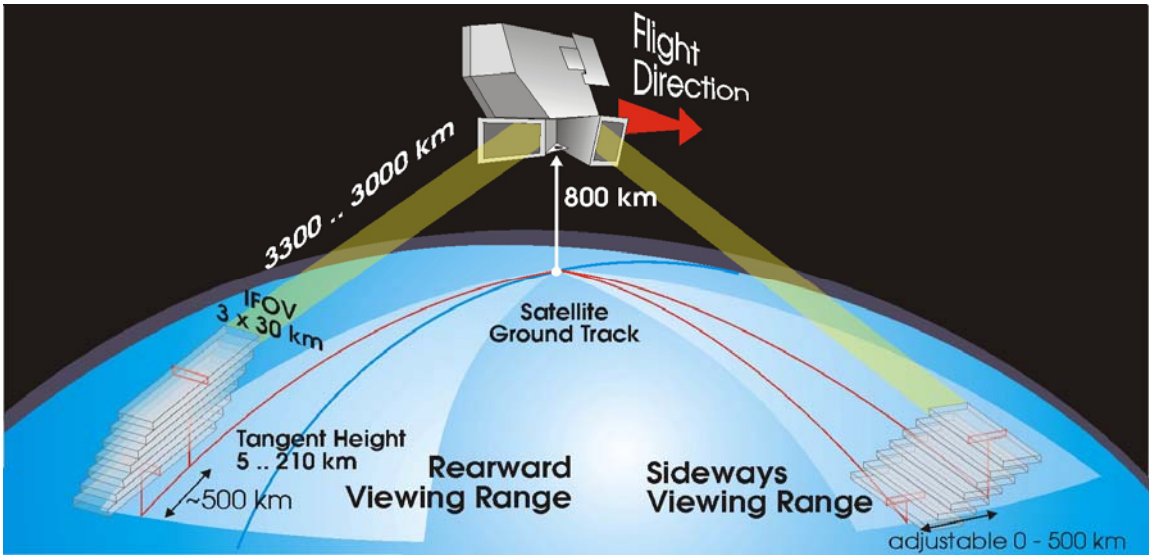
DOCUMENT

ENVISAT MIPAS Monthly Report: February 2006



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1 INTRODUCTION

The MIPAS Monthly Report (MR) documents the current status and recent changes to the MIPAS instrument, its data processing chain, and its data products.
The MR is composed of analysis results obtained by the DPQC (Data Processing and Quality Control), combined with inputs received from the different groups working on MIPAS operation, calibration, product validation and data quality. The following groups participate in the MIPAS Quality Working Group (QWG):

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

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

1.1 Scope

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

1.2 Acronyms and Abbreviations

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

CBB	Calibration Black-Body
CTI	Configuration Table Interface
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
IDU	Interferometer Drive Unit
IECF	Instrument Engineering and Calibration Facilities
IF	In-Flight
IG	Initial Guess
IGM	Interferogram
ILS	Instrument Line Shape
INT	Interferometer
I/O DD	Input/Output Data Definition
IOP	In Orbit Performance
IPF	Instrument Processing Facility
LOS	Line of Sight
MA	Middle Atmosphere
MDS	Measurements Data Set
MIO	MIPAS Optics Module
MIPAS	Michelson Interferometer for Passive Atmospheric Sounding
MPH	Main Product Header
MR	Monthly Report
MW	Micro-Window
NCR	Non-Conformance Report
NESR	Noise Equivalent Spectral Radiance
NOM	Nominal
NRT	Near-Real-Time
OFL	Off-Line
OM	Occupation Matrix
PCD	Product Confidence Data
PCF	Product Control Facility
PDS	Payload Data Segment
PFHS	Processing Facility Host Structure
QC	Quality Control
QWG	Quality Working Group

RGC	Radiometric Gain Calibration
RR	Reduced Resolution
SEM	Special Event Measurement
SPH	Specific Product header
SPR	Software Problem Report
ST	Science Team
UA	Upper Atmosphere
UTLS	Upper Troposphere Lower Stratosphere
VCM	Variance Covariance Matrix
VMR	Volume Mixing Ratio
WCC	Wear Control Cycle
2RR	Double Slide Reduced Resolution

2 THE REPORT

2.1 Summary

- The MIPAS instrument performances decline during February 2006, indeed the number of unintended anomalies reaches a critical value at the end of the month. This happens after three months of very good instrument performances, started with the switch-on of the INT heater the 17th October 2005. The increase of the anomaly rate is probably due to a degradation of the bearing performances (*cage wind-up* effect), as demonstrated by an analysis made by Astrium (P. Mosner) looking at the in-sweep motor current (see § 2.3.2).
- The increase of anomalies leads to switch-off the instrument for ten days (from 1st up to 9th March 2006); this will allow the slide mechanism to relax and the instrument to profit from the so-called "self-healing" effect. In compliance with the scientific needs, MIPAS will be switched off until 9th of March; it will perform important In-Flight calibration (IF-6, IF-9, IF-10, IF-11, IF-16) during 10-11 March and MA measurement during 19-21 March. The mission will restart systematically the 26th March in support to the SAUNA campaign, over Sodankyla (27 March to 12 April).
- During the first two weeks of February MIPAS operates in UTLS-1 mode in support of the CR-AVE campaign with 4 orbits per day, both in ascending and descending track over San Jose, Costa Rica (9° 59' North, 84° 04' West). During the last 2 weeks of February MIPAS measurements were performed in UTLS-1 mode in support to the ESABC campaign; 4 orbits per day, both in ascending and descending track over Kiruna.
- The monitoring of the instrument temperatures is reported in this MR, the most important temperature fields remain stable, the deviations being always below 1K (see § 2.3.1).
- The cooler performances were also closely monitored during this month. The cooler seems to perform really well, the vibration being well below the warning level of 8 mg (see § 2.3.3.1).
- The gain, spectral and line of sight calibrations were carried out nominally during the reporting period, including the dissemination of the related ADF, none of this calibration show anomalies.
- A monitoring of the absolute gain increase since the last decontamination (June 2005) is presented in this MR besides the long term weekly increase. This monitoring will be updated from now on and will help the planning of the future decontamination activity, expected for the end of April 2006 (see § 2.4.3).
- The manual processing with L1b prototype of the AE measurement has continued this month and now most of the orbits have been processed, the L1b files can be found on Uranus ftp server (see § 2.4.5.1).
- The latest processor IPF 4.65 was put into operation at D-PAC the 9th of February 2006 for the OFL processing of the entire MIPAS RR mission. The work order is to process up to level 2 the data taken during Aug-Sept 2004 (158 orbits) and up to level 1 all the RR data, from Aug 2004 up to now. The level 2 processing of all the relevant orbits was completed, while the level 1 production is still ongoing and will go on OFL with the continuation of the

MIPAS mission, taking into account the two weeks delay for the generation of consolidated products at LRAC.

- It has to be pointed out that these are the first products operationally delivered by ESA for the MIPAS RR mission (since August 2004), a part from some data prototype results or test data set; therefore there is an extreme interest on these data.
- The quality control of the D-PAC products is particularly important in order to check the performance of the processor and the quality of the scientific data to be delivered to the user. Besides this quality check will allow assessing the impact of the instrument aging (e.g.: degradation of the bearing performance, misalignment) on the products by means of a long term monitoring of critical L1 parameters (e.g.: FCE, ILS, NESR).
- The level 1 quality monitoring has started on a sub-set of products; furthermore a systematic daily check is going to be implemented in ESRIN. The quality check of the considered L1 products has demonstrated an overall good quality of the D-PAC results.
- A quality control check of the entire set of L2 products processed at D-PAC was completed, revealing an overall good quality of the products, nevertheless an anomaly was found for some orbits of 21 – 22 Aug 2004, this problem being now under investigation (see § 2.5.3.1).

2.2 Instrument and products availability

2.2.1 INSTRUMENT PLANNING

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

Planning strategy:

- All activities planned in nominal mode (double slide operation) with medium resolution (41% - 1.64 sec sweeps) with asymmetric transitory sweeps
- Compensation times, transitory times and other planning parameters planned according to the new operational baseline
- According to the implementation of the Autorecovery Sequence in the FOS-MPS, new MPL_CAL_MP files have been sent with RGC and WCC REPETITION fields set to zero
- Radiometric Gain calibrations (RGC) planned using the MPL_ORS_MP file
- The WCC activity cannot be explicitly requested trough the MPL_ORS_MP file, it is performed after every transition to Heater
- PRIME + 2 BACKUP LOS orbits during the week-end, with new setting and PITCH BIAS=-0.030<deg>
- For the first 2 weeks of February 2006 MIPAS measurements were performed in **UTLS-1 mode** in support of the **CR-AVE campaign**; 4 orbits per day, both in ascending and descending track over San Jose, Costa Rica (9° 59' North, 84° 04' West).

- For the last 2 weeks of February 2006 MIPAS measurements were performed in **UTLS-1 mode** in support to the **ESABC campaign**; 4 orbits per day, both in ascending and descending track over **Kiruna**.

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

2.2.2 INSTRUMENT AVAILABILITY

During February 2006 MIPAS operations were interrupted frequently due to an increased rate of slide anomalies. In particular in the second half of the month the rate of anomalies reaches critical value. Indeed during last days of February the unintended unavailibilities occur almost for all the planned orbits (see Fig.1). Owing to this high anomaly rate the number of useful scientific data was too low to continue the operations; therefore it was decided to switch off the instrument for ten days from 1st of March until 10th of March, allowing the slide mechanism to relax and the instrument to benefit for the so called "self-healing" effect. The list of unavailabilities is reported in the next table; furthermore the high rate of anomalies in the last days of February is clearly visible in the Fig. 1 (GANNT chart).

Tab. 1 List of MIPAS unavailabilities during February 2006. In red is highlighted the unavailability due to Artemis manoeuvre, which affects all the Envisat instruments.

Start Time		Stop time		Duration	Start Orbit	Stop Orbit
Date	**UTC**	**date**	**UTC**	**sec**		
03-feb-06	16.34.49	03-feb-06	17.04.52	1803	20549	20550
07-feb-06	15.21.01	07-feb-06	16.39.00	4679	20606	20607
08-feb-06	3.17.59	08-feb-06	3.38.41	1242	20613	20613
08-feb-06	**20.27.23**	**08-feb-06**	**20.55.45**	**1702**	**20623**	**20623**
09-feb-06	4.08.41	09-feb-06	5.32.12	5011	20628	20629
11-feb-06	7.48.13	11-feb-06	10.05.45	8252	20659	20660
12-feb-06	6.14.20	12-feb-06	6.34.01	1181	20672	20672
16-feb-06	20.50.01	16-feb-06	22.33.04	6183	20738	20739
17-feb-06	20.13.41	17-feb-06	22.01.27	6466	20752	20753
18-feb-06	7.33.42	18-feb-06	9.45.38	7916	20759	20760
18-feb-06	19.03.38	18-feb-06	21.29.50	8772	20766	20767
21-feb-06	8.17.57	21-feb-06	9.51.23	5606	20802	20803
21-feb-06	18.25.14	21-feb-06	18.35.06	592	20808	20808
22-feb-06	5.28.44	22-feb-06	6.19.39	3055	20815	20815
23-feb-06	7.29.12	23-feb-06	10.28.45	10773	20830	20832
23-feb-06	21.49.16	23-feb-06	22.12.57	1421	20839	20839
24-feb-06	7.02.15	24-feb-06	9.57.08	10493	20844	20846
24-feb-06	19.07.33	24-feb-06	21.41.20	9227	20851	20853

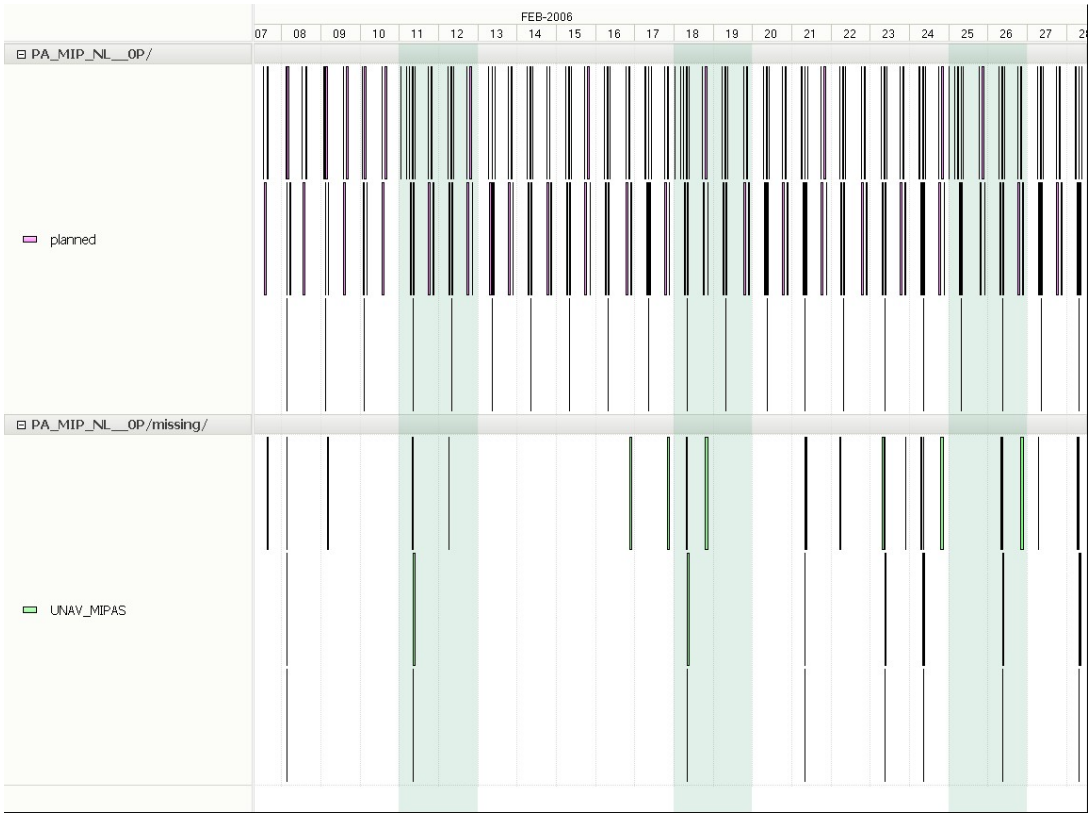


Fig. 1 Increasing rate of MIPAS anomalies during fall February 2006 (GANNT chart).

2.2.3 LEVEL 0 PRODUCT AVAILABILITY

The missing intervals (due to PDS unknown failures) for level 0 products (MIP_NL__0P) are reported in the table below. Only Level 0 data coverage is reported below, as currently the Near-Real Time (NRT) mission is suspended, and no systematic operational Off-Line (OFL) processing is performed while the processing algorithms are being adapted to the new observation modes.

Tab. 2 List of missing gaps for MIP_NL__0P during February 2006.

