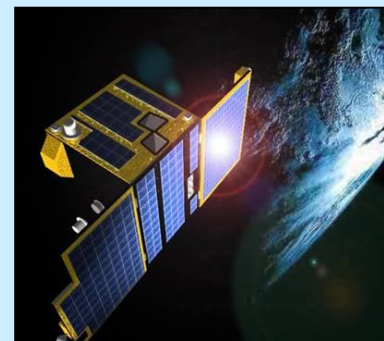
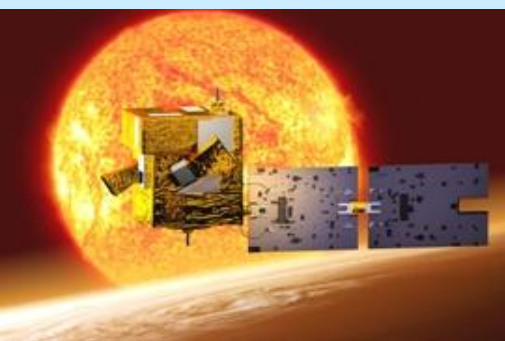


Degradation of the PREMOS instrument onboard PICARD

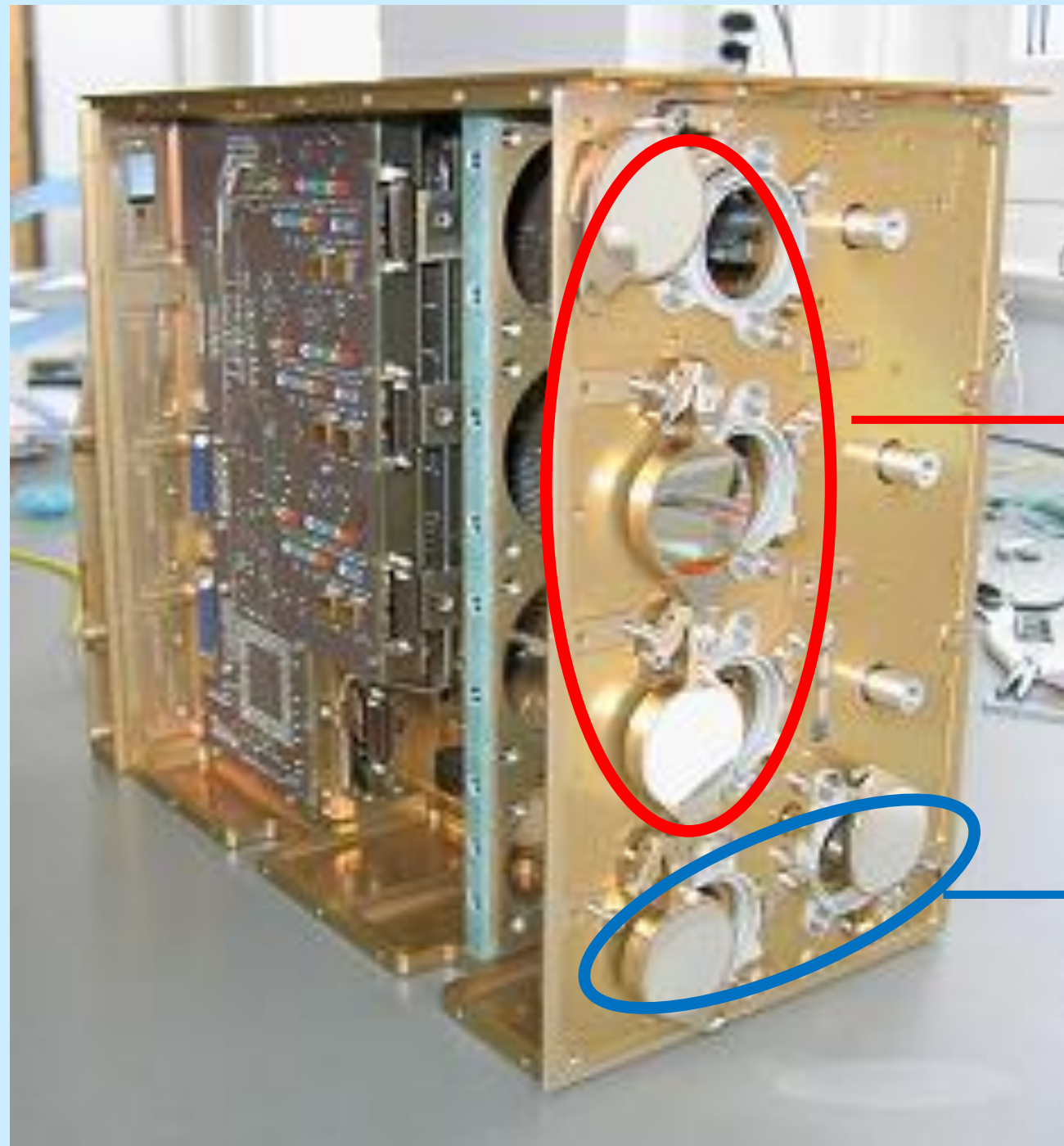
G. Cessateur for the PREMOS team
PMOD/WRC, Switzerland

On-orbit degradation of solar and space weather Instruments

Brussels, 3 May 2012



PICARD/PREMOS



215 nm (broad);
268 nm (broad);
535 nm (narrow);
607 nm (narrow);
782 nm (narrow);

Total Solar Irradiance (TSI)

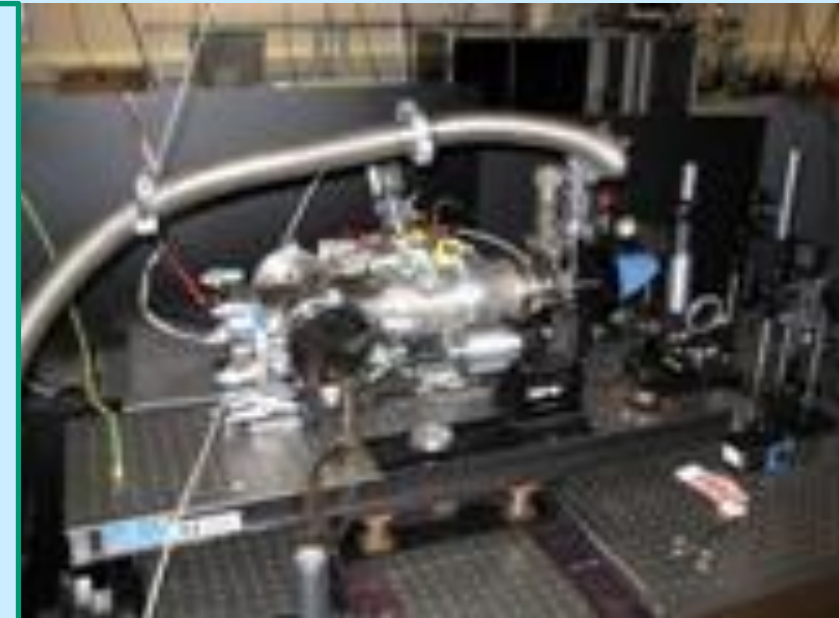
... the observation strategy

An attempt to assess instrument degradation in a self consistent way by

- referring operational measurements to occasional backup operations
- correcting the backup channel by initial ageing of operational channel

