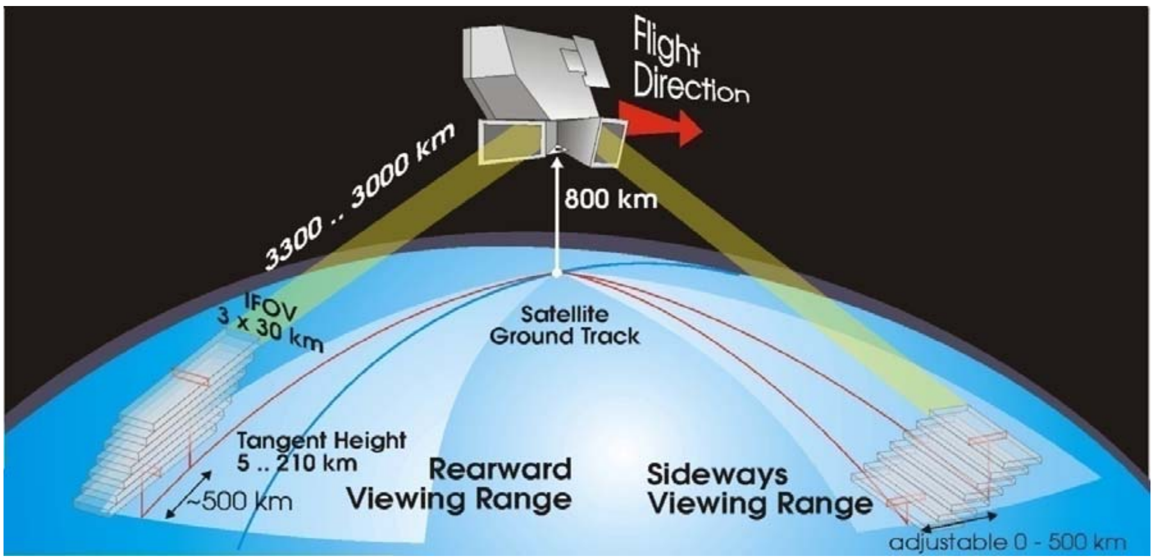
DOCUMENT

ENVISAT MIPAS MONTHLY REPORT: OCTOBER 2010



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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 (OU)
- 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
BB	Black Body

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
ICU	Instrument Control Unit
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
MCMD	Macro-Command
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
OBT	On-board time
OCM	Orbit Control Manoeuvre
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
PPM	Part per million
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

2 THE REPORT

2.1 Summary

- **The ENVISAT orbit was successfully lowered down during 22 Oct – 2 Nov 2010. The new orbit scenario will allow saving fuel and operating all payloads until end of 2013. All instruments were progressively switched back to operations since 27 Oct 2010.**
- **MIPAS successfully resumed operations on 28 Oct 2010, at 9:46:48 UTC in Nominal measurement mode. The instrument performances and the products quality in the new mission phase are fully nominal. However a degraded pointing accuracy was observed during the period 28 Oct – 2 Nov 2010, when ENVISAT was operated in YSM. Further details on the MIPAS instrument and products quality after the switch-on are reported in §2.3.**
- **During the reporting month MIPAS performs very well, however one IDU error occurred on 12 Oct and there were two planned mission interruptions, one for the decontamination during 13- 20 Oct and the other one for the ENVISAT orbit lowering monoeuvre from 22 to 28 Oct.**
- **The planned passive decontamination was successfully completed during 13 – 20 Oct 2010, as confirmed by the monitoring of the detector gain factor.**
- **The baseline planning was followed during this month (4 days NOM + 1 day UA + 4 days NOM + 1 day MA). In addition, two IF16 measurements were planned one before and one after the planned passive decontamination. A more detailed description of the instrument planning can be found in §2.3.**
- MIPAS weekly statistics since 2005 show the improvement of the instrument performances and the increase of duty cycle in the last years. The availability of L1 NRT products is also presented in this paragraph (see § 2.4.4).
- The availability of L1 OFL products with respect to the expected time is stable around 95% during the last months (see §2.4.5).
- The instrument temperatures long term analysis doesn't show any significant degradation, the seasonal trend is clearly visible (see § 2.5.1).
- The cooler performs well during the reporting month; the vibrations were well below the warning level of 8 mg (see § 2.5.3).
- The long term trend of ADC max counts in channel A1 shows a strong correlation with the instrument self-emission and with the detector ice contamination. The long term trend of ADC Max counts in the MIPAS channels highlights sensitivity degradation in channel A and B (in the order of 0.2%/month). The C and D channels don't show any degradation with time (see §2.5.4).
- The monitoring of the linear spectral correction factor shows that the variations over more than two years of operations are really small (~ 2 ppm). The observed spreading of the points is due to the noise in the determination of this parameter (see § 2.6.2).
- The gain weekly increase during the reporting month is nominal, the maximum of gain increase in all the MIPAS bands remains well below the acceptance criterion of 1%/week. On a long term basis we observe that the gain in band A after each decontaminations is slightly increasing due to the loss of sensitivity in channel A (see § 2.6.3.1).

- The analysis of the accumulated gain allows monitoring the level of detector ice contamination. During the last year we observed a decreasing slope of the gain curve, showing that the detector is more and more “ice-free”. This is due to the better performances of the cooler obtained with more frequent decontamination (see §2.6.3.2).
- The absolute mispointing is stable around a value of -25mdeg. The seasonal variations of the pointing error are small and below the fixed threshold of 8mdeg. Less and less stars are available in the last months for the LOS calibration, as a result the mispointing estimation is less precise now with respect to the beginning of mission (see §2.6.4).
- The long term monitoring of fringe count errors (FCE) shows that the width of the statistical distribution of the FCE can be used as a measure of the INT performances. In particular we observed that the FCE can be correlated with the number of IDU errors. This correlation is evident during the bad periods of the MIPAS mission (June 2005 and February 2006), while during the last months no correlation can be found (see § 2.6.5.1).
- The long term monitoring of the detected spikes shows that the number of detected spikes in channels A1, A2, B1 and B2 is varying with time with some peaks probably related to variation of the solar activity. The channels C and D (the detector most affected by spikes) didn’t show any trend so far. From this analysis we can conclude that the number of detected spikes is too small to impact the L1b products quality (see § 2.6.5.2).
- NRT and OFL MIPAS daily reports for all level of production can be accessed at the following web page:
  http://earth.esa.int/pcs/envisat/mipas/reports/daily/

2.3 Instrument and products monitoring after the ENVISAT orbit lowering

The first two critical steps of the ENVISAT orbit lowering manoeuvre were successfully completed during 22 – 26 Oct 2010 and all payloads were slowly switched back on starting on 27 October. Further details can be found at the following web page:
http://www.esa.int/esaCP/SEMEZX1PLFG_index_0.html

Between 22 October and 02 November ENVISAT was in Yaw Steering Mode (YSM). Since 2 November, 10:25 UTC, ENVISAT is in Stellar Yaw Steering Mode (SYSM), which is the nominal mode of operations. Since 4 Nov 2010 ENVISAT was moved into the final orbit corresponding to the new scenario of the mission phase 3.

MIPAS successfully resumed operations on 28 Oct 2010, at 9:46:48 UTC in Nominal measurement mode. The instrument performances and the products quality in the new mission phase are briefly described in this paragraph.

2.3.1.1 Instrument performances in new scenario

The status of instrument performances after the switch to the new mission phase is fully nominal, since all instrument parameters are within the expected range of variability. The detectors ice contamination is within the expected trend. The only issue on the instrument in the new phase was an anomaly in the Cooler Dsplacer observed after the switch-on of the instrument.

Cooler Anomaly

The Cooler Displacer monitoring showed some Out Of Limit (OOL) values after the switch-on, during 28 Oct 2010, see following picture. The analysis seems to show that these OOL were most likely due to a Single Event Upset (SEU), however an investigation is still on-going at PLSO.

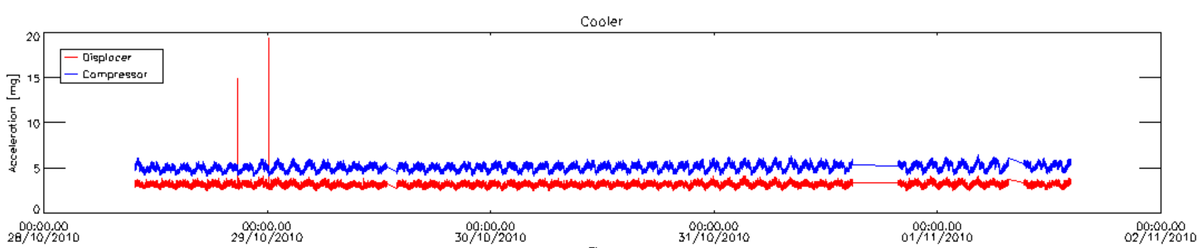


Figure 1 – MIPAS cooler acceleration level after the ENVISAT orbit lowering.

2.3.1.2 Operational products performances in new scenario

The quality of the MIPAS ESA operational products in the new orbit scenario is fully nominal for both level 1 and level 2 products in NRT and off-line processing chain. The monitoring of the most critical quality indicators in the level 1 and level 2 data shows no major issues. The only significant issue observed so far is the pointing degradation during the period 28 Oct – 2 Nov 2010.

Pointing degradation in YSM

A degraded MIPAS pointing accuracy was observed for the period: 28 Oct – 2 Nov 2010. The results of the investigation performed in ESRIN, in agreement with independent results obtained by U. of Oxford, have shown that the issue is due to the ENVISAT Yaw Steering Mode (YSM) that was used during this part of the mission. The MIPAS pointing accuracy is back to nominal values since the switch to the ENVISAT nominal attitude control, the Stellar Yaw Steering Mode (SYSM) performed on 2 Nov 2010 at 10:25 UTC.

The figure below shows the variation of the average corrected altitude in MIPAS level 2 products during October 2010. The increase in the altitude correction during the period where ENVISAT was operated in YSM is clear in this plot. The zoom on the right shows that the altitude correction was back to nominal values exactly at the time when the nominal SYSM was resumed.

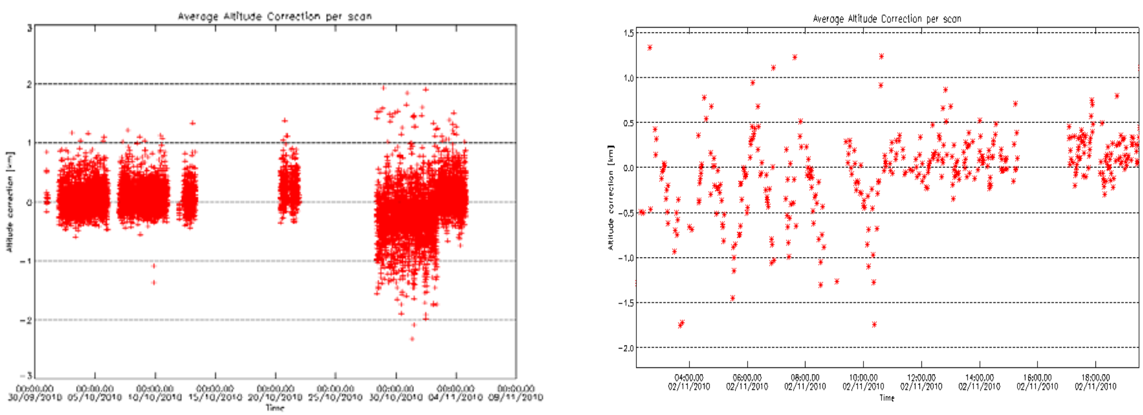


Figure 2 – MIPAS altitude correction averaged over a scan during October 2010 and zoom at the time when the ENVISA SYSM was resumed after the orbit lowering.

2.3.1.3 Instrument planning in the new scenario

The planning was resumed after the orbit lowering with 6 days of nominal operations. The nominal baseline planning (4 days NOM + 1 day UA + 4 days NOM + 1 day MA) was restarted since 4 Nov 2010. An issue was detected in the planning after the MIPAS switch-on, owing to this, the actual altitude scan pattern along the orbit moderately deviates from the baseline. The issue is illustrated in the figure below, where the tangent altitudes are reported as a function of time. We can see that the tangent altitudes did not follow the cosines law for the floating altitudes as a function of latitude, but a linear law is used. This issue was recognized to be related to a bug of the planning tool. It will be corrected in the coming days at the planning level. This issue doesn't impact the quality of the data.

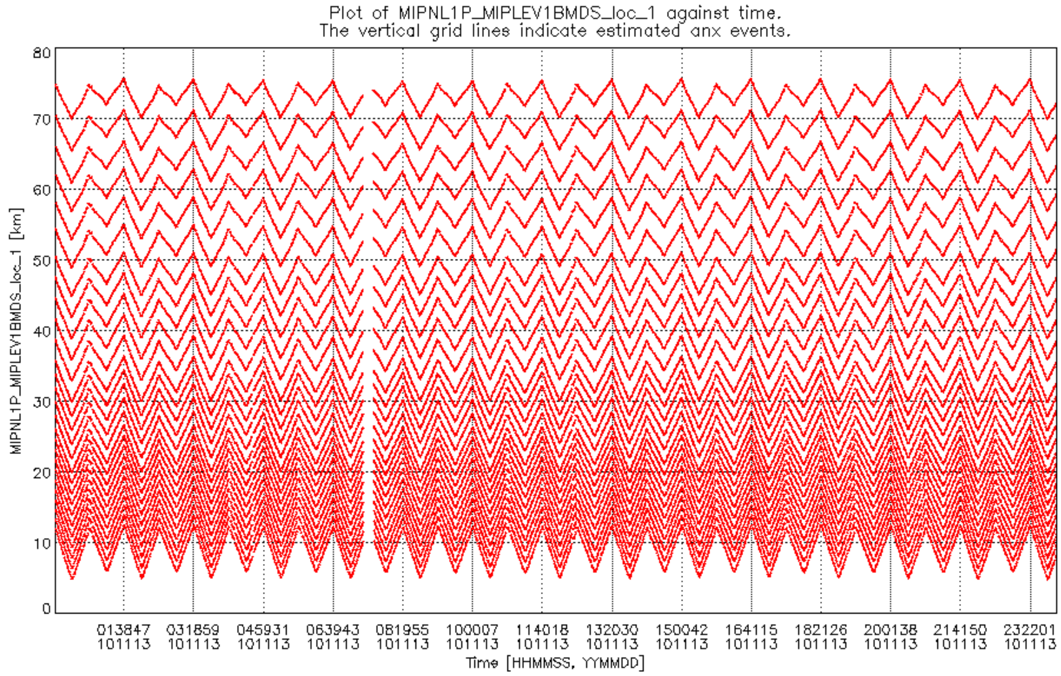


Figure 3 – MIPAS tangent altitude during 13 November 2010, showing the planning anomaly.

2.4 Instrument and products availability

2.4.1 INSTRUMENT PLANNING

The MIPAS planning the reporting month is briefly described in this section.

- The duty cycle is set to 100% since 1st December 2007
- IDU re-initialization was dismissed since 3rd March 2008, a manual recovery is now implemented at ESOC in case of instrument anomaly
- All measurement modes are double slide operation with medium resolution (41% - 1.64 sec sweeps) with asymmetric transitory sweeps
- Radiometric Gain calibrations (RGC) is planned once per day
- Deep Space (DS) offset is planned every 800 sec
- LOS calibrations rearward are planned every 10 days
- The baseline planning has been reviewed by Science Team. The new sequence "4 days NOM + 1 day UA + 4 days NOM + 1 day MA" is adopted since 6 December 2009.

An overview of the measurements planned during the reporting month is presented in Table 1. In this table the calibration measurements are discarded. For more detailed information about mission planning you should refer to the mission planning excel sheet available on Uranus server at the following location: ftp://uranus.esrin.esa.it/Mission_Planning/MIPAS/

Table 1 – Overview of the measurements planned during the reporting month. RGC and LOS calibration sequences are discarded here, refer to the planning excel sheet for further details.

Date	Orbit	Mode
1 Oct	**44889 – 44903**	MA – Middle Atmosphere
2 – 5 Oct	**44904 – 44961**	NOM - Nominal
6 Oct	**44962 – 44975**	UA – Upper Atmosphere
7 – 9 Oct	**44976 – 45028**	NOM - Nominal
10 Oct	**45029 – 45030**	IF16
11 Oct	**45031 – 45046**	MA – Middle Atmosphere
12 Oct	**45047 – 45064**	NOM - Nominal
13 – 20 Oct	**45065 – 45165**	Passive Decontamination
21 Oct	**45183 – 45184**	IF16
22 – 28 Oct	**45189 – 45280**	MIPAS in HEATER Mode due to ENVISAT Orbit Lowering
28 – 31 Oct	**45281 – 45332**	NOM - Nominal

2.4.2 INSTRUMENT AVAILABILITY

During the reporting month MIPAS performs very well, however one IDU error occurred on 16 Aug and there was a mission interruption during 6 Aug due to a planned S/W reset. More details on instrument availability are provided in the table below.

Table 2 List of MIPAS unavailabilities during the reporting month. In green are the planned unavailabilities.

Start time	Stop time	Orbit		Planned	Ref	Comments
		start	stop			
12 Oct 2010 00:34:15	12 Oct 2010 08:55:30	45046	45051	No	EN-UNA-2010/0154	IDU error
13 Oct 2010 08:05:00	20 Oct 2010 10:00:00	45065	45165	Yes	EN-UNA-2010/0155	Planned Passive Decontamination
21 Oct 2010 23:59:00	28 Oct 2010 09:46:34	45189	45280	Yes	EN-UNA-2010/0166	ENVISAT Orbit Lowering

2.4.3 NRT PRODUCT AVAILABILITY

The planned measurements that were not processed NRT due to processing failure in the Payload Data Segment (PDS) are reported in ***Appendix A*** (see $3.1) for MIP_NL__0P and MIP_LS__0P products.

2.4.4 NRT PRODUCTS STATISTICS

2.4.4.1 Weekly statistics

In Table 3 we report the weekly statistics on the instrument and products availability. The table shows the planned duty cycle, the instrument availability w.r.t. the planning and the products availability. The L0 NRT availability is calculated with respect to the planning, while the L1 NRT availability is calculated with respect to the L0 data.

Table 3 MIPAS level 0 NRT products statistics for the reporting month.

Start time	Stop time	Planned duty cycle (%)	Instrument availability (%)	L0 availability at PDHS (%)	L1 availability w.r.t. L0 (%)
04/10/2010 20:59	11/10/2010 20:39	97.89	100.00	99.78	99.60
11/10/2010 20:39	18/10/2010 21:59	15.88	100.00	100.00	99.46
18/10/2010 21:59	25/10/2010 21:39	16.75	100.00	100.00	99.50
25/10/2010 21:39	01/11/2010 21:19	59.99	100.00	100.00	83.55

2.4.4.2 Long term statistics

The weekly statistics were calculated for the entire MIPAS RR mission (since Jan 2005) and are presented in the Figure 4, in this plot the blue line is the instrument availability with respect to the total time, the magenta and red lines represent the total availability of L0 and L1 NRT products.
The total availability of the instrument increases from about 30% in 2005/2006 to 90%-100% during the last months owing to the increased duty cycle and the improved instrument performances. The L0 availability shows the performance of the PDS, in the best case the magenta line should match the instrument availability, any anomaly in the Ground Segment results in a loss of data. The L1 NRT availability is reported since February 2008, when the NRT processing was restarted at ESRIN and Kiruna sites.
The Figure 5 shows the instrument availability w.r.t the planning and the planned duty cycle. This figure shows in more details the increased planned duty cycle and the improved instrument performances in the last months.

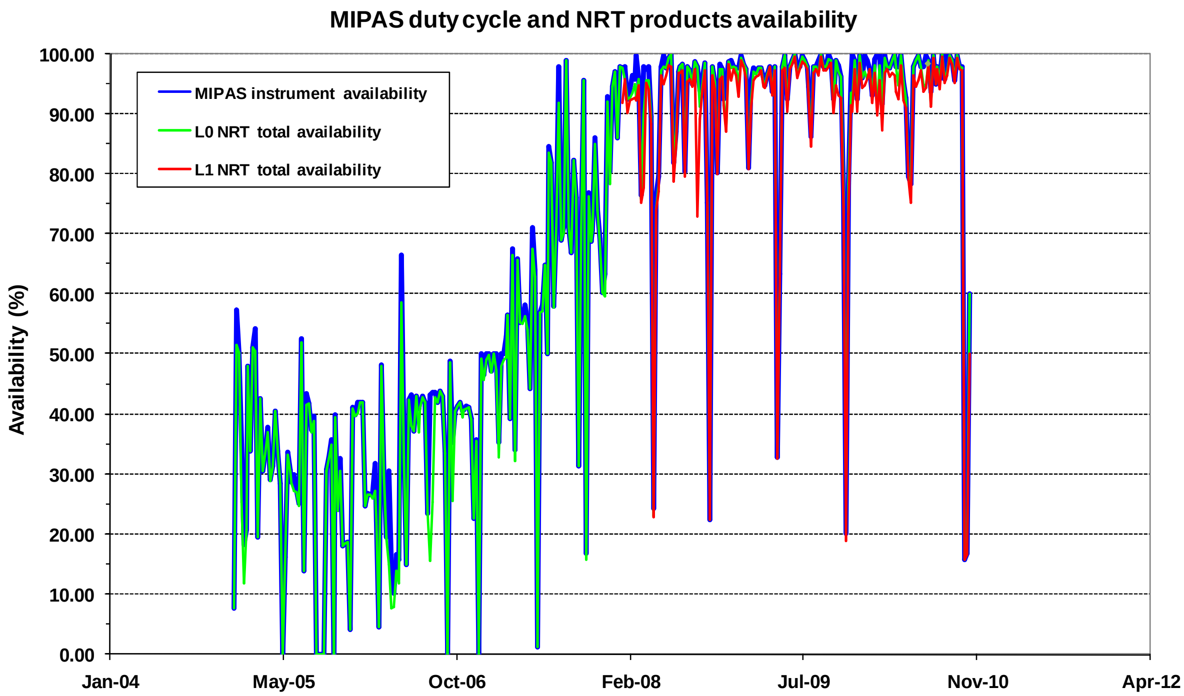


Figure 4 – MIPAS L0 NRT long term statistics since Jan 2005.

