

**SPIRE PFM CLEANLINESS REPORT**

Document Number: MSSL/SPIRE/TR/007.01 – 08 June 2004

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Author:



Date: 14 July 2004

Approved:



Date: 15 July 2004

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Author:

Date:

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| ISSUE | DATE         | PAGES<br>CHANGED | COMMENTS |
|-------|--------------|------------------|----------|
| 01    | 08 June 2004 | All New          | All new  |
|       |              |                  |          |
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## INTRODUCTION

This report documents the cleanliness control and cleanliness level obtained on the SPIRE PFM structure from the manufacturing stage at MSSL to the optical bench, photometer and spectrometer cover assembly at RAL. This document is not a contamination control plan but is meant to show that MSSL observed correct contamination control procedures. It also documents tests such as vacuum bake out, Residual Gas Analysis (RGA), visual inspection and airborne particulate monitoring results.

## 1. PROCEDURES

Contamination control procedures were used as defined in MSSL/SPIRE/PA006.01 "Structure – Cleanliness control plan". This involved careful control of materials used on SPIRE, material traceability, methodical and correct cleaning at appropriate intervals during the manufacturing and assembly stages, piece part vacuum bake out and RGA monitoring, visual inspection of all parts after manufacture, cleaning and assembly and surface particle fallout levels on a piece part basis and at the fully assembled stage. In addition to this, facility airborne particulate monitoring, airborne molecular contamination, temperature and relative humidity levels were recorded and logged.

The following is a chronological list of procedures used and test results obtained:

## 2. PIECE PART CLEANING – OFF THE SHELF MATERIALS

Materials List:

- Screws
- Nuts
- Washers, flat and Bellville
- Bolts
- Helicoils
- KayLock nuts
- Stainless steel wire locking

All off the shelf materials were inspected for defects and then rough cleaned using Acetone and then IPA. After rough cleaning, the items were then cleaned in an ultrasonic cleaner for six minutes immersed in Loxotane (hexane based solvent). After ultrasonic cleaning the items were left for ten minutes in a class 10 laminar flow bench so that residual solvent would evaporate. All items were then packaged in Llumalloy cleanroom bagging material and transferred to the cleanroom. In all cases, procedures defined in MSSL/SPIRE/PA006.01 "Structure – Cleanliness control plan" Section A.2.3 were followed when cleaning off the shelf components.

## 3. PIECE PART CLEANING – MANUFACTURED COMPONENTS

Manufactured items were rough cleaned using Acetone and IPA. After rough cleaning the items were then cleaned in an ultrasonic cleaner for six minutes immersed in Loxotane. After ultrasonic cleaning the components were left for ten minutes in a class 10 Laminar

flow bench so that residual solvent would evaporate. All items were then packaged in Llumalloy cleanroom bagging material and transferred to the MSSL cleanroom. Non metallic components were cleaned in a similar manner but with suitable solvents that would not degrade the material.

In all cases cleaning procedures were followed as defined in MSSL/SPIRE/PA006.01 “Structure – Cleanliness control plan” Appendix A, Section A.2.3.

#### **4. VISUAL INSPECTION – POST CLEANING**

Visual inspection was performed on all PFM components after the cleaning process and before vacuum bake out. Visual inspection procedures used were as defined in MSSL/SPIRE/PA006.01 “Structure – Cleanliness control plan” Appendix A, Section A.3.2. Visual inspection of the components showed that very few components were contaminated by particulates as would be expected at this stage. Fluorescing due to organics (grease, oils etc) transfer was not evident. Where fluorescing was observed the component was re-cleaned and re-inspected until clean. Please see Appendix A for complete and detailed visual inspection log.

#### **5. BAKE OUT CHAMBER CERTIFICATION**

The vacuum bake out chamber was certified prior to SPIRE component bake out. The certification ensures that transfer of particulates and molecular contamination is minimised between SPIRE hardware and chamber. Please see appendix B for detailed chamber certification log. Before chamber certification the chamber was inspected to VC-HS+UV as defined in MSSL/SPIRE/PA006.01 “Structure – Cleanliness control plan”.

#### **6. PIECE PART BAKE OUT**

Please see Appendix C for detailed bake out reports.

#### **7. VISUAL INSPECTION – POST BAKE OUT**

Visual inspection as defined in MSSL/SPIRE/PA006.01 “Structure – Cleanliness control plan” Appendix A, Section A.3.2, was performed after PFM piece part bake out and before sealing in Llumalloy cleanroom packaging ready for shipping to the RAL cleanroom. Visual inspection under Black light (VC-HS+UV) showed no change in fluorescing of particulates and organics in the inspection carried out after cleaning as indicated in point 4 above. After inspection, all pieces of PFM hardware were packaged in Llumalloy and transferred to the RAL cleanroom.

#### **8. INSPECTION OF PFM CLEANROOM FACILITY (RAL) – PRE PFM ASSEMBLY**

SPIRE PFM cleanroom walk through/inspect was performed on Fri 30<sup>th</sup> April 04. This included complete clean down and UV light inspections of the PFM turn over dolly. After clean down, the turn over dolly surfaces were covered with Llumalloy to prevent contaminant transfer to the PFM. In addition, cleanroom work surfaces and storage areas

were inspected under UV light. Some observations and recommendations were made after inspection, these being:

- SPIRE FM optical bench is uncovered
- SPIRE side covers are uncovered
- I had a quick look with black light at the bench that the Optical bench and side covers are on. The bench had large amount of particles and some fluorescence showed up (most probably Apiezon). I have cleaned as much up as possible. However, I would recommend that before FM assembly starts that the cleanroom and benches are blitzed.
- A dedicated area for FM instrument assembly is required, preferably on a bench as close to the filter bank (HEPA) as possible and clearly marked for FM assembly only.
- Tooling and tool boxes should be moved downstream to a table at the entrance to the cleanroom (FM tool box).
- I have a stainless steel container I will take to RAL which can be used for retaining the odd screws, clean Pyrex containers for cleaning small items etc. This way we avoid possibility of transfer of contamination and a tidier work area.
- A clean trolley is required to put the particle detector on.
- FM log books. I have cleanroom approved note books I can take to RAL so that activities such as cleaning, assembly etc can be recorded. Also it might be worth while to have a sign in log book so that personnel access can be controlled.
- I need to inspect the optical bench and structure sides before we start assembly activities (I did a quick inspection under UV light, however I gather that these items will be going to metrology so will almost certainly need a cleanup after)

## **9. VISUAL INSPECTION – POST METROLOGY – RAL**

Visual inspection as defined in MSSL/SPIRE/PA006.01 “Structure – Cleanliness control plan” Appendix A, Section A.3.2, was performed after PFM assembly of the optical bench, photometer and spectrometer side and cover panels at RAL on 07 June 2004.

All external and internal surfaces of the PFM covers were visually inspected and cleaned to VC-HS+UV levels. There were some areas within the internal volume that showed levels of particulates estimated at greater than level 500 (MIL.STD.1246C). This will have been partly due to metrology activities, and lack of sufficiently powerful UV inspection light. A low power (estimate 2 to 3 W) was initially used to inspect the above mentioned assembly soon after metrology tests were done. This UV light source showed little or no particulate contamination of the flight hardware.

