

Interference measurements at the Nummela Standard Baseline in 2024 for maintenance of a world-class length measurement standard

Jorma Jokela, Pasi Häkli and Timo Saari (Finland)

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SUMMARY

The Finnish Geospatial Research Institute of the National Land Survey of Finland is a Designated Metrology Institute and a National Standards Laboratory in Finland. One of our national length measurement standards is the 864-m 6-pillar Nummela Standard Baseline. The baseline and its predecessor have served in determination of the uniform and metrologically traceable scale for more than a century. Today, the baseline is maintained and developed for national and international electronic distance measurement calibration service for the most accurate instruments and for research use in developing and testing of novel measurement instruments.

The Nummela Standard Baseline is remeasured using the Väisälä Interference Comparator every 5–10 years. This historical measurement method is still the most accurate for distances up to 1 km in field conditions. The objective of the latest remeasurement in autumn 2024 was to confirm the usability and accuracy of the baseline for years to come. Also, a new calibration of the quartz metre, which determines the scale in the comparator, was performed to assure the traceability to the definition of the SI unit metre.

The new baseline section lengths in 2024 differed -0.40 mm to $+0.05$ mm from the previous results in 2013. The variation in the time series using the Väisälä method since 1947 is 0.71 mm for the entire 864 m, indicating excellent stability. The standard uncertainties of measurement have varied from 0.02 mm to 0.12 mm for lengths from 24 m to 864 m. The new values are smaller than ever, from 0.02 mm to 0.05 mm.

The accuracies of the baseline lengths are sufficient for the calibration of the most accurate electronic distance instruments. They also provide independent reference data in developing and testing of new absolute distance measurement instruments, which are based on new laser

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technologies. In this regard, international research projects are expected to continue. Various local installation and monitoring measurements are new applications for our services in dimensional metrology.

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