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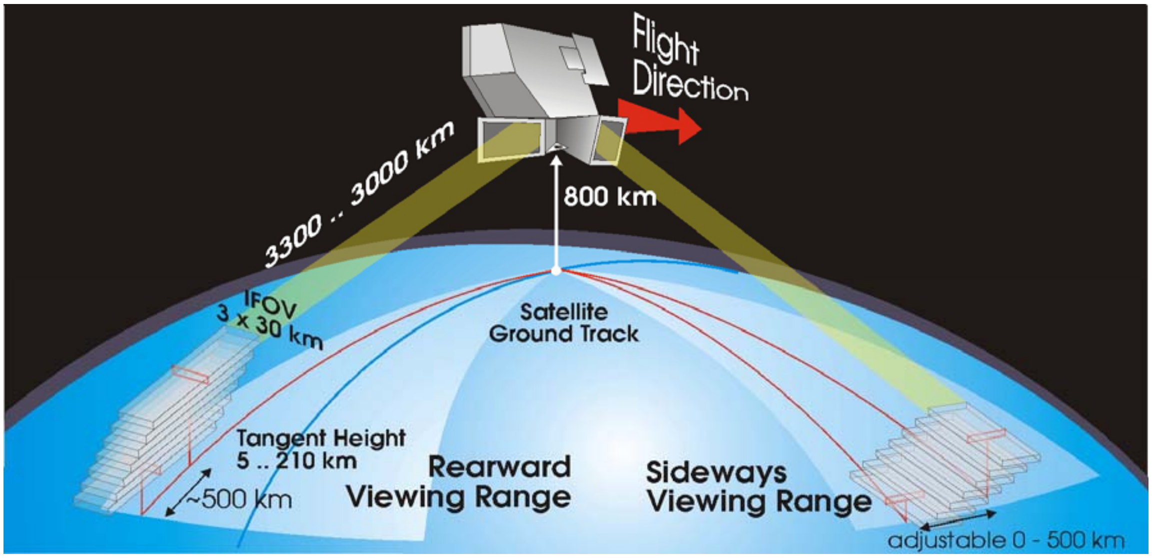
ENVISAT MIPAS BI-MONTHLY REPORT: SEPTEMBER - OCTOBER 2005



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1 INTRODUCTION

The MIPAS Bi-Monthly Report (BMR) documents the current status and recent changes to the MIPAS instrument, its data processing chain, and its data products. This issue still covers a bi-monthly period due to the fact that MIPAS was switched-off for 25 days during September to relax the IDU. Starting from the next report, monthly issues will be resumed.
The BMR is composed of analysis results obtained by the DPQC (Data Processing and Quality Control), combined with inputs received from the different groups working on MIPAS operation, calibration, product validation and data quality. The following groups participate in the MIPAS Quality Working Group (QWG):

- ESRIN-DPQC
- ESOC
- ESTEC
- ABB BOMEM
- Oxford University
- IFAC-CNR
- EADS-Astrium GmbH
- Leicester University
- LISA
- IMK
- University of Bologna
- ISAC-CNR
- IAA
- DLR
- ECMWF

In addition, the group interfaces with the Atmospheric Chemistry Validation Team (ACVT).

1.1 Scope

The main objective of the BMR is to give, on a regular basis, the status of MIPAS instrument performance, data acquisition, results of anomaly investigations, calibration activities and validation campaigns.

1.2 Acronyms and Abbreviations

ACVT	Atmospheric Chemistry Validation Team
ADF	Auxiliary Data File
ADS	Annotated Data Set
ANX	Ascending Node Crossing
AE	Aircraft Emission
AR	Anomaly Report
BMR	Monthly Report

CBB	Calibration Black-Body
CTI	Configuration Table Interface
DPAC	German Processing and Archiving Centre for ENVISAT
DPM	Detailed Processing Model
DPQC	Data Processing and Quality Control
DS	Deep Space
DSD	Data Set Description
ECMWF	European Centre for Medium-Range Weather Forecasts
FCE	Fringe Count Error
FOCC	Flight Operation Control Centre
HD	Help-Desk
IDU	Interferometer Drive Unit
IECF	Instrument Engineering and Calibration Facilities
IF	In-Flight
IG	Initial Guess
ILS	Instrument Line Shape
INT	Interferometer
I/O DD	Input/Output Data Definition
IPF	Instrument Processing Facility
LOS	Line of Sight
MA	Middle Atmosphere
MDS	Measurements Data Set
MIPAS	Michelson Interferometer for Passive Atmospheric Sounding
MPH	Main Product Header
MW	Micro-Window
NCR	Non-Conformance Report
NESR	Noise Equivalent Spectral Radiance
NOM	Nominal
NRT	Near-Real-Time
OFL	Off-Line
PCD	Product Confidence Data
PCF	Product Control Facility
PDS	Payload Data Segment
QWG	Quality Working Group
RGC	Radiometric Gain Calibration
SEM	Special Event Measurement
SPH	Specific Product header
SPR	Software Problem Report
UA	Upper Atmosphere
UTLS	Upper Troposphere Lower Stratosphere
VCM	Variance Covariance Matrix
VMR	Volume Mixing Ratio
WCC	Wear Control Cycle
1RR	Single Slide Reduced Resolution
2RR	Double Slide Reduced Resolution

2 THE REPORT

2.1 Summary

- During Sept-Oct 2005 operations the interferometer slides were still suffering from speed errors whose origin is still not fully understood (mechanical, temperature related…).
- An empirical understanding is that the interferometer performance improves after a long period of interruption ("self-healing" effect) and in general when maintaining a low duty cycle (around 40%).
- In light of this, a long mission interruption was decided for the time interval: 30 August – 26 September 2005. Therefore, this bi-monthly report is reporting mostly on October operations.
- This interruption did not have the expected effect of relaxing the IDU system, on the contrary the number of IDU anomalies after the interruption was at the same level as it was before.
- An analysis made by ESOC-Astrium shows that the IDU error rate started to increase significantly (with an exponential behaviour) around 17 July 2005, probably due to the INT heater switch-off at the end of May.
- Indeed the number of IDU errors during 2005 operations with INT heater switch-off is twice that when the INT heater was switched-on. Following this analysis, it was decided to switch-on the INT heater on 17 October 2005. The effect of this switching will be discussed in detail in the next report.
- From 26 September to 17 October, MIPAS was used in support of the Southern France validation campaign using UTLS1 mode.
- Special in-flight measurement IF9, IF10, IF11, IF16 were planned for the 28 October 2005. Most of these measurements were successful except for the IF16 measurements in raw acquisition mode; those data have been lost due to an anomaly in the PDS acquisition at Kiruna. An anomaly report has been open on AMT (OAR_20015) and the investigation is ongoing.
- Currently the Near-Real Time (NRT) mission is suspended, and no systematic operational Off-Line (OFL) processing is performed while the processing algorithms are being adapted to the new observation modes.

2.1.1 INSTRUMENT UNAVAILABILITY

During September and October 2005 operations, MIPAS was affected by frequent unplanned unavailability due to IDU system error. These errors occur when a velocity difference is observed between the two slides, in this case the interferometer is stopped and the operations are resumed using a resuming procedure, which takes one or two orbits. The MIPAS unavailability intervals during Sept-Oct 2005 operations are listed below. Highlighted in red are the unavailability periods which were planned for relaxing the IDU system.

Tab. 1 List of MIPAS unavailability in the period: 1 September - 1 November 2005.

Start time		Stop time		Duration	Start Orbit	Stop Orbit
Date	UTC	date	UTC	sec		
30-AUG-2005	14.13.34	19-SEP-2005	2.00.38	1684024	18301	18580
26-SEP-2005	6.37.18	26-SEP-2005	11.49.06	18708	18683	18686
28-SEP-2005	23.10.13	29-SEP-2005	1.51.02	9649	18721	18723
29-SEP-2005	11.03.07	29-SEP-2005	11.54.37	3090	18728	18729
30-SEP-2005	7.23.19	30-SEP-2005	8.40.54	4655	18740	18741
30-SEP-2005	9.32.37	30-SEP-2005	10.21.30	2933	18742	18742
30-SEP-2005	10.44.49	30-SEP-2005	13.03.36	8327	18742	18744
30-SEP-2005	19.56.56	30-SEP-2005	20.25.05	1689	18748	18748
30-SEP-2005	22.20.00	01-OCT-2005	0.47.48	8868	18749	18751
01-OCT-2005	7.15.03	01-OCT-2005	10.42.41	12458	18754	18757
01-OCT-2005	19.18.25	01-OCT-2005	19.53.28	2103	18762	18762
01-OCT-2005	21.02.33	01-OCT-2005	21.34.04	1891	18763	18763
01-OCT-2005	22.02.41	02-OCT-2005	0.16.11	8010	18763	18765
02-OCT-2005	6.49.13	02-OCT-2005	7.37.40	2907	18769	18769
02-OCT-2005	9.30.24	02-OCT-2005	12.00.22	8998	18770	18772
02-OCT-2005	19.02.42	02-OCT-2005	19.21.51	1149	18776	18776
02-OCT-2005	20.26.52	02-OCT-2005	21.02.27	2135	18777	18777
02-OCT-2005	21.03.57	02-OCT-2005	22.42.41	5924	18777	18778
03-OCT-2005	10.19.45	03-OCT-2005	10.27.14	449	18785	18785
03-OCT-2005	21.32.18	03-OCT-2005	22.11.26	2348	18792	18792
04-OCT-2005	6.17.46	04-OCT-2005	6.34.25	999	18797	18797
04-OCT-2005	7.01.56	04-OCT-2005	8.15.01	4385	18797	18798
04-OCT-2005	8.17.38	04-OCT-2005	9.55.37	5879	18798	18799
04-OCT-2005	10.20.32	04-OCT-2005	12.37.44	8232	18799	18801
05-OCT-2005	9.57.04	05-OCT-2005	12.06.07	7743	18813	18815
05-OCT-2005	22.56.30	06-OCT-2005	1.30.54	9264	18821	18823
06-OCT-2005	7.15.35	06-OCT-2005	8.52.02	5787	18826	18827
06-OCT-2005	9.33.11	06-OCT-2005	10.32.59	3588	18827	18828
06-OCT-2005	22.22.26	07-OCT-2005	0.59.17	9411	18835	18837
07-OCT-2005	19.48.23	07-OCT-2005	20.04.58	995	18848	18848
07-OCT-2005	21.54.52	08-OCT-2005	0.27.40	9168	18849	18851
08-OCT-2005	23.02.28	09-OCT-2005	1.36.39	9251	18864	18866
09-OCT-2005	11.26.17	09-OCT-2005	13.20.52	6875	18871	18873
09-OCT-2005	22.51.08	10-OCT-2005	1.05.03	8035	18878	18880
10-OCT-2005	6.04.41	10-OCT-2005	6.45.56	2475	18883	18883
11-OCT-2005	22.33.53	11-OCT-2005	23.00.18	1585	18907	18907
12-OCT-2005	9.24.53	12-OCT-2005	11.46.01	8468	18913	18915
12-OCT-2005	21.29.30	12-OCT-2005	22.28.41	3551	18920	18921
13-OCT-2005	10.12.54	13-OCT-2005	12.55.00	9726	18928	18930
15-OCT-2005	22.34.41	16-OCT-2005	1.16.33	9712	18964	18966

16-OCT-2005	6.09.00	16-OCT-2005	6.57.26	2906	18969	18969
16-OCT-2005	19.33.35	16-OCT-2005	20.22.14	2919	18977	18977
16-OCT-2005	22.02.51	17-OCT-2005	0.44.56	9725	18978	18980
17-OCT-2005	8.07.22	17-OCT-2005	9.47.01	5979	18984	18985
17-OCT-2005		28-OCT-2005				

2.1.2 DATA GENERATION GAPS

Only Level 0 data coverage is reported below, as currently the Near-Real Time (NRT) mission is suspended, and no systematic operational Off-Line (OFL) processing is performed while the processing algorithms are being adapted to the new observation modes.

Tab. 2 List of missing intervals for MIP_NL__0P: 1 Sept - 1 November 2005.

Start time		Stop time		Duration	Start Orbit	Stop Orbit
date	UTC	date	UTC	sec		
26-SEP-2005	20.15.39	26-SEP-2005	20.25.16	577	18691	18691
27-SEP-2005	20.52.09	27-SEP-2005	20.55.02	173	18705	18705
30-SEP-2005	8.40.54	30-SEP-2005	8.41.08	14	18741	18741
30-SEP-2005	10.21.30	30-SEP-2005	10.21.44	14	18742	18742
01-OCT-2005	22.01.58	01-OCT-2005	22.02.41	43	18763	18763
02-OCT-2005	7.37.40	02-OCT-2005	7.37.54	14	18769	18769
02-OCT-2005	20.26.09	02-OCT-2005	20.26.52	43	18777	18777
02-OCT-2005	21.02.27	02-OCT-2005	21.02.42	15	18777	18777
02-OCT-2005	21.03.15	02-OCT-2005	21.03.57	42	18777	18777
02-OCT-2005	22.42.41	02-OCT-2005	22.43.17	36	18778	18778
04-OCT-2005	8.15.01	04-OCT-2005	8.15.16	15	18798	18798
04-OCT-2005	9.55.37	04-OCT-2005	9.55.52	15	18799	18799
06-OCT-2005	8.52.02	06-OCT-2005	8.52.38	36	18827	18827
06-OCT-2005	10.32.59	06-OCT-2005	10.33.14	15	18828	18828
07-OCT-2005	21.54.49	07-OCT-2005	21.54.52	3	18849	18849
08-OCT-2005	10.18.21	08-OCT-2005	10.18.35	14	18856	18857
09-OCT-2005	11.25.35	09-OCT-2005	11.26.17	42	18871	18871
10-OCT-2005	22.28.56	10-OCT-2005	22.40.42	706	18892	18893
12-OCT-2005	20.13.57	12-OCT-2005	20.14.24	27	18920	18920
13-OCT-2005	10.09.04	13-OCT-2005	10.12.54	230	18928	18928
14-OCT-2005	7.12.21	14-OCT-2005	7.12.23	2	18941	18941
15-OCT-2005	9.57.31	15-OCT-2005	9.57.45	14	18956	18956
15-OCT-2005	22.30.37	15-OCT-2005	22.34.41	244	18964	18964
16-OCT-2005	6.57.26	16-OCT-2005	6.57.41	15	18969	18969
16-OCT-2005	20.22.14	16-OCT-2005	20.22.29	15	18977	18977
16-OCT-2005	21.59.00	16-OCT-2005	22.02.51	231	18978	18978
17-OCT-2005	7.18.06	17-OCT-2005	7.18.08	2	18984	18984

17-OCT-2005	8.02.36	17-OCT-2005	8.07.22	286	18984	18984
17-OCT-2005	9.47.01	17-OCT-2005	9.47.16	15	18985	18985
17-OCT-2005	11.03.05	17-OCT-2005	12.25.53	4968	18986	18987
22-OCT-2005	6.15.11	22-OCT-2005	6.19.51	280	19054	19055
22-OCT-2005	9.37.43	22-OCT-2005	9.37.57	14	19056	19056
28-OCT-2005	15.09.56	28-OCT-2005	15.11.07	71	19146	19146
28-OCT-2005	15.11.07	28-OCT-2005	15.13.24	137	19146	19146
28-OCT-2005	15.13.24	28-OCT-2005	15.13.28	4	19146	19146
28-OCT-2005	15.13.28	28-OCT-2005	15.15.45	137	19146	19146
28-OCT-2005	15.15.45	28-OCT-2005	15.21.15	330	19146	19146
28-OCT-2005	16.50.26	28-OCT-2005	17.00.01	575	19147	19147
29-OCT-2005	10.58.37	29-OCT-2005	10.58.52	15	19157	19158
29-OCT-2005	17.55.22	29-OCT-2005	17.59.26	244	19162	19162
29-OCT-2005	19.35.58	29-OCT-2005	19.40.02	244	19163	19163
29-OCT-2005	21.16.34	29-OCT-2005	21.20.37	243	19164	19164
29-OCT-2005	23.00.59	29-OCT-2005	23.01.13	14	19165	19165
30-OCT-2005	10.45.10	30-OCT-2005	10.45.25	15	19172	19172
30-OCT-2005	12.21.57	30-OCT-2005	12.26.00	243	19173	19173
30-OCT-2005	14.06.22	30-OCT-2005	14.06.37	15	19174	19174
31-OCT-2005	18.32.44	31-OCT-2005	18.36.48	244	19191	19191

During the period Sept-Oct 2005, no missing intervals for LOS measurements (MIP_LS__0P) occurred.
On the other hand, important MIP_RW__0P measurements were affected by unintended unavailability, as reported in Tab. 3. These measurements correspond to raw acquisition mode for special in-flight characterisation IF16 that were lost and should be re-planned for the future mission. In particular only one very small raw product was received together with two nominal MIP_NL__0P products corresponding to orbits 19146 – 19147. This problem was due to processing unavailability at Kiruna. An Anomaly Report (**OAR-2015**) was opened on the AMT web site about this problem.