Start Time		Stop time		Duration	Start Orbit	Stop Orbit	Measurement
Date	UTC	date	UTC	sec			
04-feb-06	9.37.47	04-feb-06	9.38.01	14	20559	20560	NORMAL
08-feb-06	3.38.41	08-feb-06	3.38.56	15	20613	20613	NORMAL
09-feb-06	4.07.59	09-feb-06	4.08.41	42	20628	20628	NORMAL
10-feb-06	2.26.19	10-feb-06	2.30.38	259	20641	20641	BLACK_BODY_CHAR

10-feb-06	2.30.38	10-feb-06	4.07.47	5829	20641	20642	NORMAL
11-feb-06	4.16.02	11-feb-06	4.16.16	14	20656	20657	NORMAL
12-feb-06	6.34.01	12-feb-06	6.34.16	15	20672	20672	NORMAL
18-feb-06	3.55.55	18-feb-06	3.56.09	14	20756	20757	NORMAL
22-feb-06	6.19.39	22-feb-06	6.19.54	15	20815	20815	NORMAL

The missing intervals (due to PDS unknown failures) during the LOS weekly measurements (MIP_LS__0P) are reported in the table below.

Tab. 3 List of missing intervals for MIP_LS__0P during February 2006.

Start time		**Stop time**		**Duration**	**Orbit Start**	**Orbit end**
Date	**UTC**	**Date**	**UTC**	**sec**		
04-feb-06	9.37.00	04-feb-06	9.37.07	7	20559	20559
18-feb-06	0.39.27	18-feb-06	0.39.53	26	20755	20755

2.2.4 LEVEL 0 PRODUCTS STATISTICS

The MIPAS mission is currently planned with a limited duty cycle (around 25 - 30%); this corresponds to 3 days-on and 4 days-off (in case of nominal measurement) or 4 orbits per day (in case of validation campaign). This measurement scenario was recommended by Astrium for instrument safety. As already cited in the previous paragraph the instrument performance during this month strongly degrades, the percentage time of instrument availability goes from the 98% of January 2006 to 84%, therefore the percentage of total availability of level 0 products was also decreased to 83%. The missing intervals due to PDS unknown failure was low, the unavailability due to the PDS problem is around 1%. The level 0 statistics are reported in the following table.

Tab. 4 MIPAS MIP_NL__0P products statistics during February 2006.

		Time [sec]
Total time over one month	t_{tot}	**2419200**
Time of planned measurements	t_{plan}	**649518**
Time of expected measurements	t_{exp}	**545650**
Time of L0 gaps	t_{L0gaps}	**6217**
Time of instrument unavailability	$t_{unav} = t_{plan} - t_{exp}$	**103868**
%Time of duty cycle	$(t_{plan} / t_{tot})*100$	**26,85**
% Time of Instrument availability	$[1- t_{unav} /t_{plan}]*100$	**84,01**
% Time of L0 availability (PDS failure)	$[(t_{exp} – t_{L0gaps})/t_{exp}]*100$	**98,86**
% Total time of L0 availability (PDS failure + instrument unavailability)	$[(t_{exp} – t_{L0gaps})/t_{plan}]*100$	**83,05**

2.3 Instrument monitoring

2.3.1 THERMAL PERFORMANCE

The following two plots (Fig. 2 and Fig. 3) show the long-term trends of the IDU and MIO base plate temperature. The yearly seasonal variations and the interferometer heater switching (see Tab. 5 for the schedule of heater switch-on/off) are clearly visible within the plots.

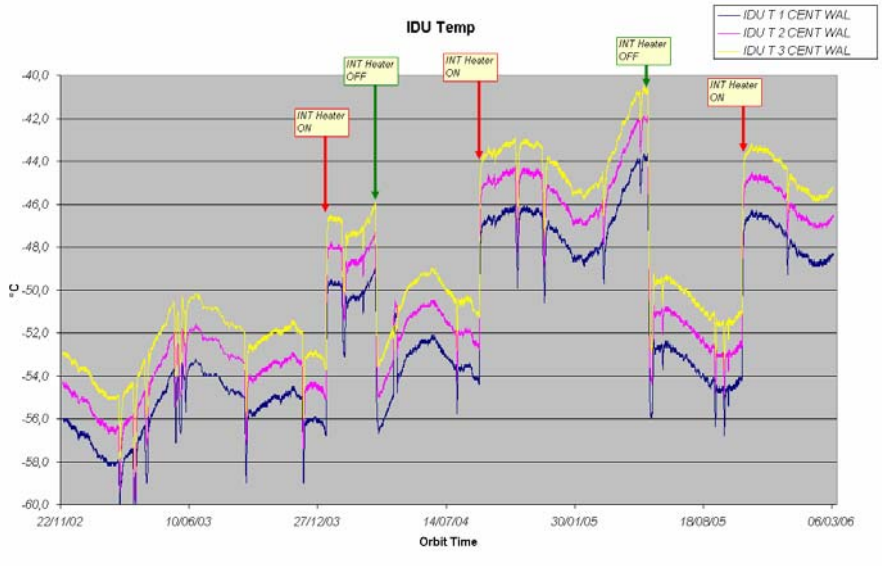


Fig. 2 IDU temperatures as a function of time: November 2002 – February 2006.

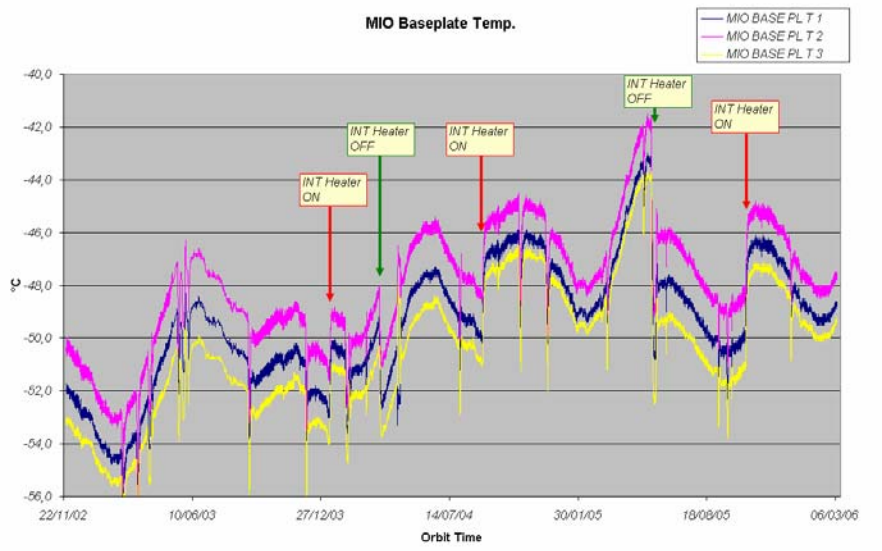


Fig. 3 MIO base plate temperatures as a function of time: November 2002 – February 2006.

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

Tab. 5 Schedule of interferometer heater switch-on/off.

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

At the end of August 2005, the temperature was about 4 K warmer than during the critical period at the beginning of 2003. However it seems that the critical temperature is increasing during the mission, nowadays we can consider the temperature of August 2005 (-52°C) as a critical value, that is to say a value when the occurrence of critical errors starts to increase. The switching-on of the INT heater during 17 October 2005 produces an increase of almost 5K of the MIO and IDU temperature; these temperatures reach values comparable to one year ago.
The increase of temperature significantly improves the INT performances from October 2005 up to January 2006, while a significant degradation of the instrument performance was observed during the reporting month. This degradation cannot be explained by looking at the instrument temperatures which look rather stable during the reporting period. The monthly monitoring of the instrument temperature is reported in the following plots, which show the IDU, MIO, CBB and FCA radiator temperatures. All the temperatures look stable during the reporting period; the deviations are always in the range of 1K or less.

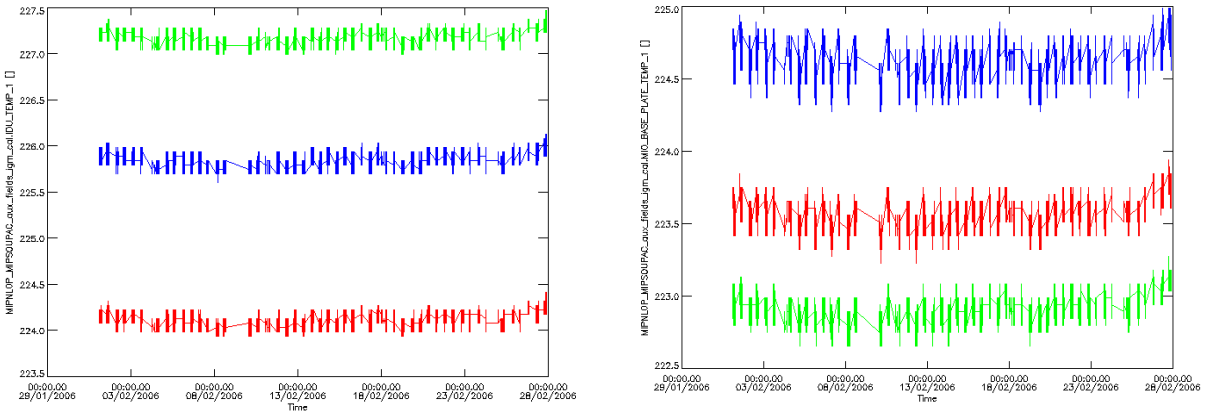


Fig. 4 IDU and MIO Base-Plate temperature during reporting period: February 2006.

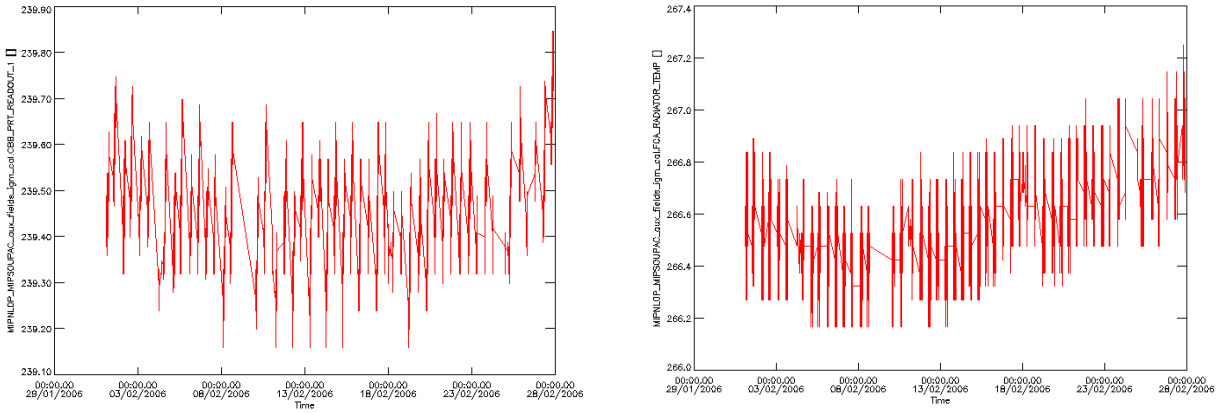


Fig. 5 CBB and FCA radiator temperature during reporting period: February 2006.

2.3.2 INTERFEROMETER PERFORMANCE

The effect of the INT heater switch-on during October 2005 was a significant improvement of the INT performances up to January 2006, indeed the number of turn-around error and the number of -4% differential speed error were drastically reduced (see Fig. 6 - 7). This dramatic reduction of anomalies was also due to the choice of a very low duty cycle, which is now set to a value of 25 – 30%.

During February 2006 this situation was changed, in particular starting from the second half of the month the -4% differential speed error starts again to increase and reach the critical value of 60%, this value was already reached during Aug – Sept 2005 (see Fig. 6). When this parameter reaches this critical value the number of turnaround anomalies starts to increase significantly, as was already observed during in the past (see Fig. 7). Owing to this increasing rate of failure the MIPAS instrument was switched off for the first ten days of March 2006, allowing the slide mechanism to relax, as the instrument is expected to benefit from the so-called “self-healing” effect, then the performances should be improved after this mission interruption.

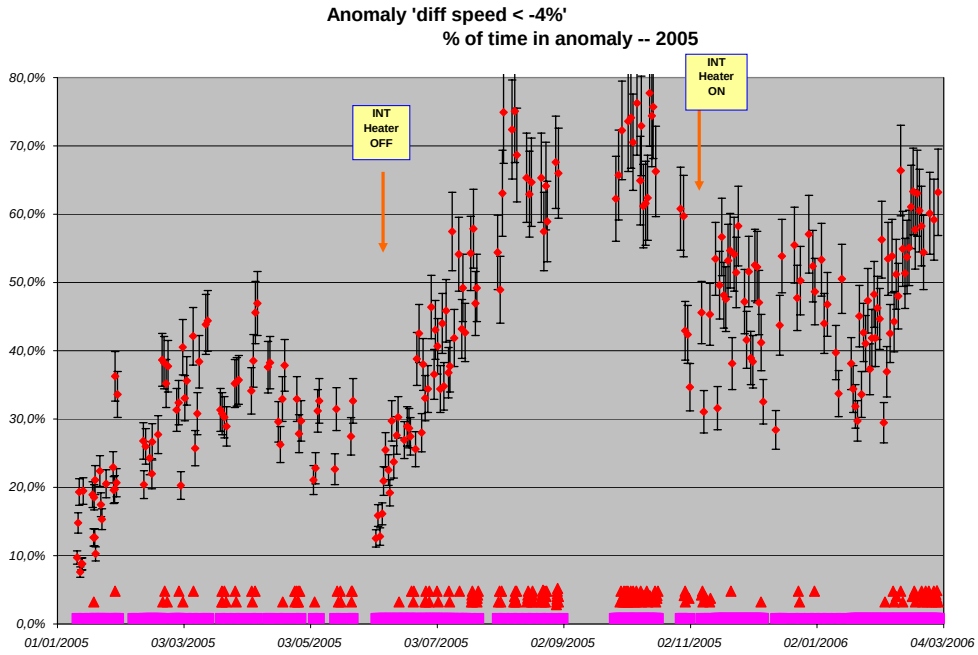


Fig. 6 MIPAS rate of -4% differential speed errors during 2005 RR mission. The magenta points in the lower part are the segment of planned measurement, the red circle are the anomalies, the red point in the plots are the -4% differential speed errors plotted with +/- 10% error bars.