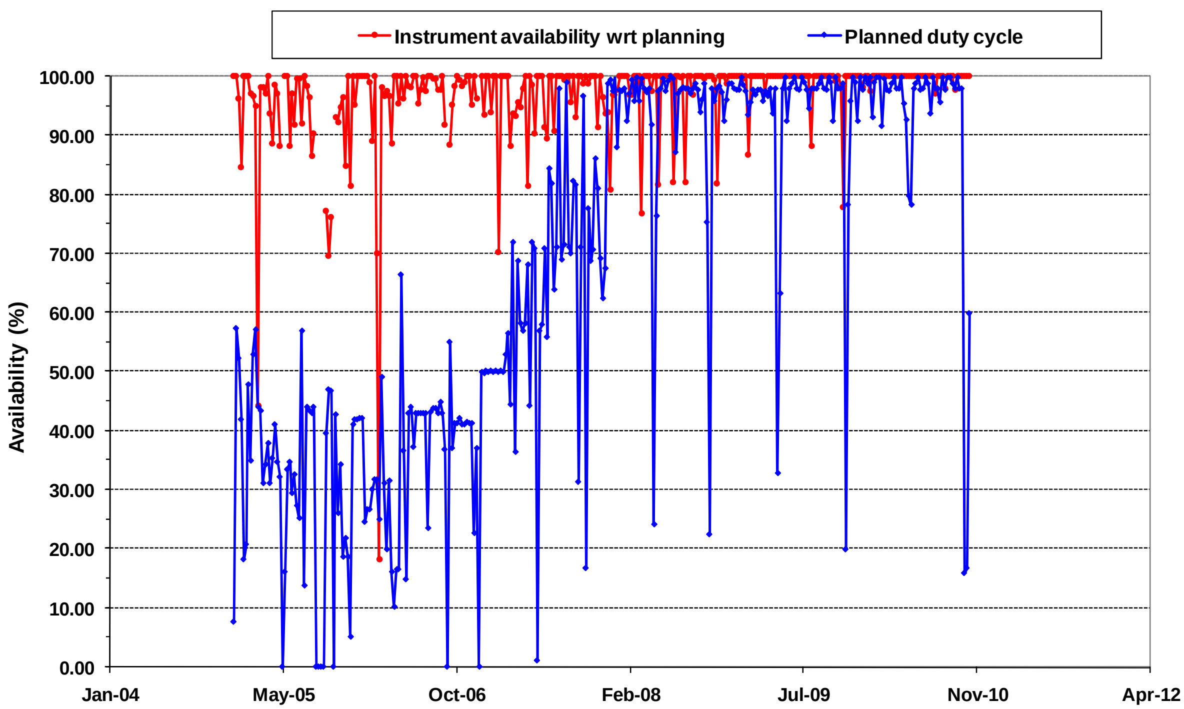


Figure 5 – MIPAS instrument availability w.r.t. planning and planned duty cycle.

2.4.5 LEVEL 1 OFF-LINE PRODUCTS STATISTICS

Since February 2006 MIPAS L1 data are routinely processed off-line at D-PAC, these data are commonly used by the MIPAS science user community. Since August 2007 ESRIN can access directly the D-PAC server, this allows us to provide rapid and reliable information about L1 data availability in the D-PAC site. In particular a script was developed to provide the list of available L1 products on the ftp server with associated information (e.g.: sensing start/stop, number of scan, measurement mode). This information can be found now for the whole MIPAS mission in the Uranus server, see the following link:

ftp://uranus.esrin.esa.it/MIPAS/DPAC_archive/

In this chapter we report the long term statistics of the L1 products availability in the D-PAC server. This is presented in Figure 6, where the statistics since June 2006 are reported with respect to the expected time and to the total time. Note that this statistic is updated with a delay of one month with respect to the reporting period; this is due to the delay in the generation of consolidated products (about 2 weeks). From this figure a problem can be observed in the data generation during March 2007, while in the last months the data availability is around 95% of the expected time. The availability with respect to the total time highlights the increased duty cycle since April 2006.

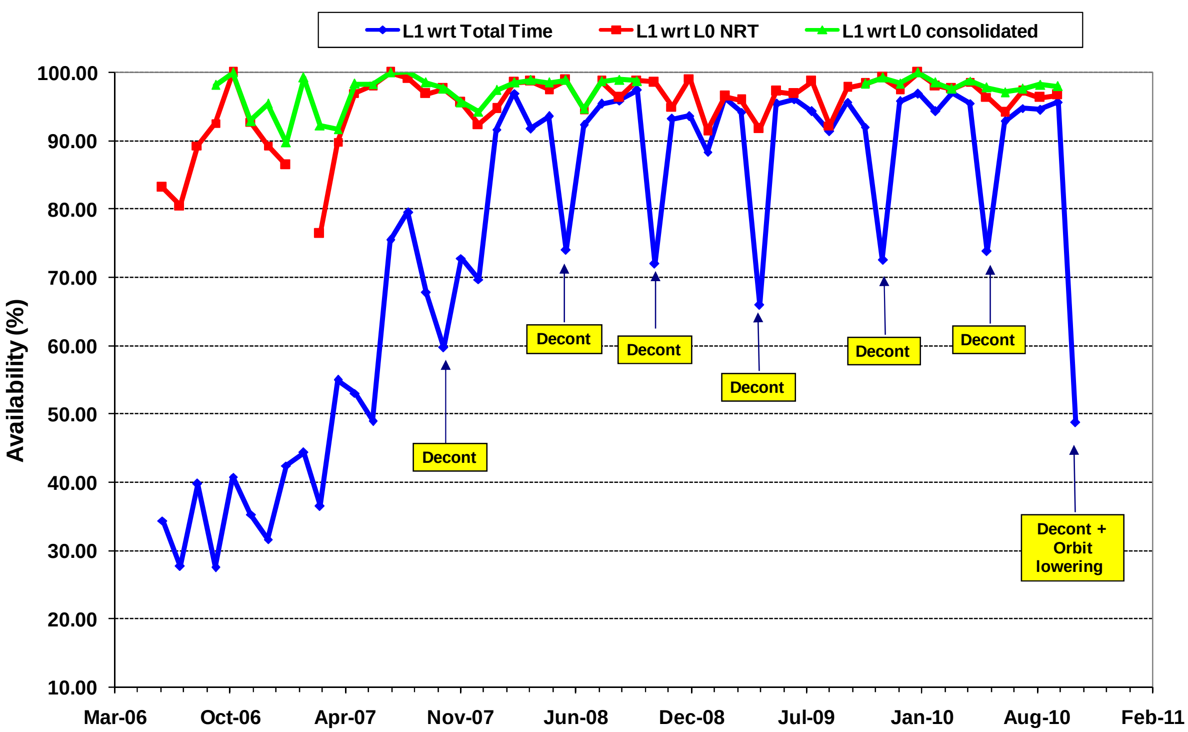


Figure 6 – MIPAS L1 off-line data at D-PAC: long term statistics since Jun 2006.

2.5 Instrument monitoring

2.5.1 THERMAL PERFORMANCE

The following two plots (Figure 7 and Figure 8) 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. Furthermore the effects of instrument decontamination are also evident with a reduction of the instrument temperatures (e.g.: the decrease of about 0.6K after the decontamination of June 2007).

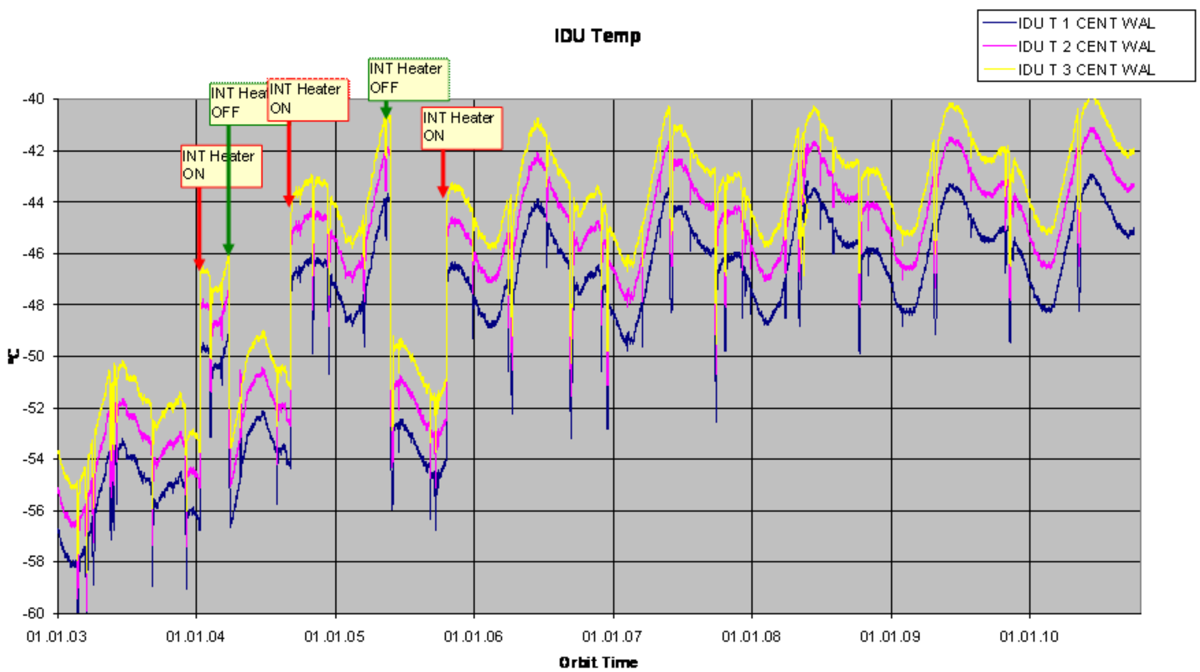


Figure 7 - IDU temperatures as a function of time since November 2002 (courtesy of Astrium).

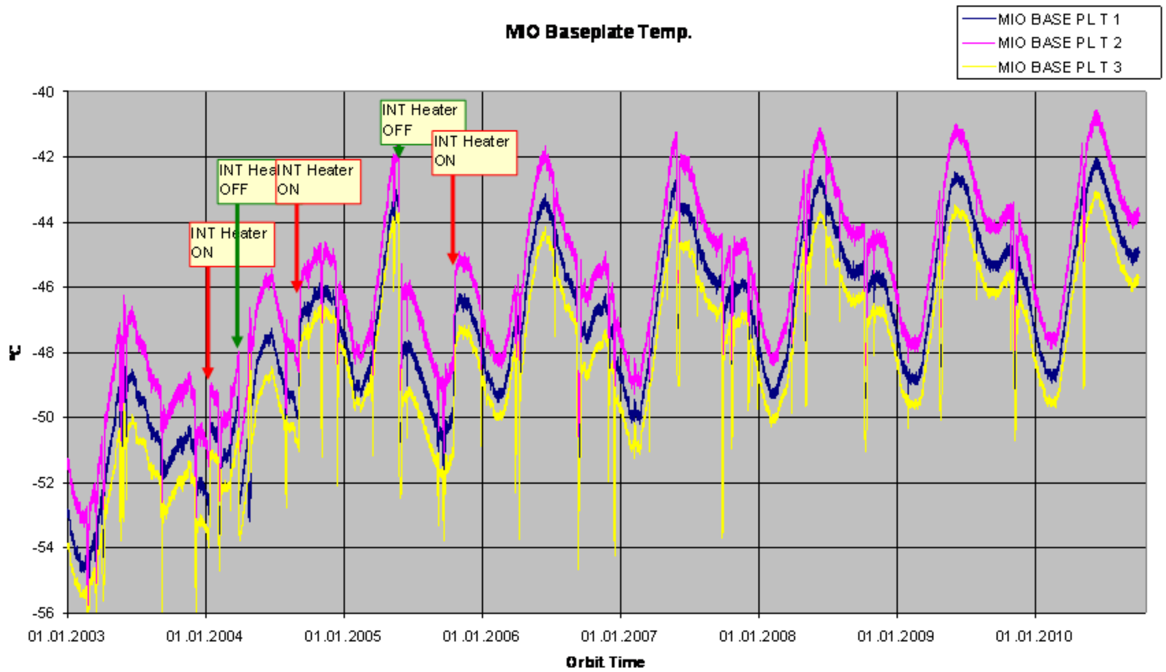


Figure 8 - MIO base plate temperatures as a function of time since November 2002 (courtesy of Astrium).

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**

2.5.2 INTERFEROMETER PERFORMANCE

The historical record of differential speed errors can be seen in Figure 9 (analysis carried out by Astrium). The -4% differential speed error is an indicator for non-perfections in the IDU system. This historical trend can be summarized in the following bullets:

- 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 was noticed that when this parameter reaches this value the number of turn-around anomalies starts to increase significantly.

- The positive effect of the heater switch-on (end of October 2005) can be appreciated with a drastic reduction of the occurrence of differential speed errors.
- The impact of the ENVISAT anomaly of 6th April 2006 is manifest in this plot, 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 -4% differential speed errors.
- The effect of the planned decontamination of September 2006 is not visible within this plot; however it should be stressed that the instrument performances were already very good before the decontamination and the situation did not changed afterward.
- During the last months the -4% differential speed error remains constant around a value of 30%. A further reduction of this parameter to 15 – 20 % is observed since Sep 2007. Finally this value reaches level close to beginning of mission since March 2008. This observation confirms that the instrument performances are continuously improving despite the fact that the duty cycle was progressively increased since May 2006.

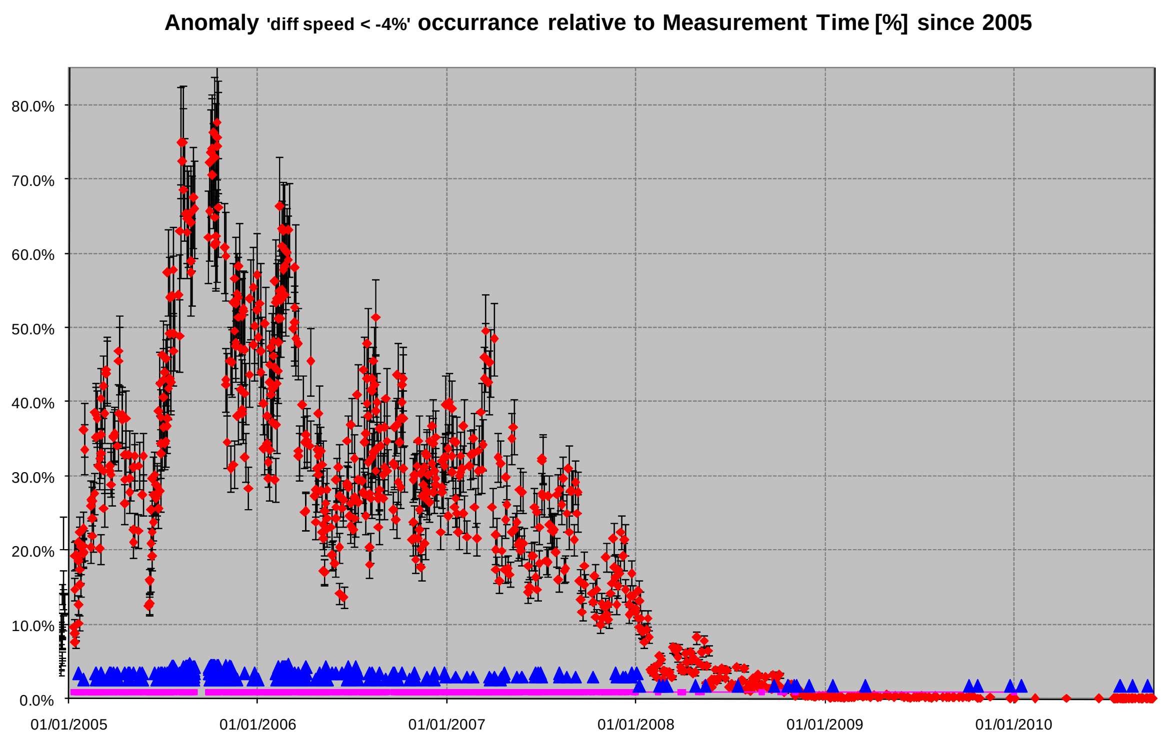


Figure 9 Occurrence of -4% differential speed error relative to measurement time since 2005 (courtesy of Astrium).

The number of INT errors per quarter and the different type of errors since 2006 can be seen in the Figure 10 (analysis carried out by Astrium). The following points can be highlighted from this long term monitoring:

- We observed that the occurrence of turn-around errors is drastically reduced demonstrating that the switch-on of the INT-heater (Oct 2005), the better performances of the cooler and the more frequent decontaminations improved significantly the instrument performances.

- It is important to stress that since Oct 2006 only 3 turn-around error has been detected. This type of error was the most frequent during the first year of the RR mission (2005) and it increased significantly when the INT heater was switched off (Aug – Oct 2005).
- On the other hand the frequency of the start-up failures that occur after an instrument interruption didn't change significantly in the last months, showing that this type of error is not correlated with INT temperatures or cooler performances.
- It has to be noted that the start-up failure in 2006 and 2007 were often caused by the automatic re-initialization procedure. In fact in an ARB held in Dec 2007 it was decided to stop the automatic recovery and resume the manual intervention at ESOC. This new procedure is operational since March 2008. Since that date we had very few IDU anomalies.
- Nowadays the turn-around errors have almost disappeared and we have about one start-up failure per quarter of continuous operations.
- In conclusion the analysis of the INT anomaly historical record demonstrates that the instrument is performing very well in the last months and that the increase of duty cycle (up to 100%) did not affect the instrument performances.

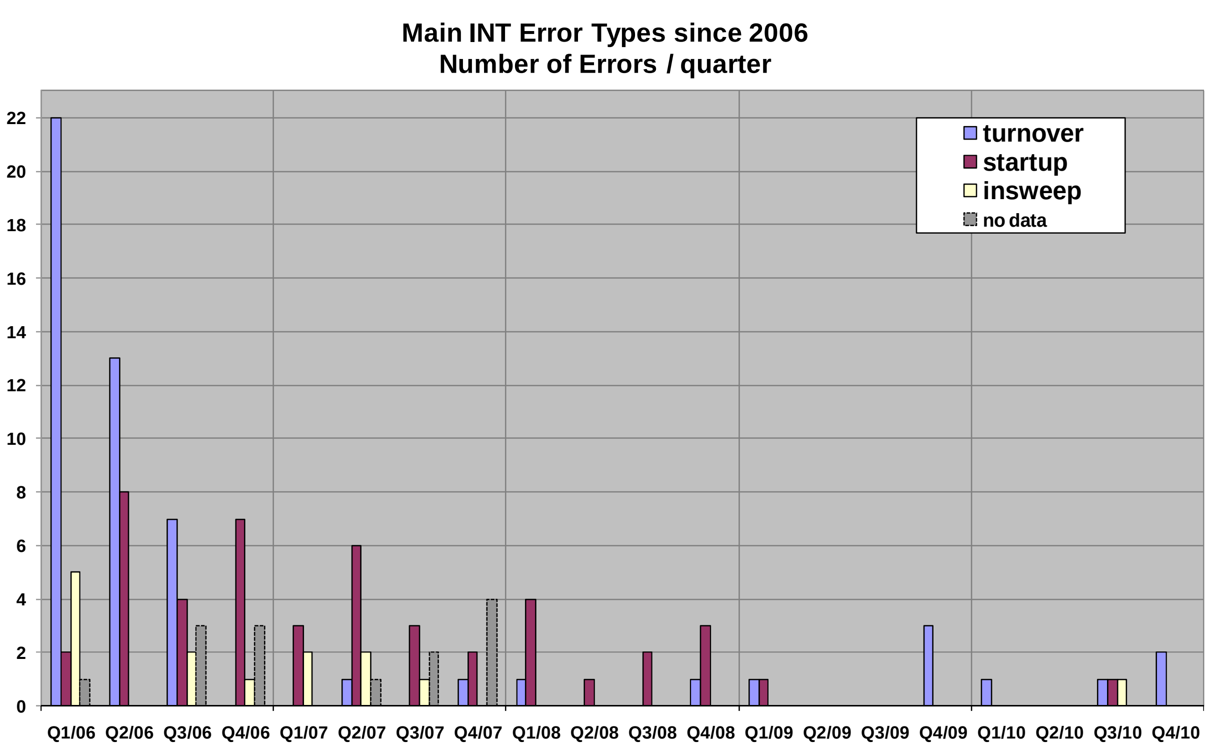


Figure 10 Main INT error types since 2006 (courtesy of Astrium).

2.5.3 COOLER PERFORMANCE

The Figure 11 shows the cooler displacer and compressor vibration level historical trend. The variations of the cooler vibrations are linked to INT heater switch and decontamination events, the decontaminations can be planned or caused by platform switch-off. Furthermore the seasonal dependency of the cooler vibrations can be clearly appreciated, indeed the vibrations increase during the hottest period of the year (May-Jun), while are decreasing on winter time (Dec-Jan).

