CENTRE NATIONAL D'ÉTUDES SPATIALES

IASI FM2 on METOP A
Performances after 1.5 year in orbit

International TOVS Study Conference 16
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Angra dos Reis, Brazil

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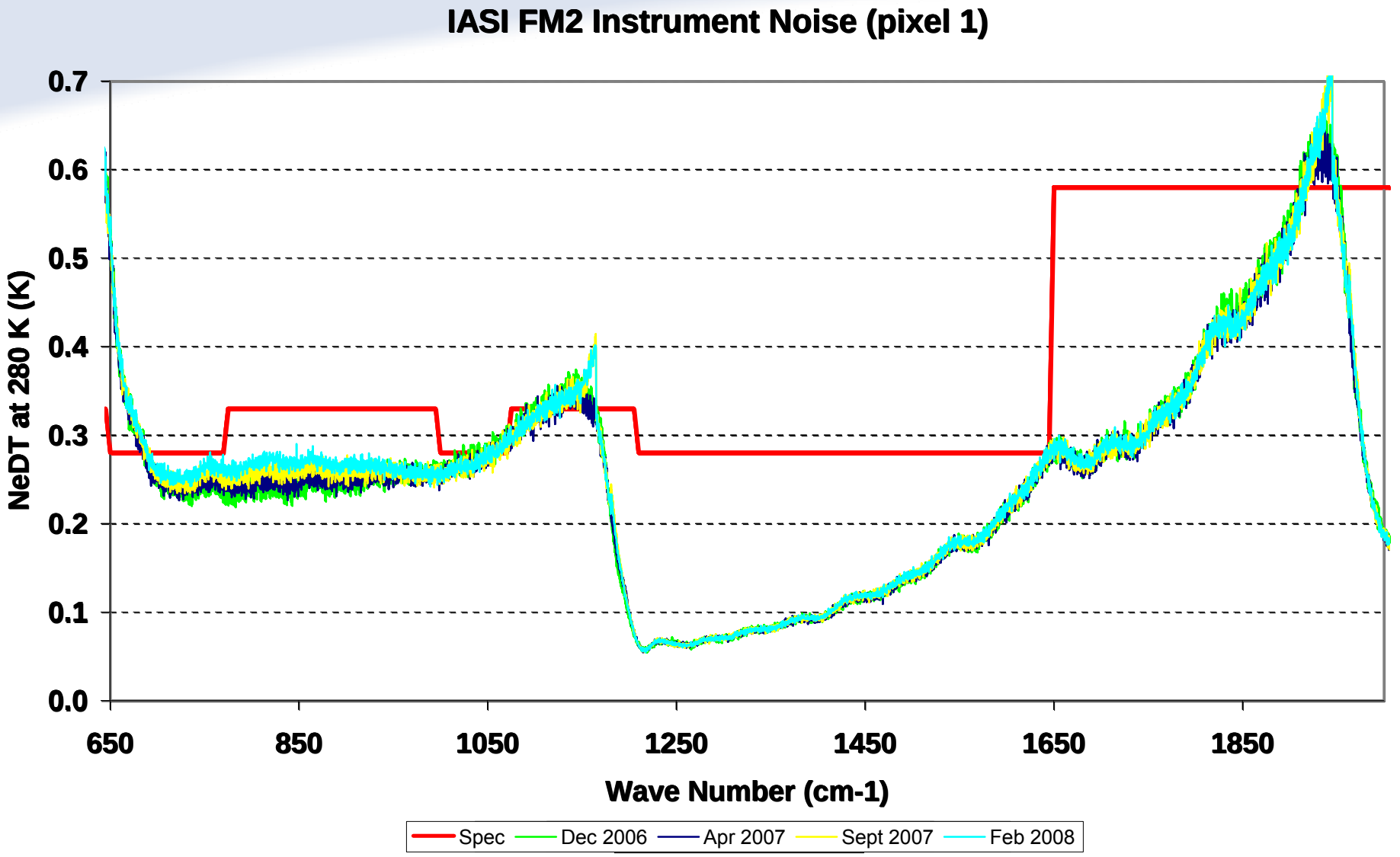
Outline

- First decontamination
- Stability of the instrument
- Spectra rejections
  - Day 2 improvements of processing
- Intercalibration IASI / AIRS

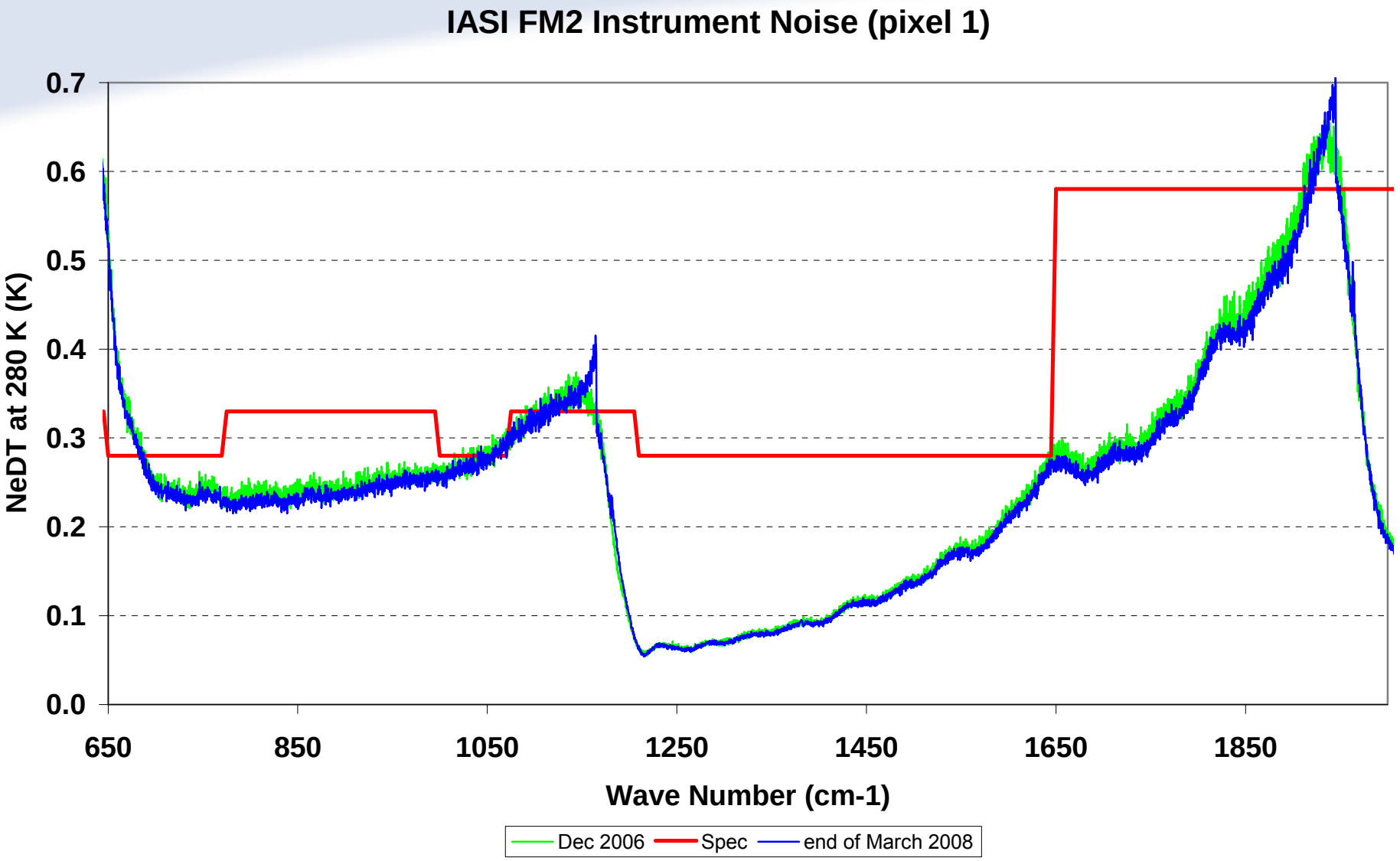
see IASI performances assessment at the 1st IASI Conference

