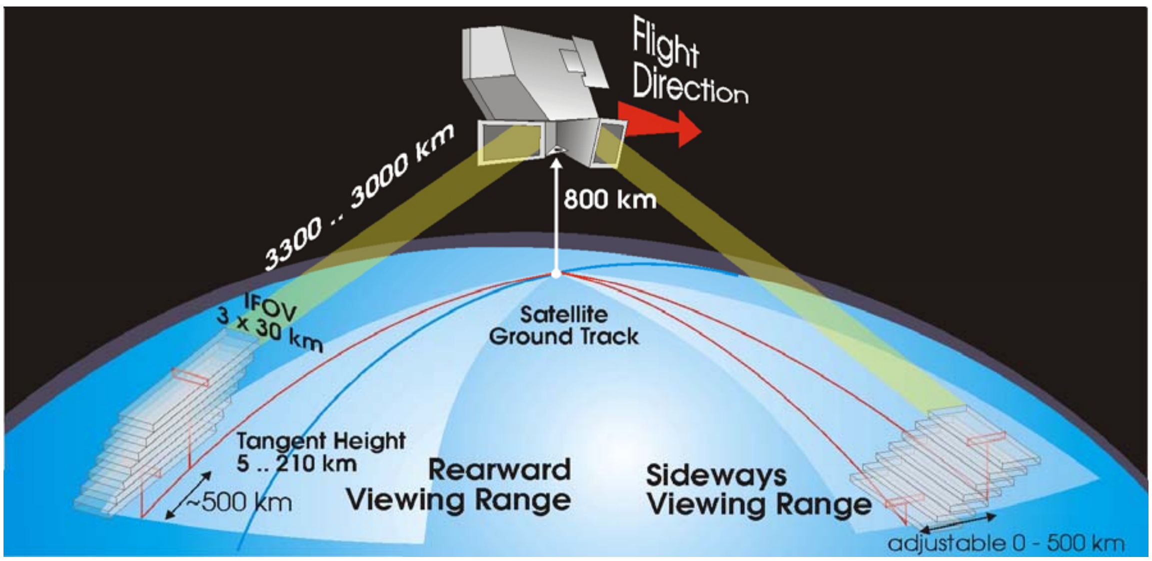
DOCUMENT

ENVISAT MIPAS MONTHLY REPORT: MAY 2006



prepared by/*préparé par*	Fabrizio Niro (mipas@dpqc.org)
checked by/vérifié par	S. Procter (qc@dpqc.org)
reference/*réference*	ENVI-SPPA-EOPG-TN-06-0023
issue/*édition*	1
revision/*révision*	1
date of issue/*date d'édition*	15/06/2006
status/*état*	Final
Document type/*type de document*	Technical Note
Distribution/*distribution*	

.

European Space Agency
Agence spatiale européenne

APPROVAL

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

author *auteur*	Fabrizio Niro (mipas@dpqc.org)	date 13/06/2006 *date*

checked by *vérifié par*	S. Procter (qc@dpqc.org)	date 15/06/2006 *date*

CHANGE LOG

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

CHANGE RECORD

Issue: 1 Revision: 1

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

TABLE OF CONTENTS

1 INTRODUCTION

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

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

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

1.1 Scope

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

1.2 Acronyms and Abbreviations

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

AR	Anomaly Report
CBB	Calibration Black-Body
CTI	Configuration Table Interface
D-PAC	German Processing and Archiving Centre for ENVISAT
DPM	Detailed Processing Model
DPQC	Data Processing and Quality Control
DS	Deep Space
DSD	Data Set Description
ECMWF	European Centre for Medium-Range Weather Forecasts
ESF	Engineering Support Facility
FCA	FPS (Focal Plane Subsystem) Cooler Assembly
FCE	Fringe Count Error
FOCC	Flight Operation Control Centre
FOS	Flight Operations Segment
FR	Full Resolution
HD	Help-Desk
IDU	Interferometer Drive Unit
IECF	Instrument Engineering and Calibration Facilities
IF	In-Flight
IG	Initial Guess
IGM	Interferogram
ILS	Instrument Line Shape
INT	Interferometer
I/O DD	Input/Output Data Definition
IOP	In Orbit Performance
IPF	Instrument Processing Facility
LOS	Line of Sight
MA	Middle Atmosphere
MDS	Measurements Data Set
MIO	MIPAS Optics Module
MIPAS	Michelson Interferometer for Passive Atmospheric Sounding
MPH	Main Product Header
MPS	Mission Planning System
MR	Monthly Report
MW	Micro-Window
NCR	Non-Conformance Report
NESR	Noise Equivalent Spectral Radiance
NOM	Nominal
NRT	Near-Real-Time
OAR	Operational Anomaly report
OFL	Off-Line
OM	Occupation Matrix
PCD	Product Confidence Data
PCF	Product Control Facility
PDS	Payload Data Segment

PFHS	Processing Facility Host Structure
PLSOL	Payload Switch off-line
QC	Quality Control
QWG	Quality Working Group
RGC	Radiometric Gain Calibration
RR	Reduced Resolution
SEM	Special Event Measurement
SPH	Specific Product header
SPR	Software Problem Report
ST	Science Team
UA	Upper Atmosphere
UTLS	Upper Troposphere Lower Stratosphere
VCM	Variance Covariance Matrix
VMR	Volume Mixing Ratio
WCC	Wear Control Cycle
2RR	Double Slide Reduced Resolution

2 THE REPORT

2.1 Summary

- The MIPAS instrument performs really well during May 2006; in fact only 7 slide errors occurred. As already noted in the previous MR the effect of the last Envisat anomaly (6th April 2006) was an overall improvement of the instrument performances, in particular the cooler, this yields also to improved interferometer performances.
- The instrument operated the first two weeks of the month in UTLS-1 mode in support of the INTEX-B campaign (4 orbits per day). Nominal modes were performed during 2 – 4 May and 29 May – 1 June and UTLS-1 modes were acquired during 22 – 25 May. During these measurement segments the instrument was operating 3 days-on followed by 4 days-off.
- The monitoring of the instrument temperatures continued nominally this month; we observe an overall warming of the instrument devices since start of the month by 1 – 2 K, in particular the FCA radiator temperature increase by about 5K and the CBB temperatures by almost 3K (see § 2.3.1). This situation is nominal during this period, which is the hottest part of the year.
- The cooler performance was closely monitored on a daily and monthly basis. The cooler seems to perform really well, even though the compressor vibrations start to increase in the second half of the month, in particular we observed some orbit-dependent spikes that reach the limit of 8 mg at their maxima (see § 2.3.3.1), these are due to the warmer environment conditions typical of this part of the year.
- The gain, spectral and line of sight calibrations were carried out nominally during the reporting period, including the dissemination of the related ADF. The gain weekly increase remains stable around the nominal value of 1%, the spectral correction factor and the mispointing are also stable (see § 2.4.2, § 2.4.3, § 2.4.4).
- 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 help the planning of the future decontamination activity. We can observe that the gain increase looks linear with time after the decontamination induced by the PLSOL of April (see § 2.4.3).
- The level 1 quality monitoring of the OFL products created at D-PAC is on going in parallel with the mission. The check of the considered L1 products has demonstrated an overall good quality of the D-PAC results. Nevertheless a major problem was observed on L1 data from 3 – 23 June 2005 and 29 July – 11 Aug 2005. These data have very poor quality due to a wrong offset calibration. This problem is now resolved with the generation of a new set of ADFs, the reprocessing of this part of mission will be carried out the next days at D-PAC (see § 2.4.6.1).
- A quality control of the entire set of L2 products processed at D-PAC with IPF 4.65 was completed, revealing an overall good quality of the products, nevertheless an anomaly was found for some orbits of 21 – 22 Aug 2004. After the investigation we found that the problem was due to a corruption in the band D spectrum. Indeed the processor flags all the sweep as corrupted even though only one single band is corrupted. This processor

specification which seems really restrictive, in particular for the band D which is not used in the retrieval, should be probably revised in the next QWG (see § 2.5.3.1).

2.2 Instrument and products availability

2.2.1 INSTRUMENT PLANNING

The planning for the MIPAS operations during May 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 set according to the new operational baseline
- According to the implementation of the auto-recovery 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 through 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>
- MIPAS acquisitions in UTLS-1 mode in support of the INTEX-B campaign; 4 orbits per day, both in ascending and descending track over Anchorage-Alaska (5-14 May)
- MIPAS operations in NOM mode in 2 – 4 May, 3-days measurement segment.
- MIPAS in UTLS-1 mode in 22 – 25 May, 3-days measurement segment followed by 4 days of mission interruption
- MIPAS in NOM mode in 29 May – 1 June, 3-days measurement segment followed by 4 days of mission interruption

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

2.2.2 INSTRUMENT AVAILABILITY

During March 2006 MIPAS performance were really satisfactory, indeed only 7 slide anomalies were registered. This improvement was already reported in the last MR and is due most likely to the decontamination induced by the PLSOL (6^{th} April). All the unavailability intervals during March 2006 are reported in the table below.

Table 1 List of MIPAS unavailabilities during March 2006.

Start time		Stop time		Duration	Start Orbit	Stop Orbit	Planned	Comments
Date	UTC	date	UTC	sec				
04-05-2006	17.36.43	04-05-2006	17.40.38	235	21838	21838	No	EN-UNA-2006/0145 MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
04-05-2006	18.20.18	04-05-2006	19.21.14	3656	21839	21839	No	EN-UNA-2006/0146 MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
10-05-2006	21.27.08	10-05-2006	22.14.30	2842	21926	21927	No	EN-UNA-2006/0152 MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
11-05-2006	5.09.05	11-05-2006	5.36.20	1635	21931	21931	No	EN-UNA-2006/0153 MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
11-05-2006	6.58.39	11-05-2006	7.16.56	1097	21932	21932	No	EN-UNA-2006/0156 MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
14-05-2006	18.18.06	14-05-2006	19.06.52	2926	21982	21982	No	EN-UNA-2006/0159 MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
23-05-2006	7.40.09	23-05-2006	8.52.49	4360	22104	22105	No	EN-UNA-2006/0168 MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR

2.2.3 LEVEL 0 PRODUCT AVAILABILITY

The missing intervals (due to PDS unknown failures) for level 0 products (MIP_NL__0P) are reported in the table below. Only Level 0 data coverage is reported, 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.

Table 2 List of missing gaps for MIP_NL__0P during March 2006.

Start Time		Stop time		Duration	Start Orbit	Stop Orbit	Measurement
Date	UTC	date	UTC	sec			
02-MAY-2006	22.15.28	02-MAY-2006	23.55.55	6027	21812	21813	MODE.NOMINAL
03-MAY-2006	2.49.17	03-MAY-2006	6.11.42	12145	21815	21817	MODE.NOMINAL
03-MAY-2006	23.25.36	04-MAY-2006	1.06.03	6027	21827	21828	MODE.NOMINAL
05-MAY-2006	18.00.57	05-MAY-2006	21.08.12	11235	21853	21855	MODE.NOMINAL
06-MAY-2006	4.36.31	06-MAY-2006	6.17.52	6081	21859	21860	MODE.NOMINAL
06-MAY-2006	15.17.44	06-MAY-2006	15.17.59	15	21865	21865	MODE.NOMINAL
06-MAY-2006	21.50.35	06-MAY-2006	22.37.07	2792	21869	21870	MODE.NOMINAL
07-MAY-2006	21.18.58	07-MAY-2006	22.05.30	2792	21883	21884	MODE.NOMINAL
10-MAY-2006	4.11.02	10-MAY-2006	5.52.09	6067	21916	21917	MODE.NOMINAL
10-MAY-2006	21.25.27	10-MAY-2006	21.27.08	101	21926	21926	MODE.NOMINAL
11-MAY-2006	5.36.20	11-MAY-2006	5.36.34	14	21931	21931	MODE.NOMINAL
11-MAY-2006	7.16.56	11-MAY-2006	7.17.10	14	21932	21932	MODE.NOMINAL
11-MAY-2006	20.47.46	11-MAY-2006	22.33.21	6335	21940	21941	MODE.NOMINAL
12-MAY-2006	22.01.40	12-MAY-2006	22.48.37	2817	21955	21956	MODE.NOMINAL
13-MAY-2006	14.58.34	13-MAY-2006	14.58.48	14	21965	21965	MODE.NOMINAL
14-MAY-2006	19.06.52	14-MAY-2006	19.07.07	15	21982	21982	MODE.NOMINAL
20-MAY-2006	9.29.42	20-MAY-2006	9.29.56	14	22062	22062	MODE.NOMINAL
23-MAY-2006	8.52.49	23-MAY-2006	8.53.26	37	22105	22105	MODE.NOMINAL
24-MAY-2006	17.54.48	24-MAY-2006	19.30.32	5744	22125	22126	MODE.NOMINAL

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

2.2.4 LEVEL 0 PRODUCTS STATISTICS

The MIPAS mission is currently planned with a limited duty cycle (around 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 were really good, the instrument availability during the reporting month is indeed 98.13% of the planned measurement time, for a 33% duty cycle. The missing intervals due to PDS unknown failure were especially high (about 8% of the planned time), giving a total L0 availability of about 90%. The MIP_NL__0P products statistics are reported in the following table.

Table 3 MIPAS MIP_NL__0P products statistics during May 2006.

