SPIRE-AST-REP-002634

Title: **H-EPLM STM TB/TV Test Report**

CI-No: 120 000

Prepared by:	G. Jahn	Date:	17.01.2006
Checked by:	R. Hohn		19.01.06
Product Assurance:	R. Stritter		19.01.06
Configuration Control:	W. Wietbrock		20.01.06
Project Management:	W. Fricke		23/01/2006

Distribution: See Distribution List (last page)

Issue	Date	Sheet	Description of Change	Release
1	17.01.06	All	First issue	

Table of Content

Table of Figures

List of Tables

1 Overview

The H-EPLM STM TB/TV test was performed in the period from 08.10.2005 to 09.11.2005 at the LSS facility in Noordwijk, NL.

This document gives an overview of the tests performed and shall be used as input to the test evaluation and TMM correlation activities. In chapter 3, the measurements performed during the TB/TV test are summarized. Chapter 4 contains a listing of individual measurement events. The filled in test procedure, test log book, procedure variation sheets (PVS) and operation request sheets (ORS) are given in the annex.

The as-run timeline of the test is described in the test conductor data sheet, see Table 1. The 48 hrs contingency included in the planning for TP5 was not needed, and the external equilibrium in TP7 was reached significantly faster than expected due to the boost heating performed with the CVV test heaters. The warm-up of the S/C in TP8 took more time than expected due to the limitation of applicable test heater power caused by unexpectedly high test harness temperatures. Additional HTT heat load measurements were performed in the frame of PVS 21. The actual test duration compares very well to the estimated duration.

Table 1: Overall TB/TV test timeline (Test Conductor Data Sheet)

H-EPLM STM TB/TV Test			
Test Phase	Estimated Duration (hrs)	Actual	
		Date & Time of TP start (UTC)	Duration (hrs)
TP0: Initial phase	-	-	-
TP1: Launch Autonomy	79	08.10.2005 11:00	74.3
TP2: LEOP	123	11.10.2005 13:20	114.3
TP3: Rapid Cool-down	99	16.10.2005 07:40	128.0
TP4: TV1	50	21.10.2005 15:40	48.9
TP5: TB1	183	23.10.2005 16:37	146.6
TP6: TV2	49	29.10.2005 19:15	59.5
TP7: TB2	103	01.11.2005 06:45	70.3
PVS 21 tests	32 (0) *)	04.11.2005 05:00	39.0 (0) *)
TP8: Recovery to ambient	40	05.11.2005 20:00	82.5
Test end	-	09.11.2005 06:30	-
Total Test Time	758 (726) *)		763.5 (724.5) *)

*) Values in parentheses don't include PVS 21 estimated / actual durations

2 Documentation

2.1 Applicable Documents

[AD1] Integrated Test Procedure for H-EPLM STM TB/TV Test, HP-2-ASED-TP-0056 Iss. 1.1

[AD2] Instrumentation Plan for Thermal Testing of H-EPLM STM, HP-2-ASED-PL-0042

2.2 Reference Documents

[RD1]	Test Prediction for H-EPLM STM TB/TV Test, HP-2-ASED-TN-0126
[RD2]	HOT Evacuation Test, HP-2-ASED-SD-0052
[RD3]	PPS Functional Check (via nozzles, without tilting), HP-2-ASED-SD-0054
[RD4]	TRR for HOT Evacuation Test, HP-2-ASED-MN-1065
[RD5]	TRR for the PPS functional test, HP-2-ASED-MN-1070
[RD6]	Delta TRR for PPS Performance And Ventline Pressure Drop Test In Combination With HOT Evacuation Test II, HP-2-ASED-MN-1072
[RD7]	PTR for HOT evacuation test, HP-2-ASED-MN-1069
[RD8]	2nd HOT evacuation PTR, HP-2-ASED-MN-1077
[RD9]	PTR for PPS functional test (w/o tilting SD-0055), HP-2-ASED-MN-1071
[RD10]	PPS 2nd Ventline Pressure Test PTR, HP-2-ASED-MN-1078
[RD11]	NRB on the PPS 2 Vent Line Pressure Test (HP-2-ASED-SD-0060), HP-2-ASED-MN-1076
[RD12]	TRR for H-EPLM STM TB/TV Test, HP-2-ASED-MN-1074
[RD13]	H-EPLM STM TB/TV TRB for TP0 - Initial Check-Out, HP-2-ASED-MN-1083
[RD14]	H-EPLM STM TB/TV TRB for TP1 - Launch Autonomy, HP-2-ASED-MN-1091
[RD15]	H-EPLM STM TB/TV TRB for TP2 - LEOP, HP-2-ASED-MN-1084
[RD16]	H-EPLM STM TB/TV TRB for TP3 - Rapid Cool-down, HP-2-ASED-MN-1085
[RD17]	H-EPLM STM TB/TV TRB for TP4 - TV1, HP-2-ASED-MN-1086
[RD18]	H-EPLM STM TB/TV TRB for TP5 - TB1, HP-2-ASED-MN-1087
[RD19]	H-EPLM STM TB/TV TRB for TP6 - TV2, HP-2-ASED-MN-1088
[RD20]	H-EPLM STM TB/TV TRB for TP7 - TB2, HP-2-ASED-MN-1089
[RD21]	H-EPLM STM TB/TV TRB for TP8 - Recovery to Ambient, HP-2-ASED-MN-1090

[RD22]	PTR for H-EPLM STM TB/TV TEST, HP-2-ASED-MN-1113
[RD23]	Herschel EPLM STM TB/TV Test LSS Facility Data Report, HP-2-ETS-RP-0001
[RD24]	Evaluation of H-EPLM STM TB/TV Test Results, HP-2-ASED-RP-0174
[RD25]	Evaluation of Instrument Thermal Interface Test Results, HP-2-ASED-RP-0180
[RD26]	Test Report of the Scientific Instrument Harness verification during TB/TV-Test, HP-2-ASED-TR-0116

3 H-EPLM STM TB / TV Test

In the following sections, the as-run test phases are described in detail, including plots of the main parameters measured. The main LSS facility and test equipment data are shown for the complete test in the following figures. Further details on the LSS parameters can be found in [RD23].

The achieved LSS temperature distribution requires an updated of the LSS TMM and GMM. Details are reported in [RD24].

A first overview of the external S/C temperatures throughout the test is given in Figure 6 and Figure 7.

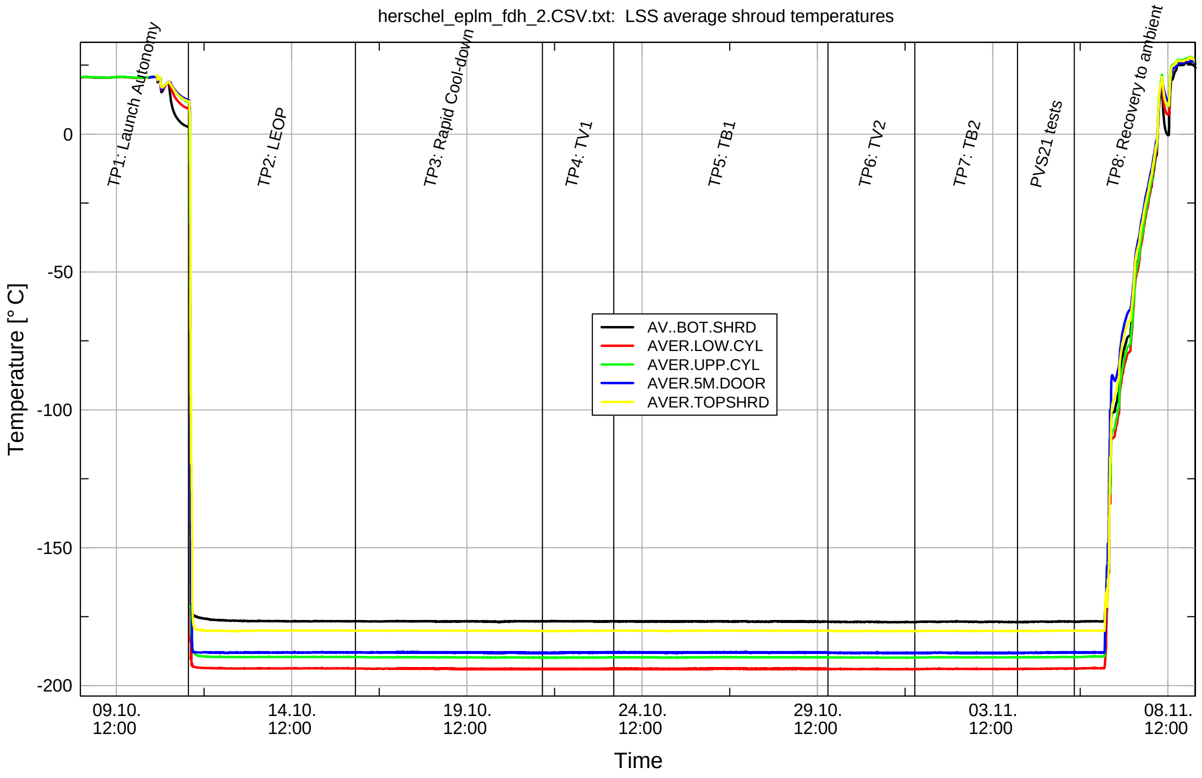


Figure 1: LSS average shroud temperatures during test

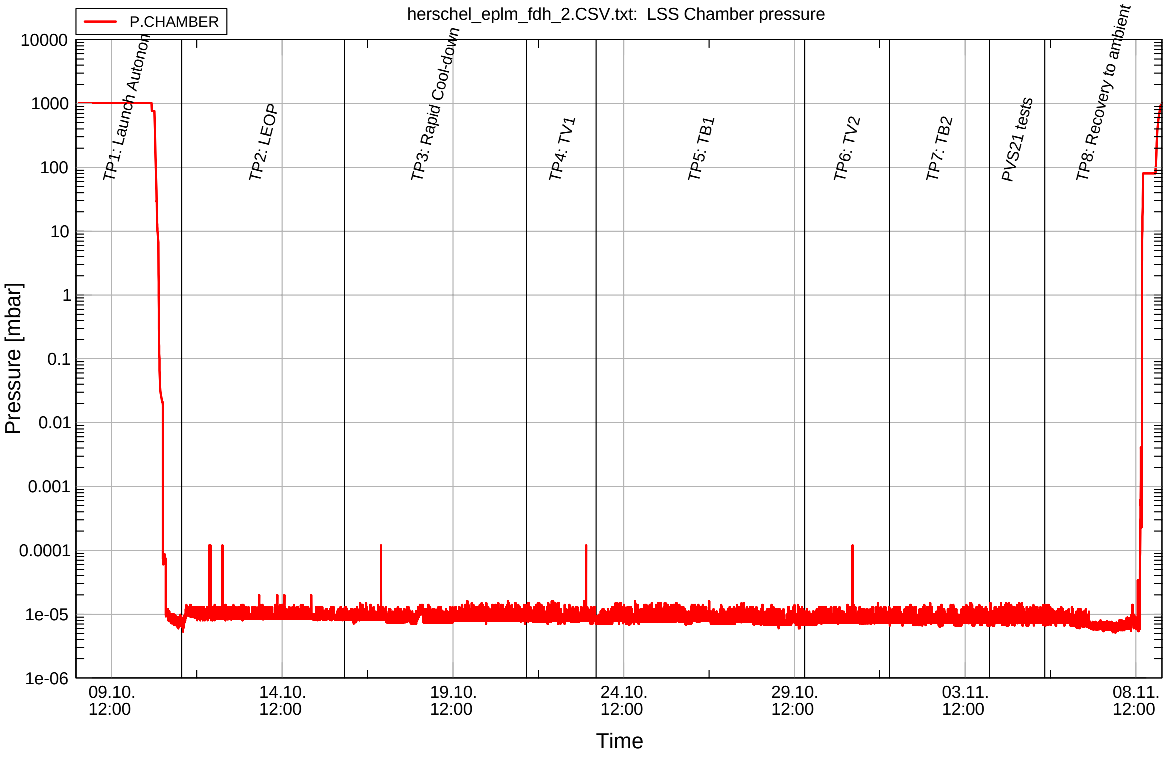


Figure 2: LSS vacuum pressure during test

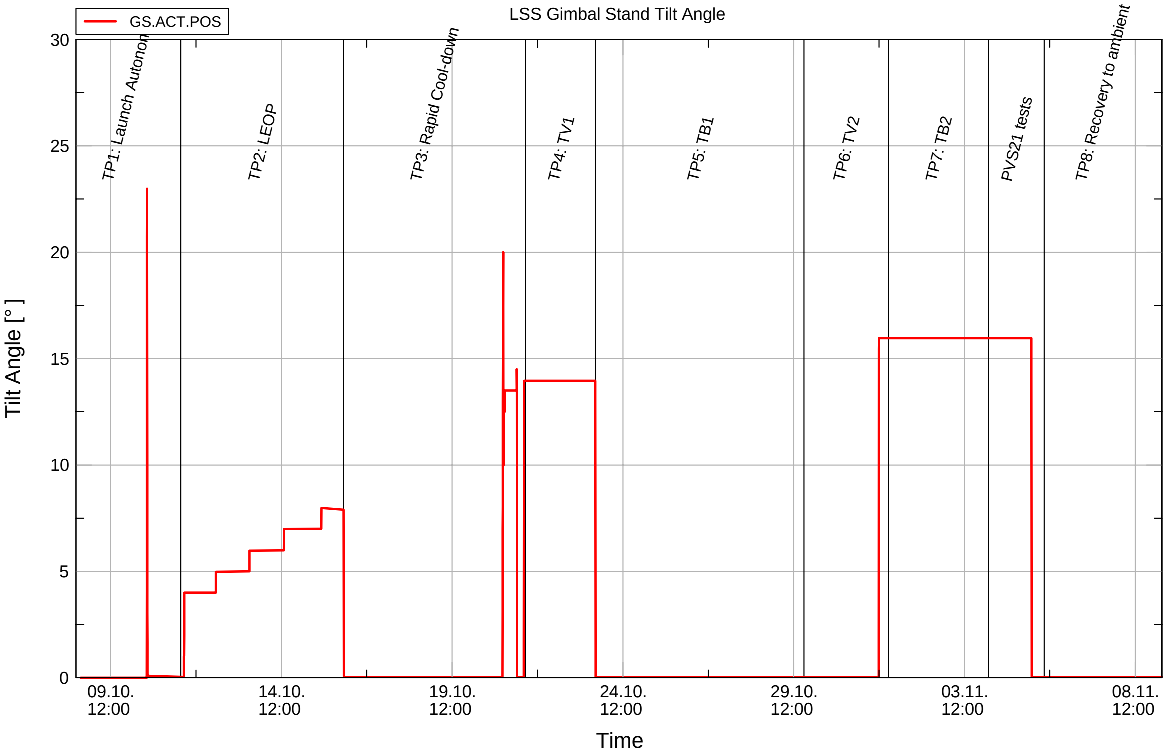


Figure 3: LSS gimbal stand tilt angles during test

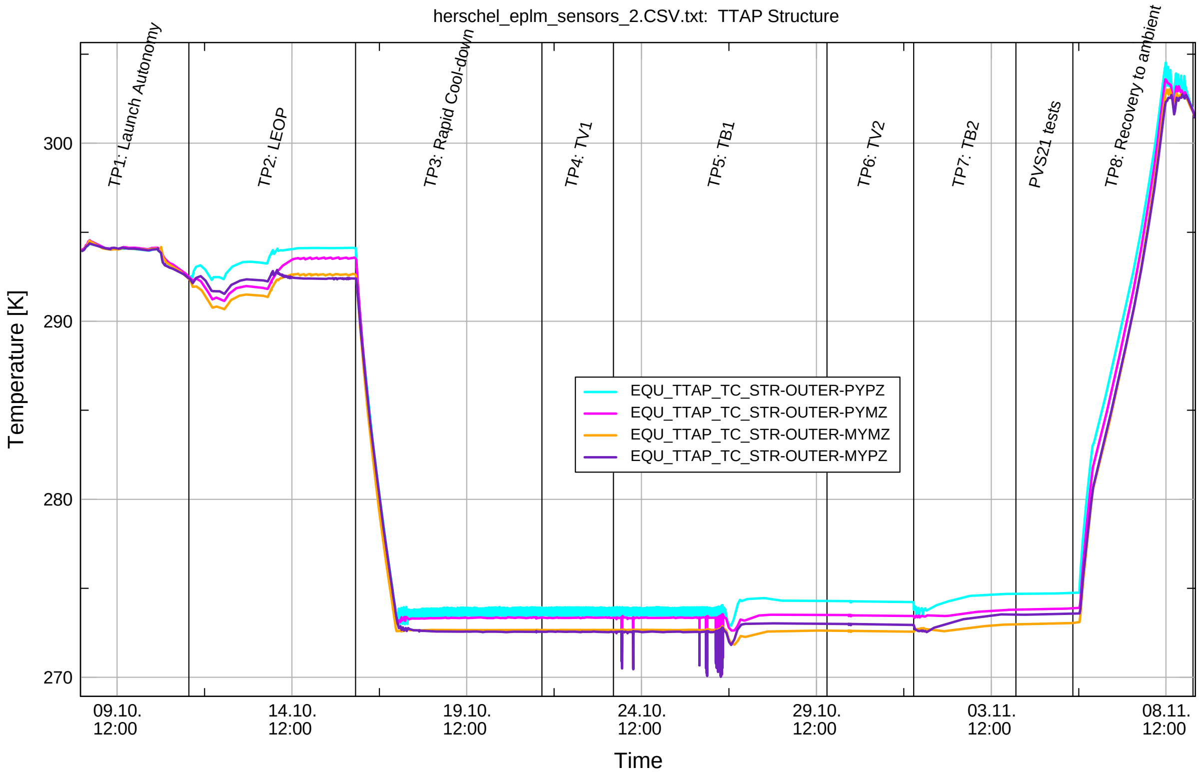


Figure 4: Thermal Test Adapter temperatures during test

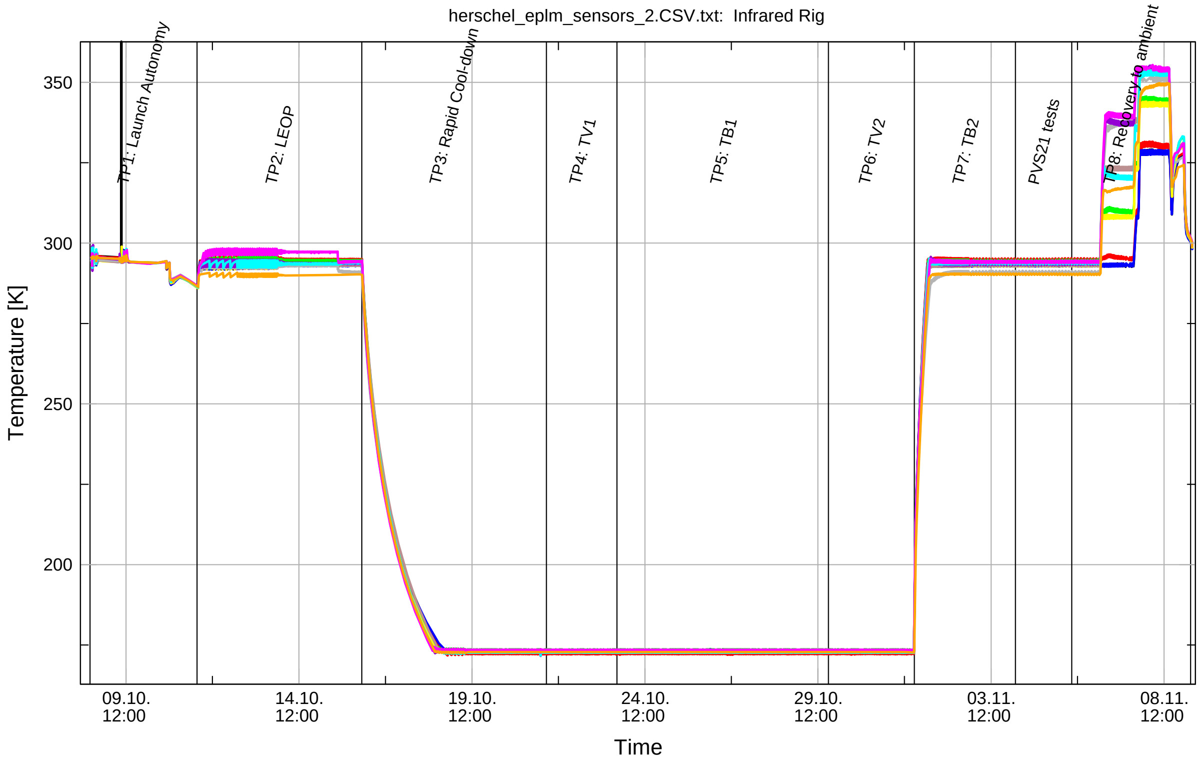


Figure 5: HSS-TCR (Infrared rig) temperatures during test

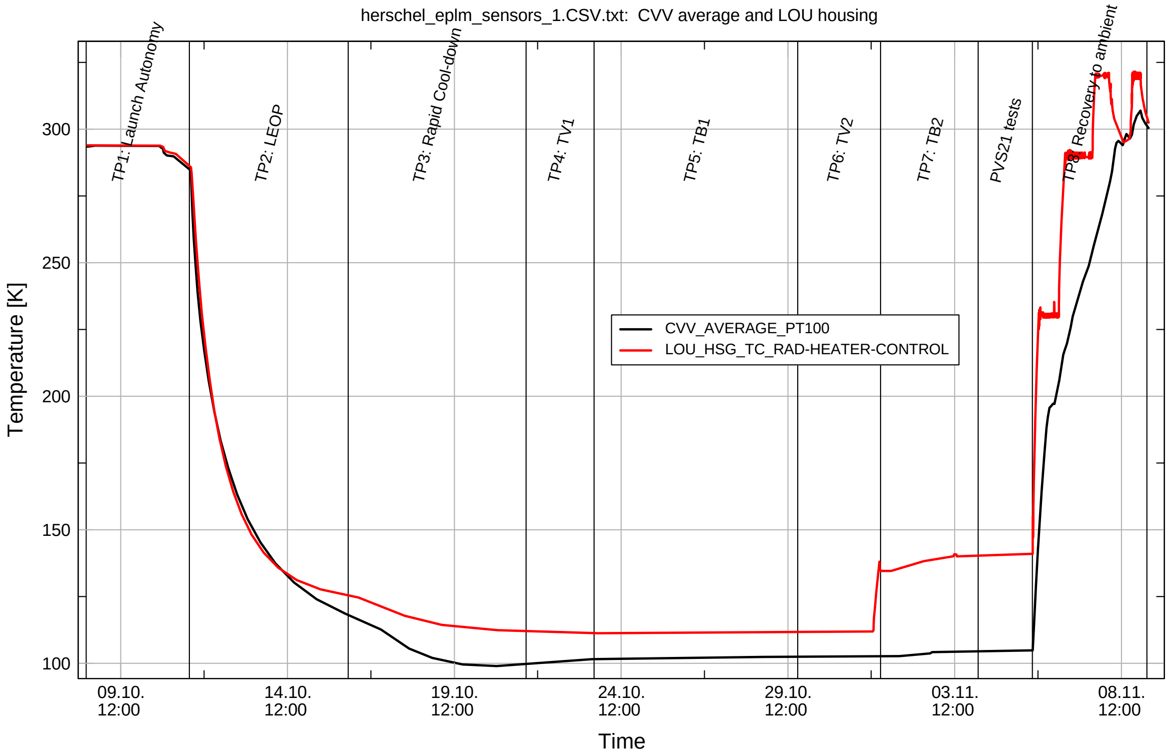


Figure 6: CVV average temperature during test

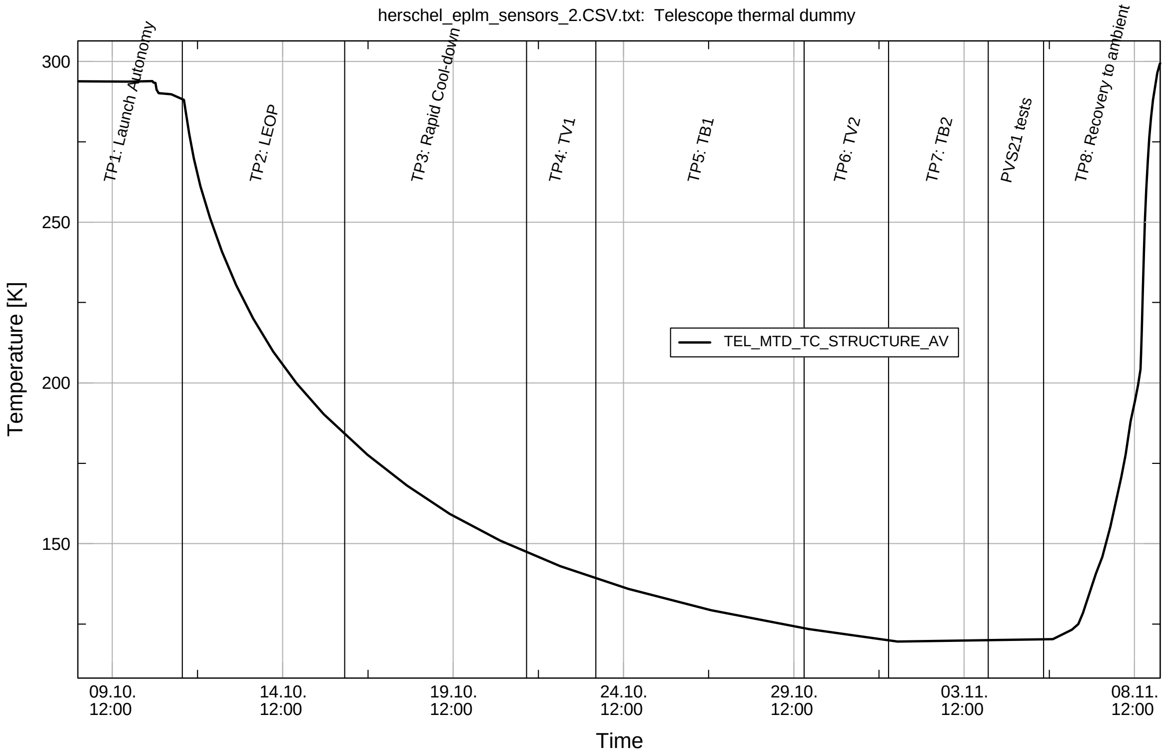


Figure 7: Telescope thermal dummy average temperature during test

3.1 TP 0 – Initial check-out

Phase duration: 08.10.2005 11:00 to 11.10.2005 13:20 (74:30 hrs)

During TP0, the spacecraft and the major part of the test equipment was installed in the LSS. The pre-TB/TV tests described in the previous section were executed during TP0.

Electrical check-outs of heaters and sensors handled by the facility Thermal Data Handling (TDH) system and by the Cryo-SCOE have been performed to the extent possible:

- SCOE instrumentation was checked out. 3 “suspicious” sensors have been identified (MT203, T231, MT306); no no-goes for starting the test were encountered
- TDH Instrumentation was checked out, with exception of HSS-TCR via final connections. All sensors and heaters ok.
- On HSS-TCR (direct check before integration), all heaters were found ok, 3 out of 48 TCs were suspicious.
- The IDAS system to be used for SIH check-out has been prepared, a first run has been performed and gave good results (all wires ok).
- HACS setup was checked and found ok. Final harness routing had to be done after HSS-TCR installation.

The last step of TP0 consisted in the final HTT top-up and the HOT refilling. With 97.04% filling level (average of the liquid level probe L101 and L102 readings) at a bath temperature of 1.83 K, the conditions reached within the HTT were well within the specified range. At a cold 100% HTT volume of 2367 l and with the He density at 1.83 K, the total He mass in the HTT was 334.1 kg.

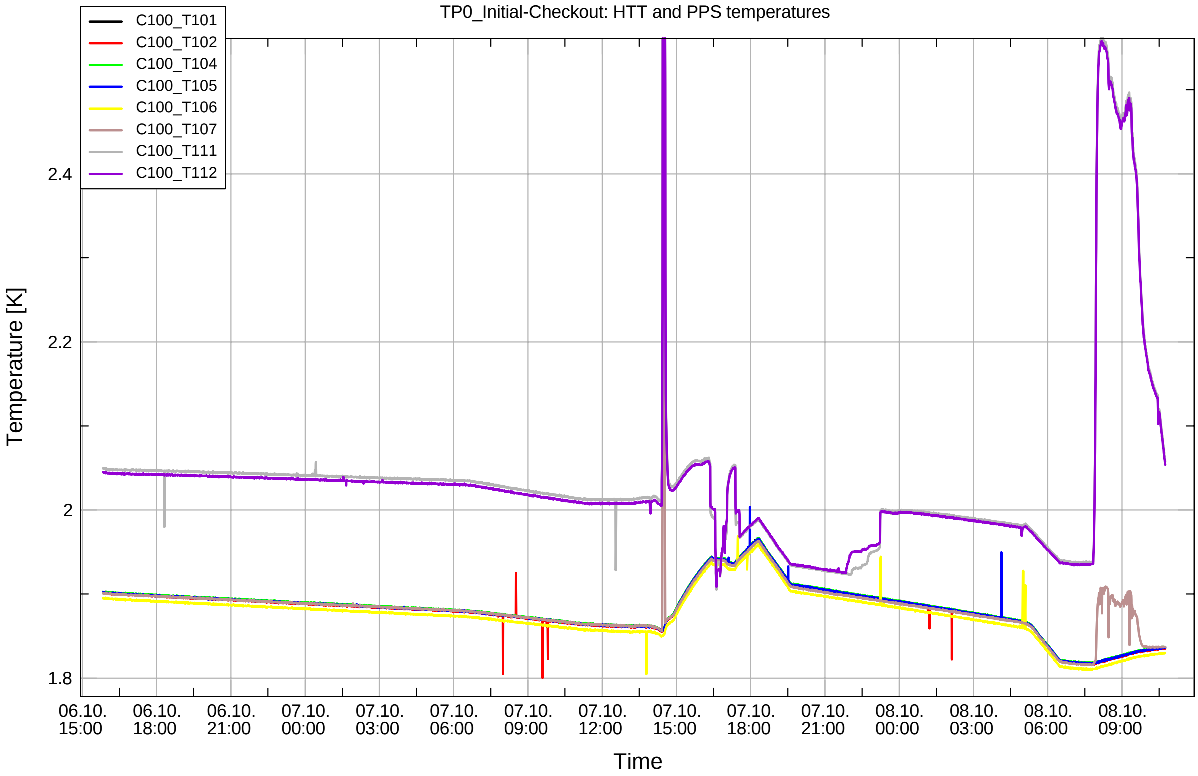


Figure 8: TP0 HTT temperatures

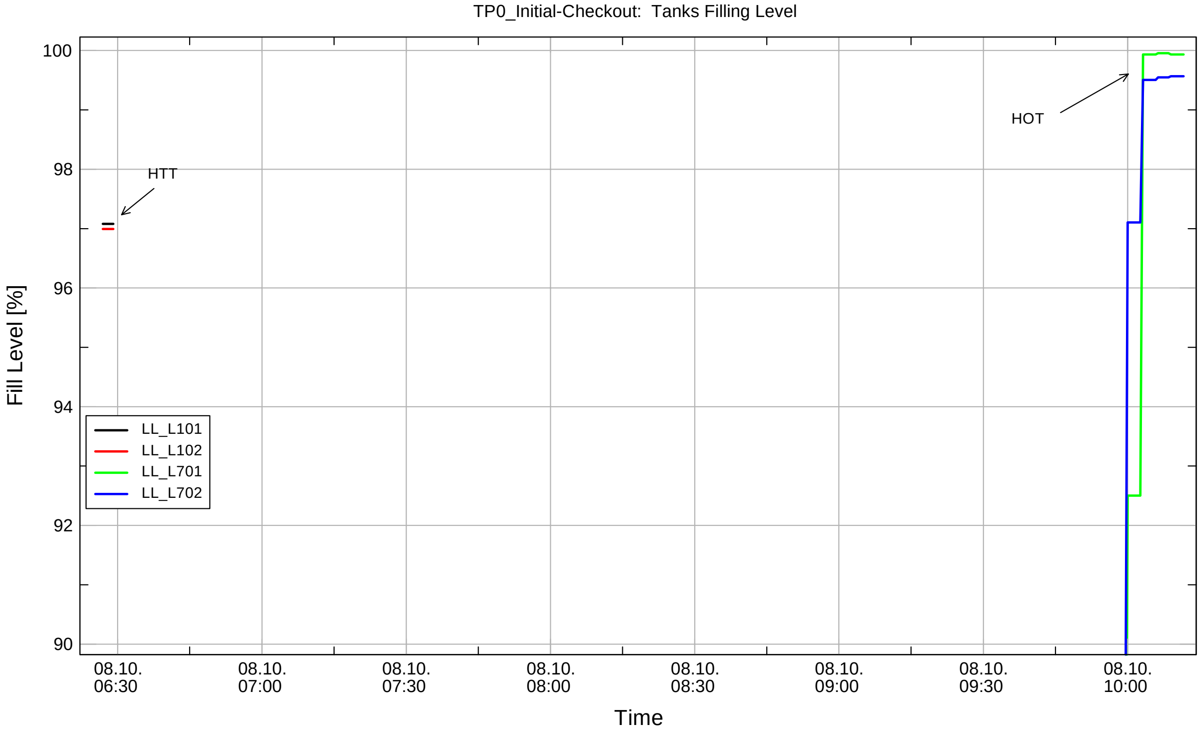


Figure 9: TP0 Tank filling levels

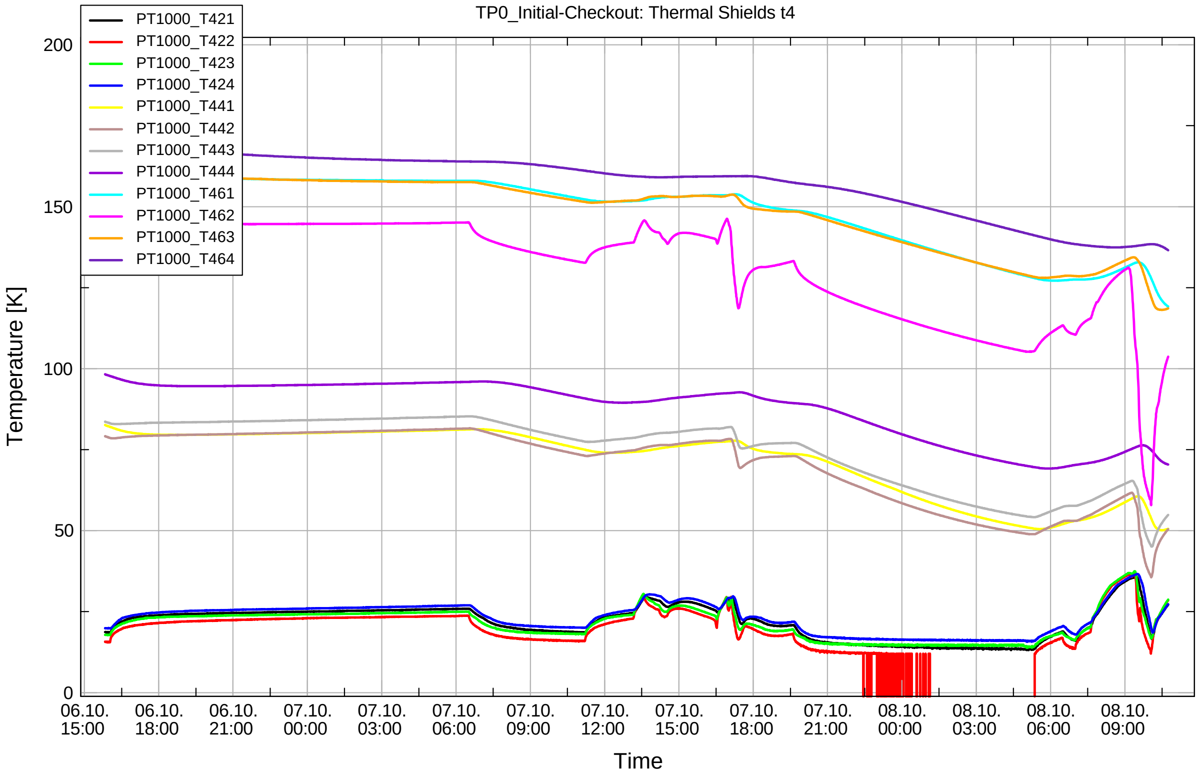


Figure 10: TP0 Thermal shield temperatures

3.2 TP 1 – Launch Autonomy

The TB/TV test was started on 08.10.2005 at 11:00 (UTC) after having reached the nominal initial conditions in the HTT and HOT. Removal of the CVSE and the LSS scaffolding was performed in the first part of TP 1.

A unexpectedly large slope of the HTT temperature was detected on 09.10.2005, a quick glance comparison to predictions indicated a factor of ~4 on the HTT heat load. Procedure variations as described below were implemented with the goal to reduce the impact on the test progress. Due to these changes, the originally planned timeline for TP 1 was changed from 51 hrs with mass flow followed by 28 hrs without to 56 hrs with and 19 hrs without cooling of the shields.

The tilting verification was performed on the 10.10.2005 between 13:25 and 13:55, when the S/C was tilted to up to +22.9°. The PPS outlet temperature dropped sharply when the PPS was immersed in the HTT liquid at 2.7° tilt angle. The remaining clearance between a hoisting bracket of the HSS-TCR and the LSS wall at 22.9° tilt angle was ~ 50 mm. Afterwards, the LSS was closed on 10.10.2005 at 17:00.

The heater H501 was operated under control of a script running on the SCOE which commanded a thermostatic on / off switching at 286 K / 299 K reading of the T502 control sensor, see Figure 16.

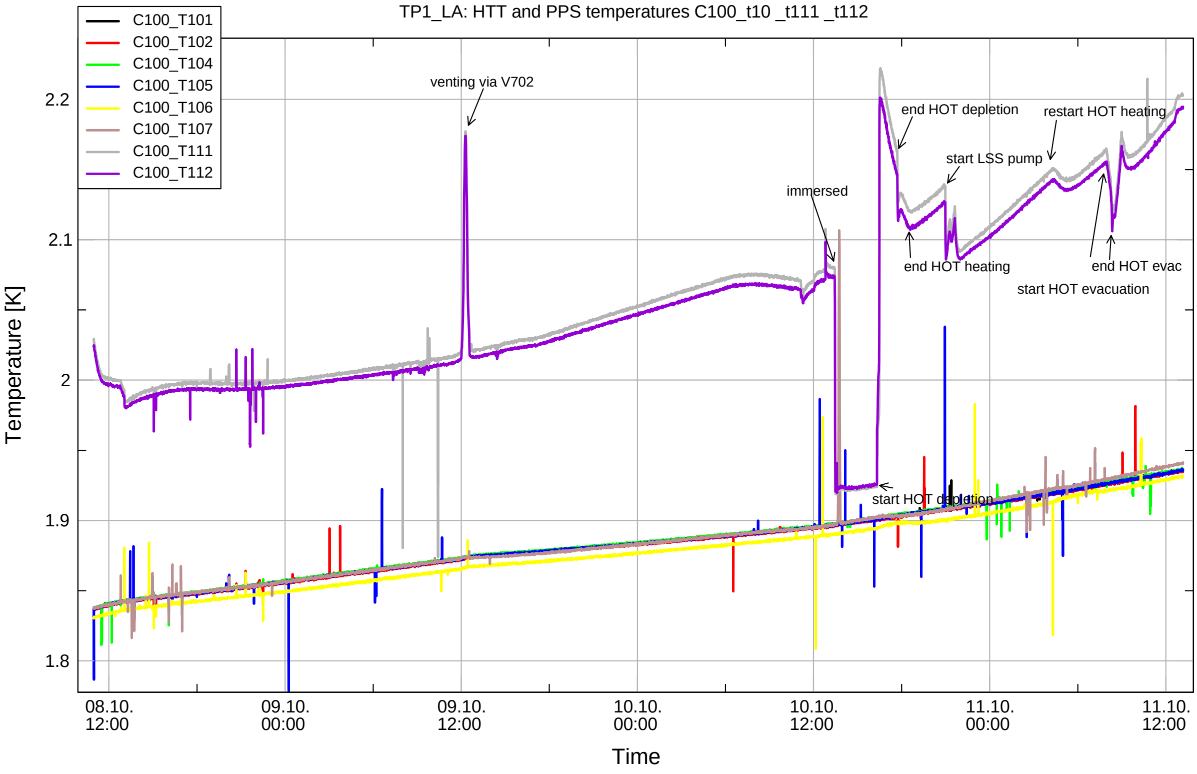


Figure 11: TP1 HTT and PPS temperatures

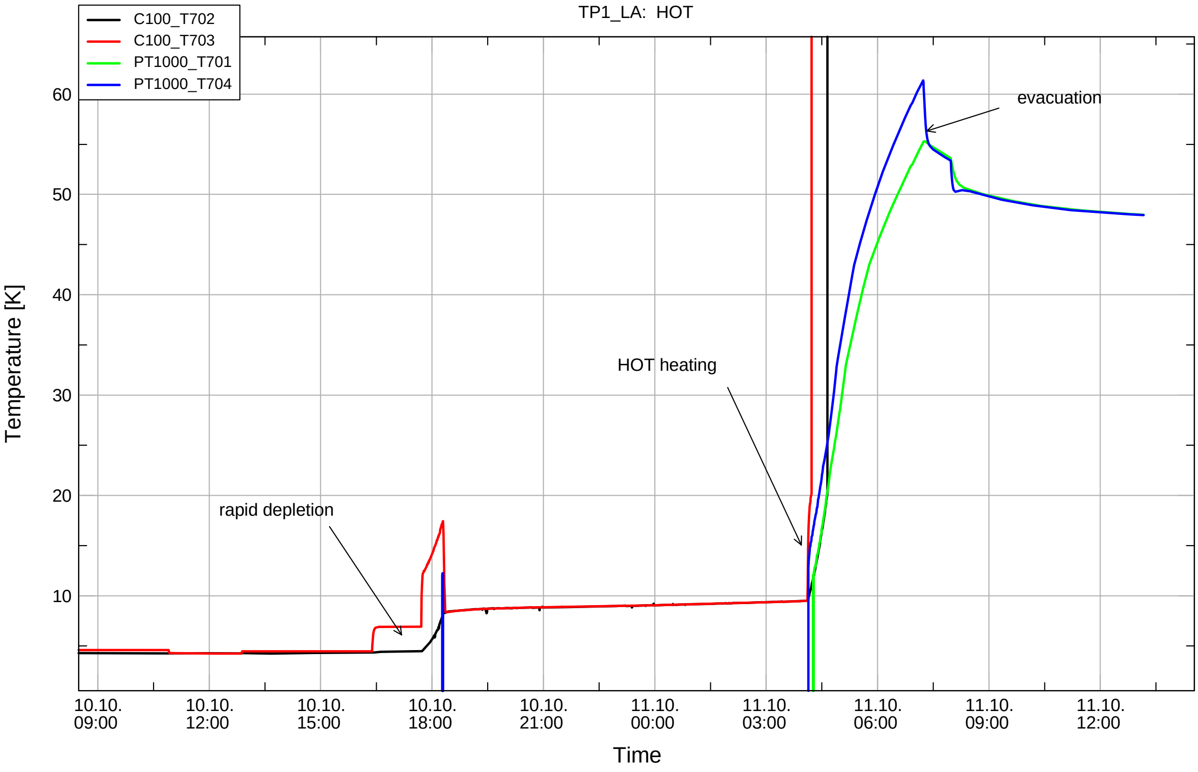


Figure 12: TP1 HOT temperatures (note the time axis zoom)

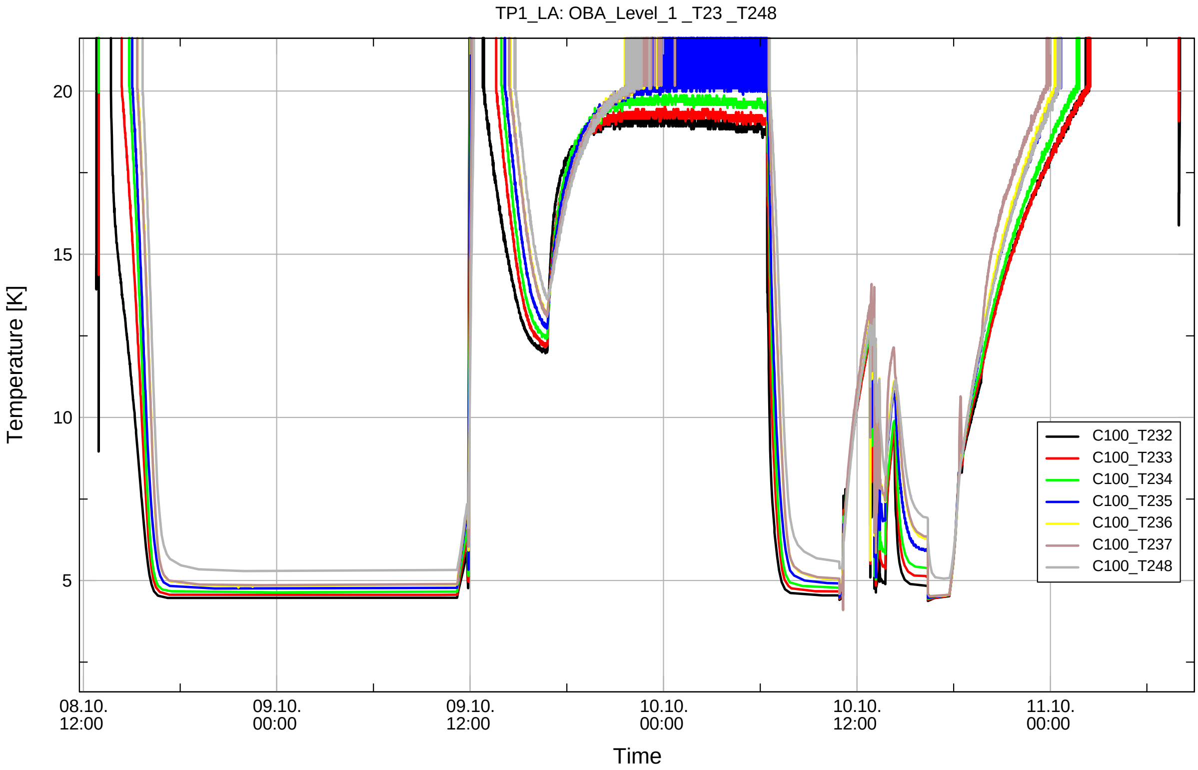


Figure 13: TP1 Level 1 interface temperatures

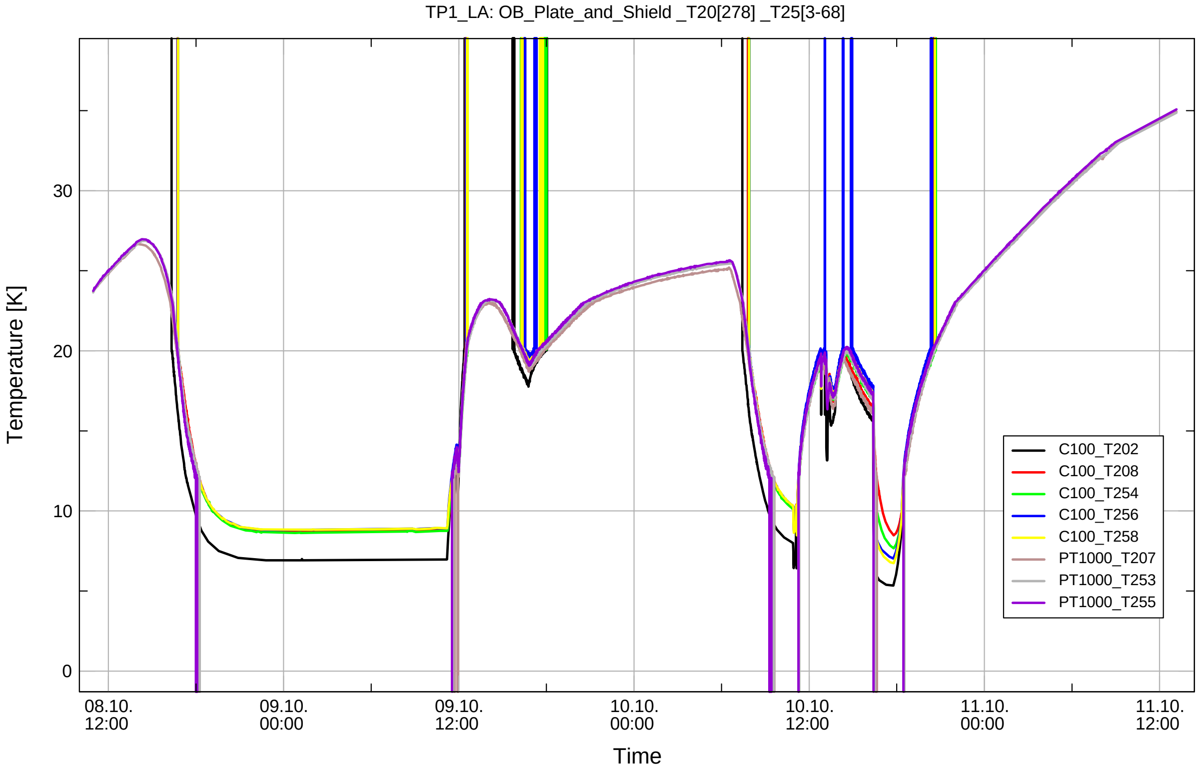


Figure 14: TP1 Optical Bench Plate and Shield temperatures

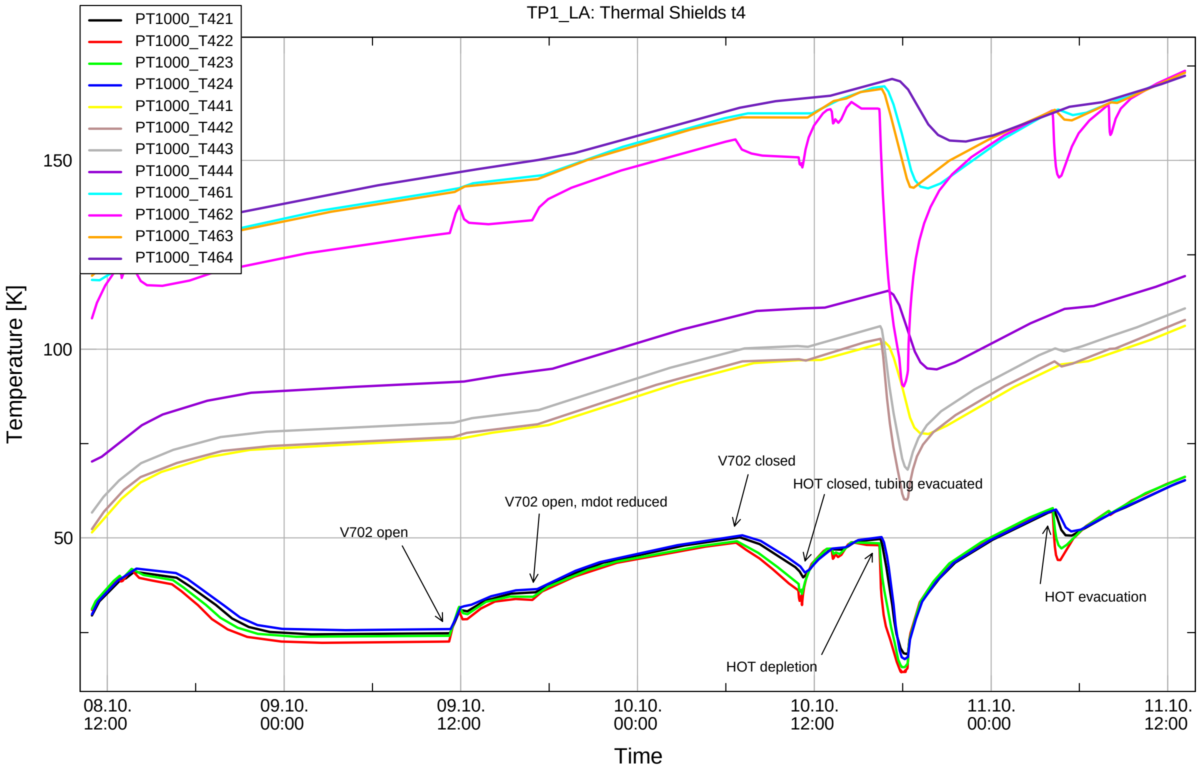


Figure 15: TP1 Thermal Shields temperatures

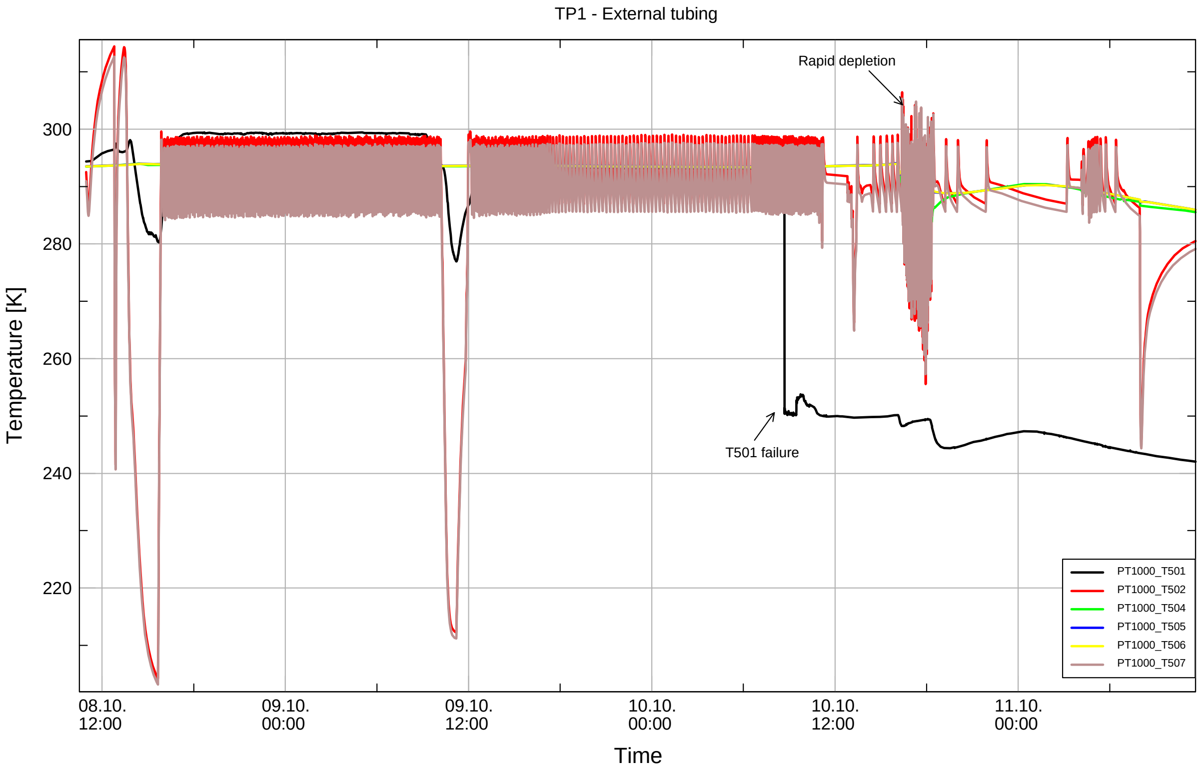


Figure 16: TP1 external tubing temperatures

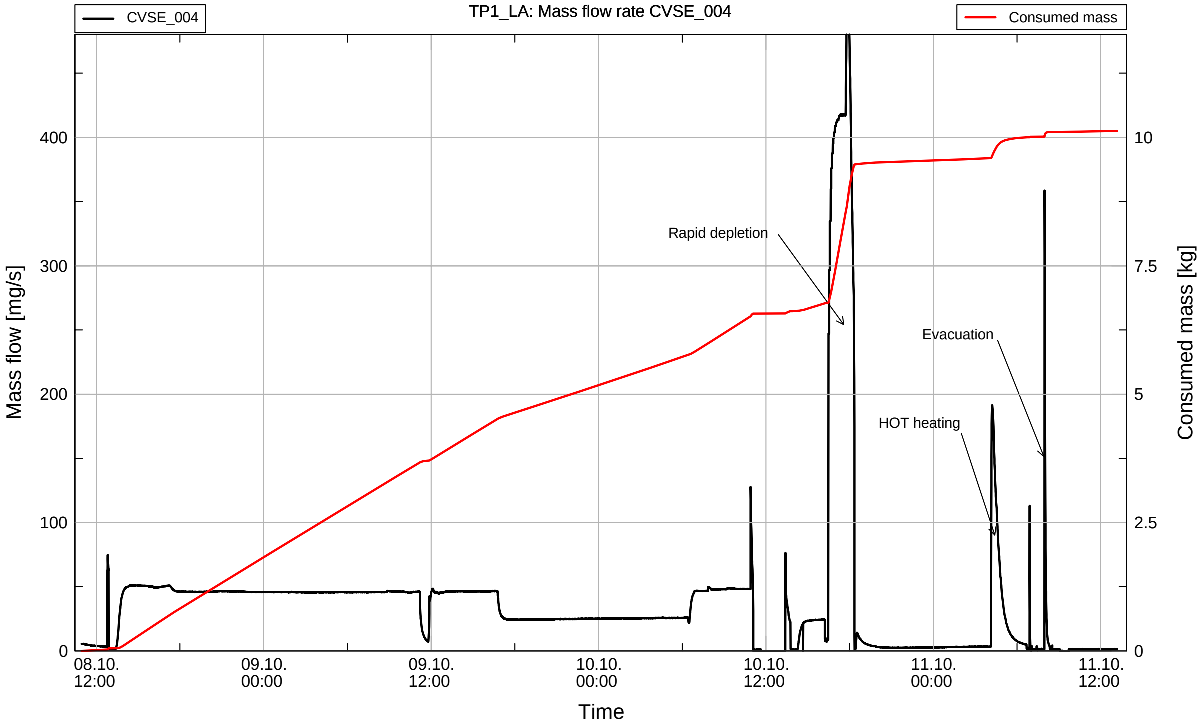


Figure 17: TP1 mass flow rate and consumed He mass (vented from HOT)

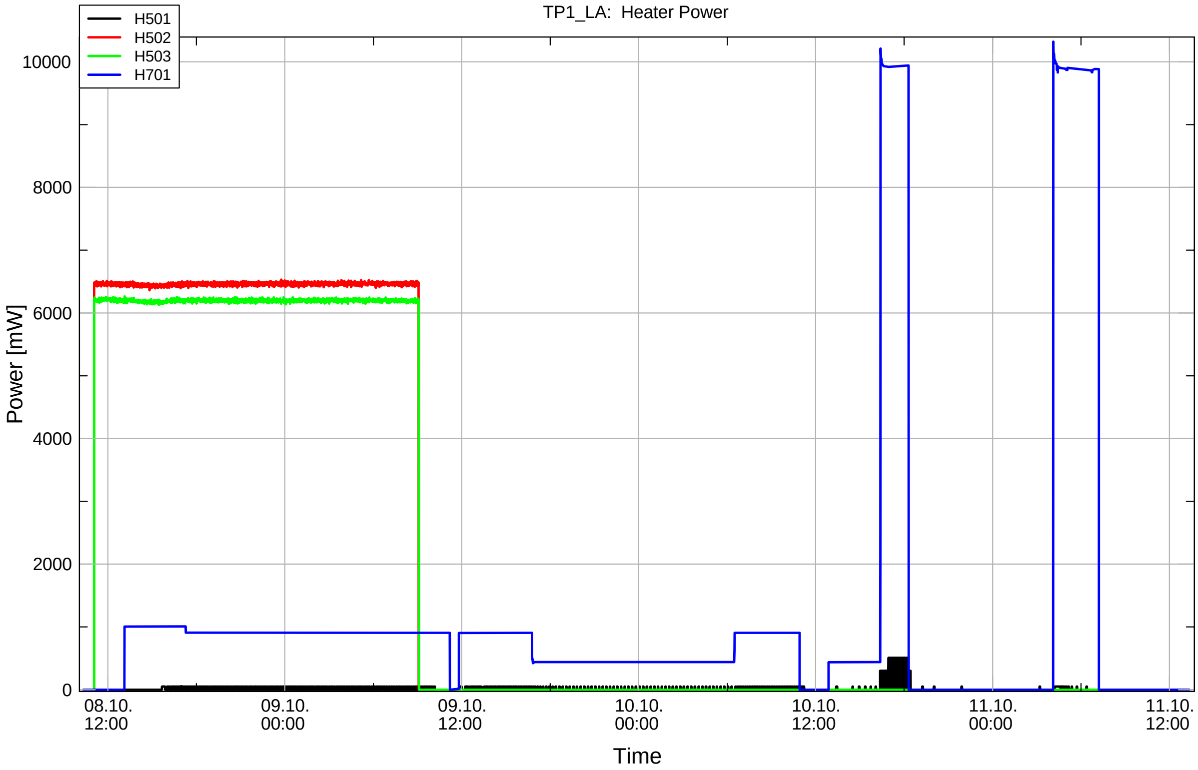


Figure 18: TP1 heater powers (only active heaters are shown

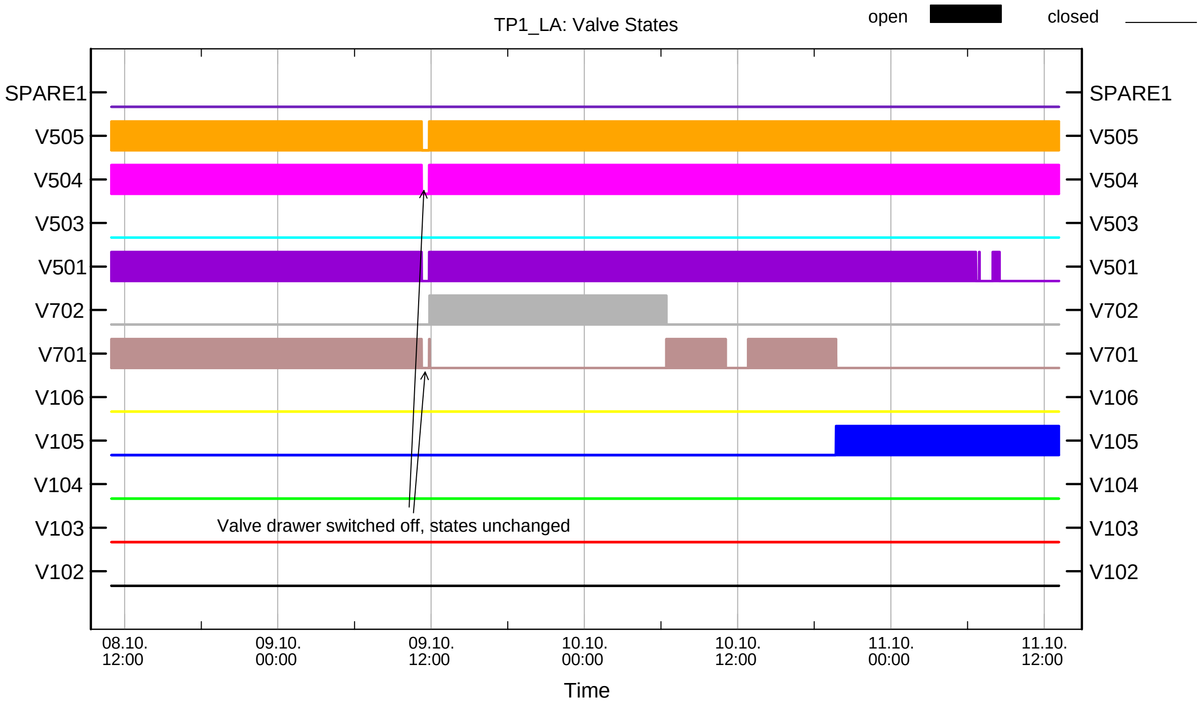


Figure 19: TP1 electromagnetic valve states

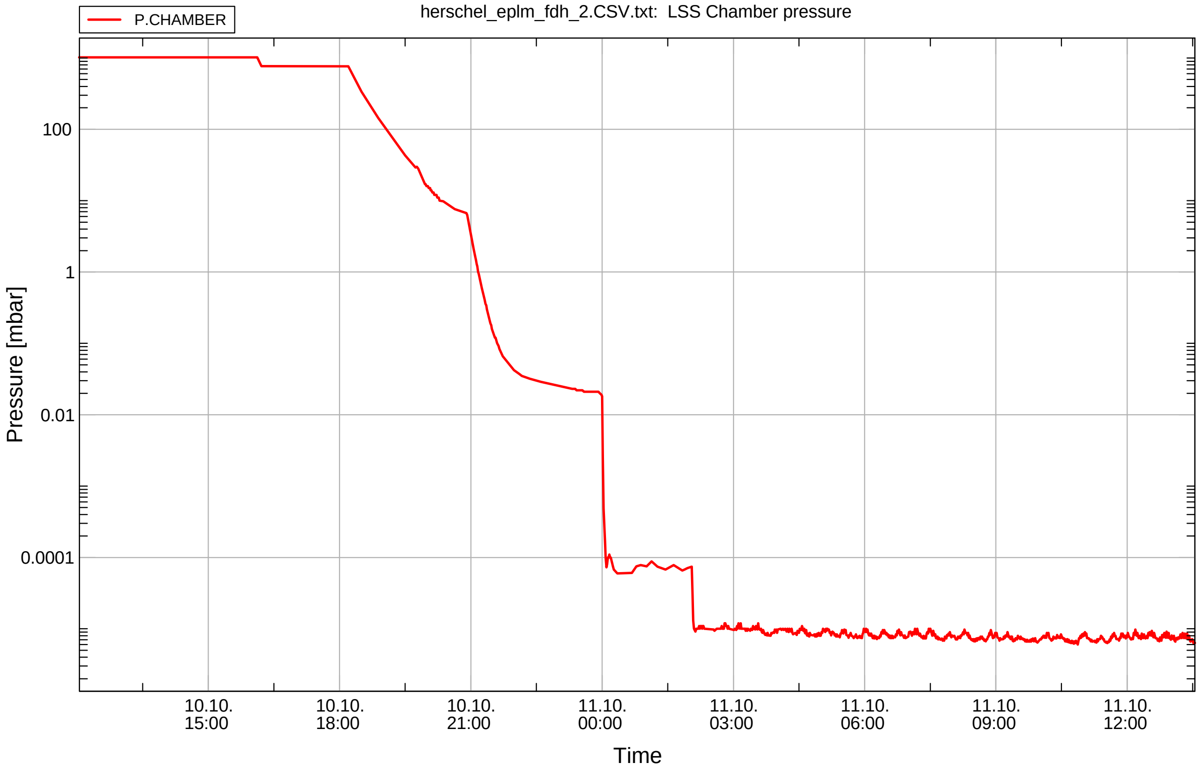


Figure 20: TP1 LSS chamber pressure

3.2.1 Procedure Variations

PVS 1: To investigate the cause for the high HTT heat load, several first steps were done, including the switching off of all heaters and the SCOE valve drawer. No impact was detected. Afterwards, the vent path from the HOT was changed from venting via V701 to venting via V702 and the filling port tubing to the OBA. A slight reduction of the temperature increase was found, and this venting path was kept. In addition, the impact on the HTT heat load with evacuated tubing was checked, but no significant influence was detected.

PVS 2: HOT rapid depletion: Oscillations in tubing were suspected as possible cause for HTT heat load, therefore it was decided to perform a LHe rapid depletion from the HOT, and to evacuate the HOT immediately after the liquid depletion. The launch delay simulation was thus carried out with evacuated HOT

3.2.2 HOT evacuation sequence

The pressure measurements taken during the HOT evacuation sequence are shown in Figure 21. The low pressure sensors CVSE_002 (large nozzle inlet), CVSE_003 (large nozzle outlet) and CVSE_005 (small nozzle inlet) were connected to their respective measurement points via ~10 m long pressure pickup lines with 4 mm diameter tubes. The analogue pressure sensor P506, which has a comparatively large measurement volume, was connected in parallel to the CVSE_002 sensor. Due to this setup, the measurements taken by CVSE_002 and P506 are significantly delayed in time before the pressure at the sensor location reaches the value at the measurement point. This observation is confirmed by the excellent accordance between CVSE_002 and P506 measurements shown in Figure 21.

The correlation curve used for the P502 has to be corrected as an outcome of the calibration measurement performed in TP8, where the P502 reading was compared HTT saturated vapour pressure, and an offset of -2.97 mbar was detected at an absolute pressure of 16 mbar. The P502 measurements corrected by 2.97 mbar as shown in Figure 21 show good agreement with the CVSE_005 data (which is also slightly delayed due to the long pressure pickup line).

In measurements performed before the TB/TV test (see [RD7], [RD8]), a pressure difference of 2.3 mbar was detected between the HOT and the P502 measurement location at the end of the HOT evacuation sequence. The criterion to reach the required 15 mbar in the HOT is therefore a P502 reading of 12.7 mbar. When the corrected P502 data are used for the HOT evacuation evaluation, the measured time required to reach this pressure is 965 s (compared to an available time of ~1200 s during launch).

The evacuation of the HOT (according to PVS2) was started on 11.10.2005 at 07:57:53, 12.7 mbar were reached at 08:13:58, see Figure 21.

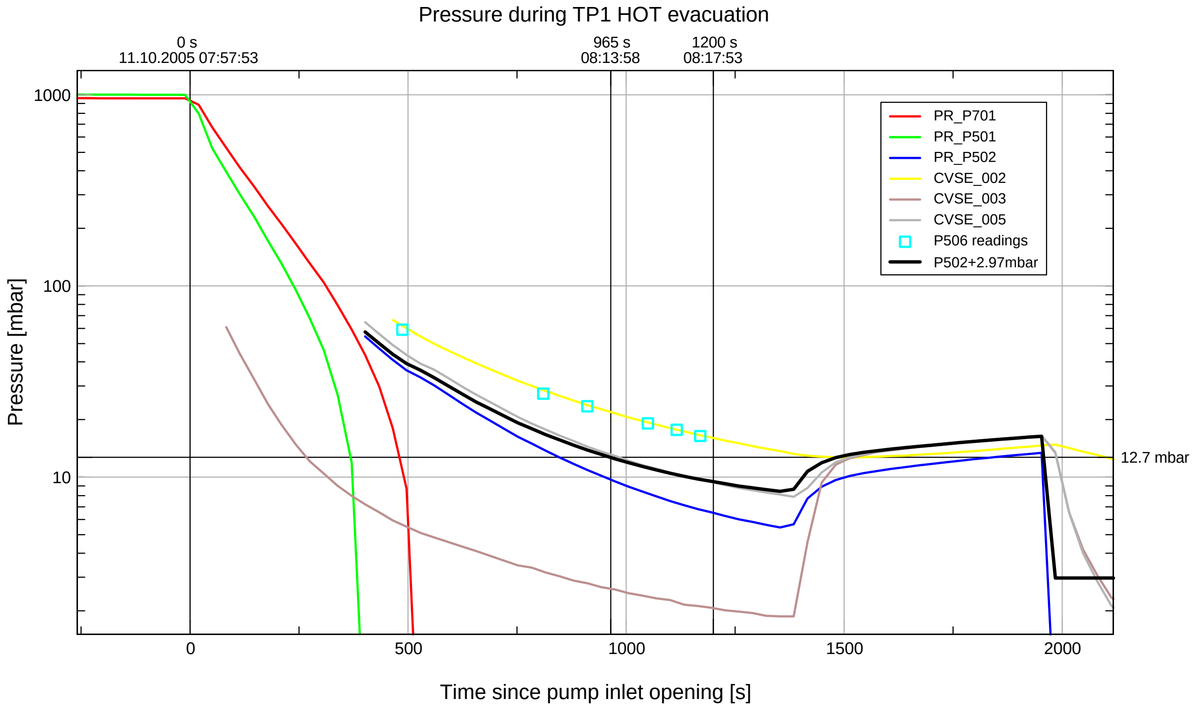


Figure 21: Pressures during HOT evacuation

3.3 TP 2 – Launch and Early Orbit Phase

The PPS outlet valves were opened at HTT temperature 1.937 K. Due to a problem with the LSS motion system, immersion of the PPS was delayed by approx. 100 minutes. PPS startup was performed at T_HTT=1.94 K at 2.7° tilt angle (as expected from tilt verification measurement). The start-up was successful, giving a temperature difference of ~36mK at a mass flow rate of ~8 mg/s.

Shortly (~15min) after opening of the PPS valves, an oscillation of the PPS outlet temperatures T111 and T112 with constant amplitude (~5mK) was observed. Another oscillation was found on the mass flow rate. These oscillations still existed after PPS start-up. Further investigations were performed in the frame of PVS 3.

During cool-down of the CVV, the HTT upper bulkhead temperature sensor T107 showed a significant increase which is assigned to the SV121 O-ring becoming leaky (on 11.10.05 18:30, CVV temperature ~230K). The safety line leading from the Filling Port I/F to the LSS flange was evacuated to ~21mbar and was kept at that pressure until the end of the test.

Daily adjustments of the tilt angle have been performed. Temperature response to tilt angle variations is visible on T107 (varying distance to liquid).

SIH checks were performed every 2 hours. No problems identified.

HACS measurements were performed as planned, preliminary evaluation of results showed good correlation to prediction. During switch on, a problem with changing signs of the rotation signal was encountered which was assessed by ASED and TERMA, see NCR 1583. No impact on STM TB/TV test.

Also in TP 2, the heat load to the HTT was considerably higher than predicted. Updated predictions with as-run initial values for the LEOP phase lead to 1.976 K peak temperature in the HTT. The difference between HTT heat load in measurement and prediction was decreasing during the LEOP phase from ~200mW at CVV ambient to ~100mW.

Additional pressure drop measurements were performed at the end of TP2 with the vent path leading via the PPS or V104 and the big or the small nozzles. The PPS behaviour during the pressure drop measurements were not understood at first, but are clarified in the meantime by an offset in the sensor calibration. The T111 and T112 measurements recorded during the TB/TV test and reported here therefore have to be corrected by a negative offset. Proper operation of the PPS was shown at the end of TP 4, see Figure 44.

The total consumed He mass during TP2 was 5.16 kg.

3.3.1 Procedure Variations

PVS 3 was defined to try to stop the oscillations by closing V105 and/or changing the venting path of the He. The T111/T112 oscillations were significantly reduced when the PPS valve V106 was opened and V103 closed, other changes in V105 and V702 states did not show an impact.

PVS 4: Evacuation of safety line due to leakage of SV121

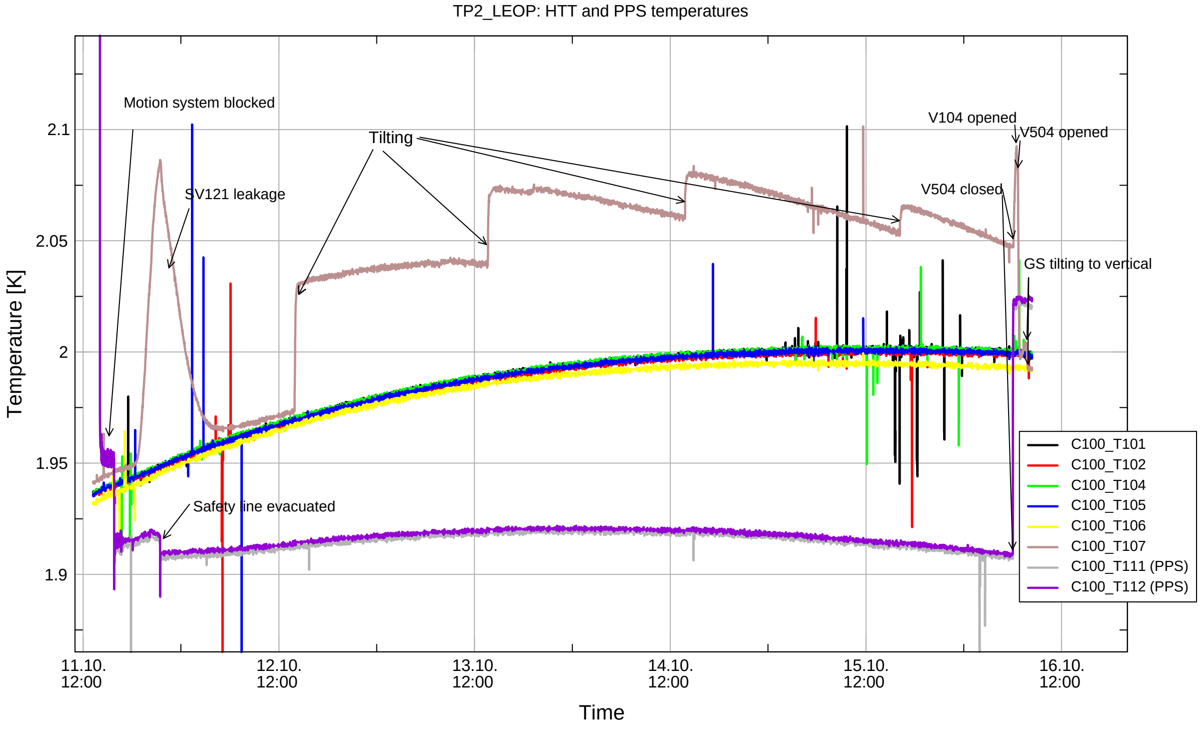


Figure 22: TP2 HTT and PPS temperatures

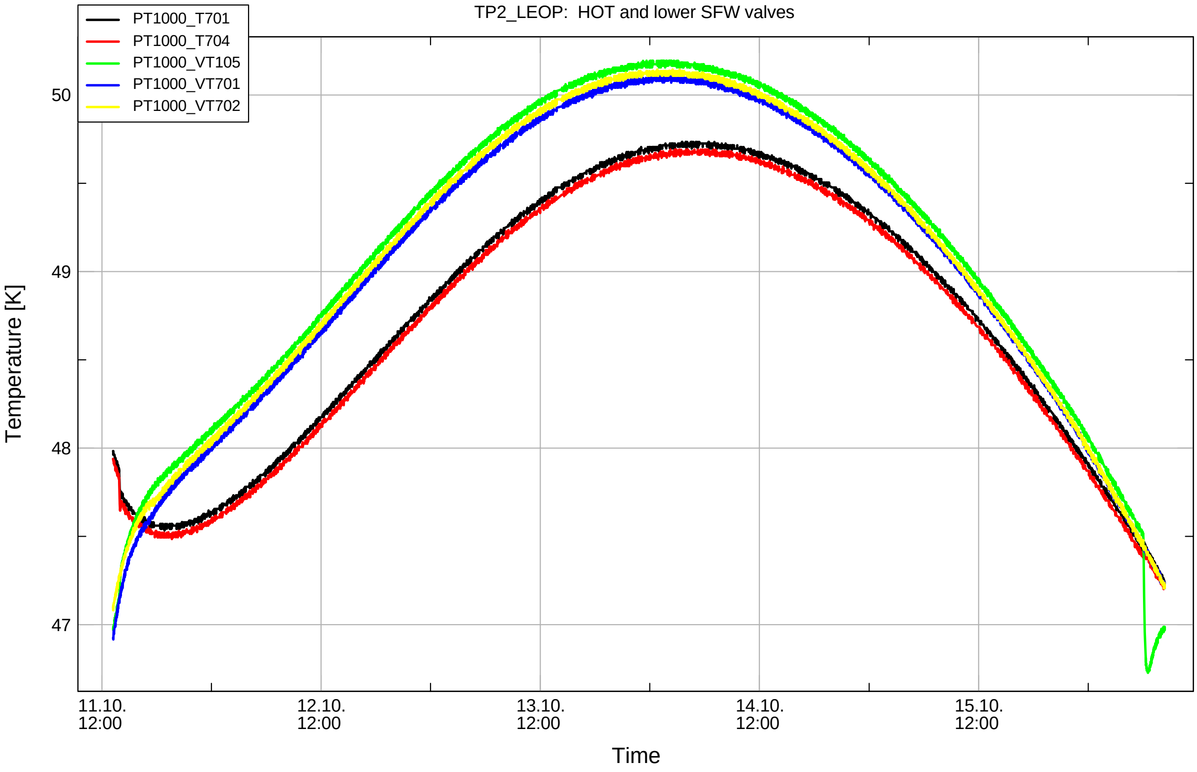


Figure 23: TP2 HOT and lower SFW valves temperatures

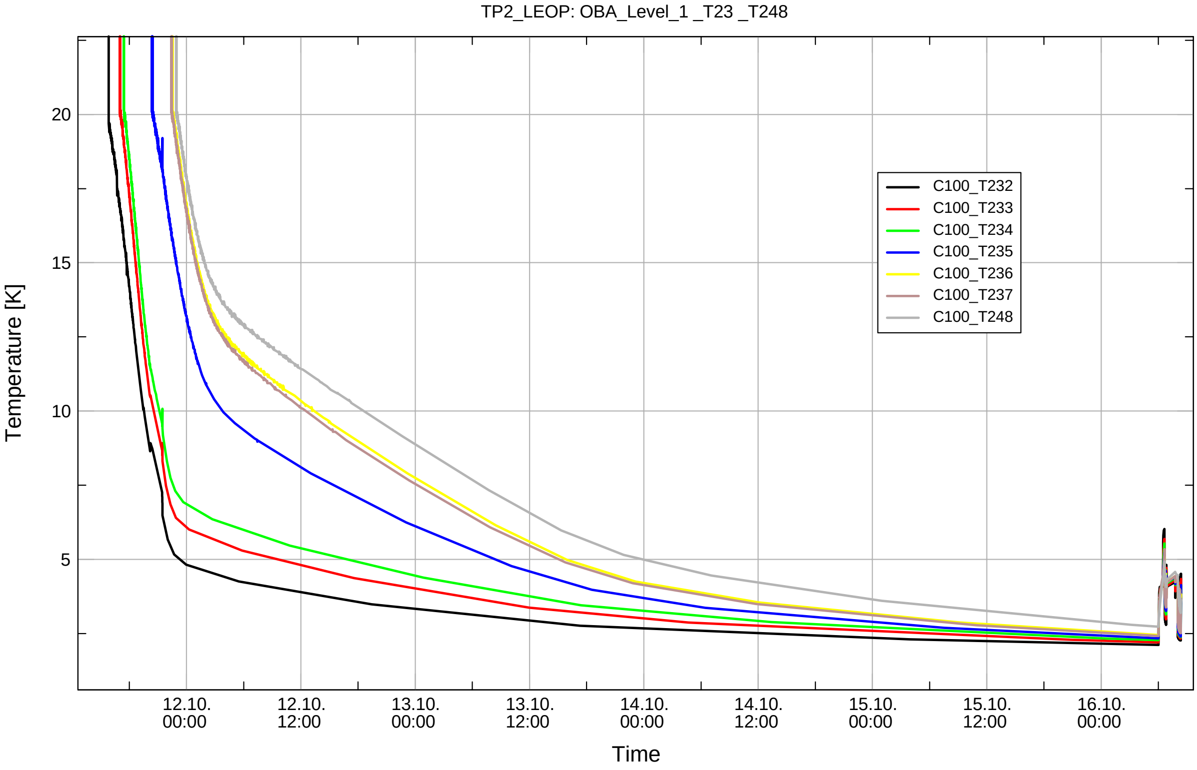


Figure 24: TP2 Level 1 interface temperatures

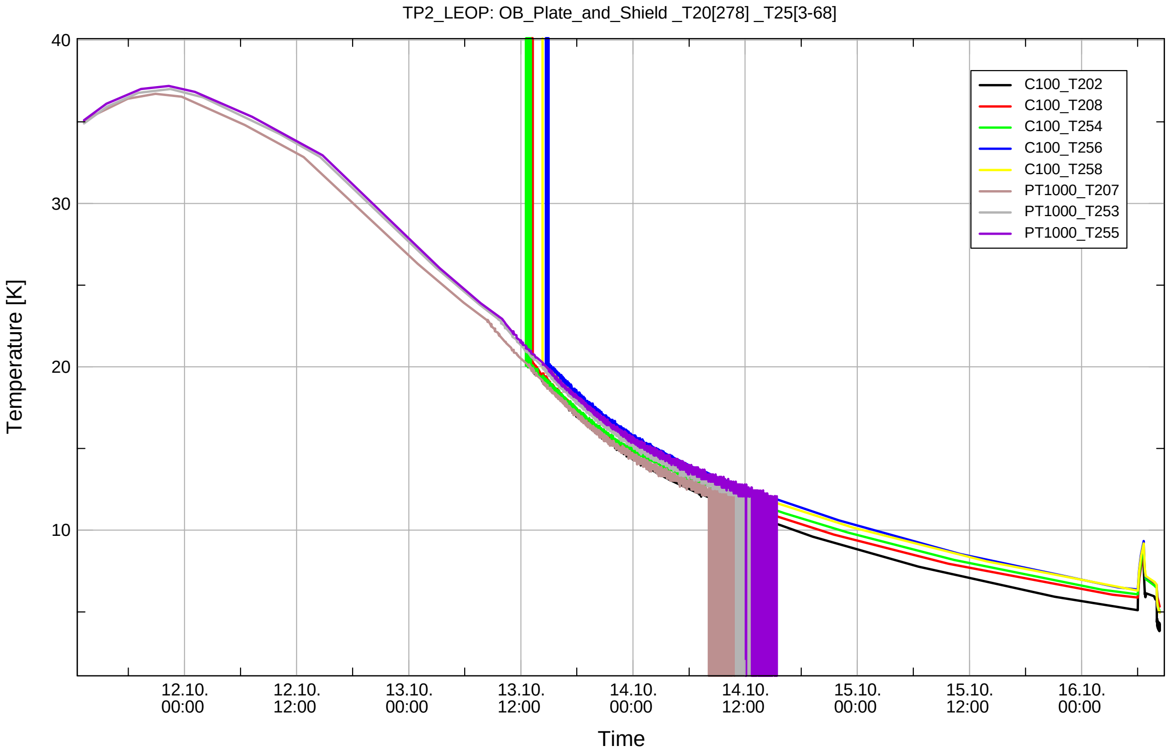


Figure 25: TP2 optical bench plate and shield temperatures

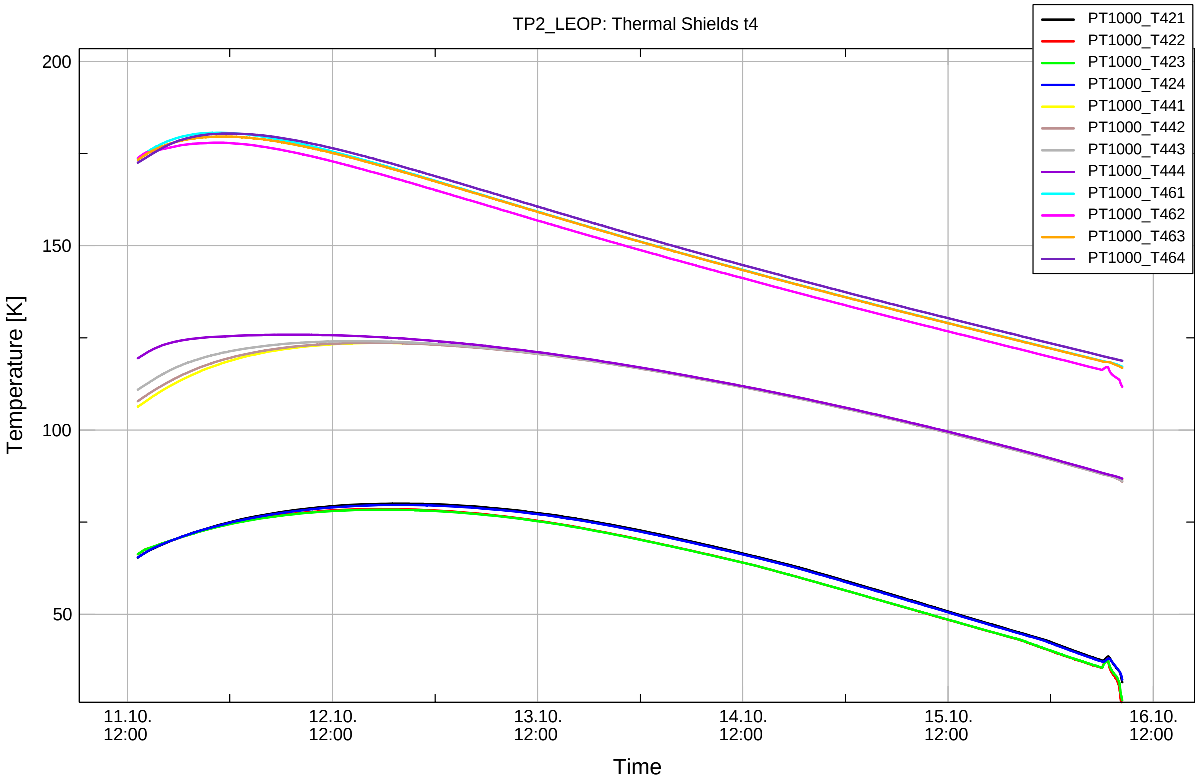


Figure 26: TP2 thermal shields temperatures

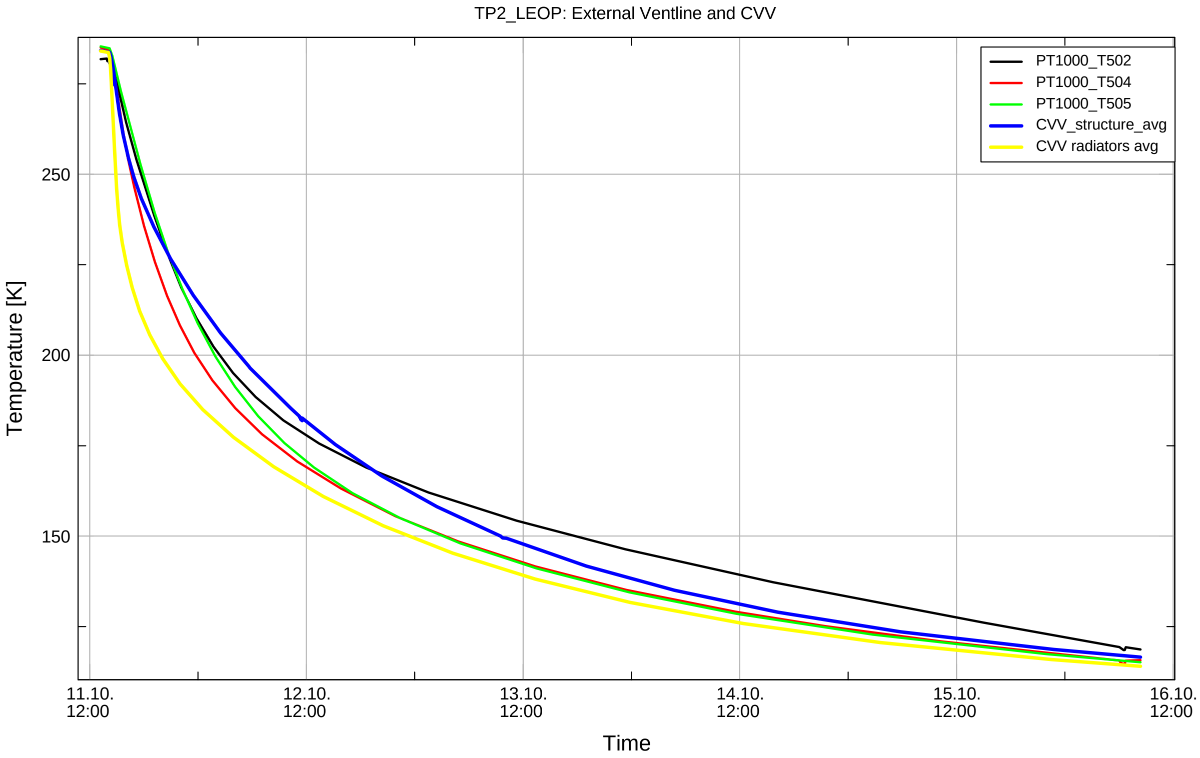


Figure 27: TP2 CVV and external vent line temperatures

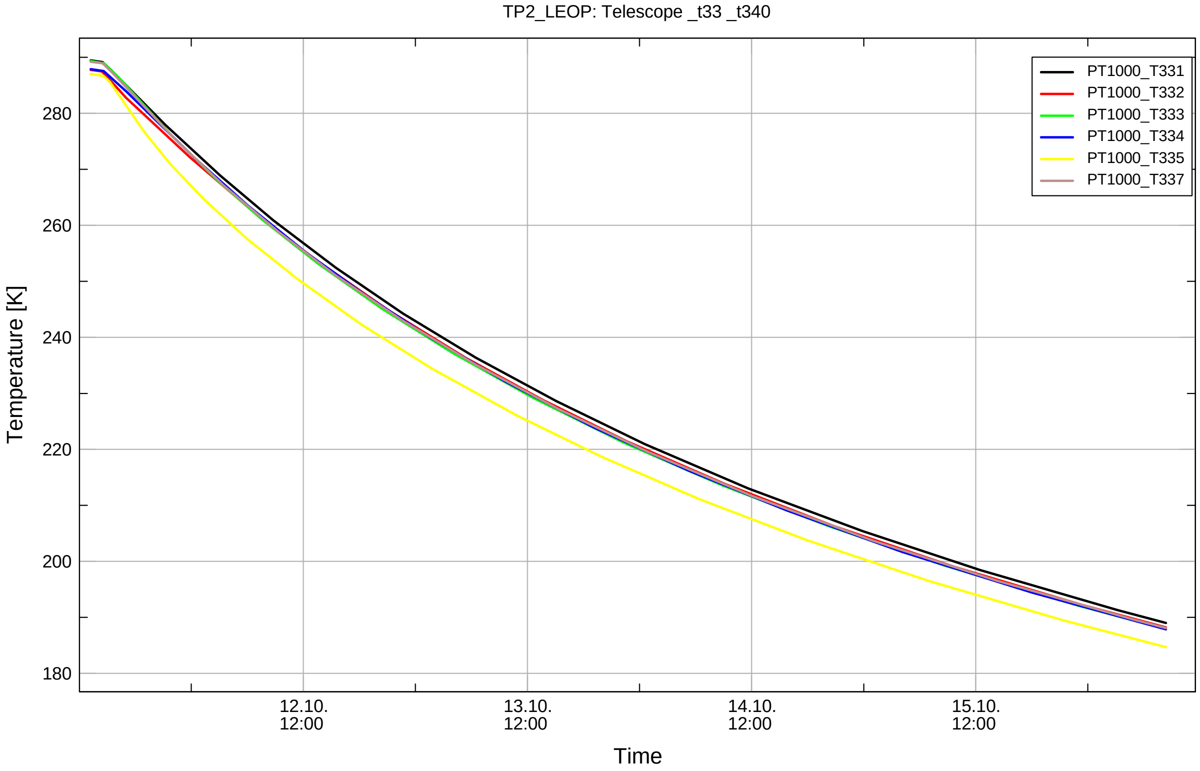


Figure 28: TP2 Telescope dummy temperatures

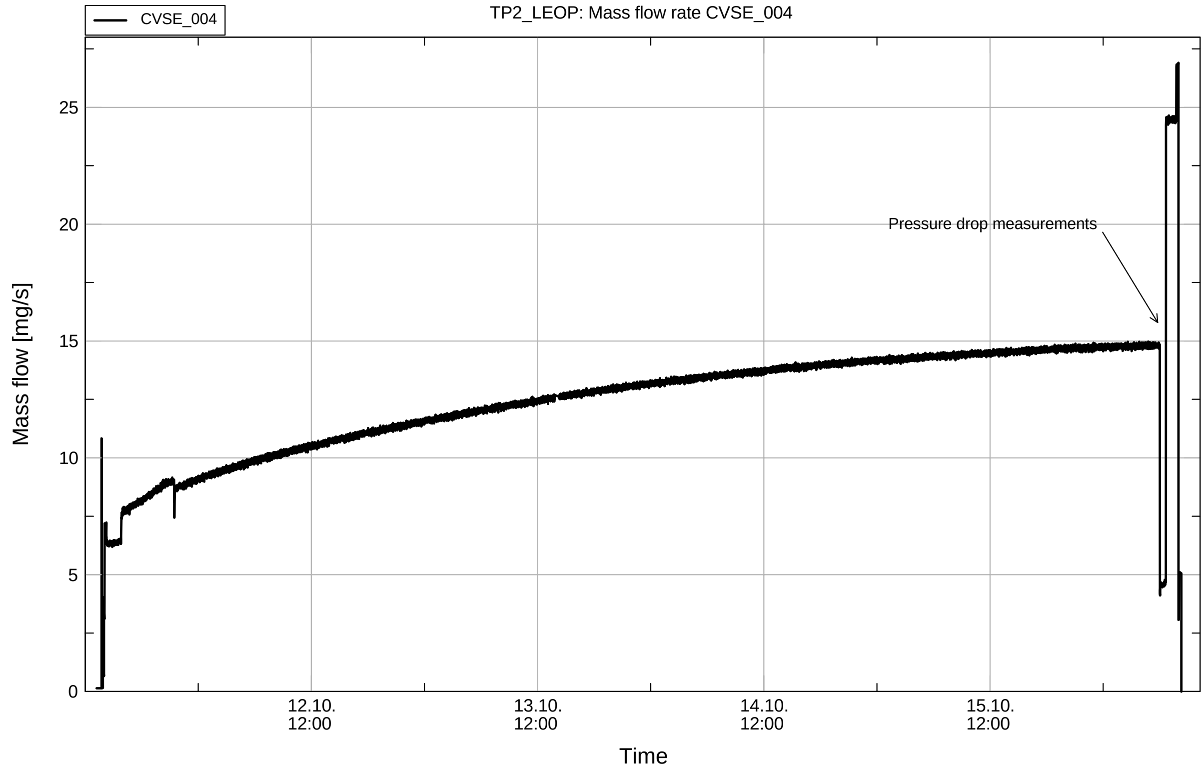


Figure 29: TP2 mass flow rate

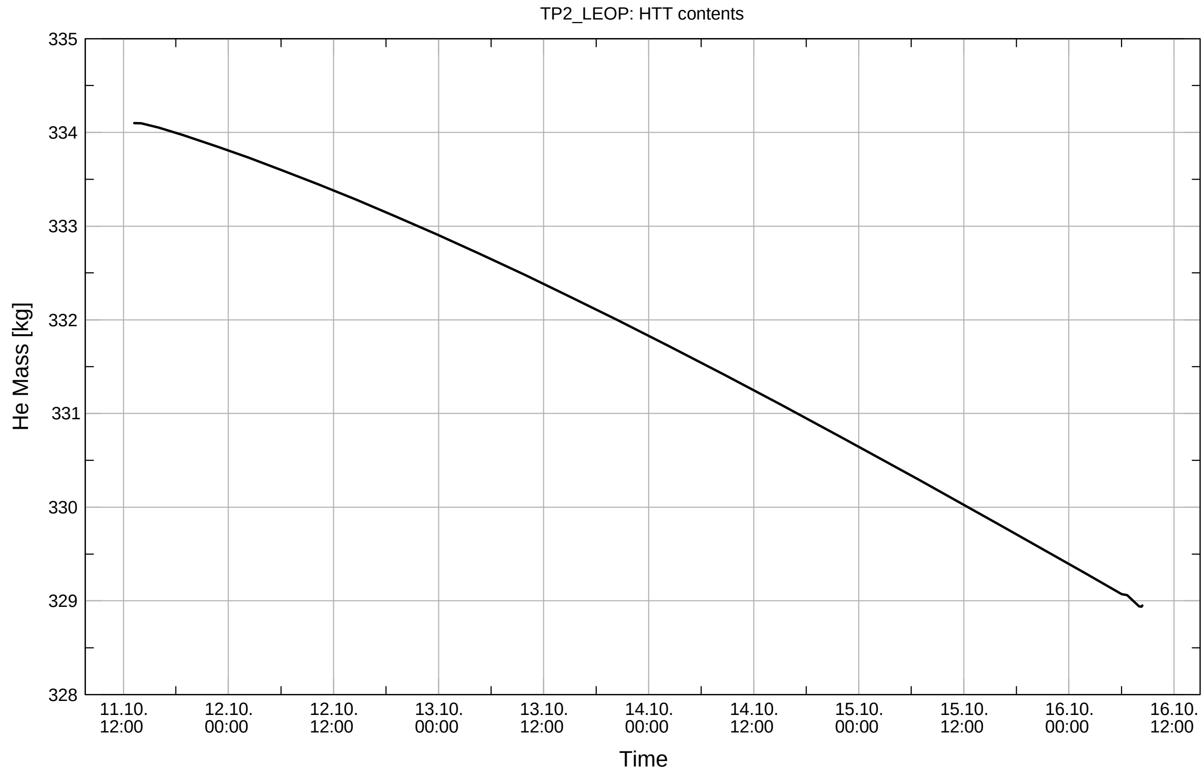


Figure 30: TP2 HTT contents

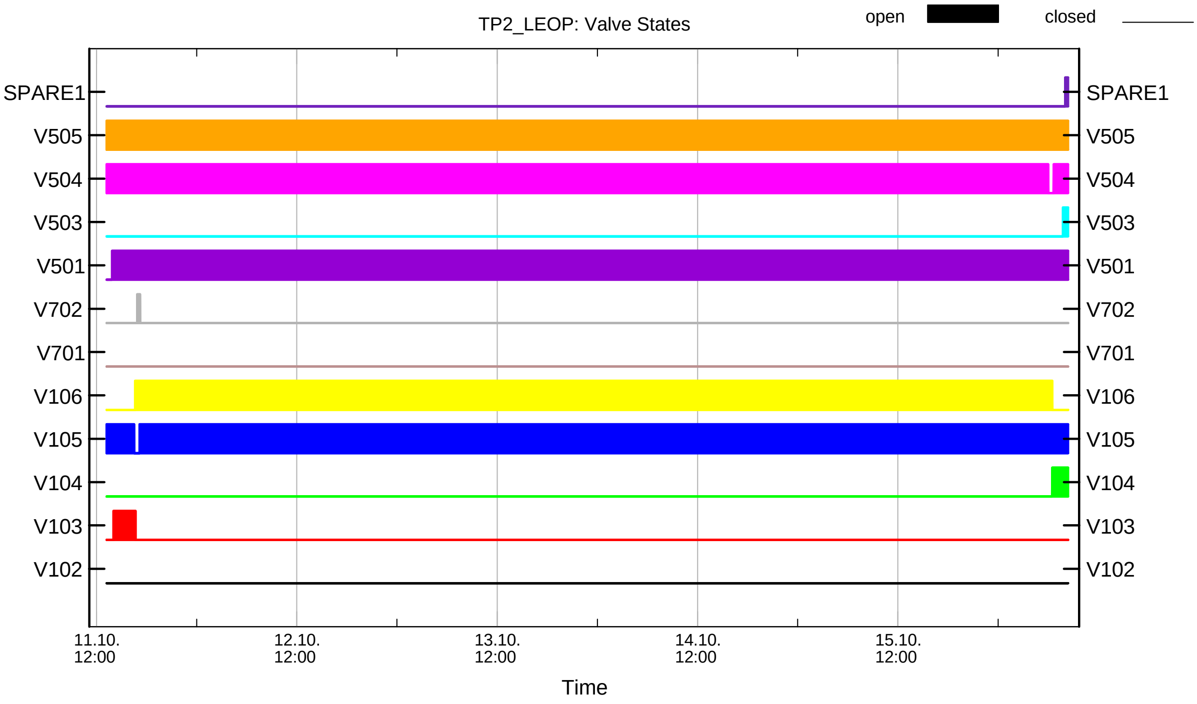


Figure 31: TP2 valve states

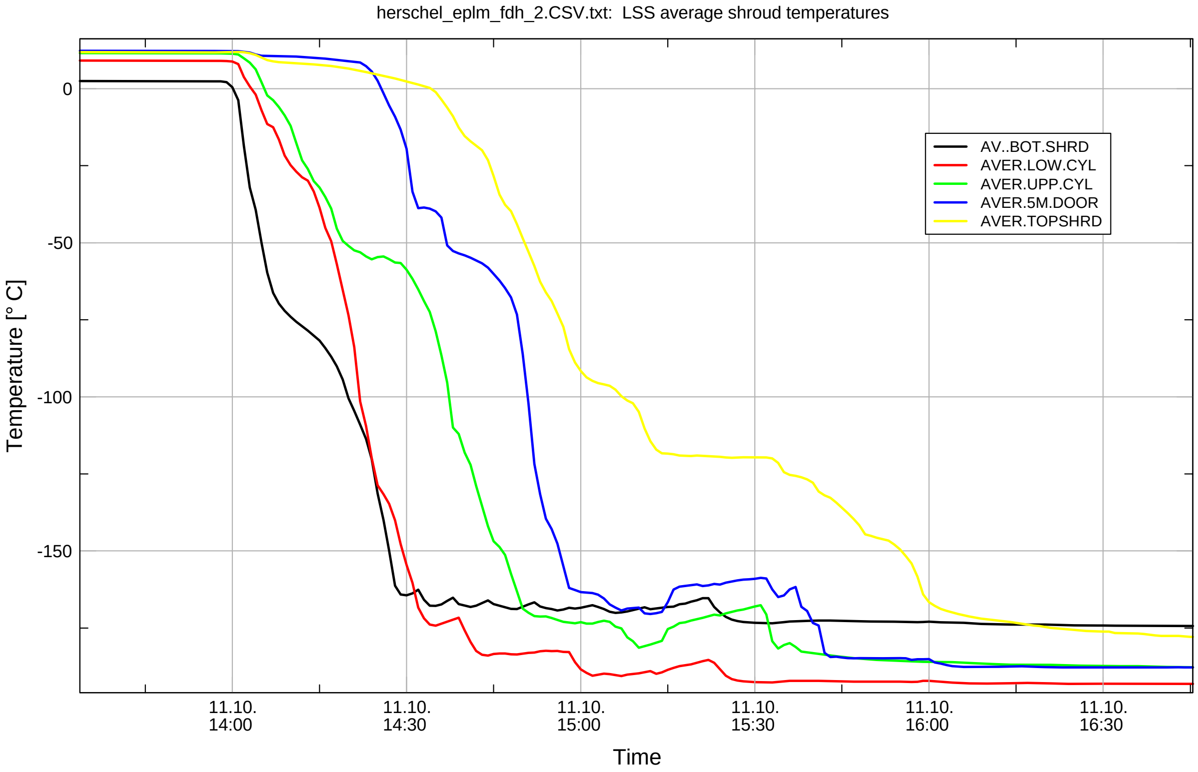


Figure 32: TP2 LSS shroud temperatures during cool-down

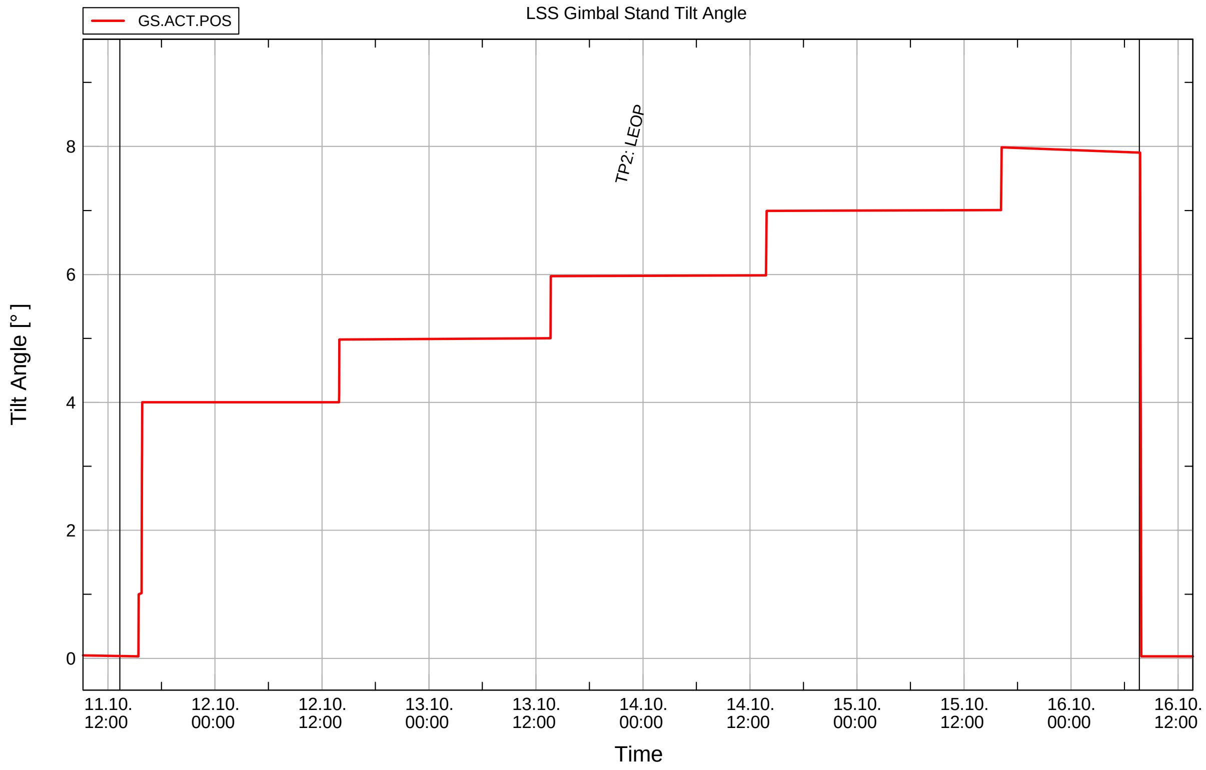


Figure 33: TP2 Gimbal Stand tilt angle during LEOP phase

3.4 TP 3 – Rapid Cool-Down

The achievable mass flow rate via the test valve (bypassing the nozzles) was smaller than expected.

The total consumed He mass in TP 3, calculated from CVSE_004 sensor integral, was 19.79 kg.

3.4.1 Procedure Variations

PVS 6: Assess impact of venting via V102 or V104 on HTT heat load, no significant impact detected.

PVS 7: HTT completely closed at end of cool-down to accelerate shields warm-up and achieve reference measurement of HTT heat load.

PVS 8: HOT forced cool-down: Opening all HOT valves did not have significant impact on HOT cool-down rate

PVS 9: SCOE powered off for 1 hour to exclude SCOE failure as reason for HTT heat load. No impact.

PVS 10: PPS start-up and nozzle switching tests: Detection of sfHe film covering the HTT upper B/H. Unclear behavior of PPS and small mass flow rate leads to decision to vent through V106 during TP4

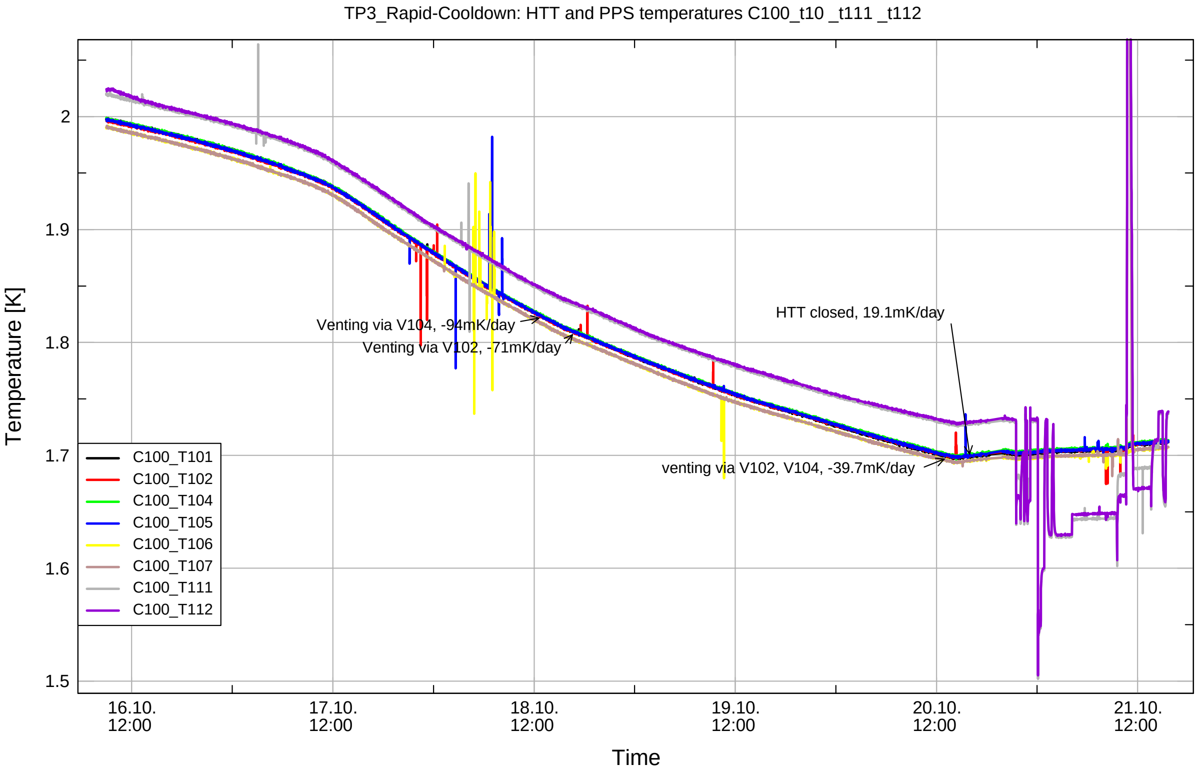


Figure 34: TP3 HTT temperatures

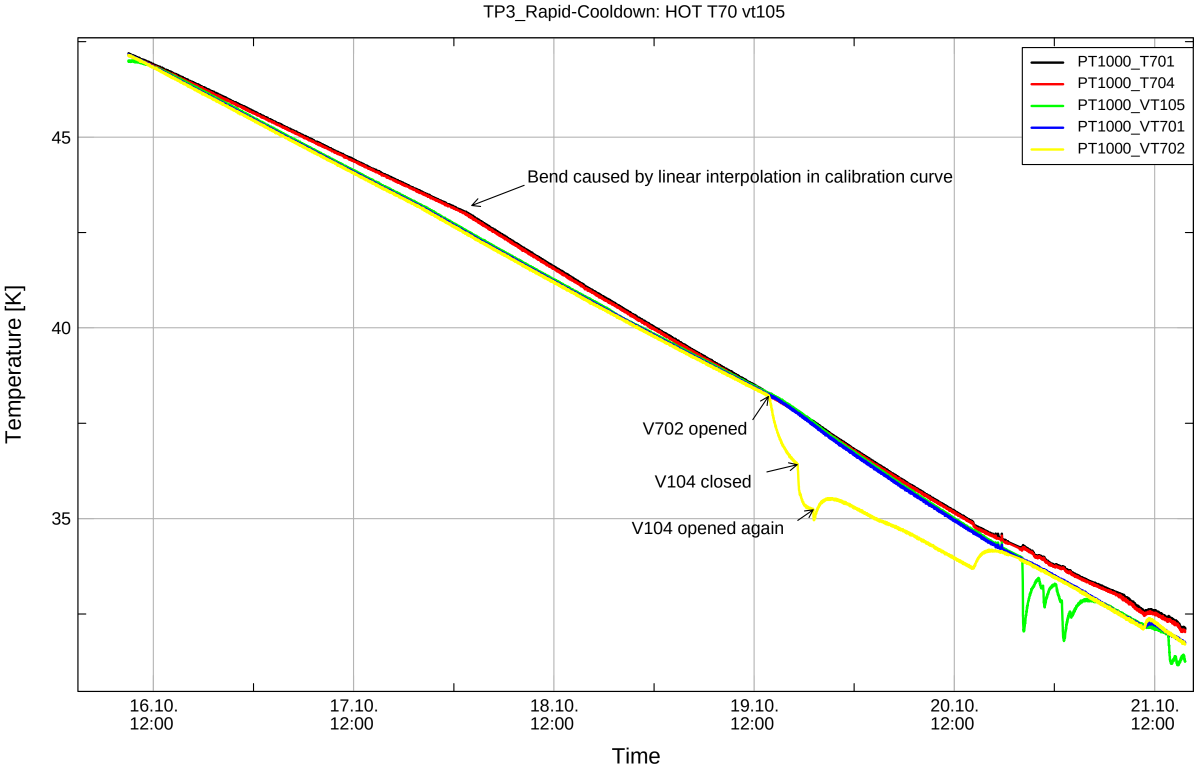


Figure 35: TP3 HOT and lower SFW valve temperatures

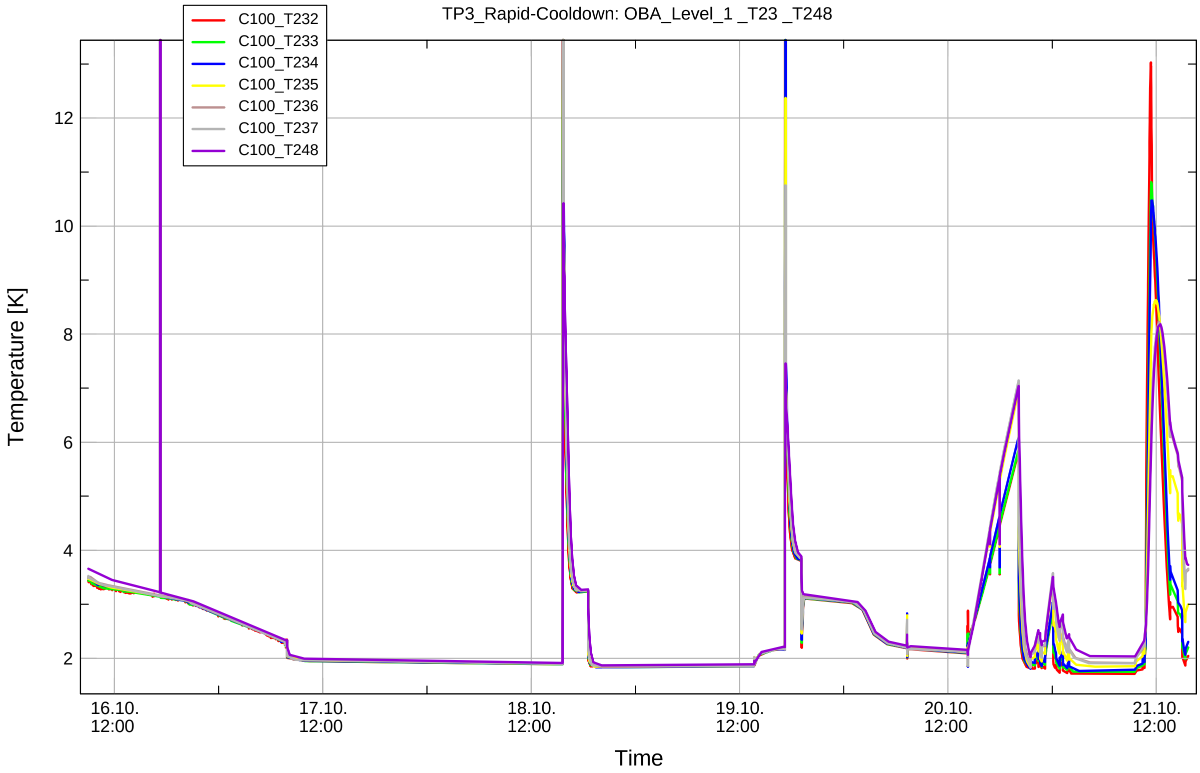


Figure 36: TP3 OBA Level 1 temperatures

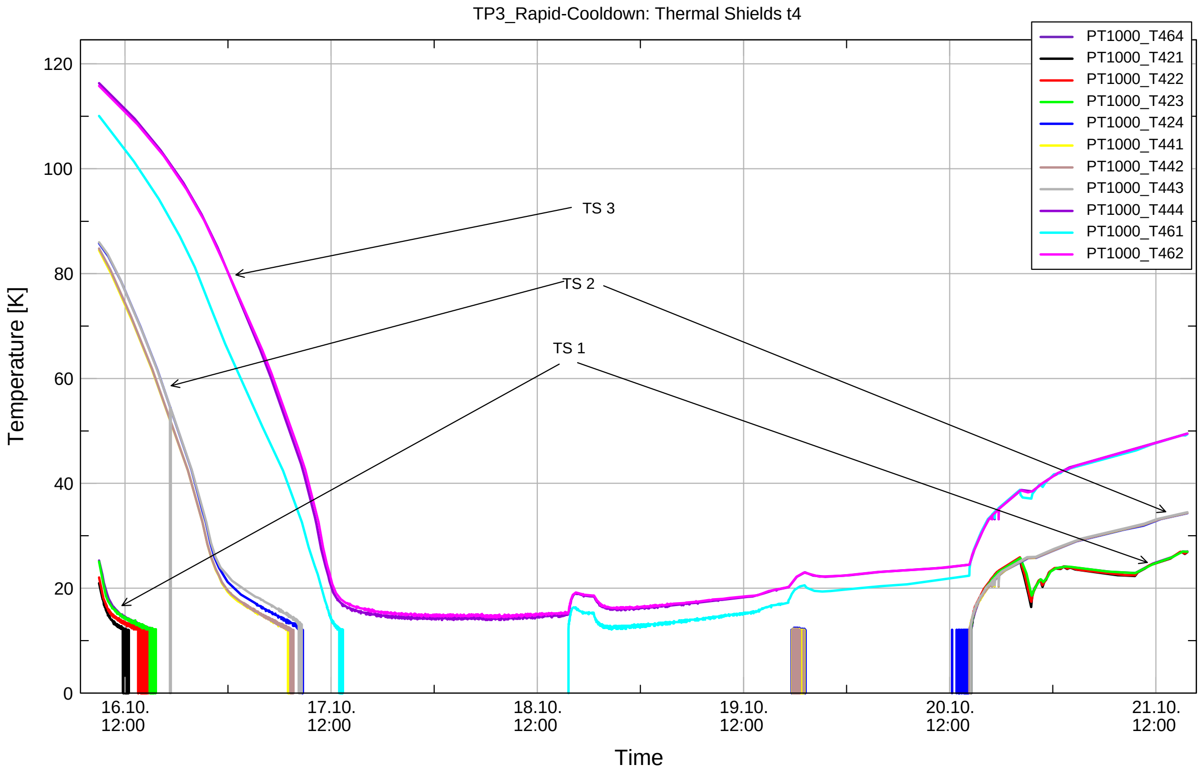


Figure 37: TP3 Thermal shields temperatures

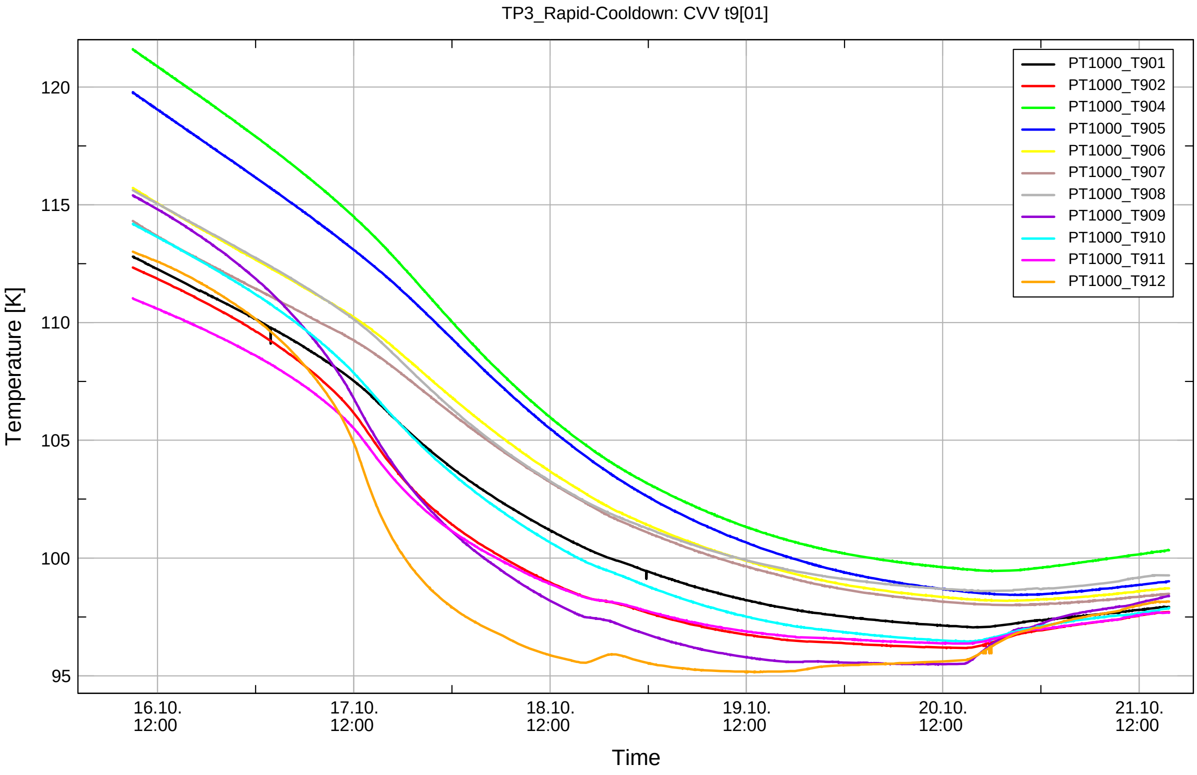


Figure 38: TP3 CVV temperatures

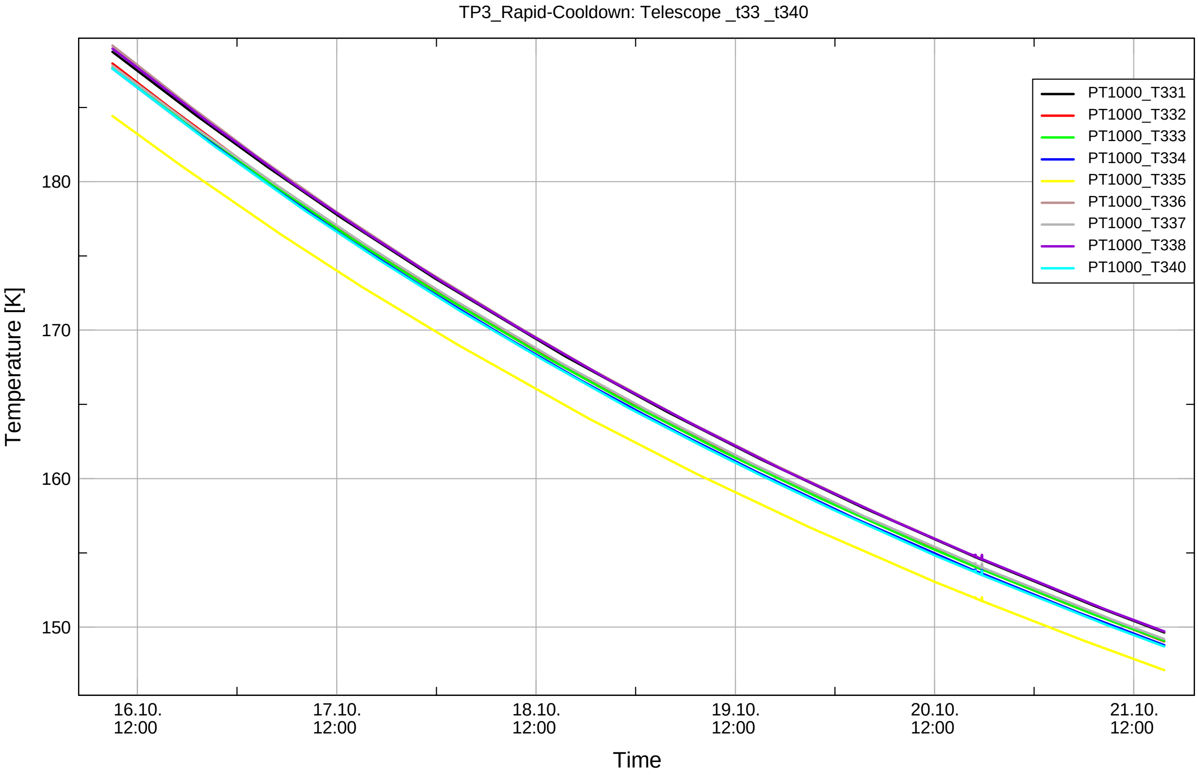


Figure 39: TP3 Telescope dummy temperatures

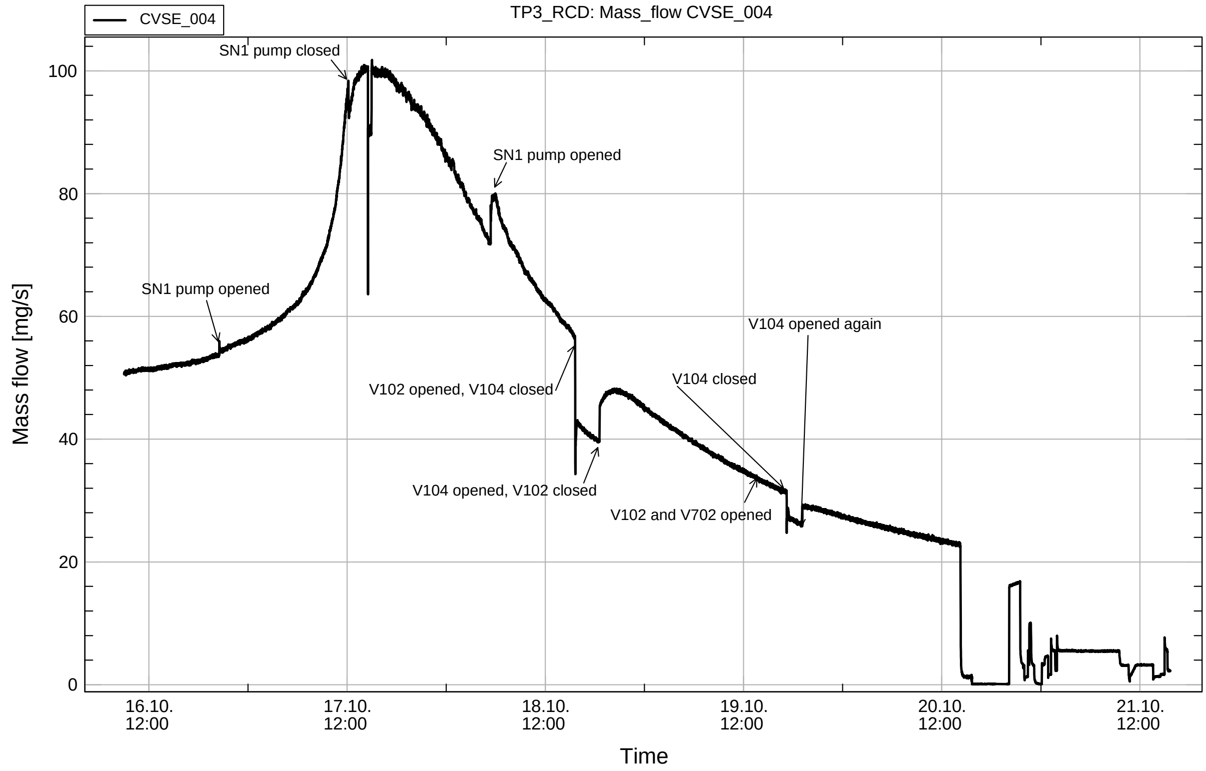


Figure 40: TP3 mass flow rate

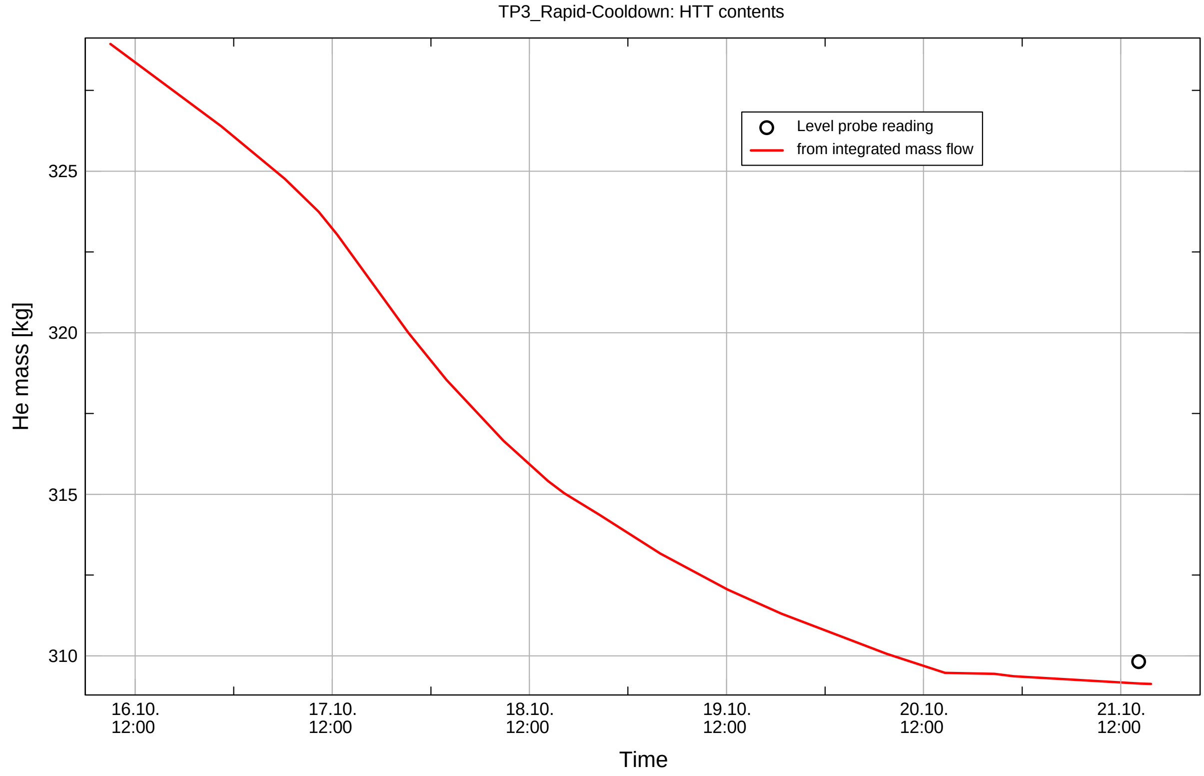


Figure 41: TP3 HTT contents

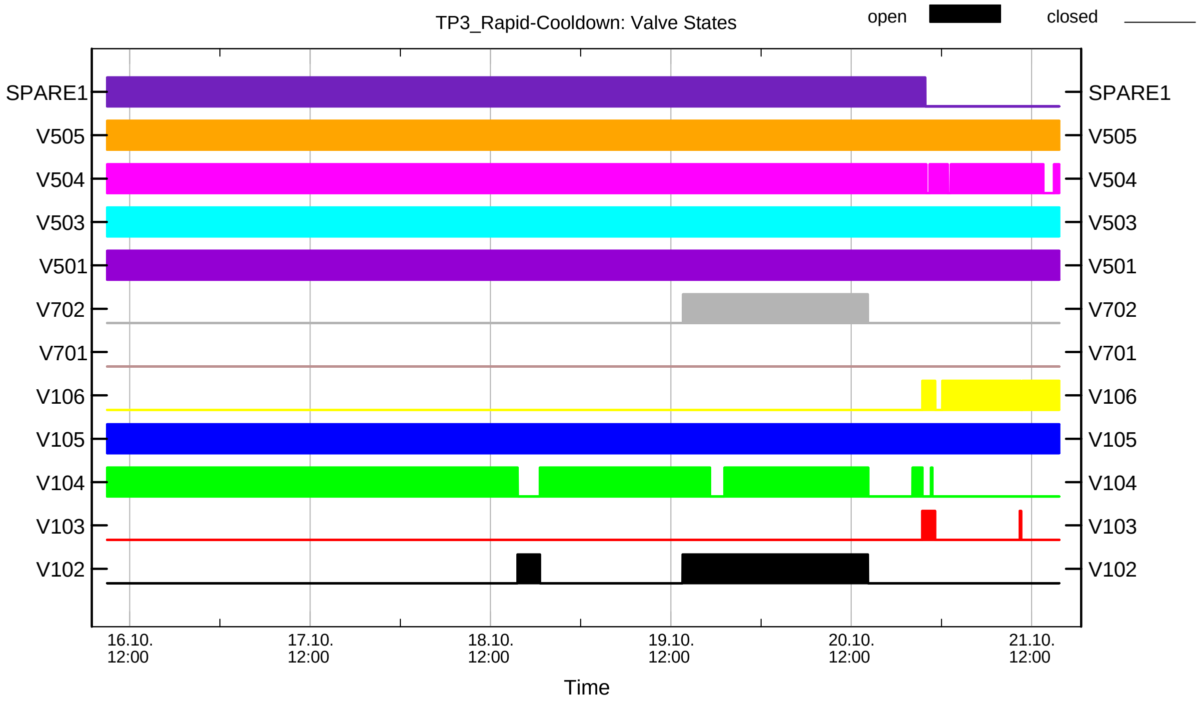


Figure 42: TP3 valve states

3.5 TP 4 – TV Phase 1

The MTD heaters were operated as planned during the TV phase 1, and sufficiently stable conditions have been reached within the predicted time frames.

