

Calibration of SLR System Delays for the European Laser Timing Reaching 20 ps Accuracy

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Recently the European Laser Timing (ELT) experiment is under preparation. It is an optical link prepared in the frame of the European Space Agency (ESA) mission “Atomic Clock Ensemble in Space” (ACES). The objective of this laser time transfer is the synchronization of the ground based clocks and the clock on board the International Space Station with precision of the order of units of picoseconds and the accuracy of 50 ps. The technique is relying on the existing ground based infrastructure used for satellite laser ranging (SLR). In order to reach the ultimate precision and accuracy the SLR ground systems participating in time transfer have to be properly calibrated for this purpose. The new tool “ELT Calibration Device” has been developed. It consists of an optical detector package, which is a “twin” of the flight module of the ELT detector operating in space, the second one is a picosecond timing system. The Calibration Device is planned to be operated successively on the participating SLR stations to characterize the ground segment timing performance prior to the mission launch.

The first calibration results have been acquired at the SLR system WLRS at Wettzell March to May this year. The overall SLR system and Calibration Device epoch timing stability and reproducibility of 20 ps have been achieved. The calibration procedure and results will be described in detail.