SPIRE-AST-REP-002645

Title: **EQM Cryostat Operation Report**

CI-No: 151 000

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1.0	20.02.06		Initial Issue	

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1 SUMMARY

This report summarizes the EQM cryostat operation during the EQM test phase in autumn 2005 at EADS Astrium GmbH in Ottobrunn. It starts with the cool down and filling of the cryostat and ends with depletion and warm up. In detail, the following phases are subject of this test report:

- Cool down and filling of the EQM cryostat
- He II production in AXT
- Cryostat operation during 1st phase of the integrated module test (IMT)
- Sorption cooler / leak problem investigations
- Cryostat operation during 2nd phase of instrument tests (IMT, EMC and special investigations)
- Cover flushing for PACS and SPIRE tests
- Warm up to He I temperature, depletion and warm up to ambient

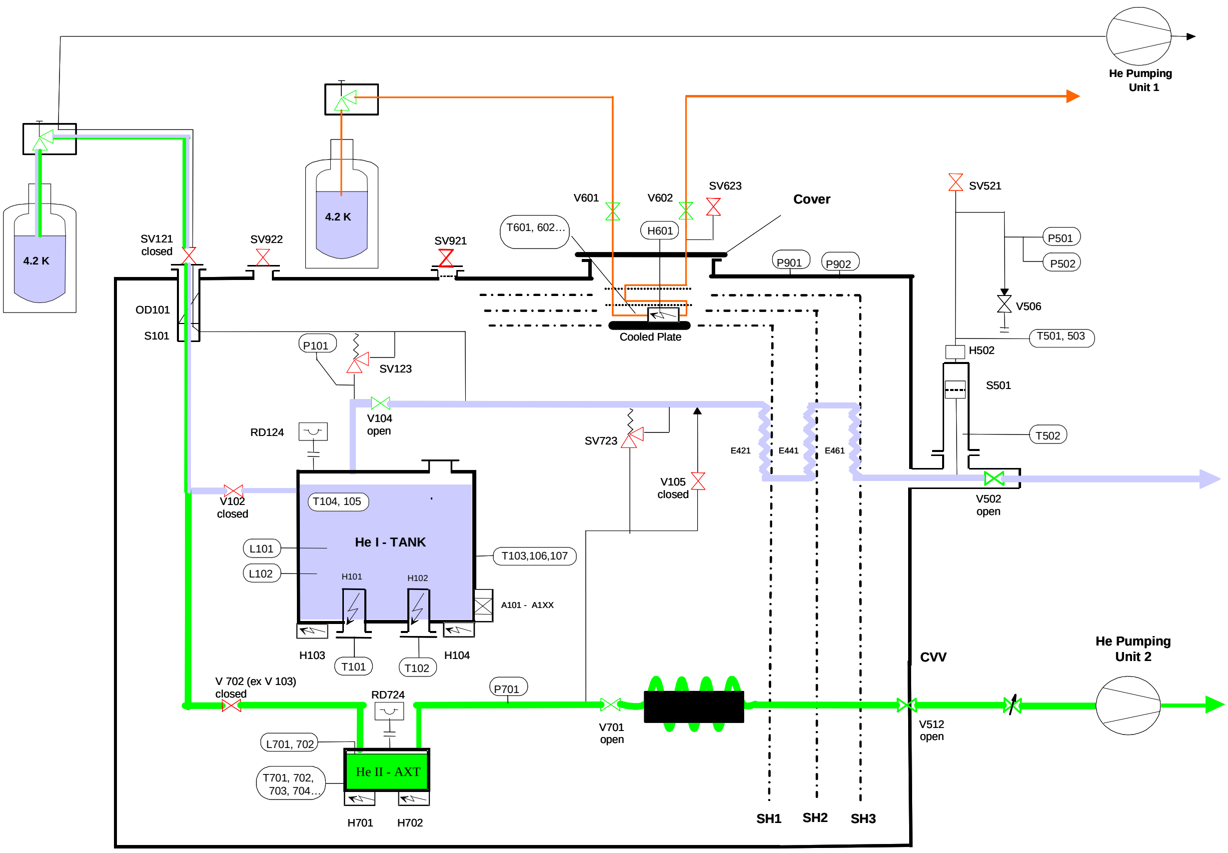

Figure 1-1: Flow Scheme of the EQM He S/S

2 Documents

2.1 Applicable Documents

The following documents of the latest issue in effect or as defined herein form a part of this document to the extent specified herein.

AD #	Document Title	Document Identifier
AD 01	Herschel EQM Cool Down and Filling	HP-2-ASED-TP-0072
AD 02	Herschel EQM AXT He II Production and Top Up	HP-2-ASED-TP-0090
AD 03	Herschel EQM Cover Flushing	HP-2-ASED-TP-0091
AD 04	Herschel EQM Depletion and Warm Up to Ambient	HP-2-ASED-TP-0098
AD 05	Summary Report of Instrument Testing on EQM Level	HP-2-ASED-TR-0092
AD 06	As-Built Configuration List EQM	HP-2-ASED-AB-0003

2.2 Reference Documents

RD #	Document Title	Document Identifier
RD 01	EQM AIT Plan	HP-ASED-PL-0022
RD 02	CVSE Set-up Description	HP-2-ASED-TN-0094
RD 03	PA Plan	HP-2-ASED-PL-0007
RD 04	Cryostat Cover Handling and Operations Manual	HP-2-AAE-MA-0003
RD 05	IID-B HIFI, section 5.7	SCI-PT-IIDB/HIFI-02125
RD 06	IID-B PACS, section 5.7 and 7.2	SCI-PT-IIDB/PACS-02126
RD 07	IID-B SPIRE, section 5.7	SCI-PT-IIDB/SPIRE-02124
RD 08	IID-A, section 9	SCI-PT-IIDA-04624

3 TEST REPORT DIGEST

3.1 Operations

The following cryostat operations were done:

- Cool down and filling of the EQM cryostat
- He II production in AXT
- Cryostat operation during instrument testing phase 1
- Sorption cooler / leak problem investigations
- Cryostat operation during instrument testing phase 2
- Cover flushing
- Depletion and warm up to ambient

3.2 Test Procedures

HP-2-ASED-TP-0072, Issue 1.0, 28.07.05	Herschel EQM Cool Down and Filling
HP-2-ASED-TP-0090, Issue 1.0, 08.09.05	Herschel EQM AXT He II Production and Top Up
HP-2-ASED-TP-0091, issue 1.0, 15.09.05	Herschel EQM Cover Flushing
HP-2-ASED-TP-0098, issue 1.0, 08.12.05	Herschel EQM Depletion and Warm Up to Ambient

3.3 Test Readiness Reviews

HP-2-ASED-MN-1042, 24.08.05	PLM EQM TRR prior to cool down
HP-2-ASED-MN-1137, 09.12.05	PLM EQM TRR prior to Warm-Up

3.4 Post Test Review

N/A

3.5 Non Conformances

All NCRs issued during EQM testing are listed in the "Summary Report of Instrument Testing on EQM Level", AD 05. The following NCRs were raised in the frame of cryostat operation or had an effect on the cryostat operations:

HP-112000-ASED-NC-1662
HP-113000-ASED-NC-1495
HP-113000-ASED-NC-1675
HP-142220-ASED-NC-1667
HP-142220-ASED-NC-1668
HP-142220-ASED-NC-1759
HP-142220-ASED-NC-1829
HP-150000-ASED-NC-1484
HP-150000-ASED-NC-1489
HP-150000-ASED-NC-1683
HP-150000-ASED-NC-1817
HP-151000-ASED-NC-0211

HP-151000-ASED-NC-1319
HP-151000-ASED-NC-1795
HP-151240-ASED-NC-1415

See section 7 for details

3.6 Test Changes (Deviations)

HP-2-ASED-SD-0058, issue 3, issued 04.10.05, status 19.10.05

3.7 Conclusion

The EQM cryostat was successfully operated to support EQM instrument testing in Ottobrunn. All required temperatures could be achieved, however with a higher mass flow.

Main problems during cryostat operation came from the differences between the EQM and PFM built standard. Especially the inexistent thermal anchoring of the cryostat harness called for an unexpected high mass flow through the OBA. In addition the heat loads from the CVV and LO windows were underestimated.

Due to straylight problems the cover had to be cooled to lower temperatures than planned.

All detected problems have been identified and NCRs have been written for non compliances or anomalies.

4 TEST REPORT ANALYSIS

This chapter contains a detailed analysis of the different operation phases. Each section contains a short description, a summary of the cryostat behaviour, deviations and lessons learnt.

Remarks: All times of the graphs below are in UTC, while the times in the log sheets and as-run copies in the annex are in local time.

4.1 Cool Down and Filling

4.1.1 Objective

Objective was the controlled cool down of the Herschel EQM cryostat to 4.2 K and the filling of the Herschel HTT to >98%. Cool-down and filling was started after evacuation and successful leak test in warm conditions. The temperature requirements of instruments as given in the IID-Bs had to be regarded.

4.1.2 Description of Operation

Cool down of the EQM cryostat started on 29.8.05 after five cycles of evacuation and flushing of the He S/S and after installation of the safety valve SV 922.

The HTT was cooled down until 31.8.05. Cooling of the HTT was not limited by a requirement. Cooling down of the AXT and OBA with instrument interfaces lasted until 7.9.05. It was agreed in the TRR that a cooling rate of 5 K/h and gradients between instrument interfaces of 20 K shall be regarded. In order not to exceed these requirements OBA and AXT was cooled down passively most of the time while the HTT was filled with LHe I.

Cool down and filling was completed on 9.9.05. The final HTT level could not be verified because the HTT liquid level probes are not functioning since ISO. However, filling level of the HTT was not relevant for the following EQM tests.

A part of the cool down was done in double shifts. The cool down was interrupted over one weekend because of a bottleneck in the Helium supply.

4.1.3 Summary Test Results / Cryostat Behaviour

The figures below show the cryostat behaviour during cool down. The switching of the Helium flow between HTT/shields and AXT/shields was necessary to avoid a too fast cool down of the AXT and the L0 interfaces which are coupled with the AXT. The effect of the switching onto the AXT temperatures can be seen in Figure 4.1-1.

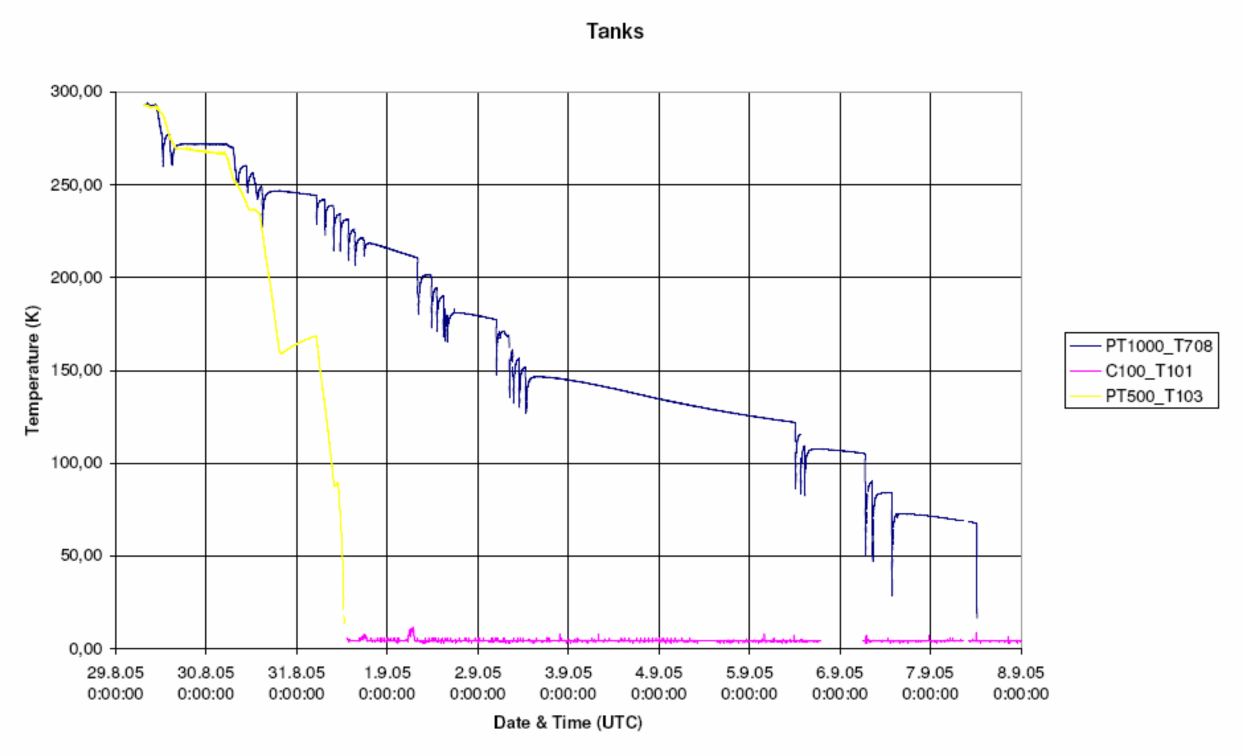

Figure 4.1-1: Cool Down of Tanks

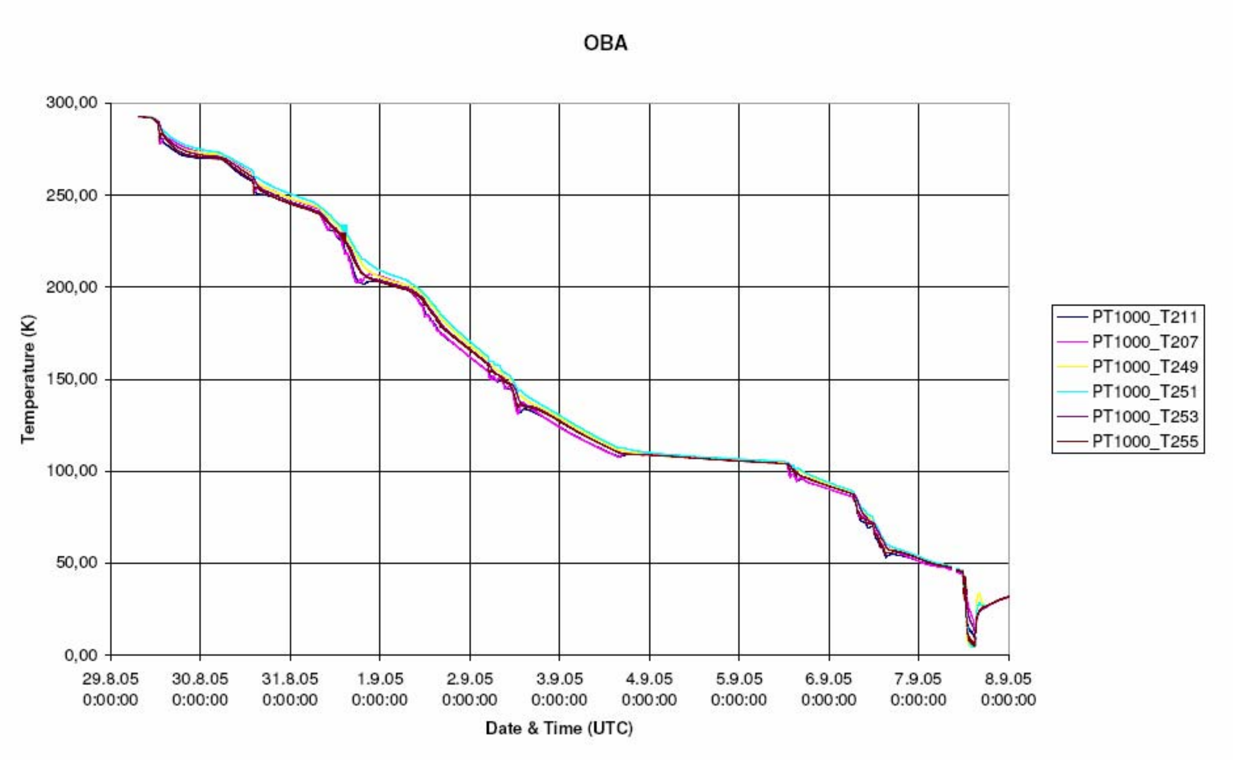

Figure 4.1-2: Cool down of OBA

4.1.4 Problems, Deviations

The most critical requirement was the restriction of the cooling rate to 5 K/h. This rate was exceeded several times when the AXT and OBA were actively cooled by cold Helium in order to speed up the cooling process.

As an example it can be seen in Figure 4.1-4 in more detail, that the rates were exceeded only for a short time and that the critical temperature (in this case T 207) dropped only about 12 K in that time. The stress which could be caused by such a temperature drop is not regarded as critical. Switching of the Helium flow avoided that the stress became critical.

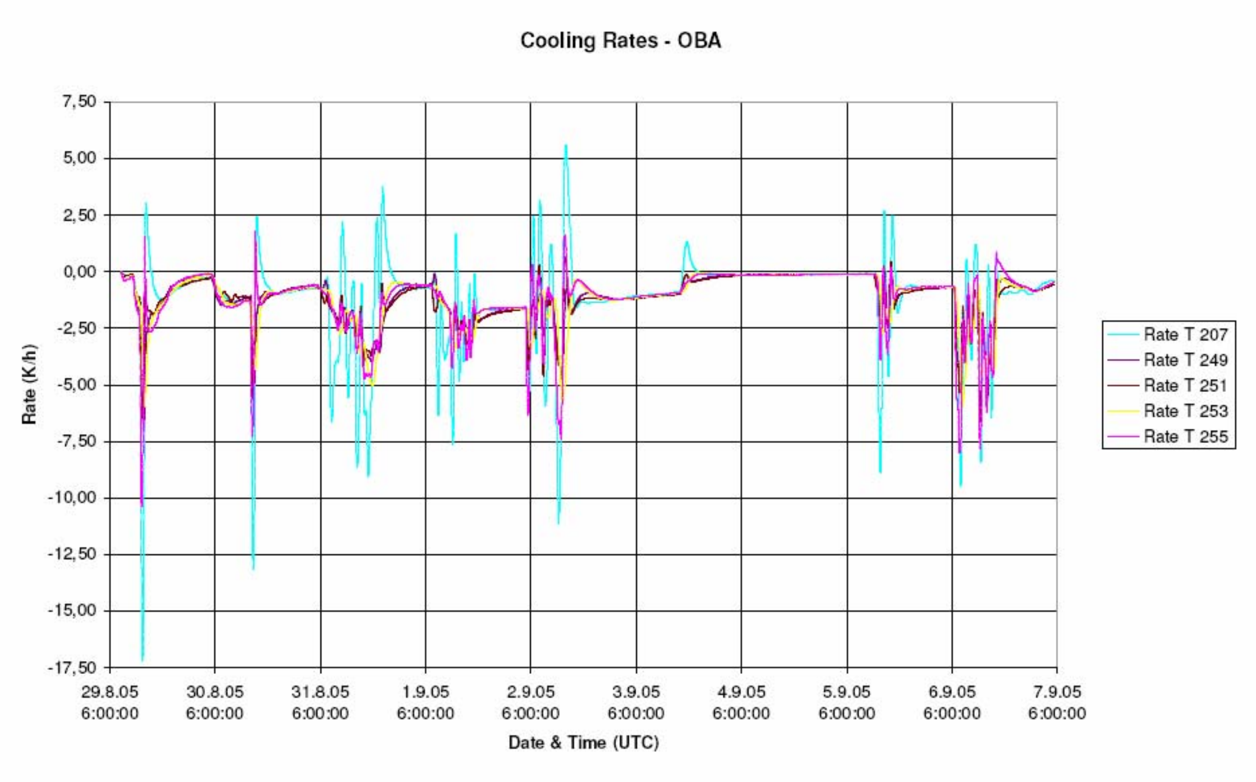

Figure 4.1-3: OBA Cooling Rates

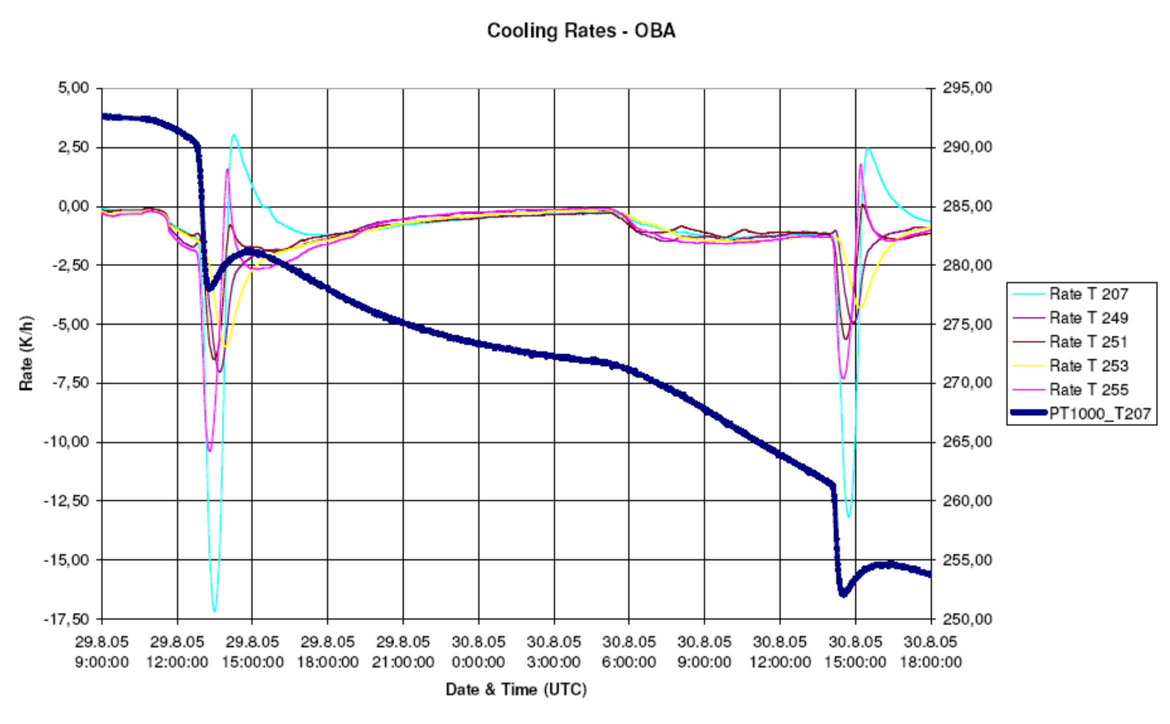

Figure 4.1-4: OBA Cooling Rates - Details

The OBA internal temperature gradients were all over the time below the required 20 K. However, the temperature gradient between the AXT (L0) and OBA was exceeded some times. Problems occurred mainly during longer non active phases. These short and only slight exceedings are not regarded as critical.

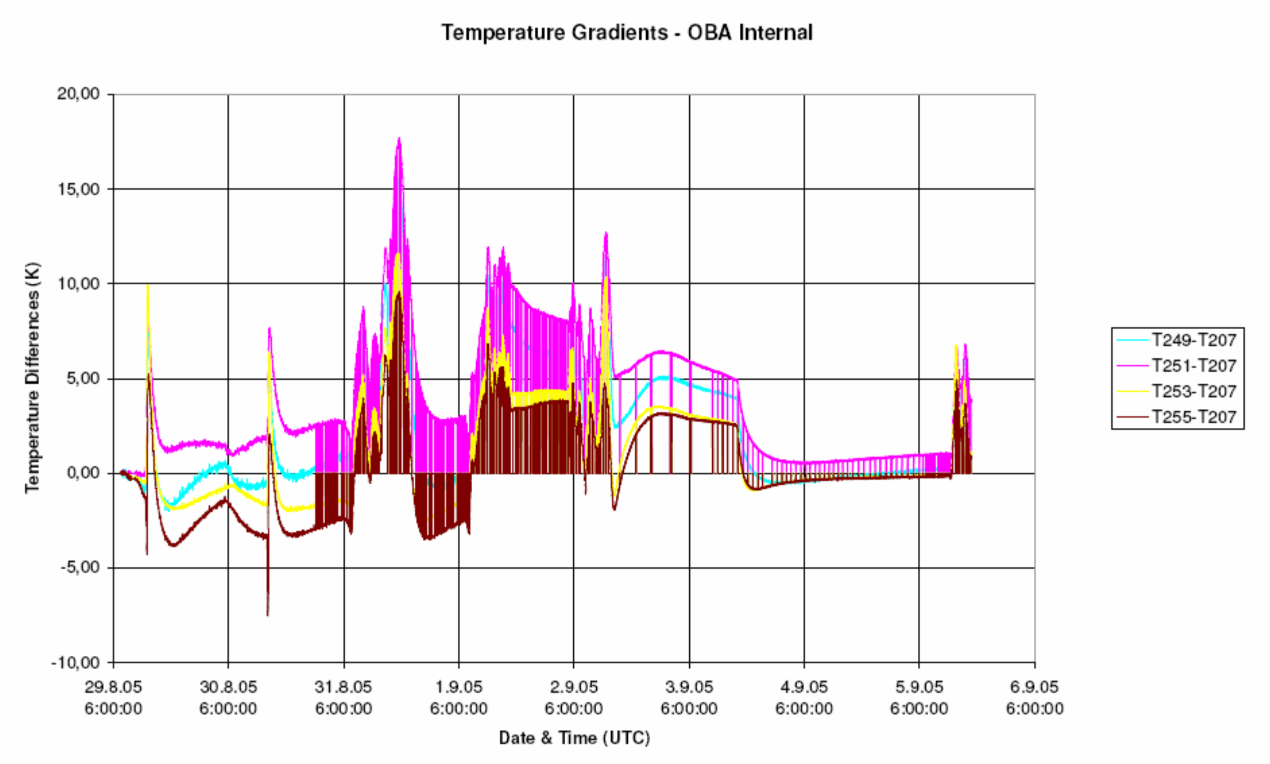

Figure 4.1-5: OBA Internal Temperature Gradients

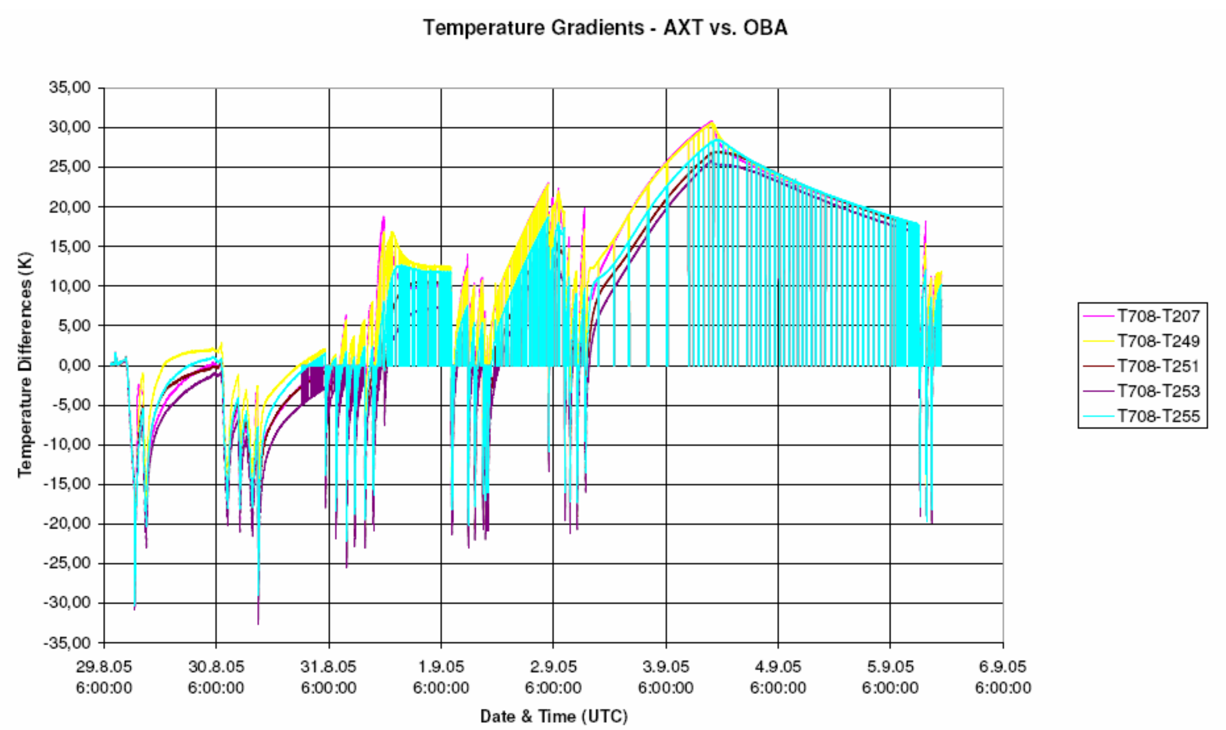

Figure 4.1-6: Temperature Gradients between AXT and OBA

4.1.5 Lessons Learnt

Due to the differences between the EQM and PFM He S/S lessons learnt for PFM are limited. However some observations made on the EQM cool down could help avoiding problems with the cool down of the FM cryostat, when the FM instruments are integrated:

– The OBA reacts quite fast on cold gas flows. It will turn out during cooling the F whether the large HTT reduces this effect. Otherwise, the OBA shall stay in by-pass most of the time. The only way to by-pass the OBA seems to be to cool the HOT instead of the HTT.

– Temperature gradients were exceeded during non active phases. Non-active phases shall be reduced to night breaks only to avoid similar problems on the FM.

– Driving parameter for the overall duration was the temperature gradient requirement from PACS.

– Temperature rates were exceeded when we tried to accelerate the process. Therefore: "keep cool"!

4.2 He II Production and Top Up

4.2.1 Objective

The objective of He II production and top us was to reach an AXT filling level of more than 95 % with T 702/T 703 < 1.8 K. The HTT remained at LHe I conditions and was used to cool the thermal isolation shields.

This activity was repeated each time after refilling the AXT.

4.2.2 Description of Operation

He II production on EQM was done by pumping with the He pumping unit I via V 512 and OBA at the AXT. In order not to overload the pumping unit, pumping speed was limited by means of a throttle valve in the venting line. This valve was opened completely after reaching the λ-point.

He II production on EQM was uncritical and was repeated during the EQM test phase whenever the AXT was refilled.

The Helium pumping unit II was used at ESTEC for the STM TB/TV test. Therefore He II production was done with the pumping unit I only and the He II transfer line could not be used. This was already known before and correct reflected in the test procedure. However, a top up of the AXT could not be performed without the He II transfer line. The final filling level of the AXT was therefore only at about 60 % or less.

The AXT could be filled and cooled down to temperatures of about 1.53 K without any problems.

4.2.3 Summary Test Results / Cryostat Behaviour

He II production and pumping down to below 1.6 K lasted about 5 h. The λ-point was reached after less than 2 h. As said above, a top up was not performed.

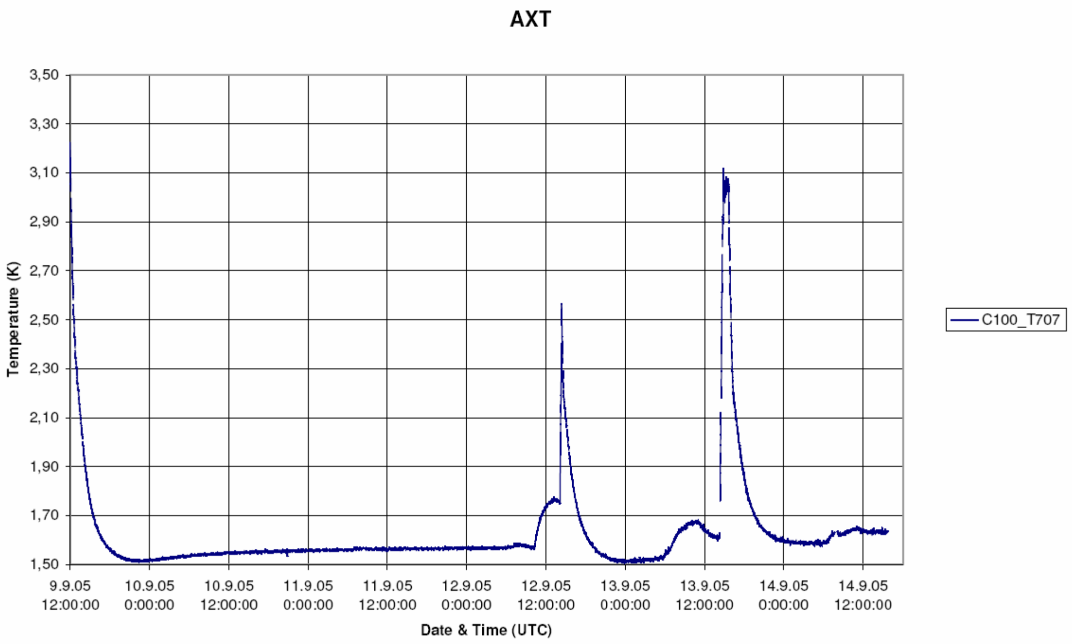

Figure 4.2-1: He II Production - AXT Temperatures

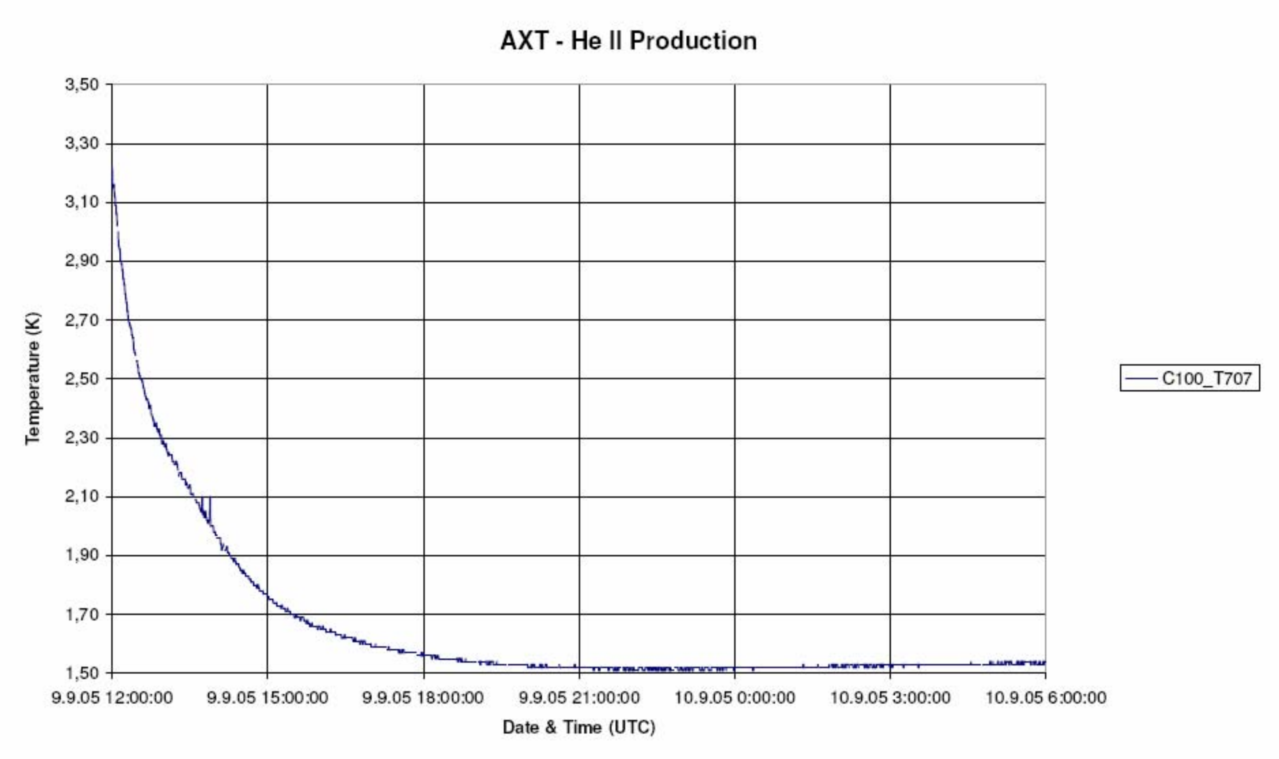

Figure 4.2-2: He II Production - AXT Temperatures - Details

4.2.4 Problems / Deviations

He II production on EQM was done without any problems. Later on during testing, He II production was performed with a 23° tilted PLM. The final filling level was therefore further limited to about 50 % or less.

4.2.5 Lessons Learnt

He II production on EQM had to be done completely different to the PFM. Lessons learnt are therefore limited to GSE issues.

It turned out that the pumping with the He pumping unit I had to be throttled as describe above to avoid an overload of the unit. A dedicated valve was installed in the venting line. For FM, a specific valve was ordered and will be installed at the next maintenance of the unit in February 2006.

4.3 Cryostat Operation during Instrument Tests Phase 1

4.3.1 Objective

Objective was to provide the specified L0, L1, L2 and L3 temperatures for the instrument testing.

4.3.2 Description of Operation

The required temperatures were achieved by continuously pumping via V 512 and OBA at the AXT while the thermal shields were cooled from a Helium flow from the HTT.

Helium flow through the OBA was increased by heating the AXT with some hundreds of milliwatt to increase cooling of the instrument interface temperatures.

The required mass flow of about 100 mg/s through the shields was achieved by heating the HTT with about 2 W. A special script was written on the CryoSCOE to automatically switch on and off heater H 101. With script the fixed heater power of 10 W was reduced to about 2 W in average.

4.3.3 Summary Test Results / Cryostat Behaviour

As described above the pumping unit I was continuously pumping at the AXT while the mass flow was increased by heating. In the first week the integrated module tests of HIFI could be successfully performed. Beside the high mass flow no problem with the cryostat occurred.

After HIFI tests the EQM was installed into the test dolly. For this reason the pumping at the CVV was stopped on 16.09.05. Pumping was not restarted because the isolation vacuum did not degrade.

For the further tests the EQM was tilted by 23°. The tilting angle could not be increased due to a problem with the test dolly gearing (see related NCR). Sorption cooler recycling was possible even with a tilting angle of 23°.

Cryostat operation was continued as for HIFI. In addition, the cryostat cover was cooled down for PACS and SPIRE testing. First attempts to perform the IMT of PACS and SPIRE after recycling the sorption coolers failed because the hold time of the coolers was too low. Some investigations were performed by changing the instrument procedures for cooler recycling. The AXT was warmed up to He I temperature to reduce or eliminate a Helium film which could be the cause of the problem. Finally, this test phase was stopped for more detailed investigations (see chapter below).

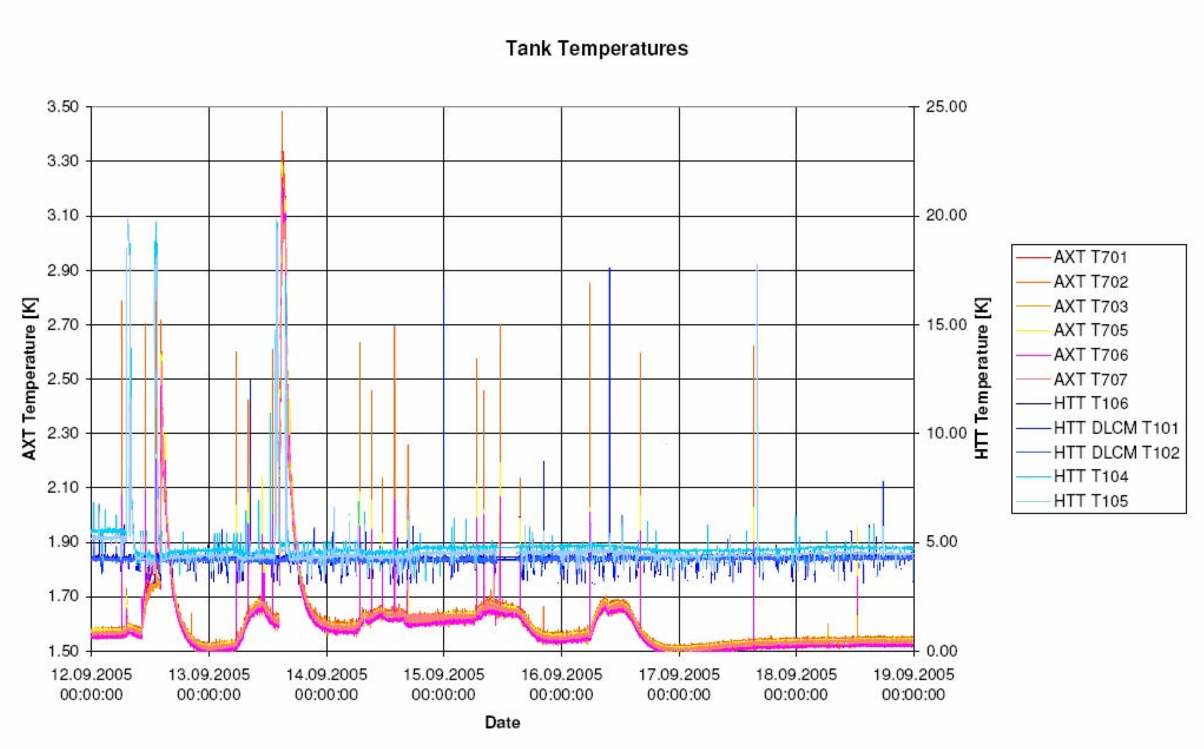

Figure 4.3-1: Tank Temperatures during HIFI IMT

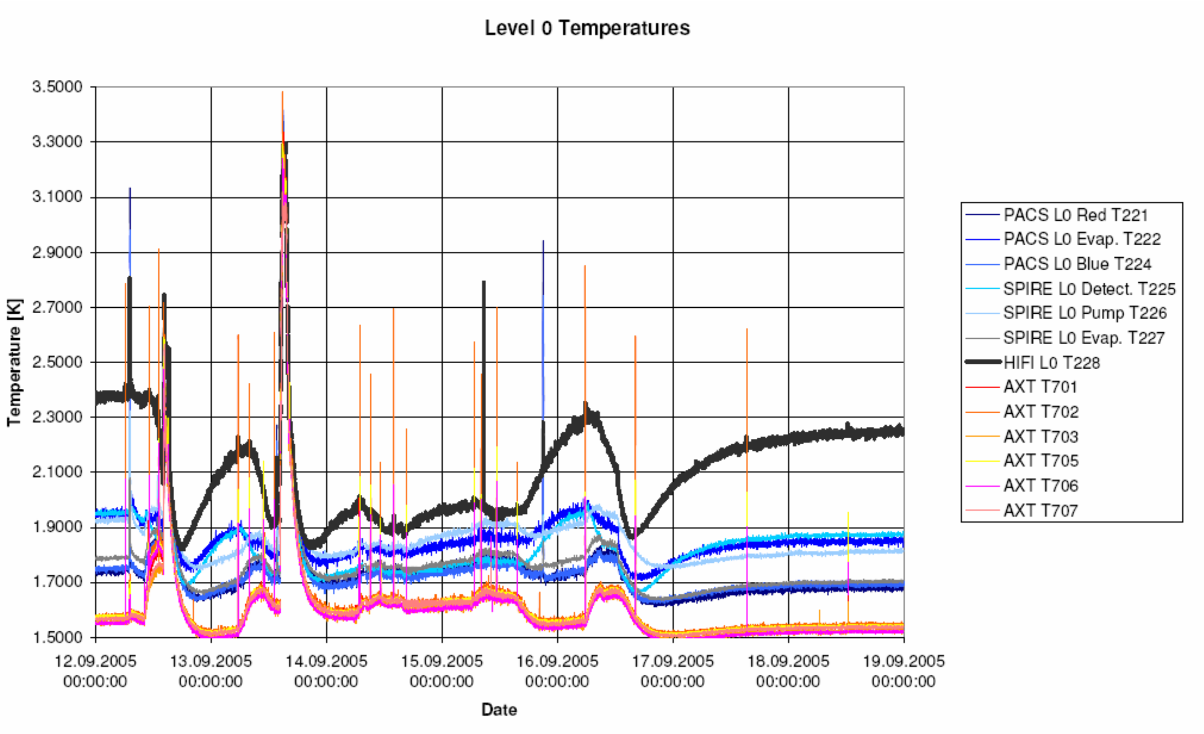

Figure 4.3-2: Level 0 Temperatures during HIFI IMT

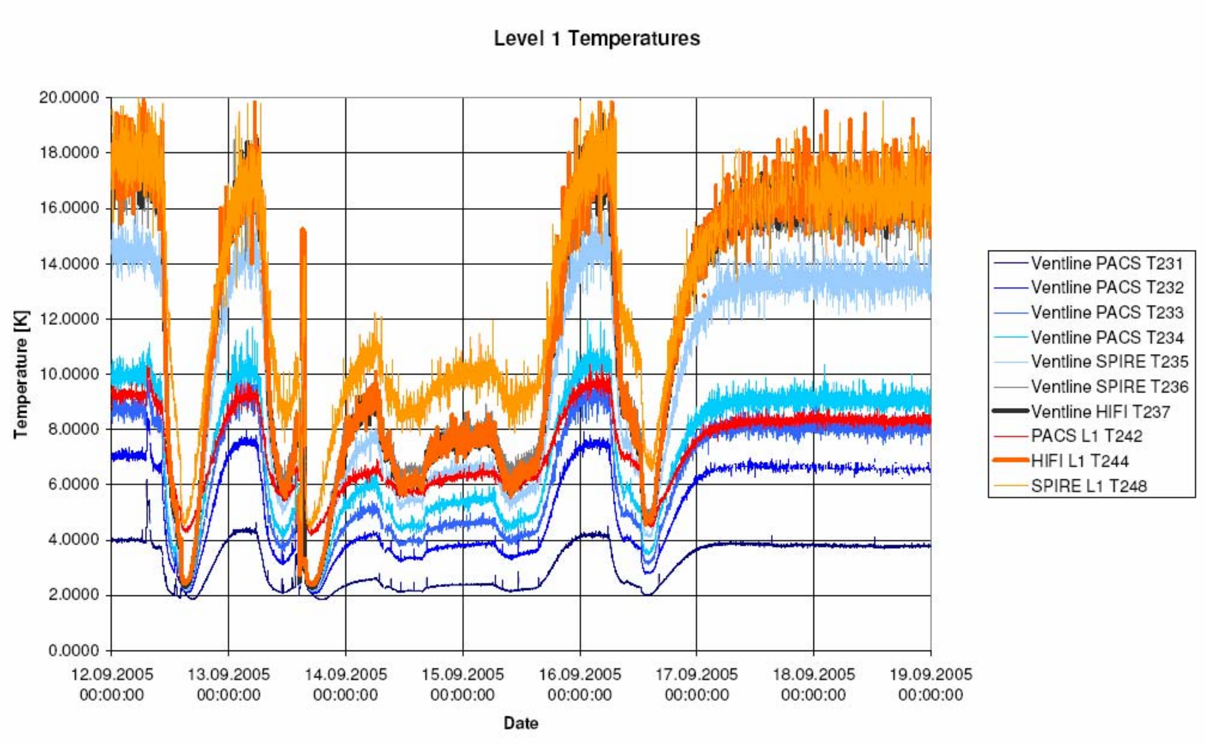

Figure 4.3-3: Level 1 Temperatures during HIFI IMT

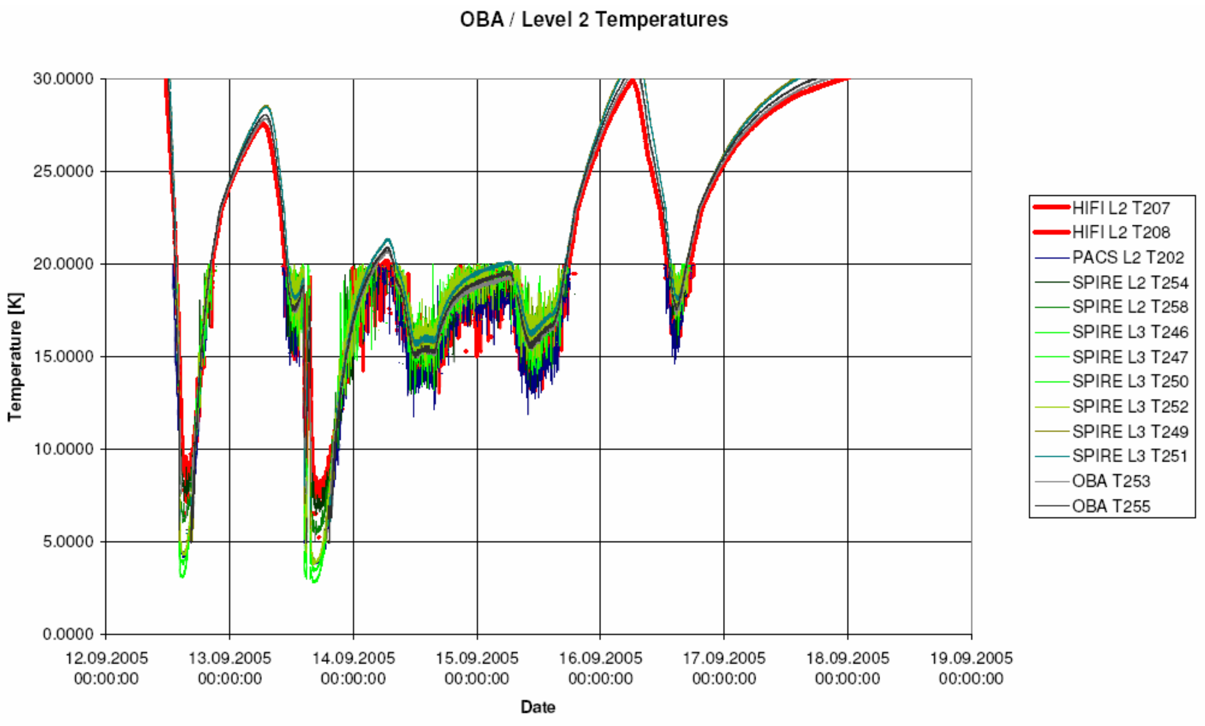

Figure 4.3-4: OBA / Level 2 Temperatures during HIFI IMT

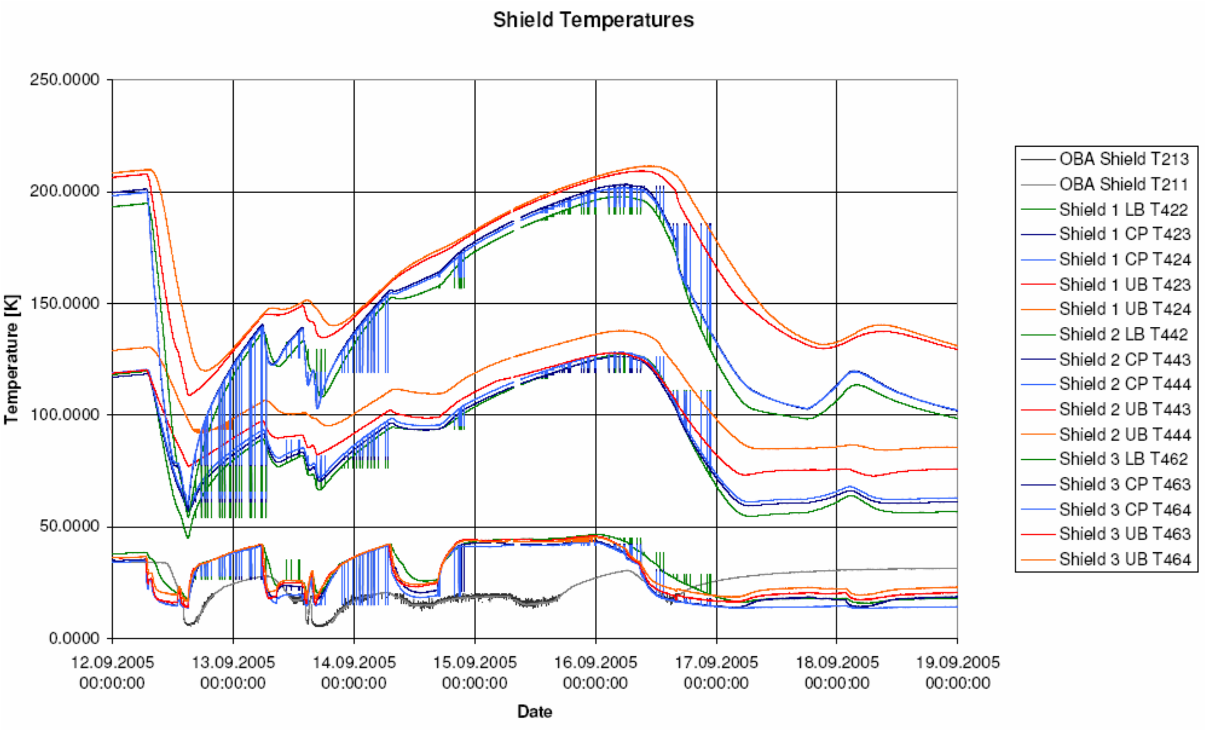

Figure 4.3-5: Shield Temperatures during HIFI IMT

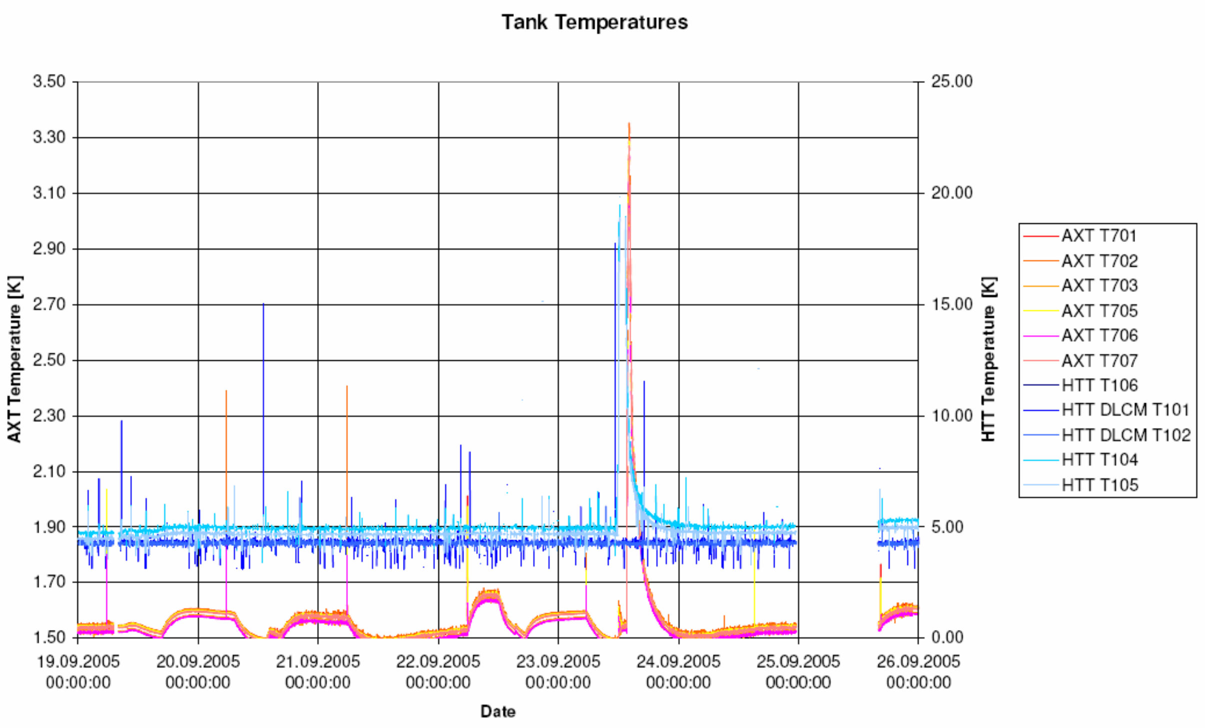

Figure 4.3-6: Tank Temperatures during PACS IMT (1st attempt)

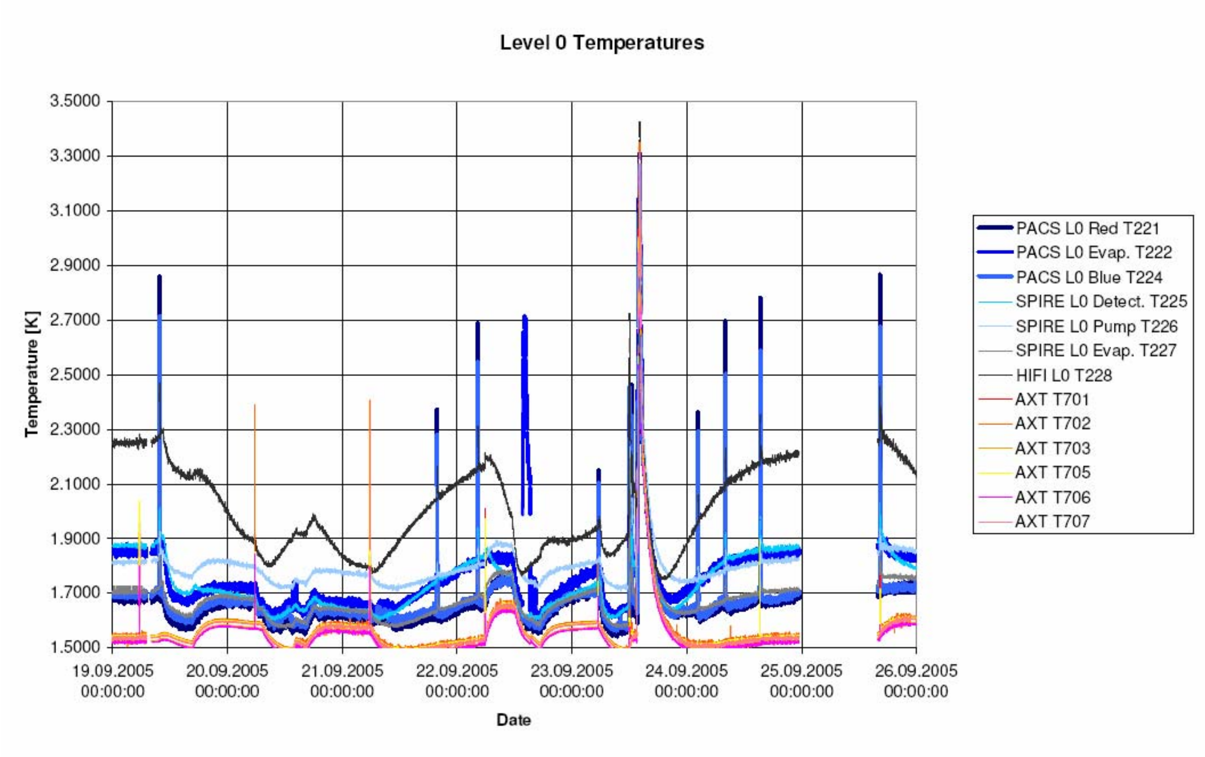

Figure 4.3-7: Level 0 Temperatures during PACS IMT (1st attempt)

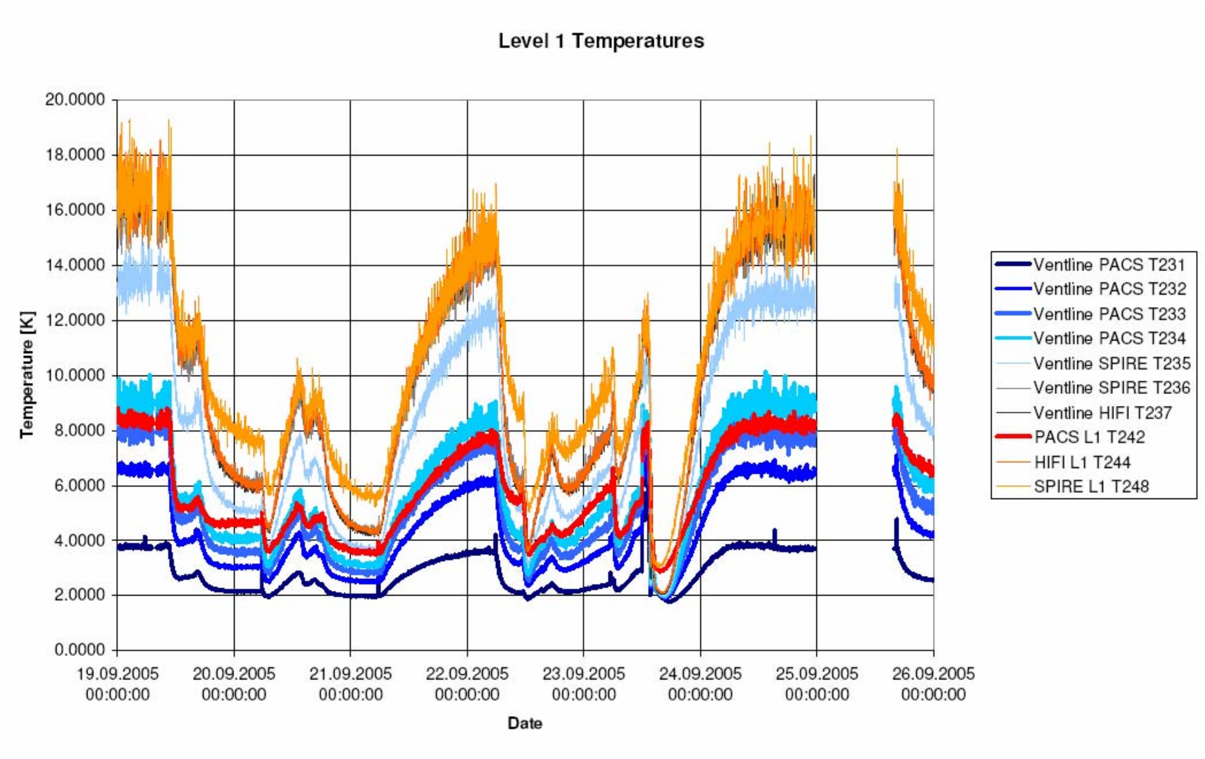

Figure 4.3-8: Level 1 Temperatures during PACS IMT (1st attempt)

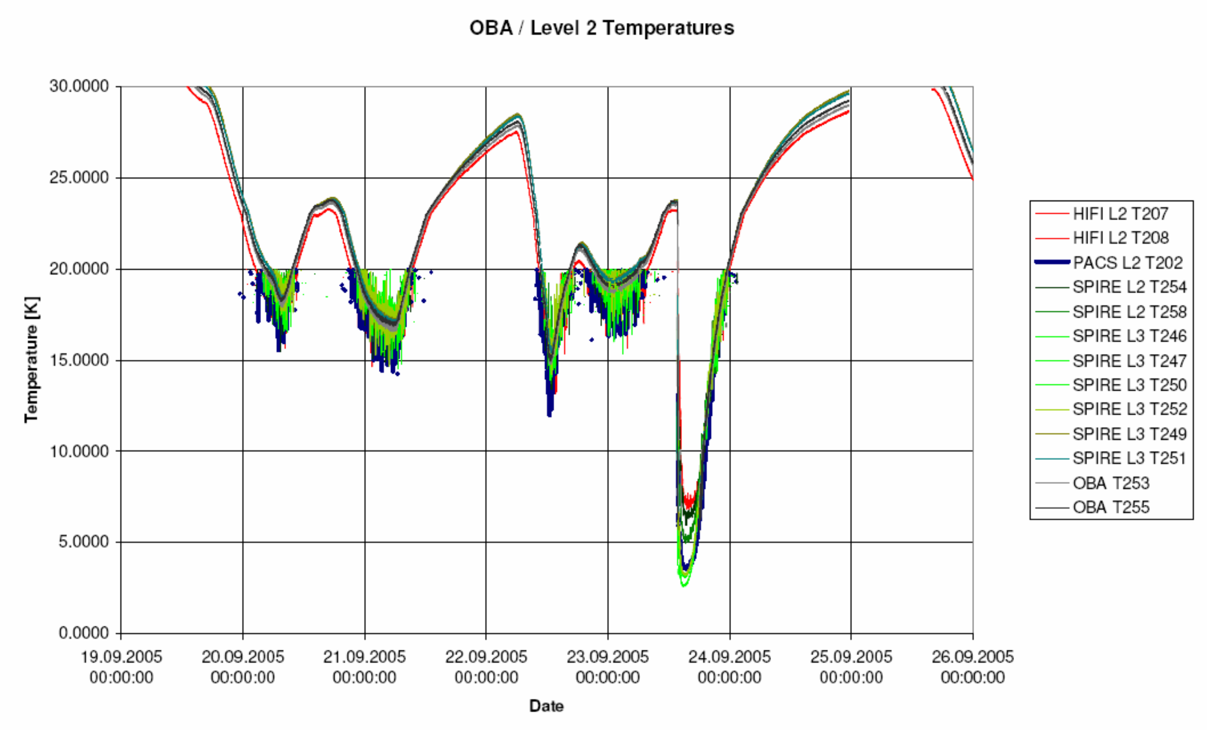

Figure 4.3-9: OBA / Level 2 Temperatures during PACS IMT (1st attempt)

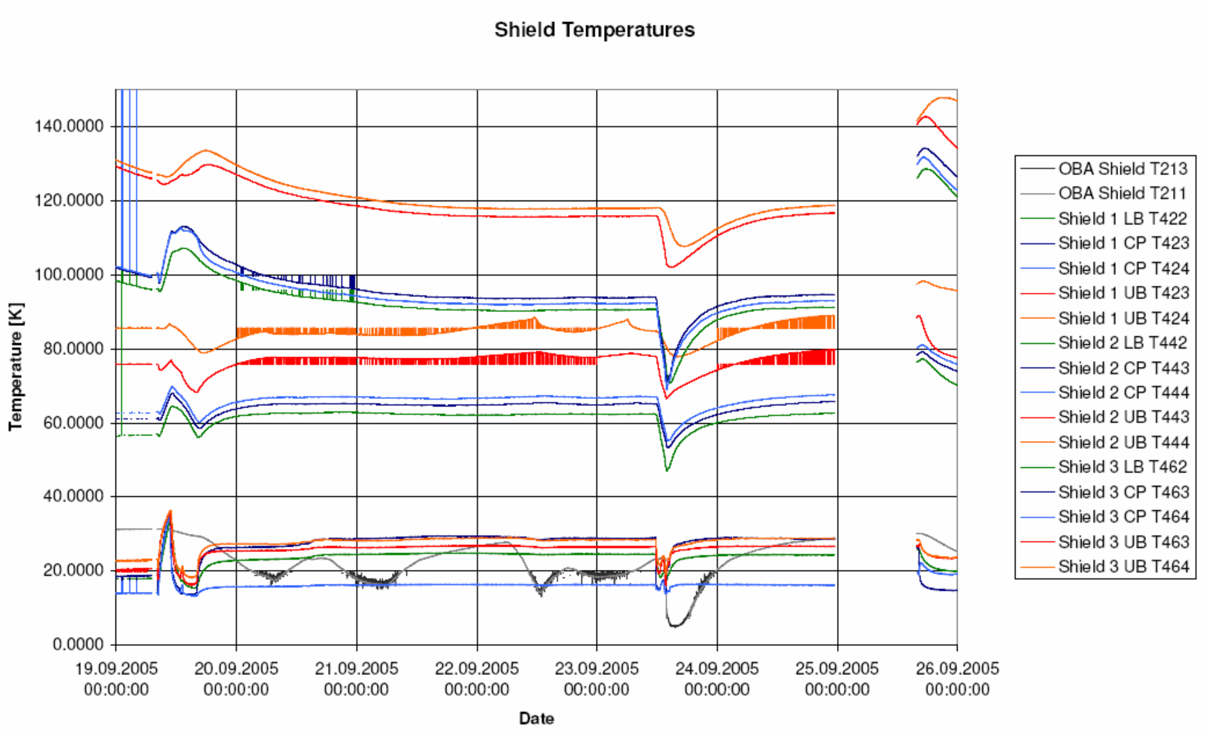

Figure 4.3-10: Shield Temperatures during PACS IMT (1st attempt)

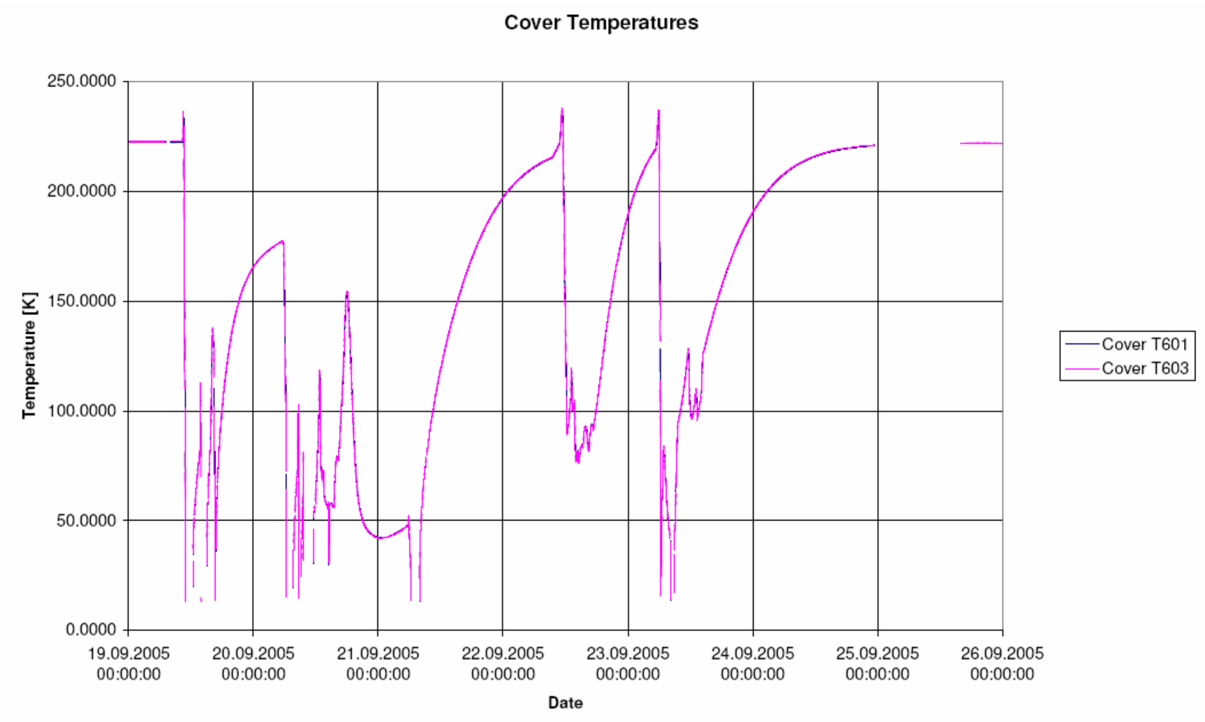

Figure 4.3-11: Cover Temperatures during PACS IMT (1st attempt)

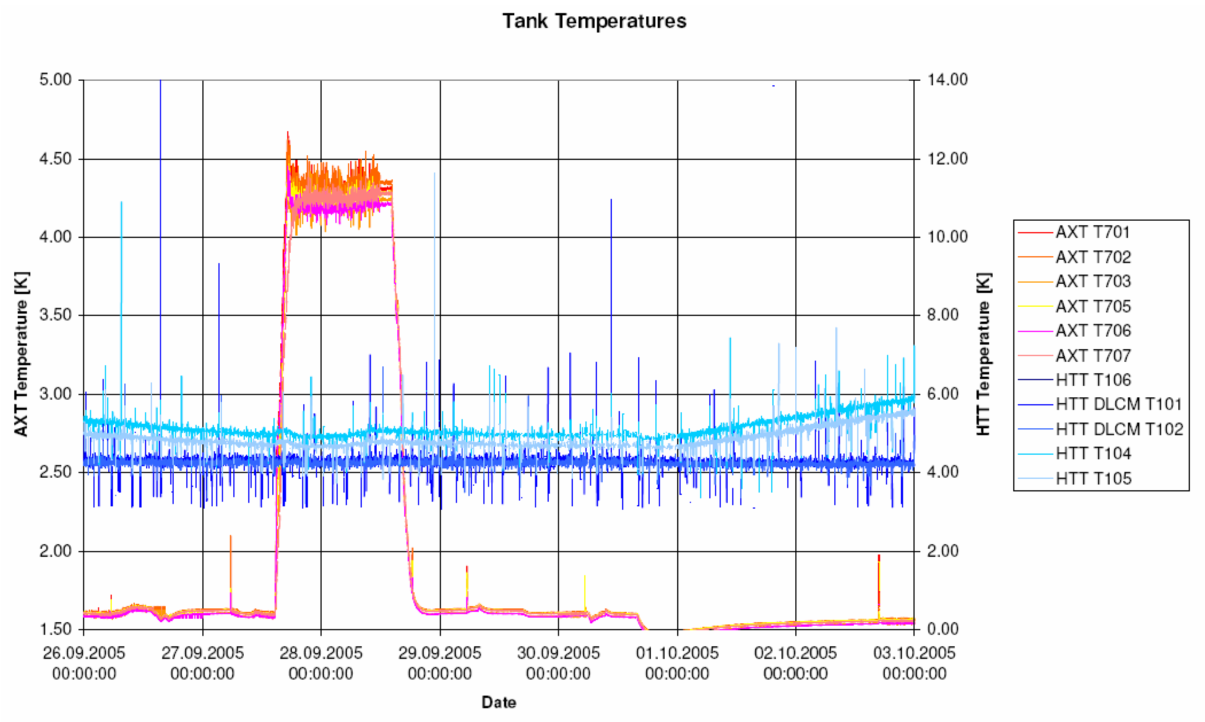

Figure 4.3-12: Tank Temperatures during SPIRE IMT (1st attempt)

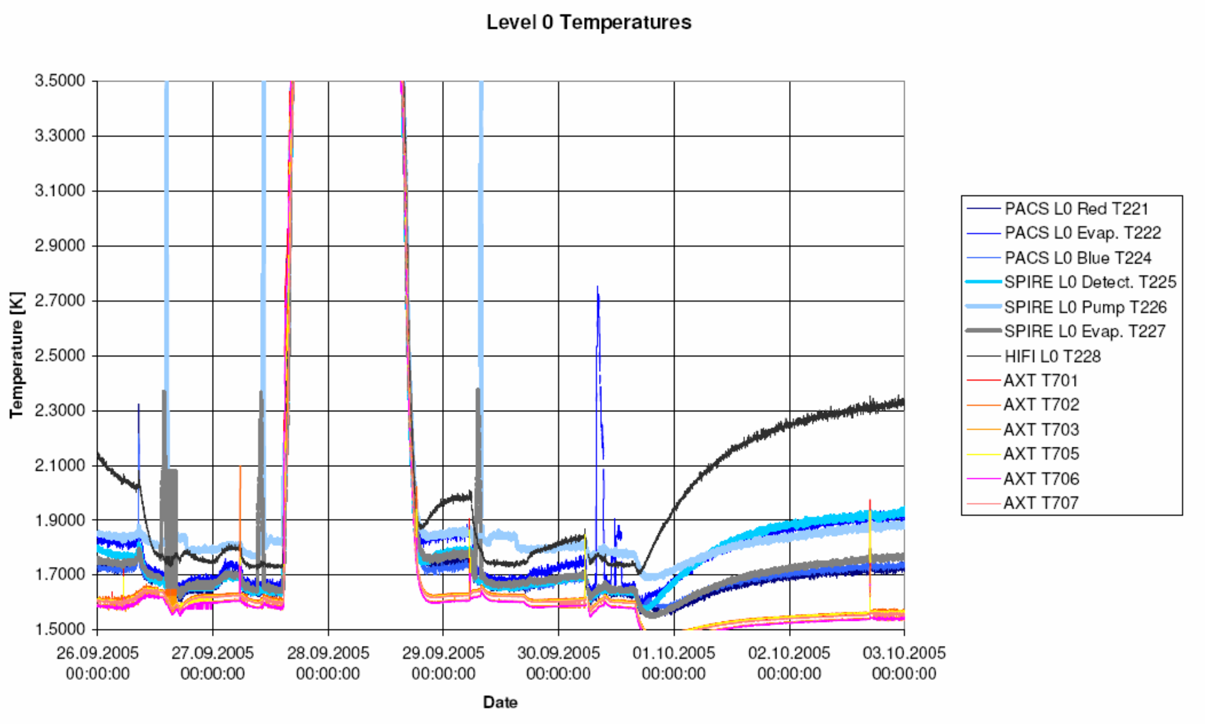

Figure 4.3-13: Level 0 Temperatures during SPIRE IMT (1st attempt)

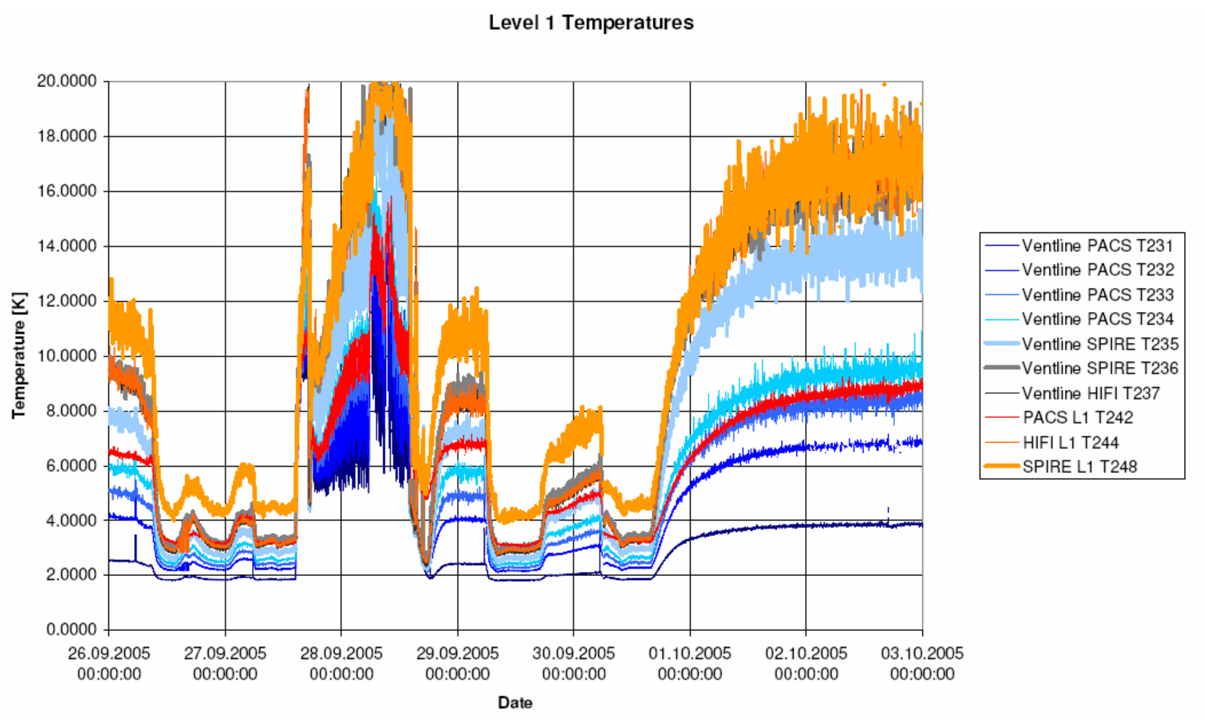

Figure 4.3-14: Level 1 Temperatures during SPIRE IMT (1st attempt)

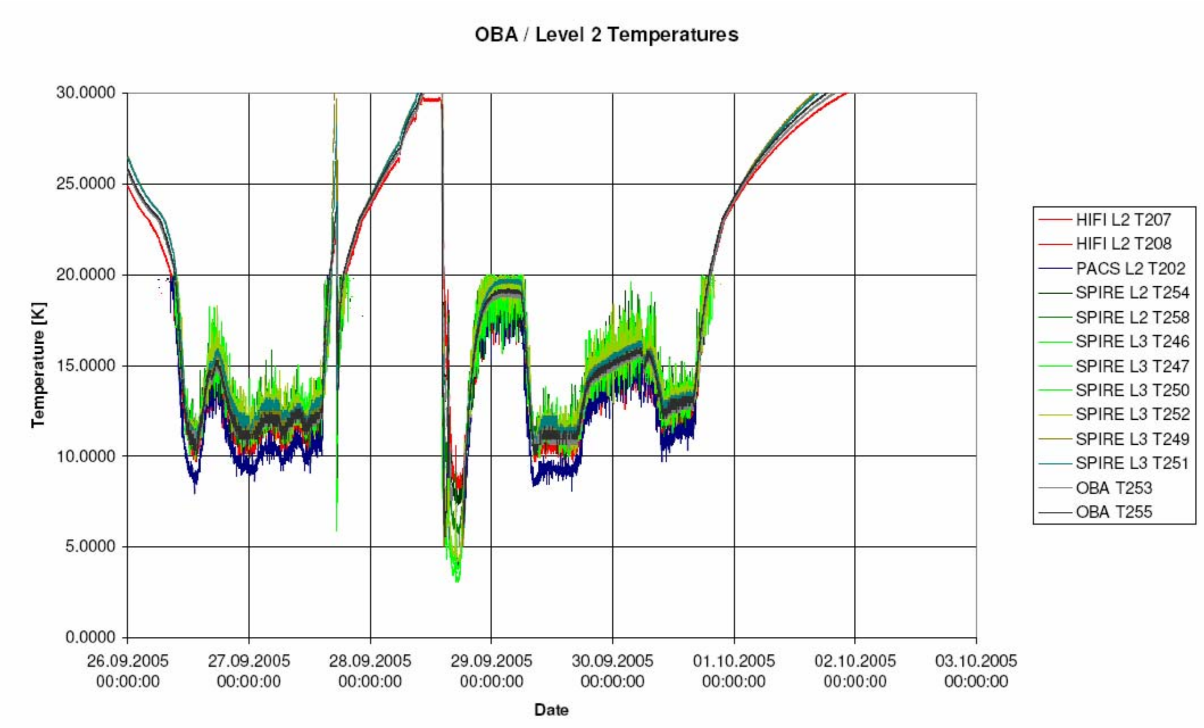

Figure 4.3-15: OBA / Level 2 Temperatures during SPIRE IMT (1st attempt)

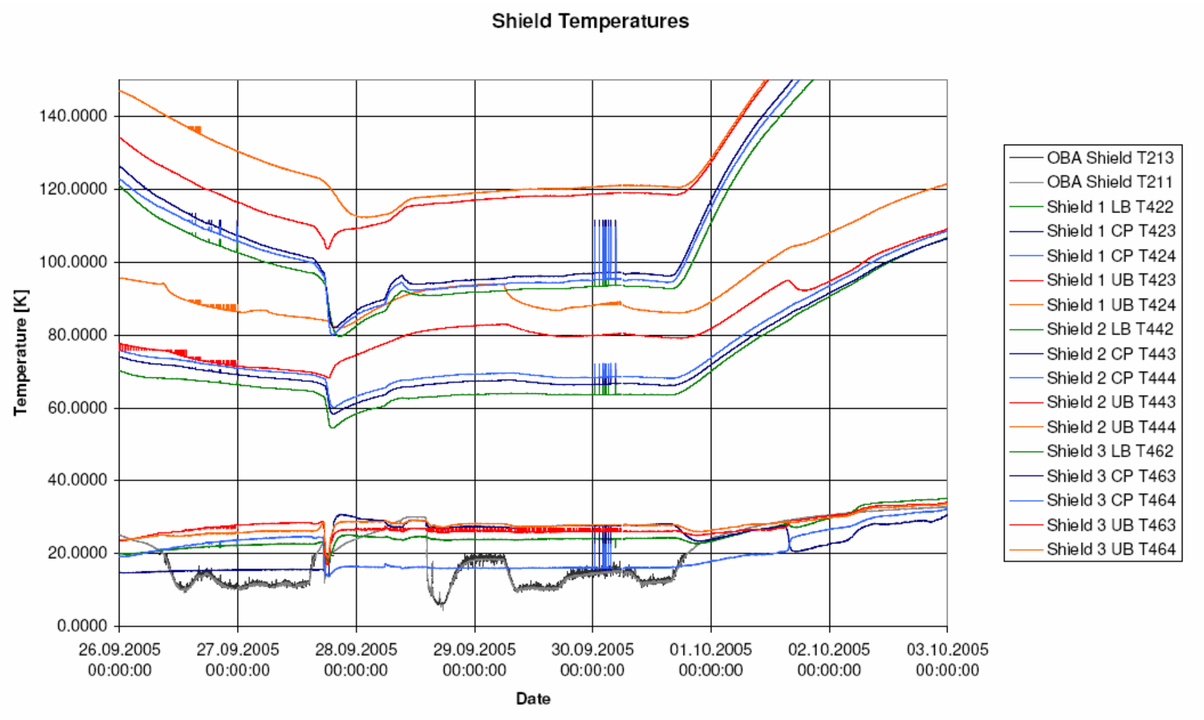

Figure 4.3-16: Shield Temperatures during SPIRE IMT (1st attempt)

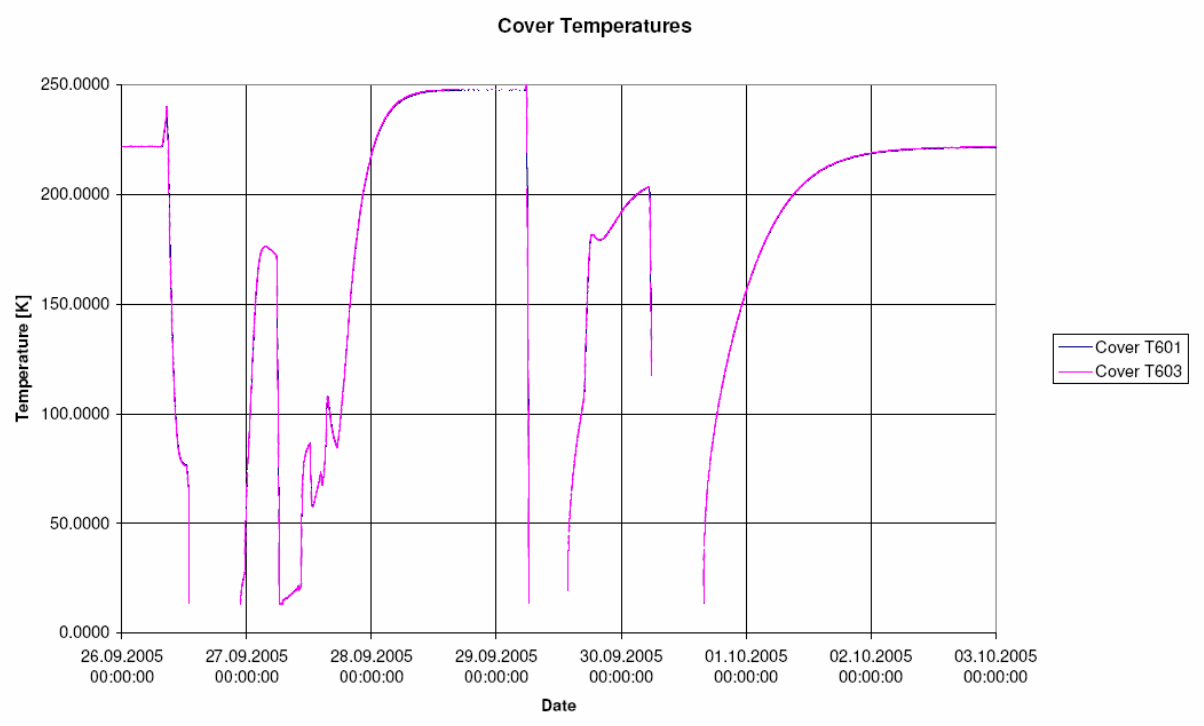

Figure 4.3-17: Cover Temperatures during SPIRE IMT (1st attempt)

4.3.4 Problems / Deviations

An unexpected high heat load on the AXT and the OBA with the instruments prevents testing with an orbit representative mass flow rate of 2.5 mg/s. A flow rate of about 25 mg/s was necessary to cool down the thermal links to the instruments to the required temperatures. This was achieved by heating the AXT (see above).

This test phase was stopped on 27.09.05 because the hold time of the sorption coolers was unacceptable low (see next chapter for details).

4.3.5 Lessons Learnt

Cooler recycling was possible with a PLM tilting angle of 23°. Further lessons learnt are addressed in the following chapters.

4.4 Sorption Cooler / Leak Problem Investigations

4.4.1 Objective

Objective of this phase was to investigate the reasons for the unacceptable short cooler hold time and to find a work around solution for performing and completing the EQM test phase.

4.4.2 Description of Operation

The investigations are described and documented in test change HP-2-ASED-SD-0058, issue 3.

Reason for the problem with the sorption coolers was found to be a Helium film between L0 interface from EQM and instrument 0.3 K stage. This Helium leak could be caused by Helium leaks in the system.

The investigation started with a detailed leak test of all parts of the He S/S to identify Helium leaks. The two already known Helium leaks at the ISO HTT (see ISO NCR MB-PLM-045, 06.07.89) and at the filling port / CVV interface (see Herschel NCR NC-1319, 03.08.05) were confirmed. No additional leaks were found.

The leak at the filling port / CVV interface was reduced by filling the gaps around the filling port screws and between filling port and CVV with glue RTV 691 A/B.

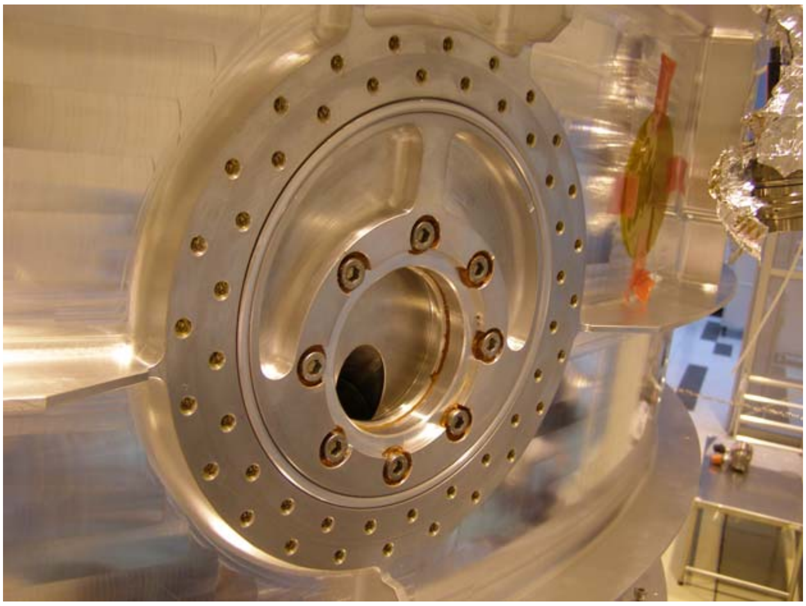

Figure 4.4-1: Gluing of Filling Port / CVV Interface (red "paste")

A new procedure to provide the thermal background for instrument testing was established:

- The HTT was pumped down to < 10 mbar to isolate the leak of the ISO HTT
- Shield cooling was provided by external dewars through SV 121, by pass HTT, shields, V 502
- Pump with turbo pump mounted at SV 922 continuously at the isolation vacuum

4.4.3 Summary Test Results / Cryostat Behaviour

The global leak rate at beginning of the investigations was 4.7 x 10^{-6} mbarl/s, measured with the leak detector connected direct at the CVV airlock SV 922. The HTT was at He I temperature and the AXT at about 1.9 K.

The He S/S was sequentially evacuated. The leak rate of the completely evacuated He S/S was about 2 x 10^{-8} mbarl/s (HTT and AXT at ~ 40 K). The leak rate increased significantly to ~ 9 x 10^{-6} mbarl/s when the filling port (and shield tubing) was flushed with He. It further increased to > 2.7 x 10^{-5} mbarl/s when the HTT was filled with He gas.

The leak rate was reduced to < 6.5 x 10^{-6} mbarl/s after gluing with RTV 691 as described above.

Mass spectrometer measurements confirmed the leak rate measurements. The partial pressure of He^4 at begin of the investigations was 3.2 x 10^{-7} mbar. At the end of the investigation phase the partial pressure of He^4 was 2.7 x 10^{-8} mbar with HTT at 150 mbar and the AXT partly filled with He II.

The instrument tests after the investigation phase confirmed the success of the sealing and isolating of the HTT leak. The cooler hold time did not degrade throughout the rest of the EQM test phase.

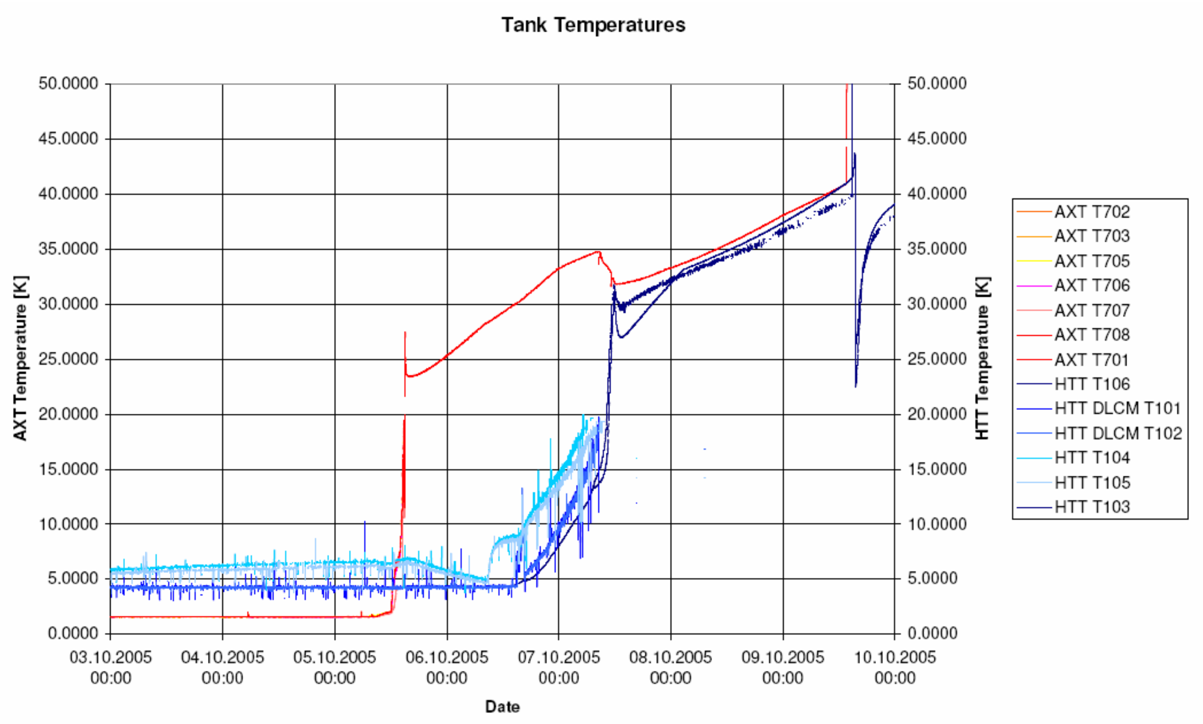

Figure 4.4-2: Tank Temperatures during Investigations (1st week)

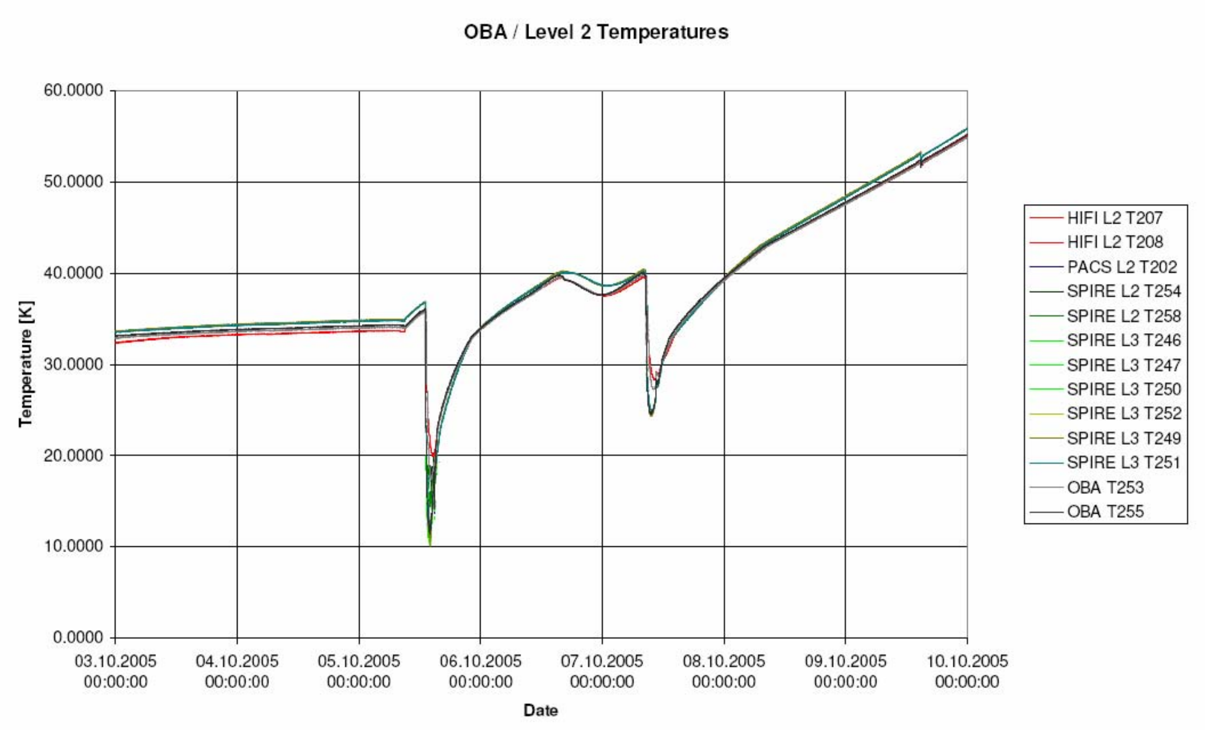

Figure 4.4-3: OBA / Level 2 Temperatures during Investigations (1st week)

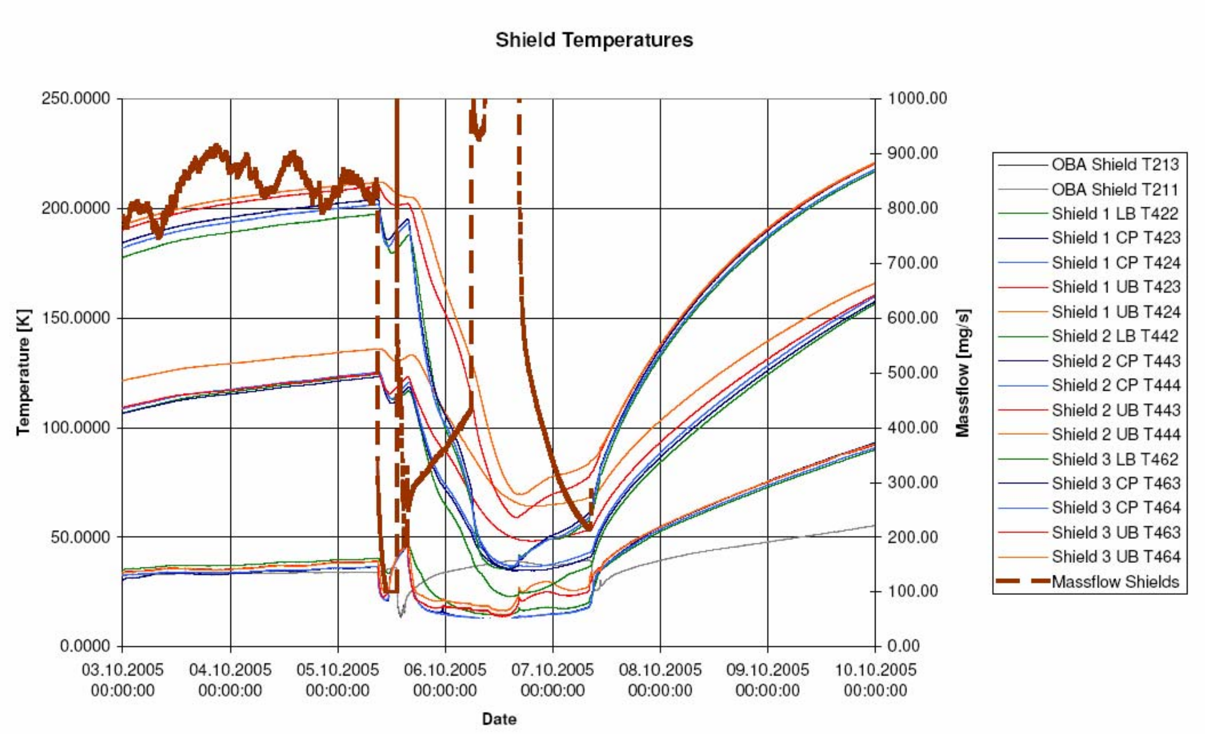

Figure 4.4-4: Shield Temperatures during Investigations (1st week)

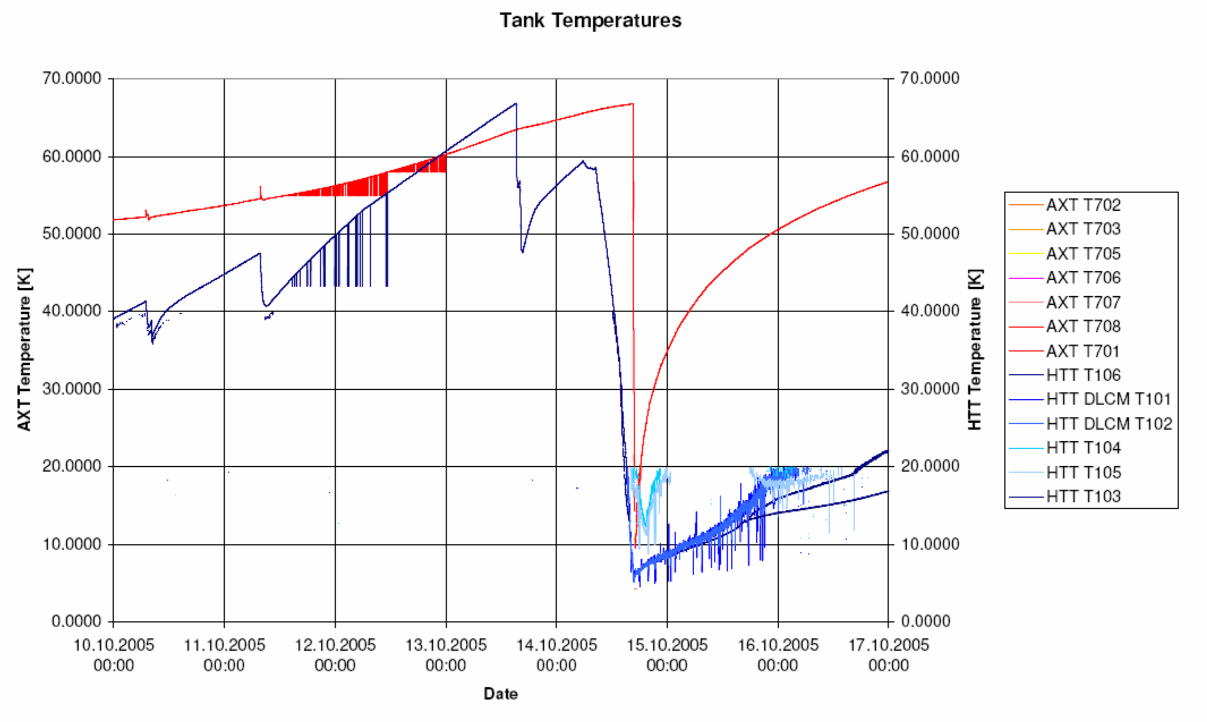

Figure 4.4-5: Tank Temperatures during Investigations (2nd week)

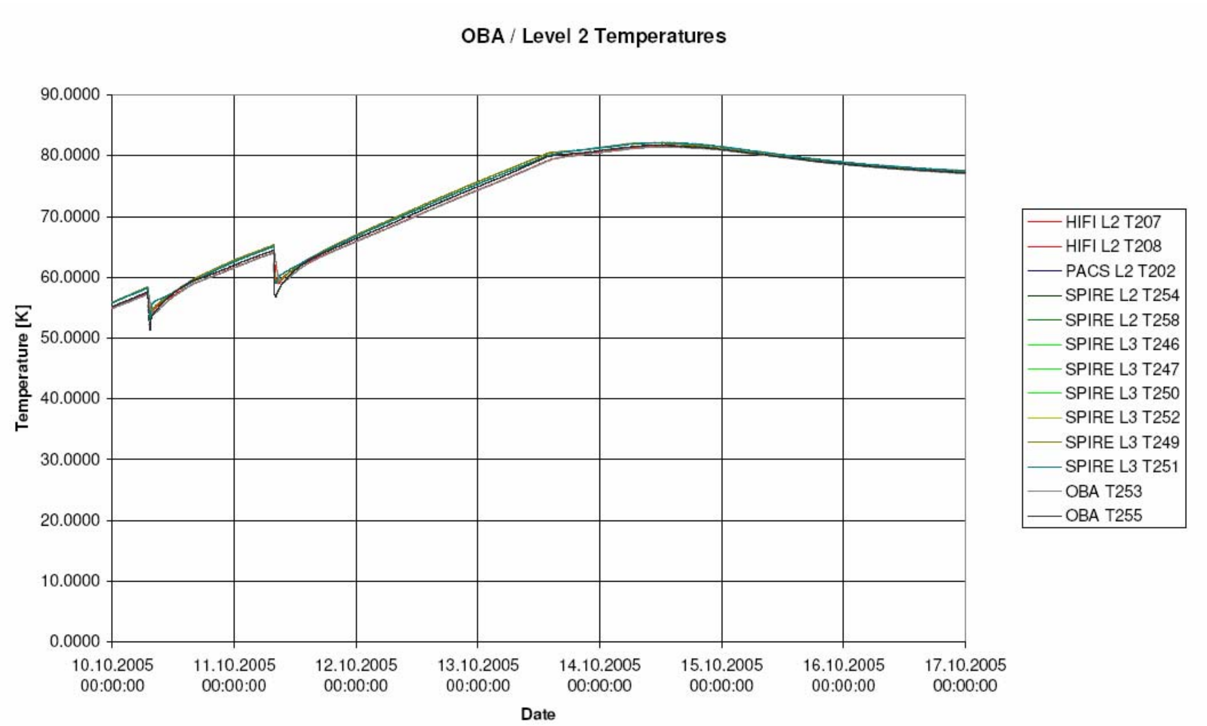

Figure 4.4-6: OBA / Level 2 Temperatures during Investigations (2nd week)

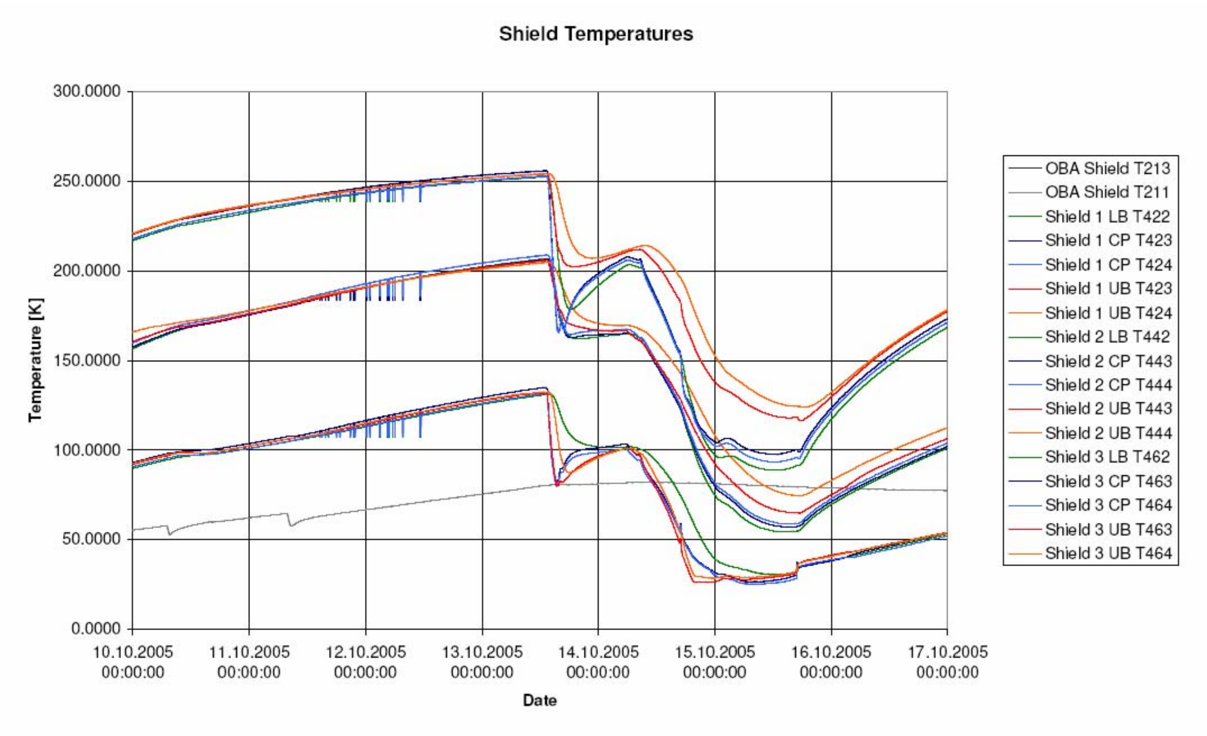

Figure 4.4-7: Shield Temperatures during Investigations (2^{nd} week)

4.4.4 Problems / Deviations

No additional problems occurred during the investigation phase.

