

The extension of the ENVISAT Atmospheric-Chemistry missions beyond 2010: status and perspectives

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ENVISAT extension beyond 2010

On October 2010, on the basis of the high demand for long term series of geophysical parameters combined with the overall excellent status of the satellite, ENVISAT operational lifetime was further extended. ENVISAT was moved to a new orbit and a new mission phase (E3) was initiated, allowing to operate all payloads up to mid 2014, far beyond the nominal lifetime originally set to five years (from 2002 until 2007).

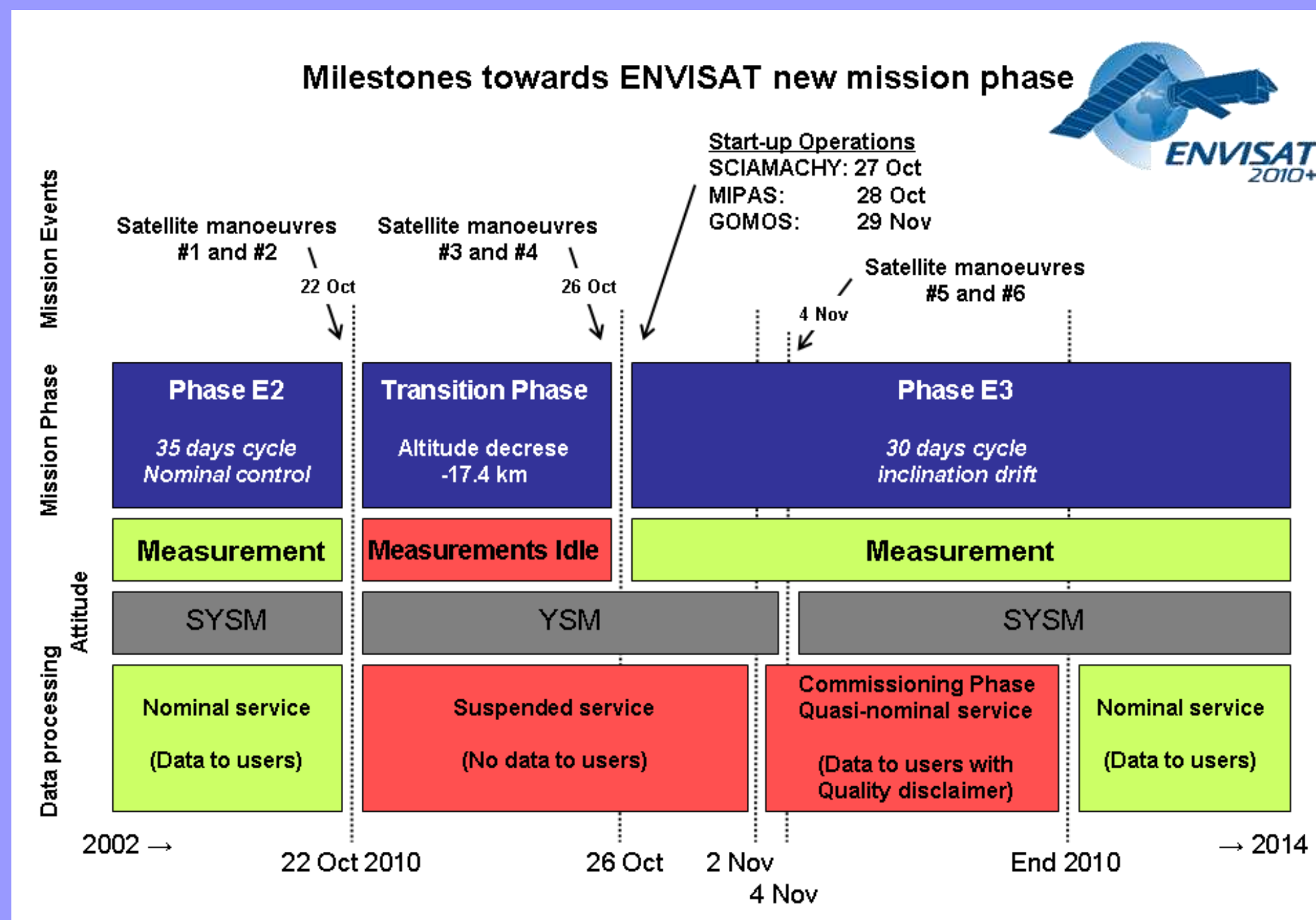
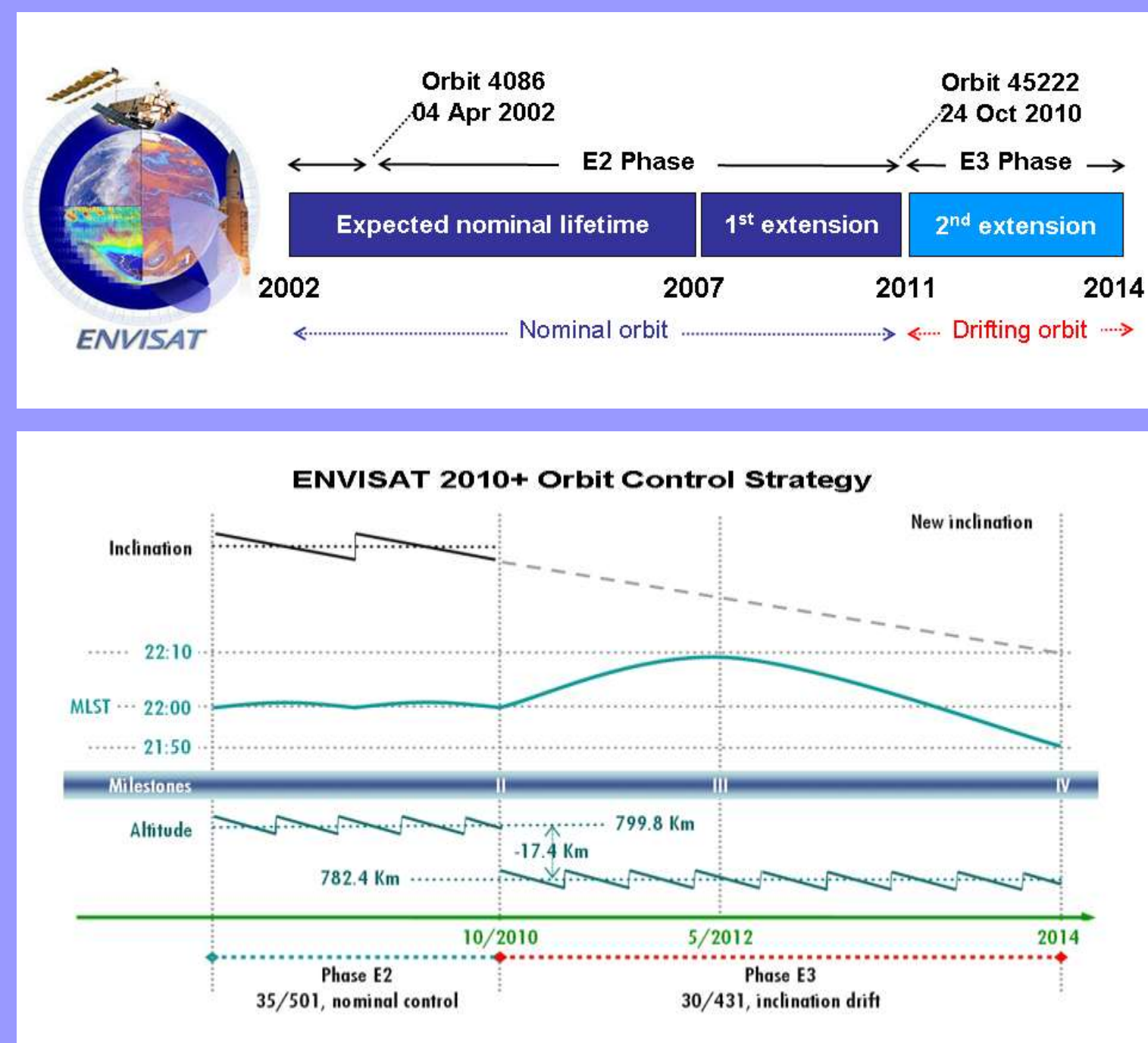
Key strategy to minimize fuel consumption was interrupting the orbital inclination control manoeuvres inducing a drifting Mean Local Solar Time (MLST) varying in the +/- 10 min range from the initial +/- 5 min range.