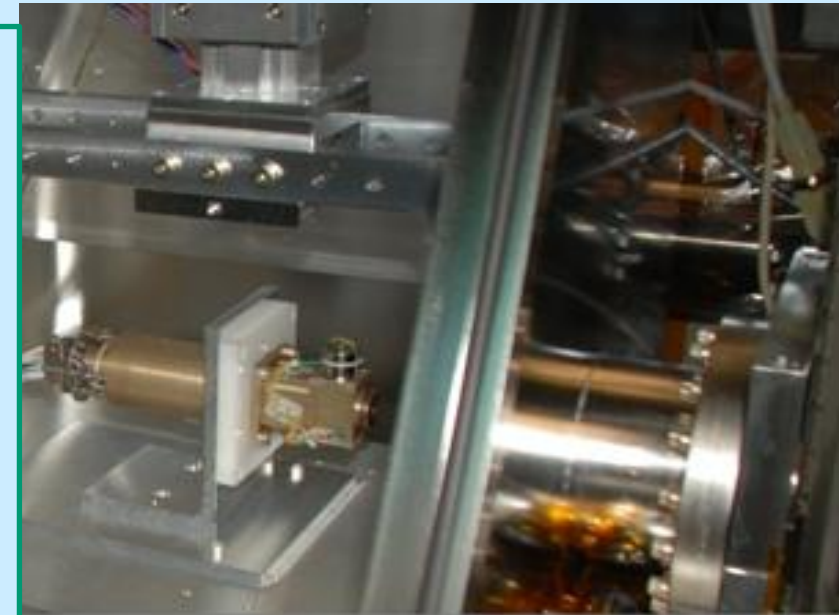
PREMOS-B

Comparison in vacuum
(power)
to Cryorad @ NPL
Aperture area @METAS



PREMOS-A

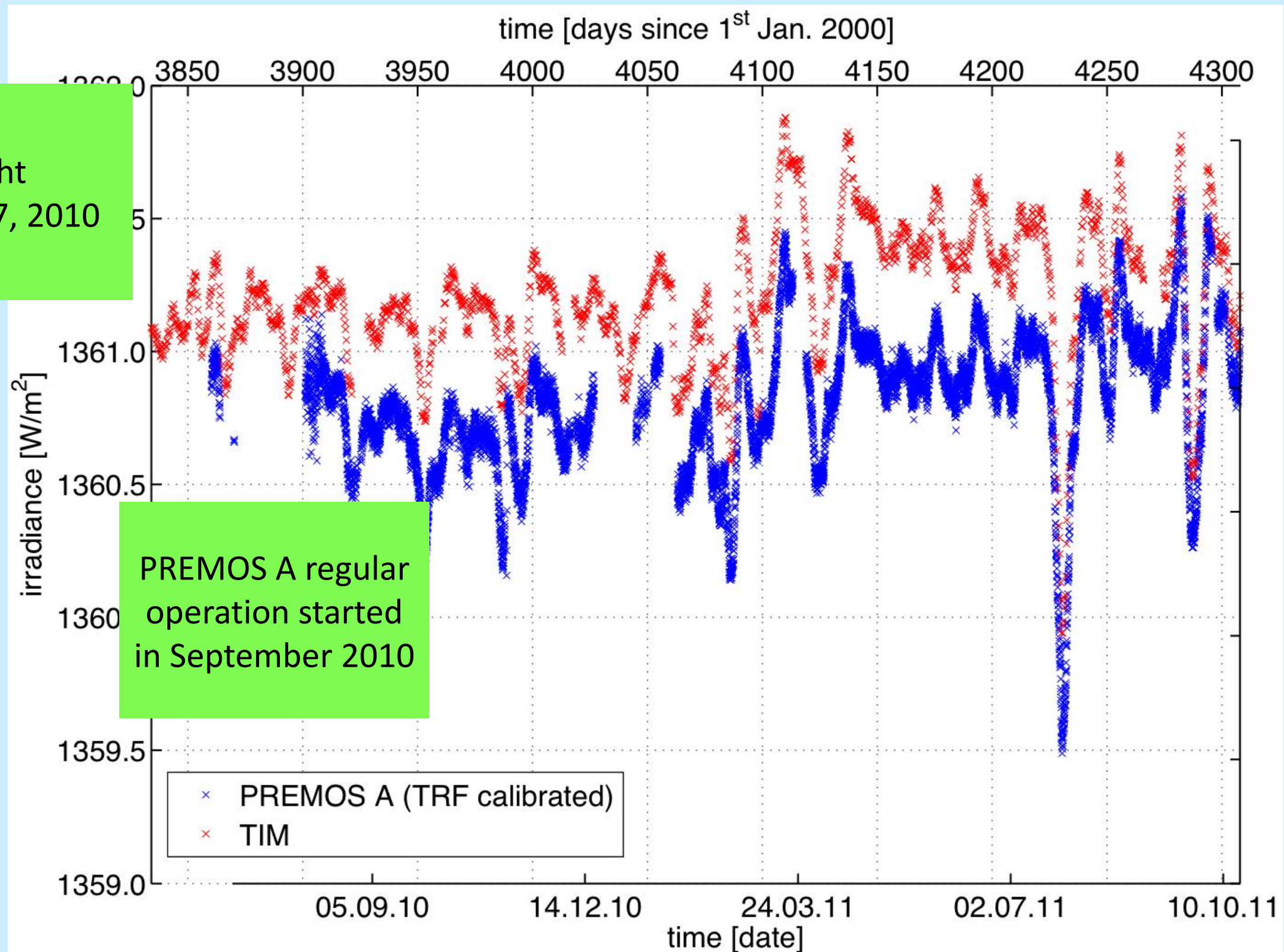
Comparison in vacuum
(power & irradiance)
to Cryorad @ LASP/TRF



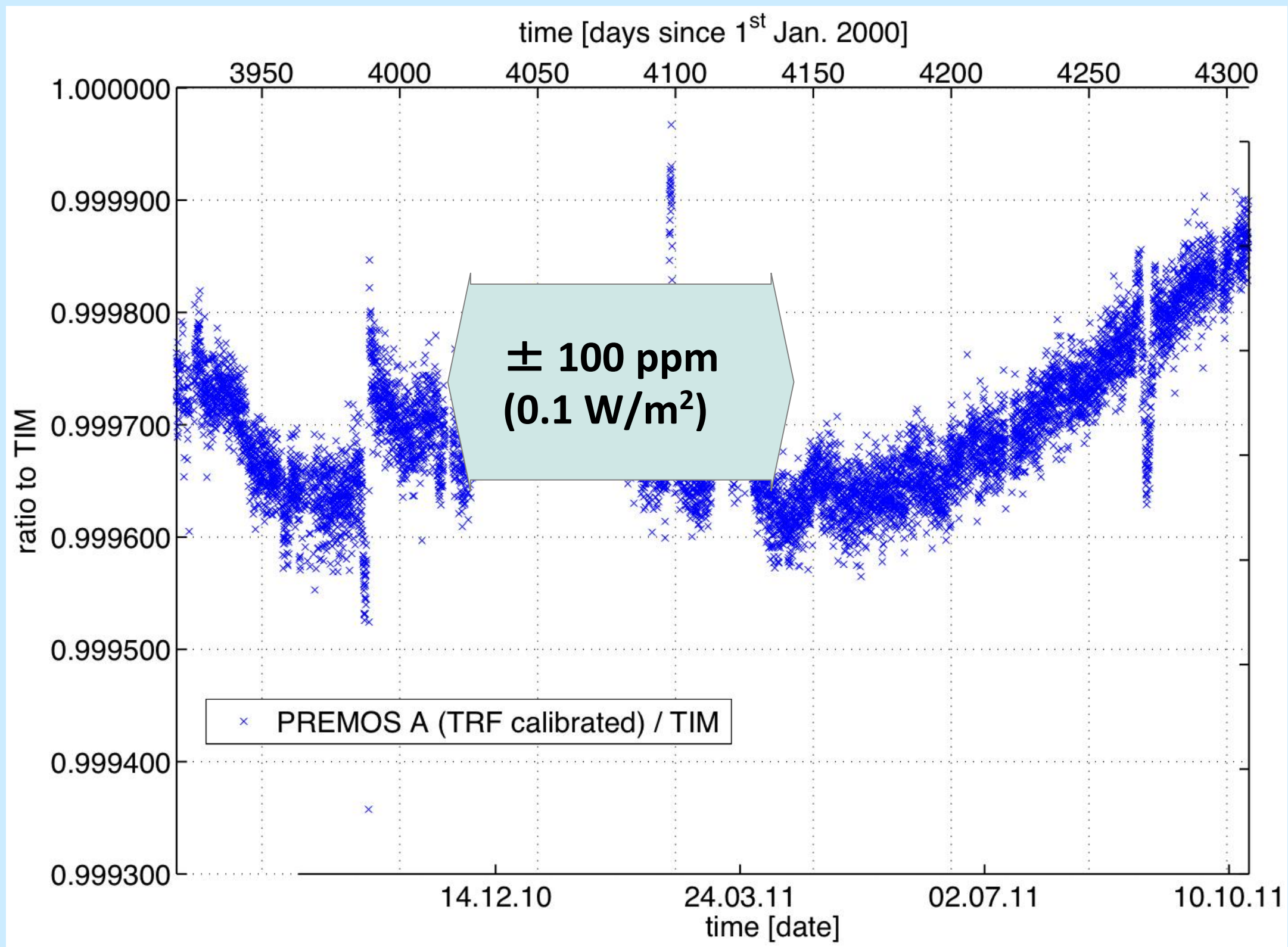
- TSI-PREMOS-A is calibrated (fully SI-traceable!)
- Absolute uncertainty is 280 ppm or 0.4 W/m^2 ($k=1$)
- PICARD/PREMOS measures 0.4 W/m^2 lower than SORCE/TIM
– thus, *agrees* with TIM within the uncertainty of the absolute calibration
- PICARD/PREMOS is about 4.5 W/m^2 lower than SOHO/VIRGO
– thus, the high value is *outside* the uncertainty limit.