- http://smsc.cnes.fr/IASI

Evolution of contamination effect (ice) 2007-2008

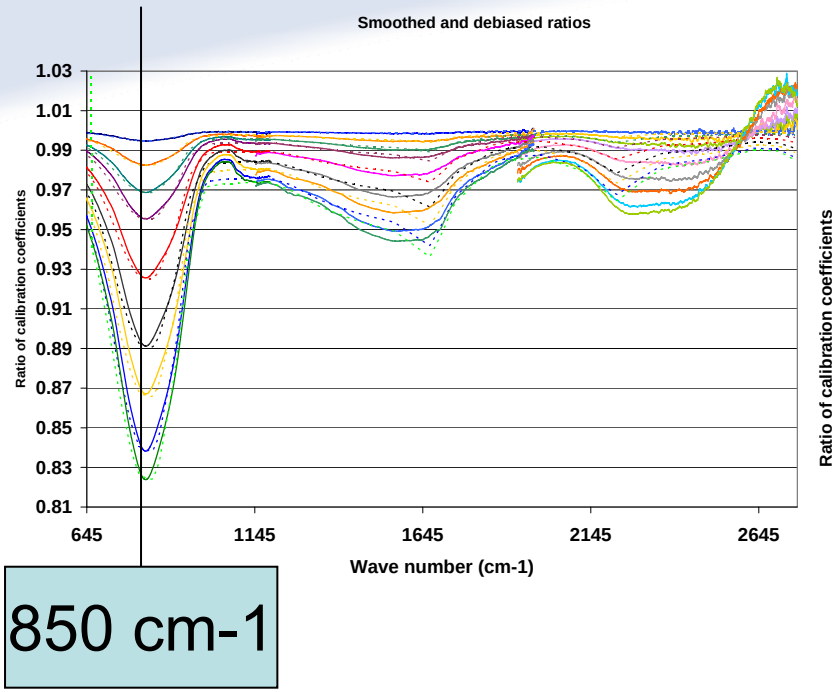


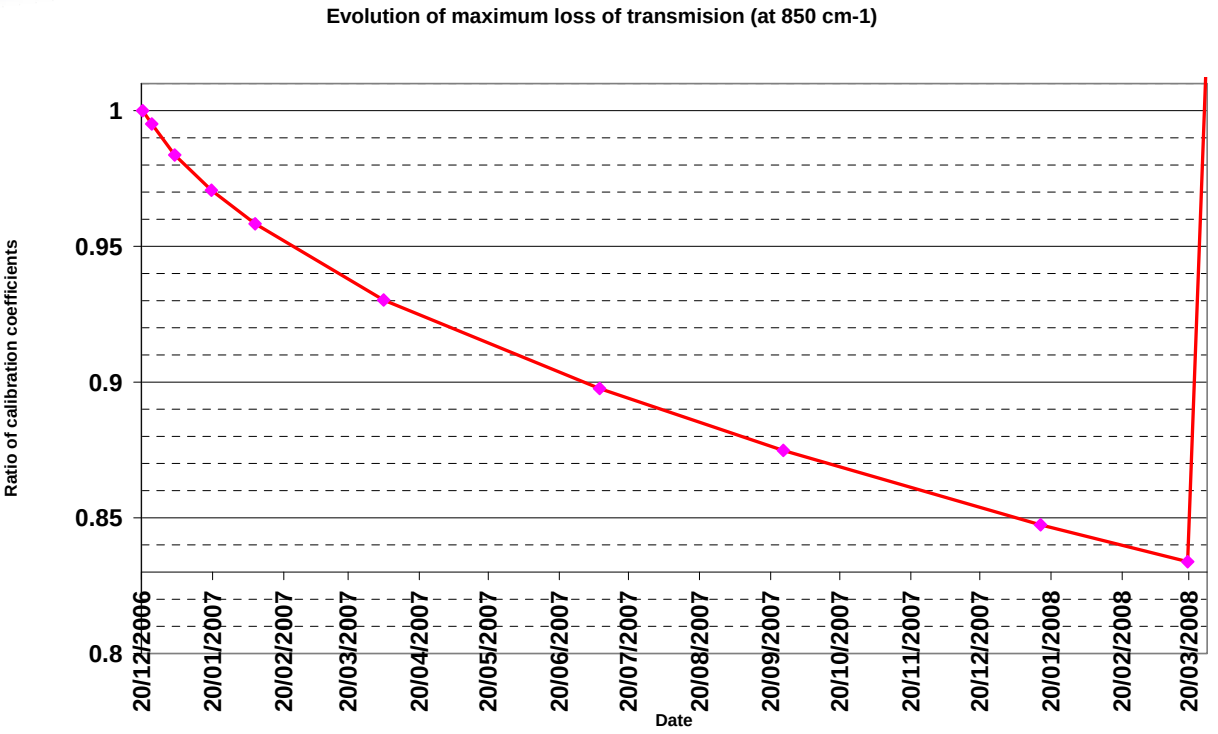
After first IASI decontamination



- First IASI decontamination end of March 2008 (1.5 year after launch)

