Extended far field diffraction pattern characterization of LAGEOS and LARES retroreflectors in isothermal conditions

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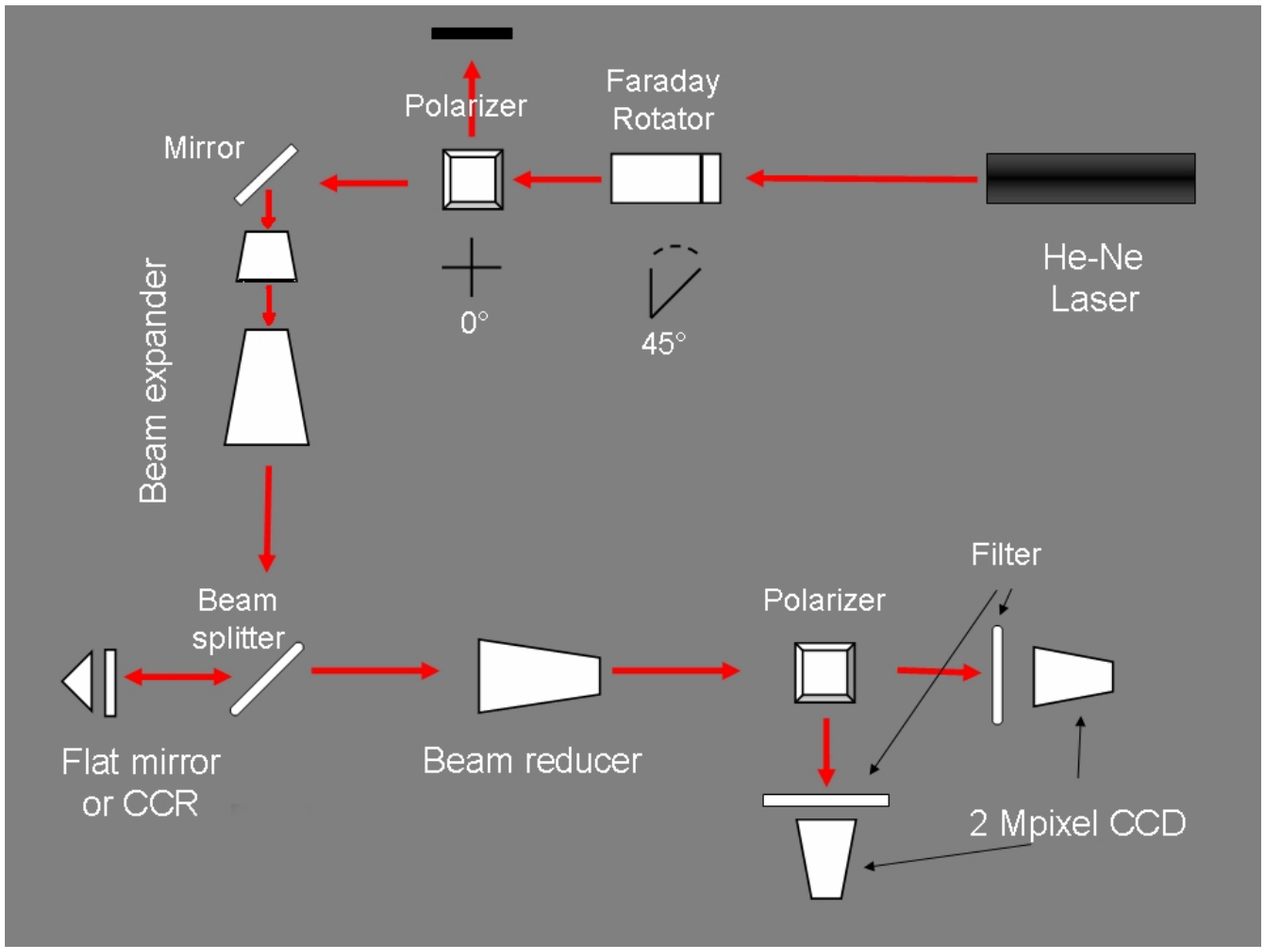
Outline

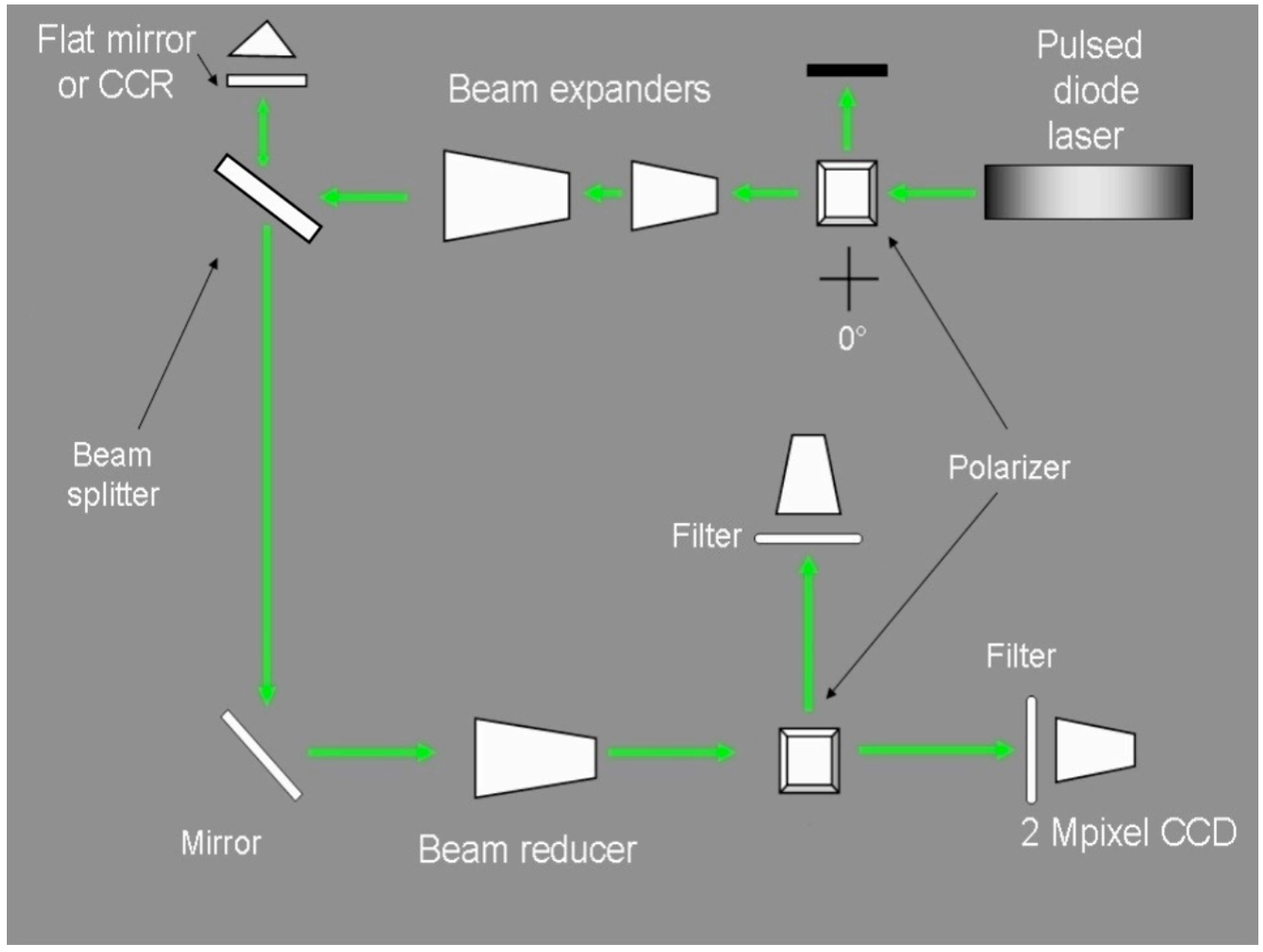
- FFDP tests in air at the SCF_Lab
- LAGEOS Sector
- Early acceptance test for SLR retroreflectors
- FFDP average intensity analysis
- LARES
- Industrial acceptance test of LARES flight CCRs
- FFDP average intensity analysis
- Conclusions

FFDP tests in air at the SCF_Lab

Optical tables arrangements

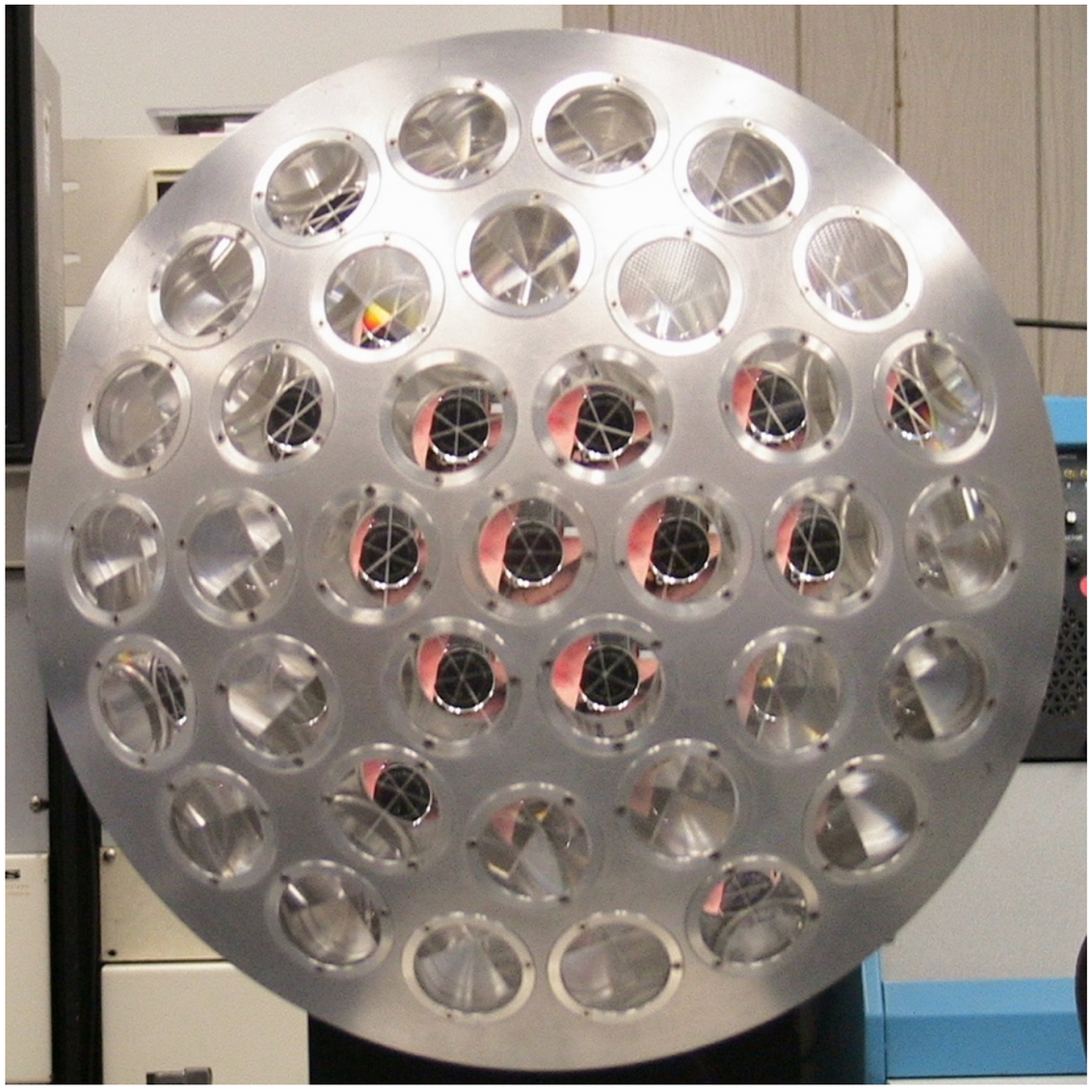


He-Ne λ=632.8 nm



Nd:Yag frequency doubled λ=532 nm

The “LAGEOS Sector”

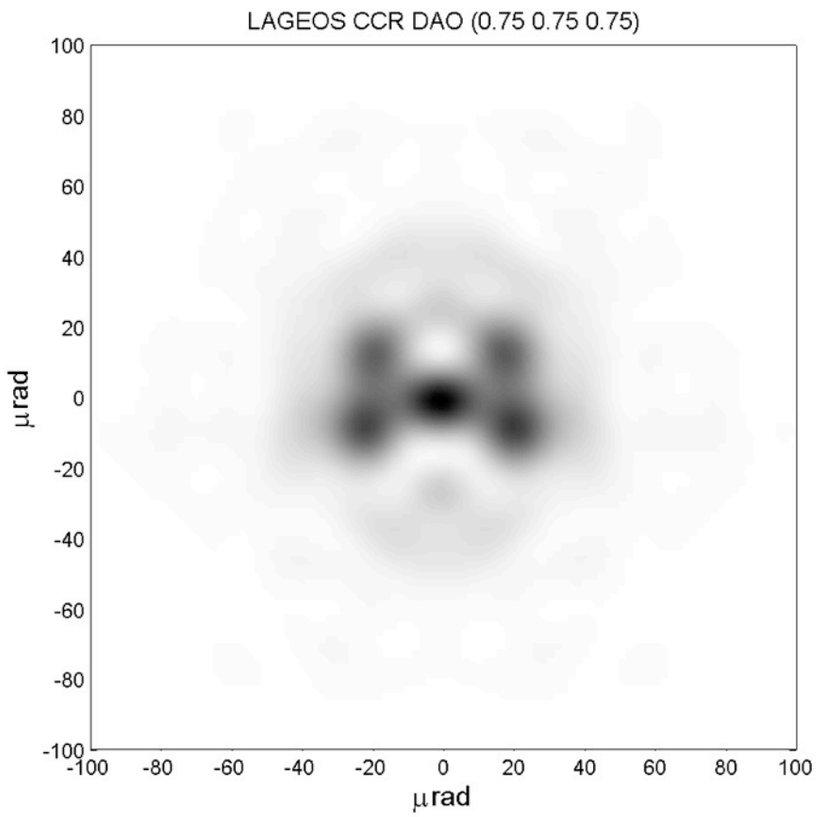


Courtesy of NASA-GSFC

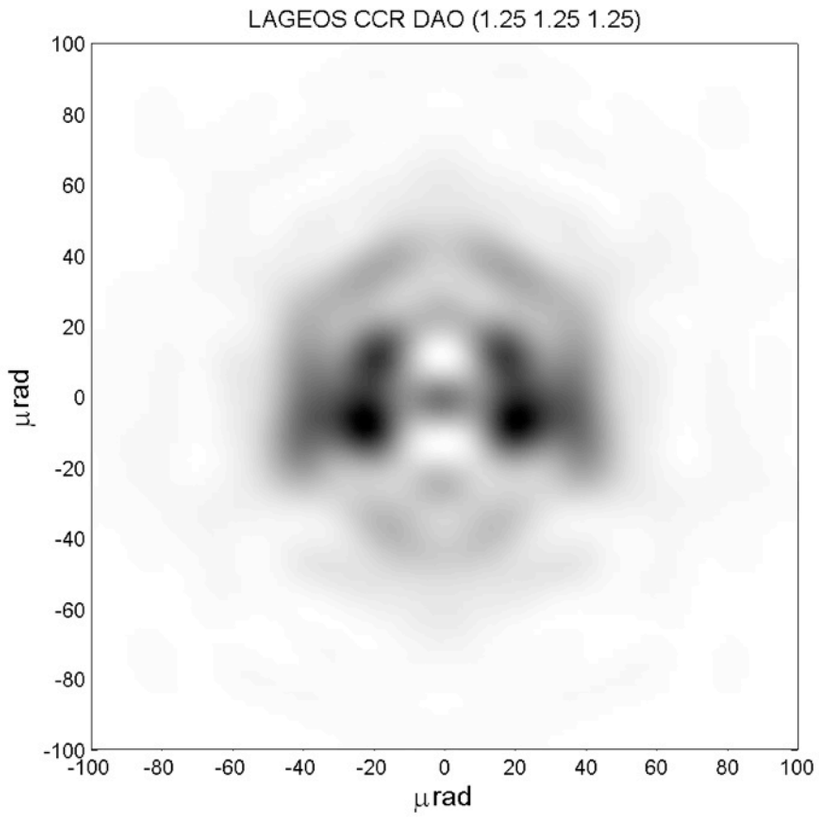
- Spherical sector of LAGEOS satellite
- Aluminum base, 380 mm diam.
- Weight ~1.5 Kg
- 37 uncoated CCRs of good optical quality
- 1.5” front face diam.
- DAO: (1.25 1.25 1.25) ±0.5 arcsec

