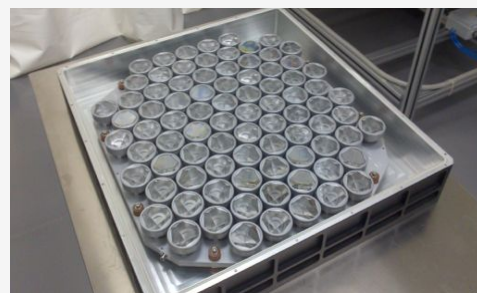


INFN-LNF/SCF_Lab and ASI-CGS/MLRO Teams
¹Istituto Nazionale di Fisica Nucleare (INFN), Laboratori Nazionali di Frascati (LNF), Frascati (Rome) Q0044, Italy.
²Agenzia Spaziale Italiana (ASI), Centro di Geodesia Spaziale (CGS), Matera (MT), Italy

Abstract

Framework	<p>SPACE. Specialized, innovative applications to and services for:</p> <ul style="list-style-type: none"> Satellite Laser Ranging (SLR) to Laser Retroreflectors Arrays (LRAs) of Galileo (the European global positioning constellation the main EU Flagship Programme) Standards and calibrations for the International Laser Ranging Service (ILRS), the network of ground laser stations tracking satellites and Moon Advanced performance characterization of LAGEOS (Laser GEodynamics Satellites), which fundamental for the definition of the center of mass of the Earth (geocenter), the origin of the International Terrestrial Reference Frame (ITRF)
Prime	ASI-CGS. Sub-structure: Matera Laser Ranging Observatory (MLRO)
Partner	INFN-LNF. Sub-structure: SCF_Lab
Brief description	Optimized technological and industrial services for precision and advanced laser tracking and characterization of Galileo (and other GNSS constellations)
Project objectives	<ul style="list-style-type: none"> Infrastructure equipment upgrade of the MLRO laser ground station of the SCF_Lab dedicated to the characterization of the laser retroreflector payloads of Galileo and LAGEOS Applications to GNSS (Galileo) and Space Geodesy (LAGEOS). Both at SCF_Lab and MLRO. SCF-Test of SLR of large diameter LRAs of Galileo and LAGEOS Tight synergy of SCF_Lab, MLRO infrastructures

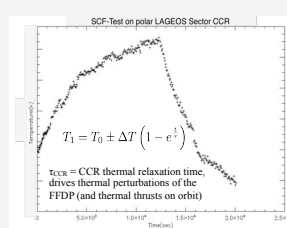
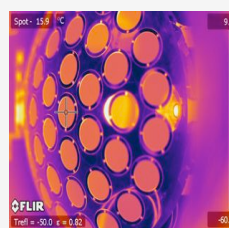
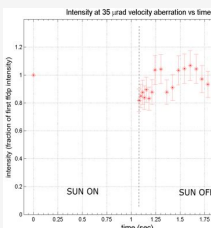
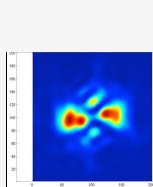
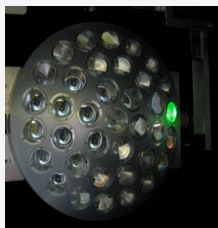


Top: LRA (Laser Retroreflector Array) flight model of the Galileo IOV satellites (on loan to INFN-LNF by ESA).
Right: 'standard' GNSS Retroreflector Array (GRA) built by INFN & ASI with the ETRUSCO-2 project



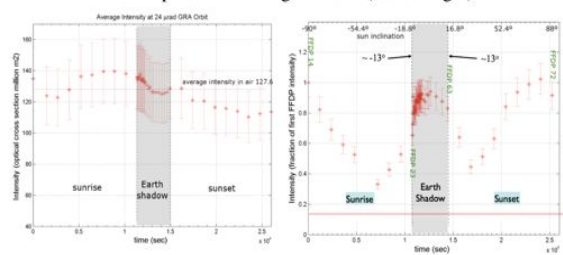
ACTIVITIES

Macro-Activity 1 Year 1 and 2	Macro-Activity 2 Year 1	Macro-Activity 3 Year 1	Macro-Activity 4 Year 2	Macro-Activity 5 Year 2	Macro-Activity 6 Year 2	Macro-Activity 7 Year 2
MLRO-SCF_Lab Harmonization of MLRO and SCF_Lab upgrades and their integration	MLRO Equipment Upgrade	SCF_Lab Equipment Upgrade	Upgraded MLRO: Laser Ranging to LRAs onboard Galileo satellites	Upgraded SCF_Lab: Lab Characterization of Galileo LRA Flight Model (on loan to LNF from ESA)	Upgraded MLRO: Optimized Laser Ranging to LAGEOS	Upgraded SCF_Lab: Characterization of LAGEOS Sector Engineering Model (on loan to LNF from NASA)

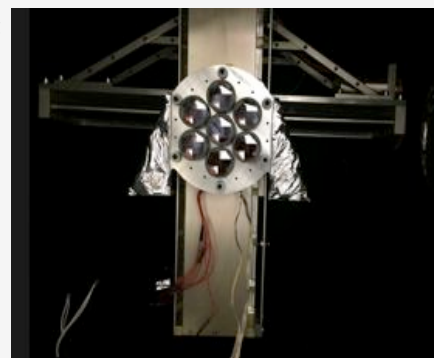
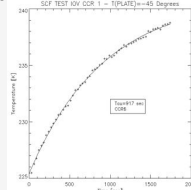


GRA and Galileo IOV: GCO SCF-Test

- GRA by INFN-ASI: 3.5 kg, 400 mm diameter; lighter/smaller than Galileo IOV. No degradations within ±15% errors (bottom left)
- Galileo IOV: in 2010 for ESA we measured one IOV reflector, which showed performance degradations (bottom right)



ESA-INFN 2014 contract on engineering LRA model of reduced size, 7 flight CCRs (right). Tests have been completed, results are under analysis, and will be delivered to ESA PM, D. Doyle. Below, an example of measurement of τ_{CCR} = CCR thermal relaxation time, which drives thermal perturbations of the FFDP



LRA engineering model built by INFN with flight reflectors of the Galileo IOV satellites, SCF-Tested in 2014 @INFN-LNF