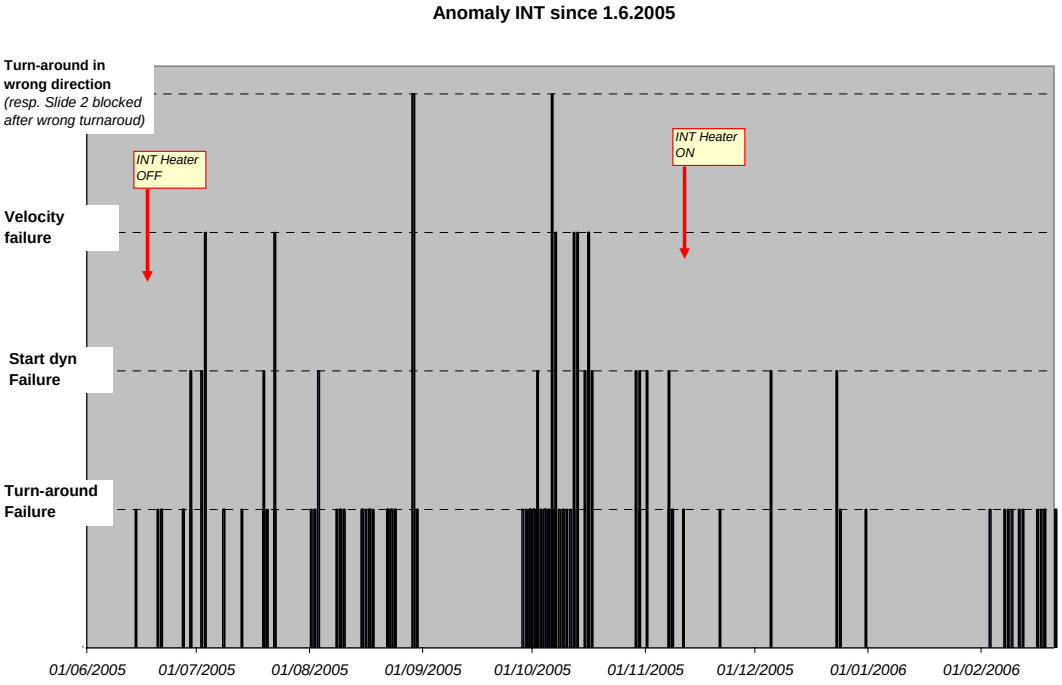


Fig. 7 MIPAS INT Anomaly since June 2005.

The reason of this increasing anomaly rate during the second half of February 2006 was a degradation of the bearing performance, the so-called *cage wind-up* effect. This was noticed by P. Mosner (Astrium) by analyzing the in-sweeps data. Indeed looking in detail to these data Astrium found a more and more increasing wind-up effect especially during movements of slide 1 into the positive direction. The force during this slide movement increased up to a value of more than 53mA (about 600 mN), which correspond to the double of what we observed during January 2006. This increased force, necessary to move the slide over the rails, reveals a problem in the slide movement, in particular in the bearing performance, what is called cage wind-up effect. This observation explains the high rate of velocity errors observed during the second part of February 2006. The increase of the drive force is reported in the following plots in terms of motor current, where the situation during January 2006 is compared to the data obtained the 1st of March 2006. In these plots we can appreciate the increase of the force, especially for slide 1 in the positive direction, indeed the current supplied to the slide 1 at the end of February 2006 was more than the double of that observed in January 2006.

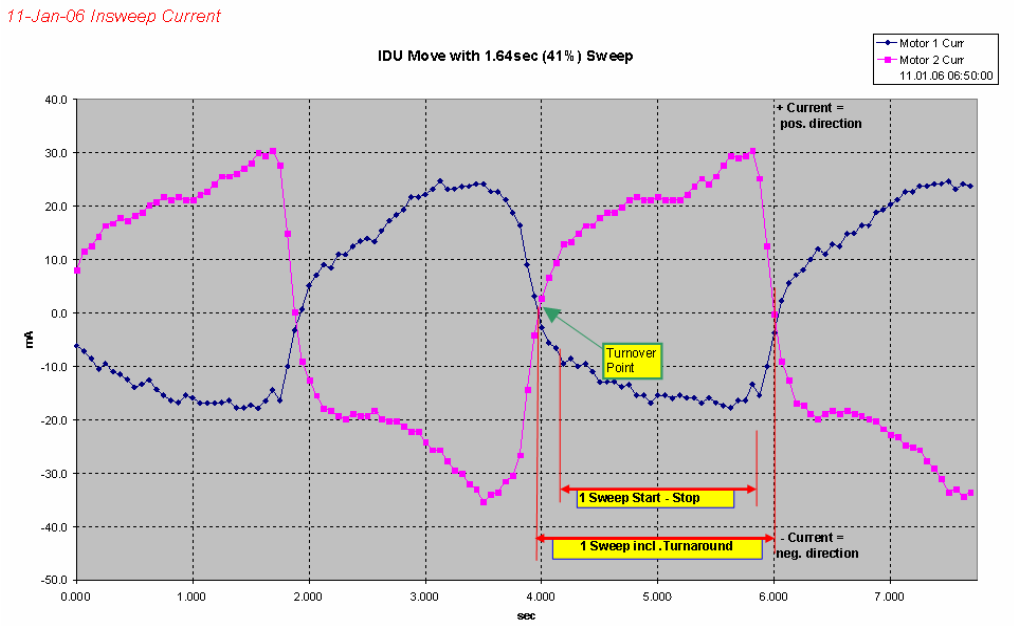


Fig. 8 Motor current taken during in-sweep movement of MIPAS slide 1 and 2. The data were taken during 11 January 2006. The positive and negative y-axis correspond to the positive and negative movement of the slide. The turnaround is the point where the slide change direction and the sweep duration is where the slide velocity is expected to be constant (when the scientific data are recorded) after the acceleration and deceleration of the turnaround.

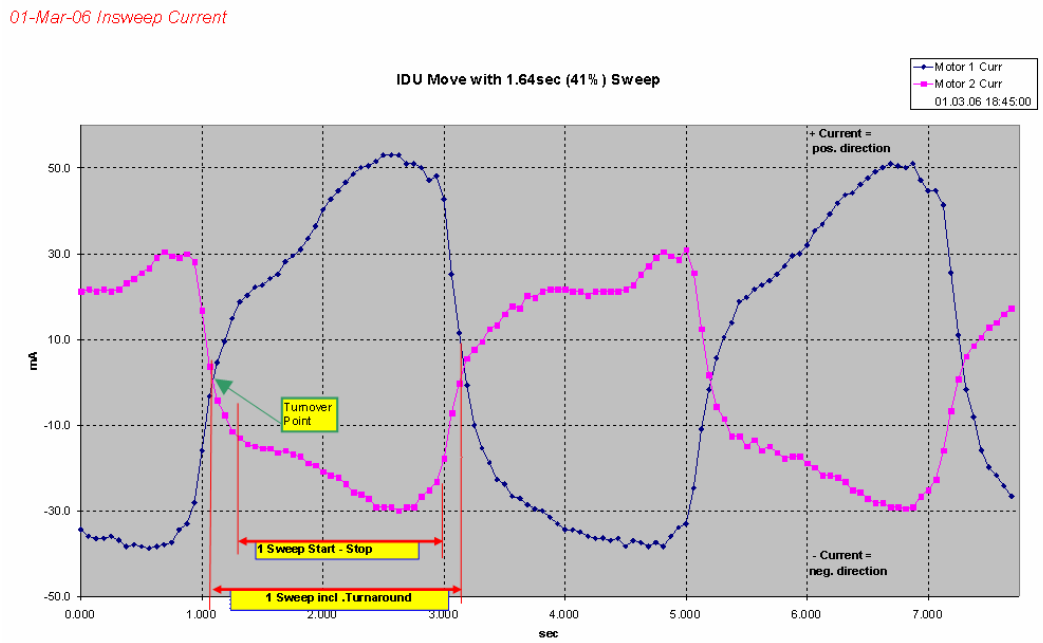


Fig. 9 Same as fig. 8 for in-sweep data taken the 1st of March 2006.

2.3.3 MECHANICAL PERFORMANCE

2.3.3.1 Cooler Performance

During March and April 2005 an evident increase in compressor vibration level has been observed, and starting from the second part of April 2005 the warning threshold of 8 mg has been exceeded many times. After an analysis done by Astrium, it has been found that the MIPAS cooler was not well balanced. The cooler rebalancing was performed from 11 May 07:39 to 12 May 12:14, during an interval of non-planned measurements. The rebalancing did not introduce the expected reduction of compressor vibration level because of the relatively warm environment. For this reason it was decided to switch-off the interferometer cooler on 25 May 2005. After the decontamination (23 May – 1 June 2005) and the INT heater switch-off, the cooler performs extremely well, the vibrations levels remain stable and well below the warning threshold (see Fig. 10).
The switch-on of the INT heater during October 2005 determines a slight increase of the compressor vibration, by about 1 mg. However the vibration level remains stable all over the reporting period and the cooler shows to perform extremely well up to February 2006.

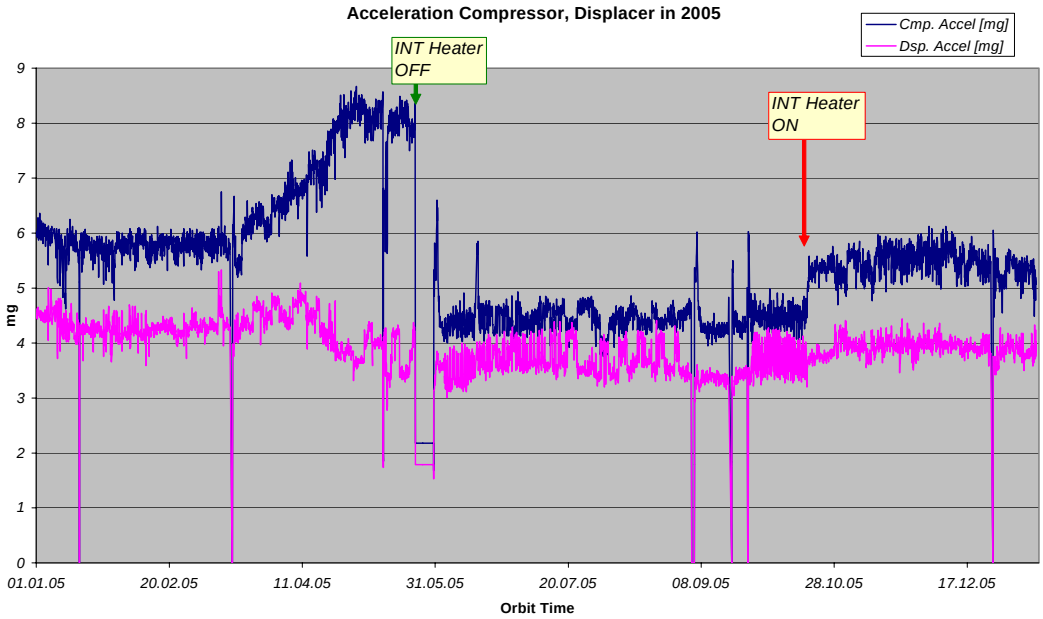


Fig. 10 MIPAS Cooler performances since January 2005: compressor and displacer acceleration.

The performance of the cooler during the reporting period (February 2006) was nominal with vibration values well below the observation warning level of 8 mg, as can be seen in Fig.11. The displacer and compressor vibration level were stable and remain steady around a value of 4 – 5 mg.

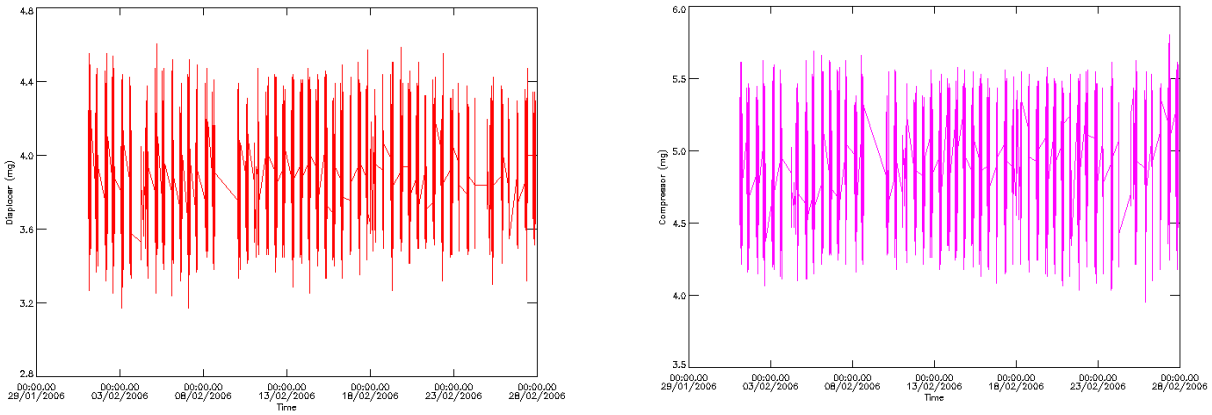


Fig. 11 February 2006: Cooler Displacer and Compressor vibration level.

2.4 Level 1b product quality monitoring

2.4.1 PROCESSOR CONFIGURATION

2.4.1.1 Version

Tab. 6 shows the list of IPF updates and the aligned DPM and the related NCR/SPRs. Currently the Near-Real Time (NRT) mission is suspended, and no systematic operational Off-Line (OFL) processing is performed while the processing algorithms are being adapted to the new observation modes.
Fig. 12 shows the alignment between the measurement mode (high resolution, reduced resolution with 17 sweeps and reduced resolution with 27 sweeps) and the corresponding valid IPF and ADF for the processing Level 1 and Level 2 products.
The validation of IPF 4.65 was completed during January 2006. This processor was installed at D-PAC and the OFL processing of MIPAS RR mission started the 9th of February 2006.

Tab. 6 Historical updates of MIPAS processor, related DPM and NCR/SPR.

IPF Version	DPM		Processor update	
	L1	L2	Level 1	Level 2
4.65	4I	4.1		Fixed NCR_1310
4.64	4I	4.1	Fixed SPR-121O0-2011	
4.63	4I	4.1	Fixed SPR-120O0-2000: Fixed SPR-120O0-2001	Fixed NCR_1278 Fixed NCR_1308 Rejected NCR_1310 Rejected NCR_1317
4.62	4H	4.0	Fixed NCR_1157 Fixed NCR_1259	Fixed NCR_1128 Fixed NCR_1275 Fixed NCR_1276

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

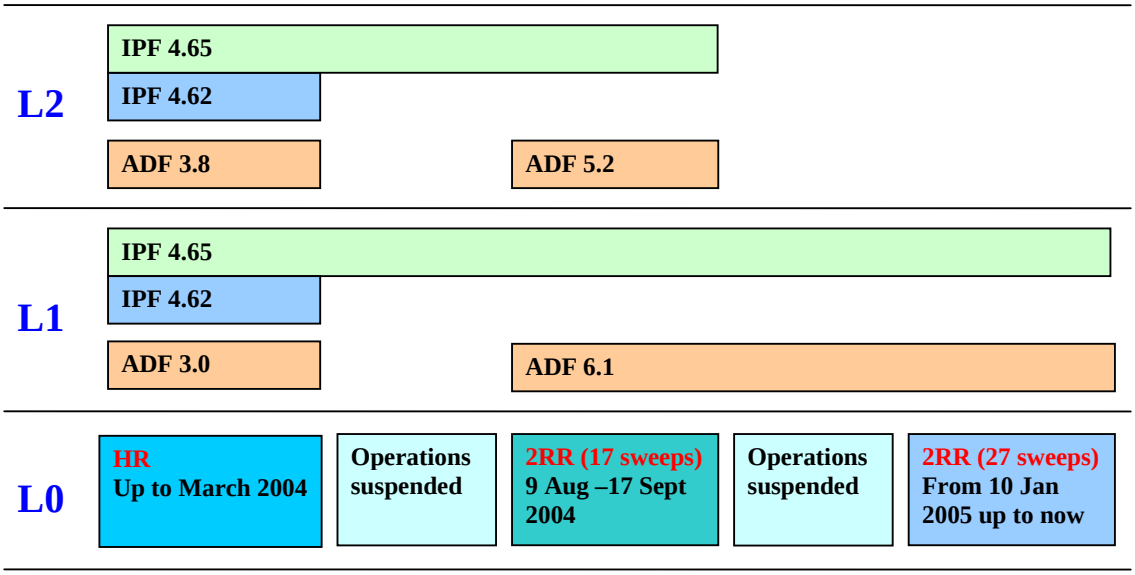


Fig. 12 IPF validity and ADFs version for processing level 1 and level 2 products. IPF 4.62 is the last operational one, while the IPF 4.65 will be installed at D-PAC for OFL processing of RR mission.