The extension orbit is characterized by an altitude decrease of 17.4 km and by a different repeating cycle (from 35/501 to 30/431 days/orbits).

ENVISAT new orbit represents the start of a "new" extension phase for all payloads owing to the number of changes involved.

A re-characterization of each subsystem (Mini-Commissioning Phase) was carried out to assess instrument performances and data quality.

The three ENVISAT Atmospheric-Chemistry sensors restarted gradually operations and are fully operational in the new mission phase.



Mission status

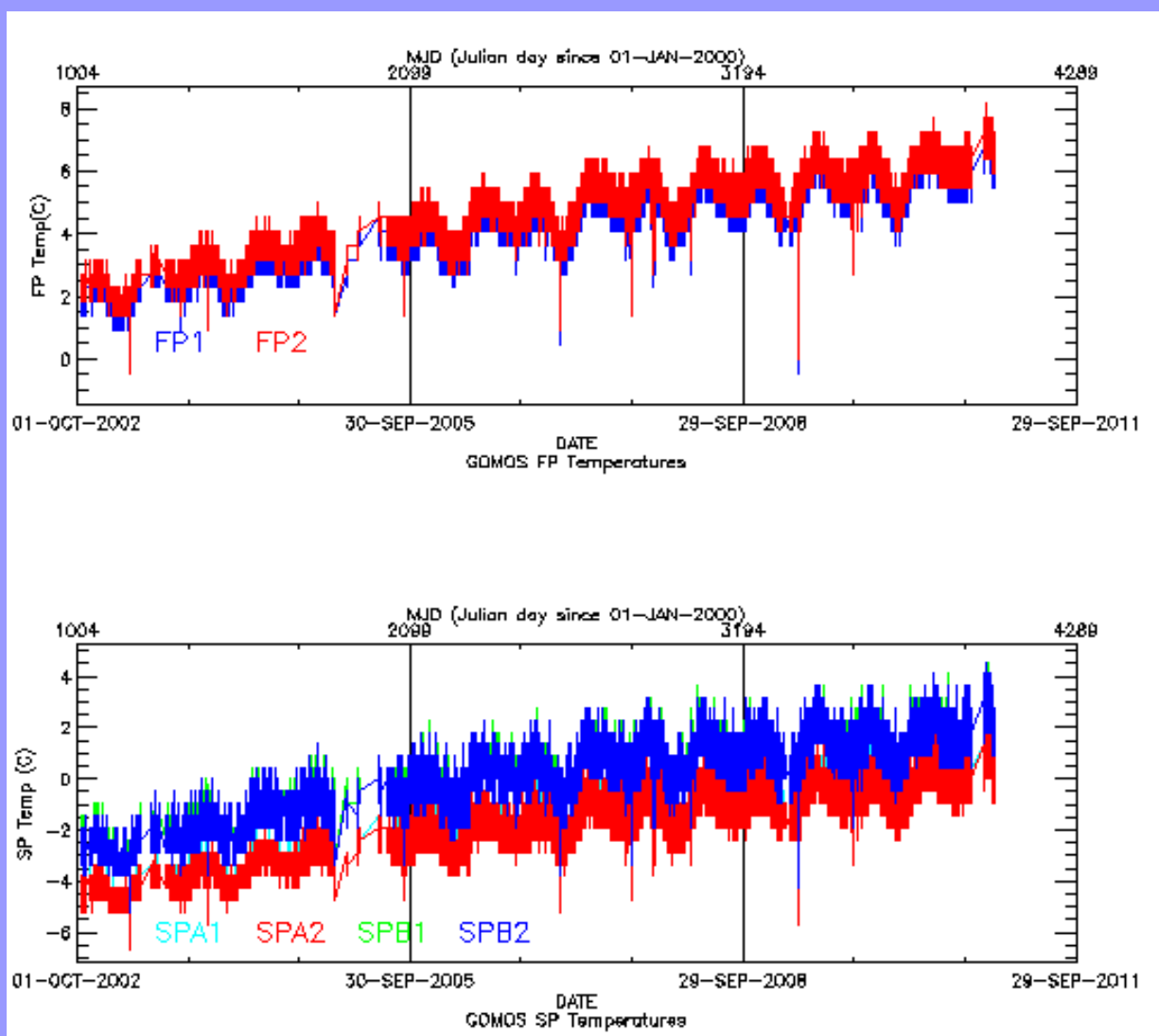
- ENVISAT orbit change project has been successful.
- The intensive checks run by many different teams have demonstrated nominal behavior of all instruments
- The orbit change has not revealed any significant impact on operations and data processing. Performances are of the same level as before the orbit lowering.
- No showstoppers found to the continuation of mission lifetime until the expected ENVISAT end-of-life.
- MIPAS, GOMOS and SCIA will continue providing the scientific community with invaluable data for the next 3 years.
- Limb data from 27 Oct to 02 Nov should be considered with caution due to degraded pointing accuracy.

GOMOS

	Anomaly	Period	Corrective action	Impact on the data
Instrument planning	Transient: Planning Tool unavailability	21/10/2010 – 29/11/2010	Bug fixing	Missing measurements between orbit 45189 and 45740

