Physikalisch-Meteorologisches Observatorium Davos
World Radiation Center

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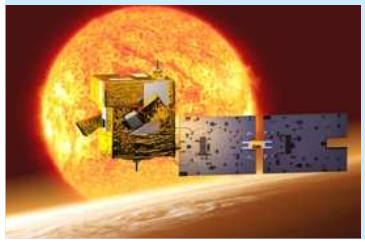
PICARD Workshop

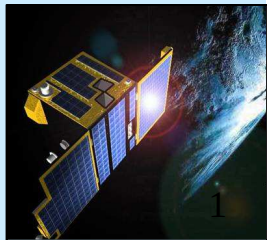
April 10th, 2012

PREMOS
Instrument status and first results

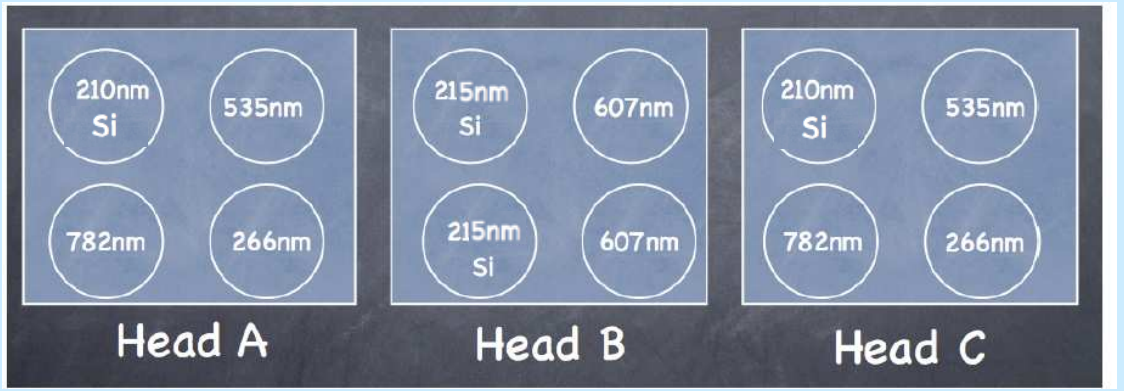
G. Cessateur for the PREMOS team

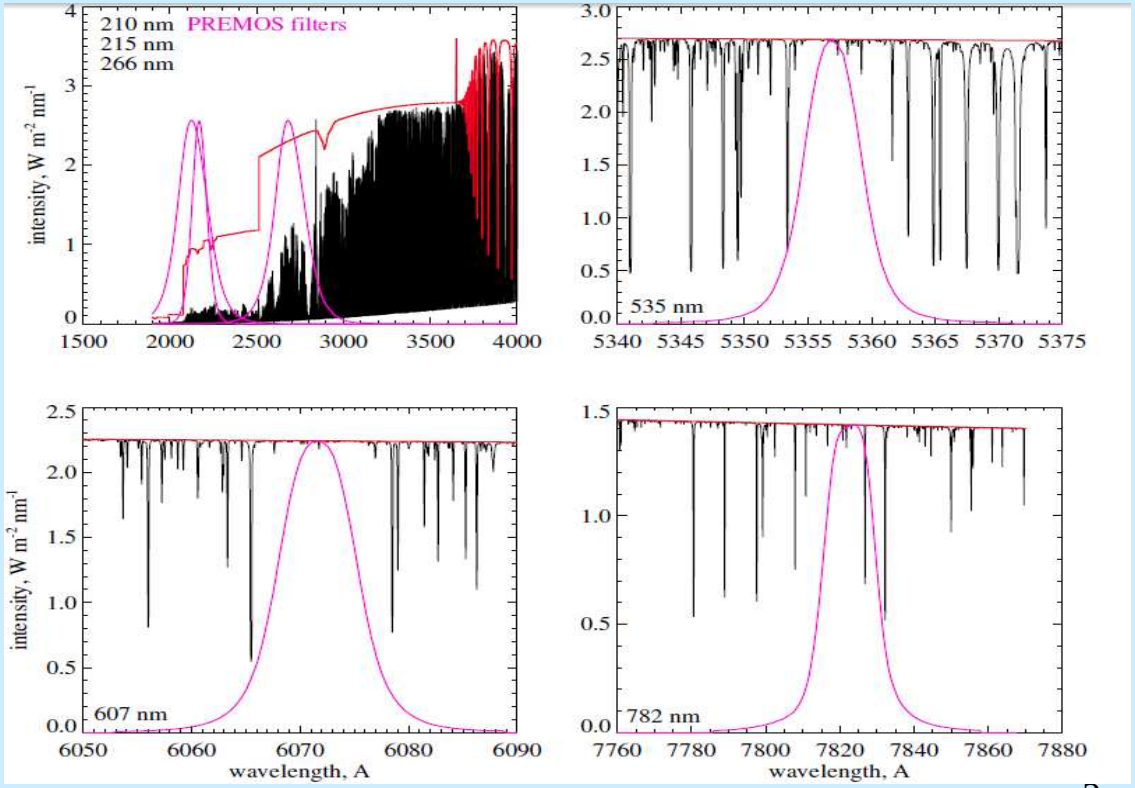
PMOD/WRC, Switzerland



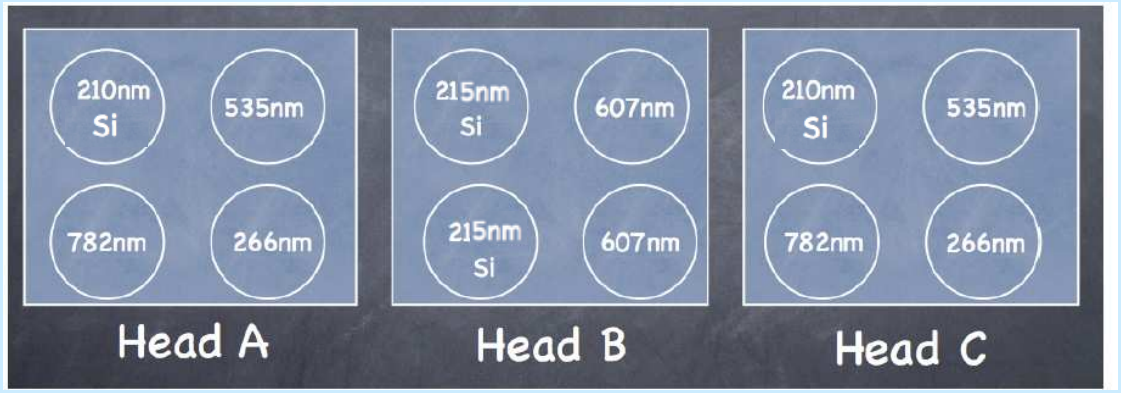


Radiometer at 6 wavelengths