From the plot of Figure 11 the following historical events can be distinguished:

- A significant decrease of the cooler vibrations was detected on June 2005 after the decontamination and the switch-off of the INT-heater
- A slight increase of the compressor vibration by about 1 mg is observed after the switch-on of the INT heater at the end of October 2005
- An important improvement in the cooler performances with a reduction of the compressor vibration can be noticed after the ENVISAT anomaly of 6th April 2006. In fact this anomaly acts as a decontamination event and results in a significant improvement of the cooler performances.
- A significant reduction of the compressor acceleration can be observed after the decontamination of September 2006 and the PLSOL at the end of November 2006
- After the passive decontamination of June 2007 the compressor acceleration levels were reduced from about 6.8 mg to 5.6 mg and in general all the cooler parameters were significantly improved after this period.

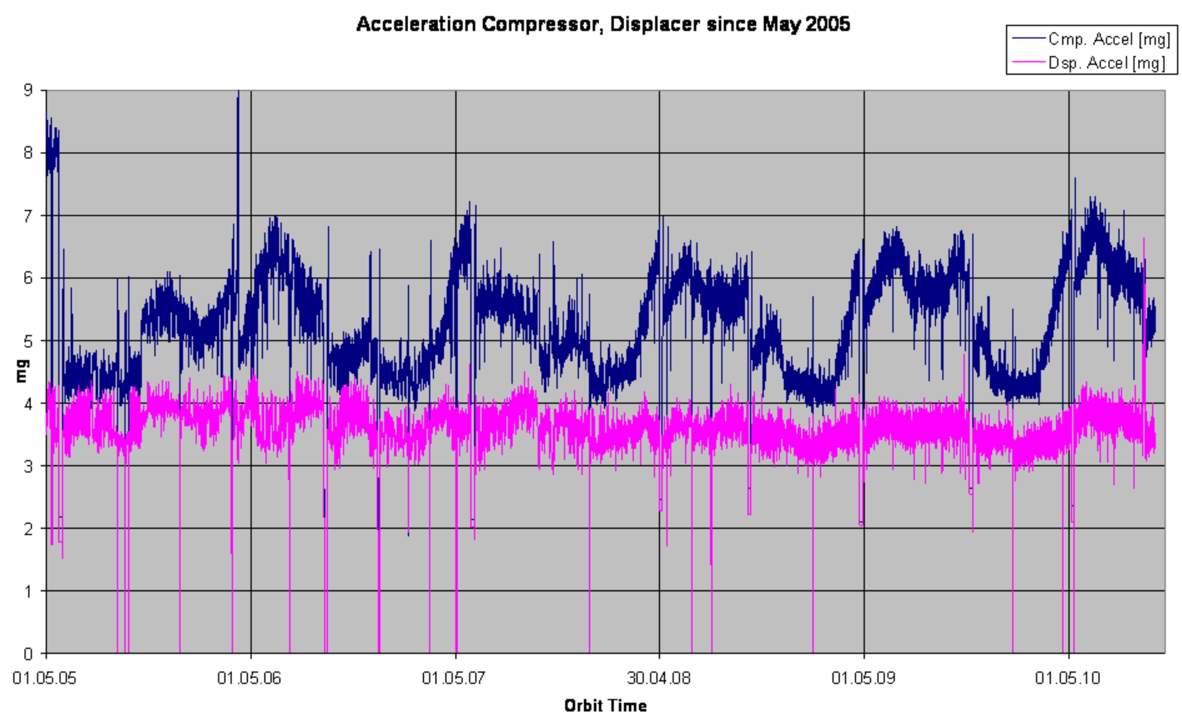


Figure 11 Cooler Displacer and Compressor vibration level, historical trend since 2005 (courtesy of Astrium).

2.5.4 ADC COUNTS LONG-TERM MONITORING

The long term monitoring of the ADC Min/Max counts along the mission is presented in this paragraph. The ADC counts is 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 instrument self-emission, forward/reverse effects, detector non-linearity and gain increase.
The long term trend of the ADC max counts in all eight MIPAS channels since June 2005 is shown in the following figures. In these figures the seasonal variation of the instrument thermal condition is clearly visible, demonstrating the effect of instrument self-emission. The split of the curve in two is due to the forward/reverse effect and it is coming from a different sampling of the IGM at its maximum in the two directions. Another effect that is superimposed to the seasonal variation is the impact of the decontamination events that result in an increase of the signal due to the ice removal (see for ex. September and December 2006). From this plot we learn that a detector sensitivity degradation is visible for channel A and B, but not for channels C and D, where an increase of signal is found due to the increased instrument temperature.

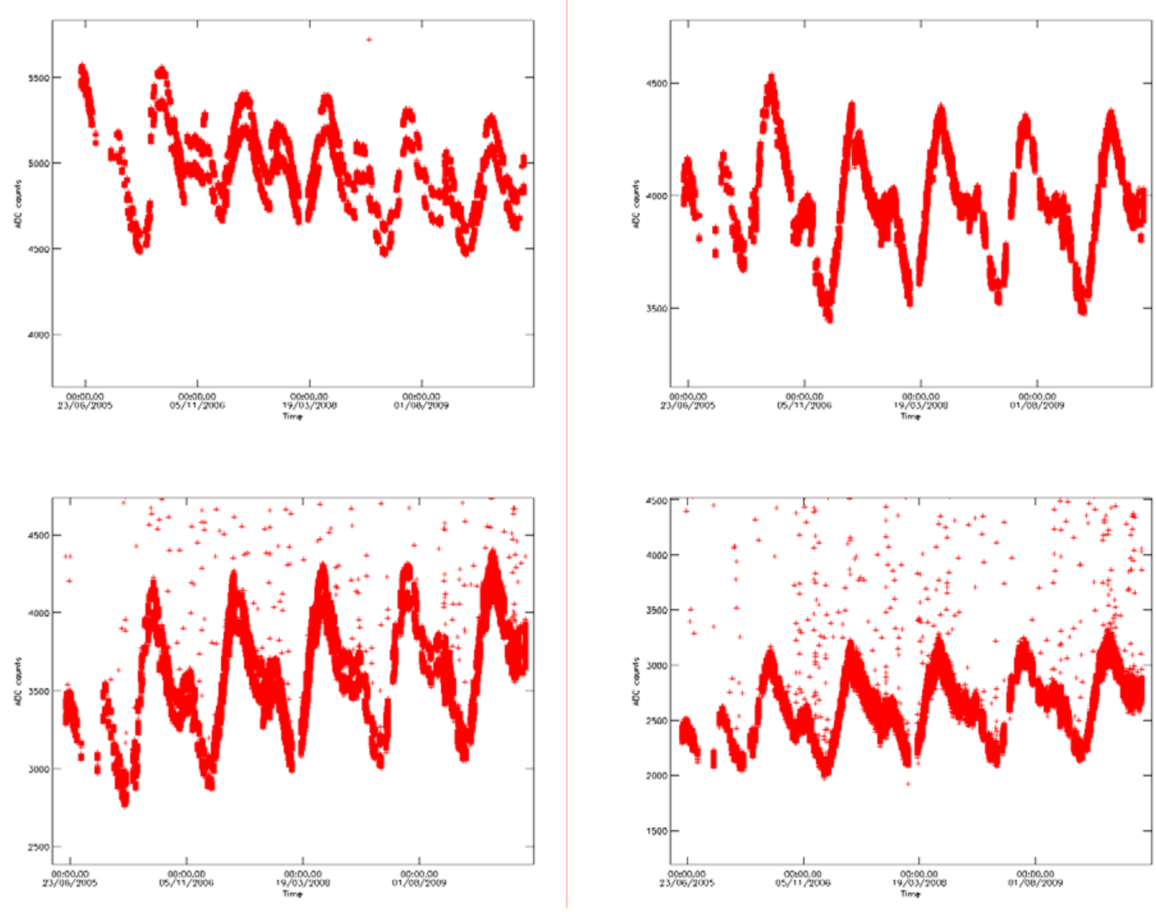


Figure 12 ADC max counts in channel A1, B1, C1 and D1 during DS measurements since June 2005.

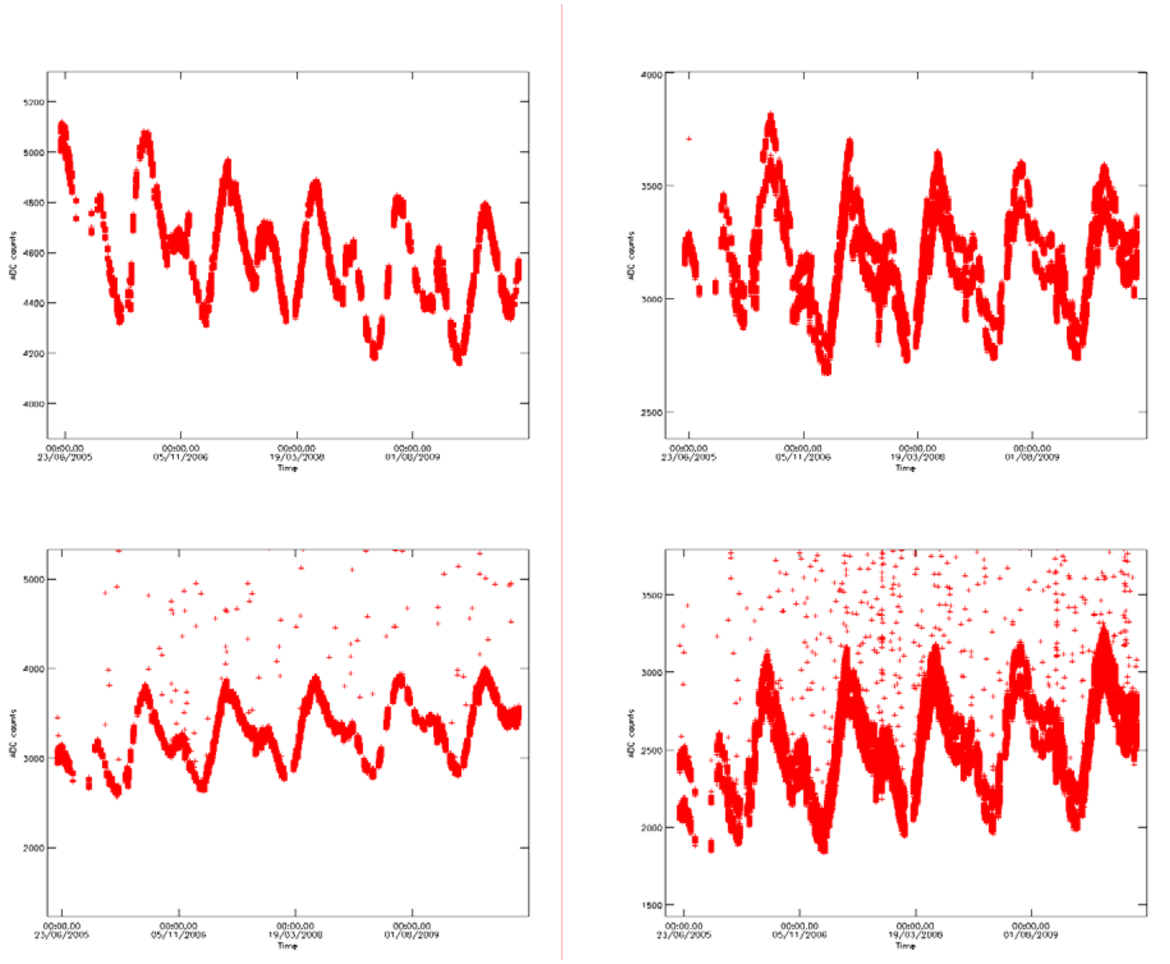


Figure 13ADC max counts in channel A2, B2, C2 and D2 during DS measurements since June 2005.

2.6 Level 1b product quality monitoring

2.6.1 PROCESSOR CONFIGURATION

2.6.1.1 Version

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	Prototype		DPM		IODD		TDS		ADF		Processor updates	
	L1 Migsp	L2 ml2pp	L1	L2	L1	L2	L1	L2	L2	L2	Level 1	Level 2
Linux version												
5.05	2.7	5.0	4L	5.2	5B	5E	7.1	4.4	8.6	6.4	Aligned to L1 DPM 4L and L2 DPM 5.2, CFI 5.8.1 integrated	
5.02	2.7	-	4L	-	5B	-	7.1	-	8.6*	-	Aligned to L1 DPM 4L. No L2 processing is foreseen with this IPF version. New Mical 1.6 switched.	
4.67L02	2.6	4.0	4Ia	4.1	4E	4.0	6.0	3.4	6.1	5.2	IPF 4.67 AIX version ported to Linux IPF 4.67L02	
AIX version												
4.67	2.6	4.0	4Ia	4.1	4E	4.0	6.0	3.4	6.1	5.2	Fixed NCR_1594 NCR_1676	Fixed NCR_1458 NCR_1521 NCR_1522
4.65	2.5	4.0	4I	4.1	4E	4.0	6.0	3.4	6.1	5.2	-	Fixed NCR_1310
4.64	2.5	4.0	4I	4.1	4E	4.0	6.0	3.4	4.0	3.8	Fixed SPR-121O0-2011	-
4.63	2.5	4.0	4I	4.1	4E	4.0	6.0	3.4	4.0	3.8	Fixed SPR-120O0-2000 SPR-120O0-2001	Fixed NCR_1278 NCR_1308 Rejected NCR_1310 NCR_1317
4.62	2.5	4.0	4H	4.0	4E	4.0	6.0	3.3	4.0	3.8	Fixed NCR_1157 NCR_1259	Fixed NCR_1128 NCR_1275 NCR_1276

***Version 8.6 is activated in synchronization with the new calibration chain (Mical 1.6)**

The historical updates in the MIPAS L1 processor are detailed in ***Appendix B*** with all the information on the related NCRs and SPRs. 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 OFL processing sites (LRAC and D-PAC), in red is the current operational IPF.

Centre	Facility Software	Date
D-PAC **PDHS-E/K**	**V5.05**	**21-06-2010** **10-06-2010**
D-PAC **PDHS-E/K**	**V5.02**	**24-01-2010** **28-01-2010**
PDHS-E/K **D-PAC**	**V4.67L02** **(Switch to ESA Linux Ground Segment)**	**28-09-2009**
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
LRAC	V4.59	20-08-2003
D-PAC	V4.59	06-08-2003
PDHS-K	V4.59	23-07-2003
PDHS-E	V4.59	23-07-2003
PDHS-K	V4.57	22-07-2003
LRAC	V4.57	22-07-2003
PDHS-K	V4.59	21-07-2003
LRAC	V4.59	21-07-2003
LRAC	V4.57	19-03-2003
PDHS-K	V4.57	18-03-2003
D-PAC	V4.57	05-03-2003
PDHS-E	V4.57	04-03-2003

2.6.1.2 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 level 1 ADF files generated and disseminated during the reporting month are listed in the following table.

Table 7 Level 1 ADFs valid in December 2006.

Auxiliary Data File	Start Validity	Stop Validity	Updated
Static AUX for NRT MIP_CA1_AXNIEC20100125_145055_20100128_000000_20150128_000000 MIP_CL1_AXNIEC20100125_145256_20100128_000000_20150128_000000 MIP_MW1_AXNIEC20100125_145445_20100128_000000_20150128_000000 MIP_PS1_AXNIEC20100125_145601_20100128_000000_20150128_000000	2010-01-28	2015-01-28	No
Static AUX for OFL MIP_CA1_AXNIEC20100125_145055_20100122_000000_20150122_000000 MIP_CL1_AXNIEC20100125_145256_20100122_000000_20150122_000000 MIP_MW1_AXNIEC20100125_145445_20100122_000000_20150122_000000 MIP_PS1_AXNIEC20100125_145601_20100122_000000_20150122_000000	2010-01-22	2015-01-22	No
MIP_CG1_AXVIEC20101004_105353_20101002_000000_20151002_000000 MIP_CO1_AXVIEC20101004_105450_20101002_000000_20151002_000000 MIP_CS1_AXVIEC20101004_105531_20101002_000000_20151002_000000	2010-10-02	2015-10-04	Yes
MIP_CG1_AXVIEC20101011_124503_20101009_000000_20151009_000000 MIP_CO1_AXVIEC20101011_124621_20101009_000000_20151009_000000 MIP_CS1_AXVIEC20101011_124715_20101009_000000_20151009_000000	2010-10-09	2015-10-09	Yes
MIP_CG1_AXVIEC20101025_091635_20101021_000000_20151021_000000 MIP_CO1_AXVIEC20101025_091803_20101021_000000_20151021_000000 MIP_CS1_AXVIEC20101025_091921_20101021_000000_20151021_000000	2010-10-21	2015-10-21	Yes
MIP_CG1_AXVIEC20101029_082957_20101028_000000_20151028_000000 MIP_CO1_AXVIEC20101029_083748_20101028_000000_20151028_000000 MIP_CS1_AXVIEC20101029_084615_20101028_000000_20151028_000000	2010-10-28	2015-10-28	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. In green is the operational version.

ADFs Version	Updated ADF	Start Validity Date	IPF version	Dissemination date
8.6	**MIP_PS1_AX MIP_CL1_AX**	**RR mission (NRT and OFL)**	**5.02 + Mical 1.6**	**28 Jan 2010**
6.1	MIP_PS1_AX	09-Aug-2004	4.63 – 4.67	27-Jun-2005
6.0	MIP_PS1_AX	-	4.63	Not disseminated
4.1 TDS6	MIP_PS1_AX	09- Aug-2004	4.63	15-Mar-2005
3.2	MIP_PS1_AX	26-Mar-2004	4.61	21Apr-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

2.6.2 SPECTRAL PERFORMANCE

The linear spectral correction factor is applied to the spectra for the spectra calibration, it is a multiplicative factor applied to the frequency axis in order to match the position of well known atmospheric line. Variations of this factor are an indication of metrology problems or ageing of the laser. During the QWG#23 it was suggested to monitor the Linear Spectral Correction Factor as it is written in the Level 1 products. (e.g.: aging of the laser). This is presented in Figure 14 since Jan 2010, in fact this parameter was not ingested in the database before this date. From this plot we observe a very stable situation with slight seasonal trend and a large spreading of the points indicating the noise in the retrieval of this parameter. This monitoring will be part of the standard monitoring baseline for the continuation of the mission.

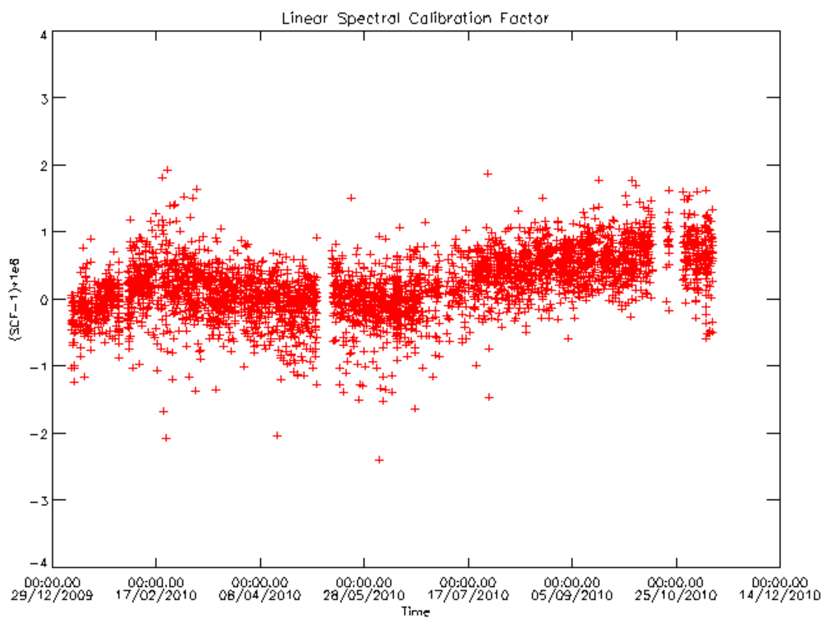


Figure 14 MIPAS Spectral Calibration Factor (SCF) since Jan 2010.

2.6.3 RADIOMETRIC PERFORMANCE

The radiometric calibration is performed on a weekly basis, furthermore the gain is always updated after long mission interruption, in case of instrument anomalies or when the instrument thermal conditions change (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 closely monitored. The increase of gain in band A is expected to be less than 1%/week at its maximum.

2.6.3.1 Weekly monitoring

The following plots show the relative changes of gain for the reporting month from one week to the other and for all the bands. Some non-corrected spikes are observed on *band AB* and *B* always at the same spectral position, this behaviour is well known and is due to the aliasing spike caused by the on-board IGM rounding and decimation.

