

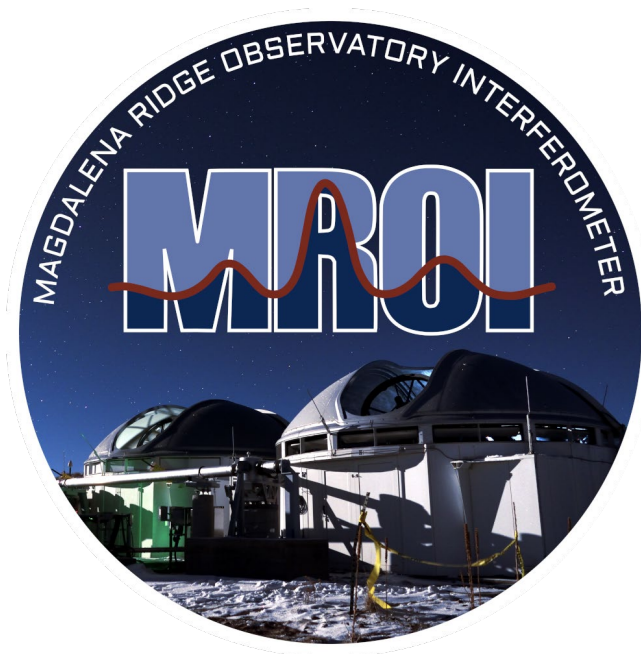


Fringes or ~~Death~~

The sprint to first fringes at the MROI

CHARA-MROI Science Meeting, March 16th 2026

James Luis, on behalf of the MROI team
at New Mexico Tech and the
University of Cambridge



Status of installed hardware at the end of summer 2024

Interferometer components	Beamline	
	W1	W2
Telescope on the array	×	✓
Fast tip-tilt system	×	✓
Beam relay pipe and mirrors	✓	✓
Delay line pipe	✓	✓
Delay line metrology	×	✓
Delay line trolley	×	✓
Beam compressor	×	✓
Alignment hardware	×	✓
Calibration light source	×	
Switchyard	×	×
Science combiner	×	

A lot of progress was made in 2024-2025.

This talk focuses on hardware. See software talk by Ian Schofield up next.

Aug 2024: Integration of UT#2 on the array



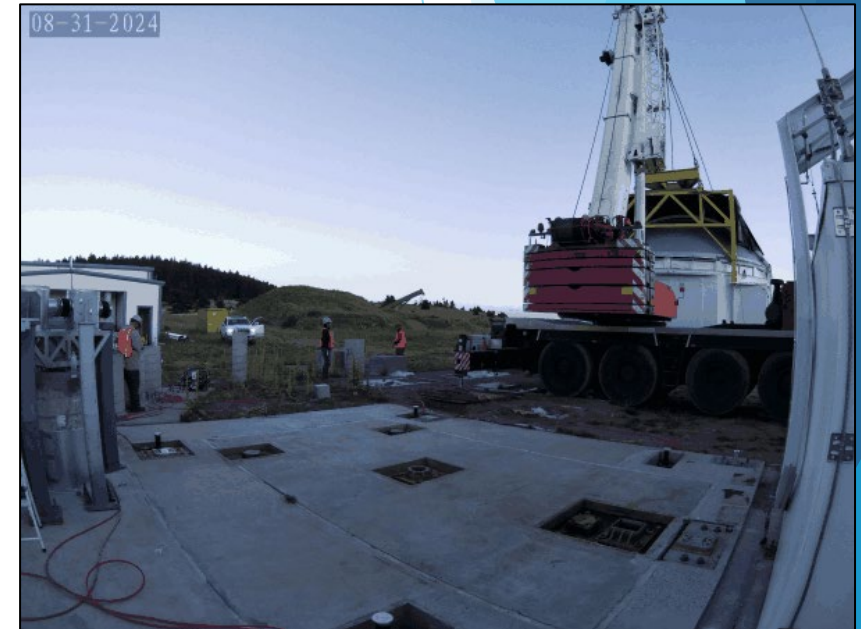
Integration of telescope and enclosure (Oct 2023)



