

PREMOS/PICARD Instrument Status, First Results Part 2 – Total Solar Irradiance

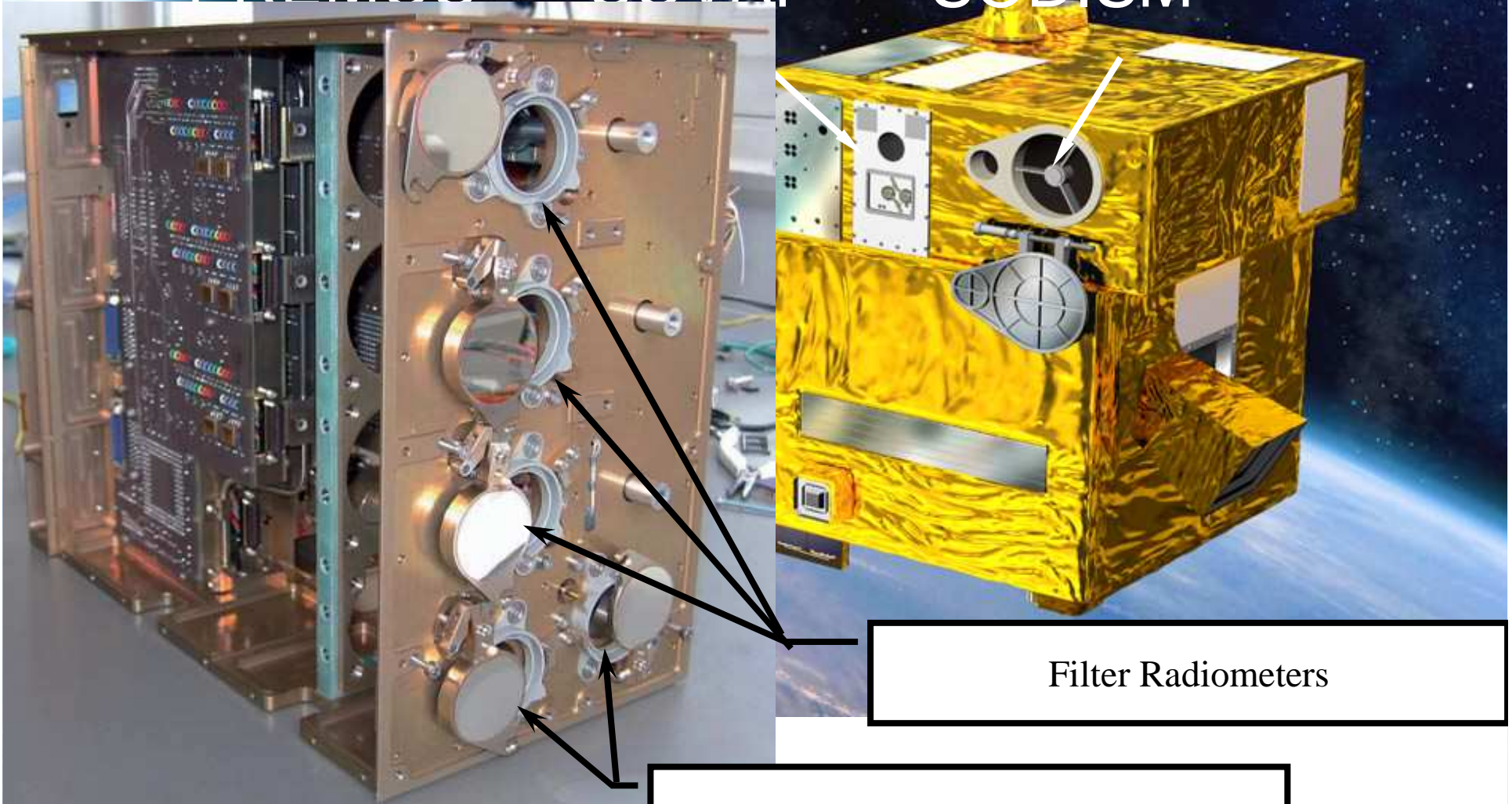
PI PREMOS
Werner Schmutz
PMOD/WRC, Switzerland

PICARD Scientific Workshop
CNES Paris, April 10, 2012

- The PREMOS experiment
- TSI absolute calibration (first light)
- TSI relative calibration
- Comparison TIM/SORCE
- The Future of TSI observations
 - Are relative observations sufficient?
 - Importance of PREMOS/PICARD for the future TSI monitoring

PICARD

PREMOS – SOVAP – SODISM



Filter Radiometers

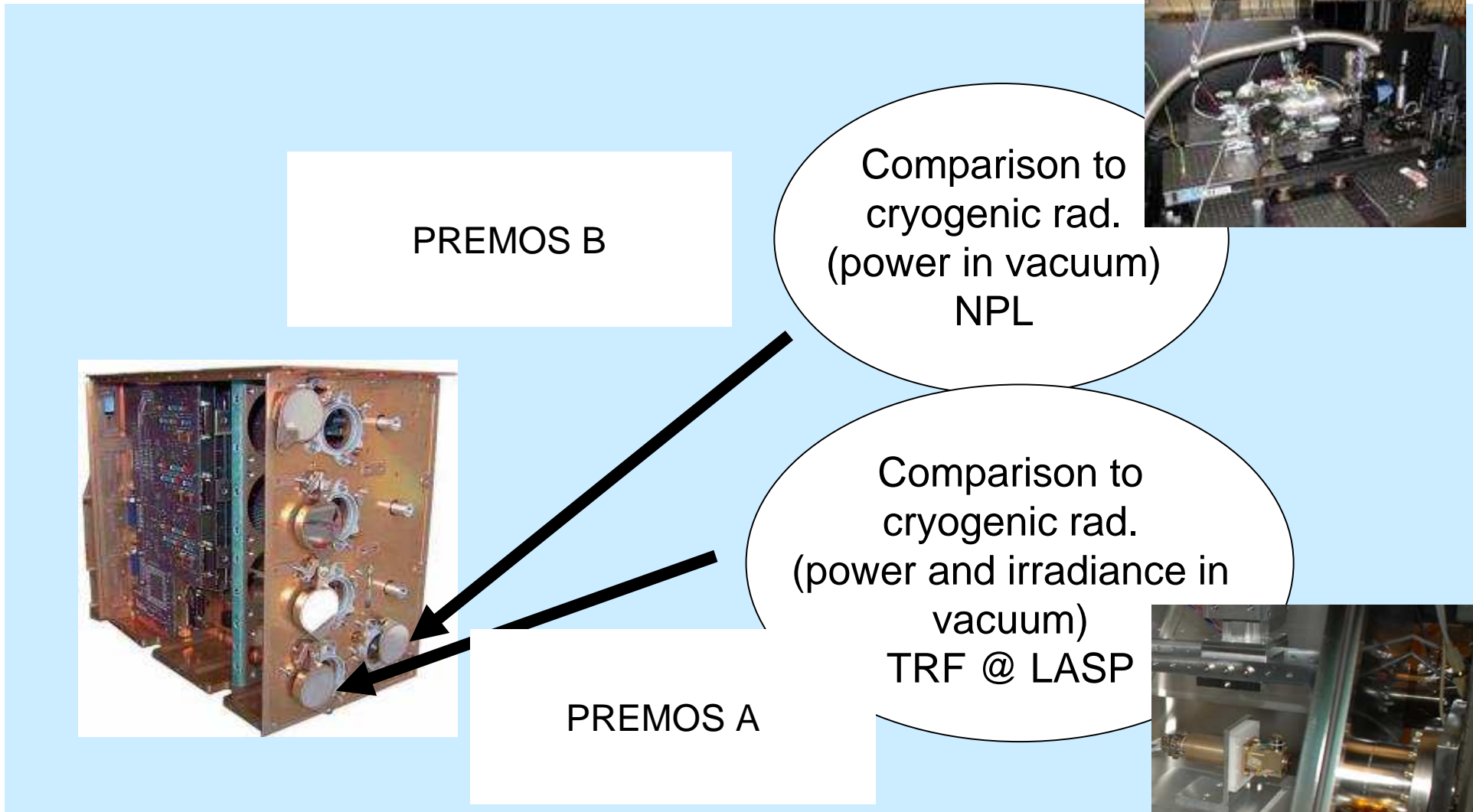
Total Solar Irradiance

10. April 2012

PREMOS A is the *first and only* radiometer in space with a SI-traceable irradiance calibration in vacuum