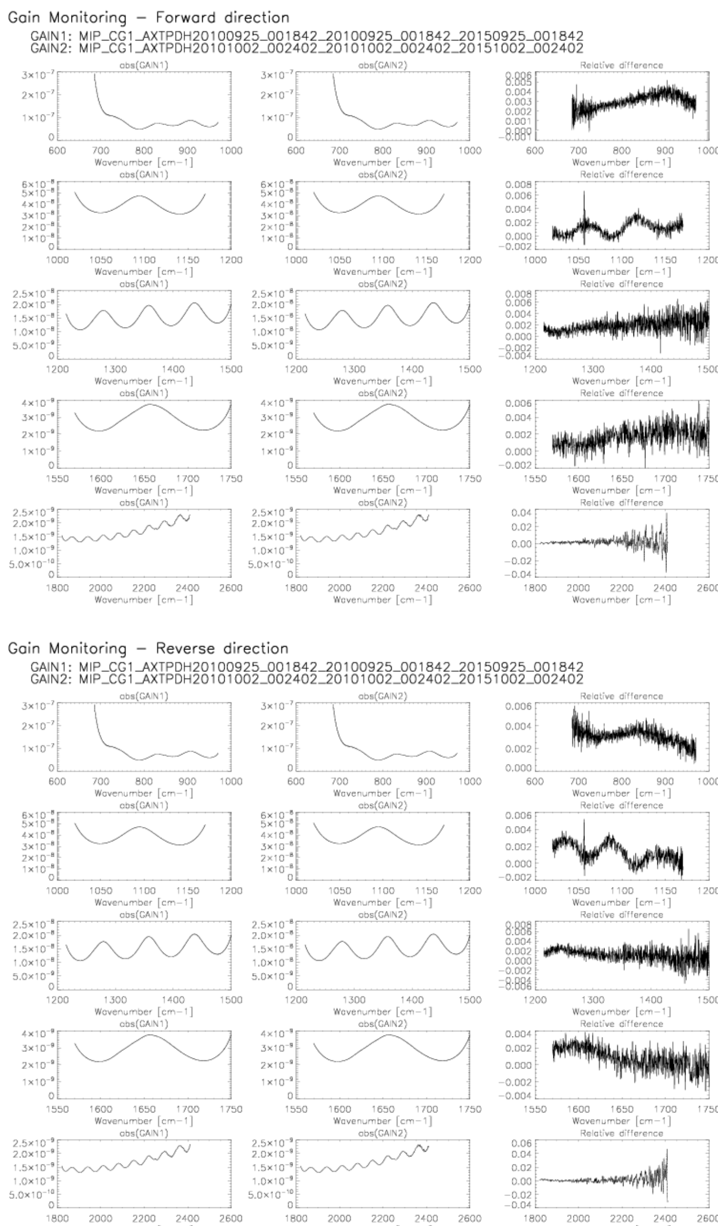


Figure 15 Relative variations of radiometric gain for consecutive disseminated gains in band A for the forward and reverse direction. The first two plots in each row are the complex modulus of the gain for each of the 5 MIPAS bands, the third plot is the ratio: *[abs(GAIN2)-abs(GAIN1)]/abs(GAIN1)*. This plot refers to a gain measured on 1 Oct 2010.

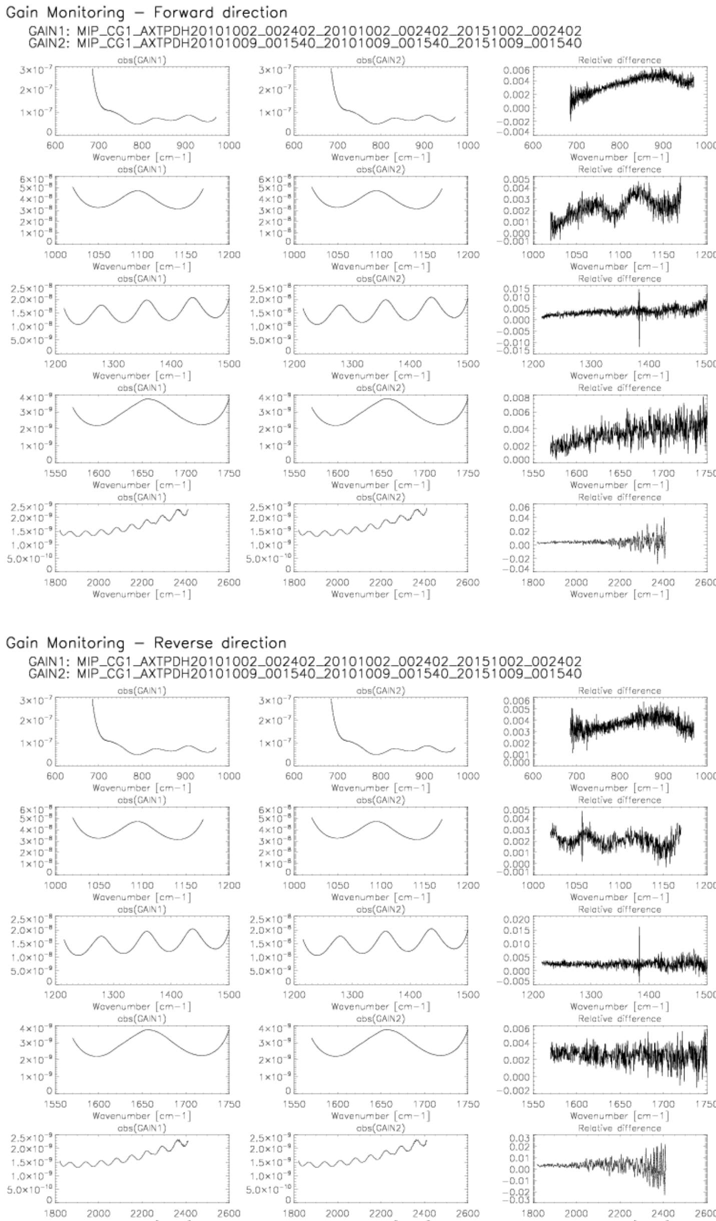


Figure 16 The same as Figure 15 but for a gain measured on 8 Oct 2010.

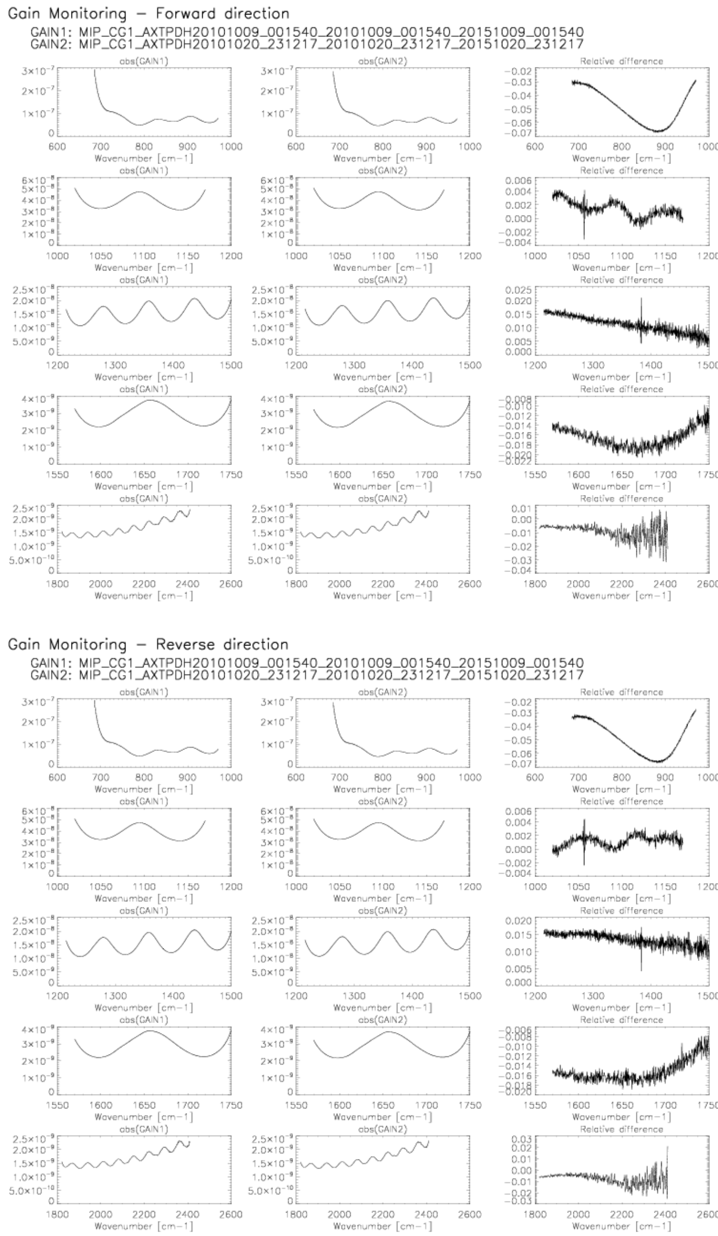


Figure 17 The same as Figure 15 but for a gain measured on 20 Oct 2010.

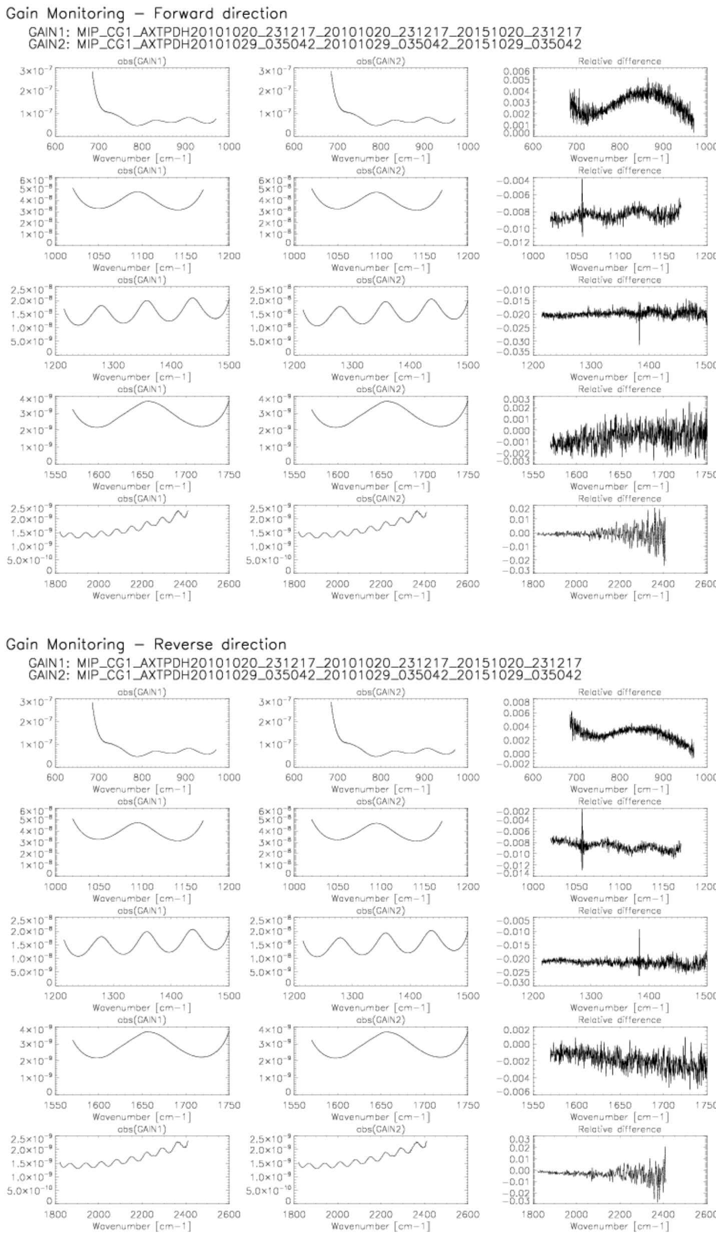


Figure 18 The same as Figure 15 but for a gain measured on 28 Oct 2010.

The maximum of gain increase is obtained as the maximum of the curves of gain relative difference presented in the previous plots. The maxima in *band A* are reported in Table 9. In this table it is also reported the long term increase, in this case we use as a reference a gain corresponding to low contaminated conditions. Note that the reference gain was changed on September 2006 after the planned decontamination.

We can observe that during the reporting month the weekly increase remains well below the acceptance criterion of 1% per week. On a long term basis we observe that we have to slightly increase the gain in band A after each decontamination, this is due to the sensitivity degradation of channel A, which is of the order of 0.2%/month.

Table 9 Weekly and long term gain increase for gains disseminated during the reporting month in *band A*. The red indicates the decrease of gain factor after the planned decontamination of the reporting month.

Orbit #	Date	Weekly max increase (%)	Long term max increase[1] (%)
44894	01/10/2010	0.52	15.05
44995	08/10/2010	0.6	15.61
45166	20/10/2010	-2.85	8.72
45283	28/10/2010	0.51	9.03

2.6.3.2 *Long term monitoring*

The long term plot of gain changes in band A between two consecutive disseminated gains is shown in Figure 19; in this figure the maximum of gain increase is normalized with respect to the time between two consecutive gains. The acceptance criterion of 1% of weekly increase is reported in the plot with the dash-dotted blue line. The anomalous increase of gain during Jan – May 2005 can be observed in this figure. After the decontamination (end of May 2005) the gain rate suddenly decreases and it remains always lower than the acceptance level unless some peaks due to instrument temperatures changes, instrument outages or decontamination. From this plot we can notice that the effect of the ice contamination is a seasonal variation of the gain weekly increase with maxima around May, corresponding to the hottest period of the year.
Note that the high variations observed after decontamination events are not presented in this plot since at this stage the goal is only to verify that the acceptance criterion of 1% of weekly increase is verified in nominal condition (e.g. excluding mission interruption or decontamination events). The effect of decontamination and changes in the instrument thermal conditions can be appreciated by analyzing the accumulation of gain over time as discussed in the next paragraph.

[1] Note that the long term increase is calculated using a different reference gain function, therefore this value doesn't correspond to a cumulative sum of the weekly increase.

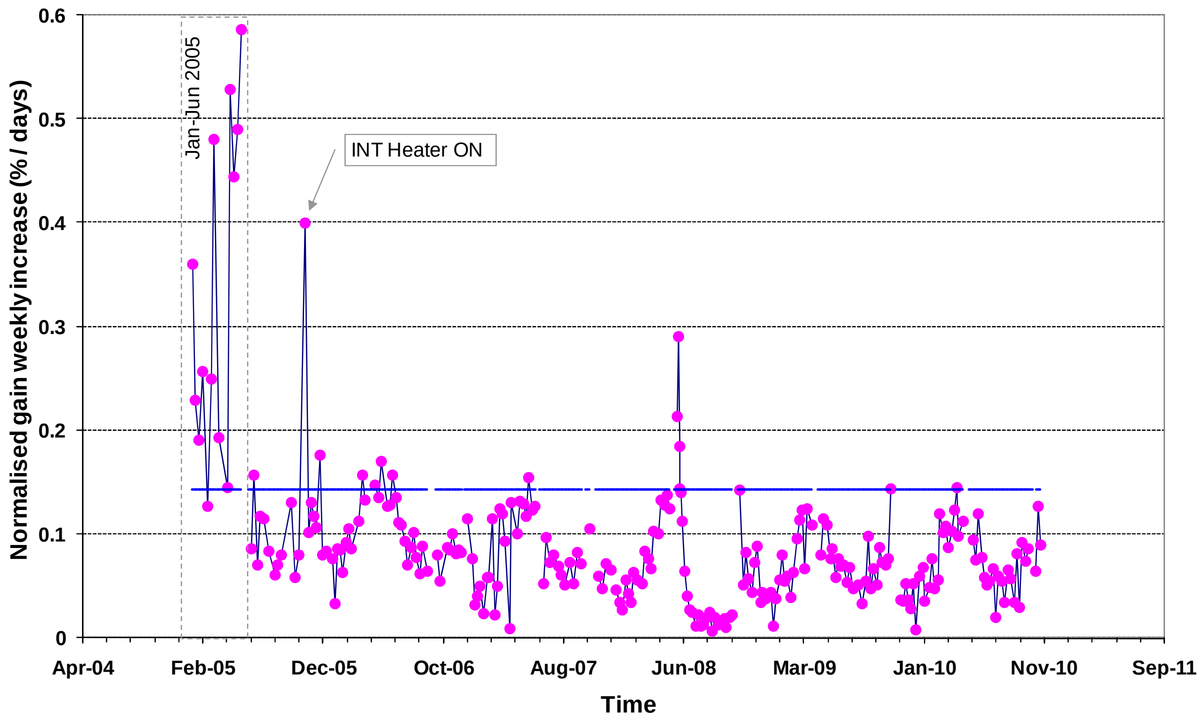


Figure 19 Gain maximum increase normalized to the time difference between consecutive disseminated gains since January 2005. The blue line represents the expected gain increase (1%/week).

The long term monitoring of the gain accumulation increase in band A is presented in Figure 20. 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 for the period June 2005 – September 2006. The reference gain was updated after the planned decontamination of September 2006. This long term investigation is useful in order to plan possible decontamination along the mission. As suggested by M. Birk (DLR) the 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 precision. The following main points can be highlighted in this figure:

- The very high increase of gain during the period Jan – May 2005. At the end of this period the gain increase reached a value of about 60%. The situation was resolved with the decontamination of June 2005.
- The linear increase of gain in the period Jun-Oct 2005.
- A sudden increase of gain due to the INT heater switch-on of October 2005.
- The significant decrease of gain after the PLSOL of April 2006 was due to the platform (and cooler) switch-off and the consequent warming up of the detector. As a result the gain was dramatically reduced by more than 25%. After this non-intended decontamination the gain increased with a constant slope up to September 2006.
- The decrease of gain by about 10% after the decontamination of September 2006 and the PLSOL of 28th November 2006.

- The decrease of gain by about 5% after the decontamination planned at the beginning of June 2007 and the other decrease due to the PLSOL of end September 2007. A slight gain decrease was also obtained with the passive decontamination planned on October 2007.

As a result of this analysis the following conclusions can be drown:

- Planned decontamination and platform switch-off always cause an ice removal from the detector and a consequent increase of the signal; as a result the gain factor is reduced.
- The dramatic increase of gain that was observed at the beginning of 2005 was never observed again due to the improvement of the cooler performances obtained with more frequent decontaminations.
- The slope of the gain increase is progressively decreasing in the last months demonstrating that the detector is more and more "ice-free".
- The gain of the first point after each decontaminations is slightly increasing with time, demonstrating the effect of the sensitivity degradation in channel A.

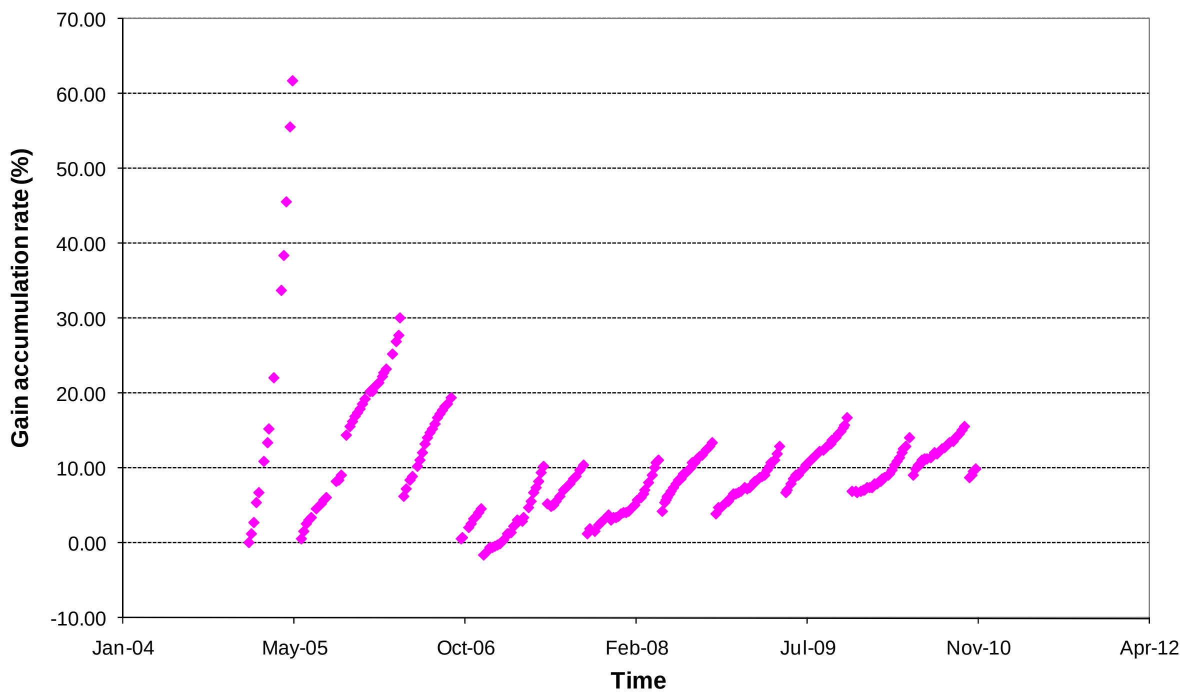


Figure 20 Gain accumulation increase since January 2005.

2.6.3.3 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***.

2.6.4 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 is a higher than **8 mdeg**. The long term trend of mispointing since start of mission is reported in Figure 21. The figure shows 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 the last months the absolute bias is stable around a value of -25 mdeg with a seasonal oscillation.
The problem observed during October 2006 on LOS calibration, namely the increase of noise in channel D2 with a resulting degradation of the star signal is still present. In fact the number of available stars for the mispointing determination is much lower than one year ago (in average 3-5 stars are now available).

During the last months the calculated absolute bias remains in the range [-20:-30] mdeg. So far no results are available concerning sideways LOS calibrations that have been routinely planned since March 2007. The problem in processing the sideways data is the poor signal recorded. During last IOP held in ESRIN during June 2008 it was agreed that the LOS calibration in sideways will be discarded in the future, since no results can be retrieved from them. In order to study the sideways mispointing a campaign of measurements was planned on November 2008. However also with this campaign no results could be found due to the weakness of the signal recorded during LOS sideways observations.

The acquisition and processing status of the LOS calibration for the reporting month is presented in the next table.