		Time [sec]
Total time over one month	t_{tot}	**2678400**
Time of planned measurements	t_{plan}	**883973**
Time of expected measurements	t_{exp}	**867423**
Time of L0 gaps	t_{L0gaps}	**68286**
Time of instrument unavailability	$t_{unav} = t_{plan} - t_{exp}$	**16550**
%Time of duty cycle	$(t_{plan} / t_{tot})*100$	**33,00**
% Time of Instrument availability	$[1- t_{unav} / t_{plan}]*100$	**98,13**
% Time of L0 availability (PDS failure)	$[(t_{exp} - t_{L0gaps})/t_{exp}]*100$	**92,13**
% Total time of L0 availability (PDS failure + instrument unavailability)	$[(t_{exp} - t_{L0gaps})/t_{plan}]*100$	**90,40**

2.3 Instrument monitoring

2.3.1 THERMAL PERFORMANCE

The following two plots (Fig. 1 and Fig. 2) show the long-term trends of the IDU and MIO base plate temperature (analysis performed at Astrium). The yearly seasonal variations and the interferometer heater switching (see Tab. 4 for the schedule of heater switch-on/off) are clearly visible within the plots.

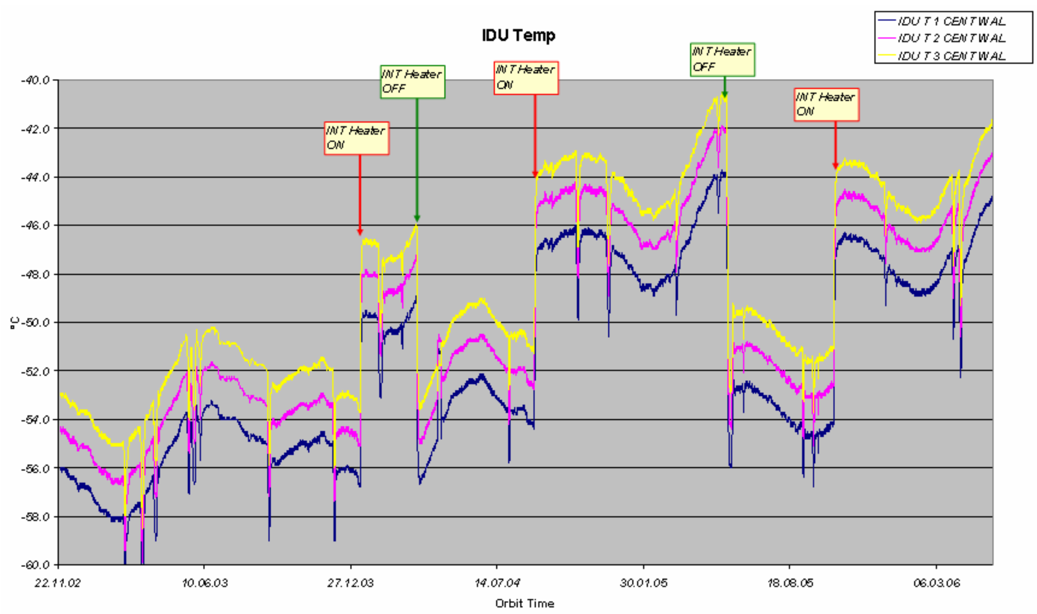


Figure 1 IDU temperatures as a function of time: November 2002 – May 2006 (courtesy of Astrium).

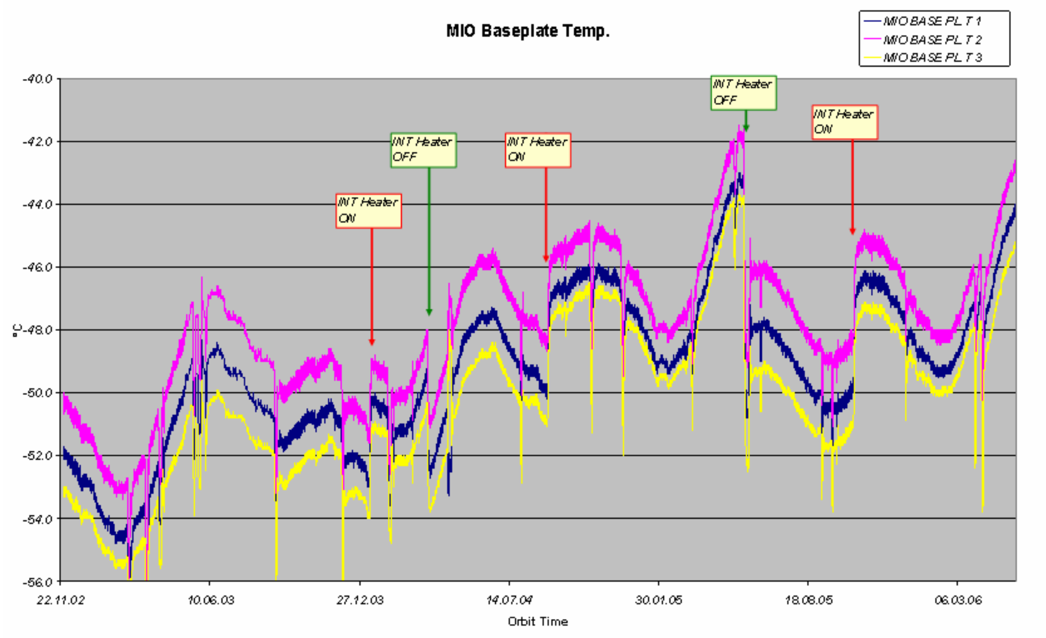


Figure 2 MIO base plate temperatures as a function of time: November 2002 – May 2006 (courtesy of Astrium).

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

Table 4 Schedule of interferometer heater switch-on/off.

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

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.

The monthly monitoring of the instrument temperatures is reported in the following plots, which show the IDU, MIO, CBB and FCA radiator temperatures. We observe an overall increase of all the temperatures, which is particularly evident for the FCA radiator. This is a nominal behaviour for this mission interval which corresponds to the hottest part of the year. The spikes that can be observed in these plots are due to an anomaly in the generation of the housekeeping data that was observed by most of the ENVISAT instruments on 12 May 2006 (orbit 21953) as a result the parameters for this orbit are unrealistically out of range.

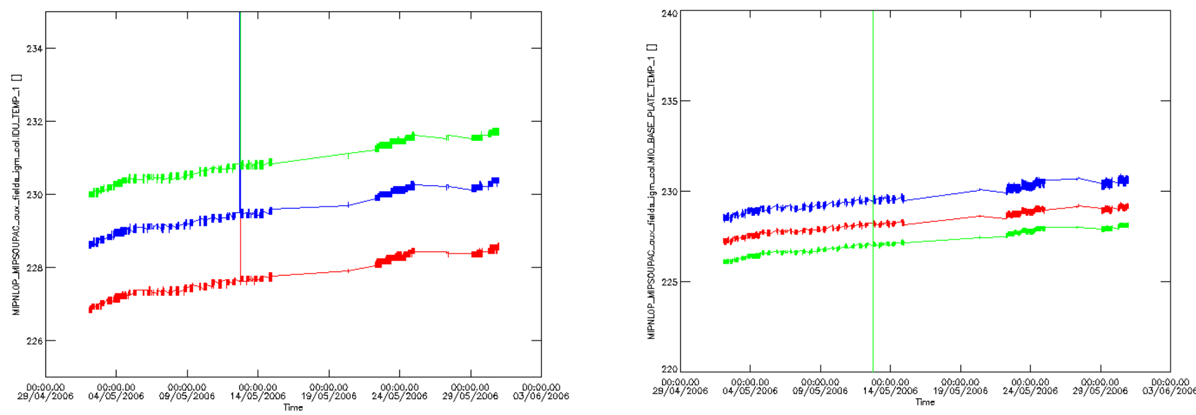


Figure 3 IDU and MIO Base-Plate temperature during reporting period: March 2006.

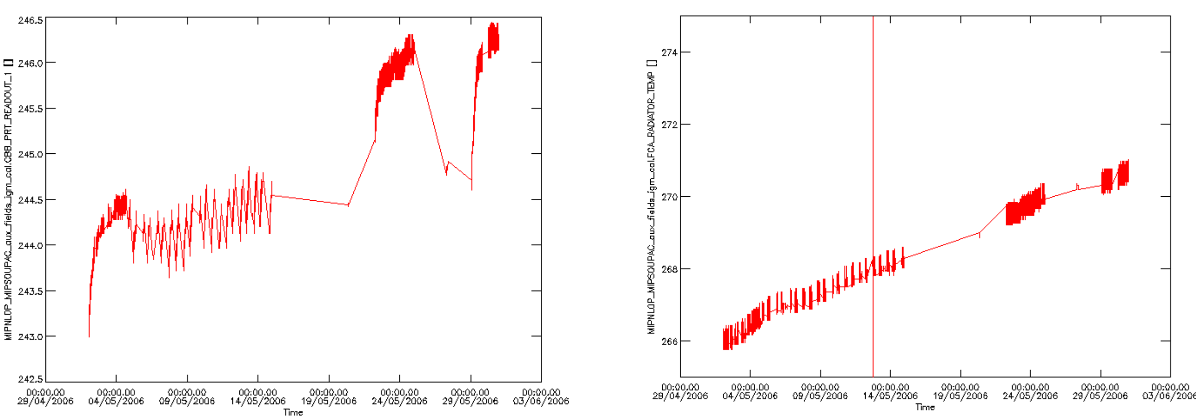


Figure 4 CBB and FCA radiator temperature during reporting period: March 2006.

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. 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. 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. 5– 6 provided by Astrium). Owing to this increasing rate of failure the MIPAS instrument was switched off for the first ten days of March 2006. The performances after this period of intended interruption were improved. Moreover the ENVISAT anomaly of 6th April 2006 yields to an overall improvement of the instrument performances with a decontamination effect and improved cooler performances, this reflect also in a significant improvement of the INT performances with a reduction of slide errors occurrence, as already observed in the April MR.

During the reporting period the situation was really good with a decrease of the velocity error occurrence (see Fig. 5). The improvement in the INT performance is demonstrated also by the decrease of the occurrence of the -4% differential speed error, which came back to a value of about 20% that were observed just after the last decontamination of June 2005 (see Fig.6).

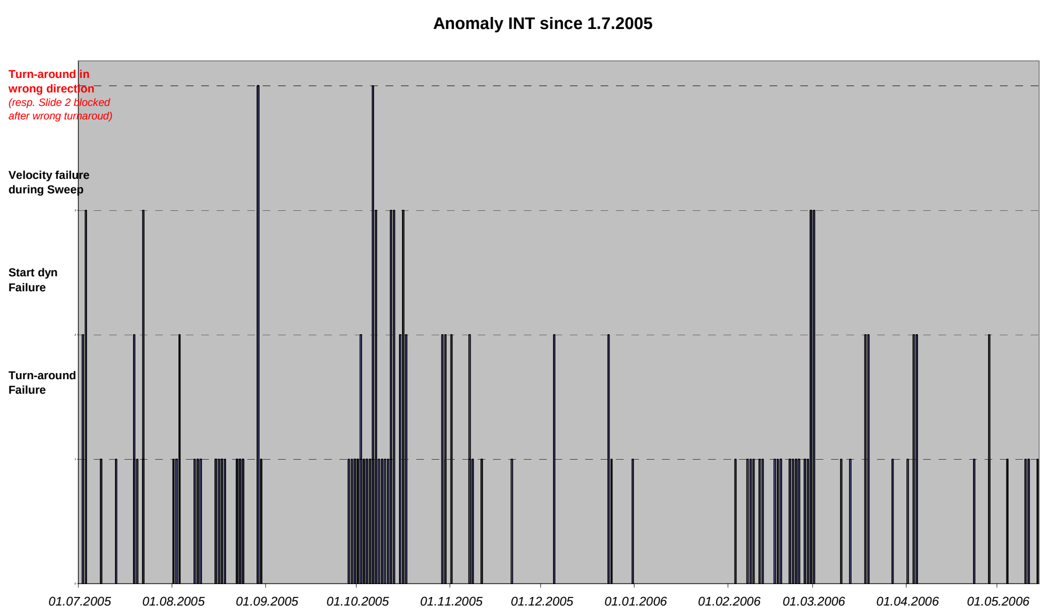


Figure 5 INT anomalies since July 2005 (courtesy of Astrium).

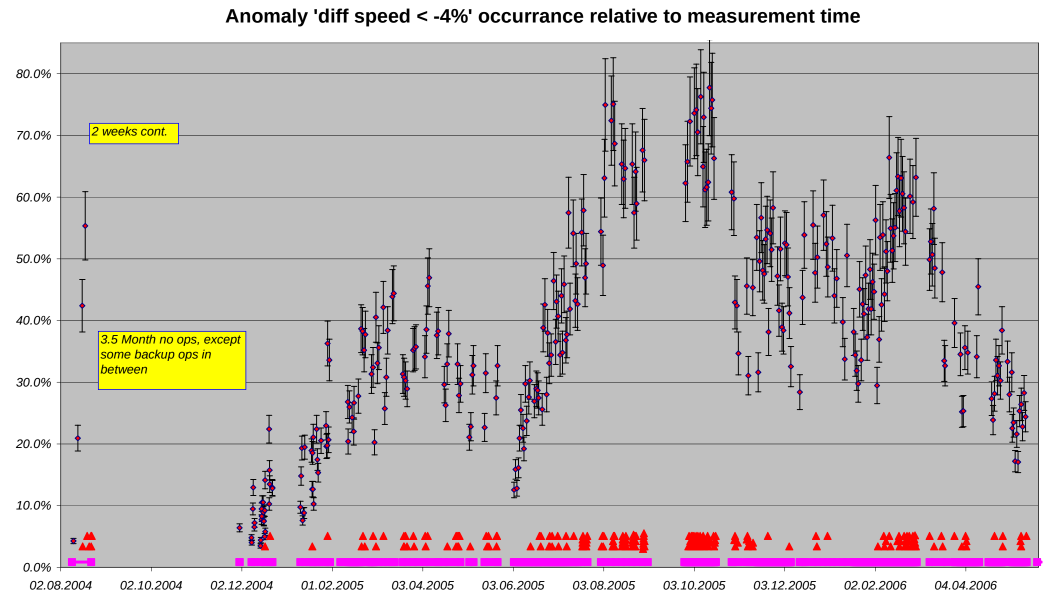


Figure 6 Occurrence of -4% differential speed error since January 2005 (courtesy of Astrium).

