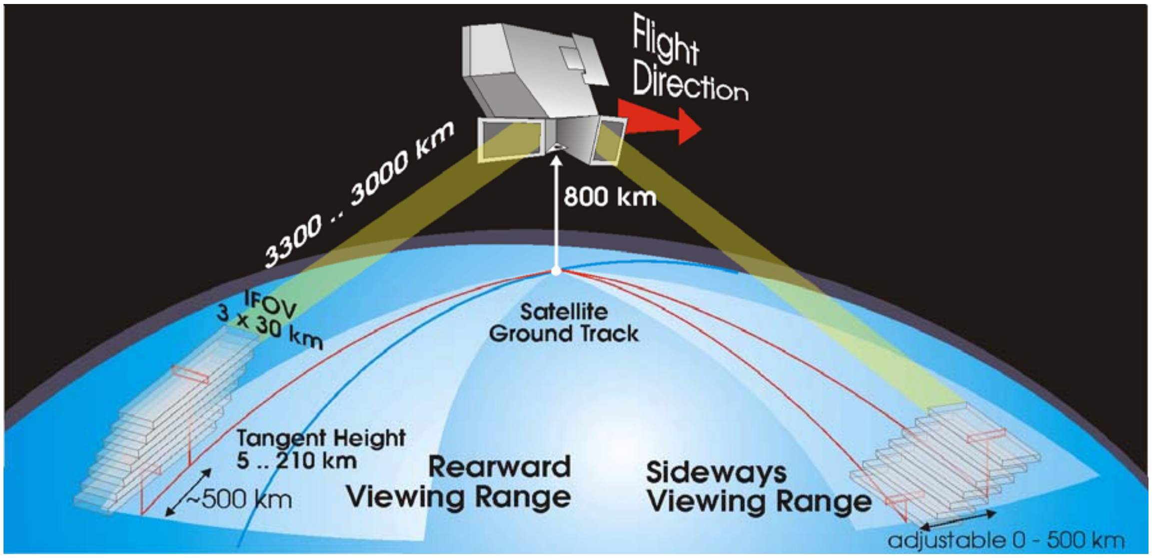
DOCUMENT

ENVISAT MIPAS MONTHLY REPORT: NOVEMBER 2005



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1 INTRODUCTION

The MIPAS Monthly Report (MR) documents the current status and recent changes to the MIPAS instrument, its data processing chain, and its data products.
The MR 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 MR 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
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
IOP	In Orbit Performance
IPF	Instrument Processing Facility
LOS	Line of Sight
MA	Middle Atmosphere
MDS	Measurements Data Set
MIO	MIPAS Optics Module
MIPAS	Michelson Interferometer for Passive Atmospheric Sounding
MPH	Main Product Header
MR	Monthly Report
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
ST	Science Team
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 November 2005 operations, the MIPAS instrument was running very well with a significant improvement of the INT performances. This results from the switching-on of the INT heater on 15 October 2005. The increase of the INT temperature by 5 K reduces drastically the number of unintended slide anomalies. Indeed during November operations we registered only 8 INT anomalies compared to the 107 anomalies observed during July-August 2005 operations when the INT heater was off.
- After switching-on the INT heater the cooler performance shall be monitored with care. Indeed during November operations an increase of the compressor vibration up to a value of 7 mg was noted. This value is not critical for the moment, but daily monitoring of the cooler will be important after the INT heater switch-on.
- For instrument safety, the MIPAS duty cycle is kept well below the value of 40%, owing to this constraint MIPAS was operating only for three orbits per day during November 2005.
- During 26-27 November 4 MIPAS anomalies were observed due to MPS (ESOC). A sequence used to generate the MIPAS Measurement command (as part of the normal automated recovery sequence) did not contain a link to the NOC_MP table, which is why Nominal Measurement Table #42 was not being selected. Owing to these anomalies 8 MIPAS measurements corresponding to orbits 19553-19554, 19560-19561, 19567-19568, 19574-19575, are wrong and should not be used for scientific purposes.
- MIPAS operations during November 2005 were in UTLS-1 mode in support to SCOUT-O3 validation campaign.
- IOP and ST Meetings were held on November 28th respectively in ESOC and IMK, a summary of these meetings is reported in the next paragraph

2.2 Summary of last IOP and ST Meeting

During 28 November 2005 the MIPAS in Orbit Performance (IOP) and Science Team (ST) Meeting took place respectively in ESOC and in IMK.

2.2.1 IOP MEETING

During the IOP meeting it was pointed out that the IDU temperature is the main driver for the absolute error rate. Indeed the very bad performances observed during August – October 2005 operations were due to the very low INT temperature, which reaches the critical value of -52°C. The need of keeping the INT temperature always above the critical value (this value is changing during the mission) was pointed out in order to avoid critical turn-around failure. Furthermore the cooler performances were discussed during the IOP. The cooler performs very well, but a closer monitoring should be done after the INT heater switch-on. Further recommendations from the IOP were the following:

- The current duty cycle shall not be increased.
- 3 days-on / 4 days-off cycle appears to be more favourable for the INT performance.
- The default orbital position for the re-initialization shall be ANX+4524 sec, where the anomalies show a strong peak. By doing so, the majority of IDU errors will be recovered immediately after occurrence.
- In case of a validation campaign the re-initialization shall be planned to be performed shortly before the overpass possibility.
- Consider test on side B, this should indicate if the problem is mainly mechanically driven or electronically related.
- Consider further increase of INT temperature using the second heater, however cooler constraints should be taken into account when performing this test.
- The tests will take place only after a global assessment of the impact of slide anomalies on L1b products, therefore only when reprocessing of RR mission will take place.

2.2.2 SCIENCE TEAM MEETING

One important point reported during the Science Team Meeting was an observed difference between Level 2 products provided by ESA (via DPAC ftp server) between 4.61 and 4.62 software versions, with significant difference at low altitude for T, N2O and CH4 profiles. This anomaly should be investigated with care.
Further recommendations were provided by the scientists:

- To keep the following nominal mode measurements with three orbits per day in order to have global coverage after 3 days of measurement, which is important for assimilate MIPAS data.
- The scientist would like to have floating data gaps instead of a fixed one in order to improve global coverage.
- Two additional modes were suggested:
  - Diurnal change Mode: the instrument looking sideways while crossing the terminator
  - Dynamic mode: already been specified
- Further operational scenario were decided:
  - AE: Aircraft Emission mode during 22-24 December 2005
  - MA-UA: Monitor Middle and Upper Atmosphere during 29-31 December
  - Support ACVT Kiruna campaign during Jan, Feb and March 2006
  - Support SAUNA campaign during Mar 27 – Apr 2006
  - Support AMMA campaign during summer over Africa

2.3 Instrument and products availability

2.3.1 INSTRUMENT AVAILABILITY

During November 2005 operations, MIPAS was affected by some unplanned unavailability due to IDU system errors. Nevertheless the number of IDU anomalies suddenly decreased after the INT heater switch-on. Among the usual IDU anomalies, the instrument was affected by 4 special anomalies, highlighted in red in the Tab. 1, these problems were due to an automatic recovery of the MPS and will be discussed in detail in the next paragraph. The MIPAS instrument unavailability intervals during November 2005 operations are listed below.

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

Start time		Stop time		Duration	Start Orbit	Stop Orbit	Description
date	UTC	date	UTC	sec			
01-nov-05	6.21.41	01-nov-05	8.01.20	5979	19198	19199	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
07-nov-05	6.14.13	07-nov-05	7.54.34	6021	19284	19284	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
07-nov-05	18.53.41	07-nov-05	19.38.43	2702	19291	19291	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
08-nov-05	1.00.20	08-nov-05	2.21.09	4849	19295	19295	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
08-nov-05	23.24.10	09-nov-05	0.21.56	3466	19308	19309	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
11-nov-05	6.42.15	11-nov-05	7.28.41	2786	19341	19341	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
11-nov-05	13.54.11	11-nov-05	14.11.05	1014	19345	19345	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
21-nov-05	13.00.43	21-nov-05	14.09.42	4139	19488	19489	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
26-nov-05	1.42.04	26-nov-05	3.08.36	5192	19553	19554	MIPAS back to operations after Heater/Refuse Mode (trigger event E3)
26-nov-05	13.26.16	26-nov-05	14.52.47	5191	19560	19561	MIPAS back to operations after Heater/Refuse Mode (trigger event E3)
27-nov-05	1.11.09	27-nov-05	2.36.59	5150	19567	19568	MIPAS back to operations after Heater/Refuse Mode (trigger event E3)

27-nov-05	12.54.39	27-nov-05	14.21.09	5190	19574	19575	MIPAS back to operations after Heater/Refuse Mode (trigger event E3)

2.3.1.1 *Unavailability during 26-27 Nov: ESU fault*

The source of the problem during 26-27 Nov (trigger event E3) has been traced to MPS (ESOC). A sequence used to generate the MIPAS Measurement command (as part of the normal automated recovery sequence) did not contain a link to the NOC_MP table, which is why Nominal Measurement Table #42 was not being selected. This did work properly in an earlier version of the MPS, but unfortunately was not carried over to the current version during an upgrade by the MPS Software Developer. Efforts are underway to correct the current version of MPS, which is expected to be implemented very quickly.
In the interim, the operational workaround is to temporarily hold the commanding sequences on the ground, and manually correct the Measurement command as required before upload. Measurement sequences already on-board were corrected manually in a similar fashion, and have already executed successfully. As a result, no measurement periods have been missed (except for the anomalies over the 26-27 Nov).