Comparison PREMOS to TIM

First light
July 27, 2010



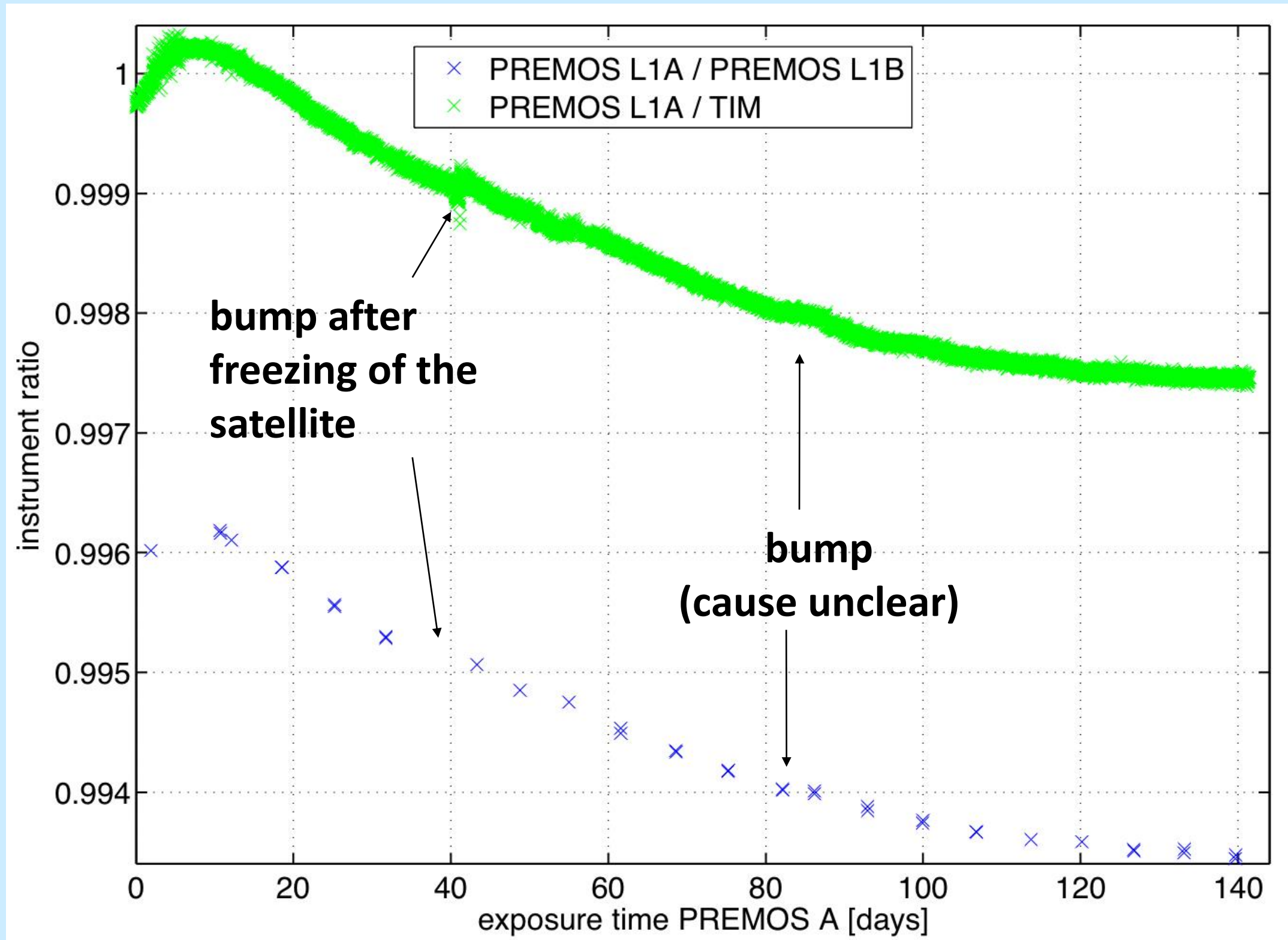
Ratio PREMOS to TIM



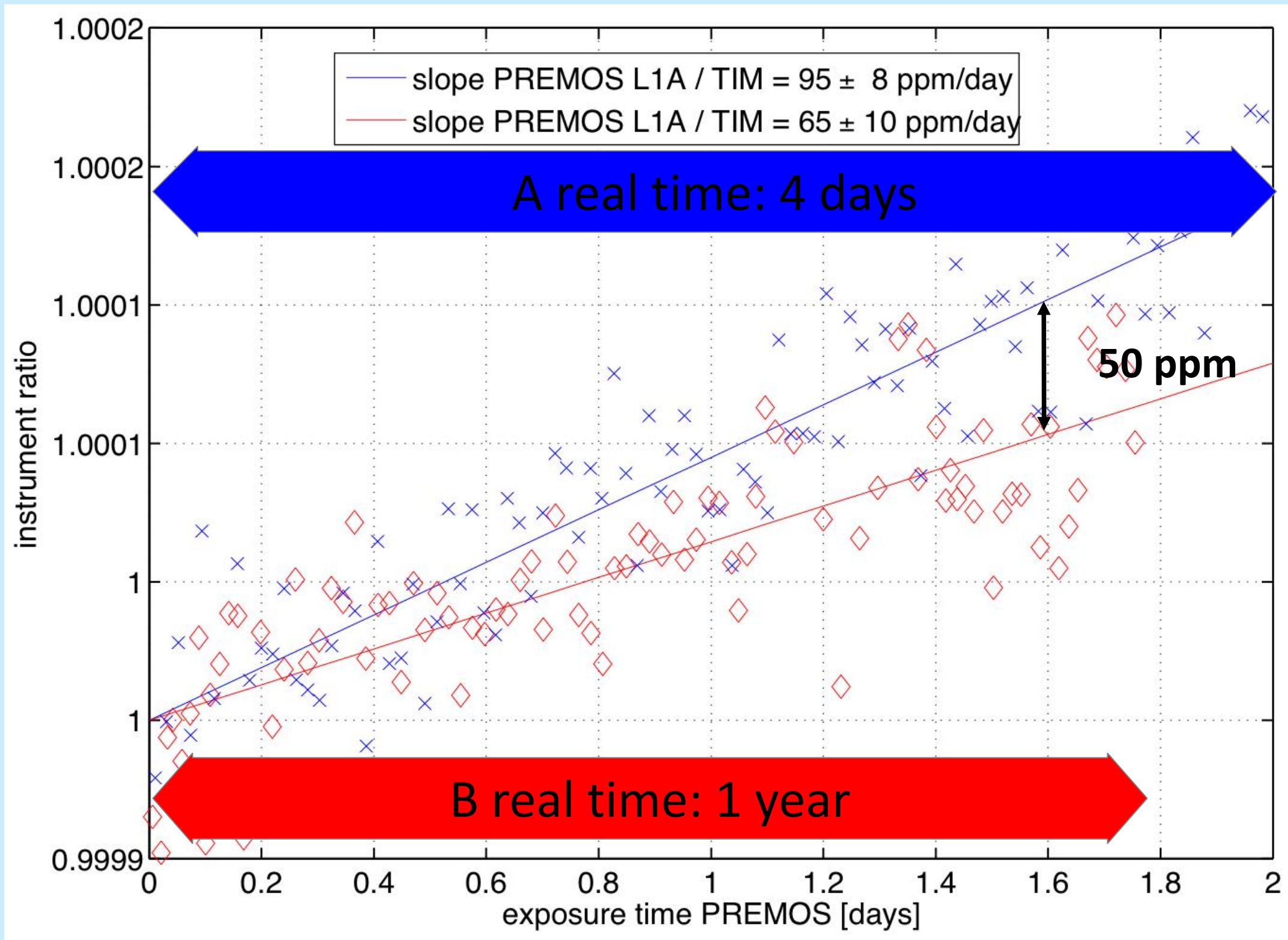
Redundancy strategies

- The sensitivity of radiometers in space change with time.
- It is thought the sensitivity change is a function of exposure time, or more accurately, of a (UV-)radiation dose.
- The sensitivity changes are evaluated by comparing two radiometers which are as identical as possible:
 - one observing the Sun operationally: PREMOS A
 - the other only occasionally: PREMOS B

Ratio PREMOS A/B

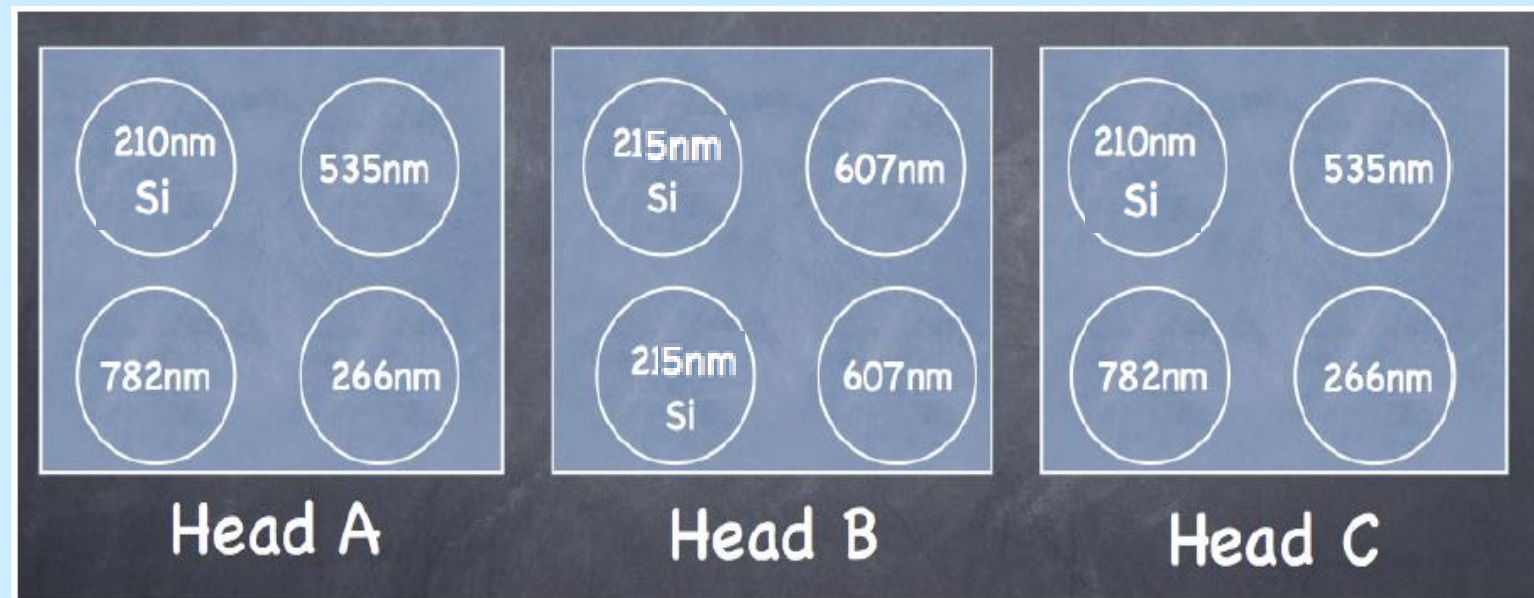


Increase relative to TIM



- The ratio of PREMOS to TIM over the first year was constant within ± 100 ppm.
- Over one year PREMOS-B, corrected with the observed sensitivity change of A, drifted relative to TIM systematically by 50 ppm.
- This can be interpreted as either:
 - TIM was drifting by 50 ppmor
 - The sensitivity changes of the two radiometers A and B are **not** identical as a function of exposure time !