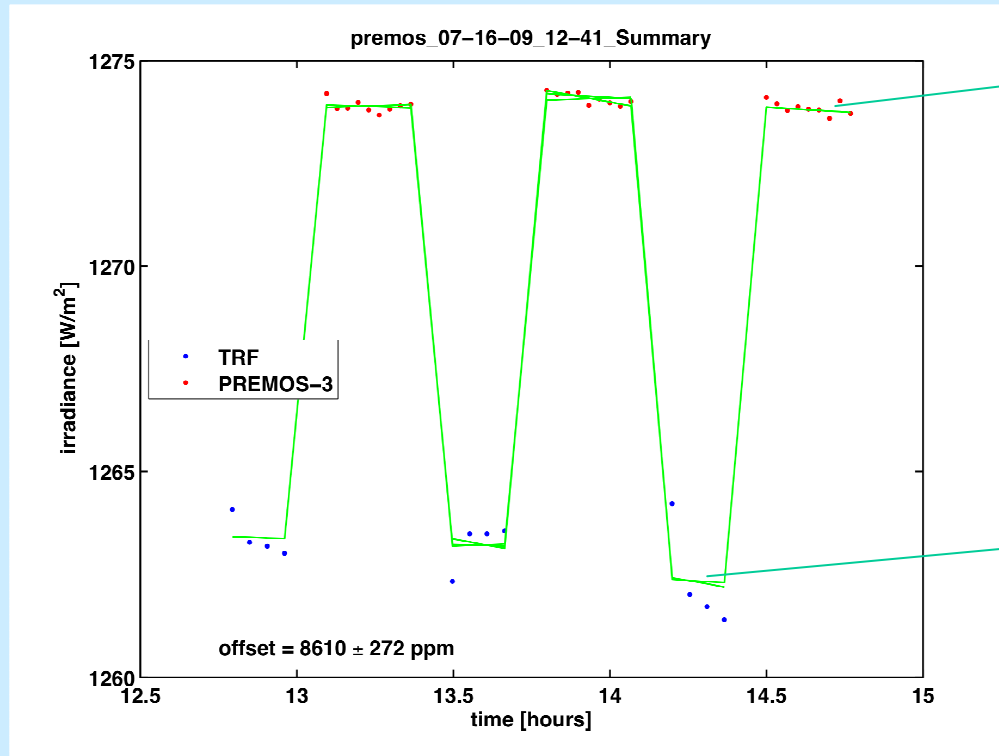
Traceable to the irradiance calibration facility at LASP in Boulder (TRF)

Traceability of PREMOS-TSI



Uncertainty of the calibration

= uncertainty of TRF comparison (220 ppm)



PREMOS A

TRF radiometer

+ absolute uncertainty of TRF facility (70 ppm)

Calibration uncertainty budget



Traceable via TRF, LASP, Boulder → to NIST

Instrument	TSI Value	Stated Uncertainty	Stated Uncertainty	Begin Date	End Date
	[SI W/m ²]	[W/m ²]	[ppm]		
ACRIM3	1360.3	1.36	1000.0	20 Sept. 2008	5-May-09
DIARAD*	1364.6	1.38	1011.3	1-Jun-08	1-Jul-08
PREMOS	1360.4	0.40	293.9	20 Sept. 2008	5-May-09
TIM	1360.8	0.48	350.0	20 Sept. 2008	5-May-09
VIRGO	1360.3	1.58	1160.2	20 Sept. 2008	5-May-09
Wgt Ave	1360.5	0.23	169.5	20 Sept. 2008	5-May-09

est. via comparisons

Uncertainties are 1- σ

*Not yet SI-traceable to irradiance via end-to-end test, so not used in average

References for Team Stated Uncertainties

ACRIM3: estimated (no team value provided)

DIARAD: Dewitte presentation at 1st ISSI Team Meeting

PREMOS: André Fehlmann thesis "Metrology of Solar Irradiance," Universität Zürich, 2011

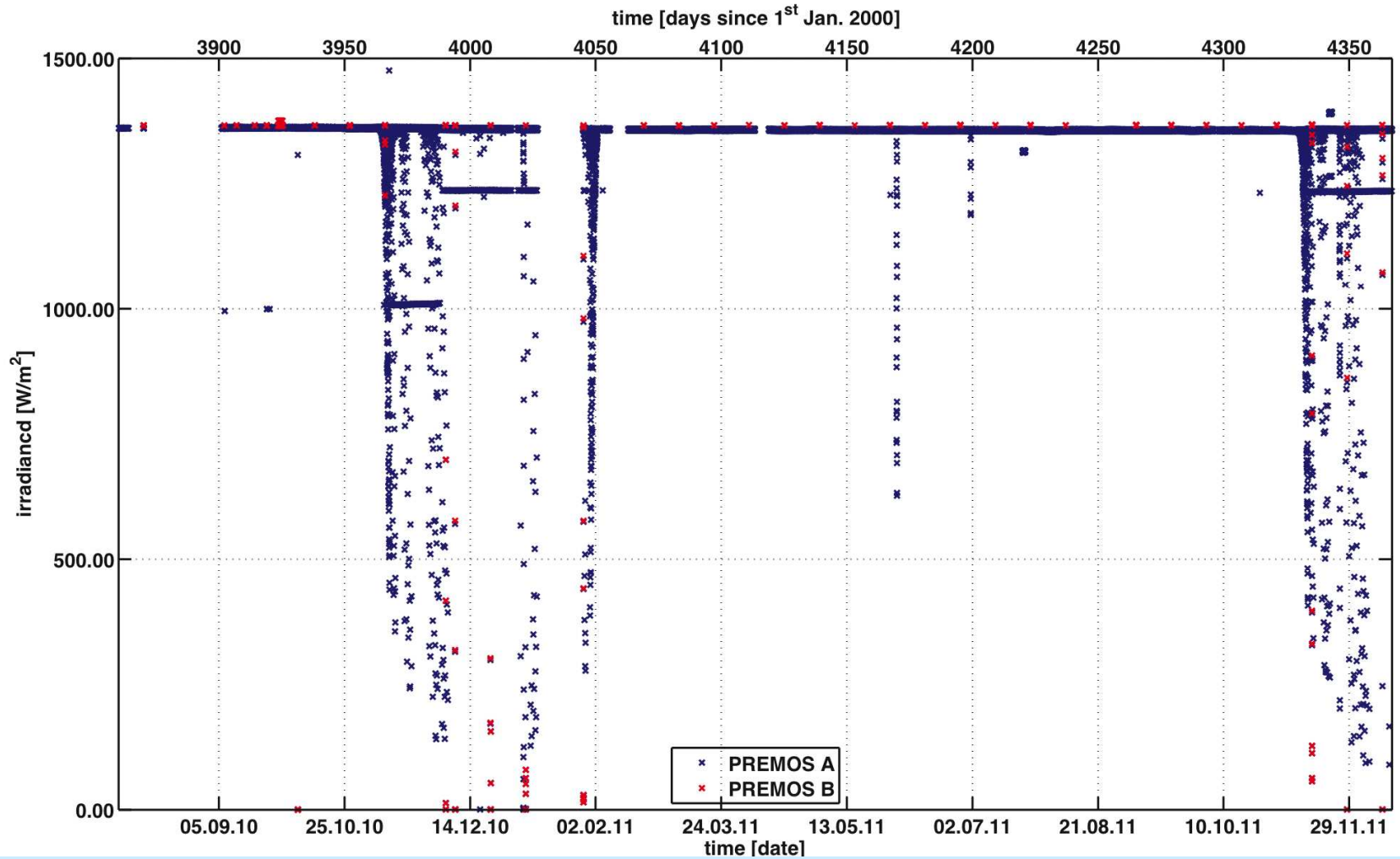
TIM: Kopp & Lean, "A New, Lower Value of Total Solar Irradiance," GRL, 38, L01706, doi:10.1029/2010GL045777, 2011