Telescope leaving the maintenance facility



Telescope being transported to the array



Laying the UT down on the pad to form a 7.9 m baseline

Oct 2024: replacement of damaged Nasmyth Table

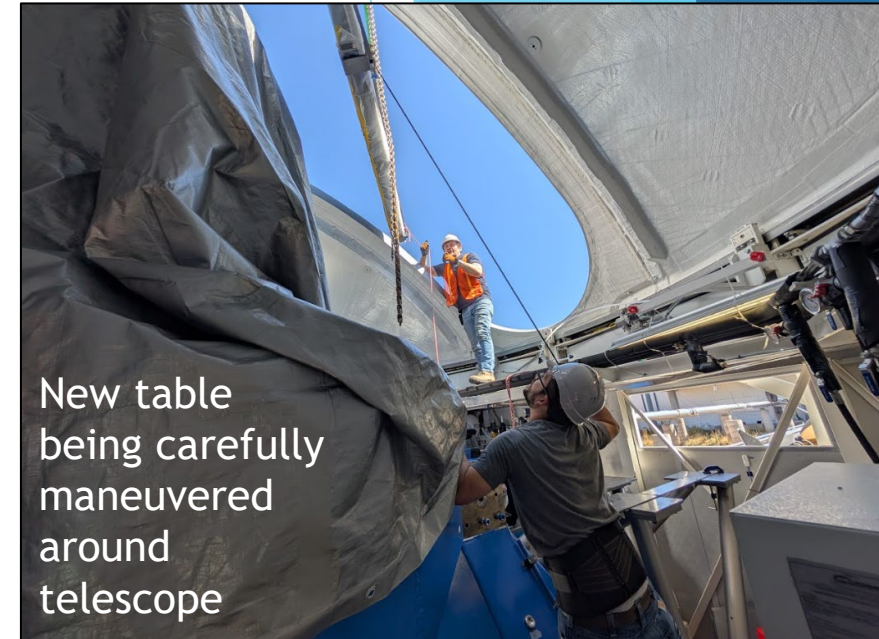
Nasmyth Table had been damaged by a collision during integration with the dome and required a full replacement, thankfully using insurance money.



Top surface of Nasmyth Table



New table being lowered into the dome through shutter opening



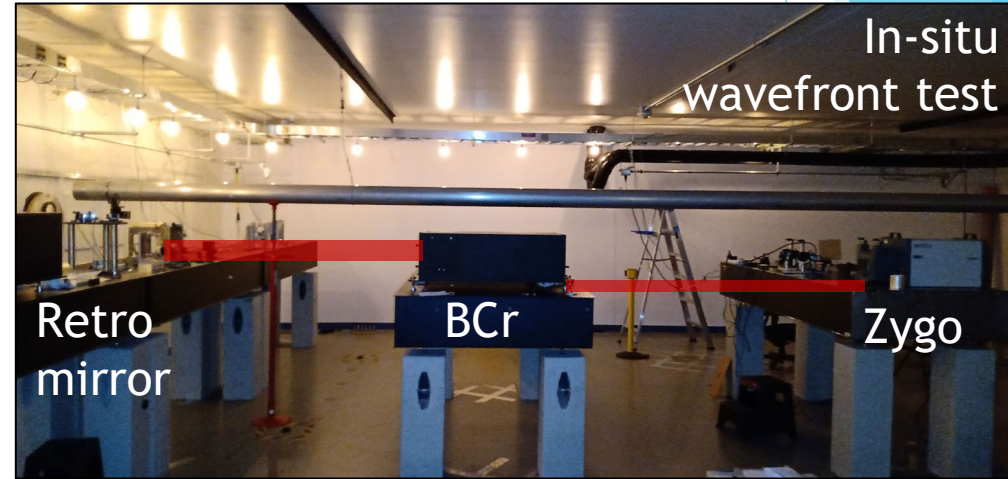
New table being carefully maneuvered around telescope