Without electrical dissipations, the vent line temperatures between sensors T234 and T235/T236 increases by 1.3 K at 2.23 mg/s mass flow, indicating a parasitic heat load of ~15mW.

During TP4, the HTT temperature increased from 1.713K to 1.738K, i.e. 14.4mK/day or ~160 mW total heat load (expected increase ~0K/day).

The He consumption during TP4 was 0.427 kg.

Evaluation of instrument interfaces is reported in [RD25].

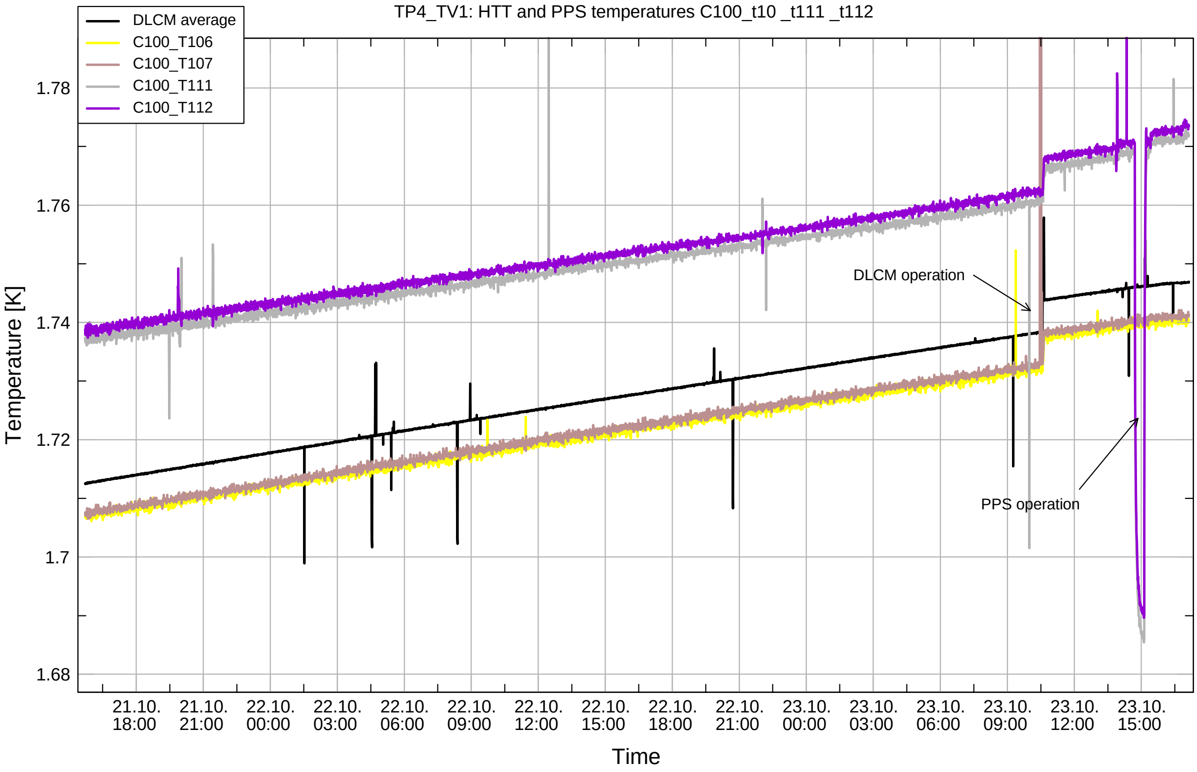


Figure 43: TP4 HTT temperatures

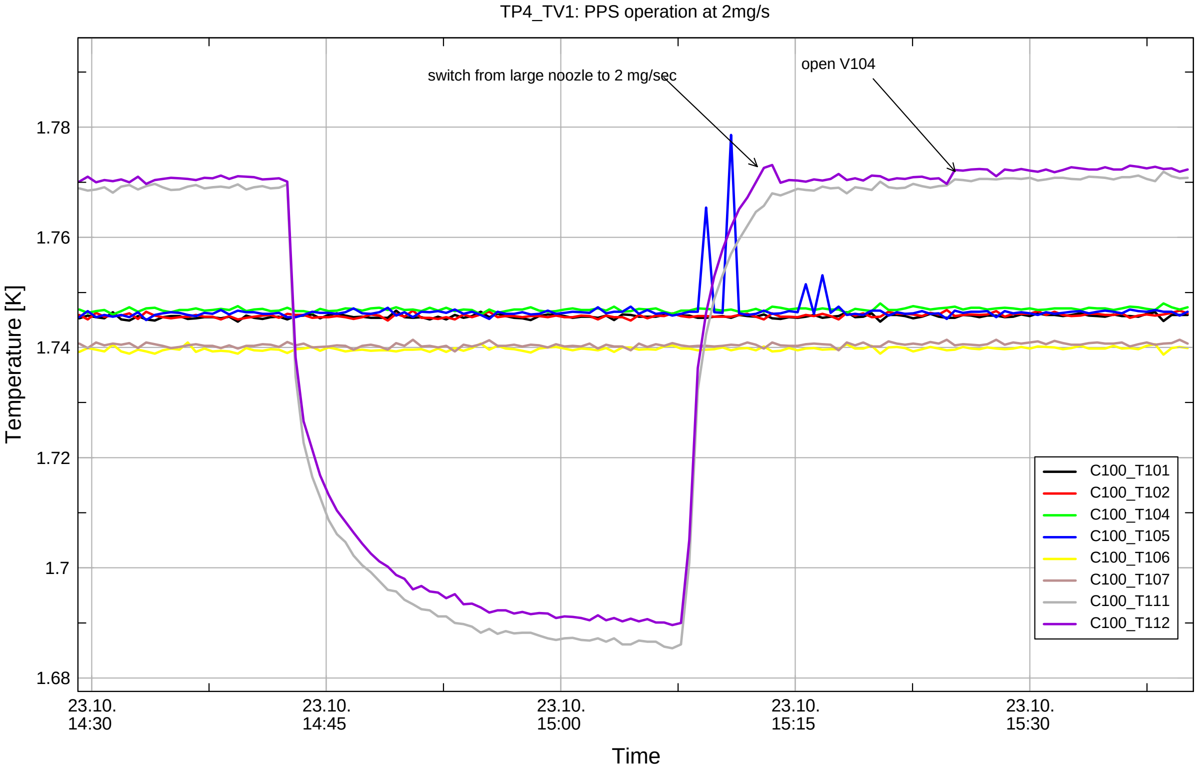


Figure 44: TP4 PPS operation and switching to 2mg/s

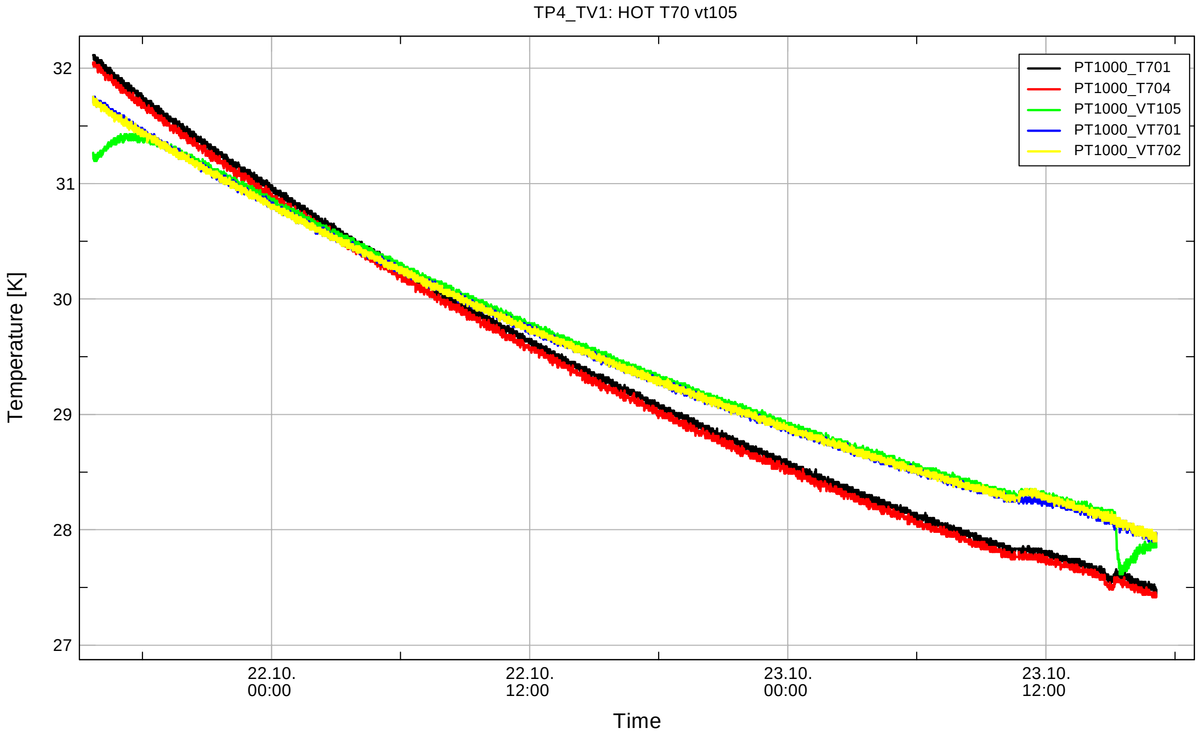


Figure 45: TP4 HOT and lower SFW valve temperatures

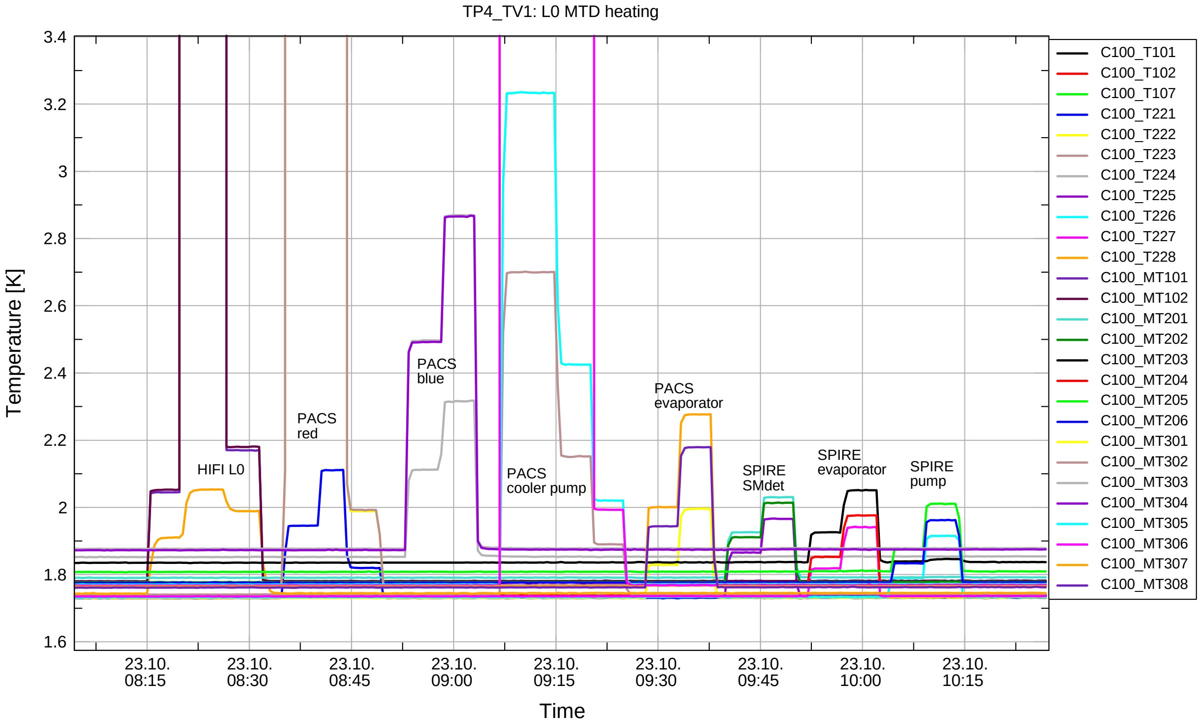


Figure 46: TP4 Temperatures during L0 heaters operation

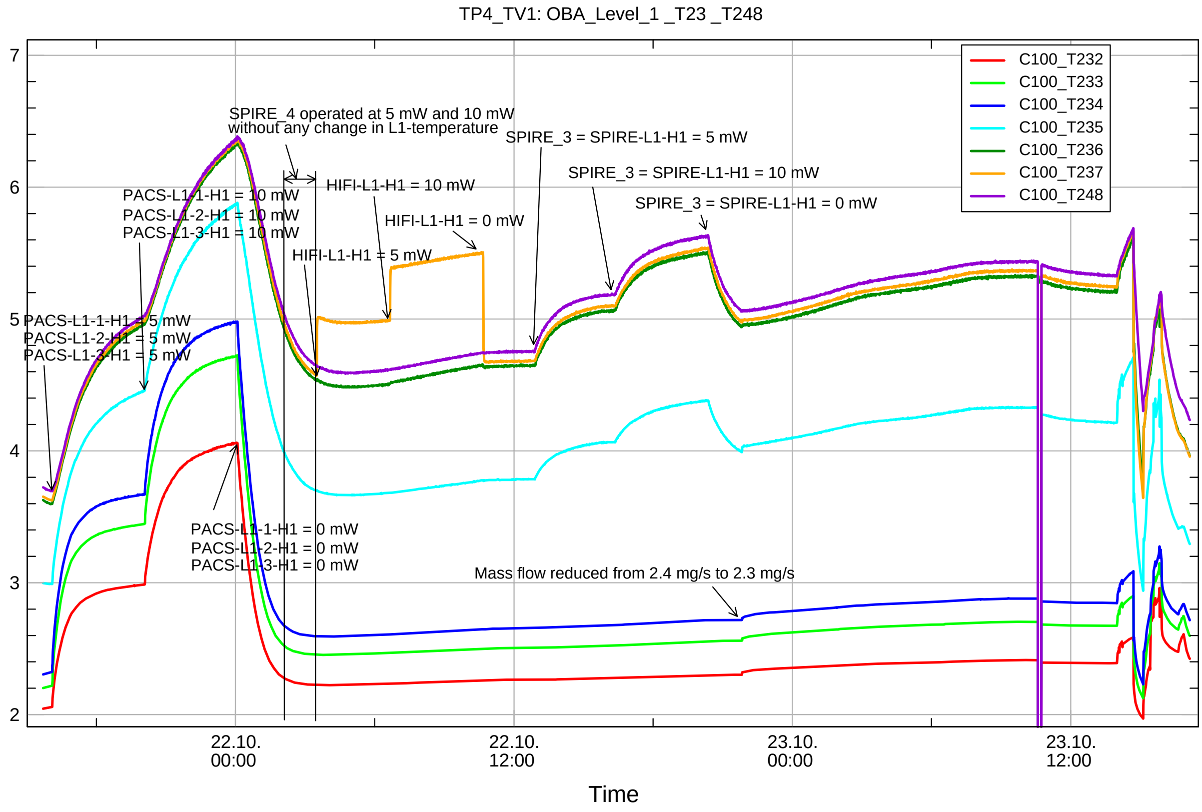


Figure 47: TP4 OBA Level 1 temperatures

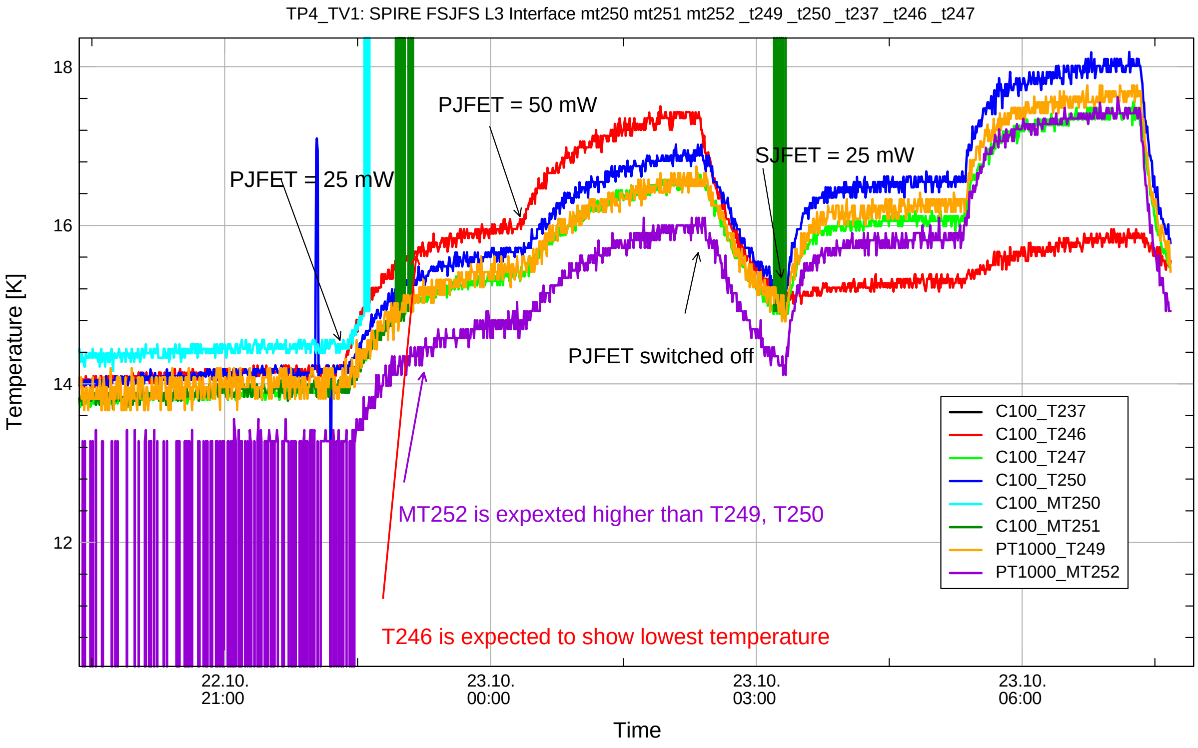


Figure 48: TP4 OBA Level 3 temperatures during L3 heater operation

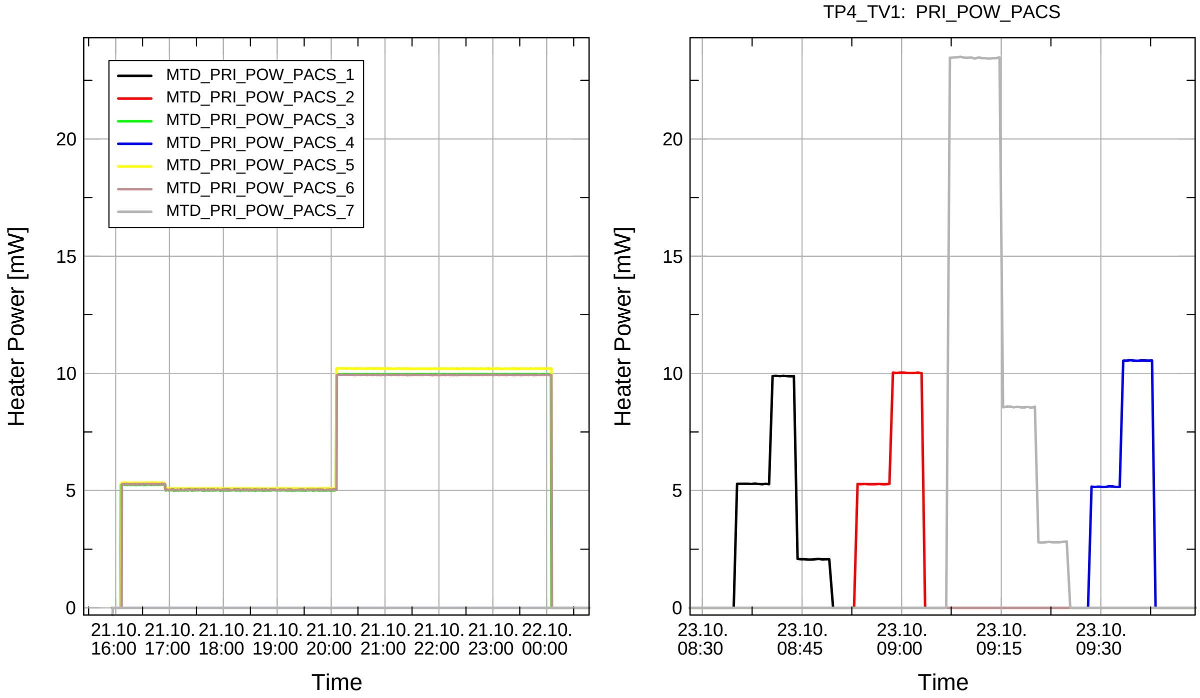


Figure 49: TP4 PACS MTD heater power

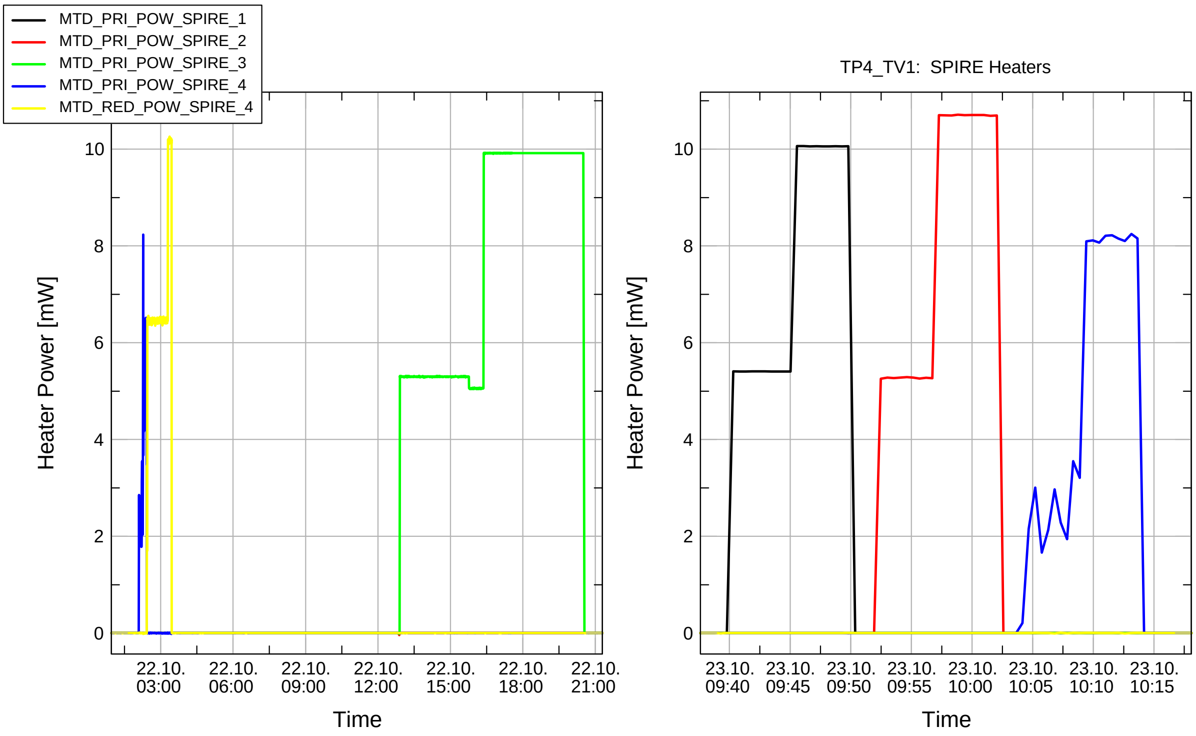


Figure 50: TP4 SPIRE MTD heater power

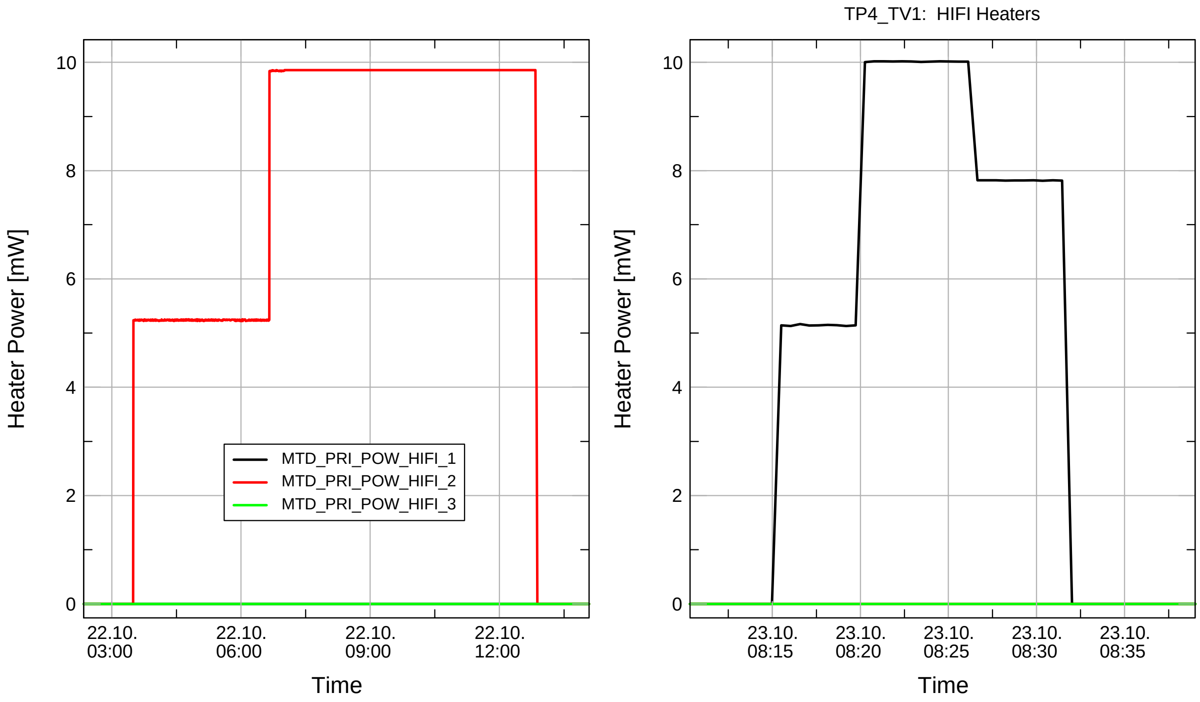


Figure 51: TP4 HIFI MTD heater power

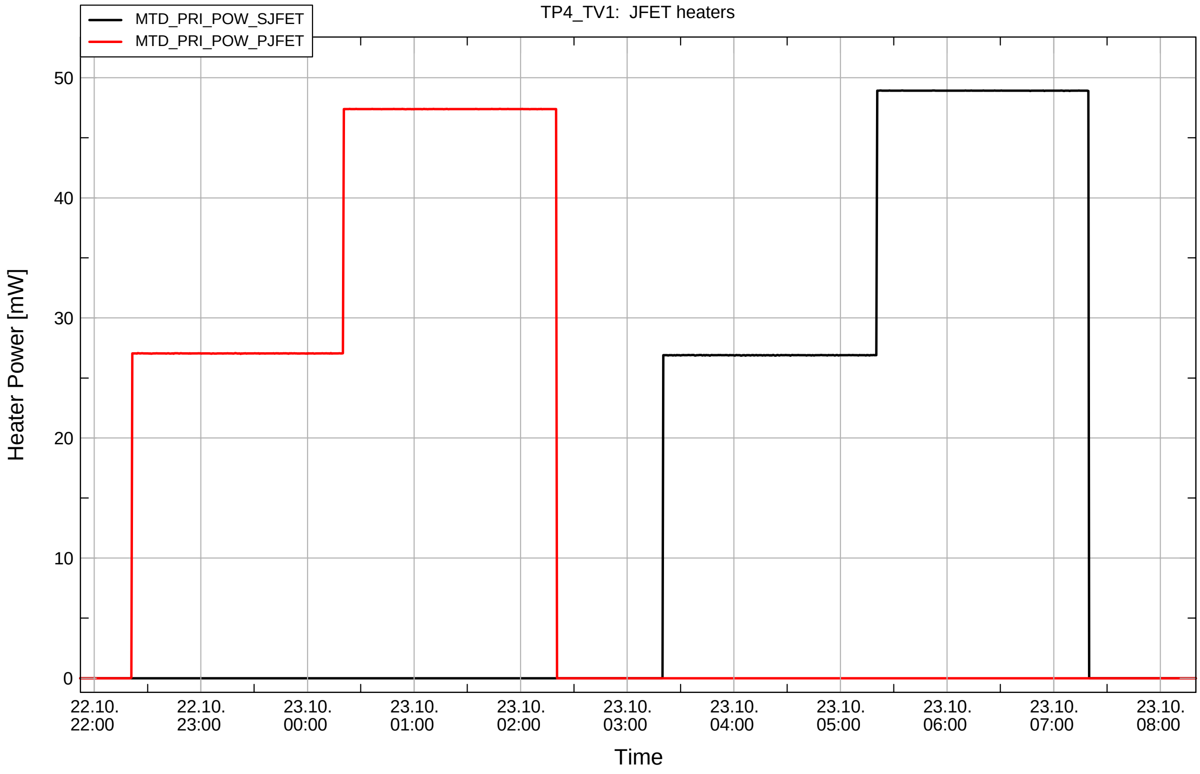


Figure 52: TP4 JFET MTD heater power

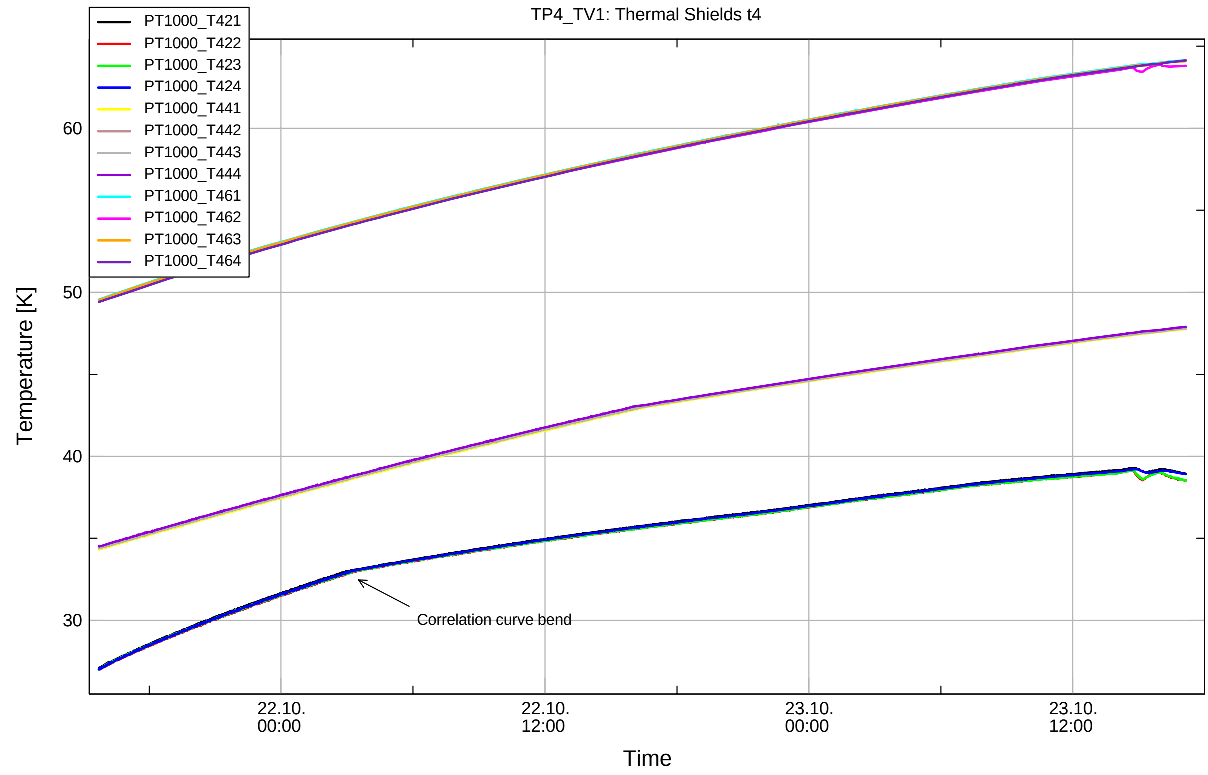


Figure 53: TP4 Thermal shields temperatures

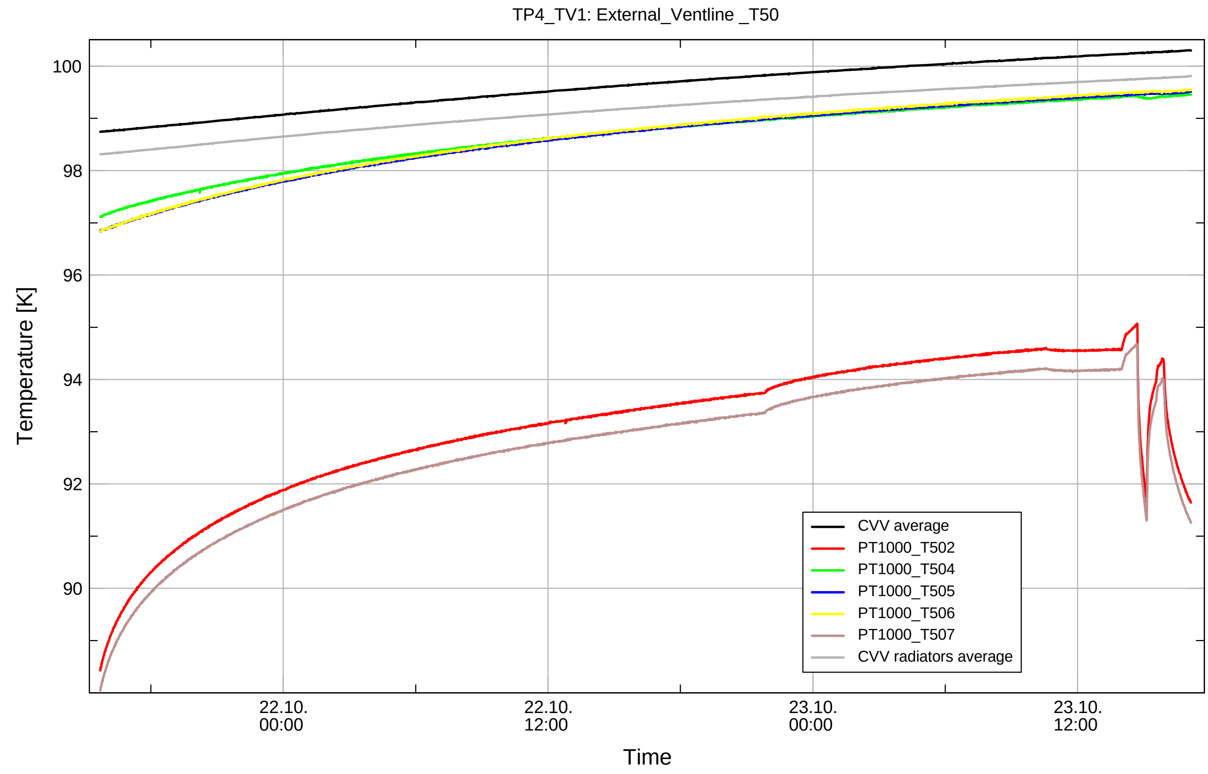


Figure 54: TP4 CVV temperatures

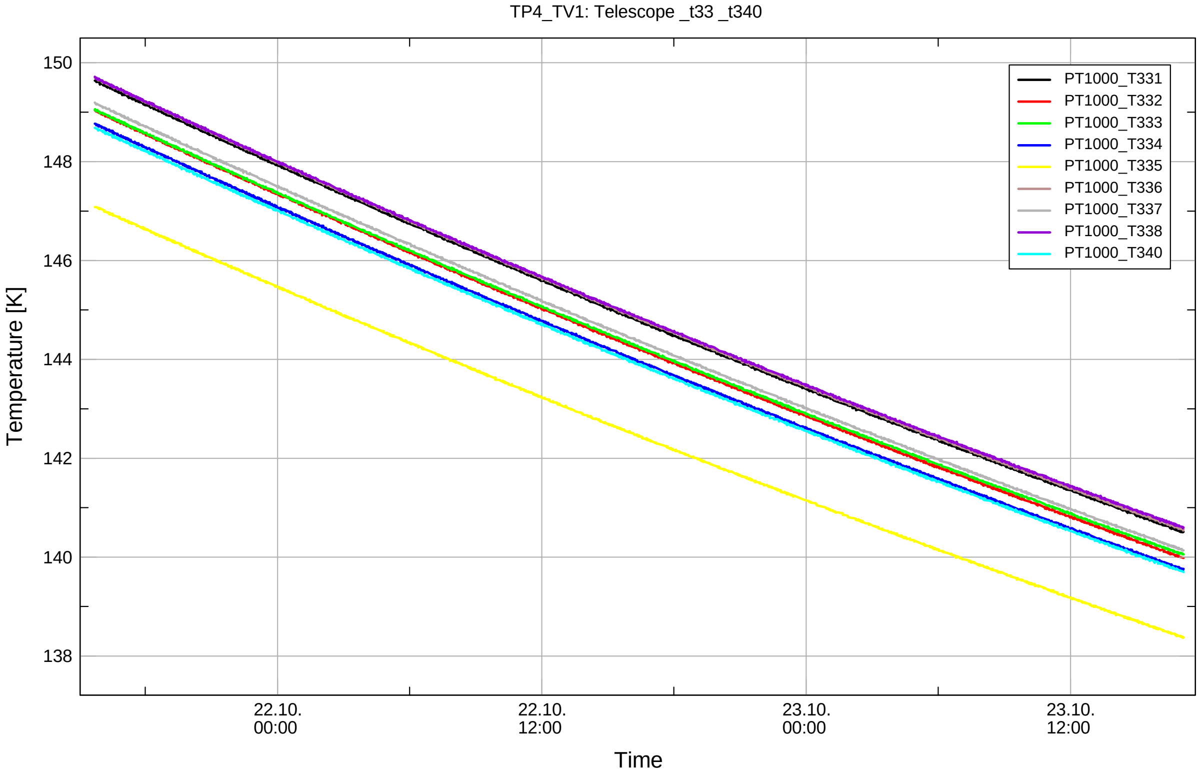


Figure 55: TP4 Telescope dummy temperatures

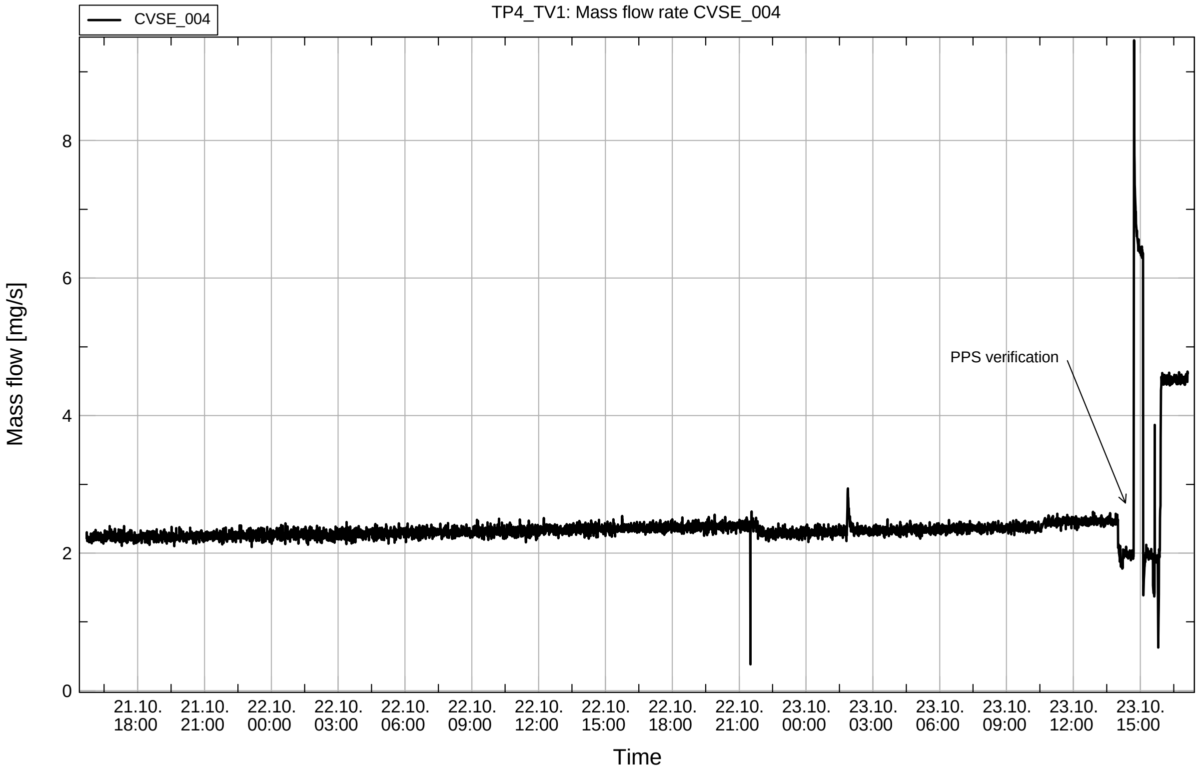


Figure 56: TP4 mass flow rate

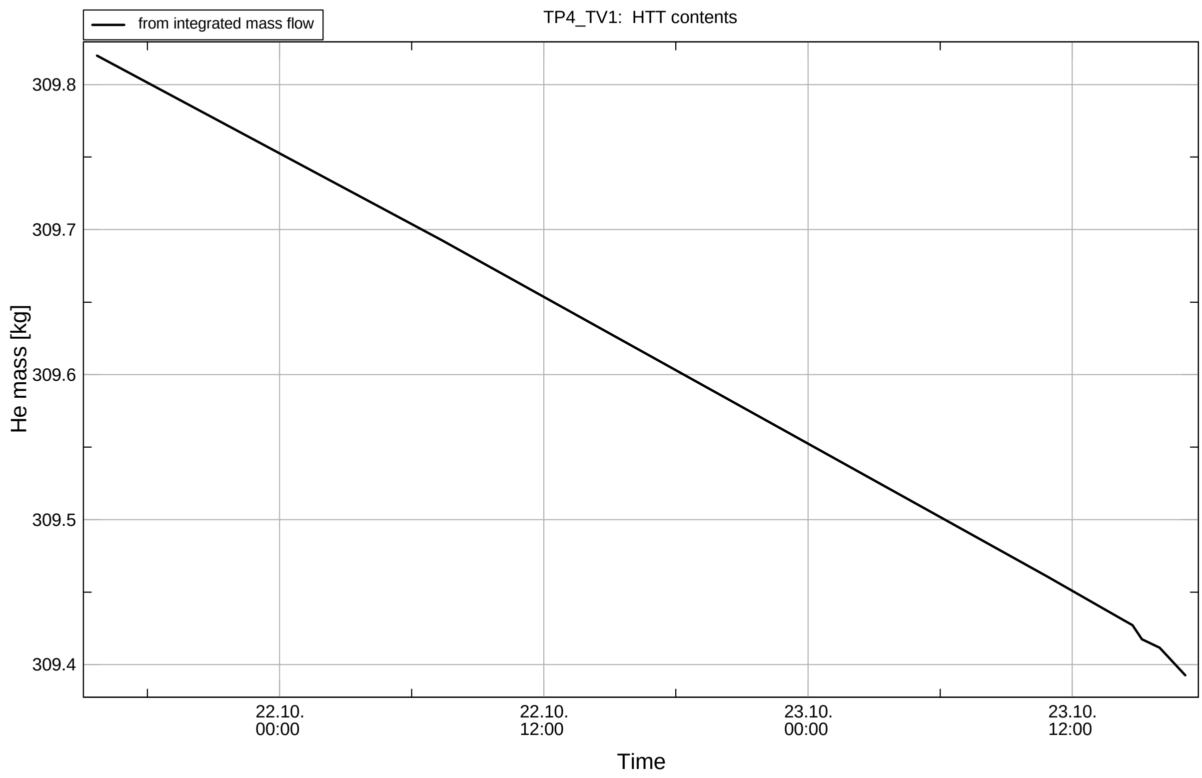


Figure 57: TP4 HTT contents

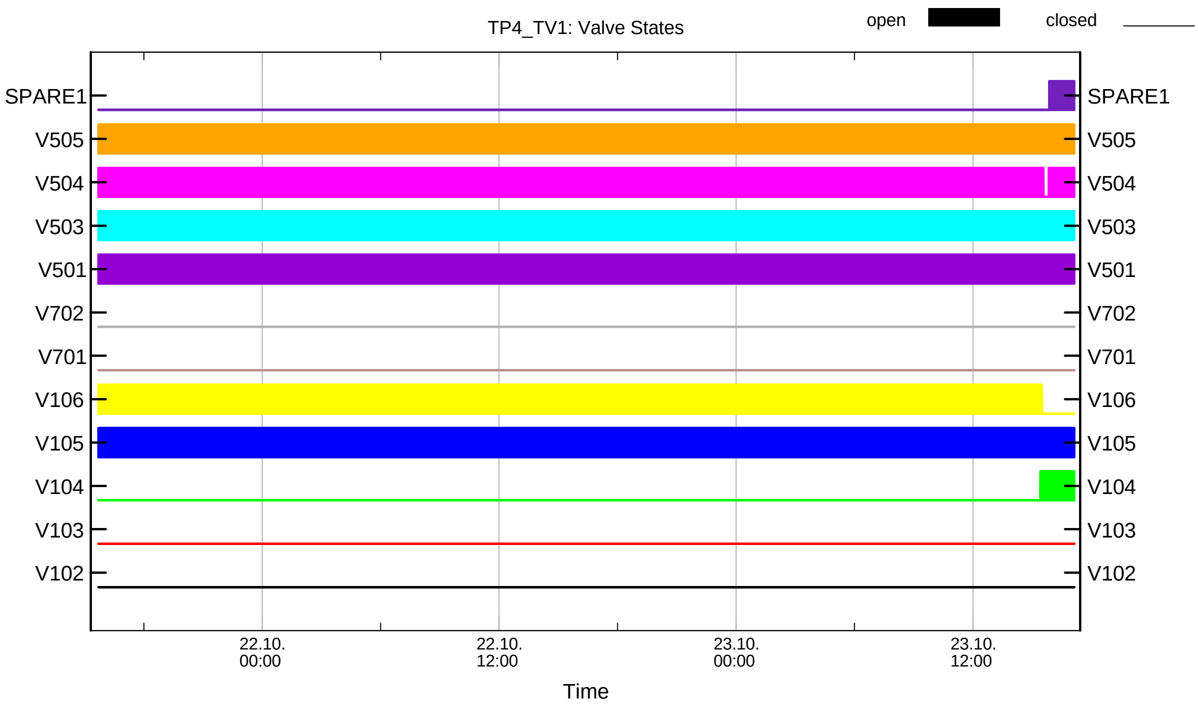


Figure 58: TP4 valve states

3.5.1 Procedure Variations

PVS 11: L0 MTD heaters operated in 2 power steps each, see Figure 46.

PVS 12: Simulation of PPS switching from big to small nozzles, PPS operation confirmed, see Figure 44. Measurement of pressure drop via V104 and small nozzles.

3.6 TP 5 – TB Phase 1

The balance phase 1 (TP5) procedure was redefined during the TP4 TRB (see HP-2-ASED-MN-1086). Due to the high HTT heat load, a temperature drift of the HTT is accepted during the TB1phase, and the mass flow rate was regularly re-adjusted to 4.5mg/s. This approach is reflected in PVS 13. On the 28.10.2005, the decision was made to make no further corrections of the mass flow rate and to let it drift until the end of the phase.

Without obvious cause, the L1 temperatures started to rise sharply against their previous trend at 17:33 on 23.10.2005 (a few minutes after the HTT liquid level probes had been read out). At this time, the temperature in the middle of the L1 OBHCL (T235) began to oscillate, see Figure 62. The reason for this behaviour is unclear; a change in the heat transfer from gas to wall is considered a possible candidate.

The HOT outlet valve V105 was closed at 12:25 on 24.10.2005. At the same time, a further increase in the OBHCL L1 temperatures was observed. Reason is unclear.

Needle valve adjustments were performed regularly. A high sensitivity of the mass flow rate even to very small changes of the needle valve (NV) was observed. On 26.10.2005 at 20:20, the mass flow increased after closing the NV by 0.02 turns. In order to reduce the sensitivity of the NV, the TVQM3 was closed and the NV was re-adjusted to come back to ~4.5 mg/s.

The TDH temperature sensors (TCs) located on the TTAP which are used for the thermostatic heater control showed a significantly increased number of bad readings (slightly too low). The heater control was changed from thermostatic to fixed current in order to achieve stable TTAP temperatures even in case of a total failure of the TTAP TCs (all routed via the same connector). Covered by ASED NCR 1595.

Equilibrium conditions were reached as follows, see Figure 70 to Figure 74:

- CVV: 24.10.2005 23:45
- TS1: 29.10.2005 02:20 (26.10.2005 08:00, with over swing)
- TS2: 29.10.2005 15:00
- TS3: 29.10.2005 18:30; all stability criteria fulfilled.

Details on temperature gradients are shown in [RD24].

The HTT temperature drift at this time was ~4.3mK/day, HOT drift -0.61K/day, mass flow rate 4.6mg/s.

A total of 2.37 kg He were consumed during TP 5, the filling level decreased from 89.9% to 89.2%.

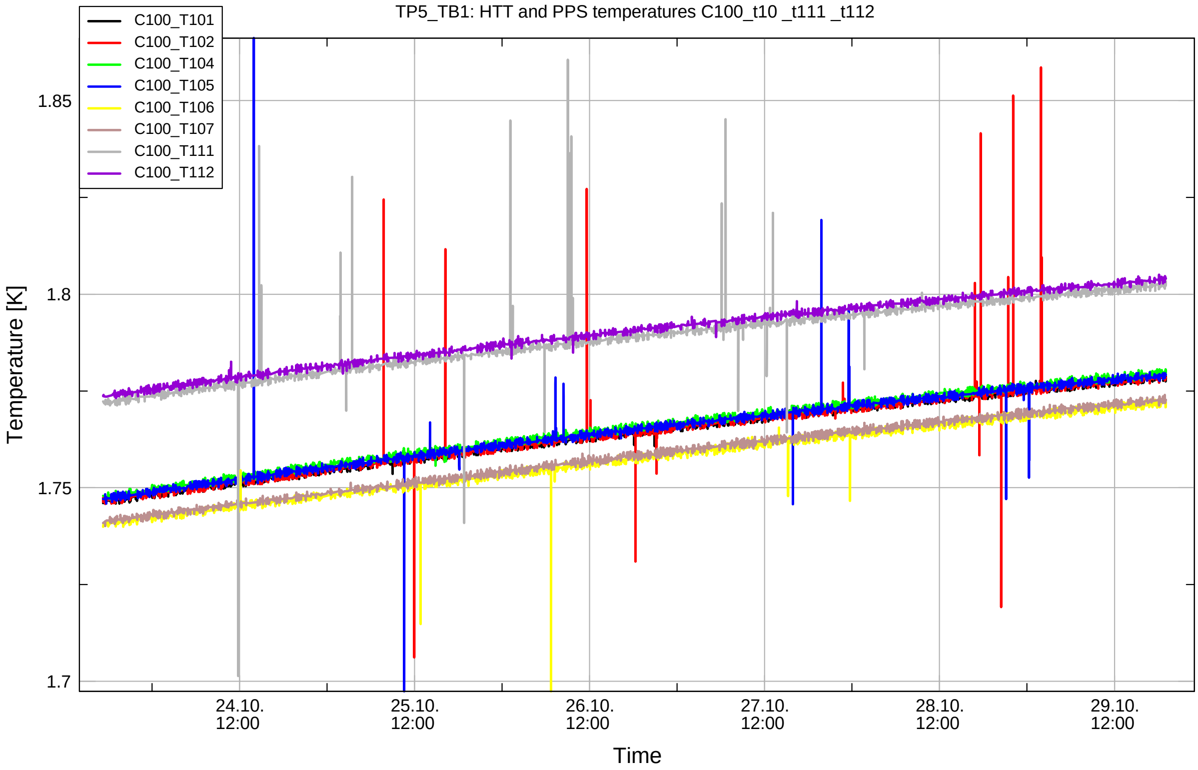


Figure 59: TP5 HTT temperatures

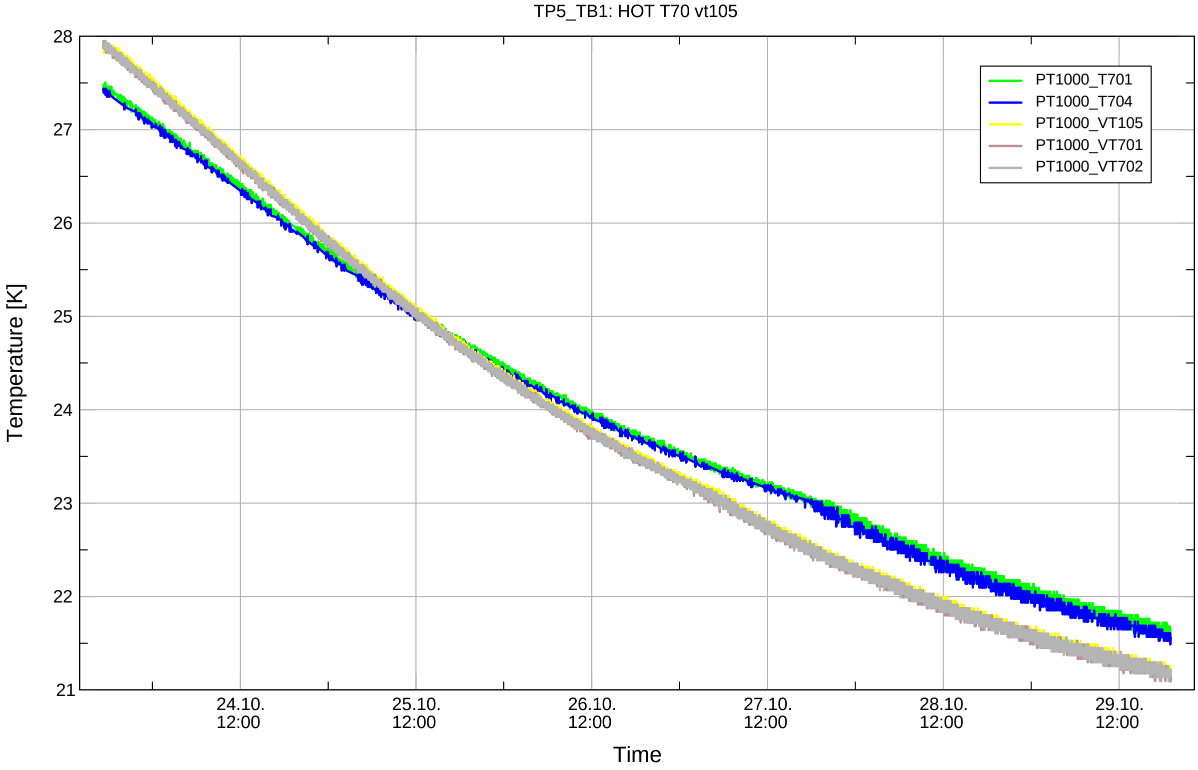


Figure 60: TP5 HOT and lower SFW valve temperatures

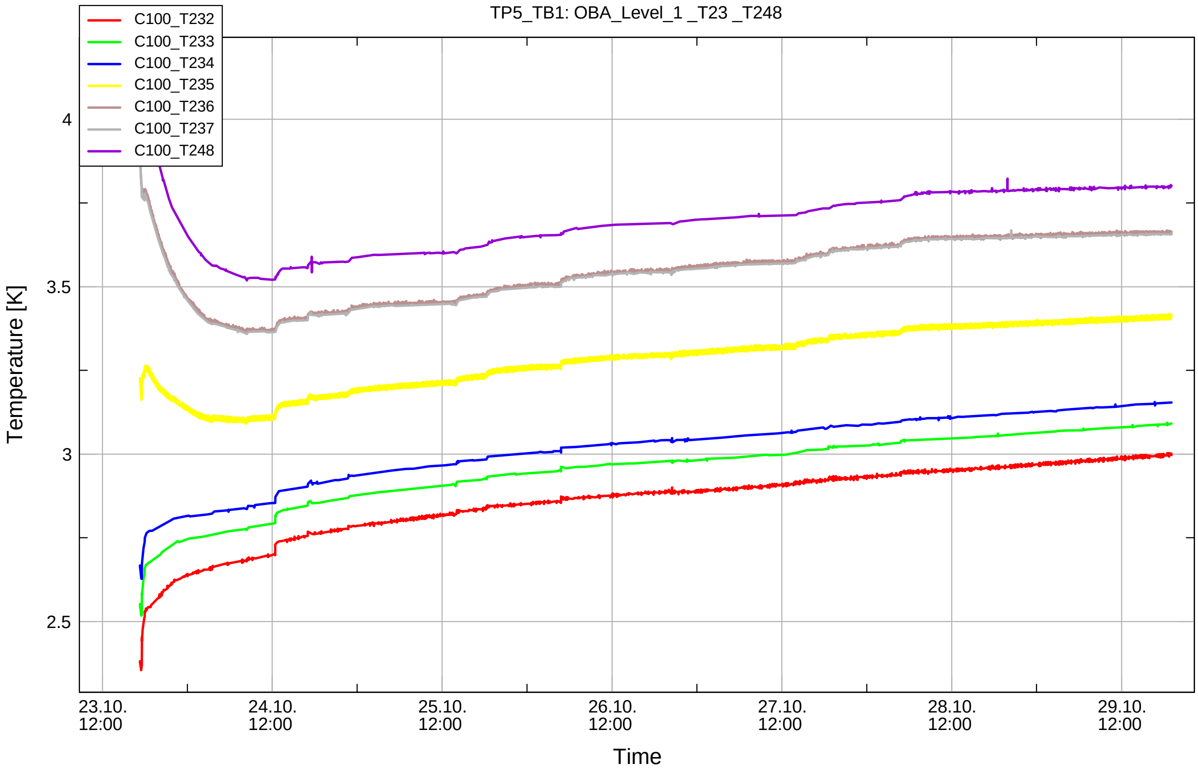


Figure 61: TP5 OBA Level 1 temperatures

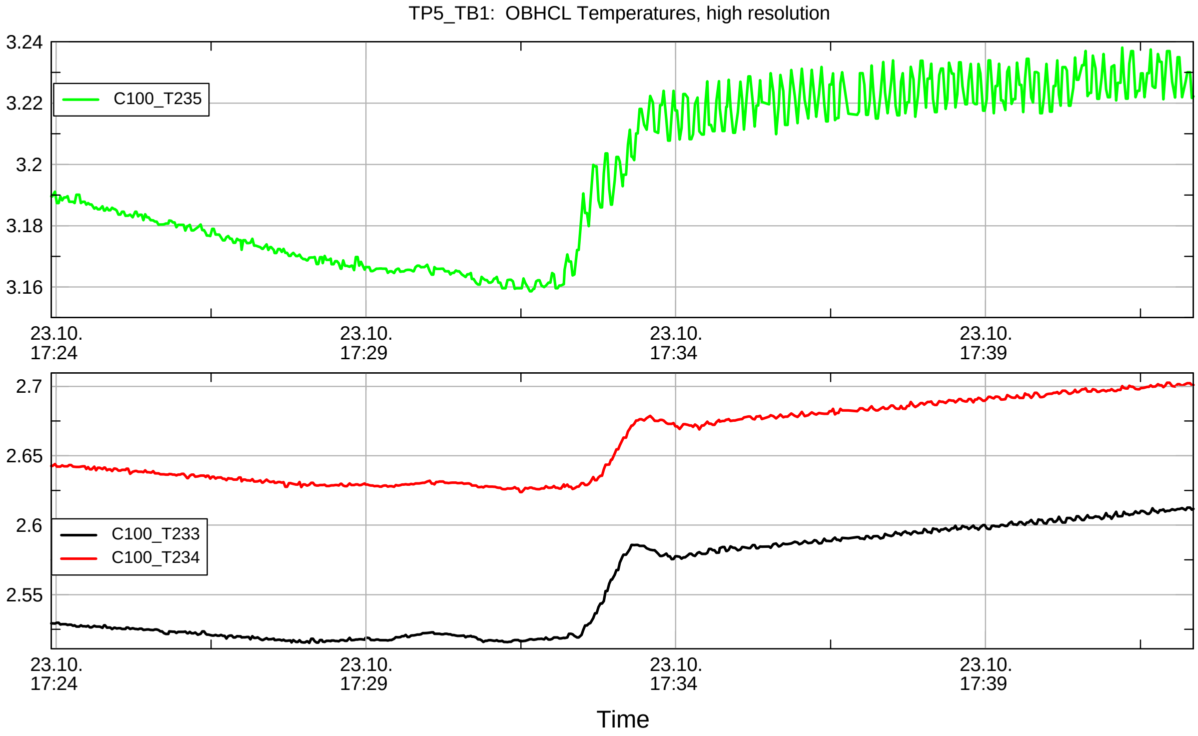


Figure 62: TP5 OBA Level 1 temperature oscillations

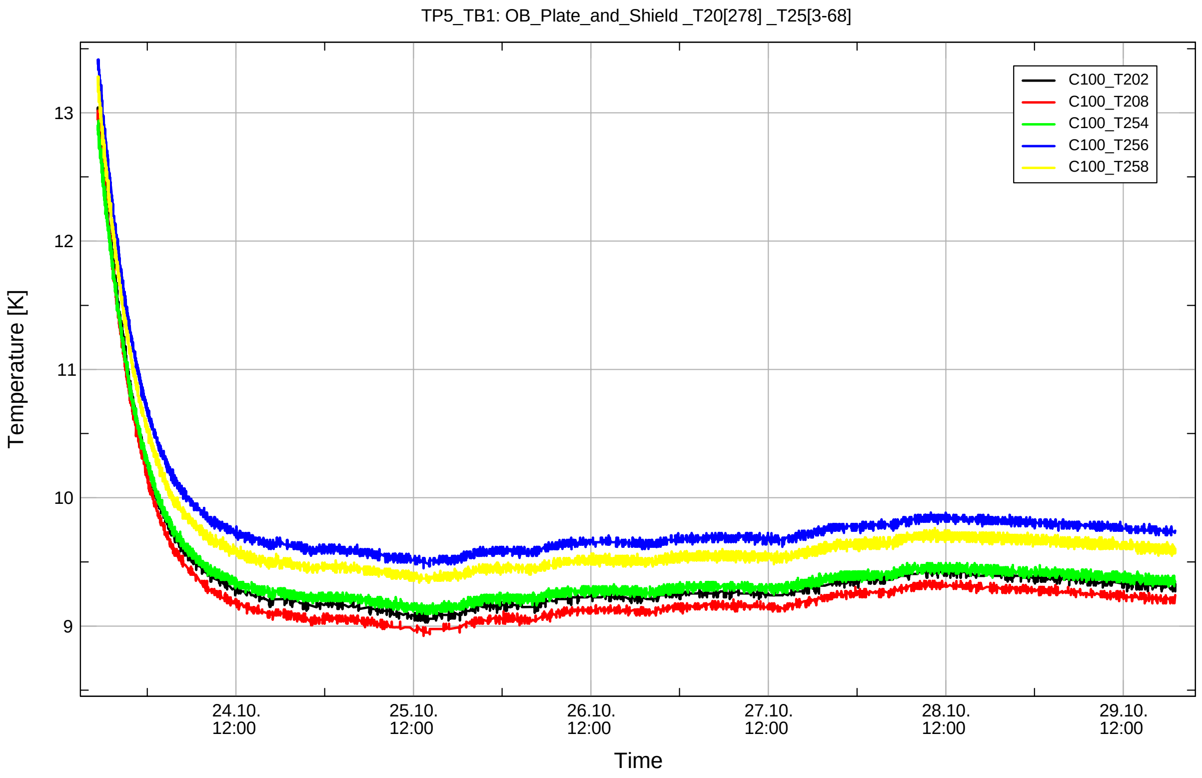


Figure 63: TP5 OB plate and shield temperatures

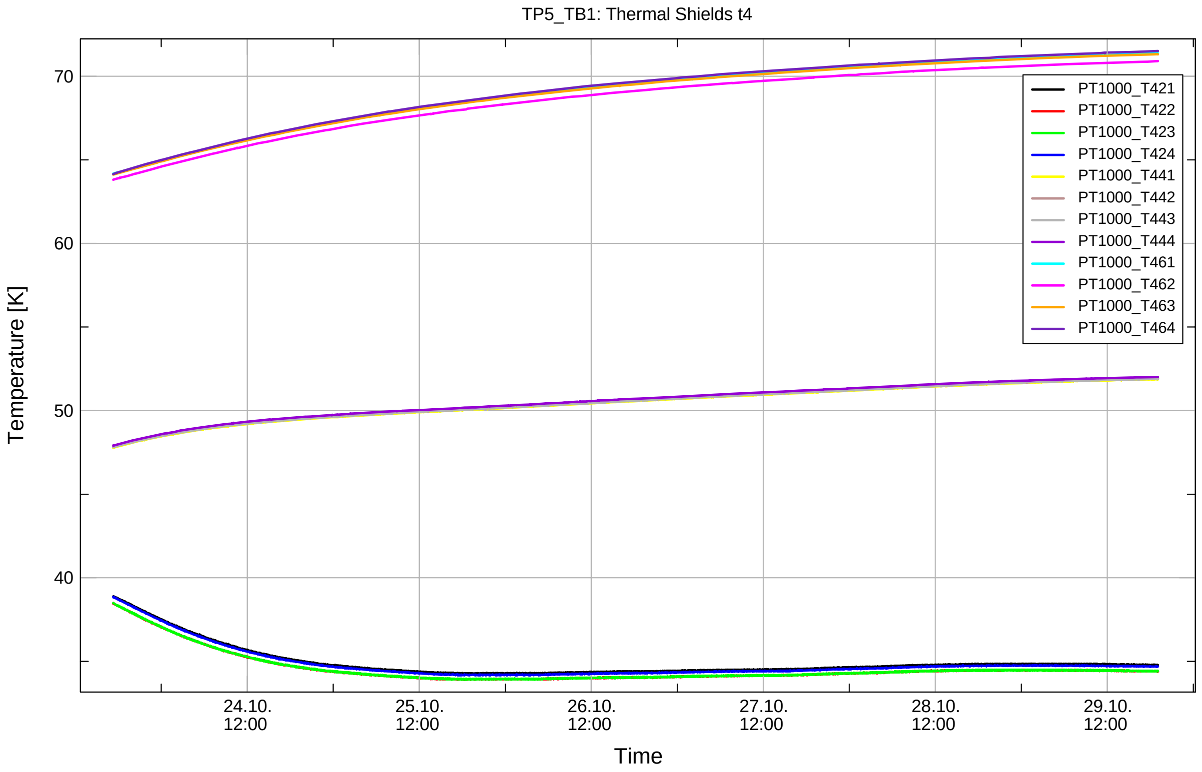


Figure 64: TP5 Thermal shields temperatures

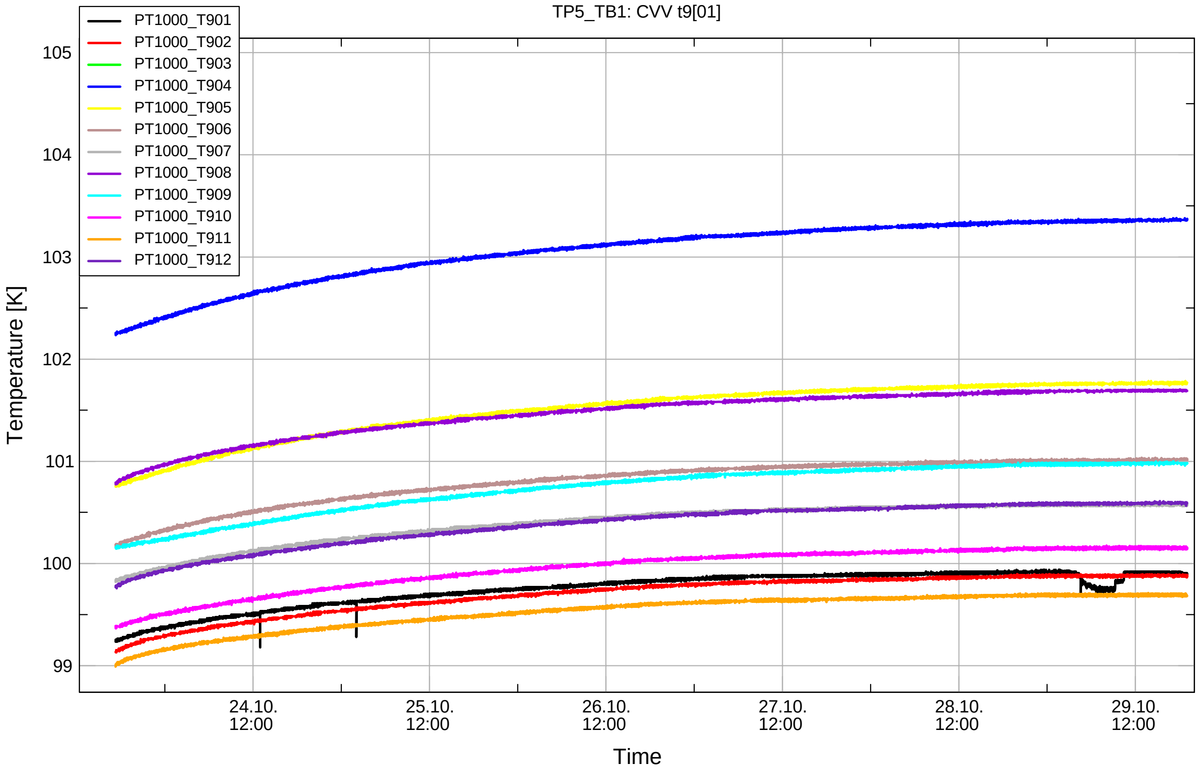


Figure 65: TP5 CVV temperatures

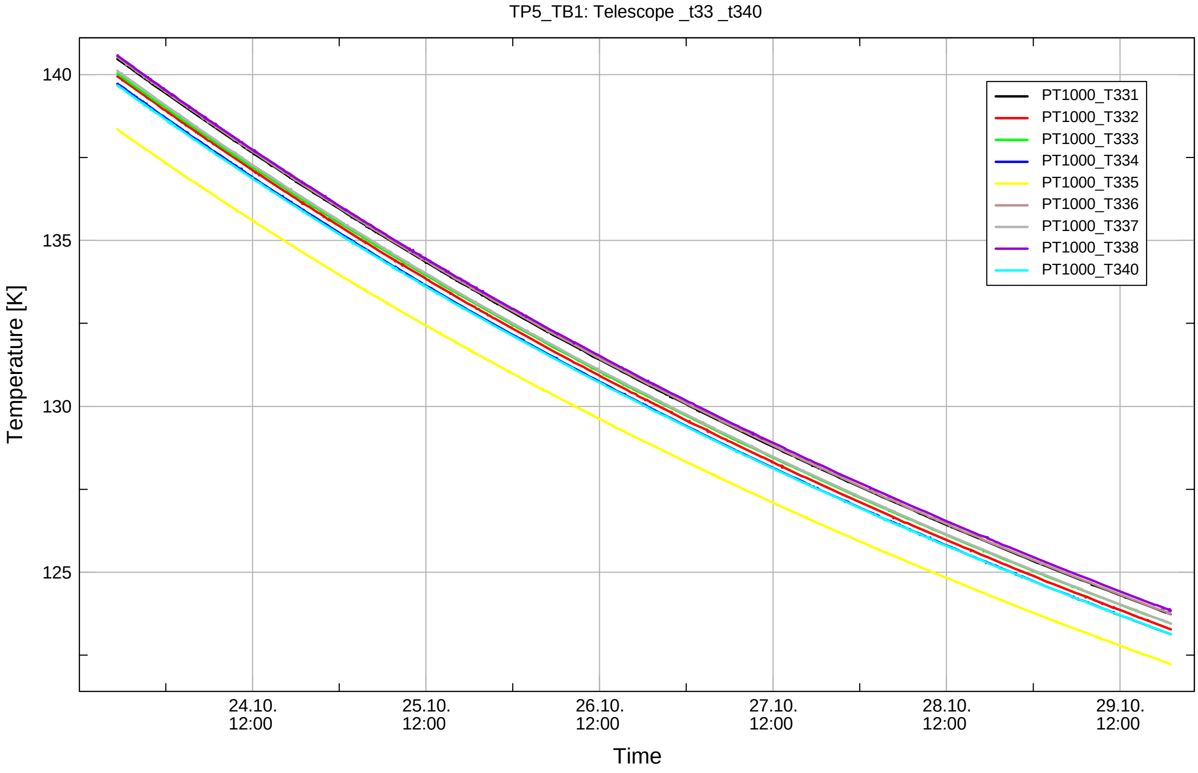


Figure 66: TP5 Telescope dummy temperatures

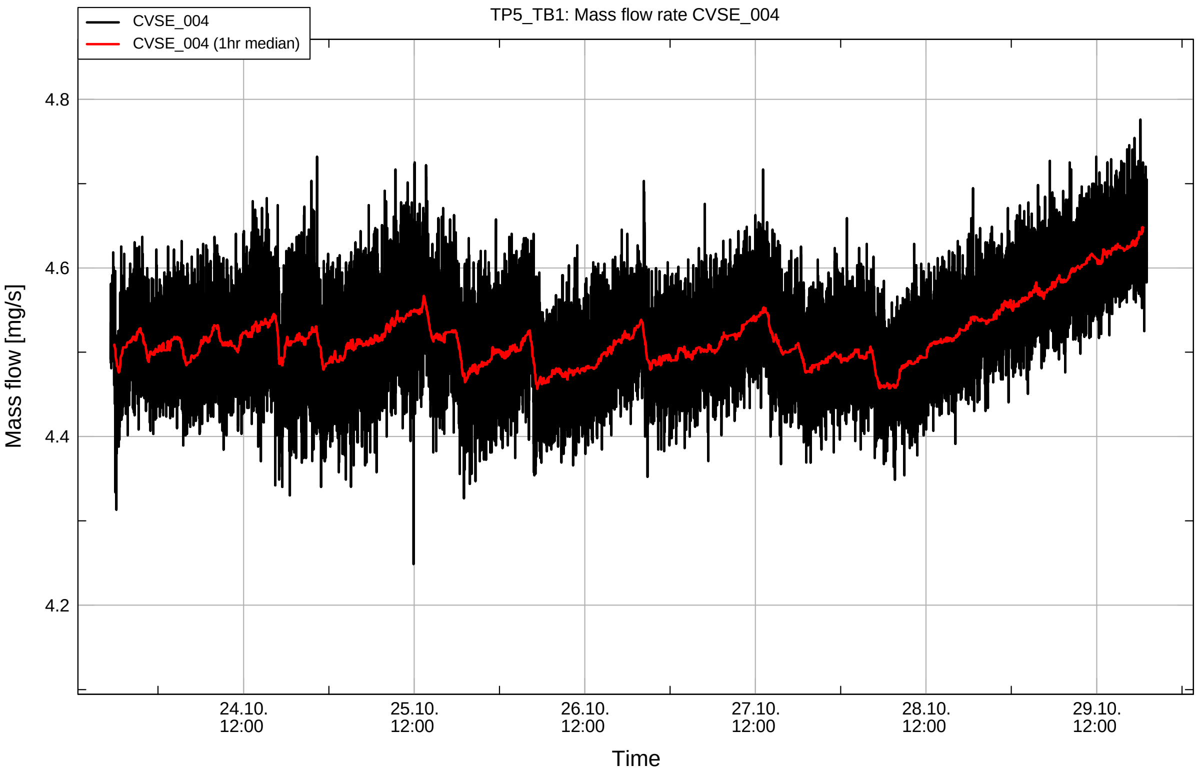


Figure 67: TP5 mass flow rate

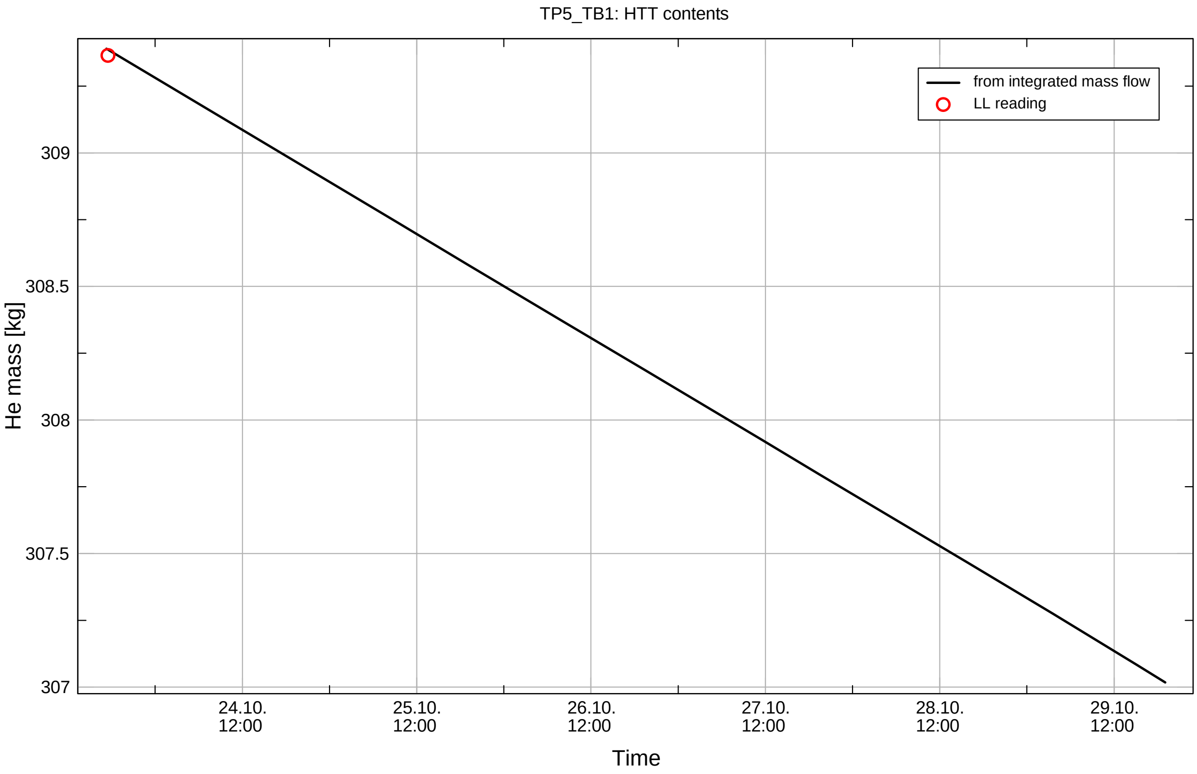


Figure 68: TP5 HTT contents

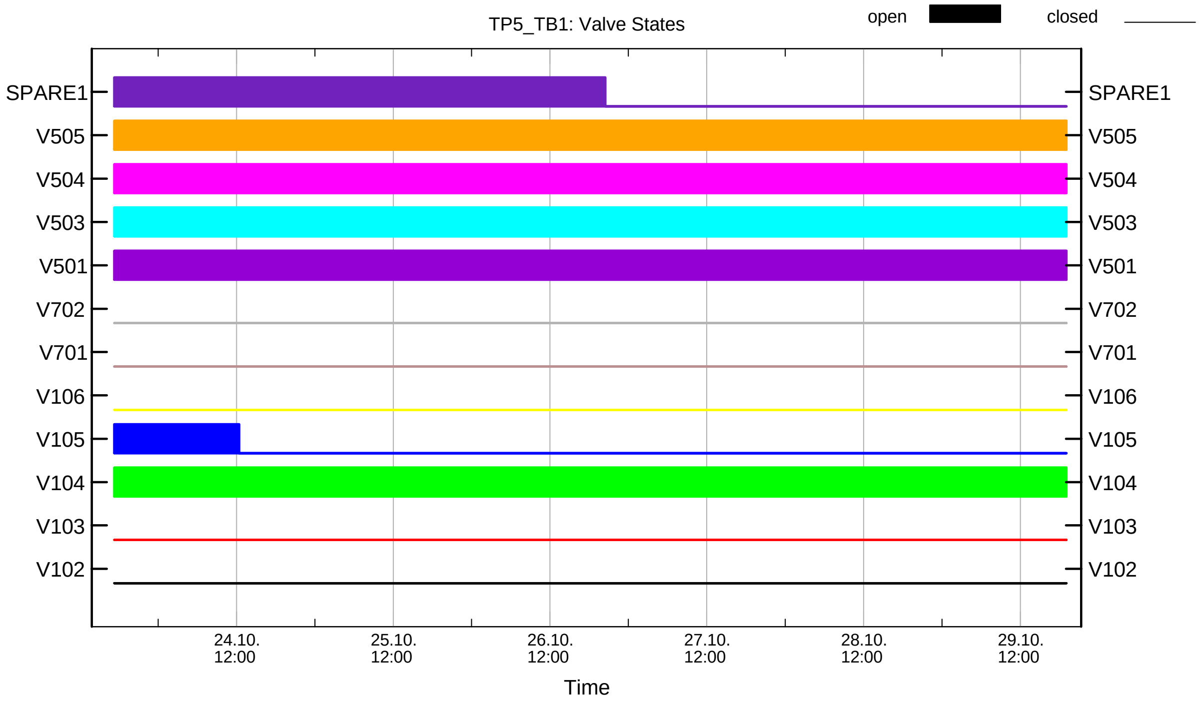


Figure 69: TP5 valve states

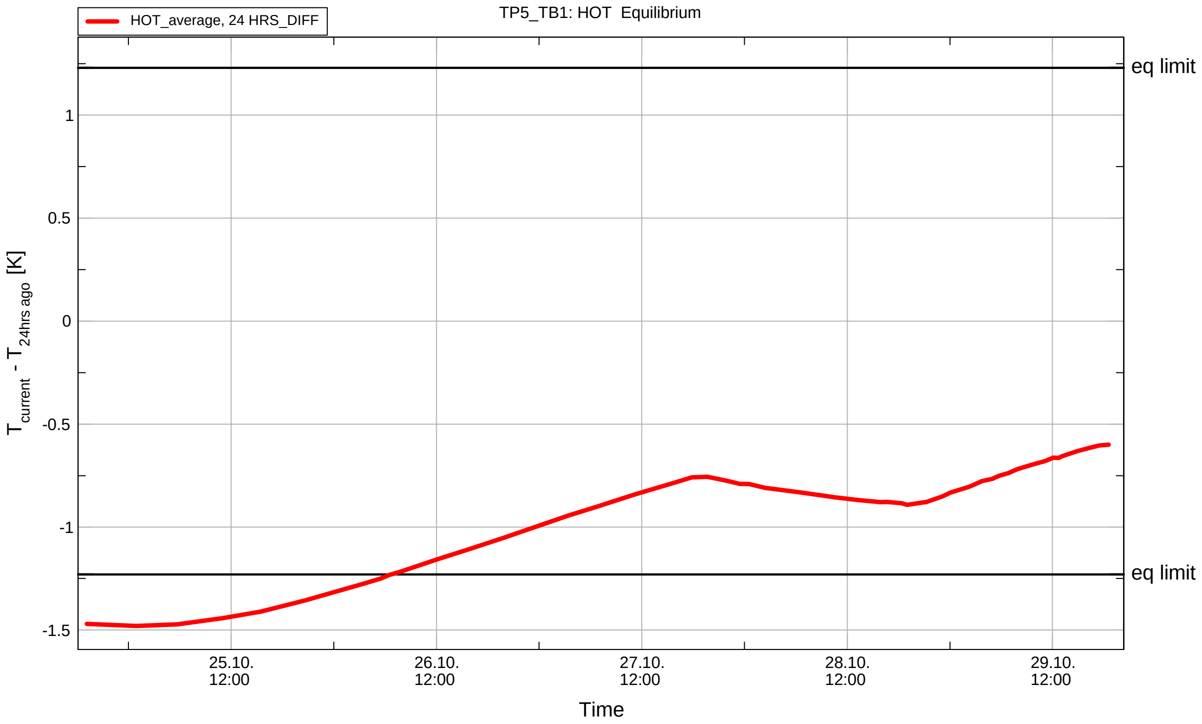


Figure 70: TP5 Equilibrium check for HOT

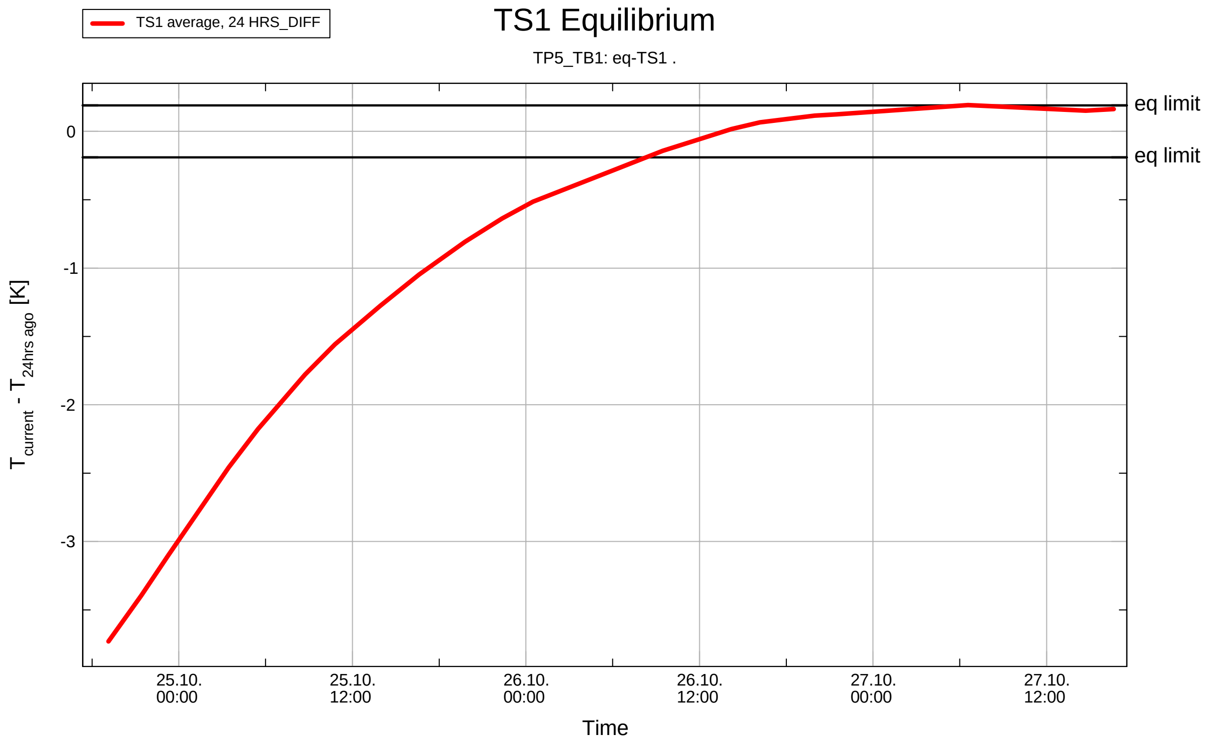


Figure 71: TP5 Equilibrium check for Thermal Shield 1

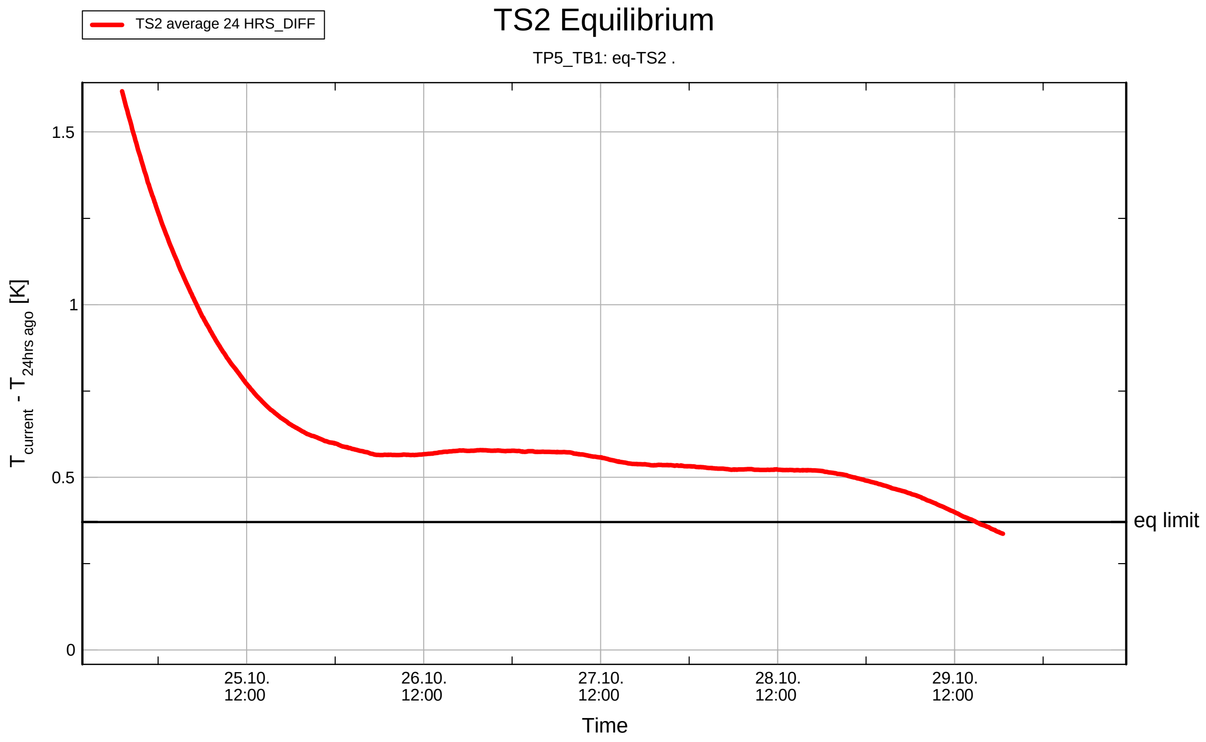


Figure 72: TP5 Equilibrium check for Thermal Shield 2

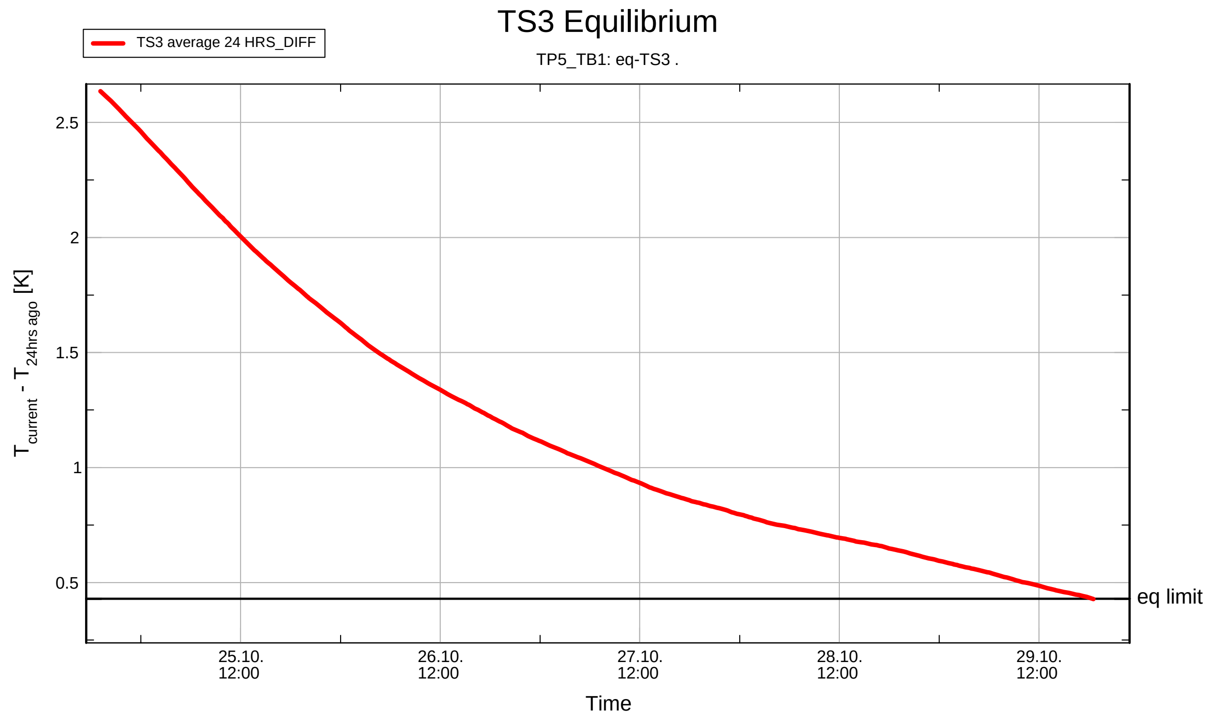


Figure 73: TP5 Equilibrium check for Thermal Shield 3

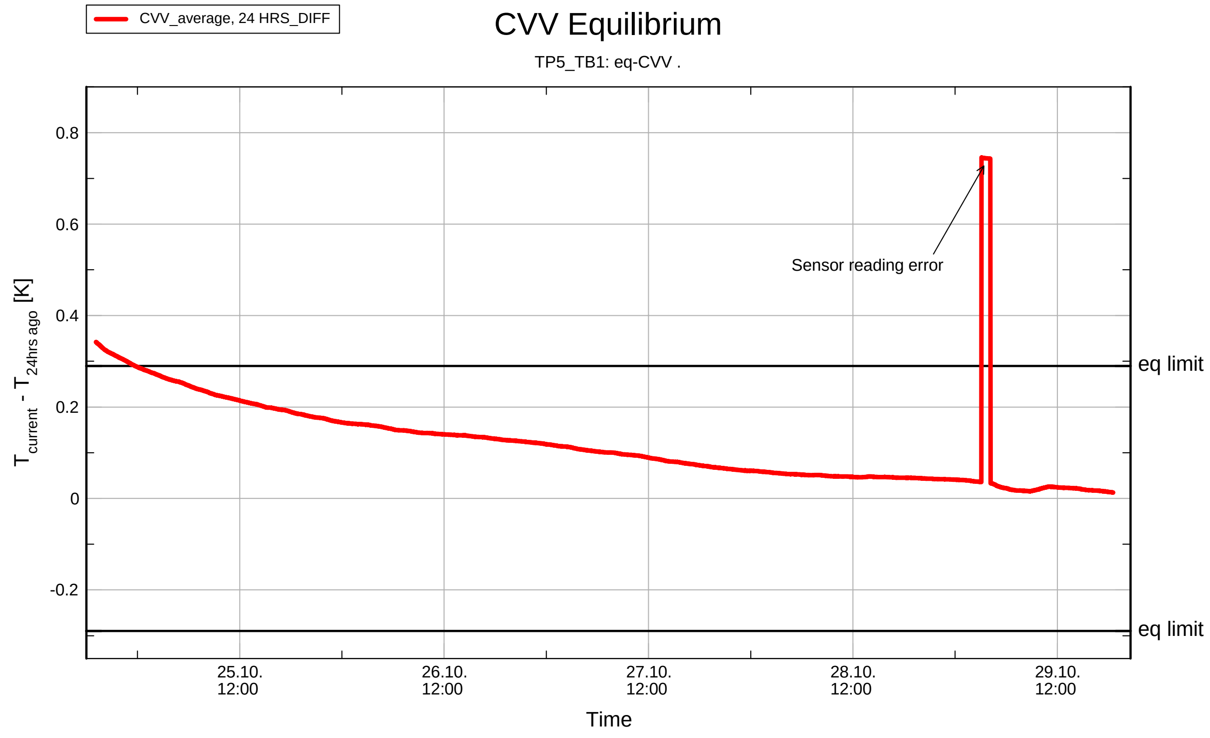


Figure 74: TP5 Equilibrium check for CVV

3.6.1 Procedure Variations

PVS 13 . Change of the thermal balance approach during TP5.

3.7 TP 6 – TV Phase 2

Since the beginning of the phase TP6, the temperature sensor T231 located on the L1 inlet could be read correctly due to a reconfiguration of the SCOE.

The sequence of the MTD heater operation was reversed with respect to the ITP in order to get clearer signals, see PVS 14.

The mass flow was drifting from ~4.63 to ~4.78 mg/s during TP6, no corrections were performed on the needle valve.

MTD heating operations were performed as planned. Stability was reached in shorter times than planned (due to the comparatively high mass flow rate).

No anomalies were detected during JFET heating.

When the HIFI L1 heater was switched on, a response on all L1 vent line sensors (T231-T237) was observed, with the upstream sensors going to lower temperatures than before. This behaviour repeated during all L1 heating operations, most significantly on T231 when the PACS heaters were operated. Temperature oscillations were observed on T231 and T232. To further assess the phenomenon, the SPIRE L1 heater was switched on in addition to the PACS heaters, which caused a further decrease of the T231 and also of the PACS L1 vent line sensors T232- T235. The corresponding MTD sensors reacted as expected to this decrease. An oscillation was observed on the vent line temperatures (e.g. T231), which stopped when the SPIRE heater was switched on in addition, and the temperatures had reached a lower level. Individual temperature peaks, reaching about the previous level, simultaneously occurred on the L1 sensors without an obvious cause. The HIFI L1 heater was switched on in addition, but this showed no further impact. HIFI and SPIRE L1 heaters were switched off again. These changes in the heating sequence are reflected in PVS 16.

After the switch-off of the HIFI and SPIRE heaters, the downstream temperature decreased as expected. About 1 hr later, the T231 temperature suddenly increased by ~0.34 K, and a significant (~250 mK peak to peak) temperature oscillation started which was damped during ~8 min to ~25 mK. All other L1 vent line sensors reacted less sharply at the same time. After ~1 hour, the level before switching on SPIRE had been reached, which indicates a stable operation point.

From this status, the V105 was opened to check a possible impact on the L1 temperatures. The reaction was a sharp decrease in L1 temperature, which can be explained by an increased mass flow from the HTT via OBA and shields to the HOT which had cooled down from 26.4 K to 21.3 K while it was closed. After this peak, the temperatures settled to values as achieved after SPIRE heating (i.e. before the unexplained rise). These valve switching operations are covered by PVS 15.

At the end of TP6, the DLCMs were operated in two steps:

- DLCM heaters operated “by hand” 20W for 20sec, resulting in HTT temperature increase by ~0.5mK (as expected); no impact on L1 temperatures (see PVS 17).
- Normal DLCM operation performed

A SCOE fatal error (assigned to operator error) occurred. Therefore a restart of the SCOE application and generation of new data files was necessary and the transition to TP7 in data handling was performed immediately. No other impact was observed.

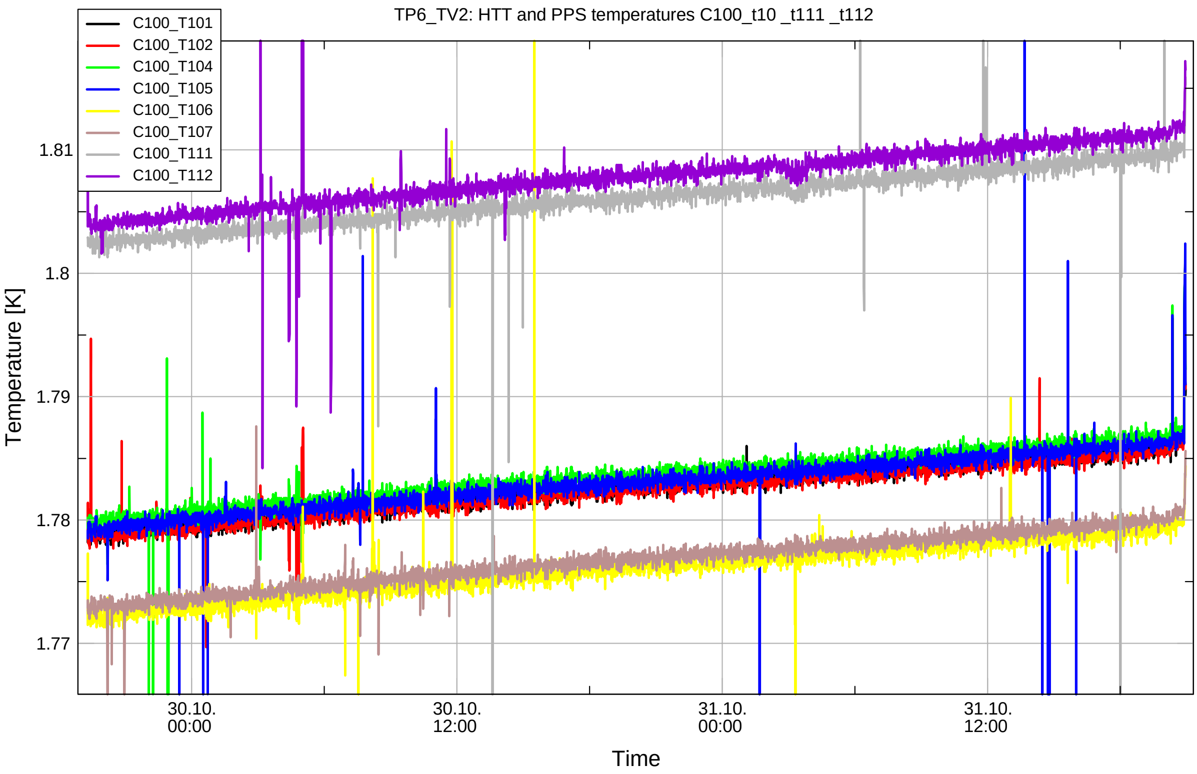


Figure 75: TP6 HTT temperatures

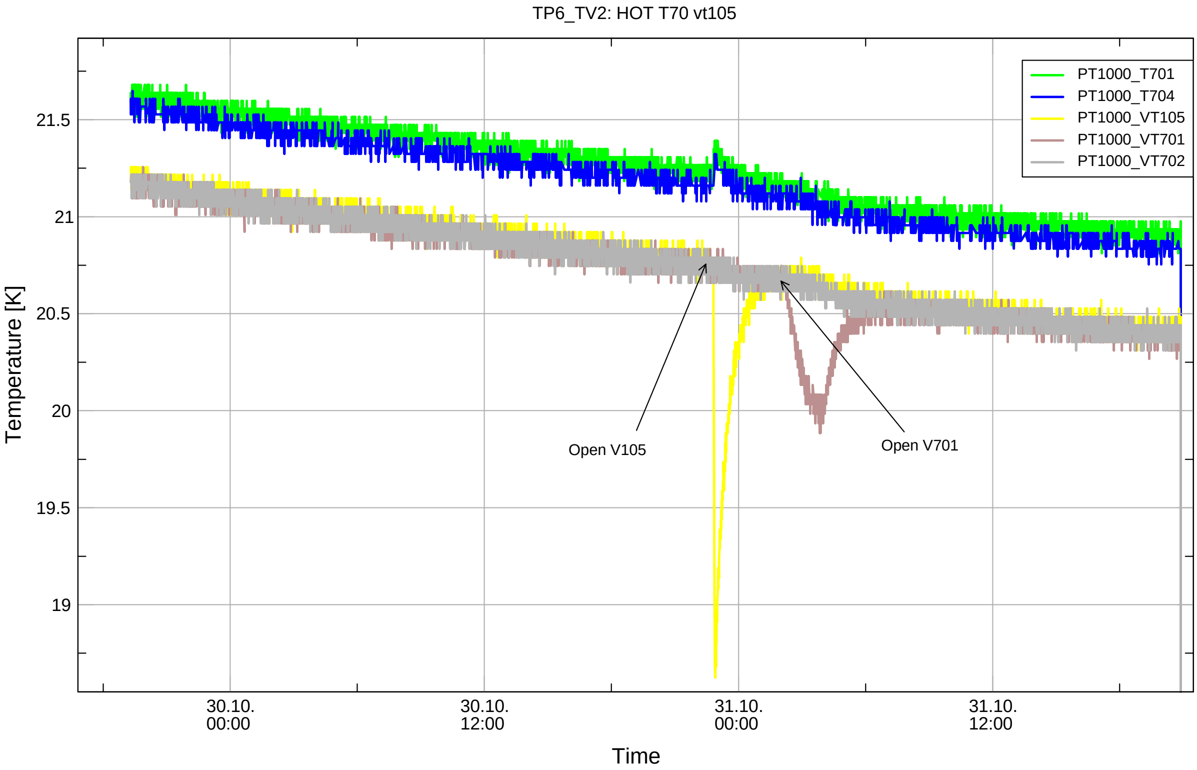


Figure 76: TP6 HOT and lower SFW valve temperatures

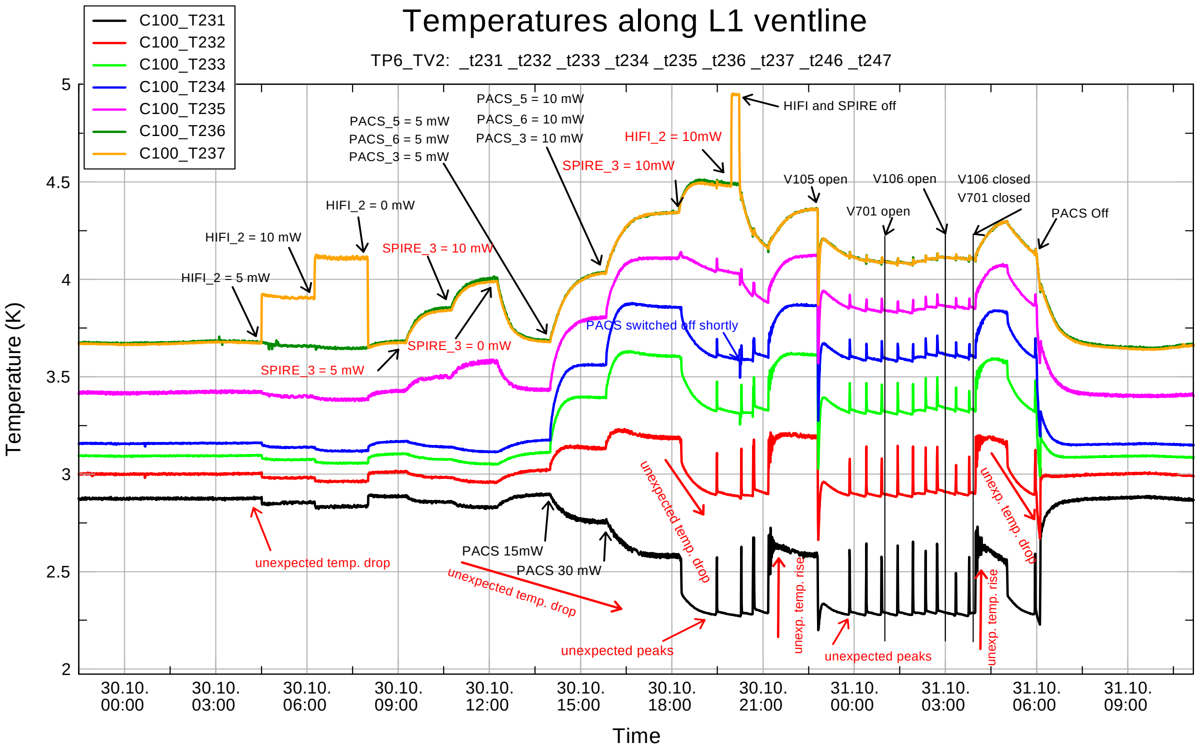


Figure 77: TP6 OBA Level 1 temperatures

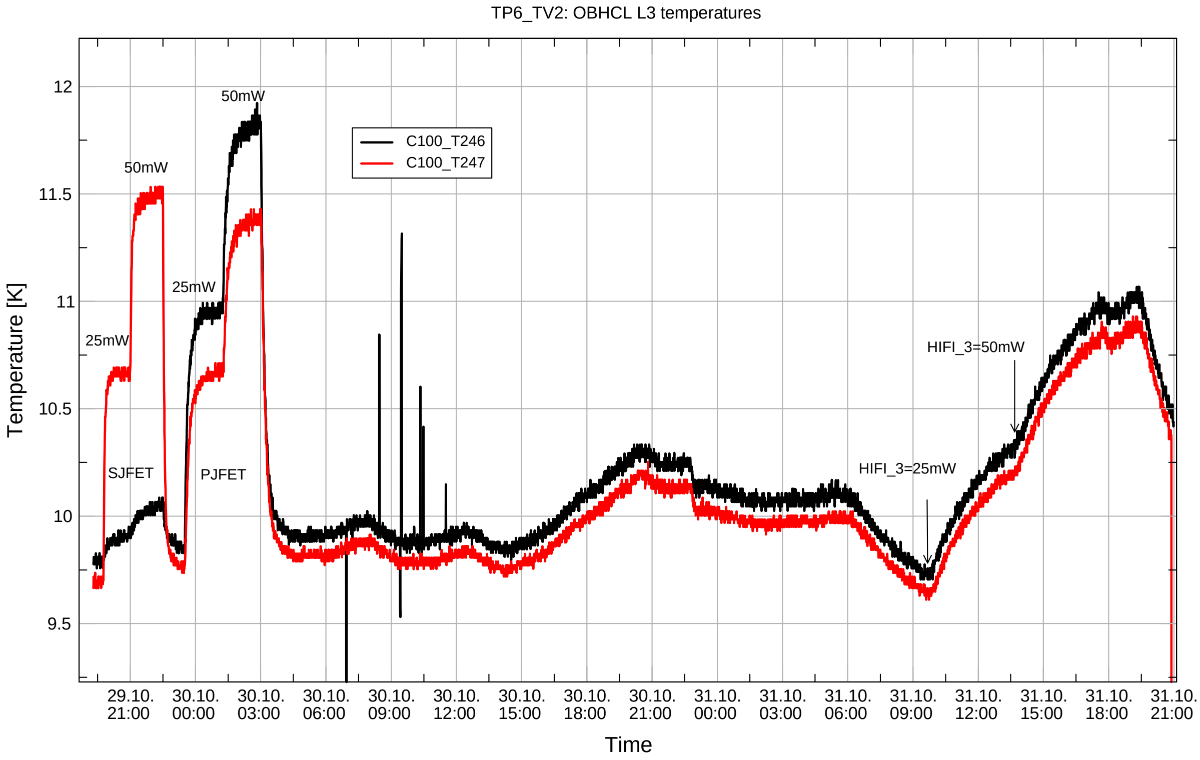


Figure 78: TP6 OBA Level 3 temperatures

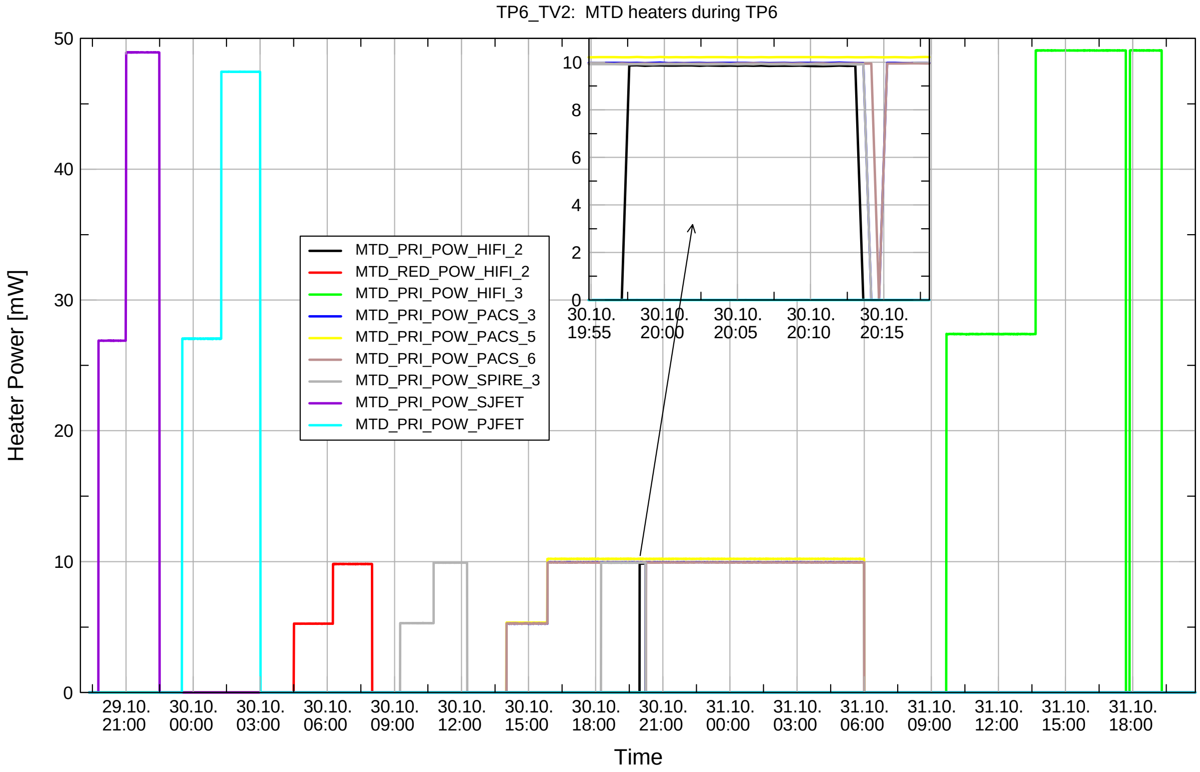


Figure 79: TP6 MTD heater power

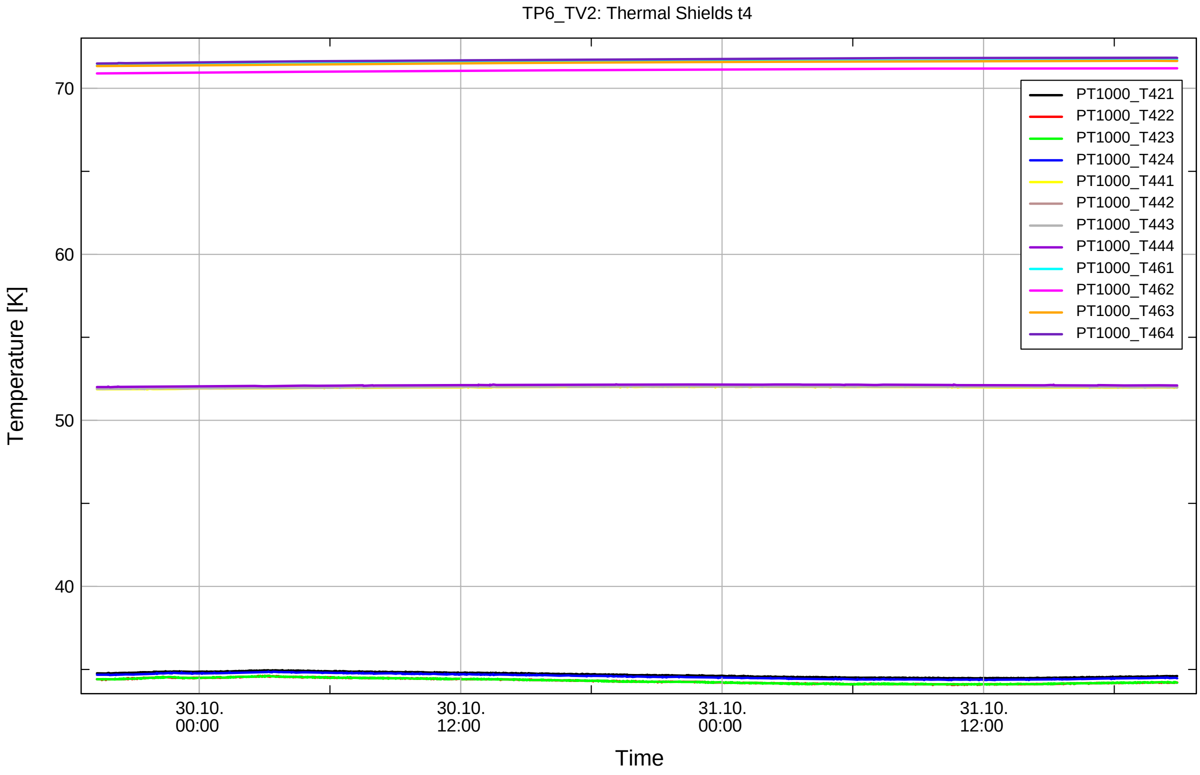


Figure 80: TP6 Thermal shields temperatures

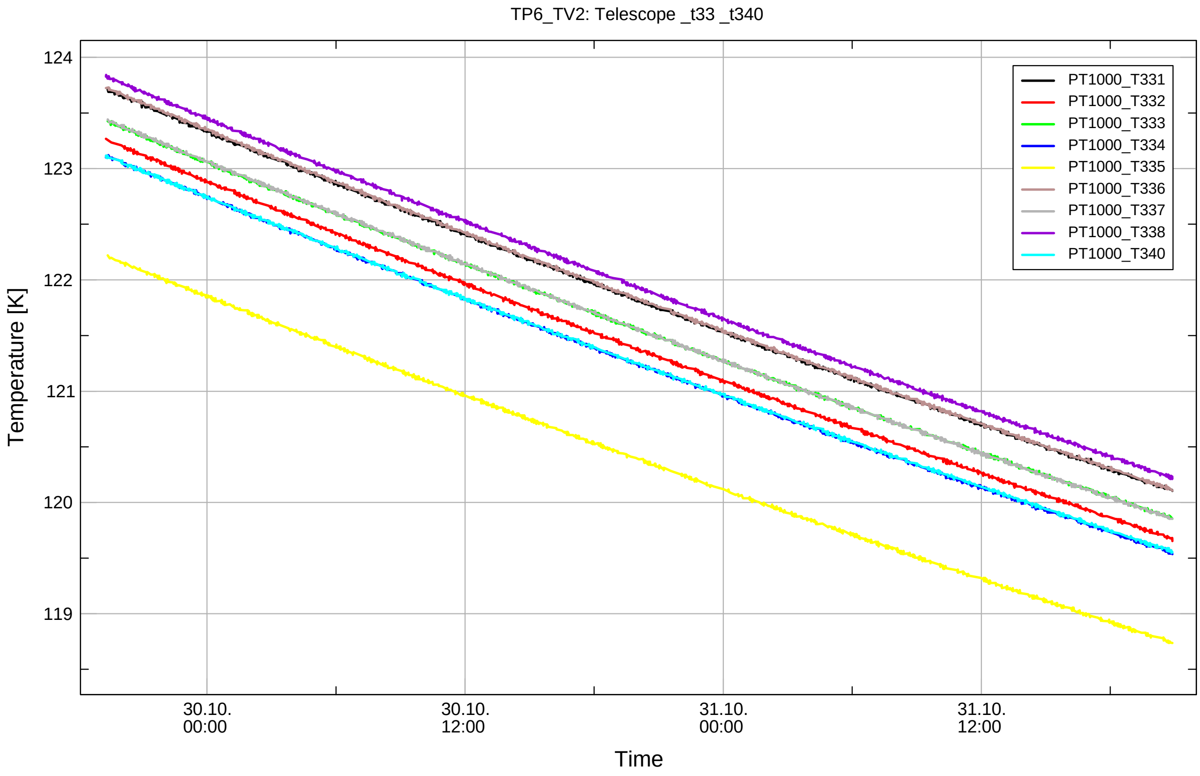


Figure 81: TP6 Telescope dummy temperatures

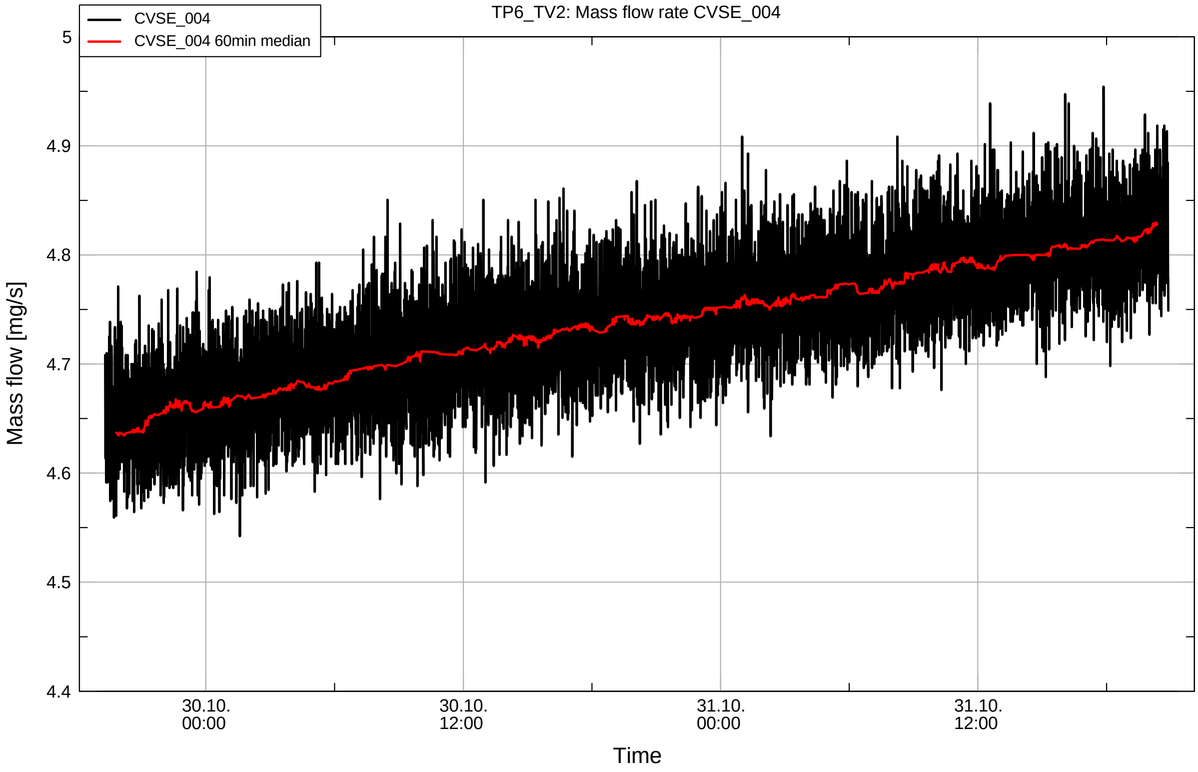


Figure 82: TP6 mass flow rate

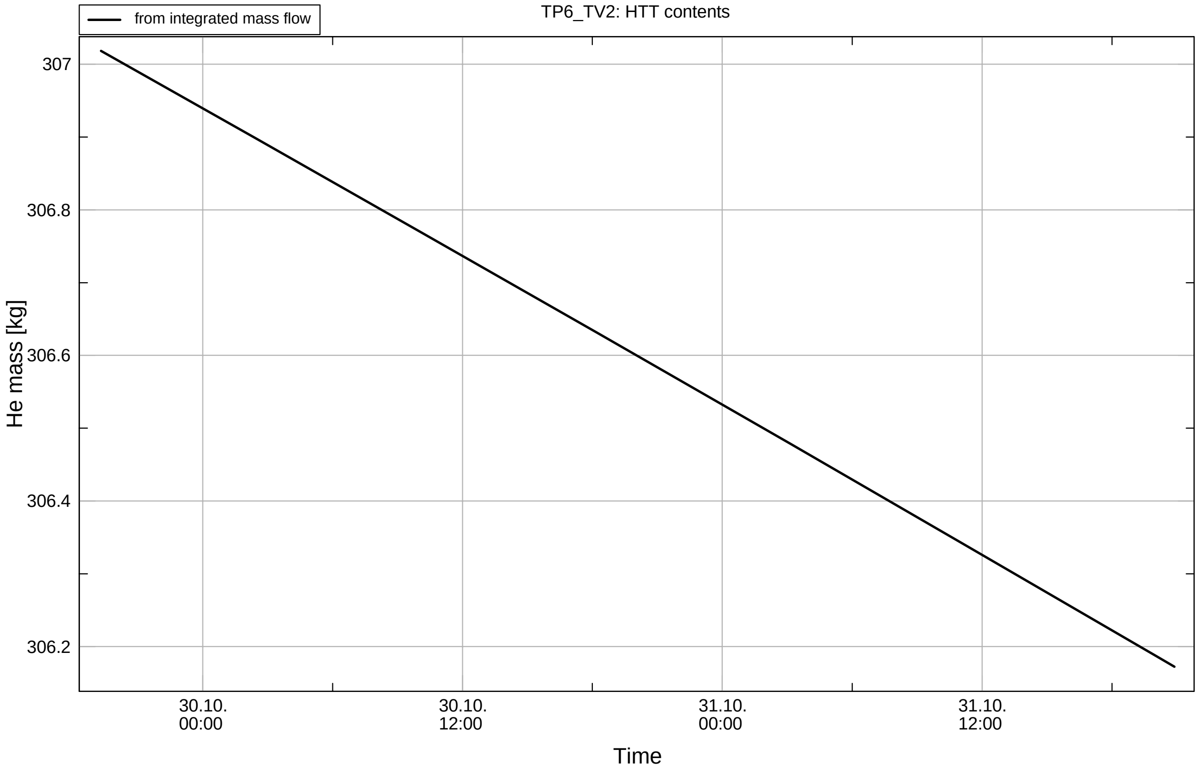


Figure 83: TP6 HTT contents

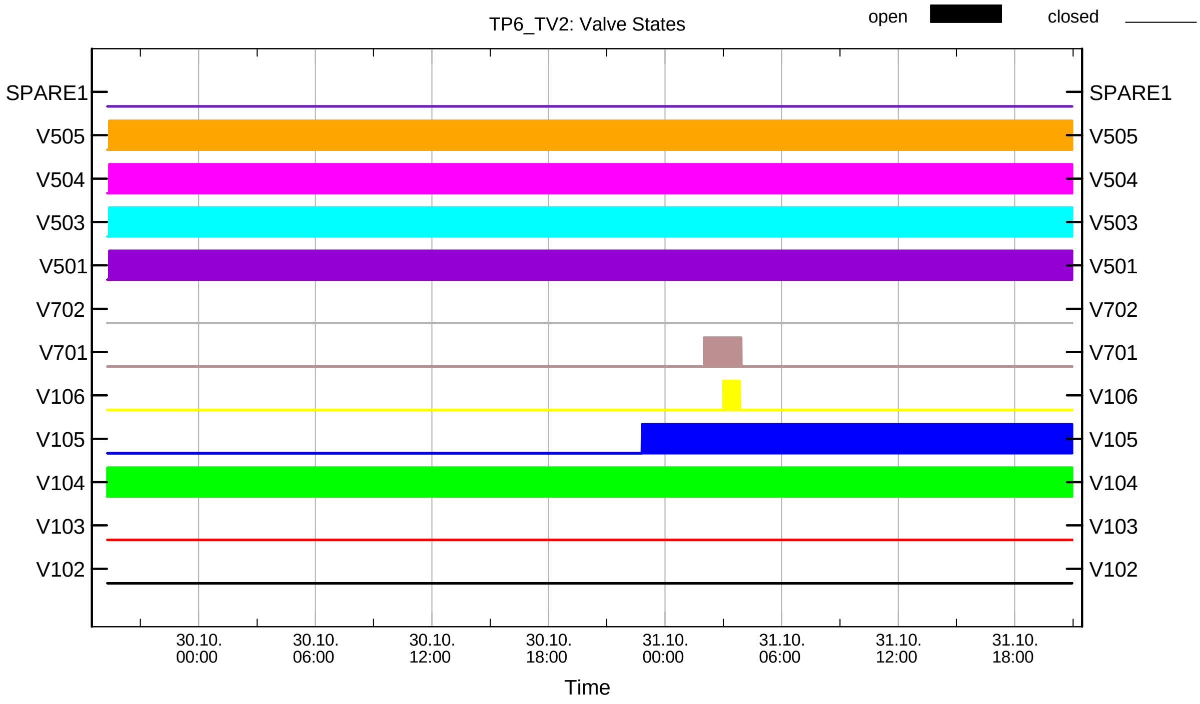


Figure 84: TP6 valve states

3.7.1 Procedure Variations

PVS 14 The sequence in which the MTD heaters are to be heated has been reversed in order to heat the most downstream locations first, and get a clearer response on the upstream heating afterwards.

