

# Fourth World Radiometric Reference to SI radiometric scale comparison and implications to on-orbit measurements of the total solar irradiance

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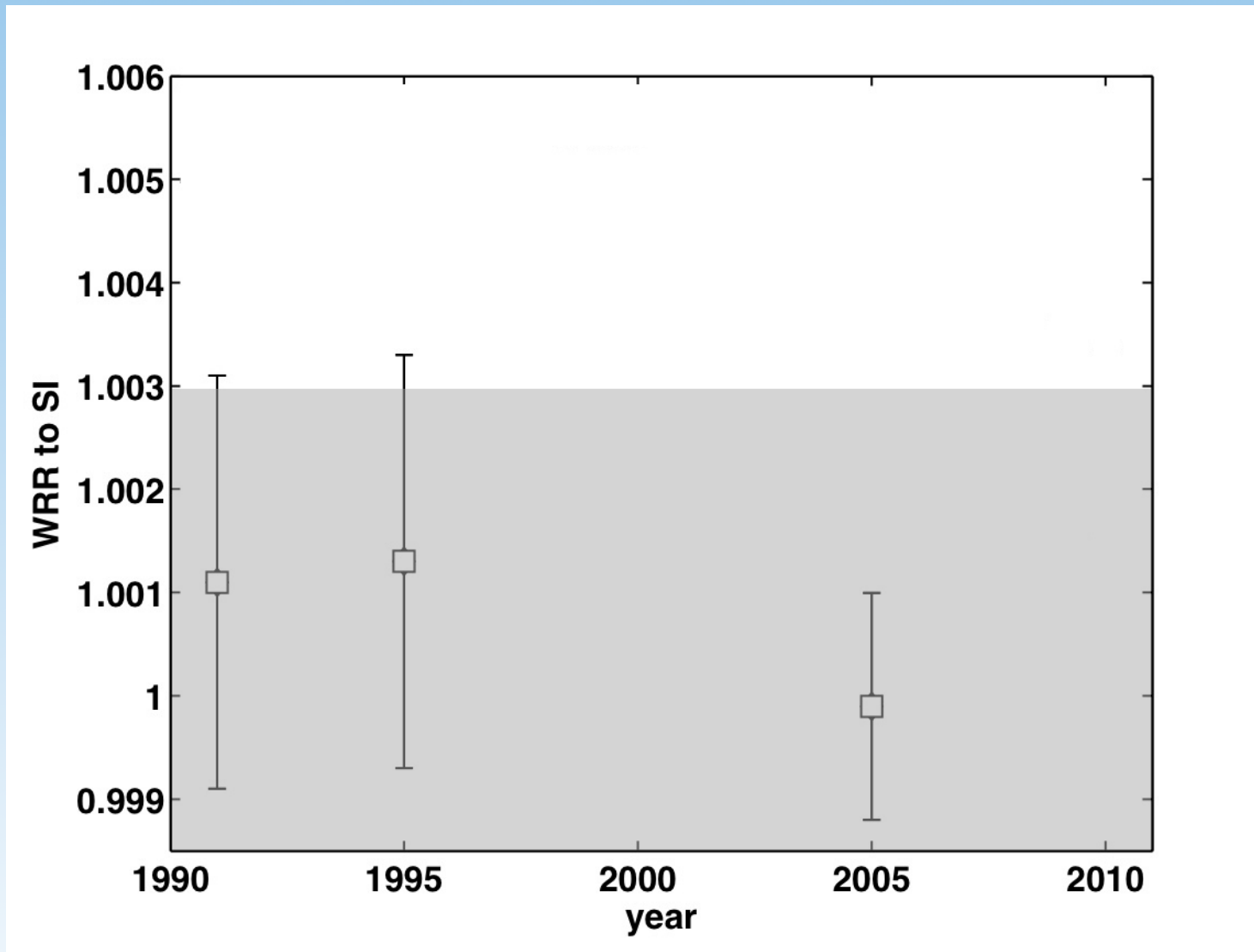
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# World Radiometric Reference (WRR)



