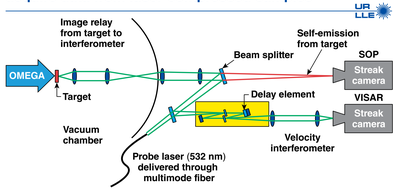
Recent Work to Improve the Omega Laser Facility's VISAR and Streaked Optical Pyrometer Diagnostics

A. T. SORCE, J. D. KENDRICK, R. BONI, M. C. GREGOR, D. N. POLSIN, B. SALTZMAN, B. HENDERSON, J. ZAO, M. COUCH, C. M. ROGOFF, and T. R. BOEHLY

University of Rochester, Laboratory for Laser Energetics

VISAR* and SOP** use a common telescope to acquire data from laser-compressed samples



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- Spatial and temporal data are collected simultaneously with a VISAR
- The brightness temperature is inferred from self-emission intensity using the absolute calibration

*Velocity interferometer system for any reflector
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E11212a

Update on VISAR and SOP diagnostics

- In response to users' requests, VISAR and SOP will have periodic timing and calibration tests
  - a T-0 test will be performed twice a year
  - SOP calibration will be performed twice a year
- Telescopes and optical relays on OMEGA and OMEGA EP will be redesigned
  - improve SOP optical performance in 590- to 850-nm ranges
  - install baffles to reduce throughput of light from outside FOV*
  - mount SOP calibration on telescope
- OMEGA EP TIM**-12 upgrade
  - install TIM periscope to improve alignment for off-axis campaigns

*FOV: field of view
**TIM: ten inch manipulator

E26082

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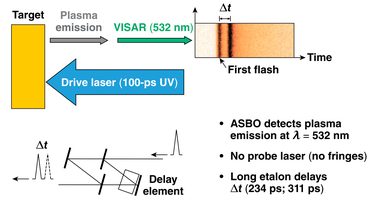

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- Long etalon delays Δt (234 ps; 311 ps)

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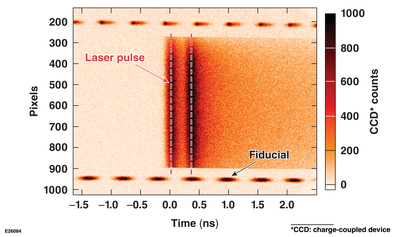
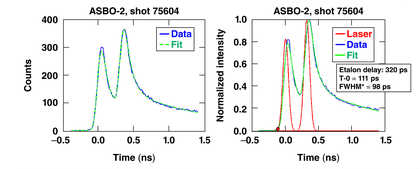


*CCD: charge-coupled device

E26084

The ASBO signal is modeled as time-integrated laser energy modified by two exponential decays



$$\text{Signal} = \left| \int_0^t e^{-c(t-t_1)^2} dt \right| Ae^{-b(t-t_1)} + Be^{-b(t-t_1)} + R \left| \int_0^t e^{-c(t-t_2)^2} dt \right| Ae^{-b(t-t_2)} + Be^{-b(t-t_2)} + C$$

Drive term | Two-component decay | Delayed duplicate signal

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The error in the T-0 measurement is within the timing resolution of the P820 streak camera

- T-0 is defined as the relative timing between the 2% rise of the Gaussian fit of the emission and the centroid of the first fiducial
- Known etalon delay: 311 ps
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- Timing resolution P820: 0.51% of sweep speed

  Sweep speed: 5 ns
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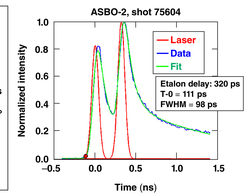

E26086

An upgraded telescope will improve SOP imaging, calibration, and VISAR alignment

Imaging

- The current telescope is only optimized for 532-nm light, which causes the SOP to have imaging capabilities that are nearly 40× the diffraction limit

Calibration

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- The design of the current telescope inhibits the ability to accurately point and center through the three primary optics
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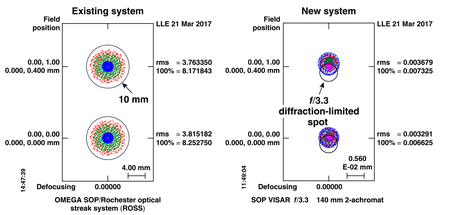

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A VISAR telescope will meet all optical and mechanical requirements while being modular and easily accessible

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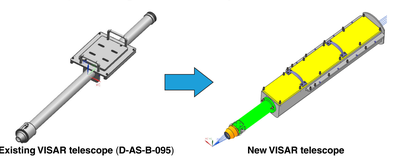

Existing VISAR telescope (D-AS-B-095) | New VISAR telescope

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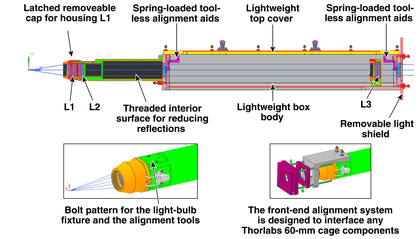

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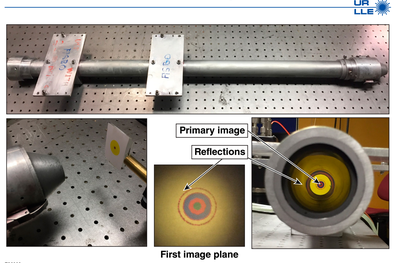

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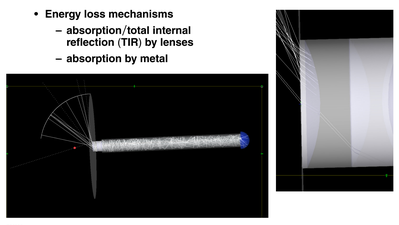

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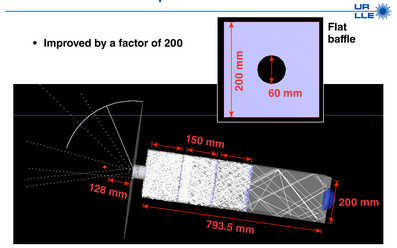

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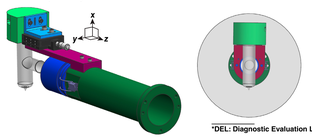

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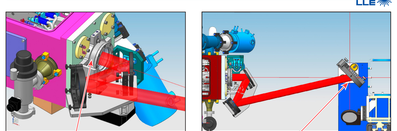
A TIM-12 periscope will allow for accurate pointing and centering down the telescope axis



The periscope mirror assembly will mount to the 4-in. rear TIM window

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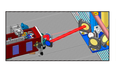