In all cases the PFM structure was cleaned and inspected to the required level as defined in the MSSL contamination control plan using the more powerful MSSL supplied 250 W UV light source. Some recommendations are made below:

## **10. RECOMMENDATIONS – POST METROLOGY - RAL**

The following is a list of recommendations for the PFM structure based on previous inspections during April to June 2004:

- 10.1.** The Spectrometer and Photometer optical bench internal volumes are very difficult to clean (large surface area, pockets and corners). In some cases it is impossible to reach certain areas to remove particulates. It is recommended that Llumalloy or cleanroom packaging material is taped down on both sides of the optical bench to stop particulates falling into the pocket volumes, cut outs can be made around the mirror mounts and boxes so that alignment activities are not hindered.
- 10.2.** Drape the Spectrometer and Photometer covers with Llumalloy cleanroom packaging material when they are taken off the structure and stored with internal surface facing up. This will stop particulate build up inside the covers and minimise transfer to the optical bench volumes. Additionally, the PFM structure (on the turn over dolly) should be draped with Llumalloy or cleanroom bagging material to minimise particle fallout and transfer.
- 10.3.** Remove contaminants, as generated during assembly, by vacuuming and solvent wiping. At the conclusion of each operation, surfaces should be cleaned and inspected to the referenced levels by the contamination control engineer or personnel involved in the assembly. Frequent inspections to VC-HS plus UV should be made between assembly stages to minimise contamination build up.
- 10.4.** Inspect the complete assembly at the conclusion of assembly activities, and before and the next activity takes place, the complete assembly should be inspected to VC-HS+UV.
- 10.5.** Once mirrors and filters are assembled the UV light source should not be used, as the filters are particularly sensitive to UV light which may change/degrade them. It is recommended that inspection should then be carried out using a powerful white light source (100W minimum) or consider covering the mirrors and filters while using the MSSL UV light source. The latter is preferred as white light is not as efficient as UV in showing up particulate and NVR.
- 10.6.** The MSSL UV light source should be used frequently during the assembly phases, up until mirror and filter assembly. Frequent inspections are crucial, as once the optical bench becomes populated, the more difficult it is to remove contaminants.



## **11. ENVIRONMENTAL MONITORING**

### **11.1. Airborne Particulate Monitoring**

Airborne particulate was monitored and recorded on a three minute sample frequency. All data was logged to the cleanroom computer. During PFM hardware exposure the airborne particulate counts were monitored and were maintained within the cleanroom specification of Class M3.5 (FED.STD. Class 100).

**APPENDIX A****Visual Inspection Log – SPIRE PFM Piece part inspection**

All SPIRE Structure components should be visually inspected as defined in MSSL/PA/PS/Q012 “Procedure for verifying surfaces to a visibly clean level”. Details of the inspection should then be logged below. Fluorescing under UV light shall be cause for re-cleaning and then inspecting to VC-HS +UV level

| DATE   | RESPONSIBLE | COMPONENT          | INSPECTION LEVEL | COMMENT  |
|--|-------------|--------------------|------------------|--|
| 16 Jan 2004  | ADR         | Batch 1 components | VC-HS +UV        | No fluorescing evident   |
| 20 Jan 2004  | ADR         | Batch 2 components | VC-HS +UV        | A frame bracket (302-26A) showed up particulates and small amount off fluorescing. Re-cleaned and re-inspected           |
| 27 Jan 2004  | ADR         | Batch 3 components | VC-HS +UV        | Cold strap & anti torque plated showed up some particulates and small amount of fluorescing. Re-cleaned and re-inspected |
| 02 Mar 2004  | ADR         | Batch 4 components | VC-HS +UV        | Mirror mounts inspected, no particulate or fluorescing evident   |
| See bake out part log (appendix C) for complete list of components inspected |             |                    |                  |  |

**APPENDIX B**

**Vacuum bake out – Chamber certification – SPIRE PFM**

**DETAIL**

DATE: 10 Feb 2004      **BAKEOUT #:** MSSL/VBO/SPIRE/0029  
 TIME: 10:00 hrs      **RESPONSIBLE:** ADR

**PAGE:** 1      **OF** 1

|  |           |                        |
|--|-----------|------------------------|
| <b>PROJECT NAME:</b>                       | SPIRE PFM |                        |
| <b>REQUIRED BAKEOUT DURATION:</b>          | 96        | Hrs                    |
| <b>ACTUAL BAKEOUT DURATION:</b>            | 128       | Hrs                    |
| <b>REQUIRED BAKEOUT TEMPERATURE:</b>       | 125       | °C                     |
| <b>BAKEOUT TEMPERATURE TOLERANCE:</b>      | ± 2       | °C                     |
| <b>REQUIRED RAMP RATE:</b>                 | 2         | °C/min                 |
| <b>ACTUAL RAMP RATE:</b>                   | 2         | °C/min                 |
| <b>MINIMUM VACUUM PRESSURE:</b>            | E-5       | Mbar                   |
| <b>ACTUAL VACUUM PRESSURE ACHIEVED:</b>    | 5.0E-8    | Mbar                   |
| <b>TQCM CHAMBER VERIFICATION REQUIRED:</b> | N         | Y/N                    |
| <b>TQCM REQUIRED FOR BAKEOUT:</b>          | N         | Y/N                    |
| <b>REQUIRED OUTGASSING RATE:</b>           | N/A       | g/cm <sup>2</sup> /sec |
| <b>ACTUAL OUTGASSING RATE:</b>             | N/A       | g/cm <sup>2</sup> /sec |
| <b>RGA DATA REQUIRED:</b>                  | Y         | Y/N                    |

