

Sub-millimetric field measurements over kilometres using Arpent two-wavelength ADM

Wednesday 9 October 2024 11:00 (25 minutes)

Cnam has developed Arpent, a two-wavelength ADM where the distances do not depend on the air refractive index, but only on the dispersion. By simultaneously measuring two optical path lengths at two different wavelengths, it is no longer necessary to determine the air temperature and pressure. Arpent measures distances consistent with the SI-metre definition and achieves uncertainties better than 1 mm over 8 km ($k=1$), which can be of great interest for the surveying of large structures such as particle accelerators. This article describes the operating principle and performance of Arpent. Firstly, compensation for changes in the air refractive index when measuring a fixed distance of 2.6 km or 5.4 km over several days showed standard deviations lower than 0.3 mm. Secondly, distances were compared with those of the GNSS-based distance meter (GBDM+) developed by UPV, for nine baselines ranging from 1.0 km to 6.5 km and located at two reference sites: EURO5000 and CERN. The distances provided by Arpent and GBDM+ proved compatible within their uncertainties ($k=1$) for seven baselines, and the differences had a standard deviation of 1.8 mm. Finally, Arpent was tested over 8 km. The two-wavelength ADM and GBDM+ will soon be used to transfer absolute scale to the new INTA1000 calibration baseline at the Spanish National Institute of Aerospace Technology (INTA).

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Session Classification: Instrumentation