VIRGO: Fröhlich, from TSI Accuracy Workshop presentation, 2005

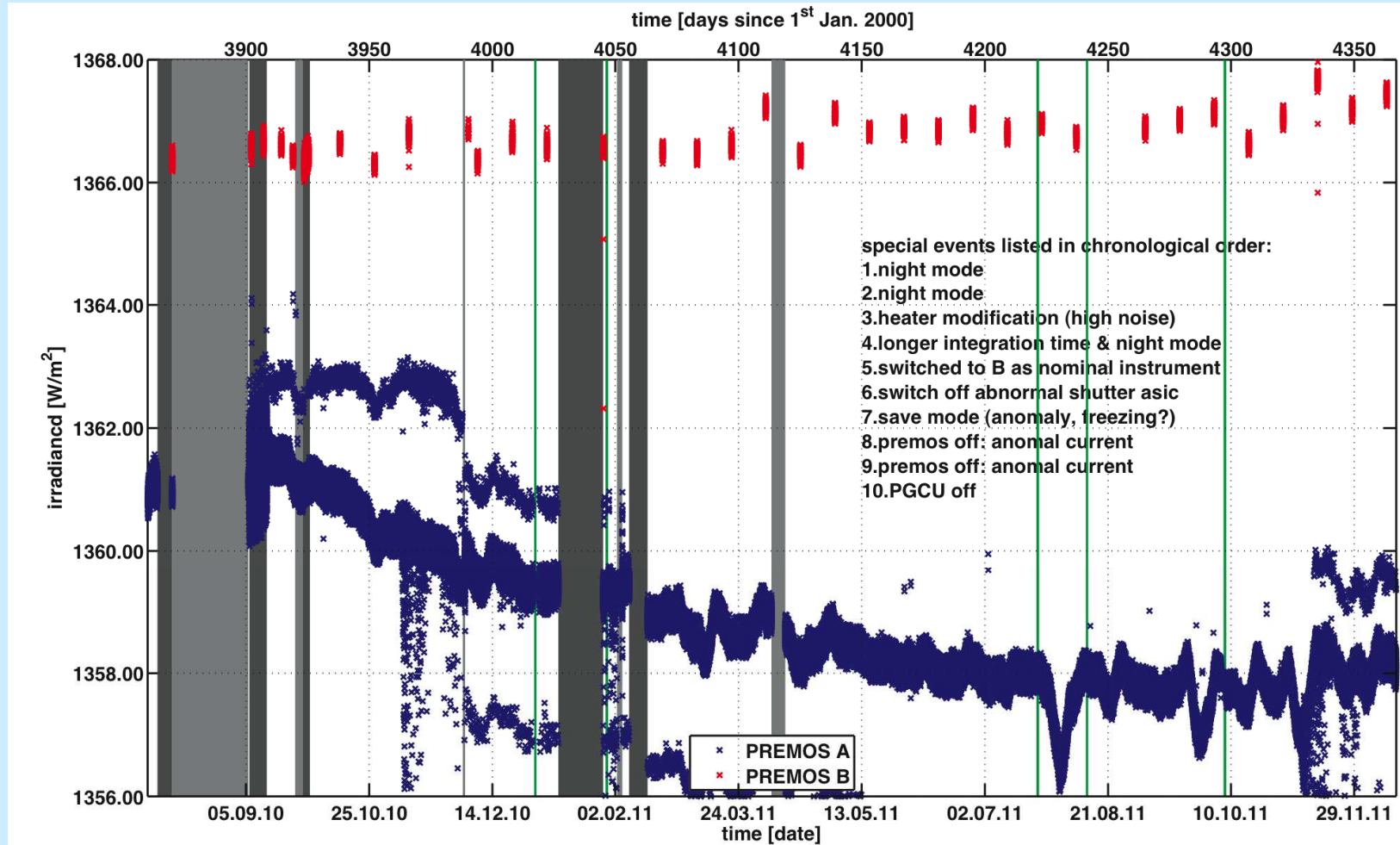
PART II

Relative calibration (sensitivity change correction)