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 was 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. 7).
The switch-on of the INT heater during October 2005 determines a slight increase of the compressor vibration, by about 1 mg. After the ENVISAT anomaly of 6th April 2006 with all the payload devices switched off we observed an important improvement in the cooler performances with a reduction of the compressor vibration level of about 1 mg (see Fig. 7).

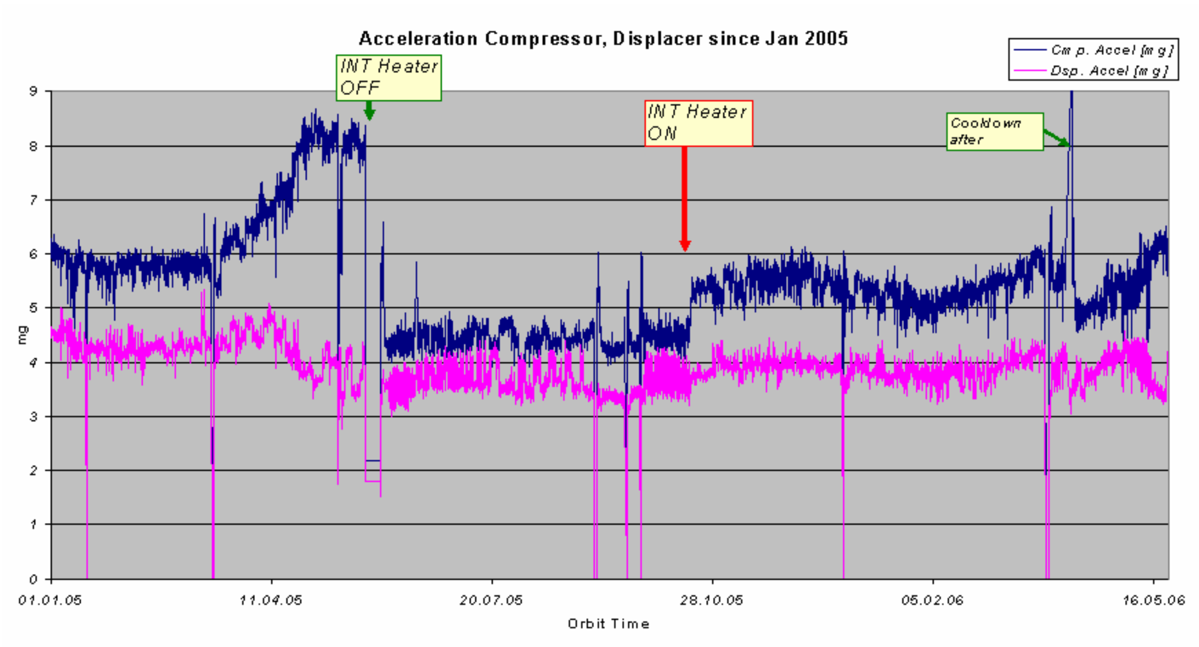


Figure 7 Cooler Displacer and Compressor vibration level, historical trend from 2002 (courtesy of Astrium).

The performances of the cooler during the reporting period (May 2006) were nominal with vibration values below the observation warning level of 8 mg, as can be seen in Fig. 8. Nevertheless the compressor vibrations start to show orbital dependent spikes in the second half of the month, with maxima reaching the 8mg warning level. These spikes, which are highlighted in Fig. 9, were already observed in the past (see November and December 2005 MR) and are due to a variation of environment condition along the orbit (supply voltage and temperature). This situation is expected for this period, which corresponds to the hottest part of the year, it is not critical but should be monitored with care.

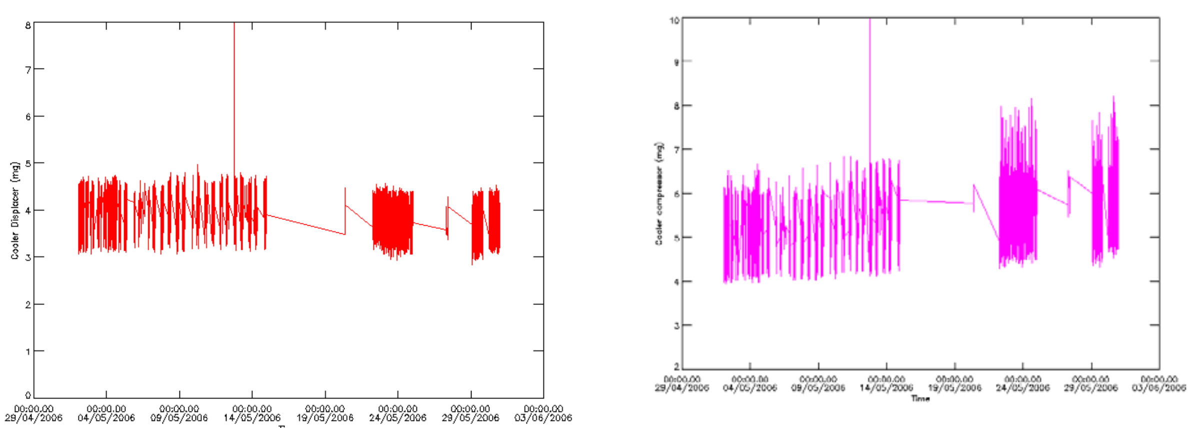


Figure 8 May 2006: Cooler Displacer and Compressor vibration level.

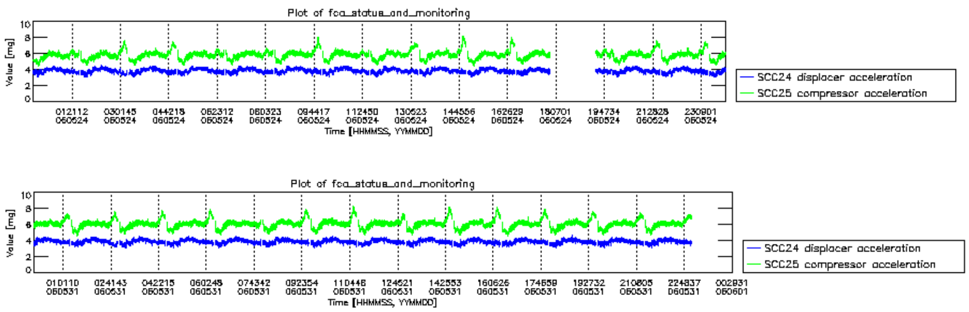


Figure 9 Cooler Displacer and Compressor vibration level observed on 24 and 31 May 2006, to note the orbital dependent pattern of the compressor vibration level with spikes reaching the 8mg warning level.

2.4 Level 1b product quality monitoring

2.4.1 PROCESSOR CONFIGURATION

2.4.1.1 Version

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

Table 5 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-12100-2011**	
4.63	**4I**	**4.1**	**Fixed SPR-12000-2000:** **Fixed SPR-12000-2001**	**Fixed NCR_1278** **Fixed NCR_1308** **Rejected NCR_1310** **Rejected NCR_1317**
4.62	**4H**	**4.0**	**Fixed NCR_1157** **Fixed NCR_1259**	**Fixed NCR_1128** **Fixed NCR_1275** **Fixed NCR_1276**

The figure below 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.

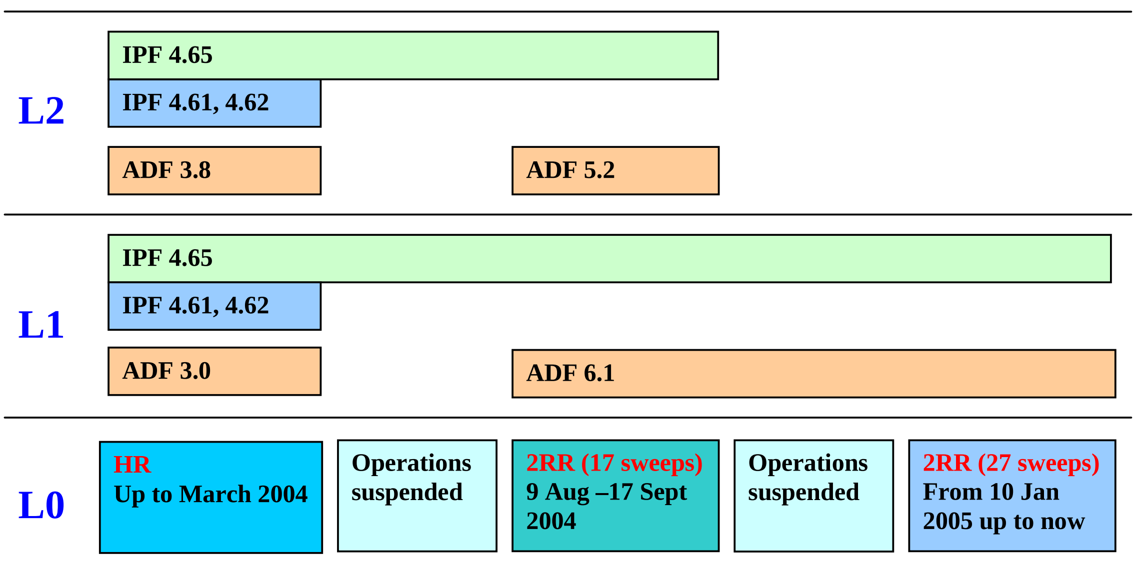


Figure 10 IPF validity and ADFs version for processing level 1 and level 2 products. IPF 4.62 is the last operational one, while the IPF 4.65 will be installed at D-PAC for OFL processing of RR mission.

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

Table 6 Historical updates of MIPAS processor at near real time (NRT) processing sites (PDHS-K and PDHS-E) and off-line processing sites (LRAC and D-PAC).

Centre	Facility Software	Date
D-PAC	V4.65	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 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 May 2006 are listed in the following table.

Table 7 Level 1 ADFs valid in May 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_AXVIEC20060504_151520_20060501_000000_20110501_000000	01-MAY-06	01-MAY-11	Yes

MIP_CG1_AXVIEC20060504_150537_20060501_000000_20110501_000000 MIP_CO1_AXVIEC20060504_150033_20060501_000000_20110501_000000			
MIP_CS1_AXVIEC20060515_151521_20060508_000000_20110508_000000 MIP_CG1_AXVIEC20060515_150532_20060508_000000_20110508_000000 MIP_CO1_AXVIEC20060515_150030_20060508_000000_20110508_000000	08-MAY-06	08-MAY-11	Yes
MIP_CS1_AXVIEC20060525_151519_20060522_000000_20110522_000000 MIP_CG1_AXVIEC20060525_150535_20060522_000000_20110522_000000 MIP_CO1_AXVIEC20060525_150027_20060522_000000_20110522_000000	22-MAY-06	22-MAY-11	Yes
MIP_CS1_AXVIEC20060609_151524_20060529_000000_20110529_000000 MIP_CG1_AXVIEC20060609_150532_20060529_000000_20110529_000000 MIP_CO1_AXVIEC20060609_150031_20060529_000000_20110529_000000	29-MAY-06	29-MAY-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***.

Table 8 Historical deliveries of level 1 ADF by Bomem

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

2.4.2 SPECTRAL PERFORMANCE

The calibration file MIP_CS1_AX contains the spectral correction factor (SCF), which compensates for variations in the instrument metrology (e.g.: aging of the laser). Figure 11 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 almost two years of operations.

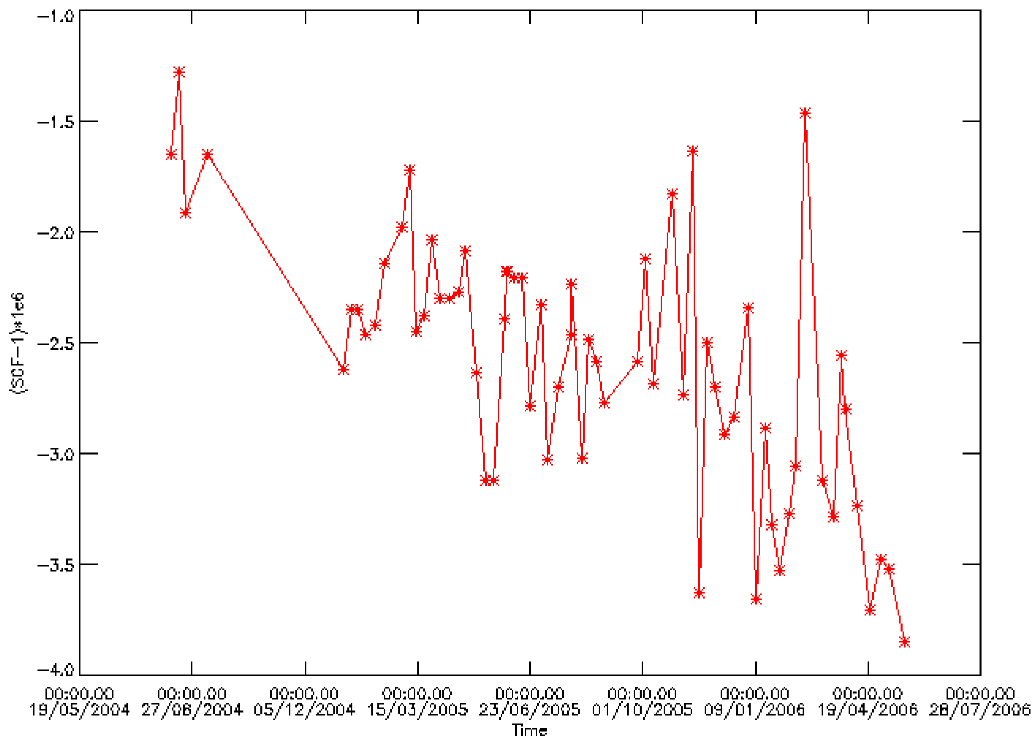


Figure 11 MIPAS Spectral Calibration Factor (SCF) during RR ops updated to end of May 2006.