finding distinctive features from FFDP

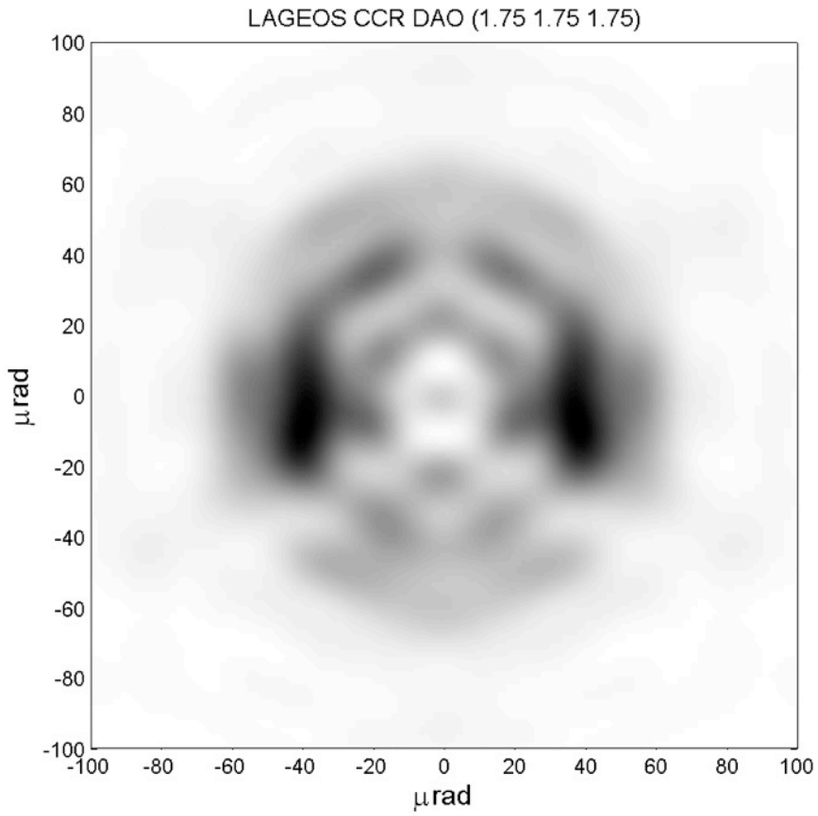
- LAGEOS simulated FFDP at 632.8 nm
- vertical edge
- horizontal polarization