PVS 15 Check different valve switching configurations and impact on L1 temperatures

PVS 16 Operate SPIRE and HIFI L1 heaters in addition to check impact on L1 temperatures

PVS 17: Operate the DLCMs, first “by hand” in standard SCOE mode and then automatically

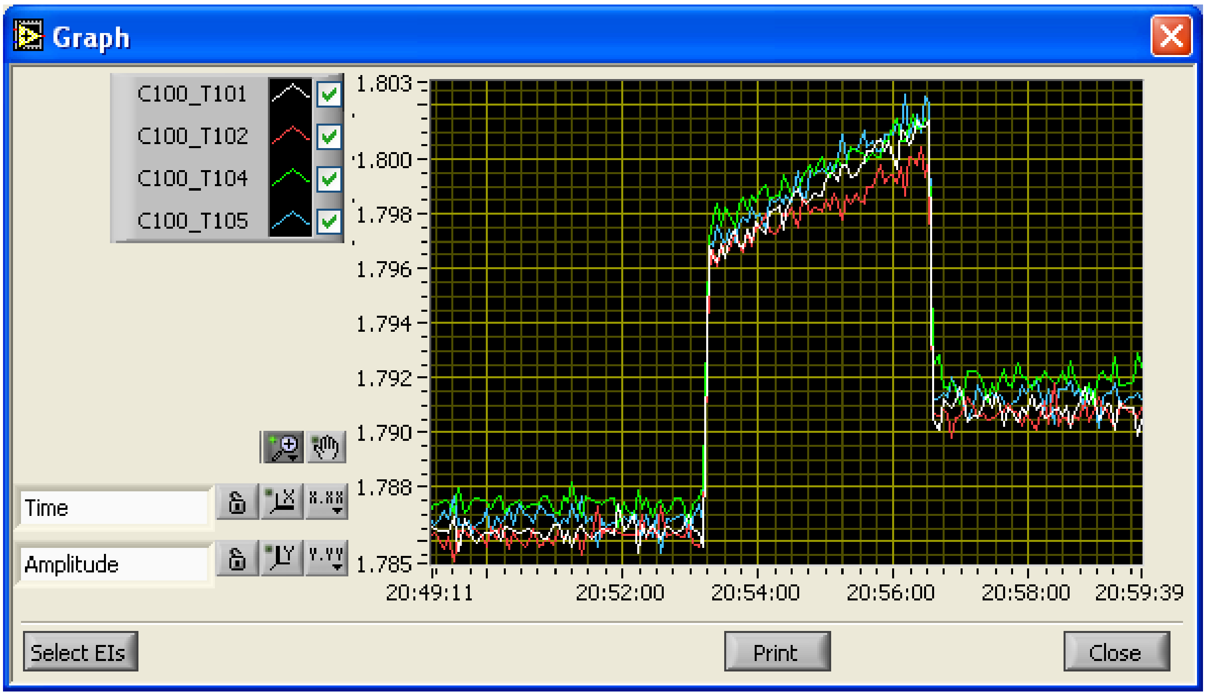


Figure 85: TP6 DLCM operation on 31.10.2005, 4 sec time resolution

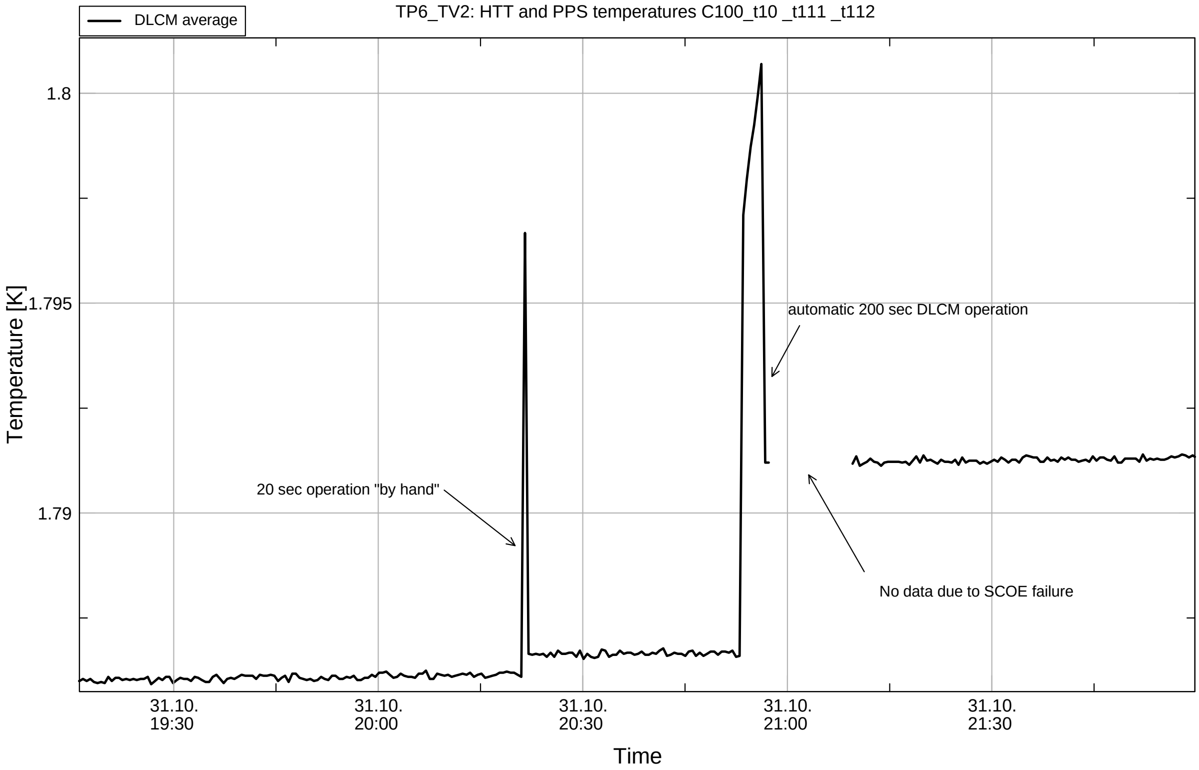


Figure 86: TP6 DLCM temperatures during operations on 31.10.2005

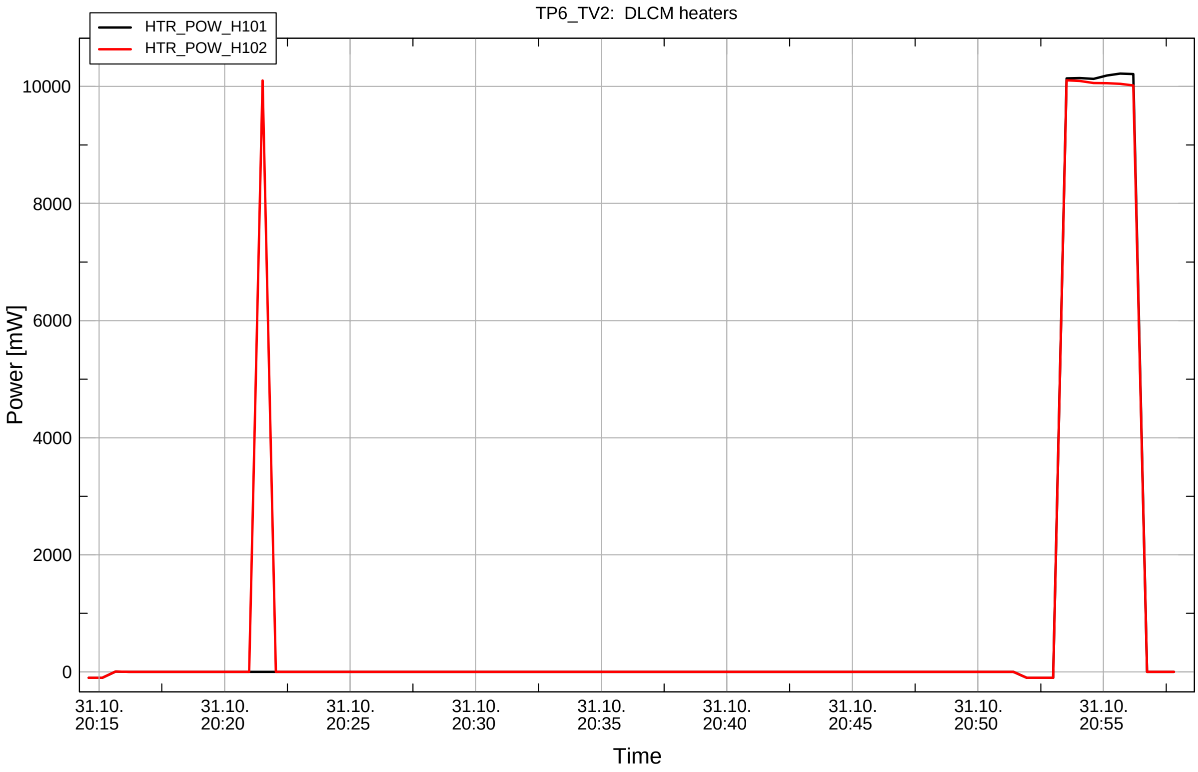


Figure 87: TP6 DLCM heater power on 31.10.2005

3.8 TP 7 – TB Phase 2

Before the beginning of the planned TP7 operations, the following activities were performed:

- Verification of correct PPS operation and impact on L1 temperatures (see PVS 18). The PPS was kept operating throughout TB2 phase to measure differences wrt TB1 phase.
- LOU MTD heater switched to 7W, additional boost heating with TDH test heaters (2x20W) to raise LOU temperature by 28 K (as predicted). Heating performed before change of temperature set point for IR Rig, see PVS 19.

The thermal balance phase TP7 was performed as planned for the external equilibrium, TTAP temperature was held constant at 273 K while the IR Rig was heated to 293 K. In order to accelerate the CVV warm-up to the expected steady-state conditions, the CVV test heaters were operated at 8% of the installed power for ~35 minutes and switched off afterwards (covered by PVS 20). After thermalization, the CVV temperatures were within the required equilibrium conditions of 0.29 K/day since 03.11.2005 21:10.

For the cryostat internal parts, a second point with stable conditions as been reached during the second balance phase (with exception of 0.27 K/day on TS1 vs. 0.19 K/day required for TP5) which was not planned in the ITP.

At the end of the stabilization phase, additional tests were performed to acquire more information on the HTT heat load cause. These tests are described in PVS21 to PVS24 as described below.

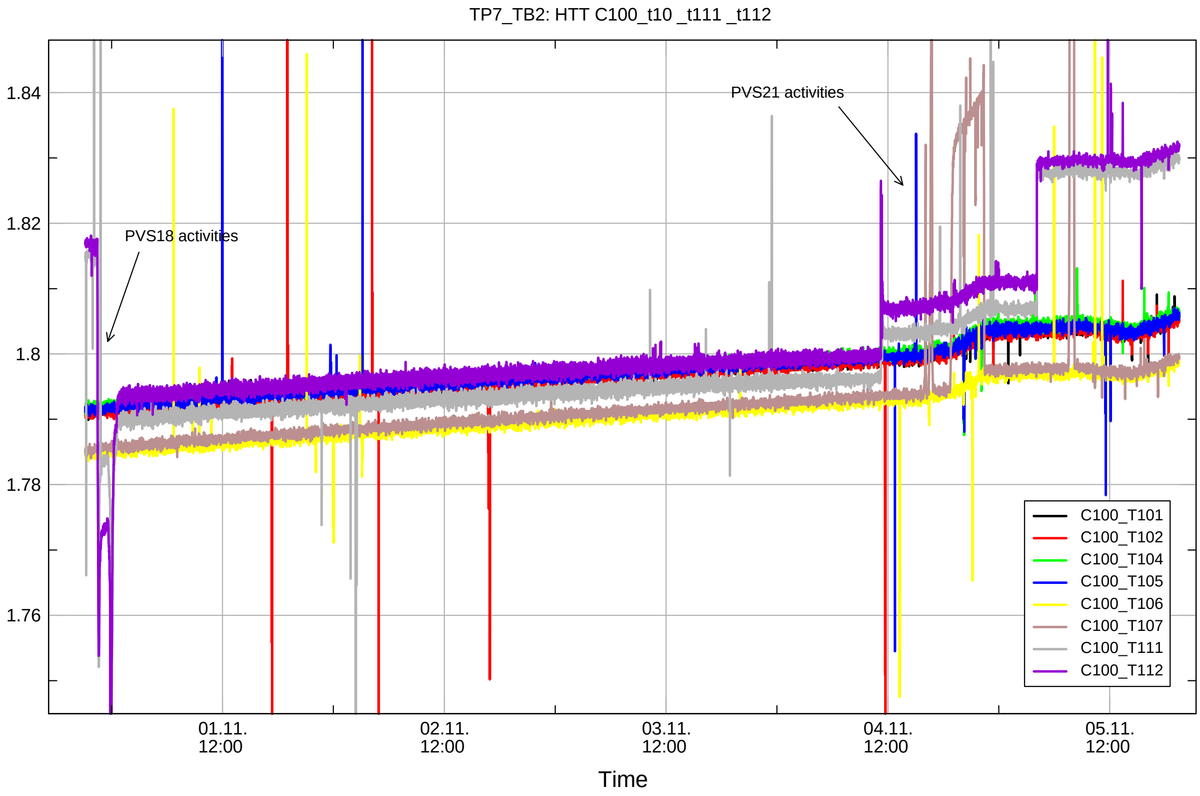


Figure 88: TP7 HTT temperatures

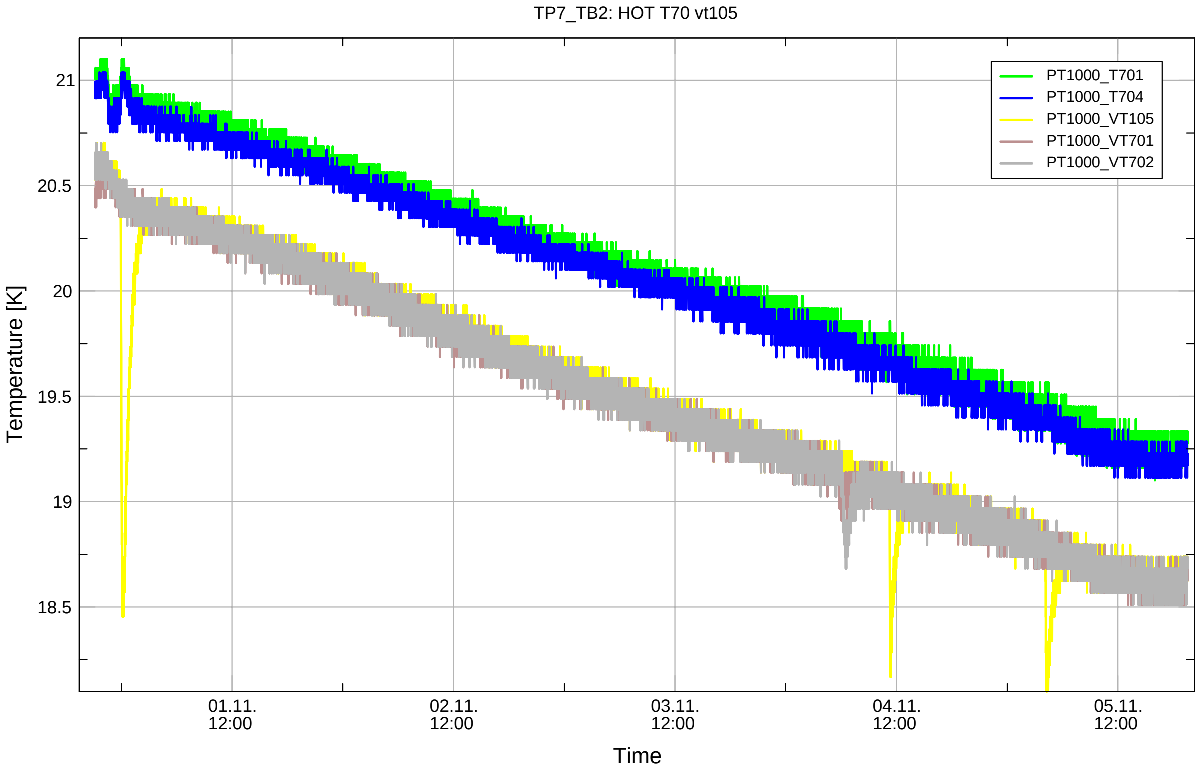


Figure 89: TP7 HOT and lower SFW valve temperatures

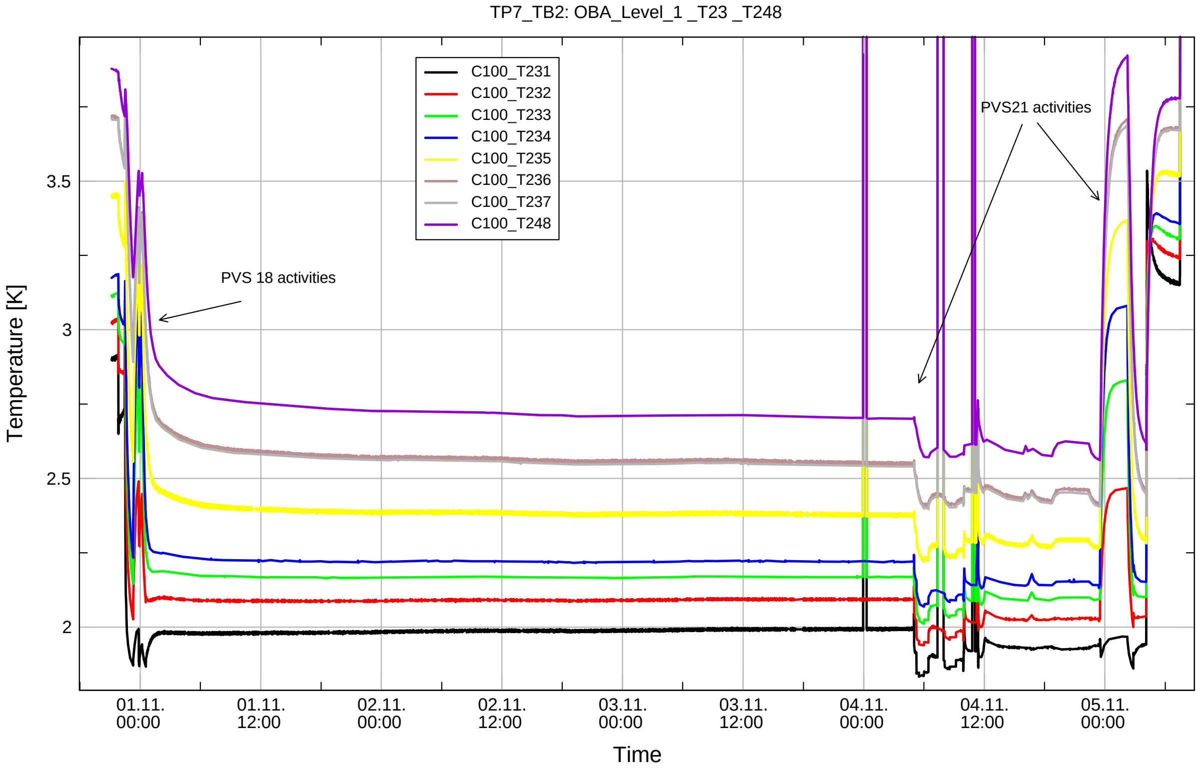


Figure 90: TP7 OBA Level 1 temperatures

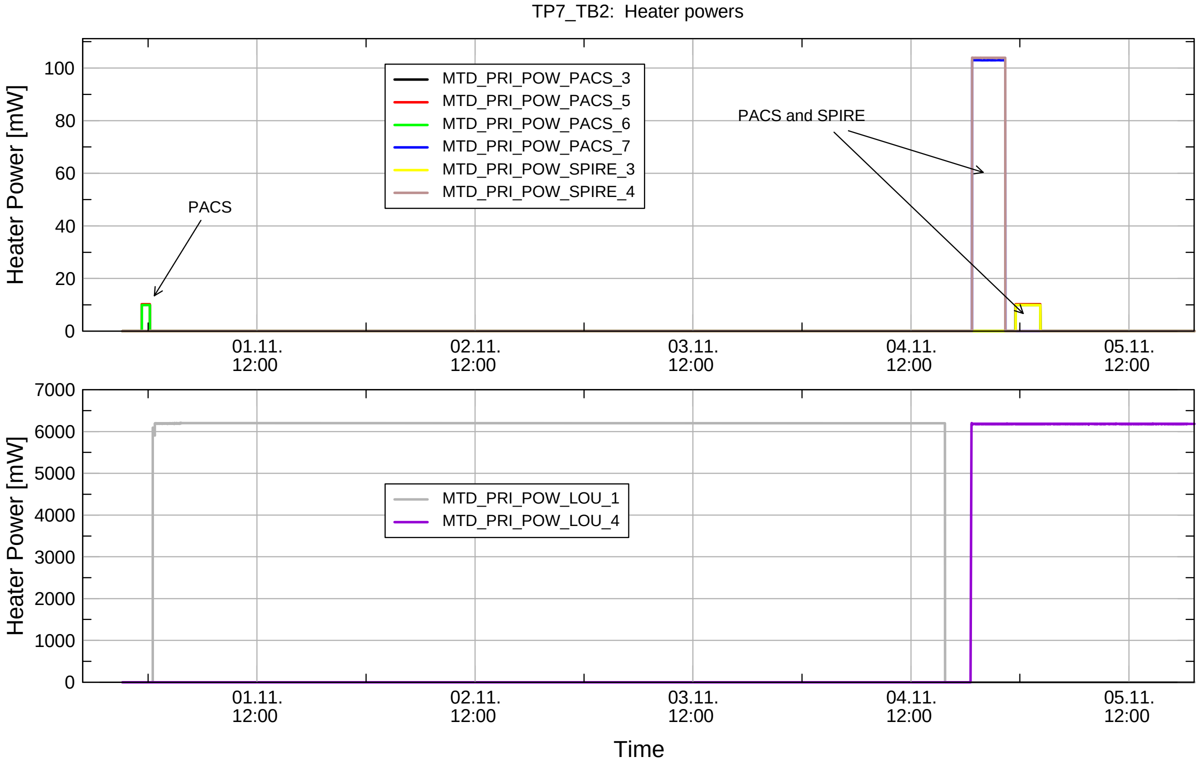


Figure 91: TP7 heater powers (only active heaters are shown)

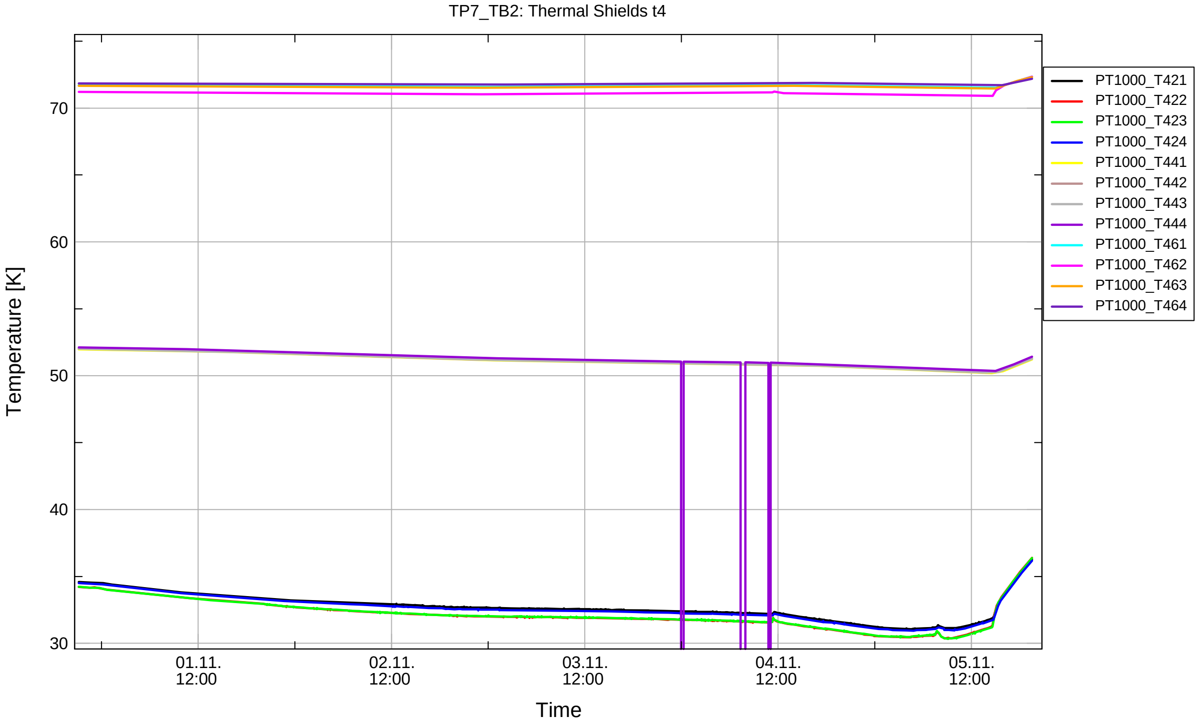


Figure 92: TP7 Thermal shields temperatures

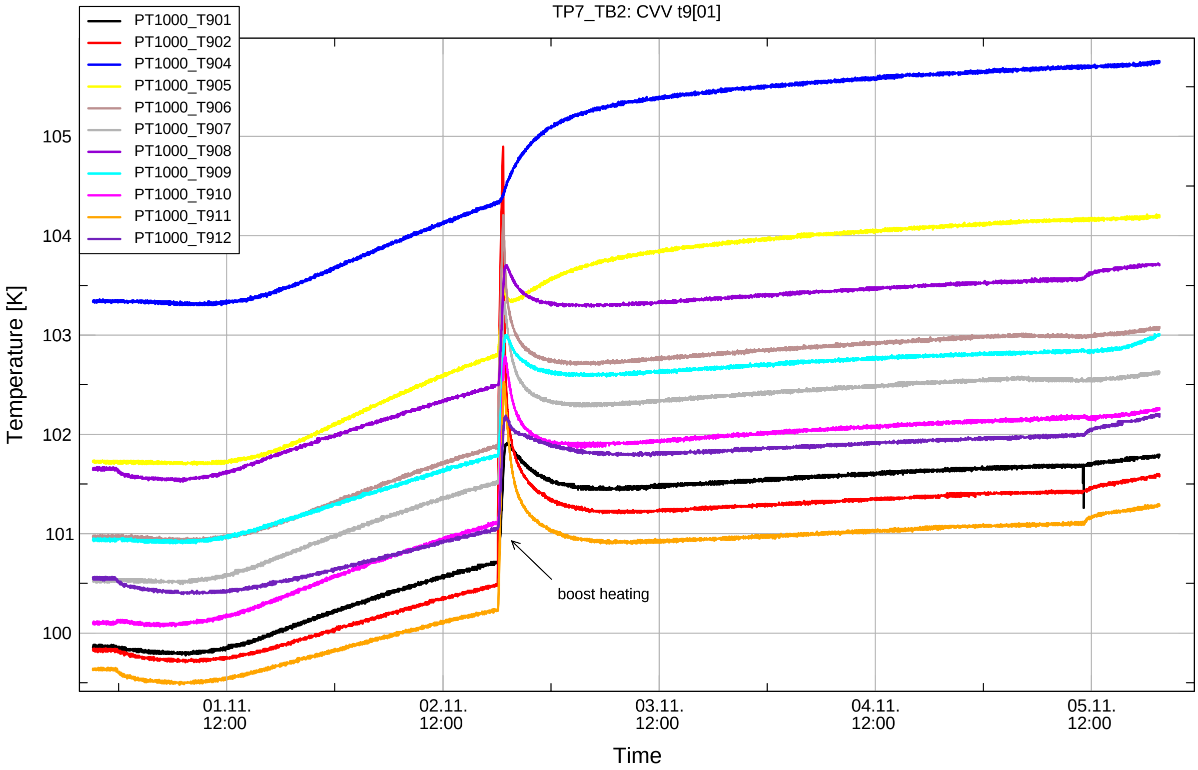


Figure 93: TP7 CVV temperatures

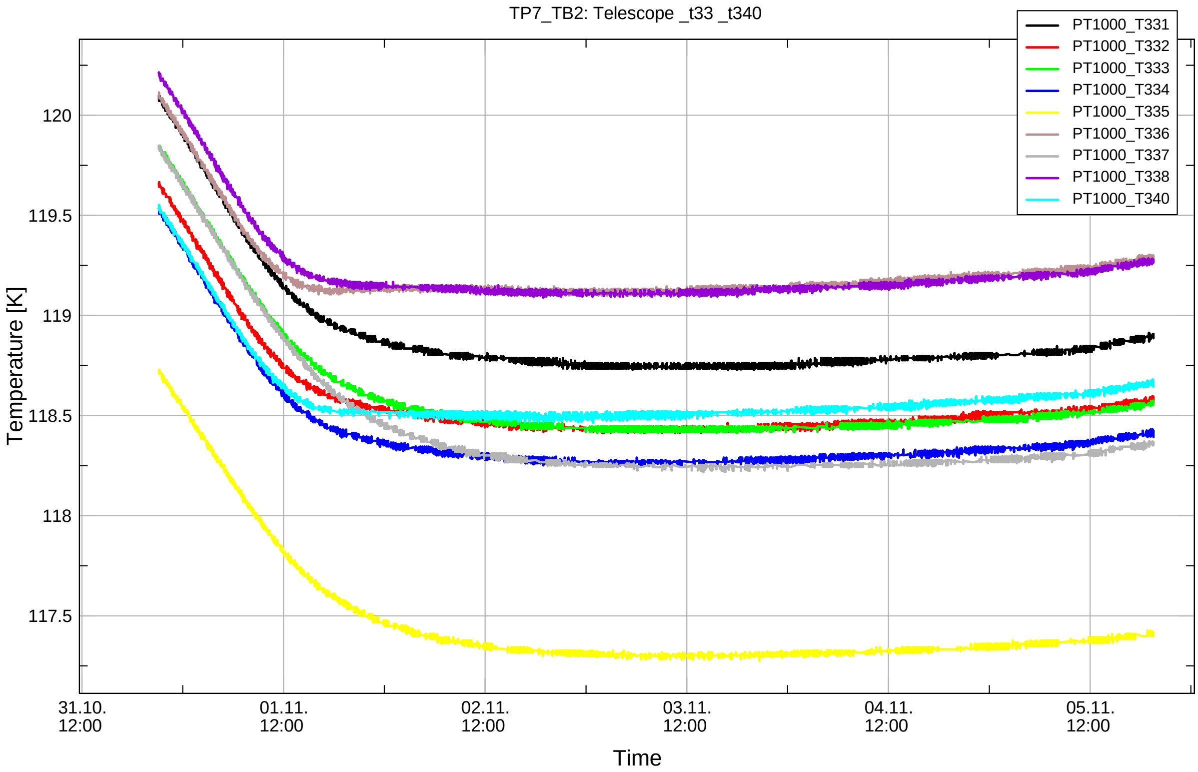


Figure 94: TP7 Telescope dummy temperatures

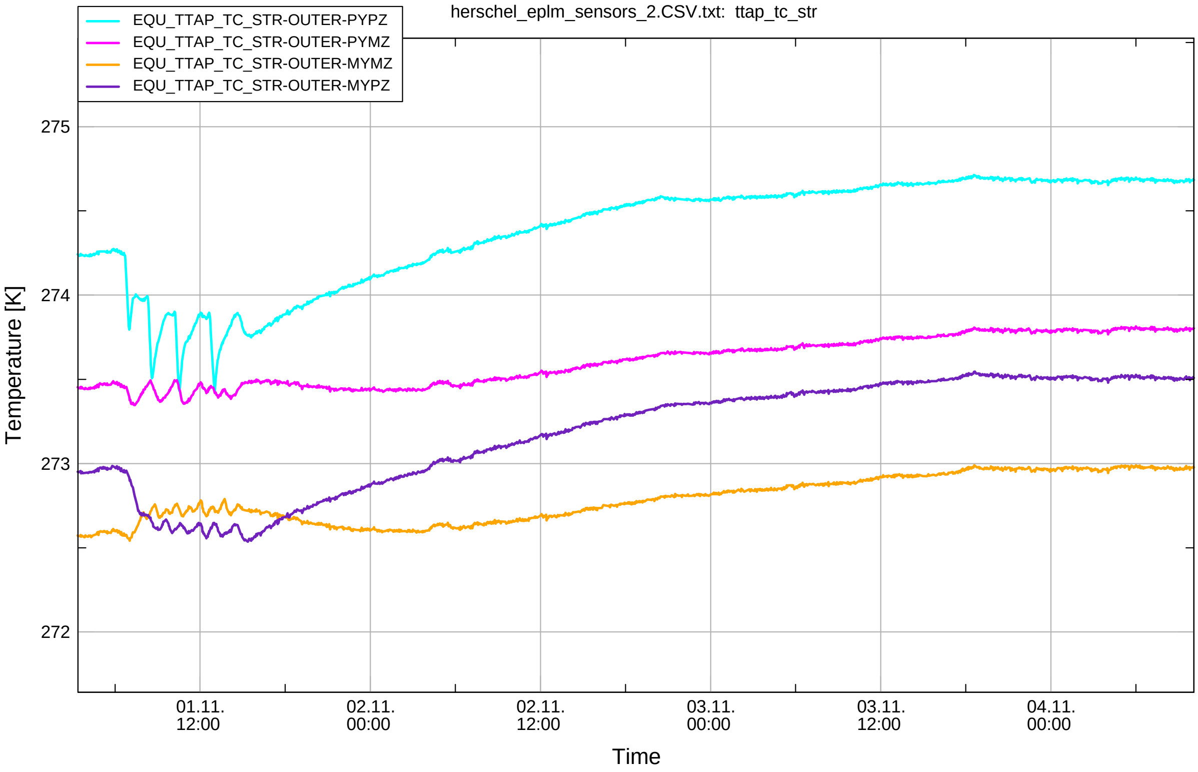


Figure 95: TP7 TTAP temperatures

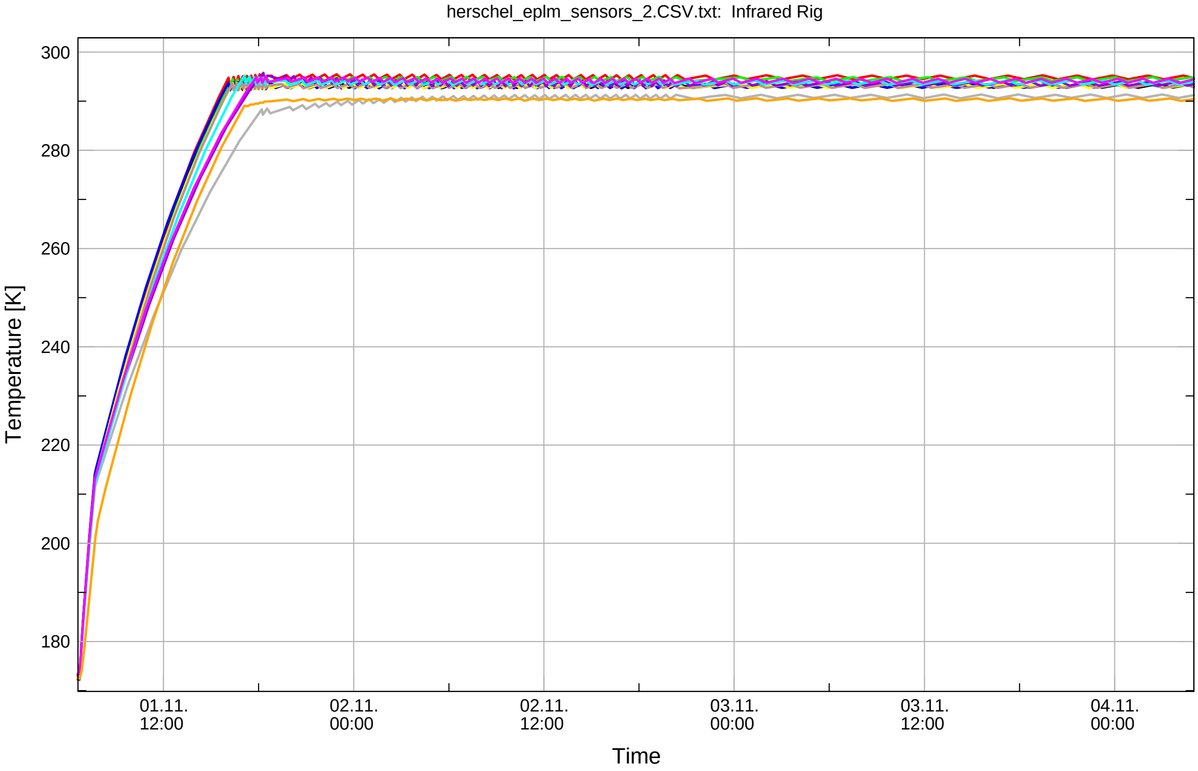


Figure 96: TP7 HSS-TCR (infrared rig) temperatures

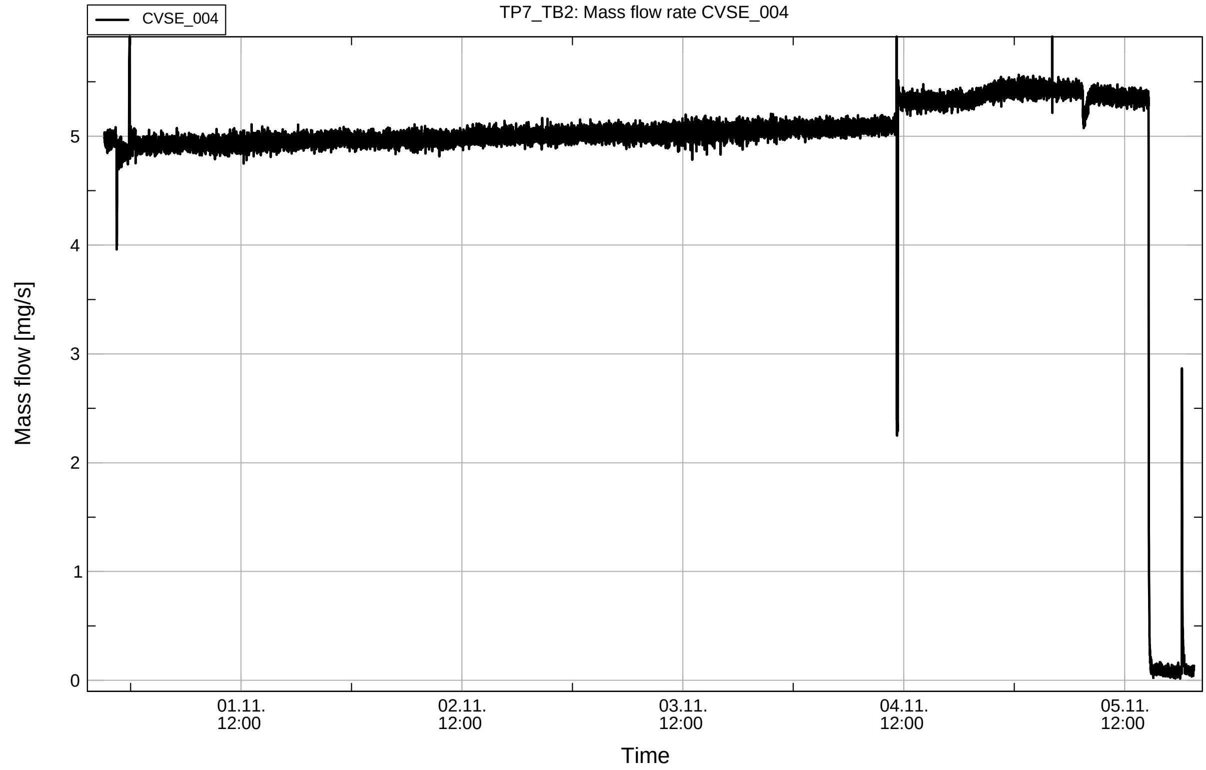


Figure 97: TP7 mass flow rate

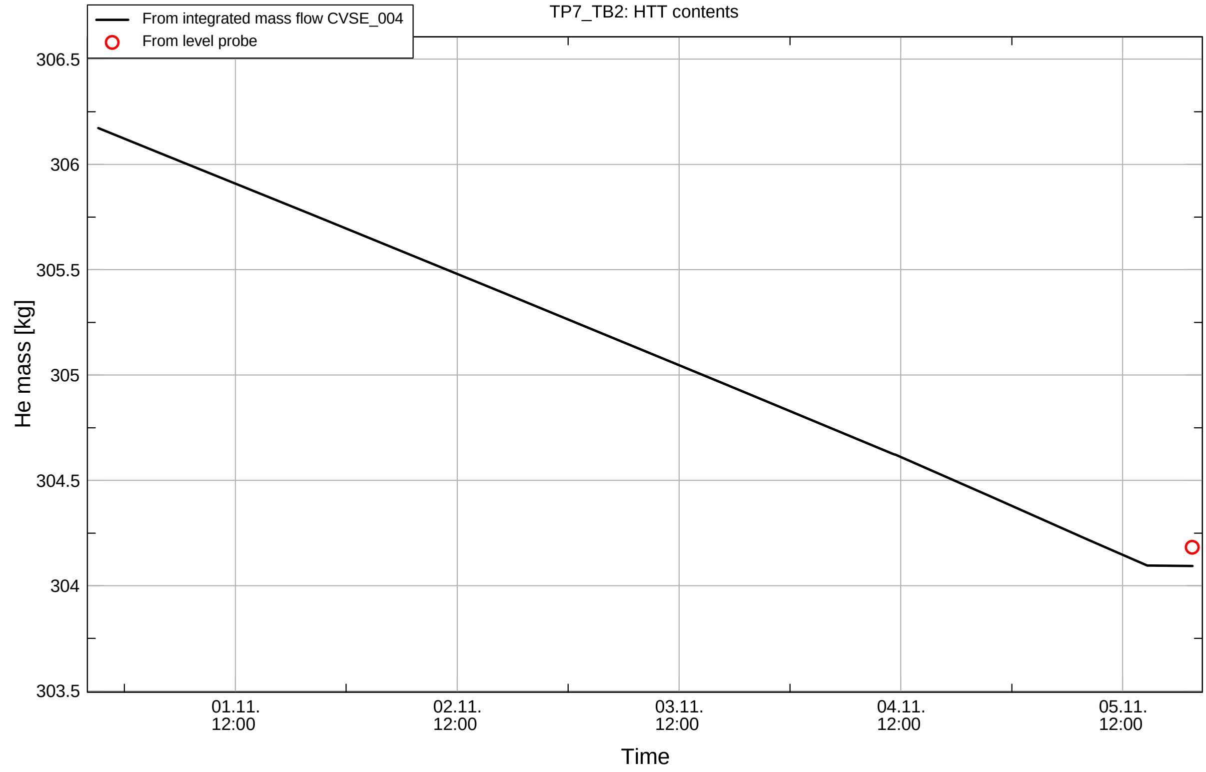


Figure 98: TP7 HTT contents

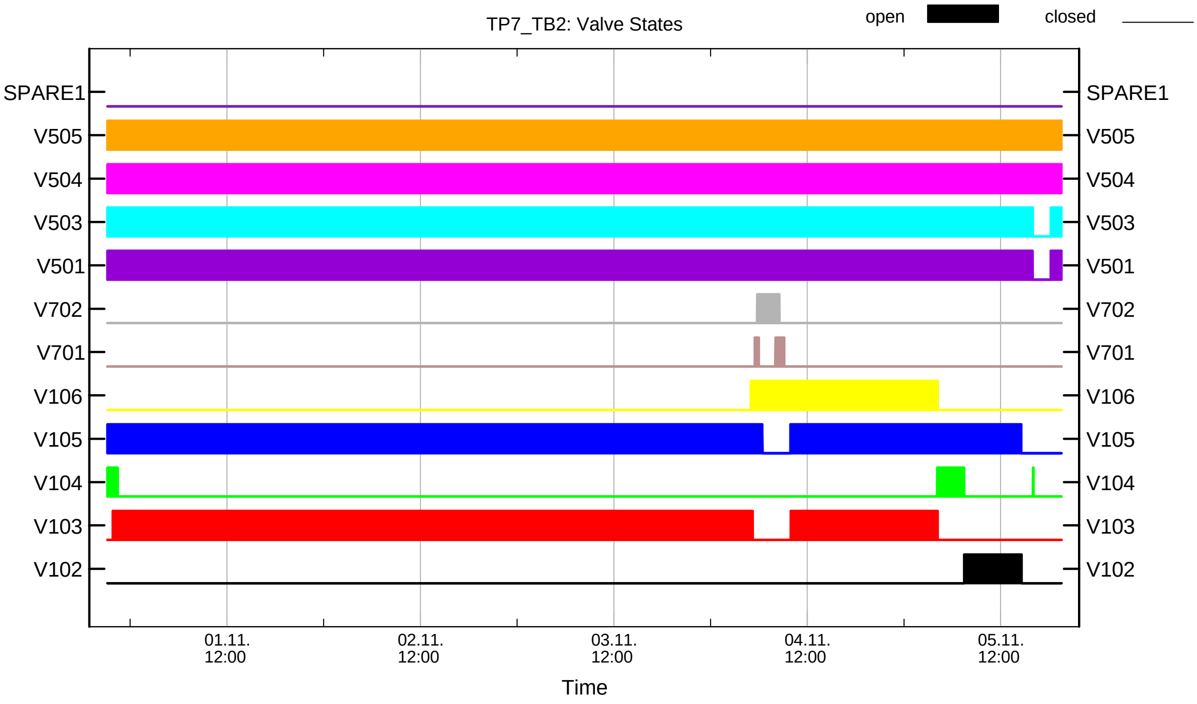


Figure 99: TP7 valve states

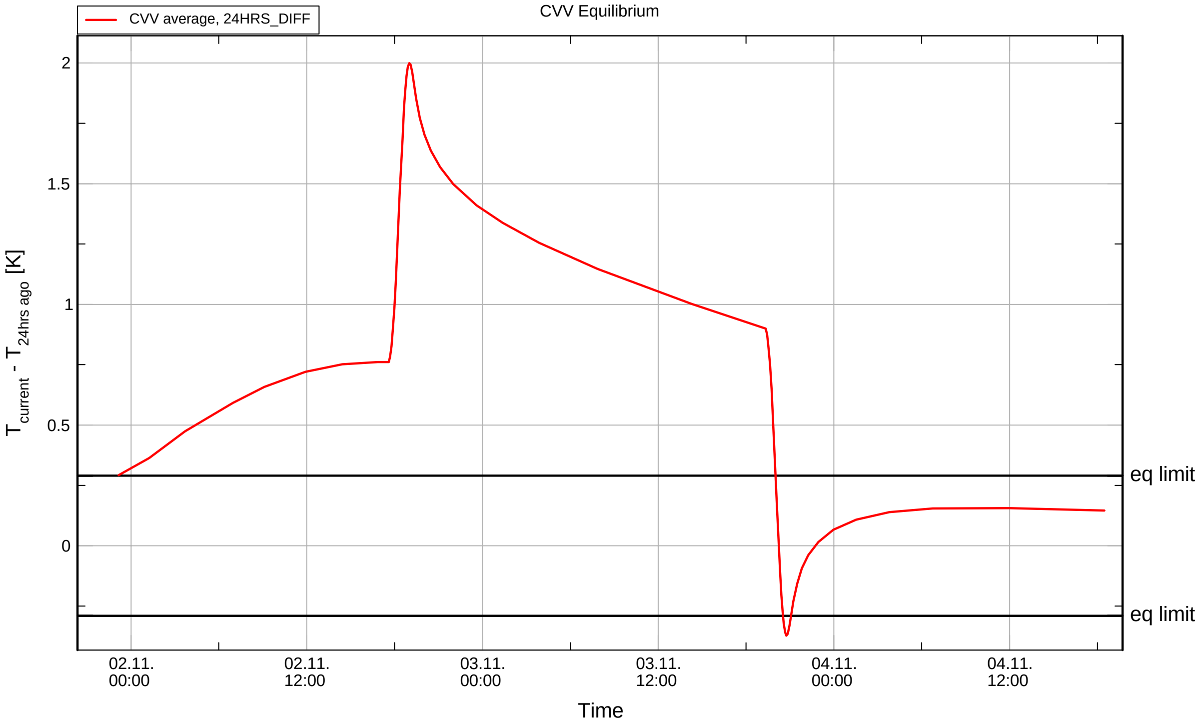


Figure 100: TP7 Equilibrium check for CVV

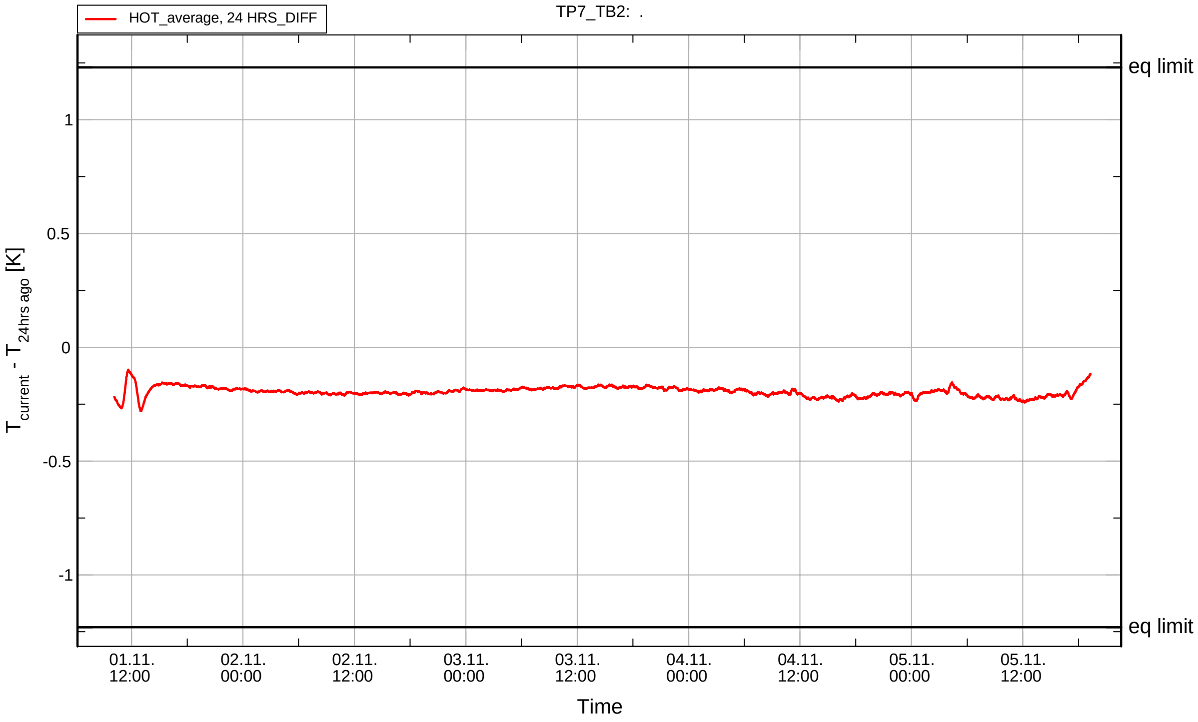


Figure 101: TP7 Equilibrium check for HOT

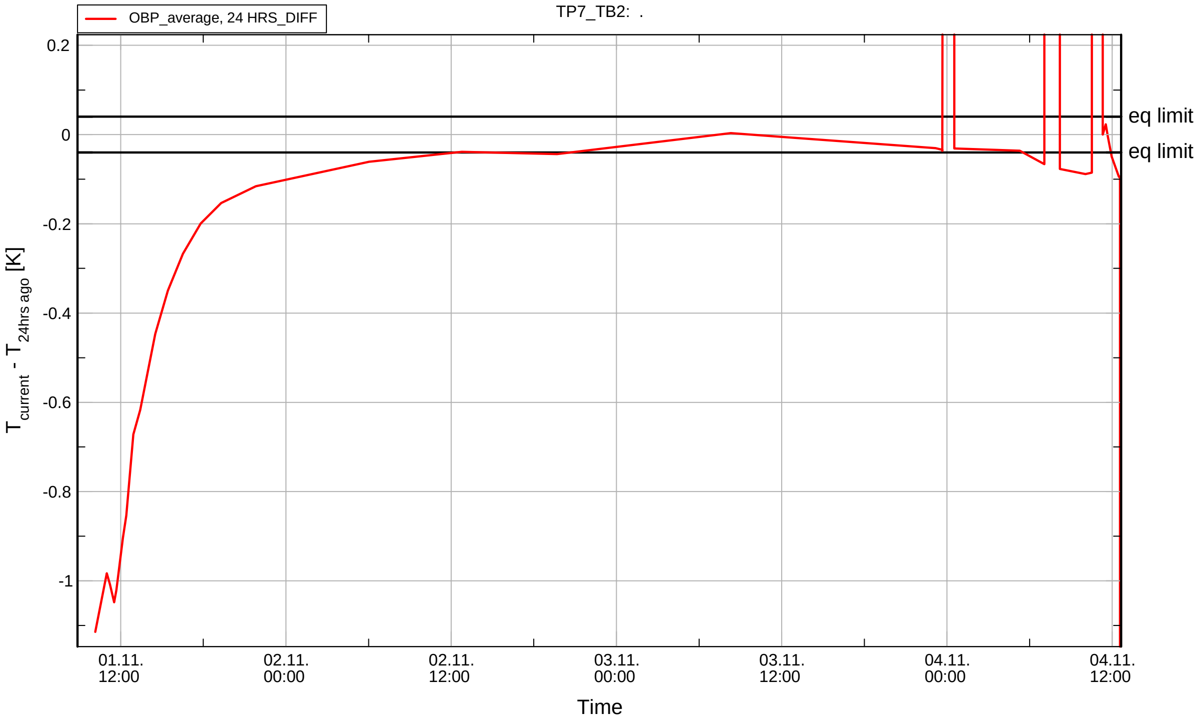


Figure 102: TP7 Equilibrium check for OBP

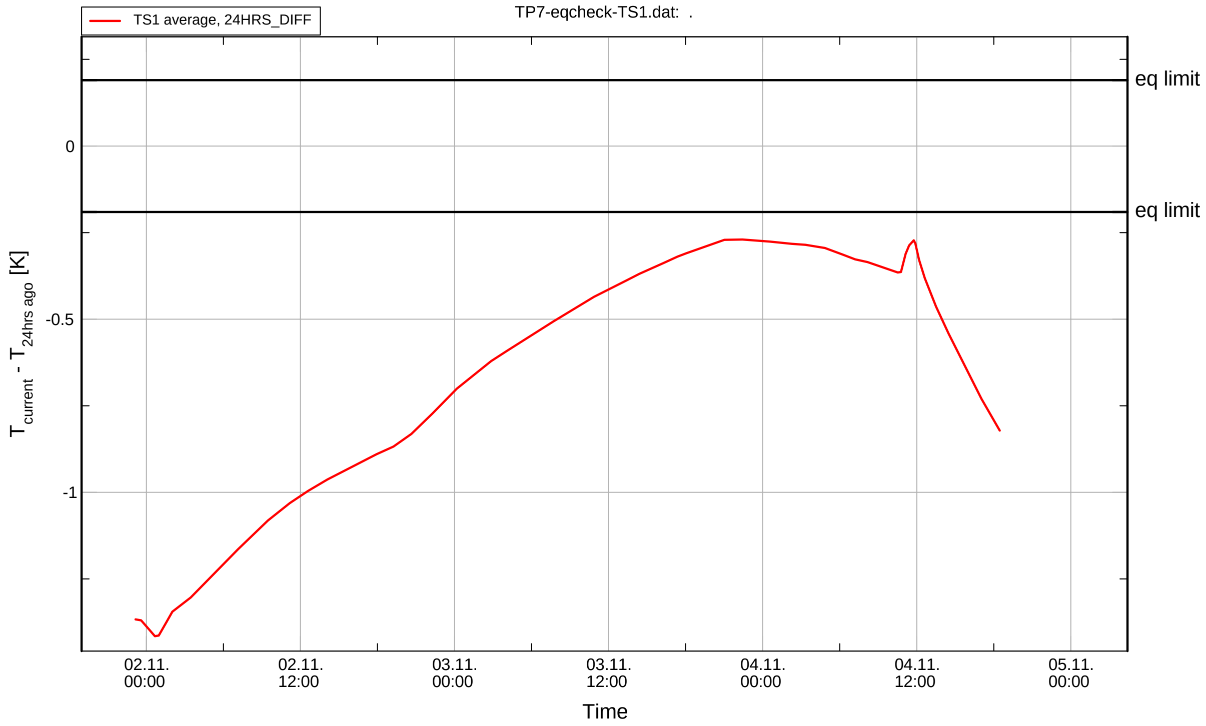


Figure 103: TP7 Equilibrium check for Thermal Shield 1

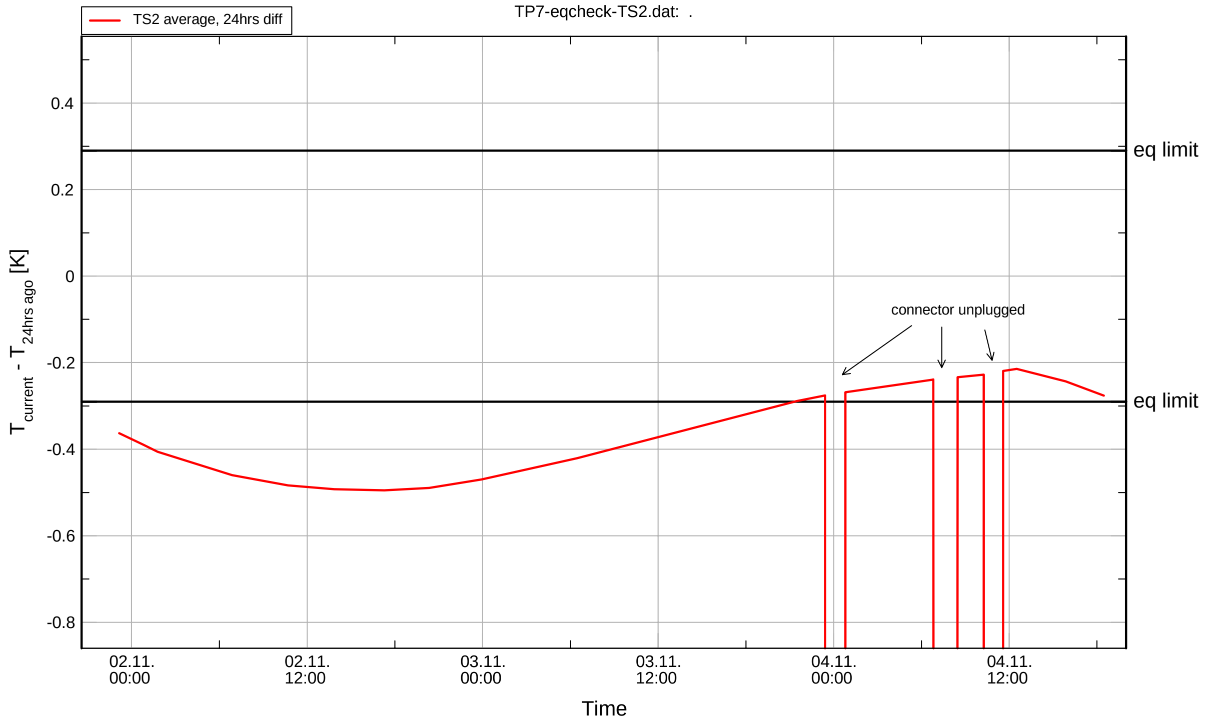


Figure 104: TP7 Equilibrium check for Thermal Shield 2

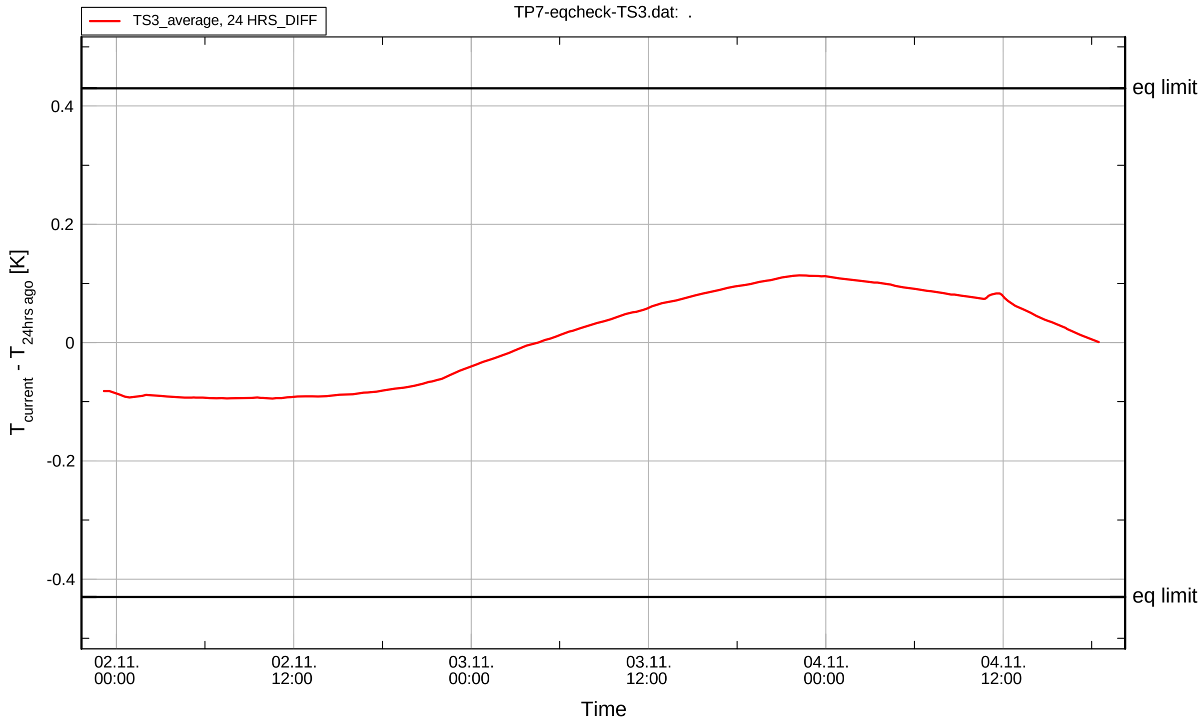


Figure 105: TP7 Equilibrium check for Thermal Shield 3

3.8.1 Procedure Variations

PVS 18 Verification of correct PPS operation and check of impact on L1 temperatures: V103 opened, drop in T231 observed. V104 closed, immediate dT over PPS shows correct operation. T231 decreases to 1.885 K, downstream sensors follow. PACS L1 heaters switched on to 3x10mW, all L1 sensors increase and show “normal” behaviour. S/C tilted to 16°, at 13° T111/112 drop sharply, mass flow increases to 6mg/s before adjustment with needle valve. The PPS was kept operating throughout TB2 phase to measure differences wrt TB1 phase

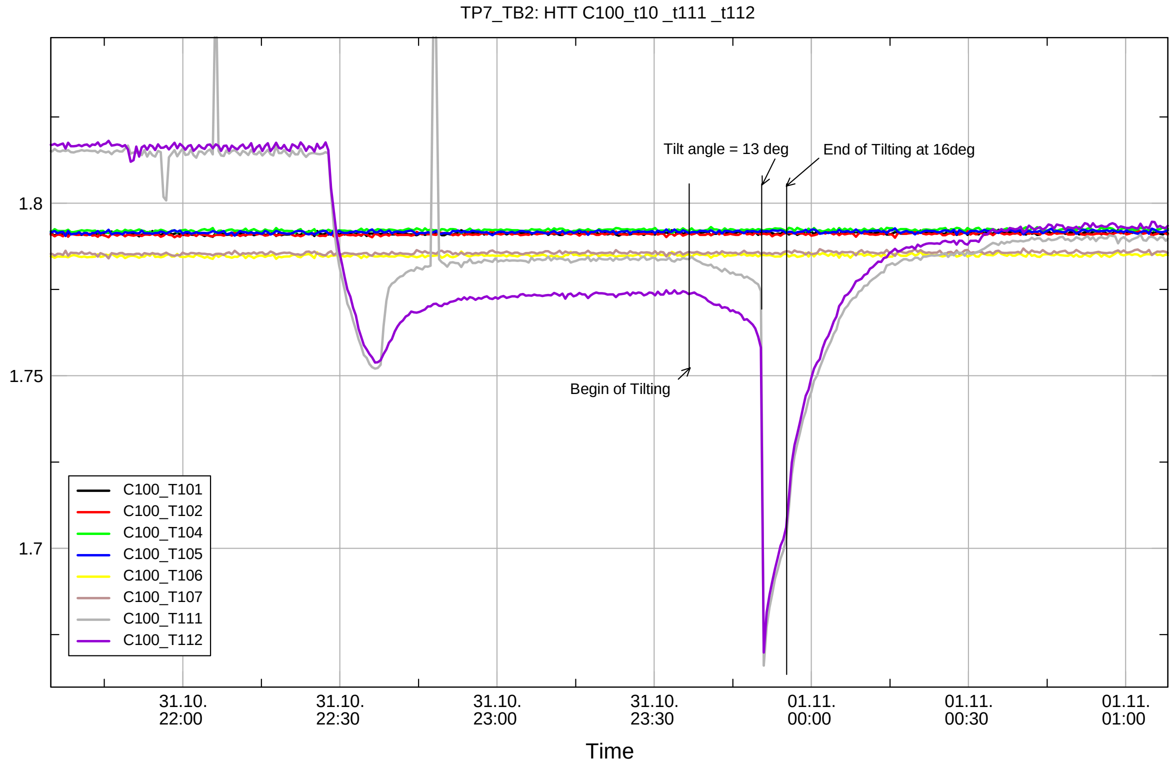


Figure 106: TP7 HTT and PPS temperatures during PVS 18

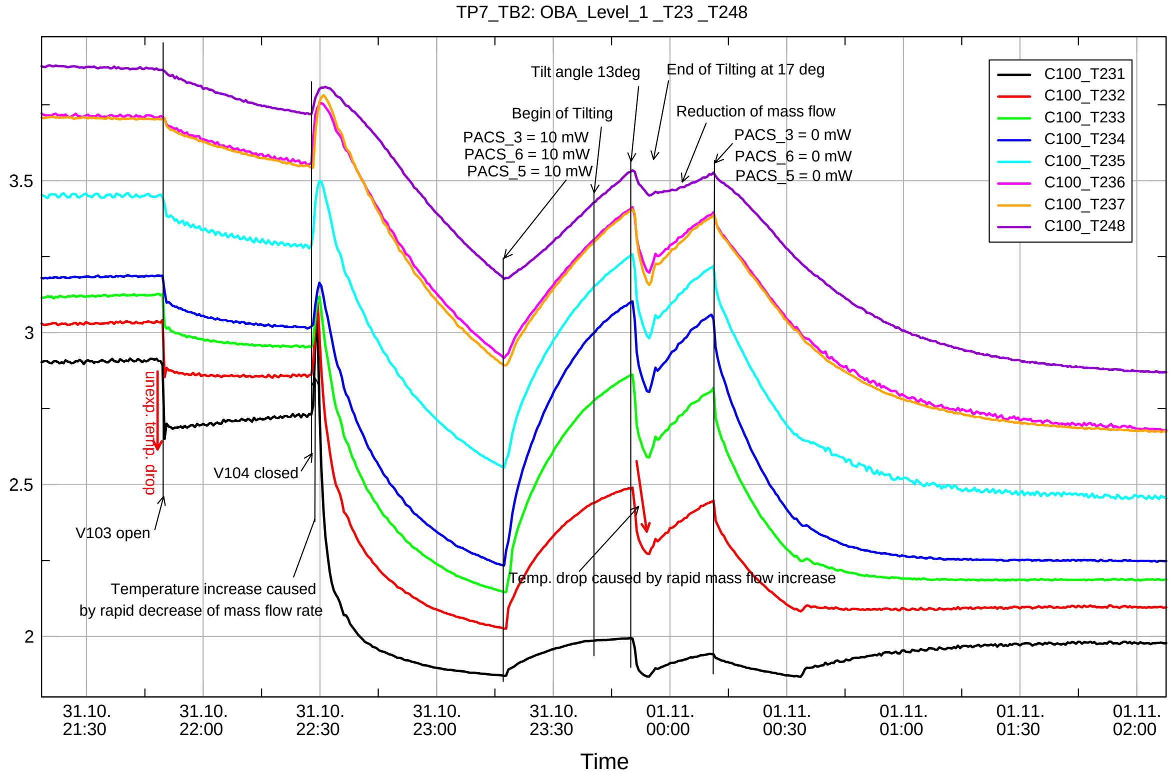


Figure 107: TP7 Level 1 temperatures during PVS 18

PVS 19 Start LOU heating before CVV heat-up with the goal to detect a possible impact on OBA temperatures. No measurable impact was detected.

PVS 20 Boost heating of CVV, to accelerate transition to external steady-state

PVS 21 Additional heat load tests at end of TP7. L1 temperatures were checked for oscillations using an oscilloscope. To connect the oscilloscope, the SCOE connector J02 had to be disconnected.

1. Check of PPS valve configuration impact on Level 1 inlet temperature (T231)
2. Check of HOT valve configuration impact on Level 1 inlet temperature (T231).
3. Check impact of pumps on L1 oscillations (no impact observed)
4. Check impact of HTT venting path on HTT heat load
5. Repeat reference test with closed HTT and evacuated helium tubing

PVS 22 Additional L0 heating test, performed during PVS21 to check whether the sfHe film covering the HTT upper bulkhead can be destroyed by heating of the L0 interfaces

PVS 23 HTT heat load measurement with L0 heaters operating, performed during PVS22 to check the HTT heat load without sfHe film on the HTT upper bulkhead

PVS 24 PACS and SPIRE L1 heaters simultaneous operation, performed during PVS21 to check the impact of additional downstream heating on the L1 inlet temperature

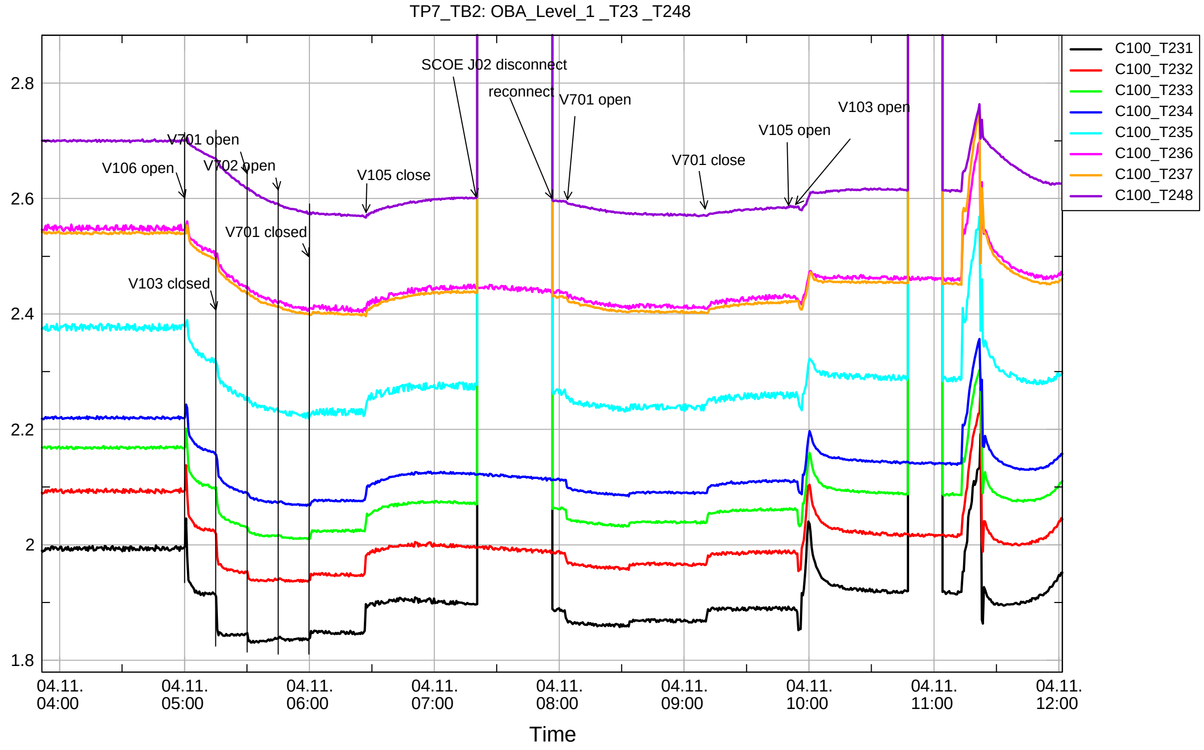


Figure 108: TP7 Level 1 temperatures during PVS 21 valve switching (steps 1 & 2)

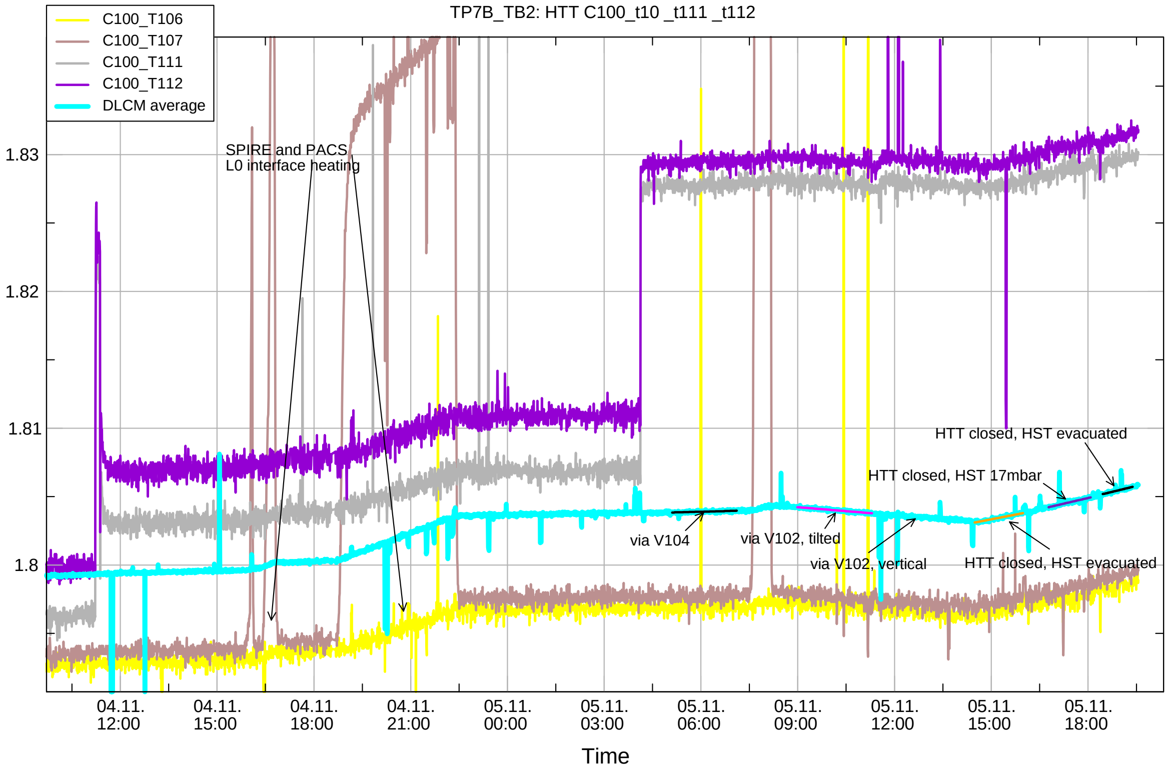


Figure 109: TP7 HTT heat load measurements during PVS 21 (step 4 & 5) and PVS 22-23

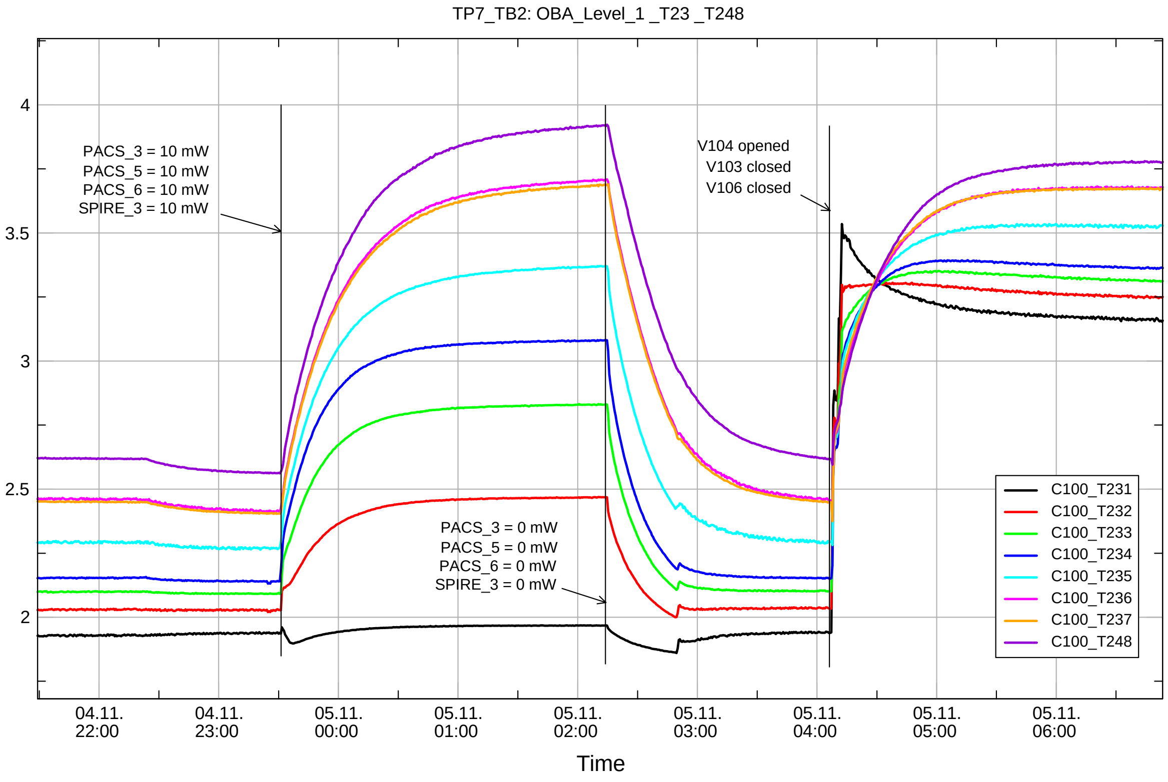


Figure 110: TP7 Level 1 temperatures during PVS 24

3.9 TP 8 – Recovery to Ambient

Since it was decided during the test that the HTT should be kept in superfluid conditions for additional tests to be performed after the TB/TV test, the configuration of the He subsystem during TP8 was changed to achieve high mass flow rates (V102 and V104 open, TVQM3 open, all external LHVs and pump inlet valves open). Covered by PVS 25.

Warm-up of the S/C took longer than predicted due to unexpectedly high temperatures on the test heater harness. The maximum temperature was limited to 125°C in order to avoid outgassing. The TDH test heater power had therefore to be reduced throughout the phase. ASED NCR 1697.

To accelerate the warm-up, the minimum temperature difference between the coldest CVV structure element (including LOU and LOR) and the LSS shrouds was reduced from -10K to 0K.

When the CVV had reached 200K, the CVV temperature was kept (roughly) constant, and a heat load of 192 mW on the HTT was measured without mass flow (covered by PVS 25)

Two heater circuits failed near the end of the phase, numbers 5 and 35 (foil heaters on CVV upper and lower bulkhead). ASED NCR was raised.

The temperature of the shrouds were raised to ambient when the CVV/LOU/LOR minimum temperature had reached 0°C. For the PFM, the end of the warm-up sequence shall be changed in order to keep the S/C warmer than the shrouds up to ambient conditions (AI AAS-F).

During the repressurization of the chamber, dry Nitrogen was inserted and a pressure of ~90mbar was held constant in order to check the integrity of the cryostat vacuum, and to warm up the telescope by convection (assisted by heating of the CVV upper bulkhead and the IR rig), covered by PVS 27.

With the CVV and external tubing at ambient temperature, the pump inlet valves were closed and the pressure sensor P502 reading (13.75 mbar) was compared to the SVP of the HTT (16.72 mbar) to get an additional reference point for the calibration, indicating an offset of -2.97 mbar at 16 mbar, PVS 28.

HTT contents at end of TP8 was 87.5% (LLP measurement).

The HACS measurements are out of range with CVV at ambient temperature as expected.

When the safety line was to be repressurized, it was noticed that the SV121 is not closed tightly, NC1698

The overall duration of the Recovery phase until opening of the chamber was 82.5 hrs vs. 40 hrs expected.

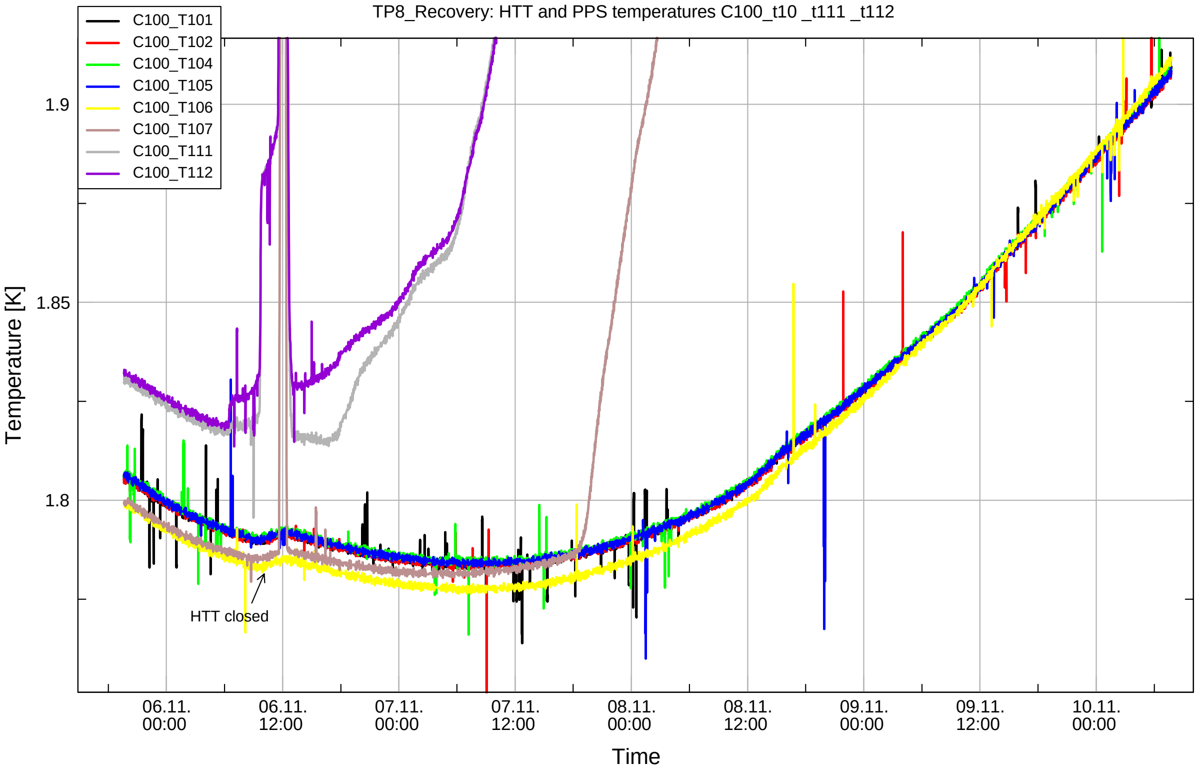


Figure 111: TP8 HTT temperatures

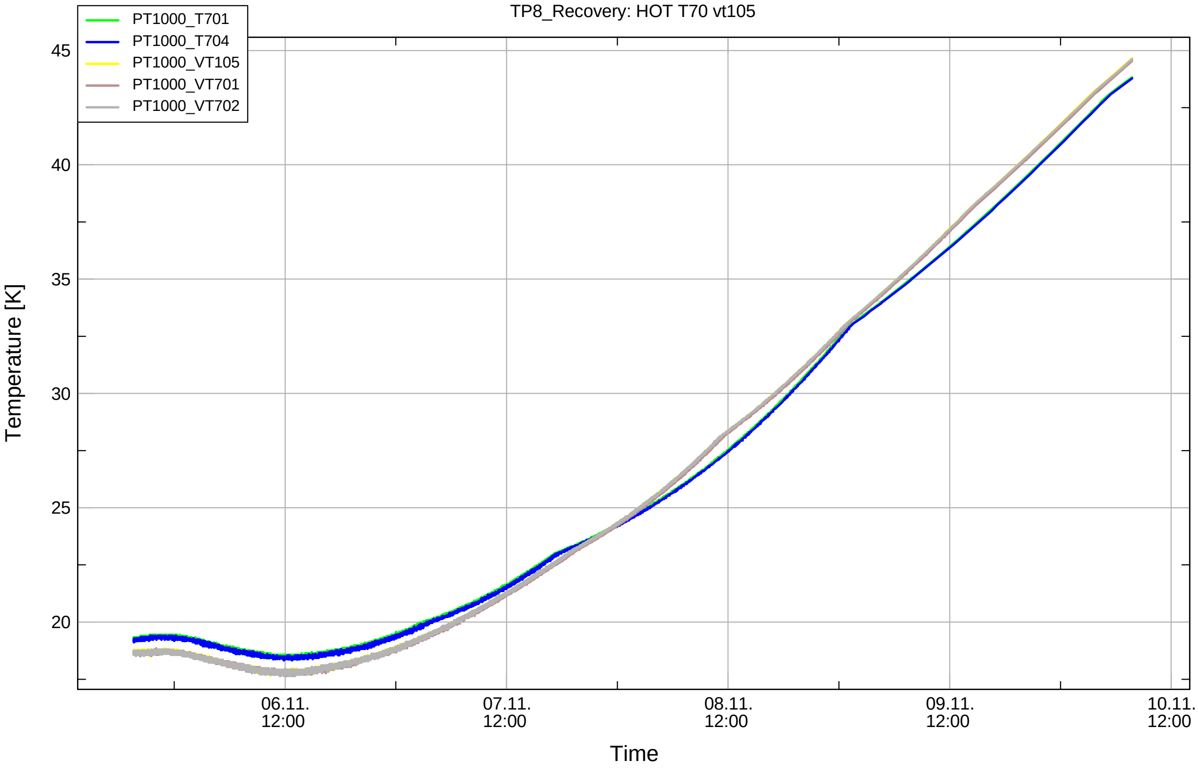


Figure 112: TP8 HOT and lower SFW valve temperatures

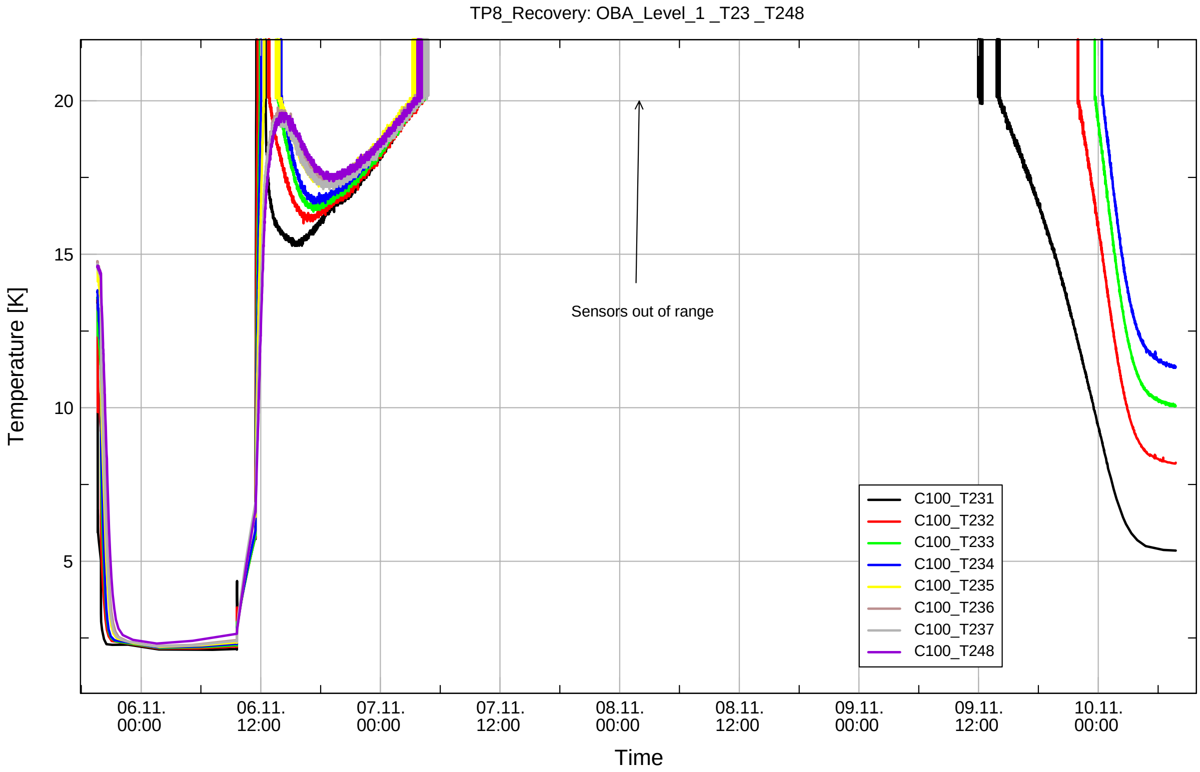


Figure 113: TP8 OBA Level 1 temperatures

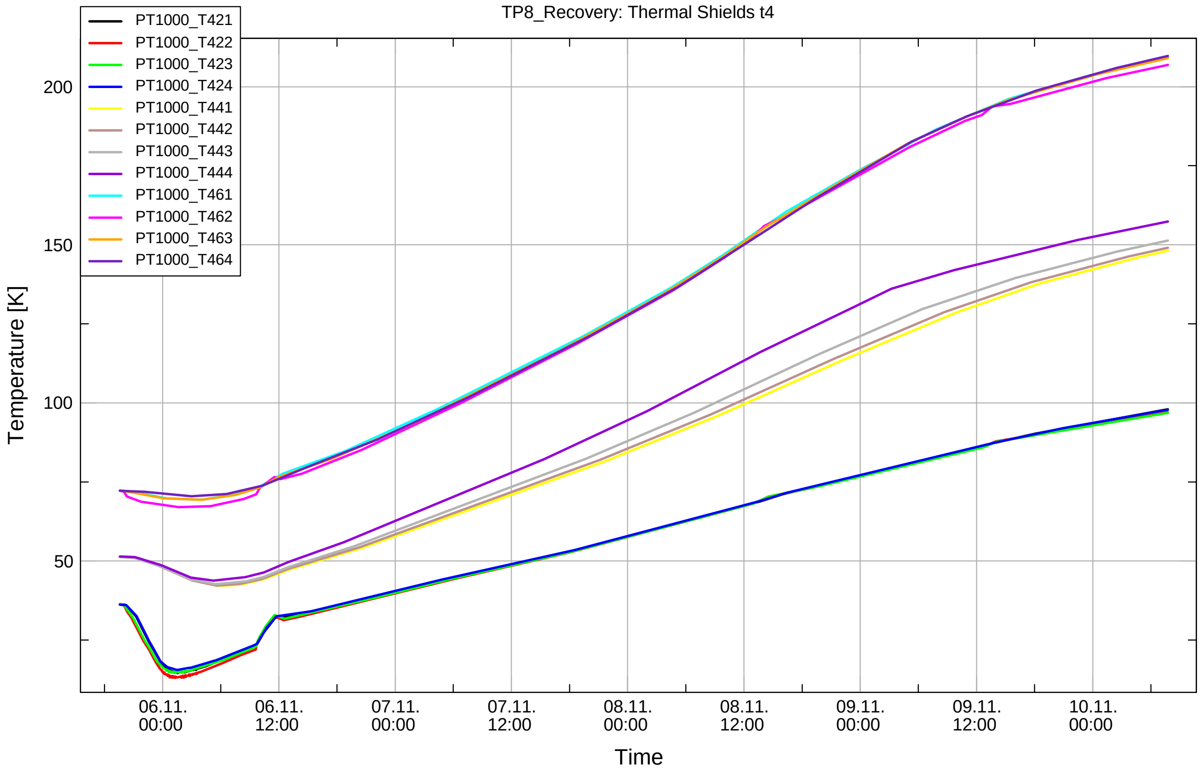


Figure 114: TP8 Thermal shields temperatures

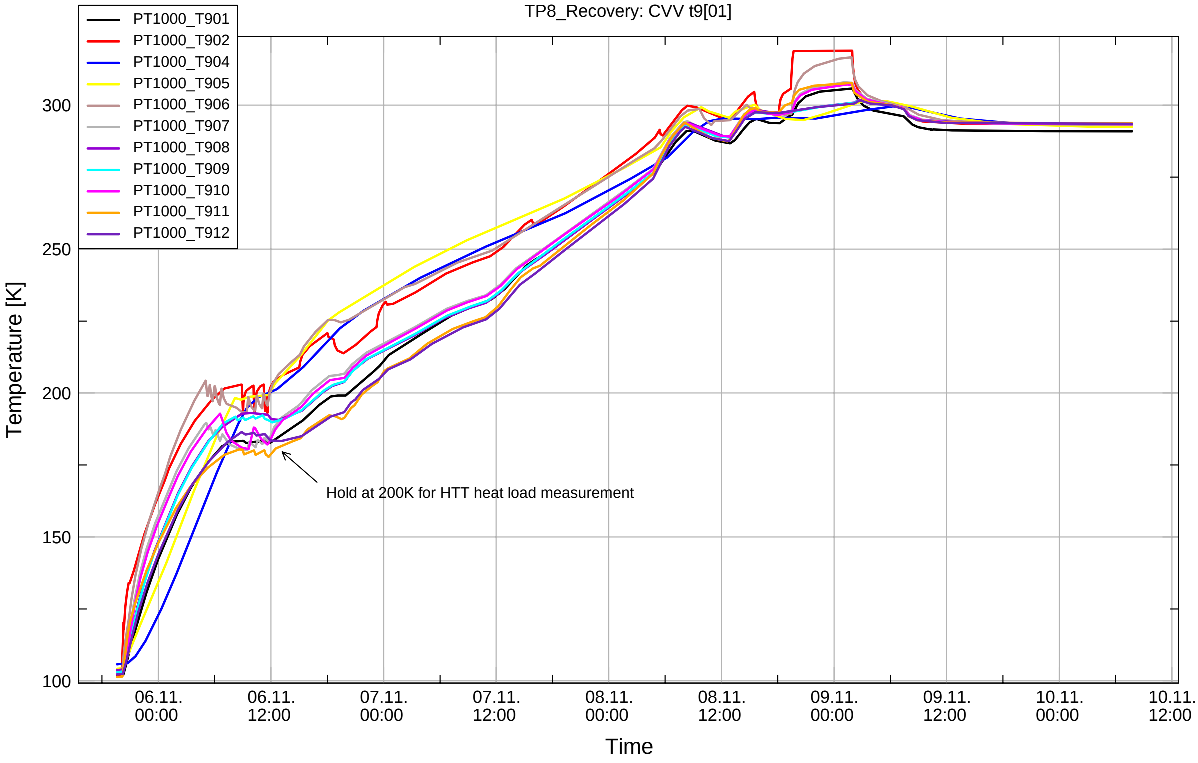


Figure 115: TP8 CVV temperatures

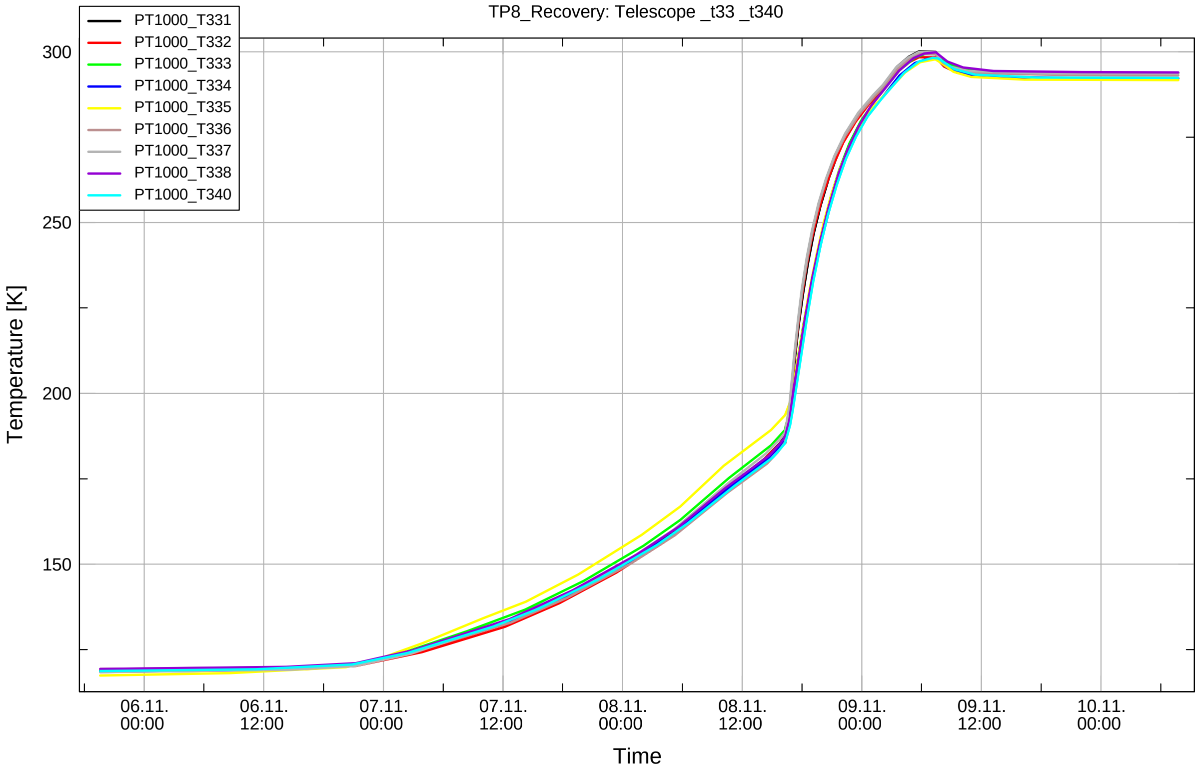


Figure 116: TP8 Telescope dummy temperatures

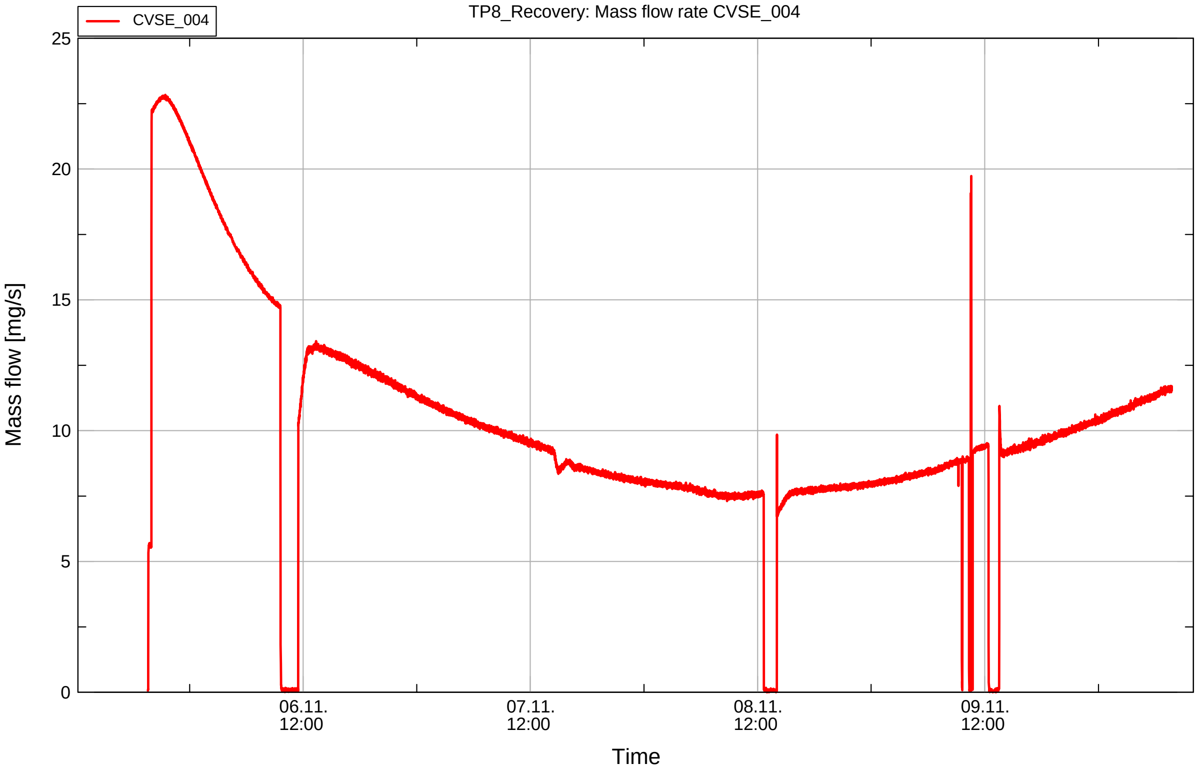


Figure 117: TP8 mass flow rate

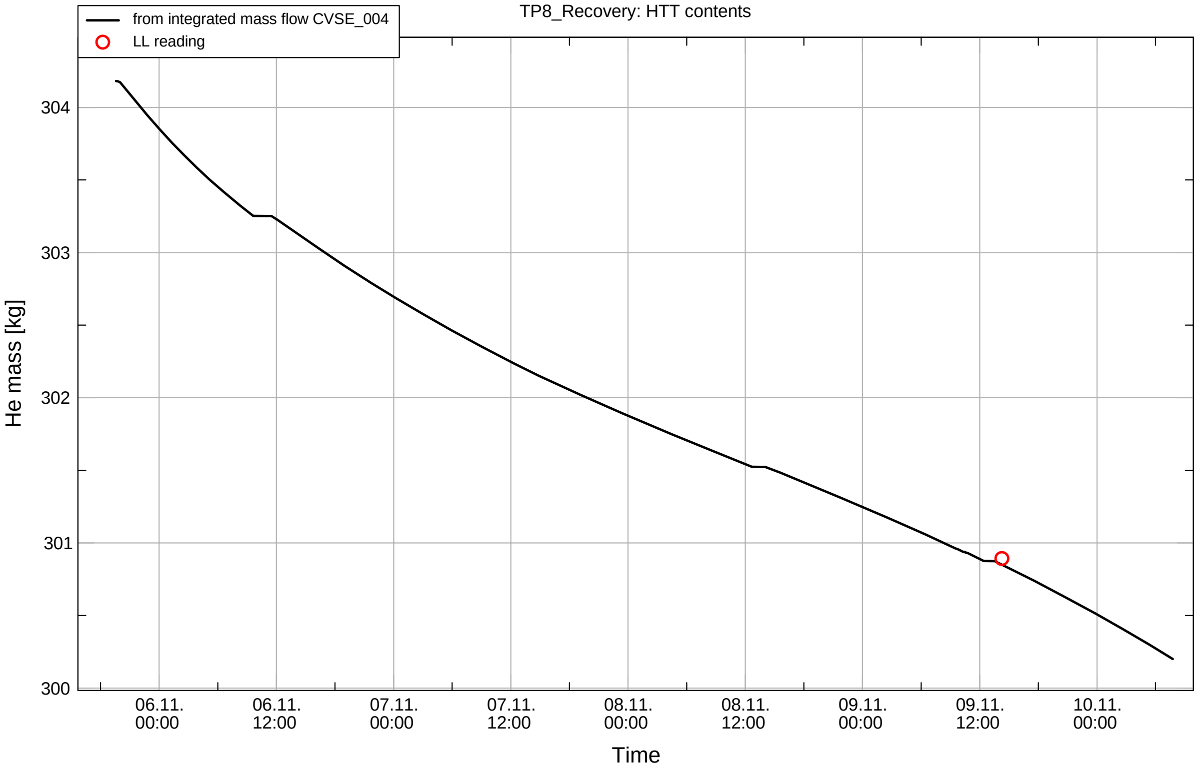


Figure 118: TP8 HTT contents

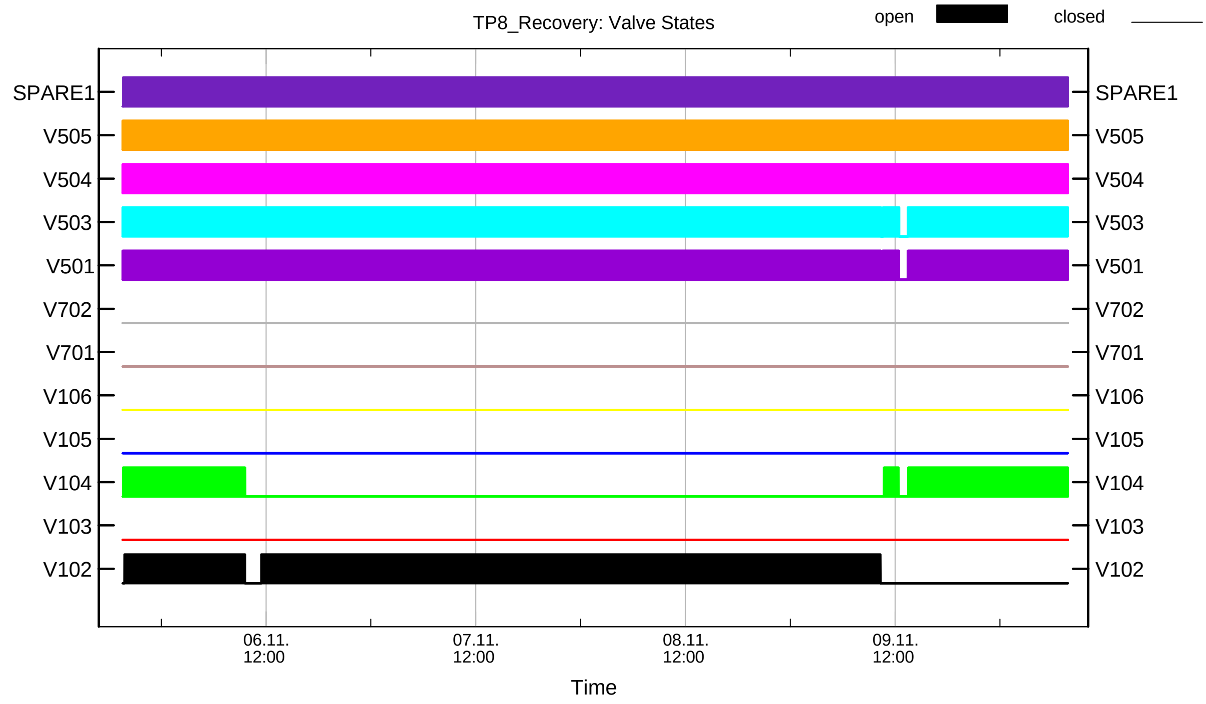


Figure 119: TP8 valve states

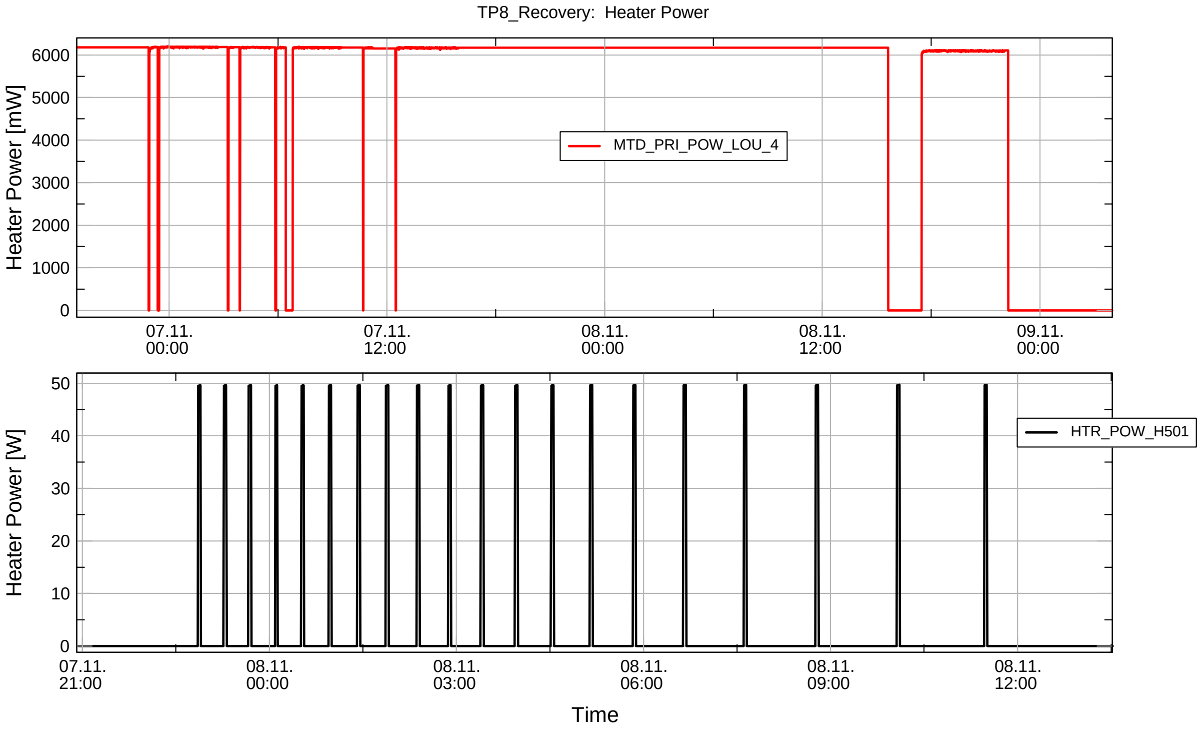


Figure 120: TP8 SCOE heater powers

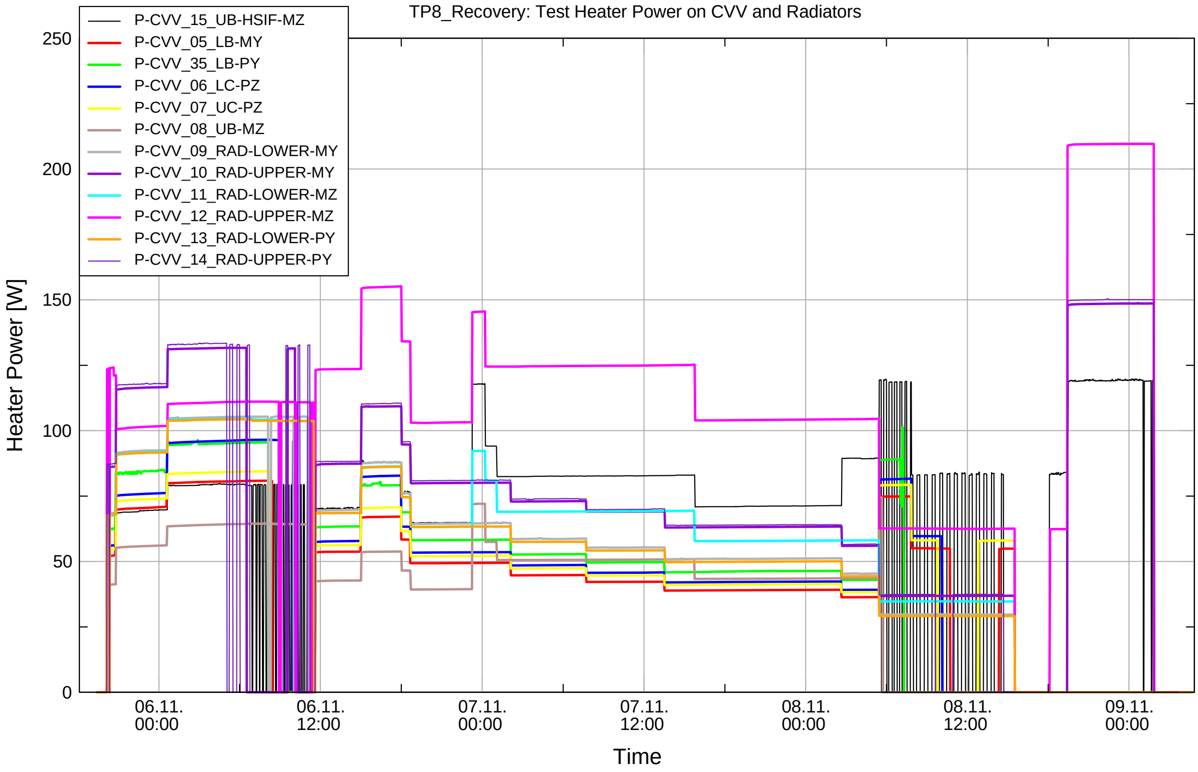


Figure 121: TP8 TDH heater powers on CVV and radiators

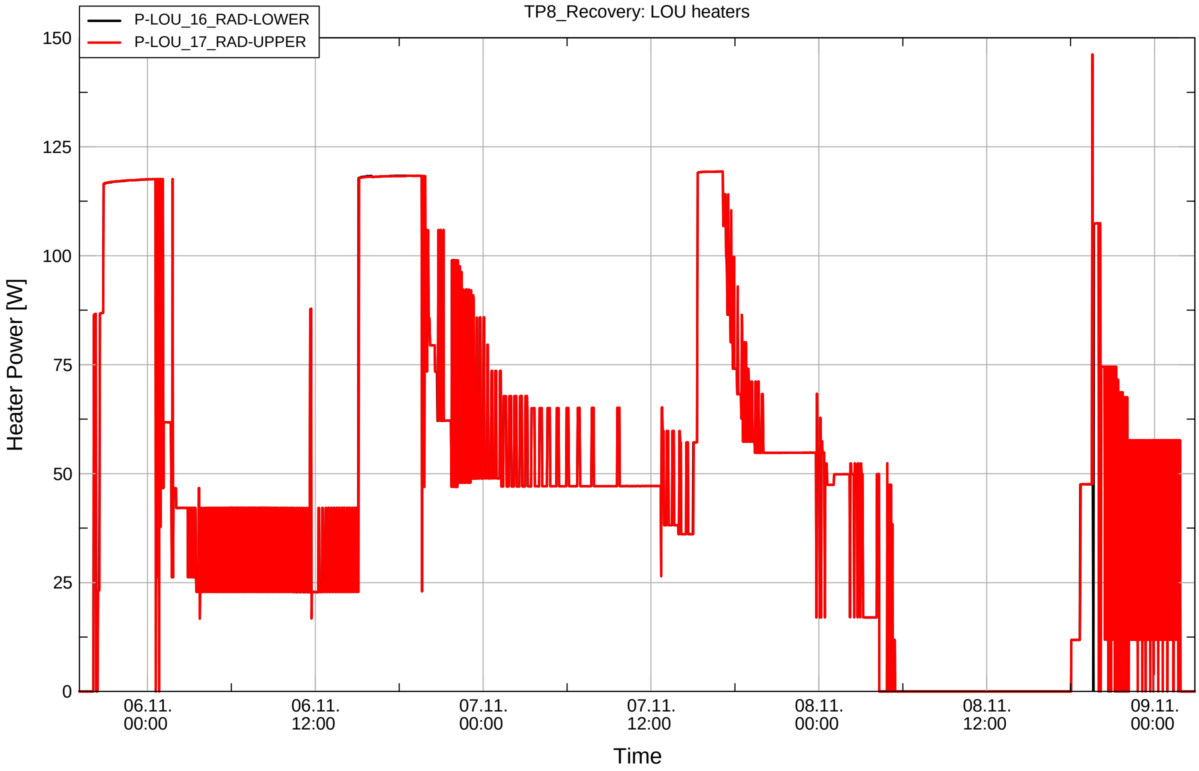


Figure 122: TP8 TDH heater powers on LOU housing

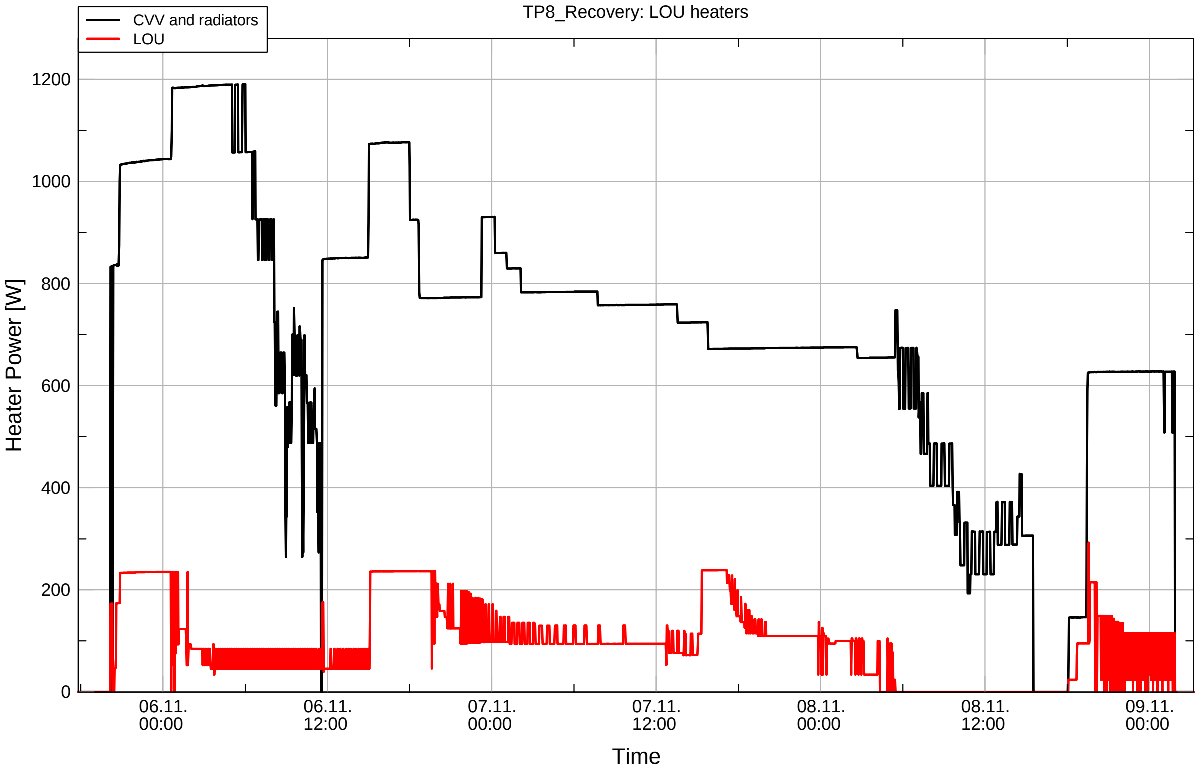


Figure 123: TP8 TDH total heater power

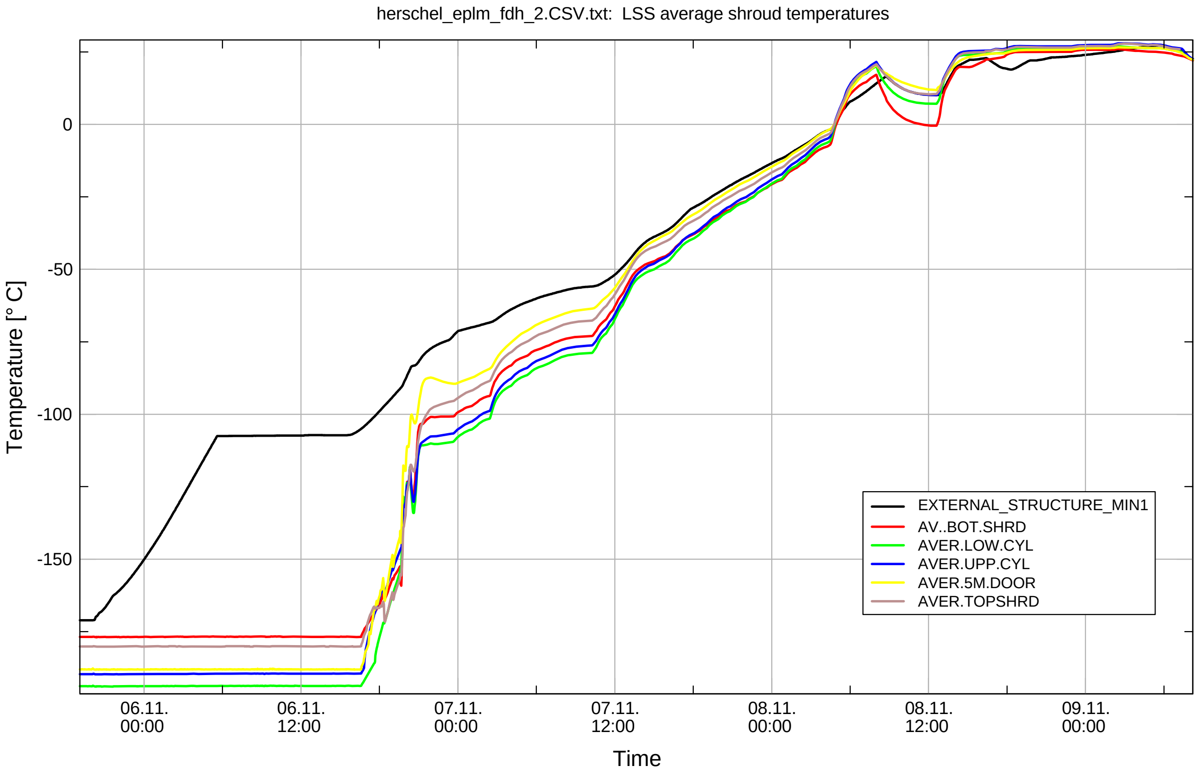


Figure 124: TP8 LSS shroud and external CVV minimum temperatures

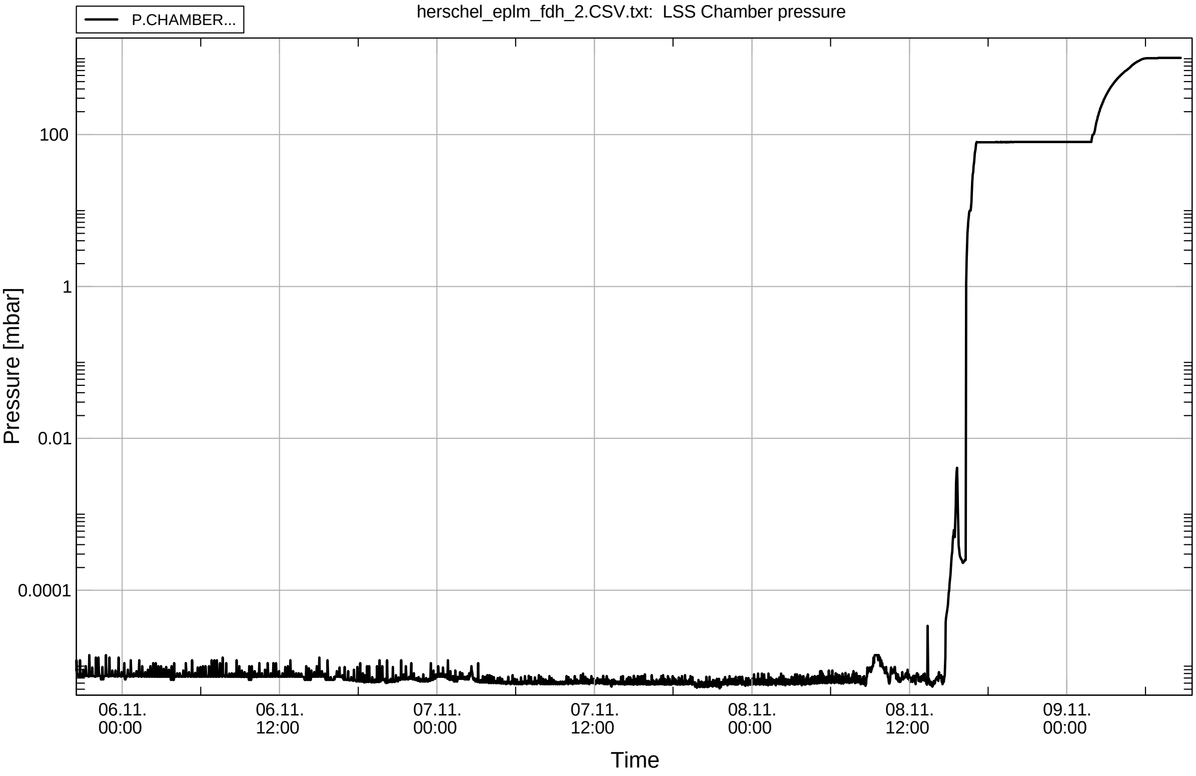


Figure 125: TP8 LSS pressure

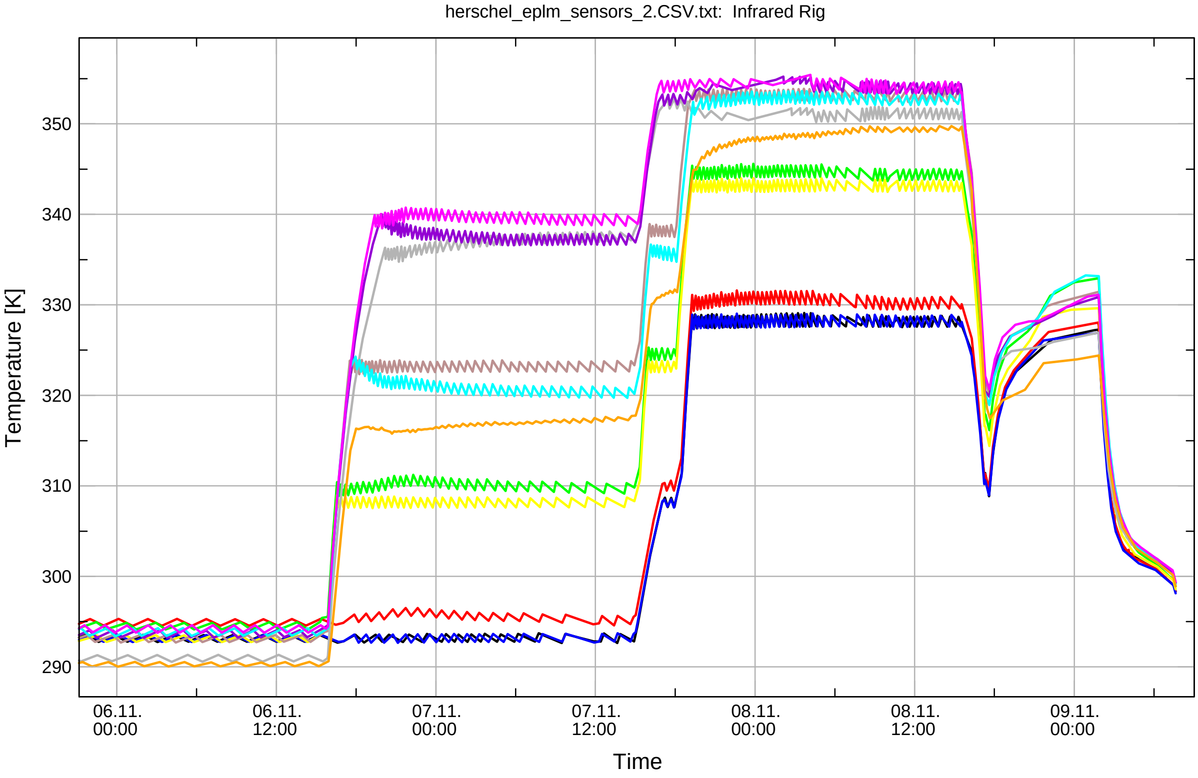


Figure 126: TP8 Infrared rig temperatures

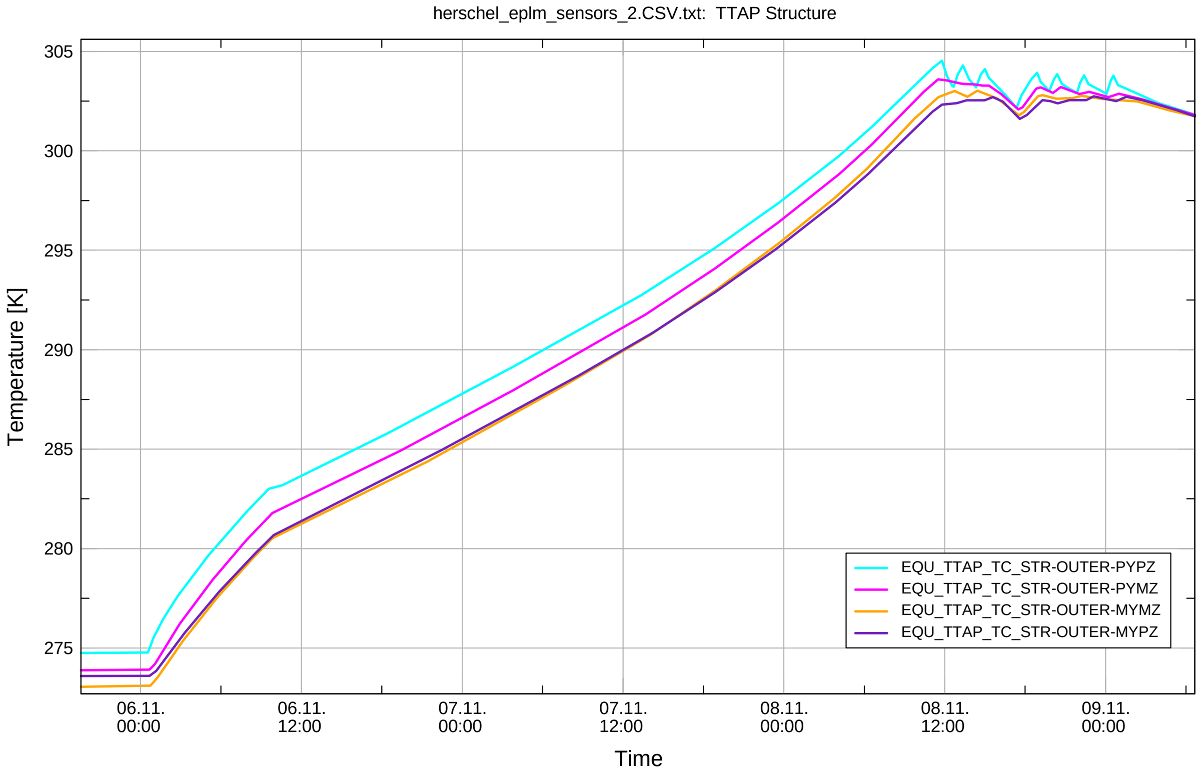


Figure 127: TP8 TTAP temperatures

3.9.1 Procedure Variations

PVS 25 HTT heat load measurement at 200K CVV temperature: performed with closed HTT and subcooled thermal shields

PVS 26 Hold at 100mbar LSS pressure: This hold was introduced to check for a possible major CVV leakage during LSS repressurization before the LSS is flooded with ambient (moist) air.

PVS 27 Reduction of LSS shroud – CVV temperature difference: To accelerate the S/C warm-up, the maximum allowed LSS shoud temperature was increased to the CVV structure minimum temperature. This restriction was kept as long as the CVV structure minimum was below 0°C.

PVS 28 Reference measurement for P502 calibration and HTT heat load: With the CVV at 293K, the pump inlet valves were closed and stable reading of the P502 was achieved, giving a reference point for the sensor calibration by comparison to the HTT saturated vapour pressure. At the same time the HTT heat load (without mass flow) was determined.

PVS 29: The repressurization of the safety line was performed only after chamber pressurization (since the SV121 safety plug was not tight).

4 Instrumentation and Sensor Anomalies

4.1 Instrumentation

The instrumentation as used during the test is reflected in the pictures given in the annex. For further details, refer to [AD2].

4.2 Anomalies

Note that sensor engineering values are set to +/- 999.99 if the raw value acquired by the SCOE is out of the calibrated range for the respective sensor.

4.2.1 Temperature Sensors

Anomalies have been observed during the TB/TV test for the temperature sensors listed in the following Table 2: All major anomalies are traced in NCR 1595.

Table 2: Temperature sensor anomalies

Sensor acronym	Sensor location	Status
MT203	TH-SPIRE-3, cooler evap L0	offset
T111	PPS	values > 4.3 K useless (invalid part of calibration curve up to 300 K implemented at beginning of test for C100 sensor)
T112	PPS	values > 4.3 K useless (invalid part of calibration curve up to 300 K implemented at beginning of test for C100 sensor)
T231	L1 ventline	channel connection corrected @ start of TP 6 (see NCR 1649)
T339	Telescope	not connected
T501	External Ventline	Failed during TP1 (11.10.2005)
T652	Cryostat baffle	not connected, NCR 1595 issued
T901	CVV; -z side, top	temporary noise/oscillation
T903	CVV; -z side, bottom	failed on 10.10.05, 8:35
1005	CVV upper Cyl +Z	temporary noise/oscillation
1103	CVV upper Cyl -Y-Z	temporary noise/oscillation
1107	LOU Radiator mid -Z	temporary noise/oscillation
2011	lower -Y radiator	temporary noise/oscillation
2111	lower -Z radiator	temporary noise/oscillation
2201	upper +Y radiator	temporary noise/oscillation
2113, 2213	lower -Z radiator, lower +Y	locations mixed up, noise

Sensor acronym	Sensor location	Status
	radiator	
2413	LOU Waveguide -Z near mid bracket	temporary noise/oscillation
2602	Harness profile 3800 -Z bottom	temporary noise/oscillation
2632	Harness profile 2900 -Y-Z bottom	temporary noise/oscillation
3263	PLM/SVM strut 26 (TMM 23) +Z bottom	temporary noise/oscillation
8301, 8511, 8312	HSS Thermal Control rig upper +Y	temporary noise/oscillation/ offset
8303	HSS Thermal Control rig upper -Y	temporary noise/oscillation
9301-9308	TTAP	temporary noise/oscillation
2612	Harness profile 4041	no data/not working
1001	CVV	noise
1003	CVV	noise
1100	CVV	noise
2004	-Y radiator	noise
2104	-Z radiator	noise
2202	CVV +Y radiator	noise
2203	CVV +Y radiator	noise
2204	CVV +Y radiator	noise

PT1000 calibration

In general, the conversion of the Pt1000 raw values (voltages) to the engineering data (temperatures) is implemented in the SCOE using linear interpolation of the calibration curves. The sampling points for the linear interpolation have been selected in comparatively large steps for temperatures between 20 K and 70 K as indicated by the vertical blue lines in Figure 128. Similar sampling points have been used for all PT1000 sensors with dedicated calibration, whereas the standard PT1000 calibration is used with significantly smaller sampling steps for the valve sensors (e.g. VT701). Due to the logarithmic behaviour of the T(R) relation for Pt1000 sensors, an error is induced by the large sampling point distance for the specifically calibrated Pt1000 sensors. Figure 128 shows as a red line the difference between the temperature values calculated for given resistance values based on the (VT701) standard calibration curve and the temperatures calculated for the same resistances based on the (T701) dedicated calibration curve. While an overall deviation between the two calibrations is expected (e.g. black curve), individual peaks appear between the interpolation sampling points for the T701 (indicated by vertical blue lines). These peaks are directly caused by the linear interpolation approach in the SCOE in combination with large temperature steps in the sampling points. A deviation of up to 0.8 K is therefore expected at 27 K, 0.4 K at 37 K, and 0.5 K at 53 K (as indicated by the difference between the black and red curves). This effect is visible as “sharp” bends in the T701 (and other Pt1000) measurements e.g. in Figure 35 on page 14.