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

Tab. 7 Historical updates of MIPAS processor at near real time (NRT) processing sites (PDHS-K and PDHS-E) and off-line processing sites (LRAC and D-PAC).

Centre	Facility Software	Date
D-PAC	V4.65	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

2.4.1.2 Performances of the IPF 4.65 at D-PAC

The very high level 2 processing time of the IPF 4.65 experienced during the validation activity (see January 2006 MR) was not observed in the D-PAC platform; here the processor performs extremely well. The level 2 production takes an average time of 6h on D-PAC platform, while 16 h was the time observed during the validation in the ESF platform.
The L2 production of RR data of Aug-Sept 2004 is already terminated at D-PAC, while the level 1 production of all the RR data (from Aug 2004 up to now) will continue in parallel with the mission operation. The L1 processing has very good performances, indeed we can expect to have more than one measuring day for each processing day, taking also in account the low duty cycle used for the RR mission; anyway this estimate can vary depending on the resources allocated at D-PAC for this activity, since the MIPAS processing shares its CPU time with other instrument processing.

2.4.1.3 Auxiliary Data Files

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

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

The ADF files generated and disseminated during February 2006 are listed in the following table.

Tab. 8 Level 1 ADFs valid in February 2006.

Auxiliary Data File	Start Validity	Stop Validity	Updated during the reporting period
V6.1 MIP_MW1_AXVIEC20050627_094928_20040809_000000_20090809_000000 MIP_PS1_AXVIEC20050627_100609_20040809_000000_20090809_000000 MIP_CA1_AXVIEC20050627_094412_20040809_000000_20090809_000000	08-JAN-05	08-JAN-09	No
MIP_CL1_AXVIEC20050308_113825_20050108_000000_20090108_000000	08-JAN-05	08-JAN-09	No
MIP_CL1_AXVIEC20050420_152028_20050420_095747_20100420_095747	20-APR-05	20-APR-10	No
MIP_CS1_AXVIEC20060224_151546_20060208_000000_20110208_000000 MIP_CG1_AXVIEC20060224_150551_20060208_000000_20110208_000000 MIP_CO1_AXVIEC20060224_150045_20060208_000000_20110208_000000	08-FEB-06	08-FEB-11	Yes
MIP_CS1_AXVIEC20060224_151657_20060214_000000_20110214_000000 MIP_CG1_AXVIEC20060224_150652_20060214_000000_20110214_000000 MIP_CO1_AXVIEC20060224_150146_20060214_000000_20110214_000000	14-FEB-06	14-FEB-11	Yes
MIP_CS1_AXVIEC20060306_104004_20060222_000000_20110222_000000 MIP_CG1_AXVIEC20060302_153412_20060222_000000_20110222_000000 MIP_CO1_AXVIEC20060306_103639_20060222_000000_20110222_000000	22-FEB-06	22-FEB-11	Yes

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

Tab. 9 Historical deliveries of level 1 ADF by Bomem

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

2.4.2 SPECTRAL PERFORMANCE

The calibration file MIP_CS1_AX contains the spectral correction factor (SCF), which compensates for variations in the instrument metrology (e.g. aging of the laser). Fig. 13 gives the variation trend all over the RR mission (from August 2004). We observe a very stable situation since the variations are of the order of 2 ppm over more than one year of operations.

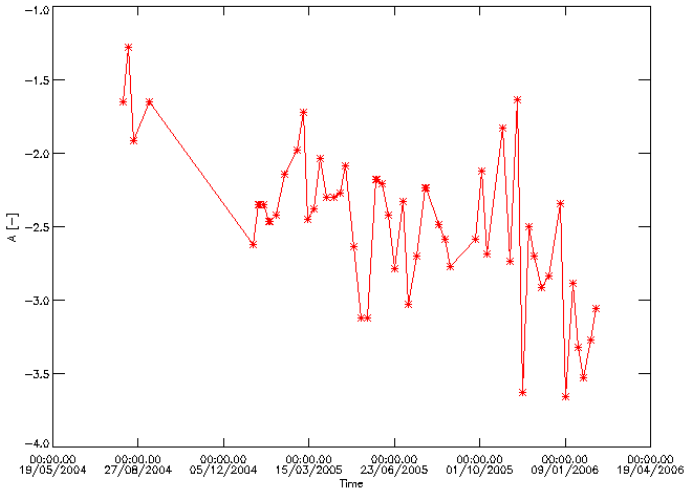


Fig. 13 MIPAS Spectral Calibration Factor (SCF) during RR ops updated to end of February 2006.

2.4.3 RADIOMETRIC PERFORMANCE

During February 2006 operations, the weekly increase of gain was always below the 1% warning threshold, as illustrated in Fig. 14. This figure shows the gain calibration check done weekly before disseminating an ADF. The check is done with respect to the last disseminated gain. In the case of a long mission interruption, the gain can change significantly; in this case the check is done the week later with respect to the first gain disseminated after the long interruption. The following figure shows that the check was always satisfied during the February 2006 interval, therefore the gain ADFs have been regularly disseminated.

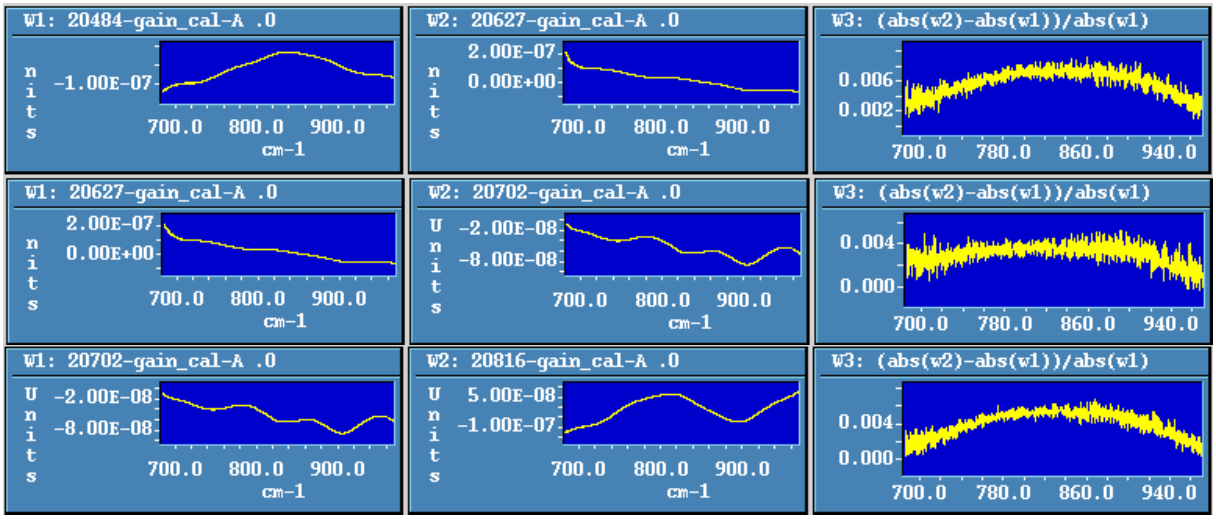


Fig. 14 Relative variations of radiometric gain for three disseminated gains (considering only band A) during February 2006 operations. The first two plots in each row are the imaginary part of the gain plotted versus the wave-number, the third plot is the ratio: *(abs(w2)-abs(w1))/abs(w1)*, which gives the gain increase with respect to the reference w1 (last disseminated ADF). The check is satisfied when the gain is lower than the warning threshold of 0.01 (1%).

Fig. 15 shows the gain rate during 2005 operations, this rate is obtained as the maximum of the curves of weekly gain variation *(abs(w2)-abs(w1))/abs(w1))* observed in Fig. 14. The very high increase of gain rate during Jan-May 2005 operations can be seen, this was due to the presence of ice near the detectors. After the decontamination (end of May 2005) the gain rate suddenly decreases to nominal value (1%) and it remains stable over the reporting period, up to the end of February 2006. The two gaps in the plots correspond respectively to the long mission interruption of September 2005 and to the INT-heater switch on of 17 October 2005. In this case a high variation of the gain was observed, which is not included in the plot, this variation is however taken into account in the absolute gain variation. This long term absolute gain increase since June 2005 is presented in Fig. 16, showing that the gain measured nowadays is about 23% higher with respect the one observed after the last decontamination of June 2005. This long term monitoring will be updated weekly and will help us in order to plan the next decontamination activity, expected for the end of April 2006.

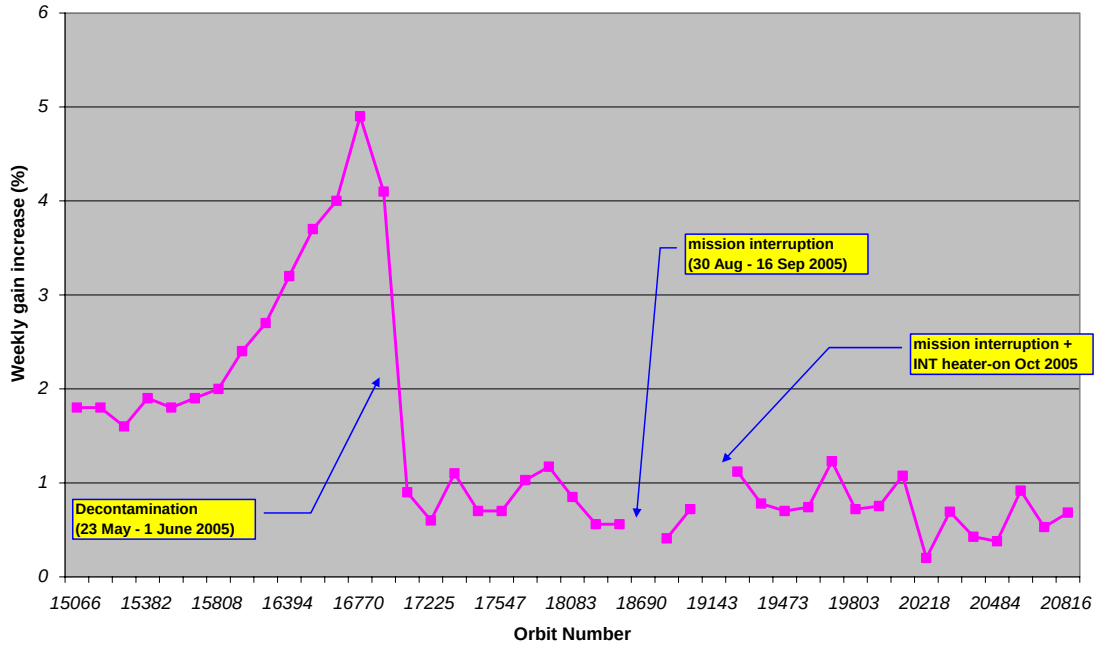


Fig. 15 Gain rate on a weekly basis since January 2005 updated to the end of Feb 2006. Note that when there is a mission interruption the weekly increase is re-initialized using as reference the first gain after interruption or INT-heater/cooler switch on.

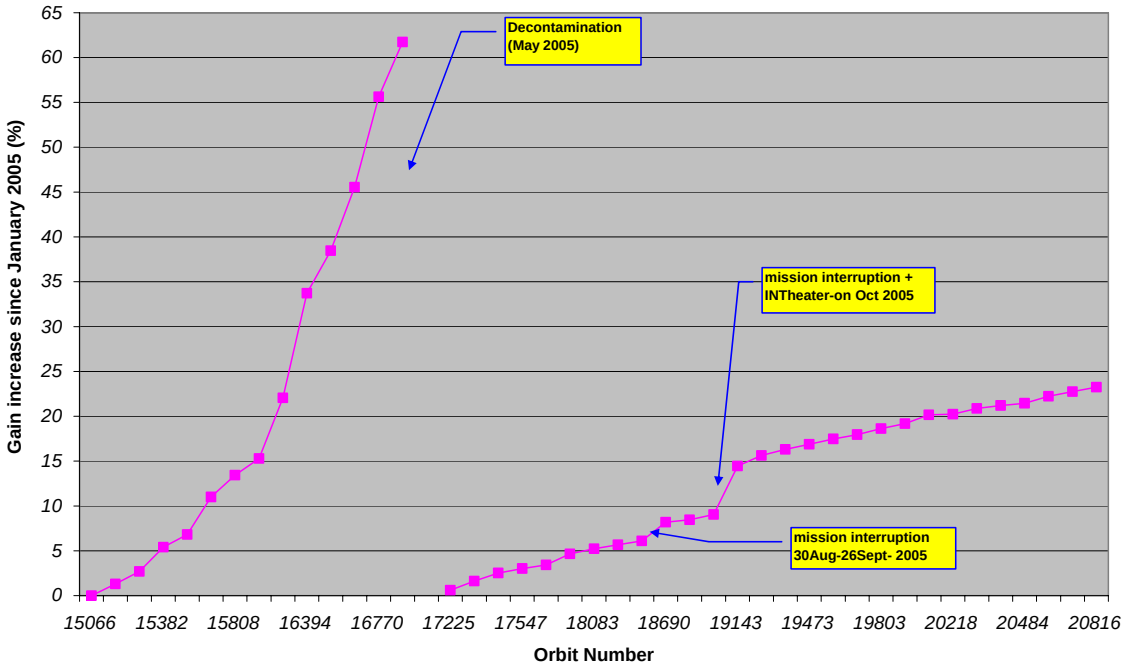


Fig. 16 Gain absolute increase since January 2005.

2.4.3.1 Interpolated gains

During the period January-May 2005, a strong gain increase was observed in the weekly 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.

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

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

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

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 ***Appendix D***. These 45 MIP_CG1__AX files should be used for the reprocessing of the 2005 2RR MIPAS mission.

2.4.4 POINTING PERFORMANCE

The LOS calibration measurements are performed every week and the mispointing is analysed on a bi-weekly basis. This plan allows the pointing stability to be analysed and guarantees the availability of the data in case of missing products. Initial analysis has shown a marked annual cycle

(as shown in Fig. 17) covering the period September 2002 – June 2005. The figure shows the relative and the absolute pointing error (evaluated taking into account the commanded elevation angle for the LOS calibration). The annual trend is not due to the MIPAS instrument itself, but to a mispointing of the entire ENVISAT platform resulting from the software response to orbit control information. In fact, the update in the pointing software implemented on 12 December 2003 (orbit 9321) has reduced the deviation trend.

During February 2006 operations, the LOS bi-weekly calibrations were performed and the results of the calibration are reported in the following table and figure. Only one calibration is presented for this month since for the other planned measurement a PDS failure prevents the LOS calibration from being successful. During the last months of operations the relative bias seems to be stable around a value of few mdeg.

Tab. 10 LOS calibration performed on February 2006.