Since these 4 anomalies were followed by an automatic recovery procedure, placed at the end of the orbit (around ANX=6032 sec), all data of the following orbits are wrong, so they are useless for scientific purposes.

NB. The orbit 19553-19554, 19560-19561, 19567-19568, 19574-19575 are wrong and should not be used for scientific purpose, this orbits are highlighted in yellow in the next table.

Date		First orbit	Last orbit	Event Driven Scenario			
				Orbit	ANX	UTC	Scenario
25-Nov-05	Fri	19538	19552	19538	500	25-Nov-2005 00:14:17	start UTLS1 - Upper Tropo Lower Strato 1
				19539	500	25-Nov-2005 01:54:53	stop UTLS1 - Upper Tropo Lower Strato 1
				19545	500	25-Nov-2005 11:58:29	start UTLS1 - Upper Tropo Lower Strato 1
				19546	500	25-Nov-2005 13:39:04	stop UTLS1 - Upper Tropo Lower Strato 1
				19552	500	25-Nov-2005 23:42:40	start UTLS1 - Upper Tropo Lower Strato 1
26-Nov-05	Sat	19553	19566	**19553**			
				19554	500	26-Nov-2005 03:03:52	stop UTLS1 - Upper Tropo Lower Strato 1
				19559	500	26-Nov-2005 11:26:52	start UTLS1 - Upper Tropo Lower Strato 1
				19560			
				19561	500	26-Nov-2005 14:48:03	stop UTLS1 - Upper Tropo Lower Strato 1
				19566	500	26-Nov-2005 23:11:03	start UTLS1 - Upper Tropo Lower Strato 1
27-Nov-05	Sun	19567	19580	**19567**			
				19568	500	27-Nov-2005 02:32:15	stop UTLS1 - Upper Tropo Lower Strato 1
				19573	500	27-Nov-2005 10:55:15	start UTLS1 - Upper Tropo Lower Strato 1
				19574			
				19575	500	27-Nov-2005 14:16:26	stop UTLS1 - Upper Tropo Lower Strato 1

2.3.2 PRODUCT AVAILABILITY

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 during November 2005.

Start time		Stop time		Duration	Start Orbit	Stop Orbit
date	UTC	date	UTC	sec		
01-nov-05	6.16.55	01-nov-05	6.21.41	286	19198	19198
01-nov-05	8.01.20	01-nov-05	8.01.35	15	19199	19199
05-nov-05	10.38.29	05-nov-05	10.38.43	14	19257	19258
07-nov-05	6.10.09	07-nov-05	6.14.13	244	19283	19284
07-nov-05	7.54.34	07-nov-05	7.54.48	14	19284	19285
07-nov-05	19.56.33	07-nov-05	19.59.47	194	19292	19292
08-nov-05	2.21.09	08-nov-05	2.21.23	14	19295	19296
11-nov-05	6.41.33	11-nov-05	6.42.15	42	19341	19341
11-nov-05	7.28.41	11-nov-05	7.28.56	15	19341	19342
12-nov-05	10.16.59	12-nov-05	10.17.13	14	19357	19357
13-nov-05	23.15.12	14-nov-05	2.42.24	12432	19380	19382
19-nov-05	9.57.12	19-nov-05	9.57.26	14	19457	19457

During the November 2005 there were two missing intervals for LOS measurements (MIP_LS__0P), these are reported in the next table.

Tab. 3 List of missing intervals for MIP_LS__0P during November 2005.

Start time		Stop time		Duration	Orbit Start	Orbit end
Date	UTC	Date	UTC	sec		
05-nov-05	10.37.38	05-nov-05	10.37.48	10	19257	19257
19-nov-05	7.07.12	19-nov-05	7.07.14	2	19456	19456

2.3.3 LEVEL 0 STATISTICS

The MIPAS mission is currently planned with a limited duty cycle (around 25%, corresponding to 3 orbits per day), as recommended by Astrium for instrument safety. Nevertheless the availability of the L0 data for the planned time of measurement is high (around 90%). Furthermore if we consider as a reference the time when the instrument is on (discarding instrument unavailability) the percentage of available L0 products is around 97%.

Tab. 4 MIPAS Level 0 products statistics during November 2005.

		Time [sec]
Total time over one month (30 days)	t_{tot}	2592000
Time of planned measurements	t_{plan}	598391
Unavailability of the instrument	t_{unav}	51679
Missing L0 products	t_{miss}	13300
Planned duty cycle	t_{plan} / t_{tot}	**23.1%**
Availability of L0 products wrt planned time	$1-[(t_{unav} + t_{miss})/t_{plan}]$	**89.14 %**
Availability of L0 products wrt instrument-on	$1-[t_{miss} /(t_{plan} - t_{unav})]$	**97.58 %**

2.4 *Instrument Planning and Performance*

2.4.1 MIPAS PLANNING

The planning for the MIPAS operations for November 2005 is described in this section.

- Following the recommendations of Astrium the instrument duty cycle is kept to a value of 25% in order to relax INT system, therefore the planned MIPAS measurements are today limited to three orbits per day.
- All activities are planned in nominal mode (2RR operation) with medium resolution (41% - 1.64 sec sweeps) with asymmetric transitory sweeps
- According to the implementation of the autorecovery sequence in the FOS-MPS, new MPL_CAL_MP files have been sent with RGC and WCC REPETITION fields set to zero
- Radiometric Gain calibrations (RGC) planned using the MPL_ORS_MP file
- The WCC activity cannot be explicitly requested trough the MPL_ORS_MP file, it is performed after every transition to Heater
- 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
- MIPAS operations in UTLS-1 mode in support of the SCOUT-O3 campaign

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

The measurements acquired during the SCOUT-O3 campaign are listed in the following table.

Tab. 5 MIPAS support to SCOUT-O3 campaign.

Time (2005)	**Mode**	**Operational Scenario**	**Objective/Remarks**
4 Nov.	UTLS-1	1 day (followed by 2 days off)	UTLS dedicated research Onset of Arctic vortex *SCOUT campaign (transfer flight O'hofen - Larnaca – Dubai)*
7-8 Nov.	UTLS-1	2 days (followed by 2 days off)	UTLS dedicated research Evolution of Arctic vortex *SCOUT campaign (transfer flight Dubai – Hyderabad - U Taphao)*
Nov. 11	UTLS-1	1 day on (followed by 2 days off)	UTLS dedicated research Evolution of Arctic vortex *SCOUT campaign (transfer flight U Taphao-Darwin)*
14 Nov – 6 Dec. (SCOUT intensive campaign period)	UTLS-1	All orbits within longitudinal sector 100-150°E at 10°S (i.e. 4-6 orbits per day), followed by three day off	UTLS dedicated research Evolution of Arctic vortex *SCOUT (intensive phase, numerous local flights from Darwin base)*

2.4.2 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.