0.75



1.25

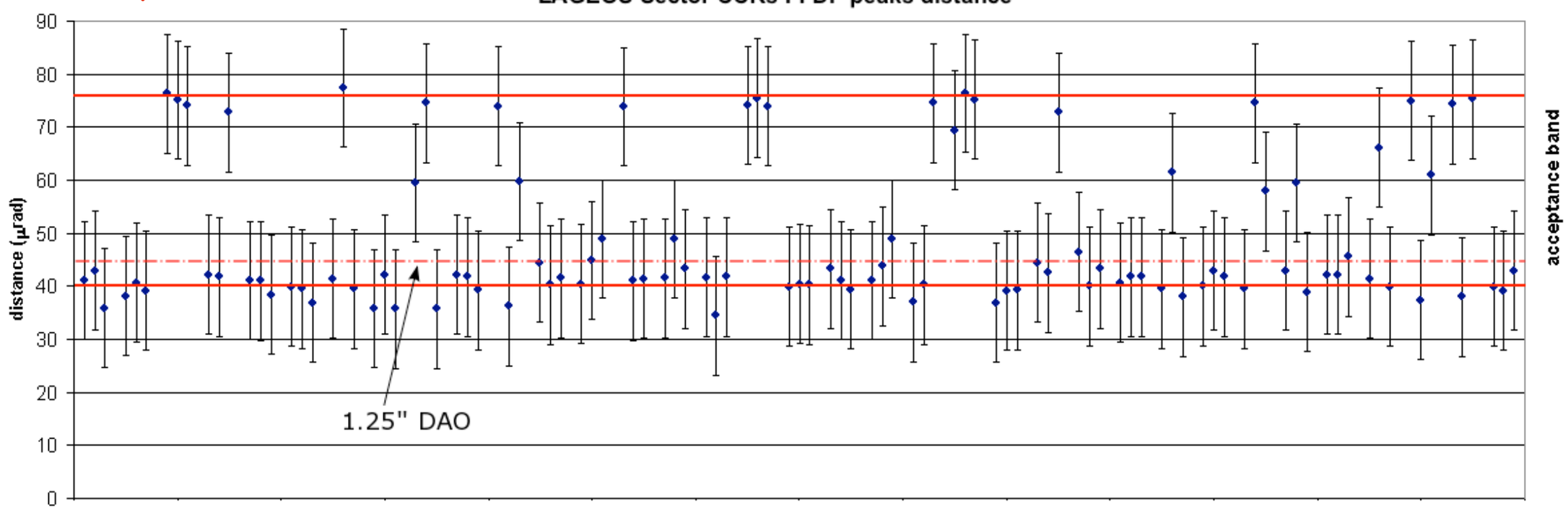


1.75

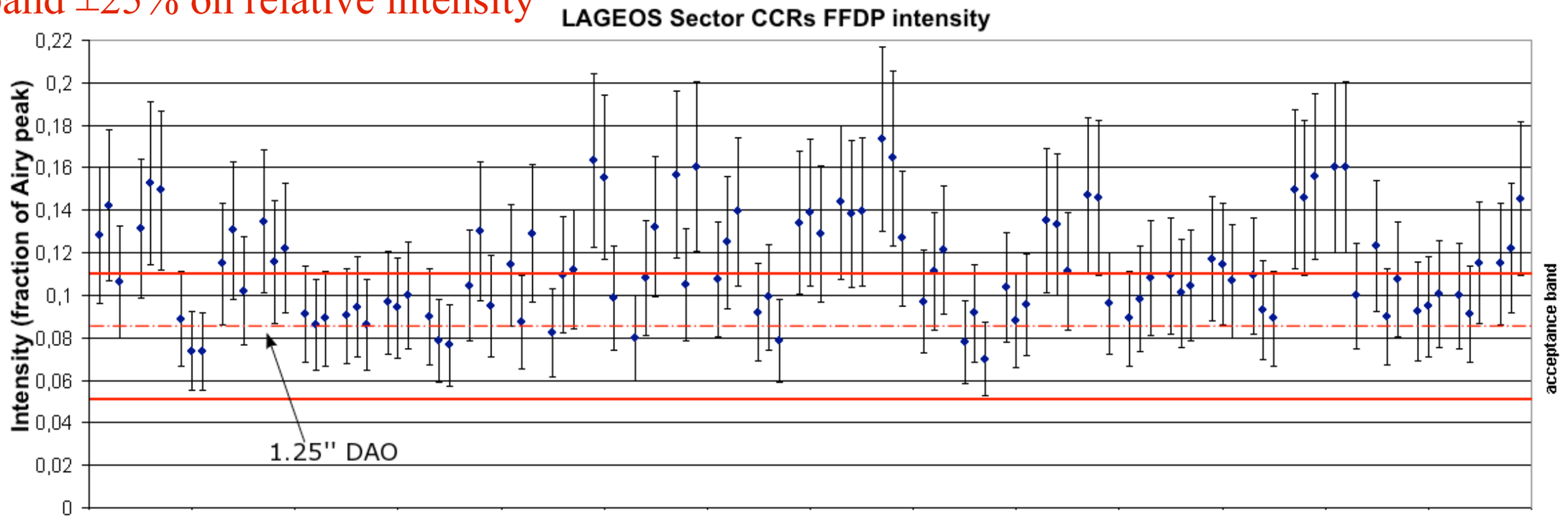
Two distinct peaks horizontally located

early acceptance test of retroreflectors

error band ±11µrad

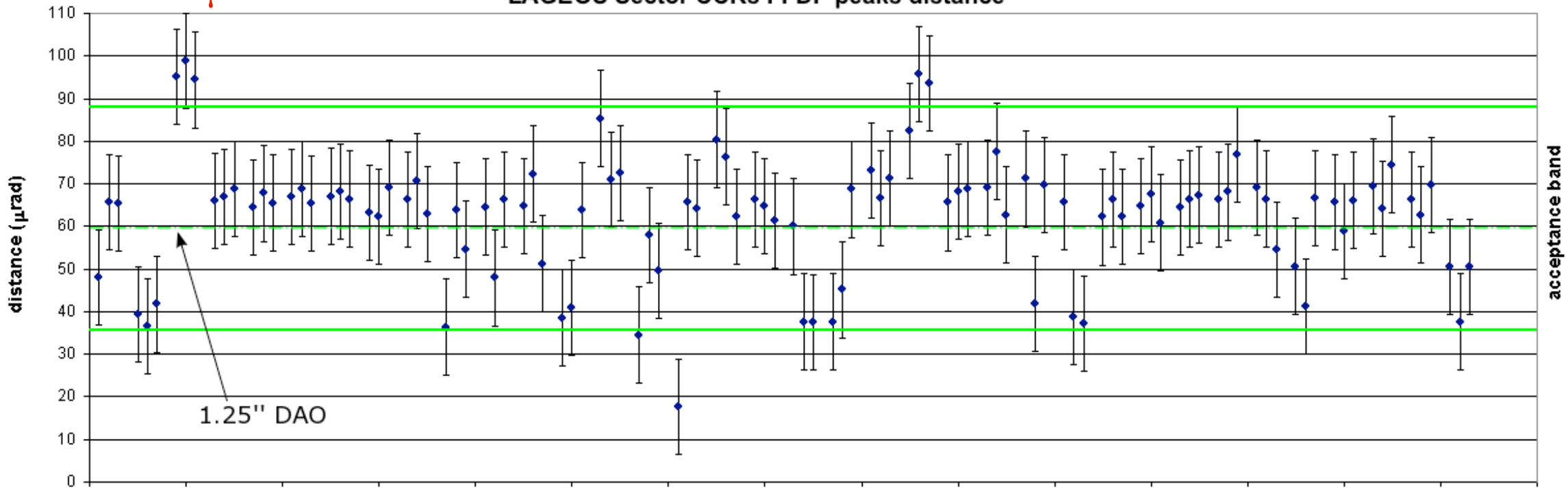


error band ±25% on relative intensity

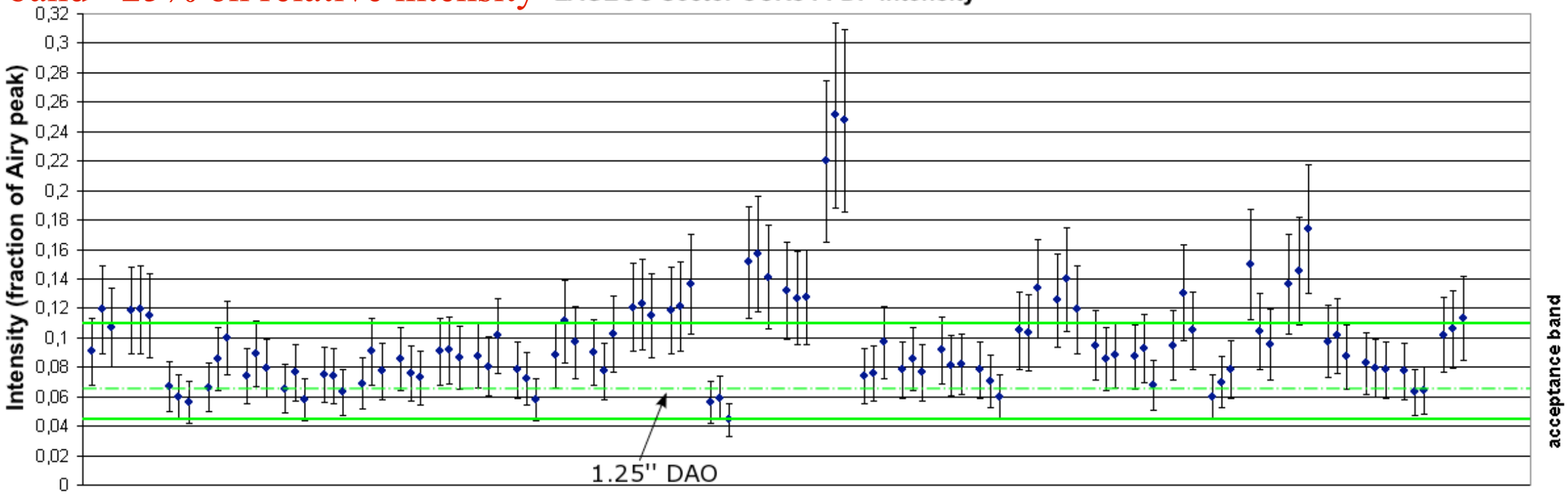


early acceptance test of retroreflectors

error band ±11μrad

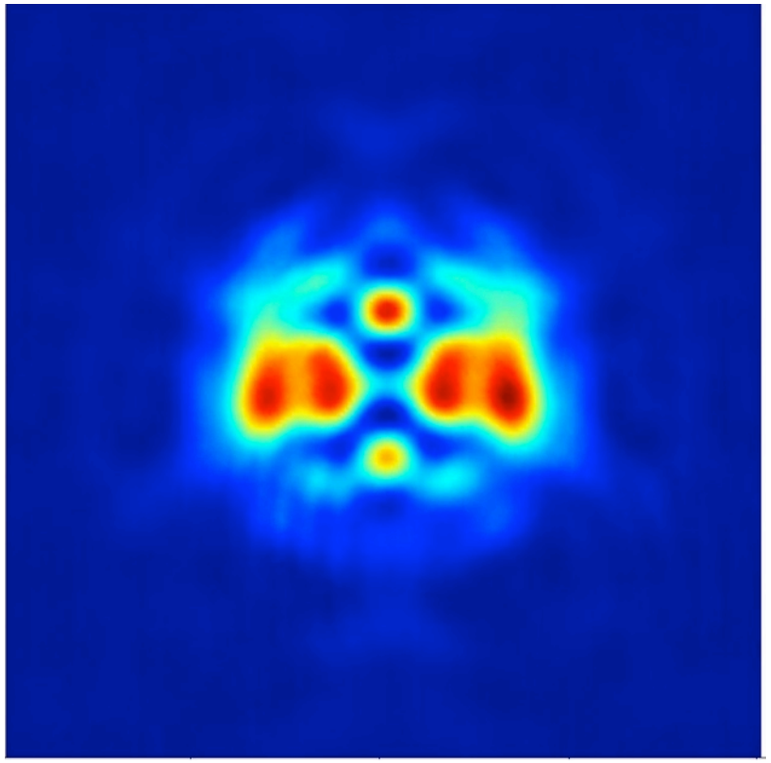


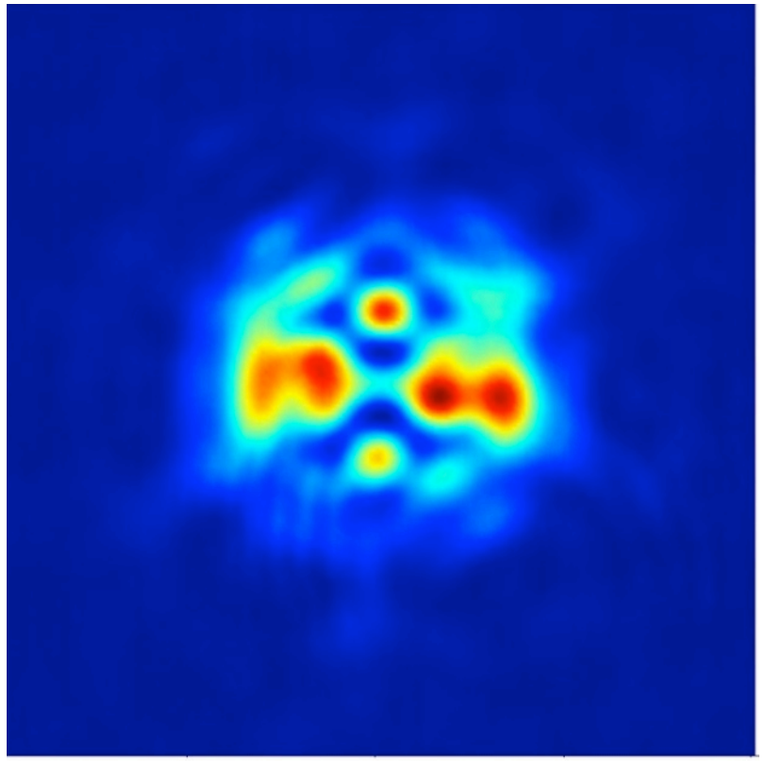
error band ±25% on relative intensity

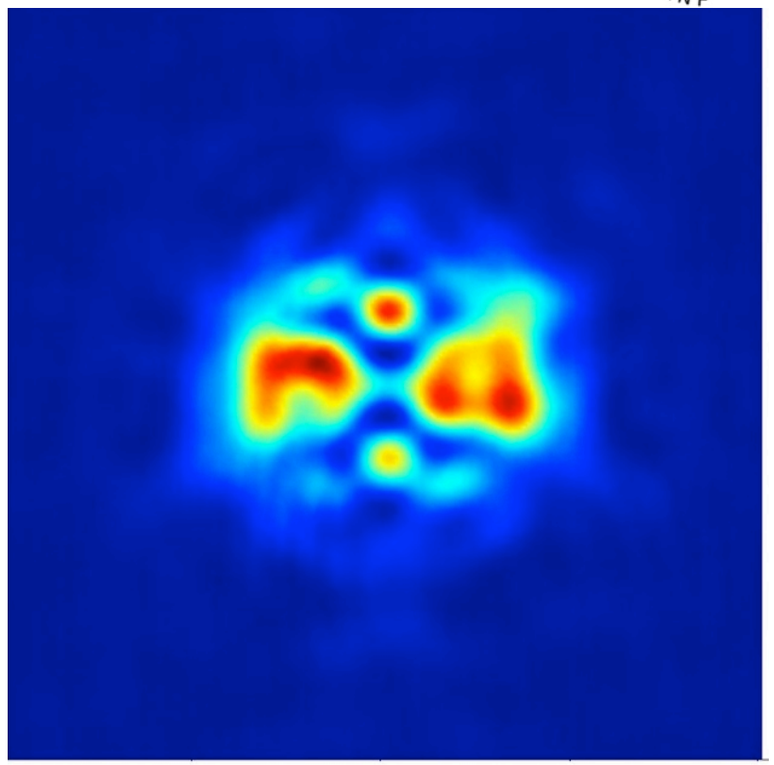


LAGEOS Sector FFDPs