4.4.5 Lessons Learnt

The sorption coolers react quite sensitive even on small amounts of Helium inside the CVV. Even the large areas with adsorbers did not avoid that a Helium film formed at the thermal links. Therefore no Helium leak is tolerable on PFM, even if there is no risk the cryostat itself.

4.5 Cryostat Operation during Instrument Tests Phase 2

4.5.1 Objective

Objective was to provide the specified L0, L1, L2 and L3 temperatures for the instrument testing.

4.5.2 Description of Operation

The required temperatures were achieved by continuously pumping via V 512 and OBA at the AXT while the thermal shields were cooled by a Helium flow from an external dewar through SV 121, by pass the evacuated HTT, then shields and V 502.

Helium flow through the OBA was increased by heating the AXT with some hundreds of milliwatt to improve cooling of the instrument interface temperatures.

In parallel, the cover was cooled for PACS and SPIRE tests (see section 4.6 for details).

All cryostat data were transferred to the I-EGSE.

4.5.3 Summary Test Results / Cryostat Behaviour

The EQM tests were restarted on 19.10.05 with a PACS sorption cooler test.

As described above the pumping unit I was continuously pumping at the AXT while the mass flow through the OBA was increased by heating the tank. Due to the higher mass flow, the AXT had to be refilled each end of the week and pumped down to about 1.65 K over the weekend.

The required temperatures could be provided during instrument testing. The AXT was at ~ 1.65 K during instrument testing. The L0 temperatures were around 1.8 K. The HTT was at about 30 K @ 150 mbar. It was pumped down to less than 20 mbar on 29.10.05 and was kept evacuated until end of the EQM tests.

In this test phase two LHe supply dewars had to be connected permanently to the EQM: one was used to cool the thermal shields and the second one was connected with the cryostat cover cooling loop. The LHe transfer line was recovered according procedure at each exchange of the shield cooling dewar. Exchange of the cover cooling dewar is described in section below,

The turbo pump was continuously pumping at the CVV to help avoiding further problems with the sorption coolers.

The cryostat was operated most of the time in extended single shift. During the last week of testing we organised a double shift for cryostat operation to get most out of the available instrument testing time. An early start of the cryostat team ensured better cryostat stabilities when the instrument teams arrive.