AMU 1 TO 99 ONLY

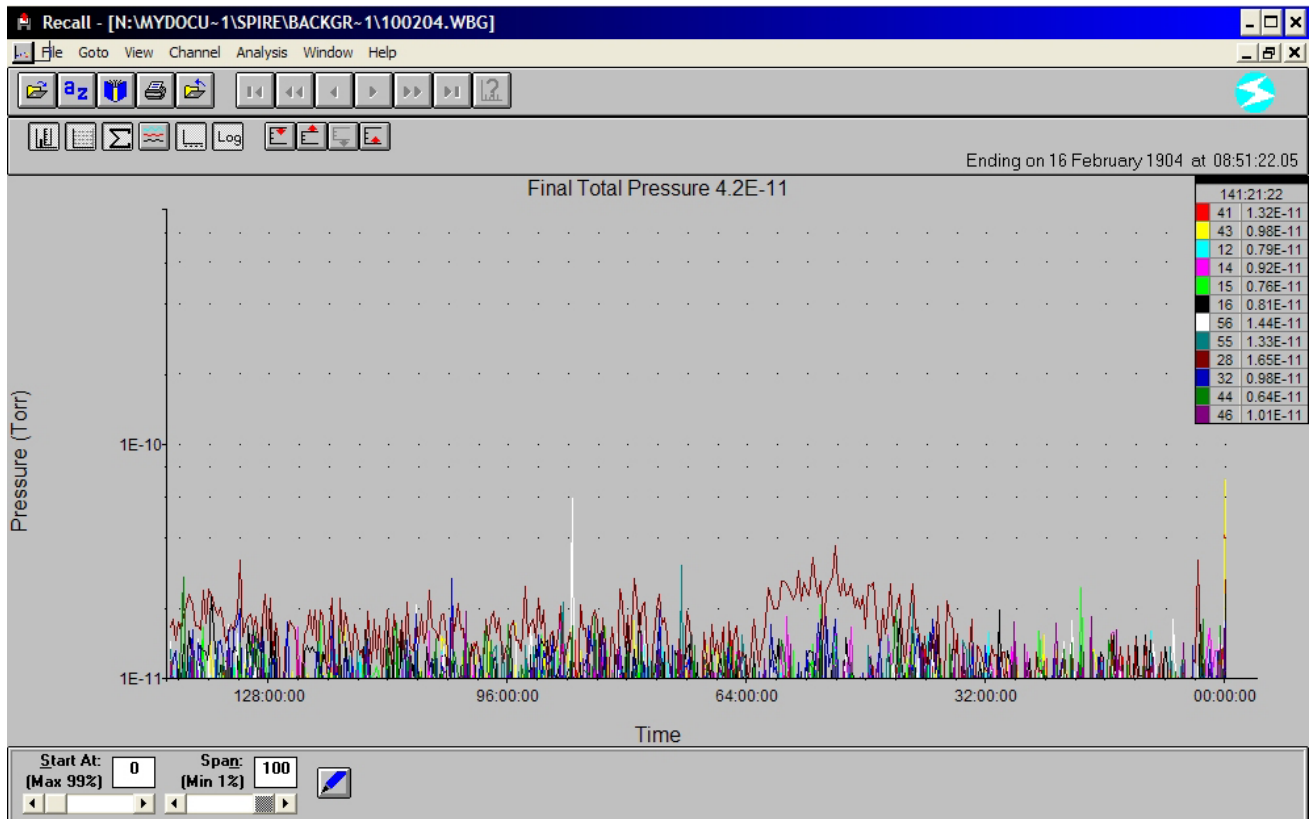
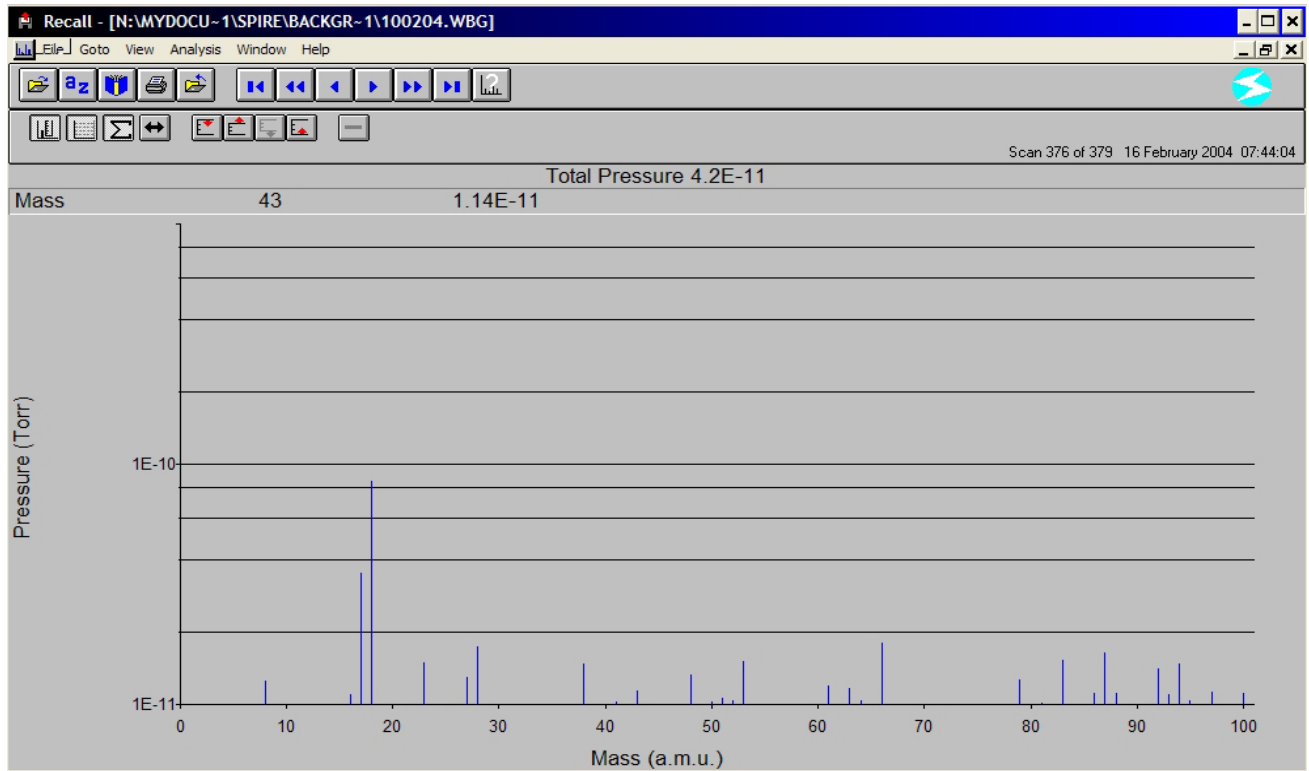
**BAKEOUT LOG**

| DATE  | TIME  | PRESSURE (Mbar) | TEMPERATURE (°C)              |
|---|-------|-----------------|-------------------------------|
| 10 Feb 04   | 08:00 | <e-3            | 20                            |
| 10 Feb 04   | 09:30 | 4.2 e-5         | 20 (Heaters switched on)      |
| 10 Feb 04   | 11:30 | 5.0e-6          | 84                            |
| 10 Feb 04   | 14:20 | 8.2e-6          | 125                           |
| 10 Feb 04   | 17:00 | 4.5e-6          | 125                           |
| 11 Feb 04   | 08:30 | 1.2e-6          | 125                           |
| 11 Feb 04   | 17:00 | 9.2e-7          | 125                           |
| 12 Feb 04   | 08:30 | 8.1e-7          | 125                           |
| 12 Feb 04   | 16:00 | 7.3e-7          | 125                           |
| 13 Feb04  | 08:30 | 6.8e-7          | 125                           |
| 13 Feb 04   | 17:00 | 6.4e-7          | 125                           |
| 14 Feb 04   | 08:30 | 6.0e-7          | 125                           |
| 15 Feb 04   | 08:30 | 3.0e-7          | 125                           |
| 15 Feb 04   | 16:00 | 8.4e-8          | 125                           |
| 16 Feb 04   | 08:30 | 5.1e-8          | Chamber heaters switched off. |
| Chamber vented with filtered (0.5µ) GN2 ready for piece part bake |       |                 |                               |
|   |       |                 |                               |
|   |       |                 |                               |
|   |       |                 |                               |

**Comment:** Prior to certification chamber was inspected to VC-HS+UV and cleaned as defined in MSSL/SPIRE/PA006.01 "Structure – Cleanliness control plan". Some particles were observed. The chamber was cleaned down using Spectro grade Acetone and IPA and then re-inspected. Re-inspection showed no fluorescing. RGA data was taken during chamber certification while at 125°C. RGA Spectra is shown on next page. Spectra shows very low levels (e-10 torr), with the dominant peaks at AMU 18 and AMU 17 indicating N<sub>2</sub>. This is expected as the chamber was exposed to cleanroom environment (water vapour/O<sub>2</sub>) and is purged with N<sub>2</sub>. All other spectra are at the limits of the faraday cup detection (2E-11).

### APPENDIX B (CONT.)

### Vacuum bake out – Chamber certification – RGA data



## APPENDIX C

### SPIRE PFM PIECE PART BAKE OUT LOG

#### Part log : Batch # 1

*Note: This log is to record the individual SPIRE structure components. It is not a detailed bake out report. For this see the SPIRE Vacuum bake out log.*

DATE: 16 Jan 2004

SHEET: 1 of 1

**Responsible: ADR**

| Part Name             | Part # (QTY) | Part Status       | Comments              |
|-----------------------|--------------|-------------------|-----------------------|
|                       | 305 – 15     | Bake out complete | Inspected to VC-HS-UV |
|                       | 305 – 14     | “                 |                       |
|                       | 305 – 8      | “                 |                       |
| SM11B                 | 305 – 912    | “                 |                       |
| PM10A                 | 305 – 17     | “                 |                       |
| SM8A                  | 305 – 4      | “                 |                       |
| SCAL exit baffle ring |              | “                 |                       |
| SCAL box              | 314 – 1A     | “                 |                       |
| SCAL cover            | 314 – 2      | “                 |                       |
| SBS1/SM9B – Baffle    | 305 – 29     | “                 |                       |
| BDA connector flange  | 302 – 23     | “                 |                       |
|                       | 305 – 12     |                   |                       |
| SBS1 + 2 filter mount | 305 – 23     | “                 |                       |
| SM12 baffle           | 303 – 6      | “                 |                       |
| SFIL 2                | 305 – 20     | “                 |                       |
| SFIL 2                | 305 – 21     | “                 |                       |
| SM11A                 | 305 – 8      | “                 |                       |
| PDIC – 1 clamp        | 310 – 2      | “                 |                       |
| PDIC – 2A clamp       | 311 – 1      | “                 |                       |
| PDIC – 1A clamp       | 310 – 1A     | “                 |                       |
|                       |              |                   |                       |
|                       |              |                   |                       |