PREMOS



Redundancy strategies

Head A: operational channel (1 measure every 10s)

Head C: backup channel of Head A (1 measure every day)

Head-B C1,C2 measure during 1 minute (6 samples), about every second orbit

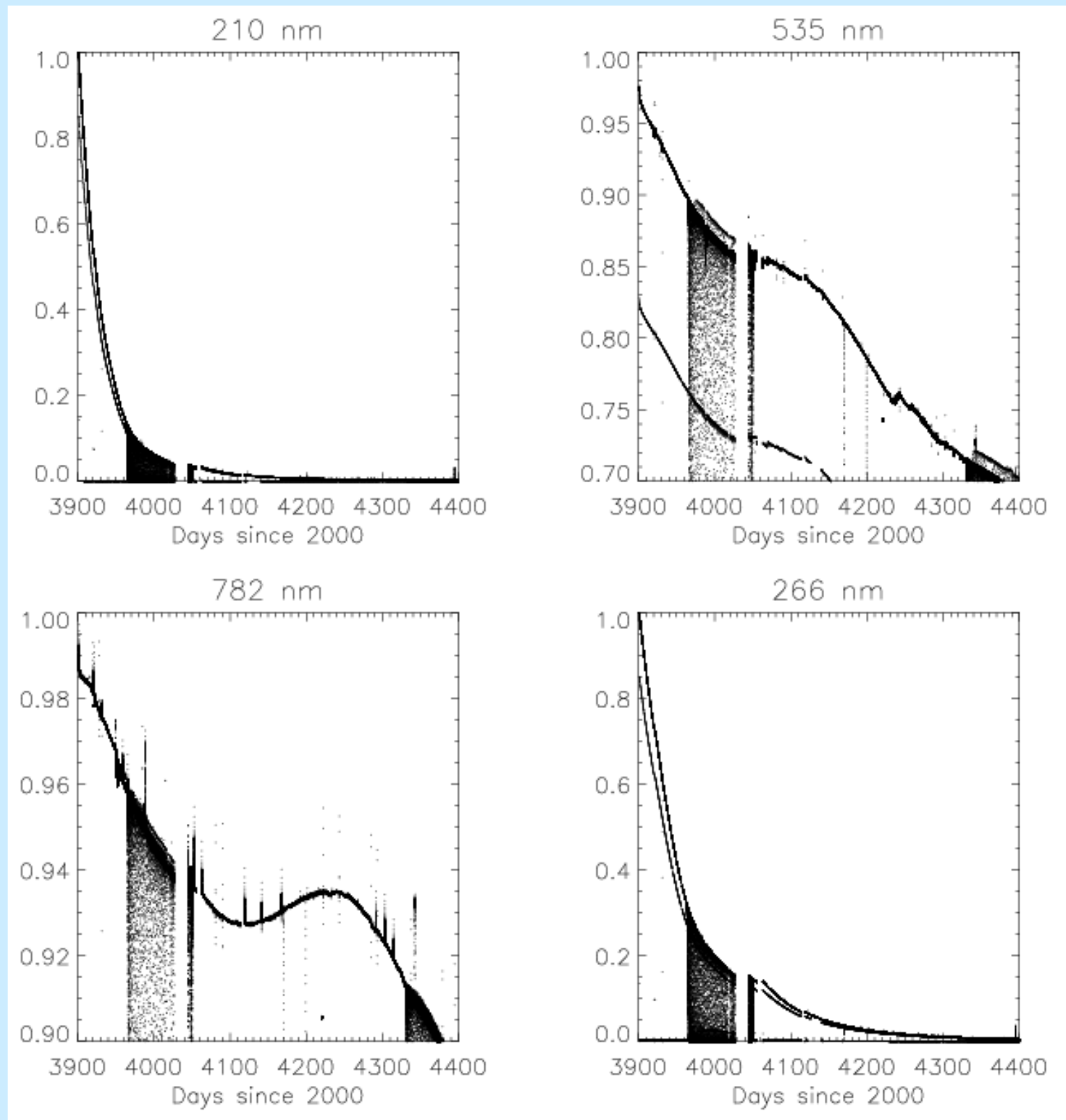
Head-B C3,C4 measure during 2 minutes (12 samples), about once a week

PREMOS-VIS 'First Light'

ATLAS & SIM spectra convoluted with actual filter transmittance

PREMOS FR	535nm	607nm	782nm
First Light @1AU	1.913	1.858	1.174
@ T=20°	1.961	1.858	1.203
ATLAS	1.983	1.772	1.188
SORCE/SIM	1.918	1.731	1.169
	 0.5%	 +6%	 +2%

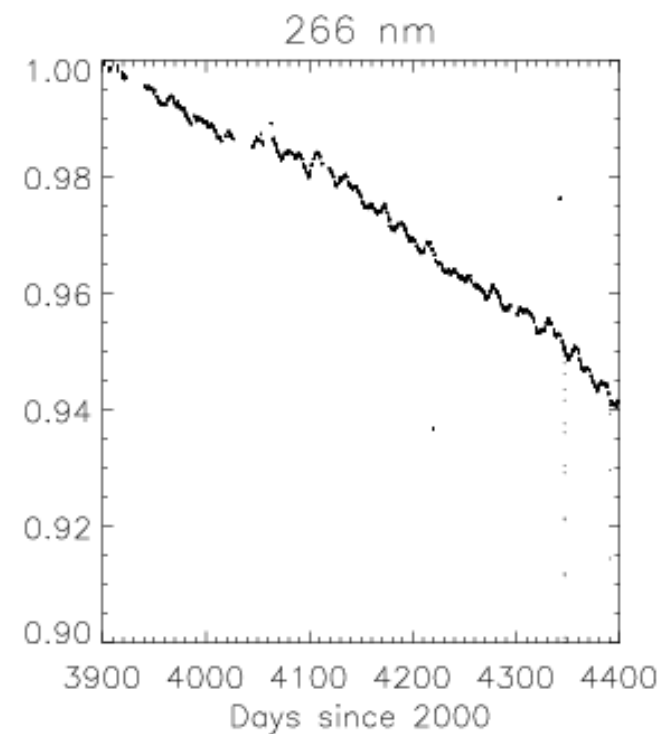
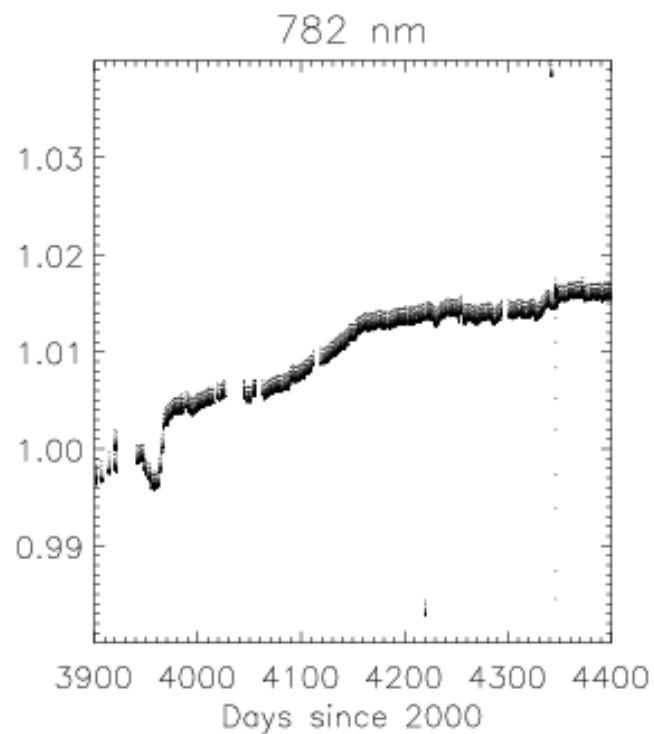
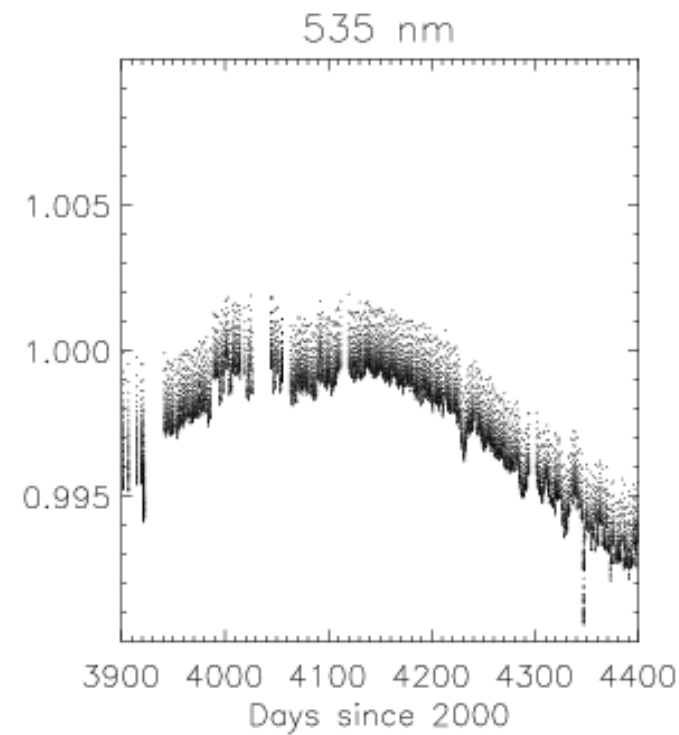
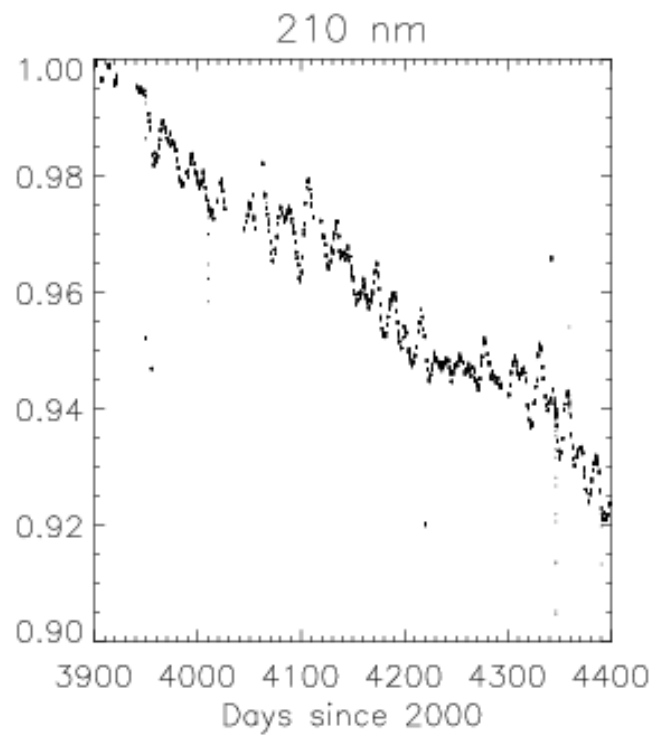
Degradation Issues



Head-A, continuous operation

- Strong degradation:
 - UV channels <1% after 461 days
 - VIS channels >50%
- Gap July – August 2010
 - exposure related degradation?
- Unexpected excursion at 782nm
 - +1% from D4114 to D4232 ?