Table 10 LOS rearward calibrations performed during the reporting period. No successful calibrations were obtained for the reporting month.

Date	Orbit	Pointing error [deg]

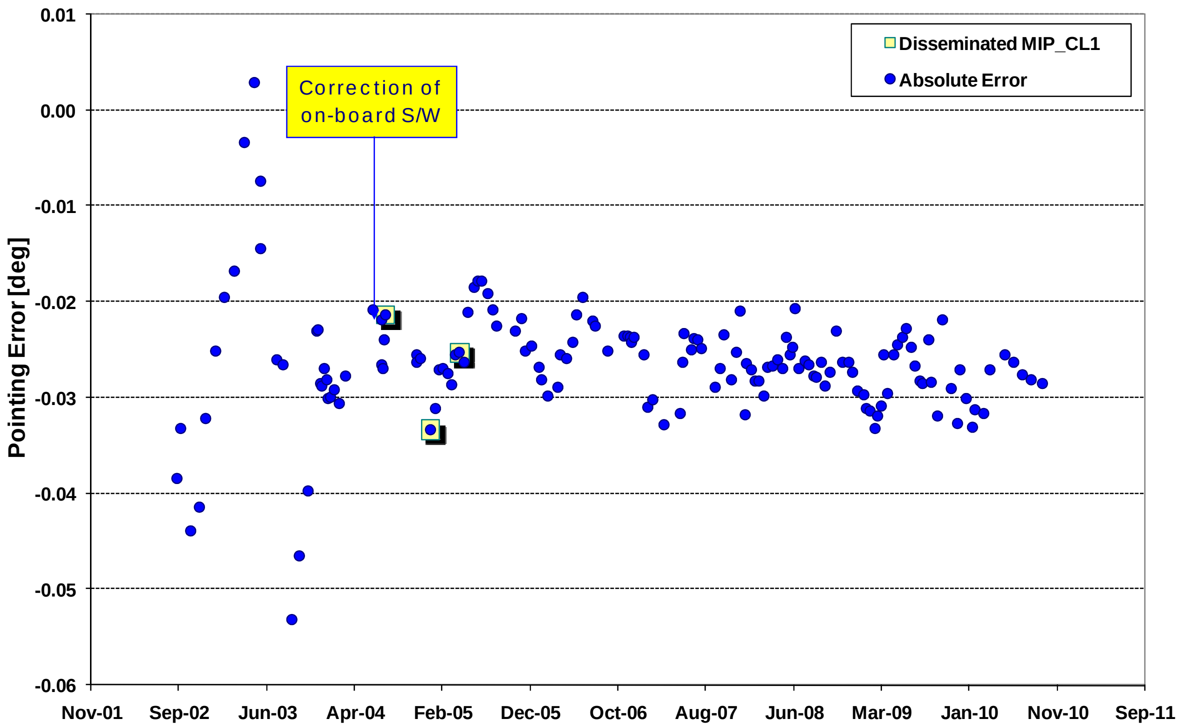


Figure 21 MIPAS long-term pointing error as a function of time since September 2002.

Table 11 shows the history of the commanded angle for LOS measurements. 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.

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

2.6.5 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/

2.6.5.1 FCE monitoring

The number of fringe count error (FCE) represents the number of points for which the measured IGM should be translated in order to match the reference IGM. As reference IGM we use the gain that is updated on a weekly basis. FCE are detected by the L1b processor and corrected, therefore no impact on the data quality is expected. A long term monitoring of the detected/corrected FCE was proposed during QWG#10 aiming at the verification of the FCE stability over time. A statistical approach based on the distribution of FCE was proposed. The outline of this approach is reported in this paragraph together with the results.

As a first step all the FCE values since Jan 2005 were analyzed on a monthly basis and the frequency distribution of the FCE was investigated. An example of the total number and frequency distribution of the FCE of one month of data is reported in the following figure.

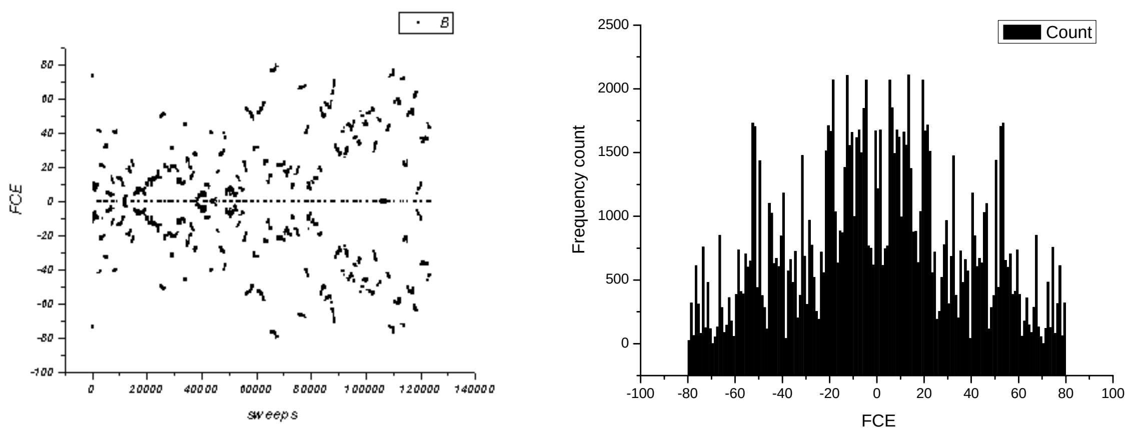


Figure 22 FCE values for one month of measurements and corresponding frequency distribution,

In order to quantify the dispersion of the frequency distribution around the mean we decide to consider the cumulative distribution function of the FCE and fit it with a sigmoid curve. The following expression was used to represent the sigmoid curve, $F(x) = A2 \frac{(A1 - A2)}{1 + e^{\frac{(x - x_0)}{s}}}$, where x_0 is the mean of the distribution, and *s* gives an indication of the slope of the sigmoid curve. An example of a typical cumulative distribution function and of the fitted curve is reported in the next figure.

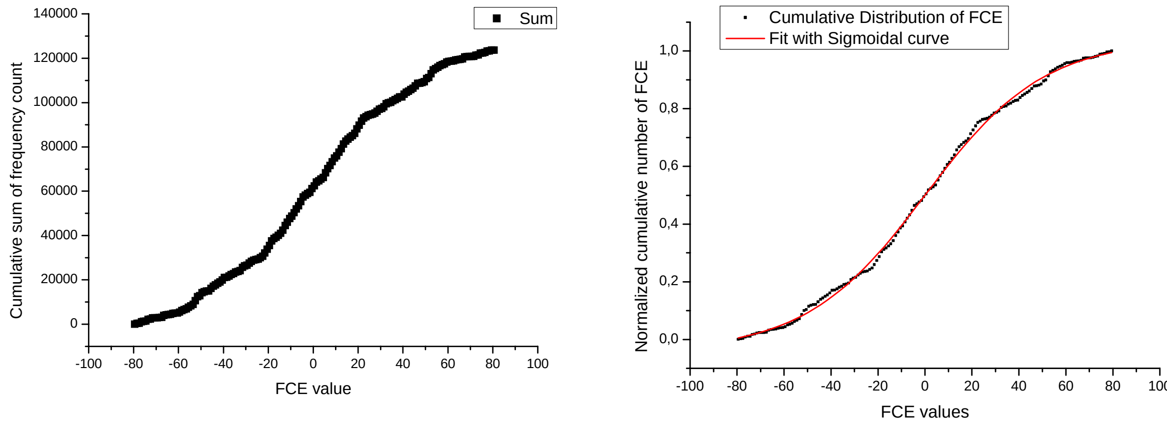


Figure 23 Cumulative distributions function of the FCE for one month of data. The fit with a sigmoid curve is reported on the right side.

The value of *s* in the expression of the fitted sigmoid curve gives an indication of the width of the probability distribution. As *s* is decreasing we approach a step-like curve, while the curve is close to be a straight line when *s* is very high. In other terms when *s* is really small we expect a distribution similar to a delta function, while when *s* is high we approach a bell-like curve. Therefore the parameter *s* can be seen as a measure of the dispersion of the points around the mean. The value of this parameter was calculated for every month since Jan 2005 and it is reported in Figure 24 together with the number of IDU errors. This figure shows that the width of the FCE distribution is highly correlated with the number of IDU errors up to May 2006, while in the last months no clear correlation can be observed. The dependency of the FCE on the IDU temperature needs to be investigated in more details.

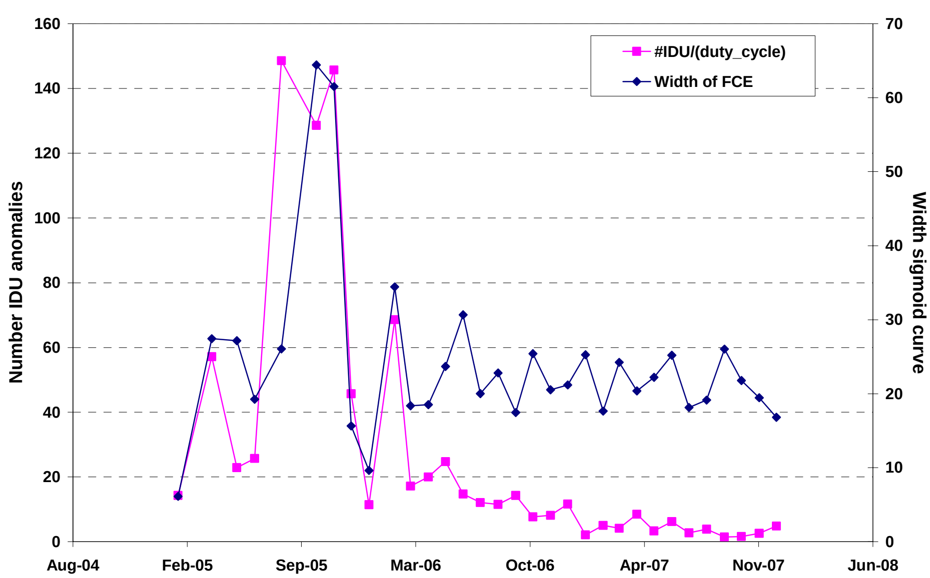


Figure 24 Width of the sigmoid curve (used to fit the FCE statistic distribution) plotted on a long term basis together with the number of IDU errors normalized to the duty cycle.

2.6.5.2 Spikes monitoring

During QWG#11 it was suggested to investigate the number of spikes detected in each MIPAS detectors. We recall here that the presence of spikes in an interferogram can be caused by cosmic radiation or transmission errors. Since the presence of a spike in the IGM will give an artifact (sinusoidal component) in the Fourier transformed spectrum, the scene IGM affected by a spike are corrected during the L1b processing by taking the mean between adjacent non affected points. Note that when a spike is detected during black body or deep space calibration measurement the corresponding IGM is discarded in order to avoid contamination in the co-addition of IGM. The L1 processor reports in the L1 products the number of detected and corrected spike for each measured scene IGM. This number was used to derive a long term statistic of detected spikes for each channel. The results are presented in Figure 25 and Figure 26 for the RR mission (starting from January 2005) in terms of percentage of sweeps affected by spikes and number of spikes/sweep. The channel C and D are the ones most affected by spikes, since they are more sensitive to high energy particle generated by cosmic rays.

A significant variability of the number of detected spikes can be observed in channels A1, A2, B1 and B2, this could be related to variation in the solar activity, but this correlation is still under investigation. The channels C and D (the detector most affected by spikes) didn't show any significant trend. In general the percentage of sweeps affected by spikes is small for the most important MIPAS bands (A, AB) while it is about 3% for band D; however the number of detected spikes is always very low for all the MIPAS bands. Finally taking into account that the spike's signal is smoothed out by the L1 processing we can conclude that the presence of spikes does not impact the quality of MIPAS L1 data.

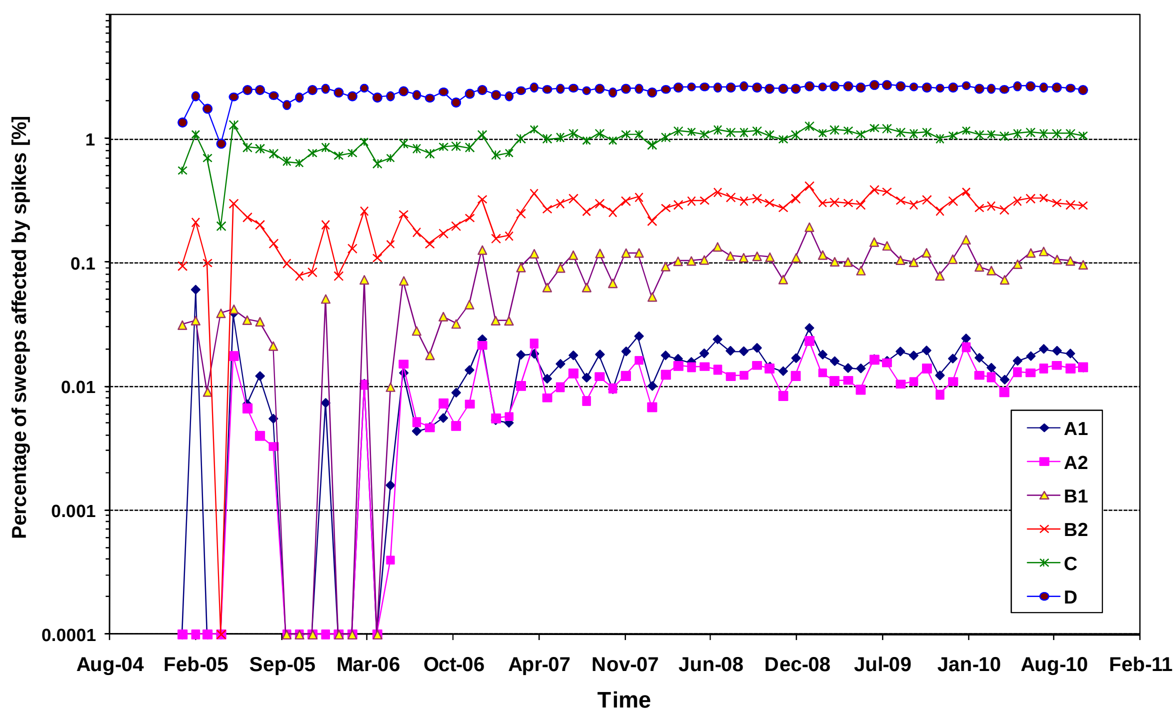


Figure 25 MIPAS long-term monitoring of spikes: percentage of spike-affected sweeps.

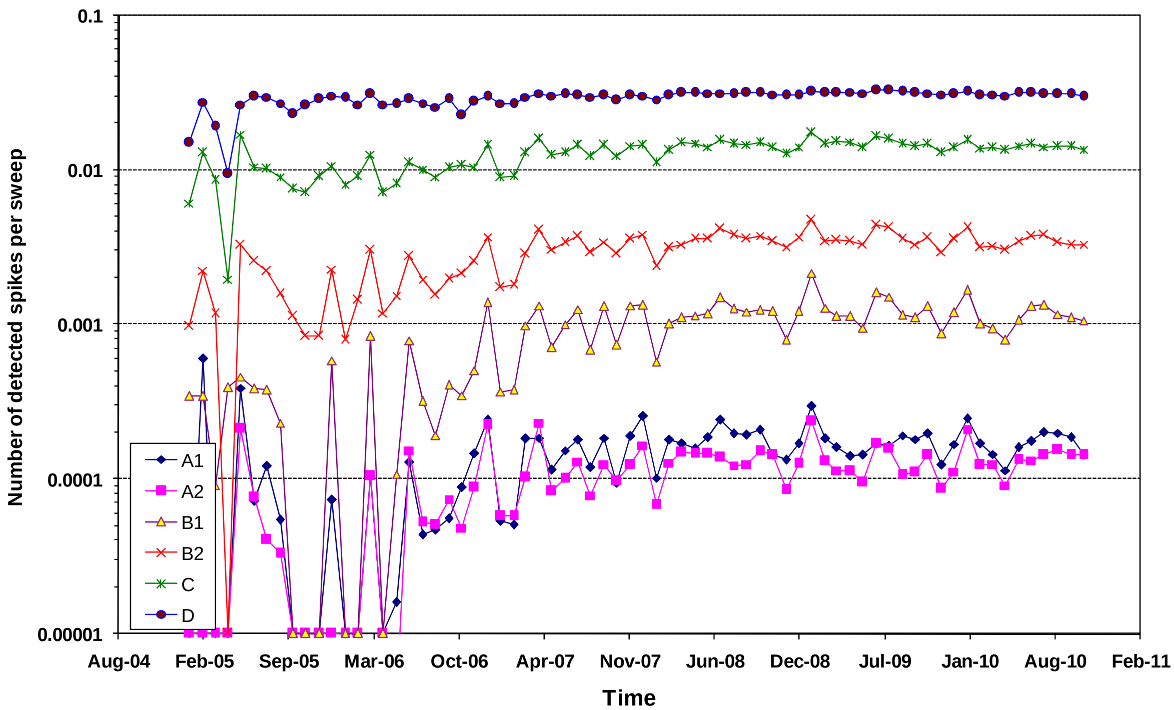


Figure 26 MIPAS long-term monitoring of spikes: number of detected spikes per sweep.

2.6.6 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, more details on anomalies investigation are reported in **§3.5**.

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

Anomaly	SPR	NCR	OAR	HD	Status	Ref.
MIPAS wrong consolidated products	/	/	2097	/	Closed	§3.5.1
Excessive number of MISSING ISPS in the MPH for MIPAS L0 products	/	/	2165	/	Closed and corrected	§3.5.2
Non-valid band A at the same geo-location	/	1594	2263	/	Closed and corrected	§3.5.3
Wrong MIPAS L1 product in D-PAC server	/	/	2303	/	Closed	§3.5.4
Badly calibrated L1 b spectra during 3 – 23 June and 29 July – 11 Aug 2005	/	/	/	/	Closed	§3.5.5
MIPAS Aircraft Emission measurements	/	/	/	/	Closed	§3.5.6
Wrongly calibrated MIPAS L1 products	/	/	/	/	Closed	§3.5.7
Anomalous scan pattern 3 – 11 Apr 2007	/	/	/	/	Closed	$3.5.8
Wrong number of sweeps per scan in L1B	/	/	/	/	Closed	$3.5.9

Anomaly	SPR	NCR	OAR	HD	Status	Ref.
Anomalous scan pattern on 15 May 2008	/	/	/	/	Closed	$3.5.10
Anomalous scan pattern: 6 – 8 Aug 2006	/	/	/	/	Closed	$3.5.11
Anomalous NESR value in band A	/	/	/	/	Closed	$3.5.12
Anomalous scan pattern n 23 Sep 2008	/	/	/	/	Closed	$3.5.13
Spurious L1B radiances during Dec/Jan 2003	/	/	/	/	Closed	$3.5.14

2.7 Level 2 product quality monitoring

2.7.1 PROCESSOR CONFIGURATION

2.7.1.1 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***.

2.7.1.2 Auxiliary Data Files

The L2 ADFs are generated by IFAC and sent to ESRIN where they are verified for format issues and disseminated to the processing centers. A New set of L2 ADFs is generated as soon as it brings an improvement of the data quality. The level 2 ADF files valid in the current configuration are reported in the next table.

Table 13 L2 ADFs valid for the current GS configuration.

Auxiliary Data File	Start Validity
OR-27 data (since Jan 2005)	
ADFs V6.4 MIP_CS2_AXVIEC20100601_142603_20050101_000000_20150101_000000 MIP_IG2_AXVIEC20100601_143357_20100601_000000_20110601_000000 MIP_MW2_AXVIEC20100601_151110_20050101_000000_20150101_000000 MIP_OM2_AXVIEC20100601_151425_20050101_000000_20150101_000000 MIP_PI2_AXVIEC20100601_152202_20050101_000000_20150101_000000 MIP_PS2_AXVIEC20100601_152623_20050603_000000_20150101_000000 MIP_SP2_AXVIEC20100601_153126_20050101_000000_20150101_000000	1-JAN-05
PS2 for MA and UA measurements MIP_PS2_AXVIEC20100614_170713_20100618_005400_20100619_002300 MIP_PS2_AXVIEC20100623_081111_20100623_013000_20100624_011000 MIP_PS2_AXVIEC20100623_083139_20100628_003000_20100629_001000 MIP_PS2_AXVIEC20100625_100319_20100703_012000_20100706_013000 MIP_PS2_AXVIEC20100708_102510_20100713_000000_20100714_004000 MIP_PS2_AXVIEC20100708_103051_20100718_000000_20100719_012200 MIP_PS2_AXVIEC20100726_103605_20100723_003000_20100724_010000 MIP_PS2_AXVIEC20100726_104300_20100728_010000_20100729_013000 MIP_PS2_AXVIEC20100726_105001_20100802_000000_20100803_003000 MIP_PS2_AXVIEC20100726_110056_20100812_000000_20100813_020000 MIP_PS2_AXVIEC20100726_110654_20100817_003000_20100818_010000 MIP_PS2_AXVIEC20100806_125256_20100822_000000_20100823_013000 MIP_PS2_AXVIEC20100806_141848_20100827_003000_20100828_010000 MIP_PS2_AXVIEC20100907_130814_20100901_010000_20100902_013000 MIP_PS2_AXVIEC20100907_131404_20100906_003000_20100907_003000 MIP_PS2_AXVIEC20100907_132104_20100911_010000_20100912_013000 MIP_PS2_AXVIEC20100907_133415_20100916_000000_20100917_020000 MIP_PS2_AXVIEC20100907_134225_20100921_003000_20100922_010000 MIP_PS2_AXVIEC20101001_093036_20100926_000000_20100927_013000 MIP_PS2_AXVIEC20101001_093556_20101001_003000_20101002_010000 MIP_PS2_AXVIEC20101008_080446_20101006_010000_20101007_013000 MIP_PS2_AXVIEC20101008_080956_20101011_010000_20101012_010000	
RR-17 data (Aug – Sep 2004)	

Auxiliary Data File	Start Validity
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
FR data (Jan 2002 – Mar 2004)	
ADFs V4.1 NRT MIP_PS2_AXVIEC20040421_095623_20040326_143428_20090326_000000 Off-line MIP_PS2_AXVIEC20040421_095923_20040326_143428_20090326_000000	26-MAR-04
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

The Level 2 ADF historical deliveries by IFAC are reported in the following table. Version 4 corresponds to a set of ADFs for processing of full resolution measurements, with the noise level adjusted for when the interferometer heaters are switched-on and a flag set for processing of only nominal measurements. Version 5 corresponds to ADFs for processing of reduced spectral resolution measurement (17 sweeps operations), so is able to process the measurements done in the Aug-Sept 2004 period. Version 6 corresponds to ADFs for processing of optimized resolution measurement (27 sweeps operations), so is able to process the measurements done since January 2005. Further details on the Level 2 ADF deliveries provided by IFAC are reported in the Appendix (see **§3.7**).