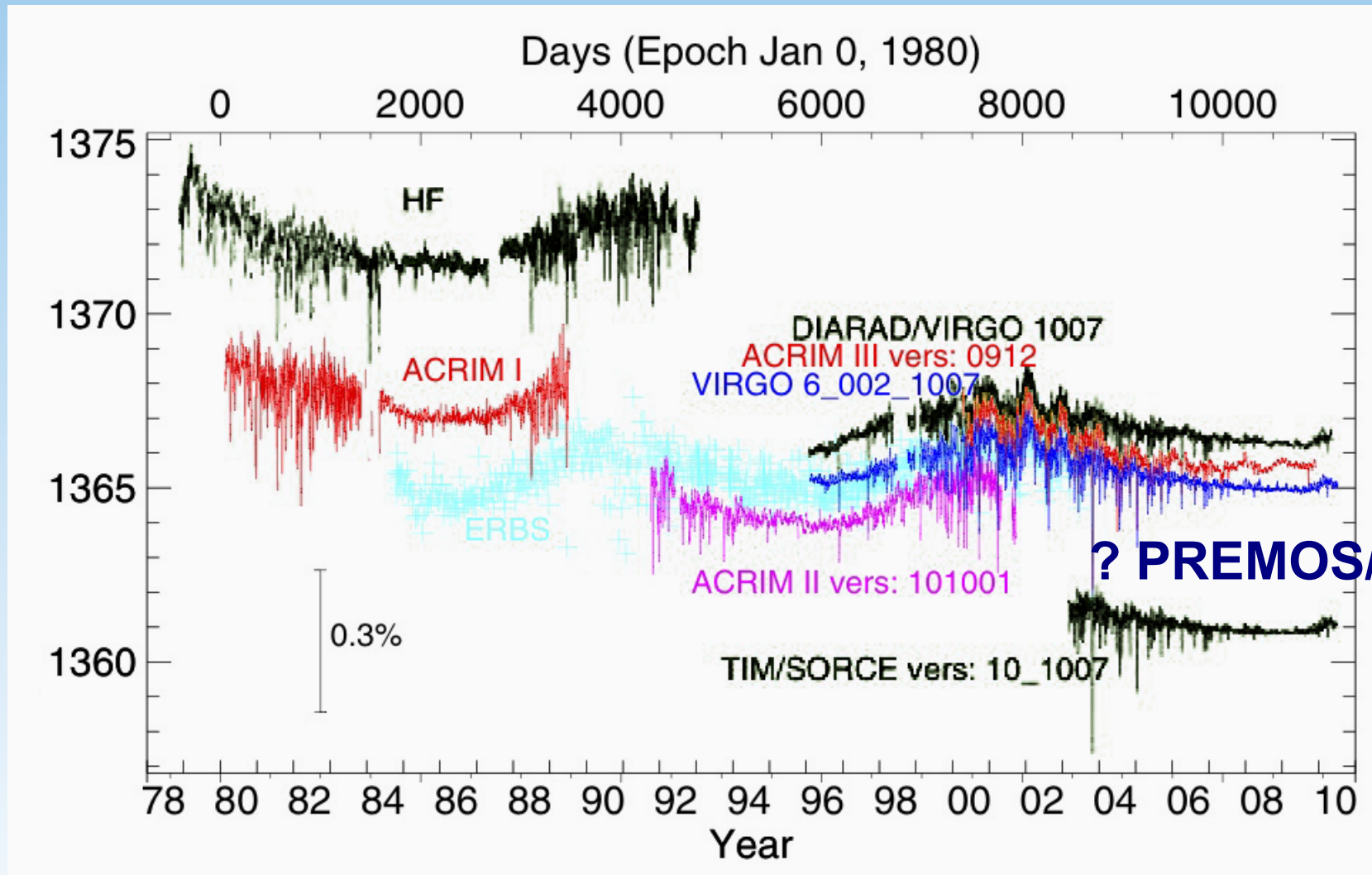
- Artefact based standard for Total Solar Irradiance
- Degradation and potential failure of 30 year old instruments – risk of gap in the continuity
- Link to SI radiometric scale via transfer absolute radiometers