2.4.3 RADIOMETRIC PERFORMANCE

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

During May 2006 operations, the relative increase of consecutive gain was monitored nominally. Figure 12 show the plots of gain and the gain relative changes for this month. The maximum increase is obtained as the maximum of the curves of weekly gain variation *(abs(w2)-abs(w1))/abs(w1))* in Figure 12. These maxima are reported in Tab. 9; in this table is also reported the long term increase, in this case we used as reference the gain made just after the last decontamination of June 2005. Tab. 9 shows that during the reporting month the nominal weekly increase (1%) was respected. The value of 1.49% observed on 2nd May is due to 4 days of planned interruption, also the 1.91% increase observed on 23rd May is due to 7 days of planned mission interruption (15 – 21 May).

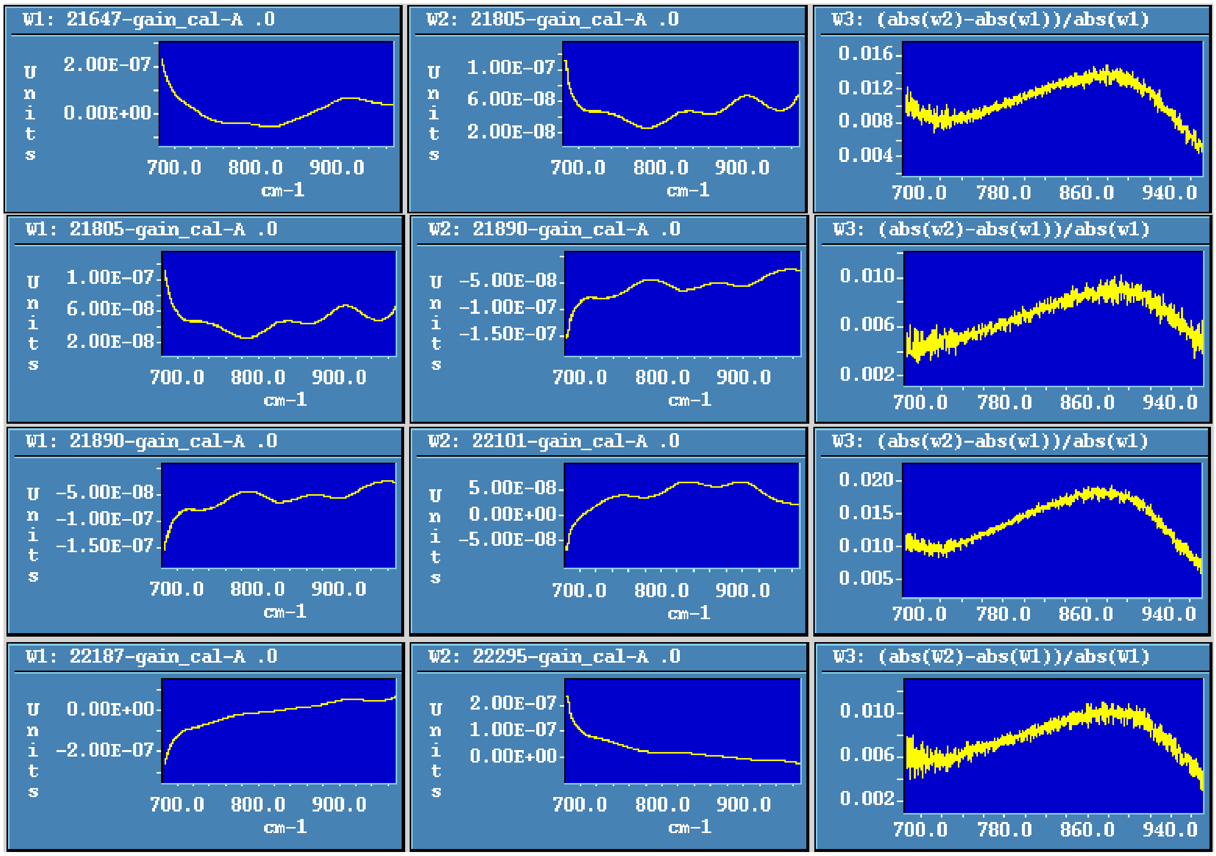


Figure 12 Relative variations of radiometric gain for three disseminated gains (considering only band A) during May 2006 operations. The first two plots in each row are the imaginary part of the gain plotted versus the wave-number, the third plot is the ratio: (abs(w2)-abs(w1))/abs(w1), which gives the 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%).

Table 9 Weekly and long term (since June 2005) gain increase for the four gain orbits of May 2006

Orbit #	Date	Weekly increase (%)	Long term increase (%)
21805	02/05/2006	1,49	8,35
21890	08/05/2006	1,02	8,94
22101	23/05/2006	1,91(*)	10,25
22187	29/05/2006	0,77	11,02

(*) Note that we have about two weeks of difference between the two consecutive gains.

The long term plot of gain changes between two consecutive disseminated gains since January 2005 is shown in Fig. 13. The very high increase of gain during Jan-May 2005 operations can be seen in this figure. After the decontamination (end of May 2005) the gain rate suddenly decreases to nominal value (1%) and it remains stable up to now. The gaps in the plots correspond to long mission interruption. In this case a high variation of the gain is observed, which is not included in the plot.

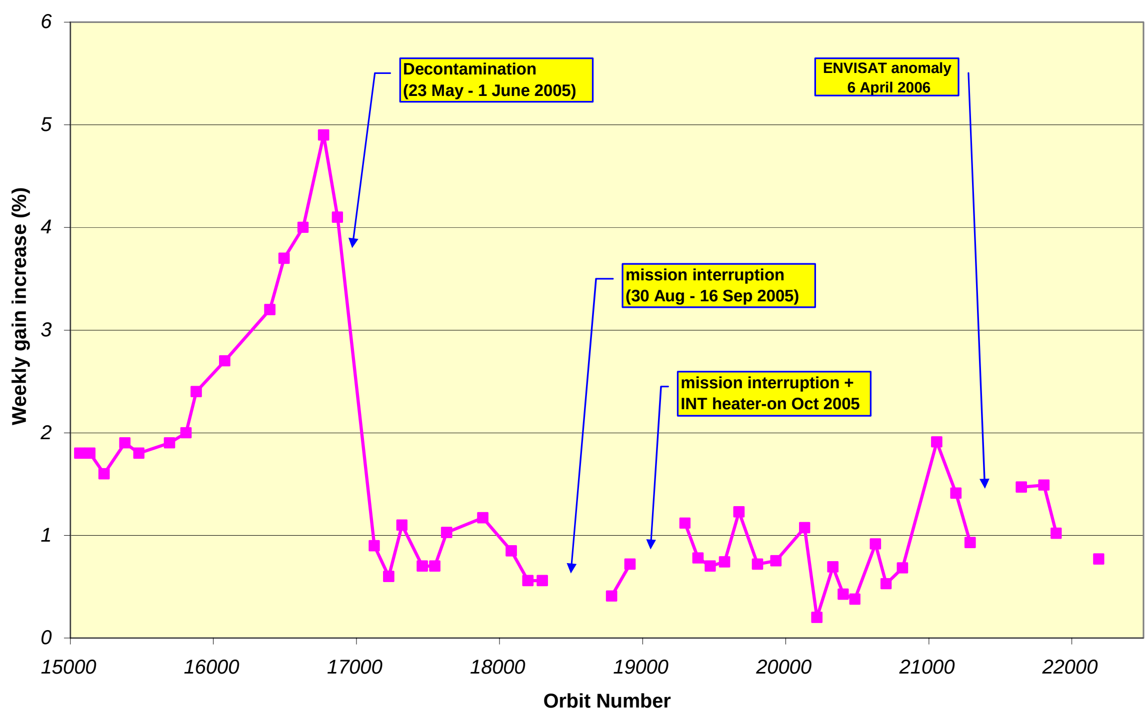


Figure 13 Gain rate on a weekly basis since January 2005 updated to the end of Feb 2006. Note that when there is a mission interruption the weekly increase is re-initialized using as reference the first gain after interruption or INT-heater/cooler switch on.

The long term monitoring of gain increase since June 2005 is presented in Fig. 14. This plot shows the increase of gain taking as reference the first calibration orbit of Jan 2005 for the period Jan – May 2005 and the first orbit of June 2005 (after the decontamination) for the rest of the considered RR mission. This long term investigation is useful in order to plan possible decontamination along the mission. As suggested by M. Birk (DLR) decontamination should be planned when the gain is increasing by more than 20% in order to prevent NESR value to become not acceptable for L2 products retrieval accuracy. We can observe in Fig. 14 the very high increase of gain during the period Jan-May 2005. At the end of May the gain increase reached a value of about 60%, the situation was resolved with the decontamination of June 2005. Since then, the gain has increased with a linear weekly rate with some sudden increase due to the INT heater switch-on of October 2005 or to instrument unavailability. A maximum value of 28% was reached at the beginning of April 2006. At this point the PLSOL causes a sort of passive decontamination, due to a warming up of the detector while the cooler was switched off. As a result the gain increase was dramatically reduced by more than 25%. After this mini-decontamination due to the payload switch-off, the gain increase was perfectly linear demonstrating improved instrument performances, in particular for the cooler.

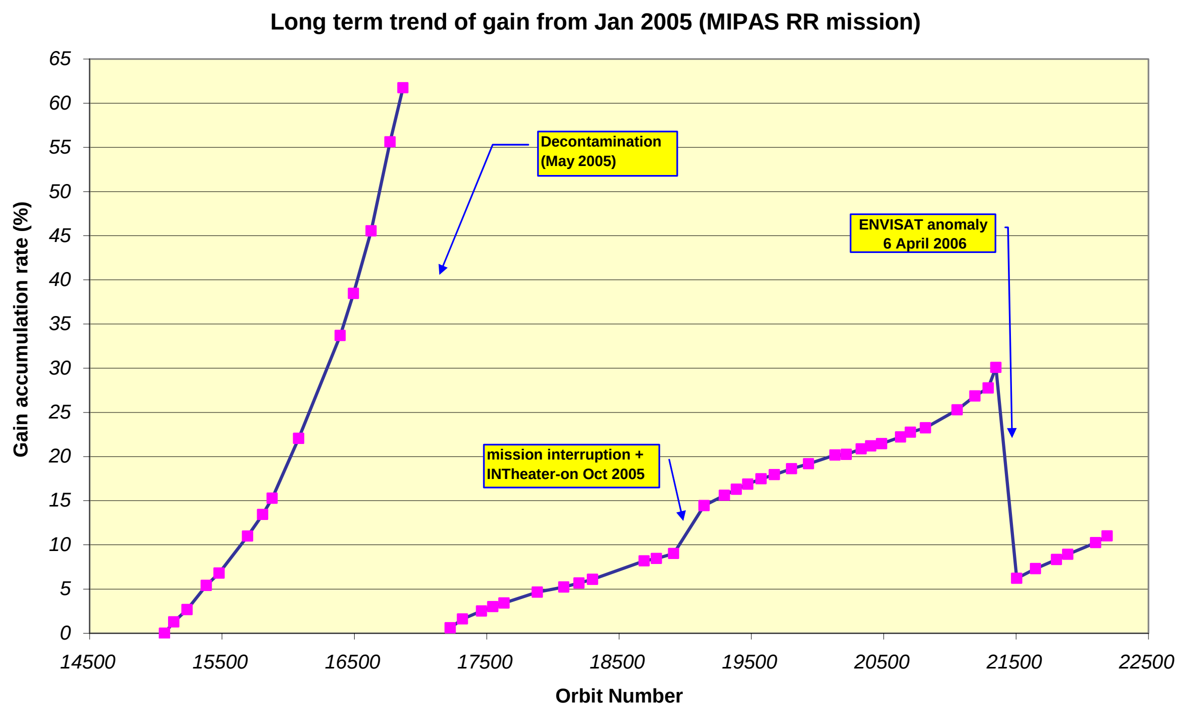


Figure 14 Gain absolute increase since January 2005.

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. The baseline for LOS calibration is now that the absolute bias is compared to the last disseminated one, then the LOS calibration ADF is used only if the difference between the two bias is a higher than 8mg.
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 May 2006 operations, the LOS calibration was performed and the results are reported in the following table and figure. During the last months of operations the relative bias seems to be stable around a value of few mdeg, indeed the last disseminated gain was on March 2005.

Table 10 LOS calibration performed on May 2006.