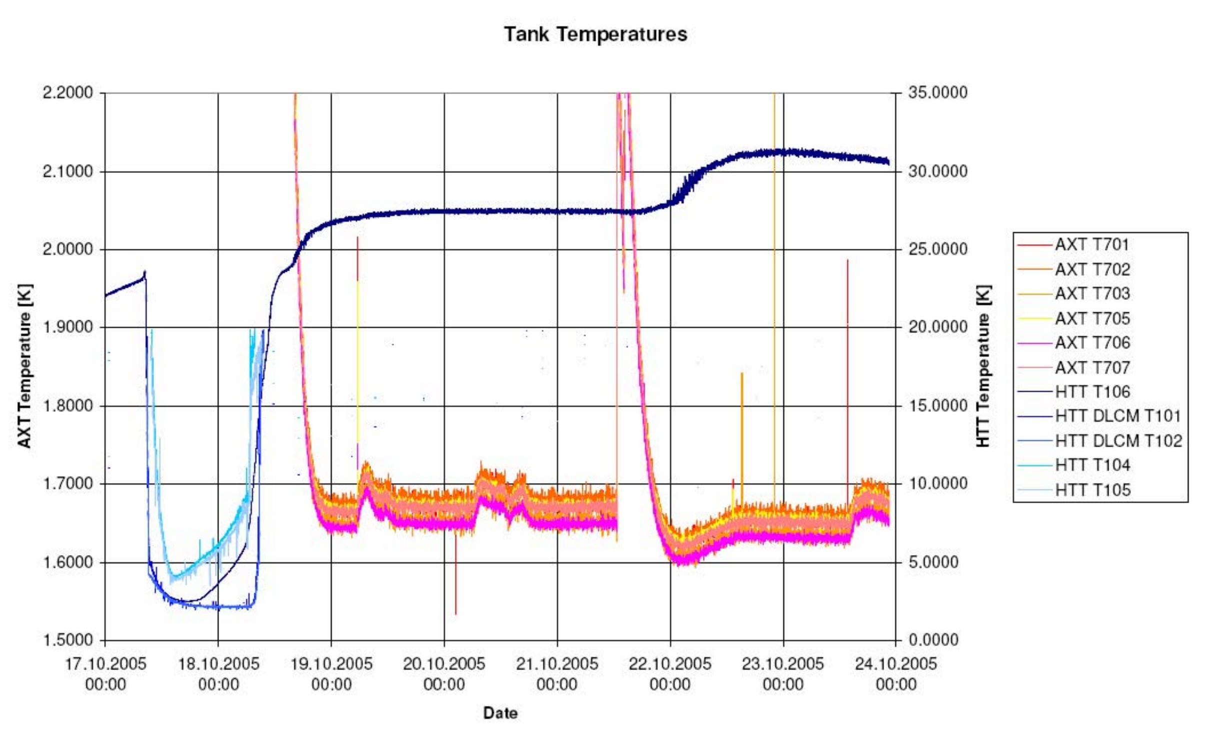

Figure 4.5-1: Tank Temperatures during PACS IMT

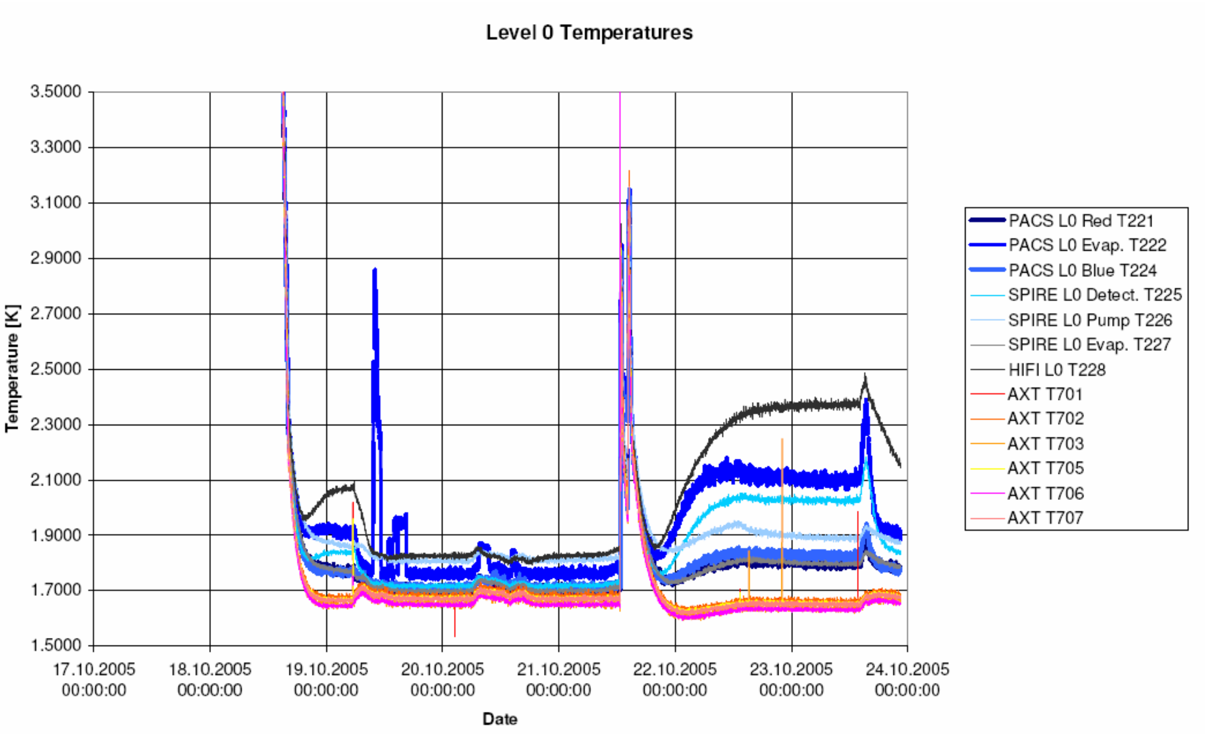

Figure 4.5-2: Level 0 Temperatures during PACS IMT

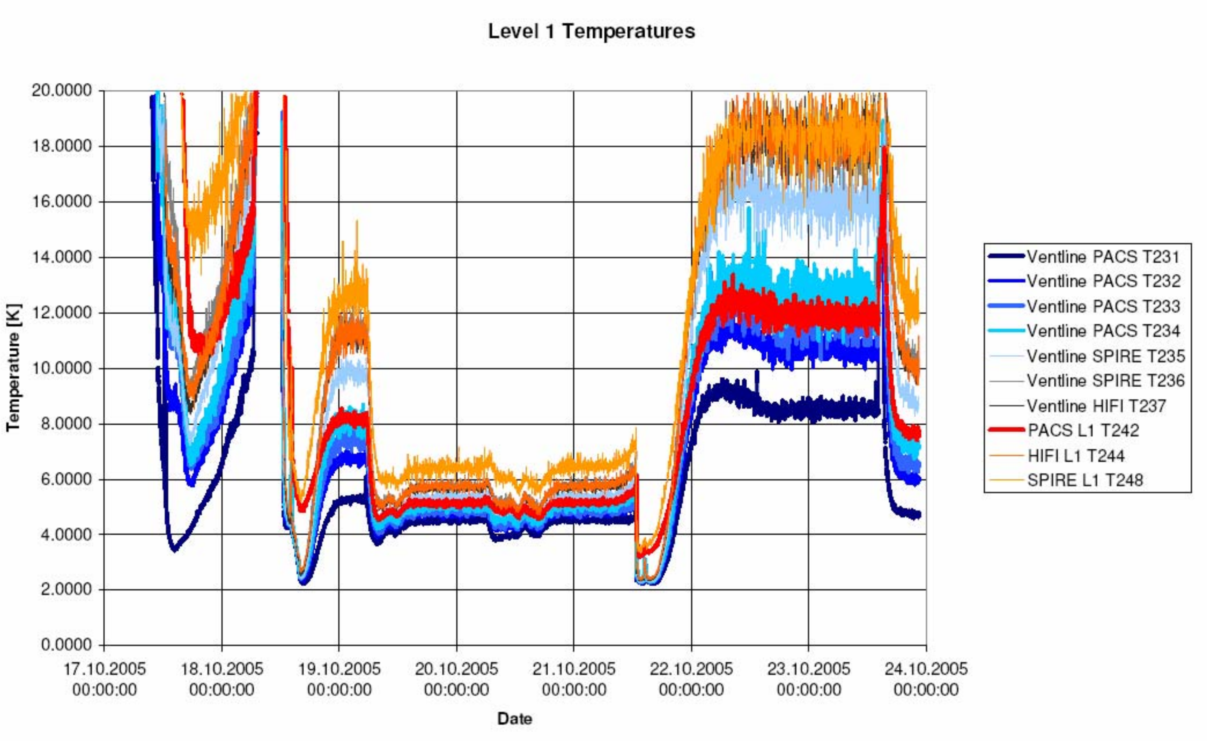

Figure 4.5-3: Level 1 Temperatures during PACS IMT

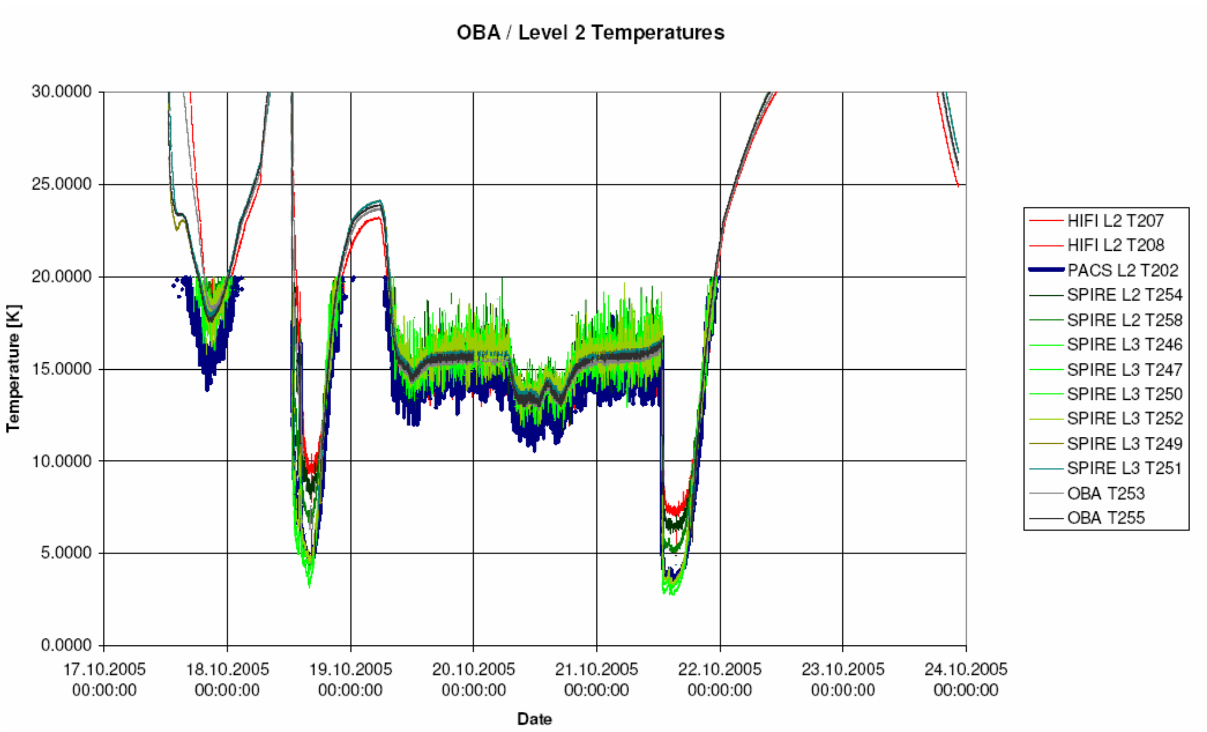

Figure 4.5-4: OBA / Level 2 Temperatures during PACS IMT

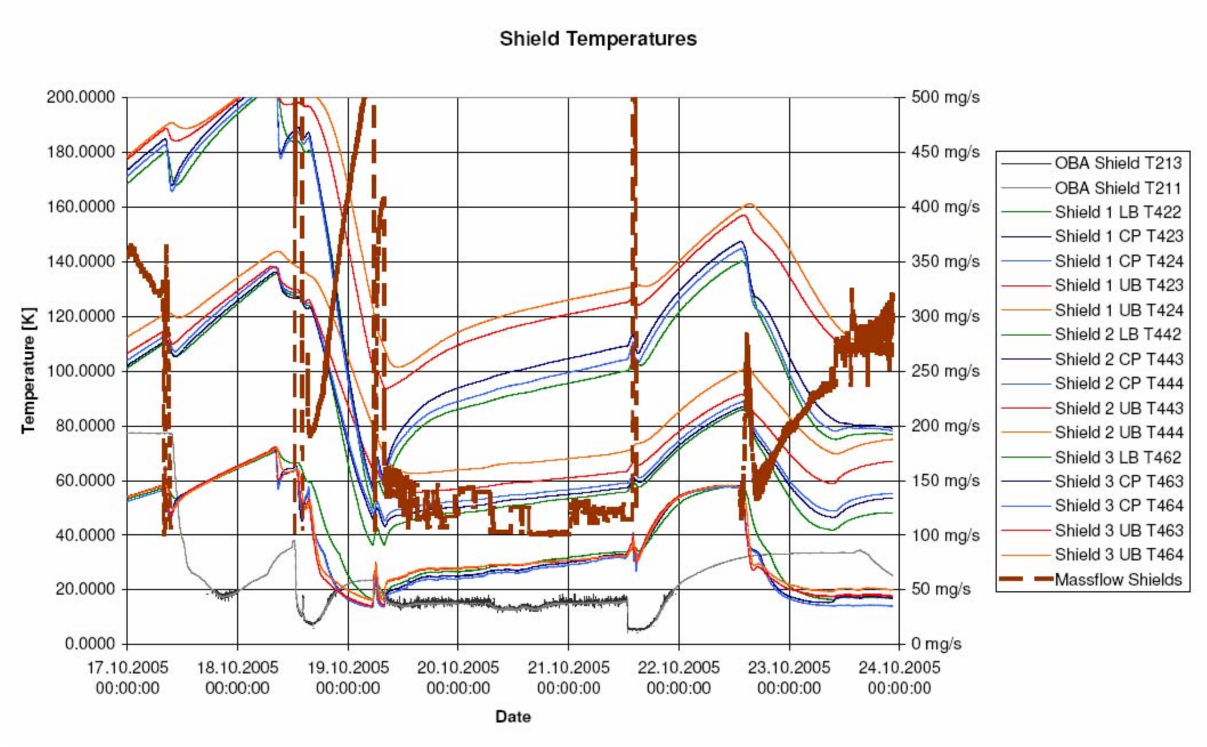

Figure 4.5-5: Shield Temperatures during PACS IMT

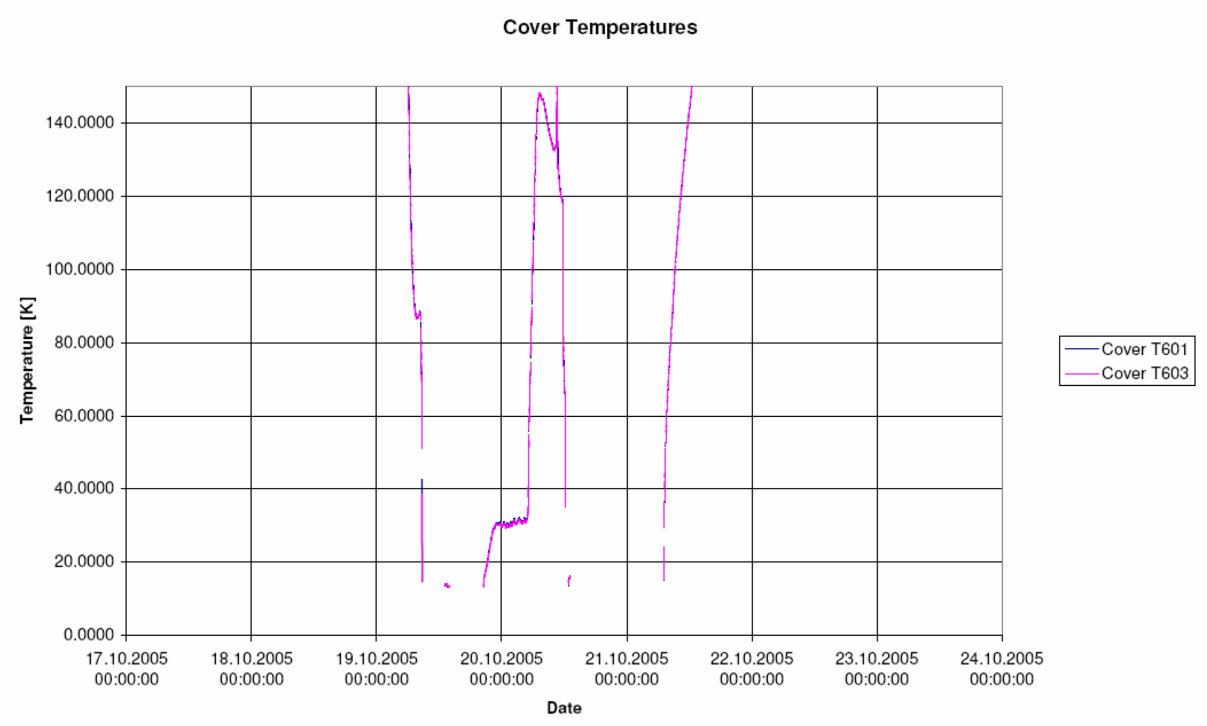

Figure 4.5-6: Cover Temperatures during PACS IMT

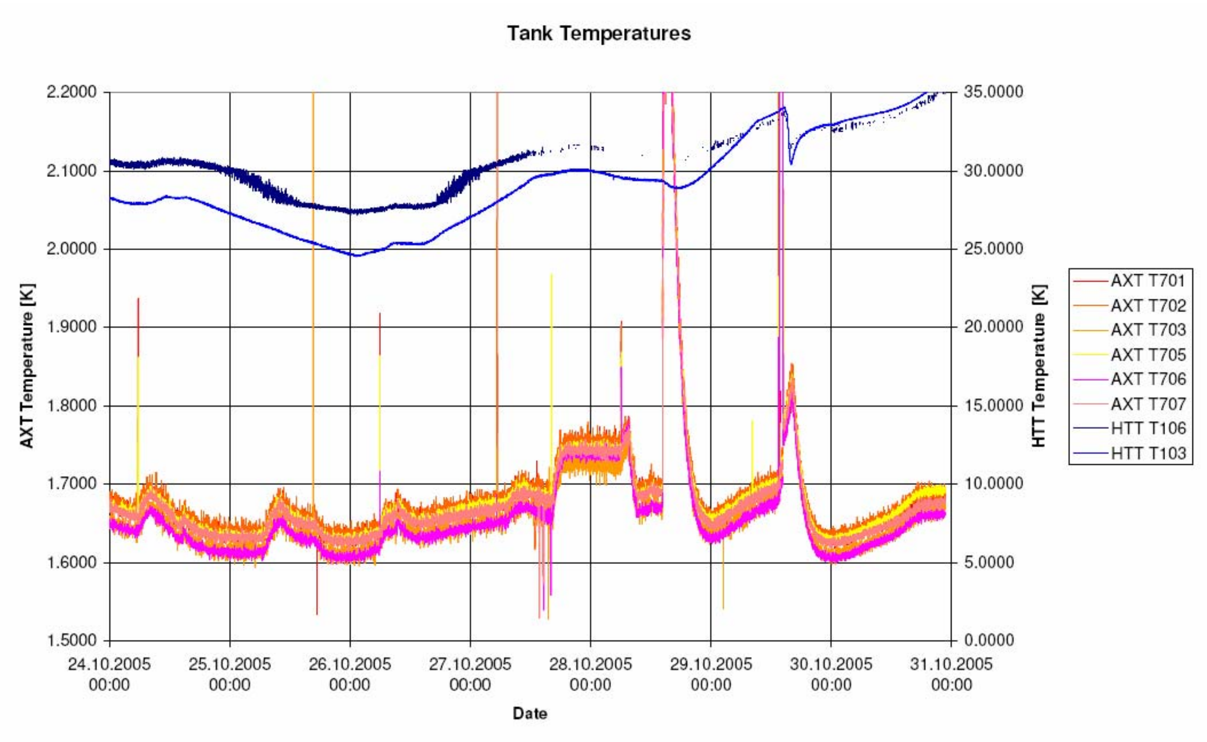

Figure 4.5-7: Tank Temperatures during SPIRE IMT

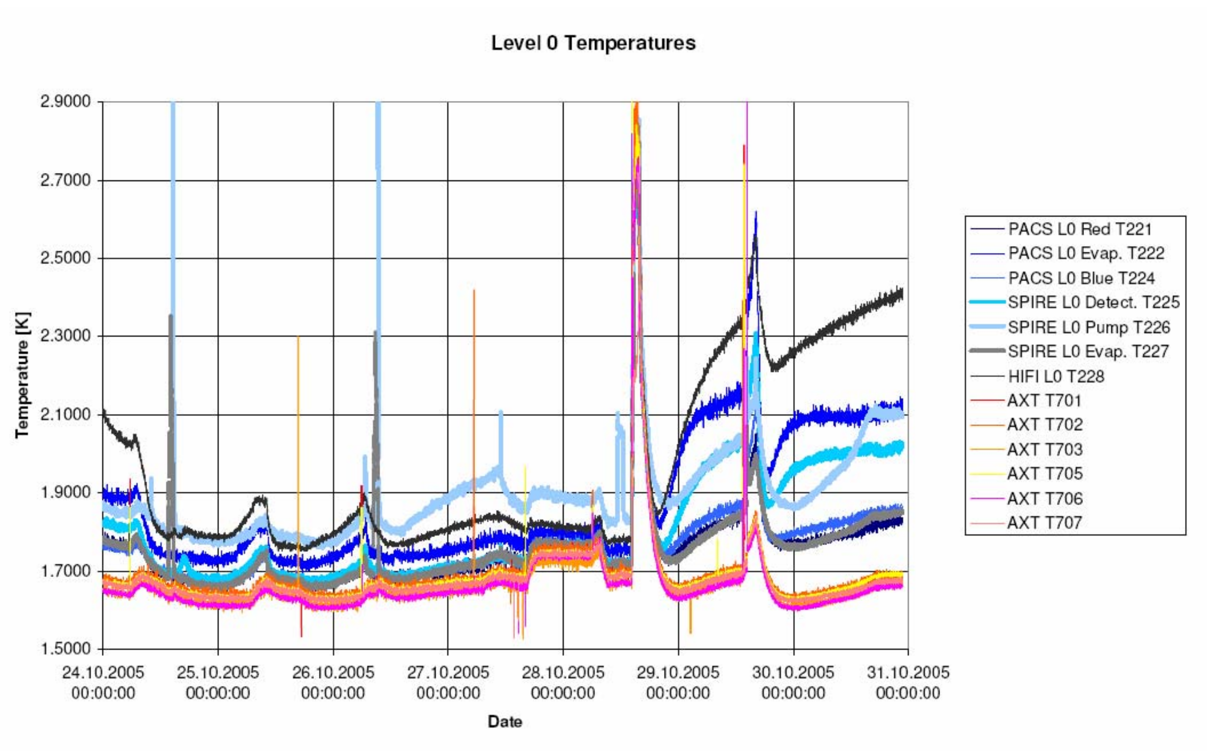

Figure 4.5-8: Level 0 Temperatures during SPIRE IMT

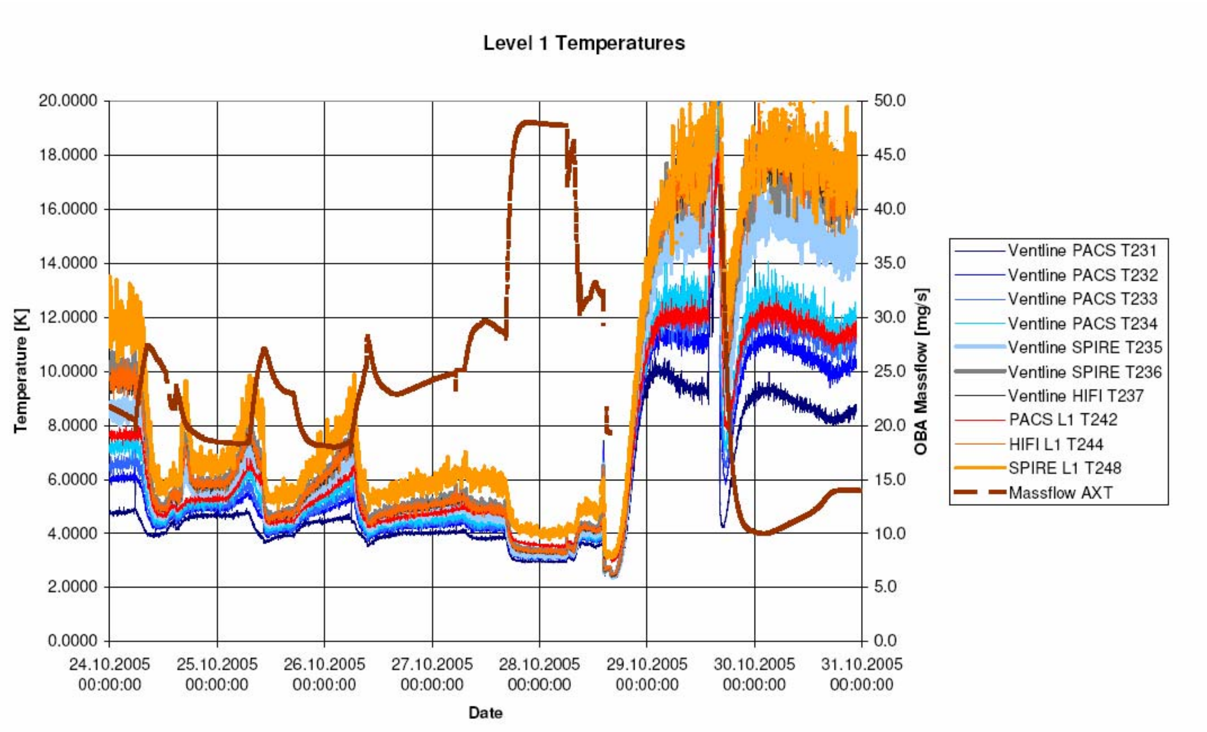

Figure 4.5-9: Level 1 Temperatures during SPIRE IMT

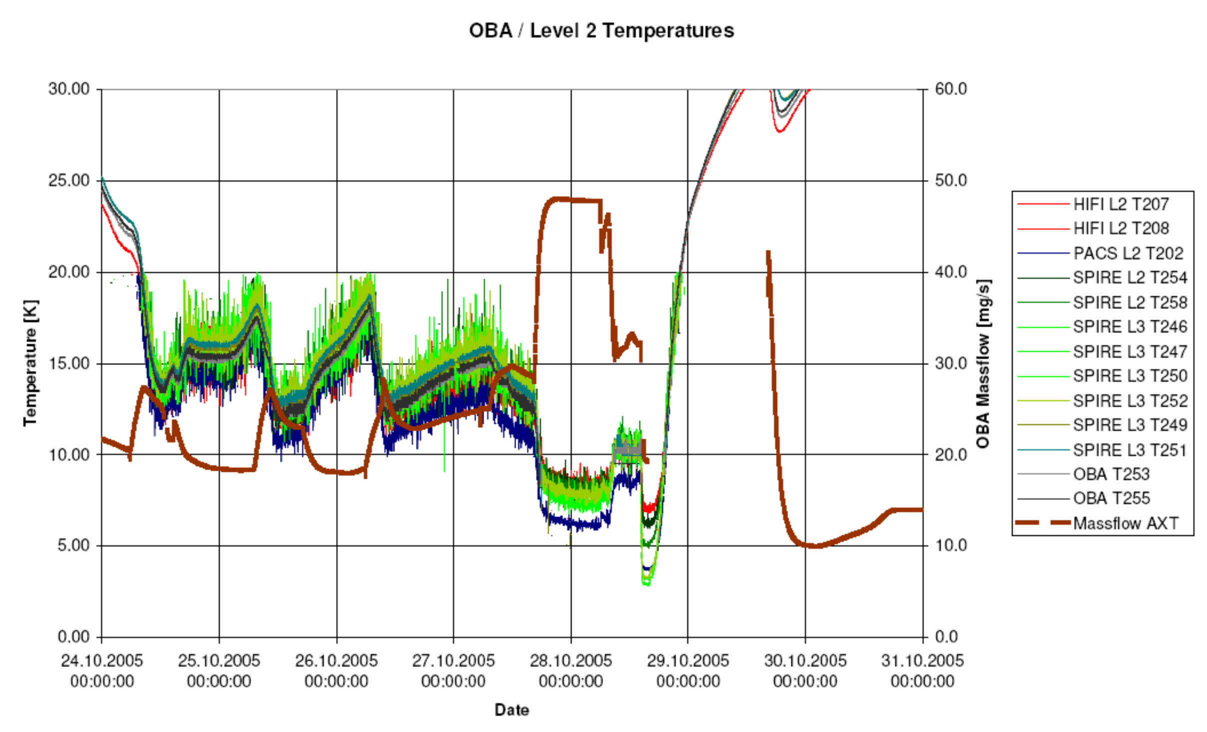

Figure 4.5-10: OBA / Level 2 Temperatures during SPIRE IMT

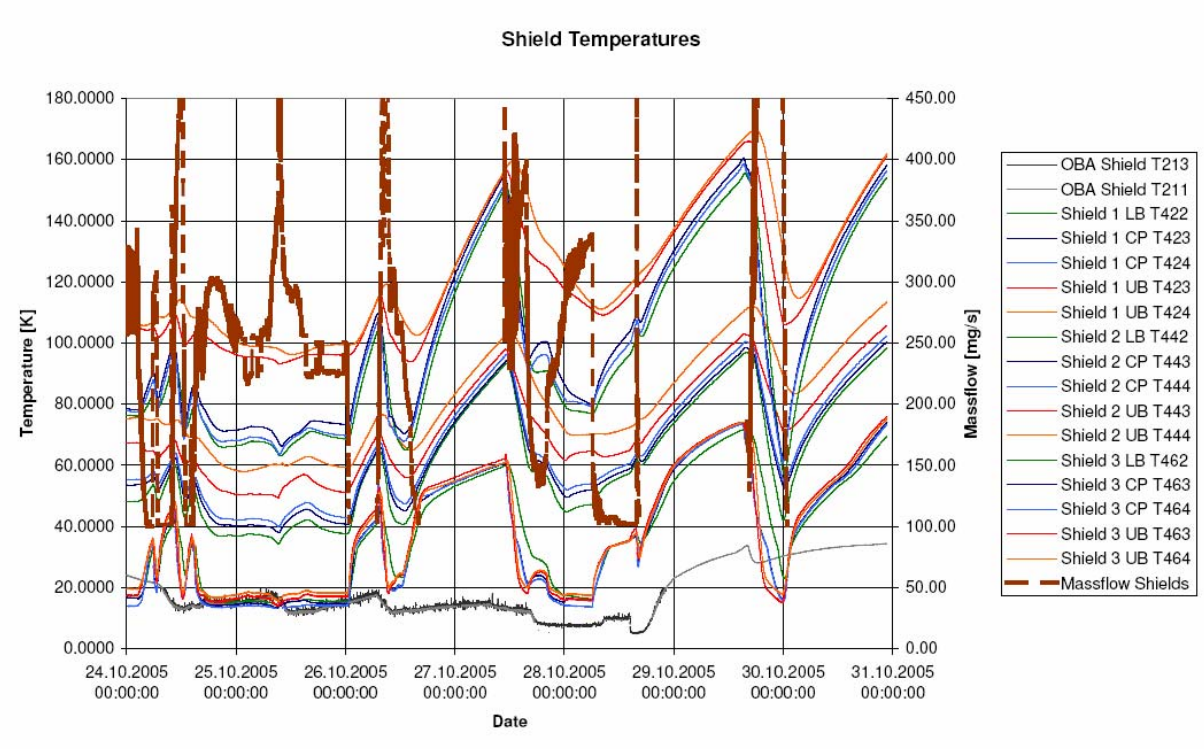

Figure 4.5-11: Shield Temperatures during SPIRE IMT

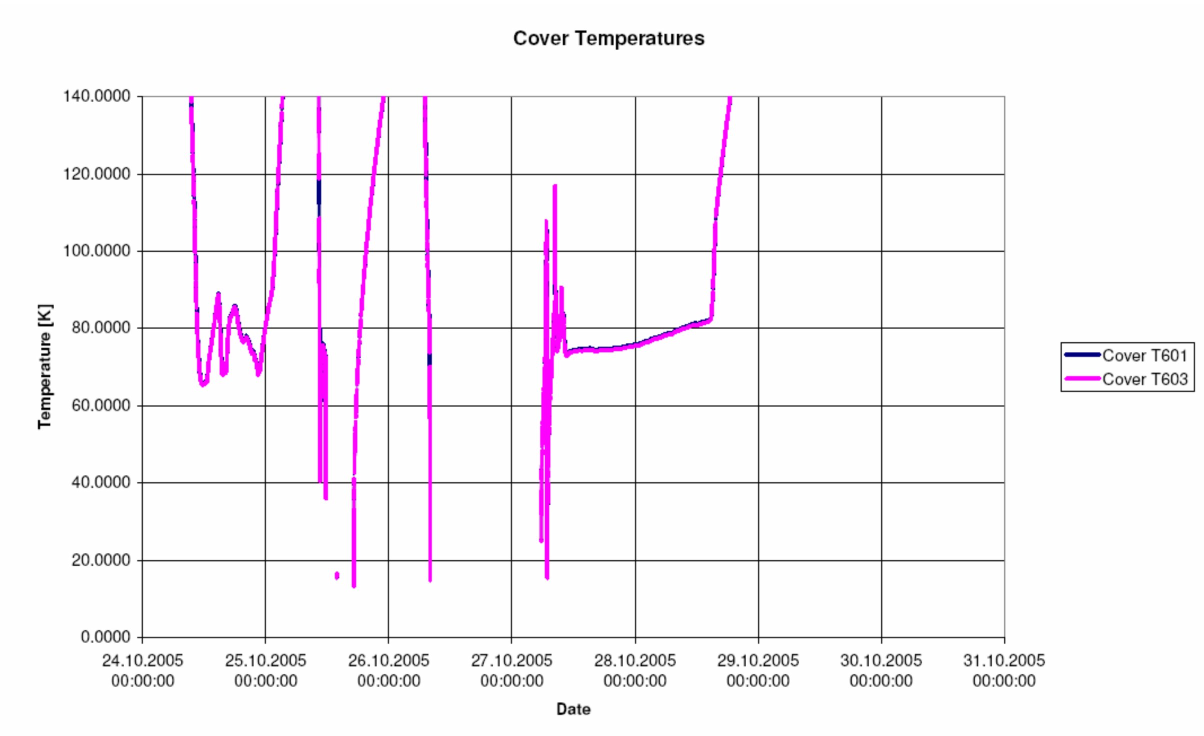

Figure 4.5-12: Cover Temperatures during SPIRE IMT

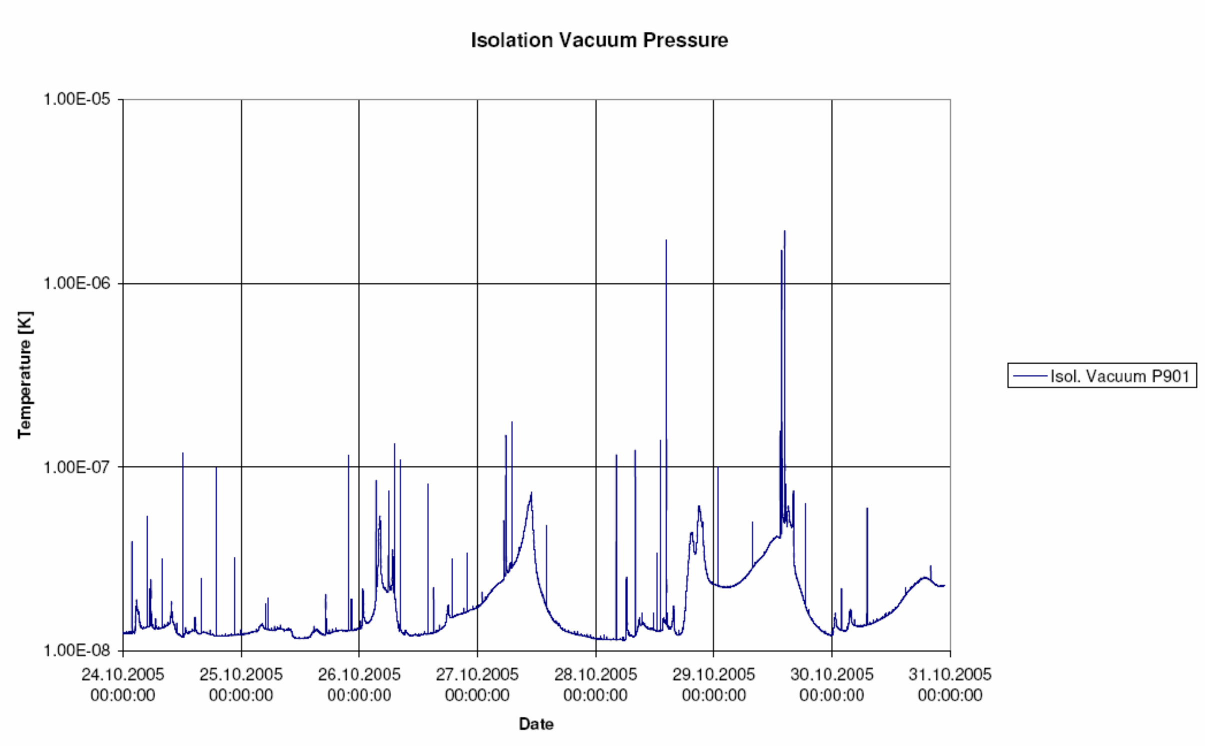

Figure 4.5-13: Isolation Vacuum during SPIRE IMT

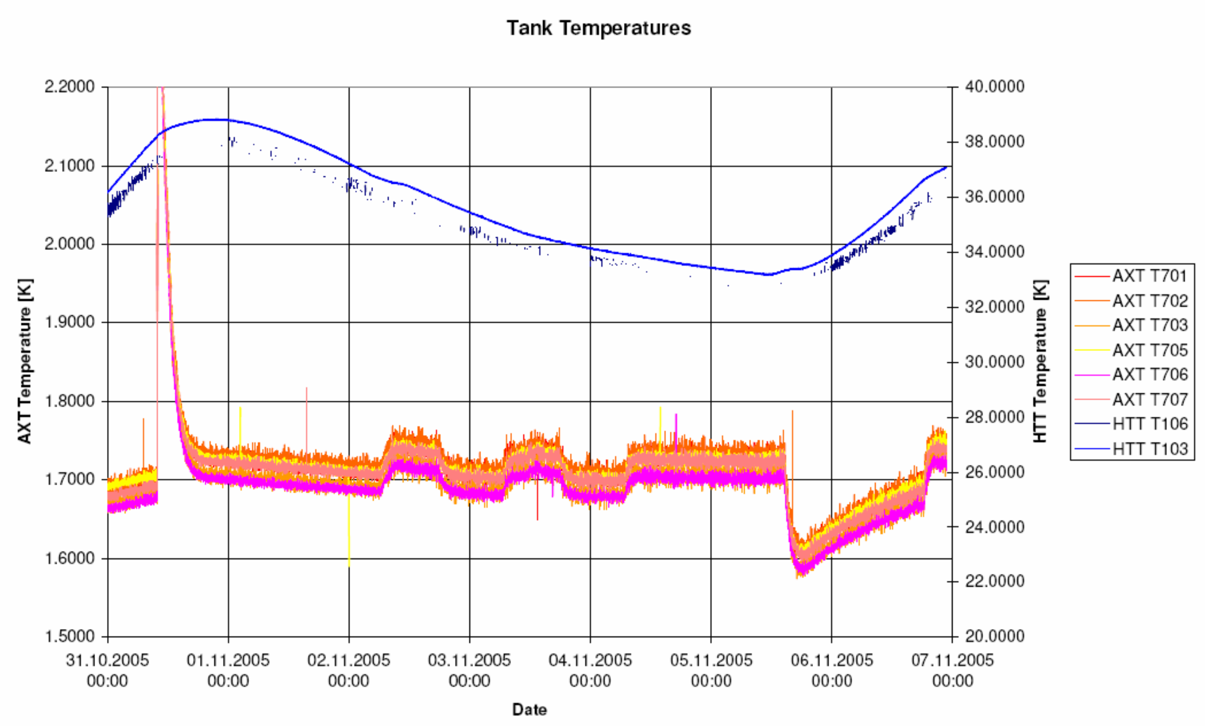

Figure 4.5-14: Tank Temperatures during Parallel Mode

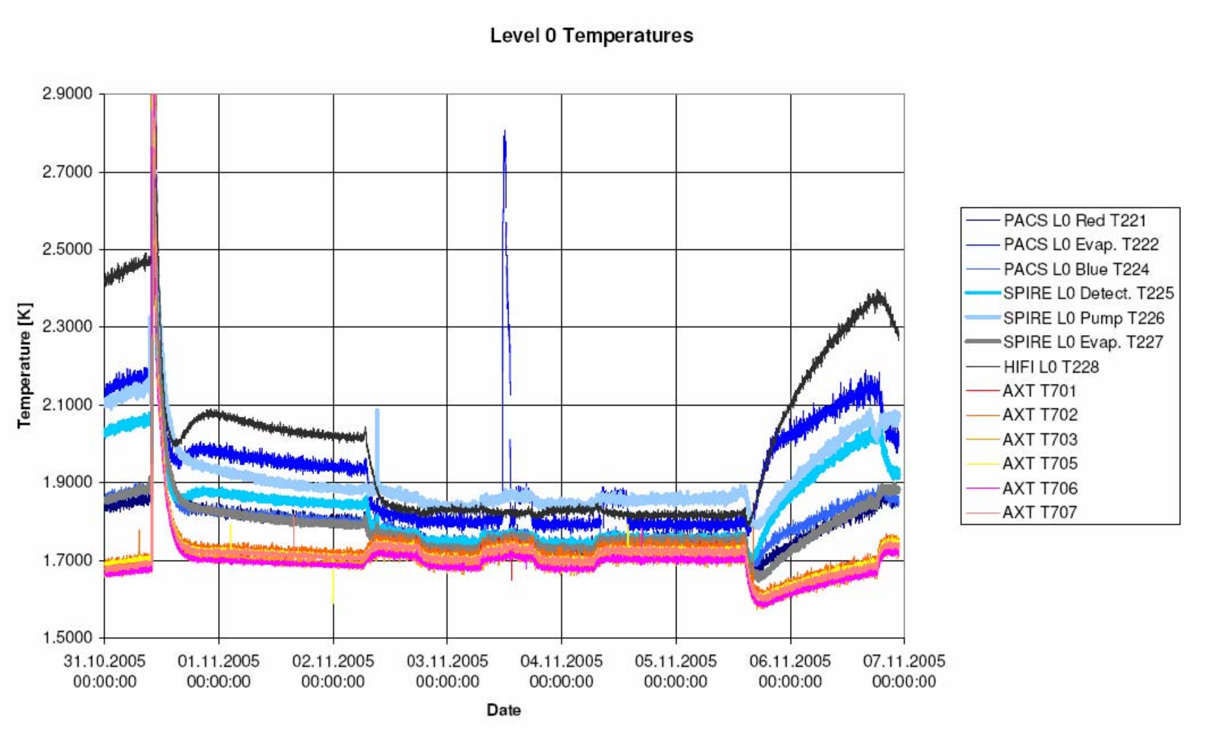

Figure 4.5-15: Level 0 Temperatures during Parallel Mode

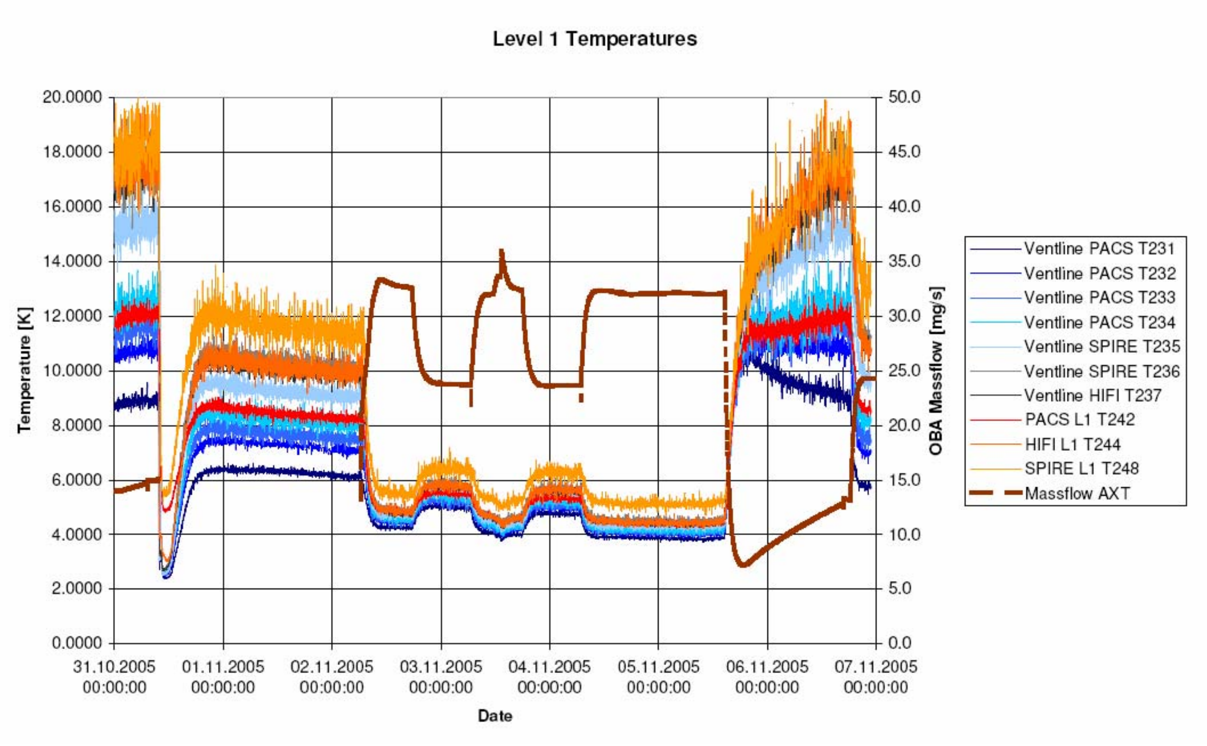

Figure 4.5-16: Level 1 Temperatures during Parallel Mode

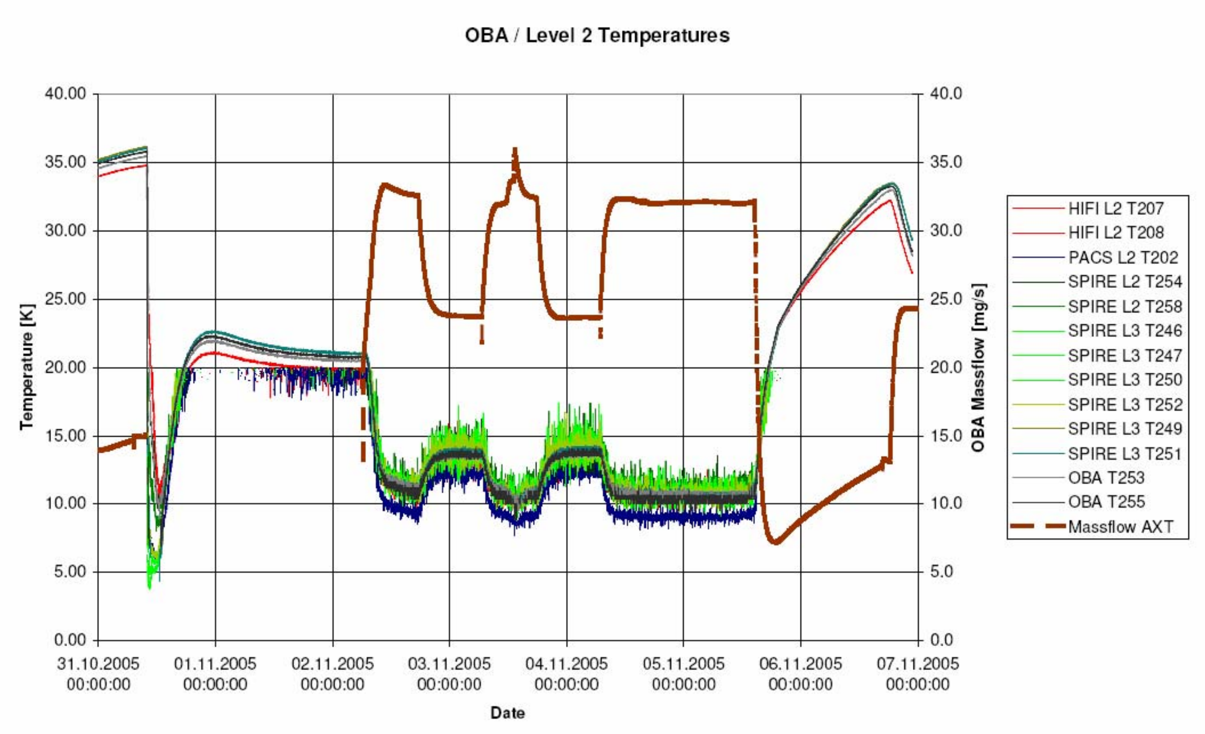

Figure 4.5-17: OBA / Level 2 Temperatures during Parallel Mode

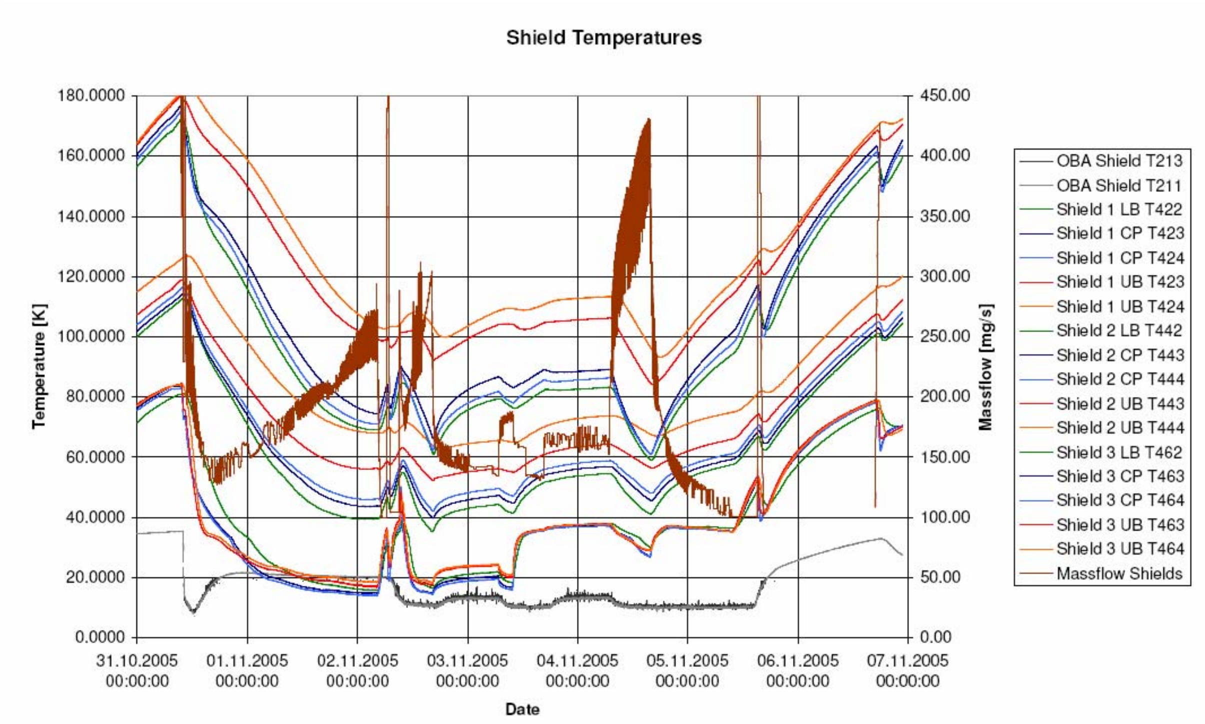

Figure 4.5-18: Shield Temperatures during Parallel Mode

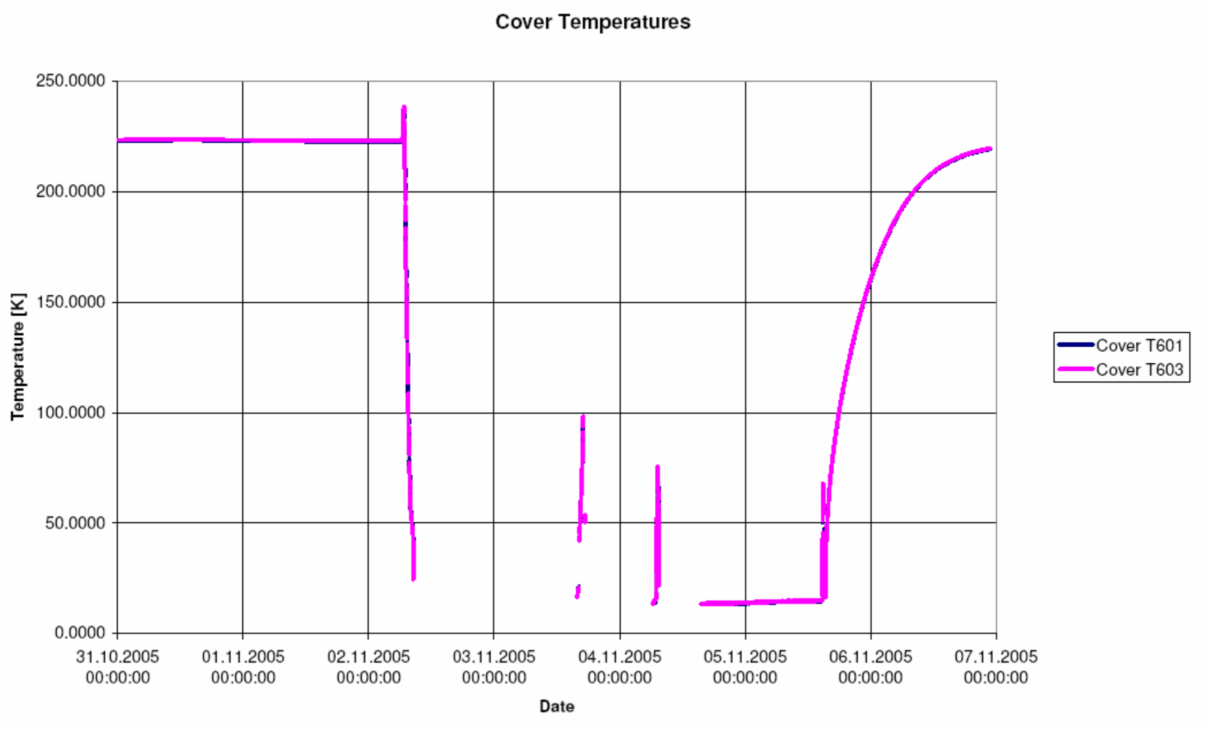

Figure 4.5-19: Cover Temperatures during Parallel Mode

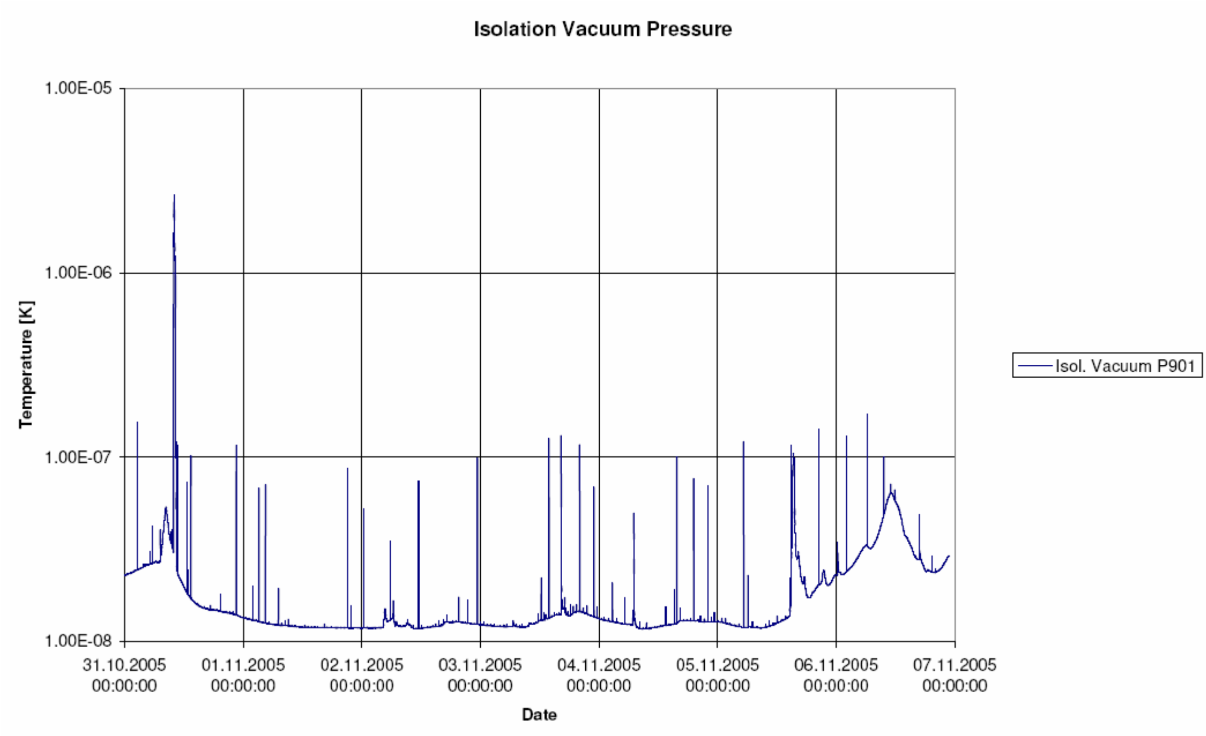

Figure 4.5-20: Isolation Vacuum during Parallel Mode

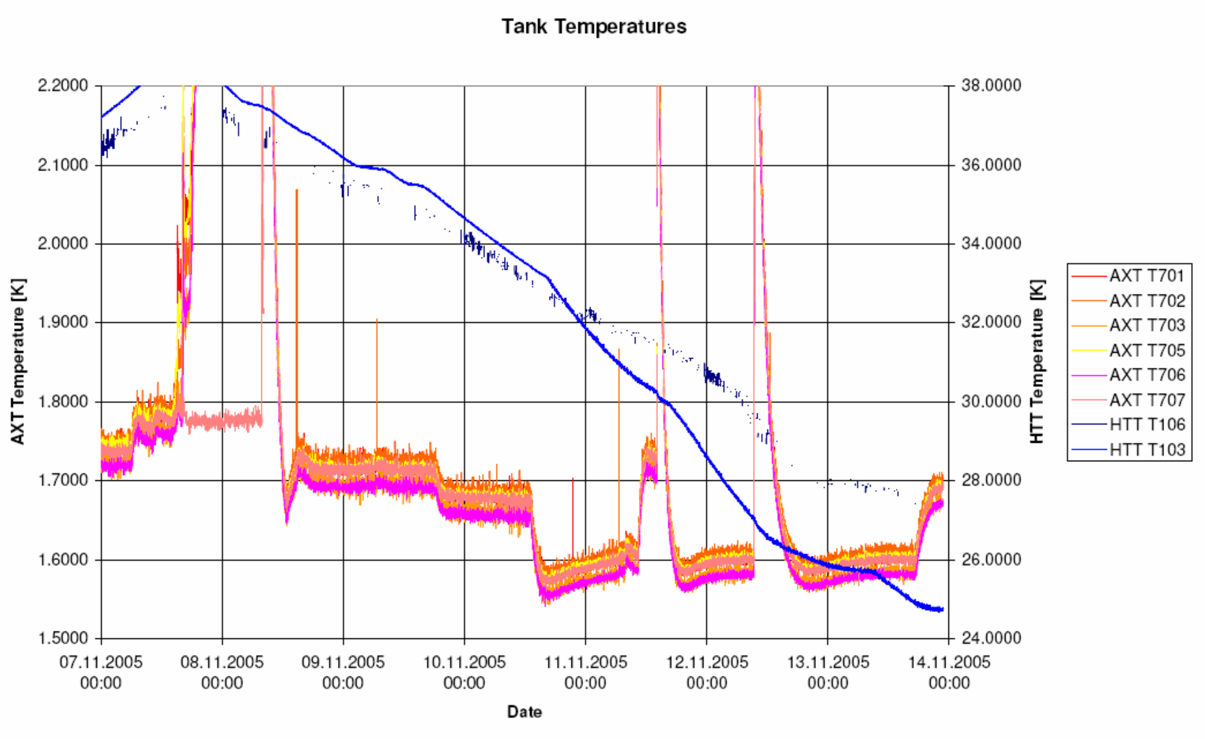

Figure 4.5-21: Tank Temperatures during PACS IMT

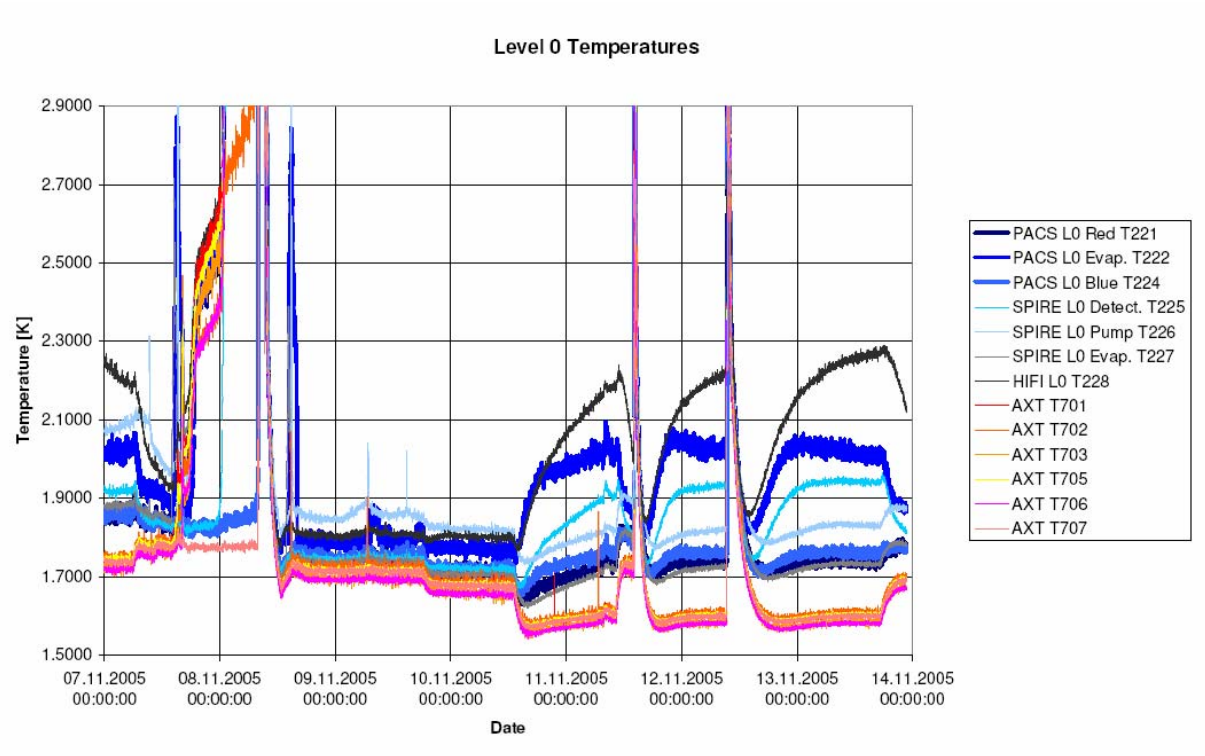

Figure 4.5-22: Level 2 Temperatures during PACS IMT

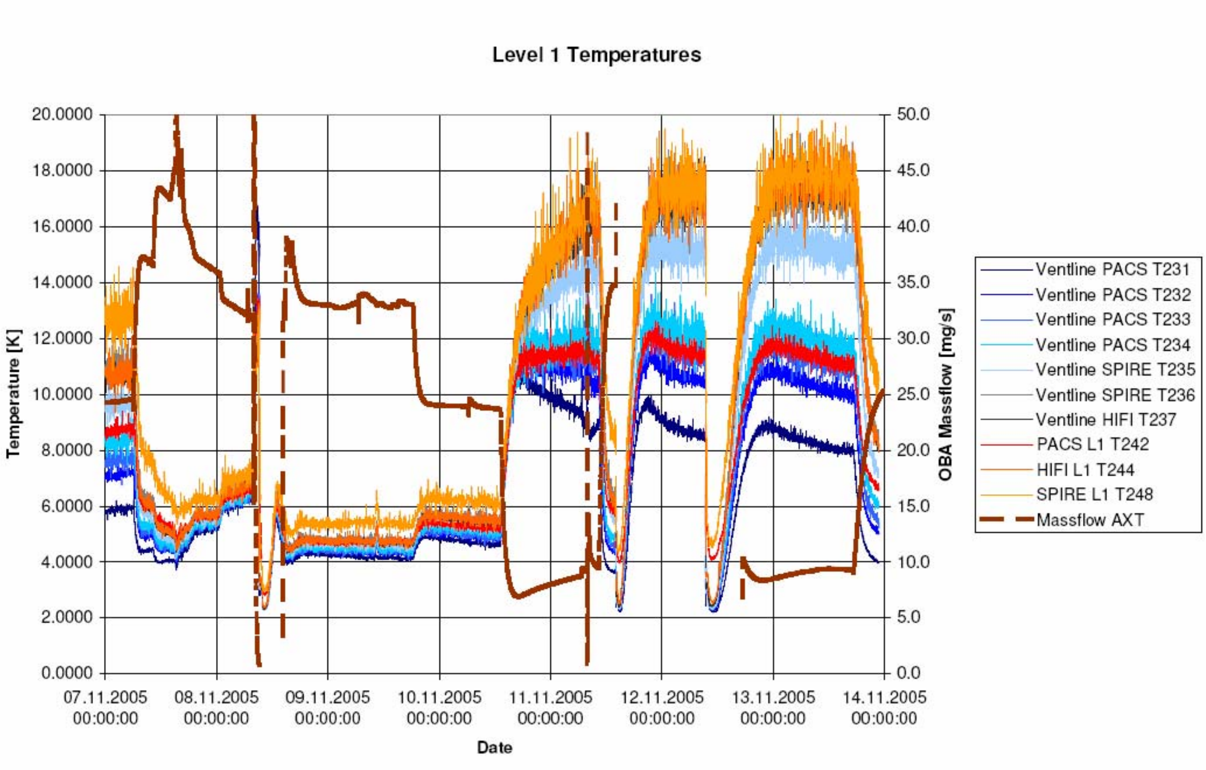

Figure 4.5-23: Level 1 Temperatures during PACS IMT

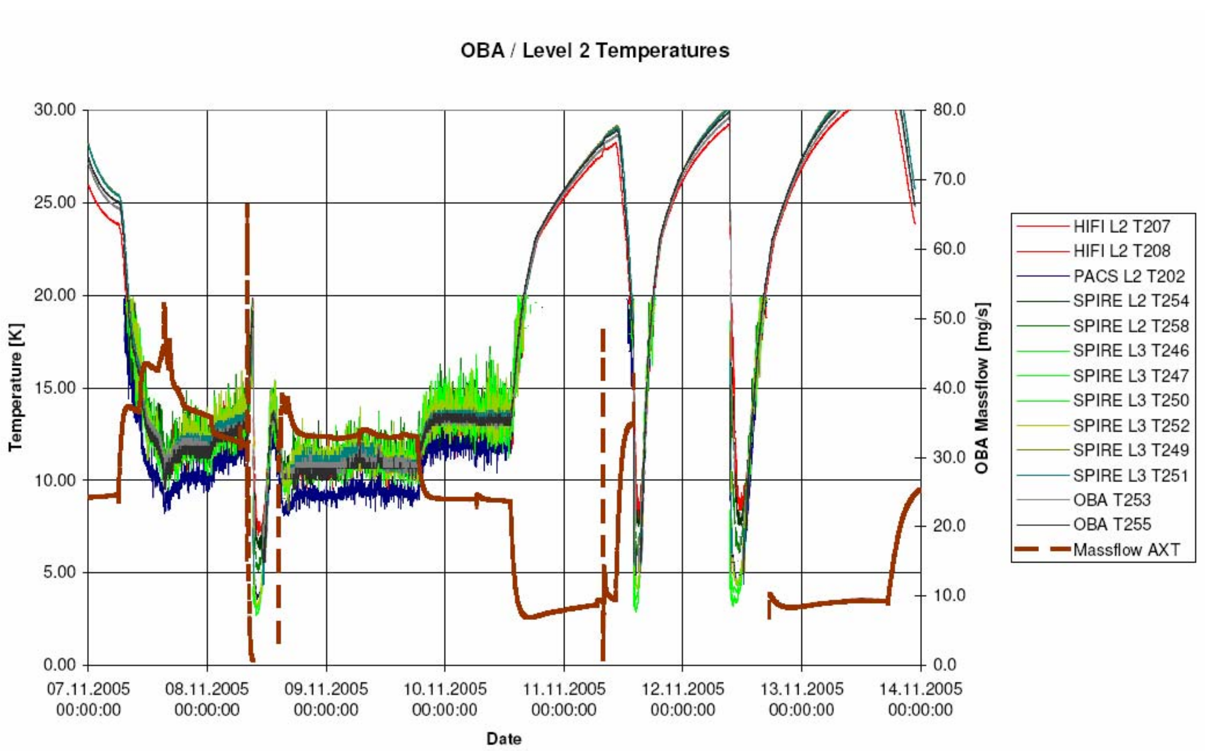

Figure 4.5-24: OBA / Level 2 Temperatures during PACS IMT

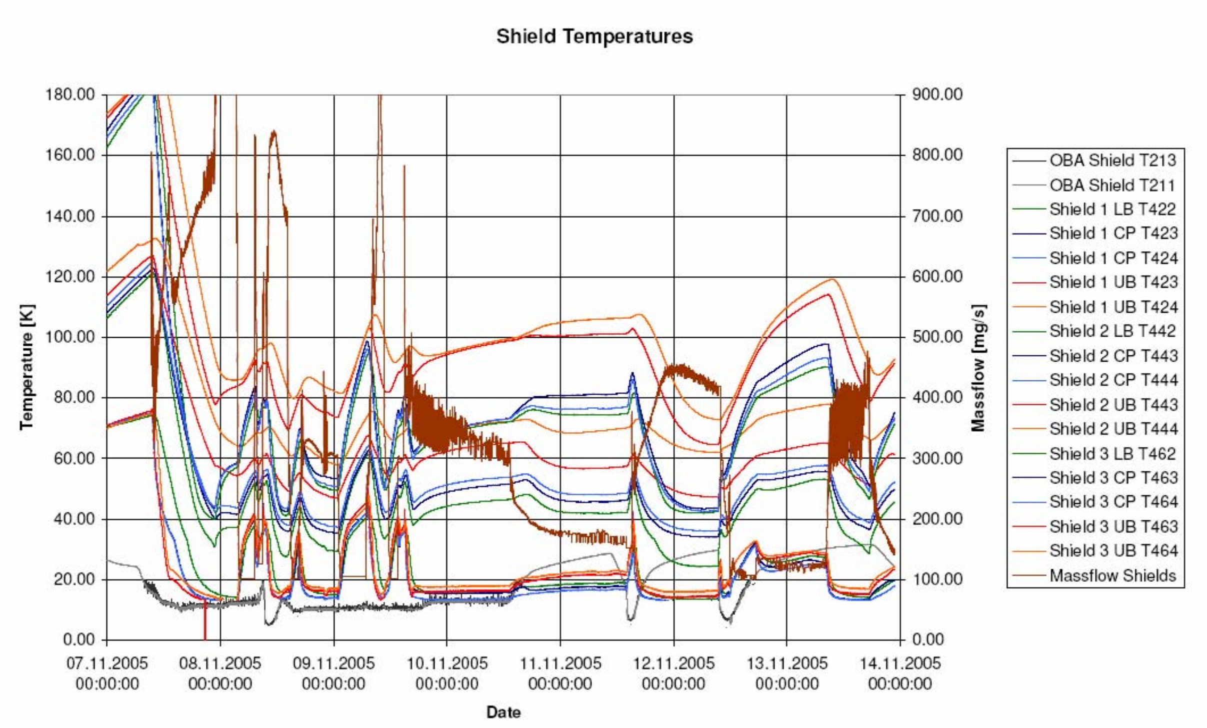

Figure 4.5-25: Shield Temperatures during PACS IMT

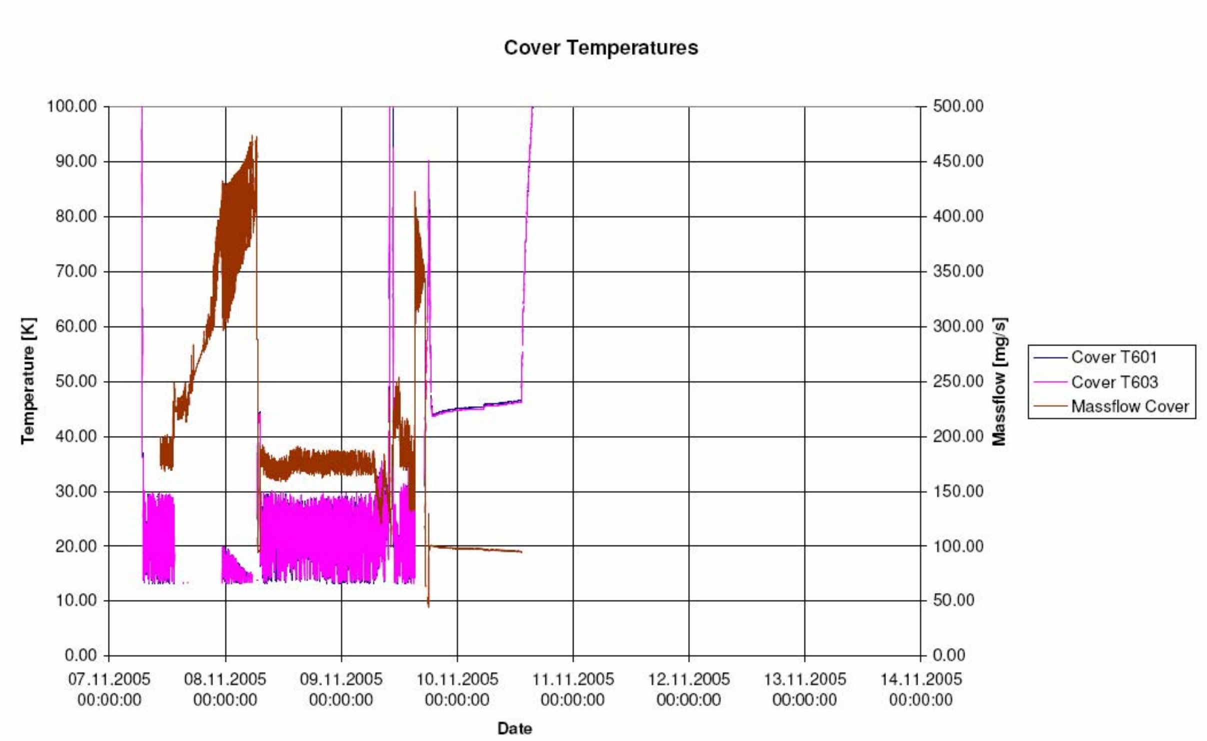

Figure 4.5-26: Cover Temperatures during PACS IMT

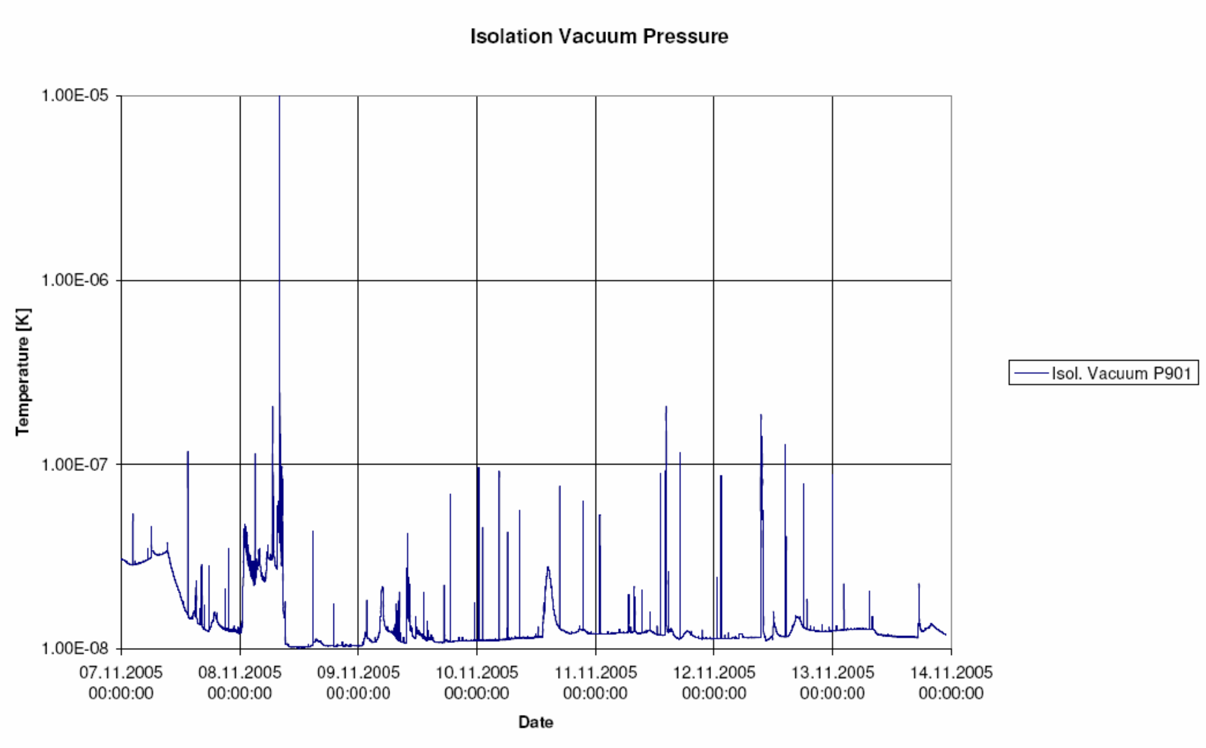

Figure 4.5-27Isolation Vacuum during PACS IMT

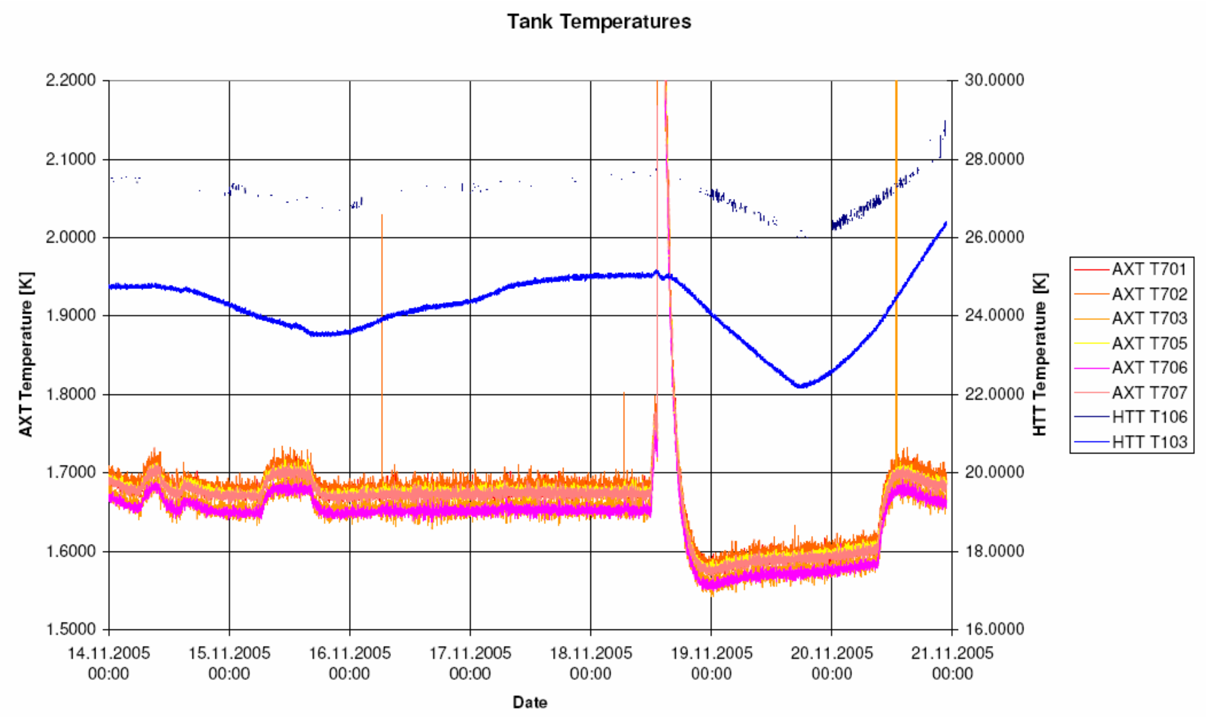

Figure 4.5-28: Tank Temperatures during HIFI EMC Test

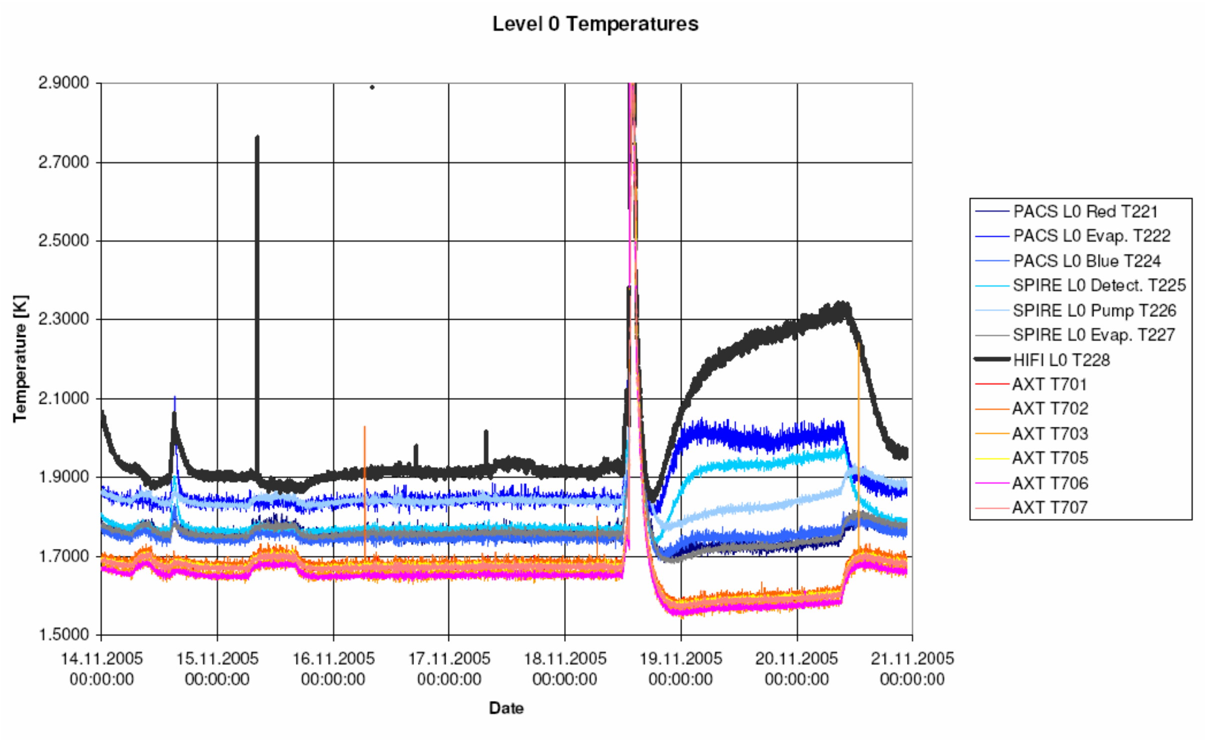

Figure 4.5-29: Level 0 Temperatures during HIFI EMC Test

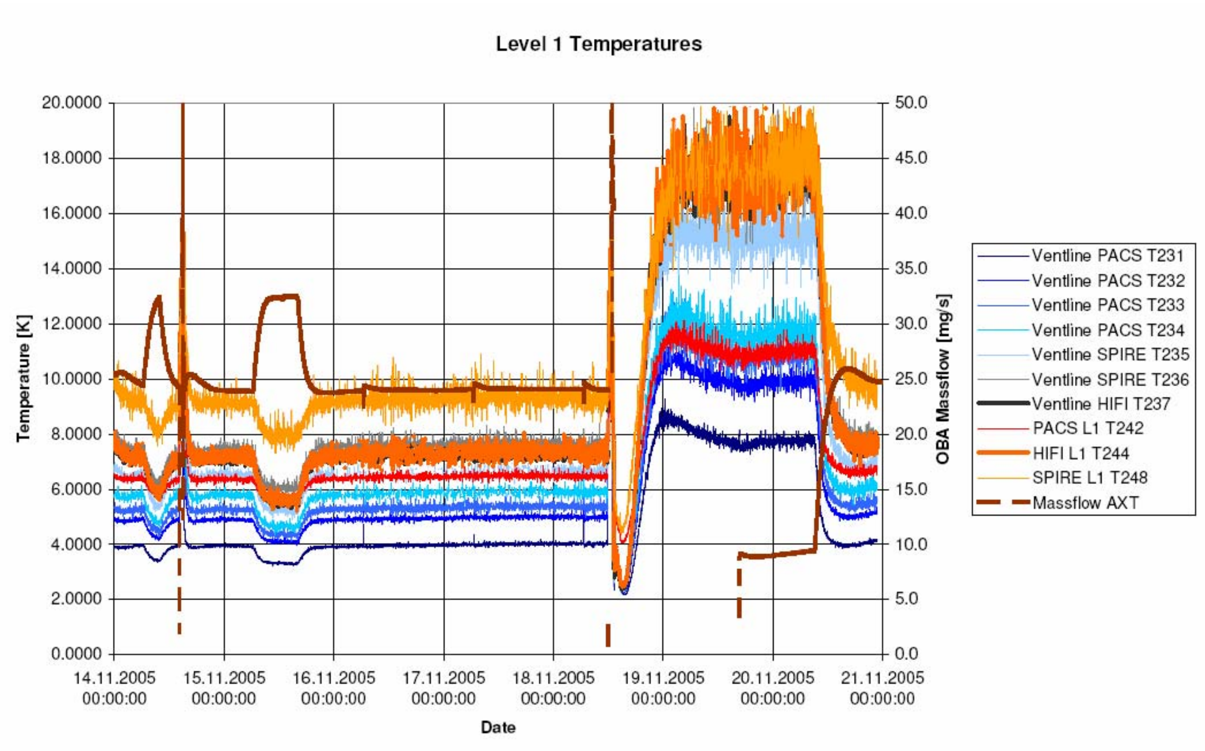

Figure 4.5-30: Level 1 Temperatures during HIFI EMC Test

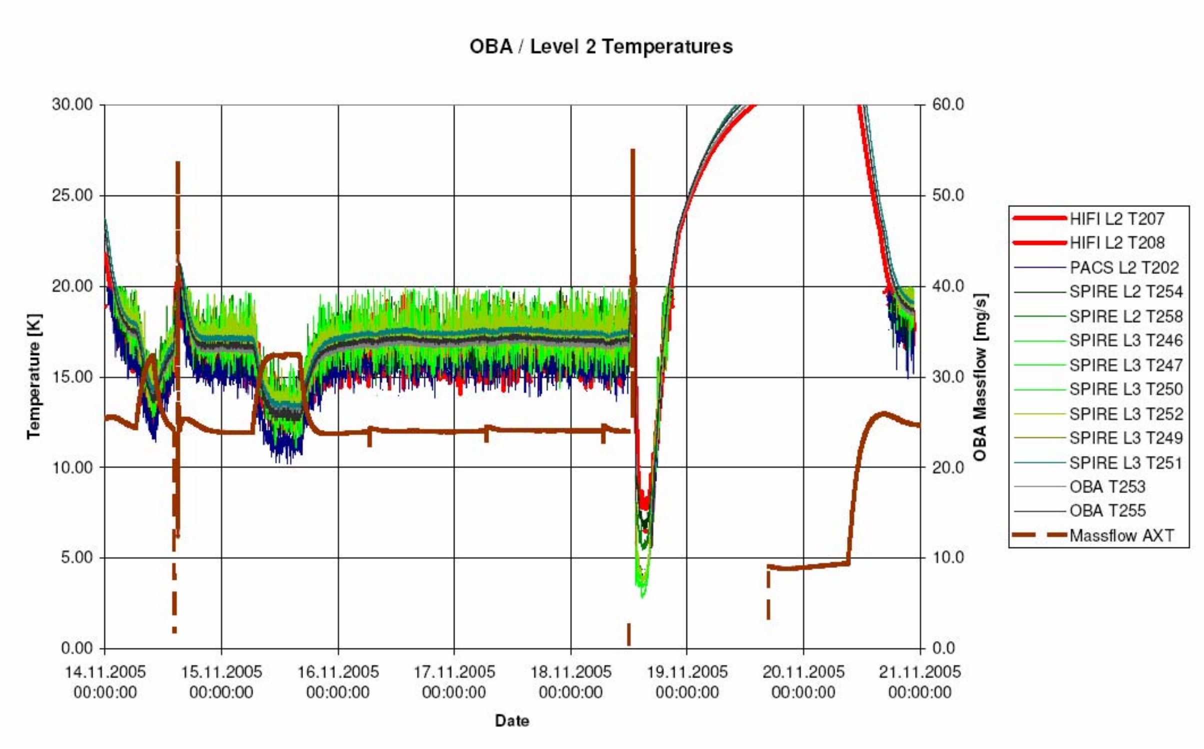

Figure 4.5-31: OBA / Level 2 Temperatures during HIFI EMC Test

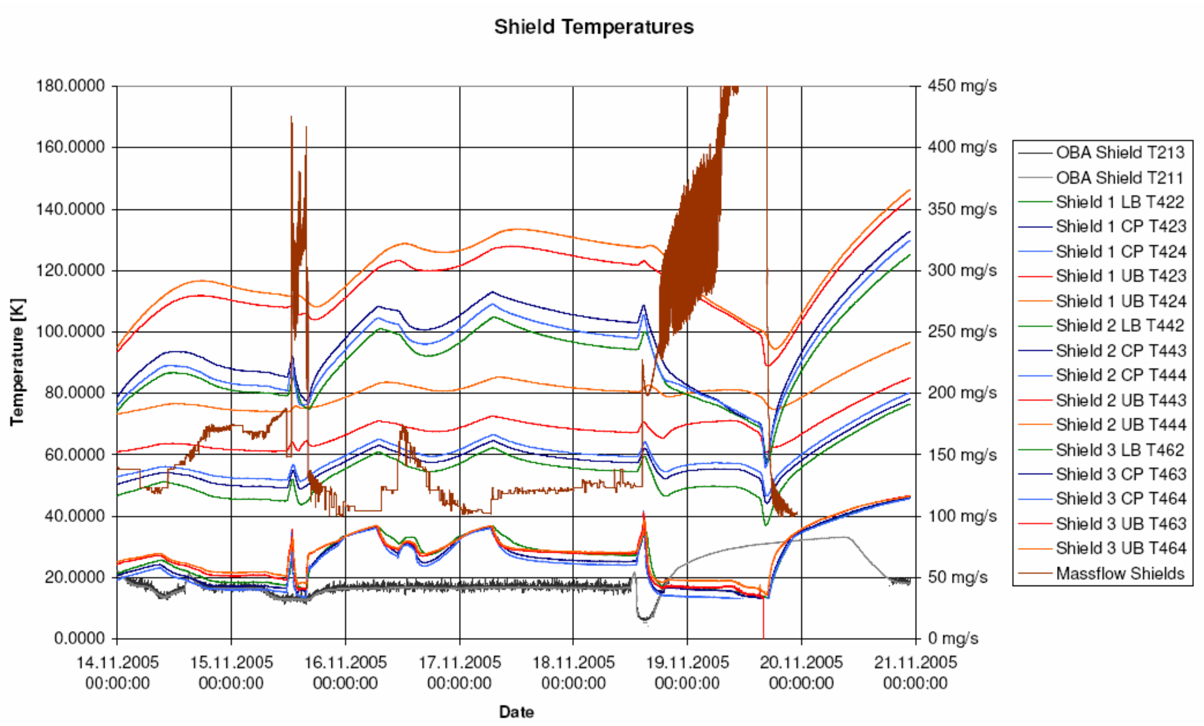

Figure 4.5-32: Shield Temperatures during HIFI EMC Test

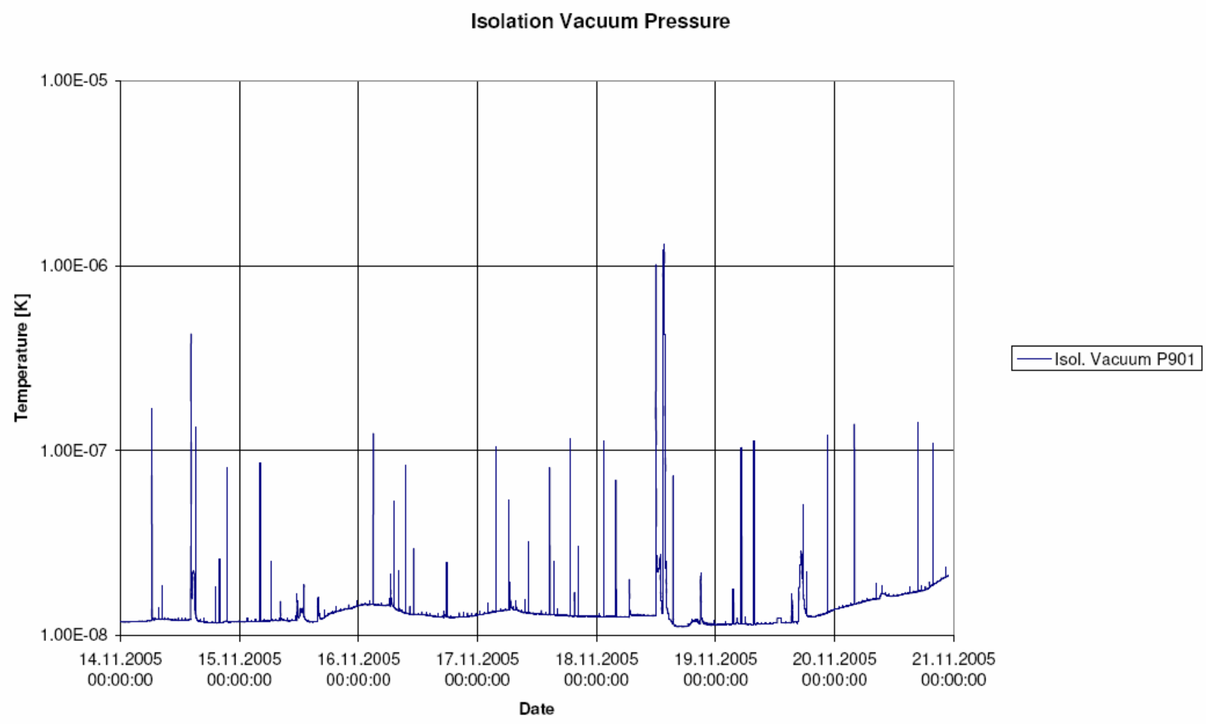

Figure 4.5-33: Isolation Vacuum during HIFI EMC Test

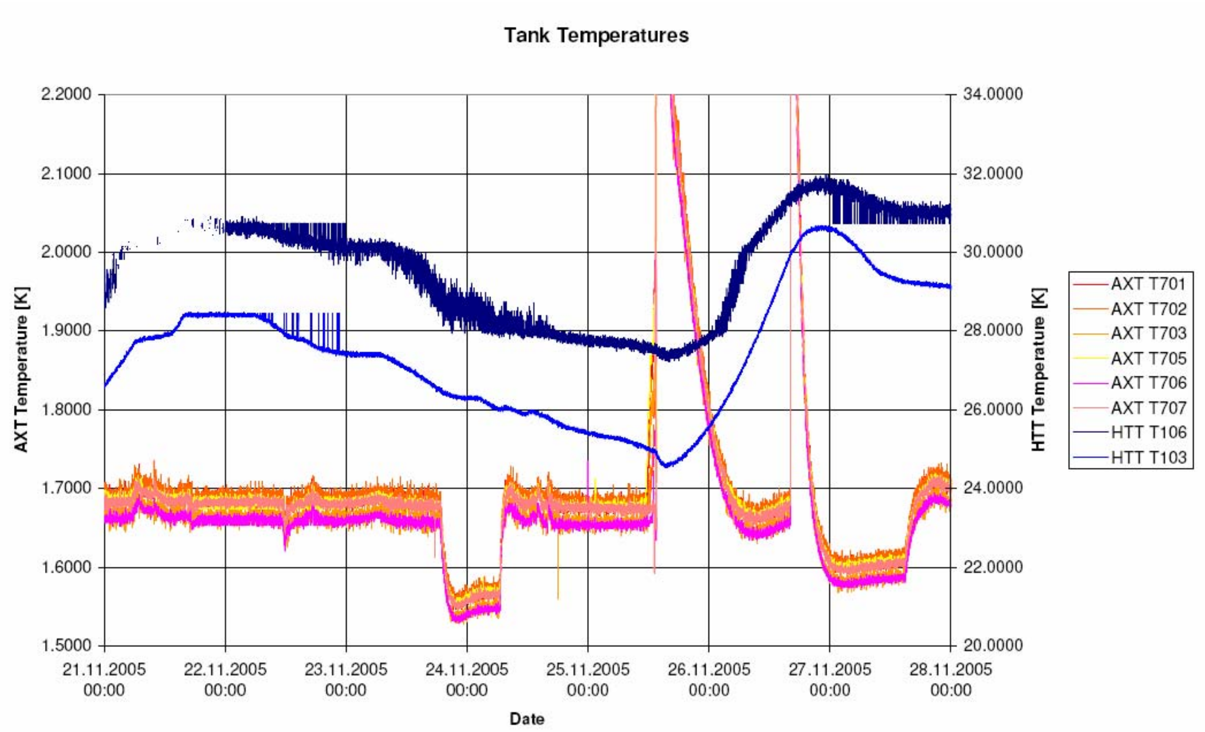

Figure 4.5-34: Tank Temperatures during PACS EMC Test

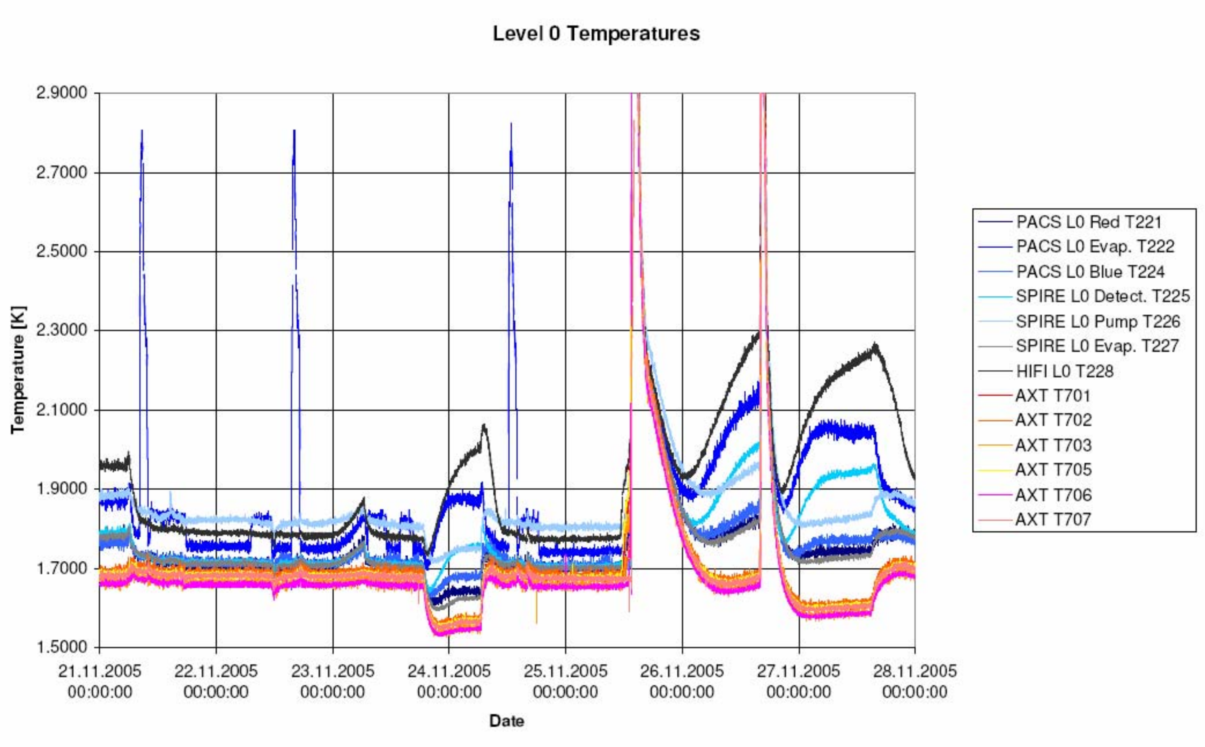

Figure 4.5-35: Level 0 Temperatures during PACS EMC Test

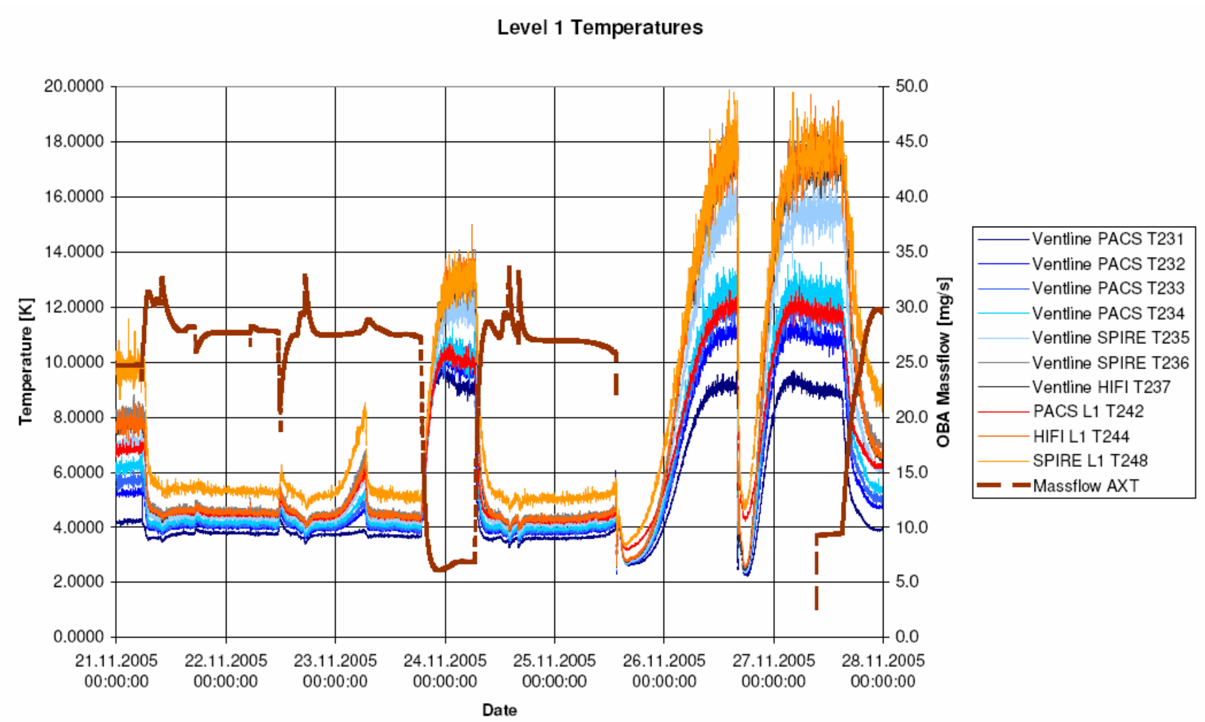

Figure 4.5-36: Level 1 Temperatures during PACS EMC Test

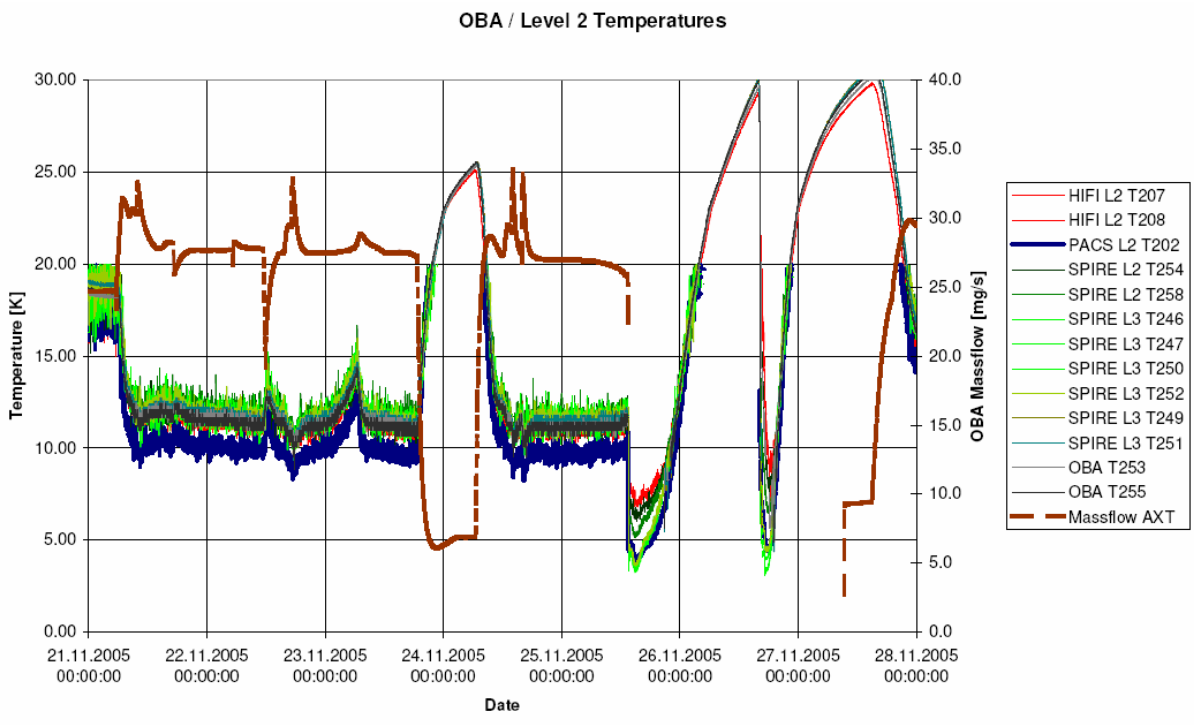

Figure 4.5-37: OBA / Level 2 Temperatures during PACS EMC Test

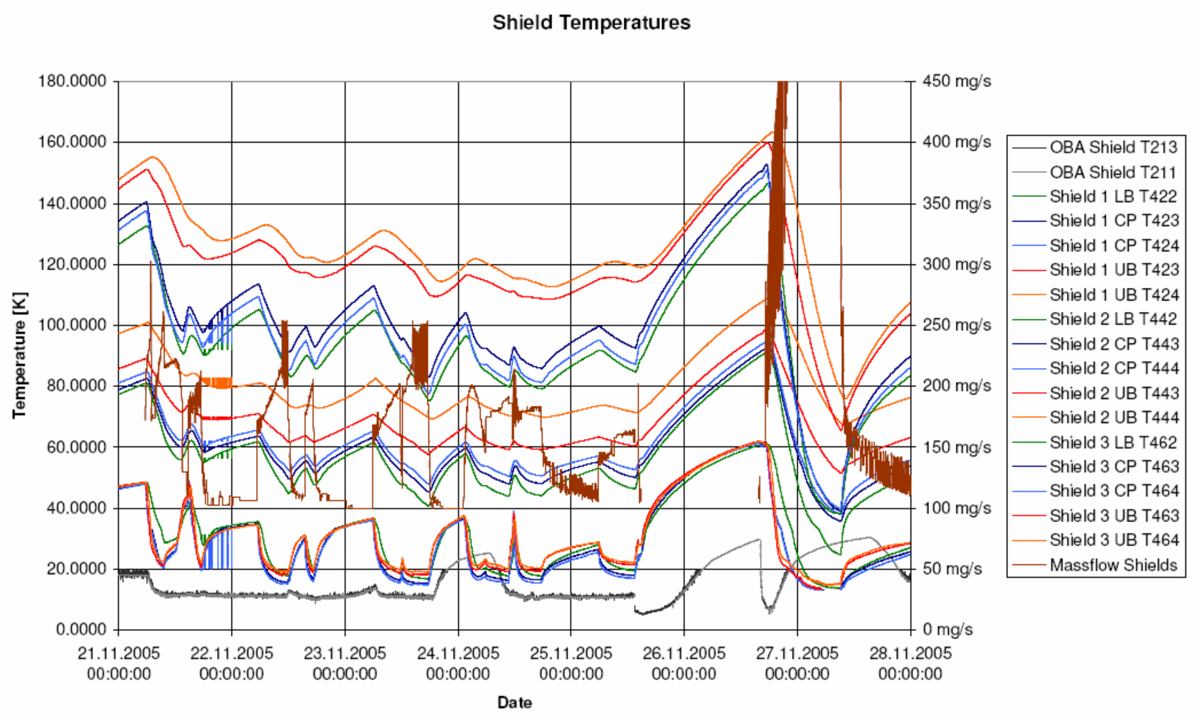

Figure 4.5-38: Shield Temperatures during PACS EMC Test

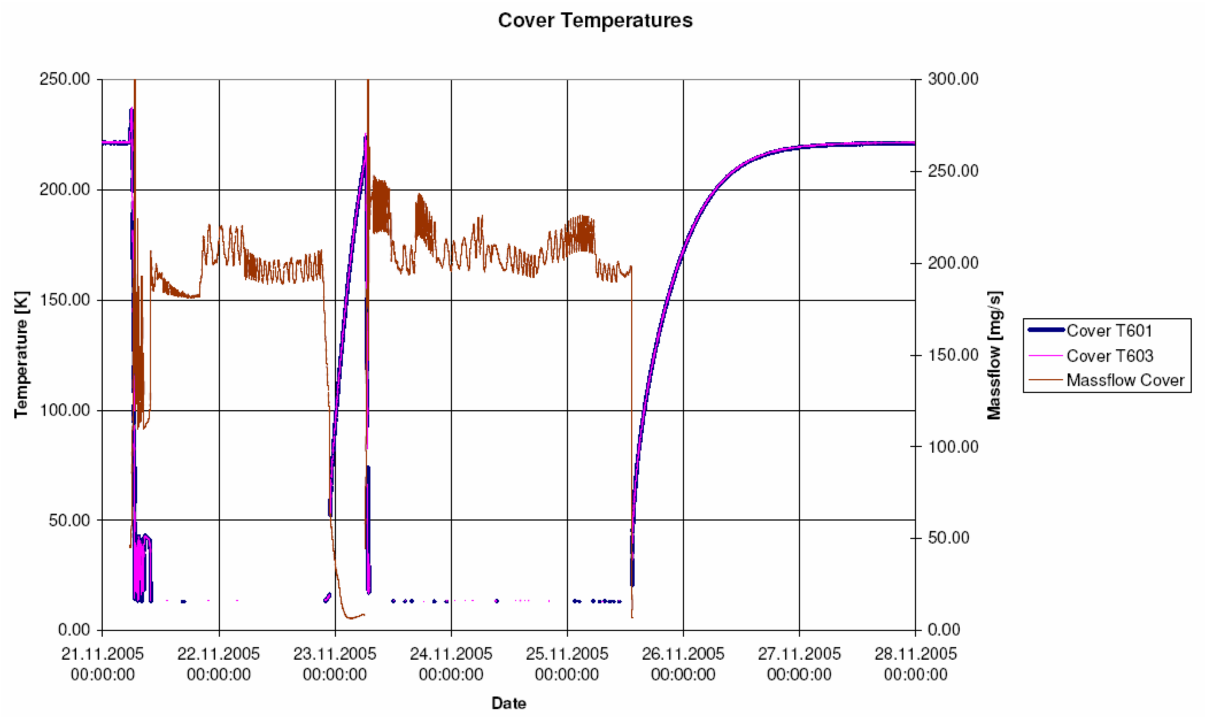

Figure 4.5-39: Cover Temperatures during PACS EMC Test

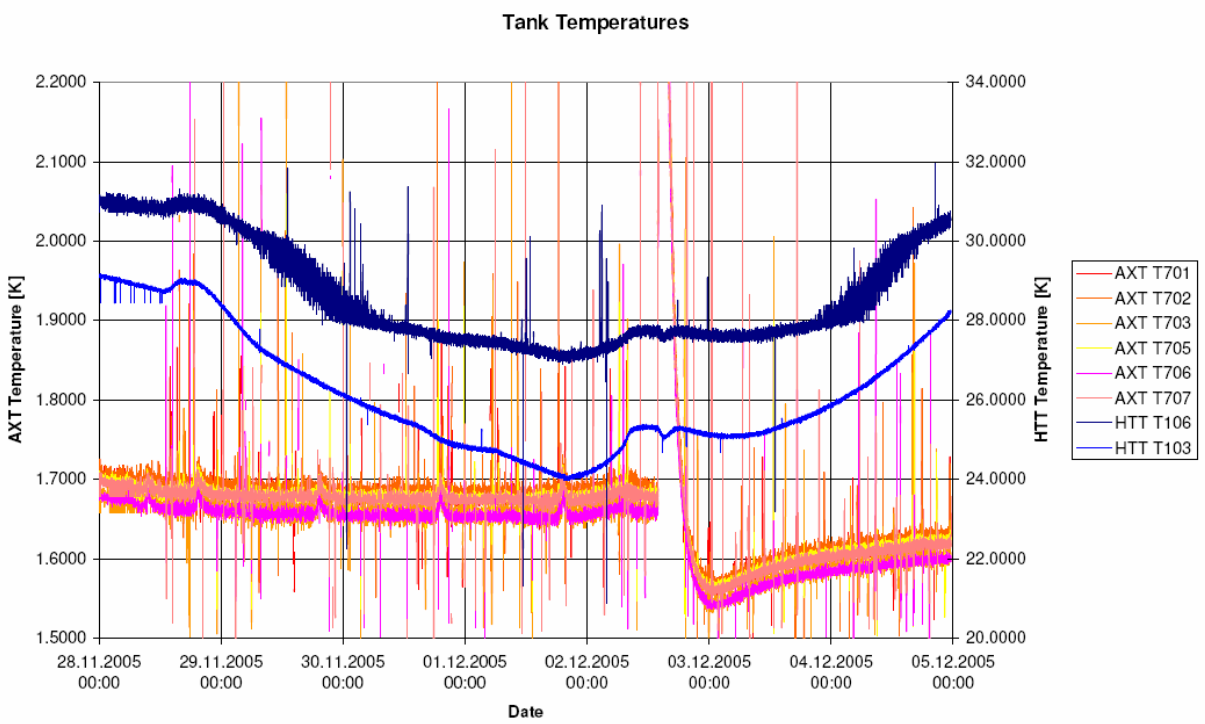

Figure 4.5-40: Tank Temperatures during SPIRE EMC Test

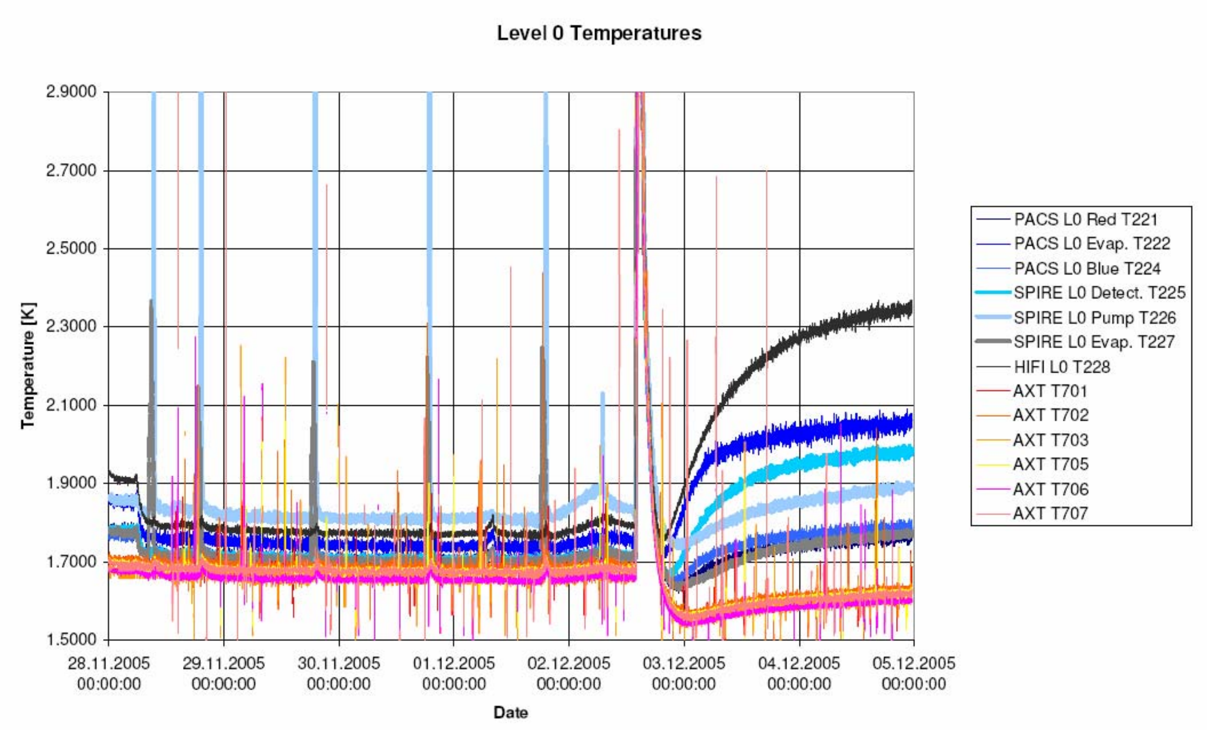

Figure 4.5-41: Level 0 Temperatures during SPIRE EMC Test

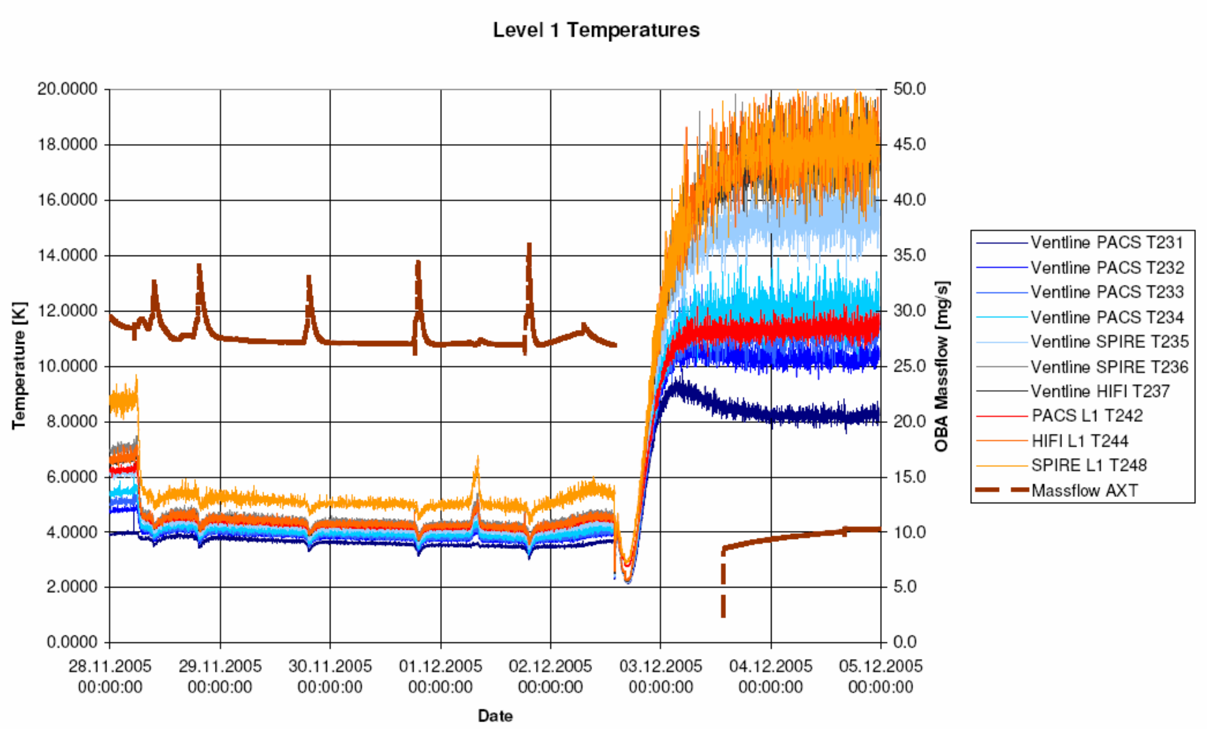

Figure 4.5-42: Level 1 Temperatures during SPIRE EMC Test

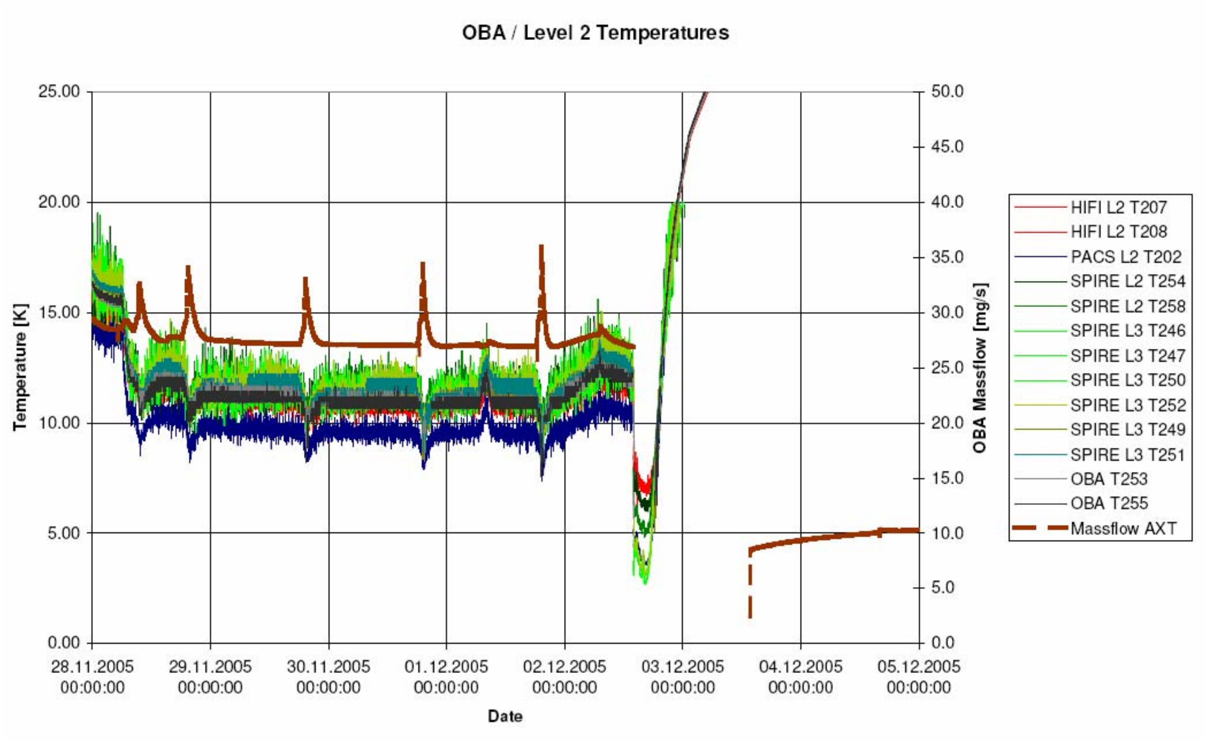

Figure 4.5-43: OBA / Level 2 Temperatures during SPIRE EMC Test

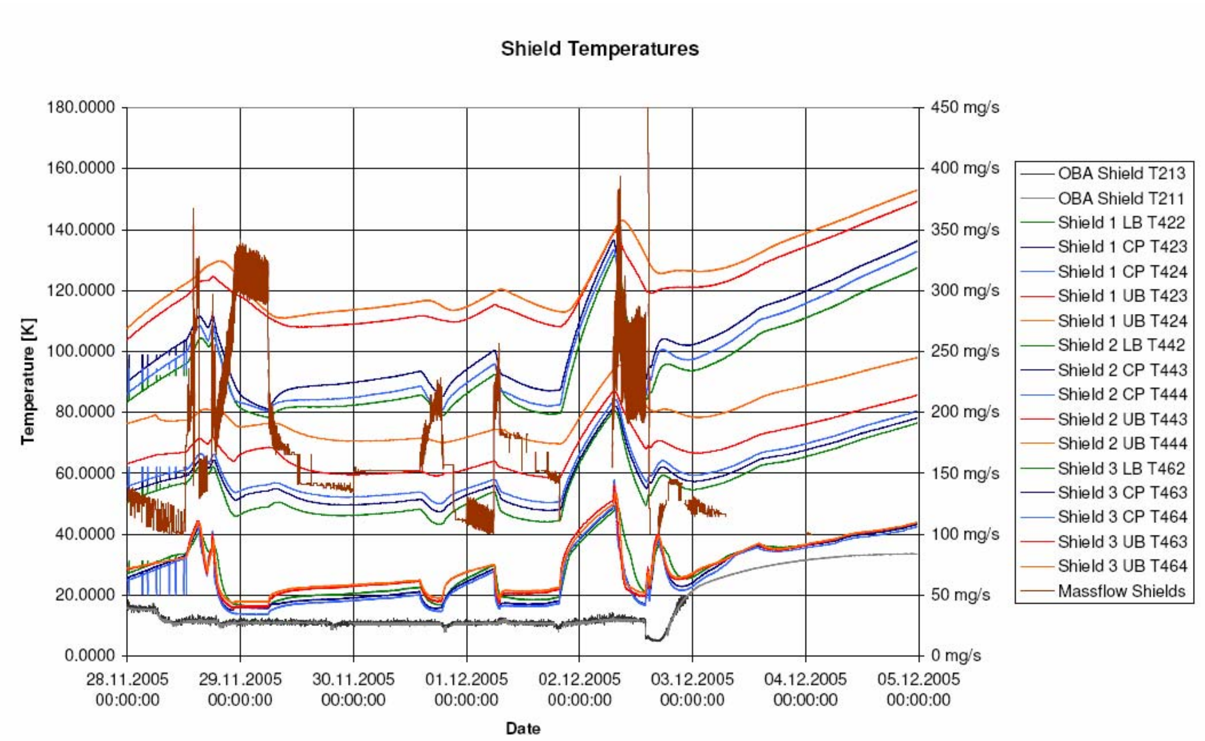

Figure 4.5-44: Shield Temperatures during SPIRE EMC Test

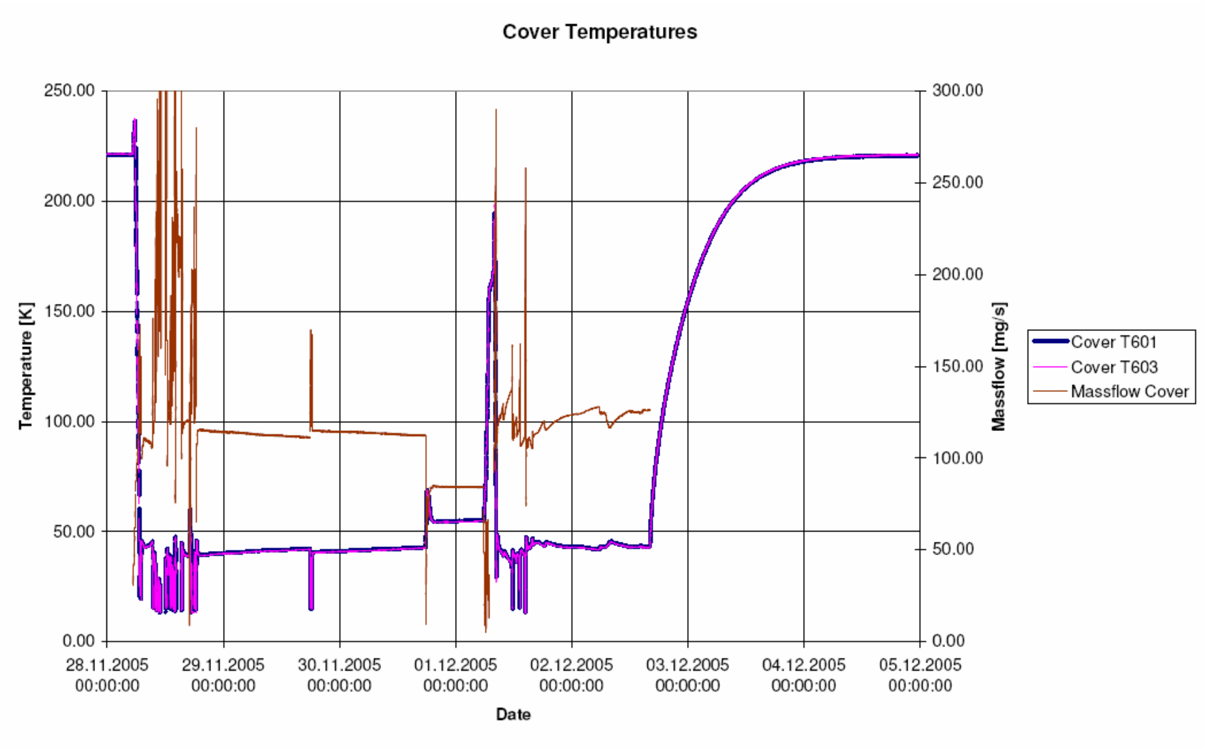

Figure 4.5-45: Cover Temperatures during SPIRE EMC Test

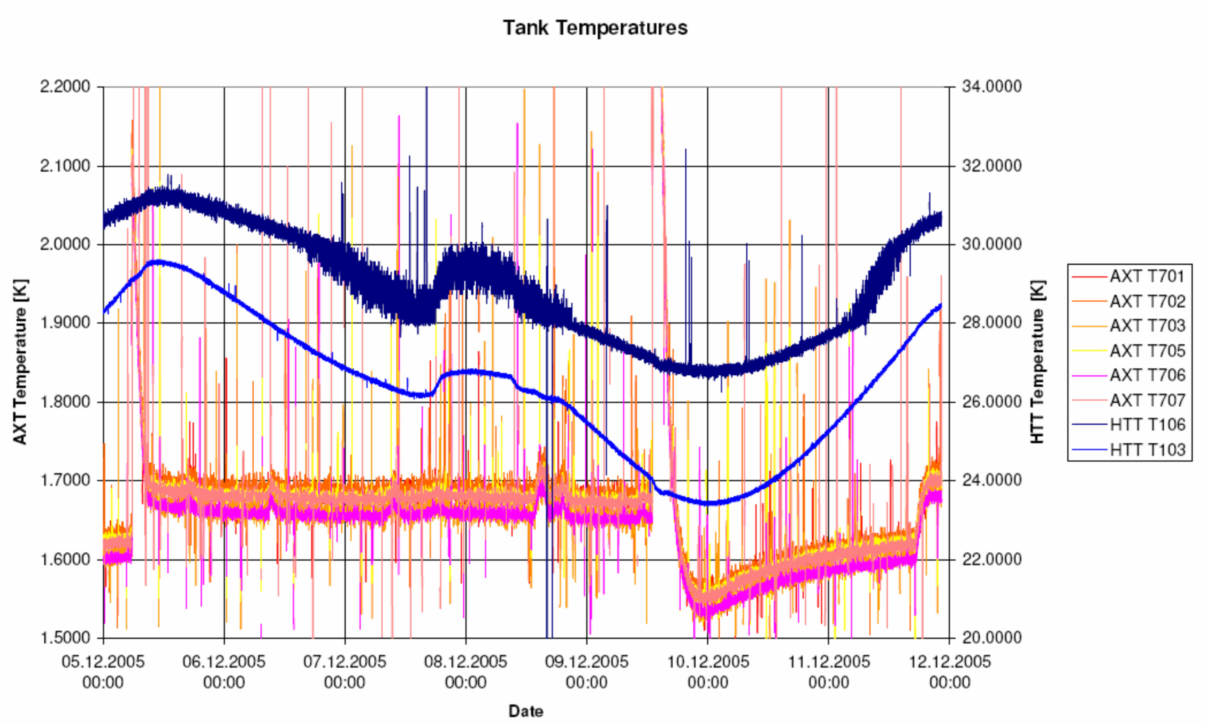

Figure 4.5-46: Tank Temperatures during Thermal Behaviour / Straylight Tests

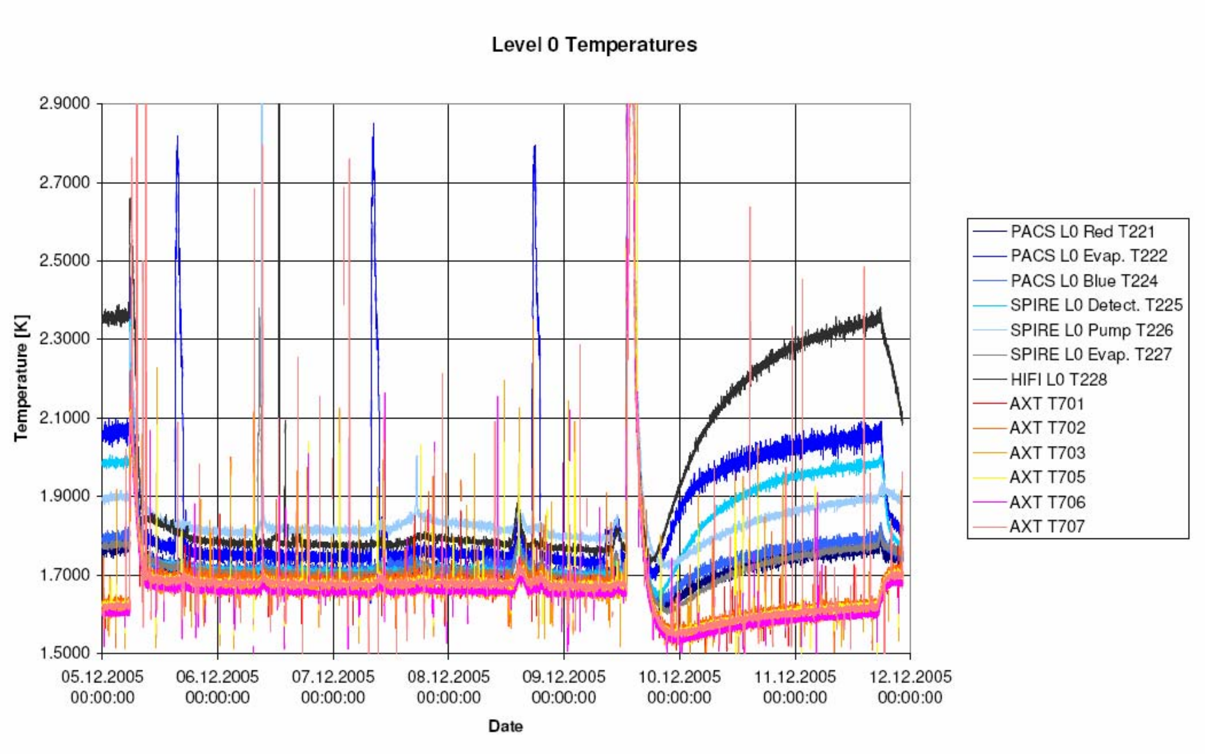

Figure 4.5-47: Level 0 Temperatures during Thermal Behaviour / Straylight Tests

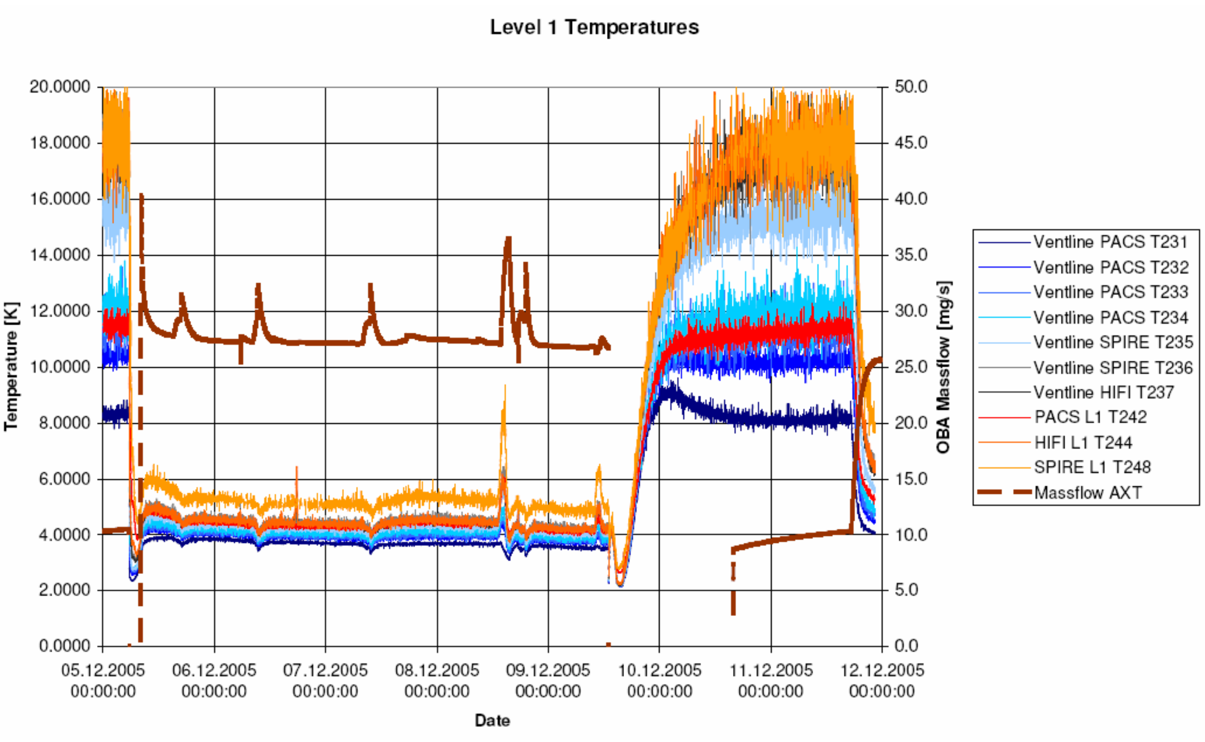

Figure 4.5-48: Level 1 Temperatures during Thermal Behaviour / Straylight Tests

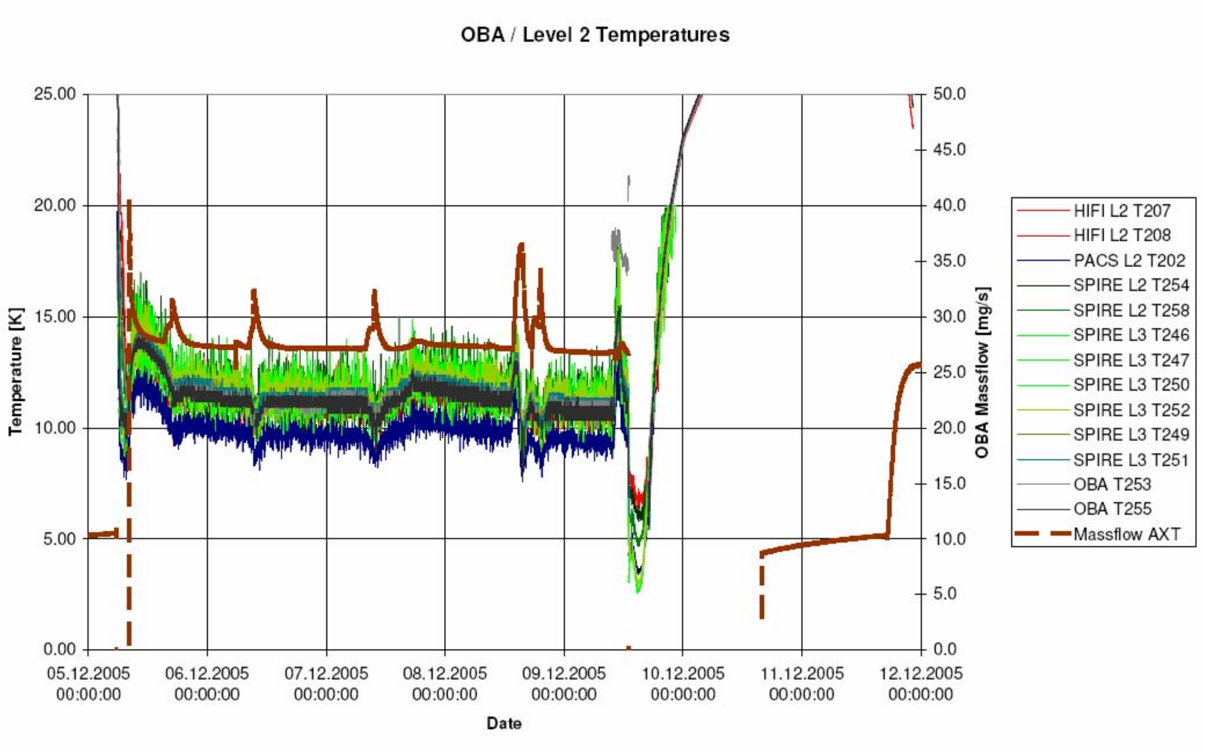

Figure 4.5-49: OBA / Level 2 Temperatures during Thermal Behaviour / Straylight Tests

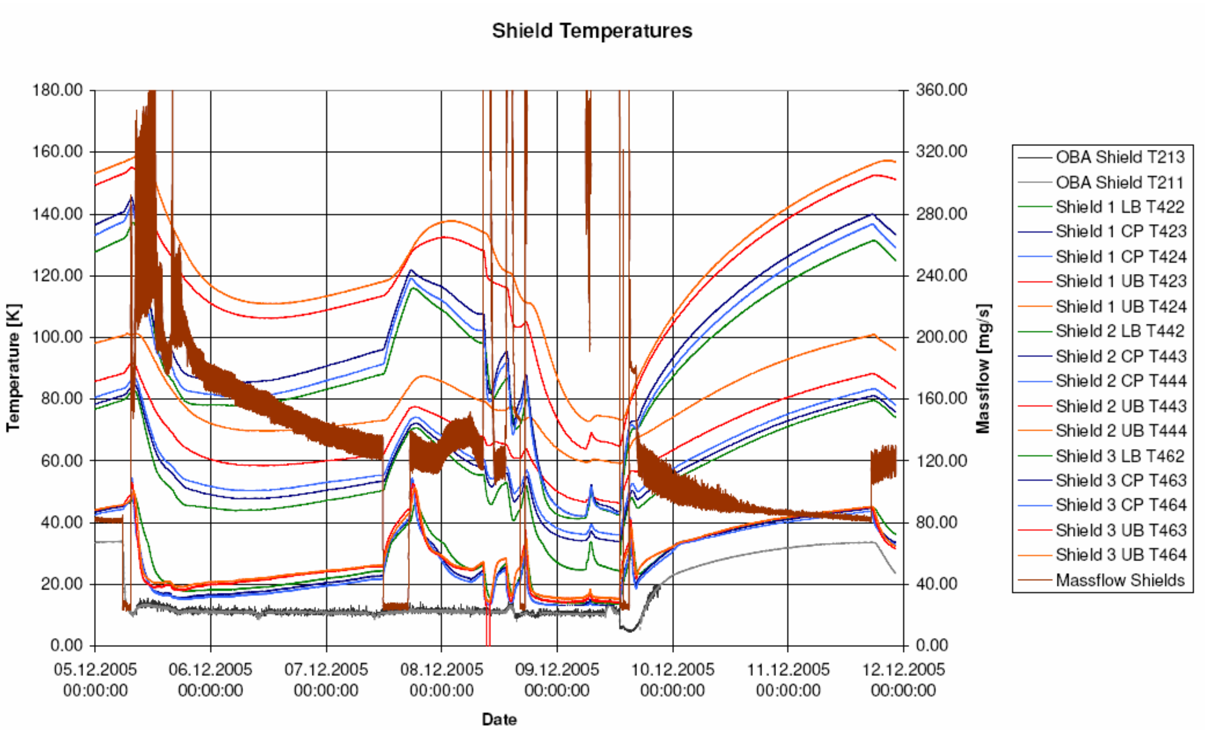

Figure 4.5-50: Shield Temperatures during Thermal Behaviour / Straylight Tests

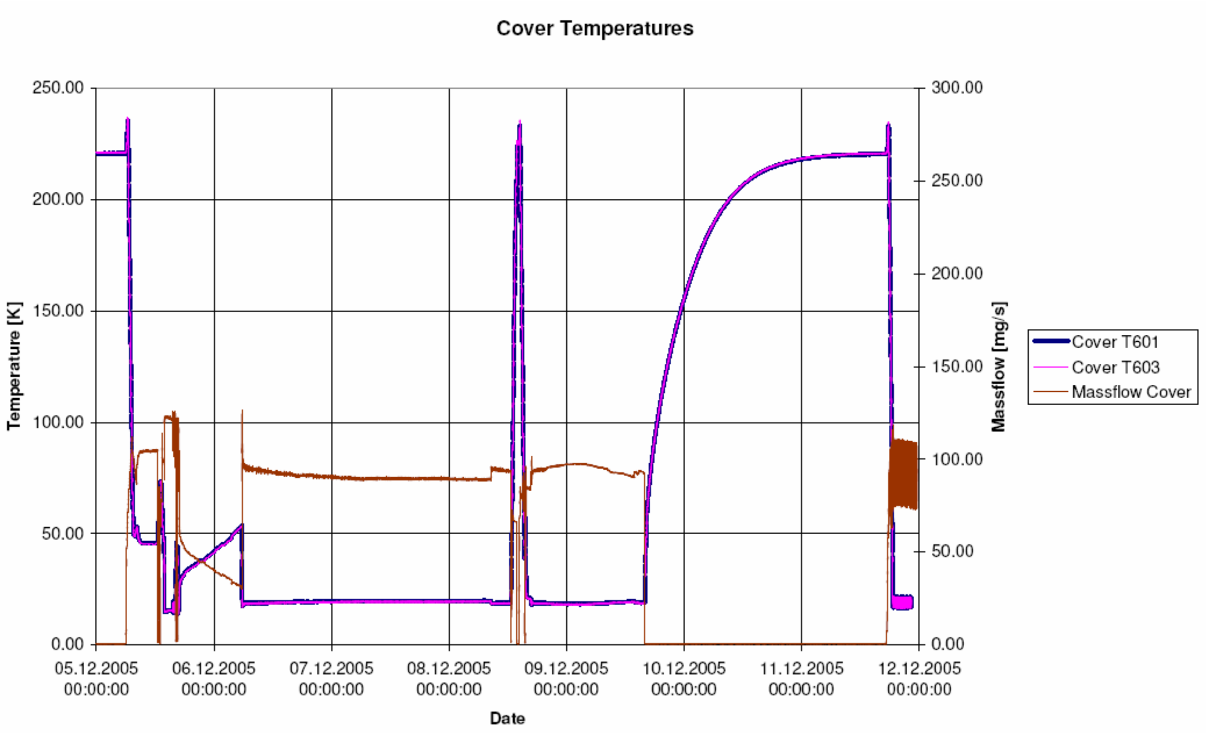

Figure 4.5-51: Cover Temperatures during Thermal Behaviour / Straylight Tests

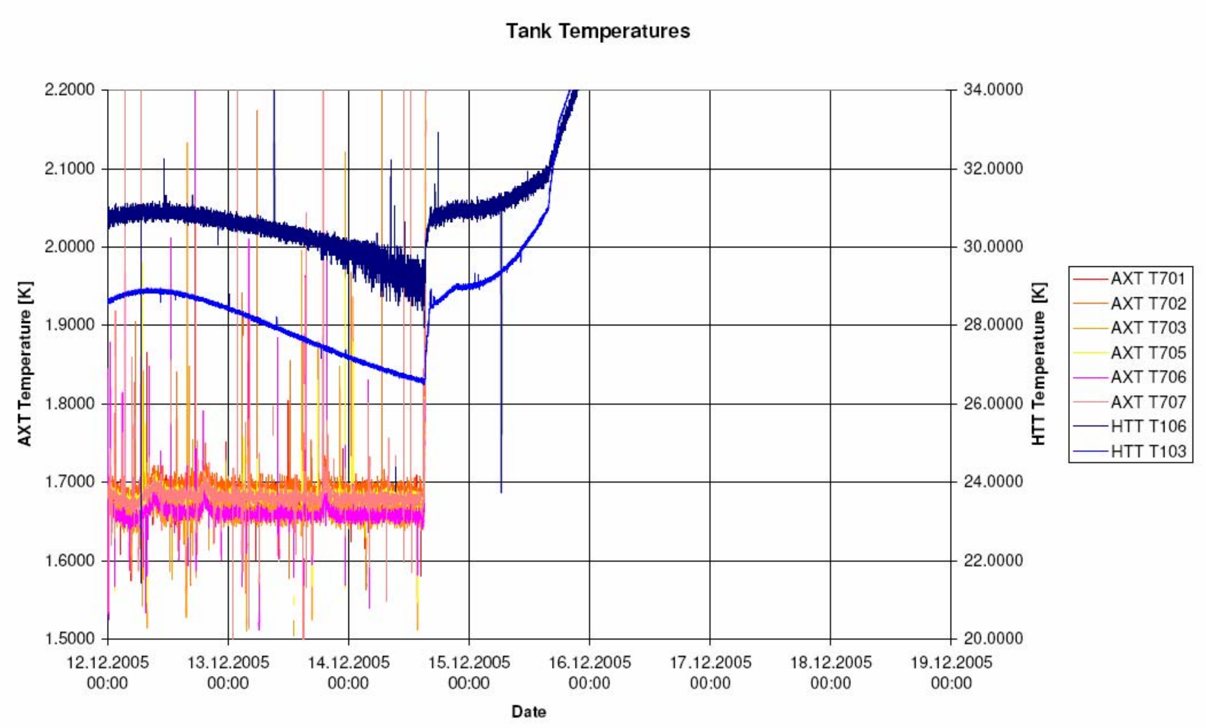

Figure 4.5-52: Tank Temperatures during SPRE EMC Test

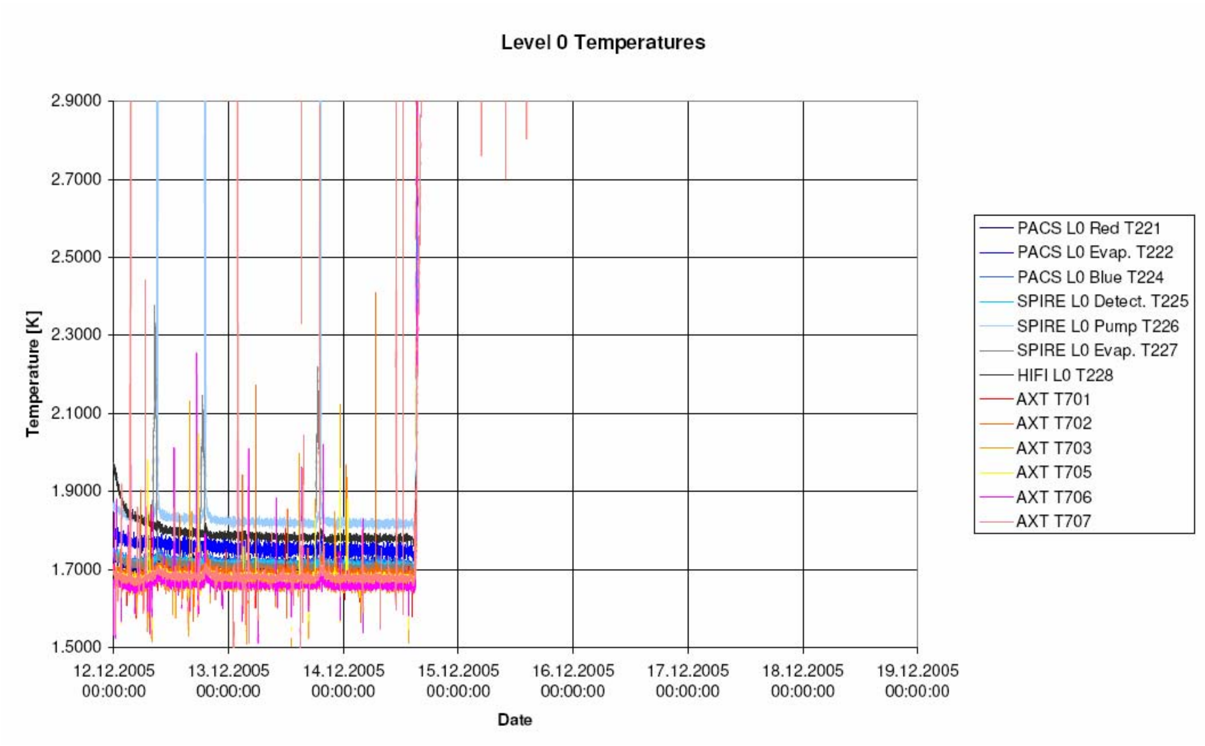

Figure 4.5-53: Level 0 Temperatures during SPRE EMC Test

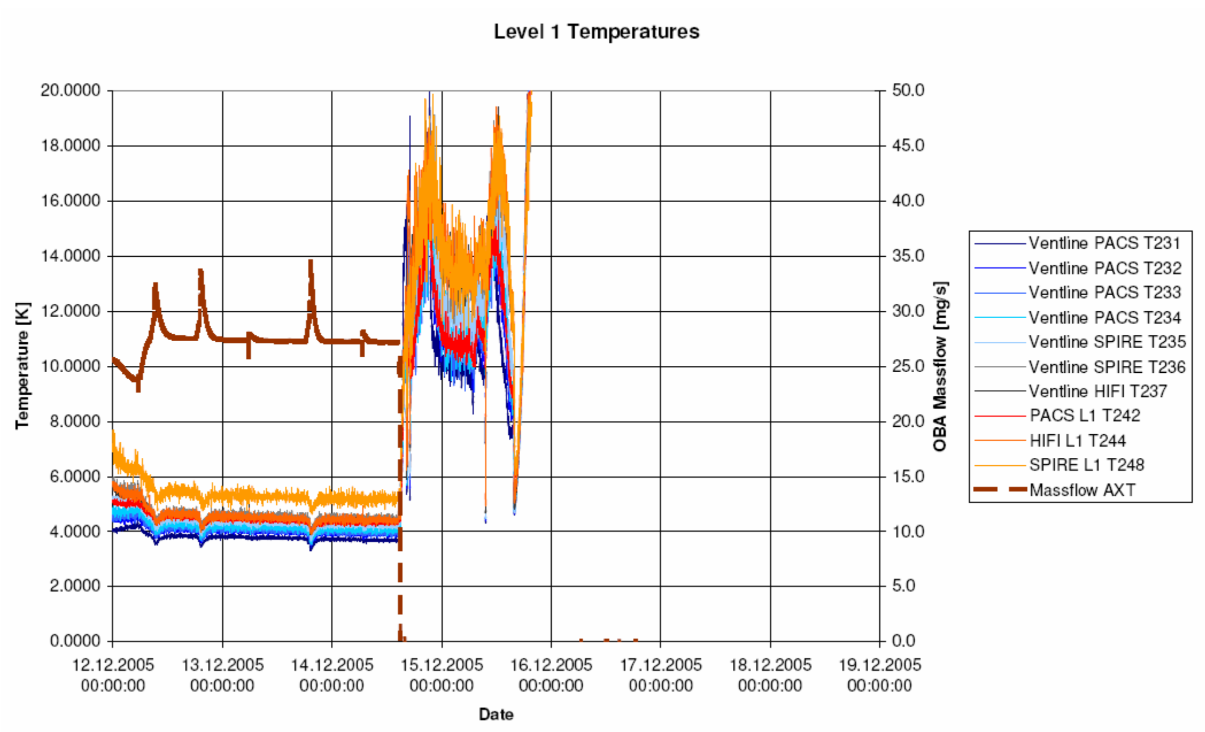

Figure 4.5-54: Level 1 Temperatures during SPRE EMC Test

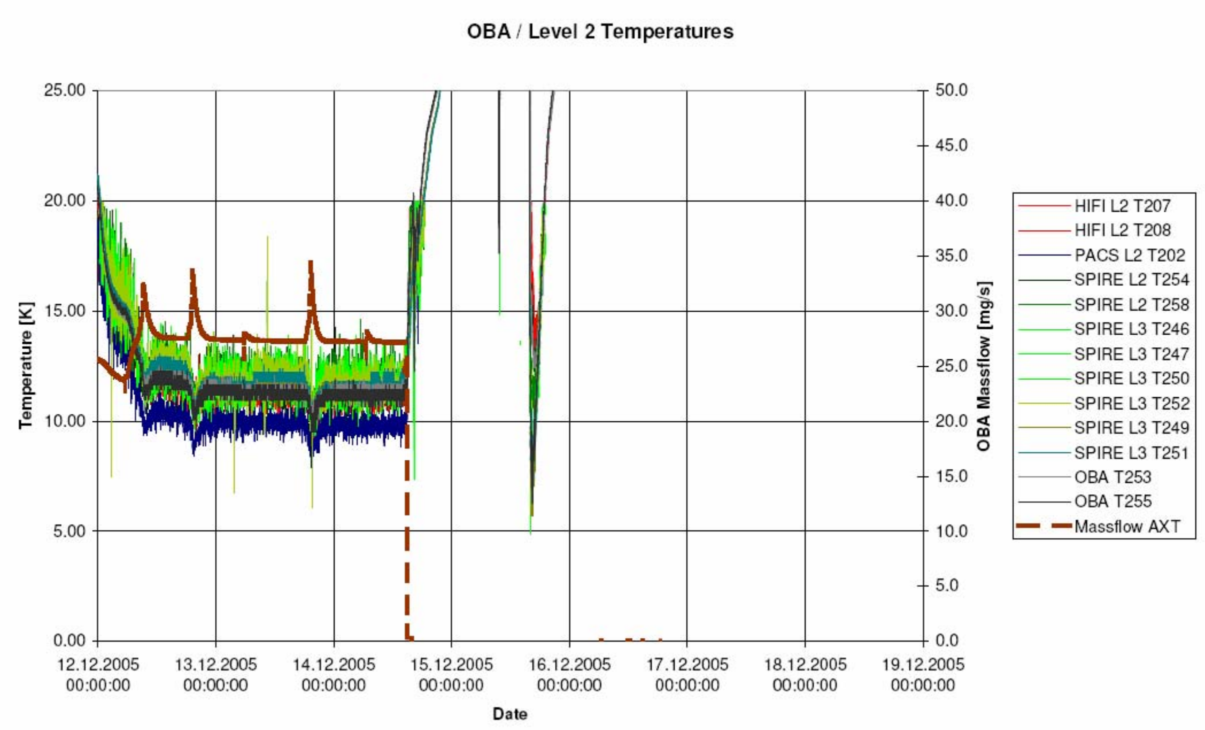

Figure 4.5-55: OBA / Level 2 Temperatures during SPRE EMC Test

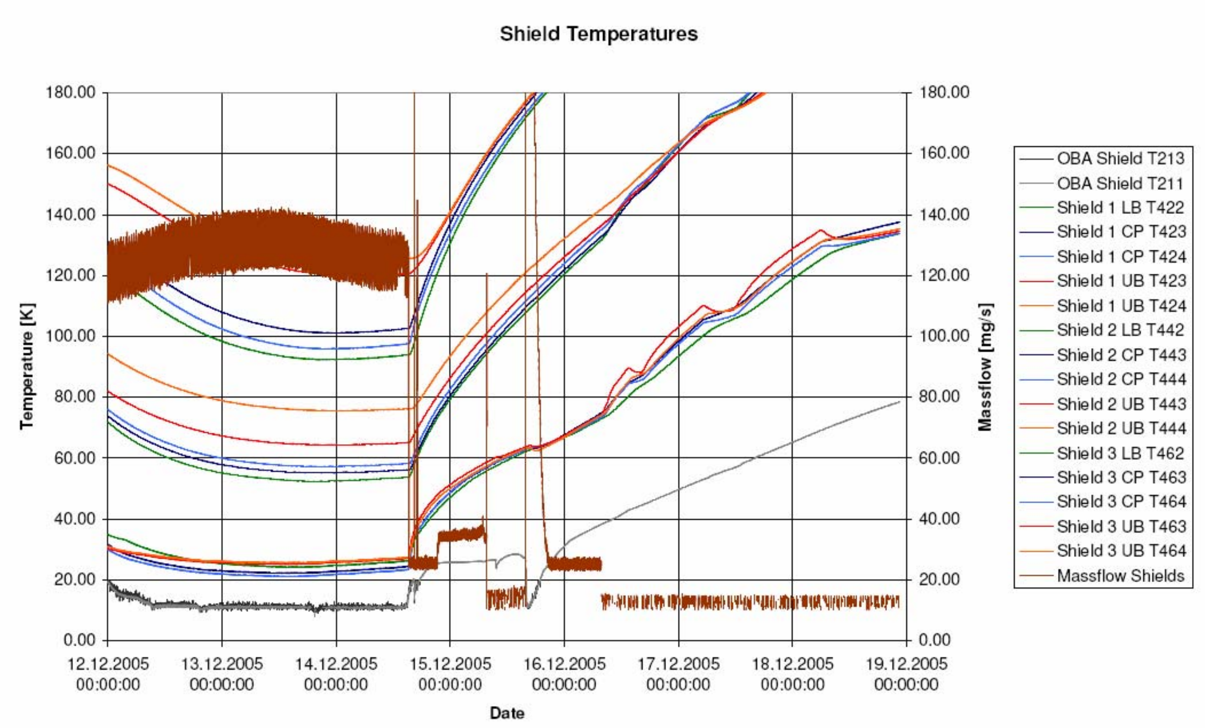

Figure 4.5-56: Shield Temperatures during SPRE EMC Test

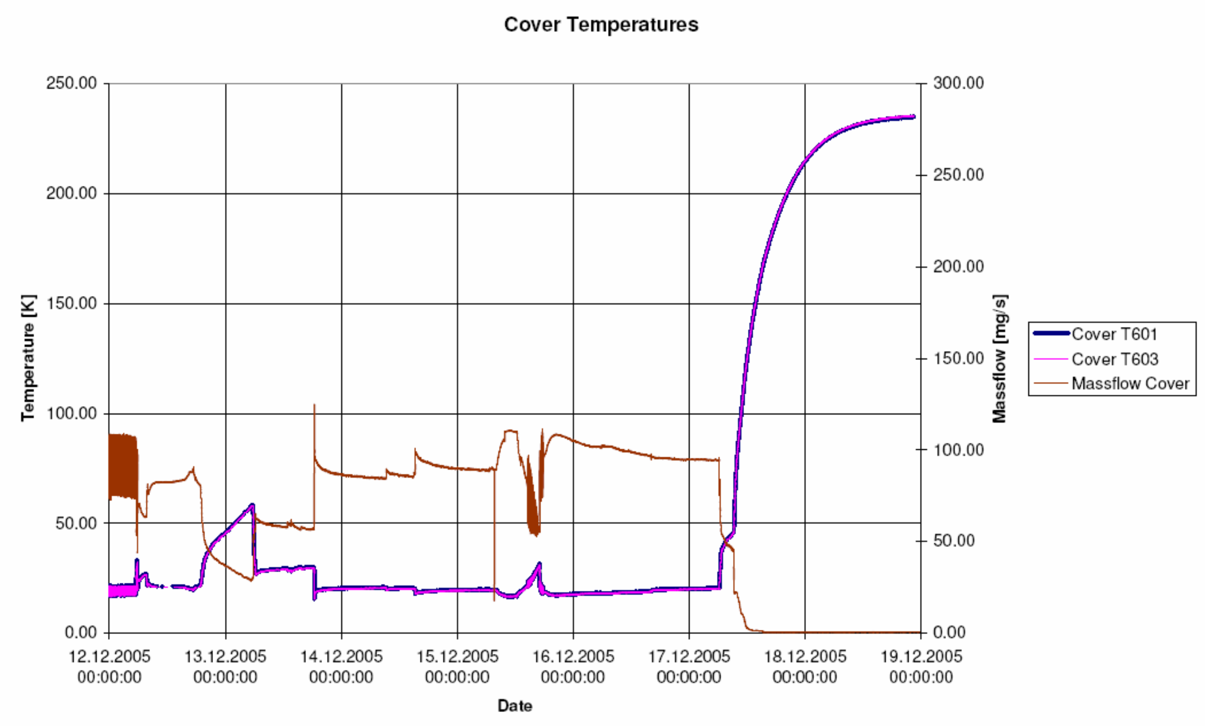

Figure 4.5-57: Cover Temperatures during SPRE EMC Test

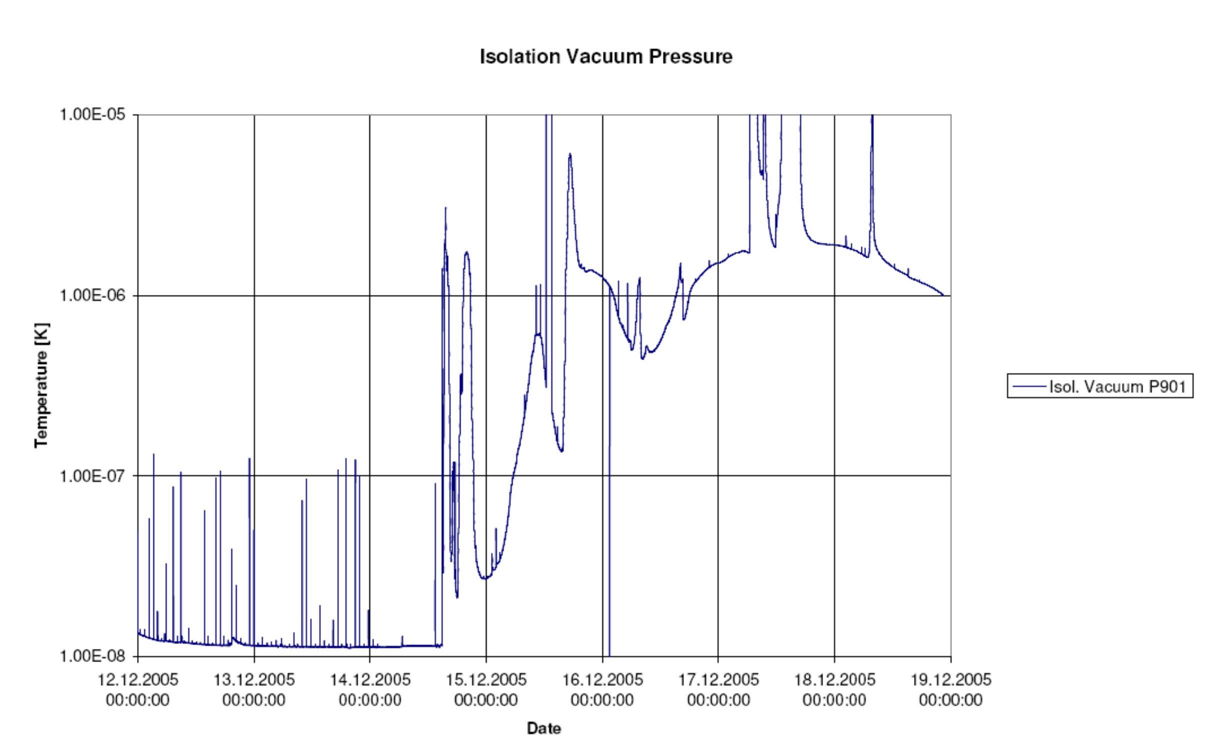

Figure 4.5-58: Isolation Vacuum during SPIRE EMC Test / Start Warm Up

4.5.4 Problems / Deviations

An unexpected high heat load on the AXT and the OBA with the instruments prevents testing with an orbit representative mass flow rate of 2.5 mg/s. The unloaded mass flow rate from the AXT, measured with no additional heat load coming from a heater or the instruments was about 8 mg/s. Due to the new concept, the HTT was at about 30 K instead of 4.2 K. This could be one reason for a higher heat load on the AXT. The high heat load on L1 interfaces and OBA can be explained by the missing thermal anchoring of the harness, by the direct heat load from the warm CVV and through the LO windows.

Adjusting the mass flow by changing the AXT heater power or adjusting the mass flow through the cryostat cover cooling loop caused some temperature variations during instrument testing. In addition temperature variation were caused by interruption of shield cooling or cover cooling because of running out supply dewars Helium supply.

It took some time to learn how to operate the cryostat with the new concept. In combination with some problems with the LHe supply due to the parallel activities (EQM in Ottobrunn and PFM at ESTEC) this caused some temperature inconsistencies.

In addition to the LHe supply problems, the liquid level measurement and pressure control of the Linde dewars type HDS450-EIDP was not running properly. Especially the measurement with the fixed installed liquid level probes of the dewars was unacceptable inaccurate for all dewars. The automated dewar pressure control worked quite fast and reliable, however the dewar pressure measurement on which the control loop based, was not correct on some dewars.

4.5.5 Lessons Learnt

A HTT temperature of about 1.7 K is adequate to achieve the required L0 temperatures. Problems with the L1 and OBA temperatures cannot be transferred to FM because of the different He S/S.

Temperature stability was a major issue of the instruments. In future a briefing shall be hold each morning to inform the cryostat team about instrument constraints but also to inform the instrument teams about cryostat constraints of each day.

The EIDP version of the dewars have to be modified such, that the liquid level measurement of the dewar is reliable.

4.6 Cover Flushing

4.6.1 Objective

Objective of this operation was to cool down the cryostat cover mirror to instrument requested temperatures. After detecting the straylight problem, the cover mirror cooling was used to eliminate straylight from cover.

4.6.2 Description of Operation

A LHe supply dewar was connected via the cryostat cover supply lines to the cover cooling loop. The exhaust of the cooling loop was connected via the cryostat cover exhaust lines to CVSE tubing, installed in the clean room in Ottobrunn. At the end of this tubing, a flow meter was installed which helped adjusting the mass flow through the cover. An additional overpressure valve was installed in the CVSE lines. A needle valve close to the flow meter helped regulating the flow.

Cryostat cover cooling was started by slightly opening of the cover supply line's needle valve. Fine adjustment was done with the needle valve at the mass flow meter.

Dewar exchange was simplified. The new dewar was placed close to the used dewar. Then the exhaust of the cover flushing line was closed to have an overpressure in the flushing line system. The cover supply line was removed from the used dewar and installed immediately in the new one. Cover flushing was restarted by reopening the exhaust line.

After completing the EQM test phase, the cryostat cover CVSE lines were removed during warm up, when the cover was above 250 K.

4.6.3 Summary Test Results / Cryostat Behaviour

At begin of operation the cover temperature was stabilized at about 80 K for a few hours. Due to the straylight problems the cover was cooled down below 13 K, which was the lowest measurable temperature.

Cryostat cover cooling was continued over night even without supervision of an operator. Thanks to three safety valves, plus the safety valve in the supply dewar, the risk for the FM cryostat cover was extremely low. Cryostat cover cooling over night was necessary to keep a cooler hold time of about 40 h.

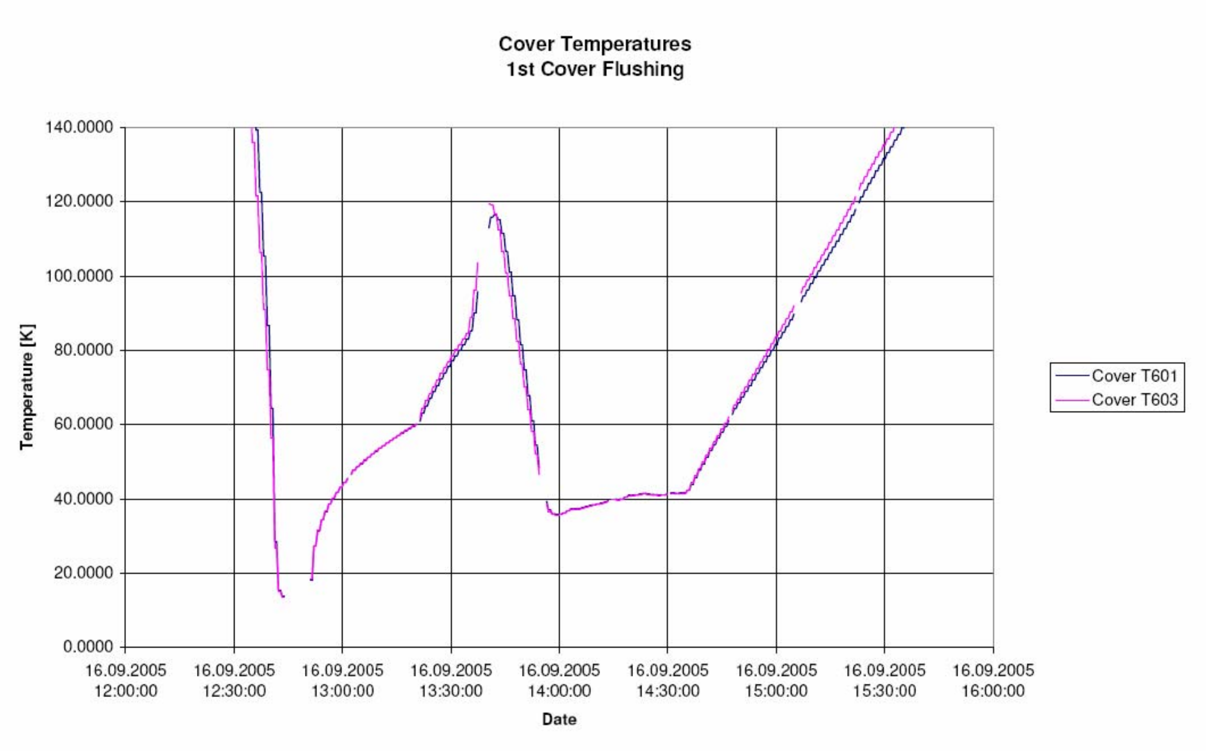

Figure 4.6-1: Cover Temperatures at 1st Cover Flushing

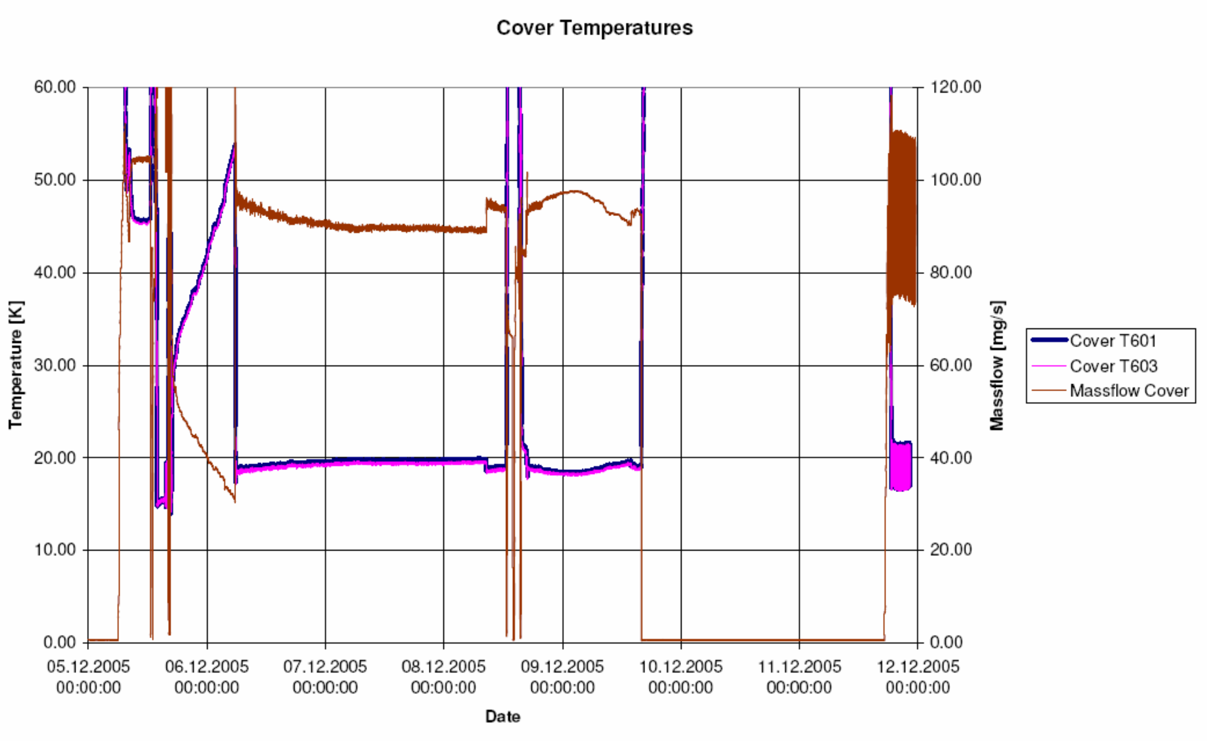

Figure 4.6-2: Cover Temperatures at End of Test Phase

4.6.4 Problems / Deviations

Throughout the EQM test phase the cover cooling behaviour degraded and that the cover mirror temperature could not be stabilized below 40 K. It turned out that the isolation vacuum of the cryostat cover supply line degraded over the time. The cryostat cover mirror temperature could be stabilized at less than 20 K over more than one day after recovering the isolation vacuum the cover. Originally, a temperature stability of a couple of minutes at a cover temperature of about 80 K was requested by instruments. This could be achieved all the time. Requests for much longer temperature stabilities at lower temperatures came up during testing.

4.6.5 Lessons Learnt

Cryostat cover temperature stability has to be (re-)defined by the instruments. If a temperature stability of less than 1 K over more than 12 h is also requested for FM testing, the cryostat cover supply line has to be modified. Potential improvements are a more sensitive needle valve with a scale and a heater with temperature sensors in the fill tube.

4.7 Depletion and Warm Up

4.7.1 Objective

Objective was depletion of the EQM tanks and a controlled warm-up of the EQM cryostat from Helium temperature to ambient. The temperature requirements of instruments as given in the IID-Bs had to be regarded.

4.7.2 Description of Operation

The AXT was heated from He II temperatures to He I temperature. After SFTs at He I temperature of SPIRE and PACS, the AXT was depleted by means of the AXT heaters and warm up started.

The cryostat cover flushing was continued at beginning of warm up.

Warming up was supported with a GHe grade 5.0 from a bottle through V 506 - shield 3 … 1 - V 105 - OBA - V 512. After reaching 80 K in the OBA, GN_2 grade 5.6 was used instead of GHe.

AXT heaters were switched only for short time during warming up not to exceed temperature gradient requirements. Most of the time, warming up was performed passively.

Pumping at the CVV with the turbo pump was continued all over the time. Irregularly mass spectrometers measurements were performed. At the end of the warming up process, the isolation vacuum was broken in steps from 10^{-5} mbar to 1 mbar to speed up the

4.7.3 Summary Test Results / Cryostat Behaviour

Depletion and warm up lasted about 4 weeks. Over Christmas break, warming up was done passively. The isolation vacuum was monitored all over the time. Some "peaks" in the isolation vacuum occurred at about 155 K and 185 K. Other peaks in the isolation vacuum measurement could be explained by switching from pumping with the turbo pump to pumping with the pump of the mass spectrometer.

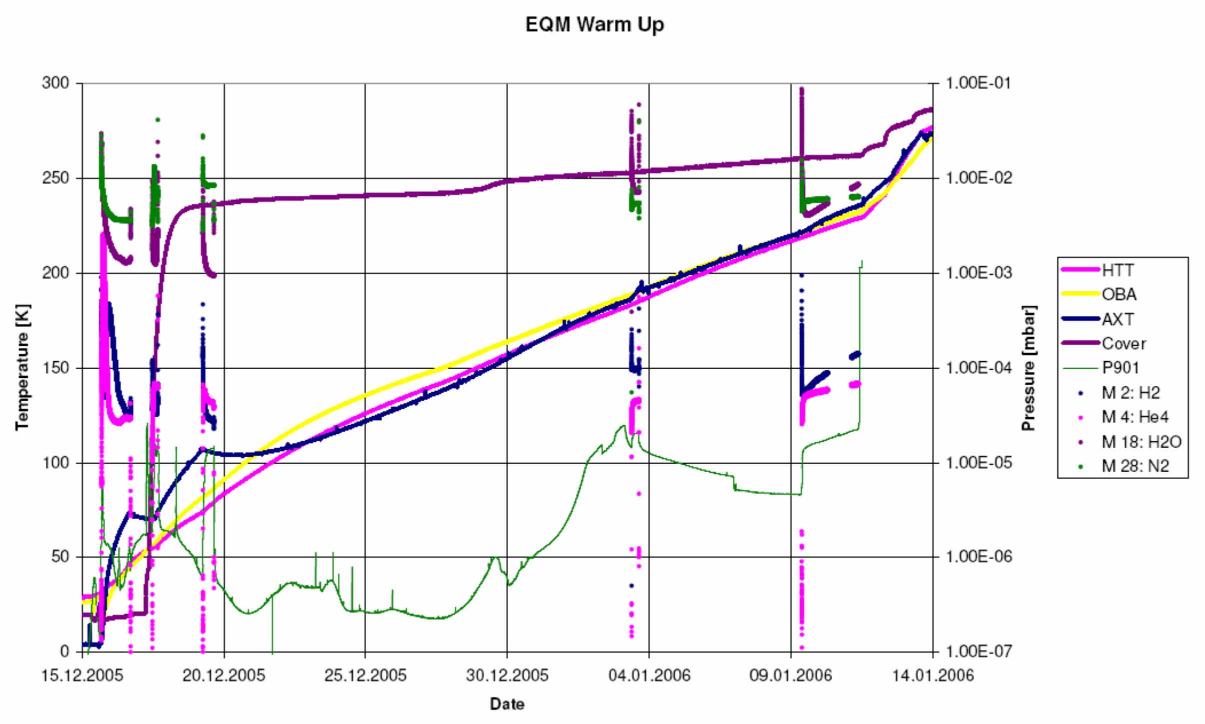

Figure 4.7-1: Temperatures and (Partial-) Pressures during Warm Up

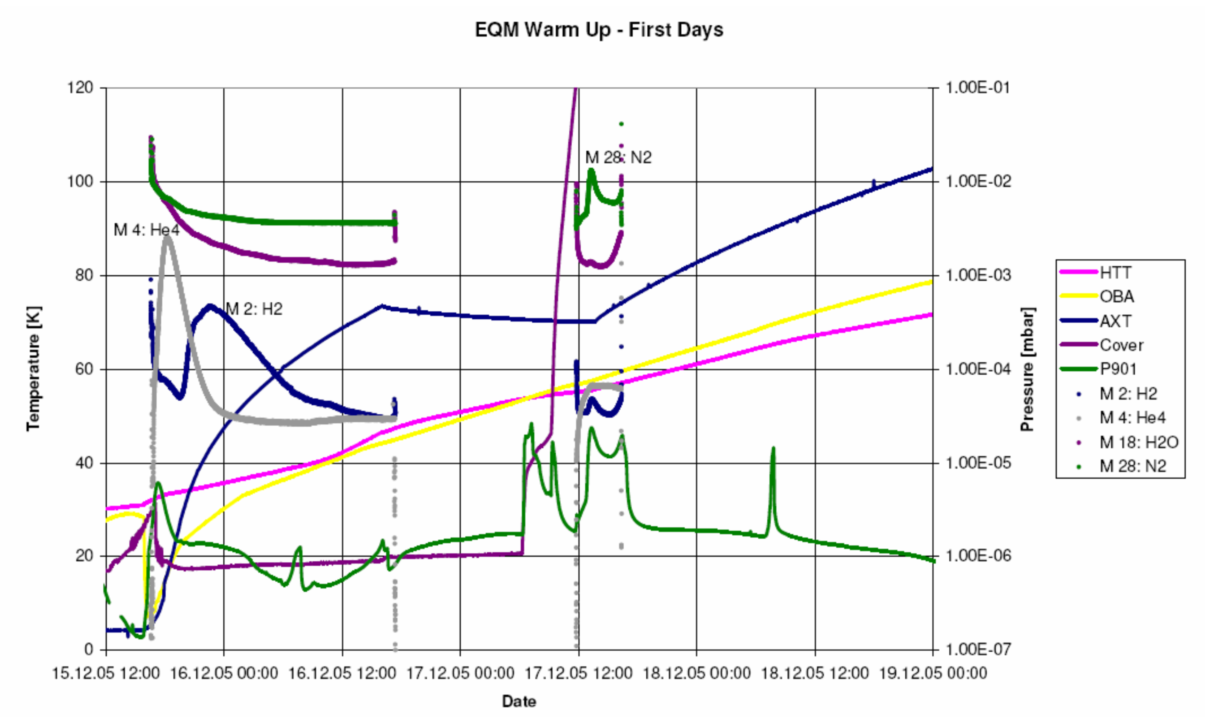

Figure 4.7-2: Temperatures an (Partial-) Pressures during first days of WU

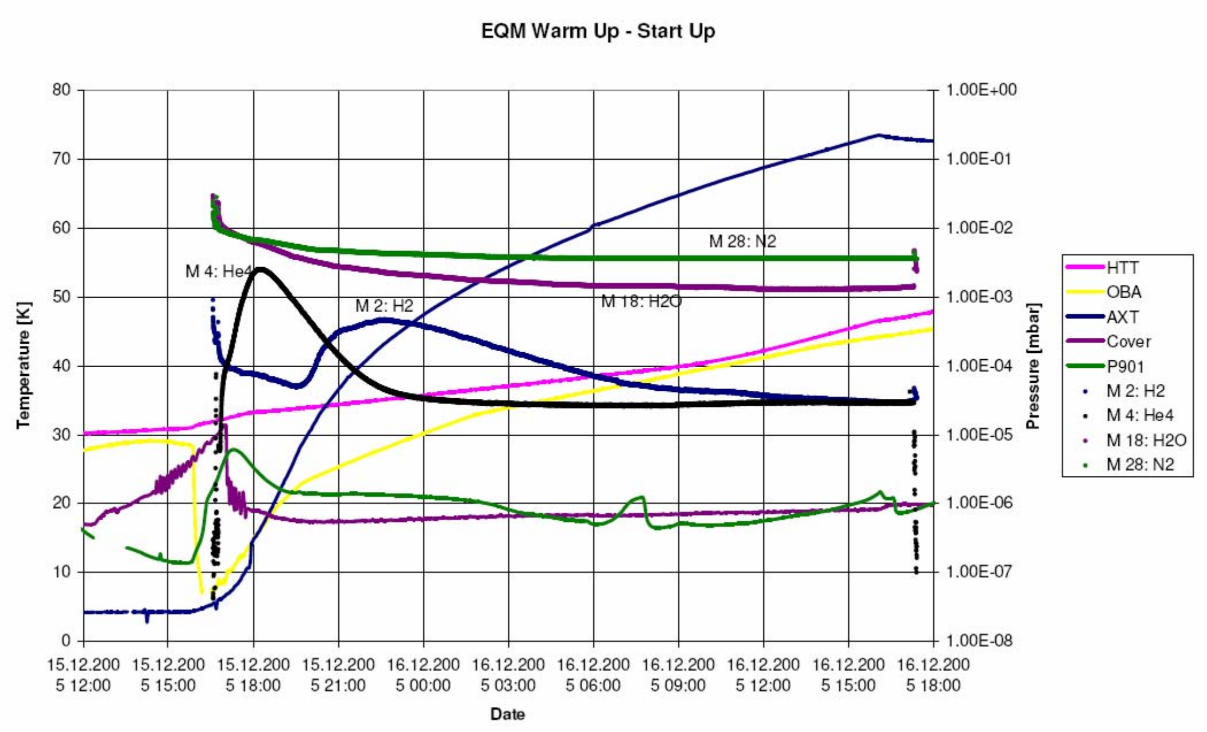

Figure 4.7-3: Temperatures and (Partial-) Pressure at start of WU

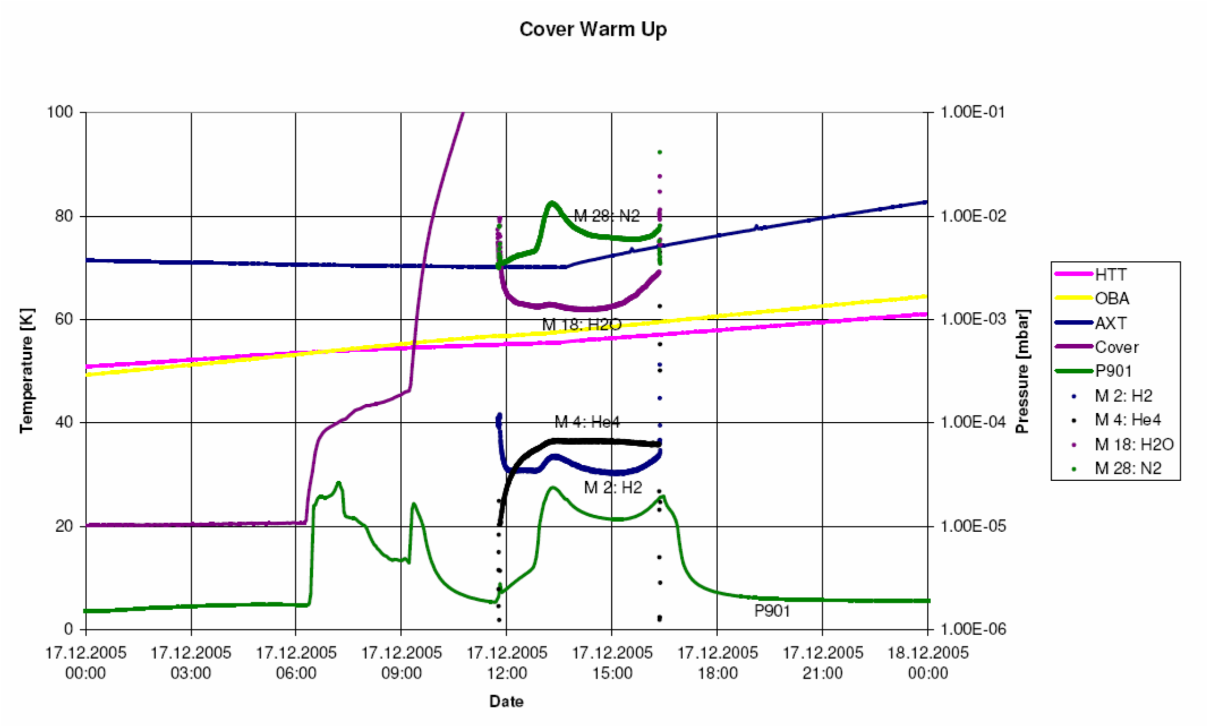

Figure 4.7-4: Temperatures and Pressure at Warm Up of Cover

4.7.4 Problems / Deviations

Except the long duration no problems were detected. The tanks could not be actively heated in order not to exceed temperature gradient requirements between AXT (L0) and OBA (L1 and L2).

4.7.5 Lessons Learnt

The warming up of the EQM cryostat had a quite limited significance for FM due to the differences in the Helium subsystems.

The driving parameters for warming up seem to be the temperature gradient requirements. The limited temperature rates are less critical.

The warming up process can be speed up by breaking the isolation vacuum with GN2 to about 10^{-2} mbar to 1 mbar.

5 CONFIGURATION STATUS

5.1 EQM System Status

At the start of the cryostat operation, the H/W configuration of the components is defined with the "As Built Configuration List" HP-2-ASED-AB-0003, issue 2 and the NCR's.

A rough summary of the initial configuration is given below:

- The PLM was closed, evacuated and leak tested
- The PLM was mated with the SVM simulator
- The PLM/SVM was placed on ground in clean room class 100 000
- The harness (CCH and SIH) was completely integrated, verified and connected with instruments

The cryostat status at start of cryostat operations:

- the He S/S was filled with GN_2 at ambient pressure and ambient temperature
- strap pretensions were about 5 kN
- 16 strap pretension measurement devices were mounted to the strap pretensioners
- CVV is flushed with GN_2 and pumped down to < 10^{-4} mbar

After the first HIFI tests at He II, the PLM/SVM was installed in the test dolly. The EQM was tilted with the test dolly by 23°.

5.2 Instrument Configuration

The instrument FPUs were integrated onto the OBA and verified at ambient temperatures together with their warm units, integrated into the SVM simulator.

HIFI:

- FPU QM
- FCU DM2
- LOU QM
- LCU DM
- LSU Simulator
- BWG Simulator
- WEH QM
- WHO QM
- HRH QM
- ICU AVM ⇨ exchanged by CFM on 18.10.05 (before EMC test)
- WIH QM
- IF attenuator ⇨ exchanged by IF up converter 18.10.05 (before EMC test)

PACS:

- FPU CQM
- DEC/MEC EM
- BOLC QM1
- DPU AVM ⇨ exchanged by CFM2 on 21.09.05 ⇨ exchanged by AVM on 17.10.05

- SPU AVM
- WIH AVM
- External power supply for BOLC

SPIRE:

- FPU CQM including IFETs
- DPU AVM1
- DCU QM1
- FCU QM1
- WIH
- External power supply

5.3 MGSE Status

The following MGSE items were used during EQM testing:

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:
1	PLM Test Dolly	APCO	CI No. 142 155-01
1	PLM Hoisting device	APCO	CI No. 142 121
2	Long Hoisting Bars for EQM	APCO	CI No. 142 129-02
	Working platform at the filling airlock		
	General Purpose Hoisting Devices	ASED	
	Set of tools	ASED	

Table 5-1: MGSE Items

5.4 EGSE Status

The following EGSE items were used during EQM testing:

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:
1	Central Checkout System (light)	Terma	CI No. 142 210
1	EQM CryoSCOE	ABSp	CI No. 142 220
1	CDMU DFE	SSBV	CI No. 142 230
1	PLM SCOE	SSBV	CI No. 142 240
1	I-EGSE (if instruments are used)		

Table 5-2: EGSE Items

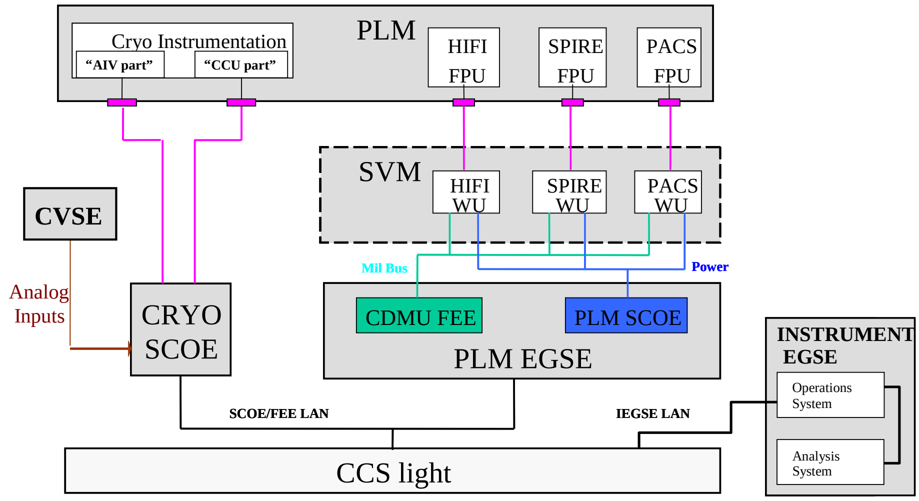

Figure 5.4-1: EGSE Set-Up

All cryostat instrumentation was monitored from the EQM CryoSCOE and in parallel by the CCS. The cryostat instrumentation was operated by the EQM CryoSCOE in stand alone configuration only.

The CCS provided a part of the cryostat data to the I-EGSE as long as the I-EGSE was switched on.

5.5 CVSE Status

The following CVSE was used during EQM testing:

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:
1	High Vacuum Pumping Unit 1	BOCE	CI No. 142 310-03
2	Turbo pumps (C0711, C0712)	BOCE	CI No. 142 310-03
1	Laboratory Vacuum Pump in safety unit	BOCE	CI No. 142 310-04
1	Laboratory Vacuum Pump in CVSE scaffolding	BOCE	CI No. 142 310-04
1	CVSE Monitoring Rack	BOCE	CI No. 142 310-06
1	Leak Detector	BOCE	CI No. 142 310-07
1	LHe transfer lines (Y0211/Y0221)	DeMaCo	CI No. 142 310-08
1	Venting line Y0601/Y0602	DeMaCo	CI No. 142 310-09
1	Safety line to SV 121 (Y0621/Y0622)	DeMaCo	CI No. 142 310-09
1	Scaffolding for CVSE lines		CI No. 142 310-10
	450 l LHe Dewars type HDS 450 -EIPS	Linde	

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:
	50 l / 200 bar GHe grade 5.0	Linde	
	Set of mass flow meters	ASED	
	Set of vacuum hoses		
	Manometer P0621-1(0,1-27 mbar) in safety unit	W & T	
	Manometer P0621-2(1-1200 mbar) in safety unit	W & T	

Table 5-3: CVSE Items

The filling airlock with SV 121 was mounted onto the CVSE. At beginning of cool down, the turbo pump 'A' (C0711) was mounted to SV 921 airlock and turbo pump 'B' (C0712) was mounted to SV 922 airlock. Turbo pump 'A' was removed during cool down and replaced by the safety valve SV 921.

The ISO external venting line was blinded and leak tested.

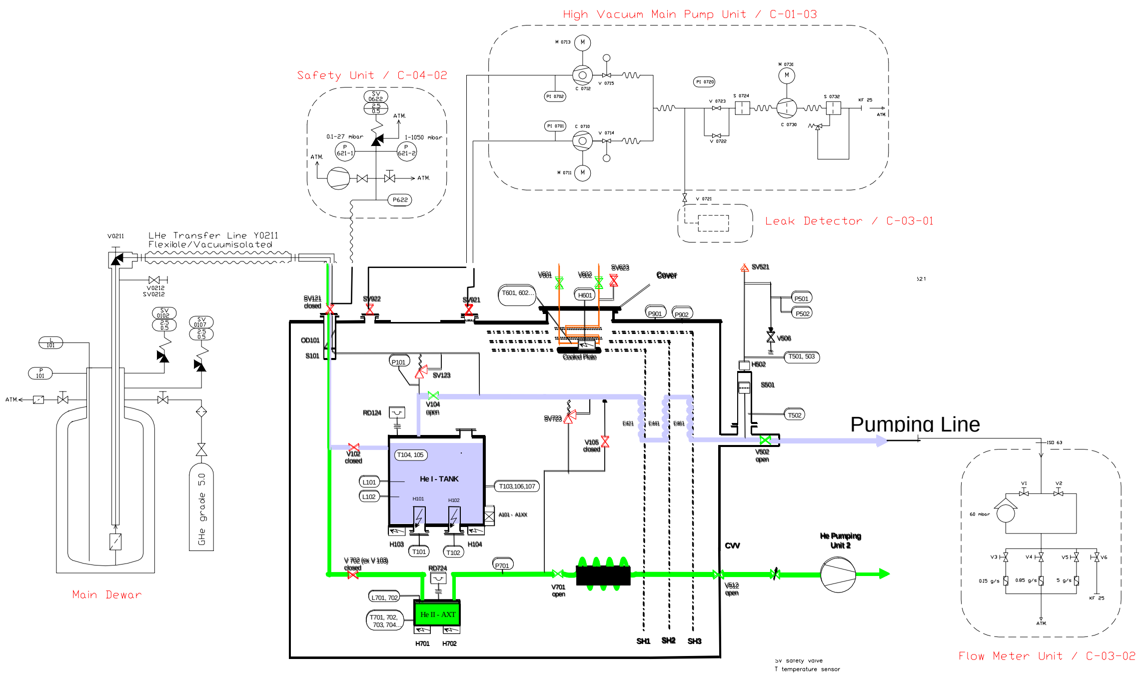

Figure 5.5-1: CVSE Configuration

6 TIME RECORD

Performed		Activity			Remark
Start	End	Procedure	Section		
25.08.05	29.08.05	HP-2-ASED-TP-0072	5.1 - 5.4	Preparation of cool down	
29.08.05	31.08.05	HP-2-ASED-TP-0072	5.5	Cool down of HTT	
29.08.05	09.09.05	HP-2-ASED-TP-0072	5.5 - 5.6	Cool down and filling of AXT	
09.09.05	14.09.05	HP-2-ASED-TP-0090	5.1 - 5.4	1st He II Production in AXT	
13.09.05	27.09.05	n/a		Cryostat operation in test phase 1	
16.09.05	16.09.05	HP-2-ASED-TP-0091	5.1 - 5.3	1st cover flushing	
05.10.05	19.10.05	HP-2-ASED-SD-0058		Sorption cooler problem investigation / leak tests	
19.10.05	14.12.05	n/a		Cryostat operation in test phase 2	
14.12.05	14.12.05	HP-2-ASED-TP-0098	5.1 - 5.2	Warm up to He I	
15.12.05	15.12.05	HP-2-ASED-TP-0098	5.3	Depletion of AXT	
16.12.05	17.01.06	HP-2-ASED-TP-0098	5.4	Warm-up to ambient	
17.01.06	18.01.06	HP-2-ASED-TP-0098	5.5	Cryostat operation completion	

Table 6-1: Time Record

7 NCR SUMMARY

In the scope of cryostat operation the following NCR's have been raised (only NCR's relevant for cryostat operation are listed):

NCR	Date	Description	Status	Effect on PFM	Remark
HP-112000-ASED-NC-1662	25.10.05	SPIRE EQM cooler recycling failed	closed	Tbd	Problem was caused by Helium leaks in the cryostat. Investigations performed according HP-2-ASED-SD-0058
HP-113000-ASED-NC-1495	20.09.05	PACS EQM cooler recycling failed	closed	Tbd	Problem was caused by Helium leaks in the cryostat. Investigations performed according HP-2-ASED-SD-0058
HP-113000-ASED-NC-1675	03.11.05	Cryostat background radiation measured by PACS much higher than predicted	closed	Tbd	The cryostat cover had to be cooled down to lower temperatures than expected. Specific tests to find the source were performed at the end of the EQM test phase 2. (see HP-2-ASED-TR-0092 for details)
HP-142220-ASED-NC-1667	15.07.05	EQM CryoSCOE heater data block in continuous acquisition mode	open	If not fixed	Only monitoring was blocked; use as is for EQM; the SCOE will be modified and validated as part of the upgrade as FM CryoCOTE
HP-142220-ASED-NC-1668	15.07.05	EQM CryoSCOE data shows regular peaks in 'once per minute' acquisition	open	If not fixed	Data had to be filtered off line; use as is for EQM; the SCOE will be modified and validated as part of the upgrade as FM CryoCOTE
HP-142220-ASED-NC-1759	22.11.05	EQM CryoSCOE heater repeated blocking and disabling	open	If not fixed	Only monitoring was blocked; use as is for EQM; the SCOE will be modified and validated as part of the upgrade as FM CryoCOTE

NCR	Date	Description	Status	Effect on PFM	Remark
HP-142220-ASED-NC-1829	06.12.05	Very high noise on C100 sensors for EQM CryoSCOE	open	If not fixed	Data had to be filtered off line; use as is for EQM; a fix was done on the PFM SCOE and worked properly; the SCOE will be modified and validated as part of the upgrade as FM CryoCOTE
HP-150000-ASED-NC-1484	18.09.05	Temperature gradient requirement during cool down of cryostat partially exceeded	closed	Y	See section 4.1 for details
HP-150000-ASED-NC-1489	21.09.05	Required tilting position of the cryostat via test dolly not secured	closed	N	Due to a problem with the test dolly gear a tilting angle of 30° could not be achieved; position of 23° (sufficient for cooler recycling) was fixed manually
HP-150000-ASED-NC-1683	07.11.05	EQM L1 temperatures higher than expected	closed	Y (tbc)	See section 4.5 for details
HP-150000-ASED-NC-1817	06.12.05	EQM mass flow through OBA from AXT higher than expected	open	Y	See section 4.5 for details
HP-151000-ASED-NC-0211	04.04.04	Internal leakage of safety valve SV121 out of spec	closed	N	Not relevant for EQM testing
HP-151000-ASED-NC-1319	02.08.05	I/F CVV/filling port is not Helium leak tight as requested	closed	Y	Leak tightness improved by gluing (see HP-2-ASED-SD-0058); one of the causes for sorption cooler problem
HP-151000-ASED-NC-1795	28.11.05	EQM cryostat cover temperature instability	open	Y	See section 4.6 for details
HP-151240-ASED-NC-1415	01.08.05	The SV121 plug remains not in safety valve position	closed	Y	Safety function was transferred to valve SV0622 in safety unit

Table 7-1: NCR Summary

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8 TEST CHANGE SUMMARY

This paragraph summarizes the major changes of the cryostat operation which have a relevant impact on the performed tests (e.g. change of the test setup, additional test steps or sequences, modification or deletion of test steps or sequences, change of expected values or pass/fail criterias).