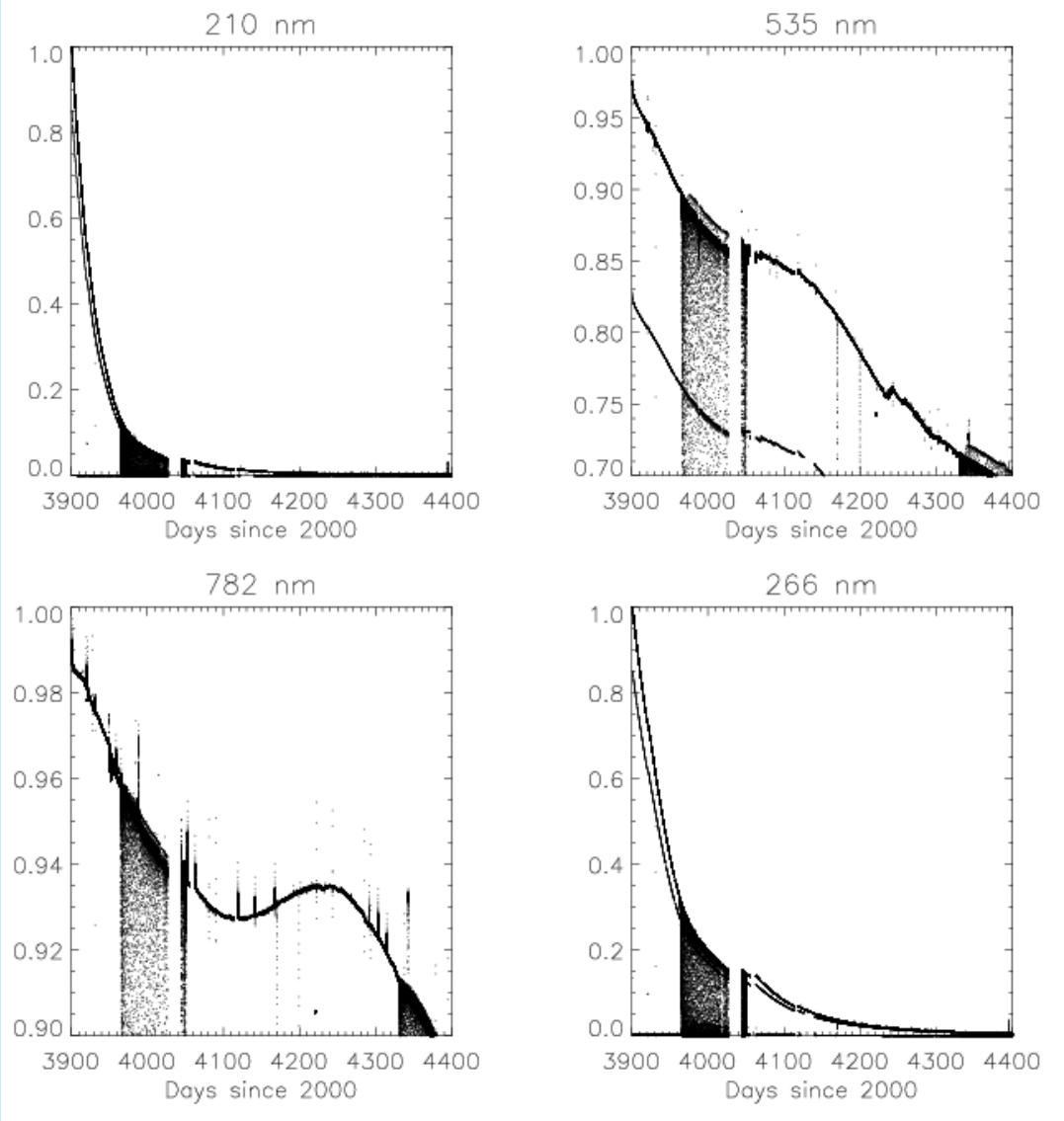


Redundancy strategies



- ✓ 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

Degradation Issues



Head-A, continuous operation

✓Strong degradation:

- UV channels <1% after 461 days
- VIS channels >50%

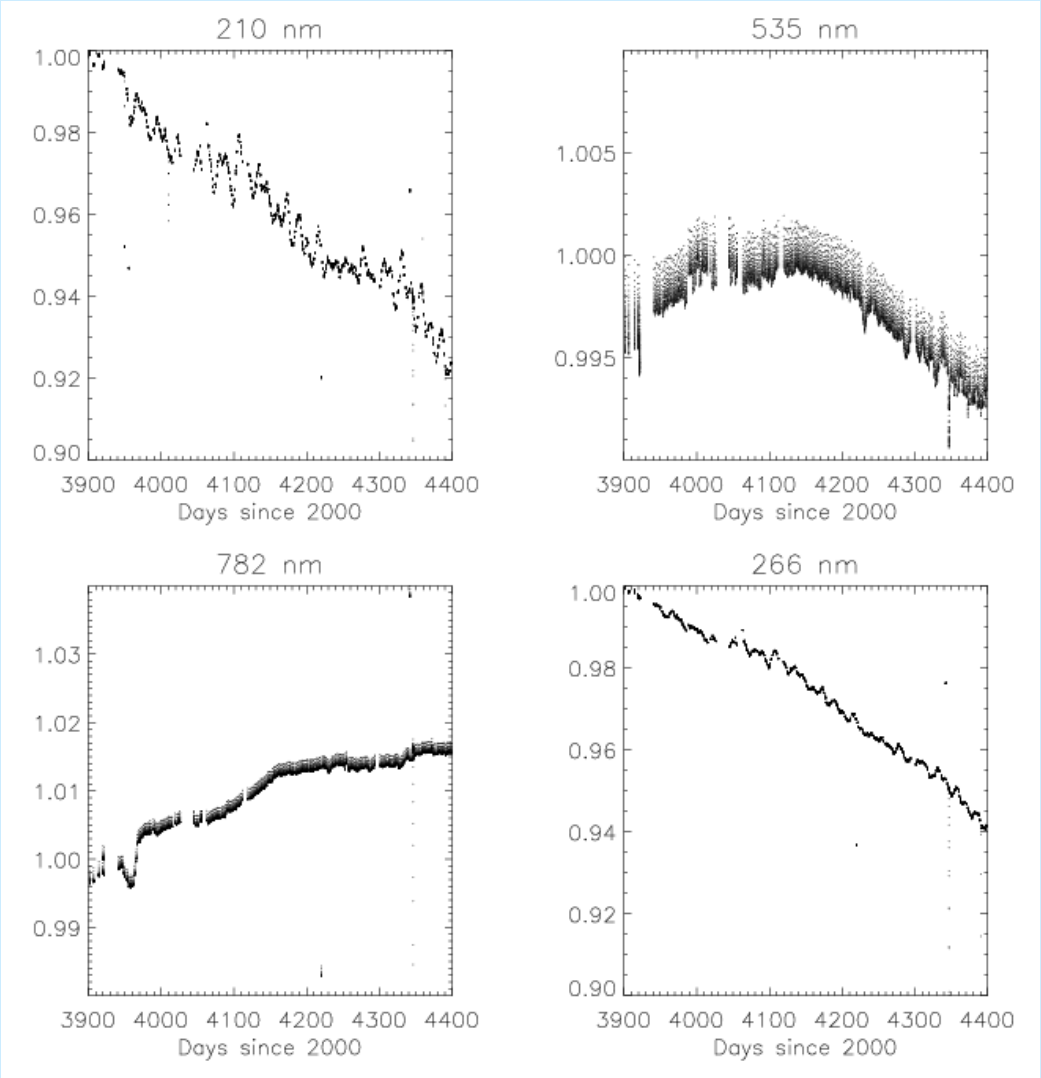
✓Gap July – August 2010

→ 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

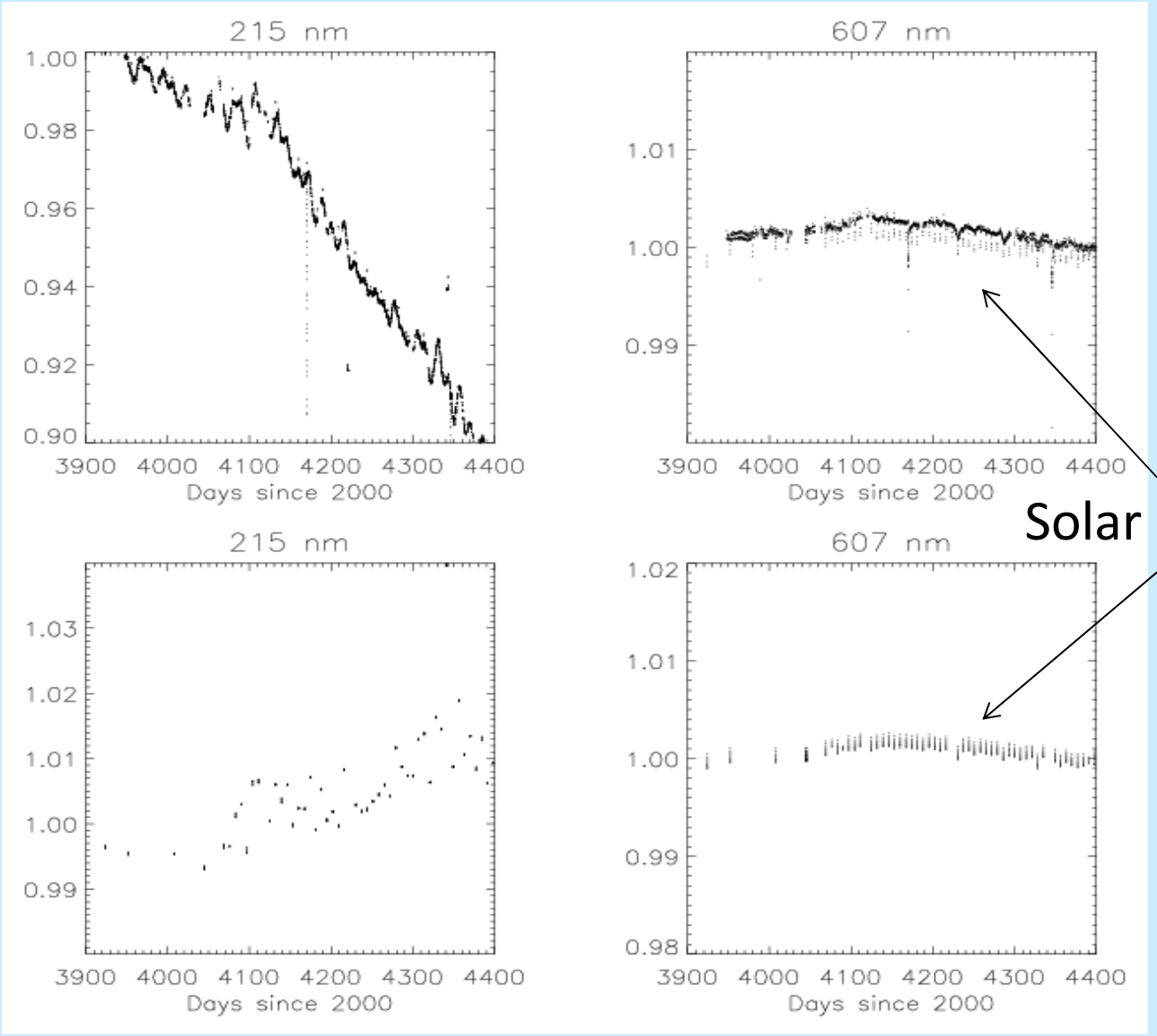
- 535nm ≈ -1%
- 782nm +2%

NIR: change of the filter transmission ?