Date	Orbit #	Relative bias [deg]	Absolute bias [deg]
6-May-2006	**21864**	0,005790	-0,024210
20-May-2006	**22061**	0,007200	-0,022800

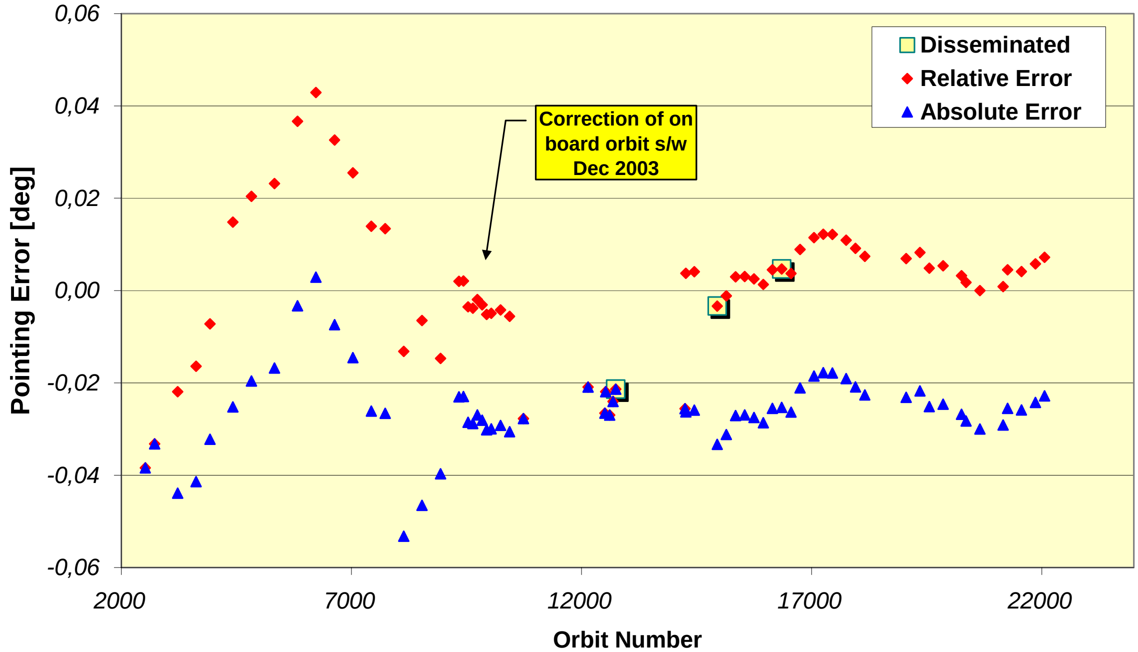


Figure 15 MIPAS long-term pointing error as a function of the orbit: September 2002- May 2006.

As can be seen in Fig. 16, there are points where the relative and absolute errors coincide because the angle for LOS measurements has been commanded to 0 mdeg. Tab. 13 shows the history of the commanded angle for LOS measurements.

Table 11 LOS commanded angle updates.

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

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

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. The figure below 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.

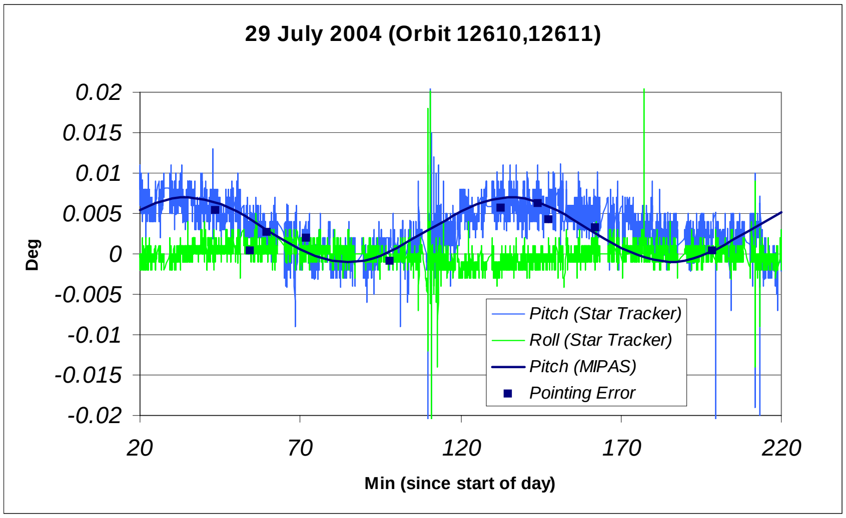


Figure 16 Comparison between MIPAS pointing and star tracker information.

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

AE ascending

#19925 **MIP_NL_1P_19925**

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

AE descending

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

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

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. 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.

Table 12 L1 OFL processing status.

Period	Status
Aug – Sept 2004	Completed
2005 data	Completed
2006 data	2006-02-01 → 2006-04-24

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.

Table 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 in the MPH for MIPAS L0 products	/	/	2165 → 342	/	Closed and merged with OAR 342 (RA-2)
Non-valid band A at the same geo-location	/	/	2263	/	Closed → OAR inserted on AMT
Wrong MIPAS L1 product in D-PAC server	/	/	2303	/	Closed and merged with OAR-2009, OAR-1845
MIPAS Aircraft Emission retrieved tangent altitude	/	/	/	/	Ongoing
Corrupted L1 b spectra during 3 – 23 June and 29 July – 11 Aug 2005	/	/	/	/	Open

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).

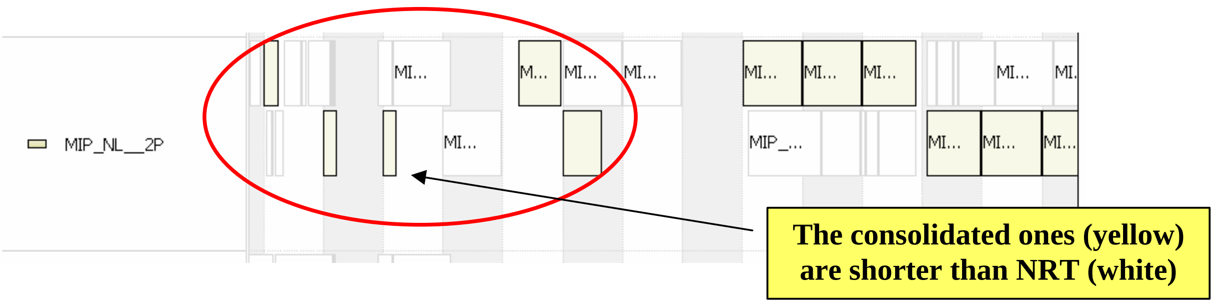


Figure 17 GANNT chart showing the anomaly in the consolidation of L2 "O" products.

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

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 as can be observed in the following figure.

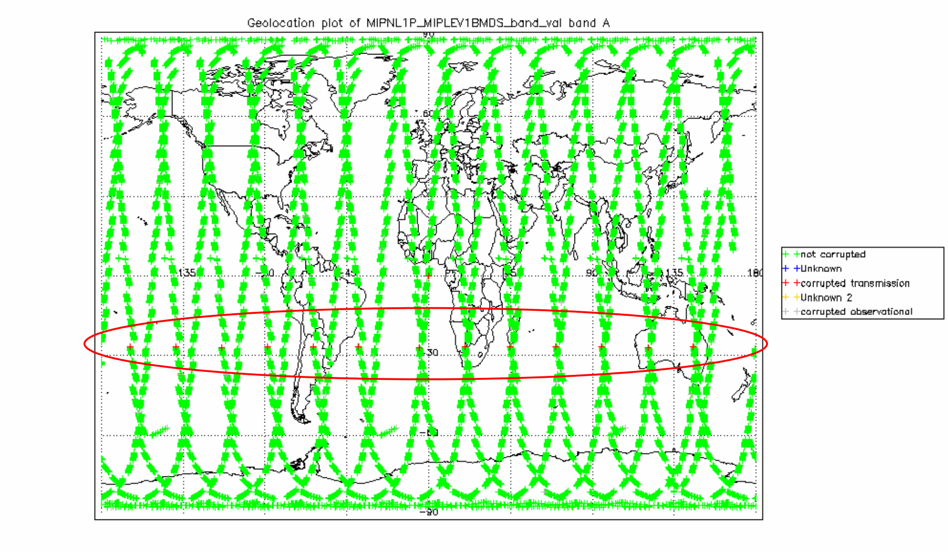


Figure 18 Corrupted sweeps are observed always at the same geo-location for these OFL L2 products of 10 March 2004 processed at D-PAC.

The investigation of the anomaly is now closed, since the reason of the problem has been recognized as an implementation error in the IPF, indeed the error is not obtained with the prototype.
The problem is the following: the IPF (version 4.61 up to 4.65) generates L1b products with wrong "NUM_DSR" value in the MPH; in particular this value is one unit higher than the "TOT_SCAN" value, while the two should be the same. As a result the Quadas tool recognize as corrupted the last scan of each orbit because the corresponding DSR is empty. For consolidated product this gives the same corruption at the same latitude for all the orbits (as observed in the figure above).
This problem will be corrected by DJO in the next processor delivery (IPF 4.66).

2.4.7.5 Wrong MIPAS L1 product in D-PAC server

One L1 product in D-PAC ftp server is corrupted (see red crosses in Fig. 22), the product was generated using one outdated ADF. The product name is:
MIP_NL__1PPDPA20051002_233211_000060362041_00188_18779_0667.N1
The IPF used the following outadated ADF:
MIP_CO1_AXVIEC20050705_134752_20050703_044401_20100703_044401
instead of the correct ADF:
MIP_CO1_AXVIEC20051003_180613_20050926_000000_20100926_000000
The other L1 ADFs of this day were correctly selected by the IPF. To be understood why the IPF used this ADF and why the problem occurred only for this product and only with the MIP_CO1_AX aux file.
The investigation by Task 4 shows that the source of the problem is a wrong auxiliary file selection by PFHS; the problem seems to be the same than the one described in OARs 2009 and 1845. The wrong MIPAS product has been removed and reprocessed at D-PAC, the new filename is:
MIP_NL__1PPDPA20051002_233211_000060362041_00188_18779_1478.N1

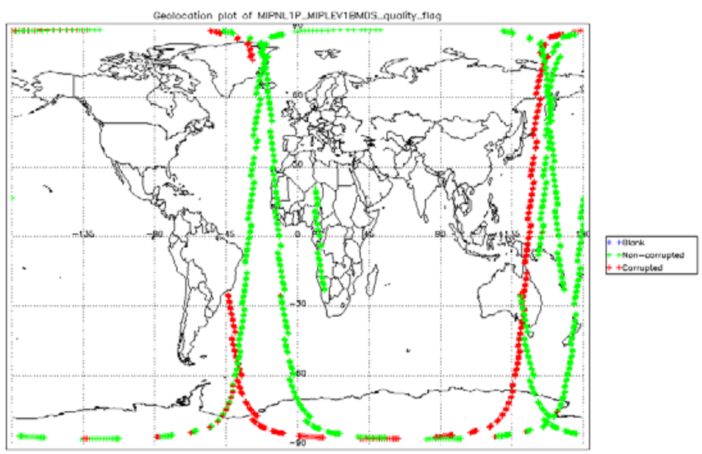


Figure 19 L1b PCD quality flag, corrupted sweep detected for 3 Oct 2005 L1b spectra

2.4.7.6 Badly calibrated L1b data during 3 – 23 June 2005

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

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

M. Hopfner (IMK) detects this problem by carrying out a systematic calculation of the clouds top heights for all the L1b spectra processed at D-PAC. The cloudy sweeps were detected using the colour index, calculated as the ratio of the integrated radiance in two specific MWs of the band A. We can see the excessive cloud top height value found on 23 June 2005 (see Fig. 20). The problem was also detected with the quality monitoring tool in ESRIN; in fact looking at the NESR level of

23 June 2005 we can see excessively high value (see red lines in Fig. 21). The two plots highlights the same anomaly in the spectra, indeed by the end of the day, when the cloud top height stops to be unrealistically high also the NESR comes back to nominal level, this is exactly the time when the correct ADF starts to be used by the processor. The problem is therefore due to a wrong calibration ADF. The first step of the investigation was to remove all the affected products from the D-PAC ftp server.

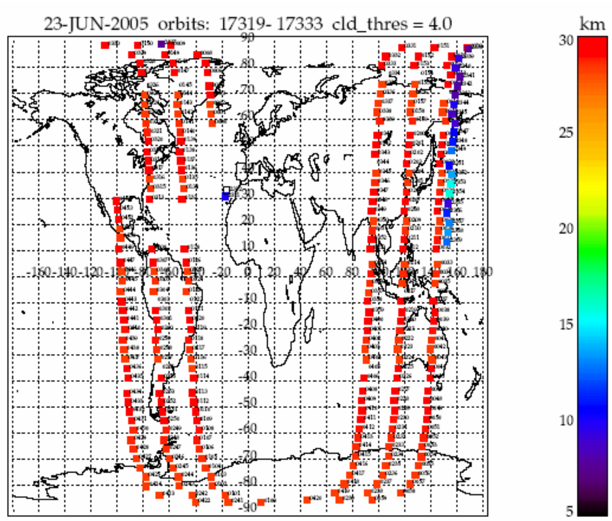


Figure 20 Cloud top height calculated by M. Hopfner (IMK) for 23 June 2005, the red points are due probably to a corruption in the band A spectrum.

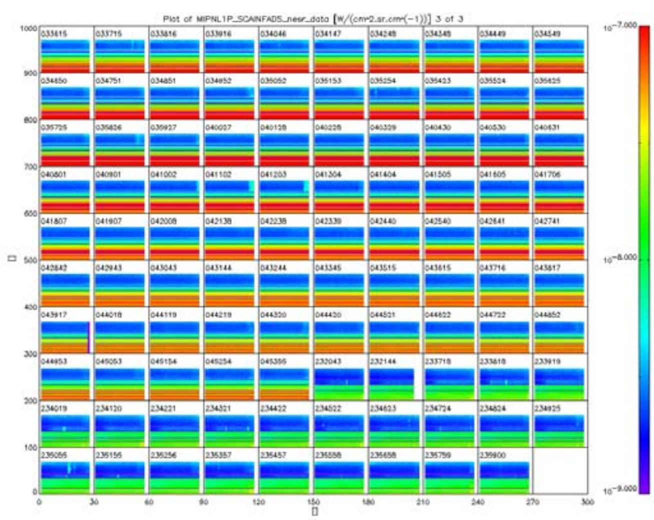


Figure 21 NESR level for different scan during 23 June 2005, each square is a scan made of 27 sweeps in nominal mode, the red lines show the anomaly of excessive high NESR, the anomaly stops when the correct ADF start to be used by the processor.