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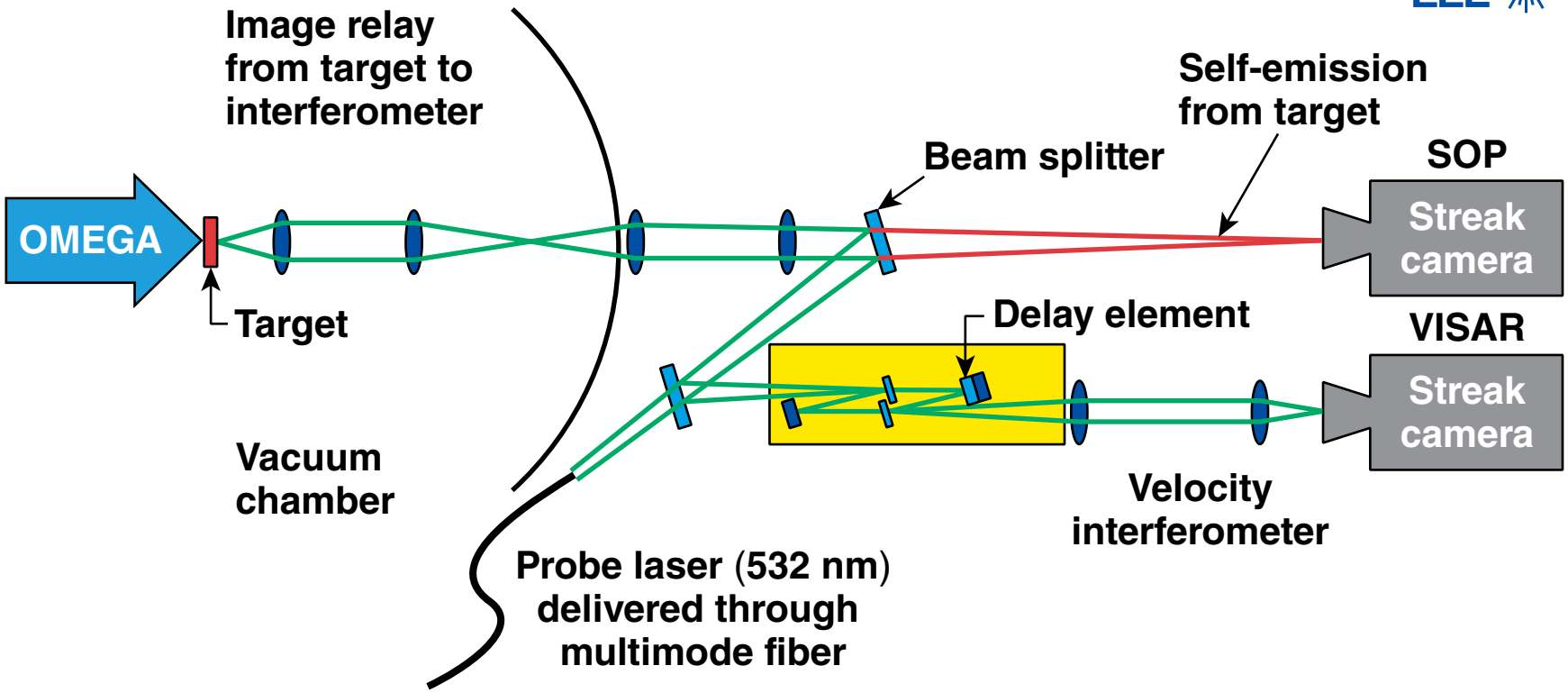

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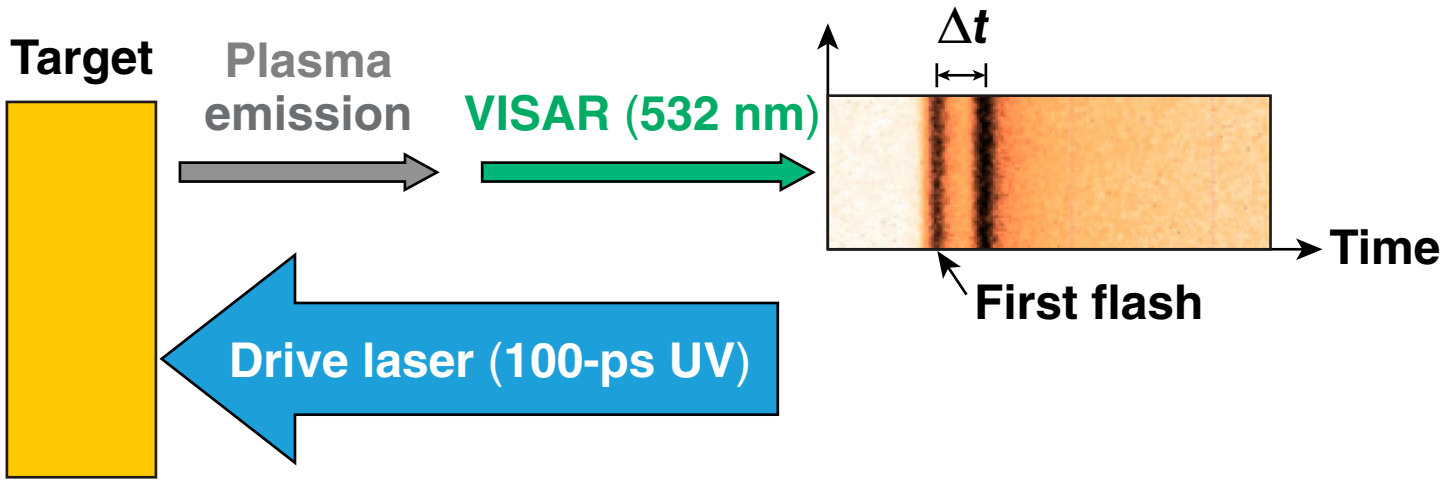