Tab. 3 List of missing intervals for MIP_RW__0P: 1 September **-** 1 November 2005.

Start time		Stop time		Duration	Orbit Start	Orbit end
Date	UTC	Date	UTC	sec		
28-OCT-2005	15.10.07	28-OCT-2005	15.10.21	14	19146	19146
28-OCT-2005	15.10.27	28-OCT-2005	15.21.07	640	19146	19146
28-OCT-2005	16.51.18	28-OCT-2005	16.59.53	515	19147	19147

2.2 Instrument Configuration and Performance

2.2.1 MIPAS OPERATIONS

The planning for the MIPAS operations for the period September - October 2005 is described in this section.

Planning strategy:

- All activities planned in nominal mode (double slide operation) with medium resolution (41% - 1.64 sec sweeps) with asymmetric transitory sweeps
- The new Nominal scenario is used with floating altitudes and new algorithm
- Compensation times, transitory times and other planning parameters are planned according to the new operational baseline
- The MIPAS activity is in support of the Southern France validation campaign, foreseen for the period 26 September - 17 October. The measurements will be commanded in UTLS-1 mode, for a few orbits per day (corresponding to the overpasses of the campaign location).
- The MIPAS activities in support of the Southern France campaign were interrupted in 17 October, following the communication of the end of the validation campaign
- According to the implementation of the Autorecovery Sequence in the FOS-MPS, a new MPL_CAL_MP file has been sent with RGC and WCC REPETITION fields set to zero
- Radiometric Gain calibrations (RGC) are planned using the MPL_ORS_MP file
- The WCC activity cannot be explicitly requested through the MPL_ORS_MP file, instead it is performed after every transition to Heater
- 2 LOS orbits during the week-end with the following inputs:
  2 consecutive PRIME orbits + 2 consecutive BACKUP orbits
  PITCH BIAS=-0.030<deg>, no harmonics (INT_AUX_MP.27)
  EL_OFFSET=+000.100000<deg> and NUM_STEPS=+15 (INT_AUM_MP.23)
- Rearward observations only
- Observation in Middle and Upper Atmosphere mode are foreseen for 29 October to 1 November
- Several In-Flight calibrations were planned during 28 October 2005: IF9 (orbit #19139-19143), IF10 (orbit #19144), IF11 (orbit#19145), IF16 (orbit# 19146-19147)

The files transferred to the FOCC for the planning of September – October 2005 operations are listed in ***Appendix A***.

The measurements acquired during the Southern French validation campaign are listed in the following table.

Tab. 4 MIPAS support to Southern France campaign. All the following measurement were performed on UTLS1 (Upper Troposphere – Lower Stratosphere Mode).

Orbit	UTC Start time
18690 – 18694	26-Sept-2005 18.26.30
18697 – 18701	27-Sept-2005 06.10.41
18705 – 18708	27-Sept-2005 19.35.29
18712 – 18715	28-Sept-2005 07.19.40
18719 – 18723	28-Sept-2005 19.03.52
18726 – 18729	29-Sept-2005 06.48.03
18733 – 18737	29-Sept-2005 18.32.15
18740 – 18744	30-Sept-2005 06.16.26
18748 – 18751	30-Sept-2005 19.41.14
18762 – 18765	01-Oct-2005 19.09.37
18769 – 18772	02-Oct-2005 06.53.48
18776 – 18780	02-Oct-2005 18.38.00
18783 – 18787	03-Oct-2005 06.22.11
18791 – 18794	03-Oct-2005 19.46.59
18797 – 18801	04-Oct-2005 05.50.34
18805 – 18808	04-Oct-2005 19.15.22
18812 – 18815	05-Oct-2005 06.59.33
18819 – 18823	05-Oct-2005 18.43.45
18826 – 18830	06-Oct-2005 06.27.56
18834 – 18837	06-Oct-2005 19.52.44
18840 – 18844	07-Oct-2005 05.56.19
18848 – 18851	07-Oct-2005 19.21.07
18862 – 18866	08-Oct-2005 18.49.30
18869 – 18873	09-Oct-2005 06.33.41
18876 – 18880	09-Oct-2005 18.17.53
18883 – 18887	10-Oct-2005 06.02.04
18891 – 18894	10-Oct-2005 19.26.52
18898 – 18901	11-Oct-2005 07.11.03
18905 – 18909	11-Oct-2005 18.55.15
18912 – 18915	12-Oct-2005 06.39.26
18919 – 18923	12-Oct-2005 18.23.38
18926 – 18930	13-Oct-2005 06.07.49
18934 – 18937	13-Oct-2005 19.32.36
18941 – 18944	14-Oct-2005 07.16.48
18948 – 18952	14-Oct-2005 19.00.59
18962 – 18966	15-Oct-2005 18.29.22
18969 – 18973	16-Oct-2005 06.13.34
18977 – 18980	16-Oct-2005 19.38.21
18984 – 18987	17-Oct-2005 07.22.33

The MIPAS special measurements recorded during Sep-Oct 2005 are reported in the next table.

Tab. 5 MIPAS Special In-Flight calibration acquired during October 2005.

Orbits	Date	Measurement	Acquisition status
19139 – 19142	**28-Oct-2005**	**IF9 - Offset Tangent Height**	**Ok**
19144	**28-Oct-2005**	**IF10 - NESR$_0$ Verification**	**Ok**
19145	**28-Oct-2005**	**IF11 - Absence of High Resolution Features Verification in Gain**	**Ok**
19146 – 19147	**28-Oct-2005**	**IF16 - Limb Scanning Sequences in raw data mode**	**Raw mode acquisition failed (AOR – 2015)**

2.2.2 THERMAL PERFORMANCE

The following two plots (Fig. 1 and Fig. 2) show the long-term trends of the IDU and MIO baseplate temperature. The yearly seasonal variations and the interferometer heater switching (see Tab. 6 for the schedule of heater switch-on/off) are clearly visible within the plots.

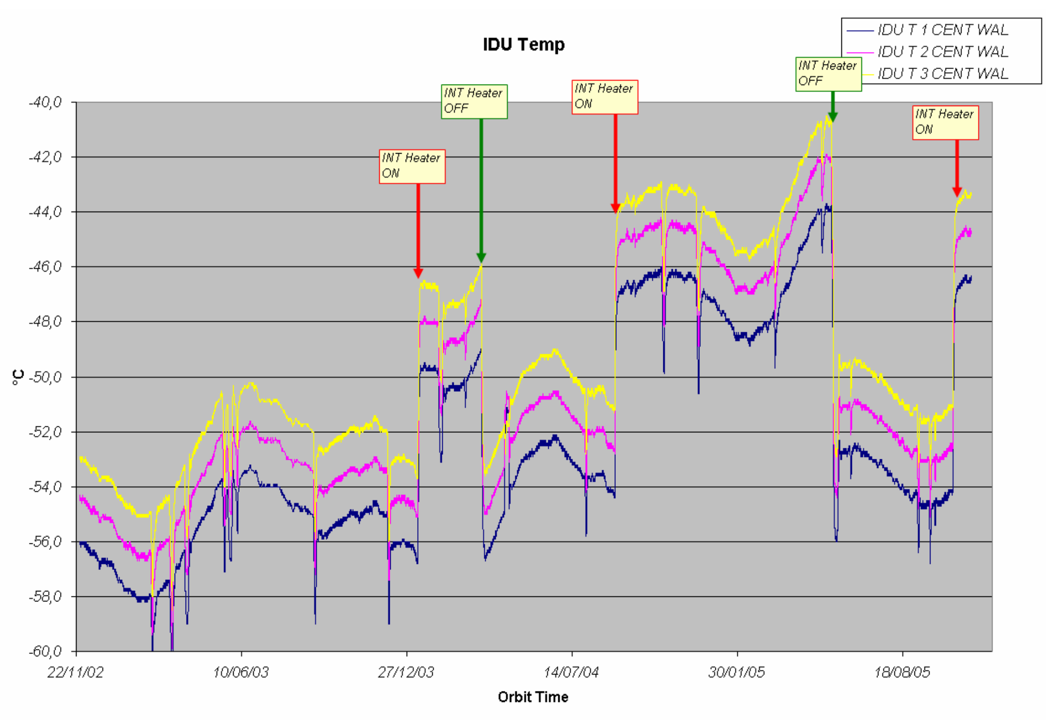


Fig. 1 IDU temperature as a function of time: November 2002 – August 2005.

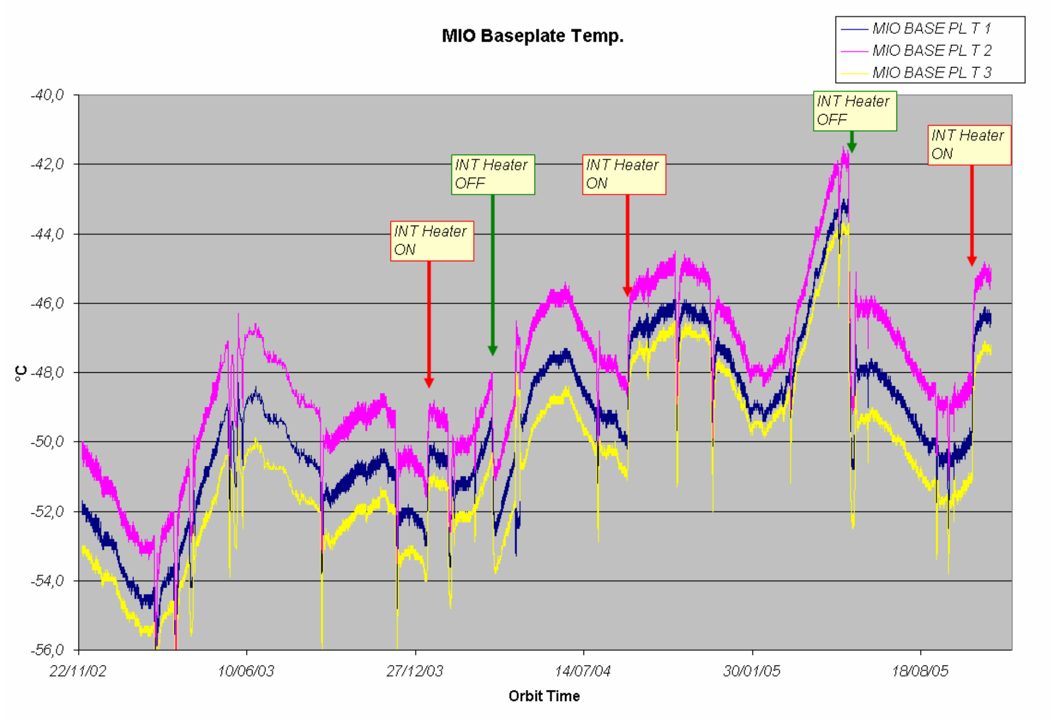


Fig. 2 MIO baseplate temperature as a function of time: November 2002 – August 2005.

Tab. 6 Schedule of interferometer heater switch-on/off.

Heater on	09-Jan-2004
Heater off	26-Mar-2004
Heater on	03-Sep-2004
Heater off	25-May-2005
Heater on	17-Oct-2005

After the last interferometer heater switch-off, there was a reduction of the temperature on the interferometer and all MIO equipments:

- The Interferometer cooled down by almost 9°C;
- The MIO Baseplate temperature was decreased by about 4°C;
- The temperature at all MIO mounted equipments was decreased by the similar value as the MIO Baseplate.

The large temperature reduction can be explained by the Interferometer heater switch-off (75%) and further due to the reduced dissipation of the cooler (25%). The cooler dissipation was reduced by approximately 10 W due to the colder compressor and displacer environment.

At the end of August, the temperature was still about 4 K warmer than during the critical period at the beginning of 2003. This temperature was not critical nevertheless an analysis made by Astrium revealed that the IDU performances improve when the INT-heater is switched-on. Indeed comparing the number of anomalies we had in 2005 operations with the INT heater switched-on wrt the INT heater-off we found:

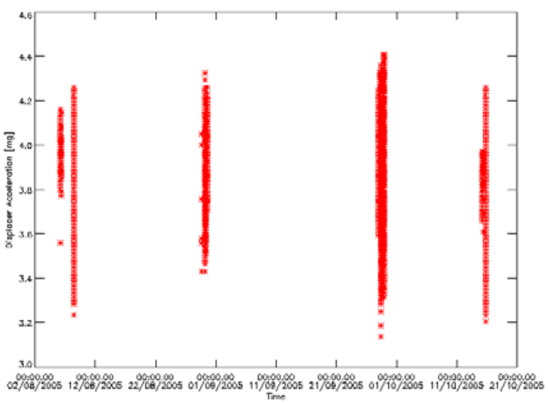
- 36 INT errors during the time where the INT heater was ON (within 5.5 Month)
- 85 INT errors during the time where the INT heater was OFF (within 3.5 Month)

After this analysis, a decision was taken to switch-on the INT-heater again on 17th October 2005 during a planned unavailability of the instrument. The effect of this new INT-heater switch-on will be discussed in detail in the next report.

2.2.3 MECHANICAL PERFORMANCE

2.2.3.1 Cooler Performance

During March and April 2005 an evident increase in compressor vibration level has been observed, and starting from the second part of April 2005 the warning threshold of 8 mg has been exceeded many times. After an analysis done by Astrium, it has been found that the MIPAS cooler was not well balanced. The cooler rebalancing was performed from 11 May 07:39 to 12 May 12:14, during an interval of non-planned measurements. The rebalancing did not introduce the expected reduction of compressor vibration level because of the relative warm environment. For this reason it was decided to switch-off the interferometer cooler on 25 May 2005. After the decontamination (23 May – 1 June 2005) and the Interferometer heater switch-off, the cooler performs extremely well.
The performance of the Displacer and Compressor during the reporting period (Sept-Oct 2005) was nominal with values well below our observation warning level of 8 mg, as can be seen in the following figures.