Degradation Issues



Head-C, backup for Head-A
UV channels

210nm -7%

266nm -5%

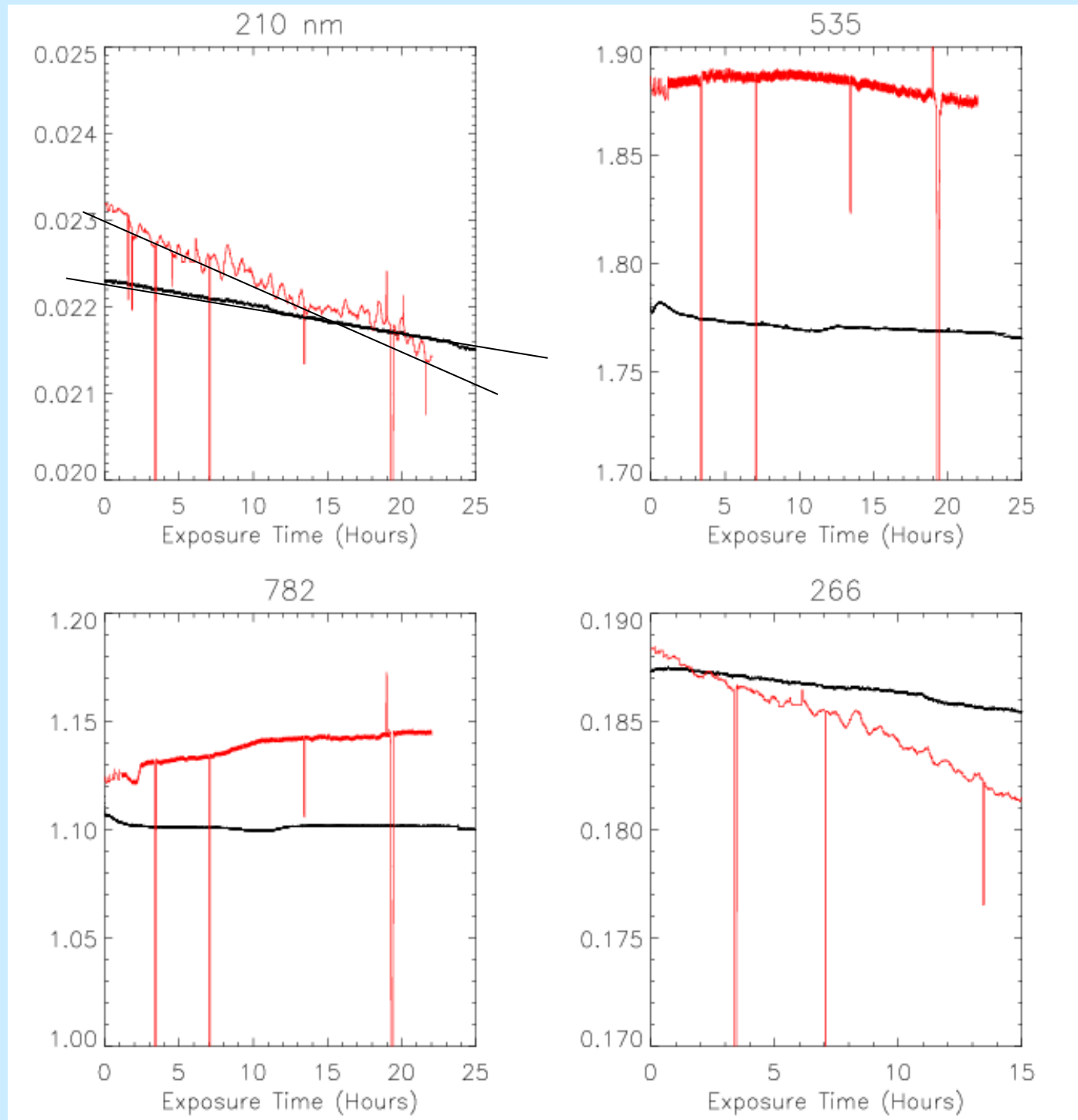
VIS-NIR channels

535nm \approx -1%

782nm +2%

NIR: change of the filter
transmission ?

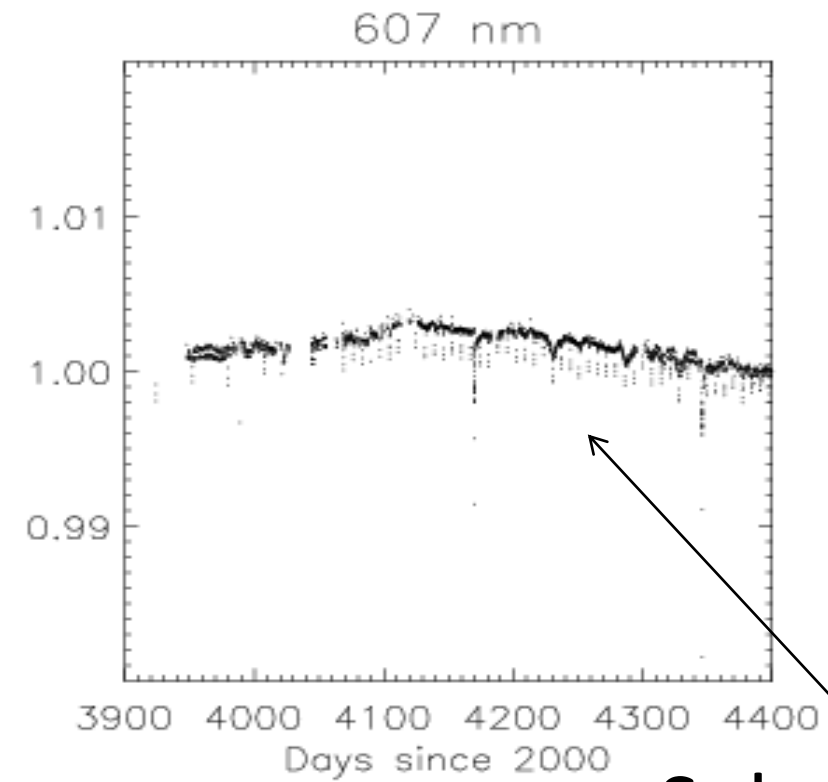
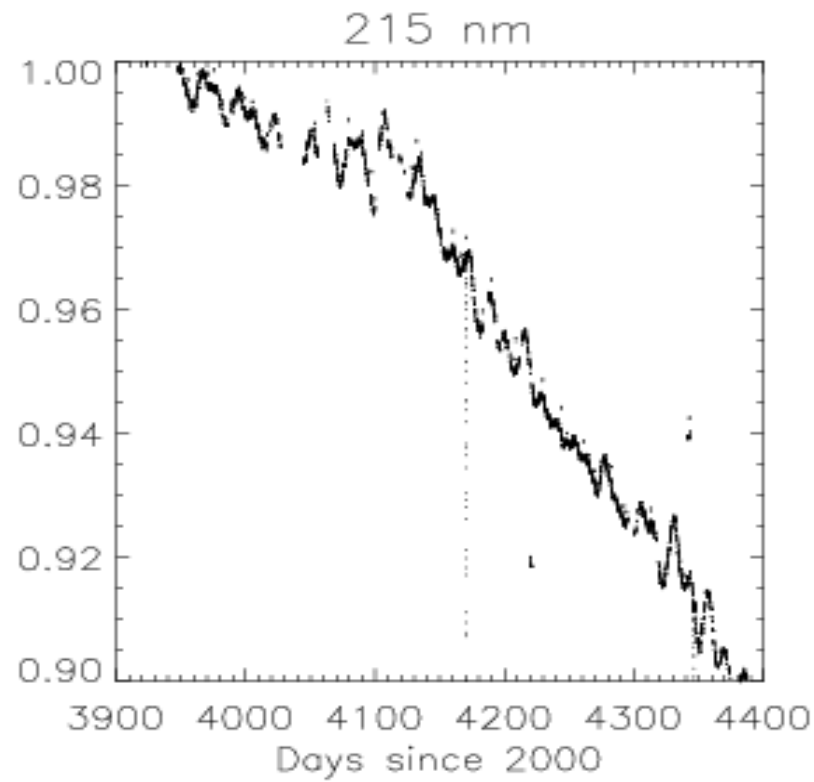
Exposure time: Operational vs. Backup



- Different behaviour according the time exposure
- Degradation of filters according the exposure time (contamination)
- Degradation of filters according real time ? (structural change, what kind of contamination ? ,...)