**SPIRE STRUCTURE – PFM – BATCH 1**

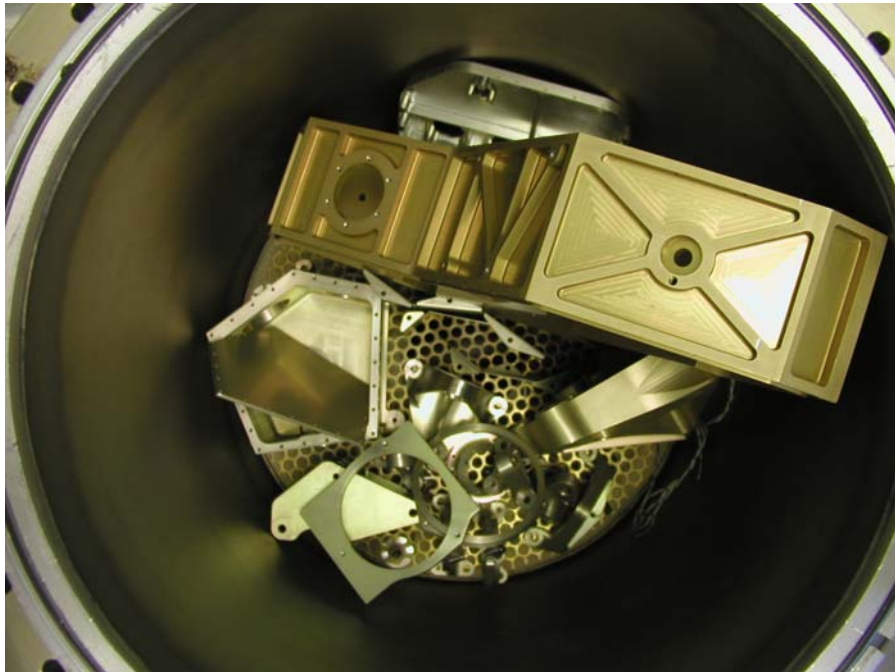
**Vacuum bake out log**

**Instrument/Component:** SPIRE PFM Batch 1 bake out  
**Facility:** Turbo pump, Chamber, thermo couples, RGA, TQCM

**DATE:** 16 Jan 2004  
**TEST #:** MSSL/VBO/0030

**SHEET:** 1 of 3

**TEST CONDITIONS:** Component install, pump down, RGA on

| TIME  | OPERATION/COMMENT  | RESPONSIBLE |
|---|--|-------------|
| 12:31<br>12:36  | Start chamber pump down, see parts log for component list<br>P = 1.1E-1 mbar, Tset = 100°C, R1 = 1°C/min | ADR         |
|  |  |             |
| 12:37   | P = 7.6E-2 mbar, T = 20°C, Turbo on, acceleration mode   | ADR         |
| 12:40   | P = 5.0E-3 mbar, T = 20°C  |             |
| 12:50   | P = 1.4E-4 mbar, T = 20°C, Turbo in normal mode  |             |
| 12:58   | P = 6.6E-5 mbar, T = 20°C, RGA on, RGA filename = SP_FM_01.wbg   | ADR         |
| 13:07   | P = 4.0E-5 mbar, T = 20°C  |             |
| 14:59   | P = 9.5E-6 mbar, T = 20°C  |             |
| 15:59   | P = 5.8E-6 mbar, T = 20°C, chamber heaters on  |             |
| 16:29   | P = 5.0E-6 mbar, T = 27°C  |             |
| 16:59   | P = 5.0E-6 mbar, T = 36°C  |             |
| 17:29   | P = 5.6E-6 mbar, T = 45°C  |             |
| 22:29   | P = 7.6E-6 mbar, T = 100°C   |             |

**SPIRE STRUCTURE – PFM – BATCH 1****Vacuum bake out log****Instrument/Component:** SPIRE PFM Batch 1 bake out**Facility:** Turbo pump, Chamber, thermo couples, RGA, TQCM**DATE:** 17 Jan 2004**TEST #:** MSSL/VBO/0030**SHEET:** 2 of 3**TEST CONDITIONS:** Component bakeout

| TIME           | OPERATION/COMMENT  | RESPONSIBLE |
|----------------|--|-------------|
| <u>17Jan04</u> |  |             |
| 08:59          | P = 1.0E-6 mbar, T = 100°C   | ADR         |
| 11:29          | P = 8.0E-7 mbar, T = 100°C   |             |
| 16:59          | P = 6.0E-7 mbar, T = 100°C   |             |
| <u>18Jan04</u> |  |             |
| 10:59          | P = 3.0E-7 mbar, T = 100°C   | ADR         |
| 15:29          | P = 3.0E-7 mbar, T = 100°C   |             |
| 20:59          | P = 2.0E-7 mbar, T = 100°C   |             |
| <u>19Jan04</u> |  |             |
| 06:29          | P = 2.0E-7 mbar, T = 100°C   |             |
| 14:29          | P = 1.0E-7 mbar, T = 100°C   |             |
| 16:59          | P = 1.0E-7 mbar, T = 100°C   | ADR         |
| <u>20Jan04</u> |  |             |
| 03:29          | P = 1.0E-7 mbar, T = 100°C   |             |
| 07:29          | P = 1.0E-7 mbar, T = 100°C   |             |
| 08:59          | P = 1.0E-7 mbar, T = 100°C, Heaters off, RGA show good decay<br>(see attached RGA report), end of bake out | ADR         |