# Previous WRR-to-SI Comparisons

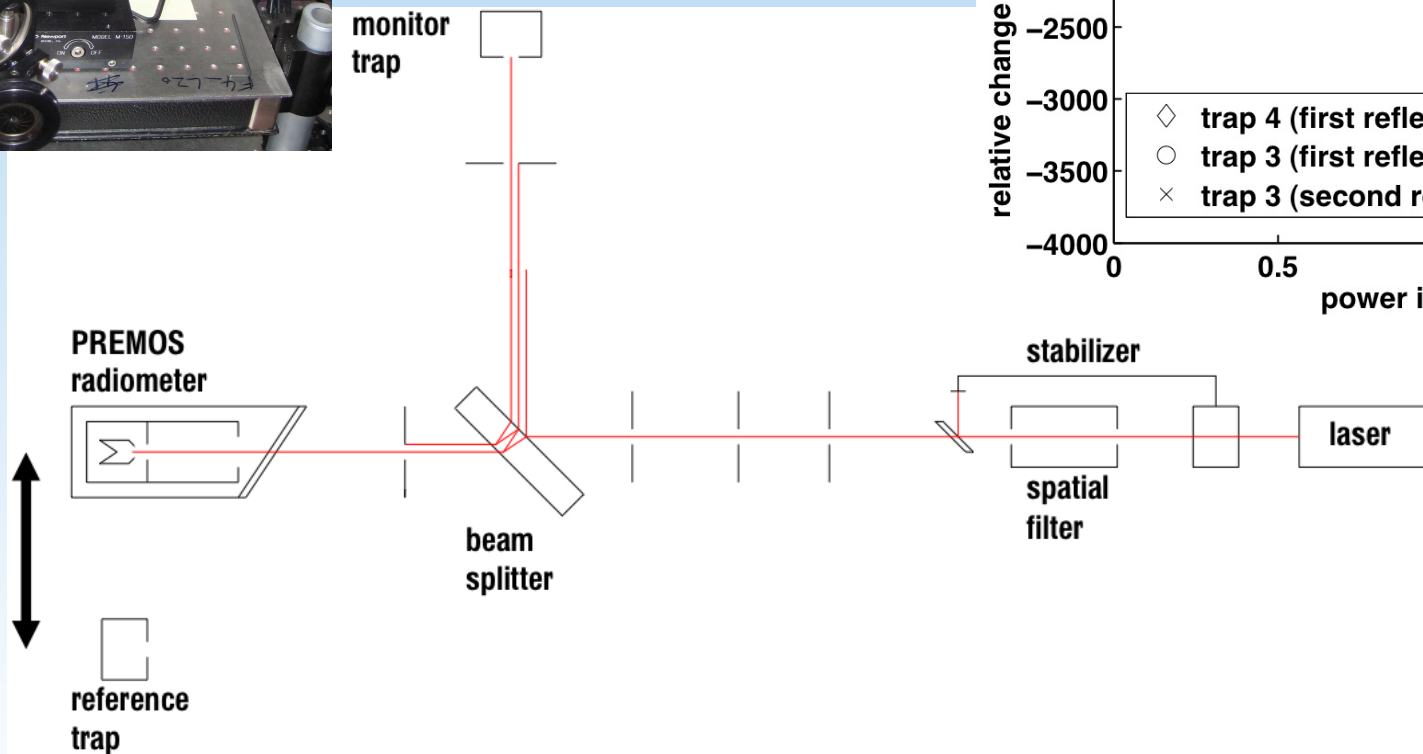
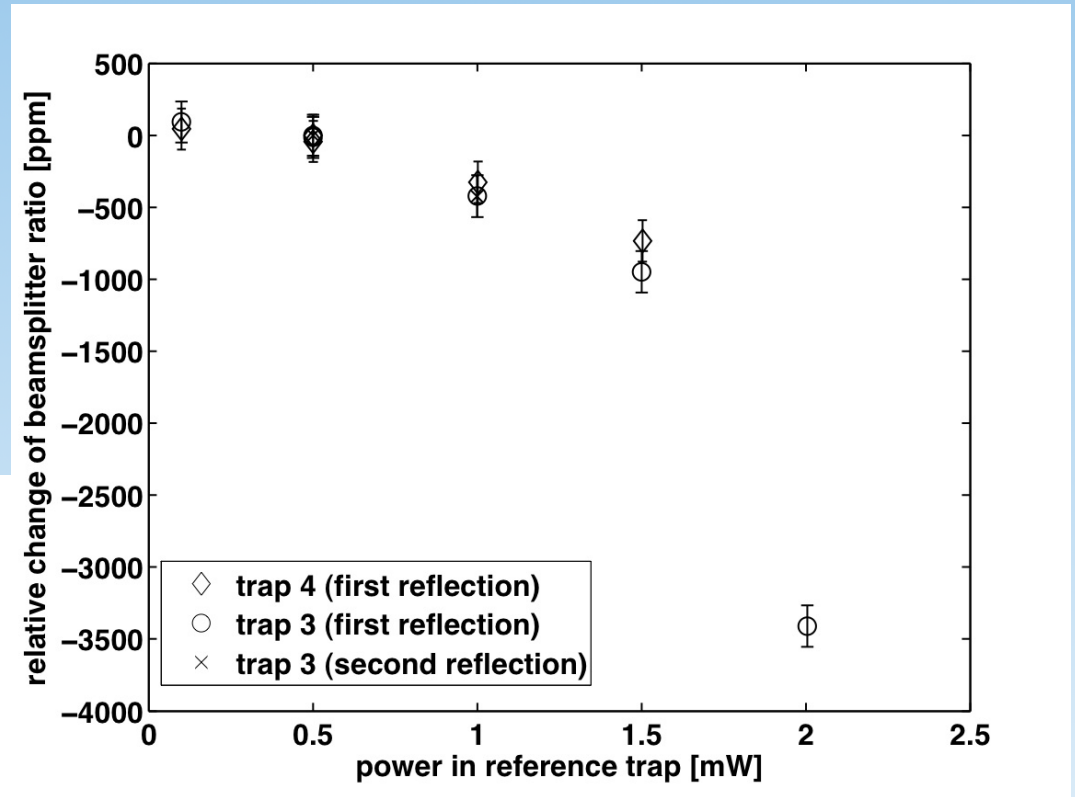
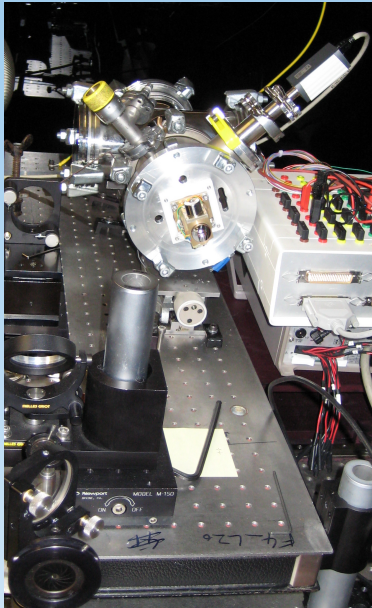