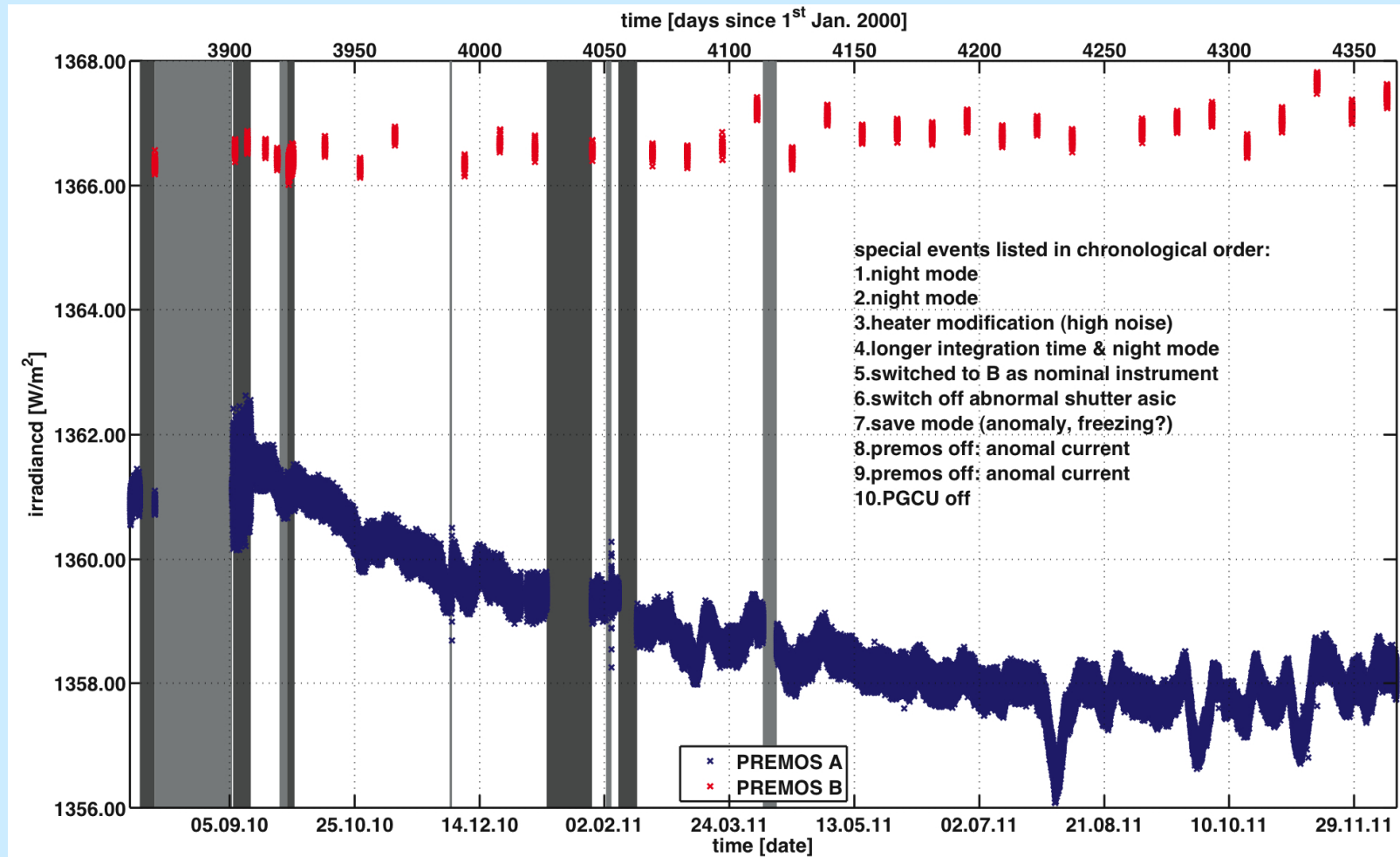
PREMOS TSI raw data



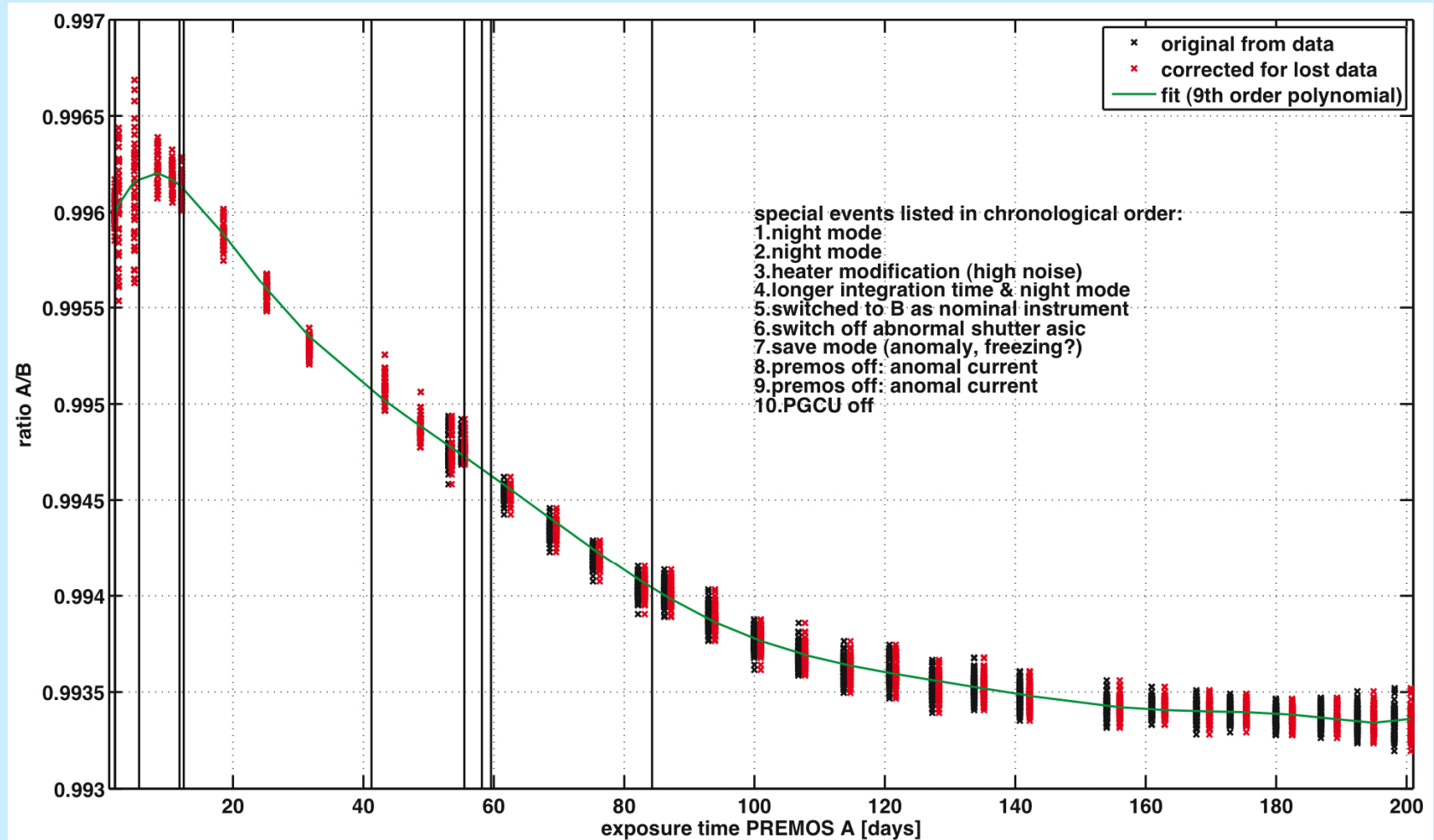
Events affecting data



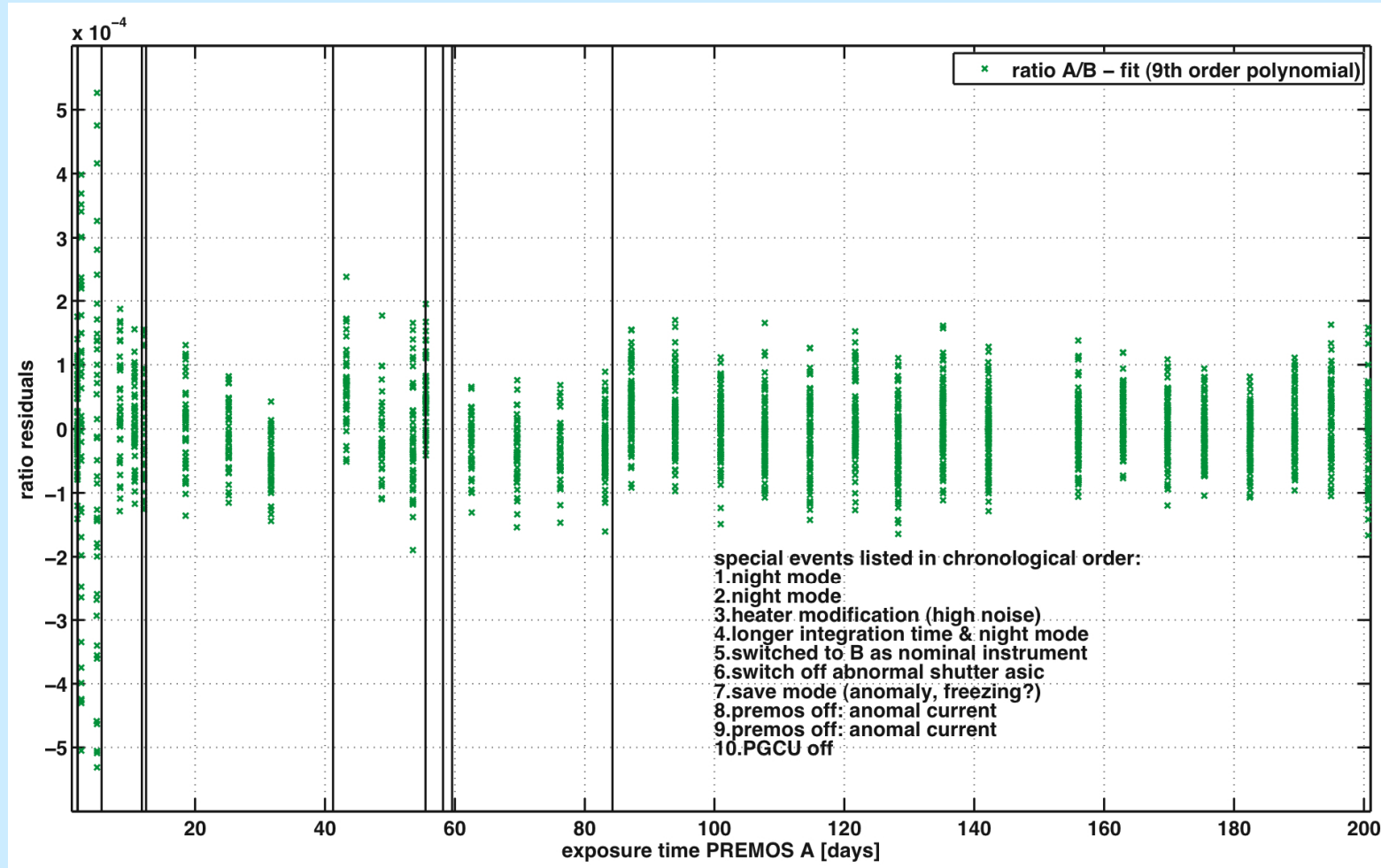
Cleaned data



Ratio PREMOS A / B



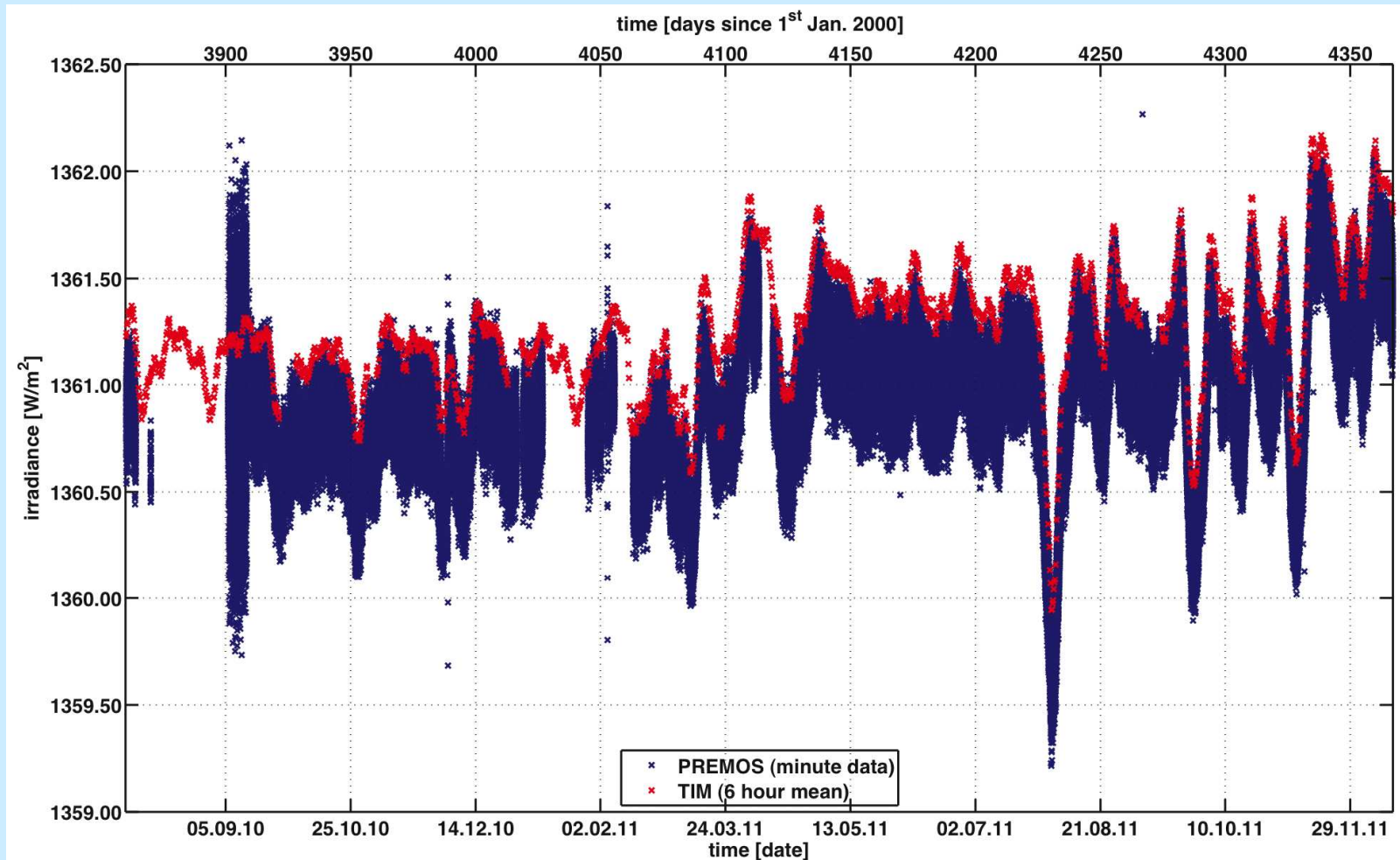