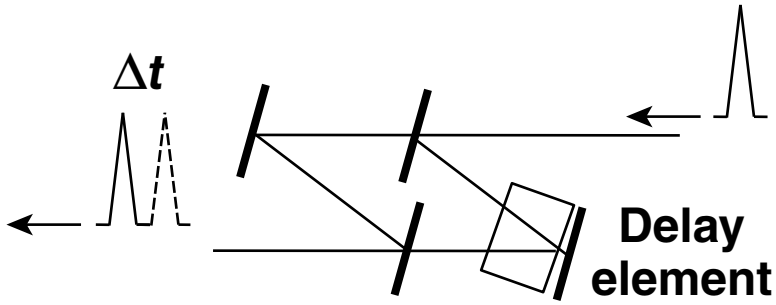

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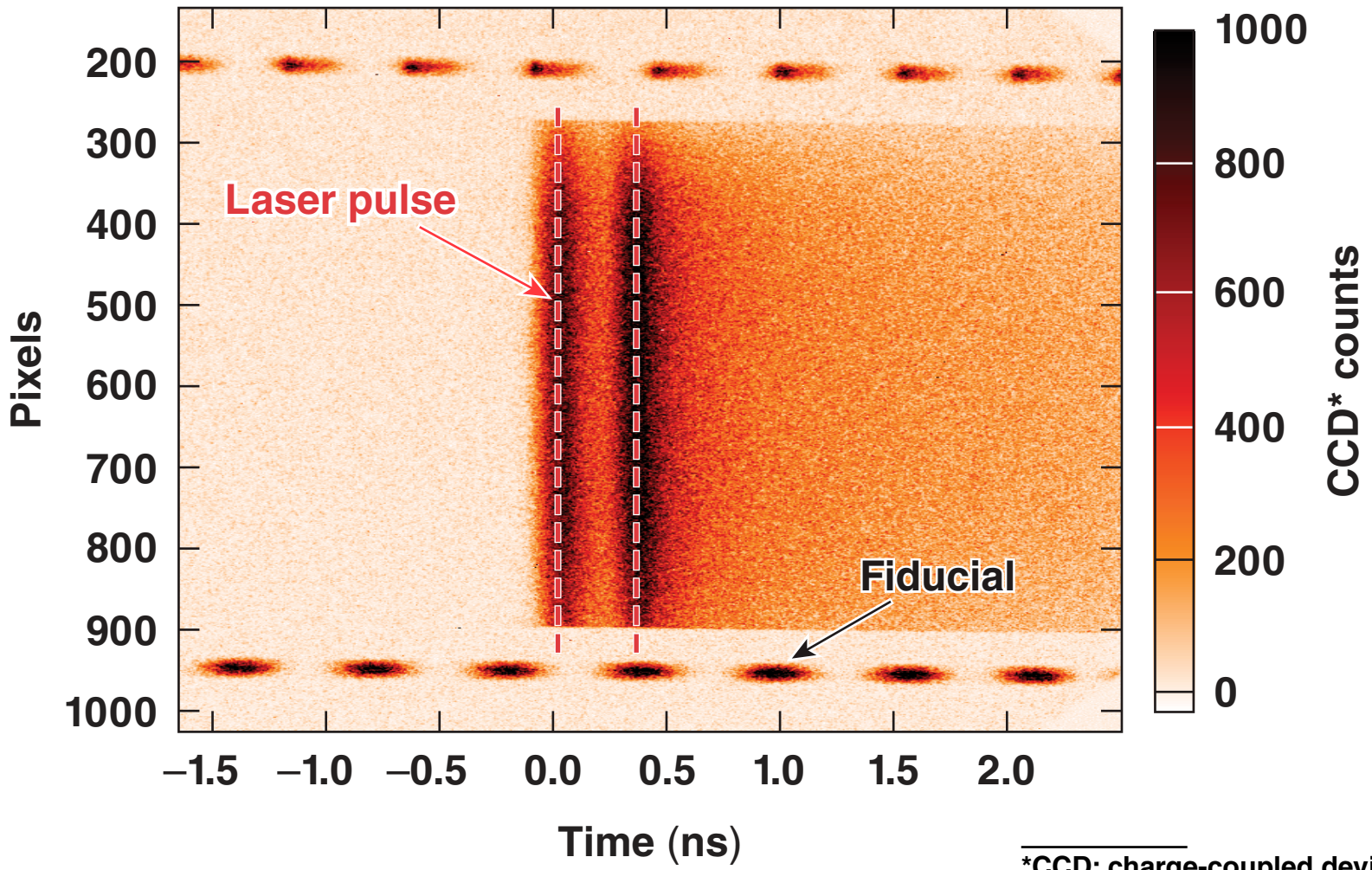

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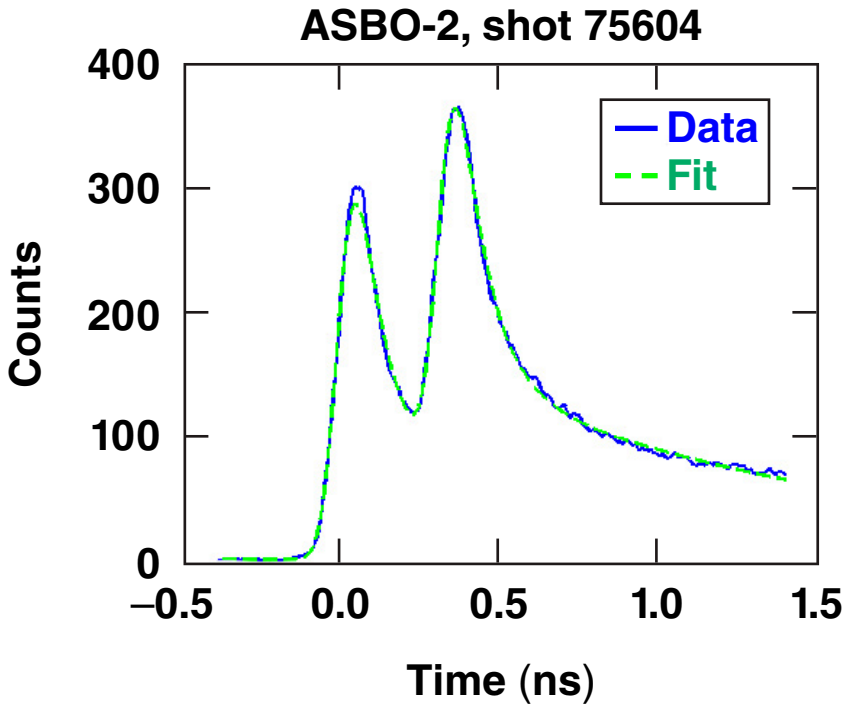