(shaded area indicates 99% confidence interval of WRR  
error bars indicate 95% confidence interval of comparison)

# Space Experiments Measuring TSI



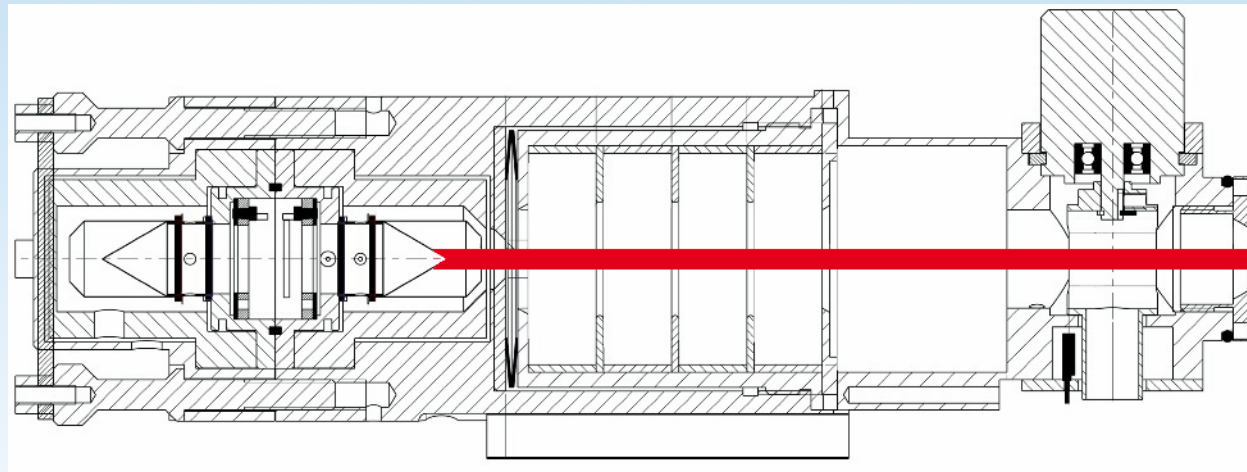
# Comparison to SI radiometric scale at NPL