Date	Orbit #	Relative bias [deg]	Absolute bias [deg]
11-Feb-2006	20655	0,000020	-0,029980

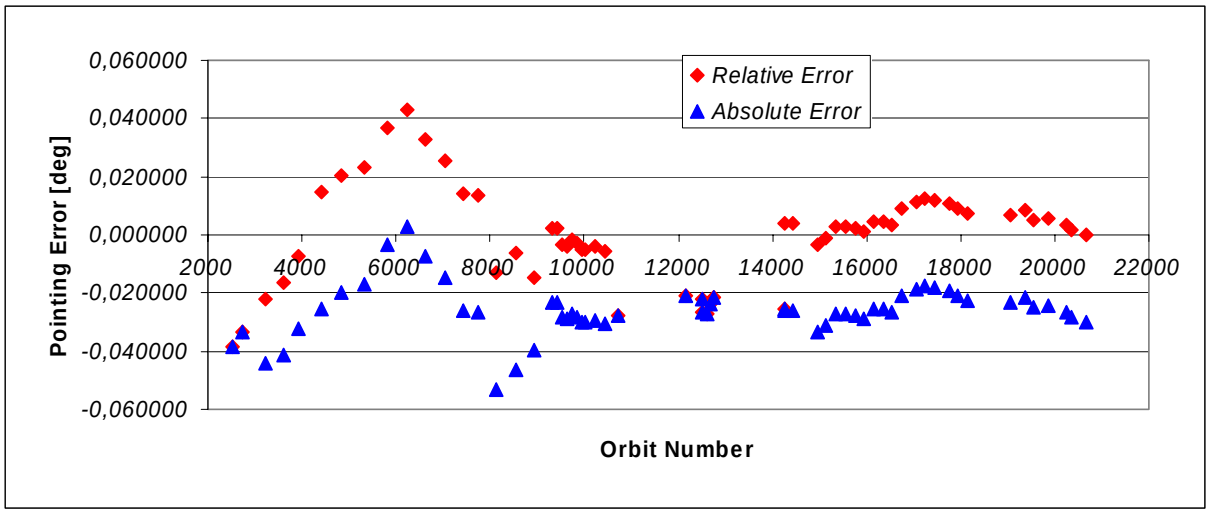


Fig. 17 MIPAS long-term pointing error as a function of the orbit: September 2002- February 2006.

As can be seen in Fig. 17, there are points where the relative and absolute errors coincide because the angle for LOS measurements has been commanded to 0 mdeg. Tab. 11 shows the history of the commanded angle for LOS measurements.

Tab. 11 LOS commanded angle updates.

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

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

During the anomaly investigation in winter 2004, the absence of interferometer operations was used for a dedicated Line of Sight campaign. MIPAS LOS data have been inter-compared with restituted attitude information from the ENVISAT star trackers, in preparation for future operational use of restituted attitude in off-line processing. Fig. 18 presents results from July 29th, 2004. Note that a bias of 24 mdeg was subtracted from the pointing error. Apart from this bias, results from the MIPAS LOS campaign agree with star tracker information. Investigations are currently ongoing to find the cause of this bias.

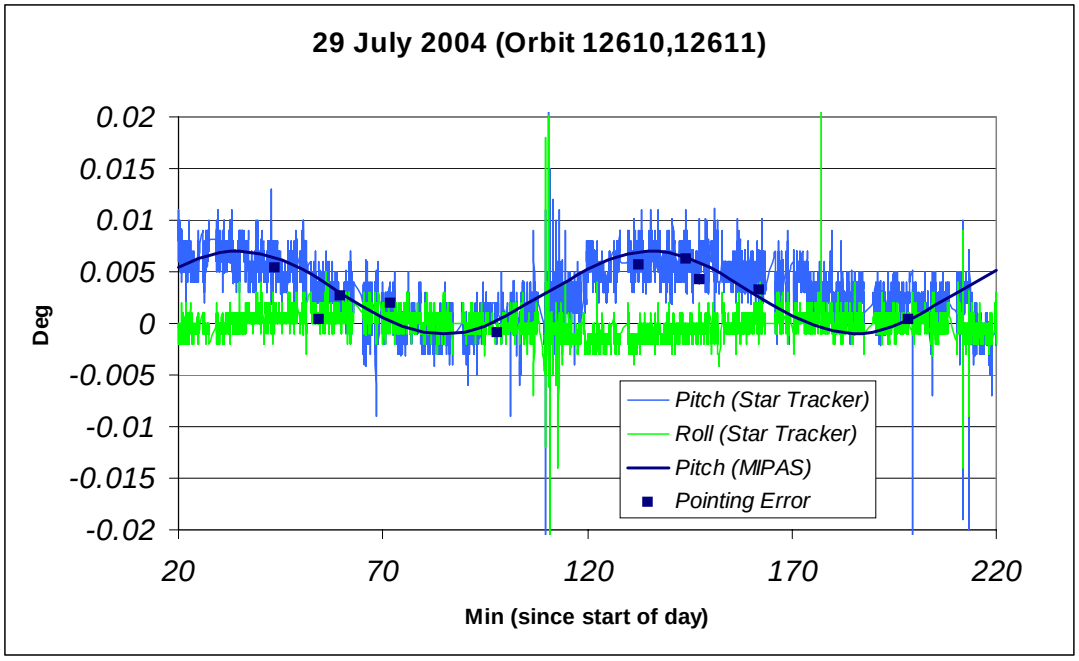


Fig. 18 Comparison between MIPAS pointing and star tracker information.

2.4.5 L1B PRODUCTS PROCESSED WITH PROTOTYPE

As noted before, no NRT product generation is foreseen for now. For the Science team and QWG, some Level 1B products have been generated using the MIGSP 2.5 prototype. The complete list of these products is reported on ***Appendix E***.

2.4.5.1 Aircraft Emission from December 2005

The Aircraft Emission measurements of 22 – 24 December 2005 are manually processed in ESRIN with the L1 prototype. The results will be put in Uranus (in the directory: /MIPAS/To_QWG/Aircraft_Emission/22-24_Dec_2005/) as soon as they are available. For the moment the following orbits were processed and delivered:

AE ascending

#19925	**MIP_NL_1P_19925**
#19926	**MIP_NL__1b_AE_19926**
#19927	**MIP_NL__1P_19927**
#19938	**MIP_NL__1P_19938.N1**
#19939	**MIP_NL__1P_19939.N1**
#19940	**MIP_NL__1P_19940.N1**

AE descending

#19929	**MIP_NL__1P_19929.N1**
#19930	**MIP_NL__1P_19930.N1**

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

2.4.5.2 Test Data Set for the new L1 prototype

A further input was provided by BOMEM, it consists of a set of L1b measurements processed with the new level 1 prototype (which is still under development). These L1b products were obtained using two new features of the processor:

- Pointing calibration using restituted attitude ADF (AUX_FRA_AX)
- Truncation of the interferogram (to 8cm) in order to avoid under sampling.

The effect of these new options on the spectra can be assessed; in particular the effect of IGM truncation can be analysed since the same orbit are processed with and without truncation, some feed-back were already given at the last QWG#9.
These files are on Uranus under directory: /MIPAS/To_QWG/TDS_proto_L1/ and the following products can be found:

MIP_NL__1P_10600-RES_ATT.040310	(orbit 10600 from 2004-03-10, Full Res)
MIP_NL__1P_12788-RES_ATT.040810	(orbit 12788 from 2004-08-10, RR 17 sweeps)
MIP_NL__1P_12963-RES_ATT.04822	(orbit 12963 from 2004-08-22, RR 17 sweeps)
MIP_NL__1P_14404-RES_ATT.041201	(orbit 14404 from 2004-12-01, RR 27 sweeps)

MIP_NL__1P_17540-RES_ATT.050708 (orbit 17540 from 2005-07-08, RR 27 sweeps)
MIP_NL__1P_12788_8cm_RES_ATT.040810 (same as before but with truncation of IGM)
MIP_NL__1P_12963-8cm_RES_ATT.04822 (same as before but with truncation of IGM)
MIP_NL__1P_17540-8cm-RES.050708 (same as before but with truncation of IGM)

2.4.6 LEVEL 1 HISTORICAL OFL PROCESSING OF RR MISSION

The Level 1 processing of RR mission has started at D-PAC the 9th of February 2006. This OFL processing activity will be carried out considering two parallel work-orders:

- **Historical processing**: data from Aug-Sept 2004 and from Jan 2005 – Jan 2006 period.
- **OFL processing**: starting from February 2006 going on with the MIPAS operations, taking into account the two weeks of delay due to the consolidation at LRAC.

The status of the L1 processing updated at the 8th of March is reported in the following table. All these data are available on D-PAC ftp server:

Tab. 12 L1 OFL processing status, 8th March 2006.

Period	Status
Aug – Sept 2004	Completed
2005 data	2005-01-10 → 2005-01-19
2006 data	2006-02-01 → 2006-02-21

A daily quality check of the L1 processed data is going to be set-up in ESRIN with automatic generation of Quadas report and ingestion of all the level 1 products in the Quadas database for long term monitoring of FCE, ILS, and NESR. Further results of this monitoring will be presented in the upcoming MR.

2.4.7 LEVEL 0 AND LEVEL 1 ANOMALY STATUS

The following table summarises the anomalies affecting Level 0 and Level 1 products and shows the associated SPR, NCR, OAR and HD code.

Tab. 13 Level 0 and Level 1 anomaly list.

Anomaly	Prototype/DPM SPR	IPF NCR	OAR	HD	Status
Number of sweeps per scan	128	/	/	HD/01-2005/1010	Closed
MIPAS wrong consolidated products	/	/	2097	/	Closed
Excessive number of MISSING ISPS	/	/	2165 → 342	/	Closed and merged with

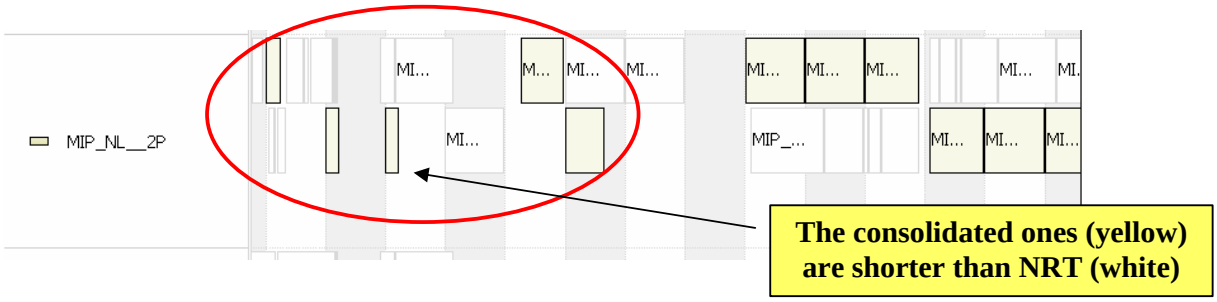
in the MPH for MIPAS L0 products					342 (RA-2)
Non-valid band A at the same geo-location	/	/	/	/	Ongoing
MIPAS Aircraft Emission retrieved tangent altitude	/	/	/	/	Ongoing

2.4.7.1 Number of Sweeps per Scan

The affected product is orbit 12963 generated with IPF 4.62. SPH gives:
"NUM_SWEEPS_PER_SCAN=+00018", but 17 is the correct value (although the last scan has 18 sweeps).
The problem has been investigated by Bomem and it has been found that the auxiliary data block is missing in the last sweep of the orbit, so detection of the beginning/end of scan cannot be done. The prototype is not affected by the problem because Bomem has solved this particular problem by rejecting the last sweep when its auxiliary data block is missing. For a definitive solution, the DMP will be changed (SPR 33) and the modifications will be implemented in next IPF delivery.

2.4.7.2 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 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 should be deleted from D-PAC and re-consolidated at LRAC.

2.4.7.3 Excessive number of MISSING ISPS in the MPH for MIPAS L0 products

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

MIP_NL__0PNPDE20060209_020145_000033732045_00032_20627_0104.N1

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

From investigation of Task 4 (S. Faluschi) a lot of ssc reset have been found in ISP list prod, the ssc should reset every 16.384 counts (going from 0 to 16383), whilst in this case it resets randomly after 110, 467, 77 ... counts. Every unexpected reset is interpreted by PFHS (processor) as missing ISPs. This is a PFHS nominal behavior, as specified in s/w requirement documents. The same behavior has been observed and traced for RA2 products, by OAR-342 / NCR-1307. We are going to evaluate if this behavior can be modified in PFHS code, in the meanwhile this OAR was closed and renamed as recurrence of OAR-342.

2.4.7.4 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. Investigations are on going with the support of BOMEM, it seems a problem in the input L0 consolidated P products. The investigation is still ongoing, this behaviour was also observed in other consolidated products; therefore it seems a problem in LRAC side.

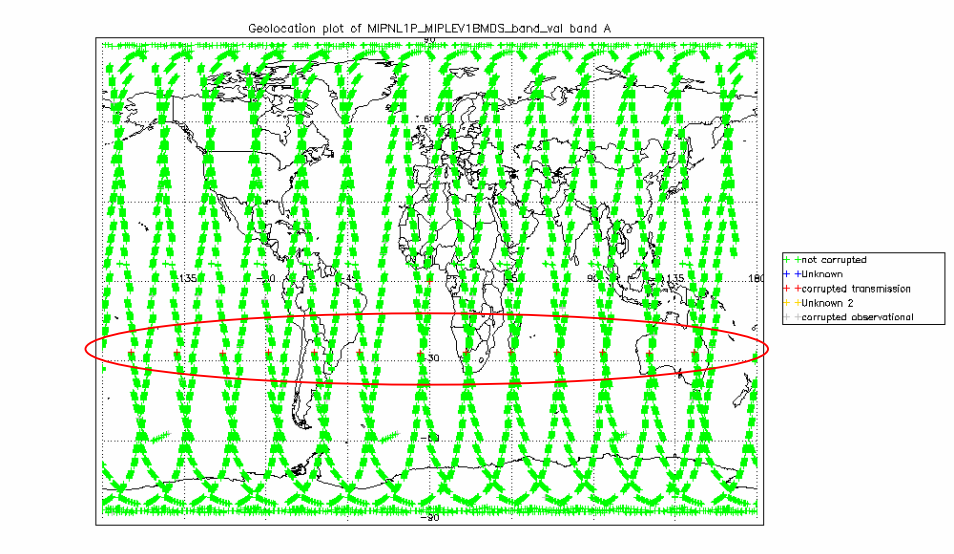


Fig. 19 Corrupted sweeps are observed always at the same geo-location for these OFL L2 products of 10 March 2004 processed at D-PAC.

2.4.7.5 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.

2.5 Level 2 product quality monitoring

2.5.1 PROCESSOR CONFIGURATION

2.5.1.1 Version

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

2.5.1.2 Auxiliary Data Files

This paragraph reports the historical update of the level 2 ADF. The latest delivery for processing full resolution mission is the v3.8, whereas for the processing of RR data of Aug 2004 the latest delivery is the v5.2. This latter version is only correcting for a bug in the previous ADF (v.5.1), there are not scientific updates in this latest delivery with respect to the previous one. The ADF version 5.2 was used for the validation of IPF 4.65.

Tab. 14 Historical update of Level 2 ADFs.