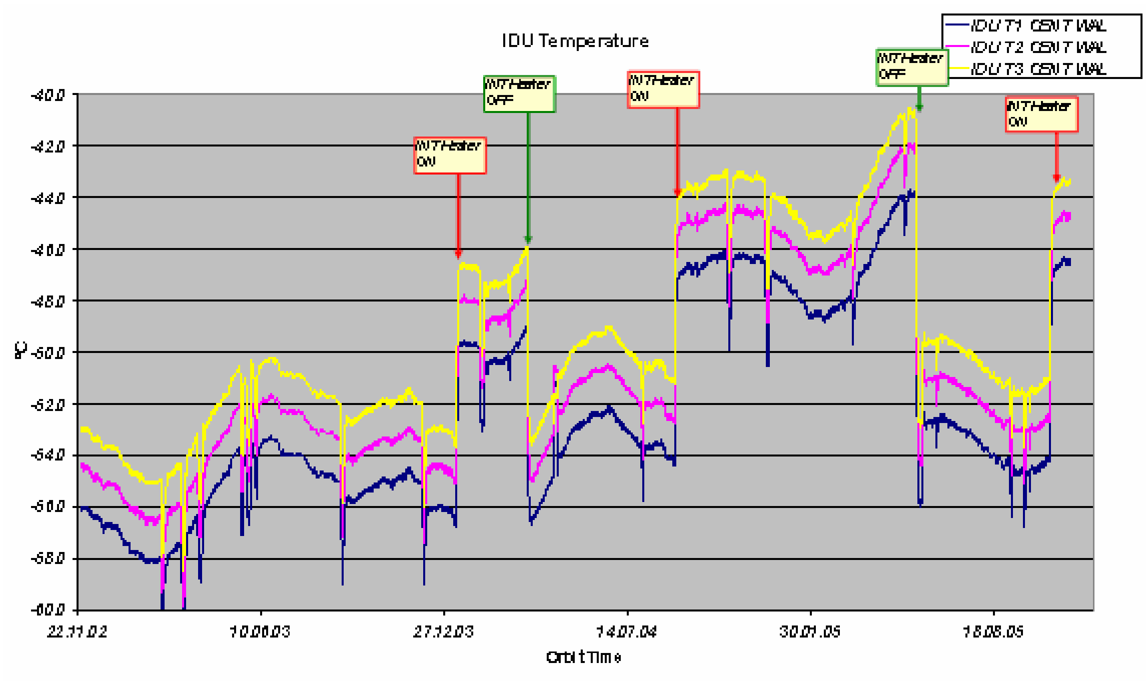

Fig. 1 IDU temperature as a function of time: November 2002 – November 2005.

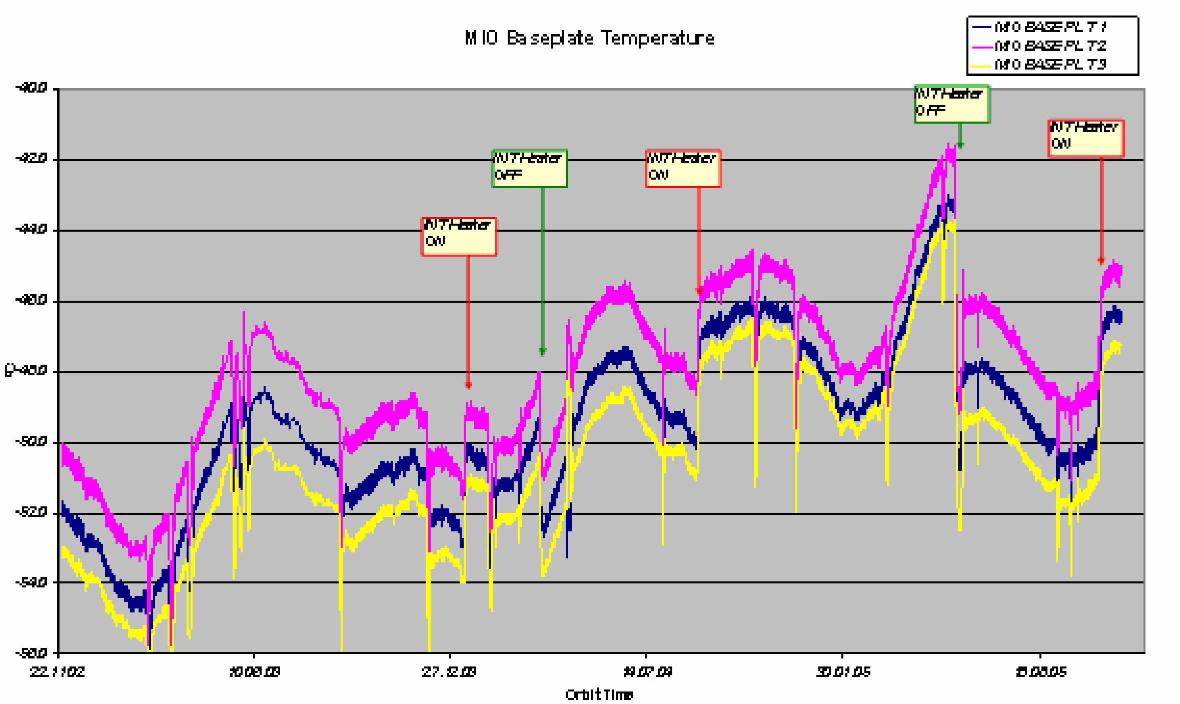

Fig. 2 MIO baseplate temperature as a function of time: November 2002 – November 2005.

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

At the end of August 2005, the temperature was about 4 K warmer than during the critical period at the beginning of 2003. However it seems that the critical temperature is increasing during the mission, nowadays we can consider the temperature of August 2005 (-52°C) as a critical value, that is to say a value when the occurrence of critical errors starts to increase. Furthermore an analysis made by Astrium revealed that the IDU performance improves 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 switching-on of the heater produce an increase of almost 5K of the MIO and IDU temperature, these temperatures reach values comparable to one year ago. The increase of temperature significantly improves the INT performances as will be discussed in the next paragraph.

2.4.3 INTERFEROMETER PERFORMANCE

2.4.3.1 INT performances after heater switch-on

The high increase of IDU anomalies during August and the beginning of October 2005 led to the decision to switch-on the INT heater on 17-Oct 2005 in order to improve the slide performance. The effect of the INT heater switch-on was a significant improvement of the INT performances, in particular the number of critical turn-around error and the number of -4% differential speed error were drastically reduced as can be observed in the next figures. In particular Fig 3 shows that after heater switch-on we didn't record any critical failure, on the contrary this was observed during end of August and beginning of October 2005 operations. In Fig. 4 we can see also that the -4% speed error after heater switch-on was reduced from a value of 70% to a more acceptable value of 40%.

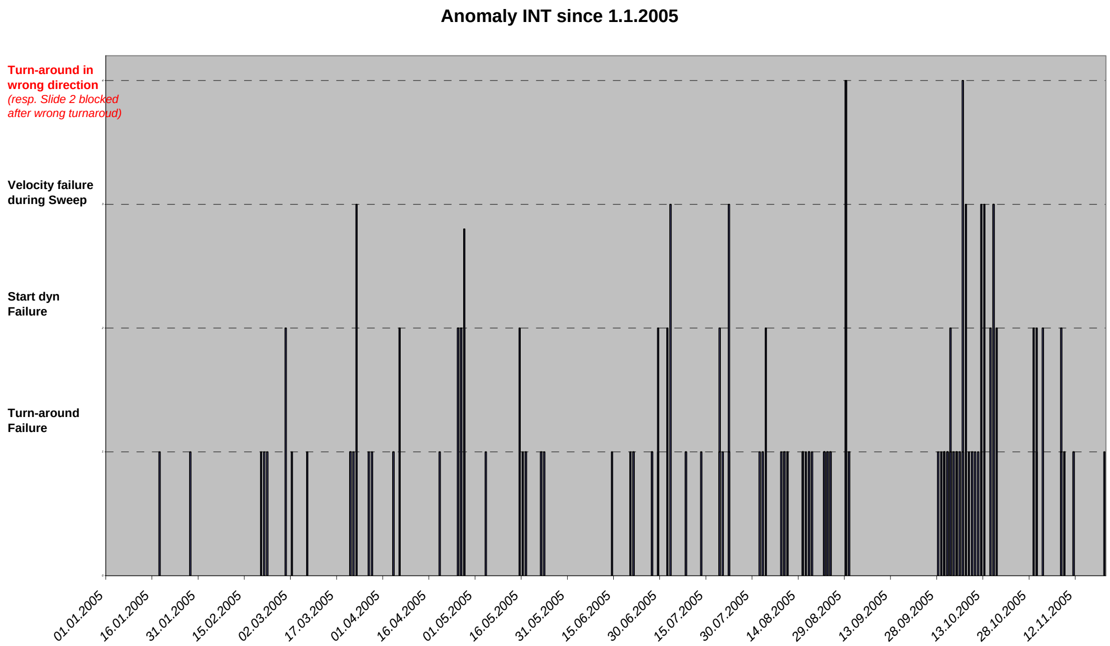

Fig. 3 MIPAS INT Anomaly during 2005 operations.