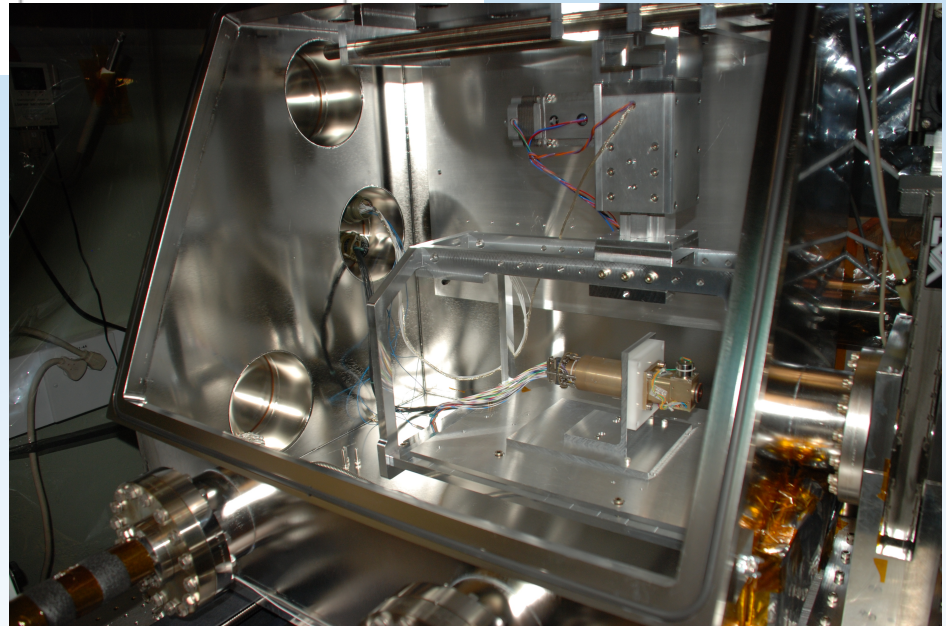
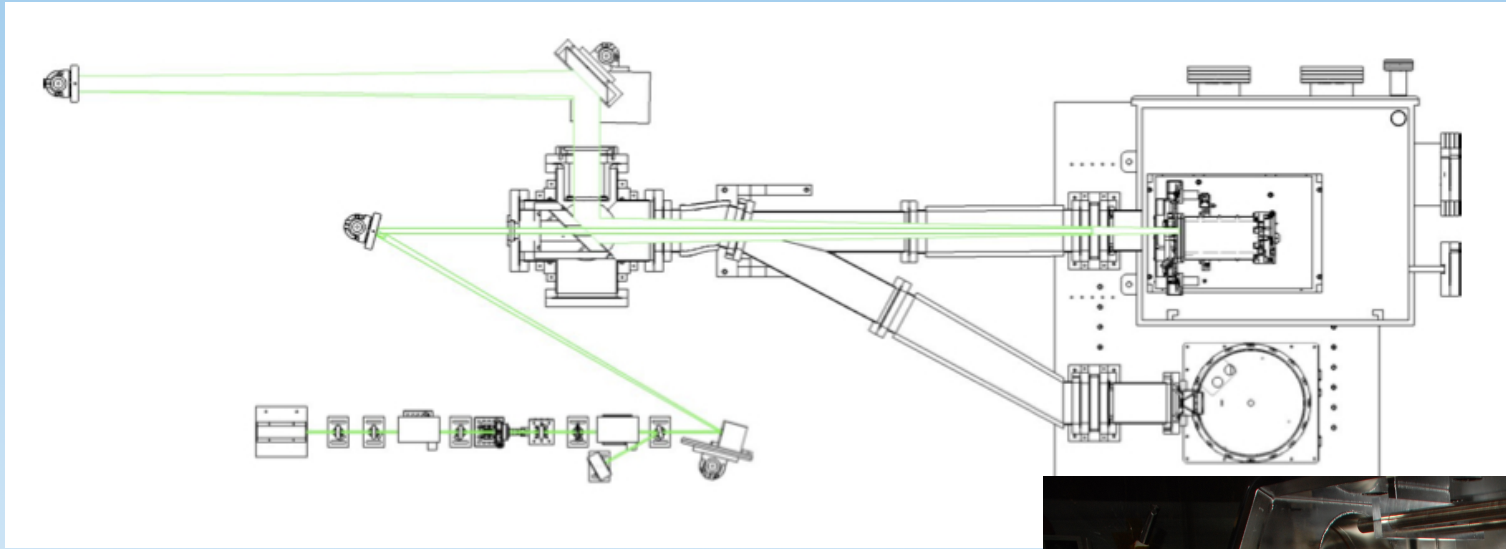
# Results of NPL SI Power Comparison

NPL power comparison 3 mm beam (20mW @ 647 nm)

PREMOS 0107 / NPL	$0.99961 \pm 0.00015$ (k=1)
PREMOS 0207 / NPL	$1.00010 \pm 0.00016$ (k=1)
PREMOS 0307 / NPL	$1.00633 \pm 0.00017$ (k=1)



# Comparison to the TRF at LASP

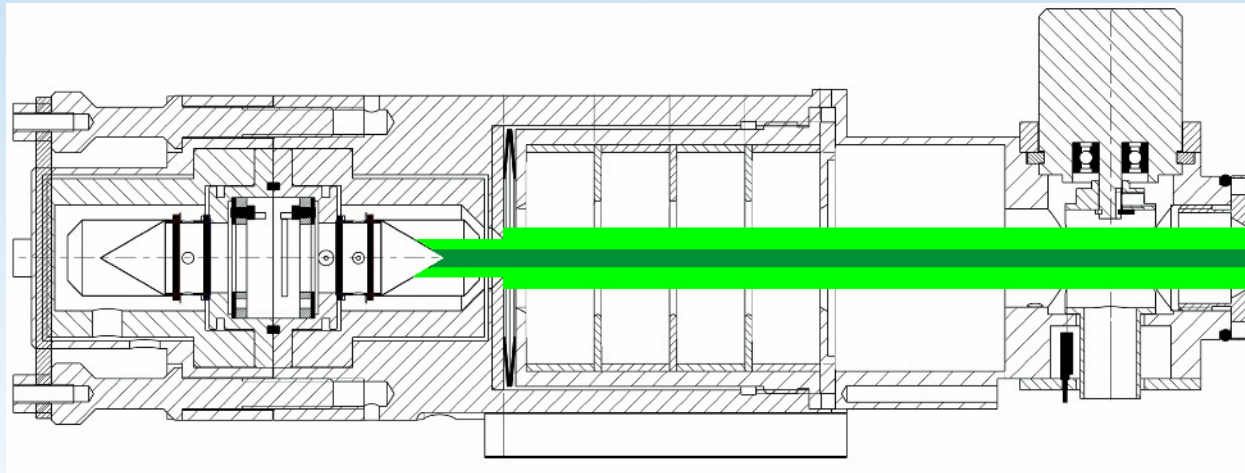


# Results of TRF SI Comparison

TRF power comparison 2 mm spiral pattern (20mW @ 532 nm)

