SCF-Test and FFDP-Test of Flight-quality Uncoated Cube Corner Laser Retroreflectors

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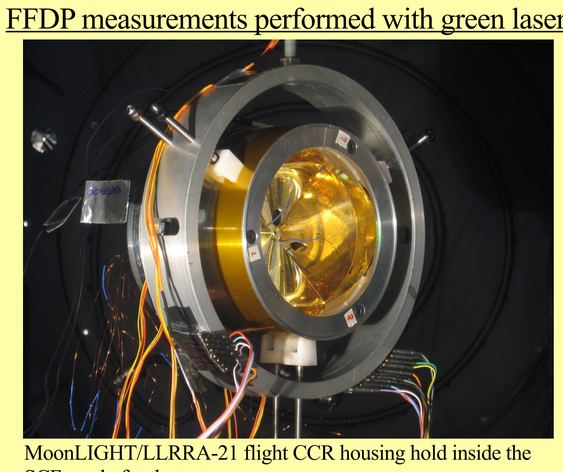
Abstract

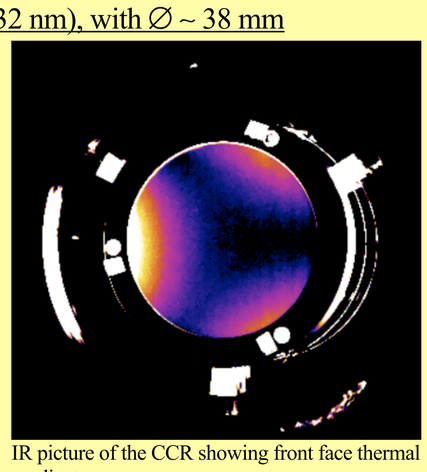
Using dedicated facilities of INFN-LNF in Frascati, Italy, including the "Satellite/lunar laser ranging Characterization Facility" (SCF, Adv. Space Res. 47 (2011) 822–842), we characterized the detailed thermal behavior and/or the optical performance of many flight units of coated and uncoated cube corner laser retroreflectors (CCRs). As a reference for the ILRS user community, with this poster we provide a compilation of the many tests carried out in the last years on uncoated CCRs (tests on coated CCR are reported in detail in the Adv. Space Res. 47 (2011) 822–842).

LLRRA-21, an uncoated lunar CCR

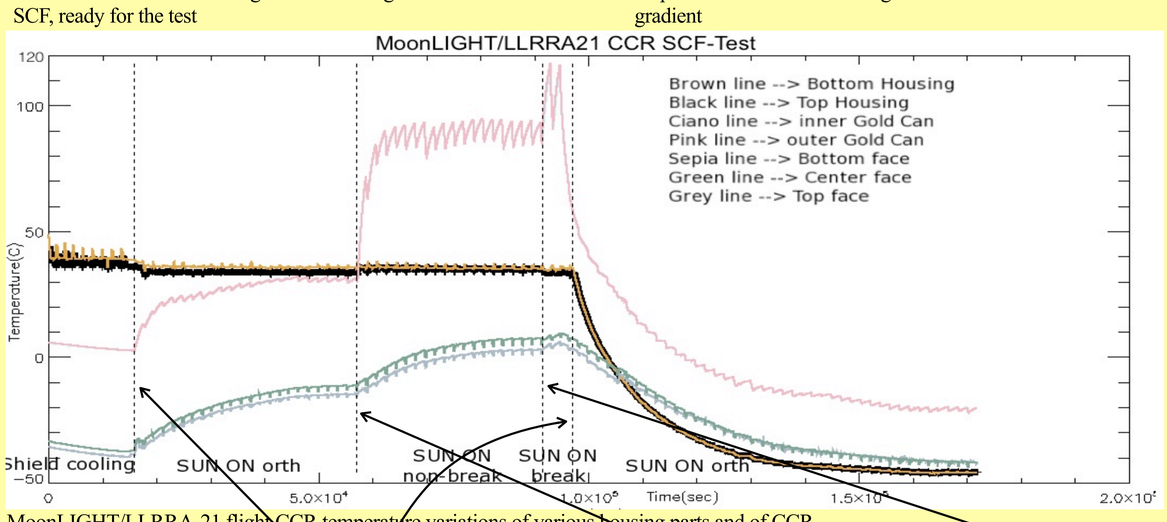
FFDP measurements performed with green laser (λ=532 nm), with ∅ ~ 38 mm