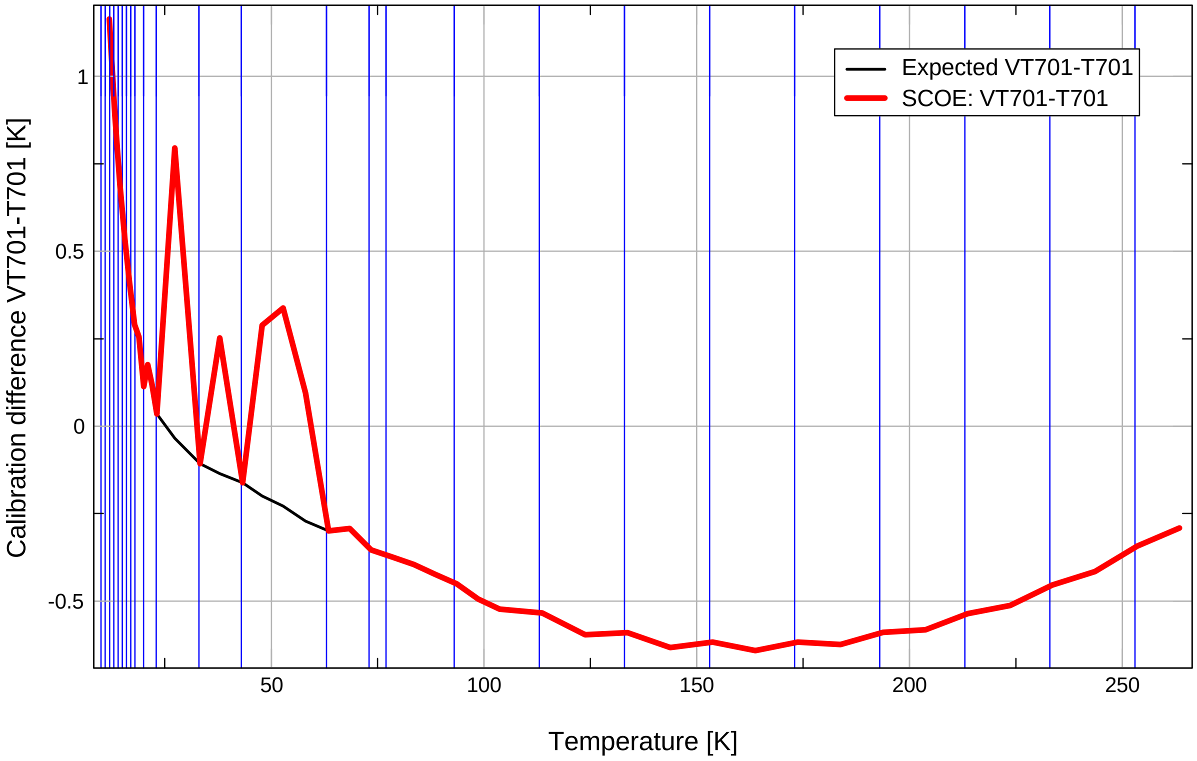


Figure 128: Typical interpolation error in temperature conversion for PT1000 sensors

The following Pt1000 sensors are not affected by this error (since a standard calibration curve with sufficiently small sampling point distance is used):

- MT107, MT108, MT109, MT110, MT213, MT252, MT255, MT315,
- T311, T312, T313, T314, T315, T316, T331, T332, T333, T334, T335, T336, T337, T338, T339, T340, T341, T342, T502, T507, T651, T652,
- VT102, VT103, VT104, VT105, VT106, VT701, VT702

4.2.2 Pressure Sensors

The original calibration data of the low pressure sensor P502 reading the pressure near the inlet to the small nozzles on the external vent line have been re-checked at the end of the TB/TV test (during TP8, time stamp 08.11.2005 12:51 UTC), and an offset of -2.97 mbar has been observed at an absolute value of 16.7 mbar. The pressure reference for this cross check was the saturated vapour pressure of the HTT, the uncertainty of this reference is ±0.35 mbar (for a calibration error of ±6 mK of the DLCM sensors). This error has not been corrected for the pressure sensor readings shown in the current report. To calculate actual pressure values, the offset of 2.97 mbar has to be added to the P502 readings as given here.

5 Non-Conformances

The NCRs listed below were raised during the STM TB/TV test:

Table 3: NCRs raised during the TB/TV test

NCR Nr	**Item Identification**	**NCR Title**	**NRB**	**I.Class**	**C.Class**	**Disposition**	**Status**
HP-120000-ASED-NC-1607	- P-120000 HERSCHEL EPLM	STM-TV: Hick-up in He S/S	INT	Maj		As is	Open
HP-120000-ASED-NC-1609	- 121000 PLM	STM-TV: High Heat Load to HTT after Rapid Cool Down Phase TP3	CUST 1	Maj	Maj	Rework	Open
HP-120000-ASED-NC-1614	- 121000 PLM	STM-TV: SPIRE-L1-H1/2 heaters show no temperature response	INT	Min	Min	Modify	Open
HP-121000-ASED-NC-1553	- 121000 PLM	STM-TV: PPS and ventline pressure drop test failed	CUST 1	Maj		Rework	Open
HP-121000-ASED-NC-1568	- 121000 PLM	STM-TV: HTT temp. increase too high, launch autonomy not succ. completed	CUST 1	Maj	Maj	Rework	Open
HP-121000-ASED-NC-1595	- 121000 PLM	STM-TV: Anomalies observed during STM TB/TV Test	NO				Open
HP-121000-ASED-NC-1623	- 121000 PLM	STM-TV: PPS startup problems at end of TP3	CUST 1	Maj	Maj	Rework	Open
HP-121000-ASED-NC-1697	- 121000 PLM	STM-TV: CVV test heaters could not be operated at maximum power	INT	Min	Min	Rework	Open
HP-121000-ASED-NC-1698	- 121000 PLM	STM-TV: SV 121 leaky under cold conditions and at end of STM TB/TV test	CUST 1	Maj	Maj	As is	Closed

NCR Nr	Item Identification	NCR Title	NRB	I.Class	C.Class	Disposition	Status
HP-142220-ASED-NC-1616	- 142200 EPLM EGSE	STM-TV: SPIRE MTD heater power not correctly monitored by PFM Cryo SCOE	INT	Min	Min	Rework	Open
HP-142410-ASED-NC-1583	- 142410 LOU Alignment Camera	STM-TV: Measurement problems detected during HACS operation	INT	Maj		Rework	Open

6 Overview of Measurement Events

6.1 HTT heat load

In addition to the planned test phases, specific HTT heat load measurements have been performed as listed in Table 4. All of these measurements have been performed in transient conditions, i.e. the temperature drift of the HTT contents has been considered in the heat load calculation as well as the heat of vaporization and the heat taken up in the He gas in the ullage volume (which is very small throughout the test). The main parameters of the thermal environment of the HTT during these tests is described in Table 5. Further details can be found in the test description given in chapter 3, using the test phase and time stamp as given in Table 4. The measured inputs used for the heat load calculation are summarized in Table 6. For the calculation of the ullage heat, the upper HTT bulkhead temperature measurement T107 is used where appropriate. For comparison, specific snapshots of the transient TMM predictions with similar thermal environment as the measurements are gathered in Table 7.

The objectives and first results of the individual measurements were as follows:

No 1: First calculation of the HTT heat load during launch autonomy under nominal conditions to assess the HTT heat load due to the high observed HTT temperature drift. A HTT heat load of ~450 mW was measured, compared to an expected value of ~83 mW.

No 2: Trying to reduce the HTT heat load in order to reach nominal conditions for launch simulation, the vent path from the HOT was changed to venting via the HOT inlet valve V702 and thus via the Filling Port to the OBA. A significant reduction of the HTT heat load was observed.

No 3: The mass flow was stopped and the helium system tubing (HST) was evacuated to a pressure below 1 mbar to assess whether oscillations in the He gas can be excluded from the possible heat load causes. The HTT heat load was reduced compared to the nominal vent path, but was higher than for the Filling Port vent path.

No 4: Venting via the HTT inlet (V102) and outlet (V104) valves to reduce the heat load and achieve the highest possible mass flow rates for subcooling the thermal shields, this measurement is used for comparison to measurement No 5.

No 5: With the coldest possible environment (Thermal Shields 1 TS1 temperature sensors out of measurement range, estimated temperature ~6K), the HTT was closed and the tubing evacuated to get an extreme reference case for the heat load.

No 6: Venting via the passive phase separator (PPS) as for orbit configuration (but with the redundant PPS valve V103 closed) and close to nominal orbit mass flow rate, a heat load of ~173 mW was measured compared to 53 mW predicted.

No 7: Venting via the HTT outlet valve for ground operations with increased mass flow rate results in smaller HTT heat load

No 8: Very similar to No 7 with similar heat load result

No 9: Vent path changed to PPS and V103, no significant impact on heat load

No 10: Reference measurement for PVS21 tests, venting via V104 with S/C tilt angle 16°

No 11: Vent path switched to V102 (i.e. via the Filling Port to the OBA). Significant reduction wrt No 10.

No 12: Conditions similar to No 11 but without mass flow and with evacuated HST. The measured HTT heat load is between the V102 venting and the V104 venting cases (No 10 and 11). The shield temperatures rise throughout No 12 – No 14.

No 13: Conditions as for No 12 but with He gas at HTT vapour pressure in HST, no mass flow. HTT heat load is similar to the V104 venting case (No 10).

No 14: Repetition of No 12 with higher shield temperatures in order to decide whether a change in the HTT heat load as seen from No 12 to No 13 is caused by the temperature change of the HTT environment alone or by the evacuation of the HST. Measured heat load is higher than for No 12 and 13. The evaluation does not show a significant impact of the HST pressure.

No 15: HTT heat load measurement performed during the S/C warm-up at the end of the TB/TV test. The CVV temperature was kept approximately constant at ~200 K , and the HTT was closed, HST evacuated during the measurement. The measured heat load is ~200 mW, while ~77 mW were expected from the predictions for a similar CVV but even higher thermal shield temperatures.

No 16: With the CVV at ambient temperature and closed HTT, but with He gas in the tubing, the measured heat load is ~580 mW. With similar shield temperatures but higher CVV temperature, a heat load of 364 mW was expected from the transient TMM predictions.

Table 4: HTT heat load measurements during TB/TV test

No	Timestamp	Phase	Vent path on HTT	HTT temp K	mass flow mg/s	Total heat load mW	Remarks
1	09.10.2005 11:00	TP1	V701	1.871	48 (HOT)	452	LA, venting from HOT
2	09.10.2005 15:00	TP1	V702	1.876	48 (HOT)	236	LA, venting from HOT via V702
3	10.10.2005 12:30	TP1	none	1.896	0	376	LA, no mass flow, tubing evacuated
4	20.10.2005 14:00	TP3	V104 & V102	1.699	23.10	215	
5	20.10.2005 15:05	TP3	none	1.699	0.00	150	HST evacuated
6	22.10.2005 12:00	TP4	V106	1.725	2.27	173	Venting via PPS
7	29.10.2005	TP5	V104	1.777	4.60	147	TB1 phase

No	Timestamp	Phase	Vent path on HTT	HTT temp K	mass flow mg/s	Total heat load mW	Remarks
	10:00						
8	31.10.2005 22:00	TP6	V104	1.791	4.97	152	
9	01.11.2005 03:30	TP6	V103	1.792	4.95	140	
10	05.11.2005 06:00	TP7	V104	1.804	5.42	141	
11	05.11.2005 11:20	TP7	V102	1.804	5.35	75	tilted and vertical, no difference
12	05.11.2005 15:15	TP7	none	1.804	0	115	HST evacuated
13	05.11.2005 17:30	TP7	none	1.805	0	138	17mbar in HST
14	05.11.2005 19:00	TP7	none	1.806	0	145	HST evacuated
15	06.11.2005 11:10	TP8	none	1.791	0	197	HST evacuated
16	08.11.2005 13:30	TP8	none	1.807	0	580	HTT vapour pressure in HST, CVV at RT

Table 5: Thermal environment during heat load measurements

No	T107 K	HOT K	OBP K	TS1 K	TS2 K	TS3 K	CVV K
1		4.4	8.5	24.3	80.9	139.9	292.2
2		4.4	22.6	34.7	83.3	142.8	292.4
3		4.3	18.8	45.7	102.0	164.1	292.2
4	1.694	34.9	3.0	~6	12.1	24.1	97.9
5		34.7	6.2	16.6	16.5	28.3	97.9
6		29.6	13.2	34.9	41.7	57.1	99.5
7	1.771	21.8	9.5	34.6	51.8	71.1	101.2
8	1.815	21.0	9.7	34.3	52.0	71.6	101.1
9	1.793	20.9	8.5	34.0	52.0	71.6	101.1
10	1.829	19.3	8.1	30.8	50.4	71.5	103.2

No	T107 K	HOT K	OBP K	TS1 K	TS2 K	TS3 K	CVV K
11	1.828	19.2	14.0	30.9	50.3	71.4	103.2
12		19.1	15.8	32.8	50.3	71.5	103.2
13		19.2	17.0	34.8	50.8	72.0	103.3
14		19.1	17.6	35.9	51.2	72.2	103.3
15		18.5	12.4	31.0	46.0	75.5	196.8
16		28.0	36.5	68.9	106.8	154.0	295.0

Table 6: Measured inputs for HTT heat load calculation

No	HTT temp K	HTT drift mK/day	mass flow mg/s	HTT contents kg	Cp gas [J/Kg-K]	Latent Heat [J/Kg]	Cp liquid [J/Kg-K]	Evapo-rization mW	ullage mW	T drift mW
1	1.871	32.54	0	334.0	3591	23058	5875	0.0	0.0	451.7
2	1.876	16.80	0	334.0	3641	23061	5879	0.0	0.0	236.5
3	1.896	25.25	0	334.1	3847	23073	5895	0.0	0.0	375.6
4	1.699	-39.69	23.10	309.6	2186	22787	5736	526.4	0.0	-310.9
5	1.699	19.20	0.00	309.6	2186	22787	5736	0.0	0.0	150.4
6	1.725	14.34	2.27	309.7	2363	22843	5757	51.9	0.0	121.4
7	1.777	4.26	4.60	307.1	2750	22941	5799	105.6	0.0	41.6
8	1.791	3.70	4.97	306.3	2866	22964	5830	114.1	0.8	37.6
9	1.792	2.59	4.95	306.3	2871	22965	5812	113.7	0.2	26.3
10	1.804	1.52	5.42	304.2	2971	22983	5842	124.6	1.0	15.9
11	1.804	-4.67	5.35	304.1	2971	22983	5841	123.0	0.9	-48.8
12	1.804	10.98	0	304.0	2967	22982	5821	0.0	0.0	114.7
13	1.805	13.14	0	304.0	2976	22984	5822	0.0	0.0	137.6
14	1.806	13.81	0	304.0	2984	22985	5823	0.0	0.0	145.0
15	1.791	19.57	0	303.1	2864	22963	5811	0.0	0.0	196.6
16	1.807	55.44	0	301.5	2999	22987	5824	0.0	0.0	580.3

Table 7: Comparison of HTT heat load measurements with predictions

No		vent path	HTT [K]	HTT drift [mK/d]	mdot [mg/s]	HOT [K]	OBP [K]	TS1 [K]	TS2 [K]	TS3 [K]	CVV [K]	**heat load [mW]**
	Predicted	V701	1.920	5.2	48 (HOT)	4.2	11.3	22.6	62.2	146.8	293.0	**83**
1	Measured	V701	1.871	32.5	48 (HOT)	4.4	8.5	24.3	80.9	139.9	292.2	**452**

No		vent path	HTT [K]	HTT drift [mK/d]	mdot [mg/s]	HOT [K]	OBP [K]	TS1 [K]	TS2 [K]	TS3 [K]	CVV [K]	**heat load [mW]**
	Predicted		1.699	0.2	2.3	30.9	10.5	34.8	40.1	57.7	99.1	**53**
6	Measured	V106	1.725	14.3	2.3	29.6	13.2	34.9	41.7	57.1	99.5	**173**
	Predicted		1.686	10.2	0.0	18.9	17.9	41.5	52.5	75.2	189.8	**77**
15	Measured	none	1.791	19.6	0.0	18.5	12.4	31.0	46.0	75.5	196.8	**197**
	Predicted		1.715	44.0	0.0	23.9	37.9	69.7	91.7	156.2	322.4	**364**
16	Measured	none	1.807	55.4	0.0	28.0	36.5	68.9	106.8	154.0	295.0	**580**

6.2 Instrument thermal interfaces

Dedicated measurements of the performance of the instrument thermal interfaces on L0, L1, L2 and L3 were performed during the test, especially in phases 4 and 6. Evaluation of these measurements is ongoing, the results will be presented in a separate document [RD25]. That document also contains L0 test results obtained outside the LSS with the CVV tilted by 90°.

6.3 DLCM

DLCM measurements have been performed during the STM campaign as listed in Table 8. Evaluation of the measurement results is ongoing. As reference values, the HTT helium contents is shown in Figure 129 as calculated from the integrated (CVSE_004) mass flow measurements in comparison with liquid level probe measurements. Note that with a total offset correction of 0.8 kg over the complete test duration with a total He consumption of 33.9 kg, the integrated mass flow measurement and the liquid level probe readings match very well.

Table 8: DLCM measurements overview

Timestamp	Phase	HTT temperature				DLCM heating	
		before		after		duration	Power setting
		value [K]	drift [K/d]	value [K]	drift [K/d]	[s]	[W]
18.09.2005 14:51:31	Pre-TBTV	1.84904	0.066529	1.8515	0.050685	200	10
23.10.2005 10:35:00	TP4	1.7384	0.014209	1.7438	0.013434	200	20
31.10.2005 20:21:00	TP6	1.78616	0.003274	1.78663	0.001496	20	20
31.10.2005 20:53:00	TP6	1.78667	0.001496	1.7913	0.001496	200	20

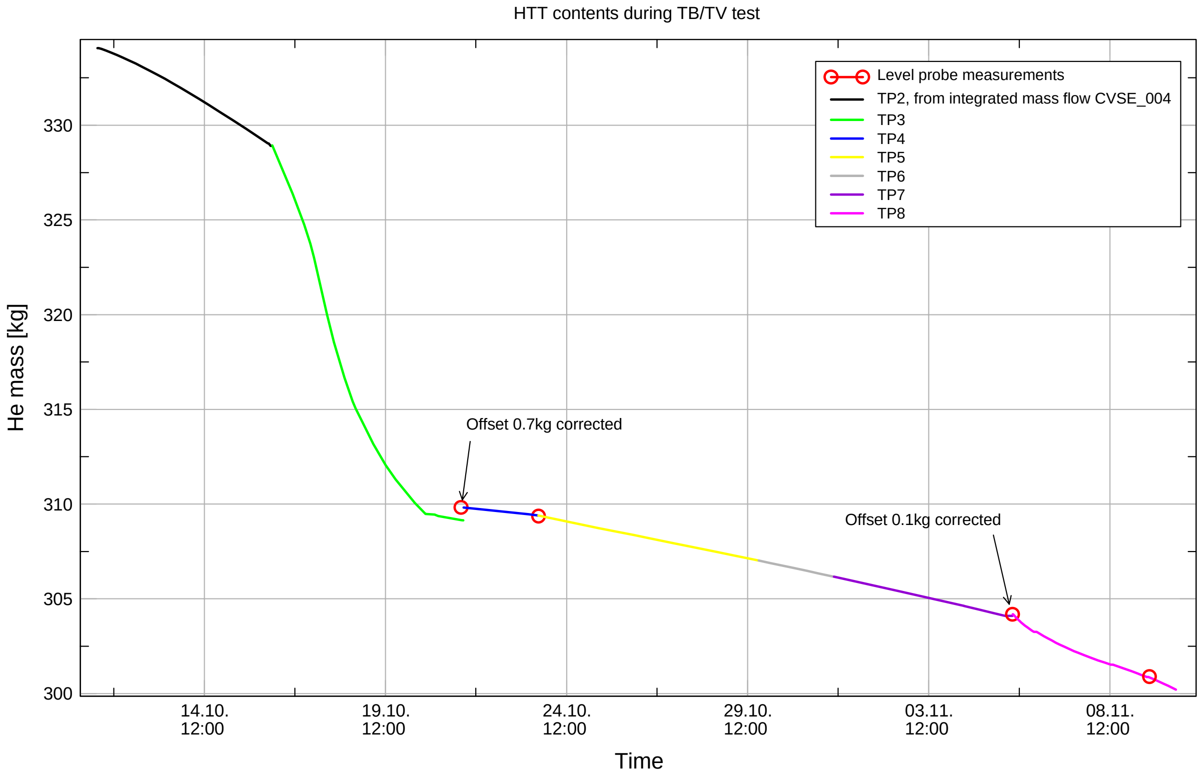


Figure 129: Integrated mass flow rate and level probe measurements

6.4 Pressure Drop

Dedicated pressure drop measurements of the helium system tubing have been performed during the TB/TV test as listed in Table 9. An evaluation of the test results will be given in [RD24].

Table 9: Pressure drop measurements overview

		Vent path		Temperatures [K]					Pressure [hPa]			mass flow [mg/s]		
Time stamp	Phase	HTT	Nozzle	HTT	TS1	TS2	TS3	Nozz.	P502 meas	nozz inlet pred	dev	meas	pred	dev
16.10.05 05:55	TP2	V106	big	2.000	38	89	116	116	14.4	18.8	31%	14.8	14.1	-5%
16.10.05 06:24	TP2	V106	small	2.000	38	89	116	116	26.9	29.8	11%	4.6	3.5	-25%
16.10.05 06:37	TP2	V104	small	2.000	38	89	116	116	26.9	30.7	14%	4.7	3.6	-24%
16.10.05 07:40	TP2	V104	big	1.999	38	89	116	116	21.5	27.0	26%	24.4	20.2	-17%
23.10.05 15:04	TP4	V106	big	1.745	38	48	63	99	7.4	6.8	-8%	6.3	5.5	-12%
23.10.05 15:47	TP4	V104	small	1.745	38	48	63	99	12.6	13.2	5%	1.9	1.7	-13%
04.11.05 11:50	TP7	V103/ V106	small	1.799	32	51	72	102	14.0	15.2	9%	2.3	1.9	-19%

6.5 Check-out of Scientific Instrument Harness

A 100% verification of the internal and external CVV Scientific Instrument Harness using „loops“ between the MTD cold units and the SVM connector brackets was performed. Measurement of the resistance of these loops was carried out during CVV cool-down and warm-up with IDAS. No problems were identified. A detailed description of the SIH check-out will be given in a dedicated document [RD26].

6.6 Alignment

Alignment measurements using the HACS camera were performed throughout the test. The evaluation of the results is ongoing and will be reported in a dedicated document.

6.7 Cleanliness

Wipe tests and tape lifts were performed before and after the TB/TV test. No significant increase of the contamination level during the test has been observed. Details will be reported in a separate document.

7 Conclusion

14 test objectives are to be fulfilled during this test campaign as defined in the Integrated Test Procedure [AD1]. At this stage, the evaluation of objectives can only be declared on the data gathered and preliminary evaluations.

In this respect, data has been correctly recorded during the test to allow the objectives to be evaluated. Preliminary evaluation shows no outstanding issues for eleven objectives (no. 1, 2, 3, 5, 6, 7, 8, 9, 10, 11 and 14). One objective remains open (10-cleanliness) awaiting completion of the analysis.

One major objective (no. 4) related to mass flow compatibility with lifetime is not met. This objective is paramount to the mission success. Several possible origins have been identified (aluminium taping on LSFW/HTT struts, grounding wires on filling port, oscillations in He S/S). Other candidates may be found during analysis and complementary testing. Frequent NRB meetings with all parties have been held, and additional tests have been defined and performed during the TB/TV test. The NRB process is ongoing.

The TB/TV test has been successfully completed

With respect to the objectives, the STM TB/TV test is currently considered to be partially successful.

As-Run Integrated TB/TV Test Procedure

Scanned_Docs\STM_TB-TV_ITP_as-run.pdf

Annex A Integrated Step-by-Step Procedure

The following chapter contains the Integrated Step-by-Step Test Procedure. Each section describes a complete test phase and is subdivided in a first overview sheet, followed by a table for the test steps in three columns, to be performed by PLM/CVSE/SCOE, ETS TDH and ETS LSS control, respectively. The test steps table for each phase contains three major lines, to be performed at the beginning, during and at the end of the phase.

Test steps can be referenced by an unambiguous identifier, e.g. TP1-B-P10, which is composed of the test phase (TP1-), the beginning (A-), during (B-) or end (C-) identifier, the PLM (P), TDH (D) or LSS control (L) identifier and the sequential number.

In cases when the test step sequence has to be followed across the three columns, the sequence number counting is continued across the columns. Where individual steps can be performed in parallel, the sequence number is counted only within the respective column.

The "maximum predicted Power" values of the test heaters in the tables below are maximum powers during the complete test, not for the individual phase.

A.0 TP0 - Initial Check-Out

Phase	**TP0 - Initial Check-Out**	**Type:** stable	**S/C Attitude**	**Tilt /° :** 0
Expected Duration / hrs	n/a	**TTA-PLM I/F** 20°C	+Z to collimator mirror	
Objective	• Install PLM on TTAS in LSS • Perform initial instrumentation check-out (SCOE and TDH) • Perform HTT top-up and HOT refill			
End of Phase Condition	• Instrumentation checked (SCOE and TDH, except HSS-TCR) • Helium tanks filled and ready for Launch Autonomy simulation			
Important	Goal for HTT top-up is to fill to 98% at T<1.8K, requirement to continue the test is 98+0-2% at 1.85±0.05K.			

Step	**Phase:**	**TP0 - Initial Check-Out**		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
TP0-A start of phase			1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: ambient C2 shroud: ambient 3. **Pressure:** ambient 4. **Spin Box:** Temperature: ambient Tilt angle: 0° 5. **5m door and Cover:** open	
TP0-B during phase	1. Installation of Scaffolding 2. Installation of S/C in LSS 3. Switch on SCOE 4. Synchronize SCOE clock to TDH UTC time 5. **Main Title:** Herschel PLM STM TB/TV Test 6. **Subtitle:** TP0 - Initial Check-Out 7. Start new section in Log Book 8. Fill in: Date / Time of start: .... /	1. Start TDH 2. Synchronize SCOE clock to TDH UTC time 3. **Main Title:** Herschel PLM STM TB/TV Test 4. **Subtitle:** TP0 - Initial Check-Out 5. **Alarm Limits:**	1. Installation of Scaffolding and S/C in LSS	

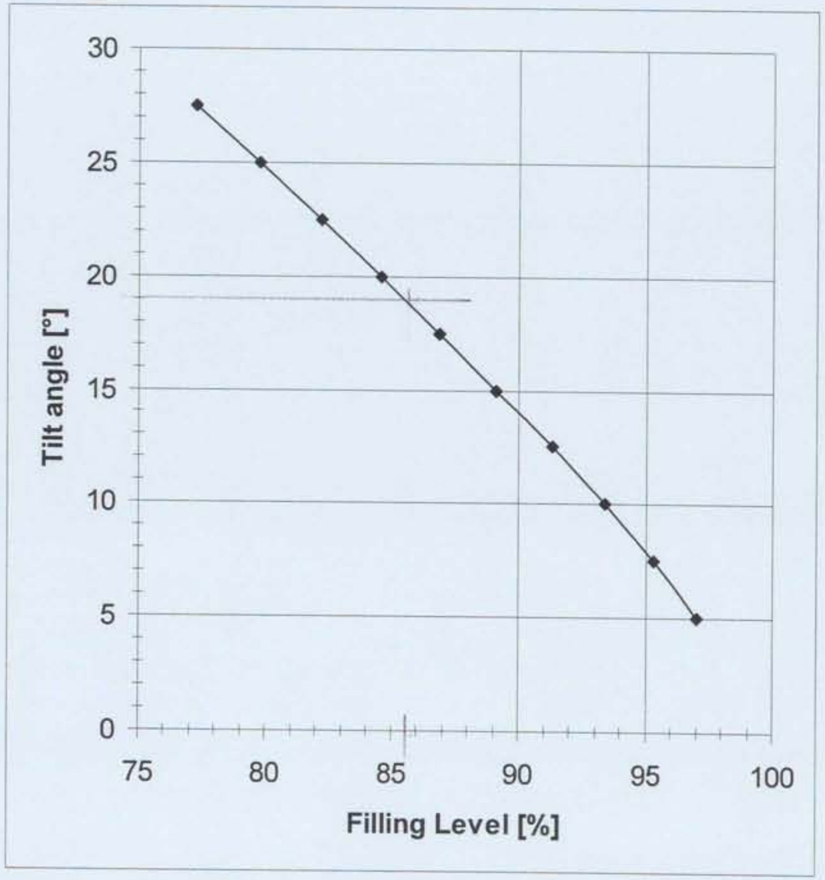
Step	Phase:	TP0 - Initial Check-Out		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	9. **SCOE Alarm Limits:** set alarm limits as defined in Annex B 10. **SCOE Acquisition Interval:** 5 min 11. **SCOE Flight/Ground Heaters:** Set all Flight / Ground heaters off Set all MTD heaters off. 12. **SCOE Valve States:** V102: closed V104: closed V103: closed V106: closed V701: open V702: closed V105: closed V501: closed V503: closed V504: open V505: open TV QM3: closed Helium venting via V502 / CVSE or via opening V501/V503 on request of Cryo Engineer 13. Start check-out of instrumentation	set alarm limits as defined in Annex B 6. **Acquisition Interval:** 5 min 7. **TDH Test Heaters:** all off 8. Start check-out of instrumentation		

Step	**Phase:**	**TP0 - Initial Check-Out**		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	14. Install LSS internal tubing: Deer head, pumping line, pressure pick-up lines ✓ 15. Install CVSE tubing for He operations ✓ 16. Perform leak test of test tubing Results: Pressure pickup lines: $\leq 10^{-6}$ mbar l/s Pumping line: $\leq 10^{-6}$ Deer head: $\leq 10^{-6}$ 17. Verify that red-tag items have been removed: • Wave guide venting holes cover ✓ 18. Perform HTT top-up to filling level 98+0-2% at 1.85±0.05K ✓ 19. Perform HOT refill ✓ 20. Bypass He pump 1 (venting to atmosphere)			
TP0-C end of phase	1. Verify that end-of-phase conditions are reached 2. Prepare EOP reports as defined in Annex D 3. Determine filling level of HTT (L101 / L102): HTT filling level: 97% 4. Determine required tilt angle for PPS start-up using table in			

Step	Phase:	TP0 - Initial Check-Out		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	section A.0.1; fill in step TP2-B-P12 5. Store SCOE data (tables and rec files) on CD ROM 6. Fill in: Date / Time of end: 08.10.05 / 11:00 UTC 7. Convene TRB			

A.0.1 Tilting Angles for PPS Operation

HTT filling level / %	Nominal tilt angle
97.9	3.5
97.6	4
97	5
95.3	7.5
93.4	10
91.3	12.5
89.1	15
86.9	17.5
84.6	20
82.2	22.5
79.75	25
77.2	27.5



A.1 TP1 - Launch Autonomy

Phase	**TP1 - Launch autonomy**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** 0
Expected Duration / hrs	79	**TTAP-PLM I/F**	20°C	+Z to collimator mirror	
Objective	• Final S/C and LSS preparation activities after last HTT top-up and HOT refill • Simulate pre-launch phase to achieve launch conditions at LSS pump-down • Keep the time frame foreseen for the pre-launch operations				
End of Phase Condition	• S/C in launch conditions (HTT closed at T~1.86 K depending on initial temperature; HOT depleted and heated to 55 K) • LSS closed and pumped down, ready for cool-down of shrouds				
Important Remarks	Although this phase comprises mainly preparations for the actual TB/TV test, **it is important to keep the nominal sequence and duration** in order to reach the representative launch conditions, especially the HTT temperature, at the end of the phase. The final depletion and heating of the HOT has to be started 51 hrs after start of the phase (28 hrs before end).				

Step	**Phase:**	**TP1 - Launch Autonomy**		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
TP1-A start of phase	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP1 - Launch Autonomy 3. Start new section in Log Book 4. Fill in: Date / Time of start: 08.10.05, 11:00 UTC TDH Phase transition at 12:04 UTC 5. **SCOE Alarm Limits:** keep alarm limits as defined in Annex B 6. **SCOE Acquisition Interval:** 2 min 7. **SCOE Flight/Ground Heaters:** Load Flight / Ground heater settings acc. to section A.1.2 Load MTD heater settings acc. to section A.1.3 8. **SCOE Valve States:** (unchanged) V102: closed V104: closed V103: closed V106: closed V701: open V702: closed V105: closed V501: closed V503: closed	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP1 - Launch Autonomy 3. **Alarm Limits:** set alarm limits as defined in Annex B 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** all off	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: ambient C2 shroud: ambient 3. **Pressure:** ambient 4. **Spin Box:** Temperature: ambient Tilt angle: 0° 5. **5m door and Cover:** open	

Step	Phase:	TP1 - Launch Autonomy		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	V504: open V505: open TV QM3: closed 9. Fill in planned start time of HOT depletion in step TP1-B-P11 and start of pump down in step TP-1-B-P9			
TP1-B during phase 08.10.05	1. Remove top-up CVSE, attach SV121 catcher, ✓ safety line ✓ and V502 blind cap ✓ 2. Perform leak test of LSS internal safety line ✓ 3. Keep helium gas with pressure ~50 mbar above ambient in safety line throughout the test ~100 mbar ✓ 4. Open V501 / V503 V503 remains closed New valve states: Open: V701, V501, ~~V503~~, V504, V505 Closed: V102, V104, V103, V106, V702, V105, TVQM3, V503 5. Set HOT depletion heater H701 to 1W (tbc) to achieve HOT mass flow rate of 45mg/s. ~ 0.9 W, on since 13:06 6. Switch on H501 to 20W (tbc), monitor external ventline (T501) and vent line unit temperatures (T502/T507) to heat gas to 16-30°C. Adjust power if necessary. On auto control 7. Monitor HOT filling level L701 / L702 (deactivate L101 / L102 before firing L701/L702!) and mass flow rate, adjust H701 setting if necessary ✓	→ HTT temp rises too fast. → PVS 1	2. Partial removal of scaffolding 3. Integration and check-out of HSS-TCR 4. Final removal of scaffolding 5. Tilting tests, setup verification 6. Clean chamber and install witness plates 7. Close LSS cover and 5m door	9.10.05 ETS 10.10.05 ETS 10.10.05 ETS

Step	Phase:	TP1 - Launch Autonomy		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	8. Start HACS operation according to RD12 ✓ 9. When 5m door is closed: Move helium pumping units 2 to basement (for nominal operation) and install vent-line to LSS flange on port A9 (in parallel to next activities); perform leak tests ✓ 10. Check HOT filling level (L701 / L702) ✓ 11. Start rapid depletion of HOT liquid contents and HOT heating to 55 K: planned at (phase start + 51 hrs): 10.10.05 / 14:00 UTC → see PVS 2 started at (date / time): 10.10.05 / 16:22 UTC - Switch HOT heater H701 to full power (10W) - Set target temperature for vent line heater H501 to 20°C to avoid condensation on external ventline. - Check T502 / T507 / T501 12. Switch off HACS to avoid overheating ✓ ok at: 10.10.05 / .... 13. Request LSS to start pump down: latest time (phase start + 55 hrs): 10.10.05 / 18:00 UTC started at (date / time): 10.10.05 / 18:05 UTC		9. Pre-operations and switch ON instructions performed Ok at date / time: .... / .... 10. Confirm facility ready to start test Ok at date / time: 10.10.05 / 15:25 UTC 11. On request of test conductor, start pumping down LSS chamber according to LSS procedure : ETS/INST/THER/211 12. Switch on door signs. Ok at date / time: 10/10 / 18^{00} 13. Install on doors the red warning notices. Ok at date / time: 10/10 / 18^{00} 14. Ask security to change to safety configuration 3. Ok at date / time: 10/10 / 18:00	

Step	Phase:	TP1 - Launch Autonomy		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	14. Monitor HOT temperature T701 / T702 / T703 / T704 to detect end of liquid depletion (T > 4.5 K) 15. HOT liquid depletion finished at (date / time): 10.10.05 / 17:41 16. Vent He gas via OBA by-pass: close V701, open V105 ✓ 19:42 New valve states: Open: V105, V501, V503, V504, V505 Closed: V102, V104, V103, V106, V701, V702, TVQM3 17. Continue HOT heating to reach 51±0.5 K at T701; keep H701 at full power; adjust H501 power setting to keep 16-18°C on external vent line (T501) 18. Monitor HOT and external vent line temperatures (T701 / T702 / T703 / T704; T501 / T502 / T507 / T504 / T506) 19. Close external vent line valves V501/V503 (already closed) New valve states: ok 06:40 11/10/05 Open: V105, V504, V505 Closed: V102, V104, V103, V106, V701, V702, V501, V503, TVQM3 20. Continue HOT heating to reach 55±0.5 K to avoid underpressure in He S/S before HOT evacuation; keep H701 at full power; switch off H501 power 21. When HOT temperature reaches 55±0.5 K: Switch off H701.	→ PVS 2 : Hot heating and depletion delayed. H701 switched off 18:18 Restarted at 04:05 11.10	Install Flange C2 15. Start chamber interseal pumps. Ok at date / time: 10/10/05 / 18:05 16. Open V7. 18:02 / 10/10/05 17. Fill in pump down sheet.Start Yew recorder.. Ok at date / time: 18:06 / 10/10/05 18. Start pumping with all CPS pumps. Ok at date / time: 18:07 / 10/10/05 19. Open mass spectrometer valves (D7, B10). Ok at date / time: 20:15 / 10/10/05 20. Start the two 20K cryo-pumps. Ok at date / time: 20:10 / 10/10/05 21. When chamber pressure is < 8 mbar, start roots 4. Ok at date / time: 22:54 / 10/10	

Step	Phase:	TP1 - Launch Autonomy		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	22. HOT heating finished at (date / time): 11.10.05 / 07:13 23. Monitor LSS pressure 24. Check alarm printer		22. When chamber pressure reaches 1x10^{-1}. start Motion System interseal pumps and auxiliaries Ok at date / time: .... / .... 23. Start SNSE sectional flushing. Ok at date / time: 10/10/05 / 22:45 24. Switch ON the 4 TM pumps at 5x10^{-2}.mbar Ok at date / time: 10/10 / 0:00 25. When chamber pressure reaches 8x10-^{2} mbar, preselect cryopanel 1. Ok at date / time: 10/10 / 23:40 26. At 2x10-^{2} mbar, close V7 and cool down CP1. Ok at date / time: 11/10 / 01:58 27. At 5x10-3 mbar open the 4 TM pumps HV valves 11/10 / 02:03 28. Verify nominal operation of	

Step	Phase:	TP1 - Launch Autonomy		Remarks / NCR
	PLM, SCOE & CVSE	FACILITY		
		DATA HANDLING	LSS CONTROL	
			the 4 TM pumps. .... /	
			29. Cool down CP2. 11/10 / 2:10	
			30. Stop roots 4 and CPS pumps. 11/10 / 2:13	
			31. Start HP GN_2 system.Mirror temp. 26° C. 11/10 / 02:20	
			32. Switch ON mass spectrometers. 11/10 / 2:31	
			33. Perform an He leak check on the 5m door shroud. .... /	
			34. Perform an He leak check on the MS shroud. .... /	
			35. Perform a leak check on flanges B2, B3, B4, B5, B6, B7, A9. .... /	
			36. If the 20K cryo-pumps are	

Step	Phase:	TP1 - Launch Autonomy		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
			ready, open the VW 100 valves of cryo No 1 and No 2. .... / .... 37. Ask the Data Handling to set an alarm on the chamber pressure (1x10^{-5} mbar). .... / .... 38. Ask the Data Handling to set an alarm on CP1 and CP2 at -170° C. .... /	
TP1-C end of phase	1. Verify that end-of-phase conditions are reached 2. Prepare EOP reports as defined in Annex D 3. Store SCOE data (tables and rec files) on CD ROM 4. Fill in: Date / Time of end: .... / .... 5. Convene TRB		1. Check LN2 tank level: it must be above 50000 l. Transfer LN2 from another tank if level is below 50000 l.	

A.1.1 TDH Test Heater Settings for TP1 - Launch autonomy

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
TTAP_01_pY	1	60	90	Thermostatic	293 K
TTAP_02_pZ	2	60	90	Thermostatic	293 K
TTAP_03_mY	3	60	90	Thermostatic	293 K
TTAP_04_mZ	4	60	90	Thermostatic	293 K
CVV_05_LB	5	90	113.7	Thermostatic	Off
CVV_35_LB	35	90	113.7	Thermostatic	Off
CVV_06_LC-pZ	6	80	92	Thermostatic	Off
CVV_07_UC-pZ	7	80	92	Thermostatic	Off
CVV_08_UB-mZ	8	60	75.8	Thermostatic	Off
CVV_09_Rad-lower-mY	9	100	120	Thermostatic	Off
CVV_10_Rad-upper-mY	10	125	150	Thermostatic	Off
CVV_11_Rad-lower-mZ	11	100	120	Thermostatic	Off
CVV_12_Rad-upper-mZ	12	175	210	Thermostatic	Off
CVV_13_Rad-lower-pY	13	100	120	Thermostatic	Off
CVV_14_Rad-upper-pY	14	125	150	Thermostatic	Off
CVV_15_UB-HSIF-mZ	15	100	120	Thermostatic	Off
LOU_16_rad-lower	16	120	150	Thermostatic	Off
LOU_17_rad-upper	17	120	150	Thermostatic	Off
TTAP_19_pY-redundant	19	60	90	Thermostatic	Off
TTAP_20_pZ-redundant	20	60	90	Thermostatic	Off
TTAP_21_mY-redundant	21	60	90	Thermostatic	Off
TTAP_22_mZ-redundant	22	60	90	Thermostatic	Off
IRRIG_23_STM_low_pY	23	100	120	Thermostatic	293 K
IRRIG_24_STM_low_mid	24	100	120	Thermostatic	293 K
IRRIG_25_STM_low_mY	25	100	120	Thermostatic	293 K

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
IRRIG_26_STM_low_pY	26	100	120	Thermostatic	293 K
IRRIG_27_STM_low_mid	27	100	120	Thermostatic	293 K
IRRIG_28_STM_low_mY	28	100	120	Thermostatic	293 K
IRRIG_29_STM_upp_pY	29	100	120	Thermostatic	293 K
IRRIG_30_STM_upp_mid	30	100	120	Thermostatic	293 K
IRRIG_31_STM_upp_mY	31	100	120	Thermostatic	293 K
IRRIG_32_STM_upp_pY	32	100	120	Thermostatic	293 K
IRRIG_33_STM_upp_mid	33	100	120	Thermostatic	293 K
IRRIG_34_STM_upp_mY	34	100	120	Thermostatic	293 K
IRRIG_43_STM_low _pY_red	43	100	120	Thermostatic	Off
IRRIG_44_STM_low _mid_red	44	100	120	Thermostatic	Off
IRRIG_45_STM_low _mY_red	45	100	120	Thermostatic	Off
IRRIG_46_STM_low _pY_red	46	100	120	Thermostatic	Off
IRRIG_47_STM_low _mid_red	47	100	120	Thermostatic	Off
IRRIG_48_STM_low _mY_red	48	100	120	Thermostatic	Off
IRRIG_49_STM_upp_pY_red	49	100	120	Thermostatic	Off
IRRIG_50_STM_upp_mid_red	50	100	120	Thermostatic	Off
IRRIG_51_STM_upp_mY_red	51	100	120	Thermostatic	Off
IRRIG_52_STM_upp_pY_red	52	100	120	Thermostatic	Off
IRRIG_53_STM_upp_mid_red	53	100	120	Thermostatic	Off
IRRIG_54_STM_upp_mY_red	54	100	120	Thermostatic	Off
IRRIG_63_STM_support	63	60	90	Thermostatic	Off

A.1.2 SCOE Flight / Ground Heater Settings for TP1 - Launch autonomy

Heater Output No.	**Heater type**	**Power Supplied**	**Output Fuse Rating**	**Set point [W]**
1	H101 : DCLM heater	10W ± 1W (fixed)	750 mA	Off
2	H102 : DCLM heater	10W ± 1W (fixed)	750 mA	Off
3	VH701 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
4	VH102 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
5	VH103 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
6	VH104 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
7	VH105 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
8	VH106 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
9	VH702 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
10	H502 : Heater foil	6W ± 1W (fixed)	500 mA	Off
11	H503 : Heater foil	6W ± 1W (fixed)	500 mA	Off
12	H701 : Tank bottom heater	10W ± 1W (fixed) or 1.5W, variable in steps of 0.1W	750 mA	variable
13	H702 : Tank bottom heater	10W ± 1W (fixed) or 1.5W, variable in steps of 0.1W	750 mA	variable
14	H103 : Depletion heater	10W ± 1W (fixed)	250 mA	Off
15	H104 : Depletion heater	10W ± 1W (fixed)	250 mA	Off
16	H501 : External depletion heater	650W, variable in steps of 10W	16 A	variable

A.1.3 SCOE MTD Heater Settings for TP1 - Launch autonomy

SCOE ID	ID	Max P [mW]	Power Steps [mW]	Set point [W]
HIFI_1	HIFI-L0-H1/2	10	0.5	Off
HIFI_2	HIFI-L1-H1/2	10	0.5	Off
HIFI_3	HIFI-L2-H1/2	50	2.5	Off
LOU_1	LOU-1-H1/2	7000	500	Off
LOU_2	LOU-2-H1/2	7000	500	Off
LOU_3	LOU-3-H1/2	7000	500	Off
LOU_4	LOU-4-H1/2	7000	500	Off
PACS_1	PACS-L0-1-H1/2	10	0.5	Off
PACS_2	PACS-L0-2-H1/2	10	0.5	Off
PACS_7	PACS-L0-3-H1/2	500	25	Off
PACS_4	PACS-L0-4-H1/2	30	0.5	Off
PACS_5	PACS-L1-1-H1/2	10	0.5	Off
PACS_6	PACS-L1-2-H1/2	10	0.5	Off
PACS_3	PACS-L1-3-H1/2	10	0.5	Off
PJFET	P-J-FET-H1/2	50	2.5	Off
SJFET	S-J-FET-H1/2	50	2.5	Off
SPIRE_1	SPIRE-L0-1-H1/2	10	0.5	Off
SPIRE_2	SPIRE-L0-2-H1/2	30	0.5	Off
SPIRE_3	SPIRE-L0-3-H1/2	500	25	Off
SPIRE_4	SPIRE-L1-H1/2	10	0.5	Off

A.2 TP2 - Launch and Early Orbit Phase

Phase	**TP2 - Launch and Early Orbit Phase**	**Type:**	transient	**S/C Attitude** +Z to collimator mirror	**Tilt /° :** 0 at beginning, to be adjusted during phase
Expected Duration / hrs	123	**TTA-PLM I/F**	20°C		
Objective	• Perform HOT GHe evacuation • Cool-down LSS shrouds (RT to LN2) • Simulate the PLM in-orbit cool-down after launch • Confirm TMM predictions of temperature peak in HTT • Verify safe PPS start-up and operation • Perform check-out of SIH during CVV cool-down • Perform alignment measurements using the HACS				
End of Phase Condition	• HTT temperature decreasing after peak value (T101. T102, T104, T105 drift < 0 for 30 min)				
Important	The launch sequence has to be followed closely, especially the time comprising opening of V501/V503, opening of V103/V106 and tilting the S/C to immerse the PPS in the HTT liquid contents. This tilting is performed in one degree steps. To operate correctly, the PPS shall be located 0 to 30 mm below the liquid surface. This is achieved by tilting the S/C by 1 (one) more degree when the PPS has already started. Correct operation of the PPS is confirmed when the temperature at the PPS outlet is lower than the temperature within the HTT, i.e. T111 & T112 < T101, T102, T104, T105 For reference, the predicted (final) tilt angle for PPS operation depending on the current HTT filling level is indicated in section A.0-1.				

Step	Phase:	TP2 - Launch and Early Orbit Phase		Remarks / NCR
	PLM, SCOE & CVSE	FACILITY DATA HANDLING	LSS CONTROL	
TP2-A start of phase	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP2 - Launch and Early Orbit Phase 3. Start new section in Log Book 4. Fill in: Date / Time of start: 11.10.05 / 13:20 UTC 5. **SCOE Alarm Limits:** keep alarm limits as defined in Annex B 6. **SCOE Acquisition Interval:** 2 min 7. **SCOE Flight/Ground Heaters:** Keep Flight / Ground heater off (settings acc. to section A.2.2.) Keep MTD heaters off (settings acc. to section A.2.3.) 8. **SCOE Valve States:** (unchanged) V102: closed V104: closed V103: closed V106: closed V701: closed V702: closed V105: open V501: closed V503: closed	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP2 - Launch and Early Orbit Phase 3. **Alarm Limits:** Keep alarm limits as defined in Annex B 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** HSS-TCR 293 K TTAP 293 K acc. to section A.2.1	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $< 1 \times 10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: 0° 5. Prepare for cool-down of shrouds to LN2 temperature	

Step	Phase:	TP2 - Launch and Early Orbit Phase		Remarks / NCR
	PLM, SCOE & CVSE	FACILITY DATA HANDLING	LSS CONTROL	
	V504: open V505: open TV QM3: closed			
TP2-B during phase	1. Start He pumping unit 2 2. Verify that V504 / V505 are open, test valve TV QM3 is closed. ✓ Ok at date / time: 11.10.05 / 7:38 3. Be prepared to execute the following steps (~~until PPS is immersed)~~ in a tight time frame! ⇝ PVS 2 4. Close pump by-pass ✓ 5. After 15 seconds: Open external vent line valve V501. Keep V503 closed to simulate worst case. Ok at date / time: ……………/…………… New valve states: Open: V105, V501, V504, V505 Closed: V102, V104, V103, V106, V503, V701, V702, TVQM3 6. Request LSS to start cool-down of shrouds ⇝ to be done later, PVS 2 Ok at date / time: ……………/…………… 7. Monitor HOT pressure P701 and external vent line pressure		1. Be prepared to adjust tilt angle immediately on request of test conductor, independently from cool-down sequence 2. On request of test conductor: start cool-down operation acc. to applicable procedure : YTO/OPE/LS4/0714/C	

Step	Phase:	TP2 - Launch and Early Orbit Phase		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	P502 / CVSE_002 8. Read gas meter at outlet of He pumping unit Gas meter value: 0.00 m^3 9. Reset gas meter 10. When external vent line pressure **P502 < 12.7 mbar** (in case of failure of P502: refer to nozzle inlet pressure sensor CVSE_002 or >20 minutes after opening of V501): Open PPS valve V103. Ok at date / time: 11.10.05 / 14.03 New valve states: Open: V103, V105, V501, V504, V505 Closed: V102, V104, V106, V503, V701, V702, TVQM3 11. Monitor HTT and PPS temperatures (T101-T107, T111, T112) and PPS temperature difference virtual sensor. 12. Request LSS to achieve tilt angle for PPS start-up 240 sec (4 minutes) after opening of V103. Approach expected tilt angle in 1° steps, command next step only after checking PPS outlet temperatures T111 / T112 Required tilt angle: 5° (predicted 2.7° seen during tilt verific) Reached at date / time: 3,99° / 11.10,05 15:50 UTC	PVS 2: 9 a) When P502 < 10 mbar: close V501 ✓ 9 b) Wait for o.k. to start PPS ✓ c) open V501 ok at 13:53 d) Request LSS to start cool-down ✓ e) continue with step 10 f) check pressure in safety line during LSS cool-down	3. Set LN2 tank pressure to 2 bar ……… / ……… 4. Check LN2 tank level: it must be above 50000 l. Transfer LN2 from another tank if level is below 50000 l. ……… / ……… 5. Check that all pumps are in nominal conditions. ……… / ……… 6. On request of test conductor: Immediately adjust tilt angle, rotation around S/C Z axis, S/C X towards S/C -Y (independent from cool-down sequence). Tilt direction: **+** Tilt speed: 1°/min 7. Cool down C1+C2 sections (use LN2 pump 1 A). Ok at date / time: ……… / ……… 8. Verify nominal cool down of all shrouds. Ok at date / time:	Tilting delayed by ~90min due to IMS problems

Step	Phase:	TP2 - Launch and Early Orbit Phase		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	13. Verify correct PPS start-up: PPS outlet temperature is lower than HTT internal temperature Ok at date / time: 11.10.05, 15:48		.... / .... 9. Establish LN2 circulation in C1+C2. Ok at date / time: .... /	
	14. Request LSS to increase tilt angle by one more degree ok ✓		10. Switch on the internal camera. Ok at date / time: .... /	
skipped ✓	15. If PPS start-up fails (no temperature gradient across PPS after 1 minute): - Request LSS to go back to 0° tilt angle Reached at date / time: .... / .... - Check HTT filling level using initial value from step TP0-C-P3, gas meter, mass flow integrals HTT filling level: .... - Determine required tilt angle acc. to section A.0.1 Required tilt angle: .... - Close PPS valve V103 Ok at date / time: .... / .... - wait for 10 minutes - open PPS valve V103 Ok at date / time: .... /			

Step	Phase:	TP2 - Launch and Early Orbit Phase		Remarks / NCR
	PLM, SCOE & CVSE	FACILITY DATA HANDLING	LSS CONTROL	
skipped	- Continue pumping for 15 minutes to evaporate liquid from PPS back side Ok at date / time: ……………/ …………… - Verify open status of V103, open V106 - Request LSS to move to tilt angle for PPS start-up. Reached at date / time: ……………/ …………… - Verify correct PPS start-up: PPS outlet temperature is lower than HTT internal temperature - Tilt by one more degree			
	16. Monitor PPS temperature drop (ok if T111 < T101) ✓		11. Verify: - Chamber pressure is $< 1 \times 10^{-5}$ mbar - Chamber temperature is ≤ 100 K - GS position is 0° (S/C -Z to collimator mirror)	
	17. Monitor HTT temperature & pressure, PPS temperature gradient, and mass flow rate	Till oscillations ND PUS 3		PUS 3
	18. When CVV temperature is below 210 K: Verify that alignment target is visible to HACS Ok at date / time: ……………/ ……………			
	19. Start HACS measurements acc. to RD 12 (continue in next test phases until CVV reaches equilibrium temperature) ✓	operating since 14:23 11.10.05		
	20. Monitor HTT filling level and adjust tilting angle every 12 hours (tbc) acc. to section A.0.1; fill in section A.2.4			
	21. Start SIH check-out, continue every 2 hours on first day, afterwards every 10 K difference on CVV until CVV reaches ✓	operating since 14:45 11.10.05		

Step	Phase:	TP2 - Launch and Early Orbit Phase		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	equilibrium temperature 22. Continue until maximum HTT temperature is passed HTT peak temperature: 2.0008 K Reached at date / time: 15.10.05, 14:30			
TP2-C end of phase	0. Perform Δp measurement, see PU85 1. Verify that end-of-phase conditions are reached 2. Prepare EOP reports as defined in Annex D 3. Store SCOE data (tables and rec files) on CD ROM 4. Fill in: Date / Time of end: 16.10.05, 08:00 5. Convene TRB			

A.2.1 TDH Test Heater Settings for TP2 - Launch and Early Orbit Phase

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
TTAP_01_pY	1	60	90	Thermostatic	293 K
TTAP_02_pZ	2	60	90	Thermostatic	293 K
TTAP_03_mY	3	60	90	Thermostatic	293 K
TTAP_04_mZ	4	60	90	Thermostatic	293 K
CVV_05_LB	5	90	113.7	Thermostatic	Off
CVV_35_LB	35	90	113.7	Thermostatic	Off
CVV_06_LC-pZ	6	80	92	Thermostatic	Off
CVV_07_UC-pZ	7	80	92	Thermostatic	Off
CVV_08_UB-mZ	8	60	75.8	Thermostatic	Off
CVV_09_Rad-lower-mY	9	100	120	Thermostatic	Off
CVV_10_Rad-upper-mY	10	125	150	Thermostatic	Off
CVV_11_Rad-lower-mZ	11	100	120	Thermostatic	Off
CVV_12_Rad-upper-mZ	12	175	210	Thermostatic	Off
CVV_13_Rad-lower-pY	13	100	120	Thermostatic	Off
CVV_14_Rad-upper-pY	14	125	150	Thermostatic	Off
CVV_15_UB-HSIF-mZ	15	100	120	Thermostatic	Off
LOU_16_rad-lower	16	120	150	Thermostatic	Off
LOU_17_rad-upper	17	120	150	Thermostatic	Off
TTAP_19_pY-redundant	19	60	90	Thermostatic	Off
TTAP_20_pZ-redundant	20	60	90	Thermostatic	Off
TTAP_21_mY-redundant	21	60	90	Thermostatic	Off
TTAP_22_mZ-redundant	22	60	90	Thermostatic	Off
IRRIG_23_STM_low_pY	23	100	120	Thermostatic	293 K
IRRIG_24_STM_low_mid	24	100	120	Thermostatic	293 K
IRRIG_25_STM_low_mY	25	100	120	Thermostatic	293 K

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
IRRIG_26_STM_low_pY	26	100	120	Thermostatic	293 K
IRRIG_27_STM_low_mid	27	100	120	Thermostatic	293 K
IRRIG_28_STM_low_mY	28	100	120	Thermostatic	293 K
IRRIG_29_STM_upp_pY	29	100	120	Thermostatic	293 K
IRRIG_30_STM_upp_mid	30	100	120	Thermostatic	293 K
IRRIG_31_STM_upp_mY	31	100	120	Thermostatic	293 K
IRRIG_32_STM_upp_pY	32	100	120	Thermostatic	293 K
IRRIG_33_STM_upp_mid	33	100	120	Thermostatic	293 K
IRRIG_34_STM_upp_mY	34	100	120	Thermostatic	293 K
IRRIG_43_STM_low _pY_red	43	100	120	Thermostatic	Off
IRRIG_44_STM_low _mid_red	44	100	120	Thermostatic	Off
IRRIG_45_STM_low _mY_red	45	100	120	Thermostatic	Off
IRRIG_46_STM_low _pY_red	46	100	120	Thermostatic	Off
IRRIG_47_STM_low _mid_red	47	100	120	Thermostatic	Off
IRRIG_48_STM_low _mY_red	48	100	120	Thermostatic	Off
IRRIG_49_STM_upp_pY_red	49	100	120	Thermostatic	Off
IRRIG_50_STM_upp_mid_red	50	100	120	Thermostatic	Off
IRRIG_51_STM_upp_mY_red	51	100	120	Thermostatic	Off
IRRIG_52_STM_upp_pY_red	52	100	120	Thermostatic	Off
IRRIG_53_STM_upp_mid_red	53	100	120	Thermostatic	Off
IRRIG_54_STM_upp_mY_red	54	100	120	Thermostatic	Off
IRRIG_63_STM_support	63	60	90	Thermostatic	293 K

A.2.2 SCOE Flight / Ground Heater Settings for TP2 - Launch and Early Orbit Phase

Heater Output No.	Heater type	Power Supplied	Output Fuse Rating	Set point [W]
1	H101 : DCLM heater	10W ± 1W (fixed)	750 mA	Off
2	H102 : DCLM heater	10W ± 1W (fixed)	750 mA	Off
3	VH701 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
4	VH102 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
5	VH103 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
6	VH104 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
7	VH105 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
8	VH106 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
9	VH702 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
10	H502 : Heater foil	6W ± 1W (fixed)	500 mA	Off
11	H503 : Heater foil	6W ± 1W (fixed)	500 mA	Off
12	H701 : Tank bottom heater	10W ± 1W (fixed) or 1.5W, variable in steps of 0.1W	750 mA	Off
13	H702 : Tank bottom heater	10W ± 1W (fixed) or 1.5W, variable in steps of 0.1W	750 mA	Off
14	H103 : Depletion heater	10W ± 1W (fixed)	250 mA	Off
15	H104 : Depletion heater	10W ± 1W (fixed)	250 mA	Off
16	H501 : External depletion heater	650W, variable in steps of 10W	16 A	Off

A.2.3 SCOE MTD Heater Settings for TP2 - Launch and Early Orbit Phase

SCOE ID	ID	Max P [mW]	Power Steps [mW]	Set point [W]
HIFI_1	HIFI-L0-H1/2	10	0.5	Off
HIFI_2	HIFI-L1-H1/2	10	0.5	Off
HIFI_3	HIFI-L2-H1/2	50	2.5	Off
LOU_1	LOU-1-H1/2	7000	500	Off
LOU_2	LOU-2-H1/2	7000	500	Off
LOU_3	LOU-3-H1/2	7000	500	Off
LOU_4	LOU-4-H1/2	7000	500	Off
PACS_1	PACS-L0-1-H1/2	10	0.5	Off
PACS_2	PACS-L0-2-H1/2	10	0.5	Off
PACS_7	PACS-L0-3-H1/2	500	25	Off
PACS_4	PACS-L0-4-H1/2	30 *)	0.5	Off
PACS_5	PACS-L1-1-H1/2	10	0.5	Off
PACS_6	PACS-L1-2-H1/2	10	0.5	Off
PACS_3	PACS-L1-3-H1/2	10	0.5	Off
PJFET	P-J-FET-H1/2	50	2.5	Off
SJFET	S-J-FET-H1/2	50	2.5	Off
SPIRE_1	SPIRE-L0-1-H1/2	10	0.5	Off
SPIRE_2	SPIRE-L0-2-H1/2	30 *)	0.5	Off
SPIRE_3	SPIRE-L0-3-H1/2	500	25	Off
SPIRE_4	SPIRE-L1-H1/2	10	0.5	Off

A.2.4 Tilt Angle Adjustment during TP2 - Launch and Early Orbit Phase

Date	Time	Tilt angle
11.10.05	15:50 UTC	3,99°
12.10.05	13:56 UTC	5°
13.10.05	13:40 UTC	5,9°
14.10.05	13:50 UTC	6,9°
15.10.05	16:11 UTC	8,0°
16.10.05	07:50 UTC	0,0°

A.2.5 SIH check-out during TP2 - Launch and Early Orbit Phase

Table is obsolete, SIH check-out results are automatically recorded on IDAS

A.3 TP3 - Rapid Cool-Down

Phase	**TP3 - Rapid Cool-Down**	**Type:**	transient	**S/C Attitude**	**Tilt /° : return to 0** at beginning, to be adjusted near end of phase to immerse PPS
Expected Duration / hrs	99	**TTA-PLM I/F**	0°C	+Z to collimator mirror	
Objective	• Bring HTT to nominal temperature as quickly as possible • Avoid excessive temperature drop of thermal shields				
End of Phase Condition	• HTT temperature below 1.7 K				
Important					

Step	Phase:	TP3 - Rapid Cool-Down		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
TP3-A start of phase	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP3 - Rapid Cool-Down 3. Start new section in Log Book 4. Fill in: Date / Time of start: 16.10.05 / 07:40 5. **SCOE Alarm Limits:** keep alarm limits as defined in Annex B 6. **SCOE Acquisition Interval:** 2 min 7. **SCOE Flight/Ground Heaters:** Set Flight / Ground heaters all off Set MTD heaters all off 8. **Set new SCOE Valve States:** (changes in **bold**) V102: closed V104: **open** V103: **closed** V106: closed V701: closed V702: closed V105: open V501: open V503: **open** See PUS 5	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP3 - Rapid Cool-Down 3. **Alarm Limits:** Keep alarm limits as defined in Annex B 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** set values acc. to table in A.3.1 TTAP: 273 K HSS-TCR 173 K all others off	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** < 1 x 10^{-5} mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: **0°** **Return to vertical S/C position**	

Step	Phase:	TP3 - Rapid Cool-Down		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	V504: open V505: open TV QM3: **open** . 8:00 open			
TP3-B during phase	1. Control He mass flow to 50±5 mg/s using the CVSE valves; keep mass flow until closure of TVQM3. → 50,8 mg/sec 2. Continue HACS measurements acc. to RD 12 until CVV reaches equilibrium temperature 3. Continue SIH check-out every 10 K until CVV reaches equilibrium temperature 4. Monitor HTT, shields and CVV temperatures. 5. When HTT temperature is < 1.72 K: ~~close nozzle by-pass valve TV QM3~~ 6. When HTT temperature is < 1.71 K: Open PPS shutoff valves V103/V106, close V104 New valve states: Open: V103, V106, V105, V501, V503, V504, V505 Closed: V102, V104, V701, V702, TVQM3 7. Request LSS to achieve tilt angle for PPS start-up. Required tilt angle: .... 9. Verify correct PPS start-up: PPS outlet temperature is lower than HTT internal temperature	see PVS 6 PVS 8; PVS 9 executed see PVS 7 see PVS 10	8. On request of test conductor, adjust tilt angle	

Step	Phase:	TP3 - Rapid Cool-Down		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	Ok at date / time: ……………. / …………… 10. When HTT temperature is < 1.70 K: shut down large nozzle by closing valves V504 / V505 Ok at date / time: ……………. / …………… New valve states: Open: V103, V106, V105, V501, V503 Closed: V102, V104, V701, V702, V504, V505, TVQM3	see PUS 10		
TP3-C end of phase	1. Verify that end-of-phase conditions are reached 2. Prepare EOP reports as defined in Annex D 3. Store SCOE data (tables and rec files) on CD ROM 4. Fill in: Date / Time of end: 21.10.05 / 15:40 5. Convene TRB			

A.3.1 TDH Test Heater Settings for TP3 - Rapid cool-down

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
TTAP_01_pY	1	60	90	Thermostatic	273 K
TTAP_02_pZ	2	60	90	Thermostatic	273 K
TTAP_03_mY	3	60	90	Thermostatic	273 K
TTAP_04_mZ	4	60	90	Thermostatic	273 K
CVV_05_LB	5	90	113.7	Thermostatic	Off
CVV_35_LB	35	90	113.7	Thermostatic	Off
CVV_06_LC-pZ	6	80	92	Thermostatic	Off
CVV_07_UC-pZ	7	80	92	Thermostatic	Off
CVV_08_UB-mZ	8	60	75.8	Thermostatic	Off
CVV_09_Rad-lower-mY	9	100	120	Thermostatic	Off
CVV_10_Rad-upper-mY	10	125	150	Thermostatic	Off
CVV_11_Rad-lower-mZ	11	100	120	Thermostatic	Off
CVV_12_Rad-upper-mZ	12	175	210	Thermostatic	Off
CVV_13_Rad-lower-pY	13	100	120	Thermostatic	Off
CVV_14_Rad-upper-pY	14	125	150	Thermostatic	Off
CVV_15_UB-HSIF-mZ	15	100	120	Thermostatic	Off
LOU_16_rad-lower	16	120	150	Thermostatic	Off
LOU_17_rad-upper	17	120	150	Thermostatic	Off
TTAP_19_pY-redundant	19	60	90	Thermostatic	Off
TTAP_20_pZ-redundant	20	60	90	Thermostatic	Off
TTAP_21_mY-redundant	21	60	90	Thermostatic	Off
TTAP_22_mZ-redundant	22	60	90	Thermostatic	Off
IRRIG_23_STM_low_pY	23	100	120	Thermostatic	173 K
IRRIG_24_STM_low_mid	24	100	120	Thermostatic	173 K
IRRIG_25_STM_low_mY	25	100	120	Thermostatic	173 K

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
IRRIG_26_STM_low_pY	26	100	120	Thermostatic	173 K
IRRIG_27_STM_low_mid	27	100	120	Thermostatic	173 K
IRRIG_28_STM_low_mY	28	100	120	Thermostatic	173 K
IRRIG_29_STM_upp_pY	29	100	120	Thermostatic	173 K
IRRIG_30_STM_upp_mid	30	100	120	Thermostatic	173 K
IRRIG_31_STM_upp_mY	31	100	120	Thermostatic	173 K
IRRIG_32_STM_upp_pY	32	100	120	Thermostatic	173 K
IRRIG_33_STM_upp_mid	33	100	120	Thermostatic	173 K
IRRIG_34_STM_upp_mY	34	100	120	Thermostatic	173 K
IRRIG_43_STM_low _pY_red	43	100	120	Thermostatic	Off
IRRIG_44_STM_low _mid_red	44	100	120	Thermostatic	Off
IRRIG_45_STM_low _mY_red	45	100	120	Thermostatic	Off
IRRIG_46_STM_low _pY_red	46	100	120	Thermostatic	Off
IRRIG_47_STM_low _mid_red	47	100	120	Thermostatic	Off
IRRIG_48_STM_low _mY_red	48	100	120	Thermostatic	Off
IRRIG_49_STM_upp_pY_red	49	100	120	Thermostatic	Off
IRRIG_50_STM_upp_mid_red	50	100	120	Thermostatic	Off
IRRIG_51_STM_upp_mY_red	51	100	120	Thermostatic	Off
IRRIG_52_STM_upp_pY_red	52	100	120	Thermostatic	Off
IRRIG_53_STM_upp_mid_red	53	100	120	Thermostatic	Off
IRRIG_54_STM_upp_mY_red	54	100	120	Thermostatic	Off
IRRIG_63_STM_support	63	60	90	Thermostatic	173 K

A.3.2 SIH check-out during TP3 - Rapid Cool-Down

Table is obsolete, SIH check-out results are automatically recorded on IDAS

A.4 TP4 - TV Phase 1

Phase	**TP4 - TV Phase 1**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** daily adjustment to keep PPS immersed
Expected Duration / hrs	50	**TTA-PLM I/F**	0°C	+Z to collimator mirror	
Objective	• Verification of L1 and L3 thermal interfaces by MTD heaters operation • Mass flow rate similar to predicted in-orbit conditions • Perform DLCM operations				
End of Phase Condition	• Verifications performed				
Important					

Step	Phase:	TP4 - TV Phase 1		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
TP4-A start of phase	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP4 - TV Phase 1 3. Start new section in Log Book 4. Fill in: Date / Time of start: 21.10.05 / 15:40 5. **SCOE Alarm Limits:** keep alarm limits as defined in Annex B 6. **SCOE Acquisition Interval:** 30 sec 7. **SCOE Flight/Ground Heaters:** Load Flight / Ground heater settings acc. to section A.4.2 Load MTD heater settings acc. to section A.4.3 MTD heater settings vary during phase! 8. **SCOE Valve States:** (unchanged) V102: closed V104: closed V103: open V106: open V701: closed V702: closed V105: open V501: open See PUS 10 V103 closed V504/505 open	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP4 - TV Phase 1 3. **Alarm Limits:** Keep alarm limits as defined in Annex B 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** set values acc. to table in A.4.1 TTAP: 273 K HSS-TCR 173 K all others off	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $< 1 \times 10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: >0° Keep tilting angle from previous phase for PPS operation.	

Step	**Phase:**	**TP4 - TV Phase 1**		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	V503: open V504: closed V505: closed TV QM3: closed see PUS 10			
TP4-B during phase	1. Keep PPS immersed during phase (monitor PPS temperature difference). Perform daily tilt angle adjustments by one degree. 2. Apply MTD heater dissipations timeline as defined in section A.4.3 LO measurements, 3. Perform DLCM operations acc. to RD 11	see PUS 11	1. Adjust tilt angle on request of test conductor	
TP4-C end of phase	1. Verify that end-of-phase conditions are reached 2. Prepare EOP reports as defined in Annex D 3. Store SCOE data (tables and rec files) on CD ROM 4. Fill in: Date / Time of end: .... / .... 5. Convene TRB			

A.4.1 TDH Test Heater Settings for TP4 - TV Phase 1

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
TTAP_01_pY	1	60	90	Thermostatic	273 K
TTAP_02_pZ	2	60	90	Thermostatic	273 K
TTAP_03_mY	3	60	90	Thermostatic	273 K
TTAP_04_mZ	4	60	90	Thermostatic	273 K
CVV_05_LB	5	90	113.7	Thermostatic	Off
CVV_35_LB	35	90	113.7	Thermostatic	Off
CVV_06_LC-pZ	6	80	92	Thermostatic	Off
CVV_07_UC-pZ	7	80	92	Thermostatic	Off
CVV_08_UB-mZ	8	60	75.8	Thermostatic	Off
CVV_09_Rad-lower-mY	9	100	120	Thermostatic	Off
CVV_10_Rad-upper-mY	10	125	150	Thermostatic	Off
CVV_11_Rad-lower-mZ	11	100	120	Thermostatic	Off
CVV_12_Rad-upper-mZ	12	175	210	Thermostatic	Off
CVV_13_Rad-lower-pY	13	100	120	Thermostatic	Off
CVV_14_Rad-upper-pY	14	125	150	Thermostatic	Off
CVV_15_UB-HSIF-mZ	15	100	120	Thermostatic	Off
LOU_16_rad-lower	16	120	150	Thermostatic	Off
LOU_17_rad-upper	17	120	150	Thermostatic	Off
TTAP_19_pY-redundant	19	60	90	Thermostatic	Off
TTAP_20_pZ-redundant	20	60	90	Thermostatic	Off
TTAP_21_mY-redundant	21	60	90	Thermostatic	Off
TTAP_22_mZ-redundant	22	60	90	Thermostatic	Off
IRRIG_23_STM_low_pY	23	100	120	Thermostatic	173 K
IRRIG_24_STM_low_mid	24	100	120	Thermostatic	173 K
IRRIG_25_STM_low_mY	25	100	120	Thermostatic	173 K

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
IRRIG_26_STM_low_pY	26	100	120	Thermostatic	173 K
IRRIG_27_STM_low_mid	27	100	120	Thermostatic	173 K
IRRIG_28_STM_low_mY	28	100	120	Thermostatic	173 K
IRRIG_29_STM_upp_pY	29	100	120	Thermostatic	173 K
IRRIG_30_STM_upp_mid	30	100	120	Thermostatic	173 K
IRRIG_31_STM_upp_mY	31	100	120	Thermostatic	173 K
IRRIG_32_STM_upp_pY	32	100	120	Thermostatic	173 K
IRRIG_33_STM_upp_mid	33	100	120	Thermostatic	173 K
IRRIG_34_STM_upp_mY	34	100	120	Thermostatic	173 K
IRRIG_43_STM_low _pY_red	43	100	120	Thermostatic	Off
IRRIG_44_STM_low _mid_red	44	100	120	Thermostatic	Off
IRRIG_45_STM_low _mY_red	45	100	120	Thermostatic	Off
IRRIG_46_STM_low _pY_red	46	100	120	Thermostatic	Off
IRRIG_47_STM_low _mid_red	47	100	120	Thermostatic	Off
IRRIG_48_STM_low _mY_red	48	100	120	Thermostatic	Off
IRRIG_49_STM_upp_pY_red	49	100	120	Thermostatic	Off
IRRIG_50_STM_upp_mid_red	50	100	120	Thermostatic	Off
IRRIG_51_STM_upp_mY_red	51	100	120	Thermostatic	Off
IRRIG_52_STM_upp_pY_red	52	100	120	Thermostatic	Off
IRRIG_53_STM_upp_mid_red	53	100	120	Thermostatic	Off
IRRIG_54_STM_upp_mY_red	54	100	120	Thermostatic	Off
IRRIG_63_STM_support	63	60	90	Thermostatic	173 K

A.4.2 SCOE Flight / Ground Heater Settings for TP4 - TV Phase 1

Heater Output No.	Heater type	Power Supplied	Output Fuse Rating	Set point [W]
1	H101 : DCLM heater	10W ± 1W (fixed)	750 mA	Off / operating during verification
2	H102 : DCLM heater	10W ± 1W (fixed)	750 mA	Off / operating during verification
3	VH701 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
4	VH102 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
5	VH103 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
6	VH104 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
7	VH105 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
8	VH106 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
9	VH702 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
10	H502 : Heater foil	6W ± 1W (fixed)	500 mA	Off
11	H503 : Heater foil	6W ± 1W (fixed)	500 mA	Off
12	H701 : Tank bottom heater	10W ± 1W (fixed) or 1.5W, variable in steps of 0.1W	750 mA	Off
13	H702 : Tank bottom heater	10W ± 1W (fixed) or 1.5W, variable in steps of 0.1W	750 mA	Off
14	H103 : Depletion heater	10W ± 1W (fixed)	250 mA	Off
15	H104 : Depletion heater	10W ± 1W (fixed)	250 mA	Off
16	H501 : External depletion heater	650W, variable in steps of 10W	16 A	Off

A.4.3 SCOE MTD Heater Settings for TP4 - TV Phase 1

			Step No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			Duration /hrs	4	4	2	4	4	2	4	4	2	~~4~~ 2	~~4~~ 2	1	~~4~~ 2	~~4~~ 2	4
SCOE ID	**ID**	**Max P [mW]**	**Power Steps [mW]**	**Set point [mW]**														
HIFI_1	HIFI-L0-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HIFI_2	HIFI-L1-H1/2	10	0.5	-	-	-	-	-	-	**5** ✓	**10** ✓	-	-	-	-	-	-	-
HIFI_3	HIFI-L2-H1/2	50	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LOU_1	LOU-1-H1/2	7000	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LOU_2	LOU-2-H1/2	7000	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LOU_3	LOU-3-H1/2	7000	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LOU_4	LOU-4-H1/2	7000	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PACS_1	PACS-L0-1-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PACS_2	PACS-L0-2-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PACS_7	PACS-L0-3-H1/2	500	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PACS_4	PACS-L0-4-H1/2	30	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PACS_5	PACS-L1-1-H1/2	10	0.5	**5** ✓	**10** ✓	-	-	-	-	-	-	-	-	-	-	-	-	-
PACS_6	PACS-L1-2-H1/2	10	0.5	**5** ✓	**10** ✓	-	-	-	-	-	-	-	-	-	-	-	-	-
PACS_3	PACS-L1-3-H1/2	10	0.5	**5** ✓	**10** ✓	-	-	-	-	-	-	-	-	-	-	-	-	-
PJFET	P-J-FET-H1/2	50	2.5	-	-	-	-	-	-	-	-	-	**25** ✓	**50** ✓	-	-	-	-
SJFET	S-J-FET-H1/2	50	2.5	-	-	-	-	-	-	-	-	-	-	-	-	**25** ✓	**50** ✓	-
SPIRE_1	SPIRE-L0-1-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPIRE_2	SPIRE-L0-2-H1/2	30	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPIRE_~~3~~4	SPIRE-L0-3-H1/2	500	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPIRE_~~4~~3	SPIRE-L1-H1/2	10	0.5	-	-	-	**5** ✓	**10**	-	-	-	-	-	-	-	-	-	-

5/10 ✓ ✓

5/10 ✓
" ✓
" ✓ (25/50)
5/10 ✓

5/10 ✓
" ✓
" ✓ !

UTC : 16^{00} 20^{00} 0^{00} 2^{00} 3^{30} 6^{40} ~~$10^{?}$~~ 10^{40}

21.10. | 22.10.

12^{55} (UTC) - 16^{22}

A.5 TP5 - TB Phase 1

Phase	**TP5 - TB Phase 1**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** 0
Expected Duration / hrs	183 (including ~48 hrs contingency)	**TTA-PLM I/F**	0°C	+Z to collimator mirror	
Objective	• Achieve quasi-stable conditions in HTT thermal environment for TMM correlation				
End of Phase Condition	• Stability criteria are reached				
Important see PUS 13	The He mass flow is set to ~ 4.5mg/s at the beginning of this phase. After this initial setting, the mass flow is drifting. The PPS and the nozzles are bypassed. To achieve a quasi-steady state of the cryostat's internal elements, a constant compensation heat will be applied on the HTT using the SPIRE L0 cooler pump MTD heater. In addition, the HIFI L2 MTD heater will be powered to raise the OBP temperature closer to its predicted orbit value. An initial HTT drift phase of 2 days is implemented to determine the required compensation heat from the measured temperature drift. 24 hours after the implementation of the compensation heat, the HTT temperature drift shall be checked to verify the correct heater setting.				

Step	Phase:	TP5 - TB Phase 1		Remarks / NCR
	PLM, SCOE & CVSE	FACILITY DATA HANDLING	LSS CONTROL	
TP5-A start of phase	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP5 - TB Phase 1 3. Start new section in Log Book 4. Fill in: Date / Time of start: 23.10.05 16:37 5. **SCOE Alarm Limits:** keep alarm limits as defined in Annex B 6. **SCOE Acquisition Interval:** 2 min 7. **SCOE Flight/Ground Heaters:** Flight / Ground heaters off acc. to section A.5.2 Load MTD heater settings acc. to section A.5.3 step 1: HIFI L2 heater 50mW SPIRE L0 heater to be powered later in phase 8. **SCOE Valve States:** (changes in **bold**) **Attention: be prepared to adjust mass flow rate via CVSE needle valves immediately after switching SCOE valves** V102: closed V104: **open** V103: **closed** V106: **closed** V701: closed	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP5 - TB Phase 1 3. **Alarm Limits:** Keep alarm limits as defined in Annex B 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** Keep settings from previous phase (see table in A.5.1): TTAP: 273 K HSS-TCR: 173 K	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** $< 1 \times 10^{-5}$ mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: 0°	

Step	Phase:	TP5 - TB Phase 1		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	V702: closed V105: open V501: open V503: open V504: **open** V505: **open** TV QM3: **open**			
TP5-B during phase	1. Adjust mass flow rate to 4.5 mg/s using the CVSE needle valve Ok at date / time: 23.10.05 / 18:00 2. No further control of the mass flow is foreseen, mass flow is drifting for the rest of this phase. 3. 48 hours after mass flow adjustment: Determine HTT compensation heat depending on HTT temperature drift and filling level acc. to section A.5.4 HTT comp. heat set point: …………………… 4. Power on SPIRE L0 heaters (SCOE IDs SPIRE_2 and SPIRE_4 SPIRE_~~3~~) to introduce in total the HTT compensation heat (see Step 2 in section A.5.3 with compensation heat update). Ok at date / time: …………… / ……………	see PUS 13		

Step	Phase:	TP5 - TB Phase 1		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	5. 24 hours after implementation of compensation heat: Check HTT temperature drift (expected drift < 1 mK / 10 hrs) measured drift: …………..K / ………..hrs ok at date / time: …………... / …………... 6. Wait until stability criteria acc. to section 6.5.1 are fulfilled.	PVS 13		
TP5-C end of phase	1. Verify that end-of-phase conditions are reached 2. Prepare EOP reports as defined in Annex D 3. Store SCOE data (tables and rec files) on CD ROM 4. Fill in: Date / Time of end: …………... / …………... 5. Convene TRB			

A.5.1 TDH Test Heater Settings for TP5 - TB Phase 1

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
TTAP_01_pY	1	60	90	Thermostatic	273 K
TTAP_02_pZ	2	60	90	Thermostatic	273 K
TTAP_03_mY	3	60	90	Thermostatic	273 K
TTAP_04_mZ	4	60	90	Thermostatic	273 K
CVV_05_LB	5	90	113.7	Thermostatic	Off
CVV_35_LB	35	90	113.7	Thermostatic	Off
CVV_06_LC-pZ	6	80	92	Thermostatic	Off
CVV_07_UC-pZ	7	80	92	Thermostatic	Off
CVV_08_UB-mZ	8	60	75.8	Thermostatic	Off
CVV_09_Rad-lower-mY	9	100	120	Thermostatic	Off
CVV_10_Rad-upper-mY	10	125	150	Thermostatic	Off
CVV_11_Rad-lower-mZ	11	100	120	Thermostatic	Off
CVV_12_Rad-upper-mZ	12	175	210	Thermostatic	Off
CVV_13_Rad-lower-pY	13	100	120	Thermostatic	Off
CVV_14_Rad-upper-pY	14	125	150	Thermostatic	Off
CVV_15_UB-HSIF-mZ	15	100	120	Thermostatic	Off
LOU_16_rad-lower	16	120	150	Thermostatic	Off
LOU_17_rad-upper	17	120	150	Thermostatic	Off
TTAP_19_pY-redundant	19	60	90	Thermostatic	Off
TTAP_20_pZ-redundant	20	60	90	Thermostatic	Off
TTAP_21_mY-redundant	21	60	90	Thermostatic	Off
TTAP_22_mZ-redundant	22	60	90	Thermostatic	Off
IRRIG_23_STM_low_pY	23	100	120	Thermostatic	173 K
IRRIG_24_STM_low_mid	24	100	120	Thermostatic	173 K
IRRIG_25_STM_low_mY	25	100	120	Thermostatic	173 K

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
IRRIG_26_STM_low_pY	26	100	120	Thermostatic	173 K
IRRIG_27_STM_low_mid	27	100	120	Thermostatic	173 K
IRRIG_28_STM_low_mY	28	100	120	Thermostatic	173 K
IRRIG_29_STM_upp_pY	29	100	120	Thermostatic	173 K
IRRIG_30_STM_upp_mid	30	100	120	Thermostatic	173 K
IRRIG_31_STM_upp_mY	31	100	120	Thermostatic	173 K
IRRIG_32_STM_upp_pY	32	100	120	Thermostatic	173 K
IRRIG_33_STM_upp_mid	33	100	120	Thermostatic	173 K
IRRIG_34_STM_upp_mY	34	100	120	Thermostatic	173 K
IRRIG_43_STM_low _pY_red	43	100	120	Thermostatic	Off
IRRIG_44_STM_low _mid_red	44	100	120	Thermostatic	Off
IRRIG_45_STM_low _mY_red	45	100	120	Thermostatic	Off
IRRIG_46_STM_low _pY_red	46	100	120	Thermostatic	Off
IRRIG_47_STM_low _mid_red	47	100	120	Thermostatic	Off
IRRIG_48_STM_low _mY_red	48	100	120	Thermostatic	Off
IRRIG_49_STM_upp_pY_red	49	100	120	Thermostatic	Off
IRRIG_50_STM_upp_mid_red	50	100	120	Thermostatic	Off
IRRIG_51_STM_upp_mY_red	51	100	120	Thermostatic	Off
IRRIG_52_STM_upp_pY_red	52	100	120	Thermostatic	Off
IRRIG_53_STM_upp_mid_red	53	100	120	Thermostatic	Off
IRRIG_54_STM_upp_mY_red	54	100	120	Thermostatic	Off
IRRIG_63_STM_support	63	60	90	Thermostatic	~~173 K~~ 203K

A.5.2 SCOE Flight / Ground Heater Settings for TP5 - TB Phase 1

Heater Output No.	Heater type	Power Supplied	Output Fuse Rating	Set point [W]
1	H101 : DCLM heater	10W ± 1W (fixed)	750 mA	Off
2	H102 : DCLM heater	10W ± 1W (fixed)	750 mA	Off
3	VH701 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
4	VH102 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
5	VH103 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
6	VH104 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
7	VH105 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
8	VH106 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
9	VH702 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
10	H502 : Heater foil	6W ± 1W (fixed)	500 mA	Off
11	H503 : Heater foil	6W ± 1W (fixed)	500 mA	Off
12	H701 : Tank bottom heater	10W ± 1W (fixed) or 1.5W, variable in steps of 0.1W	750 mA	Off
13	H702 : Tank bottom heater	10W ± 1W (fixed) or 1.5W, variable in steps of 0.1W	750 mA	Off
14	H103 : Depletion heater	10W ± 1W (fixed)	250 mA	Off
15	H104 : Depletion heater	10W ± 1W (fixed)	250 mA	Off
16	H501 : External depletion heater	650W, variable in steps of 10W	16 A	Off

A.5.3 SCOE MTD Heater Settings for TP5 - TB Phase 1

			Step No.	1	2
SCOE ID	**ID**	**Max P [mW]**	**Power Steps [mW]**	**Set point [mW]**	
HIFI_1	HIFI-L0-H1/2	10	0.5	-	-
HIFI_2	HIFI-L1-H1/2	10	0.5	-	-
HIFI_3	HIFI-L2-H1/2	50	2.5	**50**	**50**
LOU_1	LOU-1-H1/2	7000	500	-	-
LOU_2	LOU-2-H1/2	7000	500	-	-
LOU_3	LOU-3-H1/2	7000	500	-	-
LOU_4	LOU-4-H1/2	7000	500	-	-
PACS_1	PACS-L0-1-H1/2	10	0.5	-	-
PACS_2	PACS-L0-2-H1/2	10	0.5	-	-
PACS_7	PACS-L0-3-H1/2	500	25	-	-
PACS_4	PACS-L0-4-H1/2	30	0.5	-	-
PACS_5	PACS-L1-1-H1/2	10	0.5	-	-
PACS_6	PACS-L1-2-H1/2	10	0.5	-	-
PACS_3	PACS-L1-3-H1/2	10	0.5	-	-
PJFET	P-J-FET-H1/2	50	2.5	-	-
SJFET	S-J-FET-H1/2	50	2.5	-	-
SPIRE_1	SPIRE-L0-1-H1/2	10	0.5	-	-
SPIRE_2	SPIRE-L0-2-H1/2	30	0.5	-	**20 *)**
!! SPIRE_~~3~~4	SPIRE-L0-3-H1/2	500	25	-	**50 *)**
SPIRE_~~4~~3	SPIRE-L1-H1/2	10	0.5	-	-

O

O
O see PUS13

*) Predicted values, to be confirmed during test!

A.5.4 HTT Compensation Heat for TP5 - TB Phase 1

To determine the required compensation heat for the HTT, the heat balance is calculated from measured temperature drift and the current total heat capacity of the He in the HTT (metallic parts are neglected).

An Excel sheet is provided on the test floor to calculate the applicable compensation heat based on the measurements. To achieve reliable results, the time span between the HTT measurements should be 6 to 8 hours.

Description	**Source**	**Value**	**Unit**
Initial HTT filling level (%)	Measurement		%
Initial He mass	=337kg * filling level		kg
Consumed He mass	Measurement		kg
Current He mass	=initial - consumed		kg
Current HTT temperature	Measurement		K
time since previous measurement	Measurement		min
Previous HTT temperature	Measurement		K
specific heat of He, cp	Interpolation in table		J/kg/K
Total heat capacity	=curr. Mass*cp		J/K
HTT temperature drift	=(Tnew-Told)/dt		K/s
Heat imbalance	=C*dT/dt		mW
Compensation heat to be applied	Imbalance + 5 mW		mW

Temp	Cp
[K]	[J/kg-K]
1.6	1602.867
1.62	1710.077
1.64	1822.462
1.66	1940.225
1.68	2063.59
1.7	2192.804
1.72	2328.145
1.74	2469.925
1.76	2618.501
1.78	2774.28
1.8	2937.735
1.82	3109.411
1.84	3289.951
1.86	3480.114
1.88	3680.801
1.9	3893.097

n/a
see PUS 13

A.6 TP6 - TV Phase 2

Phase	**TP6 - TV Phase 2**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** 0
Expected Duration / hrs	49	**TTA-PLM I/F**	0°C	+Z to collimator mirror	
Objective	• Verification of thermal characteristics of L1 and L3 interfaces • DLCM operation verification				
End of Phase Condition	• All verifications performed				
Important	PPS and nozzles are bypassed during this phase to allow a higher mass flow rate of ~4.5mg/s				

Step	Phase:	TP6 - TV Phase 2		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
TP6-A start of phase	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP6 - TV Phase 2 3. Start new section in Log Book 4. Fill in: Date / Time of start: 29.10.05, 19:15 UTC 5. **SCOE Alarm Limits:** keep alarm limits as defined in Annex B 6. **SCOE Acquisition Interval:** 30 sec 7. **SCOE Flight/Ground Heaters:** Load Flight / Ground heater settings acc. to section A.6.2 Load MTD heater settings acc. to section A.6.3 SPIRE L0 and HIFI L2 heaters remain unchanged. Other MTD heater settings vary during phase! 8. **SCOE Valve States:** (unchanged) V102: closed V104: open V103: closed V106: closed V701: closed V702: closed V105: open	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP6 - TV Phase 2 3. **Alarm Limits:** Keep alarm limits as defined in Annex B 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** set values acc. to table in A.6.1 TTAP: 273 K HSS-TCR 173 K all others off	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** < 1 x 10^{-5} mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: 0°	

<table>
<tr><th rowspan="3">Step</th><th>Phase:</th><th colspan="2">TP6 - TV Phase 2</th><th rowspan="3">Remarks / NCR</th></tr>
<tr><th rowspan="2">PLM, SCOE & CVSE</th><th colspan="2">FACILITY</th></tr>
<tr><th>DATA HANDLING</th><th>LSS CONTROL</th></tr>
<tr><td></td><td>V501: open
V503: open
V504: open
V505: open
TV QM3: open</td><td></td><td></td><td></td></tr>
<tr><td>TP6-B during phase</td><td>1. Mass flow rate unchanged from previous phase, drifting at ~4.5mg/s (predicted)
2. Apply MTD heater dissipations timeline as defined in section A.6.3
3. Perform DLCM operations acc. to RD 11</td><td></td><td></td><td></td></tr>
<tr><td>TP6-C end of phase</td><td>1. Verify that end-of-phase conditions are reached
2. Prepare EOP reports as defined in Annex D
3. Store SCOE data (tables and rec files) on CD ROM
4. Fill in:
Date / Time of end: .... / ....
5. Convene TRB</td><td></td><td></td><td></td></tr>
</table>

A.6.1 TDH Test Heater Settings for TP6 - TV Phase 2

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
TTAP_01_pY	1	60	90	Thermostatic	273 K
TTAP_02_pZ	2	60	90	Thermostatic	273 K
TTAP_03_mY	3	60	90	Thermostatic	273 K
TTAP_04_mZ	4	60	90	Thermostatic	273 K
CVV_05_LB	5	90	113.7	Thermostatic	Off
CVV_35_LB	35	90	113.7	Thermostatic	Off
CVV_06_LC-pZ	6	80	92	Thermostatic	Off
CVV_07_UC-pZ	7	80	92	Thermostatic	Off
CVV_08_UB-mZ	8	60	75.8	Thermostatic	Off
CVV_09_Rad-lower-mY	9	100	120	Thermostatic	Off
CVV_10_Rad-upper-mY	10	125	150	Thermostatic	Off
CVV_11_Rad-lower-mZ	11	100	120	Thermostatic	Off
CVV_12_Rad-upper-mZ	12	175	210	Thermostatic	Off
CVV_13_Rad-lower-pY	13	100	120	Thermostatic	Off
CVV_14_Rad-upper-pY	14	125	150	Thermostatic	Off
CVV_15_UB-HSIF-mZ	15	100	120	Thermostatic	Off
LOU_16_rad-lower	16	120	150	Thermostatic	Off
LOU_17_rad-upper	17	120	150	Thermostatic	Off
TTAP_19_pY-redundant	19	60	90	Thermostatic	Off
TTAP_20_pZ-redundant	20	60	90	Thermostatic	Off
TTAP_21_mY-redundant	21	60	90	Thermostatic	Off
TTAP_22_mZ-redundant	22	60	90	Thermostatic	Off
IRRIG_23_STM_low_pY	23	100	120	Thermostatic	173 K
IRRIG_24_STM_low_mid	24	100	120	Thermostatic	173 K
IRRIG_25_STM_low_mY	25	100	120	Thermostatic	173 K

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
IRRIG_26_STM_low_pY	26	100	120	Thermostatic	173 K
IRRIG_27_STM_low_mid	27	100	120	Thermostatic	173 K
IRRIG_28_STM_low_mY	28	100	120	Thermostatic	173 K
IRRIG_29_STM_upp_pY	29	100	120	Thermostatic	173 K
IRRIG_30_STM_upp_mid	30	100	120	Thermostatic	173 K
IRRIG_31_STM_upp_mY	31	100	120	Thermostatic	173 K
IRRIG_32_STM_upp_pY	32	100	120	Thermostatic	173 K
IRRIG_33_STM_upp_mid	33	100	120	Thermostatic	173 K
IRRIG_34_STM_upp_mY	34	100	120	Thermostatic	173 K
IRRIG_43_STM_low _pY_red	43	100	120	Thermostatic	Off
IRRIG_44_STM_low _mid_red	44	100	120	Thermostatic	Off
IRRIG_45_STM_low _mY_red	45	100	120	Thermostatic	Off
IRRIG_46_STM_low _pY_red	46	100	120	Thermostatic	Off
IRRIG_47_STM_low _mid_red	47	100	120	Thermostatic	Off
IRRIG_48_STM_low _mY_red	48	100	120	Thermostatic	Off
IRRIG_49_STM_upp_pY_red	49	100	120	Thermostatic	Off
IRRIG_50_STM_upp_mid_red	50	100	120	Thermostatic	Off
IRRIG_51_STM_upp_mY_red	51	100	120	Thermostatic	Off
IRRIG_52_STM_upp_pY_red	52	100	120	Thermostatic	Off
IRRIG_53_STM_upp_mid_red	53	100	120	Thermostatic	Off
IRRIG_54_STM_upp_mY_red	54	100	120	Thermostatic	Off
IRRIG_63_STM_support	63	60	90	Thermostatic	173 K

A.6.2 SCOE Flight / Ground Heater Settings for TP6 - TV Phase 2

Heater Output No.	Heater type	Power Supplied	Output Fuse Rating	Set point [W]
1	H101 : DCLM heater	10W ± 1W (fixed)	750 mA	Off (operating during verification)
2	H102 : DCLM heater	10W ± 1W (fixed)	750 mA	Off (operating during verification)
3	VH701 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
4	VH102 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
5	VH103 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
6	VH104 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
7	VH105 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
8	VH106 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
9	VH702 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
10	H502 : Heater foil	6W ± 1W (fixed)	500 mA	Off
11	H503 : Heater foil	6W ± 1W (fixed)	500 mA	Off
12	H701 : Tank bottom heater	10W ± 1W (fixed) or 1.5W, variable in steps of 0.1W	750 mA	Off
13	H702 : Tank bottom heater	10W ± 1W (fixed) or 1.5W, variable in steps of 0.1W	750 mA	Off
14	H103 : Depletion heater	10W ± 1W (fixed)	250 mA	Off
15	H104 : Depletion heater	10W ± 1W (fixed)	250 mA	Off
16	H501 : External depletion heater	650W, variable in steps of 10W	16 A	Off

PVS 14: MTD heater settings for TV phase 2

			Step No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	~~15~~ 17
			max. Duration /hrs	4	4	2	4	4	2	4	4	2	4	4	2	4	4	4	4	4
SCOE ID	**ID**	**Max P [mW]**	**Power Steps [mW]**	**Set point [mW]**																
HIFI_1	HIFI-L0-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HIFI_2	HIFI-L1-H1/2	10	0.5	-	-	-	-	-	-	**5** ✓	**10** ✓	- ✓	-	-	-	-	-	-	-	-
HIFI_3	HIFI-L2-H1/2	50	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**25** ✓	**50** ✓
LOU_1	LOU-1-H1/2	7000	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LOU_2	LOU-2-H1/2	7000	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LOU_3	LOU-3-H1/2	7000	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LOU_4	LOU-4-H1/2	7000	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PACS_1	PACS-L0-1-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PACS_2	PACS-L0-2-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PACS_7	PACS-L0-3-H1/2	500	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PACS_4	PACS-L0-4-H1/2	30	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PACS_5	PACS-L1-1-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	**5** ✓	**10** ✓	-	-	-
PACS_6	PACS-L1-2-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	**5** ✓	**10** ✓	-	-	-
PACS_3	PACS-L1-3-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	**5** ✓	**10** ✓	-	-	-
PJFET	P-J-FET-H1/2	50	2.5	-	-	-	**25** ✓	**50** ✓	-	-	-	-	-	-	-	-	-	-	-	-
SJFET	S-J-FET-H1/2	50	2.5	**25** ✓	**50** ✓	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPIRE_1	SPIRE-L0-1-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPIRE_2	SPIRE-L0-2-H1/2	30	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPIRE_~~3~~4	SPIRE-L0-3-H1/2	500	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPIRE_~~4~~3	SPIRE-L1-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	**5** ✓	**10** ✓	-	-	-	-	-	-
			UTC	19^{45}	21^{00}	22:30	23^{30}	1^{15}	03:00	4^{30}	6^{15}	8^{00}	9^{15}	10^{45}	12^{15}	14^{00}	15^{50}	6^{00}	09^{40}	13^{40}

30.10.05

31.10.05

A.6.3 SCOE MTD Heater Settings for TP6 - TV Phase 2

see PV 14

and page before

				13	14	15	10	11	12	7	8	9	4	5	6	1	2	3	16	17
			Step No.	~~1~~	~~2~~	~~3~~	~~4~~	~~5~~	~~6~~	~~7~~	~~8~~	~~9~~	~~10~~	~~11~~	~~12~~	~~13~~	~~14~~	~~15~~		
			max **Duration /hrs**	4	4	2 tbc	4	4	2 tbc	4	4	2 tbc	4	4	1 tbc	4	4	4 tbc	4	4
SCOE ID	**ID**	**Max P [mW]**	**Power Steps [mW]**	**Set point [mW]**																
HIFI_1	HIFI-L0-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
HIFI_2	HIFI-L1-H1/2	10	0.5	-	-	-	-	-	-	5	10	-	-	-	-	-	-	-		
HIFI_3	HIFI-L2-H1/2	50	2.5	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	25	50
LOU_1	LOU-1-H1/2	7000	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
LOU_2	LOU-2-H1/2	7000	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
LOU_3	LOU-3-H1/2	7000	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
LOU_4	LOU-4-H1/2	7000	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
PACS_1	PACS-L0-1-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
PACS_2	PACS-L0-2-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
PACS_7	PACS-L0-3-H1/2	500	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
PACS_4	PACS-L0-4-H1/2	30	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
PACS_5	PACS-L1-1-H1/2	10	0.5	**5**	**10**	-	-	-	-	-	-	-	-	-	-	-	-	-		
PACS_6	PACS-L1-2-H1/2	10	0.5	**5**	**10**	-	-	-	-	-	-	-	-	-	-	-	-	-		
PACS_3	PACS-L1-3-H1/2	10	0.5	**5**	**10**	-	-	-	-	-	-	-	-	-	-	-	-	-		
PJFET	P-J-FET-H1/2	50	2.5	-	-	-	-	-	-	-	-	-	**25**	**50**	-	-	-	-		
SJFET	S-J-FET-H1/2	50	2.5	-	-	-	-	-	-	-	-	-	-	-	-	**25**	**50**	-		
SPIRE_1	SPIRE-L0-1-H1/2	10	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPIRE_2	SPIRE-L0-2-H1/2	30	0.5	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~	~~**20 *)**~~		
! SPIRE_~~3~~4	SPIRE-L0-3-H1/2	500	25	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~	~~**50 *)**~~		
SPIRE_~~4~~3	SPIRE-L1-H1/2	10	0.5	-	-	-	**5**	**10**	-	-	-	-	-	-	-	-	-	-		

*) Predicted values, actual value to be kept from previous phase

19^{45} | 21^{00} UTC

A.7 TP7 - TB Phase 2

Phase	**TP7 - TB Phase 2**	**Type:**	stable	**S/C Attitude**	**Tilt /° :** 0
Expected Duration / hrs	103	**TTA-PLM I/F**	0°C	+Z to collimator mirror	
Objective	• Achieve quasi-stable CVV conditions for second external correlation point • Operate LOU MTD heaters and verify alignment				
End of Phase Condition	• Stability criterion for external correlation reached				
Important	During the second TB phase, only an external quasi equilibrium will be achieved to allow correlation of the TMM wrt the CVV MLI.				

Step	Phase:	TP7 - TB Phase 2		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
TP~~6~~7-A start of phase	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP7 - TB Phase 2 3. Start new section in Log Book 4. Fill in: Date / Time of start: 01.11.05, 6:45 (in Data handling: TP7 started 31.10. 21:20) 5. **SCOE Alarm Limits:** keep alarm limits as defined in Annex B 6. **SCOE Acquisition Interval:** 2 min 7. **SCOE Flight/Ground Heaters:** Load Flight / Ground heater settings acc. to section A.7.2 Load MTD heater settings acc. to step 1 of section A.7.3: SPIRE L0 and HIFI L2 heaters remain unchanged! LOU heaters switching, step 1 initialized at beginning of TP7 8. **SCOE Valve States:** (unchanged) V102: closed V104: open V103: closed V106: closed V701: closed V702: closed V105: open	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP7 - TB Phase 2 3. **Alarm Limits:** keep alarm limits as defined in Annex B 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** all off set values acc. to table in A.6.1 TTAP: 273 K HSS-TCR 293 K all others off	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** < 1 x 10^{-5} mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: 0°	

Step	Phase:	TP7 - TB Phase 2		Remarks / NCR
	PLM, SCOE & CVSE	FACILITY DATA HANDLING	LSS CONTROL	
	V501: open V503: open V504: open V505: open TV QM3: open			
TP~~6~~7-B during phase	1. Perform HACS measurements acc. to RD12 during LOU MTD heating 2. After implementing the warmer environment conditions (293K on HSS-TCR), wait until quasi steady-state conditions acc. to section 6.5.2 are fulfilled. 3. 60 hours after start of TP7 (temperature of MT108, MT109, MT110 above 150K), switch LOU MTD acc. to step 2 of A.7.3, steps 3 & 4 follow in 2 hour periods Step 2 started at ……….. / ……….			
TP~~6~~7-C end of phase	1. Verify that end-of-phase conditions are reached 2. Prepare EOP reports as defined in Annex D 3. Store SCOE data (tables and rec files) on CD ROM			

Step	**Phase:**	**TP7 - TB Phase 2**		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	4. Fill in: Date / Time of end: …………... / …………... 5. Convene TRB			

A.7.1 TDH Test Heater Settings for TP7 - TB Phase 2

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
TTAP_01_pY	1	60	90	Thermostatic	273 K
TTAP_02_pZ	2	60	90	Thermostatic	273 K
TTAP_03_mY	3	60	90	Thermostatic	273 K
TTAP_04_mZ	4	60	90	Thermostatic	273 K
CVV_05_LB	5	90	113.7	Thermostatic	Off
CVV_35_LB	35	90	113.7	Thermostatic	Off
CVV_06_LC-pZ	6	80	92	Thermostatic	Off
CVV_07_UC-pZ	7	80	92	Thermostatic	Off
CVV_08_UB-mZ	8	60	75.8	Thermostatic	Off
CVV_09_Rad-lower-mY	9	100	120	Thermostatic	Off
CVV_10_Rad-upper-mY	10	125	150	Thermostatic	Off
CVV_11_Rad-lower-mZ	11	100	120	Thermostatic	Off
CVV_12_Rad-upper-mZ	12	175	210	Thermostatic	Off
CVV_13_Rad-lower-pY	13	100	120	Thermostatic	Off
CVV_14_Rad-upper-pY	14	125	150	Thermostatic	Off
CVV_15_UB-HSIF-mZ	15	100	120	Thermostatic	Off
LOU_16_rad-lower	16	120	150	Thermostatic	Off
LOU_17_rad-upper	17	120	150	Thermostatic	Off
TTAP_19_pY-redundant	19	60	90	Thermostatic	Off
TTAP_20_pZ-redundant	20	60	90	Thermostatic	Off
TTAP_21_mY-redundant	21	60	90	Thermostatic	Off
TTAP_22_mZ-redundant	22	60	90	Thermostatic	Off
IRRIG_23_STM_low_pY	23	100	120	Thermostatic	293 K
IRRIG_24_STM_low_mid	24	100	120	Thermostatic	293 K
IRRIG_25_STM_low_mY	25	100	120	Thermostatic	293 K

Heater circuit name	Circuit number	Max P predicted [W]	Max P allowed [W]	Control type	set point
IRRIG_26_STM_low_pY	26	100	120	Thermostatic	293 K
IRRIG_27_STM_low_mid	27	100	120	Thermostatic	293 K
IRRIG_28_STM_low_mY	28	100	120	Thermostatic	293 K
IRRIG_29_STM_upp_pY	29	100	120	Thermostatic	293 K
IRRIG_30_STM_upp_mid	30	100	120	Thermostatic	293 K
IRRIG_31_STM_upp_mY	31	100	120	Thermostatic	293 K
IRRIG_32_STM_upp_pY	32	100	120	Thermostatic	293 K
IRRIG_33_STM_upp_mid	33	100	120	Thermostatic	293 K
IRRIG_34_STM_upp_mY	34	100	120	Thermostatic	293 K
IRRIG_43_STM_low _pY_red	43	100	120	Thermostatic	Off
IRRIG_44_STM_low _mid_red	44	100	120	Thermostatic	Off
IRRIG_45_STM_low _mY_red	45	100	120	Thermostatic	Off
IRRIG_46_STM_low _pY_red	46	100	120	Thermostatic	Off
IRRIG_47_STM_low _mid_red	47	100	120	Thermostatic	Off
IRRIG_48_STM_low _mY_red	48	100	120	Thermostatic	Off
IRRIG_49_STM_upp_pY_red	49	100	120	Thermostatic	Off
IRRIG_50_STM_upp_mid_red	50	100	120	Thermostatic	Off
IRRIG_51_STM_upp_mY_red	51	100	120	Thermostatic	Off
IRRIG_52_STM_upp_pY_red	52	100	120	Thermostatic	Off
IRRIG_53_STM_upp_mid_red	53	100	120	Thermostatic	Off
IRRIG_54_STM_upp_mY_red	54	100	120	Thermostatic	Off
IRRIG_63_STM_support	63	60	90	Thermostatic	293 K

A.7.2 SCOE Flight / Ground Heater Settings for TP7 - TB Phase 2

Heater Output No.	**Heater type**	**Power Supplied**	**Output Fuse Rating**	**Set point [W]**
1	H101 : DCLM heater	10W ± 1W (fixed)	750 mA	Off
2	H102 : DCLM heater	10W ± 1W (fixed)	750 mA	Off
3	VH701 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
4	VH102 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
5	VH103 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
6	VH104 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
7	VH105 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
8	VH106 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
9	VH702 : Valve body heater	6W ± 1W (fixed)	500 mA	Off
10	H502 : Heater foil	6W ± 1W (fixed)	500 mA	Off
11	H503 : Heater foil	6W ± 1W (fixed)	500 mA	Off
12	H701 : Tank bottom heater	10W ± 1W (fixed) or 1.5W, variable in steps of 0.1W	750 mA	Off
13	H702 : Tank bottom heater	10W ± 1W (fixed) or 1.5W, variable in steps of 0.1W	750 mA	Off
14	H103 : Depletion heater	10W ± 1W (fixed)	250 mA	Off
15	H104 : Depletion heater	10W ± 1W (fixed)	250 mA	Off
16	H501 : External depletion heater	650W, variable in steps of 10W	16 A	Off

A.7.3 SCOE MTD Heater Settings for TP7 - TB Phase 2

			Step No.	1	2	3	4
			Duration /hrs	60	2	2	~~2~~ until end of TP7
SCOE ID	ID	Max P [mW]	Power Steps [mW]	Set point [mW]			
HIFI_1	HIFI-L0-H1/2	10	0.5	-	-	-	-
HIFI_2	HIFI-L1-H1/2	10	0.5	-	-	-	-
HIFI_3	HIFI-L2-H1/2	50	2.5	-	-	-	-
LOU_1	LOU-1-H1/2	7000	500	**7000**	-	-	-
LOU_2	LOU-2-H1/2	7000	500	-	**7000**	-	-
LOU_3	LOU-3-H1/2	7000	500	-	-	**7000**	-
LOU_4	LOU-4-H1/2	7000	500	-	-	-	**7000**
PACS_1	PACS-L0-1-H1/2	10	0.5	-	-	-	-
PACS_2	PACS-L0-2-H1/2	10	0.5	-	-	-	-
PACS_7	PACS-L0-3-H1/2	500	25	-	-	-	-
PACS_4	PACS-L0-4-H1/2	30	0.5	-	-	-	-
PACS_5	PACS-L1-1-H1/2	10	0.5	-	-	-	-
PACS_6	PACS-L1-2-H1/2	10	0.5	-	-	-	-
PACS_3	PACS-L1-3-H1/2	10	0.5	-	-	-	-
PJFET	P-J-FET-H1/2	50	2.5	-	-	-	-
SJFET	S-J-FET-H1/2	50	2.5	-	-	-	-
SPIRE_1	SPIRE-L0-1-H1/2	10	0.5	-	-	-	-
SPIRE_2	SPIRE-L0-2-H1/2	30	0.5	**20 *)**	**20 *)**	**20 *)**	**20 *)**
! SPIRE_~~3~~4	SPIRE-L0-3-H1/2	500	25	**50 *)**	**50 *)**	**50 *)**	**50 *)**
SPIRE_~~4~~3	SPIRE-L1-H1/2	10	0.5	-	-	-	-

*) Predicted values, actual value to be kept from previous phase

A.8 TP8 - Recovery to Ambient

Phase	**TP8 - Recovery to Ambient**	**Type:**	Transient	**S/C Attitude**	**Tilt /° :** 0
Expected Duration / hrs	40	**TTA-PLM I/F**	20°C	+Z to collimator mirror	
Objective	• Warm-up of PLM external surfaces to ambient temperature • Warm-up of LSS shrouds • Re-pressurization of LSS				
End of Phase Condition	• LSS ready to open chamber				
Important					

Step	**Phase:**	**TP8 - Recovery to Ambient**		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
TP~~7~~8A start of phase	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP8 - Recovery to Ambient 3. Start new section in Log Book 4. Fill in: Date / Time of start: 05.11.05 / 20:00 5. **SCOE Alarm Limits:** keep alarm limits as defined in Annex B 6. **SCOE Acquisition Interval:** 2 min 7. **SCOE Flight/Ground Heaters:** Load Flight / Ground heater settings acc. to section A.8.2 Load MTD heater settings acc. to section A.8.3 8. **SCOE Valve States:** (changes in **bold**) V102: ~~closed~~ open PVS 21 V104: **~~closed~~** open PVS 21 V103: closed ✓ V106: closed ✓ V701: closed ✓ V702: closed ✓ V105: ~~open~~ closed PVS 21 V501: open ✓ V503: open ✓	1. **Main Title:** Herschel PLM STM TB/TV Test 2. **Subtitle:** TP8 - Recovery to Ambient 3. **Alarm Limits:** keep alarm limits as defined in Annex B 4. **Acquisition Interval:** 2 min 5. **TDH Test Heaters:** (all on) Load test heater setting acc. to section A.8.1	1. **Sun Simulator:** off 2. **Shrouds:** C1 shroud: LN2 C2 shroud: LN2 3. **Pressure:** < 1 x 10^{-5} mbar 4. **Spin Box:** Temperature: 293 K SB shroud: LN2 Tilt angle: 0°	

Step	**Phase:**	**TP8 - Recovery to Ambient**		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	V504: open V505: open TV QM3: open			
TP~~7~~8-B during phase	1. ~~Switch off He~~ pumps see PVS 25 2. ~~Keep GHe pressure~~ above ambient in safety and pumping line 3. Monitor HTT temperature and pressure. If temperature rises above 4.2 K (p > 1 bar) open V104. 4. Monitor external temperatures to verify warm-up heaters operation 5. Monitor CVV internal pressure no monitor 6. Perform HACS measurements acc. to RD 12 during CVV warm-up 7. Perform SIH verification measurements during CVV warm-up every 2 hrs or 10 K CVV temperature increase 8. When minimum external temperature (virtual sensors) is >120 K, request LSS to initiate warm up of shrouds.	1. Remove shroud temperature alarm limits	1. On request of test conductor: stop C1 LN2 mode and open V001 (keep C2 in LN2	

Step	Phase:	TP8 - Recovery to Ambient		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
	273k = 0°C		mode). 06/11/05 / 17h36 2. Drain C1. 06/11/05 / 19h24 3. Set mirror temperature at 40°C. 6/11/05 / 21h41 4. Start C1 VTC mode to bring C1 shrouds at ambient temperature. 6/11/05 / 22h34 5. While S/C temperature below 0°C: Keep shrouds 10 K below minimum external S/C temperature (virt sensor) 6. When C1 shrouds are stabilised at ambient temperature, stop C1 VTC mode. 8/11/05 / 9 03 7. Prepare facility for C2 draining. 8/11/05 / 9 04 8. Stop LN2 pump and stop C2	

Step	Phase:	TP8 - Recovery to Ambient		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
			LN2 mode. 8/11/9 06 9. Start C2 draining mode. 8/11/9 08 10. When draining is finished, open V084 and V 085 on the LN2 pump local cabinet. 8/11/9.41 11. Start C2 warm-up mode, gas temperature set point 30°C. 8/11/9h42 12. When C2 shrouds are at ambient temperature, stop C2 warm up. 8/11/05/13h32 13. Start C1 and C2 warm-up to stabilized shrouds at ambient temperature. 8/11/05/13h33 14. When C1 and C2 are stabilized at ambient temperature, inform customer that LSS is ready for re-pressurisation.	

Step	Phase:	TP8 - Recovery to Ambient		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
			8/11/05 / 15h00	
	9. When ambient temperature is reached on structure and MLI average sensors, request LSS to initiate repressurisation		15. On test director request start chamber re-pressurisation. ……….. / ………..	
		2. Remove pressure and cryo panel temperature alarm limits	16. Ask DH to disable alarms on chamber on chamber pressure and cryo-panels temperature. 8/11/05 / 15h15	
			17. Switch off vacuum gauge RG 1102. 8/11/05 / 15h37 -	
			18. Close mass spectrometer valves. 8/11/05 / 15 37	
			19. Switch off mass spectrometers. 8/11/05 / 15 37 -	
			20. Close VV 100 valves of cryopumps 1&2. 8/11/05 15H43	
			21. Close turbo pump HV valves. 8/11/05 / 15H40	

Step	Phase:	TP8 - Recovery to Ambient		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
		16h30 PSU set to ON when Pchamber reached 1.10-3 mbar	22. Stop CP1. 8/11/05/ 15H44. 23. Stop turbopumps. ………../………. 24. When CP1 temperature is > 0° C, start repressurisation with GN2 (250 mbar/h). ~~17h17~~ 8/11/05 / 17h17 25. Decrease mirror temperature to 26°C. 8/11/05/ 17h 19 26. At 1 mbar, stop MS interseal pump. 8/11/05/ 17h 21 27. At 100 mbar, stop CP2. 9/11/05/ 2h57. 28. At ambient pressure, stop facility interseal pumps. 09/11/05 / 2h31 29. Stop MS auxiliaries. 09/11/05 / 2h32 30. Stop C1 and C2 warm-up mode.	

Step	Phase:	TP8 - Recovery to Ambient		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
			09/11/05 / 7h46 31. Notify to test director that chamber is at atmospheric pressure. 09/11/05 / 7h39 32. Stop SUSI HP GN2 sub-system. 09/11/05 / 7h52 33. On test director request, open 5-m man door. 09/11/05 / 7h55 34. On test director request, open top lid (release pressure first). 09/11/05 / 8h40 35. Open 5-m door. 15h00 / 09/11/2005 **36. WARNING :** PROHIBIT ACCESS TO CHAMBER UNTILL OXYGEN CONTENT CHECK HAS BEEN PERFORMED. 14h30 / 09/11/2005.	

Step	**Phase:**	**TP8 - Recovery to Ambient**		Remarks / NCR
		FACILITY		
	PLM, SCOE & CVSE	DATA HANDLING	LSS CONTROL	
TP8-C end of phase	1. Verify that end-of-phase conditions are reached 1a) Repressurize safety line → see PUS4 2. Switch all flight, ground and MTD heaters off 3. Prepare EOP reports as defined in Annex D 4. Store SCOE data (tables and rec files) on CD ROM 5. Fill in: Date / Time of end: 03.11.05 / 06:30 6. Convene TRB	1. Switch all test heaters OFF		

END OF TEST

TB/TV Test Logbook

Scanned_Docs\STM_TB-TV_LogBook.pdf

Start Test Phase TP1
Launch Autonomy

08.10.05 11:00 UTC / 13:00 local

HTT filled to 97% at 1.83 K
HOT filled to 100%
H501 check ok

08.10. / 18:30 UTC CUSE dismounted, release of dismounting of scaffolding

Time lap between SCOE and TDH ca 12sec (TDH leads)
mass flow unit set to 500 mg/sec range

09.10 / 09:00 UTC HTT temp rises too quickly.
PUS 1 initiated; HOT venting via V702

10.10. / 07:00 Check of HTT heat load with evacuated tubing initiated by going to nominal launch autonomy configuration

10:54 Frog removed, H701 off
11:05 V701 closed, Mass flow unit disconnected
11:07 Evacuation of tubing started

10.10.05 / 13:30 : Tilt verification : max angle 22.9° ; clearance between 12 Rig bracket and (warm!) LSS wall ~ 50 mm

16:23 Mass flow unit range set to 5 g/sec

7:00 - 9:30 HACS functional check performed

11.10.05 / 08:00 : Mass flow unit range 500 mg/sec

HOT evacuation sequence 08:14:53 SCOE = 17'

90"		425mba	
2'30"		299 mbar	
2'50"		243	
	150	199	
4'35"	100mg/s	140 mbar	
5'05"		121 mbar	
5'53"	60 mg/s	96 mbar	
6'25"	50	85	
7'08"	40	72	
8'07"	30	59	
10'10"	20	41	
11:37	15	33	
13:30	10	27,3	↓ Präzisionsmanometer
15:11	8	23,49	
17:30	6	19,1	
18:36		17.7 mbar	8,8 mbar P502
19:30	5	16,4	7,66 mbar

08:20 22:50" Inlet valve closed

12.61 mbar lowest

1,7 mg/s on display, 1,3 on analog out

		Display
08:26:30	203	12,8
	204	15,04
	201	14,73
	Analog	13,64

08:30 U501 closed d018.tif

[redacted] 13:20 UTC

Start of TP2 – LEOP

UTC beeper pid 11594 @ dc

14:00 Mass flow meter unit set to 50 mg/s

14: Tilting to 1° (steps) requested from LSS;
14:24 Problem with LSS motion system. S/C has not yet moved. Temperature on PPS outlet shows oscillations with variable frequency, fixed amp.

14:45 SIH IDAS check performed. OK.

15:29 MS working; 1° reached, no PPS reaction, first bend in LO (T221/T224)

15:48 2.7° PPS temperature drops below bath

15:50 3.99° reached. Stop tilting

16:20 Rig Support Heater Power increased to 100%
Upper Rig Panel Heater Power to ~40W increased

16:31 Oscillations on T111 and CUSE_004 → PUS 3

17:00 SIH IDAS check performed. OK.
LSS pressure has peaks above 10^{-5} mbar

HHCS - PC - to be checked frequently

17:10 P506 (Analogue) reads 14,25 mbar,
stable. Gas meter 0,53 m^3

17:50 P506 reads 14,25 mbar stable
Gas meter, 0,65 m^3

18:35 Gasmeter, 0.80 m^3, 14,25 mbar P506

18^{58} Gasmeter 0,87 m^3, 14,30 mbar P506
19^{20} 0,96 m^3, 14,35 mbar P506
19^{10} SIH IDAS check performed, ok.
19^{48} Warning limit of IR-rig support reduced
from -1°C to -25°C, ref. ORS #10
20^{15} Gasmeter 1,11 m^3, 14,40 mbar P506

21^{10} SIH: IDAS check performed, ok.
21:25 Evacuation of Safety line
from 600/21 mbar (⇒ T107 decreases)
22:30 Gasmeter 1,57 m^3, 13,9 mb P506, 20,8 mb P_{safety}
Flowmeter 8,8 mg/sec

23:05 SIH IDAS check performed, ok.
23:35 Gasmeter 1,79, P506 = 13,85 P_{safety} = 20,8 mb
Flow 9 mg/sec

12.10.05
1:00 SIH IDAS check performed, ok
1:35 Gasmeter 2,20 m^3 P_{506} = 13,85 mb P_{safety} = 20,8 mb

3:00 SIH IDAS check performed, o.k.
04:05 Gasmeter 2,74 m^3 P_{506} = 13,85 mb P_{safety} = 20,8 mb
Flow = 9,6 mg/sec

12/10/05

04:57 : TTAP HTR power increased from ~~60~~ 36W (1.47A) to ~~80~~ 48 W (1,70 A) for lines 1,2,3,4. Lower Temp alarm limit (18°C / 291K) was exceeded.

(90W is max)
there is redundancy

05:00 : SIH IDAS check performed, O.K.

HSS support structure $T_{min} = 250K$ (→ Power increase)

07:00 : SIH IDAS check successfully performed.
09:15 : SIH IDAS check successfully performed.
11:00 SIH IDAS check successfully performed.
13:00 SIH IDAS check successfully performed
13:07 TTAP HTR power increased from 1,7A/48W to 1,9A/60W for lines 1,2,3,4. Lower Temp. alarm limit (291K) was exceeded.

12.10. 13:05 New Shift
Jahn, Haeser, Kölle, Barlage

13:56 Tilt angle increased to 5°
14:30 P506: 14,0mbar / Gasmeter: 5.145 m^3 / Massflow 10.8 mg/s
15:12: Clocks on Data handling:
SCOE: 25 s behind UTC
TDH: 8s behind UTC
HACS: 17:13:00 HACS 17:17:34 MESZ
↳ HACS: 1:55:26 before UTC

15:25 SIH IDAS check performed. ok.
17:10 + 19:00 —— " —— ok
20:10 P506: 14,1 mbar / Gasmeter: 6.56 m^3 / Massflow 11.2 mg/s
21:00 SIH IDAS check performed, ok.

21:30 Night Shift

Sonn, Hinger, Huber, Langenstein.

22:35 P_{506} = 14.15 mb Gasmeter = 7.16 m³ Flow = 11.4 mg/sec

P_{safety} = 21.3 mbar

23:00 SIH IDAS check performed, o.k.

13.10.05

01:00 SIH IDAS check performed, ok.

01:15 Failed MTD sensors detected:

PT1000_MT213 ~~failed~~ since 12.10.05

below calibration limit of 13.25 K.

PT1000_MT315 below calibration limit of 13.15 K

since 12.10.05 20:00

02:40 P_{506} = 14,2 mb Gasmeter 8,23 m³ Flow = 11,8 mg/s

P_{safety} = 21,4 mb LHF = 0,75 g/min

3:00 SIH IDAS check performed, o.k.

5:00 SIH IDAS check performed, o.k.

5:00 P_{506} = 14,3 mb Gasmeter = 8,85 m³ Flow = 12,0 mg/s

P_{safety} = 21,4 mb

5:10 Alarm limits activated according to ORS 17

(has been forgotten at begin of phase).

5:30 Day Shift

Gerner, Kunz, Langfermann, Wagner

07:00 SIM IDAS check performed, 1 connection outside spec
A50J04 pin 27-29
Testhead 2

8:40 : SCOE Recording restarted (TBTV_TP2-LEOP)

09:00 SIM IDAS check, 1 as before: connection outside spec (see above)

11:00 SIM IDAS check : okay. (limits changed from 0.3kΩ to 0.
~> N. Sonn

13:00 SIH IDAS check : okay.

13.10.05 13:20 Late shift

Jahn, Hauser, Kölle, Barlage

13:40 Tilt angle increased to 5.9°

13:47 - 14:18 No data received from SCOE

15⁰⁰ & 17⁰⁰, 19⁰⁰ SIH IDAS check performed, ok.

19:15 Switch on redundant TTAP heaters in addition to the nominal ones to keep the TTAP at 293 K → ORS 20

20:16 P 506: 14,57 mbar Gasuhr: 13,11 m^3 Massflow: 12,94 mg/s

21:00 SIH IDAS check performed, ok.

13.10.05 21:00 Night shift

J. Hinger, M. Kölle, J. Huber, R. Langenste

21:15 TTAP and IR Rig Heater Control limits changed from 293 ± 1K to 293 ± 0,5K, (see ORS 21) This was done to reduce the average heater power in the test harness and to reduce the temperature fluctuations.

22:28 ~~Lower~~ High local alarm limit of Test HTR line 9812 (EQU_THA-TC-Test-harness-lower-mK) ~~reduced~~ increased from 350K to 355K.

23:00
- Cal Curves for CVSE_001, CVSE_004 & CVSE_006 implemented ⇒ Will be activated with next SCOE SW application start.
- Monitoring limits for T113 & T114 removed
- T336, T338 & T340 (Telescope) added in recording script. Will be recorded with next Recording-script start

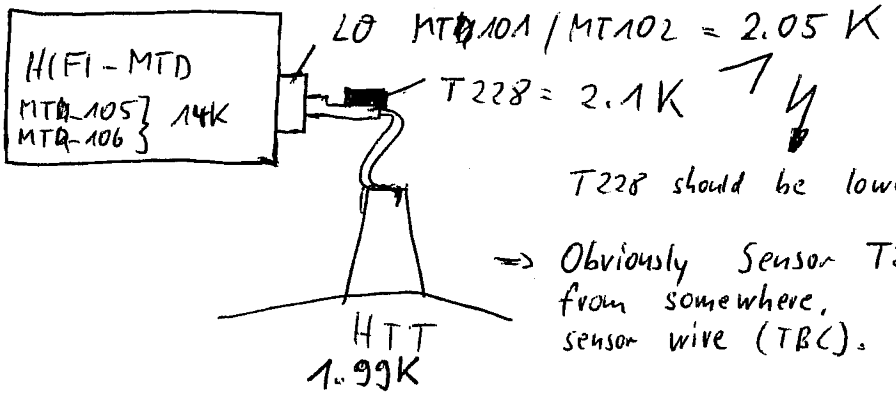
23:05 P_{506} = 14,65 mb Gasmeter 13,92 m^3 Massflow = 13,1 mg/s
P_{Safety} = 21,55 mb

change Parameter in Tetratec-Flowmeter (during change no measurement)

23:00 SIH IDAS check performed, o.k.

14.10.05

01:00 SIH IDAS check performed, o.k.
03:00 SIH IDAS check performed, o.k.
05:00 SIH IDAS check performed, o.k.
03:35 Anomaly at HIFI LO-I/F detected



T228 should be lower than MT101/102

⇒ Obviously Sensor T228 is heated from somewhere. Propably from the sensor wire (TBC).

14.10.05

04:10 P_{506} = 14,7 mb Gasmeter = 15,44 Massflow = 13,3 mg/s
P_{safety} = 21,6 mb

07:00 : SIH IDAS check : okay

MT203 SPIRE LO is not reading at all

09:00 : SIH IDAS check : okay
11:00 : SIH IDAS check : okay
13:00 : SIH IDAS check : okay

14.10. 13:30 Late Shift
Jahn, Hauser, Kölle, Barlage

13:30 Gas meter 18 m^3
13:50 Tilt angle increased to 6.9°

15:00 SIH IDAS check performed : o.k.
17:00 SIH IDAS check performed : o.k.
19:00 SIH IDAS check performed : o.k.
21:00 SIH IDAS check performed : o.k.

22:00 P_{506} = 14,85 mb Gasmeter = 20,92 Flow = 14,0 mg/s
P_{Safety} = 21,45

14.10.05 21:00 Night Shift

J. Hingen, N. Sonn, H. Huber, R. Langenstein

23:00 SIH IDAS check performed, o.k.

15.10.05

01:00 SIH IDAS check performed, o.k.

03:00 SIH IDAS check performed, o.k.

04:40 P_{SOG} = 14,85 mb Gasmeter 23,0 m³ Flow = 14,4 mg/sec
P_{safety} = 21,45 mb

4:45 Several feasibility checks performed for all sensors along $L1_T$-ventline and all affected L0-sensors:

1) ⇒ T231 (first L1-ventline node) strange.
T231 is higher than T242 but the contrary is expected.

2nd check performed: observations not confirmed

2) T233 and T235 might be exchanged.
It is expected that T233 is higher than T234 but the contrary is the case

3) HIFI IIF L1:
T236 is strange. It is expected that T236 < T244 and T236 < T237.
This is not the case.

04:50 HACS checked. Measurements running.
Heater cycling ok.

5:00 Day shift

09:30 IDAS stopped - shut down computer to check influence on SCOE.

11:00 IDAS started

12:50 IDAS check : okay

15.10.05 13:20 Late shift
John, Hauser, Kölle, Stritter

16:11 Increase tilt angle to 8°

15.10.05 21:00 Nigh shift
J. Hinger, H. Huber, N. Sonn, B. Barlage

22:45 P_{506} = 14,9 mbar Gasmeter = 28,85 m³ Flow = 14,7 mg/s
P_{Safety} = 21 mbar

16.10.05

03:45 Analysis of L1-ventline sensor anamoly.
T231 at L1-ventline entrance shows much too high temperatur
(higher than all other downstream ventline sensors ↓).
T231 and T237 at L1-ventline outlet correlates very goo
This means that there is obviously a conductive link
between L1-ventline inlet and outlet. This is not
understood.

T228 (on HIFI LO-strap) shows a too high temperature
(higher than HIFI-LO-MTD sensors MT101 and MT102)
Because the T228 sensor is also in the T231/T237 area
could mean that this problem is linked to the T231/T237
problem.

2nd check performed:
observations not confirmed

→ T231 failed · T231 and T237 a the
same connector ⇒ SCOE attributes similar T237
values to the T231 sensor ↯

⑫

16.10.05

05:00 Day Shift (Langf., Kunz, Wagner, Lerner)

05:10 SIMIDAS check: okay

06:00 close V504 acc. PVS 005
→ 4,6 mg/sec ↳ PPS ΔT gets positive!

06:29 open V104

06:29:30 close V106 - 4,7 mg/sec

06:39 open V504

07:00 LOU sensor check shows increasing noise on TC1107 / PT100,
with bandwidth ~ 3K, started at 15.10.05, 20:30

TP3
16.10.05

07:46 open V503
tilting back to 0° (vertical)

07:53 tilting finished 0°

07:46 Test heaters of TTAP, IR Rig + IR Rig support switched off, to reach TP3 lower temperatures; temperature control set accordingly (see ORS25)

07:59 Mass flow unit set to 500 mg/s range

08:02 TVQM3 opened

08:35 IR Rig support heaters re-activated to 20W, to avoid high temp. difference to IR Rig during cool-down (see ORS 26)

08:18 SCOE → stop script

12:13 Warning of TC 8702 (temp too low!)

12:15 The local lower warning/~~alarm~~ limits of the following T-sensors were changed: ㊀ (same as HSS rig global limits)

Sensor: [TC-Number]	warning limit:		alarm ~~old~~ limit:	
	old	→ new	old	→ new
8701	238	170	233	165
8702	238	170	233	165
8703	238	170	233	165
8704	238	170	233	165

㊀ according to new phase TP 3

12:36 SIH IDAS check : okay

since 09:00 : SCOE re-initialized, new calibration curves for

- CUSE_004 ~> gives correct mg/s for 50 mg/s
- CUSE_001
- CUSE_006
- P101 Point 1.1219, 0 changed to 0.40, 0
  new Point 1.40, 0.061

T336, T338, T340 new in table files

13:30 Late shift
John, Hauser, Kölle, Stritter

17:15
-17:20 $\boxed{T231}$ measurement : SCOE connector J02 disconnected.

pins
I+ 73] 3,26 kΩ
I- 74
U+ 75] 3,26 kΩ
U- 76
1,22 kΩ [I+ … U+]

$\Rightarrow R_{T231} \approx 7{,}04\ k\Omega$, SCOE measured ~ 2000 Ω

Conclusion: T231 seems to be ok.

17:30 SVM TS warning limit 130K reached. Check of documentation: Spec is 125K, Qualification test procedure 115K. Low temperature not considered critical, warning limit reduced to 120K, alarm to 115K.

19:35 HSS IR Rig Support warning/alarm limits changed (local alarm) Sensor 8701, 8702, 8703, 8704
Warning from 170K to 205K
Alarm from 165K to 200K.
Reason: ΔT support – Rig of 30K should be such, that support is at higher temperature than the Rig to reduce ΔT between Support and TTAS. (A.H)

20:30 He pump2 SN1 inlet valve opened to increase pumping speed. Short $\dot{m}$ peak, going back to ~1mg/s above previous rate. SN1 inlet pressure 1,8mbar, SN2=5mbar Safety line p=27mbar Gasmeter 44,88m³

21:00 Night Shift
J. Hinger, H. Huber, B. Barlage

22:05 P_{506} = 17,1 mbar Gasmeter = 46.44 Flow = 55,3 mg
LHF 2.95 g/min P_{safety} ~ 28.5 mb CUSE 09 Integrator 36.3

17.10.05

02:30 P_{506} = 17,25 Gasmeter = 51,30 m^3 Flow = 58,3 mg
LMF = 3,1 g/min P_{safety} ≅ 27.8 mbar CVSE
1143,8 g

04:00 L0 - temperature anomalies detected:

1. PACS - Cooler Evaporator L0 - Interface
   T222 on Strap < T101, T102 = He-bath

2. PACS - Red Detector L0 - Interface
   T221 on Strap < T101, T102 = He-bath

3. SPIRE SM Detector L0 - Interface
   T225 on Strap < T101, T102 = He-bath

4. HIFI L0 Interface
   T228 on Strap < T101, T102 = He-bath

⇛ It is physically not possible that any L0-strap temperature ~~in the system~~ is lower than the He-bath temperature.