The ADFs suspected were identified (the complete list is provided in the Tab. 14) and removed from all the processing centers. A first quality check (for format and scientific issue) of these ADFs didn't show any manifest anomaly; furthermore the gain calibration looks nominal, as resulted from comparison to other gain measurements of the same mission period. In order to better understand the problem we re-generate these ADFs from the same gain measurement orbit (the list of new ADFs is reported in Tab. 15). The only difference between these two sets of aux files is that the old ADFs were created from L0 NRT data, while the new ones are obtained from consolidated L0 products.
Comparing the two sets of ADFs we observed an anomaly in the off-set calibration data set (MIPAS OFFSET VECTOR field in the MIP_CO1_AX ADF). The interferogram (IGM) recorded during the deep-space scene is compared for the old and the new ADF in the following Fig 22, 23. The IGM of the old ADFs looks really different, the maximum being much less pronounced with respect to the new offset calibration ADF.

Table 14 List of wrong ADFs used by the OFL processor, which causes the anomaly of badly calibrated L1 data.

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

Table 15 List of new ADFs generated for repairing the anomaly.

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

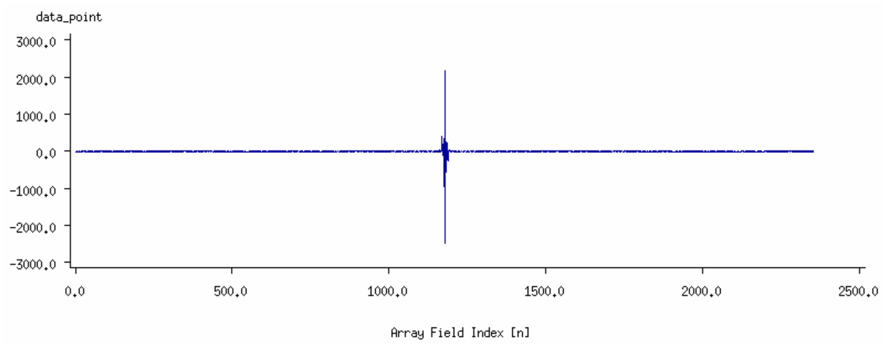


Figure 22 IGM recorded in the deep space measurement and stored in the wrong ADF.

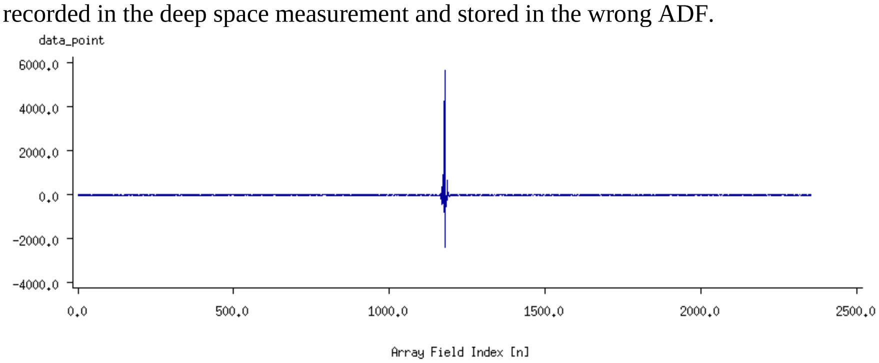


Figure 23 IGM recorded in the deep space measurement and stored in the new correct ADF.

The problem appears to be due to the offset calibration auxiliary file (MIP_CO1_AX). As a second step we generate two L1 prototype products from the same level 0, using respectively the old and the new set of ADFs. The comparison of the two resulting level 1 products is presented in the following figures (Figs. 24 – 25). The comparison of the calibrated spectra shows that the use of the old MIP_CO1_AX file introduces a strange offset in the spectra, while the new set of ADFs allows a correct calibration of the measurements.

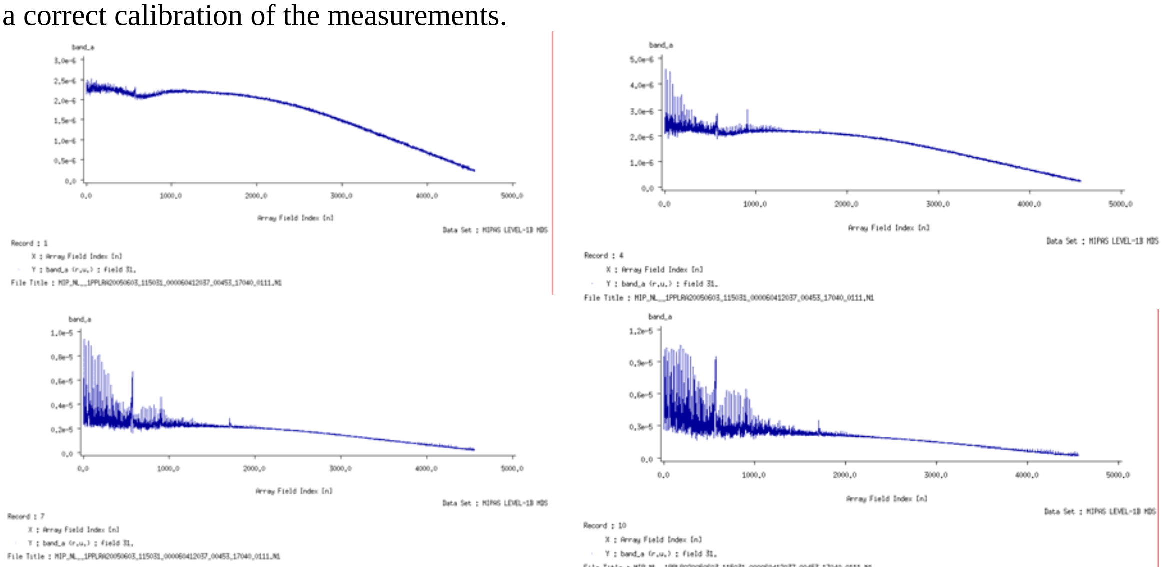


Figure 24 Example of badly calibrated spectra obtained with the old ADFs.

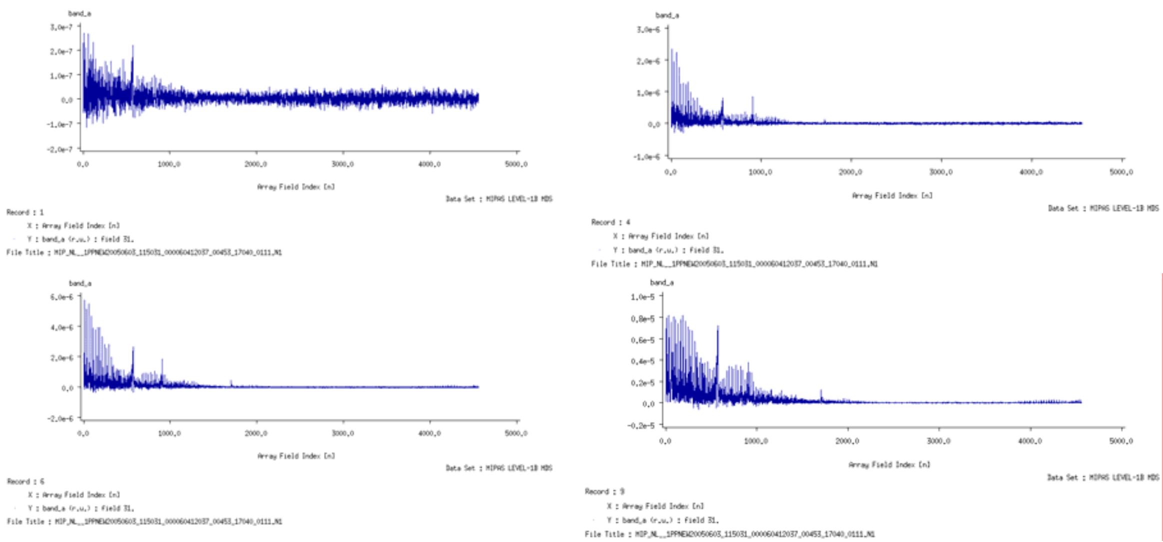


Figure 25 Example of correctly calibrated spectra obtained with the new ADFs.

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

The final step of the investigation consisted in trying to understand why the calibration algorithm (mical) generates such strange MIP_CO1_AX file. The problem is still not fully understood, it is probably related to an anomaly in the NRT L0 products, this problem was observed during June – Aug 2005. The anomaly was that the gain measurement was separated in two L0 NRT products owing to the Kiruna dump, as a consequence the calibration algorithm do not use the whole calibration data for the ADF generation, but only a part of it. This may have caused this problem, nevertheless further investigations are needed.

The anomaly is going to be closed soon, since the new ADFs were generated and tested with the prototype showing correct results, the D-PAC centre will reprocess these data in the next days, full reprocessing of this mission interval will be very quick (about one day).

2.4.7.7 MIPAS Aircraft Emission Measuremens

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.

Table 16. 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	9-AUG-04	Correction of a bug in the previous L2 ADF v5.1 MIP_IG2_AX, MIP_SP2_AX

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		
ADFs V5.1 MIP_CS2_AXVIEC20050722_082136_20040809_000000_20040917_220643 MIP_IG2_AXVIEC20050721_130007_20040809_000000_20040901_000000 MIP_IG2_AXVIEC20050721_134702_20040901_000000_20040917_220643 MIP_MW2_AXVIEC20050721_144629_20040809_000000_20040917_220643 MIP_OM2_AXVIEC20050721_143058_20040809_000000_20040917_220643 MIP_PI2_AXVIEC20050721_142545_20040809_000000_20040917_220643 MIP_PS2_AXVIEC20050721_141630_20040809_000000_20040917_220643 MIP_SP2_AXVIEC20050721_140636_20040809_000000_20040917_220643	9-AUG-04	For processing RR measurement with fixed altitude and old vertical sampling
ADFs V3.8 NRT MIP_PS2_AXVIEC20040421_095623_20040326_143428_20090326_000000 Off-line MIP_PS2_AXVIEC20040421_095923_20040326_143428_20090326_000000	26-MAR-04	With respect to V3.7, adjusted the threshold to the new noise level.
ADFs V3.7: NRT MIP_MW2_AXVIEC20031021_145505_20020706_060000_20080706_060000 MIP_OM2_AXVIEC20040302_110723_20020706_000000_20080706_000000 MIP_PS2_AXVIEC20040302_110923_20040109_000000_20090209_000000 MIP_PI2_AXVIEC20031021_145745_20020706_060000_20080706_060000 MIP_CS2_AXVIEC20031021_145337_20020706_060000_20080706_060000 MIP_SP2_AXVIEC20031021_150016_20020706_060000_20080706_060000 Off-line MIP_MW2_AXVIEC20031027_100858_20020706_060000_20080706_060000 MIP_OM2_AXVIEC20040302_110823_20020706_000000_20080706_000000 MIP_PS2_AXVIEC20040302_111023_20040109_000000_20090209_000000 MIP_PI2_AXVIEC20031027_101146_20020706_060000_20080706_060000 MIP_CS2_AXVIEC20031027_100559_20020706_060000_20080706_060000 MIP_SP2_AXVIEC20031027_101441_20020706_060000_20080706_060000	06-JUL-02 and 09-JAN-04	With respect to V3.6: Eliminated scans with one or two altitude levels; adjusted the threshold to the new noise level.
MIP_IG2_AXVIEC20040227_081527_20040301_000000_20090301_000000	01-MAR-04	Seasonal update of climatological initial guess.
MIP_IG2_AXVIEC20031118_151533_20031201_000000_20081201_000000	01-DEC-03	Seasonal update of climatological initial guess.
ADFs V3.6: NRT MIP_MW2_AXVIEC20031021_145505_20020706_060000_20080706_060000 MIP_OM2_AXVIEC20031021_145630_20020706_060000_20080706_060000 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 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.

Table 17 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.

2.5.2.1 Quality Control of reprocessed L2 data

A quality control of these products was completed, showing an overall good quality of the level 2 data; see Figs. 26 – 32 for summary results. In fact the number of successful retrieval is generally around the nominal value of 7 (purple in the plot) which corresponds to the number of ESA L2 products. In some case the number of successful retrieval is equal to 1; this means that the sequential ESA L2 processor stops just after the p-T retrieval, at the time of H2O inversion. This behaviour is not surprising; indeed the H2O retrieval is very difficult due to the particular shape of the H2O profiles (very high in the troposphere with a sharp decrease in the stratosphere). Most of the failed H2O retrievals are located around the Equator, where the H2O concentration in the troposphere is very high and the tropopause altitude suddenly increases.
Only one major problem was found in the L2 RR data processed with IPF 4.65 for some orbits recorded during 21 – 22 Aug 2004 (see Fig. 31). The investigation of this problem shows that a

corruption in the band D was verified for these orbits. As reported by Astrium the processor flags as corrupted one sweep even though only one band is corrupted. This processor specification seems excessively restrictive and a discussion should be addressed at the next QWG to understand if it can be modified, in particular in this case when the only the band D is corrupted, even though this band is not used in the retrieval.