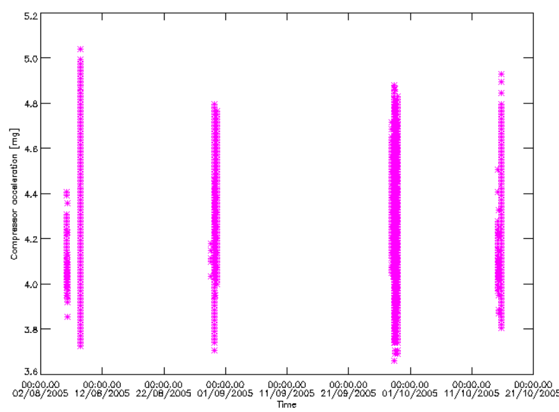


Fig. 3 September-October 2005: Displacer and Compressor vibration level.

Starting from 3rd of June 2005, a spike characterizes the Compressor vibrations and it is observed more or less at the same orbital position. These spikes are caused either by a rapid voltage transition (battery charger) or to a temperature transition on the edge of the cooler external structure elements. This is the reason why they occur always at nearly the same orbit position. This behaviour persisted during July operations but it seems to be reduced during August and it was not observed during October operations. Nevertheless, the amplitude of the spike is of about 1 mg, which is well below our observation warning level of 8 mg. Therefore, the situation is not critical at the moment, but need to be monitored with care. If extreme values are reached, a re-coarse balance will be needed.

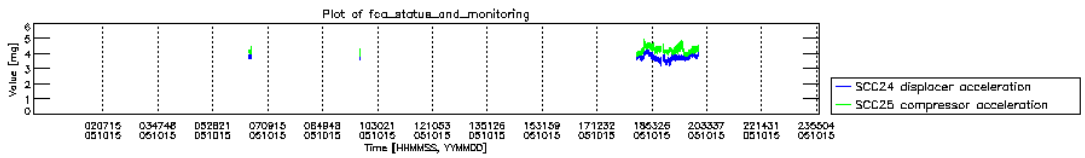


Fig. 4 Displacer and Compressor vibration level: 15th October 2005.

2.2.4 INTERFEROMETER PERFORMANCE

2.2.4.1 INT performances

There was no improvement on the -4% differential speed error rate visible after the 25 day (from 30 Aug to 26 Sept) relaxing period for the interferometer. The number of -4% errors restarted at the same level as at the time of switch-off. By 15th October, the value was already increased up to a failure value of 77%. Such an effect, of not having a visible relaxation after such a long relaxing period has not been seen before.

In particular, from 28-Sept-2005 until 16-Oct-2005 (during the South France campaign) 43 IDU failures occurred (see Fig. 5). Most of the IDU errors were the well known turnaround failures, however one of them (6-Oct-05) was a re-occurrence of a highly critical error with acceleration of slide 2 to the outside and the risk of blocking. By chance, the slide stopped just at the last marker for the re-initialization, without being blocked.

This high increase of IDU anomalies led to the decision to switch-on the INT heater on 17-Oct 2005 in order to improve the slide performance. The effect of this decision on the IDU performances will be analyzed in the next report.

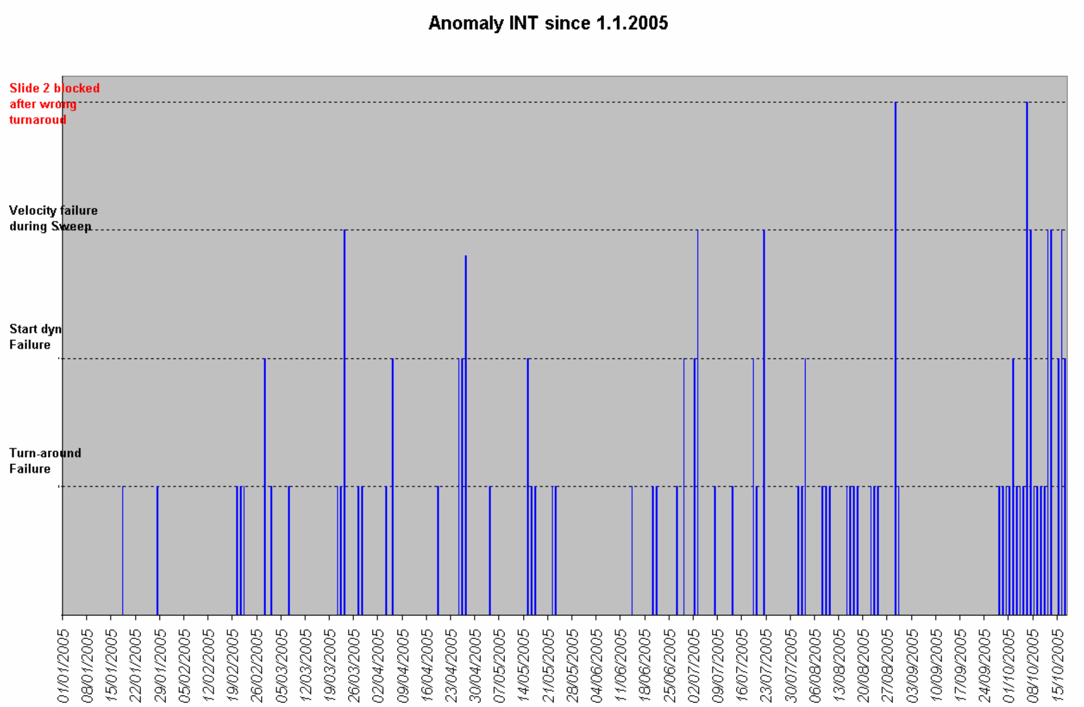


Fig. 5 MIPAS INT Anomaly during 2005.

2.2.4.2 Analysis of the IDU errors

The IDU situation at the beginning of October was critical due to the fact that no improvement was observed after the 25 day relaxing period. An intensive analysis on the IDU performance was then carried out by Astrium-ESOC. The following points came out of this study:

- The IDU performance is degrading.
- If the number of IDU error is plotted versus time of 2005 operations (see Fig. 6):
  - Linear behaviour is expected for constant error rate, this seems the case until about 13 July (~0.2 anomaly/day), afterward an exponential increase can be observed
  - The reason for the exponential increase in the IDU error rate is still not fully understood, but it can be an effect of the INT heater switch-off at the end of May.
- A correlation of the IDU wrt the INT temperature can be seen:
  - The lower the temperature, the lower the drive force, which could be interpreted as a reduction of pre-load. A system with reduced pre-load is easier to be disturbed, especially in turn around.
  - The higher the temperature, the higher the drive force, the easier the control. Therefore, the switch-on of the INT heater will probably improve the IDU performance.

- An unexpected orbital dependence of IDU occurrence (wrt ANX) can be observed, but not explained. Some possible explanations are:
  - o The DRS antenna is moving a lot and rapidly at dedicated positions (ANX) of the orbit. However, it will be difficult, if not impossible to correlate this with IDU errors. Several cases were investigated, which did not show any movement at all.
  - o A lat/long dependency, especially wrt regions of high radiation was investigated, but without significant results.
- Some increase in noise is observed which could point at degraded bearings.
- Some asymmetry in the drive force (different for forward and backward strokes) may be an additional cause of problem. The origin of the asymmetry is not fully understood, but a cage/bearing effect is suspected.
- From the motor current analysis, it remains unclear which of the two drives has the (bigger) problem.

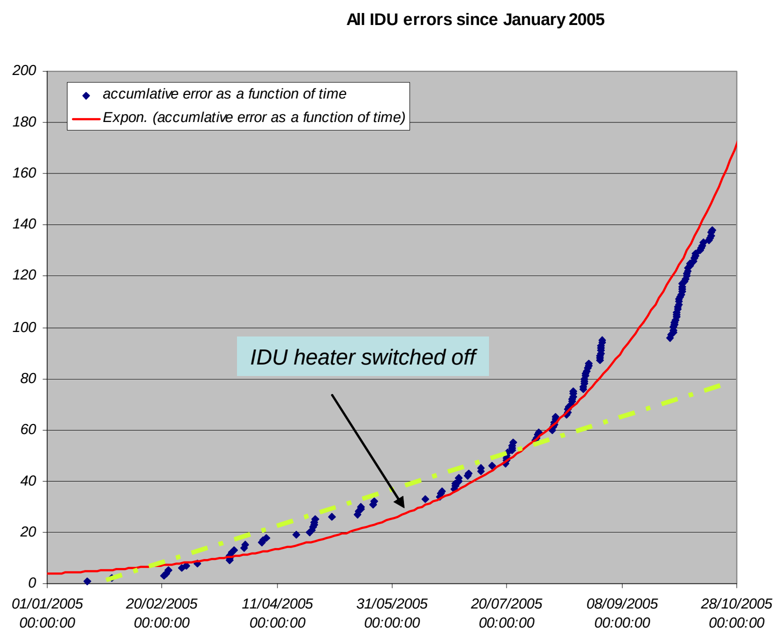


Fig. 6 The cumulative error (error event counter) as a function of days in operation shows a linear behaviour until about mid-July, while afterward an exponential trend can be observed, demonstrating a systematic degradation of the MIPAS IDU system. This plot will be revised after the INT heater switch-on during October.

2.3 Level 1 Product Quality Monitoring

2.3.1 PROCESSING CONFIGURATION

Tab. 7 shows the list of IPF updates and the aligned DPM/ADFs and the related NCR/SPRs. Currently the Near-Real Time (NRT) mission is suspended, and no systematic operational Off-Line (OFL) processing is performed while the processing algorithms are being adapted to the new observation modes.
Fig. 7 shows the alignment between the measurement mode (high resolution, reduced resolution with 17 sweeps and double-slide reduced resolution with 27 sweeps) and the corresponding valid IPF and ADF for the processing of both Level 1 and Level 2 products.

Tab. 7 Historical updates of MIPAS processor and related DPM, ADF and NCR/SPR.

IPF Version	DPM		ADF		Processor update	
	L1	L2	L1	L2	Level 1	Level 2
4.65	**4I**	**4.1**	**4.1**	**5.1**		Fixed NCR_1310
4.64	**4I**	**4.1**	**4.1**	**5.1**	Fixed SPR-12100-2011	
4.63	**4I**	**4.1**	**4.1**	**5.1**	Fixed SPR-12000-2000: Fixed SPR-12000-2001	Fixed NCR_1278 Fixed NCR_1308 Rejected NCR_1310 Rejected NCR_1317
4.62	**4H**	**4.0**	**4.0**	**3.8**	Fixed NCR_1157 Fixed NCR_1259	Fixed NCR_1128 Fixed NCR_1275 Fixed NCR_1276

The historical updates in the MIPAS Level 1 processor are detailed in ***Appendix B*** with all the information on the related NCRs and SPRs.

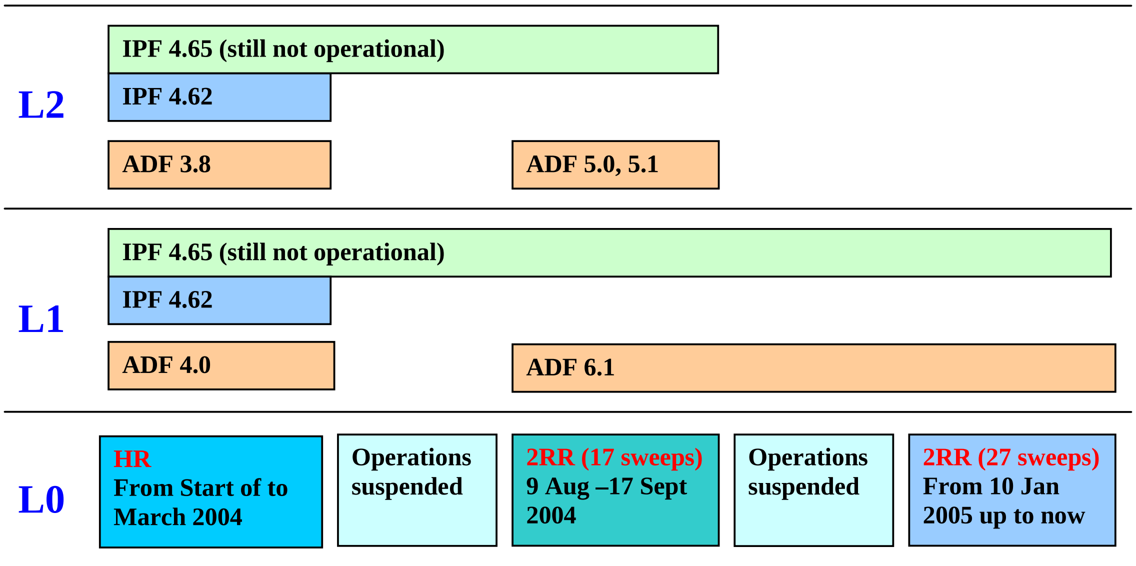


Fig. 7 IPF validity and ADFs version for processing level 1 and level 2 products. IPF 4.62 is the last operational one, while the IPF 4.65 is currently under validation and will be delivered to DPAC for OFL processing of 2RR mission.

The history of the update of the IPF at each processing site is shown in the following table. IPF 4.62 is the last IPF which was put into operation.

Tab. 8 Historical updates of MIPAS processor at near real time (NRT) processing sites (PDHS-K and PDHS-E) and off-line processing sites (LRAC and D-PAC).

Centre	Facility Software	Date
D-PAC	V4.62	06-09-2004
LRAC	V4.62	02-09-2004
D-PAC	V4.61	15-03-2004
LRAC	V4.61	18-03-2004
PDHS-K	V4.61	17-03-2004
PDHS-E	V4.61	17-03-2004
LRAC	V4.59	20-08-2003
D-PAC	V4.59	06-08-2003
PDHS-K	V4.59	23-07-2003
PDHS-E	V4.59	23-07-2003
PDHS-K	V4.57	22-07-2003
LRAC	V4.57	22-07-2003
PDHS-K	V4.59	21-07-2003
LRAC	V4.59	21-07-2003
LRAC	V4.57	19-03-2003

PDHS-K	V4.57	18-03-2003
D-PAC	V4.57	05-03-2003
PDHS-E	V4.57	04-03-2003

2.3.1.1 Auxiliary Data Files

The strategy for the level 1 ADFs update is as follows:

- The MIP_CO1_AX, MIP_CG1_AX and MIP_CS1_AX are updated every week and after a long detectors/cooler switch-off or after a long unavailability
- The MIP_CL1_AX is analysed every two weeks and updated when the pointing error differs with respect to the last disseminated by more than 8 mdeg.
- The MIP_PS1_AX is updated every time there is a setting update.
- The MIP_MW1_AX is updated when the micro-window is changed.
- The MIP_CA1_AX is updated when new characterization parameters are defined.

The ADF files generated and disseminated during September-October 2005 are listed in the following table.

Tab. 9 Level 1 ADFs valid in September October 2005.