λ=632.8 nm

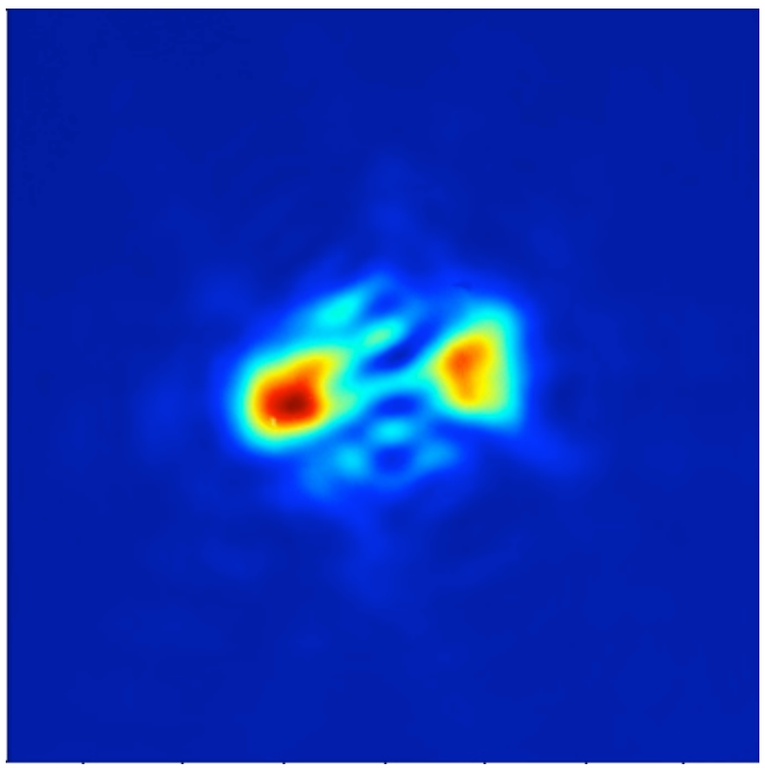


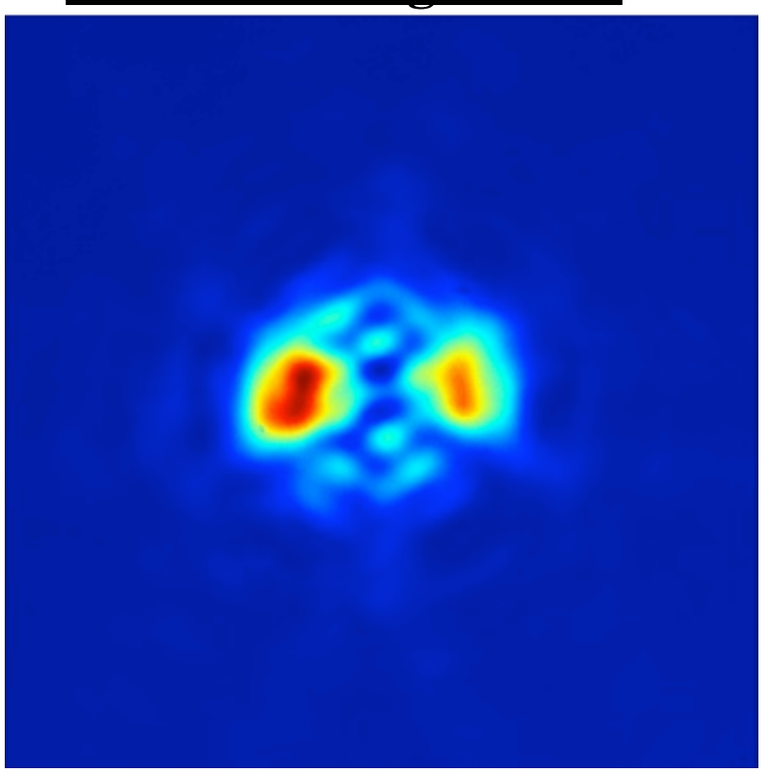


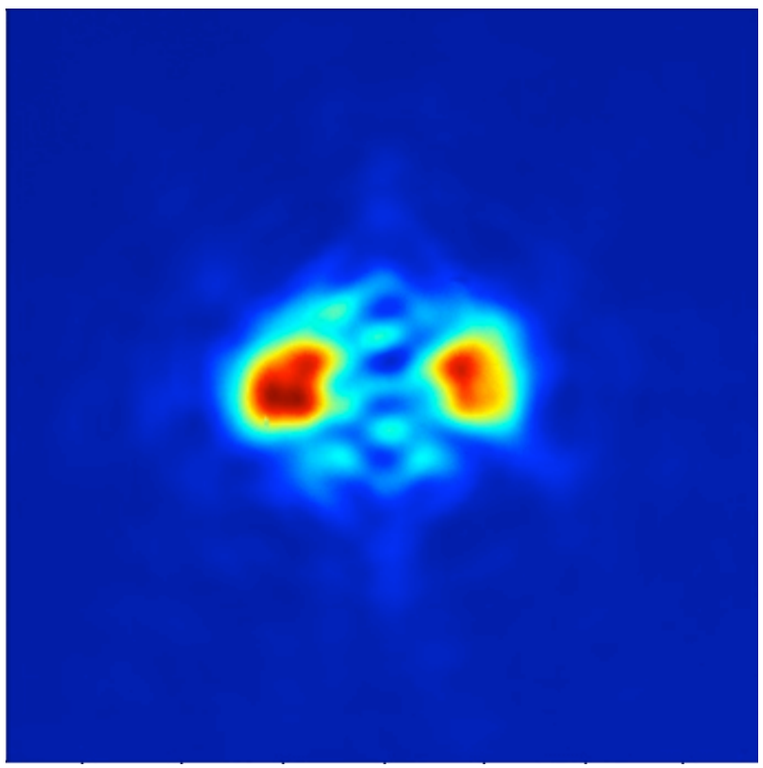


λ=532 nm

not the same grid size

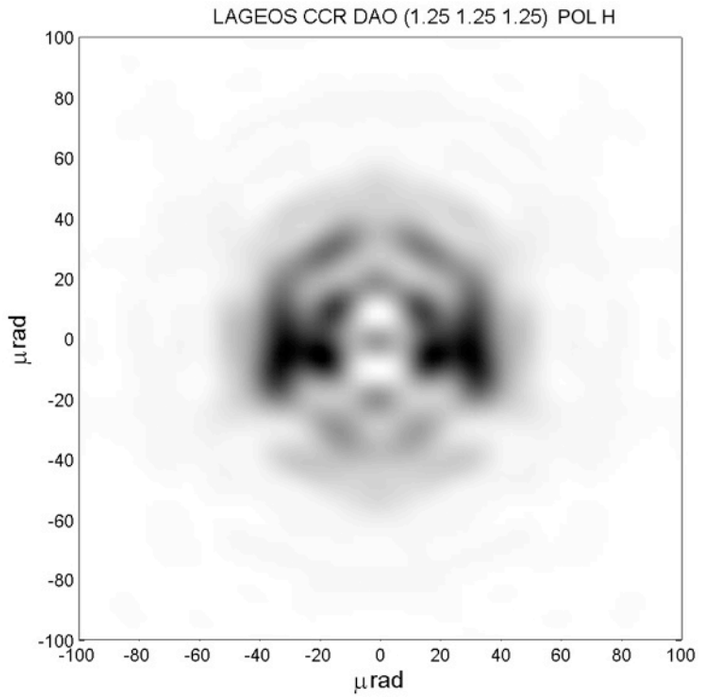


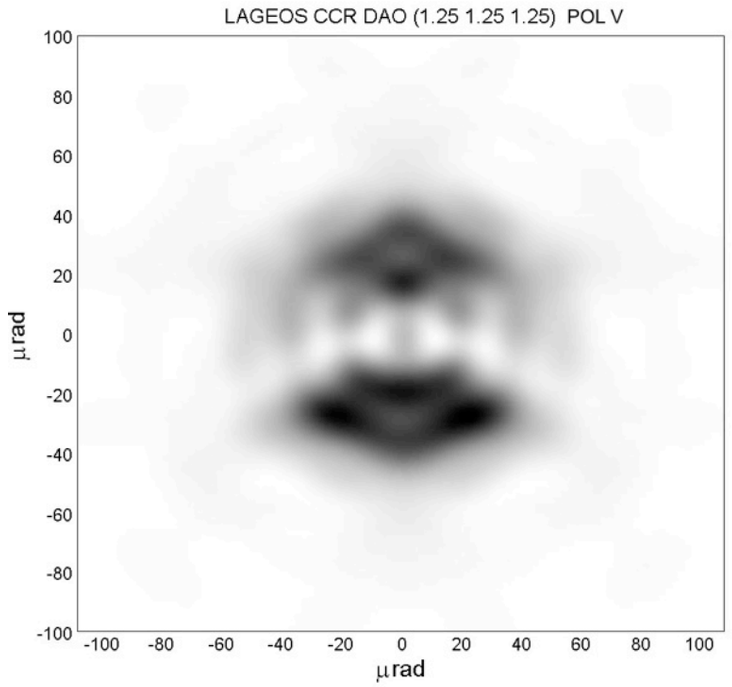




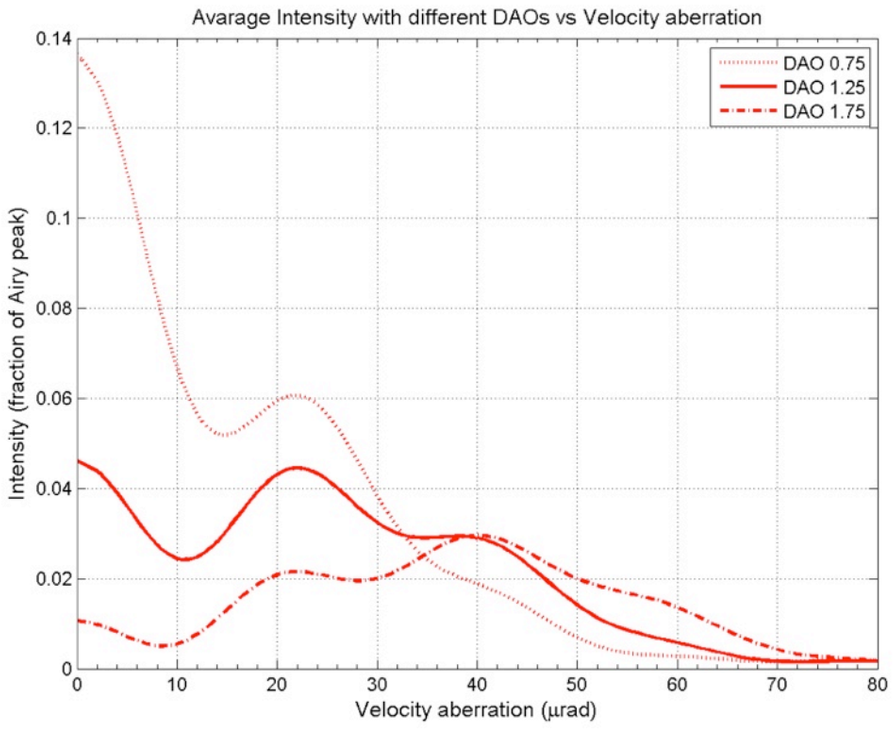
FFDP average intensity analysis

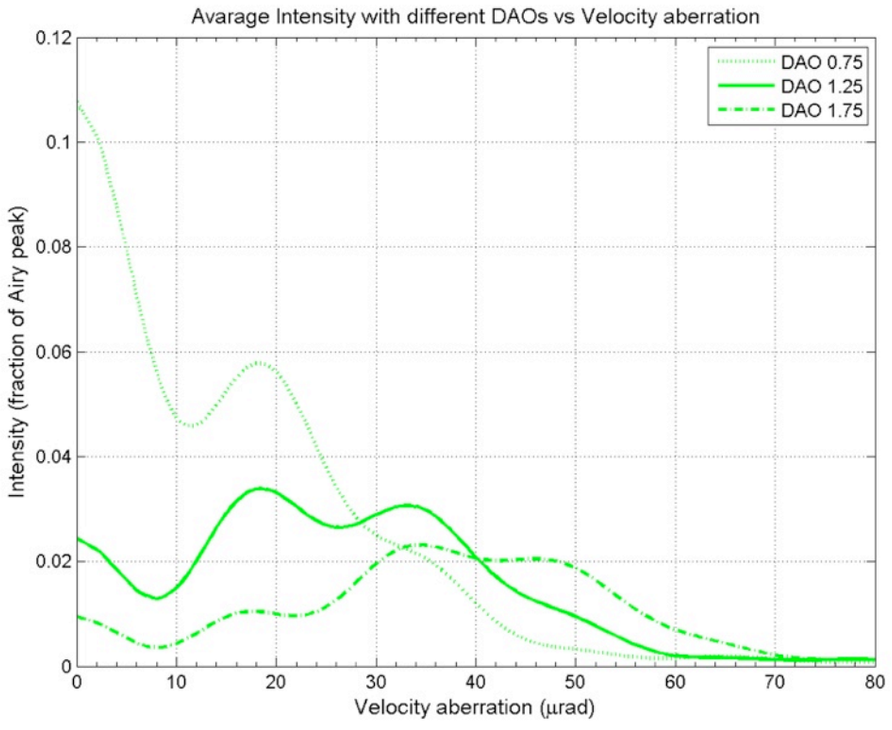
What if we change polarization direction?



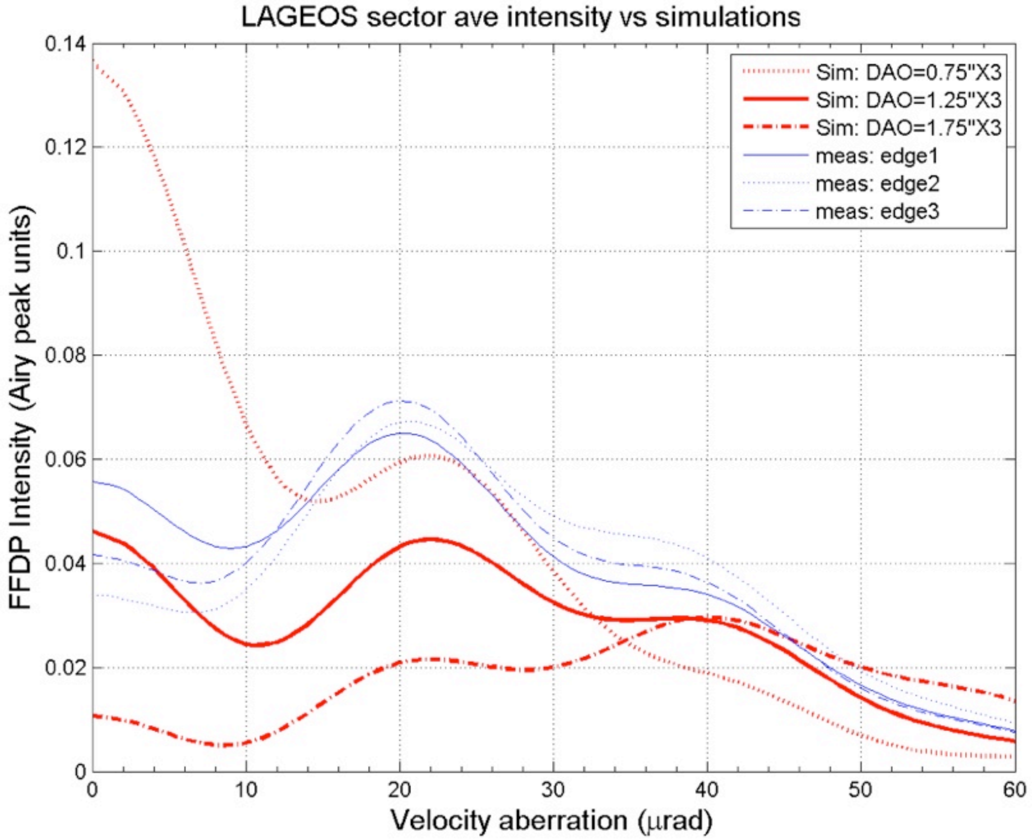


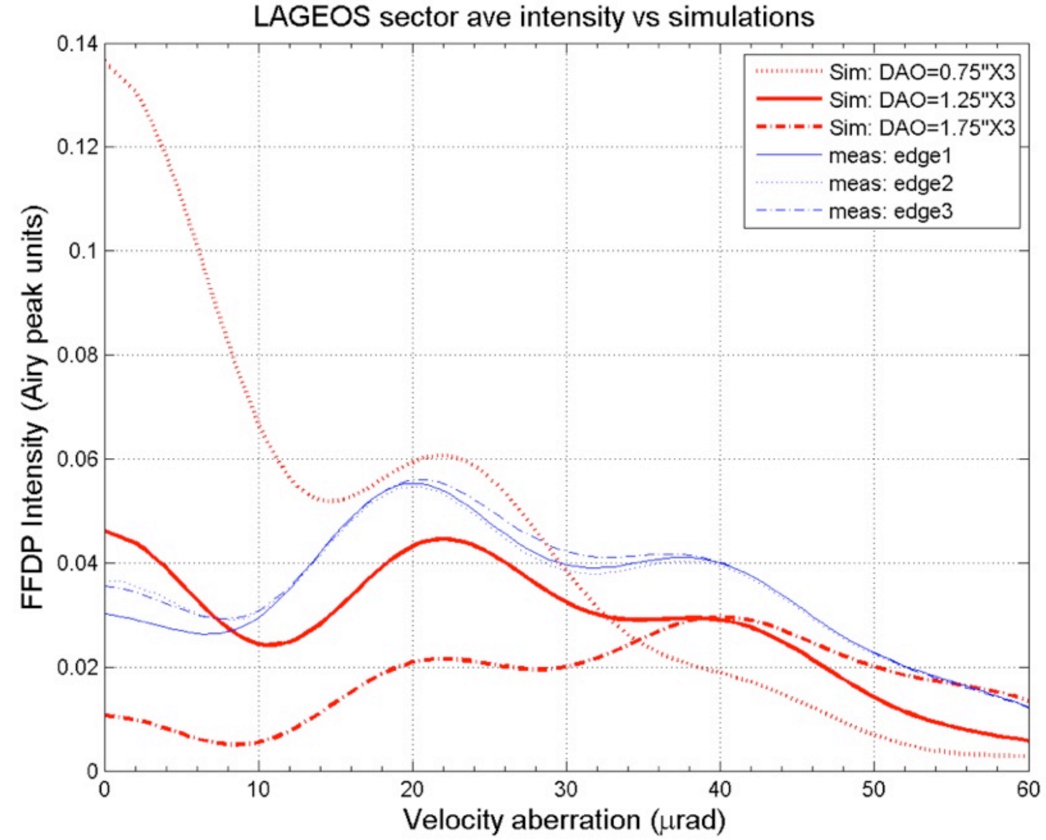
Average intensity plots remain the same despite the polarization orientation

