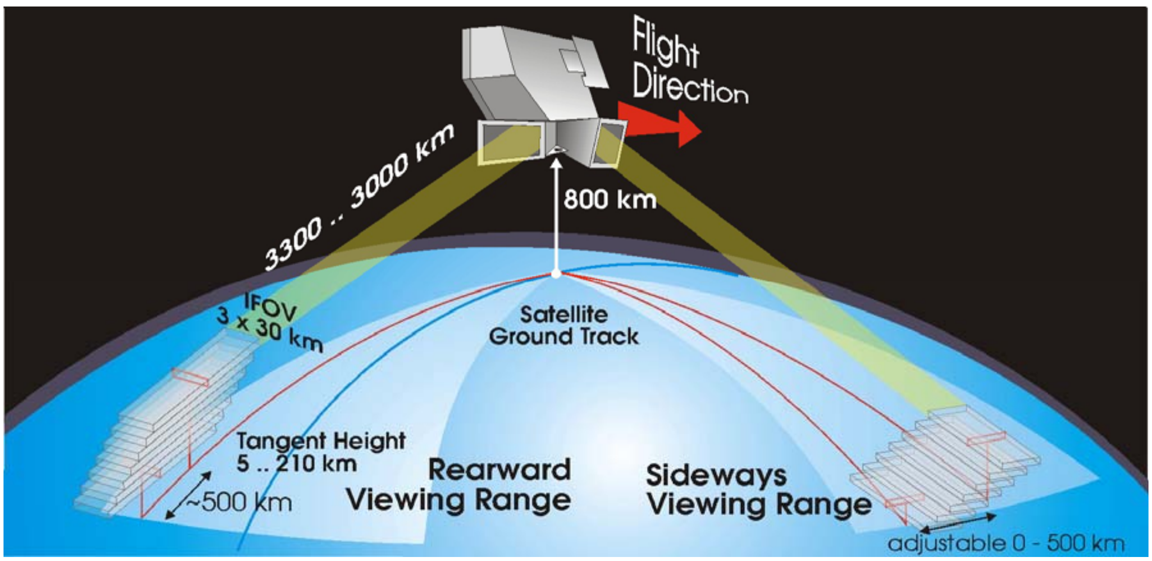
DOCUMENT

ENVISAT MIPAS MONTHLY REPORT: JULY 2006



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1 INTRODUCTION

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

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

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

1.1 Scope

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

1.2 Acronyms and Abbreviations

ACVT	Atmospheric Chemistry Validation Team
ADF	Auxiliary Data File
ADS	Annotated Data Set
AMT	Anomaly Management Tool
ANX	Ascending Node Crossing
AE	Aircraft Emission
AR	Anomaly Report
CBB	Calibration Black-Body

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

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

2 THE REPORT

2.1 *Summary*

- The MIPAS instrument performs really well during the reporting month; in fact only 4 instrument anomalies were recorded (IDU velocity error). As a result of this new operation stability the MIPAS Science Team in agreement with industry and ESA decided to increase the duty cycle of the instrument by slightly change the mission planning; in particular starting from this month the following corrective actions were implemented for increasing the duty cycle:
    - o Planning of 6 orbits/day during mission campaign instead of 4 orbits/day, increasing the duty cycle from typically 30% to 42%.
    - o Reduce the frequency of the IDU re-initialization from once per orbit to one every three orbits during the 3 days-on/4 days-off operations
- During July 2006 the instrument operated with a duty cycle of about 34%, this seems to disagree with respect to what stated in the previous bullet; nevertheless this low duty cycle is due to two planned long mission interruptions (11 days in total), these two periods were explicitly planned in order to have the instrument in the best condition for the kick-off of AMMA campaign.
- The instrument operated during July with the following plan:
    - o NOM modes were planned during 4 – 7 and 12 – 13 July
    - o UTLS-1 mode were planned starting from 21 July in support to AMMA campaign with 6 orbits per day, both in ascending and descending track over Central-West Africa (20°N-20°S, 25°W-25°E)
- We already pointed out that MIPAS performs really well during this month; in fact the instrument availability is equal to 98.6 % of the planned measurement time. The missing gaps due to PDS failure were very high (about 17% of the planned time) due to a major anomaly in the data acquisition and downlink. The anomaly was due to the HSM input module; as a result no MIPAS level0 could be generated from 27 July to 3 August 2006. The problem was resolved the 3rd August with a HSM module reset.
- The monitoring of the instrument temperatures continued nominally this month. We observe an overall stability of all the devices temperatures, the variation over the entire month being less than 2K (see § 2.3.1).
- The cooler performance was closely monitored on a daily and monthly basis. The cooler seems to perform really well, even though we observed some orbit-dependent spikes that reach the limit of 8 mg at their maxima. These spikes that start to appear during May 2006 seem to be reduced during the reporting month (see § 2.3.3.1).
- The spectral correction factor long term monitoring of the RR mission (since Aug 2004) shows a stable situation since the variations are of the order of 3 ppm over almost two years of operations, a decreasing trend can be observed along the mission, this is nominal and is due to the aging of the laser metrology (see § 2.4.2).
- The gain calibrations were carried out nominally during the reporting period on a weekly basis including the dissemination of the related ADF. The gain weekly increase remains

stable, the maximum of gain increase in the band A between two consecutive disseminated gains remains below the acceptance criterion of 1% (see § 2.4.3.1).

- The long term gain increase monitoring since the last decontamination (June 2005) is presented in this MR. This monitoring will help the planning of the future decontamination activity (to be expected at least twice per year). We can observe that the gain increase looks linear with time after the decontamination induced by the PLSOL of April. Nowadays the gain in the band A is about 17% higher (at its maximum) with respect to the first gain disseminated after the decontamination of June 2005 (see § 2.4.3.2).
- The mispointing long term monitoring shows a steady situation; in fact during the last year the relative bias seems to be stable around a value of few mdeg. To be noted that the last disseminated LOS ADF was on March 2005 (see § 2.4.4).
- The level 1 quality monitoring of the OFL products created at D-PAC is on going in parallel with the mission. The level 1b daily reports can be accessed at the following address: http://earth.esa.int/pcs/envisat/mipas/reports/daily/Level_1_OFL/.
- The long term monitoring of fringe count errors (FCE) for the RR mission is shown in this MR; this analysis is based on the L1b products generated OFL at D-PAC. This monitoring aims at the verification of the stability of FCE over time; furthermore this analysis is useful in order to verify if any correlation exists with the INT performances degradation. So far no correlation can be appreciated from this analysis.
- A quality control of L2 RR OFL products processed with the latest IPF 4.65 (Aug – Sept 2004) was carried out at ESRIN, showing an overall good quality of the level 2 data. To see all the L2 OFL daily reports of RR mission follow the link below: http://earth.esa.int/pcs/envisat/mipas/reports/daily/Level_2_OFL/

2.2 Instrument and products availability

2.2.1 INSTRUMENT PLANNING

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

Planning strategy:

- All measurement mode are double slide operation with medium resolution (41% - 1.64 sec sweeps) with asymmetric transitory sweeps
- Radiometric Gain calibrations (RGC) planned once per day
- The WCC activity performed after every transition to heater
- LOS sequence planned once per week, with new setting and PITCH BIAS=-0.030<deg>
- DS offset planned every 800 sec.
- NOM modes were planned during 4 – 7 and 12 – 13 July
- A period of 6 days of mission interruption was planned before starting of the AMMA campaign (15 – 20 July 2006)
- UTLS-1 mode were planned starting from 21 July in support to AMMA campaign with 6 orbits per day, both in ascending and descending track over Central-West Africa (20°N-20°S, 25°W-25°E)

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

2.2.2 INSTRUMENT AVAILABILITY

During July 2006 MIPAS performance was really satisfactory; indeed only 4 slide anomalies were registered. All the unavailability intervals during July 2006 are reported in the table below.

Table 1 List of MIPAS unavailabilities during July 2006; highlighted in red are the ARTEMIS unavailabilities, in blue is the unavailability due to ESOC MCMD transfer error (not related to the instrument).

Start time		Stop time		Duration	Start Orbit	Stop Orbit	Code	Comments
Date	UTC	date	UTC	sec				
04-JUL-2006	5.24.02	04-JUL-2006	6.52.33	5311	22704	22705	EN-UNA-2006/0213	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
04-JUL-2006	17.18.48	04-JUL-2006	17.56.49	2281	22711	22712	ART-UNA-2006/0021	ARTEMIS unavailability
06-JUL-2006	12.28.51	06-JUL-2006	12.38.00	549	22737	22737	ART-UNA-2006/0022	ARTEMIS unavailability
07-JUL-2006	0.29.53	07-JUL-2006	0.38.20	507	22744	22744	ART-UNA-2006/023a	ARTEMIS unavailability
07-JUL-2006	1.58.31	07-JUL-2006	2.10.10	699	22745	22745	ART-UNA-2006/023b	ARTEMIS unavailability
08-JUL-2006	7.13.10	08-JUL-2006	10.38.12	12302	22762	22764	EN-UNA-2006/0217	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
08-JUL-2006	17.00.03	10-JUL-2006	10.07.51	148068	22768	22793	EN-UNA-2006/0218	MIPAS return to Operation after MCMD TRANSFER ACKNOW ERROR
12-JUL-2006	20.15.14	12-JUL-2006	21.06.13	3059	22827	22828	EN-UNA-2006/0224	MIPAS return to operation from Heater/Refuse mode due to IDU SYS TOL ERR
13-JUL-2006	12.54.23	13-JUL-2006	13.51.51	3448	22837	22838	EN-UNA-2006/0226	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. Note that a critical anomaly was observed in the data downlink, the problem was due to the HSM overflow in the payload data handling unit (see further details in §2.2.3.1). As a result the level 0 data could not be processed. The problem started on 27 July and was solved only the 3rd August 2006 with a HSM module reset, during this period no level0 data were available.

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

Start Time		Stop time		Duration	Start Orbit	Stop Orbit	Measurement
Date	UTC	date	UTC	sec			
01-JUL-2006	10.58.15	01-JUL-2006	10.58.29	14	22664	22664	NORMAL
07-JUL-2006	0.55.32	07-JUL-2006	1.16.11	1239	22744	22745	NORMAL
08-JUL-2006	10.38.12	08-JUL-2006	10.39.12	60	22764	22765	NORMAL
12-JUL-2006	21.06.13	12-JUL-2006	21.06.27	14	22828	22828	NORMAL
13-JUL-2006	13.51.51	13-JUL-2006	13.52.27	36	22838	22838	NORMAL
15-JUL-2006	10.18.17	15-JUL-2006	10.18.31	14	22864	22865	NORMAL
22-JUL-2006	16.40.39	22-JUL-2006	16.40.53	14	22968	22969	NORMAL
23-JUL-2006	20.48.54	23-JUL-2006	20.52.16	202	22985	22985	NORMAL
27-JUL-2006	20.23.02	28-JUL-2006	1.30.49	18467	23042	23045	NORMAL
28-JUL-2006	6.26.38	28-JUL-2006	8.03.34	5816	23048	23049	NORMAL
28-JUL-2006	8.03.34	28-JUL-2006	8.10.39	425	23049	23049	DEEP_SPACE_CHAR
28-JUL-2006	8.10.39	28-JUL-2006	8.17.44	425	23049	23049	BLACK_BODY_CHAR
28-JUL-2006	8.17.44	28-JUL-2006	11.34.25	11801	23049	23051	NORMAL
28-JUL-2006	19.51.25	29-JUL-2006	0.59.12	18467	23056	23059	NORMAL
29-JUL-2006	7.35.37	29-JUL-2006	9.12.32	5815	23063	23064	NORMAL
29-JUL-2006	9.12.32	29-JUL-2006	9.19.38	426	23064	23064	DEEP_SPACE_CHAR
29-JUL-2006	9.19.38	29-JUL-2006	9.26.43	425	23064	23064	BLACK_BODY_CHAR
29-JUL-2006	9.26.43	29-JUL-2006	12.43.24	11801	23064	23066	NORMAL
29-JUL-2006	14.36.57	29-JUL-2006	14.41.38	281	23067	23068	NORMAL
29-JUL-2006	18.01.05	29-JUL-2006	18.02.05	60	23069	23070	NORMAL
29-JUL-2006	19.19.48	30-JUL-2006	0.27.35	18467	23070	23073	NORMAL
30-JUL-2006	7.04.00	30-JUL-2006	8.40.55	5815	23077	23078	NORMAL
30-JUL-2006	8.40.55	30-JUL-2006	8.48.01	426	23078	23078	DEEP_SPACE_CHAR
30-JUL-2006	8.48.01	30-JUL-2006	8.55.06	425	23078	23078	BLACK_BODY_CHAR
30-JUL-2006	8.55.06	30-JUL-2006	12.11.47	11801	23078	23080	NORMAL
30-JUL-2006	20.28.47	31-JUL-2006	1.36.34	18467	23085	23088	NORMAL
31-JUL-2006	6.32.22	31-JUL-2006	8.09.18	5816	23091	23092	NORMAL
31-JUL-2006	8.09.18	31-JUL-2006	8.16.23	425	23092	23092	DEEP_SPACE_CHAR
31-JUL-2006	8.16.23	31-JUL-2006	8.23.29	426	23092	23092	BLACK_BODY_CHAR
31-JUL-2006	8.23.29	31-JUL-2006	11.40.10	11801	23092	23094	NORMAL

During the reporting period the following missing intervals (due to PDS unknown failures) were observed during the LOS weekly measurements (MIP_LS__0P). Also in this case a part from the first gap all the remaining missing intervals were due to the anomaly of the HSM overflow.

Table 3 List of MIPAS missing LOS measurement segments during July 2006.