All other minor deviations to or adaptations of the integration procedure are hand marked at the respective test step.

Test Change	Issue	Date	Description	Status	Remark
HP-2-ASED-SD-0058	3	04.10.05	Activities to localize Helium leaks, tighten the leaks where possible and verify final status.	performed	Activities were necessary to improve operation of the sorption coolers

Table 8-1: Test Change Summary

9 AS-RUN PROCEDURE

Test Facilities

Astrium OTN, Building 5.0, cleanroom class 100.000

Operation Dates

See Time Record in section 6

Test Procedures

Integration Procedure for AXT CCH onto AXT

HP-2-ASED-TP-0021

Issue 1, Rev. -, 23.07.04

Issue 2, Rev. -, 22.09.04

Integration Sequences

Integration of mechanical part	Performed
Health Check	N/A
Integration of Cryo Components	Performed
Integration and Routing of Harness Bundles on AXT	Performed
Insulation Test	Performed
Connection of harness to Cryo Components / Location Test	Performed
Loop-Resistance Test (Verification)	Performed
Loop-Resistance Test (Final)	N/A

Personnel:

Test Manager:	C. Schlosser / S. Idler
Test Conductors:	P. Mack
Cryo./Mech. AIT:	A. Runge / J. Schäffler / R. Kameter
El. AIT:	A. Grasl / R. Kameter
QA:	E. Lamprecht
EGSE:	S. Ilsen

10 ATTACHMENTS

I. As-Run Copy of the Cool Down and Filling Procedure HP-2-ASED-TP-0072

II. As-Run Copy of the He II Production & Top Up Procedure HP-2-ASED-TP-0090

III. As-Run Copy of the Cover Flushing Procedure HP-2-ASED-TP-0091

IV. As-Run Copy of the Depletion & Warm Up Procedure HP-2-ASED-TP-0098

V. Test change HP-2-ASED-SD-0058, issue 3

VI. Copy of filled in Log Sheets 1

VII. Copy of filled in Log Sheets 2

VIII. Copy of strap pretension measurements

IX. Copy of the NCR's

I. As-Run Copy of the Cool Down and Filling Procedure

HP-2-ASED-TP-0072

Working Copy

start: 25.08.05

end:

Title: **Herschel EQM Cool Down and Filling**

CI-No: 151 000

Prepared by:	Herschel Team / A. Runge	Date:	28.07.05
Checked by:	C. Schlosser		28.7.05
Product Assurance:	R. Stritter		03.08.05
Configuration Control:	W. Wietbrock		03.08.05
Project Management:	Dr. W. Fricke		05/08/2005

Distribution: See Distribution List (last page)

Issue	Date	Sheet	Description of Change	Release
1	28.07.05	All	initial issue	

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1 Scope

1.1 Objective

This test procedure describes the controlled cool down of the Herschel EQM cryostat to 4.2 K and the filling of the Herschel Tanks. Cool-down and filling will be started after evacuation and successful leak test in warm conditions. The temperature requirements have to be regarded, even if CQMs instead of the FM FPUs are integrated in the PLM.

This procedure summarises the nominal activity flow, operational constraints, GSE set up and the step by step procedure. The operations are given in correct timely order. All activities are performed in clean room class 100.000.

1.2 Activity Flow

The activity flow below summarizes the activities to be performed during cool down and filling. Cool down and filling is completed with the steps in section 5.6. Sections 5.7 to 5.9 have to be repeated for each exchange of dewar.

The cool down and filling in coarse steps:

§ 5.1	**Check of PLM Status**	Configuration check according chapter 3.1 and 3.2 PLM-FM flushed with GN2 Increase of strap pretension to –10 - 15 kN Isolation vacuum < 1 x 10^{-4} mbar Valve status check
§ 5.2	**Installation of Auxiliary Lines and Components**	Installation and leak test of safety line Y0621 Installation and leak test of vent line Y0601/Y0602
§ 5.3	**Evacuation and Purging of He S/S**	Evacuation of tubing via V 502, V 105 and V 701 Evacuation of HTT Preparation of filling line Flushing of He S/S with GHe Leak test of He S/S Evacuation and flushing with GHe of the He S/S (4 x)
§ 5.4	**Installation of Safety Valve SV 922**	Installation of SV 922
§ 5.5	**Cool down of Cryostat**	He S/S evacuated at start of cool down Stop pumping with He II pumping unit Pressurization of He S/S to 1 bar from LHe dewar Cool down to 4.2 K
§ 5.6	**Filling of HTT**	Filling of HTT to 100 % Closing and dismounting of airlock to SV 921 Mounting of 50 mg/s flow meter after end of filling Final configuration: • HTT filled up to LHe I • AXT partly filled with LHe I • Venting via V 104, V 701 and V 502
§ 5.7	**Night Break**	• Establishing of night configuration: o Removal of transfer line o Venting via V 104, V 701 and V 502 • Restart after night configuration

§ 5.8	**Exchange of LHe Dewar**	• Removal of transfer line • Installation of new dewar and transfer line
§ 5.9	**Preparation of LHe I Transfer Line**	• Preparations • Evacuation of transfer line • Flushing of transfer line with GHe
§ 5.10	**Installation of Transfer Line**	• Installation of transfer line in dewar • Installation of transfer line in SV 121 • Evacuation and purging of filling airlock • Pre-cooling of transfer line

1.3 Requirements

During cool-down the following requirements have to be regarded:

Temperature requirements:

HTT: $\Delta T103/\Delta t < 50$ K/h
HIFI/(PACS): $\Delta T207/\Delta t < 20$ K/h (above 50 K for HIFI)
$\Delta T207/\Delta t <$ ~~20~~ K/h (above 50 K for PACS; < 5 K defined by PACS not yet agreed by ASED) 5 K/h see HN-1042
SPIRE/(PACS): $\Delta T253$ (T255)/$\Delta t < 20$ K/h (above 50 K for PACS; no requirement from SPIRE)
SPIRE J-FET: $\Delta T249$ (T251)/$\Delta t < 20$ K/h (above 50 K; no requirement from SPIRE)

Remark: There are no specific PT1000 temperature sensors to monitor PACS cool down, PT1000 sensors close to HIFI foot and SPIRE foot shall be used instead.

The large tank shall always to be colder than OBA and FPUs:

T 207 - T 701 > 30 K
T 253 - T 701 > 30 K

Keep AXT as long as possible colder than the HTT:

T 103 – T 701 > 30 K

Temperature differences between L0, L1 and L2 shall not exceed 20 K. (HIFI). This requirement can only be controlled by indirect measurements (AXT vs. OBA plate vs. SPIRE L3) or by instrument internal sensors:

|T 701 – T 207| < 20 K
|T 207 – T 249 (T 251)| < 20 K
|T 701 – T 249 (T 251)| < 20 K

2 Documents/Drawings

2.1 Applicable Documents

The following documents of the latest issue in effect or as defined herein form a part of this document to the extent specified herein.

AD #	Document Title	Document Identifier
AD 01	CVSE Set-up Description	HP-2-ASED-TN-0094
AD 02	PA Requirements for Subcontractors	HP-1-ASPI-SP-0018

2.2 Reference Documents

RD #	Document Title	Document Identifier
RD 01	Documentation Identification Procedure and Documentation Management	HP-2-ASED-PR-0001
RD 02	EQM AIT Plan	HP-ASED-PL-0022
RD 03	PA Plan	HP-2-ASED-PL-0007
RD 04	Contamination Control Plan	HP-2-ASED-PL-0023
RD 05	General Design and Interface Requirements (GDIR)	H-P-1-ASPI-SP-0027
RD 06	Reinigungsvorschrift für Komponenten im Projekt Herschel	HP-2-ASED-PR-0008
RD 07	List of Acronyms	HP-2-ASPI-LI-0077
RD 08	IID-B HIFI, section 5.7	SCI-PT-IIDB/HIFI-02125
RD 09	IID-B PACS, section 5.7 and 7.2	SCI-PT-IIDB/PACS-02126
RD 10	IID-B SPIRE, section 5.7	SCI-PT-IIDB/SPIRE-02124
RD 11	IID-A, section 9	SCI-PT-IIDA-04624

2.3 Other Documents

OD #	Document Title	Document Identifier
OD 01	Manual of High Vacuum pumping unit	
OD 02	Manual of He II pumping unit	

3 Configuration

3.1 General Hardware Configuration

At the start of the activities, the H/W configuration of the components is defined with the "As Built Configuration List" and the NCR's.

A rough summary of the initial configuration is given below:

- The PLM is closed, evacuated and leak tested ✓
- The PLM is mated with the SVM simulator ✓
- The PLM/SVM is integrated in ~~the test dolly~~ SVM simulator and placed in clean room class 100 000 ✓
- The instrument FPUs are integrated onto the OBA and verified at ambient temperatures together with their warm units, integrated into the SVM simulator
- The harness (CCH and SIH) is completely integrated, verified and connected with instruments

3.2 Cryostat Configuration

The cryostat status at start of cool down and filling shall be:

- the He S/S is filled with GN_2 at ambient pressure and ambient temperature
- filling airlock with SV 121 is mounted
- Turbo pump 'A' (C0711) mounted to SV 921 airlock for continuous evacuation of the cryostat during cool down
- Turbo pump 'B' (C0712) mounted to SV 922 airlock
- strap pretensions are about 5 kN
- 16 strap pretension measurement devices are mounted to the strap pretensioners
- the Cryo SCOE shall be operational and instrumentation connected
- external venting line is blinded and leak tested ✓
- CVV is flushed with GN_2 and pumped down to < 10^{-4} mbar ✓

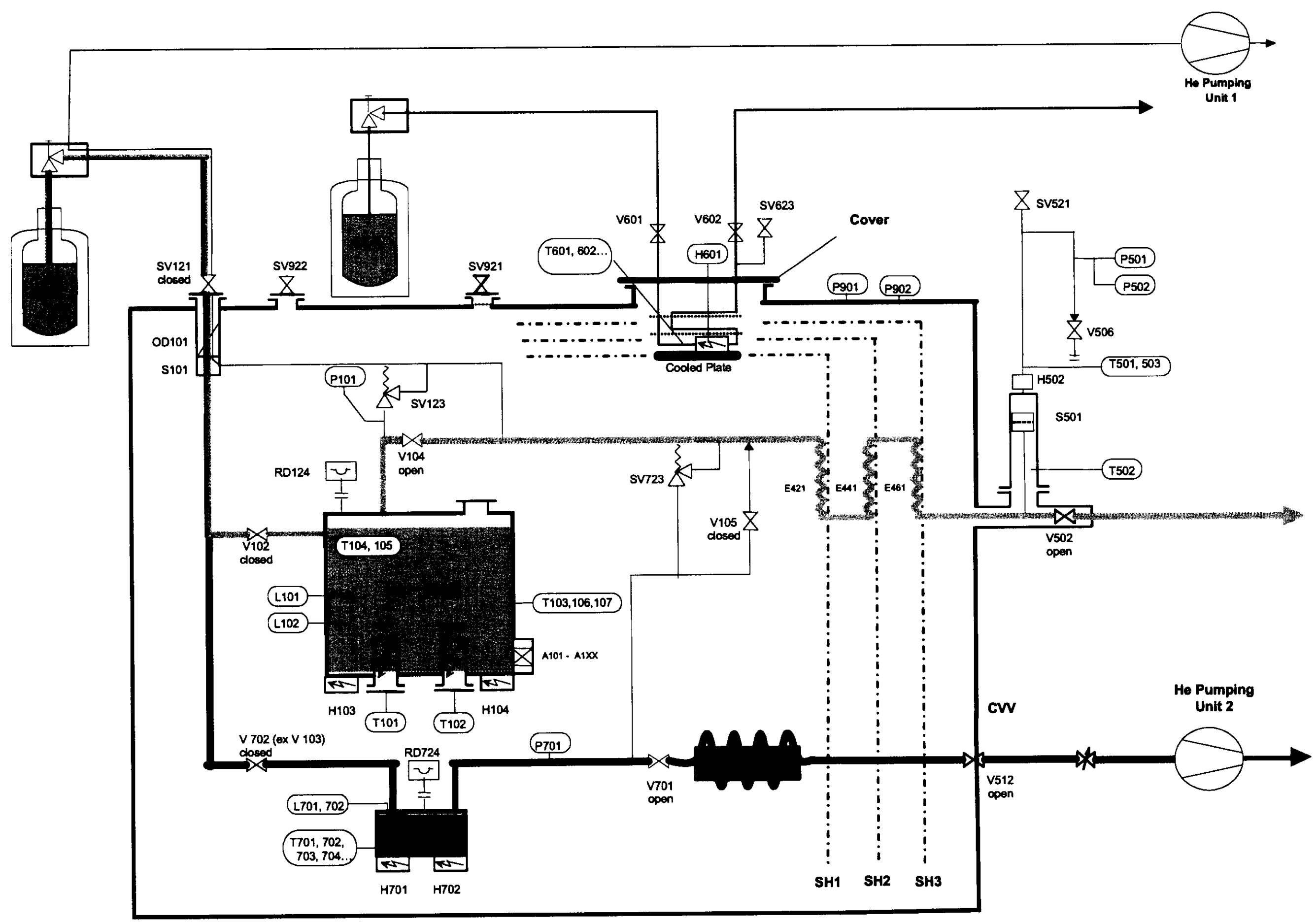


Figure 3-1: EQM PLM Helium S/S Flow Schema

3.3 Set-up

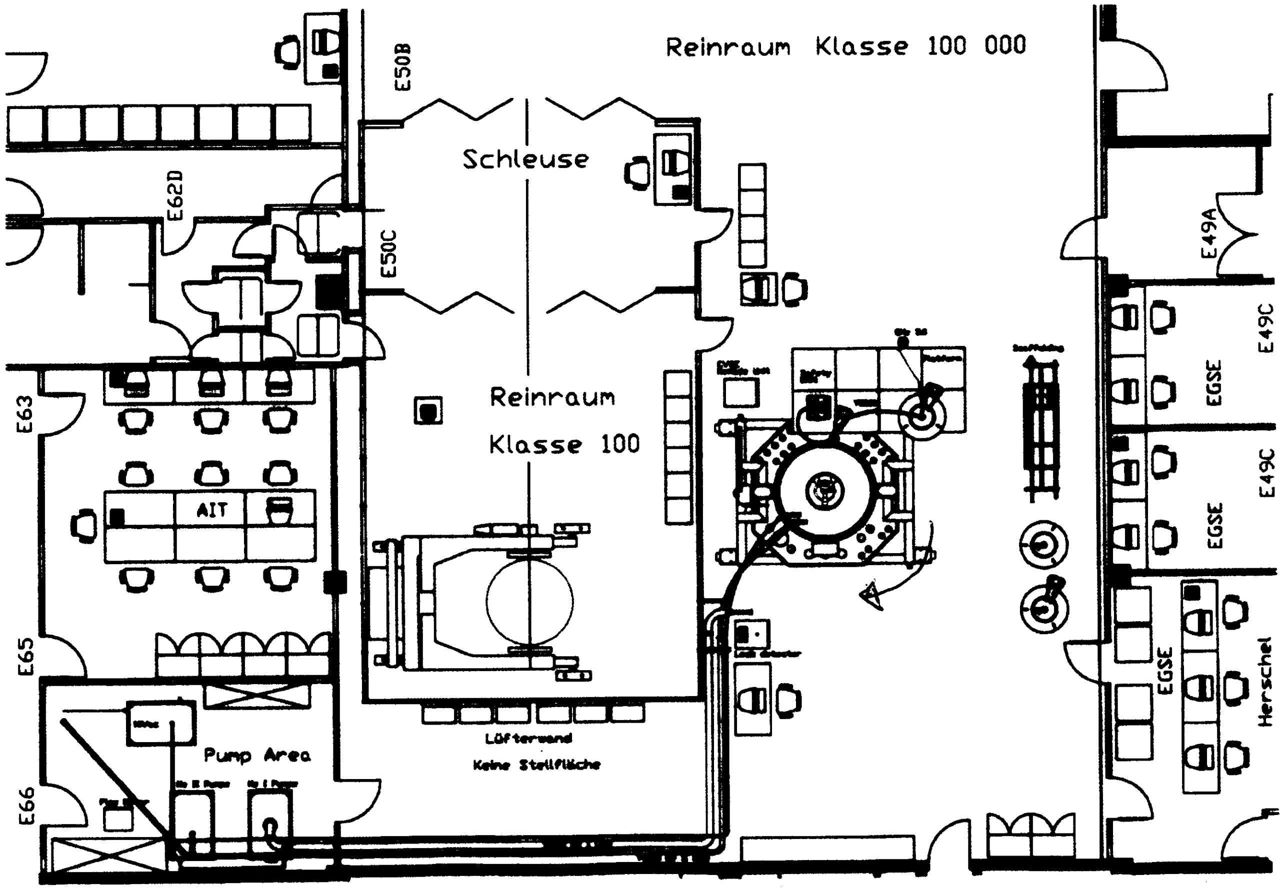


Figure 3-2: General set-up in clean room class 100 000

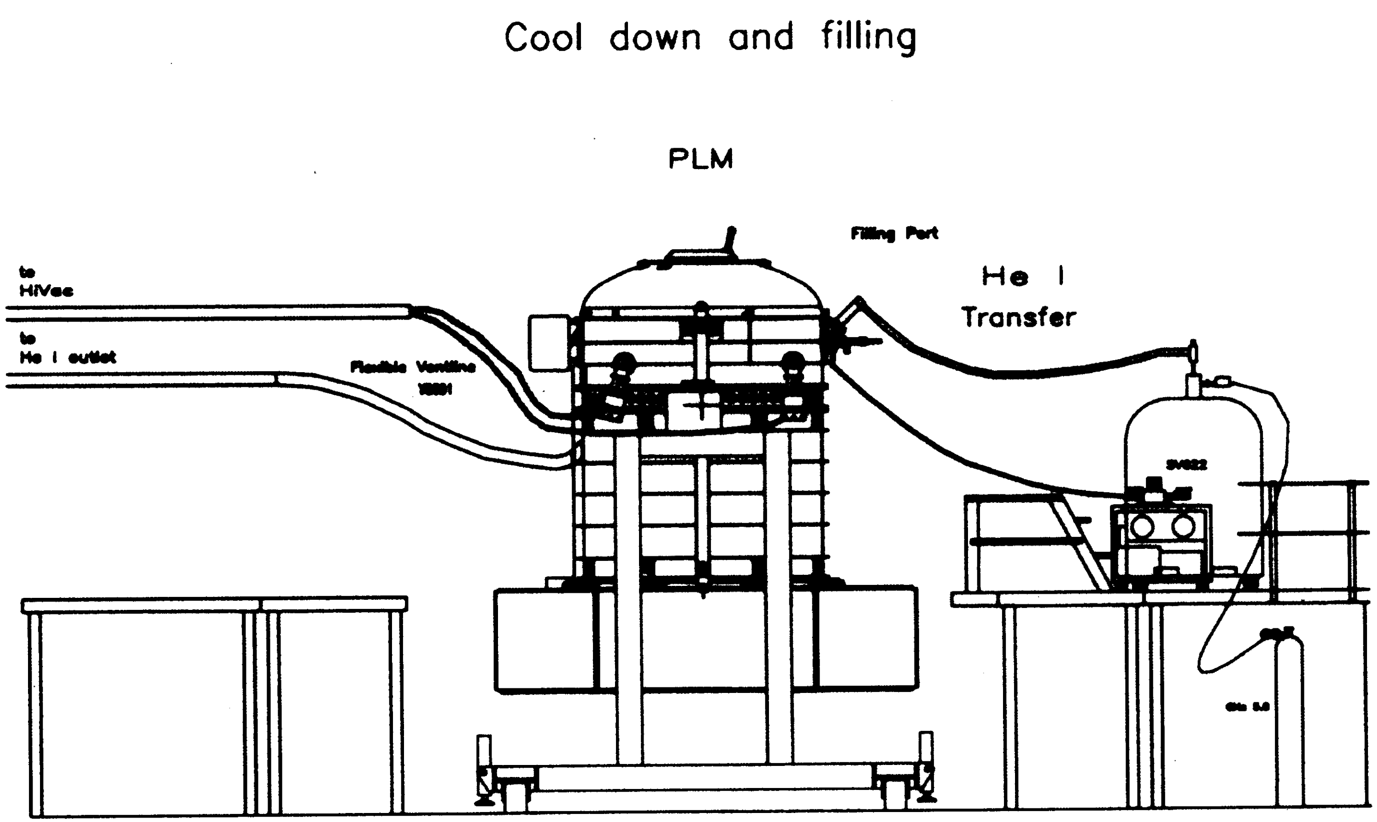


Figure 3-3: Set-up during cool down and filling

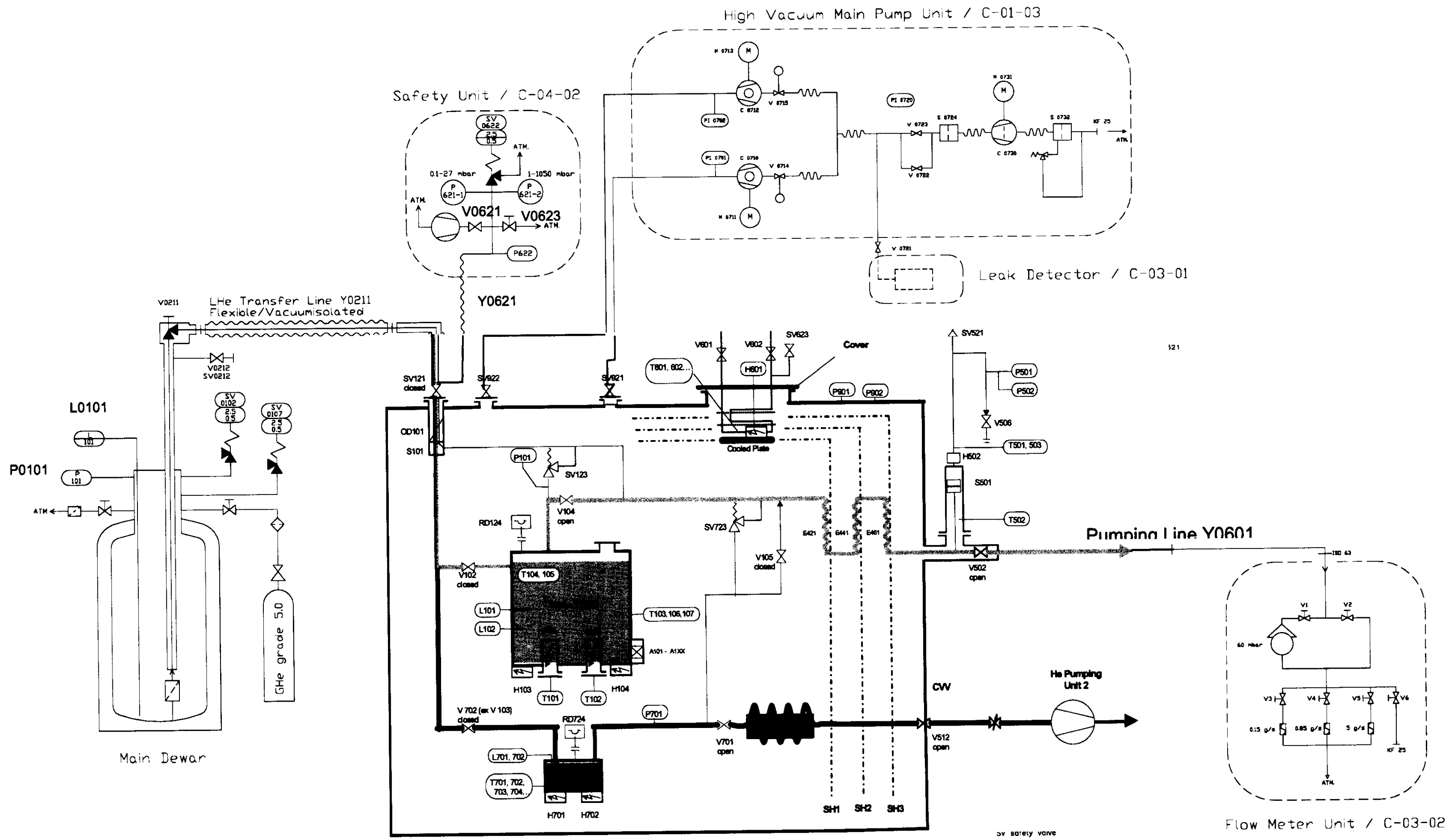
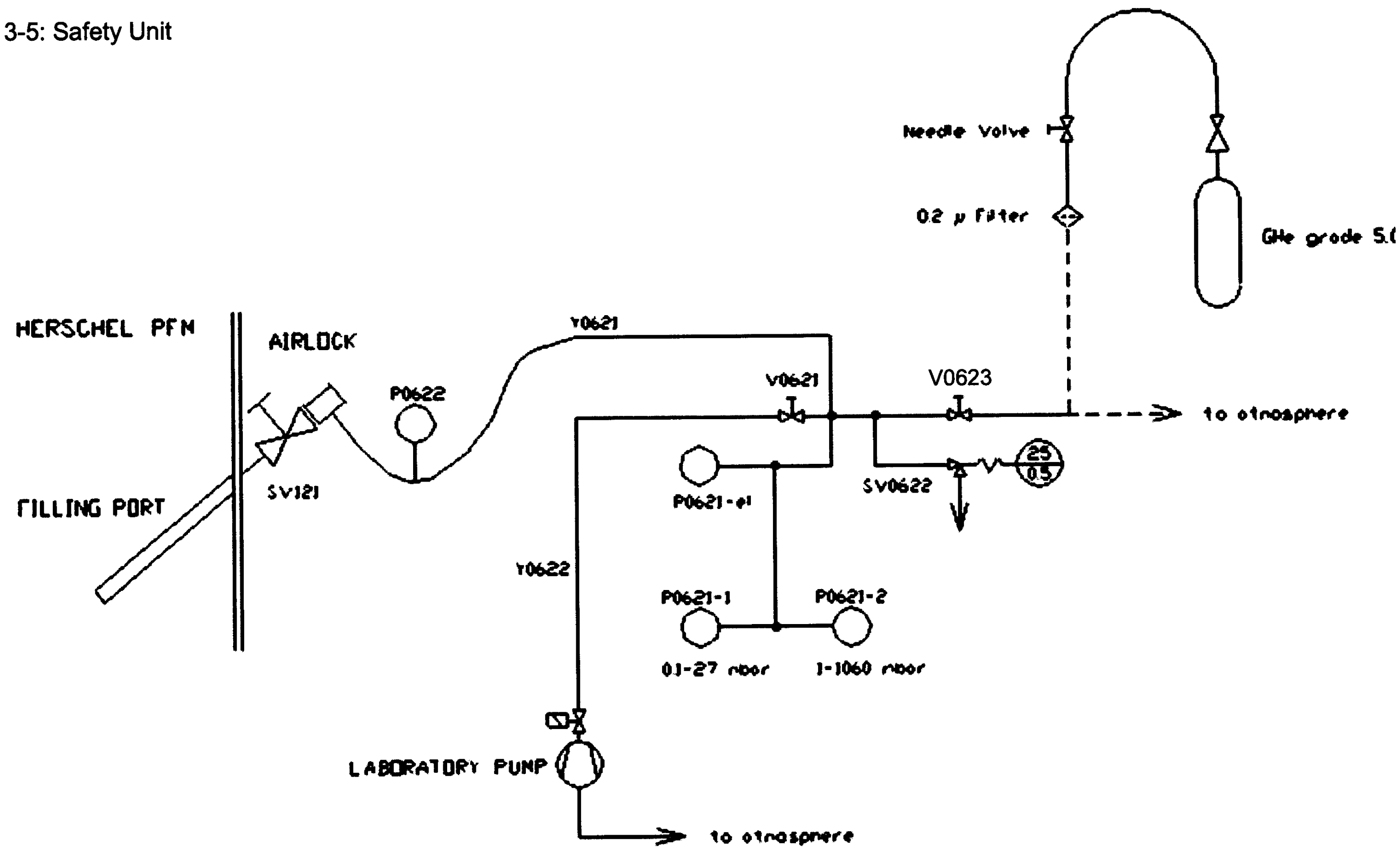


Figure 3-4: CVSE for cool down and filling

Figure 3-5: Safety Unit



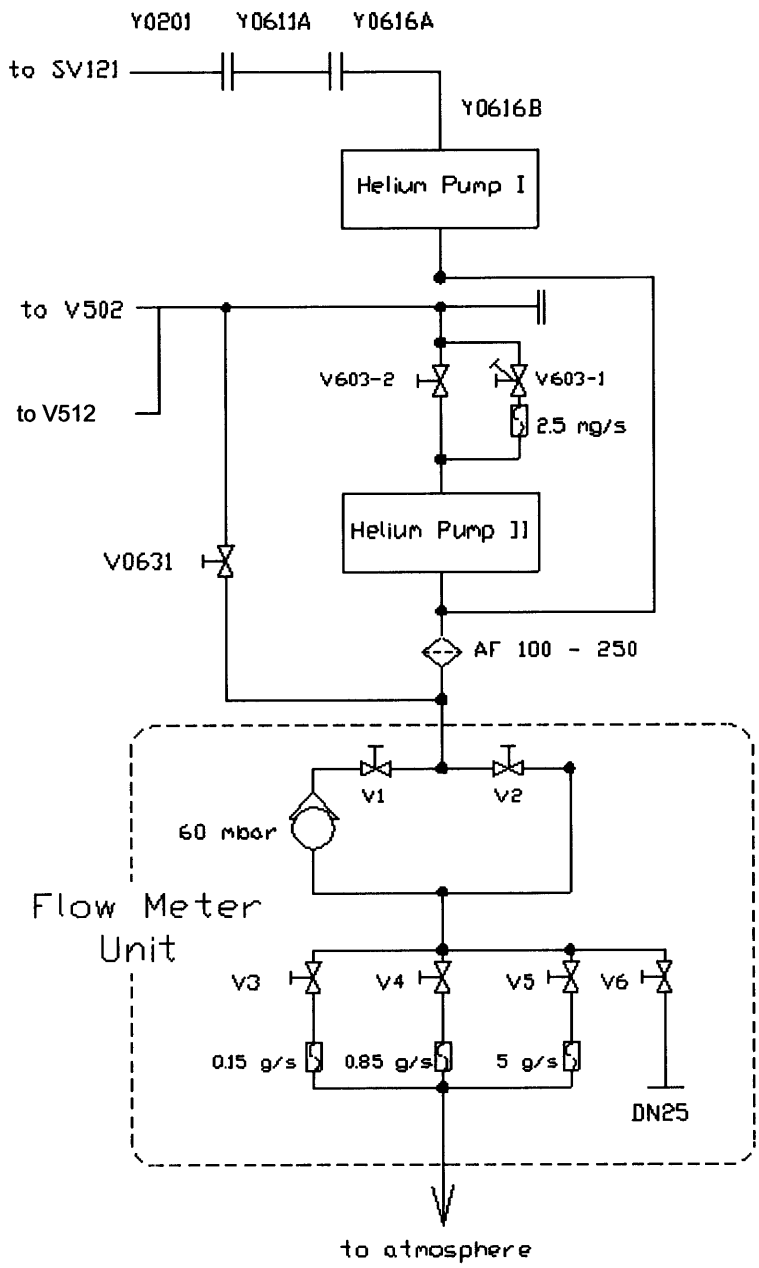


Figure 3-6: Flow Meter Unit

4 Conditions

4.1 Personnel

Cool down and filling shall be performed in double shift. Personnel necessary to perform activities according to this present procedures are:

Responsibility	Name / Organisation
Test Manager	*) C. Schlosser
Test conductors	*) C. Schlosser
Cryostat Operators	*) P. Mack A. Runge
EGSE Operators	*) J. Stijn
PA Responsible	*) C. Lamprecht D. Hendry

*) Names and possible additional personnel to be registered prior to the start of activities

4.2 Environmental

All activities according this procedure have to be performed in a clean room class 100 000 according Federal standard 209 E:

Cleanliness:	class 100 000
Temperature:	22°C ± 3°C
Pressure:	ambient
Rel. humidity:	40 % - 65 %

4.3 General Instructions for Integration

4.3.1 *General Safety Requirements, Precautions*

The following general rules have to be regarded:

- Respect standard technical rules for mechanical and electrical integration and test activities
- Special hazard precautions are not expected, except for the comments below and the comments mentioned in the step by step procedure
- The H/W has to be handled by authorized personnel only

The following specific rules have to be regarded:

- In case of an unexpected large release of helium it may be necessary to treat victims for suffocation and cold burns. If required, remove the victim from immediate vicinity of the leak
- In case of operation of the Cryostat safety system the following immediate activities shall be performed:
  - operation of safety valve: everybody has to leave the test room, except test conductor and necessary CVSE operations personnel
  - operation of burst disc: everybody has to leave the test room
- Contact facility emergency services immediately and explain nature and location of accident

4.3.2 *QA Requirements*

QA shall monitor all operations (handlings, transportation and installation) as necessary to assure compliance with this procedure and the applicable sections of the PA Plan (RD 3).

In the course of this procedure QA shall pay particular attention to

- integrity of every tightening surfaces and seals
- ensure adequate cleanliness conditions
- ensure that all safety aspects are considered
- the application of adequate protections to critical surfaces
- the records in the log sheet
- to ensure that tools and test equipment used is within current calibration cycle

4.3.3 *ESD constraints*

No specific ESD precautions have to be regarded during cool down and filling.

4.3.4 *Prerequisites*

At least the following tasks have to be successfully completed before start with cryostat cool down:

- TRR has been successfully held to ensure that the relevant procedures, drawings, applicable documents are available, reviewed and approved
- Formal release to start with activity is given by QA / safety
- The necessary GSE and H/W is available, accepted and applicable for use
- Safe working conditions for personnel and H/W are existing and will be applied
- Skilled and authorized personnel is available
- An access restricted area has been defined and marked by QA / safety
- Incoming inspection of H/W have been performed by QA and engineering

All parts and tools required available and operational

4.4 GSE

All GSE and integration equipment is fit checked and carries valid calibration certificates.

4.4.1 *MGSE*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	PLM Test Dolly	APCO	CI No. 142 155-01	N/A
1	PLM Hoisting device	APCO	CI No. 142 121	N/A
2	Long Hoisting Bars for EQM	APCO	CI No. 142 129-02	N/A
	Working platform		N/A	N/A
	General Purpose Hoisting Devices	ASED	N/A	N/A
	Set of tools	ASED	N/A	N/A

Table 4-1: MGSE

4.4.2 *EGSE*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	Central Checkout System (light)	Terma	CI No. 142 210	
1	EQM Cryo SCOE	ABSp	CI No. 142 220	
1	CDMU DFE	SSBV	CI No. 142 230	
1	PLM SCOE	SSBV	CI No. 142 240	
1	I-EGSE (if instruments are used)			
	Digital Multimeters (troubleshooting only)	ASED		
	Set of break out boxes (troubleshooting only)	ASED		
	Ohm -meter (troubleshooting only)	ASED		

Table 4-2: EGSE

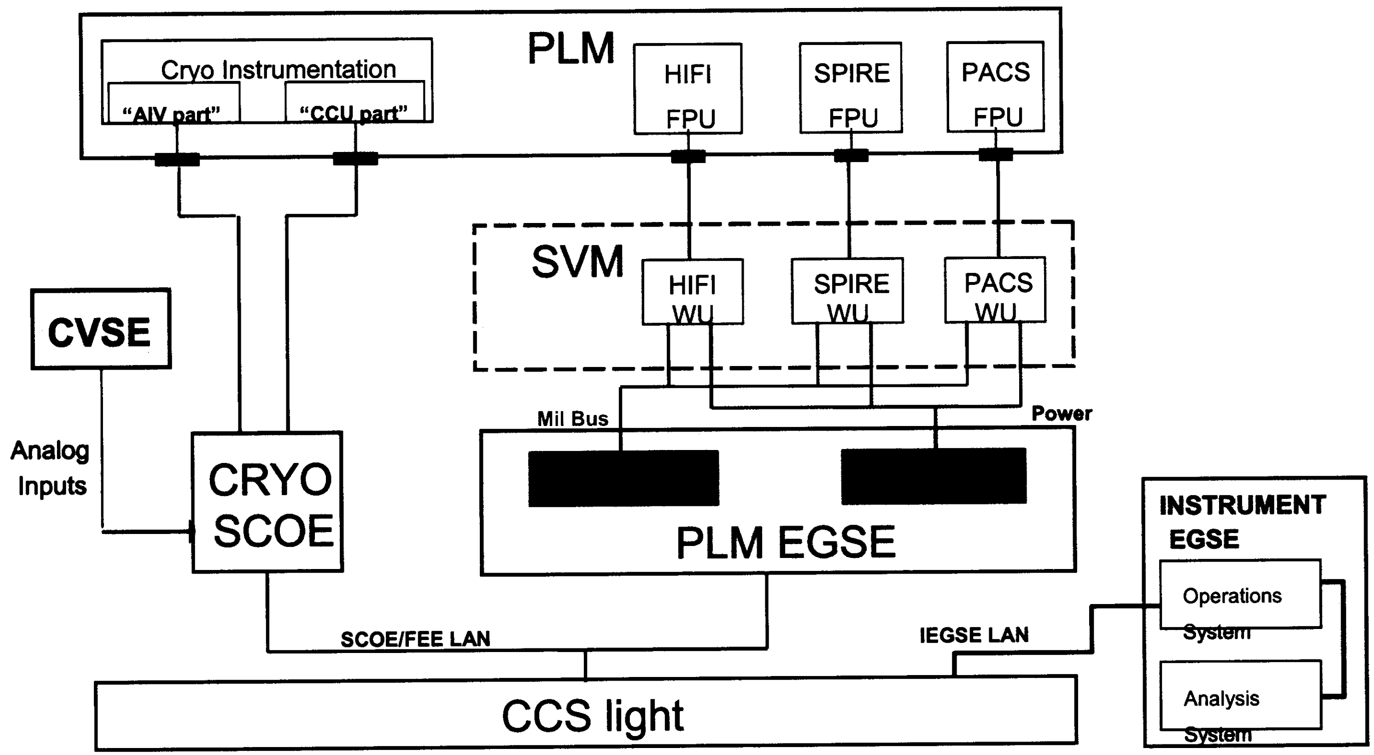


Figure 4-1: EGSE Configuration

4.4.3 *OGSE*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
	Theodolites	ASED		

Table 4-3: OGSE

4.4.4 *Cryo Vacuum Servicing Equipment (CVSE)*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	High Vacuum Pumping Unit	BOCE	CI No. 142 310-03	N/A
2	Turbo pumps (C0711, C0712)	BOCE	CI No. 142 310-03	
1	Laboratory Vacuum Pump in safety unit	BOCE	CI No. 142 310-04	
1	Laboratory Vacuum Pump in CVSE scaffolding	BOCE	CI No. 142 310-04	
1	CVSE Monitoring Rack	BOCE	CI No. 142 310-06	
1	Leak Detector	BOCE	CI No. 142 310-07	
2	LHe transfer lines (Y0211/Y0221)	DeMaCo	CI No. 142 310-08	
1	Venting line Y0601/Y0602	DeMaCo	CI No. 142 310-09	
1	Safety line to SV 121 (Y0621/Y0622)	DeMaCo	CI No. 142 310-09	
1	Scaffolding for CVSE lines		CI No. 142 310-10	
10	450 l LHe Dewars type HDS 450 -EIPS	Linde		
	50 l / 200 bar GHe grade 5.0	Linde		
	Set of mass flow meters	ASED		
	Set of vacuum hoses			
	Manometer P0621-1(0,1-27 mbar) in safety unit	W & T		
	Manometer P0621-2(1-1200 mbar) in safety unit	W & T		

Table 4-4: CVSE

5 Step-by-Step Procedure

5.1 Check of PLM Status

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
	The following configuration set-up is required prior to start of cool down and filling and shall be checked prior to test:				✓	
5.1.1.1	PLM/SVM installed in test dolly and set-up according Figure 3-2 and Figure 3-3		o.k.	PLM on SVM (not in test dolly)	✓	
5.1.1.2	16 load cells mounted to the strap pretensioners. Increase strap pretensions and make a printout of strap pretensions	ca. 2 ~~10~~ kN - 15 kN	2,74 kN to 5,09 kN	see printout	✓	
5.1.1.3	He S/S flushed with GN_2 at ambient temperature and pressure; T 103 P 101	 < 313 K 0,95 - 1,2 bar	 275K ~ 950 mbar		✓	
5.1.1.4	Turbo pump A mounted on upper bulkhead SV 921 interface, turbo pump is running and airlock to isolation vacuum is open		o.k.		✓	
5.1.1.5	Turbo pump B mounted on upper bulkhead SV 922 interface, turbo pump is running and airlock to isolation vacuum is open		o.k.		✓	
5.1.1.6	Airlock SV 121 installed and leak test of filling port performed. Airlock configured for LHe I transfer line.		o.k.		✓	

Location: OTN	PA: [signature] Date: 25.8.05	Operator: [signature] Date: 25.08.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.1.1.7	Two manometers P0621-1 (0,1-27 mbar) and P0621-2 (1-1200 mbar) installed in safety unit and connected with the safety line of filling port airlock.		O.k.		✓	
5.1.1.8	Safety line Y0621, valves V0621, V0623, manometers P0621-1 and P0621-2, safety valve SV0622, vent line Y0622 and vacuum pump C 1100 connected with filling airlock and leak test performed. A metal gasket must be used at the interface line Y0621 to filling port SV 121!				✓	
5.1.1.9	Plug of SV 121 is closed - SV 121 is activated				✓	
5.1.1.10	Cryo SCOE connected and operational - functional test at ambient temperature successfully performed.		O.k.		✓	
5.1.1.11	Blind flanges installed at external vent line and leak tested		O.k.		✓	
5.1.1.12	5 g/s mass flow meter installed in the Y0602 vent line and connected with a strip chart recorder and the Cryo SCOE					
5.1.1.13	Check valves status: V 102, V 104, V 105, V 502, V 512, V 701, V 702, SV 121	closed		V105 open O.k. V701 open O.k. V702 open O.k.	✓	
5.1.1.14	Check isolation vacuum: P 901 (P 902)	< 1 x 10^{-4} mbar	6.3·10^{-5} mbar		✓	
5.1.1.15	P 501 interface at PLM connected with manometer and leak tested		✓		✓	

Location: OTN	PA: [signature] Date: 26.8.05	Operator: [signature] Date: 25.08.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.1.1.16	Fill out log sheet 1 and 2 - see annex 1				✓	
5.1.1.17	Attention: Do not operate liquid level sensors at temperatures above 10 K: L 701, L 702 if T 703 > 10 K Do not continuous operate L 701 or L 702 and do not operate L 701 and L 702 at the same time.				✓	

Location: OTN	PA: [signature] Date: 25.8.05	Operator: [signature] Date: 25.08.05		

5.2 Installation of Auxiliary Lines and Components

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.2.1.1	Connect GHe supply bottle grade 5.0 with 2 µm filter to valve V0623. See Figure 3-4 and Figure 3-5		✓		✓	
5.2.1.2	Connect leak detector to valve V0623 and perform leak test of line Y0621 with all connections. Note leak rate	< $1x10^{-5}$ mbarl/s	✓		✓	
5.2.1.3	Installation of vent line Y0601 to V 502 (V 502 still closed). Perform leak rate measurement of Y0601 and not leak rate Check isolation vacuum of venting line Y0601!	< $1x10^{-5}$ mbarl/s	✓ ✓		✓	
5.2.1.4	Connect He pumping unit II via V6 of the flow meter unit with Y0601				✓	
5.2.1.5	Connect venting line to V 512 and - via T-piece - to the inlet of the flow meter unit		✓		✓	
5.2.1.6	Connect leak tester at the entrance of PLM evacuation line Y0673 (upstream of backing pump)		✓		✓	
5.2.1.7	Connect transfer lines to the cover cooling loop according AAE procedure		✓		✓	
5.2.1.8	connect a GHe bottle to the filling line entrance to the cover cooling loop		✓		✓	
5.2.1.9	Connect a laboratory vacuum pump at the exit of the cover cooling loop		✓		✓	

Location: OTN	PA: [signature] Date: 25.8.05	Operator: [signature] Date: 25.08.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.2.1.10	Perform a leak test of the cover cooling loop and its set-up		✓		P	
5.2.1.11	Evacuate cover cooling loop to	< 2,5 mbar	✓		P	
5.2.1.12	Flush the cover cooling loop with GHe grade 5.0 from bottle to	~ 1 bar	✓		P	
5.2.1.13	Repeat steps 5.2.1.11 to 5.2.1.12 5 times		✓		P	
5.2.1.14	Close both cover cooling loop CVSE lines with a plug or a blind cap. Ensure that an over pressure valve is installed in the line.		✓		P	
5.2.1.15	Fill out log sheets 1 & 2		✓		P	

Location:	PA: Campw Date: 25.8.05	Operator: [signature] Date: 25.8.05		

5.3 Evacuation and Purging of He S/S

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.1	***1st Evacuation Cycle***					
5.3.1.1	Open V 701 and V 105		✓		✓	
5.3.1.2	Check venting line valves closed: V1, V2 and V6 of the flow meter unit and V0631, V0603 (bypass He-pump-II)	closed	✓		✓	
5.3.1.3	Start He-pump II, C0500 Open inlet valve He-pump II (V6 of flow meter unit) and evacuate venting line Y0601		✓		✓	
5.3.1.4	Open V ~~502~~ V512 and evacuate He S/S without HTT to P 501	< ~~2,5~~ 10 mbar	✓		✓	
5.3.1.5	Check valve status: • V 102, 104, V ~~512~~ V502, V ~~702~~, SV 121 • V 105, V 701, V ~~502~~ V512, V702	closed open	✓ ✓	o. k.	✓	
5.3.1.6	Close V 502. Observe P 101, P 501. P 101 = P 501 = If no pressure increase at P 501 and no change at P 101 all valves at HTT are closed	approx. 1 bar < ~~2,5~~ 10 mbar	950 mbar 5,2 mbar Pressure stable		✓	

Location: OTN	PA: [signature] Date: 26.8.05	Operator: Jchl Date: 25.08.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.1.7	Open V 501 ⇨ check pressure at P 501 increases. Wait until P 501 remains constant after initial slight increase.			Step not relevant on EQM	/	
5.3.1.8	Open V 502 and V 512 and continue evacuation of He S/S		✓		✓	
5.3.1.9	~~Close V 105, V 701~~ Note P 501		5,7 mbar	valves to AxT kept open	✓	
5.3.1.10	Open V 104 and start evacuation of HTT		✓		✓	
5.3.1.11	Check valve status: • V 102, V ~~105~~, V ~~701~~, V ~~702~~, SV 121, V 502 • V 104, V ~~502~~, V 512, V105, V701, V702	 closed open	 ✓ ✓		✓	
5.3.1.12	Fill out log sheets 1 & 2		✓		✓	

Location: OTN	PA: [signature] Date: 25.8.05	Operator: Sohl	Date: 25.8.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.1.13	Continue evacuation of He S/S to P 101 approx. Close V 502 and V 512 and wait for pressure equilibrium to check installed manometers Note: P 101 (on monitor) P 701 (on monitor) P 501 (manometer at V 506) Open V 502 and V 512	 < 50 mbar	 ✓ 0,007 ~~mbar~~ -0,021 ~~mbar~~ 10,1 mbar	 raw 0,367 mV raw -0,34 mV	✓	
5.3.1.14	Open V 105, V 701, V 702 and V 102 and continue evacuation of He S/S to	< ~~2.5~~ 10 mbar	8,6 mbar		✓	
5.3.1.15	Check valve status: • SV 121, V502 • V 102, V 104, V 105, ~~V 502~~, V 512, V 701, V 702	 closed open	✓		✓	
5.3.2	***Preparation of filling port***					
5.3.2.1	Evacuate vacuum line Y0621 and airlock via valve V0621 and lab. vac. pump C1100		✓		✓	
5.3.2.2	Close Y0621 (line to vacuum lab. pump)		✓		✓	

Location: OTN	PA: [signature] Date: 26.8.08	Operator: [signature] Date: 26.08.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.2.3	Pressurize line Y0621 and air lock SV 121 with GHe grade 5.0, connected at valve V0623 until P0621 = 1 bar		✓		✓	
5.3.2.4	Repeat evacuation and pressurization of Y0621 and airlock SV 121 two times		✓		✓	
5.3.2.5	Evacuate line Y0621 and airlock SV 121		✓		✓	
5.3.2.6	Close V0621 (line to lab. vac. pump)		✓		✓	
5.3.3	***1st Pressurization Cycle*** 1st pressurization cycle via needle valve at V512					
5.3.3.1	Close V ~~502~~, V ~~512~~ and V 104		✓			
5.3.3.2	Open SV 121		n.a.	pressurization via V512	✓	
5.3.3.3	Check valve status: • V 104, V 502, V ~~512~~ SV121 • V 102, V 105, V 701, V 702, ~~SV 121~~, V512	 closed open			✓	
5.3.3.4	Pressurize line Y0621 and air lock SV 121 with GHe grade 5.0, connected at valve V0623 until P0621 = 1 bar		950mbar		✓	
5.3.3.5	Close SV 121				✓	
5.3.3.6	Close V 102 ~~and V 702~~				✓	

Location: OTN	PA: [signature] Date: 26.8	Operator: [signature] Date: 26.8.		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.3.7	Perform leak test of He S/S: He S/S flushed with GHe, close inlet valve to laboratory pump C0730 • P 901 • P 501 • P 101 tolerable leak rate < $1x10^{-6}$ mbar l/s	 < 10^{-4} mbar approx. 1 bar approx. 1 bar ≤ $1x10^{-6}$ mbarl/s	 5,5 10^{-5} mbar 991 mbar 0,1206 bar P701 : 0,9393 bar	 raw: 6,4025 mV raw: 15,2633 mV	✓	
5.3.3.8	After successful leak test close inlet valve to leak tester and open inlet valve to low vacuum stage pump C0730				✓	
5.3.4	***Evacuation / Pressurization Cycles***					
5.3.4.1	Open V 104		✓		✓	
5.3.4.2	Check valve status: • V 102, V 502, V 512, ~~V 702~~, SV 121 • V 104, V 105, V 701, V702	 closed open	 ✓ ✓		✓	
5.3.4.3	Open ~~V 502~~ and V 512		✓		✓	
5.3.4.4	Pump down HTT to P 101 approx. 10 mbar	 < 10 mbar	 5,2 mbar		✓	

Location: OTN	PA: Cap Date: 26.8	Operator: JiH	Date: 26.8.05	

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.4.5	Close V 502 and V 512 Note P 501		✓		✓	
5.3.4.6	Close V 104		✓		✓	
5.3.4.7	Open V 102 ~~and V 702~~ La		✓		✓	
5.3.4.8	Evacuate line Y0621 and airlock SV 121		n.a.	La	✓	
5.3.4.9	Close Y0621 (line to lab. vac. pump)		n.a.	La	✓	
5.3.4.10	Open SV 121		n.a.	La	✓	
5.3.4.11	Check valve status: • V 104, V 502, ~~V 512~~, SV121 La • V 102, V 105, V 701, V 702, ~~SV 121~~, V512 La	 closed open	 ✓ ✓		✓	
5.3.4.12	Note P 501 (see 5.3.4.15) Fill out log sheet 1 & 2		5,8 mbar		✓	
5.3.4.13	Pressurize He S/S via valve ~~V0623~~ V512 La and connected GHe supply until P 501 approx. 1 bar absolute		✓		✓	
5.3.4.14	Repeat step 5.3.3.5 – 5.3.4.13 ~~three times~~ once La (except step 5.3.3.7)		✓	agreed by ESA (DW, W.RK)	✓	

Location: OTP	PA: [signature] Date: 26.8	Operator: [signature] Date: 26.8.		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.4.15	Note: -P 501 (V 502 and V 512 closed) Start date and time of 1st run Stop date and time of 1st run -P 501 (V 502 and V 512 closed) Start date and time of 2nd run Stop date and time of 2nd run -P 501 (V 502 and V 512 closed) Start date and time of 3rd run Stop date and time of 3rd run	< 50 mbar < 50 mbar < 50 mbar	4,7 mbar ./. ./.		✓	
5.3.4.16	Close and block SV 121		✓		✓	
5.3.4.17	Close V 102 ~~and V 702~~ la		✓		✓	
5.3.4.18	Open V 104		✓		✓	
5.3.4.19	Check valve status: • V 102, ~~V 502~~, V 512, ~~V 702~~, SV 121 la • V 104, V 105, V 701, V 702, V502 la	 closed open	 ✓		✓	

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.4.20	Leak rate measurement Leak detector in line to turbo pump. Start leak tester: • calibration of leak tester • open inlet valve of leak tester Close inlet valve to low vacuum stage pump C0730 Note leak rate					
5.3.4.21	Open V 502 and V 512		✓		✓	
5.3.4.22	Pump down He II tank until P 101 constant		✓		✓	
5.3.4.23	Close V 502 and V 512		✓		✓	
5.3.4.24	Perform P 101 in situ zero calibration at room temperature Note: P 101 data on synoptic monitor P 101 raw data on monitor P ~~501~~ 701 eng. data (G P ~~501~~ 701 raw data (G Pressure measured with external manometer connected at V 506			→ calibration curve for P101 and P701 corrected accordingly	✓	
5.3.4.25	Open V 502 and V 512		✓		✓	

Location: CTN	PA: [signature] Date: 26.8.05	Operator: [signature]	Date: 26.08.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.4.26	Close V104		✓.	Kept open for flushing	✓	
5.3.4.27	Close V502 ~~and V 512~~ (a			(V512 closed by ext. valve)	✓	
5.3.4.28	Check valve status: • V 102, ~~V 104~~, V 502, V 512, ~~V 702~~, SV 121 • V 105, V 701, V 702, V 104 (a	 closed open	 ✓ ✓		✓	
5.3.4.29	Fill out log sheet 1 & 2				✓	

5.4 Installation of Safety Valve SV 922

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.4.1.1	Close airlock SV 922 at upper bulkhead and install fixation device. Note P 901/P 902		✓		✓	
5.4.1.2	Close hand sliding valve behind turbo pump		✓		✓	
5.4.1.3	Stop turbo pump C0712 and wait until pump rotor stops. (observe revolution counter in low vacuum stage C0730)		✓		✓	

Location: OTN	PA: [signature] Date: 29.8.05	Operator: [signature] Date: 29.8.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.4.1.4	Pressurize air lock with GN_2. (Observe P 901) Disconnect backing valve V0715 from turbo pump C0712. Protect open end of V0715 with blind cap.		✓		✓	
5.4.1.5	De-integrate turbo pump C0712 and air lock SV 922 from PLM upper cone		✓		✓	
5.4.1.6	Install safety valve SV 922 to PLM upper cone. Use special installation device.		✓		✓	
5.4.1.7	Fixing and marking of screws with tightening torque. Torque value	6 Nm	✓		✓	

5.5 Cool down of Cryostat

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.1	***Initial Configuration***					
5.5.1.1	He S/S evacuated to < 20 mbar		4,7 mbar		✓	
5.5.1.2	Safety valve SV 922 installed.		✓		✓	

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.1.3	Check valve status: • V 102, V 104, V 502, V 512, V ~~702~~, SV 121 Ca • V 105, V 701, V 702 Ca	 closed open			✓	
5.5.1.4	Prepare and install LHe I transfer line as described in chapters 5.7 to 5.10		✓		✓	
5.5.1.5	Close V0623. Open V0621.		✓		✓	
5.5.1.6	Continue evacuation of transfer line < 1mbar		✓		✓	
5.5.1.7	Close V0621 and perform leak test of compression fitting at SV 121. (Method of pressure increase: max. permitted pressure increase < 3 mbar within 15min.)		✓		✓	
5.5.1.8	Documentation of pressure increase at P0621. Note estimated volume for leak rate calculation and calculate leak rate	 < 3 mbar	~5 l 0.~~3~~1 mbar	≙ 3·10⁻³ mbar·l/s	✓	
5.5.1.9	If compression fitting is tight continue evacuation via V0621 until P0621 < 1 mbar.		✓		✓	
5.5.1.10	Close V0621, stop lab. vac. pump C1100 and close inlet valve of He-pump II		✓		✓	
5.5.1.11	Remove fixation device and open airlock SV 121 Open V702 Ca		✓ ✓		✓	
5.5.1.12	Fill out log sheets 1 & 2		✓		✓	

Location: OTN	PA: [signature] Date: 29.8.05	Operator: Ich Date: 29.8.05	

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.2	***Pressurization of He S/S to 1 bar***					
5.5.2.1	Open V0211 slowly and fill He-tubing, HTT and AXT to about 1 bar absolute at P 501; Observe P 901.		✓		✓	
5.5.2.2	Measure leak rate in PLM evacuation line Y0673 (Inlet valve to low vacuum stage pump C0730 closed) and document leak rate	< 1×10^{-6} mbarl/s	~ $2 \cdot 10^{-5}$ mbar	see 150 NCR	✓	
5.5.2.3	Close V0211 (needle valve at transfer line)		✓		✓	
5.5.2.4	~~Close V 105.~~			has to remain open	✓	
5.5.2.5	Check valve status: • V ~~102~~, V ~~104~~, V 502, V 512, V ~~702~~, ~~V 105~~ • V 701, SV 121, V105, V102, V104, V702	 closed open			✓	
5.5.2.6	Move transfer line in SV 121 to lower position		✓		✓	
5.5.2.7	Note P 501 P0621		960 960		✓	
5.5.2.8	Open V 102 and V 702			already open	✓	

Location: OTW	PA: [signature] Date: 29.8.05	Operator: [signature] Date: 29.8.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.2.9	Note P 501 P0621 P 101		988 mbar 1060 mbar 1,07 bar		✓	
5.5.2.10	(if no significant change, sealing at the end of transfer line in fill/vent tube is tight)				✓	
5.5.2.11	Open V0211 and purge HTT and AXT to approx. 1 bar (measured at P 101)				✓	
5.5.2.12	Monitor leak rate in PLM evacuation line Y0673 (Inlet valve to low vacuum stage pump C0730 closed) and note leak rate	$<1x10^{-5}$ mbar l/s			✓	
5.5.2.13	Close V 102			remains open		
5.5.2.14	Open V 105			already open	✓	
5.5.2.15	Open V 502 and flush venting line to approx. 1000 mbar at P 501 by opening V0211. Note P 501	approx. 1 bar	988 mbar		✓	
5.5.2.16	Check valve status: • V ~~102~~, V ~~104~~, V 512 • V 105, V 502, V 701, V 702, SV 121, V102, V104	closed open			✓	
5.5.2.17	Close V0211 (needle valve at transfer line)		✓		✓	

Location: OTN	PA: [signature] Date: 29.08.05	Operator: [signature] Date: 29.8.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.2.18	Open V0631 (bypass at He-pump II, connect vent line to recovery unit)		✓		✓	
5.5.2.19	Open V 104		✓		✓	
5.5.2.20	Check valve status: • V ~~102~~, V 512, V0211 • V 104, V 105, V 502, V 701, V 702, SV 121, V0631, V102	 closed open	 ✓ ✓		✓	
5.5.2.21	Fill out log sheets 1 & 2 ~~every 30 min~~		✓	data stored in CryoSCOE	✓	
5.5.3	***Start Cool Down***					
5.5.3.1	Install mass flow meter with range 0-5 g/s in bypass of He-pump II, to V0631. (see Figure 3-4) Connect flow meter to exhaust line and connect flow meter with recorder and Cryo SCOE		✓		✓	
5.5.3.2	Switch on HIFI in standby mode if required by HIFI		./.	Step can be done later when requested by instrument		
5.5.3.3	Switch on PACS in standby mode if requested by PACS		./.	Step can be done later when requested by instrument		
5.5.3.4	Switch on SPIRE in standby mode if requested by SPIRE		./.	Step can be done later when requested by instrument		

Location: OTN	PA: [signature] Date: 19.8.05	Operator: [signature] Date: 29.8.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.3.5	Start cool down of LHe transfer line and AXT by opening V0211 until: T 701 < 150 K			skipped, ΔT between L0 and L1,L2 < 20K!	✓	
5.5.3.6	When T 701 < 150 K: • close V 702 • open V 102		n.a.		✓	
5.5.3.7	Start cool down of HTT until final values of: • T 101 • T 102 • T 106	 ≈ 4,2 K ≈ 4,2 K ≈ 4,2 K	 4,2K 4,2K 4,5K	1st time 31.8.05 13:15 2nd time 1.9.05 10:00	✓	
5.5.3.8	Observe pressure requirements during cool down: • P 101 • P 501 • P 901 • Leak rate at Y0673 line	 ≤ 1,2 bar ≤ 1,2 bar	 1,09 bar 993 mbar 2,0 · 10⁻⁷ mbar	not working	✓	

Location: OTP	QA: [signature] Date: 1.9.05	Operator: [signature] Date: 1.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.3.9	Respect temperature requirements during cool down as defined in 1.3:					
	HTT: $\Delta T103/\Delta t$	< 50 K/h		See records	✓	
	HIFI/(PACS): $\Delta T207/\Delta t$	< 5 K/h		(above 50 K)		
	SPIRE/(PACS): $\Delta T253$ (T255)/Δt	< 20 K/h		(above 50 K)		
	SPIRE J-FET: $\Delta T249$ (T251)/Δt	< 20 K/h		(above 50 K)		
	Remark 1: Temperature sensors at SPIRE and HIFI foots are used to monitor PACS.			due to ~~temperature~~ cool down rate requirements, cool down of AXT lasted 4 days longer		
	Remark 2: The cool down rate can be controlled by adjusting pressure inside the LHe dewar.					
5.5.3.10	AXT (T 701) shall be as long as possible colder than OBA and FPUs:				✓	
	T 207 - T 708	> 30 K		See records		
	T 253 - T 708	> 30 K				
5.5.3.11	Keep AXT as long as possible 30 K colder than HTT:				✓	
	T 103 - T 708	≥ 30 K		See records		

Location: OTN	PA:	Date: 7.9.05	Operator:	Date: 7.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.3.12	Keep temperature differences between L0, L1 and L2 on HIFI below 20 K: |T 708 – T 207| |T 207 – T 249 (T 251)| |T 708 – T 249 (T 251)|	 < 20 K < 20 K < 20 K		see records	✓	
5.5.3.13	**Reduce mass flow if temperature gradients or ΔT's are not correct by reducing the pressure of the LHe dewar!**				✓	
5.5.3.14	If T 103 - T 708 < 30 K: • close V 102 • open V 702 until T 103 - T 708 > 40 K, then: • close V 702 • open V 102			see records	✓	
5.5.3.15	If the present dewar is not sufficient for obtaining the required temperatures, change LHe supply dewar. See chapters 5.7 to 5.10				✓	

Location: OTN	Date: 7.9.05	Operator:	Date: 7.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.3.16	As strap pretension will decrease during cool down, check strap pretension and adjust strap pretension according following procedure in coordination with alignment measurements: • nominal value of strap pretension is 15 kN +0/-2 kN on lower straps • nominal value of strap pretension is 13,5 kN +/-2 kN on upper straps			see printout (No. 9-16) (No. 1-8)	✓	
5.5.3.17	If pretension decreases to less than approx. 5 KN, increase strap pretension to nominal value. Any changing of the strap pretension has to be done in coordination with alignment measurements. make a printout of pretension values before and after each pretension activity to keep strap pretension nominal				✓	
5.5.4	***End of Cool Down***					
5.5.4.1	Note status at end of cool down: • T 101 • T 708 ca. • T 207 • P 101	≈ 4,2 K	4,24 K 225 K 219 K 0,94 bar		✓	
5.5.4.2	Make a printout of the final strap pretensions				✓	

Location: OTN	QA: [signature] Date: 29.9.05	Operator: Schl Date: 29.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.4.3	Close SV 921		n.a.	SV 921 remains open as decided in TRR	✓	
5.5.4.4	Check valve status: • ~~V 512, V 702, V0211~~ • V 102, V 104, V 105, V 502, V 701, SV 121, V0631, V512, V702, V0211	 closed open	 ✓		✓	
5.5.4.5	Fill out log sheets 1 & 2		✓		✓	

5.6 Filling of HTT

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.6.1.1	Continue LHe transfer until HTT is completely filled				✓	
5.6.1.2	Change LHe dewar if the liquid level in the present dewar is below 10 %				✓	
5.6.1.3	Final values to be reached when the LHe level in He II tank 100% : • T 101 • T 106 • P 101	 ~ 4.2 K ~ 4.2 K < 1,2 bar	 4,24 4,2 K 1,1 bar		✓	
5.6.1.4	A quick and significant increase of the mass flow rate in the vent line and pressure oscillations at P 501 indicates that HTT is completely filled		✓			

Location: OTN	PA: [signature] Date: 9.9.05	Operator: Jchl Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.6.2	***End of Filling***					
5.6.2.1	Stop transfer by closing V0221(V0211)		✓		✓	
5.6.2.2	Close V 102		✓		✓	
5.6.2.3	Check valve status: • V 102, V ~~512~~, V 702, V0211 • V 104, V 105, V 502, V 701, SV 121, V0631, V512	 closed open	 ✓ ✓		✓	
5.6.2.4	Documentation of final values: • T 101 • T 106 • P 101	 ≈ 4,2 K ≈ 4,2 K < 1,2 bar	 4,2 K 4,2 K 1,1 bar		✓	
5.6.2.5	Fill out log sheets 1 & 2		✓		✓	
5.6.2.6	Date: AIV: QA:		9.9.05 [signature]		✓	
5.6.2.7	Depressurize supply dewar, close V0101, remove pressurization line, open V0102		✓		✓	

Location: OTN	QA: [signature] Date: 9.9.05	Operator: [signature] Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.6.2.8	Retract transfer line to upper position in SV 121, close and activate SV 121.		✓		✓	
5.6.2.9	Remove transfer line from airlock, close compression fitting with blind plug and protect open end of transfer line		✓		✓	
5.6.2.10	Remove transfer line from supply dewar, and store the line on the scaffolding		✓		✓	
5.6.2.11	Mount 60 mbar overpressure one way valve behind V0631		✓		✓	
5.6.2.12	Monitor flow rate in vent line. If actual flow rate < 50 mg/sec change mass flow meter to one with a range of 0 - 50 mg/s. Connect flow meter with recorder and Cryo SCOE		✓		✓	
5.6.2.13	Dismount airlock and install safety valve SV 921 as described in 5.4		n.a.	airlock and turbo remain installed see TPR		
5.6.3	***Final Configuration***					
5.6.3.1	Check mass flow rate	< 50 mg/s	24,7 mg/s		✓	
5.6.3.2	Check valve status: • V 102, ~~V 512~~, V 702 La • V 104, V 105, V 502, V 701, SV 121, V 512 La	 closed open	 ✓ ✓		✓	

Location: OTN	QA: [signature]	Date: 9.5.05	Operator: Schl	Date: 9.5.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.6.3.3	Documentation of final values:				✓	
	• T 101	≈ 4,2 K	4,35 K			
	• T 106	≈ 4,2 K	4,15 K			
	• P 101	< 1,2 bar	not working at cold temps	see NCR		
5.6.3.4	Fill out log sheets 1 & 2		✓		✓	

5.7 Night Configuration

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
	The following activities have to be performed at the end of each working day to get the cryostat in safe configuration and at begin of the next day to restart cool down and filling. It is useful to go for a night break at the end of a dewar.					
5.7.1	***Establish Night Configuration***					
5.7.1.1	Close valve V0211 (or V0221) in transfer line and stop LHe flow ✓			30.8.	✓	
5.7.1.2	Close V 702 (if open) ✓			30.8.	✓	

Location: OTN	PA:	Date: 9.9.05	Operator: Jchl	Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.7.1.3	Close V 102 (if open) ✓			30.8.	✓	
5.7.1.4	Check V 104 open, V 105 open ✓			30.8.	✓	
5.7.1.5	Reduce pressure in dewar by opening of V0101 ✓			30.8.	✓	
5.7.1.6	Retract transfer line to upper position in airlock SV 121 N.A.	G		/		
5.7.1.7	Close airlock SV 121 N.A.	G		/		
5.7.1.8	Remove transfer line from airlock, close compression fitting with blind plug and protect open end of transfer line. N.A.	G		/		
5.7.1.9	Remove transfer line from supply dewar and prepare it for next use. N.A.	G		/		
5.7.1.10	Mount 60 mbar overpressure one way valve behind V0631 ✓			30.8.	✓	
5.7.1.11	Monitor flow rate in vent line. If actual flow rate < 50 mg/sec change mass flow meter to one with a range of 0 - 50 mg/s. Connect flow meter with recorder and Cryo SCOE			30.8.	✓	
5.7.1.12	Check mass flow rate	< 50 mg/s		30.8.	✓	

Location: OTP	PA: [signature] Date: 9.9.05	Operator: [signature] Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.7.1.13	Check valve status: • V 102, V 512, V 702 ✓ • V 104, V 105, V 502, V 701, SV 121 ✓	 closed open		30.8.	✓	
5.7.1.14	Fill out log sheets 1 & 2 ✓			30.8.	✓	
5.7.2	***Restart after Night Break***					
5.7.2.1	Install second transfer line into a full supply dewar and into SV 121. (see chapter 5.10 for details)		✓	✓	✓	
5.7.2.2	Evacuation and flush the transfer line with GHe grade 5.0 three times. (see chapter 5.10 for details)		✓	✓	✓	
5.7.2.3	Close V 104, open V 702		✓	n.a.	✓	
5.7.2.4	Pre-cool the transfer line for at least 3 min. (see chapter 5.10 for details)		✓	n.a.	✓	
5.7.2.5	Close V0623 and open SV 121 immediate after pre-cooling		✓	n.a.	✓	
5.7.2.6	Insert transfer line completely into airlock and retract it again about 1 mm. Fix the compression fitting		✓		✓	
5.7.2.7	Open V0211 (or V0221) and restart cool down (filling) of AXT via V 702 and V 105 until T 702 is below 5 K or 30 K below T 103		✓		✓	

Location: OTN	PA:	Date: 8.9.05	Operator:	Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.7.2.8	Open V 102 Open V 104 Close V 702 and continue filling of HTT		n.a.		✓	

Location: OTN	PA: [signature] Date: 9.9.05	Operator: Ichl Date: 9.9.05		

5.8 Exchange of LHe Dewar

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.8.1	***General Remarks***					
5.8.1.1	The following paragraphs have to be repeated at each dewar exchange		✓		✓	
5.8.1.2	**Attention:** Do not empty dewars completely Remaining liquid level in dewar shall always be L0101>100 mm		✓		✓	
5.8.1.3	Use leather gloves and protect eyes by glasses when installing or removing transfer line LHe supply dewar.		✓		✓	
5.8.1.4	At each dewar change write down in log sheet: • dewar No. • liquid level at start • liquid level at end • LHe-consumption • used transfer line		✓	see log sheets	✓	
5.8.1.5	Fill out log sheets 1 & 2		✓		✓	
5.8.2	***Removing Transfer Line***					
5.8.2.1	Prepare second transfer line according step 5.9		✓		✓	

Location: OTN	PA: [signature]	Date: 3.9.05	Operator: [signature]	Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.8.2.2	Close valve V0211 (or V0221) in transfer line and stop LHe flow		✓		✓	
5.8.2.3	Close V 702 (if open)		n.a.		✓	
5.8.2.4	Close V 102 (if open)		~~n.a.~~ ✓		✓	
5.8.2.5	Check V 104 open, V 105 open		✓		✓	
5.8.2.6	Reduce pressure in dewar, remove pressurization line and open V0101		✓		✓	
5.8.2.7	Retract transfer line to upper position in airlock SV 121		✓		✓	
5.8.2.8	Close airlock SV 121		✓		✓	
5.8.2.9	Remove transfer line from airlock, close compression fitting with blind plug and protect open end of transfer line.		✓		✓	
5.8.2.10	Remove transfer line from supply dewar and prepare it for next use.		✓		✓	
5.8.3	***Installation of new Dewar and Transfer Line***					
5.8.3.1	Install second transfer line into a full supply dewar and into SV 121. (see chapter 5.10 for details)		✓		✓	
5.8.3.2	Evacuation and flush the transfer line with GHe grade 5.0 three times. (see chapter 5.10 for details)		✓		✓	
5.8.3.3	Close V 104, open V 702		✓		✓	

Location: OTP	PA: [signature] Date: 9.9.05	Operator: [signature] Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.8.3.4	Pre-cool the transfer line for at least 3 min. (see chapter 5.10 for details)		✓		✓	
5.8.3.5	Close V0623 and open SV 121 immediate after pre-cooling		✓		✓	
5.8.3.6	Insert transfer line completely into airlock and retract it again about 1 mm. Fix the compression fitting		✓		✓	
5.8.3.7	Open V0211 (or V0221) and restart cool down (filling) of AXT via V 702 and V 105 until T 702 is below 5 K		✓		✓	
5.8.3.8	Open V 102 Open V 104 ~~Close V 702~~ as needed to cool down AXT and continue filling of HTT		✓ ✓		✓	

5.9 Preparation of LHe I Transfer Line

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.9.1	***Preparations***					
5.9.1.1	Cleaning of inlet filter: • remove the inlet filter from the line • clean the filter in ultrasonic bath with isopropyl alcohol • dry the filter with a heat gun • tie Teflon tape around the filter thread and screw the filter onto the tube		✓		✓	
5.9.1.2	Description of installations at transfer line - Interfaces at dewar side: • compression fitting • valve V01 • pressure gauge P01 • flex. line DN25 as connection to vacuum line Y0622 and laboratory pump C1100		✓		✓	

Location: OTL	QA: [signature] Date: 9.9.05	Operator: [signature]	Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.9.1.3	Description of installations at transfer line – Interfaces at PLM side: • compression fitting, • valve V02 • filter • GHe supply • pressure reducer DM1 • flex. line DN4 with a minimum length of 2 m		✓		✓	
5.9.1.4	Check that V0211 (or V0221) is open		✓		✓	
5.9.2	***Evacuation of Transfer Line***					
5.9.2.1	Close V02 to the GHe bottle		✓		✓	
5.9.2.2	Start laboratory pump C1100		✓		✓	
5.9.2.3	Open V01 and evacuate transfer line for 5 min.		✓		✓	
5.9.3	***Flushing of transfer line:***					
5.9.3.1	Close V01 to the laboratory vacuum pump		✓		✓	
5.9.3.2	Open GHe supply and V02		✓		✓	

Location: OTN	PA: [signature] Date: 9.9.05	Operator: Schl	Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.9.3.3	Adjust DM1 at dewar to P01=300 to 500 mbar		✓		✓	
5.9.3.4	Flush transfer line for min. 30 s		✓		✓	
5.9.3.5	Close V02		✓		✓	
5.9.3.6	Repeat evacuation / flushing cycle 4 times		✓		✓	
5.9.3.7	Flush transfer line during transport to the dewar:		✓		✓	
5.9.3.8	Open V02 and pressurize the transfer line to approximately 500 mbar overpressure		✓		✓	
5.9.3.9	Disconnect transfer line from V01.		✓		✓	
5.9.3.10	Check/adjust that transfer line is under small overpressure. He flow at open end of transfer line must be noticeable.		✓		✓	

Location: OTL	PA: [signature] Date: 9.9.05	Operator: Jche	Date: 9.7.05		

5.10 Installation of Transfer Line

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.10.1	***Preparation of LHe Dewar***					
5.10.1.1	Check that the dewar is released by PA for use on Herschel.		✓		✓	
5.10.1.2	Check that head of dewar is equipped with one feed through 16 mm. Check that the dewar is equipped with *Electronic Internal Pressurizing System* (EIPS). Fix the blind plug in feed through 16 mm.		✓		✓	
5.10.1.3	Position 450 l dewar near SV 121 on working platform. Activate break mechanism at dewar.		✓		✓	
5.10.1.4	Establish a clear control area of about 2 m round the dewar		✓		✓	
5.10.1.5	Open valve V0101 of dewar gently and depressurize to atmospheric pressure. **ATTENTION:** cold gas, use leather gloves and eye glasses		✓		✓	
5.10.2	***Installation of Transfer Line into Dewar***					
5.10.2.1	Transport the transfer line to the dewar while flushing it with GHe. (3 persons necessary)		✓		✓	
5.10.2.2	Remove compression fitting from transfer line (dewar side) and check/adjust DM1 that a slight He flow is at open end of transfer line		✓		✓	

Location: BTN	PA: [signature]	Date: 5.5.05	Operator: [signature]	Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.10.2.3	Remove blind plug 16 mm from head of supply dewar and insert transfer line in the dewar by about 200 mm		✓		✓	
5.10.2.4	Stop transfer line flushing: -close V02 -close DM1 and GHe supply		✓		✓	
5.10.2.5	Push the transfer line slowly in the dewar until stop at filter reaches the bottom of dewar (the filter is equipped with a 100 mm distance pin to avoid that the transfer line is taking LHe from the bottom of the dewar)		✓		✓	
5.10.2.6	Close V0211 (or V0221)		✓		✓	
5.10.2.7	Adjust dewar pressure at EIPS to 100 mbar - 200 mbar overpressure as needed during filling activities		✓		✓	
5.10.3 *Installation of Transfer Line at SV 121*						
5.10.3.1	Check that airlock SV 121 is closed, blocked and at atmospheric pressure		✓		✓	
5.10.3.2	Open V0211 (or V0221) slightly Remove compression fitting with valve V02 from transfer line. Check/adjust GHe flow with V0211 (or V0221) at open end of transfer line		✓		✓	

Location: OTV	QA: [signature] Date: 9.9.05	Operator: Schl	Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.10.3.3	Remove blind plug from SV 121. Insert transfer line in SV 121 and fix transfer line in upper position. Close V0211 (or V0221) immediate.		✓		✓	
5.10.3.4	Tighten compression fitting.		✓		✓	
5.10.3.5	**Attention:** Don't damage the seal at transfer line when installing transfer line in SV 121.		✓		✓	
5.10.4 ***Evacuation and Purging of Filling Airlock***					✓	
5.10.4.1	Check: • transfer line is prepared and installed according steps above • airlock SV 121 is closed and blocked • pre-cooling valve is closed • dewar overpressure is adjusted to about 200 mbar		✓		✓	
5.10.4.2	Start lab. pump C1100, open valve V0621 and evacuate transfer line for about 5 min		✓		✓	
5.10.4.3	Check P0621< 1 mbar Close valve V0621		✓		✓	

Location: OTN	PA: [signature] Date: 5.9.05	Operator: Jchl Date: 5.9.05			

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.10.4.4	Purge line to ambient pressure by opening valve V0211 (or V0221) until P0621 is at about ambient pressure Then close V0211 (or V0221)	1000 mbar	✓		✓	
5.10.4.5	Repeat step 5.10.4.2 to 5.10.4.4 two times.		✓		✓	
5.10.5	***Pre-cooling of Transfer Line***			Steps skipped due to problems with SV0621 flag		
5.10.5.1	Open valve V0211 (or V0221)		✓	Ca	✓	
5.10.5.2	Open valve V0623 (pre-cooling valve) and pre-cool transfer line for at least 3 min		✓	Ca	✓	
5.10.5.3	Observe housing of airlock SV 121: when moisture appears at venting line Y0621: • stop cooling • close V0211		✓	Ca	✓	
5.10.5.4	Close V0623 and observe P0621 Release overpressure if P0621	> 1100 mbar	✓	Ca	✓	
5.10.5.5	Open SV121		✓	Ca	✓	
5.10.5.6	Continue with LHe transfer in PLM		✓	Ca	✓	

Location: OTN	PA: [signature] Date: 9.9.05	Operator: Sche	Date: 9.9.05		

6 Summary Sheets

6.1 Procedure Variation Summary

	Test Change	Curr. No.: Date: Page 1 of

Test designation	Test Procedure HP-2-ASED-TP-0072	Issue 1	Rev.

Test step changed see below	Reason for Change:

5.1.1.2 New value 2 # 15 Nm
5.3.1.4 -"- 10 mba
5.3.1.6 -"- 10 mba
5.3.1.11 closed V102, SV121, V502
-"- open V104, V512, V105, V701, V702
5.3.1.14 New value 10 mba
5.3.1.13 P701 instead P501
5.3.1.15 SV121, V502 closed
5.3.3.1 close V104 only
5.3.3.3 closed V104, V502, SV121
5.3.3.6 close V102 only
5.3.4.2 V102, V502, V512, SV121 closed
-"- V104, V105, V701, V702 open
5.3.4.3 open V512 only
5.3.4.7 open V102, only
5.3.4.11 SV121 closed instead V512
-"- V512 open instead SV121
5.3.4.13 V512 instead V0623
5.3.4.14 Repeat only once
see changes mentioned in Redline on Para. 5.3.4.12 # 19, 5.3.4.24, 5.3.4.28, 5.4.1.4, 5.5.1.3, 5.5.1.10, 5.5.2.5, 5.5.2.16, 5.5.2.20, 5.5.3 10/11

Prepared by: [signature]	Resp. Test Leader [signature]	Project Engineer
PA/QA [signature]		

6.2 Non Conformance Report (NCR) Summary

Status list of applicable NCR to be attached

NCR - No.	NCR - Title	Date	Status
HP-150000-ASED-NC-1484	Temperature gradient requirement during cool down of cryostat partially exceeded	18.9.05	
HP-151240-ASED-NC-1415	The SV121 plug remains not in safety valve position	1.8.05	

6.3 Sign-off Sheet

	Date	Signature
Test Manager	9.9.05	[signature]
Test Conductor	9.9.05	[signature]
PA Responsible	9.9.05	[signature]

ANNEX Log Sheets

Herschel EQM																	LOGSHEET 1 for COOL DOWN and FILLING			
Date	Time	Valve Status								P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow	He Dewar S/N D0101	Liquid level Dewar L0101		REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121										AIV	QA

Herschel EQM																	LOGSHEET 2 for COOL DOWN and FILLING		
Date	Time	Temperatures in [K]															REMARKS	Sign	
		DLCM T101	HTT T103 T106	PPS T111	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Ext. ventl. T501	Cover T601	AXT T701 T 702				AIV	QA

END OF DOCUMENT

	Name	Dep./Comp.		Name	Dep./Comp.
X	Alberti von Mathias Dr.	AOE22	X	Stritter Rene	AED11
	Barlage Bernhard	AED11		Thörmer Klaus-Horst Dr.	OTN/AED65
X	Bayer Thomas	AOA52		Wagner Klaus	AOE22
	Fehringer Alexander	AOE13	X	Wietbrock Walter	AET12
	Fricke Wolfgang Dr.	AED 63		Wöhler Hans	AOE22
	Geiger Hermann	AOA52		Wössner Ulrich	ASE442
	Gerner Willi	AED11			
	Grasl Andreas	OTN/AET52			
	Grasshoff Brigitte	AET12			
X	Hauser Armin	AOE22	X	Alcatel	ASP
X	Hendry David	Terma Resid.	X	ESA/ESTEC	ESA
	Hinger Jürgen	AOE22			
	Hofmann Rolf	ASE442		**Instruments:**	
X	Hohn Rüdiger	AED65		MPE (PACS)	MPE
X	Huber Johann	AOA52		RAL (SPIRE)	RAL
	Hund Walter	ASE442		SRON (HIFI)	SRON
X	Idler Siegmund	AED432			
X	Ilsen Stijn	Terma Resid.		**Subcontractors:**	
	Ivády von András	FAE22		Air Liquide, Space Department	AIR
X	Jahn Gerd Dr.	AOE22		Air Liquide, Space Department	AIRS
	Kalde Clemens	APE3		Air Liquide, Orbital System	AIRT
	Kameter Rudolf	OTN/AET52		Alcatel Bell Space	ABSP
	Kettner Bernhard	AET42		Astrium Sub-Subsyst. & Equipment	ASSE
	Knoblauch August	AET32		Austrian Aerospace	AAE
X	Koelle Markus	AOA53		Austrian Aerospace	AAEM
	Kroeker Jürgen	AED65		APCO Technologies S. A.	APCO
X	Kunz Oliver Dr.	AOE22		Bieri Engineering B. V.	BIER
X	Lamprecht Ernst	OTN/ASI21		BOC Edwards	BOCE
	Lang Jürgen	ASE442		Dutch Space Solar Arrays	DSSA
X	Langfermann Michael	AOA51		EADS CASA Espacio	CASA
X	Mack Paul	OTN/AET52		EADS CASA Espacio	ECAS
	Müller Jörg	AOA52		EADS Space Transportation	ASIP
X	Pastorino Michel	ASPI Resid.		Eurocopter	ECD
	Peltz Heinz-Willi	AOE13		European Test Services	ETS
	Pietroboni Karin	AED65		HTS AG Zürich	HTSZ
	Platzer Wilhelm	AED22		Linde	LIND
	Rebholz Reinhold	AOA51		Patria New Technologies Oy	PANT
	Reuß Friedhelm	AED62		Phoenix, Volkmarsen	PHOE
X	Rühe Wolfgang	AED65		Prototech AS	PROT
X	Runge Axel	OTN/AET52		QMC Instruments Ltd.	QMC
	Sachsse Bernt	AED21		Rembe, Brilon	REMB
	Schink Dietmar	AED44		Rosemount Aerospace GmbH	ROSE
X	Schlosser Christian	OTN/AET52		RYMSA, Radiación y Microondas S.A.	RYM
	Schmidt Rudolf	FAE22		SENER Ingenieria SA	SEN
	Schweickert Gunn	AOE22		Stöhr, Königsbrunn	STOE
	Sonn Nico	AOE51		Terma A/S, Herlev	TER
	Steininger Eric	AED44			

II. As-Run Copy of the He II Production & Top Up Procedure

HP-2-ASED-TP-0090

Working copy

start 9.9.05 Schl

Title: **Herschel EQM AXT Helium II Production and Top Up**

CI-No: 151 000

Prepared by:	Herschel Team	Date:	08.09.05
Checked by:	C. Schlosser		9.9.05
Product Assurance:	for R. Stritter		12.09.05
Configuration Control:	W. Wietbrock		12.09.05
Project Management:	Dr. W. Fricke		12/09/05

Distribution: See Distribution List (last page)

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1 Scope

1.1 Objective

This test procedure describes the He II production and top up of the Herschel EQM cryostat. The objective of these activities is to reach an AXT filling level of more than 95 % with T 702/T 703 < 1.8 K. The HTT shall be at LHe I conditions and shall have a filling level of at least 40 %.

This procedure summarises the nominal activity flow, operational constraints, GSE set up and the step by step procedure. The operations are given in correct timely order. All activities are performed in clean room class 100.000.

This procedure is applicable for each He II production and top-up during the Herschel EQM tests at He II conditions.

1.2 Activity Flow

The activity flow below summarizes the activities to be performed during He II production and top up. He II production and top up is completed with the steps in section 5.4. Sections 5.5 to 5.8 have to be repeated whenever necessary.

§ 5.1	**Preparation of Set-up**	Configuration check according table in step 3.1 Liquid level of He II tank > 40 % (estimated value) FM airlock SV 121 installed Installation of auxiliary lines Preparation of transfer lines Preparation of venting lines to He pumping unit I Valve status check
§ 5.2	**He II Production in AXT**	Check / establish required cryostat configuration Start pumping down of AXT with He pumping unit I Pumping down of the AXT to reach a temperature of T 701 < 2.0 K
§ 5.3	**He II Top Up in AXT**	Install He I transfer line Top up AXT from LHe I supply while pumping at V 512 Pumping down of AXT to required temperature Repeat process until required temperature at a filling level of > 75 % is reached
§ 5.4	**Final Status**	Check and monitor final status: • AXT filled and at He II temperature • AXT venting via OBA and V 512, He pumping unit I running • HTT partly filled with He I • HTT venting via shields and V 502
§ 5.5	**Night Break**	• Establishing of night configuration: o Removal of transfer line o Venting via V 104 and V 502 o Pumping at AXT via V 512 and V 701 • Restart after night configuration
§ 5.6	**Exchange of LHe Dewar**	• Removal of transfer line • Installation of new dewar and transfer line
§ 5.7	**Preparation of LHe I Transfer Line**	• Preparations • Evacuation of transfer line

		• Flushing of transfer line with GHe
§ 5.8	**Installation of Transfer Line**	• Installation of transfer line in dewar • Installation of transfer line in SV 121 • Evacuation and purging of filling airlock

1.3 Requirements

During He II production no specific requirements have to be regarded. Final temperatures to be achieved are:

HIFI:

Level 0:	Detector (T 228):	< 2 K
Level 1:	L1 (T 237):	< 6 K
Level 2:	FPU (T 207, T 208):	< 20 K

PACS:

Level 0:	Red Detector (T 221):	< 1.75 K
	Blue Detector (T 224):	< 2 K
	Cooler Pump (T 223):	< 2 K
	Cooler Evaporator (T 222):	< 1.85 K
Level 1:	FPU (T 231 ... T 234, T 242):	2 K - 5 K
Level 2:	OBP near PACS (T 202):	< 16 K

SPIRE:

Level 0:	Detector (T 225):	< 2 K (< 1.75 K goal)
	Cooler Pump (T 226):	< 2 K
	Cooler Evaporator (T 227):	< 1.85 K (< 1.75 K goal)
Level 1:	FPU (T 235, T 236, T 248):	< 5.5 K (< 3.7 K goal)
Level 2:	OBP near SPIRE (T 254, T 256) T 258):	< 16 K
Level 3:	PM-JFET (T 246, T 251, T 252):	< 20 K
	SM-JFET (T 247, T 249, T 250):	< 20 K

2 Documents/Drawings

2.1 Applicable Documents

The following documents of the latest issue in effect or as defined herein form a part of this document to the extent specified herein.

AD #	Document Title	Document Identifier
AD 01	CVSE Set-up Description	HP-2-ASED-TN-0094
AD 02	PA Requirements for Subcontractors	HP-1-ASPI-SP-0018

2.2 Reference Documents

RD #	Document Title	Document Identifier
RD 01	Documentation Identification Procedure and Documentation Management	HP-2-ASED-PR-0001
RD 02	EQM AIT Plan	HP-ASED-PL-0022
RD 03	PA Plan	HP-2-ASED-PL-0007
RD 04	Contamination Control Plan	HP-2-ASED-PL-0023
RD 05	General Design and Interface Requirements (GDIR)	H-P-1-ASPI-SP-0027
RD 06	Reinigungsvorschrift für Komponenten im Projekt Herschel	HP-2-ASED-PR-0008
RD 07	List of Acronyms	HP-2-ASPI-LI-0077
RD 08	IID-B HIFI, section 5.7	SCI-PT-IIDB/HIFI-02125
RD 09	IID-B PACS, section 5.7 and 7.2	SCI-PT-IIDB/PACS-02126
RD 10	IID-B SPIRE, section 5.7	SCI-PT-IIDB/SPIRE-02124
RD 11	IID-A, section 9	SCI-PT-IIDA-04624

2.3 Other Documents

OD #	Document Title	Document Identifier
OD 01	Manual of High Vacuum pumping unit	
OD 02	Manual of He II pumping unit	

3 Configuration

3.1 General Hardware Configuration

At the start of the activities, the H/W configuration of the components is defined with the "As Built Configuration List" and the NCR's.

A rough summary of the initial configuration is given below:

- The PLM is closed, evacuated and leak tested
- The PLM is mated with the SVM simulator
- The PLM/SVM is integrated in the test dolly or standing on the SVM simulator and placed in clean room class 100 000
- The instrument FPUs are integrated onto the OBA and verified at ambient temperatures together with their warm units, integrated into the SVM simulator
- The harness (CCH and SIH) is completely integrated, verified and connected with instruments

3.2 Cryostat Configuration

The cryostat status at start of cool down and filling shall be:

- HTT is partly filled with LHe I
- AXT is partly filled with LHe I
- filling airlock with SV 121 is mounted
- SV 921 installed
- Turbo pump 'B' (C0712) mounted to SV 922 airlock for continuous evacuation of the cryostat
- strap pretensions are about 5 kN
- the Cryo SCOE shall be operational and instrumentation connected
- external venting line is blinded and leak tested
- CVV is pumped down to < 10^{-6} mbar

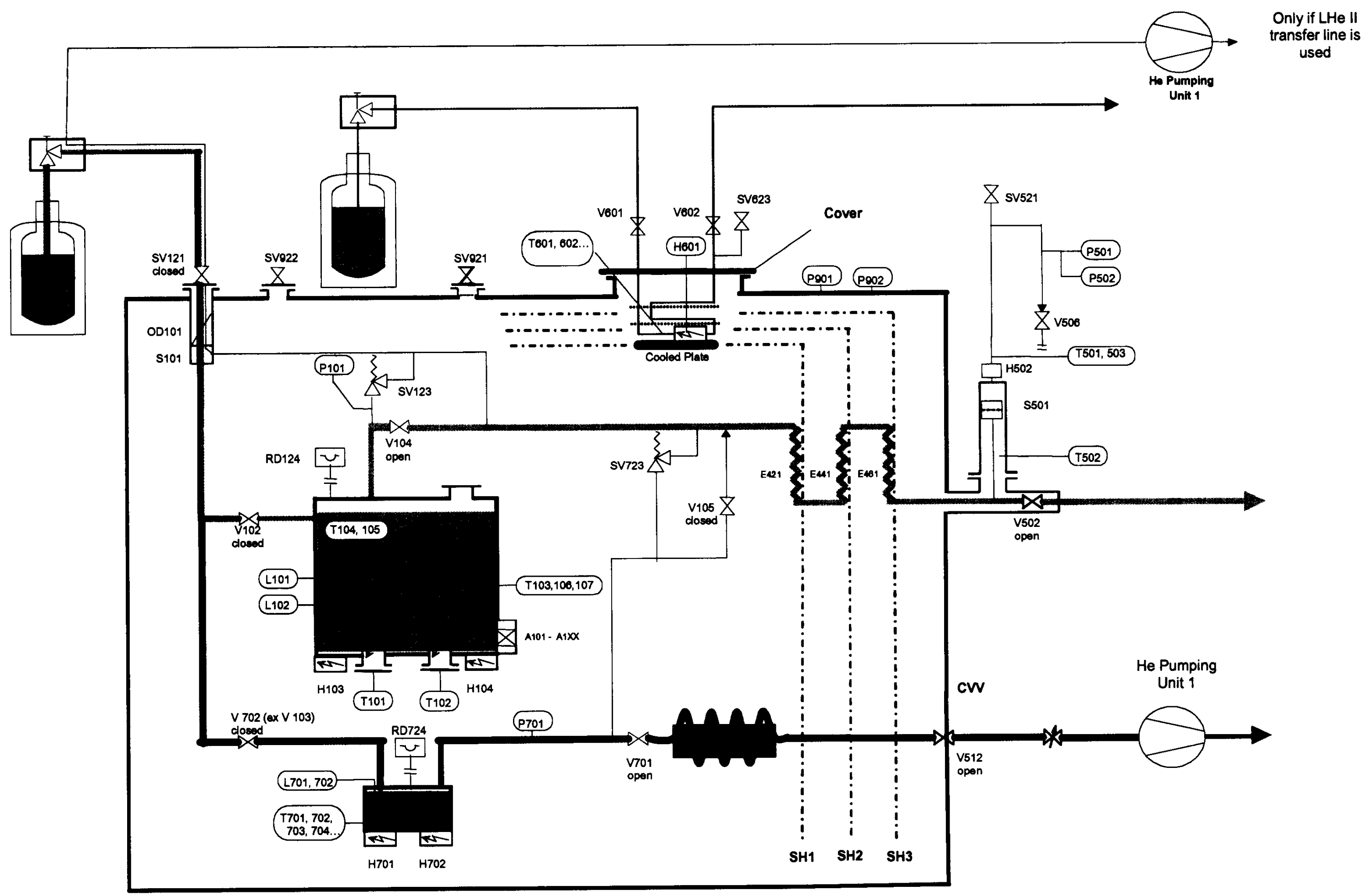


Figure 3-1: EQM PLM Helium S/S Flow Schema

3.3 Set-up

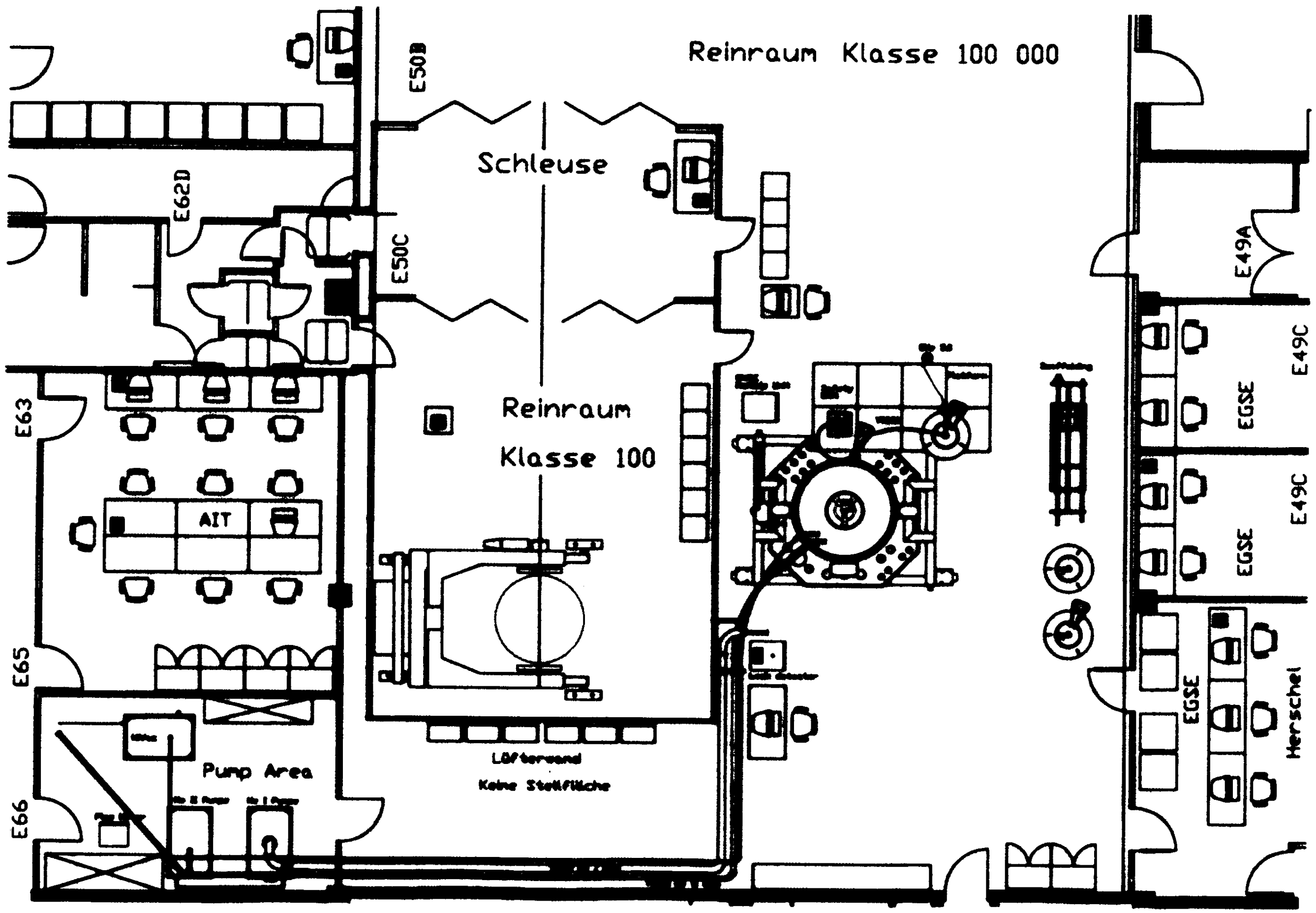


Figure 3-2: General set-up in clean room class 100 000

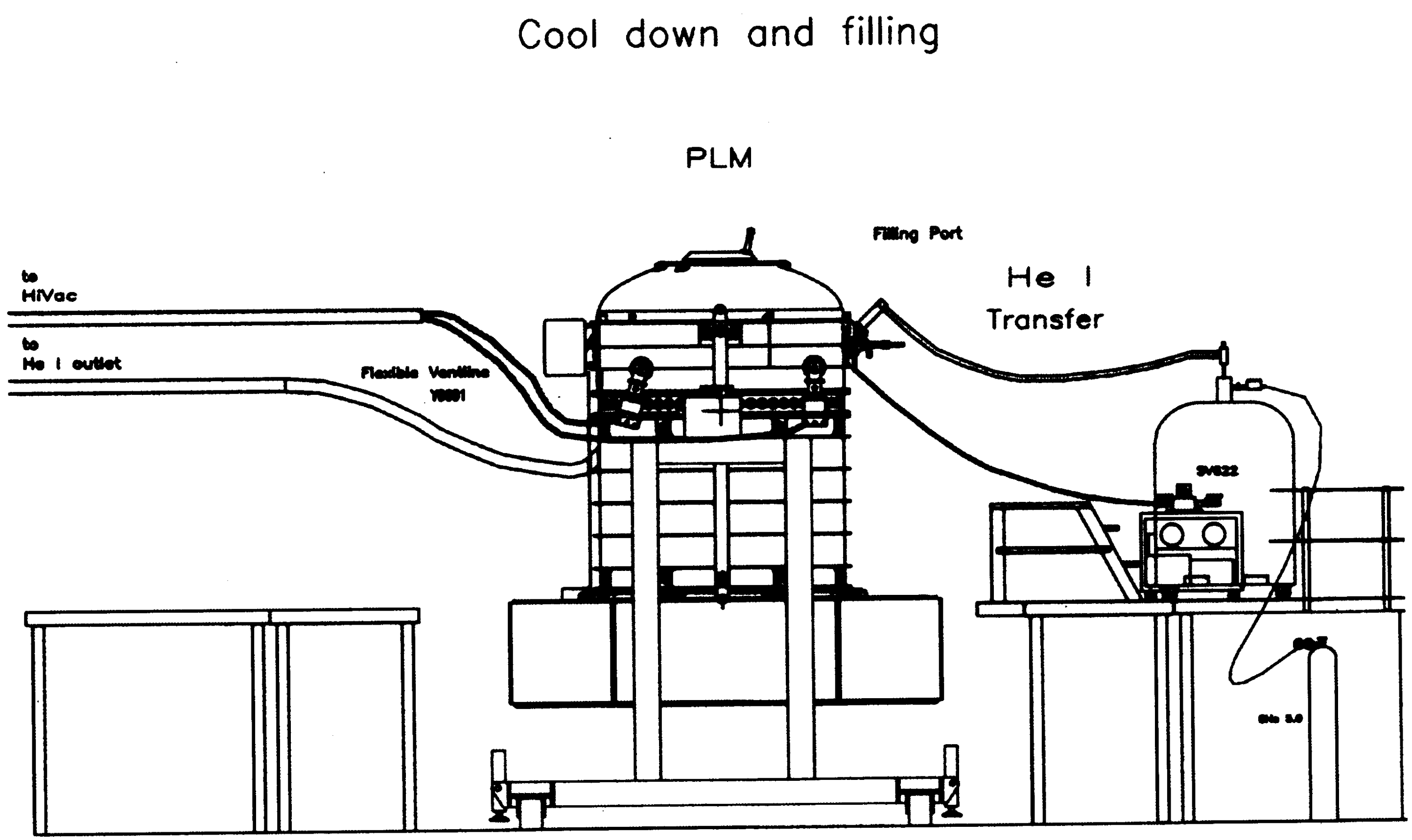


Figure 3-3: Set-up during LHe II Production

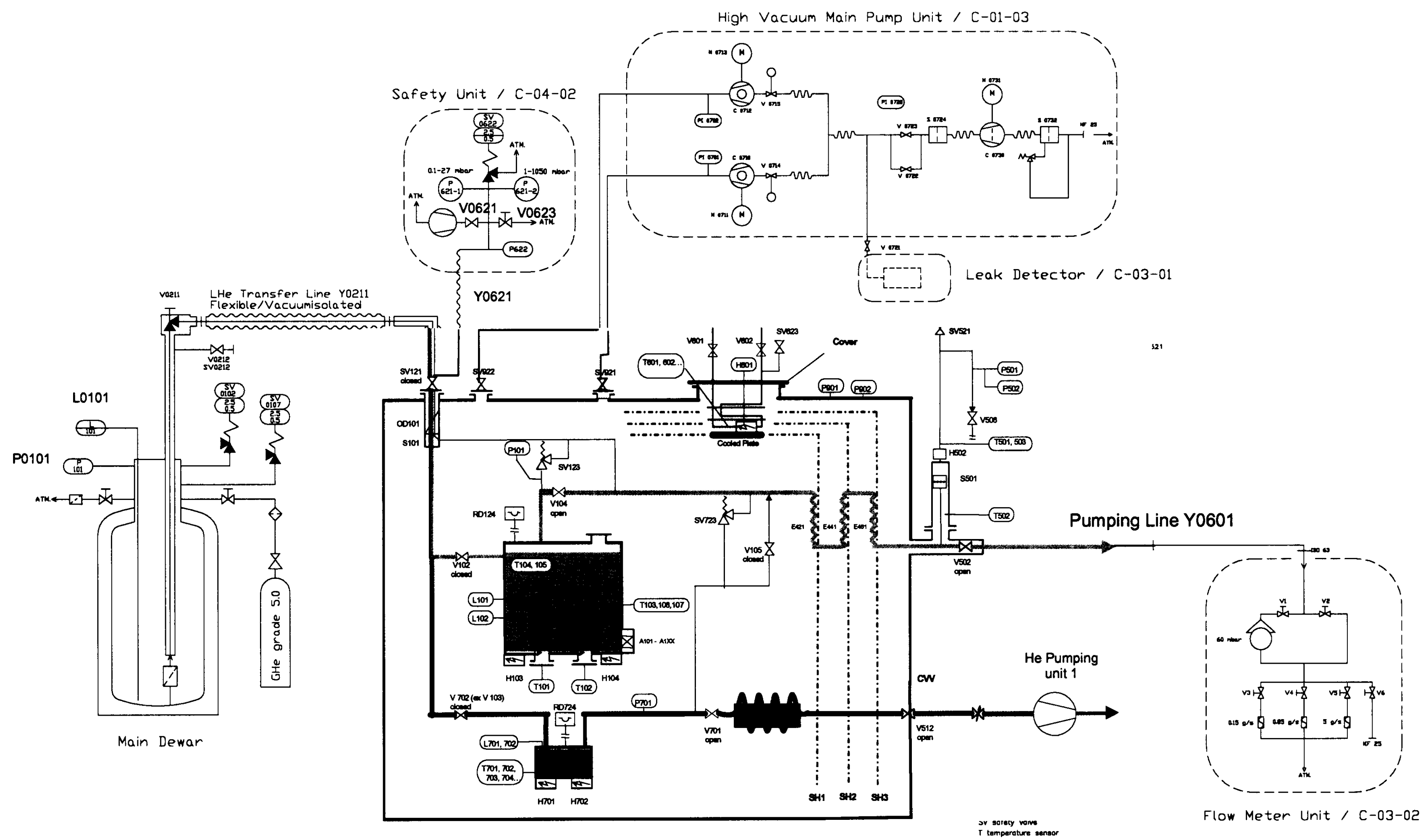
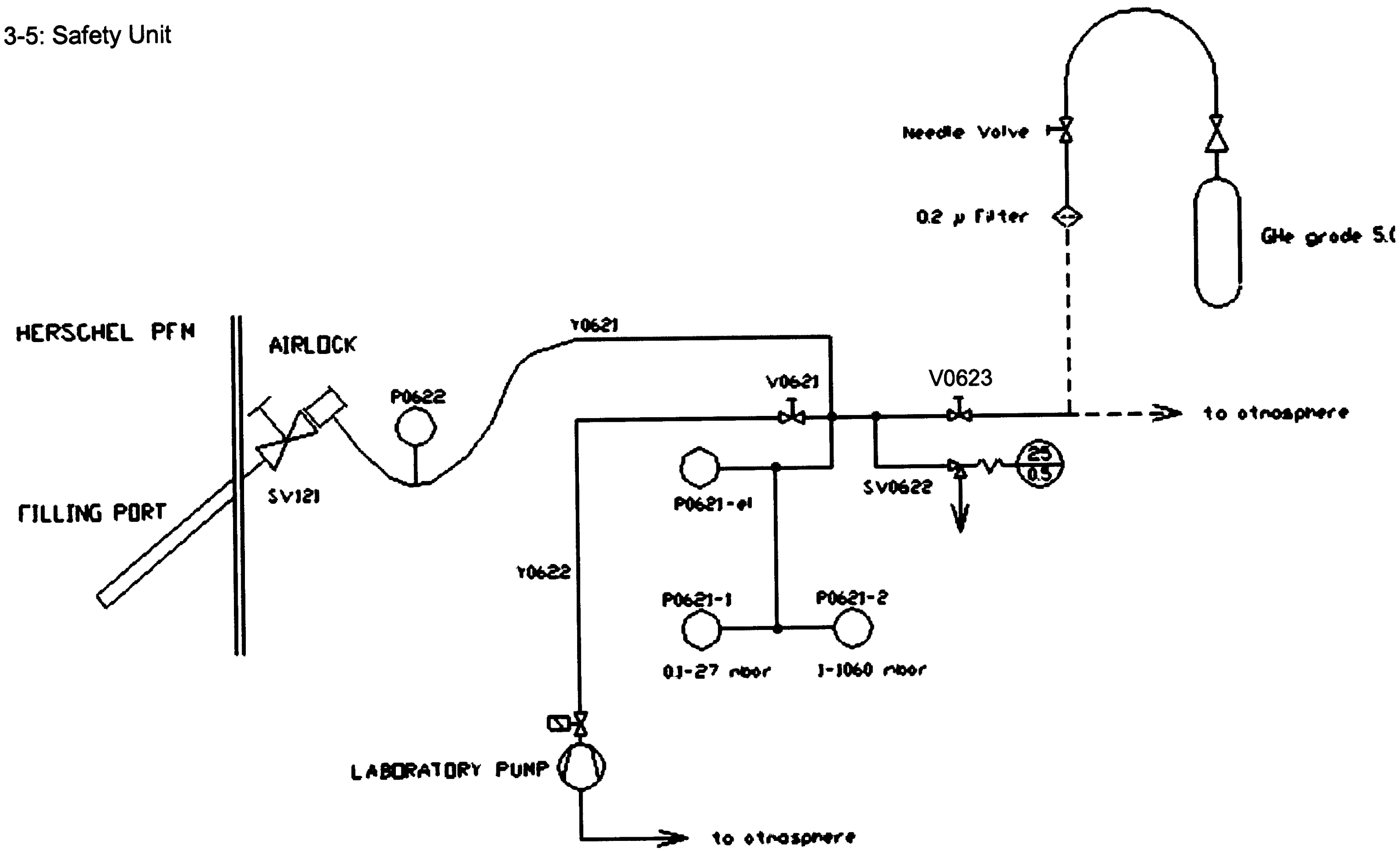


Figure 3-4: CVSE for LHe II Production in AXT

Figure 3-5: Safety Unit



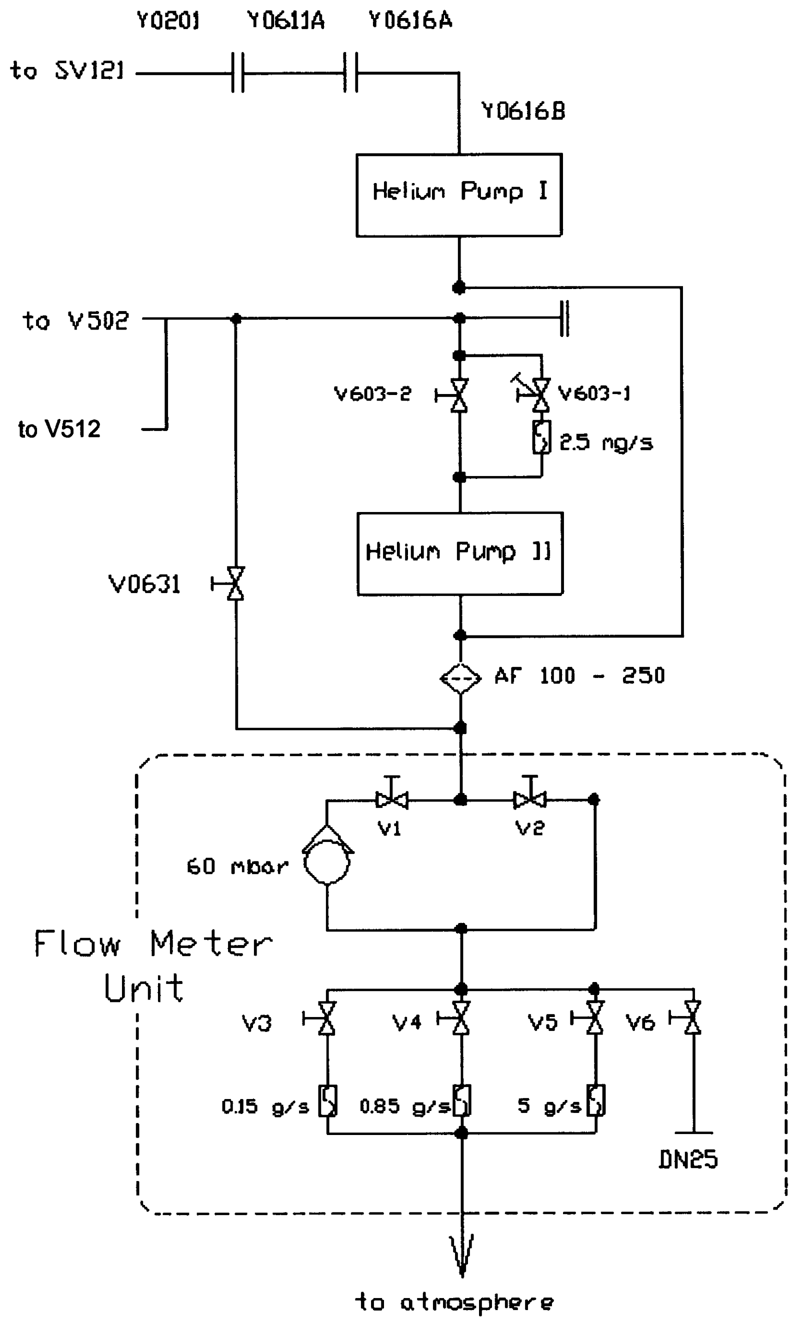


Figure 3-6: Flow Meter Unit

4 Conditions

4.1 Personnel

Personnel necessary to perform activities according to this present procedure are:

Responsibility	Name / Organisation
Test Manager	*) C. Schlosser
Test conductors	*) C. Schlosser
Cryostat Operators	*) A. Runge
EGSE Operators	*) S. Dehn
PA Responsible	*) E. Lamprecht

*) Names and possible additional personnel to be registered prior to the start of activities

4.2 Environmental

All activities according this procedure have to be performed in a clean room class 100 000 according Federal standard 209 E:

Cleanliness:	class 100 000
Temperature:	22°C ± 3°C
Pressure:	ambient
Rel. humidity:	40 % - 65 %

4.3 General Instructions for Integration

4.3.1 *General Safety Requirements, Precautions*

The following general rules have to be regarded:

- Respect standard technical rules for mechanical and electrical integration and test activities
- Special hazard precautions are not expected, except for the comments below and the comments mentioned in the step by step procedure
- The H/W has to be handled by authorized personnel only

The following specific rules have to be regarded:

- In case of an unexpected large release of helium it may be necessary to treat victims for suffocation and cold burns. If required, remove the victim from immediate vicinity of the leak
- In case of operation of the Cryostat safety system the following immediate activities shall be performed:
  - operation of safety valve: everybody has to leave the test room, except test conductor and necessary CVSE operations personnel
  - operation of burst disc: everybody has to leave the test room
- Contact facility emergency services immediately and explain nature and location of accident

4.3.2 *QA Requirements*

QA shall monitor all operations (handlings, transportation and installation) as necessary to assure compliance with this procedure and the applicable sections of the PA Plan (RD 3).