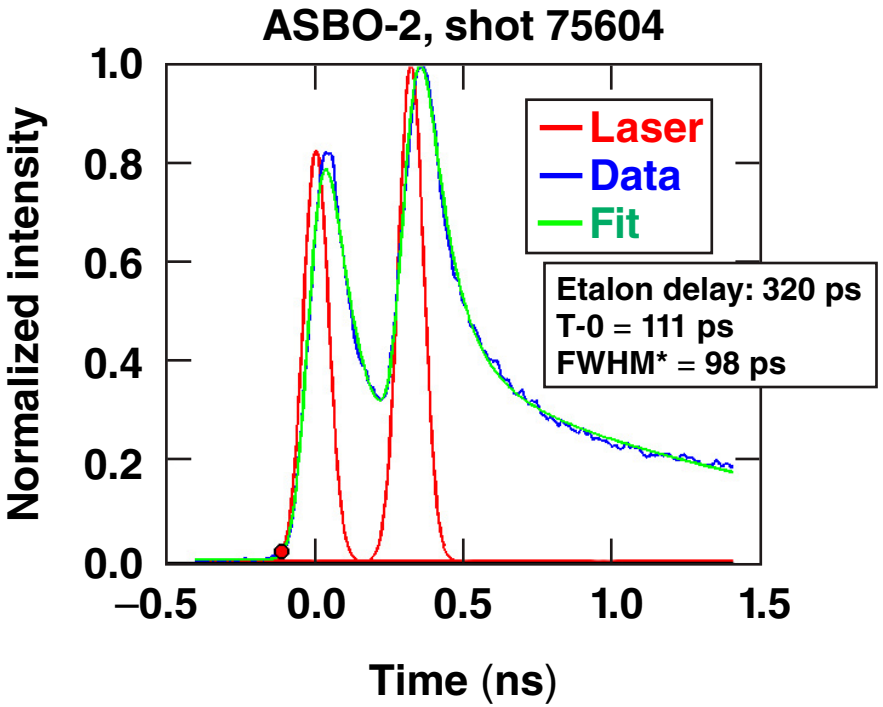

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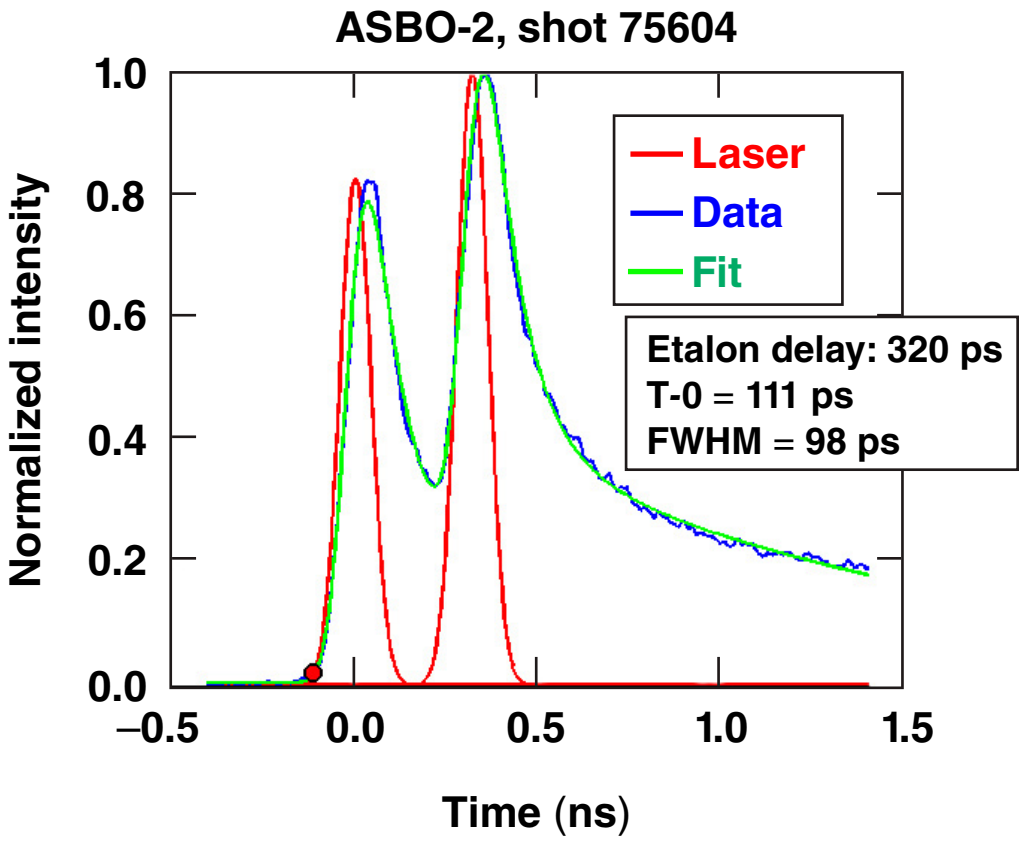

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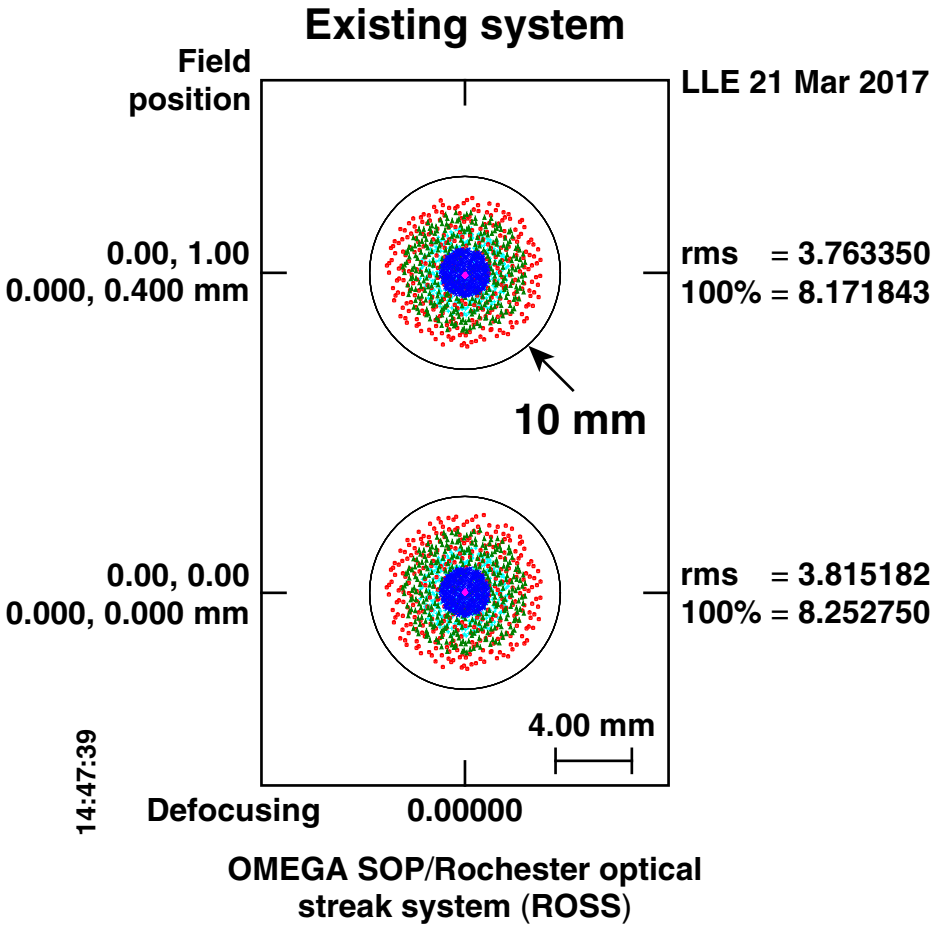