Start time		Stop time		Duration	Start Orbit	Stop Orbit
Date	UTC	date	UTC	sec		
01-JUL-2006	9.48.28	01-JUL-2006	9.48.38	10	22664	22664
29-JUL-2006	14.42.38	29-JUL-2006	14.43.21	43	23068	23068

29-JUL-2006	14.47.22	29-JUL-2006	14.48.06	44	23068	23068
29-JUL-2006	14.53.55	29-JUL-2006	14.54.39	44	23068	23068
29-JUL-2006	14.59.48	29-JUL-2006	15.00.22	34	23068	23068
29-JUL-2006	15.01.03	29-JUL-2006	15.01.47	44	23068	23068
29-JUL-2006	15.02.28	29-JUL-2006	15.03.18	50	23068	23068
29-JUL-2006	15.05.12	29-JUL-2006	15.06.00	48	23068	23068
29-JUL-2006	15.08.47	29-JUL-2006	15.09.35	48	23068	23068
29-JUL-2006	15.10.23	29-JUL-2006	15.11.06	43	23068	23068
29-JUL-2006	15.13.31	29-JUL-2006	15.14.14	43	23068	23068
29-JUL-2006	15.16.19	29-JUL-2006	15.17.05	46	23068	23068
29-JUL-2006	15.21.21	29-JUL-2006	15.22.05	44	23068	23068
29-JUL-2006	15.23.21	29-JUL-2006	15.24.05	44	23068	23068
29-JUL-2006	15.24.47	29-JUL-2006	15.25.32	45	23068	23068
29-JUL-2006	15.26.51	29-JUL-2006	15.27.37	46	23068	23068
29-JUL-2006	15.33.41	29-JUL-2006	15.34.28	47	23068	23068
29-JUL-2006	15.48.50	29-JUL-2006	15.49.42	52	23068	23068
29-JUL-2006	15.50.42	29-JUL-2006	15.51.32	50	23068	23068
29-JUL-2006	15.52.49	29-JUL-2006	15.53.42	53	23068	23068
29-JUL-2006	15.55.16	29-JUL-2006	15.56.07	51	23068	23068
29-JUL-2006	15.56.48	29-JUL-2006	15.57.01	13	23068	23068
29-JUL-2006	15.57.42	29-JUL-2006	15.57.49	7	23068	23068
29-JUL-2006	15.59.50	29-JUL-2006	16.00.41	51	23068	23068
29-JUL-2006	16.05.58	29-JUL-2006	16.06.27	29	23068	23068
29-JUL-2006	16.07.11	29-JUL-2006	16.08.01	50	23068	23068
29-JUL-2006	16.16.11	29-JUL-2006	16.16.58	47	23068	23068
29-JUL-2006	16.19.45	29-JUL-2006	16.20.29	44	23068	23068
29-JUL-2006	16.23.14	29-JUL-2006	16.23.58	44	23069	23069
29-JUL-2006	16.27.58	29-JUL-2006	16.28.42	44	23069	23069
29-JUL-2006	16.34.31	29-JUL-2006	16.35.15	44	23069	23069
29-JUL-2006	16.40.24	29-JUL-2006	16.40.58	34	23069	23069
29-JUL-2006	16.41.39	29-JUL-2006	16.42.23	44	23069	23069
29-JUL-2006	16.43.05	29-JUL-2006	16.43.54	49	23069	23069
29-JUL-2006	16.45.49	29-JUL-2006	16.46.36	47	23069	23069
29-JUL-2006	16.49.23	29-JUL-2006	16.50.11	48	23069	23069
29-JUL-2006	16.50.59	29-JUL-2006	16.51.43	44	23069	23069
29-JUL-2006	16.54.07	29-JUL-2006	16.54.50	43	23069	23069
29-JUL-2006	16.56.56	29-JUL-2006	16.57.41	45	23069	23069
29-JUL-2006	17.01.57	29-JUL-2006	17.02.41	44	23069	23069
29-JUL-2006	17.03.57	29-JUL-2006	17.04.41	44	23069	23069
29-JUL-2006	17.05.24	29-JUL-2006	17.06.09	45	23069	23069
29-JUL-2006	17.07.27	29-JUL-2006	17.08.13	46	23069	23069
29-JUL-2006	17.14.17	29-JUL-2006	17.15.04	47	23069	23069
29-JUL-2006	17.29.26	29-JUL-2006	17.30.18	52	23069	23069
29-JUL-2006	17.31.18	29-JUL-2006	17.32.09	51	23069	23069
29-JUL-2006	17.33.26	29-JUL-2006	17.34.18	52	23069	23069
29-JUL-2006	17.35.52	29-JUL-2006	17.36.43	51	23069	23069
29-JUL-2006	17.37.24	29-JUL-2006	17.37.38	14	23069	23069

29-JUL-2006	17.38.18	29-JUL-2006	17.38.25	7	23069	23069
29-JUL-2006	17.40.26	29-JUL-2006	17.41.17	51	23069	23069
29-JUL-2006	17.46.35	29-JUL-2006	17.47.03	28	23069	23069
29-JUL-2006	17.47.47	29-JUL-2006	17.48.37	50	23069	23069
29-JUL-2006	17.56.47	29-JUL-2006	17.57.34	47	23069	23069
29-JUL-2006	18.00.22	29-JUL-2006	18.00.25	3	23069	23069

2.2.3.1 Anomaly in the data downlink

MIPAS data downlink via both chains (Kiruna and Artemis) shows an error starting from 27 July 2006. This type of behavior has been seen before on other instruments and has been attributed to an HSM[1] input module problem. This type of problem in the HSM has been solved before by an HSM input module reset. Also in this case a HSM reset was planned to solve the MIPAS problem, the anomaly was solved the 3rd August, therefore about 6 days of planned measurement were not processed to level0.

2.2.4 LEVEL 0 PRODUCTS STATISTICS

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

- Planning of 6 orbits/day during mission campaign instead of 4 orbits/day, increasing the duty cycle from typically 30% to 42%.
- Reduce the frequency of the IDU re-initialization from once per orbit to one every three orbits during the 3 days-on/4 days-off operations. This new scenario was adopted for the first time during the reporting month for the AMMA campaign.

During July 2006 the instrument operated with a duty cycle of about 34%, in fact even if the new planning options were implemented, a total of 11 days of mission interruption was planned in order to prepare the instrument to the AMMA campaign and to 3 days of NOM operations. As already cited in the previous paragraph the instrument performances were really good during the reporting month; the instrument availability is in fact equal to 98.6 % of the planned measurement time. The missing intervals due to PDS unknown failure were about 17% of the planned time, due to the HSM anomaly reported in the previous paragraph. The MIP_NL__0P products statistics are reported in the following table.

[1] The High-Speed Multiplexer (HSM) is part of the Payload Data Handling (PDH) system; the HSM selects and assemble the data coming from the different ENVISAT instruments into a continuous data stream. The HSM sends this information to the four onboard 30 Gbytes Tape Recorders, which allow for intermediate storage of HSM output data during periods without direct ground station coverage, finally the data are sent to the Encoding and Switching Unit (ESU) for the final downlink.

Table 4 MIPAS MIP_NL__0P products statistics during July 2006.

		Time [sec]
Total time over one month	t_{tot}	**2678400**
Time of planned measurements	t_{plan}	**908817**
Time of expected measurements	t_{exp}	**896211**
Time of L0 gaps	t_{L0gaps}	**149671**
Time of instrument unavailability	$t_{unav} = t_{plan} - t_{exp}$	**12606**
%Time of duty cycle	$(t_{plan} / t_{tot})*100$	**33,93**
% Time of Instrument availability	$[1- t_{unav} / t_{plan}]*100$	**98,61**
% Time of L0 availability (PDS failure)	$[(t_{exp} – t_{L0gaps})/t_{exp}]*100$	**83,30**
% Total time of L0 availability (PDS failure + instrument unavailability)	$[(t_{exp} – t_{L0gaps})/t_{plan}]*100$	**82,14**

2.3 Instrument monitoring

2.3.1 THERMAL PERFORMANCE

The following two plots (Fig. 1 – 2) show the long-term trends of the IDU and MIO base plate temperature (analysis performed by Astrium). The yearly seasonal variations and the interferometer heater switching (see Tab. 5 for the schedule of heater switch-on/off) are clearly visible within the plots. In particular the switching-on of the INT heater during 17 October 2005 produces an increase of almost 5K of the MIO and IDU temperature. The increase of temperature significantly improves the INT performances from October 2005 up to January 2006. During May – June 2006 the seasonal increase of temperature can be observed (this is the hottest period of the year for MIPAS), with an increasing slope similar to that observed on 2005.

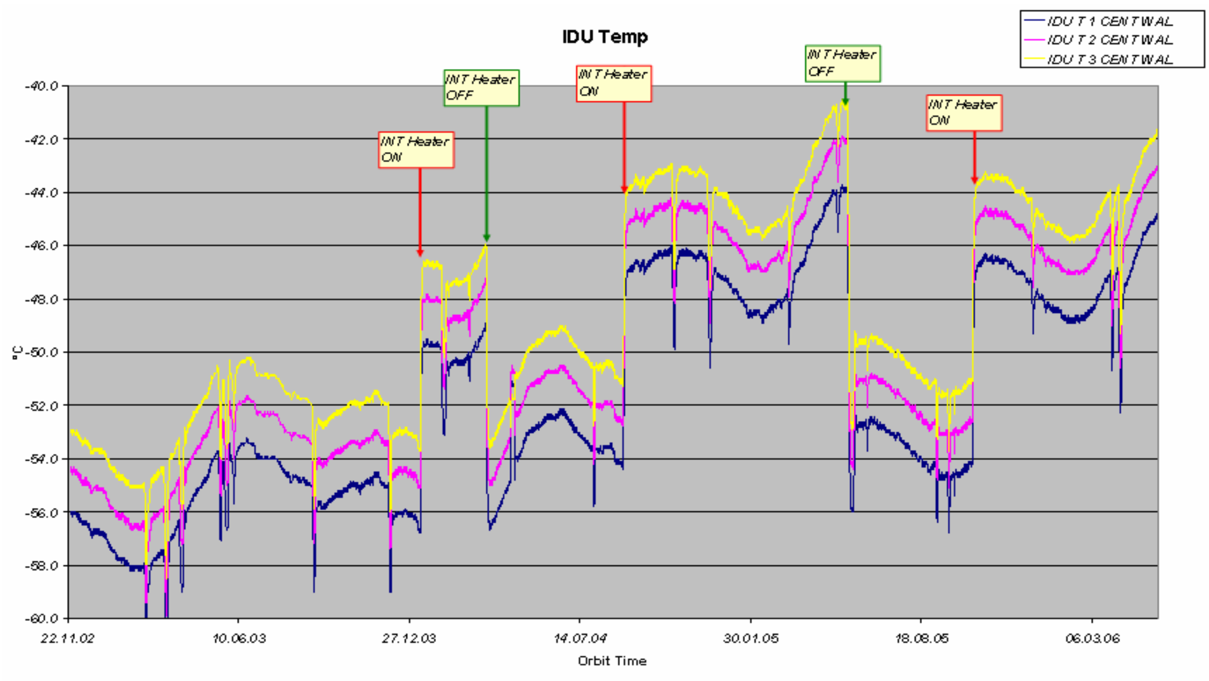


Figure 1 IDU temperatures as a function of time: November 2002 – July 2006 (courtesy of Astrium).

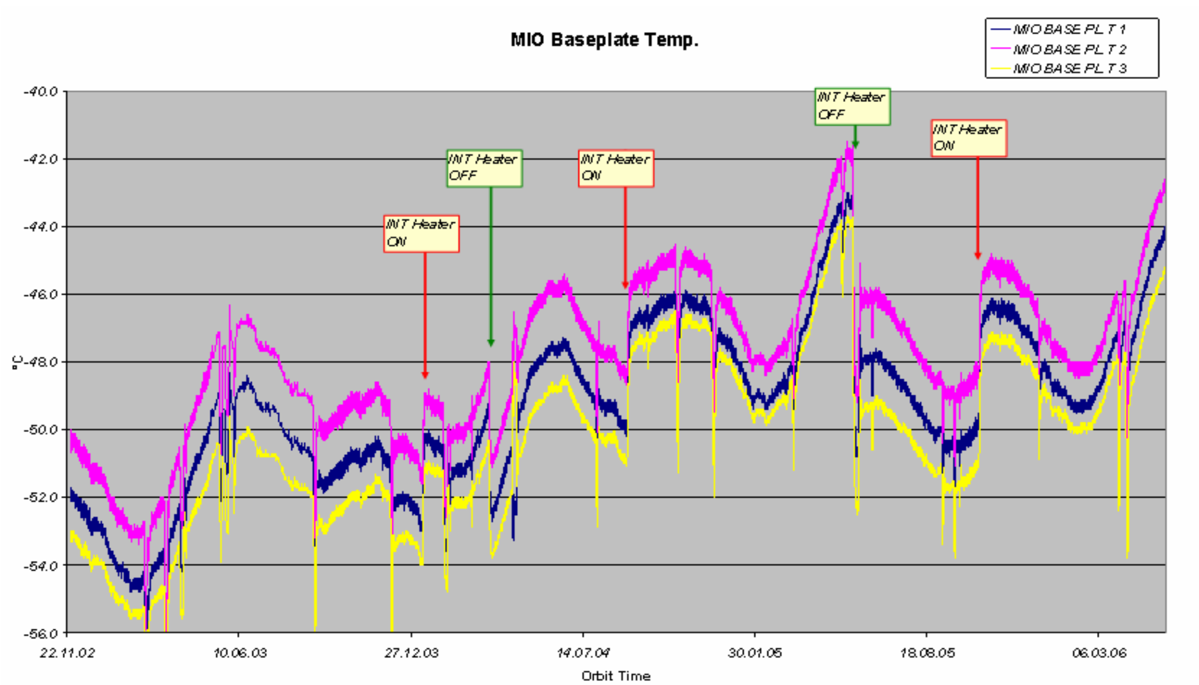


Figure 2 MIO base plate temperatures as a function of time: November 2002 – July 2006 (courtesy of Astrium).

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

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

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

The monthly monitoring of the instrument temperatures is reported in the following plots, which show the IDU, MIO, CBB and FCA radiator temperatures. We observe an overall stability of all the temperatures, the variation over the entire month being less than 1.5K.

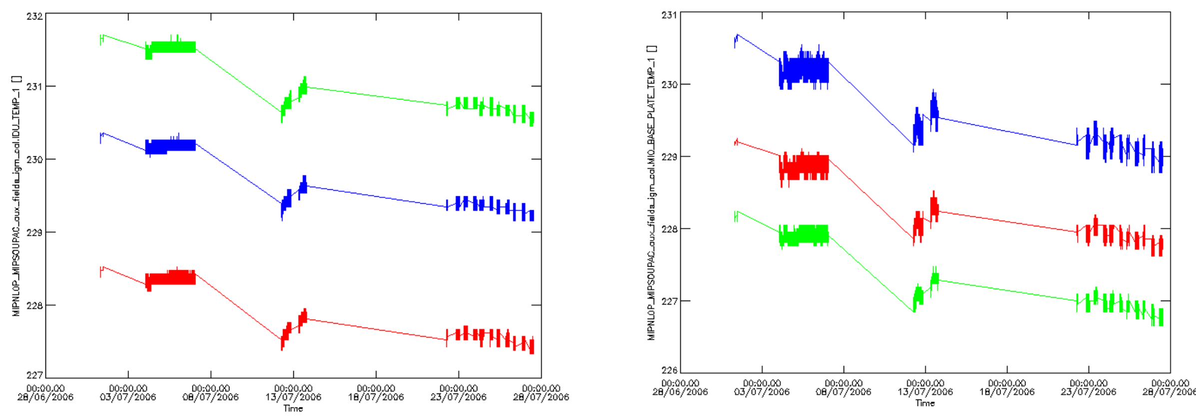


Figure 3 IDU and MIO Base-Plate temperature during reporting period: July 2006.

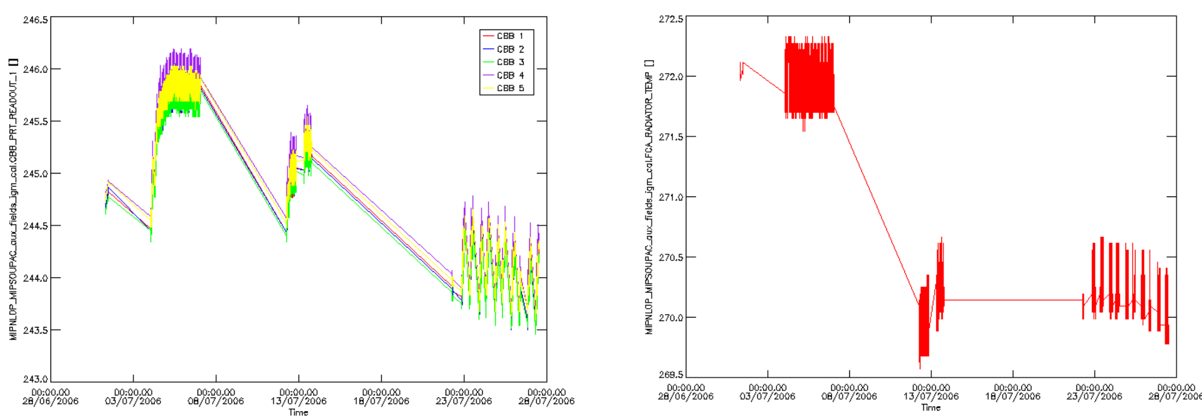


Figure 4 CBB and FCA radiator temperature during reporting period: July 2006.