Table 14 Historical update of Level 2 ADFs provided by IFAC.

ADFs Version	Updated ADF	Start Validity Date	IPF version	Dissemination date
For RR-o mission (from Jan 2005 onward)				
6.4	MIP_SP2_AX MIP_IG2_AX MIP_PI2_AX	01-Jan-2005 RR-o mission	5.05	Disseminated on 10 June 2010 with the switch of IPF 5.05
6.3	MIP_PS2_AX MIP_MW2_AX MIP_CS2_AX MIP_OM2_AX	01-Jan-2005 RR-o mission	5.05	*Not disseminated* *To be used with IPF 5.00*

ADFs Version	**Updated ADF**	**Start Validity Date**	**IPF version**	**Dissemination date**
6.2	*MIP_OM2_AX* *MIP_IG2_AX*	*01-Jan-2005* *RR-o mission*	*5.00*	*Not disseminated* *To be used with IPF 5.00*
6.1	*MIP_PS2_AX* *MIP_MW2_AX* *MIP_CS2_AX* *MIP_SP2_AX* *MIP_OM2_AX* *MIP_IG2_AX*	*01-Jan-2005* *RR-o mission*	*5.00*	*Not disseminated* *To be used with IPF 5.00*
6.0	*MIP_PS2_AX* *MIP_MW2_AX* *MIP_CS2_AX* *MIP_SP2_AX* *MIP_OM2_AX* *MIP_IG2_AX*	*01-Jan-2005* *RR-o mission*	*5.00*	*Not disseminated used only for GRIMI-2*
For RR-17 mission (Aug – Sep 2004)				
5.2	MIP_SP2_AX MIP_PS2_AX	09-Aug-2004 RR-17 mission	4.65/ 4.67	5-Jan-2006
5.1	*MIP_SP2_AX* *MIP_OM2_AX* *MIP_MW2_AX*	*09-Aug-2004* *RR-17 mission*	*4.65/* *4.67*	*Not used for processing due to a format error*
5.0	*MIP_PS2_AX* *MIP_MW2_AX* *MIP_PI2_AX*	*09-Aug-2004* *RR-17 mission*	*4.65/* *4.67*	*/*
For FR mission (Jun 2002 – Mar 2004)				
4.1	NRT: MIP_PS2_AX_NRT_V4.1 OFL: MIP_PS2_AX_OFL_V4.1	FR mission	4.61/ 4.62	13.02.2004
4.0	NRT: MIP_PS2_AX_NRT_V4.0 OFL: MIP_PS2_AX_OFL_V4.0	FR mission	4.61/ 4.62	03.09.2004

2.7.2 QUALITY CONTROL OF L2 NRT DATA

A quality control of L2 NRT data started with the switch of IPF 5.05, the monitoring baseline will be refined with the upcoming Monthly Report. The first monitoring plot is presented here. It is the evolution of the final chi square value for NRT retrieval parameters. We can observe in the first products generated NRT a general high value of chi square for CH4 and N2O retrieval, this issue is currently under investigation.

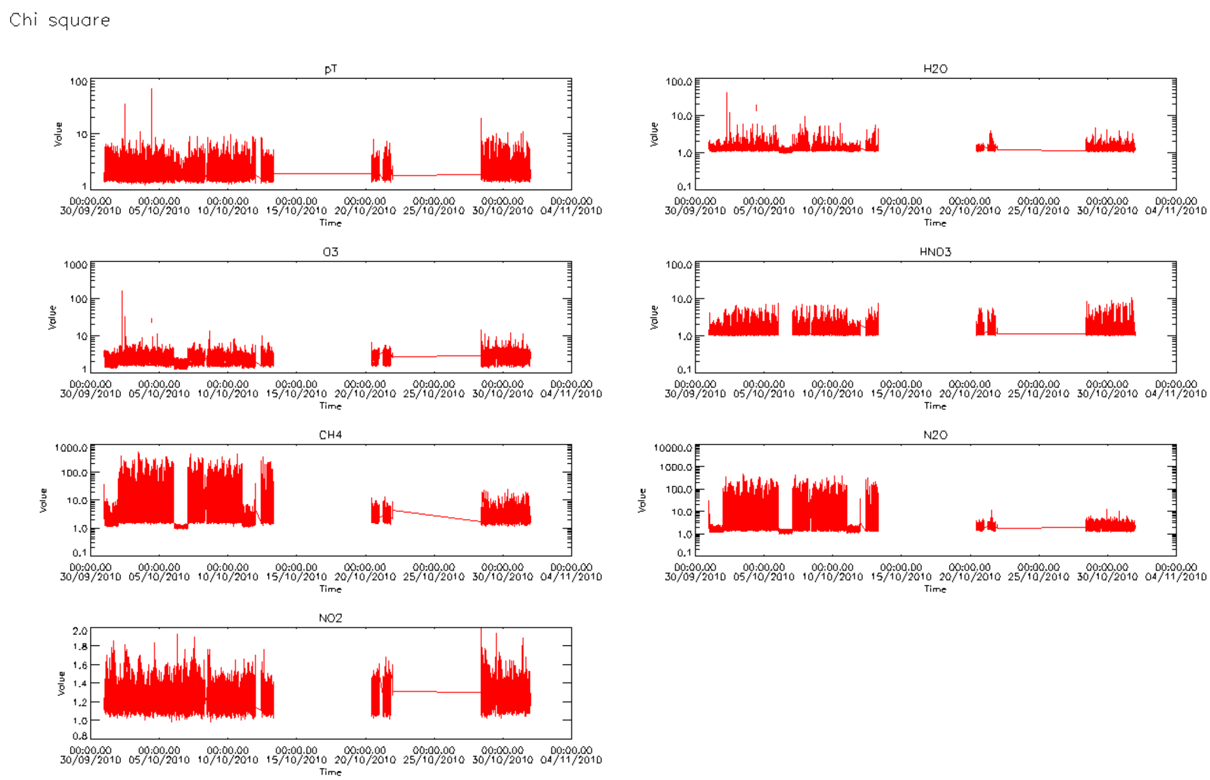


Figure 27 MIPAS last chi square values for NRT retrieval parameters.

2.7.3 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 **§3.8**.

Table 15 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	§3.8.1
Difference on L2 products between v4.61 and v4.62	/	1521	2074	/	Closed with IPF 4.67	§3.8.2
NO2 retrieval during polar condition	/	/	/	/	Closed	§3.8.3
L2 OFL missing data around the South Pole	/	/	/	/	Closed	§3.8.4
L2 continuum anomaly	/	/	/	/	Closed	§3.8.5

2.8 Processing/Re-processing Status

2.8.1 PROCESSING STATUS

Since February 2008 the L1b NRT processing was restarted at ESRIN and Kiruna sites, the products can be found at the ftp rolling archives. L1b off-line processing is operational at D-PAC.

Level 2 NRT was resumed on 10 June 2010 with IPF 5.05. The Level 2 off-line switch was performed on 21 June 2010.

2.8.2 RE-PROCESSING STATUS

2.8.2.1 Second re-processing with version 4

The first re-processing of the FR MIPAS mission (Jul 2002 – Mar 2004) 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.
Processing flag for this re-processing is set to “P”.

2.8.2.2 Third re-processing with version 5

The Level 1 re-processing of the full mission (Jul 2002 – Jan 2010) with IPF 5.02 was completed at D-PAC and data is available to the users on the eoa ftp server.
The Level 2 re-processing with version 5.05 will be started in Q4 2010.
Processing flag for this re-processing is set to “R”.

3 APPENDICES

3.1 Appendix A – NRT products availability

Table 16 List of missing gaps for MIP_NL__0P during the reporting month.

Start time	Stop time	Duration (sec)

Table 17 List of missing gaps for MIP_LS__0P during the reporting month.

Start time	**Stop time**	**Duration (sec)**

3.2 Appendix B – Level 1 IPF historical updates

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

- **Version V5.05** it is equivalent to IPF 5.02, but the new CFI 5.8.1 for the ENVISAT mission extension are integrated
- **Version V5.02** (aligned with L1 DPM 4L and L1 ADFs V8.6) upgrade of the Level 1 processor. The L2 processing with this IPF is disabled, due to the investigation on-going on the discrepancies between IPF and reference prototype processor. For Level 1 the following upgrades were included:
    - Truncation of the Interferogram to 8.0 cm in order to avoid under-sampling the spectrum for the Optimized Resolution mission
    - Improved Level 1b engineering heights calculation
    - Calculation of the quadratic terms for spectral calibration that are provided in the output products
    - Additional fields in the Level 1b products, such as the auxiliary L0 data packets that provide information about house keeping data
- **Version V04.67L02** Linux porting version of 4.67 AIX processor
- **Version V4.67** the following updates were introduced for L1 processing
    - 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.
    - 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 activation date of these ADFs with respect to the operational processor are reported in the table below.

Table 18 Level 1 ADF start validity date

ADFs Version	Updated ADF	Start Validity Date	IPF version	Dissemination Date
8.6	MIP_PS1_AX MIP_CL1_AX	09-Aug-2004 RR mission	5.02 + Mical 1.6	28 Jan 2010
6.1	MIP_PS1_AX	09-Aug-2004 RR mission	4.65 4.67	27-Jun-2005
5.0	MIP_PS1_AX	/	/	Not used for processing
4.1	MIP_PS1_AX	/	/	Not used for processing
3.2	MIP_PS1_AX	26-Mar-2004	4.61	21Apr-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 FR mission	4.61	4-Nov-2003

A more detailed description of the historic updates of the L1 ADF is reported hereafter.

Version 8.6

MIP_PS1_AX

- Rejection Threshold NESR assessment = 1.0
- Changing the pitch, roll and yaw bias taking into account the alignment matrix correction introduced in the planning for reduced resolution data.
- The OPD is set also to 8.0 instead of 8.2 cm.
- Attitude flag set to 0 since for the IPF 5.02 the usage of AUX_FRA is disabled

MIP_CL1_AX

- A specific MIP_CL1_AX files has to used with ADF 8.6m, this ADF LOS calibration files has no pitch bias correction and allows to correct for the problem in the alignment matrix when used with the MIP_PS1_AX file of version 8.6

Mical 1.6

- The version 8.6 is activated in correspondence with the new Mical chain 1.6

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 19 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 0 and Level 1 anomaly status

3.5.1 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).

The consolidated ones (yellow)
are shorter than NRT (white)

Figure 28 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 were deleted from D-PAC and re-consolidated at LRAC.

3.5.2 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

The investigation on the ground segment has demonstrated that the problem is due to the L0 processing of the MIPAS instrument source packets. The problem was resolved since Dec 2006 after the switch of the “new” FEOMI infrastructure with the EXTPS module.

3.5.3 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 29 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.

3.5.4 WRONG MIPAS L1 PRODUCT IN D-PAC SERVER

One L1 product in D-PAC ftp server is corrupted (see red crosses in **Figure 30**), 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 outdated 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

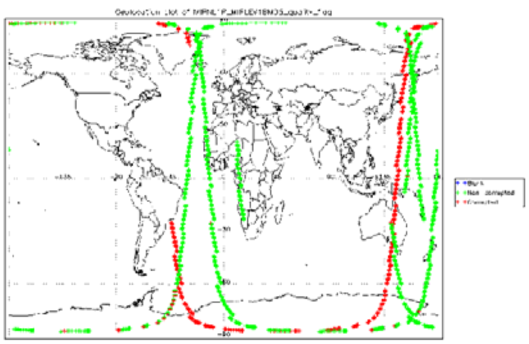


Figure 30 L1b PCD quality flag, corrupted sweep detected for 3 Oct 2005 L1b spectra

3.5.5 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 31**).

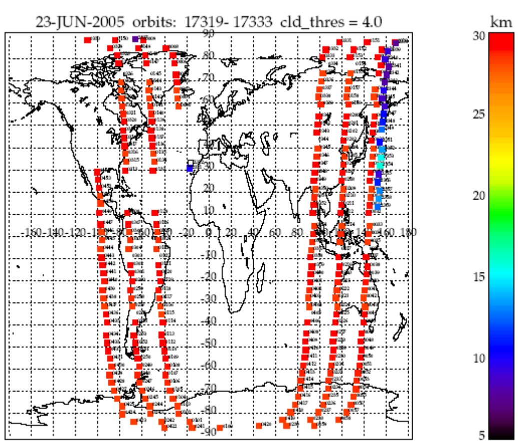


Figure 31 Cloud top height calculated by M. Hopfner (IMK) for 23 June 2005, the red points are due probably to a corruption in the band A spectrum.

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 32**). 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.

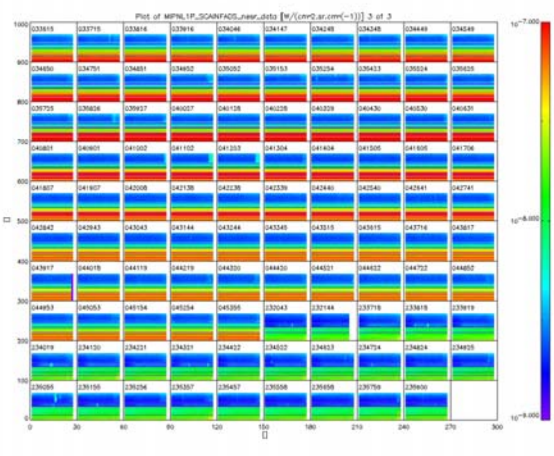


Figure 32 NESR level for different scan during 23 June 2005, each square is a scan made of 27 sweeps in nominal mode, the red lines show the anomaly of excessive high NESR, the anomaly stops when the correct ADF start to be used by the processor.

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 20 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 21 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.

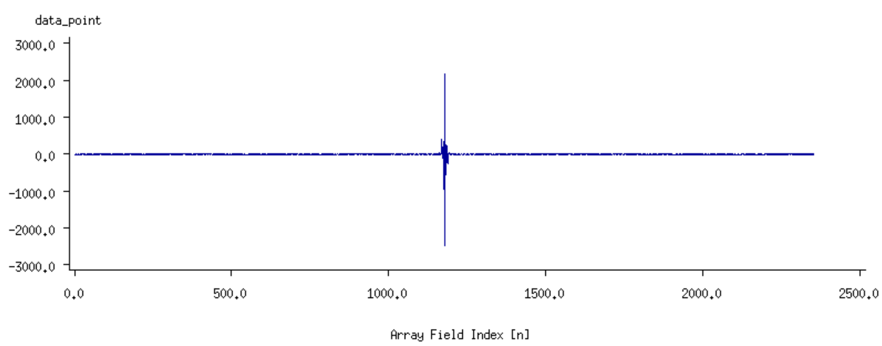


Figure 33 IGM recorded in the deep space measurement and stored in the wrong ADF.

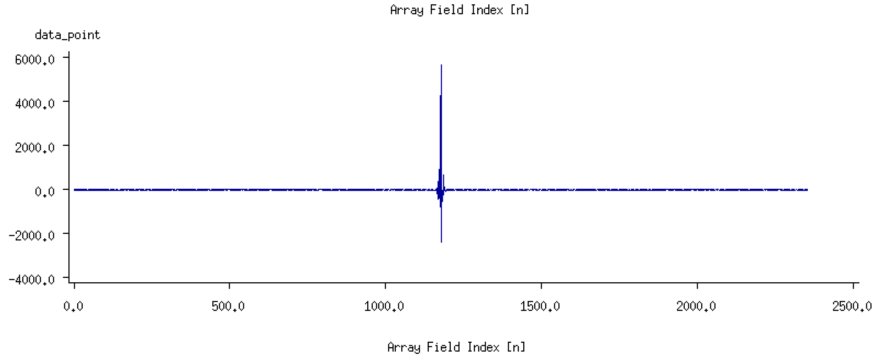


Figure 34 IGM recorded in the deep space measurement and stored in the new correct ADF.

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.

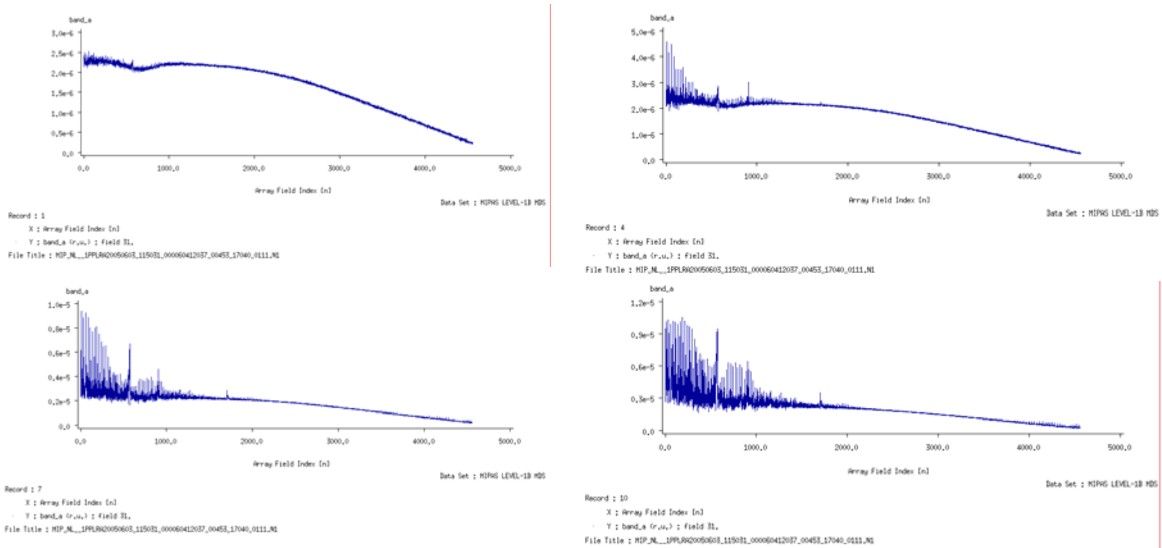


Figure 35 Example of badly calibrated spectra obtained with the old ADFs.

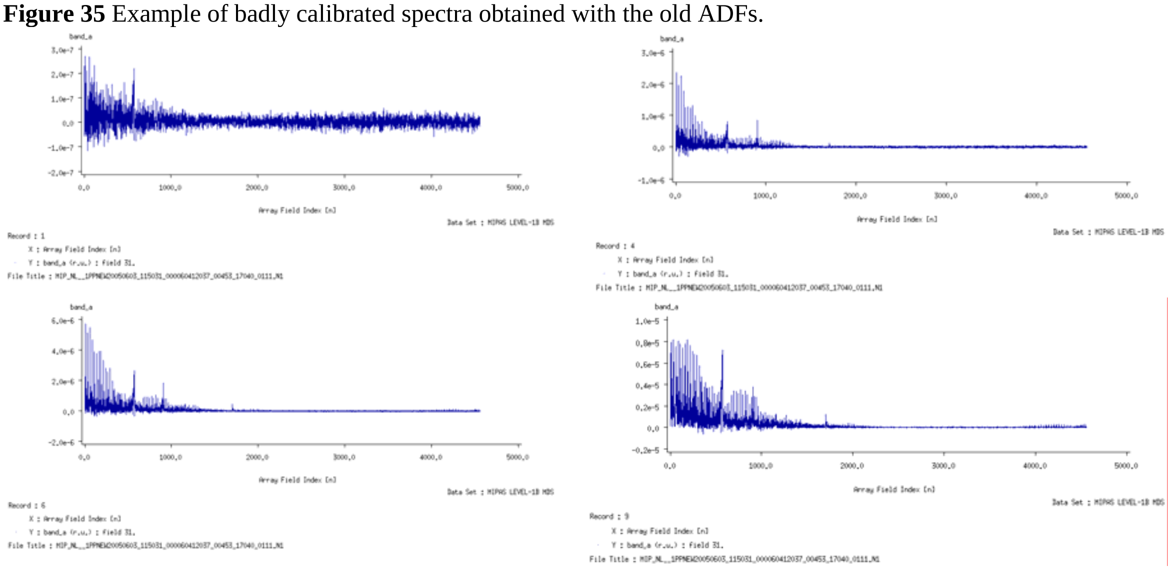


Figure 36 Example of correctly calibrated spectra obtained with the new ADFs.

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).

3.5.6 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.