# SPIRE STRUCTURE – PFM – BATCH 1

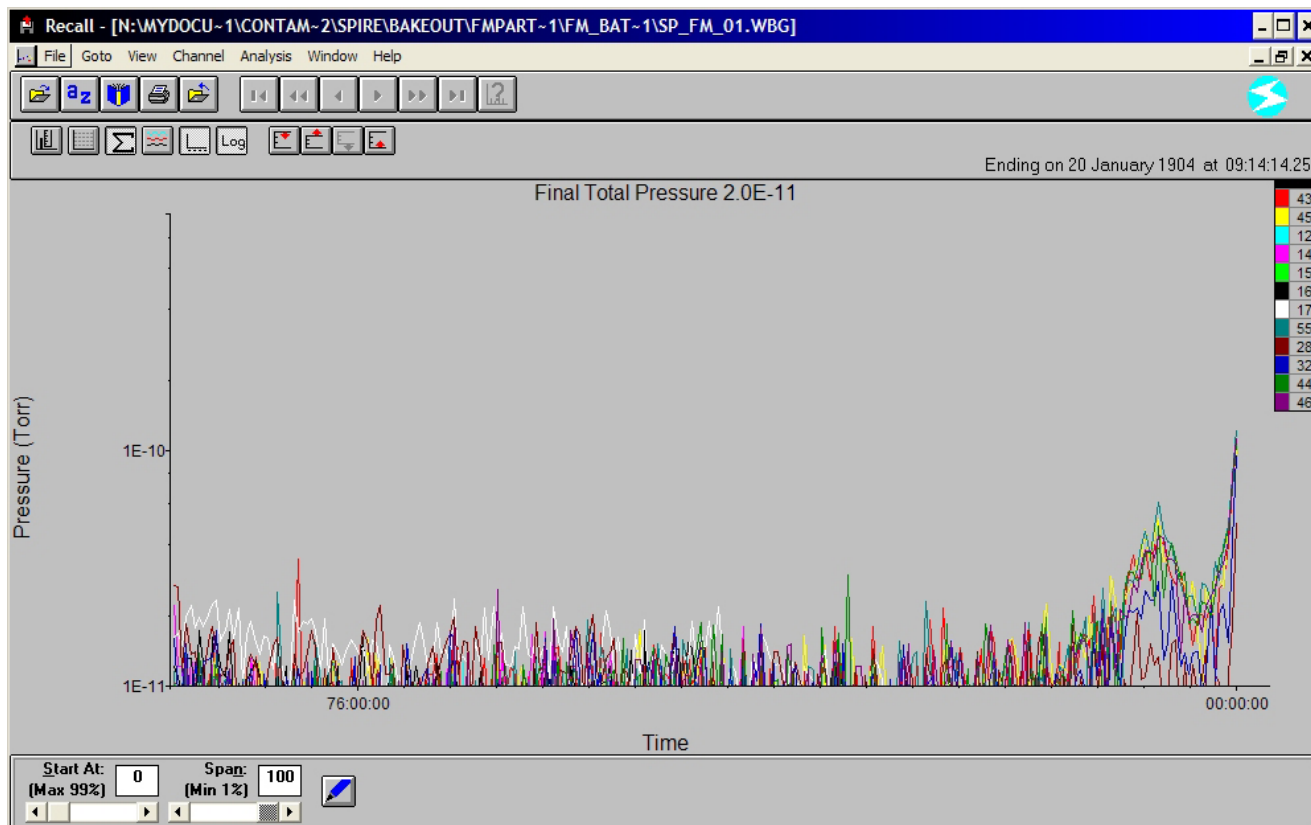
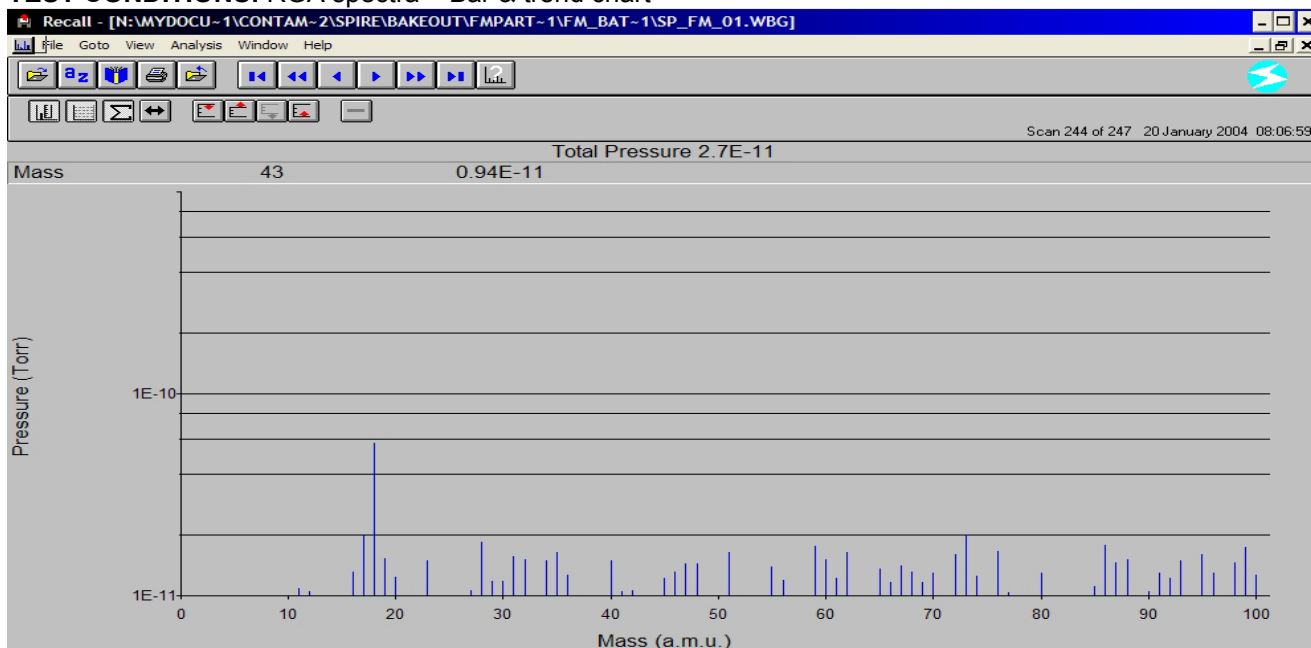
## Vacuum bake out log

**Instrument/Component:** SPIRE PFM Batch 1 bake out  
**Facility:** Turbo pump, Chamber, thermo couples, RGA, TQCM

**DATE:** 17 Jan 2004  
**TEST #:** MSSL/VBO/0030

**SHEET:** 3 of 3

### TEST CONDITIONS: RGA spectra – Bar & trend chart





**APPENDIX C (Cont)**  
**SPIRE PFM PIECE PART BAKE OUT LOG**

**Part log : Batch # 2**

*Note: This log is to record the individual SPIRE structure components. It is not a detailed bake out report. For this see the SPIRE Vacuum bake out log.*

DATE: 20 Jan 2004

SHEET: 1 of 1

| Part Name               | Part # (QTY) | Part Status       | Comments              |
|-------------------------|--------------|-------------------|-----------------------|
| 2K outer lid            | 306 – A      | Bake out complete | Inspected to VC-HS-UV |
| Photometer inner cover  | 306 – 1A     | “                 |                       |
| Blanking plate          | 302 – 44     | “                 |                       |
| Assembly jig for bosses |              | “                 |                       |
| Bosses SMEC elec        |              | “                 |                       |
| Fixed mount             |              | “                 |                       |
| BDA connector flange    | 302 – 22     | “                 |                       |
| 2K Spectrometer box     | 307          | “                 |                       |
| Spectrometer baffle     | 303 – 3      | “                 |                       |
| A frame Brkt spec       | 302 – 26A    | “                 |                       |
| A frame spt plt spec    | 302 – 15A    | “                 |                       |
| Dowel retaining plate   | 302 – 39     | “                 |                       |
| Mounting block          | 303 – 1A     | “                 |                       |
| 2K blade B              | 307 – 4      | “                 |                       |
| 2K filter mating plate  | 307 – 2      | “                 |                       |

**SPIRE STRUCTURE – PFM - BATCH 2**


**Vacuum bake out log**

**Instrument/Component:** SPIRE PFM Batch 2 bake out  
**Facility:** Turbo pump, Chamber, thermo couples, RGA, TQCM

**DATE:** 20 Jan 2004  
**TEST #:** MSSL/VBO/0031

**SHEET:** 1 of 3

**TEST CONDITIONS:** Component install, pump down, RGA on

| TIME  | OPERATION/COMMENT   | RESPONSIBLE |
|---|---|-------------|
| 10:58<br>11:36<br>12:00<br>13:35<br>14:45   | Start pump down, for component list see component log<br>P = 3.7E-2 mbar, T = 20°C, Turbo on, acceleration mode, R1 = 1°C/min<br>P = 3.13E-5 mbar, T = 20°C, Tset = 100°C<br>P = 8.0E-6 mbar, T = 20°C<br>P = 6.8E-6 mbar, T = 20°C, RGA on, RGA filename = FM_B2.wbg | ADR         |
|  |   |             |
| 14:20<br>17:32<br>22:02   | P = 6.7E-6 mbar, T = 20°C, chamber heaters on<br>P = 9.5E-6 mbar, T = 84°C<br>P = 3.0E-6 mbar, T = 100°C  | ADR         |
| <u>21Jan04</u>  |   |             |
| 05:02<br>08:32<br>21:02   | P = 8.0E-7 mbar, T = 100°C<br>P = 6.0E-7 mbar, T = 100°C<br>P = 3.0E-7 mbar, T = 100°C  |             |
| <u>22Jan04</u>  |   |             |
| 02:32   | P = 3.0E-7 mbar, T = 100°C  | ADR         |

**SPIRE STRUCTURE – PFM - BATCH 2****Vacuum bake out log****Instrument/Component:** SPIRE PFM Batch 2 bake out**Facility:** Turbo pump, Chamber, thermo couples, RGA, TQCM**DATE:** 20 Jan 2004**TEST #:** MSSL/VBO/0031**SHEET:** 2 of 3**TEST CONDITIONS:** Component install, pump down, RGA on

| TIME    | OPERATION/COMMENT   | RESPONSIBLE |
|---------|---|-------------|
| 22Jan04 |   |             |
| 07:32   | P = 3.0E-7 mbar, T = 100°C  | ADR         |
| 08:02   | P = 2.0E-7 mbar, T = 100°C  |             |
| 08:20   | P = 2.0E-7 mbar, T = 100°C, heaters off, RGA shows good decay<br>End of bakeout |             |