Residuals ratio PREMOS A / B



PART III

Comparison to TIM

Comparison PREMOS – TIM



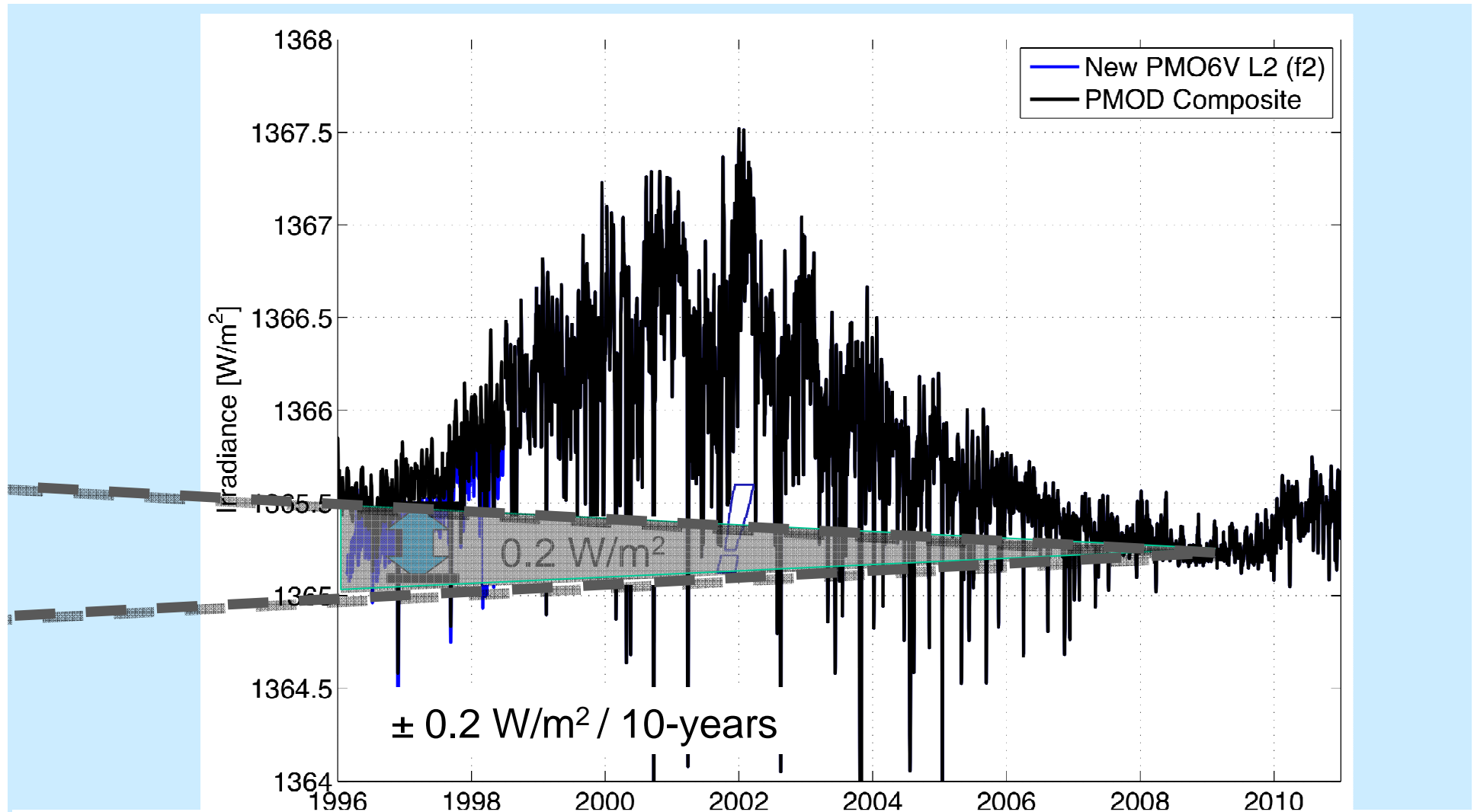
„PREMOS is in excellent health“

- PREMOS-TSI is the most accurate absolute measurement;