Auxiliary Data File	Start Validity	Description
ADFs V5.2 MIP_CS2_AXVIEC20060105_121012_20040809_000000_20040917_220643 MIP_IG2_AXVIEC20060105_113531_20040901_000000_20040917_220643 MIP_IG2_AXVIEC20060105_114108_20040809_000000_20040901_000000 MIP_MW2_AXVIEC20060105_130642_20040809_000000_20040917_220643 MIP_OM2_AXVIEC20060105_130954_20040809_000000_20040917_220643 MIP_PI2_AXVIEC20060105_131141_20040809_000000_20040917_220643 MIP_PS2_AXVIEC20060105_131340_20040809_000000_20040917_220643 MIP_SP2_AXVIEC20060105_131744_20040809_000000_20040917_220643	9-AUG-04	Correction of a bug in the previous L2 ADF v5.1 MIP_IG2_AX, MIP_SP2_AX
ADFs V5.1 MIP_CS2_AXVIEC20050722_082136_20040809_000000_20040917_220643 MIP_IG2_AXVIEC20050721_130007_20040809_000000_20040901_000000 MIP_IG2_AXVIEC20050721_134702_20040901_000000_20040917_220643 MIP_MW2_AXVIEC20050721_144629_20040809_000000_20040917_220643 MIP_OM2_AXVIEC20050721_143058_20040809_000000_20040917_220643 MIP_PI2_AXVIEC20050721_142545_20040809_000000_20040917_220643 MIP_PS2_AXVIEC20050721_141630_20040809_000000_20040917_220643 MIP_SP2_AXVIEC20050721_140636_20040809_000000_20040917_220643	9-AUG-04	For processing RR measurement with fixed altitude and old vertical sampling
ADFs V3.8 NRT MIP_PS2_AXVIEC20040421_095623_20040326_143428_20090326_000000 Off-line MIP_PS2_AXVIEC20040421_095923_20040326_143428_20090326_000000	26-MAR-04	With respect to V3.7, adjusted the threshold to the new noise level.
ADFs V3.7: NRT MIP_MW2_AXVIEC20031021_145505_20020706_060000_20080706_060000 MIP_OM2_AXVIEC20040302_110723_20020706_000000_20080706_000000 MIP_PS2_AXVIEC20040302_110923_20040109_000000_20090209_000000	06-JUL-02 and 09-JAN-04	With respect to V3.6: Eliminated scans with one or two altitude levels; adjusted the threshold to the new noise level.

MIP_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		
MIP_IG2_AXVIEC20040227_081527_20040301_000000_20090301_000000	01-MAR-04	Seasonal update of climatological initial guess.
MIP_IG2_AXVIEC20031118_151533_20031201_000000_20081201_000000	01-DEC-03	Seasonal update of climatological initial guess.
ADFs V3.6: NRT MIP_MW2_AXVIEC20031021_145505_20020706_060000_20080706_060000 MIP_OM2_AXVIEC20031021_145630_20020706_060000_20080706_060000 MIP_PS2_AXVIEC20031021_145858_20020706_060000_20080706_060000 MIP_PI2_AXVIEC20031021_145745_20020706_060000_20080706_060000 MIP_CS2_AXVIEC20031021_145337_20020706_060000_20080706_060000 MIP_SP2_AXVIEC20031021_150016_20020706_060000_20080706_060000 Off-line MIP_MW2_AXVIEC20031027_100858_20020706_060000_20080706_060000 MIP_OM2_AXVIEC20031027_101029_20020706_060000_20080706_060000 MIP_PS2_AXVIEC20031027_101319_20020706_060000_20080706_060000 MIP_PI2_AXVIEC20031027_101146_20020706_060000_20080706_060000 MIP_CS2_AXVIEC20031027_100559_20020706_060000_20080706_060000 MIP_SP2_AXVIEC20031027_101441_20020706_060000_20080706_060000	06-JUL-02	Activation of cloud detection; removal of the gaps between the altitude validity ranges; altitudes margins fixed to +/- 4 km; short-term ILS bug fix. **NRT** Old convergence criteria; nominal altitude range. **Off-line** Improved convergence criteria; altitude range extended to 6-68 km.
MIP_IG2_AXVIEC20030731_134035_20030901_000000_20080901_000000	01-SEP-03	Seasonal update of climatological initial guess.
MIP_IG2_AXVIEC20030522_104714_20030601_000000_20080601_000000	01-JUN-03	Seasonal update of climatological initial guess.
MIP_IG2_AXVIEC20030307_142141_20030310_000000_20080301_000000	10-MAR-03	Seasonal update of climatological initial guess: This dissemination substitute the corrupt file disseminated previously.
MIP_IG2_AXVIEC20030214_130918_20030301_000000_20080301_000000	01-MAR-03	Seasonal update of climatological initial guess: This auxiliary file turned out to be corrupt, and a corrected version has been disseminated on 10 March 2003.
ADFs V3.1: MIP_MW2_AXVIEC20030722_134301_20030723_000000_20080722_000000 MIP_OM2_AXVIEC20030722_134602_20030723_000000_20080722_000000 MIP_PS2_AXVIEC20030722_102142_20030723_000000_20080722_000000 MIP_PI2_AXVIEC20030722_134848_20030723_000000_20080722_000000 MIP_CS2_AXVIEC20030722_133331_20030723_000000_20080722_000000 MIP_SP2_AXVIEC20030722_093046_20030723_000000_20080722_000000	23-JUL-03	Cloud detection enabled and improved validity mask range in Microwindows files; improved Occupation Matrices (no gaps between altitude validity ranges).

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

2.5.2 RE-PROCESSING STATUS OF FR MISSION AT D-PAC

Figure 20 shows the reprocessing status at the end of February 2006. The L0 expected field on the figure takes into account all instrument and product generation unavailability, so it describes what is actually expected. The discrepancy between expected and received is caused by a delay in the generation of consolidated Level 0 at LRAC. The situation at the beginning of 2006 is that almost all the products that arrived at D-PAC were processed up to L2.

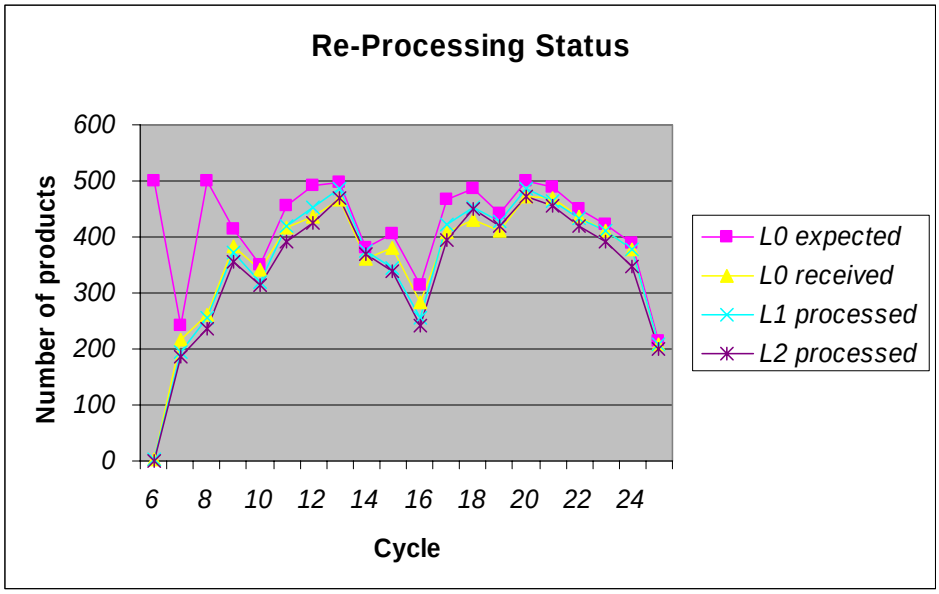


Fig. 20 Re-processing status at the end of February 2006

2.5.3 LEVEL 2 HISTORICAL OFL PROCESSING OF RR MISSION

The level 2 processing of RR mission at D-PAC has started the mid of February 2006 with the latest processor (IPF 4.65). This IPF is able to process all the FR MIPAS mission up to L2 (data before March 2004), furthermore it can process RR data up to L2 for the Aug-Sept 2004 period, when the instrument was still working with the old vertical sampling (17 sweeps for each scan). This period corresponds to the measurement segments reported in the table below.

Tab. 15 Measurement segments processed OFL up to Level 2 for RR mission data.

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

The L2 processing of all these RR measurement was completed during February 2006, a total of 158 orbits were processed up to L2. All these data are available on D-PAC ftp server.

2.5.3.1 Quality Control of reprocessed L2 data

A quality control of these products was completed, showing an overall good quality of the level 2 processing. Only one major problem was found for some orbits recorded during 21 – 22 Aug 2004. The investigation of this problem is still ongoing, the summary report for these two days are reported below (Figs 21 – 22) showing that a high number of retrieval failed for some orbits, in particular the problem was observed for orbits #12945 – #12957. The plot of 20 Aug 2004 where the processing of all the orbits was successful is also reported for comparison (Fig. 23).

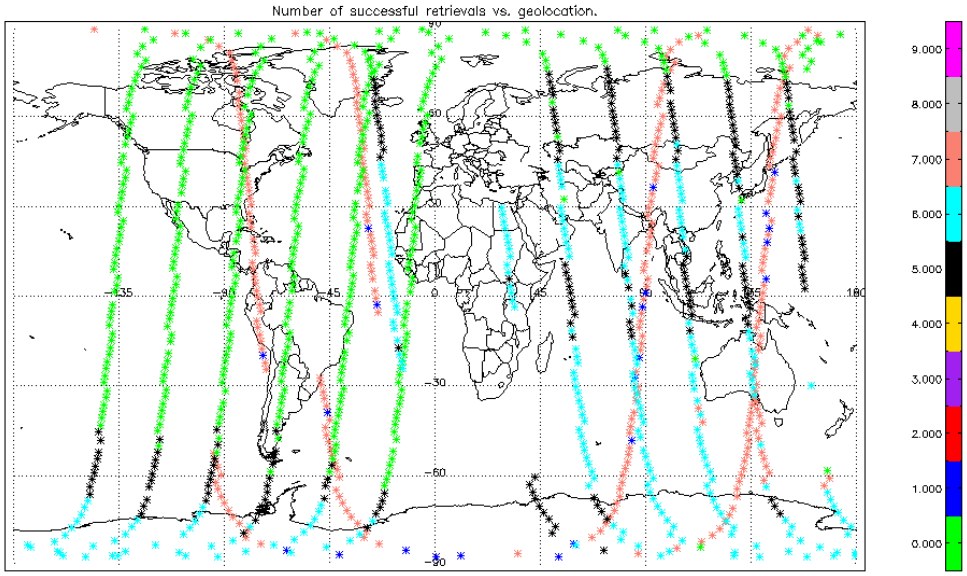


Fig. 21 Number of successful retrieval as a function of geo-location for 21 Aug 2004, anomalous behaviour: many retrievals failed. Note that 7 is the nominal value (purple in the plot), corresponding to the standard ESA products (pT+h2o+o3+n2o+no2+ch4+hno3).

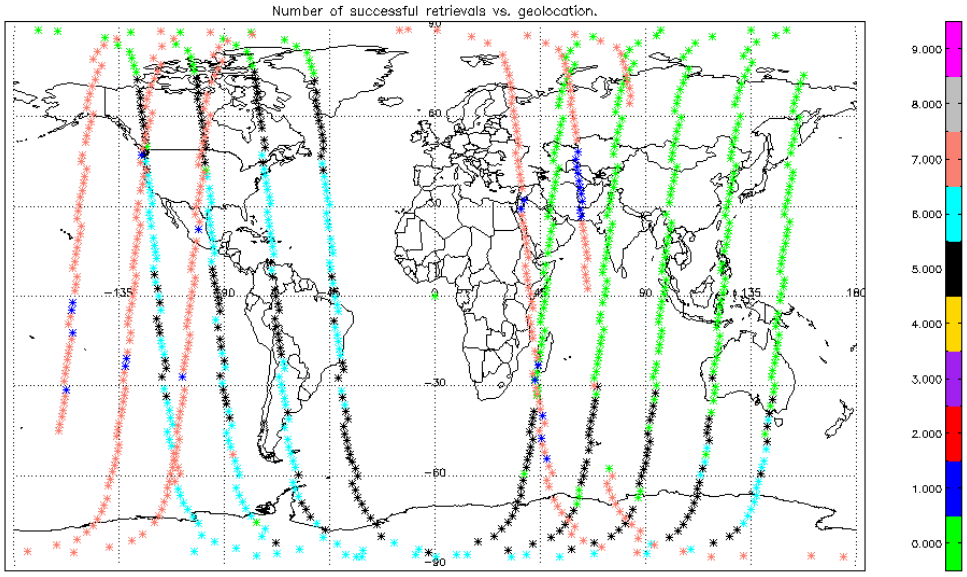


Fig. 22 Number of successful retrieval as a function of geo-location for 22 Aug 2004 anomalous behaviour: many retrievals failed. Note that 7 is the nominal value (purple in the plot), corresponding to the standard ESA products (pT+h2o+o3+n2o+no2+ch4+hno3).

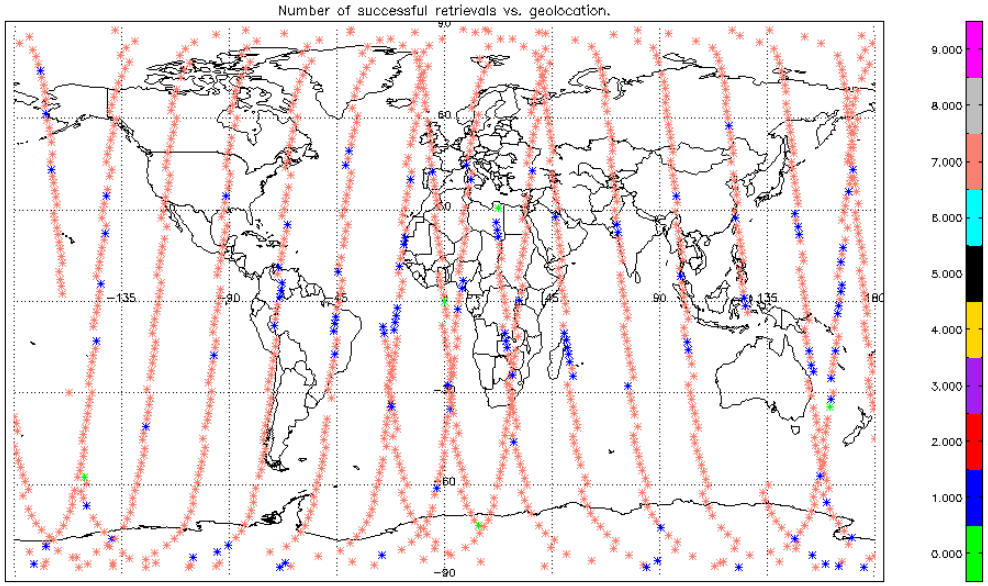


Fig. 23 Number of successful retrieval as a function of geo-location for 20 Aug 2004, normal behaviour. Note that 7 is the nominal value (purple in the plot), corresponding to the standard ESA products (pT+h2o+o3+n2o+no2+ch4+hno3).