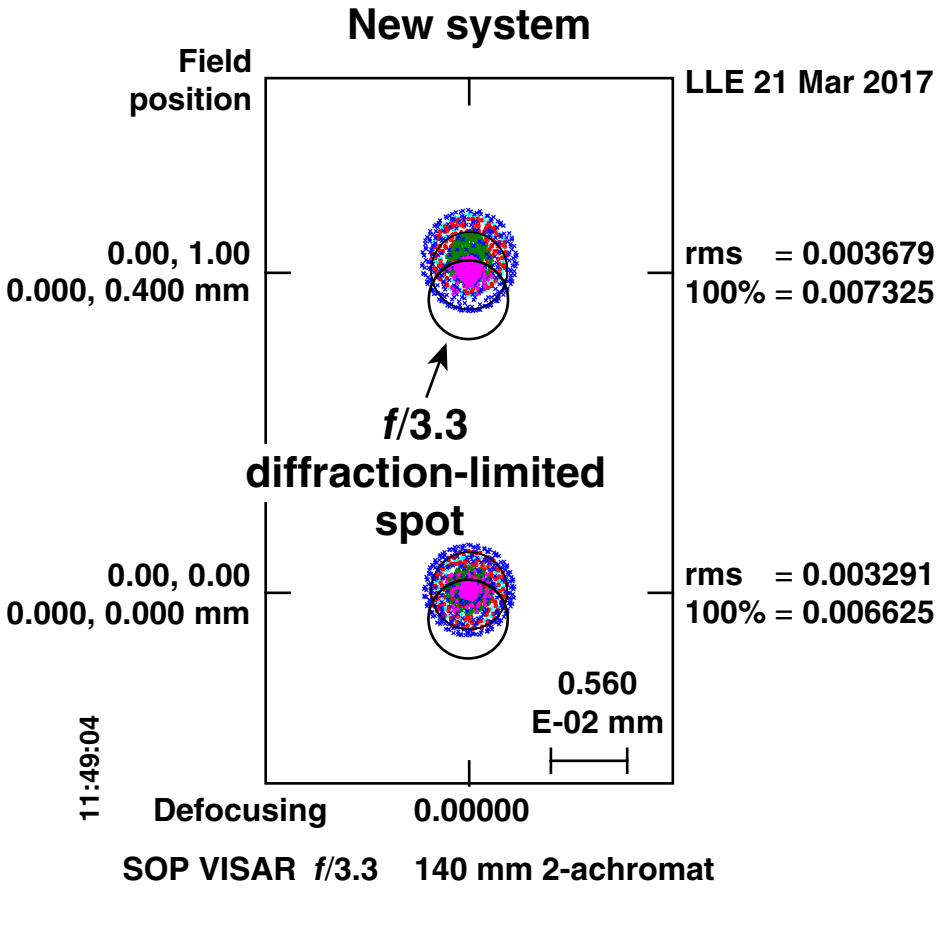

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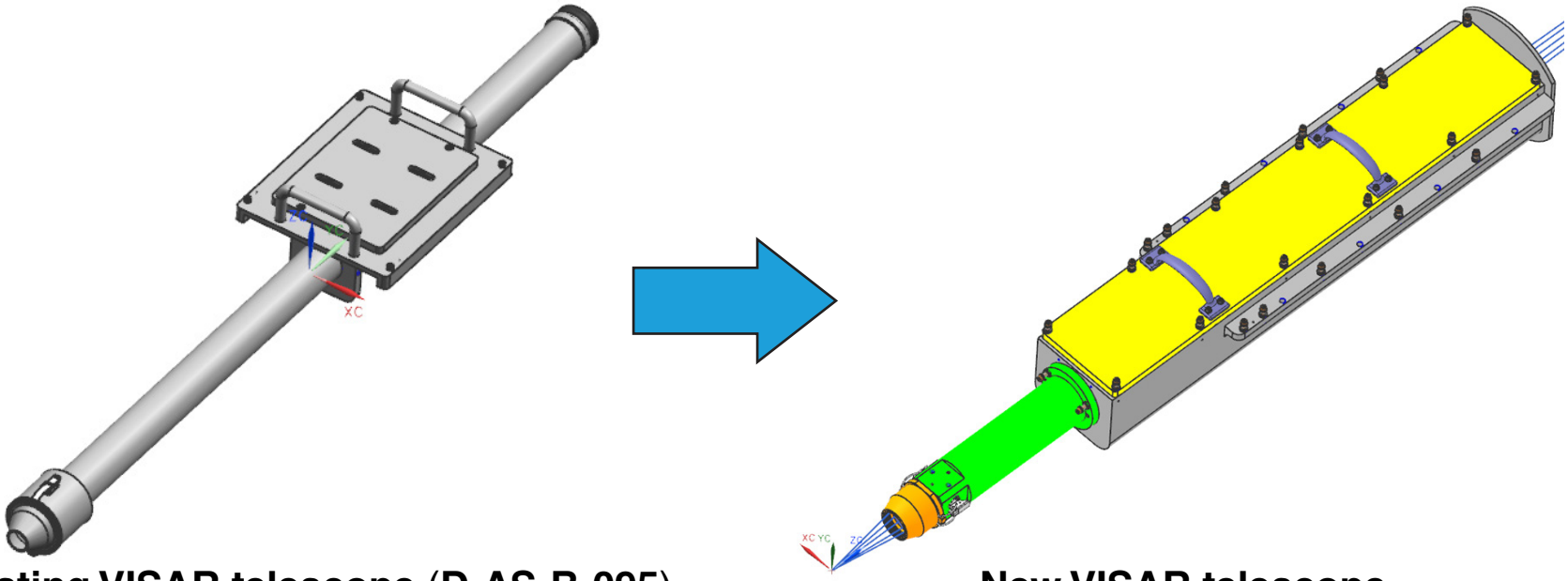

Existing VISAR telescope (D-AS-B-095)