Evolution of the measured transmission loss



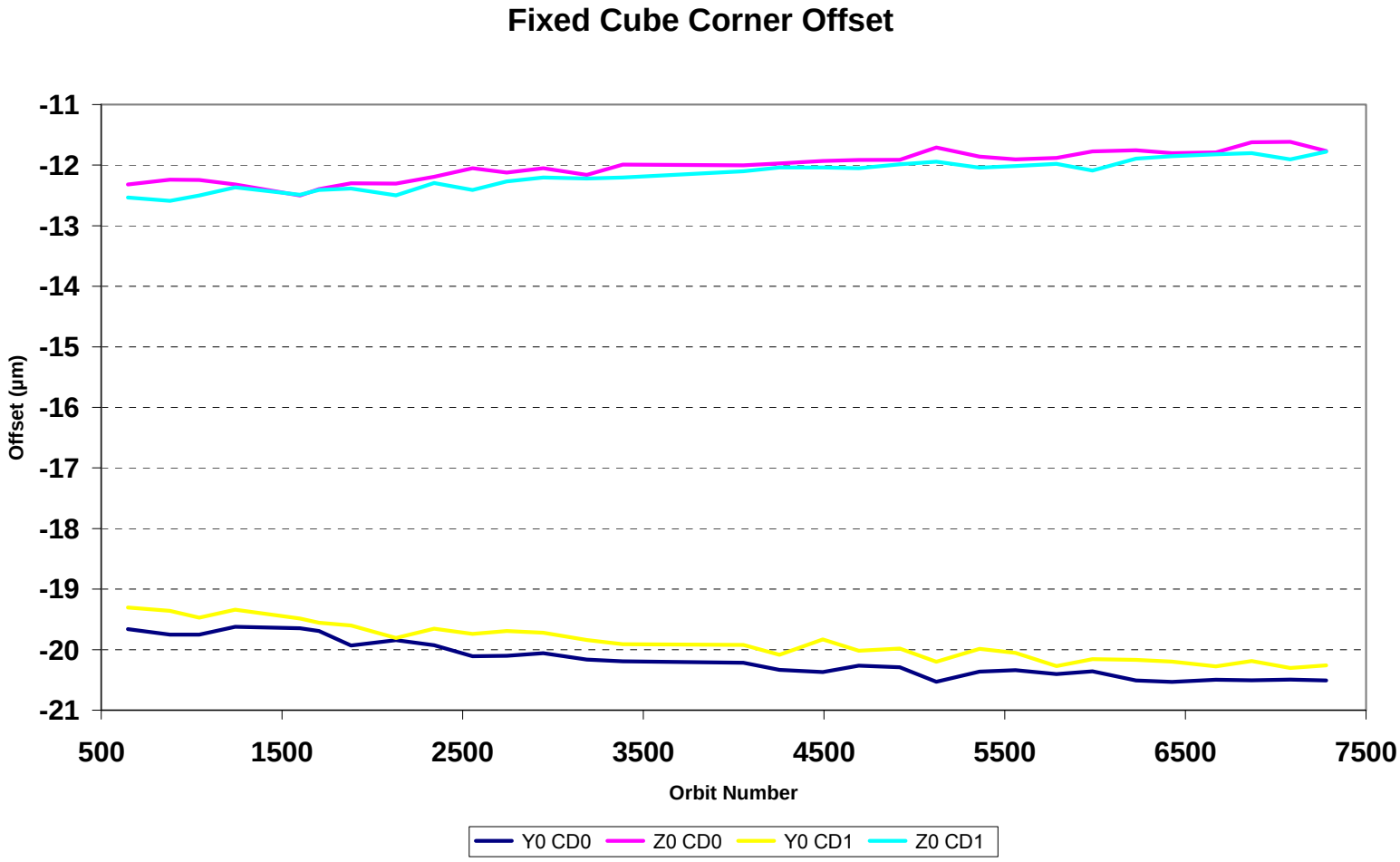


- **First IASI decontamination**
  - **end of March 2008 (1.5 year after launch)**
- **Successul**
  - **recovery of the initial radiometric noise IASI**
    - Initially measured beginning of December 2006

- **Contamination rate**
  - **Now 1/4 of the initial rate**
  - **No need for new deconta-mination before 2 years**

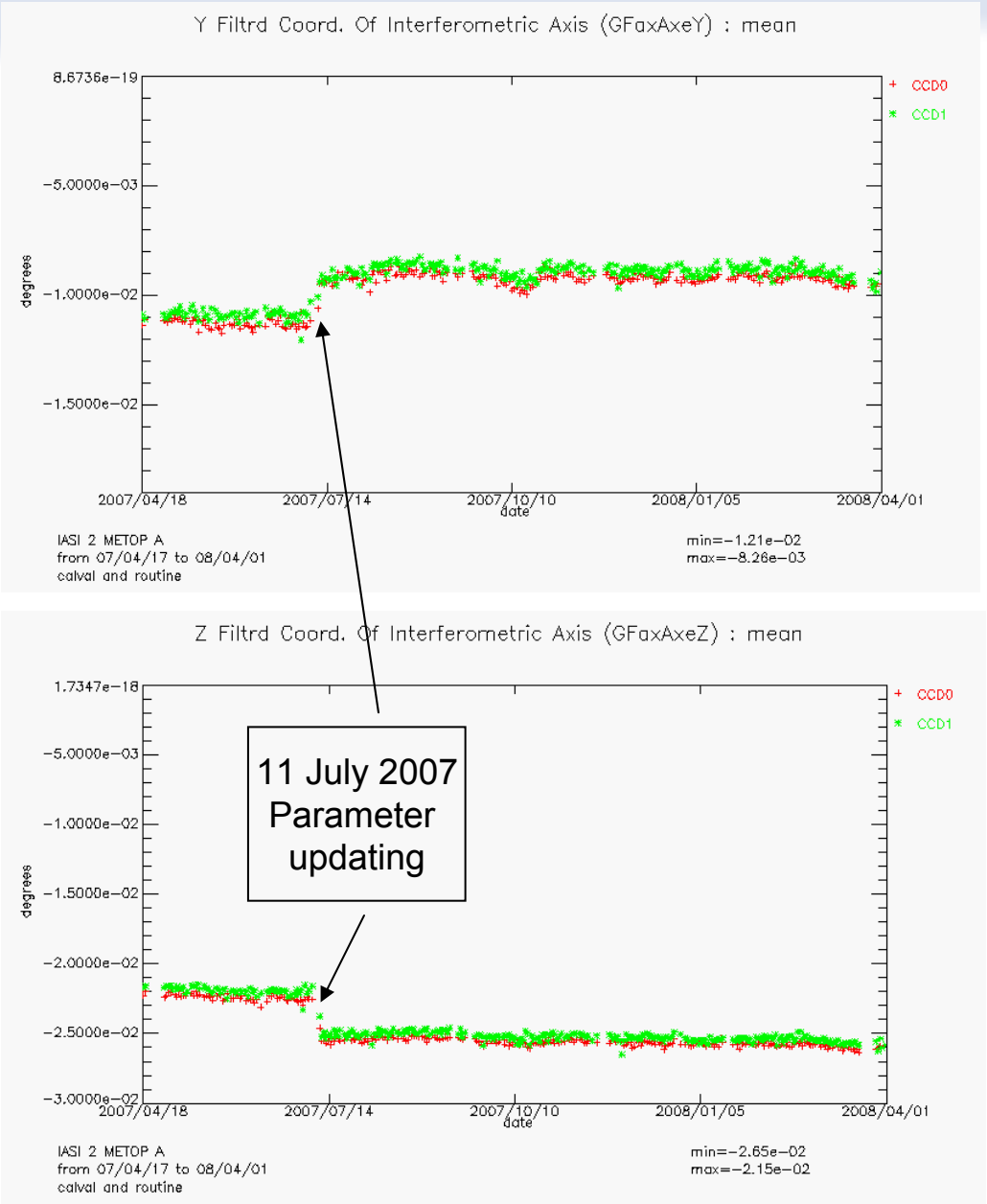
Fixed Cube Corner Offset

- **Accurate determination**
  - Std < 0.2 µm
- **Stability over 16 months**
  - Small drift
  - 1 µm
- **Period of analysis**
  - 4th Dec 2006
  - 31th Mar 2008