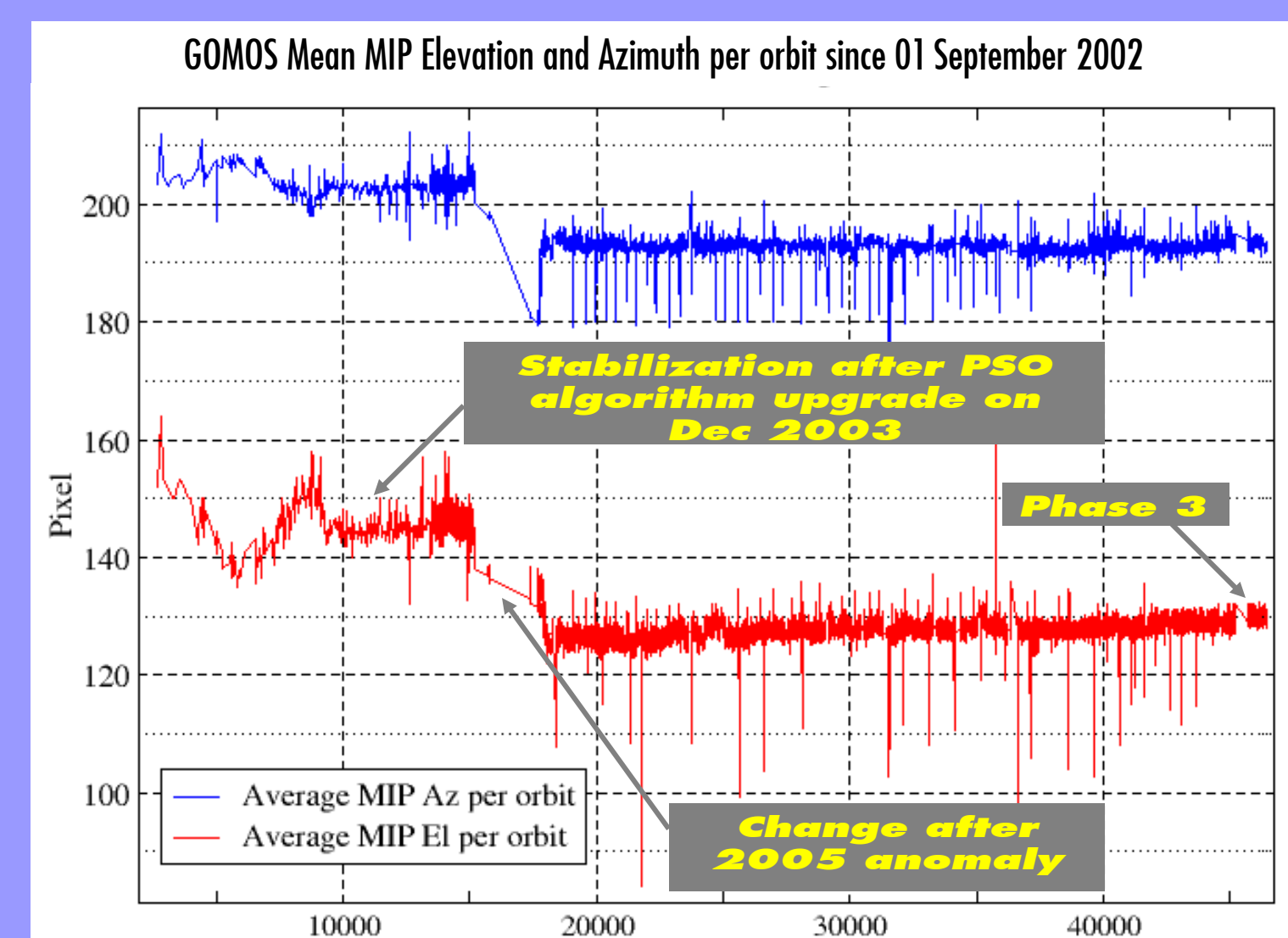
Thermal performance

CCD temperatures show no changed trend after the orbit lowering. The global increase is due to the expected radiator ageing.



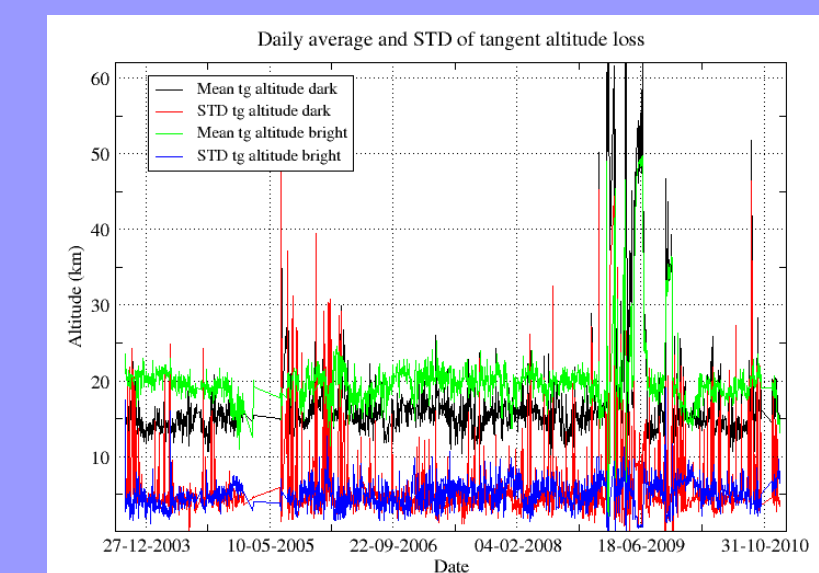
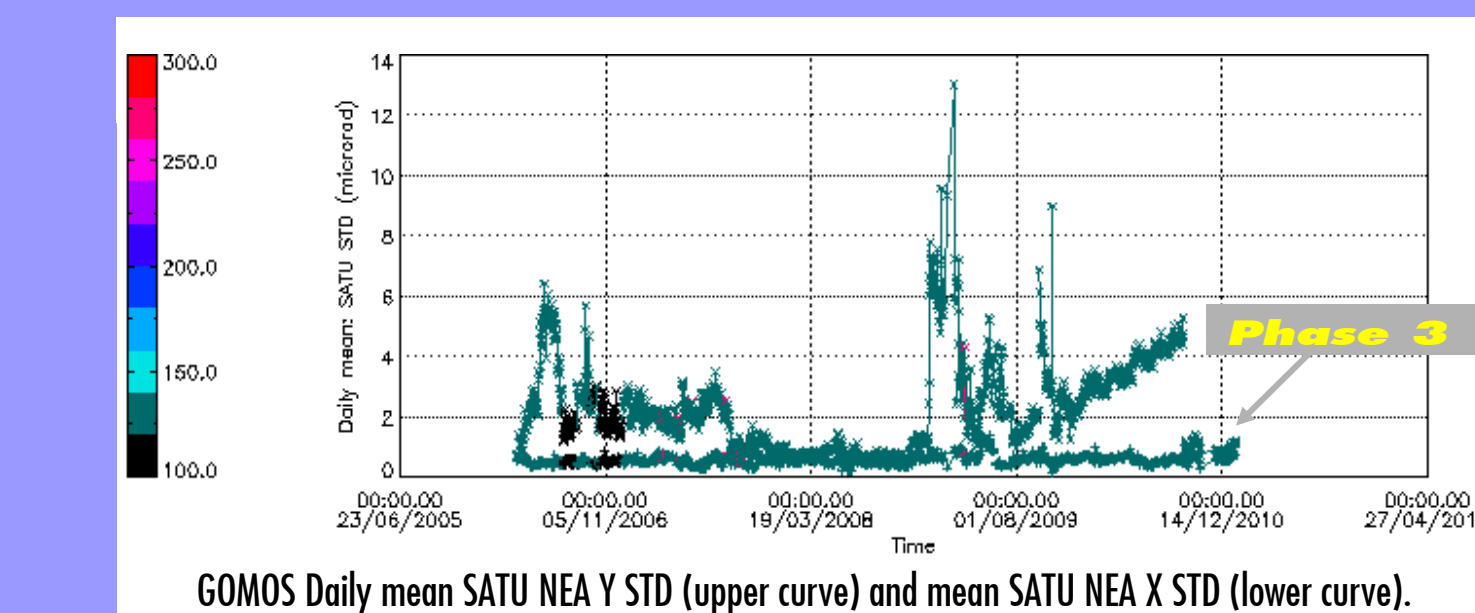
Acquisition and detection performance

The Most Illuminated Pixel (star position on the SATU CCD in detection mode) shows no new trend during the first stages of new mission scenario.