First light paper in preparation

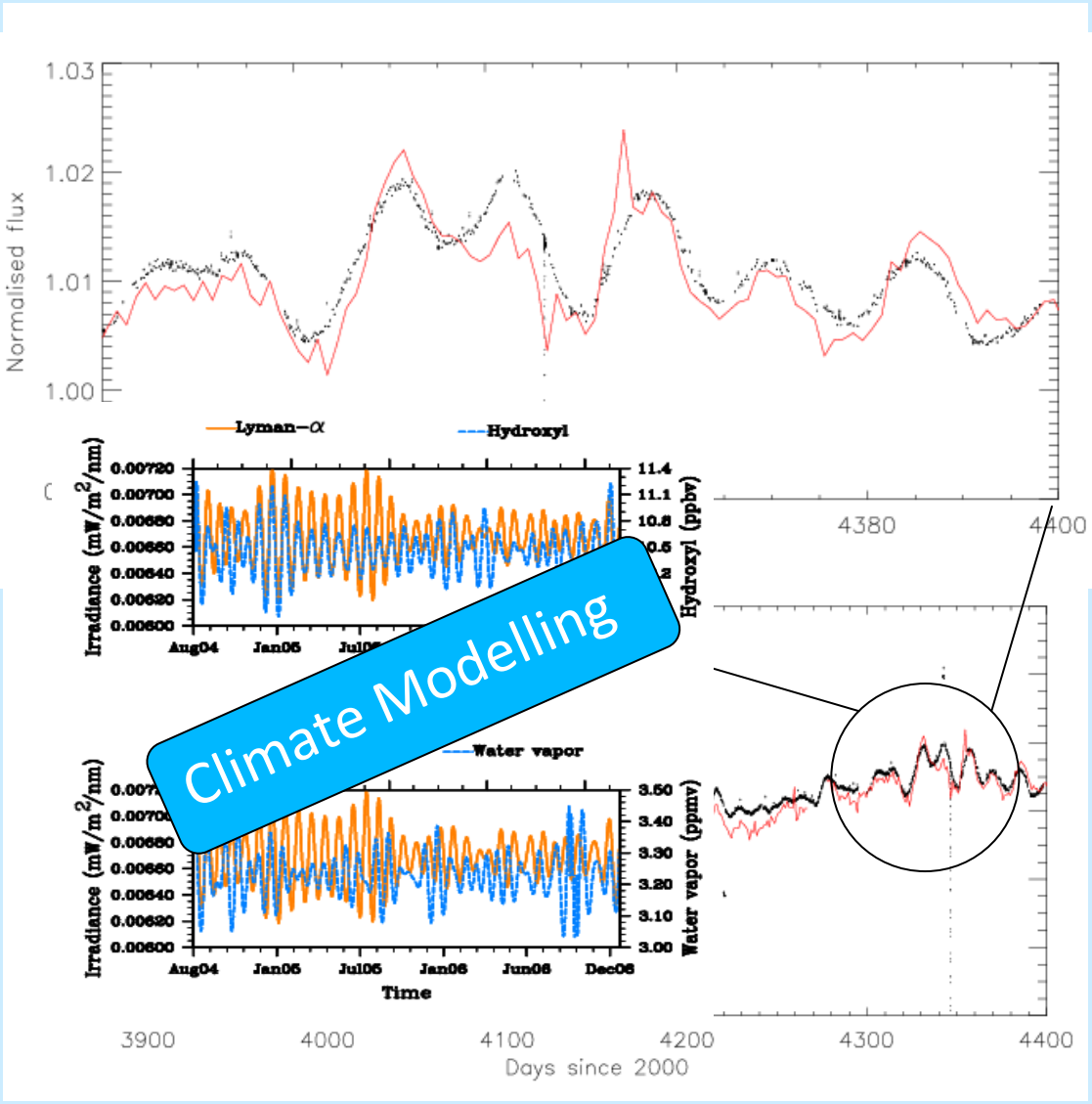
Head B: Interesting first results

Degradation ~10%



No degradation (?)