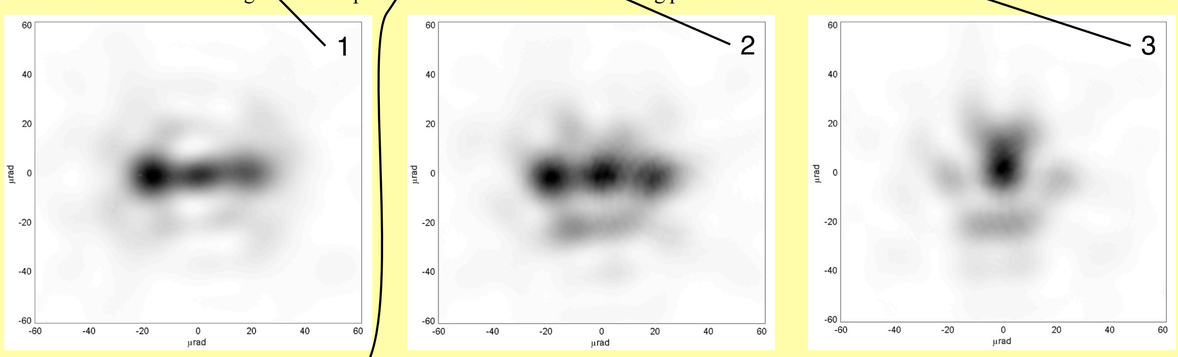
MoonLIGHT/LLRRA-21 flight CCR housing hold inside the SCF, ready for the test



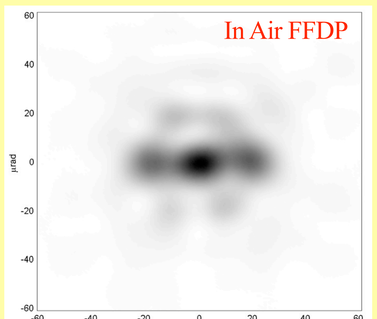
IR picture of the CCR showing front face thermal gradient

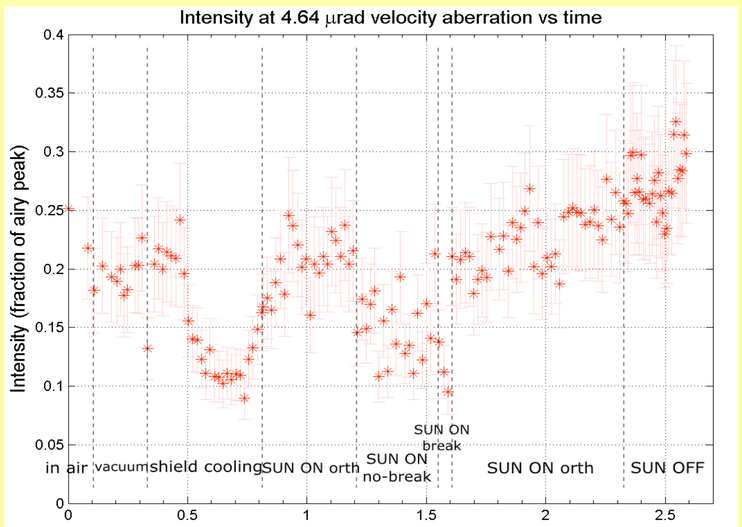


MoonLIGHT/LLRRA-21 flight CCR temperature variations of various housing parts and of CCR.