Tracking performance

The Star Acquisition and Tracking Unit noise equivalent angle (SATU NEA) is the statistical angular variation of the SATU data above the atmosphere at the beginning of the star tracking. The mean of the standard deviation above 105 km are computed for every occultation; the daily mean value is monitored in order to assess instrument performance in terms of star pointing. No new trend has been detected during the first stages of the new mission phase (E3).

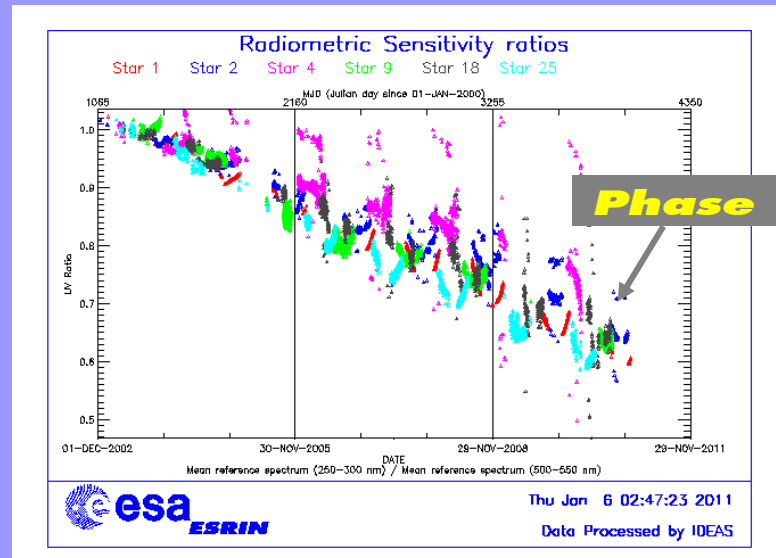


The monitoring of the tangent altitude at which the star is lost (Last Tangent Altitude) is an indicator of the pointing performance: no new trends of these parameters have been detected.

Radiometric performance

The radiometric sensitivity of each of the four CCDs (UV, Visible, IR1 and IR2) and for the two photometers has been monitored by computing the ratio between parts of the reference spectrum using specific stars. For SPA1 detector (UV), the ratio has decreased around 40% over the mission.

This variation is due to the expected ageing of the contamination on the telescope optics which affects mainly the UV wavelengths. After the orbit lowering no changes in the trend are visible.

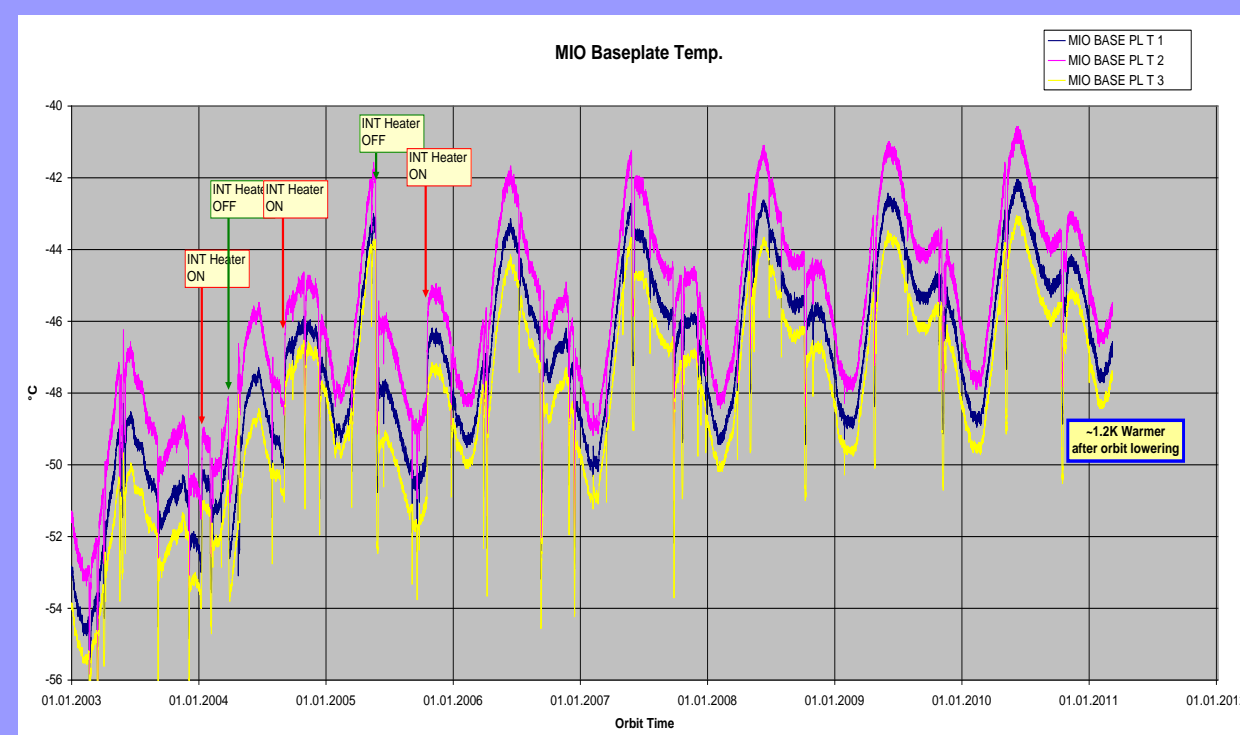


MIPAS

	Anomaly	Degraded mission period	Corrective action	Impact on the data
Instrument planning	Transient: re-init every 3 orbits	28/10/2010 – 02/11/2010	Upload of corrected CFI	Re-initialization was planned every three orbits. No impact on data quality, but small data gap around - 40 deg lat.
	Transient: unwanted altitude scan pattern	28/10/2010 – 30/11/2010	S/W patch for RGT tool	Scan pattern tangent altitudes slightly deviates from baseline. No impact on data quality.
Cooler performances	Transient: displacer spikes	28/10/2010	None	The cooler spikes could not be correlated to any other parameters, they are considered as SEU.
Pointing performances	Transient: ENVISAT YSM	28/10/2010 – 02/11/2010	Switch to ENVISAT SYSM	Degraded pointing accuracy when ENVISAT was working on Yaw Steering Mode (YSM).