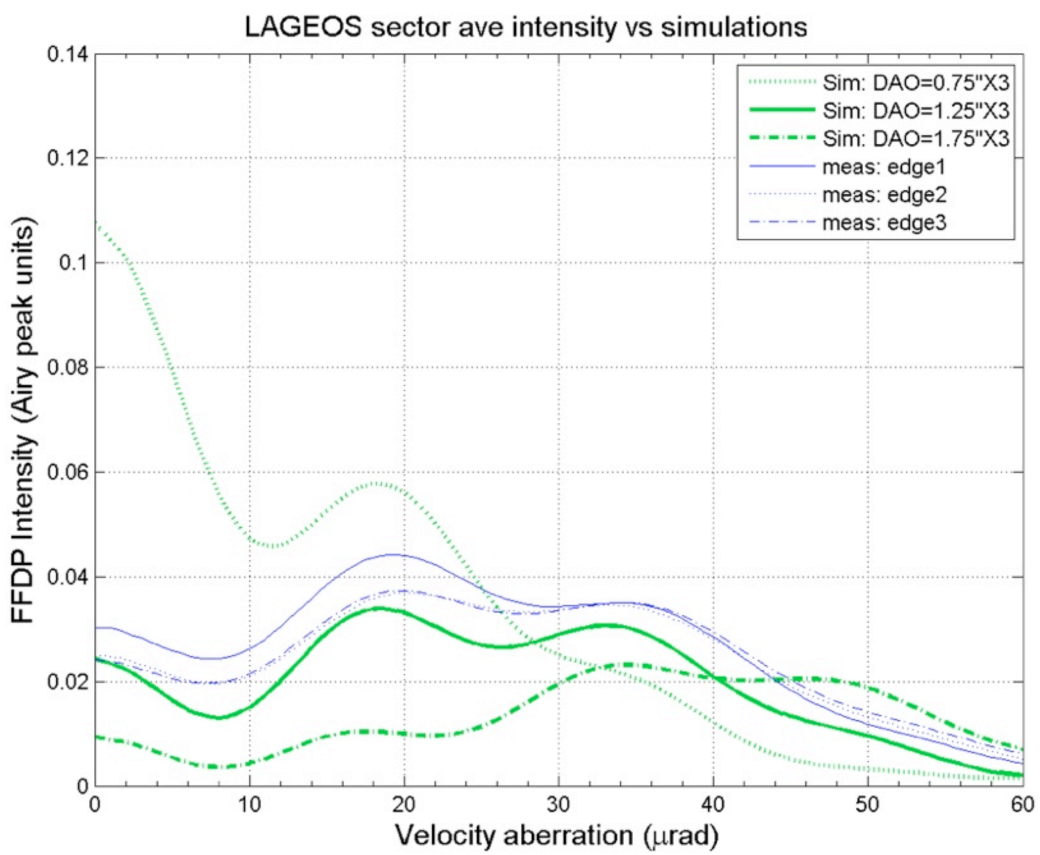


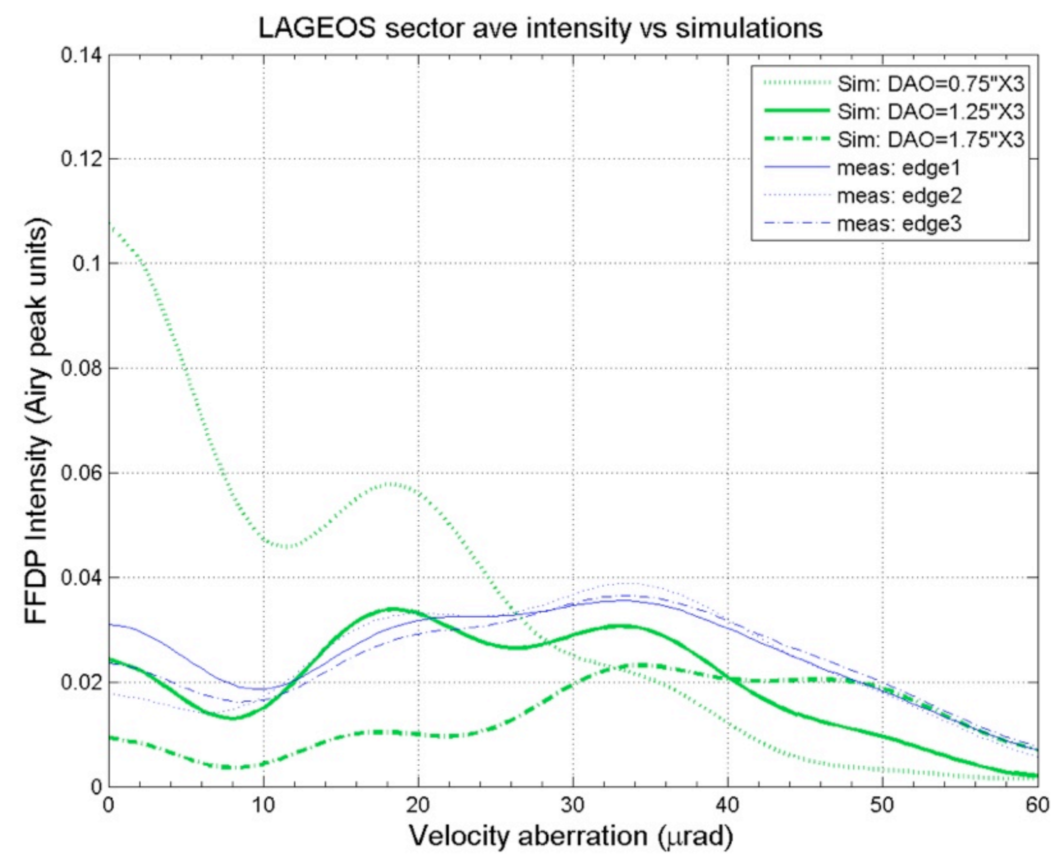


Meas_Sim average intensity comparisons

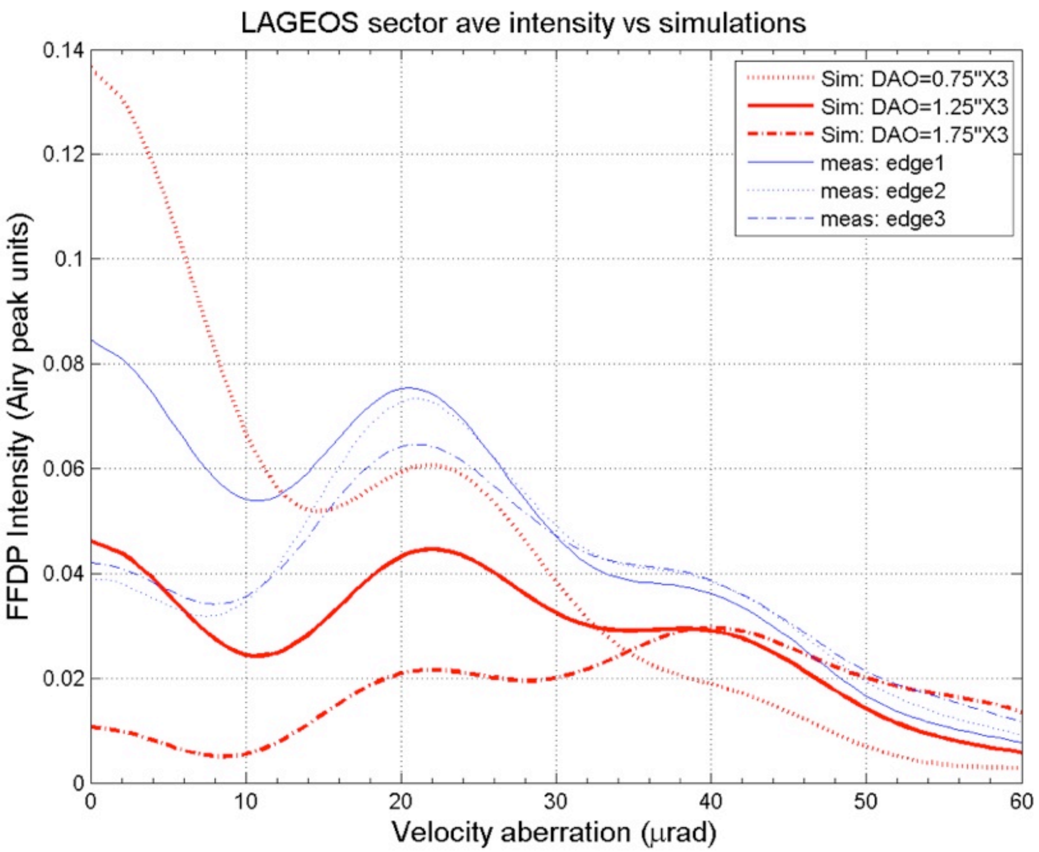


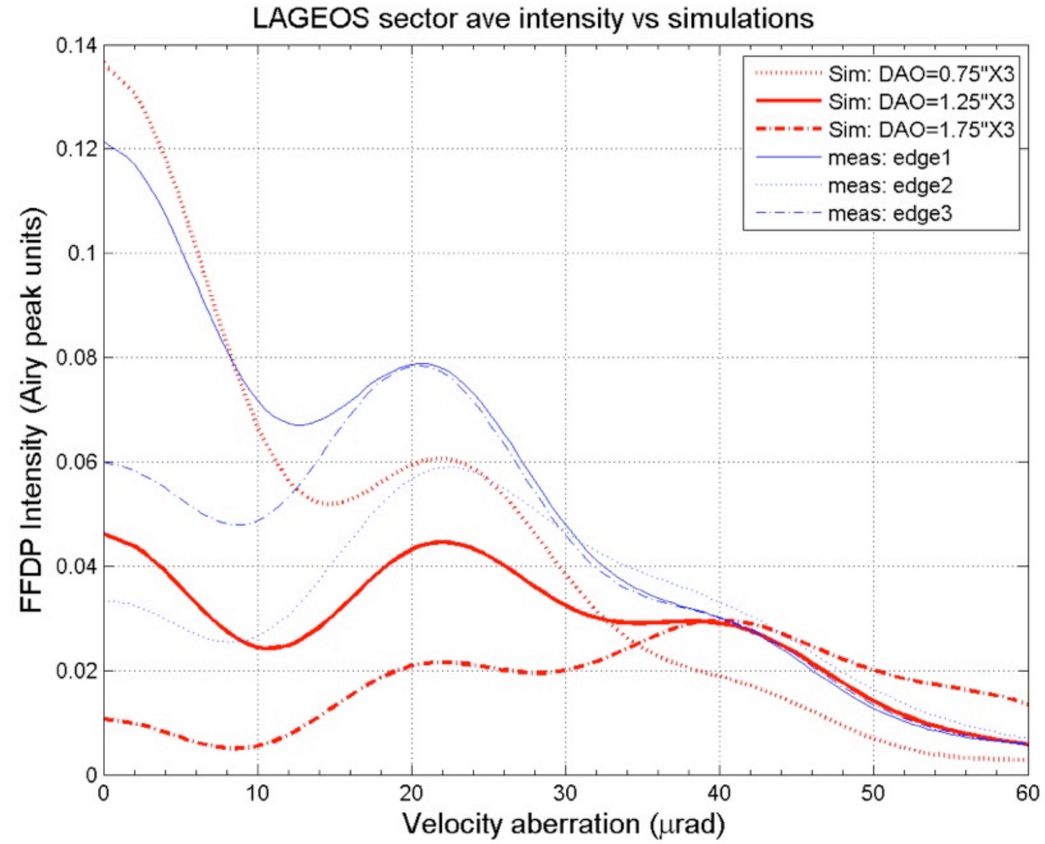


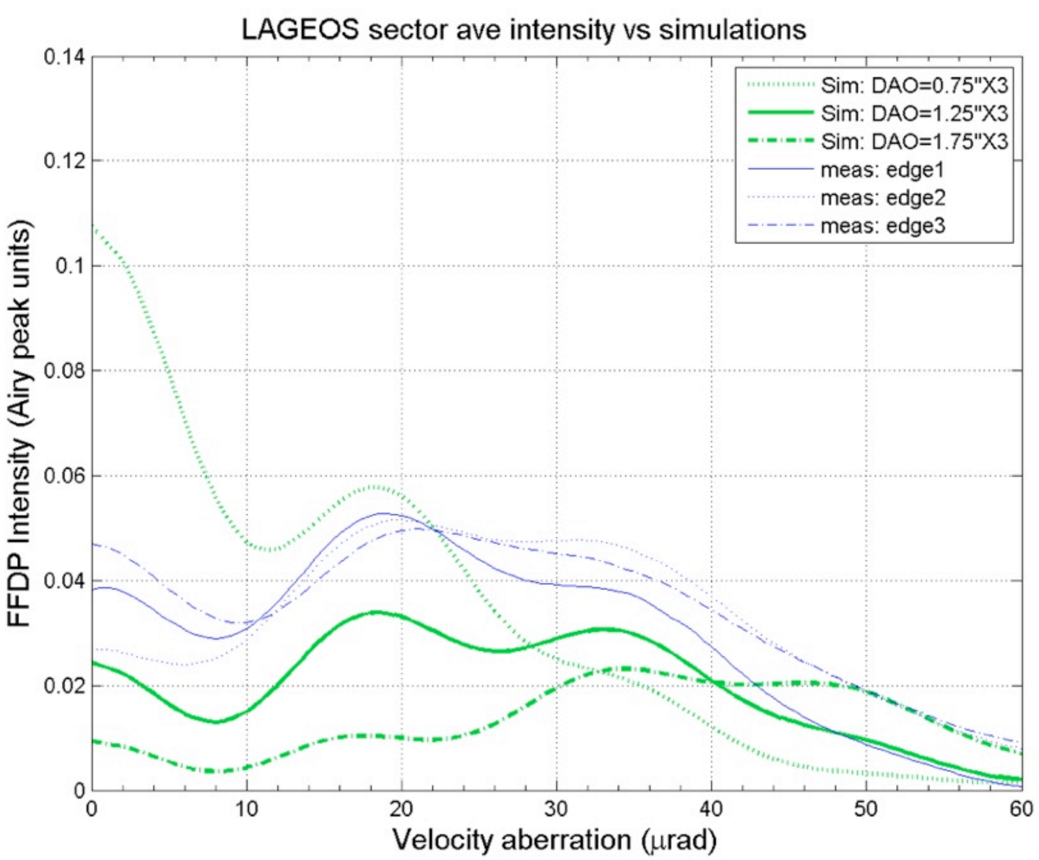


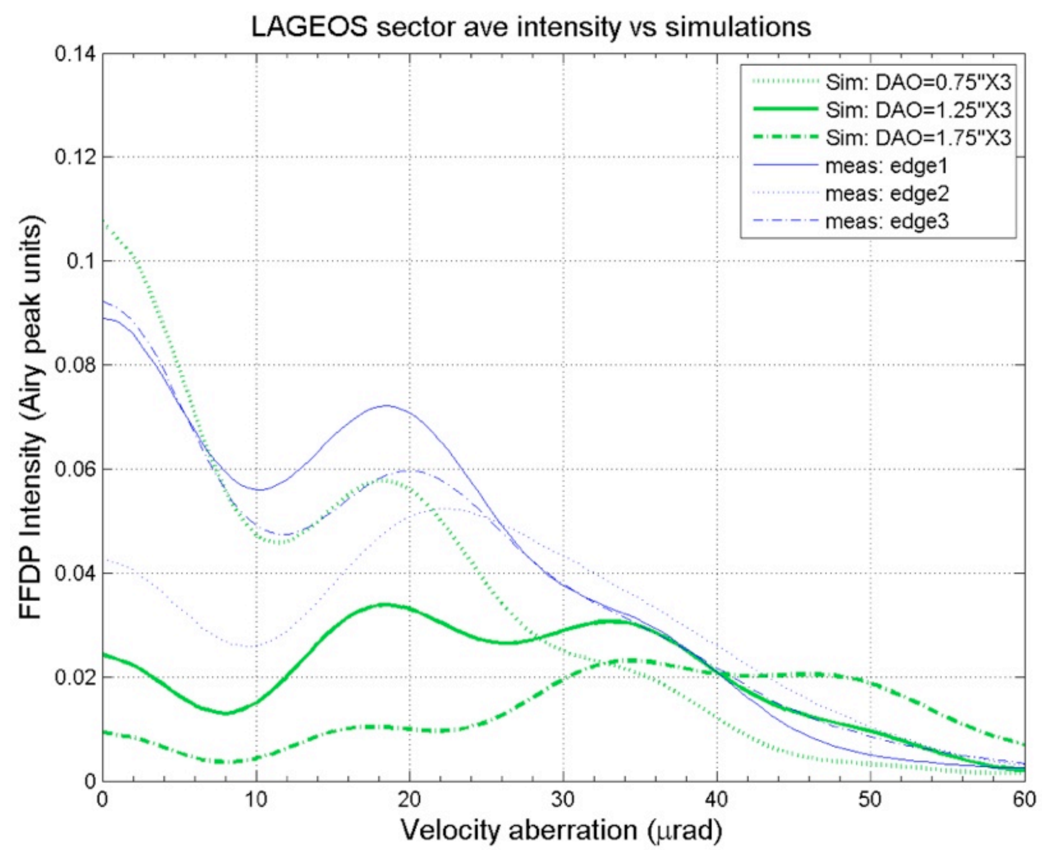


Meas_Sim average intensity comparisons

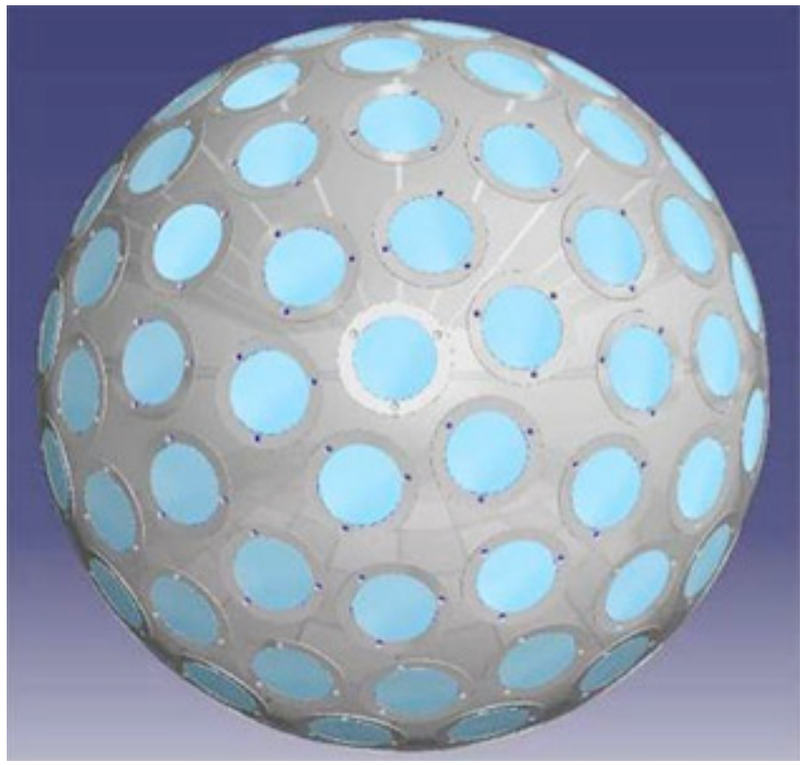








LARES



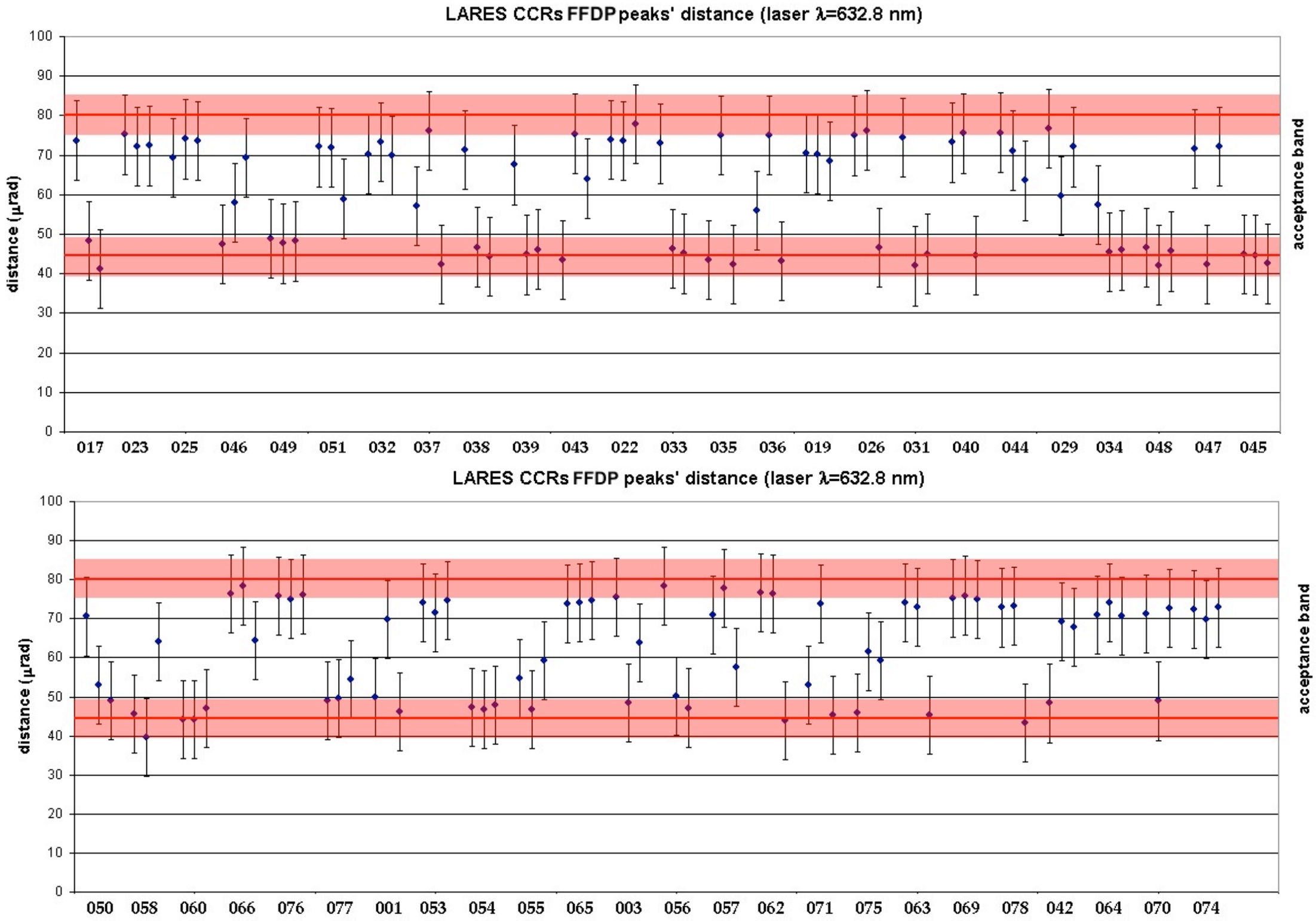
Courtesy of ASI