FFDPs at key points of the SCF-Test:
1- beginning of SCF-Test
2- end of "SUN ON orth"
3- end of "SUN ON non-break"
4- end of "SUN ON break"

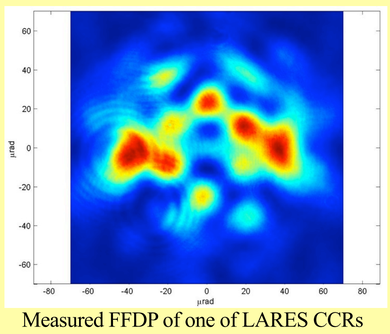




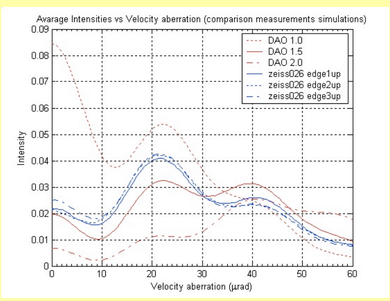
MoonLIGHT/LLRRA-21 flight CCR FFDP intensity variation at Moon velocity aberrations (2V/c) during tests

LARES flight CCRs (FFDP test in air, by INFN-LNF authors only)

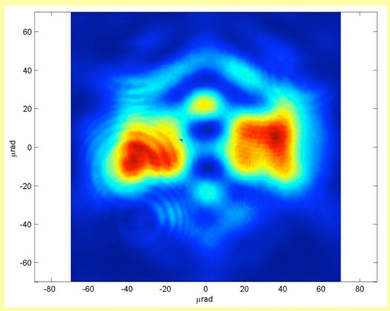
- Industrial ACCEPTANCE tests in air at λ=632.8nm were performed by INFN-LNF on all of the 110 flight CCRs manufactured by ZEISS for the LARES satellite, in order to asses the compliance of the CCRs with the following optical specifications: DAOs = 1.5 ± 0.5 arcsec. This work, requested by ASI to INFN-LNF, was performed in 3 working weeks before Christmas 2008. This work was completely successful and approved by ASI with ASI reference document: DC-OSU-2009-012.
- Definition of an acceptance band (using CODE V software simulations) for FFDP measurements. Priority for the acceptance given to peaks distances.
- Test and analysis procedures developed in the framework of the ETRUSCO INFN-LNF experiment (PI S. Dell'Agnello of INFN-LNF).



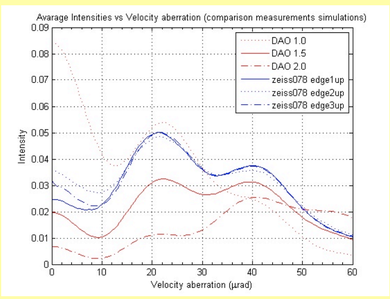
Measured FFDP of one of LARES CCRs



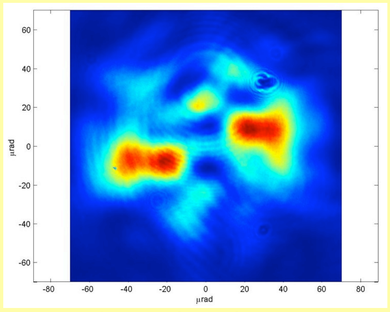
Average intensity vs distance from FFDP center. Comparison between simulated patterns (CODEV) and measured patterns