2.5.4 LEVEL 2 ANOMALY STATUS

The following table summarises the anomalies affecting Level 2 products and shows the associated SPR, NCR, OAR and HD code.

Tab. 16 Level 2 anomaly list.

Anomaly	Prototype/DPM SPR	IPF NCR	OAR	HD	Status
Jump anomaly	/	/	/	HD/01-2005/1013	Closed
Anomalous processing time	33	1127	1361	/	Closed
Strange Impossible values	/	/	/	HD 2005003487	Closed
NO2 retrieval during polar condition	/	/	/	/	Closed
Excessive Chi-square	/	1458	1929	/	To be corrected in IPF 4.66
Difference on L2 products between v4.61 and v4.62	/	1521	2074	/	To be corrected in IPF 4.66
Beatcheck failure on some L2 products	/	1522	2081	HD 2005007448	To be corrected in IPF 4.66

2.5.4.1 Jump Anomaly

Oxford University detected a jump in the zonal means of all Level 2 NRT data produced after switch-on on 8th February until 16th February 2004, compared with Level 2 data generated from 17th March 2004 but also with the data until switch-off on 9th February 2004. The jump has been caused by the use of a not updated gain after the decontamination. Therefore this anomaly can be considered closed.

2.5.4.2 Anomalous Processing Time

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

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

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

2.5.4.3 Strange Impossible values

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

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

Note that the retrieval of p-T is performed at the same time and that the corrected altitudes are simply the engineering values corrected for the hydrostatic equilibrium using the retrieved p-T profile. Finally, a deeper analysis of the results shows that a strange value in the pressure or temperature results in errors in the corrected altitudes or that negative variances in the temperature often correspond to negative variances for pressure and for corrected altitude.
In conclusion in most of the cases these strange values are due only to instability in the (p+ T+ Zcorr) retrieval stage due to different reasons, some of them explained above. Nevertheless it will be important to isolate the most particular cases to see if there is any significant anomaly and it will be very important for the future to set up a strategy for masking unphysical results in the L2 products.

2.5.4.4 Excessive chi-square

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

2.5.4.5 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 OAR is now under investigation by the IPF developers (DJO). They found a bug in the IPF and they will correct it in the next IPF delivery (IPF 4.66). Between 4.61 and 4.62 there was a correction in reading the MW2 auxiliary file, but this correction needs also a change in the initial guess section of MIPAS L2 processor. Because the problem is in the initial guess section it should be happen in most case that after fitting the result vector is in the minima and not in a local minima. Therefore the problem affects only some products or only parts of the product.

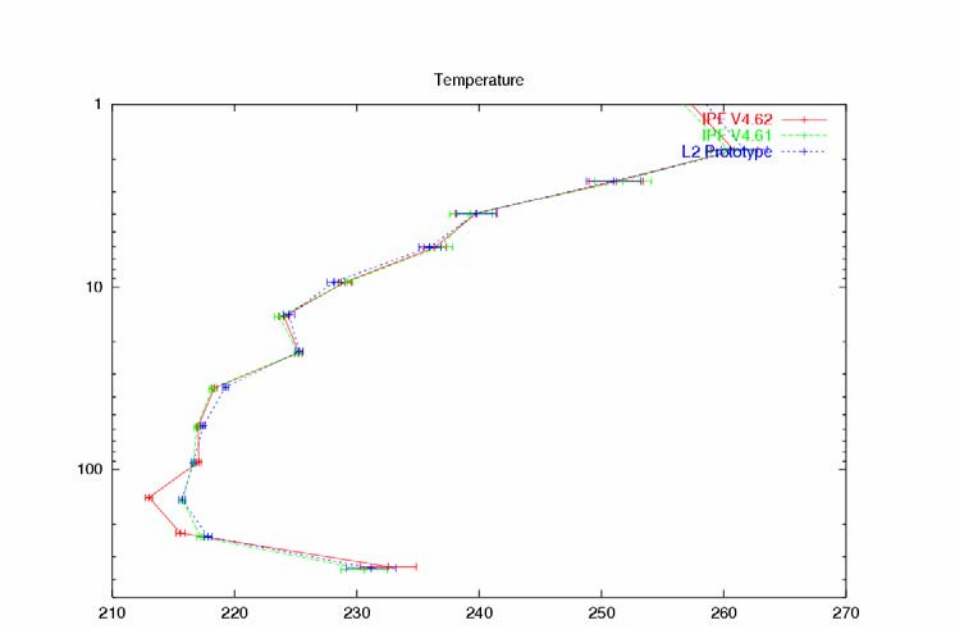


Fig. 24 Temperature profiles as a function of pressure retrieved with IPF 4.62 and 4.61 compared to the prototype for seq. 16 of orbit 2975. The 4.61 profile is the reference, validated by a IMK balloon flight.

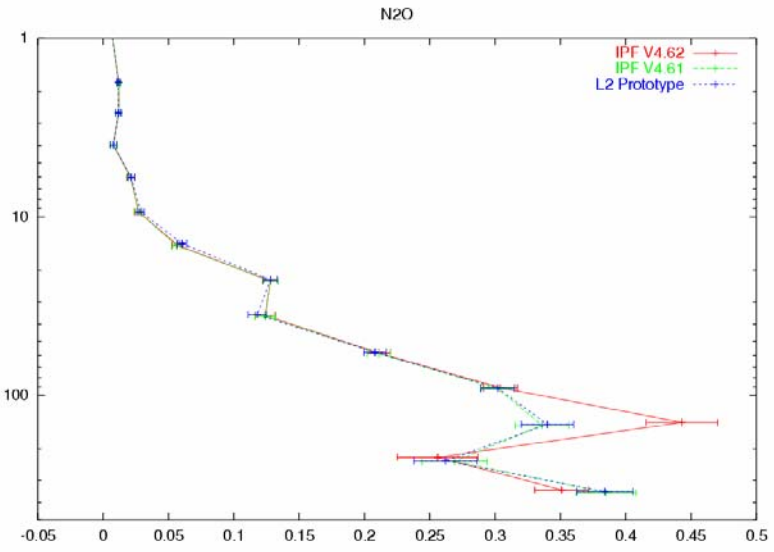


Fig. 25 N2O profiles 8ppmV) as a function of pressure retrieved with IPF 4.62 and 4.61 compared to the prototype for seq. 16 of orbit 2975. The 4.61 profile is the reference, validated by a IMK balloon flight.

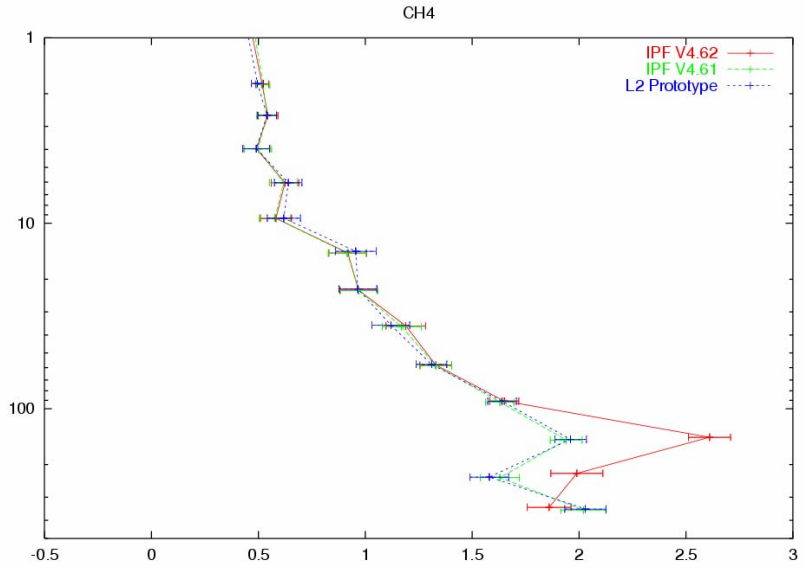


Fig. 26 CH4 profiles 8ppmV) as a function of pressure retrieved with IPF 4.62 and 4.61 compared to the prototype for seq. 16 of orbit 2975. The 4.61 profile is the reference, validated by a IMK balloon flight.

2.5.4.6 Beatcheck failure on some L2 products

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

MIP_NL__2PODPA20030702_064249_000059652017_00421_06988_2699.N1
MIP_NL__2PPDPA20030702_064249_000059652017_00421_06988_0369.N1
MIP_NL__2PPDPA20030827_065146_000060152019_00221_07790_0938.N1

The same products processed at D-PAC with the IPF 4.62 give the same format error. The same L2 production made with the prototype didn't show this anomaly. The beatcheck output for these products is the following:

```
MIP_NL__2PODPA20030702_064249_000059652017_00421_06988_2699.N1
ERROR: could not calculate size of "SCAN INFORMATION MDS "
(MIPAS Level-2 STRUCTURES-dataset format error)
ERROR: could not calculate size of "PT RETRIEVAL MDS "
(MIPAS Level-2 STRUCTURES-dataset format error)
ERROR: could not calculate size of "H2O RETRIEVAL MDS "
(MIPAS Level-2 STRUCTURES-dataset format error)
ERROR: could not calculate size of "O3 RETRIEVAL MDS "
(MIPAS Level-2 STRUCTURES-dataset format error)
ERROR: could not calculate size of "HNO3 RETRIEVAL MDS "
```

(MIPAS Level-2 STRUCTURES-dataset format error)
ERROR: could not calculate size of "CH4 RETRIEVAL MDS "
(MIPAS Level-2 STRUCTURES-dataset format error)
ERROR: could not calculate size of "N2O RETRIEVAL MDS "
(MIPAS Level-2 STRUCTURES-dataset format error)
ERROR: could not calculate size of "NO2 RETRIEVAL MDS "
(MIPAS Level-2 STRUCTURES-dataset format error)
ERROR: could not calculate size of "CONTINUUM AND OFFSET MDS "
(MIPAS Level-2 STRUCTURES-dataset format error)
ERROR: could not calculate size of "PCD INFORMATION ADS "
(MIPAS Level-2 STRUCTURES-dataset format error)
ERROR: could not calculate size of "MICROWINDOW OCCUPATION ADS "
(MIPAS Level-2 STRUCTURES-dataset format error)
ERROR: could not calculate size of "RESIDUAL SPECTRA ADS "
(MIPAS Level-2 STRUCTURES-dataset format error)
ERROR: could not calculate size of "PROCESSING PARAMETERS ADS "
(MIPAS Level-2 STRUCTURES-dataset format error)

The IPF developers are investigating on this issue; they will correct this bug in the next IPF delivery (4.66).

2.5.4.7 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).

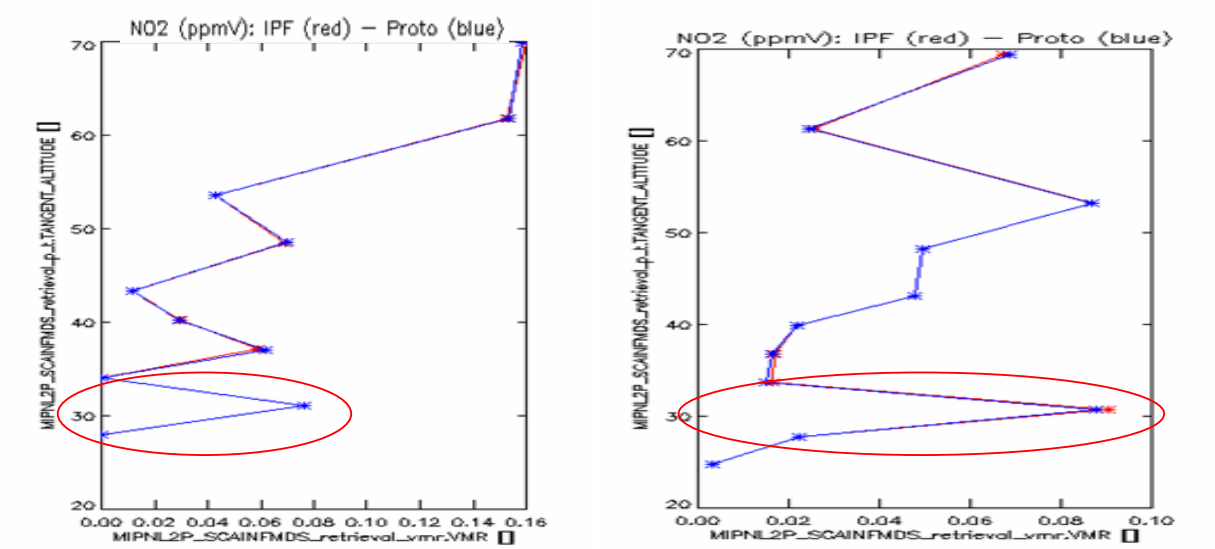


Fig. 27 NO2 profiles obtained with the IPF and prototype for two particular scan of 6 June 2003 in Antarctic winter condition, highlighted in red are the region around 30 km with sudden increase of NO2 value, which has no physical meaning. Note the degraded profile shape, namely the zigzag and the zero 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.

APPENDIX A *FILES TRANSFERRED TO THE FOCC*

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

RGT files already transferred to the FOCC:

AVI_UAV_TLVFOS20060118_160855_00000000_00000445_20060129_130058_20060130_021545.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000446_20060130_054657_20060130_135957.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000447_20060130_173108_20060131_014408.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000448_20060131_051520_20060131_132820.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000449_20060131_165931_20060201_025307.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000450_20060201_062419_20060201_125643.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000451_20060201_162754_20060202_022130.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000452_20060202_055242_20060202_122506.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000453_20060202_155617_20060203_014953.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000454_20060203_052105_20060203_133404.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000455_20060203_170516_20060204_061333.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000456_20060204_094226_20060204_130227.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000457_20060204_163339_20060205_022715.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000458_20060205_055827_20060205_123050.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000459_20060205_160202_20060206_015538.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000460_20060206_052650_20060206_133949.N1
AVI_UAV_TLVFOS20060118_160856_00000000_00000461_20060206_171101_20060207_012401.N1
AVI_UAV_TLVFOS20060118_161136_00000000_00000462_20060207_045513_20060207_130812.N1
AVI_UAV_TLVFOS20060118_161136_00000000_00000463_20060207_163924_20060208_023300.N1
AVI_UAV_TLVFOS20060118_161136_00000000_00000464_20060208_060412_20060208_123635.N1
AVI_UAV_TLVFOS20060118_161136_00000000_00000465_20060208_160747_20060209_020123.N1
AVI_UAV_TLVFOS20060118_161136_00000000_00000466_20060209_053235_20060209_134534.N1
AVI_UAV_TLVFOS20060118_161136_00000000_00000467_20060209_171646_20060210_012946.N1
AVI_UAV_TLVFOS20060118_161136_00000000_00000468_20060210_050058_20060210_131357.N1
AVI_UAV_TLVFOS20060118_161136_00000000_00000469_20060210_164509_20060228_120000.N1
AVI_UAV_TLVFOS20060123_203116_00000000_00000470_20060210_164509_20060211_005233.N1
...
AVI_UAV_TLVFOS20060123_203116_00000000_00000520_20060305_215857_20060331_120000.N1

MPL_LOS_MPVRGT20060117_175038_00000000_00000191_20060204_061832_20060205_104605.N1
MPL_LOS_MPVRGT20060123_150512_00000000_00000192_20060211_005733_20060212_102644.N1
MPL_LOS_MPVRGT20060123_155049_00000000_00000193_20060218_003825_20060219_100638.N1
MPL_LOS_MPVRGT20060123_174523_00000000_00000194_20060225_001824_20060226_094530.N1
MPL_LOS_MPVRGT20060123_182925_00000000_00000195_20060304_013933_20060305_110612.N1

MPL_ORS_MPVRGT20060117_183026_00000000_00000110_20060130_030225_20060205_032806.N1
MPL_ORS_MPVRGT20060118_105346_00000000_00000111_20060206_024218_20060210_023036.N1
MPL_ORS_MPVRGT20060123_151104_00000000_00000112_20060211_082712_20060216_074354.N1
MPL_ORS_MPVRGT20060123_153913_00000000_00000113_20060217_083842_20060222_075524.N1
MPL_ORS_MPVRGT20060123_170619_00000000_00000114_20060223_085012_20060228_080654.N1
MPL_ORS_MPVRGT20060123_174703_00000000_00000115_20060301_090142_20060305_085001.N1

APPENDIX B *LEVEL 1 IPF HISTORICAL UPDATES*

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

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

APPENDIX C *LEVEL 1 ADF HISTORICAL UPDATES*

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

Version 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.