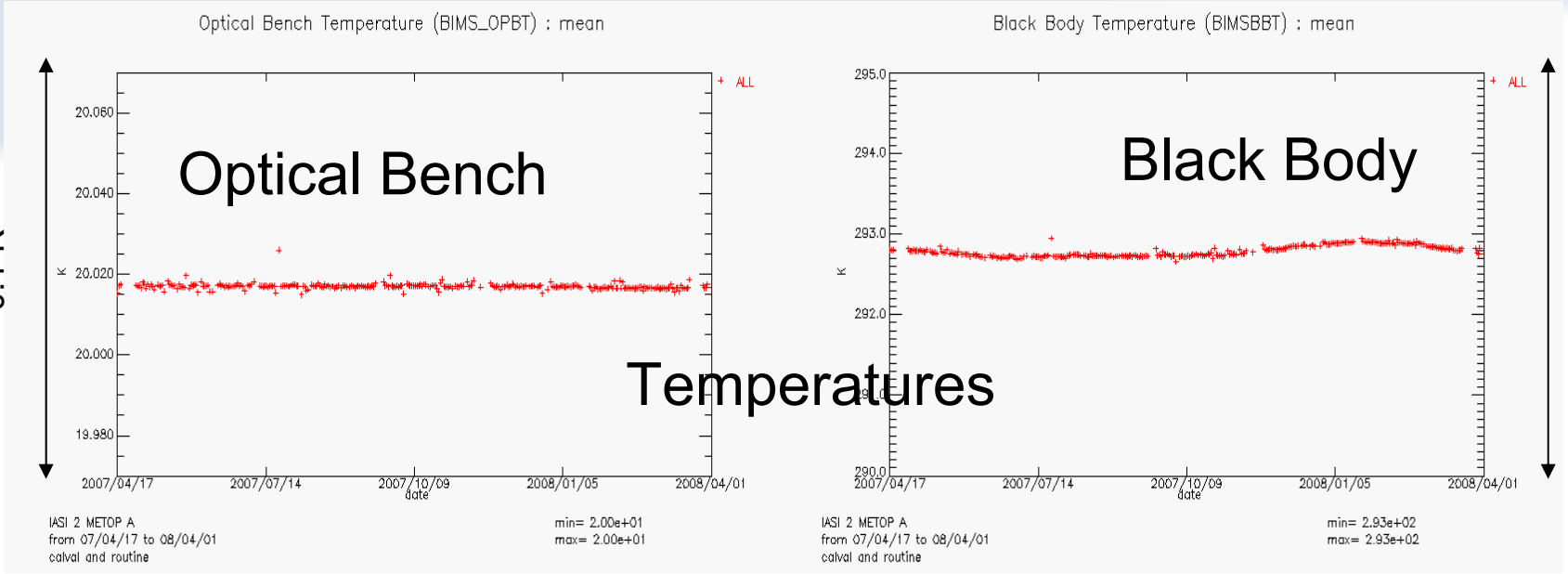


Interferometric Axis Position

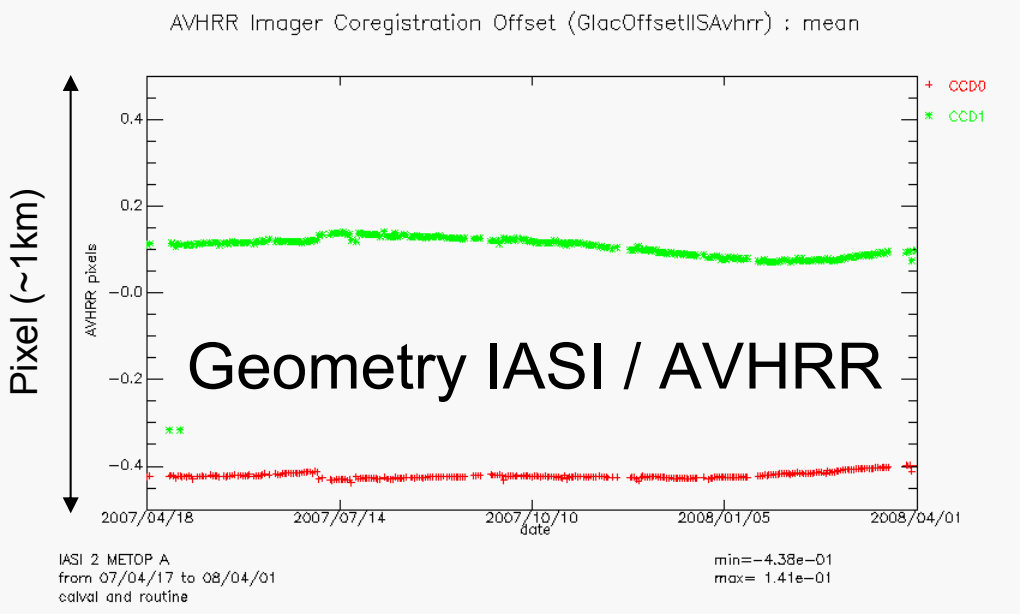
- **Stability over 12 months**
  - **Negligible drift**
  - **Results provided at Anglet conference confirmed**
    - Obtained at that time from 5.5 months of data
- **Period of analysis**
  - **16 th Apr 2007**
  - **1 th Mar 2008**
- **Small evolution 11 July 2007**
  - **Cause by parameter updating (spectral database)**
  - **Amplitude 30 µrad**
  - **Equivalent to $\Delta\nu/\nu = 5\ 10^{-7}$**



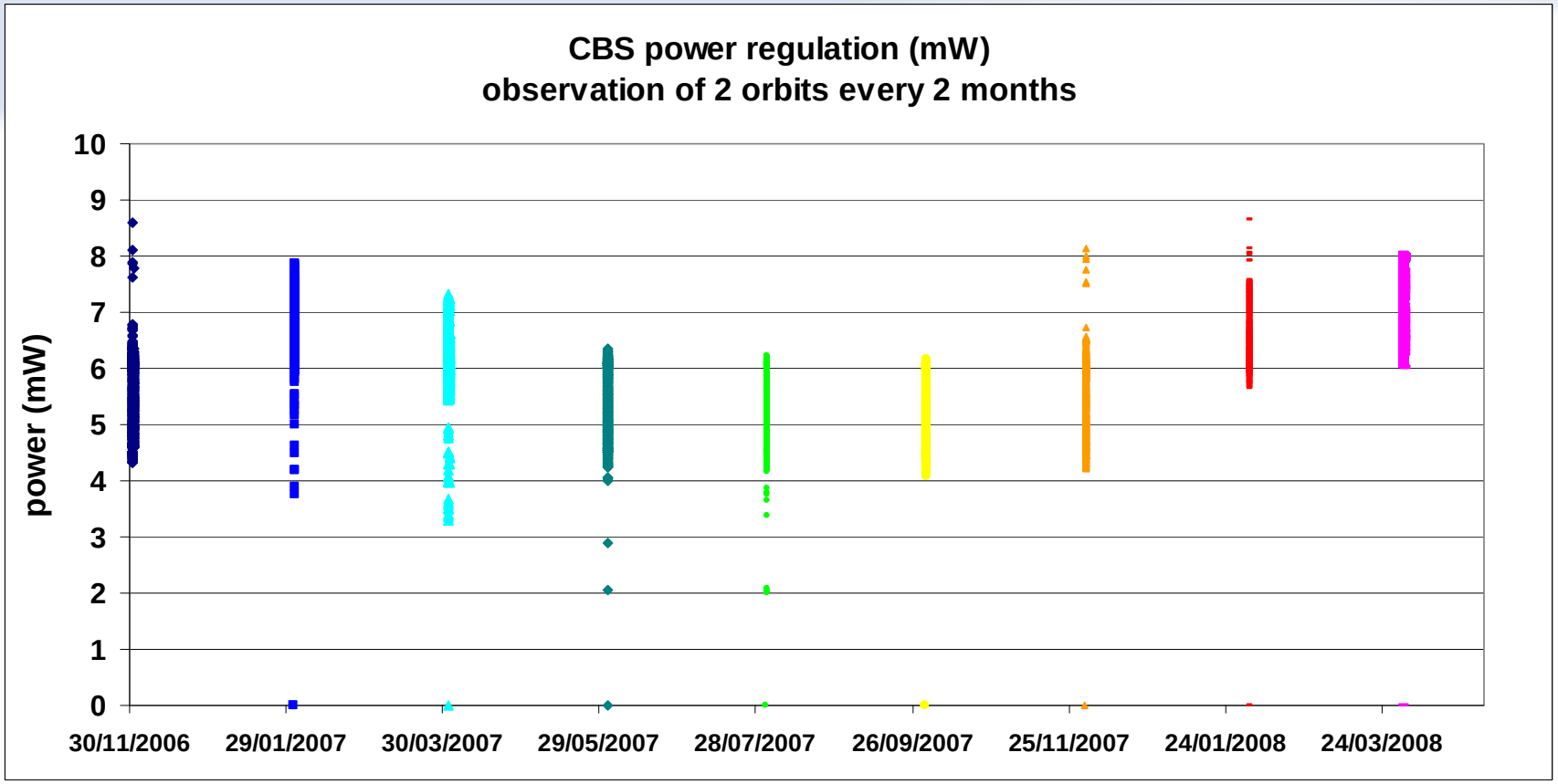
Long term evolution of other parameters



- **Long term evolution over 1 year**
  - **1 point per orbit**
  - **average over 1 orbit**
- **Period of analysis**
  - **16 th Apr 2007**
  - **1 th Apr 2008**
- **Reminder : orbital stability verified during Cal/Val**