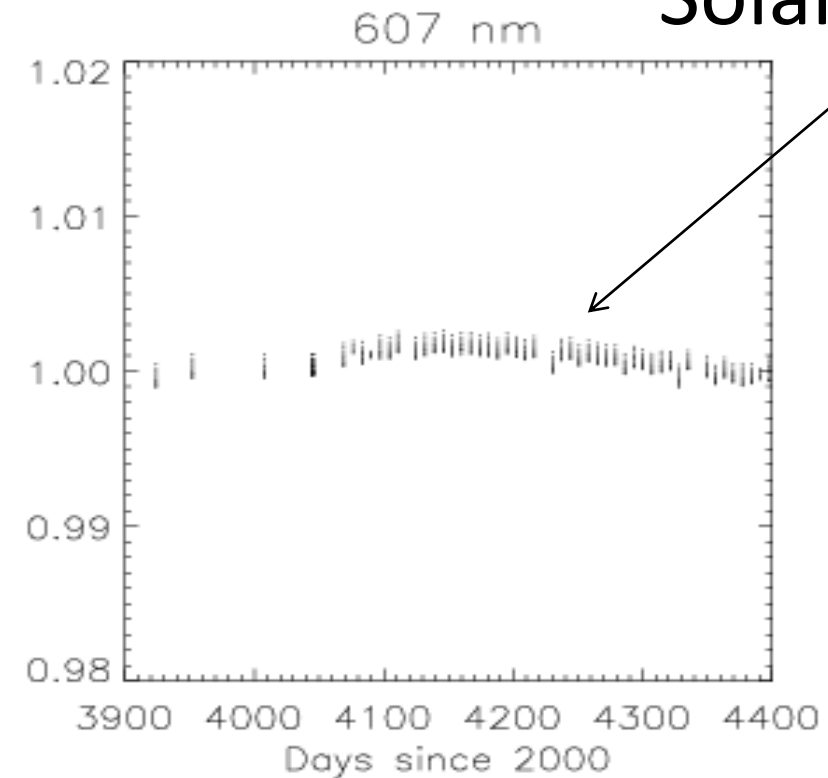
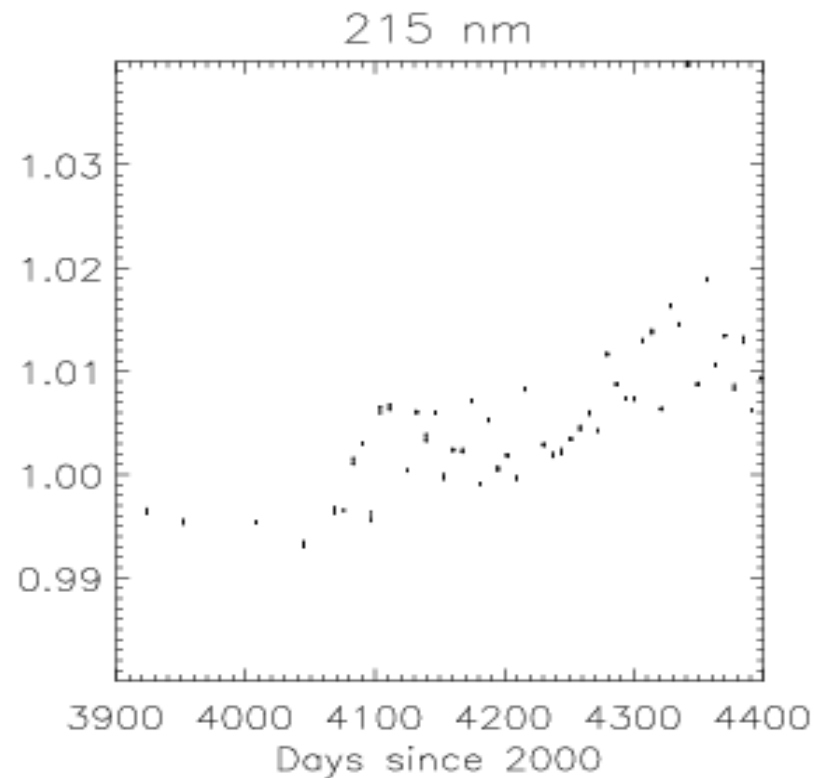
Head B

Degradation ~10%

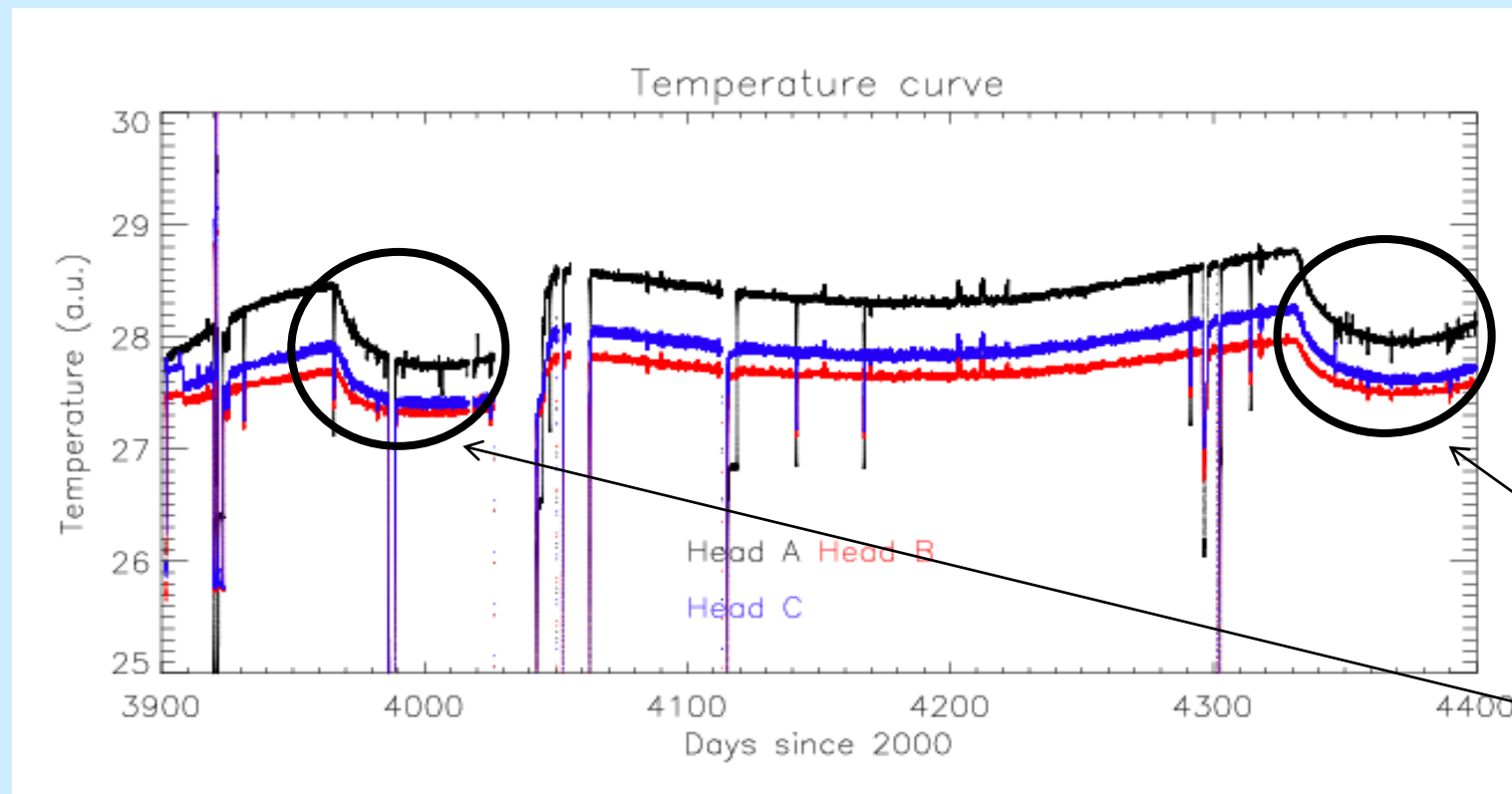


Solar signal ?

No degradation (?)