- Tungsten sphere of 182 mm diam.
- 92 uncoated retroreflectors (Suprasil311)
- 1.5” front face diam.
- DAO: (1.5 1.5 1.5) ±0.5 arcsec

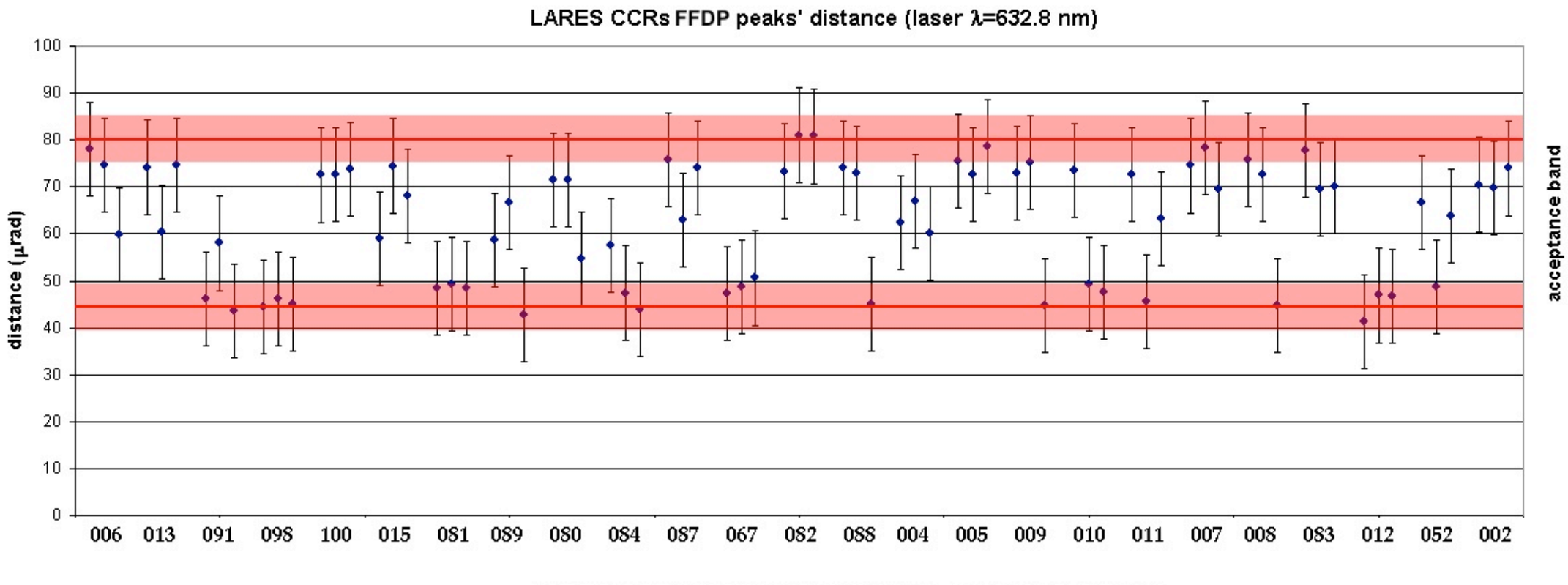
INFN performed in December 2008 **industrial optical acceptance test of the all 110 LARES flight CCRs requested by ASI** (ASI reference document: DC-OSU-2009-012)

LARES CCRs optical acceptance test

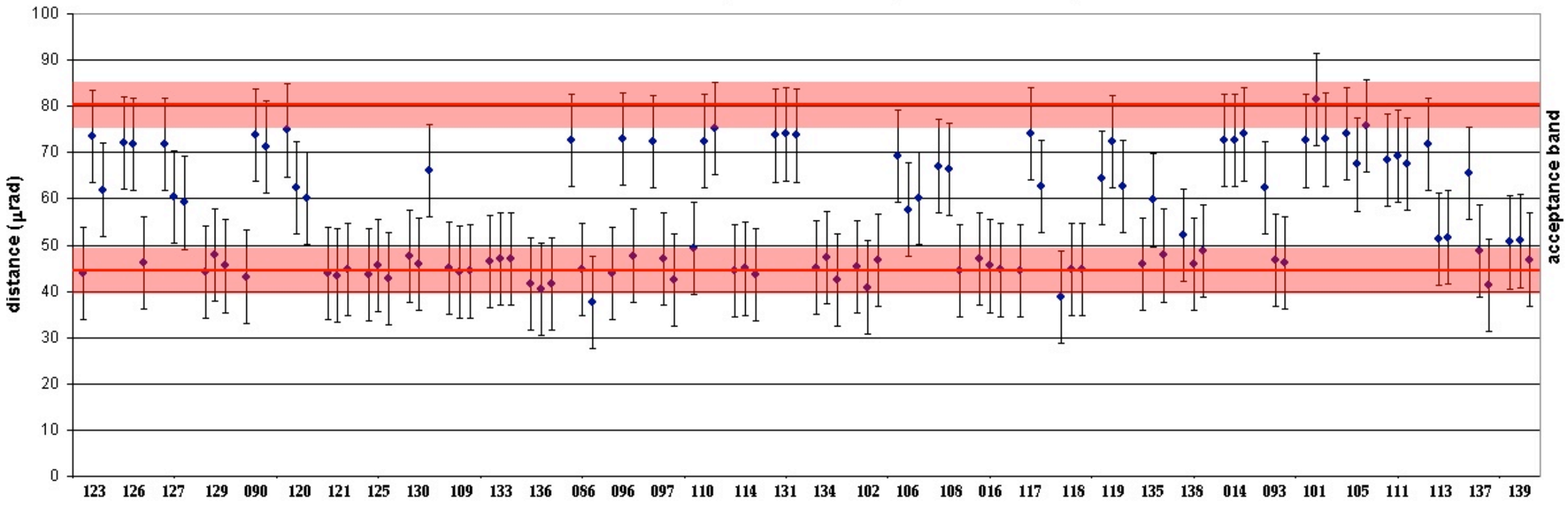
FFDP tests performed with He-Ne laser (λ= 632.8 nm)