⇛ Maybe the lower strap temperatures can be explained by the calibration curves.

L1 - temperature anomalies detected:

1. SPIRE L1 Interface
   T235 (upstream ventline node) considerably higher than T236 (downstream ventline node).

17.10.0

05:00 <u>Day Shift</u> (Langkrimann, Kunz, Wagner, Gerner)

05:00 SIH IDAS check : okay

11:53 TTAP dropped down to 273K @ 11:20 as expected.
Automatic thermostatic control initiated.

13:00 SIH IDAS Check : okay

13:00 ~~D~~Late Shift
Jahn, Hauser, Kölle, Barlage

14:31 Mass flow meter range set to 5 g/s range
Reading goes from 100 mg/s (500 mg/s range) to
90 mg/s (5 g/s)

14:58 Mass flow meter range back to 500 mg/s ;
reading goes from 90 mg/s to 101 mg/s

21:00 Night Shift
J. Hinger, H. Huber, R. Langenstein

21:45 P_{506} = 16,8 mb Gasmeter = 81,26 m³ Flow = 91,7 mg/sec
P_{Safety} = 21,8 mb

23:10 Local Alarm limits changed: EQU_Rig_TC_Support_pZ1 (870
Kept at 200K alarm 205K warning
EQU_Rig_TC_Support_pK (8701)
EQU_Rig_TC_Support_pZ2 (8703) } alarm/warning switched off.

(17

18.10.05

01:20 Estimation: HTT will reach 1,72 K in 32 h, i.e. on Wednesday, 20.10.05 ≈ 12:00 UTC

03:25 P_{506} = 15,3 mb Gasmeter = 90,02 Flow = 77,0 mg/
P_{safety} = 20,0 mb

03:30 HACS camera operation checked. Measurement are in progress. → o.K.

04:30 Local alarm/warning limit of sensor EQU_Rig_TC_Support_pZ1 (8702) which is used as control sensor for the RIG support heater circuit, is switched off.
HTR's cycle between 202.5K and 203.5K. → Alarm/warning limits are not used anymore.

05:00 Day Shift

05:00 SIM IDAS check: okay
open valve on HeZP SN1 in ↑

07:00 Local warning/alarm limits of TC Rig support re-activated (for better control):

	low warning	low alarm
EQU_Rig_TC_Support-pY / 8701 ...	195K	190K
-"- pZ1 / 8702 (pilot)	200K	195K
-"- pZ2 / 8703	200K	195K
-"- mY / 8704	195K	190K

08:50 TC Rig has reached 173K and is now in thermostatic control.

09:19 Observation of Test sensors 2113 / -Z radiator and 2213 / +Y radiator lead to the conclusion that the two sensors had been mixed up during integration;
2113 shows a behaviour similar to the +Y radiator ,
2213 — " — -Z "

12:30 SIM IDAS check performed: okay
10:45 Data handling & Thermal verbally agreed to optimise (decrease heater power of TC Rig and TC Rig support in order to smooth temperature curves/reduce cycles.

18.10.05
13:30 Late shift
John, Hauser, Kölle, Barlage

15:35 Open V102 close V104 ⇝ PUS 6
15:37
d008.tif d009.tif

10:00 – 15:00 LSS vacuum pressure rises; probably caused by reduced He mass flow and increasing temperature in CUSE LSS internal tubing. After 15:00, pressure drops again to nominal

! ⇒ Inform LSS when He mass flow rate is decreasing !

18:34 Open V104 d010.tif }
18:35:00.376 Close V102 d011.tif } PUS 6, back to initial conf

18.10.05 21:00 **Night Shift**

J. Hinger, H. Huber, A. ~~[illegible]~~ Grasl, R. Langenstein

02:35 P_{506} = 11,25 mb Gasmeter = 111,73 Flow = 46,7 mg
19.10.05 P_{safety} = 15,6 mb LHF = 2,46 g/min

05:00 P_{506} = 10,4 mb Gasmeter = 117,13 Flow = 40,4
P_{safety} = 14,55 mb LHF = 2,14 g/min

09:00 IDAS Test peformed – OK

05:00 **Day Shift**

05:05 SIM IDAS check : okay

06:20 SVM Thermal shield stabilises at 125 to 135 K, which is above Qualification Test Procedure minimum value of 115 K.

13:00 : SIM IDAS check : okay

13:30 **Late Shift**

13:35 PUS 8 : Forced HOT cooldown
V102 opened 13:35 d012.tif
V702 opened 13:36 d013.tif (Stokes initic. o
17:13 V104 closed d014.tif
19:07 V104 opened

19.10.05 21:00 **Night Shift**

J. Hingen, H. Huber, A. Grasl, R. Langenstein

00:30 P_{506} = 8,4 mbar Gasmeter = 129,58 m^3
Flow = 27,3 mg/sec P_{Safety} = 12,3 mb LMF 1,47 g/min

21:00 IDAS Test performed — OK.

20.10.05

05:43 HACS camera checked. Measurements running. → O.K.
Electronics heater cycling ok.

05:00 SIH IDAS check : okay

05:00 **Day Shift**

13:00 SIH IDAS check : okay

15:40 switched to 0-50 mg/sec mass flow meter

13:40 **Late Shift**

14:12 close V702 } PUS 8
14:13 close V102 }

14:16 close V104, no mass flow → PUS 7

16:32 SCOE acquisition rate reduced to 2 min

17:35 Heater Control & Monitor Drawer (SCOE) switched OFF
& Valve Stimulus & Monitor Drawer (SCOE) switched OFF

18:28 SCOE acquisition rate back to continuous ⑪

20.10.2005

~~18:28~~ 18:35 SCOE switched off to ensure that no electrical heating of HTT is happening

~~20:05~~ Gas meter: 136,72 m^3

19:45 SCOE started again

20:10 V104 opened

21:15 Night shift

21:27 V103 opened d020.tif
21:28 V106 opened d021.tif
21:29 V104 closed d022.tif

PPS goes to operation (althoug s/c is vertical)

21:50 TUQ143 closed d023.tif
↳ slight m decrease; slight ΔT increase!?
22:00 V504 closed d024.tif
↳ after initial peak down, PPS outlet increases to HTT temp.

22:25 V504 opened d025.tif
↳ stable PPS operation
22:36 V104 opened d026.tif
↳ PPS ΔT jumps to positive

22:47 V104 closed again d027.tif
↳ PPS gets operative?! (S/C still vertical)

~~23:10~~

23:10 V103 closed d 028.tif
V106 closed ~~d 029.tif~~ d 030.tif
↳ PPS closed, ΔT is positive

HTT is valved off, start tilting of S/C to find the PPS immersion angle

23:21 2° reached, no PPS response
23:23 3° reached, " " "
23:25 3.99° " " " "
23:26 4.98° " " " "
23:28 5.99
23:30 6.99
23:31 8.00
23:33 8.99
23:35 9.996
23:36 11.0
38 12.00
40 12.98
42 14.00
44 14.99
45 16.00
23:47 17.00
49 18.00
51 19.00
53 20.00

PPS outlet is unchanged at 27 mK above HTT bath.
expected angle for immersion was ~ 13.5°

↳ Decision: go to 10° tilt angle; start PPS

23:54 start tilting back to 10°

21.10.05

0:05 10° reached

0:06 V106 opened, d031.tif PPS is operating, ΔT ~ 180mK

0:23 Stable conditions reached. Start increasing tilt angle to 13° in 1° steps

0:25 11°

0:26:19 11.5° : PPS outlet temp + mass flow increases sharply

0:27 12°

0:32 12.5°

0:51 V504 d032.tif closed, PPS ΔT becomes positive.

1:08 tilt angle increased to 13.5°; no reaction

1:13 V504 opened (d033.tif)
↳ PPS resumes operation

1:35 137,05 m³ Gasuhr (gas meter)

1:42 Pump inlet valves closed, both needle valves open. Try to set 2.5mg with needle valves

21.10.05 02:15 Night Shift

J. Hinger, A. Runge, N. Sonn, R. Langenstein

The nightshift members were present since 20.10.05 21:00 UTC together with the late shift members.

04:08 PPS temperatures T111/T112 show an increase of 18 mK, while mass flow remains constant.

04:30 Analysis of HTT-temp. warm-up with closed VT102, VT104, VT109, VT106 on 20.10.05

Measured $\frac{\Delta T}{\Delta t} = \frac{1.702\,K - 1.698\,K}{(18{:}15{:}27 - 14{:}28{:}40)} = \frac{0.004\,K}{3.78\,h}$

$= 0.00106\ K/h$

fill-rate 89.7% calculated

$\Rightarrow$ At 1.698 K $\rightsquigarrow$ $m_l = 308.7$ kg calculated

A) $\dot{Q} = m\, c_l \frac{dT}{dt}$

$\quad \llcorner\ c_l = \left[2185 + 7410\,(T - 1.7)\right] \frac{J}{kg\,K}$

$1.7 < T < 1.8\,K$

$$\rightsquigarrow \frac{Q}{m} = \int_{1.698}^{1.702} c_l(T)\, dT = 8.74\ J/kg$$

$$\rightsquigarrow \dot{Q}_{average} = m \frac{Q}{\Delta t} = \frac{308.7 \cdot 8.74}{3.78 \cdot 3600}\ W = \underline{198\,mW}$$

B) $\dot{Q} = m \frac{dH}{dt}$, $h = (1-x)\,h_l + x \cdot h_g$, $x = \frac{m_l}{m_l + m_g}$

$\rightsquigarrow$ with MATHCAD-analysis

$\dot{Q}_{average} = 205\,mW$

With closed HTT (geschlossenes System) methods A and B seem to be equivalent.

21.10.07

05:00 Day Shift

09^{22} tilt to 14,5° (1°/min)
no change in PPS

09^{27} tilt back to 0° w/o interruption

09^{29} 12° PPS drops

09^{31} 10°

33 8° PPS T increase step

35 6°

36 5°

37 4°

38 3°

39 2°

41 0°

10^{24} open V103 C34.TIF

10^{33} close V106 000.TIF ↓ record:

10^{38} close V103 001.H4

10^{42} heater on V106 to vent warm gas into the closed HTT
PPS Temp ↑

10^{47} open V106 (002.H4) switch off heater V1

21.10.05

13:30 Late shift

PPS temp decreases from 2.8K to 20-40mK below bath

13:35 V504 closed (d003.tif)

14:04 T112 reads same as DLCM sensors.

14:09 Level probes HTT: 90.06%

14:16 Start tilting to 14°

14:24 8°

14:26 9.6° slight upwards bend on T111/112

14:28 11.7° steep up T111

14:29 13°

14:30 14°, stopped tilting

14:41 CFM switched to small range

14:58 V504 opened d004.tif

He pumps SN1 and 2 ball valves closed

SN1 Needle valve closed

SN2 Needle valve adjusted to 3. to achieve mass flow of ~ 2.25 mg/s

TP4

Start of TP4 - TVA

21.10.05 15:40 UTC

MTD heaters switched ON

16^{05} PACS_3 with 5mW (prime)
- PACS_5 with 5mW "
16^{06} PACS_6 with 5mW "
20^{05} PACS_3, 5 & 6 power increased to 10mW

21.10.05 21:00 **Night Shift**

J. Hinger, A. Runge, N. Sonn, R. Langenstein

22.10.05

00:05 PACS-L1-1-H1 switched off SCOE I-D PACS_5
PACS-L1-2-H1 " " SCOE ID PACS_6
PACS-L1-3-H1 " " SCOE ID PACS_3
02:05 SPIRE-L1-H1 switched on at 5mW SCOE ID SPIR
02:14 " switched off/on at 5mW
due to U and I oscillations.
02:18 Power setting increased to 8mW ⇝ calculated power is 6.5 mW.
↯ Below 8mW power setting caused unstable U, I, P valu

02:25 SPIRE_4 switched off because no temp. increase detectable ↯

SPIRE_4 redundant switched on at 5mW power setting

02:26 power increased to 6.5mW (8mW setting) because below 8mW setting no stable conditions could be obtained.

⤳ no temp. increase at SPIRE L1-Interface detectable ↯

03:17 Still no temp. increase detected ↯

03:18 power setting of SPIRE 4 redundant increased to 10.2mW (12mW setting)

⤳ no temp. increase at SPIRE L1-interface detectable. ↯ → NCR HP-120 000-ASED-NC-1614

03:27 SPIRE_4 redundant switched off

03:30 HIFI-L1-H1 (SCOE ID HIFI_2) switched on at 5 mW setting, 5.25 mW calculated

→ immediate reaction in temperatures detected → o.k.

04:26 Analysis of SPIRE L1-HTR problem:
SPIRE-L1-H1/2 heaters (SCOE ID SPIRE_4) are located on SPIRE Cooler Pump L0 interface, instead of SPIRE-L0-3-H1/2 (SCOE ID SPIRE 3).

04:48 HACS camera checked. Measurement running, heaters are nominally cycling → o.k.

05:00 Day Shift

06:40 HiFi-L1-H1 (SCOE ID HiFI-2) switched to 10mW → 9,841 read out
(Power Voltage too high)
(5mW Temperature was stable from beginning

10:40 HIFI_L1-H1 (SCOE ID HIFI-2) switched off.

12:30 Observation; L3 temperatures are only ~0.2K higher than OBP temperatures during TP4 so far. The TMM predicts however ~2K higher temperatures; JFET feet design? JFET heating phase could give more information.

12:55: SPIRE-L1-H1(SPIRE3) set to 5.0 mW

22.10.05 13:15 Late shift

16:22 SPIRE-L1-H1 (SPIRE_3) prime power increased to 10.0 mW

since 14:00 Sensor T231 reading obviously gives Vent line temperature between SPIRE and HIFI L1 Interfaces!

Sensor T235 sees SPIRE L1 heat load although located upstream!

High heat load on vent line between sensors T234 and T236

21:53 Mass flow rate adjusted to 2.3 mg/s (CVSE_004) by reducing needle valve.

22.10.05 22:00 Night Shift

J. Hinger, A. Runge, N. Sonn, R. Langenstein

Night shift was present since 21:00 together with late shift.

22:20 PJFET switched on at 25 mW setpoint (27.0 mW calculated by SCOE)

23.10.05

00:20 PJFET power increased to 50mW setpoint (47.4 mW calculated by SCOE)

02:20 PJFET switched off.

During the PJFET heating the following anomalies were detected:

- MT 255 (within JFET-P) showed lower temperature than T251 and T252 on copper strap.
- T246 (on L3-ventline) showed the highest temperature whereas the lowest temperature was expected.
- MT 252 (within JFET-S) showed lower temperature than T249 and T250 on the copper strap. → heat flowing from L3 into JFET-S MTD.

This is in contradiction to the fact that T250 and T249 on the copper strip show slightly higher temperatures than T247 on L3-ventline → heat flowing from JFET-S into ventline.

~~It is most likely that JFET-S is heated via the OBP from the JFET-P heater.~~

23.10.05

03:20 SJFET switched on at 25 mW power setting (26.9 mW calculated by SCOE)

05:00 Day Shift

05:20 SJFET increased to 50 mW (SCOE: 48.923)
(Alarm: SJFET too high)

07:20 SJFET heater turned off.

8:15 HIFI_1 started with 5 mW (SCOE: 5.147)
8:20 HIFI_1 increased to P = 10 mW (SCOE: 10.009)
(Alarm: MTD_PRI_VOLT_HIFI1: high)
8:26 HIFI_1 set to P = 7.5 mW (SCOE: 7.821)
8:31 HIFI_1 switched off
08:35 PACS_1 started with P = 5 mW (SCOE: 5.273)
08:40 PACS_1 set to P = 10 mW (SCOE: 9.895)
(Alarm: Voltage to high)
08:44 PACS_1 switched to 2 mW (SCOE: 2.057)
08:49 PACS_1 switched off
08:53 PACS_2 set to P = 5 mW (SCOE: 5.267)
08:58 PACS_2 set to P = 10 mW (SCOE: 10.023)
(Alarm: Voltage too high)
09:03 PACS_2 switched off
09:07 PACS_7 switched to 25 mW (SCOE: 23.467)
09:15 PACS_7 set to 10 mW (SCOE: 8.580)
09:20 PACS_7 set to 5 mW (SCOE: 2.782)
09:25 PACS_7 switched off

09 : 28 PACS_4 set to 5 mW (SCOE : 5.165)

09 : 33 PACS_4 set to 10 mW (SCOE : 10.560)

09 : 38 PACS_4 switched off

09 : 40 SPIRE_1 set to 5 mW (SCOE : 5.411)

09 : 45 SPIRE_1 set to 10 mW (SCOE : 10.062)
(Alarm : Voltage high)

09 : 50 SPIRE_1 switched off

09 : 52 SPIRE_2 set to 5 mW (SCOE : 5.258)

09 : 57 SPIRE_2 set to 10 mW (SCOE : 10.714)

10 : 02 SPIRE_2 switched off

10 : 04 SPIRE_4 set to 5 mW (SCOE : 2,209)

10 : 09 SPIRE_4 set to 10 mW (SCOE : 8.237)

10 : 14 SPIRE_4 switched off

10:30 Level probe L101 = 84,44 L102 = 89.76 %

10:32-42 DLCM Mode (stop acq. since T10, heating 5 min
DLCM.scr Acq. back to normal)

14:00 Day shift

33

23.10.

14:40 $\dot{m} = 2$ mg/s

14:42 Ball valve on pump inlet opened

15:07 Ball valve onpamp closed

15:25 Open V104 → small increase of T111/T112
↳ PPS was operating

15:29 Close V106

15:34 Close V504

15:48 Ball valve closed after opening (15:

15:50 open V504

15:51 open QM3 valve (SPARE.1)

16:00 Mass flow rate adjusted to 4.5mg/s (needle valve at 5.1)

16:37 start TPS

16:37 start tilting to 0°

16:37 13.2° → MT303/MT304 temperature drop

16:46 4.9° → MT303/MT304 curves become stable

16:51 0.04° final position reached

TB phase to be performed in vertical position and venting via V104 to have PACS ZO pool in contact with He

17:30 Liquid level probes activated
L101 = 89,95% L102 = 89,85%

17:57 Mass flow corrected ; ~ 0,05 turns

23.10.05 21:00 Night Shift
J. Hinger, A. Runge, N. Sonn, R. Langenstein

22:00 - 23:00 Control Sensors for TTAP Heaters showed strange temperature drops. The problem is due to a Data Handling error. The physical temperatures did not drop.

24.10.05

03:10 HACS camera checked. Measurements running.
Heaters are nominally cycling → O.K.

03:30 Mass flow at needle valve adjusted
from 4.59 mg/s to 4.51 mg/s (CVSE_004)

08^{07} → needle valve 0,8 mm

12^{25} close V105 (HOT closed for heat
TPS 5 load test)

13:20 Late shift

17:03 Mass flow adjusted from 4.55 mg/s to 4.45 mg/s
17:46 " " " 4.45 mg/ to 4.50 mg/s

[illegible]

24.10.05 21:00 **Night Shift**

J. Hinger, A. Runge, N. Sonn, R. Langenstein

22:40 Mass flow rate adjusted from 4.73 mg/s to 4.5 mg/s.

25.10.05

04:42 HACS camera checked → o.K.

Late Shift: G. Jahn, M. Kölle, A. Hauser, B. Barlage

$14^{\underline{00}}$ Mass flow rate adjusted from 4.6 mg/s to 4.5 mg/s

$14^{\underline{45}}$ all CVV Sensors reached stability of ≤ 0.29 K/day set point reduced to ≤ 0.20 K/day

$18^{\underline{15}}$ Mass flow rate adjusted from 4.55 mg/s to 4.47 mg/s

25.10.05 21:00 **Night Shift**

J. Hinger, A. Runge, N. Sonn, R. Langenstein

No mass-flow adjustment performed.

04:15 HACS camera checked → o.K.

04:30 Sensor 3263 (PLM-Strut_TC-PLMSVM-26-Pz-bottom) showed a rapid temperature decrease of ≈ 20 K at 24.10.05 ≈ 19:30. → Sensor to be investigated after Test.

26.10.05

$16^{\underline{15}}$ All CVV sensors reached stability of ≤ 0.20 K/day Set point reduced to 0.15 K/day (just for fun)

26.10.05

20:20 Needle valve adjusted from 4.90 to 4.88
↳ mass flow increases 4.55 → 4.58 mg/s
→ TVQM3 closed to reduce
Needle valve sensitivity.

Needle valve set to 4.90

26.10.05 21:00 Night Shift

J. Hinger, M. Kölle, A. Runge, R. Langenstein

21:20 Due to severe temperature oscillations of TTAP heater control sensors 9304, 9305, 9306, 9307, 9308 occuring at 26.10.05 03:30, 08:00-09:00 and especially at 26.10.05 15:00 - 20:00 leading to disturbances of the TTAP temperature it was decided to change the heater control into a fixed current heating.
→ NCR see HP-2-120000-ASED-NC-1595 Point 8
→ ORS 34

22:35 ORS 35: Change current settings of TTAP heaters
It was detected that current settings and measured currents are different! Imeasured < Isetting due to the control algorithm of the TDH power supply control.

23:00 ORS 36: Change current settings of TTAP heaters

23:42 ORS 37: //

27.10.05

00:09 ORS 38: //

[illegible]

27.10.05

01:05 ORS 35: Heater power settings of TTAP heaters increased.

03:01 ORS 40: "

03:35 Spikes detected at control temperature sensor TC 8001 for the IRRIG support heaters. Also small oscillations at sensors TC 8101, TC8011 and TC 8201. Heater control seems to be o.K.

05:00 ORS 41: Adjustment of TTAP heater current settings.

05:00 Day Shift

07:25 TTAP heater power settings decreased according to ORS 42.

09:20 TTAP heater power settings adjusted according to ORS 43.

14^{00} Needle Valve from 4.88 to 4.86; i.e. mass flow from 4.56 mg/s to 4.52 mg/s

15^{20} Needle Valve from 4.86 to 4.85, $\dot{m}$ from 4.53 mg/s to 4.50 mg/s

18^{20} Needle Valve from 4.85 to 4.84: $\dot{m}$ from 4.51 to 4.48 mg/s

19^{45} Set upper warning/alarm limit of Rig Support to 205K/2 and of Rig Panel T/C sensors to 178K/183K

27.10.05 21:00 Night Shift

J. Hinger, A. Runge, M. Kölle, R. Langenstein

23:15 Fine adjustment of TTAP current settings according to ORS 44

28.10.05

01:45 Tütärätä : All TDH equilibrium sensors have reached the equilibrium !

01:55 HACS camera checked, is running and running.... heaters are nominally cycling → o.K.

T231 reads T248 ($T_{Raw}231 \equiv T_{Raw}248$)

~~T231 Raw (Lf raw.txt) shows different~~ values

13:15 Late Shift

John, Hauser, Sonn, Balaye

At end of TB1 phase!
Read T231 raw data
manually with DVM on
SCOE I/F connector !!

28.10.05 21:00 Night Shift

J. Hinger, A. Runge, M. Kölle, R. Langenstein

No adjustment done at needle valve.

→ mass-flow is slightly increasing but TS-temperatures become stable.

29.10.05

CVV T903 peak disturbs trend.

T901 drops slightly?

C100_T246 /247 are unused!

this is not compatible with T231 problem

→ Not confirmed by SCOE verification

10:30 T901 rises again and shows now obviously correct temperature (peak of anomality ~0,25K)

MT203 wrong Temp.

ΔT PACS → L1 T233 = 0,18K → T234 = 0,11K

SPIRE → L1 T235 = 0,51K T236 = 0,26K

19:15 SCOE stopped and restarted, T231 is now available *

19:20 T903 has been measured with Ohmmeter at Cryo SCOE interface (into Testharness).

Interface = J09 : I+ = pin 37

I− = pin 38

U+ = pin 39

U− = pin 40

Conclusion: I+ not connected

Measurements: 37-38, 37-39, 37-40 } all „OL"

38-39 = 676,3Ω

38-40 ≈ 420Ω

39-40 ≈ 740Ω

19:30 New Test Phase TP6 - TV2

19:30 SIH verification with IDAS performed. Ok.

19:45 SJFET heater switched on at 25mW according to red-lined test procedure (PVS 14)

21:00 SJFET heater power increased to 50mW.

turg

29.10.05 Night Shift

J. Hinger, A. Runge, M. Kölle, R. Langenstein

22:30 SJFET heater switched off

23:30 PJFET switched on at 25mW

01:15 PJFET heater power increased to 50mW

03:00 PJFET heater switched off

04:30 HIFI_2 | switched on at 5mW
redundant

05:50 HACS camera heater cycling stopped at 01:00 UTC (change of summer time / local time).
Heaters are permanently on, they do not switch off again. → seem to stabilize HACS electronics at T≈270 K.

06:00 HACS is running again, heaters are off.
→ Monitor if cycling will be continued.

06:15 HIFI-2/redundant heater power increased to 10mW

07:15 HACS PC re-boot, HACS working normally

---

* T231 was erroneously connected to channel 42 when T248 was connected, too. → T231 showed exactly the same raw data as T248. Now T231 is connected to channel 46 which was not used before.
→ The T231 temperatures before 29.10.2005 19:15 are wrong!

7:30 Observation: HIFI L1 heating was also seen by PACS L1 (ΔT ~ -0,02K step function) and SPIRE L1 (ΔT ~ -0,04K continuous decrease); such behaviour has not been observed during TP4/TV1.

08:00 HIFI_2 redundant Heater stopped

09:15 SPIRE_3 heater 5 mW (5,296 mW)
10:45 SPIRE_3 heater 10 mW (9,915 mW)

Pt1000_T501 reads 143K & noise?

12:15 SPIRE_3 heater switched off

14:00 PACS_5 heater set to 5 mW (5.325 mW)
PACS_6 heater set to 5 mW (5.284)
PACS_3 heater set to 5 mW (5.246)

14:00 Late Shift Dahn, Hauser, Sonn, Burlage
15:50 PACS_5 set to 10 mW (10,21 mW)
PACS_6 10 mW (9.95 mW)
PACS_3 10 mW (9.98 mW)

$18^{\underline{13}}$ SPIRE_3 set to 10 mW (9.94 mW)
$20^{\underline{00}}$ HIFI_2 set to 10 mW (9.85 mW)
$20^{\underline{15}}$ Switch-off HIFI_2 and SPIRE_3 (L1 heaters)

30.10.05 22:00 Night Shift

J. Hinger, A. Runge, M. Kölle, R. Langenstein

G. Jahn was present until 23:45 UTC.

22:50 V105 opened. → A rapid temperature decrease of ≈ 0.3K was observed at the L1 temperature sensors T231 – T237, followed by a rapid increase. Then the temperatures gradually decreased, however, interrupted by some peaks in the order of + 0.35K (T231) and

31.10.05

02:00 V701 opened

03:00 V106 opened
PPS sensors T111, T112 show not at all any reaction.

03:50 V106 closed

03:55 V701 closed

06:00 PACS_5 } L1-heaters switched off
PACS_6
PACS_3

09:40 HIFI_3 set to 25mW (27.408mW)

13:40 HIFI_3 set to 50mW (49.091mW)
(Error/Alarm Voltage too high: 12.69V)

14:00 Late Shift (G. Jahn, A. Hauser, B. Barlage, N. Sonn)

17:42 switch-off HIFI_3

17:52 Switch-on HIFI_3 to 50mW (49.1mW)

19:18 Switch-off HIFI-3

$20^{\underline{45}}$ Gas Flow meter : 160.89 m^3
P 506 : 14.7 mbar
$\dot{m}$ ≈ 4.85 mg/s

20:21 DLCM heaters H101 and H102 operated for 20sec, simultaneously
↳ see PVS 17
No impact on Z1 temperatures
↳ HTT temperature increase 0.5mK

20:52 Normal DLCM operation
HTT temperature increase from 1.7866 to 1.7912 K

21:00 "cryo-pfm.exe has encountered a problem"
↳ SCOE application restarted, and new test phase initiated

[redacted]

21:49 V103 opened (d017.tif)
↳ PPS operation PVS 18
T231 drops by 0.23K, stable;
no reaction on T111 / T112 (increased noisy ? oscillation)
downstream L1 temperatures decrease slowly

22:00 <u>Night Shift: J. Hinger, A. Runge, M. Kölle, R. Langenstein</u>

K 22:28:00 V104 closed (d018.tif)
T112/111 immediately drop by ~60mK,
stabilize at ΔT~40mK → PPS operates
Mass flow drops from ~5mg/s to ~4mg/s
before adjustment of Needle valve to ~4.8mg/s
Nozzle pressures decrease slowly
T231 increases over 1 min, then decreases
to ~1.88 K, other L1 sensors follow
<u>G. Jahn left the control floor !</u>

23:17 MTD heater PACS L1 (PACS_3, _5, _6) switch ON,
powered with 10.0 mW each

23:40 start tilting to 16° (PPS Temp 1,782 T111)
2° first reaction on PPS Temp. (T111 & T112)
23:42 4°
⋮ 13° drop of temp. to ~1,66 K (23:50:25)

01.11.|

0:11 MTD PACS L1 heater switched OFF

0:30 LOU_1 switched on at 6 W power setting (6.09 W)

01:41 LOU_16_rad_lower switched on at 1.296 A

LOU_17_rad_upper " " " 1.296 A

current settings (ORS 48)

→ The measured powers were:

$U_m \cdot I_m = (R_H + R_{HTR}) I_{measured}^2 = 19.13 W$ shown by channel 417

$U_m \cdot I_m = (R_H R_{HTR}) I_{measured}^2 = 19.17 W$ shown by channel 418

Harness Heater

whereas the heater power in the heater resistor was only

$R_H \cdot I_{measured}^2 = 16.63 W$ shown by channel 317

$R_H \cdot I_{measured}^2 = 16.63 W$ shown by channel 318

02:32 ORS 49

Heater power settings adjusted:

	I_{set}	$I_{measured}$	$R_H I_{measured}^2$	Ch
LOU_16_rad_lower	1.421A	1.417A	20.04W	317
LOU_17_rad_upper	1.421A	1.418A	20.05W	318

T224 (PACS LO) has increased due to tilting !

T107 did not ($Y_{T07} > Y_{T224}$)

↳ LO is surrounded by the safety line +SV123

06^{44} OSR 50 IRR116 → 100 W support → 60 W

07^{35} " 51 → 50 W → 90 W

07:55 Upper local alarm limits changed:

IR Rig: 295K / 300K (178K / 183K before)

Rig Supp.: — " — (205K / 210K before)

Observation:

16:00 (Tilting from 0° to 16° at 23.^{40}/31.10.05 obviously has been detected by CVV MLI temp. sensors 1403 + 1400 (increased ~ 1K)

13^{40} Oszillation of Tank and Ventline T-sensors (started before 11^{00}) discovered : frequency ≈ 0.1 Hz

15^{25} TC 1107 removed from CVV average calculation formula → TC1900, because TC 1107 is located at the LOU.

➔ Values of TC 1900 for TB1 phase to be corrected!

01.11.2005 22:00 Night Shift

J. Hinger, A. Runge, M. Kölle, R. Langenstein

02.11.2005

07:00 Day Shift

11:30 Following lower local alarm/warning limits changed:

IR Rig: 280K / 285K (165K / 170K before)

Rig Supp.: 263K / 268K (195K / 200K before)

14^{00} Late Shift Jahn, Hunser, Soan, Barlage

18:05 Switch on TDH heaters on CVV with 8% of max. Power to accelerate CVV warm-up

18:40 CVV average temperature has increased by 1.5 K (SCOE T900 - T912 sensors). TDH heaters switched off

20^{15} TTAP Heater Currents adjusted

02.11.2005 22:00 Night Shift

J. Hinger, A. Runge, M. Kölle, R. Langenstein

Day Shift

09:15 switch off LOU_1 heater
switch on LOU_2 heater to 6 W (not shown on SCOE!)
(old LOU_1 voltage/power values are still displayed)

11:15 switch off LOU_2 heater
switch on LOU_3 heater 6W (Power/Voltage not shown on SCOE)

13:15 switch off LOU_3 heater
switch on LOU_4 heater 6W (Power/Voltage not shown on SCOE)

17:30 TTAP Heater Currents adjusted

03.11.05 22:00 Night Shift

J. Hinger, A. Runge, M. Kölle, R. Langenstein

22:30 Equilibrium criteria for LOU sensors (TC's) changed from $\frac{\Delta T}{\Delta t} = 0.29\ K/24hrs$ to $\frac{\Delta T}{\Delta t} = 0,145K/12hrs$
Equilibrium criteria for CVV TC-sensors changed from $\frac{\Delta T}{\Delta t} = 0.29K/24hrs$ to $\frac{\Delta T}{\Delta t} = 0.145K/24hrs$
LOU sensors TC2404, 2414 and 2310, 2321 are disturbed from LOU-HTR switching.

PVS 21 shall be executed when TS1 fulfills the equilibrium condition of $\Delta T/\Delta t \lesssim 0.19 K/24hrs$.

23:57 SCOE connector J02 disconnected to monitor T231 sensor with Oscilloscope.
No oscillations detected with Fourier Transform.
Setting 1s/div (next time 10s/div check)
Remark: SCOE also didn't show oscillations

0:16 SCOE connector J02 connected again

Starting of PVS21 sequence "Step-by-Step procedure for the additional TP7 test":

1.: Testing of PPS valves with unchanged mass flow and check of impact on L1 temperatures.

05:00 Open V106 → ΔT231 = - 0,1K, PPS shows no reaction mass flow unchanged
05:15 Close V103
→ $\Delta T_{231} = - 0,08$ K
PPS shows no reaction, mass-flow shows no disturbances.
OBP temperature decreases ≈ 0,02K

2.: Switch HOT valves configuration and check T231 impact for each step.

05:30 Step 1, open V701
→ ΔT 231 = - 0,020 K
PPS shows no reaction, mass-flow remains unchanged

05:45 Step 2, open V702
A marginal temperature decrease $\Delta T_{231} \approx - 10$ mK detected

06:00 Step 3, close V701
↳ oscillations on L1 sensors

Day Shift

7:35 CVV Test sensors reach equilibrium

07:20 SCOE J02 disconnected
DVM + Osci on T235
↳ now >1sec oscillations visible
5,681 - 5,693 kΩ reading not continous

08^{04} open V701
observations on T224 !

08^{33} close V702

09^{10} close V701

09:50 open V105

09:55 open V103

10^{47} disconnect J02

11^{05} reconnect J02

14^{00} Late Shift

15:42 to 15:47 LOU_4 switched off due to a Reset of the MTD Heater Control & Monitoring Drawer.
(MHD did not accept any command !)
see - HP-142220-ASED-NC-1616

15:52 SPIRE_4 set to 100 mW

16:00 SPIRE_4 set to 200 mW

16:05 SPIRE_4 off

16:17 PACS_7 set to 100 mW
16:22 PACS_7 set to 200 mW
16:35 PACS_7 set to 300 mW
16:40 PACS_7 set to 400 mW
16:43 PACS_7 switched off

18:43 SPIRE_4 set to 100 mW
PACS_7 set to 100 mW
↳ ~150 mW
netto on HTT

04.11.2005 22:00 Night Shift
J. Hinger, A. Ringe, M. Kölle, R. Langenstein

22:23 PACS_7 and SPIRE_4 MTD heaters switched off.

23:31 L1 - Heaters switched on according to PVS 24
PACS_3 10 mW
PACS_5 10 mW
PACS_6 10 mW
SPIRE_3 10 mW
~~↳ netto ~ 150 mW on HTT~~

02:15 PACS_3]
PACS_5 } switched off according to PVS 24
PACS_6 }
SPIRE_3]

Continuing with PVS 21:

04:07 V104 opened]
04:10 V103 closed } § 4.a) of PVS 21
04:11 V101 closed] ~ 199.0 mW

051105 | 07:27 open V 102
07:29 close V 104

~10 mW !?!

11^{03} Start tilting back to 0°

11^{24} Stop tilting at 0°
T224 did not change since V102 film immerged

14^{38} close V105
close V102

HTT closed heat load test
with evacuated HST

15:59 V501 closed
V503 closed

110 mW

16:00 V104 opened
16:05 V104 closed

131 mW

18:13 V501 opened
V503 opened } repeat HTT heat load test with evacuated tubing

19:30 Liquid level probes read-out
L101 = 88,51 %
L102 = 88,25 %

5.11.05 19:35 Start TP8 + Recovery

19:38 V104 open
19:40 TVQM3 open
19:47 V102 open
19:57 Ball valves on both He pumps open
19:45 S IH IDAS-check performed, o.k.

05.11.2005 22:00 Night Shift

J. Hinger, A. Runge, M. Kölle, R. Langenstein

06.11.2005

00:30 + 00:38 CVV Test heater current settings and TTAP Test heater current settings increased according to OPS 62.

00:45 High Warning Limits of TTAP sensors 9301 – 9313 increased from 275 K to 295K

03:50 High Warning / Alarm Limits of the Harness sensors 9810, 9811, 9812 increased from 355K/N.A. to 373K/393K

05:25 High Warning Limits of the Harness sensors 9810, 9811, 9812 increased from 373K to 388K, i.e. only 5K below 393K (120°C) which is maximum allowed harness temperature!

Monitor carefully harness temp. sensors

06:30 Warning / Alarm limits of all ~~TTAP~~ [illegible]
~~control~~ sensors 9800 ÷ 9812 reduced
to 383 K / 388 K.

9:20 TTAP heater power decreased acc. to ORS 63 (to limit test
harness temperature

9^{25} CVU average has reached ~ 190K
(heater control is on 7 9XX sensors visible)

9^{35} U102 close

9^{36} V104 close

switch from MK0 → MK1 on Telrates,
(large mass flow rate

V = 179 m³

11^{00} . ~ 190 mW 1mK/73 min

11^{30} open V102 200 mW 1,44K/104 min

13:00 SIH check: okay

1400 Late Shift

15:00 SIH verification, ok.

17:00 SIH verification, ok.

19:00 SIH verification, ok.

06.11.2005 22:00 Night Shift

J. Hinger, A. Runge, M. Kölle, R. Langenstein

23:15 CVV Heater power increased from 665 W to 797 W

→ ORS 71

07.11.2005

00:12 CVV Heater power reduced from 797 W to 738 W
to reduce harness temperature (sensor 9810)
→ ORS 72

01:04 CVV Heater power reduced from 738 W to 712 W
to reduce harness temperature (sensor 9810)
→ ORS 73

02:06 CVV Heater power reduced from 712 W to 672 W
to reduce harness temperature (sensor 9810)
→ ORS 74

06:00 Day Shift

06:30 LOU Waveguide TC sensor 2413 shows high peaks
($\Delta T \sim 90K$) since 6.11.05 / 20:00

07:40 CVV heater power reduced from 672 W to 648 W
to reduce harness temperature (sensor 9810)
→ ORS 76

13:35 CVV heater power reduced from 648 W to 617 W
to reduce harness temperature (sensor 9810)
→ ORS 78

15^43 CW Heater power reduced

15^44 HACS Camera Sensors at -4°C and -4,9°C

16^00 SIH IDAS check performed, ok.

17^00 HACS Camera Sensors at -0.7°C and -1.6°C

19^20 TTAP set to 30°C I11 Temperature Control
without changing the current setting.
Change noticed later in ORS 60 (Nachtrag)

18^00 SIH IDAS check performed, ok.
20^00 SIH IDAS check performed, ok.
21^00 Hacs Camera Sensors at +15°C

07.11.2005 22:00 Night Shift
J. Hünger, A. Linge, M. Kölle, R. Langenstein

HACS camera shall be switched off when internal sensor (at HACS display) has reached 55°C / 328K

On 06.11.05 ≈ 18:00 the tank sensor T107 rapidly increased from bath-temp. level to 1.9 K at 01:30 UTC and is still increasing.

08.11.2005

00:19 Sensors 2403 and 2413 (waveguides) removed from minimum CVV temp. definition (virtual ser
1902) → ORS 82

02:42 CVV heater power reduced from 573 W to 556 W → ORS 84
to reduce test harness temp. (sensor 9810) that has achieved 397 K (124°C!)

03:10 LOU heater (LOU_16 and LOU_17) "thermostat" switching limits reduced from 320 ± 1K to 310 ± 1K (37°C ± 1K)
to reduce test harness temp. → ORS 85
→ sensor 9810 is decreasing again.

04:30 Execution of ORS 83
Warm-up of Shrouds to ambient temperatures
T1902 = 271.5 K (driven by LOU radiator)
CVV – Radiators > 273 K
CVV – Structure > 276 K
HACS camera internal sensors at 26.5 / 27.5 °C

05:26 LOU_16 and LOU_17 switched off and CVV HTR power changed from 556 W to 634 W.
→ ORS 86

05:50 CVV heater circuit CVV_08_UB-MZ shows no current anymore. (was on at 100%, i.e. I = 2.18 A, P = 60 W). A verification by TDH revealed that the fuses were ok but the circuit open.
After some minuts a resistance higher than expected and oscillating was measured → Heater is defect and is switched off.

ensor

$7^{\underline{25}}$ heater CVV 35 failed
lower Bulkhead +Y

7:40 CVV heater power reduced acc. ORS 88,
to prevent failing of further heater circuits

12:39 Pump inlet valves closed for P502 reference
measurement → PVS 28

$14:^{02}$ pump inlet open again

$15^{\underline{00}}$ HACS Sensors show +44°C

$15^{\underline{08}}$ HACS PC time is 16:04:25
UTC 15:08:00 ≙ HACS 16:04:25

$15^{\underline{35}}$ LOU_4 off
H501 - script ~~off~~ stopped

$15^{\underline{35}}$ HACS Sensors show +45°C

~ $16^{\underline{00}}$ HACS switched off

$17^{\underline{30}}$ LOU_4 set to 6 mW
H501 - script started

$22^{\underline{15}}$ LOU_4 switched off
H501 - script stopped

08.11.2005 22:00

Last Night Shift

J. Hinger, R. Langenstein

23:04 Absolute pressure in safety line : 17.4 mbar

01:53 All heaters switched off according to ORS 92
Pressurization of LSS with air to ambient pressure
started, according to ORS 92.
All Telescope PT 1000 sensors T331 ÷ T340 > 286 K
All Telescope TCS 6000 ÷ 6830 > 286.6 K

02:10 Verification that all heater have been switched off.
→ o.k. all off.

06:17 Ambient pressure 1017 mbar achieved.
06:30 Man door opened
SCOE
07:23:00 TDH clock reads 07:24:20

09.11.2005

9^{30} IDAS SIM check : okay!
13^{24} HACS PC started (light source attenuation Green 2050 Red 2250)
14^{08} HACS PC shut down (~~during~~ after opening of 5m LSS door) ≈ 13^{50}
14:15 HTT Level probes : 87,51 L101
87,26 L102

Procedure Variations

Scanned_Docs\Herschel-PVS.pdf

H-EPLM STM TB/TV - List of Procedure Variation Sheets

No.	Test Phase	Test Step	Date/Time UTC	PVS Title	Originator
1	1	TP1-B-P7	09.10.05 09:00	HTT temperature rise	Jahn
2	TP1	TP1-B-	10.10.05	HOT rapid depletion	Jahn
3	TP2	TP2-B-P17	11.10.05	Closure of V105, change of ventpath	Jahn
4	TP4	TP2-B-P20 TP8-C-P1	12.10.05	Evacuation of safety line	Jahn
5	TP2	TP2-C-0		Pressure drop measurement	Jahn
6	TP3	TP3-B-P4		Change TP3 flow path	Jahn
7	TP3	TP3-B-P4		Close off HTT at end off TP3	Jahn
8	TP3	TP3-B-P4	19.10.05	HOT forced cool-down	"
9	TP3	PVS 7	20.10.05	Shut down SCOE	"
10	TP3	TP3-B-P6	20.10.05	PPS startup tests	"
11	TP4	TP4-B-P2	23.10.05	LO measurements	"
12	"	TP4-C-P1	"	Pressure drop and PPS measurements	"
13	TP5	TP5-B-P2-	"	TB 1 procedure variation	"
14	"/TP6	TP6-A	28.10.05	Transition to TP6; heating sequence	"
15	TP6	TP6-B	30.10.05	Check different valve configurations	"
16	TP6	TP6-B	30.10.5	Switch on SPIRE and HIFI L1 heater	Hauser
17	"	TP6-B-P3	31.10.05	Operate DLCM heaters in standard SCOE mode	Jahn
18	TP7	TP7-A	31.10.05	Operate PPS, check impact on L1	"
19	"	TP7-A	31.10.05	LOU heating	"
20	"	TP7-B	02.11.05	Accelerated CVV warm-up	"
21	"	TP7-C1	03.11.05	Additional heat load tests at end of TP7	"
22	"	"	04.11.05	Add. LO heating test to influence of the film	Langfermann
23	"	"	04.11.05	HTT heat load measurement with LO heaters on	Jahn
24	"	"	"	L1 heaters operation at end of TP7 PVS 21	"
25	TP8		06.11.05	HTT heat load measurement at 200 K on CVV	Jahn

No.	Test Phase	Test Step	Date/Time UTC	PVS Title	Originator
26	TP8	TP8-B-P9		Hold ~100mbar LSS pressure	Jahn
27	TP8		7.11.05	Reduction of T-diff CVU-LSS shroud	Langfermann
28	"		8.11.05	Reference measurement for PS02 and HTT heat load	Jahn
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					

PROCEDURE VARIATION SHEET					**No.:** 29	
Variation Step	**Date**	**Test Step Variation Description**	**Expecte Value**	**Measure Value**	**AIV**	**PA**
C	08.11.2005	Pressure in safety-line, Pressurization of chamber shall be performed without re-pressurization of safety-line. Chamber can be opened before repressurization of safety-line.	≈ 21 mbar	17,4 mbar		

REMARKS

PROCEDURE VARIATION SHEET						No.: 28
Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	Reference measurement for PS02 and HTT heat load	Value	Value		
TP8-B-	P9 08.11.05	Get reference point for PS02 calibration with warm PS02 on HTT SVP : Close Pump inlet valves, HTT outlet open Wait for stable PS02 reading ~~Open pump inlet valves~~ Wait 1hr to get reference value for HTT heat load with CVV at 290K Open pump inlet valves				

REMARKS

PROCEDURE VARIATION SHEET

No.: 27

Variation Step	Date	Test Step Variation Description Reduction of LSS shroud-CVV temperature difference	Expecte Value	Measure Value	AIV	PA
TP8		In order to accelerate S/C warm up the temperature difference between the LSS-shroud ~~cylinder~~ and the CVV minimum sensor 1902 shall be reduced to 0°				

REMARKS

AAS-F

PROCEDURE VARIATION SHEET

No.: 26

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	Hold ~100 mbar LSS pressure	Value	Value		
TP8-B-P9		During repressurization: When LSS pressure has reached ~100 mbar, hold pressure constant for ~1hr. Monitor cryostat temperatures to check for leakage. Release further repressurization by ORS.				

REMARKS

PROCEDURE VARIATION SHEET	No.: 25

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	HTT heat load measurement at 200K on CVV	Value	Value		
TP8		The HTT heat load shall be measured at higher CVV temperatures. The Thermal Shields shall be sub-cooled to minimize normal parasitics.				
TP8-	B-P1	Keep He pumps running. Value configuration: Open: V102, V104, V501, [illegible], V503, V504, V505, TVQM3, all pump inlet values Closed: V103, V106, V105, V701, V702 When CVV has reached 200K: Keep CVV temperature, close all HTT valves (V102, V104), wait until HTT heat load can be determined (~ 1.5 hrs). Then continue CVV warm-up and return to "HTT pump-down" valve configuration as defined above, but keep V104 closed.				

REMARKS

PROCEDURE VARIATION SHEET

No.: 24

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	L1 heaters operation at end of TP7/PVS21-3	Value	Value		
		Before step 4 of PVS21: Operate PACS and SPIRE L1 heaters simultaneously: PACS_3 10mW PACS_5 10mW PACS_6 10mW SPIRE_3 10mW Wait for stable conditions, then switch off heaters, wait for stable conditions, continue with PVS21 step 4				

REMARKS

PROCEDURE VARIATION SHEET	No.: 23

Variation Step	 Date	Test Step Variation Description HTT heat load measurement with LO heaters on	Expecte Value	Measure Value	AIV	PA
TP7-C1	04.11.05	Switch on PACS_7 and SPIRE_4 LO heaters to 100mW each to burn off stike film. Continue for 3 hours to measure HTT heat load impact. After 3 hours, switch off PACS_7 and SPIRE_4 and continue with PVS 21 step 4.				

REMARKS

PROCEDURE VARIATION SHEET						No.: 22
Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	Additional LO heating test to influence of He film	Value	Value		
	4.11.05	Test to be performed after TP07 and before PVS 21 step 4. Set Spire heater No. 4 to 100/200/500 mW. for 5min each Set Pacs heater No 7 to 100/200/500 mW. If T107 on HTT increases stop test for Spire/Pacs ~~respectively~~ (switch off heater)				

REMARKS

ESA:

PROCEDURE VARIATION SHEET

No.: 21

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	**Date**	Additional heat load test at end of TP7	**Value**	**Value**		
TP7-C-P1		The following additional test shall be performed at the end of TP7: 1. Testing of PPS valves with unchanged mass flow and check of impact on T231 2. Switching HOT valve configurations 3. Check impact of pumps on L1 oscillations 4. Check impact of HTT venting path on HTT heat load 5. Repeat reference test with closed tank and evacuated HST				

REMARKS

See detailed Step-by-Step procedure in annex

Step-by-step procedure for the additional TP7 test – Annex to PVS 21:

1. Testing of PPS valves with unchanged mass flow and check of impact on L1 temperatures:
    a) Open V106. Check impact on L1 temperature and oscillations
    b) Close V103. Check impact on L1 temperature and oscillations
    c) Switch to valve configuration via PPS with lowest T231.

2. Switch HOT valves configuration and check T231 impact for each step. Return to configuration with obvious oscillation.

	✓	✓	✓	✓	✓	✓	✓	✓	
Step	0	1	2	3	4	5	6	7	8
V105	open	open	open	open	**closed**	closed	closed	closed	tbd
V701	closed	**open**	open	**closed**	closed	**open**	open	**closed**	tbd
V702	closed	closed	**open**	open	open	open	**closed**	closed	tbd
L1 impact	—	—	—	—	oscillating	—	—	—	

3. Check pump impact on L1 oscillations:
    a) Open ball valve, close V504 (without delay)
    b) Wait 5 minutes, check L1 temperature oscillations
    c) open V504, close ball valve (without delay)

PVS 22
PVS 23 →

4. Check HTT venting paths and impact on HTT heat load. Wait for 3 hours after each step a) to c):
    a) open V104, close PPS valves V103 and V106, adjust mass flow rate via needle valve to previous value
    b) open V102, close V104, adjust mass flow rate via needle valve to previous value
    c) Tilt S/C to vertical position
    d) Remark: Venting via V104 in vertical position, V102 closed was already tested in TP5-TB1 and is not repeated now.

Evacuated tubing test performed first.

5. Repeat reference test:
    a) Close V501 and V503
    c ~~b)~~ Close V102 and all HOT valves V105, V701, V702 (i.e. all HTT and HOT valves closed), wait ~~3 hrs~~ max 2h min 1h → ~~[illegible]~~
    b ~~c)~~ Open V501 and V503 to evacuate helium tubing system, wait ~~3~~ 2 hrs
    d) Open V104 to establish safe conditions

6. Continue with nominal ITP

ASED __________ ESA __________ AAS-F __________

PROCEDURE VARIATION SHEET

No.: 20

Variation Step	 Date	Test Step Variation Description Accelerated CVV warm-up	Expecte Value	Measure Value	AIV	PA
TP7-B	02.11.05	Use CVV test heaters to accelerate the CVV warm-up to predicted value. Operate at 8% of max power to avoid overshooting				

REMARKS

PROCEDURE VARIATION SHEET						**No.:** 19
Variation		**Test Step Variation Description** LOU heating	**Expecte**	**Measure**	**AIV**	**PA**
Step	**Date**		**Value**	**Value**		
TP7-A		• Keep IR-Rig and TTHP in cold conditions • Switch on LOU MTD heater LOU_1 to 6 W • Wait until LOU MTD sensors MT108/109/110 confirm correct operation of heater • Switch on test heaters, LOU_16_rad_lower and LOU_17_rad_upper to 20 W each. Monitor temperatures MT108/9/10, switch off LOU test heaters when temperatures have increased by 23K, i.e. when TDH sensor 2321 reaches 135K. • 5 hrs after switch-on of MTD heater, start HSS-TCR and TTHP heating.				

REMARKS

PROCEDURE VARIATION SHEET

No.: 18

Variation Step	Date	Test Step Variation Description Operate PPS, check impact on L1	Expecte Value	Measure Value	AIV	PA
~~TP6-C~~ ~~P1~~ TP7	-A	At end of TP6: • Start PPS via V103, keep previous mass flow rate constant. S/C in vertical position. Check impact on L1 temps. • Operate PACS L1 heaters with 3 x 10mW; check L1 temperatures • Tilt S/C to immerse PPS; tilt until PPS temperature reacts or 16° max tilt angle. Check L1 impact • Return to nominal conditions: ~~- Tilt to 0°~~ ~~- Open V104, check T112~~ ~~- Close V103/V106~~ ~~- Adjust mass flow to previous value~~ - switch off PACS L1 heaters		Changed: Keep PPS operative during TB2 phase, just switch off L1 heaters		

REMARKS

A priori, it is not required to wait for stable conditions before performing the next steps.

AAS-F

PROCEDURE VARIATION SHEET

No.: 17

Variation Step	Variation Date	Test Step Variation Description Operate DLCM heaters in standard SCOE mode	Expecte Value	Measure Value	AIV	PA
TP6-B-P3	31.10.05	Before the normal DLCM operation planned in step TP6-B-P3: In the normal SCOE mode, switch on the DLCM heaters H101 and H102 to 10 W each for 20 sec (simultaneously). Switch off both heaters after 20 sec. Check impact on L1 temperatures. Continue with TP6-B-P3				
		Operate HTT level probes after DCCM sequence (after PPS ops, PVS 18)	}	Skipped since in tilted configuration		

REMARKS

AAS-F ·

PROCEDURE VARIATION SHEET

No.: 16

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
		Switch on SPIRE and HIFI L1 Heaters				
Step	Date		Value	Value		
TP6		Heat SPIRE L1 MTD with 10mW to check impact on temperature distribution on ventline (PACS L1 MTDs are still on with 3x 10mW). Afterwards switch on additional HIFI L1 MTD with 10mW.				

REMARKS

PROCEDURE VARIATION SHEET

No.: 15

Variation Step	Variation Date	Test Step Variation Description Check different valve configurations	Expected Value	Measure Value	AIV	PA
TP6 Heating step 14 acc. to PVS 14	30.10.05	In order to check the impact on the ventline temperature distribution, ~~the~~ different configurations of valve states shall be used at the end of the PACS L1 heating: • Open V105 • Open V701 • Open V106 (check PPS temp. oscill.)				

REMARKS

AAS-F

PROCEDURE VARIATION SHEET

No.: 14

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	Transition to TV2 phase; heating sequence	Value	Value		
TP6-A		Authorisation to start the operations planned for phase TP6-TV2 is given, pending that the TS1-TS2-TS3-CVV stability criteria are fulfilled. TRB5 to be performed during TP6. The heating sequence shall be reversed during TP6, i.e. downstream heaters are operated first. T231 raw data to be read manually before TV2 operations !				

REMARKS

ok ESA

PROCEDURE VARIATION SHEET

No.: 13

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	TB1 procedure variation	Value	Value		
TPS-B-P2 to P6		Variation of TB1 approach due to high HTT heat load: • Mass flow rate to be controlled at 4.5 mg/s throughout TB1 • HTT temperature drift is tolerated • Stability criteria for TS1, TS2, TS3 and CVV are applicable, HOT and OBA stability is not required. Criteria values as of ITP to be confirmed during TB1 • No compensation heat to be implemented on HTT and on HIFI L2 • close the HOT by closing V105	24.10.05 14^{25}			

REMARKS

PROCEDURE VARIATION SHEET

No.: 12

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	Pressure drop and PPS measurements	Value	Value		
TP4-C-1	23.10.05	At end of TP4: Simulate switching from big to small nozzles with PPS operation: - With closed Ball valve (and open V504), adjust needle valve to 2 mg/s. - Open ball valve → big nozzle - Close ball valve → "small nozzle" Measure pressure drop and mass flow through V104 and small nozzles with open ball valve.				

REMARKS

PROCEDURE VARIATION SHEET

No.: 11

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	LO measurements	Value	Value		
TP4-B -P2	23.10.05	Operate all LO MTD heaters one by one in power steps of 5 and 10 mW. Wait for stable conditions before next step.				

REMARKS

PROCEDURE VARIATION SHEET

No.: 10

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	**Date**	PPS startup tests	**Value**	**Value**		
TP3-B-P6	20.10.05	PPS starts up in vertical position, but ΔT becomes positive when big nozzle is closed. • Search for dip point by tilting with closed HTT ↳ no response seen up to 20° • tilt to 10°, start PPS with big nozzle, increase tilt angle ↳ response seen at 11.5°, increased to 13.5° ↳ switch off big nozzle, ΔT becomes positive As-run see attachment ↳ Decision to go to TP4 with venting through V106 ~~open~~, and large nozzle, adjusting mass flow rate with pump needle valve				

REMARKS

NCR: Anomalies seen during PPS activation at Test Step TP4 of EPLM TBTV Test

Step-by-step log of PPS investigations 20 & 21 October 2005

End of TP3 with HTT closed

1. Open V104

2. Open V103
3. Open V106
4. Close V104
5. PPS is operating despite vertical configuration.

6. V504 Closed – after initial peak down PPS outlet temperature increases to the HTT bath temperature.

7. V504 opened – Stable PPS operation

8. V104 opened – PPS delta T jumps to positive

9. V104 closed – PPS operates (S/C vertical)

10. V103 closed
11. V106 closed – PPS closed delta T positive

12. HTT valved off
13. Start tilting of S/C to find PPS immersion angle
14. Tilt to 20 degrees – PPS outlet unchanged at 27mK above HTT bath temperature. Expected immersion angle ~ 13.5 degrees

15. Decision to go to 10 degree tilt angle and start PPS
16. At 10 degrees – open V106, PPS operating at Delta T ~150mK
17. Stable conditions reached

18. Start increasing tilt angle to 13 degrees in 1 degree steps
19. At 11.5 degrees PPS outlet temperature and mass flow increase sharply

20. At 12.5 degrees
21. Close V504, PPS delta T becomes positive

22. 13.5 degrees, no reaction
23. Open V504, PPS resumes
24. Tilt to 14.5 degrees (1 degree per minute)
25. No change in PPS

26. Tilt back to vertical
27. At 12 degrees PPS drops
28. At 8 degrees PPS temperature increases
29. At vertical

30. Open V103
31. Close V106
32. Close V103

33. Heater on V106 to vent warm gas into closed HTT
34. PPS temperature increase
35. Open V106
36. Switch off heater V106
37. PPS temperature decreases from 2.8K to 20 – 40 mK below bath

38. V504 closed
39. T112 reads the same as DLCM temperatures

40. LLPs show HTT at 90.06%

41. Start tilting to 14 degrees
42. 9.6 degrees, slight upward bend on T111/112
43. 11.7 degrees steep up T111
44. 14 degrees stop tilting
45. V504 opened

PROCEDURE VARIATION SHEET

No.: 9

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	Shut down SCOE	Value	Value		
TP3-B-P9	20.10.05	Shut down /power off the SCOE for 1hour to exclude electrical heating of HTT				

REMARKS

PROCEDURE VARIATION SHEET

No.: 8

Variation Step	Date	Test Step Variation Description	Expecte Value	Measure Value	AIV	PA
		HOT forced cool-down				
TP3-B-P4		Cool down HOT to 25 K by (small) He mass flow via V102 and [illegible] V702. V102 opened 13:33:15 V702 opened 13:35:41 V104 closed 17:13 V104 opened 19:07 Close V102 and V702 before next test step V702 closed 14:12 V102 closed 14:13	19.10.05 20.10.05 20.10.05			

REMARKS

ok. ESA

PROCEDURE VARIATION SHEET					**No.:** 7	
Variation		**Test Step Variation Description**	**Expecte**	**Measure**	**AIV**	**PA**
Step	**Date**	Close off HTT at end of TP3	**Value**	**Value**		
TP3-B-P5		When HTT has reached 1.7 K: Close off all HTT valves V102, V104, V103, V106 for 6 hours or, Wait until the first of the following temperatures is reached:	ok 20.	10.05 14:16		
		HTT: 1,72 (T101, 102, 104, 105)				
		TS1: ~~20.0~~ (T42*)	→ 30,	0K	changed	
		TS2: ~~30,0~~ (T44*)	35.	0K	20.10.05	
		TS 3: 46.0 (T46*)				
		~~OBP: 10.0 (T254, 256, 258)~~				
		Close TUQ143 Open V103 and V106				
		Continue with step TP3-B-P6				
		Before step TP3-B-P10: ensure ~~check~~ that OBA < 10 K MT309 - MT315 < 5K MT207, 208, 213 < 5K				

TS1,2 < 30 K

REMARKS

Ok. ESA

AAS-F

PROCEDURE VARIATION SHEET

No.: 6

Variation		**Test Step Variation Description**	**Expecte**	**Measure**	**AIV**	**PA**
Step	**Date**	Change TP3 flow path	**Value**	**Value**		
TP3		Open V102 Close V104 ok 15:34 Wait and check mass flow and HTT drift Go back to previous configuration (tbc) Open V104 Close V102 ok 18:35				

REMARKS

ok ESA (

PROCEDURE VARIATION SHEET

No.: 5

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	Pressure drop measurement	Value	Value		
TP2-C-0		Perform Δp measurements at end of TP-2: 6:00 1. Close V504, wait for stable mass flow 6:00 2. Open V104, close V106, wait for "stable" mass flow 06:29 3. Open V504, wait for "stable" mass flow 4. Open TVQM3, continue with TP3-A-P8		4,6 mg/sec 4,7 mg/sec 24,5 mg/sec		16/10/2005

REMARKS

PROCEDURE VARIATION SHEET

No.: 4

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	Evacuation of safety line	Value	Value		
	11.10.05 ~~22~~ 21:25	T701 increased sharply since 18:36. SV121 o-ring is leaking. Safety line (CVV external parts) is evacuated to ~ 21 mbar to be re-pressurised before opening of LSS				

REMARKS

Thermostatic control of heaters for Herschel PLM STM

The following procedure is agreed with the customer:

- The customer will use an ORS every time when the allowed temperature range of a control will change. The temperatures will be in Celsius.
- The customer will use an ORS every time the maximum allowed control current for a control is changed. The values shall be given in A.
- The first maximum allowed current shall be based on 30% of the absolute maximum power. Due to the 2-minute scan rate overshoots can be expected so a conservative approach is required. When the current is not sufficient, it will be increased after approval of the customer via an ORS.
- The control will start with an on/off approach, which will change later to a low and high limit approach and possibly to a fixed value. Via an ORS the customer will agree on all mode changes. During the low and high limit approach the DH operator is free to change the high and low limits as long as they are below the maximum allowed current.
- The temperature range will start with plus and minus 1 degree from the required temperature. Later via an ORS sheet this range will be lowered to plus and minus 0.5 degrees if possible.
- The maximum overshoot and undershoot warning levels of the temperature shall be plus and minus 1 degrees on top of the temperature range.

See for a description of the thermostatic control the STAMP End-user manual version v1.4, section 7.3.2.

ok

11.10.05

Jacob van der Meulen Date: 11-10-2005

PROCEDURE VARIATION SHEET					No.: 3	
Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date	Closure of V105, change in venting path	Value	Value		
TP-2-B-P17	11.10.05	Close V105 to see whether mass flow oscillation visible on CVSE_004 and T111 can be stopped. V105 closed 16:31 UTC no impact V106 opened 16:37 no impact V103 closed 16:41 PPS oscillations reduced, CVSE_004 unchanged V702 opened 16:52 steep PPS T111 drop, slow increase afterwards. No other impact V105 opened 17:10 no impact V702 closed 17:14 no impact				

REMARKS

PROCEDURE VARIATION SHEET

No.: 2

Variation Step	Variation Date	Test Step Variation Description HOT rapid depletion	Expecte Value	Measure Value	AIV	PA
TP1-B	10/10/05	Start HOT rapid depletion with H701 and/or H702 power = 10W; check HS01 icing by monitoring temperatures ⊛. Depletion to be done before LSS pump-down to avoid de-rating problem on HS01 harness. To avoid oscillations, the HOT evacuation shall be done immediately after depletion (and heating to 55K). Launch delay simulation to be done after evacuation. ⊛ In case of icing, reduce HOT heater power.				

REMARKS

Procedure variation discussed and agreed with AAS-F/ESA.

G. John

C. Jewell

B. Demolder

M. Linder

M. Pastorino

Goal of this procedure variation is to achieve correct initial conditions for LEOP simulation.

PROCEDURE VARIATION SHEET

No.: 1

Variation		Test Step Variation Description	Expecte	Measure	AIV	PA
Step	Date		Value	Value		
TP1-B-P7	09.10.05	HTT temp increase during Launch autonomy	~4mK/12h	~15mK/12h		
		Search for cause:				
		H501 switched off 10:13				
		H701 switched off 11:07				
		H701 switched on, 0.9W 11:47				
		H501 on 11:49				
		Value drawer off 11:15, on 11:50				
		V702 open, V701 closed 11:53				
		↳ Temp increase reduced ~ 8mK/12h ; H701 set to 0.938 W				
	10.10.05	Check whether high heat load on HTT is still there when internal tubing is evacuated:				
		V701 open, V702 closed, H701 0.9W 08:30 (local)				

REMARKS

Operation Requests

Scanned_Docs\Herschel-ORS-compl.pdf

H-EPLM STM TB/TV - List of Operation Request Sheets

No.	Test Phase	Date/Time UTC	ORS Title	Originator
1	TP 0	08.10./11:00	Transition to Test Phase TP 1	Jahn
2	TP 1	8.10/17:20	Dismounting of scaffolding	Jahn
3	"	9.10./	Removal of scaffolding A + basic	Jahn
4	TP 1	10.10./07:00	Close B Port flanges	Jahn
5	"	10.10./15:45	Start pumping down LSS	Balage/Kunz
6	"	10.10.05/16:15	Stop LSS pump down	Jahn
7	"	10.10.05/18:05	Re-start LSS pump down	Jahn
8	TP1	11.10.05/13:05	Start TP 2 and cool-down	"
9	TP2	11.10.05/	Tilt S/C to start PPS	"
10	TP 2	11.10.05/19:48	Reduce warning limit of IR-rig support	Hauser
11	TP2	12.10.05/04:52	Increase of TTAP Heater lines 1-4 power	Hinger
12	TP2	12.10.05/12:45	"	~~Jahn~~ Wagner
13	"	12.10.05/13:45	Increase tilt angle to 5°	Jahn
14	TP2	12.10.05/	Increase Power of Rig Support Heater	Hauser
15	TP2	12.10.05	Change of max. allowable Voltage	Hauser
16	TP2	12.10.05	Reduce max allowable Current for Rig	Hauser
17	TP2	13.10.05	Activate Alarm Limits	V./Hinger
18	"	"	Increase tilt angle to 6°	Jahn
19	"	"	Reduce Alarm Limits of HACS Sensors	A. Hauser
20	"	"	Reduce Current and Switch-on also red. TTAP Heater	Hauser
21	"	"	Change of TTAP and IR RIG Heater Control limits	Hauser
22	"	"	Increase tilt angle to 7°	Jahn
23	"	14.10.05	Change Temp. Sensors for IR Rig Control	Hauser
24	"	15.10.05	Increase tilt angle to 8°	Jahn
25	TP3	16.10.05	Start TP2	

No.	Test Phase	Date/Time UTC	ORS Title	Originator
26	TP3	16.10.05	switch on TC Rig support heater	Wagner
27	TP3	17.10.05	Set IR Rig support target temperature to 203K	Jahn
28	TP3	"	Set thermostat switching temperatures for TTAP	Jahn
29	TP3	20.10.05	Stop Herschel He mass flow	Jahn
30	TP3	20.10.05	Tilting of S/C on request	Jahn
31	TP3	20.10.05	Tilt S/C on request	Langferm
32	TP4	21.10.05	Start TP4 - TV 1	Jahn
33	TP5	23.10.05	Start TP5 - TB1	Jahn
34	TP5	26.10.05	Switch TTAP heaters to fixed current	Jahn
35	TP5	26.10.05	Change fixed current settings of TTAP heaters	Hinger
36	TP5	26.10.05	//	Hinger
37	TP5	26.10.05	"	Hinger
38	TP5	27.10.05	//	Hinger
39	TP5	27.10.05	"	Hinger
40	TP5	27.10.05	//	//
41	TP5	27.10.05	"	"
42	TP5	27.10.05	"	Wagner
43	TP05	27.10.05	"	"
44	TP05	27.10.05	"	Hinger
45	TP06	29.10.05	Start TP6 - TV2 phase	Hauser
46	TP07	31.10.05	Start TP7 - TB2 phase	Hinger
47	"	"	Tilt S/C to 16°	Jahn
48	"	01.11.05	Switch on LOU heaters	Hinger
49	"	01.11.05	Adjust LOU heater settings	Hinger
50	"	"	Change TTAP and IRRIG Heater Control	Hinger
51	"	"	Change IR Rig and Rig Support heater power	Wagner

No.	Test Phase	Date/Time UTC	ORS Title	Originator
52	TP7	01.11.05	Set fixed current settings for TTAP	Hauser
53	TP7	01.11.05	Remove TC 1107 from CVV average (1900)	Hauser
54	TP7	01.11.05	Switch-off LOU_16 and LOU_17	Hauser
55	TP7	02.11.05	Switch on CVV heater Circuits	"
56	"	"	Switch off CCU heaters	Jahn
57	"	"	Adjust TTAP Heater Current	Hauser
58	"	"	"	Hauser
59	TP7	05.11.05	Tilt S/C to 0°	Michel
60	TP8	05.11.05	Start TP8 and Switch on CVV heater	Hauser
61	TP8	"	Change CVV heater power	Hauser
62	TP8	06.11.05	Increase of CVV + TTAP Test Heater Currents	Hinger
63	TP8	"	Decrease TTAP Heater Power/Current	Wagner
64	"	"	Continue Heating of CVV	Michel
65	"	"	Increase CVV + LOU Heater currents	Hauser
66	"	"	Increase HSS Rig temperatures	Hauser
67	"	"	Define Virtual Sensor for min. Temp.	Jahn
68	"	"	Start LSS Shrouds warmup	"
69	"	"	Reduce CVV Heater currents	Hauser
70	TP8	06.11.05	"	Hauser
71	TP8	06.11.05	Change CVV Heater current	Hinger
72	TP8	07.11.05	"	Hinger
73	TP8	07.11.05	Reduction of CVV Heater currents	"
74	TP8	"	"	"
75	TP8	"	Change Shroud warm-up	"
76	TP8	"	Reduce CVV heater power	Wagner
77	TP8	"	Reduce Temp. diff. CVV - LSS shroud	Langfelder

No.	Test Phase	Date/Time UTC	ORS Title	Originator
78	TP8	07.11.05	Reduce CVV heater power	Wagner
79	TP8	07.11.05	Increase HSS Rig and LOU MTD Temp.	Hauser
80	〃	〃	Reduce CVV Heater power	Wagner
81	〃	〃	Increase HSS IR Rig Temperature	Hauser
82	〃	〃	Change Definition of virtual sensor 1902	Hingen
83	〃	08.11.05	Warm-up shrouds to ambient temperature	〃
84	〃	〃	Change CVV Heater Current Settings	〃
85	〃	〃	Change LOU Heater switching Limits	〃
86	〃	〃	Switch off LOU-Rad. HTR's and change	〃
~~87~~	—	—	CVV HTR currents	—
88	〃	〃	Change CVV Heater Current Settings	Wagner
89	TP8	08.11.05	Warm-up CP1 and pressurize to 90 mbar N_2	Dahn
90	TP8	08.11.05	Restart TTAP, IRRIG and LOU, CVV Heating	Hauser
91	〃	〃	Increase CVV Temperature (upper Bulkhead)	Hauser
92	〃	09.11.05	Pressurization to ambient pressure	Hingen
93				
94				
95				
96				
97				
98				
99				
100				
101				
102				
103				

OPERATION REQUEST SHEET

No.: 1

Title: Phase Transition to TP1 - Launch Autonomy

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Testdirector ☐ Data Handling

Name:

To
☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ □□□□□.. ☒ Data Handling

Action:

Start Test Phase TP1 acc. to ITP

Reason:

Date to be executed 08.10.2005	**Time to be executed** UTC 11:00	Local 13:00	**Test Phase:** TP0 → TP1 **Test step:**
Executed Date: 8-10-2005	**Executed Time:** UTC 12:04	Local 14:04	**Sign.:** Jacob v.d. Meulen

Approval:

Shift Leader 8.10.05

PA 08/10/2005

OPERATION REQUEST SHEET

No.: 2

Title: Dismounting of scaffolding

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Test director ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:
Remove Level C + B of LSS scaffolding

Reason: as planned

Date to be executed
08.10.05

Time to be executed
UTC 17:30
Local 19:30

Test Phase: TP1
Test step: TP1-8-L2

~~Executed~~ Date:
Started
8.10.05

Executed Time:
UTC 18:00
Local 20:00

Sign.:

Approval:

Shift Leader

PA

OPERATION REQUEST SHEET

No.: 3

Title: Removal of Scaffolding A

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. John

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:

Remove Scaffolding level A and
basic scaffolding

Reason:

Date to be executed 09.10.05	**Time to be executed** UTC 15:40	Local 17:40	**Test Phase:** TP1 **Test step:** TP1-B-C4
Executed Date: 09./10.10.05	**Executed Time:** UTC	Local 10/10/05 10^{H}20	**Sign.:** M. MANOU

Approval:

Shift Leader

PA

OPERATION REQUEST SHEET

No.: 4

Title: Close B Port flanges

From

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. Jahn

To

☐ Thermal ☐ SCOE ☒ LSS Control

☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:

Close all LSS flanges on the B-Ports

(including B-10)

Reason: Harness checked

Date to be executed 10.10.05	**Time to be executed** UTC 07:00	Local 09:00	**Test Phase:** TP1 **Test step:** TP1-B-24
Executed Date: 10.10.05	**Executed Time:** UTC	10/10/05 Local 11 H 00	**Sign.:** MANOU.

Approval:

Shift Leader

PA

OPERATION REQUEST SHEET

No.: 5

Title: Start pumping down LSS

From

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☒ Test director ☐ Data Handling

Name:

To

☐ Thermal ☐ SCOE ☒ LSS Control

☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:

Start pumping down LSS chamber according to LSS procedure: ETS/INST/THER/211

Reason: as planned

Date to be executed 10.10.05	**Time to be executed** UTC 15:45	Local 17:45	**Test Phase:** TP1 **Test step:** TP1-B-L11
Executed Date:	**Executed Time:** UTC	Local 18:00	**Sign.:** M.MANOU

Approval:

Shift Leader O. Kunt **PA** B. Balage

OPERATION REQUEST SHEET

No.: 6

Title: Stop LSS pump-down

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. John

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ …………….. ☐ Data Handling

Action:

Stop LSS pump-down

Reason:

Date to be executed 10/10/05

Time to be executed UTC 16:15 Local 18:15

Test Phase: TPI

Test step:

Executed Date: 10.10.05

Executed Time: UTC 16:15 Local 18h15

Sign.: M. MAMOU

Approval:

Shift Leader

PA

OPERATION REQUEST SHEET

No.: 7

Title: Re-start LSS pump down

From
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. Jahn

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:

Restart the pump-down of the LSS chamber

Reason: HOT depletion complete

Date to be executed 10/10/05	**Time to be executed** UTC 18:05	Local 20:05	**Test Phase:** TPI **Test step:**
Executed Date: 10.10.05	**Executed Time:** UTC 18:10	Local 20:10	**Sign.:** M.MAMOO

Approval:

Shift Leader

PA

OPERATION REQUEST SHEET

No.: 8

Title: Start Test Phase 2 and cool-down

From ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Test director ☐ Data Handling

Name: G. Jahn

To ☐ Thermal ☒ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Start TP2

Start Cool-down of Shrouds

Reason:

Date to be executed 11.10.05/	**Time to be executed** UTC 13:20	Local 15:20	**Test Phase:** TP1 -> 2 **Test step:**
Executed Date:	**Executed Time:** UTC	Local	**Sign.:** 18 25

Approval:

Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 9

Title: Tilt S/C to start PPS

From ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Test conductor ☐ Data Handling

Name: G. John

To ☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action: start tilting of S/C in + direction in 1° steps. Speed 1°/min. Wait for test conductor ok before each following 1° step

Reason: as planned

Date to be executed 11.10.05	**Time to be executed** UTC 14:07	Local 16:07	**Test Phase:** **Test step:** TP2-B-P12
Executed Date: 11/10/05 at 17^{48}	**Executed Time:** UTC	Local	**Sign.:** PERROTTE

Approval:

Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 10

Title: Reduce warning limit of IR-rig support

From
☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:
Reduce warning limit of IR Rig support from -1°C to -25°C

Reason:
Allowable Gradient between lower Rig panels and Rig Support is 50K at least

Date to be executed
11.10.05

Time to be executed
UTC 19:48
Local 21:48

Test Phase: TP2

Test step:

Executed Date:
11-10-05

Executed Time:
UTC 19:54
Local 21:54.

Sign.:

Approval:

Shift Leader A. Hauser

PA B. Bodage

OPERATION REQUEST SHEET

No.: 11

Title: Increase of TTAP Test Heater Power

From
☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Name: D. Hinger

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please increase the following power settings from 60 W to 80 W:

		Old setting	New setting
HTR line	1	60 W / 1.47 A	80 W / 1.70 A
"	2	60 W / 1.47 A	80 W / 1.70 A
"	3	60 W / 1.47 A	80 W / 1.70 A
"	4	60 W / 1.47 A	80 W / 1.70 A
"	~~5~~		

Reason:

Date to be executed 12.10.2005	**Time to be executed** UTC 04:45	Local	**Test Phase:** TP2 **Test step:** 22
Executed Date: 12-10-05	**Executed Time:** UTC	Local 6:53	**Sign.:** JA

Approval:

Shift Leader

PA

OPERATION REQUEST SHEET

No.: 12

Title: Increase of TTAP Test Heater Power

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: K. Wagner

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please increase the following current settings:

	Old setting	New Setting
TTAP_01_pY	1,70 A	1,90 A (≙ 60 W)
" _02_pZ	1,70 A	1,90 A (")
" _03_mY	1,70 A	1,90 A (")
" _04_mZ	1,70 A	1,90 A (")

Reason:

Date to be executed 12.10.2005	**Time to be executed** UTC 12:45	Local 14:45	**Test Phase:** TP2 **Test step:** 22
Executed Date: 12-10-2005	**Executed Time:** UTC 13:07	Local 15:07	**Sign.:**

Approval:
Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 13

Title: Increase tilt angle to 5°

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. Jochen

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:

Increase tilt angle to +5°
(speed 1°/min)

Reason: daily adjustment

Date to be executed	**Time to be executed**		**Test Phase:** TP2
12.10.05	UTC 13:45	Local 15:45	**Test step:** TP2-B-P20
Executed Date: 12/10/05 15 56 12/10/05 15 57	**Executed Time:** UTC	Local	**Sign.:** BEVILACQUA

Approval:

Shift Leader **PA** J. Balogh

OPERATION REQUEST SHEET

No.: 14

Title: Increase Power of Rig Support Heater

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Increase Power of Heater Circuit 63 (Rig Support)
to maximum allowable current (2,49 A)

2.2 A is maximum reachable
at 36,17V maximum

Now set to 2.2A

Reason:
Reduce Gradient between Rig Support and Rig Lower Panel

Date to be executed 12.10.05	**Time to be executed** UTC 15⁵⁰	Local 17.50	**Test Phase:** **Test step:**
Executed Date:	**Executed Time:** UTC 15:55	Local 17:55	**Sign.:**

Approval:
Shift Leader **PA** B. Dalage

OPERATION REQUEST SHEET

No.: 15

Title: Change of max. allowable Voltage for Heater Circuits

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ ……………… ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ …………….. ☒ Data Handling

Action:
Change max Voltage Values acc. to attached values.

- Increased Heater Circuit 63 (Rig Support) to max. (2.49A) ~~still not reached, so set to 2.35A~~
- Extra changes at 21:07 + 22:25 (see attachment)

Reason: Electrical Resistance of lead wires is not considered for the original values

Date to be executed	Time to be executed		Test Phase:
12.10.2005	UTC 18^{25}	Local 20^{25}	Test step:
Executed Date:	**Executed Time:** UTC 18:35	Local 20:35	**Sign.:**

Approval:

Shift Leader

PA D. Belaye

attachment to ORS-15

Maximum voltage change proposal

#Customer name	Original	New	5% more	Better calculated	2% more
#					
CVV_05_LB-mY	30.90	31.07	32.62	31.24	32.80
CVV_06_LC-pZ	30.93	34.40	36.12	38.25	40.16
CVV_07_UC-pZ	30.93	33.95	35.65	37.27	39.13
CVV_08_UB-mZ	30.90	33.94	35.64	37.28	39.14
CVV_09_Rad-lower-mY	38.69	42.41	44.53	46.49	48.81
CVV_10_Rad-upper-mY	38.69	42.18	44.29	45.98	48.28
CVV_11_Rad-lower-mZ	38.69	41.96	44.06	45.50	47.78
CVV_12_Rad-upper-mZ	38.69	42.17	44.28	45.97	48.27
CVV_13_Rad-lower-pY	38.69	41.96	44.06	45.50	47.78
CVV_14_Rad-upper-pY	38.69	42.30	44.42	46.25	48.56
CVV_15_UB-HSIF-mZ	38.69	42.24	44.35	46.12	48.43
CVV_35_LB-pY	30.90	33.62	35.30	36.57	38.40
IRRIG_23_STM_low_pY	69.28	70.32	73.84	71.38	74.95
IRRIG_24_STM_low_mid	69.28	70.67	74.20	72.09	75.69
IRRIG_25_STM_low_mY	69.28	70.84	74.38	72.43	76.05
IRRIG_26_STM_low_pY	69.28	70.52	74.05	71.78	75.37
IRRIG_27_STM_low_mid	69.28	70.42	73.94	71.57	75.15
IRRIG_28_STM_low_mY	69.28	70.43	73.95	71.60	75.18
IRRIG_29_STM_upp_pY	69.28	70.77	74.31	72.30	75.92
IRRIG_30_STM_upp_mid	69.28	70.61	74.14	71.97	75.57
IRRIG_31_STM_upp_mY	69.28	70.27	73.78	71.27	74.83
IRRIG_32_STM_upp_pY	69.28	70.82	74.36	72.38	76.00
IRRIG_33_STM_upp_mid	69.28	70.98	74.53	72.71	76.35
IRRIG_34_STM_upp_mY	69.28	71.33	74.90	73.44	77.11
IRRIG_63_STM_support	36.12	38.80	40.74	41.68	43.76
LOU_16_rad-lower	38.69	42.21	44.32	46.06	48.36
LOU_17_rad-upper	38.69	42.27	44.38	46.17	48.48
TTAP_01_pY	38.69	41.04	43.09	43.52	45.70
TTAP_02_pZ	38.69	40.83	42.87	43.08	45.23
TTAP_03_mY	38.69	40.73	42.77	42.87	45.01
TTAP_04_mZ	38.69	40.74	42.78	42.89	45.03
TTAP_19_pY-redundant	38.69	41.00	43.05	43.45	45.62
TTAP_20_pZ-redundant	38.69	40.93	42.98	43.29	45.45
TTAP_21_mY-redundant	38.69	40.83	42.87	43.08	45.23
TTAP_22_mZ-redundant	38.69	41.26	43.32	44.01	46.21
New was implemented at:		**20:35**			
5% more was implemented at		**21:07**			
2% more was implemented at		**22:25**			

The "Original" values are the maximum values allowed on the heater. To get those, a higher voltage is required from the power supply.

The "New" values where wrongly calculated. At these values the maximum allowed power is injected in the total circuit, so not enough in the heater.

The "Better calculated" values will give the maximum voltage on the heater at the maximum allowed current. This will give the real maximum allowed power on the heater.

To compensate against line resistor changes, an extra 2% is added.

Jacob van der Meulen

Date: 12-10-2005

OPERATION REQUEST SHEET

No.: 16

Title: Reduce max. allowable current for IR Rig heaters

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ …………….. ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ …………….. ☒ Data Handling

Action:
Reduce max. allowable current for the IR Rig heater circuits to the values attached (from 2.5A to 1.73A)

Reason:
to be compatible with the max allowed power of 120W

Date to be executed 12.10.05	**Time to be executed** UTC 20⁵⁰	Local 22⁵⁰	**Test Phase:** **Test step:**
Executed Date: 12-10-2005	**Executed Time:** UTC 20:54	Local 22:54	**Sign.:**

Approval:
Shift Leader **PA** B. Baloza

Attachment to OSR-16

Maximum current proposal

Heater circuit name	Circuit No.	Original Max I allowed	Max I allowed as should be
IRRIG_23_STM_low_pY	23	2.5	1.73
IRRIG_24_STM_low_mid	24	2.5	1.73
IRRIG_25_STM_low_mY	25	2.5	1.73
IRRIG_26_STM_low_pY	26	2.5	1.73
IRRIG_27_STM_low_mid	27	2.5	1.73
IRRIG_28_STM_low_mY	28	2.5	1.73
IRRIG_29_STM_upp_pY	29	2.5	1.73
IRRIG_30_STM_upp_mid	30	2.5	1.73
IRRIG_31_STM_upp_mY	31	2.5	1.73
IRRIG_32_STM_upp_pY	32	2.5	1.73
IRRIG_33_STM_upp_mid	33	2.5	1.73
IRRIG_34_STM_upp_mY	34	2.5	1.73
IRRIG_43_STM_low _pY_red	43	2.5	1.73
IRRIG_44_STM_low _mid_red	44	2.5	1.73
IRRIG_45_STM_low _mY_red	45	2.5	1.73
IRRIG_46_STM_low _pY_red	46	2.5	1.73
IRRIG_47_STM_low _mid_red	47	2.5	1.73
IRRIG_48_STM_low _mY_red	48	2.5	1.73
IRRIG_49_STM_upp_pY_red	49	2.5	1.73
IRRIG_50_STM_upp_mid_red	50	2.5	1.73
IRRIG_51_STM_upp_mY_red	51	2.5	1.73
IRRIG_52_STM_upp_pY_red	52	2.5	1.73
IRRIG_53_STM_upp_mid_red	53	2.5	1.73
IRRIG_54_STM_upp_mY_red	54	2.5	1.73

Jacob van der Meulen

Date: 12-10-2005

OPERATION REQUEST SHEET

No.: 17

Title: Activation of TDH Alarm Limits

From
☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please activate the warning and alarm limits as compiled in the annexed table.

These values correspond to those as compiled in the ITP HP-2-ASED-TP-0056, Iss. 1.1 Annex B

Reason:

The activation was forgotten at begin of the test phase

Date to be executed 13.10.05

Time to be executed UTC asap Local

Test Phase: TP2-B

Test step: 21

Executed Date: 13.10.05

Executed Time: UTC Local 7:27

Sign.: J. A.

Approval:

Shift Leader

PA

ORS 17

#Name	Number	Low alarm	Low warnir	High warni	High alarm	Extrapolation range
#						
EQU_RIG_TC_HSS-Rig-lower-py-l2	8002 ✓	165	170	323	328	00:00:00
EQU_RIG_TC_HSS-Rig-lower-mid-l2	8102 ✓	165	170	323	328	00:00:00
EQU_RIG_TC_HSS-Rig-lower-my-r2	8212 ✓	165	170	323	328	00:00:00
EQU_RIG_TC_HSS-Rig-lower-py-l4	8004 ✓	165	170	323	328	00:00:00
EQU_RIG_TC_HSS-Rig-lower-mid-l4	8104 ✓	165	170	323	328	00:00:00
EQU_RIG_TC_HSS-Rig-lower-my-r4	8214 ✓	165	170	323	328	00:00:00
EQU_RIG_TC_HSS-Rig-upper-py-l2	8302 ✓	165	170	323	328	00:00:00
EQU_RIG_TC_HSS-Rig-upper-mid-l2	8402 ✓	165	170	323	328	00:00:00
EQU_RIG_TC_HSS-Rig-upper-my-r2	8512 ✓	165	170	323	328	00:00:00
EQU_RIG_TC_HSS-Rig-upper-py-l4	8304 ✓	165	170	323	328	00:00:00
EQU_RIG_TC_HSS-Rig-upper-mid-l4	8404 ✓	165	170	323	328	00:00:00
EQU_RIG_TC_HSS-Rig-upper-my-r4	8514 ✓	165	170	323	328	00:00:00
EQU_HACS_TC_mZ-radiator	9000 ✓	243	248	313	318	00:00:00
EQU_HACS_TC_mZ-electronics	9001 ✓	243	248	323	333	**00:10:00**
EQU_HACS_TC_mZ-support	9002 ✓					00:00:00
EQU_HACS_TC_mZ-optics	9003 ✓					00:00:00
EQU_HACS_TC_pZ-radiator	9010 ✓	243	248	313	318	00:00:00
EQU_HACS_TC_pZ-electronics	9011 ✓	243	248	323	333	**00:10:00**
EQU_HACS_TC_pZ-support	9012 ✓					00:00:00
EQU_HACS_TC_pZ-optics	9013 ✓					00:00:00
EQU_TTAP_TC_Structure_1	9301 ✓	248	253	308	313	00:00:00
EQU_TTAP_TC_Structure_2	9302 ✓	248	253	308	313	00:00:00
EQU_TTAP_TC_Structure_3	9303 ✓	248	253	308	313	00:00:00
EQU_TTAP_TC_Structure_4	9304 ✓	248	253	308	313	00:00:00
EQU_TTAP_TC_Structure_5	9305 ✓	248	253	308	313	00:00:00
EQU_TTAP_TC_Structure_6	9306 ✓	248	253	308	313	00:00:00
EQU_TTAP_TC_Structure_7	9307 ✓	248	253	308	313	00:00:00
EQU_TTAP_TC_Structure_8	9308 ✓	248	253	308	313	00:00:00
EQU_TTAP_TC_Str-outer-pYpZ	9310 ✓	248	253	308	313	00:00:00
EQU_TTAP_TC_Str-outer-pYmZ	9311 ✓	248	253	308	313	00:00:00
EQU_TTAP_TC_Str-outer-mYmZ	9312 ✓	248	253	308	313	00:00:00
EQU_TTAP_TC_Str-outer-mYpZ	9313 ✓	248	253	308	313	00:00:00
EQU_SVM_TS_pX_facesheet_pY	4001 ✗	125	130	313	318	00:00:00
EQU_SVM_TS_pX_facesheet_mY	4002 ✗	125	130	313	318	00:00:00
EQU_SVM_TS_strut_pY_near SVM	4010 ✗	125	130	313	318	00:00:00
EQU_SVM_TS_strut_pY_near Shield	4011 ✗	125	130	313	318	00:00:00
EQU_SVM_TS_facesheet_pY_strut_I/F	4012 ✗	125	130	313	318	00:00:00
EQU_SVM_TS_strut_mZ_near_SVM	4020 ✗	125	130	313	318	00:00:00
EQU_SVM_TS_strut_mZ_near_Shield	4021 ✗	125	130	313	318	00:00:00
EQU_SVM_TS_facesheet_mZ_strut_I/I	4022 ✗	125	130	313	318	00:00:00

} wrong name

Name	Number	Low alarm	Low warning	High warning	High alarm	Extrapolation range
PLM_SVTS_TC_SVM-TS-Face-pY	4001	K	K	K	K	00:00:00
PLM_SVTS_TC_SVM-TS-Face-mY	4002	K	K	K	K	00:00:00
PLM_SVTS_TC_SVM-TS-Strut-pY-lower	4010	K	K	K	K	00:00:00
PLM_SVTS_TC_SVM-TS-Strut-pY-upper	4011	K	K	K	K	00:00:00
PLM_SVTS_TC_SVM-TS-Strut-pY-face	4012	K	K	K	K	00:00:00
PLM_SVTS_TC_SVM-TS-Strut-mZ-lower	4020	K	K	K	K	00:00:00
PLM_SVTS_TC_SVM-TS-Strut-mZ-upper	4021	K	K	K	K	00:00:00
PLM_SVTS_TC_SVM-TS-Strut-mZ-face	4022	K	K	K	K	00:00:00

Sensors 4001 – 4022 had the wrong name!

D25 17

OPERATION REQUEST SHEET

No.: 18

Title: Increase tilt angle to 6°

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. Jahn

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ …………….. ☐ Data Handling

Action:

Increase s/c tilt angle to 6°
(speed 1°/min)

Reason:

as planned

Date to be executed 13.10.05	**Time to be executed** UTC 13:40	Local 15:40	**Test Phase:** TP-2 **Test step:**
Executed Date: 13/10/05	**Executed Time:** UTC	Local 15:40	**Sign.:**

Approval:
Shift Leader **PA** B. Balogh

OPERATION REQUEST SHEET

No.: 19

Title: Reduce Alarm Limits of HACS Temp. Sensors

From
☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Reduce Alarm Limit of Sensor 9000, 9001, 9010 and 9011 from 243 K to 230 K

and the warning limits from 248 K to 235 K

Reason:

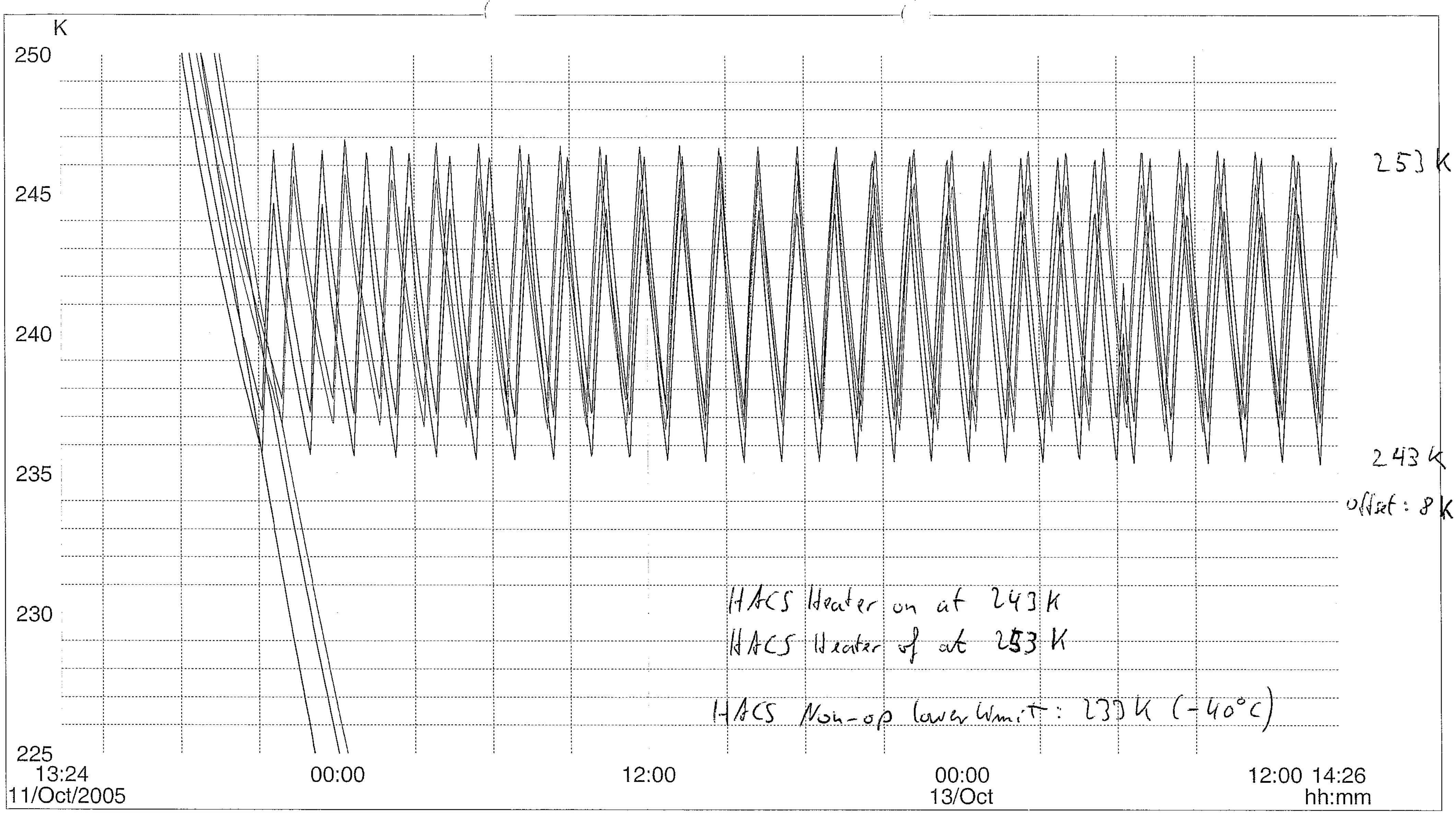
Above Sensors show 8 K lower temperature than the HACS internal Sensor (close to the electronics), see ANNEX HACS-Lower limit is 233 K, i.e. 225 K for the a.m. sensors

Date to be executed 13.10.2005	**Time to be executed** UTC 15:50	Local 17:50	**Test Phase:** TP2 **Test step:**
Executed Date: 17:55	**Executed Time:** UTC	Local	**Sign.:** J. Weber

Approval:

Shift Leader **PA**

ANNEX to ORS-19



ESTEC - Large Space Simulator

Test : HERSCHEL EPLM STM TB/TV

Specimen : HERSCHEL EPLM STM TB/TV

Date : 13/10/2005

Sensor label	*TC Number*	*Phase name*
EQU_HACS_TC_mZ-radiator	9000	TP2 - Launch and Early Orbit Phase
EQU_HACS_TC_mZ-electronics	9001	TP2 - Launch and Early Orbit Phase
EQU_HACS_TC_mZ-support	9002	TP2 - Launch and Early Orbit Phase
EQU_HACS_TC_mZ-optics	9003	TP2 - Launch and Early Orbit Phase
EQU_HACS_TC_pZ-radiator	9010	TP2 - Launch and Early Orbit Phase
EQU_HACS_TC_pZ-electronics	9011	TP2 - Launch and Early Orbit Phase
[illegible]	[illegible]	[illegible]
EQU_HACS_TC_pZ-optics	9013	TP2 - Launch and Early Orbit Phase

OPERATION REQUEST SHEET

No.: 20

Title: Reduce Current and Switch-on also Redundant TTAP Heaters

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Switch on Heater Circuits 19, 20, 21 and 22 with 1,47 A
(redundant TTAP heaters)

and reduce Current of Heater Circuits 1, 2, 3 and 4 from
1,9 A to 1,47 A (TTAP heaters)

Reason:
TTAP cannot be kept at 293K with nominal heaters

Date to be executed 13.10.05	**Time to be executed** UTC 18:55	Local 2055	**Test Phase:** TP2 **Test step:**
Executed Date: 13.10.05	**Executed Time:** UTC	Local 21:00	**Sign.:**

Approval:
Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 21

Title: Change of TTAP and IR Rig Heater Control Limits

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Change TTAP and IR Rig Heater Control Limits
from 293K ± 1K to 293K ± 0.5K or lower.

Reason:
Reduce Temperature Fluctuations

Date to be executed 13.10.05	**Time to be executed** UTC 21:10	Local 23:10	**Test Phase:** **Test step:**
Executed Date:	**Executed Time:** UTC 21:15	Local 23:15	**Sign.:**

Approval:
Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 22

Title: Increase tilt angle to 7°

From
☐ Thermal
☐ Cryo / CVSE
☐ SCOE
☒ Shift leader
☐ LSS Control
☐ Data Handling

Name: G. Jahn

To
☐ Thermal
☐ Cryo / CVSE
☐ SCOE
☐ ....
☑ LSS Control
☐ Data Handling

Action:
Increase tilt angle to 7°
Speed 1°/min

Reason:
as planned

Date to be executed	Time to be executed		Test Phase: TP2
14.10.05	UTC 13:50	Local 15:50	Test step:
Executed Date:	**Executed Time:** UTC	Local 15:54	**Sign.:** MAMOU

Approval:
Shift Leader
PA

OPERATION REQUEST SHEET

No.: 23

Title: Change Temp. Sensors for IR Rig Control

From

☒ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Replace TC 8514 by TC 8513 and
TC 8304 by TC 8313 for heater control

Reason:

Adjacent Sensors around current T/C Sensors show 2-3K higher temperature because T/C Sensors 8514 and 8304 are located at the "coldest" edge of the IR Rig.

Date to be executed 14.10.05	**Time to be executed** UTC 14^{25}	Local 16^{25}	**Test Phase:** TP2 **Test step:**
Executed Date: 14.10.05	**Executed Time:** UTC	Local 17^{00}	**Sign.:** J. Weber

Approval:

Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 24

Title: Increase tilt angle to 8°

From ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. John

To ☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:

Increase tilt angle to 8°
Speed 1°/min

Reason: as planned

Date to be executed 15.10.05	**Time to be executed** UTC 16:05	Local 18:05	**Test Phase:** TP2 **Test step:**
Executed Date: 15/10/2005	**Executed Time:** UTC	Local 18h13	**Sign.:** P. PERROTTE

Approval:
Shift Leader PA

OPERATION REQUEST SHEET

No.: 25

Title: Start test phase 3 (TP3)

From

☐ Thermal ☐ SCOE ☒ LSS Control

☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name:

To

☐ Thermal ☐ SCOE ☒ LSS Control

☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action: Start TP3

1. switch off heaters on IRR-Rig and IRR-Rig support if Temperature difference between IRRIG_63 and any of IRRIG 23 – 33 exceed 30°C inform Astrium
2. Adjust tilt angle to 0° (vertical position)
3. Set TTAP control to 0°C (current unchanged)
   TTAP 01 – 04, TTAP19-22
4. When IRRIG + support reaches -200°C switch to heater control to -100°C ±0.5°C for all heaters mentioned in 1.

Reason:

Date to be executed 16.10.05

Time to be executed UTC 07 40 Local 9 40

Test Phase: TP3

Test step:

Executed Date: ~~9:59~~ 16-10-05

Executed Time: UTC Local 9:59

Sign.: J.A.

Approval:

Shift Leader Landfermann, Michael

PA

Name	Control mode	Fixed Setpoint	Thermostatic Lowest setpoint	Thermostatic Low setpoint	Thermostatic High setpoint	Thermostatic Highest setpoint	Thermostatic Highest limit	Thermostatic High limit	Thermostatic Low limit	Thermostatic Lowest limit
IRRIG_23_STM_low_pY	Thermostatic current	0.000 A	0.000 A	0.720 A	0.900 A	1.000 A	21.00	20.25	19.75	19.00
IRRIG_25_STM_low_mY	Thermostatic current	0.000 A	0.000 A	0.700 A	0.900 A	1.000 A	21.00	20.25	19.75	19.00
IRRIG_26_STM_low_pY	Thermostatic current	0.000 A	0.000 A	0.650 A	0.820 A	1.000 A	21.00	20.25	19.75	19.00
IRRIG_29_STM_upp_pY	Thermostatic current	0.000 A	0.000 A	0.660 A	0.850 A	1.000 A	21.00	20.25	19.75	19.00
IRRIG_31_STM_upp_mY	Thermostatic current	0.000 A	0.000 A	0.720 A	0.900 A	1.000 A	21.00	20.25	19.75	19.00
IRRIG_34_STM_upp_mY	Thermostatic current	0.000 A	0.000 A	0.760 A	0.980 A	1.100 A	21.00	20.25	19.75	19.00
IRRIG_24_STM_low_mid	Thermostatic current	0.000 A	0.000 A	0.730 A	0.870 A	1.000 A	21.00	20.25	19.75	19.00
IRRIG_27_STM_low_mid	Thermostatic current	0.000 A	0.000 A	0.690 A	0.860 A	1.000 A	21.00	20.25	19.75	19.00
IRRIG_28_STM_low_mY	Thermostatic current	0.000 A	0.000 A	0.720 A	0.890 A	1.000 A	21.00	20.25	19.75	19.00
IRRIG_30_STM_upp_mid	Thermostatic current	0.000 A	0.000 A	0.660 A	0.820 A	1.000 A	21.00	20.25	19.75	19.00
IRRIG_32_STM_upp_pY	Thermostatic current	0.000 A	0.000 A	0.790 A	0.990 A	1.100 A	21.00	20.25	19.75	19.00
IRRIG_33_STM_upp_mid	Thermostatic current	0.000 A	0.000 A	0.730 A	0.950 A	1.100 A	21.00	20.25	19.75	19.00

025 25

Name	Control mode	Fixed Setpoint	Thermostatic Lowest setpoint	Thermostatic Low setpoint	Thermostatic High setpoint	Thermostatic Highest setpoint	Thermostatic Highest limit	Thermostatic High limit	Thermostatic Low limit	Thermostatic Lowest limit
TTAP_02_pZ	Thermostatic current	0.000 A	0.000 A	0.000 A	1.470 A	1.470 A	21.00	20.25	19.75	19.00
TTAP_03_mY	Thermostatic current	0.000 A	0.000 A	0.000 A	1.470 A	1.470 A	21.00	20.25	19.75	19.00
CVV_35_LB-pY	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
CVV_08_UB-mZ	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
CVV_11_Rad-lower-mZ	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
CVV_13_Rad-lower-pY	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
TTAP_19_pY-redundant	Thermostatic current	0.000 A	0.000 A	0.000 A	1.470 A	1.470 A	21.00	20.25	19.75	19.00
TTAP_22_mZ-redundant	Thermostatic current	0.000 A	0.000 A	0.000 A	1.470 A	1.470 A	21.00	20.25	19.75	19.00
TTAP_01_pY	Thermostatic current	0.000 A	0.000 A	0.000 A	1.470 A	1.470 A	21.00	20.25	19.75	19.00
IRRIG_63_STM_support	Thermostatic current	0.000 A	0.000 A	0.000 A	2.490 A	2.490 A	22.00	21.00	19.00	-25.00
TTAP_21_mY-redundant	Thermostatic current	0.000 A	0.000 A	0.000 A	1.470 A	1.470 A	21.00	20.25	19.75	19.00
TTAP_20_pZ-redundant	Thermostatic current	0.000 A	0.000 A	0.000 A	1.470 A	1.470 A	21.00	20.25	19.75	19.00
LOU_17_rad-upper	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
LOU_16_rad-lower	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
CVV_14_Rad-upper-pY	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
CVV_12_Rad-upper-mZ	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
CVV_10_Rad-upper-mY	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
CVV_09_Rad-lower-mY	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
CVV_07_UC-pZ	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
CVV_06_LC-pZ	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
CVV_05_LB-mY	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00
TTAP_04_mZ	Thermostatic current	0.000 A	0.000 A	0.000 A	1.470 A	1.470 A	21.00	20.25	19.75	19.00
CVV_15_UB-HSIF-mZ	Fixed current	0.000 A	0.000 A	0.000 A	0.000 A	0.000 A	0.00	0.00	0.00	0.00

025 25

OPERATION REQUEST SHEET

No.: 26

Title: Switch on TC Rig support heaters

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Name: Wagner

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Switch on heaterpower of TC Rig Support
IRRIG_63_STM_support
to 20W / 1,17A

Reason: Avoid too high temperature difference between TC Rig and TC Rig support during transient cool-down.

Date to be executed 16.10.05

Time to be executed UTC 8:35 Local 10:35

Test Phase: TP03

Test step:

Executed Date: 16/10/05

Executed Time: UTC Local 10:37

Sign.: JA

Approval:

Shift Leader

PA

OPERATION REQUEST SHEET

No.: 27

Title: Set IR Rig support target temperature to 203K

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. Jahn

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Set control temperatures for
IR Rig support circuit 63 to 203 ± 0.5 K
(sensor 8702) (= −70 ± 0.5 °C)
and increase current to 1,4 A (29 W)
(on = 1.4A)
(off = 0A)

Reason: To stabilize Rig support temperature and the temperature difference between Rig support and panels.

Date to be executed 17.10.05	**Time to be executed** UTC 22:50	Local	**Test Phase:** TP3 **Test step:** B
Executed Date: 17-10-2005/ 18-10-2005	**Executed Time:** UTC 23:07	Local 1:07	**Sign.:**

Approval:
Shift Leader
PA B. Balage

OPERATION REQUEST SHEET

No.: 28

Title: Set thermostat switching temperatures for TTAP

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. Jahn

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Reduce switching distance for TTAP heaters circuit 1,2,3,4 to 0°C ± 0.25°C

Reason: Reduce impact on CVV and strut temperature stability

Date to be executed 17.10.05	**Time to be executed** UTC 20:10	Local 22:10	**Test Phase:** TP3 **Test step:**
Executed Date: 17-10-2005	**Executed Time:** UTC 19:40	Local 21:40	**Sign.:**

Approval:
Shift Leader

PA

OPERATION REQUEST SHEET

No.: 29

Title: Stop Herschel He mass flow

From ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shiftleader ☐ Data Handling

Name: G. John

To ☐ Thermal ☒ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:
H-PLM He mass flow has been stopped at
20.10.05 16:16 (local)
-D watch LSS pressure and take corrective
actions if necessary, in case of any recognized
anomaly TIS shall inform ASED immediately!

Reason:

Date to be executed 20.10.05	**Time to be executed** UTC 15:00	Local 17:00	**Test Phase:** TP3 **Test step:**
Executed Date: 20/10/2005 17^{00}	**Executed Time:** UTC	Local	**Sign.:** BARLACQUA – 17^{00}

Approval:
Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 30

Title: Tilt S/C on request

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ Shift leader ☐ Data Handling

Name: G. Jahn

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:
Increase GS tilt angle in 1° steps,
speed 1°/min.
Wait for ASED ok for every step

Reason:

Date to be executed 21.10.05	**Time to be executed** UTC	Local 01:15	**Test Phase:** TP3 **Test step:**
Executed Date: 21/10/2005	**Executed Time:** UTC	Local	**Sign.:** TLAHOO

Approval:

Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 30

Title: ~~4~~ Tilt S/C on request

From ☐ Thermal ☐ SCOE ☐ LSS Control
☒ Cryo / CVSE ☐ .... ☐ Data Handling

Name:

To ☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action: current tilt angle 13,5 degree
LSS to increase to 14.5 degree on request
LSS to tilt to 0° w/o interruption on request
~~LSS to tilt in minus direction in steps at 1° on request~~
LSS to tilt to +14,0° w/o interruption (1°/min) on request

Reason:

Date to be executed 211005

Time to be executed UTC 09:20 Local 11:20

Test Phase: TP3

Test step:

Executed Date: 21/10/2005

Executed Time: UTC Local $16^{h}31$

Sign.:

Approval:
Shift Leader

PA 21/10/2005

OPERATION REQUEST SHEET

No.: 32

Title: Start TP4 – TV1

From

☐ Thermal
☐ Cryo / CVSE
☐ SCOE
☒ Shift leader
☐ LSS Control
☐ Data Handling

Name: G. John

To

☐ Thermal
☐ Cryo / CVSE
☒ SCOE
☐ ....
☐ LSS Control
☒ Data Handling

Action:

Start test phase TP4 - TV Phase 1

Reason:

Date to be executed 21.10.05	**Time to be executed** UTC 15:40	Local 17:40	**Test Phase:** TP3 -> TP4 **Test step:**
Executed Date: 21.10.05	**Executed Time:** UTC 15:45	Local 17:45	**Sign.:** J. Zeller

Approval:

Shift Leader

PA

OPERATION REQUEST SHEET

No.: 33

Title: Start TPS – TB1

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. John

To
☐ Thermal ☒ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Start test phase TPS – TB1

Set S/C tilt angle to 0° (1°/min)

Reason:

Date to be executed 23.10.05	**Time to be executed** UTC 16:35	Local 18:35	**Test Phase:** TPS-A-1 **Test step:**
Executed Date: 23/10/2005	**Executed Time:** UTC	Local 18h51	**Sign.:** P. PERROTTE

Approval:
Shift Leader

PA D. Balage

OPERATION REQUEST SHEET

No.: 34

Title: Switch TTAP heaters to fixed current mode

From
☐ Thermal
☐ Cryo / CVSE
☐ SCOE
☒ Shift leader
☐ LSS Control
☐ Data Handling

Name: G. John

To
☐ Thermal
☐ Cryo / CVSE
☐ SCOE
☐ ………………
☐ LSS Control
☒ Data Handling

Action:

Switch TTAP nominal + redundant heaters to fixed current mode.
Currents as given in Annex

Reason: Scatter on TTAP control sensors

Date to be executed 26.10.2005	**Time to be executed** UTC 21:20	Local 23:20	**Test Phase:** TPS **Test step:**
Executed Date: 26-10-05	**Executed Time:** UTC 21:30	Local 23:30	**Sign.:** 23:30

Approval:

Shift Leader

PA B. Balazs

Annex to ORS 34

Heater currents to be applied for fixed current mode: 26.10.2005 / 21:20 UTC

Current [A]	Heater circuit
1.0119	I - TTAP_01_pY
0.7989	I - TTAP_02_pZ
0.9607	I - TTAP_03_mY
0.9935	I - TTAP_04_mZ
1.0021	I - TTAP_19_pY-redundant
0.7953	I - TTAP_20_pZ-redundant
0.9608	I - TTAP_21_mY-redundant
0.9875	I - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 35

Title: Change current settings of TTAP Heaters

From ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please change the fixed current settings of the TTAP heaters according to the attached sheet

Reason:

Date to be executed 26.10.05	**Time to be executed** UTC 22:25	Local	**Test Phase:** TB 5 **Test step:** B
Executed Date: 27-10-05	**Executed Time:** UTC 22:23	Local 00:23	**Sign.:**

Approval:

Shift Leader Jürgen Hinger **PA**

Annex to ORS 35

Heater currents to be applied for fixed current mode: 26.10.2005 / 22:25 UTC

Current [A]	Heater circuit
1.0220	I - TTAP_01_pY
0.8069	I - TTAP_02_pZ
0.9607	I - TTAP_03_mY
1.0034	I - TTAP_04_mZ
1.0122	I - TTAP_19_pY-redundant
0.8033	I - TTAP_20_pZ-redundant
0.9608	I - TTAP_21_mY-redundant
0.9974	I - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 36

Title: Change current setting of TTAP heaters

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please change the TTAP heater current settings according to the attached sheet

Reason: To adjust the TTAP temperatures

Date to be executed 26.10.05	**Time to be executed** UTC	Local	**Test Phase:** TP 5 **Test step:** B
Executed Date: 27:10:05 local	**Executed Time:** UTC 23:00 26-10-05	Local 01:00	**Sign.:**

Approval:

Shift Leader

PA

ORS 36

Heater currents to be applied for fixed current mode: 26.10.2005 / 23:00 UTC

1.0475	S - TTAP_01_pY
0.8476	S - TTAP_02_pZ
0.9455	S - TTAP_03_mY
1.0225	S - TTAP_04_mZ
1.0475	S - TTAP_19_pY-redundant
0.8476	S - TTAP_20_pZ-redundant
0.9455	S - TTAP_21_mY-redundant
1.0225	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 37

Title: Change TTAP Heater current settings

From

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please change the TTAP heater current settings according to the attached table.

Reason: To control TTAP at 273 ± 1 K

Date to be executed 26.10.05	**Time to be executed** UTC 23:40	Local	**Test Phase:** TP5 **Test step:** B
Executed Date: 27-10-05 Local	**Executed Time:** UTC 23:42	Local 01:42	**Sign.:**

Approval:

Shift Leader **PA**

Annex to ORS 37

Heater currents to be applied for fixed current mode: 26.10.2005 / 23:~~2~~45 UTC

1.100	S - TTAP_01_pY
0.890	S - TTAP_02_pZ
0.993	S - TTAP_03_mY
1.074	S - TTAP_04_mZ
1.100	S - TTAP_19_pY-redundant
0.890	S - TTAP_20_pZ-redundant
0.993	S - TTAP_21_mY-redundant
1.074	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 38

Title: Change TTAP Heater current setting

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please change the TTAP heater current settings according to the attached table

Reason: To control TTAP at 273 ± 1 K

Date to be executed 27.10.05	**Time to be executed** UTC 00:15	Local	**Test Phase:** TP5 **Test step:** B
Executed Date: 27-10-05 Local	**Executed Time:** UTC 00:09	Local 02:09	**Sign.:**

Approval:

Shift Leader **PA**

Annex to OSR 38

Heater currents to be applied for fixed current mode: 27.10.2005 / 00:15 UTC

1.133	S - TTAP_01_pY
0.979	S - TTAP_02_pZ
1.023	S - TTAP_03_mY
1.106	S - TTAP_04_mZ
1.133	S - TTAP_19_pY-redundant
0.979	S - TTAP_20_pZ-redundant
1.023	S - TTAP_21_mY-redundant
1.106	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 33

Title: Change TTAP Heater current settings

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ .... ☒ Data Handling

Action:

Please change the TTAP heater current settings according to the attached table.

Reason: To control the TTAP at 273±1 K

Date to be executed 27.10.05	**Time to be executed** UTC 01:15	Local	**Test Phase:** **Test step:**
Executed Date: 27-10-05	**Executed Time:** UTC 01:05	Local 03:05	**Sign.:**

Approval:

Shift Leader **PA**

Annex to OSR 39

Heater currents to be applied for fixed current mode: 27.10.2005 / 01:15 UTC

1.190	S - TTAP_01_pY
1.273	S - TTAP_02_pZ
1.074	S - TTAP_03_mY
1.161	S - TTAP_04_mZ
1.190	S - TTAP_19_pY-redundant
1.273	S - TTAP_20_pZ-redundant
1.074	S - TTAP_21_mY-redundant
1.161	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 40

Title: Change TTAP Heater current settings

From

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please increase the TTAP heater power settings according to the attached table

Reason: To control the TTAP at 273 ±1 K

Date to be executed 27.10.05	**Time to be executed** UTC 03:00	Local	**Test Phase:** **Test step:**
Executed Date: 27-10-05	**Executed Time:** UTC 03:01	Local 05:01	**Sign.:**

Approval:

Shift Leader **PA**

Annex to ORS 40

Heater currents to be applied for fixed current mode: 27.10.2005 / 03:00 UTC

1.273	S - TTAP_01_pY
1.425	S - TTAP_02_pZ
1.149	S - TTAP_03_mY
1.242	S - TTAP_04_mZ
1.273	S - TTAP_19_pY-redundant
1.425	S - TTAP_20_pZ-redundant
1.149	S - TTAP_21_mY-redundant
1.242	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 41

Title: Change TTAP Heater current settings

From

☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To

☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please adjust the TTAP heater current settings according to the attached table

Reason: To control TTAP at 273±1 K

Date to be executed 27.10.05	**Time to be executed** UTC 07:00	Local 07:00	**Test Phase:** **Test step:**
Executed Date: 27.10.05	**Executed Time:** UTC	Local 7:02	**Sign.:**

Approval:

Shift Leader PA

Annex to O&RS 41

Heater currents to be applied for fixed current mode: 27.10.2005 / 0~~7~~5:00 UTC

1.336	S - TTAP_01_pY
1.283	S - TTAP_02_pZ
1.206	S - TTAP_03_mY
1.329	S - TTAP_04_mZ
1.336	S - TTAP_19_pY-redundant
1.283	S - TTAP_20_pZ-redundant
1.206	S - TTAP_21_mY-redundant
1.329	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 42

Title: Change TTAP Heater Current Settings

From

☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ …………….. ☐ Data Handling

Name:

To

☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ ……………. ☒ Data Handling

Action:

Please adjust the TTAP heater current settings according to the attached table

Reason: To control TTAP at 273 ± 1K

Date to be executed 27.10.05	**Time to be executed** UTC 7:25	Local 9:25	**Test Phase:** TP-5 **Test step:**
Executed Date: 27-10.05	**Executed Time:** UTC	Local 9:26	**Sign.:** U. Wagner

Approval:
Shift Leader

PA

ORS #42

Heater currents to be applied for fixed current mode: 27.10.2005 / 07:25 UTC

1.203	S - TTAP_01_pY
1.283	S - TTAP_02_pZ
1.086	S - TTAP_03_mY
1.196	S - TTAP_04_mZ
1.203	S - TTAP_19_pY-redundant
1.283	S - TTAP_20_pZ-redundant
1.086	S - TTAP_21_mY-redundant
1.196	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 43

Title: Change TTAP Heater Current Settings

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ ……………… ☐ Data Handling

Name:

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ ……………… ☒ Data Handling

Action:

Please adjust the TTAP heater current settings according to the attached table.

Reason: To control TTAP at 273 ± 1K

Date to be executed 27.10.05	**Time to be executed** UTC 09:20	Local 11:20	**Test Phase:** TP-5 **Test step:**
Executed Date: 27-10.05	**Executed Time:** UTC	Local 11:24	**Sign.:**

Approval:
Shift Leader **PA**

Annex sheet to ORS No. 43

Heater currents to be applied for fixed current mode: 27.10.2005 / 09:20 UTC

1.239	S - TTAP_01_pY
1.193	S - TTAP_02_pZ
1.118	S - TTAP_03_mY
1.232	S - TTAP_04_mZ
1.239	S - TTAP_19_pY-redundant
1.193	S - TTAP_20_pZ-redundant
1.118	S - TTAP_21_mY-redundant
1.232	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 44

Title:

From ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please change the TTAP Heater current settings according to the attached table (only small reductions -1% - 2%)

Reason: To stabilize TTAP temperatures

Date to be executed 27.10.05	**Time to be executed** UTC 23:15 Local	**Test Phase:** **Test step:**
Executed Date: 28-10-05 Local	**Executed Time:** UTC 23:15 Local 01:15	**Sign.:**

Approval:

Shift Leader **PA**

Annex sheet to ORS No 44

Heater currents to be applied for fixed current mode: 27.10.2005 / 23:~~00~~15 UTC

1.214	S - TTAP_01_pY
1.169	S - TTAP_02_pZ
1.118	S - TTAP_03_mY
1.220	S - TTAP_04_mZ
1.214	S - TTAP_19_pY-redundant
1.169	S - TTAP_20_pZ-redundant
1.118	S - TTAP_21_mY-redundant
1.220	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 45

Title: Start TP6 - TV2

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shiftleader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Start Test Phase TP6 - TV2

Reason:

Date to be executed 29.10.05	**Time to be executed** UTC 19^{30}	Local 21^{30}	**Test Phase:** TP6 **Test step:** TV2
Executed Date: 29.10.05	**Executed Time:** UTC	Local 21:52	**Sign.:**

Approval:

Shift Leader

PA D. Balogh

OPERATION REQUEST SHEET

No.: 46

Title: Start TP7 -TB2

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. John

To
☐ Thermal ☒ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Start next test phase: TP7 - TB2

Keep TTAP and LSS-TCR settings as defined for previous phase, change only on separate ORS!

Reason:

Date to be executed 31.10.2005	**Time to be executed** UTC 21:15	Local 22:15	**Test Phase:** TP7 **Test step:**
Executed Date: 31-10-05	**Executed Time:** UTC 21:16	Local 22:16	**Sign.:**

Approval:
Shift Leader **PA** B Balage

OPERATION REQUEST SHEET

No.: 47

Title: Tilt S/C to 16°

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. John

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:

Tilt S/C to 16°, speed 1°/min

Reason:

Date to be executed 31.10.05	**Time to be executed** UTC 23:40	Local 0:40 (1.11.05)	**Test Phase:** TP 7 **Test step:**
Executed Date:	**Executed Time:** UTC	Local 00:55	**Sign.:** Fyrnou

Approval:

Shift Leader | **PA**

OPERATION REQUEST SHEET

No.: 48

Title: Switch on LOU heaters

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Activate test heaters in thermostatic control mode:

Ω	Name	Power/W	Current/A	switch on/K	off/K
11.91	LOU_16_rad_lower	20	1.296	130	135
11.91	LOU_17_rad_upper	20	1.296	130	135

Control sensor 2321

Reason: Boost heating for LOU before IRRig warm-up

Date to be executed 01.11.05

Time to be executed UTC 01:40 Local

Test Phase: TP7

Test step: A

Executed Date: 1-11-05

Executed Time: UTC 01:41 Local 02:41

Sign.:

Approval:

Shift Leader

PA

OPERATION REQUEST SHEET

No.: 49

Title: Change LOU Heater Current settings

From

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please change the power settings of the following heater circuits:

LOU_16_vad_lower: 1.421 A

LOU_17_vad_upper: 1.421 A

Reason: To achieve a heater power $R_{HTR} \cdot J^2_{measured}$ of 20W

Date to be executed 01.11.05	**Time to be executed** UTC	Local	**Test Phase:** TP7 **Test step:** A
Executed Date: 1-11-05	**Executed Time:** UTC 02:32	Local 03:32	**Sign.:**

Approval:

Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 50

Title: Change TTAP and IRRIG Heater Control

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
1, Please activate the TTAP heater control again at a temperature of 273K ± 1K (0°C ± 1K). The currents of the heater circuits TTAP_01, TTAP_02, TTAP_03, TTAP_04 and TTAP_19, TTAP_20, TTAP_21, TTAP_22 shall be limited to 1,3 A corresponding to P_{HTR} = 20W.

2. Change the IRRIG heater control to 20°C ± 0,5 K
The currents of the circuits IRRIG-23 ... IRRIG_34 shall be limited to 1,580 A corresponding to P_{HTR} = 100W.
The current of the support rig heater circuit IRRIG-63 shall be limited to 2.03 A (60 W)

Reason: To adjust TP-7 heater settings and elevate the TTAP and IRRIG temperature level.

Date to be executed 01.11.2005	**Time to be executed** UTC	Local	**Test Phase:** **Test step:**
Executed Date: 1-11-2005	**Executed Time:** UTC	Local 7:44	**Sign.:** J.A.

Approval:

Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 51

Title: Change IR Rig and IR Rig Support heater power

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name:

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

1. Please change the currents of the circuits IRRIG_23 ... IRRIG_34 to 1,12 A corresponding to P_{HTR} = 50W
2. Please change the current of the circuit IRRIG_63 to 2,49 A corresponding to P_{HTR} = 90 W.

Reason: Avoid large differences between Rig and Support during transient heating to 293K.

Date to be executed 1.11.2005	**Time to be executed** UTC 7:35	Local 8:35	**Test Phase:** **Test step:**
Executed Date: 1-11-2005	**Executed Time:** UTC	Local 8.40	**Sign.:** JA

Approval:
Shift Leader
PA

OPERATION REQUEST SHEET

No.: 52

Title: Set fixed current settings for TTAP Heaters

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Set TTAP Heater current settings to constant values according to attached table

Reason:

Date to be executed 01.11.05	**Time to be executed** UTC 1445	Local 15 45	**Test Phase:** **Test step:**
Executed Date: 01-11-05	**Executed Time:** UTC 14:45	Local 15:45	**Sign.:**

Approval:

Shift Leader | **PA** B. Balage

Annex sheet to ORS No ~~44~~ 52

Heater currents to be applied for fixed current mode: 01. 11. 05, 14^{45} UTC

1.214	S - TTAP_01_pY
1.169	S - TTAP_02_pZ
1.118	S - TTAP_03_mY
1.220	S - TTAP_04_mZ
1.214	S - TTAP_19_pY-redundant
1.169	S - TTAP_20_pZ-redundant
1.118	S - TTAP_21_mY-redundant
1.220	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 53

Title: Remove TC1107 from CVV average (TC1900)

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Remove TC 1107 from average calculation formula for CVV temperature : TC 1900

Reason:

TC 1107 is located on the LOA and not on the CVV

Date to be executed 01.11.05

Time to be executed UTC 15^{35} Local 16^{35}

Test Phase:

Test step:

Executed Date: 01.11.05

Executed Time: UTC Local 16:30

Sign.:

Approval:

Shift Leader

PA D. Barlage

OPERATION REQUEST SHEET

No.: 54

Title: Switch-off LOU_16 and LOU_17

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Switch-off LOU_16 and LOU_14 Heater Circuits

Reason:
LOU is controlled by the MTD Heaters only

Date to be executed	Time to be executed		Test Phase:
01.11.05	UTC	Local	Test step:
Executed Date:	**Executed Time:**		**Sign.:**
01.11.05	UTC	Local 20:38	

Approval:

Shift Leader A Hauser | **PA** B. Dalorgh

OPERATION REQUEST SHEET

No.: 55

Title: Switch on CVV Heater Circuits

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: G. Jahn

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Switch on CVV heater circuits acc. to attached list

Reason:
Accelerate CVV warm-up to the TBL Temperature level

Date to be executed 02.11.05	**Time to be executed** UTC 18:10	Local 19:10	**Test Phase:** TP7 **Test step:**
Executed Date: 02/11/2005	**Executed Time:** UTC	Local 19h07	**Sign.:**

Approval:
Shift Leader

PA B. Balage

Annex to ORS 55			
		02.11.2005 18:00	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	0.93	7.2
CVV_35_LB-pY	35	0.93	7.2
CVV_06_LC-pZ	6	0.78	6.4
CVV_07_UC-pZ	7	0.78	6.4
CVV_08_UB-mZ	8	0.62	4.8
CVV_09_Rad-lower-mY	9	0.80	8
CVV_10_Rad-upper-mY	10	1.00	10
CVV_11_Rad-lower-mZ	11	0.80	8
CVV_12_Rad-upper-mZ	12	1.40	14
CVV_13_Rad-lower-pY	13	0.80	8
CVV_14_Rad-upper-pY	14	1.00	10

OPERATION REQUEST SHEET

No.: 56

Title: Switch off CVV heaters

From ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. Jahn

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Switch off the heaters on the CVV; circuit numbers
5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 35

Reason:

Date to be executed 02.11.05	**Time to be executed** immediately UTC	Local	**Test Phase:** TP 7-8 **Test step:**
Executed Date: 02/11/05	**Executed Time:** UTC	Local 19h42	**Sign.:**

Approval:

Shift Leader **PA** D. Dalage

OPERATION REQUEST SHEET	**No.:** 57

Title: Adjust TTAP Heater Current

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please adjust TTAP heater current settings to the values attached.

Reason: Control TTAP at 273 K.

Date to be executed 2.11.05	**Time to be executed** UTC 20 25	Local 21 25	**Test Phase:** **Test step:**
Executed Date: 2.11.05	**Executed Time:** UTC	Local 21:20	**Sign.:**

Approval:
Shift Leader A. Hauser | **PA** D. Balogh

Annex sheet to ORS No 57

Heater currents to be applied for fixed current mode: 02.11.2005 / 20:

1.196	A	S - TTAP_01_pY
1.157	A	S - TTAP_02_pZ
1.107	A	S - TTAP_03_mY
1.214	A	S - TTAP_04_mZ
1.196	A	S - TTAP_19_pY-redundant
1.157	A	S - TTAP_20_pZ-redundant
1.107	A	S - TTAP_21_mY-redundant
1.214	A	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 58

Title: Adjust TTAP Heater Current

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ ……………… ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ ……………… ☒ Data Handling

Action:

Adjust TTAP Heater circuit settings to the Values attached.