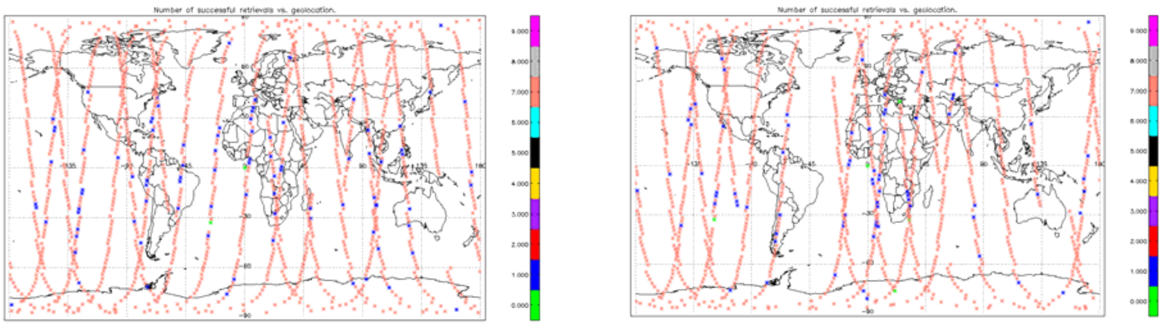


Figure 26 Number of successful retrieval as a function of geo-location for 10 and 11 Aug 2004. Note that 7 is the nominal value (purple in the plot), corresponding to the standard ESA products (pT+h2o+o3+n2o+no2+ch4+hno3).

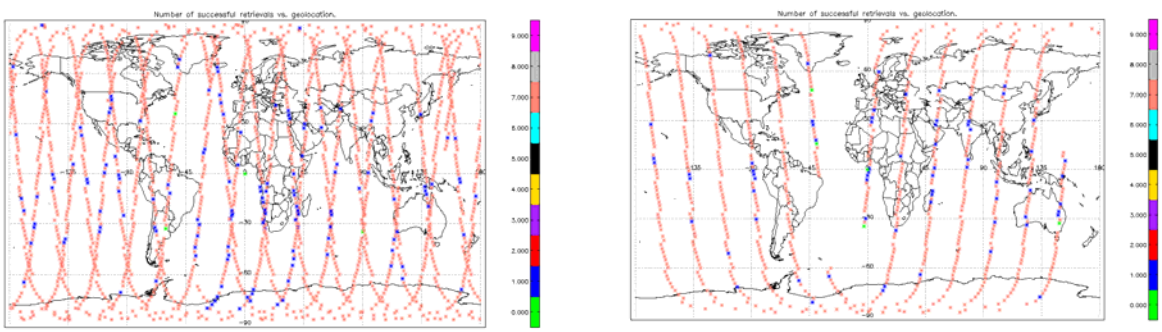


Figure 27 Same as Fig. 26 for 12 and 13 Aug 2004.

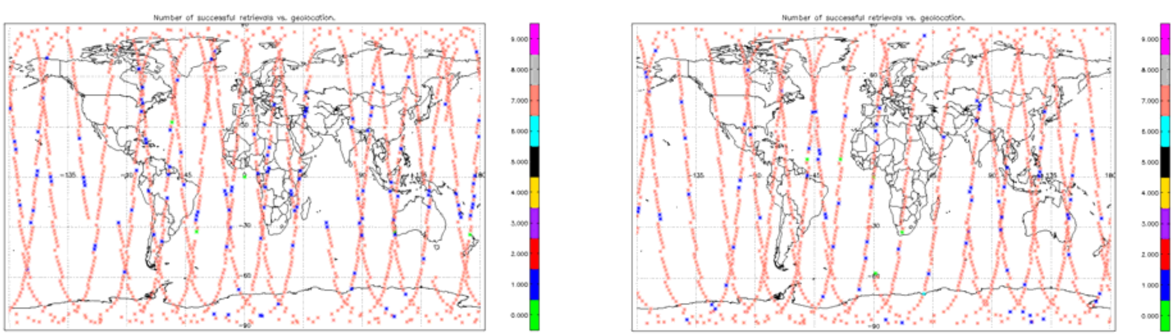


Figure 28 Same as Fig. 26 for 15 and 16 Aug 2004.

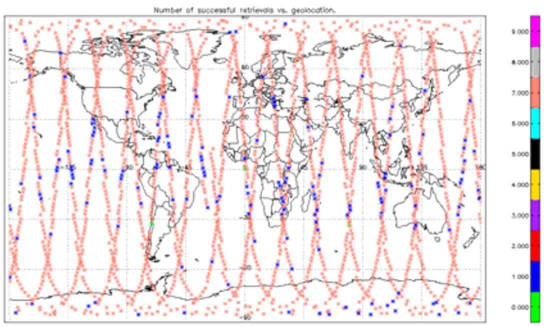


Figure 29 Same as Fig. 26 for 17 and 18 Aug 2004.

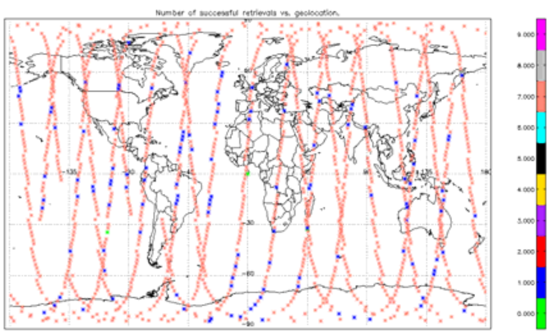


Figure 30 Same as Fig. 26 for 19 and 20 Aug 2004.

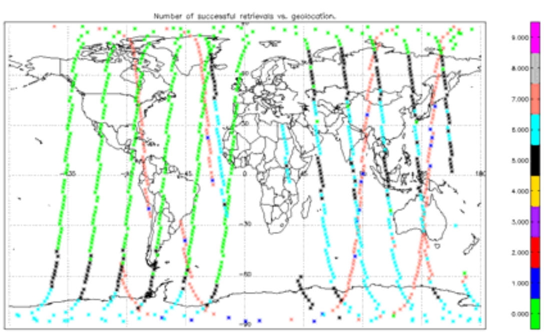


Figure 31 Same as Fig. 26 for 21 and 22 Aug 2004, anomalous behavior: many retrievals failed.

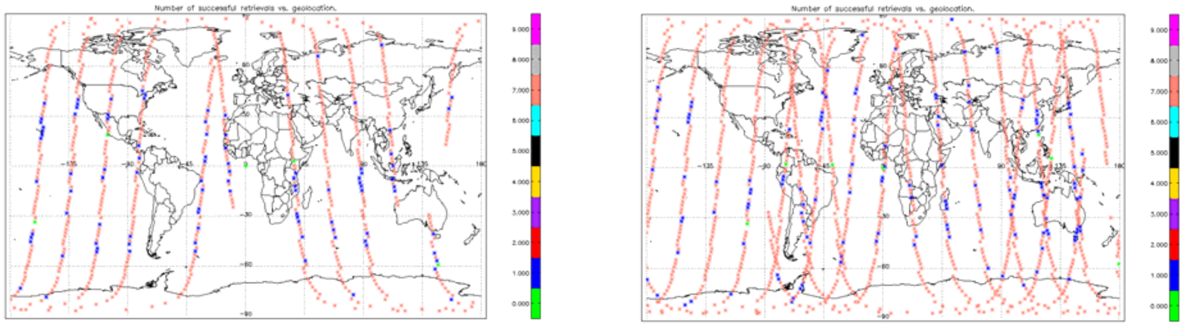


Figure 32 Same as Fig. 26 for 16 and 17 Sept 2004.

2.5.3 LEVEL 2 ANOMALY STATUS

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

Table 18 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

2.5.3.1 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.

2.5.3.2 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.

2.5.3.3 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.

2.5.3.4 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).

2.5.3.5 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.

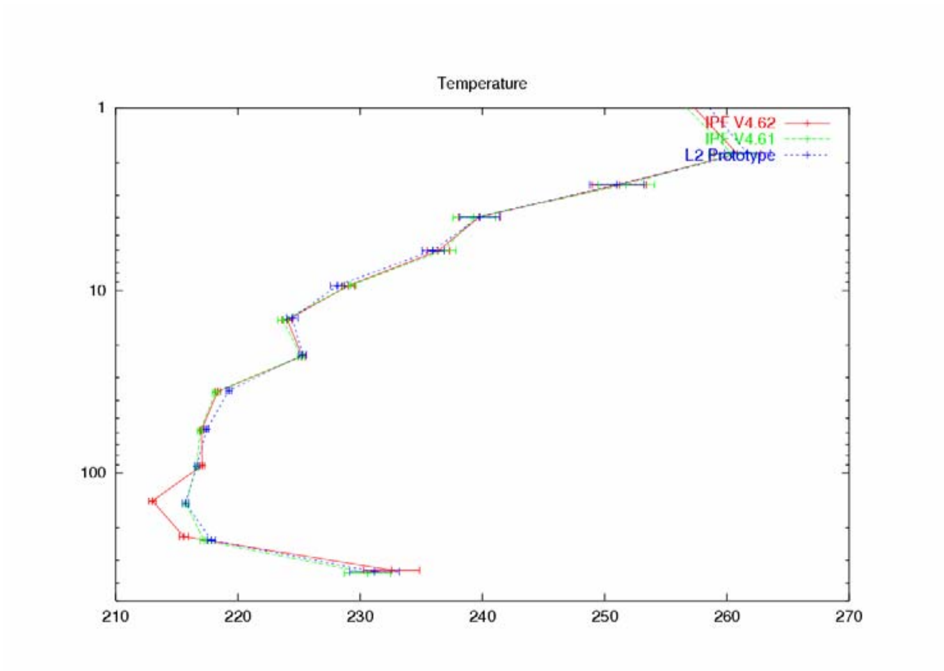


Figure 33 Temperature profiles as a function of pressure retrieved with IPF 4.62 and 4.61 compared to the prototype for seq. 16 of orbit 2975. The 4.61 profile is the reference, validated by a IMK balloon flight.

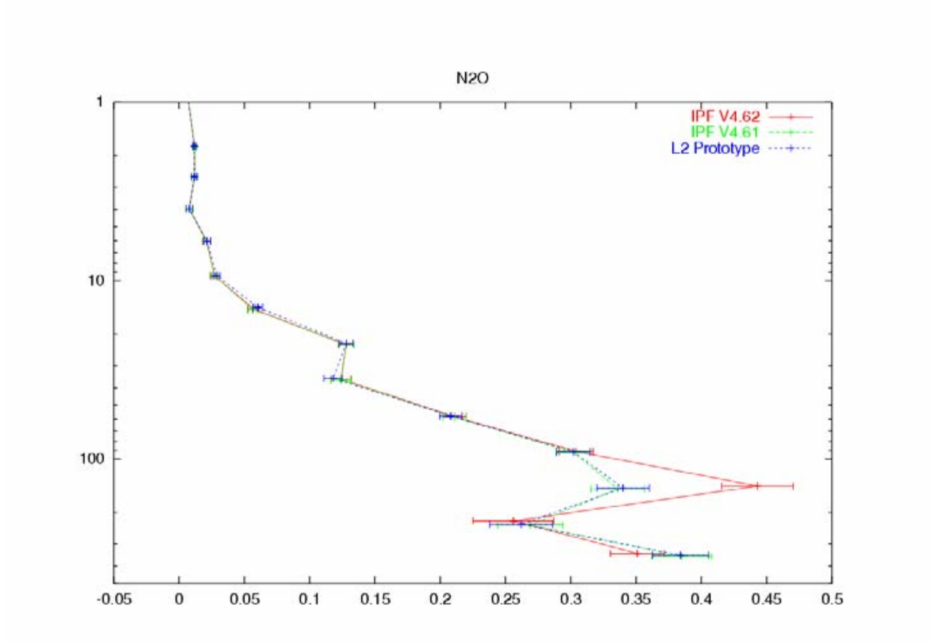


Figure 34 N2O profiles 8ppmV) as a function of pressure retrieved with IPF 4.62 and 4.61 compared to the prototype for seq. 16 of orbit 2975. The 4.61 profile is the reference, validated by a IMK balloon flight.

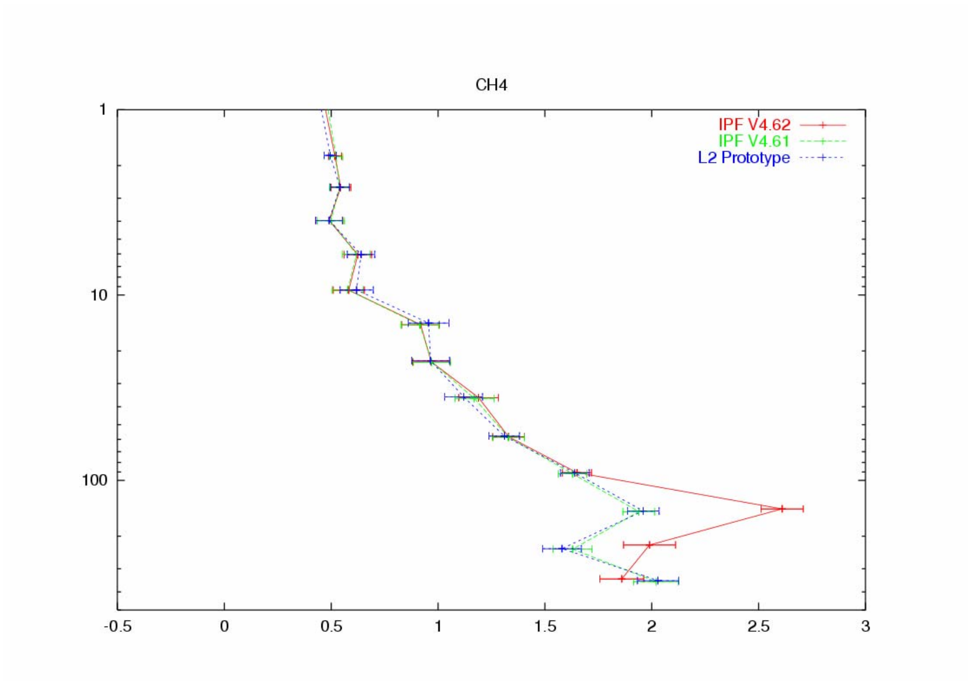


Figure 35 CH4 profiles 8ppmV) as a function of pressure retrieved with IPF 4.62 and 4.61 compared to the prototype for seq. 16 of orbit 2975. The 4.61 profile is the reference, validated by a IMK balloon flight.