In the course of this procedure QA shall pay particular attention to

- integrity of every tightening surfaces and seals
- ensure adequate cleanliness conditions
- ensure that all safety aspects are considered
- the application of adequate protections to critical surfaces
- the records in the log sheet
- to ensure that tools and test equipment used is within current calibration cycle

4.3.3 *ESD constraints*

No specific ESD precautions have to be regarded during cool down and filling.

4.3.4 *Prerequisites*

At least the following tasks have to be successfully completed before start with cryostat cool down:

- TRR has been successfully held to ensure that the relevant procedures, drawings, applicable documents are available, reviewed and approved
- Formal release to start with activity is given by QA / safety
- The necessary GSE and H/W is available, accepted and applicable for use
- Safe working conditions for personnel and H/W are existing and will be applied
- Skilled and authorized personnel is available
- An access restricted area has been defined and marked by QA / safety
- Incoming inspection of H/W have been performed by QA and engineering

All parts and tools required available and operational

4.4 GSE

All GSE and integration equipment is fit checked and carries valid calibration certificates.

4.4.1 *MGSE*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	PLM Test Dolly	APCO	CI No. 142 155-01	N/A
1	PLM Hoisting device	APCO	CI No. 142 121	N/A
2	Long Hoisting Bars for EQM	APCO	CI No. 142 129-02	N/A
	Working platform		N/A	N/A
	General Purpose Hoisting Devices	ASED	N/A	N/A
	Set of tools	ASED	N/A	N/A

Table 4-1: MGSE

4.4.2 *EGSE*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	Central Checkout System (light)	Terma	CI No. 142 210	
1	EQM Cryo SCOE	ABSp	CI No. 142 220	
1	CDMU DFE	SSBV	CI No. 142 230	
1	PLM SCOE	SSBV	CI No. 142 240	
1	I-EGSE (if instruments are used)			
	Digital Multimeters (troubleshooting only)	ASED		
	Set of break out boxes (troubleshooting only)	ASED		
	Ohm -meter (troubleshooting only)	ASED		

Table 4-2: EGSE

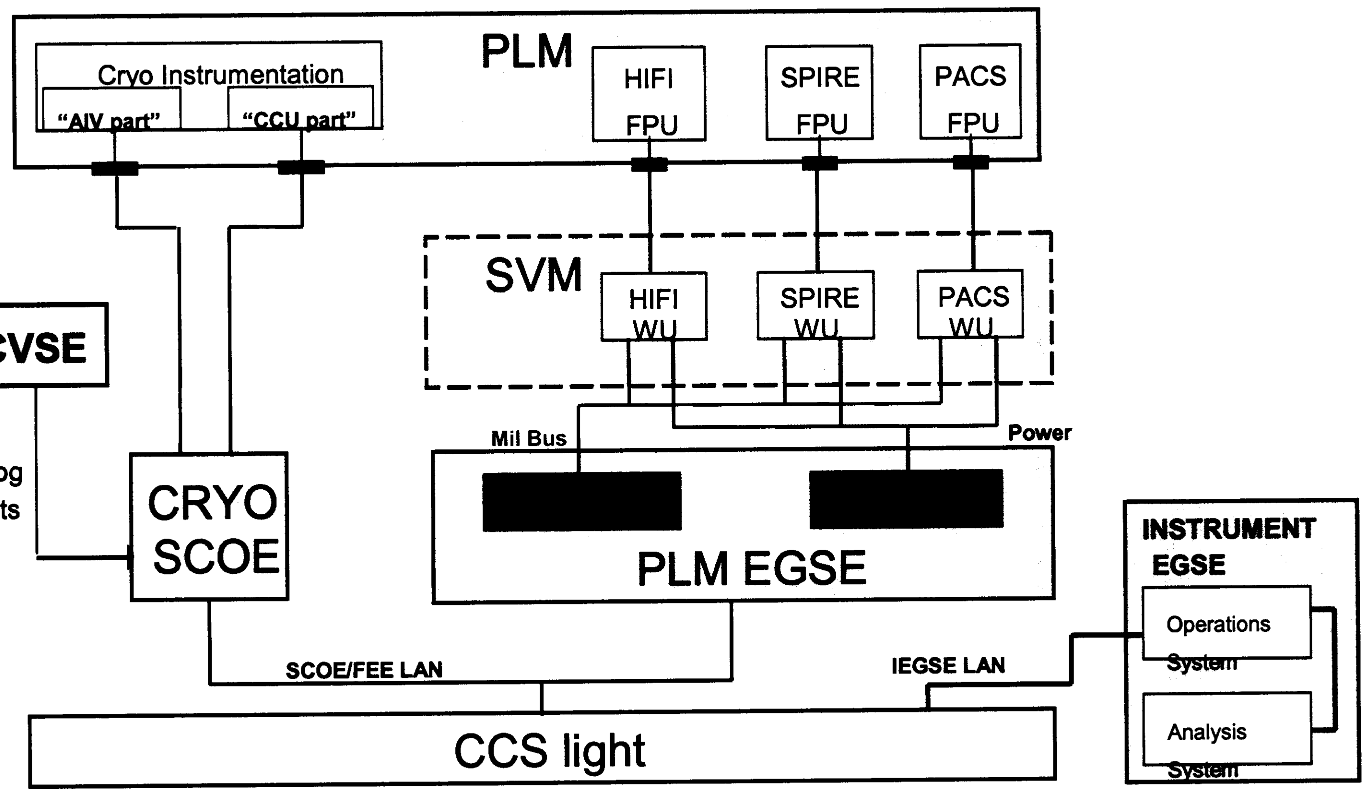


Figure 4-1: EGSE Configuration

4.4.3 *OGSE*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
	Theodolites	ASED		

Table 4-3: OGSE

4.4.4 *Cryo Vacuum Servicing Equipment (CVSE)*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	High Vacuum Pumping Unit 1	BOCE	CI No. 142 310-03	
2	Turbo pumps (C0711, C0712)	BOCE	CI No. 142 310-03	
1	Laboratory Vacuum Pump in safety unit	BOCE	CI No. 142 310-04	
1	Laboratory Vacuum Pump in CVSE scaffolding	BOCE	CI No. 142 310-04	
1	CVSE Monitoring Rack	BOCE	CI No. 142 310-06	
1	Leak Detector	BOCE	CI No. 142 310-07	
2	LHe transfer lines (Y0211/Y0221)	DeMaCo	CI No. 142 310-08	
1	Venting line Y0601/Y0602	DeMaCo	CI No. 142 310-09	
1	Safety line to SV 121 (Y0621/Y0622)	DeMaCo	CI No. 142 310-09	
1	Scaffolding for CVSE lines		CI No. 142 310-10	
10	450 l LHe Dewars type HDS 450 -EIPS	Linde		
	50 l / 200 bar GHe grade 5.0	Linde		
	Set of mass flow meters	ASED		
	Set of vacuum hoses			
	Manometer P0621-1(0,1-27 mbar) in safety unit	W & T		
	Manometer P0621-2(1-1200 mbar) in safety unit	W & T		

Table 4-4: CVSE

5 Step-by-Step Procedure

5.1 Preparation of Set-Up

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
	The following configuration set-up is required prior to start of He II production and shall be checked prior to test:					
5.1.1.1	PLM/SVM installed in test dolly or standing on SV simulator and set-up according Figure 3-2 and Figure 3-3		✓		✓	
5.1.1.2	Make a printout of current strap pretension	~ 5 kN	✓			
5.1.1.3	He S/S filled with LHe I:					
	HTT LHe temperature T 101	~ 4.2 K	4.31 K	4.28		
	HTT tank pressure P 101 (or P0621)	0.95 - 1.2 bar	1.016 bar	1.054		
	Liquid level in HTT (estimated value)	> 20 %	> 60%	> 20% estimated		
	AXT LHe temperature T 707	~ 4.2 K	4.26 K	4.28K		
	AXT tank pressure P701	0.95 - 1.2 bar	1.00 bar	1.04 bar		
	Liquid level in AXT	> 75 %	59,1 cm	36,2 cm / 54.6 cm ✓ ≈23%		
5.1.1.4	SV 921 installed					

Location: OTN	PA: [signature] Date: 5.5.05	Operator: [signature] Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.1.1.5	Turbo pump B mounted on upper bulkhead SV 922 interface, turbo pump is running and airlock to isolation vacuum is open		✓		✓	
5.1.1.6	Airlock SV 121 installed and leak test of filling port performed. Airlock configured for LHe I transfer line.		✓		✓	
5.1.1.7	Two manometers P0621-1 (0,1-27 mbar) and P0621-2 (1-1200 mbar) installed in safety unit and connected with the safety line of filling port airlock.		✓		✓	
5.1.1.8	Safety line Y0621, valves V0621, V0623, manometers P0621-1 and P0621-2, safety valve SV0622, vent line Y0622 and vacuum pump C 1100 connected with filling airlock and leak test performed. A metal gasket must be used at the interface line Y0621 to filling port SV 121!		✓		✓	
5.1.1.9	Plug of SV 121 is closed - SV 121 is activated		✓	SV121 open in safety position see NCR	✓	
5.1.1.10	Cryo SCOE connected and operational - functional test at ambient temperature successfully performed.		✓		✓	
5.1.1.11	Blind flanges installed at external vent line and leak tested		✓		✓	
5.1.1.12	5 g/s mass flow meter installed in the Y0602 vent line and connected with a strip chart recorder and the Cryo SCOE		✓		✓	
5.1.1.13	Check configuration of safety unit according Figure 3-4 and Figure 3-5		✓		✓	
5.1.1.14	Connect He pumping unit II via V6 of the flow meter unit with Y0601		✓	w/o He pump II	✓	

Location: OTN	PA: [signature] Date: 9.9.05	Operator: Jche	Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.1.1.15	Connect venting line from V 512 with pumping line of He pumping unit I		✓		✓	
5.1.1.16	Check that transfer lines are connected to the cover cooling loop according AAE procedure		✓		✓	
5.1.1.17	Check valves status: • V 104, V 105, V 502, V 512, V 701 • V 102, V 702, SV 121	Open Closed	✓ ✓	V105 closed	✓	
5.1.1.18	Check isolation vacuum: P 901 (P 902)	$< 1 \times 10^{-6}$ mbar	$2.1 \cdot 10^{-7}$ mbar	$3.1 \cdot 10^{-7}$ mbar	✓	
5.1.1.19	P 501 interface at PLM connected with manometer and leak tested		✓		✓	
5.1.1.20	Fill out log sheet 1 and 2 - see annex 1		✓			
5.1.1.21	Attention: Do not operate liquid level sensors at temperatures above 10 K: L 701, L 702 if T 703 > 10 K Do not continuous operate L 701 or L 702 and do not operate L 701 and L 702 at the same time.		✓		✓	

Location: OTL	PA: [signature] Date: 9.9.05	Operator: [signature] Date: 9.9.05		

5.2 He II Production in AXT

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.2.1	***Check / Establish Cryostat Configuration***					
5.2.1.1	Close V 105 Don't reopen valve !		✓	13:37	✓	
5.2.1.2	Check valves status: • V 104, V 502, V 512, V 701 • V 102, V 105, V 702, SV 121	 Open Closed	 ✓ ✓		✓	
5.2.1.3	Check mass flow via V 502 Check mass flow via V 512	> 0 mg/s > 0 mg/s	22.2 mg/s ≈0	} 133 mg/s npt	✓	
5.2.1.4	Check pressures: HTT pressure P 101 (or P0621): AXT pressure P 701 GHe exhaust pressure P 501	 0.95 - 1.2 bar 0.95 - 1.2 bar 0.95 - 1.2 bar	 1.016 bar 1.00 bar 1018 bar	 1.054 bar 1.04 bar "	✓	
5.2.1.5	Fill in log sheets every 1 h minimum		✓		✓	
5.2.2	***Start He II Production of AXT***					
5.2.2.1	Close bypass from He pumping unit 1 to ambient		n.a.		✓	

Location: OTP	PA: [signature] Date: 9.9.05	Operator: [signature] Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.2.2.2	Start water cooling of pumping unit Check that air pressure is open		✓		✓	
5.2.2.3	Start He-pumping unit 1 Note: Pumping speed must be limited to 10 m³/h Open inlet valve He-pumping unit 1 (V6 of flow meter unit) and evacuate venting line Y0611		✓		✓	
5.2.2.4	Note date and time		9.9.05 13:42	28.9.05 16:15	✓	
5.2.2.5	Check that un-isolated part of suction lines Y0701 and Y0616 are not covered by frost more than approx. 1 m upstream of He pumping units		✓	cooling water too hot ?	✓	
5.2.2.6	If frost is too close to the pumping units, reduce pump flow rate		n.a	~ 27°C inlet temperature	✓	
5.2.2.7	Continue pumping down of AXT and note the date and time of λ-point crossing • T 707 • P 701 Note date and time	≤ 2.17 K ≤ 50 mbar	2.164 0.05 bar 9.9.05 15:21	2,160 0.05 28.9.05 19:15	✓	
5.2.2.8	Final values to be reached: • T 707 • P 701	≤ 1.7 K ≤ 32 mbar			✓	

Location: OTN	PA: [signature] Date: 9.9.05	Operator: [signature]	Date: 9.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.2.2.9	Fill out log sheet 1 and 2		✓		✓	

5.3 He II Top Up in AXT

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.1	***Install He I Transfer Line***		already done for HTT filling		✓	
5.3.1.1	Prepare and install LHe I transfer line as described in chapters 5.5 to 5.8		already		✓	
5.3.1.2	Evacuate and flush airlock and transfer line three times as described in chapters 5.5 to 5.8.				✓	
5.3.1.3	Pressurize transfer line and filling airlock to about 950 mbar				✓	
5.3.2	***Top Up with LHe II in AXT***					
5.3.2.1	Open SV 121 and insert LHe I transfer line completely		✓		✓	
5.3.2.2	Check He pumping unit 1 is running and pumping at AXT		✓		✓	
5.3.2.3	Open V 702		✓		✓	

Location: OTN	PA: [signature] Date: 13.9.05	Operator: [signature] Date: 13.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.2.4	Check valve status: • V 102, V 105 • V 104, V 502, V 512, V 701, V 702, SV 121	 closed open	 ✓ ✓		✓	
5.3.2.5	Open needle valve at LHe I transfer line and fill AXT smoothly		✓		✓	
5.3.2.6	Observe bath temperature in AXT (T 101) Stop LHe I transfer by closing the needle valve at transfer line if the temperature at T 707 > 2.1 K or if the AXT is full		✓	T707 increased > 2,5 K, but ok.	✓	
5.3.2.7	Check liquid level in AXT		✓		✓	
5.3.3	***Pumping Down of AXT to Required Temperature***					
5.3.3.1	Close V 702		✓		✓	
5.3.3.2	Retract transfer line to upper position and close SV 121		n.a.		✓	
5.3.3.3	Check valve status: • V 102, V 105, V 702, ~~SV 121~~ • V 104, V 502, V 512, V 701, SV121	 closed open	 ✓ ✓		✓	
5.3.3.4	Pump down AXT until T 707 < 1.7 K		1,62 K	pumped over night	✓	

Location: OTP	PA: [signature] Date: 13.9.05	Operator: [signature] Date: 13.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.3.5	Check liquid level in AXT Not Helium bath temperature in AXT T 707	< 1.7 K	1.52 K		✓	
5.3.4	***Complete LHe II Top Up***					
5.3.4.1	Repeat steps 5.3.2 and 5.3.3 until AXT has reached the required status: • Helium bath temperature T 707 • Liquid level	< 1.7 K > 75 %	1.52 K 48,4 cm	(of 64 cm)	✓	
5.3.4.2	Fill out log sheets 1 & 2		✓		✓	

5.4 Final Status

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.4.1.1	Check and monitor final status at the end of He II production and top up:		✓		✓	
5.4.1.2	AXT filled with LHe II and pumped down		✓		✓	
5.4.1.3	AXT venting via OBA and V 512, He pumping unit I running		✓		✓	
5.4.1.4	HTT partly filled with LHe I		✓		✓	

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.4.1.5	HTT venting via shields and V 502		✓		✓	
5.4.1.6	Check valve status: • V 102, V 105, V 702 • V 104, V 502, V 512, V 701, SV 121	 closed open	 ✓ ✓		✓	
5.4.1.7	Depressurize supply dewar, close V0101		✓		✓	
5.4.1.8	Remove transfer line from airlock, close compression fitting with blind plug and protect open end of transfer line		n.a.	kept installed for HTT filling		
5.4.1.9	Remove transfer line from supply dewar, and store the line on the scaffolding		n.a			
5.4.1.10	Fill out log sheets 1 & 2		✓		✓	

5.5 Night Configuration

n.a.

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
	The following activities have to be performed at the end of each working day to get the cryostat in safe configuration and at begin of the next day to restart He II top up. This chapter is only required when top up is ongoing.					

Location: OTN	PA: [signature]	Date: 14.9.05	Operator: [signature]	Date: 14.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.1	***Establish Night Configuration***					
5.5.1.1	Close valve V0211 (or V0221) in transfer line and stop LHe flow					
5.5.1.2	Close V 702					
5.5.1.3	Check V 701 and V 104 open					
5.5.1.4	Reduce pressure in dewar by opening of V0101					
5.5.1.5	Retract transfer line to upper position in airlock SV 121					
5.5.1.6	Close airlock SV 121					
5.5.1.7	Remove transfer line from airlock, close compression fitting with blind plug and protect open end of transfer line.					
5.5.1.8	Remove transfer line from supply dewar and prepare it for next use.					
5.5.1.9	Check valve status: • V 102, V 512, V 702 • V 104, V 105, V 502, V 701, SV 121	 closed open				
5.5.1.10	Fill out log sheets 1 & 2					
5.5.2	***Restart after Night Break***					

Location:	PA: Date:	Operator: Date:		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.2.1	Install transfer line into a supply dewar and into SV 121. (see chapter 5.8 for details)					
5.5.2.2	Evacuation and flush the transfer line with GHe grade 5.0 three times. (see chapter 5.8 for details)					
5.5.2.3	Restart activities as described in chapter 5.3					

5.6 Exchange of LHe Dewar

n. a.

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.6.1	***General Remarks***					
5.6.1.1	The following paragraphs have to be repeated at each dewar exchange					
5.6.1.2	**Attention:** Do not empty dewars completely Remaining liquid level in dewar shall always be L0101>100 mm					
5.6.1.3	Use leather gloves and protect eyes by glasses when installing or removing transfer line LHe supply dewar.					
5.6.1.4	At each dewar change write down in log sheet: • dewar No. • liquid level at start • liquid level at end • LHe-consumption • used transfer line					
5.6.1.5	Fill out log sheets 1 & 2					
5.6.2	***Removing Transfer Line***					
5.6.2.1	Prepare second transfer line according step 5.7					

Location:	PA: Date:	Operator: Date:		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.6.2.2	Close valve V0211 (or V0221) in transfer line and stop LHe flow					
5.6.2.3	Close V 702 (if open)					
5.6.2.4	Close V 102 (if open)					
5.6.2.5	Check V 104 open, V 701 open					
5.6.2.6	Reduce pressure in dewar, remove pressurization line and open V0101					
5.6.2.7	Retract transfer line to upper position in airlock SV 121					
5.6.2.8	Close airlock SV 121					
5.6.2.9	Remove transfer line from airlock, close compression fitting with blind plug and protect open end of transfer line.					
5.6.2.10	Remove transfer line from supply dewar and prepare it for next use.					
5.6.3	***Installation of new Dewar and Transfer Line***					
5.6.3.1	Install second transfer line into a full supply dewar and into SV 121. (see chapter 5.8 for details)					
5.6.3.2	Evacuation and flush the transfer line with GHe grade 5.0 three times. (see chapter 5.8 for details)					
5.6.3.3	Close V 104, open V 702					

Location:	PA: Date:	Operator: Date:		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.6.3.4	Insert transfer line completely into airlock and retract it again about 1 mm. Fix the compression fitting					
5.6.3.5	Open V0211 (or V0221) and restart top up as described in chapter 5.3					

Location:	PA: Date:	Operator: Date:		

5.7 Preparation of LHe I Transfer Line

n.a.

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.7.1	***Preparations***					
5.7.1.1	Cleaning of inlet filter: • remove the inlet filter from the line • clean the filter in ultrasonic bath with isopropyl alcohol • dry the filter with a heat gun • tie Teflon tape around the filter thread and screw the filter onto the tube					
5.7.1.2	Description of installations at transfer line - Interfaces at dewar side: • compression fitting • valve V01 • pressure gauge P01 • flex. line DN25 as connection to vacuum line Y0622 and laboratory pump C1100					

Location:	PA: Date:	Operator: Date:		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.7.1.3	Description of installations at transfer line – Interfaces at PLM side: • compression fitting, • valve V02 • filter • GHe supply • pressure reducer DM1 • flex. line DN4 with a minimum length of 2 m					
5.7.1.4	Check that V0211 (or V0221) is open					
5.7.2	***Evacuation of Transfer Line***					
5.7.2.1	Close V02 to the GHe bottle					
5.7.2.2	Start laboratory pump C1100					
5.7.2.3	Open V01 and evacuate transfer line for 5 min.					
5.7.3	***Flushing of transfer line:***					
5.7.3.1	Close V01 to the laboratory vacuum pump					
5.7.3.2	Open GHe supply and V02					

Location:	PA: Date:	Operator: Date:		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.7.3.3	Adjust DM1 at dewar to P01=300 to 500 mbar					
5.7.3.4	Flush transfer line for min. 30 s					
5.7.3.5	Close V02					
5.7.3.6	Repeat evacuation / flushing cycle 4 times					
5.7.3.7	Flush transfer line during transport to the dewar:					
5.7.3.8	Open V02 and pressurize the transfer line to approximately 500 mbar overpressure					
5.7.3.9	Disconnect transfer line from V01.					
5.7.3.10	Check/adjust that transfer line is under small overpressure. He flow at open end of transfer line must be noticeable.					

Location:	PA: Date:	Operator: Date:		

5.8 Installation of Transfer Line

n.a.

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.8.1	***Preparation of LHe Dewar***					
5.8.1.1	Check that the dewar is released by PA for use on Herschel.					
5.8.1.2	Check that head of dewar is equipped with one feed through 16 mm. Check that the dewar is equipped with *Electronic Internal Pressurizing System* (EIPS). Fix the blind plug in feed through 16 mm.					
5.8.1.3	Position 450 l dewar near SV 121 on working platform. Activate break mechanism at dewar.					
5.8.1.4	Establish a clear control area of about 2 m round the dewar					
5.8.1.5	Open valve V0101 of dewar gently and depressurize to atmospheric pressure. **ATTENTION:** cold gas, use leather gloves and eye glasses					
5.8.2	***Installation of Transfer Line into Dewar***					
5.8.2.1	Transport the transfer line to the dewar while flushing it with GHe. (3 persons necessary)					
5.8.2.2	Remove compression fitting from transfer line (dewar side) and check/adjust DM1 that a slight He flow is at open end of transfer line					

Location:	PA: Date:	Operator: Date:		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.8.2.3	Remove blind plug 16 mm from head of supply dewar and insert transfer line in the dewar by about 200 mm					
5.8.2.4	Stop transfer line flushing: -close V02 -close DM1 and GHe supply					
5.8.2.5	Push the transfer line slowly in the dewar until stop at filter reaches the bottom of dewar (the filter is equipped with a 100 mm distance pin to avoid that the transfer line is taking LHe from the bottom of the dewar)					
5.8.2.6	Close V0211 (or V0221)					
5.8.2.7	Adjust dewar pressure at EIPS to 100 mbar - 200 mbar overpressure as needed during filling activities					
5.8.3	***Installation of Transfer Line at SV 121***					
5.8.3.1	Check that airlock SV 121 is closed, blocked and at atmospheric pressure					
5.8.3.2	Open V0211 (or V0221) slightly Remove compression fitting with valve V02 from transfer line. Check/adjust GHe flow with V0211 (or V0221) at open end of transfer line					

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.8.3.3	Remove blind plug from SV 121. Insert transfer line in SV 121 and fix transfer line in upper position. Close V0211 (or V0221) immediate.					
5.8.3.4	Tighten compression fitting.					
5.8.3.5	**Attention:** Don't damage the seal at transfer line when installing transfer line in SV 121.					
5.8.4	***Evacuation and Purging of Filling Airlock***					
5.8.4.1	Check: • transfer line is prepared and installed according steps above • airlock SV 121 is closed and blocked • pre-cooling valve is closed • dewar overpressure is adjusted to about 200 mbar					
5.8.4.2	Start lab. pump C1100, open valve V0621 and evacuate transfer line for about 5 min					
5.8.4.3	Check P0621< 1 mbar Close valve V0621					

Location:	PA: Date:	Operator: Date:		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.8.4.4	Purge line to ambient pressure by opening valve V0211 (or V0221) until P0621 is at about ambient pressure Then close V0211 (or V0221)	1000 mbar				
5.8.4.5	Repeat step 5.8.4.2 to 5.8.4.4 two times.					
5.8.4.6	Open SV121					
5.8.4.7	Continue with LHe transfer in PLM					

Location:	PA: Date:	Operator: Date:		

6 Summary Sheets

6.1 Procedure Variation Summary

	Test Change		Curr. No.: Date: Page 1 of
Test designation	Test Procedure	Issue 1	Rev.
Test step changed	Reason for Change:		

Prepared by:	Resp. Test Leader	Project Engineer
PA/QA		

6.2 Non Conformance Report (NCR) Summary

Status list of applicable NCR to be attached

NCR - No.	NCR - Title	Date	Status
	none		

6.3 Sign-off Sheet

	Date	Signature
Test Manager	14.9.05	[signature]
Test Conductor	14.9.05	[signature]
PA Responsible	14.9.05	[signature]

ANNEX Log Sheets

Herschel EQM														LOGSHEET 1 for He II Production in AXT						
Date	Time	Valve Status								P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	Mass flow via shields mg/s	AXT LL1 cm	AXT LL2 cm	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121										AIV	QA

Herschel EQM																	LOGSHEET 2 for He II Production in AXT		
Date	Time	Temperatures in [K]															REMARKS	Sign	
		DLCM T101	HTT T106	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T707				AIV	QA

END OF DOCUMENT

	Name	Dep./Comp.		Name	Dep./Comp.
X	Alberti von Mathias Dr.	AOE22	X	Stritter Rene	AED11
	Barlage Bernhard	AED11		Thörmer Klaus-Horst Dr.	OTN/AED65
X	Bayer Thomas	AOA52		Wagner Klaus	AOE22
	Fehringer Alexander	AOE13	X	Wietbrock Walter	AET12
	Fricke Wolfgang Dr.	AED 63		Wöhler Hans	AOE22
	Geiger Hermann	AOA52		Wössner Ulrich	ASE442
	Gerner Willi	AED11			
	Grasl Andreas	OTN/AET52			
	Grasshoff Brigitte	AET12			
X	Hauser Armin	AOE22	X	Alcatel	ASP
X	Hendry David	Terma Resid.	X	ESA/ESTEC	ESA
	Hinger Jürgen	AOE22			
	Hofmann Rolf	ASE442		**Instruments:**	
X	Hohn Rüdiger	AED65		MPE (PACS)	MPE
X	Huber Johann	AOA52		RAL (SPIRE)	RAL
	Hund Walter	ASE442		SRON (HIFI)	SRON
X	Idler Siegmund	AED432			
X	Ilsen Stijn	Terma Resid.		**Subcontractors:**	
	Ivády von András	FAE22		Air Liquide, Space Department	AIR
X	Jahn Gerd Dr.	AOE22		Air Liquide, Space Department	AIRS
	Kalde Clemens	APE3		Air Liquide, Orbital System	AIRT
	Kameter Rudolf	OTN/AET52		Alcatel Bell Space	ABSP
	Kettner Bernhard	AET42		Astrium Sub-Subsyst. & Equipment	ASSE
	Knoblauch August	AET32		Austrian Aerospace	AAE
X	Koelle Markus	AOA53		Austrian Aerospace	AAEM
	Kroeker Jürgen	AED65		APCO Technologies S. A.	APCO
X	Kunz Oliver Dr.	AOE22		Bieri Engineering B. V.	BIER
X	Lamprecht Ernst	OTN/ASI21		BOC Edwards	BOCE
	Lang Jürgen	ASE442		Dutch Space Solar Arrays	DSSA
X	Langfermann Michael	AOA51		EADS CASA Espacio	CASA
X	Mack Paul	OTN/AET52		EADS CASA Espacio	ECAS
	Müller Jörg	AOA52		EADS Space Transportation	ASIP
X	Pastorino Michel	ASPI Resid.		Eurocopter	ECD
	Peltz Heinz-Willi	AOE13		European Test Services	ETS
	Pietroboni Karin	AED65		HTS AG Zürich	HTSZ
	Platzer Wilhelm	AED22		Linde	LIND
	Rebholz Reinhold	AOA51		Patria New Technologies Oy	PANT
	Reuß Friedhelm	AED62		Phoenix, Volkmarsen	PHOE
X	Rühe Wolfgang	AED65		Prototech AS	PROT
X	Runge Axel	OTN/AET52		QMC Instruments Ltd.	QMC
	Sachsse Bernt	AED21		Rembe, Brilon	REMB
	Schink Dietmar	AED44		Rosemount Aerospace GmbH	ROSE
X	Schlosser Christian	OTN/AET52		RYMSA, Radiación y Microondas S.A.	RYM
	Schmidt Rudolf	FAE22		SENER Ingenieria SA	SEN
	Schweickert Gunn	AOE22		Stöhr, Königsbrunn	STOE
	Sonn Nico	AOE51		Terma A/S, Herlev	TER
	Steininger Eric	AED44			

III. As-Run Copy of the Cover Flushing Procedure

HP-2-ASED-TP-0091

working copy

start: 16.9.05 Ide

Title: **Herschel EQM Cover Flushing**

CI-No: 151 000

Prepared by:	Herschel Team	Date:	15.09.05
Checked by:	C. Schlosser		15.9.05
Product Assurance:	R. Stritter		15.09.05
Configuration Control:	W. Wietbrock		15.9.05
Project Management:	Dr. W. Fricke		15/09/05

Distribution: See Distribution List (last page)

Issue	Date	Sheet	Description of Change	Release
1	15.09.05	All	initial issue	

Table of Content

Table of Figures

List of Tables

1 Scope

1.1 Objective

This test procedure describes the cover flushing activities on the Herschel EQM cryostat. The objective of these activities is to reach the required temperatures for the EQM instrument tests, the Integrated Module Test and the EMC test. The required temperature level will be defined and verified by the instruments during testing. The required temperature stability is regarded as a goal.

This procedure summarises the nominal activity flow, operational constraints, GSE set up and the step by step procedure. The operations are given in correct timely order. All activities are performed in clean room class 100.000.

This procedure is applicable for each cover flushing activity.

1.2 Activity Flow

Chapter 5.1 to 5.4 of the activity flow below summarize the activities to be performed during cover flushing. Chapter 5.5 needs only to be performed if the flushing lines needs have to be removed. Chapter 5.6 shall be repeated each time the supply line has to be installed.

§ 5.1	**Preparation of Set-up**	Configuration check according table in step 3.1 HTT at He I conditions, liquid level > 20 % (estimated value) AXT at He II conditions, liquid level > 20% Check installation of auxiliary lines Preparation of cover flushing lines Installation of cover evacuation line Valve status check
§ 5.2	**Cover Flushing**	Installation of cover filling line Start cover flushing
§ 5.3	**Adjustment of Cover Temperature**	Adjust cover temperature according instrument inputs by throttling the flow from supply dewar
§ 5.4	**End of cover flushing**	Stop flow from dewar Wait for temperatures above 170 K
§ 5.5	**Removal of Cover Flushing Lines**	Temperatures shall be between 170 K and 303 K Removal of filling line Removal of exhaust line
§ 5.6	**Preparation of Supply Line**	Preparations Evacuation of transfer line Flushing of transfer line with GHe

1.3 Requirements

Temperature levels and stability requirements will be defined together with the instruments during testing in the range of 25 K to 115 K at a temperature stability of 1K/10 s at 80 K. The temperature uniformity and measurement accuracy is defined in the cryostat cover procurement specification (RD 12).

2 Documents/Drawings

2.1 Applicable Documents

The following documents of the latest issue in effect or as defined herein form a part of this document to the extent specified herein.

AD #	Document Title	Document Identifier
AD 01	CVSE Set-up Description	HP-2-ASED-TN-0094
AD 02	PA Requirements for Subcontractors	HP-1-ASPI-SP-0018
AD 03	Cryostat Cover Handling and Operations Manual	HP-2-AAE-MA-0003

2.2 Reference Documents

RD #	Document Title	Document Identifier
RD 01	Documentation Identification Procedure and Documentation Management	HP-2-ASED-PR-0001
RD 02	EQM AIT Plan	HP-ASED-PL-0022
RD 03	PA Plan	HP-2-ASED-PL-0007
RD 04	Contamination Control Plan	HP-2-ASED-PL-0023
RD 05	General Design and Interface Requirements (GDIR)	H-P-1-ASPI-SP-0027
RD 06	Reinigungsvorschrift für Komponenten im Projekt Herschel	HP-2-ASED-PR-0008
RD 07	List of Acronyms	HP-2-ASPI-LI-0077
RD 08	IID-B HIFI, section 5.7	SCI-PT-IIDB/HIFI-02125
RD 09	IID-B PACS, section 5.7 and 7.2	SCI-PT-IIDB/PACS-02126
RD 10	IID-B SPIRE, section 5.7	SCI-PT-IIDB/SPIRE-02124
RD 11	IID-A, section 9	SCI-PT-IIDA-04624
RD 12	Procurement Spec. for Cryostat Cover, Cryostat Baffle and Test Components	HP-2-ASED-PS-0018

2.3 Other Documents

OD #	Document Title	Document Identifier
OD 01	Manual of High Vacuum pumping unit	
OD 02	Manual of He II pumping unit	

3 Configuration

3.1 General Hardware Configuration

At the start of the activities, the H/W configuration of the components is defined with the "As Built Configuration List" and the NCR's.

A rough summary of the initial configuration is given below:

- The PLM is closed, evacuated and leak tested
- The PLM is mated with the SVM simulator
- The PLM/SVM is integrated in the test dolly or standing on the SVM simulator and placed in clean room class 100 000
- The instrument FPUs are integrated onto the OBA and verified at ambient temperatures together with their warm units, integrated into the SVM simulator
- The harness (CCH and SIH) is completely integrated, verified and connected with instruments

3.2 Cryostat Configuration

The cryostat status at start of cool down and filling shall be:

- the HTT is partly filled with LHe I
- the AXT is partly filled with LHe II
- the CC-part of the Cover Supply Line is installed
- the CC-part of the Cover Exhaust Line is installed
- the cover cooling loop is filled with Helium gas at about ambient pressure
- filling airlock with SV 121 is mounted
- SV 921 installed
- Turbo pump 'B' (C0712) mounted to SV 922 airlock for continuous evacuation of the cryostat
- the Cryo SCOE shall be operational and instrumentation connected
- external venting line is blinded and leak tested
- CVV is pumped down to < 10^{-6} mbar

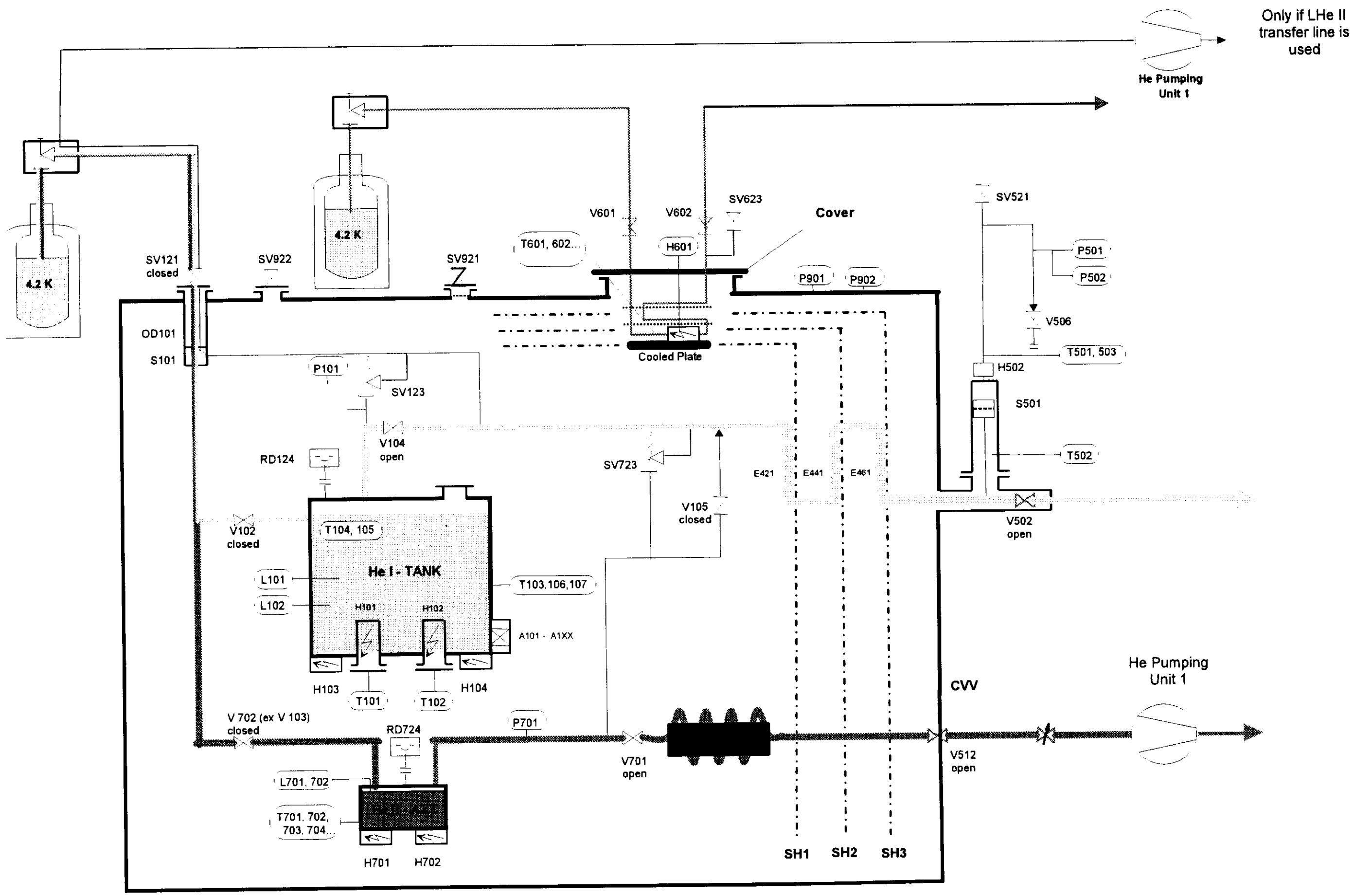


Figure 3-1: EQM PLM Helium S/S Flow Schema

3.3 Set-up

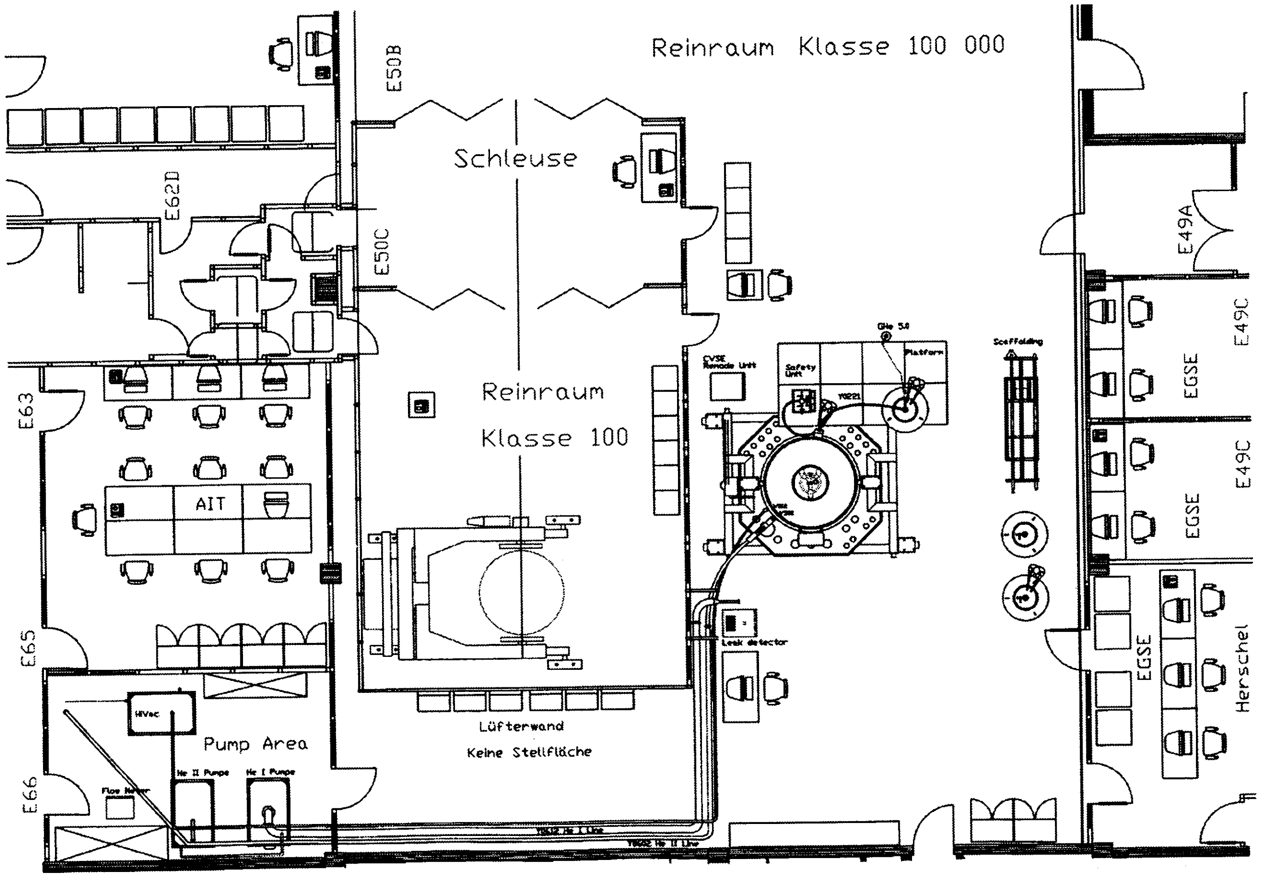


Figure 3-2: General set-up in clean room class 100 000

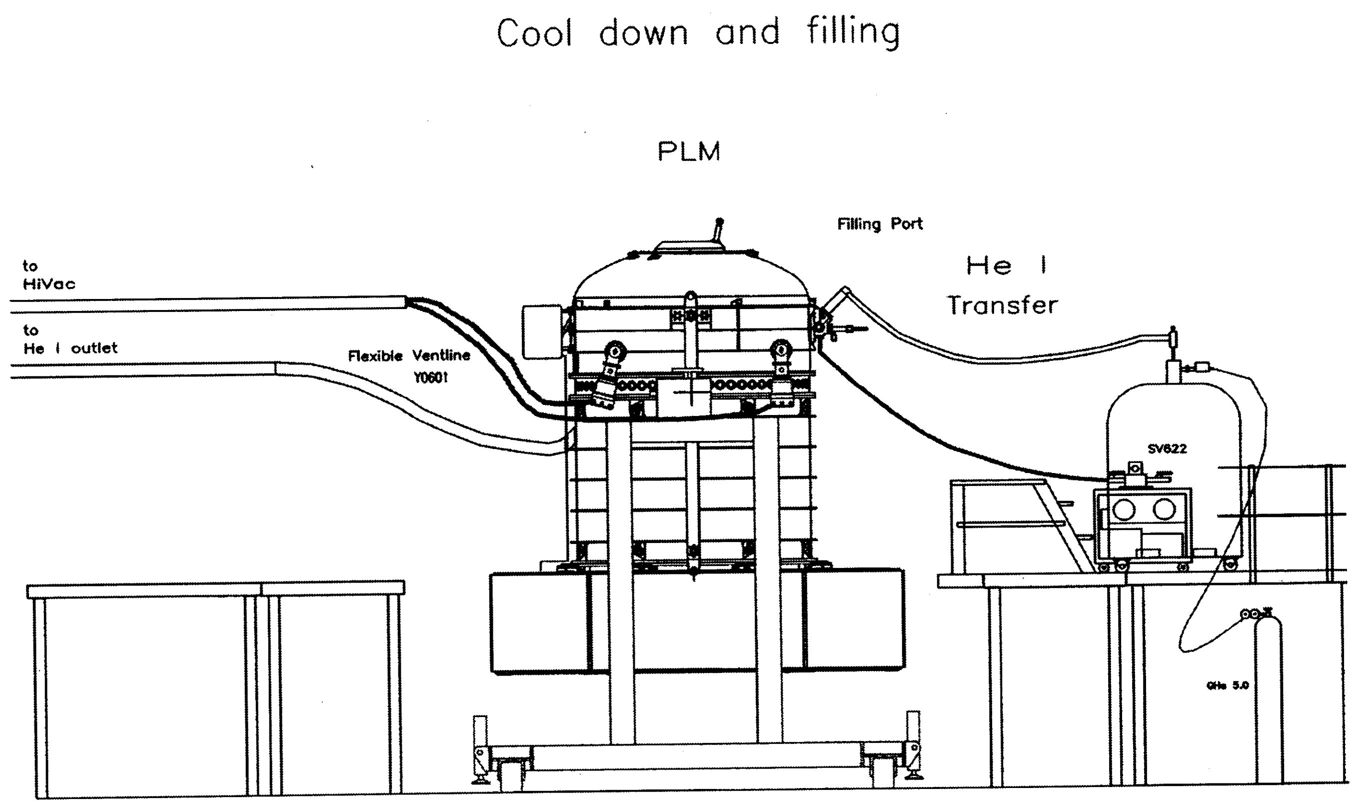


Figure 3-3: Set-up during LHe II Operation

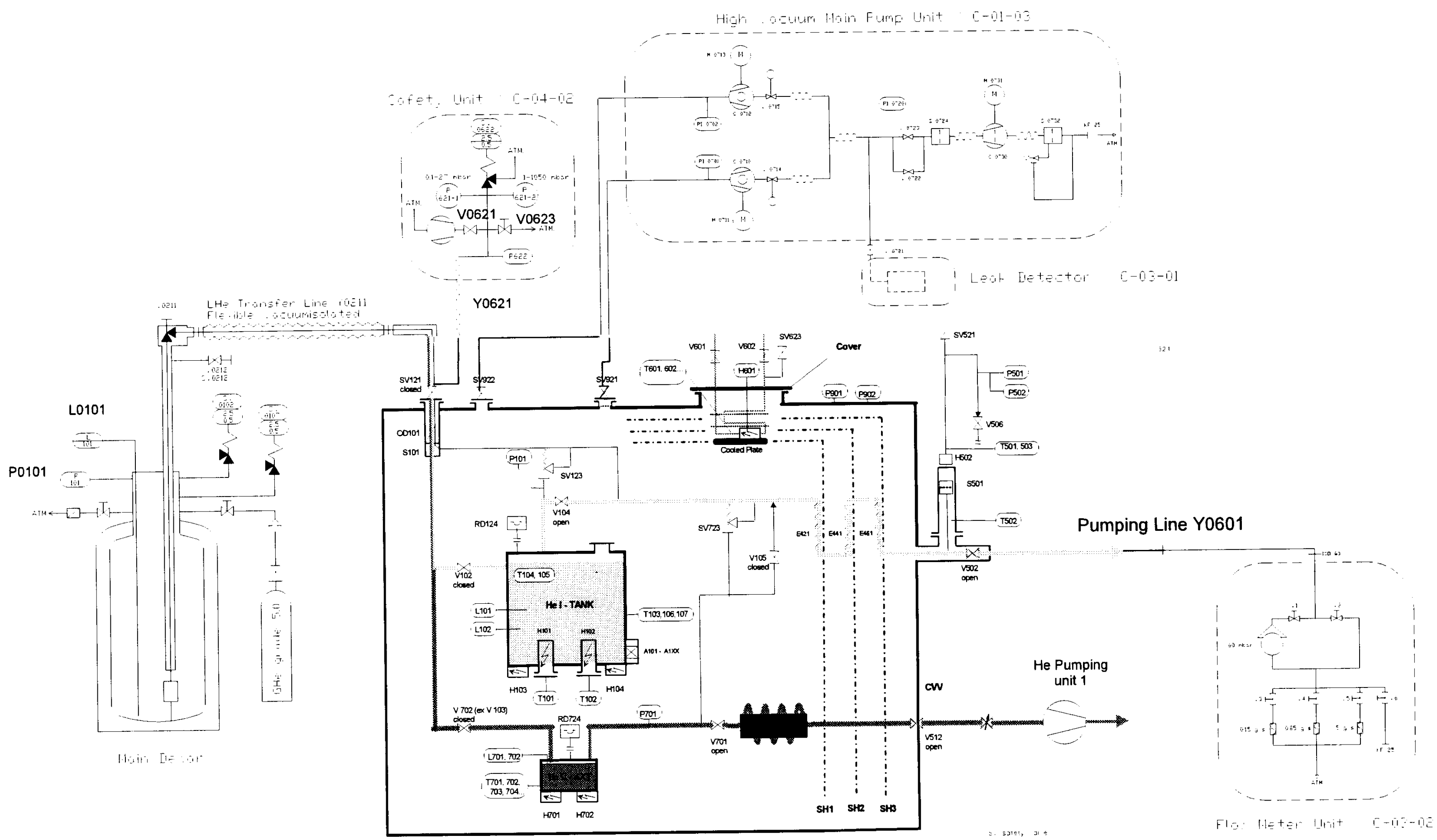
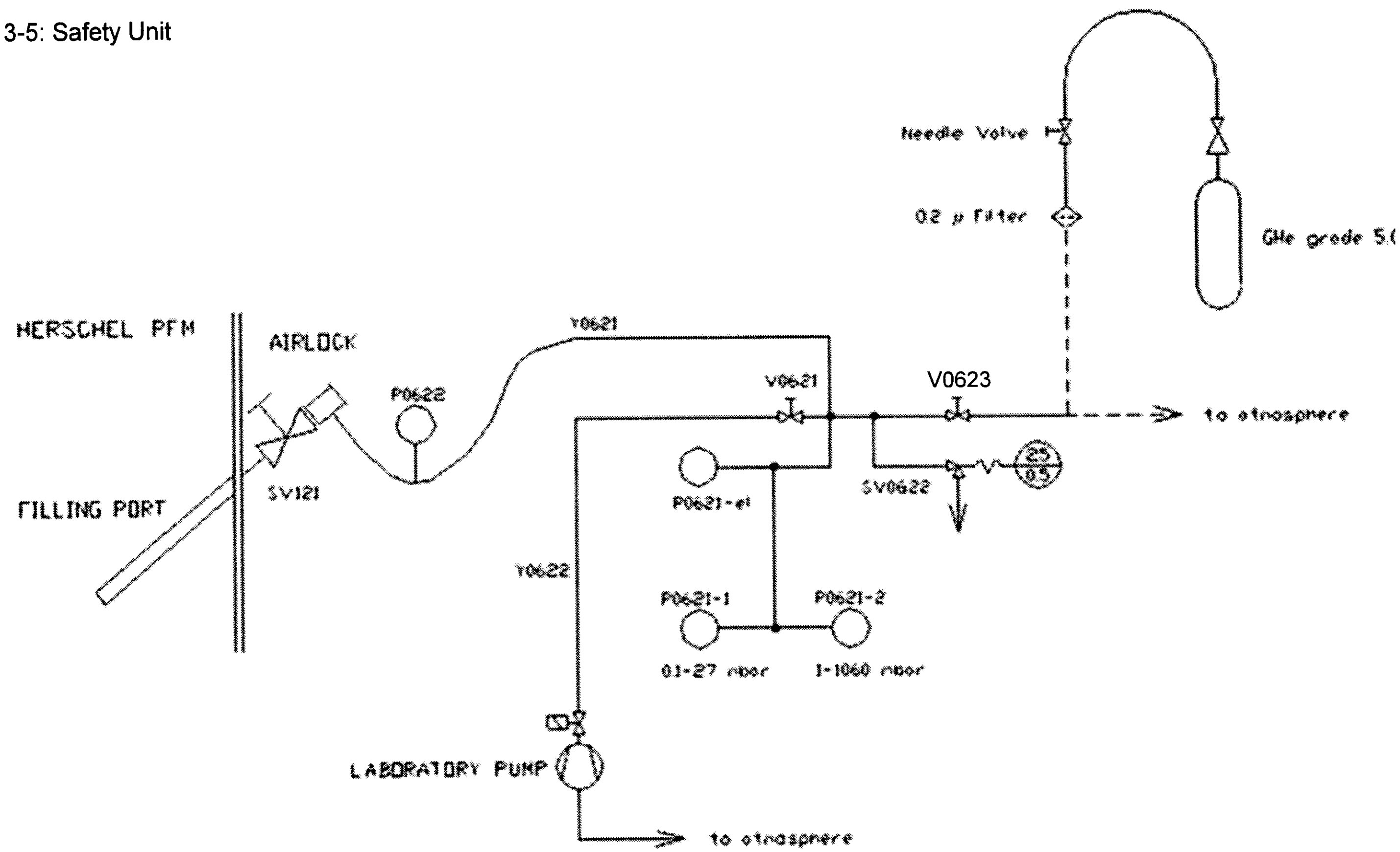


Figure 3-4: CVSE for LHe II Operation

Figure 3-5: Safety Unit



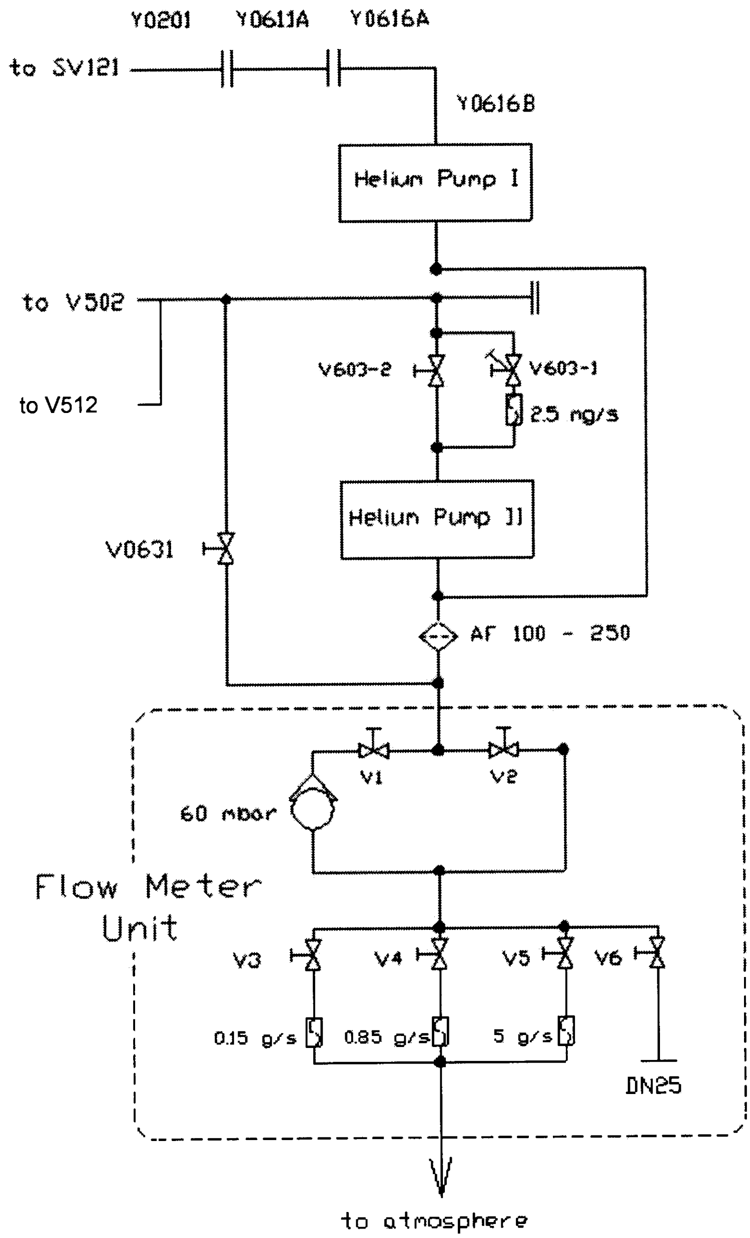


Figure 3-6: Flow Meter Unit

4 Conditions

4.1 Personnel

Cover flushing will be performed on request and in single shift. Personnel necessary to perform activities according to this present procedures are:

Responsibility	Name / Organisation
Test Manager	*) C. Schlone
Test conductors	*) P. Mack
Cryostat Operators	*) P. Mack
EGSE Operators	*) R. Kamete
PA Responsible	*) E. Campiello

*) Names and possible additional personnel to be registered prior to the start of activities

4.2 Environmental

All activities according this procedure have to be performed in a clean room class 100 000 according Federal standard 209 E:

Cleanliness: class 100 000

Temperature: 22°C ±3°C

Pressure: ambient

Rel. humidity: 40 % - 65 %

4.3 General Instructions for Integration

4.3.1 *General Safety Requirements, Precautions*

The following general rules have to be regarded:

- Respect standard technical rules for mechanical and electrical integration and test activities
- Special hazard precautions are not expected, except for the comments below and the comments mentioned in the step by step procedure
- The H/W has to be handled by authorized personnel only

The following specific rules have to be regarded:

- In case of an unexpected large release of helium it may be necessary to treat victims for suffocation and cold burns. If required, remove the victim from immediate vicinity of the leak
- In case of operation of the Cryostat safety system the following immediate activities shall be performed:
  - operation of safety valve: everybody has to leave the test room, except test conductor and necessary CVSE operations personnel
  - operation of burst disc: everybody has to leave the test room
- Contact facility emergency services immediately and explain nature and location of accident

4.3.2 *QA Requirements*

QA shall monitor all operations (handlings, transportation and installation) as necessary to assure compliance with this procedure and the applicable sections of the PA Plan (RD 3).

In the course of this procedure QA shall pay particular attention to

- integrity of every tightening surfaces and seals
- ensure adequate cleanliness conditions
- ensure that all safety aspects are considered
- the application of adequate protections to critical surfaces
- the records in the log sheet
- to ensure that tools and test equipment used is within current calibration cycle

4.3.3 *ESD constraints*

No specific ESD precautions have to be regarded during cool down and filling.

4.3.4 *Prerequisites*

At least the following tasks have to be successfully completed before start with cover flushing:

- TRR for IMT or EMC test has been successfully held to ensure that the relevant procedures, drawings, applicable documents are available, reviewed and approved
- Formal release to start with activity is given by QA / safety
- The necessary GSE and H/W is available, accepted and applicable for use
- Safe working conditions for personnel and H/W are existing and will be applied
- Skilled and authorized personnel is available
- An access restricted area has been defined and marked by QA / safety
- Incoming inspection of H/W have been performed by QA and engineering

All parts and tools required available and operational

4.4 GSE

All GSE and integration equipment is fit checked and carries valid calibration certificates.

4.4.1 *MGSE*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	PLM Test Dolly	APCO	CI No. 142 155-01	N/A
1	PLM Hoisting device	APCO	CI No. 142 121	N/A
2	Long Hoisting Bars for EQM	APCO	CI No. 142 129-02	N/A
	Working platform		N/A	N/A
	General Purpose Hoisting Devices	ASED	N/A	N/A
	Set of tools	ASED	N/A	N/A

Table 4-1: MGSE

4.4.2 *EGSE*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	Central Checkout System (light)	Terma	CI No. 142 210	
1	EQM Cryo SCOE	ABSp	CI No. 142 220	
1	CDMU DFE	SSBV	CI No. 142 230	
1	PLM SCOE	SSBV	CI No. 142 240	
1	I-EGSE (if instruments are used)			
	Digital Multimeters (troubleshooting only)	ASED		
	Set of break out boxes (troubleshooting only)	ASED		
	Ohm -meter (troubleshooting only)	ASED		

Table 4-2: EGSE

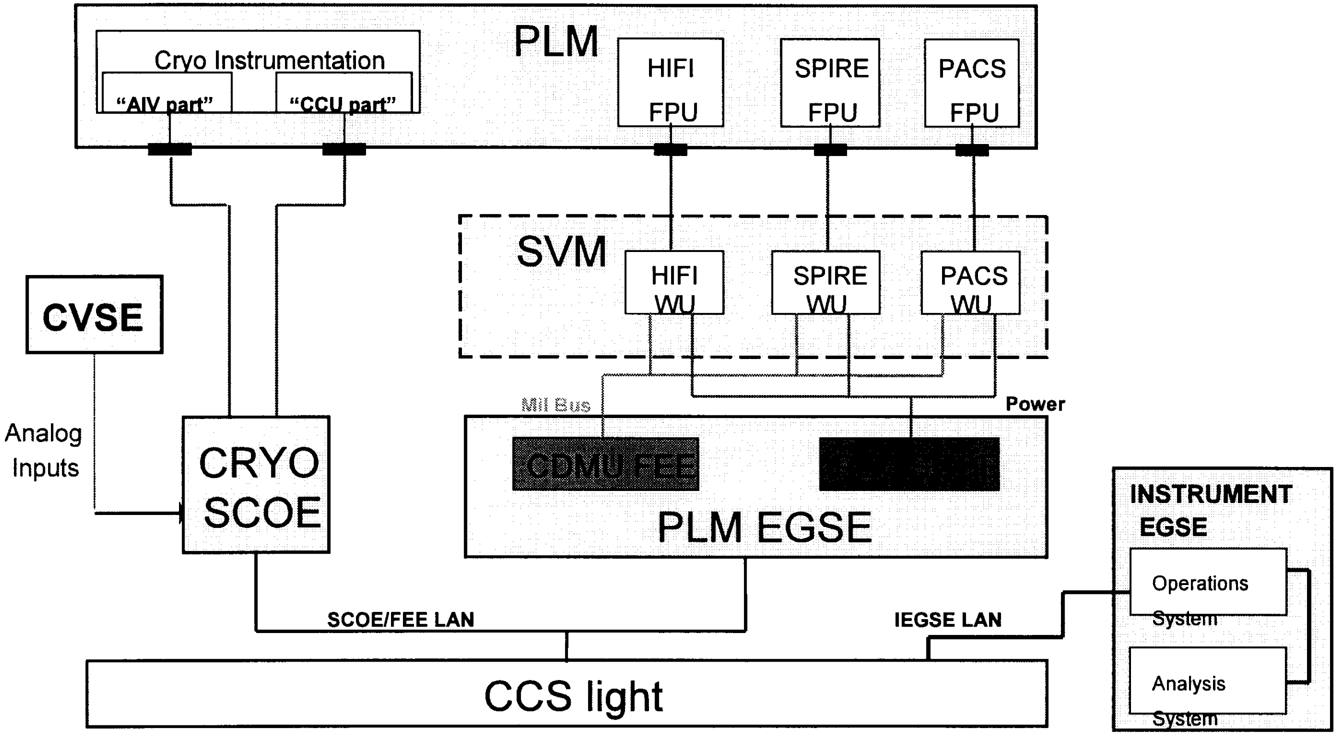


Figure 4-1: EGSE Configuration

4.4.3 *OGSE*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
	Theodolites	ASED		

Table 4-3: OGSE

4.4.4 *Cryo Vacuum Servicing Equipment (CVSE)*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	High Vacuum Pumping Unit 1	BOCE	CI No. 142 310-03	
2	Turbo pumps (C0711, C0712)	BOCE	CI No. 142 310-03	
1	Laboratory Vacuum Pump in safety unit	BOCE	CI No. 142 310-04	
1	Laboratory Vacuum Pump in CVSE scaffolding	BOCE	CI No. 142 310-04	
1	CVSE Monitoring Rack	BOCE	CI No. 142 310-06	
1	Leak Detector	BOCE	CI No. 142 310-07	
2	LHe transfer lines (Y0211/Y0221)	DeMaCo	CI No. 142 310-08	
1	Venting line Y0601/Y0602	DeMaCo	CI No. 142 310-09	
1	Safety line to SV 121 (Y0621/Y0622)	DeMaCo	CI No. 142 310-09	
1	Scaffolding for CVSE lines		CI No. 142 310-10	
10	450 l LHe Dewars type HDS 450 -EIPS	Linde		
	50 l / 200 bar GHe grade 5.0	Linde		
	Set of mass flow meters	ASED		
	Set of vacuum hoses			
	Manometer P0621-1(0,1-27 mbar) in safety unit	W & T		
	Manometer P0621-2(1-1200 mbar) in safety unit	W & T		
1	Cover Supply Line (2 parts)	DeMaCo		
1	Cover Exhaust Line (2 parts)	DeMaCo		

Table 4-4: CVSE

5 Step-by-Step Procedure

5.1 Check of PLM Status

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
	The following configuration set-up is required prior to start of cover flushing and shall be checked prior to test:					
5.1.1.1	PLM/SVM installed in test dolly or standing on SV simulator and set-up according Figure 3-2 and Figure 3-3		on SVM simulator		✓	
5.1.1.2	HTT filled with LHe I: HTT LHe temperature T 101 HTT tank pressure P 101 (or P0621) Liquid level in HTT (estimated value)	 ~ 4.2 K 0.95 - 1.2 bar > 20 %	 4.26 K 1.016 bar ~ 95 %		✓	
5.1.1.3	AXT filled with LHe II: AXT LHe temperature T 707 AXT tank pressure P701 Liquid level in AXT	 < 1.7 K < 0.05 bar > 20 %	 1.57 K 0.01 bar 42 cm ≙ ~	 68 %	✓	
5.1.1.4	SV 921 installed		✓		✓	

Location: OTN	PA: [signature] Date: 19.9.05	Operator: [signature] Date: 16.9.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.1.1.5	Turbo pump B mounted on upper bulkhead SV 922 interface, turbo pump is running and airlock to isolation vacuum is open				✓	
5.1.1.6	Cryo SCOE connected and operational				✓	
5.1.1.7	Check configuration of safety unit according Figure 3-4 and Figure 3-5				✓	
5.1.1.8	Check He pumping unit I running nominally				✓	
5.1.1.9	Check that CC-part of cover supply line and CC-part of cover exhaust line are connected to the cover cooling loop according AAE procedure (AD 03)				✓	
5.1.1.10	Prepare CVSE-part of cover supply line according to chapter 5.6				✓	
5.1.1.11	Check that cover cooling loop temperature is between 170 K and 303 K • T 601	170 ... 303 K	224K		✓	
5.1.1.12	Install CVSE-part of cover exhaust line: • Move CVSE-part of cover exhaust line close to CC-part at CVV • Remove blind cap at Johnston coupling • Install CVSE-part into Johnston coupling of the CC-part		O.K.		✓	

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.1.1.13	Evacuation and flushing of exhaust line and cooling loop: • Connect laboratory pump and GHe flushing line with exhaust line • Evacuate cooling loop and exhaust line with laboratory pump until pressure < 2 mbar • Flush cooling loop and exhaust line with GHe up to about 1 bar absolute • Repeat evacuation/flushing cycle two times		✓		✓	
5.1.1.14	Check valves status: • V 104, V 502, V 512, V 701 • V 102, V 105, V 702, SV 121	Open Closed	✓ ✓		✓	
5.1.1.15	Check isolation vacuum: P 901 (P 902)	$< 1 \times 10^{-6}$ mbar	$3.0 \cdot 10^{-7}$ mbar		✓	
5.1.1.16	Fill out log sheet 1 and 2 - see annex 1				✓	
5.1.1.17	Attention: Do not operate liquid level sensors at temperatures above 10 K: L 701, L 702 if T 703 > 10 K Do not continuous operate L 701 or L 702 and do not operate L 701 and L 702 at the same time.		o.k.		✓	

Location: OTN	PA: [signature] Date: 19.9.05	Operator: [signature] Date: 16.9.05		

5.2 Cover Flushing

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.2.1	***Installation of Cover Supply Line***					
5.2.1.1	Check that CVSE-part of supply line is prepared according section 5.6		✓		✓	
5.2.1.2	Transport CVSE-part of supply line to the cover and LHe supply dewar while flushing with GHe		✓		✓	
5.2.1.3	Install CVSE-part of supply line in LHe supply dewar		✓		✓	
5.2.1.4	Connect CVSE-part of supply line with CC-part of supply line		✓		✓	
5.2.1.5	Evacuate and flush cover cooling loop and LHe lines with He from dewar three time		✓		✓	
5.2.1.6	Fill in log sheets every 1 h minimum		during operation only		✓	
5.2.2	***Start Cover Flushing***					
5.2.2.1	Start Helium transfer through cover cooling loop by opening the needle valve of the supply line and the exhaust line		✓		✓	
5.2.2.2	Note date and time		16.9.05 14:25		✓	
5.2.2.3	Throttle Helium transfer from dewar when T 601 < 80 K		continued until < 10 K		✓	
5.2.2.4	Fill out log sheet 1 and 2				✓	

Location: OTN	QA: [signature] Date: 19.9.05	Operator: Schl Date: 16.9.05		

5.3 Adjustment of Cover Temperature

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.1.1	Request from instrument in test desired cover temperature			see logsheets	✓	
5.3.1.2	Increase / reduce flow from dewar to achieve requested cover temperature				✓	
5.3.1.3	Stabilize cover temperature by regulating the flow from the dewar				✓	
5.3.1.4	Fill out log sheets 1 & 2				✓	
5.3.1.5	Repeat steps above for new temperature				✓	

5.4 End of Cover Flushing

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.4.1.1	Close needle valve at CVSE-part of supply line to stop Helium transfer from dewar			not relevant cryo cover flushing was ~~stopped~~ completed with warm up of EQM see TP-0098		
5.4.1.2	Wait until cover temperature T 601 > 170 K	> 170 K				
5.4.1.3	Close valve at CVSE-part of exhaust line					
5.4.1.4	Observe pressure in exhaust line	< 1.2 bar				

Location: OTN	PA: [signature] Date: 16.9.05	Operator: [signature]	Date: 16.9.05		

5.5 Removal of Cover Flushing Lines

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
	The following activities have to be performed when no further cover flushing activities are foreseen.					
5.5.1	***Removal of CVSE-part of Supply Line***					
5.5.1.1	Wait until cover temperature T 601 and T 602 > 170 K	> 170 K				
5.5.1.2	Check pressure of cover tube	1.0 … 1.2 bar				
5.5.1.3	Disconnect CVSE-part of supply line from Johnston coupling, close Johnston coupling of CC-part of supply line by blind cap		N/A			
5.5.1.4	Remove CVSE-part of supply line from dewar, close inlet of dewar					
5.5.1.5	Transport CVSE-part of supply line to CVSE scaffolding and store the line					
5.5.2	***Removal of CVSE-part of exhaust line***					
5.5.2.1	Wait until cover temperature T 601 and T 602 > 170 K	> 170 K				
5.5.2.2	Check pressure of cover tube	1.0 … 1.2 bar				

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.2.3	Disconnect CVSE-part of exhaust line from Johnston coupling, close Johnston coupling of CC-part of exhaust line by blind cap					
5.5.2.4	Transport CVSE-part of exhaust line to CVSE scaffolding and store the line					

N/A

Location:	PA: Date:	Operator: Date:		

5.6 Preparation of CVSE-Part of Supply Line

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.6.1	***Preparations***					
5.6.1.1	Cleaning of inlet filter: • remove the inlet filter from the line • clean the filter in ultrasonic bath with isopropyl alcohol • dry the filter with a heat gun • tie Teflon tape around the filter thread and screw the filter onto the tube					
5.6.1.2	Description of installations at transfer line - Interfaces at dewar side: • compression fitting • valve V01 • pressure gauge P01 • flex. line DN25 as connection to vacuum line Y0622 and laboratory pump C1100					

N/A [illegible]

Location:	PA: Date:	Operator: Date:		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.6.1.3	Description of installations at CVSE-part of supply line – Interfaces at CC-part side: • compression fitting, • valve V02 • filter • GHe supply • pressure reducer DM1 • flex. line DN4 with a minimum length of 2 m					
5.6.1.4	Check that V0211 (or V0221) is open					
5.6.2	***Evacuation of CVSE-part of Supply Line***					
5.6.2.1	Close V02 to the GHe bottle					
5.6.2.2	Start laboratory pump C1100			N/A [signature]		
5.6.2.3	Open V01 and evacuate transfer line for 5 min.					
5.6.3	***Flushing of CVSE-part of Supply Line***					
5.6.3.1	Close V01 to the laboratory vacuum pump					

Location:	PA: Date:	Operator: Date:		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.6.3.2	Open GHe supply and V02					
5.6.3.3	Adjust DM1 at dewar to P01=300 to 500 mbar					
5.6.3.4	Flush transfer line for min. 30 s					
5.6.3.5	Close V02					
5.6.3.6	Repeat evacuation / flushing cycle 4 times					
5.6.3.7	Flush transfer line during transport to the dewar:					
5.6.3.8	Open V02 and pressurize the transfer line to approximately 500 mbar overpressure			N/A [signature]		
5.6.3.9	Disconnect transfer line from V01.					
5.6.3.10	Check/adjust that transfer line is under small overpressure. He flow at open end of transfer line must be noticeable.					

Location:	PA: Date:	Operator: Date:		

6 Summary Sheets

6.1 Procedure Variation Summary

	Test Change		Curr. No.: Date: Page 1 of
Test designation	Test Procedure	Issue 1	Rev.
Test step changed	Reason for Change:		

Prepared by:	Resp. Test Leader	Project Engineer
PA/QA		

6.2 Non Conformance Report (NCR) Summary

Status list of applicable NCR to be attached

NCR - No.	NCR - Title	Date	Status
	none		

6.3 Sign-off Sheet

	Date	Signature
Test Manager	16.9.05	[signature]
Test Conductor	16.9.05	[signature]
PA Responsible	16.9.05	[signature]

ANNEX Log Sheets

Herschel EQM **LOGSHEET 1 for COVER FLUSHING**

Date	Time	Valve Status								P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s		REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121											AIV	QA

Herschel EQM																	LOGSHEET 2 for COVER FLUSHING		
Date	Time	Temperatures in [K]															REMARKS	Sign	
		DLCM T101	HTT T106	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T707				AIV	QA

END OF DOCUMENT

	Name	Dep./Comp.		Name	Dep./Comp.
X	Alberti von Mathias Dr.	AOE22	X	Stritter Rene	AED11
	Barlage Bernhard	AED11		Thörmer Klaus-Horst Dr.	OTN/AED65
X	Bayer Thomas	AOA52		Wagner Klaus	AOE22
	Fehringer Alexander	AOE13	X	Wietbrock Walter	AET12
	Fricke Wolfgang Dr.	AED 63		Wöhler Hans	AOE22
	Geiger Hermann	AOA52		Wössner Ulrich	ASE442
	Gerner Willi	AED11			
	Grasl Andreas	OTN/AET52			
	Grasshoff Brigitte	AET12			
X	Hauser Armin	AOE22	X	Alcatel	ASP
X	Hendry David	Terma Resid.	X	ESA/ESTEC	ESA
	Hinger Jürgen	AOE22			
	Hofmann Rolf	ASE442		**Instruments:**	
X	Hohn Rüdiger	AED65		MPE (PACS)	MPE
X	Huber Johann	AOA52		RAL (SPIRE)	RAL
	Hund Walter	ASE442		SRON (HIFI)	SRON
X	Idler Siegmund	AED432			
X	Ilsen Stijn	Terma Resid.		**Subcontractors:**	
	Ivády von András	FAE22		Air Liquide, Space Department	AIR
X	Jahn Gerd Dr.	AOE22		Air Liquide, Space Department	AIRS
	Kalde Clemens	APE3		Air Liquide, Orbital System	AIRT
	Kameter Rudolf	OTN/AET52		Alcatel Bell Space	ABSP
X	Kettner Bernhard	AET42		Astrium Sub-Subsyst. & Equipment	ASSE
	Knoblauch August	AET32		Austrian Aerospace	AAE
X	Koelle Markus	AOA53		Austrian Aerospace	AAEM
	Kroeker Jürgen	AED65		APCO Technologies S. A.	APCO
X	Kunz Oliver Dr.	AOE22		Bieri Engineering B. V.	BIER
X	Lamprecht Ernst	OTN/ASI21		BOC Edwards	BOCE
	Lang Jürgen	ASE442		Dutch Space Solar Arrays	DSSA
X	Langfermann Michael	AOA51		EADS CASA Espacio	CASA
X	Mack Paul	OTN/AET52		EADS CASA Espacio	ECAS
	Müller Jörg	AOA52		EADS Space Transportation	ASIP
X	Pastorino Michel	ASPI Resid.		Eurocopter	ECD
	Peltz Heinz-Willi	AOE13		European Test Services	ETS
	Pietroboni Karin	AED65		HTS AG Zürich	HTSZ
	Platzer Wilhelm	AED22		Linde	LIND
	Rebholz Reinhold	AOA51		Patria New Technologies Oy	PANT
	Reuß Friedhelm	AED62		Phoenix, Volkmarsen	PHOE
X	Rühe Wolfgang	AED65		Prototech AS	PROT
X	Runge Axel	OTN/AET52		QMC Instruments Ltd.	QMC
	Sachsse Bernt	AED21		Rembe, Brilon	REMB
	Schink Dietmar	AED44		Rosemount Aerospace GmbH	ROSE
X	Schlosser Christian	OTN/AET52		RYMSA, Radiación y Microondas S.A.	RYM
	Schmidt Rudolf	FAE22		SENER Ingenieria SA	SEN
	Schweickert Gunn	AOE22		Stöhr, Königsbrunn	STOE
	Sonn Nico	AOE51		Terma A/S, Herlev	TER
	Steininger Eric	AED44			

IV. As-Run Copy of the Depletion & Warm Up Procedure

HP-2-ASED-TP-0098

WORKING COPY
„AS RUN"
14.12.05

Title: **Herschel EQM Depletion and Warm-Up to Ambient**

CI-No: 151 000

Prepared by:	Herschel Team	Date:	08.12.05
Checked by:	C. Schlosser		9.12.05
Product Assurance: for	R. Stritter		9.12.05
Configuration Control:	W. Wietbrock		12.12.05
Project Management:	Dr. W. Fricke		12/12/2005

Distribution: See Distribution List (last page)

Issue	Date	Sheet	Description of Change	Release
1	08.12.05	All	initial issue	

Table of Content

Table of Figures

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1 Scope

1.1 Objective

This test procedure describes the warming up of the Herschel EQM cryostat to ambient temperatures. The objective of these activities is to reach ambient conditions after completing the EQM test phase. Temperature rates and gradients as required in the IID-B's have to be respected as during cool down phase.

This procedure summarises the nominal activity flow, operational constraints, GSE set up and the step by step procedure. The operations are given in correct timely order. All activities are performed in clean room class 100.000.

1.2 Activity Flow

Chapter 5.1 to 5.5 of the activity flow below summarize the activities to be performed for depletion and warm-up of the EQM cryostat.

§ 5.1	**Preparation of Set-up**	Configuration check according table in step 3.1 HTT pumped down to < 0.05 bar and at ~ 30 K AXT at He II conditions, no liquid level defined Check CVSE configuration Connect leak detector and mass spectrometer to CVV (for monitoring during warm up to ambient) Valve status check
§ 5.2	**Warm-up to He I**	Stop pumping at AXT Warm-up of AXT to He I by means of AXT heaters Perform instrument SFTs at He I conditions for procedure validation
§ 5.3	**Depletion of AXT**	Deplete AXT by means of AXT heaters
§ 5.4	**Warm-up of cryostat**	Warm-up AXT/OBA with AXT heaters Warm-up of HTT with AXT heaters Adjust AXT and HTT heater power to respect temperature rate and gradient requirements of instruments Ensure "cold trap" by continue shield cooling or cover flushing if needed Stop cover flushing and shield flushing when AXT/OBA is at ambient temperatures (if active)
§ 5.5	**Cryostat Operation Completion**	Stop heating of AXT and HTT Remove CVSE Check final EQM configuration

1.3 Requirements

During warm-up the following requirements have to be regarded:

<u>Temperature requirements:</u>

HTT: $\Delta T103/\Delta t < 50$ K/h
HIFI/(PACS): $\Delta T207/\Delta t < 20$ K/h (above 50 K for HIFI)
$\Delta T207/\Delta t < 5$ K/h (above 50 K for PACS)
SPIRE/(PACS): $\Delta T253$ (T255)/$\Delta t < 20$ K/h (above 50 K for PACS; no requirement from SPIRE)

SPIRE J-FET: ΔT249 (T251)/Δt < 20 K/h (above 50 K; no requirement from SPIRE)

Remark: There are no specific PT1000 temperature sensors to monitor PACS cool down, PT1000 sensors close to HIFI foot and SPIRE foot shall be used instead.

AXT, HTT, OBA shield **or** cover shall always be colder than the FPUs. FPU temperatures will be represented by the OBA temperature sensors.

Temperature differences between L0, L1 and L2 shall not exceed 20 K. (HIFI). This requirement can only be controlled by indirect measurements (AXT vs. OBA plate vs. SPIRE L3) or by instrument internal sensors:

$|T\ 707 - T\ 207| < 20\ K$
$|T\ 207 - T\ 249\ (T\ 251)| < 20\ K$
$|T\ 707 - T\ 249\ (T\ 251)| < 20\ K$

2 Documents/Drawings

2.1 Applicable Documents

The following documents of the latest issue in effect or as defined herein form a part of this document to the extent specified herein.

AD #	Document Title	Document Identifier
AD 01	CVSE Set-up Description	HP-2-ASED-TN-0094
AD 02	PA Requirements for Subcontractors	HP-1-ASPI-SP-0018
AD 03	Cryostat Cover Handling and Operations Manual	HP-2-AAE-MA-0003
AD 04	Cover Flushing Procedure	HP-2-ASED-TP-0091

2.2 Reference Documents

RD #	Document Title	Document Identifier
RD 01	Documentation Identification Procedure and Documentation Management	HP-2-ASED-PR-0001
RD 02	EQM AIT Plan	HP-ASED-PL-0022
RD 03	PA Plan	HP-2-ASED-PL-0007
RD 04	Contamination Control Plan	HP-2-ASED-PL-0023
RD 05	General Design and Interface Requirements (GDIR)	H-P-1-ASPI-SP-0027
RD 06	Reinigungsvorschrift für Komponenten im Projekt Herschel	HP-2-ASED-PR-0008
RD 07	List of Acronyms	HP-2-ASPI-LI-0077
RD 08	IID-B HIFI, section 5.7	SCI-PT-IIDB/HIFI-02125
RD 09	IID-B PACS, section 5.7 and 7.2	SCI-PT-IIDB/PACS-02126
RD 10	IID-B SPIRE, section 5.7	SCI-PT-IIDB/SPIRE-02124
RD 11	IID-A, section 9	SCI-PT-IIDA-04624

2.3 Other Documents

OD #	Document Title	Document Identifier
OD 01	Manual of High Vacuum pumping unit	
OD 02	Manual of He II pumping unit	

3 Configuration

3.1 General Hardware Configuration

At the start of the activities, the H/W configuration of the components is defined with the "As Built Configuration List" and the NCR's.