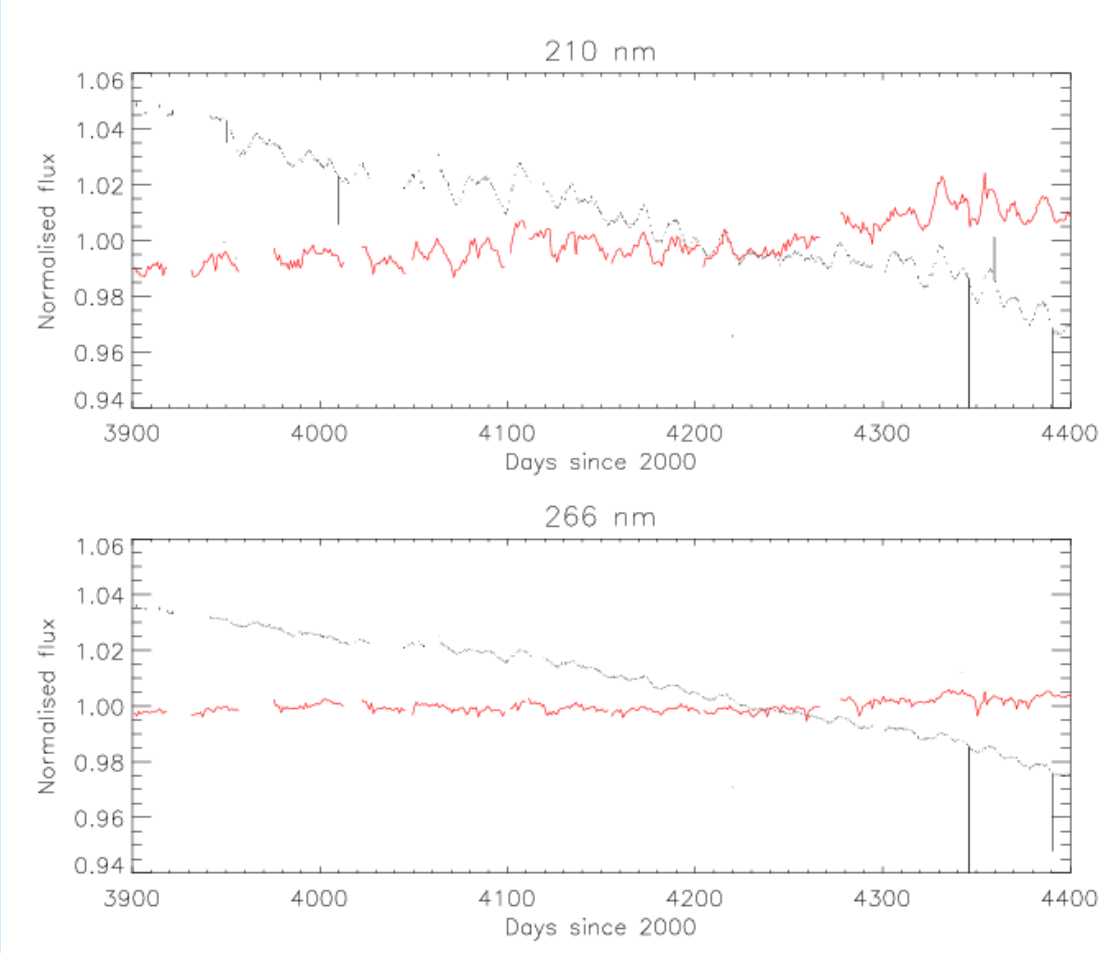
Comparison with SOLSTICE



- ✓ Independant correction
- ✓ Strong correlation

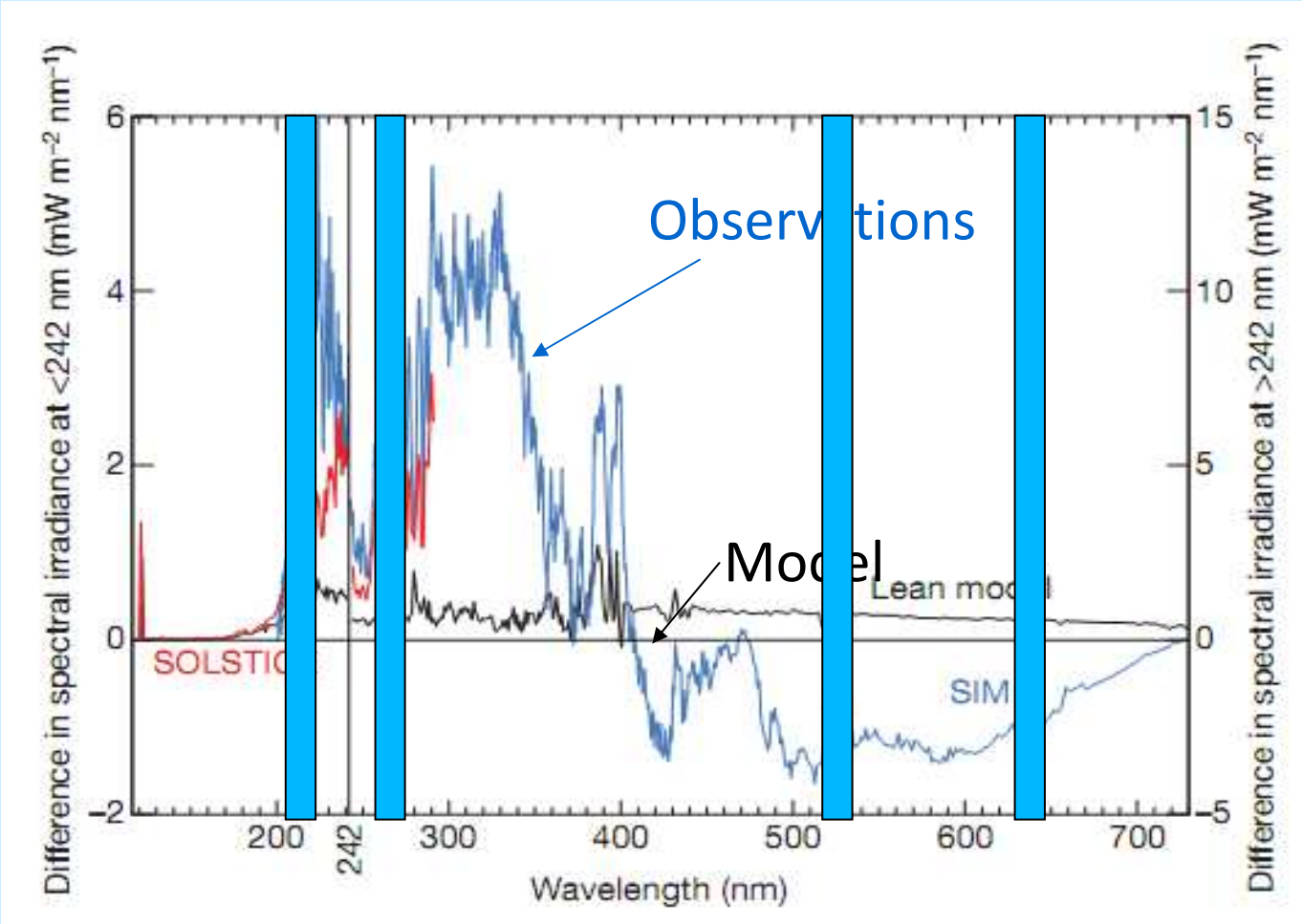
  13.5 and 27 days modulation
- ✓ **Rotational modulation more accurate**
- ✓ Solar modelling : current work (paper in preparation)
- ✓ Similar paper with PROBA2/LYRA data recently published

Comparison with SOLSTICE



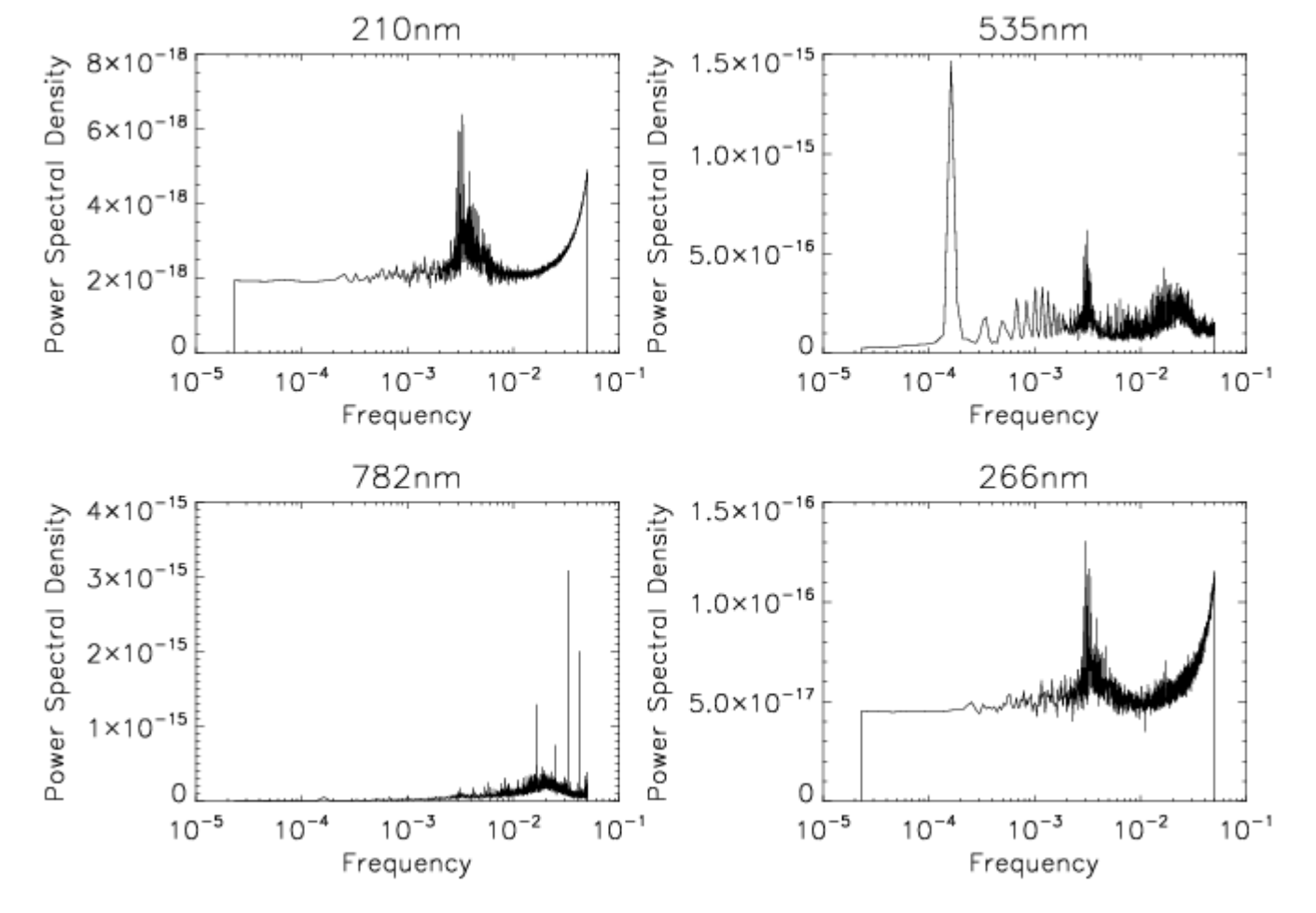
- Degradation correction for others UV channels in progress
- Solar modelling: current work (paper in preparation)
- Collaboration with ROB comparison of degradation model with LYRA (next summer)

Comparison with SORCE



Information about the inversion point ?
Longer time series really needed!!!
Current work: comparison with SIM data

Helioseismology



Current work: degradation correction to get a better statistics

Perspectives

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Interesting Physics burried in PREMOS data

Solar modelling
Climate modelling
Head B and C still excellent for duty !