Reason: Control TTAP at 273 K

Date to be executed 3.11.05	**Time to be executed** UTC 17:30	Local	**Test Phase:** **Test step:**
Executed Date: 3/11/05	**Executed Time:** UTC W. Baumann	Local 18h30	**Sign.:**

Approval:

Shift Leader

PA

Annex sheet to ORS No 58

Heater currents to be applied for fixed current mode: 03.11.2005 /17:30

1.190	S - TTAP_01_pY
1.146	S - TTAP_02_pZ
1.100	S - TTAP_03_mY
1.208	S - TTAP_04_mZ
1.190	S - TTAP_19_pY-redundant
1.146	S - TTAP_20_pZ-redundant
1.100	S - TTAP_21_mY-redundant
1.208	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 59

Title: Tilt S/C to 0°

From ☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name:

To ☐ Thermal ☐ SCOE ☒ LSS Control

☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:
Tilt S/C to 0° speed 1°/min

Reason:

Date to be executed 051105	**Time to be executed** UTC 14^{10}	Local	**Test Phase:** TP7 **Test step:** PVS 21
Executed Date: 05/11/2005	**Executed Time:** UTC	Local $12^{h}19$	**Sign.:**

Approval:
Shift Leader

PA

OPERATION REQUEST SHEET

No.: 60

Title: Start TP8

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Start test phase TP8 (warm-up)

Switch on CVV Heater Circuits acc. to attached List
and Control Temperature at 200K ± 3K -73° ±

Switch on LOU Heater Circuits acc. to attached List
and Control Temperature at 230K ± 3K

-43° ±

Reason:

Date to be executed 05.11.05	**Time to be executed** UTC 19:36	Local 20:36	**Test Phase:** TP8 **Test step:**
Executed Date: 05-11-05	**Executed Time:** UTC 20:05	Local 21:05	**Sign.:**

Approval:
Shift Leader **PA**

Annex to ORS 60			
		05.11.2005 19:50	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	2.54	54
CVV_35_LB-pY	35	2.54	54
CVV_06_LC-pZ	6	2.15	48
CVV_07_UC-pZ	7	2.15	48
CVV_08_UB-mZ	8	1.69	36
CVV_09_Rad-lower-mY	9	2.19	60
CVV_10_Rad-upper-mY	10	2.74	75
CVV_11_Rad-lower-mZ	11	2.19	60
CVV_12_Rad-upper-mZ	12	3.84	105
CVV_13_Rad-lower-pY	13	2.19	60
CVV_14_Rad-upper-pY	14	2.74	75
CVV_15_UB-HSIF-mZ	15	2.19	60
LOU_16_rad-lower	16	2.74	75
LOU_17_rad-upper	17	2.74	75

OPERATION REQUEST SHEET

No.: 61

Title: Change CVV Heater Power

From ☒ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Change CVV Heater Power acc. to attached list

Reason:

Limit Gradients within CVV

Date to be executed 05-11-05	**Time to be executed** UTC 20:40	Local 21:40	**Test Phase:** **Test step:**
Executed Date: 05-11-05	**Executed Time:** UTC 20:52	Local 21:52	**Sign.:**

Approval:

Shift Leader **PA**

Annex to ORS 61			
		05.11.2005 20:40	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	2.93	72
CVV_35_LB-pY	35	2.93	72
CVV_06_LC-pZ	6	2.48	64
CVV_07_UC-pZ	7	2.48	64
CVV_08_UB-mZ	8	1.95	48
CVV_09_Rad-lower-mY	9	2.53	80
CVV_10_Rad-upper-mY	10	3.17	100
CVV_11_Rad-lower-mZ	11	2.53	80
CVV_12_Rad-upper-mZ	12	3.50	87.5
CVV_13_Rad-lower-pY	13	2.53	80
CVV_14_Rad-upper-pY	14	3.17	100
CVV_15_UB-HSIF-mZ	15	2.19	60
LOU_16_rad-lower	16	3.17	100
LOU_17_rad-upper	17	3.17	100

OPERATION REQUEST SHEET

No.: 62

Title: Increase of CVV Test Heater Current

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Please increase the current settings of the TTAP and CVV Test heaters according to the attached table

Reason: To accelerate warm-up

Date to be executed 06.11.05	**Time to be executed** UTC 00:30	Local	**Test Phase:** TP8 **Test step:** A
Executed Date: 6-11-05	**Executed Time:** UTC 00:40	Local 01:40	**Sign.:**

Approval:
Shift Leader Jürgen ...
PA

Annex sheet to ORS No 62

Heater currents to be applied for fixed current mode: 06.11.05 □UTC 00:30

1.785	S - TTAP_01_pY
1.719	S - TTAP_02_pZ
1.652	S - TTAP_03_mY
1.812	S - TTAP_04_mZ
1.785	S - TTAP_19_pY-redundant
1.719	S - TTAP_20_pZ-redundant
1.652	S - TTAP_21_mY-redundant
1.812	S - TTAP_22_mZ-redundant

01:32 GMT+1
local

Annex to ORS 62			
		06/11/2005 00:27	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	3.11	81
CVV_35_LB-pY	35	3.11	81
CVV_06_LC-pZ	6	2.77	80
CVV_07_UC-pZ	7	2.63	72
CVV_08_UB-mZ	8	2.07	54
CVV_09_Rad-lower-mY	9	2.69	90
CVV_10_Rad-upper-mY	10	3.36	112.5
CVV_11_Rad-lower-mZ	11	2.69	90
CVV_12_Rad-upper-mZ	12	3.64	94.5
CVV_13_Rad-lower-pY	13	2.69	90
CVV_14_Rad-upper-pY	14	3.36	112.5
CVV_15_UB-HSIF-mZ	15	2.33	67.5
LOU_16_rad-lower	16	3.17	100
LOU_17_rad-upper	17	3.17	100

01:40 GMT+1
Local

OPERATION REQUEST SHEET

No.: 63

Title: Decrease TTAP Heater Power / Current

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name:

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please derease the current settings of the TTAP heaters according to the attached table.
and control at 30 °C ± 1K   ok @ 20h18
7/11/2005

Reason: To limit test harness temperature

Date to be executed 6.11.05	**Time to be executed** UTC 9:10	Local 10:10	**Test Phase:** TP 8 **Test step:**
Executed Date: 6-11-05	**Executed Time:** UTC	Local 10:28	**Sign.:** J.A.

Approval:
Shift Leader

PA

Annex sheet to ORS No 63

Heater currents to be applied for fixed current mode: 06.11.05 □UTC 09:10

1.606352	S - TTAP_01_pY
1.546958	S - TTAP_02_pZ
1.486968	S - TTAP_03_mY
1.63059	S - TTAP_04_mZ
1.606352	S - TTAP_19_pY-redundant
1.546958	S - TTAP_20_pZ-redundant
1.486968	S - TTAP_21_mY-redundant
1.63059	S - TTAP_22_mZ-redundant

OPERATION REQUEST SHEET

No.: 64

Title: Continue heating of CVV

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: Langfermann

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Switch off heater control of CVV
and keep heater power acc. ORS 60

Reason:

Date to be executed 061105	**Time to be executed** UTC 11^{30}	Local 12^{30}	**Test Phase:** **Test step:**
Executed Date: 6-11-05	**Executed Time:** UTC	Local 12:44	**Sign.:** JA

Approval:
Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 65

Title: Increase CVV and LOU Heater Current

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Increase CVV Heater Circuits acc. to attached List
and Control temperature at 298K ± 2K (25°C)
~~the~~ Control LOU at 290K ± 2K (17°C) with
currents as listed in the attached table

Reason:
Accelerate Warm-Up

Date to be executed	Time to be executed UTC	Local	Test Phase: Test step:
6.11.05			
Executed Date:	**Executed Time:** UTC	Local	**Sign.:**
6/11/05		16h08	W. Baumann

Approval:
Shift Leader **PA** R.

Annex to ORS 65

06/11/2005 14:50

Circuit name	Circuit number	Current [A]	Power [W]	
CVV_05_LB-mY	5	2.83	67.5	✓
CVV_35_LB-pY	35	2.83	67.5	✓
CVV_06_LC-pZ	6	2.56	68	✓
CVV_07_UC-pZ	7	2.40	60	✓
CVV_08_UB-mZ	8	1.89	45	✓
CVV_09_Rad-lower-mY	9	2.45	75	✓
CVV_10_Rad-upper-mY	10	3.06	93.75	✓
CVV_11_Rad-lower-mZ	11	2.45	75	✓
CVV_12_Rad-upper-mZ	12	4.29	131.25	✓
CVV_13_Rad-lower-pY	13	2.45	75	✓
CVV_14_Rad-upper-pY	14	3.06	93.75	✓
CVV_15_UB-HSIF-mZ	15	2.45	75	✓
LOU_16_rad-lower	16	3.17	100	✓
LOU_17_rad-upper	17	3.17	100	✓
			1126.75	

ANNEX 2 to ORS65

#Name	Maximum<	Maximum<	Control mo	Fixed 	Thermosta	Thermosta	Thermosta	Thermosta	Thermosta	Thermosta	Thermosta	Thermostatic Lo	
#													
CVV_05_L	32.8	3.68	Fixed curre	2.83	0	0	3.11	3.11	-70	-72.5	-73.5	-110	
CVV_06_L	40.16	2.97	Fixed curre	2.56	0	0	2.77	2.77	-70	-72.5	-73.5	-110	
CVV_07_U	39.13	2.97	Fixed curre	2.4	0	0	2.63	2.63	-70	-72.5	-73.5	-110	
CVV_08_U	39.14	2.45	Fixed curre	1.89	0	0	2.07	2.07	-70	-72.5	-73.5	-110	
CVV_09_R	48.81	3.1	Fixed curre	2.45	0	0	2.69	2.69	-70	-72.5	-73.5	-76	
CVV_10_R	48.28	3.88	Fixed curre	3.06	0	0	3.36	3.36	-70	-72.5	-73.5	-76	
CVV_11_R	47.78	3.1	Fixed curre	2.45	0	0	2.69	2.69	-70	-72.5	-73.5	-110	
CVV_12_R	48.27	5.43	Fixed curre	4.29	0	0	3.64	3.64	-70	-72.5	-73.5	-110	
CVV_13_R	47.78	3.1	Fixed curre	2.45	0	0	2.69	2.69	-70	-72.5	-73.5	-110	
CVV_14_R	48.56	3.88	Fixed curre	3.06	0	0	3.36	3.36	-70	-72.5	-73.5	-76	
CVV_15_U	48.43	3.1	Fixed curre	2.45	0	0	2.33	2.33	-70	-72.5	-73.5	-76	
CVV_35_L	38.4	3.68	Fixed curre	2.83	0	0	3.11	3.11	-70	-72.5	-73.5	-76	
LOU_16_ra	48.36	3.88	Thermosta	2.74	1.2	1.4	1.9	3.17	19	17.5	16.5	16	
LOU_17_ra	48.48	3.88	Thermosta	2.74	1.2	1.4	1.9	3.17	19	17.5	16.5	16	

OPERATION REQUEST SHEET

No.: 66

Title: Increase IR Rig Temperatures

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: Hansen

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Control IR Rig Heater Circuits H_26, H_27 and H_28
to 35°C ± 1 K with 1.5 A [91 W]
Control IR Rig Heater Circuits H_29, H_30 and H_31
to 50°C ± 1 K with 1.5 A [91 W]
Control IR Rig Heater Circuits H_32, H_33 and H_34
to 65°C ± 1 K with 1.5 A, [92 W]

Reason:
Increase Telescope MTD temperature

Date to be executed 6.11.05	**Time to be executed** UTC	Local 16²³	**Test Phase:** **Test step:**
Executed Date: 6/11/2005	**Executed Time:** UTC	Local 16h23	**Sign.:** W. Baumann

Approval:
Shift Leader **PA**

ANNEX to ORS66

#Name	Maximum<	Maximum<	Control mo	Fixed 	Thermosta	Thermosta	Thermosta	Thermosta	Thermosta	Thermosta	Thermosta	Thermostatic Low	
#													
IRRIG_26_	75.37	1.73	Thermosta	0	0	0.71	1.5	1.6	36	35.5	19.5	19	
IRRIG_29_	75.92	1.73	Thermosta	0	0	0.73	1.5	1.6	51	50.5	19.5	19	
IRRIG_31_	74.83	1.73	Thermosta	0	0	0.8	1.5	1.6	51	50.5	19.5	19	
IRRIG_34_	77.11	1.73	Thermosta	0	0	0.85	1.5	1.6	66	65.5	20	19	
IRRIG_24_	75.69	1.73	Thermosta	0	0	0.78	0.85	1.12	21	20.5	19.5	19	
IRRIG_27_	75.15	1.73	Thermosta	0	0	0.75	1.5	1.6	36	35.5	19.5	19	
IRRIG_28_	75.18	1.73	Thermosta	0	0	0.78	1.5	1.6	36	35.5	19.5	19	
IRRIG_30_	75.57	1.73	Thermosta	0	0	0.71	1.5	1.6	51	50.5	19.5	19	
IRRIG_32_	76	1.73	Thermosta	0	0	0.89	1.5	1.6	66	65.5	19.5	19	
IRRIG_33_	76.35	1.73	Thermosta	0	0	0.85	1.5	1.6	66	65.5	19.5	19	

OPERATION REQUEST SHEET

No.: 67

Title: Define virtual Sensor for minimum temperature

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name:

To ☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:

Define Sensor 1902 acc. to attached list

Reason:

Date to be executed 6.11.05	**Time to be executed** UTC $21^{\underline{10}}$	Local $22^{\underline{10}}$	**Test Phase:** TP8 **Test step:** B
Executed Date: 6.11.05	**Executed Time:** UTC	Local 22.10	**Sign.:**

Approval:
Shift Leader A. Dauser
PA

ANNEX to ORS 67

Minimum temperature sensor selection for external structure

#Name	Number	Formula	Presentation format	Conversion	Compensation sensdef	Unit	User groups
#							
Ext_struct_minimum	1901	min(#1000,#1001,#1002,#1003,#1004,#1005,#1006,#1007,#1008,#1009,#1100,#1101,#1102,#1103,#1104,#1105,#1106,#1107,#1108,#1109,#1200,#1201,#1202,#1203,#1204,#1205,#1300,#1301,#1302,#2001,#2002,#2003,#2004,#2011,#2012,#2013,#2014,#2101,#2102,#2103,#2104,#2105,#2111,#2112,#2113,#2201,#2202,#2203,#2204,#2211,#2212,#2213,#2214,#2300,#2301,#2302,#2303,#2304,#2310,#2320,#2321,#2403,#2404,#2413,#2414,#2501,#2502,#2503,#2600,#2601,#2602,#2610,#2611,#2620,#2621,#2622,#2630,#2631,#2632,#2640,#2641,#2642,#2701,#2702,#3240,#3241,#3242,#3243,#3260,#3261,#3262,#3263,#3330,#3331,#3332,#3333,#3360,#3361,#3362,#3363,#3380,#3381,#3382,#3383,#3410,#3411,#3412,#3413,#3440,#3441,#3442,#3443,#4001,#4002,#4010,#4011,#4012,#4020,#4021,#4022,#6800,#6801,#6820,#6821,#6830,#6831)	Natural 1 digit	(None)	(None)	K	Customer PC, General PC, Herschel
External_Structure_Min1	1902	Min(#1000,#1001,#1002,#1003,#1004,#1005,#1006,#1007,#1008,#1009,#1101,#1102,#1103,#1104,#1105,#1106,#1107,#1107,#1108,#1109,#1200,#1201,#1202,#1203,#1204,#1205,#1300,#1301,#1302,#2001,#2002,#2003,#2004,#2011,#2012,#2013,#2014,#2101,#2102,#2103,#2104,#2105,#2111,#2112,#2113,#2201,#2202,#2203,#2204,#2211,#2212,#2213,#2214,#2300,#2301,#2302,#2303,#2304,#2310,#2320,#2321,#2403,#2404,#2413,#2414,#2501,#2502,#2503,#2600,#2601,#2602,#2610,#2611)	Natural 2 digits	(None)	(None)	K	Customer PC, General PC, Herschel
External_Structure_Min2	1903	Min(#2620,#2621,#2622,#2630,#2631,#2632,#2640,#2641,#2642,#2701,#2702,#3240,#3241,#3242,#3243,#3260,#3261,#3262,#3263,#3330,#3331,#3332,#3333,#3360,#3361,#3362,#3363,#3380,#3381,#3382,#3383,#3410,#3411,#3412,#3413,#3440,#3441,#3442,#3443,#4001,#4002,#4010,#4011,#4012,#4020,#4021,#4022,#6800,#6801,#6820,#6821,#6830,#6831)	Natural 2 digits	(None)	(None)	K	Customer PC, General PC, Herschel
External_Structure_Min3	1904	#1902-293.15	Natural 2 digits	(None)	(None)	°C	Customer PC, General PC, Herschel

Jacob van der Meulen

Date: 06-11-2005

OPERATION REQUEST SHEET

No.: 68

Title: Start LSS shrouds warm up

From

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. Jahn

To

☐ Thermal ☐ SCOE ☒ LSS Control

☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:

Start warm-up of LSS shrouds.

Control shrouds temperatures always

at least 20 K below virtual sensor #1902,

"External_Structure_Min1"

Reason: SVM-TS, Telescope MS, PLM-SVM-struts not used in minimum 'determination' to enable LSS warm-up

Date to be executed 6.11.05	**Time to be executed** UTC 16:05	Local 17:05	**Test Phase:** TP8 **Test step:**
Executed Date:	**Executed Time:** UTC	Local 3:30 6-11-05	**Sign.:**

Approval:

Shift Leader

PA

OPERATION REQUEST SHEET

No.: 69

Title: Reduce CVV Heater Currents

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Reduce CVV Heater Currents to the Values attached

Reason:

Temperature of Heater Harness too high

Date to be executed 6.11.05	**Time to be executed** UTC	Local 19⁰⁵	**Test Phase:** TP8 **Test step:** B
Executed Date: 6/11/2005	**Executed Time:** UTC	Local 19h05	**Sign.:** W Baumann

Approval:

Shift Leader A. Hauser **PA** B. Balage

Annex to ORS 69

06/11/2005 17:56

Circuit name	Circuit number	Current [A]	Power [W]
CVV_05_LB-mY	5	2.64	58.5
CVV_35_LB-pY	35	2.64	58.5
CVV_06_LC-pZ	6	2.24	52
CVV_07_UC-pZ	7	2.24	52
CVV_08_UB-mZ	8	1.76	39
CVV_09_Rad-lower-mY	9	2.28	65
CVV_10_Rad-upper-mY	10	2.85	81.25
CVV_11_Rad-lower-mZ	11	2.28	65
CVV_12_Rad-upper-mZ	12	3.99	113.75
CVV_13_Rad-lower-pY	13	2.28	65
CVV_14_Rad-upper-pY	14	2.85	81.25
CVV_15_UB-HSIF-mZ	15	2.28	65
LOU_16_rad-lower	16	3.17	100
LOU_17_rad-upper	17	3.17	100
			996.25

ANNEX 2 to ORS 69

#Name	Maximum<	Maximum<	Control mo	Fixed 	Thermosta	Thermosta	Thermosta	Thermosta	Thermosta	Thermosta	Thermosta	Thermostatic Lov	
#													
CVV_05_L	32.8	3.68	Fixed curre	2.64	0	0	3.11	3.11	28	27	-73.5	-110	
CVV_06_L	40.16	2.97	Fixed curre	2.24	0	0	2.77	2.77	-70	-72.5	-73.5	-110	
CVV_07_U	39.13	2.97	Fixed curre	2.24	0	0	2.63	2.63	-70	-72.5	-73.5	-110	
CVV_08_U	39.14	2.45	Fixed curre	1.76	0	0	2.07	2.07	-70	-72.5	-73.5	-110	
CVV_09_R	48.81	3.1	Fixed curre	2.28	0	0	2.69	2.69	-70	-72.5	-73.5	-76	
CVV_10_R	48.28	3.88	Fixed curre	2.85	0	0	3.36	3.36	-70	-72.5	-73.5	-76	
CVV_11_R	47.78	3.1	Fixed curre	2.28	0	0	2.69	2.69	-70	-72.5	-73.5	-110	
CVV_12_R	48.27	5.43	Fixed curre	3.99	0	0	3.64	3.64	-70	-72.5	-73.5	-110	
CVV_13_R	47.78	3.1	Fixed curre	2.28	0	0	2.69	2.69	-70	-72.5	-73.5	-110	
CVV_14_R	48.56	3.88	Fixed curre	2.85	0	0	3.36	3.36	-70	-72.5	-73.5	-76	
CVV_15_U	48.43	3.1	Fixed curre	2.28	0	0	2.33	2.33	-70	-72.5	-73.5	-76	
CVV_35_L	38.4	3.68	Fixed curre	2.64	0	0	3.11	3.11	-70	-72.5	-73.5	-76	
LOU_16_ra	48.36	3.88	Thermosta	2.74	1.2	1.4	3.17	3.17	19	17.5	16.5	-26	
LOU_17_ra	48.48	3.88	Thermosta	2.74	1.2	1.4	3.17	3.17	19	17.5	16.5	-26	

OPERATION REQUEST SHEET

No.: 70

Title: Reduce CVV Heater Currents

From
☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Reduce CVV Heater Currents to the Values attached

Reason:

Harness Temperature too high

Date to be executed 6.11.05	**Time to be executed** UTC	Local	**Test Phase:** TP8 **Test step:** B
Executed Date: 6/11/2005	**Executed Time:** UTC	Local 19h44	**Sign.:** W. Baumann

Approval:
Shift Leader A. Hauser
PA B. Balonge

Annex to ORS 70			
		06/11/2005 18:34	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	2.43	49.5
CVV_35_LB-pY	35	2.43	49.5
CVV_06_LC-pZ	6	2.06	44
CVV_07_UC-pZ	7	2.06	44
CVV_08_UB-mZ	8	1.62	33
CVV_09_Rad-lower-mY	9	2.10	55
CVV_10_Rad-upper-mY	10	2.62	68.75
CVV_11_Rad-lower-mZ	11	2.10	55
CVV_12_Rad-upper-mZ	12	3.50	87.5
CVV_13_Rad-lower-pY	13	2.10	55
CVV_14_Rad-upper-pY	14	2.62	68.75
CVV_15_UB-HSIF-mZ	15	2.10	55
LOU_16_rad-lower	16	3.17	100
LOU_17_rad-upper	17	3.17	100
			865

OPERATION REQUEST SHEET

No.: 71

Title: Change of CVV Heater Current Settings

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Please change the CVV heater current settings
according to the attached table
(increase from 665 W to 797 W CVV HTR power)

Reason: To accelerate warm-up

Date to be executed 06.11.2005	**Time to be executed** UTC 23:15 Local	**Test Phase:** TP8 **Test step:** B
Executed Date: 07.11.2005	**Executed Time:** UTC Local 0:15 ~~24:15~~	**Sign.:**

Approval:
Shift Leader Jürgen
PA

Annex to ORS 71

06/11/2005 22:57

Circuit name	Circuit number	Current [A]	Power [W]
CVV_05_LB-mY	5	2.43	49.5
CVV_35_LB-pY	35	2.43	49.5
CVV_06_LC-pZ	6	2.06	44
CVV_07_UC-pZ	7	2.06	44
CVV_08_UB-mZ	8	2.18	60
CVV_09_Rad-lower-mY	9	2.10	55
CVV_10_Rad-upper-mY	10	2.62	68.75
CVV_11_Rad-lower-mZ	11	2.53	80
CVV_12_Rad-upper-mZ	12	4.15	122.5
CVV_13_Rad-lower-pY	13	2.10	55
CVV_14_Rad-upper-pY	14	2.62	68.75
CVV_15_UB-HSIF-mZ	15	2.83	100
LOU_16_rad-lower	16	3.17	100
LOU_17_rad-upper	17	3.17	100
Total power without LOU			797

thermostat-controlled

OPERATION REQUEST SHEET

No.: 72

Title: Change CVV Heater Currents

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please reduce the CVV heater current settings according to the attached table (from 797 W to 738 W)

Reason: To reduce the temperature in the test harness (sensor 9810)

Date to be executed 07.11.2005	**Time to be executed** UTC 00:15	Local	**Test Phase:** TP8 **Test step:** B
Executed Date: 07.11.2005	**Executed Time:** UTC	Local 1:12	**Sign.:**

Approval:

Shift Leader PA

Annex to ORS 72			
		07/11/2005 00:02	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	2.43	49.5
CVV_35_LB-pY	35	2.43	49.5
CVV_06_LC-pZ	6	2.06	44
CVV_07_UC-pZ	7	2.06	44
CVV_08_UB-mZ	8	1.95	48
CVV_09_Rad-lower-mY	9	2.10	55
CVV_10_Rad-upper-mY	10	2.62	68.75
CVV_11_Rad-lower-mZ	11	2.37	70
CVV_12_Rad-upper-mZ	12	3.84	105
CVV_13_Rad-lower-pY	13	2.10	55
CVV_14_Rad-upper-pY	14	2.62	68.75
CVV_15_UB-HSIF-mZ	15	2.53	80
LOU_16_rad-lower	16	3.17	100
LOU_17_rad-upper	17	3.17	100
Total power without LOU			737.5

} thermostat-controlled without any change

OPERATION REQUEST SHEET

No.: 73

Title: Reduction of CVV Heater Currents

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please reduce the CVV heater current settings according to the attached table

Reason: to reduce test harness temperature

Date to be executed 07.11.2005	**Time to be executed** UTC 01:10	Local	**Test Phase:** **Test step:**
Executed Date: 07.11.2005	**Executed Time:** UTC	Local 2:04	**Sign.:**

Approval:
Shift Leader PA

Annex to ORS 73			
		07/11/2005 00:57	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	2.43	49.5
CVV_35_LB-pY	35	2.43	49.5
CVV_06_LC-pZ	6	2.06	44
CVV_07_UC-pZ	7	2.06	44
CVV_08_UB-mZ	8	1.83	42
CVV_09_Rad-lower-mY	9	2.10	55
CVV_10_Rad-upper-mY	10	2.62	68.75
CVV_11_Rad-lower-mZ	11	2.19	60
CVV_12_Rad-upper-mZ	12	3.84	105
CVV_13_Rad-lower-pY	13	2.10	55
CVV_14_Rad-upper-pY	14	2.62	68.75
CVV_15_UB-HSIF-mZ	15	2.37	70
LOU_16_rad-lower	16	3.17	100
LOU_17_rad-upper	17	3.17	100
Total power without LOU			711.5

} thermostat-controlled

OPERATION REQUEST SHEET

No.: 74

Title: Reduce CVV Heater Power Settings

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please reduce the CVV heater current settings according to the attached table

Reason: To reduce the test harness temperature (sensor 3810)

Date to be executed 07.11.2005	**Time to be executed** UTC 02:00	Local	**Test Phase:** TP8 **Test step:** B
Executed Date: 07-11-2005	**Executed Time:** UTC	Local 3:06	**Sign.:**

Approval:
Shift Leader **PA**

Annex to ORS 74			
		07/11/2005 01:50	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	2.31	45
CVV_35_LB-pY	35	2.31	45
CVV_06_LC-pZ	6	1.96	40
CVV_07_UC-pZ	7	1.96	40
CVV_08_UB-mZ	8	1.83	42
CVV_09_Rad-lower-mY	9	2.00	50
CVV_10_Rad-upper-mY	10	2.50	62.5
CVV_11_Rad-lower-mZ	11	2.19	60
CVV_12_Rad-upper-mZ	12	3.84	105
CVV_13_Rad-lower-pY	13	2.00	50
CVV_14_Rad-upper-pY	14	2.50	62.5
CVV_15_UB-HSIF-mZ	15	2.37	70
LOU_16_rad-lower	16	3.17	100
LOU_17_rad-upper	17	3.17	100
Total power without LOU			672

} thermostat-controlled

OPERATION REQUEST SHEET

No.: 75

Title:

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ ……………. ☐ Data Handling

Action:

Please increase the LSS Shroud warm-up according to the following criteria:

1. The top shroud shall be controlled only 10K below the CVV minimum temperature.
2. The shroud of the 5m door and the SPOUT may achieve temperatures that are 5K higher than the CVV minimum temperature
3. The cylinder shroud temperatures shall be controlled 20K below the CVV minimum temperature (sensor 1902)

Reason:

To accelerate warm-up

Date to be executed 07.11.2005	**Time to be executed** UTC 02:30	Local	**Test Phase:** **Test step:**
Executed Date: 7/11/05	**Executed Time:** UTC	Local 11h17	**Sign.:**

Approval:

Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 76

Title: Reduce CW Heater Power Settings

From ☒ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☐ …………….. ☐ Data Handling

Name:

To ☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☐ ……………. ☒ Data Handling

Action:

Please reduce the CW heater current settings according to the attached table.

Reason: To reduce the test harness temperature (sensor 9810)

Date to be executed 7.11.05	**Time to be executed** UTC 7:35	Local 8:35	**Test Phase:** TP 8 **Test step:**
Executed Date: 7-11-05	**Executed Time:** UTC	Local 8:42	**Sign.:** JA.

Approval:

Shift Leader **PA**

Annex to ORS 76			
		07/11/2005 07:20	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	2.24	42.3
CVV_35_LB-pY	35	2.24	42.3
CVV_06_LC-pZ	6	1.90	37.6
CVV_07_UC-pZ	7	1.90	37.6
CVV_08_UB-mZ	8	1.83	42.0
CVV_09_Rad-lower-mY	9	1.94	47.0
CVV_10_Rad-upper-mY	10	2.43	58.8
CVV_11_Rad-lower-mZ	11	2.19	60.0
CVV_12_Rad-upper-mZ	12	3.84	105.0
CVV_13_Rad-lower-pY	13	1.94	47.0
CVV_14_Rad-upper-pY	14	2.43	58.8
CVV_15_UB-HSIF-mZ	15	2.37	70.0
Total power without LOU			648.3

OPERATION REQUEST SHEET

No.: 707

Title: Reduce Temp. difference between LSS-shroud and S/C

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☑ shift leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
In order to accelerate the warm-up of the S/C the temperature of the LSS shrouds* shall be equal to the virtual sensor #1902 "external_structure_Mini"

* shroud cylinder upper

Reason:
speed up warm-up see ORS # 68

Date to be executed 7.11.05	**Time to be executed** UTC 10^{15}	Local	**Test Phase:** TP8 **Test step:**
Executed Date: 7/11/05	**Executed Time:** UTC	Local 4:20	**Sign.:**

Approval:
Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 78

Title: Reduce CW heater power settings

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name:

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Please reduce the CW heater current settings according to the attached table.

Reason: To reduce the test harness temperature (sensor 9810)

Date to be executed 7.11.05	**Time to be executed** UTC 13:30	Local 14:30	**Test Phase:** TP8 **Test step:**
Executed Date: 7/11/2005	**Executed Time:** UTC	Local 14:34	**Sign.:** W. Baumann

Approval:

Shift Leader i.A. K. Wagner

PA

Annex to ORS 78

07/11/2005 13:24

Circuit name	Circuit number	Current [A]	Power [W]	
CVV_05_LB-mY	5	2.15	38.7	
CVV_35_LB-pY	35	2.15	38.7	
CVV_06_LC-pZ	6	1.82	34.4	
CVV_07_UC-pZ	7	1.82	34.4	
CVV_08_UB-mZ	8	1.83	42.0	Not changed
CVV_09_Rad-lower-mY	9	1.86	43.0	
CVV_10_Rad-upper-mY	10	2.32	53.8	
CVV_11_Rad-lower-mZ	11	2.19	60.0	Not changed
CVV_12_Rad-upper-mZ	12	3.84	105.0	
CVV_13_Rad-lower-pY	13	1.86	43.0	
CVV_14_Rad-upper-pY	14	2.32	53.8	
CVV_15_UB-HSIF-mZ	15	2.37	70.0	Not changed
[illegible]	[illegible]		[illegible]	
Total power without LOU			616.7	

OPERATION REQUEST SHEET

No.: 79

Title: Increase IR Rig and LOU MTD Temperature

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: Hauser

To ☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:

Control H_23, H_24 and H_25 to 35°C ± 1K
Control H_26, H_27 and H_28 to 50°C ± 1K
Control H_29, H_30 and H_31 to 65°C ± 1K
Control H_32, H_33 and H_34 to 80°C ± 1K

with upto 1.5 A per Circuit

Control LOU_16 and LOU_17 at 320K ± 1K
↳ 46,85 +/- 1°C

Reason:

Accelerate Warm-Up

Date to be executed 7.11.05	**Time to be executed** UTC	Local 1550	**Test Phase:** **Test step:**
Executed Date: 7/11/2005	**Executed Time:** UTC	Local 16h00	**Sign.:** W. Baumann

Approval:

Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 80

Title:

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: Wagner

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please reduce the CVV heater current settings according to the attached table.

Reason: To reduce the test harness temperature (sensor 9810).

Date to be executed 7.11.05	**Time to be executed** UTC	Local	**Test Phase:** TP 8 **Test step:**
Executed Date: 7/11/2005	**Executed Time:** UTC	Local 16h45	**Sign.:** W. Baumann

Approval:

Shift Leader

PA

Annex to ORS 80			
		07/11/2005 15:40	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	2.15	38.7
CVV_35_LB-pY	35	2.15	38.7
CVV_06_LC-pZ	6	1.82	34.4
CVV_07_UC-pZ	7	1.82	34.4
CVV_08_UB-mZ	X 8	1.69	36.0
CVV_09_Rad-lower-mY	9	1.86	43.0
CVV_10_Rad-upper-mY	10	2.32	53.8
CVV_11_Rad-lower-mZ	X 11	2.00	50.0
CVV_12_Rad-upper-mZ	X 12	3.50	87.5
CVV_13_Rad-lower-pY	13	1.86	43.0
CVV_14_Rad-upper-pY	14	2.32	53.8
CVV_15_UB-HSIF-mZ	X 15	2.19	60.0
LOU_16_rad-lower	16	3.17	100.0
LOU_17_rad-upper	17	3.17	100.0
Total power without LOU			573.2

OPERATION REQUEST SHEET

No.: 81

Title: Increase IR Rig Temperature

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Control IRRIG_63 to 30°C ± 1K
Control H_23, H_24 and H_25 to 55°C ± 1K
Control H_26, H_27 and H_28 to 70°C ± 1K
Control H_29, H_30 and H_31 to 80°C ± 1K

with up to 1.6 A per circuit

Reason:

Accelerate WG and telescope Temperature

Date to be executed 7.11.05	**Time to be executed** UTC	Local 19^{00}	**Test Phase:** **Test step:**
Executed Date: 7/11/05	**Executed Time:** UTC	Local 19h07	**Sign.:** N.Baumann

Approval:

Shift Leader A. Hauser **PA**

ANNEX to ORS 81

Name	Control mode	Fixed Setpoint	Thermostatic Lowest setpoint	Thermostatic Low setpoint	Thermostatic High setpoint	Thermostatic Highest setpoint	Thermostatic Highest limit	Thermostatic High limit	Thermostatic Low limit	Thermostatic Lowest limit
IRRIG_23_STM_low_pY	Thermostatic current	0.000 A	0.000 A	0.600 A	1.000 A	1.120 A	56.00	55.50	54.50	34.00
IRRIG_25_STM_low_mY	Thermostatic current	0.000 A	0.000 A	0.560 A	1.000 A	1.120 A	56.00	55.50	54.50	34.00
IRRIG_26_STM_low_pY	Thermostatic current	0.000 A	0.000 A	0.670 A	1.500 A	1.600 A	71.00	70.50	69.50	49.00
IRRIG_29_STM_upp_pY	Thermostatic current	0.000 A	0.000 A	0.800 A	1.500 A	1.600 A	81.00	80.50	79.50	64.00
IRRIG_31_STM_upp_mY	Thermostatic current	0.000 A	0.000 A	0.850 A	1.500 A	1.600 A	81.00	80.50	79.50	64.00
IRRIG_34_STM_upp_mY	Thermostatic current	0.000 A	0.000 A	1.150 A	1.400 A	1.600 A	81.00	80.50	79.50	79.00
IRRIG_24_STM_low_mid	Thermostatic current	0.000 A	0.000 A	0.560 A	1.000 A	1.120 A	56.00	55.50	54.50	34.00
IRRIG_27_STM_low_mid	Thermostatic current	0.000 A	0.000 A	0.700 A	1.500 A	1.600 A	71.00	70.50	69.50	49.00
IRRIG_28_STM_low_mY	Thermostatic current	0.000 A	0.000 A	0.740 A	1.500 A	1.600 A	71.00	70.50	69.50	49.00
IRRIG_30_STM_upp_mid	Thermostatic current	0.000 A	0.000 A	0.750 A	1.500 A	1.600 A	81.00	80.50	79.50	64.00
IRRIG_32_STM_upp_pY	Thermostatic current	0.000 A	0.000 A	1.200 A	1.400 A	1.600 A	81.00	80.50	79.50	79.00
IRRIG_33_STM_upp_mid	Thermostatic current	0.000 A	0.000 A	1.200 A	1.400 A	1.600 A	81.00	80.50	79.50	79.00

OPERATION REQUEST SHEET

No.: 82

Title: Change Definition of Virtual Sensor 1902

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Please remove the following sensors from the virtual sensor 1902 definition:
Sensor 2413 PLM_LOWG_TC_LOU-waveguide-m2-mid
Sensor 2403 PLM_LOWG_TC_LOU-waveguide-p2-mid

Reason: The waveguide sensors are not important for the minimum temperature definition of sensor 1902.
Taking them out of the definition helps to accelerate the warm-up

Date to be executed	**Time to be executed** UTC	Local	**Test Phase:** TP 8 **Test step:** B
Executed Date: 8-11-05	**Executed Time:** UTC 00:19	Local 01:19	**Sign.:**

Approval:
Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 83

Title: Warm-up Shrouds to Ambient Temperature

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:
Please warm-up Shrouds to ambient temperature
and inform customer when ready for repressurization
with dry N_2
Warm-up shall begin on 04:30 UTC
Shrouds are allowed to exceed S/C temperatures, in particular
sensor 1902.

Reason: Minimum temp. sensor 1902 is expected to reach 273K±1K
at 04:30.

Date to be executed 08.11.2005	**Time to be executed** UTC 04:30	Local	**Test Phase:** TP8 **Test step:** B
Executed Date: 8/11/2005	**Executed Time:** UTC	Local 15⁰⁰	**Sign.:**

Approval:
Shift Leader **PA**

OPERATION REQUEST SHEET

No.: 84

Title: Change CVV heater current settings

From

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please change the CVV heater current settings according to the attached table. (from 573 W to 556 W)

Reason: To reduce test harness temperature and to reduce HTR-power on ±Y radiators which are already above 270 K in favour to move HTR-power on Upper Bulkhead.

Date to be executed 08.11.2005	**Time to be executed** UTC 02:35	Local	**Test Phase:** TP 8 **Test step:** B
Executed Date: 08-11-05	**Executed Time:** UTC 02:42	Local 03:42	**Sign.:**

Approval:

Shift Leader **PA**

Annex to ORS 84

		08/11/2005 02:26	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	2.07	36.0
CVV_35_LB-pY	35	2.07	36.0
CVV_06_LC-pZ	6	1.75	32.0
CVV_07_UC-pZ	7	1.75	32.0
CVV_08_UB-mZ	8	1.69	36.0
CVV_09_Rad-lower-mY	9	1.75	38.0
CVV_10_Rad-upper-mY	10	2.18	47.5
CVV_11_Rad-lower-mZ	11	2.00	50.0
CVV_12_Rad-upper-mZ	12	3.50	87.5
CVV_13_Rad-lower-pY	13	1.75	38.0
CVV_14_Rad-upper-pY	14	2.18	47.5
CVV_15_UB-HSIF-mZ	15	2.45	75.0
LOU_16_rad-lower	16	2.74	75.0
LOU_17_rad-upper	17	2.74	75.0
Total power without LOU			555.5

} thermostat-controlled, unchanged

OPERATION REQUEST SHEET

No.: 85

Title: Change LOU Heater Switching Limits

From

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To

☐ Thermal ☐ SCOE ☐ LSS Control

☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action: Please reduce the "thermostat" limits of the LOU heaters LOU_16 and LOU_17 from 320K ± 1K to 310K ± 1K (37°C ± 1K)

Reason: To reduce Test harness temperature

Date to be executed 08.11.2005	**Time to be executed** UTC 03:05	Local	**Test Phase:** TP8 **Test step:** B
Executed Date: 08-11-05	**Executed Time:** UTC 03:10	Local 04:10	**Sign.:**

Approval:

Shift Leader

PA

OPERATION REQUEST SHEET **No.:** 86

Title: Change CVV Heater Current Settings

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Please switch-off LOU heaters LOU-16 and LOU-17 and change the CVV heater currents according to the attached table

Reason: To put more HTR-power into CVV (LOU is already above ambient temp.) to accelerate further warm-up

Date to be executed 08.11.2005	**Time to be executed** UTC 05:30	Local	**Test Phase:** TP8 **Test step:** B
Executed Date: 08.11.2005	**Executed Time:** UTC	Local 6:26	**Sign.:**

Approval:
Shift Leader **PA**

Annex to ORS 86

		08/11/2005 05:16	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	2.96	73.8
CVV_35_LB-pY	35	2.96	73.8
CVV_06_LC-pZ	6	2.51	65.6
CVV_07_UC-pZ	7	2.51	65.6
CVV_08_UB-mZ	8	2.18	60.0
CVV_09_Rad-lower-mY	9	1.42	25.0
CVV_10_Rad-upper-mY	10	1.77	31.3
CVV_11_Rad-lower-mZ	11	1.55	30.0
CVV_12_Rad-upper-mZ	12	2.71	52.5
CVV_13_Rad-lower-pY	13	1.42	25.0
CVV_14_Rad-upper-pY	14	1.77	31.3
CVV_15_UB-HSIF-mZ	15	2.83	100.0
LOU_16_rad-lower	switch off		
LOU_17_rad-upper	switch off		
Total power without LOU			633.8

OPERATION REQUEST SHEET

No.: 88

Title: Change CVV heater Current Settings

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name:

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Please change the CVV heater current settings according to the attached table.

Reason: To reduce test harness temperature / prevent failing of further heater circuits

Date to be executed 08.11.2005	**Time to be executed** UTC 7:50	Local 8:50	**Test Phase:** TP-8 **Test step:**
Executed Date:	**Executed Time:** UTC	Local 8:52	**Sign.:**

Approval:
Shift Leader | **PA**

Annex to ORS 88

		08/11/2005 07:39	
Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
CVV_05_LB-mY	5	2.54	54.0
CVV_35_LB-pY	35	2.54	failed
CVV_06_LC-pZ	6	2.15	48.0
CVV_07_UC-pZ	7	2.15	48.0
CVV_08_UB-mZ	8	1.83	failed
CVV_09_Rad-lower-mY	9	1.42	25.0
CVV_10_Rad-upper-mY	10	1.77	31.3
CVV_11_Rad-lower-mZ	11	1.55	30.0
CVV_12_Rad-upper-mZ	12	2.71	52.5
CVV_13_Rad-lower-pY	13	1.42	25.0
CVV_14_Rad-upper-pY	14	1.77	31.3
CVV_15_UB-HSIF-mZ	15	2.37	70.0
LOU_16_rad-lower	switch off		
LOU_17_rad-upper	switch off		
Total power without LOU			415.0

OPERATION REQUEST SHEET

No.: 89

Title: Warm up CP1 and pressurise to 90mbar N_2

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift leader ☐ Data Handling

Name: G. John

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Action:
Start warm-up of CP1
Pressurize with GN2 to 90 mbar
Wait for instructions before insertion of air inlets!
Switch off TDH heaters before pressurization

Reason: Leak check of CVV and Telescope heating

Date to be executed 8.11.05	**Time to be executed** UTC 14:30	Local 15:30	**Test Phase:** FP8 **Test step:**
Executed Date: 8/11/2005	**Executed Time:** UTC	Local 18h07	**Sign.:**

Approval:
Shift Leader
PA

OPERATION REQUEST SHEET

No.: 90

Title: Restart TTAP, IRRIG, Lou and CVV Heating

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:
Control IR Rig Temperature as defined in ORS 81
Control TTAP Temperature at 30°C ± 1K
Control LOU_Heaters at 310K ± 1K (as ORS 79)
Control CVV_15 at 310K ± 1K with 2.8 A max.
Control CVV_12 at 310K ± 1K with 3.8 A max.
↳ 36,85°C

Reason:

Date to be executed 8.11.05	**Time to be executed** UTC	Local 18^{55}	**Test Phase:** **Test step:**
Executed Date: 8/11/2005	**Executed Time:** UTC	Local 19h07	**Sign.:** W. Baumann

Approval:
Shift Leader A. Hauser **PA**

OPERATION REQUEST SHEET

No.: 91

Title: Increase CVV Temperature (upper bulkhead)

From ☒ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☐ Data Handling

Name: A. Hauser

To ☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Control CVV at 323 K ± 1 K (50°C) with the currents up to the values as listed in the attached table

Reason:

Enforce Konvection to speed up telescope heating

Date to be executed 8.11.05	**Time to be executed** UTC	Local 20^{20}	**Test Phase:** **Test step:**
Executed Date: 8/11/2005	**Executed Time:** UTC	Local 20h28	**Sign.:** W. Baumann

Approval:

Shift Leader A. Hauser **PA**

	Annex to ORS 91			
			08/11/2005 19:08	
	Circuit name	**Circuit number**	**Current [A]**	**Power [W]**
	CVV_05_LB-mY	5	0.00	0.0
	CVV_35_LB-pY	35	0.00	0.0
	CVV_06_LC-pZ	6	0.00	0.0
	CVV_07_UC-pZ	7	0.00	0.0
	CVV_08_UB-mZ	8	0.00	0.0
	CVV_09_Rad-lower-mY	9	0.00	0.0
	CVV_10_Rad-upper-mY	10	3.54	125.0
	CVV_11_Rad-lower-mZ	11	0.00	0.0
	CVV_12_Rad-upper-mZ	12	4.95	175.0
	CVV_13_Rad-lower-pY	13	0.00	0.0
	CVV_14_Rad-upper-pY	14	3.54	125.0
	CVV_15_UB-HSIF-mZ	15	2.83	100.0
	LOU_16_rad-lower			
	LOU_17_rad-upper			
	Total power without LOU			525

OPERATION REQUEST SHEET

No.: 92

Title: Pressurization to ambient pressure.

From
☐ Thermal ☐ SCOE ☐ LSS Control
☐ Cryo / CVSE ☒ Shift Leader ☐ Data Handling

Name:

To
☐ Thermal ☐ SCOE ☒ LSS Control
☐ Cryo / CVSE ☐ .... ☒ Data Handling

Action:

Please switch off all heaters and pressurize LSS to ambient pressure.

Reason: All relevant S/C temperatures are above the dew point.

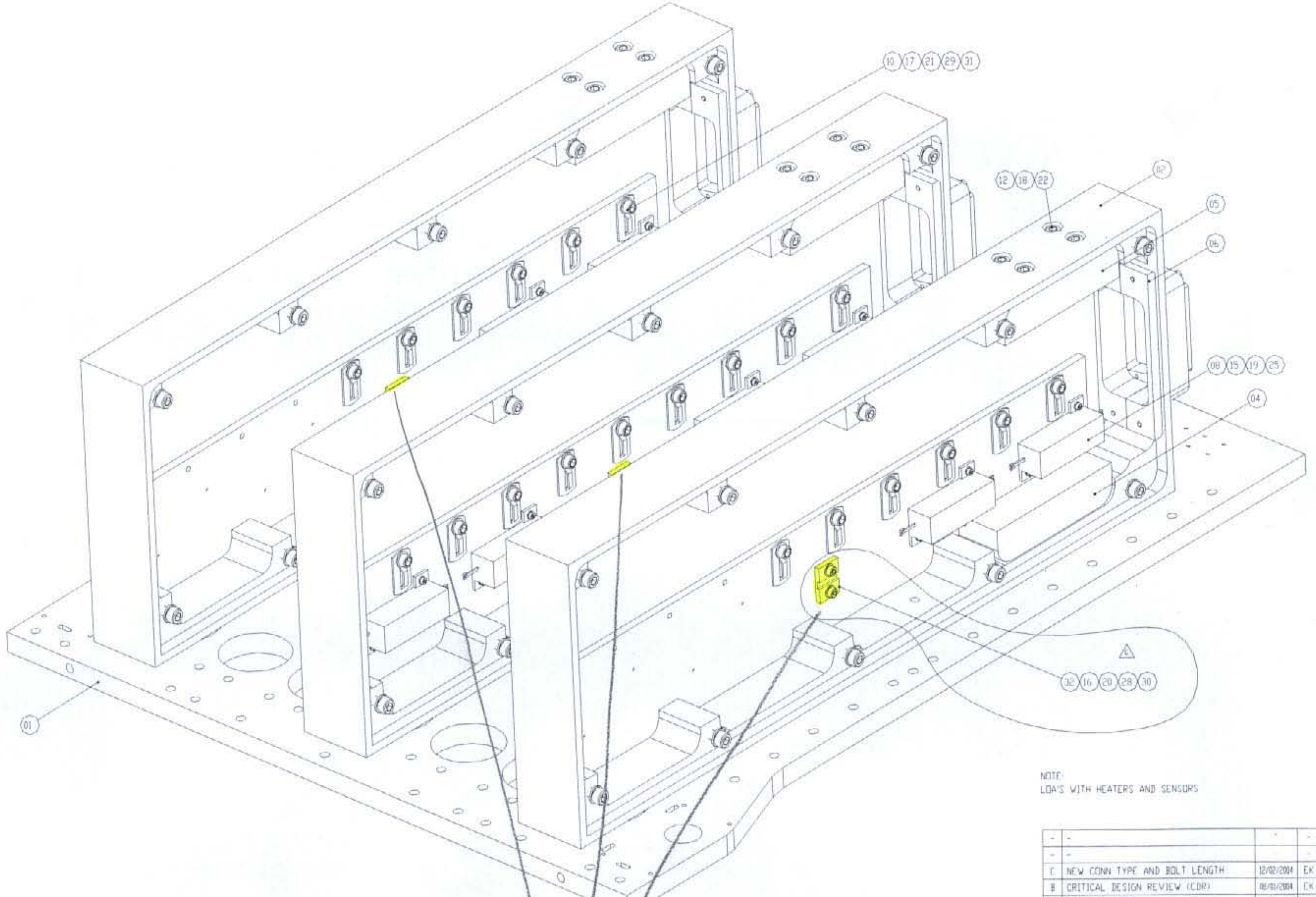
Date to be executed 09.11.05	**Time to be executed** UTC 02:00	Local	**Test Phase:** TP8 **Test step:** C
Executed Date: 09/11/05	**Executed Time:** UTC 01:50	Local 02:50	**Sign.:**

Approval:

Shift Leader **PA**

Sensor and Heater Positions

Scanned_Docs\Sensor_locations.pdf



MT108, MT109,
MT110

NOTE:
LDA'S WITH HEATERS AND SENSORS

-	-	-	-	-	-	-	-
-	-		-	-	-	-	-
C	NEW CONN TYPE AND BOLT LENGTH	12/02/2004	EK	AS	EK	LB	GD
B	CRITICAL DESIGN REVIEW (CDR)	08/01/2004	EK	AS	EK	LB	GD
A	FIRST DRAWING	03/06/2003	EK	AMAA	-	-	-
Issue	Status/Change	Date (dd/mm/yyyy)	Constr	Drawn	Check	Prod	Appr

Drw stand: NS (CORRESP.ISO)
Material: -
General tol: NS ISO 2768-1-MEDIUM
Mat cert: -
Surf rough: -
Proj:

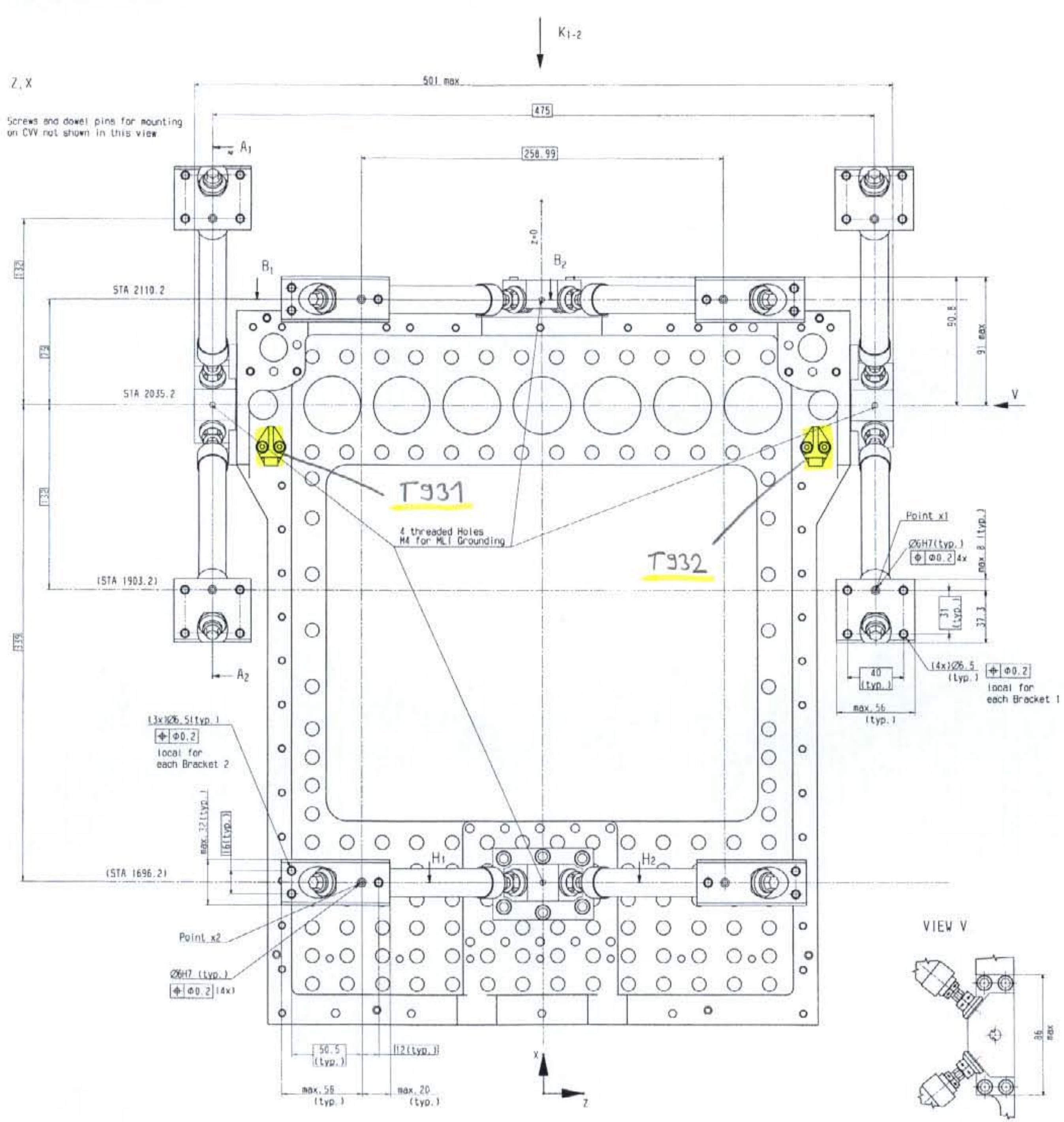
prototech

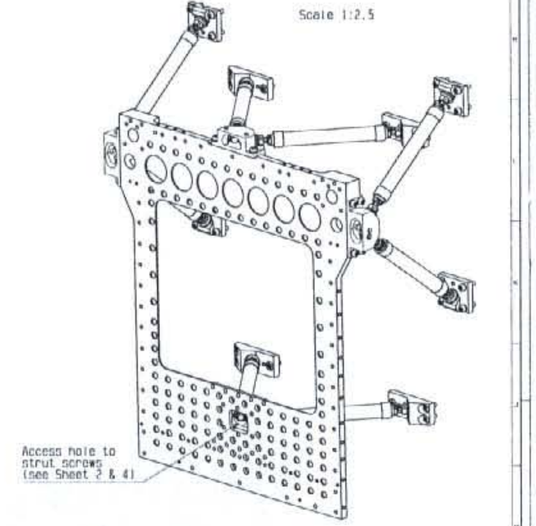
Scale: 1:1
Drg format: A1

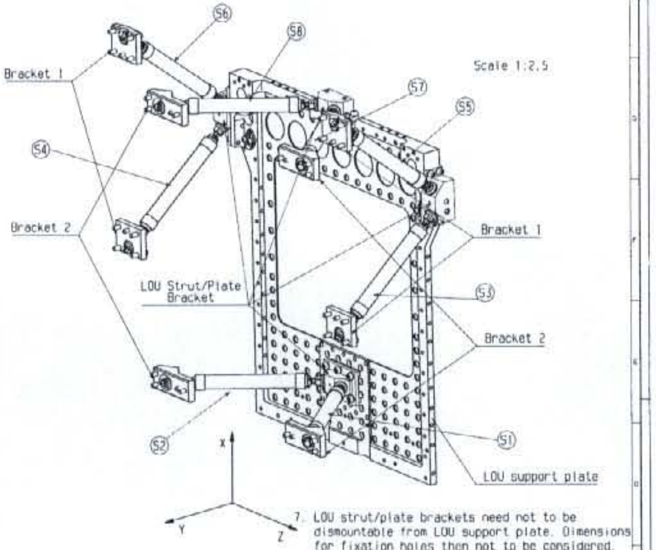
Title: HP MASS AND THERMAL DUMMIES, COLD UNITS
HIFI LOU - ASSEMBLY DRAWING
ASSEM DRAWING
Sheet 1 of 2

Drw no: 30089_02_ASM_C
HP-2-PROT-DW-0002

CI-No:142511-02







7. LOU strut/plate brackets need not to be dismountable from LOU support plate. Dimensions for fixation holes then not to be considered.
6. Allowed envelope for strut/plate brackets is applicable.
5. All struts provide ventholes
4. Dowel pins to be retractable
3. Each strut must be seperately removeable

② Bracket to provide venthole for closed volumes

① Maximum envelope

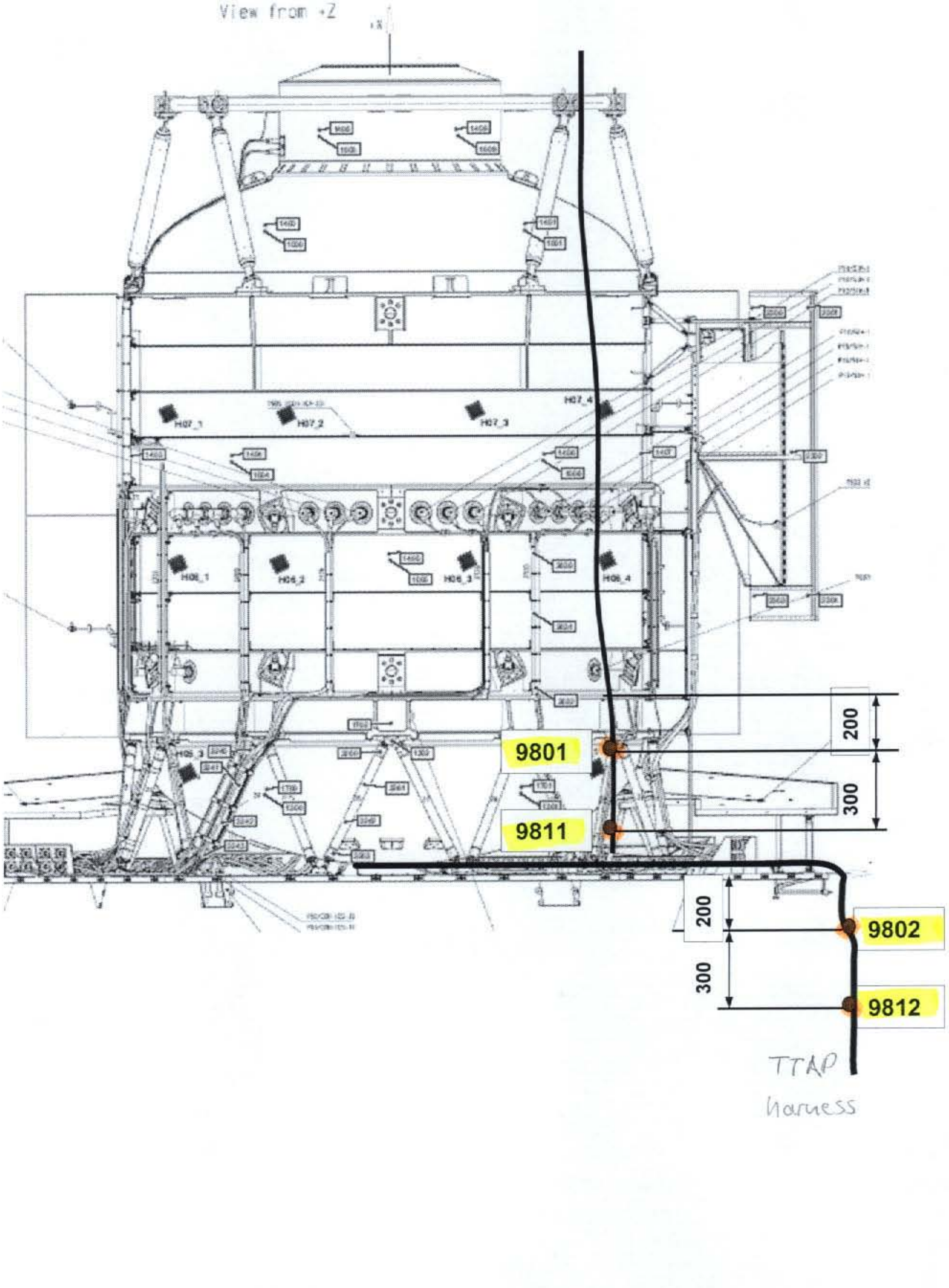
Surface Treatment: TBD

All pins to be secured with suitable locking elements

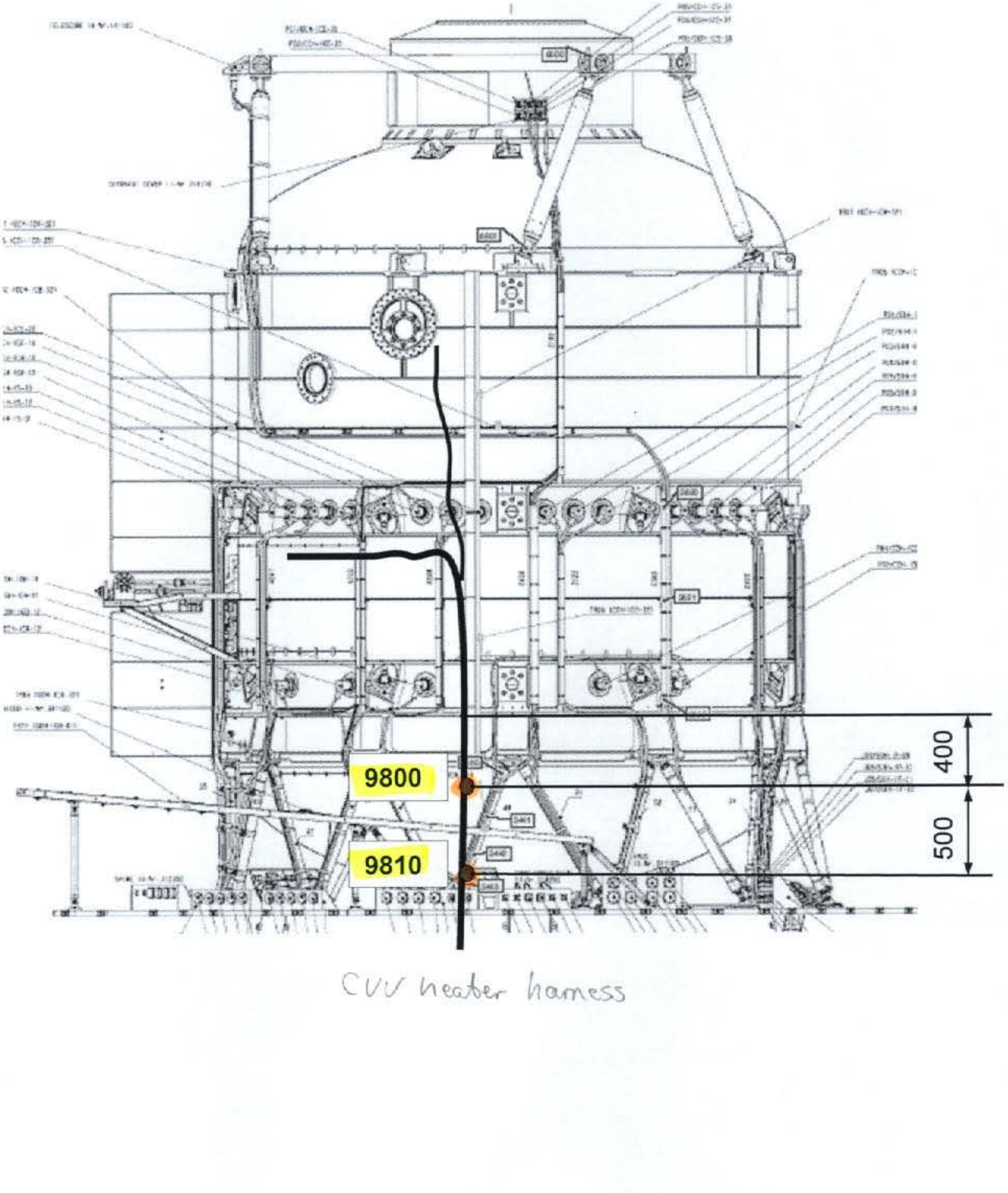
Valid for all boreholes and threaded inserts (helicoils) w/o specific tolerance:
⊕ Φ0.1

FREIGABE
FESTIGKEIT
VERTEILER
DATUM
HP-2-ASED-ID-0044-01-0C
CI-121520
FREIGABE AUSGABE
ZUL. ABW. DIN ISO 2768 FH
OBERFL. ISO 1302
MASSTAB 1:1 (1:2.5)
GEW.
WERKSTOFF
DATUM
NAME
HERSCHEL
LOU SUPPORT STRUCTURE
interface drawing
Astrium GmbH
2547-121520-000-01-0C
DATUM
NAME

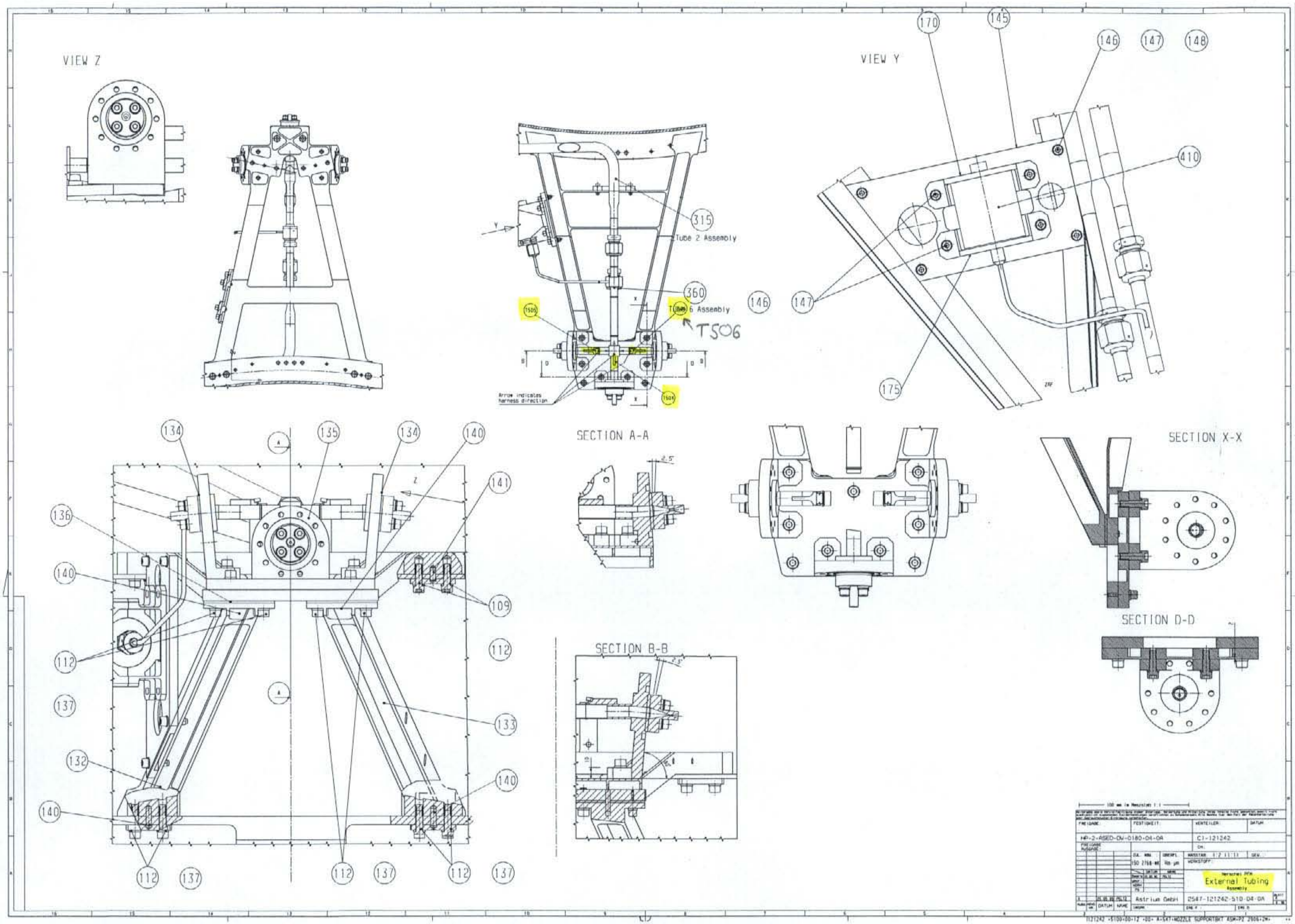
Test Harness for TTAP and Telescope at -Y Side

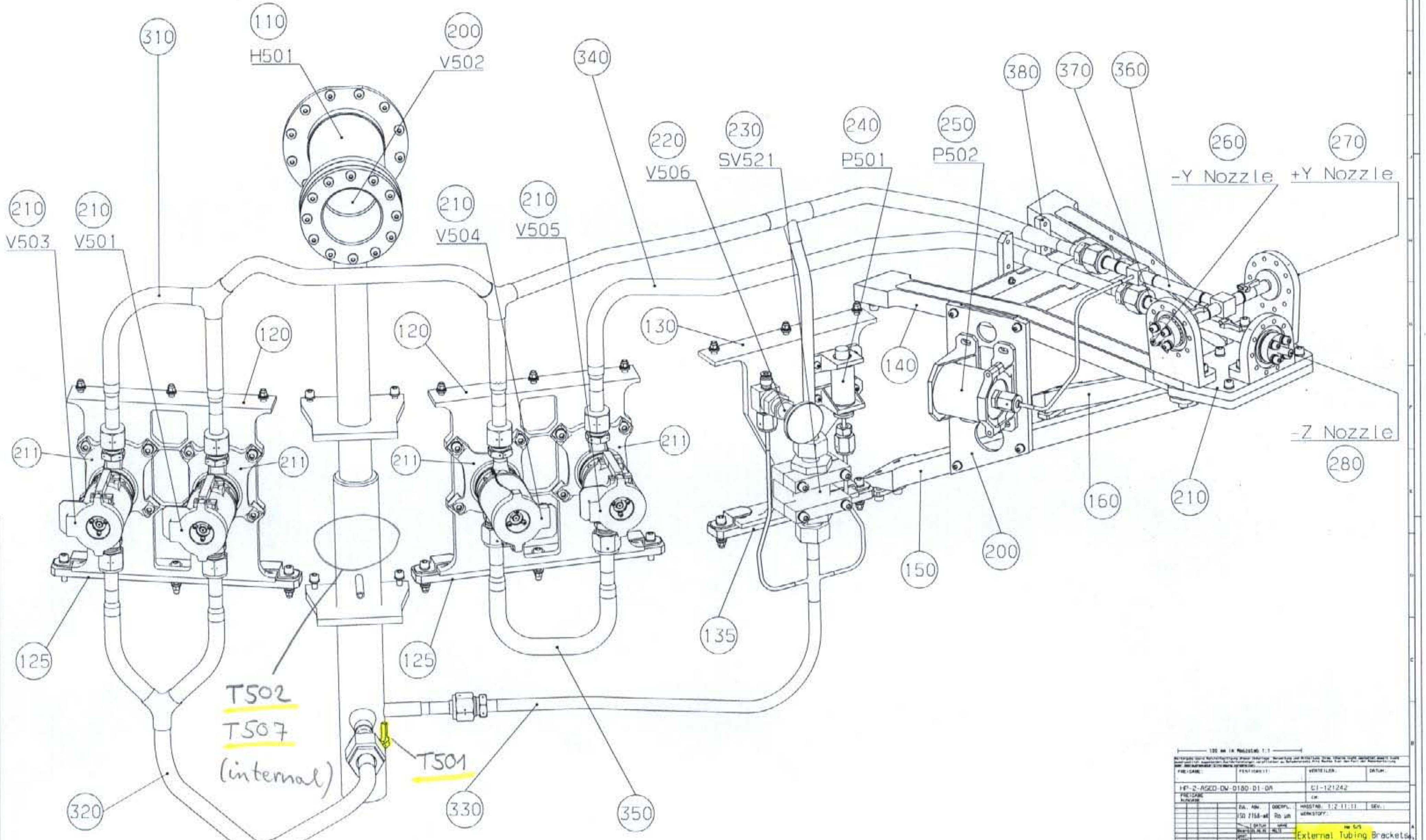


Cold Test Harness at +Y side



CVV heater harness


VIEW Z
VIEW Y
170
145
146
147
148
410
315
Tube 2 Assembly
360
T505
T506 6 Assembly
T506
146
147
175
Y
X
B
D
Arrow indicates harness direction
T508
134
135
134
140
141
136
140
109
112
112
137
133
132
140
140
112
137
112
137
112
137
A
Z
SECTION A-A
2.5°
SECTION X-X
SECTION D-D
SECTION B-B
2.5°
100 mm im Maßstab 1:1
FREIGABE:
FESTIGKEIT:
VERTEILER:
DATUM
HP-2-ASED-DW-0180-04-0A
CI-121242
FREIGABE AUSGABE:
CM:
ZUL. ABW.
ISO 2768-mK
OBERFL.
Ra µm
MASSTAB 1:2 11:11
GEW.
WERKSTOFF:
DATUM
NAME
Herschel PFM
External Tubing
Assembly
Astrium GmbH
2547-121242-510-04-0A
DATUM
NAME
121242 -5100-00-12 -00- A-547-NOZZLE SUPPORTBKT ASM-PZ 2506-2M-

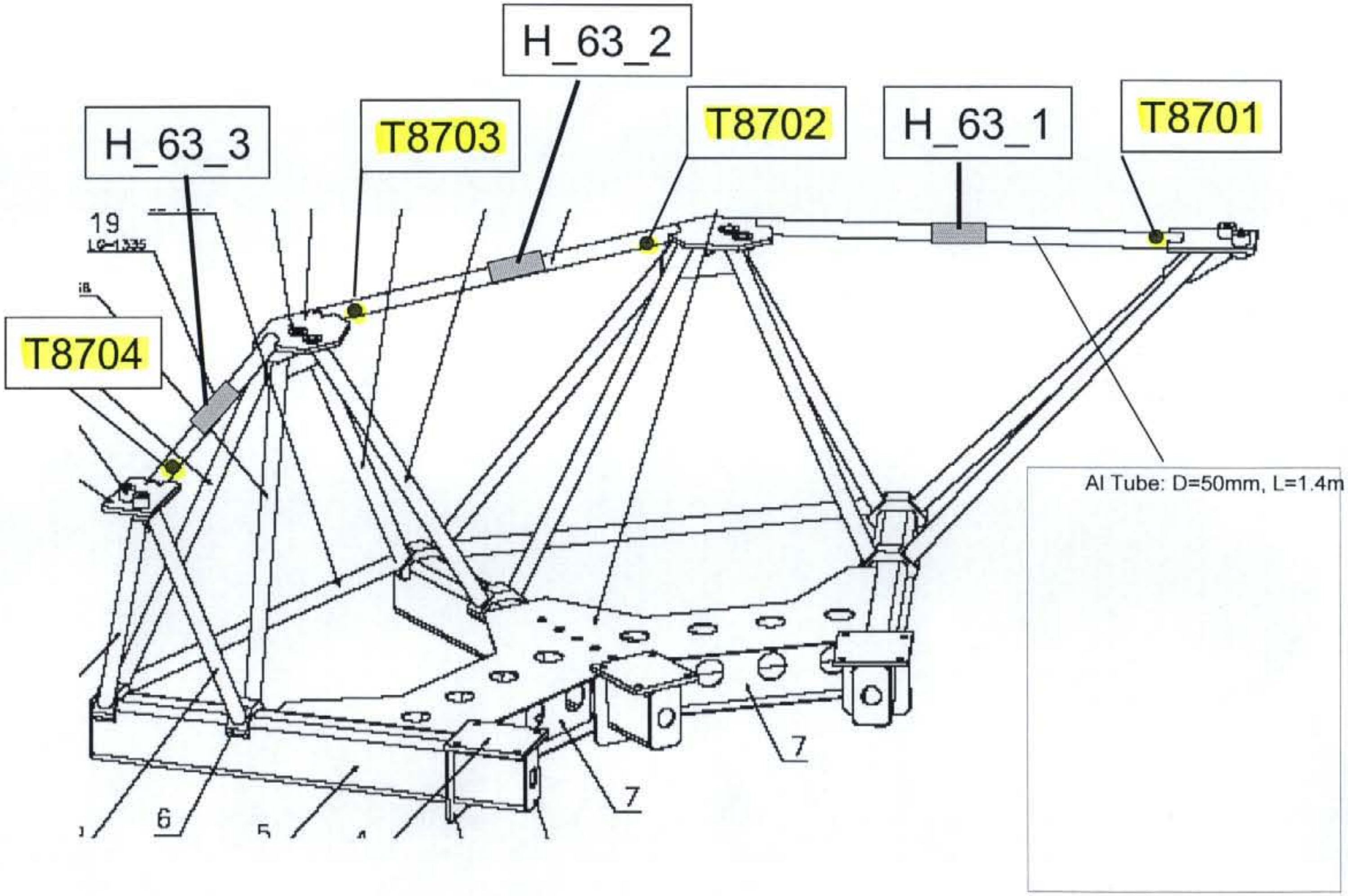


100 mm im Maßstab 1:1

FREIGABE:
FERTIGUNG:
VERTEILER:
DATUM:
HP-2-ASED-DW-0180-01-0A
CI-121242
FREIGABE AUSGABE
CM:
ZUL. ABW.
ISO 2768-mK
OBERFL.
Ra µm
MASSTAB: 1:2 11:11
GEW.:
WERKSTOFF:
DATUM
NAME
Bearb.
MLT
External Tubing Brackets,
Nozzle & SV521
A
29.08.05
MELTZ
Astrium GmbH
2547-121242-510-01-0A
BLATT
1
AUSG.
DATUM
NAME
URSPR.:
ERS.F.:
ERS.D.:

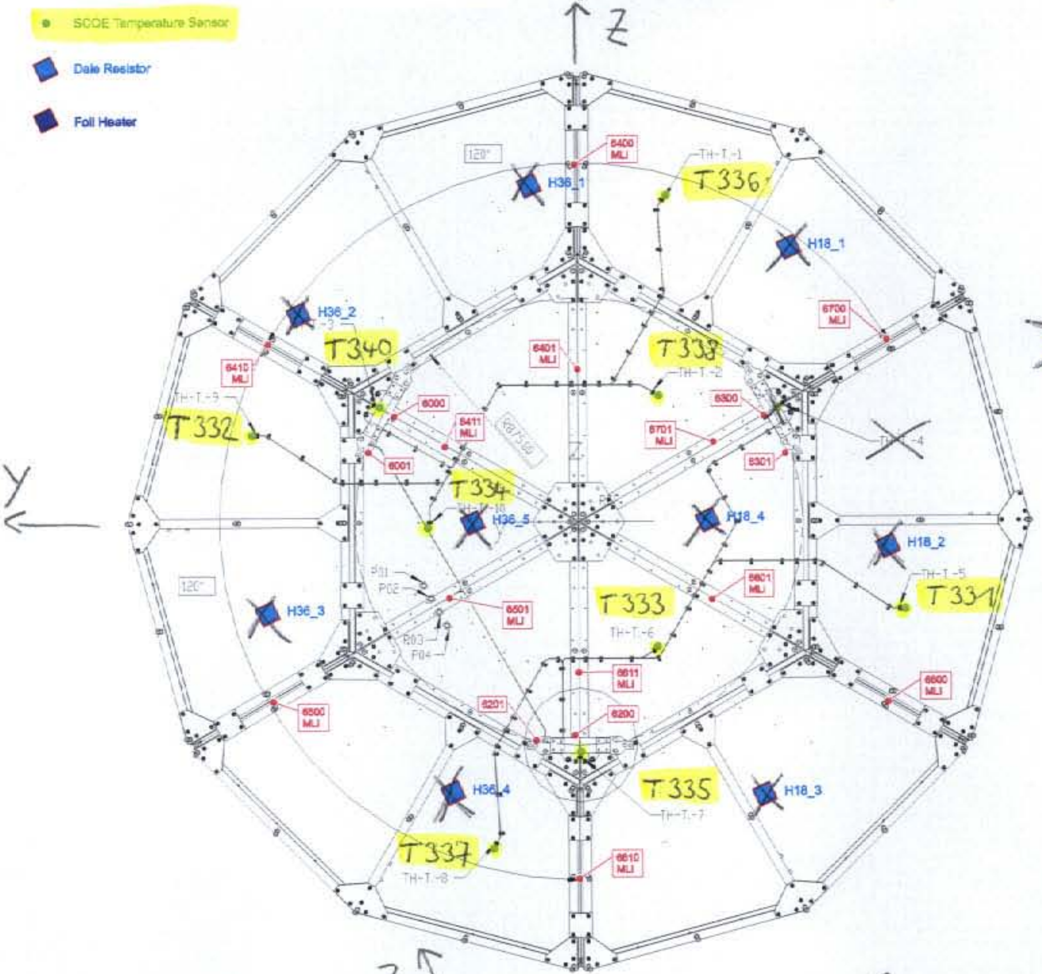
II21242 +5100+00+12 +00+ A+547+NOZZLE SUPPORTBRT ASM+PZ 2906+2M+

Thermocouples and Heaters on Rig Support Bracket (see next page)



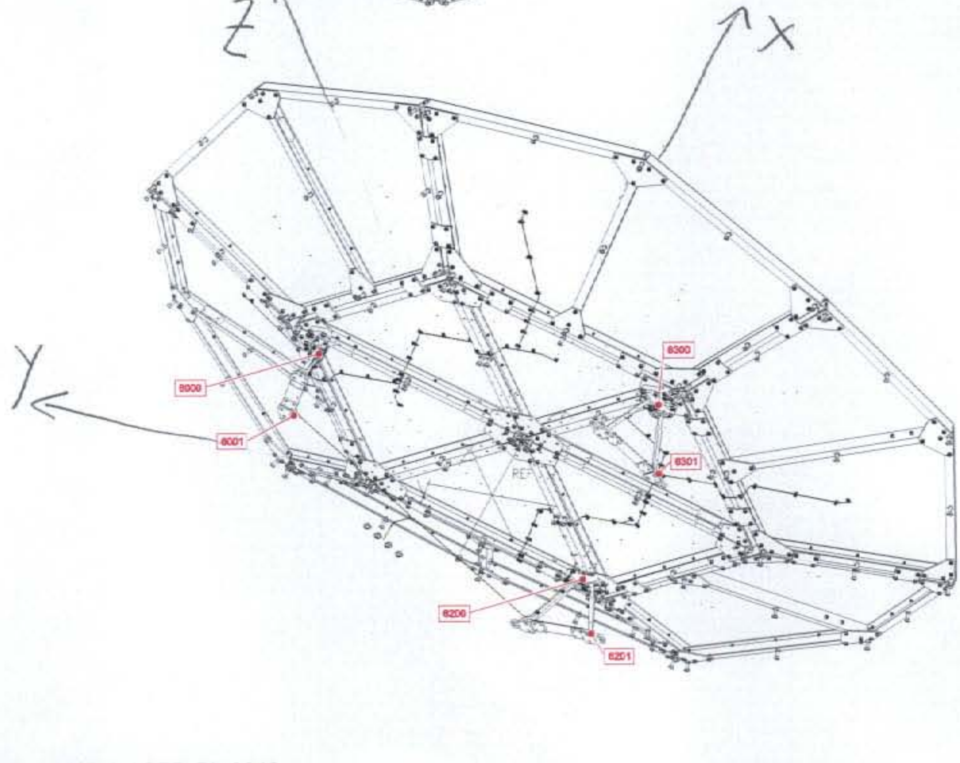
Telescope Thermal Dummy

- ● Pt100 Sensor
- ● Thermocouple
- ● SCOE Temperature Sensor
- ◆ Dale Resistor
- ◆ Foil Heater



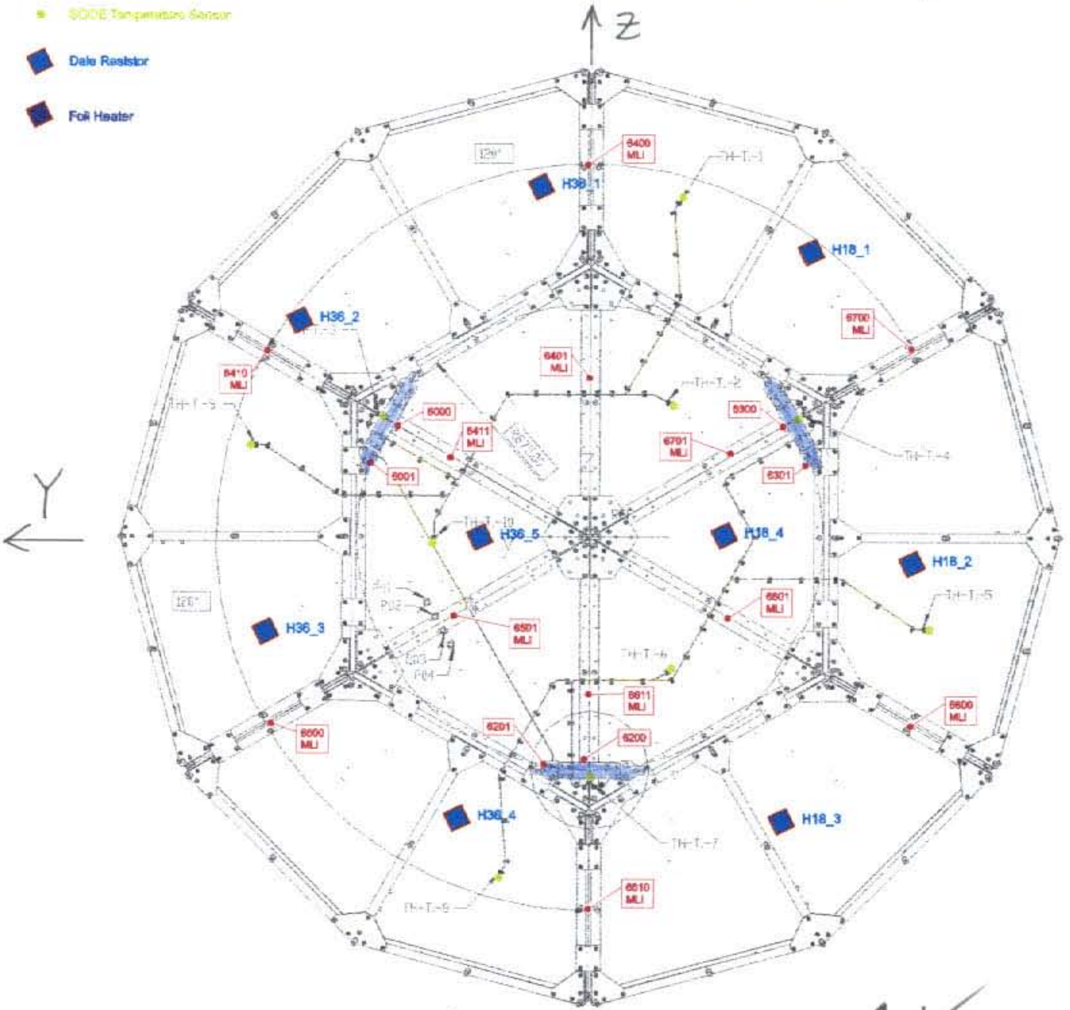
~~Dale resistors to be glued on the TD +X side~~

No heaters attached

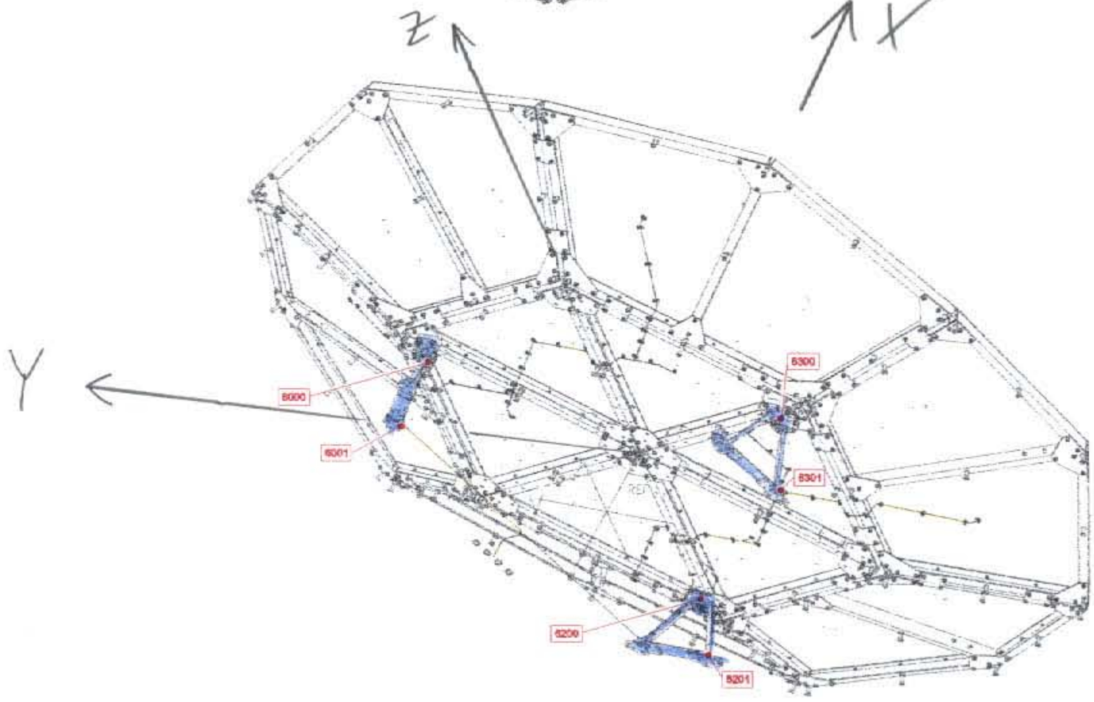


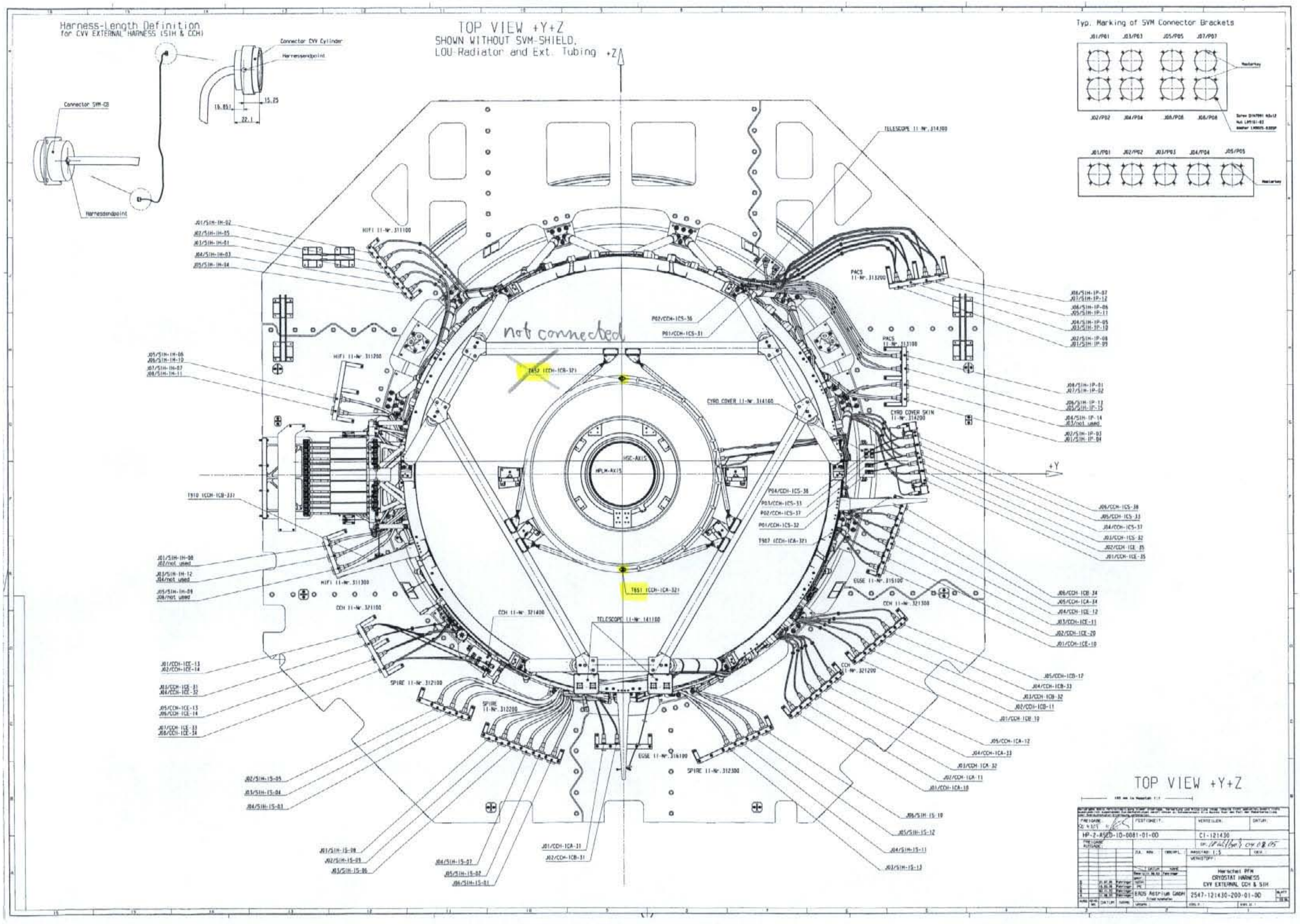
Telescope Thermal Dummy

- ● Pt100 Sensor
- ● Thermocouple
- ● SODE Temperature Sensor
- ■ Dale Resistor
- ■ Foil Heater



Dale resistors to be glued on the TD +X side

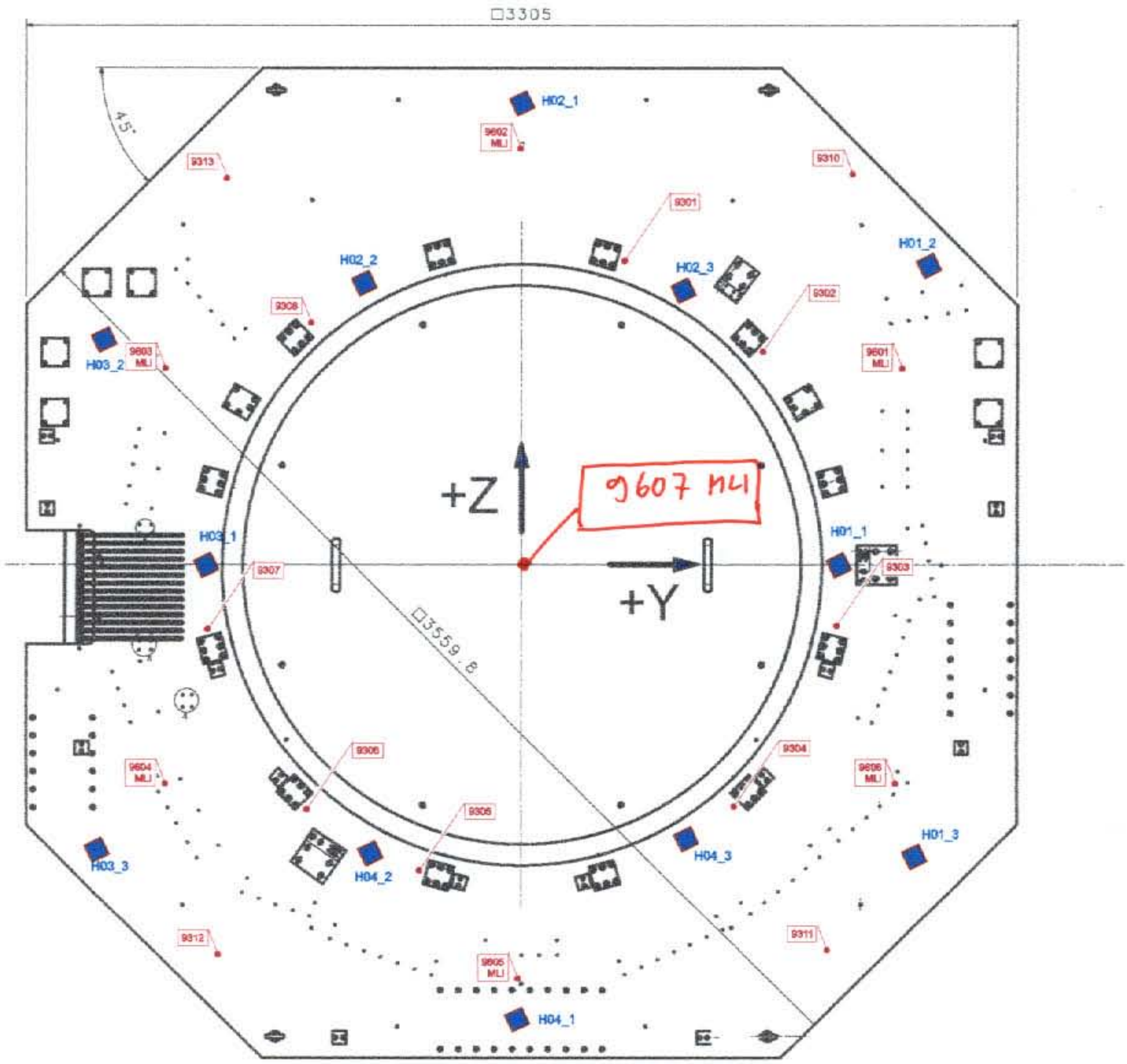




FREIGABE: CC 4321
FESTIGKEIT:
VERTEILER:
DATUM:
HP-2-ASED-ID-0081-01-00
CI-121430
FREIGABE AUSGABE:
Walther 04.08.05
MASSTAB: 1:5
WERKSTOFF:
EADS Astrium GmbH
Herschel PFM
CRYOSTAT HARNESS
CVV EXTERNAL CCH & SIH
2547-121430-200-01-00

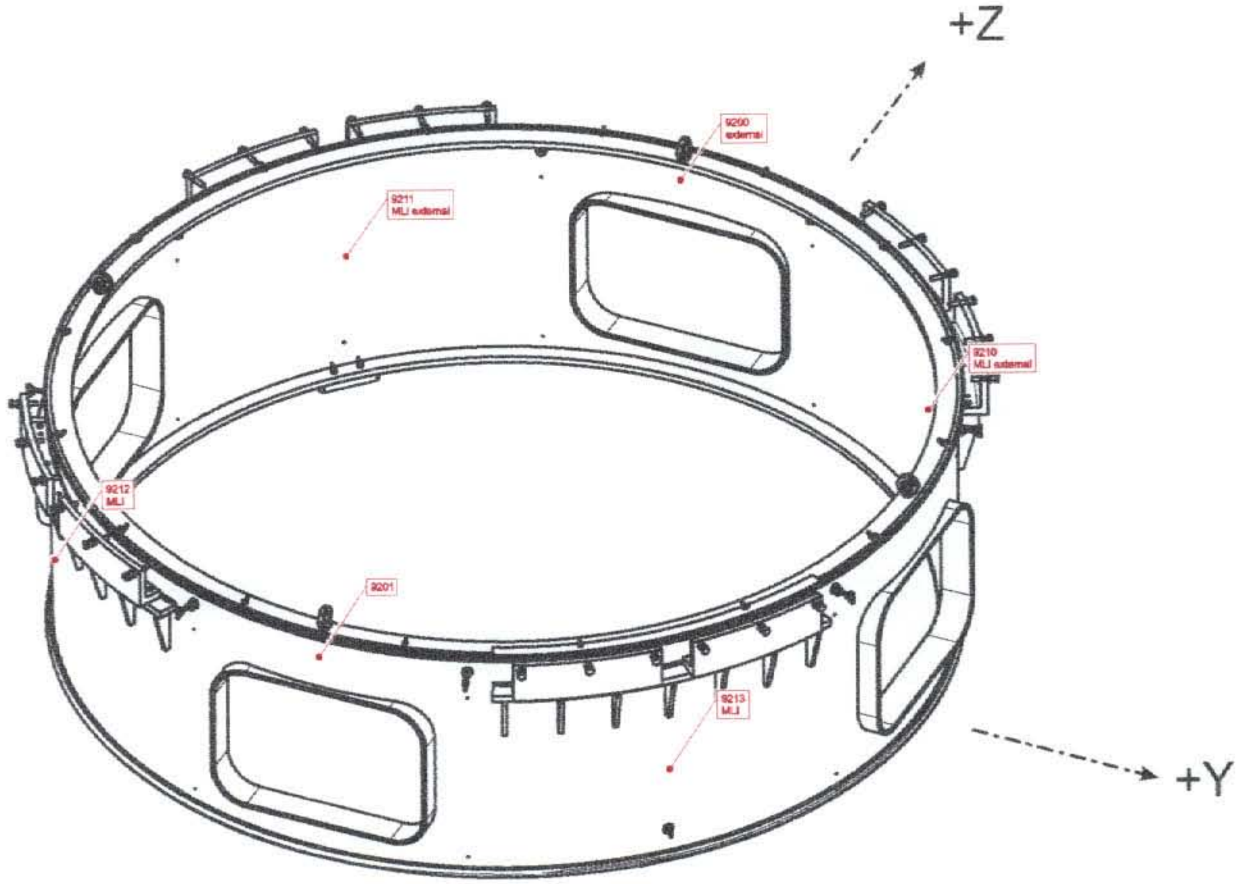
●— Pt100 Sensor
●— Thermocouple
● SCOE Temperature Sensor
◆ Dale Resistor
◆ Foil Heater

TTAP



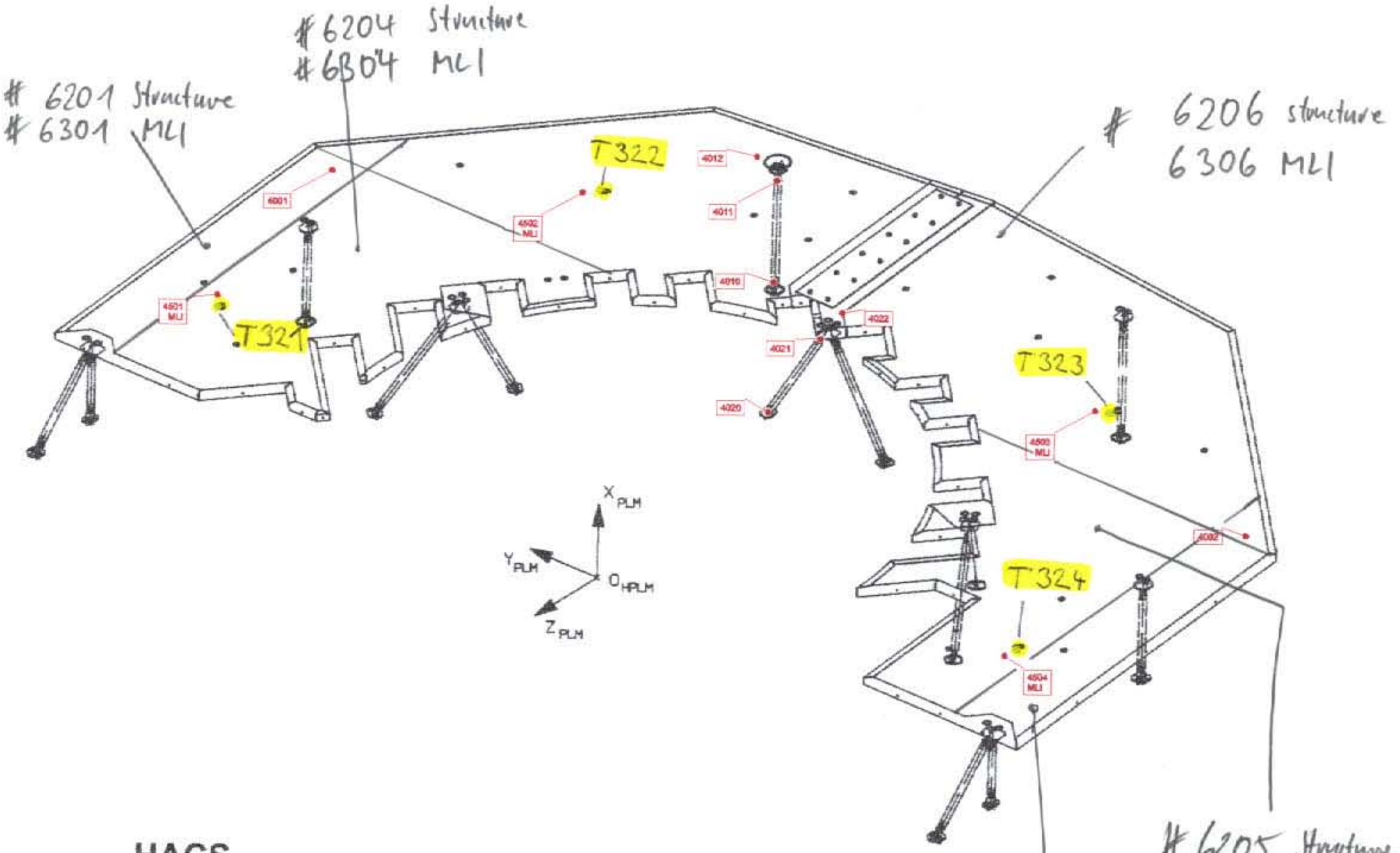
- ● Pt100 Sensor
- ● Thermocouple
- ● SCOE Temperature Sensor
- ◆ Dale Resistor
- ◆ Foil Heater

IAD



- ● Pt100 Sensor
- ● Thermocouple
- ● SCOS Temperature Sensor
- ◆ Dale Resistor
- ◆ Foil Heater

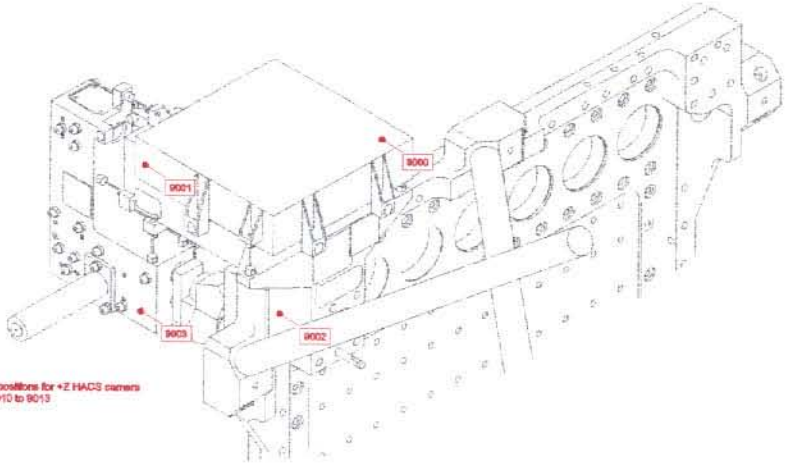
SVM Thermal Shield



HACS

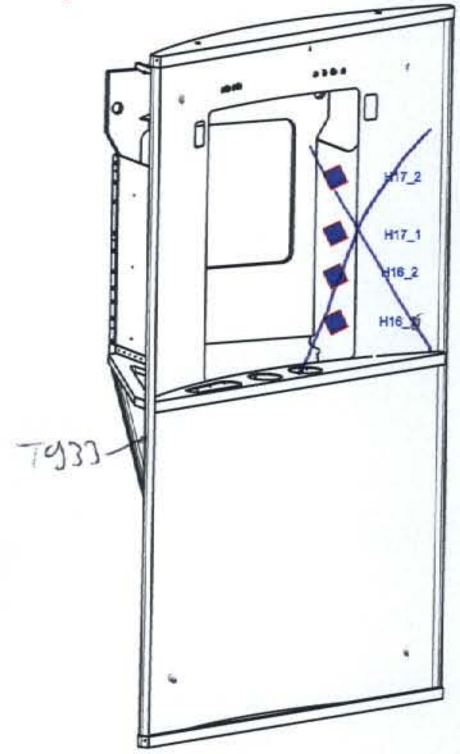
6205 Structure
6305 MLI

6202 Structure
6302 MLI

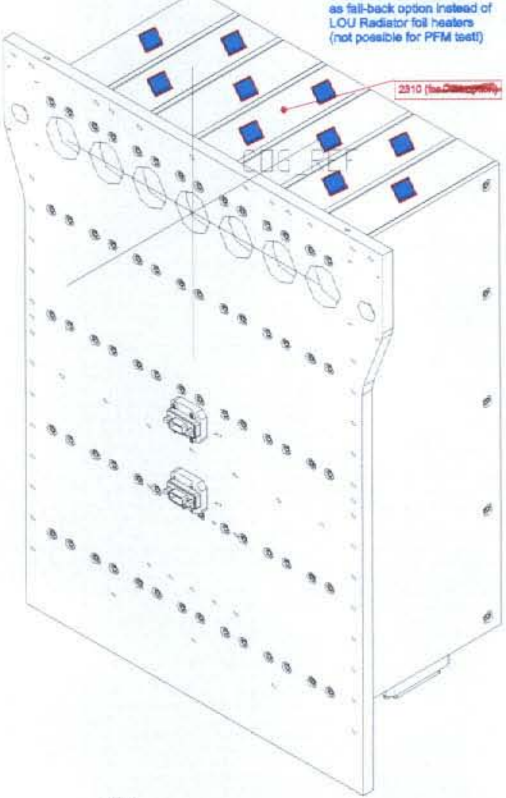


Symmetric TC positions for +Z HACS camera
TC numbers 9010 to 9013

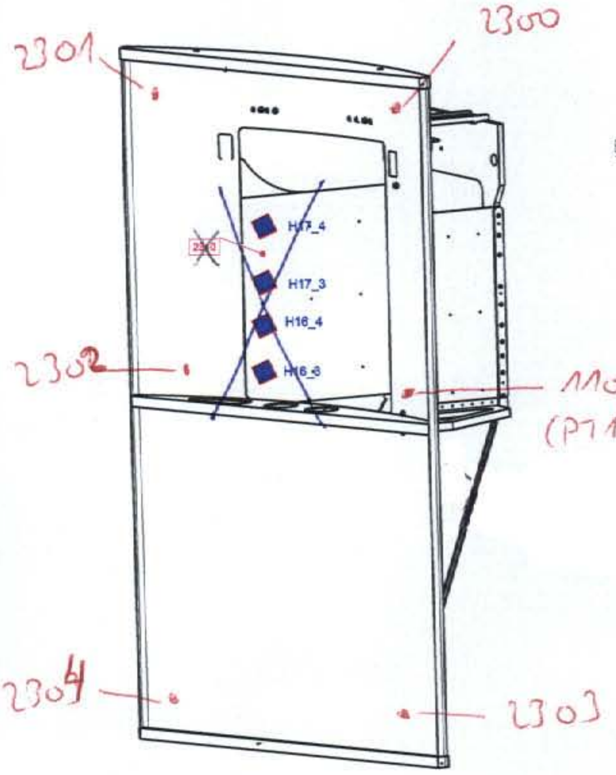
- ●— Pt100 Sensor
- ●— Thermocouple
- ● SCOE Temperature Sensor
- ◆ Dale Resistor
- ◆ Foil Heater

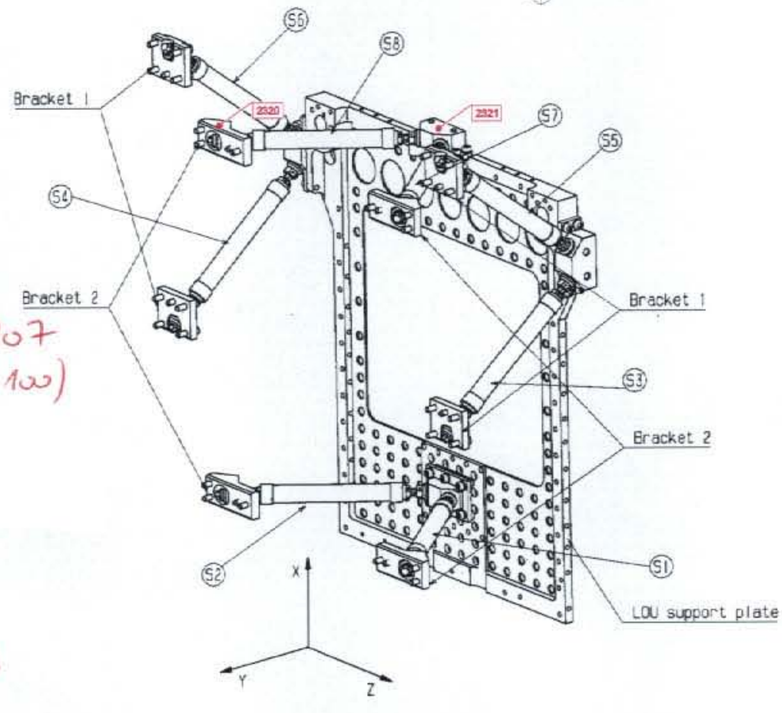


~~Foil heaters on inner side of radiator mounting structure. Total installed power is 300W.
Proposed heaters: (tbc)
Minco HK5274, 25.2Ohm, 19x47mm^2~~



Dale Resistors 10x30W
as fall-back option instead of
LOU Radiator foil heaters
(not possible for PFM test!)





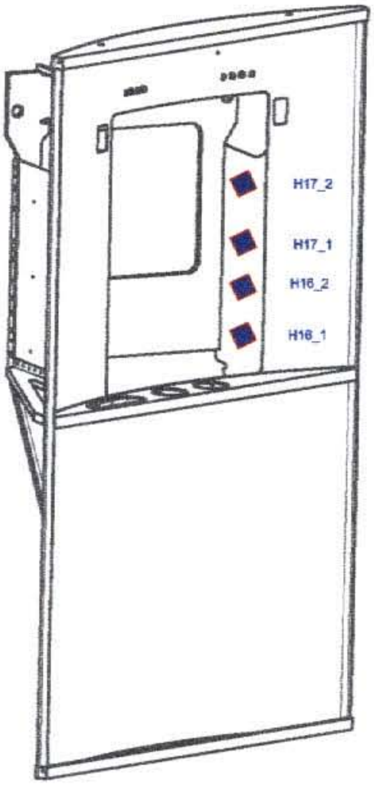
●— Pt100 Sensor

●— Thermocouple

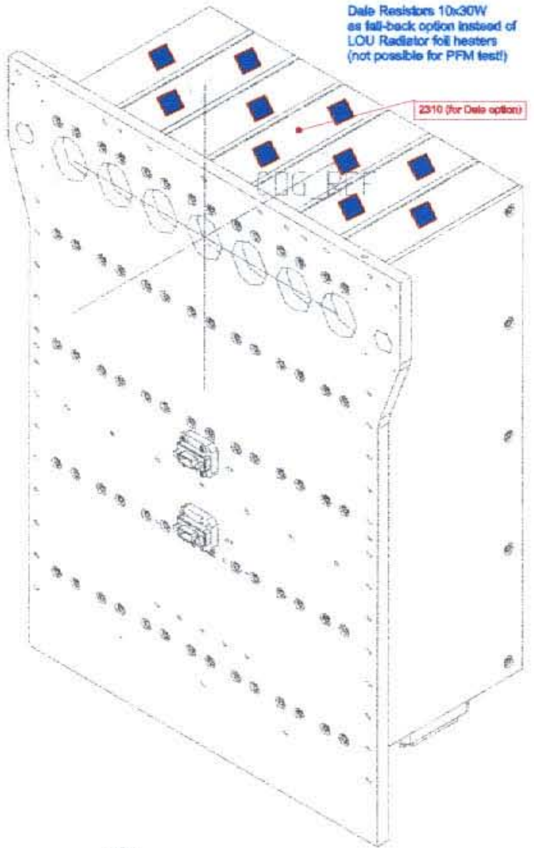
● SCOE Temperature Sensor

◆ Dale Resistor

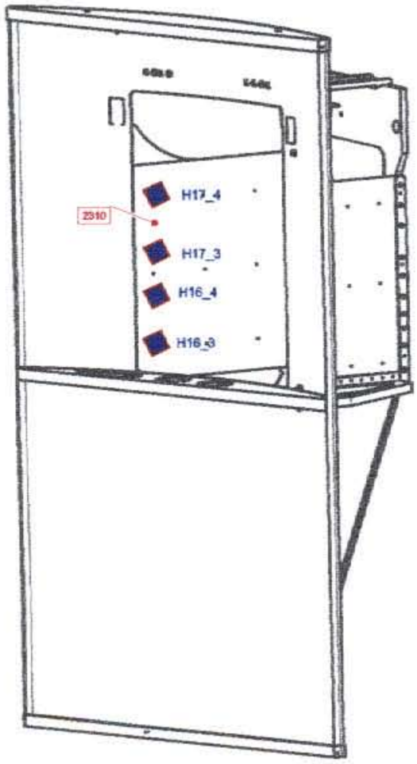
◆ Foil Heater

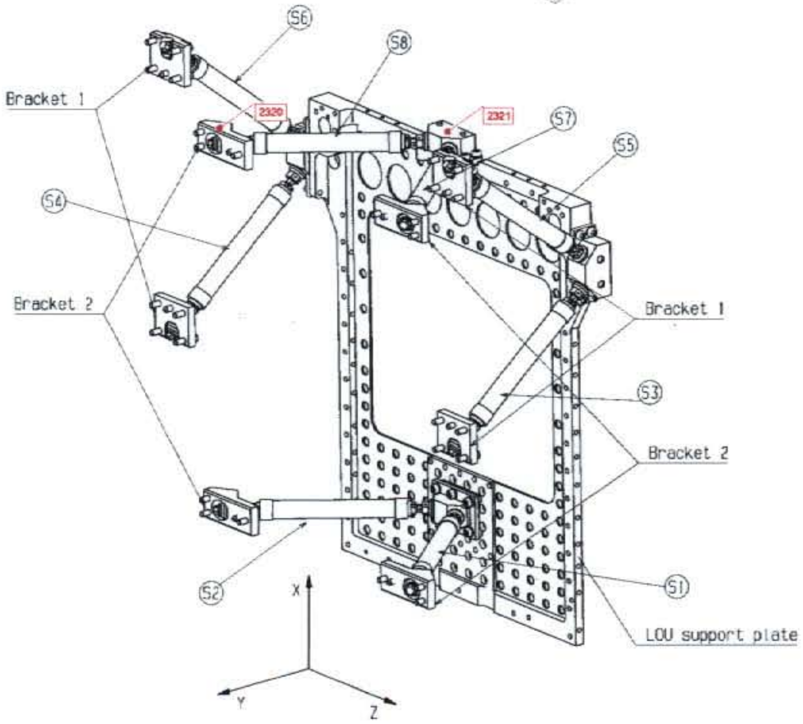


Foil heaters on inner side of radiator mounting structure. Total installed power is 300W.
Proposed heaters: (tbc)
Minco HK5274, 25.2Ohm, 19x47mm^2

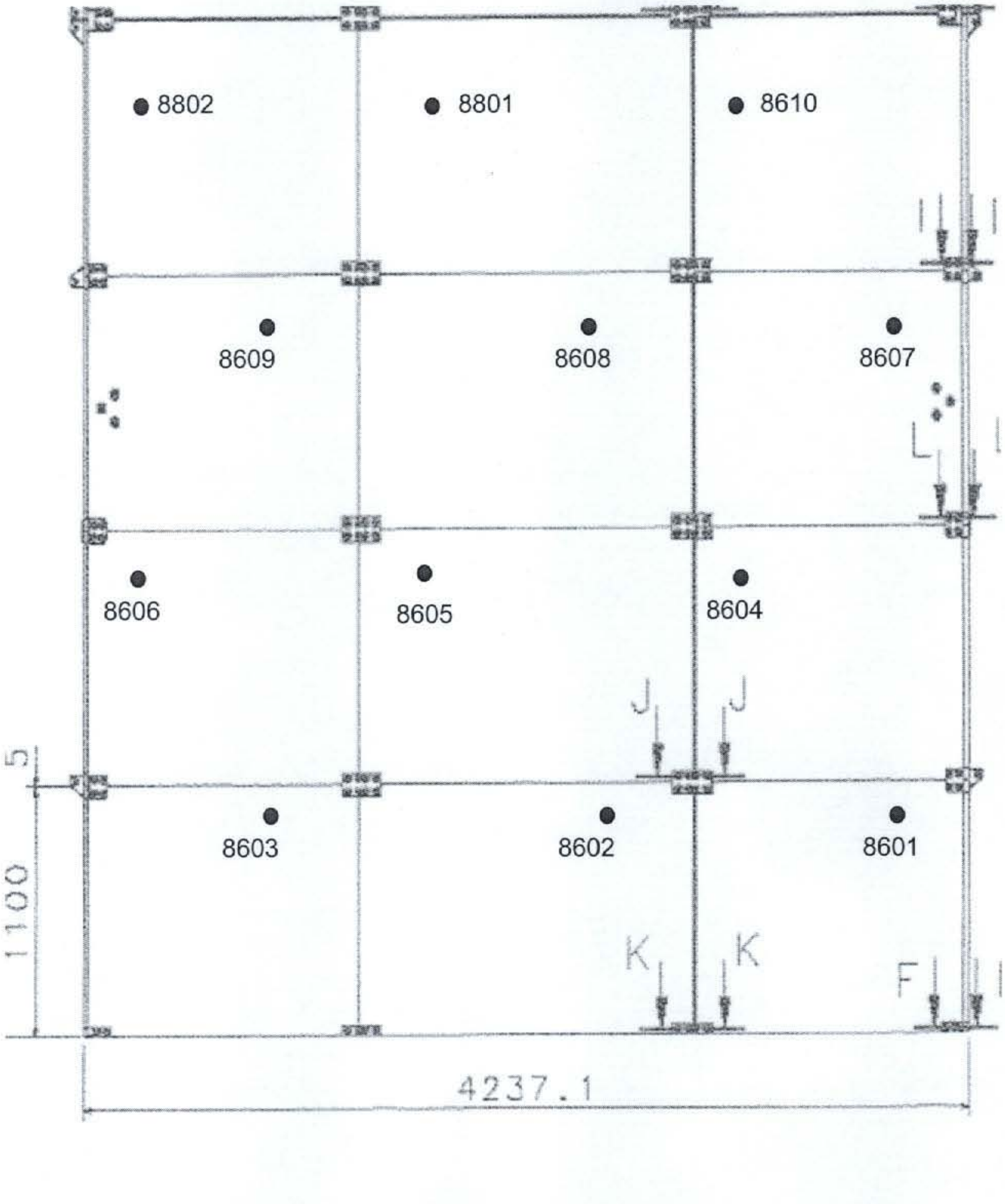


Dale Resistors 10x30W as fall-back option instead of LOU Radiator foil heaters (not possible for PFM test!)



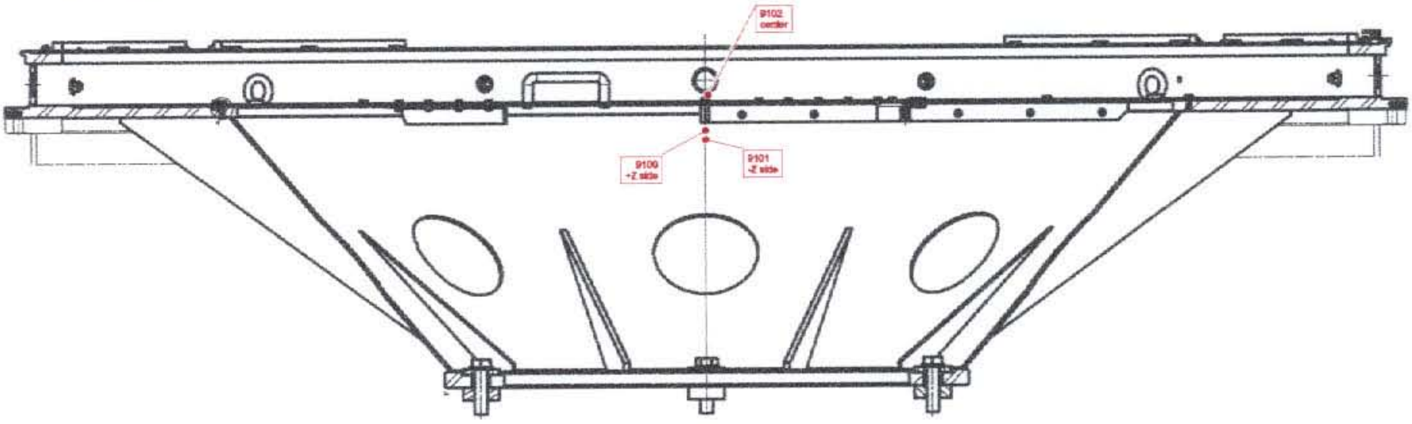


HSS T/C Rig MLI

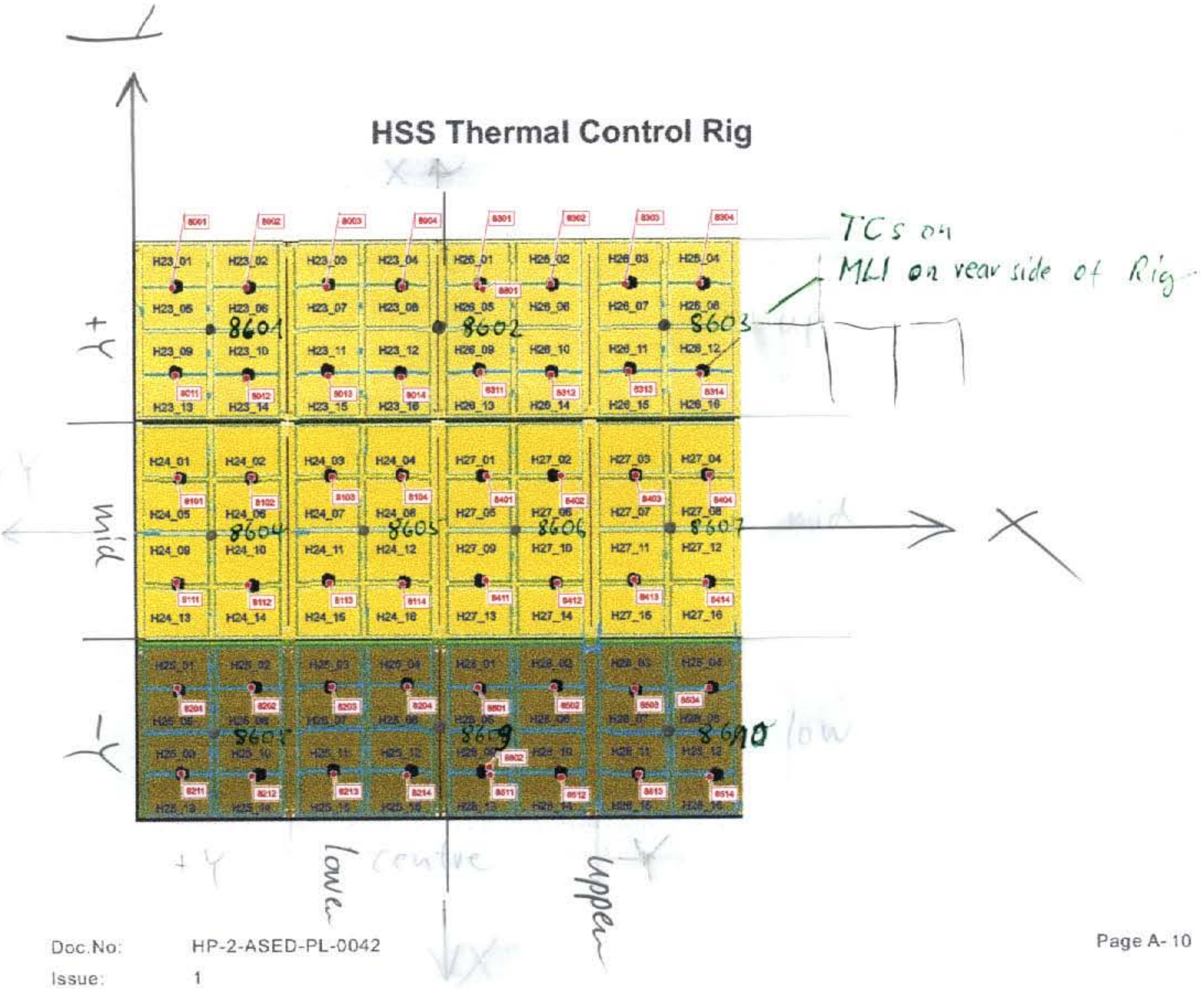


● Pt100 Sensor
● Thermocouple
● SCOE Temperature Sensor
◆ Dale Resistor
◆ Foil Heater

TTAS



HSS Thermal Control Rig



TCs on
MLI on rear side of Rig

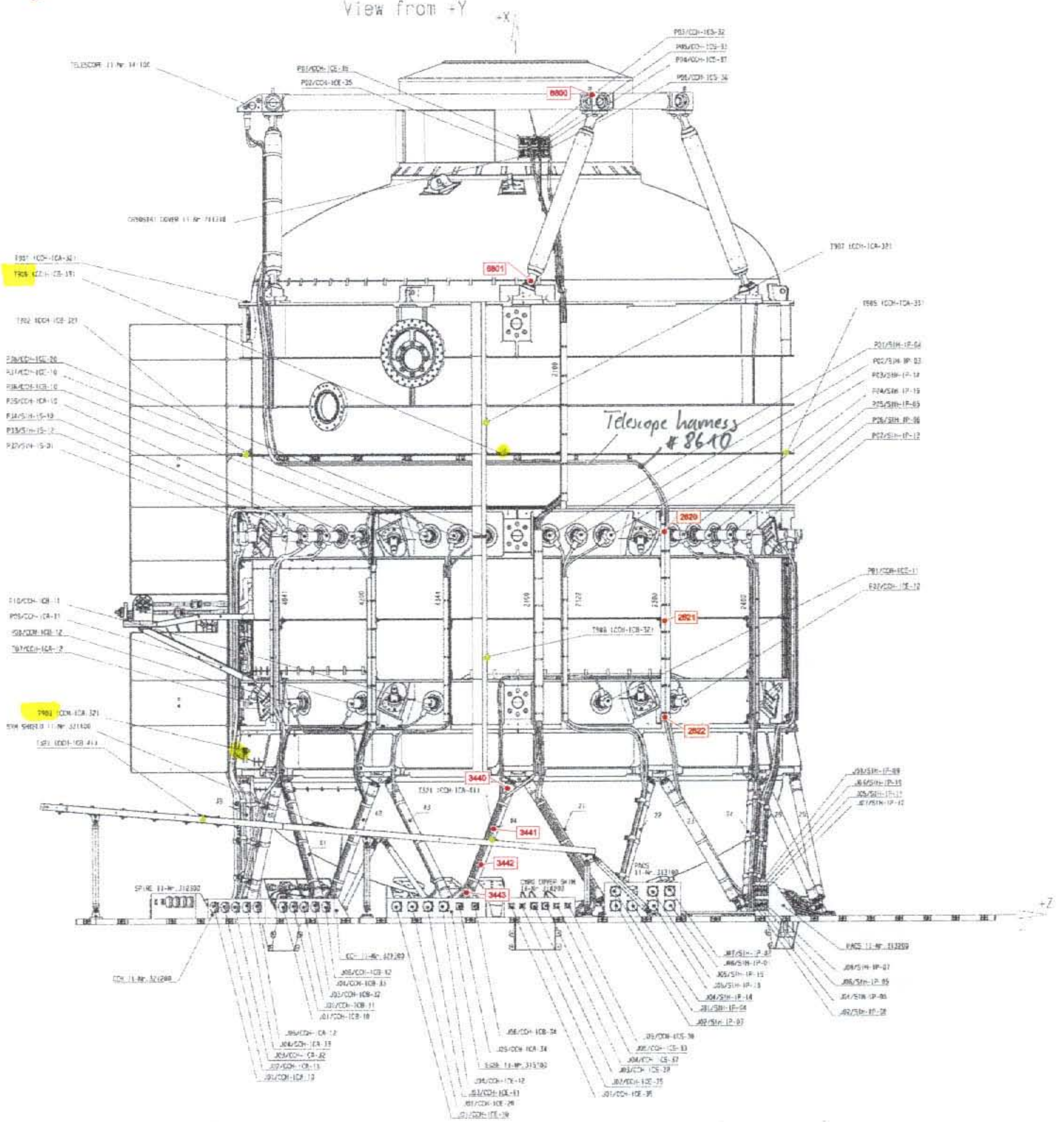
● Pt100 Sensor

● Thermocouple

● [illegible] Temperature Sensor

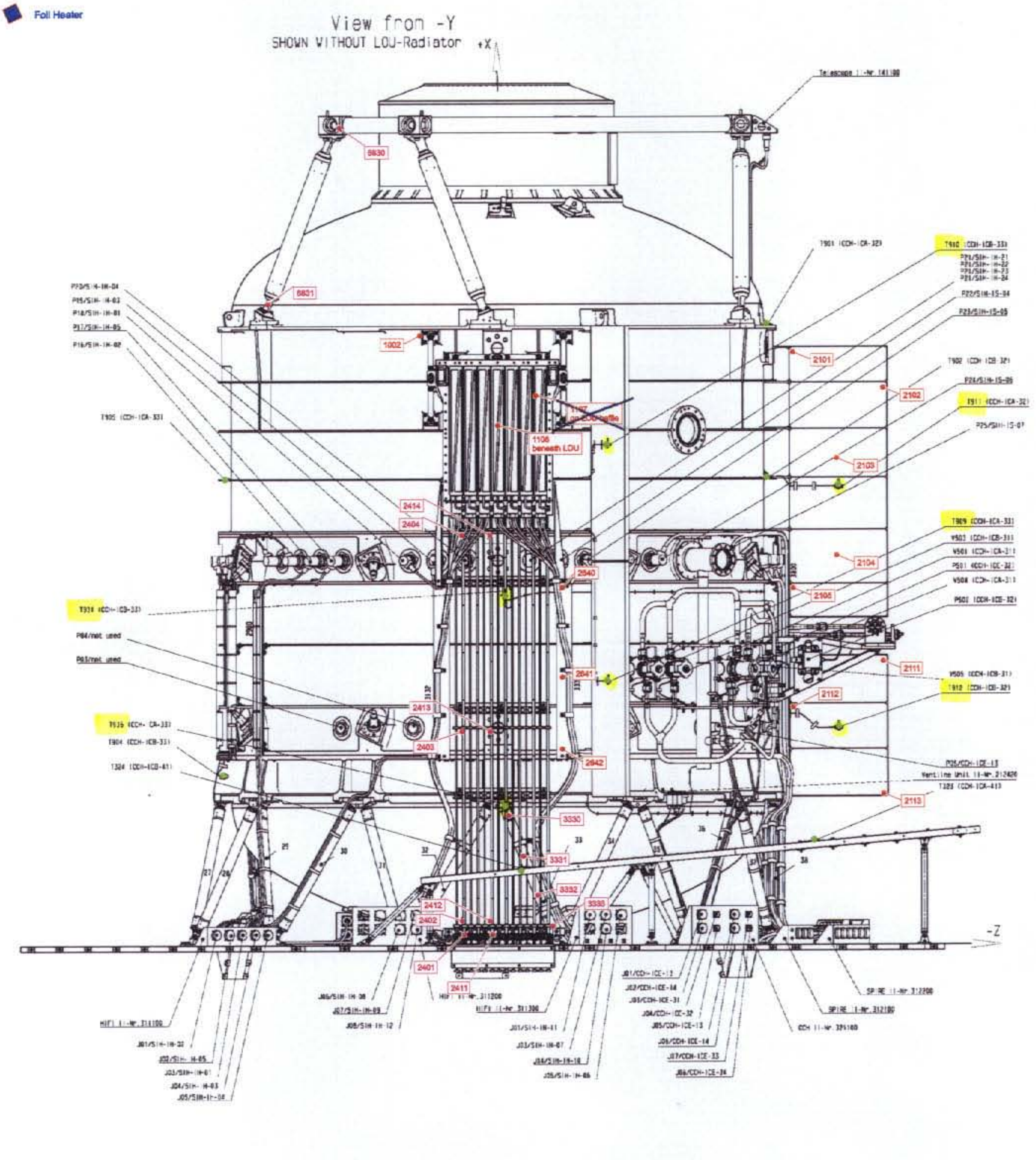
◆ Dale Resistor

◆ Foil Heater

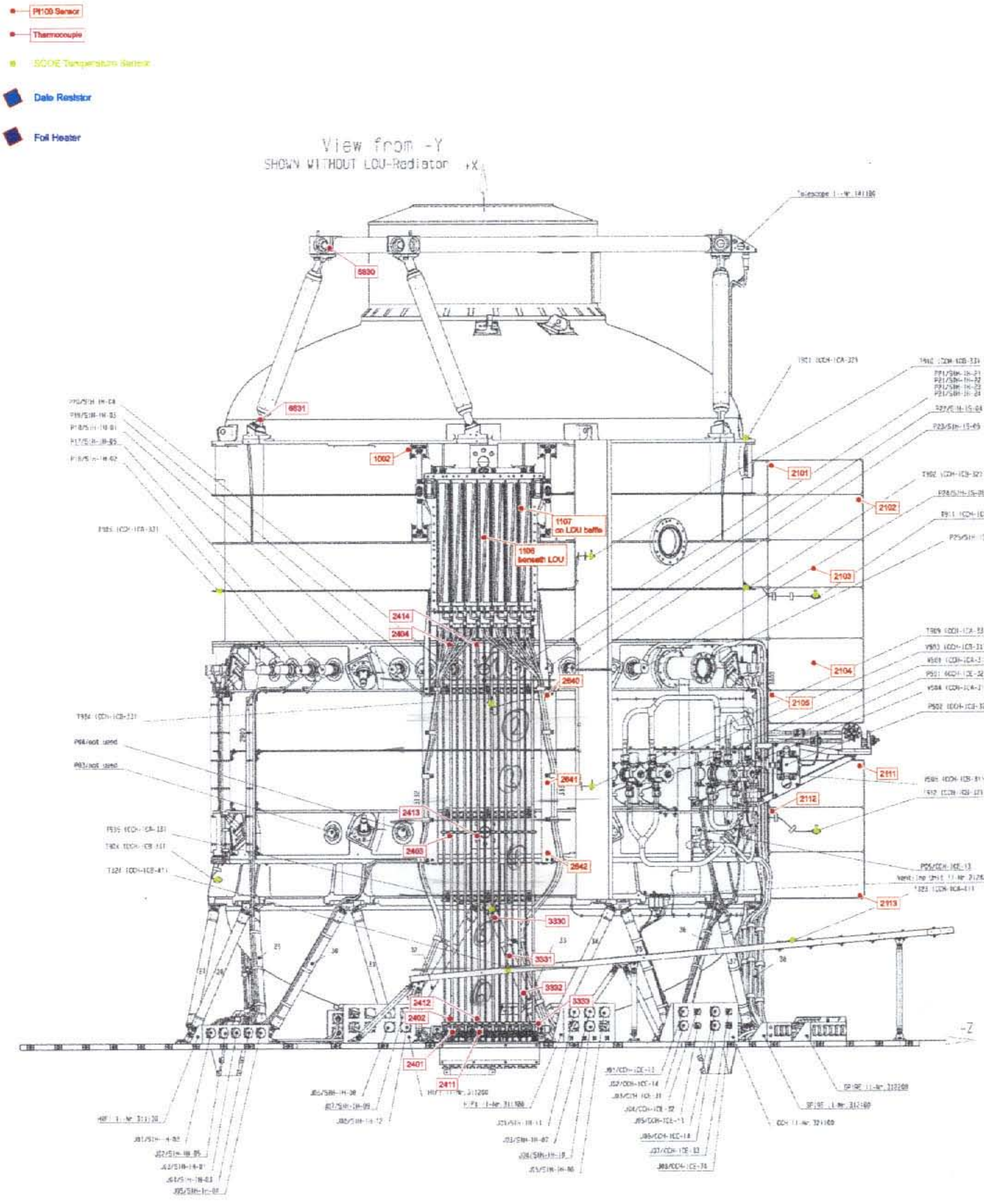


Telescope harness #8610

- Pt100 Sensor
- Thermocouple
- ● SCOE Temperature Sensor
- Dale Resistor
- Foil Heater



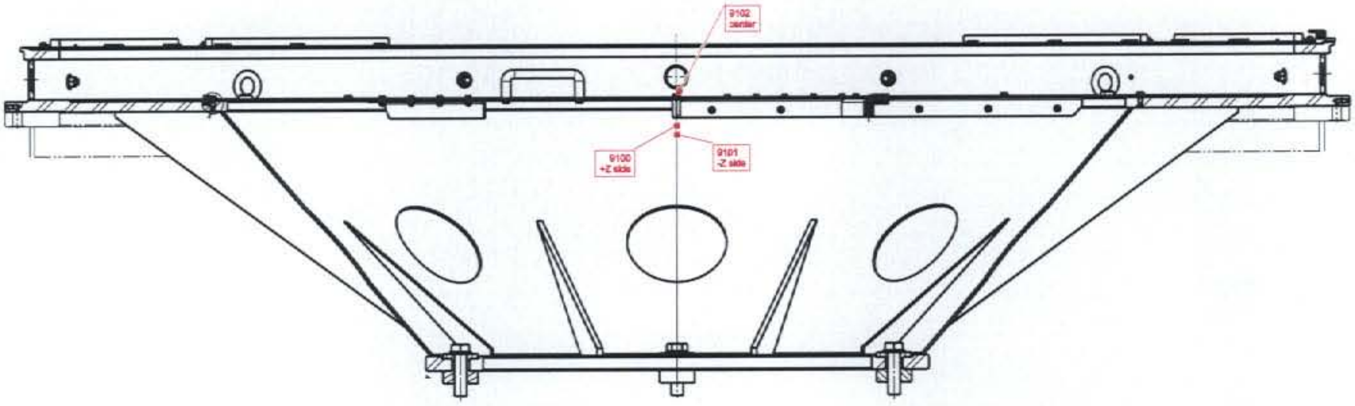
1107 on LOU baffle; baffle
not applicable/not integrated,
1107 attached to LOU radiator
mid-Z instead.