2.3.2 INTERFEROMETER PERFORMANCE

The historical record of INT velocity errors and differential speed errors since July 2005 can be seen in Fig. 5 – 6 (analysis carried out by Astrium). In this figures the very bad periods of August 2005 and October 2005 can be distinguished. During these periods the INT velocity errors occurred with high frequency and the differential speed errors reached the maximum value of about 70%. The positive effect of the heater switch-on (end of October 2005) can be appreciated within these plots with a significant reduction of the velocity errors occurrence and a drastic reduction of differential speed errors. This situation changed during end of Feb 2006, when the -4% differential speed error starts again to increase and reach the critical value of 60%. It has been noted that when this parameter reaches this value the number of turnaround anomalies starts to increase significantly. 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 improved cooler performances this reflects into a significant improvement of the INT performances with a reduction of slide errors occurrence. During the reporting period the interferometer performances were really good with a decrease of the velocity error occurrence (only 4 IDU anomalies over the reporting month) and a very low (about 25%) and stable value of differential speed errors.

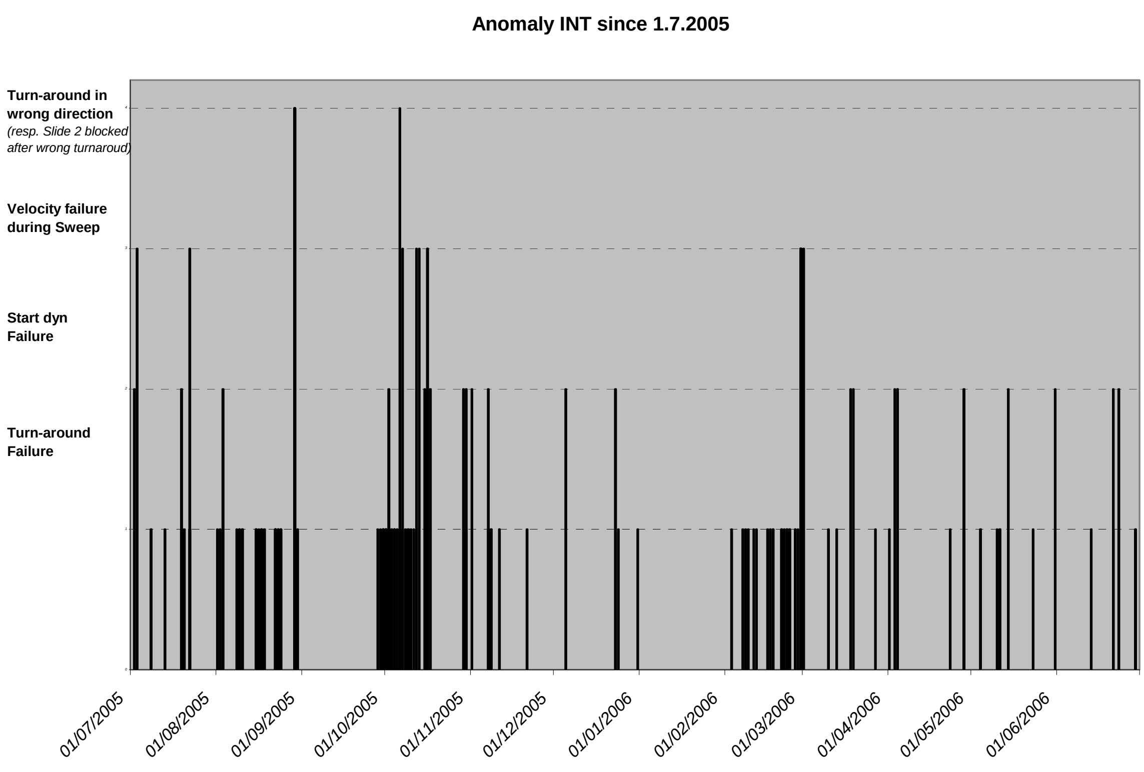


Figure 5 INT anomalies since July 2005 (courtesy of Astrium).

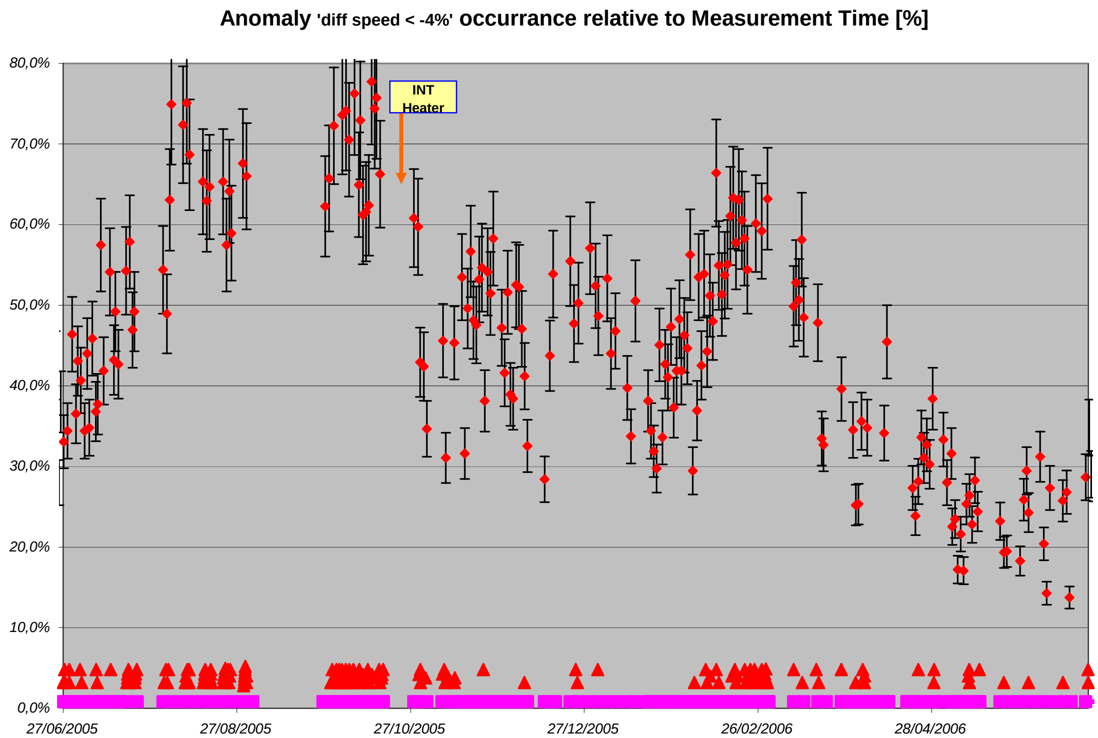


Figure 6 Occurrence of -4% differential speed error relative to measurement time since January 2005 (courtesy of Astrium).

2.3.3 COOLER PERFORMANCE

Fig. 7 shows the cooler displacer and compressor vibration level from start of mission (analysis performed by Astrium). It can be noticed the evident increase in compressor vibration level during March – April 2005. After an analysis done by Astrium, it was found that the MIPAS cooler was not well balanced. The cooler rebalancing was performed from 11 May 07:39 to 12 May 12:14 2005, 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. In Fig.7 it can be seen also the effect of the switch-on of the INT heater during end of October 2005, this determines a slight increase of the compressor vibration by about 1 mg. After the ENVISAT anomaly of 6th April 2006, with all the payload devices switched off, we observed an important improvement in the cooler performances with a reduction of the compressor vibration level of about 1 mg. The increase of vibration levels observed since May 2006 is nominal and is due to the warming environment in this part of the year.

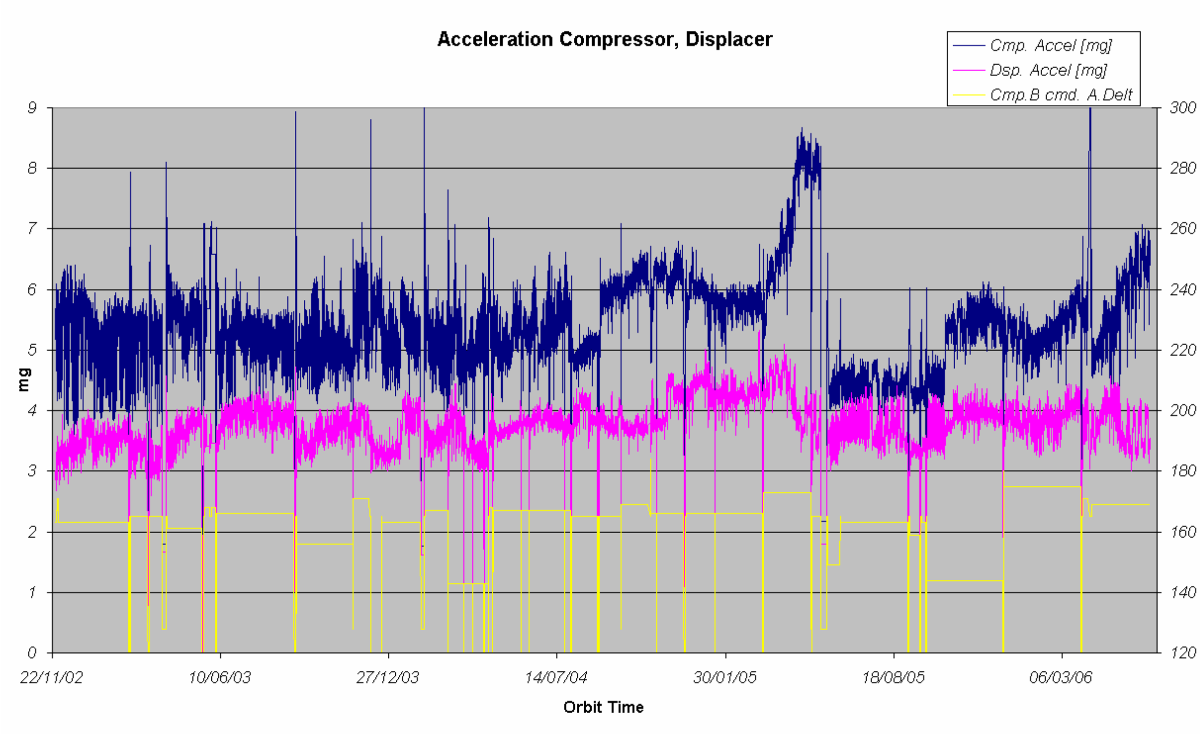


Figure 7 Cooler Displacer and Compressor vibration level, historical trend from 2002 (courtesy of Astrium).

The performances of the cooler during the reporting period were nominal with vibration values 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 since May 2006, with maxima reaching sometimes the warning level. These spikes, which are highlighted in the daily plots of Fig. 9, are due to a variation of environment condition along the orbit (supply voltage and temperature). This situation is expected for this period (May – July), which corresponds to the hottest part of the year, indeed during July the magnitude of these spikes starts to decrease and in average we observe a decrease of the compressor vibration of about 1 mg.

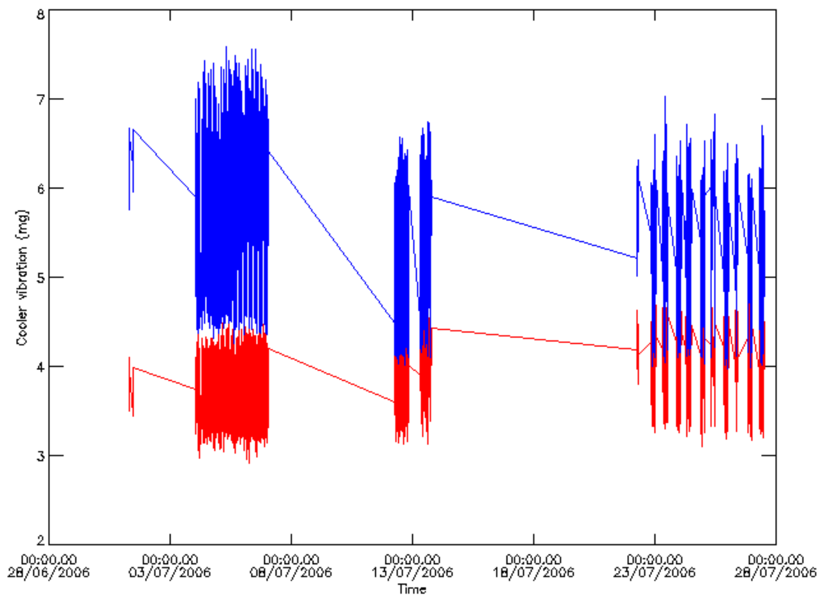


Figure 8 July 2006: Cooler Displacer and Compressor vibration level.

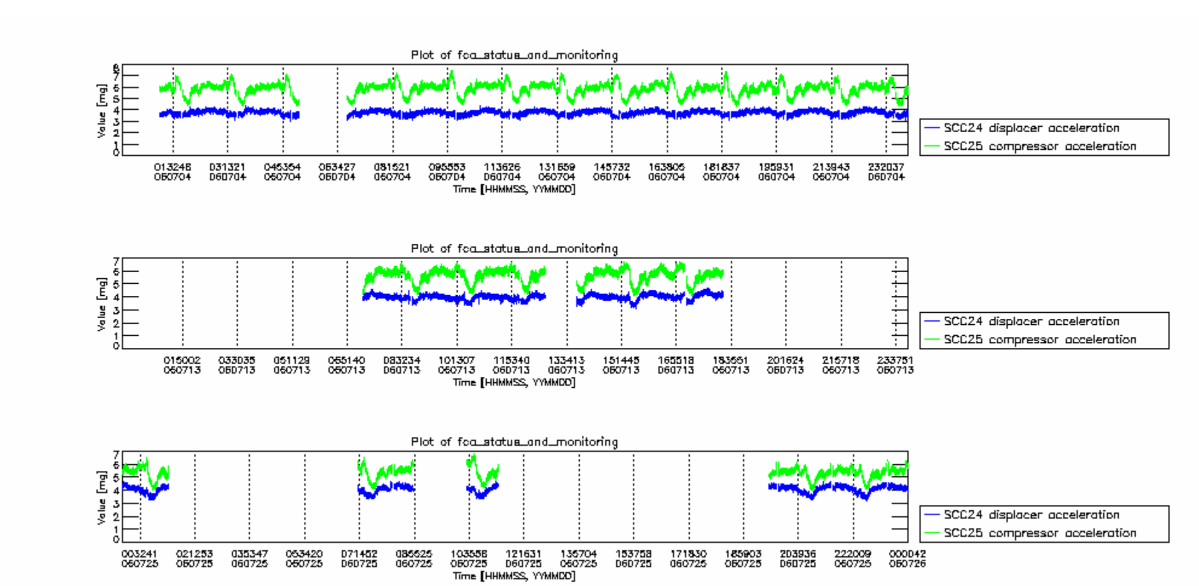


Figure 9 Cooler Displacer and Compressor vibration level observed on 4, 13 and 25 July 2006.

2.4 Level 1b product quality monitoring

2.4.1 PROCESSOR CONFIGURATION

2.4.1.1 Version

The latest operational processor (IPF 4.65) was installed at D-PAC on February 2006 for the OFL processing of MIPAS RR mission. The table below shows the list of IPF updates and the aligned prototype, DPM, IODD and the related NCR/SPRs.
A new IPF (4.67) is planned to be validated and put into operations at D-PAC for replacing the 4.65 version. This new processor, which corrects for five NCRs with respect to the previous version, is now under validation at ESRIN and is expected to be operational OFL at the beginning of September 2006.

