

19 August 2023

2023 CCPR WG-SP

To: Maria Nadal, NIST, Chairperson for CCPR WG-SP

From: John Lehman, NIST

Subject: TG 14: Discussion Forum on Radiometry to Support Gravitational Wave Detection

John Lehman (Chair), Peter Blattner, Dong-Hoon Lee, Stefan Kück, Steven van den Berg, Joaquin Campos, Jimmy Dubard.

Objectives of the CCPR-WG-SP Task Group 14 are:

- to discuss measurement issues and report on progress of the work performed in NMIs
- to identify new measurements needs of the community undertaking detection of gravitational waves
- to define priorities in terms of research activities
- to facilitate coordinated research work between country specific NMIs and the respective gravitational wave observatories.

The activities of this TG most recently are comparisons between NIST and PTB and discussions with LIGO about future calibration campaigns. This is also driven by the desire from gravitational wave observatories for lower uncertainty and calibration of the so-called “P-cal” transfer standards employed by multiple observatories. See for example, Y. Inoue, et al. Phys. Rev. D 98 022005 (2018). “[...] the Pcal still [presents] challenges in finding the absolute calibration because of the uncertainty in the laser power standards published by different national metrology institutes [...]” Two dedicated transfer standards have been designated: TSA and TSB. The results are shown below.

For the record, we point to: “A bilateral comparison of NIST and PTB laser power standards for scale realization confidence by gravitational wave observatories,” Matthew Spidell et al., 2021, Metrologia **58** 055011.

A full presentation will be provided by Dr. Richard Savage of CalTech at Newrad 2023, in Teddington, UK.

Calibrating the global network of gravitational wave observatories via laser power calibration at NIST and PTB.

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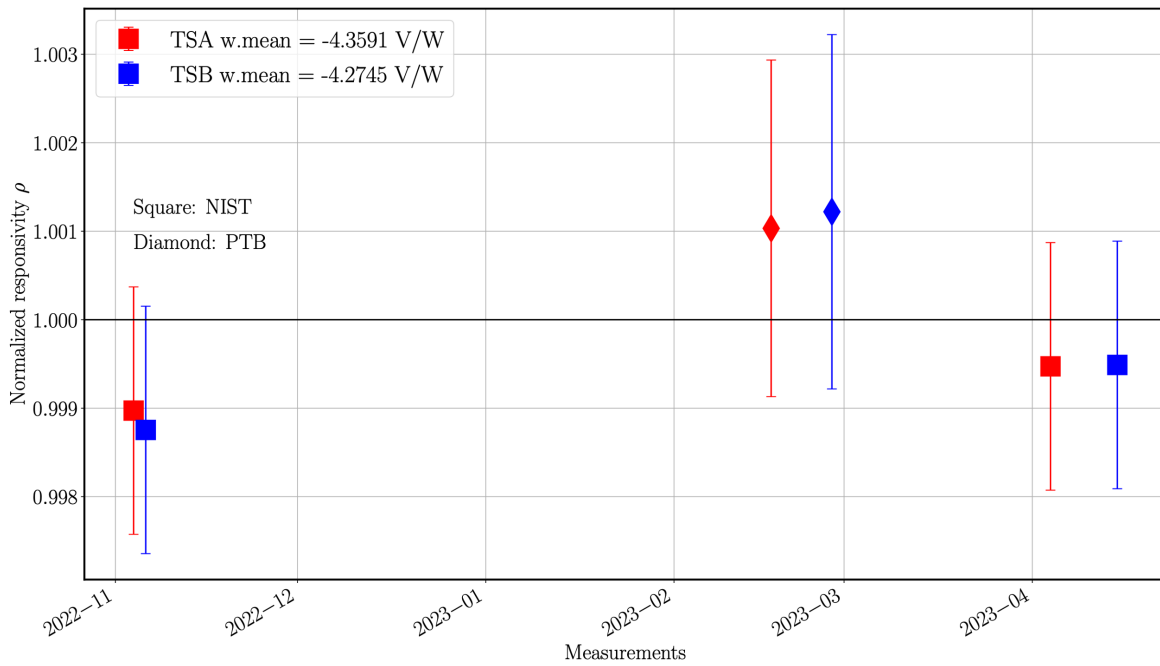


Figure 1. Measurement Results for two dedicated transfer standards during 2022 and 2023.

Following further discussions with Dr. Richard Savage of LIGO, the following calibration scheme was proposed.

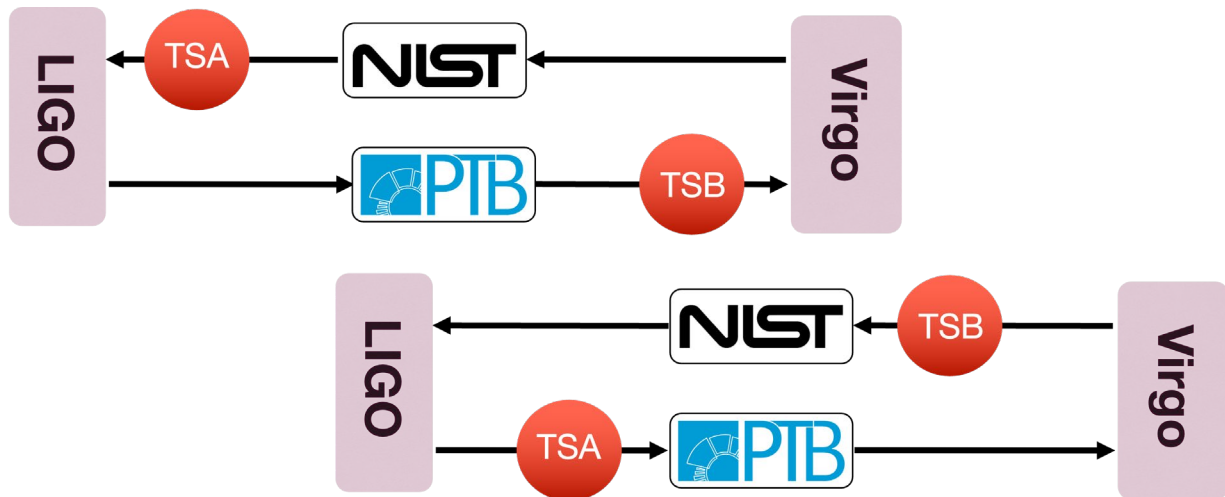


Figure 2. Measurement scheme for annual calibration of the traveling transfer standards.