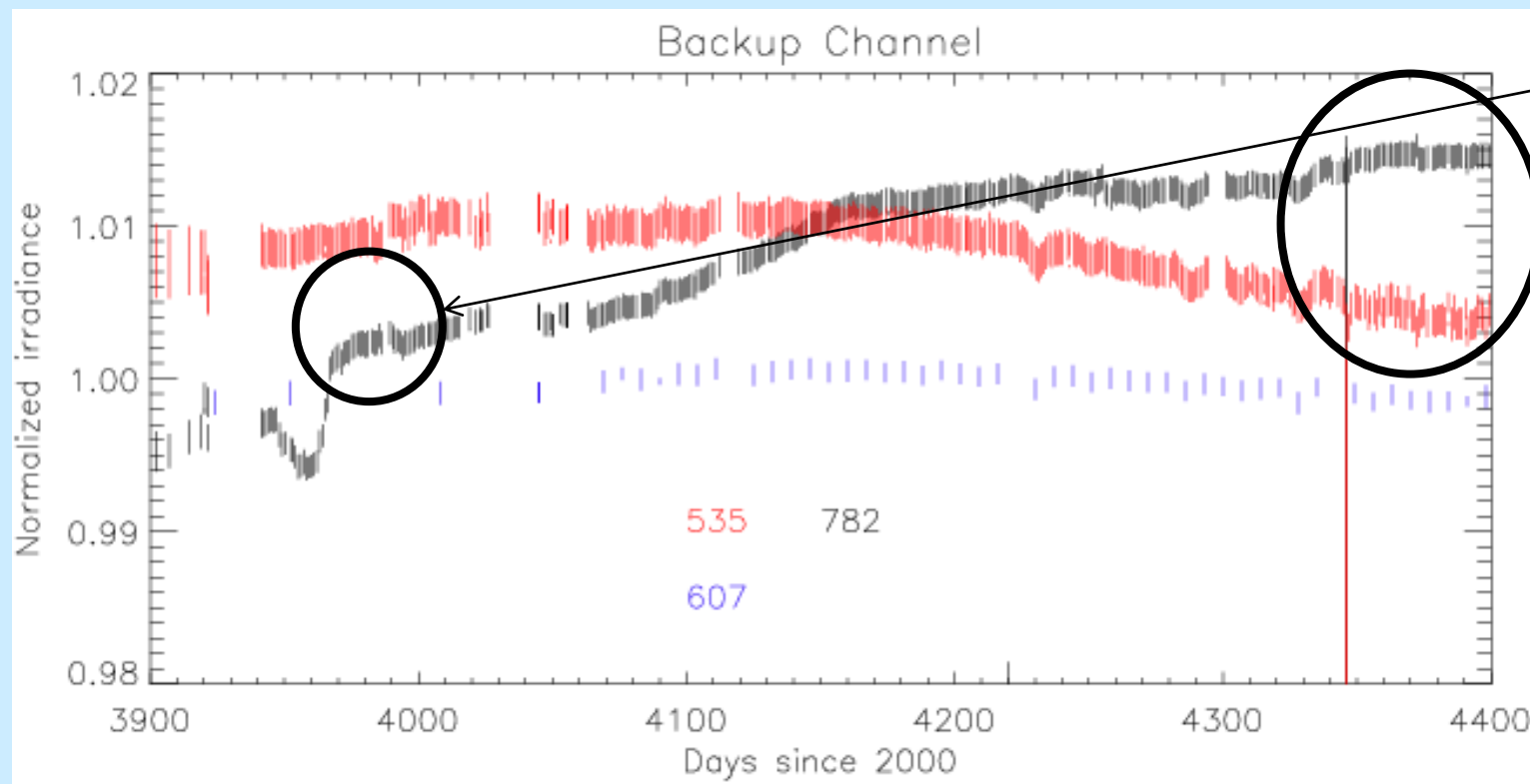


Effect of the temperature



Long term trend

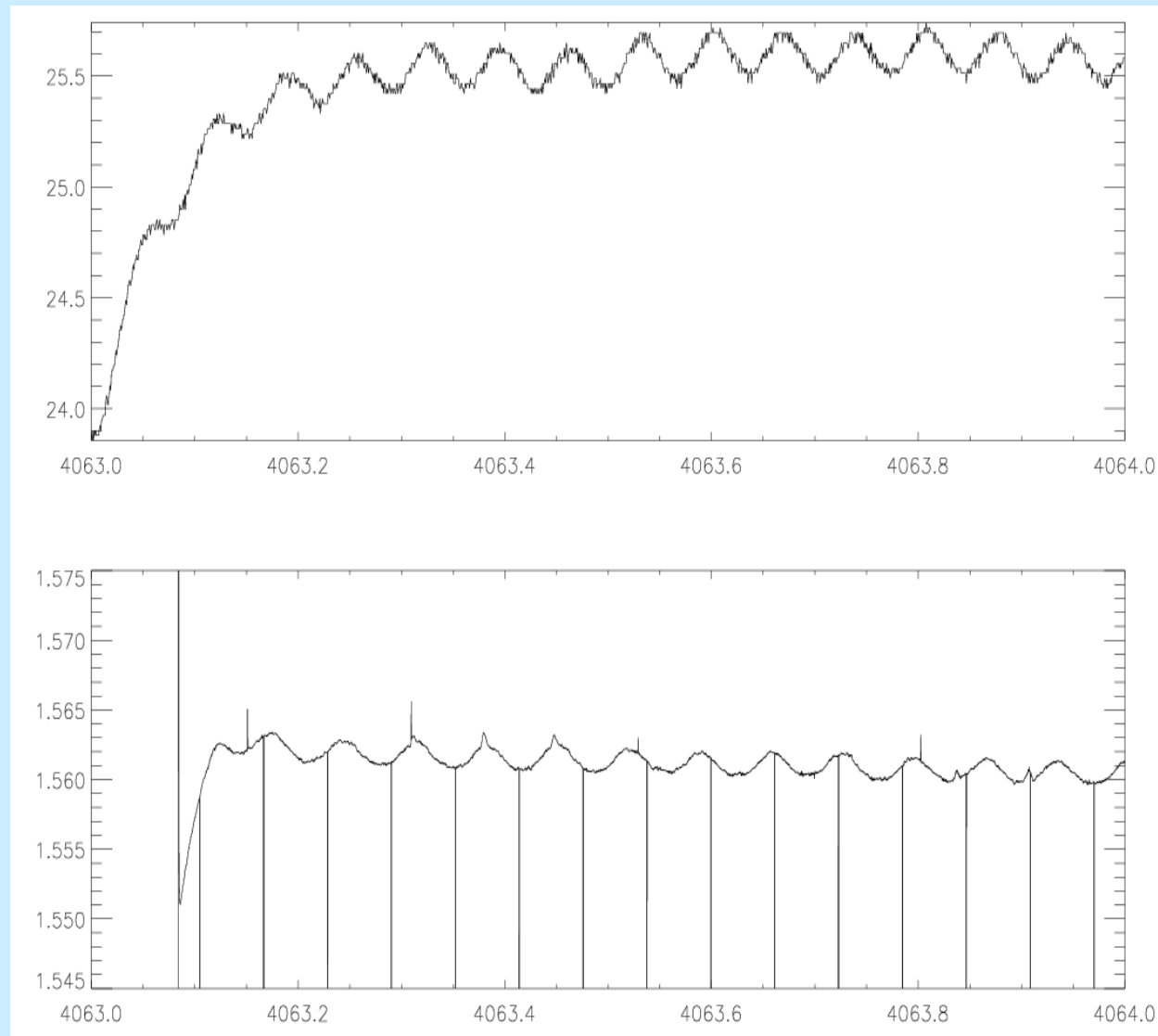
Occultation
season



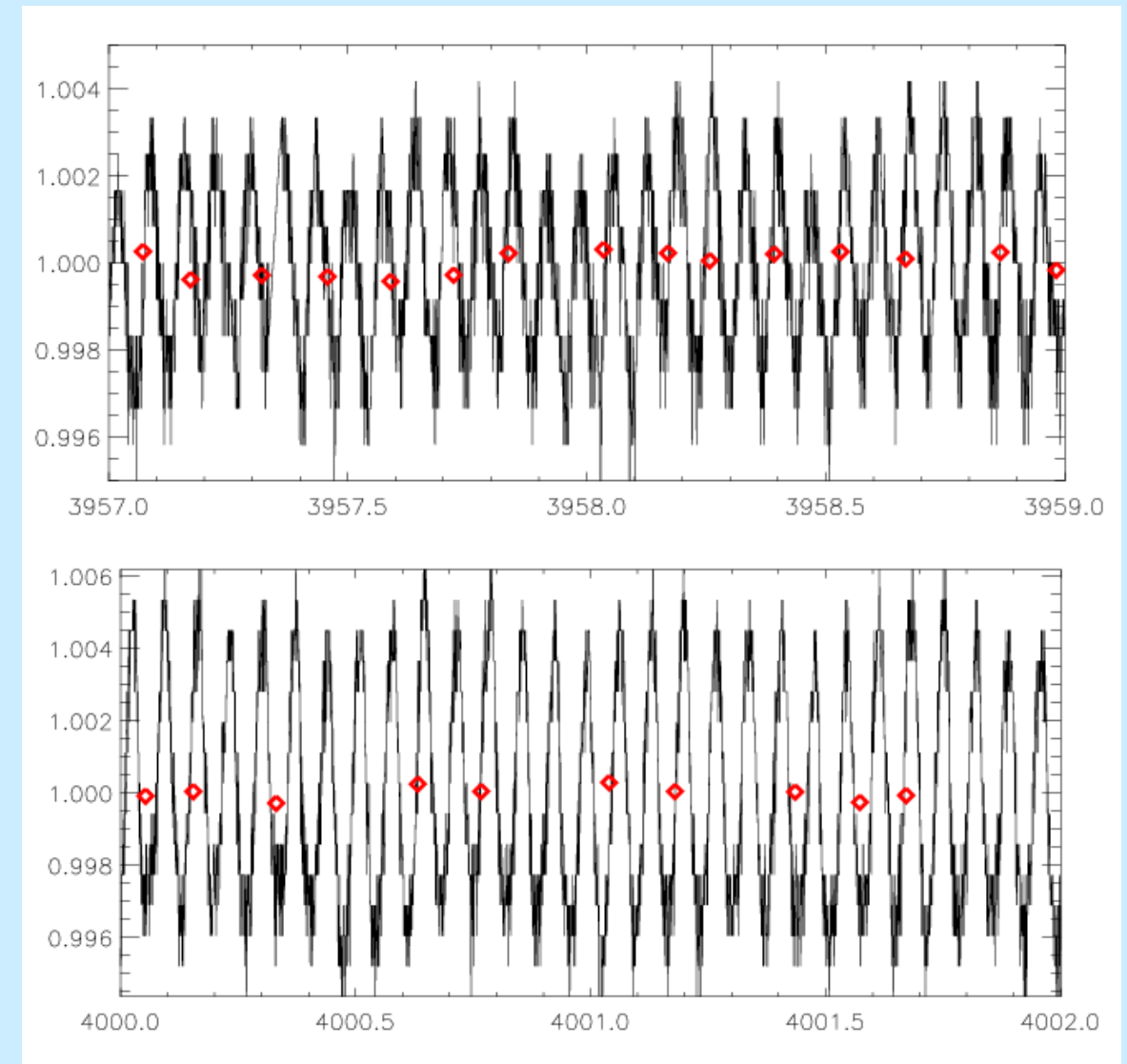
Effect of the temperature

Daily effect

535 nm

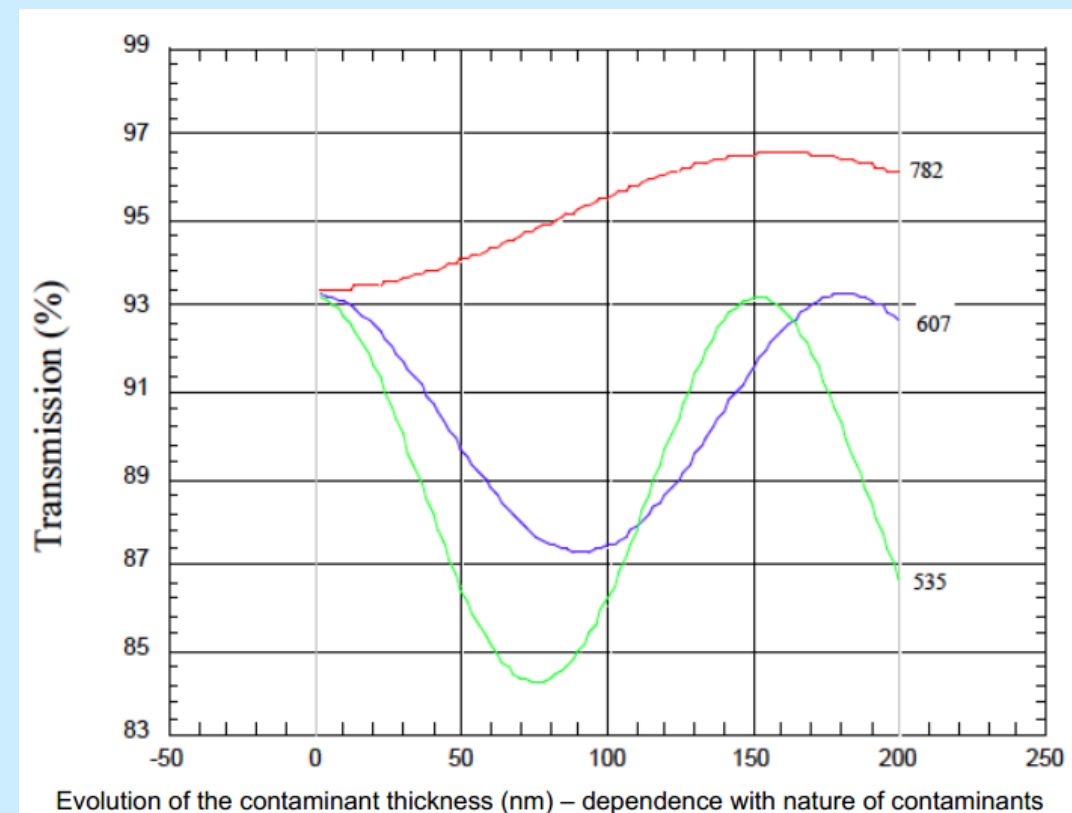
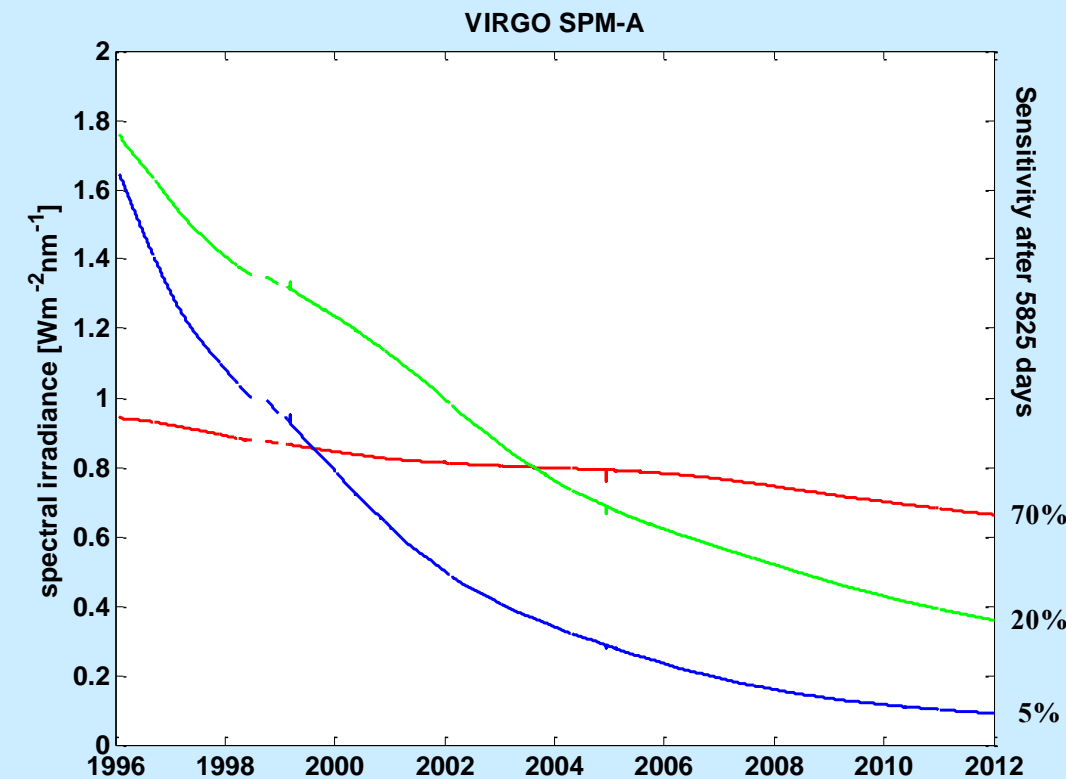


607 nm



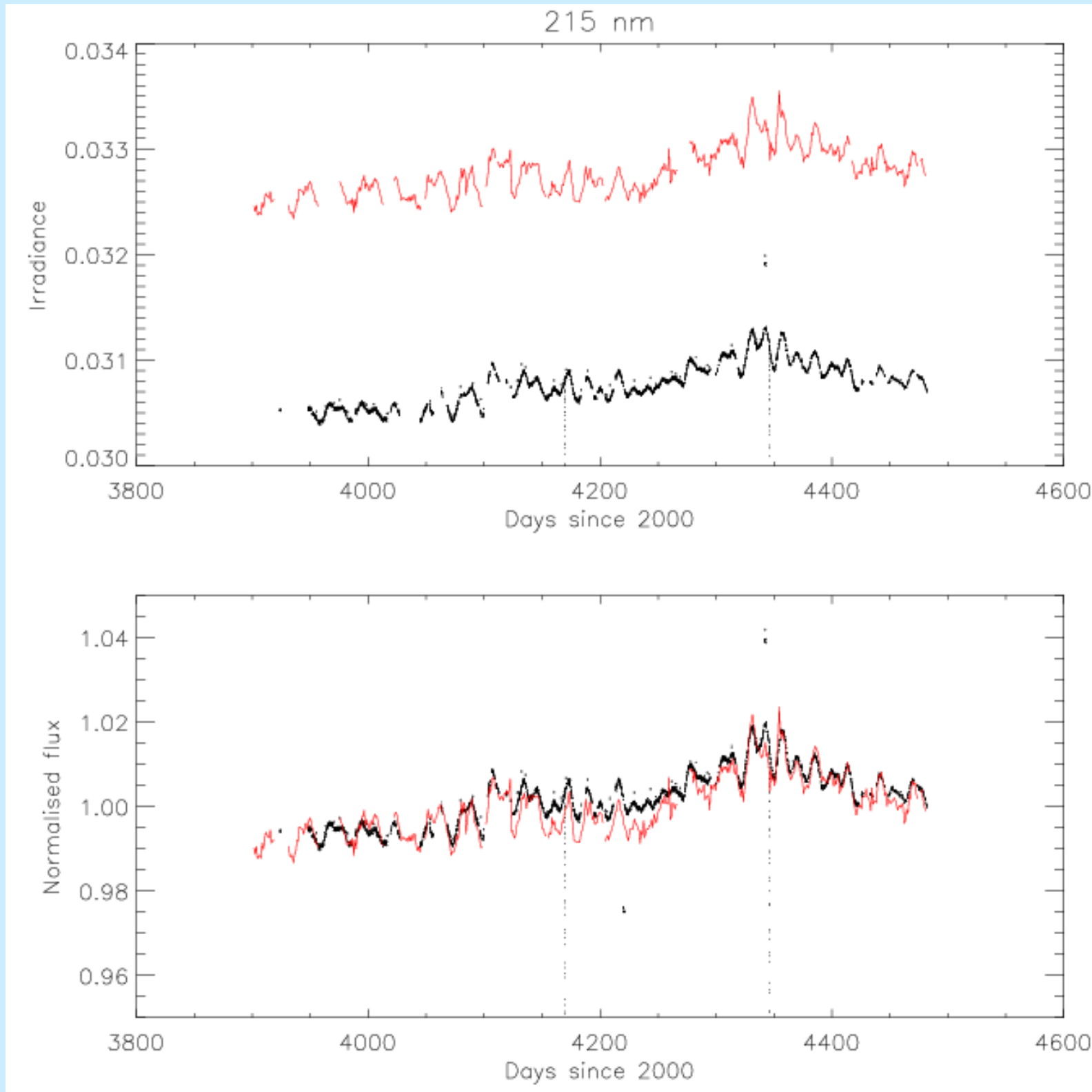
Summary of FR performance

- Strong degradation in operational UV channels
- Exposure time: Operational – Backup channels differ markedly
- Degradation in VIS channels is significantly larger than in VIRGO filter radiometer
- Signals anomalies in visible channels under investigations



First results of PREMOS

Comparison with SORCE/SOLSTICE and Head B



Independant correction

Strong correlation

13.5 and 27 days modulation

Data needed to compare 535 nm, 607 nm and 782 nm !

- SIM ? Degradation issues
- SOLSPEC ? Low time resolution
- SCHIAMACHY ? No calibration

Thank you

pmod  *wrc*

