ENVISAT MIPAS Monthly Report: September 2006

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checked by/*vérifié par*	
reference/*réference*	ENVI-SPPA-EOPG-TN-06-0038
issue/*édition*	1
revision/*révision*	1
date of issue/*date d'édition*	15/10/2006
status/*état*	Final
Document type/*type de document*	Technical Note
Distribution/*distribution*	
.	

European Space Agency
Agence spatiale européenne

A P P R O V A L

Title *titre*	ENVISAT MIPAS Monthly Report: September 2006	issue *issue*	1	revision *revision*	1

author *auteur*	Fabrizio Niro (mipas@dpqc.org)	date *date*	15/10/2006

checked by *vérifié par*		date *date*	

C H A N G E   L O G

reason for change /*raison du changement*	issue/*issue*	revision/*revision*	date/*date*

C H A N G E   R E C O R D

Issue: 1 Revision: 1

reason for change/*raison du changement*	page(s)/*page(s)*	paragraph(s)/*paragraph(s)*

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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
AMT	Anomaly Management Tool
ANX	Ascending Node Crossing
AE	Aircraft Emission
AR	Anomaly Report
CBB	Calibration Black-Body

CTI	Configuration Table Interface
D-PAC	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
ESF	Engineering Support Facility
FCA	FPS (Focal Plane Subsystem) Cooler Assembly
FCE	Fringe Count Error
FOCC	Flight Operation Control Centre
FOS	Flight Operations Segment
FR	Full Resolution
HD	Help-Desk
HSM	High-Speed Multiplexer
IDU	Interferometer Drive Unit
IECF	Instrument Engineering and Calibration Facilities
IF	In-Flight
IG	Initial Guess
IGM	Interferogram
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
MPS	Mission Planning System
MR	Monthly Report
MW	Micro-Window
NCR	Non-Conformance Report
NESR	Noise Equivalent Spectral Radiance
NOM	Nominal
NRT	Near-Real-Time
OAR	Operational Anomaly report
OFL	Off-Line
OM	Occupation Matrix
PCD	Product Confidence Data
PCF	Product Control Facility
PDS	Payload Data Segment
PFHS	Processing Facility Host Structure
PLSOL	Payload Switch off-line
QC	Quality Control

QWG	Quality Working Group
RGC	Radiometric Gain Calibration
RR	Reduced Resolution
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
2RR	Double Slide Reduced Resolution

2   THE REPORT

2.1   *Summary*

- During the reporting month the MIPAS mission was strongly impacted by two ENVISAT anomalies; one occurred the 7th September and causes the switch-off of all the payload instruments, the second occurred on 26th September and consists on a problem with Ka Band antenna that transmits data via the Artemis satellite. The effect of these two anomalies on the MIPAS mission is detailed below.
  - o The ENVISAT payload switch-off, occurred on 7th September, gives the opportunity to perform the instrument decontamination, originally planned for week 39. This decision allowed minimizing measurement data loss. As a result no MIPAS measurements were taken from 7 Sept 16:46 UTC to 19 Sept 02:00 UTC. The MIPAS mission restarts with the MA/UA scenario in correspondence to the Equinox. The performances of the instrument after the switch-off were nominal.
  - o The anomaly on the Ka-Band antenna occurred on 26th September prevents Envisat to transmit data via the Artemis Relay Satellite. ESA put in place a temporary data acquisition scenario based on the use of European polar acquisition stations (9 orbits send to Kiruna and 5 orbits to Svalbard, with X-Band downlink). This scenario is similar to what was arranged at the beginning of the mission before the start of Artemis operation. This configuration started during night of 1st October. This means that from 26 September to 1st October the orbits to be acquired via Artemis satellite were lost. The impact of this anomaly on MIPAS data acquisition was actually less important with respect to other ENVISAT instruments due to the planned mission interruption of 28 September – 1 October; in total only 10 orbits segments were not acquired due to this anomaly.
- The instrument operated during the reporting month with the following planning (see § 2.2.1):
  - o Decontamination was planned during week #37 (from 11 to 19 Sept)
  - o NOM measurements during 30 Aug – 2 Sept and 25 – 28 Sept.
  - o UTLS-1 measurements during 5 – 8 Sept.
  - o MA/UA mode during 19 – 22 Sept in correspondence to the Equinox.
- The MIPAS instrument performs really well during the reporting month; in fact only 5 instrument anomalies were observed due to IDU velocity error (see § 2.2.4).
- The L0 statistics are reported on § 2.2.4; the statistics of the reporting month are highly influenced by the payload anomalies reported above and by the planned decontamination period.
- The effect of the instrument decontamination was an overall reduction of all the instrument temperatures by few degrees, this is due to the better performance of the cooler after the switch-off (see § 2.3.1).
- The long term trend of the ADC max counts in channel A1 shows to be highly correlated with the seasonal variation of the instrument thermal condition. The recent decontamination results in an increase of ADC maximum counts, this was expected since the ice removal causes an increase of signal at the detector (see § 2.3.2).

- The cooler perform really well during this month, the spikes that were observed in the hottest part of the year (starting from May 2006) are now significantly reduced; the effect of the decontamination was a decrease of the cooler vibration by about 1mg (see § 2.3.3.1).
- The spectral correction factor long term monitoring shows a stable situation since the variations are of the order of 3 ppm over almost two years of operations (see § 2.4.2).
- The decontamination induced a gain reduction of about 10%. The gain increase restarted nominally after the 19th September with weekly increase below the acceptance criterion of 1% (see § 2.4.3.1).
- The long term gain analysis was updated during this month, in particular the reference gain was set to the first disseminated gain after the recent decontamination (see § 2.4.3.2).
- The mispointing long term monitoring shows a steady situation; in fact during the last year the relative bias seems to be stable around a value of few mdeg. To be noted that the last disseminated LOS ADF was on March 2005. During the reporting month only one LOS calibration was performed since two planned weekly calibrations were lost due to the decontamination and the PLSOL (see § 2.4.4).
- The investigation on the anomaly of L2 OFL data detected by C. Piccolo (OU) is now concluded. The problem was that during July - November 2002 several L2 profiles are missing in the Antarctic region, due to retrieval failure. The investigation shows that the problem appears at the South Pole when the tangent altitude of the highest sweep exceeds 72km; this value corresponds to the upper limit defined in the OM. A solution for this problem would be to relax the OM altitude range definition, however with the new algorithm baseline (V5.0) this problem will be overcome owing to the capability of handling floating altitude scenario (see § 2.5.3).
- Another L2 anomaly was investigated during this month, it was the continuum problem detected by C. Bellotti and reported at the QWG #10. The problem was that the processor retrieves sometimes the continua above the limit defined in the PS2 setting file (20 km). The anomaly happens whenever the lowest fitted altitude is higher than the continuum altitude limit (20 km). The problem was recognized as a weakness in the L2 processor baseline and it will be corrected within the new prototype delivery (see § 2.5.3).
- The long term monitoring of fringe count errors (FCE) for the RR mission was updated this month; this analysis shows that so far no correlation can be appreciated with respect to interferometer degradation.
- The level 1 quality monitoring of the OFL products created at D-PAC is on going in parallel with the mission. The level 1b daily reports can be accessed at the following address: http://earth.esa.int/pcs/envisat/mipas/reports/daily/Level_1_OFL/
- The level 0 NRT daily reports can be accessed at the following address: http://earth.esa.int/pcs/envisat/mipas/reports/daily/Level_0_NRT/

2.2   *Instrument and products availability*

2.2.1   INSTRUMENT PLANNING

The planning for the MIPAS operations during September 2006 is briefly described in this section.

Planning strategy:

- All measurement mode are double slide operation with medium resolution (41% - 1.64 sec sweeps) with asymmetric transitory sweeps
- Radiometric Gain calibrations (RGC) planned once per day
- The WCC activity performed after every transition to heater
- LOS sequence planned once per week, with new setting and PITCH BIAS=-0.030<deg>
- DS offset planned every 800 sec.
- Decontamination was planned during week #37 (from 11 to 15 Sept)
- NOM measurements were planned during 30 Aug – 2 Sept and 25 – 28 Sept. IDU re-initialization was set every 3 orbits
- UTLS-1 measurements were taken during 5 – 8 Sept. IDU re-initialization was commanded every orbits
- MA/UA modes were planned during 19 – 22 Sept in correspondence to the Equinox. IDU re-initialization was commanded every 3 orbits

The files transferred to the FOCC for the planning of September 2006 operations are listed in *Appendix A*.

2.2.2   INSTRUMENT AVAILABILITY

During September 2006 MIPAS performances were really satisfactory; indeed only 5 instrument anomalies were registered. All the unavailability intervals during September 2006 are reported in the Table 1. The unavailability highlighted in red and blue are not due to the instrument, but are due to the PLSOL, the planned decontamination and the Artemis unavailability.

Table 1 List of MIPAS unavailabilities during September 2006; highlighted in red are the mission interruption due to the PLSOL and the consequent decontamination, in blue are the ARTEMIS unavailabilities.

Start time		Stop time		Duration	Start Orbit	Stop Orbit	Code	Comments
Date	UTC	date	UTC	sec				
05-SEP-2006	13.57.42	05-SEP-2006	18.56.26	17924	23611	23614	EN-UNA-2006/0267	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
07-SEP-2006	16.40.30	08-SEP-2006	2.54.45	36855	23641	23647	EN-UNA-2006/0275	PLSOL-Payload off due to Service Module Anomaly
09-SEP-2006	11.02.58	19-SEP-2006	1.58.46	831348	23667	23804	EN-UNA-2006/0277	Planned decontamination
19-SEP-2006	23.08.22	20-SEP-2006	2.07.42	10760	23817	23819	EN-UNA-2006/0285	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
20-SEP-2006	9.39.01	20-SEP-2006	12.11.17	9136	23823	23825	EN-UNA-2006/0286	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
20-SEP-2006	16.32.14	20-SEP-2006	17.00.30	1696	23827	23828	ART-UNA-2006/0027	Unavailability Artemis
21-SEP-2006	3.16.55	21-SEP-2006	8.18.07	18072	23834	23837	EN-UNA-2006/0287	MIPAS return to operation from Heater/Refuse mode due

								to IDU SYS TOL ERR
22-SEP-2006	10.07.28	22-SEP-2006	10.26.47	1159	23852	23852	ART-UNA-2006/0028	Unavailability Artemis
27-SEP-2006	17.18.56	27-SEP-2006	20.13.50	10494	23928	23930	EN-UNA-2006/0294	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR

2.2.3 LEVEL 0 PRODUCT AVAILABILITY

The missing intervals (due to PDS unknown failures) for level 0 products (MIP_NL__0P) are reported in Table 2. Most of the time lost due to the PDS failure was caused by the Ka Band anomaly, which prevents Envisat to transmit data via the Artemis Relay Satellite.

Table 2 List of missing gaps for MIP_NL__0P during September 2006. In red are highlighted the segments lost due to the anomaly of the Ka Band antenna.

Start time		Stop time		Duration	Start Orbit	Stop Orbit	Measurement
Date	UTC	date	UTC	sec			
02-SEP-2006	9.37.15	02-SEP-2006	9.37.29	14	23565	23565	NORMAL
05-SEP-2006	18.56.26	05-SEP-2006	18.57.02	36	23614	23614	NORMAL
07-SEP-2006	15.46.20	07-SEP-2006	16.36.56	3036	23641	23641	NORMAL
19-SEP-2006	21.02.04	19-SEP-2006	21.06.08	244	23816	23816	NORMAL
20-SEP-2006	2.07.42	20-SEP-2006	2.07.56	14	23819	23819	NORMAL
20-SEP-2006	12.11.17	20-SEP-2006	12.11.32	15	23825	23825	NORMAL
21-SEP-2006	3.12.51	21-SEP-2006	3.16.55	244	23834	23834	NORMAL
21-SEP-2006	8.18.07	21-SEP-2006	8.18.43	36	23837	23837	NORMAL
21-SEP-2006	18.18.15	21-SEP-2006	18.22.19	244	23843	23843	NORMAL
25-SEP-2006	17.52.24	25-SEP-2006	17.56.28	244	23900	23900	NORMAL
26-SEP-2006	19.01.23	26-SEP-2006	19.05.27	244	23915	23915	NORMAL
26-SEP-2006	20.44.11	27-SEP-2006	7.34.28	39017	23916	23922	NORMAL
27-SEP-2006	20.13.50	28-SEP-2006	2.22.29	22119	23930	23933	NORMAL

During the reporting period no missing intervals (due to PDS unknown failures) were observed during the LOS weekly measurements (MIP_LS__0P). Two measurements segments were lost due to the planned decontamination period.

2.2.4 LEVEL 0 PRODUCTS STATISTICS

The MIPAS mission is currently planned with a limited duty cycle (30 – 40 %); this measurement scenario was suggested by Astrium for instrument safety. In the last months due to the new operation instrument stability the MIPAS Science Team in agreement with industry and ESA decided to increase the duty cycle of the instrument by slightly change the mission planning, in particular starting from July 2006 the following corrective actions were implemented for increasing the duty cycle:

- Planning of 6 orbits/day during mission campaign instead of 4 orbits/day, increasing the duty cycle from typically 30% to 42%.
- Reduce the frequency of the IDU re-initialization from once per orbit to one every three orbits during the 3 days-on/4 days-off operations.

During September 2006 the instrument operated with a duty cycle of about 32%. As already cited in the previous paragraph this low duty cycle is due to the planned instrument decontamination and the PLSOL. The instrument availability disregarding the planned decontamination period is equal to 89.44 % of the planned measurement time. The missing intervals due to PDS unknown failure were about 9% of the planned time, most of them were due to the anomaly of the Ka Band. The MIP_NL__0P products statistics are reported in the following table.

Table 3 MIPAS MIP_NL__0P products statistics during September 2006.