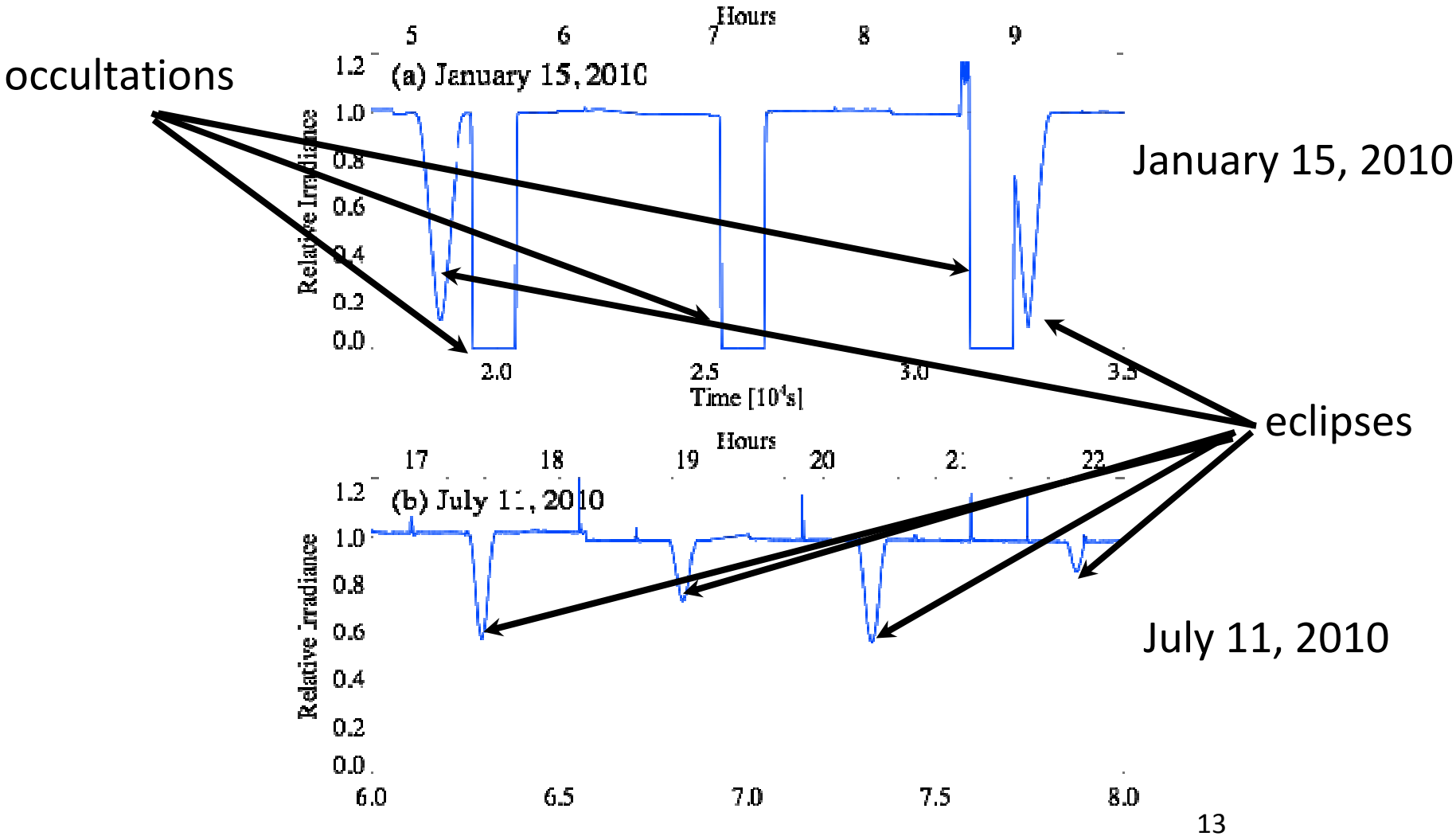
The only one instrument left after SORCE ends !

(2012 ? 2013 ?)

Herzberg, Visible and InfraRed ranges
Continuous measurements is a real necessity for the community!

Additional Material

Eclipses and Occultations



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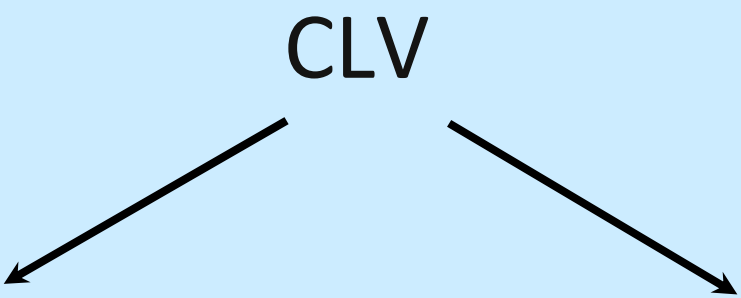
Aims

The light curves of the eclipses allow one to accurately retrieve the center-to-limb variations (CLV) of the solar brightness



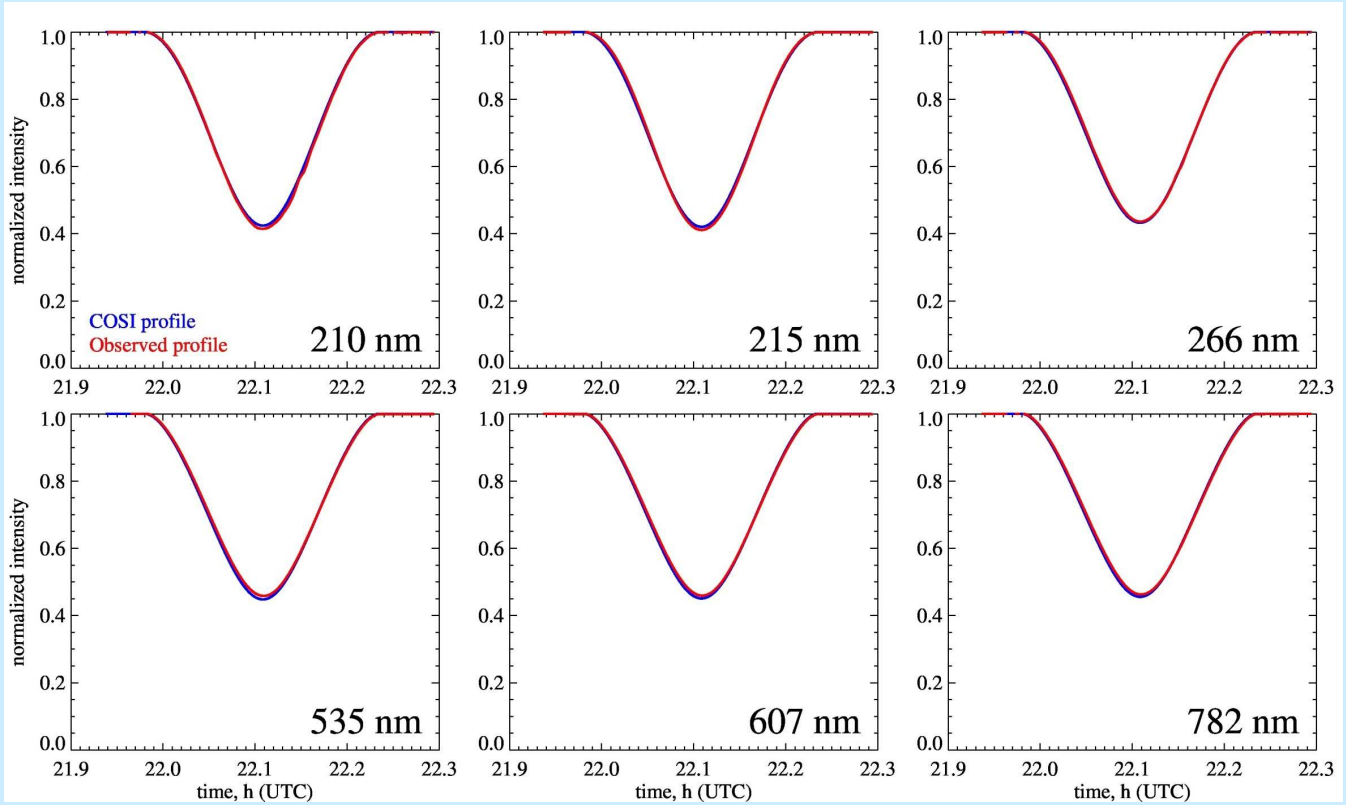
Important for modeling of the irradiance variations on the time-scale of the solar rotation

Provide a valuable information about the solar atmosphere

We employ the 1D NLTE radiative transfer COde for Solar Irradiance (see Shapiro et al. 2010, A&A 529, 67) to calculate the CLV

Comparison of the eclipses profiles COSI/PREMOS

June 01, 2011 (Transit 2)