Oct 2024: Confirming wavefront performance of optics in the beam combining lab

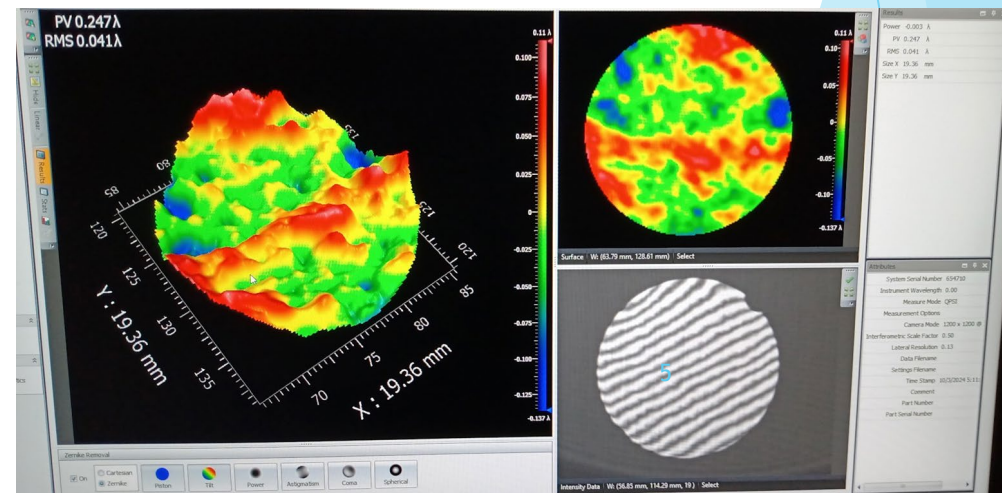
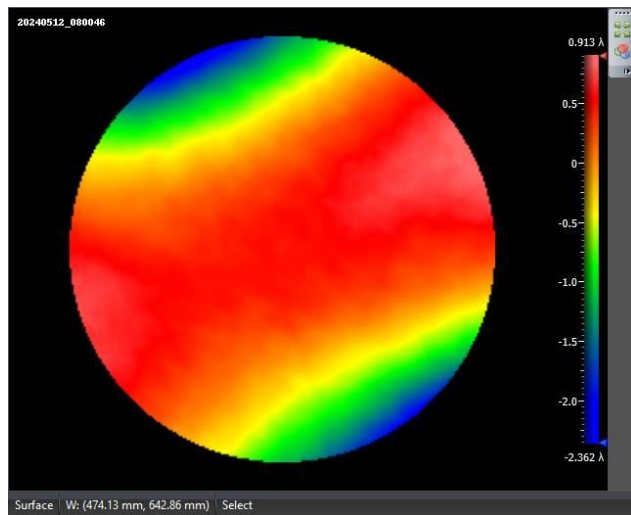
Design flaw had been found with 7.35x beam compressors that had been received from a vendor.

Wavefront error was strongly temperature dependent, and had been optimized at a warmer temperature than the beam combining lab ($\Delta T \sim 5^\circ\text{C}$).

Units were shipped back to vendor for modification and returned to us in Fall 2024.