		Time [sec]
Total time over one month	t_{tot}	**2592000**
Time of planned measurements	t_{plan}	**837870**
Time of expected measurements	t_{exp}	**749365**
Time of L0 gaps	t_{L0gaps}	**65507**
Time of instrument unavailability	$t_{unav} = t_{plan} - t_{exp}$	**88505**
%Time of duty cycle	$(t_{plan} / t_{tot})*100$	**32,33**
% Time of Instrument availability (not-planned instrument unavailability)	$[1- t_{unav} /t_{plan}]*100$	**89,44**
% Time of L0 availability (PDS failure)	$[(t_{exp} - t_{L0gaps})/t_{exp}]*100$	**91,26**
% Total time of L0 availability (PDS failure + not planned unavailability)	$[(t_{exp} - t_{L0gaps})/t_{plan}]*100$	**81,62**

2.3   Instrument monitoring

2.3.1   THERMAL PERFORMANCE

The following two plots (Figure 1 and Figure 2) show the long-term trends of the IDU and MIO base plate temperature (analysis performed by Astrium). The yearly seasonal variations and the interferometer heater switching (see Tab. 5 for the schedule of heater switch-on/off) are clearly visible within these plots. In particular the switching-on of the INT heater during 17 October 2005 produces an increase of almost 5K of the MIO and IDU temperature. The increase of temperature significantly improves the INT performances from October 2005 up to January 2006.
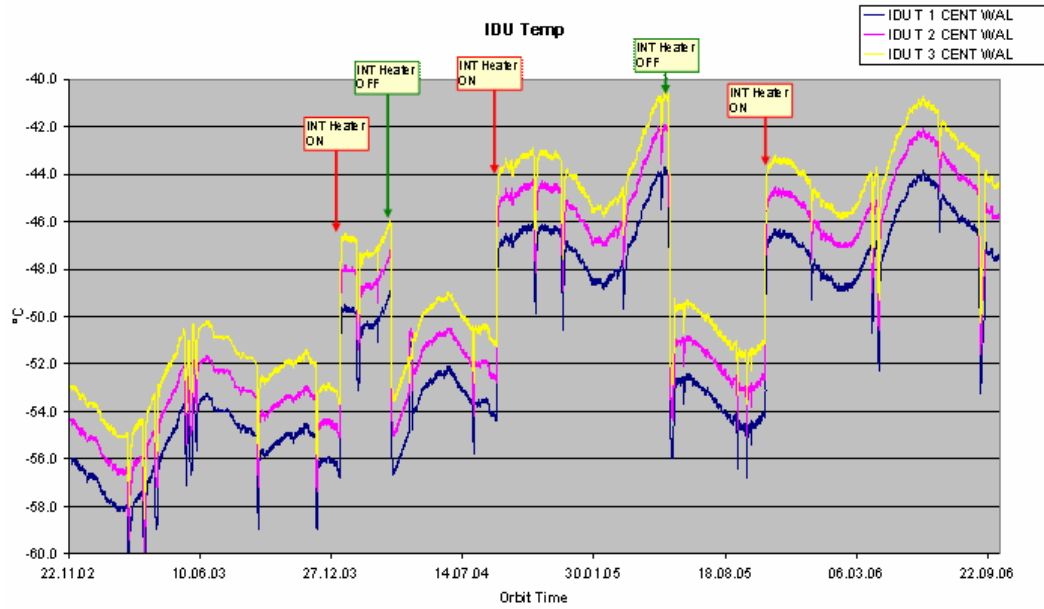
Figure 1 IDU temperatures as a function of time: November 2002 – September 2006 (courtesy of Astrium).
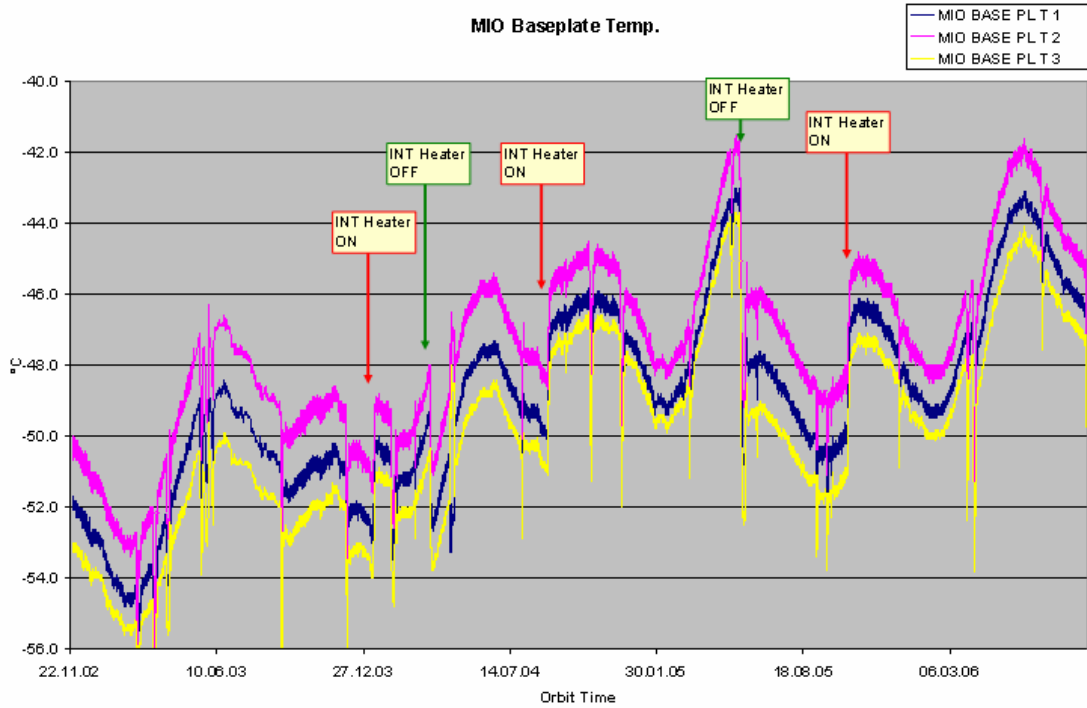
Figure 2 MIO base plate temperatures as a function of time: November 2002 – September 2006 (courtesy of Astrium).

The time of switch-on of the INT heater are reported in the following table.

Table 4 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

The monthly monitoring of the instrument temperatures is reported in the following plots, which show the IDU, MIO, CBB and FCA radiator temperatures. The effect of the planned decontamination can be observed in these plots and consists in an overall decrease of all the temperatures by few degrees, due to the better performance of the cooler after the decontamination.
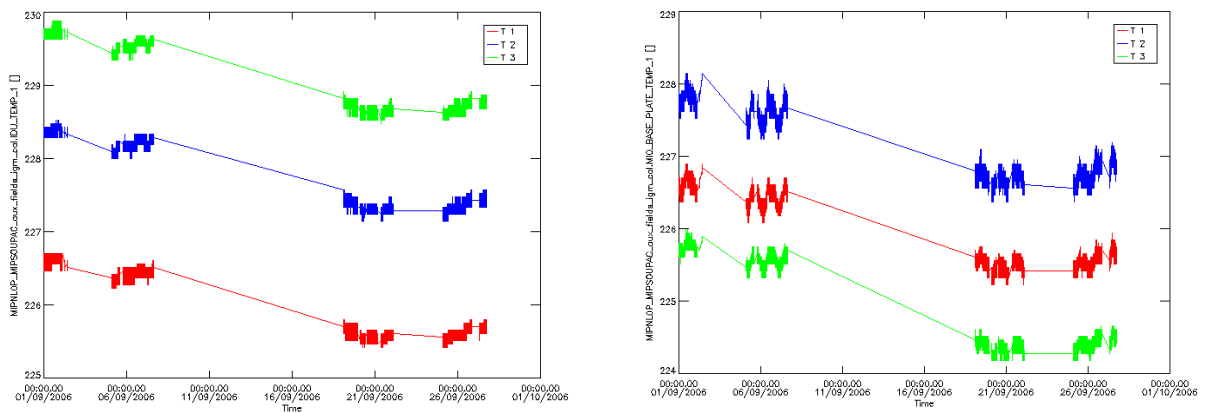
Figure 3 IDU and MIO Base-Plate temperature during reporting period: September 2006.
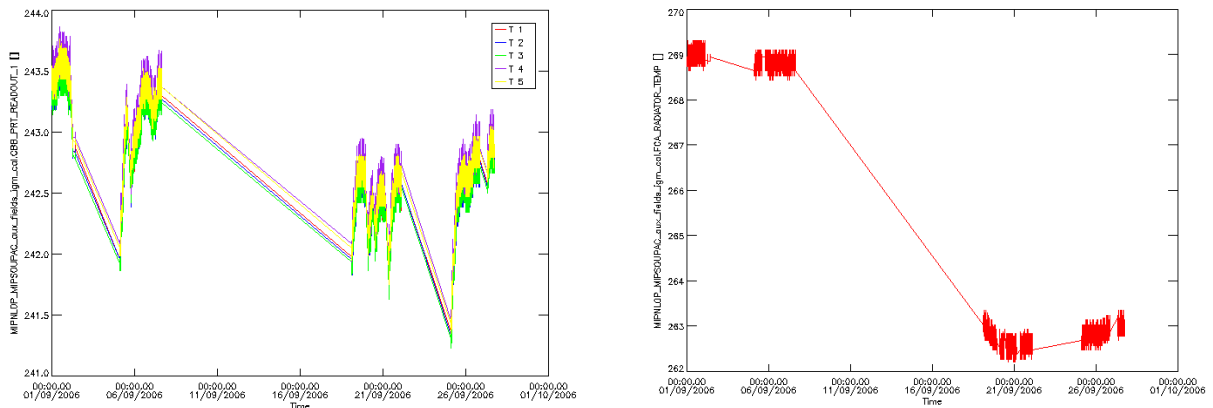
Figure 4 CBB and FCA radiator temperature during reporting period: September 2006.

2.3.2   ADC COUNTS LONG-TERM MONITORING

A new analysis was proposed during the MIPAS QWG#10, it consists in the long term monitoring of the ADC Min/Max counts along the mission. The ADC counts will be monitored only for deep-space measurements, when the instrument is looking at the cold space; in fact for the rest of the measurement modes this value depends upon the measurement scenario (e.g. when looking down in the atmosphere the signal increases). The monitoring of ADC counts could give interesting insight into different instrument-related topics such as self-emission, forward/reverse effects, detector non-linearity and gain increase.

The long term trend of the ADC max counts in channel A1 since last decontamination (June 2005) is shown in Figure 5. In this figure the seasonal variation of the instrument thermal condition is clearly visible; in fact this ADC counts curve matches really well the instrument temperature long term trend (see previous paragraph), showing the influence of instrument self-emission. The split of the curve in two is due to the forward/reverse effect and is a well known behavior, according to A. Kleinert (IMK).

The effect of the passive decontamination of 7 – 19 September is clearly visible in Figure 5 and it is highlighted in the zoom on the right side. The ice removal causes, as expected, an increase of the ADC maximum counts.
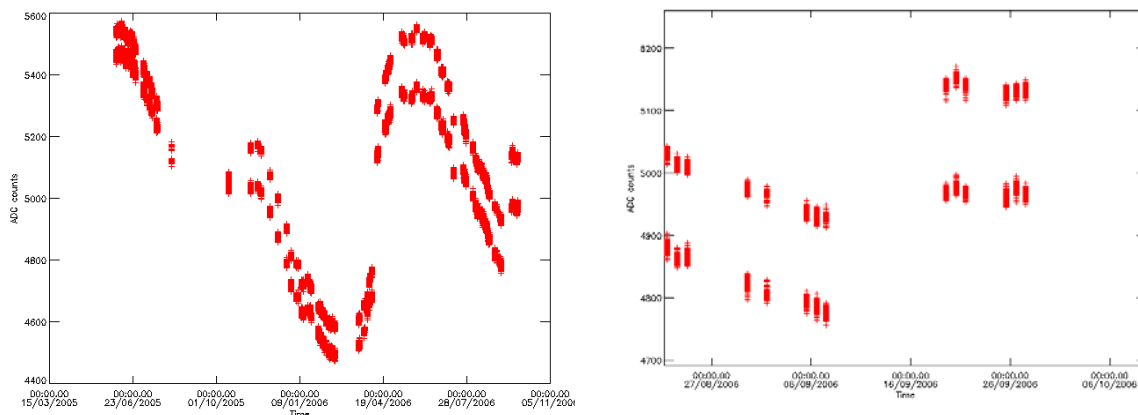
Figure 5 ADC max counts in channel A1 during DS measurements: from June 2005 to September 2006. The effect of the decontamination is highlighted in the zoom on the right.

2.3.3   INTERFEROMETER PERFORMANCE

The historical record of the INT velocity errors and the differential speed errors since July 2005 can be seen in the Figure 6 and Figure 7 (analysis carried out by Astrium). In this figures the very bad periods of August 2005, October 2005 and February 2006 can be distinguished. During these periods the INT velocity errors occurred with high frequency and the differential speed errors reached the maximum value of about 70%. It has been noted that when this parameter reaches this

value the number of turnaround anomalies starts to increase significantly. The positive effect of the heater switch-on (end of October 2005) can be appreciated within these plots with a significant reduction of the velocity errors occurrence and a drastic reduction of differential speed errors. Moreover the impact of the ENVISAT anomaly of 6th April 2006 is manifest, this anomaly yields to improved cooler performances, due to the not intended decontamination and reflects into a significant improvement of the INT performances with a reduction of slide errors occurrence.

The effect of the decontamination of September 2006 is not clearly visible within these plots; however it should be stressed that the instrument performances were already very good before the decontamination and the situation is not changed afterward.
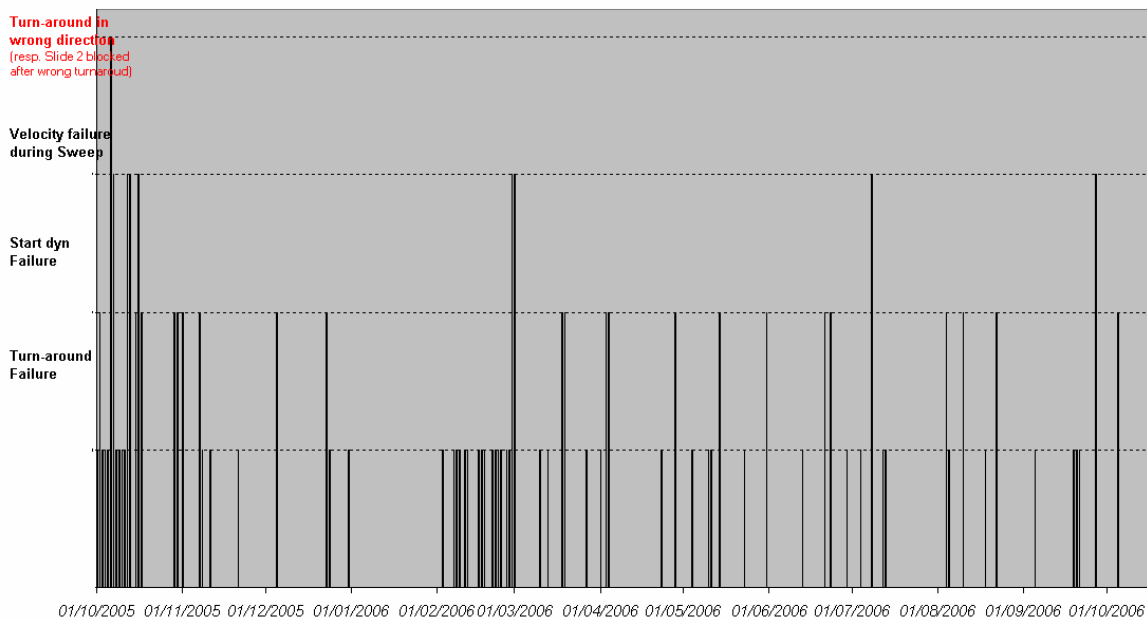
Figure 6 INT anomalies since Oct 2005 (courtesy of Astrium).
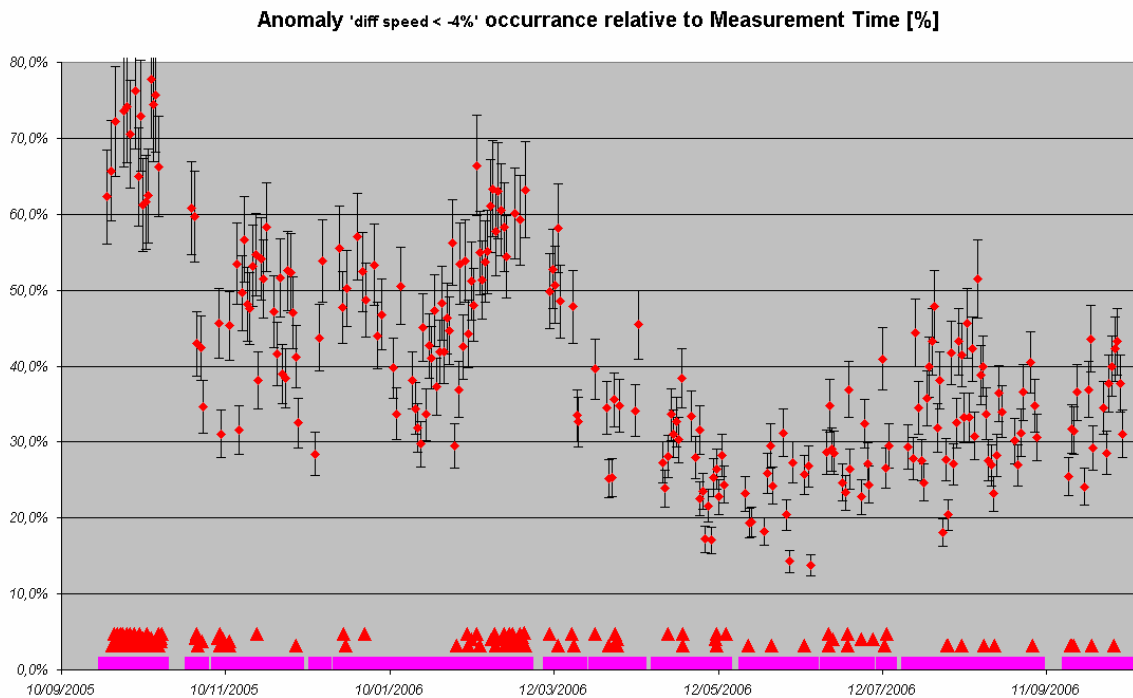
Figure 7 Occurrence of -4% differential speed error relative to measurement time since January 2005 (courtesy of Astrium).