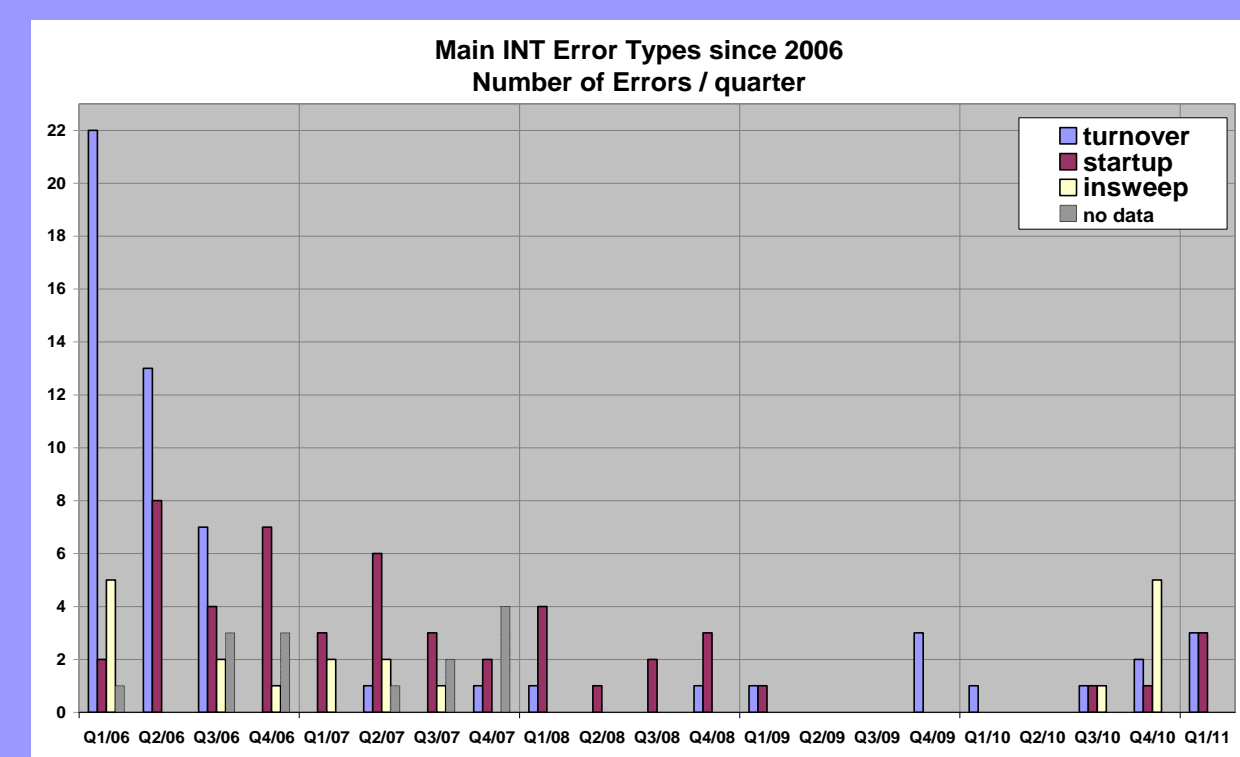
Thermal performances

The MIO temperatures along the mission are presented in the plot below. After the orbit lowering we observed a slight increase of the overall instrument temperature (1.2K) that was also seen in other ENVISAT sensors.