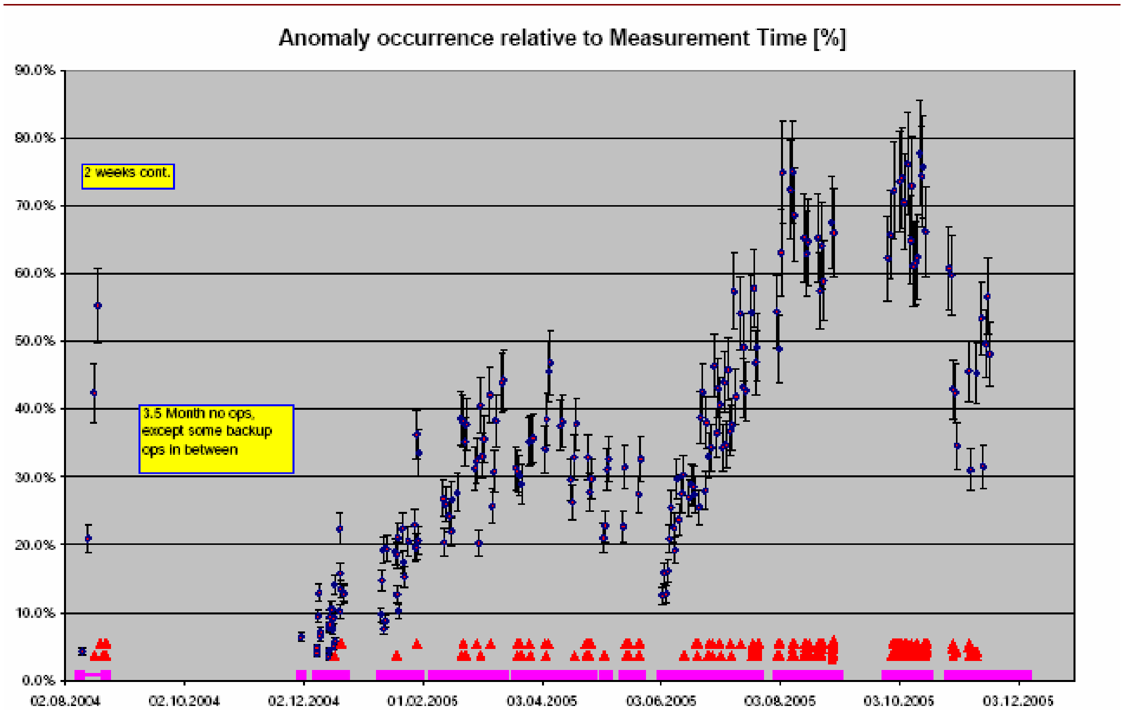

Fig. 4 MIPAS -4% differential speed errors during 2RR mission (from Aug 2004 to Nov 2005).

During the last IOP meeting it was also pointed out that the critical temperature is now raised to a value of about -53°C. Indeed when the instrument temperature fell below this temperature (during August 2005) the number of critical turnaround errors increased considerably.
In general, the instrument will perform even better with further increased temperature, for example by switching-on the second INT heater. This strategy can be interesting for future operations and it was proposed during the last IOP as a test scenario for future MIPAS measurements. Nevertheless when further increasing temperature the cooler performances should be monitored with care.

2.4.4 MECHANICAL PERFORMANCE

2.4.4.1 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 relatively 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 cooler during the reporting period (November 2005) was nominal with vibration values below our observation warning level of 8 mg, as can be seen in the following figures.

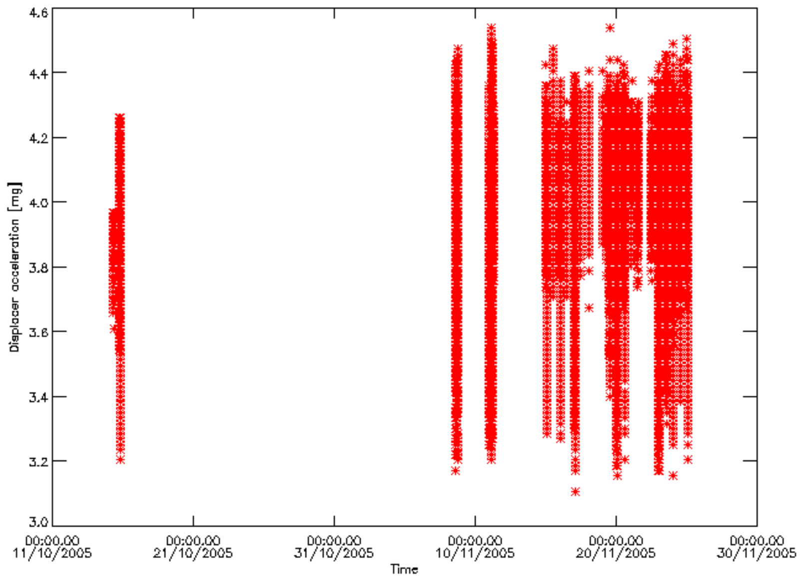

Fig. 5 November 2005: Displacer vibration level.

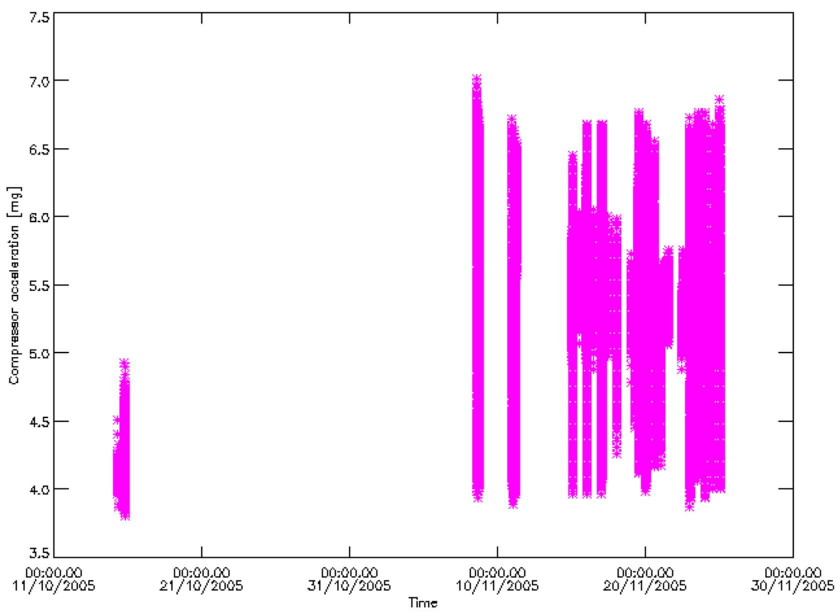

Fig. 6 November 2005: Compressor vibration level.

The switching-on of the heater leads to increased effort from the cooler, with a slight increase of the compressor vibration level (up to a value of 7 mg) as can be observed in Fig. 6. This behaviour was also noted in the daily cooler plots that are shown in Fig. 7. In these plots a specific pattern can be appreciated with a fixed orbital oscillation and a maximum value of almost 7 mg. The period of the pattern is 100 minutes, this is due to the orbital variation of the environment. In particular there are two environmental factors influencing the cooler:

- <u>The supply voltage</u>: The cooler electronic is supplied by the unregulated ENVISAT power bus. The cooler compressors, which mainly introduce the acceleration, are supplied by use of a PWM (pulse wide modulator) from this bus. Now due to the history of the MIPAS cooler, we have two completely different cooler compressors with a fairly different performance at the cooler. Nominally the compressor A and B are mounted perpendicularly so that the accelerations are minimised during operations. At the end of the cool-down a coarse balance between compressor A and B is performed. The best driving value for compressor B is taken to generate a minimum vibration. Compressor B is always driven by a setting of the percentage (around 102.5 ... 103.5%) to compressor A. Due to the performance variations depending on supply voltage, the vibration pattern varies.
- <u>The environmental temperature</u>: The environmental temperature varies during one orbit and this influences the cooler performance as well. Nevertheless, the influence is much lower than the supply voltage variation.

This behaviour is nominal, but it should be monitored with care, in particular after the INT heater switch-on.