Table 6 Historical updates of MIPAS processor, related prototype, DPM, IODD and NCR/SPR.

IPF Version	Prototype		DPM		IODD		Processor update	
	L1 Migsp	L2 Ml2pp	L1	L2	L1	L2	Level 1	Level 2
4.65	2.5	4.0	4I	4.1	4E	4.0		Fixed NCR_1310
4.64	2.5	4.0	4I	4.1	4E	4.0	Fixed SPR-12100-2011	
4.63	2.5	4.0	4I	4.1	4E	4.0	Fixed SPR-120O0-2000: Fixed SPR-120O0-2001	Fixed NCR_1278 Fixed NCR_1308 Rejected NCR_1310 Rejected NCR_1317
4.62	2.5	4.0	4H	4.0	4E	4.0	Fixed NCR_1157 Fixed NCR_1259	Fixed NCR_1128 Fixed NCR_1275 Fixed NCR_1276

The historical updates in the MIPAS L1 processor are detailed in ***Appendix B*** with all the information on the related NCRs and SPRs.
The figure 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 L1 and L2 processing.

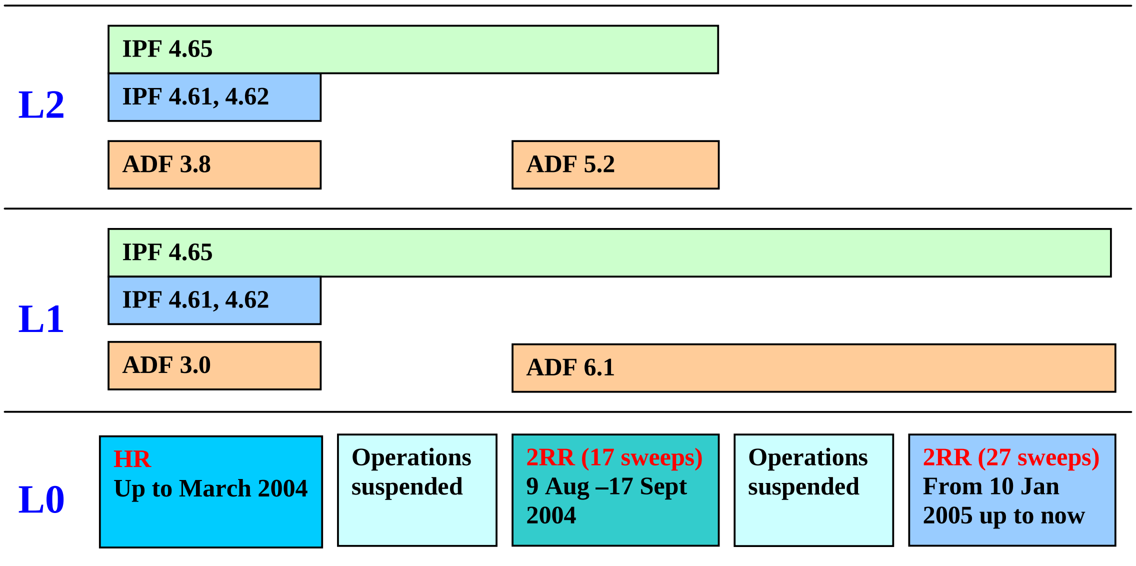


Figure 10 IPF validity and ADFs version for processing level 1 and level 2 products. IPF 4.62 – 4.61 were used for re-processing of FR mission, while the IPF 4.65 is now operational at D-PAC for OFL processing of RR mission.

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

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

Centre	Facility Software	Date
D-PAC	V4.65	09-02-2006
D-PAC	V4.62	06-09-2004
LRAC	V4.62	02-09-2004
D-PAC	V4.61	15-03-2004
LRAC	V4.61	18-03-2004
PDHS-K	V4.61	17-03-2004
PDHS-E	V4.61	17-03-2004
LRAC	V4.59	20-08-2003
D-PAC	V4.59	06-08-2003
PDHS-K	V4.59	23-07-2003
PDHS-E	V4.59	23-07-2003
PDHS-K	V4.57	22-07-2003
LRAC	V4.57	22-07-2003
PDHS-K	V4.59	21-07-2003
LRAC	V4.59	21-07-2003
LRAC	V4.57	19-03-2003
PDHS-K	V4.57	18-03-2003
D-PAC	V4.57	05-03-2003
PDHS-E	V4.57	04-03-2003

2.4.1.2 Auxiliary Data Files

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

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

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

Table 8 Level 1 ADFs valid in July 2006.

Auxiliary Data File	Start Validity	Stop Validity	Updated during the reporting period
V6.1 MIP_MW1_AXVIEC20050627_094928_20040809_000000_20090809_000000 MIP_PS1_AXVIEC20050627_100609_20040809_000000_20090809_000000 MIP_CA1_AXVIEC20050627_094412_20040809_000000_20090809_000000	08-JAN-05	08-JAN-09	No
MIP_CL1_AXVIEC20050420_152028_20050420_095747_20100420_095747	20-APR-05	20-APR-10	No
MIP_CS1_AXVIEC20060713_151520_20060704_000000_20110704_000000 MIP_CG1_AXVIEC20060713_150542_20060704_000000_20110704_000000 MIP_CO1_AXVIEC20060713_150030_20060704_000000_20110704_000000	04-JUL-06	04-JUL-06	Yes
MIP_CS1_AXVIEC20060724_092003_20060712_000000_20110712_000000 MIP_CG1_AXVIEC20060724_091945_20060712_000000_20110712_000000 MIP_CO1_AXVIEC20060724_091656_20060712_000000_20110712_000000	12-JUL-06	12-JUL-11	Yes
MIP_CS1_AXVIEC20060801_073619_20060721_000000_20110721_000000 MIP_CG1_AXVIEC20060731_150534_20060721_000000_20110721_000000 MIP_CO1_AXVIEC20060731_150107_20060721_000000_20110721_000000	21-JUL-06	21-JUL-11	Yes

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

Table 9 Historical deliveries of level 1 ADF by Bomem

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

	MIP_PS1_AX			

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 over the RR mission (from August 2004). We observe a very stable situation since the variations are of the order of 3 ppm over almost two years of operations. An overall decrease of the SCF can be observed, this is a nominal situation that was already observed for the FR mission and is due to the aging of the laser metrology.

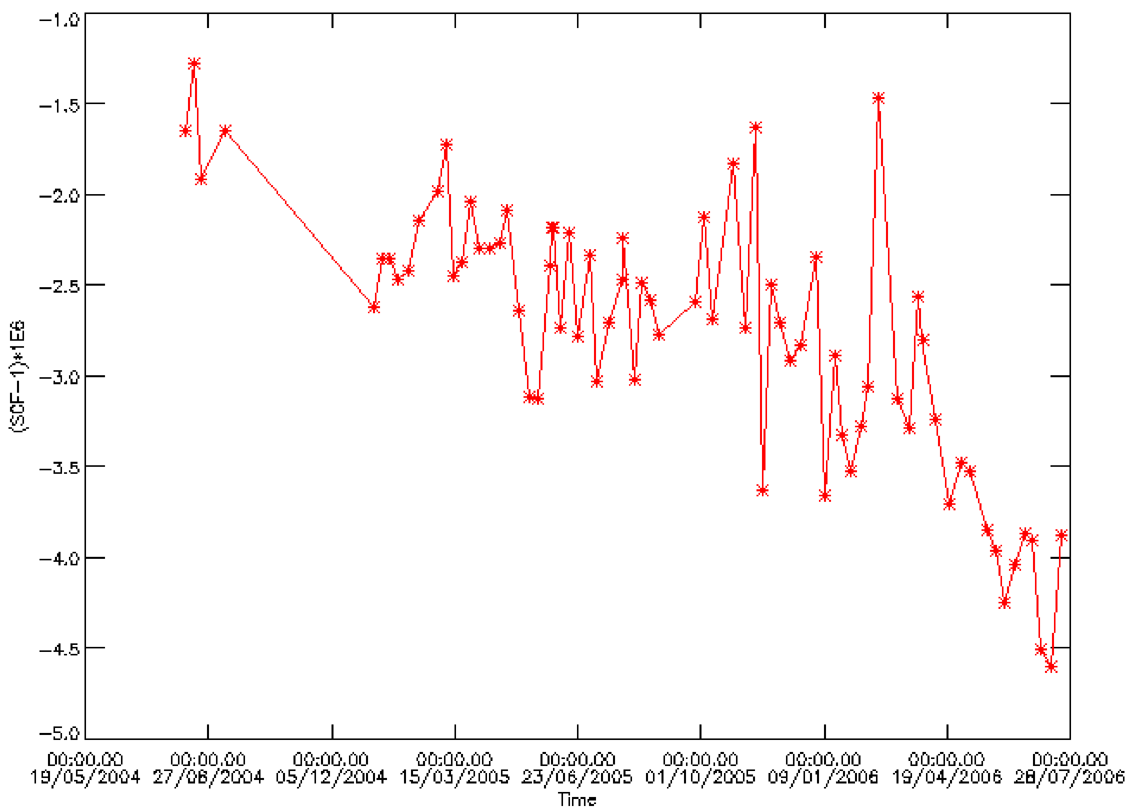


Figure 11 MIPAS Spectral Calibration Factor (SCF) during RR ops updated to end of July 2006.

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 switching). The maximum of the gain increase between two consecutive disseminated gains in the band A (where we expect the maximum of gain variation due to ice contamination) is carefully monitored. The weekly increase of gain is expected to be around 1% at its maximum.

2.4.3.1 Monthly monitoring

During July 2006 operations, the relative increase of consecutive disseminated gain was monitored nominally. Figure 12 shows 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. 10; 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. 10 shows that during the reporting month the weekly increase was always lower than the acceptance criterion (1%).

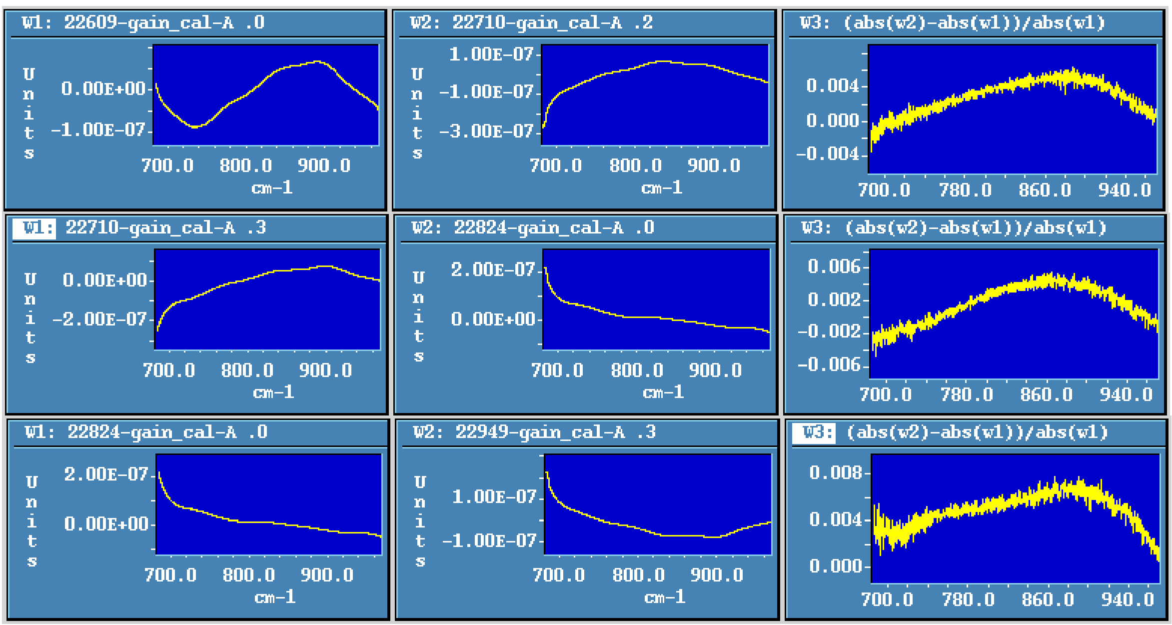


Figure 12 Relative variations of radiometric gain for consecutive disseminated gains in band A during July 2006 operations. The first two plots in each row are the imaginary part of the gain plotted versus the wave-number, the third plot is the ratio: (abs(w2)-abs(w1))/abs(w1), which gives the gain increase 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 10 Weekly and long term (since June 2005) gain increase for the four disseminated gain orbits of July 2006

Orbit #	Date	Weekly max increase (%)	Long term max increase (%)
22710	04/07/2006	0,65	15,28
22824	12/07/2006	0,56	15,92
22949	21/07/2006	0,78	16,69

2.4.3.2 Long term monitoring

The long term plot of gain changes between two consecutive disseminated gains since January 2005 is shown in the figure below, in this figure the maximum gain is normalized with respect to the time in order to avoid for artifacts due to different time intervals between consecutive gains. The acceptance criterion of 1% weekly increase is highlighted with the dotted line (it corresponds to 1% / 7 days). The very high increase of gain during Jan-May 2005 operations can be seen in this figure. After the decontamination (end of May 2005) the gain rate suddenly decreases and it remains generally lower than the acceptance level unless some spikes due to the INT heater switch-on, the instrument anomaly of 28th March 2006 and the PLSOL of 6th April 2006.

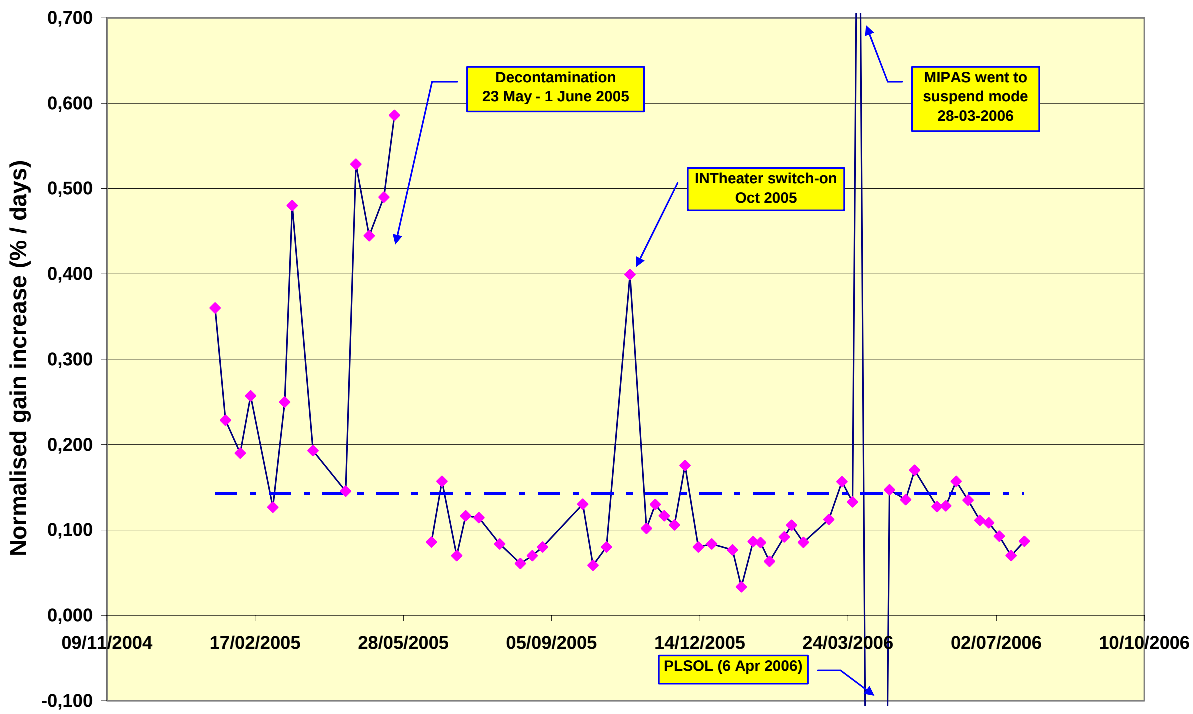


Figure 13 Gain maximum increase normalized to the time difference between consecutive disseminated gains since January 2005.