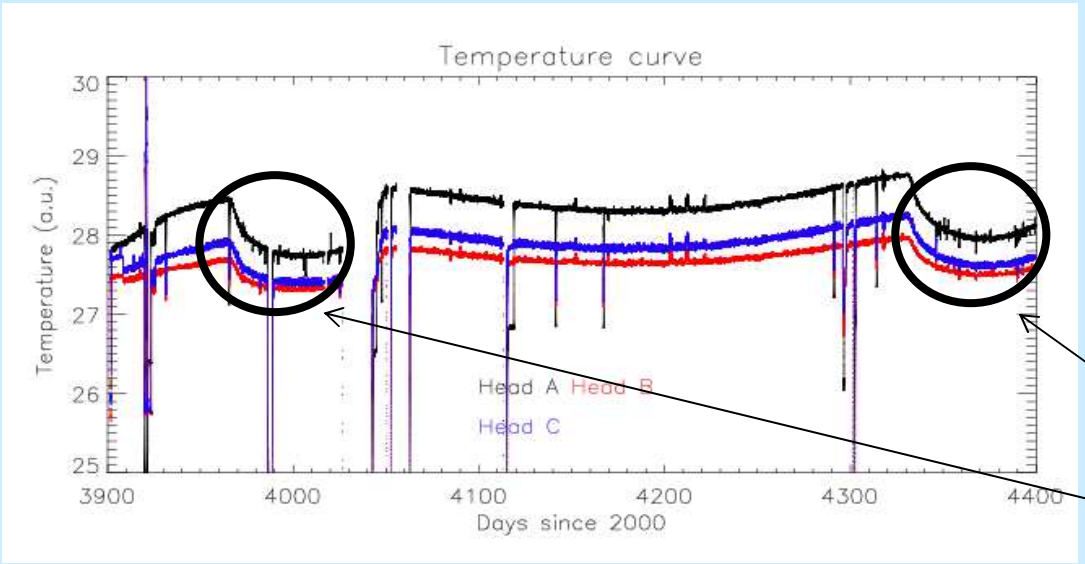


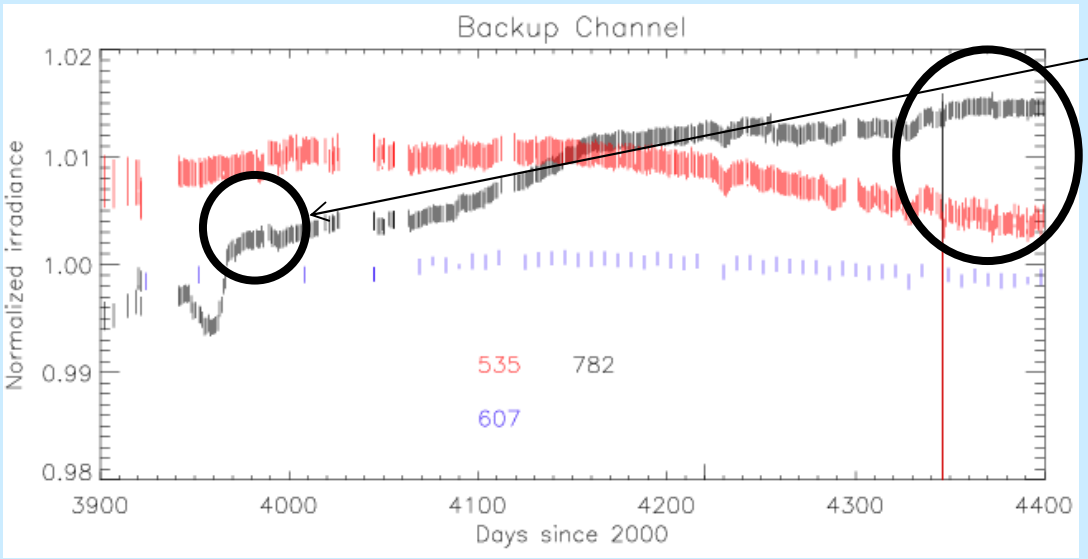
- Similar paper with PROBA2/LYRA data recently published
  (only one Herzberg channel)
- PREMOS: more information about the whole spectral range
  (paper in preparation)

Comparison with SIM ?

SIM/SOLSPEC/SCHIMACHY data needed to compare 535 nm, 607 nm and 782 nm !