# SPIRE STRUCTURE – PFM – BATCH 2

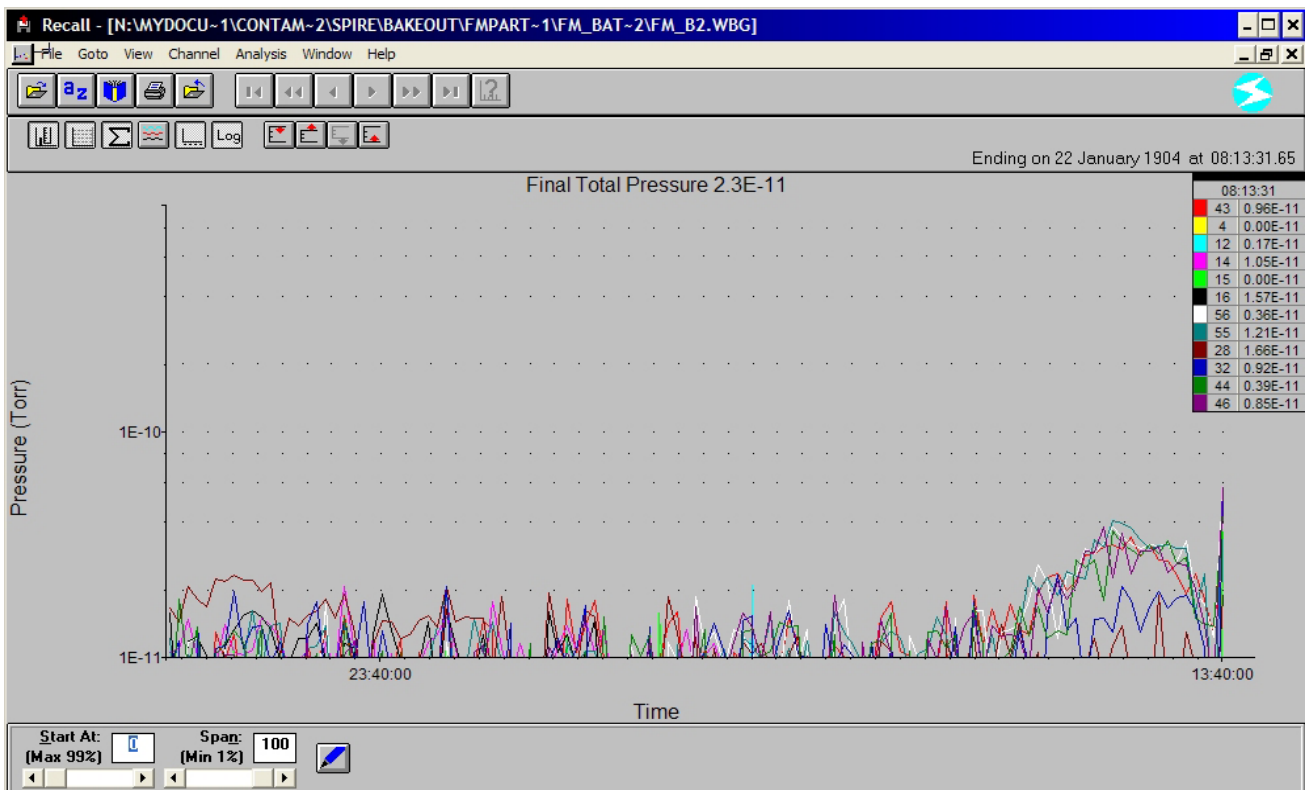
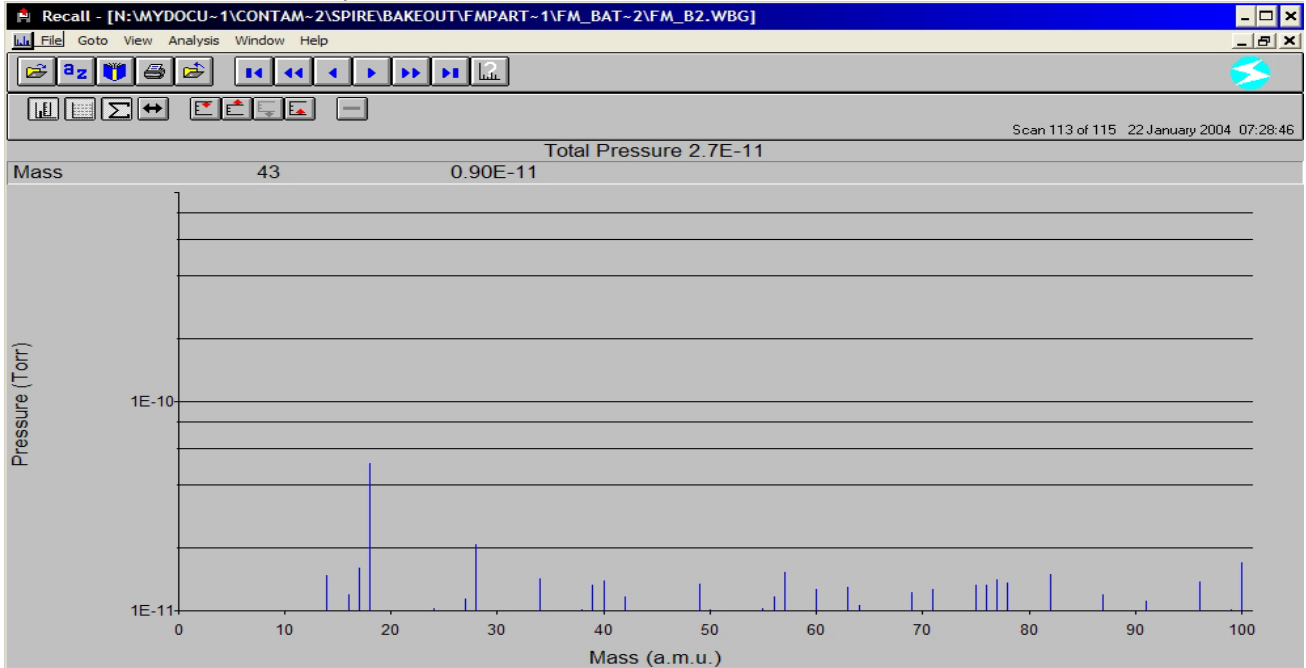
## Vacuum bake out log

**Instrument/Component:** SPIRE PFM Batch 2 bake out  
**Facility:** Turbo pump, Chamber, thermo couples, RGA, TQCM

**DATE:** 20 Jan 2004  
**TEST #:** MSSL/VBO/0031

**SHEET:** 3 of 3

### TEST CONDITIONS: RGA spectra – Bar & trend chart



## APPENDIX C (Cont)

### SPIRE PFM PIECE PART BAKE OUT LOG

#### Part log : Batch # 3

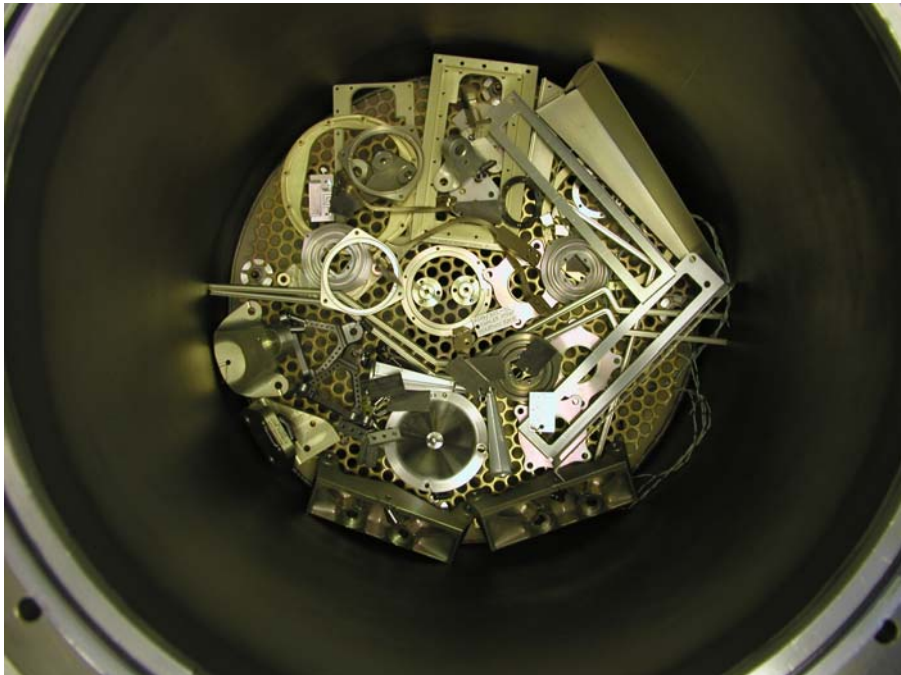
*Note: This log is to record the individual SPIRE structure components. It is not a detailed bake out report. For this see the SPIRE Vacuum bake out log.*