A rough summary of the initial configuration is given below:

- The PLM is closed, evacuated and leak tested
- The PLM is mated with the SVM simulator
- The PLM/SVM is integrated in the test dolly or standing on the SVM simulator and placed in clean room class 100 000
- The instrument FPUs are integrated onto the OBA and verified at ambient temperatures together with their warm units, integrated into the SVM simulator
- The harness (CCH and SIH) is completely integrated, verified and connected with instruments
- The EQM tests are finished

3.2 Cryostat Configuration

The cryostat status at start of warm-up shall be:

- the HTT is pumped down to < 0.05 bar and at about 30 K
- the AXT is partly filled with LHe II
- the CC-part of the Cover Supply Line is installed
- the CC-part of the Cover Exhaust Line is installed
- the cover cooling loop is filled with Helium gas
- filling airlock with SV 121 is mounted
- SV 921 installed
- Turbo pump 'B' (C0712) mounted to SV 922 airlock for continuous evacuation of the cryostat (pumping will be stopped for He background measurement)
- the Cryo SCOE is operational and instrumentation connected
- external venting line is blinded and leak tested
- CVV is < 10^{-6} mbar

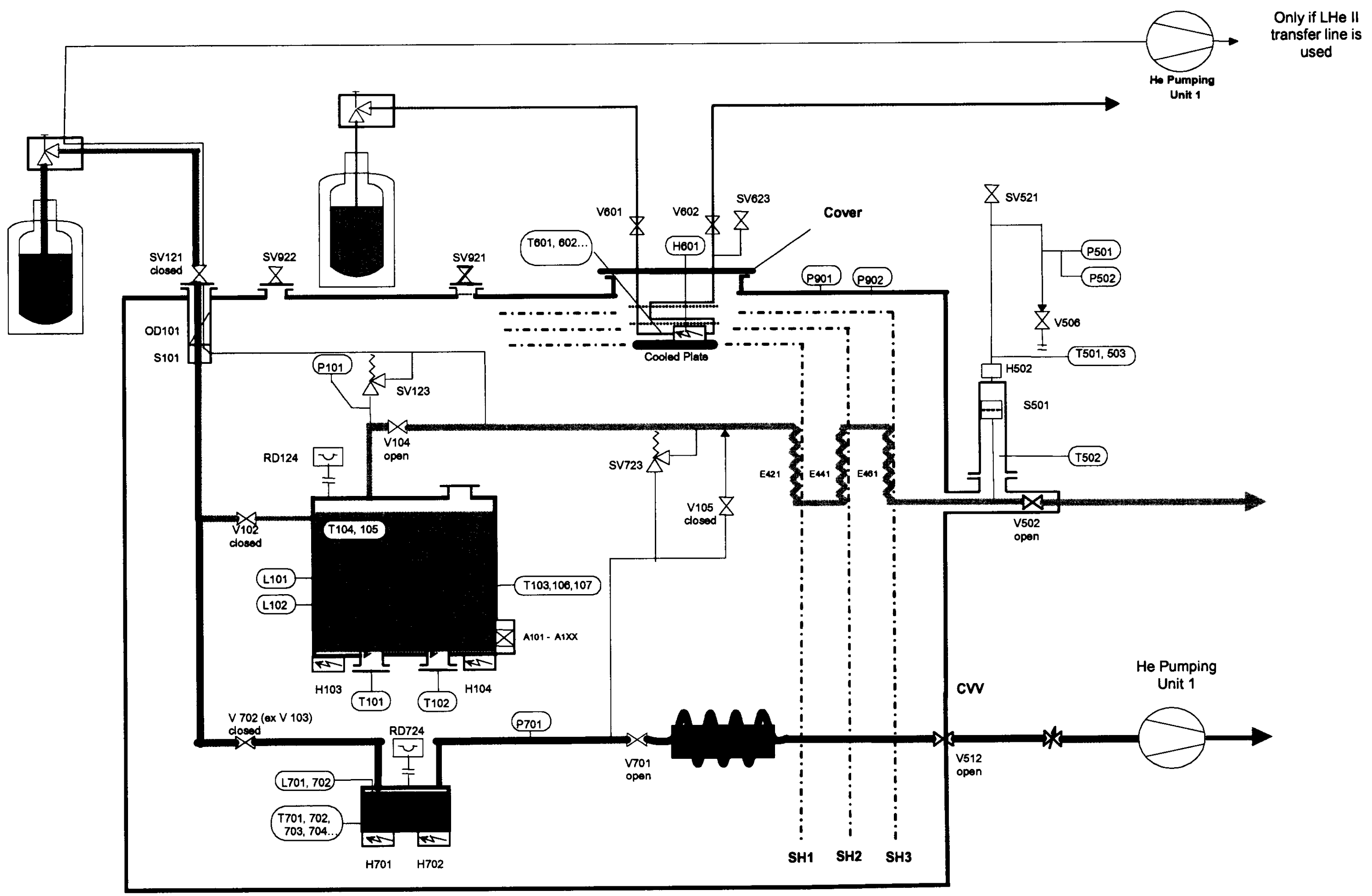


Figure 3-1: EQM PLM Helium S/S Flow Schema

3.3 Set-up

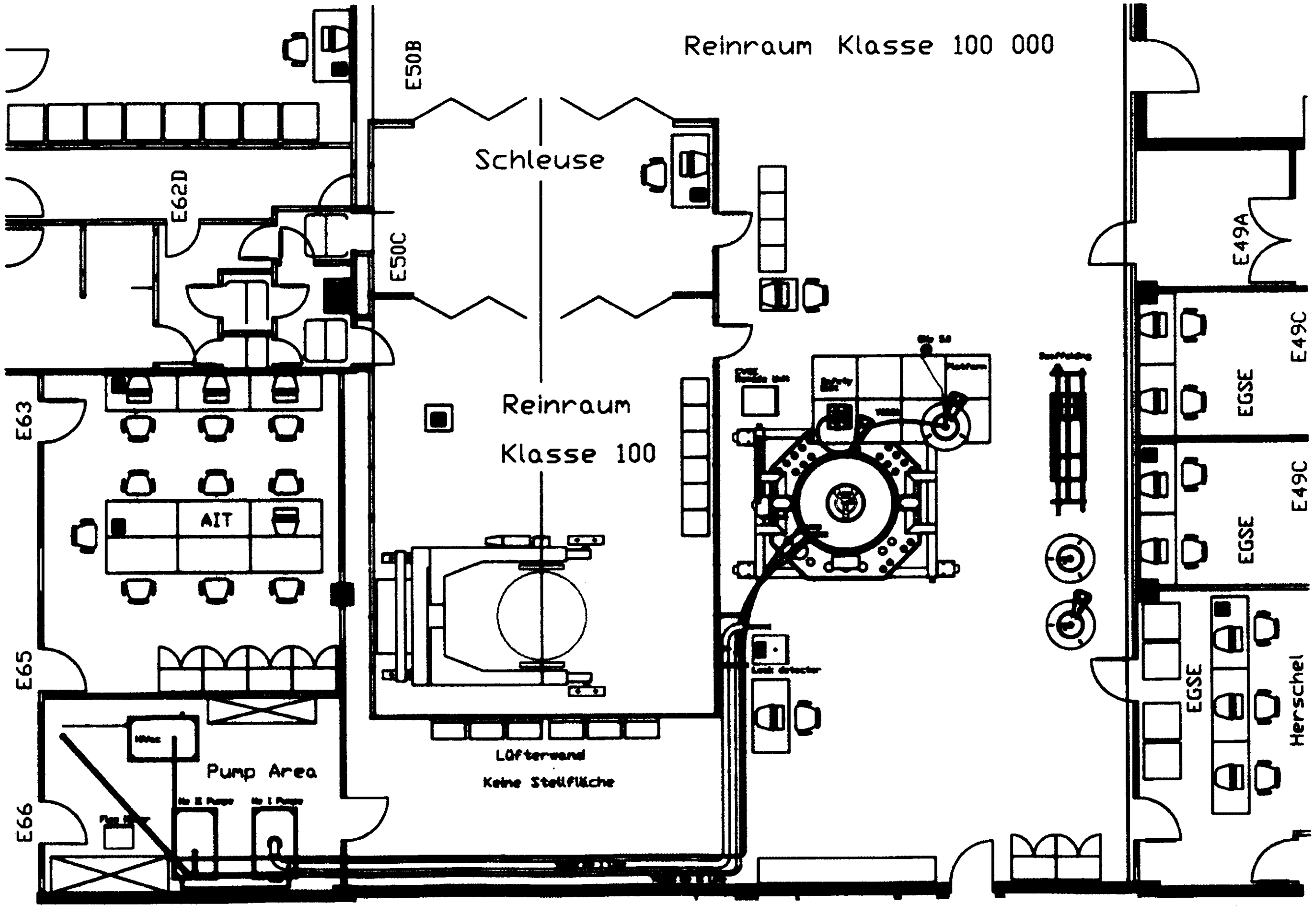


Figure 3-2: General set-up in clean room class 100 000

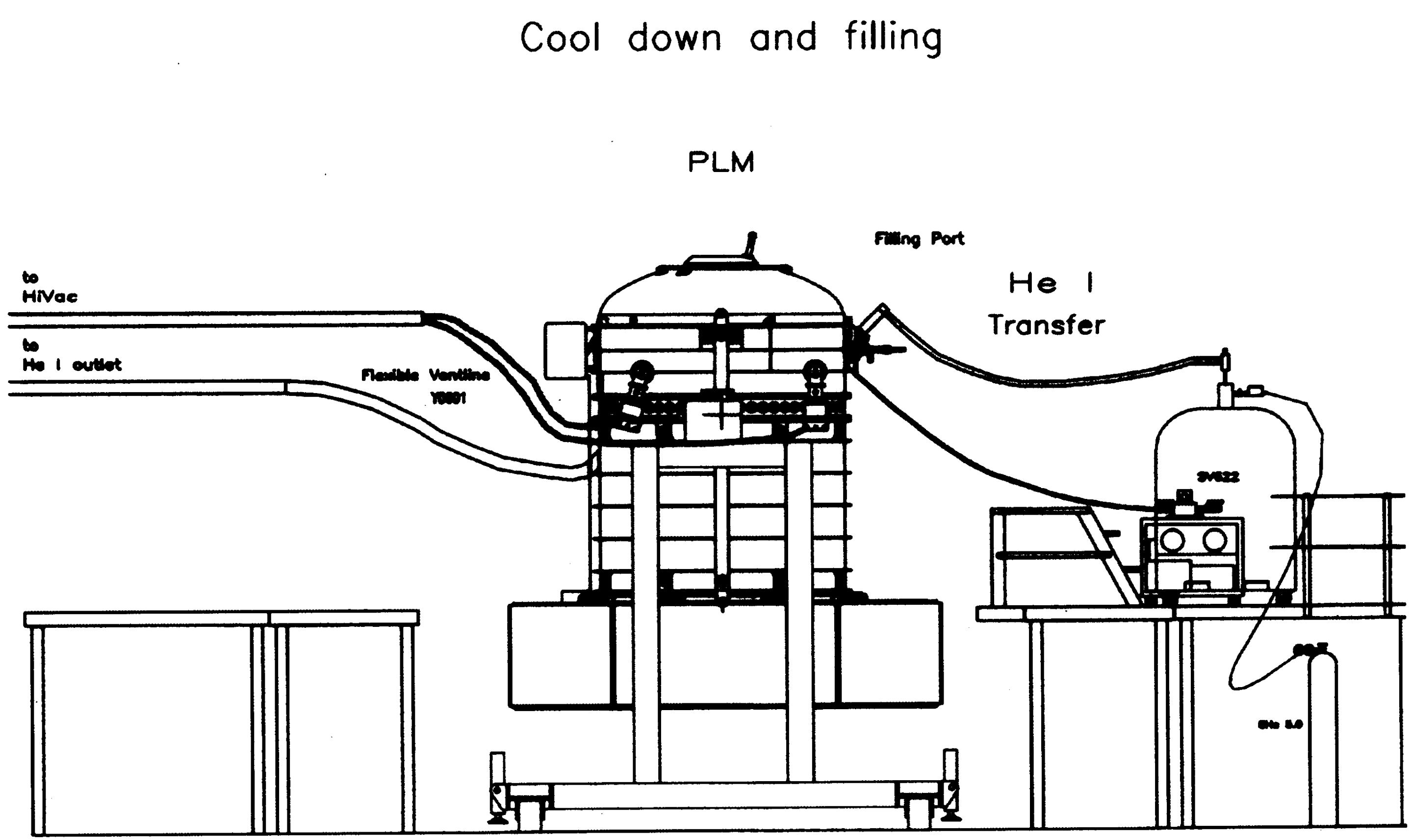


Figure 3-3: Set-up during Cryostat Operation

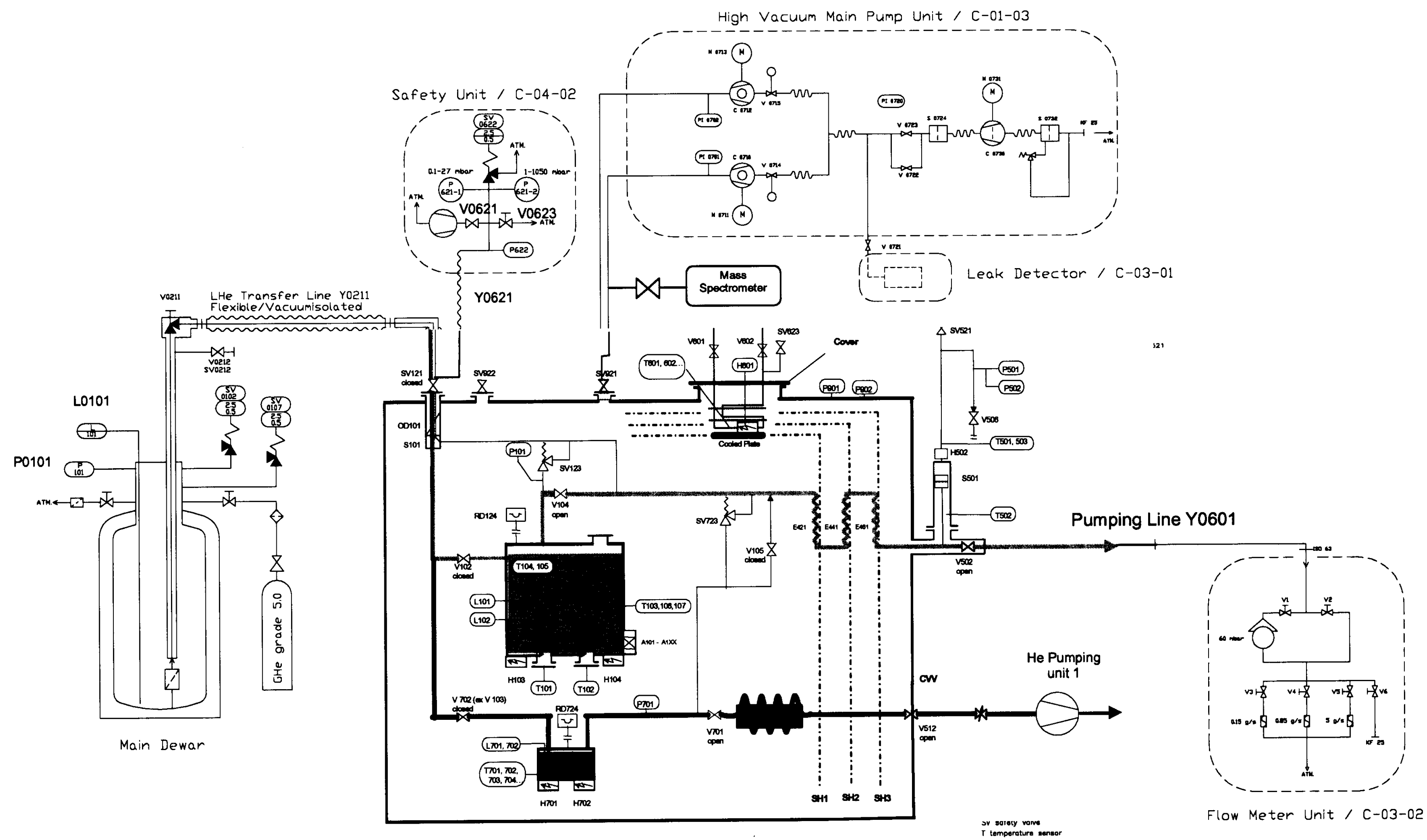
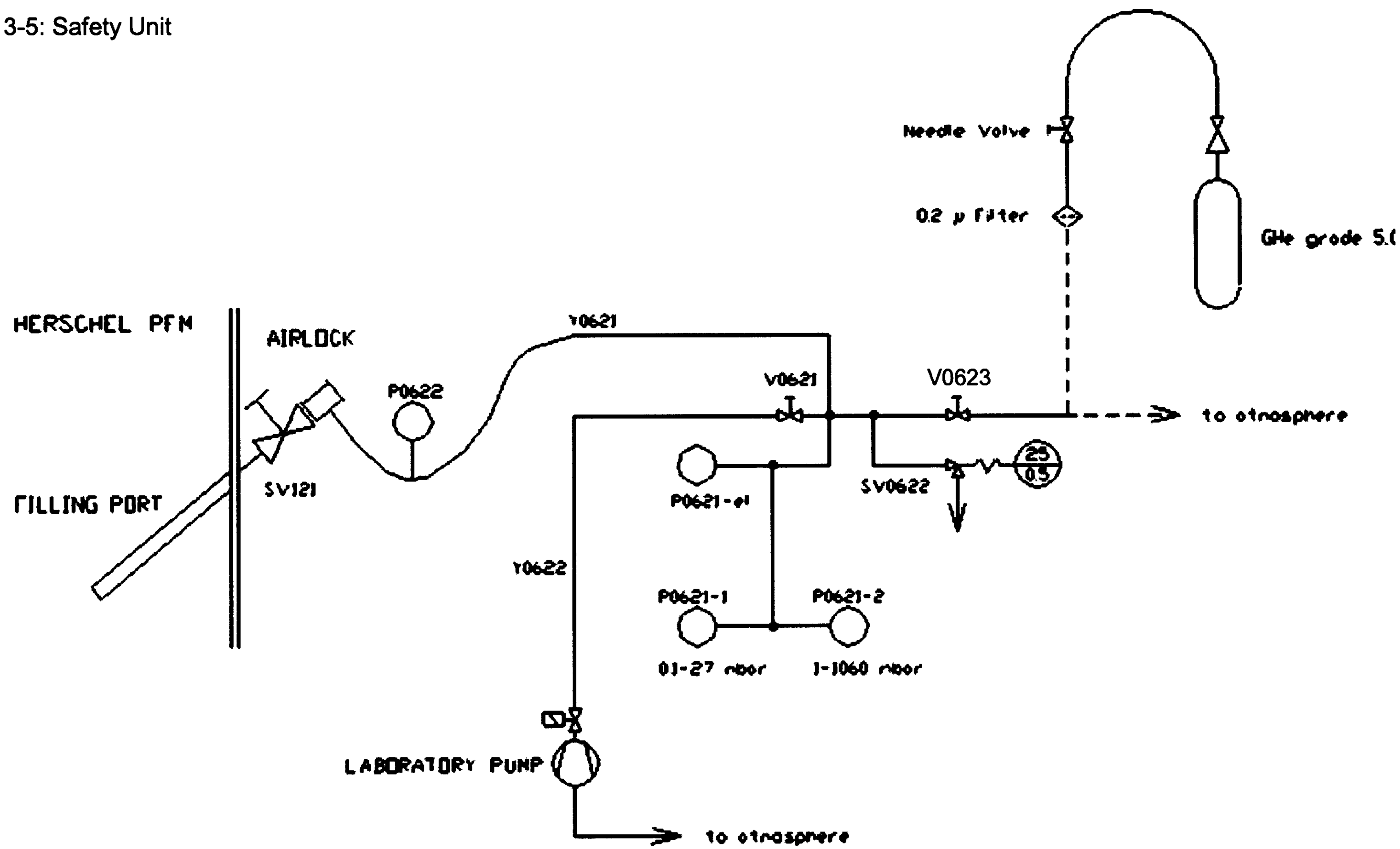


Figure 3-4: CVSE for Cryostat Operation

Figure 3-5: Safety Unit



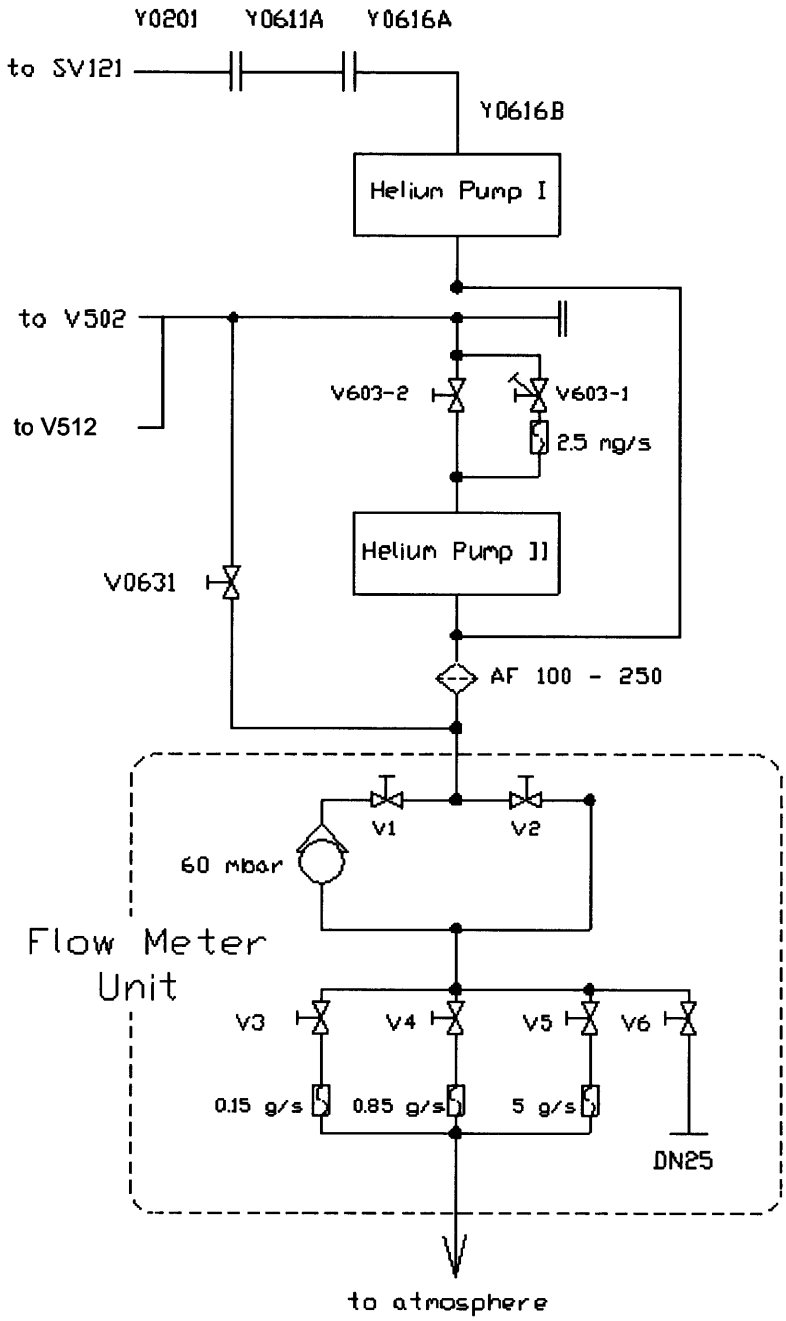


Figure 3-6: Flow Meter Unit

4 Conditions

4.1 Personnel

Depletion and warm up will be performed in single shift. However heaters will continue to be operated over night. Personnel necessary to perform activities according to this present procedure are:

Responsibility	Name / Organisation
Test Manager	*) C. Schlosser
Test conductors	*) C. Schlosser
Cryostat Operators	*) A. Runge R. Kameter
EGSE Operators	*) S. Ilsen
PA Responsible	*) E. Lamprecht

*) Names and possible additional personnel to be registered prior to the start of activities

4.2 Environmental

All activities according this procedure have to be performed in a clean room class 100 000 according Federal standard 209 E:

Cleanliness:	class 100 000
Temperature:	22°C ± 3°C
Pressure:	ambient
Rel. humidity:	40 % - 65 %

4.3 General Instructions for Integration

4.3.1 *General Safety Requirements, Precautions*

The following general rules have to be regarded:

- Respect standard technical rules for mechanical and electrical integration and test activities
- Special hazard precautions are not expected, except for the comments below and the comments mentioned in the step by step procedure
- The H/W has to be handled by authorized personnel only

The following specific rules have to be regarded:

- In case of an unexpected large release of helium it may be necessary to treat victims for suffocation and cold burns. If required, remove the victim from immediate vicinity of the leak
- In case of operation of the Cryostat safety system the following immediate activities shall be performed:
    - operation of safety valve: everybody has to leave the test room, except test conductor and necessary CVSE operations personnel
    - operation of burst disc: everybody has to leave the test room
- Contact facility emergency services immediately and explain nature and location of accident

4.3.2 *QA Requirements*

QA shall monitor all operations (handlings, transportation and installation) as necessary to assure compliance with this procedure and the applicable sections of the PA Plan (RD 3).

In the course of this procedure QA shall pay particular attention to

- integrity of every tightening surfaces and seals
- ensure adequate cleanliness conditions
- ensure that all safety aspects are considered
- the application of adequate protections to critical surfaces
- the records in the log sheet
- to ensure that tools and test equipment used is within current calibration cycle

4.3.3 *ESD constraints*

No specific ESD precautions have to be regarded during depletion and warm up.

4.3.4 *Prerequisites*

At least the following tasks have to be successfully completed before start with depletion and warm up:

- PTR for IMT or EMC test has been successfully held to ensure that all tests with the EQM have been completed
- TRR for depletion and warm up has been held
- Formal release to start with activity is given by QA / safety
- The necessary GSE and H/W is available, accepted and applicable for use
- Safe working conditions for personnel and H/W are existing and will be applied
- Skilled and authorized personnel is available
- An access restricted area has been defined and marked by QA / safety

All parts and tools required available and operational

4.4 GSE

All GSE and integration equipment is fit checked and carries valid calibration certificates.

4.4.1 *MGSE*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	PLM Test Dolly	APCO	CI No. 142 155-01	N/A
2	Long Hoisting Bars for EQM	APCO	CI No. 142 129-02	N/A
	Working platform		N/A	N/A
	General Purpose Hoisting Devices	ASED	N/A	N/A
	Set of tools	ASED	N/A	N/A

Table 4-1: MGSE

4.4.2 *EGSE*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	Central Checkout System (light)	Terma	CI No. 142 210	
1	EQM Cryo SCOE	ABSp	CI No. 142 220	
1	CDMU DFE	SSBV	CI No. 142 230	
1	PLM SCOE	SSBV	CI No. 142 240	
1	I-EGSE (if instruments are used)			
	Digital Multimeters (troubleshooting only)	ASED		
	Set of break out boxes (troubleshooting only)	ASED		
	Ohm -meter (troubleshooting only)	ASED		

Table 4-2: EGSE

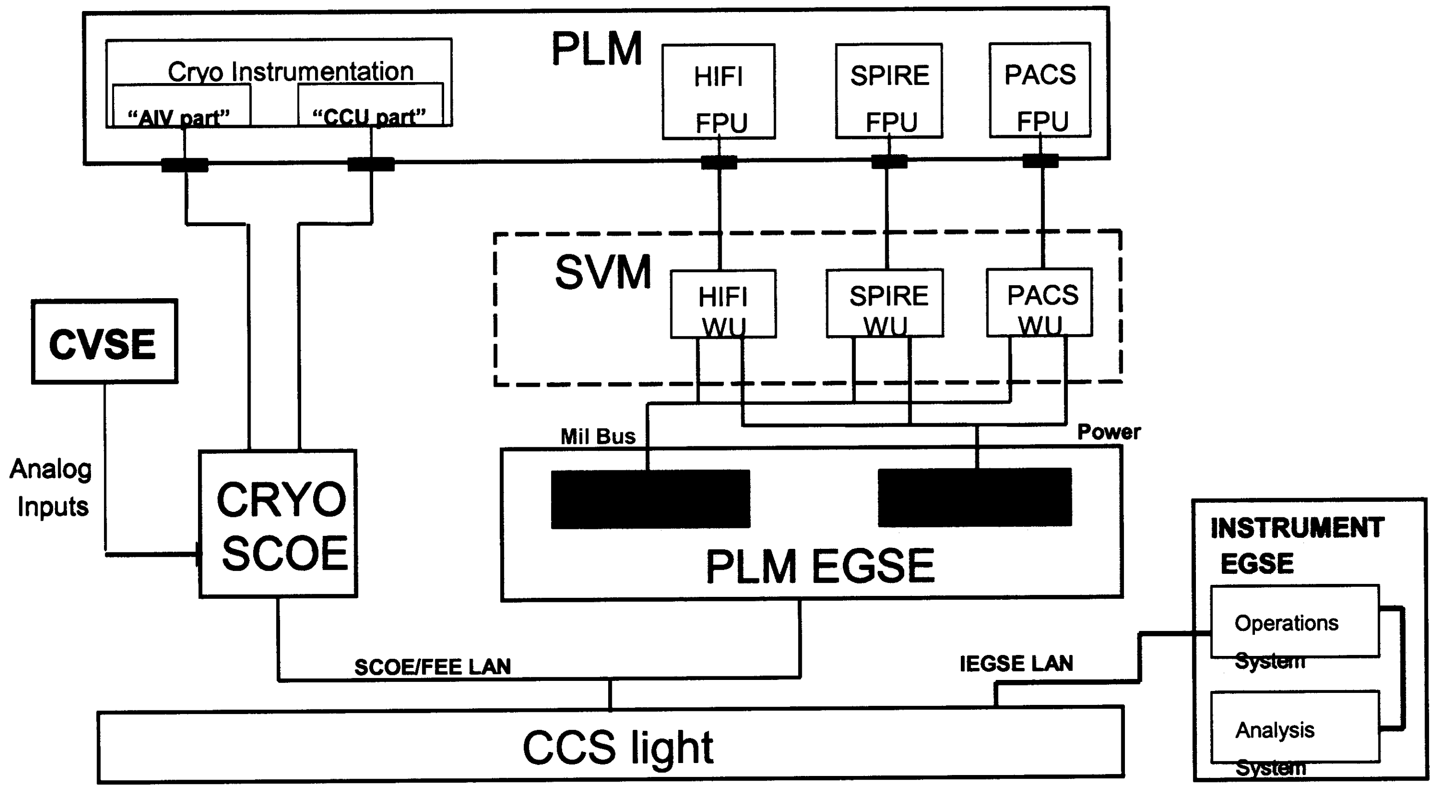


Figure 4-1: EGSE Configuration

4.4.3 *OGSE*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
	n/a			

Table 4-3: OGSE

4.4.4 *Cryo Vacuum Servicing Equipment (CVSE)*

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
1	High Vacuum Pumping Unit 1	BOCE	CI No. 142 310-03	
2	Turbo pump (C0711)	BOCE	CI No. 142 310-03	
1	Laboratory Vacuum Pump in safety unit	BOCE	CI No. 142 310-04	
1	Laboratory Vacuum Pump in CVSE scaffolding	BOCE	CI No. 142 310-04	
1	CVSE Monitoring Rack	BOCE	CI No. 142 310-06	
1	Leak Detector	BOCE	CI No. 142 310-07	
2	LHe transfer lines (Y0211/Y0221)	DeMaCo	CI No. 142 310-08	
1	Venting line Y0601/Y0602	DeMaCo	CI No. 142 310-09	
1	Safety line to SV 121 (Y0621/Y0622)	DeMaCo	CI No. 142 310-09	
1	Scaffolding for CVSE lines		CI No. 142 310-10	
10	450 l LHe Dewars type HDS 450 -EIPS	Linde		
	50 l / 200 bar GHe grade 5.0	Linde		
	Set of mass flow meters	ASED		
	Set of vacuum hoses			
	Manometer P0621-1(0,1-27 mbar) in safety unit	W & T		
	Manometer P0621-2(1-1200 mbar) in safety unit	W & T		
1	Cover Supply Line (2 parts)	DeMaCo		
1	Cover Exhaust Line (2 parts)	DeMaCo		

Table 4-4: CVSE

5 Step-by-Step Procedure

5.1 Check of PLM Status

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
	The following configuration set-up is required prior to start of depletion and warm up and shall be checked prior to test:					
5.1.1.1	PLM/SVM installed in test dolly or standing on SV simulator and set-up according Figure 3-2 and Figure 3-3		test dolly		✓	✓
5.1.1.2	16 load cells mounted to the strap pretensioners. Strap pretension ~ 5 kN	~ 5 kN	~ 5kN		✓	✓
5.1.1.3	HTT pumped down: HTT temperature T 101 HTT tank pressure P 101 (or P0621)	 ~ 30 K < 0.05 bar	 26.6 K 0.05 bar		✓	
5.1.1.4	AXT partly filled with LHe II: AXT LHe temperature T 707 AXT tank pressure P701 Liquid level in AXT	 < 1.7 K < 0.05 bar no requirement	 1.67 K 0.01 bar 17,1cm / 7,4cm	 ≮23°	✓	
5.1.1.5	SV 921 installed		✓			

Location: OTN	FA [signature] Date: 14.12.05	Operator: [signature] Date: 14.12.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.1.1.6	Turbo pump B mounted on upper bulkhead SV 922 interface, turbo pump is running and airlock to isolation vacuum is open		✓	Pumping shall be switched off for leak measurements	✓	
5.1.1.7	Cryo SCOE connected and operational		✓		✓	
5.1.1.8	Check configuration of safety unit according Figure 3-4 and Figure 3-5		✓		✓	
5.1.1.9	Check He pumping unit I running nominally		✓		✓	
5.1.1.10	Check that cover flushing lines are installed and capable of venting during warm up		✓		✓	
5.1.1.11	Note cover cooling loop temperature • T 601	No requirement	20,8K		✓	
5.1.1.12	Check valves status: • V 502, V 512, V 701, SV 121 • V 102, V104, V 105, V 702	Open Closed	✓		✓	
5.1.1.13	Check isolation vacuum: P 901 (P 902)		$7 \cdot 10^{-9}$ mbar		✓	
5.1.1.14	Fill out log sheet 1 and 2 - see annex 1		✓		✓	

Location: OTN	PA: [signature] Date: 14.12.05	Operator: [signature] Date: 14.12.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.1.1.15	Attention: Do not operate liquid level sensors at temperatures above 10 K: L 701, L 702 if T 703 > 10 K Do not continuous operate L 701 or L 702 and do not operate L 701 and L 702 at the same time.		✓		✓	

Location: OTN	PA: Date: 14.12.05	Operator: Date: 14.12.05		

5.2 Warm-up to He I Temperatures

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.2.1	***Warm-up from He II to He I***					
5.2.1.1	Close manual valve between V 512 and pumping tube		✓		✓	
5.2.1.2	Stop He pumping unit I		✓		✓	
5.2.1.3	Switch on H 702 with 1.5 W and observe temperature increase in AXT		✓ 15:57		✓	
5.2.1.4	Increase H 702 to 10 W on request of cryostat operator to speed up warming up process. Observe AXT temperature and pressure P 512		start H701 with 10W (5.7W) 16:10 increase H702 to 10W		✓	
5.2.1.5	Open manual valve between V 512 and pumping tube when P 512 > 1 bar and pressurize tube to He pumping unit I		17:20		✓	
5.2.1.6	Connect by-pass of pumping unit with inlet of mass flow unit		✓		✓	
5.2.1.7	Open by-pass when P 512 > 1 bar and observe mass flow		17:23 >100mg/s increasing		✓	
5.2.1.8	Stop H 702 and H701		17:25		✓	
5.2.2	***Instrument SFT at He I temperatures***					
5.2.2.1	Perform HIFI SFT at He I temperature according HIFI procedure		n.a.		✓	
5.2.2.2	Perform PACS SFT at He I temperature according PACS procedure		o.k.		✓	

Location: GTN	PA: [signature]	Date: 14/15.12.05	Operator: [signature]	Date: 14./15.12.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.2.2.3	Perform SPIRE SFT at He I temperature according SPIRE procedure		o.k.		✓	

5.3 Depletion of AXT

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.3.1.1	Note liquid level in AXT		LL1 = 5,9 cm	LL2 = 4,6 cm	✓	
5.3.1.2	By-pass one way valve		n.a.		✓	
5.3.1.3	Start H 702 with 10 W and observe mass flow		16:51		✓	
5.3.1.4	Reduce H 702 to 1.5 W if mass flow > 2 g/s Start H 701 with 10 W if mass flow < 1 g/s		n.a.			
5.3.1.5	Observe T 707: Depletion is completed when T 707 > 5 K				✓	

Open V105 to avoid pressure increase in shields due to close V502 — 17:50 ✓

Location: OTP	PA: [signature]	Date:	Operator: [signature]	Date: 15.12.05		

5.4 Warm-up of Cryostat

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.4.1	***Warm-up of AXT/OBA***					
5.4.1.1	Increase H 702 to 10 W Switch on H 701 with 10 W		already at 10W ✓ 6:45		✓	
5.4.1.2	Check valves status: • V 502, V 512, V 701, SV 121 , V105 • V 102, V104, V 105, V 702 , V502, SV121	Open Closed	✓ ✓		✓	
5.4.1.3	Observe temperature rates: HTT: $\Delta T103/\Delta t < 50$ K/h L0: $\Delta T207/\Delta t < 5$ K/h L2: $\Delta T253$ (T255)/$\Delta t < 20$ K/h L3: $\Delta T249$ (T251)/$\Delta t < 20$ K/h Reduce heater power if one of the requirements is exceeded.		see log files	(above 50 K) (above 50 K) (above 50 K) (above 50 K)	✓	
5.4.1.4	Observe temperature gradients: $\lvert$T 708 – T 207$\rvert$ < 20 K $\lvert$T 207 – T 249 (T 251)$\rvert$ < 20 K $\lvert$T 708 – T 249 (T 251)$\rvert$ < 20 K Reduce heater power if one of the requirements is exceeded.		see log files	(above 50 K) (above 50 K) (above 50 K)	✓	

Location: OTN	PA: [signature]	Date:	Operator: Schl	Date: 16.12.05		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.4.1.5	Make sure that another item in the PLM is always minimum about 10 K colder than the OBA. Cool down cover if it is not the case.		see log files		✓	
5.4.1.6	Warming up of AXT/OBA can be supported by flushing the AXT/OBA with warm GHe through SV 121 - V 702 - AXT - V 701 - OBA - V 512 - ambient Switching of valves have to be recorded in the log sheets		✓ started 16.12.05		✓	
5.4.1.7	Switch off H 701 and H 702 when AXT and OBA temperatures are above 293 K		see log files		✓	
5.4.1.8	Check isolation vacuum; measure leak rate and take mass spectrum during warming up		mass spectrometer connected		✓	
5.4.2	***Warm-up of HTT/Cryostat***			Steps can be performed in parallel to section 5.4.1		
5.4.2.1	Start H 103 and H 104 with 10 W each.		not started	→ warm up passively performed	✓.	
5.4.2.2	Connect GHe supply to safety unit		9.1.06	GN2 instead GHe, used for warm-up	✓	
5.4.2.3	Open V 102 and pressurize HTT to ~ 1 bar		no. ✓.	not relevant, HTT pressurized by warming up of cold gas		
5.4.2.4	Open V 104		12.1.06		✓	
5.4.2.5	Start H 101 and H 102 if cool down rate of the HTT is too low		✓.			

Location: OTN	PA: [signature]	Date: 12.1.06	Operator: [signature]	Date: 12.1.06		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.4.2.6	Warming up of HTT/shields can be supported by flushing the HTT/shields with warm GHe through SV 121 - V ~~102 - HTT - V 104~~ (by passed) - shields - V 502 - ambient Switching of valves have to be recorded in the log sheets		✓	GN_2 used since 19.12.05	✓	
5.4.2.7	Check strap pretensions. Reduce strap pretensions to ~ 5 kN when they are > 15 kN		see records		✓	
5.4.3	***End of Warm-up***					
5.4.3.1	Stop cover flushing when AXT/OBA temperatures > 293 K		16.12.05 → cover starts	latest !	✓	
5.4.3.2	Warm-up is completed when all cryostat temperatures are above 273 K		slowly warming 17.1.06	up.	✓	

Location: OTN	PA: [signature] Date: 17.1.06	Operator: [signature] Date: 17.1.06		

5.5 Cryostat Operation Completion

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.1.1	Switch off heaters H 101, H 102, H 103, H 104, H 701 and H 702		✓		✓	
5.5.1.2	Wait for temperature equilibrium in the cryostat	285 K ± 10 K	17.1.06		✓	
5.5.1.3	Close HTT valves V 102 and V 104 if open		close V 104		✓	
5.5.1.4	Close AXT valves V 702 and V 701 if open, close by-pass valve V 105		close V701, V702		✓	
5.5.1.5	Close V 502 and V 512		✓		✓	
5.5.1.6	Check valves status: • V 102, V104, V 105, V 502, V 512, V 701, V 702, SV 121	Closed	✓		✓	
5.5.1.7	Check cover status: Note temperatures T 601 and T 603		292.0 K		✓	
5.5.1.8	Make a print out of strap pretensions		✓		✓	
5.5.1.9	Fill out logsheets 1 & 2		✓		✓	
5.5.1.10	Remove venting line Y0601 from V 502		✓		✓	
5.5.1.11	Remove AXT/OBA pumping line from V 512		✓		✓	
5.5.1.12	Remove cover flushing lines according AAE procedure		✓		✓	

Location: OTN	PA: [signature] Date: 17.1.06	Operator: [signature] Date: 17.1.06		

Step-No.	Activity	Nominal Value	Actual Value	Remarks	P	N
5.5.1.13	Disconnect strap pretension measurement devices		✓		✓	
5.5.1.14	Disconnect EGSE harness (to Cryo SCOE and PLM EGSE)		✓		✓	

Location: OTN	PA: [signature] Date: 18.1.06	Operator: Schl	Date: 18.1.06		

6 Summary Sheets

6.1 Procedure Variation Summary

	Test Change	Curr. No.: Date: Page 1 of	
Test designation	Test Procedure	Issue 1	Rev.
Test step changed	Reason for Change:		

Prepared by:	Resp. Test Leader	Project Engineer
PA/QA		

6.2 Non Conformance Report (NCR) Summary

Status list of applicable NCR to be attached

NCR - No.	NCR - Title	Date	Status

6.3 Sign-off Sheet

	Date	Signature
Test Manager	18.1.06	[signature]
Test Conductor	18.1.06	[signature]
PA Responsible	18.1.06	[signature]

ANNEX Log Sheets

Herschel EQM																LOGSHEET 1 for Depletion & Warm Up						
Date	Time	Valve Status								P901 mbar	P101 bar	P701 bar	P501 mbar	P0621 mbar	P516 mbar	Mass flow via AXT mg/s	Mass flow via shields mg/s	Mass flow via cover mg/s	Cover flushing dewar press.	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121												AIV	QA

Herschel EQM																	LOGSHEET 2 for Depletion & Warm Up		
Date	Time	Temperatures in [K]															REMARKS	Sign	
		HTT T103	HIFI T207 T208	SPIRE T249 T254	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T707					AIV	QA

END OF DOCUMENT

	Name	Dep./Comp.		Name	Dep./Comp.
	Alberti von Mathias Dr.	AOE22		Schink Dietmar	AED44
	Barlage Bernhard	AED11	X	Schlosser Christian	OTN/AOA54
	Bayer Thomas	AOA52		Schmidt Rudolf	FAE22
	Brune Holger	AOA55		Schweickert Gunn	AOE22
	Fehringer Alexander	AOE13		Sonn Nico	AOE51
	Fricke Wolfgang Dr.	AED 65		Steininger Eric	AED32
	Geiger Hermann	AOA52	X	Stritter Rene	AED11
	Gerner Willi	AED11		Suess Rudi	AOA54
	Grasl Andreas	OTN/AOA54		Thörmer Klaus-Horst Dr.	OTN/AED65
	Grasshoff Brigitte	AET12		Wagner Klaus	AOE22
X	Hauser Armin	AOE22	X	Wietbrock Walter	AET12
X	Hendry David	Terma Resid.		Wöhler Hans	AOE22
	Hengstler Reinhold	AOA 5		Wössner Ulrich	ASE442
	Hinger Jürgen	AOE22	X	Alcatel	ASP
	Hofmann Rolf	ASE442	X	ESA/ESTEC	ESA
X	Hohn Rüdiger	AED65		**Instruments:**	
	Hölzle Edgar Dr.	AED44		MPE (PACS)	MPE
	Huber Johann	AOA52		RAL (SPIRE)	RAL
	Hund Walter	ASE442		SRON (HIFI)	SRON
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	Ivády von András	FAE22		Air Liquide, Space Department	AIRS
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	Kalde Clemens	APE3		Alcatel Bell Space	ABSP
	Kameter Rudolf	OTN/AOA54		Astrium Sub-Subsyst. & Equipment	ASSE
	Kettner Bernhard	AET42		Austrian Aerospace	AAE
	Knoblauch August	AET32		Austrian Aerospace	AAEM
	Koelle Markus	AOA53		APCO Technologies S. A.	APCO
	Koppe Axel	AED312		Bieri Engineering B. V.	BIER
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X	Langfermann Michael	AOA51		Eurocopter	ECD
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	Maute Thomas	AOA52		HTS AG Zürich	HTSZ
	Müller Jörg	AOA52		Linde	LIND
	Müller Martin	AOA53		Patria New Technologies Oy	PANT
	Müller Ralf	FAE22		Phoenix, Volkmarsen	PHOE
	Peltz Heinz-Willi	AOE13		Prototech AS	PROT
	Pietroboni Karin	AED65		QMC Instruments Ltd.	QMC
	Platzer Wilhelm	AED22		Rembe, Brilon	REMB
	Reichle Konrad	AOA52		Rosemount Aerospace GmbH	ROSE
	Reuß Friedhelm	AED62		RYMSA, Radiación y Microondas	RYM
	Rühe Wolfgang	AED6		SENER Ingenieria SA	SEN
X	Runge Axel	OTN/AOA54		Stöhr, Königsbrunn	STOE
	Sachsse Bernt	AED21		Terma A/S, Herlev	TER

V. Copy of the Test Change HP-2-ASED-SD-0058, issue 3

Location : OTN	Title: Localization of Leaks in EQM PLM		
Facility : Laboratory	Model: EQM	Subsystem: PLM EQM	Date: 04.10.05
	Test Conductor:	C. Schlosser	NCR Ref: n/a
CI No 151 000	Prepared By:	C. Schlosser	CIL No:

Scope:
This procedure covers the activities to localize leaks of the He S/S vs. the isolation vacuum. The content of Helium inside the isolation vacuum has to be decreased to improve the performance of the SPIRE and PACS sorption coolers (see NCR ASED-NC-1513).

EGSE S/W reference and issue n/a	**On-Board S/W** reference and Issue n/a

Facilities required:	EGSE: n/a MGSE: n/a Measurement equipment: leak detector Consumables: glue RTV 691 A/B	
Personnel required:	2 AIT eng + crane operator + PA	
Safety and Hazards:	Cold Helium gas evaporating from He S/S when SV 121 plug is removed.	
Constraints:	It must be ensured that the isolation vacuum does not decrease. The screws of the filling port must not be removed!	

No:	Activity	Proc/Drg/Result	Responsible & sign off
1.	Preparatory Activities	05.10.05	
1.1	Prepare mass spectrometer: – Connect mass spectrometer and leak tester to SV 922 airlock – Start-up mass spectrometer and leak tester (valve to SV 922 airlock closed) – Close SV 922 – Open valve from mass spectrometer to SV 922 airlock – Close manual valve behind turbo pump – Shut down turbo pump – Perform a background leak rate measurement of the set-up – Not pressure in PLM – Open SV 922	OK OK OK OK OK OK $5{,}6 \times 10^{-9}$ mbarl/s $5{,}8 \times 10^{-7}$ mbar 10:44	[signature]
1.2	Check background leak rate: – Note current leak rate	$4{,}7 \times 10^{-6}$ mbarl/s	[signature]
1.3	Note current cryostat status: V 102, V 105, V 702 - closed V 104, V 502, V 512, V 701 - open SV 121 in safety position Pressure in AXT and OBA tubing: ~ 0.01 bar Pressure in HTT and shield tubing: ~ 1.0 bar Pressure in cryostat cover tubing: ~ 1.0 bar	OK OK OK P 701 = 0.01 bar P 0621 = 1024 mbar P cover = 958 mbar	[signature]
1.4	Reduce pressure in the He S/S by removing the one-way valve	10:52	[signature]
1.5	Close SV 121 and secure the plug	OK	[signature]
2.	Leak rate measurement with OBA tubing excluded		

Release AIT:	Release SE:	Release PA/Safety:	Sign off (PA/QC/Team Leader)
P. Mack	C. Schlosser	E. Lamprecht [signature]	[signature]

No:	Activity	Proc/Drg/Result	Responsible & sign off
2.1	Close V 701	10:57	
2.2	Evacuate OBA tubing to P 512 < 1 mbar	OK	
2.3	Wait 10 min and not leak rate and take a mass spectrum Note pressure in PLM	$4{,}8 \times 10^{-6}$ mbarl/s $6{,}6 \times 10^{-7}$ mbar	
3.	Leak rate measurement with OBA tubing, shield tubing and filling port interface excluded		
3.1	Close V 104 (observe HTT temperature at T 101 < 4.4 K)	OK	
3.2	Close V 502	13:21	
3.3	Start laboratory pump in safety unit, open SV 121 and evacuate tubing and filling port interface until P 512 < 5 mbar	13:24	
3.4	Wait 10 min and not leak rate and take a mass spectrum	$4{,}45 \times 10^{-6}$ mbarl/s	
3.5	If leak rate changes significant then further investigations at the filling port interface are necessary -> perform steps in section 8	NA	
4.	Leak rate measurement with OBA tubing, shield tubing, filling port interface and cover tube excluded		
4.1	Evacuate cover tube to P_{CCT} < 1 mbar	13:46	
4.2	Wait 10 min and not leak rate and take a mass spectrum	$4{,}55 \times 10^{-6}$ mbarl/s	
5.	Leak rate measurement with OBA tubing, shield tubing, filling port interface, cover tube and AXT excluded		
5.1	Switch on heaters H 701 and H 702 with 10 W each	14:08	
5.2	When P 701 ~ 1 bar: – Close inlet valve of He pumping unit I – Prepare by-pass to flow meter unit (do not open it!) – Open V 701	 15:06 OK 15:08	
5.3	When P516 (at OBA ventline outlet) ~ 1 bar: – Open by pass at pumping unit	OK	
5.4	Continue heating until AXT is empty and at 1 bar Note leak rate and take a mass spectrum	$1{,}45 \times 10^{-5}$ mbarl/s	
5.5	Continue heating of AXT until T 708 > 20 K	OK	
5.6	Stop heaters H 701 and H 702	17:02	
5.7	Close by pass and start pumping at AXT and OBA until pressure P516 < 1 mbar	OK	
5.8	Wait 10 min and note leak rate	$1{,}0 \times 10^{-5}$ mbarl/s	
6.	Leak rate measurement with OBA tubing, shield tubing, filling port interface, cover tube, AXT and HTT excluded		
6.1	Open V 104	17:42	
6.2	Open V 502	17:27	
6.4	Switch on heaters H 101, H 102, H 103 and H 104 with 10 W each; stop one or more heaters when mass flow > 2 g/s	06.10.05 07:45	
6.5	Deplete HTT and warm up HTT to T 103 > 20 K, but < 40 K	07.10.05 10:00	
6.7	Note leak rates (He^4 and He^3) and take mass spectrum	He^3: $1{,}6 \times 10^{-8}$ mb/s He^4: 9×10^{-4} mbarl/s	
6.8	Close and lock SV 121	10:30	

No:	Activity	Proc/Drg/Result	Responsible & sign off
6.9	Close V 502	10:33	[signature]
6.10	Open V 105 and evacuate HTT and tubing to P 512 < 1 mbar	Start: 10:34	[signature]
6.11	Continue heating of HTT until T 103 > 30 K, but < 40 K Stop H 101 and H 102 -> observe tank temperatures	13:41	[signature]
6.12	Stop H 103 and H 104	13:48	[signature]
6.13	Not leak rate when it has stabilized	08.10.05 16:07 1,7 x 10^{-8} mbarl/s repeated 24 h later: 2,3 x 10^{-8} mbarl/s	[signature]
7.	Leak rate measurement of filling port interface and shield tubing		
7.1	Close V 105	09.10.05 15:12	[signature]
7.2	Close V 104	OK	[signature]
7.3	Open SV 121 and flush filling port and tubing with He from dewar	OK	[signature]
7.4	Wait 10 min and not leak rate	3,5 x 10^{-6} mbarl/s (increasing)	[signature]
7.5	Close V 701 Open V 702 and flush the AXT with He from dewar	15:33	[signature]
7.6	Wait 10 min and not leak rate	9,0 x 10^{-6} mbarl/s (increasing)	[signature]
7.7	Close V 702 and evacuate filling port and shield tubing	OK	[signature]
7.8	Wait 10 min and not leak rate	6,0 x 10^{-6} mbarl/s (decreasing)	[signature]
7.9	Open V 701 and evacuate AXT	OK	[signature]
7.10	Wait 10 min and not leak rate	5,7 x 10^{-6} mbarl/s (decreasing as before)	[signature]
7.11	Open V 102, open V 104 and flush the HTT with He from dewar	OK	[signature]
7.12	Wait 10 min and not leak rate	1,9 x 10^{-6} mbarl/s (increasing)	[signature]
7.13	Close V 105, open V 105 and evacuate filling port and shield tubing	OK	[signature]
7.14	Wait 10 min and not leak rate	2,0 x 10^{-6} mbarl/s (increasing) repeated 15 h later: 1,7 x 10-5 mbarl/s (increasing)	[signature]
7.15	Close V 105, open V 104 and flush filling port and shield tubing with He from HTT	10.10.05 08:56	[signature]
7.16	Wait 10 min and not leak rate	2,7 x 10^{-5} mbarl/s (increasing)	[signature]
7.17	Open V 502 (check that one way valve is installed	OK	[signature]
8.	Sealing of filling port (activity to be released in telecon)	12.10.05	[signature]
8.1	Remove airlock - check that plug of SV 121 stays in place	OK	[signature]
8.2	Prepare plug for filling port tube	OK	[signature]

No:	Activity	Proc/Drg/Result	Responsible & sign off
8.3	Remove plug of SV 121 and insert immediate plug for filling port tube - **Attention**: Cold Helium gas is evaporating the filling port! Check that not Helium is evaporating through the plug.	OK	[signature]
8.4	Remove pressure plate	OK	[signature]
8.5	Check the leak rate	6,5 x 10^{-6} mbarl/s (slowly decreasing)	[signature]
8.6	Cover filling port interface with a plastic foil and evacuate this volume to reduce Helium content around this interface	already covered by steps before	[signature]
8.7	Check leak rate	already covered by steps before	[signature]
8.8	Remove the plastic foil	already covered by steps before	[signature]
8.9	Seal filling port / CVV interface and screws of filling port with RTV 691 A/B	12.10.05	[signature]
8.10	Check leak rate	step skipped	[signature]
8.12	Repeat gluing and leak rate measurement if leak rate doesn't improve	n.a.	[signature]
8.13	Mount pressure plate	OK	[signature]
8.14	Remove plug of filling port tube and insert immediate plug of SV 121 **Attention**: Cold Helium gas is evaporating the filling port!	OK	[signature]
8.15	Mount airlock	OK	[signature]
8.16	Evacuate airlock and flush airlock with GHe 3 x	OK	[signature]
8.17	Open SV 121	OK	[signature]
8.18	Check leak rate	2,1 x 10^{-6} mbarl/s	[signature]
9.	Get cryostat back to IMT conditions with HTT evacuated (to isolate the HTT leak) and AXT filled at He II temperatures:		
9.1	Open V 102 and V 104 to cool down HTT to about 5 K	OK	[signature]
9.1	Close V 102 and V 502 Open V 701 to pump down AXT and HTT	OK	[signature]
9.2	Close V 104 (HTT evacuated and isolated)	OK	[signature]
9.3	Open V 702 and cool down AXT	OK	[signature]
9.4	Fill AXT with LHe II	OK	[signature]
9.5	Close V 105 and start He pump I to start He II production in AXT	OK	[signature]
9.6	Open V 502 Set transfer line into filling airlock and open SV 121 to cool shields from external dewar (parallel to He II production in AXT)	OK	[signature]
9.7	Final status to be reached: HTT evacuated AXT partly filled with LHe II Shield cooling provided by external dewar	 0.16 bar OK OK	[signature]

Logsheet

05.10.05 10:38	Close inlet valve of leak tester (LT) Open inlet valve of mass spectrometer (MS) Take a mass spectrum (partial pressure): $He^4 = 3,2 \times 10^{-9}$ mbar $He^3 = 4,0 \times 10^{-10}$ mbar $N_2 = 3,2 \times 10^{-5}$ mbar
10:41	Close MS / open LT Note background leak rate: $4,7 \times 10^{-9}$ mbarl/s
10:44	Open SV 922
10: 49	Close LT / open MS Take a mass spectrum (partial pressure): $He^4 = 3,2 \times 10^{-7}$ mbar $He^3 = 4,0 \times 10^{-10}$ mbar $N_2 = 2,5 \times 10^{-5}$ mbar
10:52	Close SV 121
10:55	Close MS / open LT
10:57	Close V 701
11:07	Close LT / open MS Take a mass spectrum (partial pressure): $He^4 = 3,6 \times 10^{-7}$ mbar $He^3 = 2,2 \times 10^{-10}$ mbar $N_2 = 2,3 \times 10^{-5}$ mbar $p_{MS} = 4,3 \times 10^{-6}$ mbar $p_{isol} = 6,4 \times 10^{-7}$ mbar
	Close SV 922 for launch break Close MS
13:10	Re-open SV 922
13:21	Close V 502
13:22	Close V 104
13:24	Open SV 121 and evacuate tubing to HTT and through shields
13:40	Open MS Take a mass spectrum (partial pressure): $He^4 = 3,1 \times 10^{-7}$ mbar $He^3 = 1,2 \times 10^{-10}$ mbar $N_2 = 2,1 \times 10^{-5}$ mbar $p_{MS} = 2,6 \times 10^{-6}$ mbar $p_{isol} = 3,2 \times 10^{-6}$ mbar
13:45	Close MS / open LT
13:46	Start evacuation of cover tube
13:59	Close LT / open MS Take a mass spectrum (partial pressure): $He^4 = 2,8 \times 10^{-7}$ mbar $He^3 = 1,7 \times 10^{-10}$ mbar $N_2 = 2,1 \times 10^{-5}$ mbar $p_{MS} = 2,5 \times 10^{-6}$ mbar $p_{isol} = 1,0 \times 10^{-6}$ mbar

14:03	Flushing cover tube with GHe to 1 bar
14:07	Close MS / open LT
14:08	Start H 701 and H 702 with 10 W each
15:06	Close inlet valve of He pump I
15:08	Open V 701
15:15	Close LT / open MS Take a mass spectrum (partial pressure) - AXT at 4,2 K, 1 bar, OBA tube at 1 bar: $He^4 = 1,2 \times 10^{-6}$ mbar $He^3 = 2,2 \times 10^{-10}$ mbar $N_2 = 2,0 \times 10^{-5}$ mbar $p_{MS} = 2,0 \times 10^{-6}$ mbar $p_{isol} = 2,1 \times 10^{-6}$ mbar
15:24	Close MS / open LT
16:35	AXT empty; AXT and OBA tubing at 1 bar Leak rate = $1,45 \times 10^{-5}$ mbarl/s
16:37	Close LT / open MS Take a mass spectrum (partial pressure): $He^4 = 1,0 \times 10^{-6}$ mbar $He^3 = 2,0 \times 10^{-10}$ mbar $N_2 = 1,9 \times 10^{-5}$ mbar $p_{MS} = 2,3 \times 10^{-6}$ mbar $p_{isol} = 1,8 \times 10^{-6}$ mbar
16:45	Close MS / open LT
16:50	Close by-pass at He pump I -> stop flow Start pumping at AXT and OBA tubing
17:02	Switch off H 701 and H 702
17:10	Close LT / open MS Take a mass spectrum (partial pressure): $He^4 = 5,3 \times 10^{-7}$ mbar $He^3 = 1,2 \times 10^{-10}$ mbar $N_2 = 1,9 \times 10^{-5}$ mbar $p_{MS} = 2,1 \times 10^{-6}$ mbar $p_{isol} = 1,5 \times 10^{-6}$ mbar
17:17	Close MS / open LT
17:23	Close SV 121
17:24	Open V 104 -> flush shield tubing
17:27	Open V 502 (one way valve installed)
17:31	Close LT / open MS Take a mass spectrum (partial pressure): $He^4 = 6,8 \times 10^{-7}$ mbar $He^3 = 3,2 \times 10^{-11}$ mbar $N_2 = 1,9 \times 10^{-5}$ mbar $p_{MS} = 2,1 \times 10^{-6}$ mbar $p_{isol} = 1,2 \times 10^{-6}$ mbar
17:33	Close MS / open LT
17:35	Start H 101 with 10 W
17:37	Close SV 922 (for night break) Close MS and LT

	Start turbo pump
17:44	Open SV 922
06.10.05 7:45	Remove one-way valve Start H 102 with 10 W
10:38	Start H 103 with 10 W (5 W effective)
11:00	Start H 104 with 10 W (5 W effective)
18:15	Close backing valve of turbo pump Open valve to MS/LT at airlock Open LT -> perform leak test with warming up HTT at 1 bar: $q = 3 \times 10^{-4}$ mbarl/s
18:22	Close LT / open MS Take a mass spectrum (partial pressure) @ T 101 = 9.03 K; T 102 = 8.93 K; T 106 = 4.88 K $He^4 = 2,8 \times 10^{-5}$ mbar $He^3 = 3,7 \times 10^{-9}$ mbar $N_2 = 2,4 \times 10^{-5}$ mbar $p_{MS} = 1,0 \times 10^{-5}$ mbar $p_{isol} = 4,2 \times 10^{-5}$ mbar
18:25	Close valve to MS/LT at airlock
18:26	Close MS
18:28	Switch off H 101 and H 102
18:30	Install one-way valve
07.10.05 09:30	Perform background leak rate measurement of set-up (w/o airlock): He^4: $2,0 \times 10^{-9}$ mbarl/s He^3: $2,0 \times 10^{-8}$ mbarl/s
09:52	Close LT / open MS Take a mass spectrum (partial pressure) of set-up (w/o airlock): $He^4 = 1,9 \times 10^{-9}$ mbar $He^3 = 1,5 \times 10^{-10}$ mbar $N_2 = 2,0 \times 10^{-5}$ mbar $p_{MS} = 6,4 \times 10^{-6}$ mbar
09:54	Close MS / open LT Close backing valve of turbo pump Stop turbo pump
09:57	Open valve at airlock to MS / LT
10:03	Open MS Take a mass spectrum (partial pressure) of set-up (with airlock): $He^4 = 6,5 \times 10^{-9}$ mbar $He^3 = 1,0 \times 10^{-10}$ mbar $N_2 = 2,0 \times 10^{-5}$ mbar $p_{MS} = 5,8 \times 10^{-6}$ mbar
10:07	Close MS / open LT Perform background leak rate measurement of set-up (with airlock): He^3: $2,1 \times 10^{-8}$ mbarl/s
10:09	Open airlock
10:11	Close LT / open MS Take a mass spectrum (partial pressure) @ HTT at ~ 15 K, 1 bar $He^4 = 3,7 \times 10^{-5}$ mbar $He^3 = 4,7 \times 10^{-9}$ mbar $N_2 = 2,0 \times 10^{-5}$ mbar $p_{MS} = 7,1 \times 10^{-6}$ mbar $p_{isol} = 5,5 \times 10^{-5}$ mbar Switch LT to He^4

10:16	Close MS / open LT Perform leak rate measurement: 8×10^{-4} mbarl/s increasing
10:22	Close airlock Close valve to MS / LT at airlock Start turbo pump
10:26	Open airlock
10:27	Start H 101 and H 102 with 10 W each
10:30	Close SV 121
10:33	Close V 502
10:34	Open V 105, start pumping down HTT
13:19	Close airlock Close backing valve of turbo pump Stop turbo pump
13:21	Open valve at airlock to MS / LT
13:25	Open airlock
13:41	Switch off H 101 and H 102
13:42	Close LT / open MS Take a mass spectrum (partial pressure) @ HTT at ~ 30 K, p_{HTT} < 100 mbar $He^4 = 1,1 \times 10^{-7}$ mbar $He^3 = 1,0 \times 10^{-10}$ mbar $N_2 = 1,6 \times 10^{-5}$ mbar $p_{MS} = 1,9 \times 10^{-6}$ mbar $p_{isol} = 3,8 \times 10^{-5}$ mbar P 516 (OBA tube outlet) = 22.5 mbar
13:48	Switch off H 103 and H 104
13:53	Close MS / open LT
14:27	Close LT / open MS Take a mass spectrum (partial pressure) @ HTT at ~ 30 K, p_{HTT} < 50 mbar $He^4 = 1,3 \times 10^{-7}$ mbar $He^3 = 1,0 \times 10^{-10}$ mbar $N_2 = 1,5 \times 10^{-5}$ mbar $p_{MS} = 1,8 \times 10^{-6}$ mbar $p_{isol} = 3,9 \times 10^{-7}$ mbar
14:45	Close MS / open LT Leak rate: $2,5 \times 10^{-6}$ mbarl/s
15:16	Leak rate: $2,4 \times 10^{-6}$ mbarl/s
15:17	Close LT / open MS Take a mass spectrum (partial pressure) @ HTT at ~ 30 K, p_{HTT} < 50 mbar $He^4 = 1,2 \times 10^{-7}$ mbar $He^3 = 1,0 \times 10^{-10}$ mbar $N_2 = 1,6 \times 10^{-5}$ mbar $p_{MS} = 1,9 \times 10^{-6}$ mbar $p_{isol} = 3,2 \times 10^{-7}$ mbar
15:20	Close airlock Close valve to MS / LT at airlock Open backing valve of turbo and start turbo
15:24	Open airlock
08.10.05 15:36	Close airlock, close backing valve of turbo pump, shut down turbo pump Open valve at airlock to MS / LT Perform leak test of set-up and airlock: 3.5×10^{-9} mbarl/s

15:50	Close LT / open MS Take a mass spectrum (partial pressure) of set-up (with airlock): He^4 = 2,4 x 10^{-9} mbar He^3 = 1,8 x 10^{-10} mbar N_2 = 2,2 x 10^{-5} mbar p_{MS} = 7,5 x 10^{-6} mbar
15:53	Close MS / open LT
15:55	Open airlock Leak rate: 1,3 x 10^{-8} mbarl/s (slowly increasing)
15:58	Close LT / open MS Take a mass spectrum (partial pressure) @ HTT at ~ 35 K, p_{HTT} < 1 mbar He^4 = 2,0 x 10^{-9} mbar He^3 = 1,9 x 10^{-10} mbar N_2 = 1,7 x 10^{-5} mbar p_{MS} = 4,1 x 10^{-6} mbar p_{isol} = 1,8 x 10^{-7} mbar
16:01	Close MS / open LT
16:07	Leak rate: 1,7 x 10^{-8} mbarl/s (slowly increasing)
16:08	Close airlock Close valve at airlock to MS / LT, open backing valve of turbo pump, start-up turbo pump
16:24	Open airlock
09.10.05 14:40	Close airlock, close backing valve of turbo pump, shut down turbo pump Open valve at airlock to MS / LT Perform leak test of set-up and airlock: 3.6 x 10^{-9} mbarl/s
14:53	Close LT / open MS Take a mass spectrum (partial pressure) of set-up (with airlock): He^4 = 2,4 x 10^{-9} mbar He^3 = 2,0 x 10^{-10} mbar N_2 = 2,1 x 10^{-5} mbar p_{MS} = 8,0 x 10^{-6} mbar
15:00	Close MS / open LT
15:03	Open airlock Leak rate: 1,9 x 10^{-8} mbarl/s (slowly increasing)
15:05	Close LT / open MS Take a mass spectrum (partial pressure) @ HTT at ~ 39 K, p_{HTT} < 1 mbar He^4 = 2,5 x 10^{-9} mbar He^3 = 1,5 x 10^{-10} mbar N_2 = 1,7 x 10^{-5} mbar p_{MS} = 4,8 x 10^{-6} mbar p_{isol} = 1,3 x 10^{-6} mbar
15:09	Close MS / open LT
15:11	Leak rate: 2,3 x 10^{-8} mbarl/s (slowly increasing)
15:12 15:19	Close V 104 Close V 105 Open SV 121 -> flush filling port and shield tubing with He from dewar to 1 bar
15:24	Perform leak test of filling port and shield tubing (all other components evacuated): 1,2 x 10^{-6} mbarl/s (increasing)
15:25	Close LT / open MS Take a mass spectrum (partial pressure) of filling port and shield tubing He^4 = 1,1 x 10^{-7} mbar (increasing) He^3 = 1,2 x 10^{-10} mbar N_2 = 1,6 x 10^{-5} mbar p_{MS} = 3,3 x 10^{-6} mbar p_{isol} = 1,6 x 10^{-6} mbar

15:30	Close MS / open LT Repeat leak test: 3,5 x 10^{-6} mbarl/s (increasing)
15:33	Close V 701 Open V 702 -> flush AXT with GHe from dewar
15:47	Perform leak test of AXT,filling port and shield tubing (all other components evacuated): 7,2 x 10^{-6} mbarl/s (increasing)
15:49	Close LT / open MS Take a mass spectrum (partial pressure) of AXT, filling port and shield tubing He^4 = 3,8 x 10^{-7} mbar (increasing) He^3 = 1,0 x 10^{-10} mbar N_2 = 1,6 x 10^{-5} mbar p_{MS} = 2,8 x 10^{-6} mbar p_{isol} = 3,5 x 10^{-7} mbar
15:54	Close MS / open LT Repeat leak test: 9,0 x 10^{-6} mbarl/s (increasing)
15:56	Close V 702 Evacuate filling port and shield tubing with laboratory pump in safety unit (AXT at 1 bar)
16:35	Perform leak test of AXT (all other components evacuated - filling port ~10 mbar): 6,75 x 10^{-6} mbarl/s (decreasing)
16:37	Close LT / open MS Take a mass spectrum (partial pressure) of AXT He^4 = 3,1 x 10^{-7} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 1,5 x 10^{-5} mbar p_{MS} = 2,3 x 10^{-6} mbar p_{isol} = 3,2 x 10^{-6} mbar
16:44	Close MS / open LT Repeat leak test: 6,0 x 10^{-6} mbarl/s (decreasing)
16:48	Open V 701 and evacuate AXT
16:54	Perform leak test: 5,7 x 10^{-6} mbarl/s (decreasing - behaviour as with filled AXT -> no significant leak at AXT)
16:57	Stop pumping at filling port Flush filling port and shield tubing with He from dewar
16:58	Note leak rate: 6,0 x 10^{-6} mbarl/s (increasing again)
17:00	Open V 102 Open V 104 -> flush HTT with He from dewar
17:32	Close V 102
17:37	Close SV 121
17:39	Perform leak test of HTT, filling port and shield tubinng (all other components evacuated): 1,7 x 10^{-5} mbarl/s (increasing)
17:40	Close LT / open MS Take a mass spectrum (partial pressure) of AXT He^4 = 8,3 x 10^{-7} mbar (increasing) He^3 = 1,0 x 10^{-10} mbar N_2 = 1,3 x 10^{-5} mbar p_{MS} = 2,2 x 10^{-6} mbar p_{isol} = 3,1 x 10^{-6} mbar
17:44	Close MS / open LT Repeat leak test: 1,9 x 10^{-5} mbarl/s (increasing)
17:45	Close V 104 Open V 105 -> evacuate filling port and shield tubing
1748	Perform leak test of HTT, filling port and shield tubinng (all other components evacuated): 1,9 x 10^{-5} mbarl/s
17:49	Close LT / open MS Take a mass spectrum (partial pressure) of AXT He^4 = 9,6 x 10^{-7} mbar (increasing) He^3 = 1,0 x 10^{-10} mbar N_2 = 1,4 x 10^{-5} mbar

	p_{MS} = 2,1 x 10^{-6} mbar p_{isol} = 3,3 x 10^{-6} mbar
17:52	Close MS / open LT Repeat leak test: 2,0 x 10^{-5} mbarl/s (slowly increasing)
17:56	Close airlock Close valve at airlock to MS / LT, open backing valve of turbo pump, start-up turbo pump
18:01	Open airlock
10.10.05 07:43	Close airlock, close backing valve of turbo pump, shut down turbo pump Open valve at airlock to MS / LT Perform leak test of set-up and airlock: 5,0 x 10^{-9} mbarl/s
07:55	Open airlock Leak rate: 4,1 x 10^{-6} mbarl/s (increasing)
08:46	Close LT / open MS Take a mass spectrum (partial pressure) of HTT (~1,15 bar), all other items are evacuated He^4 = 6,6 x 10^{-7} mbar (increasing) He^3 = 1,0 x 10^{-10} mbar N_2 = 1,4 x 10^{-5} mbar p_{MS} = 2,6 x 10^{-6} mbar p_{isol} = 4,3 x 10^{-6} mbar
08:53	Close MS / open LT
08:55	Perform leak test of HTT (all other components evacuated): 1,7 x 10^{-5} mbarl/s (slowly increasing)
08:56	Close V 105 Open V 104 and flush filling port and shield tubing with He from HTT
09:21	Perform leak test of HTT, filling port and shield tubing (all other components evacuated): 2,7 x 10^{-5} mbarl/s
09:23	Close LT / open MS Take a mass spectrum (partial pressure) of HTT, filling port and shield tubing He^4 = 1,2 x 10^{-6} mbar (increasing) He^3 = 1,0 x 10^{-10} mbar N_2 = 1,4 x 10^{-5} mbar p_{MS} = 2,2 x 10^{-6} mbar p_{isol} = 4,7 x 10^{-6} mbar
09:33	Close MS / open LT Repeat leak test: 2,9 x 10^{-5} mbarl/s (slowly increasing)
09:59	Close LT / open MS Take a mass spectrum (partial pressure) of HTT, filling port and shield tubing He^4 = 1,7 x 10^{-6} mbar (increasing) He^3 = 2,0 x 10^{-10} mbar N_2 = 1,6 x 10^{-5} mbar p_{MS} = 1,9 x 10^{-6} mbar p_{isol} = 5,3 x 10^{-6} mbar
10:22	Close MS / open LT
10:27	Open V 502 (one way valve installed)
10:29	Repeat leak test: 3,8 x 10^{-5} mbarl/s (slowly increasing)
17:30	Repeat leak test: 7,7 x 10^{-5} mbarl/s (constant)
17:40	Close airlock Close valve at airlock to MS / LT, open backing valve of turbo pump, start-up turbo pump
17:48	Open airlock
11.10.05 09:39	Close V 502
09:43	Move transfer line to upper position Close SV 121
09:45	Open V 105 -> start evacuating HTT

13:10	Close airlock, close backing valve of turbo pump, shut down turbo pump Open valve at airlock to MS / LT Perform leak test of set-up and airlock: 3,9 x 10^{-9} mbarl/s
13:16	Close LT / open MS Take a mass spectrum (partial pressure) of HTT (~1,15 bar), all other items are evacuated He^4 = 1,0 x 10^{-9} mbar (increasing) He^3 = 1,0 x 10^{-10} mbar N_2 = 1,7 x 10^{-5} mbar p_{MS} = 4,7 x 10^{-6} mbar
13:18	Close MS / open LT
13:21	Open airlock Leak rate: 1,4 x 10^{-7} mbarl/s (slowly increasing)
13:32	Close LT / open MS Take a mass spectrum (partial pressure) of HTT (~1,15 bar), all other items are evacuated He^4 = 6,5 x 10^{-9} mbar (increasing) He^3 = 1,0 x 10^{-10} mbar N_2 = 1,4 x 10^{-5} mbar p_{MS} = 2,7 x 10^{-6} mbar p_{isol} = 4,2 x 10^{-7} mbar
14:30	Close MS / open LT Leak rate: 2,4 x 10^{-7} mbarl/s (slowly increasing)
14:32	Close airlock Close valve at airlock to MS / LT, open backing valve of turbo pump, start-up turbo pump
14:40	Open airlock
12.10.05 07:43	Close airlock, close backing valve of turbo pump, shut down turbo pump Open valve at airlock to MS / LT Perform leak test of set-up and airlock: 4,2 x 10^{-9} mbarl/s
07:50	Open airlock
08:47	Leak rate: 4,5 x 10^{-8} mbarl/s (slowly increasing)
08:48	Close LT / open MS Take a mass spectrum (partial pressure) He S/S evacuated He^4 = 2,6 x 10^{-9} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 1,5 x 10^{-5} mbar p_{MS} = 2,4 x 10^{-6} mbar p_{isol} = 1,7 x 10^{-6} mbar
08:55	Close MS / open LT Leak rate: 4,7 x 10^{-8} mbarl/s (slowly increasing)
08:56	Close V 104 Close V 105
09:00	Open SV 121 -> flush filling port and shield tubing with Helium from dewar to 1 bar
	Leak rate: 6,8 x 10^{-6} mbarl/s (increasing)
09:25	Remove airlock Remove SV 121 plug; install dummy plug in filling port Remove pressure plate
09:30	Leak rate: 6,5 x 10^{-6} mbarl/s (slowly decreasing)
09:30	Close LT / open MS Take a mass spectrum (partial pressure) of filling port and shield tubing, airlock and pressure plate removed, all other items are evacuated He^4 = 2,6 x 10^{-7} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 1,4 x 10^{-5} mbar p_{MS} = 2,0 x 10^{-6} mbar p_{isol} = 2,8 x 10^{-6} mbar

09:35	Close MS / open LT Leak rate: 6,0 x 10^{-6} mbarl/s (slowly decreasing)
	Rework at filling port / CVV interface with glueing using RTV 691 A/B
15:32	Leak rate: 2,3 x 10^{-6} mbarl/s (constant)
15:33	Close LT / open MS Take a mass spectrum (partial pressure) of filling port and shield tubing, airlock and pressure plate removed, all other items are evacuated - after rework He^4 = 1,1 x 10^{-7} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 1,8 x 10^{-5} mbar p_{MS} = 1,4 x 10^{-6} mbar p_{isol} = 4,8 x 10^{-6} mbar
15:45	Close MS / open LT Leak rate: 2,1 x 10^{-6} mbarl/s
15:48	Close airlock Close valve at airlock to MS / LT, open backing valve of turbo pump, start-up turbo pump
15:53	Open airlock
13.10.05 07:41	Close airlock, close backing valve of turbo pump, shut down turbo pump Open valve at airlock to MS / LT Perform leak test of set-up and airlock: 5 x 10^{-9} mbarl/s
08:00	Open airlock Leak rate: 6,9 x 10^{-7} mbarl/s (increasing)
09:14	Leak rate: 2,2 x 10^{-6} mbarl/s
09:18	Close LT / open MS Take a mass spectrum (partial pressure) He S/S evacuated He^4 = 9,2 x 10^{-8} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 2,0 x 10^{-5} mbar p_{MS} = 4,7 x 10^{-6} mbar p_{isol} = 1,0 x 10^{-5} mbar
09:31	Close MS / open LT Leak rate: 2,2 x 10^{-6} mbarl/s
	Re-mount pressure plate Re-mount airlock Install transfer line Evacuate/flush airlock and transfer line 3 x Evacuate airlock and transfer line (laboratory pump still pumping)
11:20	Open SV 121 -> evacuate filling port and shield tubing with laboratory pump
11:35	Flush filling port and airlock with Helium from dewar Evacuate / flush with Helium 3 x
12:00	Leak rate: 3,2 x 10^{-6} mbarl/s at the end of evacuation cycle (tubing, filling port and airlock evacuated)
12:00	Close LT / open MS Take a mass spectrum (partial pressure) at the end of evacuation cycle (tubing, filling port and airlock evacuated) He^4 = 1,1 x 10^{-7} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 1,8 x 10^{-5} mbar p_{MS} = 2,1 x 10^{-6} mbar p_{isol} = 1,5 x 10^{-5} mbar
12:03	Close MS / open LT Leak rate: 3,1 x 10^{-6} mbarl/s at the end of evacuation cycle (tubing, filling port and airlock evacuated)
12:05	Flush shield tubing, filling port and airlock with He from dewar
12:08	Leak rate: 3,2 x 10^{-6} mbarl/s at the end of evacuation cycle (tubing, filling port and airlock flushed)

12:09	Close LT / open MS Take a mass spectrum (partial pressure) at the end of evacuation cycle (tubing, filling port and airlock flushed) He^4 = 1,2 x 10^{-7} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 1,9 x 10^{-5} mbar p_{MS} = 2,0 x 10^{-6} mbar p_{isol} = 1,5 x 10^{-5} mbar
12:12	Close MS / open LT Leak rate: 3,2 x 10^{-6} mbarl/s
14:44	Repeat leak rate measurement: 4,1 x 10^{-6} mbarl/s
14:44	Close LT / open MS Take a mass spectrum (partial pressure) at the end of evacuation cycle (tubing, filling port and airlock flushed) He^4 = 1,7 x 10^{-7} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 2,4 x 10^{-5} mbar p_{MS} = 2,1 x 10^{-6} mbar p_{isol} = 1,9 x 10^{-5} mbar
14:52	Close MS / open LT Leak rate: 3,2 x 10^{-6} mbarl/s
14:55	Open transfer line valve and insert transfer line completely and move it back by ~ 20 mm
15:10	Open V 502 Remove one way valve -> start cooling down shields (HTT still closed and evacuated) Mass flow increases to ~ 0,8 g/s
15:42	Repeat leak rate measurement: 4,1 x 10^{-6} mbarl/s
15:42	Close LT / open MS Take a mass spectrum (partial pressure) at the end of evacuation cycle (tubing, filling port and airlock flushed) He^4 = 1,6 x 10^{-7} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 1,3 x 10^{-5} mbar p_{MS} = 1,2 x 10^{-6} mbar p_{isol} = 6,4 x 10^{-7} mbar
15:53	Close MS / open LT Leak rate: 3,9 x 10^{-6} mbarl/s
17:10	Repeat leak rate measurement: 4,7 x 10^{-6} mbarl/s
17:10	Close LT / open MS Take a mass spectrum (partial pressure) at the end of evacuation cycle (tubing, filling port and airlock flushed) He^4 = 1,9 x 10^{-7} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 1,3 x 10^{-5} mbar p_{MS} = 1,5 x 10^{-6} mbar p_{isol} = 5,5 x 10^{-7} mbar
17:15	Close MS / open LT Leak rate: 4,6 x 10^{-6} mbarl/s
17:17	Open V 102
17:27	Open V104 when P 101 > 0,95 bar -> cool down of HTT to 4.2 K to activate adsorbers
17:40	No flow when inserting the transfer line completely -> V 104 frozen? Close V 104 Start VH 104
18:02	Open V 104 Stop VH 104 -> mass flow increases -> blockage removed
18:23	Close LT / open MS Take a mass spectrum (partial pressure) with HTT, filling port, shield tubing and airlock

	flushed with Helium, HTT at 48 K He^4 = 5,8 x 10^{-7} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 2,4 x 10^{-5} mbar p_{MS} = 1,8 x 10^{-6} mbar p_{isol} = 1,8 x 10^{-5} mbar
18:30	Close MS / open LT Leak rate: 1,5 x 10^{-5} mbarl/s
	Install 76 mbar overpressure valve at dewar and keep small Helium flow from dewar through HTT running over night Install one way valve
18:36	Close airlock Close valve at airlock to MS / LT, open backing valve of turbo pump, start-up turbo pump
18:41	Open airlock
14:10:05 07:15	Remove one-way valve Increase dewar pressure
07:32	Close airlock, close backing valve of turbo pump, shut down turbo pump Open valve at airlock to MS / LT Perform leak test of set-up and airlock: 5 x 10^{-9} mbarl/s
07:41	Open airlock Leak rate: 5,8 x 10^{-6} mbarl/s (increasing)
07:57	Close LT / open MS Take a mass spectrum (partial pressure) with HTT, filling port, shield tubing and airlock flushed with Helium, HTT at 48 K He^4 = 2,1 x 10^{-7} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 1,1 x 10^{-5} mbar p_{MS} = 2,9 x 10^{-6} mbar p_{isol} = 7,6 x 10^{-7} mbar
08:07	Close MS / open LT Leak rate: 7,8 x 10^{-6} mbarl/s
08:32 08:42	Close V 104 Heat V 104 to 90 K Open V 104
16:48	Close LT / open MS Take a mass spectrum (partial pressure) with HTT, filling port, shield tubing and airlock flushed with Helium, HTT at 20 K He^4 = 1,7 x 10^{-6} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 1,3 x 10^{-5} mbar p_{MS} = 1,4 x 10^{-6} mbar p_{isol} = 4,2 x 10^{-6} mbar
16:55	Close MS / open LT Leak rate: 4,2 x 10^{-5} mbarl/s
17:50	Leak rate starts to decrease slowly at a HTT temperature of ~12 K (bottom part) q_{max} = 4,85 x 10^{-5} mbarl/s
17:53	Close LT / open MS Take a mass spectrum (partial pressure) with HTT, filling port, shield tubing and airlock flushed with Helium, HTT at 12 K He^4 = 1,6 x 10^{-7} mbar He^3 = 3,0 x 10^{-10} mbar N_2 = 1,1 x 10^{-5} mbar p_{MS} = 1,6 x 10^{-6} mbar p_{isol} = 4,6 x 10^{-6} mbar
18:00	Close MS / open LT Leak rate: 3,9 x 10^{-5} mbarl/s
18:31	Repeat leak rate measurement: 2,2 x 10^{-6} mbarl/s
18:31	Close LT / open MS Take a mass spectrum (partial pressure) with HTT, filling port, shield tubing and airlock flushed with Helium, HTT at 7 K

	He^4 = 6,3 x 10^{-8} mbar (decreasing) He^3 = 1,0 x 10^{-10} mbar N_2 = 1,1 x 10^{-5} mbar p_{MS} = 1,2 x 10^{-6} mbar p_{isol} = 1,5 x 10^{-7} mbar
18:36	Close MS / open LT Leak rate: 1,5 x 10^{-6} mbarl/s
18:38	Close V 701 Open V 702 -> flush AXT with Helium from dewar
18:41	Open V 105 when P 701 > 0,95 bar
18:45	Close V 102 -> speed up cool down of AXT
18:59	Open V 102
19:00	Close V 702
	Install one way valve
19:06	Repeat leak rate measurement: 1,6 x 10^{-6} mbarl/s
19:06	Close LT / open MS Take a mass spectrum (partial pressure) with HTT, filling port, shield tubing and airlock flushed with Helium, HTT at 6 K He^4 = 6,2 x 10^{-8} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 1,1 x 10^{-5} mbar p_{MS} = 1,3 x 10^{-6} mbar p_{isol} = 1,5 x 10^{-7} mbar
19:10	Close MS / open LT Leak rate: 1,8 x 10^{-6} mbarl/s
19:12	Close airlock Close valve at airlock to MS / LT, open backing valve of turbo pump, start-up turbo pump
19:17	Open airlock
15:10:05 18:00	Close airlock, close backing valve of turbo pump, shut down turbo pump Open valve at airlock to MS / LT Perform leak test of set-up and airlock: 3,2 x 10^{-9} mbarl/s
18:06	Open airlock Leak rate: 6,0 x 10^{-6} mbarl/s (increasing)
18:18	Close LT / open MS Take a mass spectrum (partial pressure) with HTT, filling port, shield tubing and airlock flushed with Helium, HTT at 13 K He^4 = 4,1 x 10^{-7} mbar He^3 = 1,0 x 10^{-10} mbar N_2 = 1,1 x 10^{-5} mbar p_{MS} = 3,1 x 10^{-6} mbar p_{isol} = 1,4 x 10^{-6} mbar
18:25	Close MS / open LT Leak rate: 7,8 x 10^{-6} mbarl/s
	Close MS and LT Close airlock Close valve at airlock to MS / LT Install line to MS / LT between electrical and manual backing valve of turbo pump
18:55	Close SV 121
	Open backing valve of turbo pump Close manual backing valve of turbo pump Open valve to MS / LT Perform background measurement: 5,3 x 10^{-9} mbarl/s
19:07	Start-up turbo pump Perform background measurement: 4,6 x 10^{-9} mbarl/s

19:13	Open airlock Leak rate: 1,1 x 10^{-4} mbarl/s (decreasing)
19:23	Close V 102
19:24	Close LT / open MS Take a mass spectrum (partial pressure) with HTT, filling port, shield tubing and airlock flushed with Helium, HTT at 13 K He^4 = 2,2 x 10^{-6} mbar He^3 = 7 x 10^{-10} mbar N_2 = 2,1 x 10^{-5} mbar p_{MS} = 1,5 x 10^{-5} mbar p_{isol} = 4,3 x 10^{-8} mbar
19:29	Close MS / open LT Leak rate: 0,9 x 10^{-4} mbarl/s
19:33	Close valve to MS / LT Open valve to fore pump
17.10.05	
09:50	Open SV 121 Open V 102 -> restart cool down of HTT
11:20	Close valve at transfer line Close SV 121 Close V 102 Close V 502
11:30	Open V 701 -> start pump down of AXT and HTT
	Leak rate: 4 x 10^{-6} mbarl/s
18.10.05	Close valve to fore pump Open valve to MS / LT Leak rate: 5,4 x 10^{-5} mbarl/s
	Close LT / open MS Take a mass spectrum (partial pressure) with He S/S evacuated, HTT at 7 K He^4 = 3,3 x 10^{-6} mbar He^3 = 1 x 10^{-9} mbar N_2 = 1,9 x 10^{-5} mbar p_{MS} = 7,7 x 10^{-6} mbar p_{isol} = 4,3 x 10^{-8} mbar (measurement behind turbo pump)
08:30	Close V 104 -> isolate HTT Close V 701
08:40	Open SV 121 Close V 105 -> flush tubing and filling port
08:50	Insert transfer line Open V 702 Open V 105 -> flush AXT
08:52	Open V 502 -> cool down and fill AXT
08:54	Take a mass spectrum (partial pressure) with filling port, shield tubing and AXT flushed, HTT at 7 K, AXT at 50 K He^4 = 6,8 x 10^{-6} mbar He^3 = 1,1 x 10^{-9} mbar N_2 = 1,4 x 10^{-5} mbar p_{MS} = 5,3 x 10^{-6} mbar p_{isol} = 4,3 x 10^{-8} mbar (measurement behind turbo pump)
08:56	Close MS / open LT Leak rate: 3,4 x 10^{-4} mbarl/s
13:45	Close V 105 Open V 701 -> cool AXT via OBA
14:20	Open V 105 Open by pass at He pump I -> start filling of AXT
15:55	End of dewar Close V 702, retract transfer line

	Close SV 121
16:10	AXT filling level: LL1 = 38,9 cm; LL2 = 61,4 cm
	Close V 105 Close ball valve / needle valve to He pump I Close by pass valve at He pump I Restart He pump I -> start He II production in AXT
17:06	New dewar: open SV 121 and start cooling of shields from external dewar
17:48	Leak rate: 5,6 x 10^{-7} mbarl/s
17:49	Take a mass spectrum (partial pressure) with filling port and shield tubing flushed, HTT at 130 mbar and 30 K, AXT partly filled and pumped down @ 60 mbar, 2,4 K He^4 = 1,3 x 10^{-8} mbar He^3 = 1 x 10^{-10} mbar N_2 = 1,4 x 10^{-5} mbar p_{MS} = 2,3 x 10^{-6} mbar p_{isol} = 1,9 x 10^{-8} mbar (measurement behind turbo pump)
17:59	Close MS / open LT Leak rate: 5,4 x 10^{-7} mbarl/s
18:04	Close valve to MS / LT Open valve to fore pump
19.10.05	H 702 power adjusted to 0,3 W Shield cooling adjusted: dewar pressure 185 mbar Cover flushing started with dewar pressure ~70 mbar
09:45	Leak rate: 9,5 x 10^{-7} mbarl/s
09:46	Take a mass spectrum (partial pressure) with filling port and shield tubing flushed, HTT at 150 mbar and 30 K, AXT partly filled with LHe II He^4 = 1,9 x 10^{-8} mbar He^3 = 1 x 10^{-10} mbar N_2 = 1,3 x 10^{-5} mbar p_{MS} = 2,9 x 10^{-6} mbar p_{isol} = 6,9 x 10^{-9} mbar (measurement behind turbo pump)
09:55	Close MS / open LT Leak rate: 8,5 x 10^{-7} mbarl/s
16:00	Leak rate: 1,2 x 10^{-6} mbarl/s
16:08	Take a mass spectrum (partial pressure) with filling port and shield tubing flushed, HTT at 150 mbar and 30 K, AXT partly filled with LHe II He^4 = 2,7 x 10^{-8} mbar He^3 = 1 x 10^{-10} mbar N_2 = 1,2 x 10^{-5} mbar p_{MS} = 2,6 x 10^{-6} mbar p_{isol} = 7,0 x 10^{-9} mbar (measurement behind turbo pump)
16:12	Close MS / open LT Leak rate: 8,5 x 10^{-7} mbarl/s
16:15	Close valve to MS / LT Open valve to fore pump

Anna 1

Wednesday October 26 2005 6:0 PM

Company	Project Name	NCR-No: HP-112000-ASED-NC-1513
ESTEC	HERSCHEL-PLANCK	Related internal NCR-No:
		Critical Item: Yes ☐ No ☒ Revision 1
		Page 1 of 6

Nonconformance Report

NCR Title SPIRE EQM Cooler recycling

NC Item **Identification** SPIRE

Next Higher Assembly HERSCHEL INSTRUMENTS AND TELESCOPE (CFE)

Drawing No	Sr No. EQM
Procedure No	
Supplier RAL	Purchase Order
Subsystem	Model EQM
NC Observation Date: 27-SEP-05 Location: ASEDOTN	NC Detected During Test

Description of Nonconformance

The first SPIRE cooler recycling performed on 26.09.05 only achieved a temp of app 0.420 K and a hold time of
less than 3 hrs.
A second recycle was tried on 27.09.05 after the cryostat had been pumped/evacuated for 3 hrs.
The air lock had been closed for app 10 days when the PLM was moved to the tilting dolly prior to the start of IMT,Pump was still running following the reintegration.
The leak detection was 10-4mblt/sec.
The second recycle achieved a temp of 0.328k but this is not sufficient for performance tests.(Temp plots to
be attached).
Customer NRB to be held 27.09.05 (telecon ESA)

Requirements Violated

SPIRE IMT TP

Initiator: Date, Name and Signature 27-SEP-05 D.Hendry

Internal NRB Dispositions

27.09.05 ESA,ASP,ASED,RAL.
SPIRE consider that IMT cannot continue until cooler recycling can be successfully performed and a temp below 0.300k can be achieved.
The possible causes of the failure were identified as follows.
1)He 4 leak causing a He film on the detector surface.This was seen during ILT and the temp was increased to 4.2k to remove the film and was successful in achieving a good recycling and hold time.
2)He 3 problem with strap or heat switch.
The NRB agrees 2 parallel actions.
AI/1 SPIRE to analyse the load curves to investigate problems of strap and heat switch
AI/2 ASED to heat up AXT to 4.2k and continue pumping for 24 to 36 hrs (till 29.09.05 morning)to remove the He film from the detector and evaporator surfaces and remove the He.
Vacuum and leak detection will be monitored.
Temp,vacuum and leak detection values will be assessen prior to a further cooler recycle on 29.09.05 AM, the results of this test will be discussed in a follow on NRB to be reconvened after the test.

Ref. to MoMs

Classification:
Major ☒ **Minor** ☐

Customer Notification
27-SEP-05

Cause of NC Ref to Failure Report	Corrective/Preventative Actions	Verification

Date: Name: Signature:	**PA** 27-SEP-05 D.Hendry	**Engineering** 27-SEP-05 S.Idler	27-SEP-05 D.Hendry	27-SEP-05 C.Schlosser	27-SEP-05 S.Ilsen	27-SEP-05 G.Doubrovik	27-SEP-05 C.Jewell	27-SEP-05 C.Schermberg	27-SEP-05 W.Pinter-Krainer	27-SEP-05 B.Swinyard	

Company	Project Name	
ESTEC	HERSCHEL-PLANCK	NCR-No: HP-112000-ASED-NC-1513 Related internal NCR-No: Critical Item: Yes ☐ No ☒ Revision 1 Page 2 of 6

Nonconformance Report - Continuation Sheet -

Customer NRB Dispositions (Class Major Only) Ref. to MoMs | Verification

28.09.05 follow on NRB ESA,ASP,ASED.RAL
Following the warm up to 4.2k and pumping for 36 hrs (20hrs at AXT temp 4.2k + 16hrs during cool down of AXT to 1.6k)a 3rd cooler recycle was performed with the following conditions.

Evaporator temp 1.75k
cover temp app 10 k
Vacuum 1.5x10-7
Back ground leak rate 1.3x10-4
During recycling after 2.5 hrs the cooler temp was 0.284k
Temp started to rise and was 0.318k after 1 hr (temp plots will be attached to this NCR)
SPIRE consider this is not acceptable to continue with IMT.
The NRB considers that the heat transfer is caused by free He flow between cold and warm surfaces which causes a film to form on the detectors and evaporator.
This free He probably comes from the know leak on the filling port I/F into the CVV and has also saturated the absorbers at the bottom of the main tank.
The NRB considered that the leak tightness of the filling port/CVV I/F could be improved by inserting a glue at this I/F.
For this activity the airlock and the pressure plate has to be removed and the He SS has to be closed by a dummy plug in the filling port instead of the SV121.
ASED say it is not certain that the gluing of the I/F will have an effect on the leak tightness
ASED advise that due to the isolation vacuum there is a risk during the rework operation,

For the proposed rework ASED will provide a detailed drawing of the I/F and plug and will identify the materials and procedure to be used AI/ASED 30.09.05.
In an attempt to remove the He film and the free He within the cryostat(and instruments) the AXT will be depleted and warmed to above 20k with continual pumping.
The warm up/cooldown and filling port I/F rework is estimated to take 1 week.
It is also considered that even with the warm up and rework there is still the possibility that as the absorbers are saturated not all the free He will be removed and could still have an effect on the cooler hold time and operation.
ASP will review the load curves and temperature profile of the recycling and provide an analysis.AI/ASP

29.09.05 Follow on investigations to measure the leak rate.
A mass spectrometer has been connected to the airlock SV922.
The turbo pump is still running but the backing valve behind the pump is closed (ie, turbo pump not effective)
The measurements from the mass spectrometer are the following.
Hydrogen =1.6*10-9
He3 =1.3*10-12
He4 =1.0*10-9
Water=1.9*10-8
N2=6.5*10-9
O2=1.4*10-9
The results will be assesed by ASED cryo engineering.

Finally Determined Cause of NC	Corrective/Preventative Actions
Ref to Failure Report	

Request for Waiver	Alert	Other related Documents
Yes ☐ No ☐ Reference:	Yes ☐ No ☐ Reference:	

NCR Close Out

Company	Project Name	NCR-No: HP-112000-ASED-NC-1513
ESTEC	HERSCHEL-PLANCK	Related internal NCR-No:
		Critical Item: Yes [ ] No [X] Revision 1
		Page 3 of 6

Nonconformance Report - Continuation Sheet -

NRB Approval

Organization/
Name

Date, Signature

Company	Project Name	NCR-No: HP-112000-ASED-NC-1513
ESTEC	HERSCHEL-PLANCK	Related internal NCR-No:
		Critical Item: Yes [ ] No [X] Revision 1
		Page 4 of 6

Nonconformance Report - Continuation Sheet -

Customer NRB Dispositions (Class Major Only) Ref. to MoMs — Verification

Follow on NRB with ESA, ASP and ASED (C. Jewell, M. Pastorino, R. Hohn, C. Schlosser):
Status:
2 leaks identified: HTT with 2 x 10-5 mbarl/s and filling port + shield tubing with 2 x 10-5 mbarl/s, in total 4 - 5 x 10-5 mbarl/s
A first leak test at IMT conditions (HTT at 4,2 K and AXT at 1,55 K) a total leak rate of 4,5 x 10-6 mbarl/s was measured -> the adsorbers were still active and improved the leak rate by a factor of 10.
3,42 m? Grafoil adsorbers are installed in the EQM PLM = 3420 std cm? (see ISO NCR MB-PLM-045, rev B, 30.01.1990.

The following options have been discussed during the NRB:
1. Start cool down and get IMT conditions as fast as possible. Perform PACS sorption cooler test on 13.10.05.
2. Sealing of filling port I/F according HP-2-ASED-SD-0058 step 8. This would improve the leak rate by a factor of 2 in best case. (remember: measured leak rate of filling port I/F during integration was 3 x 10-6 mbarl/s)
3. Sealing of filling port I/F according HP-2-ASED-SD-0058 step 8, evacuating and isolating HTT combined with cooling of shields via an external supply (via cryostat internal safety line). This is a new procedure and it has to be verified that it is possible at all. Impact on schedule of option 3 is 2 days.

ESA request to go as proposed in option 3, because, although not known that it reduces the leak rate distinctly, it is the best what can be done to for the instruments.

ASED stated that all thermal requirements for instrument tests on the EQM have been fulfilled (L0, L1 and L2 temperatures) and that there is no requirement specifying the allowable leak rate respectively the allowable Helium content in the cryostat.

SPIRE made similar observations during FM ILT. SPIRE shall provide information about their set-up (e.g. leak rate of cryostat, temperature characteristics) when they detected the problem.

After the NRB, ASED PM agrees to follow option 3. However it has to be noted that there is no guarantee that the environmental conditions for instrument test can be improved by that measures. The interface between filling port and CVV will be sealed with a liquid leak seal, the screws of the filling port will be sealed with STYCAST 2850 GT.

closed see ACD 0059 and MoM HP-2-ASED-MN-1096 (The filling port leak has been tightened with glue (RTV 691)).