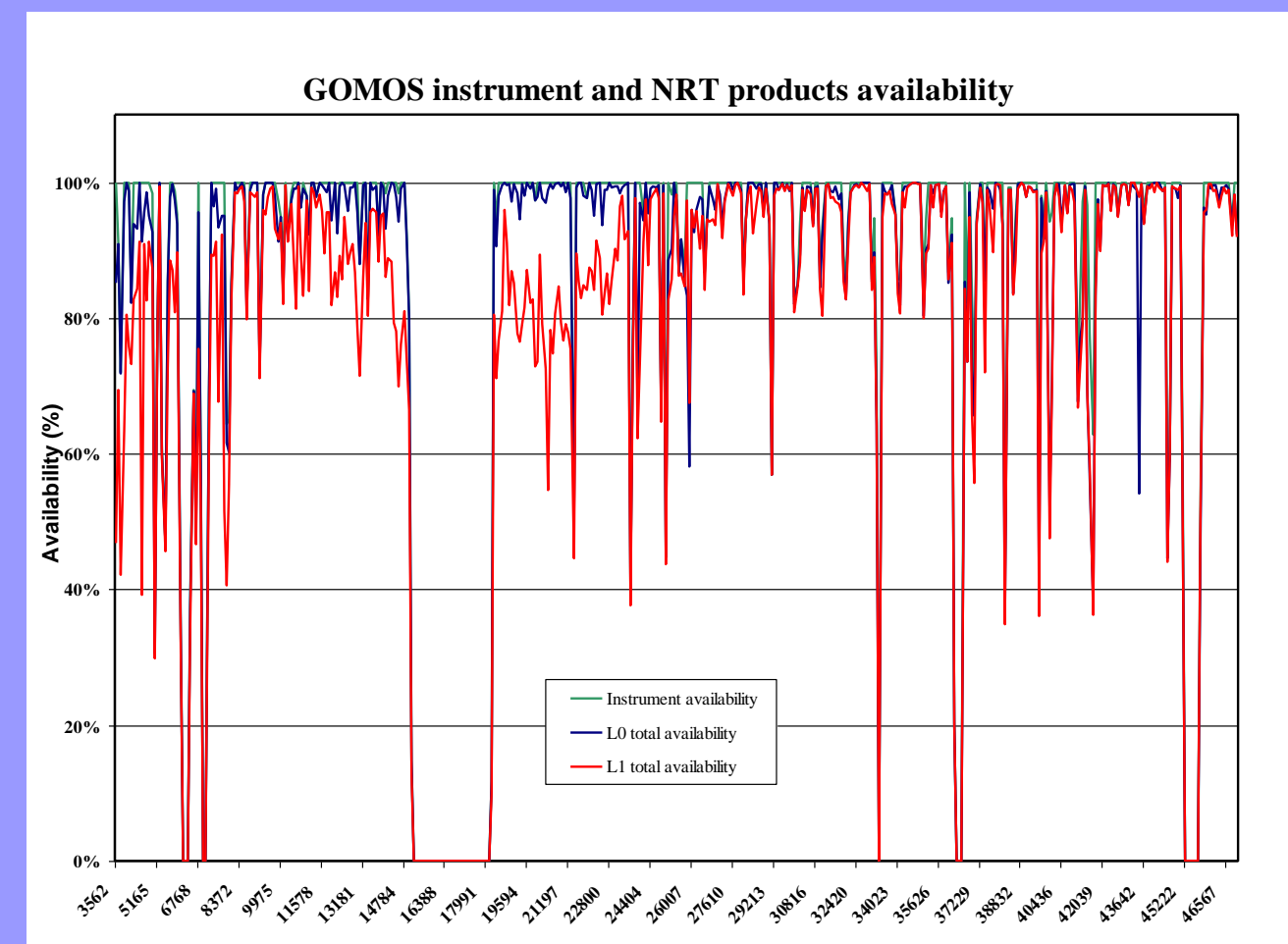


Interferometer performances

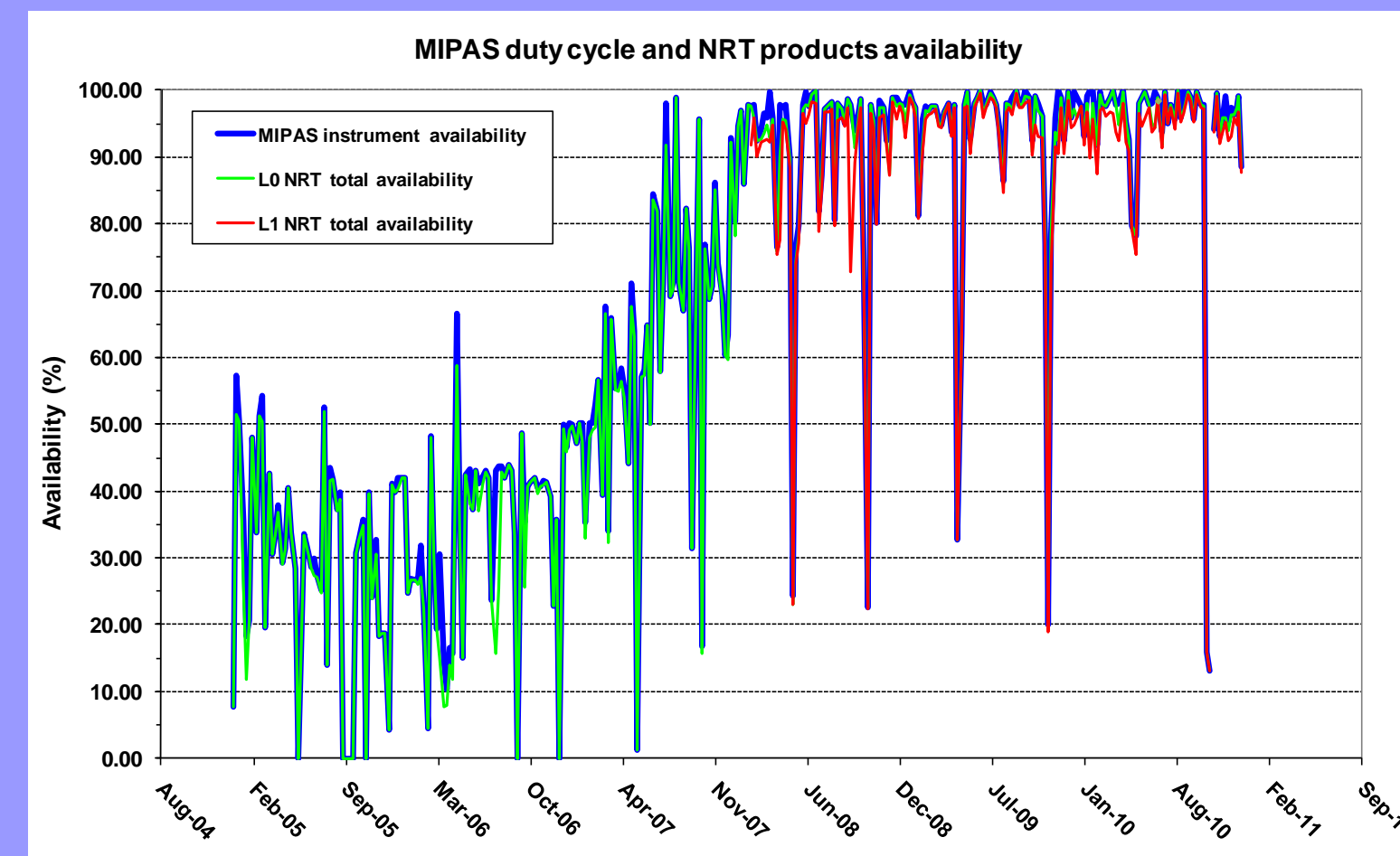
The increase of IDU errors detected with the restart of the mission in the Phase 3 (see plot below), was explained with a temporary degradation of the motor currents performances. The situation is far to be critical and it will be monitored closely in the next months. It may be that the increased temperature have influenced somehow the INT, but this has to be demonstrated.