3.5.7 WRONGLY CALIBRATED L1 PRODUCTS

This anomaly was detected during the daily monitoring of the L1 products of 18th April 2007 generated at D-PAC. The problem consists in a wrong calibration for the following data:

MIP_NL__1PPDPA20070418_151435_000060452057_00226_26833_2624.N1
MIP_NL__1PPDPA20070418_165526_000060292057_00227_26834_2626.N1
MIP_NL__1PPDPA20070418_183601_000060162057_00228_26835_2629.N1
MIP_NL__1PPDPA20070418_201623_000060452057_00229_26836_2630.N1
MIP_NL__1PPDPA20070418_215714_000060292057_00230_26837_2632.N1
MIP_NL__1PPDPA20070418_233749_000060162057_00231_26838_2633.N1
MIP_NL__1PPDPA20070419_011811_000060452057_00232_26839_2636.N1
MIP_NL__1PPDPA20070419_025902_000060292057_00233_26840_2637.N1
MIP_NL__1PPDPA20070419_043937_000060162057_00234_26841_2638.N1
MIP_NL__1PPDPA20070419_061958_000060452057_00235_26842_2639.N1
MIP_NL__1PPDPA20070419_080049_000060292057_00236_26843_2645.N1

The anomaly was detected by looking at the NESR values (see Figure 37). The problem consisted in excessive NESR values in the band AB and B and was due to the usage of a wrong MIP_CO1_AX file. If the input MIP_CO1_AX is very different from the offsets in the L0 product, all the offsets are flagged as invalid and the IPF uses the input MIP_CO1_AX as the good offset and subtract it from the scene. In this case, the ZPD position of the offset and the ZPD position of the scene are mostly not aligned creating this oscillation in the calibrated spectrum. This oscillation effect was already observed in the past in case of usage of a wrong MIP_CO1_AX auxiliary file, it can be observed also in the products of 19th April 2007 as shown in Figure 38.
These products were deleted from D-PAC archive and reprocessed using correct auxiliary files.

Figure 37 NESR value during 18th Apr 2007. The red stripes show the anomaly consisting in excessive NESR values in the band AB and B.

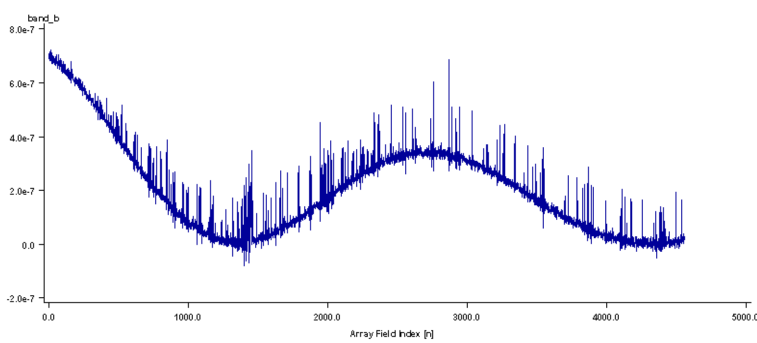


Figure 38 Band B spectrum for orbit 26839 measured on 19th April 2007.

The corrupted products have been reprocessed at D-PAC, below is the list of the re-processed data:

MIP_NL__1PPDPA20070418_151435_000060452057_00226_26833_0940.N1
MIP_NL__1PPDPA20070418_165526_000060292057_00227_26834_0012.N1
MIP_NL__1PPDPA20070418_183601_000060162057_00228_26835_0927.N1
MIP_NL__1PPDPA20070418_201623_000060452057_00229_26836_0932.N1
MIP_NL__1PPDPA20070418_215714_000060292057_00230_26837_0929.N1
MIP_NL__1PPDPA20070418_233749_000060162057_00231_26838_0930.N1
MIP_NL__1PPDPA20070419_011811_000060452057_00232_26839_0931.N1
MIP_NL__1PPDPA20070419_025902_000060292057_00233_26840_0933.N1
MIP_NL__1PPDPA20070419_043937_000060162057_00234_26841_0934.N1
MIP_NL__1PPDPA20070419_061958_000060452057_00235_26842_0935.N1
MIP_NL__1PPDPA20070419_080049_000060292057_00236_26843_0936.N1

3.5.8 ANOMALOUS SCAN PATTERN

On 21 May Anu Dudhia (OU) reported an anomalous scan pattern that was performed in the period 3-11 April 2007, in particular the following measurement pattern was adopted:

- 22-sweep scans
- tangent heights from 101 to 37 Km, at 6 Km steps
- each tangent altitude scanned twice

The altitudes of these measurements as a function of ANX are presented in **Figure 39**.

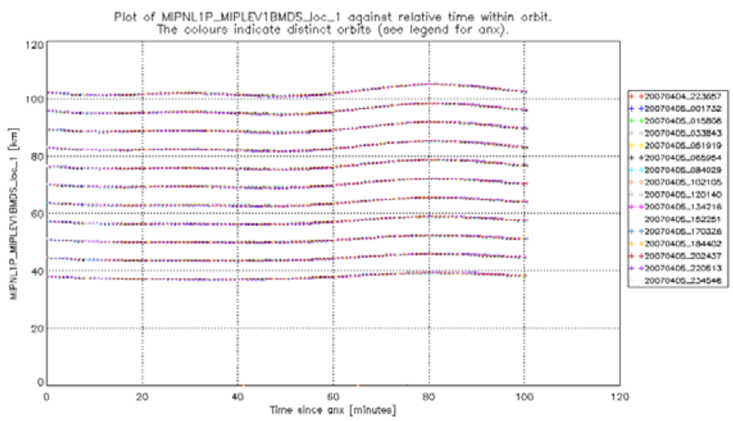


Figure 39 Altitude of the measured sweeps as a function of ANX for the anomalous scan pattern.

The investigation shows that the CTI tables were not correctly up linked to the platform. In fact when the CTI table were supposed to be sent there was a planned unavailability due to the OCM. As a result the instrument starts the measurement without all the correct CTI tables even though the planning was correctly prepared.
All the measurements taken during 3 – 11 April 2007 have this anomalous scan pattern and the L2 processing of these data will be strongly affected.

3.5.9 WRONG NUMBER OF SWEEPS PER SCAN IN L1B

Anu Dudhia noticed that in some L1 NRT data the field NUM_SWEEPS_PER_SCAN in the SPH is wrongly filled with “28” while the considered orbits are nominal (27 sweeps).
The following products are affected by this problem:

MIP_NL__1PNPDK20080329_205706_000063852067_00172_31789_4285.N1
MIP_NL__1PNPDK20080330_053327_000062032067_00177_31794_4483.N1
MIP_NL__1PNPDK20080330_103531_000059902067_00180_31797_4901.N1
MIP_NL__1PNPDK20080404_075857_000060212067_00250_31867_3948.N1
MIP_NL__1PNPDK20080404_075857_000060212067_00250_31867_3970.N1
MIP_NL__1PNPDK20080411_141639_000057792067_00354_31971_6354.N1
MIP_NL__1PNPDK20080411_190838_000060502067_00357_31974_6724.N1
MIP_NL__1PNPDE20080414_002019_000059292067_00388_32005_0574.N1
MIP_NL__1PNPDE20080420_020922_000047802067_00475_32092_0274.N1
MIP_NL__1PNPDK20080507_171229_000059602068_00227_32345_6296.N1

The investigation carried out with the support of Bomem has shown that:

- The issue on how to calculate the NUM_SWEEPS_PER_SCAN was not clear in DPM 4L-a (baseline for L1B IPF v4.67), since there can be different #sweeps/scan in a L1B product. This has been clarified in the latest DPM 4M (baseline for L1B IPF v5.00)
- Actually the L1B IPF is taking the last number of sweeps/scan found in the product to fill this field of the SPH.
- In the observed anomalous products the last scan contains 27 nominal sweeps, 1 transitory sweep and 1 incomplete nominal sweep (without auxiliary data). The prototype is rejecting the last incomplete sweep, while this sweep is accounted in the IPF, giving 28 sweeps in the last scan and in the SPH field
- This type of problem should no longer occur with IPF 5.00.
- The problem is not observed in the corresponding OFL products

3.5.10 ANOMALOUS SCAN PATTERN ON 15 MAY 2008

During 15 May 2008, after a MIPAS anomaly, not all the CTI were correctly uploaded to the platform. As a result we observed an anomalous scan pattern, in particular the start altitude and the latitude dependence was the one of the nominal measurements, while the altitude spacing and the number of sweeps per scan was the one of the UA mode (35 sweeps). The effect of this anomaly was that most of the sweeps in the measured scan have tangent altitude below the Earth surface (Figure 40). These measurements are useless for atmospheric retrieval, but some of them could be used for studying the Earth surface radiation. The problem of the CTI was solved starting from 16th May when a new set of CTI was correctly uploaded to the platform for the UA mode.

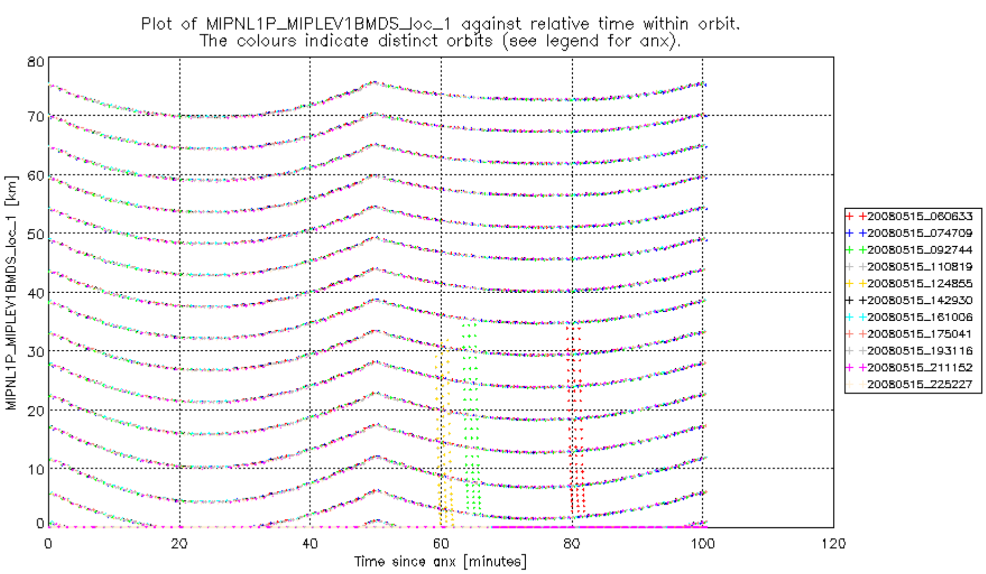


Figure 40 Altitude scan as a function of ANX for the orbit measured on 15 May 2008. The three series of scans in the figure are the volcanic emission mode measured during this day.

3.5.11 ANOMALOUS SCAN PATTERN: 6 – 8 AUG 2006

A problem in old MIPAS measurements was recognized by Anu Dudhia (OU) and reported to ESRIN. The anomaly consisted in a wrong scan pattern used during 6 – 8 August 2006. The problem was most likely due to the usage of an incomplete set of CTI, in particular the commanded altitude spacing and number of sweeps was the one of NOM, while the starting altitude was the one of UTLS-1. As a result the last 10 sweeps measured during these days have altitude below Earth surface (see Figure 41) and cannot be used for atmospheric studies.

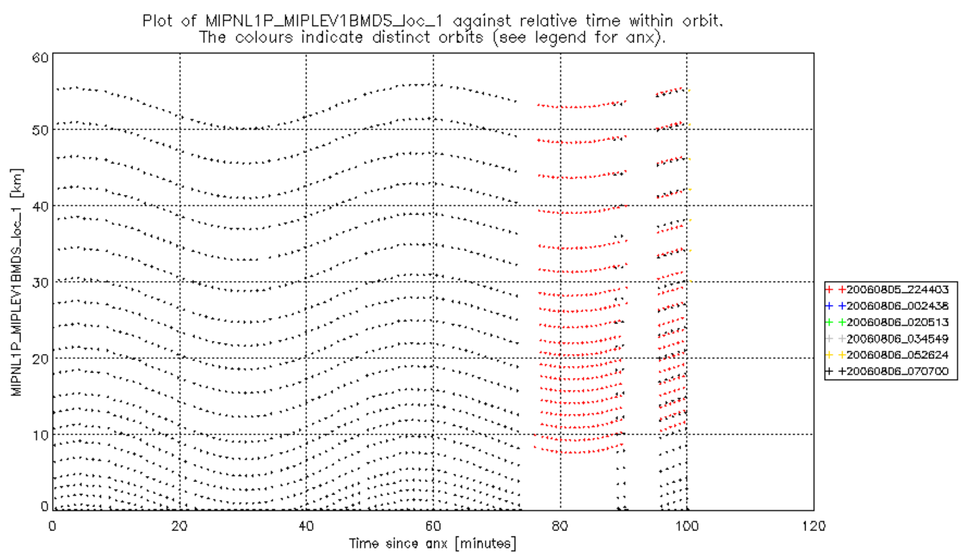


Figure 41 Altitude scan as a function of ANX for the orbit measured on 8 Jun 2006.

3.5.12 ANOMALOUS NESR VALUE IN BAND A

An anomaly was detected in one L1 product generated OFL at D-PAC center, the problem was an anomalous high NESR level in band A (see Figure 42). The filename of the anomalous product is the following:

MIP_NL__1PPDPA20080623_185916_000060162069_00400_33019_2267.N1

The problem was not observed in the corresponding NRT data, although they used the same set of auxiliary files. Investigations are on-going to understand the root cause of the problem.

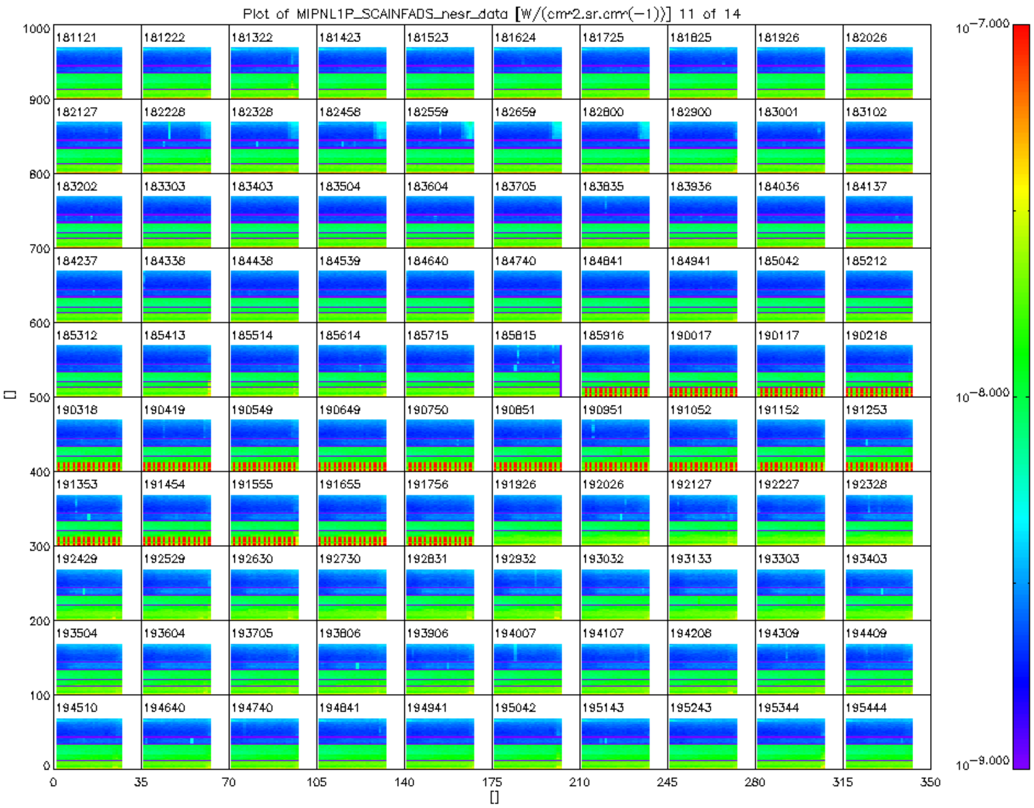


Figure 42 NESR value during 23 Jun 2008. The red stripes show the anomalous high NESR values in band A for orbit 33019.

3.5.13 ANOMALOUS SCAN PATTERN: 23 SEP 2008

After an IDU anomaly occurred on 23 September 2008 the instrument was manually put back to measurement at ESOC, however not all the CTI were correctly uploaded to the platform, so that the instrument measured using a non-intended scanning pattern, in particular the start altitude was the UA one (around 100km) while the altitude spacing was the one of the NOM. The problem was detected at ESOC and the instrument was stopped for few minutes in order to upload all the CTI for the planned UA measurements. The anomalous scan pattern impacted about 7h of MIPAS measurements as can be seen in the figure below.

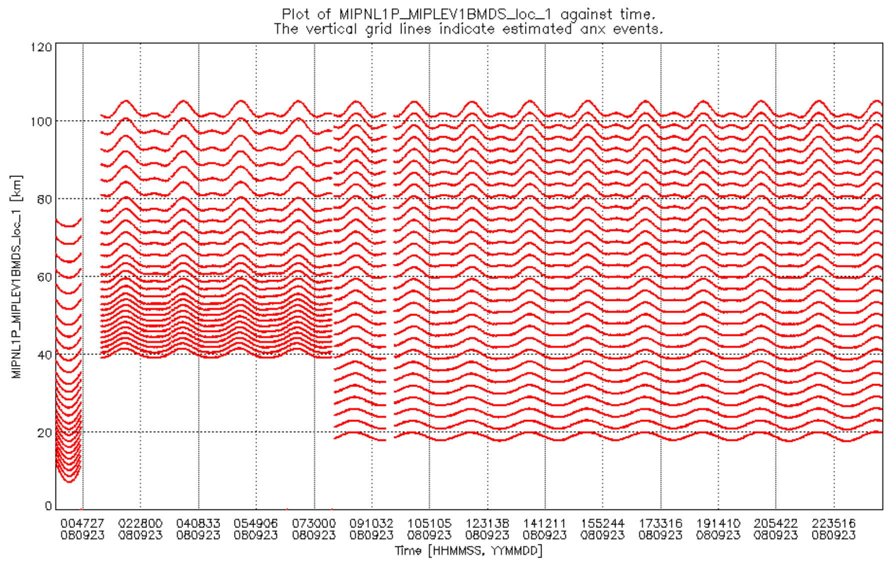


Figure 43 Tangent altitude measured by MIPAS during 23 September 2008.

3.5.14 SPURIOUS L1B RADIANCES DURING DEC/JAN 2003

R. Spang noticed on Oct 2008 an anomaly in some MIPAS L1b spectra of the FR mission in the January and December 2003 period. The problem was found with a statistical analysis on a monthly basis of the cloud index in band A, where 'unrealistic' extremely low values of CIA were found at high altitudes see Figure below. These values of the CI indicate an anomaly in the radiometric calibration of the L1b data.

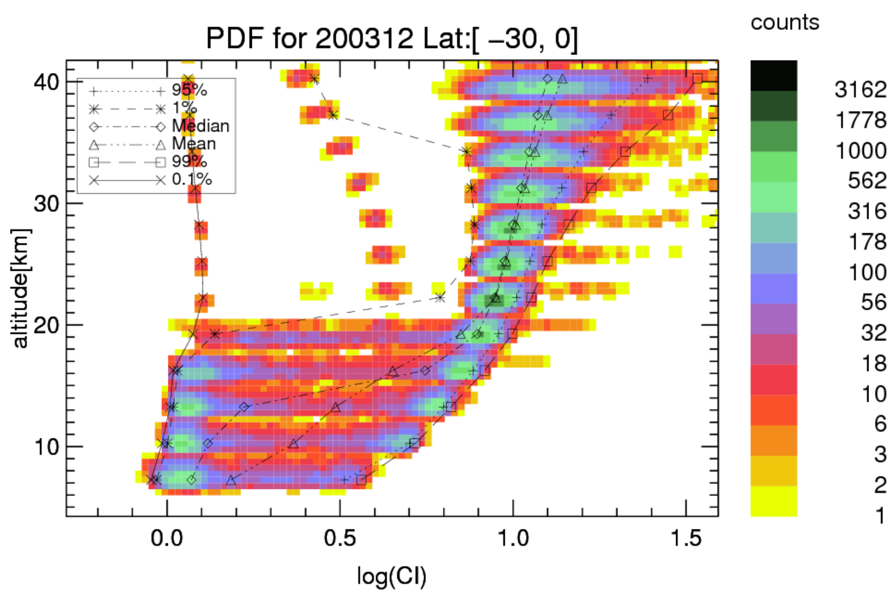


Figure 44 Cloud Index in band A for MIPAS L1b radiances of Dec 2003. Above 20 km we noticed unrealistic low CI.

The problem is due to wrongly calibrated L1b products, for which the incorrect set of auxiliary files was used in the processing. These anomalous data was deleted from the D-PAC ftp server and reprocessed (during Dec 2008) with correct and updated auxiliary files, for the L1b products of the FR mission the corresponding L2 products were also generated.
Below is reported the list of wrongly calibrated and reprocessed L1b and L2 products.