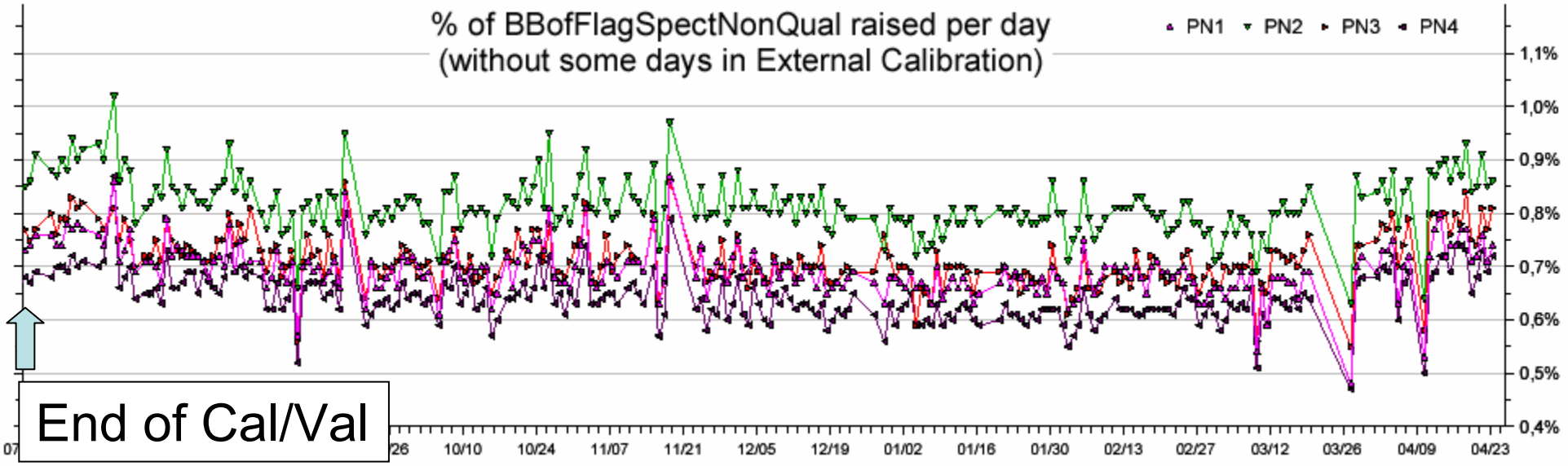


Regulation margin of the detectors temperature

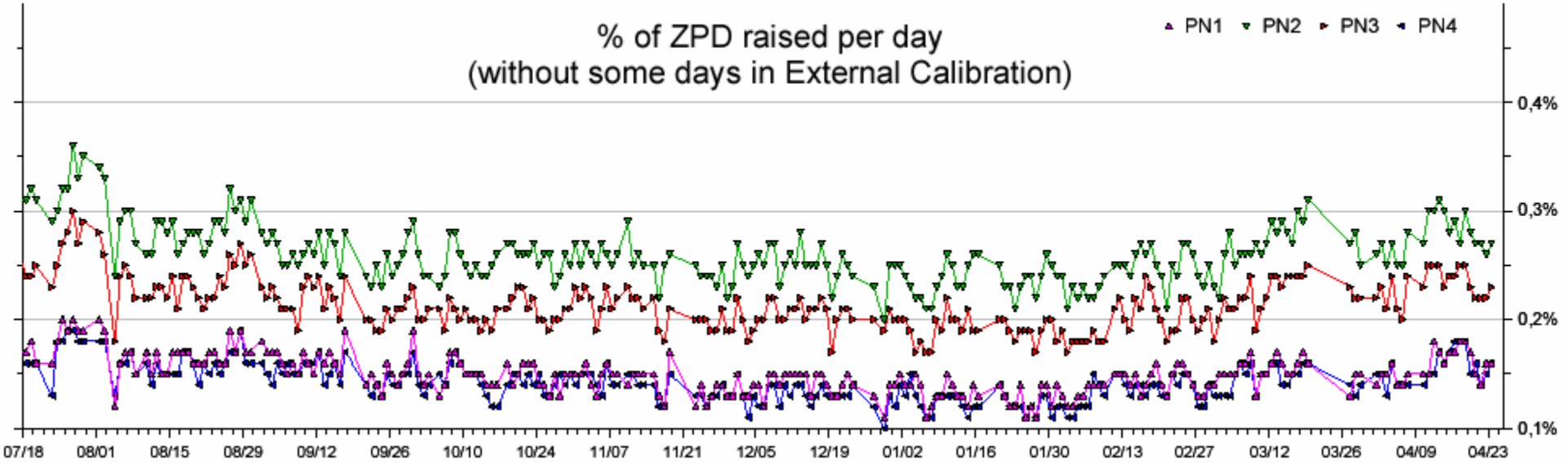


- Stable on the long term
  - Small seasonal effect, small orbital variation
- Very good indicator that the temperature of the detectors will be kept low
  - Strong impact on the radiometric noise for long wavelength

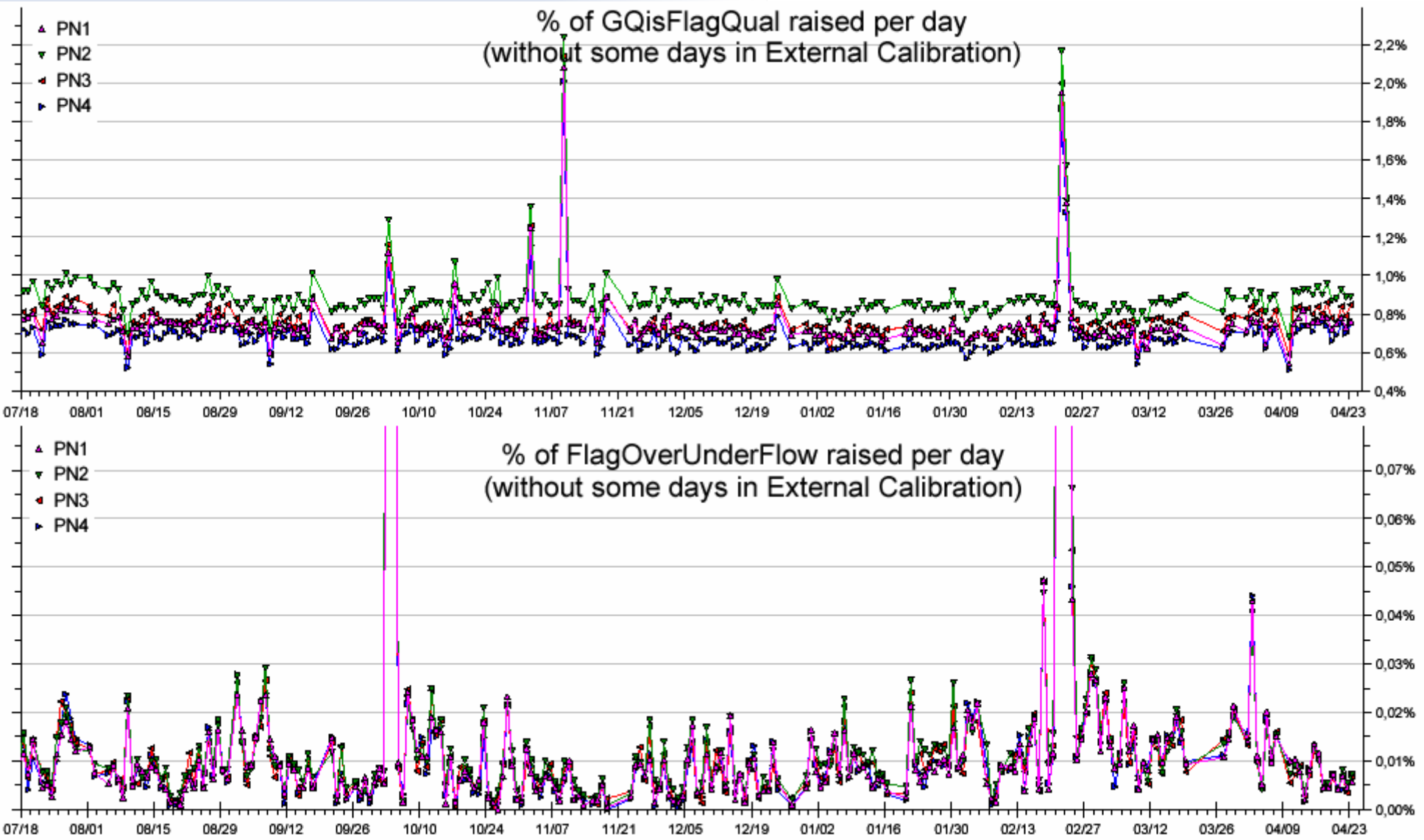
Fraction of Spectra rejected by on-board processing