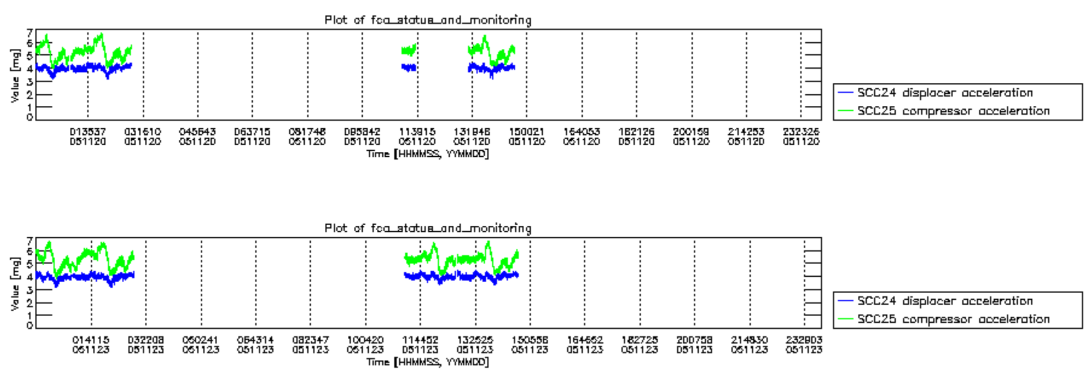

Fig. 7 Displacer and Compressor vibration level: 15th October 2005.

2.5 *Level 1 Product Quality Monitoring*

2.5.1 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.
The validation of IPF 4.65 is underway and when completed this IPF will be put into operations at the DPAC for reprocessing of RR mission.

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-121O0-2011	
4.63	**4I**	**4.1**	**4.1**	**5.1**	Fixed SPR-120O0-2000: Fixed SPR-120O0-2001	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.

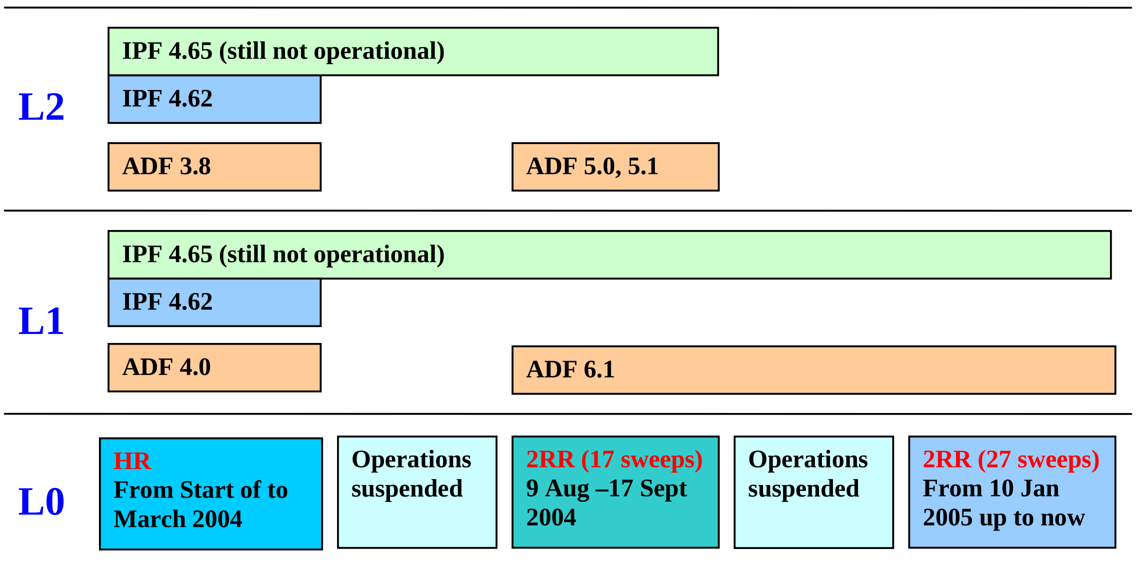

Fig. 8 IPF validity and ADFs version for processing level 1 and level 2 products. IPF 4.62 is the last operational one, while the IPF 4.65 is currently under validation and will be delivered to DPAC for OFL processing of 2RR mission.

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

2.5.1.1 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 November 2005 are listed in the following table.

Tab. 9 Level 1 ADFs valid in November 2005.

Auxiliary Data File	Start Validity	Stop Validity	Updated in Nov 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_AXVIEC20051110_102129_20051106_000000_20101106_000000 MIP_CG1_AXVIEC20051110_100847_20051106_000000_20101106_000000 MIP_CO1_AXVIEC20051110_101206_20051106_000000_20101106_000000	6-NOV-05	6-NOV-10	Yes
MIP_CS1_AXVIEC20051121_151601_20051114_000000_20101114_000000 MIP_CG1_AXVIEC20051121_150557_20051114_000000_20101114_000000 MIP_CO1_AXVIEC20051121_150104_20051114_000000_20101114_000000	14-NOV-05	14-NOV-10	Yes
MIP_CS1_AXVIEC20051123_151546_20051120_000000_20101120_000000 MIP_CG1_AXVIEC20051124_150556_20051120_000000_20101120_000000 MIP_CO1_AXVIEC20051124_150101_20051120_000000_20101120_000000	20-NOV-05	20-NOV-10	Yes
MIP_CS1_AXVIEC20051129_151549_20051127_000000_20101127_000000 MIP_CG1_AXVIEC20051130_150604_20051127_000000_20101127_000000 MIP_CO1_AXVIEC20051129_150049_20051127_000000_20101127_000000	27-NOV-05	27-NOV-10	Yes

In order to prepare the reprocessing of the RR mission some previously disseminated ADFs were corrected and deleted from all the processing centres in order to adjust the start time just before an anomaly event (long detectors/cooler switch-off or after a long unavailability). The list of ADFs deleted and the newly disseminated ones are summarised in the next table.

Tab. 10 Level 1 ADFs deleted and corrected for reprocessing of 2005 RR mission.

Auxiliary Data File	Start Validity	Stop Validity	Updated in Nov 2005
MIP_CS1_AXVIEC20050310_091926_20050116_000000_20090116_000000 MIP_CO1_AXVIEC20050310_091805_20050116_000000_20090116_000000 MIP_CG1_AXVIEC20050310_091646_20050116_000000_20090116_000000			Deleted
MIP_CS1_AXVIEC20051115_100927_20050115_061110_20090115_000000 MIP_CO1_AXVIEC20051115_100856_20050115_061110_20090115_000000 MIP_CG1_AXVIEC20051115_140009_20050115_061110_20090115_000000	15-JAN-05	15-JAN-09	Yes
MIP_CS1_AXVIEC20050314_154734_20050128_000000_20090128_000000 MIP_CO1_AXVIEC20050314_154452_20050128_000000_20090128_000000 MIP_CG1_AXVIEC20050314_154134_20050128_000000_20090128_000000			Deleted
MIP_CS1_AXVIEC20051115_101430_20050127_101949_20090127_000000 MIP_CO1_AXVIEC20051115_101353_20050127_101949_20090127_000000 MIP_CG1_AXVIEC20051115_140519_20050127_101949_20090127_000000	27-JAN-05	27-JAN-09	Yes
MIP_CS1_AXVIEC20050616_090921_20050603_000000_20090603_000000 MIP_CO1_AXVIEC20050616_090308_20050603_000000_20090603_000000 MIP_CG1_AXVIEC20050616_085854_20050603_000000_20090603_000000			Deleted
MIP_CS1_AXVIEC20051115_101936_20050601_082740_20090601_000000 MIP_CO1_AXVIEC20051115_101908_20050601_082740_20090601_000000 MIP_CG1_AXVIEC20051115_141026_20050601_082740_20090601_000000	01-JUN-05	01-JUN-09	Yes
MIP_CS1_AXVIEC20050810_180640_20050730_000000_20100803_104839 MIP_CO1_AXVIEC20050811_181639_20050730_000000_20100803_113811 MIP_CG1_AXVIEC20050810_180640_20050730_000000_20100803_170424			Deleted
MIP_CS1_AXVIEC20051115_102512_20050729_005430_20100729_000000 MIP_CO1_AXVIEC20051115_102420_20050729_005430_20100729_000000 MIP_CG1_AXVIEC20051115_141830_20050729_005430_20100729_000000	29-JUL-05	29-JUL-10	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. 11 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

2.5.2 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. 7 gives the variation trend over all the 2RR mission (from August 2004). We observe a very stable situation since the variations are of the order of 2 ppm over more than one year of reporting period.