Finally Determined Cause of NC Ref to Failure Report	Corrective/Preventative Actions

Request for Waiver Yes [ ] No [ ] Reference:	Alert Yes [ ] No [ ] Reference:	Other related Documents

	NCR Close Out

NRB Approval

Organization/
Name

Date, Signature

Company	Project Name	
ESTEC	HERSCHEL-PLANCK	NCR-No: HP-112000-ASED-NC-1513 Related internal NCR-No: Critical Item: Yes [ ] No [X] Revision 1 Page 5 of 6

Nonconformance Report - Continuation Sheet -

NCR Treatment Sequence / Findings / Statements / Actions

Int. Ref	Actionee	Due Date	Action	Conclusion / Remark	Closed
C1-1	RAL	30-SEP-05	AI/1 SPIRE to analyse the load curves to investigate problems of strap and heat switch		Yes [ ] No [X]
C1-2	ASED	30-SEP-05	AI/2 ASED to heat up AXT to 4.2k and continue pumping for 24 to 36 hrs	Closed	Yes [X] No [ ]
C1-3	ASED	30-SEP-05	For the proposed rework ASED will provide a detailed drawing of the I/F and plug and will identify the materials and procedure to be used AI/ASED 30.09.05.		Yes [X] No [ ]
C1-4	ASP	30-SEP-05	ASP will review the load curves and temperature profile of the recycling and provide an analysis.AI/ASP		Yes [ ] No [X]

Company	Project Name	
ESTEC	HERSCHEL-PLANCK	NCR-No: HP-112000-ASED-NC-1513 Related internal NCR-No: Critical Item: Yes ☐ No ☒ Revision 1 Page 6 of 6

Nonconformance Report - Continuation Sheet -

NCR/NRB Attachments

	Description	Filename	Last Updated
1	Graph of 1st SPIRE cooler recycle	SPIRE_Cooler_Recycle_1.jp	30-SEP-05 08:42:17
2	Graph of 2nd SPIRE cooler recycle	SPIRE_Cooler_Recycle_2.jp	30-SEP-05 08:42:30
3	Graph of 3rd SPIRE cooler recycle	SPIRE_Cooler_Recycle_3.jp	30-SEP-05 08:42:44
4	As run procedure for leak testing	HP-2-ASED-SD-0058_2-AsRun	10-OCT-05 17:20:07
5	Drawing of filling port interface and set-up for l	FillingPort-SetUp.pdf	10-OCT-05 17:22:46

	Name	Dep./Comp.		Name	Dep./Comp.
	Alberti von Mathias Dr.	AOE22		Schink Dietmar	AED44
	Barlage Bernhard	AED11	x	Schlosser Christian	OTN/AOA54
	Bayer Thomas	AOA52		Schmidt Rudolf	FAE22
	Brune Holger	AOA55		Schweickert Gunn	AOE22
	Fehringer Alexander	AOE13		Sonn Nico	AOE51
x	Fricke Wolfgang Dr.	AED 65		Steininger Eric	AED32
	Geiger Hermann	AOA52	x	Stritter Rene	AED11
	Gerner Willi	AED11		Suess Rudi	AOA54
X	Grasl Andreas	OTN/AOA54		Thörmer Klaus-Horst Dr.	OTN/AED65
	Grasshoff Brigitte	AET12		Wagner Klaus	AOE22
	Hauser Armin	AOE22		Wietbrock Walter	AET12
X	Hendry David	Terma Resid.		Wöhler Hans	AOE22
	Hengstler Reinhold	AOA 5		Wössner Ulrich	ASE442
	Hinger Jürgen	AOE22	X	Alcatel	ASP
	Hofmann Rolf	ASE442	X	ESA/ESTEC	ESA
X	Hohn Rüdiger	AED65		**Instruments:**	
	Hölzle Edgar Dr.	AED44		MPE (PACS)	MPE
	Huber Johann	AOA52		RAL (SPIRE)	RAL
	Hund Walter	ASE442		SRON (HIFI)	SRON
	Idler Siegmund	AED312		**Subcontractors:**	
	Ilsen Stijn	Terma Resid.		Air Liquide, Space Department	AIR
	Ivády von András	FAE22		Air Liquide, Space Department	AIRS
	Jahn Gerd Dr.	AOE22		Air Liquide, Orbital System	AIRT
	Kalde Clemens	APE3		Alcatel Bell Space	ABSP
X	Kameter Rudolf	OTN/AOA54		Astrium Sub-Subsyst. & Equipment	ASSE
	Kettner Bernhard	AET42		Austrian Aerospace	AAE
	Knoblauch August	AET32		Austrian Aerospace	AAEM
	Koelle Markus	AOA53		APCO Technologies S. A.	APCO
	Koppe Axel	AED312		Bieri Engineering B. V.	BIER
X	Kroeker Jürgen	AED65		BOC Edwards	BOCE
	Kunz Oliver Dr.	AOE22		Dutch Space Solar Arrays	DSSA
x	Lamprecht Ernst	OTN/ASI21		EADS CASA Espacio	CASA
	Lang Jürgen	ASE442		EADS CASA Espacio	ECAS
	Langenstein Rolf	AED15		EADS Space Transportation	ASIP
X	Langfermann Michael	AOA51		Eurocopter	ECD
X	Mack Paul	OTN/AOA54		European Test Services	ETS
	Maute Thomas	AOA52		HTS AG Zürich	HTSZ
	Müller Jörg	AOA52		Linde	LIND
	Müller Martin	AOA53		Patria New Technologies Oy	PANT
	Müller Ralf	FAE22		Phoenix, Volkmarsen	PHOE
	Peltz Heinz-Willi	AOE13		Prototech AS	PROT
	Pietroboni Karin	AED65		QMC Instruments Ltd.	QMC
	Platzer Wilhelm	AED22		Rembe, Brilon	REMB
	Reichle Konrad	AOA52		Rosemount Aerospace GmbH	ROSE
	Reuß Friedhelm	AED62		RYMSA, Radiación y Microondas	RYM
x	Rühe Wolfgang	AED6		SENER Ingenieria SA	SEN
X	Runge Axel	OTN/AOA54		Stöhr, Königsbrunn	STOE
	Sachsse Bernt	AED21		Terma A/S, Herlev	TER

VI. Copy of filled in Log Sheets 1

Herschel EQM — **LOGSHEET 1 for COOL DOWN and FILLING**

Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow	He Dewar S/N D0101	Liquid level Dewar L0101	P701	REMARKS	Sign AIV	Sign QA
25.08.05	10:20	C	C	O	C	O	O	O	C	6.2·10^5	/	950	–	/	–	–			[signature]	[signature]
-"-	10:30									start evacuation with He II pump-unit at V512									[signature]	[signature]
-"-	11:18									open V104 → evacuate HTT									[signature]	[signature]
-"-	11:20	C	O	O	C	O	O	O	C										[signature]	[signature]
-"-	15:35									close V104, open V102 ~ start flushing with GHe grade 5.0									[signature]	[signature]
-"-	15:35	O	C	O	C	O	O	O	C										[signature]	[signature]
-"-	17:30	—	—	—	"	—	—	—	—	end of flushing P101 ~ 960 mbar									[signature]	[signature]
-"-	17:33	C	O	O	C	O	O	O	C	open V104, close V102									[signature]	[signature]
-"-	17:36	—	—	—	"	—	—	—	—	start evacuation interval He S/S at 960 mbar									[signature]	[signature]
26.08.05	7:20	—	—	—	"	—	—	—	—	5.3·10^5	0.01	5.2	/	/	–	/	-0.03		[signature]	[signature]
-"-	7:30									stop pumping, close V104, open V102 start flushing with GHe via V512									[signature]	[signature]
-"-	10:10									stop purging										[signature]
-"-	16:40									open V104, close V102 start P101 evacuation open V502									[signature]	[signature]
27.08.05	14:50									5.2x10^5	–	4.7	950	–	–	–	–	Hiven, He II pump running	[signature]	[signature]
28.08.05	9:30									4.4x10^5	–	–	950	-	-	-	-	" "	[signature]	[signature]
29.08.05	7:20	C	O	O	O	C	O	O	C	4.7·10^5	0	4.7	950	–	–	–	0	– " –	[signature]	[signature]
-"-	10:15									open V102									[signature]	[signature]
-"-	10:30									close inlet valve to He 2 pump, open SV121 → start flushing with He from dewar									[signature]	[signature]
-"-		O	O	O	O	C	O	O	O										[signature]	[signature]
-"-	10:50									insert transfer line into SV121, stop flushing, start He 2 pump → evacuation									[signature]	[signature]
-"-										of He S/S (4th cycle)									[signature]	[signature]

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Herschel EQM																	LOGSHEET 1 for COOL DOWN and FILLING			
		Valve Status																	Sign	
Date	Time	V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow	He Dewar S/N D0101	Liquid level Dewar L0101	P701 bar	REMARKS dewar pressure	AIV	QA
29.8.05	12:35	O	O	O	O	C	O	O	O	5,5·10^-5	0,004	~~0,004~~ 4,8	2,8	/	9112	505	0,004		[illegible]	[illegible]
-"-	12:40									stop He 2 pump, start flushing with He from dewar								(4th cycle)	[illegible]	[illegible]
-"-	13:00									1.0·10^-5	1,07	988	1060	380mg/s	9112	465	1,07	120 mbar	[illegible]	[illegible]
-"-	14:00	O	O	O	O	C	O	O	O	2,2·10^-6	1,07	994	1060	435mg/s	"	390	1,06	120mbar	[illegible]	[illegible]
-"-	14:35									open V512 → start flow through AKT/10BA									[illegible]	[illegible]
-"-	14:40									close V702 → stop flow through AKT; increase dewar pressure to 150mbar									[illegible]	[illegible]
-"-	14:55									increase Dewar pressure from 150mbar to 200 mbar									[illegible]	[illegible]
-"-	15:00	O	O	O	O	O	O	C	O	close hand valve behind V512; stop flow through OB									[illegible]	[illegible]
-"-	15:02	O	O	O	O	C	O	C	O	1,1·10^-6	1,13	1025	1120	850mg/s	9112	310	1,1 bar	200	[illegible]	[illegible]
-"-	16:00	O	O	O	O	C	O	C	O	6,5·10^-7	1,12	1025	1120	850mg/s	"	205	1,08	200	[illegible]	[illegible]
-"-	16:15	O	O	O	O	C	O	O	O	open V702 → start flow through AKT								200	[illegible]	[illegible]
-"-	~~17~~ 17:00	—	—	—	—	"	—	—	—	4,7·10^-7	1,13	1004	1120	560	9112	170	1,12	200	[illegible]	[illegible]
-"-	17:05	O	O	O	O	O	O	C	O	close V702									[illegible]	[illegible]
-"-	17:45	—	—	—	—	"	—	—	—	activate one way valve										[illegible]
-"-	17:47	—	—	—	—	"	—	—	—	3,9·10^-7	1,14	1055	1130	385	9112	150	1,11	200		[illegible]
30.8.05	6:50	O	O	O	O	C	O	C	O	8,2·10^-6	0,97	980	981	0	9112	150	0,97	5	[illegible]	[illegible]
-"-	7:00	—	—	—	—	"	—	—	—	de-activate one-way valve increase dewar pressure to 200mbar, open									[illegible]	[illegible]
-"-	"	—	—	—	—	"	—	—	—	needle valve at transfer line → restart cool down									[illegible]	[illegible]
-"-	8:00	O	O	O	O	C	O	C	O	9,3·10^-7	1,13	1042	1120	920	9112	105	1,09	200	[illegible]	[illegible]
-"-	9:00	—	—	—	—	"	—	—	—	3,7·10^-7	1,13	1060	1120	920	9112	80	1,11	200	[illegible]	[illegible]
-"-	9:05	—	—	—	—	"	—	—	—	open V702									[illegible]	[illegible]

↑ *2

Herschel EQM — **LOGSHEET 1 for COOL DOWN and FILLING**

Date	Time	V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow	He Dewar S/N D0101	Liquid level Dewar L0101	P701 bar	Dewar pressure REMARKS	Sign AIV	Sign QA
30.08.05	10:00	O	O	O	O	C	O	O	O	2,8·10^-7	1,13	1004	1140	1,03	9112	65	1,12	205	Sch	[illegible]
-"-	10:25	O	O	O	O	C	O	O/C	O		close V702								[illegible]	[illegible]
-"-	11:00	O	O	O	O	C	O	C	O	2,4·10^-7	1,14	1006	1130	1,08	9112	55	1,11	210	[illegible]	[illegible]
-"-	12:00	—	—	—	"	—	—	—	—	2,1·10^-7	1,11	994	1120	0,83	9112	40	1,07	200	[illegible]	[illegible]
-"-	12:30	—	—	—	"	—	—	—	—	pressure in dewar increased to 220 mbar									Sch	[illegible]
-"-	12:42	O	O	O	O	C	O	O	O	open V702 → cool down AKT									Sch	[illegible]
-"-	12:45	—	—	—	"	—	—	—	—	increase pressure in dewar to 250 mbar									Sch	
-"-	13:03	O	O	O	O	C	O	C	O	close V702					9112	35		250	Sch	[illegible]
-"-	13:05	—	—	—	"	—	—	—	—	1,3·10^-6	[illegible]	980	1010	0,47	9112	35	1,03	250	Sch	[illegible]
"										stop transfer from dewar, close V102						35		mdewar = 3,25 kg ≙ 26 l	Sch	
-"-	14:07	C	O	O	O	C	O	C	O	New dewar installed No.: 9156									Sch	[illegible]
-"-	14:15	O	O	O	O	C	O	C	O	dewar level 703 mm				, open V102					Sch	[illegible]
-"-	14:22	O	O	O	O	C	O	O	O	— OPEN V702									Sch	[illegible]
-"-	15:00	O	O	O	O	C	O	O	O	2,1·10^-7	1,11	1006	1120	1,12	9156	400	1,10	200	Sch	[illegible]
-"-	15:10													increase dewar pressure to 250 mbar					Sch	[illegible]
-"-	15:40									close V702									Sch	[illegible]
-"-	15:55									open V512 (at the input to the flowmeter unit)									Sch	[illegible]
-"-	16:00	O	O	O	O	O	O	C	O	1,7·10^-7	1,14	1056	1140	2,09	9156	270	1,11	250	Sch	[illegible]
-"-	16:47	O	O	O	O	O	O	O	O	open V802										[illegible]
-"-	16:48									1,4·10^-7	1,14	992	1120	0,86	9156	230	1,13	250	[illegible]	[illegible]
-"-	16:58									close V702			T243 – T708 > 200							[illegible]

T249 – T708 > 20°

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Herschel EQM																		LOGSHEET 1 for COOL DOWN and FILLING		
		Valve Status																	Sign	
Date	Time	V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow g/s	He Dewar S/N D0101	Liquid level Dewar L0101	P701	dewar pressure REMARKS	AIV	QA
30/8/05	17:15									reduce dewar pressure 250mb → 200mb										
	~~17~~									~~open V702~~										
—"—	18:10	O	O	O	O	C	O	C	O	$2,1\cdot10^{-7}$	1,12	985	1090	0,68	9156	205	1,08	215	[signature]	[signature]
—"—	18:30	—	—	—	—	"	—	—	—	$2,0\cdot10^{-7}$	1,09	993	1065	0,87	"	155	1,05	215	[signature]	
—"—	20:00	—	—	—	—	"	—	—	—	$2,0\cdot10^{-7}$	1,08	994	1059	0,89	"	145	1,04	215	[signature]	
—"—	20:30	—	—	—	—	"	—	—	—	$2,0\cdot10^{-7}$	1,08	994	1058	0,90	"	130	1,04	215	[signature]	
—"—	21:00	—	—	—	—	"	—	—	—	$1,9\cdot10^{-7}$	1,08	995	1058	0,91	"	125	1,04	210	[signature]	
—"—	21:20	—	—	—	—	"	—	—	—	activate one way valve									[signature]	
"	21:25					"	—	—	—	stop the transfer, close V0211 at transferline									[signature]	
"	21:30	C	O	O	O	C	O	C	O	close V102									[signature]	
"	21:40	—	—	—	—	"	—	—	—	$2,6\cdot10^{-7}$	0,98	1020	1022	2,6	"	115	1,02	30	[signature]	
31.8.05	6:35	C	O	O	O	C	O	C	O	$5,0\cdot10^{-7}$	/	957	958	0	"	110	/	P101 raw 234 / P701 raw: 442	[signature]	
|	7:00									set dewar pressure 200 mbar, open V102 restart cool down									[signature]	
|	7:15									open V702 → cool down AKT									[signature]	
|	7:18									close V702 → stop cool down AKT									[signature]	
—"—	8:00	O	O	O	O	C	O	C	O	$3,3\cdot10^{-7}$	/	996	1062	0,97	9156	85	/	210	[signature]	
|	8:15									slightly opening of bypass through OBA									[signature]	
|	9:00	O	O	O	O	C	O	C	O	$2,7\cdot10^{-7}$	1,06	996	1056	0,97	9156	70	1,06	200	[signature]	
|	9:30									open V702									[signature]	
|	9:35									close V702									[signature]	
|	10:00	O	O	O	O	C	O	C	O	$2,1\cdot10^{-7}$	1,05	1000	1054	1,05	9156	55	1,05	200	[signature]	[signature]

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Herschel EQM																		LOGSHEET 1 for COOL DOWN and FILLING		
		Valve Status																	Sign	
Date	Time	V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow	He Dewar S/N D0101	Liquid level Dewar L0101	P701 bar	Dewar pressure / REMARKS	AIV	QA
31.8.05	11:00	o	o	o	o	c	o	c	o	$1{,}7\cdot10^{-7}$	1,04	1002	1055	1,09	200	40	1,06		Schl	la
↓	11:44									—	open	V702	—						Schl	lan
	11:50									—	close	V702	—						Schl	la
	11:59									—	close	V1202	—	m dewar = 331 kg				dewar empty, rest: 24 l	Schl	la
	12:45									install new dewar									Schl	la
										# 8074 /450 level high =								m dewar = 383,5 kg ≙ 412 l	Schl	la
	13:00	o	o	o	o	c	o	c	o	$1{,}2\cdot10^{-7}$	1,03	970	8074	0,42		125	1,00	200	Schl	la
	13:30										open	V702							Schl	la
	13:34										close	V702							Schl	la
	14:00	o	o	o	o	c	o	c	o	$1{,}3\cdot10^{-7}$	1,05	1014	1062	0,84	200	130	1,08		Schl	la
	14:36	o	o	o	o	c	o	c	o		.			0,216					Schl	la
	14:35	—	—	—	—	v	—	—	—	decrease of mass flow, decrease of P101									Schl	
	14:55	—	—	—	—	h	—	—	—	Change T103 to T106									Schl	
	15:00	—	—	—	—	h	—	—	—	$1{,}2\cdot10^{-7}$	1,02	978	998	0,63	8074	115	0,93	200	Schl	
	15:38										open	V702			"				Schl	
	15:46										close	V702			"				Schl	la
	16:05	o	o	o	o	c	o	c	o	$1{,}2\cdot10^{-7}$	0,92	986	1008	0,82	"	30	1,02	200	Schl	
	16:30									Turb: A o//									Schl	
	17:00	o	o	o	o	c	o	c	o	$1{,}6\cdot10^{-7}$	0,96	1032	1054	1,75	"	0	1,07	140	Schl	
	17:20										open	V702							Schl	
↓	17:32										close	V702							Schl	

Herschel EQM — **LOGSHEET 1 for COOL DOWN and FILLING**

Date	Time	V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow	He Dewar S/N D0101	Liquid level Dewar L0101	P701	Dewar pressure REMARKS	Sign AIV	Sign QA
31.8.05	18:05	O	O	O	O	C	O	C	O	$2{,}3\cdot10^{-7}$	0,93	1016	1032	1,44	8074	0	1,05	110	JH	
	18:20									close V102, remove dewar						m dewar = 387 kg ≤ 80 l			JH	
										new dewar #8484			mass 3865 kg						JH	
	19:05										open V102, restart filling								Hde	
	19:20	O	O	O	O	C	O	C	O	$2{,}2\cdot10^{-7}$	0,93	1006	1022	1,23	8484	375		new dewar 190 mbar	Ju	
	19:45									open V702									Hde	
	19:55									close V702										
	20:00	O	O	O	O	C	O	C	O	$2{,}2\cdot10^{-7}$	0,91	984	1005	1,02	-"-	355	1,02	180	Ju	
	20:30	———			"	———				$9{,}8\cdot10^{-8}$	0,88	975	983	0,58	-"-	275	1,00	220	Ju	
	21:00	———			"	———				$9{,}5\cdot10^{-5}$	0,88	982	991	0,76	-"-	165	1,010	220	Ju	
	21:01									stop LHe transfer, retract transferline, close SV121									Ju	
	21:10	C	O	O	O	C	O	C	C	close V102, activate one way valve								close OR bypass valve	Ju	
	21:45	———			"	———				$1{,}2\cdot10^{-7}$	0,95	1040	1050	0,55	/	/	1,07	safety position of SV121	Ju	
																		plug not possible ! → SV121 kept open		
1.9.05	7:15	C	O	O	O	C	O	C	O	$3{,}0\cdot10^{-7}$	0,92	1036	1030	0	/	/	1,04	SV121 function done by JV0621		
	8:15	C	O	O	O	C	O	C	O	$2{,}8\cdot10^{-7}$		1055	1060	0			1,07		B	
	8:50									open V102, restart cool down / filling									JH	
	9:10	O	O	O	O	C	O	C	O	$5{,}1\cdot10^{-8}$	0,88	968	974	0,42	8484	[illegible]	0,99	180	JH	Ca
	9:15										liquid in tank (T102 = 4,2K)								JH	Ca
	10:00	O	O	O	O	C	O	C	O	$5{,}1\cdot10^{-8}$	0,88	974	978	0,56	8484	30	0,99	224	JH	Ca
	10:05										open V702								Hde	Ca

7/

Herschel EQM — LOGSHEET 1 for COOL DOWN and FILLING

Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow g/s	He Dewar S/N D0101	Liquid level Dewar L0101	P701 bar	dewar pressure	REMARKS	Sign AIV	Sign QA
19.05	10:22										close V702								≙ ~602 ?	Jdl	
-"-	11:00										close V102			(end of dewar)			m = 338,5 kg		(~384 l entnommen)	Jdl	
-"-	11:10	C	O	O	O	C	O	C	C	6.7·10⁻⁸	0,87	968	955	0,39	8484	0	0,98	0		Jdl	
-"-	12:00	—	—	—	"	—	—	—	—	7,7×10⁻⁸	0,87	967	953	0,376	-"-	-"-	0,98			VD	G
-"-											new dewar # 9158			m = 370 kg			≙ 408 l			Jdl	G
-"-	13:00	←	—	—	"	—	—	—	—	8,6·10⁻⁸	0,87	966	956	0,35	9158	470*	0,98	/	*w/o transfer line	Jdl	G
-"-	13:25										open SV121, V102 → restart filling									Jdl	G
-"-	13:33	C	O	O	O	C	O	O	C		open V702									Gu	G
-"-	13:??	C	O	O	O	C	O	C	C		close V702			0,74						Gu	G
-"-	14:10	C	O	O	O	C	O	C	C	6,3×10⁻⁸	0,89	1002	1004	0,87	9158	70	1,02				G
-"-	15:00	C	O	O	O	C	O	C	C	8,4×10⁻⁸	0,89	1012	1032	1,34	-"-	-"-	1,03				G
-"-	15:05	C	O	O	O	C	O	O	C	—	open V702										G
-"-	15:13	C	O	O	O	C	O	C	C	—	close V702										G
↓	15:46									—	close SV121									Jdl	G
										—	close V102 end of dewar						m = 330,5 kg ≙ 461			Jdl	G
											new dewar # 8527					373,5					G
-"-	16:07	C	O	O	O	C	O	C	C	1,0×10⁻⁸	0,90	889	955	0,88	8527	855	1,00				G
-"-	16:42	O	O	O	O	C	O	O	C		open V702										G
-"-	16:51										open V702				-"-					Gu	G
-"-	16:55										close V702				-"-					Gu	G
-"-	17:00	O	O	O	O	C	O	C	C	8,6×10⁻⁸	0,90	1006	1008	1,20	-"-	555	1,02				G

Herschel EQM																		LOGSHEET 1 for COOL DOWN and FILLING		
		Valve Status																	Sign	
Date	Time	V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow	He Dewar S/N D0101	Liquid level Dewar L0101	P701 bar	dewar pressure REMARKS	AIV	QA
1.9.05	18:00								stop	transfer from dewar, close V102, bring SV121 in "safe state"									[signature]	
↓										install one-way valve										
	18:15	C	O	O	O	O	O	C	C"	1,2·10⁻⁷	0,93	1037	1042	0,51	8527	300	1,05	15		
2.9.05	6:10	—		:		—				9,2·10⁻⁸	0,93	1028	1032	0,2	/	/	1,02		[signature]	
	6:45	O	O	O	O	O	O	C	O	open SV121, open V102, bypass one way valve									[signature]	
	6:53									open V702									[signature]	
	6:48									close V702									[signature]	
	7:00	O	O	O	O	O	O	C	O	6,9·10⁻⁸	0,93	986	998	0,78	8527	225	1,02		[signature]	
	7:48									open V702									[signature]	
	7:51									close V702				m					[signature]	
	8:00									close V102, close SV121						dewar empty		m = 330kg ≙ 36 l	[signature]	
	8:15	C	O	O	O	O	O	C	O	7,9·10⁻⁸	0,87	976	/	0,48	/	/	0,99	/	[signature]	
	9:00									open V102, open V702, close V104								(cool down AXT from HTT)	[signature]	
	9:05	O	C	O	O	O	O	O	O	8,9·10⁻⁸	0,87	970	/	0,33	/	/	0,98	/ due to no LHe available	[signature]	
										now dewar			8073 = 387 kg			(488 l ?)			[signature]	
	9:55									open V104, close V702, close V102									[signature]	
	10:11									open V102, start LHe transfer									[signature]	
	10:20										open	V702							[signature]	
	10:22										close	V702							[signature]	
	11:00	O	O	O	O	O	O	C	O	8,7·10⁻⁸	0,9	1000	1002	0,98	8073	defekt	1,00	202	[signature]	[signature]
↓	11:12										open V702								[signature]	[signature]

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Herschel EQM																	LOGSHEET 1 for COOL DOWN and FILLING			
Date	Time	Valve Status								P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow	He Dewar S/N D0101	Liquid level Dewar L0101	P701	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121					mf					AIV	QA
2.9.05	11:31										close	V702								
-"-	12:10	O	O	O	O	O	O	C	O	1,2×10⁻⁷	–	1026	1030	1,516	8073	1810	1,03	200 mbar		[illegible]
-"-	12:53										open V702								[illegible]	
-"-	13:03										close V702								[illegible]	
-"-	13:05	O	O	O	O	O	O	C	O	1,4·10⁻⁷	/	1045	1050	1,85	8073	1810	1,05	200 mbar	[illegible]	[illegible]
2.9.05	14:10	O	O	O	O	O	O	C	O	1,2×10⁻⁷	0,43	1023	1032	1,47	-"-	1810	1,03	170 mbar	[illegible]	[illegible]
-"-	14:40										open V702								[illegible]	[illegible]
-"-	14:50										close V702								[illegible]	[illegible]
-"-	15:00										close	V102,	end	of dewar			m=	3295 l ≘ 26 h	[illegible]	[illegible]
-"-	15:05											one	-way	valve	installed				[illegible]	[illegible]
-"-	16:00	C	O	O	O	O	O	C	C	1,7×10⁻⁷	/	1030	1032	–	–	–				[illegible]
3.09.05	17:30		—		·		—			1,7×10⁻⁷	–	1030	1030	112 mg/s	–	–	–	NCR: 1415 SV 121	[illegible]	
"	17:50		—		·		—			1,6×10⁻⁷	–	1030	1030	112	–	–	–	Closed OBA Bypass	[illegible]	
"	18:10		—		·		—			1,7×10⁻⁷	–	1030	1030	115	–	–	–		[illegible]	
4.9.05	9:30		—		·	·	—			9,5×10⁻⁸	–	1026	1030	95				start [illegible]	[illegible]	
5.9.05	7:10		—		·	-	—			7,3·10⁻⁸	–	1030	1030	83	-	–	-		[illegible]	
-"-	9:30		—		·		—			9,3·10⁻⁸	/	1020	1024	82 mg/s	/	/	1,01	/	[illegible]	
-"-	13:35								close	SV121,		remove	one	-way	valve				[illegible]	
-"-										new	dewar	9156;		mass	380,5 kg	≘	484 l		[illegible]	[illegible]
-"-	13:48									open	V102,		re-start	filling					[illegible]	[illegible]
-"-	14:00	O	O	O	O	C	O	C	O	1,4·10⁻⁸	0,95	917	976	365	9156	605	0,98	200		[illegible]

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Herschel EQM — **LOGSHEET 1 for COOL DOWN and FILLING**

Date	Time	V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow mg/l	He Dewar S/N D0101	Liquid level Dewar L0101	P701	dewar pressure REMARKS	Sign AIV	Sign QA
5.9.05	14:07											open V702							[signature]	[signature]
↓	14:16											close V702			9156				[signature]	[signature]
	15:00	0	0	0	0	pt.	0	c	0	1,1·10⁻⁸	/	965	967	327	[illegible]0	170	0,96	200	[signature]	[signature]
	15:30										open V702								[signature]	[signature]
	15:31										close V702								[signature]	[signature]
	16:00	0	0	0	0	c	0	c	0	6,9·10⁻⁸	/	981	990	746	9156	75	0,98	200	[signature]	[signature]
	16:40										open V702								[signature]	[signature]
	16:45										close V702								[signature]	[signature]
	17:05	0	0	0	0	c	0	c	0	9,2x10⁻⁸	/	988	1004	1,118	-1-	-0-	0,98	-"-	[signature]	[signature]
	17:10											close V102, close SV121, end of dewar m=330kg ≙ ~80 l							[signature]	[signature]
↓	17:30											install one-way valve							[signature]	|
														9/1						|
6.7.05	7:00	—	—	—	.	.	—	—	—	9,1x10⁻⁸	/	1017	1018	1,05	/	/	/		[signature]	[signature]
↓	8:30										remove one-way valve, open SV121, open V102								[signature]	[signature]
											new dewar #8484				m = 389 kg ≙ 480 l ?				[signature]	|
	8:40											open V702							[signature]	|
	[illegible]:54											close V702							[signature]	|
	9:00	0	0	0	0	0	0	C	0		/				8484		/	180 mbar	[signature]	|
↓	10:00	0	0	0	0	0	0	c	0	9,2x10⁻⁸	/	982	994	0,82	-"-	130	0,97	230	[signature]	[signature]
	10:31											close V702							[signature]	[signature]
	10:44											close V702							[signature]	[signature]

Herschel EQM **LOGSHEET 1 for COOL DOWN and FILLING**

Date	Time	Valve Status								P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow	He Dewar S/N D0101	Liquid level Dewar L0101	P 701	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121										AIV	QA
6.9.05	11:10	0	0	0	0	0	0	C	0	9,8·10⁻⁸	–	1001	1008	1,2	8484	50	0,99		[signature]	[signature]
↓	11:45										close V102, SV121			end of dewar			m= 341 kg ≙ ~96 l		[signature]	[signature]
											new dewar				m= 327,5 kg ≙ 468 l				[signature]	[signature]
	13:00	C	0	0	0	0	0	C	[illegible]	9,9·10⁻⁸	–	962	954	0,329	9158	585	0,94		[signature]	[signature]
	13:40										open SV121, open V102 restart filling								[signature]	[signature]
	14:10	0	0	0	0	0	0	C	0	8,7·10⁻⁸	–	976	986	0,69	9158	445	0,97		[signature]	[signature]
↓	15:05	—	—	—	x	—	—	—	—	1,0×10⁻⁷	–	988	1000	1,516	9158	150	0,98	180	[signature]	[signature]
	15:48	0	0	0							open V702								[signature]	[signature]
	15:52										close V202								[signature]	[signature]
	16:00	0	0	0	0	PO	0	C	0	1,0·10⁻⁷	–	1000	1004	1,224	9158	60	0,99	180	[signature]	[signature]
	17:00	0	0	0	0	PO	0	C	0	1,1·10⁻⁷	–	993	995	1,084	9158	0	0,98	140	[signature]	[signature]
↓	17:15										close V102, SV121 in safety position, one-way valve installed								[signature]	[signature]
7.9.05	7:40	C	0	0	0	0	0	C	C		–				–	–	0,99	– m dewar = 3305 kg	[signature]	[signature]
	9:05	C	0	0	0	0	0	C	C					0,54	–	–	0,59	≙ 92 l	[signature]	[signature]
↓	13:15	C	0	0	0	0	0	C	C	1,1×10⁻⁷	–	1102	950	–	–	–	0,99	(8527 845 not installed)	[signature]	[signature]
											NEW dewar 8527				m= 382 kg			≙ 488 l	[signature]	
	13:50	0	0	0	0	0	0	C	0		open SV121, open V102								[signature]	[signature]
	14:00									2,3×10⁻⁷	1,02	974		0,65	8527	710	0,96	205	[signature]	[signature]
	14:15										open V702								[signature]	[signature]
	14:30										T707 = 4,3 K ⇒ start filling of ACT								[signature]	[signature]
↓	15:15	0	0	0	0	0	0	0	0	5,7·10⁻⁸	–	1005	1011	1,307	8527	445	0,99	150	[signature]	[signature]
	16:00	0	0	0	0	0	0	0	0	5,5·10⁻⁸	–	1004	1010	1,299	8527	200	0,99	180	[signature]	[signature]

Herschel EQM																	LOGSHEET 1 for COOL DOWN and FILLING			
Date	Time	Valve Status								P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow	He Dewar S/N D0101	Liquid level Dewar L0101	P701	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121										AIV	QA
7.9.05	17:00	C	O	O	O	O	O	C	C	close	V702	V102	SV121	end	of dewar	8527		m = 330 kg ≙ 72 l	[illegible]	[illegible]
" –	17:25	—	—	—	—	—	—	—		6,8x10^-8	0	1000	955	925			0,99		[illegible]	[illegible]
													1016		8073				[illegible]	[illegible]
	19:10	C	O	O	O	O	O	C	C		–	1016	~~996~~	16,1 mg/s	/	/	1,00		[illegible]	[illegible]
8.9.05	7:05	C	O	O	O	O	O	C	C	1,2·10^-7	—	1018	1018	56 mg/s	—	—	—	15,7 mg/s	[illegible]	[illegible]
	9:35	—	—	—	—	—	—	—			on ~~way val~~			15,7	→ one	way valve		removed 472 l	[illegible]	[illegible]
	9:40										open	SV121,	V102	→ restart	filling			new dewar 8073 m = 385 kg	[illegible]	[illegible]
	10:00	O	O	O	O	O	O	C	O	2,8·10^-7	1,07	994	1002	971	—	8073	0,98	215	[illegible]	[illegible]
	10:42										open	V702								[illegible]
	10:49										close	V102	→ fill	only	AKF					[illegible]
	11:00									AKF	fill	→	open	V102,	close	V702		LL1 = 62,1 cm, LL2 = 62,4 cm		[illegible]
	11:02	O	O	O	O	O	O	C	O	1,2·10^-7	–	994	1006	1,16	8073	/	1,01	180	[illegible]	[illegible]
	12:00	—	—	—	—	—	—	—	—		–	1000	1006	1,12	8073	/	0,99	180	[illegible]	[illegible]
	13:00	—	—	—	—	—	—	—	—	9,6·10^-8	/	1000	1004	1,11	8073	/	0,98	180 LL1 = 62,1 cm, LL2 = 62,4 cm	[illegible]	[illegible]
	14:00	—	—	—	—	—	—	—	—	1,2·10^-7	—	1020	1028	1,5	8073	/	1,01		[illegible]	[illegible]
	14:25										close	V102,	SV121	→ end	of dewar					
	14:40										install	one	way	valve						
	15:00	C	O	O	O	O	O	C	C	1,1x10^-7	0	1010	955				1,00			[illegible]
	16:30	C	O	O	O	O	O	C	C	1,1·10^-7	—	1014	953	10 mg/s	—	—	1,0		[illegible]	
	17:15									1,2x10^-7	1050			0						[illegible]
	18:35	C	O	O	O	O	O	C	C	1,1·10^-7	—	1011	1016	16,9	/	/	1,003	LL1 = 61,9 cm LL2 = 62,3 cm	[illegible]	[illegible]

Liquid level AKF:
LL1 51,9 cm
LL2 52,0 cm
≙ 74,2 %

Herschel EQM																		LOGSHEET 1 for COOL DOWN and FILLING		
Date	Time	Valve Status								P901 mbar	P101 mbar	P501 mbar	P0621 mbar	Mass flow	He Dewar S/N D0101	Liquid level Dewar L0101	P701	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121										AIV	QA
9.9.05	7:20	C	O	O	O	O	O	C	C	$1{,}2 \cdot 10^{-7}$	/	1015	1016	22,7	/	/	1,001	LL1: 60,0cm, LL2: 60,4cm	Schl	G
	11:00	C	O	O	O	O	O	C	C	$1{,}4 \times 10^{-7}$		1015					1,02			G
	13:00	—	—	—	〃	—	—	—		$1{,}9 \cdot 10^{-7}$	/	1015	1016	24,7	/	/	1,00	LL1: 59,1cm, LL2: 59,4cm	Schl	G

He II Production

Doc. No: HP-2-ASED-TP-0072
Issue: 1
Date: 28.07.05
File: HP-2-ASED-TP-0072_1.doc

Herschel EQM																		LOGSHEET 1 for He II Production in AXT		
Date	Time	Valve Status								P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	Mass flow via shields mg/s	AXT LL1 cm	AXT LL2 cm	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121										AIV	QA
9.9.05	13:30	C	O	O	O	O	O	C	C	2.1·10⁻⁷	1.00	1019	1016	1016	22.2	59.0	59.4		[illegible]	[illegible]
"	13:37									close	V105	→	13:42		start	pumping			[illegible]	[illegible]
"	14:00	C	O	C	O	O	O	C	C	1.0·10⁻⁷	0.24	1017	1014	210	18.5	/	/		[illegible]	[illegible]
"	14:30		—	—	"		—			1.1·10⁻⁷	0.10	1016	1014	86	16.8	/	/		[illegible]	[illegible]
"	15:00		—	—	"		—			1.4·10⁻⁷	0.06	1016	1014	54	17.0	/	/		[illegible]	[illegible]
"	15:30		—	—	"		—			1.3·10⁻⁷	0.04	1017	948	28	19.4	/	/		[illegible]	[illegible]
"	16:00		—	—	"		—			1.5·10⁻⁷	0.03	1016	948	20.4	20.6	39.0	39.0		[illegible]	[illegible]
"	18:30		—	—	"		—			1.7·10⁻⁷	0.01	1015	1012	5.6	19.1	/	/		[illegible]	[illegible]
10.9.05	13:10	—	—	—	"	—	—	—		1.6·10⁻⁷	0.00	1018	1016	3.5	21.2	36.5	36.3		[illegible]	
"	17:00	—	—	—	"	—	—	—		1.6·10⁻⁷	0.00	1018	1015	3.5	22.6	—	—		[illegible]	
11.9.05	8:45	—	—	—	"	—	—	—		1.4·10⁻⁷	0.01	1017	1015	3.7	25.5	35.3	35.1			
"	16:50	—	—	—	"	—	—	—		1.3×10⁻⁷	0.01	1017	1015	3.7	25.6	—	—		[illegible]	
12.9.05	6:40	—	—	—	"	—	—	—		1.3·10⁻⁷	0.01	1019	1016	3.8	25.2	—	—		[illegible]	
	8:10	—	—	—	"	—	—	—		1.4·10⁻⁷	0.01	1017	1016	3.8	24.3	33.7	34.0		[illegible]	
	9:05									open	SV121,	open		V102	→ start	refilling		HIT dewar 915 g	[illegible]	
	"	O	O	C	O	O	O	C	O									m = 370,5 kg ≙ 476 l	[illegible]	
	9:30	—	—	—	"	—	—	—		2.8·10⁻⁷	0.01	973	986	4.0	528	—	—	250 mbar, 580 mm	[illegible]	
	10:00	—	—	—	"	—	—	—		1.0·10⁻⁷	0.01	915	976	4.0	425	—	—	200 mbar, 510 mm	[illegible]	
	11:00	—	—	—	"	—	—	—		8.7·10⁻⁸	0.01	999	1004	4.0	1061	—	—	200 mbar, 145 mm → 10 mbar	[illegible]	
	12:00	—	—	—	"	—	—	—		9.4·10⁻⁸	0.01	994	995	3.9	969			150 mbar, 75 mm → 200 mbar	[illegible]	
	12:15									set	H20h	to	1W						[illegible]	

Herschel EQM — LOGSHEET 1 for He II Production in AXT

Date	Time	V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	Mass flow via shields mg/s	AXT LL1 cm	AXT LL2 cm	REMARKS	Sign AIV	Sign QA
12.9.05	13:00	O	O	C	O	O	O	C	O	$2.0 \cdot 10^{-7}$	0.01	996	996	5.9	978	33.3	34.0	dewar 9158, 200 mbar, 40cm	[signature]	
	13:45									close V102, SV121, end of dewar m = 329.5 kg ≙ 84 l									[signature]	
										new dewar 9156 m = 379.5 kg ≙ 476 l									[signature]	
	14:50									open SV121, open V102 → restart filling, UTF 20 mbar, 620mm									[signature]	
	15:05	O	O	C	O	O	O	C	O	$3.3 \cdot 10^{-7}$	0.02	978	981	9.0	594	32.[illegible]	33.2	200 mbar, 595mm	[signature]	
	16:08									close transfer line, close V102, open V702									[signature]	
	16:10									open transfer line → start filling of AXT									[signature]	
	16:22									close transfer line, close V702, open V102 → open transfer line → restart UTF [illegible]									[signature]	
	16:45									close transfer line, close V102 → SV121 in safety position									[signature]	
	17:00	C	O	C	O	O	O	C	C	$1 \cdot 10^{-7}$	0.04	972	971	27	471	39.4	39.2		[signature]	
13.9.05	6:50	—	—	—	"	—	—	—	—	$27 \cdot 10^{-7}$	0.00	1022	1018	3.4	??.1*	—	—	* investigations:	[signature]	
	7:40															36.3	36.1	open V102 → no change	[signature]	
	7.45									start H701 with 0.77 W								change flow-meter → no change	[signature]	
	8:50									H701 re-started with 0.451 W								close V102, remove one-way valve → flow increases significantly	[signature]	
																			[signature]	
																			[signature]	
	10:00	C	O	C	O	O	O	C	C	$2.2 \cdot 10^{-7}$	0.01	911	912	5.1	104	36.1	35.9		[signature]	
	12:55	—	—	—	—	"	—	—	—	$1.9 \cdot 10^{-7}$	0.01	970	966	6.5	24.9	35.6	35.4		[signature]	
	13:00									reduce H701 to 0.[illegible] W									[signature]	
	15:00	—	—	—	—	"	—	—	—	$1.8 \cdot 10^{-7}$	0.01	969	966	5.5	24.0	35.2	35.0			
	15:35									open SV121, V102 → restart filling of AXT										

Herschel EQM																	LOGSHEET 1 for He II Production in AXT			
		Valve Status																Sign	
Date	Time	V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	Mass flow via shields mg/s	AXT LL1 cm	AXT LL2 cm	REMARKS	AIV	QA
	16:19									close transfer line, close V102, open V202									[illegible]	
	16:20									open transfer line → start refilling of AXT									[illegible]	
	16:52									close transfer line → open transfer-line, V102									[illegible]	
	18:20									close transfer line, close V102, SV121 in safety position, install one-way									[illegible]	
	18:25									start H701 with 0.177W						54,3			[illegible]	
14.9.05	8:15									increase of heater power to 0,5 W H701									[illegible]	
–"–	8:45									3,5·10^-7	0,01	1024	1020	5,0	3	48,4	48,4		[illegible]	
–"–	8:55									Remove one way valve (transfer)									[illegible]	
"	10:30									change heater power H701 to 0,4 W (after SCOE Reset)									[illegible]	
"	11:10									change heater power H701 to 0,5 W									[illegible]	
"	11:17									2,4·10^-7	0,01	975	972	5,6	40,2	48,1	48,1	H701 = 0,451 W	[illegible]	
"	13:15									change heater power H701 0,3 W								H701 = 0,266 W	[illegible]	
"	13:40									2,3·10^-7	0,01	974	970	6,2	35,2	47,7	47,7		[illegible]	
"	14:30									change heater power H701 to 0,4 W (T237 6,04K)									[illegible]	
"	15:53									2,4·10^-7	0,01	972	[illegible]	5,9	32,7	47,3	47,2		[illegible]	
"	18:15									change heater power H701 to 0,3 W									[illegible]	
"	18:31									2,3·10^-7	0,01	970	976	5,5	29,3	46,8	46,8	activate one way valve	[illegible]	
"	18:36									activate one way valve									[illegible]	
15.09.05	8:10									increase heater power H701 to 0,5 W									[illegible]	
"	8:36									3,2·10^-7	0,01	1026	1022	5,7	13,2	44,9	44,8		[illegible]	
"	10:05									3,0·10^-7	0,01	1026	1022	6,3	13,7	44,7	44,6		[illegible]	

Herschel EQM																		LOGSHEET 1 for He II Production in AXT		
Date	Time	Valve Status								P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	Mass flow via shields mg/s	AXT LL1 cm	AXT LL2 cm	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121										AIV	QA
15.09.05	12:00									change heater power H701 to 0,4W									[signature]	
"	13:20									$3,0\cdot10^{-7}$	0,01	1025	1022	6,4	14,5	44	43,9		[signature]	
"	16:40									change heater power H701 to 0,3W									[signature]	
"	17:15									change heater power H701 to 0,2W									[signature]	
"	17:35									$3,0\cdot10^{-7}$	0,01	1022	1020	5,9	14,3	43,2	43,1		[signature]	
"	17:40									schwitch off H701									[signature]	
16.09.05	7:40	C	O	C	O	O	O	C	C	$3.0\cdot10^{-7}$	0.01	1018	1016	3.8	28.5	42.1	42.0		[signature]	
	7:50									switch on H103 → 10.37 W ! → switch off H103								} NCR	[signature]	
	7:52									switch on H104 → 8.87 W ? → switch off H104									[signature]	
	7:55									switch on H101 → 10.77 W o.k. → switch off H101								~~NCR~~	[signature]	
	7:57									switch on H102 → 10.09 W o.k. → switch off H102										
	8:00									switch on H701 with 0.5 W (447mbar)										
	11:00									script for H101 started (2 min on / 10 min off)										
	11:35									script H201 with (2 min on / 5 min off), H701 to 0.4W										
	11:25									start cont. flushing										

Herschel EQM — **LOGSHEET 1 for COVER FLUSHING**

Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	AxT LK1 cm	REMARKS (cc pressure)	Sign AIV	Sign QA
16.9.05	18:15	c	o	c	o	o	o	c	c	/								40.5			
17.9.05	17:15	c	o	c	o	o	o	c	c	$4.2\cdot10^{-7}$	0.00	1050	1048	3.3	8527	~~8527~~	122	39.7	in average 955 mbar	[signature]	[signature]
18.9.05	14:20	c	o	c	o	o	o	c	c	$4.4\cdot10^{-7}$	0,01	1054	1060	3,4	–	–	110	38.2	960 mbar	[signature]	[signature]
19.9.05	7:30	—	—	—	—	—	—	—		$4.4\cdot10^{-7}$	0.01	1051	1053	3.4	–	–	124	37.1	959 mbar	[signature]	[signature]
	[illegible]									start cover flushing by opening dewar valve										[signature]	[signature]
	18:40									start H701 with 0,2W									42 42,4 tilting 19°	[signature]	[signature]
20.9.05	7:35	—	—	—	"	—	—	—		$9.6\cdot10^{-7}$	0.01	/	1052	4.8	8527	565	122	32.2	dewar 25 mbar 960 mbar	[signature]	[signature]
	9:15									switch off H701											[signature]
-"-	13:10			–	"	–					9∞			3,2			121				[signature]
"	18:45	—	—	—	"	—	—	—	—	$8,2\cdot10^{-7}$	0,00			3,3	/	/	177		96 mbar	[signature]	[signature]
21.9.05	7:40	—	—	—	"					$6.0\cdot10^{-7}$	0.01	/	1050	4.6	8527	36	124	30.4/40.0	∢23° 96 mbar	[signature]	[signature]
	7:50										H701 off										[signature]
22.9.05	7:45		—	—	"		—	—		$6.6\cdot10^{-7}$	0.01	/	1048	3.4	8527	160	125	29.6/39.0	∢23° 958 mbar	[signature]	[signature]
	7:50										start H701 with 0.4W										[signature]
	14:10										stop H701			3,8							[signature]
	17:00			—	"	—				$5,7\cdot10^{-7}$				3,8			128	—			[signature]
	19:20										start H701 with 0,2W								∢2 ~~957 mbar~~		
23.9.05	7:25	—	—	—	"	—	—	—		$7.3\cdot10^{-7}$	0.01	/	1050	4.8	8527	170	125	27.8/34.6	∢23 957 mbar	[signature]	[signature]
	7:30										switch off H701								dewar #8073 : 382,5kg	[signature]	[signature]
	13:55									open SV121, open V102 → start filling of AXT									≙ 482 l	[signature]	[signature]
	15:40									close V102, open V702 → start filling of AXT										[signature]	[signature]

dewar #8527 : 331,5kg ≙ 78 l

Herschel EQM — **LOGSHEET 1 for COVER FLUSHING**

Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	AXT LL	REMARKS (c.c. pressure)	Sign AIV	Sign QA
23.9.05	11:10									Close V702, open V102											G
	16:17									close V102, SV121 in safety position							353kg ≙ 216 l				G
	16:37																	48.8/53.9	∢23°		G
										~~H702~~ H701 control with 2/6 started											
24.9.05	17:10	C	O	C	O	O	O	C	C	$6.7\cdot10^{-7}$	0.01	/	1046	3.4	8073		122	41.3/[illegible]	∢23° 956mbar	[illegible]	G
25.9.05	18:20	C	O	C	O	O	O	C	C	$2.9\cdot10^{-6}$	0.01	/	1025	3.6	8073		47	40.2/[illegible]	∢23° 953mbar	[illegible]	G
26.9.05	7:25	—	—	—	—	—	—	—	—	$6.6\cdot10^{-7}$	0.01	/	1045	4.9	"		108	39.1/53.1	∢23° 957mbar	[illegible]	G
"	7:30									increase H702 to 0.8W (0.252W)										[illegible]	G
"	9:30									increase H702 to 0.4W (0.346W)										[illegible]	G
	10:40									increase H702 to 0.5W (0.433W)										[illegible]	G
	13:10									restart H701 to 0.4W (0.363W)										[illegible]	G
27.9.05	7:35	—	—	—	—	—	—	—	—	$7.4\cdot10^{-7}$	0.01	/	1051	6.0	8073	/	115	36.3/53.1	∢23° dewar 80mb 961mbar	[illegible]	G
	7:45									→ reduce H701 to 0.3W (0.268W)										[illegible]	
	11:36									Close valve to the pump I → stop pumping at AXT										[illegible]	
	11:40									increase H701 to 1.5W, switch on H702 with 1,5W										[illegible]	
	16:50									increase H701 to 10W										[illegible]	
	17:00									increase H702 to 10W										[illegible]	
	17:20									end of dewar 8073							m= 3295kg ≙ 28 l			[illegible]	
	19:30									switch off H701 and H702								dewar # 9156: m= 881,5kg ≙ 488 l		[illegible]	
28.9.05	7:30	—	—	—	—	—	—	—	—	$2.6\cdot10^{-7}$	1.01	/	1027	1025	9156	945	147*	36.6/55.7	∢23° 970mb	[illegible]	
										start H701 with 0.3W (0.27W)											

* +AXT

Herschel EQM																			LOGSHEET 1 for COVER FLUSHING		
Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s		REMARKS	Sign AIV	QA
																			CC pressure		
28.9.05	20:20	C	O	C	O	O	O	C	C	1,1·10⁻⁷	0,01	/	1050	/	/	/	117	26,0 / 29,3	< 23° 971	[illegible]	
29.9.05	7:25	—			—					5.5·10⁻⁷	0.01	/	1048	5.5	9156	930	120	24,4 / 26,5	< 23° 968	[illegible]	
	7:30										increase H701 to 0.4W (0,318W)										
	7:45									start cover flushing											
	18:50										decrease H701 to 0,3W										
30.9.05	7:20	—			—					2.8·10⁻⁷	0.01	/	1012	5.4	9156	280	120	21,6 / 19,0	< 23° 962	[illegible]	
	17:50									switch off H701, H101 and stop cover flushing										[illegible]	
02.10.05	18:45	—			—					3.0·10⁻⁷	0.01	/	1020	3.7	9156	145	23.5	18,7 / 18,4	< 23° 956	[illegible]	
04.10.05	7:25	—			—					2.9·10⁻⁷	0.01	/	1023	3.9	9156	140	25.8	17,2 / 8,3	< 23° 956	[illegible]	
05.10.05	7:40	—		"	—					2.9·10⁻⁷	0.01	/	1024	3.9	9156	140	24.9	18,3 / 8,4	< 23° 958	[illegible]	
								activities according HP-2-ASED-SD-0058:												[illegible]	
								subsequent leak test while pumping, warming AXT, evacuating AXT ...												[illegible]	
06.10.05	7:40	C	O	C	O	O	O	C	C	2,5·10⁻⁷	0.00	/	1040	0,5	9156	/	430	0	< 23° 958	[illegible]	
~~7.10.05~~										activities according HP-2-ASED-SD-0058										[illegible]	
7.10.05	7.45	C	O	C	O	O	O	C	C	7.1·10⁻⁶	0.00	/	1030	0.4	9156	/	238	0	< 23° 958	[illegible]	
8.10.05	15:47	C	O	O	C	O	O	C	C	6,1·10⁻⁸	0,0	/	/	4,1	9156	/	/	0	< 23° 957	[illegible]	
8.10.05	14:40	—			—					1,4·10⁻⁷	0,0	/	/	0,4	9156	/	/	0	< 23° 955	[illegible]	
9.10.05	14:30	—			—					1,1·10⁻⁶	0,0	/	/	0,4	9156	/	/	0	< 23° 961	[illegible]	
"										activities according HP-2-ASED-SD-0058										[illegible]	
"	17:50	C	C	O	C	O	O	C	C		0,0	/	/		/	/	/	/		[illegible]	
10.10.05	7:20	—			—					2,8·10⁻⁶	0,0	/	/	0.4	/	/	/	/	< 23° 962	[illegible]	

7.10.05 dewar # 8484 385,5kg
for tanks filling

Doc. No: HP-2-ASED-TP-0091
Issue: 1.0
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Herschel EQM																			LOGSHEET 1 for COVER FLUSHING		
Date	Time	Valve Status								P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s		REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121										CC premi…	AIV	QA
10.10.05	17:45	O	O	C	O	O	O	C	O	1.1·10^-5	0,00	/	1020	0.4	/	/	/		<23° 962	Jdl	
	17:50										close V102									Jdl	
11.10.05	7:45	C	O	C	O	O	O	C	O	1.1·10^-5	0,00	/	1016	0.3	/	/	/		<23° 952	Jdl	
	9:39										close V502									Jdl	
	9:48										close JV121									Jdl	
	9:45										open V105 → evacuate HST									Jdl	
										see HP-2-ASED-JD-0058										Jdl	
12.10.05	7:35	C	O	O	C	O	O	C	C	1.1·10^-6	0.00	/	/	0.5	/	/	/	/	<23° 958	Jdl	
13.10.05	7:35	C	C	C	C	O	O	C	/	1.5·10^-6	0.00	/	/	0.3	/	/	/		<23° ~~see 10-0058~~ 956	Jdl	
14.10.05	7:15	O	O	C	O	O	O	C	O	remove one way valve, increase dewar pressure										Jdl	
	7:20	—	—	—	—	—	—	—		3.6·10^-7	0,00	/	918	0.3	8484	100	0.08		<23° 962	Jdl	
~~15.10.05~~	~~17.35~~	O	O		14.10.						activities according HP-2-ASED-JD-0058									Jdl	
15.10.05	17:35	O	O	O	O	O	C	C	O	4.1·10^-8	1,00	/	1030	0.7	/	/	0.12		<23 964	Jdl	
											see HP-2-ASED-JD-0058									Jdl	
	19:20	C	O	O	O	O	C	C	C											Jdl	
17.10.05	7:25	—	—	—	—	—	—	—	—	4.4·10^-8	1,00	/	/	0.8	/	/	9.8 mg/s		<23° 962	Jdl	
	9:50										open JV121, open V102 → restart cooldown									Jdl	
												with dewar #9158 371.5 kg ≙ 42 l								Jdl	
	11:20								close dewar, close JV121, close V102											Jdl	
		C	O	O	C	O	C	C	C			close V502								Jdl	
	11:30										open V701 → pump down AKT and OTT									Jdl	

Herschel EQM																			LOGSHEET 1 for COVER FLUSHING		
Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	dewar pressure mbar	REMARKS	Sign AIV	QA
18.10.05	7:35	C	O	O	C	O	O	C	C	5.5·10⁻⁸	0.01	/	/	7.2	9158		0		≮23° 910	[signature]	
										~~open [illegible]~~1 close V104, close V701, close V105, open JV121 ⇒ open V702, V105 ⇒ open V502										[signature]	
	13:45	C	C	%	O	O	%	O	O	close V105, open V707										[signature]	
	14:20										open V105, open bypass at He pump I									[signature]	
	15:55									end of dewar #9158 329.5 kg ≙ 84 l										[signature]	
	16:10										close V702, retract transfer line, close JV121								LL1=38.9 LL2=61.4	[signature]	
											close V105, close ball valve/needle valve to He I pump									[signature]	
											close bypass at He I									[signature]	
											restart He I pump									[signature]	
											open needle valve to He I pump and start He II production in AXI									[signature]	
	17:06									new dewar #8484, 391 kg → open JV121 → start cooling of										[signature]	
										shields from external dewar										[signature]	
	18:07	C	C	C	O	O	O	C	O	1.9·10⁻⁸	0.05	/	970	26.0	8484	585	195	160	≮23° P101=0.13 959	[signature]	
	18:12										start H702 with 0.2 W (0.119 W)									[signature]	
19.10.05	7:15	C	C	C	O	O	O	C	O	7.1·10⁻⁹	0.01	/	980	5.8	8484	180	584	175	<23° P101=0.15 957	[signature]	
	7:22										increase H702 to 0.4 W								LL1=26.9 LL2=32.1	[signature]	
	7:25										install one-way valve										
	7:26										start cover flushing										
	7:30										increase ~~H~~702 to 0.5 W										
	9:30										reduce H702 to 0.4 W										
	10:00										reduce H702 to 0.3 W										

Herschel EQM																			LOGSHEET 1 for COVER FLUSHING		
Date	Time	Valve Status								P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s		REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121											AIV	QA
20.10.05	7:50	C	C	C	0	0	0	C	0	8,4e-3		—	1018			95	137		Dewar for Cover flushing empty	Sd.	
	8:15									increase H 702 to 0,4										Sd.	
	8:20									increase H 702 to 0,5										Sd.	
	9:45									decrease H 702 to 0,4										Sd.	
	12:00									remove dewar # 9756 (cover flushing)										Sd.	
	12:15									new dewar # 8528 (weight: 372-kg)									h = 610 mm	Sd.	
	12:20									restart of cover flushing (p = 100 mbar)										Sd.	
	12:45									reduce pressure to 80 mbar										Sd.	
	13:40									increase pressure to 100 mbar + opening of transferline valve (½ rot.)										Sd.	
	14:35									reduce H 702 to 0,3 W										Sd.	
	14:40									reduce pressure to 70 mbar, valve to the marked position										Sd.	
	15:10									increase 80 mbar										Sd.	
	16:00									increase H 702 to 0,4 W										Sd.	
	19:00									reduce " 0,3 W / reduce dewar pressure to 70 mbar										Stijn	
21.10.05	8.40									8,4e-3		—				55	115		Dewar for Cover fl.: 75	Sd.	
	9:00									reduce cover dewar pressure to 50 mbar										Sd.	
	14:25									switch off H702										[illegible]	
	14:30									stop cover flushing (blind cap at end of line)										[illegible]	
										Open V702 → start filling of AST										[illegible]	
	14:50									close V702 → end of dewar										[illegible]	
										# 8444, 338,5 kg, Δ = 52,5 kg ≙ 420 l										[illegible]	

Herschel EQM																			LOGSHEET 1 for COVER FLUSHING		
Date	Time	Valve Status								P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	dewar pressure	REMARKS (LL1 / LL2 / Cover pres.)	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121											AIV	QA
21.10.05	16:00	C	C	C	O	O	O	C	O	new dewar # 8527 378,5kg ≙ 460l										[illegible]	
	16.10									open V702 → restart filling of ACT										[illegible]	
	16:33									close V702 → end of ACT filling									LL1 = 50,6 LL2 = 63,9	[illegible]	
	〃																		770 → 2,99 k	[illegible]	
22.10.05	15.15	C	C	C	O	O	O	C	O	3,2·10⁻⁸	0,01	/	1030	3,9	8527	465	76	85	39,6cm 63,9cm 954	[illegible]	
~~[illegible]~~	15.50										→ increase dewar pressure → increase mass flow through shields									[illegible]	
23.10.05	15:30	C	C	C	O	O	O	C	O	8,9·10⁻⁹	0.01	/	1035	4,0	8527	261	230	105	38.1cm 60.6cm 962	[illegible]	
	17.30										start H702 with 0,3W (0,258W)									[illegible]	
24.10.05	7:35	———			→	———				9,8·10⁻⁹	0.01	/	1030	5,5	8527	70	99	80	36,5cm 56,5cm 968	[illegible]	
										→ set dewar (shields) pressure to 110mbar										[illegible]	
	7:50									start cover flushing										[illegible]	[illegible]
	7:55										increase ~~ACT~~ H702 to 0,5W (0,443W)									[illegible]	[illegible]
	10:25										reduce H702 to 0,4W (0,354W)									[illegible]	[illegible]
	11:00										end of dewar									[illegible]	[illegible]
	11:55										new dewar #8074 379,5kg									[illegible]	[illegible]
	14:30										reduce H702 to 0,3W									[illegible]	[illegible]
25.10.05	8:45	———			"	———				8,8×10⁻⁹	0,01	/	1050	5,5	8074	(115)	245			[illegible]	[illegible]
	9:00										increase H702 to 0,4W									[illegible]	[illegible]
	9:20										increase H702 to 0,5W									[illegible]	[illegible]
	9:40										Dewar 8528 changed									[illegible]	[illegible]
	11:45										install new dewar # 9158						300		Liquid level: 635	[illegible]	[illegible]

Herschel EQM																			LOGSHEET 1 for COVER FLUSHING		
Date	Time	Valve Status								P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	cover flushing dewar pressure	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121											AIV	QA
25.10.05	11:45	C	C	C	O	O	O	C	O										Start of cover flushing	[illegible]	[illegible]
	12:10										decrease H702 to 0,4W									[illegible]	[illegible]
	13:30										flow for cover flushing increased (opening of dewar valve by 1/2 rev.)									[illegible]	[illegible]
	13:40										T601/602 below regen. temp. (closing of " 1/4 rev.)									[illegible]	[illegible]
	19:05										decrease H702 to 0,3 W									Sl.	[illegible]
	19:05										decrease flow for cover flushing (closing of dewar valve by 1/8 rev.)									Sl.	[illegible]
26.10.05	7:45	C	C	C	O	O	O	C	O	2,0·10⁻⁸	0,07	/	1002	5,3	9158	310	0	110	+23° 31,4cm 43,4cm 963	[illegible]	[illegible]
	7:55	———			———						increase H702 to 0,4W									[illegible]	[illegible]
27.10.05	7:15	———			———					24·10⁻⁸	0.07	/	984	6,1	9158	70	0	125	+23° 28,4cm 31,3cm 965	[illegible]	[illegible]
	7:45										cover dewar exchanged: #9158 = 344,5kg Δ = 38,5kg ≙ 308 l									[illegible]	[illegible]
											new dewar #8528 = 382kg ≙									[illegible]	[illegible]
	8:15										shield dewar exchange: #8074 = 382 kg ≙ 32 l									[illegible]	[illegible]
											new dewar #8484 = 390,5 kg									[illegible]	[illegible]
	9:12										increase H702 to 0,5W (0,44W)									Sl.	[illegible]
	11:30										increase H202 to 1,0W (0,917W)						238			[illegible]	[illegible]
28.10.05	7:55	———			———					7,0·10⁻⁹	0.07	/	1046	9.1	8528	/	~~47,8~~	110	+23° 23.7cm 22.7cm 963	[illegible]	[illegible]
	8:10										flow through A45 throttled									[illegible]	[illegible]
	9:40										reduce H702 to 0,5W (0,444W)									[illegible]	[illegible]
	9:45										reduce H702 to 0,4W (0,355W)									[illegible]	[illegible]
											throttle valve to pumping unit									[illegible]	[illegible]
	11:10										open valve to pumping unit									[illegible]	[illegible]

Herschel EQM																			LOGSHEET 1 for COVER FLUSHING		
Date	Time	Valve Status								P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	Cover flushing dewar press	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121											AIV	QA
28.10.05	11:15	C	C	C	O	O	O	C	O			increase H702 to 0,6 W (0,556 W)								[signature]	[signature]
	16:15										insert transfer line completely, open V702									[signature]	[signature]
	16:30											mass of cover dewar 380kg (incl. 6kg additional ... + 4 kg transfer line) ⇒ Δ = 12kg/32h								[signature]	[signature]
	"									measured flow through cover ~ 22mg/s										[signature]	[signature]
	16:40										switch off H702									[signature]	[signature]
	16:57										blind cap at cover outlet → stop cover flushing									[signature]	[signature]
	17:50										close V702 → end of refilling AxT LL1 = 28.8 LL2 = 35.3									[signature]	[signature]
29.10.05	15:25	C	C	C	O	O	O	C	O	$4.9 \cdot 10^{-8}$	0.01	r	1024	4.2	8528	760?	56	105	423° 24,5cm 265cm 1077	[signature]	
	15:38									close V502, retract transfer line and close SV121										[signature]	
	15:43										open V105 and pump down tubing via AxT									[signature]	
	16:20										Open V104 to pump down HTT via AxT									[signature]	
	16:25									leak rate increases, isolation vacuum increases → close V104										[signature]	
	16:32										close V105, start laboratory pump in safety unit → open SV121									[signature]	
	16:37										open V104 and pump down HTT via filling port with lab. pump									[signature]	
	16:50										close AxT/OBA tubing to the pump I (ball valve in pumping line)									[signature]	
	16:55										open by pass from V502/flowmeter unit to the pump I and evacuate venting									[signature]	
															line to V502					[signature]	
	17:00										close SV121, open V502 and evacuate HTT with the pump I									[signature]	
	17:54										close V104 (HTT pressure at 0,02 bar)									[signature]	
	18:00									close by pass to flowmeter unit, open SV121 and pressurize tubing from dewar										[signature]	
	18:10										open by pass valve to AxT/OBA and restart pumping with the pump I at AxT									[signature]	

Herschel EQM																		LOGSHEET 1 for COVER FLUSHING			
Date	Time	Valve Status								P901 mbar	P701 mbar	P701 (P504 struck) mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	cover flushing dewar pressure	REMARKS (cover pres.)	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121											AIV	QA
31.10.05	8:10	C	C	C	O	O	O	C	O	2.0·10⁻⁸	0.01	0.04	1014	4.7	8528	575	35	115	K23° 21.7cm 19.0cm 107.6	Schl	
	8:15										close SV121									Schl	
	9:30									end of shield cooling dewar #8484							m=339.5kg		Δ=51kg ≙ 408 l	Schl	
										new dewar #8527						m=380 kg ≙ 472 l				Schl	
	10:25									open SV121 → restart cooling of shields										Schl	
	10:50										open V702 → start re-filling of AxT									Schl	
	11:23										close V702 → end of filling AxT								44.9cm 63.9cm	Schl	
	11:25										continue shield cooling (extend transfer line by 3cm)									Schl	
	12:10										start H702 with 0.3W (0.257W)									Schl	
2.11.05	7:10	C	C	C	O	O	O	C	O	1.3·10⁻⁸	0.01	0.04	1028	5.6	8528	560	95	110	K23° 32.0cm 45.0cm 107.8	Schl	Ca.
	7:25										start cover flushing, increase cover dewar pressure to 140 mbar									Schl	Ca.
	7:27										increase H702 to 0.5 W (0.447W)									Schl	Ca.
	8:40										increase H702 to 0.6W									Schl	Ca.
	8:50					close SV121					end of shield dewar 8527						331.0kg ≙ 80 l		Δ=392 l	Schl	Ca.
											new shield dewar #9156						321.0kg ≙ 488 l			Schl	Ca.
	10:05										open SV121, restart cooling of shields									Schl	Ca.
	16:30	C	C	C	O	O	O	C	O		0.01	0.04		7.2			35.92			SZL	Ca.
	18:35 (local time)										decrease H702 to 0.4 W									SZL	
3.11.05	7:30	C	C	C	O	O	O	C	O	7.6·10⁻⁹	0.01	0.03	1052	6.0	8528	145	145	125	K23° 28.5cm 36.3cm 96.4	Schl	Ca.
	7:40										increase H702 to 0.6W (0.536W), increase shield dewar pressure to 140 mbar									Schl	Ca.
	17:00										end of cover flushing dewar #8528								330kg ≙ 72 l	Schl	

Herschel EQM — **LOGSHEET 1 for COVER FLUSHING**

Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	P101 (P501) mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	Cover flushing dewar (pressure) flow	REMARKS (Cover pres.)	Sign AIV	Sign QA
3.11.05	17:30									new cover flushing dewar #8484 m= 390,5 kg										[illegible]	[illegible]
3.11.05	19:06										reduce H702 to 0,4W								pressure	[illegible]	[illegible]
4.11.05	7:45	c	c	c	o	o	o	c	o	5,7·10⁻⁷	0.01	6.04	1062	6.0	8484	120	166	220	≮23° 24,8cm 26,8cm 957	[illegible]	[illegible]
	7:55										increase H702 to 0,6W					increase shield cooling dewar press. to 150mbar				[illegible]	[illegible]
											cover flushing flow adjusted to ~210 mg/s → ok for testing at <134									[illegible]	[illegible]
	16:40										cover flushing flow re-adjusted to ~180 mg/s ⇒ too low to keep it <134?									[illegible]	[illegible]
5.11.05	15:25	—	—	—	←	—	—	—	—	9,6·10⁻⁹	0,01	0,03	1077	7,1	8484	30	62	280 (235)	≮23° 19,4cm 14,0cm 994	[illegible]	
	15:30										switch off H702									[illegible]	
	16:40										stop cover flushing									[illegible]	
6.11.05	17:40	—	—	—	—	←	—	—	—	2,9·10⁻⁹	0.01	0.04	1030	4,4	8484	0	52	0	≮23° 18,1cm 10,7cm 1029	[illegible]	
	18:00									end of cover flushing dewar #8484 m= 342,0 kg									Δ= 48,5 kg ≙ 388 l	[illegible]	
										~~end~~ new cover flushing dewar #9158 m= 378,5 kg ≙ 476 l										[illegible]	
	19:00	c	c	c	o	o	o	c	c	close V121 + end of shield flushing dewar #9156									m= 327 kg ≙ 56 l	[illegible]	
	19:15										start H702 with 0,5W (0,259W)									[illegible]	
7.11.05	7:00	c	c	c	o	o	o	c	c	3,3·10⁻⁸	0.01	0.05	/	6,1	9158	600	0	0	≮23° 16,3cm 8,6cm 1087	[illegible]	[illegible]
	7:05										increase H702 to 0,6 W (0,537W)									[illegible]	[illegible]
	7:20										start cover flushing with 140 mbar dewar pressure & throttle - valve completely open									[illegible]	[illegible]
	7:40										cover flushing dewar pressure increased to 130 mbar, flow adjusted to 180 mg/s									[illegible]	[illegible]
	10:20									open SV121 → new shield flushing dewar #8527 m= 384 kg ≙ 480 l										[illegible]	[illegible]
	11:12										increase H702 to 0,8W (0,730W)									[illegible]	[illegible]
	14:20										flow through cover increased, through shield reduced									[illegible]	[illegible]

8.11.05 7:30 7,4·10⁻⁸ 0.01 0.05 1030 7.0 9158 110 2g 45? ≮23° 9,4 8,6cm [illegible]
reduce ~~main~~ cover flushing mass flow to ~140 mg/s

Herschel EQM — **LOGSHEET 1 for COVER FLUSHING**

Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	101 P501 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	Cover flushing flow	REMARKS	Sign AIV	Sign QA
8.11.05	8:30	c	c	c	o	o	o	c	o		open V702 → try to refill AXT									Schl	Ca
	8:53										temp in AXT increases → close V702									Schl	Ca
	9:00								close SV121 end of shield flushing dewar # 8527 m= 327 kg ≙ 48 l											Schl	Ca
	9:50										open SV121 new shield flushing dewar # 8074 m= 376,5 kg ≙ 46 l									Schl	Ca
	10:10										open V702 start refilling AXT										Ca
	10:47										close V702 stop refilling of AXT										Ca
	13:40										switch ON H702 (0,4 W)								L1 PACS = 5,5K / L1 SPIRE = 6,2K	Schl.	Ca
	13:50										increase H702 to 0,6 W									Schl.	Ca
	19:00									5.8×10^{-9}											
9.11.05	7:30	c	c	c	o	o	o	c	o	$7.9 \cdot 10^{-9}$	0.01	0.04	1012	7.2	9158	25	[illegible].0	-180	±23° 23.8cm 22.9cm 1098	Schl	
	10:50									end of cover flushing dewar # 9158 m= 329,5 kg ≙ 284 l										Schl	
	11:55									new cover flushing dewar # 8528 m= 383,5 kg ≙ 500 l										Schl	
	14:55									close SV121 → end of shield flushing dewar # 8074 m= 333 kg ≙ 40 l										Schl	
										new shield flushing dewar # 9156 m= 381,5 kg ≙ 492 l										Schl	
	15:55									open SV121 → restart shield flushing										Schl	
	16:15									cover flushing flow increased for PACS straylight test										Schl	
	18:30									Cover flushing (coco) decreased for PACS straylight test										SI.	
	18:45									Valve of cover flushing dewar closed								"		SI.	
	19:00									adjust cover flushing to 100 mg/sec										SI.	
	19:15									decrease H702 to 0.4 W										SI.	
10.11.05	7:15	c	c	c	o	o	o	c	o	$6.7 \cdot 10^{-9}$	0.01	0.04	1059	6.0	8528	560	310	97	±23° 19.1cm 12.2cm 1073	Schl	Ca

Herschel EQM — **LOGSHEET 1 for COVER FLUSHING**

Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	P101 (~~P501~~) mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	Cover flushing flow	REMARKS (LL1 LL1 cover plenum)	Sign AIV	Sign QA
10.11.05	14:10	C	C	C	O	O	O	C	O		stop H702, stop cover flushing, reduce flow through shield									Schl	Q
11.11.05	7:35	—	—	—	—	—	—	—	—	7,8·10⁻⁹	0.01	0.03	1048	3,6	8528	500	172	0	823° 16,9cm 7,0cm /	Schl	Q
	11:23										start H702 with 0,6 W									Schl	Q
	15:00										stop H702, open V702 → start filling of Axt									Schl	Q
	15:20										close V702, close JV121 end → shield flushing dewar #5756 m=330,c kg									Schl	Q
											new shield flushing dewar #8484 m=390 kg									Schl	Q
	16:05										open JV121 → restart shield flushing								823° 21,5cm 18,1cm /	Schl	Q
12.11.05	10:15	C	C	C	O	O	O	C	O	7.0·10⁻⁹	0.01	0.02	1066	3.7	8528	500	407	0	823° 19,8cm 15,0cm /	Schl	
	10:25										open V702 → start filling of Axt									Schl	
	10:55										close V702									Schl	
	12:50										end of shield flushing dewar #8484 m=341,5 kg 0=48,5 kg ≙ 388 l									Schl	
	13:00										new shield flushing dewar #8074 m=389,0 kg ≙ 488 l									Schl	
	13:20										0.02	0.02							26,5cm 56,6cm	Schl	
	18:00									in=100 mbar, shield flushing dewar increased to 110 mbar										Schl	
13.11.05	18:20									7.0·10⁻⁹	0.01	0.02	1080	3.8	8528	490	400	0	823° 347cm 52,0cm /	Schl	
	18:25										start H702 with 0,4 W (0,356 W)									Schl	
14.11.05	7:10									8,9x10⁻⁹	start H702 with 0,6 W (0,536) W									[illegible]	
14.11.05	7:25									8,9x10⁻⁹	—	—		6,1	—	—	25,2mg/s			[illegible]	
	8:30									7,8x10⁻⁹	—	.	1060	6,6	—	—	27,2mg/s			[illegible]	
	10:50											reduce H702 to 0,4 W								Schl	

Herschel EQM — **LOGSHEET 1 for He II Production in AXT**

Date	Time	Valve Status								P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	Mass flow via shields mg/s	AXT LL1 cm	AXT LL2 cm	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121										AIV	QA
15.11.05	7:15											Start	LT702	with	0,6	W			[signature]	
"	7:20									7,6x10⁻⁷	0,2	~~80~~	1060	6,0	166	—	—		[signature]	
"	12:00										0,2	—	1060	6,0	186	—			[signature]	
"	13:30										Change	Damper	for	shield	cooling			560 mm	[signature]	
"	15:15									7,6x10⁻⁹	0,2	—	1040	7,0	320	—	—		[signature]	
"	17:10										switch		LT702	to	0,4	W			[signature]	
16.11.05	7:25	C	C	C	O	O	O	C	O											

See next page

Herschel EQM																			LOGSHEET 1 for COVER FLUSHING		
Date	Time	Valve Status								P901 mbar	P701 mbar	P701 (~~P501~~) mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	Cover flushing flow	REMARKS (Cover pres.)	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121											AIV	QA
16.11.05	7:25	C	C	C	O	O	O	C	O	1,0·10⁻⁸	0.01	0.02	1025	6.0	8528	470	97	0	+23° 26.8cm 32.0cm	[signature]	
〃	7:30										increase shield flushing dewar pressure to 100 mbar									[signature]	
〃	13:30		—	—	〃	—	—	—		9,6x10⁻⁹	—	0,02	1042	6,0	〃	265	163	/		[signature]	
17.11.05	7:30		—	—	〃	—	—	—		9.8·10⁻⁹	0.01	0.02	1030	5.9	〃	460/175	100	0	+23° 23.6cm 23.8cm	[signature]	
—	7:35										increase shield flushing dewar pressure to 110 mbar									[signature]	
—	13:30		—	—	〃	—	—			8,8x10⁻⁹		0,02	1030	6,0	〃	150	120	/		[signature]	
18.11.05	7:30		—	—	〃	—	—			8.3·10⁻⁹	0.01	0.02	1042	5.9	〃	453/95	122	0	+23° 20.2cm 15.2cm	[signature]	
	14:15									H2O off, open V702 + restart filling of #8528										[signature]	
	14:40											close V702 end of dewar #9158							m = 328 kg ≙ 72 l	[signature]	
										new shield flushing dewar #8522 m = 384 kg ≙ 480 l										[signature]	
	15:30									open SV121 restart shield flushing										[signature]	
	15:50		—	—	〃	—	—				0.05	0.02			8528/8522	—/700		0	+23° 35.2cm 51.0cm	[signature]	
19.11.05	17:35		—	—	〃	—	—			7.·10⁻⁹	0.01	0.02	1026	3.7	8528/8522	445/175	940	0	+23° 30.7cm 42.0cm	[signature]	
	17:45										reduce shield flushing dewar pressure									[signature]	
20.11.05	10:00		—	—	〃	—	—			1,2x10⁻⁸		0,02	1042	3,8		165	85	—		[signature]	
〃	10:10										switch on heater H702						0,354 W			[signature]	
	10:40		—	—	〃	—	—			1,3x10⁻⁸		0,02	1042	4,4	/	165	0,354			[signature]	
21.11.05	6:30		—	—	〃	—	—			2,8·10⁻⁸	0.01	0.03	1036	1,1	8528/8522	450/165	75	0	+23° 27.4cm 34,5cm	[signature]	
	6:35										increase shield dewar pressure to 120 mbar, increase H702 to 0,8 W									[signature]	
	6:40										start cover flushing									[signature]	
	7:45											reduce H702 to 0,5 W								[signature]	

Herschel EQM — **LOGSHEET 1 for COVER FLUSHING**

Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	~~P501~~ P101 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	~~Cover~~	REMARKS	Sign AIV	QA
21.11.05	14:30										close SV121, end of shield flushing dewar #8527 m=325kg ≙32 l									[illegible]	
"											new shield flushing dewar #8484 m=380kg ≙ ?									[illegible]	
"	15:25										open SV121, restart shield flushing									[illegible]	
"	17:45									/	0,01	–	1064	6,5	8527	505	184	182	Cover 182 mg/s	[illegible]	
"	18:25										Restart Cryo SCOE									[illegible]	
"	18:40											Shield Dewar reduce pressure							10mbar (11mbar)	[illegible]	
"	18:50									/	0,01	–	1052	6,3	"	505	134	181	end of test	[illegible]	
22.11.05	6:15	c	c	c	o	o	o	c	o	/	0.01	0.03	1050	6.5	8527/8484	185/505	101	210	23° 23.8cm 24.1cm	[illegible]	
	6:20										reduce pressure in cover flushing dewar to preadjusted value (~10mbar)									[illegible]	
	6:25										increase shield flushing dewar set-pressure to "200mbar" (~130mbar)									[illegible]	
	12:00										reduce shield flushing dewar set-pressure to "190mbar"									[illegible]	
	14:20									/	0,01	0,03	1050	6,2	"	505?	113	188	23° L1=22,7 L2=22,5	[illegible]	
	18:30										stop heater H702 and set heater von 0,5W									[illegible]	
	18:50									/	0,01	0,03	1050	6,2	"	505?	129	202		[illegible]	
	6:50									/	0,01	0,03	1050	6,5	"	"	162	/	Cover dewar empty	[illegible]	
	7:00										Change Cover dewar				8074		488 kg.		545 mm	[illegible]	
	7:55									/	0,01	0,03	1064	6,5	"	~~545~~	170	28,7		[illegible]	
	12:45									/	0,01	0,03	1060	6,5	"	505	192	~~197~~,5	207mg/s	[illegible]	
	18:30									–						505	251		277mg/s	[illegible]	
24.11.05	6:50										H702 stopped in the night								power 0 W	[illegible]	
	7:00									/	0,01	0,03	1052	3,4	"	60	174	220		[illegible]	

Herschel EQM																		LOGSHEET 1 for COVER FLUSHING			
Date	Time	Valve Status								P901 mbar	P701 mbar	P501 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	Cover ~	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121											AIV	QA
24.11.05	7:30	—	—		-		—	—			Restart H702 to 0,8 W									[signature]	
"	8:50		—		"		—			—	0,01	0,03	1052	6,2	~~55~~	55	180	202		[signature]	
"	12:30									Change dewar 9156						730			(shield) m=379,0 kg	[signature]	
"	14:00	—	—		c	—	—			—	0,01	0,03	1060	6,6	9156	730	176	199		[signature]	
"	18:30	—	—		y		—	—		—					"	730	182	193		[signature]	
25.11.05	6:45		—		"		—			—	0,01	0,03	1025	6,5	"	"	145	216		[signature]	
	14:20										stop Cover flushing!									[signature]	
	14:25									stop H702, LL1 = 9,7 cm LL2 = 8,8 cm										[signature]	
	14:30										open V702 → start re-filling of AxT									[signature]	
	15:10										close V702							LL1 = 41,5	LL2 = 64,0	[signature]	
	15:15									end of cover flushing dewar # 8079							m= 343,0 kg ≙ 126 l			[signature]	
	15:20									new cover flushing dewar # 9158							m= 377,5 kg ≙ 468 l			[signature]	
26.11.05	16:45	—	—		c	—	—			—	0,01	0,04	1010	7,6	9156	755?	108	—		[signature]	
—	16:50										LL1 = 29,9 cm LL2 = 39,8 cm									[signature]	
	17:00									open V702 → start re-filling of AxT										[signature]	
	17:20									close V702										[signature]	
	17:25									end of shield flushing dewar # 9156							m= 330 kg ≙ 80 l			[signature]	
	18:00									new shield flushing dewar # 8527						m= 382,5 kg ≙ 492 l				[signature]	
	18:10									restart shield cooling						LL1 = 35,4 cm		LL2 = 52,7 cm		[signature]	
27.11.05	10:00									reduce shield flow to < 100 mg/s									(> 1000 mg/s)	[signature]	
	10:15				-						correct Ax flow meter									[signature]	

Herschel EQM — LOGSHEET 1 for COVER FLUSHING

Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	P101 (~~P501~~) mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	Cover in	REMARKS	Sign AIV	QA
27.11.05	10:30		—	—	—		—	—		—	0,01	0,04	1020	3,8	—	240	207	—		[signature]	
"	15:45									—	0,01	0,04	1012	3,8	—	230	127	—		[signature]	
"	16:00		—		—		—			start heater				4,17	0 2	0,4	W		= (0,35 W)	[signature]	
"	16:30		—	—	—		—			—	0,01	0,04	1012	4,4	—	230	130	—		[signature]	
28.11.05	06:10		—	—	—		—	—		—	0.01	0.04	1010	6,6	9158/8527	705/155	108	0	~~23°~~ 29,2cm 38,1cm	[signature]	
	6:15										start cover flushing				"	"				[signature]	
	15:20	—			—		—			—	0,01	0,04	1020	6,6	"	605/70	230	270		[signature]	
	16:30										Stop for Cover flow measurement [illegible]								?	[signature]	
	19:30										Change shield [illegible] 8528					740	224	112		[signature]	
29.11.05	6:50		—	—	—		—	—		—	0,01	0,04	1022	6,4	"	735	213	112		[signature]	
"	13:00		—	—	—		—	—		—	0,01	0,04	1022	6,4	"	"	160	112		[signature]	
	18:30		—	—	—		—	—		—	0,01	0,04	1022	6,4	"	"	152	111,7		[signature]	
30.11.05	6:30		—	—	—		—	—		—	0,01	0,04	1028	6,4	"	"	137	113		[signature]	
	18:45										end of cover flushing dewar # 9158						m =	343,0 kg ≙ 192 l		[signature]	
	19:00										new cover flushing dewar # 8484						m =	388,5 kg ≙		[signature]	
	19:25										LL1 = 19,6 cm				LL2 = 13,5 cm					[signature]	
	19:40									set pressure in shield flushing dewar reduced to 20 mbar										[signature]	
	20:15									/	0,01	0,04		7,2	8484/8527	500/205	128	85,0		[signature]	
1.12.05	6:30		—	—							Restricted Cover flow							~~60~~		[signature]	
											Pump and purge Cover and lines									[signature]	
	9:30										Restart of cover flushing									[signature]	

Herschel EQM — LOGSHEET 1 for COVER FLUSHING

Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	~~P701~~ mbar	P101 ~~P501~~ mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	Conc / m	REMARKS LL1 LL2	Sign AIV	Sign QA
1.12.05	9:45	—	—		"	—	—			—	0,01	0,04	1020	6,5	8528	120	175	118		[illegible]	
	19:20	—	—		"	—	—			—	0.01	0.03	1030	6.4	8484 / 8528	35	165	118	15,1 cm 3,8 cm	Schl	
2.12.05	6:30	—	—		"						change of shield dewar					3216		670 mm, m=323,5 kg ≙ 541 l		[illegible]	
	8:25	—	—		"	—				—	0,01	0,04	1080	6.6	3216	665	270	117.2		[illegible]	
	13:00	—	—		"	—	—			—	0,01	0,04	1075	6,4	"	623	201	125.0		[illegible]	
	14:55										open V702 → start filling of AXT								14.1 cm 4.4 cm	Schl	
	15:35										close V702								41,0 cm 64,0 cm	Schl	
	17:10										stop cover flushing (blind cap at the end of flushing line, reduce dewar pr.)									Schl	
	17:15	C	C	C	O	O	O	C	O	—	0.05	0.04		38	3216	359	—	0	33,1 cm 47,3 cm	Schl	
3.12.05	15:00	—	—		"	—	—			—	0,01	0,04	1030		"	254	94	—	Conduct flow meter AX	[illegible]	
4.12.05	17:00	—	—		"	—	—			—	0.01	0.04		3,9	"	156	88	0	28,7 cm 37,0 cm	Schl	
5.12.05	6:30	—	—		"	—	—			—	0.01	0.04	1024	4,0	"	110	80	0	28,0 cm 35,0 cm	Schl	
	6:35										start H702 with 0,8 W, increase pressure in shield flushing dewar									Schl	
	6:40										switch off H702, open V702 → re-fill AXT									Schl	
	6:50									close	V702, SV121 → end of shield flushing dewar #3216, LL=78 mm, 274,5 kg = 124 l, Δ=392 l									Schl	
	7:15										start cover flushing									Schl	
	8:20										new shield flushing dewar #3022 684 mm, 301,5 kg									Schl	
	9:30										start H702 with 0,5 W									Schl	
	14:00										end of cover flushing dewar #8484 m=311,5 kg									Schl	
	14:05										new cover flushing dewar #9156 m=383 kg Δ=216 l									Schl	
	18:35									—	0,01	0,05	1042	6,8	3022	583	200	55		[illegible]	

Herschel EQM — **LOGSHEET 1 for COVER FLUSHING**

Date	Time	V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	~~P501~~ P101 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	cover flushing flow mg/s	REMARKS (LL1 LL2)	Sign AIV	Sign QA
6.12.05	6:35	C	C	C	O	O	O	C	O	–	0.01	0.05	1030	6,4	9156/3022	765/488	170	31,3	26,1 31,4	[illegible]	
"	6:50										increase cover flushing flow									[illegible]	
"	17:00	—	—		"		—	—		—	0,01	0,05	1030	6,4	9156/3022	765/410	153	92		[illegible]	
"	19:00	—	—		"		—	—		—	0,01	0,05	1030	6,5	9156/3022	765/404	145	91,1		[illegible]	
7.12.05	6:40	—	—		"		—	—		—	0,01	0,05	1030	6,5	9156/3022	765/341	128	90,0		[illegible]	
"	12:40	—	—		"		—	—		—	0,01	0,04	1030	6,5	" "	715/310	130	89,5		[illegible]	
"	12:45				"					stop shield flushing										[illegible]	
	17:50				"												25	89,7	Ext flow: 27 mg/sec	[illegible]	
	17:55				"					Restart of shield flushing										[illegible]	
	18:45	—	—		"		—	—		—	0,01	0,04	1030		9156/189	765/301	128	89,8	27,8	[illegible]	
8.12.05	6:45	—	—		"		—	—		—	0,01	0,05	1052	6,5	"	765/290	147	89,4		[illegible]	
	9:45									shield mass flow > 1 g/s										[illegible]	
	10:00			—	"	—				—	0,01	0,05	>1050	6,5	"	765/210	27	74,5		[illegible]	
	13:40										stop cover flushing ~ warm-up cover to								220 K	[illegible]	
	14:42										increase W202 to 0,1 W on request of BC									[illegible]	
	16:32										W202 set to 0 W									[illegible]	
	17:20		close V121							end of shield flushing dewar # 3022							m = 287,5 L		Δ = 50 kg ≙ 400 l	[illegible]	
	18:20				open V121					V121; new shield flushing dewar # 3074							m = 387 kg ≙ 472 l			[illegible]	
	18:30											LL1 = 15,9 cm			LL2 = 3,7 cm					[illegible]	
	19:40									$8.1 \cdot 10^{-9}$	0.01	0.04	1060	6.6	9156/8.74	765/425	427	94.4		[illegible]	
9.12.05	6:40		—		"			—		$7.0 \cdot 10^{-9}$	0,01	0,05	1060	6,3	" "	765/145	450	96.2		[illegible]	

Herschel EQM — **LOGSHEET 1 for COVER FLUSHING**

Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P701 mbar	P101 (P501 struck) mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s	cover flushing flow	REMARKS LL1 LL2	Sign AIV	QA
9.12.05	14:00										open V702 → start refilling of AXT									Schl	
	14:45										close V702 → end of refilling AXT									Schl	
	15:00				close SV121						end of shield flushing dewar # 8074 m = 335,5 kg ≙ 60 l									Schl	
	16:00				open SV121						new shield flushing dewar # 9158 m = 378 kg ≙ 472 l									Schl	
	17:00			stop cover flushing ;							end of cover flushing dewar # 9156 m = 342,5 kg ≙ 180 l									Schl	
	17:10										new cover flushing dewar # 8528 m = 381,5 kg ≙ 484 l									Schl	
	17:15	c	c	c	o	o	o	c	o	7.6·10⁻⁹	0.01	0.04	1050	10.6	8528 9158	765 / 680	180	0	29,5 cm 39,0 cm	Schl	
10.12.05	12:00		—	″	—		—			1×10⁻⁸	0,01	0,04	1050	3,6	″ ″	″ / 680	87	0		[illegible]	
11.12.05	18:10	—		″	—					2.2·10⁻⁸	0.01	0.05	1042	3.9	″	740 / 680	82	0	26,9 cm 33,4 cm	Schl	
	18:15										start cover flushing, increase shield flushing flow									Schl	
	18:20										start H202 with 4 W									Schl	
	18:30										H202 set to 0,1 W									Schl	
12.12.05	6:30	—		″	—					7.7·10⁻⁹	0.01	0.06	1042	5.9	8528 9158	35 / 680	115	90	25.3 cm 28,1 cm	Schl	
″	7:00										increase H202 to 0,5 W				″					Schl	
″	12:30		—	″	—					7,1×10⁻⁹	0,01	0,06	1043	6,4	″	680 / 570	126	86		[illegible]	
″	19:00		—	″	—					7,0×10⁻⁹	0,01	0,06	1043	6,4	″	600 / 545	121	84		[illegible]	
13.12.05	6:40	—		″	—					6.8·10⁻⁹	0.01	0.05	1044	6.4	″	680 / 530	133	30	21.5 cm 18.4 cm	Schl	
″	6:45									Glebottle at cover flushing dewar empty → start dewar heater regulation → increase in										Schl	
″	18:30		—	″	—					6,8×10⁻⁹	0,01	0,05	1044	6,4	″	680 / 490	140	56,6		[illegible]	
	19:30									adjust mass flow [illegible] cover to								~ 96 mg/s		[illegible]	
14.12.05	7:30									5.5·10⁻⁹	0.01	0.05	1036	6.3	″	150 / 425	120	85.1	11.1 cm 7.4 cm	Schl	

Herschel EQM																				LOGSHEET 1 for Depletion & Warm Up		
Date	Time	Valve Status								P901 mbar	P101 bar	P701 bar	P501 mbar	P0621 mbar	P516 mbar	Mass flow via AXT mg/s	Mass flow via shields mg/s	Mass flow via cover mg/s	Cover flushing dewar press.	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121												AIV	QA
14.12.05	15:50	c	c	c	o	o	o	c	o	$7\cdot10^{-5}$	0.05	0.01	/	1040	6.2	25.7	113	855	159	≮23°	Schl	
	15.52										increase H702 to 1,5W										Schl	
	16:10										start H701 with 10W, increase H702 to 10W										Schl	
	16.20										close JV121 → stop shield flushing										Schl	
	16.25										remove transferline and shield flushing dewar # 9?28 m = 337,0 kg ≙ 96 l										Schl	
	17:20										open by pass to flowmeter, can't stop H701 and H702										Schl	
	17:36										ṁ = 0 ⇒ start H702 with 0.5W										Schl	
	18:00	c	c	c	(c)	o	o	c	c			switch off H702									Schl	
15.12.05	7:40	——	——	——	——	·	——	——	——	$1.6\cdot10^{-7}$	0.06	1.00	/	954	1013	35 ↔		90.0	154	≮23° 7,1cm 4,6cm	Schl	
	10:30											close V502, remove V0601									Schl	
	10.50											tilting back to vertical									Schl	
	14:00											remove PLR/JVR from test dolly and put composite on ground									Schl	
	15:40											close JV921 switch to mass spectrometer open JV921									Schl	
	15:51										start depletion of AXT with H702 = 10W										Schl	
	17:50											open V105 (to avoid closed volumes during warm-up)									Schl	
	18:15	c	c	o	c	o	o	c	c	$6.7\cdot10^{-6}$	0.07	1.01	/	/	1022	233	.0	80	122		Schl	
16.12.05	6:40		——	——		ı	——			$5.6\cdot10^{-7}$	0.10	0.92	/	/	950	0	0	101	153		Schl	
	6.45										start H701 with 10W										Schl	
	6.55										switch off H701 due to temp gradient between 21/22 and AXT										Schl	
	8.45										connect GHe supply to V506 to flush shields → OBA for OBA warm-up										Schl	
	10:45										start V105 heater to improve warm-up of OBA										Schl	

Herschel EQM — **LOGSHEET 1 for Depletion & Warm Up**

Date	Time	Valve Status V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121	P901 mbar	P101 bar	P701 bar	P501 mbar over-pressure	P0621 mbar	P516 mbar	Mass flow via AXT mg/s	Mass flow via shields mg/s	Mass flow via cover mg/s	Cover flushing dewar press.	REMARKS	Sign AIV	Sign QA
16.12.05	17:00	C	C	O	C	O	O	C	C			switch off		H202							[illegible]	
	17:10											switch off		VH105							[illegible]	
	17:30	—	—	—	—	—	—	—	—	1.0·10⁻⁶	0.14	0.98	122	/	996	2.1	27	96.4	141		[illegible]	
17.12.05	12:20	—	—	—	—	—	—	—	—	2.3·10⁻⁶	0.17	0.92	0	/	940	0	0	7.8	30		[illegible]	
	12:30										restart flushing of shields 10 bar with GHe from bottle										[illegible]	
	14:35											switch on H201									[illegible]	
	17:25										switch back to turbo					~~switch off H201?~~					[illegible]	
	17:30	—	—	—	—	—	—	—	—	2.4·10⁻⁵	0.18	0.98	146	/	1004	7.9	7.9	0	/		[illegible]	
19.12.05	7:25	—	—	—	—	—	—	—	—	5.8·10⁻⁷	0.26	0.94	12	/	960	0	0	/	/		[illegible]	[illegible]
	7:50											switch off H201, switch on VH105									[illegible]	[illegible]
	8:15									Cover shield flushing dewar removed #8528 m = 330 - 4,2 = 76 e											[illegible]	[illegible]
	16:30										switch from flushing with GHe to flushing with GN₂										[illegible]	[illegible]
	16:35										release pump to safety position										[illegible]	[illegible]
	16:40	—	—	—	—	—	—	—	—	1.5·10⁻⁵	0.28	1.00	392	1032	1018	4.3*	4.3*	/	/	*GN₂	[illegible]	[illegible]
	16:55										switch from mass spectrometer to turbo pump										[illegible]	[illegible]
	17:00											switch off VH105									[illegible]	[illegible]
20.12.05	10:20									3.5·10⁻⁷	0.32	1.00	232	1027	1020	—	—	—	—		[illegible]	[illegible]
	16:00									3.4·10⁻⁷	0.33	1.00	227	1025	1018	—	—	—	—		[illegible]	[illegible]
21.12.05	10:00									3.8·10⁻⁷			205	1024	1017	—	—	—	—		[illegible]	[illegible]
	16:00									4.3·10⁻⁷			206	1022	1016	—	—	—	—		[illegible]	[illegible]
27.12.05	15:30	—	—	—	—	—	—	—	—	2.9·10⁻⁷	0.56	0.97	111	384	968	0	0	/	/		[illegible]	[illegible]

Herschel EQM																LOGSHEET 1 for Depletion & Warm Up						
Date	Time	Valve Status								P901 mbar	P101 bar	P701 bar	P501 mbar over-pressure	P0621 mbar	P516 mbar	Mass flow via AXT mg/s	Mass flow via shields mg/s	Mass flow via cover mg/s	Cover flushing dewar press.	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121												AIV	QA
27.12.05	16:50	C	C	O	C	O	O	C	O		mass flow through shields increased										[signature]	[signature]
	16:25	—	—	—	.	—	—			$2.9\cdot10^{-7}$	0.56	0.99	535	1020	1000	12.3	dto.	–	–		[signature]	[signature]
30.12.05	16:30	—	—	—	.	—	—	—		$7.0\cdot10^{-7}$	0.64	1.01	535	1030	1013	12.0	dto	–	–		[signature]	[signature]
3.1.06	9:40	—	—	—	.	—	—	—		$1.5\cdot10^{-5}$	0.74	1.01	559	1032	1022	12.6	dto.	–	–		[signature]	[signature]
	10:00									switch to mass spectrometer, start VH105, H701											[signature]	[signature]
	14:05	—	—	—	.	—	—	—		$2.5\cdot10^{-5}$	0.75	1.02	555	1030	1024	12.7	dto.	–	–		[signature]	[signature]
	14:15										open V702										[signature]	[signature]
	16:10	C	C	O	C	O	O	O	O	$2.6\cdot10^{-5}$	0.75	1.02	563	1030	1024	12.6	dto	–	–		[signature]	[signature]
	16:15									switch off H701, close V702											[signature]	[signature]
	16:25									switch H turbo pump											[signature]	[signature]
9.1.06	7:30	C	C	O	C	O	O	C	O	$5.6\cdot10^{-6}$	0.90	1.03	547	1030	1024	12.4	dto	–	–		[signature]	[signature]
	10:00									switch from turbo pump to mass spectrometer											[signature]	[signature]
	10:05									open V702											[signature]	[signature]
	10:10									change N_2 flushing from V506 to safety unit / filling port											[signature]	[signature]
	16:50	C	C	O	C	O	O	O	O	$1.6\cdot10^{-5}$	0.91	1.05	–	1040	1032	37.3	dto	–	–		[signature]	[signature]
	16:55									switch off VH105											[signature]	[signature]
10.1.06	7:53	C	C	O	C	O	O	O	O	$2.0\cdot10^{-5}$	0.93	1.05	–	1042	1032	37.3	dto	–	–		[signature]	[signature]
	11:30	—	—	—	.	—	—	—	—	$2.3\cdot10^{-5}$	0.94	1.06	–	1050	1040	64.2*	dto.	–	–	* higher mass flow because "bypass" via V0601 closed	[signature]	[signature]
11.1.06	7:40	—	—	—	.				—	$2.8\cdot10^{-5}$	0.95	1.06	–	1048	1039	63.9	dto.	–	–		[signature]	[signature]
	10:25									stop mass spectrometer meas. and provide "isolation vacuum" with GN_2 grade 5.0 to 1×10^{-3} mbar											[signature]	[signature]
																					[signature]	[signature]

Herschel EQM																			LOGSHEET 1 for Depletion & Warm Up			
Date	Time	Valve Status								P901 mbar	P101 bar	P701 bar	P501 mbar	P0621 mbar	P516 mbar	Mass flow via AXT mg/s	Mass flow via shields mg/s	Mass flow via cover mg/s	Cover flushing dewar press.	REMARKS	Sign	
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121												AIV	QA
11.1.05	13:15									isolation vacuum ~~flushed~~ pressurized with GN2 grade 5.6 to 1.4 x10^-2 mbar											[signature]	[signature]
	13:30	C	C	O	C	O	O	O	O	$1.4\cdot10^{-2}$	0.96	1.06	/	1046	1038	64.1	dto.	/	/		[signature]	[signature]
	13:35									start H701 with 10W											[signature]	[signature]
	15:55									switch on H103 and H104 with 10W each											[signature]	[signature]
	16:10	—	—	—	"	—	—	—	—	/	0.96	1.06	-	1046	1038	64.1	dto.	/	—		[signature]	[signature]
12.1.06	7:35	—	—	—	"	—	—	—	—	$1.6\cdot10^{-2}$	1.01	1.06	/	1050	1040	63.7	dto.	/	/		[signature]	[signature]
	7:45									increase ins. vacuum pressure to $1.2\cdot10^{-1}$ mbar with GN2 grade 5.6											[signature]	[signature]
	"									start H101 with 10W											[signature]	[signature]
	10:55									start H102 with 10W											[signature]	[signature]
	14:35									start H702 with 10W											[signature]	[signature]
	16:13	—	—	—	"	—	—	—	—	/	1.05	1.06	/	1050	1040	64.1	dto	/	/		[signature]	[signature]
	16:15									open V104											[signature]	[signature]
13.1.06	7:35	C	O	O	C	O	O	O	O	$1.2\cdot10^{-1}$	1.03	1.04	/	1050	1040	64.3	dto.	/	/		[signature]	[signature]
	8:00									CVV pressure increased to 1 mbar with GN2 grade 5.6											[signature]	[signature]
	14:35	—	—	—	"	—	—	—	—	/	1.04	1.04	/	1050	1040	64.5	dto.	/	/		[signature]	[signature]
	14:40									stop flushing the d/d with GN2											[signature]	[signature]
	14:55									stop all heaters											[signature]	[signature]
14.1.06	13:00	—	—	—	"	—	—	—	—	/	1.01	0.89	/	1012	1012	/	/	/	/		[signature]	[signature]
	13:15									start CVV pressurization; P901 at start ~1 mbar; T708=287.3K											[signature]	[signature]
	14:08									P901 = 11 mbar												[signature]
	15:25									P901 = 81 mbar												[signature]
~~17.1.06~~	~~7:29~~									~~430~~	~~1.06~~	~~0.99~~	~~/~~	~~1009~~	~~1008~~	~~/~~	~~/~~	~~/~~	~~/~~		[signature]	

Herschel EQM																		LOGSHEET 1 for COVER FLUSHING		
Date	Time	Valve Status								P901 mbar	P701 mbar	~~P501~~ 101 mbar	P0621 mbar	P516 mbar	He Dewar S/N D0101	Liquid level Dewar L0101	Mass flow via shields mg/s		REMARKS	Sign
		V 102	V 104	V 105	V 502	V 512	V 701	V 702	SV 121											AIV	QA
16.01.06	16:30	C	O	O	C	O	O	O	O	190										[signature]	[signature]
	17:20									282										[signature]	[signature]
	17:50									342	0,99		1012	1012	–	–	–		P101 = 1,0; T103 = 288,01K	[signature]	[signature]
17.1.06	7:25									430	0,98	1,00	1008	1008	–	–	–			[signature]	[signature]
	10:20									close	V104,	V105,	V702,	V701						[signature]	[signature]
	10:30	C	C	C	C	O	C	C	O	730	0.99	1,00	1004	1004	–	–	–			[signature]	[signature]
	10:50										close SV121									[signature]	[signature]
	11:05										close V512									[signature]	[signature]

VII. Copy of filled in Log Sheets 2

11

Herschel EQM — LOGSHEET 2 for COOL DOWN and FILLING

Date	Time	DLCM T101	HTT T103 ~~T106~~	PPS T111	PACS T202	HIFI T207 ~~T208~~	SPIRE T253 ~~T254~~	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Ext. ventl. T501	Cover T601	AXT ~~T701~~ T702	T708		REMARKS	Sign AIV	Sign QA
25.08.05	10.20	/	275	/	/	293	293	293	293	292	293	/	/	283				[signature]	[signature]
26.08.05	7:20	/	273	/	/	293	293	293	293	292	293	/	/	283				[signature]	[signature]
-"-		/	293	/	/	293	293	293	293	293	293	/	/	293				[signature]	[signature]
29.08.05	12:35	/	292	/	/	293	292	292	290	292	293	/	/	293				[signature]	[signature]
-"-	13:00	/	291	/	/	292	292	292	288	292	293	/	/	291				[signature]	[signature]
-"-	14:00	/	289	/	/	291	291	291	248	284	287	/	/	279				[signature]	[signature]
-"-	15:00	/	285	/	/	284	289	287	222	273	276	/	/	272				[signature]	[signature]
-"-	16:00	/	278	/	/	280	283	279	194	258	255	/	/	277				[signature]	[signature]
-"-	17:00	/	273	/	/	281	28.1	277	183	245	239	/	/	262				[signature]	[signature]
-"-	17:45	/	271	/	/	280	280	276	174	236	250	/	/	270				[signature]	[signature]
30.8.05	6:50	/	267	/	/	272	271	270	252	233	832	/	/	272				[signature]	[signature]
-"-	8:00	/	263	/	/	271	270	269	211	228	224	/	/	271				[signature]	[signature]
-"-	9:00	/	254	/	/	270	269	267	172	216	168	/	/	270				[signature]	[signature]
-"-	10:00	/	251	/	/	269	268	266	172	207	161	/	/	254				[signature]	[signature]
-"-	11:00	/	247	/	/	268	267	264	161	200	190	/	/	267				[signature]	[signature]
-"-	12:00	/	242	/	/	266	265	262	153	178	147	/	/	260				[signature]	[signature]
-"-	13:05	/	238	/	/	265	264	261	163	172	149	/	/	249				[signature]	[signature]
-"-	15:00	/	236	/	/	263	261	258	163	172	157	/	/	251				[signature]	[signature]
-"-	16:00	/	235	/	/	261	260	257	141	165	135	/	/	246				[signature]	[signature]
-"-	16:50	/	225	/	/	252	256	251	164	157	161	/	/	239				[signature]	[signature]
-"-	18:00	/	207	/	/	255	254	250	195	162	160	/	/	245				[signature]	[signature]

Herschel EQM																	**LOGSHEET 2 for COOL DOWN and FILLING**		
Date	Time	Temperatures in [K]															REMARKS	Sign	
		~~DLCM~~ T101	HTT T103 ~~T106~~	PPS T111	PACS T202	HIFI T207 ~~T208~~	SPIRE T253 ~~T254~~	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Ext. ventl. T501	Cover T601	AXT ~~T701~~ T702	T702			AIV	QA
30.8.05	19⁰⁰	/	197	/	/	254	252	250	200	167	170	–	–	246				[signature]	[signature]
"	19:30	/	150	/	/	254	252	250	200	170	174	/	–	246				[signature]	
"	20:00	/	182	/	/	253	251	249	200	173	179	/	–	246				[signature]	
"	20:30	/	173	/	/	253	251	249	199	175	181	/	/	246				[signature]	
"	21:00	/	167	/	/	252	250	249	197	177	183	/	/	246				[signature]	
"	21:40	/	159	/	/	252	250	248	194	178	184	/	/	246				[signature]	
31.8.05	6:55	/	168	/	/	244	243	242	207	190	203	/	/	244				Schl	
	8:00	/	155	/	/	249	242	242	198	191	202	/	/	241				Schl	
	9:00	/	138	/	/	243	241	241	188	191	196	/	/	242				Schl	
	10:00	/	123	/	/	241	241	240	186	194	201	/	/	236				Schl	[signature]
	11:00	/	105	/	/	235	238	235	171	185	198	/	/	238				Schl	[signature]
	13:00	/	89	/	/	232	234	231	167	186	186	/	/	234				Schl	[signature]
	14:00	/	55	/	/	229	232	229	151	176	170	/	/	229				Schl	[signature]
	15:00	/	7,3	/	/	227	229	226	138	168	155	/	/	231				[signature]	
	16:05		4,2	/	/	221	227	223	123	161	152	/	/	222				[signature]	
	17:00	4,32	5,96	/	/	218	225	219	105	155	133	/	/	226				Schl	
	18:10	4,30	6,44	/	/	213	221	214	93,9	141	104	/	/	220				Schl	
	19:15	4,3		/	/	204	215	207	87	128	94	/	/	221				[signature]	
	20:00	6,9				202	212	203	84	121	88	/	/	214				[signature]	
	20:30	5,5		/	/	203	210	202	81	117	85	/	/	217				[signature]	
	21:00	4,2		/	/	203	208	202	80	113	87	/	/	218				[signature]	[signature]

Herschel EQM														LOGSHEET 2 for COOL DOWN and FILLING					
Date	Time	Temperatures in [K]															REMARKS	Sign	
		~~DLCM~~ T101	HTT ~~T103~~ T106	PPS T111	PACS T202	HIFI T207 ~~T208~~	SPIRE T253 ~~T254~~	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Ext. ventl. T501	Cover T601	AXT ~~T701~~ T 702 708				AIV	QA
31.8.05	21:45	4,18	/	/	/	204,7	206	201	78	105	88	/	/	218				[illegible]	/
1.9.05	7:15	4,80	9,05	/	/	202	201	200	47	69	72	/	/	212				Schl	/
1.9.05	8^10	9,87	9,07			201	200	199	46,6	68	74			211				[illegible]	/
-"-	9:10	6,08	6,32	/	/	201	199	199	43,1	66,7	70,4	/	/	211				Schl	[illegible]
-"-	10:00	4,22	4,51	/	/	201	199	198	45,6	80,3	92,3	/	/	211				Schl	/
-"-	11:10	4,19	4,54	/	/	196	198	195	45,4	77,6	89,2	/	/	199				Schl	/
-"-	12:02	4,18	4,603	/	/	193	196	192	39,05	60,33	67,6	/	/	201				[illegible]	Ca
"	13:00	4,22	4,67	/	/	190	195	191	45,5	74,9	89,7	/	/	201				Schl	Ca
-"-	14:10	4,32	4,432	/	/	183	192	186	45,04	72,9	86,85	/	/	191					Ca
-"-	15:10	4,39	4,35	/	/	183	188	184	41,85	68,52	79,76	/	/	174,13					Ca
-"-	16:02	4,213	4,306	/	/	181	186	181	37,45	60,1	74,45	/	/	188,7					Ca
-"-	17:07	4,10	4,32	/	/	176	183	178	23,42	45	44	/	/	180,34					Ca
"	18:00	4,40	4,34	/	/	174	180	175	23,2	42,8	44,9	/	/	177				Schl	/
2.9.05	6:05	4,3	/	/	/	155	159	155	33	34	82	/	/	177				[illegible]	/
"	6:45	4,27	4,29			154	158	154	32	55	84	/	/	177				[illegible]	/
"	7:00	4,20	4,29	/	/	152	158	154	35	55	82	/	/	156				[illegible]	/
"	8:15	4,2	4,24	/	/	151	154	150	18	48	60	/	/	170				[illegible]	/
"	9:03	4,21	4,22	/	/	148	153	149	21	45	62	/	/	171				[illegible]	/
"	11:00	4,25	4,25	/	/	147	150	147	16	42	52	/	/	155				[illegible]	/
"	12:00	4,12	4,29	/	/	145	148	145	15	39	42	/	/	153				[illegible]	[illegible]
	13:05	4,27	4,29	/	/	145	147	144	15,3	36,9	40,7	/	/	149				Schl	Ca

Herschel EQM — **LOGSHEET 2 for COOL DOWN and FILLING**

Date	Time	DLCM T101	HTT T106	PPS T111	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Ext. ventl. T501	Cover T601	AXT T701 T702			REMARKS	Sign AIV	Sign QA
		Temperatures in [K]																	
2.9.05	14:05	4,25	4,28	/	/	135,1	144,5	138,77	25,9	50,42	66,60	/	/	151,56					Ca
-"-	16:00	4,19	4,29	/	/	137,0	136,45	137,03	40,6	56,4	63,77	/	/	145,28					Ca
3.9.05	17:30	4,37	–	–	–	107	110	108	50	88	149	–	–	138				Kj	Ca
-"-	18:10	4,37	–	–	–	108	109	107	49	89	150	–	–	138				Kj	Ca
4.9.05	9:30	4,37	–	–	–	108	107	107	25	74	150	–	–	131				Kj	Ca
5.9.05	7:15	4,12	–	–	–	105	104	104	77	73	149	–	–	123				Kj	Ca
↓	9:30	4,26	4,23	/	/	105	105	105	27,3	73,9	149,7	/	/	123				Schl	Ca
	14:00	4,30	4,22	/	/	104	104	104	26,9	73,8	155,4	/	/	122				Schl	Ca
	15:00	4,20	4,19	/	/	102	104	103	35,5	74,1	142,9	/	/	114				Schl	Ca
↓	16:00	4,29	4,20	/	/	97,7	102	98	29,5	72,4	137,9	/	/	106				Schl	Ca
↓	17:15	4,21	/	/	–	94,78	99,58	96	21,09	67,43	123	/	/	104,56				Schl	Ca
6.9.05	7:30	4,?	4,22	/	/	86,4	88,4	86,6	36,4	78,8	138,5	/	/	105,5			→ ΔT <40K	Schl	Ca
↓	9:00	4,28	4,21	/	/	84,0	86,7	84,0	44,0	78,2	138,1	/	225	70,8			instead <20K	Schl	Ca
↓	10:00	4,13	4,21	/	/	76,12	81,41	75,06	22,94	74,75	132,19	/	225	89,45				Schl	Ca
↓	11:00	4,18	4,21	–	–	75	76,9	72,8	20,8	70	119	–	–	78,3				Kj	Ca
↓	13:00	3,88	4,16	/	/	72,3	72,7	69,6	21,0	65,7	107	/	/	83,8				Schl	Ca
↓	14:10	4,20	4,15	/	/	67,37	70,79	65,52	18,85	64,53	104	/	225	81,98					Ca
↓	15:05	4,21	4,18	/	/	65,07	67,3	62,04	16,12	60,18	95,58	/	225	83,97					Ca
	16:00	4,16	4,17	/	/	64,3	63,7	59,5	24,0	57,7	87,2	/	225	60,1				Schl	Ca
	17:00	4,24	4,17	/	/	58,4	60,1	58,3	15,3	54,3	80,1	/	225	72,5				Schl	Ca