The long term monitoring of gain accumulation increase since Jan 2005 is presented in 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 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 this figure the very high increase of gain during the period Jan – May 2005. At the end of May the gain increase reached a value of about 60%. The situation was resolved with the decontamination of June 2005. Since then, the gain has increased with a linear rate with some spikes 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 up to now demonstrating the improved cooler performances after the PLSOL.

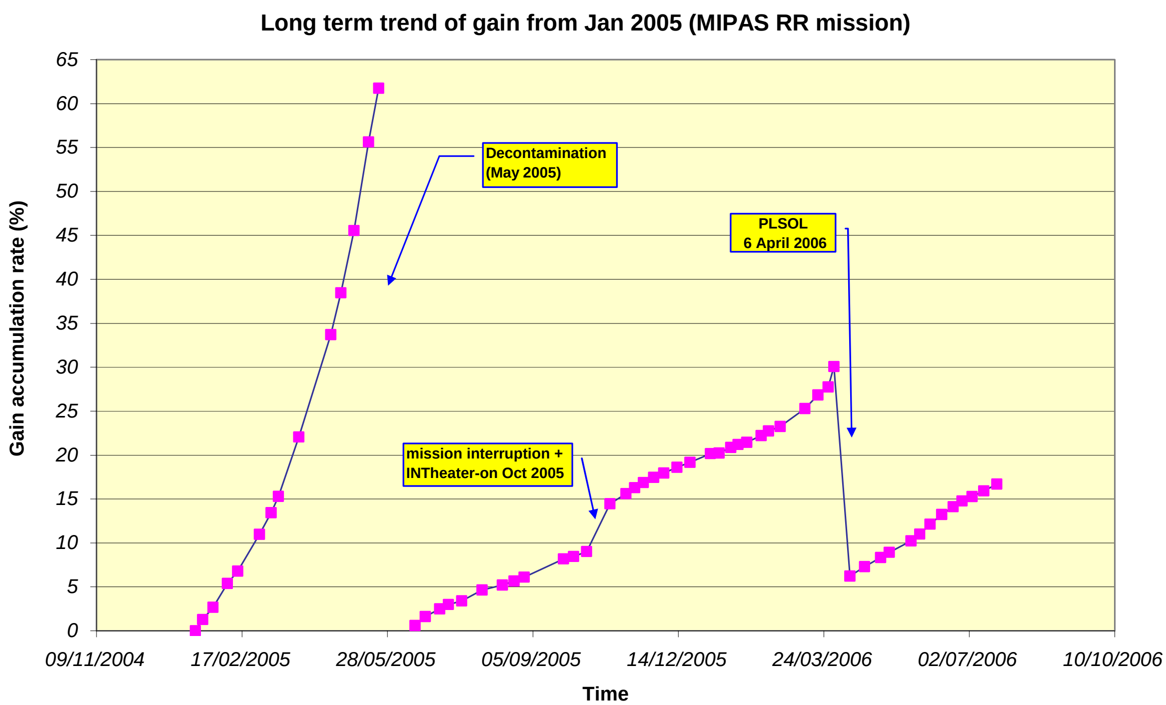


Figure 14 Gain accumulation increase since January 2005.

2.4.3.3 Interpolated gains

During the period January-May 2005, a strong gain increase was observed in the gain variation, as observed in the previous paragraph. This increase acts on the data quality in two ways:

- If the gain functions are only determined once per week, the drift leads to a scaling error in the calibrated spectra of up to 3.5 % in band A.
- The increase of the gain function corresponds to a decrease of the instrument response. This also decreases the signal-to-noise-ratio and leads to higher NESR-values.

In order to reduce the scaling error in the calibrated spectra the solution was to calculate and disseminate further gain values in between the already disseminated ones in order to comply with the condition for the gain 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***.

2.4.4 POINTING PERFORMANCE

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

The long term trend of mispointing since start of mission is reported in Fig. 15. The figure shows the relative and the absolute pointing error (evaluated taking into account the commanded elevation angle for the LOS calibration). The very pronounced annual trend at the beginning of the mission was not due to the MIPAS instrument itself, but to a mispointing of the entire ENVISAT platform resulting from the software response to orbit control information. In fact, after the update in the pointing software, implemented on 12 December 2003 the deviation trend was drastically reduced.
During July 2006 operations, the LOS calibration was performed and the results are reported in the following table and figure. The LOS calibration planned for 29 July 2006 was lost due to the HMS anomaly and the resulting PDS failure (see §2.2.2). During the last year of operations the relative bias seems to be stable around a value of few mdeg, indeed the last disseminated LOS ADF was on March 2005.

Table 11 LOS calibration performed on July 2006.

Date	Orbit #	Relative bias [deg]	Absolute bias [deg]
15/7/2006	22862	0,007959	-0,022041
22/7/2006	22966	0,007423	-0,022577

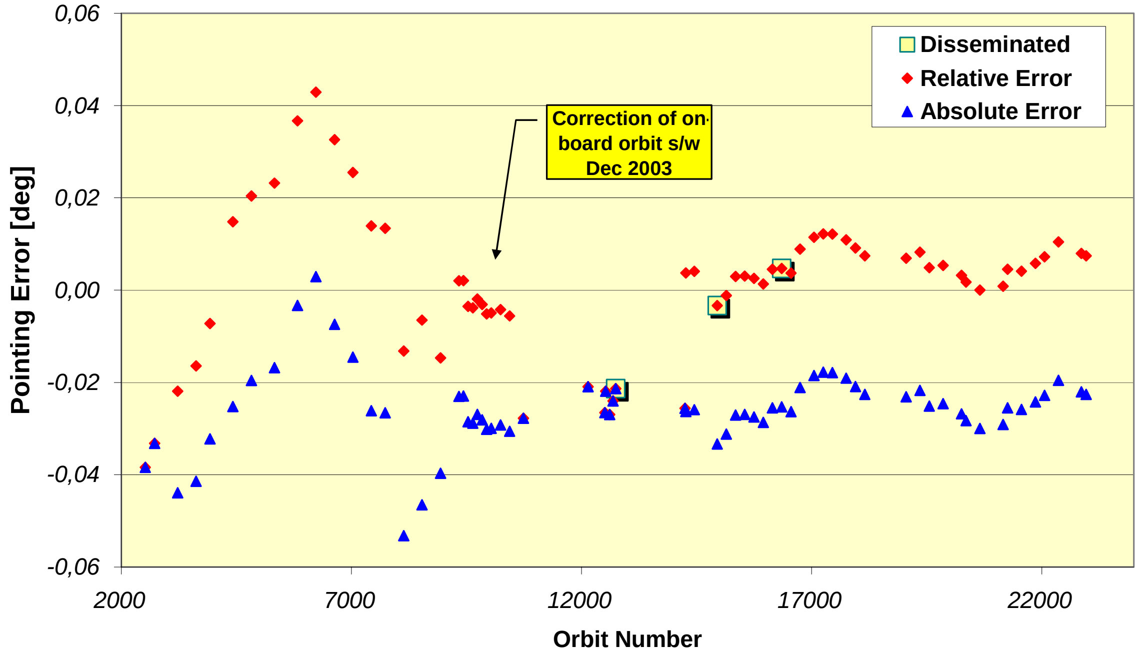


Figure 15 MIPAS long-term pointing error as a function of the orbit: September 2002- July 2006.

As can be seen in the figure above, there are points where the relative and absolute errors coincide because the angle for LOS measurements has been commanded to 0 mdeg. Tab. 12 shows the history of the commanded angle for LOS measurements.

Table 12 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. 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.

2.4.5 QUALITY CONTROL OF L1 OFL DATA

The quality control of L1 OFL data processed at D-PAC is going-on in parallel with the processing, the L1b daily report are uploaded on the web as soon as they are generated, they can be accessed at the following address:
http://earth.esa.int/pcs/envisat/mipas/reports/daily/Level_1_OFL/
These daily monitoring shows an overall good quality of the L1b processed data.
A long term monitoring of the fringe count errors (FCE) is going to be reported from now on in the MR. The number of fringe count represent the number of points for which the measurement IGM should be translated in order to match the reference IGM (the closest disseminated gains). This long term monitoring aims at the verification of the stability of this parameter over time; furthermore this analysis is useful in order to verify if any correlation exists with the INT performances degradation. The long term plot of FCE is presented in Fig. 17. In this plot the number of fringe count are plotted for each sweep (+ and – sign represent the forward/reverse measurement). No evident trend can be observed over more than one year of mission.

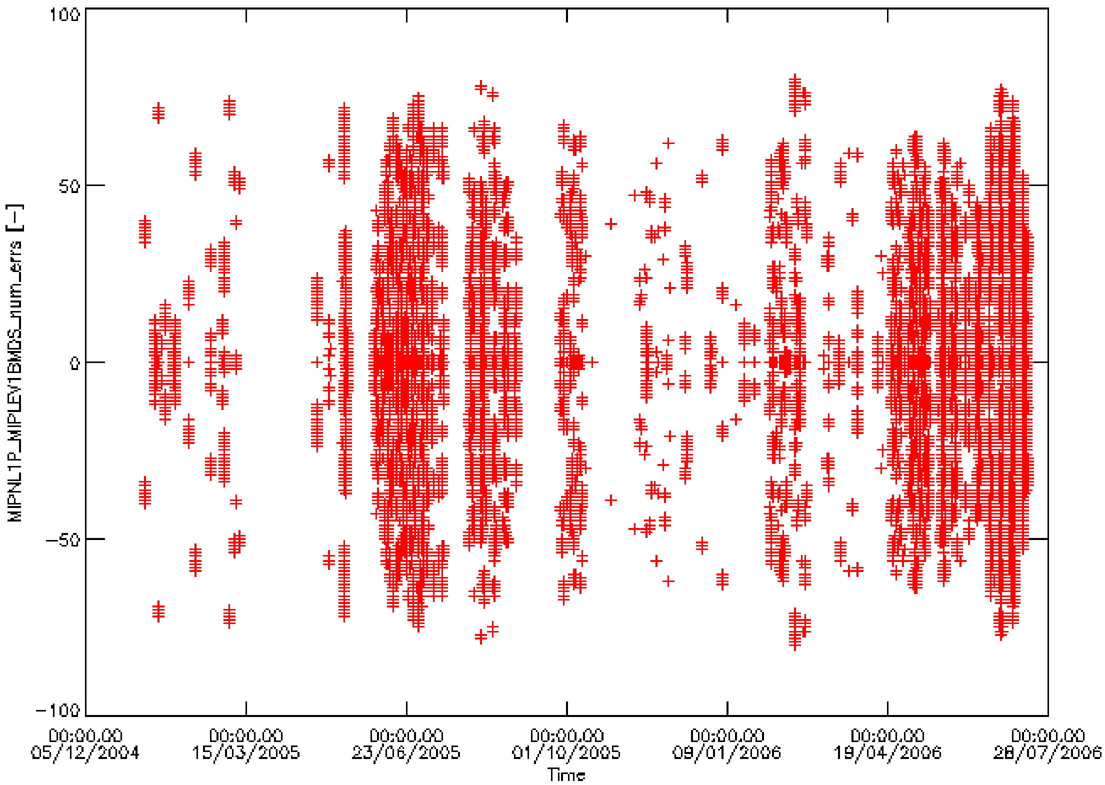


Figure 16 MIPAS long-term FCE values: January 2005 - July 2006.

2.4.6 LEVEL 0 AND LEVEL 1 ANOMALY STATUS

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

Table 13 Level 0 and Level 1 anomaly list. Refer to the appendices for further details on anomaly investigation.

Anomaly	Proto/DPM SPR	IPF NCR	OAR	HD	Status	Ref.
Number of sweeps per scan	128	/	/	HD/01-2005/1010	Closed	§3.6.1
MIPAS wrong consolidated products	/	/	2097	/	Closed	§3.6.2
Excessive number of MISSING ISPS in the MPH for MIPAS L0 products	/	/	2165	/	Closed and merged with OAR 342 (RA-2)	§3.6.3

Non-valid band A at the same geo-location	/	1594	2263	/	Closed To be corrected in IPF 4.67	§3.6.4
Wrong MIPAS L1 product in D-PAC server	/	/	2303	/	Closed and merged with OAR-2009, OAR-1845	§3.6.5
Badly calibrated L1 b spectra during 3 – 23 June and 29 July – 11 Aug 2005	/	/	/	/	Closed	§3.6.6
MIPAS Aircraft Emission measurements	/	/	/	/	Ongoing	§3.6.7

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 FR mission is the v3.8, whereas for the processing of RR data of Aug 2004 the latest delivery is the v5.2. The ADF version 5.2 was used for the L2 processing of RR not over-sampled data (Aug – Sept 2004).

Table 14. Historical update of Level 2 configuration ADFs.

Auxiliary Data File	Start Validity	Description
ADFs V5.2 MIP_CS2_AXVIEC20060105_121012_20040809_000000_20040917_220643 MIP_IG2_AXVIEC20060105_113531_20040901_000000_20040917_220643 MIP_IG2_AXVIEC20060105_114108_20040809_000000_20040901_000000 MIP_MW2_AXVIEC20060105_130642_20040809_000000_20040917_220643 MIP_OM2_AXVIEC20060105_130954_20040809_000000_20040917_220643 MIP_PI2_AXVIEC20060105_131141_20040809_000000_20040917_220643 MIP_PS2_AXVIEC20060105_131340_20040809_000000_20040917_220643 MIP_SP2_AXVIEC20060105_131744_20040809_000000_20040917_220643	9-AUG-04	Correction of a bug in the previous L2 ADF v5.1 MIP_IG2_AX, MIP_SP2_AX
ADFs V5.1 MIP_CS2_AXVIEC20050722_082136_20040809_000000_20040917_220643 MIP_IG2_AXVIEC20050721_130007_20040809_000000_20040901_000000 MIP_IG2_AXVIEC20050721_134702_20040901_000000_20040917_220643 MIP_MW2_AXVIEC20050721_144629_20040809_000000_20040917_220643 MIP_OM2_AXVIEC20050721_143058_20040809_000000_20040917_220643 MIP_PI2_AXVIEC20050721_142545_20040809_000000_20040917_220643 MIP_PS2_AXVIEC20050721_141630_20040809_000000_20040917_220643	9-AUG-04	For processing RR measurement with fixed altitude and old vertical sampling

MIP_SP2_AXVIEC20050721_140636_20040809_000000_20040917_220643		
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 QUALITY CONTROL OF L2 OFL DATA

A quality control of L2 RR OFL products was carried out at ESRIN, showing an overall good quality of the level 2 data. To see all the L2 OFL daily reports of RR mission follow the link below:
http://earth.esa.int/pcs/envisat/mipas/reports/daily/Level_2_OFL/
Looking at these daily reports we observe an overall good quality of L2 products. Only one major problem was found in the L2 RR data processed with IPF 4.65 for some orbits recorded during 21 – 22 Aug 2004. The investigation of this problem showed that a corruption in the band D was verified for these orbits. As reported by Astrium the processor flags as corrupted one sweep even though only one band is corrupted. This processor specification seems excessively restrictive and it should 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.