End of Cal/Val

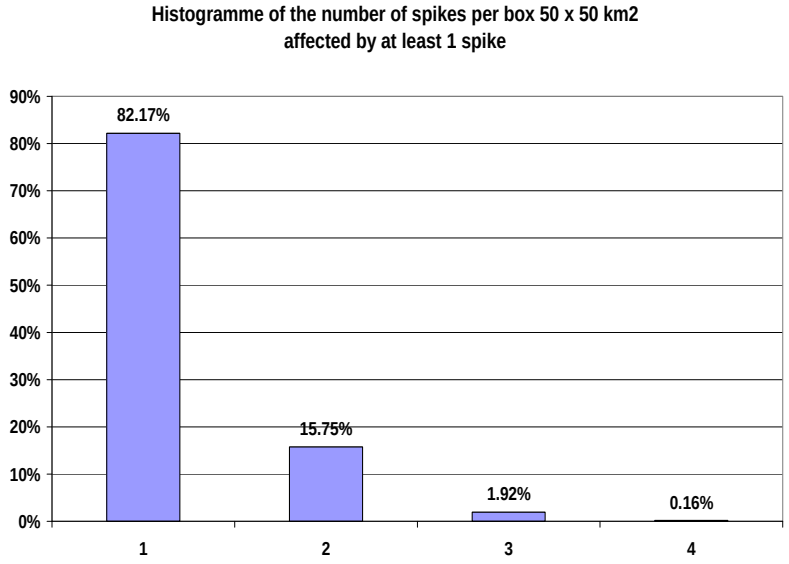


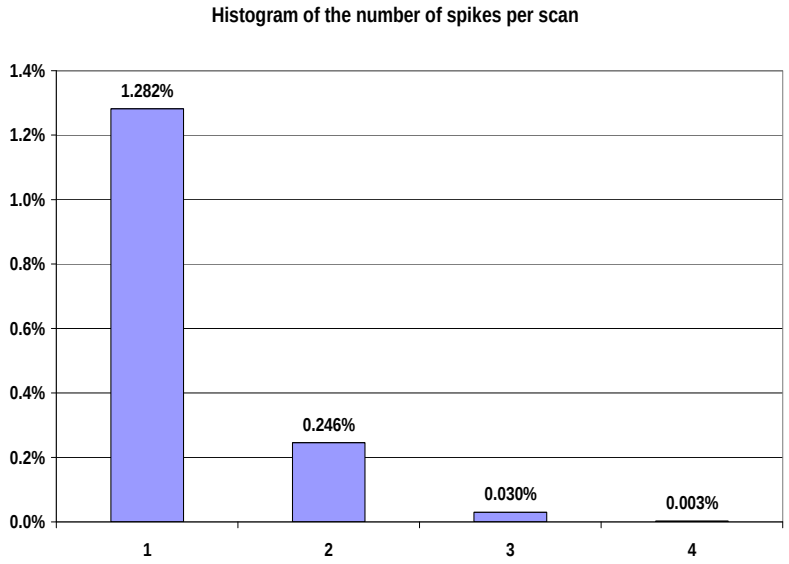
Fraction of Spectra rejected by on-ground processing



Spectra affected by Spikes

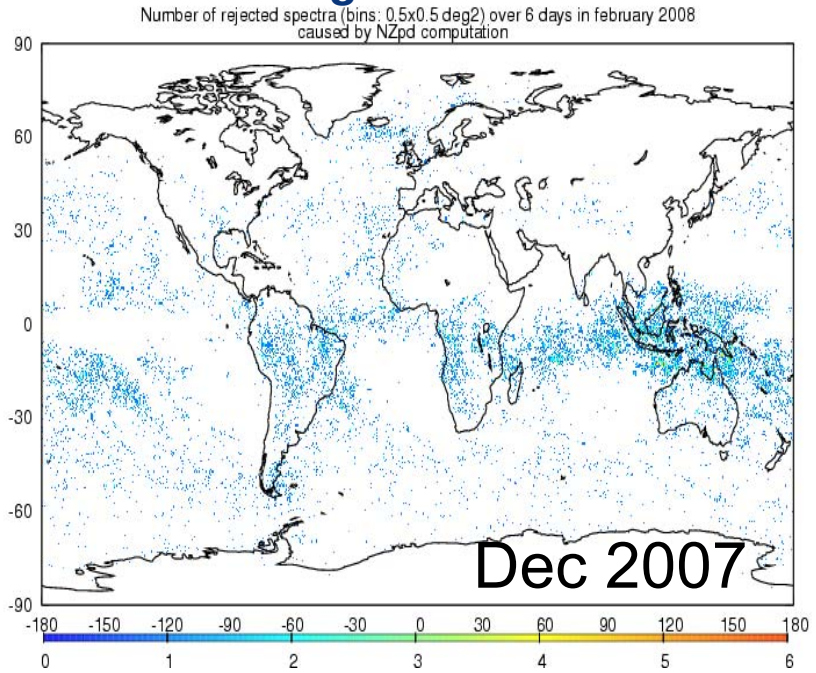
- 98.5 % of earth views (groups of 4 soundings) not affected by spikes
- Among the 1.5 % of earth views affected by spikes
  - E.g. over the South Atlantic Anomaly (SAA)
  - 82.2 % have more than 3 spectra available
  - 97.9 % have more than 2 spectra available
  - 99.8 % have more than 1 spectrum
- If the 4 IASI pixels of each Earth View are not assimilated
  - Dynamic selection of the selected sounding increase availability of the measurements
- On the long term
  - Proposal for Day 2 evolution of IASI processing