New VISAR telescope

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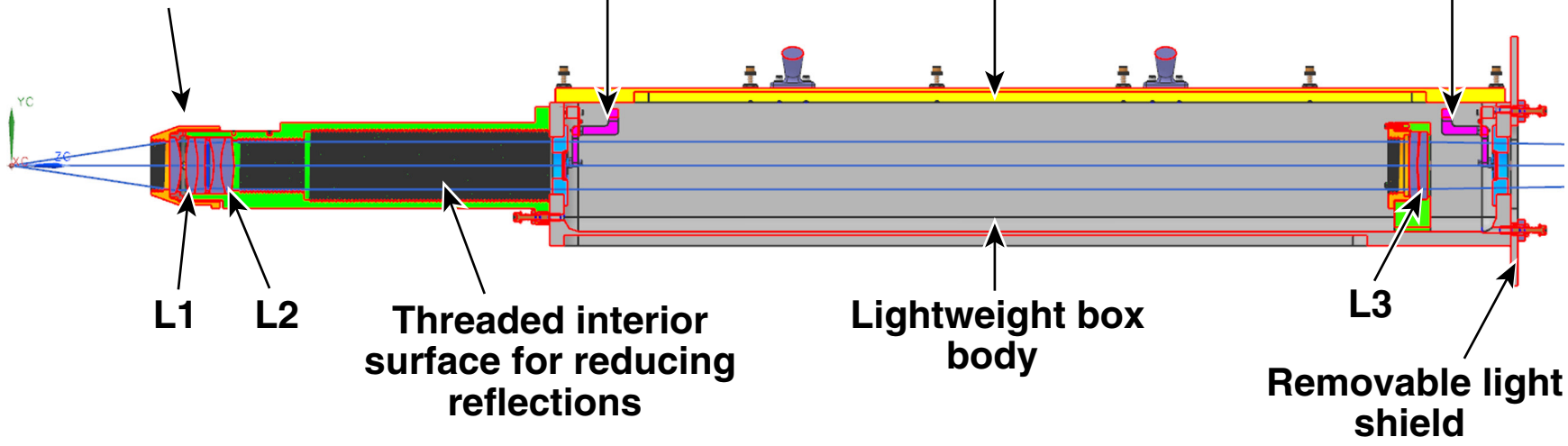
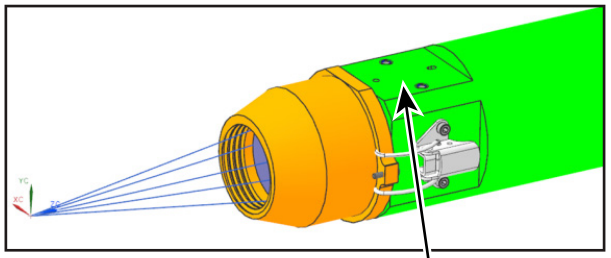
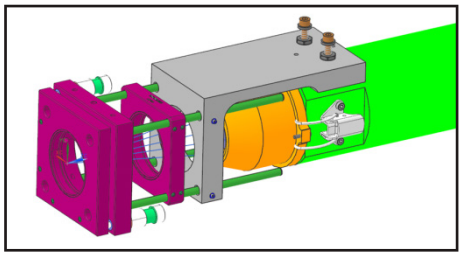




Bolt pattern for the light-bulb fixture and the alignment tools



The front-end alignment system is designed to interface any Thorlabs 60-mm cage components

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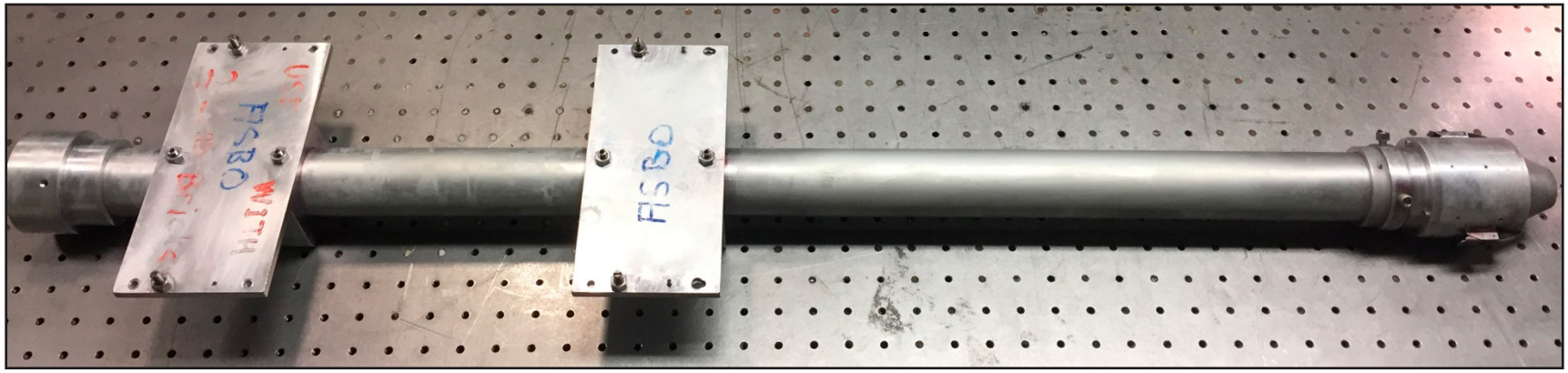
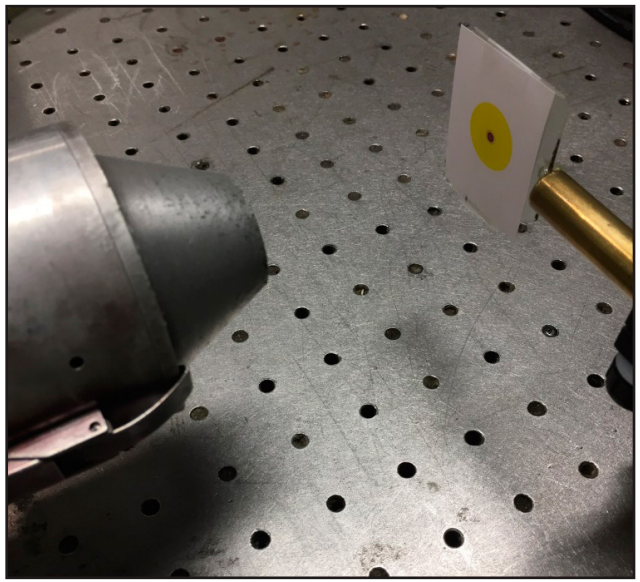
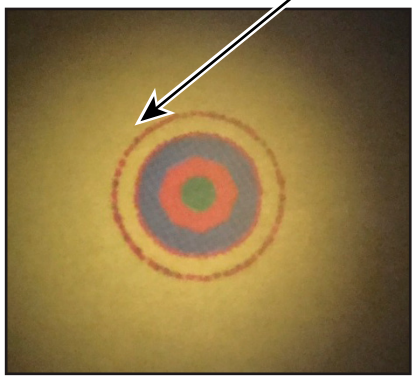
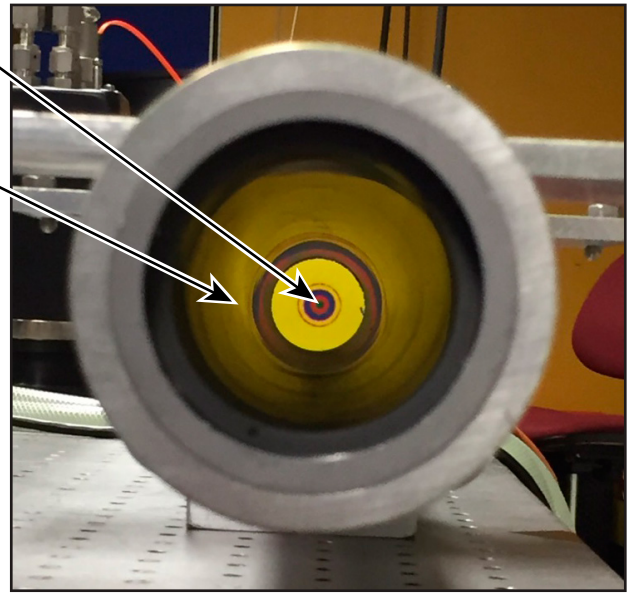