Wrongly calibrated data deleted for D-PAC server on Dec 2008

MIP_NL__1PPDPA20030131_130330_000034742013_00253_04816_0619.N1
MIP_NL__1PODPA20030131_130330_000034742013_00253_04816_1817.N1
MIP_NL__1PODPA20030131_141949_000051722013_00254_04817_1651.N1
MIP_NL__1PPDPA20030131_040733_000060382013_00248_04811_0264.N1
MIP_NL__1PPDPA20031206_111433_000033932022_00166_09238_0548.N1
MIP_NL__1PPDPA20031206_122815_000054942022_00167_09239_0445.N1
MIP_NL__1PPDPA20031206_135958_000060162022_00168_09240_0511.N1
MIP_NL__1PPDPA20031206_154023_000054502022_00169_09241_0519.N1
MIP_NL__1PPDPA20031223_000042_000060152022_00403_09475_0829.N1
MIP_NL__1PPDPA20031223_014107_000060382022_00404_09476_0740.N1
MIP_NL__1PPDPA20040106_010052_000060382023_00103_09676_2391.N1
MIP_NL__1PPDPA20040108_132236_000060272023_00139_09712_2315.N1
MIP_NL__1PPDPA20040108_150312_000060272023_00140_09713_2306.N1
MIP_NL__1PPDPA20040108_164348_000060272023_00141_09714_1946.N1
MIP_NL__1PPDPA20040108_182424_000060162023_00142_09715_2380.N1
MIP_NL__1PPDPA20040108_200449_000060382023_00143_09716_2407.N1
MIP_NL__1PPDPA20040108_214536_000060272023_00144_09717_2151.N1
MIP_NL__1PPDPA20040108_232612_000060272023_00145_09718_2317.N1
MIP_NL__1PPDPA20040109_194158_000055002023_00157_09730_2184.N1
MIP_NL__1PPDPA20040110_154034_000060272023_00169_09742_2316.N1
MIP_NL__1PPDPA20060502_122502_000060302047_00210_21807_2750.N1
MIP_NL__1PPDPA20060502_172650_000060302047_00213_21810_2669.N1
MIP_NL__1PPDPA20060502_190726_000060302047_00214_21811_2658.N1
MIP_NL__1PPDPA20060502_204802_000052132047_00215_21812_2684.N1

Reprocessed products available in the D-PAC ftp server since Dec 2008

Level 1 data

MIP_NL__1PPDPA20030131_040733_000060382013_00248_04811_4952.N1
MIP_NL__1PPDPA20030131_130330_000034742013_00253_04816_4955.N1
MIP_NL__1PODPA20030131_141949_000051722013_00253_04816_4954.N1
MIP_NL__1PODPA20030131_160048_000049072013_00254_04817_4956.N1
MIP_NL__1PODPA20031206_111433_000033932022_00166_09238_4957.N1
MIP_NL__1PODPA20031206_122815_000054942022_00167_09239_4958.N1
MIP_NL__1PODPA20031206_135958_000060162022_00168_09240_4959.N1
MIP_NL__1PODPA20031206_154023_000054502022_00169_09241_4960.N1
MIP_NL__1PODPA20031223_000042_000060152022_00403_09475_4961.N1
MIP_NL__1PODPA20031223_014107_000060382022_00404_09476_4962.N1
MIP_NL__1PODPA20040106_010052_000060382023_00103_09676_4966.N1
MIP_NL__1PODPA20040108_132236_000060272023_00139_09712_4967.N1
MIP_NL__1PODPA20040108_150312_000060272023_00140_09713_4968.N1
MIP_NL__1PODPA20040108_164348_000060272023_00141_09714_4969.N1
MIP_NL__1PODPA20040108_182424_000060162023_00142_09715_4970.N1
MIP_NL__1PODPA20040108_200449_000060382023_00143_09716_4971.N1

MIP_NL__1PODPA20040108_214536_000060272023_00144_09717_4972.N1
MIP_NL__1PODPA20040108_232612_000060272023_00145_09718_4973.N1
MIP_NL__1PODPA20040109_194158_000055002023_00157_09730_4974.N1
MIP_NL__1PODPA20040110_154034_000060272023_00169_09742_4975.N1
MIP_NL__1PPDPA20060502_122502_000060302047_00210_21807_4976.N1
MIP_NL__1PPDPA20060502_125216_000043352047_00210_21807_4977.N1
MIP_NL__1PPDPA20060502_172650_000010542047_00213_21810_4979.N1
MIP_NL__1PPDPA20060502_172650_000060302047_00213_21810_4978.N1
MIP_NL__1PPDPA20060502_190726_000060302047_00214_21811_4980.N1
MIP_NL__1PPDPA20060502_204802_000052132047_00215_21812_4981.N1
MIP_NL__1PPDPA20060502_210239_000043352047_00215_21812_4982.N1

Level 2 data

MIP_NL__2PPDPA20030131_130330_000034742013_00253_04816_4991.N1
MIP_NL__2PODPA20030131_160048_000049062013_00254_04817_4992.N1
MIP_NL__2PODPA20031206_111433_000033932022_00166_09238_4993.N1
MIP_NL__2PODPA20031206_122815_000054942022_00167_09239_4994.N1
MIP_NL__2PODPA20031206_135958_000060152022_00168_09240_4995.N1
MIP_NL__2PODPA20031206_154023_000054502022_00169_09241_4996.N1
MIP_NL__2PODPA20031223_000042_000060152022_00403_09475_4997.N1
MIP_NL__2PODPA20031223_014107_000060372022_00404_09476_4998.N1
MIP_NL__2PODPA20040106_010052_000060372023_00103_09676_4999.N1
MIP_NL__2PODPA20040108_132236_000060262023_00139_09712_5000.N1
MIP_NL__2PODPA20040108_150312_000060262023_00140_09713_5001.N1
MIP_NL__2PODPA20040108_164348_000060262023_00141_09714_5002.N1
MIP_NL__2PODPA20040108_182424_000060152023_00142_09715_5003.N1
MIP_NL__2PODPA20040108_200449_000060372023_00143_09716_5004.N1
MIP_NL__2PODPA20040108_214536_000060262023_00144_09717_5005.N1
MIP_NL__2PODPA20040108_232612_000060262023_00145_09718_5006.N1
MIP_NL__2PODPA20040109_194158_000055002023_00157_09730_5007.N1
MIP_NL__2PODPA20040110_154034_000060262023_00169_09742_5008.N1

3.6 Appendix F – Level 2 IPF historical updates

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

- **Version V5.05** first IPF that allows L2 processing of Optimized Resolution mission, it is aligned with DPM 5.2 and ADF 6.4
- **Version V5.02** No L2 processing will be made with this version since some inconsistencies are still present with respect of the reference algorithm.
- **Version V04.67L02** Linux porting version of 4.67 AIX processor
- **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

3.7 Appendix G – Level 2 ADF historical updates

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). The versions 6.0 – 6.2 were still not used for operational processing. Version 6.4 was used for the switch of IPF 5.05.

Table 22. Historical update of Level 2 configuration ADFs. In green are the operational ones.

Version	Date of delivery	List of files upgraded by IFAC	Main modifications
ADF V6.0: to be used to process MIPAS measurements from January 2005 on, characterized by reduced spectral resolution and new measurements scenario (1.5 km step at low altitudes). To be used with ML2PP V5.0			
ADF V6.4	10.06.2010	MIP_IG2_AX_V6.4_2010_january MIP_SP2_AX_V6.4 MIP_PI2_AX_V6.4	Bug correction in MIP_IG2 and MIP_SP2 file. MIP_PI2 file updated to handle UA mode where 35 sweeps per scan are measured, VCM matrix of LOS increased in size up to 35.
ADF V6.3	29.03.2010	MIP_OM2_AX_V6.3 MIP_CS2_AX_V6.3 MIP_PS2_AX_V6.3_nom_before_5june2005_l MIP_PS2_AX_V6.3_nom_after_5june2005_l MIP_PS2_AX_V6.3_utls1_ECMWF_l MIP_PS2_AX_V6.3_ma_ua MIP_MW2_AX_V6.3	MIP_MW2_AX: correction of an error in the MW_PT ascii file for cloud detection microwindow pairs that brought an inconsistency in the MIP_MW2_AX binary file. • MIP_OM2_AX: inclusions of OMs used to process MA and UA measurement modes. • MIP_PS2_AX: 1. Modification in the threshold defining minimum value of eigenvalue (for inversion of matrix) for all species: old value: 1.e-30; new value: 1.e-17 2. Regularization for H2O set to 'off' Added a dedicated file to be used for processing MA and UA modes (these 2 modes, despite NOM and UTLs-1 modes, do not have floating altitudes). • MIP_CS2_AX: added LUTs per MWs contained in OMs for MA e UA modes (respectively OM_*_70* and OM_*_80*)
ADF V6.2	27.06.2008	MIP_IG2_AX_V6.2_2005_january MIP_OM2_AX_V6.2	New IG2 files (IG2 V4.1) Extended altitude bands for both UTLS1 and NOM OMs (± 4 km). Inserted pT error propagation matrices in nominal OMs for both NOM and UTLS-1 modes.

Version	Date of delivery	List of files upgraded by IFAC	Main modifications
ADF2 V6.1	21.12.2007	MIP_CS2_AX_V6.1 MIP_OM2_AX_V6.1 MIP_SP2_AX_V6.1 MIP_PS2_AX_V6.1_nom_before_5june2005 MIP_PS2_AX_V6.1_nom_after_5june2005 MIP_PS2_AX_V6.1_utls1 MIP_MW2_AX_V6.1 MIP_IG2_AX_V6.1_2005_april MIP_IG2_AX_V6.1_2005_january MIP_IG2_AX_V6.1_2005_july MIP_IG2_AX_V6.1_2005_october MIP_IG2_AX_V6.1_2006_april MIP_IG2_AX_V6.1_2006_january MIP_IG2_AX_V6.1_2006_july MIP_IG2_AX_V6.1_2006_october	New MW of O3. Extended altitude range for UTLS-1 OMs. New cloud MW to allow cloud filtering algorithm to discard from the analysis measurements with tangent altitudes below 4.5 km. Reduced vertical resolution for CH4 and N2O profiles. New settings for retrieved tangent altitude correction with ECMWF.
ADF2 V6.0	21.11.2006	MIP_CS2_AX_V6.0_nom MIP_OM2_AX_V6.0_nom MIP_PS2_AX_V6.0_nom MIP_SP2_AX_V6.0_nom MIP_PS2_AX_V6.0_nom_before_05june2005 MIP_PS2_AX_V6.0_nom_after_05june2005 MIP_PS2_AX_V6.0_utls1 MIP_MW2_AX_V6.0_nom_patch MIP_IG2_AX_2005_april MIP_IG2_AX_2005_january MIP_IG2_AX_2005_july MIP_IG2_AX_2005_october MIP_IG2_AX_2006_april MIP_IG2_AX_2006_january MIP_IG2_AX_2006_july MIP_IG2_AX_2006_october	New MW database and LUTs (MW_330 for pT, MW_360 for the other species.) New occupation matrices. New line list database New cloud indeces and cloud microwindows New climatological profiles IG2 V4.0 New PS settings with several new items added required by new or modified functionalities in ML2PP V5.0.
ADF2 V5.*: to be used for processing MIPAS measurements of August/September 2004, characterized by reduced spectral resolution, old measurements scenario (3 km step at low altitudes)			
ADF V5.2	16.12.2005	MIP_SP2_AX_V5.2 MIP_IG2_october_V5.2	Corrected error in binary files
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; extension of a microwindow for cloud detection corrected.
ADF V5.0	18.03.2005	MIP_PS2_AX_V5 MIP_CS2_AX_V5 MIP_MW2_AX_V5 MIP_PI2_AX_V5 MIP_I2_AX_V5 MIP_OM2_AX_V5	New microwindows selected for reduced spectral resolution, and corresponding cross section LUT, occupation matrices and Initial Guess for continuum. 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.
ADF2 V4.*: to be used for processing MIPAS FR mission			

Version	Date of delivery	List of files upgraded by IFAC	Main modifications
ADF V4.0	03.09.2004	NRT: MIP_PS2_AX_NRT_V4.0 OFL: MIP_PS2_AX_OFL_V4.0	Changed the flag in PS2 file spec_events_flag from "B" (dec 66) to "N" (dec 78). Increased NESR threshold in PS2 files as in V3.7.
ADF V4.1	03.09.2004	NRT: MIP_PS2_AX_NRT_V4.1 OFL: MIP_PS2_AX_OFL_V4.1	Changed the flag in PS2 file spec_events_flag from "B" (dec 66) to "N" (dec 78). NESR threshold in PS2 files as in V3.6.
ADF2 V3.*: to be used for processing MIPAS FR mission			
ADF V3.7	13.02.2004	NRT: MIP_OM2_AX_NRT_V3.7 MIP_PS2_AX_NRT_V3.7 OFL: MIP_OM2_AX_OFL_V3.7 MIP_PS2_AX_OFL_V3.7	Increased NESR threshold in PS2 files to face the increase of NESR after the switch-on of the heater (since the middle of January 2004). Eliminated the OMs with fewer than 3 sweeps from the OM database.
ADF V3.6	20.10.2003	NRT: MIP_PS2_AX_V3.6_NRT OFL: MIP_PS2_AX_V3.6_OFL	Increased dimension of some vectors in MIP_PS2_AX files
ADF V3.5	26.09.2003	OFL: MIP_OM2_AX_V3.5	Introduced PT error propagation matrices different of 0 in MIP_OM2_AX_Offline
ADF V3.4	29.08.2003	NRT: MIP_MW2_AX_V3.4 OFL: MIP_MW2_AX_V3.4 MIP_OM2_AX_V3.4_OFL	Two set of aux ADF: one for NRT and one for Off-line. NRT: old conv. criteria, nom. altitude range, ILS bug correction ; Off-line : new conv. criteria, altitude range 6-68 km, ILS bug correction
ADF V3.3	08.08.2003	MIP_PS2_AX_V3.3	Short-term bug fix for ILS in PS2 file
ADF V3.2	31.07.2003	MIP_OM2_AX_V3.2 MIP_PS2_AX_V3.2 MIP_CS2_AX_V3.2	OMs for retrieval range 9-68 km, PS2 for improved convergence criteria, modification in the name of some cross-section files
ADF V3.1	19.06.2003	MIP_MW2_AX_V3.1_CD MIP_MW2_AX_V3.1_noCD MIP_OM2_AX_V3.1	In reply to SPR MIPAS_OM2_AX_3.0: no gaps between altitude validity range and improved validity mask range in MW db.
ADF V3.0	14.05.2003	MIP_CS2_AX_V3.0 MIP_MW2_AX_V3.0_CD MIP_MW2_AX_V3.0_noCD MIP_OM2_AX_V3.0 MIP_PS2_AX_V3.0 MIP_SP2_AX_V3.0	MIPAS dedicated spectroscopic db. hitran_mipas_pf3.1, cloud detection enabled mws, improved OM for the nominal altitude range

3.8 Appendix H – Level 2 anomaly status

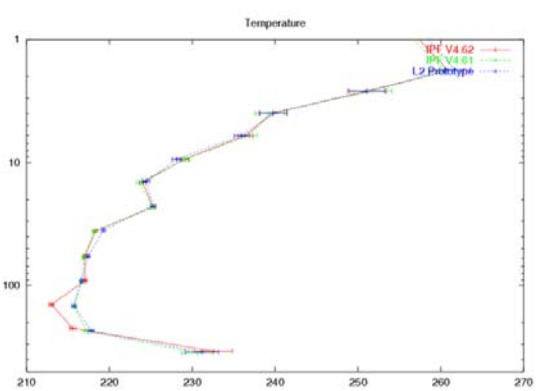
3.8.1 EXCESSIVE CHI-SQUARE

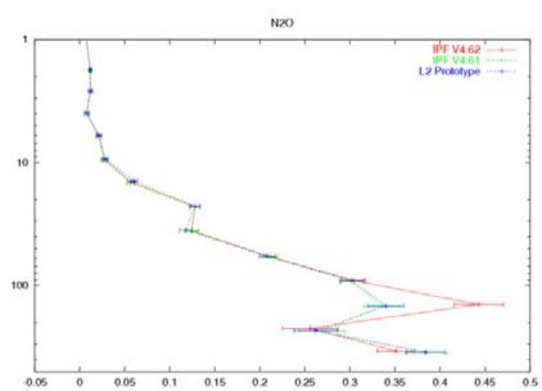
NO2 MIPAS products for orbit #7000 (3 July 2003) came with high values of chi2, that were not reproduced in retrievals performed with the prototype using the same aux files set. This NCR 1458 was classified as critical and is going to be analyzed by the IPF developers.

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).

3.8.2 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.





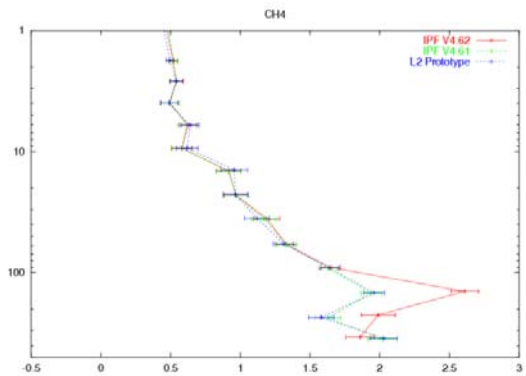


Figure 45 Temperature N2O and CH4 profiles as a function of pressure retrieved with IPF 4.62 and 4.61 compared to the prototype for seq. 16 of orbit 2975. The 4.61 profile is the reference, validated by a IMK balloon flight.

3.8.3 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 46 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.

3.8.4 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 47 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.

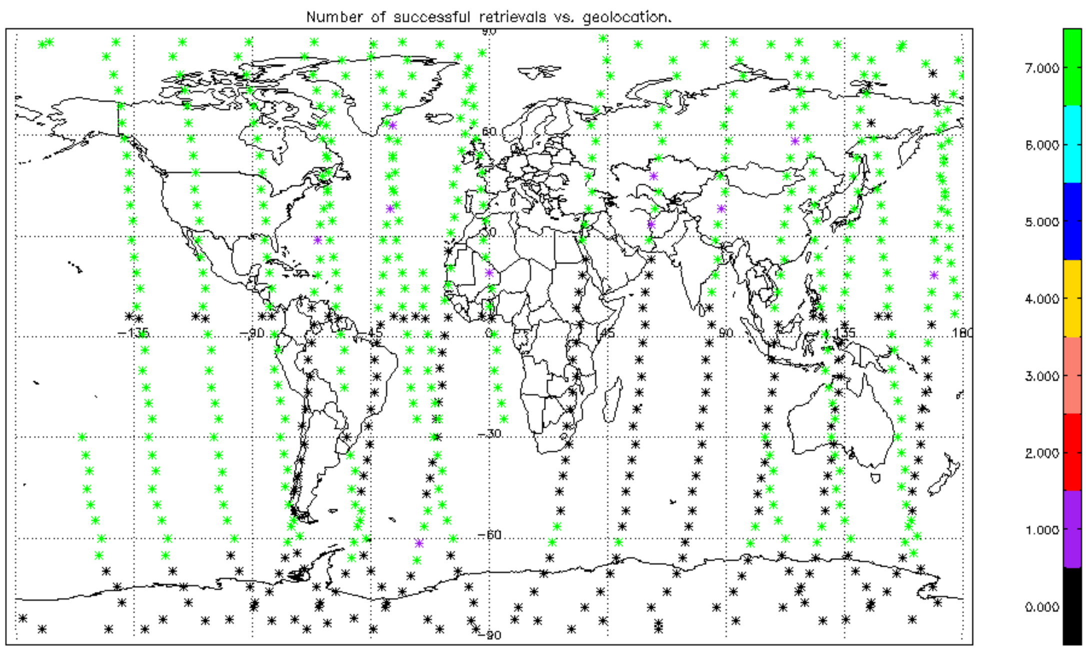


Figure 47 MIPAS number of successful retrieval for 25 July 2002. Note that 7 is the nominal value corresponding to the target species of the ESA MIPAS products. Zero value means that the retrieval fails already at the p-T stage.

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 48), 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 48, 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 21). 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.

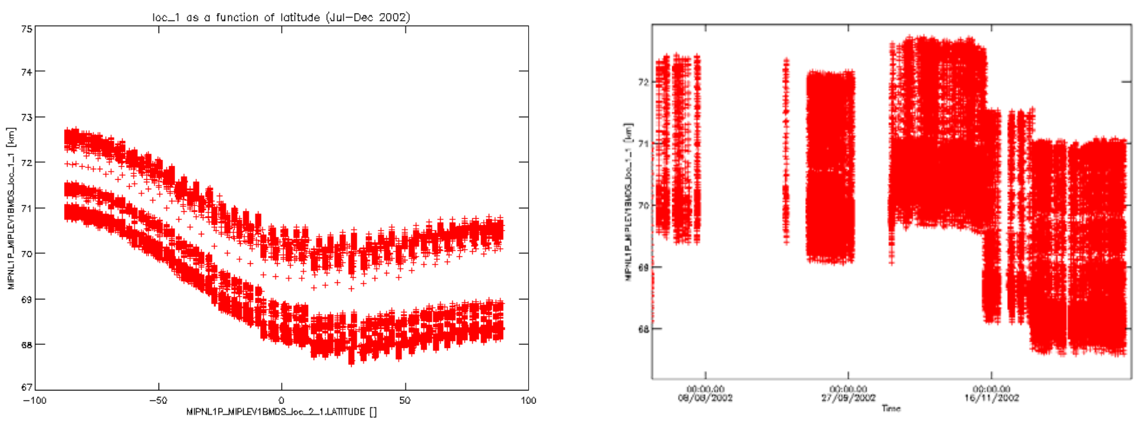


Figure 48 MIPAS engineering tangent altitude as written in the L1b files (loc_1 field) as a function of latitude and time.

3.8.5 CONTINUUM 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).