LARES CCRs optical acceptance test

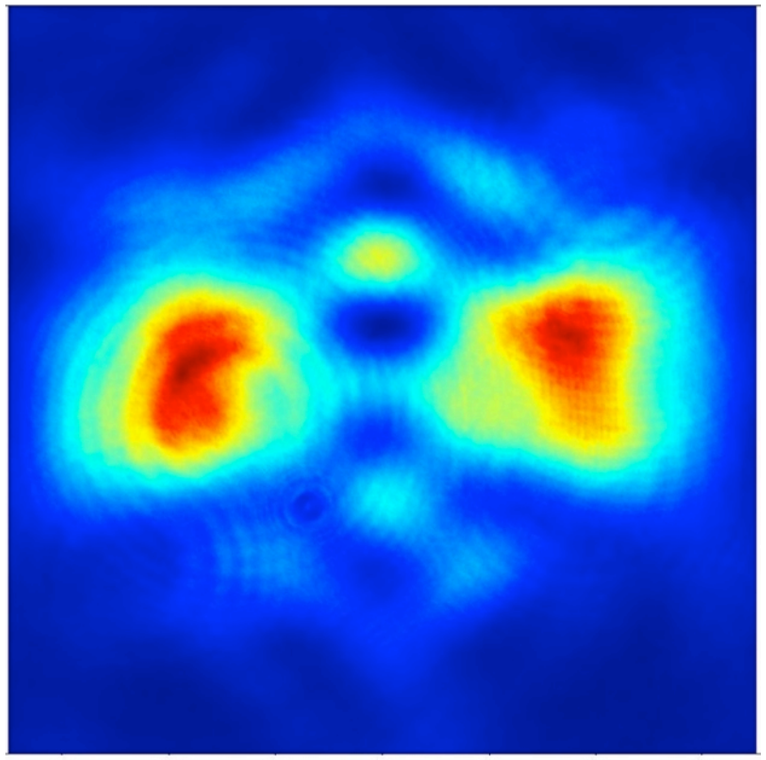
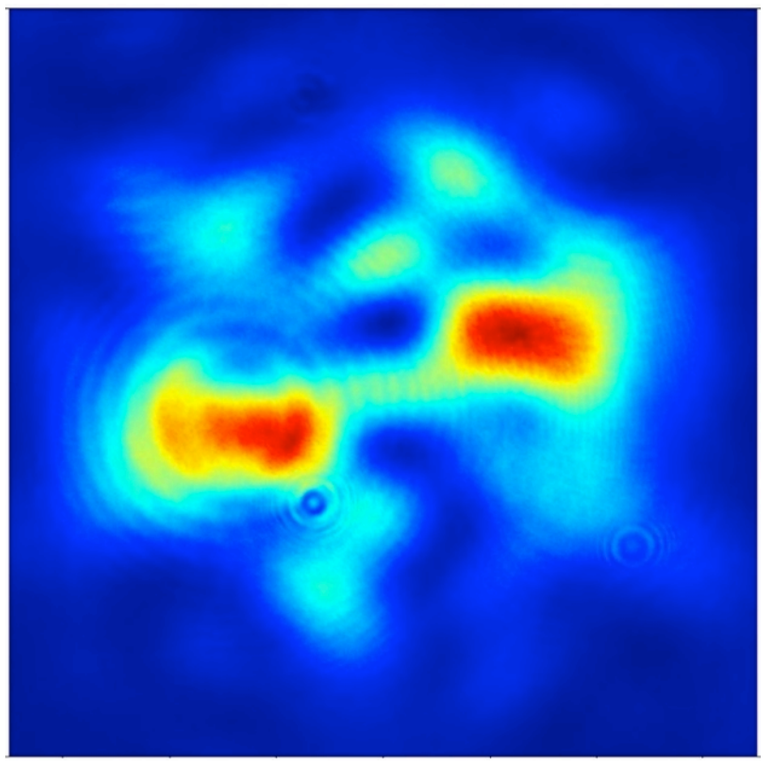
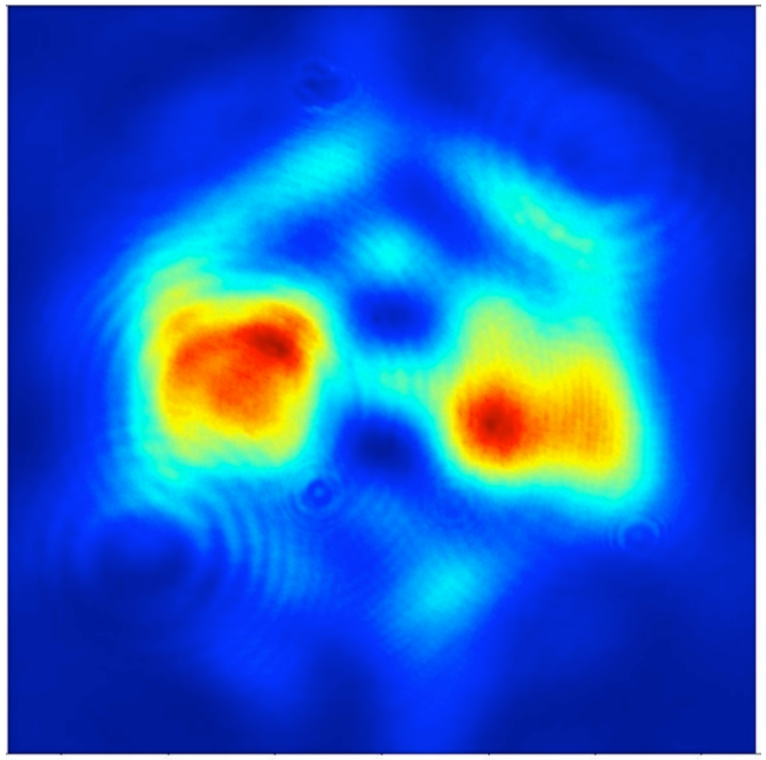
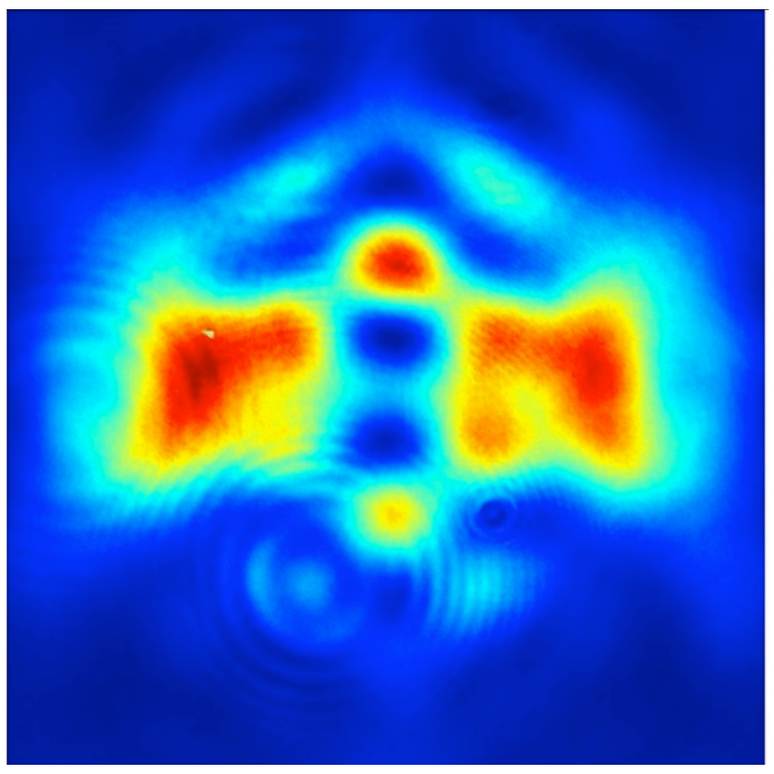
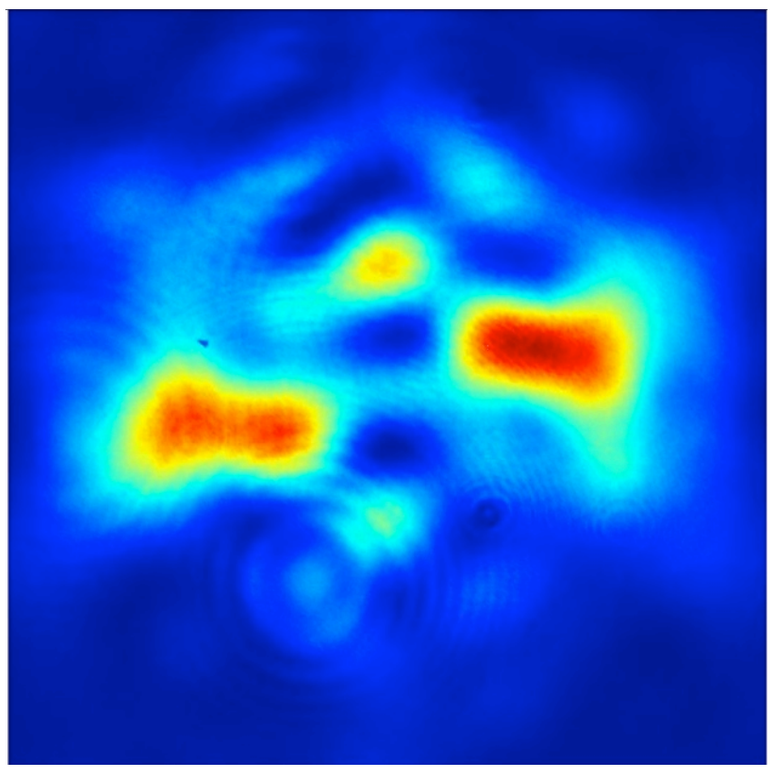
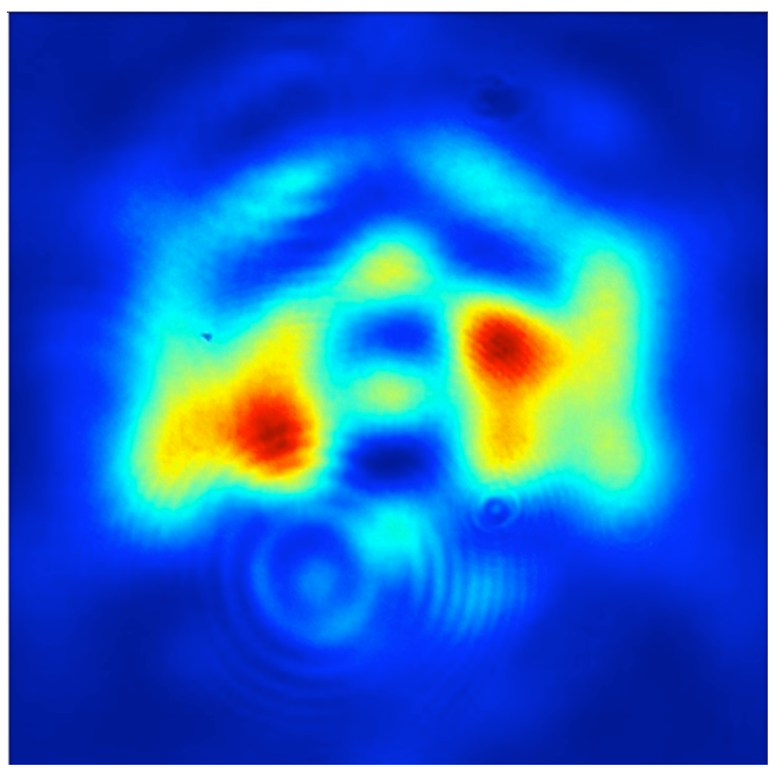


LARES CCRs FFDP peaks' distance (laser λ=632.8 nm)