Primary image

Reflections



First image plane

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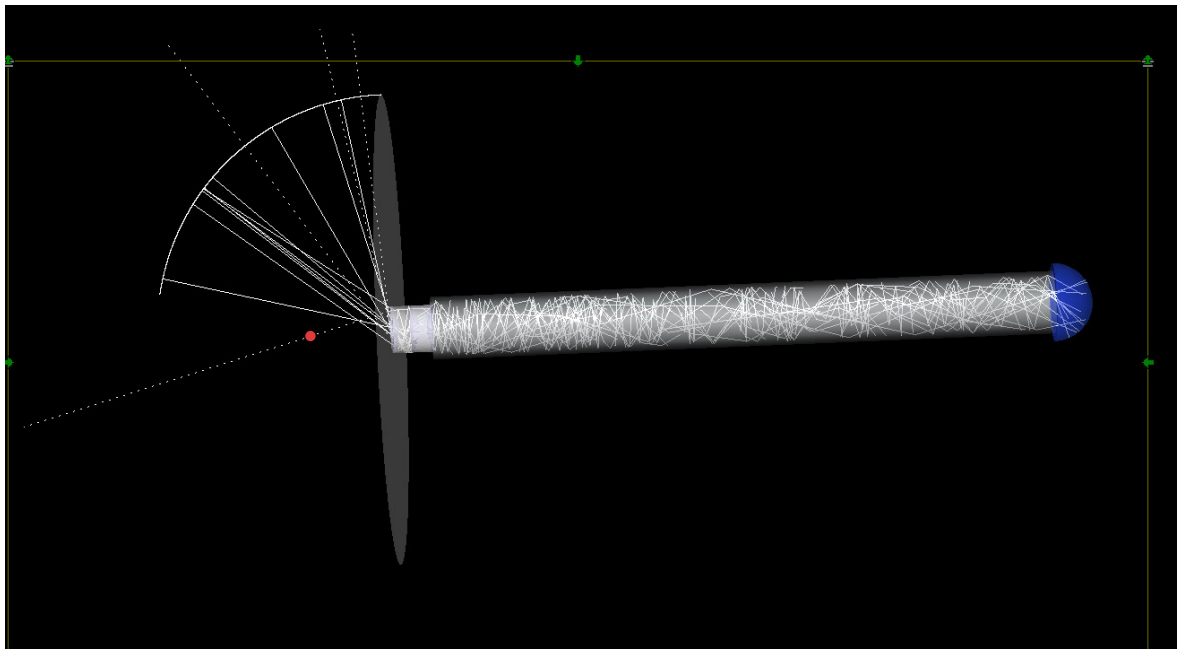

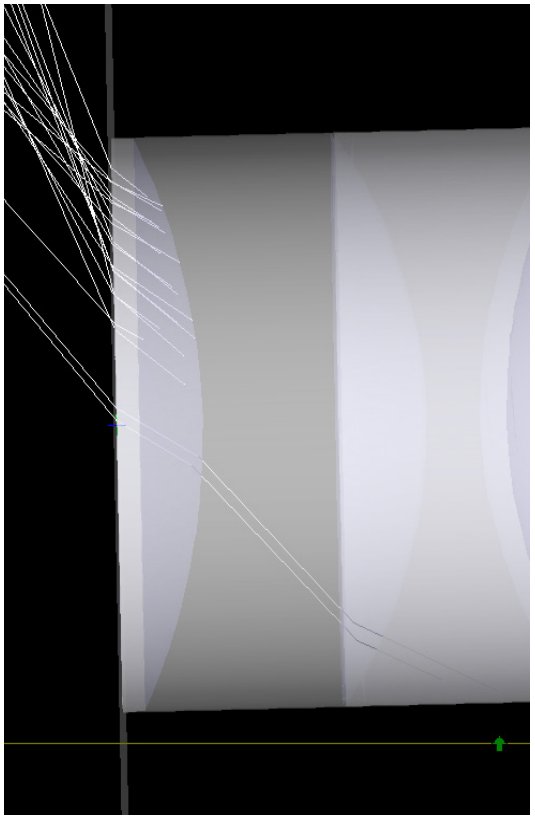

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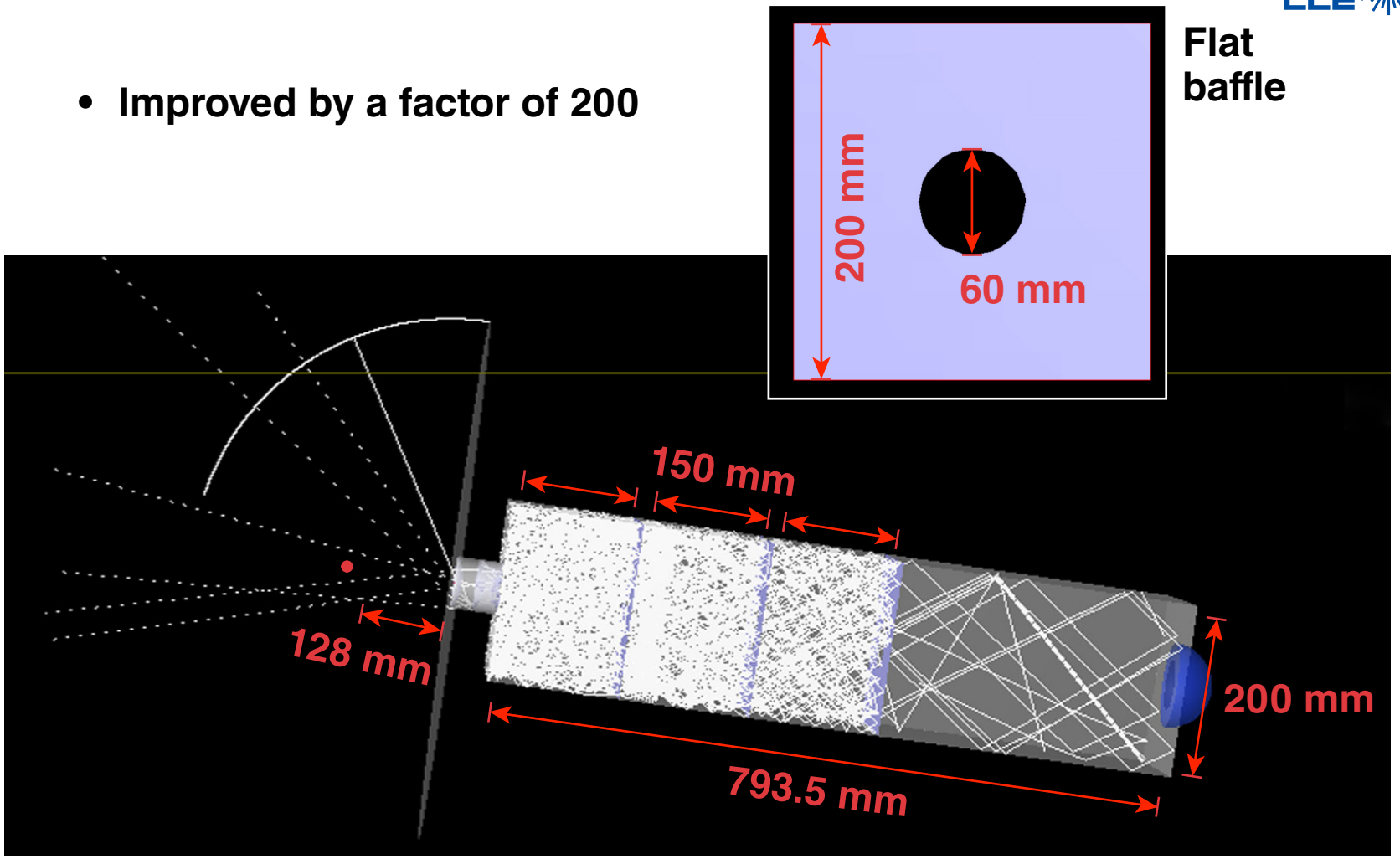