2.3.4   COOLER PERFORMANCE

The Figure 8 shows the cooler displacer and compressor vibration level from start of mission (analysis performed by Astrium). It can be noticed the evident increase in compressor vibration level during March – April 2005. An analysis done by Astrium reveals that the MIPAS cooler was not well balanced. After the decontamination (23 May – 1 June 2005) and the INT heater switch-off, the cooler performs extremely well, the vibrations levels remain stable and well below the warning threshold of 8 mg. In Figure 8 it can be seen also the effect of the switch-on of the INT heater during end of October 2005, this determines a slight increase of the compressor vibration by about 1 mg. After the ENVISAT anomaly of 6th April 2006, with all the payload devices switched off, we observed an important improvement in the cooler performances with a reduction of the compressor vibration level of about 1 mg. The increase of vibration levels observed since May 2006 is nominal and is due to the warming environment in this part of the year.
The decrease of cooler vibration by 1 mg after the decontamination of 7 – 19 September is also visible within this plot.
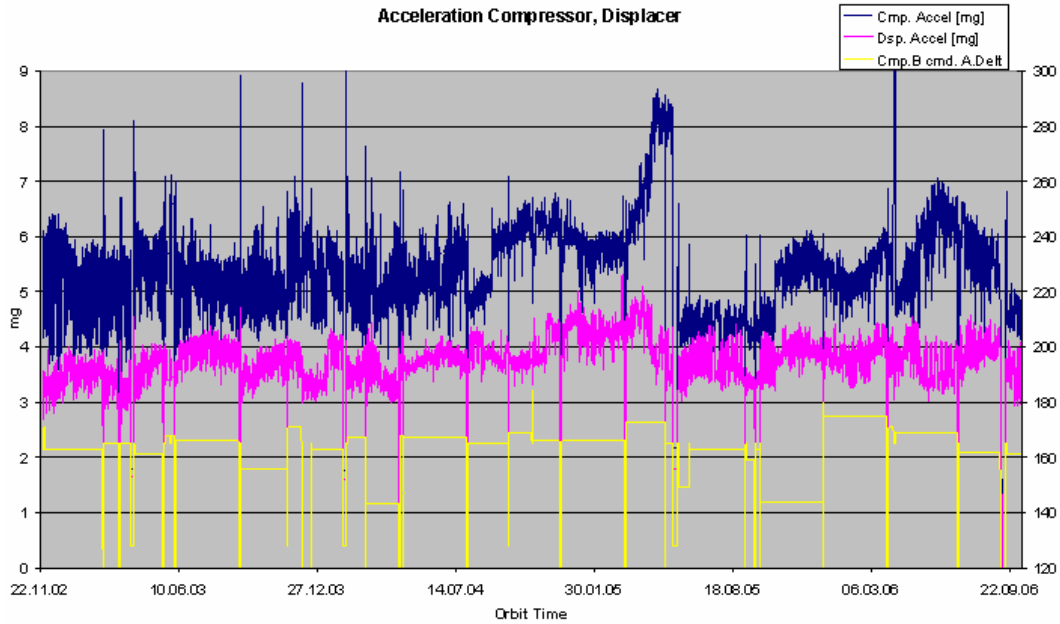
Figure 8 Cooler Displacer and Compressor vibration level, historical trend from 2002 (courtesy of Astrium).

The performances of the cooler during the reporting period were nominal with vibration values well below the observation warning level of 8 mg, as can be seen in Figure 9, in this figure the effect of the decontamination of 7 – 19 September is clearly visible with a reduction of about 1mg of the cooler vibration. Moreover the orbital-dependent spikes are now significantly reduced (see Figure 10).
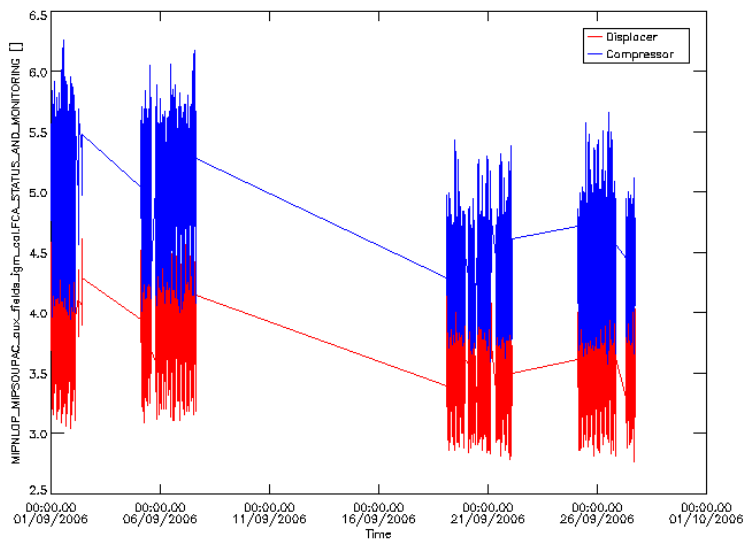
Figure 9 September 2006: Cooler Displacer and Compressor vibration level.
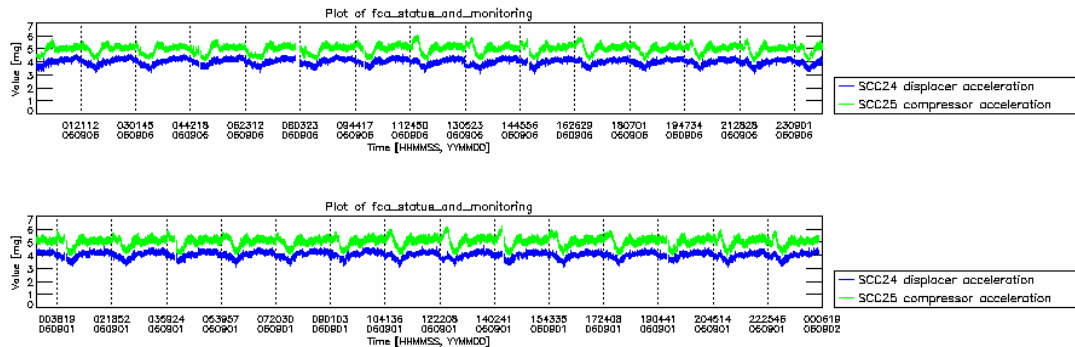
Figure 10 Cooler Displacer and Compressor vibration level observed on 6th and 25th September 2006.

2.4   Level 1b product quality monitoring

2.4.1   PROCESSOR CONFIGURATION

2.4.1.1 Version

The new IPF 4.67 was put into operations at D-PAC on 4th September 2006. This new processor corrects for five NCRs with respect to the previous version (v4.65), further details about this release are reported in ***Appendix B and G***. It is important to stress that this new release does not impact the scientific L1 products, in fact the modification implemented for L1 processing are only operational issues related to processing performances on D-PAC machine. On the contrary for L2 processing important upgrades were introduced in order to fix two important anomalies (the high NO2 chi-square value and the difference between 4.61 and 4.62 results).

The table below shows the list of IPF updates and the aligned prototype, DPM, IODD and the related NCR/SPRs.

Table 5 Historical updates of MIPAS processor, related prototype, DPM, IODD and NCR/SPR.

IPF Version	Prototype		DPM		IODD		Processor update	
	L1 Migsp	L2 Ml2pp	L1	L2	L1	L2	Level 1	Level 2
4.67	2.6	4.0	4Ia	4.1	4E	4.0	**Fixed NCR_1594** **Fixed NCR_1676**	**Fixed NCR_1458** **Fixed NCR_1521** **Fixed NCR_1522**
4.65	2.5	4.0	4I	4.1	4E	4.0		**Fixed NCR_1310**

4.64	2.5	4.0	4I	4.1	4E	4.0	Fixed SPR-121O0-2011	
4.63	2.5	4.0	4I	4.1	4E	4.0	Fixed SPR-120O0-2000: Fixed SPR-120O0-2001	Fixed NCR_1278 Fixed NCR_1308 Rejected NCR_1310 Rejected NCR_1317
4.62	2.5	4.0	4H	4.0	4E	4.0	Fixed NCR_1157 Fixed NCR_1259	Fixed NCR_1128 Fixed NCR_1275 Fixed NCR_1276

The historical updates in the MIPAS L1 processor are detailed in **Appendix B** with all the information on the related NCRs and SPRs.

The Figure 11 shows the alignment between the measurement mode (high resolution, reduced resolution with 17 sweeps and reduced resolution with 27 sweeps) and the corresponding valid IPF and ADF for the L1 and L2 processing.
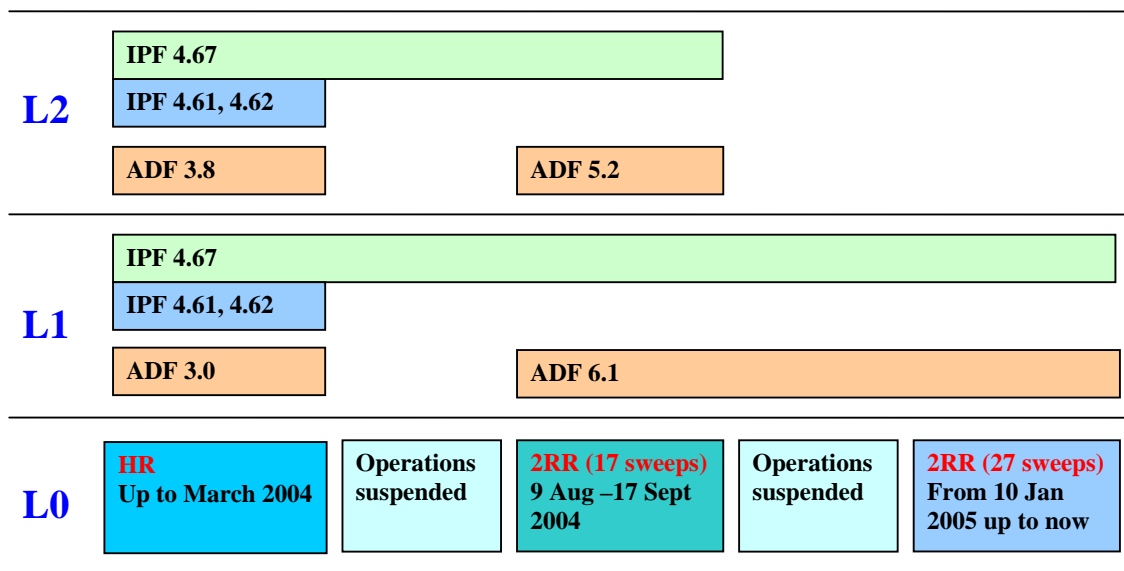
Figure 11 IPF validity and ADFs version for processing level 1 and level 2 products. IPF 4.62 – 4.61 were used for re-processing of FR mission, while the IPF 4.67 is now operational at D-PAC for OFL processing of RR mission.

The historical update of the IPF at each processing site is shown in the following table.

Table 6 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	**V4.67**	**04-09-2006**
D-PAC	V4.65	09-02-2006

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

2.4.1.2 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 analyzed 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 2006 are listed in the following table.

Table 7 Level 1 ADFs valid in September 2006.

Auxiliary Data File	Start Validity	Stop Validity	Updated during the reporting period
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_AXVIEC20050420_152028_20050420_095747_20100420_095747	20-APR-05	20-APR-10	No
MIP_CS1_AXVIEC20060921_161418_20060919_000000_20110919_000000 MIP_CG1_AXVIEC20060921_161412_20060919_000000_20110919_000000 MIP_CO1_AXVIEC20060921_161428_20060919_000000_20110919_000000	19-SEP-06	19-SEP-11	Yes
MIP_CS1_AXVIEC20060927_151524_20060925_000000_20110925_000000 MIP_CG1_AXVIEC20060927_150559_20060925_000000_20110925_000000 MIP_CO1_AXVIEC20060927_150102_20060925_000000_20110925_000000	25-SEP-06	25-SEP-11	Yes

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

Table 8 Historical deliveries of level 1 ADF by Bomem

ADFs Version	Updated ADF	Start Validity Date	IPF version	Dissemination date
6.1	MIP_PS1_AX	09-Aug-2004	4.63	27-Jun-2005
6.0	MIP_PS1_AX	Not disseminated	4.63	-
5.0 draft	MIP_PS1_AX	Not disseminated	4.63	-
4.1 TDS6	MIP_PS1_AX	09- Aug-2004	4.63	15-Mar-2005

4.0 draft	MIP_PS1_AX	Not disseminated	4.62	-
3.2	MIP_PS1_AX	26-Mar-2004	4.61	21-Apr-2004
3.1	MIP_PS1_AX	09-Jan-2004	4.61	17-Mar-2004
3.0	MIP_CA1_AX MIP_MW1_AX MIP_PS1_AX	April-2002	4.61	4-Nov-2003