DATE: 27 Jan 2004

SHEET: 1 of 1

| Part Name               | Part # (QTY) | Part Status       | Comments              |
|-------------------------|--------------|-------------------|-----------------------|
| PFIL 2 H seal           | 302 – 13     | Bake out complete | Inspected to VC-HS-UV |
| CFIL 1 H seal           | 302 – 16     | “                 | “                     |
| Photometer cover insert | 302 – 9      | “                 | “                     |
| PFIL 2 clamp ring       | 302 – 17     | “                 | “                     |
| PFIL 2 baffle plate     | 312 – 12     | “                 | “                     |
| CFIL 1 clamp ring       | 304 – 7F     | “                 | “                     |
| Baffle mount            | 306 – 6F     | “                 | “                     |
| Dowel retaining plate   | 302 – 29     | “                 | “                     |
| A frame spt plt         | 302 – 15     | “                 | “                     |
| Cold strap clamp        | 302 – 21     | “                 | “                     |
| Baffle (outer)          | 309 – 2      | “                 | “                     |
| Baffle (inner)          | 309 – 1      | “                 | “                     |
| Temp RFI brkt           | 302 – 28     | “                 | “                     |
| RFI Filter frame        | 302 – 27     | “                 | “                     |
| RFI filter frame        | 302 – 29     | “                 | “                     |
| Anti torque plt         | 309 – 5      | “                 | “                     |
| SM9/SM10A               | 305 – 6      | “                 | “                     |
| SM9/SM10B               | 305 – 7      | “                 | “                     |
| SM07A                   | 305 – 3      | “                 | “                     |
| Photometer A frame brkt | 302 – 14A    | “                 | “                     |
| Photometer cold stop    | 306 – 4A     | “                 | “                     |
| A frame                 | 313B         | “                 | “                     |
| BDA plug connector      | 306 – 5      | “                 | “                     |
|                         | 302 – 25     | “                 | “                     |
| PDIC 2 clamp finger     | 311 – 2      | “                 | “                     |
| 2K box cone mount       | 312B         | “                 | “                     |
| Dowels                  |              | “                 | “                     |
| Light trap              | 302 – 33     | “                 | “                     |
| Isolation plate         | 302 – 32     | “                 | “                     |
| Cold strap support      | 307 – 13     | “                 | “                     |
| Bracket                 | 315 – 23     | “                 | “                     |
| Bracket                 | 315 – 22B    | “                 | “                     |
| SM12B                   | 305 – 11     | “                 | “                     |
| SM12A                   | 305 – 10     | “                 | “                     |
| SBS 1 & 2               | 305 – 24     | “                 | “                     |
| SFIL 3                  | 307 – 3      | “                 | “                     |
| Insulating bush         | 307 – 36     | “                 | “                     |
| Insulating bush         | 302 – 38     | “                 | “                     |
| Isolating plate         | 302 – 35     | “                 | “                     |
| Detector box strap      | 302 – 31     | “                 | “                     |
| Detector box strap      | 302 – 30     | “                 | “                     |

**SPIRE STRUCTURE – PFM - BATCH 3****Vacuum bake out log****Instrument/Component:** SPIRE PFM Batch 3 bake out**Facility:** Turbo pump, Chamber, thermo couples, RGA, TQCM**DATE:** 27 Jan 2004**TEST #:** MSSL/VBO/0033**SHEET:** 1 of 2**TEST CONDITIONS:** Component install, pump down, RGA on

| TIME  | OPERATION/COMMENT   | RESPONSIBLE |
|---|---|-------------|
| 10:20   | Start pump down, for component list see part log                | ADR         |
| 10:35   | P = 4.2E-2 mbar, T = 20°C, turbo on, acceleration mode          |             |
| 10:37   | P = 6.6E-3 mbar, T = 20°C                                       |             |
| 10:39   | P = 5.0E-4 mbar, T = 20°C                                       |             |
|  |   |             |
| 10:40   | P = 1.7E-4 mbar, T = 20°C, Tset = 100°C, Turbo to normal mode   | ADR         |
| 10:42   | P = 7.8E-5 mbar, T = 20°C, RGA on, RGA filename = SP_B3.wbg     |             |
| <u>28Jan04</u>  |   |             |
| 11:13   | P = 4.0E-7 mbar, T = 20°C, chamber heaters on                   | ADR         |
| 13:00   | P = 1.2E-6 mbar, T = 50°C                                       |             |
| 17:00   | P = 3.2E-6 mbar, T = 100°C                                      |             |
| <u>2Feb04</u>   |   |             |
| 09:15   | P = 7.0E-7 mbar, T = 100°C                                      | ADR         |
| <u>3Feb04</u>   |   |             |
| 09:00   | P = 6.0E-7 mbar, T = 100°C                                      |             |
| <u>4Feb04</u>   |   |             |
| 08:50   | P = 5.0E-7 mbar, T = 100°, chamber heaters off, end of bake out | ADR         |