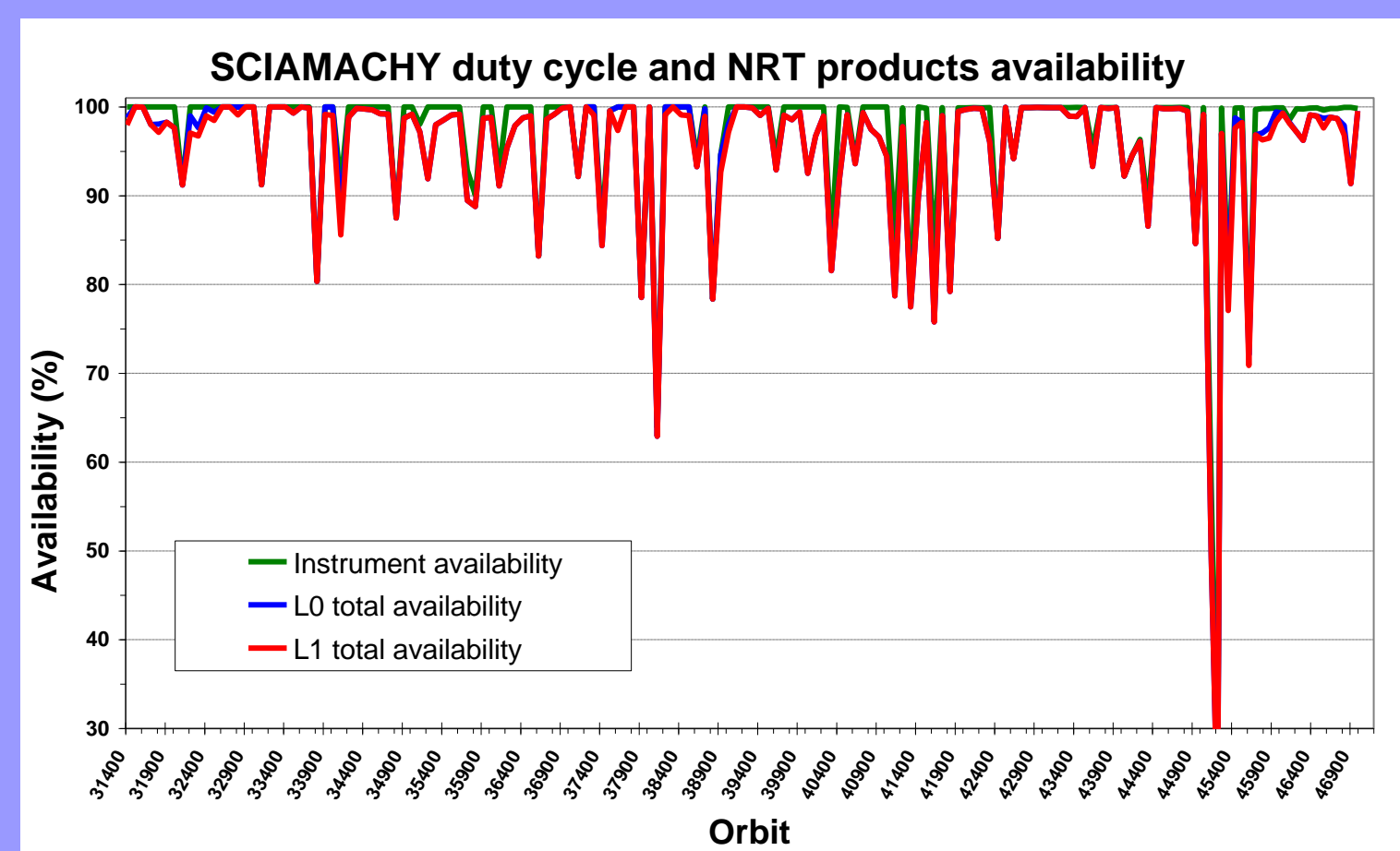
GOMOS



MIPAS



SCIAMACHY

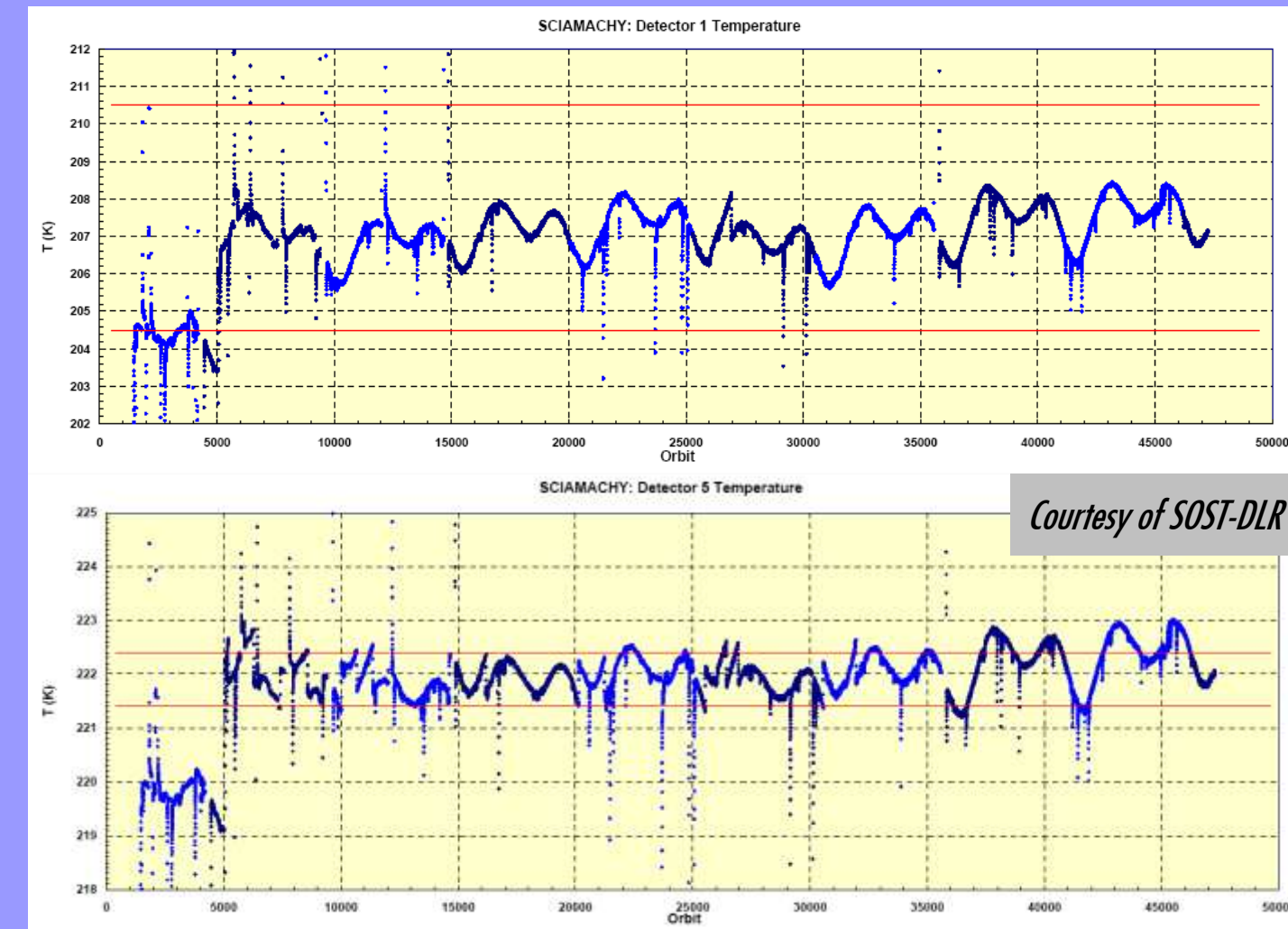


SCIAMACHY

	Anomaly	Degraded mission period	Corrective action	Impact on the data
Instrument planning	Transient: discrepancy between specified and executed limb tangent heights	27/10/2010 – 10/01/2011	Upload of modified ESM Basic Scan Profile parameters (OCR 50)	Between orbits 45262 and 46340, start/stop tangent heights for limb-type measurements resulted different by several kilometres from the specified values with top most height (90 km) missing in the Level 2 products.
Thermal performances	Transient: SCIAMACHY detector temperatures resulted higher by about 0.3-0.5K.	27/10/2010 – 31/12/2010	None	Temperatures for channels 1-3 and 6-8 remained within nominal operational ranges, while temperatures of detectors 4 and 5 were above the upper limit, even more than usually tolerated.
Pointing performances	Transient: ENVISAT YSM	28/10/2010 – 02/11/2010	Switch to ENVISAT SYSM	Degraded pointing accuracy when ENVISAT was working on Yaw Steering Mode (YSM). Throughput monitoring data during this period are more variable and may also contain slight offsets.