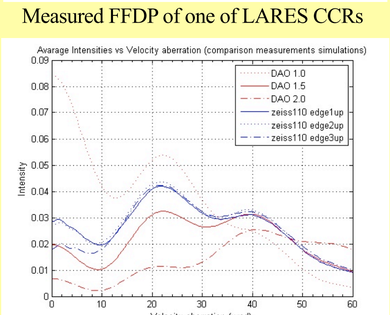
Measured FFDP of one of LARES CCRs



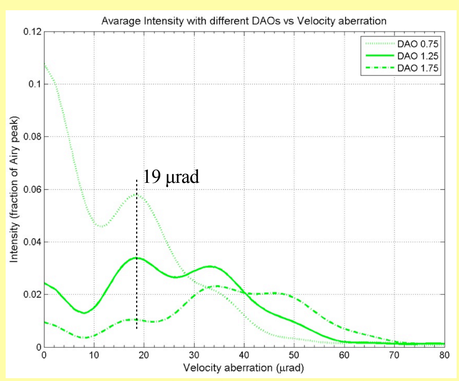
Average intensity comparison sim/meas



Measured FFDP of one of LARES CCRs



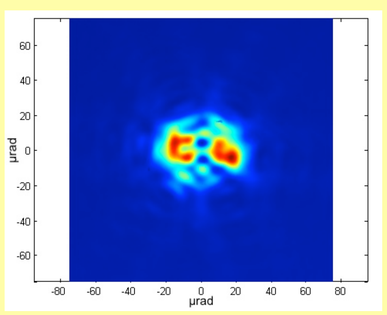
Average intensity comparison sim/meas

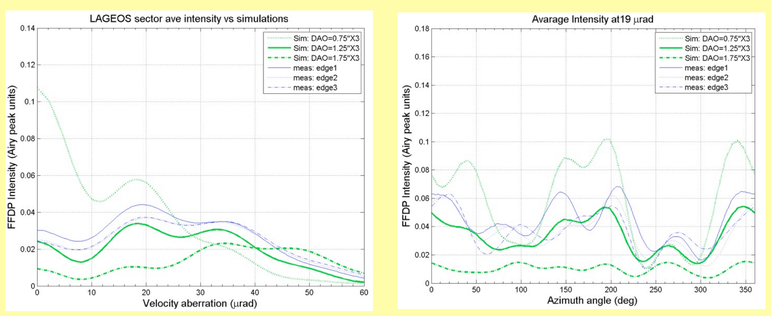


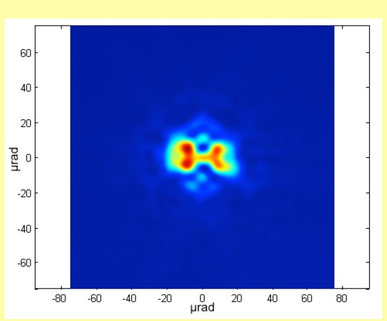
Average intensity of simulated FFDP vs velocity aberration for λ= 532 nm

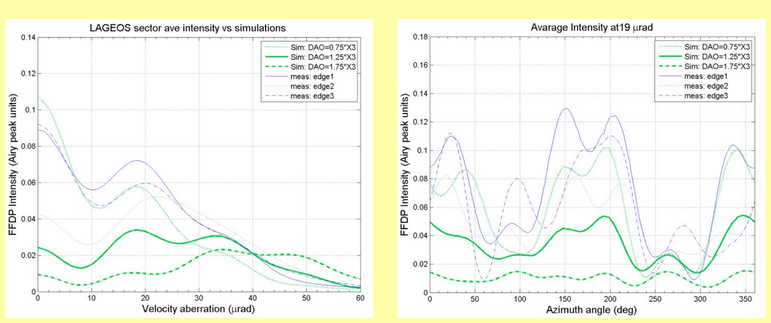
Industrial acceptance Test performed on 110 flight CCRs by INFN-LNF authors. Figure shows results for all of the four lots measured on a red laser optical table

LAGEOS Sector CCRs (in air FFDP test)









GREEN LASER MEASUREMENTS. Edge 1 FFDPs (left plots). Average intensity vs distance from FFDP center (central plots); comparison between simulated patterns (CODEV) and measured patterns. Intensity along a circle at a certain velocity aberration (19 rad for right plots)

acronyms

DAO: Dihedral Angle Offset

MoonLIGHT: Moon Laser Instrumentation for General RelativityHigh-accuracy Tests

LLRRA-21: Lunar Laser Ranging Retroreflector Array for the 21st century

FFDP: Far Field Diffraction Pattern