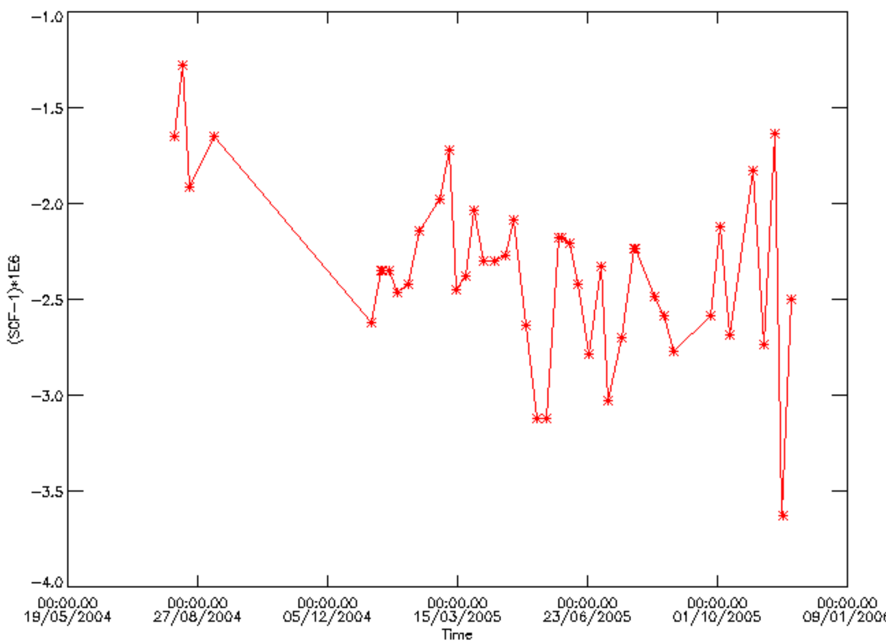

Fig. 9 MIPAS Spectral Calibration Factor (SCF) during RR ops updated to end of Nov 2005.

2.5.3 RADIOMETRIC PERFORMANCE

During November 2005 operations, 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 November 2005 interval, therefore the gain ADFs have been regularly disseminated.

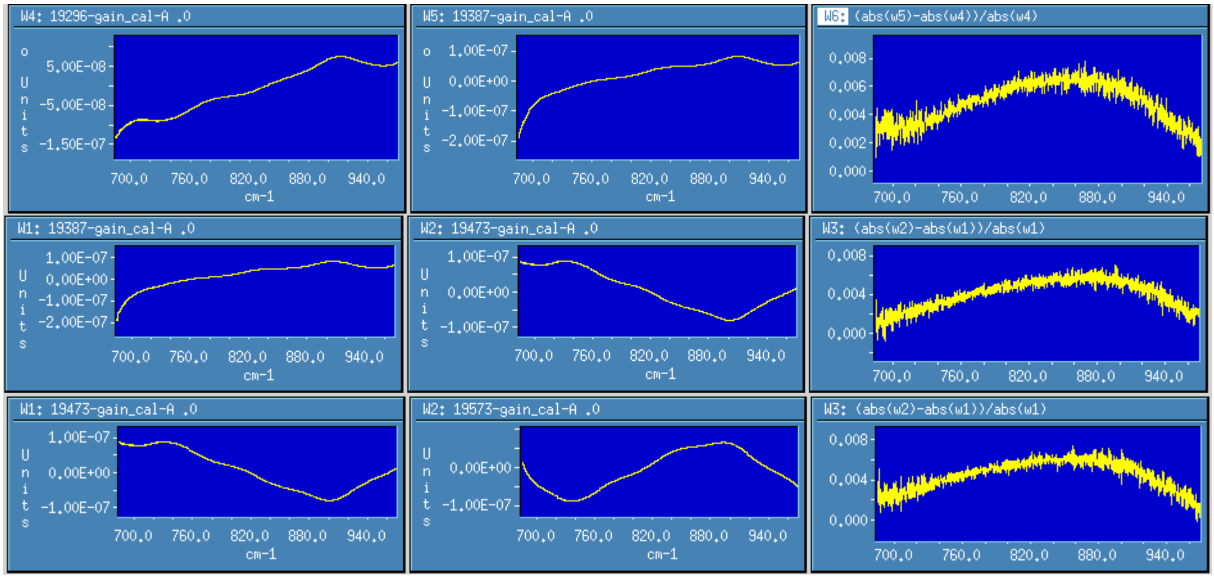

Fig. 10 Relative variations of radiometric gain for three disseminated gains (considering only band A) during November 2005 operations. The first two plots in each row are the imaginary gains plotted versus the wave-number, the third plot is the ratio: (abs(w2)-abs(w1))/abs(w1), which gives the gain 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%).

Figure 11 shows the gain rate during 2005 operations, this rate is obtained as the maximum of the curves of weekly gain variation (abs(w2)-abs(w1))/abs(w1)) observed in Fig. 10. The very high increase of gain rate during Jan-May 2005 operations due to the presence of ice in the detectors can be seen. After the decontamination (end of May 2005) the gain rate suddenly decreases to nominal value (1%) and it remains stable all over the reporting period, up to the end of November 2005.

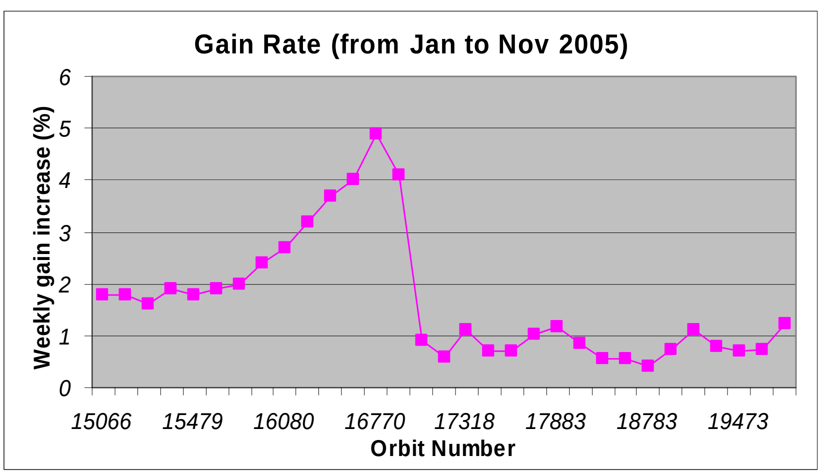

Fig. 11 Gain rate on a weekly basis during 2005 MIPAS operations updated to the end of Nov 2005.

2.5.3.1 Interpolated gains

During the period January-May 2005, a strong gain increase was observed in the weekly gain variation, as observed in Fig 9. 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 in ***Appendix D***.

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)

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 and disseminated via IECF is reported in ***Appendix D***. These 45 MIP_CG1__AX files should be used for the reprocessing of the 2005 2RR MIPAS mission.

2.5.4 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 November 2005 operations, the LOS calibrations were performed twice and the results of the calibration are reported in the following table and figure. During the last 3 months of operations the relative bias seems to be stable around the value of 5-8 mdeg.

Tab. 12 LOS calibration performed on November 2005.

Date	Orbit #	Relative bias	Absolute bias
12-Nov-2005	19356	0,008258	-0,021742
26-Nov-2005	19556	0,004861	-0,025139

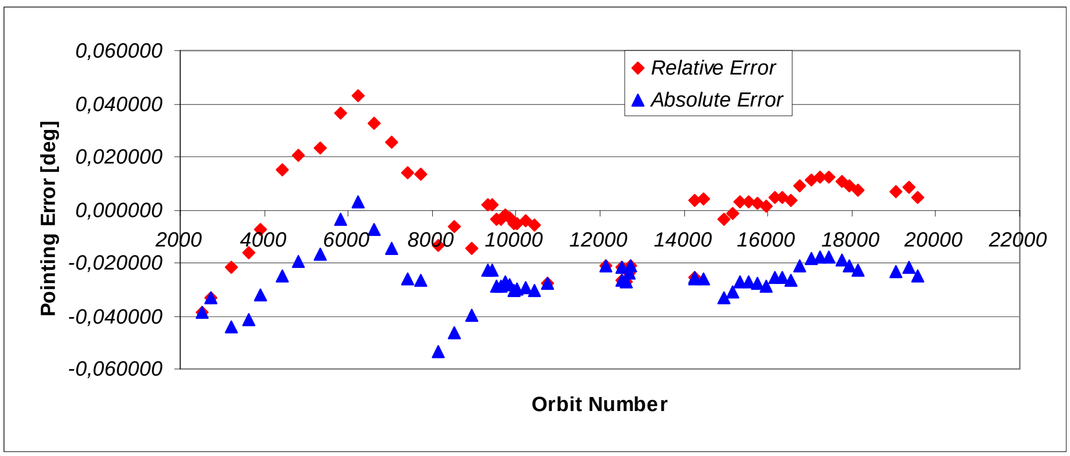

Fig. 12 MIPAS pointing error as a function of the orbit number: September 2002- November 2005.