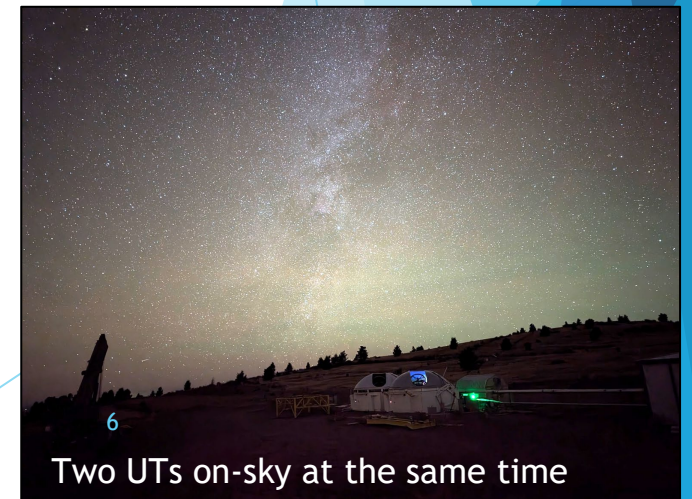
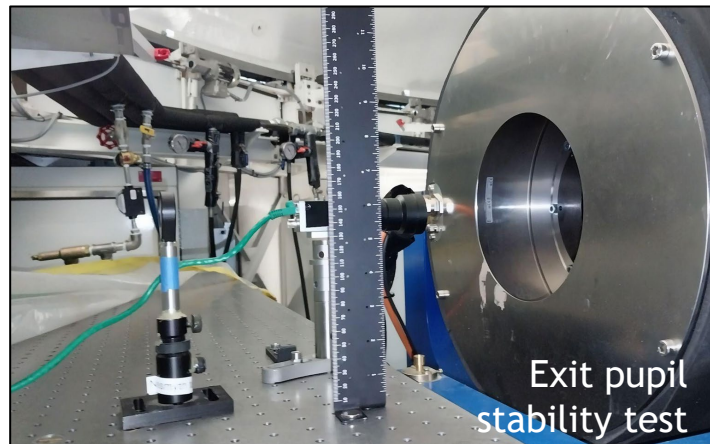
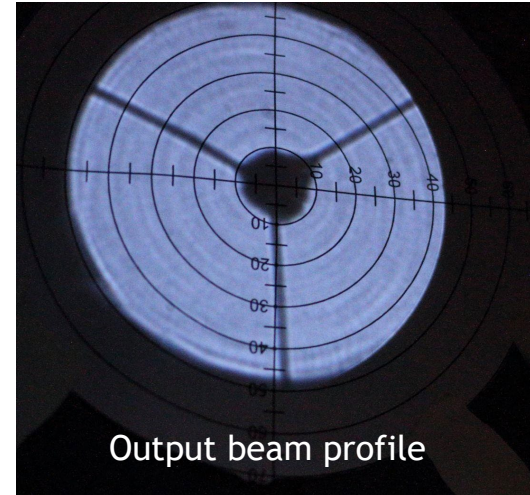
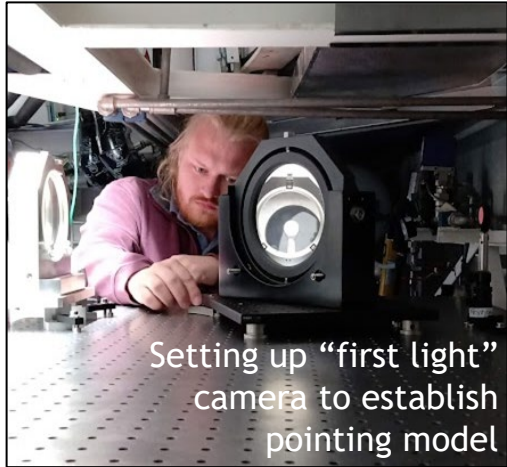


Almost 3λ PV when BCr moved to combining lab

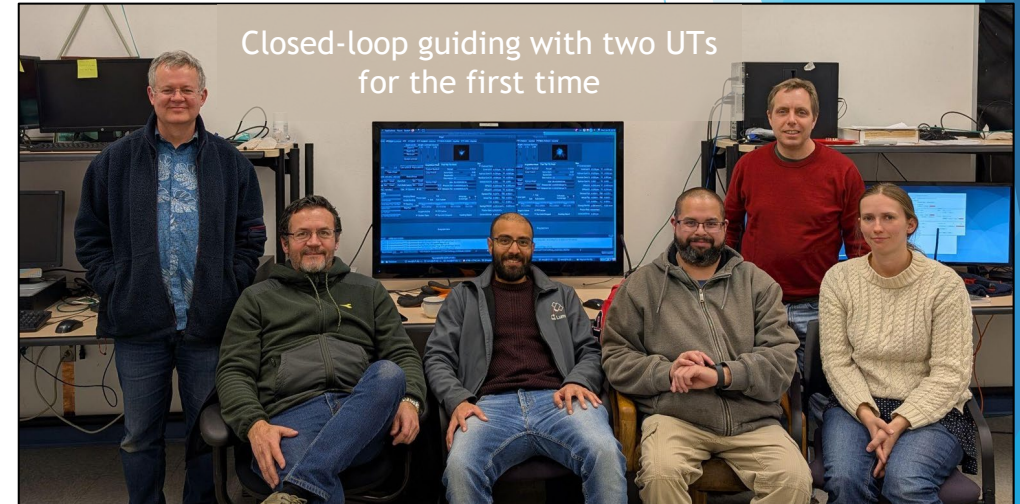
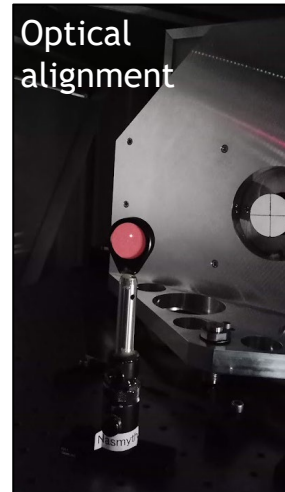
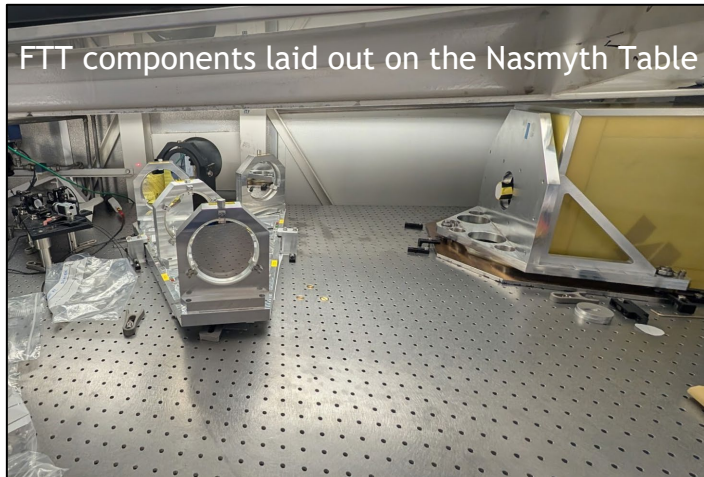