 $\pm 0.4 \text{ W/m}^2$ or $\pm 290 \text{ ppm}$
- After 2 years, PREMOS-TSI has at most 50 ppm relative deviation to TIM/SORCE.

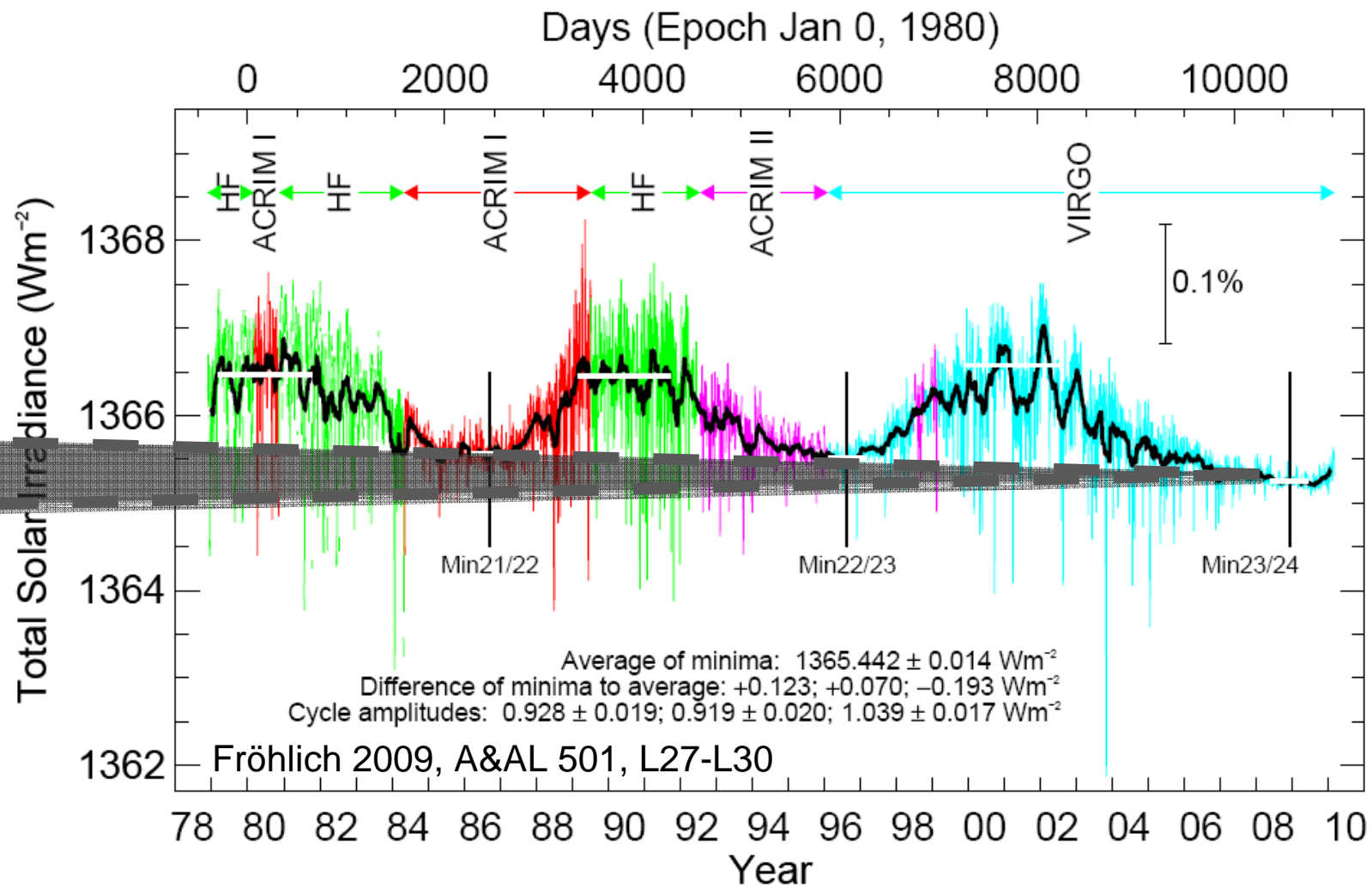
PART IV

The Future of TSI observations:
Are relative observations sufficient?