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 the 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.

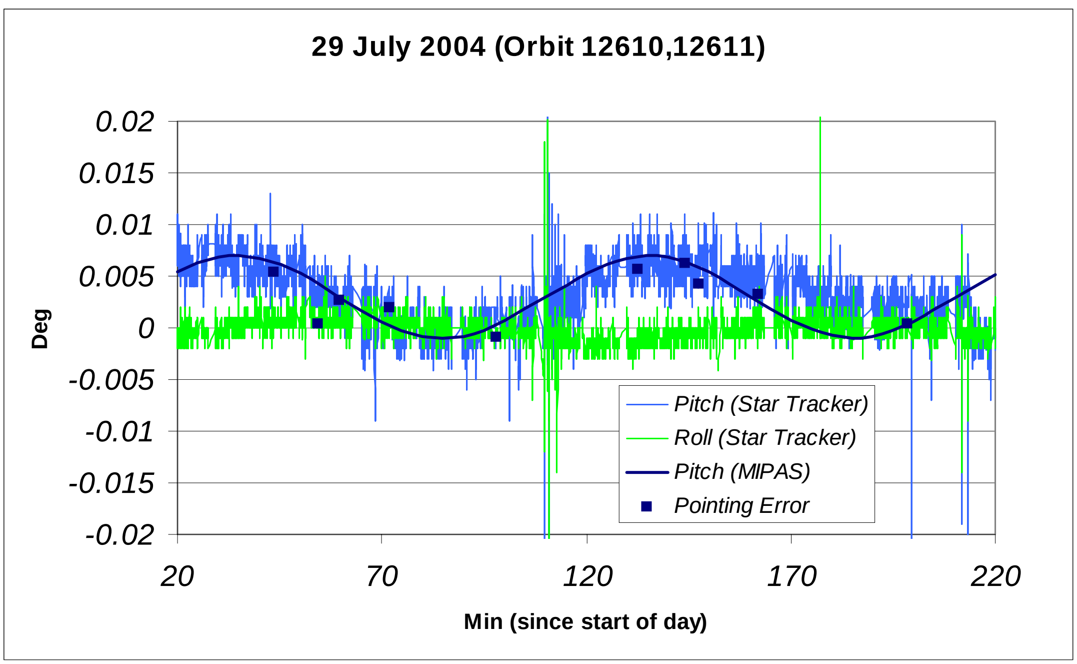

Fig. 13 Comparison between MIPAS pointing and star tracker information.

2.5.5 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	/

2.5.5.1 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.

2.5.5.2 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.

2.5.5.3 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.

2.5.6 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 is actually expected. The discrepancy between expected and received is caused by a delay in the generation of consolidated Level 0 at LRAC.

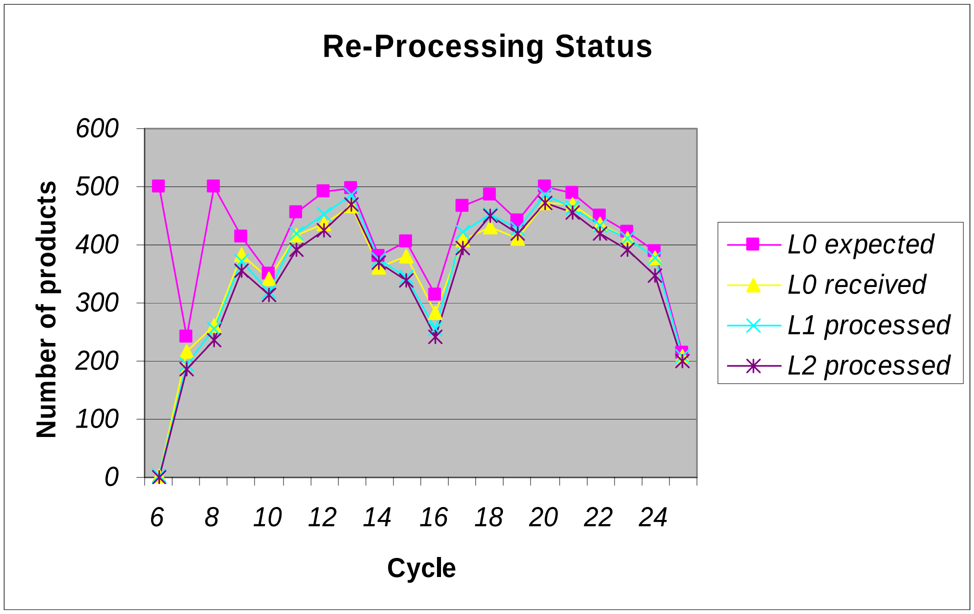

Fig. 14 Re-processing status at the end of November 2005

2.5.7 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***.

2.6 Level 2 Product Quality Monitoring

2.6.1 PROCESSOR CONFIGURATION

2.6.1.1 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***.

2.6.1.2 Auxiliary Data Files

Tab. 15 shows the historical dissemination (from January 2003) of Level 2 ADFs until the mission interruption occurred in March 2004. In order to reprocess 2RR mission the latest version of level 2 ADF (version 5.1) was disseminated during November 2005.

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 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	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** 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.
ADFs V5.1 MIP_CS2_AXVIEC20050722_082136_20040809_000000_20040917_220643 MIP_IG2_AXVIEC20050721_130007_20040809_000000_20040901_000000 MIP_IG2_AXVIEC20050721_134702_20040901_000000_20040917_220643 MIP_MW2_AXVIEC20050721_144629_20040809_000000_20040917_220643 MIP_OM2_AXVIEC20050721_143058_20040809_000000_20040917_220643 MIP_PI2_AXVIEC20050721_142545_20040809_000000_20040917_220643 MIP_PS2_AXVIEC20050721_141630_20040809_000000_20040917_220643 MIP_SP2_AXVIEC20050721_140636_20040809_000000_20040917_220643	8-SET-04	For processing RR measurement with fixed altitude and old vertical sampling

Further details on the Level 2 ADF deliveries provided by IFAC are reported in ***Appendix G***.

2.6.2 ANOMALY STATUS

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

Tab. 16 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	/

2.6.2.1 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.

2.6.2.2 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.

2.6.2.3 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.

2.6.2.4 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 it was classified as critical and will be analyzed by the IPF developers.

APPENDIX A *FILES TRANSFERRED TO THE FOCC*

The following files were transferred to the FOCC for the November 2005 planning activities.

RGT files already transferred to the FOCC

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
AVI_UAV_TLVFOS20051027_164957_00000000_00000352_20051112_102127_20051113_231440.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000353_20051114_024552_20051114_105852.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000354_20051114_143004_20051115_002339.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000355_20051115_021415_20051115_120751.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000356_20051115_135827_20051115_235202.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000357_20051116_014238_20051116_113614.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000358_20051116_132650_20051116_232025.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000359_20051117_025137_20051117_110437.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000360_20051117_143549_20051118_002924.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000361_20051118_022000_20051118_121336.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000362_20051118_140412_20051118_235747.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000363_20051119_014823_20051119_063121.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000364_20051119_100141_20051119_114159.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000365_20051119_133235_20051119_232610.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000366_20051120_025722_20051120_111022.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000367_20051120_144134_20051121_003509.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000368_20051121_022545_20051121_121921.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000369_20051121_140957_20051122_000332.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000370_20051122_015408_20051122_114744.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000371_20051122_133820_20051122_233155.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000372_20051123_030307_20051123_111607.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000373_20051123_144718_20051124_004054.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000374_20051124_023130_20051124_104430.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000375_20051124_141541_20051125_000917.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000376_20051125_015953_20051125_115329.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000377_20051125_134404_20051125_233740.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000378_20051126_030852_20051126_061204.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000379_20051126_094203_20051126_112152.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000380_20051126_145303_20051126_230603.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000381_20051127_023715_20051127_105015.N1
AVI_UAV_TLVFOS20051027_164957_00000000_00000382_20051127_142126_20051130_120000.N1
AVI_UAV_TLVFOS20051028_162900_00000000_00000383_20051119_100141_20051119_114159.N1
AVI_UAV_TLVFOS20051028_163000_00000000_00000384_20051126_094203_20051126_112152.N1