Performance within spec (32nm RMS) after modification by vendor

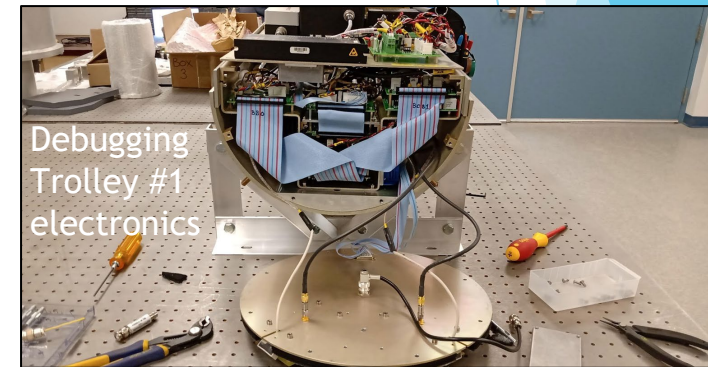
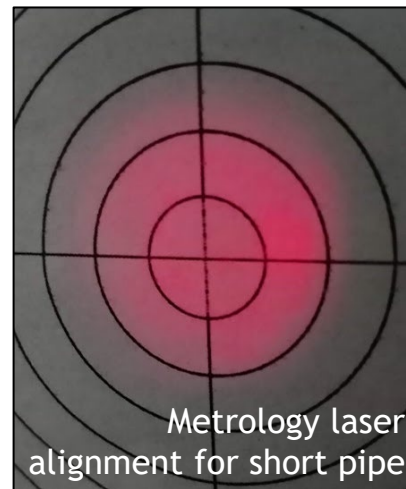
Nov 2024 to Jan 2025: Commissioning of UT#2 on the array