Auxiliary Data File	Start Validity	Stop Validity	Updated in Sept/Oct 2005
V6.1 MIP_MW1_AXVIEC20050627_094928_20040809_000000_20090809_000000 MIP_PS1_AXVIEC20050627_100609_20040809_000000_20090809_000000 MIP_CA1_AXVIEC20050627_094412_20040809_000000_20090809_000000	08-JAN-05	08-JAN-09	No
MIP_CL1_AXVIEC20050308_113825_20050108_000000_20090108_000000	08-JAN-05	08-JAN-09	No
MIP_CL1_AXVIEC20050420_152028_20050420_095747_20100420_095747	20-APR-05	20-APR-10	No
MIP_CS1_AXVIEC20051004_073212_20050926_000000_20100926_000000 MIP_CG1_AXVIEC20051003_180647_20050926_000000_20100926_000000 MIP_CO1_AXVIEC20051003_180613_20050926_000000_20100926_000000	26-SEP-05	26-SEP-10	Yes
MIP_CS1_AXVIEC20051006_181713_20051003_114911_20101003_114911 MIP_CG1_AXVIEC20051006_172534_20051003_122148_20101003_122148 MIP_CO1_AXVIEC20051006_172031_20051003_123505_20101003_123505	03-OCT-05	03-OCT-10	Yes
MIP_CS1_AXVIEC20051013_151542_20051010_000000_20101010_000000 MIP_CG1_AXVIEC20051013_150556_20051010_000000_20101010_000000 MIP_CO1_AXVIEC20051013_150057_20051010_000000_20101010_000000	10-OCT-05	10-OCT-05	Yes
MIP_CS1_AXVIEC20051103_151614_20051028_000000_20101028_000000 MIP_CG1_AXVIEC20051103_150700_20051028_000000_20101028_000000 MIP_CO1_AXVIEC20051103_150142_20051028_000000_20101028_000000	28-OCT-05	28-OCT-05	Yes

The characterization level 1 ADFs (MIP_PS1_AX, MIP_CA1_AX, MIP_MW1_AX) are generated by Bomem. The following table illustrate the history Table of level 1 ADF deliveries, more details can be found in ***Appendix C***.

Tab. 10 Historical deliveries of level 1 ADF by Bomem

ADFs Version	Updated ADF	Start Validity Date	IPF version	Dissemination date
3.0	MIP_CA1_AX MIP_MW1_AX MIP_PS1_AX	April-2002	4.61	4-Nov-2003
3.1	MIP_PS1_AX	09-Jan-2004	4.61	17-Mar-2004
3.2	MIP_PS1_AX	26-Mar-2004	4.61	21-Apr-2004
4.0 draft	MIP_PS1_AX	Not disseminated	4.62	-
4.1 TDS6	MIP_PS1_AX	09- Aug-2004	4.63	15-Mar-2005
5.0 draft	MIP_PS1_AX	Not disseminated	4.63	-
6.0	MIP_PS1_AX	Not disseminated	4.63	-
6.1	MIP_PS1_AX	09-Aug-2004	4.63	27-Jun-2005

2.3.2 SPECTRAL PERFORMANCE

The calibration file MIP_CS1_AX contains the spectral correction factor (SCF), which compensates for variations in the instrument metrology e.g., aging of the laser. Fig. 8 gives the variation trend over the period Sept-Oct 2005. We observe a very stable situation since the variations are of the order of 1 ppm (nominal situation).

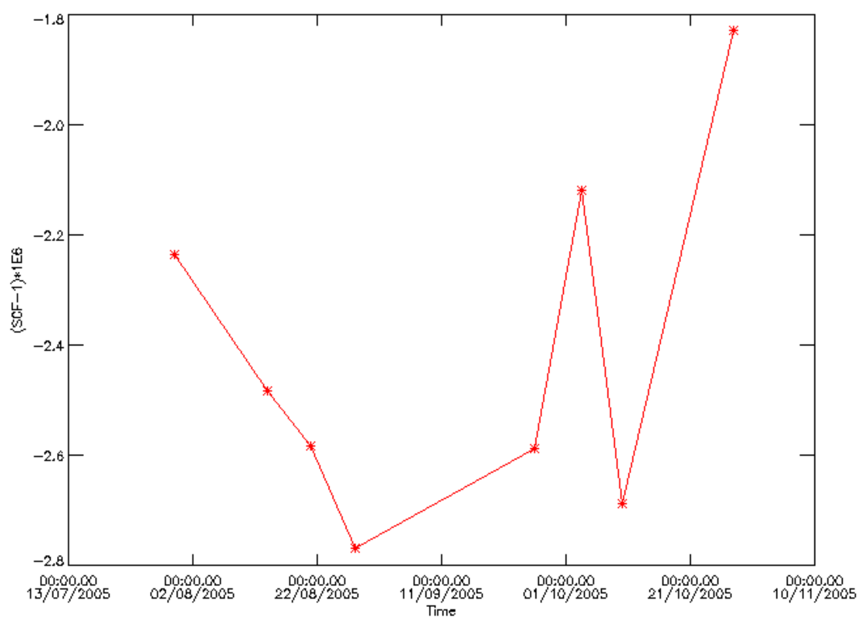


Fig. 8 MIPAS Spectral Calibration Factor (SCF) variation over September-October 2005.

2.3.3 RADIOMETRIC PERFORMANCE

During September-October, the weekly increase of gain was always below the 1% warning threshold, as illustrated in Fig. 9.This figure shows the gain calibration check done weekly before disseminating an ADF. The check is done with respect to the last disseminated gain. In the case of a long mission interruption, the gain can change significantly; in this case the check is done the week later with respect to the first gain disseminated after the long interruption. The following figure shows that the check was always satisfied during the Sept-Oct 2005 interval, therefore the gain ADFs have been regularly disseminated.

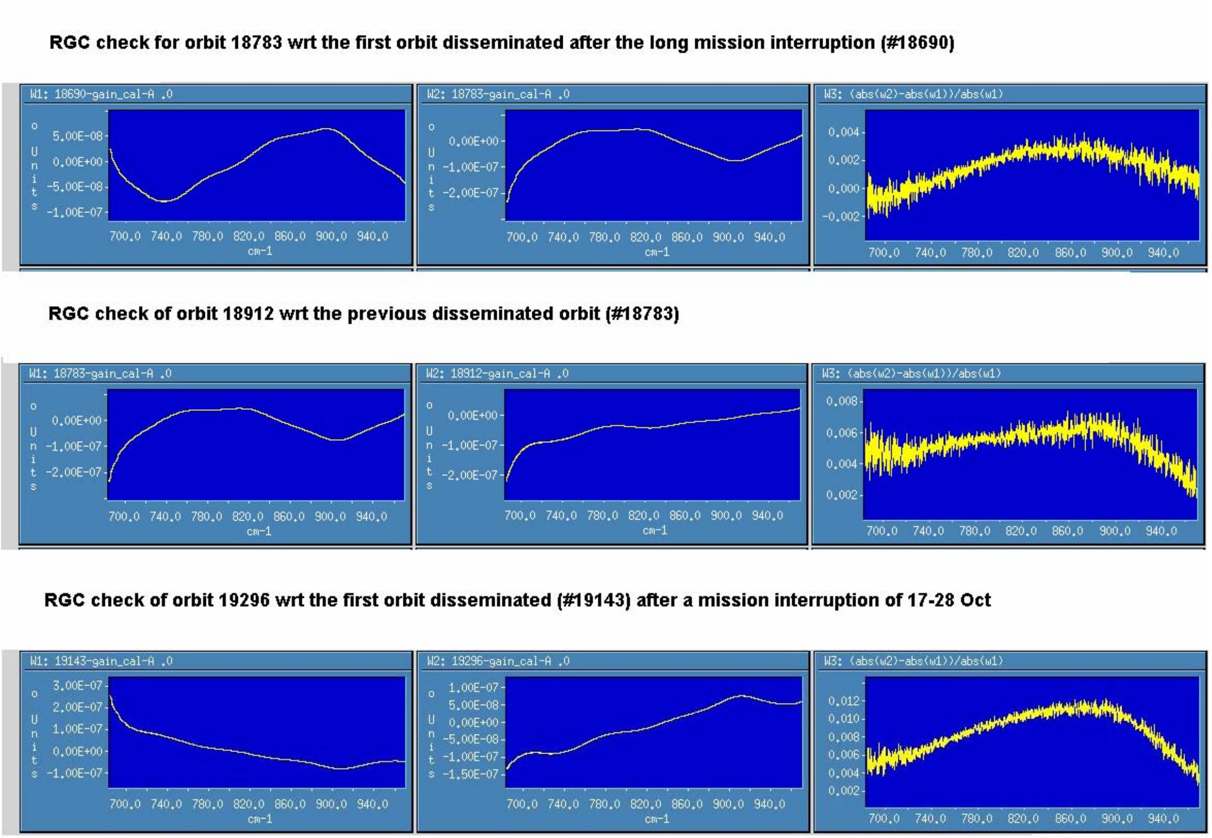


Fig. 9 Relative variations of radiometric gain for three disseminated gains (considering only band A) during Sept-Oct 2005 operations. The first two plots in each row are the imaginary gains plotted versus the wave-number, the third plot is the ratio: (abs(w2)-abs(w1))/abs(w1), which gives the gain increase wrt the reference w1 (last dissemiated ADF). The check is satisfied when the gain is lower than the warning threshold of 0.01 (1%).

2.3.3.1 Interpolated gains

During the period January-May 2005, a strong gain increase was observed with weekly gain variation up to +7%. This increase acts on the data quality in two ways:

- If the gain functions are only determined once per week, the drift leads to a scaling error in the calibrated spectra of up to 3.5 % in band A.
- The increase of the gain function corresponds to a decrease of the instrument response. This also decreases the signal-to-noise-ratio and leads to higher NESR-values.

The presence of ice near the detector was found to be the most probable source of this gain increase. Actually the ice reduces the radiation received by the detectors and this is the cause of the gain increase: the gain compensates for the lack of radiation.
Before processing 2005 level 0 data to level 1, a solution had to be found in order to reduce the scaling error in the calibrated spectra. The solution was to calculate and disseminate further gain values in between the already disseminated ones in order to comply with the condition for the gain increase to be lower than 1% between consecutive gains. This gain reprocessing has been done with the support of Bomem and the results are reported here.

Due to missing L0 products to calculate all the gain calibration ADF files, a program was developed to estimate the missing gain calibration files using the gain calibration ADF files available (already disseminated via the IECF). The program simply performs a linear interpolation between 2 known gains. The second gain is first aligned on the same fringe as the 1st gain before doing the interpolation. The interpolation factor is specified such that there is less than 1% gain difference between 2 consecutive gains.

$$Gain\_i = \left(G2 \times factor\right) + \left(G1 \times (1 - factor)\right)$$

Gain_I:	Interpolated Gain vector
G1:	1st Gain Calibration vector
G2:	2nd Gain Calibration vector
Factor:	Interpolation factor (0 < range < 1)

Tab. 11 Gain relative error of interpolated gains generated by Bomem

Existing gain calibration files	Relative error between consecutive gains	Interpolation factors
CG_0	-	
CG_1	1.2 %	0.5
CG_2	1.2 %	0.5
CG_3	1.5 %	0.5
CG_4	2.5 %	0.33, 0.67
CG_5	1.5 %	0.5
CG_6	4 %	0.2, 0.4, 0.6, 0.8
CG_7	2.3 %	0.33, 0.67
CG_8	1.6 %	0.5

CG_9	3.3 %	0.25, 0.5, 0.75
CG_10	2.6 %	0.33, 0.67
CG_11	2.6 %	0.33, 0.67
CG_12	3.5 %	0.25, 0.5, 0.75
CG_13	3.2 %	0.25, 0.5, 0.75
CG_14	3.5 %	0.25, 0.5, 0.75
CG_15	5.2 %	0.167, 0.33, 0.5, 0.67, 0.83
CG_16	7 %	0.125, 0.25, 0.375, 0.5, 0.625, 0.75, 0.875
CG_17	4 %	0.2, 0.4, 0.6, 0.8

For the interpolated gain calibration files, the "SENSING_START" and "SENSING_STOP" fields are set according to the interpolation factors. For example, an interpolation factor of 0.33 applied to two existing gains (acquired 8 days apart), will fix the interpolated gain "SENSING_START" to 8 * 0.33 = 2.6 days later than the 1st gain "SENSING_START". The sensing stop is set to the end of the mission: "SENSING_STOP" = "SENSING_START" + 5 years.
The complete list of the new interpolated gains MIP_CG1__AX files provided by Bomem is reported in ***Appendix D***. These 45 MIP_CG1__AX files should be used for the reprocessing of the 2005 2RR MIPAS mission, therefore a bulk dissemination of these files is planned for mid-November. Note that after the dissemination by the IECF the filename of these ADFs will change, and an updated file list will be included in the next report.

2.3.4 POINTING PERFORMANCE

The LOS calibration measurements are performed every week and the mispointing is analysed on a bi-weekly basis. This plan allows the pointing stability to be analysed and guarantees the availability of the data in case of missing products. Initial analysis has shown a marked annual cycle (as shown in Fig. 10) covering the period September 2002 – June 2005. The figure shows the relative and the absolute pointing error (evaluated taking into account the commanded elevation angle for the LOS calibration). The annual trend is not due to the MIPAS instrument itself, but to a mispointing of the entire ENVISAT platform resulting from the software response to orbit control information. In fact, the update in the pointing software implemented on 12 December 2003 (orbit 9321) has reduced the deviation trend (see last points in Fig. 12).
During Sept-Oct 2005, the LOS calibrations were performed 3 times, but in two cases the LOS calibration algorithm (migsp) failed. This anomaly is still under investigation with the support of Bomem. For the moment, only one LOS calibration result is presented here and the related orbits and pointing errors are shown in Tab. 12. During the last 3 months of operations the relative bias seems to be stable around the value of 7 mdeg.

Tab. 12 LOS calibration performed on July-Aug 2005.

Date	Orbit #	Relative bias	Absolute bias
22-Oct-2005	19055	0,006899	-0,023101

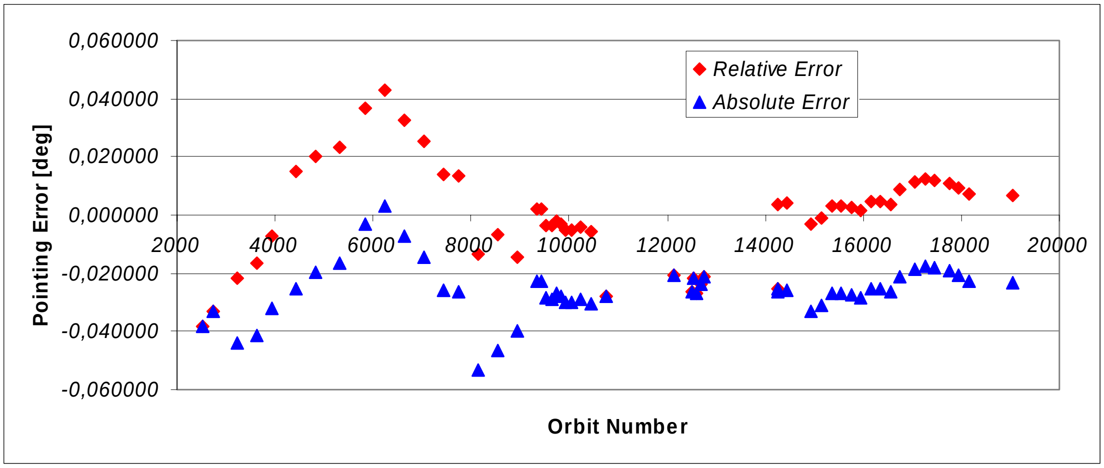


Fig. 10 MIPAS pointing error as a function of the orbit number: September 2002- October 2005.

As can be seen in Fig. 10, there are points where the relative and absolute errors coincide because the angle for LOS measurements has been commanded to 0 mdeg. Tab. 10 shows the history of the commanded angle for LOS measurements.