2.5.3.6 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).

2.5.3.7 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).

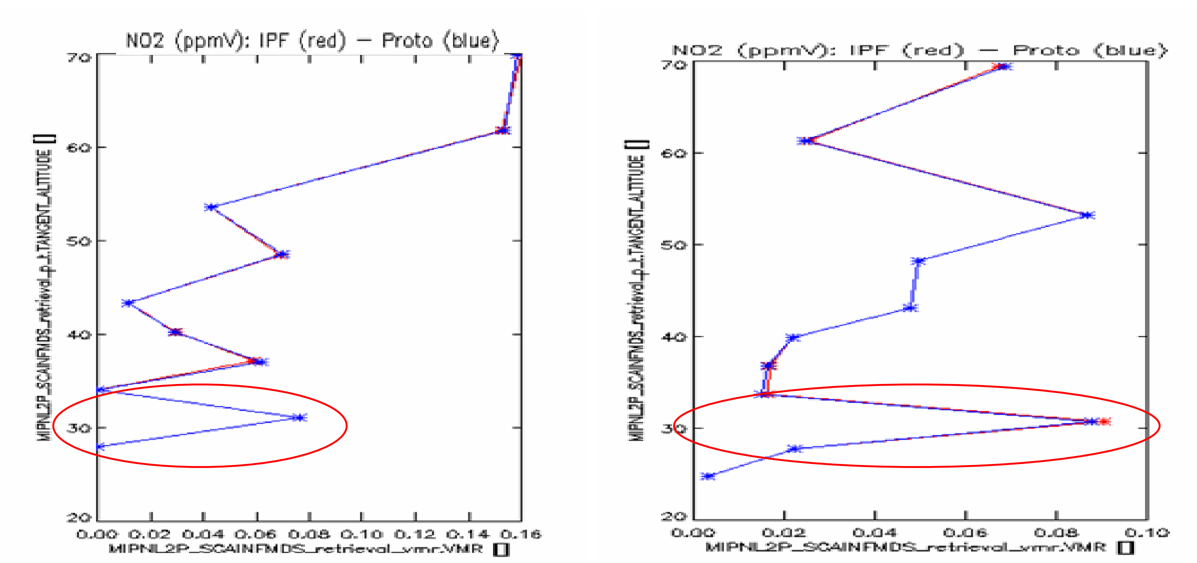


Figure 36 NO2 profiles obtained with the IPF and prototype for two particular scan of 6 June 2003 in Antarctic winter condition, highlighted in red are the region around 30 km with sudden increase of NO2 value, which has no physical meaning. Note the degraded profile shape, namely the zigzag and the 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 May 2006 planning activities.

AVI_UAV_TLVFOS20060404_110748_00000000_00000590_20060504_234355_20060505_043543.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000591_20060505_094731_20060505_180031.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000592_20060505_231218_20060506_040406.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000593_20060506_091554_20060506_115705.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000594_20060506_152218_20060506_172854.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000595_20060506_224041_20060507_033229.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000596_20060507_084417_20060507_165717.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000597_20060507_220904_20060508_044128.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000598_20060508_095316_20060508_180616.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000599_20060508_231803_20060509_040951.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000600_20060509_092139_20060509_173439.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000601_20060509_224626_20060510_033814.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000602_20060510_085002_20060510_170302.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000603_20060510_221449_20060511_044713.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000604_20060511_095901_20060511_181200.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000605_20060511_232348_20060512_041536.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000606_20060512_092724_20060512_174023.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000607_20060512_225211_20060513_034359.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000608_20060513_085547_20060513_113724.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000609_20060513_150307_20060513_170846.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000610_20060513_222034_20060514_031222.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000611_20060514_082410_20060514_181745.N1
AVI_UAV_TLVFOS20060404_110748_00000000_00000612_20060514_232933_20060630_120000.N1
AVI_UAV_TLVFOS20060425_121133_00000000_00000613_20060514_232933_20060520_061504.N1
AVI_UAV_TLVFOS20060425_121133_00000000_00000614_20060520_093415_20060630_120000.N1
AVI_UAV_TLVFOS20060508_152051_00000000_00000615_20060520_093415_20060522_001502.N1
AVI_UAV_TLVFOS20060508_152056_00000000_00000616_20060525_003047_20060527_073549.N1
AVI_UAV_TLVFOS20060508_152056_00000000_00000617_20060527_105508_20060529_013531.N1
AVI_UAV_TLVFOS20060508_152056_00000000_00000618_20060601_015116_20060603_071559.N1

MPL_CAL_MPVRGT20060508_140740_00000000_00000078_20060522_001142_20781231_235959.N1

MPL_ORS_MPVRGT20060508_143042_00000000_00000128_20060522_022308_20060531_025433.N1
MPL_ORS_MPVRGT20060403_172903_00000000_00000125_20060502_100146_20060504_105319.N1
MPL_ORS_MPVRGT20060403_174049_00000000_00000126_20060505_082655_20060509_081514.N1
MPL_ORS_MPVRGT20060403_175656_00000000_00000127_20060510_072926_20060514_071745.N1

MPL_LOS_MPVRGT20060403_162436_00000000_00000203_20060506_120204_20060507_094418.N1
MPL_LOS_MPVRGT20060403_165204_00000000_00000204_20060513_114224_20060514_110545.N1
MPL_LOS_MPVRGT20060425_110712_00000000_00000205_20060520_062004_20060521_103836.N1
MPL_LOS_MPVRGT20060508_122624_00000000_00000206_20060527_074049_20060528_101854.N1
MPL_LOS_MPVRGT20060508_125212_00000000_00000207_20060603_072059_20060604_100258.N1

<u>NOM mode starting in orbit #21800 at ANX=2000 sec:</u>
CTI_E02_MPVRGT20060403_170749_00000000_00000101_20060502_011241_20781231_235959.N1

CTI_E01_MPVRGT20060403_170749_00000000_00000101_20060502_011244_20781231_235959.N1
CTI_AST_MPVRGT20060403_170749_00000000_00000101_20060502_011247_20781231_235959.N1
CTI_N02_MPVRGT20060403_170749_00000000_00000051_20060502_011250_20781231_235959.N1
CTI_S08_MPVRGT20060403_170748_00000000_00000026_20060502_011253_20781231_235959.N1
CTI_NOC_MPVRGT20060403_170749_00000000_00000101_20060502_011256_20781231_235959.N1

UTLS-1 mode starting in orbit #21845 at ANX=2000 sec:
CTI_E02_MPVRGT20060403_171723_00000000_00000102_20060505_043937_20781231_235959.N1
CTI_E01_MPVRGT20060403_171723_00000000_00000102_20060505_043940_20781231_235959.N1
CTI_AST_MPVRGT20060403_171723_00000000_00000102_20060505_043943_20781231_235959.N1
CTI_N01_MPVRGT20060403_171723_00000000_00000051_20060505_043946_20781231_235959.N1
CTI_S02_MPVRGT20060403_171723_00000000_00000027_20060505_043949_20781231_235959.N1
CTI_NOC_MPVRGT20060403_171723_00000000_00000102_20060505_043952_20781231_235959.N1

NOM mode starting in orbit #22187 at ANX=500 sec:
CTI_E02_MPVRGT20060508_141347_00000000_00000103_20060529_013925_20781231_235959.N1
CTI_E01_MPVRGT20060508_141346_00000000_00000103_20060529_013928_20781231_235959.N1
CTI_AST_MPVRGT20060508_141347_00000000_00000103_20060529_013931_20781231_235959.N1
CTI_N02_MPVRGT20060508_141346_00000000_00000052_20060529_013934_20781231_235959.N1
CTI_S04_MPVRGT20060508_141346_00000000_00000026_20060529_013937_20781231_235959.N1
CTI_NOC_MPVRGT20060508_141346_00000000_00000103_20060529_013940_20781231_235959.N1

APPENDIX B *LEVEL 1 IPF HISTORICAL UPDATES*

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

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

APPENDIX C *LEVEL 1 ADF HISTORICAL UPDATES*

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

Version 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.

Table 19 List of the gain files to be used during the period of enhanced gain increase of Jan – May 2005, the gain files already disseminated are highlighted in green, while the newly generated gains are in orange.

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

MIP_CG1_AXVIEC20051115_131404_20050418_000000_20100418_000000	Gain (CG_12_c) *
MIP_CG1_AXVIEC20050421_065554_20050420_133450_20100420_133450	Gain calibration (CG_13)
MIP_CG1_AXVIEC20051115_131917_20050421_120000_20100421_120000	Gain (CG_13_a) *
MIP_CG1_AXVIEC20051115_132409_20050423_000000_20100423_000000	Gain (CG_13_b) *
MIP_CG1_AXVIEC20051115_132925_20050424_120000_20100424_120000	Gain (CG_13_c) *
MIP_CG1_AXVIEC20050427_150526_20050426_225532_20100426_225532	Gain calibration (CG_14)
MIP_CG1_AXVIEC20051115_133432_20050427_160000_20100427_160000	Gain (CG_14_a) *
MIP_CG1_AXVIEC20051115_133942_20050429_070000_20100429_070000	Gain (CG_14_b) *
MIP_CG1_AXVIEC20051115_134453_20050501_000000_20100501_000000	Gain (CG_14_c) *
MIP_CG1_AXVIEC20051115_134947_20050502_160000_20100502_160000	Gain (CG_14_d) *
MIP_CG1_AXVIEC20051115_135453_20050504_070000_20100504_070000	Gain (CG_14_e) *
MIP_CG1_AXVIEC20050509_150546_20050506_153444_20100506_153444	Gain calibration (CG_15)
MIP_CG1_AXVIEC20051115_154052_20050507_030000_20100507_030000	Gain (CG_15_a) *
MIP_CG1_AXVIEC20051115_151144_20050508_060000_20100508_060000	Gain (CG_15_b) *
MIP_CG1_AXVIEC20051115_151255_20050509_090000_20100509_090000	Gain (CG_15_c) *
MIP_CG1_AXVIEC20051115_151358_20050510_120000_20100510_120000	Gain (CG_15_d) *
MIP_CG1_AXVIEC20051115_151458_20050511_150000_20100511_150000	Gain (CG_15_e) *
MIP_CG1_AXVIEC20051115_151558_20050512_180000_20100512_180000	Gain (CG_15_f) *
MIP_CG1_AXVIEC20051115_151702_20050513_210000_20100513_210000	Gain (CG_15_g) *
MIP_CG1_AXVIEC20050523_090017_20050515_000000_20090515_000000	Gain calibration (CG_16)
MIP_CG1_AXVIEC20051115_150616_20050516_090000_20100516_090000	Gain (CG_16_a) *
MIP_CG1_AXVIEC20051115_150747_20050517_190000_20100517_190000	Gain (CG_16_b) *
MIP_CG1_AXVIEC20051115_150831_20050519_040000_20100519_040000	Gain (CG_16_c) *
MIP_CG1_AXVIEC20051115_150940_20050520_140000_20100520_140000	Gain (CG_16_d) *
MIP_CG1_AXVIEC20050524_081749_20050522_000000_20090522_000000	Gain calibration (CG_17)

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
MIP_NL__1P_19941.N1
MIP_NL__1P_19942.N1

AE descending December 2005
MIP_NL__1P_19929.N1
MIP_NL__1P_19930.N1
MIP_NL__1P_19945.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, V4.61** has solved the following problems:
  - Fixed NCR_992: Inconsistency in number of profiles in MIPAS Level_2.
  - Fixed NCR_1068: Number of computed residual spectra not consistent with the number of observations.
- **Version V4.59**, operational since 23 July 2003, has introduced only Level 2 processing modifications. The main improvements introduced via both the processor V4.59 and the installation of a new set of ADFs have been:
  - Fixed NCR_892: Inconsistency in number of scans.
  - Fixed NCR_893: Different values for same scans.
  - The cloud filtering (that is, every time a cloud is detected at a given altitude, the retrieval is performed only above that altitude)
  - The removal of the gaps between the altitude validity ranges (allowing retrievals in the Antarctic region not feasible with the old MIP_MW2_AX)
  - Altitudes margins fixed to +/- 4 km
  - MIPAS-SPR-MAINT-0011 Wrong DSD name in L2 product in case of not requested VMR
  - MIPAS-SPR-MAINT-0012 Filling of SPH field 22 of MIPAS Level 2 ProductsMIPAS-SPR-MAINT-0013 Filling of the MIPAS MPH and MIPAS Level 2 SPH fields
  - MIPAS-SPR-MAINT-0014 Wrong writing of PCD String to the PCD Information ADS
  - MIPAS-SPR-MAINT-0015 Too strong test and skipping retrieval
  - MIPAS-SPR-MAINT-0016 Not initialised nucl1 and nucl2 in R 8.5.6.3-7A
  - ENVI-GSOP-EOAD-NC-03-0539 MIPAS L2 processing aborted

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.

Table 20 Historical delivery of L2 ADF by IFAC.

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.