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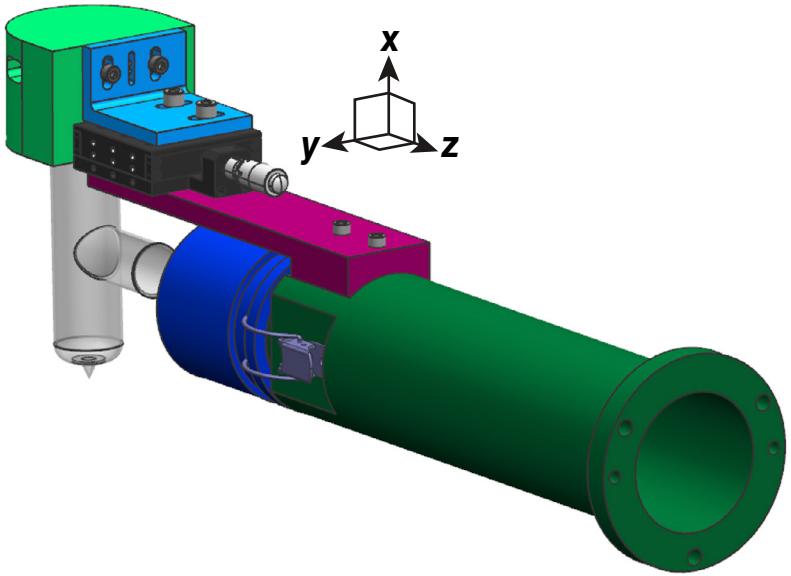

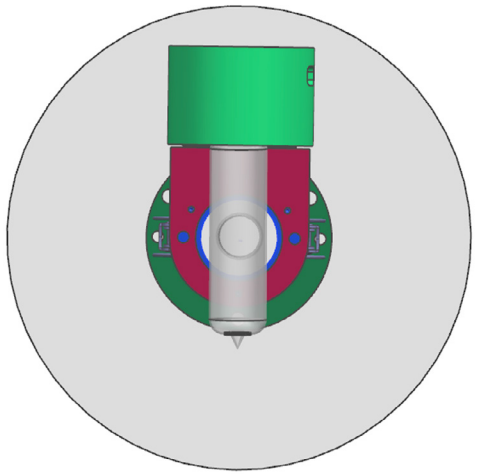

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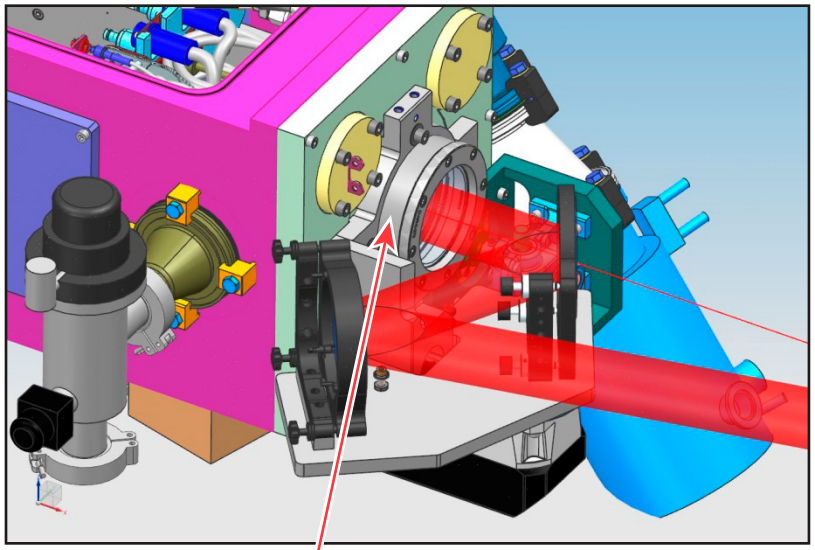
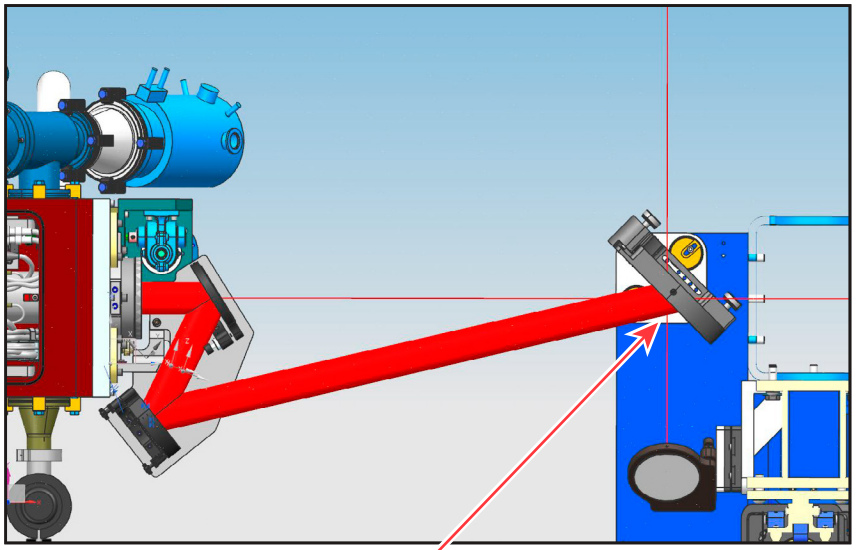


The periscope mirror assembly will mount to the 4-in. rear TIM window



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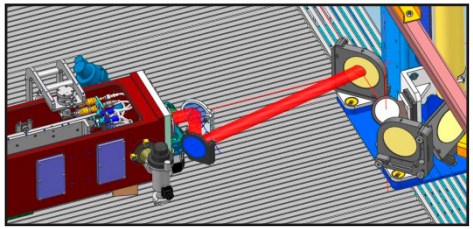

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