2.5.3 LEVEL 2 ANOMALY STATUS

The following table summarizes the anomalies affecting Level 2 products and shows the associated SPR, NCR, OAR and HD code.
No new anomalies were observed during the reporting period, more details on anomalies investigation are reported in ***Appendix I (§3.9)***.

Table 15 Level 2 anomaly list. Refer to the appendices for more information on the anomaly investigation.

Anomaly	Proto/DPM SPR	IPF NCR	OAR	HD	Status	Ref
Jump anomaly	/	/	/	HD/01-2005/1013	Closed	§3.9.1
Anomalous processing time	33	1127	1361	/	Closed	§3.9.2
Strange Impossible values	/	/	/	HD 2005003487	Closed	§3.9.3
NO2 retrieval during polar condition	/	/	/	/	Closed	§3.9.4
Excessive Chi-square	/	1458	1929	/	To be corrected in IPF 4.66	§3.9.5
Difference on L2 products between v4.61 and v4.62	/	1521	2074	/	To be corrected in IPF 4.66	§3.9.6
Beatcheck failure on some L2 products	/	1522	2081	HD 2005007448	To be corrected in IPF 4.66	§3.9.7

2.6 Processing/Re-processing Status

2.6.1 FIRST RE-PROCESSING OF FR MISSION

The first re-processing of the FR MIPAS mission was terminated at D-PAC using IPF software version 4.61, 4.62. All the received consolidated L0 products were processed to L1 and L2. The complete list of L1 and L2 re-processed products at D-PAC (with the corresponding IPF software version) was provided to the QWG and can be found on Uranus ftp server (MIPAS/To_QWG/ DPAC_L1_L2_archive.xls).

2.6.2 L1B PRODUCTS PROCESSED WITH PROTOTYPE

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

2.6.3 OFL PROCESSING OF RR MISSION

2.6.3.1 Level 1b

The Level 1 processing of RR mission has started at D-PAC the 9th of February 2006 with IPF 4.65. The status of the L1 processing updated at the 5th of June is reported in the following table. All these data are available on D-PAC ftp server.

Table 16 L1 OFL processing status.

Period	Status
Aug – Sept 2004	Completed
2005 data	Completed
2006 data	2006-01-01 → 2006-07-15

2.6.3.2 Level 2

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

Table 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

3 APPENDICES

3.1 Appendix A - Files transferred to the FOCC

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

MPL_LOS_MPVRGT20060609_115511_00000000_00000211_20060701_073756_20060702_102626.N1
MPL_LOS_MPVRGT20060609_123120_00000000_00000212_20060708_071758_20060709_100624.N1
MPL_CAL_MPVRGT20060609_120232_00000000_00000080_20060627_012041_20781231_235959.N1
MPL_ORS_MPVRGT20060609_131225_00000000_00000132_20060627_133542_20060706_140708.N1

<u>UTLS-1 mode starting in orbit #22602 at ANX=500 sec:</u>
CTI_E02_MPVRGT20060609_124900_00000000_00000109_20060627_012755_20781231_235959.N1
CTI_E01_MPVRGT20060609_124900_00000000_00000109_20060627_012758_20781231_235959.N1
CTI_AST_MPVRGT20060609_124900_00000000_00000109_20060627_012801_20781231_235959.N1
CTI_N02_MPVRGT20060609_124900_00000000_00000055_20060627_012804_20781231_235959.N1
CTI_S08_MPVRGT20060609_124900_00000000_00000028_20060627_012807_20781231_235959.N1
CTI_NOC_MPVRGT20060609_124900_00000000_00000109_20060627_012810_20781231_235959.N1

<u>NOM mode starting in orbit #22702 at ANX=500 sec:</u>
CTI_E02_MPVRGT20060609_130028_00000000_00000110_20060704_010748_20781231_235959.N1
CTI_E01_MPVRGT20060609_130028_00000000_00000110_20060704_010751_20781231_235959.N1
CTI_AST_MPVRGT20060609_130028_00000000_00000110_20060704_010754_20781231_235959.N1
CTI_N01_MPVRGT20060609_130028_00000000_00000055_20060704_010757_20781231_235959.N1
CTI_S02_MPVRGT20060609_130027_00000000_00000029_20060704_010800_20781231_235959.N1
CTI_NOC_MPVRGT20060609_130027_00000000_00000110_20060704_010803_20781231_235959.N1

AVI_UAV_TLVFOS20060620_145723_00000000_00000629_20060707_011939_20060708_071258.N1
AVI_UAV_TLVFOS20060620_145723_00000000_00000630_20060708_104240_20060712_001209.N1
AVI_UAV_TLVFOS20060620_145723_00000000_00000631_20060715_002754_20060715_065304.N1
MPL_CAL_MPVRGT20060619_141727_00000000_00000081_20060712_000849_20781231_235959.N1
MPL_LOS_MPVRGT20060619_101025_00000000_00000213_20060715_065803_20060716_094629.N1
MPL_ORS_MPVRGT20060619_095643_00000000_00000133_20060712_140427_20060714_145600.N1

<u>Nominal LOS observations:</u>
MPL_LOS_MPVRGT20060704_103217_00000000_00000214_20060722_132037_20060723_110700.N1
MPL_LOS_MPVRGT20060704_110626_00000000_00000215_20060729_144125_20060730_104401.N1
MPL_LOS_MPVRGT20060704_115203_00000000_00000216_20060805_142140_20060806_102400.N1
MPL_LOS_MPVRGT20060704_124002_00000000_00000217_20060812_135849_20060813_100411.N1
MPL_LOS_MPVRGT20060704_131103_00000000_00000218_20060819_133924_20060820_094431.N1

<u>IDU re-initialisation every orbit at ANX=5500 sec:</u>
MPL_CAL_MPVRGT20060704_095954_00000000_00000082_20060721_052752_20781231_235959.N1

<u>RGC calibration every 2nd descending track at ANX=4500 sec:</u>
MPL_ORS_MPVRGT20060704_110900_00000000_00000134_20060721_082328_20060728_081731.N1
MPL_ORS_MPVRGT20060704_114534_00000000_00000135_20060729_091219_20060805_090623.N1
MPL_ORS_MPVRGT20060704_123356_00000000_00000136_20060806_082035_20060813_081439.N1
MPL_ORS_MPVRGT20060704_130514_00000000_00000137_20060814_090927_20060821_090331.N1

UTLS-1 mode starting in orbit #22948 at ANX=5000sec:
CTI_E02_MPVRGT20060704_100554_00000000_00000111_20060721_065006_20781231_235959.N1
CTI_E01_MPVRGT20060704_100554_00000000_00000111_20060721_065009_20781231_235959.N1
CTI_AST_MPVRGT20060704_100555_00000000_00000111_20060721_065012_20781231_235959.N1
CTI_N02_MPVRGT20060704_100554_00000000_00000056_20060721_065015_20781231_235959.N1
CTI_S04_MPVRGT20060704_100554_00000000_00000028_20060721_065018_20781231_235959.N1
CTI_NOC_MPVRGT20060704_100554_00000000_00000111_20060721_065021_20781231_235959.N1

3.2 Appendix B – Level 1 IPF historical updates

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

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

3.3 Appendix C – Level 1 ADF historical updates

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

Version 6.1

MIP_PS1_AX

- OPD set to 8.2 cm
- Spike detection standard deviation threshold set to 10
- Spike detection number of points per block set to 256
- Set standard deviation threshold to 5 for Scene measurement quality

Version 6.0

MIP_PS1_AX

- OPD set to 20 cm
- Spike detection standard deviation threshold set to 10
- Spike detection number of points per block set to 256
- Set standard deviation threshold to 5 for Scene measurement quality

Version 5.0 draft

MIP_PS1_AX

- OPD set to 10 cm
- Channel A set to 5701 points
- Channel AB set to 3001 points
- Channel B set to 5701 points
- Channel C set to 3601 points
- Channel D set to 11801 points
- Set standard deviation threshold to 5 for Scene measurement quality

Version 4.1 (TDS 6)

MIP_PS1_AX

- OPD set to 8.2 cm
- Channel A set to 4561 points
- Channel AB set to 2401 points
- Channel B set to 4561 points
- Channel C set to 2881 points
- Channel D set to 9441 points
- Number of co-additions for ILS retrieval was set to 5
- Set standard deviation threshold to 5 for Scene measurement quality

Version 4.0 draft

MIP_PS1_AX

- OPD set to 8.2 cm
- Channel A set to 4561 points
- Channel AB set to 2401 points
- Channel B set to 4561 points
- Channel C set to 2881 points

- Channel D set to 9441 points
- Number of co-additions for ILS retrieval was set to 5

Version 3.2

MIP_PS1_AX

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

Version 3.1

MIP_PS1_AX

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

Version 3.0

MIP_CA1_AX

- Modify non-linearity coefficients for reverse sweep. Coefficients for forward are kept as is
- Neutral equalization filter for band A

MIP_MW1_AX

- Removal of band D microwindow D_H20b at 1870.8049 cm-1
- Set spectral calibration microwindow altitude to 32 km

MIP_PS1_AX

- Number of co-additions for spectral calibration was set to 4
- Number of co-additions for ILS retrieval was set to 10

When one ADF is modified the three AUX file are disseminated with the same START/STOP time and this correspond to a new level 1 ADF delivery, this prevents confusion.

3.4 Appendix D – Interpolated gains

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

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

Gain_i: Interpolated Gain vector
G1: 1st Gain Calibration vector
G2: 2nd Gain Calibration vector
Factor: Interpolation factor (0 < range < 1)

For the interpolated gain calibration files, the "SENSING_START" and "SENSING_STOP" fields are set according to the interpolation factors. For example, an interpolation factor of 0.33 applied to two existing gains (acquired 8 days apart), will fix the interpolated gain "SENSING_START" to 8 * 0.33 = 2.6 days later than the 1st gain "SENSING_START". The sensing stop is set to the end of the mission: "SENSING_STOP" = "SENSING_START" + 5 years.
The complete list of the new interpolated gains MIP_CG1__AX files provided by Bomem and disseminated via IECF is reported in the table below. These 45 MIP_CG1__AX files were used for the reprocessing of the 2005 RR MIPAS mission.

Table 18 List of the gain files to be used during the period of enhanced gain increase of Jan – May 2005, the gain files already disseminated are highlighted in green, while the newly generated gains are in orange.

ADF file name	**Type (* - interpolated gains)**
MIP_CG1_AXVIEC20050309_081858_20050108_000000_20090108_000000	Gain calibration (CG_0)
MIP_CG1_AXVIEC20051115_085521_20050118_120000_20100118_120000	Gain (CG_0_a) *
MIP_CG1_AXVIEC20050310_091646_20050116_000000_20090116_000000	Gain calibration (CG_1)
MIP_CG1_AXVIEC20051115_085521_20050118_120000_20100118_120000	Gain (CG_1_a) *
MIP_CG1_AXVIEC20050311_085855_20050121_000000_20090121_000000	Gain calibration (CG_2)
MIP_CG1_AXVIEC20051115_090016_20050124_120000_20100124_120000	Gain (CG_2_a) *
MIP_CG1_AXVIEC20050314_154134_20050128_000000_20090128_000000	Gain calibration (CG_3)
MIP_CG1_AXVIEC20051115_090529_20050130_150000_20100130_150000	Gain (CG_3_a) *
MIP_CG1_AXVIEC20051115_091036_20050202_080000_20100202_080000	Gain (CG_3_b) *
MIP_CG1_AXVIEC20050315_131822_20050205_000000_20090205_000000	Gain calibration (CG_4)
MIP_CG1_AXVIEC20051115_101639_20050209_120000_20100209_120000	Gain (CG_4_a) *
MIP_CG1_AXVIEC20050316_081309_20050214_000000_20090214_000000	Gain calibration (CG_5)
MIP_CG1_AXVIEC20051115_102136_20050217_000000_20100217_000000	Gain (CG_5_a) *
MIP_CG1_AXVIEC20051115_102701_20050220_000000_20100220_000000	Gain (CG_5_b) *
MIP_CG1_AXVIEC20051115_103156_20050223_000000_20100223_000000	Gain (CG_5_c) *
MIP_CG1_AXVIEC20051115_103702_20050226_000000_20100226_000000	Gain (CG_5_d) *
MIP_CG1_AXVIEC20050405_145110_20050301_000000_20090301_000000	Gain calibration (CG_6)
MIP_CG1_AXVIEC20051115_104209_20050303_150000_20100303_150000	Gain (CG_6_a) *

MIP_CG1_AXVIEC20051115_104705_20050306_080000_20100306_080000	Gain (CG_6_b) *
MIP_CG1_AXVIEC20050406_070802_20050309_000000_20090309_000000	Gain calibration (CG_7)
MIP_CG1_AXVIEC20051115_105212_20050311_000000_20100311_000000	Gain (CG_7_a) *
MIP_CG1_AXVIEC20050407_072135_20050314_000000_20090313_000000	Gain calibration (CG_8)
MIP_CG1_AXVIEC20051115_105723_20050315_000000_20100315_000000	Gain (CG_8_a) *
MIP_CG1_AXVIEC20051115_110250_20050316_115754_20100316_000000	Gain (CG_8_b) *
MIP_CG1_AXVIEC20051115_122231_20050319_000000_20100319_000000	Gain (CG_8_c) *
MIP_CG1_AXVIEC20050407_143713_20050321_000000_20090321_000000	Gain calibration (CG_9)
MIP_CG1_AXVIEC20051115_122732_20050323_070000_20100323_070000	Gain (CG_9_a) *
MIP_CG1_AXVIEC20051115_123244_20050325_160000_20100325_160000	Gain (CG_9_b) *
MIP_CG1_AXVIEC20050411_123723_20050328_000000_20090328_000000	Gain calibration (CG_10)
MIP_CG1_AXVIEC20051115_123754_20050330_070000_20100330_070000	Gain (CG_10_a) *
MIP_CG1_AXVIEC20051115_124300_20050401_160000_20100401_160000	Gain (CG_10_b) *
MIP_CG1_AXVIEC20050412_072926_20050404_000000_20090404_000000	Gain calibration (CG_11)
MIP_CG1_AXVIEC20051115_124808_20050406_000000_20100406_000000	Gain (CG_11_a) *
MIP_CG1_AXVIEC20051115_125321_20050408_000000_20100408_000000	Gain (CG_11_b) *
MIP_CG1_AXVIEC20051115_125829_20050410_000000_20100410_000000	Gain (CG_11_c) *
MIP_CG1_AXVIEC20050415_073538_20050412_231018_20100412_231018	Gain calibration (CG_12)
MIP_CG1_AXVIEC20051115_130340_20050414_000000_20100414_000000	Gain (CG_12_a) *
MIP_CG1_AXVIEC20051115_130903_20050416_000000_20100416_000000	Gain (CG_12_b) *
MIP_CG1_AXVIEC20051115_131404_20050418_000000_20100418_000000	Gain (CG_12_c) *
MIP_CG1_AXVIEC20050421_065554_20050420_133450_20100420_133450	Gain calibration (CG_13)
MIP_CG1_AXVIEC20051115_131917_20050421_120000_20100421_120000	Gain (CG_13_a) *
MIP_CG1_AXVIEC20051115_132409_20050423_000000_20100423_000000	Gain (CG_13_b) *
MIP_CG1_AXVIEC20051115_132925_20050424_120000_20100424_120000	Gain (CG_13_c) *
MIP_CG1_AXVIEC20050427_150526_20050426_225532_20100426_225532	Gain calibration (CG_14)
MIP_CG1_AXVIEC20051115_133432_20050427_160000_20100427_160000	Gain (CG_14_a) *
MIP_CG1_AXVIEC20051115_133942_20050429_070000_20100429_070000	Gain (CG_14_b) *
MIP_CG1_AXVIEC20051115_134453_20050501_000000_20100501_000000	Gain (CG_14_c) *
MIP_CG1_AXVIEC20051115_134947_20050502_160000_20100502_160000	Gain (CG_14_d) *
MIP_CG1_AXVIEC20051115_135453_20050504_070000_20100504_070000	Gain (CG_14_e) *
MIP_CG1_AXVIEC20050509_150546_20050506_153444_20100506_153444	Gain calibration (CG_15)
MIP_CG1_AXVIEC20051115_154052_20050507_030000_20100507_030000	Gain (CG_15_a) *
MIP_CG1_AXVIEC20051115_151144_20050508_060000_20100508_060000	Gain (CG_15_b) *
MIP_CG1_AXVIEC20051115_151255_20050509_090000_20100509_090000	Gain (CG_15_c) *
MIP_CG1_AXVIEC20051115_151358_20050510_120000_20100510_120000	Gain (CG_15_d) *
MIP_CG1_AXVIEC20051115_151458_20050511_150000_20100511_150000	Gain (CG_15_e) *
MIP_CG1_AXVIEC20051115_151558_20050512_180000_20100512_180000	Gain (CG_15_f) *
MIP_CG1_AXVIEC20051115_151702_20050513_210000_20100513_210000	Gain (CG_15_g) *
MIP_CG1_AXVIEC20050523_090017_20050515_000000_20090515_000000	Gain calibration (CG_16)
MIP_CG1_AXVIEC20051115_150616_20050516_090000_20100516_090000	Gain (CG_16_a) *
MIP_CG1_AXVIEC20051115_150747_20050517_190000_20100517_190000	Gain (CG_16_b) *
MIP_CG1_AXVIEC20051115_150831_20050519_040000_20100519_040000	Gain (CG_16_c) *
MIP_CG1_AXVIEC20051115_150940_20050520_140000_20100520_140000	Gain (CG_16_d) *
MIP_CG1_AXVIEC20050524_081749_20050522_000000_20090522_000000	Gain calibration (CG_17)