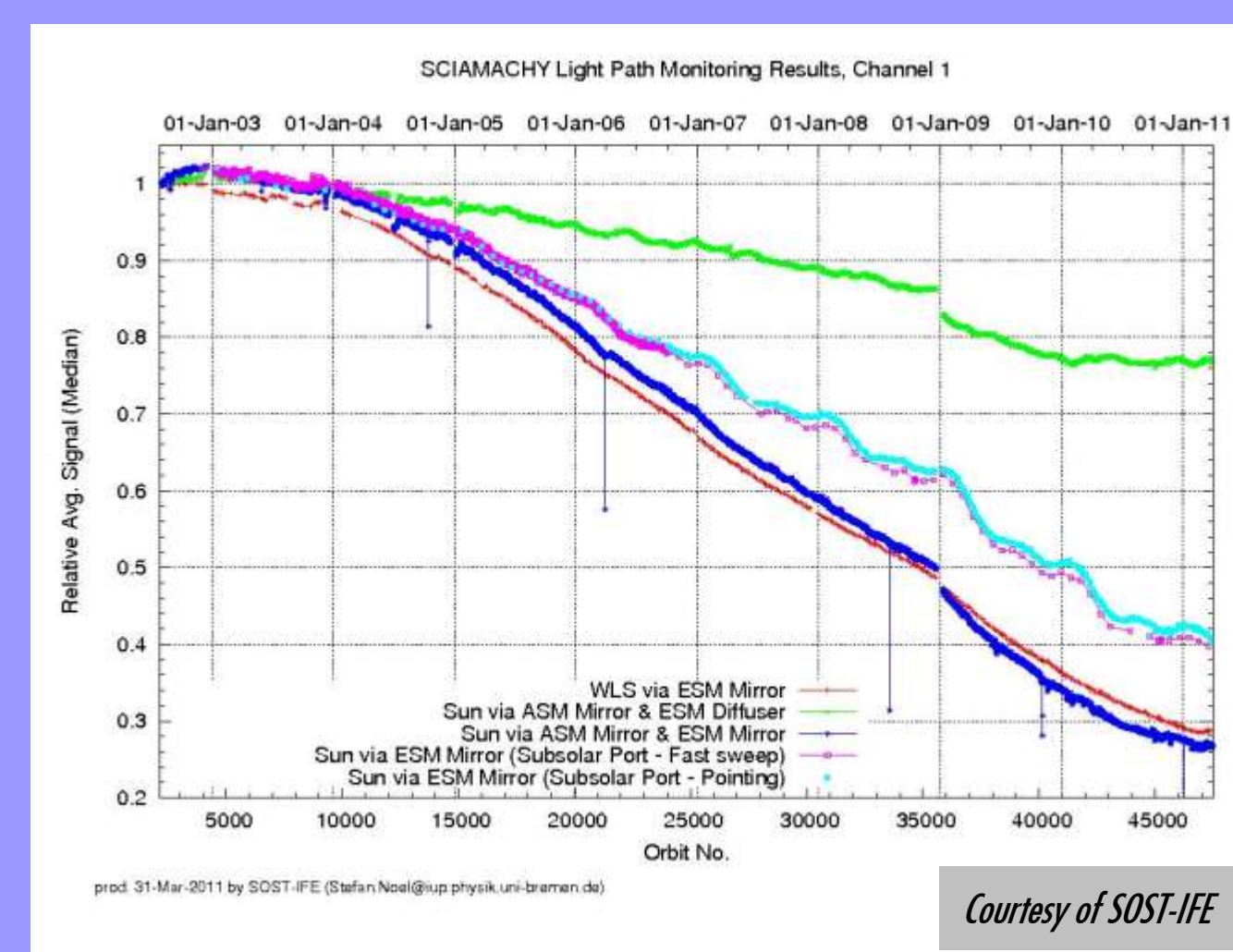
Thermal performances

Increased detector temperatures persisted during Oct/Nov 2010; temperatures started to stabilize returning to the specified ranges by the end of the year.



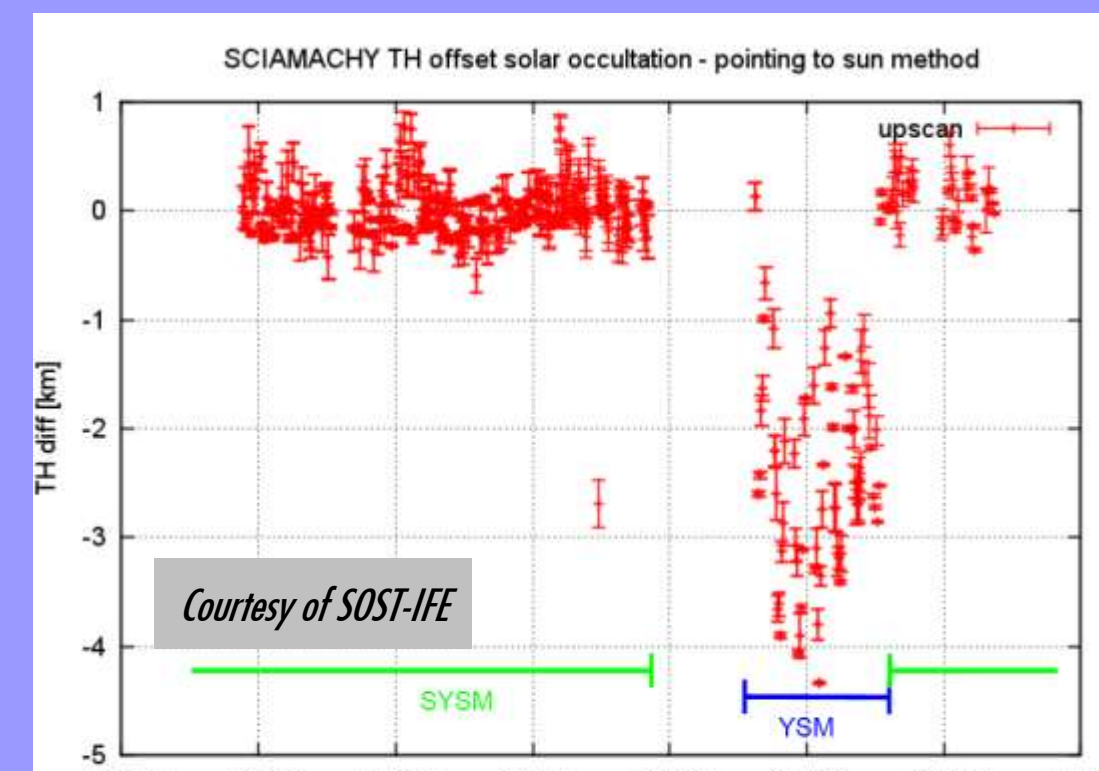
Spectral Light Path monitoring

Long-term analysis of measurements of SCIAMACHY light paths for different viewing geometries did not highlight major impact on throughput following the orbit change.

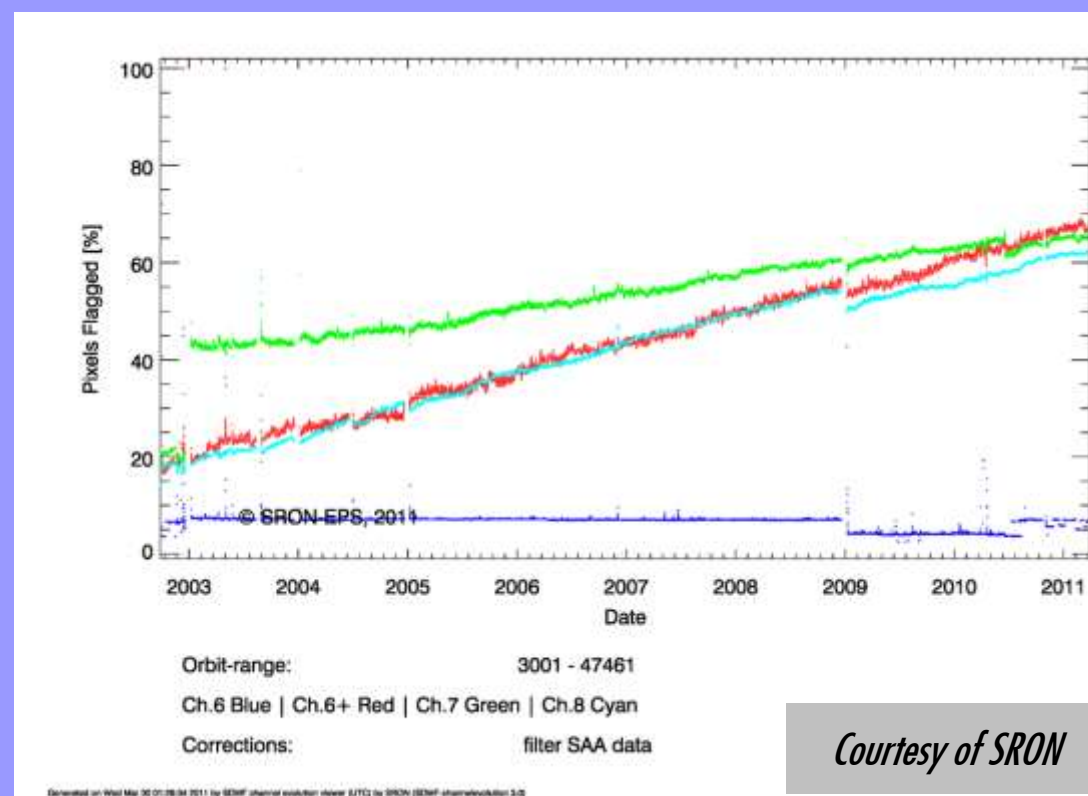


Pointing performances

Degraded pointing accuracy during YSM. Back to previous with SYSM.



Bad and dead Pixel Mask



The orbit manoeuvre was suspected to cause potential contamination of the optical surfaces (mirrors, detector array) for the exhaust emissions of the thrusters, located in close vicinity of SCIAMACHY. SWIR detector degradation monitored at SRON by the total number of dead pixels hasn't significantly increased indicating no signs of induced contamination.