APPENDIX D *INTERPOLATED GAINS*

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

ADF file name	Type (* - interpolated gains)
MIP_CG1_AXVIEC20050309_081858_20050108_000000_20090108_000000	Gain calibration (CG_0)
MIP_CG1_AXVIEC20051115_085521_20050118_120000_20100118_120000	Gain (CG_0_a) *
MIP_CG1_AXVIEC20050310_091646_20050116_000000_20090116_000000	Gain calibration (CG_1)
MIP_CG1_AXVIEC20051115_085521_20050118_120000_20100118_120000	Gain (CG_1_a) *
MIP_CG1_AXVIEC20050311_085855_20050121_000000_20090121_000000	Gain calibration (CG_2)
MIP_CG1_AXVIEC20051115_090016_20050124_120000_20100124_120000	Gain (CG_2_a) *
MIP_CG1_AXVIEC20050314_154134_20050128_000000_20090128_000000	Gain calibration (CG_3)
MIP_CG1_AXVIEC20051115_090529_20050130_150000_20100130_150000	Gain (CG_3_a) *
MIP_CG1_AXVIEC20051115_091036_20050202_080000_20100202_080000	Gain (CG_3_b) *
MIP_CG1_AXVIEC20050315_131822_20050205_000000_20090205_000000	Gain calibration (CG_4)
MIP_CG1_AXVIEC20051115_101639_20050209_120000_20100209_120000	Gain (CG_4_a) *
MIP_CG1_AXVIEC20050316_081309_20050214_000000_20090214_000000	Gain calibration (CG_5)
MIP_CG1_AXVIEC20051115_102136_20050217_000000_20100217_000000	Gain (CG_5_a) *
MIP_CG1_AXVIEC20051115_102701_20050220_000000_20100220_000000	Gain (CG_5_b) *
MIP_CG1_AXVIEC20051115_103156_20050223_000000_20100223_000000	Gain (CG_5_c) *
MIP_CG1_AXVIEC20051115_103702_20050226_000000_20100226_000000	Gain (CG_5_d) *
MIP_CG1_AXVIEC20050405_145110_20050301_000000_20090301_000000	Gain calibration (CG_6)
MIP_CG1_AXVIEC20051115_104209_20050303_150000_20100303_150000	Gain (CG_6_a) *
MIP_CG1_AXVIEC20051115_104705_20050306_080000_20100306_080000	Gain (CG_6_b) *
MIP_CG1_AXVIEC20050406_070802_20050309_000000_20090309_000000	Gain calibration (CG_7)
MIP_CG1_AXVIEC20051115_105212_20050311_000000_20100311_000000	Gain (CG_7_a) *
MIP_CG1_AXVIEC20050407_072135_20050314_000000_20090313_000000	Gain calibration (CG_8)
MIP_CG1_AXVIEC20051115_105723_20050315_000000_20100315_000000	Gain (CG_8_a) *
MIP_CG1_AXVIEC20051115_110250_20050316_115754_20100316_000000	Gain (CG_8_b) *
MIP_CG1_AXVIEC20051115_122231_20050319_000000_20100319_000000	Gain (CG_8_c) *
MIP_CG1_AXVIEC20050407_143713_20050321_000000_20090321_000000	Gain calibration (CG_9)
MIP_CG1_AXVIEC20051115_122732_20050323_070000_20100323_070000	Gain (CG_9_a) *
MIP_CG1_AXVIEC20051115_123244_20050325_160000_20100325_160000	Gain (CG_9_b) *
MIP_CG1_AXVIEC20050411_123723_20050328_000000_20090328_000000	Gain calibration (CG_10)
MIP_CG1_AXVIEC20051115_123754_20050330_070000_20100330_070000	Gain (CG_10_a) *
MIP_CG1_AXVIEC20051115_124300_20050401_160000_20100401_160000	Gain (CG_10_b) *
MIP_CG1_AXVIEC20050412_072926_20050404_000000_20090404_000000	Gain calibration (CG_11)
MIP_CG1_AXVIEC20051115_124808_20050406_000000_20100406_000000	Gain (CG_11_a) *
MIP_CG1_AXVIEC20051115_125321_20050408_000000_20100408_000000	Gain (CG_11_b) *
MIP_CG1_AXVIEC20051115_125829_20050410_000000_20100410_000000	Gain (CG_11_c) *
MIP_CG1_AXVIEC20050415_073538_20050412_231018_20100412_231018	Gain calibration (CG_12)
MIP_CG1_AXVIEC20051115_130340_20050414_000000_20100414_000000	Gain (CG_12_a) *
MIP_CG1_AXVIEC20051115_130903_20050416_000000_20100416_000000	Gain (CG_12_b) *
MIP_CG1_AXVIEC20051115_131404_20050418_000000_20100418_000000	Gain (CG_12_c) *

MIP_CG1_AXVIEC20050421_065554_20050420_133450_20100420_133450	Gain calibration (CG_13)
MIP_CG1_AXVIEC20051115_131917_20050421_120000_20100421_120000	Gain (CG_13_a) *
MIP_CG1_AXVIEC20051115_132409_20050423_000000_20100423_000000	Gain (CG_13_b) *
MIP_CG1_AXVIEC20051115_132925_20050424_120000_20100424_120000	Gain (CG_13_c) *
MIP_CG1_AXVIEC20050427_150526_20050426_225532_20100426_225532	Gain calibration (CG_14)
MIP_CG1_AXVIEC20051115_133432_20050427_160000_20100427_160000	Gain (CG_14_a) *
MIP_CG1_AXVIEC20051115_133942_20050429_070000_20100429_070000	Gain (CG_14_b) *
MIP_CG1_AXVIEC20051115_134453_20050501_000000_20100501_000000	Gain (CG_14_c) *
MIP_CG1_AXVIEC20051115_134947_20050502_160000_20100502_160000	Gain (CG_14_d) *
MIP_CG1_AXVIEC20051115_135453_20050504_070000_20100504_070000	Gain (CG_14_e) *
MIP_CG1_AXVIEC20050509_150546_20050506_153444_20100506_153444	Gain calibration (CG_15)
MIP_CG1_AXVIEC20051115_154052_20050507_030000_20100507_030000	Gain (CG_15_a) *
MIP_CG1_AXVIEC20051115_151144_20050508_060000_20100508_060000	Gain (CG_15_b) *
MIP_CG1_AXVIEC20051115_151255_20050509_090000_20100509_090000	Gain (CG_15_c) *
MIP_CG1_AXVIEC20051115_151358_20050510_120000_20100510_120000	Gain (CG_15_d) *
MIP_CG1_AXVIEC20051115_151458_20050511_150000_20100511_150000	Gain (CG_15_e) *
MIP_CG1_AXVIEC20051115_151558_20050512_180000_20100512_180000	Gain (CG_15_f) *
MIP_CG1_AXVIEC20051115_151702_20050513_210000_20100513_210000	Gain (CG_15_g) *
MIP_CG1_AXVIEC20050523_090017_20050515_000000_20090515_000000	Gain calibration (CG_16)
MIP_CG1_AXVIEC20051115_150616_20050516_090000_20100516_090000	Gain (CG_16_a) *
MIP_CG1_AXVIEC20051115_150747_20050517_190000_20100517_190000	Gain (CG_16_b) *
MIP_CG1_AXVIEC20051115_150831_20050519_040000_20100519_040000	Gain (CG_16_c) *
MIP_CG1_AXVIEC20051115_150940_20050520_140000_20100520_140000	Gain (CG_16_d) *
MIP_CG1_AXVIEC20050524_081749_20050522_000000_20090522_000000	Gain calibration (CG_17)

APPENDIX E *LEVEL 1B PRODUCTS GENERATED WITH PROTOTYPE*

The following level 1b products were created by running the migsp prototype and were delivered to the QWG. All products can be found on Uranus ftp server.

AE ascending December 2005
MIP_NL_1P_19925
MIP_NL__1b_AE_19926
MIP_NL__1P_19927
MIP_NL__1P_19938.N1
MIP_NL__1P_19939.N1
MIP_NL__1P_19940.N1

AE descending December 2005
MIP_NL__1P_19929.N1
MIP_NL__1P_19930.N1

TDS for development of new L1 proto
MIP_NL__1P_10600-RES_ATT.040310
MIP_NL__1P_12788-RES_ATT.040810
MIP_NL__1P_12963-RES_ATT.04822
MIP_NL__1P_14404-RES_ATT.041201
MIP_NL__1P_17540-RES_ATT.050708
MIP_NL__1P_12788_8cm_RES_ATT.040810
MIP_NL__1P_12963-8cm_RES_ATT.04822
MIP_NL__1P_17540-8cm-RES.050708

MA
MIP_NL__1PPLRA20050111_014126_000060332033_00404_14987_0765.N1

UTLS-1
MIP_NL__1PPLRA20050117_115639_000060122033_00496_15079_0824.N1
MIP_NL__1PMPDK20051120_111053_000014832042_00381_19473_0493.N1
MIP_NL__1PMPDK20051120_131234_000051352042_00382_19474_0494.N1

UA
MIP_NL__1PPLRA20050121_113027_000060312034_00052_15136_0855.N1

UTLS-2
MIP_NL__1PPLRA20050123_120742_000060732034_00081_15165_0874.N1

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

MIP_NL__1PPLRA20050128_161233_000060212034_00155_15239_0910.N1

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

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

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

AE_Canada_US_a:
MIP_NL__1PNPDE20050506_031821_000000632037_00047_16634_0806.N1
MIP_NL__1PNPDE20050506_031922_000000332037_00047_16634_0795.N1
MIP_NL__1PNPDE20050506_031954_000000332037_00047_16634_0792.N1
MIP_NL__1PNPDE20050506_032025_000000332037_00047_16634_0791.N1
MIP_NL__1PNPDE20050506_032056_000000332037_00047_16634_0796.N1
MIP_NL__1PNPDE20050506_032128_000000332037_00047_16634_0800.N1
MIP_NL__1PNPDE20050506_032159_000000332037_00047_16634_0799.N1
MIP_NL__1PNPDE20050506_032231_000000332037_00047_16634_0793.N1
MIP_NL__1PNPDE20050506_032302_000000332037_00047_16634_0794.N1
MIP_NL__1PNPDE20050506_032334_000000332037_00047_16634_0797.N1

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

MIP_NL__1PNPDK20050505_123822_000000332037_00038_16625_1260.N1
MIP_NL__1PNPDK20050505_123854_000000332037_00038_16625_1254.N1
MIP_NL__1PNPDK20050505_123925_000000332037_00038_16625_1249.N1
MIP_NL__1PNPDK20050505_123957_000000352037_00038_16625_1255.N1

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

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

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

APPENDIX F *LEVEL 2 IPF HISTORICAL UPDATES*

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

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

APPENDIX G *LEVEL 2 ADF HISTORICAL UPDATES*

The Level 2 ADF files historical deliveries by IFAC are reported in the following table and paragraph. Version 4 corresponds to a set of ADFs for processing of full resolution measurements, with the noise level adjusted for when the interferometer heaters are switched-on and a flag set for processing of only nominal measurements. Version 5 corresponds to ADFs for processing of reduced spectral resolution measurement (17 sweeps operations), so is able to process the measurements done in the Aug-Sept 2004 period.

Version	Date of delivery	List of files upgraded by IFAC	Main modifications
ADF V5.2	05.12.2005	MIP_SP2_AX_V5.2 MIP_OM2_AX_V5.2_october	Correct for a bug in the binary conversion of these two ADF. The ascii version of these files was correct then it was just a problem in the binary conversion of the ADF.
ADF V5.1	05.07.2005	MIP_MW2_AX_V5.1 MIP_SP2_AX_V5.1 MIP_OM2_AX_V5.1	Spectroscopic line list relative to the new microwindow database for reduced spectral resolution; PT error propagation matrices for nominal OMs added in file MIP_OM2_AX; upper limit of a microwindow for cloud detection changed.
ADF V5.0	18.03.2005	MIP_PS2_AX_V5 MIP_CS2_AX_V5 MIP_MW2_AX_V5 MIP_PI2_AX_V5 MIP_IG2_AX_V5_july MIP_IG2_AX_V5_october MIP_OM2_AX_V5	New microwindows selected for reduced spectral resolution, and corresponding cross section LUT, occupation matrices and Initial Guess for continuum (July and October seasons). Boundaries of the microwindows for cloud detection modified to match the new spectral grid at reduced resolution. New Pointing Information (PI) with a smaller error in LOS, new settings (PS) for handling reduced resolution measurements and optimised convergence criteria thresholds for reduced resolution mws.
ADF V4.1	03.09.2004	NRT: MIP_PS2_AX_NRT_V4.1 OFL: MIP_PS2_AX_OFL_V4.1	Changed the flag in PS2 file spec_events_flag from "B" (dec 66) to "N" (dec 78). NESR threshold in PS2 files as in V3.6.
ADF V4.0	03.09.2004	NRT: MIP_PS2_AX_NRT_V4.0 OFL: MIP_PS2_AX_OFL_V4.0	Changed the flag in PS2 file spec_events_flag from "B" (dec 66) to "N" (dec 78). Increased NESR threshold in PS2 files as in V3.7.

- **ADFs V5.2**

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

- **ADFs V5.1**

In this latest release of the ADFs, the spectroscopic line list relative to the new microwindow database for reduced spectral resolution was updated. Also, the PT error propagation matrices

for nominal OMs (file MIP_OM2_AX) and the upper limit of a microwindow for cloud detection were changed.

- **ADFs V5.0**

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

- **ADFs V4.1**

ADFs for processing of full resolution measurements, with MIP_PS2_AX file with noise level adjusted to interferometer heaters switched-off and flag set for processing of only nominal measurements.

- **ADFs V4.0**

ADFs for processing of full resolution measurements, with MIP_PS2_AX file with noise level adjusted to interferometer heaters switched-on and flag set for processing of only nominal measurements.