Effect of the temperature





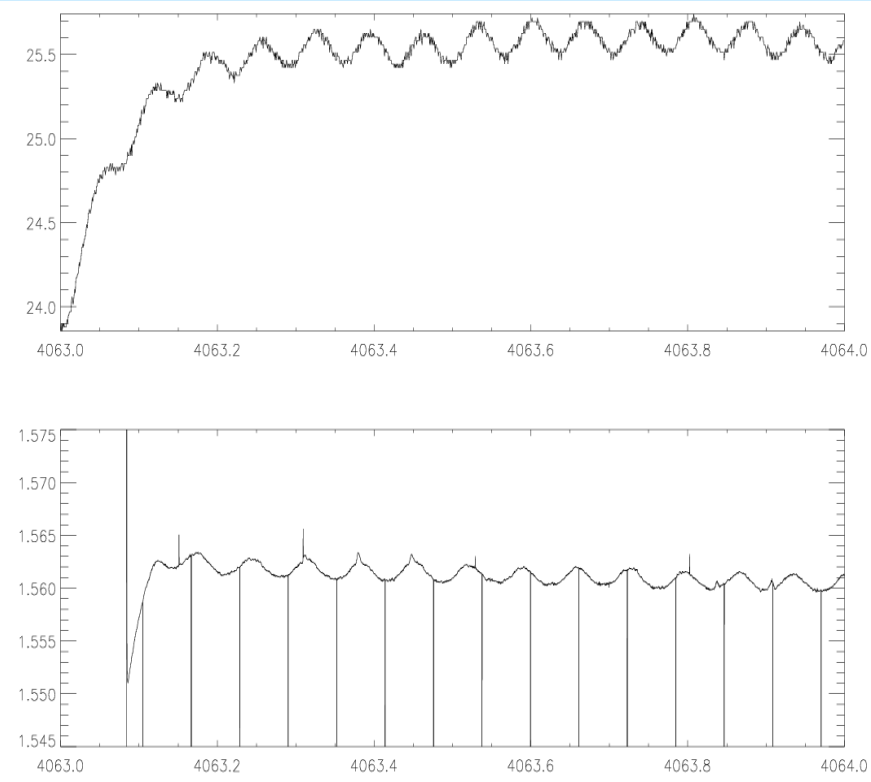
Long term trend

Occultation season

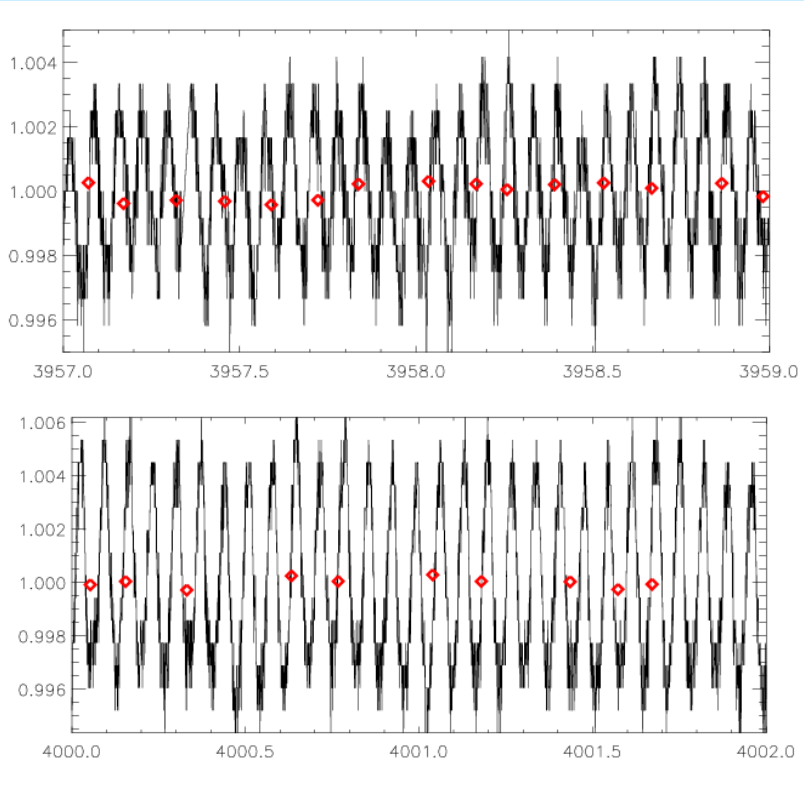
Effect of the temperature

Daily effect

535 nm

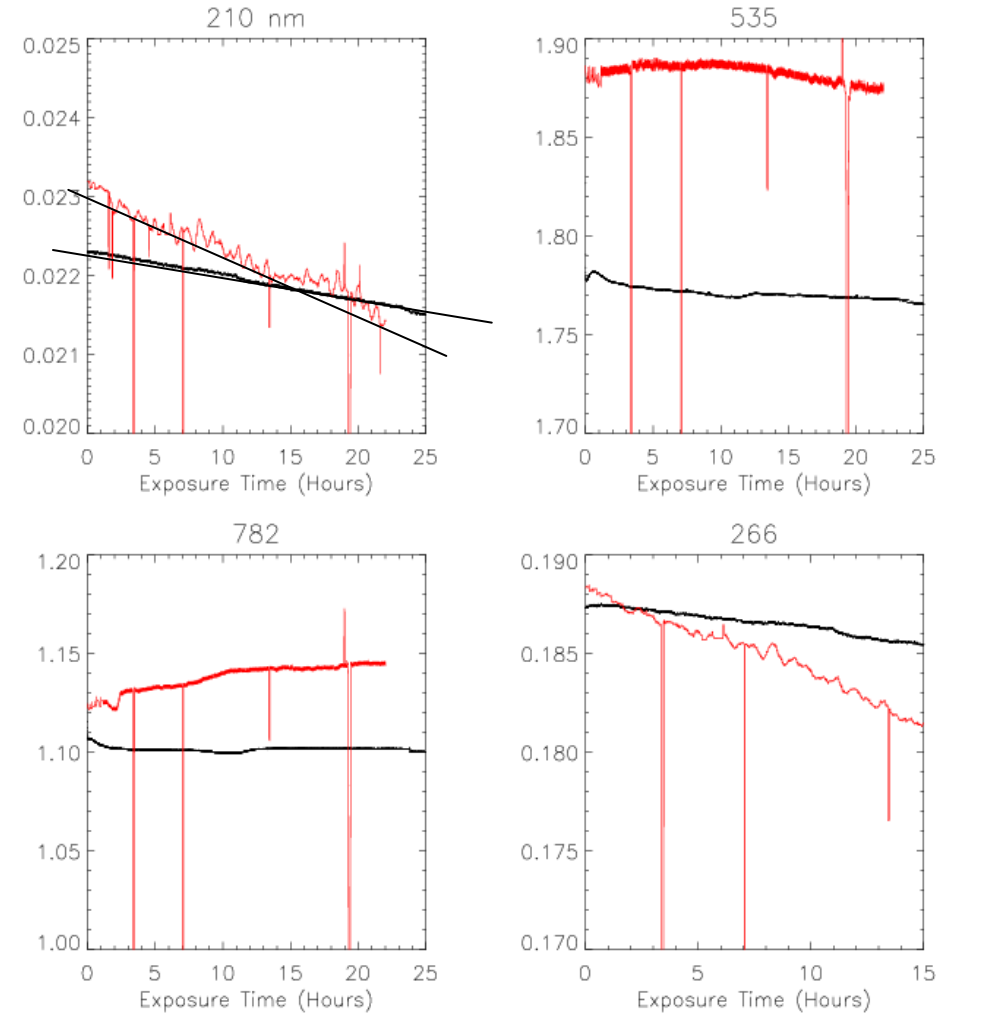


607 nm



Degradation Issues

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, increasing of filters' width,...)

Plan

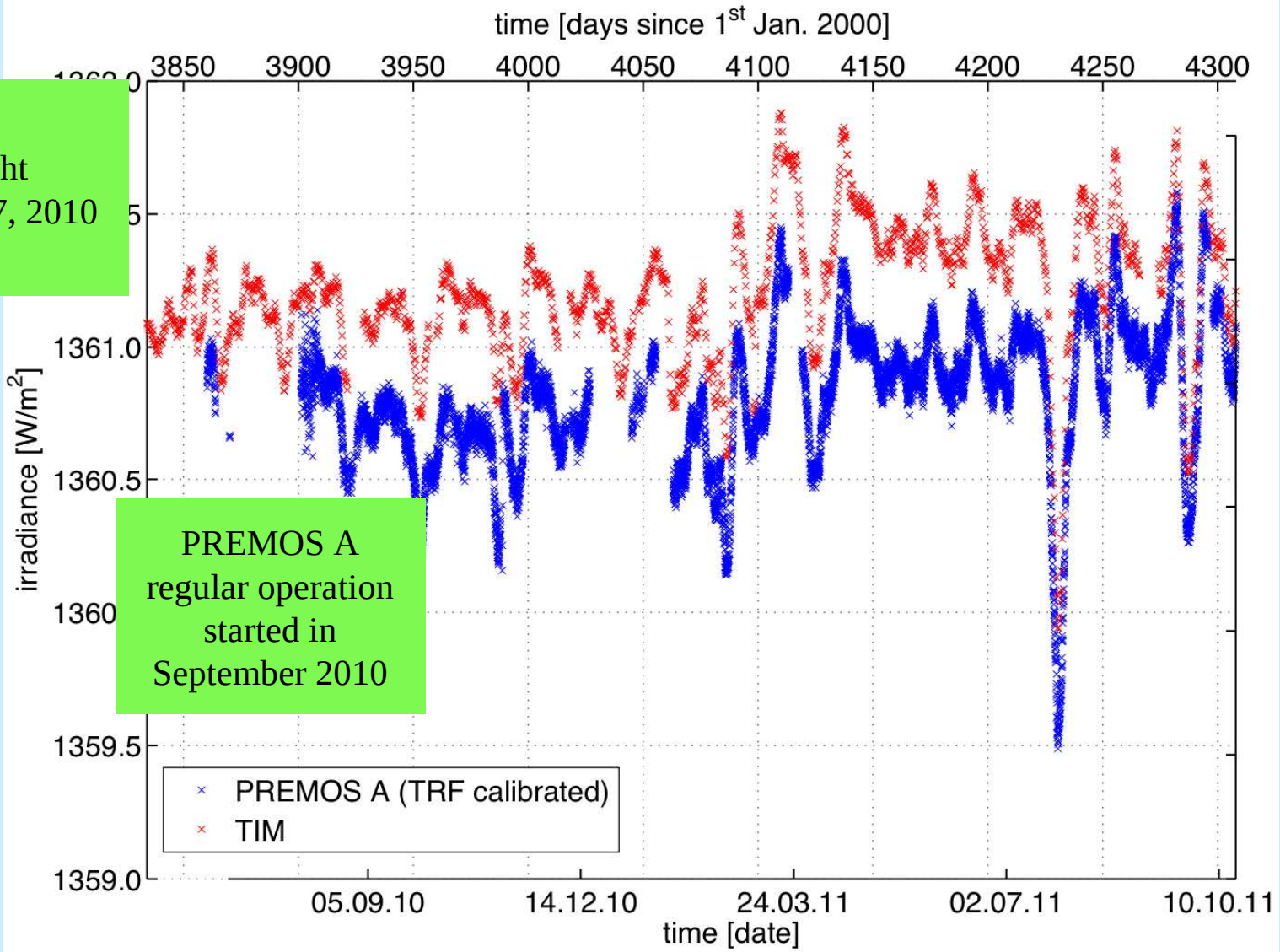
- TSI PMO6 absolute radiometer
- SSI filter radiometer at 6 wavelengths
- Comparison with SORCE/SOLSTICE

Calibration of TSI instrument

- 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.