Tab. 13 LOS commanded angle updates.

Start Date	Start Orbit	Stop Date	Stop Orbit	Angle [mdeg]
beginning	/	28 Sep 2002	3024	0
05 Oct 2002	3123	26 Oct 2002	3424	- 22
02 Nov 2002	3524	30 Nov 2002	3926	- 25
07 Dec 2002	4025	01 Nov 2003	8738	- 40
08 Nov 2003	8835	08 Nov 2003	8836	- 25
10 Nov 2003	8864	10 Nov 2003	8865	0
15 Nov 2003	8934	6 Mar 2004	10538	- 25
13 Mar 2004	10639	20 Nov 2004	14250	0
21 Nov 2004	14265	/	/	- 30

Starting from the second part of September 2003, only measurements from channel D2 are processed because of the increased noise affecting channel D1. In order to reduce that noise, from 21 November 2004 (orbit 14265), the planning strategy for LOS measurements has been changed and the number of observations per star has been doubled.

During the anomaly investigation in winter 2004, the absence of interferometer operations was used for a dedicated Line of Sight campaign. MIPAS LOS data have been inter-compared with restituted attitude information from the ENVISAT star trackers, in preparation for future operational use of restituted attitude in off-line processing. Fig. 11 presents results from July 29th, 2004. Note that a bias of 24 mdeg was subtracted from pointing error. Apart from this bias, results from the MIPAS

LOS campaign agree with star tracker information. Investigations are currently ongoing to find the cause of this bias.

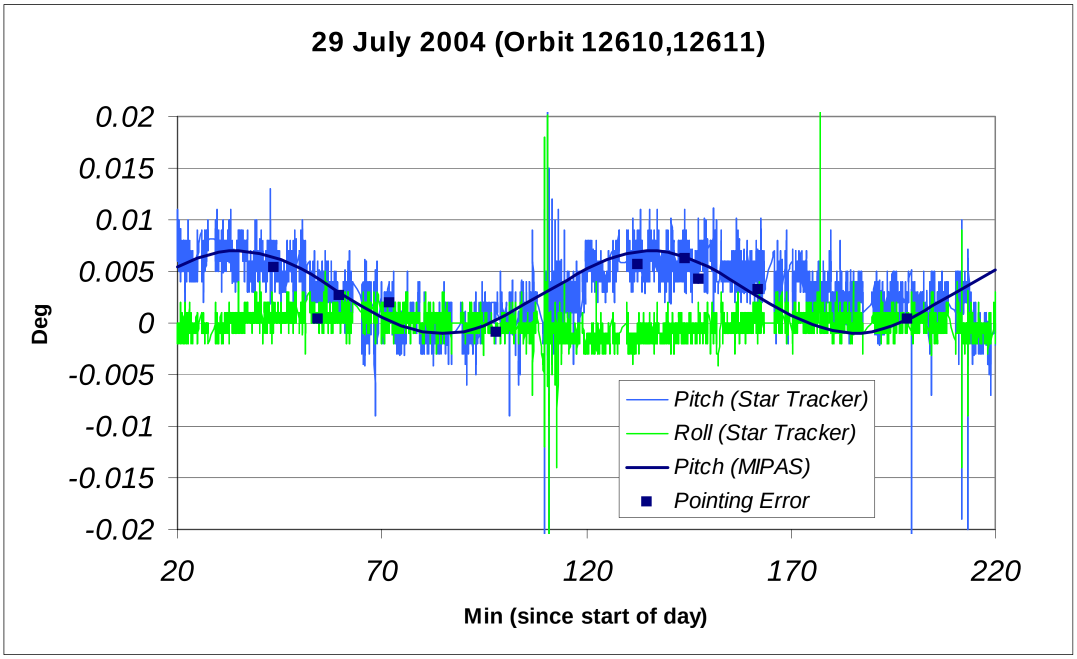


Fig. 11 Comparison between MIPAS pointing and star tracker information.

2.3.5 ANOMALY STATUS

The following table summarises the anomalies affecting Level 1 products and shows the associated SPR, NCR, AR and HD code.

Tab. 14 Level 1 anomaly list.

Anomaly	Prototype/DPM SPR	IPF NCR	OAR	HD
Number of sweeps per scan	128	/	/	HD/01-2005/1010
Truncated MIPAS Gain measurements	132	1421	1828	/
MIPAS Aircraft Emission measurements	/	/	1843	/

2.3.5.1 Number of Sweeps per Scan

The affected product is orbit 12963 generated with IPF 4.62. SPH gives:
"NUM_SWEEPS_PER_SCAN=+00018", but 17 is the correct value (although the last scan has 18 sweeps).
The problem has been investigated by Bomem and it has been found that the auxiliary data block is missing in the last sweep of the orbit, so detection of the beginning/end of scan cannot be done. The prototype is not affected by the problem because Bomem has solved this particular problem by rejecting the last sweep when its auxiliary data block is missing. This specific case is not documented in the DPM and an SPR will be raised.

2.3.5.2 Truncated MIPAS Gain Measurements

Starting from June 2005, the DS (Deep-Space) and BB (Black-Body) sequence of measurements for MIPAS gain calibration is truncated at the end of a product and continues in the next one. The anomaly prevents automatic processing of gain measurements (with MICAL chain 06 algorithm) with a related delay to the generation and dissemination of Auxiliary Data Files (CS1_AX, CO1_AX, CG1_AX).
The investigation shows that in the planning the Kiruna/Artemis dump times were not taken into account, therefore some calibrations have been split into 2 different Level 0 files.
A workaround was found with the support of Bomem. This process consists of using one MIGSP special function, in order to "reconstruct" the calibration L0 file (by merging two products) and then using it as input to the processor, then finally getting the ADF calibration files.
Since the source and the solution of this problem have been found, this anomaly can be considered closed and the L0 calibration files affected by this problem have been successfully processed in order to get ADF calibration files.

2.3.5.3 MIPAS Aircraft Emission Measurements

Looking at the AE L1B file taken on 5/6 May 2005 (processed with MIGSP), the tangent altitudes seem to be approximately 2km below the 7-38 km range specified in Mission_Plan_V4.1.pdf dated 3 May 2005.
Bomem check these L1B products and the problem does not seem to be due to processing (MIGSP 2.5). The problem was found to be due to the commanding, in particular to the software (SEM mode algorithm) used for the AE measurements. The software was designed only for localized SEM measurements, such as volcano eruptions. The use of this algorithm over a wide area around the globe (such is the case of AE measurements) can lead to very important deviations owing to the earth ellipsoid. This is the cause of the deviation between the planned and measured tangent altitude for these AE measurements. In this sense this anomaly is closed, nevertheless Anu Dudhia reported at the last QWG a further anomaly affecting these products. This consists of a difference of almost 3 km between the retrieved and engineering altitude. This anomaly is not related to the planning and will need a different anomaly report and a deeper investigation in collaboration with Bomem and OU.

2.3.6 RE-PROCESSING STATUS

Figure 14 shows the reprocessing status at the end of August 2005. The L0 expected field on the figure takes into account all instrument and product generation unavailability, so it describes what it's actually expected. The discrepancy between expected and received is caused by a delay in the generation of consolidated Level 0 at LRAC.

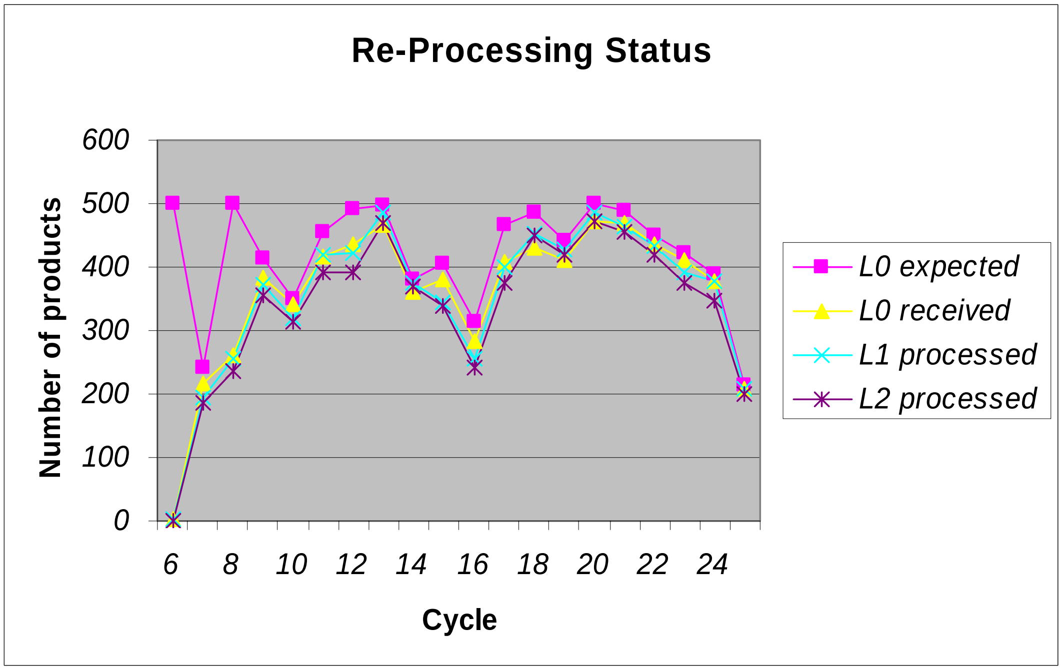


Fig. 12 Re-processing status at the end of October 2005

2.3.7 OTHER RESULTS

As noted before, no NRT product generation is foreseen for now. For the Science team and QWG, some Level 1B products have been generated using the migsp prototype. The complete list of these products is reported on ***Appendix E***.

2.4 Level 2 Product Quality Monitoring

2.4.1 PROCESSOR CONFIGURATION

2.4.1.1 Version

The historical updates in the MIPAS Level 2 IPF processor are summarized in Table 7 and Figure 7 and listed in detail in ***Appendix F***.

2.4.1.2 Auxiliary Data Files

Tab. 15 shows the historical dissemination (from January 2003) of Level 2 ADFs until the mission interruption occurred in March 2004. The ADFs have not been updated since the mission interruption.

Tab. 15 Historical update of Level 2 ADFs.

Auxiliary Data File	Start Validity	Description
ADFs V3.1: MIP_MW2_AXVIEC20030722_134301_20030723_000000_20080722_000000 MIP_OM2_AXVIEC20030722_134602_20030723_000000_20080722_000000 MIP_PS2_AXVIEC20030722_102142_20030723_000000_20080722_000000 MIP_PI2_AXVIEC20030722_134848_20030723_000000_20080722_000000 MIP_CS2_AXVIEC20030722_133331_20030723_000000_20080722_000000 MIP_SP2_AXVIEC20030722_093046_20030723_000000_20080722_000000	23-JUL-03	Cloud detection enabled and improved validity mask range in Microwindows files; improved Occupation Matrices (no gaps between altitude validity ranges).
MIP_IG2_AXVIEC20030214_130918_20030301_000000_20080301_000000	01-MAR-03	Seasonal update of climatological initial guess: This auxiliary file turned out to be corrupt, and a corrected version has been disseminated on 10 March 2003.
MIP_IG2_AXVIEC20030307_142141_20030310_000000_20080301_000000	10-MAR-03	Seasonal update of climatological initial guess: This dissemination substitute the corrupt file disseminated previously.
MIP_IG2_AXVIEC20030522_104714_20030601_000000_20080601_000000	01-JUN-03	Seasonal update of climatological initial guess.
MIP_IG2_AXVIEC20030731_134035_20030901_000000_20080901_000000	01-SEP-03	Seasonal update of climatological initial guess.
ADFs V3.6: NRT MIP_MW2_AXVIEC20031021_145505_20020706_060000_20080706_060000 MIP_OM2_AXVIEC20031021_145630_20020706_060000_20080706_060000 MIP_PS2_AXVIEC20031021_145858_20020706_060000_20080706_060000 MIP_PI2_AXVIEC20031021_145745_20020706_060000_20080706_060000 MIP_CS2_AXVIEC20031021_145337_20020706_060000_20080706_060000 MIP_SP2_AXVIEC20031021_150016_20020706_060000_20080706_060000 Off-line	06-JUL-02	Activation of cloud detection; removal of the gaps between the altitude validity ranges; altitudes margins fixed to +/- 4 km; short-term ILS bug fix. **NRT** Old convergence criteria; nominal altitude range. **Off-line**

MIP_MW2_AXVIEC20031027_100858_20020706_060000_20080706_060000 MIP_OM2_AXVIEC20031027_101029_20020706_060000_20080706_060000 MIP_PS2_AXVIEC20031027_101319_20020706_060000_20080706_060000 MIP_PI2_AXVIEC20031027_101146_20020706_060000_20080706_060000 MIP_CS2_AXVIEC20031027_100559_20020706_060000_20080706_060000 MIP_SP2_AXVIEC20031027_101441_20020706_060000_20080706_060000		Improved convergence criteria; altitude range extended to 6-68 km.
MIP_IG2_AXVIEC20031118_151533_20031201_000000_20081201_000000	01-DEC-03	Seasonal update of climatological initial guess.
MIP_IG2_AXVIEC20040227_081527_20040301_000000_20090301_000000	01-MAR-04	Seasonal update of climatological initial guess.
ADFs V3.7: NRT MIP_MW2_AXVIEC20031021_145505_20020706_060000_20080706_060000 MIP_OM2_AXVIEC20040302_110723_20020706_000000_20080706_000000 MIP_PS2_AXVIEC20040302_110923_20040109_000000_20090209_000000 MIP_PI2_AXVIEC20031021_145745_20020706_060000_20080706_060000 MIP_CS2_AXVIEC20031021_145337_20020706_060000_20080706_060000 MIP_SP2_AXVIEC20031021_150016_20020706_060000_20080706_060000 Off-line MIP_MW2_AXVIEC20031027_100858_20020706_060000_20080706_060000 MIP_OM2_AXVIEC20040302_110823_20020706_000000_20080706_000000 MIP_PS2_AXVIEC20040302_111023_20040109_000000_20090209_000000 MIP_PI2_AXVIEC20031027_101146_20020706_060000_20080706_060000 MIP_CS2_AXVIEC20031027_100559_20020706_060000_20080706_060000 MIP_SP2_AXVIEC20031027_101441_20020706_060000_20080706_060000	06-JUL-02 and 09-JAN-04	With respect to V3.6: Eliminated scans with one or two altitude levels; adjusted the threshold to the new noise level.
ADFs V3.8 NRT MIP_PS2_AXVIEC20040421_095623_20040326_143428_20090326_000000 Off-line MIP_PS2_AXVIEC20040421_095923_20040326_143428_20090326_000000	26-MAR-04	With respect to V3.7, adjusted the threshold to the new noise level.

IFAC provided four sets of ADFs which have still not been disseminated, the main features of which are summarised in Table 16. Version 4 corresponds to a set of ADFs for processing of full resolution measurements, with the noise level adjusted for when the interferometer heaters are switched-on and a flag set for processing of only nominal measurements. Version 5 corresponds to ADFs for processing of reduced spectral resolution measurement (17 sweeps operations), so is able to process the measurements done in the Aug-Sept 2004 period. Further details on these latest Level 2 ADF updates are reported in ***Appendix G***.

Tab. 16 Level 2 ADF provided by IFAC and still not disseminated.