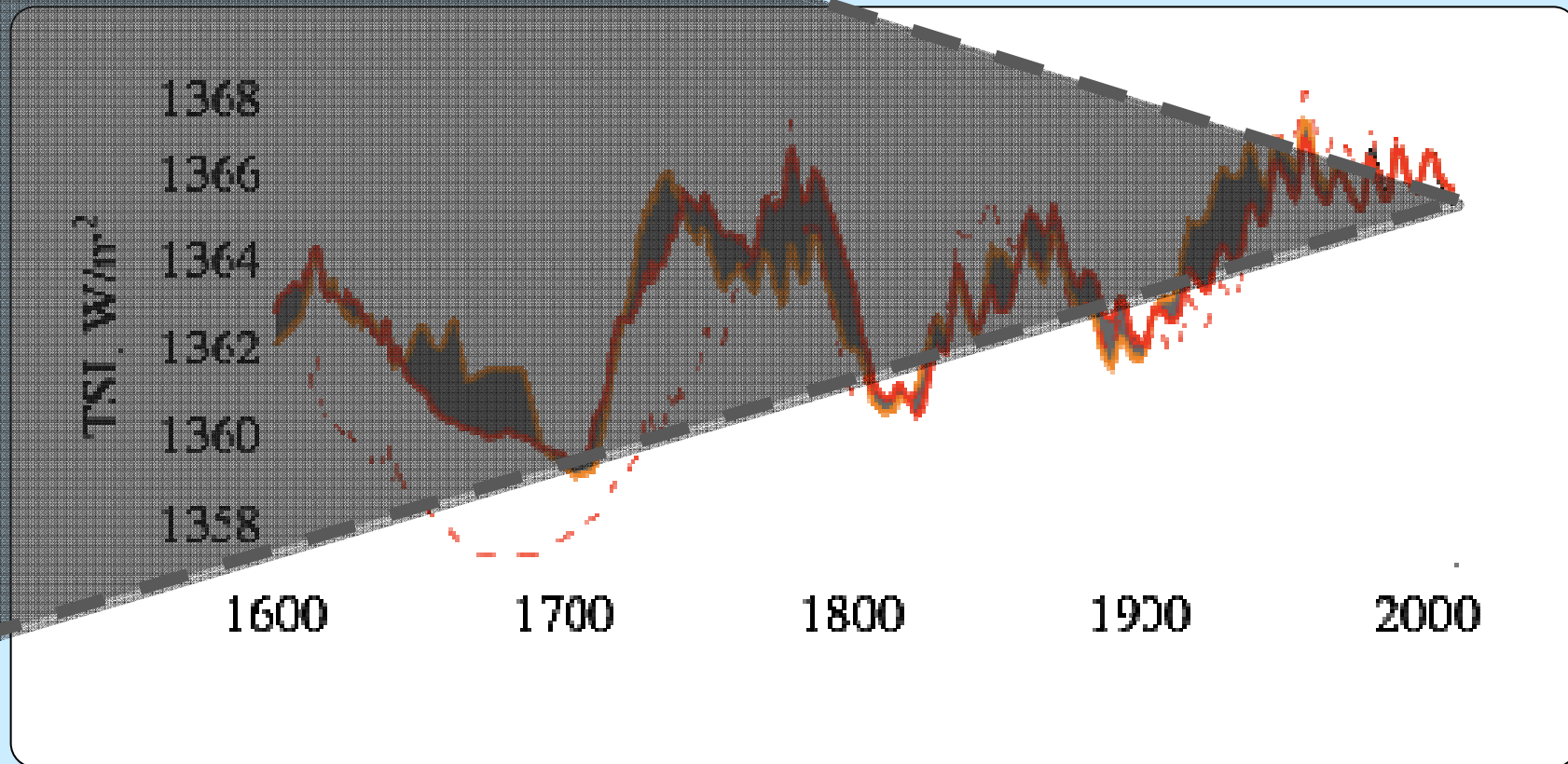
Composite 1996-2010



Is there a long-term trend?



Could we detect a trend with a composite?



„Any plan to rely on an unbroken chain of measurements is broken“

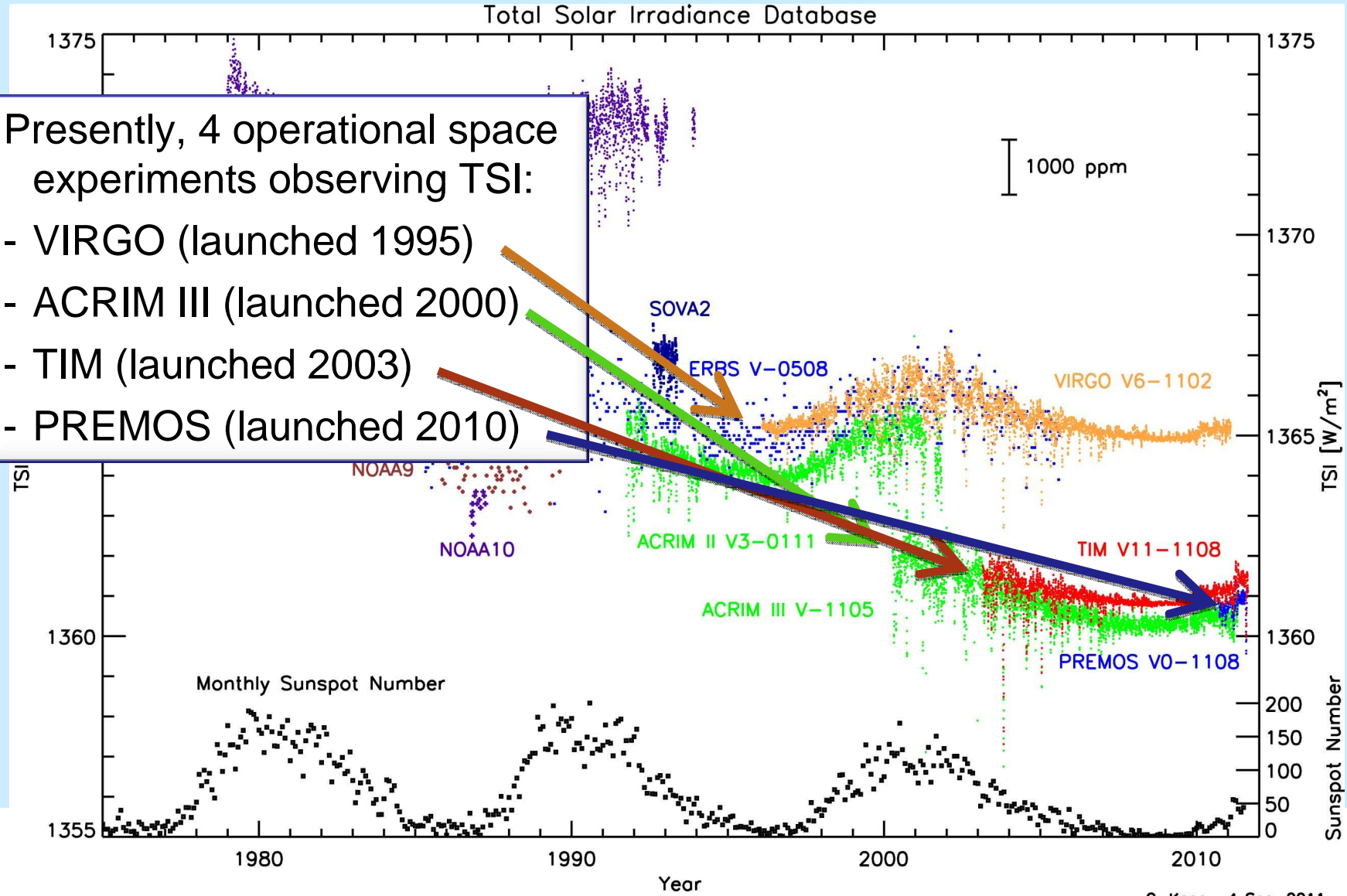
- Not only because of a potential gap;
 - But mainly because of the continuously increasing uncertainty.
- ➔ Accurate absolute measurements are required !

- Accurate **absolute** measurements are required:
Nowadays possible !
- *But we certainly also want to assess the variations of TSI and therefore, we still need to aim for continues and overlapping data !*