2.4.2   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). Figure 12 gives the variation trend over the RR mission (from August 2004). We observe a very stable situation since the variations are of the order of 3 ppm over almost two years of operations. An overall decrease of the SCF can be observed since August 2004, this is a nominal situation that was already observed for the FR mission and is due to the aging of the laser metrology.
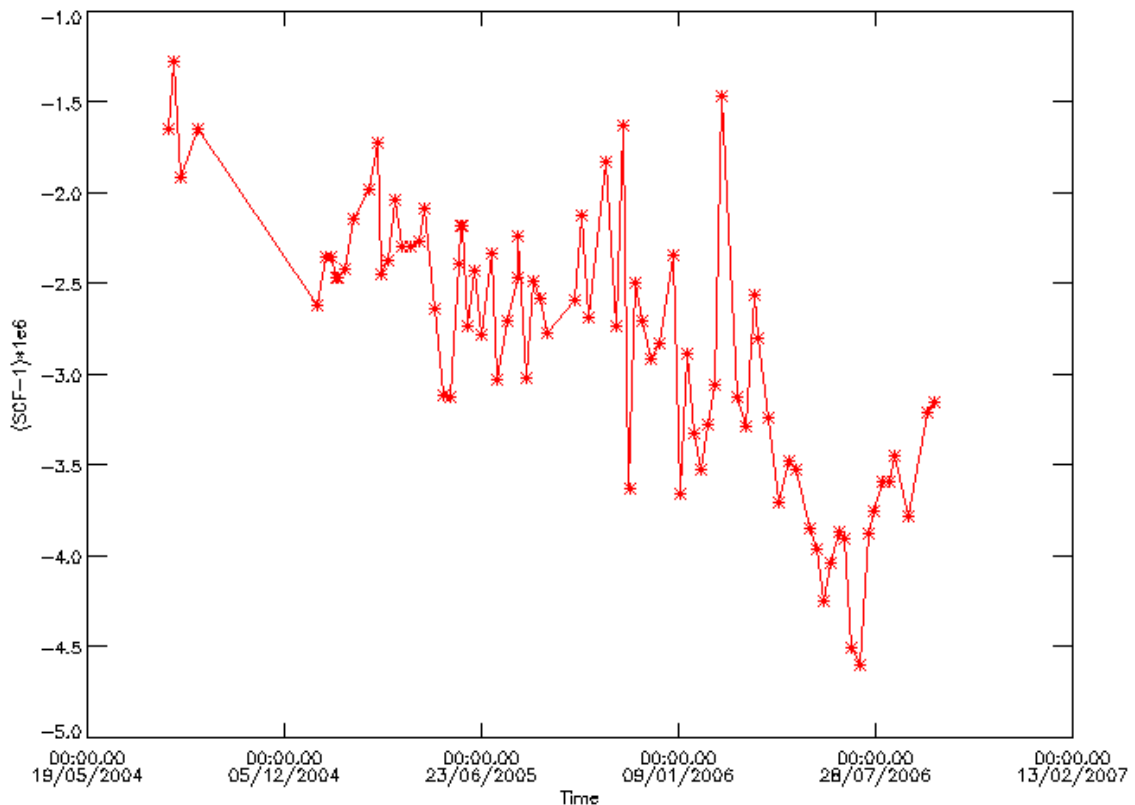
Figure 12 MIPAS Spectral Calibration Factor (SCF) during RR ops updated to end of September 2006.

2.4.3   RADIOMETRIC PERFORMANCE

The radiometric calibration is performed on a weekly basis, furthermore the gain is always updated after long mission interruption (planned or not planned), in case of instrument anomalies or when the instrument environment conditions changes (e.g.: heater or cooler switching). The maximum of the gain increase between two consecutive disseminated gains in the band A (where we expect the maximum of gain variation due to ice contamination) is carefully monitored. The weekly increase of gain is expected to be around 1% at its maximum.

2.4.3.1 Weekly monitoring

During September 2006 the weekly gain trend was nominally monitored. The Figure 13 shows the plots of gain and the gain relative changes for this month. Only two gains were disseminated during this month due to the long mission interruption induced by the PLSOL and the decontamination. The decontamination of 7 – 19 September induces a reduction of the gain by more than 10% with respect to a gain before the decontamination as can be seen in Figure 13.
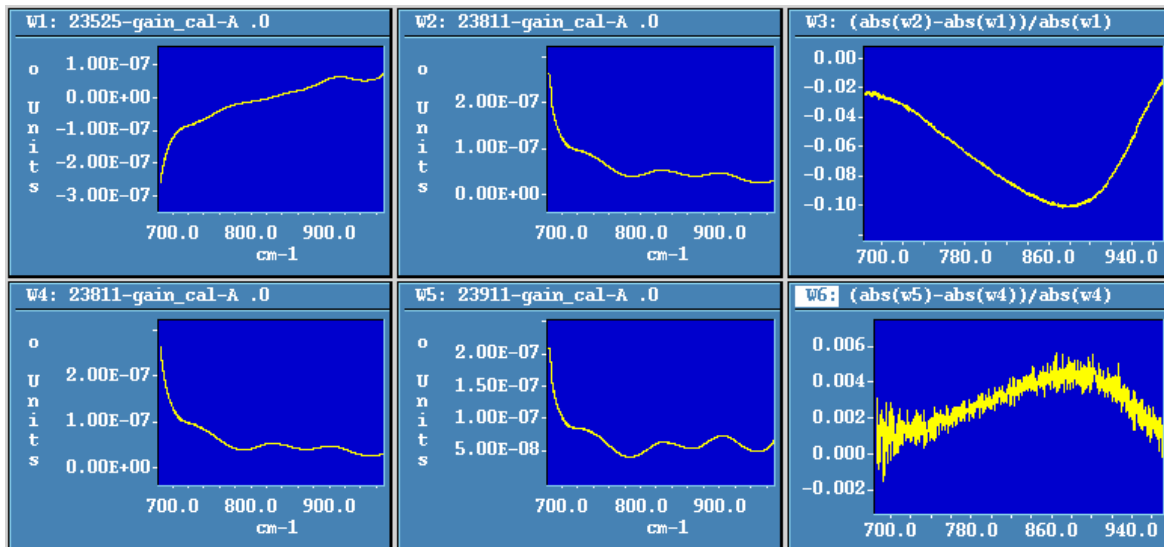
Figure 13 Relative variations of radiometric gain for consecutive disseminated gains in band A during September 2006 operations. The first two plots in each row are the imaginary part of the gain plotted versus the wave-number, the third plot is the ratio: (abs(w2)-abs(w1))/abs(w1), which gives the gain increase with respect to the reference w1 (last disseminated ADF). The check is satisfied when the gain is lower than the warning threshold of 0.01 (1%).

The maximum increase of gain is obtained as the maximum of the curves of weekly gain variation *(abs(w2)-abs(w1))/abs(w1))* of Figure 13. The maxima of consecutive gain variation are reported in Table 9; in this table is also reported the long term increase, in this case as scaling factor we use a reference gain corresponding to very low contaminated condition. In this table it can be seen that the decontamination performed during 7 – 19 September causes a decrease of the gain by 10.16% at its maximum. Owing to this decontamination we decided to update our reference gain for the long term analysis, using orbit #23811 as reference point from now on. This decision was taken also because the gain curve changes significantly after the decontamination and the maximum was not

anymore representative of the gain variation over time, being its location confined to the edges of the band A, while the ice contamination is expected to be more important around 800 cm^{-1}.

Table 9 Weekly and long term (since June 2005) gain increase for gains disseminated in September 2006

Orbit #	Date	Weekly max increase (%)	Long term max increase (%)
23811	19/09/2006	-10,16	
23911	26/09/2006	0,56	0,56

2.4.3.2 Monthly monitoring

The long term plot of gain changes between two consecutive disseminated gains since January 2005 is shown in Figure 14; in this figure the maximum gain is normalized with respect to the time in order to avoid for artifacts due to different time intervals between consecutive gains. The acceptance criterion of 1% weekly increase is highlighted with the dotted line (it corresponds to 1% of increase in one week). The very high increase of gain during Jan-May 2005 operations can be seen in this figure. After the decontamination (end of May 2005) the gain rate suddenly decreases and it remains usually lower than the acceptance level unless some spikes corresponding to the INT heater switch-on, to the instrument anomaly of 28th March 2006 and to the PLSOL of 6th April 2006.

In Figure 14 the gain decrease caused by the decontamination of September 2006 is not plotted. After this decontamination the weekly increase shows to be well below the acceptance criterion of 1%/week.
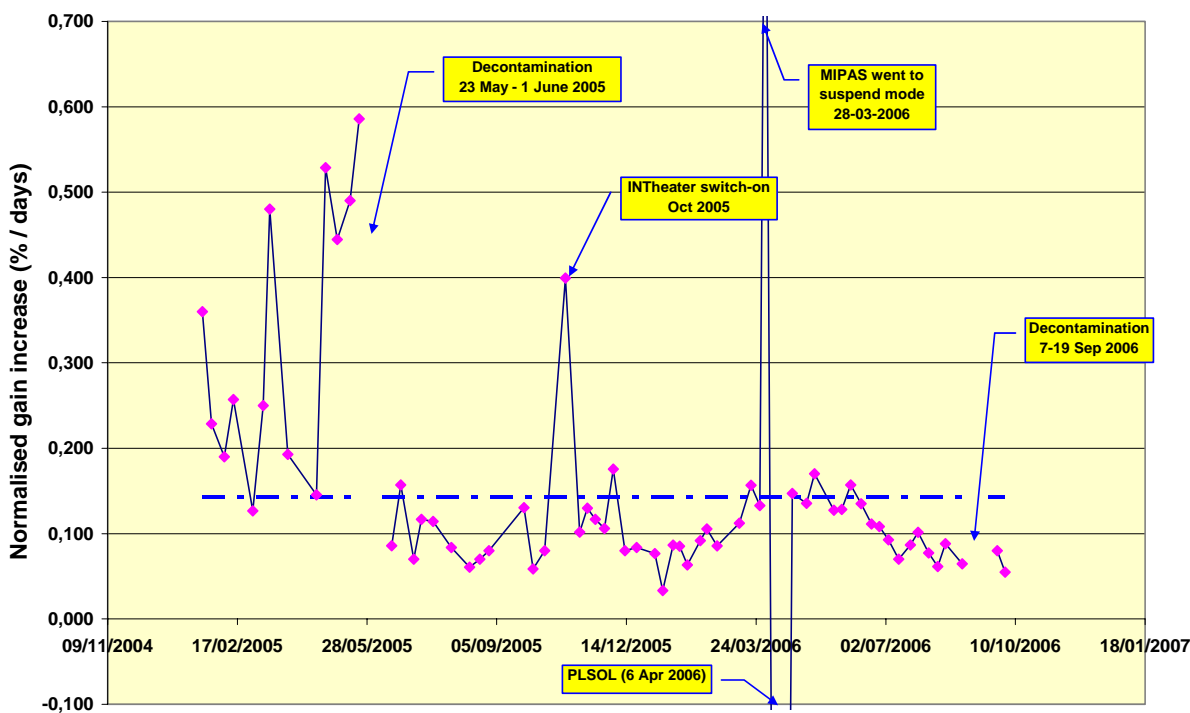
Figure 14 Gain maximum increase normalized to the time difference between consecutive disseminated gains since January 2005.

The long term monitoring of gain accumulation increase since Jan 2005 is presented in Figure 15. This plot shows the increase of gain taking as reference the first calibration orbit of Jan 2005 for the period Jan – May 2005 and the first orbit of June 2005 up to September 2006. As discussed in the previous paragraph the reference gain was updated after the decontamination of 7 – 19 September 2006. This long term investigation is useful in order to plan possible decontamination along the mission. As suggested by M. Birk (DLR) decontamination should be planned when the gain has increased by more than 20% in order to prevent NESR value to become not acceptable for level 2 products retrieval accuracy. We can observe in Figure 15 the very high increase of gain during the period Jan – May 2005. At the end of May the gain increase reached a value of about 60%. The situation was resolved with the decontamination of June 2005. Since then the gain has increased with a linear rate, except for some sudden changes due to the INT heater switch-on of October 2005 or to instrument unavailability. A maximum value of 28% was reached at the beginning of April 2006. At this point the PLSOL causes a sort of passive decontamination, due to a warming up of the detector while the cooler was switched off. As a result the gain increase was dramatically reduced by more than 25%. After this non intended decontamination due to the payload switch-off, the gain increase was perfectly linear up to September 2006 demonstrating the improved cooler performances after the PLSOL.

The decontamination performed on 7 – 19 September 2006 causes a decrease of gain of about 10% as already reported in the previous paragraph. Starting from this point the reference gain was updated to the first gain orbit after the switch-on (#23811).
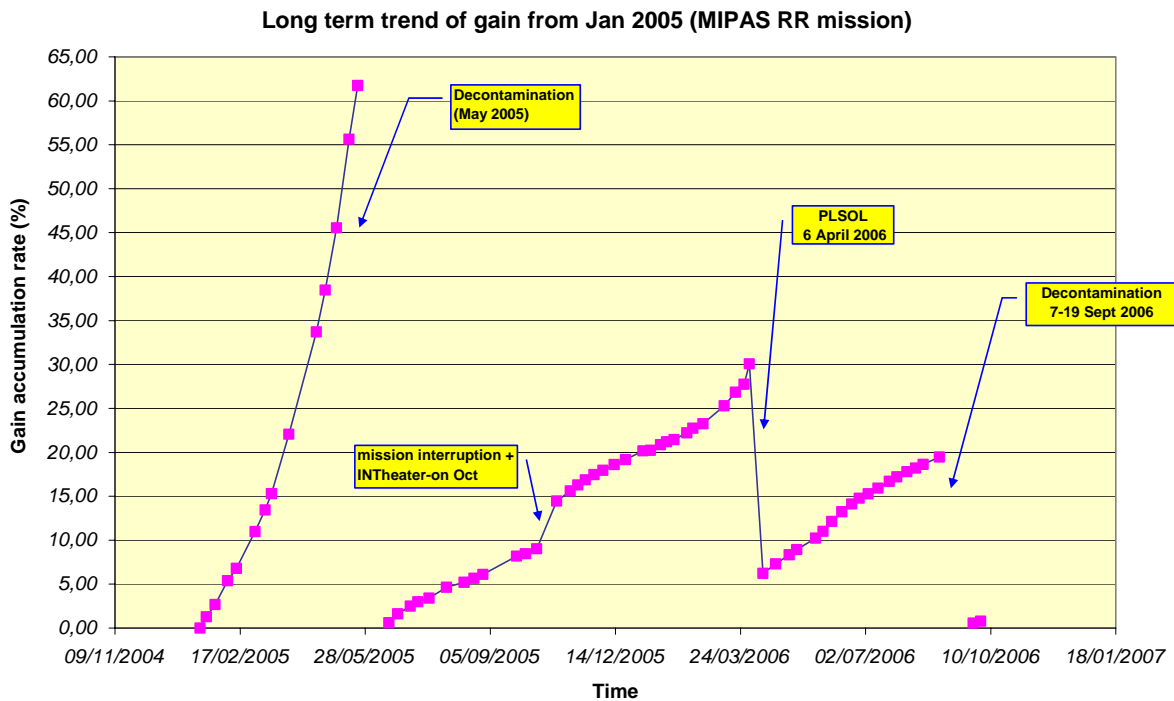
Figure 15 Gain accumulation increase since January 2005.

2.4.3.3 Interpolated gains

During the period January-May 2005, a strong gain increase was observed in the gain variation, as observed in the previous paragraph. 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.

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 weekly increase to be lower than 1%. This gain reprocessing has been done with the support of Bomem and the results are reported in **Appendix D**.

2.4.4 POINTING PERFORMANCE

The LOS calibration measurements are performed every week and the mispointing is analyzed on a bi-weekly basis. This plan allows the pointing stability to be analyzed and guarantees the availability of the data in case of missing products. The baseline for LOS calibration is now that the absolute bias is compared to the last disseminated one, then a new LOS calibration ADF is disseminated only if the difference between the two bias is a higher than **8 mdeg**.

The long term trend of mispointing since start of mission is reported in Figure 16. The figure shows the relative and the absolute pointing error (evaluated taking into account the commanded elevation angle for the LOS calibration). The very pronounced annual trend at the beginning of the mission was 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, after the update of the pointing software (December 2003) the deviation trend was drastically reduced.