3.5 Appendix E – Level 1b products generated with prototype

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

AE ascending

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

AE descending

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

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

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

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

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

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

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

MA
MIP_NL__1PPLRA20050111_014126_000060332033_00404_14987_0765.N1

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

UA
MIP_NL__1PPLRA20050121_113027_000060312034_00052_15136_0855.N1

UTLS-2
MIP_NL__1PPLRA20050123_120742_000060732034_00081_15165_0874.N1

Nominal Measurements (RR, 27 sweeps per scan) with fixed altitude
MIP_NL__1PPLRA20050128_125114_000060542034_00153_15237_0908.N1
MIP_NL__1PPLRA20050128_143210_000060212034_00154_15238_0909.N1
MIP_NL__1PPLRA20050128_161233_000060212034_00155_15239_0910.N1

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

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

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

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

AE_Canada_US_d:
MIP_NL__1PNPDK20050505_122836_000000542037_00038_16625_1245.N1
MIP_NL__1PNPDK20050505_123002_000000632037_00038_16625_1261.N1
MIP_NL__1PNPDK20050505_123103_000000332037_00038_16625_1253.N1
MIP_NL__1PNPDK20050505_123134_000000332037_00038_16625_1251.N1
MIP_NL__1PNPDK20050505_123206_000000332037_00038_16625_1256.N1
MIP_NL__1PNPDK20050505_123237_000000332037_00038_16625_1262.N1
MIP_NL__1PNPDK20050505_123308_000000332037_00038_16625_1264.N1
MIP_NL__1PNPDK20050505_123340_000000332037_00038_16625_1252.N1
MIP_NL__1PNPDK20050505_123411_000000332037_00038_16625_1258.N1
MIP_NL__1PNPDK20050505_123443_000000332037_00038_16625_1257.N1
MIP_NL__1PNPDK20050505_123514_000000332037_00038_16625_1263.N1
MIP_NL__1PNPDK20050505_123545_000000332037_00038_16625_1259.N1
MIP_NL__1PNPDK20050505_123617_000000332037_00038_16625_1246.N1
MIP_NL__1PNPDK20050505_123648_000000332037_00038_16625_1247.N1
MIP_NL__1PNPDK20050505_123720_000000332037_00038_16625_1248.N1
MIP_NL__1PNPDK20050505_123751_000000332037_00038_16625_1250.N1
MIP_NL__1PNPDK20050505_123822_000000332037_00038_16625_1260.N1
MIP_NL__1PNPDK20050505_123854_000000332037_00038_16625_1254.N1
MIP_NL__1PNPDK20050505_123925_000000332037_00038_16625_1249.N1
MIP_NL__1PNPDK20050505_123957_000000352037_00038_16625_1255.N1

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

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

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

3.6 Appendix F – Level 0 and Level 1 anomaly status

3.6.1 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.

3.6.2 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).

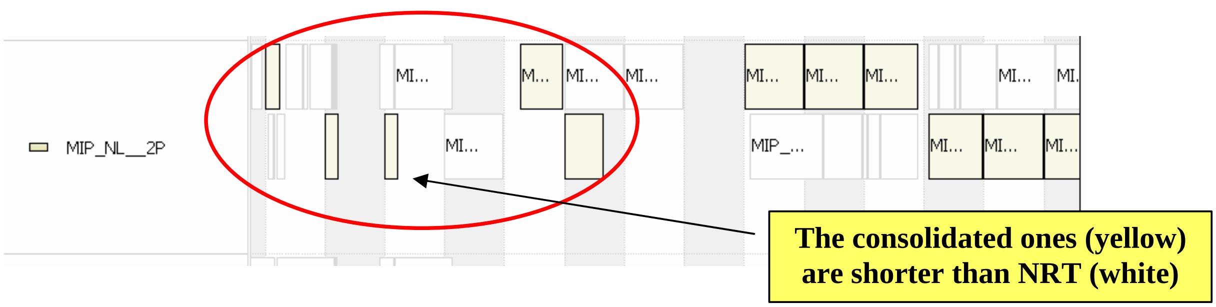


Figure 17 GANNT chart showing the anomaly in the consolidation of L2 "O" products.

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.

3.6.3 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.

3.6.4 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.

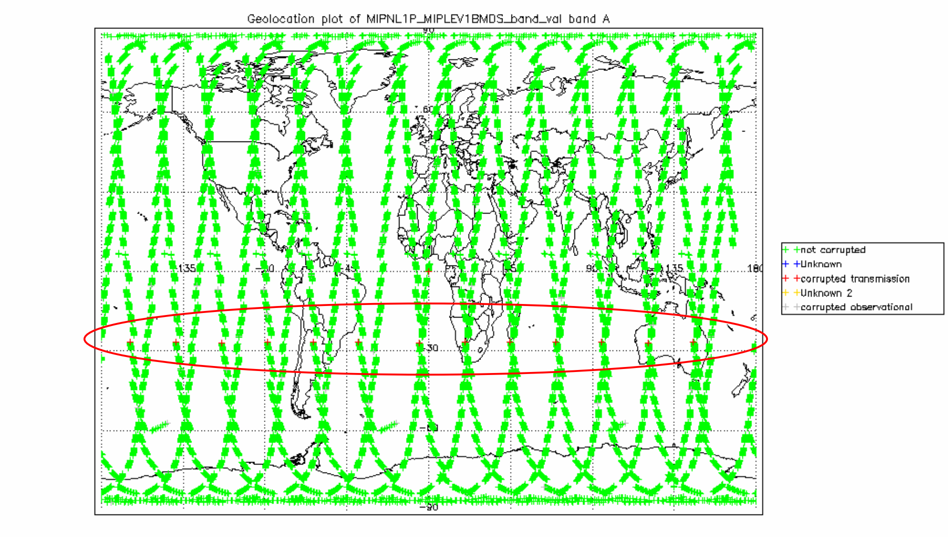


Figure 18 Corrupted sweeps are observed always at the same geo-location for these OFL L2 products of 10 March 2004 processed at D-PAC.

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).

3.6.5 WRONG MIPAS L1 PRODUCT IN D-PAC SERVER

One L1 product in D-PAC ftp server is corrupted (see red crosses in the figure below), 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

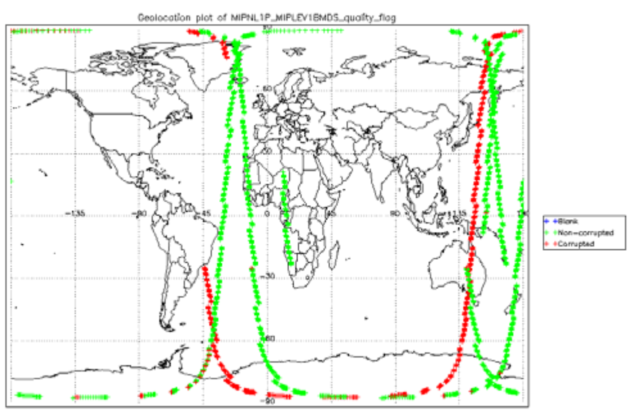


Figure 19 L1b PCD quality flag, corrupted sweep detected for 3 Oct 2005 L1b spectra

3.6.6 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 figure below).

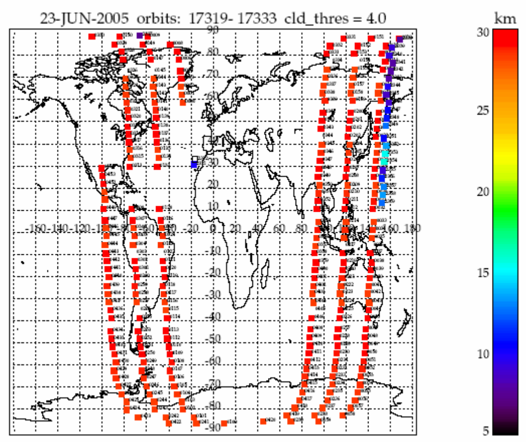


Figure 20 Cloud top height calculated by M. Hopfner (IMK) for 23 June 2005, the red points are due probably to a corruption in the band A spectrum.

The problem was also detected with the quality monitoring tool in ESRIN; in fact looking at the NESR level of 23 June 2005 we can see excessively high value (see red lines in the figure below). 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.

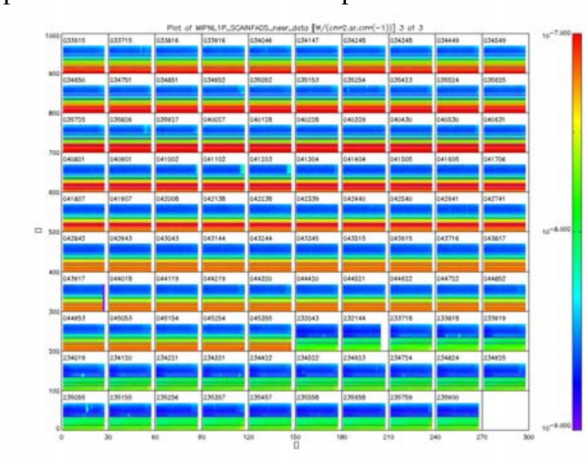


Figure 21 NESR level for different scan during 23 June 2005, each square is a scan made of 27 sweeps in nominal mode, the red lines show the anomaly of excessive high NESR, the anomaly stops when the correct ADF start to be used by the processor.

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

Table 19 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 20 List of new ADFs generated for repairing the anomaly.

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

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

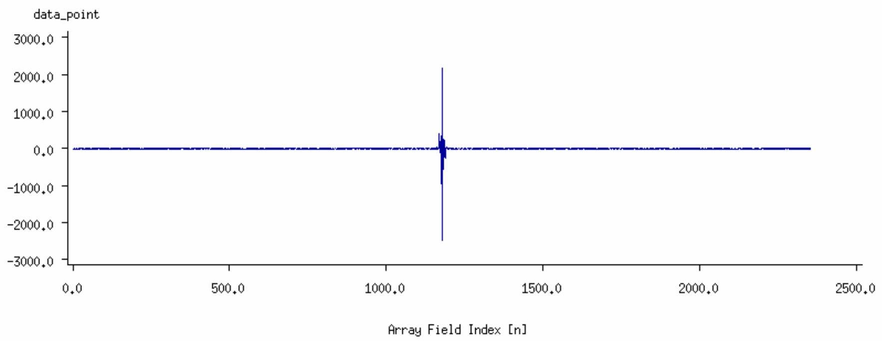


Figure 22 IGM recorded in the deep space measurement and stored in the wrong ADF.

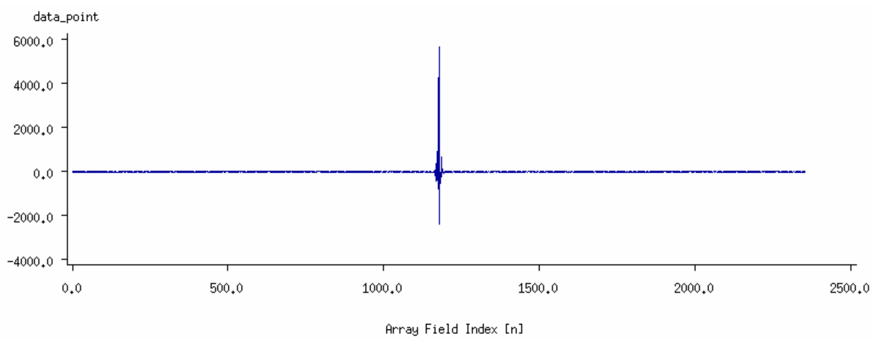


Figure 23 IGM recorded in the deep space measurement and stored in the new correct ADF.

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. 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.