Version	Date of delivery	List of files upgraded by IFAC	Main modifications
ADF V4.0	03.09.2004	NRT: MIP_PS2_AX_NRT_V4.0 OFL: MIP_PS2_AX_OFL_V4.0	Changed the flag in PS2 file spec_events_flag from "B" (dec 66) to "N" (dec 78). Increased NESR threshold in PS2 files as in V3.7.
ADF V4.1	03.09.2004	NRT: MIP_PS2_AX_NRT_V4.1 OFL: MIP_PS2_AX_OFL_V4.1	Changed the flag in PS2 file spec_events_flag from "B" (dec 66) to "N" (dec 78). NESR threshold in PS2 files as in V3.6.

ADF V5.0	18.03.2005	MIP_PS2_AX_V5 MIP_CS2_AX_V5 MIP_MW2_AX_V5 MIP_PI2_AX_V5 MIP_IG2_AX_V5_july MIP_IG2_AX_V5_october MIP_OM2_AX_V5	New microwindows selected for reduced spectral resolution, and corresponding cross section LUT, occupation matrices and Initial Guess for continuum (July and October seasons). Boundaries of the microwindows for cloud detection modified to match the new spectral grid at reduced resolution. New Pointing Information (PI) with a smaller error in LOS, new settings (PS) for handling reduced resolution measurements and optimised convergence criteria thresholds for reduced resolution mws.
ADF V5.1	05.07.2005	MIP_MW2_AX_V5.1 MIP_SP2_AX_V5.1 MIP_OM2_AX_V5.1	Spectroscopic line list relative to the new microwindow database for reduced spectral resolution; PT error propagation matrices for nominal OMs added in file MIP_OM2_AX; upper limit of a microwindow for cloud detection changed.

2.4.2 ANOMALY STATUS

Table 12 summarises the anomalies affecting Level 2 products and shows the associated SPR, NCR, AR and HD code.

Tab. 14 Level 2 anomaly list.

Anomaly	Prototype/DPM SPR	IPF NCR	AR	HD
Anomalous processing time	33	1127	1361	/
Jump anomaly	/	/	/	HD/01-2005/1013
Strange Impossible values	/	/	/	HD 2005003487
Excessive Chi-square	/	1458	1929	/

2.4.2.1 Anomalous Processing Time

An anomalous processing time characterises the processing of some offline products generated with IPF 4.59. Two different anomalies have been observed:

- 9 hours of processing instead of nominal 6 hours. Example:
  MIP_NL__1POLRA20031006_005226_000060272020_00289_08359_1882.N1
  MIP_NL__2PODPA20031006_005226_000060262020_00289_08359_0261.N1
- Processing failure after 24 hours of processing. Example:
  MIP_NL__1POLRA20031024_012653_000060272021_00046_08617_0043.N1

For the first case, the anomaly is still under investigation. The second problem has been temporarily solved with a new MIP_OM2_AX that filter scans composed by only one vertical level (generating a loop that causes the processing to fail). For a definitive solution, the DMP will be changed (SPR 33) and the modifications will be implemented in next IPF delivery.

2.4.2.2 Jump Anomaly

Oxford University detected a jump in the zonal means of all Level 2 NRT data produced after switch-on on 8th February until 16th February 2004, compared with Level 2 data generated from 17th March 2004 but also with the data until switch-off on 9th February 2004. The anomaly is still under investigation, but aux data activation can already be excluded as the potential cause.

2.4.2.3 Strange Impossible values

When considering 6971 L2 product files (processed by the D-PAC with IPF 4.61 and 4.62) from all the mission (464546 profiles), Fricke found strange or impossible values in 231 profiles. “Impossible values" are negative variances in the corrected altitude, pressure, and temperature profiles. “Strange values" are geophysically strange values, such as pressure higher than 1.5 bar, pressure below 1 microbar, temperatures below 130 K or above 450 K, differences among LOS altitudes and corrected altitudes larger than 5 km. Since a detailed analysis of each of the 231 products is not feasible due to the operations deadline, a general explanation was supplied to the user.

- The presence of strange values in the retrieved product is not surprising. Actually we are retrieving some "information" (atmospheric profiles) from the MIPAS measurement (radiance spectra). In some cases, these spectra are not sensitive to the parameter to be retrieved for many reasons (e.g.: unflagged cloudy sweeps, corruption in the spectra, very low value of the parameter to be retrieved). In these cases, the uncertainty in the parameter is comparable to its value, therefore this parameter is undetermined: it can assume any value based around the uncertainty (negative, very small or very high).
- These strange values can also result from an instability in the retrieval due to the presence of cloudy or corrupted sweeps. In fact the p-T profile is retrieved all at once (from 6 to 68 km) and a corruption in one sweep can propagate to neighbouring sweeps (e.g.: an instability can occur just above a cloudy measurement).
- The presence of negative variance is not real, but it happens when the VCM matrix to be inverted is ill-conditioned (due to high correlation between parameters for example). In this case, the routine used to invert the matrix can give very strange results and in the diagonal you can find also negative values, which is due to the fact that the matrix to be inverted is close to being singular.

Note that the retrieval of p-T is performed at the same time and that the corrected altitudes are simply the engineering values corrected for the hydrostatic equilibrium using the retrieved p-T profile. Finally, a deeper analysis of the results shows that a strange value in the pressure or temperature results in errors in the corrected altitudes or that negative variances in the temperature often correspond to negative variances for pressure and for corrected altitude.

In conclusion in most of the cases these strange values are due only to instability in the (p+ T+ Zcorr) retrieval stage due to different reasons, some of them explained above. Nevertheless it will be important to isolate the most particular cases to see if there is any significant anomaly and it will be very important for the future to set up a strategy for masking unphysical results in the L2 products.

2.4.2.4 Excessive chi-square

NO2 MIPAS products for orbit #7000 (3 July 2003) came with high values of chi2, that were not reproduced in retrievals performed with the prototype using the same aux files set. This NCR 1458 will be analyzed with the support of the IPF developers.

APPENDIX A *FILES TRANSFERRED TO THE FOCC*

The following files were transferred to the FOCC for the September – October 2005 planning activities.

RGT files already transferred to the FOCC:
AVI_UAV_TLVFOS20050908_154000_00000000_00000274_20050926_014531_20050926_063718.N1
AVI_UAV_TLVFOS20050908_154500_00000000_00000275_20050926_114906_20050926_182130.N1
AVI_UAV_TLVFOS20050908_155000_00000000_00000276_20050927_011354_20050927_060541.N1
AVI_UAV_TLVFOS20050908_155500_00000000_00000277_20050927_125805_20050927_193029.N1
AVI_UAV_TLVFOS20050908_160000_00000000_00000278_20050928_004217_20050928_071440.N1
AVI_UAV_TLVFOS20050908_160500_00000000_00000279_20050928_122628_20050928_185852.N1
AVI_UAV_TLVFOS20050909_101500_00000000_00000280_20050929_015116_20050929_064303.N1
AVI_UAV_TLVFOS20050909_102000_00000000_00000281_20050929_115451_20050929_182715.N1
AVI_UAV_TLVFOS20050909_102500_00000000_00000282_20050930_011939_20050930_061126.N1
AVI_UAV_TLVFOS20050909_103000_00000000_00000283_20050930_130350_20050930_193614.N1
AVI_UAV_TLVFOS20050909_144000_00000000_00000284_20051001_004802_20051001_071327.N1
AVI_UAV_TLVFOS20050909_144500_00000000_00000285_20051001_104255_20051001_190437.N1
AVI_UAV_TLVFOS20050909_145000_00000000_00000286_20051002_001625_20051002_064848.N1
AVI_UAV_TLVFOS20050909_145500_00000000_00000287_20051002_120036_20051002_183300.N1
AVI_UAV_TLVFOS20050909_150000_00000000_00000288_20051003_012523_20051003_061711.N1
AVI_UAV_TLVFOS20050909_150500_00000000_00000289_20051003_130935_20051003_194159.N1
AVI_UAV_TLVFOS20050909_151000_00000000_00000290_20051003_130935_20051003_194159.N1
AVI_UAV_TLVFOS20050909_151500_00000000_00000291_20051004_005346_20051004_054534.N1
AVI_UAV_TLVFOS20050909_152000_00000000_00000292_20051004_123758_20051004_191022.N1
AVI_UAV_TLVFOS20050909_152500_00000000_00000293_20051005_002209_20051005_065433.N1
AVI_UAV_TLVFOS20050909_153000_00000000_00000294_20051005_120621_20051005_183845.N1
AVI_UAV_TLVFOS20050909_153500_00000000_00000295_20051006_013108_20051006_062256.N1
AVI_UAV_TLVFOS20050909_154000_00000000_00000296_20051006_131520_20051006_194744.N1
AVI_UAV_TLVFOS20050909_154500_00000000_00000297_20051007_005931_20051007_055119.N1
AVI_UAV_TLVFOS20050909_155000_00000000_00000298_20051007_124343_20051007_191607.N1
AVI_UAV_TLVFOS20050909_155500_00000000_00000299_20051008_002754_20051008_065348.N1
AVI_UAV_TLVFOS20050909_160000_00000000_00000300_20051008_102249_20051008_184430.N1
AVI_UAV_TLVFOS20050909_160500_00000000_00000301_20051009_013653_20051009_062841.N1
AVI_UAV_TLVFOS20050909_161000_00000000_00000302_20051009_132105_20051009_181253.N1
AVI_UAV_TLVFOS20050909_161500_00000000_00000303_20051010_010516_20051010_055704.N1
AVI_UAV_TLVFOS20050909_162000_00000000_00000304_20051010_124928_20051010_192152.N1
AVI_UAV_TLVFOS20050909_162500_00000000_00000305_20051011_003339_20051011_070603.N1
AVI_UAV_TLVFOS20050909_163000_00000000_00000306_20051011_121751_20051011_185015.N1
AVI_UAV_TLVFOS20050909_163500_00000000_00000307_20051012_014238_20051130_120000.N1
AVI_UAV_TLVFOS20050929_115000_00000000_00000309_20051012_014238_20051012_063426.N1
AVI_UAV_TLVFOS20050929_115500_00000000_00000310_20051012_114614_20051012_181838.N1
AVI_UAV_TLVFOS20050929_120000_00000000_00000311_20051013_011101_20051013_060249.N1
AVI_UAV_TLVFOS20050929_120500_00000000_00000312_20051013_125513_20051013_192736.N1
AVI_UAV_TLVFOS20050929_121000_00000000_00000313_20051014_003924_20051014_071148.N1
AVI_UAV_TLVFOS20050929_121500_00000000_00000314_20051014_122336_20051014_185559.N1
AVI_UAV_TLVFOS20050929_122000_00000000_00000315_20051015_014823_20051015_063412.N1
AVI_UAV_TLVFOS20050929_122500_00000000_00000316_20051015_100158_20051015_182422.N1
AVI_UAV_TLVFOS20050929_123000_00000000_00000317_20051016_011646_20051016_060834.N1
AVI_UAV_TLVFOS20050929_151000_00000000_00000318_20051016_130058_20051016_193321.N1
AVI_UAV_TLVFOS20050929_151500_00000000_00000319_20051017_004509_20051017_071733.N1

AVI_UAV_TLVFOS20050929_152000_00000000_00000320_20051017_122921_20051017_190144.N1
AVI_UAV_TLVFOS20050929_152500_00000000_00000321_20051018_001332_20051018_064556.N1
AVI_UAV_TLVFOS20050929_153000_00000000_00000322_20051018_115744_20051018_183007.N1
AVI_UAV_TLVFOS20050929_153500_00000000_00000323_20051019_012231_20051019_061419.N1
AVI_UAV_TLVFOS20050929_154000_00000000_00000324_20051019_130643_20051019_193906.N1
AVI_UAV_TLVFOS20050929_154500_00000000_00000325_20051020_005054_20051020_054242.N1
AVI_UAV_TLVFOS20050930_111500_00000000_00000326_20051020_123506_20051020_190729.N1
AVI_UAV_TLVFOS20050930_112000_00000000_00000327_20051021_001917_20051021_065141.N1
AVI_UAV_TLVFOS20050930_112500_00000000_00000328_20051021_120329_20051021_183552.N1
AVI_UAV_TLVFOS20050930_113000_00000000_00000329_20051022_012816_20051022_061438.N1
AVI_UAV_TLVFOS20050930_113500_00000000_00000330_20051022_094210_20051022_194451.N1
AVI_UAV_TLVFOS20050930_114000_00000000_00000331_20051023_005639_20051023_054827.N1
AVI_UAV_TLVFOS20050930_114500_00000000_00000332_20051023_124050_20051023_191314.N1
AVI_UAV_TLVFOS20050930_115000_00000000_00000333_20051024_002502_20051024_065726.N1
AVI_UAV_TLVFOS20050930_115500_00000000_00000334_20051024_120913_20051024_184137.N1
AVI_UAV_TLVFOS20050930_120000_00000000_00000335_20051025_013401_20051025_062549.N1
AVI_UAV_TLVFOS20050930_120500_00000000_00000336_20051025_131812_20051025_195036.N1
AVI_UAV_TLVFOS20050930_121000_00000000_00000337_20051026_010224_20051026_055412.N1
AVI_UAV_TLVFOS20050930_121500_00000000_00000338_20051026_124635_20051026_191859.N1
AVI_UAV_TLVFOS20050930_122000_00000000_00000339_20051027_003047_20051027_070311.N1
AVI_UAV_TLVFOS20050930_122500_00000000_00000340_20051027_121458_20051027_184722.N1
AVI_UAV_TLVFOS20050930_123000_00000000_00000341_20051028_013946_20051130_120000.N1
AVI_UAV_TLVFOS20051017_160800_00000000_00000342_20051021_001917_20051022_061438.N1
AVI_UAV_TLVFOS20051017_161600_00000000_00000343_20051022_094210_20051130_120000.N1
AVI_UAV_TLVFOS20051019_121623_00000000_00000001_20051022_094210_20051025_094300.N1
AVI_UAV_TLVFOS20051018_194641_00000000_00000344_20051025_094341_20051028_031022.N1
AVI_UAV_TLVFOS20051018_194641_00000000_00000345_20051028_182545_20051029_073201.N1
AVI_UAV_TLVFOS20051018_194641_00000000_00000346_20051029_110304_20051029_142256.N1
AVI_UAV_TLVFOS20051018_194641_00000000_00000347_20051101_175953_20051105_071236.N1
AVI_UAV_TLVFOS20051018_194641_00000000_00000348_20051105_104256_20051106_233448.N1
AVI_UAV_TLVFOS20051018_194641_00000000_00000349_20051109_002209_20051110_230855.N1
AVI_UAV_TLVFOS20051018_194641_00000000_00000350_20051112_002754_20051112_065328.N1
AVI_UAV_TLVFOS20051018_194641_00000000_00000351_20051112_102127_20051130_120000.N1

MPL_LOS_MPVRGT20051018_113900_00000000_00000179_20051029_073700_20051030_020346.N1
MPL_LOS_MPVRGT20051018_122914_00000000_00000180_20051105_071736_20051106_100640.N1
MPL_LOS_MPVRGT20051018_140306_00000000_00000181_20051112_065827_20051113_094512.N1

MPL_CAL_MPVRGT20051018_145352_00000000_00000070_20051028_030701_20781231_235959.N1
MPL_CAL_MPVRGT20051019_133850_00000000_00000071_20051106_233127_20781231_235959.N1