~~T255~~ *T254 T213 * T424

Herschel EQM																	LOGSHEET 2 for COOL DOWN and FILLING		
		Temperatures in [K]																	
Date	Time	DLCM T101	HTT ~~T108~~ T106	PPS T111	PACS T202	HIFI ~~T207~~ T208	SPIRE ~~T253~~ T256	OBA Shield T211 T212	1. shield T423	2. shield T443	3. shield T463	Ext. ventl. T501	Cover T601	AXT ~~T701~~ T702	T701 T708		REMARKS	Sign AIV	Sign QA
7.9.05	7:40	4,26	4,19	/	/	50,0	48,8	48,2	34,6	80,6	130,8	/	225	69,8				Schl	Ca.
-"-	9:00	4,23	4,19	/	/	47,6	48,2	47,8	35,3	82,5	134,7		225	69,8				Schl	Ca.
-"-	11:15	4,23	4,19	/	/	44,3	45,5	44,6	37,7	88,4	145,9	/	225	67,9				Schl	Ca.
-"-	14:00	4,21	4,21	/	/	38,23	41,66	35,04	37,09	84,5	142,40		225	67,65				Schl	Ca.
-"-	15:15	4,25	4,21	/	9,71	26,6	15,9	15,2	17,6	85,4	140,2	/	225	4,39				Schl	Ca.
-"-	16:00	4,23	4,19	/	8,00	22,4	x	12,7	15,0	80,1	136,5	/	225	4,26	T707 / T702			Schl	Ca.
-"-	17:15	4,22	4,18	/	17,72	16,28	16,26	15,02	17,82	75,7	131,72	/	225	4,39		4,02		Schl	Ca
-"-	19:05	4,24	4,19	/	/	25,3	25,5	25,6	34,6	78,3	137,9	/	225	4,31				Schl	Ca
8.9.05	7:45	4,28	4,20	/	/	33,1	33,3	33,3	26,5	85,2	152,7	/	225	4,29				Schl	Ca
	9:40	4,29	4,19	/	13,8	26,0	28,6	19,0	22,4	86,6	155,9	/	225	4,24				Schl	Ca
	10:00	4,29	4,22	/	19,4	25,0	24,0	22,0	24,2	85,5	151,0	/	225	4,30				Schl	Ca
	11:00	4,32	4,19	/	6,00	14,25	4,88	12,9	14,1	82,0	154,0	/	225	4,21				Schl	Ca
	12:00	4,27	4,19	/	5,79	9,58	7,24	17,71	13,4	77,8	145,6	/	225	4,22				Schl	Ca
	13:00	4,22	4,20	/	6,08	9,47	8,27	7,56	15,2*	73,4	129,5	/	225	4,24				Schl	Ca
	14:00	4,25		/	6,06	9,5		[illegible]											
	15:00	4,28	4,19		16,04	16,89	16,63	16,08	22,63	67,36	110,69		224	/					Ca.
	16:30	4,20	4,2	—	/	/	/	22,5	26,9	70,6	113,0	/	224	—				[illegible]	
	17:15	4,23	4,2		16,23	18,6	19,19												Ca
	18:35	4,34	4,19	/	/	25,1	25,0	25,2	29,3	73,3	117,1	-	225	-				Schl	Ca
9.9.05	7:15	4,35	4,19	/	/	37,2	33,2	33,3	25,0	85,9	144,9	/	224	/				Schl	Ca
-"-	11:00	4,32	4,20	✓	/	39,86	34,43	34,0	26,03	88,49	154,0	/		/					Ca

Herschel EQM — **LOGSHEET 2 for COOL DOWN and FILLING**

Date	Time	DLCM T101	HTT ~~T103~~ T106	PPS T111	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Ext. ventl. T501	Cover T601	AXT T701 T 702			REMARKS	Sign AIV	Sign QA
		Temperatures in [K]																	
9.9.05	13:00	4,30	4,19	/	/	34,1	34,1	34,2	26,7	89,9	157,7	-	224	4,26					[illegible]
9.9.05	18:40	4,27	-	-	-	14,1	14,3	14,0	27,0	93	166	-	224	1,60			Ax He II Produktion	[illegible]	

He II Production

Herschel EQM																	LOGSHEET 2 for He II Production in AXT		
Date	Time	Temperatures in [K]															REMARKS	Sign	
		DLCM T101	HTT T106	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T707	[illegible]			AIV	QA
9.9.05	13:30	4.29	4.20	–	33.6	34.0	12.7	–	33.8	26.2	90.2	158.5	224	4.23				[signature]	
"	14:03	4.27	4.20	8.00	23.0	19.9	3.02	3.21	12.3	26.4	90.6	159.4	224	3.09				[signature]	
"	14:30	4.25	4.20	6.76	20.1	14.1	2.54	2.86	9.81	25.5	90.8	160.2	224	2.51				[signature]	
"	15:00	4.18	4.19	6.32	15.2	12.1	2.28	2.77	10.6	25.6	87.3	161.0	224	2.37				[signature]	
"	15:30	4.28	4.20	6.47	10.20	9.24	2.12	2.35	6.38	25.5	91.5	161.8	224	2.11				[signature]	
"	16:00	4.24	4.20	4.23	8.45	8.60	1.99	2.35	5.07	25.1	91.9	162.6	224	1.96				[signature]	
	18:40	4.27	–	–	14.1	14.3	–	–	19.0	27.0	93.0	166	224	1.60				[signature]	
10.9.05	13:10	4.30	4.21	–	30.4	30.7	4.14	16.4	30.8	35.6	108.1	189.1	224	1.54				[signature]	
"	17:00	4.23	–	–	31.5	31.5	4.02	16.9	31.5	34.7	107	192	224	1.55				[signature]	
11.9.05	8:45	4.31	4.22	–	33.1	33.4	4.01	17.5	33.4	34.4	114.7	201.2	224	1.56				[signature]	
"	16:50	4.26	4.21	–	33.4	33.7	3.9	16.9	33.6	33.9	114.4	196.0	224	1.56				[signature]	
12.9.05	6:40	4	4.29	–	33.7	34.1	3.98	17.1	34.0	34.7	117	200.6	224	1.56				[signature]	
	8:00	4.28	4.22	–	33.8	34.2	4.01	17.4	34.1	36.6	110.0	207.8	224	1.57				[signature]	
	9:30	4.23	4.22	–	33.7	34.1	5.37	17.2	34.0	26.7	120.0	202.0	224	1.58				[signature]	
	10:00	4.24	4.21	–	33.7	34.1	4.05	17.6	34.0	22.7	113.3	195.0	224	1.59				[signature]	
	11:00	4.20	4.21	–	33.6	34.0	3.73	16.4	33.9	17.4	107.2	175.6	224	1.58				[signature]	
	12:00	4.28	4.20	–	33.6	33.9	3.71	15.5	33.8	16.6	101.0	159.2	224	1.57				[signature]	
	13:00	4.23	4.21	–	32.2	33.6	2.55	11.5	33.0	16.4	96.5	147.3	224	1.67	0.924			[signature]	
	15:05	4.23	4.21	19.5	23.2	23.6	2.31	5.52	21.5	20.3	86.2	127.8	224	1.76	0.924			[signature]	
	17:00	4.21	4.18	4.18	9.49	8.13	2.13	2.37	1.31	14.3	77.6	109.7	224	2.12	0			[signature]	
13.9.05	6:50	4.25	4.19	–	27.0	27.2	4.34	16.7	27.3	41.7	96.5	142	224	1.52				[signature]	

Herschel EQM															LOGSHEET 2 for He II Production in AXT				
Date	Time	Temperatures in [K]													H701		REMARKS	Sign	
		DLCM T101	HTT T106	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T707	W			AIV	QA
13.9.05	10:00	4.19	4.16	/	26.5	27.4	2.56	10.61	26.8	18.4	90.3	144.9	223	1.63	0.452			[signature]	
	12:50	4.	4.15	18.3	19.8	20.6	2.09	6.33	19.5	24.8	90.2	145.7	223	1.67	0.451			[signature]	
	15:00	4.15	4.15	16.5	16.9	17.6	2.25	7.14	17.2	24.8	90.9	148.1	223	1.62	0.177			[signature]	
14.9.05	8:20	4,2	4,4	20,04	19,6	20,7	2,55	9,05	20,4	41,9	101,4	157,9	222	1,60	0,45			[signature]	
"	11:00	4,2	4,1	17,44	17,7	19,0	2,23	7,7	18,0	25,1	100,2	162,7	222	1,62	0,363			[signature]	
"	13:20	4,2	4,1	16,8	14,9	15,4	2,14	6,28	14,9	23,2	99,2	165,0	222	1,65	0,267			[signature]	
"	15:50	4,1	4,1	13,7	14,7	15,4	2,16	6,5	15,04	23,5	98,6	168,9	222	1,63	0,362			[signature]	
"	18:30	4,0	4,1	15,0	15,4	16,4	2,26	7,04	15,5	24,6	96,8	171,8	222	1,63	0,266			[signature]	
15.09.05	8:30	4,2	4,1	18,1	18,3	19,2	2,37	7,8	18,7	44,1	116	190	223	1,64	0,452			[signature]	
"	10:00	4,2	4,2	16,3	16,6	17,5	2,25	7,0	16,9	44,2	117	191	223	1,66	0,454			[signature]	
	13:35	4,3	4,2	14	14,9	15,6	2,2	6,8	15,3	43,9	119	195	223	1,65	0,365			[signature]	
	17:30	4,2	4,2	15,8	15,0	16,9	2,3	7,4	16,6	44,0	121	198	223	1,64	0,178			[signature]	
16.09.05	7:40	4.26	4.23	/	29.7	30.1	4.17	17.2	30.2	40.6	127	209	224	1.57	0			[signature]	
[illegible]																			

Herschel EQM																	**LOGSHEET 2 for COVER FLUSHING**		
Date	Time	Temperatures in [K]													H701	H101 on/off	REMARKS	Sign	
		DLCM T101	HTT T106	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T707				AIV	QA
17.9.05	17:15		4.25	/	29.3	29.5	3.80	15.9	29.5	20.0	75.3	134.2	220	1.53	0	2/6		Schl	
18.9.05	14:30		4,24	/	30,7	31,0	3,78	15,9	31,06	19,5	74,5	126,4	222	1,53	0	2/6		[illegible]	
19.9.05	7:30	4.33	4.25	–	31.0	31.4	3.76	16.1	31.4	20.7	75.9	126.6	222	1.54	0	2/6		Schl	[illegible]
– " –	14:30	4.34	4,24	–	30,16	30,71	2,63	10,56	30,94	15,3	66,03	112,3	49,36	1,53	0	2/6			[illegible]
– " –	16:10	4,31	4,23	/	29,16	30,20	2,66	10,61	29,87	16,67	78,15	112,95	/	1,52	0	2/6			[illegible]
– " –	17:15	4,28	4,23	/	27,3	29,2	2,70	10,72	/	11,69	80,61	111,65	67,2	1,52	0	2/6			[illegible]
– " –	18:30	4,37	4,25		/		2,83		27,99	22,28	69,3	118,1		1,51	0	2/6			[illegible]
20.9.05	7:30	4.30	4.25	18.9	18.7	17.7	2.16	6.01	18.7	25.5	77.5	123.9	177.3	1.59	0.178	2/6		Schl	
– " –	13:00	4,27	4,258	/	/	20,76	2,53	7,73	21,02	16,92	63,14	98,21		1,50	– " –	– " –		[illegible]	[illegible]
"	18:35	4,38	4,26	/	23,2	23,6	8,59	8,64	23,47	26,4	77,67	125,6	88,17	1,50	0,178	– " –			[illegible]
21.9.05	7:40	4.25	4.26	15.8	17.0	16.9	1.98	4.39	16.3	26.4	77.4	117.5	49.10	1.57	0.177	"		Schl	[illegible]
22.9.05	7:45	4.33	4.24	/	27.5	27.8	3.33	14.8	27.7	26.8	78.5	115.7	211	1.53	0	"		Schl	[illegible]
22.9.05	17:00	4,35	4,24	/	18,55	18,19	2,17	5,61	17,9	26,99	78,6	115,75	84,4	1,53	0	"			[illegible]
23.9.05	7:25	4.37	4.25	18.6	18.1	20.1	2.40	8.13	19.3	26.6	78.6	115.9	219	1,59	0.177	"		Schl	[illegible]
24.9.05	17:10	4.32	4.25	/	27.5	28.0	3.80	15.1	27.8	26.7	79.9	116.1	218	1.53	0	2/6		Schl	[illegible]
25.9.05	17:15				cryo SCOE off => restart cryo SCOE													[illegible]	[illegible]
	18:15	4,27	4,20		29,8	30,2	3,7	15,2	30,22	24,3	78,7	132,7	/	1,54	0,166	2/6		[illegible]	[illegible]
26.9.05	7:15	4,29	4,25	/	22,4	23,2	2,52	9,22	22,8	24,9	76,3	128,8	221.8	1.60	0.166	2/6		Schl	[illegible]
27.9.05	7:35	4.30	4.25	10.0	11.6	12.8	1.92	4.15	11.6	26.9	71.0	113.5	172.6	1.62	0.365	2/6		Schl	[illegible]
28.9.05	7:30	4.28	4.22	/	26.4	26.7	6.35	16.43	26.7	26.6	77.5	110.9	242	4.26	0	2/6		Schl	

Herschel EQM																	LOGSHEET 2 for COVER FLUSHING		
Date	Time	Temperatures in [K]															REMARKS	Sign	
		DLCM T101	HTT T106	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T707	H701	H101 on/off		AIV	QA
29.9.05	7:25	4.27	4.25	17.5	18.6	18.9	2.44	8.71	18.4	26.2	82.9	117.6	247.6	1.63	0.270	2/6		[signature]	
30.9.05	7:20	4.18	4.25	14.1	15.2	15.7	2.11	5.89	15.3	26.2	80.4	119.1	203.3	1.61	0.271	2/6		[signature]	
02.10.05	18:45	4.23	4.21	/	32.0	32.8	3.87	16.7	32.4	33.5	105.9	184.8	221.3	1.56	0	0		[signature]	
04.10.05	7:25	4.28	4.22	/	33.4	33.9	3.94	17.3	33.7	36.1	118.4	203.9	222.1	1.57	0	0		[signature]	
05.10.05	7:40	4.28	4.23	/	33.7	34.3	4.05	15.8	34.1	38.6	123.9	209.4	222.4	1.57	0	0		[signature]	
06.10.05	7:40	4.31	4.28	/	26.3	36.2	/	/	36.4	17.5	70.0	115.8	221.8	27.2	0	10.7W		[signature]	
07.10.05	7:45	14.3	11.7	/	38.8	39.0	/	/	38.8	23.9	52.0	74.5	219.4	34.4	0	H103/H104 with ~5W each		[signature]	
8.10.05	16:45	/	30.1	/	32.5	33.0	/	/	33.07	42.9	71.02	102.2	219.9	31.9	0	off		[signature]	
8.10.05	14:45	/	34.3	/	44.3	44.2	/	/	44.5	66.2	115.0	169.7	221.5	35.6	0	0		[signature]	
9.10.05	14:25	/	39.3	/	51.4	51.3	/	/	51.7	84.4	147.6	208.3	222.0	40.7	0	0		[signature]	
10.10.05	7:20	/	39.5	/	56.8	56.6	/	/	57.2	95.8	156.7	225.8	225.7	52.1	0	0		[signature]	
"	17:45	/	42.0	/	58.8	58.8	/	/	59.9	98.6	171.4	232.4	228.3	53.0	0	0		[signature]	
11.10.05	7:45	/	46.8	/	63.5	63.4	/	/	64.1	105.0	179.5	238.9	229.9	54.3	0	0		[signature]	
12.10.05	7:35	/	52.9	/	67.9	68.3	/	/	68.8	117.8	193.8	247.4	231.8	57.0	0	0		[signature]	
13.10.05	7:35	/	63.0	/	76.3	76.3	/	/	77.5	130.0	203.7	253.0	238.3	61.4	0	0		[signature]	
14.10.05	7:20	/	[illegible]	/	81.2	81.4	/	/	81.8	100.9	166.7	210.2	229.6	65.6	0	0		[signature]	
15.10.05	17:35	14.2	12.4	/	79.6	79.4	/	/	79.7	30.6	65.3	118.2	225.9	47.1	0	0		[signature]	
17.10.05	7:25	/	17.9	/	77.0	76.9	-	-	[illegible]	[illegible]	112.2	185.1	225.6	57.8	0	0		[signature]	
18.10.05	7:35	2.20	6.00	/	24.5	25.0	9.77	18.84	25.0	69.7	136.4	206.3	226.0	53.5	0	0		[signature]	
"	18:07	/	20.8	4.62	9.63	8.79	2.29	2.61	7.52	42.9	128.8	195.8	226.1	2.23	0.169	0		[signature]	
19.10.05	7:15	/	23.8	/	23.2	23.7	5.34	11.15	23.6	14.1	64.2	101.7	225.4	1.67	0.162	0		[signature]	

Herschel EQM | **LOGSHEET 2 for COVER FLUSHING**

Date	Time	Temperatures in [K] DLCM T101	HTT (T103) T106	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T707	47-1	ṁ AXT	REMARKS	Sign AIV	Sign QA
20.10.05	7:45	–	27,4	14,7	14,9	15,4	4,5	5,8	15,0	28,7	57,7	113,1	988	1,62	0,258			[illegible]	
21.10.05	8.30	–	27,4	14,5	14,8	15,5	4,5	5,7	15,1	31,9	62,2	123,2	below 20K	1,66	0,258			[illegible]	
22.10.05	15:15	/	28,4	–	30,9	31,4	8,6	19,4	31,6	57,7	91,4	158,5	252	1,65	0			[illegible]	
23.10.05	15:30	/	29.0	/	33.2	33.5	8.48	18.0	33.6	18.3	63.7	109.5	234.7	1.65	0			[illegible]	
24.10.05	7:35	/	27.9	/	19.87	22.1	4.88	9.90	21.8	35.8	64.7	104.8	235.7	1.66	0.257	20,5		[illegible]	[illegible]
25.10.05	8:45	–	29,3	15,9	16,5	18,1	4,7	7,8	17,7	16,5	59,5	95,0	203	1,64	0,257	18,6		[illegible]	[illegible]
26.10.05	7:45	/	24,9	16,2	16,8	17,3	4,50	7,34	17,2	44,2	66,9	109,9	187,3	1,64	0.251	18,5		[illegible]	[illegible]
27.10.05	7:15	/	28.0	13.2	14.0	15.3	4.07	5.28	15.00	59.3	88.4	141.2	<13	1.67	0.345	24,8		[illegible]	[illegible]
28.10.05		/	29.6	6.00	8.55	8.15	2.97	3.42	7.52	15.9	64.6	111.2	78.6	1.74	0.917	47,8		[illegible]	[illegible]
28.10.05	15:45	/	29.4	8,82	9,71	10,65	3,96	4,59	10,72	35,0	64,65	114,2	81,3	1,69				[illegible]	[illegible]
29.10.05	15:25	/	33.8	/	30.8	31.3	9.14	17.00	31.5	73.6	100.3	162.4	216.5	1.69	0			[illegible]	
31.10.05	8:10	/	37.7	/	34.6	35.3	8.95	17.79	35.2	83.5	115.4	176.5	228.3	1.69	0	14.6		[illegible]	
2.11.05	7:10	/	36.7	20.0	19.7	20.2	6.28	10.19	20.3	35.4	58.3	99.2	222.9	1.70	0.259	21.1		[illegible]	[illegible]
– u –	16:30	/		9.46	11,24	11,42	4,72	4,83	11,17	17,87	53,54	95,43	/	1,74	0,728			[illegible]	[illegible]
3.11.05	7:30	/	35.0	12.5	13.35	13.95	4.96	5.31	13.9	24.1	56.3	104.0	<13	1.70	0.354	23,7		[illegible]	[illegible]
4.11.05	7:45	/	38.9	12.3	13.47	14.51	4.71	5.62	13.4	37.9	64.8	106.8	<13	1.69	0.354	23,6		[illegible]	[illegible]
5.11.05	18:25	/	33.3	9,52	11,28	11,30	3,86	4,56	10,73	51,8	73,1	128,5	14,8	1,72	0,537	32,1		[illegible]	
6.11.05	17:40	/	36,4	/	31.9	32.6	8.97	16.51	32.64	78.8	107.2	167.8	215.2	1.68	0	12.8		[illegible]	
7.11.05	7:00	/	37.8	/	23.9	24.8	5.98	11.12	24.4	74.8	122.8	182.9	221.3	1.73	0.258	24.6		[illegible]	[illegible]
8.11.05	7:30	/	37.5	11.8	12.9	12.6	6.19	6.49	13.2	40.2	58.9	90.0	<18K	1.78	0.731	30.0		[illegible]	[illegible]
9.11.05	8:30	/	35.9	9.79	10.64	11.48	4.14	4.88	10.86	44.9	66.3	100.1	18.3	1.72	0.536	33,2		[illegible]	

Herschel EQM — LOGSHEET 2 for COVER FLUSHING

Date	Time	DLCM T101	HTT 103 T106	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T707	W702	ṁ AXT	REMARKS	Sign AIV	Sign QA
		Temperatures in [K]																	
16.11.05	7:15	/	34.1	12.0	13.15	11.57	4.73	5.54	12.99	16.4	64.1	96.9	45.9	1.68	0.354	22.4		[illegible]	[illegible]
11.11.05	7:35	–	31.0	/	27.4	27.6	9.68	16.09	27.7	21.8	56.8	100.9	201.9	1.60	0	8.6		[illegible]	[illegible]
12.11.05	10:15	/	27.0	–	29.2	29.6	8.58	16.85	29.8	14.9	47.4	64.6	221.7	1.59	0	/		[illegible]	
13.11.05	18:20	/	24.5	–	31.1	31.5	8.00	17.31	31.7	15.2	51.3	79.2	221.9	1.60	0	9.3		[illegible]	
14.11.05	7:10	–	24.72	–	16.53	16.9	3.9	7.5	17.0	26.7	62.0	107.9	221.9	1.678*	0.6	/	*(T701)	[illegible]	
"	8:30		24.8	–	15.35	15.9	3.6	6.8	15.4	27.0	63.0	105.6	221.0	1.694	0.6	/		[illegible]	
15.11.05	7:15	–	23.93	–	15.65	16.3	3.8	7.5	16.1	20.7	61.7	108	221.8	1.669	0.6	/		[illegible]	
"	9:00	–	27.9	–	14.13	14.6	3.4	6.7	14.4	20.4	61.2	108.4	221.8	1.69	0.6	–		[illegible]	
"	12:00	–	23.84	–	12.8	12.9	3.34	6.04	12.93	19.2	61.3	108.8	221.8	1.677	0.6	–		[illegible]	
"	15:10	–	23.7	–	13.0	13.5	3.01	6.03	11.8	16.3	61.5	105.2	221.8	1.692	0.6	–		[illegible]	
	17:30		23.5	–	12.6	12.8	3.37	6.04	12.9	18.1	63.2	104	221.0	1.686	0.4	–		[illegible]	
16.11.05	7:25	–	23.9	15.8	16.1	11.8	3.96	7.65	16.6	37.0	70.9	120.4	221.8	1.67	0.354	23.9		[illegible]	
"	13:30	–	24.12	15.9	16.3	15.4	3.97	7.72	16.7	31.0	69.2	122.4	221.8	1.67	0.354	/		[illegible]	
17.11.05	7:30	–	24.7	15.2	16.5	16.0	4.00	7.51	16.8	36.8	72.5	126.8	221.6	1.67	0.354	24.1		[illegible]	
"	13:30	–	24.8	15.2	16.2	16.6	4.09	7.6	16.9	28.9	71.1	127.8	221.7	1.67	0.354	24.1		[illegible]	
18.11.05	7:30	/	25.0	15.7	16.1	16.4	4.06	7.65	16.6	27.8	67.7	128.2	221.6	1.66	0.354	24.1		[illegible]	
	15:50	/	25.0	3.92	7.99	6.86	2.27	2.43	6.40	39.8	70.70	128.2	221.2	2.24	0	/		[illegible]	
19.11.05	17:35	/	22.2	/	30.5	30.9	7.84	17.63	31.1	<13	60.9	89.1	221.6	1.59	0	9.2		[illegible]	
20.11.05	10:00	/	23.6	–	32.6	33.8	7.8	16.9	33.2	41.2	74.7	123.0	221.5	1.60	–	9.1		[illegible]	
"	10:40	/	23.8	/	32.47	33.10	6.44	16.4	33.10	41.9	75.5	124	221.5	1.63	0.354	13.1		[illegible]	
21.11.05	6:30	/	27.6	18.1	18.4	18.1	4.22	8.03	18.1	48.6	89.0	150.9	221.4	1.68	0.354	24.8		[illegible]	

Herschel EQM — LOGSHEET 2 for COVER FLUSHING

Date	Time	Temperatures in [K] DLCM T101	HTT T108 (5)	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T707	H702	P4	REMARKS	Sign AIV	Sign QA
21.11.05	17:45	–	28,4	10,29	11,6	11,6	3,78	4,66	11,35	23,1	70,9	123,5	13,1	1,68	0,079	28		[signature]	
"	18:50	–	28,4	10,8	11,9	12,8	3,91	4,8	12,2	23,7	67,2	122,2	<13	1,68	0,443	26		[signature]	
22.11.05	6:15	–	26,4	10,1	11,26	11,78	3,79	4,63	11,39	34,7	71,0	127,8	<13	1,68	0,448	27,7		[signature]	
"	14:20	–	27,8	10,8	11,6	12,08	3,85	4,80	11,8	27,3	62,4	118,0	<13	1,67	0,442	25,9		[signature]	
"	18:50	–	27,6	8,7	10,4	12,2	3,5	4,1	9,78	23,6	62,0	115,1	<13	1,68	0,448	30,6		[signature]	
23.11.05	6:50	–	27,4	12,8	13,5	13,3	3,8	6,3	13,7	56,0	70,8	125,2	208	1,67	0,442	27,8		[signature]	
	7:55	–	27,4	11,5	12,4	12,8	3,7	5,1	12,3	24,6	67,7	125,8	19	1,69	0,442	28,7		[signature]	
	12:45	–	27,1	9,3	11,2	11,2	3,66	4,43	11,12	18,8	63,7	121,4	<13	1,68	0,442	27,5		[signature]	
	18:30	–	26,6	10,0	11,0	10,97	3,67	4,44	/	18,75	57,9	111,0	"	<1,5	0,442	27,4		[signature]	
24.11.05	6:50	–	26,5	–	21,9	26,1	8,9	11,8	25,1	21,2	61,9	114	<13	1,56	*0	6,0	H702 [illegible]	[signature]	
"	8:45	–	26,1	10,6	22,4	23,1	3,8	6,2	22,9	20,4	60,8	113	13,5	1,69	0,159	25,3		[signature]	
"	11:00	–	25,7	9,7	11,2	11,4	3,48	4,2	10,8	21,5	60,6	109,7	<13	1,68	0,438	29,4		[signature]	
	18:30	–	25,7	9,6	10,7	10,9	3,57	4,3	10,8	19,5	59,3	108,9	<13	1,67	0,439	27,6		[signature]	
25.11.05	6:45		25,3	9,7	10,7	10,9	3,6	4,3	10,8	28,3	63,8	115,0	<13	1,67	0,437	26,9		[signature]	
26.11.05	16:45	–	29,75	/	29,1	29,8	9,1	18,2	21,0	82,0	96,8	157,0	215,4	1,67	/	/		[signature]	
27.11.05	10:15	–	29,5	/	28,3	28,6	9,0	18,0	16,8	16,3	51,0	65,0	220,7	1,60	/	7,8		[signature]	
"	10:30	–	29,5	–	28,4	28,7	9,1	18,0	17,2	17,8	52,0	67,0	220,4	1,60	–	9,2		[signature]	
"	15:50	–	29,2	–	29,7	30,1	8,9	17,8	30,4	21,0	57,1	86,2	221,0	1,60	–	9,4		[signature]	
"	16:30	–	29,6	–	29,6	30,2	7,4	16,9	30,2	25,0	58,2	88,2	221,3	1,63	0,25	12,8		[signature]	
28.11.05	6:10	–	29,0	13,9	14,51	15,90	3,98	7,06	15,11	30,2	66,6	110,9	221,1	1,69	0,438	28,4		[signature]	
"	15:30	–	28,8	10,5	11,6	12,2	3,84	4,68	11,8	43,0	70,2	121,4	221,0	1,68	0,439	28,5		[signature]	

Herschel EQM — LOGSHEET 2 for COVER FLUSHING

Date	Time	DLCM T101	HTT 103 (~~T408~~)	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T707	H702	AX	REMARKS	Sign AIV	Sign QA
		Temperatures in [K]																	
28.11.05	19:10	–	28.9	10.5	11.2	11.65	3.86	4,71	11.33	39,3	71.8	124,3	~~52,1~~	1,68	0,439	27,2		[illegible]	
29.11.05	6:50	–	27,5	9,5	11,2	11,2	3,73	4,52	11,2	16,6	68,5	109,3	47,2	1,67	0,439	27,3		[illegible]	
"	13:00	–	26,93	9,6	11,2	10,68	3,71	4,52	10,8	21,7	62,4	108,1	41,6	1,68	0,439	27,3		[illegible]	
	18:30	–	26,5	9,6	10,7	10,9	3,67	4,43	10,6	22,4	60,3	108,3	42,1	1,67	0,439	27,2		[illegible]	
30.11.05	6:30	–	25,7	9,5	10,7	10,9	3,6	4,3	10,5	23,6	59,8	109,0	41,6	1,67	0,439	27,1		[illegible]	
	20:15	–	25,0	8,20	10,10	10,20	3,18	3,87	9,88	21,7	60,0	110,2	55,2	1,70	0,439	33,3		[illegible]	
1.12.05	7:45	–	24,7	9,8	11,1	11,4	3.5	4.3	10.8	20.6	61,4	113.8	45,2	1,67	0,439	27,3		[illegible]	
	19:20	–	24,1	9,28	10,42	11,20	3,47	4,09	10,78	21.6	58.6	108,5	43,5	1,68	0.439	27,5		[illegible]	
2.12.05	8:30	–	24,9	10,7	11,1	11,2	3,56	4,55	11,8	55,9	86,7	139,3	43,9	1,67	0,437	28.5		[illegible]	
	13:00	–	25.6	10.4	11,6	12,9	3,65	4,61	11.35	20,3	73,0	126,1	43,18	1,67	0,439	27,1		[illegible]	
	17:45	–	25.1	3.69	7.42	6.39	2.27	2.32	5.05	39,0	70,5	119,8	49.8	2,17	0	–		[illegible]	
3.12.05	15:00	–	25,2	–	28,5	28,7	8,5	16,6	28,9	36.7	72.8	127,9	209,1	1,59	0	8,5		[illegible]	
4.12.05	17:00	–	27,3	–	33,0	33,3	8,1	17,0	33,4	41,3	82,6	144,3	220,6	1,61	0	10,1		[illegible]	
5.12.05	6:30	–	29.0	–	33.5	33.8	8.3	17.2	33.9	45.6	81.3	152.9	220.9	1.62	0	10.5		[illegible]	
"	18:30	–	29,2	–	11,4	11,8	3,7	4,4	11,1	19,2	66,5	111,8	30,5	1,69	0,439	30,2		[illegible]	
6.12.05	6:35	–	28.3	9.81	11.07	11.51	3.80	4.53	11.2	20.7	58.8	107.4	53.6	1.68	0.439	27,2		[illegible]	
"	17:00	–	27,4	9,85	10,73	10,97	3,74	4,39	10,57	22,6	58,6	106,6	19,03	1,67	0,439	27,1		[illegible]	
	18:00	–	27,3	9,85	11,45	10,65	3,73	4,56	10,57	23,15	59,11	107,03	19,40	1,67	0,439	27,1		[illegible]	
7.12.05	6:40	–	26,7	9,6	10,45	11,2	3,64	4,59	10,8	25,0	61,1	111,1	17,7	1,67	0,437	27,1		[illegible]	
	12:40	–	26,2	9,3	10,7	10,8	3,61	4,46	10,5	25,9	62,3	113,5	19,6	1,67	0,439	27,5		[illegible]	
	~~17:50~~	~~—~~		9,8	~~11,24~~	~~11,8~~	~~3,6~~	~~4,57~~	~~11,58~~	44,3	76,6	~~120,1~~	~~19,7~~	1,68	~~—~~	~~27,6~~		[illegible]	

Herschel EQM — LOGSHEET 2 for COVER FLUSHING

Date	Time	Temperatures in [K] DLCM T101	HTT T106	PACS T202	HIFI T207 T208	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T707	H/Ω2	Ax in	REMARKS	Sign AIV	Sign QA
7.12.05	13:00	—	26,17	9,5	11,02	10,97	3,63	4,47	10,57	29,2	62,6	113,7	19,7	1,67	0,439	27,3		[signature]	
	17:50	—	26,21	9,8	11,24	11,8	3,6	4,57	11,58	44,3	76,6	126,7	19,7	1,68	—	27,6		[signature]	
8.12.05	6:45	—	26,7	9,0	11,24	11,6	3,67	4,52	11,12	24,5	69,1	130,1	17,7	1,68	0,439	27,3		[signature]	
	10:00	—	26,5	10,0	11,0	11,2	3,66	4,56	10,86	15,2	66,6	128,3	18,8	1,67	0,439	27,3		[signature]	
	19:40	/	26.0	9.42	10.25	10.6	3.50	9.00	10.04	16.5	60.2	99.2	18.9	1.69	0.439	29.3		[signature]	
9.12.05	6:45	—	24,8	9,3	10,7	10,6	3,53	4,22	10,5	14,77	46,78	63,91	18,7	1,68	0,439	26.8		[signature]	
	17:15	/	23.7	4.54	7.23	6.82	2.38	2.58	5.81	22.9	56.6	82.9	49.6	1.81	0			[signature]	
10.12.05	17:00	—	24,3	/	29,4	29,7	8,1	17,7	29.8	37,1	75,2	129,4	212,0	1,59	0	8,4		[signature]	
11.12.05	18:40	/	21.7	/	23.2	33.6	8.1	18.0	33.6	45.1	88.2	152.2	220.6	1.61	0	10.3		[signature]	
12.12.05	6:30	/	28.8	[illegible]	14,1	14,7	4.19	5.47	14.68	28.6	77.0	145.5	21.6	1.67	0.4[illegible]	23.7		[signature]	
"	11:30	—	28,7	10,1	11,4	11,8	3,85	4,70	11,12	26,4	70,0	134,9	20,4	1,68	0,9	27,5		[signature]	
"	19:00	—	28,7	10,0	11,6	12,09	3,85	4,71	11,11	26,2	69,5	133,7	20,8	1,67	0,9	27,5		[signature]	
13.12.05	6:40	—	28.1	9.03	11.49	11.72	3.78	4.60	11.15	25.5	66.0	125.5	58.4	1.68	0.9	27.4		[signature]	
"	18:30	—	27,5	10,0	11,2	11,2	3,72	4,42	10,3	29,1	64,3	121,1	30,1	1,67	0,9	27,2		[signature]	
14.12.05	7:30	—	26.9	10.0	11.4	11.5	3.72	4.63	11.4	26.3	64.5	120.0	20.8	1.68	0.9	27.2		[signature]	

Herschel EQM — **LOGSHEET 2 for Depletion & Warm Up**

Date	Time	Temperatures in [K] HTT T103	HIFI T207 T208	SPIRE T249 T250	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T708 T707	VT105	VT702	VT701	REMARKS	Sign AIV	Sign QA
14.12.05	15:50	26.6	11.2	11.8	11.8	3.75	4.65	11.5	27.1	65.1	120.6	20.7	1.69					Schl	
15.12.05	7:40	29.4	25.6	26.7	26.3	9.59	13.9	26.1	57.5	93.4	157.6	20.0	4.26					Schl	
	18:15	32.6	13.6	10.9	12.9	8.27	8.63	13.2	64.0	116.5	179.5	23.3	7.43					Schl	
16.12.05	6:40	35.3	36.3	36.1	36.3	–	–	36.7	72.5	133.8	199.4	18.5	59.4					Schl	
	17:30	46.8	44.4	44.4	44.4	–	–	44.7	88.6	149.7	215.8	19.8	[illegible].2					Schl	
17.12.05	12:30	55.1	56.0	56.7	56.0	–	–	56.7	108.6	174.0	235.9	113.4	70.2					Schl	
	17:30	57.1	59.2	59.6	59.3	–	–	60.4	119.0	178.2	240.1	176.9	[illegible].3					Schl	
19.12.05	7:25	74.3	80.6	81.9	81.6	–	–	82.5	137.1	205.1	254.7	235.7	106.9					Schl	Ca
	16:40	79.3	85.5	86.4	85.7	–	–	87.8	147.4	209.1	257.5	236.4	105.2					Schl	Ca
20.12.05	10:30	87.5	94.6	95.8	94.9	–	–	97.1	159.6	217.9	262.4	237.6	103.9					Schl.	Ca
	16:00	89.7	97.1	98.3	97.5	–	–	99.7	161.5	219.7	263.3	237.8	104.0					Schl.	Ca
21.12.05	10:00	97.3	105.9	107.0	106.3	–	–	108.6	166.7	224.0	265.4	238.7	105.2					Schl.	Ca
	16:00	99.5	108.3	109.5	108.7	–	–	111.1	167.8	224.8	265.9	239.0	105.8					Schl.	Ca
22.12.05	15:30	141.6	149.4	149.4	149.6	–	–	151.2	182.2	231.1	268.4	242.4	137.6					Schl	Ca
	16:25	141.9	149.5	149.5	149.7	–	–	152.0	183.2	231.2	268.5	242.2	137.7					Schl	Ca
30.12.05	16:30	161.3	167.0	167.7	167.3	–	–	168.7	202.6	244.1	275.0	249.5	160.5					Schl	Ca
3.1.06	9:40	182.2	188.3	188.7	187.5	–	–	189.8	212.6	249.6	277.0	253.3	181.2					Schl	Ca
	14:05	184.6	189.4	189.7	189.5	–	–	190.8	213.1	250.0	277.2	253.4	190.1	232.9				Schl	Ca
	16:10	185.2	190.0	190.3	190.1	–	–	191.4	213.5	250.0	277.3	253.4	192.2	235.4				Schl	Ca
9.1.06	7:30	218.4	220.7	221.0	220.9	–	–	221.8	233.0	255.7	275.8	260.5	221.1	258.3				Schl	Ca
	11:50	220.4	223.0	223.1	223.2	–	–	223.9	232.2	258.3	279.3	260.9	223.8	274.9	252.7	238.4		Schl	Ca

Herschel EQM | **LOGSHEET 2 for Depletion & Warm Up**

Date	Time	Temperatures in [K] HTT T103	HIFI T207 T208	SPIRE T249 T254	SPIRE T253 T254	OBA in T231	OBA out T236	OBA Shield T211	1. shield T423	2. shield T443	3. shield T463	Cover T601	AXT T709 T707	VT105	VT202	VT701	REMARKS	Sign AIV	Sign QA
10.1.06	7:35	223.7	226.4	226.9	226.9	/	/	227.3	234.1	256.8	277.9	261.1	229.8	241.7	254.1	234.5		Jdl	Ca
	12:05	224.6	227.5	227.5	227.8	/	/	228.5	234.6	256.4	277.5	261.3	230.2	247.3	254.6	235.3		Jdl	Ca
	16:30	225.3	228.4	228.6	228.8	-	-	229.3	235.3	256.5	277.5	261.5	231.5	247.6	255.1	236.1		Jdl	Ca
11.1.06	7:40	228.6	231.5	231.8	231.8	/	/	232.1	237.5	256.6	276.9	262.0	235.0	249.3	251.3	238.7		Jdl	Ca
	13:30	229.8	232.9	233.4	233.2	/	/	234.7	238.7	256.8	276.5	262.6	236.4	241.9	254.4	238.1		Jdl	Ca
	16:40	230.8	233.9	234.0	234.4	/	/	237.1	240.5	257.1	275.8	264.9	238.8	243.2	252.0	238.1		Jdl	Ca
12.1.06	7:35	241.2	240.6	241.8	241.2	/	/	243.3	247.2	260.4	276.4	268.4	247.6	249.2	257.0	244.3		Jdl	Ca
	16:10	251.2	246.7	248.6	247.3	/	/	252.6	258.0	268.4	280.3	277.3	253.8	253.7	260.9	250.2		Jdl	Ca
13.1.06	7:35	267.0	258.4	259.6	257.8	/	/	262.7	267.8	275.2	284.1	[illegible]	267.8	265.6	271.0	263.7		Jdl	Ca
	14:35	274.0	264.4	265.8	264.6	/	/	279.6	274.9	280.3	281.6	284.9	273.3	271.3	275.8	270.0		Jdl	Ca
17.1.06	11:25	290.0	289.5	289.6	289.6	/	/	290.5	290.3	291.1	292.4	291.6	290.7	289.2	289.4	289.0		Jdl	Ca
	10:30	290.4	290.2	290.1	290.1	/	/	291.2	290.9	291.4	292.8	292.0	290.2	/	/	/		Jdl	Ca
	10:45		shut down Cryo JCOE																

VIII. Copy of the Strap Pretension Measurements

Strap Pretension before cool down

Projekt: HERSCHEL_EQM_012

Ausdruck: 25.08.2005

25.08.05 11:05

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	4.95	kN
18:	MATH	no. 2	4.41	kN
19:	MATH	no. 3	5.36	kN
20:	MATH	no. 4	5.24	kN
21:	MATH	no. 5	5.39	kN
22:	MATH	no. 6	7.32	kN
23:	MATH	no. 7	2.74	kN
24:	MATH	no. 8	4.51	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	8.09	kN
27:	MATH	no.10	6.92	kN
28:	MATH	no.11	5.51	kN
29:	MATH	no.12	7.88	kN
30:	MATH	no,13	6.23	kN
31:	MATH	no.14	7.46	kN
32:	MATH	no.15	4.86	kN
33:	MATH	no.16	4.60	kN

Herschel EQM

Measurement of Strap Pretension during Cool Down Phase

T103 = 285K

29.08.2005

15:16:49

Schaeffler

(

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	2.71	kN
18:	MATH	no. 2	2.28	kN
19:	MATH	no. 3	3.19	kN
20:	MATH	no. 4	2.97	kN
21:	MATH	no. 5	3.17	kN
22:	MATH	no. 6	4.57	kN
23:	MATH	no. 7	0.94	kN
24:	MATH	no. 8	2.53	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	5.89	kN
27:	MATH	no.10	4.43	kN
28:	MATH	no.11	3.25	kN
29:	MATH	no.12	5.43	kN
30:	MATH	no,13	4.03	kN
31:	MATH	no.14	5.56	kN
32:	MATH	no.15	2.62	kN
33:	MATH	no.16	2.46	kN

(

Herschel EQM

Measurement of Strap Pretension during Cool Down Phase

T103=282 K

29.08.2005

15:29:17

mack

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	2.30	kN
18:	MATH	no. 2	3.02	kN
19:	MATH	no. 3	3.22	kN
20:	MATH	no. 4	2.69	kN
21:	MATH	no. 5	2.45	kN
22:	MATH	no. 6	3.86	kN
23:	MATH	no. 7	2.70	kN
24:	MATH	no. 8	2.17	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	6.50	kN
27:	MATH	no.10	4.07	kN
28:	MATH	no.11	3.45	kN
29:	MATH	no.12	5.28	kN
30:	MATH	no,13	4.01	kN
31:	MATH	no.14	5.38	kN
32:	MATH	no.15	2.79	kN
33:	MATH	no.16	2.25	kN

Note: no. 7 readjusted

Herschel EQM

Measurement of Strap Pretension during Cool Down Phase

T103 = 266K

30.08.2005

07:17:04

J. Schäffler

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.48	kN
18:	MATH	no. 2	0.79	kN
19:	MATH	no. 3	1.06	kN
20:	MATH	no. 4	0.40	kN
21:	MATH	no. 5	0.39	kN
22:	MATH	no. 6	1.67	kN
23:	MATH	no. 7	0.62	kN
24:	MATH	no. 8	0.48	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	3.81	kN
27:	MATH	no.10	2.05	kN
28:	MATH	no.11	1.43	kN
29:	MATH	no.12	2.79	kN
30:	MATH	no,13	2.17	kN
31:	MATH	no.14	2.99	kN
32:	MATH	no.15	0.99	kN
33:	MATH	no.16	0.87	kN

Herschel EQM

Measurement of Strap Pretension during Cool Down Phase

T103 = 178 K

30.08.2005

20:14:28

Mack

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	2.28	kN
18:	MATH	no. 2	2.57	kN
19:	MATH	no. 3	2.84	kN
20:	MATH	no. 4	2.58	kN
21:	MATH	no. 5	4.59	kN
22:	MATH	no. 6	2.12	kN
23:	MATH	no. 7	2.33	kN
24:	MATH	no. 8	4.42	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	5.46	kN
27:	MATH	no.10	4.93	kN
28:	MATH	no.11	4.31	kN
29:	MATH	no.12	5.07	kN
30:	MATH	no,13	3.43	kN
31:	MATH	no.14	5.15	kN
32:	MATH	no.15	3.84	kN
33:	MATH	no.16	2.82	kN

Note: after readjustment of all straps

Herschel EQM

Measurement of Strap Pretension during Cool Down Phase

T103 = 159 K

30.08.2005

21:48:28

P. Mack

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.59	kN
18:	MATH	no. 2	0.71	kN
19:	MATH	no. 3	0.96	kN
20:	MATH	no. 4	0.69	kN
21:	MATH	no. 5	1.89	kN
22:	MATH	no. 6	0.47	kN
23:	MATH	no. 7	0.63	kN
24:	MATH	no. 8	2.01	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	3.19	kN
27:	MATH	no.10	2.77	kN
28:	MATH	no.11	2.12	kN
29:	MATH	no.12	2.81	kN
30:	MATH	no,13	1.84	kN
31:	MATH	no.14	2.88	kN
32:	MATH	no.15	2.04	kN
33:	MATH	no.16	1.30	kN

Herschel EQM

Measurement of Strap Pretension during Cool Down Phase

T103 = 165 K

31.08.2005

07:28:39

J. Schäffler

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.77	kN
18:	MATH	no. 2	0.89	kN
19:	MATH	no. 3	1.15	kN
20:	MATH	no. 4	0.88	kN
21:	MATH	no. 5	2.34	kN
22:	MATH	no. 6	0.64	kN
23:	MATH	no. 7	0.72	kN
24:	MATH	no. 8	2.43	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	3.50	kN
27:	MATH	no.10	3.06	kN
28:	MATH	no.11	2.35	kN
29:	MATH	no.12	3.10	kN
30:	MATH	no,13	2.06	kN
31:	MATH	no.14	3.15	kN
32:	MATH	no.15	2.24	kN
33:	MATH	no.16	1.42	kN

Herschel EQM

Measurement of Strap Pretension during Cool Down Phase

T101 = 10 K

01.09.2005

09:03:07

J. Schäffler

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	2.51	kN
18:	MATH	no. 2	2.22	kN
19:	MATH	no. 3	2.58	kN
20:	MATH	no. 4	1.39	kN
21:	MATH	no. 5	0.70	kN
22:	MATH	no. 6	2.73	kN
23:	MATH	no. 7	1.05	kN
24:	MATH	no. 8	2.52	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	3.00	kN
27:	MATH	no.10	4.02	kN
28:	MATH	no.11	2.52	kN
29:	MATH	no.12	3.03	kN
30:	MATH	no,13	4.17	kN
31:	MATH	no.14	2.53	kN
32:	MATH	no.15	3.63	kN
33:	MATH	no.16	2.80	kN

Herschel EQM

Measurement of Strap Pretension during Cool Down Phase

T101 = 4.2 K

02.09.2005

12:09:45

J.Schäffler

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	2.30	kN
18:	MATH	no. 2	2.06	kN
19:	MATH	no. 3	2.46	kN
20:	MATH	no. 4	1.23	kN
21:	MATH	no. 5	0.69	kN
22:	MATH	no. 6	2.49	kN
23:	MATH	no. 7	0.92	kN
24:	MATH	no. 8	1.69	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	3.06	kN
27:	MATH	no.10	4.09	kN
28:	MATH	no.11	2.59	kN
29:	MATH	no.12	3.03	kN
30:	MATH	no,13	4.17	kN
31:	MATH	no.14	2.57	kN
32:	MATH	no.15	3.69	kN
33:	MATH	no.16	2.80	kN

PLM EQM COOL DOWN

Projekt: HERSCHEL_EQM_01

Ausdruck: 07.09.2005

AXT T208 67k

#	Kan	Wert	Einheit
17:	MATH	2.38	kN
18:	MATH	2.11	kN
19:	MATH	2.12	kN
20:	MATH	1.03	kN
21:	MATH	0.64	kN
22:	MATH	2.52	kN
23:	MATH	0.92	kN
24:	MATH	1.81	kN
25:	001	-----	Skip
26:	MATH	3.22	kN
27:	MATH	4.17	kN
28:	MATH	2.67	kN
29:	MATH	3.15	kN
30:	MATH	4.14	kN
31:	MATH	2.73	kN
32:	MATH	3.81	kN
33:	MATH	2.92	kN

Herschel EQM

Measurement of Strap Pretension during Cool Down Phase

T 101 = 4.3 K

30.09.2005

14:15:24

J. Schäffler

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	2.26	kN
18:	MATH	no. 2	3.10	kN
19:	MATH	no. 3	3.10	kN
20:	MATH	no. 4	1.13	kN
21:	MATH	no. 5	0.41	kN
22:	MATH	no. 6	1.71	kN
23:	MATH	no. 7	0.70	kN
24:	MATH	no. 8	1.71	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	3.15	kN
27:	MATH	no.10	3.61	kN
28:	MATH	no.11	2.07	kN
29:	MATH	no.12	2.93	kN
30:	MATH	no,13	4.29	kN
31:	MATH	no.14	2.82	kN
32:	MATH	no.15	4.11	kN
33:	MATH	no.16	2.84	kN

Herschel EQM

Measurement of Strap Pretension during Cool Down Phase

T103 = 28 K

24.10.2005

14:10:05

J. Schäffler

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	1.92	kN
18:	MATH	no. 2	2.72	kN
19:	MATH	no. 3	2.93	kN
20:	MATH	no. 4	0.88	kN
21:	MATH	no. 5	0.37	kN
22:	MATH	no. 6	1.42	kN
23:	MATH	no. 7	0.59	kN
24:	MATH	no. 8	1.86	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	2.70	kN
27:	MATH	no.10	3.22	kN
28:	MATH	no.11	1.78	kN
29:	MATH	no.12	2.48	kN
30:	MATH	no,13	3.73	kN
31:	MATH	no.14	2.31	kN
32:	MATH	no.15	3.60	kN
33:	MATH	no.16	2.40	kN

Herschel EQM

Measurement of Strap Pretension during Cool Down Phase

T103 = 35K

09.11.2005

08:32:36

J. Schäffler

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	1.87	kN
18:	MATH	no. 2	2.73	kN
19:	MATH	no. 3	2.95	kN
20:	MATH	no. 4	0.88	kN
21:	MATH	no. 5	0.35	kN
22:	MATH	no. 6	1.42	kN
23:	MATH	no. 7	0.57	kN
24:	MATH	no. 8	1.76	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	2.67	kN
27:	MATH	no.10	3.19	kN
28:	MATH	no.11	1.74	kN
29:	MATH	no.12	2.49	kN
30:	MATH	no,13	3.66	kN
31:	MATH	no.14	2.31	kN
32:	MATH	no.15	3.56	kN
33:	MATH	no.16	2.36	kN

Herschel EQM

Measurement of Strap Pretension during ~~Cool Down~~ warm up Phase

T103 = 40 K

16.12.2005

10:58:11

J. Schäffler

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	2.32	kN
18:	MATH	no. 2	1.88	kN
19:	MATH	no. 3	2.37	kN
20:	MATH	no. 4	1.08	kN
21:	MATH	no. 5	1.80	kN
22:	MATH	no. 6	2.47	kN
23:	MATH	no. 7	0.93	kN
24:	MATH	no. 8	0.62	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	2.88	kN
27:	MATH	no.10	3.65	kN
28:	MATH	no.11	2.52	kN
29:	MATH	no.12	2.69	kN
30:	MATH	no,13	3.72	kN
31:	MATH	no.14	2.47	kN
32:	MATH	no.15	3.45	kN
33:	MATH	no.16	2.62	kN

Herschel EQM

Measurement of Strap Pretension during ~~Cool-Down~~ Phase warm up

T103 = 47 K, lower sensors loos

16.12.2005

17:21:05

J. Schäffler

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.02	kN
18:	MATH	no. 2	0.26	kN
19:	MATH	no. 3	0.95	kN
20:	MATH	no. 4	0.71	kN
21:	MATH	no. 5	0.67	kN
22:	MATH	no. 6	0.13	kN
23:	MATH	no. 7	0.11	kN
24:	MATH	no. 8	0.10	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	0.15	kN
27:	MATH	no.10	0.01	kN
28:	MATH	no.11	0.06	kN
29:	MATH	no.12	0.16	kN
30:	MATH	no,13	0.10	kN
31:	MATH	no.14	0.00	kN
32:	MATH	no.15	0.11	kN
33:	MATH	no.16	-0.01	kN

Herschel EQM

Measurement of Strap Pretension during ~~Cool Down~~ warm up Phase

HTT = 79,4 K

19.12.2005

16:52:51

C. Schlosser

#	Kan	Wert	Einheit
17:	MATH	0.15	kN
18:	MATH	0.22	kN
19:	MATH	0.58	kN
20:	MATH	0.59	kN
21:	MATH	0.73	kN
22:	MATH	0.18	kN
23:	MATH	0.15	kN
24:	MATH	0.09	kN
25:	001	-----	Skip
26:	MATH	0.13	kN
27:	MATH	-0.00	kN
28:	MATH	0.07	kN
29:	MATH	0.17	kN
30:	MATH	0.10	kN
31:	MATH	0.01	kN
32:	MATH	0.11	kN
33:	MATH	-0.01	kN

Herschel EQM

Measurement of Strap Pretension during ~~Cool Down~~ warm up Phase

T103 = 89,6 K

20.12.2005

15:27:15

J. Schäffler

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.17	kN
18:	MATH	no. 2	0.26	kN
19:	MATH	no. 3	0.73	kN
20:	MATH	no. 4	0.68	kN
21:	MATH	no. 5	0.76	kN
22:	MATH	no. 6	0.23	kN
23:	MATH	no. 7	0.26	kN
24:	MATH	no. 8	0.10	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	0.14	kN
27:	MATH	no.10	0.00	kN
28:	MATH	no.11	0.07	kN
29:	MATH	no.12	0.17	kN
30:	MATH	no,13	0.10	kN
31:	MATH	no.14	0.01	kN
32:	MATH	no.15	0.12	kN
33:	MATH	no.16	-0.00	kN

Herschel EQM

Measurement of Strap Pretension during ~~Cool Down~~ Warm up Phase

T103 = 98,7 K

21.12.2005

14:01:46

J. Schäffler

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.18	kN
18:	MATH	no. 2	0.26	kN
19:	MATH	no. 3	0.79	kN
20:	MATH	no. 4	0.73	kN
21:	MATH	no. 5	0.77	kN
22:	MATH	no. 6	0.22	kN
23:	MATH	no. 7	0.26	kN
24:	MATH	no. 8	0.10	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	0.14	kN
27:	MATH	no.10	0.00	kN
28:	MATH	no.11	0.07	kN
29:	MATH	no.12	0.17	kN
30:	MATH	no,13	0.10	kN
31:	MATH	no.14	0.01	kN
32:	MATH	no.15	0.12	kN
33:	MATH	no.16	-0.01	kN

Herschel EQM

Measurement of Strap Pretension during ~~Cool Down~~ warm up Phase

T 103 = 161.3 K

30.12.2005

16:38:00

C. Schlosser

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.18	kN
18:	MATH	no. 2	0.26	kN
19:	MATH	no. 3	0.95	kN
20:	MATH	no. 4	1.09	kN
21:	MATH	no. 5	1.30	kN
22:	MATH	no. 6	0.21	kN
23:	MATH	no. 7	0.23	kN
24:	MATH	no. 8	0.11	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	0.14	kN
27:	MATH	no.10	-0.00	kN
28:	MATH	no.11	0.07	kN
29:	MATH	no.12	0.17	kN
30:	MATH	no,13	0.10	kN
31:	MATH	no.14	0.00	kN
32:	MATH	no.15	0.11	kN
33:	MATH	no.16	-0.01	kN

Herschel EQM

Measurement of Strap Pretension during ~~Cool Down~~ warm up Phase

T 103 = 188.2 K

03.01.2006

09:46:29

C. Schlosser

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	0.34	kN
18:	MATH	no. 2	0.36	kN
19:	MATH	no. 3	0.98	kN
20:	MATH	no. 4	1.25	kN
21:	MATH	no. 5	1.57	kN
22:	MATH	no. 6	0.21	kN
23:	MATH	no. 7	0.29	kN
24:	MATH	no. 8	0.11	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	0.13	kN
27:	MATH	no.10	0.00	kN
28:	MATH	no.11	0.07	kN
29:	MATH	no.12	0.16	kN
30:	MATH	no,13	0.09	kN
31:	MATH	no.14	0.04	kN
32:	MATH	no.15	0.11	kN
33:	MATH	no.16	-0.02	kN

Herschel EQM

Measurement of Strap Pretension during ~~Cool Down~~ Warm up Phase

T 103 = 218.9 K

09.01.2006

09:52:49

C. Schlosser

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	1.74	kN
18:	MATH	no. 2	1.52	kN
19:	MATH	no. 3	2.34	kN
20:	MATH	no. 4	2.45	kN
21:	MATH	no. 5	2.32	kN
22:	MATH	no. 6	2.41	kN
23:	MATH	no. 7	0.65	kN
24:	MATH	no. 8	0.17	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	0.14	kN
27:	MATH	no.10	0.00	kN
28:	MATH	no.11	0.07	kN
29:	MATH	no.12	0.17	kN
30:	MATH	no,13	0.11	kN
31:	MATH	no.14	0.23	kN
32:	MATH	no.15	0.12	kN
33:	MATH	no.16	0.00	kN

Herschel EQM

Measurement of Strap Pretension during ~~Cool Down~~ warm up Phase

T 103 = 241.5 K

12.01.2006

07:49:54

C. Schlosser

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	4.04	kN
18:	MATH	no. 2	3.82	kN
19:	MATH	no. 3	4.05	kN
20:	MATH	no. 4	4.79	kN
21:	MATH	no. 5	3.53	kN
22:	MATH	no. 6	4.52	kN
23:	MATH	no. 7	2.48	kN
24:	MATH	no. 8	0.79	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	0.14	kN
27:	MATH	no.10	0.01	kN
28:	MATH	no.11	0.07	kN
29:	MATH	no.12	0.17	kN
30:	MATH	no,13	0.10	kN
31:	MATH	no.14	0.72	kN
32:	MATH	no.15	0.12	kN
33:	MATH	no.16	-0.00	kN

Herschel EQM

Measurement of Strap Pretension during ~~Cool Down~~ Warm up Phase

T 103 = 273.7 K

13.01.2006

14:16:59

C. Schlosser

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	7.92	kN
18:	MATH	no. 2	8.14	kN
19:	MATH	no. 3	7.31	kN
20:	MATH	no. 4	8.82	kN
21:	MATH	no. 5	7.10	kN
22:	MATH	no. 6	7.50	kN
23:	MATH	no. 7	6.40	kN
24:	MATH	no. 8	3.86	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	0.14	kN
27:	MATH	no.10	0.01	kN
28:	MATH	no.11	0.07	kN
29:	MATH	no.12	0.20	kN
30:	MATH	no,13	0.10	kN
31:	MATH	no.14	2.48	kN
32:	MATH	no.15	0.11	kN
33:	MATH	no.16	-0.01	kN

Herschel EQM

Measurement of Strap Pretension during ~~Cool Down~~ Warm up Phase

T 103 = 288 K

16.01.2006

14:18:23

J. Schäffler

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	10.28	kN
18:	MATH	no. 2	10.45	kN
19:	MATH	no. 3	9.48	kN
20:	MATH	no. 4	11.05	kN
21:	MATH	no. 5	9.32	kN
22:	MATH	no. 6	9.12	kN
23:	MATH	no. 7	8.78	kN
24:	MATH	no. 8	5.80	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	0.14	kN
27:	MATH	no.10	0.01	kN
28:	MATH	no.11	0.07	kN
29:	MATH	no.12	0.21	kN
30:	MATH	no,13	0.10	kN
31:	MATH	no.14	4.36	kN
32:	MATH	no.15	0.12	kN
33:	MATH	no.16	0.00	kN

Herschel EQM

Measurement of Strap Pretension during ~~Cool Down Phase~~ CVV pressurization

T103 = 2 88,7 K

16.01.2006

17:38:15

P. Mack

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	7.13	kN
18:	MATH	no. 2	7.50	kN
19:	MATH	no. 3	5.64	kN
20:	MATH	no. 4	7.30	kN
21:	MATH	no. 5	6.01	kN
22:	MATH	no. 6	5.00	kN
23:	MATH	no. 7	5.93	kN
24:	MATH	no. 8	5.30	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	6.52	kN
27:	MATH	no.10	8.21	kN
28:	MATH	no.11	6.64	kN
29:	MATH	no.12	6.76	kN
30:	MATH	no,13	7.57	kN
31:	MATH	no.14	6.94	kN
32:	MATH	no.15	7.68	kN
33:	MATH	no.16	7.47	kN

Herschel EQM

Measurement of Strap Pretension ~~during Cool Down Phase~~ *at the end of EQM phase*

T 103 = 290.4 K

17.01.2006

11:36:56

C. Schlosser

#	Kan	Mess-Stelle	Wert	Einheit
17:	MATH	upper no. 1	7.15	kN
18:	MATH	no. 2	7.54	kN
19:	MATH	no. 3	5.75	kN
20:	MATH	no. 4	7.28	kN
21:	MATH	no. 5	6.03	kN
22:	MATH	no. 6	5.12	kN
23:	MATH	no. 7	5.98	kN
24:	MATH	no. 8	5.32	kN
25:	001		-----	Skip
26:	MATH	lower no. 9	6.58	kN
27:	MATH	no.10	8.23	kN
28:	MATH	no.11	6.75	kN
29:	MATH	no.12	6.79	kN
30:	MATH	no,13	7.60	kN
31:	MATH	no.14	7.03	kN
32:	MATH	no.15	7.74	kN
33:	MATH	no.16	7.48	kN

IX. Copy of the NCR's

Company	**Project Name**	
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-151000-ASED-NC-1795 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 0 Page 1 of 1

Nonconformance Report

NCR **Title** EQM Cryo cover temp instability	
NC Item **Identification** PLM EQM	
Next Higher Assembly HERSCHEL PLM EQM	
Drawing No	Sr No. EQM
Procedure No SPIRE EMC Test	
Supplier ASED	Purchase Order SPIRE EMC Test
Subsystem	Model EQM
NC Observation Date: 28-NOV-05 Location: ASED Otn	NC Detected During Test

Description of Nonconformance

During cryo cover flushing the temperature of the cover became unstable and oscillations were apparent within the Cryo cover flushing circuit piping and the associated metering valves.
Possible cause is that the exhaust line is long and the metering vale is right at the end of this line before going to atmosphere.
EQM Cryo cover flushing circuit configuration to be reviewed and assessed.

Requirements Violated

Cryo Operations

Initiator: Date, Name and Signature 29-NOV-05 D.Hendry

Internal NRB Dispositions

Investigations performed. It has been detected that the insulation vacuum of the cover flushing line was bad. Cover temperature stabilized at low twmperature after improoving the insulation vacuum

Ref. to MoMs

Classification:

Major [X] **Minor** [ ]

Customer Notification

Cause of NC	Corrective/Preventative Actions	Verification
Ref to Failure Report		

Date:
Name:
Signature:

Company	Project Name	
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-151000-ASED-NC-1319 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 1 of 6

Nonconformance Report

NCR **Title**	I/F CVV to fill./ vent tube of filling port is not He leaktight as req.		
NC Item **Identification**	PLM EQM		
Next Higher Assembly	HERSCHEL PLM EQM		
Drawing No		Sr No.	EQM
Procedure No	Cryo integration Leak test		
Supplier	APCO/ STOEHR	Purchase Order	Cryo integration leak test
Subsystem		Model	EQM
NC Observation Date: 02-AUG-05 Location: ASED Otn		NC Detected During	Test

Description of Nonconformance

Requirements Violated

During leaktest performed after integration of the upper bulkhead it was detected that the interface CVV upper bulkhead to the fill/ venttube of filling port is not leaktight as required (Helico- flex seal integrated on fill/ venttube of filling port: typ HN 200, outer diameter 132,1; inner diameter 122,3 batch 93766/03/41; Helicoflex on I/F to pressure plate of SV121 is Helicoflex Type: HNV 200 batch 109459/01 Outerdiameter 183,4; Inner diameter 173,6.

-required leakrate is <10 -8 mbarl/s-1
-actual leakrate is > 10 -5 mbarl/s-1.

Summary of activities performed in the frame of assy the I/F fill/ venttube with upper bulkhead and performance of leaktest:

-I/F fill/ venttube with upper bulkhead I/F screws mounted first crosswise, then 3 times clockwise with 22Nm torqued.
(Helicoflex ring mounted typ acc. to lindedrawing..)

-Outer diameter of SV121 pressure plate reworked to remove dia ~0.1mm in order to enable mounting. (I/F problem) Pressure plate mounted with MA= 6,5Nm (helicoflex seal mounted)

-Blind plug integrated into the filling port tube

-First leak test performed from pressure plate side by using a vacuum clock but this mounted plug was not

tight caused by the applied vacuum for the He- leak test purpose

-After this not successful performed leak test it was decided to evacuate first the line from the V512 side to <1mbar by using the small vacuum pump in order to hold the blind plug in position.

-first leak test on 01.08. 18:00 # 18:30 by spraying Ghe into the the mounting I/F for SV921/ 922 promptly a significantly leak signal of 10-5 occurred, the leak test was stopped

It was also observed that despite application of final torque moment that a gap of 0,25 # 0,35mm is existing between the fillingport flange and the corresponding CVV area.

for the applied test set-up see annex 1 and 2

Remark- close-out information:
Additional sealing according to HP-2-ASED-SD_0058 related to NCR HP-2-ASED-NC-1513 successfull performed,
leakreate measured after sealing activities performed is ~ 1 x 10-6 mbarl/s.
The Nonconformance is considered as closed.

Company	**Project Name**	
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-151000-ASED-NC-1319 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1

Nonconformance Report - Continuation Sheet -

02-AUG-05 ASED/ STOEHR Cryo integration leak test EQM Cryo integration leak test

Additional information: According to the Linde statement from 17.11.89 to the same problem the total
pumping
capacity of the adsorbers is equivalent to a leak rate of 1x 10-4 mbar l/s for 9500 h (396days) (ref. 9/2374)

Initiator: Date, Name and Signature 02-AUG-05 Lamprecht

Internal NRB Dispositions

Internal NRB held by telecon on 02.07.05: M. Alberti/ M. Langfermann/ T.Bayer/ P. Mack:
After discussion the following is proposed:

<remove the mounted SV121 pressure plate
<Remove 1 screw I/F fill/ vent tube with upper bulkhead
<apply an thin layer of vacuum grease to the threads
<remount this screw with an cu be washer below (or messing) washer also to be coated with an thin layer of vacuum grease. <apply 22Nm as before. <apply stepwise torque up to 28Nm

<perform this modification on each of the other 7 screws.
<re- torque all 8 screws with MA 28Nm.
<after 24 hours perform an re-torque again with 28Nm.
<re- mount the pressure plate with MA= 6,5Nm (new helicon-flex seal or o-ring pending inspection tbd?) perform an He leaktest on these mounted interfaces.
Official NRB with higher level tbd

Ref. to MoMs

Classification:
Major [X] **Minor** [ ]

Customer Notification
02-AUG-05

Cause of NC	Corrective/Preventative Actions	Verification
Ref to Failure Report		

	PA	**Engineering**		
Date:	02-AUG-05	02-AUG-05	02-AUG-05	02-AUG-05
Name:	M. Langfermann	T. Bayer	M. v. Alberti	P. Mack
Signature:				

Company	Project Name	
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-151000-ASED-NC-1319 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 3 of 6

Nonconformance Report - Continuation Sheet -

Customer NRB Dispositions (Class Major Only) Ref. to MoMs

Verification

Follow- ON NRB 03.08.05

The activities in the frame of the performed mounting of "filling port, SV121 pressure plate" has been expressly explained by Paul Mack. The proposal for re-mounting which was distributed with the internal NRB was discussed and was in principal agreed with slight changes as follows.
The Follow On Disposition is as follows:
1.) a.)The pressure plate shall be dismounted --> closed OK
b.) The Helico flex seal shall be inspected after removal --> closed OK
c.) the outer diameter of the pressure shall be verified.--> closed OK see LLK

2.The Fixation screws for the filling port shall loosened one by one clockwise and re-mounted after/ under the following actions:
-Apply a thin layer vacuum grease below the screw heads and onto the threads.
-Perform first torque with MA 18Nm.
-After performance of this activities on all fixation screws the MA shall be increased stepwise in cross direction in steps of 2Nm to the new final torque of 28Nm (20, 22, 24, 26, 28) After the final torque is applied (28Nm) this torque shall be applied again after 1 hour and after 24h. --> closed OK

Re- mount the pressue plate
Perform an He- leak test according to the test set-up as mentioned in annex 1.
OK= 3x 10-6 mbar l/s

AI to ASED is to check the NCR database& regarding to NCRs about surface defects of filling port or CVV sealing grooves areas.
--> closed during review of the Upper bulkhead EIDP/ NCRs no NCR affecting the surface of sealing areas where detected. During review of the fillingport documentatation regardingly the NCR ASED-0181 has been found which threates minor imperfections on the O-ring groove.

Finally Determined Cause of NC Ref to Failure Report	Corrective/Preventative Actions

Request for Waiver	Alert	Other related Documents
Yes [ ] No [ ] Reference:	Yes [ ] No [ ] Reference:	

NCR Close Out
28-OCT-05

NRB Approval	Chairman								
Organization/ Name	ASED M. Langfermann	ASED R. Stritter	ASED P. Mack	ESA C. Jewell	ESA M. v. Hoegen	ESA W. Pinterkrainer	ASED M. v. Alberti	ASED T. Bayer	ASED E. Lamprecht
Date, Signature	03-AUG-05	03-AUG-05	03-AUG-05	03-AUG-05	03-AUG-05	03-AUG-05	03-AUG-05	03-AUG-05	03-AUG-05

Company	Project Name	
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-151000-ASED-NC-1319 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 4 of 6

Nonconformance Report - Continuation Sheet -

Customer NRB Dispositions (Class Major Only) Ref. to MoMs

Verification

Follow ON NRB 05.08.05

The situation after performed re- torque and Repeat of the He- leaktest on the I/F CVV to fill./ vent tube of filling port was discussed and the following disposition was made:
-No further activities regarding Re- torque, change of seals etc. shall be performed.
-The go- ahead for start of the pumping down of the insulation vacuum as pre- condition for the filling of the cryostat with LHe has been given.
-In parallel a rough analysis shall be performed in order to analyse the thermal behaviour of the EQM taking into acount the actual leak rate(s), numbers of and actual conditions of mounted adsorbers, etc.

Finally Determined Cause of NC	Corrective/Preventative Actions
Ref to Failure Report	

Request for Waiver	Alert	Other related Documents
Yes [ ] No [ ] Reference:	Yes [ ] No [ ] Reference:	

NCR Close Out
28-OCT-05

NRB Approval	Chairman				
Organization/ Name	ASED C. Schlosser	ASED E. Lamprecht	ASED M. v. Alberti	ESA C. Jewell	
Date, Signature	05-AUG-05	05-AUG-05	05-AUG-05	05-AUG-05	

Company	Project Name	
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-151000-ASED-NC-1319 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 5 of 6

Nonconformance Report - Continuation Sheet -

NCR Treatment Sequence / Findings / Statements / Actions

Int. Ref	Actionee	Due Date	Action	Conclusion / Remark	Closed
C1-1	Mack	04-AUG-05	1.) a.)The pressure plate shall be dismounted b.) The Helicoflex seal shall be inspected after removal c.) the outer diameter of the pressure plate shall be verified. 2.The Fixation screws for the filling port shall loosened one by one clockwise and remounted after/ under the following actions: -Apply a thin layer vacuum grease below the screw heads and onto the threads. -Perform first torque with MA 18Nm. -After performance of this activities on all fixation screws the MA shall be increased stepwise in cross direction in steps of 2Nm to the new final torque of 28Nm (20, 22, 24, 26, 28) After the final torque is applied (28Nm) this torque shall be applied again after 1 hour and after 24h. Re- mount the pressue plate . Perform an He- leak test according to the test set-up as mentioned in annex 1. AI to ASED is to check the NCR data-base& regarding to NCRs about surface defects of filling port or CVV sealing grooves areas.		Yes [X] No [ ]

Int. Ref	Actionee	Due Date	Action	Conclusion / Remark	Closed
C2-2	C. Schlosser	05-AUG-05	In parallel a rough analysis shall be performed in order to analyse the thermal behaviour of the EQM taking into acount the actual leak rate(s), numbers of and actual conditions of mounted adsorbers, etc.		Yes [X] No [ ]

Company	Project Name	
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-151000-ASED-NC-1319 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 6 of 6

Nonconformance Report - Continuation Sheet -

NCR/NRB Attachments

	Description	Filename	Last Updated
1	Annex 1	Annex 1.pdf	04-AUG-05 09:51:44
2	Annex 2	Annex 2.pdf	04-AUG-05 09:52:43
3	HP-2-ASED-SD_0058	HP-2-ASED-SD_0058.pdf	28-OCT-05 14:22:37
4	Annex 4 to NC 1319 Linde Fax	Annex 4 to NC1319 .pdf	28-OCT-05 15:29:40

Company	**Project Name**	
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-151000-ASED-NC-0211 Related internal NCR-No: Critical Item: Yes ☐ No ☒ Revision 0 Page 1 of 2

Nonconformance Report

NCR **Title**	Internal leakage of SV123 out of spec (ISO QM SV123)		
NC Item **Identification**	PLM EQM		
Next Higher Assembly	HERSCHEL PLM EQM		
Drawing No		Sr No.	13076/1
Procedure No	HP-2-ASED-TP-0001		
Supplier	ASPI	Purchase Order	Pre integration Test
Subsystem		Model	EQM
NC Observation Date: 06-APR-04 Location: Otn		NC Detected During	Test

Description of Nonconformance

Requirements Violated

During retest of the ISO SV123 spare valve S/N 13076/1 it was found that the internal leakrate is out of spec:
a.) 1. Test performed with valve closed outlet evacuated, Q: 1x 10 -3 mbar l/sec-1
b.) 2. Test performed with valve closed inlet evacuated, Q: 1x 10 -4 mbar l/sec-1
c.) 3. Test performed with valve closed outlet evacuated, Q: 1x 10 -3 mbar l/sec-1
Required leakrate according to TP: HP-2-ASED-TP-0001 is: < 10-7 mbar l/sec-1

Initiator: Date, Name and Signature 06-APR-04 E. Lamprecht

Internal NRB Dispositions

Use as is, a since slightly higher leakrate is acceptable for the Herschel EQM. No impact to safety.

Ref. to MoMs

Classification:
Major ☐ **Minor** ☒

Customer Notification
06-APR-04

Cause of NC	Corrective/Preventative Actions	Verification
Ref to Failure Report		

Date: Name: Signature:	**PA**	**Engineering**				
	06-APR-04 R. Stritter	06-APR-04 A. Runge	06-APR-04 P. Mack	06-APR-04 A. Knight	06-APR-04 B. Barlage	06-APR-04 E. Lamprecht

Company	Project Name	
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-151000-ASED-NC-0211 Related internal NCR-No: Critical Item: Yes [ ] No [X] Revision 0 Page 2 of 2

Nonconformance Report - Continuation Sheet -

NCR/NRB Attachments

	Description	Filename	Last Updated
1	Annex1 ASED-0211	Annex1 ASED-0211.pdf	30-JUN-05 09:37:03

Company ASTRIUM FRIEDRICHSHAFEN	**Project Name** HERSCHEL-PLANCK	NCR-No: HP-150000-ASED-NC-1817 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 0 Page 1 of 1

Nonconformance Report

NCR **Title** EQM mass flow through OBA from AXT higher that expected	
NC Item **Identification** HERSCHEL PLM EQM	
Next Higher Assembly HERSCHEL SATELITE	
Drawing No	Sr No. EQM
Procedure No EQM System level Test	
Supplier ASED	Purchase Order EQM System level Test
Subsystem	Model EQM
NC Observation Date: 06-DEC-05 Location: ASED Otn	NC Detected During Test

Description of Nonconformance

For PFM the nominal mass flow is expected to be 2.2 mg/sec, instead for EQM Instrument testing the mass flow
through the AXT to achieve the required temperatures for L1/L2 was about 25mg/sec with heating applied to the
AXT.
Without heating the mass flow was measured at about 8.5 mg/ sec but this did not achieve the required L1/L2 temperatures, these mass flows were not as expected.
The measured flows are recorded and have been distributed for review.

Requirements Violated

Mass Flow

Initiator: Date, Name and Signature 06-DEC-05 D.Hendry

Internal NRB Dispositions

EQM TMM will be checked in the frame of the post EQM test activities as normal work.
ASED propoes to close this NCR

Ref. to MoMs

Classification:
Major [X] **Minor** [ ]

Customer Notification

Cause of NC Ref to Failure Report	Corrective/Preventative Actions	Verification

Date:
Name:
Signature:

Company	Project Name	
ASTRIUM FRIEDRICHSHAFEN,ESTEC	HERSCHEL-PLANCK	NCR-No: HP-150000-ASED-NC-1683 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 1 of 4

Nonconformance Report

NCR **Title**	EQM L1 temperatures higher that expected
NC Item **Identification**	HERSCHEL PLM EQM,SPIRE,PACS
Next Higher Assembly	HERSCHEL SATELITE,HERSCHEL INSTRUMENTS AND TELESCOPE (CFE),HERSCHEL INSTRUMENTS AND TELESCOPE (CFE)

Drawing No		Sr No.	EQM
Procedure No	PACS/SPIRE//Mode IMT		
Supplier	ASED	Purchase Order	PACS/SPIRE // Mode IMT
Subsystem		Model	EQM
NC Observation Date: 07-NOV-05 Location: ASED OTN		NC Detected During	Test

Description of Nonconformance	Requirements Violated
During PACS SPIRE // Mode IMT test preparation the AXT heater was increased to 800 mw to maintain the test operating temperatures within the cryostat L1 temperature rose to 6k PACS, 8k Spire , nominal setting to maintain stability is 200 to 400 mw. Subsequent to this the AXT was found to be depleted.	Cryo operations

Initiator: Date, Name and Signature 08-NOV-05 D.Hendry

Internal NRB Dispositions	Classification:
ASED NRB 08.11.05 Cryo operation to be reviewed with customer Ref. to MoMs	**Major** [X] **Minor** [ ] Customer Notification 08-NOV-05

Cause of NC	Corrective/Preventative Actions	Verification
Ref to Failure Report		

	PA	**Engineering**		
Date: Name: Signature:	08-NOV-05 D.Hendry	08-NOV-05 S.Idler	08-NOV-05 D.Hendry	08-NOV-05 C.Schlosser

Company	Project Name	
ASTRIUM FRIEDRICHSHAFEN,ESTEC	HERSCHEL-PLANCK	NCR-No: HP-150000-ASED-NC-1683 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 2 of 4

Nonconformance Report - Continuation Sheet -

Customer NRB Dispositions (Class Major Only) Ref. to MoMs ATT 3 of NCR NRB 08.11.05 ESA,ASP,ASED, C.Scharmberg, C.Jewell, A.Heske, J.Rautakoski., W.Pinter-Krainer, G Doubrovik, C.Schlosser, S.Idler, E.Lamprecht, D.Hendry. See Attachment 3 of the NCR		Verification
Finally Determined Cause of NC Ref to Failure Report	Corrective/Preventative Actions	

Request for Waiver Yes [ ] No [ ] Reference:	Alert Yes [ ] No [ ] Reference:	Other related Documents
		NCR Close Out 11-NOV-05

NRB Approval	Chairman									
Organization/ Name	ASED D.Hendry	ASED D.Hendry	ASED S.Idler	ASED C.Schlosser	ESA W.Pinter-Krainer	ESA A.Heske	ESA C.Scharmberg	ESA C.Jewell	ESA J.Rautakoski	
Date, Signature	10-NOV-05	10-NOV-05	10-NOV-05	10-NOV-05	10-NOV-05	10-NOV-05	10-NOV-05	10-NOV-05	10-NOV-05	

Company	Project Name	
ASTRIUM FRIEDRICHSHAFEN,ESTEC	HERSCHEL-PLANCK	NCR-No: HP-150000-ASED-NC-1683 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 3 of 4

Nonconformance Report - Continuation Sheet -

	ASP G.Doubrovik 10-NOV-05	

Company	Project Name	
ASTRIUM FRIEDRICHSHAFEN,ESTEC	HERSCHEL-PLANCK	NCR-No: HP-150000-ASED-NC-1683 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 4 of 4

Nonconformance Report - Continuation Sheet -

NCR/NRB Attachments

	Description	Filename	Last Updated
1	PACS and SPIRE sensor data during first cooler rec	SPIRE_PACS_Sensors.zip	10-NOV-05 09:20:52
2	PACS cooler recycle Friday (4/11 - Day 308) to Sat	PACS_1st_Cooler_Recycle_G	10-NOV-05 13:46:26
3	NRB 08.11.05 Mom	ASED-NC-1683 NRB 08.doc	10-NOV-05 15:14:34

Company	Project Name	
APCO,ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-150000-ASED-NC-1489 Related internal NCR-No: Critical Item: Yes [ ] No [X] Revision 0 Page 1 of 1

Nonconformance Report

NCR **Title**	Required tilting position of the cryostat via transport dolly not secured		
NC Item **Identification**	HERSCHEL PLM EQM,Integration Dolly		
Next Higher Assembly	HERSCHEL SATELITE,EQM additional Refurbished ISO MGSE		
Drawing No		Sr No.	EQM
Procedure No	Prep IMT/Cooldown		
Supplier	ASED Otn	Purchase Order	Prep IMT/Cooldown
Subsystem		Model	EQM
NC Observation Date: 21-SEP-05	Location: ASED Otn	NC Detected During	Test

Description of Nonconformance

For PACS (and SPIRE) IMT it is necessary to tilt the EQM by about 30 degree (more than 20 degree). The

tilting should be managed by the test dolly #1.
During tilting of the cryostat with the motor of the test dolly, the PLM moved back to about 15 degree when a
tilting level of about 21 degree was achieved. The EQM was installed 200mm out of the emphasis point.
After adjustment of this position via turning the transport container gear handweel it was observed that the gear was moving back to a ~15 degree lower position caused by the proper weight of the cryostat and consequently connected cryo equipments (T- pumps, ventline etc.)
During short investigation performed it was detected that this used integrated gear is not fully self blocking. The blocking can only ensured if the main brake is constantly powered, which cannot be performed in
order to avoid a problems with the brake electronic.

Requirements Violated

testprocedure

Initiator: Date, Name and Signature 21-SEP-05 Lamprecht

Internal NRB Dispositions

As interim solution the cryostat shall be tilted back to its required position and this position shall be ensured via fixation by using fixation belts --> AI closed

Follow ON NRB 27.11.05: C. Schlosser, Lamprecht
Due to the fact that the use of the dolly for the required tests, goals was possible after the performed corrective actions have been performed, it is decided to perform not any additional work on the this dolly the final diposition is: use as is

Ref. to MoMs

Classification: **Major** [ ] **Minor** [X]

Customer Notification

Cause of NC	Corrective/Preventative Actions	Verification
Ref to Failure Report		

Date: Name: Signature:	**PA**	**Engineering**	
	21-SEP-05 E. Lamprecht	21-SEP-05 P. Mack	21-SEP-05 C. Schlosser

Company	Project Name	
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-150000-ASED-NC-1484 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 1 of 2

Nonconformance Report

NCR **Title**	Temp. gradient requirement during Cooldown of cryostat partially exceeded		
NC Item **Identification**	HERSCHEL PLM EQM		
Next Higher Assembly	HERSCHEL SATELITE		
Drawing No		Sr No.	EQM
Procedure No	HP-2-ASED-TP-0072		
Supplier	ASED	Purchase Order	EQM PLM Cooldown
Subsystem		Model	EQM
NC Observation Date: 18-SEP-05 Location: ASED Otn		NC Detected During	Test

Description of Nonconformance

The temperature requirements valid for cooldown of the PLM EQM with integrated instruments have been exceeded
at certain times (see attached graphs).
Required cooling rate of 5 K/h above 50 K, calculated over one hour, was exceeded for short time when the
flow through the OBA gets too high (see attachment 1).
Required temperature gradients between L0, L1, L2 and L3 were exceeded for very short times, when the AXT
gets too cold during active cooling and at two non active phases, when the AXT warmed up slowly (see attachment 2).

Requirements Violated

Cool Down rate

Initiator: Date, Name and Signature 20-SEP-05 Lamprecht/ Schlosser

Internal NRB Dispositions

Internal NRB 21.09.05: C. Schlosser, P. Mack, E. Lamprecht
Proposed disposition is: use as is for EQM, since the requirement for cooling rates has been exceeded only for a minimal time and the gradients have been exceeded only by less than 50%.
Higher level NRB 26.09.05 (tbc).
Closeout:
Due to the performed IMT tests it is confirmed that no degradation of the instruments have been occured due to the short exceedind of the gradient requirements. ASED Otn proposes to close the NCR with the final disposition Use as is.

See HP-2-ASED-MN-1119, It is agreed by higher level to declare the NCR closed by the performed Final disposition: Use as is!

Ref. to MoMs

Classification:
Major [X] **Minor** [ ]

Customer Notification
21-SEP-05

Cause of NC	Corrective/Preventative Actions	Verification
Ref to Failure Report		

	PA	**Engineering**	
Date:	21-SEP-05	21-SEP-05	21-SEP-05
Name:	E. Lamprecht	P. Mack	C. Schlosser
Signature:			

Company	Project Name	
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-150000-ASED-NC-1484 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 2 of 2

Nonconformance Report - Continuation Sheet -

NCR/NRB Attachments

	Description	Filename	Last Updated
1	Temperature Gradients OBA vs. AXT	Gradients-AXTvsOBA.pdf	21-SEP-05 10:40:38
2	OBA cool down rates	CoolingRates-OBA.PDF	21-SEP-05 10:39:46

Company	**Project Name**	
ASTRIUM	HERSCHEL-PLANCK	NCR-No: HP-142220-ASED-NC-1829 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 0 Page 1 of 2

Nonconformance Report

NCR **Title** Very high noise on C100 sensors for EQM CRYO SCOE	
NC Item **Identification** Cryo SCOE	
Next Higher Assembly EPLM EGSE	
Drawing No	Sr No.
Procedure No HIFI System Level Test Thermal	
Supplier ABSP	Purchase Order HIFI System level Test Thermal
Subsystem	Model EQM
NC Observation Date: 06-DEC-05 Location: ASED OTN	NC Detected During Test

Description of Nonconformance | Requirements Violated

The noise on the C100 thermistors is much too high for the EQM CRYO SCOE

From the spec, the accuracies of the C100 thermistors are :
1.6 K to 1.8 K : +/- 1mK Measured Value : 23.8 mK
1.8 K to 5.0 K : +/- 10mK Measured Value : 60.6 mK
5.0 K to 20.0 K : +/- 100mK Measured Value : 1700 mK

Graphs showing these noise levels are attached to this NCR.

On PFM, a similar NCR was raised some time ago (HP-141200-ASED-NC-1434).

Answer from ABSP on 06/12/2005

Hello, Stijn

The fix for this is the same as was done for the PFM SCOE, i.e. replacing the capacitor in the external harness
(between the harness screen and the connector chassis) with a short circuit.
The capacitor was initially inserted to prevent dc ground loops, and worked OK at AAS-A. However, the noise
environments seem to be much higher (possibly due to all of the MGSE) at your facilities.

The external harness cables which have been made by Astrium, also directly short the screen to the connector
bodies at both ends of the cable.

Regards, Ian

Initiator: Date, Name and Signature 06-DEC-05 S. ILSEN

Date:
Name:
Signature:

Company	Project Name	
ASTRIUM	HERSCHEL-PLANCK	NCR-No: HP-142220-ASED-NC-1829 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 0 Page 2 of 2

Nonconformance Report - Continuation Sheet -

NCR/NRB Attachments

	Description	Filename	Last Updated
1	C100 Noise data	Noise_on_C100_sensors.zip	06-DEC-05 17:17:46

Company	**Project Name**	
ASTRIUM	HERSCHEL-PLANCK	NCR-No: HP-142220-ASED-NC-1759 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 0 Page 1 of 1

Nonconformance Report

NCR **Title** CRYO SCOE Heater repeated blocking and disabling	
NC Item **Identification** Cryo SCOE	
Next Higher Assembly EPLM EGSE	
Drawing No	Sr No. EQM
Procedure No PACS EMC	
Supplier ABSP	Purchase Order PACS EMC
Subsystem	Model EQM
NC Observation Date: 22-NOV-05 Location: ASED OTN	NC Detected During Test

Description of Nonconformance

Requirements Violated: SCOE FW

This NCR is related to HP-142220-ASED-NC-1667 and HP-142220-ASED-NC-1668.

On 21/11/05, the heater data acquisition blocked (similar to NCR 1667). The main difference with NCR 1667 is
that the SCOE was in 'once per minute' acquitision mode and not in 'continious mode'. The heater stayed on
however (could be seen from the helium flow). The SCOE is powered down and up again and the problem disappeared.

on 22/11/05 very early in the morning, the HCMD data acquisition blocked again (0h03m). This was not noticed
at that time. Around noon, suddenly the heater powered down from itself (could be seen from the helium flow).
Because of the blocking however, the scoe still indicated the expected power. Some time later (11h25m), all
heater values went to the default value and the HCDM deblocked from itself.

The heater is switched on again without problems.

Added on 23/11/2005 by S ILSEN

After analysis by ABSP the following is concluded:
* Reset of heater output most probably related to 'peaks in data' (NCR 1668). Solution is not easy.
Workaround could be to switch to continious acquisition (need to solve NCR 1667 before!). Since problem does
occur very often and the cryo scoe cannot be swithced off for a long time currently, more analysis will be
done after the EQM phase. For now, ASED personel will monitor the helium flow closely. Closed for EQM, open
for PFM.

Initiator: Date, Name and Signature 22-NOV-05 S. ILSEN

Date:
Name:
Signature:

Company	Project Name	
ASTRIUM	HERSCHEL-PLANCK	NCR-No: HP-142220-ASED-NC-1668 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 1 of 1

Nonconformance Report

NCR **Title** EQM CRYO SCOE data shows regular peaks in 'once per minute' acquisition	
NC Item **Identification** Cryo SCOE	
Next Higher Assembly EPLM EGSE	
Drawing No	Sr No.
Procedure No HIFI SIH Elev int test	
Supplier ABSP	Purchase Order HIFI SIH Elec Int test
Subsystem	Model EQM
NC Observation Date: 15-JUL-05 Location: ASED OTN	NC Detected During Test

Description of Nonconformance

In 'once per minute' acquisition mode, the EQM cryo scoe, shows peaks in the data.
Every time a new sample is taken (once a minute), the value of a parameter goes to an unrealistic high value
(more then a million times then actual value). These wrong values are seen for ~2 seconds.
This means that every 60 seconds, the data is corrupted for 2 seconds. These 'wrong' values are also seen in
the log files and in the TM data to the CCS.

In 'continous' acquisition mode, the peaks are not seen.

Remark: sometimes the peaks are much lower then a million times the actual value. Sometimes they stay within
10% of the actual value. These peaks are however NOT the actual data, which makes it very difficult to filter
data afterwards.

Requirements Violated

SCOE SW/FW

Initiator: Date, Name and Signature 03-NOV-05 S ILSEN

Date:
Name:
Signature:

Company	**Project Name**	
ASTRIUM	HERSCHEL-PLANCK	NCR-No: HP-142220-ASED-NC-1667 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 0 Page 1 of 1

Nonconformance Report

NCR **Title** EQM CRYO SCOE heater data block in 'continious acquisition' mode	
NC Item **Identification** Cryo SCOE	
Next Higher Assembly EPLM EGSE	
Drawing No	Sr No.
Procedure No HIFI Elec int Test	
Supplier ABSP	Purchase Order HIFI Elec Int Test
Subsystem	Model EQM
NC Observation Date: 15-JUL-05 Location: ASED OTN	NC Detected During Test

Description of Nonconformance	Requirements Violated
The EQM cryo scoe has different modes for the acquisition of data from the SCAU boards. In the continious mode (sample every ~2 seconds), the heater data acquisition blocks after about 2 hours of operation. This can be recovered by restarting the SCOE or a 5-minute procedure. This behaviour was also seen for other SCAU boards (for thermistor acquisition). It could however be solved by an update of the firmware of the SCAU boards. The firmware of the heater scau board was not updated since it is not easy accessible. This problem does not occur in 'once per minute' acquisition.	SCOE Firm ware

Initiator: Date, Name and Signature 03-NOV-05 S. ILSEN

Date:
Name:
Signature:

Company	Project Name	
ESTEC	HERSCHEL-PLANCK	NCR-No: HP-113000-ASED-NC-1675 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 1 of 2

Nonconformance Report

NCR **Title** Cryostat background radiation measured by PACS much higher than predicted

NC Item **Identification** PACS

Next Higher Assembly HERSCHEL INSTRUMENTS AND TELESCOPE (CFE)

Drawing No	Sr No. EQM
Procedure No IMT Pt 2	
Supplier MPI	Purchase Order IMT Pt 2
Subsystem	Model EQM
NC Observation Date: 03-NOV-05 Location: ASED OTN	NC Detected During Test

Description of Nonconformance | Requirements Violated

Cryostat background radiation measured by PACS much higher than predicted
PACS IMT revealed that cryostat background signals measured by PACS spectrometer at 88 ? / 177 ?m are by
factor 60 / 48 higher than expected (see PACS analysis in attachment x).
See analysis report attached
Way forward: Perform additional measurements:

NCR update 09.11.05
Investigation tests have been performed see ACS HP-2-ASED-SD-0064 and 0067 attached.
MPI are reviewing the results.
1) Planck-curve in order to retrieve the temperature of the strylight source and
2) map in order to localise the straylight source.
NCR update 09.11.05
The investigation testing has been performed by ACS HP-2-ASED-SD-0067 and 0064 see attached
MPI are reviewing the results.

Initiator: Date, Name and Signature 04-NOV-05 D.Hendry

Internal NRB Dispositions	Classification:
NRB ASED,PACS,ESA 04.11.05 Perform stray light test according to ASED ACS attachment 2 Ref. to MoMs	**Major** [X] **Minor** [ ] Customer Notification 04-NOV-05

Cause of NC	Corrective/Preventative Actions	Verification
Ref to Failure Report		

Date: Name: Signature:	**PA**	**Engineering**				
	04-NOV-05 D.Hendry	04-NOV-05 S.Idler	04-NOV-05 D.Hendry	04-NOV-05 S.Ilsen	04-NOV-05 H.Feuchtgruber	04-NOV-05 A.Heske

Company	Project Name	
ESTEC	HERSCHEL-PLANCK	NCR-No: HP-113000-ASED-NC-1675 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 1 Page 2 of 2

Nonconformance Report - Continuation Sheet -

NCR/NRB Attachments

	Description	Filename	Last Updated
1	PACS Background radiation report from IMT	eqmimt_background_report.	04-NOV-05 10:48:13
2	ASED ACS For Stray light test during 2nd part IMT	ACS_for_Straylight_Test_o	04-NOV-05 11:07:30
3	ACS HP-2-ASED-SD-0067 stray light investigation te	HP-2-ASED-SD-0067 - Speci	10-NOV-05 10:04:40

Company	**Project Name**	NCR-No: HP-113000-ASED-NC-1495
ESTEC	HERSCHEL-PLANCK	Related internal NCR-No:
		Critical Item: Yes [ ] No [X] Revision 2
		Page 1 of 3

Nonconformance Report

NCR **Title** PACS: Cooler Recycle Failed	
NC Item **Identification** PACS	
Next Higher Assembly HERSCHEL INSTRUMENTS AND TELESCOPE (CFE)	
Drawing No	Sr No.
Procedure No PACS IMT	
Supplier MPI	Purchase Order PACS IMT
Subsystem	Model EQM
NC Observation Date: 20-SEP-05 Location: ASED OTN	NC Detected During Test
Description of Nonconformance During the first cooler recycle in the IMT, PACS detected that this step was not successful. PACS will revise the procedure for the cooler operation.	Requirements Violated NA
Initiator: Date, Name and Signature 21-SEP-05 S ILSEN	
Internal NRB Dispositions PACS shall revise the procedure for the cooler operation -->closed see HP-2-ASED-MN-1096 - TRR for Restart of PACS IMT closeout: Cooler recycling tests and IMT tests successfully performed --> ASED Otn proposes to close this NCR by Use as is due to the performed and verified hardware and procedure changes. Ref. to MoMs	Classification: **Major** [X] **Minor** [ ] Customer Notification

Cause of NC Ref to Failure Report	Corrective/Preventative Actions	Verification

Date: Name: Signature:	**Engineering** 24-OCT-05 H. Feuchtgruber	24-OCT-05 S. Idler	24-OCT-05 E. Wiezorrek	24-OCT-05 T. Muller	24-OCT-05 B. Collaudin	24-OCT-05 W. Pinter-Krainer	24-OCT-05 S. Ilsen	24-OCT-05 C. Schlosser

Company	Project Name	
ESTEC	HERSCHEL-PLANCK	NCR-No: HP-113000-ASED-NC-1495 Related internal NCR-No: Critical Item: Yes ☐ No ☒ Revision 2 Page 2 of 3

Nonconformance Report - Continuation Sheet -

Customer NRB Dispositions (Class Major Only) Ref. to MoMs HP-2-ASERD-MN-1109

NRB part of IMT PTR 04.11.05
Procedure for commanding has been updated. The cryostat filling port leak has been tightened with glue (RTV 691). The cryostat main tank (HTT) has been depleted and evacuated and remained evacuated during instrument testing. The heat shields are cooled instead by helium flushing from an external dewar. With that measures the cooler recycle could be successfully performed. The achieved hold time was approx. 40 h.
NCR to be closed.

Verification

Finally Determined Cause of NC

Ref to Failure Report

Corrective/Preventative Actions

Request for Waiver	Alert	Other related Documents
Yes ☐ No ☐ Reference:	Yes ☐ No ☐ Reference:	

NCR Close Out
09-NOV-05

NRB Approval	Chairman						
Organization/ Name	ASED D.Hendry	ASED D.Hendry	ASED S.Idler	ASED S.Ilsen	ESA A.Heske	MPI H. Feuchtgruber	MPI E. Wiezorrek
Date, Signature	09-NOV-05	09-NOV-05	09-NOV-05	09-NOV-05	09-NOV-05	09-NOV-05	09-NOV-05

Company	**Project Name**	
ESTEC	HERSCHEL-PLANCK	NCR-No: HP-113000-ASED-NC-1495 Related internal NCR-No: Critical Item: Yes [ ] No [X] Revision 2 Page 3 of 3

Nonconformance Report - Continuation Sheet -

NCR/NRB Attachments

	Description	Filename	Last Updated
1	Graphs of cryo scoe data during PACS IMT (and cool	Data and Graphs PACS IMT	27-SEP-05 11:58:18
2	Graph of 1st PACS cooler recycle	PACS_Cooler_Recycle_1.jpg	30-SEP-05 08:41:24
3	Graph of 2nd PACS cooler recycle	PACS_Cooler_Recycle_2.jpg	30-SEP-05 08:41:40
4	HP-2-ASED-MN-1096 - TRR for Restart of PACS IMT	HP-2-ASED-MN-1096 - TRR f	24-OCT-05 16:03:48
5	IMT restart (Spire and PACS) MOM H-P-ASP-MN-6975	H-P-ASP-MN-6975 - SPIRE I	02-NOV-05 15:26:04

Company	**Project Name**	NCR-No: HP-112000-ASED-NC-1662
ESTEC	HERSCHEL-PLANCK	Related internal NCR-No:
		Critical Item: Yes [X] No [ ] Revision 0

Nonconformance Report

NCR **Title**	High correlation between cryo cover temp and SPIRE L1 temp		
NC Item **Identification**	SPIRE		
Next Higher Assembly	HERSCHEL INSTRUMENTS AND TELESCOPE (CFE)		
Drawing No	ASED-TR-0101	Sr No.	EQM
Procedure No			
Supplier	RAL	Purchase Order	SPIRE IMT Pt 2
Subsystem		Model	EQM
NC Observation Date: 25-OCT-05 Location: ASED OTN		NC Detected During	Test

Description of Nonconformance

Requirements Violated

Unexpectedly high correlation between cryo cover temperature and SPIRE L1 temperature
Cause is currently not understood and needs to be investigated by SPIRE.
Temperature plots are attached to this NCR

Initiator: Date, Name and Signature 02-NOV-05 D.Hendry

Date:
Name:
Signature:

Company	Project Name	
ESTEC	HERSCHEL-PLANCK	NCR-No: HP-112000-ASED-NC-1662 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 0 Page 2 of 2

Nonconformance Report - Continuation Sheet -

NCR/NRB Attachments

	Description	Filename	Last Updated
1	Cover temperature plot	Cover_Temperature_25_10_2	02-NOV-05 15:08:00
2	Cryo cover temp related to L1	CRYOCOVER_L1_RELATION_.jp	02-NOV-05 15:10:19
3	Cover + L1 graphs	Cover_influence_on_L1_SPI	03-NOV-05 18:16:38
4	PACS-SPIRE with rec. cooler during cover dewar exc	BumpL1CoverExchange.zip	10-NOV-05 11:47:27

Company	**Project Name**	
ASTRIUM FRIEDRICHSHAFEN	HERSCHEL-PLANCK	NCR-No: HP-151240-ASED-NC-1415 Related internal NCR-No: Critical Item: Yes [X] No [ ] Revision 0 Page 1 of 1

Nonconformance Report

NCR **Title**	The SV121 plug remains not in safety valve position		
NC Item **Identification**	ISO QM modified Filling Port (incl SV 121)		
Next Higher Assembly	Cryostat Helium SS		
Drawing No		Sr No.	01
Procedure No	HP-2-ASED-TP-0072		
Supplier	Stoehr	Purchase Order	EQM PLM Cryo Cooldown
Subsystem		Model	EQM
NC Observation Date: 01-AUG-05 Location: ASED Otn		NC Detected During	Test

Description of Nonconformance

Requirements Violated

During Cool- down operations according to HP-2-ASED-TP-0072 "1": it was observed several times that the SV
plug of SV 121 (S/N 01) remains not in safety position after separation of plug from spindl (if one way valve

with 60 mbar overpressure is installed during over night configuration)

Initiator: Date, Name and Signature 01-SEP-05 Lamprecht

Internal NRB Dispositions

-As first actions the valve shall be kept open and the safety function shall be ensured via connection to the SV 0622/ YO 621-2 line. performed OK

-Follow ON NRB tbd --> closed see below
Follow ON NRB 23.09.05: Schlosser, Mack, Lamprecht
Final disposition is: Use as is after the safety function was provided via connection to the SV 0622/ YO 621-2 line. The NCR is considered as closed1

Ref. to MoMs

Classification:
Major [ ] **Minor** [X]

Customer Notification
01-SEP-05

Cause of NC Ref to Failure Report	Corrective/Preventative Actions	Verification

Date: Name: Signature:	**PA** 01-SEP-05 E. Lamprecht	**Engineering** 01-SEP-05 A. Runge	01-SEP-05 C. Schlosser

E N D O F D O C U M E N T

	Name	Dep./Comp.		Name	Dep./Comp.
	Alberti von Mathias Dr.	AOE22	X	Runge Axel	OTN/AOA54
	Barlage Bernhard	AED11		Schink Dietmar	AED44
	Bayer Thomas	AOA52	X	Schlosser Christian	OTN/AOA54
	Brune Holger	AOA55		Schmidt Rudolf	FAE22
	Edelhoff Dirk	AED2		Schweickert Gunn	AOE22
	Fehringer Alexander	AOE13		Steininger Eric	AED32
X	Fricke Wolfgang Dr.	AED 65	X	Stritter Rene	AED11
	Geiger Hermann	AOA52		Suess Rudi	AOA54
	Gerner Willi	AED11		Thörmer Klaus-Horst Dr.	OTN/AED65
	Grasl Andreas	OTN/AOA54		Wagner Klaus	AOE22
	Grasshoff Brigitte	AET12		Wietbrock Walter	AET12
X	Hauser Armin	AOE22		Wöhler Hans	AOE22
X	Hendry David	Terma Resid.		Wössner Ulrich	ASE442
	Hengstler Reinhold	AOA 52	X	Alcatel	ASP
	Hinger Jürgen	AOE22	X	ESA/ESTEC	ESA
	Hofmann Rolf	ASE442		**Instruments:**	
X	Hohn Rüdiger	AED65	X	MPE (PACS)	MPE
	Hölzle Edgar Dr.	AED32	X	RAL (SPIRE)	RAL
	Huber Johann	AOA52	X	SRON (HIFI)	SRON
	Hund Walter	ASE442		**Subcontractors:**	
X	Idler Siegmund	AED312		Air Liquide, Space Department	AIR
X	Ilsen Stijn	Terma Resid.		Air Liquide, Space Department	AIRS
	Ivády von András	FAE22		Air Liquide, Orbital System	AIRT
	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
	Kunz Oliver Dr.	AOE22		EADS CASA Espacio	CASA
X	Lamprecht Ernst	OTN/ASI21		EADS CASA Espacio	ECAS
	Lang Jürgen	ASE442		EADS Space Transportation	ASIP
	Langenstein Rolf	AED15		Eurocopter	ECD
X	Langfermann Michael	AOA51		European Test Services	ETS
X	Mack Paul	OTN/AOA54		HTS AG Zürich	HTSZ
	Maute Thomas	AOA52		Linde	LIND
	Much Christoph	AOA53		Patria New Technologies Oy	PANT
	Müller Jörg	AOA52		Phoenix, Volkmarsen	PHOE
	Müller Martin	AOA53		Prototech AS	PROT
	Müller Ralf	FAE22		QMC Instruments Ltd.	QMC
	Peltz Heinz-Willi	AOE13		Rembe, Brilon	REMB
	Pietroboni Karin	AED65		Rosemount Aerospace GmbH	ROSE
	Platzer Wilhelm	AED2		RYMSA, Radiación y Microondas S.A.	RYM
	Reichle Konrad	AOA52		SENER Ingenieria SA	SEN
	Reuß Friedhelm	AED62		Stöhr, Königsbrunn	STOE
X	Rühe Wolfgang	AED6		Terma A/S, Herlev	TER