During September 2006 operations, the LOS calibration could not be performed nominally since two weekly measurements were lost due to the decontamination and the PLSOL and two other were not planned due to the quick change of the planning after the PLSOL. The table below shows the LOS calibration made on the 2nd September. During the last year of operations the relative bias seems to be stable around a value of few mdeg, indeed the last disseminated LOS ADF was on March 2005.

Table 10 LOS calibration performed on July 2006.

Date	Orbit #	Relative bias [deg]	Absolute bias [deg]
2/9/2006	**23564**	0,004855	-0,025145
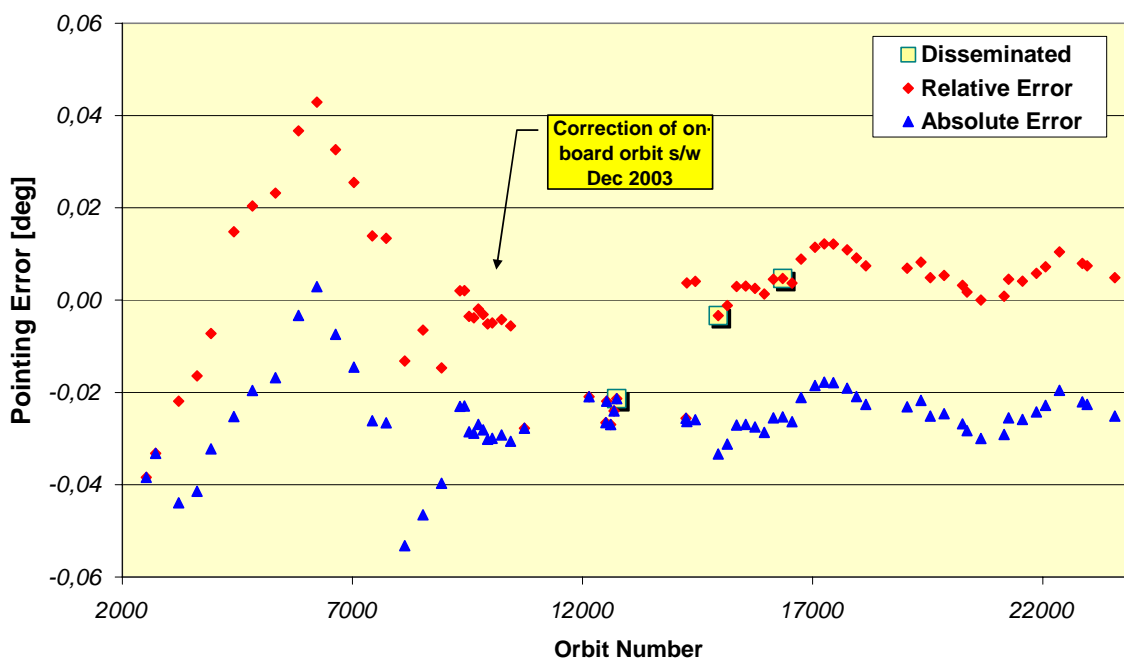
Figure 16 MIPAS long-term pointing error as a function of the orbit: September 2002- September 2006.

As can be seen in Figure 16, there are points where the relative and absolute errors coincide because the angle for LOS measurements has been commanded to 0 mdeg. Table 11 shows the history of the commanded angle for LOS measurements.

Table 11 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.

2.4.5   QUALITY CONTROL OF L1 OFL DATA

The quality control of L1 data processed at D-PAC is going-on in parallel with the OFL processing, the L1b daily report are uploaded on the web as soon as they are generated, they can be accessed at the following address:

http://earth.esa.int/pcs/envisat/mipas/reports/daily/Level_1_OFL/

These daily monitoring shows an overall good quality of the L1b processed data.

A long term monitoring of the fringe count errors (FCE) is going to be reported from now on in the MR. The number of fringe count represent the number of points for which the measurement IGM should be translated in order to match the reference IGM (the closest disseminated gains). This long term monitoring aims at the verification of the stability of this parameter over time; furthermore this analysis is useful in order to verify if any correlation exists with the INT performances degradation. The long term plot of FCE is presented in Figure 17. In this plot the number of fringe count are plotted for each sweep (+ and –represent the forward/reverse measurement). No evident trend can be observed over more than one year of mission.
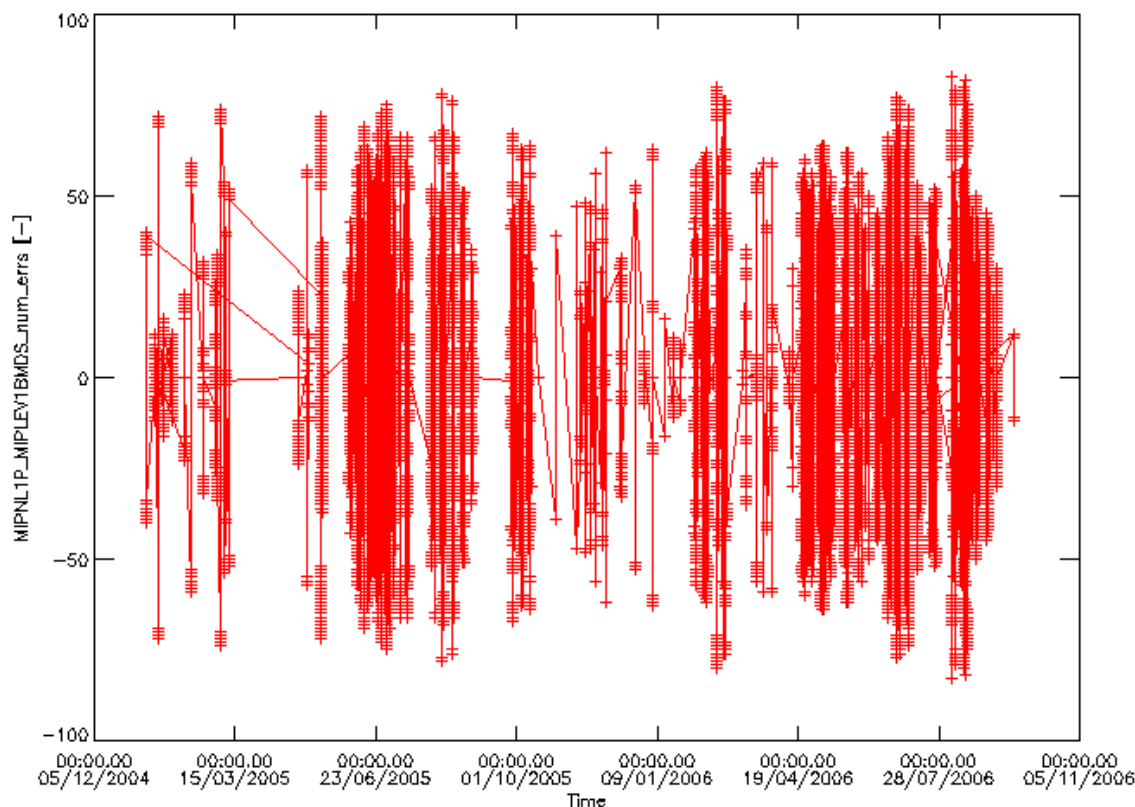
Figure 17 MIPAS long-term FCE values: January 2005 - September 2006.

2.4.6   LEVEL 0 AND LEVEL 1 ANOMALY STATUS

The following table summarizes the anomalies affecting Level 0 and Level 1 products and shows the associated SPR, NCR, OAR and HD code. No new anomalies were observed during the reporting period, more details on anomalies investigation are reported in *Appendix F (§3.6)*.

Table 12 Level 0 and Level 1 anomaly list. Refer to the appendices for further details on anomaly investigation.

Anomaly	Proto/DPM SPR	IPF NCR	OAR	HD	Status	Ref.
MIPAS wrong consolidated products	/	/	2097	/	Closed	§3.6.1
Excessive number of MISSING ISPS in the MPH for MIPAS L0 products	/	/	2165	/	Closed and merged with OAR 342 (RA-2)	§3.6.2
Non-valid band A at the same geo-location	/	1594	2263	/	Closed To be corrected in IPF 4.67	§3.6.3
Wrong MIPAS L1 product in D-PAC server	/	/	2303	/	Closed and merged with OAR-2009, OAR-1845	§3.6.4
Badly calibrated L1 b spectra during 3 – 23 June and 29 July – 11 Aug 2005	/	/	/	/	Closed	§3.6.5
MIPAS Aircraft Emission measurements	/	/	/	/	Ongoing	§3.6.6

2.5   *Level 2 product quality monitoring*

2.5.1   PROCESSOR CONFIGURATION

2.5.1.1 *Version*

The list of IPF updates and the aligned DPM and the related NCR/SPRs is presented in the paragraph 2.4.1. The historical updates in the MIPAS Level 2 processor are listed in detail in *Appendix G*.

2.5.1.2 *Auxiliary Data Files*

This paragraph reports the historical update of the level 2 ADF. The latest delivery for processing FR mission is the v3.8, whereas for the processing of RR data of Aug 2004 the latest delivery is the v5.2. The ADF version 5.2 was used for the L2 processing of RR not over-sampled data (Aug – Sept 2004). Further details on the Level 2 ADF deliveries provided by IFAC are reported in *Appendix H*.

Table 13. Historical update of Level 2 configuration ADFs.

Version	Date of delivery	List of files upgraded by IFAC	Main modifications
ADF V5.2	05.12.2005	MIP_SP2_AX_V5.2 MIP_OM2_AX_V5.2_october	Correct for a bug in the binary conversion of these two ADF. The ascii version of these files was correct then it was just a problem in the binary conversion of the ADF.
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.
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 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 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.

2.5.2   QUALITY CONTROL OF L2 OFL DATA

A quality control of L2 RR OFL products was carried out at ESRIN, showing an overall good quality of the level 2 data. To see all the L2 OFL daily reports of RR mission follow the link below:
http://earth.esa.int/pcs/envisat/mipas/reports/daily/Level_2_OFL/
Looking at these daily reports we observe an overall good quality of L2 products. Only one major problem was found in the L2 RR data processed with IPF 4.65 for some orbits recorded during 21 – 22 Aug 2004. The investigation of this problem showed that a corruption in the band D was verified for these orbits. As reported by Astrium the processor flags as corrupted one sweep even though only one band is corrupted. This processor specification seems excessively restrictive in particular in this case, since the band D is not even used in the retrieval.

2.5.3   LEVEL 2 ANOMALY STATUS

The following table summarizes the anomalies affecting Level 2 products and shows the associated SPR, NCR, OAR and HD code. Further details on anomalies investigation are reported in *Appendix*

I (§3.9). Two anomalies were investigated during this month, they are highlighted in orange in the table below.

Table 14 Level 2 anomaly list. Refer to the appendices for more information on the anomaly investigation.

Anomaly	Proto/DPM SPR	IPF NCR	OAR	HD	Status	Ref
Excessive Chi-square	/	1458	1929	/	Closed with IPF 4.67	§3.9.1
Difference on L2 products between v4.61 and v4.62	/	1521	2074	/	Closed with IPF 4.67	§3.9.2
Beatcheck failure on some L2 products	/	1522	2081	HD 2005007448	Closed with IPF 4.67	§3.9.3
NO2 retrieval during polar condition	/	/	/	/	Closed	§3.9.4
L2 OFL missing data around the South Pole	/	/	/	/	Closed	§3.9.5
L2 continuum anomaly	/	/	/	/	Closed	§3.9.6

NEW

2.6 Processing/Re-processing Status

2.6.1 FIRST RE-PROCESSING OF FR MISSION

The first re-processing of the FR MIPAS mission was terminated at D-PAC using IPF software version 4.61, 4.62. All the received consolidated L0 products were processed to L1 and L2. The complete list of L1 and L2 re-processed products at D-PAC (with the corresponding IPF software version) was provided to the QWG and can be found on Uranus ftp server (MIPAS/To_QWG/ DPAC_L1_L2_archive_FR_mission.xls).

2.6.2 L1B PRODUCTS PROCESSED WITH PROTOTYPE

As noted before, no NRT product generation is foreseen for now. Before the start of the OFL processing at D-PAC, some Level 1B products have been generated using the MIGSP 2.5 prototype and delivered to QWG via Uranus ftp server. The complete list of these products is reported on *Appendix E*.

2.6.3 OFL PROCESSING OF RR MISSION

2.6.3.1 Level 1b

The Level 1 processing of RR mission has started at D-PAC the 9th of February 2006 with IPF 4.65. The status of the L1 processing updated at the 5th of June is reported in the following table. All these data are available on D-PAC ftp server. The complete list of L1 processed products at D-PAC was provided to the QWG and can be found on Uranus ftp server (MIPAS/To_QWG/ DPAC_L1_archive_RR_mission.xls).

Table 15 L1 OFL processing status.

Period	Status
Aug – Sept 2004	Completed
2005 data	Completed
2006 data	2006-01-01 → 2006-09-20

2.6.3.2 Level 2

The level 2 processing of RR mission at D-PAC has started the mid of February 2006 with the latest processor (IPF 4.65). This IPF is able to process the FR MIPAS mission up to L2 (data before March 2004), furthermore it can process RR data up to L2 for the Aug-Sept 2004 period (17 sweeps for each scan). The L2 processing of all these RR measurement was completed. A total of 158 orbits were processed up to L2. All these data are available on D-PAC ftp server.

Table 16 Measurement segments processed OFL up to Level 2 for RR mission data.

	UTC		Orbit #	
	start	**stop**	**start**	**stop**
1ˢᵗ period	9 Aug 2004 16:42:00	22 Aug 2004 20:41:10	12783	12965
2ⁿᵈ period	16 Sept 2004 12:00:10	17 Sept 2004 22:06:43	13318	13338

3 APPENDICES

3.1 Appendix A - Files transferred to the FOCC

The following files were transferred to the FOCC for the September 2006 planning activities.