MPL_ORS_MPVRGT20051018_183744_00000000_00000098_20051028_112905_20051028_165939.N1
MPL_ORS_MPVRGT20051018_184432_00000000_00000099_20051029_155916_20051111_005926.N1
MPL_ORS_MPVRGT20051019_134639_00000000_00000100_20051029_155916_20051111_040228.N1

IF-9 calibration starting in orbit #19139 at ANX=500 sec:
CTI_E02_MPVRGT20051018_150747_00000000_00000086_20051028_031416_20781231_235959.N1
CTI_E01_MPVRGT20051018_150747_00000000_00000086_20051028_031419_20781231_235959.N1
CTI_AST_MPVRGT20051018_150747_00000000_00000086_20051028_031422_20781231_235959.N1
CTI_N01_MPVRGT20051018_150747_00000000_00000043_20051028_031425_20781231_235959.N1
CTI_S02_MPVRGT20051018_150747_00000000_00000023_20051028_031428_20781231_235959.N1
CTI_NOC_MPVRGT20051018_150747_00000000_00000086_20051028_031431_20781231_235959.N1

MA mode starting in orbit #19143 at ANX=500 sec:
CTI_E02_MPVRGT20051018_153413_00000000_00000087_20051028_095640_20781231_235959.N1
CTI_E01_MPVRGT20051018_153413_00000000_00000087_20051028_095643_20781231_235959.N1
CTI_AST_MPVRGT20051018_153413_00000000_00000087_20051028_095646_20781231_235959.N1
CTI_N02_MPVRGT20051018_153412_00000000_00000044_20051028_095649_20781231_235959.N1
CTI_S04_MPVRGT20051018_153412_00000000_00000022_20051028_095652_20781231_235959.N1
CTI_NOC_MPVRGT20051018_153412_00000000_00000087_20051028_095655_20781231_235959.N1

IF-10 calibration in orbit #19144:
CTI_DSN_MPVRGT20051018_161029_00000000_00000147_20051028_122821_20781231_235959.N1
CTI_DSN_MPVRGT20051018_161433_00000000_00000148_20051028_123001_20781231_235959.N1
CTI_DSN_MPVRGT20051018_161639_00000000_00000149_20051028_123141_20781231_235959.N1
CTI_DSN_MPVRGT20051018_161856_00000000_00000150_20051028_123321_20781231_235959.N1
CTI_DSN_MPVRGT20051018_162103_00000000_00000151_20051028_123501_20781231_235959.N1
CTI_DSN_MPVRGT20051018_162357_00000000_00000152_20051028_123641_20781231_235959.N1
CTI_DSN_MPVRGT20051018_162906_00000000_00000153_20051028_123821_20781231_235959.N1
CTI_DSN_MPVRGT20051018_163149_00000000_00000154_20051028_124001_20781231_235959.N1
CTI_DSN_MPVRGT20051018_163429_00000000_00000155_20051028_124141_20781231_235959.N1

IF-11 calibration in orbit #19145:
CTI_DSN_MPVRGT20051018_164925_00000000_00000156_20051028_133537_20781231_235959.N1
CTI_BBN_MPVRGT20051018_165242_00000000_00000085_20051028_133637_20781231_235959.N1

IF-16 calibration in orbits #19146-19147:
CTI_DSN_MPVRGT20051018_175003_00000000_00000157_20051028_145253_20781231_235959.N1
CTI_BBN_MPVRGT20051018_175255_00000000_00000086_20051028_145353_20781231_235959.N1

re-set default DS and BB tables:
CTI_DSN_MPVRGT20051018_175613_00000000_00000158_20051028_163329_20781231_235959.N1
CTI_BBN_MPVRGT20051018_180827_00000000_00000087_20051028_163429_20781231_235959.N1

UA mode starting in orbit #19190 at ANX=500 sec:
CTI_E02_MPVRGT20051018_155459_00000000_00000088_20051031_164448_20781231_235959.N1
CTI_E01_MPVRGT20051018_155459_00000000_00000088_20051031_164451_20781231_235959.N1
CTI_AST_MPVRGT20051018_155459_00000000_00000088_20051031_164454_20781231_235959.N1
CTI_N01_MPVRGT20051018_155459_00000000_00000044_20051031_164457_20781231_235959.N1
CTI_S06_MPVRGT20051018_155459_00000000_00000021_20051031_164500_20781231_235959.N1
CTI_NOC_MPVRGT20051018_155459_00000000_00000088_20051031_164503_20781231_235959.N1

UTLS-1 mode starting in orbit #19280 at ANX=500 sec:
CTI_E02_MPVRGT20051019_165720_00000000_00000089_20051106_233842_20781231_235959.N1
CTI_E01_MPVRGT20051019_165720_00000000_00000089_20051106_233845_20781231_235959.N1
CTI_AST_MPVRGT20051019_165720_00000000_00000089_20051106_233848_20781231_235959.N1
CTI_N02_MPVRGT20051019_165720_00000000_00000045_20051106_233851_20781231_235959.N1
CTI_S08_MPVRGT20051019_165720_00000000_00000023_20051106_233854_20781231_235959.N1
CTI_NOC_MPVRGT20051019_165720_00000000_00000089_20051106_233857_20781231_235959.N1

MPL_ORS_MPVRGT20050909_102340_00000000_00000086_20050926_070718_20050928_075851.N1
MPL_ORS_MPVRGT20050909_110058_00000000_00000087_20050928_192852_20050930_202025.N1
MPL_ORS_MPVRGT20050909_111839_00000000_00000088_20051001_193437_20051003_202609.N1
MPL_ORS_MPVRGT20050909_115340_00000000_00000089_20051004_061534_20051006_070707.N1
MPL_ORS_MPVRGT20050909_121439_00000000_00000090_20051006_201743_20051009_071252.N1
MPL_ORS_MPVRGT20050909_122523_00000000_00000091_20051009_184252_20051011_193425.N1
MPL_ORS_MPVRGT20050929_150150_00000000_00000092_20051012_070426_20051014_075559.N1

MPL_ORS_MPVRGT20050929_152129_00000000_00000093_20051014_192559_20051017_080144.N1
MPL_ORS_MPVRGT20050929_154059_00000000_00000094_20051017_193144_20051019_202317.N1
MPL_ORS_MPVRGT20050930_092328_00000000_00000095_20051020_061242_20051022_202902.N1
MPL_ORS_MPVRGT20050930_093401_00000000_00000096_20051023_061826_20051025_070959.N1
MPL_ORS_MPVRGT20050930_094924_00000000_00000097_20051025_202036_20051027_193133.N1

MPL_LOS_MPVRGT20050908_154047_00000000_00000175_20051001_071826_20051002_100638.N1
MPL_LOS_MPVRGT20050909_111621_00000000_00000176_20051008_065847_20051009_094632.N1
MPL_LOS_MPVRGT20050929_112057_00000000_00000177_20051015_063911_20051016_110619.N1
MPL_LOS_MPVRGT20050929_135140_00000000_00000178_20051022_061937_20051023_104631.N1

APPENDIX B *LEVEL 1 IPF HISTORICAL UPDATES*

The historical updates to the MIPAS Level 1 IPF processor are listed here:

- **Version V4.65** no update of Level 1 for this version
- **Version V4.64** (aligned with DPM 4I and ADFs V4.1) introduced modifications only for the Level 1 processor, with the following update:
  - Fixed internal SPR-121O0-2011: Problem with the block sequence
- **Version V4.63** (aligned with DPM 4I and ADFs V4.1) introduced modifications for both Level 1 and Level 2 processors. For the Level 1 processor, the following updates were introduced:
  - Processing of low resolution measurements, with reduced resolution also for offset and gain data.
  - Solution of internal SPR-120O0-2000: Band D oscillations in forward sweeps for MIPAS reduced-resolution products
  - Solution of internal SPR-120O0-2001: NESR data problem
- **Version V4.62** (aligned with DPM 4H and ADFs V4.0) introduced modifications for both Level 1 and Level 2 processors. For the Level 1 processor, the following updates were introduced:
  - Processing of low resolution measurements, without reduced resolution for offset and gain data that will be implemented in IPF 4.63.
  - Fixed NCR_1157: Bug in the MIPAS processor ILS retrieval.
  - Fixed NCR_1259: Scans with null NESR.
- **Version V4.61** consists of updates for both Level 1 and Level 2:
  - Fixed NCR_1143: Sparse corruption of bands between 1 and 4 January 2004.
- **Version V4.59** has introduced only upgrade on Level 2 processor.
- **Version V4.57** involved only Level 1 processor update, introducing the following modifications:
  - Modification of FCE algorithm
  - Elimination of strong anomalous oscillations in the spectra
  - Modification of NESR reporting
  - ADC saturation flagging
  - Addition of aliasing spike suppression algorithm

APPENDIX C *LEVEL 1 ADF HISTORICAL UPDATES*

The Level 1 characterization files (MIP_CA1_AX, MIP_MW1_AX, MIP_PS1_AX) are provided by Bomem and updated when needed, the historic updates of these three ADF are listed hereafter.

Version 3.0
MIP_CA1_AX
- Modify non-linearity coefficients for reverse sweep. Coefficients for forward are kept as is
- Neutral equalization filter for band A

MIP_MW1_AX
- Removal of band D microwindow D_H20b at 1870.8049 cm-1
- Set spectral calibration microwindow altitude to 32 km

MIP_PS1_AX
- Number of co-additions for spectral calibration was set to 4
- Number of co-additions for ILS retrieval was set to 10

Version 3.1
MIP_PS1_AX
- Changed the threshold to take into account the modified noise level

Version 3.2
MIP_PS1_AX
- Changed the threshold to take into account the modified noise level

Version 4.0 draft
MIP_PS1_AX
- OPD set to 8.2 cm
- Channel A set to 4561 points
- Channel AB set to 2401 points
- Channel B set to 4561 points
- Channel C set to 2881 points
- Channel D set to 9441 points
- Number of co-additions for ILS retrieval was set to 5

Version 4.1 (TDS 6)
MIP_PS1_AX
- OPD set to 8.2 cm
- Channel A set to 4561 points
- Channel AB set to 2401 points
- Channel B set to 4561 points
- Channel C set to 2881 points
- Channel D set to 9441 points

- Number of co-additions for ILS retrieval was set to 5
- Set standard deviation threshold to 5 for Scene measurement quality

Version 5.0 draft
MIP_PS1_AX

- OPD set to 10 cm
- Channel A set to 5701 points
- Channel AB set to 3001 points
- Channel B set to 5701 points
- Channel C set to 3601 points
- Channel D set to 11801 points
- Set standard deviation threshold to 5 for Scene measurement quality

Version 6.0
MIP_PS1_AX

- OPD set to 20 cm
- Spike detection standard deviation threshold set to 10
- Spike detection number of points per block set to 256
- Set standard deviation threshold to 5 for Scene measurement quality

Version 6.1
MIP_PS1_AX

- OPD set to 8.2 cm
- Spike detection standard deviation threshold set to 10
- Spike detection number of points per block set to 256
- Set standard deviation threshold to 5 for Scene measurement quality

When one ADF is modified the three AUX file are disseminated with the same START/STOP time and this correspond to a new level 1 ADF delivery, this allows avoiding confusion.

APPENDIX D *INTERPOLATED GAINS*

The following table lists the interpolated gain files generated by Bomem in order to solve the problem of the strong gain increase during Jan-May 2005 operations. The gain files already disseminated are highlighted in the table in green, while the newly generated gains are in orange.

ADF file name	**Type** **(* - interpolated gains)**
MIP_CG1_AXVIEC20050309_081858_20050108_000000_20090108_000000	Gain calibration (CG_0)
MIP_CG1_AXTLRA20051013_111248_20050112_000000_20100112_000000	Gain (CG_0_a) *
MIP_CG1_AXVIEC20050310_091646_20050116_000000_20090116_000000	Gain calibration (CG_1)
MIP_CG1_AXTLRA20051013_112348_20050118_120000_20100118_120000	Gain (CG_1_a) *
MIP_CG1_AXVIEC20050311_085855_20050121_000000_20090121_000000	Gain calibration (CG_2)
MIP_CG1_AXTLRA20051013_113136_20050124_120000_20100124_120000	Gain (CG_2_a) *
MIP_CG1_AXVIEC20050314_154134_20050128_000000_20090128_000000	Gain calibration (CG_3)
MIP_CG1_AXTLRA20051013_113256_20050130_150000_20100130_150000	Gain (CG_3_a) *
MIP_CG1_AXTLRA20051013_113351_20050202_080000_20100202_080000	Gain (CG_3_b) *
MIP_CG1_AXVIEC20050315_131822_20050205_000000_20090205_000000	Gain calibration (CG_4)
MIP_CG1_AXTLRA20051013_113536_20050209_120000_20100209_120000	Gain (CG_4_a) *
MIP_CG1_AXVIEC20050316_081309_20050214_000000_20090214_000000	Gain calibration (CG_5)
MIP_CG1_AXTPDH20051013_113733_20050217_000000_20100217_000000	Gain (CG_5_a) *
MIP_CG1_AXTPDH20051013_113835_20050220_000000_20100220_000000	Gain (CG_5_b) *
MIP_CG1_AXTPDH20051013_114235_20050223_000000_20100223_000000	Gain (CG_5_c) *
MIP_CG1_AXTPDH20051013_114530_20050226_000000_20100226_000000	Gain (CG_5_d) *
MIP_CG1_AXVIEC20050405_145110_20050301_000000_20090301_000000	Gain calibration (CG_6)
MIP_CG1_AXTPDH20051013_114634_20050303_150000_20100303_150000	Gain (CG_6_a) *
MIP_CG1_AXTPDH20051013_114721_20050306_080000_20100306_080000	Gain (CG_6_b) *
MIP_CG1_AXVIEC20050406_070802_20050309_000000_20090309_000000	Gain calibration (CG_7)
MIP_CG1_AXTPDH20051013_114815_20050311_000000_20100311_000000	Gain (CG_7_a) *
MIP_CG1_AXVIEC20050407_072135_20050314_000000_20090313_000000	Gain calibration (CG_8)
MIP_CG1_AXTPDH20051013_114932_20050315_000000_20100315_000000	Gain (CG_8_a) *
MIP_CG1_AXTPDH20051013_115015_20050317_000000_20100317_000000	Gain (CG_8_b) *
MIP_CG1_AXTPDH20051013_115116_20050319_000000_20100319_000000	Gain (CG_8_c) *
MIP_CG1_AXVIEC20050407_143713_20050321_000000_20090321_000000	Gain calibration (CG_9)
MIP_CG1_AXTPDH20051013_115201_20050323_070000_20100323_070000	Gain (CG_9_a) *
MIP_CG1_AXTPDH20051013_115249_20050325_160000_20100325_160000	Gain (CG_9_b) *
MIP_CG1_AXVIEC20050411_123723_20050328_000000_20090328_000000	Gain calibration (CG_10)
MIP_CG1_AXTPDH20051013_115346_20050330_070000_20100330_070000	Gain (CG_10_a) *
MIP_CG1_AXTPDH20051013_115427_20050401_160000_20100401_160000	Gain (CG_10_b) *
MIP_CG1_AXVIEC20050412_072926_20050404_000000_20090404_000000	Gain calibration (CG_11)
MIP_CG1_AXTPDH20051013_115518_20050406_000000_20100406_000000	Gain (CG_11_a) *
MIP_CG1_AXTPDH20051013_115602_20050408_000000_20100408_000000	Gain (CG_11_b) *
MIP_CG1_AXTPDH20051013_115643_20050410_000000_20100410_000000	Gain (CG_11_c) *
MIP_CG1_AXVIEC20050415_073538_20050412_231018_20100412_231018	Gain calibration (CG_12)
MIP_CG1_AXTPDH20051013_115723_20050414_000000_20100414_000000	Gain (CG_12_a) *
MIP_CG1_AXTPDH20051013_115801_20050416_000000_20100416_000000	Gain (CG_12_b) *
MIP_CG1_AXTPDH20051013_115843_20050418_000000_20100418_000000	Gain (CG_12_c) *