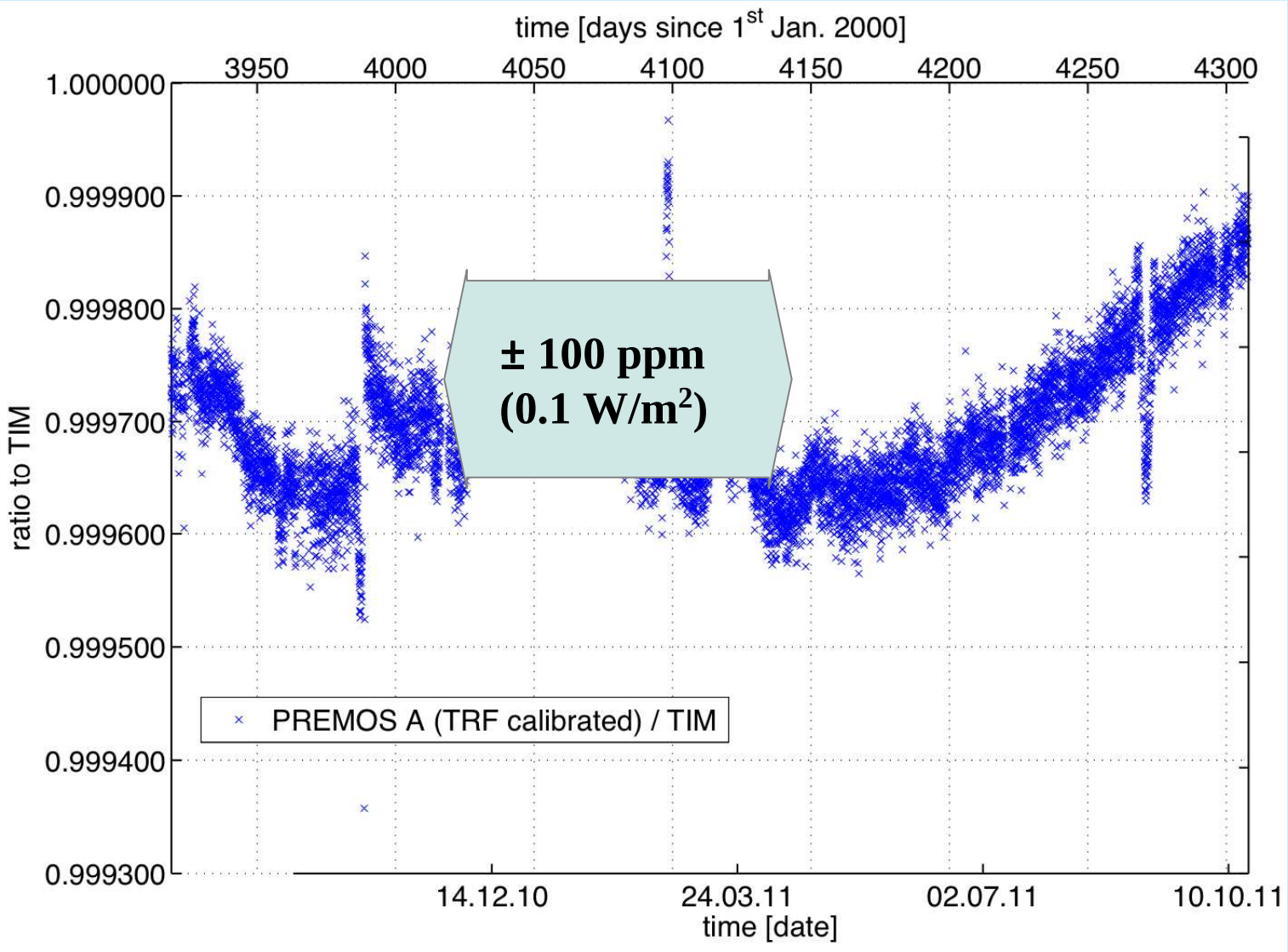
Comparison PREMOS to TIM

First light
July 27, 2010



PREMOS A
regular operation
started in
September 2010

Ratio PREMOS to TIM



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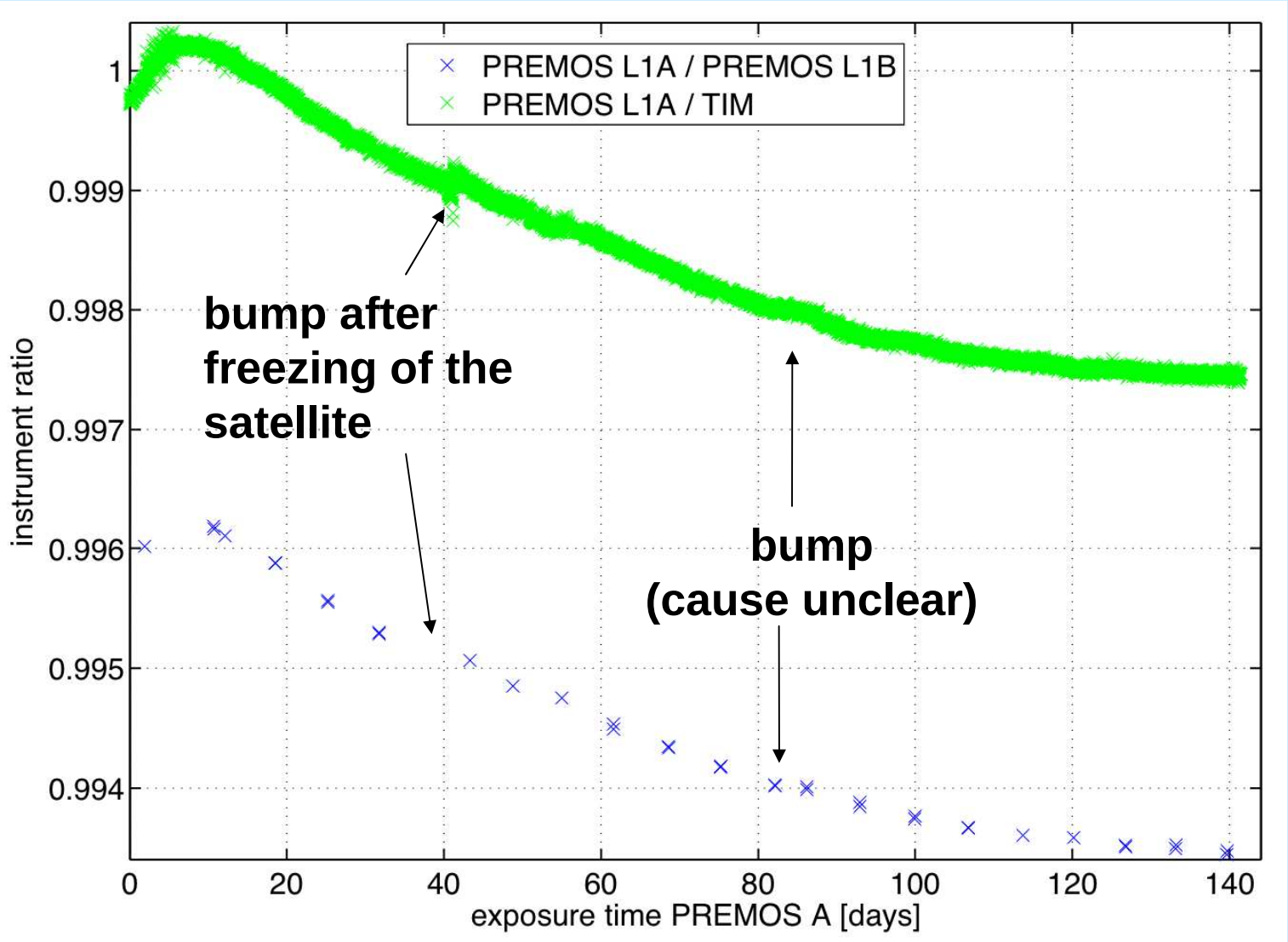
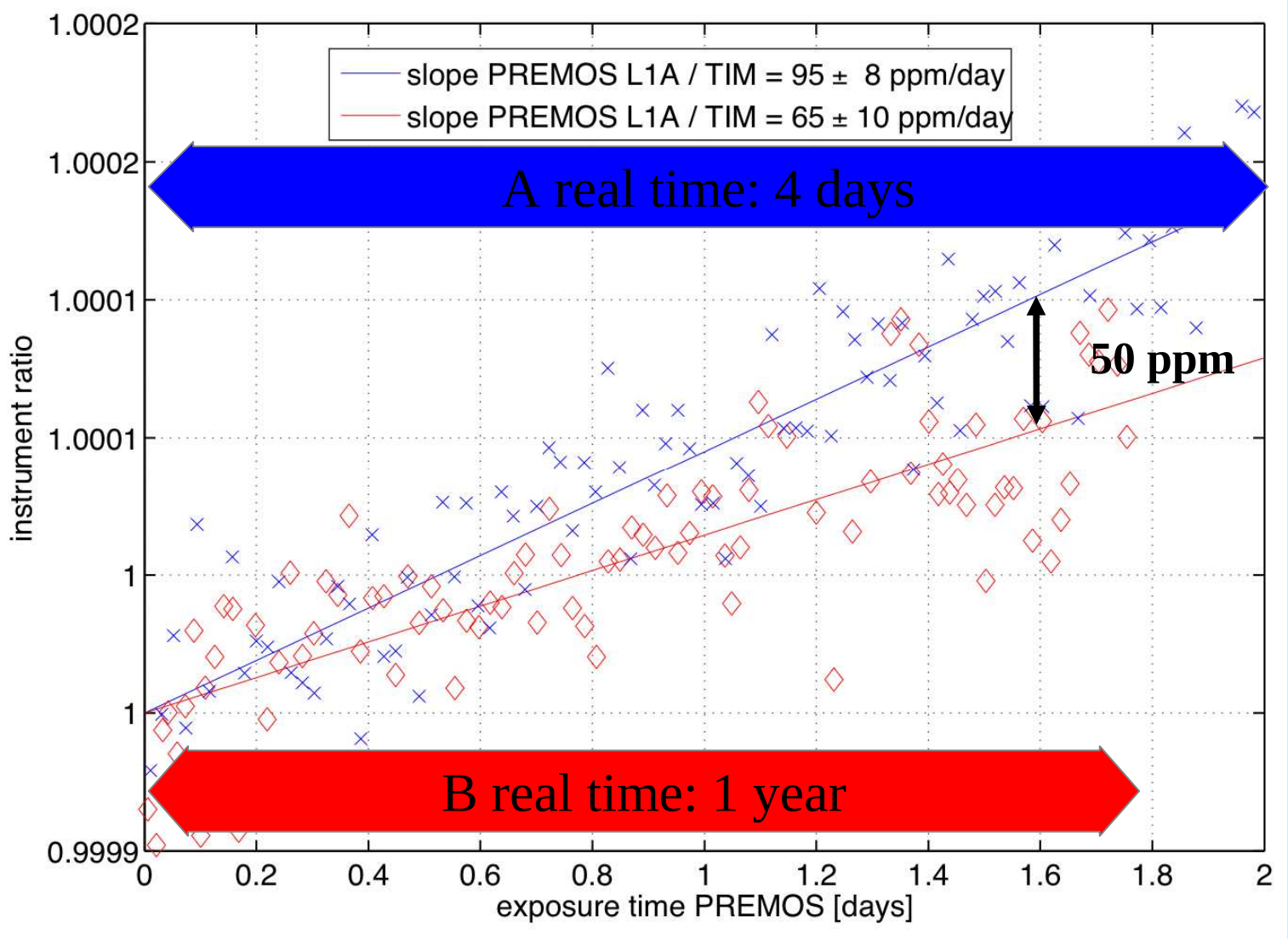
Redundancy strategies

- 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



Discussion

- 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 ppm

or

  - The sensitivity changes of the two radiometers A and B are ***not*** identical as a function of exposure time ***!***