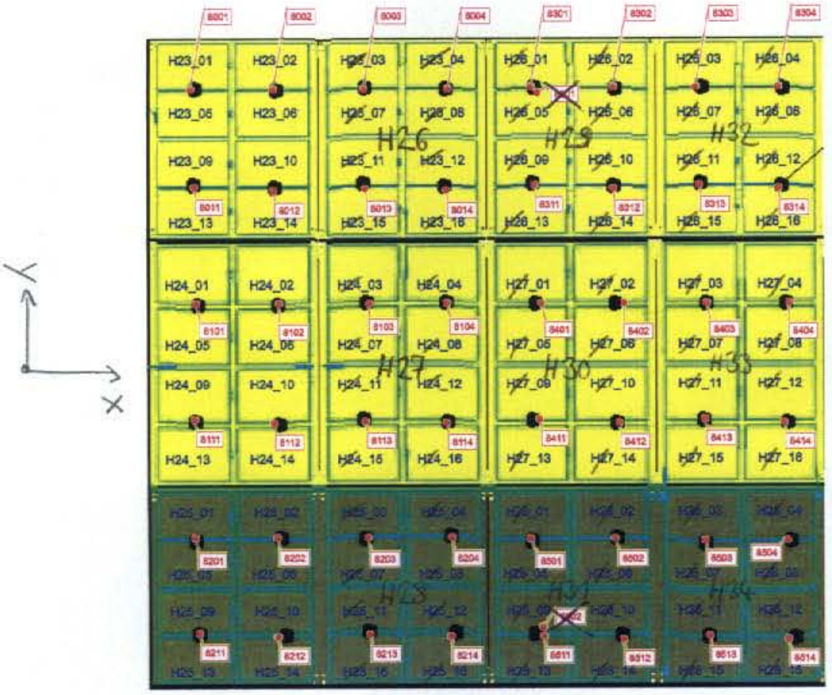
● Pt100 Sensor
● Thermocouple
● SCOE Temperature Sensor
◆ Dale Resistor
◆ Foil Heater
View from -Y
SHOWN WITHOUT LOU-Radiator
+X
5830
6831
1002
1107 on LOU baffle
1106 beneath LOU
2101
2102
2103
2104
2105
2111
2112
2113
2414
2404
2640
2641
2413
2403
2642
3330
3331
3332
3333
2412
2402
2401
2411
-Z

- ● Pt100 Sensor
- ● Thermocouple
- ● SCOE Temperature Sensor
- ◆ Dale Resistor
- ◆ Foil Heater

TTAS

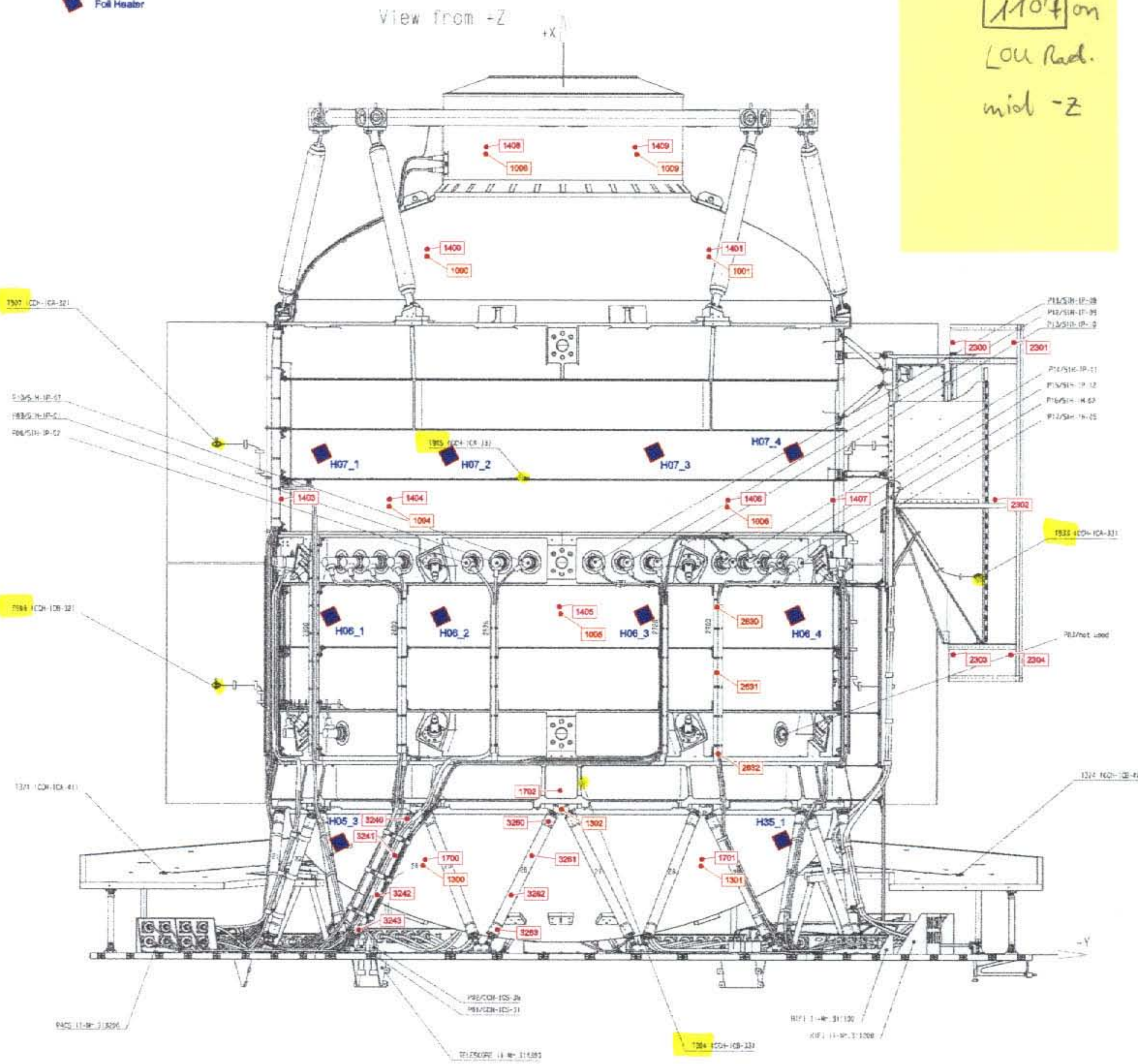


HSS Thermal Control Rig



8801 + 8802 attached to TC Rig MLI

- ● Pt100 Sensor
- ● Thermocouple
- ■ SCOE Temperature Sensor
- ◆ Dale Resistor
- ◆ Foil Heater



1107 on
LOU Rad.
mid -Z

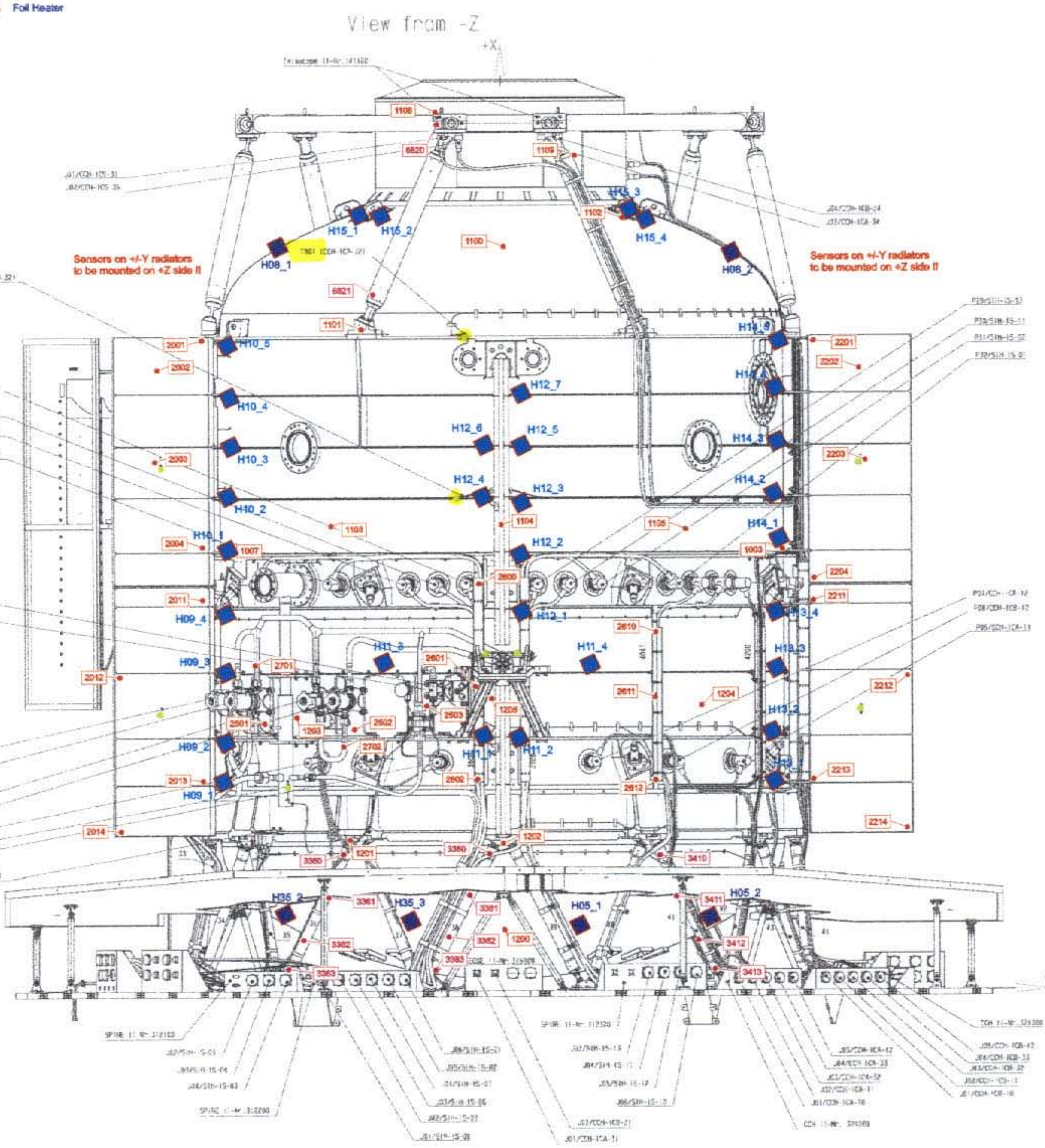
● Pt100 Sensor

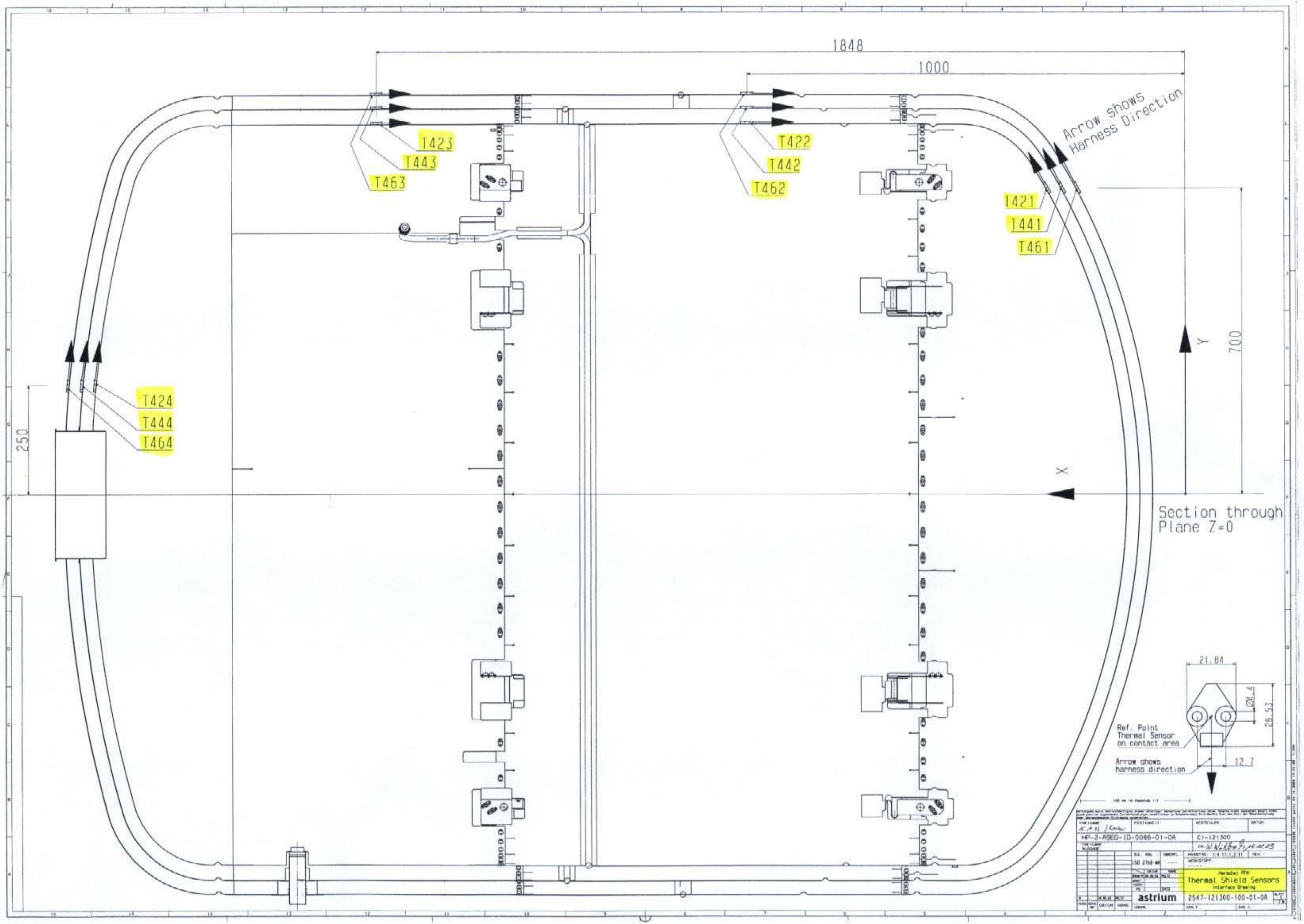
● Thermocouple

● [illegible] Temperature Sensor

◆ Dale Resistor

◆ Foil Heater





HP-2-ASED-ID-0086-01-0A

CI-121300

ISO 2768-mK

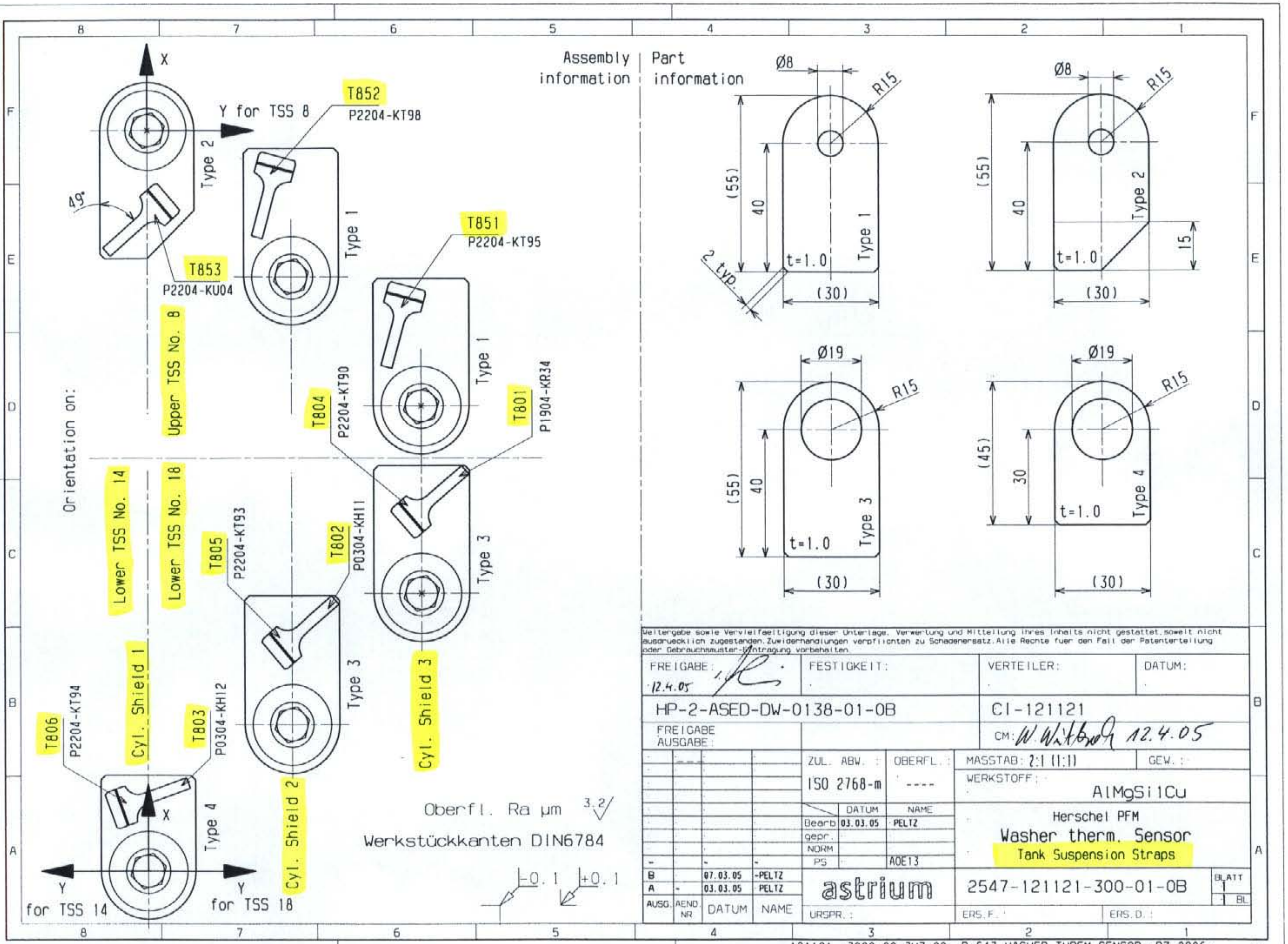
astrium

Herschel PFM

Thermal Shield Sensors

Interface Drawing

2547-121300-100-01-0A



Weitergabe sowie Vervielfaeltigung dieser Unterlage, Verwertung und Mitteilung ihres Inhalts nicht gestattet, soweit nicht ausdruecklich zugestanden. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte fuer den Fall der Patenterteilung oder Gebrauchsmuster-Eintragung vorbehalten.

FREIGABE: 12.4.05
FESTIGKEIT:
VERTEILER:
DATUM:

HP-2-ASED-DW-0138-01-0B
CI-121121

FREIGABE AUSGABE:
CM: W. Wittbrodt 12.4.05

ZUL. ABW.: ISO 2768-m
OBERFL.: ----
MASSTAB: 2:1 (1:1)
GEW.:
WERKSTOFF: AlMgSi1Cu

	DATUM	NAME
Bearb	03.03.05	PELTZ
gepr.		
NORM		
PS		AOE13

Herschel PFM
Washer therm. Sensor
Tank Suspension Straps

AUSG.	AEND. NR	DATUM	NAME
-		-	-
B		07.03.05	PELTZ
A	-	03.03.05	PELTZ

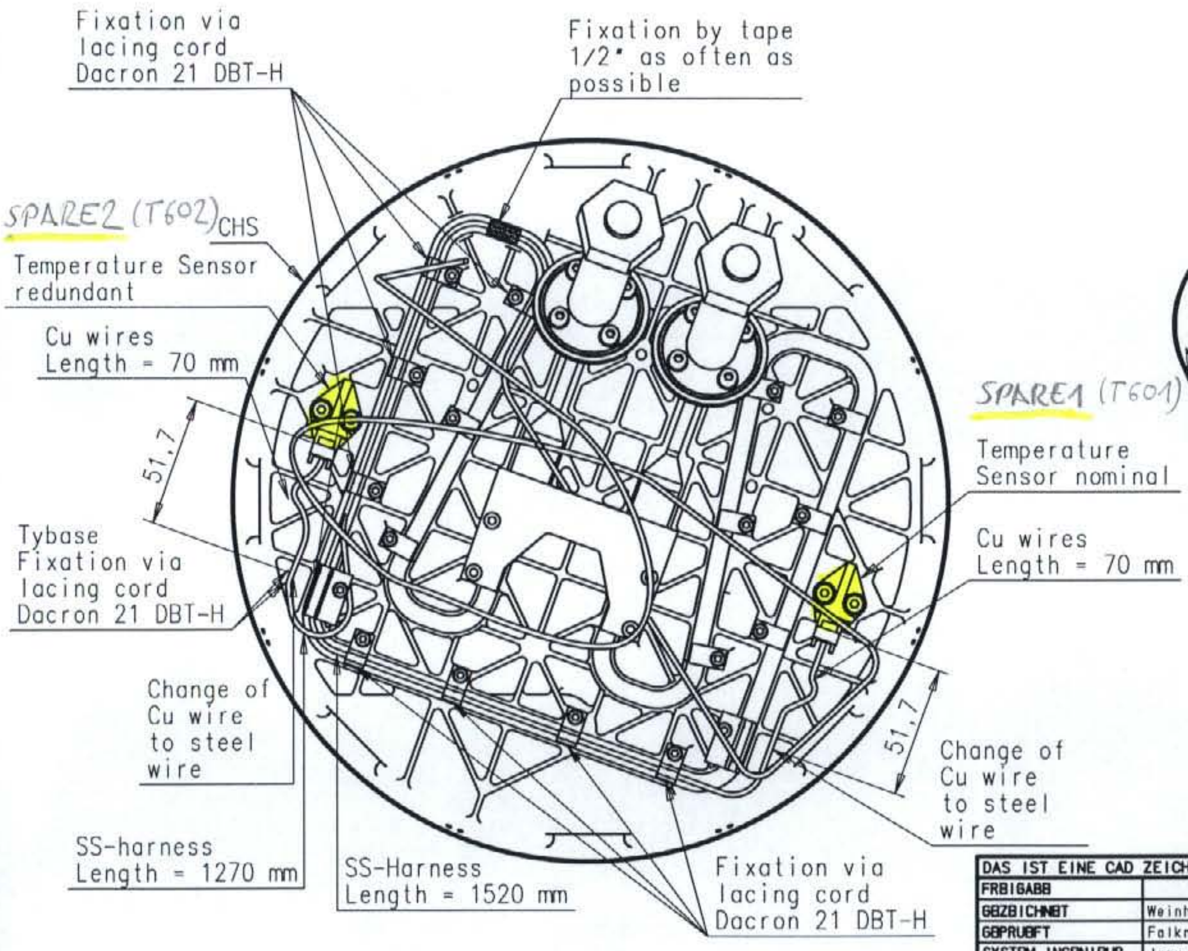
astrium

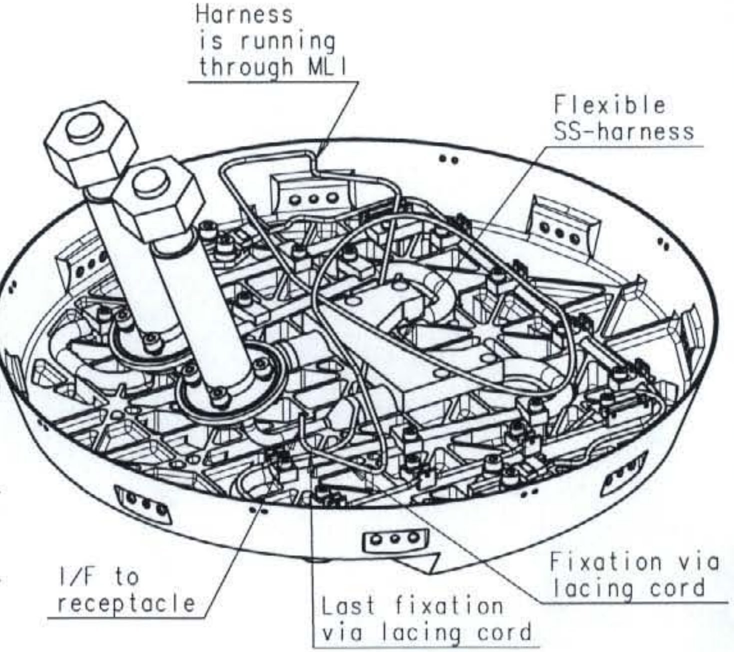
2547-121121-300-01-0B
BLATT 1
1 BL

URSPR.:
ERS. F.:
ERS. D.:

121121_+3000+00+3HZ+00+_B+547+WASHER_THREM_SENSOR_+PZ_2906+_____++

Scale 1:2





All bolts M3x10 for fixation of the Cooling Loop to the CHS shall be torqued to 0.8 +/- 0.1 Nm except the bolts of the clamps next to the Transitions. These bolts shall be torqued to 0.5 Nm +/- 0.1 Nm.

The bolts M4x10 for fixation of the temperature sensors shall be torqued to 1.5 Nm. Special Invar washers shall be used in addition to the standard washers.

DAS IST EINE CAD ZEICHNUNG. KEINE MANUELLEN AENDERUNGEN. THIS IS A CAD DRAWING. NO MANUAL CHANGES.

FREIGABE	NAME	DATUM	FREIGABE	NAME	DATUM	FREIMASZTOLERANZ GEN. TOLERANCES
GEZEICHNET	Weinhappl	30-06-2003	BERECHNUNG	Schermann	30-06-2003	
GEPRUEFT	Falkner	30-06-2003	PRODUKTSICHERUNG	Supper	30-06-2003	
SYSTEM INGENIEUR	Janu	30-06-2003	FERTIGUNG	Zadrazil	30-06-2003	

Austrian Aerospace

OBERFLAECHENRAUHEIT/SURFACE FINISH
ISO 1302
DIN 4763
SCHUTZVERMERK NACH DIN 34 BEACHTEN
OBSERVE COPYRIGHT ACCORDING TO DIN 34

OBERFLAECHENBEHANDLUNG SURFACE TREATMENT

H			
G			
F			
E	CRI 56		
D	CRI 37	23-07-2004	OLR
C	ISSUED	15-10-2003	OLR
B	CRI 16		
A			
	AENDERUNG	DATUM	NAME

CADM-RELEASE

MASSTAB/SCALE
M 1:2

ALLE SCHARFEN KANTEN BRECHEN
BREAK ALL SHARP EDGES

ROHTEIL NR./RAWPART NO.

FILE NAME:

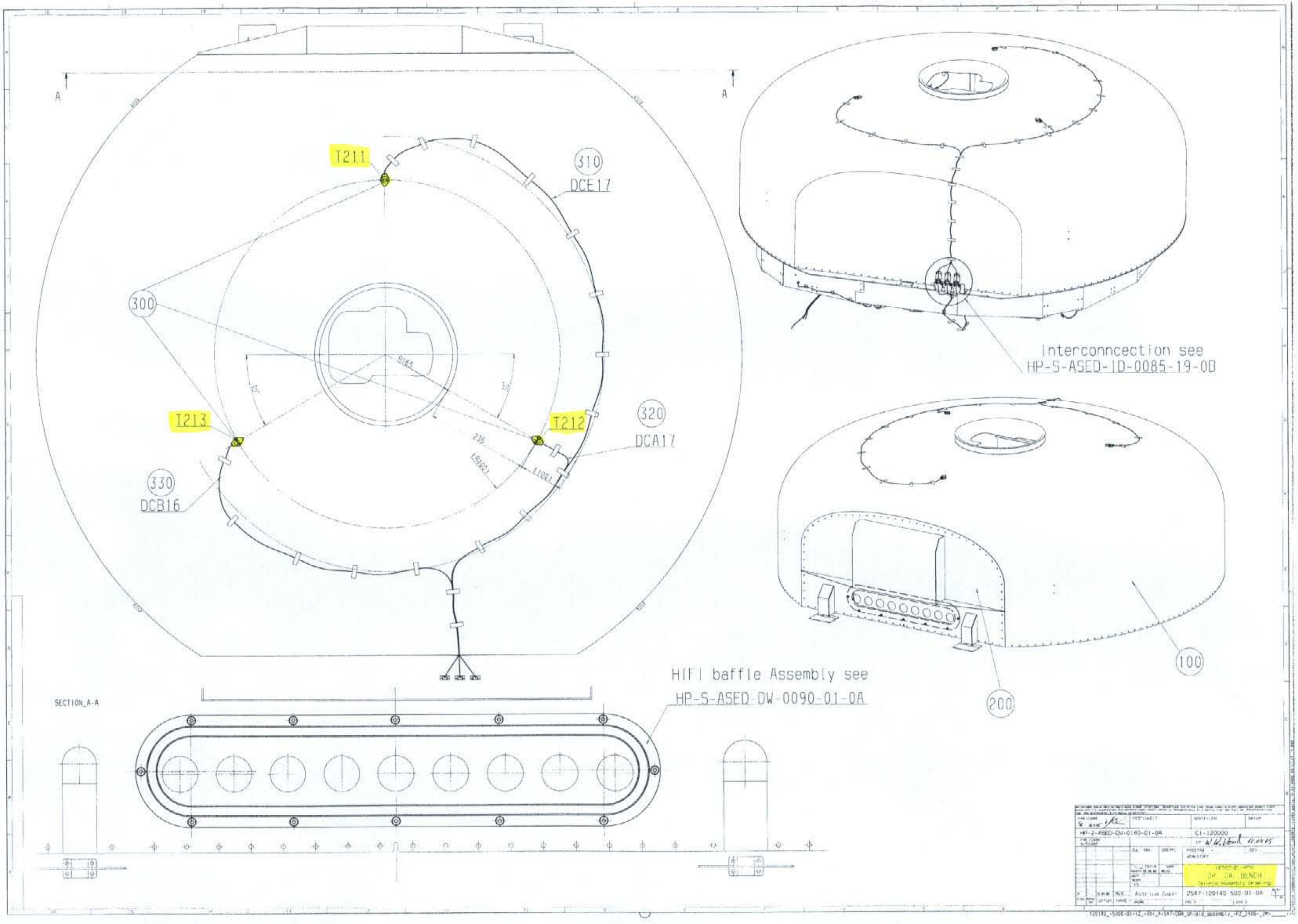
Cryostat Cover &
Cryostat Baffle

PROJECT: HCRC
ITEM: CC

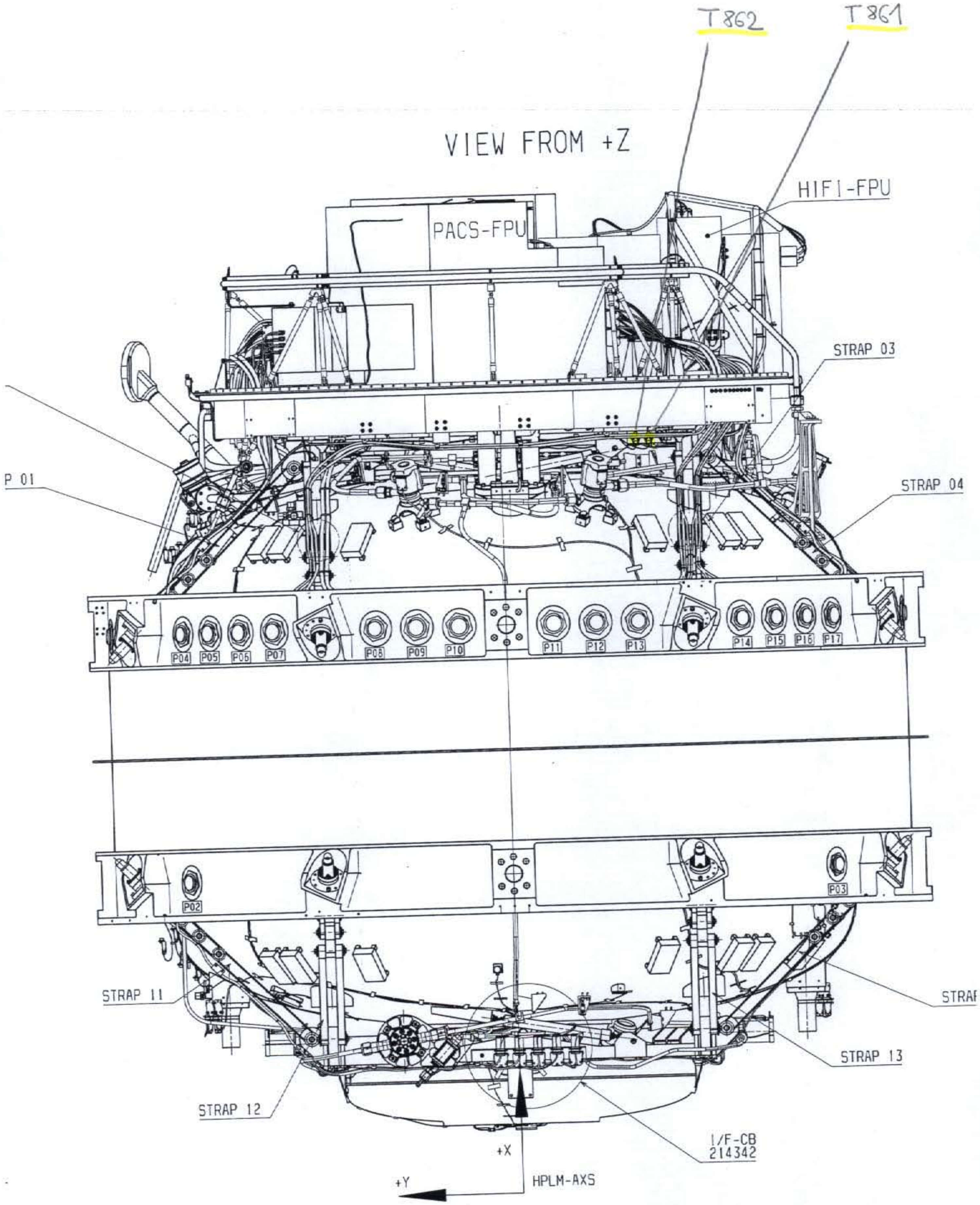
ICD2830-000-000-00

Blatt: sheet: 9
von: of: 11

CAD SYSTEM: I-DEAS 9m3


A
A
T211
310
DCE17
300
9165
T213
T212
320
DCA17
235
330
DCB16
Interconncection see
HP-S-ASED-ID-0085-19-0B
HIFI baffle Assembly see
HP-S-ASED-DW-0090-01-0A
SECTION_A-A
100
200
HP-2-ASED-DW-0140-01-0A
CI-120000
W. Weblondt 17.04.05
OB CAL BENCH
Shield Assembly Drawing
Astrium GmbH
2547-120140-500-01-0A
120140_-500-01-12_-00-_A-547-0BA_Shield_assembly_-P2_2906-_2M-

Upper Spatial Framework



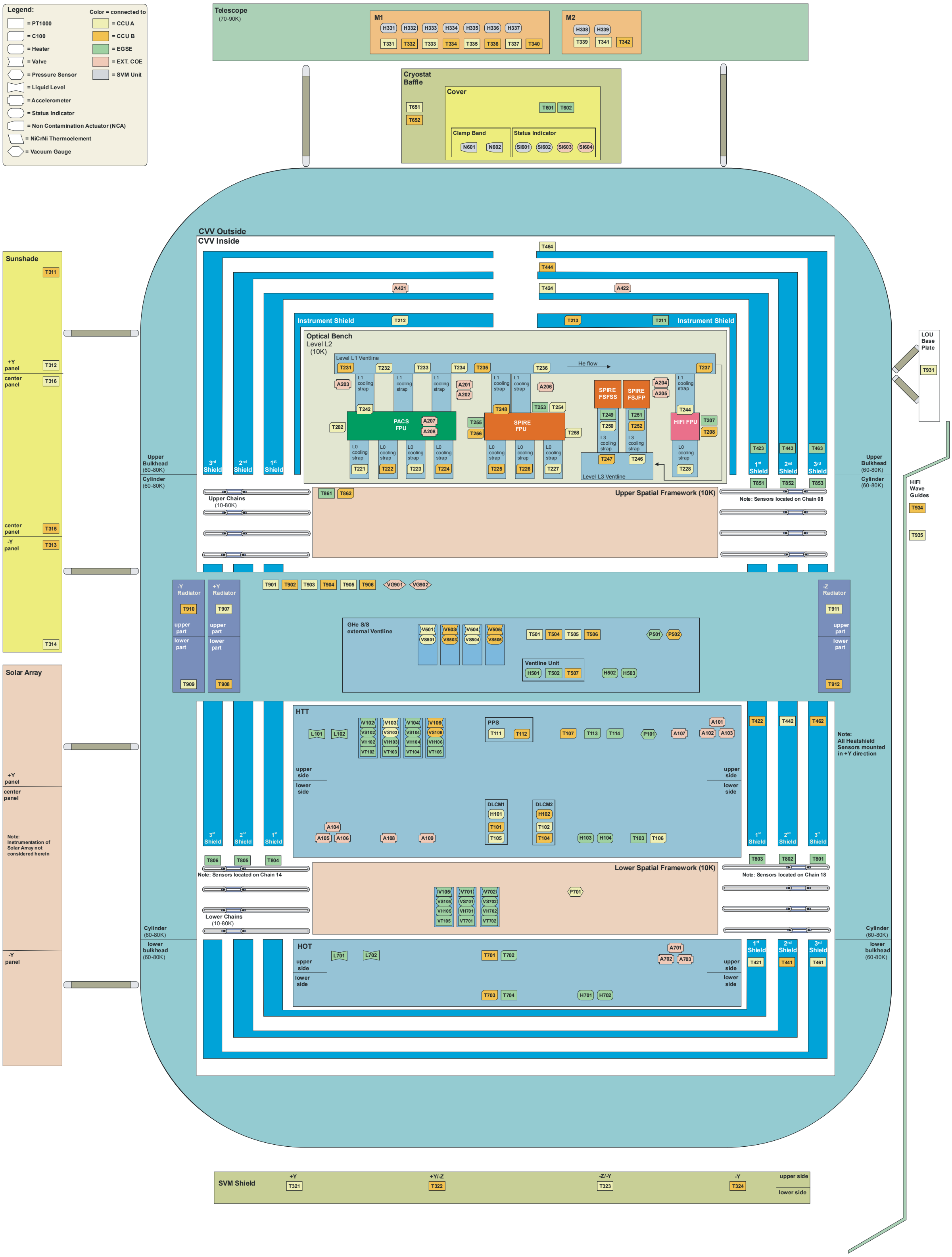


Figure 3.3.1: Component Distribution General Overview

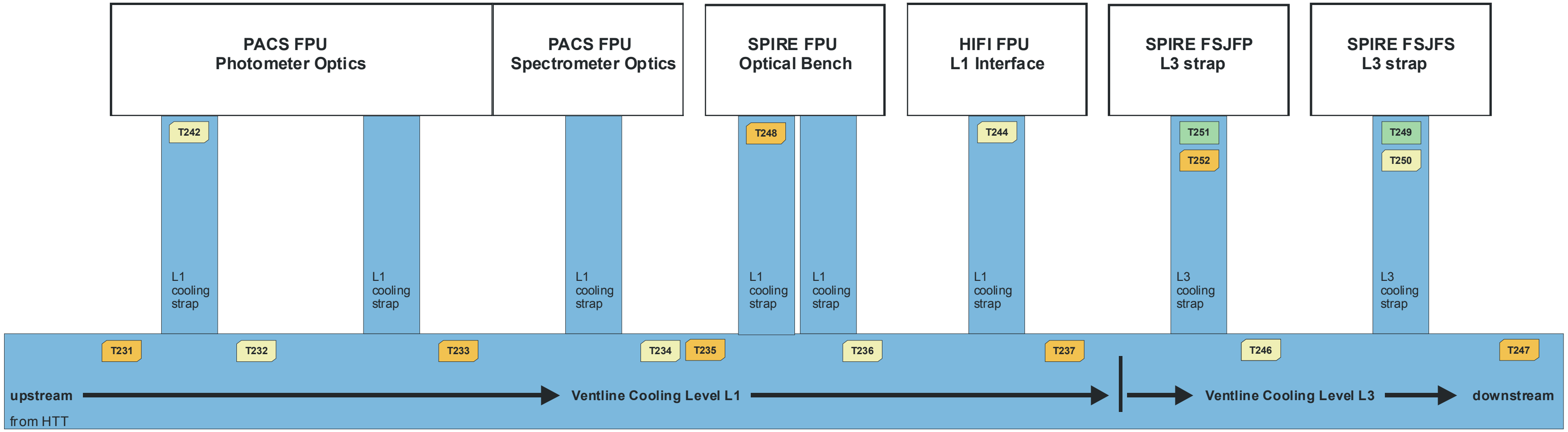
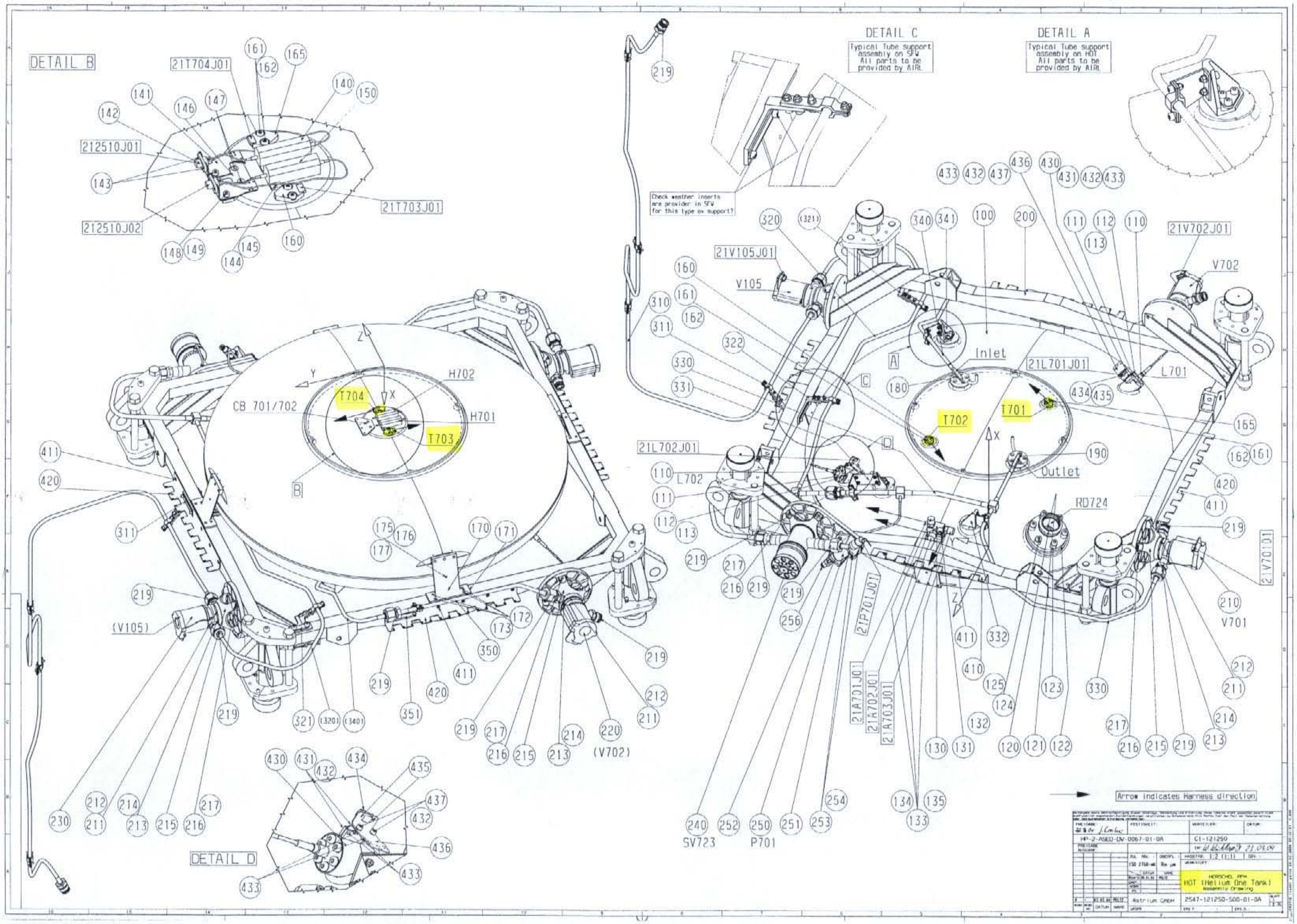


Figure 3.3.2: Component Distribution on OBA Ventline



Arrow indicates Harness direction

HP-2-ASED-DW-0067-01-0A

CI-121250

21.03.04

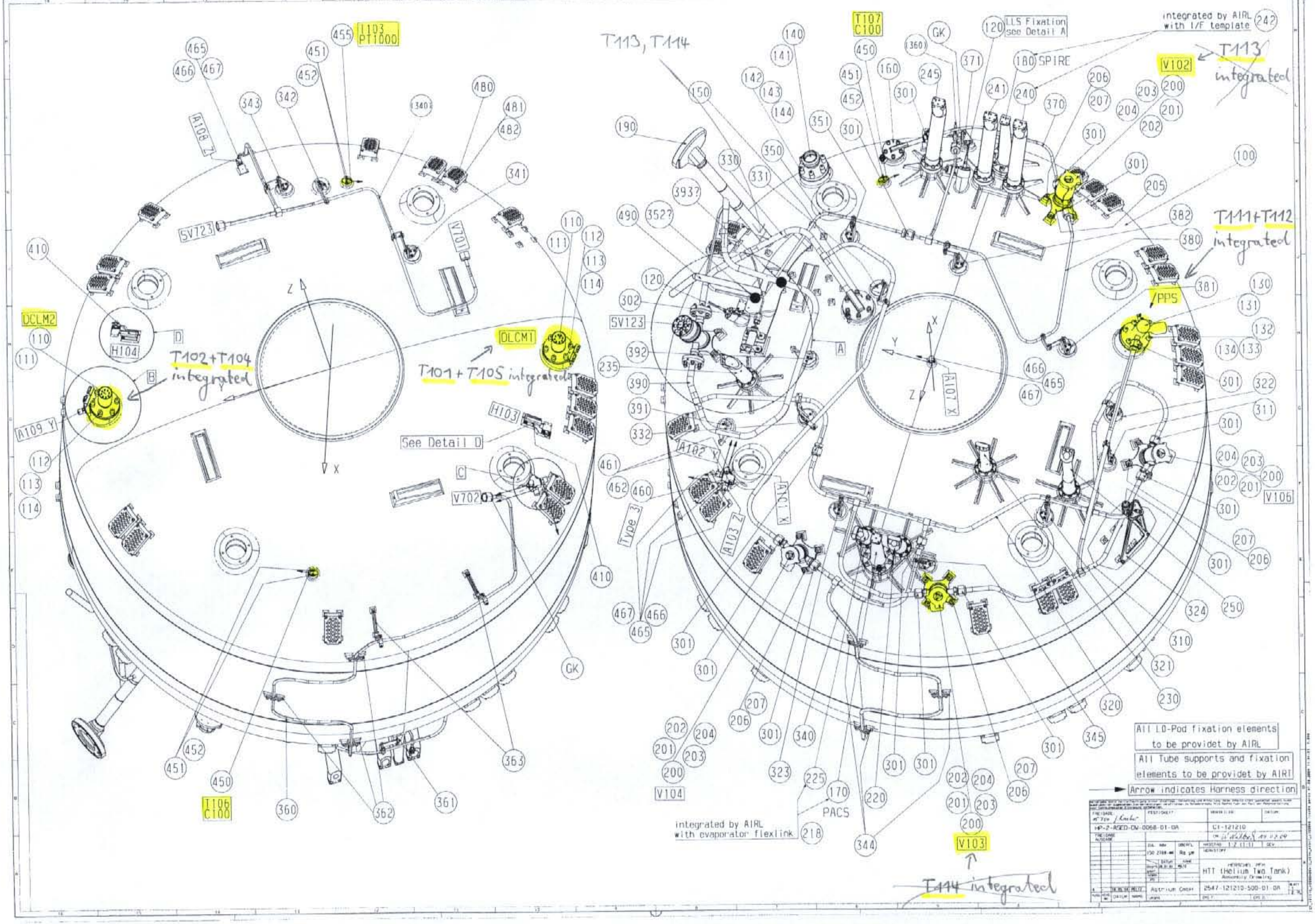
MASSTAB: 1:2 (1:1)

ISO 2768-mK Ra µm

HERSCHEL PFM
HOT (Helium One Tank)
Assembly Drawing

Astrium GmbH

2547-121250-500-01-0A



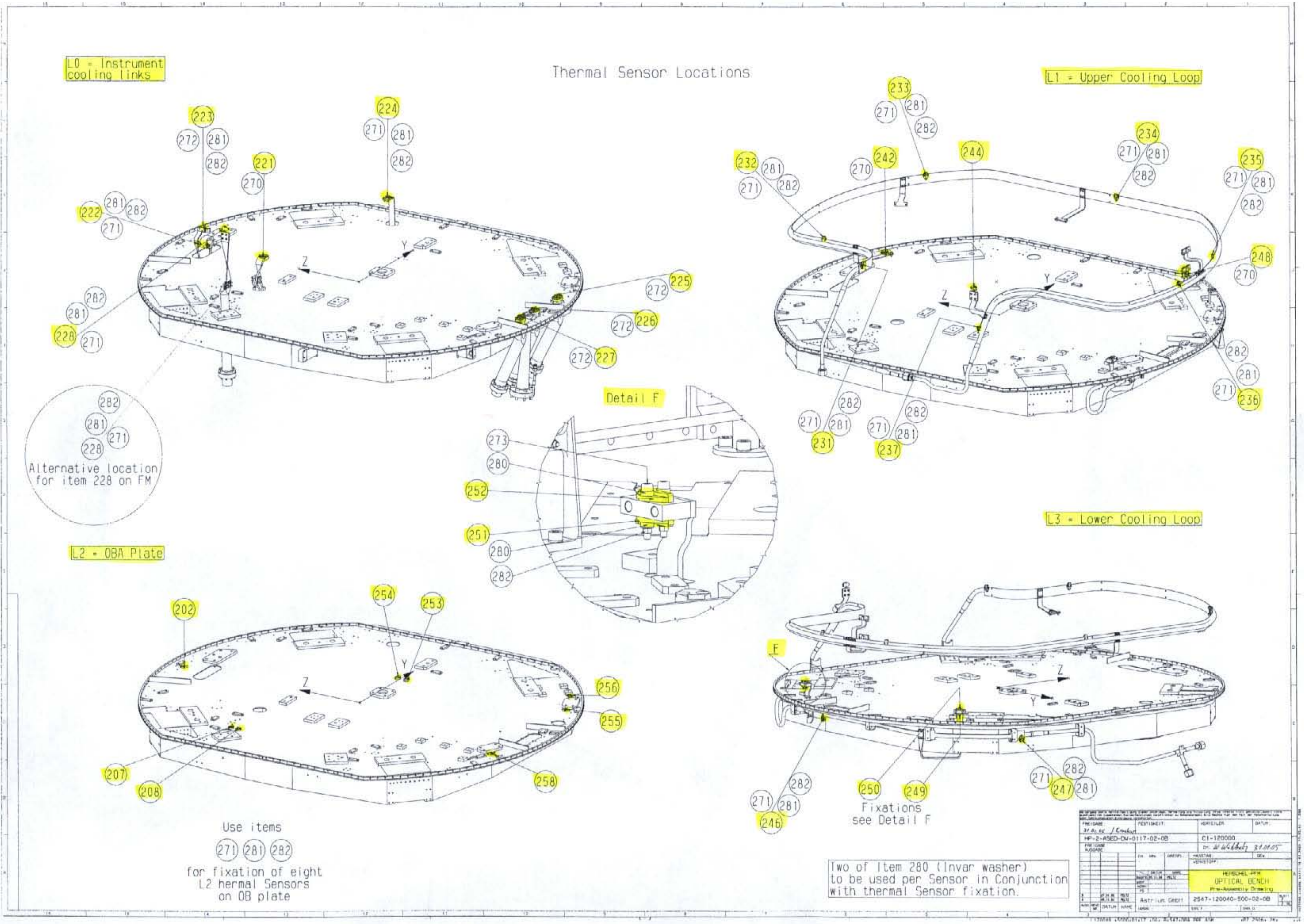
All LD-Pod fixation elements to be providet by AIRL

All Tube supports and fixation elements to be providet by AIRT

Arrow indicates Harness direction

FREIGABE:
HP-2-ASED-DW-0068-01-0A
CI-121210
MASSTAB: 1:2 (1:1)
Astrium GmbH
HERSCHEL PFM
HTT (Helium Two Tank)
Assembly Drawing
2547-121210-500-01-0A

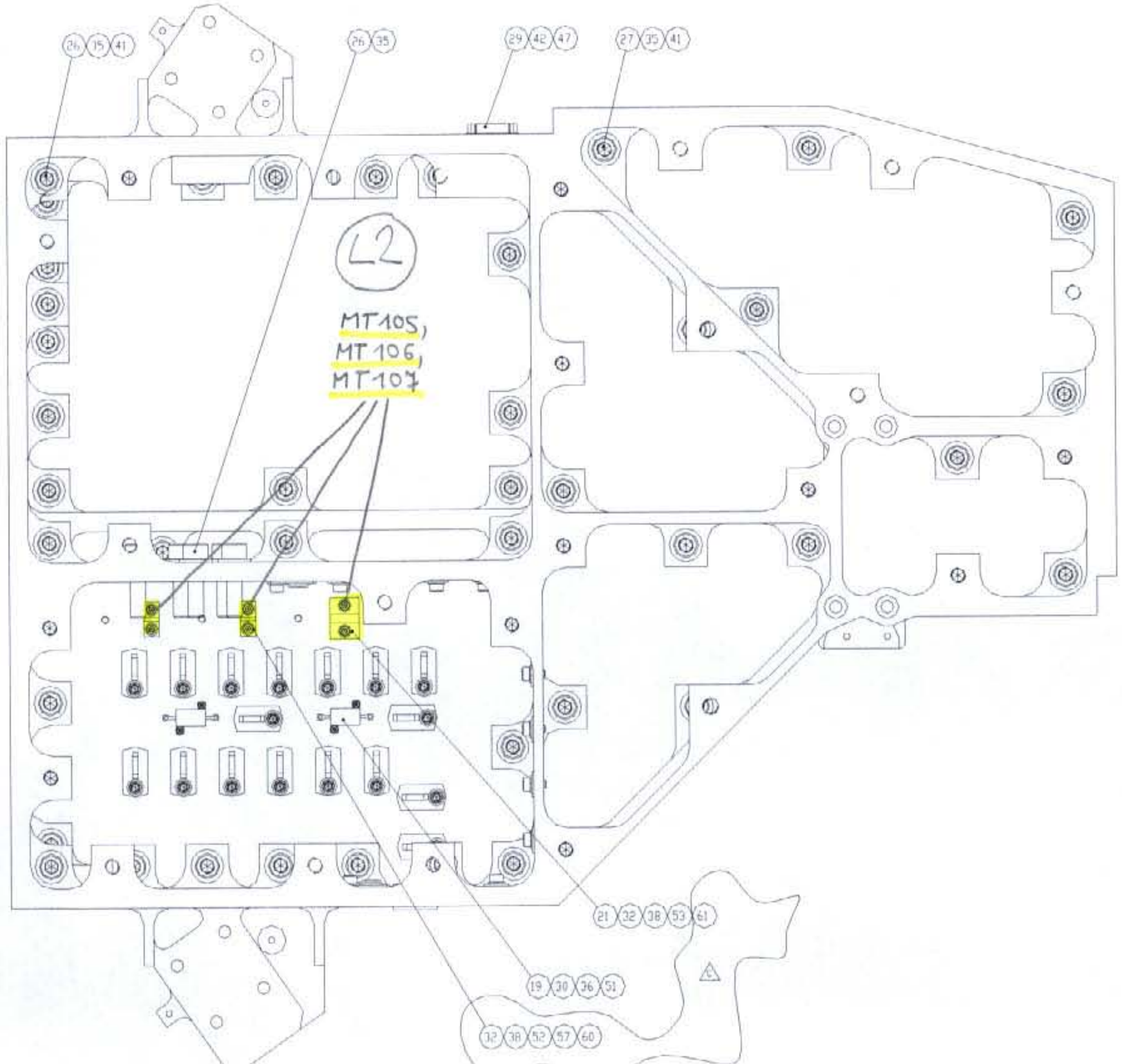
Thermal Sensor Locations

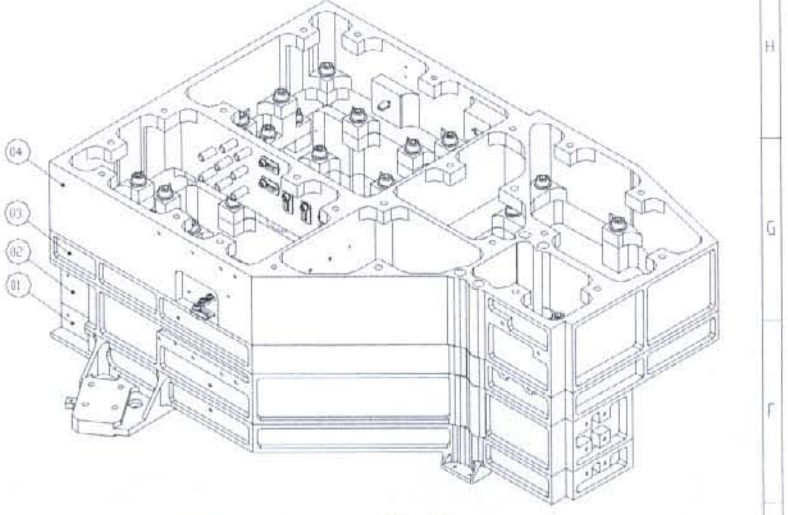


Use items
(271) (281) (282)
for fixation of eight L2 hermal Sensors on OB plate

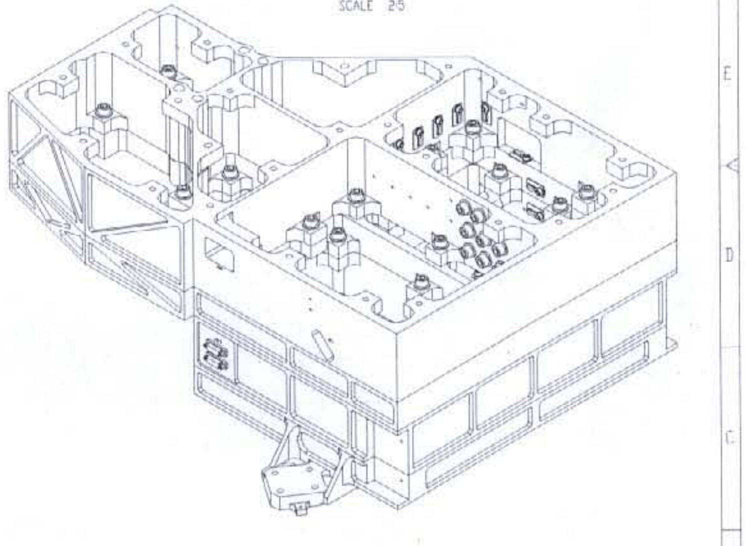
Two of Item 280 (Invar washer) to be used per Sensor in Conjunction with thermal Sensor fixation.

FREIGABE
31.01.05 / Emrich
FESTIGKEIT:
VERTEILER
DATUM:
HP-2-ASED-DW-0117-02-08
C1-120000
FREIGABE AUSGABE
DR: W. Wikbaty 31.01.05
MASSTAB:
GEW.
WERKSTOFF:
HERSCHEL-PFM
OPTICAL BENCH
Pre-Assembly Drawing
Astrium GmbH
2547-120040-500-02-08
AEND. | MERK. | DATUM | NAME





SCALE 2:5



SCALE 2:5

Issue	Status/Change	Date (dd/mm/yyyy)	Constr.	Drawn	Check	Prod	App
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
C	POS.NO.ADDED / CHANGED	25/02/2004	EK	AS	EK	LB	GD
B	CRITICAL DESIGN REVIEW (CDR)	09/01/2004	EK	AMAA	EK	LB	GD
A	FIRST DRAWING	02/10/2003	EK	AMAA	-	-	-

Draw. stand: NS (CORRESP.ISO)
General tol: NS ISO 2768-1-MEDIUM
Surf. rough: -
Material: -
Mat. cert.: -
Proj.

THIS DRAWING SHALL NOT BE COPIED OR COMMUNICATED TO ANY THIRD PERSON WITHOUT CONSENT FROM PROTOTECH A.S. N-5892 BERGEN, NORWAY

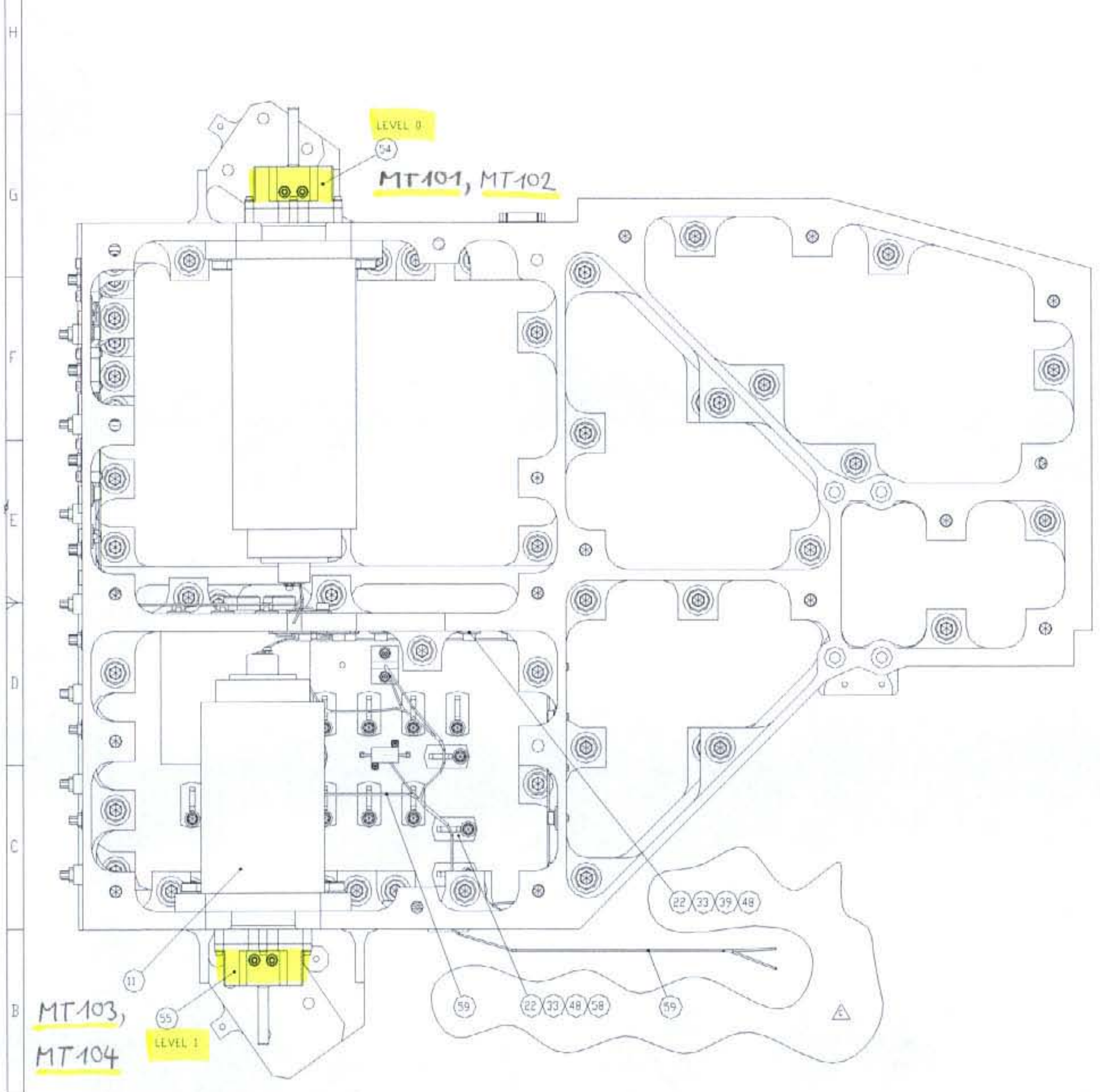
prototech

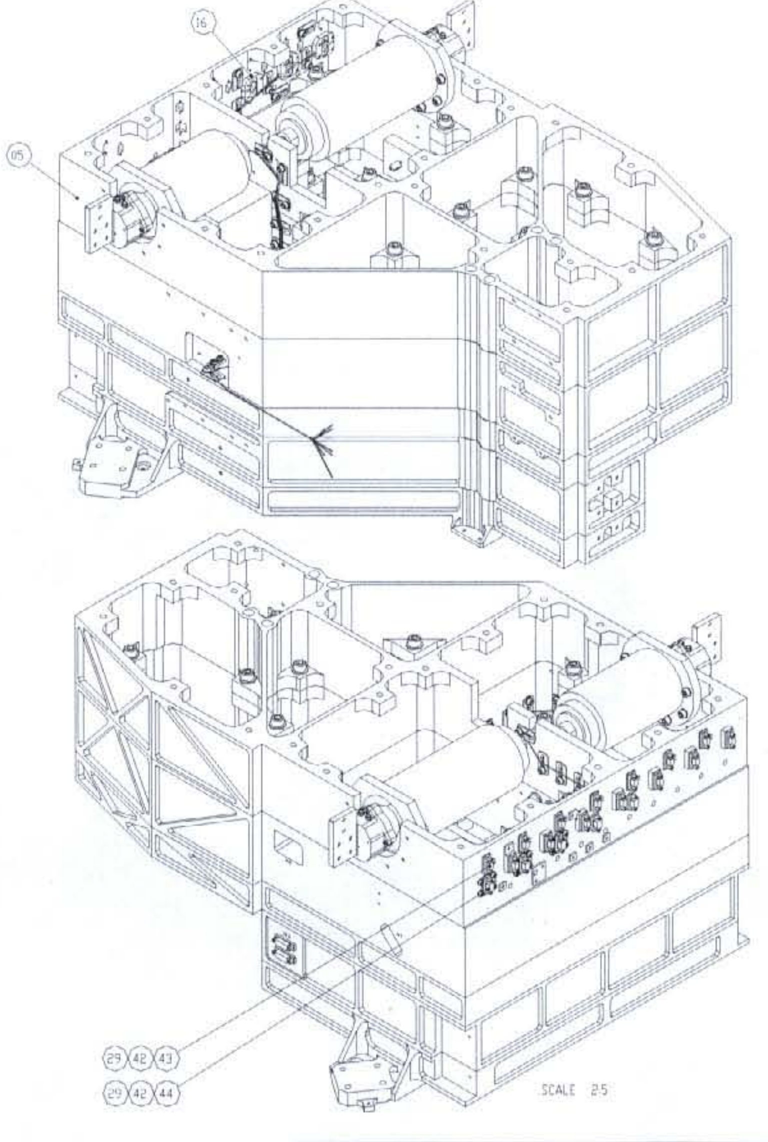
Issue: 45
Drg. format: A1

Title: HP MASS AND THERMAL DUMMIES, COLD UNITS
HIFI FPU DUMMY - ASSEMBLY
ASSEM DRAWING
Sheet 1 of 5

Draw. no: 30089_01_ASM_C
HP-2-PROT-DW-0001

CI-No. 142511-01





-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
C	POS.NO. ADDED / CHANGED	25/02/2004	EK	AS	EK	LB	GD
B	CRITICAL DESIGN REVIEW (CDR)	09/01/2004	EK	AMAA	EK	LB	GD
A	FIRST DRAWING	02/10/2003	EK	AMAA	-	-	-
Issue	Status/Change	Date (dd/mm/yyyy)	Constr.	Drawn	Check	Prop.	App.

Draw stand.: NS (CORRESP.ISO)
Material: -
General tol.: NS ISO 2768-1-MEDIUM
Mat cert.: -
Surf. rough.: -
Proj.:

THIS DRAWING SHALL NOT BE COPIED OR COMMUNICATED TO ANY THIRD PERSON WITHOUT CONSENT FROM PROTOTECH AS N-5892 BERGEN NORWAY

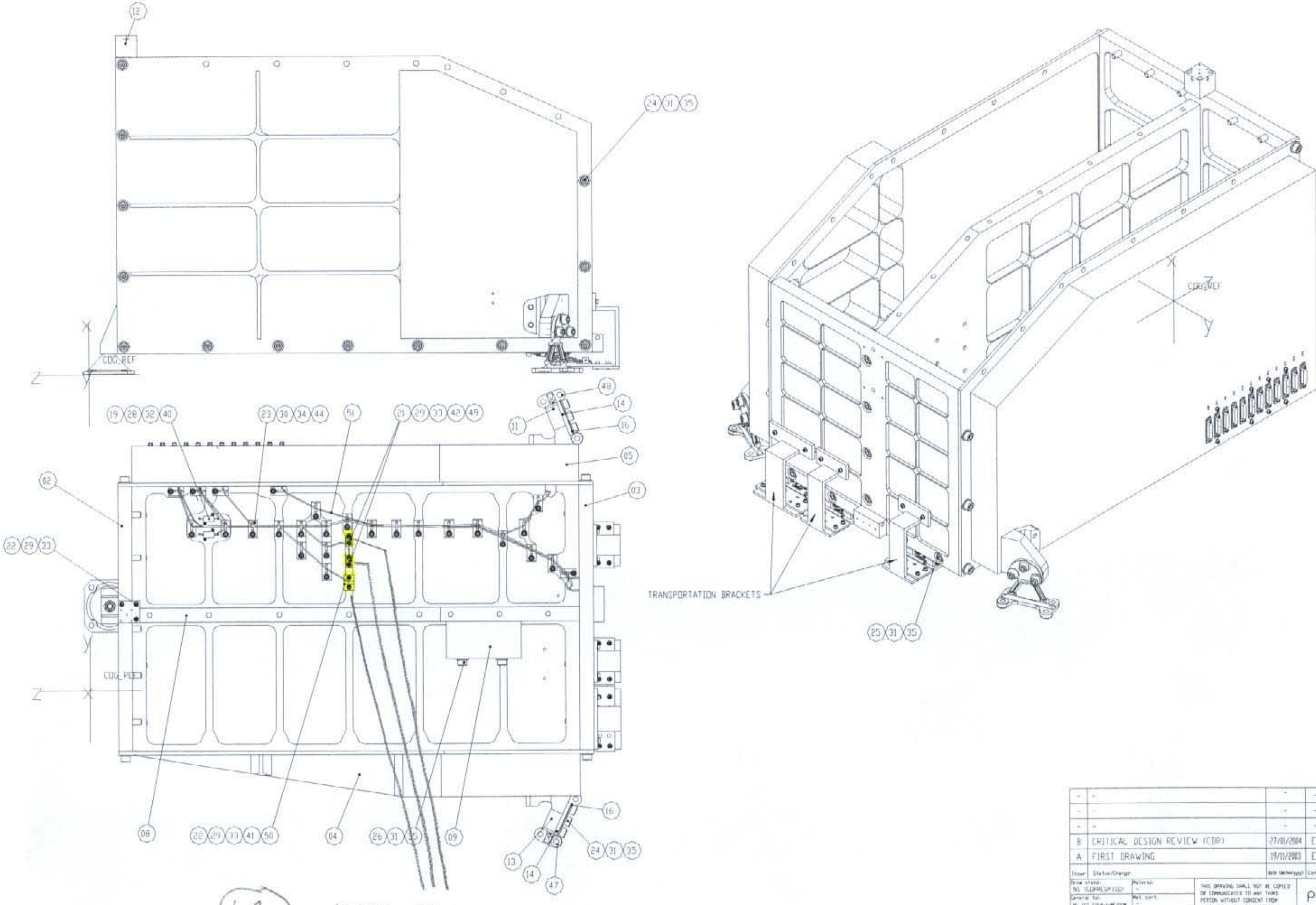
prototech

Scale: 4:5
Drg. format: A1

Title: HP MASS AND THERMAL DUMMIES, COLD UNITS
HIFI FPU DUMMY - ASSEMBLY
ASSEM DRAWING
Sheet 2 of 5

Drw. no.: 30089_01_ASM_C
HP-2-PROT-DW-0001

CI-No: 142511-01



L1

MT207, MT208, MT213

-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
B	CRITICAL DESIGN REVIEW (CDR)	27/01/2004	EK	AS	EK	LB	GO
A	FIRST DRAWING	19/11/2003	EK	AMAA	-	-	-
Issue	Status/Change	Date (dd/mm/yyyy)	Contr.	Drawn	Check	Prod	App.

Draw stand: NS (CORRESP.ISO)
General tol: NS ISO 2768-1-MEDIUM
Surf. rough:
Material: -
Mat cert: -
Proj:

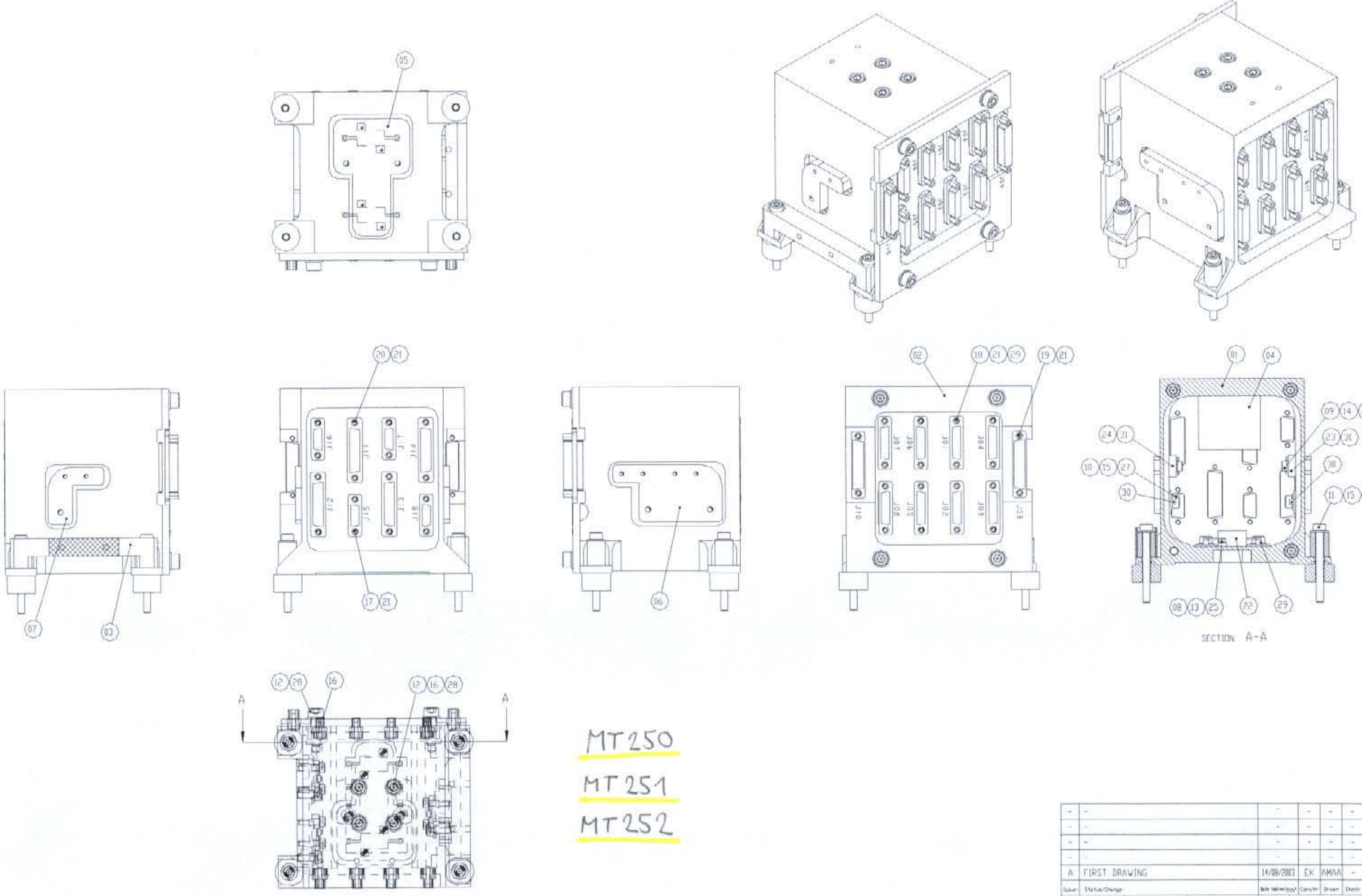
THIS DRAWING SHALL NOT BE COPIED OR COMMUNICATED TO ANY THIRD PERSON WITHOUT CONSENT FROM PROTOTECH AS, N-5892 BERGEN, NORWAY.

prototech

Scale: 2:5
Drg format: A1

Title: HP MASS AND THERMAL DUMMIES, COLD UNITS
SPIRE FPU - ASSEMBLY DRAWINGS
ASSEM DRAWING Sheet 1 of 3

Draw no: 30089_03_ASM_B
HP-2-PROT-DW-0003



MT250

MT251

MT252

-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
A	FIRST DRAWING	14/08/2003	EK	AMAA	-	-	-
Issue	Status/Change	Date (dd/mm/yyyy)	Constr	Drawn	Check	Prod	App

Draw stand: NS (CORRESP.ISO)
Material: -
General tol: NS ISO 2768-1-MEDIUM
Mat cert: -
Surf. rough:
Proj:

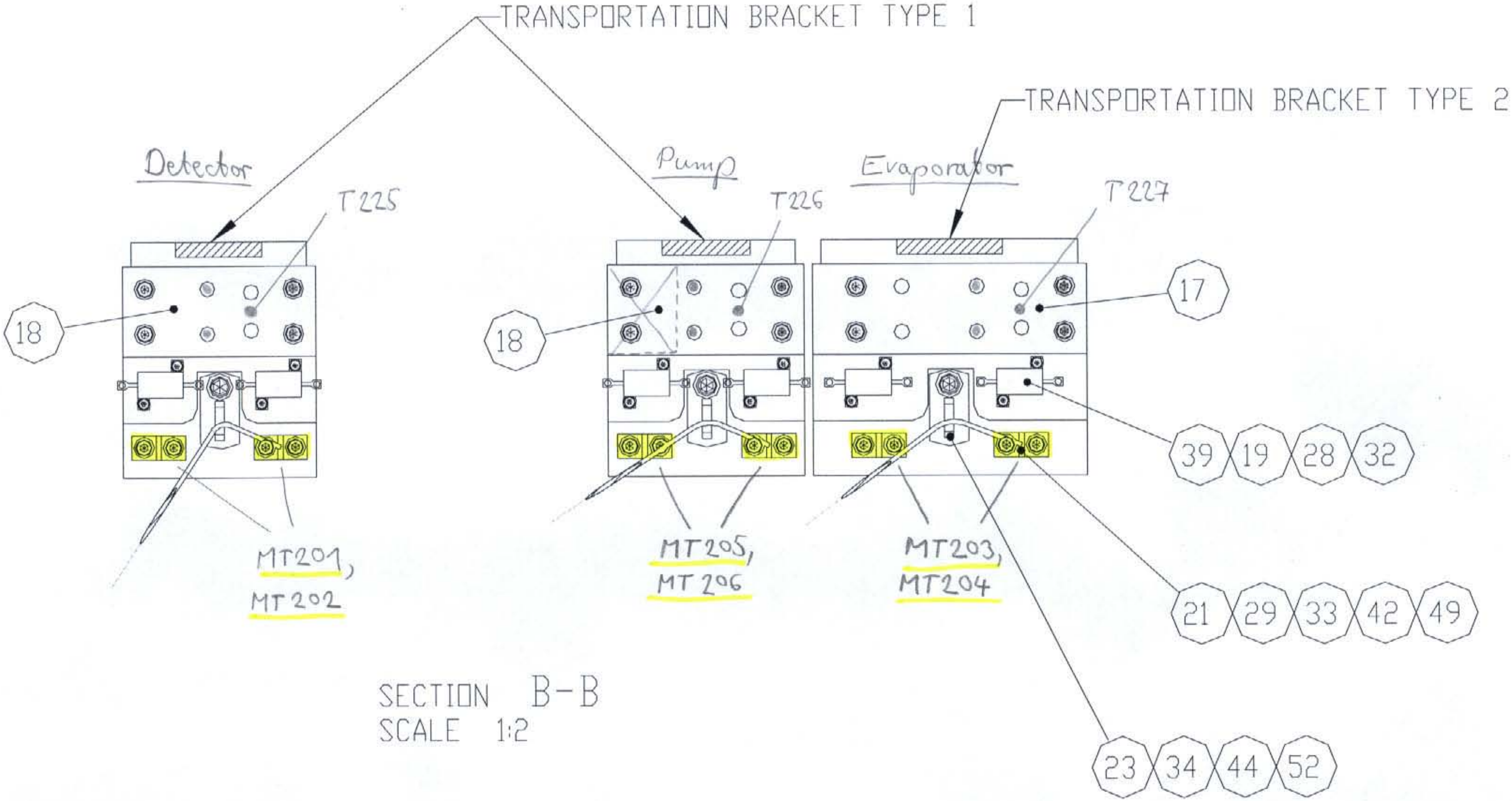
THIS DRAWING SHALL NOT BE COPIED OR COMMUNICATED TO ANY THIRD PERSON WITHOUT CONSENT FROM PROTOTECH A.S. N-5892 BERGEN, NORWAY

prototech

Scale: 1:1
Drg format: A1

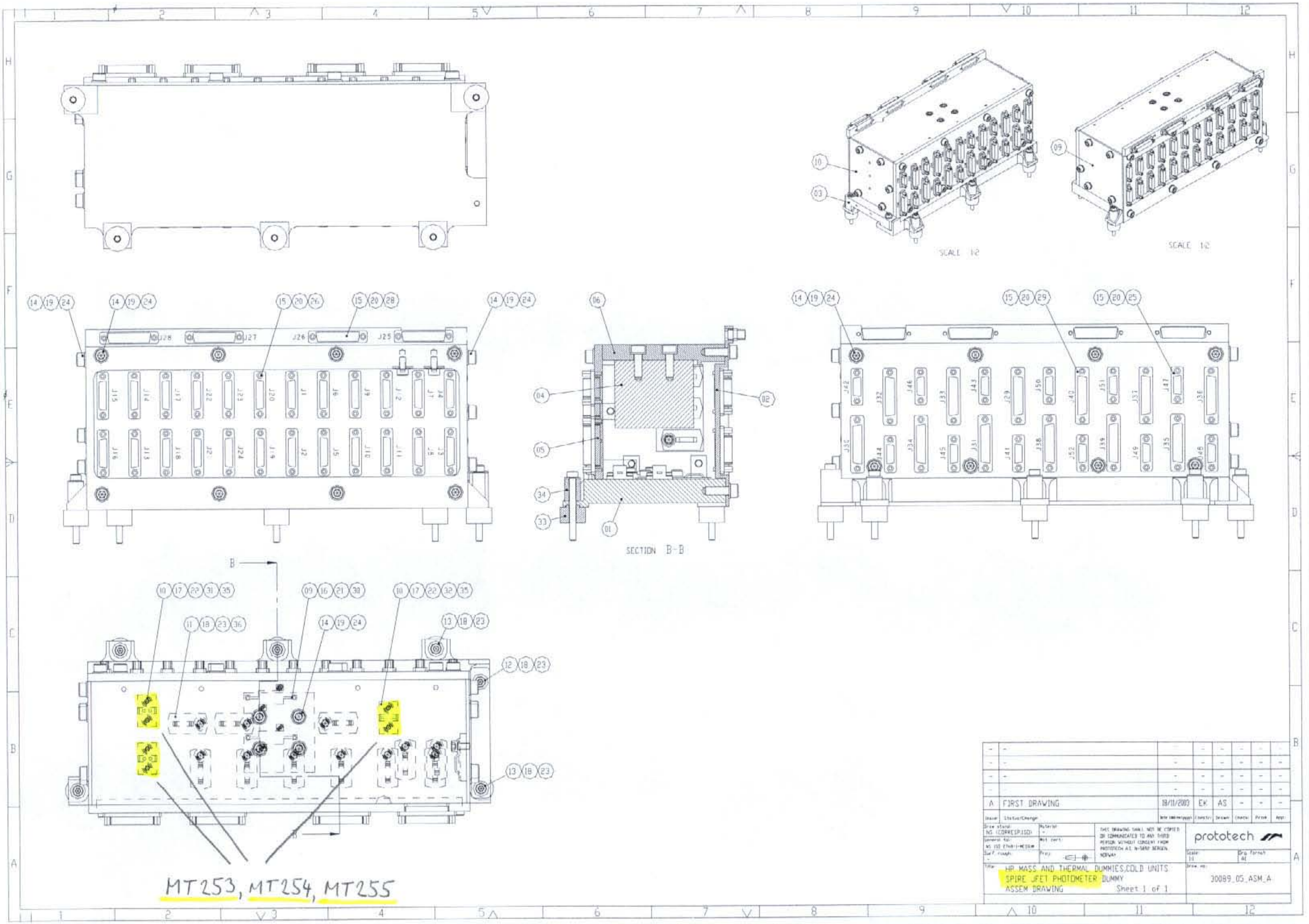
Title: HP MASS AND THERMAL DUMMIES.COLD UNITS
SPIRE JFET SPECTROMETER DUMMY
ASSEM DRAWING
Sheet 1 of 1

Draw no: 30089_04_ASM_A



SECTION B-B
SCALE 1:2

SPIRELO



MT253, MT254, MT255

Issue	Status/Change	Date (dd/mm/yyyy)	Constr.	Drawn	Check	Prod.	App.
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
A	FIRST DRAWING	18/11/2003	EK	AS	-	-	-

Draw. stand.: NS (CORRESP.ISO)
Material: -
General tol.: NS ISO 2768-1-MEDIUM
Mat. cert.:
Surf. rough.: -
Proj.:

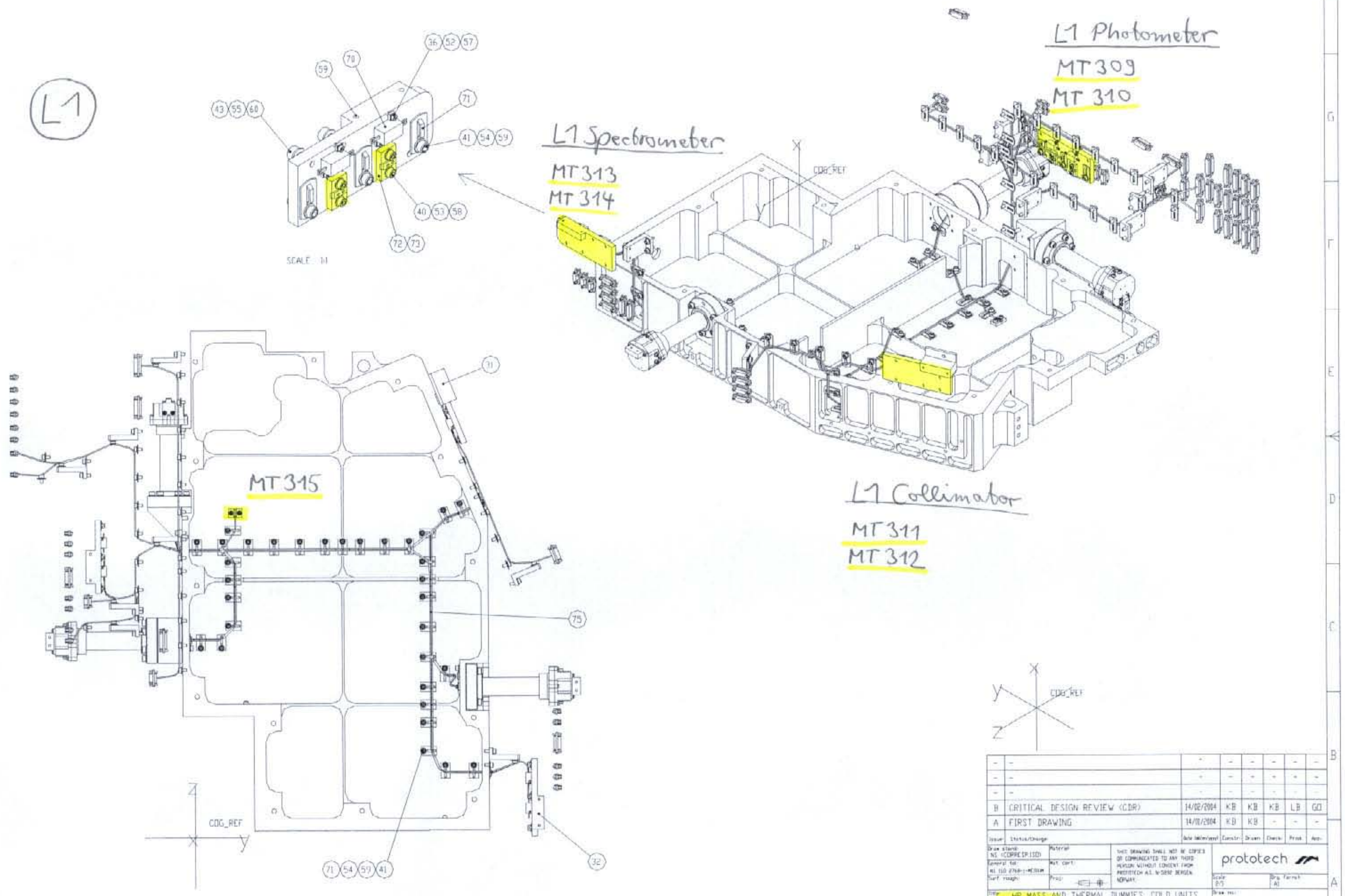
THIS DRAWING SHALL NOT BE COPIED OR COMMUNICATED TO ANY THIRD PERSON WITHOUT CONSENT FROM PROTOTECH A.S. N-5892 BERGEN NORWAY

prototech

Scale: 1:1
Drg. format: A1

Title:
HP MASS AND THERMAL DUMMIES,COLD UNITS
SPIRE JFET PHOTOMETER DUMMY
ASSEM DRAWING
Sheet 1 of 1

Draw. no.: 30089_05_ASM_A



Issue	Status/Change	Date (dd/mm/yyyy)	Constr.	Drawn	Check.	Prod.	App.
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
B	CRITICAL DESIGN REVIEW (CDR)	14/02/2004	KB	KB	KB	LB	GO
A	FIRST DRAWING	14/01/2004	KB	KB	-	-	-

Draw stand: NS (CORRESP.ISO)
General tol: NS ISO 2768-1-MEDIUM
Surf rough:
Material:
Mat. cert:
Proj:

THIS DRAWING SHALL NOT BE COPIED OR COMMUNICATED TO ANY THIRD PERSON WITHOUT CONSENT FROM PROTOTECH AS. N-5892 BERGEN NORWAY.

prototech

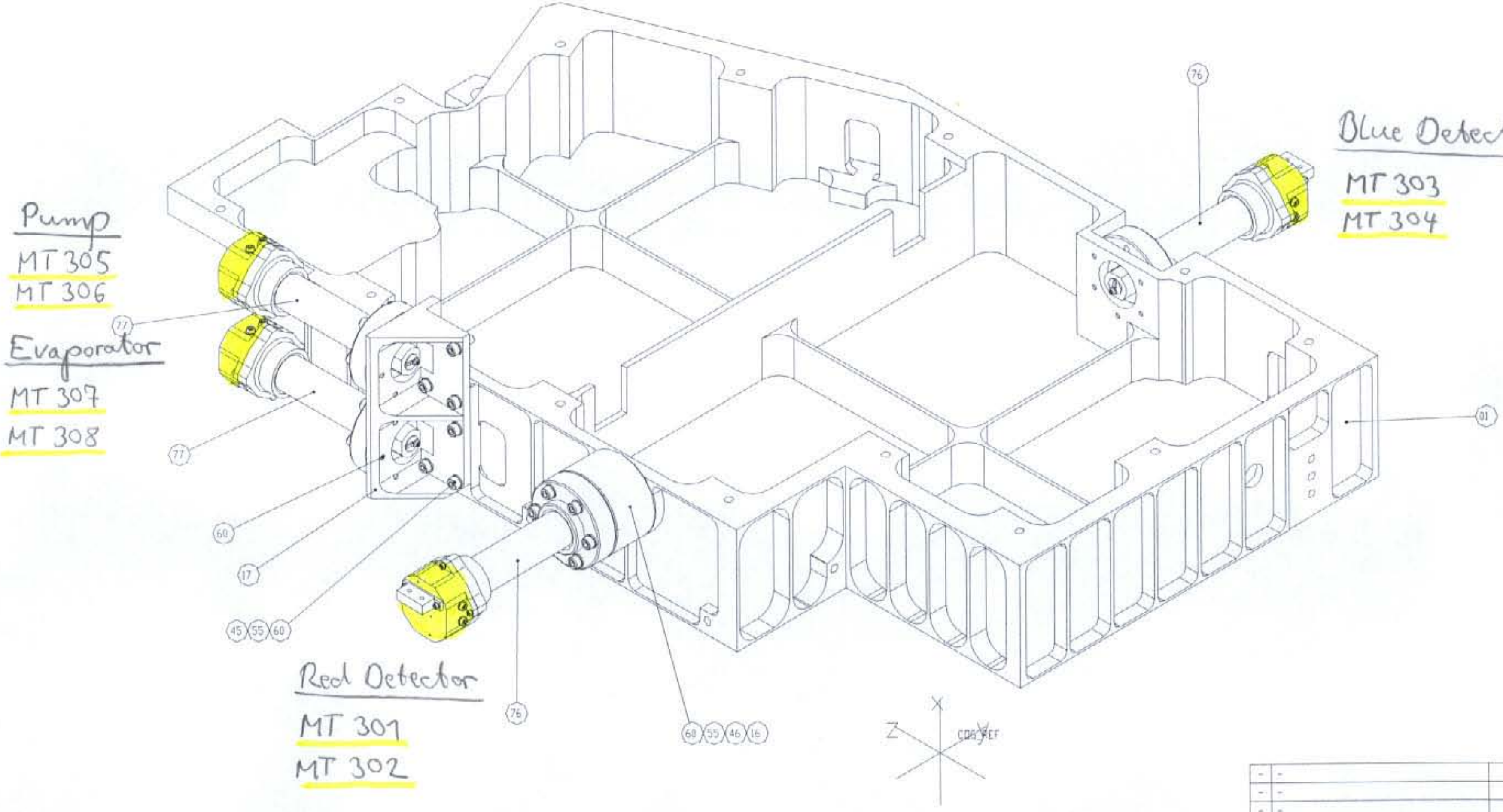
Scale: 1:1
Drg. format: A1

Title: HP MASS AND THERMAL DUMMIES, COLD UNITS
PACS FPU - TOTAL ASSEMBLY
ASSEM DRAWING Sheet 12 of 12

Draw no: 30089_06_ASM_B
HP-2-PROT-DW-0006

CI-No:142513-01

LO



-	-		-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
A	FIRST DRAWING	08/01/2004	KB	AMAA	KB	LB	GD
Issue	Status/Change	Date (dd/mm/yyyy)	Constr.	Drawn	Checked	Prod.	Appr.

Draw stand: NS (CORRESP.ISO)
Material: -
General tol: NS ISO 2768-1-MEDIUM
Mat. cert: -
Surf. rough: -
Proj:

THIS DRAWING SHALL NOT BE COPIED OR COMMUNICATED TO ANY THIRD PERSON WITHOUT CONSENT FROM PROTOTECH AS, N-5892 BERGEN, NORWAY.

prototech

Scale: 710
Drg. format: A1

Title: HP MASS AND THERMAL DUMMIES, COLD UNITS
PACS FPU - TOTAL ASSEMBLY
ASSEM DRAWING
Sheet 1 of 12

Draw. no: 30089_06_ASM_B
HP-2-PROT-DW-0006

CI-No:142513-01

Cryostat Logbook

Scanned_Docs\cryo-logbook_2005-09-02_till_2005-12-08.pdf

HERSCHEL

EADS Astrium GmbH

HERSCHEL

Content:

Flight H/W: ☐ **Non Flight H/W:** ☐

Container Number:

CRYOSTAT OPERATION
LOG BOOK

L=
(cm)
W=
H=

08.06.05 -

02 09 05

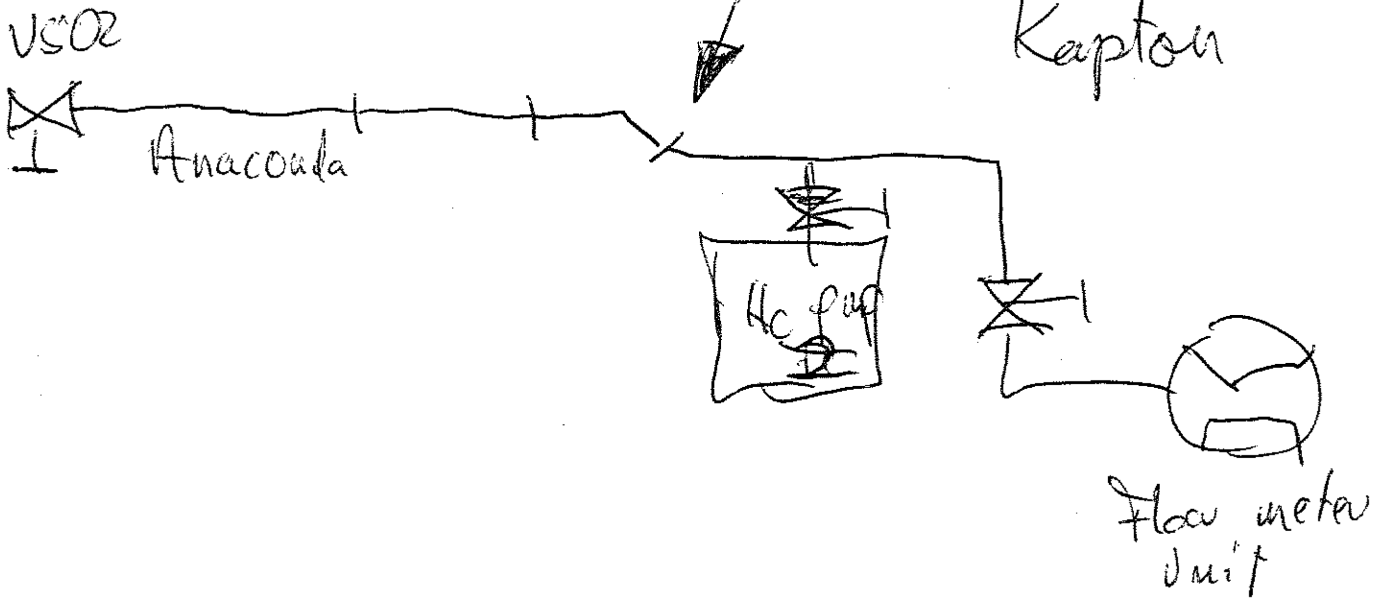
P_{901} $8,3 \times 10^{-8}$ mbar

$P_{101} = 1,0476$ $P_{701} = 0,973$

22,3 mg/sec $P_{502} = 1050$ mbar

Vent line connected to V502

↳ NCR Viton in one seal instead of Kapton



9^{30} open V502

open bypass to frog → 200 mg/sec

Hand valve mounted to HS01 outlet

Fill line connected to dewar

and to filling Port

3 x flushing via needle valve

Dewar No 8528 C 444,8 liter
565 mm

10^{28} Open SV121 plug

Filling line inserted totally

P_{Dewar} 245 mbar

m_{Dewar} incl. filling line $\boxed{375,8\text{ kg}}$

$\dot{m}$ 71.2 mg/sec

~11^{00} open V~~102~~ 102

P_{Dewar} = 295 mb Flow 44 mg/sec → increasing

11^{14} P_{Dewar} 300 mb Flow 570 mg/sec increasing

11^{17} 305 mb 750

11^{20} 265 990 375,0 kg

time	P_{Dewar}	LL_{Dewar}	m_{Dewar}	$\dot{m}$	$P_{Ziegler}$	VG_{gon}
11^{25}	230	550	374,4	731		
11^{35}	230	515	371,6	540		$5,5 \times 10^{-8}$ mbar
11^{56}	250	420	364,0	417	1034,6	$5,2 \cdot 10^{-8}$
12^{05}	250	380	361.4	419	1034.6	$5.0 \cdot 10^{-8}$
12^{15}	250	330	358.0	422	1034.6	4.6×10^{-8}
12^{25}	250	280	355.2	434	1035.2	4.8×10^{-8}
12^{35}	250	230	352.4	453	1036.0	4.0×10^{-8}
12^{45}	250	200	350.0	470	1036.4	3.8×10^{-8}
12^{55}	250	170	347,8	489	1037,0	$3,5 \cdot 10^{-8}$
13^{12}	280	120	344,0	529	1038,2	
13^{25}	280	80	341,0	560	1039	
13^{45}	265	0	336,8	614	1046	
14^{00}	195	0	335,4	651	1042	2.9×10^{-8}
14^{12}	175	0	335,2	663↓	1042,4	needle valve clos

extraction of filling line in air lock

dewar depressurisation

↳ flow rate increases up to 2 g/sec

pressure in P701 increases ↑

P101 was ~~ge~~ decreasing

✳ icing on vent line up to flow meter

new dewar connected $\boxed{9157}$ 451,2 l

---

time	P_{Dew}	LL_{Dew}	m_{Dew}	$\dot{m}$	P_{Ziegle}	
15^{17}	240 mb	525	375,8	67	1027	open needle valve
15^{55}	310	520	375,4	553	1039	depressure dewar → 200 mbar

no filling but flow close needle valve

time	P_{Dew}	LL_{Dew}	m_{Dew}	$\dot{m}$	P_{Ziegle}	
16^{15}	185	520	375,4	371	1034,3	open needle valve
16^{36}	210	520	375,4	328	1033	→ no filling needle valve closed
17^{14}	–	–	–	200	1030	open valve
	160	520	375,4	200	1030	
17^{45}	220	510	375,2	240	1031	open V702
17^{50}	200	500	374,4	760	1048	filling 4OT immediately
17^{55}	200	490	373,8	1080	1061	
18^{00}	~~1440~~ lead off	485	372,8	1477	1080,2	close V702

$\dot{m}$ drop down P701 ditto P101 increases slowly

time	P_{Dew}	LL_{Dew}	m_{Dew}	$\dot{m}$	P_{Ziegle}	
18^{05}	150	475	372,8	416	1036,1	→ no fill
18^{45}			372,8			close needle valve

dismount fill line

SV121 in safety position

Frog enabled

19^{30} open V104 again (was open but $\dot{m}$ 22 mg/sec P101 was increasing while P701 was constant)

open V102 → $\dot{m}$ 18 mg/sec

19^{40} → p101 increases p701 decreases

LLP 101 = 46,9 cm 102 = 40,5 cm 701 = 2,16 702 = 2,59

030905 / 9^{30} $\dot{m}$ = 228 mg/sec with oscillation

~~Helium~~ Lauf P_{901} = $3{,}8 \times 10^{-8}$ mbar P_{Zigle} = 1,081 bar

Kölle p_{101} = 1,05 p_{701} = 1,00 bar

V 102, 104, 701 open

→ bypass frog open

filling line evacuated & filled GHe

Inserted into fi Port

1010 flow released   Dewar 371,4 kg

Valve Operations

02.09.2005

V102 opened	Not recorded	
V702 opened	D000.tif + D001.tif	
V702 closed	D002.tif	ca 16:05 SCOE time (= MEZ - 2h)
V102 closed	D003.tif	ca 17:06 SCOE time
V102 opened	D004.tif	ca 17:29 SCOE time

03.09.2005

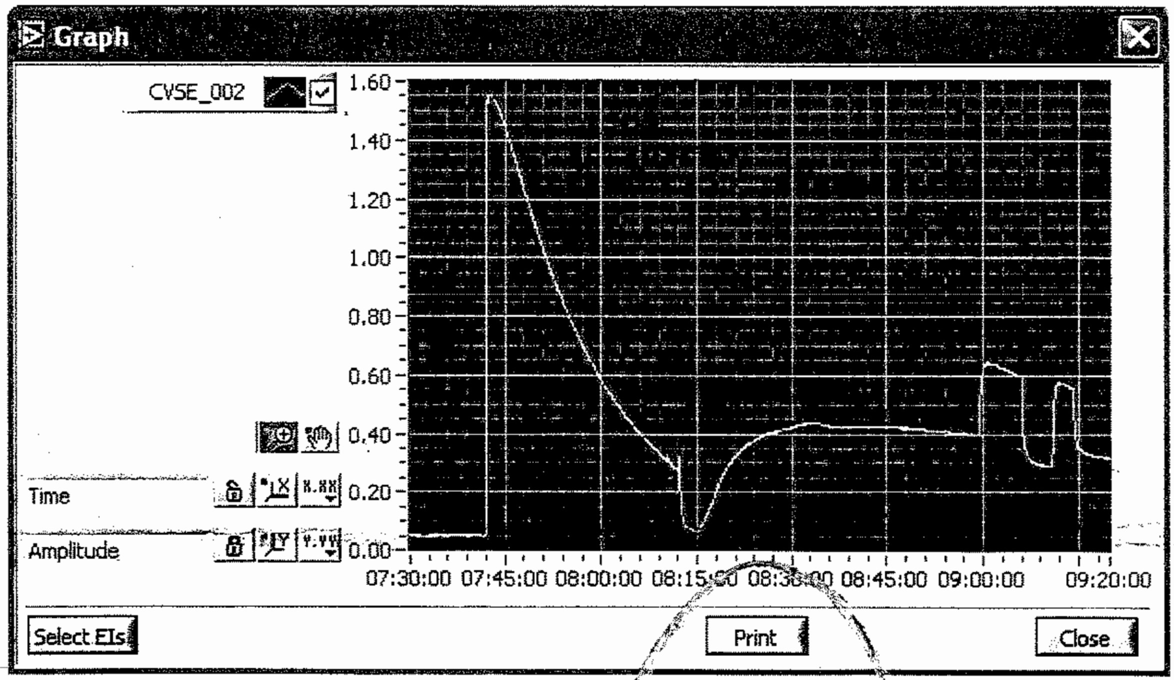
V103 opened	D005.tif	ca 8:59 SCOE time
V104 closed	Not recorded	ca 9:06
V104 opened	D006.tif	ca 9:11
V103 closed	D007.tif	ca 9:14

open V103

close V104

open V104

close V103



time	P Dewar	Ch Dewar	m Dew.	$\dot{m}$	P_{Zig}	
10^{20}	205	435	~~3~~71,2	182	1034,5	
16^{30}	150	425	371,2	222	1035,5	
16^{40}	160	425	371,2	213	1035,1	needle valve closed

pressure in HTT increases while flow is constant

Assumption: something blocks the HTT outlet ?

flow is bypassing through safety line?

10^{55} open V103 (P101) flow increases immediately ~300 mg/sec

11^{02} close V104 → no current on Osci

flow drops → 148 mg/sec

11^{06} open V104 → current on Osci

~~flow~~ flow → increases 288 mg/sec

11^{08} close V103 → current

flow drops

11^{45}	120	425	371,0	135	1033,3	open needle valve
12^{40}	140	425	371,0	159	1033,6	

12^{44} open V702 ↑ flow 1,390 mg/sec peak

12^{48} close V702

12^{48} @ 184 mg/sec open V106 $\dot{m}$ 290 mg/sec

12^{56} open V103 @ 292 mg/sec $\dot{m}$ = 292 mg/sec

13^{02} V104 close $\dot{m}$ drops   155 mg/sec

	P_D	L_D	m_D	$\dot{m}$	P_Z
13^{35}	190	425	371,0	163	1033

13^{44} Heater V104 on $2,1 \times 10^{-8}$ mbar

13^{51} VT104 55,6 K

14^{02} VT104 72 K $\dot{m}=167$

VT102 is at 105K ?

14^{11} * Dewar balance 370,8 kg ; pressure 245, reduced to 185

~~open V104 164~~ mg/sec

* T107 drops & P101 drops

14^{21} open V104 @86K → ≥ 300 mg/sec

V104 was blocked

VT 104 drops very slowly !!!
at this high flow rate

14^{30} close V103

14^{32} close V106

	P	L	m	$\dot{m}$	P	
	200	350	366,4	604	1044	
15^{16}	200	165	357,2	553	1042,6	
15^{31}	200	125	352,8	570	1043,2	Psoll 250
15^{46}	250	75	346,6	689	1046,9	280 ↑
16^{05}	280	35	339,4	806	1051,3	
16^{20}	180	0	334,6	828	1057,6	close needle valve

close by pass frog

SV121 in safety position
with frog by pass + 35 mbar only
V102 remains open !

This was a hard day !

Ø 16 mm Quetsch ?

040905 9^{25} $\dot{m} \hat{=} 28$ mg/sec
Langf

VG 30×10^{-8} mbar
P101 = 1050 mbar
701 = 990 mbar

Pzylinder = 1078,3

050905 7^{55}
Langf

31 mg/sec
$4,4 \times 10^{-8}$ mbar
1,069.2 = Pzyl

P101 = 1,046 P701 = 0,9808

9^{03} open bypass frog
flushing filling line 3x
inserting to air lock + flushing < 1ppm

t	P_D	L_D	m_D	$\dot{m}$	P_Z	
925	100	275	373,2	246	1027,6	open needle valve
9^{40}	195	270	372,8	1980	1100,7	$3,0 \times 10^{-8}$
9^{55}	180	220	368,6	1030	1047,2	
10^{35}	180	105	353,0	880	1040,2	Psoll = 200
11^{01}	200	50	341,8	1030	1046,4	
11^{20}	180	6	336,2	1140	1051	~ 10,8 g/h
11^{30}	180	0	335,6	1045	1043,7	needle valve closed

Dewar 7069 ↳ 376 kg, not [illegible] at

new Dewar 8483 384,2 kg
flüssig in + connected

t	P_D	L_D	m_D	$\dot{m}$	P_Z	
13^{16}	175	460	384,2	40	1014	needle valve open
13^{36}	140	450	384,0	1640	1076,4	
13^{45}	140	400	381.6	1105	1046,9	
14^{30}	140	165	368,6	992	1042,4	~ 18,3 g/h
14^{42}	180	130	364,4	1099	1047	~ 20 g/h

L101 = 86,4 ↳ $\hat{=}$ 60% L102 = 85,6 L701 = 0,268 L702 = 0,8

14^{52}	180	105	361,0	1950	1049,6	~ 20 g/h
15^{10}	180	75	355.6	1216	1052.3	icing up to flow meter Psoll = 160
15^{20}	160	55	351,4	1234	1052	→ 17 g/h
15^{45}	160	35	346,0	1231	1052	↓ 140 icing
15^{50}	140	30	344,6	1257	1053,4	needle valve close

SN 8483 : Gewicht nach Füllen: 338.4 kg

L101 = 89,0 cm 102 = 89,3 cm
$\hat{=}$ 63%

060905 | $2,5 \times 10^{-8}$ mbar VG 901
8^{00}

~29 mg/sec 1063,2 mbar Ptiegle

P_{101} 1,041 P_{701} 0,975 bar

8^{55} open frog by pass

flushing of filling line 3 (diamond ~990)

364,4 kg No 9111

flushing of Air lock < 1ppm

368,4 kg

9^{27} Filling line inserted with pre-cooling through safety Unit until the line is icing

t	P_D	L_D	m_D	$\dot{m}$	P_2	
9^{30}	120	325	367,6	475	1023	
9^{35}	120	300	366,2	760	1033	filling
9^{40}	120	250	364,4	880	1036,7	~19 kg/h
9^{46}	120	235	363,2	915	1038	~ 14,5 kg/h
10:00	120	190	359,2	969	1040	
10:18	120	115	355,4	1008	1042	
10^{30}	120	115	353,0	1014	1042	12 kg/h
10^{35}	160	115	351,2	1088	1044	~20 kg/h

t	P_D	L_D	m_D	$\dot{m}$	P_2	
10^{45}	160	100	348,0	1140	1042	18 kg/h
10^{55}	160	80	344,8	1167	1047	19 kg/h
11^{05}	160	65	342.4	1181	1046	14.4 kg/h
11^{15}	160	55	339.8	1190	1048	15.6 kg/h
11^{40}	120	0	333.2	1182	1048	15 kg/s
11^{42}	105	0	332,6	↓		needle valve closed

13^{30} Filling line removed 35 kg
SV122 spindle retracted with ~70 mbar inside air lock

by pass „frog" closed

L101 = 95,6 L102 = 94,7 ≙ 66%

07.09.05

16^{30} open bypass "frog"
Dewar 8074

t	P_D	L_D	m_D	$\dot{m}$	P_2	
16^{30}	10	565	387.4	978	1042	
17^{05}	200	285	391.2	90	1014	
17^{15}	100	280	395.6	400	1022	
17^{25}	120	280	394.2	607	1028	
17^{35}	120	280	389.0	653	1029	(Waagenmasse geändert da, Dewar bewegt!)
"	150	280	389.0	653	1029	Druck erhöht
17^{45}	150	260	386.6	710	1031	
18^{00}	150	260	383.4	750	1033	12.8 kg/h
18^{15}	150	230	379,6	830	1036	
18^{30}	150	225	376,8	861	1037	

t	P_D	L_D	m_D	$\dot{m}$	P_Z	
18^{45}	150	95	373.0	884	1037	15.2 kg/h
19^{05}	150	95	368.8	899	1035	12.6 kg/h
19^{15}	150	95	366.8	902	1038	12 kg/h
19^{20}	Druckerhöhung auf P_D = 170 mbar ;					
19^{30}	170	95	363.4	956	1040	13.6 kg/h
19^{45}	170	95	360.0	978	1041	13.6 kg/h
20^{00}	170	65	356.8	981	1040	12.8 kg/h
20^{17}	170	50	353,4	995	1041	13.6 kg/h
20^{30}	170	50	351.0	1001	1041	10 kg/h
20^{45}	170	50	348.0	1008	1042	12 kg/h
20^{51}	Druckerhöhung auf p_D = 200 mbar					
21^{00}	200	50	345,2	1064	1045	11,2 kg/h
21^{10}	700	45	343.2	1150	1045	

21^{11} Regler STOP

21^{13} Nadelventil zu Kannengewicht: $m_D = 343.0$ kg

21^{30} Heber entfernt, 70 mbar Überdruck notwendig um Stopfen zu halten !

CS 8074 Kannenanzeige: leer !

21^{35} Frosch rein, Feierabend!
bypass zu

CS 8074 Leergewicht: 335.6 kg 08-09.05
(ohne Quetschverb. / ohne Kabel)

08.09.05

9^{25} New Kanne SN 9112
Weight w/o cable, w/o Quetschverb m_D = 375.4 kg
Füllhöhe: 680 mm

09^{38} start pump → flushing transferline 3x

9^{42} bypass of "Frog" opened

9^{47} Transferline in Dewar → He → blow off
safe SU 121

10^{00} Safety unit pump on

3x flushing of transferline + airlock

10^{07} 1017,2 mbar 152 mg/sec 660 cm

10^{11} remove SU121
flushing transferline

t	P_D	L_D	m_D	$\dot{m}$	P_Z	Δm/h
10^{17}	100	660	382.8	570	1028	
10^{25}	100	640	381,8	701	1033	
10^{30}	100	605	381,0	714	1033,6	
10^{45}	100	540	378.2	753	1035	11.2 kg/h
10^{45}	Druckerhöhung auf 120 mbar					
11^{00}	120	470	375,2	854	1039	12 kg/h
11^{00}	Druckerhöhung auf 150 mbar					
11^{15}	150	385	371,4	985	1044	15.2 kg/h
11^{30}	150	315	368.0	1049	1046	13.6 kg/h
11^{30}	Erhöhung auf 170 mbar					
11^{45}	170	220	363.4	1130	1050	18.4 kg/h
12^{00}	170	180	359.6	1186	1052	15.24 kg/h

time	PD	L_D	m_D	$\dot{m}$	P_z	fill rate
12^{15}	170	155	355.8	1213	1053	15.2 kg/h
12^{30}	170	125	351,4	1209	1053	17,6 kg/h
12^{47}	170	100	347,2	1213	1053	16 kg/h
13^{00}	170	90	344,2	1213	1053	13,5 kg/h
13^{17}	170	75	340,0	1199	1057	~~14,6 kg/h~~

13^{27} open V702 to cool/fill the HOT

13^{30}	170	65	336,6	1028	1044,5

13^{42} flow increases above previous value

→ close valve 702 T70 = 4,9 K

13^{45}	170	50	332,6	1250	1055

13^{47} → flow increases → close needle valve

14^{20} – SN9112 Dewar 45 mm (=empty) m = 328.4 kg

m_{Dewar} = 324.0 kg (without cable + [illegible])

14^{40} New Dewar SN 8520

L_D = 655 mm

evacuation + flushing
with pre-cooling

14^{55} flow enabled

	75	645	$\boxed{382,6}$	824	1042	
15^{02}	120	635	381,8	982	1043	
15^{15}	120	605	379.2	911	1040	11 kg/h
15^{30}	150	555	375.2	961	1042	16 kg/h
15^{45}	150	495	371,2	1036	1045	15 kg/h
16^{02}	170	440	367,2	1130	1049	16 kg/h
16^{16}	170	390	364,0	1160	1050	13,5 kg/h

time	PD	L_D	m_D	$\dot{m}$	P_z	fill rate
16^{30}	170	345	360.6	1135	1049	14 kg/h ↳200 mbar
16^{45}	200	290	357,2	1135	1049	
17^{01}	200	210	352,6	1480	1051	17 kg/h
17^{18}	200	155	348,0	1180	1050	17 kg/h
17^{30}	200	120	345,4	1206	1051	
17^{40}	200	70	341,6	1210	1051,4	
17^{56}	200	(25)	338,4	1199	1051,3	

(25) → Switch off ~~Dewar~~ Regulator

18^{00}	175	0	337,8	1210	1051,6	Regler on

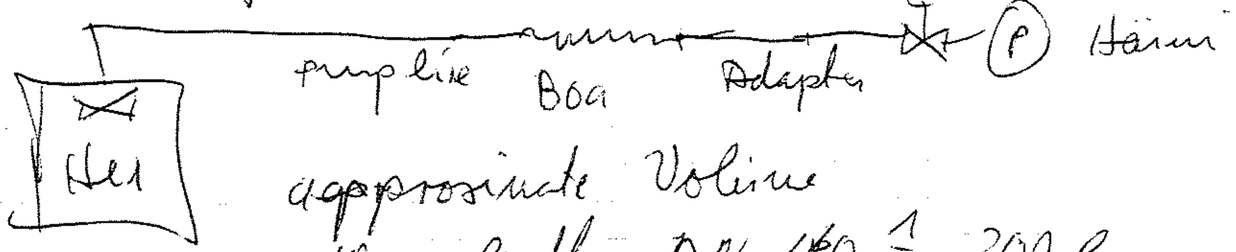
18^{05} Dewar empty

	195	0	337,4	1190	1048

Air lock + SV122 Plug in safety with 400 mbar from dewar

„frog" enabled dev 330,4 kg

He pump I 16^{08} 2,1 mbar „isolated"



approximate Volume

10 m length DN 160 ≙ 200 l

16:40 0,5 mbar! Sensor warm up?

Leak tester on He pump line 1

background 2×10^{-5} mbar l/sec

no signal with Gas on flanges

Power off test at 1,3 mbar with running pump

17^{15} └ 2,2 mbar afterwards

18^{20} 2,0 mbar

080905 L101 L102 L701 L702

140,9 136,8 9,4 9,6 ~91%

LL 84,21

090905 28 mg/sec $2{,}6\times10^{-8}$ mbar

Lampf P101 = 1,0118 P701 1,0180

L101 L102 L701 L702

139,8 135,8 9,2 9,4

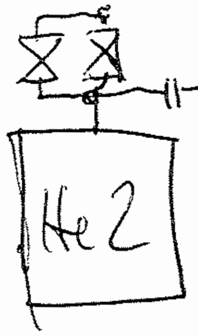
100905 $\dot{m}$ = 21 mg/sec with oscillation

900 P101 = 1,0125 P_{701} = 1,0148

Lampf $7{,}9\times10^{-8}$ mbar

Heuber T702 = 4,297 T703 = 4,263 T106 = 4,264 107=4,403

Zeuge He pump ~~II~~ 2



Ⓟ Ziegler connected to pump inlet
main and by-pass valve closed
pump on + evacuate

16^{03} P Ziegler = 0,6 mbar

power off → P Ziegler = 13,6 mbar

10^{50} retorque 15,8

14,8 mbar

11^{40} 17,0

$$L_R = \overset{\sim 3\ell}{\underline{2\,\text{mbar}\cdot 3\ell}} = 2\times10^{-3}\ \text{mbar}\ \ell/\text{sec}$$

15^{45} He II Transferline installed
Leak test with background 7×10^{-4} decreasing
→ safety unit, Air lock with Helicoflex
to transfer line (Boa I/F blind flanged)

110905
Langf

$\dot{m}$ = 23,3 mg/sec

901 = $5{,}2\times10^{-8}$ mbar

P Ziegler = 77,8 mbar

120907
Langf

24,0 mg/sec 136,2 mbar = P Ziegler

$5{,}6\times10^{-8}$ mbar = VG 901

P101 = 1,019 P701 = 1,019

Hänni 0–100 mbar sensor
mounted to H501 side outlet
with hand valve

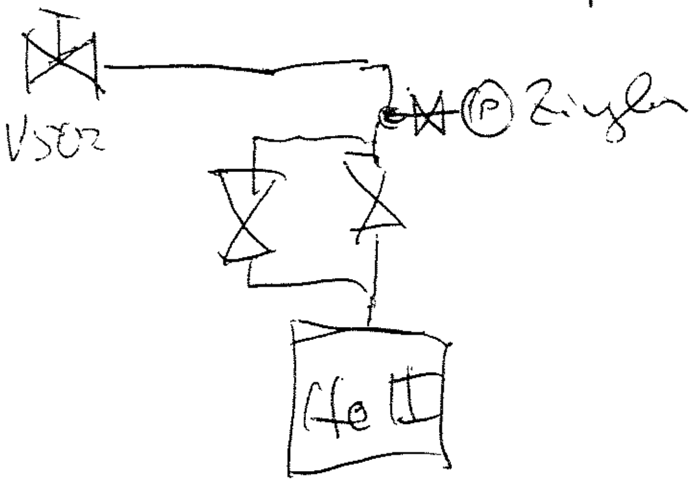
120905 Prep for He II production

2x600 + 1x900 W heater on pumpline 1 CO transfer line

1x900W on vent line with Alu tape

10^{16} close V102 ; file: D0002. txt (10:24)
Jcl = 222 mA

Ziegler connected to vent line before He pump II valves



10^{33} Start_Aq_SCAO_5_4 (Level probe)

L101	102	701	702
136,9	132,5	4,65	5,02

10^{38} Stop 5_4

10^{39} SV 121 closed

10^{44} close SV121

He I evacuate → 1 mbar P622

isolate P622 ↓ 0,5 mbar

fill line with He from dewar

10^{32} evacuate line with He I pump 0,2 mbar

10^{57} fill line with He from dewar

11^{23} evacuate line with He I pump till p=0,2 mbar

11^{27} vent line with GHe from Dewar

11^{28} remove SV121 plug

11^{31} insert transferline to end position

12^{50} P506 (Ziegler) = 1070 mbar

P101 = 1,02 P701 = 1,02 bar T106 = 4,2K T708 = 4,2K

V104 + V701 open others closed

$\dot{m}$ = 29 mg/sec

12^{55} close He by pass valve pump 2
check out flow meter in pump 2
→ only possible in MAN mode

13^{04} He 1 pump evacuate with $\dot{m}$ 10 m³/h control on

Flow is not under control; Flowmeter is ~~is~~ limited to 100 n m³/h → real flow probably greater
Same in Manual mode - flow regulator inside Housing shows closed position when pumps manually on

13^{55} by pass He P2 open (vent active)

14^{35} close by pass pump 2

120908

cont. Kunz

open throttle valve He 2
$\dot{m}$ = 50 mg/sec is max
↳ in Auto mode (max flow is by pass)

15^{10} Start He 1 → after 5 min
self shutdown Alarm: rotary pump fault
? Temperature problem ?

16^{30} SU121 in safety position

Do not open He 1 valve

He 2 is still pumping

Temp. sens. reset

He vent line from Pump 1 increased to DN 40

16^{20} SU121 removed + transfer line inserted

16^{26} Start He pump 1

16^{30} Rotary pump fail at water temp 23,8

ρ He 0,0001787 g/cm³

0,8645 = ρ 101

$16^{52\,00}$ → evacuate P1 = 737 mbar
P2 = 878

after 3 min switch of T water 24,0°C

0,832 = ρ 101

17^{04} He 1 in Manual mode
Start pumping with rotary alone

17^{08} 720 mbar at rotary inlet
T water 21,3 °C

17^{12} rotary failed again

17^{25} SU121 in Safety position

17^{40} He 2 56 mbar inlet
1222 mbar before rotary pump

18^{25} open V102 (D0003.txt) 18:32 h

18^{55} Pziegler connected to SCOE
CUSE03 5V ≙ 1,7 bar

13/09/05

8:00 P_{101} = 0,495 P_{101} = 0,494 VG_{901} = $1,9 \cdot 10^{-8}$

P_{Regler} = 540 mbar pumps running

He II 30 / 29 / 85 mbar

valve adjusted to 57 / 56 / 122 mbar

T462 = 45 T442 = 20 T422 = <10 K

T101 = 4,01 K T106 = 3,63 K

L101 = 110 L102 = 112 L701 = 1,7 L702 = 2,2 an

8:27 close V102 TIF D0004?