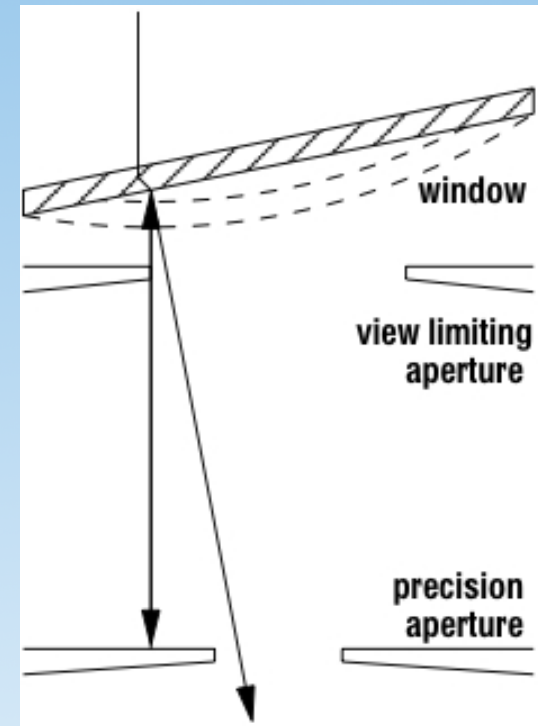
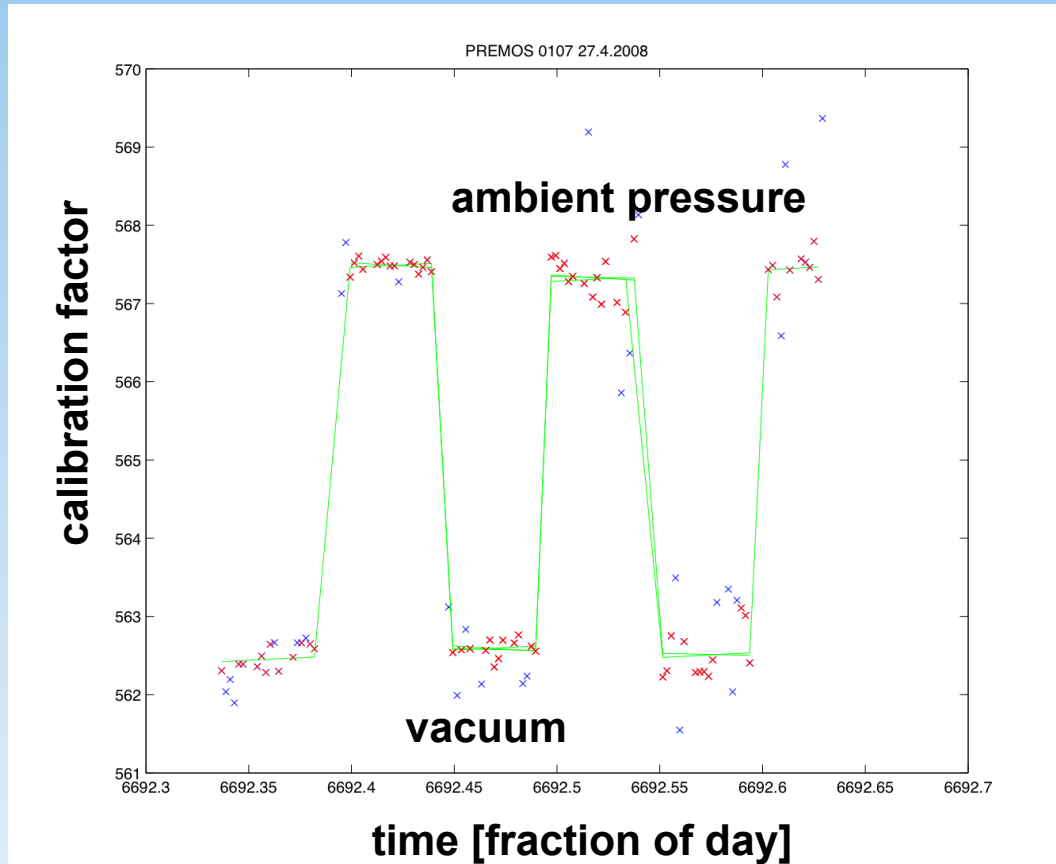
TRF irradiance comparison 7.3 mm and 11 mm spiral pattern (20mW @ 532 nm)