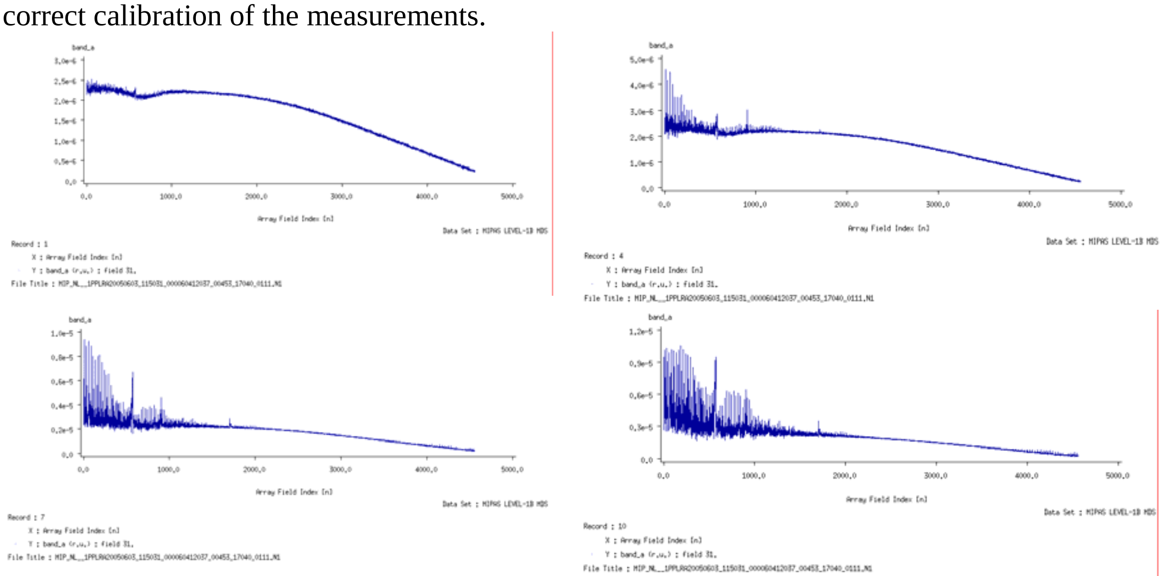
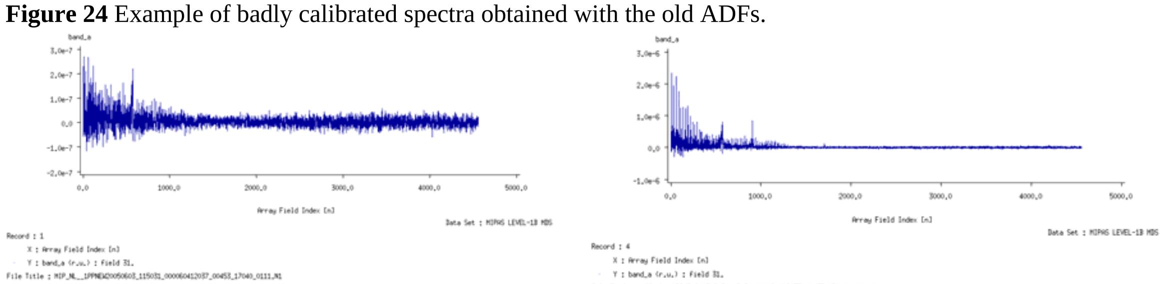


Figure 24 Example of badly calibrated spectra obtained with the old ADFs.



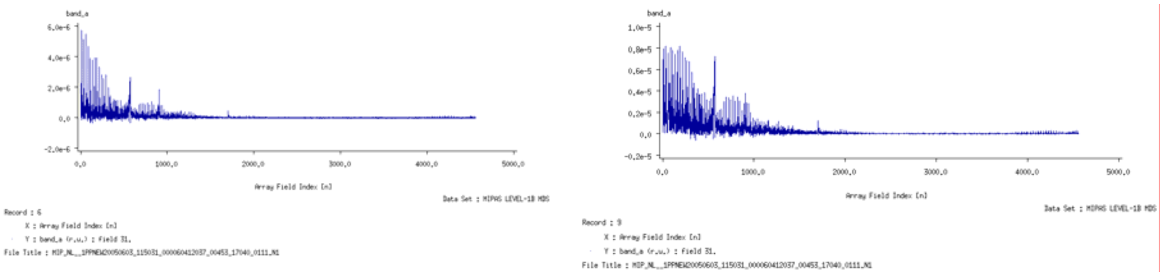


Figure 25 Example of correctly calibrated spectra obtained with the new ADFs.

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

3.6.7 MIPAS AIRCRAFT EMISSION MEASUREMENTS

Looking at the AE L1B file taken on 5/6 May 2005 (processed with MIGSP), the tangent altitudes seem to be approximately 2km below the 7-38 km range specified in Mission_Plan_V4.1.pdf dated 3 May 2005.
Bomem check these L1B products and the problem does not seem to be due to processing (MIGSP 2.5). The problem was found to be due to the commanding, in particular to the software (SEM mode algorithm) used for the AE measurements. The software was designed only for localized SEM measurements, such as volcano eruptions. The use of this algorithm over a wide area around the globe (such is the case of AE measurements) can lead to very important deviations owing to the earth ellipsoid. This is the cause of the deviation between the planned and measured tangent altitude for these AE measurements. In this sense the planning anomaly is closed, nevertheless Anu Dudhia reported at the QWG#8 a further anomaly affecting these products. This consists of a difference of almost 3 km between the retrieved and engineering altitude. This anomaly is not related to the planning and the investigation is ongoing in collaboration with BOMEM and OU.

3.7 Appendix G – Level 2 IPF historical updates

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

- **Version V4.65** (aligned with DPM 4.1 and ADFs V5.1, under validation) introduces modifications only for the Level 2 processor, with the following update:
  - Solution of NCR_1310: Problem with MIP_NL__2P
- **Version V4.64** no update for the Level 2 processor in this version
- **Version V4.63** (aligned with DPM 4.1 and ADFs V5.1) has introduced the following modifications:
  - Processing of reduced resolution measurements in old configuration (17 sweeps per scan and fixed altitude – August/September 2004 measurements).
  - Solution of NCR_1278: Some MIPAS profiles have zero pressure
  - Solution of NCR_1308: MIPAS Level 2 failure.
  - Rejection of NCR_1310: Problem with MIPNL__2P
  - Rejection of NCR_1317: One second discrepancy in IPF 4.61
- **Version V4.62** (aligned with DPM 4.0) has solved the following problems:
  - Fixed NCR_1128: Cloud-detection anomaly.
  - Fixed NCR_1275: Inconsistent values in MIPAS files.
  - Fixed NCR_1276: Level2 profile counting bug.
- **Version V4.60, V4.61** has solved the following problems:
  - Fixed NCR_992: Inconsistency in number of profiles in MIPAS Level_2.
  - Fixed NCR_1068: Number of computed residual spectra not consistent with the number of observations.
- **Version V4.59**, operational since 23 July 2003, has introduced only Level 2 processing modifications. The main improvements introduced via both the processor V4.59 and the installation of a new set of ADFs have been:
  - Fixed NCR_892: Inconsistency in number of scans.
  - Fixed NCR_893: Different values for same scans.
  - The cloud filtering (that is, every time a cloud is detected at a given altitude, the retrieval is performed only above that altitude)
  - The removal of the gaps between the altitude validity ranges (allowing retrievals in the Antarctic region not feasible with the old MIP_MW2_AX)
  - Altitudes margins fixed to +/- 4 km
  - MIPAS-SPR-MAINT-0011 Wrong DSD name in L2 product in case of not requested VMR
  - MIPAS-SPR-MAINT-0012 Filling of SPH field 22 of MIPAS Level 2 ProductsMIPAS-SPR-MAINT-0013 Filling of the MIPAS MPH and MIPAS Level 2 SPH fields
  - MIPAS-SPR-MAINT-0014 Wrong writing of PCD String to the PCD Information ADS
  - MIPAS-SPR-MAINT-0015 Too strong test and skipping retrieval
  - MIPAS-SPR-MAINT-0016 Not initialised nucl1 and nucl2 in R 8.5.6.3-7A
  - ENVI-GSOP-EOAD-NC-03-0539 MIPAS L2 processing aborted

3.8 Appendix H – Level 2 ADF historical updates

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

Table 21 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.

3.9 Appendix I – Level 2 anomaly status

3.9.1 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.

3.9.2 ANOMALOUS PROCESSING TIME

An anomalous processing time characterizes 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.

3.9.3 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.

3.9.4 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).

3.9.5 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.

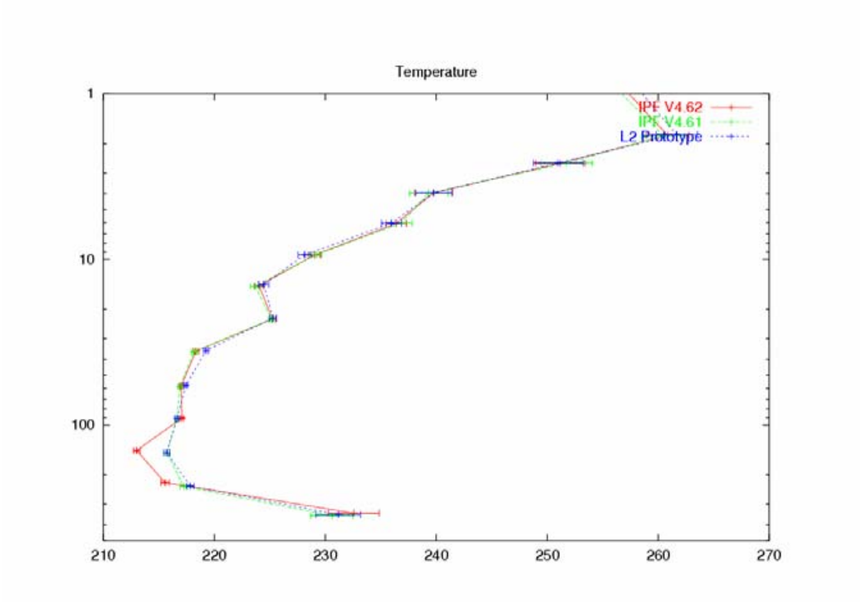


Figure 26 Temperature profiles as a function of pressure retrieved with IPF 4.62 and 4.61 compared to the prototype for seq. 16 of orbit 2975. The 4.61 profile is the reference, validated by a IMK balloon flight.

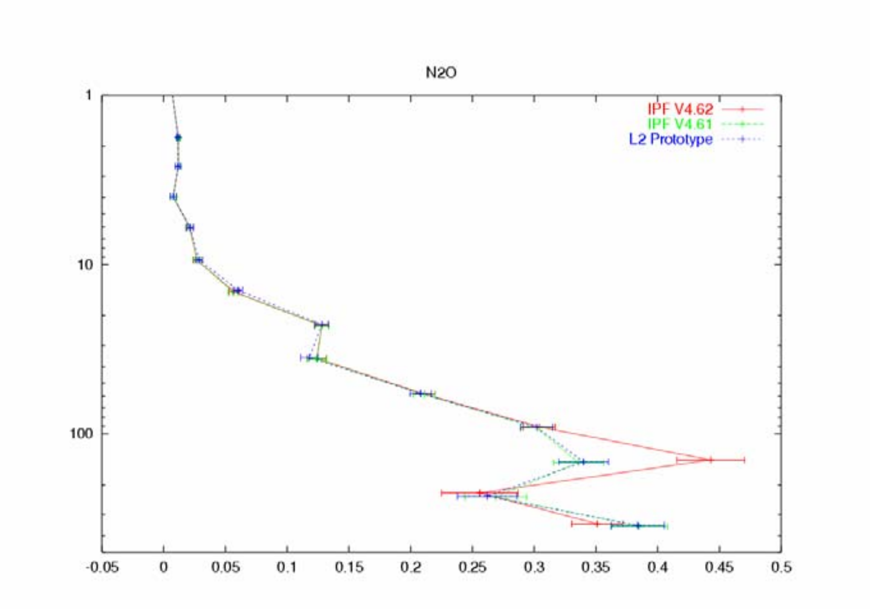


Figure 27 N2O profiles 8ppmV) as a function of pressure retrieved with IPF 4.62 and 4.61 compared to the prototype for seq. 16 of orbit 2975. The 4.61 profile is the reference, validated by a IMK balloon flight.

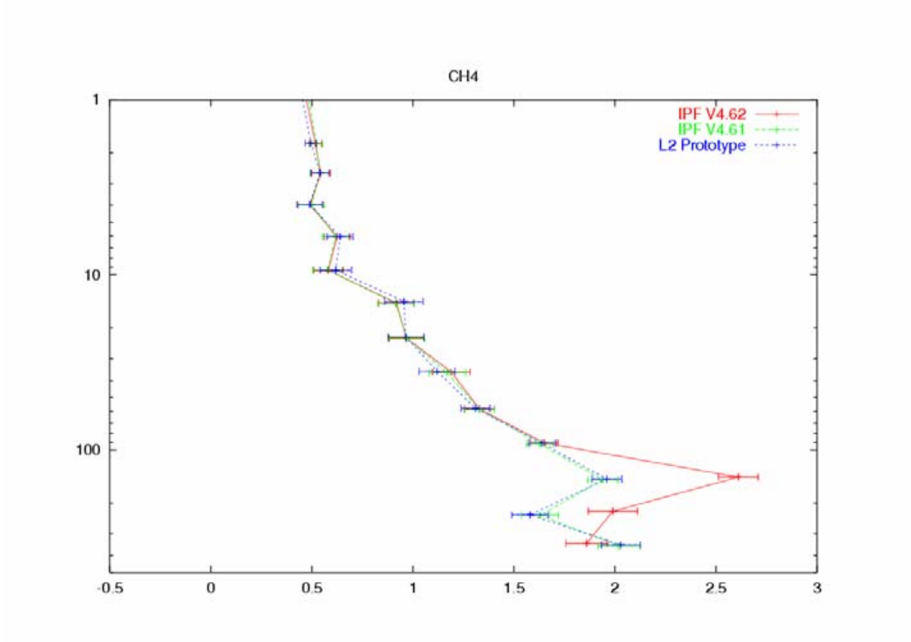


Figure 28 CH4 profiles 8ppmV) as a function of pressure retrieved with IPF 4.62 and 4.61 compared to the prototype for seq. 16 of orbit 2975. The 4.61 profile is the reference, validated by a IMK balloon flight.

3.9.6 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).

3.9.7 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).

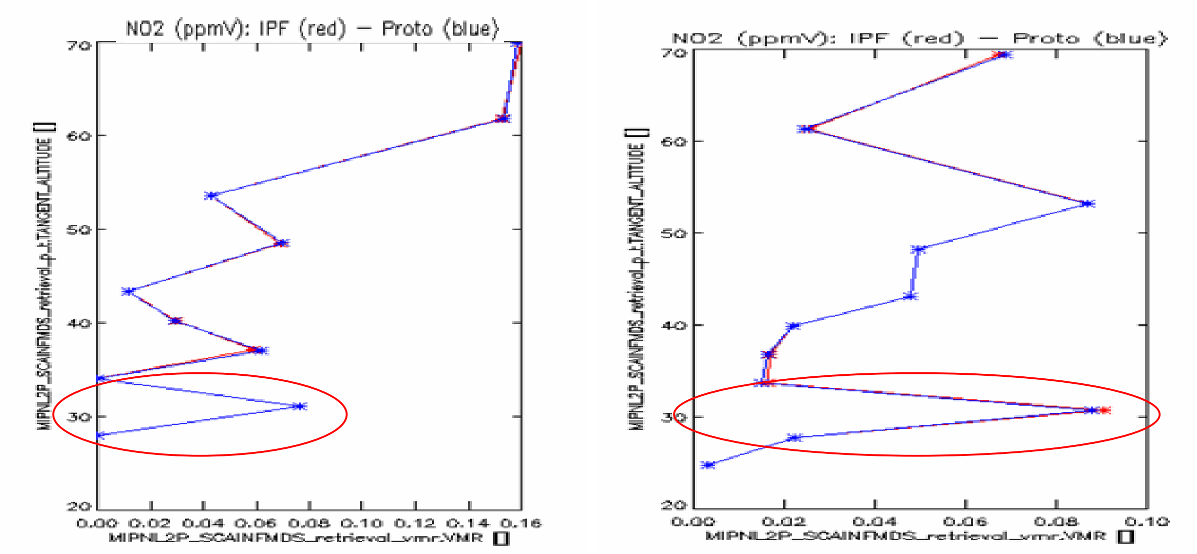


Figure 29 NO2 profiles obtained with the IPF and prototype for two particular scan of 6 June 2003 in Antarctic winter condition, highlighted in red are the region around 30 km with sudden increase of NO2 value, which has no physical meaning. Note the degraded profile shape, namely the zigzag and the 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.