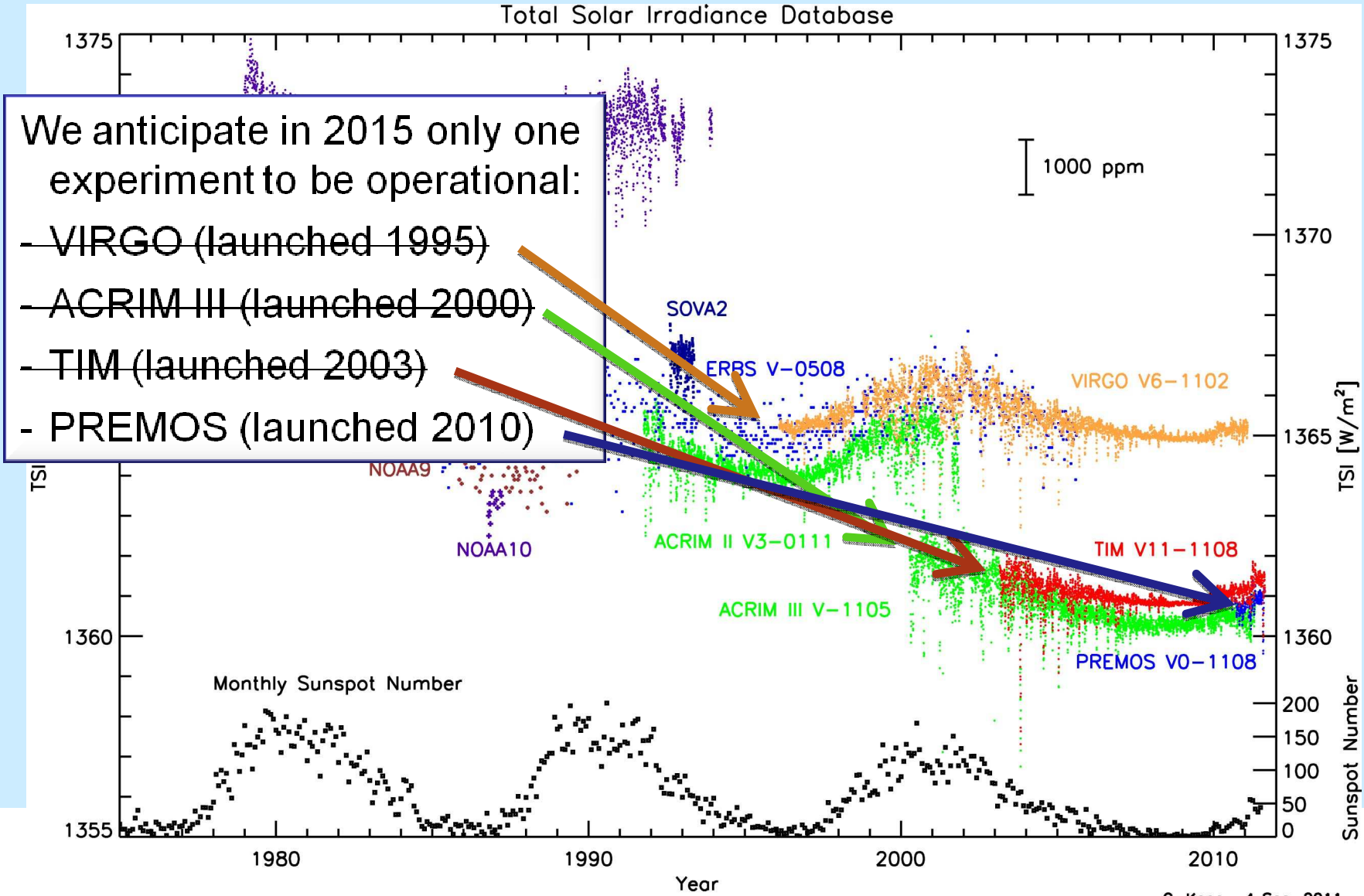
TSI monitoring today ...

Presently, 4 operational space experiments observing TSI:

- VIRGO (launched 1995)
- ACRIM III (launched 2000)
- TIM (launched 2003)
- PREMOS (launched 2010)



TSI monitoring in 2015

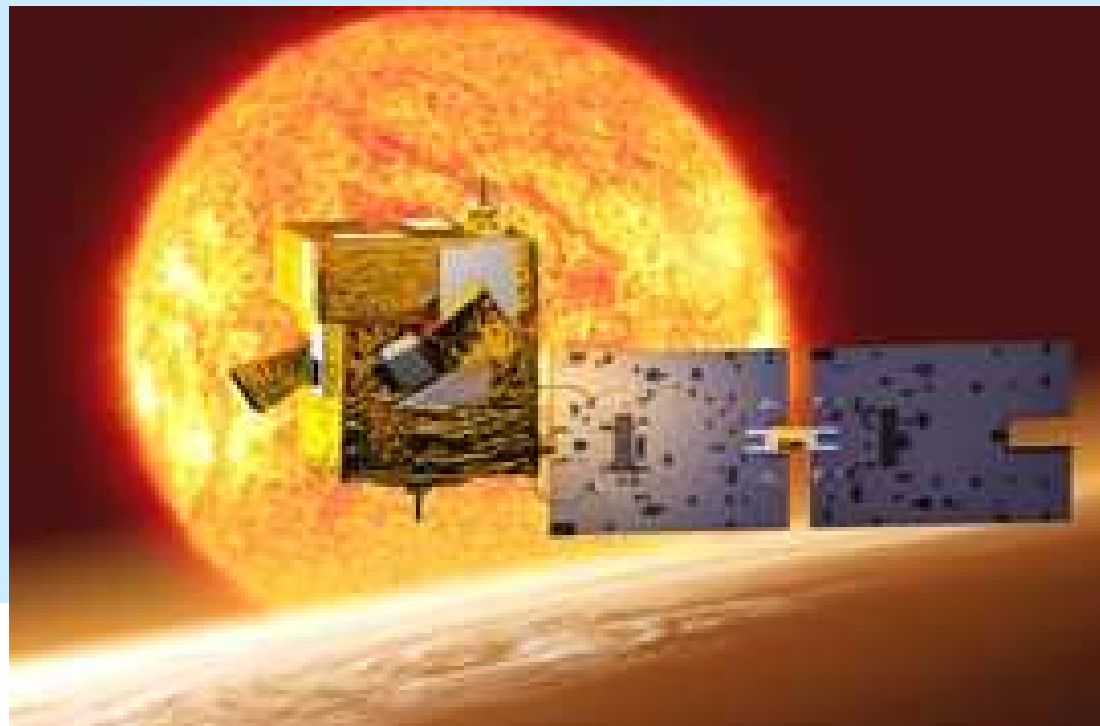


We anticipate in 2015 only one experiment to be operational:

- VIRGO (launched 1995)
- ACRIM III (launched 2000)
- TIM (launched 2003)
- PREMOS (launched 2010)

The Solar Constant

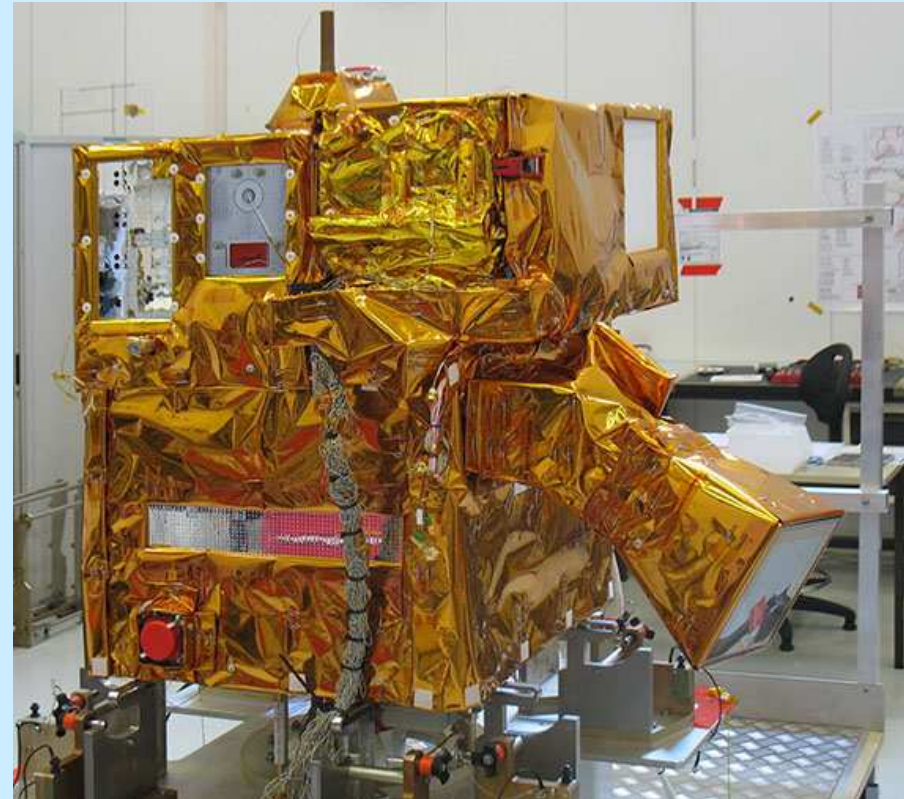
In 2 to 4 years PICARD is potentially the only space experiment operationally monitoring Total Solar Irradiance



Thank you for your attention



PREMOS



PICARD