AVI_UAV_TLVFOS20051028_165741_00000000_00000385_20051127_142126_20051128_001502.N1
AVI_UAV_TLVFOS20051028_165741_00000000_00000386_20051128_020538_20051128_115913.N1
AVI_UAV_TLVFOS20051028_165741_00000000_00000387_20051128_134949_20051128_234325.N1
AVI_UAV_TLVFOS20051028_165844_00000000_00000388_20051129_013401_20051129_112736.N1
AVI_UAV_TLVFOS20051028_165844_00000000_00000389_20051129_131812_20051129_231148.N1
AVI_UAV_TLVFOS20051028_165844_00000000_00000390_20051130_024300_20051130_105559.N1
AVI_UAV_TLVFOS20051028_165844_00000000_00000391_20051130_142711_20051201_002047.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_LOS_MPVRGT20051027_121634_00000000_00000182_20051119_063620_20051120_110603.N1
MPL_LOS_MPVRGT20051027_141507_00000000_00000183_20051126_061703_20051127_104626.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
MPL_ORS_MPVRGT20051027_153721_00000000_00000101_20051114_121702_20051120_124242.N1
MPL_ORS_MPVRGT20051027_160529_00000000_00000102_20051121_133730_20051127_122235.N1
MPL_ORS_MPVRGT20051028_122557_00000000_00000103_20051128_131723_20051204_134304.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

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 prevents 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_AXVIEC20051115_085521_20050118_120000_20100118_120000	Gain (CG_0_a) *
MIP_CG1_AXVIEC20050310_091646_20050116_000000_20090116_000000	Gain calibration (CG_1)
MIP_CG1_AXVIEC20051115_085521_20050118_120000_20100118_120000	Gain (CG_1_a) *
MIP_CG1_AXVIEC20050311_085855_20050121_000000_20090121_000000	Gain calibration (CG_2)
MIP_CG1_AXVIEC20051115_090016_20050124_120000_20100124_120000	Gain (CG_2_a) *
MIP_CG1_AXVIEC20050314_154134_20050128_000000_20090128_000000	Gain calibration (CG_3)
MIP_CG1_AXVIEC20051115_090529_20050130_150000_20100130_150000	Gain (CG_3_a) *
MIP_CG1_AXVIEC20051115_091036_20050202_080000_20100202_080000	Gain (CG_3_b) *
MIP_CG1_AXVIEC20050315_131822_20050205_000000_20090205_000000	Gain calibration (CG_4)
MIP_CG1_AXVIEC20051115_101639_20050209_120000_20100209_120000	Gain (CG_4_a) *
MIP_CG1_AXVIEC20050316_081309_20050214_000000_20090214_000000	Gain calibration (CG_5)
MIP_CG1_AXVIEC20051115_102136_20050217_000000_20100217_000000	Gain (CG_5_a) *
MIP_CG1_AXVIEC20051115_102701_20050220_000000_20100220_000000	Gain (CG_5_b) *
MIP_CG1_AXVIEC20051115_103156_20050223_000000_20100223_000000	Gain (CG_5_c) *
MIP_CG1_AXVIEC20051115_103702_20050226_000000_20100226_000000	Gain (CG_5_d) *
MIP_CG1_AXVIEC20050405_145110_20050301_000000_20090301_000000	Gain calibration (CG_6)
MIP_CG1_AXVIEC20051115_104209_20050303_150000_20100303_150000	Gain (CG_6_a) *
MIP_CG1_AXVIEC20051115_104705_20050306_080000_20100306_080000	Gain (CG_6_b) *
MIP_CG1_AXVIEC20050406_070802_20050309_000000_20090309_000000	Gain calibration (CG_7)
MIP_CG1_AXVIEC20051115_105212_20050311_000000_20100311_000000	Gain (CG_7_a) *
MIP_CG1_AXVIEC20050407_072135_20050314_000000_20090313_000000	Gain calibration (CG_8)
MIP_CG1_AXVIEC20051115_105723_20050315_000000_20100315_000000	Gain (CG_8_a) *
MIP_CG1_AXVIEC20051115_110250_20050316_115754_20100316_000000	Gain (CG_8_b) *
MIP_CG1_AXVIEC20051115_122231_20050319_000000_20100319_000000	Gain (CG_8_c) *
MIP_CG1_AXVIEC20050407_143713_20050321_000000_20090321_000000	Gain calibration (CG_9)
MIP_CG1_AXVIEC20051115_122732_20050323_070000_20100323_070000	Gain (CG_9_a) *
MIP_CG1_AXVIEC20051115_123244_20050325_160000_20100325_160000	Gain (CG_9_b) *
MIP_CG1_AXVIEC20050411_123723_20050328_000000_20090328_000000	Gain calibration (CG_10)
MIP_CG1_AXVIEC20051115_123754_20050330_070000_20100330_070000	Gain (CG_10_a) *
MIP_CG1_AXVIEC20051115_124300_20050401_160000_20100401_160000	Gain (CG_10_b) *
MIP_CG1_AXVIEC20050412_072926_20050404_000000_20090404_000000	Gain calibration (CG_11)
MIP_CG1_AXVIEC20051115_124808_20050406_000000_20100406_000000	Gain (CG_11_a) *
MIP_CG1_AXVIEC20051115_125321_20050408_000000_20100408_000000	Gain (CG_11_b) *
MIP_CG1_AXVIEC20051115_125829_20050410_000000_20100410_000000	Gain (CG_11_c) *
MIP_CG1_AXVIEC20050415_073538_20050412_231018_20100412_231018	Gain calibration (CG_12)
MIP_CG1_AXVIEC20051115_130340_20050414_000000_20100414_000000	Gain (CG_12_a) *
MIP_CG1_AXVIEC20051115_130903_20050416_000000_20100416_000000	Gain (CG_12_b) *
MIP_CG1_AXVIEC20051115_131404_20050418_000000_20100418_000000	Gain (CG_12_c) *

MIP_CG1_AXVIEC20050421_065554_20050420_133450_20100420_133450	Gain calibration (CG_13)
MIP_CG1_AXVIEC20051115_131917_20050421_120000_20100421_120000	Gain (CG_13_a) *
MIP_CG1_AXVIEC20051115_132409_20050423_000000_20100423_000000	Gain (CG_13_b) *
MIP_CG1_AXVIEC20051115_132925_20050424_120000_20100424_120000	Gain (CG_13_c) *
MIP_CG1_AXVIEC20050427_150526_20050426_225532_20100426_225532	Gain calibration (CG_14)
MIP_CG1_AXVIEC20051115_133432_20050427_160000_20100427_160000	Gain (CG_14_a) *
MIP_CG1_AXVIEC20051115_133942_20050429_070000_20100429_070000	Gain (CG_14_b) *
MIP_CG1_AXVIEC20051115_134453_20050501_000000_20100501_000000	Gain (CG_14_c) *
MIP_CG1_AXVIEC20051115_134947_20050502_160000_20100502_160000	Gain (CG_14_d) *
MIP_CG1_AXVIEC20051115_135453_20050504_070000_20100504_070000	Gain (CG_14_e) *
MIP_CG1_AXVIEC20050509_150546_20050506_153444_20100506_153444	Gain calibration (CG_15)
MIP_CG1_AXVIEC20051115_154052_20050507_030000_20100507_030000	Gain (CG_15_a) *
MIP_CG1_AXVIEC20051115_151144_20050508_060000_20100508_060000	Gain (CG_15_b) *
MIP_CG1_AXVIEC20051115_151255_20050509_090000_20100509_090000	Gain (CG_15_c) *
MIP_CG1_AXVIEC20051115_151358_20050510_120000_20100510_120000	Gain (CG_15_d) *
MIP_CG1_AXVIEC20051115_151458_20050511_150000_20100511_150000	Gain (CG_15_e) *
MIP_CG1_AXVIEC20051115_151558_20050512_180000_20100512_180000	Gain (CG_15_f) *
MIP_CG1_AXVIEC20051115_151702_20050513_210000_20100513_210000	Gain (CG_15_g) *
MIP_CG1_AXVIEC20050523_090017_20050515_000000_20090515_000000	Gain calibration (CG_16)
MIP_CG1_AXVIEC20051115_150616_20050516_090000_20100516_090000	Gain (CG_16_a) *
MIP_CG1_AXVIEC20051115_150747_20050517_190000_20100517_190000	Gain (CG_16_b) *
MIP_CG1_AXVIEC20051115_150831_20050519_040000_20100519_040000	Gain (CG_16_c) *
MIP_CG1_AXVIEC20051115_150940_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
MIP_NL__1PMPDK20051120_111053_000014832042_00381_19473_0493.N1
MIP_NL__1PMPDK20051120_131234_000051352042_00382_19474_0494.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 table and paragraph. 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.

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.

- **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.