MPL_LOS_MPVRGT20060817_141528_00000000_00000219_20060902_061646_20060903_104612.N1
MPL_LOS_MPVRGT20060817_145900_00000000_00000220_20060909_073727_20060910_102641.N1
MPL_LOS_MPVRGT20060817_155159_00000000_00000221_20060916_071737_20060917_100634.N1

daily RGC calibration at ANX=1850 sec, starting from orbit #23525:
MPL_ORS_MPVRGT20060818_104228_00000000_00000139_20060830_132412_20060907_124639.N1

UTLS-1 mode starting in orbit #23604 at ANX=5000 sec:
CTI_E02_MPVRGT20060817_165340_00000000_00000113_20060905_024255_20781231_235959.N1
CTI_E01_MPVRGT20060817_165340_00000000_00000113_20060905_024258_20781231_235959.N1
CTI_AST_MPVRGT20060817_165340_00000000_00000113_20060905_024301_20781231_235959.N1
CTI_N02_MPVRGT20060817_165340_00000000_00000057_20060905_024304_20781231_235959.N1
CTI_S08_MPVRGT20060817_165340_00000000_00000029_20060905_024307_20781231_235959.N1
CTI_NOC_MPVRGT20060817_165340_00000000_00000113_20060905_024310_20781231_235959.N1

NOM mode starting in orbit #23704 at ANX=5000 sec:
CTI_E02_MPVRGT20060817_170522_00000000_00000114_20060912_022248_20781231_235959.N1
CTI_E01_MPVRGT20060817_170522_00000000_00000114_20060912_022251_20781231_235959.N1
CTI_AST_MPVRGT20060817_170522_00000000_00000114_20060912_022254_20781231_235959.N1
CTI_N01_MPVRGT20060817_170522_00000000_00000057_20060912_022257_20781231_235959.N1
CTI_S02_MPVRGT20060817_170521_00000000_00000030_20060912_022300_20781231_235959.N1
CTI_NOC_MPVRGT20060817_170521_00000000_00000114_20060912_022303_20781231_235959.N1

IDU re-initialisation every 3rd orbit at ANX=850 sec, starting from orbit
#23804:
MPL_CAL_MPVRGT20060817_145948_00000000_00000084_20060919_004026_20781231_235959.N1

MA mode starting in orbit #23804 at ANX=5000 sec:
CTI_E02_MPVRGT20060818_094638_00000000_00000115_20060919_020241_20781231_235959.N1
CTI_E01_MPVRGT20060818_094638_00000000_00000115_20060919_020244_20781231_235959.N1
CTI_AST_MPVRGT20060818_094638_00000000_00000115_20060919_020247_20781231_235959.N1
CTI_N02_MPVRGT20060818_094638_00000000_00000058_20060919_020250_20781231_235959.N1
CTI_S04_MPVRGT20060818_094637_00000000_00000029_20060919_020253_20781231_235959.N1
CTI_NOC_MPVRGT20060818_094638_00000000_00000115_20060919_020256_20781231_235959.N1

daily RGC calibration at ANX=5980 sec, starting from orbit #23811:
MPL_ORS_MPVRGT20060818_110102_00000000_00000140_20060912_131535_20060921_131515.N1

UA mode starting in orbit #23833 at ANX=5000 sec:
CTI_E02_MPVRGT20060818_102233_00000000_00000116_20060921_024003_20781231_235959.N1
CTI_E01_MPVRGT20060818_102232_00000000_00000116_20060921_024006_20781231_235959.N1
CTI_AST_MPVRGT20060818_102233_00000000_00000116_20060921_024009_20781231_235959.N1
CTI_N01_MPVRGT20060818_102232_00000000_00000058_20060921_024012_20781231_235959.N1
CTI_S06_MPVRGT20060818_102232_00000000_00000028_20060921_024015_20781231_235959.N1

CTI_NOC_MPVRGT20060818_102232_00000000_00000116_20060921_024018_20781231_235959.N1

RGT files already transferred to the FOCC:
  instrument unavailability:
AVI_UAV_TLVFOS20060908_143404_00000000_00000709_20060922_021431_20061002_003509.N1
...
AVI_UAV_TLVFOS20060908_143659_00000000_00000835_20061112_174238_20061112_223426.N1

3.2   *Appendix B – Level 1 IPF historical updates*

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

- **Version V4.67** the following updates were introduced for L1 processing
  - o Fixed NCR-1522 → The MIPAS IPF (from version 4.61 to version 4.65) generates L1b products with wrong "NUM_DSR" value in the SPH; in particular this value differs by one unit from the "TOT_SCAN" value, while the two should be the same. The L1 prototype doesn't show this anomaly.
  - o Fixed NCR-1676 → This problem was detected at D-PAC during OFL L1 processing of MIPAS RR data; in particular it was observed that the MIPAS IPF 4.65 is violating the shared memory area of PFHS. PFHS performance is seriously affected, because too many manual re-starts become necessary.
- **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

3.3   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 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

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

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

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

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.

3.4   Appendix D – Interpolated gains

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.

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

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 the table below. These 45 MIP_CG1__AX files were used for the reprocessing of the 2005 RR MIPAS mission.

Table 17 List of the gain files to be used during the period of enhanced gain increase of Jan – May 2005, the gain files already disseminated are highlighted 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)

3.5 Appendix E – Level 1b products generated with prototype

The Aircraft Emission measurements of 22 – 24 December 2005 were manually processed in ESRIN with the L1 prototype. The results are on Uranus (in the directory: /MIPAS/To_QWG/Aircraft_Emission/22-24_Dec_2005/). The following orbits were processed and delivered to QWG:

AE ascending
#19925	**MIP_NL_1P_19925**
#19926	**MIP_NL__1b_AE_19926**
#19927	**MIP_NL__1P_19927**
#19938	**MIP_NL__1P_19938.N1**
#19939	**MIP_NL__1P_19939.N1**
#19940	**MIP_NL__1P_19940.N1**
#19941	**MIP_NL__1P_19941.N1**
#19942	**MIP_NL__1P_19942.N1**

AE descending
#19929	**MIP_NL__1P_19929.N1**
#19930	**MIP_NL__1P_19930.N1**
#19945	**MIP_NL__1P_19945.N1**

Note that these L1b files contain the 19 scans of the AE measurement which were performed in the middle of NOM mode, each AE scan contains 17 sweeps.

A further input was provided by BOMEM, it consists of a set of L1b measurements processed with the new level 1 prototype (which is still under development). These L1b products were obtained using two new features of the processor:
- Pointing calibration using restituted attitude ADF (AUX_FRA_AX)
- Truncation of the interferogram (to 8cm) in order to avoid under sampling.

The effect of these new options on the spectra can be assessed; in particular the effect of IGM truncation can be analysed since the same orbit are processed with and without truncation, some feed-back were already given at the last QWG#9.

These files are on Uranus under directory: /MIPAS/To_QWG/TDS_proto_L1/ and the following products can be found:

MIP_NL__1P_10600-RES_ATT.040310	(orbit 10600 from 2004-03-10, Full Res)
MIP_NL__1P_12788-RES_ATT.040810	(orbit 12788 from 2004-08-10, RR 17 sweeps)
MIP_NL__1P_12963-RES_ATT.04822	(orbit 12963 from 2004-08-22, RR 17 sweeps)
MIP_NL__1P_14404-RES_ATT.041201	(orbit 14404 from 2004-12-01, RR 27 sweeps)
MIP_NL__1P_17540-RES_ATT.050708	(orbit 17540 from 2005-07-08, RR 27 sweeps)
MIP_NL__1P_12788_8cm_RES_ATT.040810	(same as before but with truncation of IGM)
MIP_NL__1P_12963-8cm_RES_ATT.04822	(same as before but with truncation of IGM)
MIP_NL__1P_17540-8cm-RES.050708	(same as before but with truncation of IGM)

The following level 1b products were created by running the migsp prototype and were delivered to the QWG via Uranus ftp server (MIPAS/To_QWG/low_res).

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

3.6   Appendix F – Level 0 and Level 1 anomaly status

3.6.1   MIPAS WRONG CONSOLIDATED PRODUCTS

LRAC wrong consolidated L0 products (type "O" from cycle 7, 10, 11; end of 2002) were ingested into the D-PAC database and processed to L1 and L2 anomalous products. There was a bug in the LRAC consolidation at that time, this bug was fixed later and in general is not found in the consolidated "P" products. As a result in D-PAC L1/L2 archive (from the end of 2002) you can find wrong products: the consolidated data are shorter than unconsolidated near-real-time ones (type N).
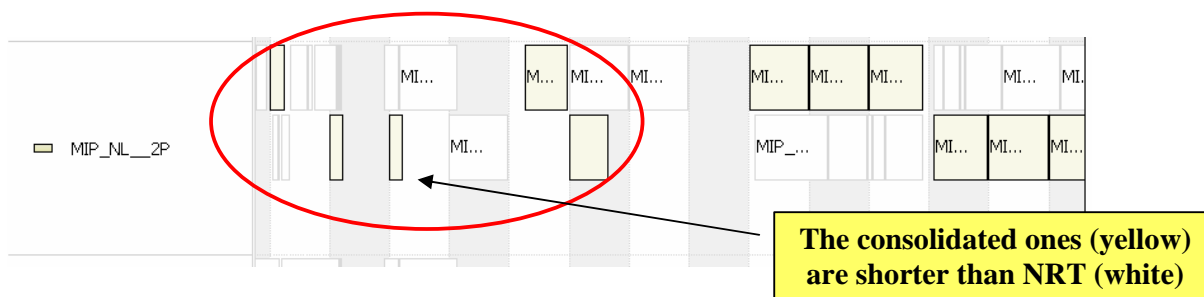

Figure 18 GANNT chart showing the anomaly in the consolidation of L2 "O" products.

The wrong consolidated orbits have been identified; a list was provided to QWG and can be found on Uranus ftp server (/MIPAS/To_QWG/Wrong_MIPAS_consolidated_Products.xls).
These products are going to be deleted from D-PAC and re-consolidated at LRAC. After the re-consolidation the products will be reprocessed at D-PAC.

3.6.2   EXCESSIVE NUMBER OF MISSING ISPS IN THE MPH FOR MIPAS L0 PRODUCTS

Several MIPAS level 0 products have excessive NUM MISSING ISPS in the MPH, while the content of the products is correct. An example of this anomalous number can be found for the following product:

MIP_NL__0PNPDE20060209_020145_000033732045_00032_20627_0104.N1

In the MPH we find:
NUM_MISSING_ISPS=+0002102752
MISSING_ISPS_THRESH=+0.00000000E+00
NUM_DISCARDED_ISPS=+0000000000
DISCARDED_ISPS_THRESH=+0.00000000E+00
NUM_RS_ISPS=+0000000000
RS_THRESH=+0.00000000E+00

From investigation of Task 4 (S. Faluschi) a lot of ssc reset have been found in ISP list prod, the ssc should reset every 16,384 counts (going from 0 to 16383), whilst in this case it resets randomly after 110, 467, 77 ... counts. Every unexpected reset is interpreted by PFHS (processor) as missing ISPs. This is a PFHS nominal behavior, as specified in s/w requirement documents. The same

behavior has been observed and traced for RA2 products, by OAR-342 / NCR-1307. We are going to evaluate if this behavior can be modified in PFHS code, in the meanwhile this OAR was closed and renamed as recurrence of OAR-342.

3.6.3   NON-VALID BAND A AT THE SAME GEO-LOCATION

As can be observed in the following plot corrupted sweeps in band A are always found at the same geo-location (level 1b OFL consolidated products type "P"). The same is observed for all the other bands as can be observed in the following figure.
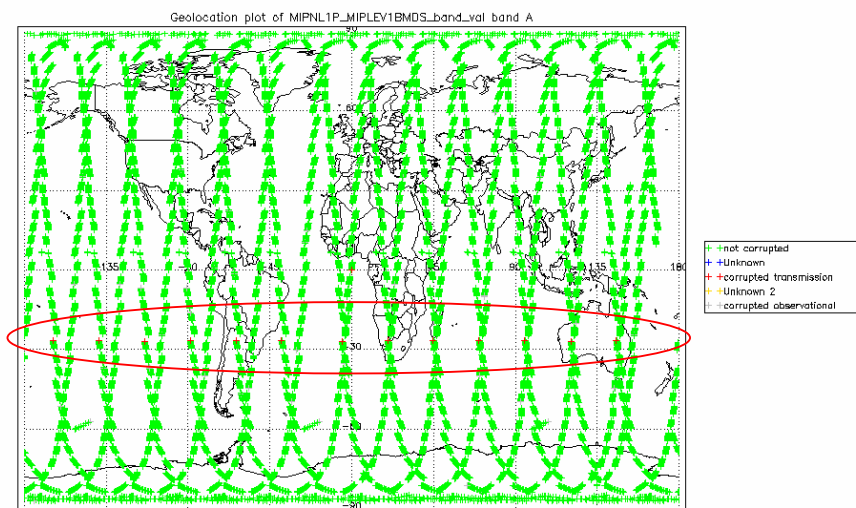
Figure 19 Corrupted sweeps are observed always at the same geo-location for these OFL L2 products of 10 March 2004 processed at D-PAC.

The investigation of the anomaly is now closed, since the reason of the problem has been recognized as an implementation error in the IPF, indeed the error is not obtained with the prototype.
The problem is the following: the IPF (version 4.61 up to 4.65) generates L1b products with wrong "NUM_DSR" value in the MPH; in particular this value is one unit higher than the "TOT_SCAN" value, while the two should be the same. As a result the Quadas tool recognize as corrupted the last scan of each orbit because the corresponding DSR is empty. For consolidated product this gives the same corruption at the same latitude for all the orbits (as observed in the figure above).
This problem was corrected within IPF 4.67 even though a discrepancy between the prototype and the IPF number of scans still remains, it will be discussed in more detail at the QWG#11.

3.6.4   WRONG MIPAS L1 PRODUCT IN D-PAC SERVER

One L1 product in D-PAC ftp server is corrupted (see red crosses in Figure 20), the product was generated using one outdated ADF. The product name is:
MIP_NL__1PPDPA20051002_233211_000060362041_00188_18779_0667.N1
The IPF used the following outadated ADF:
MIP_CO1_AXVIEC20050705_134752_20050703_044401_20100703_044401

instead of the correct ADF:
MIP_CO1_AXVIEC20051003_180613_20050926_000000_20100926_000000
The other L1 ADFs of this day were correctly selected by the IPF. To be understood why the IPF used this ADF and why the problem occurred only for this product and only with the MIP_CO1_AX aux file.
The investigation by Task 4 shows that the source of the problem is a wrong auxiliary file selection by PFHS; the problem seems to be the same than the one described in OARs 2009 and 1845. The wrong MIPAS product has been removed and reprocessed at D-PAC, the new filename is:
MIP_NL__1PPDPA20051002_233211_000060362041_00188_18779_1478.N1
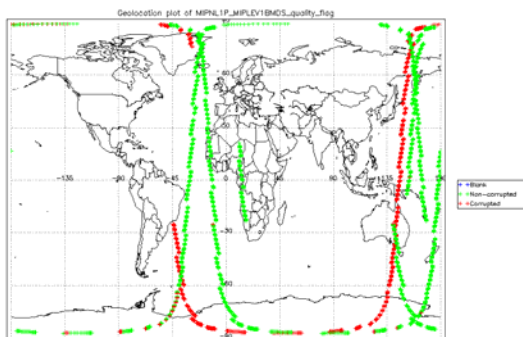
Figure 20 L1b PCD quality flag, corrupted sweep detected for 3 Oct 2005 L1b spectra

3.6.5   BADLY CALIBRATED L1B DATA DURING 3 – 23 JUNE 2005

The quality control of RR data generated OFL at D-PAC shows that a series of L1 spectra were highly corrupted due to a wrong calibration. This anomaly affects the L1 products corresponding to the following mission interval:

     3 – 23 June 2005.   Orbit # 17039 – 17332
     29 Jul – 11 Aug 2005.   Orbit # 17835 – 18021

M. Hopfner (IMK) detects this problem by carrying out a systematic calculation of the clouds top heights for all the L1b spectra processed at D-PAC. The cloudy sweeps were detected using the colour index, calculated as the ratio of the integrated radiance in two specific MWs of the band A. We can see the excessive cloud top height value found on 23 June 2005 (see Figure 21).
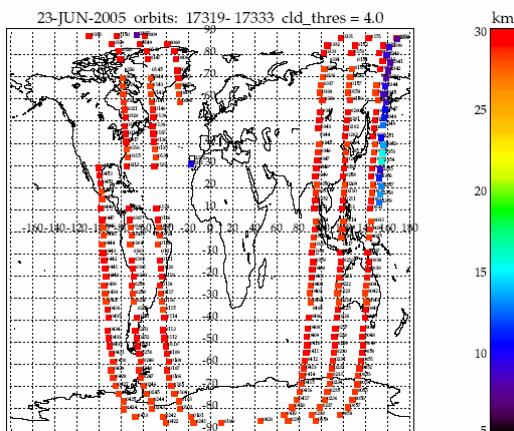
Figure 21 Cloud top height calculated by M. Hopfner (IMK) for 23 June 2005, the red points are due probably to a corruption in the band A spectrum.