8:35 evacuate Airlock and open SV121

insert transfer line

He 1 in Manual mode only rotary

8:42 Start He 1 440 mbar at inlet

T_{water} = 20,6 T_{rotary} on top 55°C

8:46 off Pump

8:52 pump on ⇒ 87, m³/h 430 mbar

8:56 pump off

09:03 pump on Start: flow = 81 m³/h 410 mbar

09:07 pump off 79 m³/h 407 mbar

09:10 Pump II Flow increased (P_{pump} = 120 mbar)

9:13 pump on 78 m³/h 404 mbar

9:17 pump off 76 m³/h 390 mbar

		Tpump	$\dot{V}$	P
09:23	pump on	(T = 70°C)	75 m³/h	386 mbar
09:28	pump off	(T = 65°C)	72	374
9:34	Pump II flow adjusted (P_{pump} = 120 mbar)			
09:35	pump on	(T = 69°C)	70	365
09:39	pump off	(T = 65°C)	68	357
09:45	pump on	(T = 68°C)	67	350
09:50	pump off	(T = 66 °C)	65	342
09:55	pump on	T = 72°C	63	331
	change to: 5 min pump running + 5 min pause			
10:01	pump off	T = 65°C	62	325
10:06	pump on	T = 72°C	59	316
	change to: 6 min pumping + 5 min pause			
10:12	pump off	~~T~~ 67°C	58	309
10:13	pump II flow adjusted (P_{pump} = 122 mbar)			
10:17	pump on	T = 71	55	300
10:24	pump off	T = 68	53	289
10:30	pump on	T = 72	52	285
	change to: 8 min pumping + 5 min pause adjust Pump II to 120 mbar			
10:38	pump off	T = 67	49	272
10:43	pump on	T = 71	50	272
10:51	pump off	T = 65	45	252
10:56	pump on	T = 70	45	250
11:05	pump off	T = 69	42	237
11:10	pump on	T = 70	42	236
11:18	pump off	T = 70	39	229
	adjust pump II to 120 mbar			
11:23	pump on	T = 71	39	220

3.09.05

time	Tpump[°C]	$\dot{V}$[m³/h]	P [mbar]	Output
11^{30}	pump off	36	208	
12^{56} pump on ;	48°C	~~24~~ 34	~~183~~ 185	
adjust pump II to p=125 mbar				
13^{10} adjust Pump II to p= 125 mbar				
13^{15}	64°C	28	~~166~~	
13^{25}	67°C	26.7	160	
13^{35}	71	24,5	149	
13^{40}	72.5	23.7	144	
13^{45}	73,5	22,9	141	
adjust pump II to 125 mbar				
13^{50}	72.7	22	135	
13^{55}	74	22	131	
13^{56} change of pump set point to 2 m³/h (Drosselklappe)				
14^{00}	75	20	128	
change of pump set point to 5 m³/h				
14^{10}	75	18,9	121	
14^{12} change of pump set point to 10 m³/h (no reaction)				
14^{15}	75	18,1	117	
change of pump set point to 20 m³/h → Flow increases Output 95 → 72%				
14^{22}	74	19,2	113,1 mb	63%
14^{30}	76	17,8	106,5	48%
14^{35}	75	17	104	0%
Switch on booster EH 2600 :		35	80	95%
14^{36}	77			
14^{40} Failure of pump : Booster A fail				
14^{41} Restart without Booster				

Continuous pumping II

time	temp	$\dot{V}$	p
14^{50} Adjust pump II to ~~100~~ 110 mbar			
14^{51}	74°C	15.7 m³/h	94 mbar
15^{00}	73°C	14.8	90
15^{07}	74°C	14.1	87
15^{16}	74	13.6	85
15^{21}	74	13.0	82
15^{36}	72	11.9	77
15^{41} pump II adjusted to 125 mbar			
15^{50}	73	10.6	70
16^{00}	74	10.1	67
16^{44}	71	8.1	56

16^{45} Pump II adjusted and <u>fully opened</u> p=118 mbar

Haenni 0 ... 100 mbar (on Header 502)

connected to CUSE 004

18^{23} He 1 -43,7 / 51,3 mbar

5,8 m³/h 59°C on rotary

valve → isolate

L101 = 78,1 102 66,6 701 0,5 0,9:702

T101 = 102 = 2,30 K P101 = 6,7 mbar 701 = 0,0

P Häni = 43,01 mbar

P 901 = 1,7 x 10^{-8}

SV121 in safety position

18^{50} V102 open D005.tif

140905 | P_{Zapf} 20,8 Häumi 22,84

7^{50}

Lang

$P101 = P701 = 0,0$

$T101 = 2,019$ $1,9 \times 10^{-8}$ mbar

$T106 = 2,066$

He 2 28 / 25 / 78 mbar

Start SCAU 5_4

$L101 = 72,3$ cm $L102 = 59,6$ $L701 = 0,3$ $L702 = 0,6$

~ 53 % filling level

8^{40} Switch on He 1 in Auto mode

open SV121 + insertion of transfer line

close V102 (D006.tif)

He 1 → evacuate

	P_{pipe}	$P_{Rot\ pump}$	$\dot{V}$	$T_{wastewater}$
8^{53}	0,6	11,4	3,4 m³/h	22,5 °C
8^{54}	0,6	13	3,2	22,4
08^{56}	0,7	14	3,3	22,2
09^{15}	3.0	50	10.4	23.5

09^{17} switch off level probes, STOP SCAU 5_4

9^{26}			10.6	shield Temp ↑
09^{30}	3,0	58	10,5	24,7

Supply Dewar : SV678

Transport Dewar : SV 7069 m = 362.6 kg

09^{45}	2,8	57	10,1	25,2

10^{00} Transport Dewar SV 7069 with transfer line to supply Dewar installed.

$m_{Dewar} = 366.2$ kg (before the transfer in supply dewar)

- Measuring device installed at filling port
- Transfer Dewar and supply dewar connected.

	P_{pipe}	$P_{rot\ pump}$	$\dot{V}$	T
10^{03}	2.5	55.4	9.6	25.8
10^{15}	2.3	52.8	9.3	25.6
10^{30}	2.1	49.9	8.9	25.7
10^{55}	2.0	47	8.2	25^{5}

12^{42} 1,808 K at T101

$P_{Häumi}$ 1,88 mbar

open V102 (D007.tif) Start 5_4

L_{SDewar} 629 mm $L_{TDewar} = 240$

$m_{Dewar} = 366.0$ kg

$P_{Dewar} = \sim 60$ mbar

Transfer line retract $X = 0,6$ mm with 13 er

13^{06} $L_{Dewar} = 615$ mm $m_{TD} = 366,0$ kg

13^{12} " 606 mm

$T01 = 1,86$ ↑

↳ $x = ^{\sim}0,4$ mm

13^{20} $L_{Dewar} = 591$ mm

13^{30} 585 mm

↳ T101 ↑ C = const

$x = 0,6$ mm

13^{35} 578 mm

↳ $0,4$ mm

13^{44}

$\boxed{14.09.05}$

13^{45} dx changed to: $\boxed{dx = 0.3\ mm}$

$T_{101} = 1.94K$

$L_{Dewar} = 565\ mm$

13^{50} $L_{Dewar} = 561\ mm$

13^{55} $\boxed{dx = 0.2\ mm}$ changed

$T_{101} = 1.96\ K$

14^{00} $L_{Dewar} = 556\ mm$

Filling port temp. varies from 4 to 10K

14^{05} dx increased to $\boxed{dx \approx 0.5\ mm}$

$L_{Dewar} = 554\ mm$

$T_{101} = 1.98$

14^{07} open V702 (D008.tif);

filling of HOT, pump II : 10.3 m³/h

14^{15} $L_{Dewar} = 546\ mm$

14^{20} p = 11 mbar (P622 expansion pressure) /was: 3-4 mbar

14^{50} V102 close (D009.tif) V104 blocked?

$\dot{n}$ ↑ He1 13 m³/h

15^{00} open V102 (D010.tif)

close V702 (D011.tif)

$L_{SD} \approx 485\ mm$

15^{02} dx = 0.2 mm

$L_{SD} = 480\ mm$

15^{15} needle valve in transfer line close

15^{47} Isolate He I Pump

$L_{SD} = 479\ mm$

$P_{exp} = 6.7\ mbar$

16^{00} Close V104 (D012.tif)

switch on Heater of V104

16^{24} Stop heating @ 71K

Open V104 (D013.tif) change floppy disk

16^{26} Close V104 (D000.tif)

16^{28} V104 heater on

16^{52} V104 heater off @ 88 K

16^{53} V104 open (D001.tif)

V102 close (D002.tif)

16^{55} V102 open (D003.tif)

transfer line pre-cooled

17^{10} dx = 0.6 mm

17^{11} flow = 10.9 m³/h , p_{expans} = 15 mbar

$L_{SD} = 470\ mm$

17^{25} $L_{SD} = 442\ mm$

17^{30} change of dx = 0.4 mm

L_{SD} : 430 mm

17^{40} He pump I Inlet 3,3 mbar

before rotary 57 mbar

10,4 m³/h

water out 27,4°C

14/09/05 I

18^{00} close Needle valve at Dewar

18^{04} Level probes off

18^{05} remove Fill-line from Filling port
insert SV121 → Safe mode !!

$m_{\text{transport Dewar}}$ Level : 240 mm

m = 366.0 kg No 7069

supply dewar: 419 mm

19^{00} 481 mm 359,6 kg

19^{10} 495 mm 358,2 kg 9,9 m³ Gzähler

19^{25} T101 = 2,040

Pump II 23 mbar Inlet

68,9 mbar before Rotary pump

VG 901 = $1,9 \cdot 10^{-8}$

15.09.05
Kunz

8^{30} T_{101} = 1.867 K
VG901 = 1.9×10^{-8}

09^{15} dx = 0.6 mm

09^{20} needle valve opend / flow ≈ 1.5 m³/h

09^{28} Open V702 (D004.tif = D005.tif)

9^{44} L_{101} = 68.85
L_{102} = 55,57
T_{101} = 1.96

9^{46} L_{701} = 0.596
L_{702} = 0.857

10^{01} dx 0,6 → 1 mm (1,05)

10^{12} L_{101} = 70.11 L_{701} = 0.28
L_{102} = 57.23 L_{702} = 0.77

10^{18} He Pump I pinlet 4,5 mbar
prot 84,1 mbar
15,2 m³/h 26°C

10^{21} dx 1,2 mm

10^{20} m_{Dewar} = 357,6 kg He II Dewar 388 mm

10^{52} close V702 D0006.TIF
L_{101} = 71,96 L_{701} 4.75
L_{102} = 59,33 L_{702} 5,301

10^{50} Pump I pinlet = 4,3 mbar
Prot 84,4 mbar
15,1 m³/h 27 °C

11^{05} dx = 1,0 mm

11^{10} P Kanne 180 mbar 354,2 kg
N kl m³/h L_S = 347 mm

11^{25} dx = 0,85

11^{33} close needle valve at He II - Dewar
L_{701} = 4,215 L_{702} 4,63 L_{101} 75,17 L_{102} 63,28
T_{101} = 2,076 K VG901 = $1,9 \cdot 10^{-8}$

12^{43} He Pump I pinlet 26 mbar
Prot 58 mbar 10 m³/h 27°C

15/09/05

12^{44} $L_{101} = 71,11$ $L_{701} = 4,16$

$T_{101} = 2,035K$

12^{45} open Needle Valve at Dewar for Dewar filling

$L_S = 301$ mm $P_T = 85$ mbar

$P_S = 60$ mbar [frog]

$12^{25} = 351,6$ kg 27,00 m^3

13^{10} 351,0 m 303 mm 120 mbar

15^{00} Open Needle valve at Transfer - Dewar

$T_{701} = 1,95K$ 1/2 turn for 5 min

15^{05} open completely

15^{30} close needle valve. STOP filling

18^{10} $L_{701} = 3,89$ $L_{702} = 4,33$ $L_{101} = 72,49$ $L_{102} = 59,89$

Stop Level probes

$T_{101} = 1,90$ K $T_{702} = 1,67K$ $VG_{901} = 2,1 \cdot 10^{-8}$

$P_{502} = 16,2$ mbar

18^{15} He Pump I isolate

remove Filling line

18^{30} SV121 in safety position

He 1 pump off + venting inside

→ vent valve blind flange

$T101 = 1,90$ K $L101 = 72,1$ cm

Stop SEAV 5.4

16/09/05

9^{00} $VG_{901} = 2,0 \cdot 10^{-8}$

$T_{101} = 1,778$ $T_{702} = 1,75$ K

connect new supply dewar SN 9112

Transport Dewar SN 9111

10^{58} evacuate He II pumping line

11^{00} ~0,1 mbar

11^{10} ~0,1 mbar

venting with GHe

evacuate with He Pump I

venting with GHe to 1000 mbar

12^{26} Evacuation He pump 1

12^{27} Isolate ; SV 121 opened

12^{35} Transfer line partly inserted in filling port → evacuate

$T_{101} = 1,76$ K $T_{702} = 1,72K$

$L_{101} = 70,24$ $L_{701} = 3,60$

13^{05} Pre-cooling

13^{10} $dx = 1.0$ mm (≙ kleiner Zeiger : 3 / großer Zeiger : 0)

Start → open needle valve

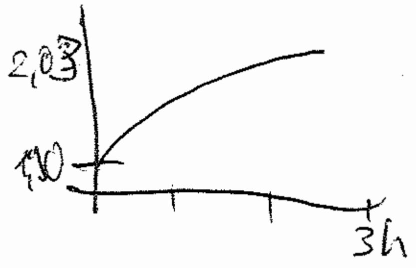
13^{18}	L_S	P_S	m_T	L_T	P_T	
	657 mm	41 mbar	364,6	225	60 mbar	✓
13^{30}	637	52	361.4	225	60	
13^{35}	In case of	p_T to 70 mbar (Regler)				
13^{40}	615	36	361.4	230	80	
13^{50}	595	61	361.6	230	96	5.5 l/min

13^{55} change $dx = 0.8$ mm

16/09/05

14^{30} change $dx = 0,6$ mm
14^{55} change $dx = 0.5$ mm

15^{58} close needle valve in He II transfer for filling of supply dewar
since beginning level increased linear for 10 cm

T101 

with ~ 18 m³/h in He 1 pump

17^{00} Restart of Filling (1/4 turn @ needle valve)
17^{53} Stop Filling (close needle valve)
17^{35} Isolate He pump 1
remove filling line partly
set SVR1
vent Tubing to He I Pump

17^{54} $T_{101} = 1,977$ $T_{702} = 1,98$
$L_{101} = 80,74$ $L_{701} = 3,33$
Stop SCAU 5,4 switch off level probes
$VG_{901} = 2,0 \cdot 10^{-8}$

17.09.05

8^{45} Kurz $T_{101} = 1.805$ $T_{702} = 1.799$
$L_{101} = 77.64$ $L_{701} = 3.08$
$VG_{901} = 1.8 \times 10^{-8}$

9^{20} Exchange Transport Dewar. New Dewar SN957
$L_T = 585$ mm

14^{45} $L_{101} = 77,15$ $L_{701} = 2,86$
$T_{101} = 1,764$ $T_{702} = 1,852$
$VG_{901} = 1,9 \cdot 10^{-8}$

14^{50} switch on Heater 702 for 20sec
arm 1 / power | arm 0

14^{53} close V102 D007.TIF
14^{55} close V104 P008.TIF
15^{00} T101 = 1,764 T102 = 1,764 | 104 = 1,764 | 105 = 1,764
15^{10} SV121 fastened Air Lock evacuated with He p 1 < 0,5 mbar
15^{18} He 1 = isolate
Venting via He II transfer line from Dewar to 1000 mbar
15^{30} Switch on H702 for 30sec 1,5W
15^{38} Switch on H703 1,0W
15^{39} Switch off level probes
15^{46} Switch off H703 $T_{703} = > 4K$

15^{52} close needle valve (Dewar)
close SV121 $P_{Ziegler}$ 1029,5 mb
15^{58} Pziegler 1031,2
15^{59} 1033,5
16^{00} 1042,9
16^{11} 1068,5
16^{15} 1070.4 Frog of flow unit on
insert HeI fill line in Dewar 9757
insert HeI " in Filling port
3x evacuate + flush with GHe
16^{26} open V702 (D0010.TIF + D009.tif ohne Balken)
16^{28} Pziegler 1071 mb (open) bypass "Frog" oscillation 1025 ± 6 mb
16^{36} insert filling line in filling port after pre-cooling

Start filling HOT $p = 1022$ mbar
$\dot{m} = 50$ mg/sec

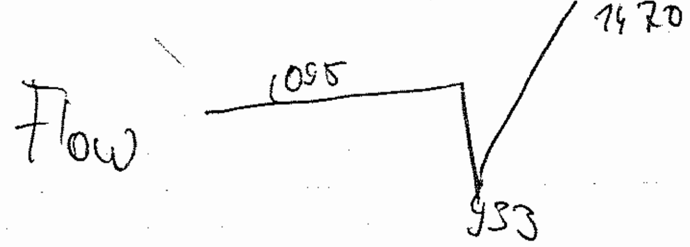
$m_T = 352.0$ kg P_D = ~~100mbar~~ 80 mb

6^{53} $P_D = 113$
$L_{101} = 76.85$ $L_{102} = 64.84$
$L_{701} = 1.16$ $L_{702} = 1.52$
$T_{101} = 1.800$ $T_{102} = 1.799$
$T_{703} = 4.31$ $T_{702} = 15.09$

16^{56} P_D = ~~0~~172 mbar $\dot{m} = 264$ mg/sec
17^{10} $P_D = 219$ mbar $\dot{m} = 302$ mg/s
17^{30} $m_D = 350.0$ kg, $P_D = 200$ mbar
Filling HOT!

time	m_D	PD	$\dot{m}$	L_{701}	L_{702}
17^{35}	348.8	200	630	5.61	6.79
	SCAO 5-4 off (level probes off!)				
17^{40}	347.6	200	888	switched off	
17^{45}	346.2	200	1090		
	SCAO-5-4 switched on				
17^{53}	344.4	200	1164	14,9	15,5
18^{15}	340,2	50	1117	24,0	p–1055,7
18^{25}	338,6	40	1095	26,27	1055,7

→ HOT full
Flow 1095 → 933 mg/sec
Pressure 1055 → 1054



$L_{701} = 26,48$
$L_{702} = 26,38$

18^{29} Flow 1493 close needle valve at dewar

Stop filling

18^{32} close V702 (D011.tif)

18^{34} Stop Level probes

– 18^{45} remove fill line partly
install SU 121 safety position

$18^{5\cancel{6}}$ frog bypass closed

Flow meter changed

5000 mg/s → ~~500~~ 50 mg/sec

$VG_{901} = 4{,}2 \cdot 10^{-8}$

19^{05} H 702 1,0 W 9,6 V 0,10A

19^{30} $\boxed{T_{101} = 1{,}822\,K}$

$T_{702} = 4{,}29K$ 1,0W

16,8 mg/sec

18/09/05

11^{05} $\boxed{T_{101} = 1{,}854}$ $P_{Zeigler} = 1077{,}9$ mb

$T_{702} = 4{,}280$ 1,0W

$\dot{m} = 45{,}78$ mg/sec

11^{07} Start SCAN 5,4 Level probes

$P_{701} = 1{,}039$

11^{15} $L_{101} = 77{,}00$ $L_{102} = 65{,}14$
$L_{101} = 17{,}73$ $L_{702} = 12{,}67$

11^{19} Stop level probes

11^{50} Reduce Heater Power H702 1,0 → 0,5W

14^{00} $T_{101} = 1{,}860\,K$ $P_{Zeigler} = 1074{,}4$

$\dot{m} = 23{,}8$ mg/sec $P_{H702} = 0{,}515W$

$T_{702} = 4{,}27K$

18^{10} $\boxed{T_{101} = 1{,}870\,K}$

$T_{702} = 4{,}28\,K$ $\dot{m} = 24{,}2$ mg/sec $P_{Zeigler} = 1074{,}9$

$P_{H702} = 0{,}515W$

19/09/05

7^{52} $\boxed{T_{101} = 1{,}899}$

$T_{702} = 4{,}29$ $\dot{m} = 24{,}96$ mg/sec $P_{Zeigler} = 1075{,}4$

Power 0,5W → 0,1W

Start Level probes

$L_{101} =$ ~~12,07~~ 76,96 $L_{701} =$ ~~1~~ 12,07
$L_{102} = 65{,}11$ $L_{702} = 12{,}20$

Stop Level probes

07^{58} ~~Heater Power 0,1 ⇒ 0,5W~~

$VG_{901} = 1{,}2 \cdot 10^{-7}$

Install [illegible] Flow meter + freq for Transport

8^{45} Heater Power 0,1 ⇒ 0,5 W

$\boxed{T_{101} = 1{,}9016}$

T_{102} 1,9000

T_{702} 4,2924

P_{701} = 1,025 bar

08^{30} Close V502

09^{03} Heater Power off start Flow

Flow meter 15 l

SCOE shut down

Remove SCOE Harness

09^{48} Flow meter 72 l

10^{20} 93 l

Transport to LSS

10^{58} Cleanroom before LSS Flow meter 149 l

12^{38} " 250 l

13^{45} 330 l

13^{46} Safety cart disconnected

15^{15} 470 l in LSS

16^{40} $VG_{901} = 1.0 \times 10^{-7}$ mbar

17^{15} Flow 660 l

connected 321 100 J01 L701
J02 (J04 J08) L702 + H702
J05 L102
J06 L101 + H702

321 200 J02 (J05) C100

321 300 J02 (J05) C100

315 100 J03 C100

17^{23} $\boxed{T_{101} = 1{,}9268}$

T_{702} 4,26

L_{101} = 45,9 % (34,85 Ω) L_{102} = 38,7 %

L_{701} = 42,2 % (38,65 Ω) L_{702} = 42,6 %

17^{25} Start Heater Power H702 0,5 W

18^{24} Flow meter 1,15 m^3

Flowrate ~ 10 l/min

VG_{901} $6{,}1 \cdot 10^{-8}$ mbar

T_{101} = 1,92

2010|09|05

08^{10} T_{101} = 1,955 4

T_{702} 4,35 4 0,5W

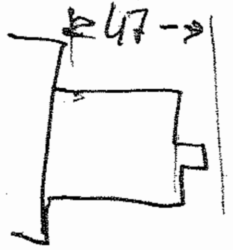
Flow meter = 9,64 m^3

Start level probes

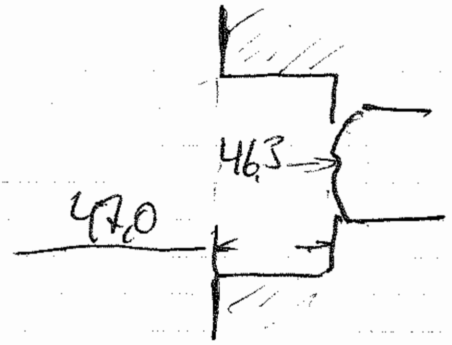
L_{101}= 45,87 % L_{102} = 38,70 %

L_{701}= 24,78 % L_{702} = 25,77 % Stop level probes

Anaconda 47,0
47,3



H 501



→ remove Safety screws at end of release screw ("anaconda")

connect Pump II to Cryostat

17^{30} T_{101} = 1,978 K

T_{702} = 4,40 K

P_{H702} = 0,5 W

He Pump II evakuieren

Power Fail Test Pzeiger −1,1 mbar

→ pressure increase leak in tubing

17^{45} Heater Power 0,5 → 0,310 W

Start level probes

Flowmeter 15,40 m³ 9 l/min

L_{701} = 12,11 % L_{702} = 13,43 %

L_{101} = 45,85 % L_{102} = 38,69 %

Stop level probes

leak test of He Pump II tubing

Background $1,3 \cdot 10^{-4}$

LR < $1,5 \cdot 10^{-4}$ no Signal detected

18^{12} pressure hold test "isolate"

Pzeiger −1,5 mb | pump 0,3 mbar

18^{20} Pzeiger ~1,5 mb pump 0,2 mbar

18^{22} Power fail test

Pzeiger = −1,5 → no change ✓

18^{25} Stop Heating H 202

p_{701} = 1,034

close Valve at He pump II

close Valve at H 501

18^{31} Open V506

pressure increase in He - line

Pzeiger = 1074,4

18^{36} V502 open / start pumping with needle valve

Prolong pump < 150 mbar

20/09/05

19^{29} Valve at He Pump II complete open

p_{701} = 57 mbar T_{702} = 2,52 K

VG_{801} = $4,4\cdot10^{-8}$

19^{47} T_{702} = 2,12 K T_{705} = 2,12 K

20^{05} T_{101} = 1,980

T_{702} = 1,965

open V104

20^{21} Open V104 T_{101} = 1,93

D000.TIF

increase of Temperature in T702 HOT!

20^{35} T_{101} = 1,980 K decreasing

T_{702} = 2,784 K

T_{705} = 1,92 K

21/09/05

10^{17} T_{101} = 1,856 K

T_{102} = 1,859 K

T_{702} = 1,845 K

Start level probes

10^{44} L_{101} = 44,61 % L_{102} = 37,13 %

L_{701} = 4,54 % L_{702} = 6,22 %

14^{15} Start HTD Heater-Test

14^{35} Close Valve on He Pump II

Open Needle Valve complete

Setup He I Pump Tubing

Leaktest Background $6.6\cdot10^{-6}$

Leck

19^{28} T_{101} = 1,809 K

T_{702} = 1,798 K

22/09/05

08^{06} T_{101} = 1781

T_{111} 3,277

T_{112} = 3,26 Pzigler = 7,3 mb

open Valve at He Pump II

Pzigler = 1,1 mbar

pump in manual mode Flow 47,8 mg/sec

08^{10} close ~~manual~~ main valve

Flow = 37 mg/sec

08^{45} 37,5 mg/sec

08^{46} open V106 D001.TIF

08^{47} 37,6 mg/sec 7,5 mbar

08^{50} close V104 D002.TIF

22/09/05

08^{57} $\dot{m}$ = 29,2 $p_{Zoegler}$ = 5,1 mbar

T_{101} = 1,779 T_{111} = 3,14 K T_{112} = 3,13 K T_{702} = 1,75

08^{55} $\dot{m}$ = 28,5 $p_{Zoegler}$ = 4,4

09^{08} $\dot{m}$ = 26,1 $p_{Zoegler}$ = 3,6

T_{101} = 1,778 T_{111} = 3,243 T_{112} = 3,36 T_{702} = 1,69

09^{35} T_{101} = 1,782 T_{111} = 3,37 T_{112} = 3,36 T_{702} = 1,62

$\dot{m}$ = 22,4 $p_{Zoegler}$ = 2,3

10^{05} $\dot{m}$ = 21,4 $p_{Zoegler}$ = 1,6

T_{101} = 1,78 T_{111} = 3,43 T_{112} = 3,43 T_{702} = 1,59

Leaktest Tubing He I Pump

Background $6 \cdot 10^{-8}$

Leakrate < $8 \cdot 10^{-8}$ ✓

10^{17} $\dot{m}$ = 21,3 $p_{Zoegler}$ = 1,8 mbar

T_{101} = 1,78 T_{111} = 3,45 T_{112} = 3,45 T_{702} = 1,58

10^{25} open V 104 Flow = 20,9 mg/sec

D003.TIF

Flow 39,6 mg/sec

10^{27} close V 106 D004.TIF + 005.GIF (correct 3 pixels)

10^{28} Flow 36,6 mg/sec

14^{50} T_{101} = 1.778

T_{111} = 3,405

T_{702} = 1,971

Switch on Level probes

15^{00} L_{101} = 43,46 % L_{102} = 55,84 % L_{701} = 1,01 %

L[illegible] = 2,95 %

Stop Level probes

15^{15} close needle valve at He Pump II

isolate → switch To Auto-Mode

evacuate → open needle valve

19^{00} T_{101} = 1,773 K T_{111} = 3,464

T_{702} = 1,771 K T_{112} = 3,45 K

230905 | 7^{00} T101 = 1,773
102 = "
T702 = 1,776
= 1,779

Bayer
Barlage
Kunze
Langst

Switch on He pump 1

Transfer line connected with Ir' Ar
T-Dewar + S-dewar + viton seal connected
→ thread bold is damaged M8×1
evacuate + flushing of air lock

7^{30} Start He P 1
Pzegler = 6,0 mbar

He1 1,6 m^3/h

7^{35} 1,8 m^3/h HeP2 1,5 mbar in

7^{50} open needle valve 1/4
until 24 m^3/h
then transfer line inserted
needle valve close
open V102

dx = 0,9 mm retracted

8^{03} needle valve 1 turn open 2,3 m^3/h

8^{10} 6,8 m^3/h L_S 603 mm

8^{20} 13,2 m^3/h 590 mm T104=1,917K

8^{30} dx = 0,75

8^{45} He P2 valve open → 2,6 mbar
Pzegler = 1,6 mbar

9^{45} Cut off close SV121 sinter filter on transfer line

open SV121
~~8~~9^{45} pre cooling of transfer line
1/4 needle valve

46 18 m^3/h
22 m^3/h
dx = 0,6 mm needle valve open

10^{15} dx = 0,8 mm P_{He2} = 2,4 mbar
$\dot{m}$ 1 = 14,7 m^3/h
T111 = 2,0 K HOT is empty?
I Dewar is filling 485 mm
L_S = 515

T222 = 40K T~~24~~2 = 110K T262 = 170K

shields are to high

10^{35} $\dot{m}_{He1}$ = 15,4 m^3/h P_{He2} = 2,7 mbar
L401 = 46,4 % T101 = 2,01

11^{30} p_{He2} = 3,3 mbar $\dot{m}$ He1 = 16,7

~~dx = 0,7 mm~~ L_{101} = 47,7 %

T101 = 2,047

12^{05} dx = 0,5 mm p_{He2} = 3,8 $\dot{m}$ = 17,8 m³/h

L101 = 49,1 % T101 = 2,064

12^{20} dx = 0,4 mm p_{He2} = 4,2 $\dot{m}$ = 18,0 m³/h

L101 = 49,6 T101 = 2,072

13^{55} Dewar empty needle valve 1/16

p_{He2} = 4,4 mbar $\dot{m}_{He1}$ = 16,5 m³/h

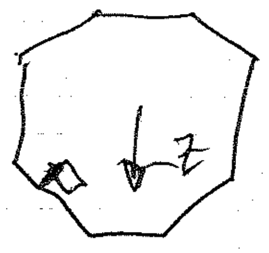
L_{101} = 50,5 % T101 = 2,05 K

T702 = 10,4 K

14^{30} Switch off Level probes Stop SCAU 5,4

L 701 connected 321 100 J01 < H 701, V 105, V 701

L 702 " 321 100 J02 → H702, V 702



very left side

disconnected !

14^{45} Start level probes Start SCAU 5,4

15^{55} open needle valve

15^{55} dx = 0,4

21^{57} STOP SCAU-5-4 (switchoff level probes)

22^{30} L_{101} = 57.36 L_{102} = 51.71

23^{45} Safety plug in ; Safe conditions

T_{101} = 2,0725 T_{702} = 15.26

L_{101} = 58,31 %

L_{102} = 52,72 %

VB_{901} = 3.6×10^{-8}

240905

6^{30} T 101 = 2,01 K

702 = 16,6 K

T 462 = 92 K

242 = 42 K

L101 = 58,1 %

Bayer
Langfermann
Reichle
Barlage

7^{15} open SV 121 insert transfer line to x + 60 mm

Start He 1 Pump

3,1 m³/h

p sample 14,6 mbar p_{He2} = 15,8

721 $\dot{m}_{He2}$ = 4,7 mbar

240908

7^{55} $\dot{m}_{He1} = 13,5$ m³/h

$T101 = 1,97$ K

08^{10} 12,8 m³/h 1,95 K 56,4 % L101

8^{25} Transferline inserted with pre cooling

$x=0 = 3,0$ mm

$\boxed{dx = 0,5}$ (3,5mm)

$T101 = 1,950$ $L101 = 56,2$

$\dot{m} = 12,7$ m³/h

8^{35} $\boxed{dx = 0,6}$

9^{10} $T101 = 1,983$ K $L101 = 57,36$

$T702 = 16,16$

$\dot{m} = 14,5$ m³/h

$P_{He2} = 6.0$ mbar

10^{00} $T101 = 2,01$ $L101 = 58,9$ %

$m = 15,9$ m³/h ~ 18% h

10^{35} $\boxed{dx = 0,5}$

2,03K 60,1 %

16,6 m³/h

11^{22} 2,046 K 61,4 %

17,4 m³/h

13^{10} new Dewar connected
while Needle valve in transfer line ~1/16

2,048 K 62,7%

17,3 m³/h

14^{12} 2,062 K 64,2 %

18,1 m³/h

14^{20} $\boxed{dx = 0,4 \text{ mm}}$

15^{30} change from day to night shift
new: Kunz, Huber, Hungstler

16^{50} $T_{101} =$ 2.077 K

$L_{101} = 67.5$%

$\dot{V} = 18.9$ m³/h

21^{00} Stop Filling

$T_{101} = 2,086$

$L_{101} = 72,58$ %

He Pump II rough valve closed
needle valve complete open

250905 P_{He2} = 8,3 mbar
Conf
Bayer

T ~~1~~01 = 2,026 K T702 = 12,6 K

T422 = 13 T442 = 36 T462 = 72 K

L 101 = 71,33 %

26/09/05

08^{50} T_{101} = 1,933 K
T_{702} = 15,09 K

T_{422} = 13 T_{442} = 47 T_{462} = 88 K

L_{101} = 69,6 %

Stop SCAN 5.4 (Level probes)

12^{45} T_{101} = 1,918 K
T_{702} = 15,70 K

12^{55} Block SU121 2x evacuate and vent
with He

12^{56} Open main valve at He Pump II $P_{Ziegler}$ = 17,4
12^{57} $P_{Ziegler}$ = 8,9 mbar
VG 901 = $1,8 \cdot 10^{-8}$ mbar

13^{00} isolate He Pump I → remove SU121
insert He II Transferline (- ~40 mm)

13^{05} evacuate with He Pump I

13^{07} 2,3 m^3/h
13^{15} 3,3 m^3/h

13^{20} 4,0 m^3/h
13^{26} 9,5 m^3/h
open needle valve at dewar → cooling of transferline

13^{36} dx = 0,4 mm 10 m^3/h
filling

13^{52} 12,1 m^3/h $P_{Ziegler}$ = 3,0 T_{101} = 1,926 K
14^{25} 13,0 m^3/h " 3,7
14^{52} dx = 0,38
15^{20} dx = 0,28

16^{05} 15,2 m^3/h 72,53 % T_{101} = 1,988 K

16^{08} dx = 0,18 mm

16^{20} dx = 0,18 + 0,25 = 0,43
close needle valve at dewar and open 1/16 turn

16^{25} 15.6 m^3 T_{101} = 2,005 K

17^{15} 15,6 m^3 T_{101} = 2,005 73,17 %

17^{40} dx 0,4 → 1,4
17^{42} Level probes off
close valve at dewar
isolate pumps
close V 102 (D006.tif + D007.tif) ohne 3 schritt
close V104 (D008.tif)
remove Transferline partly
vent lines with He to > 1030 mb

18^{02} ~~17^{58}~~ open V702 insert Transferline
(D009.tif)

18^{05} Supply : 150 mbar -> needle valve opened

18^{07} Filling HOT $\dot{m}$ ≈ 300 mg/sec p = 1090 mbar

18^{13} $\dot{m}$ ≈ 336 mg/sec Pzeiger ≈ 1090 mbar T_{702} = 12K

	$\hat{m}$	p zeiger	T_{702}	P_D
18^{15}	345 mg/sec	1095 mbar	13,5 K	230 mbar
18^{20}	~~256~~ 300	1085	14,5 K	220
18^{25}	310	1087	15,4 K	230
18^{33}	288	1081	17K	
18^{35}	289	1081		
18^{40}	293	1082	19K	229

Abbruch

close Needle valve of Dewar

remove transferline

17^{46} close V702 D010.TIF

set SV121

close ventline

17^{50} evacuate ventline with He Pump II

SV121 safe mode

19^{15} Pzeiger = 13,8 mbar

open V104 D011.TIF

Pzeiger = 25 mbar

pumping with open needle valve

T101 = 1,951 K T111 = 2,4 K

T702 = 16,2 K

270905

Pzeiger = 20,2 mbar PHe2 = 5,7 mbar

280905

VG901 = 2,7 x 10^{-8}

2 pressure gauging lines connected

red tie-rap label to large nozzle Inlet

red tape label to small nozzle outlet @TY

27.9.05 Vent ventline + dewar head + LHV QM + pumping line connected and leak tested < 10^{-8} mbar l/sec

fit check for LSS internal lines from inside to LSS I/F mounting performed

11^{17} T111 = 1,863 K

T702 = 18,17 K

T462 = 110 442 = 60 422 = 19 K

leak test all except downstairs connection < 10^{-8} mbar l/sec

PHe2 = 3,~~2~~ mbar

14^{45}

280905

HOT evacuation test

ASED-SD-0055

13^{30}

0,4-2V CVSE 002 = large nozzle inlet pressu
0-~~8~~0 mbar
003 = small nozzle outlet
10V = 5 g/sec 004 = 0-5000 mg/sec

002 = 0,38V 003 = 0,41V 004 = 0,02V

14^{45} disconnect HOT - level probe connectors
121 100 J01 / J02
evacuate dewar head PIR 203 -0,47 mbar
PIR 204 0,22 mbar

16^{36} close V104 D0012.TIF
T_{101} = 1,8488
vent dewar head with He

16^{42} isolate He Pump II

16^{48} DLCM - Modus secure SV 121
evacuate and vent He II - Production Line 2x
switch on Level probes
L_{101} = 75,93 %
L_{102} = 75,57 %
Switch off level probes

17^{20} remove SV 121

17^{22} vent HOT with He
close V601 → fail
Open V601 ok D0013.TIF

mount ext tubes H501 → tubing
at 1060 mbar flushing through cryostat

18^{00} close V506
pressure increase to 200 mbar rel
Sniff leak Test LR < 7,5 · 10^-5
off outer Tubing
release pressure to ambient
Test set up for HOT evacuation Test

20^{30} Test finished
V501 closed
open V502
SV121 in safety position

29/09/05

06^{20} T_{101} = 1,891 K
T_{701} = 44,84
VG_{901} = 5,8 · 10^-8
V104 / V105 open

06^{25} open manual valve at He Pump II
~~fille~~ filling Dewar 9111 in Supply Dewar
block SV 121
He II Pump line 2x evacuate and vent mit He
Pump evacuate / isolate
remove SV 121
insert He II Transferline - 40 mm
T_{101} = 1,884
Psafety - 21,2 mb

07^{40} pump with He II pump

Open V102 D0021.TIF

08^{05} 5,5 m^3 open needle valbe at Dewar

08^{08} 13,8 m^3

disconnect 321 100 J01 / J02

insert transfer line

dt = ~~0,5~~ 0,4 change of distance measurement

08^{20} Start level probes

L_{101} = 75, 52 % L_{102} = 75, 15 %

08^{27} dt = 0,6 mm

08^{42} dt = 0,85 mm

08^{45} dt = 1,05

08^{54} dt = 0,75 mm 4,4 m^3/h

08^{58} dt = 0,50 mm 4,5 m^3/h

09^{04} dt = 0,35 mm 4,6 m^3/h

09^{30} dt = 0,80 mm 5,1 m^3/h

09^{58} dt = 0,20 mm 5,5 m^3/h

11^{12} dt = 0,1 mm 6,5 m^3/h

11^{50} try new dt dt 0 set → dt = 0,2

13^{35} remove transfer line Flow 5,5 → 20

set new dt = 0,4

13^{45} open V 702 D022. TIF no status change

13^{52} close V 104 D023. TIF

13^{53} Start Heating V104 6,1 W

14^{18} VT~~7~~104 71 K T702 = 15K

14^{20} VT104 ~~75~~ K m He1 = 4,3 m^3/h

Stop heating + open V 104

(T = 2,16 K) 24 TIF

14^{22} close V702 25. TIF

m He1 = 9,8 m^3/h

14^{30} m = 23,9 m^3/h

14^{40} He I Pump Booster fail

~~per~~ close needle valve / restart

14^{45} dt 04 → 0,3mm $\dot{m}$ = 24,9 m^3/h

15^{06} dt 04 → 0,2 mm

~~15~~ only Rotary pump ~ 6 m^3/h

restart in Auto mode

15^{15} close needle valve at supply dewar

15^{16} $\dot{m}$ = 24.3 m^3/h prot = 130 mbar

Booster fail – restart

15^{30} $\dot{m}$ 24,0 m^3 prot = 125 mbar

15^{53} He pump 1 overheat shut off

~ 23 m^3/h

T101 = 2,12 K

16^{08} Booster failed restart

He 1 pump throttle from 20 → 25 m/h

Restart

17^{18} T101 = 2,053 K

$\dot{m}_{He1}$ = 19,1 m^3/h

18^{10} open V702 26.TIF no status change

close V702 27.TIF

18^{30} T111 = 1,98 K

V_{He1} 15,8 m³/h P_{He2} = 5,4 mbr

pre cooling through transfer line retracted

because of problems with V702 Status

18^{45} T111 = 1,98 K constant

15,6 m³/h P_{He2} 4,8 mbar

dx = 0,4 mm

L101 = 76,4 %   102 = 76,1

19^{45} dx = 0,5

77,0%

20^{30} 77,5%   2,08 K

dx = 0,6 mm   17,0 m³/h

21^{00} 78,3 %   2,020 K

17,5 m³/h

23^{00} 19 m³/h   2,048 K

81 %

new Dewar ready for use !!

with new transfer from OTN

23^{15} switch OFF He pump 1

He pump 2 adjusted to 20 mbar

inlet for overnight pumping

Stop SCAU 5_4

81% , 2,048 K

pre cooling with extracted transfer line

20 min pumping on HTT

needle valve on dewar open to ~ 20 m³/h

for 5-8 min than inserting w/o interruption

missing 12er Quetschverschraubung

V702 Status is still missing inside CVV

L270X disconnected @ TTAP

30/09/05

06^{28} open valve at He Pump II

SV121 blocked

He II Pump line 2x evacuated and vented

T_{101} = 1,992   VG 901 = $1,8 \cdot 10^{-8}$

Pump evacuate / isolate

Remove SV121 / insert He II Transferline (– 40 mm)

6^{50} start Pumping He Pump I

6^{52} 3,5 m³/h

30/09/05

07^{00} $\dot{m} = 6.4\ m^3/h$

07^{06} $\dot{m} = 16.1\ m^3/h$ Filling Port

07^{10} $\dot{m} = 16.2\ m^3/h$ $T_{101} = 1{,}978\ K$ $T_{113} = 5{,}934$

$T_{111} = 2{,}17\ K$ $T_{114} = 5{,}92\ K$

07^{14} open needle valve at Dewar 30 m³h
flushing $\dot{m}$
reduce needle valve

07^{14} insert transferline complete
$dx = 0{,}4$

07^{18} $\dot{m} = 15{,}0\ m^3/h$
Start Level probes SCAU 5,4

07^{25} $L_{101} = 79{,}91\ \%$ $L_{102} = 79{,}60\ \%$

08^{06} $L_{101} = 80{,}4\ \%$ $T_{101} = 1.98$ $T_{111} = 2{,}08$ $\dot{m} = 15{,}8\ m^3/h$

08^{51} $L_{101} = 80{,}78\ \%$ $T_{101} = 1{,}996$ $T_{111} = 2{,}094$ $\dot{m} = 16{,}1\ m^3/h$

09^{58} $L_{101} = 81{,}9\ \%$ $T_{101} = 2.01$ $T_{111} = 2{,}10$ $\dot{m} = 16{,}7\ m^3/h$

PIR201 connect 4mm tube to NZ11 inlet (Kapton Tape)
el connect with 107,1Ω to CVSE05
new 4mm tube flushed with GHe

12^{35} $T_{101} = 2{,}029\ K$ $L_{101} = 84{,}27\ \%$ $T_{111} = 2{,}12\ K$ $\dot{m} = 17{,}6\ m^3/h$

14^{50} $T_{101} = 2{,}035\ K$ $L_{101} = 85{,}69\ \%$ $T_{111} = 2{,}14\ K$ $\dot{m} = 17{,}8\ m^3/h$
Ventil Adj. 0,5 mm

15^{20} $T_{101} = 2{,}042\ K$ $L_{101} = 86{,}58\ \%$ $T_{111} = 2{,}145\ K$ $\dot{m} = 18{,}2\ m^3/h$

16^{20} $dx = 0{,}6\ mm$ $18{,}6\ m^3/h$
$2{,}048\ K$ $87{,}5\ \%$ $P_{He2} = 11{,}4\ mbar$

18^{06} new Dewar
$2{,}065\ K$ $89{,}7\ \%$ $19{,}3\ m^3/h$
$P_{He2} = 12{,}5\ mbar$

18^{43} $19{,}6\ m^3/h$ $90{,}7\ \%$ $2{,}070\ K$

20^{30} $20{,}1\ m^3/h$ $93{,}9\ \%$ $2{,}080\ K$

20^{45} PPS Sensor in increasing
T111 = 112 = 2,26 K ↑
since 18:40 UT

22^{45} SCAU 5_4 off 95,01 %
T111 = 2,082 He 1 pump off
He pump 2 valve all open for
pump down

New dewar ~~is~~ in place → ~~waiting~~ prepared
for 100% filling ratio !
good luck !
Michel 0162 2949680

01.10.05

6^{15} SCAU_5_4 on : 93.38%
$T_{111} = 2.1835$
$T_{101} = 2.016$

Kunz
Runge
Pumpstar
Langenton
(=100% Team)

Head of transport dewar iced overnight.

06^{50} SV121 opened, Pump I + II running
precooling

7^{15} T_{101} = 2.005

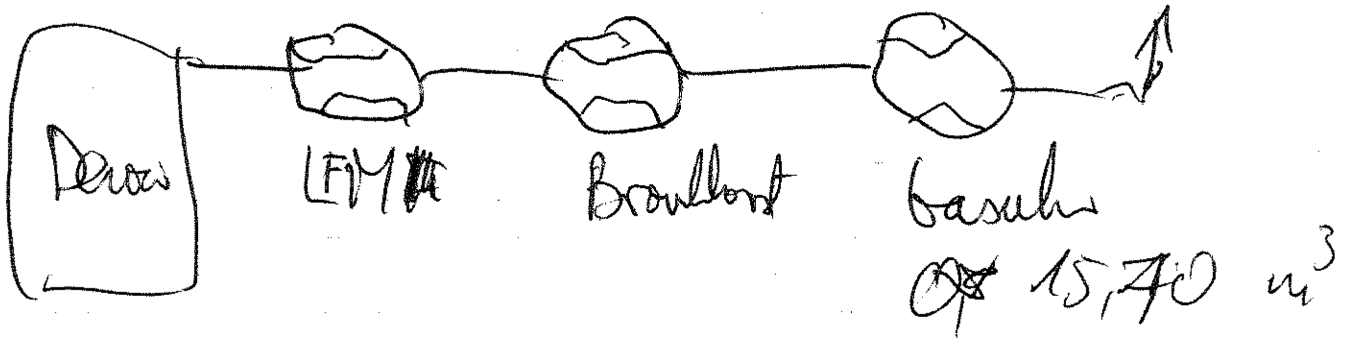
7^{25} dx = 0.4

07^{30} T_{101} = 1.998
L_{101} = 92.86
$\dot{m}$ = 15.9 m³/h

09^{00} T_{101} = 2.011 T_{111} = 2.168
L_{101} = 94.17 T_{112} = 2.162 slightly oszilating + moving
$\dot{m}$ = 16.6

11^{15} Dewar replaced : New dewar 8073

13^{55} L_{101} out of range (> 98.3%)
14^{03} PPS dipped in L 102 = 98,15 %
14^{14} needle valve closed on dewar



14^{25} V103 opened 0.000 tif ↓ Neue Datei
V106 opened (not logged)

PIR 203 = ~~10,20~~ 10,14
PIR 204 = 10,92

15^{35} V103 + V106 closed 001.tif
002.tif

17^{30} new dewar installed but no flow
L_S = 530

dx = 0,55

V_{He1} = 14,5 1,967 K 97,4%

18^{23} V103 opened 003.tif
18^{24} V104 closed 004.tif
18^{27} V501 opened 005.tif ← ? 124,5 mg/sec
18^{40} close V102 006tif SV121 closed
18^{42} Gasuhr Ø 16,46 m³ $\dot{m}$ = 117,4 mg/sec
He pump 1 is closed [1,1 m³/h = 0]
p_{Zuflu} = 7,0 p_{He2} = 7,9

18^{47}	p_{Zuf} = 4,4	p_{He2} = 5,6	64,4 mg/sec
18^{49}	4,0	5,2	60,8 mg/sec
18^{52}	3,2	4,5	55,5
18^{55}	2,3	3,6	48.2

	Pzigler	P_{He2}	ṁ	20's	20x
18^{52}	2,1	3,4	46,9	3,97 mbar	4,77
18^{59}	1,8	3.2	45,0		
19^{04}	1,4	2,9	43,5		
19^{07}	1,0	2.6	40,0		
19^{11}	0,8	2,4	37,7		
19^{15}	0,7	2,3	36,8		
19^{18}	0,6	2,2	36,3/37,0		
19^{24}	0,4	2,2	35,7		
19^{31}	0,3	2,0	35,5		
19^{36}	0,2	1,9	33,5		

19^{38} close V501 007

33,4

15^{40} open V104 → 129 mg/sec
mass flow disconnected

close V103 009 Aif

He pump 2 remains open
SV121 is safe

T102 = 1,8718 K 11^{20} 021005
Baye
Langf

~~T702 = 2,05 K~~

Pzigler = 11,8 mbar P_{He2} = 12,6

main valve of He pump 2 closed ~ 20°
by pass full open

P zigler 13,2 mbar P_{He2} = 10,5 mbar

L101 = 96,17 % L102 = 96,00 %

11 40

He p 2 valve closed

Pzigler = 16,7 P_{He2} = 4,2 mbar

12^{35} T = 1,867 K

P502 = 53 mbar

13^{40} Cryo SCOE Applic. stopped and restarted ⇒ CUSE_002 & CUSE_003
new calibr. curves activated

031005
Lauf

T111 = 1,826 K
T422 = 22 442 = 65 462 = 110 K

Pzigler = 11,3 P_{He2} = 2,7 mbar
P6901 = 2,4 x 10^{-8} mbar
L101 = 95,19 L102 = 95,05

15⁰⁰ P7101 connectors plugged
T701 = 16,5 K T702 = 16,4 K

15⁴⁰ close V104 10. TIF

15⁵⁰ Heater V105 start
16⁰⁵ Heater V105 stopped ; Temp = 75 K
16¹⁵ ~~He~~ p 2 isolat
SU121 open

open needle valve from Dewar S. for venting the He S/S including Anaconda
Pzigler = > 1000 mbar needle valve open for moments V506
↑ P506 + Wallace Tiernan

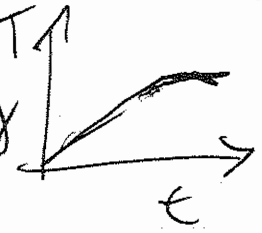
and 4mm line to PIR 201
16²⁸ needle valve closed
Plug SV121 blocken
V502 closed
V506 open

He 2 Pump on
~~SU 521 opens~~
V502 open
evacuate and flushing of P506 with GH to < 1ppm
pressure hold test @ 0,8 mbar OK
with scroll pump
V506 close and new Man Valve close
Leak test in sniff mode on PIR 201 < 1x10^{-4} mbar l/sec

18¹⁵ start evacuate with HeP 2
18³⁷ Pzigler 7,4 P_{HeP2} = 1,6 P701 = 0,04
V104 open TIF = 0,11
Pzigle = 3,5 P_{HeP2} = 0,7
18⁴² " 4,7 1,0

18^{52} P2igla = 6,6 P_{He2} = 1,4

T101 slowly



19^{15}

P2ogla = 8,0 P_{He2} = 1,6

041005 8^{45} V104 partly blocked?

T101 = 1,838 K

T701 = 28,23 K

P2igla = 9,7 P_{He2} = 2,3

T422 = 44 K 442 = 93 K 462 = 145 K

L101 94,46 %

L102 94,33 %

Air lock SV121 blocked

evacuate + flushing 2x

9^{05} close V104 (D012.64f)

close He P by pass valve

close V502

evacuate air lock

retract SV 121

flush with GHe from Dewar

9^{15} → He S/S

9^{25} SV121 closed at 1025 mbar

9^{30} open V506 p506 = 995 mbar

9^{40} open V501 (D013.64f +D014.64f)

9^{45} He venting into Anaconda

11^{03} Close V501 (D015.64f)

He Pump 2 connected to mass flow 500 mg/sec + Gasuhr

$\dot{m}$ 0 = 1,5 mg/sec 17,12 m^3

w/o pump

with pump connected and valves closed

18,8 mg/sec

11^{45} Open V501 (D016.64f)

HOT evacuation

9^{52} 69,1 mg/sek

11:57 → P 506

+1min

41 mbar
36 mbar
30 mbar
25,4 mbar
22,2 mbar
19,4 mbar
17,1 mbar
15,3 mbar
13,6 mbar
12,2 mbar
11,0 mbar
10,0 mbar
9,3 mbar

Closed pump inlet Valve

10,9 mbar

12^{20} close V501 (D017.tif)

12^{23} close large valve open by pass on He P 2

open V502

12^{25} open V104 (D018.tif)

$P_{Ziegler}$ = 7,8 P_{HeP2} = 1,7 mbar

13^{10} $P_{Ziegler}$ = 9,4 P_{He2P} = 2,1 mbar

T_{101} = 1,861 K T_{701} = 49,87 K

13^{12} close V104 D019.TIF

VT104 = 13,15 K

13^{14} switch on Heater V104 ~ 6,17 W

$P_{Ziegler}$ = 0,2 mbar P_{He2P} = 0,0 mbar

13^{44} VH 104 off P = 5,97 W VT 104 = 78,6 K

$P_{Ziegler}$ = 1,4 P_{He2P} = 0,0 mbar

13^{47} open V 104 D020.TIF

13^{50} $P_{Ziegler}$ = 6,3 mbar P_{He2P} = 1,3 mb

13^{56} $P_{Ziegler}$ = 7,7 mb P_{He2P} = 7,7 mb

16^{20} T101 = 1,874

$P_{Ziegler}$ = 9,7 P_{He2P} = 2,3 mbar

18^{00} T_{101} = 1,874

$P_{Ziegler}$ = 10,0 mb P_{He2P} = 2,5 mb

Top Up
→ page 201

05.10.05 T101=1,868 K T701 = 47,4

Bayer Lauf

P2zyl = 11,0 P_{HeP2} = 2,6

7^{45} Disconned HOI Sensor J01+02

Start SCAN 5_4

L101 = 93,7 % L102 = 93,6

SV121 blocked

evacuat + flushing

valve on He P 2 full open

8^{08} He 1 running on

Transferline inserted x ~ 40 mm

P2zyl 2,7 P_{HeP2} = 4,0 mbar

$\dot{V}_{He1}$ = 2,0 m^3/h

8^{12} open V102 21. TIF

8^{27} 4,0 m^3/h HeP1

8^{40} 8,4 m^3/h

Level Probe connectors on SCOF will be disconnected and modified one after the other

8^{47} 9,6 m^3/h

9^{00} Transfer line precooled insertion

$\boxed{dx = 0,4 \text{ mm}}$

T101 = ~~2~~ 1,855

L102 = 93,67 %

11,0 m^3/h

P2zyl 0,2 P_{He2P} = 1,5 mbar

9^{20} 93,38 % 1,868 K

11,3 m^3/h

9^{35} 11,6 m^3/h

9^{48} 1,875 K 93,6 %

9^{55} $\boxed{dx = 0,5 \text{ mm}}$

10^{20} 1,893 K 93,8 %

12,4 m^3/h

10^{25} $\boxed{dx = 0,6 \text{ mm}}$

10^{32} back to $\boxed{dx = 0,5 \text{ mm}}$ and open needle valve in transfer line

He Top Up 191
→ page 201

051005

11^{08} 94,7% 1,923 K

13,7 m³/h

11^{47} 1,950 K L101 = 95,7%

14,7 m³/h

12^{03} 1,96 K 96,2%

15,1 m³/h

13^{00} new Dewar

1,985 K L101 = 97,38%

16,3 m³/h

13^{30} T 101 1,996 K

98,2% T_{111} T_{112} decreases

Level probes → no values 999

14^{02} $\dot{m}_{HeI}$ = 17,3 m³/h 5,2 mbar Inlet pressure

Pzügler 2,5

T_{101} = 2,004 T_{111} = 2,026 T_{112} = 2,028

disconnect J18 at SCOE

measure P502 R 25 I+ 26 I- 6.884 kΩ

R 27 U+ 28 U- 5,63 kΩ

14^{30} 17,4 m³/h

14^{40} $\dot{m}$ = 17,5 m³/h p_{HeII} 5,5 mbar Pzügler = 2,7

↳ supply -26 mm/15 min ~ 18l (416 mm)

↳ 9l sfHe

↳ ~1%h

15^{00} 2,015 K 2,7 mbar pzügler 392 mm

17,7 m³/h 4,2 mbar P_{He2P}

18,4 m³ ↗

close needle valve on transfer line

16^{33} SV121 close + safe

V102 closed He1P off

pzügler = 8,7 P_{He2P} = 10,0

ext outline to He2P connected + valve open

V506 open

He2P to mass flow meter

12,3 mbar at PS06

close valve He2P for 0 check in

↳ pzügler 28,8 mbar PS06 ~ 29,0 mbar

1,8·1,5 mg/sec = 0 ~~8~~00 mg/sec

~~1~~0,08 mg/sec = 0 50 mg/sec new Disk

000.TIF

15^{44} open valve He2P

V501 open V502 closed

53488

Przyglo 8.3 P_{He2P} = 9,4
switch heater #502 /503
~ 28 mbar P506

16^{50} open V103 001.TIF

16^{52} close V104 002.TIF

$\dot{m}$ = 8,8 mg/sec
17^{26} $\dot{m}$ = 8,7 mg/sec   Przyglo = 12 mb

17^{45} TVQ013 opened 003.TIF
PPS starts operating

17^{56} close TVQ013 004.TIF

17^{06} open V502   SCAU S=4

18^{00} SV opend, HeII transfer on site

18^{05} p = 26.4 mbar on system

18^{06} pump on Helium I pump

18^{07} $\dot{m}$ = 1,6 m³/h

18^{11} 1,6 m³/h

18^{15} V104 opend (D005. tif)

18^{25} 13,6 m³/h

19^{00} 15,9 m³/h   1,970 K

19^{30} Dip in T111 → He1P isolate

19^{30} close V104 (D006.tif)

19^{35} change Flowmeter 500 → 50 mg/sec

19^{55} V104 opened (D007.tif)
again pumping with HeP1 ~

20^{00} 12 m³/h

20^{01} V104 closed (D008.tif)
L_{102} = 98.137%

20^{08} SU121 in safety position

20^{08} open V106 (D009.tif)

20^{22} V103 closed (D010.tif)

20^{25} open V503 (D011.tif)

20^{30} close V501 (D012.tif) → open V502/close

20^{37} open V104 (D013.tif)

20^{49} close V106 (D014.tif)   heater H503-off

20^{55} close V503 (D015.tif)

21^{00} Przyglo 14,5 mbar   PHe2P = 4
big valve on He2P

06/10/05

08^{28} Przyglo = 14,8 P_{He2P} = 3,9

T_{101} = 1,9280 T_{111} = 2,083 T_{112} = 2077
Start level probes T_{701} = 44,5 K

L_{101} = 97,59 % L_{102} = 97,51 %

051005

11^{08} 94,7% 1,923 K
13,7 m³/h

11^{47} 1,950 K ∠101 = 95,7%
14,7 m³/h

12^{03} 1,96 K 96,2%
15,1 m³/h

13^{00} new Dewar

1,985 K ∠101 = 97,38%

16,3 m³/h

13^{30} T 101 1,996 K
98,2 % T_{111} T_{112} decreases
Level probes → no values 999

14^{02} $\dot{m}_{He\,I}$ = 17,3 m³/h 5,2 mbar Inlet pressure
$P_{Bessler}$ 2,5
T_{101} = 2,004 T_{111} = 2,026 T_{112} = 2,028

disconnect J18 at SCOE

Measure R 25 I+ 26 I- 6.884 kΩ
P502
R 27 U+ 28 U- 5,63 kΩ

14^{30} 17,4 m³/h

14^{40} $\dot{m}$ = 17,5 m³/h $P_{He\,II}$ 5,5 mbar $P_{Bessler}$ = 2,7
supply −26 mm/15 min ~ 18 l (416 mm)
↳ 9 l sfHe
~ 1%/h

15^{00} 2,045 K 2,7 mbar $P_{Bessler}$ 392 mm
17,7 m³/h 4,2 mbar P_{He2P}
18,4 m³ ↗
close needle valve on transfer line

16^{32} SV121 close + safe
V 102 closed He 1 P off
$P_{Bessler}$ = 8,7 P_{He2P} = 10,0
ext outline to He2P connected + valve open
V506 open
He 2 P to mass flow meter
12,3 mbar at P506
~~close valve He2P for 0 check in~~
↳ $P_{Bessler}$ 28,8 mbar P506 ~ 29,0 mbar

1,8-1,5 mg/sec = 0 500 mg/sec
0,08 mg/sec = 0 50 mg/sec new Disk

16^{47} open valve He2P 000.TIF
V501 open V502 closed

Pzyglo 8.3 P_{He2P} = 9,4
switch heater H 502 / 503
16^{50} ~ 28 mbar P506
open V103 001.TIF
16^{52} close V104 002.TIF
$\dot{m}$ = 8,8 mg/sec
17^{26} $\dot{m}$ = 8,7 mg/sec Pzyglo = 12 mb
17^{45} TVQ013 opened 003.TIF
PPS starts operating
17^{56} close TVQ013 004.TIF
17^{06} open V502 SCAU 5_4
18^{00} SV opened, He II transfer on setup
18^{05} p = 26.4 mbar in system
18^{06} pump on Helium I pump
18^{07} $\dot{m}$ = 1,6 m^3/h
18^{11} 1,6 m^3/h
18^{15} V104 opened (D005.tif)
18^{25} 13,6 m^3/h
19^{00} 15,9 m^3/h 1,970 K
19^{30} Dip in T111 → He1P isolate

19^{30} close V104 (D006.tif)
19^{35} change Flowmeter 500 → 50 mg/sec
19^{55} V104 opened (D007.tif)
again pumping with HeP1 -
20^{00} 12 m^3/h
20^{01} V104 closed (D008.tif)
L_{102} = 98.137%
20^{08} SU121 in safety position
20^{08} open V106 (D009.tif)
20^{22} V103 closed (D010.tif)
20^{25} ~~close~~ open V503 (D011.tif)
20^{30} close V501 (D012.tif) → open V502/close
20^{37} open V104 (D013.tif)
20^{49} close V106 (D014.tif) heater H503 off
20^{56} close V503 (D015.tif)
21^{00} Pzyglo 14,5 mbar P_{He2P} = 4
big value on He2P

06/10/05

08^{28} P_{zyglo} = 14,8 P_{HeP} = 3,9
T_{101} = 1,9280 T_{111} = 2,083 T_{112} = 2077
Start level probes T_{701} = 44,5 K
L_{101} = 97,59 % L_{102} = 97,51 %

06/10/05

09^{10} open manual valve at the pump II
Pvorgber 19,7mb → 5,2 mbar

Valve status

Kunz / Huber | closed : 102 103 106 701 702 501 503 601
open : 104 105 504 505
P_{506} : 18mbar

9^{30} V506 opened
P_{506} : 9[illegible]mbar

9^{31} open V501 (D016.tif)

$\dot{m}$ = 77.1 mg/s

close V502
$\dot{m}$ = 7.1 mg/s (offset : 1.4)
P_{506} = 24.1 mbar

⇒ ① venting through V501 and all nozzles

9^{37} change flowmeter to small range (50mg/s) ~~offset : 0.11 mg/s~~
$\dot{m}$ = 5.34 mg/s

9^{39} SCOE : CVSE_002 : 20.84
CVSE_003 : 2.68
CVSE_004 : 1.07 (Volt)
CVSE_005 : 21.38
P_{502} : 18 mbar

9^{44} P_{506} : 24.0 ; $\dot{m}$ = 5.35 mg/s

9^{45} ② Next config : Venting through V501 and only small nozzle

9^{47} close V504 (D017.tif)
close V505 (D018.tif)
P_{506} : 24.8 mbar
$\dot{m}$ = 1.69 mg/s

9^{52} CVSE_002 : 0.64
_003 : 2.26
_004 : 0.32
_005 : 23.9
P_{502} : 21 mbar

9^{55} $\dot{m}$ = 1.63 mg/s
P_{506} = 24.8 mbar

9^{56} ③ Next config: Venting through V501 + V503 and only small nozzle

9^{57} open V503 (D019.tif)
$\dot{m}$ = 1.72 mg/s
P_{506} = 24.8 mbar

Notabene: CVSE_005:
durch parallelen Flug
durch V501 und V503
Druckanstieg bei CVSE
005 um : ≈ 0.3mbar

10^{00} CVSE_002 : 0.57
CVSE_003 : 2.25
CVSE_004 : 0.34
CVSE_005 : 24.25
P_{502} : 21.2 mbar

10^{05} $\dot{m}$ = 1.68 mg/s
P_{506} = 24.8 mbar

10^{06} ④ Next config: Venting through V501+V503 and all nozzles.

open V504 (D020.tif)
open V505 (D021.tif)
$\dot{m}$ = 5.70 mg/s
P_{506} = 23.85 mbar

V_{6901} : 4×10^{-8}

10^{10} CVSE_002 : 21,78
_003 : 2,67
_004 : 1,148
_005 : 22.30
P_{502} : 19.2 mbar

10^{15} $\dot{m}$ = 5.72 mg/s
P_{506} = 24.2 mbar

10^{20} ⑤ Next config! Venting through V503 and <u>all</u> nozzles.

10^{20} close V501 (D022.Hf)

$\dot{m}$ = 5.35 mg/s
P_{506} = 24.1 mbar

10^{21} CVSE_002 : 20.7
_003 : 2.63
_004 : 1.08
_005 : 21.2
P_{502} : 18.3 mbar

10^{24} $\dot{m}$ = 5.34
P_{506} = 23.95 ; flowmeter changed to ~500 mg/s

10^{25} open V502 + ~~open~~ close V503 (D023Hf) 10^{20}
P_{506} = 7.7 mbar
Close V506

<u>Final Configuration:</u>
open: V104, V105, V504, V505
closed: V102, V103, V106, V701, V702, V501, V503
TVAM3, V506

13^{10} 1,918 K

18^{00} 1,90 K
pzeiger > 5,7 P_{He2P} = 6,9
close main valve on top of He2P
600 mm n in supply dewar

setup with LSS Feedthroug + ext tubing

Safety line leak test LR < $7 \cdot 10^{-6}$ mbl/s
venting with He

evacuation of pumping line to < 10 mbar
isolate pump
pressure decreases

19^{21} CVSE 02 4,4 mb
03 4,8 mb
05 7,6 mb

07/10/05

08^{18} T_{101} = 1,880 K
T_{111} = 2,034 Pzeiger = 12,8 mb

08^{25} open manual valve at He Pump II

13^{10} close " "
1,865K

L101/2 96,05 % 95,93 %

→ P204

160905 Transport procedure for clean room to LSS

HTT closed

HOT Top up (1. attempt with He II transfer line
else: He I line)

HOT heating ~ 2W continuously wherever possible

preps
Vent line: DN25 flex line connected to H801 outlet + frog + Gasuhr!!
Fastening to TTAP
Anaconda dismounting

safety unit with „long tube" but not connected during crane activity

in LSS 1. SCOE + cable + 2W to HOT
2. Helium pump 2 connect with Anaconda (at man door)

eset ventline + leak test

041005

LSS Flansch einbauen nach PPS Test
+ Lecktest
P506 Wallace & Tiernan im Keller an kleine Düse
PIR 003

– after He II Top Up (100%?)

~~for~~ before HOT filling
vent the system with pre cooled gas with He II line
remove He II line
insert He I line & pre-cool in airlock
open V702 + insert it to end position – 1mm
fill HOT to top > 96% (1,9) 21,85
watch HTT temp. decide if ready for test
close V502 + remove Anaconda, place blind plug

remove air lock
remove retaining plate under foil with GHe flushing from bottle ~~repla~~
replace seal with Helicoflex
insert retaining plate incl. SV121
and mount Air lock adapter
perform sniff test

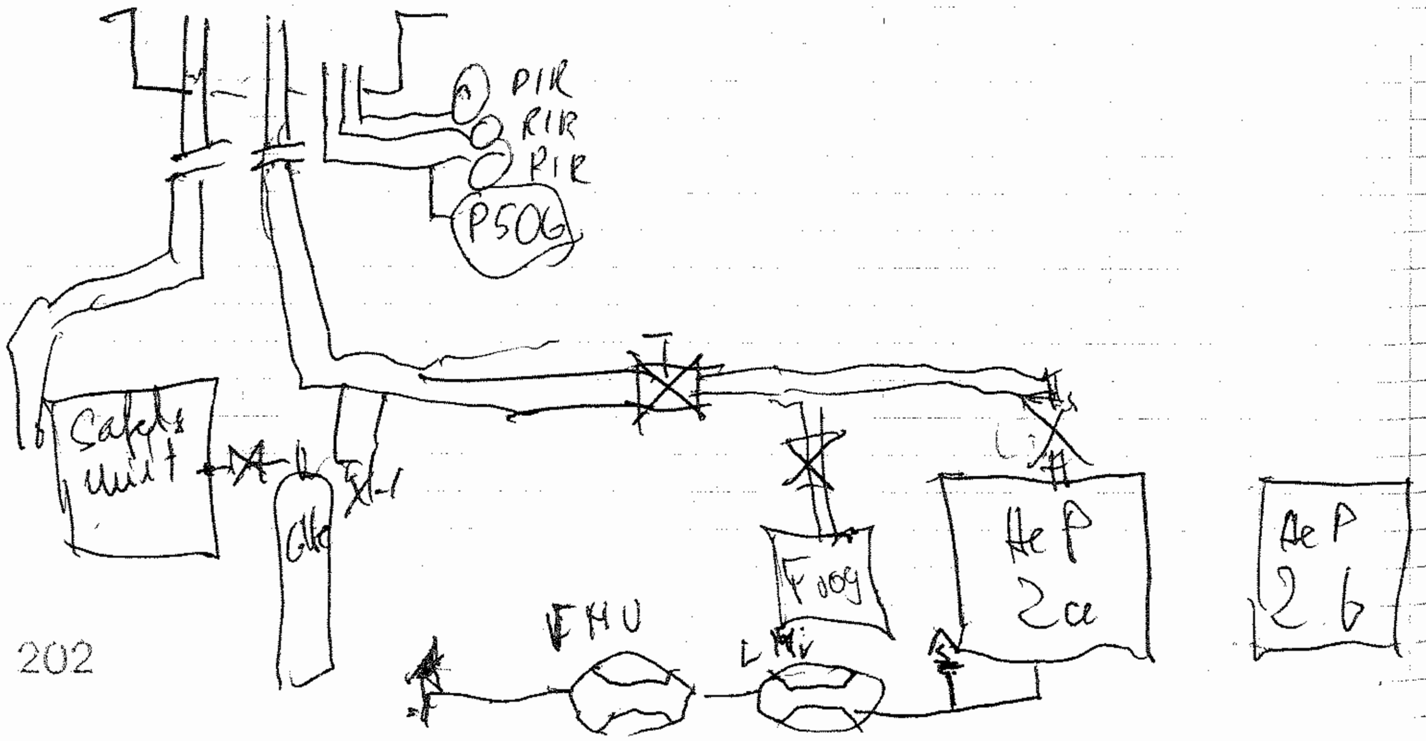
V506 Blind flange + remove V506 handrail

Helicoflex → ~~Rota~~ Pressure plate

H501 + 20W for Laurel autonomy

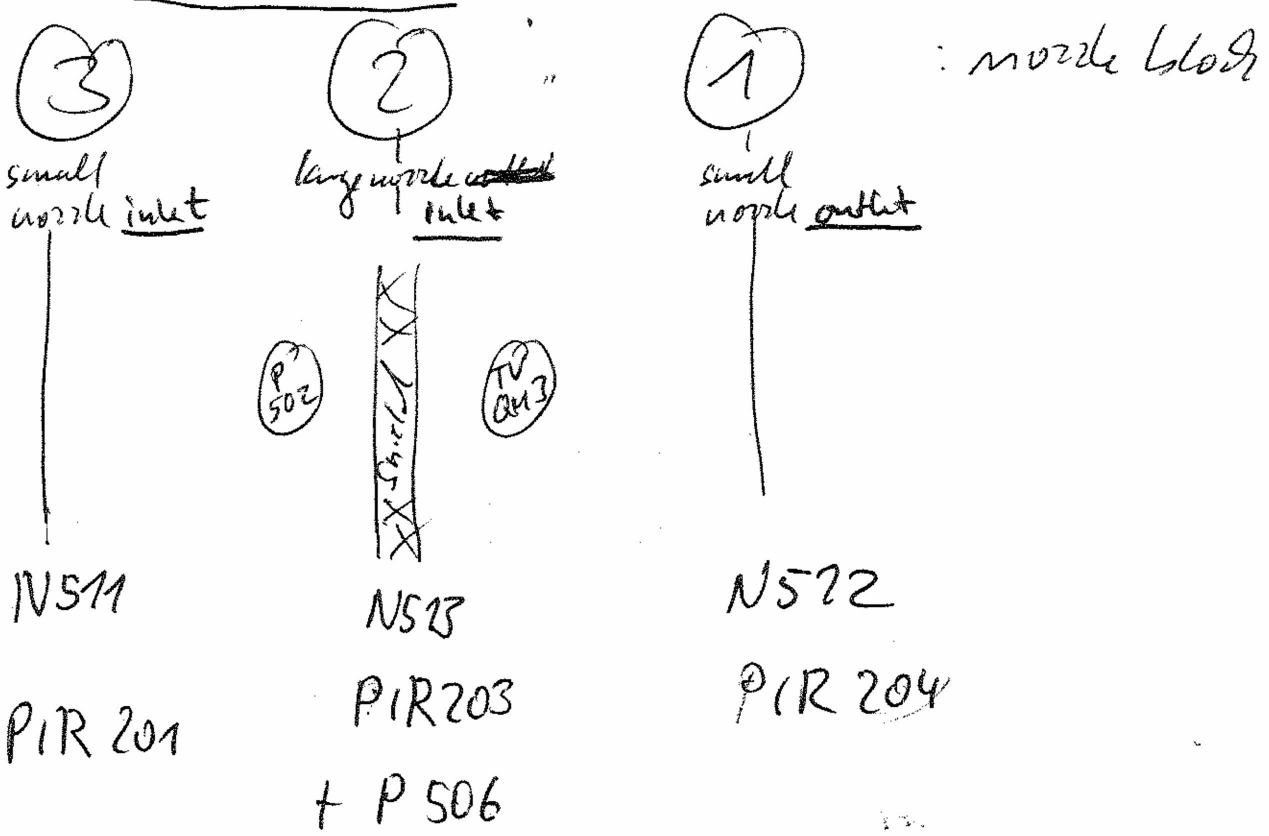
VG901 Magnet

inserto Safety line with „bloche" with GHe from basement



07.10.05

Nozzle lines:



07. 10. 05

New Disk for LHV switching

13^{45} Leak test : Nozzle line : BR = $8 \cdot 10^{-6}$

① Spraying of GHe around nozzles + nozzle block
⇒ no increase of LR.

② 3 LSS pressure line feed through : no increase of LR.

Flow rate Test :

① Configuration : Venting through all nozzles
opened: V104✓, V506, V501, V504✓, V505✓
closed : TVQM3✓, V102✓, V103✓, V106✓, V502

15^{05} V506 opened P_{506} = 14.4 mbar

V501 opened (D000-txt)

15^{08} $\dot{m}$ = 9 mg/s
P_{506} = 18.85 mbar

CVSE_ 002 = 14.045
003 = 4.764
004 = 1.579
005 = 15.407

P_{502} = 12.17 mbar

15^{15} $\dot{m}$ = 7.21 mg/s
P_{506} = 18.8 mbar

15[illegible] ② Configuration : Venting through small nozzles only

close V504 (D001-txt)
~~close V505~~

15^{20} $\dot{m}$ = 1.38 mg/s
P_{506} = 20.20 mbar
CVSE_ 002 = 2.44
003 = 2.94
004 = 0.264
005 = 19.648
P_{502} = 16.00

15^{24} $\dot{m}$ = 1.35 mg/s
P_{506} = 20.21 mbar

15^{27} open V504 (D002.txt)
close V501 (D003.txt)

Final configuration :
opened : V104, V506, ~~V504~~, V504, V505
closed : TVQM3, V102, V103, V106, V501

15^{42} SV blocked, 2x flushed + isolated

pre-cooling

16^{00} He I pump: ~~[illegible]~~ 2,2 Nm^3/h

16^{05} 2.5 Nm^3/h

16^{10} open Valve of He II pump

3-0 Nm^3/h

16^{15} 3.5 Nm^3/h ↑ 17.5Nm/h

16^{20} V506 closed

16^{23} V102 opened (D004.tif)

16^{30} $\boxed{dx = 0.5}$; 10.6 Nm^3/h

16^{31} Start SCAD 5-4

16^{35} $L_{101} = 95.86\ \%$

$L_{102} = 95.74\ \%$

16^{48} $\boxed{dx = 0.6mm}$

17^{00} 12,2 m^3/h 96,2% 101

1,885 K

18^{22} needle valve closed

L101 > 98%

102 98,1% T111 ↓

18^{26} He P 1 isolate

open V501 (D005.tif)

18^{28} close V102 (D006.tif)

18^{30} V 502 closed

$P_{506} = 24.5 mbar$

18^{32} V103 opened (D007.tif)

V104 closed (D008.tif)

18^{37} Basement He P 3,8 mbar inlet

18^{43} V504 closed (D009.tif)

18^{50} open V104 (D010.tif)

Close V501 (no recording! D011.tif)

18^{51} Open V504 (D012.tif)

18^{55} close V103 (D013.tif)

PPS Test terminated

18^{58} open V 702 (14.tif) → 13,9 m^3/h

19^{01} open needle valve slightly

→ 12,4 m^3/h ~ T704 ≈ 35K

19^{03} 11,7 m^3/h

19^{07} 11,3 m^3/h ~20K

19^{18} T702 3,5 K 15. TIF
open valve 102
close valve 702 D016.TIF
close transfer Dewar L_S = 659 mm

19^{35} 15,0 m³/h

19^{55} 15,4 m³/h

20^{10} 15,7 m³/h L_S = 579 mm

20^{17} close ~~needle~~ valve on Suppl
T = 1,967 K L_S = 562 mm
L expected ~ 99,5 %

21^{00} 13,8 m³/h

21^{30} 1,915 K
close V102 → device full?

21^{40} Stop He 1 1,813 K
close SV121 + safe
Wasser zu

08/10/05

06^{20} T_{101} = 1,869 K Pzugkr = 6,7 mbar
T_{111} = 1,983 K VG 901 = 2,3·10⁻⁸ mb
T_{701} = 27,4 K
Block SV121
evacuate and vent He II Pump line 2x
remove SV121

~~6~~7^{55} Start pumping

7^{14} 4,1 m³/h T_{101} = 1,863

07^{30} 9,4 m³/h T_{101} = 1,854

07^{50} 9,3 m³/h T_{101} = 1,841

08^{20} 8,7 m³/h T_{101} = 1,824 K Start level probes
L_{101} = 97,08 %
L_{102} = 96,99 %

08^{25} isolate He I Pump
Block SV121

08^{37} T_{101} = 1,819 K

08^{57} T_{101} = 1,818 K close $\overset{\text{rough}}{\text{valve}}$ at He pump II

09^{30} closer bypass valve on He2P [illegible] ↓

09^{43} close V104 000.TIF
evacuate He II pump line
remove SU 121 → vent He SS to ambient
block SU121
remove He II Filling line from airlock

11^{00} HeS/S started with
new Dewar
vent line connected to He2P Bypass

11^{03} open V702 D001.TIF

pre cooling in Air lock

11^{12} Dewar $^{595\,mm}$ connected flow enabled
P=110 mbar Casula 0,2

11^{29} T702 T703 2,2
p=
167 8,3 4,2 2,6

11 33 open V701 D002.TIF
close V105 D003.TIF

LT
↳ 176 395
156

11^{45} 156 340 4,2 18,2 65%

12^{00} close needle valve $\boxed{100\%}$
close V702 D004

connect Flowmeter 0 ... 500 mg/sec
to CVSE04 + ~~Frog~~
close valve bypass
open V501 005.TIF
↳ basement

12^{05} $\bar{m}$ 36,6

H501 check

≈ 12^{13} ~~open~~ bypass "frog"
12^{20} close ~~p~~ bypass

12^{25} Heater 502+503 on

15^{06} H701 1,0 W
Helioflex under ~~Rot~~ pressure plate mounted with GHe flow from inside

Leak test by sniffer background 9×10^{-8} mbar l/sec
Δp~50 mbar no change in signal

16^{20} V502 closed and Aaurondo dismounted + Blindflange with Helioflex

17^{50} H501 enabled with 50W

C\ Program files\ Cryo-Pfm\ userscr\ Enable H501.
(H501 Control) → internal → script Autocontrol .SEF

Sniff leaktest

of ~~Safety~~ Filling Port Adapter

Background $8 \cdot 10^{-5}$ at 111 mbar

no leak detectable LR $< 1 \cdot 10^{-6}$

of V502 Blind cap

Background $8 \cdot 10^{-5}$ $\Rightarrow$ LR $< 1 \cdot 10^{-6}$

Safety line pressure 111mbar ~~to~~

09/10/05

10^{58} MTD Drawer off

Level probes disconnect 701/702

11^{04} Switch off H 502 6,4W → 0W

Switch off H 505 6,1 W → 0W

Remove fuses from Heater control drawer except H201 and H501

12^{00} 46,30 mg/sec

12^{10} H501 script stop

12^{25} close command to V702

was closed D006-TIF 0

13^{10} H701 off

13^{15} valve drawer off

13^{47} H701 on 0,9W

13^{49} H501 on

13^{50} valve drawer on

13^{52} open V702 007.TIF

13^{54} close V701 008.TIF

16^{25} $\dot{m}$ = 46.6 mg/sec

18^{10} 1,877 K , < 0,7mK/h

18^{47} H701 Heater set to 0,45W Reading is 0,491

H701 set to 0,43

reading is 0,42

H701 set to 0,44

reading is 0,438 W

10.10.05

7^{55} Kunz Huber

T_{101} = 1.888 T_{111} = 2.07
T_{102} = 1.887 T_{701} = 4.28
T_{113} = 7.26

8^{03} Start SCA05_4 : LL 701 = 40.99
8^{06} Stop SCA05_4
8^{25} ~~close~~ open V701 009.TIF
close V702 010.TIF
8^{30} H701 set to 0,9 W → 0,895 W
9^{45} switch on Level probes
L101=96,94 L102 = 96,84 L701 = 38,4 L702 = 39,1
10^{05} Installation of P506 (manual)
parallel to PIR 203

V702 Status seems to be working

8^{41} UTC : T501 seems NOT to work anymore !
(dropped from ~295°K to 250°K)

HTT heat load test with
He S/S piping evacuated & HOT closed

12^{54} Tray by pass
H701 off
13^{05} close V701 011.txt
start evacuating the pipes
13^{20} 20 mbar T111 ↓ 10 mK
T107 weak change
13^{30} 17,8 mbar

T101 felt

14^{49} open V701 (012.txt)
Heater H701 → 0,45 W
15^{03} Dismount He-line in cellar.
15^{26} start tilting Test
2,6° clear signal on PPS
19° signal on PPS
15^{36} 23°
15^{54} 2° PPS change
15^{54} 0°

18^{07} Pumpdown of LSS started
and stopped at 720 mbar

mass flow meter on 5mg/sec

HoT depletion

- H501 set to 300W

H701 set to 10W

18^{24} L701 = 29.2 L702 = 29.6

Frog bypassed

PPS is free of sfHe

19^{28}	260 mg/sec	1050 mbar
	313 mg/sec	1027
	373	1030 mbar
	391	1031 mbar
	400	1031
	405	1031
	410	1031

H501 to 500 W

425 1031

19^{40} switch off Level Probe

19^{45} HOT empty

20^{20} switch off H701 @ 8K

20^{21} Frog enabled

mass flow to 500 mg/sec

Weck Kriterium

Extrapolation of T111 Sensor

for 11.10.05 8:00 LT

6:00 UT

> 1,920 K → Alarm to Langfermann

Jahn

21:42 V105 opened d013.tif

V701 closed d014.tif

Sensor PT1000_T903 (CW -z side bottom)

failed since 10.10.2005 08:35 UTC

11.10.05

8^{20} Stop H501 Script

8^{40} T701 = 51K

V501 closed ~~do~~ no trigger

8^{54} V501 open ~~D015.tif~~ no trigger

8^{57} V501 closed D015.tif + D016.tif (identical)

V501 open D017.tif

10^{30} V501 closed D018.tif + D019.tif

11.0805 | 15^{30}

T422 = 66,5K T442 = 108K T462 = 172

T111 = 1,937 K T701 = 48,0K

15^{50} Basement:

Gasuhr 000 m^3

LFM MK1 0,0,80 g/min
with running pumps

pressure on safety line
15^{55} 70 mbar

15^{55} open V501 (D020-G0f)

16^{03} 16^{00} Psafety line = 100 mbar
V103 opened D021.Hf

16^{55} Safety line pressure increased from 28 mbar to 100 mbar

A. Hauser

17^{25} 45 → 100 mbar

18^{06} 44 → 101 mbar

Oscillations on PPS T111 / T112 0,8 Hz 6 mK

18^{30} close V105 to check oscillations
22 til

18^{31} Safety line pressure increased from 78 mbar to 101 mbar

18^{37} open V106 23.TIF

18^{40} close V103 000.TIF

open V702 001.TIF

18^{52} 19^{03} 72 mbar → 101 mbar Safety line pressure

19^{10} open V105 002.TIF

19^{14} close V702 003.TIF

19^{50} 58 mbar → 101 mbar Safety line pressure

20^{35} 22 mbar → 100 mbar "

20^{58} 18 mbar → 101 mbar "

21^{30} ? ~63 mbar → 101 mbar "

22^{15} ~130 mbar → 101 mbar "

HACS Temp Regelung?

T501 back again ??? ~17^{45}

23^{25} Psafety line ~600 mbar abs
start pump → evacuate line to 21,7 mbar
close valve to pump

06^{05} T_{101} = 1,958 K T_{701} = 48,2K. 12/10/05
T_{111} = 1,909 K
Gasmeter 2,74 m^3 P_{506} = 13,8 mb P_{safety} = 20,8 mb
Flow = 9,6 mg/sec

12^{00} Psafety = 21 mbar 4,04 m^3
10,3 mg/sec 1,966 K

16^{30} P506 : 14,0 mbar
P622 : 21,1 mbar (Safety line)
Gasuhr : 5.145 m^3
mass flow : 10,8 mg/s

22^{20} P506 : 14,1 mbar
P622 : 21,3 mbar (Safety line)
Gasuhr : 6.56 m^3
Mass flow : 11,2 mg/s

13 10 05 | 7^{15} Shift hand over
„Freßpaket"
shield 1 + 2 over maximum
IR Rig heater increased in evening shift
Alarm settings were not loaded up to
5^{10} now running Alarm
tilting & HACS signal
SIH is OK resistance is decreasing.
new calibration CVSE 1/4/6
/eigene Dokumente/ @ new start up of SCOE

Benoit + Computer shut down
Demodder

2:B. OBA plate Pt1000 have a kick
because of ~~cla~~ calibration

10^{40} SCOE Recording file restarted (TBTV_TP2_LOOP)
T228 (HiFI LO) ist obviously wrong ?

14/10/05

01^{30} Tetratec - Flow meter
analog out Parameter changed
~~R~~ P0903 $3{,}33 \cdot 10^{-6}$ => $1{,}666 \cdot 10^{-5}$ kg/sec

CVSE_01/04/06 implemented - will be
activated ~~the~~ at next restart

Calibrated Ranges
MK0 3,8 .... 15 mg/sec
CVSE06 0,4-2V
0-16,6mg/sec
MK1 16 .... 55 mg/sec
CVSE01 0,4 - 2,0V
≙ 0 - 58,3 mg/sec

14 10 05

IR/TTAP ~~Heater~~ control 293 ± 0,5 K
↳ because heater power in Lamps (70°C)
+ redundant ~~on~~ TTAP
H 9812 Alarm 350 → 355 K
SIH OK

MT203 SPIRE LO not present!

151005 Keine PA

Gerner bringt Langenstein → Schiphol

heaters are stable

Test harness cool down a bit

check of C0 C1 C3 plausibility

0°C = 273 K (not 273,15 K)

9^{50} V = 24.01 m^3

$P_{safe,1}$ = 21,5 mbar

P506 = 14,88 mbar

161005 Spikes

Heizer OK HACS auch

T231 defekt

233
235
236

08:00 close V504 (000 + 001.tif) 4,6 mg/sec

08:29 open V404 (002.tif

close V106 (003.tif)

08:40 open V504 (004.tif) **PPS stopped**

09:46 open V503 (005.tif)

09 44 tilting back to 0°C

09^{55} tilting terminated

10^{00} 0-500 g/sec mass flow

open Nozzle by pass valve (Spare 1 006.TIF)

He P2 from 4,2 → 6.2 mbar inlet pressure

171005

T231 ist da

night shift no changes

IR Rig support auf 203 K

SVM shield auf 120 K limit

9^{30} P506 : 17,53 mbar
65,0 mg/sec

Safe,1 26,68 mbar 3,396 g/m
56,98 m^3

HeP2/1 in 1,9 mbar
/2 in 5,3 mbar

IR rig sensors & waiver

shroud Temp + average

new TB prediction @ for start of phase

new C100 calibration with Gerd

exit ventline Temp + qualification

rapid cool down duration

memo USB Stick delete content

CVV Temp decrease slower than predicted mass?

cover shield is „warm" ?

T228 T231

$14^{\underline{15}}$ close <u>both</u> inlet valves of He2P-SN1

17^{00} mass flow to 5000 mg/sec & back

18/10/05 $7^{\underline{00}}$ 208K ±0,5K @ IR support

no Alarm on IR Rig support

No Network

open valve on He2P-SN1

end of phase 1,70 K

close V104

wait for shields to limit

then open V103 close by pass

tilt PPS+ 1° then close V504

$15^{\underline{35}}$ Valve V102 opened (D007?) D008.tif

$15^{\underline{37}}$ Valve V104 closed D009.tif

$18^{\underline{34}}$ Valve V104 opened D010.tif

$18^{\underline{35}}$ Valve V102 closed D011.tif

19 10 05

LSS Vakuum OK.

V702 V102

20 10 05

el. grounding of IR Rig + TTAS

was passiert

V702 is open V102 open V104 open

Markus 11^{00} Jürgen 13^{00}

Gert 18^{00}

Liste suspekter Sensore

CP Temp

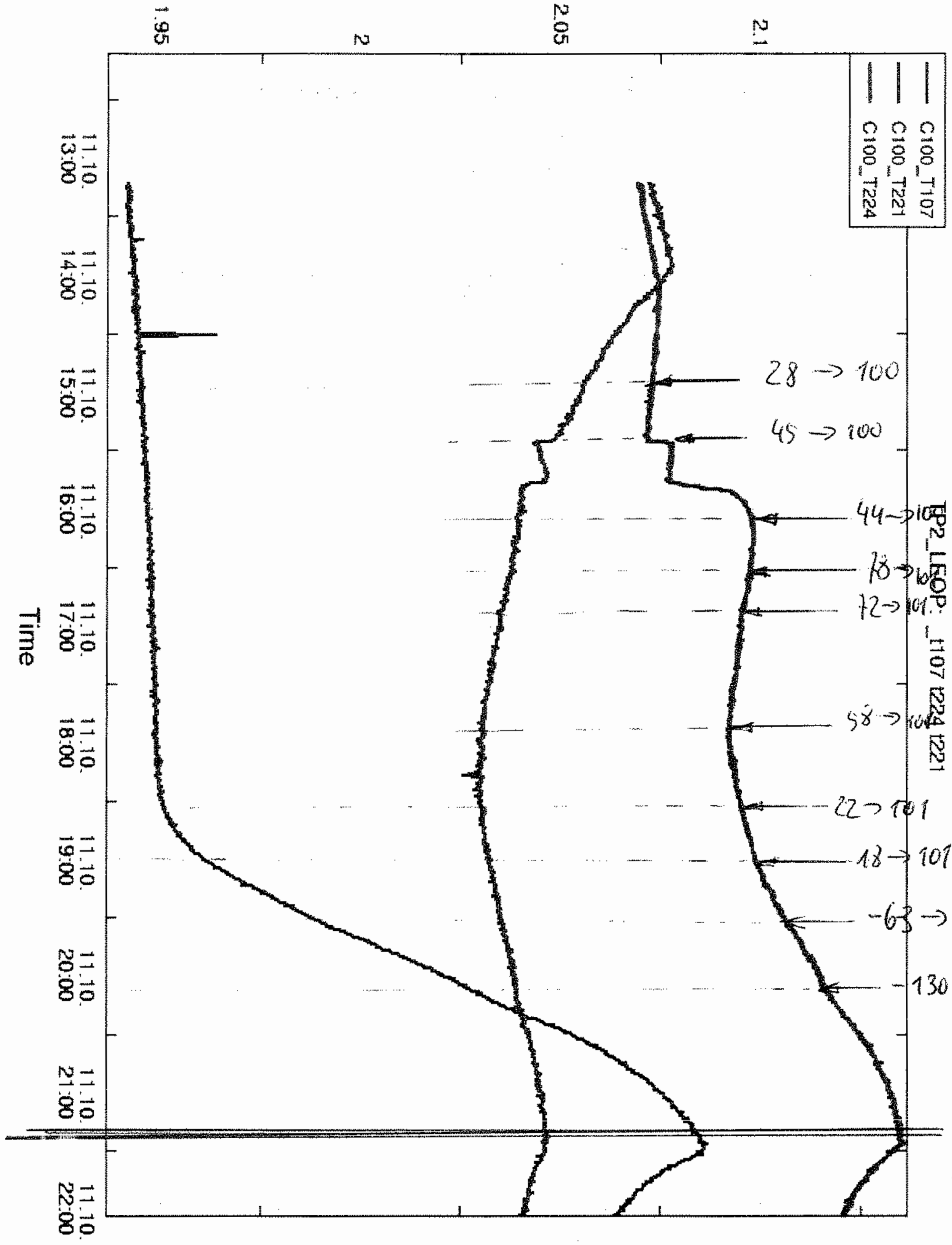
SVM Thermal shield 124 K

L1+L2+L3 drops at 2^{00} UTC

↳ oscillation FiPo

07:17??

Nachtrag TP 2

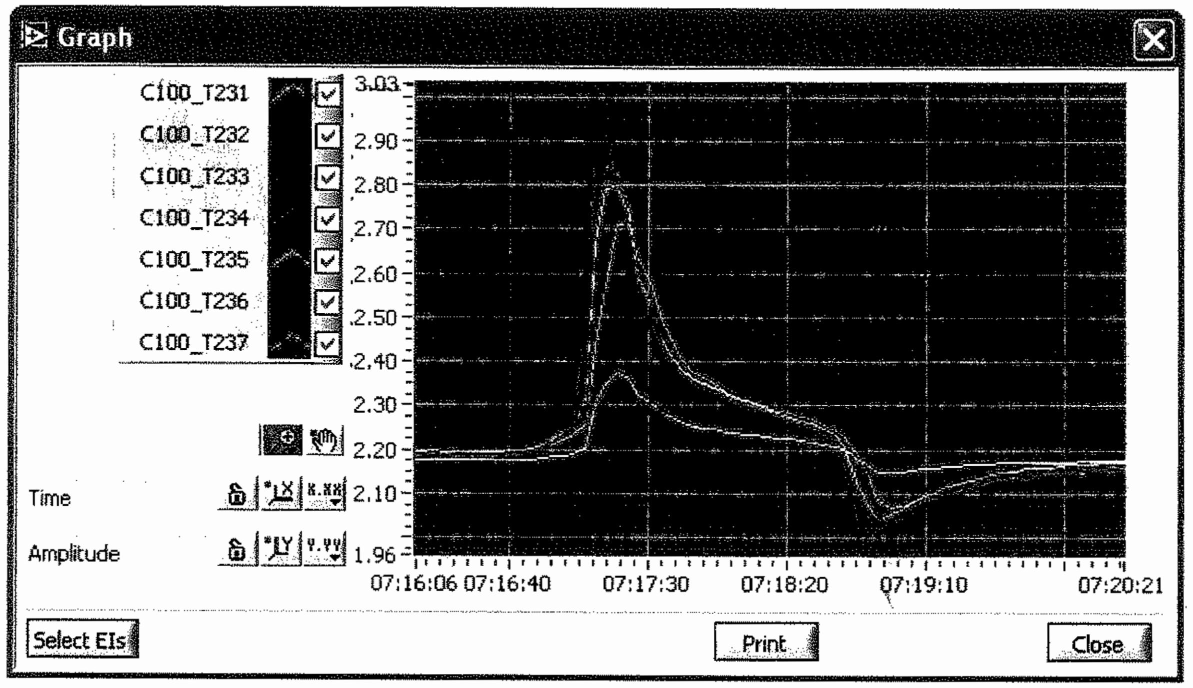


SV121 leakage → safety line pressure increase

evacuation of safety line

2010 05

Hick UP → MCR 1607



on ETS side there was a LN2 pump P1 running for 10 min.

↳ it could be seen on L2, L3, OBS but not on mass flow and PS02
it must be something out of the HTI/HOT piping system

14^{14} Restart of LN_2 pump P2 → no signal

16^{14} close V702 0016.tif

16^{5} close V102 0017.tif

16^{12} close V104 no trigger
D0018.tif ?

201005 136,72 m^3

HTT closed p506 = 1,48 mbar

mass flow to 50 mg/sec

shut down Heater drawer in SCOE
Valve drawer

20^{15} P safety line = 0,1 mbar

20^{40} 0,85 mbar P506
0,1 mbar p safety

~~20~~ 22^{10} V104 opened D0019.tif

22^{30} V104 closed
22^{50} TVQM3 closed
22^{55} V504 closed

21.10.05

22:20 V504 opened
22:40 V104 opened
22:50 V104 closed
23:10 V103 ~~opened~~ closed
V106 closed
23:20 start tilting S/C 1°/min
23:21 1° no response PPS TCs +
23:22 2° "
23:23 3° "

23:25 4° no PPS response
23:26 5° "
23:28 6° "
23:30 7° "
23:31 8° "
23:33 9° "
23:35 10° "
23:36 11° "
23:38 12° "
23:40 13° "
23:42 14° "
23:44 15° "
23:45 16° "
23:47 17° "
23:49 18° "
23:51 19° "
23:53 20° "
stop got back to 10°

00:05 10°
open V106 PPS operating
00:24 tilting to 13° / steps to 1°
00:28 11,5° PPS outlet contact to Heatsink
00:31 12,5° end of tilting
00:50 V504 closed
1:05 tilting to 13,5°
no effect to PPS
1:14 V504 open

1:30 V 137,05 m³
Safety unit 7,2 mbar
P506 5,7 mbar

1:50 He II Pumps
Closed Ballvalve
Adjust inletValve 2,3 mg/s

2:00 open Ball Valve maßflow 7,33 mg

211005

P506 = 5,95 mbar
PIR 203 = 4,87 204 = 1,29
201 = 5,67 mbar
P_{safety} = 7,22 mbar
5.48 mg/sec
0,551 g/min

both He2P open
SN1 0,0 mbar inlet
SN2 2,7 mbar inlet

137,56 m³

Valve status

V102	closed
V103	closed
V104	closed
V105	open
V106	open

V701	closed
V702	closed

V501 V503 V504 V505 open
Vspare closed

see test log for [illegible]

15³⁵ close V504 (003:H) durch PRS + [illegible]

21:35 UTC
He II Pumps
SN001 Inlet 0,0 mbar (Ballvalve, Needlevalve closed)
SN002 " 2,7 mbar (Ballvalve closed Needlevalve Adjusted)

Safety Unit P = 11,6 mbar

P506 = 11,7 mbar
PIR 201 = 11,06 mbar
" 203 = 10,60 mbar
" 204 = 11,11 mbar
Maßflow 2,34 mg

221005

3:00 UTC
He II Pump Status
SN001 Ball and Needle Valve closed
Inlet P = 0 mbar
SN002 Ball Valve closed
Needle Valve adjusted
Inlet P = 2,8 mbar
P506 = 11,8 mbar
PIR 201 = 11,19 mbar
" 203 = 10,73 mbar
" 204 = 11,30 mbar
Safety Unit P = 11,8 mbar
V = 138,98 m³ / Maßflow 2,35 mg/s

221005 heat load on tank 169 mW

Spire L1 heater ? is on L0
L04

03 on L1

needle valve 1/3 open

PPS T111 T112 verification

10.10.05 15^{00} ΔT111/T101 = 22,3 mK
@ 1,89 K T112 = 22,2 mK

011005 18^{00}
@ 1,994 K T111 = 23 mK
T112 ≈ 24,4

051005 13^{00} ΔT111 ≈ 28
@ 2,006 K ΔT112 ≈ 24

03^{00} UTC 138,98 m^3

21:30 UTC
Disconnect TetraTec Flowunit from
He II pump outlet

21:50 1/8 turned Needle Valve on He II pump SV02
Mass flow Adjust 2,4 → 2,32 mg/s

~~231005~~

22:20 UTC Mass flow 2,30 mg/s
$V = 139.97 \, m^3$
P 506 = 12,3 mbar
DIR 201 = 11,61 mbar
203 = 11,24 mbar
204 = 11,81 mbar
Safety unit P = 12,3 mbar

231005
1:55 UTC
Connected TetraTec Flowmeter to He II pump outlet
Measurement Value: TetraTec ≈ 3 mg/s (0,179 g/min)
Standard flow. 2,34 mg/s

3:00 UTC Mass flow
TetraTec = 0,174 g/min (2,9 mg/s)
Standard Flowmeter = 2,33 mg/s
$V = 140,21 \, m^3$
(100 min = 90 l = 2,5 mg/s)

231005 | yesterday in adjusted

Spike of Pet heater
both of Fet's see warning due to
ventline

SCOE S/W NCR on heating

TB equilibrium necessary for correlati
(T231 / Filling Port)

06^{30} UTC 140,32 m^3

MKO = 0,178 g/min

m = 2,34 mg/sec

231005	6^{30}	140,32
	3^{00}	140,21
221005	22^{20}	139,97
	3^{00}	138,98
201005		

1,34 m^3 / 27,5 h
↳ 0,0487 m^3/h
= 2,416 mg/sec
$\times \frac{293}{273}$ = 2,59 mg/sec

ρ_{Hen} = 0,1785 kg/m^3

LO Verification

1. TP4_TV1_HIFI_LO.agr

8^{15} UTC	5 mW	on HIFI_1
8^{20}	10 mW	TMTD out of range
8^{25}	7,5 mW	
8^{35}	5 mW	PACS_1 Red Det.
8^{40}	10	↳ TMTD out of range
8^{45}	2 mW	
8^{50}	5 mW	PAC2_2 = Blue
55	10 mW	
9^{05}	25 mW	PACS_7 → Cooler pump
9^{10}	10 mW	
9^{26}	5 mW	PACS_4
9^{30}	5 mW	evaporator
9^{35}	10 mW	
9^{40}	5 mW	SPIRE_1 ~~evaporator~~ SM Detector
	10 mW	
9^{50}	5 mW	SPIRE_2 evaporator
55	10 mW	
10^{00}		(LO_3)
10^{10}	5 mW	SPIRE_4 pump
10^{15}	10 mW	

10^{20} UTC HOT is at 28K

VT105/701/702 28,3K

10^{30} L101 = 84.437 L102 = 89,760 %

10^{35}- 40 DLCM Mode

14^{10} needle valve to ~2,0 mg/sec

$14^{\underline{45}}$ Ball Valve on Pump opened

$15^{\underline{07}}$ Ball Valve on Pump closed

$15^{\underline{25}}$ valve V104 opened D005.tif

$15^{\underline{29,5}}$ valve V106 closed D006.tif

$15^{\underline{34}}$ valve V504 closed D007.tif

$15^{\underline{50}}$ valve V504 opened D008.tif

$15^{\underline{51}}$ spare valve QM3 opened D009.tif

TRB 2,0 2,3 mg/sec → valve on pump open + closed with PPS

Δp on small nozzles with V104 open

21:51

Adjusted Needle Valve He II Pump

5,05 → 5,03 4,56 mg/s → 4,49 mg/s

P506 = 12,7 mbar

PIR 201 = 12,12 mbar

" 203 = 11,57 mbar

" 204 = 12,03 mbar

Safety limit P = 13,3 mbar

V = 141,52 m³

241005

2:20 UTC

Mass flow 4,47 mg/s

V = 141,95 m³

3:30 Adjusted Needle Valve He II Pump

5.03 to 5.02 4,59 to 4,51 mg/s

241005

06^{20} UTC

HTT = 1,750 K

ṁ = 4,5 mg/sec

LFM = 4,75 mg/sec

L1 entry T232 = 2,6670 K

L1 outlet T237 = 3,536 K

OBP „in" T208 = 9,37 K

out T256 = 9,91 K Average = 9,7

L3 in T246 = 9,89

T247 = 10

10K - 2K ≙ 180 mW

T233 = 2,77

34 = 2,836

35 = 3,102

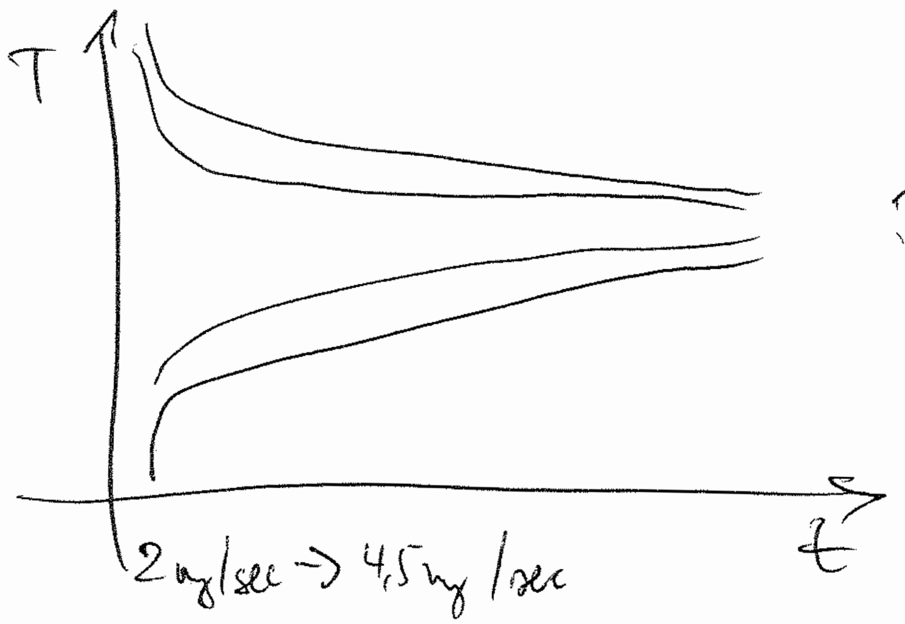
36 = 3,382

241005 | 08^{07} UTC → needle valve 0,8mm ↻

12^{20} (UTC) V105 closed (D010-67)

OBA

L1 Sensors



why?

22^{40} UTC

Adjust → needl valve ↻ 0,6 mm

$V = 144,01\ m^3$

LMF = 4,73 mg/s

St. Flow = 4,5 mg/s

251005 | HTT T101 = 1.755 K

L1 in T232 = 2.788 K　　L3 T246 = 9,67 K

L1 out T237 = 3,438 K　　T247 = 9,55 K

OBA in T208 = 9,05 K

out T256 = 9.60 K

T233 = 2,884 T234 = 2,94 K T235 = 3,189 K

T236 = 3,44 K

Massflow 4,5 mg/s (LMF 4,72 mg/s)

261005

00:30 UTC

Massflow　LFM = 0,283 g/min

Flowunit = 4,48 mg/s

$V = 146,62\ m^3$

He II pump SN02 inlet P - 2,8 mbar

Pressure:

P506 = 13,4 mbar　　Safety limit

PIR 201 - 12,73 mbar　　P = 13,8 mbar

203 - 12,23 mbar

204 - 12,66

4:38 Adjust needl Valve ↻ 0,6 mm

20:20 closed TVQM3 Valve / Adj. needlevalve (massflow sensitive) (D11.07)

Hinges MLI grounding concept as well Alu tape removal qualification on cfc

271005

5:00 UTC Adjust needle valve

T231 has exactly same raw data as
T248 on SCOE screen + grace display
~~[command wd -f lf-raw.txt]~~
~~the ASCI file shows totaly different~~
~~values [which are physical with correct]~~

L1
L3
Alarm again off
Heater fine adjust on TTAP
Hänger MLI grounding AWG 22

291005

19:30 Start Test-Case TC6 - TV2

23:00 Massflow:

LFM = 0,290 g/min
Standart Flow = 4,63 mg/S

V ≈ 156,15 m³

He II Pumps running

SV02 inlet P ≈ 2,7 mbar

P506 = 14,3 mbar
PIR 201 = 13,77 mbar
203 = 13,22 mbar
204 = 13,46

Safety unit P = 14,8 mbar

T101 = 1,779 K

30:10.05

22:48 open **V105** D012 dil.

311005

T701 = 21,3 K

2:00 open V701 D013 dil.

3:00 open V106 D014 dil.

[illegible] T111 = 1,807 T112 = 1,809

3:50 T111 = 1,807 T112 = 1,807

3:50 closed V106 D015 dil.

3:55 closed V701 D016 dil.

21:49 open V103 (017.dil)

22:28 closed V104 (018 dil)

Adjust mass flow 4,85 mg/s

23:40 Tilting to 16°
2° first reaction to PPS
16° PPS T111 1,698 K

021105

Activity after LSS testing

Pump 1 at side + pumping

2 at 5m door

→ icing after venting with air

↳ basic scaffolding H501

IR'g. removal

flex lines disconnected from flange & attached to TTAP including pressure pick Up lines

pressure to 100 mbar

4h

12h pressure 66h

20d warm up

Tür auf

1d

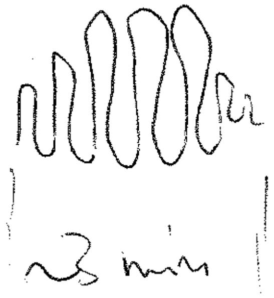
→

031105 Barlage mage T harness

Oscillations on 1.11:05

~1400 T235 5mK

up to 10mK



Markus: at least T111 is wrong in raw_record_file

L00 Heater monitoring is not working on display

041105 Start Valve switching

5:00	open	V106
5:15	closed	V103
5:30	open	V701
5:45	open	V702
6:00	closed	V701

SIH ?

Pin allocation IC0002 05.xls

6^{25} close V105

→ oscillations on L1

7^{35} J02 disconnected

DVM on T235 →

041105| T235 = 5,685 .

last digit changes from 81 -> 92

↳ not continuous several seconds

08:05 open V701

08:34 V702 closed (no Trigger)

09:00 V701 closed

9:50 open V105

09:55 open V103

11:15 V504 closed

11:24 V504 open (no Trigger)

051105|

04:07 V104 opened

04:10 V103 closed

04:11 V106 closed

Adjust mass flow 4,42 mg/s

7 27 open V102

7 29 close V104

19:30 Liquid level probes read-out

L101 = 88,51 %

L102 = 88,23 %

19:35 Start TP8 -

19:38 open V104

19:40 open TVQM3

19:47 open V102

19:57 open Ball Valves on bath Pumps

Massflow 22,5 mg/s

T101 = 1,805 K

061105|

00:30 T101 = 1,7992

9^{42} Basement Tetratec switch to MK1

179,7 m^3

P506 = 6,2 mbar

081105|

5:00 Massflow = 7,8 mg/s

T101 = 1,7936 K increasing!

08 11 05 | 13^{45} UTC valves on He2pump closed 142

for PS'02 calibration
& HTT heat test

14^{05} open valve on pumps

---

9 11 05 | LSS door open

9^{00} Local time
first inspection

~~11~~ Local Time Remove He pumps from Basement.

11^{20} Close U102

11^{24} Close V501

Close V503

increase pressure in safety line
→ Flow increase → open SV521
open V501 + V505

11^{45} open V104

12^{25} close V104

12^{40} close V501 , close V503

13^{30} open V501 open V503

13^{32} open V104

10/11/05 |

8^{00} T_{101} = 1,906 K
T_{107} = 2,42 K 2,8 mK/h
T_{111} = 3,16 K
Flow = 11,6 mg/sec

18^{05} T_{101} = 1,935 K
T_{107} = 2.48 K
T_{111} = 3,26 K

18^{05} open V102 Flow = 13,4 mg/sec

11/11/05

7^{58} T_{101} = 1,975 K T_{111} = 3,35 K
T_{107} = 2,53 K
Flow = 16,2 mg/sec 2,8 mK/h

10^{45} Stop SCOE replace TBTV harness
except for 306 321 100 307 (pin/pin)

13^{45} Restart SCOE - SCAU's
except for H501 script

16^{04} Start H501 Script

17^{10} T_{101} = 2.000 K
T_{107} = 2.55 K

12/11/05

10^{20}

T_{101} = 2,045 K T_{111} = 3,34 K
T_{107} = 2,56 K ≈ 2,6 ~~mg~~ mK/h

Gas meter 216,9 m^3 Flow 22,6 mg/sec

12/11/05
15^{45} T_{101} = 2,054 K
T_{107} = 2,56 K
Flow = 23,9 mg/sec

13/11/05 11^{10} T_{101} = 2,080 K
T_{107} = 2,54 K
Flow = 30,4 mg/sec

14/11/05

07^{55} T_{101} = 2,10 K
T_{107} = 2,50 K
Flow = 35,3 mg/sec

09:40 V102 closed
V104 Closed
$\dot{m} = 0$

09:53 start flooding the S/S with gHe

10:15 50 mbar overpressure in the S/S reached

11:05 Safety valve integrated at Filling Port

11:28 Evacuate the S/S

~~12:10~~ ~~isolate pump~~
12:10 $\dot{m} \approx 0.15$ mg/s

12:20 Open V104
12:28 $\dot{m}$ = 35 mg/s

13:38 H501 switched off → Heater not connected; stopping of Script did not disarm the heater. (U=69V)

13:50 V104 closed
V501 closed
V503 closed

14:20 Shut down of SCOE.

15^{00} Start Transfer of S/C to cleanroom

18^{50} Test of CUSE venting: pressure holding evacuate with He II pump until Deer led
18^{54} p= -1.6 mbar

19^{35} SCOE restarted (it works perfectly!)
T_{101} = 2.123 K

19^{41} open V 501 (~~000.~~ if) no reading Iopen = 291mA
open V 503 (~~001.0~~f) no reading Iopen = 268mA
19^{52} Open V104 (no reading) Iopen = 313mA

20^{40} Start Heat H502 (SCOE shows no power/current!)
Pump isolate 42,0 mb Gasuhr 245,20 m^3

Cryostat aus LSS

HTT valves 20   HOT: V105 auf ✓

$\dot{m} \rightarrow 0$

GHe in He S/S via ext. Ventline

leichter Überdruck 30 mbar lang

unter Überdruck Safety line am Flansch des Adapters F1 P0 öffnen und Sicherheitsventil einbauen mit O-Ring weil kein Lecktest möglich

↳ He S/S durch ext. vent line evakuieren

HTT valves open and pumping

vor S/C Ausbau

HTT valve zu & vent line valve zu

GHe Überdruck in Abgasleitungen

3x Kapillaren öffnen und blind in LSS

dann von unten Abgasleitung am Flansch

öffnen und ~~blindflansche~~ Überdruckventil (Frosch)

Leitung an z.B. TTAP anbinden

Transport to clean room S/C + SCOE

dort die SCOE anschließen (valve switch)

und die LSS Abgasleitung an He pump 2

---

14 - 15.11.

Pump outlet connection has a leakage

no Flow-measurement during night !   !!

15/11/05

07^{54} T_{101} = 2,13 k

T_{107} = 2,544

Flow = 39,8 mg/sec Gasmeter 245,31

Harness Connections during TV-TB-Test - Harness removal / Installation in Cleanroom

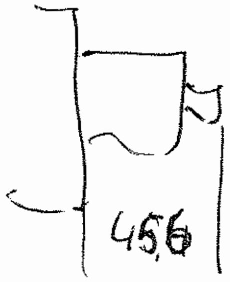
SCOE	PLM
J04	321300 - J02
	321200 - J02 T102 T111 T105
J20	316 100 J01 V501 V504 J02 V503 V505
J06	321 100 J07 H501 → cannot be connected Socket Socket J03 H502 1503
J11	321 100 J05 V102
J18	321 300 J03 T507 P502
J03	321 100 J06 V104

16^{22} close V104

vent He S/S via pumping line:

close valve on pump ~50 mbar Ü druck

Anaconda lekin



SV121 plug was in catched position
↳ inserted

Air lock mounted SV121 flooded

leak check with safety unit ~~Bb~~He vent

Mini Anaconda mounted

17^{40} V501 closed

17^{41} V503 closed

18^{05} Additional Harness connected

SCOE:

J01

J07

J08

18^{10} Pressure hold test line V502 to pump p = 1.4 mbar

18^{12} ~~user~~ change to mass flow range 0-500 mg/s

18^{15} line V502 to pump = leaktight (p = 1.4 mbar = const.)

18^{16} open V502 ; start pump down of the S/S

18^{22} SV121 in safety position

18^{35} open V104

$T_{101} = 2.140 K$ | $T_{701} = 64.7 K$

Gasuhr = 252.30 m^3

18^{40} needle valve adjusted to 56,6 mg/sec

16.11.2005

08^{30} $T_{101} = 2.13 K$ | $T_{701} = 64.35 K$

Gasuhr = 269.60 m^3 ; $\dot{m} = 87.5$ mg/s

VG901 = 5×10^{-8} mbar

09^{00} $\dot{m}$ adjusted to $\dot{m} = 99$ mg/s (needle valve)

16^{15} $T_{101} = 2.119 K$ $T_{701} = 63.40 K$

Gasuhr = 280.7 m^3 ; $\dot{m} = 101.8$ mg/s

17.11.2005

08^{80} $T_{101} = 2.092 K$ $T_{701} = 60.707$

Gasuhr = 303.9 $\dot{m} = 107.4$ mg/s

VG901 = 3×10^{-8} mbar

15^{50} T_{101} : 2.0795 K T_{701} : 59.4257

Gasuhr : 313.96 $\dot{m}$: 107.7 mg/s

VG901 3×10^{-8}

18.11.2005

08^{45} $T_{101} = 2.047$ $T_{701} = 56.651$

Gasuhr = 335.9 m^3 $\dot{m} = 107.8$ mg/s

VG901 = 2.7×10^{-8}

09^{03} L101 = 80.35 %

L102 = 80.11 %

closed HTT test

09^{20} close V104

11^{20} $T_{101} = 2.0497 K$ $T_{701} = 56.08 K$

~~Gasuhr~~ VG = $3 \cdot 10^{-8}$

12^{45} close needle valve at HeII pump

12^{46} open V104 closed needle valve

P Zähler 33,8 mbar open needle valve to 8Skt

20.11.2005

7^{30} T_{101} = 1.9840 T_{701} = 49.678

Gasuhr = 381.48 m^3 $\dot{m}$ = 106.8 mg/s

V6901 = 2.8×10^{-8} mbar

21.11.2005

8^{30} T_{101} = 1.946 K T_{701} = 46.526 K

Gasuhr : 402.86 m^3 $\dot{m}$ = 106.0 mg/s

V6901 : 3.2 × 10^{-8} mbar

11^{35} L101 = 77,3 L 102 = 76,9

13^{40} open V102 ∂ 106 mg/sec

close V104

14^{40} $\dot{m}$ = 93,9 mg/sec

17^{50} $\dot{m}$ = 93,4 mg/sec (Oscillation 2,5sec?)

22.11.05

8^{30} T101 = 1,922 K T701 = 44,7 K

3,3 × 10^{-8} mbar 98,5 mg/sec oscillation?

418,47 m^3

8^{40} V102 close closed HTT test

13^{28} open V104

23.11.05

8^{15} T101 = 1,9915 K T701 = 43,8 K

T231 = 3,26 K 430,9 m^3

105 mg/sec 3,5 × 10^{-8}

8^{25} close V104 for SVM Mating

L101 = 76,1% L102 = 75,7%

09^{01} V502 closed

16^{40} SCOE harness disconnected

18^{35} open V502 zügig 1.7 mbar before opening

1.7 mb after opening

18^{40} open V104 $\dot{m}$ ↑

$\dot{m}$ = 107,4 mg/sec

T_{101} = 1.9379 K

24.11.05 T101 = 1,935 K

$\dot{m}$ = 105,9 mg/sec Pzipfer = 16,4 mbar

440,24 m^3

12^{40} L_{101} = 75.61 % L_{102} = 75.14 %

T_{101} = 1.933 K

VG901 = 4.3×10^{-8}

13^{25} V105 close Heat load test closed HOT

16^{30} close V502 → 55 mK/d

17^{50} open V502

$\dot{m}$ adjusted to ~ 50 mg/sec

25.11.05

8^{30} VG901 : 1.0×10^{-7}

$\dot{m}$ = 66.8 mg/s , 449.7 m^3

T_{101} = 1.954

9^{45} adjust $\dot{m}$ to $\dot{m}$ = 47 mg/s

12^{05} SV121 opened to change internal He-volume

Pressure 27,3 mbar on Wallace+Tiernan

no oscillations visible

13^{15} SV121 closed and safe again

no changes on Cryo-Sensors were visible

$\dot{m}$ adjusted to 100 mg/s

13^{20} VG901 = $1,4 \times 10^{-7}$ mbar

open V105 =

14^{45} L101 = 75,13 L102 = 74,71

Testotherm RT = 18,3 °C

CVV under MLI 17,4 °C

14^{55} 451,7 m^3

16^{45} 105,8 mg/sec adjusted

$1,1 \times 10^{-7}$ mbar

261105

9^{30} $5,0 \times 10^{-8}$ mbar

$\dot{m}$ = 106,9 mg/sec 466,8 m^3

T101 = 1,946 K T701 = 47,8 K

$\dot{m}$ → 91,2 mg/sec adjusted

271105 | 97,2 mg/sec 1,963 K = T101

11^{00} $6{,}6 \times 10^{-8}$ mbar 479,8 m^3

T701 = 48,8 K

→ mass flow variations adjusted to 105 mg/sec

$17^{\underline{10}}$ $\dot{m}$ = 105.4 mg/s

V6901 = 6.0×10^{-8}

484.28 m^3

T_{701} = 48.91 K

T_{101} = 1.960 K

28.11.05 | $08^{\underline{25}}$ $\dot{m}$ = 105.1 mg/s

V6901 = 5.1×10^{-8}

Gasuhr = 495.2 m^3

T_{101} = 1.954

T_{701} = 49.38

$09^{\underline{50}}$ L101 = 72,94 L102 = 72,69 %

14^{50} LHe II transfer line connected to Air lock + 3x flushed

Inserted into filling port to lower position

15^{50} close V104 HTT heat load test

17^{42} open V104 $5{,}6 \times 10^{8}$ mbar

17^{50} removal of Transfer line in Air lock and safe position @ 1bar in "

29.11.05 $8^{\underline{20}}$ V6901 = 4.9×10^{-8} mbar

$\dot{m}$ = 106.0 mg/s

Gasuhr : 510.67 m^3

T_{101} = 1.946 K

T_{701} = 49.47 K

$8^{\underline{36}}$ close V104

$9^{\underline{50}}$ open V104

301105

8^{30} $4{,}7 \cdot 10^{-8}$ mbar

106,7 mg/sec 1,938 K

526,0 m^3 T701 = 49,4

open V102 close V104

HTT test

$10^{\underline{43}}$ $\dot{m}$ = 102.9 mg/s ; 527.14 m^3

10^{45} close V102 (⇒ HTT closed)

$11^{\underline{45}}$ open V104 (no trigger)

301105 17^{05} $\dot{m}$ adjusted to 24,1 mg/sec

17^{20} $\dot{m}$ stable 24,1 mg/sec

01.12.05
8^{30}

$V6 = 1.1 \times 10^{-7}$

$\dot{m} = 33.3$ mg/s

$\dot{V} = 532.5\ m^3$

$T_{101} = 1.9742K$

$T_{701} = 50.041K$

09^{45} mass flow adjusted to $\dot{m} = 105$ mg/s

$VG = 9{,}2 \times 10^{7}$ mbar

Temp. CVV under MCI near struts = 19,4°C

RT = 20,2°C

16^{25} $L101 = 71{,}19$ $L102 = 70{,}91$

$532{,}98\ m^3$

10^{30} $\dot{m}$ adjusted to 110 mg/sec

14^{00} HTT temp. is not decreasing

14^{01} close V104

→ 80,1mK/d

15^{08} open V104

02.12.05
8^{20}

8^{20} $V6901 = 6.7 \times 10^{-8}$

$\dot{m} = 106.7$

Gasuhr = $547.36\ m^3$

$T_{101} = 1{,}9842\ K$

$T_{701} = 52{,}52K$

15^{00} $V6901 = 6.0 \times 10^{-8}$ mbar

$\dot{m} = 106.5$ mg/s

Gasuhr : $552.16\ m^3$

$T_{101} = 1.9826\ K$

$T_{701} = 52.84\ K$

03.12.05

07^{50} $V6901 = 5.0 \times 10^{-8}$ mbar

$\dot{m} = 106.4$ mg/s

Gasuhr : $564.3\ m^3$

$T_{101} = 1.974K$

$T_{701} = 53.06K$

16^{20} $VG901 = 4{,}9 \times 10^{-8}$ mbar

$\dot{m} = 106{,}4$ mg/s

Gasuhr = $570{,}3\ m^3$

$T_{101} = 1{,}9709\ K$

$T_{701} = 52{,}9806\ K$

04.12.05 $10:\underline{20}$ uhr

VG901 = $4{,}6 \times 10^{-8}$ mbar
$\dot{m}$ = 106,4 mg/s
Gasuhr = 582,9 m^3
T101 = 1,958 K
T701 = 52,53 K

18^{10}

VG901 = $4{,}4 \times 10^{-8}$ mbar
$\dot{m}$ = 106,0 mg/s
Gasuhr = 588,1 m^3
T101 = 1,958 K
T701 = 52,3 K

05.12.05

14^{20} VG901 = $4{,}2 \times 10^{-8}$ mbar
$\dot{m}$ = 106,1 mg/s
Gasuhr = 601,47 m^3
T101 = ~~51,65~~ 1,943 K
T701 = 51,65 K

06.12.05

09^{15}

VG901 = $4{,}1 \times 10^{-8}$ mbar
$\dot{m}$ = 106,3 mg/s
Gasuhr = 613,35 m^3
T101 = 1,938 K
T701 = 51,09 K

13^{40} L101 = 67,5 L102 = 67,1
V = 616,15 m^3

14^{30} ? start strap pre-tension
from 25 → 5 kN each
↳ no observation on sensors

17^{10} close V104 closed HTT heat load
↳ 67 mK/d
18^{32} open V104 002.TIF
↳ oscilloscope does not work
to store the data

$\boxed{071205}$

VG901 = $4{,}4 \cdot 10^{-8}$
$\dot{m}$ = 107,1 mg/sec
V = 626,4 m^3
T101 = 1,933 K
T701 = 51 K

09^{25} close V104 → STM moving & lifting

needle valve on pump is 9,x SKT

071205 9^{40} V502 closed

dismounting of He II transfer line from Air lock

evacuation + flushing of Air lock & safety position

S/C moved + lifted for SVM lower plate integration

11^{20} V502 opened

V104 open 004.tif

14^{00} VG 901 $5{,}1 \times 10^{8}$ mbar

start lowering HTT ~ 2mm −X via straps

15^{20} close V104 005.Tif

HTT head load

only 2 mm strap moving was possible

this is ~ 1,4 mm in − X

16^{40} open V104 006.tif

081205

8^{10} VG 901 = $5{,}0 \times 10^{-8}$

$\dot{m}$ = 108,3 mg/sec V = 638,8 m^3

T101 = 1,538 K T701 = 50,9 K

14^{20} close V104 for S/C lifting

→ no trigger

15^{35} open V104 007.tif

S/C on MPT

18^{00} needle valve complete open

→ 116,8 mg/sec

main valve on He pump open

to achieve lower HTT temperature for LO testing next week.

121.8 mg/sec

091205

8^{20} VG 901 = $3{,}3 \cdot 10^{-8}$

10^{15} $\dot{m}$ = 122,3 mg/sec | V = 662.7 m^3

T701 = 50,6 K T101 = 1,888 K

L101 = 65,3 L102 = 65,0

10.12.05

14:15 VG 801 : 3.1×10^{-8} T701 : 1.801 K

$\dot{m}$: 112.6mg/s T101 : 47.65 K

V : 688.24 m^3

11 12 05

12^{30} $3{,}2 \times 10^{-8}$ mbar 1,769 K

108.1 mg/sec 45,9 K

701,76 m^3

14^{30} L101 = 63,57 L102 = 63,03

m = 108 mg/sec

switched to 0,5 g/sec $\Rightarrow$ 32 mg/sec

0-5g zero flow → 10 mg/sec

wrong mass flow!

121205 $\dot{m}$ = 107,2 → wrong

8^{40} $3{,}4 \cdot 10^{8}$ mbar 711,23 m^3

T 101 = 1,763 T701 = 45,2

$\dot{V}$ = 420 l/h

Test Data Archives

The data acquired during the STM TB/TV test are attached to the electronic distribution of this document as compressed (zip) archive files.

Thermal Data Handling Files

The data acquired by the LSS Thermal Data Handling system are gathered in the following files:

Table 10: TDH data files

Filename	Remark
herschel_eplm_fdh_1.CSV	Facility data
herschel_eplm_fdh_2.CSV	
herschel_eplm_power.CSV	Measured power
herschel_eplm_sensors_1.CSV	Sensor values
herschel_eplm_sensors_2.CSV	
herschel_eplm_setpoints_1.CSV	Power setpoints
herschel_eplm_setpoints_2.CSV	

SCOE Data Table Files

The SCOE data acquired during the test are converted to engineering values in the SCOE and then written to table files. In these original table files, the mass flow rate value (sensor CVSE_004) has been corrected with respect to the measurement range set at the mass flow unit. In addition to the original table files, the heater powers have been calculated and are also distributed in the files called “localfile.txt-htrpowers.txt” for all phases where SCOE heaters were activated.

The SCOE records all measured raw data and other events at a higher sampling rate (~2 sec) in recording files which can be used to extract dedicated information when necessary. These recording files require approx. 60 MB storage capacity per measurement day (when compressed). Due to the large size, these files are not distributed but can be made available by the Herschel documentation office on specific request.

Table 11: SCOE data files

Directory	Filename
0-Init	20051006-154944-PreTBTV_Eng_data.txt
1-LA	20051008-105736-TBTV_TP1_LA_Eng_data.txt_local
1-LA	localfile.txt-htrpowers.txt

Directory	**Filename**
2-LEOP	20051013-141836-TBTV_TP2_LEOP_Eng_data.txt-merged
3-Rapid_Cooldown	20051016-085928-TBTV_TP3_RCD_Eng_data-complete.txt
3-Rapid_Cooldown	localfile.txt-htrpowers.txt
4-TV1	20051021-154233-TBTV_TP4_TV1_Eng_data.txt
4-TV1	localfile.txt-htrpowers.txt
5-TB1	20051023-171808-TBTV_TP5_TB1_Eng_data.txt
5-TB1	localfile.txt-htrpowers.txt
6-TV2	20051029-191814-TBTV_TP6_TV2_Eng_data.txt
6-TV2	localfile.txt-htrpowers.txt
7-TB2	20051104-184007-TBTV_TP7B_TB2_Eng_data.txt
7-TB2	localfile.txt-htrpowers.txt
8-Recovery	20051105-193559-TBTV_TP8_Recovery_Eng_data.txt
8-Recovery	localfile.txt-htrpowers.txt

END OF DOCUMENT

	Name	Dep./Comp.		Name	Dep./Comp.
X	Alberti von Mathias Dr.	AOE22	X	Schink Dietmar	AED44
X	Barlage Bernhard	AED11	X	Schlosser Christian	OTN/AOA54
	Bayer Thomas	AOA52		Schmidt Rudolf	FAE22
	Brune Holger	AOA55		Schweickert Gunn	AOE22
	Edelhoff Dirk	APS3		Steininger Eric	AED32
	Fehringer Alexander	AOE13	X	Stritter Rene	AED11
X	Fricke Wolfgang Dr.	AED 65		Suess Rudi	AOA54
	Geiger Hermann	AOA52		Thörmer Klaus-Horst Dr.	OTN/AED65
X	Gerner Willi	AED11	X	Wagner Klaus	AOE22
	Grasl Andreas	OTN/AOA54	X	Wietbrock Walter	AET12
	Grasshoff Brigitte	AET12		Wöhler Hans	AOE22
X	Hauser Armin	AOE22		Wössner Ulrich	ASE442
	Hendry David	Terma Resid.			
	Hengstler Reinhold	AOA 5	X	Alcatel	ASP
X	Hinger Jürgen	AOE22	X	ESA/ESTEC	ESA
	Hofmann Rolf	ASE442		**Instruments:**	
X	Hohn Rüdiger	AED65	X	MPE (PACS)	MPE
	Hölzle Edgar Dr.	AED44	X	RAL (SPIRE)	RAL
X	Huber Johann	AOA52	X	SRON (HIFI)	SRON
	Hund Walter	ASE442		**Subcontractors:**	
X	Idler Siegmund	AED312		Air Liquide, Space Department	AIR
	Ilsen Stijn	Terma Resid.		Air Liquide, Space Department	AIRS
	Ivády von András	FAE22		Air Liquide, Orbital System	AIRT
X	Jahn Gerd Dr.	AOE22		Alcatel Bell Space	ABSP
	Kalde Clemens	APE3		Astrium Sub-Subsyst. & Equipment	ASSE
	Kameter Rudolf	OTN/AOA54		Austrian Aerospace	AAE
	Kettner Bernhard	AET42		Austrian Aerospace	AAEM
	Knoblauch August	AET32		APCO Technologies S. A.	APCO
X	Koelle Markus	AOA53		Bieri Engineering B. V.	BIER
	Koppe Axel	AED312		BOC Edwards	BOCE
X	Kroeker Jürgen	AED65		Dutch Space Solar Arrays	DSSA
X	Kunz Oliver Dr.	AOE22		EADS CASA Espacio	CASA
	Lamprecht Ernst	OTN/ASI21		EADS CASA Espacio	ECAS
	Lang Jürgen	ASE442		EADS Space Transportation	ASIP
X	Langenstein Rolf	AED15		Eurocopter	ECD
X	Langfermann Michael	AOA51	X	European Test Services	ETS
	Mack Paul	OTN/AOA54		HTS AG Zürich	HTSZ
	Maute Thomas	AOA52		Linde	LIND
	Müller Jörg	AOA52		Patria New Technologies Oy	PANT
	Müller Martin	AOA53		Phoenix, Volkmarsen	PHOE
	Müller Ralf	FAE22		Prototech AS	PROT
	Peltz Heinz-Willi	AOE13		QMC Instruments Ltd.	QMC
	Pietroboni Karin	AED65		Rembe, Brilon	REMB
	Platzer Wilhelm	AED22		Rosemount Aerospace GmbH	ROSE
	Reichle Konrad	AOA52		RYMSA, Radiación y Microondas	RYM
	Reuß Friedhelm	AED62		SENER Ingenieria SA	SEN
X	Rühe Wolfgang	AED6		Stöhr, Königsbrunn	STOE
X	Runge Axel	OTN/AOA54		Terma A/S, Herlev	TER