### SPIRE STRUCTURE – PFM – BATCH 3

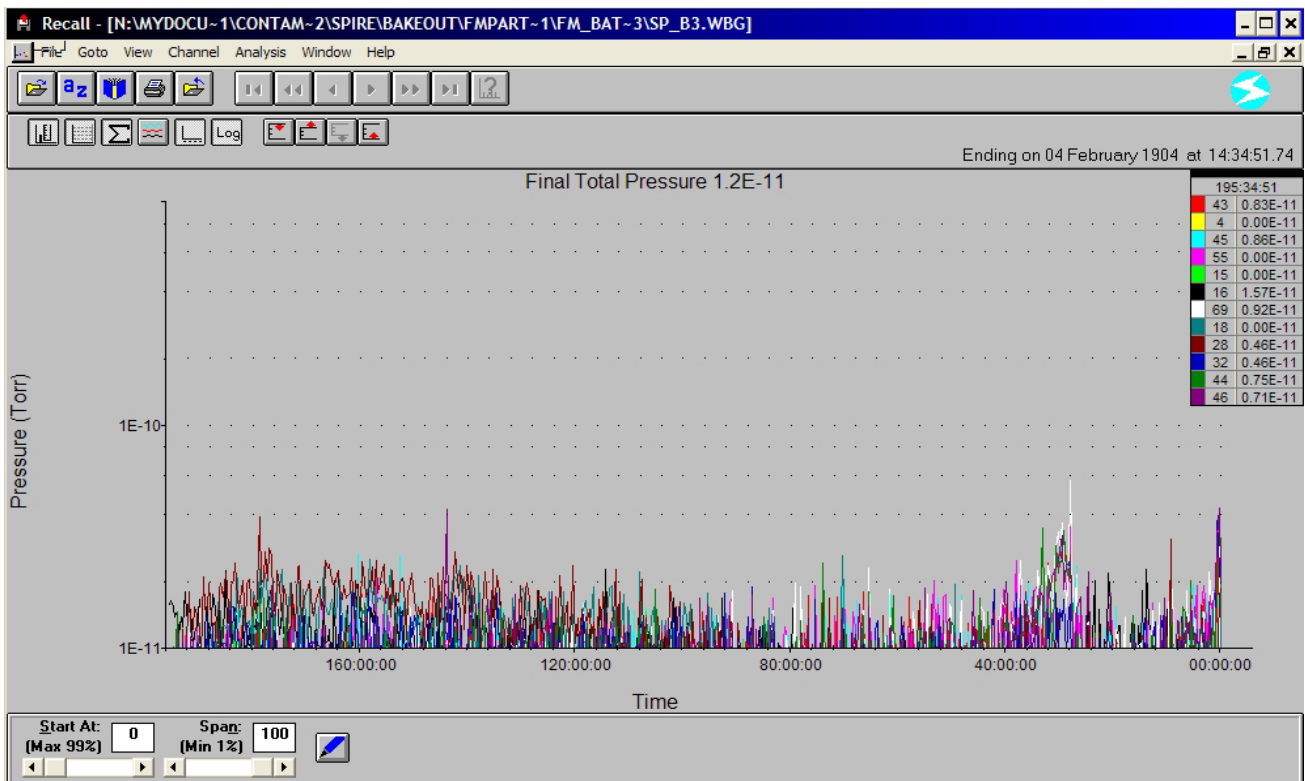
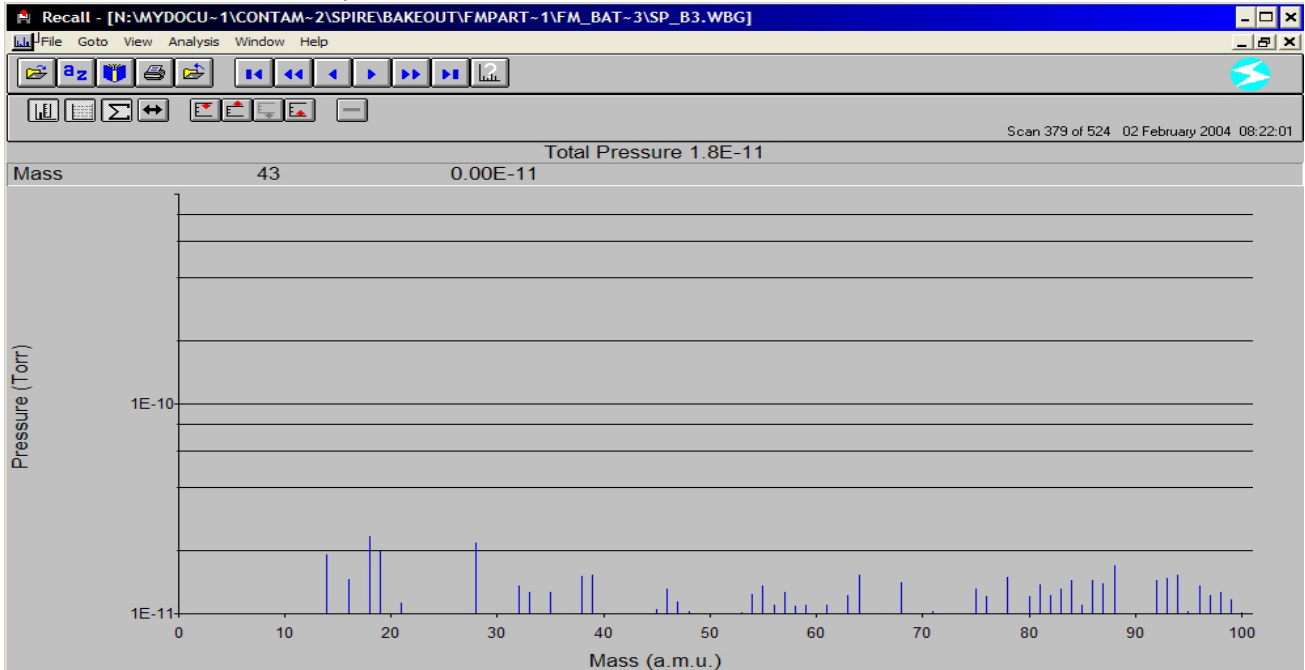
### Vacuum bake out log

**Instrument/Component:** SPIRE PFM Batch 2 bake out  
**Facility:** Turbo pump, Chamber, thermo couples, RGA, TQCM

**DATE:** 27 Jan 2004  
**TEST #:** MSSL/VBO/0033

**SHEET:** 3 of 2

#### TEST CONDITIONS: RGA spectra – Bar & trend chart



**APPENDIX C (Cont)****SPIRE PFM PIECE PART BAKE OUT LOG****Part log : Batch # 4**

*Note: This log is to record the individual SPIRE structure components. It is not a detailed bake out report. For this see the SPIRE Vacuum bake out log.*

DATE: 27 Jan 2004

SHEET: 1 of 1

| <b>Part Name</b>  | <b>Part # (QTY)</b> | <b>Part Status</b> | <b>Comments</b>       |
|-------------------|---------------------|--------------------|-----------------------|
| Mirror mount PM06 | 5264 305 – 13       | Bake out complete  | Inspected to VC-HS-UV |
| Mirror mount SM06 | 5264 305 – 2        | "                  | "                     |



**SPIRE STRUCTURE – PFM - BATCH 4****Vacuum bake out log****Instrument/Component:** SPIRE PFM Batch 4 bake out**Facility:** Turbo pump, Chamber, thermo couples, RGA, TQCM**DATE:** 02 March 2004**TEST #:** MSSL/VBO/0036**SHEET:** 1 of 2**TEST CONDITIONS:** Component install, pump down, RGA on

| TIME          | OPERATION/COMMENT   | RESPONSIBLE |  |
|---------------|---|-------------|--|
| 09:17         | Install mirror mounts in chamber, start pump down           | ADR         |  |
| 09:18         | P = 5.4E-1 mbar, T = 20°C, Tset = 100°C                     |             |  |
| 09:20         | P = 7.6E-2 mbar, T = 20°C                                   |             |  |
| 09:21         | P = 5.2E-2 mbar, T = 20°C, turbo on, acceleration mode      |             |  |
| 09:24         | P = 1.7E-4 mbar, T = 20°C                                   |             |  |
| 09:25         | P = 7.0E-5 mbar, T = 20°C, RGA on, RGA filename = FM_B4.wbg |             |  |
| 15:30         | P = 1.1E-6 mbar, T = 20°C                                   |             |  |
| 19:24         | P = 9.0E-7 mbar, T = 20°C                                   |             |  |
| <u>3Mar04</u> |   |             |  |
| 12:24         | P = 7.0E-7 mbar, T = 20°C, chamber heaters on               |             |  |
| 13:24         | P = 3.0E-7 mbar, T = 54°C                                   |             |  |
| 14:24         | P = 3.0E-7 mbar, T = 84°C                                   |             |  |
| 15:24         | P = 5.0E-7 mbar, T = 100°C                                  |             |  |
| <u>4Mar04</u> |   |             |  |
| 13:54         | P = 1.0E-7 mbar, T = 100°C                                  |             |  |
| <u>5Mar04</u> |   |             |  |
| 13:54         | P = 1.0E-7 mbar, T = 100°C                                  |             |  |
| <u>6Mar04</u> |   |             |  |
| 13:54         | P = 1.0E-7 mbar, T = 100°C                                  |             |  |
| <u>8Mar04</u> |   |             |  |
| 13:54         | P = 5.0E-8 mbar, T = 100°C                                  |             |  |
| <u>9Mar04</u> |   |             |  |
| 08:54         | P = 5.0E-8 mbar, T = 100°C, heaters off, end of bakeout     | ADR         |  |

# SPIRE STRUCTURE – PFM – BATCH 4

## Vacuum bake out log

**Instrument/Component:** SPIRE PFM Batch 4 bake out  
**Facility:** Turbo pump, Chamber, thermo couples, RGA, TQCM

**DATE:** 02 March 2004  
**TEST #:** MSSL/VBO/0036

**SHEET:** 2 of 2

### TEST CONDITIONS: RGA spectra – Bar & trend chart