MIP_CG1_AXVIEC20050421_065554_20050420_133450_20100420_133450	Gain calibration (CG_13)
MIP_CG1_AXTPDH20051013_115941_20050421_120000_20100421_120000	Gain (CG_13_a) *
MIP_CG1_AXTPDH20051013_120019_20050423_000000_20100423_000000	Gain (CG_13_b) *
MIP_CG1_AXTPDH20051013_120115_20050424_120000_20100424_120000	Gain (CG_13_c) *
MIP_CG1_AXVIEC20050427_150526_20050426_225532_20100426_225532	Gain calibration (CG_14)
MIP_CG1_AXTPDH20051013_120202_20050427_160000_20100427_160000	Gain (CG_14_a) *
MIP_CG1_AXTPDH20051013_120309_20050429_070000_20100429_070000	Gain (CG_14_b) *
MIP_CG1_AXTPDH20051013_120434_20050501_000000_20100501_000000	Gain (CG_14_c) *
MIP_CG1_AXTPDH20051013_120520_20050502_160000_20100502_160000	Gain (CG_14_d) *
MIP_CG1_AXTPDH20051013_120642_20050504_070000_20100504_070000	Gain (CG_14_e) *
MIP_CG1_AXVIEC20050509_150546_20050506_153444_20100506_153444	Gain calibration (CG_15)
MIP_CG1_AXTPDH20051109_091325_20050507_030000_20100507_030000	Gain (CG_15_a) *
MIP_CG1_AXTPDH20051109_091424_20050508_060000_20100508_060000	Gain (CG_15_b) *
MIP_CG1_AXTPDH20051109_091606_20050509_090000_20100509_090000	Gain (CG_15_c) *
MIP_CG1_AXTPDH20051109_091854_20050510_120000_20100510_120000	Gain (CG_15_d) *
MIP_CG1_AXTPDH20051109_091957_20050511_150000_20100511_150000	Gain (CG_15_e) *
MIP_CG1_AXTPDH20051109_092036_20050512_180000_20100512_180000	Gain (CG_15_f) *
MIP_CG1_AXTPDH20051109_092139_20050513_210000_20100513_210000	Gain (CG_15_g) *
MIP_CG1_AXVIEC20050523_090017_20050515_000000_20090515_000000	Gain calibration (CG_16)
MIP_CG1_AXTPDH20051107_182819_20050516_090000_20100516_090000	Gain (CG_16_a) *
MIP_CG1_AXTPDH20051107_183037_20050517_190000_20100517_190000	Gain (CG_16_b) *
MIP_CG1_AXTPDH20051107_183400_20050519_040000_20100519_040000	Gain (CG_16_c) *
MIP_CG1_AXTPDH20051107_183506_20050520_140000_20100520_140000	Gain (CG_16_d) *
MIP_CG1_AXVIEC20050524_081749_20050522_000000_20090522_000000	Gain calibration (CG_17)

APPENDIX E *LEVEL 1B PRODUCTS GENERATED WITH PROTOTYPE*

The following level 1b products were created by running the migsp prototype and were delivered to the QWG.

MA
MIP_NL__1PPLRA20050111_014126_000060332033_00404_14987_0765.N1

UTLS-1
MIP_NL__1PPLRA20050117_115639_000060122033_00496_15079_0824.N1

UA
MIP_NL__1PPLRA20050121_113027_000060312034_00052_15136_0855.N1

UTLS-2
MIP_NL__1PPLRA20050123_120742_000060732034_00081_15165_0874.N1

Nominal Measurements (RR, 27 sweeps per scan) with fixed altitude
MIP_NL__1PPLRA20050128_125114_000060542034_00153_15237_0908.N1
MIP_NL__1PPLRA20050128_143210_000060212034_00154_15238_0909.N1
MIP_NL__1PPLRA20050128_161233_000060212034_00155_15239_0910.N1

Nominal Measurements (RR, 27 sweeps per scan) with floating altitude
MIP_NL__1PNPDK20050301_113042_000060482035_00109_15694_0774.N1
MIP_NL__1PNPDK20050301_131032_000059792035_00110_15695_0766.N1

July 2003 S6 reprocessing
MIP_NL__1PNPDK20030704_121645_000060262017_00453_07020_0120.N1
MIP_NL__1PNPDK20030704_135638_000059212017_00454_07021_0127.N1
MIP_NL__1PNPDK20030704_153445_000058952017_00455_07022_0122.N1
MIP_NL__1PNPDK20030704_171226_000058622017_00456_07023_0123.N1
MIP_NL__1PNPDK20030704_184910_000061052017_00457_07024_0124.N1
MIP_NL__1PNPDK20030704_202907_000062392017_00458_07025_0125.N1
MIP_NL__1PNPDK20030705_050206_000045322017_00463_07030_0133.N1
MIP_NL__1PNPDK20030705_093800_000017672017_00466_07033_0134.N1

5-6 May Aircraft Emission (AE) Measurements
Only 6 orbits have been processed, due to a processing problem we have one file for each measured scan. The following files have been delivered to the QWG team.

AE_Canada_US_a:
MIP_NL__1PNPDE20050506_031821_000000632037_00047_16634_0806.N1
MIP_NL__1PNPDE20050506_031922_000000332037_00047_16634_0795.N1
MIP_NL__1PNPDE20050506_031954_000000332037_00047_16634_0792.N1

MIP_NL__1PNPDE20050506_032025_000000332037_00047_16634_0791.N1
MIP_NL__1PNPDE20050506_032056_000000332037_00047_16634_0796.N1
MIP_NL__1PNPDE20050506_032128_000000332037_00047_16634_0800.N1
MIP_NL__1PNPDE20050506_032159_000000332037_00047_16634_0799.N1
MIP_NL__1PNPDE20050506_032231_000000332037_00047_16634_0793.N1
MIP_NL__1PNPDE20050506_032302_000000332037_00047_16634_0794.N1
MIP_NL__1PNPDE20050506_032334_000000332037_00047_16634_0797.N1

AE_Canada_US_d:
MIP_NL__1PNPDK20050505_122836_000000542037_00038_16625_1245.N1
MIP_NL__1PNPDK20050505_123002_000000632037_00038_16625_1261.N1
MIP_NL__1PNPDK20050505_123103_000000332037_00038_16625_1253.N1
MIP_NL__1PNPDK20050505_123134_000000332037_00038_16625_1251.N1
MIP_NL__1PNPDK20050505_123206_000000332037_00038_16625_1256.N1
MIP_NL__1PNPDK20050505_123237_000000332037_00038_16625_1262.N1
MIP_NL__1PNPDK20050505_123308_000000332037_00038_16625_1264.N1
MIP_NL__1PNPDK20050505_123340_000000332037_00038_16625_1252.N1
MIP_NL__1PNPDK20050505_123411_000000332037_00038_16625_1258.N1
MIP_NL__1PNPDK20050505_123443_000000332037_00038_16625_1257.N1
MIP_NL__1PNPDK20050505_123514_000000332037_00038_16625_1263.N1
MIP_NL__1PNPDK20050505_123545_000000332037_00038_16625_1259.N1
MIP_NL__1PNPDK20050505_123617_000000332037_00038_16625_1246.N1
MIP_NL__1PNPDK20050505_123648_000000332037_00038_16625_1247.N1
MIP_NL__1PNPDK20050505_123720_000000332037_00038_16625_1248.N1
MIP_NL__1PNPDK20050505_123751_000000332037_00038_16625_1250.N1
MIP_NL__1PNPDK20050505_123822_000000332037_00038_16625_1260.N1
MIP_NL__1PNPDK20050505_123854_000000332037_00038_16625_1254.N1
MIP_NL__1PNPDK20050505_123925_000000332037_00038_16625_1249.N1
MIP_NL__1PNPDK20050505_123957_000000352037_00038_16625_1255.N1

AE_Europe_a:
MIP_NL__1PNPDE20050505_235709_000000632037_00045_16632_0749.N1
MIP_NL__1PNPDE20050505_235913_000000332037_00045_16632_0756.N1
MIP_NL__1PNPDE20050505_235945_000000332037_00045_16632_0765.N1
MIP_NL__1PNPDE20050506_000016_000000332037_00045_16632_0755.N1
MIP_NL__1PNPDE20050506_000047_000000332037_00045_16632_0760.N1
MIP_NL__1PNPDE20050506_000119_000000332037_00045_16632_0753.N1

AE_Ocean_a:
MIP_NL__1PNPDE20050506_013745_000000632037_00046_16633_0787.N1
MIP_NL__1PNPDE20050506_013846_000000332037_00046_16633_0786.N1
MIP_NL__1PNPDE20050506_013918_000000332037_00046_16633_0777.N1
MIP_NL__1PNPDE20050506_013949_000000332037_00046_16633_0788.N1
MIP_NL__1PNPDE20050506_014021_000000332037_00046_16633_0778.N1
MIP_NL__1PNPDE20050506_014052_000000332037_00046_16633_0783.N1
MIP_NL__1PNPDE20050506_014123_000000332037_00046_16633_0773.N1
MIP_NL__1PNPDE20050506_014155_000000332037_00046_16633_0771.N1
MIP_NL__1PNPDE20050506_014226_000000332037_00046_16633_0781.N1
MIP_NL__1PNPDE20050506_014258_000000332037_00046_16633_0785.N1

AE_Ocean_d:
MIP_NL__1PNPDK20050505_090850_000000632037_00036_16623_1186.N1
MIP_NL__1PNPDK20050505_090951_000000332037_00036_16623_1194.N1
MIP_NL__1PNPDK20050505_091331_000000332037_00036_16623_1209.N1
MIP_NL__1PNPDK20050505_091402_000000332037_00036_16623_1212.N1
MIP_NL__1PNPDK20050505_091434_000000332037_00036_16623_1219.N1
MIP_NL__1PNPDK20050505_091505_000000332037_00036_16623_1217.N1
MIP_NL__1PNPDK20050505_091536_000000332037_00036_16623_1214.N1

APPENDIX F *LEVEL 2 IPF HISTORICAL UPDATES*

The historical updates to the MIPAS Level 2 IPF processor are listed hereafter:

- **Version V4.65** (aligned with DPM 4.1 and ADFs V5.1, under validation) introduces modifications only for the Level 2 processor, with the following update:
  - Solution of NCR_1310: Problem with MIP_NL__2P
- **Version V4.64** no update for the Level 2 processor in this version
- **Version V4.63** (aligned with DPM 4.1 and ADFs V5.1) has introduced the following modifications:
  - Processing of reduced resolution measurements in old configuration (17 sweeps per scan and fixed altitude – August/September 2004 measurements).
  - Solution of NCR_1278: Some MIPAS profiles have zero pressure
  - Solution of NCR_1308: MIPAS Level 2 failure.
  - Rejection of NCR_1310: Problem with MIPNL__2P
  - Rejection of NCR_1317: One second discrepancy in IPF 4.61
- **Version V4.62** (aligned with DPM 4.0) has solved the following problems:
  - Fixed NCR_1128: Cloud-detection anomaly.
  - Fixed NCR_1275: Inconsistent values in MIPAS files.
  - Fixed NCR_1276: Level2 profile counting bug.
- **Version V4.60** has solved the following problems:
  - Fixed NCR_992: Inconsistency in number of profiles in MIPAS Level_2.
  - Fixed NCR_1068: Number of computed residual spectra not consistent with the number of observations.
- **Version V4.59**, operational since 23 July 2003, has introduced only Level 2 processing modifications. The main improvements introduced via both the processor V4.59 and the installation of a new set of ADFs have been:
  - Fixed NCR_892: Inconsistency in number of scans.
  - Fixed NCR_893: Different values for same scans.
  - The cloud filtering (that is, every time a cloud is detected at a given altitude, the retrieval is performed only above that altitude)
  - The removal of the gaps between the altitude validity ranges (allowing retrievals in the Antarctic region not feasible with the old MIP_MW2_AX)
  - Altitudes margins fixed to +/- 4 km
  - MIPAS-SPR-MAINT-0011 Wrong DSD name in L2 product in case of not requested VMR
  - MIPAS-SPR-MAINT-0012 Filling of SPH field 22 of MIPAS Level 2 ProductsMIPAS-SPR-MAINT-0013 Filling of the MIPAS MPH and MIPAS Level 2 SPH fields
  - MIPAS-SPR-MAINT-0014 Wrong writing of PCD String to the PCD Information ADS
  - MIPAS-SPR-MAINT-0015 Too strong test and skipping retrieval
  - MIPAS-SPR-MAINT-0016 Not initialised nucl1 and nucl2 in R 8.5.6.3-7A
  - ENVI-GSOP-EOAD-NC-03-0539 MIPAS L2 processing aborted

APPENDIX G *LEVEL 2 ADF HISTORICAL UPDATES*

The Level 2 ADF files historical deliveries by IFAC are reported in the following paragraph.

- **ADFs V5.1**
In this latest release of the ADFs, the spectroscopic line list relative to the new microwindow database for reduced spectral resolution was updated. Also, the PT error propagation matrices for nominal OMs (file MIP_OM2_AX) and the upper limit of a microwindow for cloud detection were changed.
- **ADFs V5.0**
ADFs for processing of double-slide reduced resolution measurements in the old configuration (17 sweeps per scan, fixed altitude – August/September 2004 data). Those ADFs contain new settings (convergence criteria, NESR threshold in MIP_PS2_AX) and new MWs (MIP_MW2_AX) and OMs (MIP_OM2_AX) optimised for the reduced resolution mode. They also contain a new MIP_PI2_AX updated taking into account the results of an investigation done by Bologna University on LOS. In fact, a new definition of the pointing covariance data was performed according to the available pointing characterization measurements. In particular, the errors on tangent altitude increments obtained from the analysis of LOS-specific measurements were found to be smaller (87 m versus 120 m) than those derived using an empirical model based on the pointing specifications. Tests on Level 2 p, T retrievals confirmed that a LOS pointing error of about 80 m provides a constraint for p, T retrieval that is perfectly compliant with the observed limb radiances. Eighty metres is a reasonably conservative estimate of the error on tangent altitude increments that can be used in the PDS for operational MIPAS retrievals. Reduction of the LOS error from 120 to 80 m leads to a reduction of both p and T errors. Namely, on average, p error turns-out to be reduced from 1.27 to 1.1 % and T error turns-out to be reduced from 1.1 to 1.0 K. The delivered auxiliary data file containing LOS VCM data (MIP_PI2_AX) can be used in Level 2 to process both high and low resolution measurements acquired either in the new or in the old measurement scenario.
- **ADFs V4.1**
ADFs for processing of full resolution measurements, with MIP_PS2_AX file with noise level adjusted to interferometer heaters switched-off and flag set for processing of only nominal measurements.
- **ADFs V4.0**
ADFs for processing of full resolution measurements, with MIP_PS2_AX file with noise level adjusted to interferometer heaters switched-on and flag set for processing of only nominal measurements.