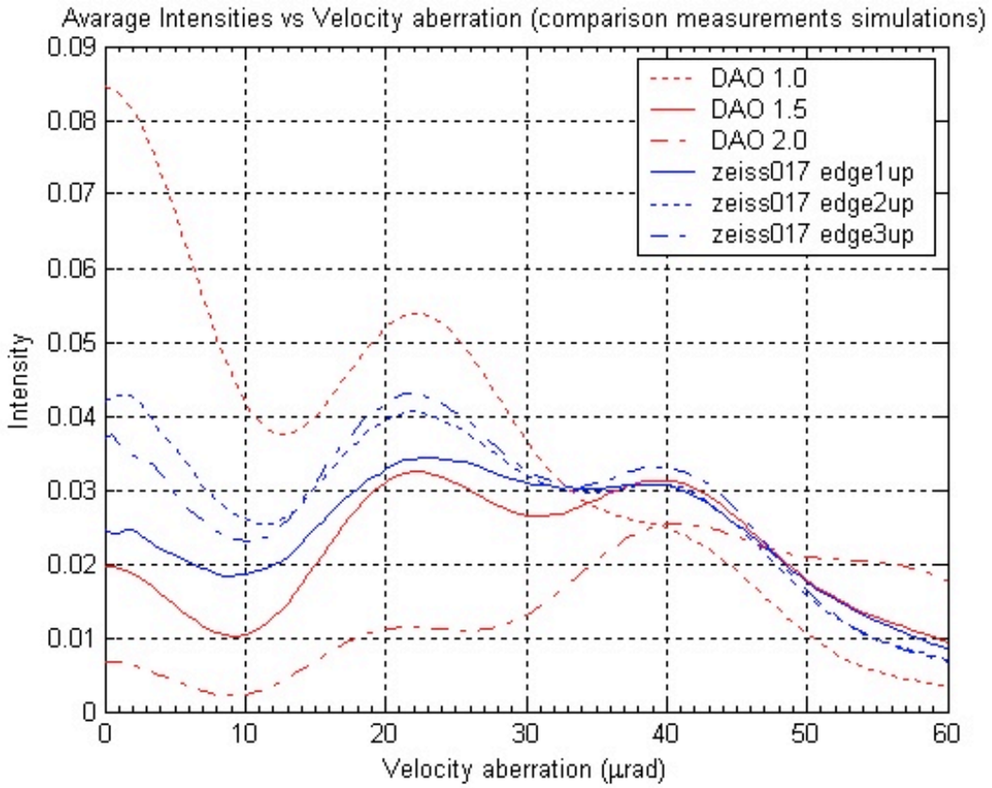


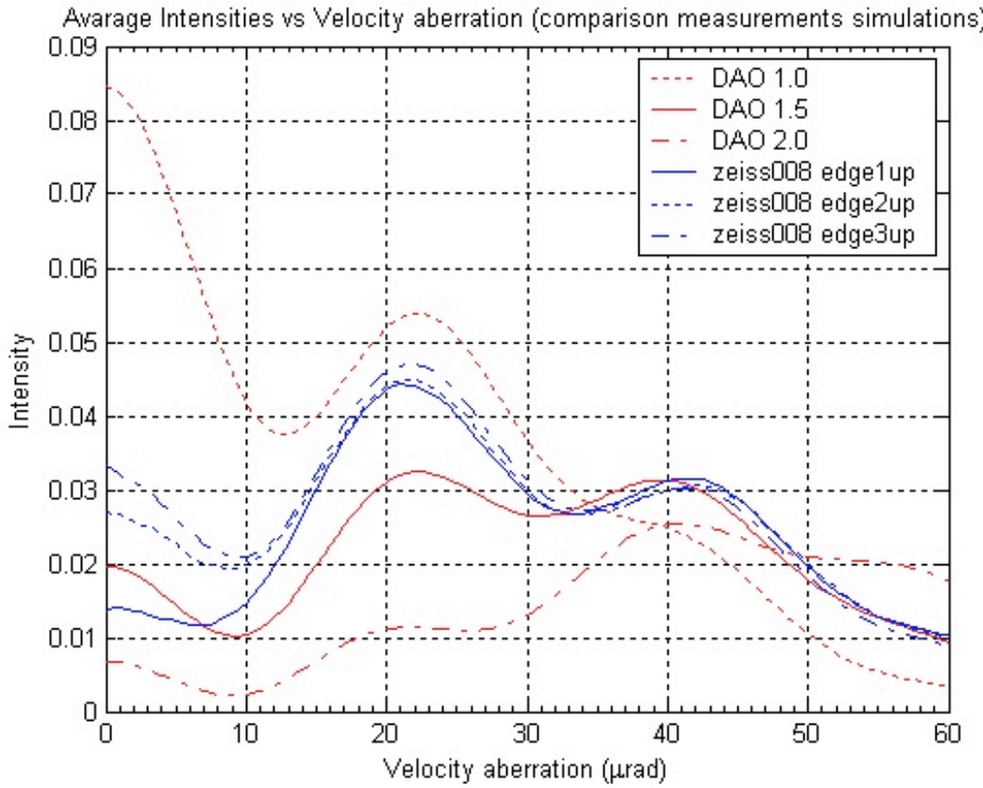
LARES CCRs FFDPs

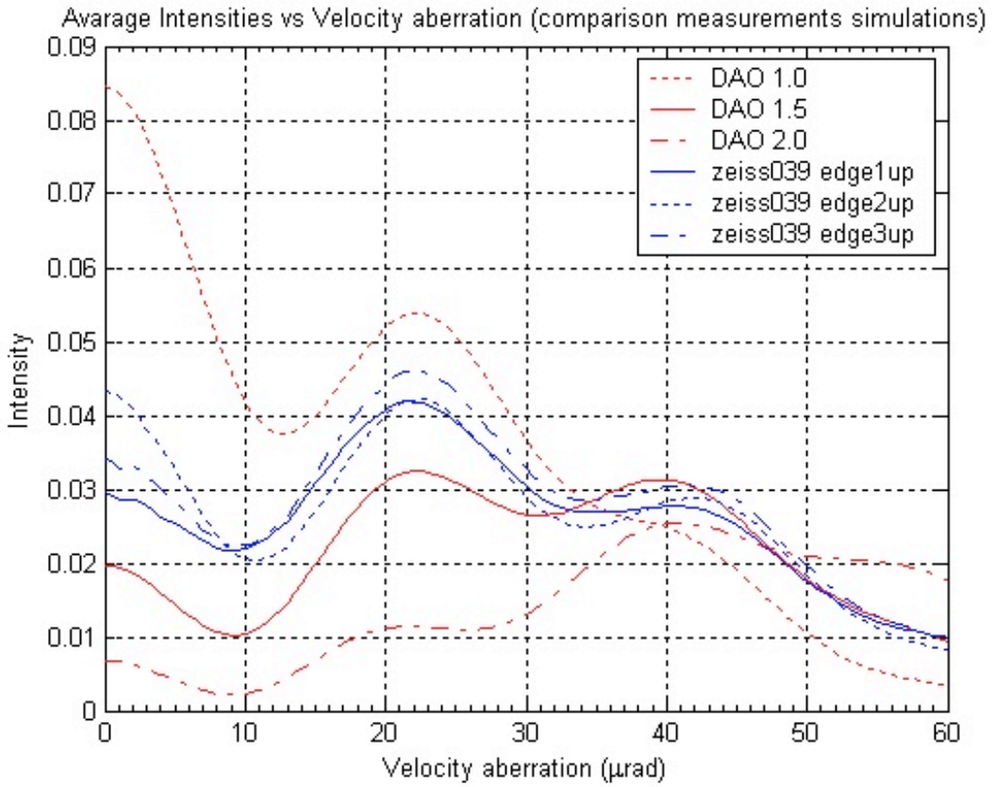
grid limits ±70 μrad

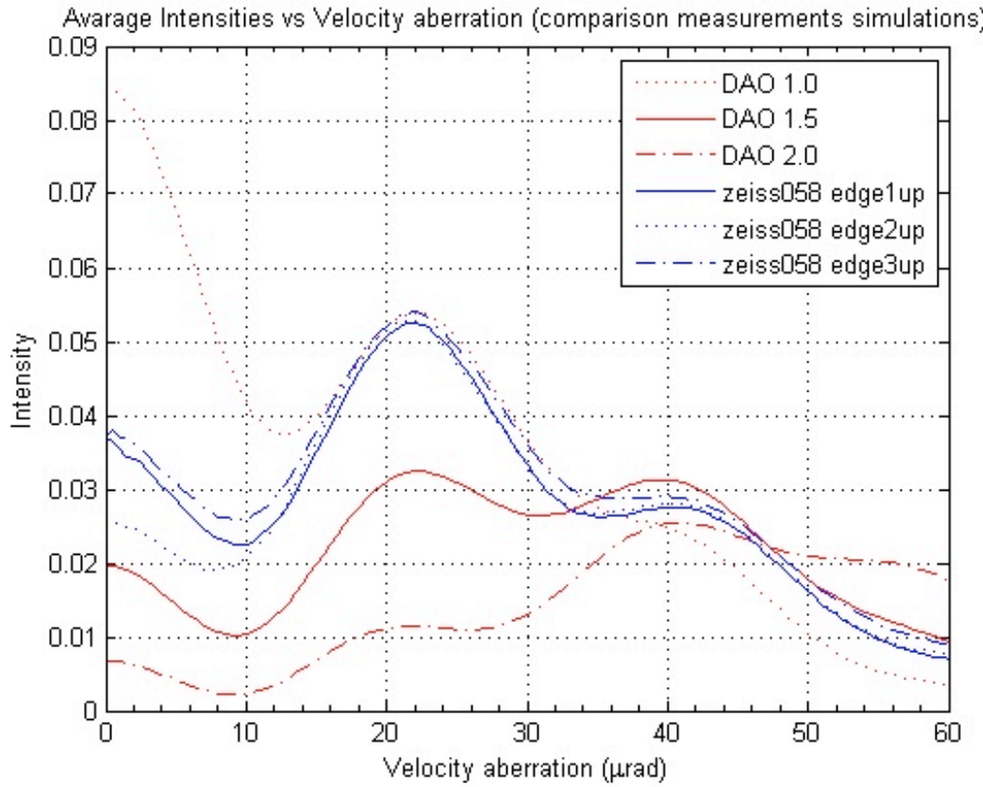







Meas_Sim average intensity comparisons

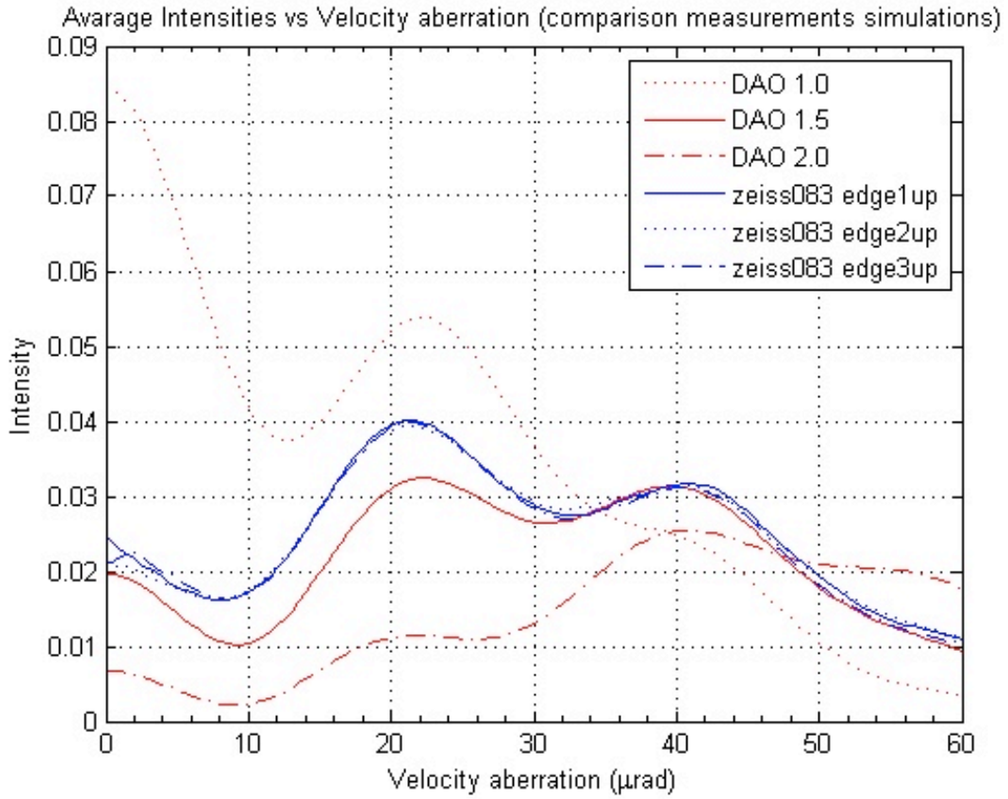


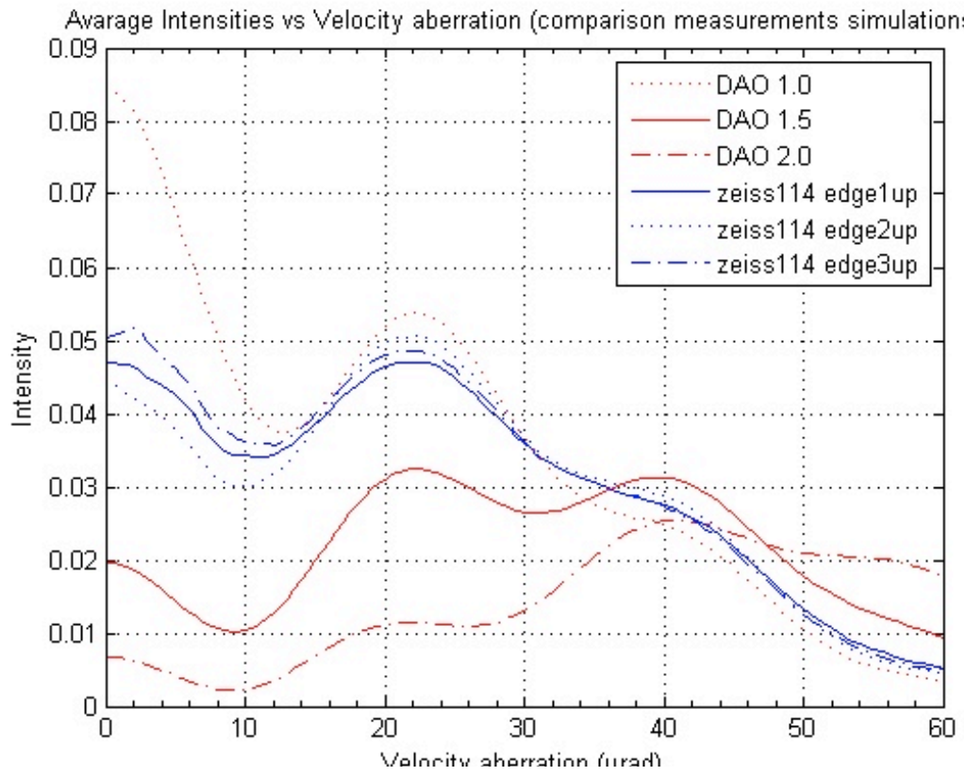


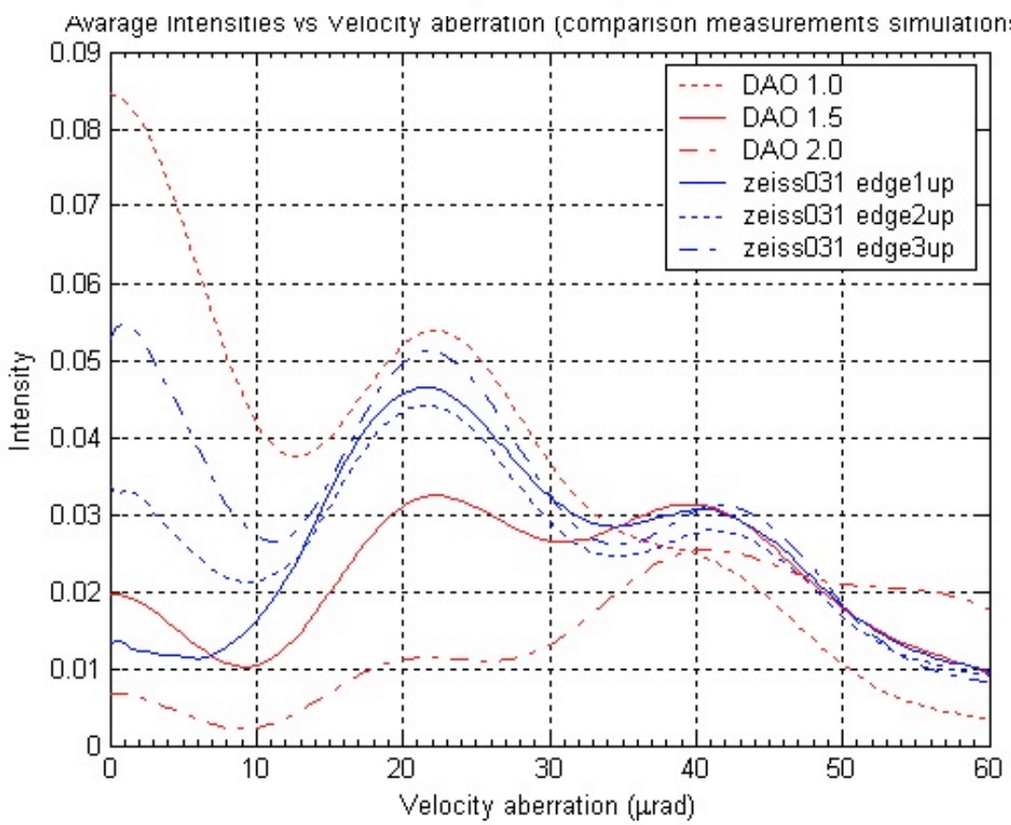


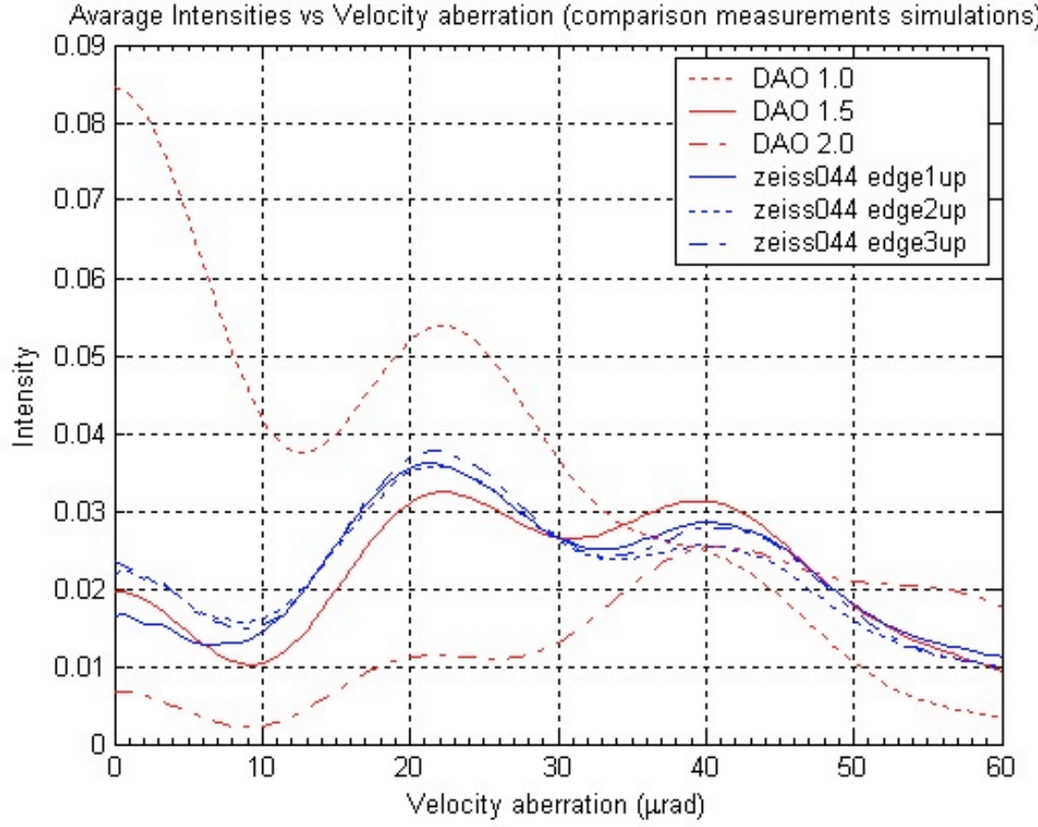


Meas_Sim average intensity comparisons









Conclusions

- We recognized FFDP measurements in air important to asses CCR compliance with vendor specifications (apart from interferometric measurements).

- FFDP measurements in air are moreover important to test the circuit

- Basic acceptance test based on peaks distance check.

- LARES CCRs acceptance is based on this early test.

- Both LAGEOS Sector 37 CCRs and LARES 110 CCRs agreed with specs.

- Average intensity comparison (sim vs meas) give further informations detached from laser polarization.

- In addition to average intensity plots intensity must be checked at some indicative velocity aberration. This gives information both on the CCR and on the optical circuit.

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Thank you for your attention.

Any question?

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Intensity check at distinctive VA