PREMOS 0307 / TRF (2 mm)	$1.00634 \pm 0.00024$ (k=1)
PREMOS 0307 / TRF (7.3 mm)	$1.00653 \pm 0.00029$ (k=1)
PREMOS 0307 / TRF (11 mm)	$1.00790 \pm 0.00033$ (k=1)
<b>Scattered light (11mm / 2mm)</b>	<b>1.00164</b>





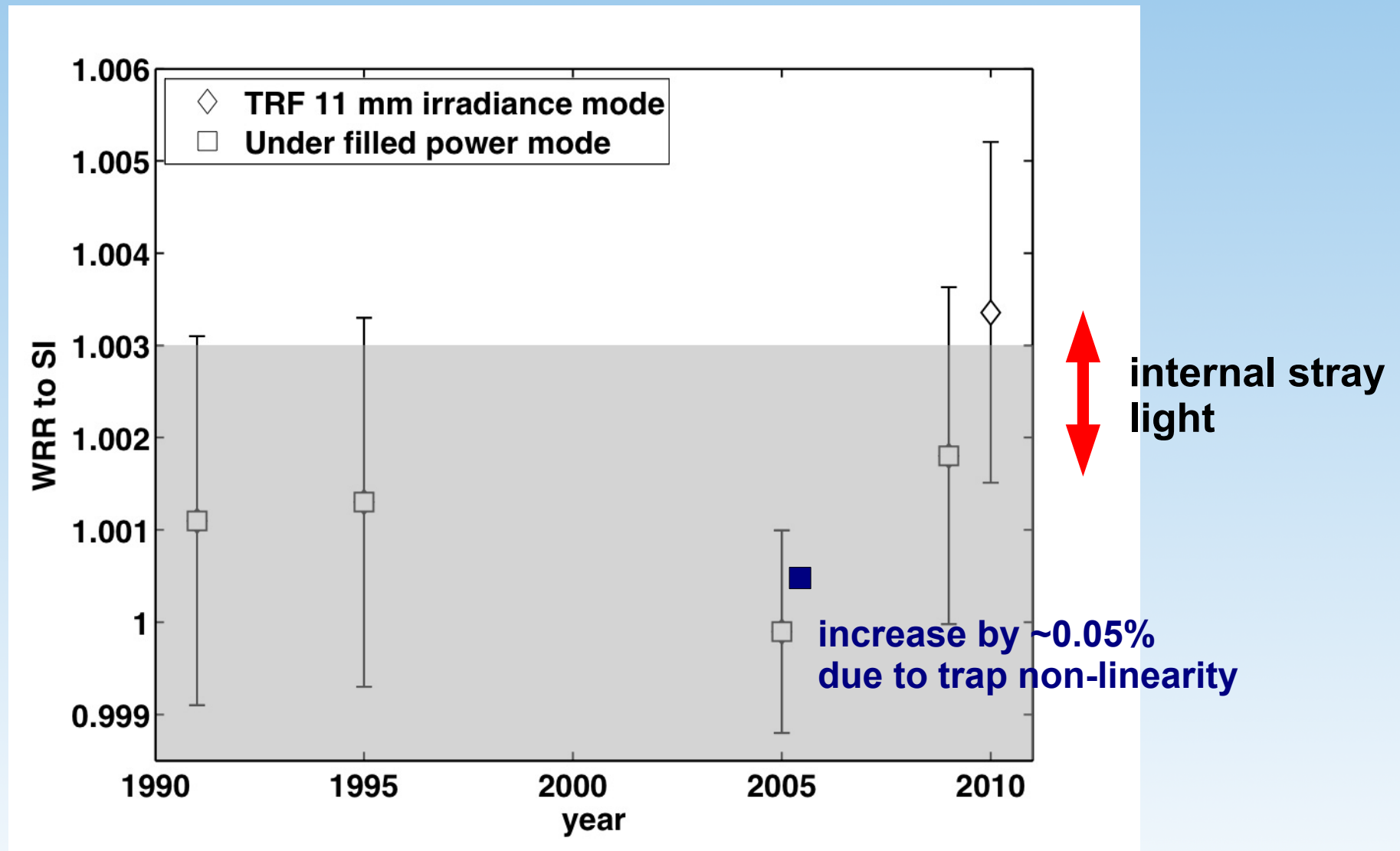
# WRR Comparison



**inter-reflections!**

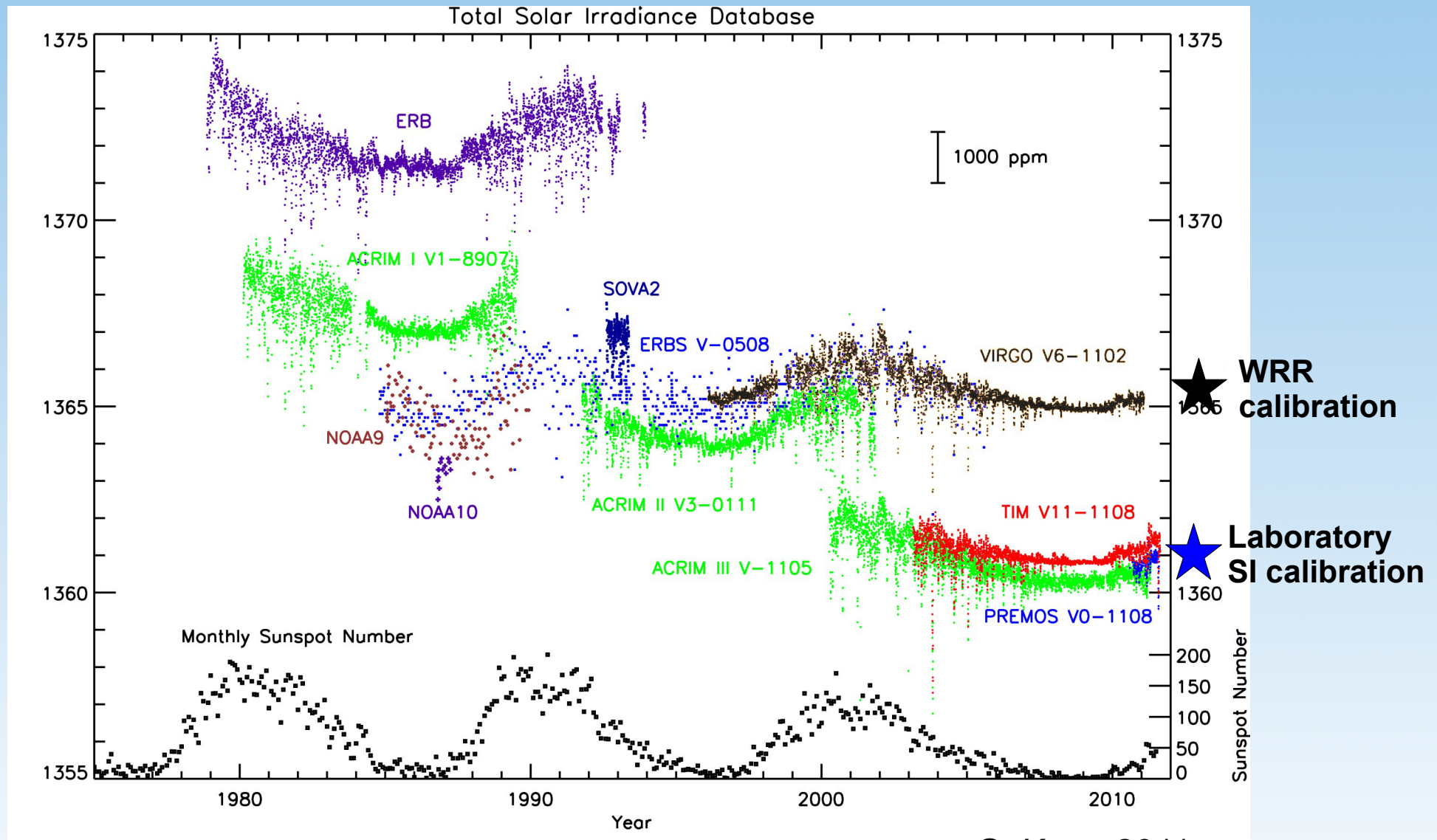
PREMOS 0307 air-to-vacuum	$1.00671 \pm 0.00029$ (k=1)
PREMOS 0307 / WRR	$1.00453 \pm 0.00086$ (k=1)

# WRR-to-SI Comparison



(shaded area indicates 99% confidence interval of WRR  
error bars indicate 95% confidence interval of comparison)

# Space Experiments Measuring TSI



G. Kopp 2011

# Summary

- NIST to NPL SI radiometric scale compared via PREMOS and TRF –  $0.99999 \pm 0.00030$  ( $k=1$ ) – confirms proper characterization of comparison set ups and stability of PREMOS radiometers.
- Stated 3<sup>rd</sup> WRR-to-SI ratio might be too low due to trap non-linearity.
- Internal stray light in our absolute radiometers is about an order of magnitude higher than assumed.
- TRF irradiance calibration compared to WRR calibration shows a scale difference of 0.34 % which offers an explanation for the observed difference in TSI measurements.