The problem was also detected with the quality monitoring tool in ESRIN; in fact looking at the NESR level of 23 June 2005 we can see excessively high value (see red lines in the Figure 22). The two plots highlights the same anomaly in the spectra, indeed by the end of the day, when the cloud top height stops to be unrealistically high also the NESR comes back to nominal level, this is exactly the time when the correct ADF starts to be used by the processor. The problem is therefore due to a wrong calibration ADF. The first step of the investigation was to remove all the affected products from the D-PAC ftp server.
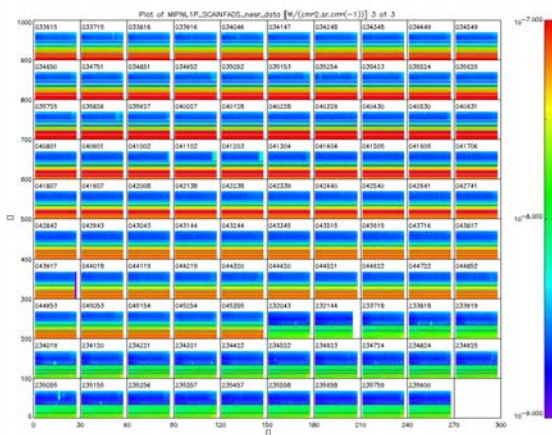
Figure 22 NESR level for different scan during 23 June 2005, each square is a scan made of 27 sweeps in nominal mode, the red lines show the anomaly of excessive high NESR, the anomaly stops when the correct ADF start to be used by the processor.

The ADFs suspected were identified and removed from all the processing centers. A first quality check (for format and scientific issue) of these ADFs didn't show any manifest anomaly; furthermore the gain calibration looks nominal, as resulted from comparison to other gain measurements of the same mission period. In order to better understand the problem we re-generate these ADFs from the same gain measurement orbit. The lists of outdated wrong ADFs and of the new ADFs are reported in the tables below. The only difference between these two sets of aux files is that the old ADFs were created from L0 NRT data, while the new ones are obtained from consolidated L0 products.

Table 18 List of wrong ADFs used by the OFL processor, which causes the anomaly of badly calibrated L1 data.

```
MIP_CS1_AXVIEC20051115_101936_20050601_082740_20090601_000000
MIP_CO1_AXVIEC20051115_101908_20050601_082740_20090601_000000
MIP_CG1_AXVIEC20051115_141026_20050601_082740_20090601_000000
MIP_CS1_AXVIEC20050627_084317_20050609_000000_20090609_000000
MIP_CO1_AXVIEC20050617_090408_20050609_000000_20090609_000000
MIP_CG1_AXVIEC20050617_090045_20050609_000000_20090609_000000
MIP_CS1_AXVIEC20050721_081614_20050616_000000_20090616_000000
MIP_CO1_AXVIEC20050617_132252_20050616_000000_20090616_000000
MIP_CG1_AXVIEC20050617_132141_20050616_000000_20090616_000000
MIP_CS1_AXVIEC20051115_102512_20050729_005430_20100729_000000
MIP_CO1_AXVIEC20051115_102420_20050729_005430_20100729_000000
MIP_CG1_AXVIEC20051115_141830_20050729_005430_20100729_000000
```

Table 19 List of new ADFs generated for repairing the anomaly.

```
MIP_CS1_AXVIEC20060524_152132_20050601_000000_20100601_000000
MIP_CO1_AXVIEC20060524_150040_20050601_000000_20100601_000000
MIP_CG1_AXVIEC20060524_152144_20050601_000000_20100601_000000
MIP_CS1_AXVIEC20060524_152232_20050609_000000_20100609_000000
MIP_CO1_AXVIEC20060525_080629_20050609_000000_20100609_000000
MIP_CG1_AXVIEC20060524_152244_20050609_000000_20100609_000000
MIP_CS1_AXVIEC20060524_152325_20050616_000000_20100616_000000
MIP_CO1_AXVIEC20060524_171909_20050616_000000_20100616_000000
MIP_CG1_AXVIEC20060524_152334_20050616_000000_20100616_000000
MIP_CS1_AXVIEC20060524_152430_20050729_000000_20100729_000000
MIP_CO1_AXVIEC20060524_172132_20050729_000000_20100729_000000
MIP_CG1_AXVIEC20060524_152419_20050729_000000_20100729_000000
MIP_CS1_AXVIEC20060524_152523_20050808_000000_20100808_000000
MIP_CO1_AXVIEC20060524_172132_20050808_000000_20100808_000000
MIP_CG1_AXVIEC20060524_152537_20050808_000000_20100808_000000
```

Comparing the two sets of ADFs we observed an anomaly in the off-set calibration data set (MIPAS OFFSET VECTOR field in the MIP_CO1_AX ADF). The interferogram (IGM) recorded during the deep-space scene is compared for the old and the new ADF in the following figures. The IGM of the old ADFs looks really different, the maximum being much less pronounced with respect to the new offset calibration ADF.
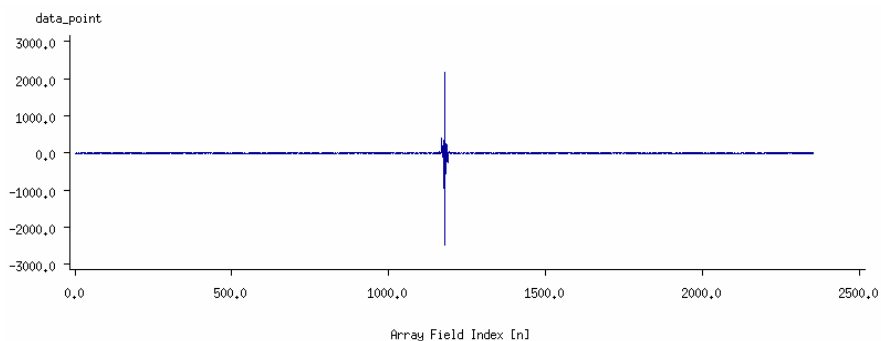

Figure 23 IGM recorded in the deep space measurement and stored in the wrong ADF.
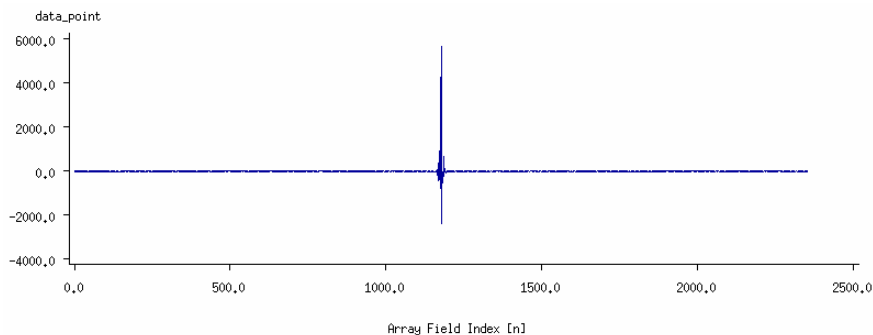
Figure 24 IGM recorded in the deep space measurement and stored in the new correct ADF.

The problem appears to be due to the offset calibration auxiliary file (MIP_CO1_AX). As a second step we generate two L1 prototype products from the same level 0, using respectively the old and the new set of ADFs. The comparison of the two resulting level 1 products is presented in the following figures. The comparison of the calibrated spectra shows that the use of the old MIP_CO1_AX file introduces a strange offset in the spectra, while the new set of ADFs allows a correct calibration of the measurements.
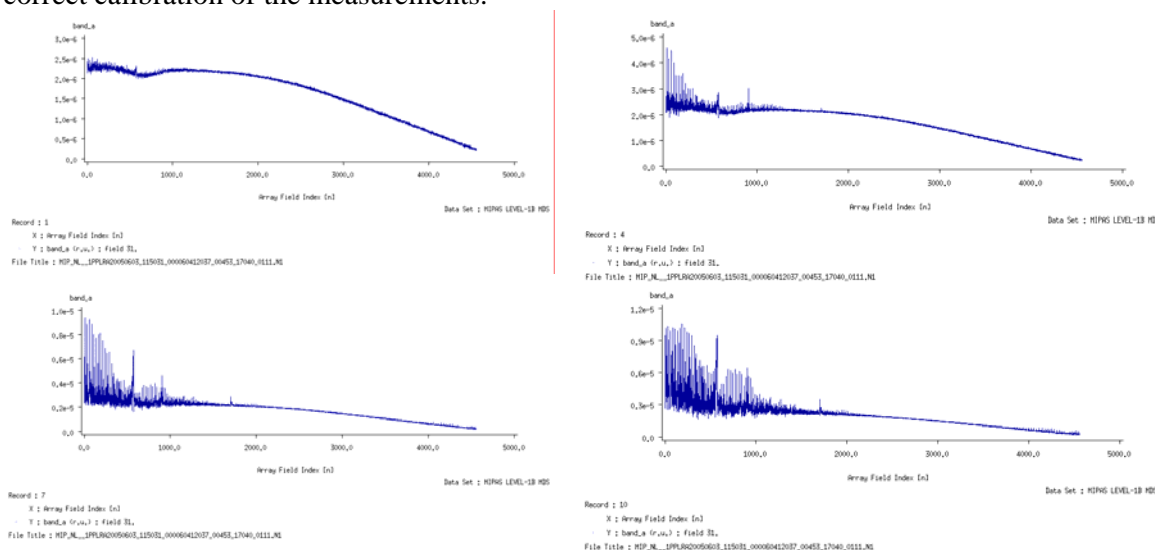
Figure 25 Example of badly calibrated spectra obtained with the old ADFs.
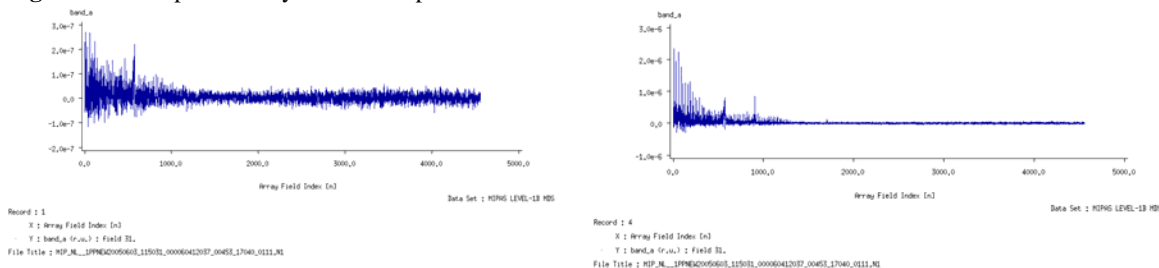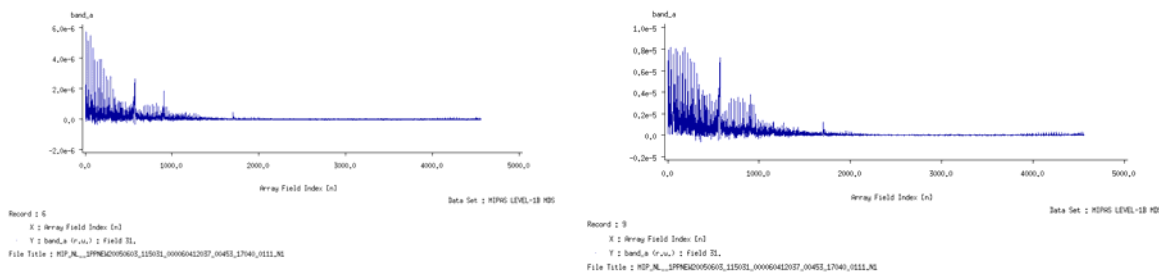
Figure 26 Example of correctly calibrated spectra obtained with the new ADFs.

The reason for these results was anyhow not fully clear; in fact the MIP_CO1_AX file is not used by the processor for the offset calibration of the spectra, for this calibration the IPF is using the closest offset scene contained in the L0 product. Note that one offset measurement is made every 4 MIPAS scans, which means that each L0 products contains several offset scenes. This choice is due to the fact that the instrument self-emission strongly depends on the platform position (e.g.: illumination) along the orbit; therefore in order to improve the quality of the offset calibration, the closest offset scene from the L0 product is used, instead of using the ADF. Support was requested to Bomem to understand why the processor used the offset contained in the ADF instead of using one offset scene from the L0 product. Bomem explained that since the offset scene contained in the L0 product is very different from the one stored in the wrong ADF, the processor automatically flags as corrupted the off-set of the L0 and it uses the off-set of the ADF, resulting in a weird calibration. The final step of the investigation consisted in trying to understand why the calibration algorithm (mical) generates such strange MIP_CO1_AX file. The problem is still not fully understood, it is probably related to an anomaly in the NRT L0 products.

The anomaly is now closed, since the D-PAC centre reprocessed all the affected L1 products. The list of re-processed products was delivered to QWG and can be found on Uranus (MIPAS/To_QWG/ New_L1_June-Aug_2005.txt).

3.6.6   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 the planning anomaly is closed, nevertheless Anu Dudhia reported at the QWG#8 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 the investigation is ongoing in collaboration with BOMEM and OU.

3.7 *Appendix G – Level 2 IPF historical updates*

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

- **Version V4.67** the following updates were introduced for L2 processing:
  - Fixed NCR-1458 → NO2 MIPAS products relative to orbit #7000 (3 July 2003) came with high values of chi2, that were not reproduced in the retrievals performed with the prototype using the same set of auxiliary files.
  - Fixed NCR-1521 → Some Level 2 products processed at DPAC with IPF 4.62 differ from the corresponding products processed with IPF 4.61, revealing a problem in the new 4.62 data. In fact the IPF 4.61 results were carefully validated using a balloon flight with very good space and time collocation.
  - Fixed NCR-1522 → Some L2 products processed at DPAC with IPF 4.61 and IPF 4.62 give beat-check format error. The same L2 production made with the prototype doesn't show this anomaly.

- **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, V4.61** 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

3.8   *Appendix H – 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.

Table 20. Historical update of Level 2 configuration ADFs.

Auxiliary Data File	Start Validity	Description
ADFs V5.2 MIP_CS2_AXVIEC20060105_121012_20040809_000000_20040917_220643 MIP_IG2_AXVIEC20060105_113531_20040901_000000_20040917_220643 MIP_IG2_AXVIEC20060105_114108_20040809_000000_20040901_000000 MIP_MW2_AXVIEC20060105_130642_20040809_000000_20040917_220643 MIP_OM2_AXVIEC20060105_130954_20040809_000000_20040917_220643 MIP_PI2_AXVIEC20060105_131141_20040809_000000_20040917_220643 MIP_PS2_AXVIEC20060105_131340_20040809_000000_20040917_220643 MIP_SP2_AXVIEC20060105_131744_20040809_000000_20040917_220643	9-AUG-04	Correction of a bug in the previous L2 ADF v5.1 MIP_IG2_AX, MIP_SP2_AX
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	9-AUG-04	For processing RR measurement with fixed altitude and old vertical sampling
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 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.
MIP_IG2_AXVIEC20040227_081527_20040301_000000_20090301_000000	01-MAR-04	Seasonal update of climatological initial guess.
MIP_IG2_AXVIEC20031118_151533_20031201_000000_20081201_000000	01-DEC-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	06-JUL-02	Activation of cloud detection; removal of the gaps between the altitude validity ranges; altitudes margins fixed to +/-

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		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_AXVIEC20030731_134035_20030901_000000_20080901_000000	01-SEP-03	Seasonal update of climatological initial guess.
MIP_IG2_AXVIEC20030522_104714_20030601_000000_20080601_000000	01-JUN-03	Seasonal update of climatological initial guess.
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_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.
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).