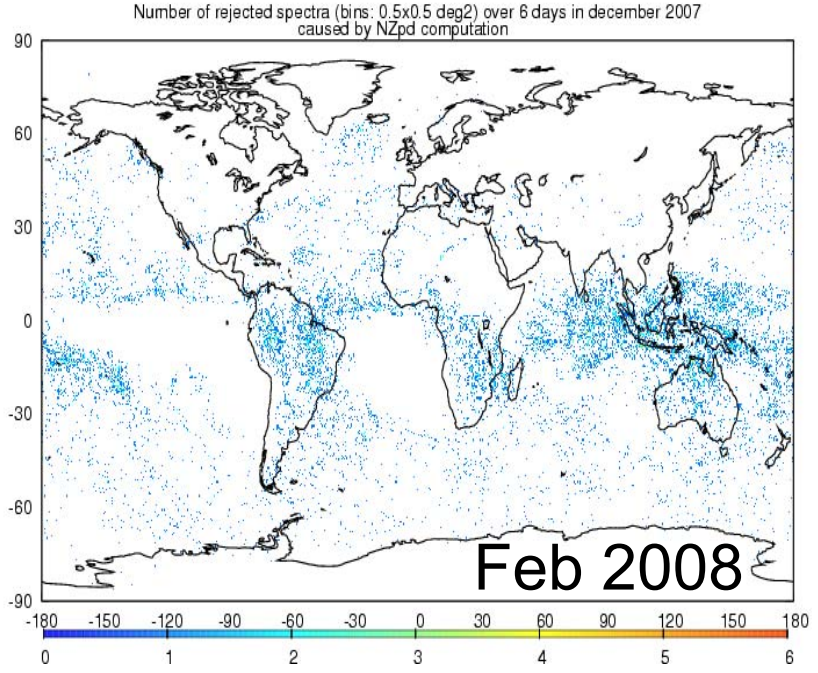




Spectra not computed because of NZPD error

- **Small fraction of spectra not available because not computed by on-board processing**
  - **Between 0.15 % (Pixel 1&4) and 0.3 % (Pixel 2)**
  - **Stable over 9 months**
- **Geographic repartition**
  - **1 or 2 occurrences max per month per bin of 0.5 x 0.5 deg^2**



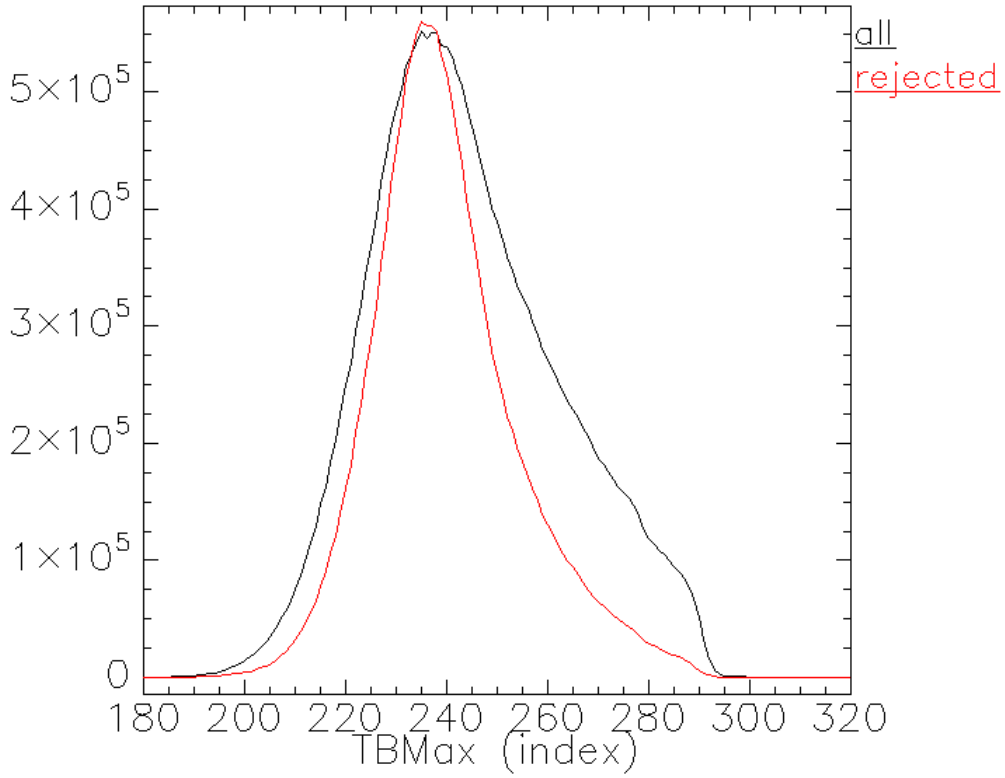


Spectra not computed because of NZPD error

- **Brightness Temperatures from the IIS imager**
  - **Black curve : Histogram of BT in the vicinity of rejected spectra**
    - 1/4 of the IIS image
  - **Red curve : Histogram of BT in the IASI footprint for rejected spectra**

- **Conclusion**
  - **Affected pixels : 0.3 %**
  - **Histogram of rejected pixels**

    FWHM = 25 K
  - **Close shape of the 2 histograms**

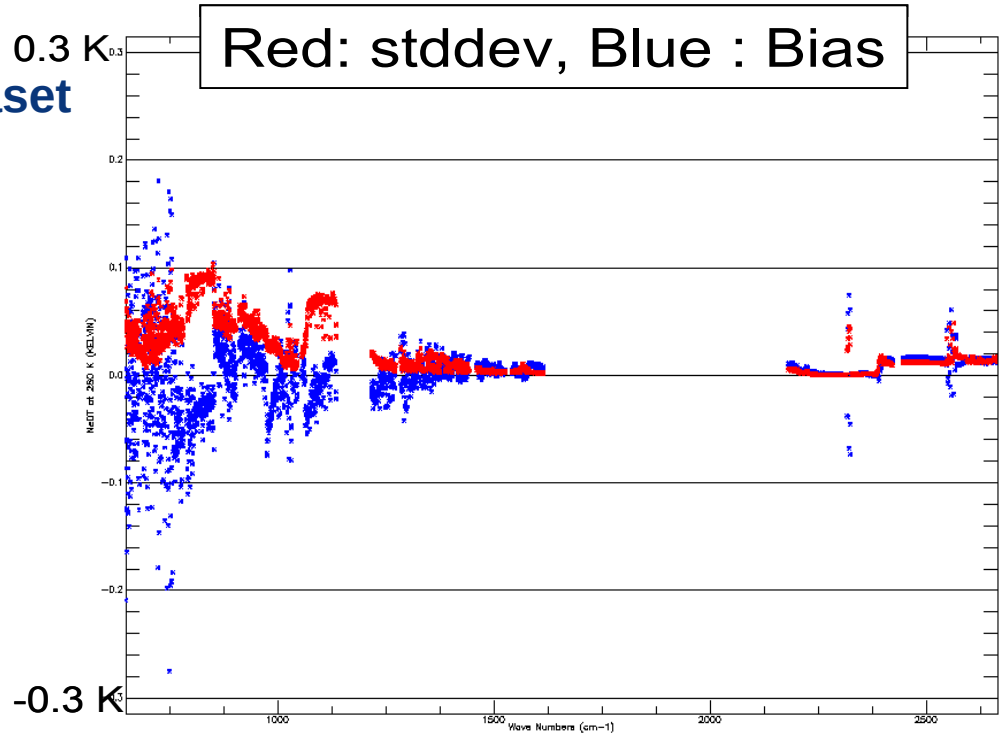


Proposed evolutions of IASI processing for the day 2

- Add more detailed information for the cause of rejected spectra
  - Spike reason,
  - NZPD reason,
  - OverFlows,
  - Other
- In case of a spike occurrence, provide B1 and B2 spectra when available
  - With proper flagging
- Add AVHRR L1B cloud mask information in the L1C product
- Add IIS image Brightness Temperature average and variance in L1C prod
  - For easy spatially uniform scenes detection
- Add minor modifications for improving (or easing) the monitoring of IASI performance by the TEC
  - No impact on the L1C products

Intercalibration IASI-AIRS (GSICS)

- **Method : for intercomparison at high spectral resolution**
  - **Precompute TF of each AIRS Spectral Response Function ➔Ak, k=1..2378**
  - **IASI calibrated spectra (L1B or L1C TBC) ➔interferogram I0**
  - **For each k, Sk=TF-1(I0/Af*Ak) , … AIRS like spectrum, interpolated at nuk**
    - ➔SAIRS_like (k)
    - Af is IASI apodisation function
      (G if L1C spectrum, self-apodisation if L1B spectrum)
- **Validation**
  - **Over 2000 spectra from the TIGR dataset**



- **On-going activities**
  1. **Intercomparison with GCC/GSICS results**
  2. **Increase the number of comparison opportunities (generalization of the SNO concept)**

Conclusions

- **After more than 17 months in orbit**
  - **IASI is performing very well**
    - all mission requirements are met
    - both instrument and processing
- **All performances very stable in the long term**
  - **Radiometry, spectral, geometry**
- **During the routine phase, IASI Technical Expertise Center (IASI TEC) located in CNES/Toulouse takes care of**
  - **In-depth Performance monitoring**
  - **Processing parameters updating**
- **In parallel with the operational monitoring performed by the EUMETSAT EPS/CGS teams**
  - **Near Real Time**
  - **Radiances monitoring (wrt Radiative Transfer)**

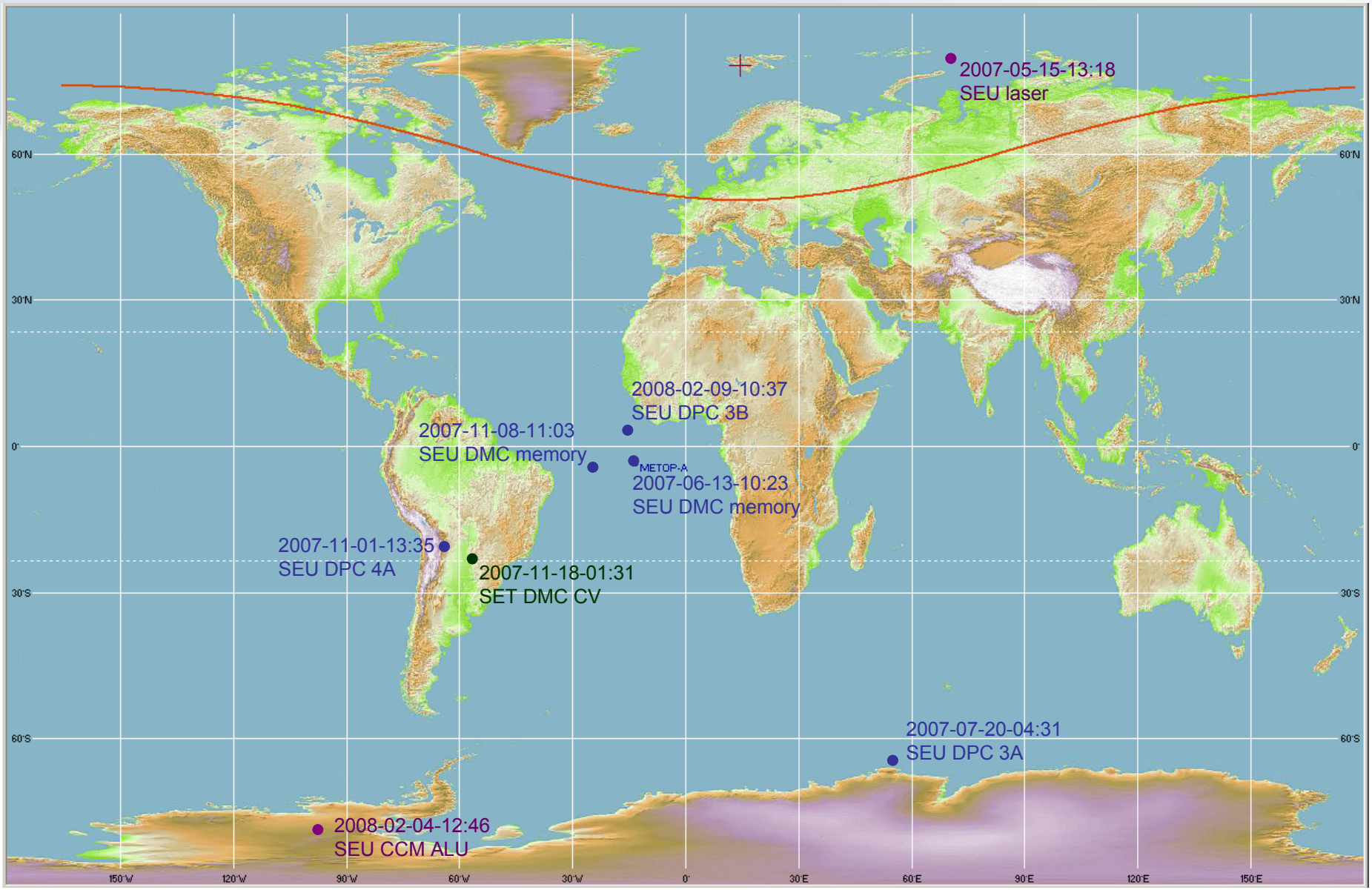
Spares

IASI outages : SEU/SET anomalies

Date	Mission outage	Origine	Sub-system	Détails
15/05/2007	~ 1day 5h	SEU	LAS	Target LAS T° corruption, due to an SEU on CCE or LAS
13/06/2007	~ 1day 7h	SEU	DPS	DMC checksum error
20/07/2007	~ 1day 9h	SEU	DPS	DPC pixel 3A checksum error
01/11/2007	~ 10h	SEU	DPS	DPC pixel 4A checksum error
08/11/2007	~ 11h	SEU	DPS	DMC checksum error
18/11/2007	~ 4days 9h	SET	DPS	Communication error IMS-DPS with OOLs on DPS voltages due to an SET on DMC converter *
04/02/2008	7h 50min	SEU	CCM	Overflow on ALU computation. Error disapear after reset which confirms SEU, probably on CCE RAM
09/02/2008	3h 45min	SEU	DPS	DPC pixel 3B checksum error
5 occurrences		SEU	OBDH	OBDH corruption zone OBDH (EDAC counter anomalie) without mission outage

- Proton or Heavy ion events caused IASI to go into safe mode (1 or 2)

* long outage due to detectors temperature stabilization after safe mode 2


2007-05-15-13:18
SEU laser
2008-02-09-10:37
SEU DPC 3B
2007-11-08-11:03
SEU DMC memory
METOP-A
2007-06-13-10:23
SEU DMC memory
2007-11-01-13:35
SEU DPC 4A
2007-11-18-01:31
SET DMC CV
2007-07-20-04:31
SEU DPC 3A
2008-02-04-12:46
SEU CCM ALU
60°N
30°N
0°
30°S
60°S
150°W
120°W
90°W
60°W
30°W
0°
30°E
60°E
90°E
120°E
150°E

IASI availability in Operational modes

	% in each mode between 07/05/07 and 03/31/08		
Operational Modes	**90 %**	Normal OP	89%
		External Calibration	1%
Non Operational Modes	**10 %**	decontamination, IASI anomalies and platform anomalies	

- EUMETSAT / CNES / ALCATEL Working group has proposed recommendations for diminishing impact of SEU anomalies (on-board)
- Before these recommendations are implemented
  - Strong involvement of the EUMETSAT and CNES operational teams to reduce the duration of unavailability periods
  - E.g. IASI decontamination implemented consecutively to a plate-form anomaly to save 2 days in non operational modes