- **ADFs V5.2**

Correct for a bug in the binary conversion of the following ADF: MIP_SP2_AX and MIP_IG2_AX files.

- **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.

3.9 Appendix I – Level 2 anomaly status

3.9.1 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 was classified as critical and is going to be analyzed by the IPF developers.

The first analysis by DJO shows that we were actually looking at an implementation error, then a bug in the IPF. DJO found a bug in the code in the 'Compute Optimum Estimate for Temperature/VMR' R 8.2.8.7-6. There was a wrong assignment of PS2 setting for Eo, po, grad E and Cr1 to the corresponding profile. After correction of this bug the IPF and prototype NO2 chi2 values for these orbit show to be the same. A patched version of the IPF will be delivered by DJO (4.66).

3.9.2 DIFFERENCE ON L2 PRODUCTS BETWEEN V4.61 AND V4.62

Some Level 2 products processed at D-PAC with IPF 4.62 differ from the corresponding products processed with IPF 4.61. Since the IPF 4.61 products were validated using one IMK balloon flight (with a very good space/time coincidence), this discrepancy reveals a problem in the new 4.62 data. In particular the most significant differences were detected for seq. # 16 of orbit 2975 (measured on 24 Sept 2002) for T, N2O and CH4 profile at low altitude (around 140 hPa). This anomaly on 4.62 L2 products was not observed with the prototype, which is in accordance with 4.61 data and with the reference balloon profiles. The following three figures show the tests made by IFAC on seq. no. 16 of orbit 2975 with Level 2 prototype using the same input data as the operational processor. This test confirms that the anomalous results in the ESA processor V4.62 cannot be reproduced with the prototype. In the following plots all the results by IPF 4.62, IPF 4. 61 and L2 prototype are reported for T, N2O and CH4 profiles (the profiles for which the most significant discrepancies have been detected). This problem was corrected with IPF 4.67 delivery.
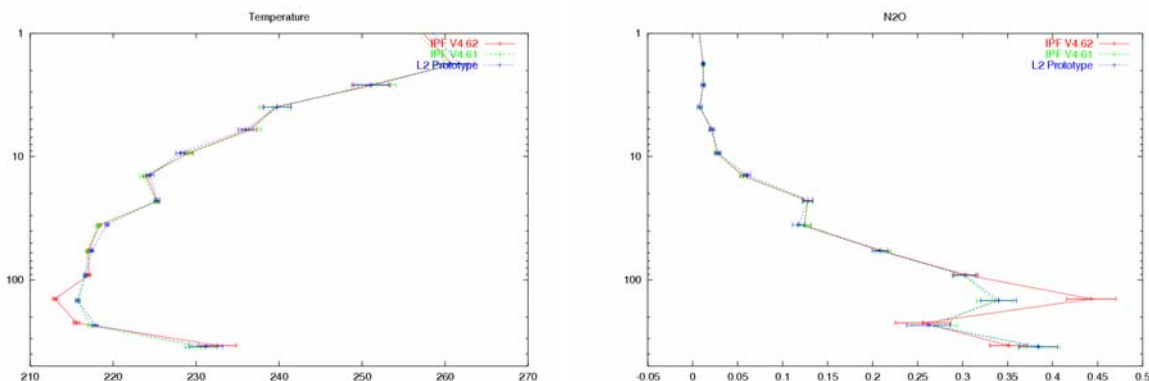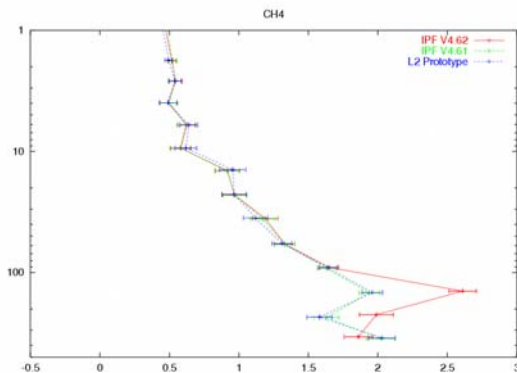
Figure 27 Temperature N2O and CH4 profiles as a function of pressure retrieved with IPF 4.62 and 4.61 compared to the prototype for seq. 16 of orbit 2975. The 4.61 profile is the reference, validated by a IMK balloon flight.

3.9.3   BEATCHECK FAILURE ON SOME L2 PRODUCTS

Some L2 products processed at D-PAC with IPF 4.61, 4.62 give beatcheck format error, as reported by the K.H. Fricke (HD 2005007448). The L2 products where this anomaly was found are the following:

    MIP_NL__2PODPA20030702_064249_000059652017_00421_06988_2699.N1
    MIP_NL__2PPDPA20030702_064249_000059652017_00421_06988_0369.N1
    MIP_NL__2PPDPA20030827_065146_000060152019_00221_07790_0938.N1

The same products processed at D-PAC with the IPF 4.62 give the same format error. The same L2 production made with the prototype didn't show this anomaly. This bug was corrected within IPF 4.67 release.

3.9.4   NO2 RETRIEVAL DURING POLAR CONDITION

NO2 profiles of OFL products during Antarctic winter (June 2003) show unrealistically high value in the low stratosphere and in general they present a degradation of the NO2 profiles (zigzagging zero value). This happens in correspondence of very high NO2 in the stratosphere. The same behavior was observed with the prototype (see plots below).
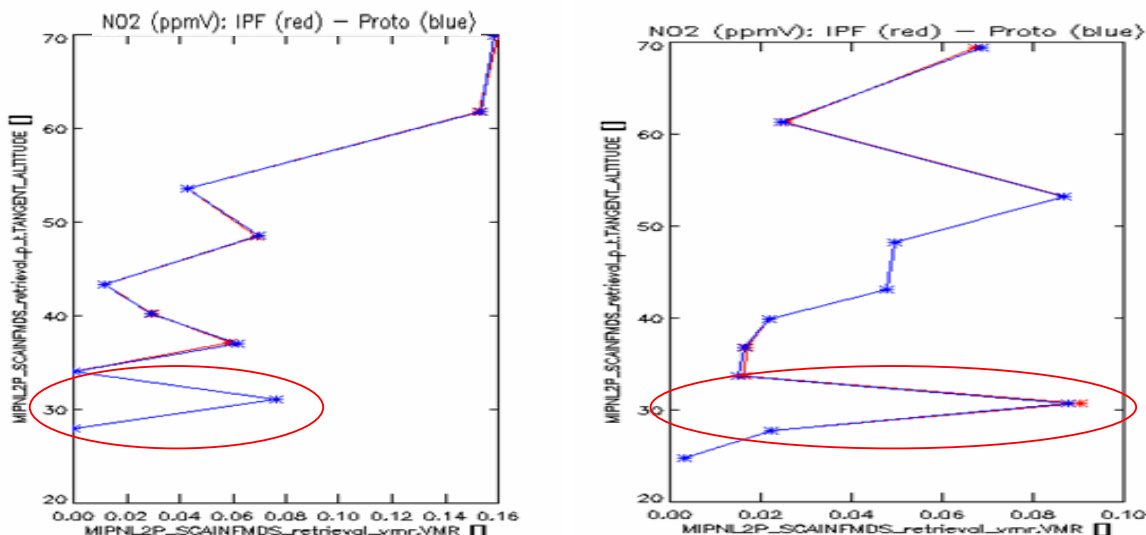
Figure 28 NO2 profiles obtained with the IPF and prototype for two particular scan of 6 June 2003 in Antarctic winter condition, highlighted in red are the region around 30 km with sudden increase of NO2 value, which has no physical meaning. Note the degraded profile shape, namely the zigzag and the zero value.

The investigation done by IFAC arrives at the following conclusions:
- It seems that the cause of the instabilities in the NO2 profile for the analyzed scans is the saturation of NO2 lines below 43 km
- No significant improvements were obtained when adding other micro-windows in the OM from the current NO2 MW database
- The micro window selection should consider the case of enhanced NO2 concentration.

3.9.5   MISSING L2 PROFILES AOURND THE SOUTH POLE

An anomaly on L2 OFL data of the FR mission was reported by Chiara Piccolo (OU). The problem is that several L2 products from July to Nov 2002 have missing data around the South Pole; the anomaly can be observed in Figure 29 where the number of successful retrieval is plotted as a function of geo-location. In this figure we observe that all the retrievals around the South Pole failed, in particular the processing chain fails already with the pT retrieval.
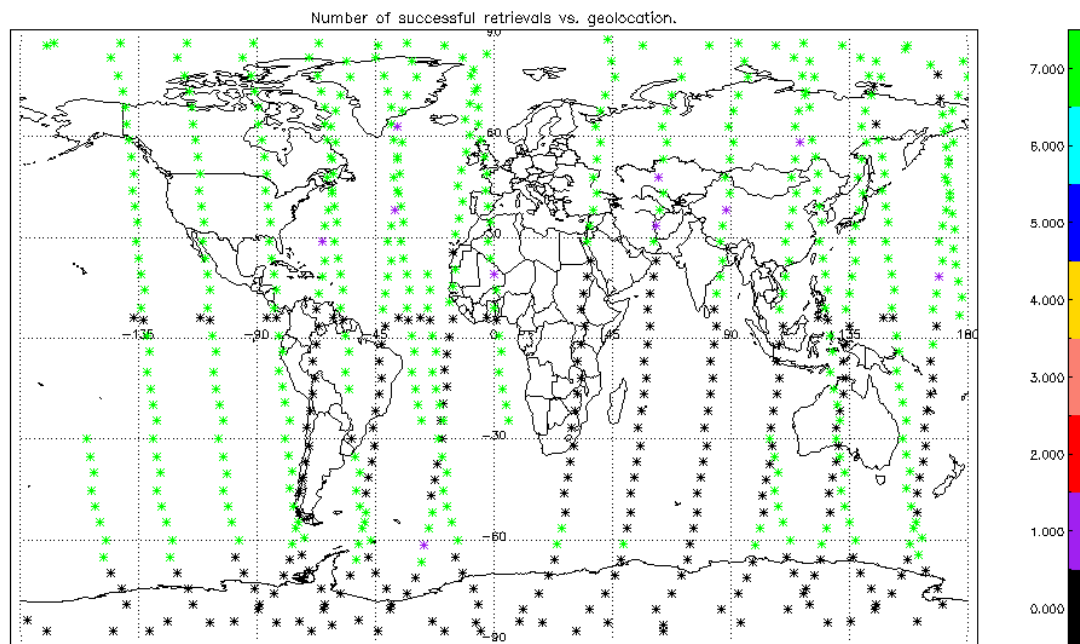
Figure 29 MIPAS number of successful retrieval for 25 July 2002. Note that 7 is the nominal value corresponding to the target species of the ESA MIPAS products. Zero value means that the retrieval fails already at the p-T stage.

The anomaly was investigated in collaboration with S. Bartha (Astrium). It was found that the problem is due to a too restrictive definition of the altitude range of the OM. In the used PS2 file the maximum altitude for a sweep was fixed to 72 km. During July – Nov 2002 around the South Pole it happens that the highest sweep exceeds sometimes this upper altitude limit, in such a case the algorithm couldn't select a valid OM for p-T and the retrieval of the corresponding scan was skipped. The problem happens in particular around the South Pole where the engineering tangent altitudes are higher with respect to other latitude regions (see left plot of Figure 30), this feature already known and is due to a problem on the MIPAS pointing knowledge. It should be noted also that the 72km limit is exceeded several times from July to November 2002, while afterwards the maximum of tangent altitude remains lower than the critical value. This can be observed in the right panel of Figure 30, where a long term trend of the pointing is clearly noticed. This annual trend of the tangent altitude is due to a mispointing of the entire ENVISAT platform which was already discussed in the LOS long term analysis (see Figure 16). The problem was corrected on December 2003 with the upgrades of the platform s/w.

An easy solution to the problem of missing L2 profiles around the South Pole will be to relax the altitude range in the OM, however this problem will be overcame with the new algorithm baseline (ml2pp 5.00) where the floating altitude scenario will be handled.
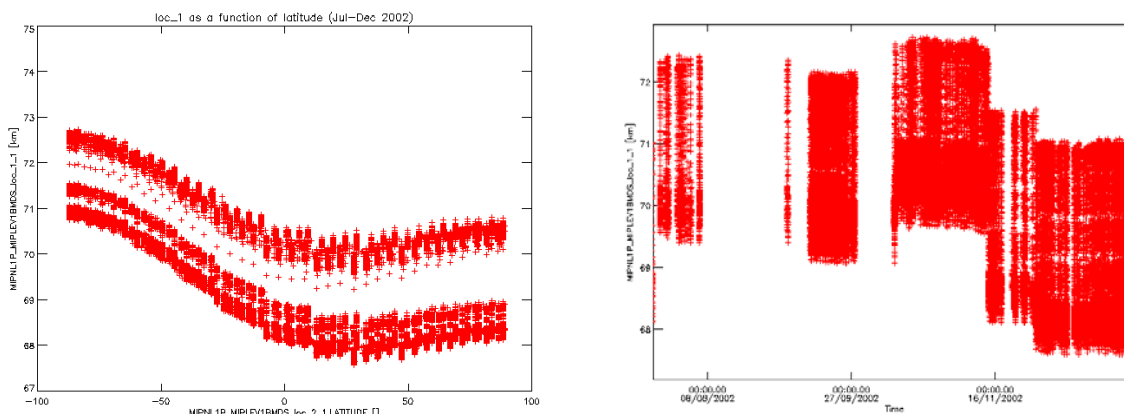
Figure 30 MIPAS engineering tangent altitude as written in the L1b files (loc_1 field) as a function of latitude and time.

3.9.6   L2 CONTINUOS ANOMALY

This anomaly was reported by C. Bellotti (IFAC) at the QWG#10. The problem is that for some scans the operational processor retrieves continuum value even for very high altitude sweeps, while in the PS2 setting the highest altitude at which the continuum shall be fitted (rzUcl) is set to 20km. This anomaly doesn't affect the quality of the data, since when continuum is fitted for very high altitude the retrieved value is equal to zero. Nevertheless this feature is time consuming, since we spend time to retrieve a quantity which is known to be zero, moreover it was important to understand why this problem happens.

The investigation carried out with the support of S. Bartha (Astrium) highlights an anomaly in the algorithm baseline; in fact the same behaviour was observed when using the prototype. The problem appears whenever the lowest fitted sweep is above the limit defined by rzUcl parameter (20km); this can happen in case of cloud flagging or corruption of the lowermost sweeps. In these cases the algorithm has a weakness and it fits the continua for all the sweeps except for the highest one. This problem has been recognized and it was corrected within the new algorithm baseline delivery (ml2pp 5.0).