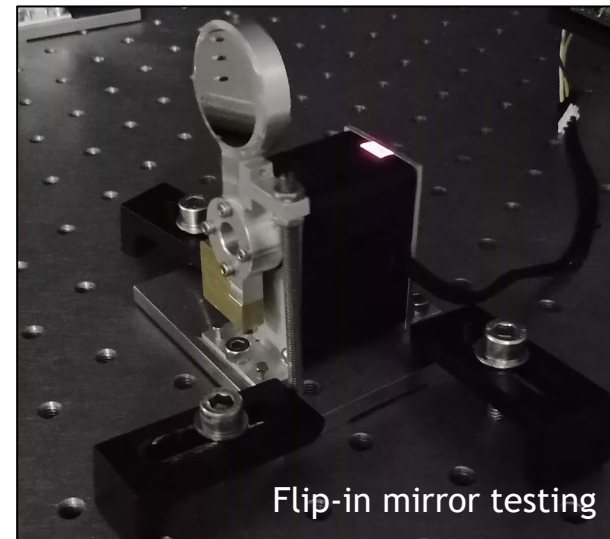
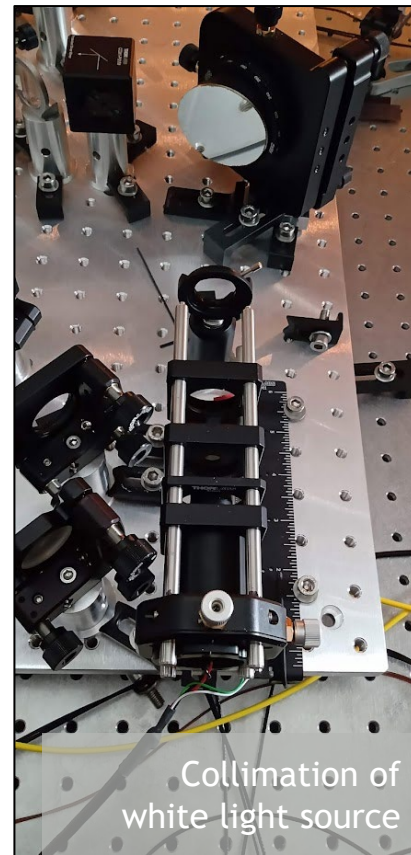
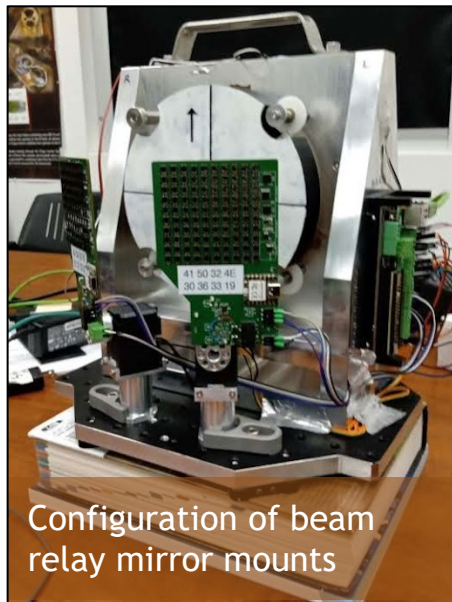
Nov 2024 -Jan 2025: installation and site acceptance for FTT#2



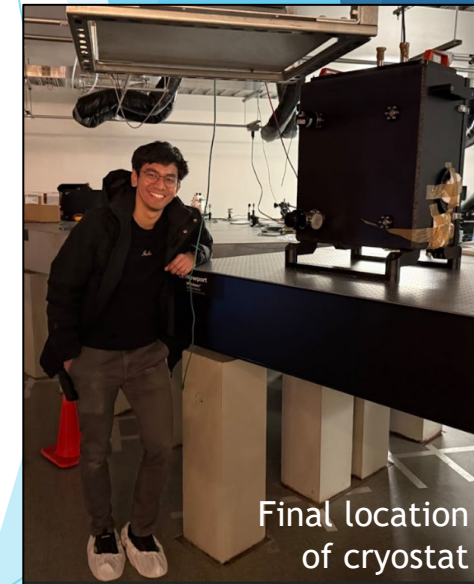
Jan 2025: site acceptance of DL trolley #2 and tune-up of Trolley #1



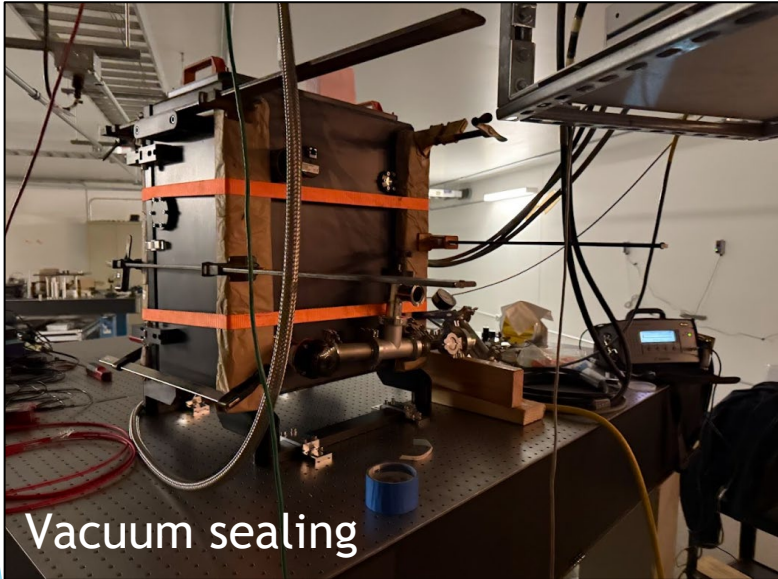
Mar 2025: installation/testing of alignment system components



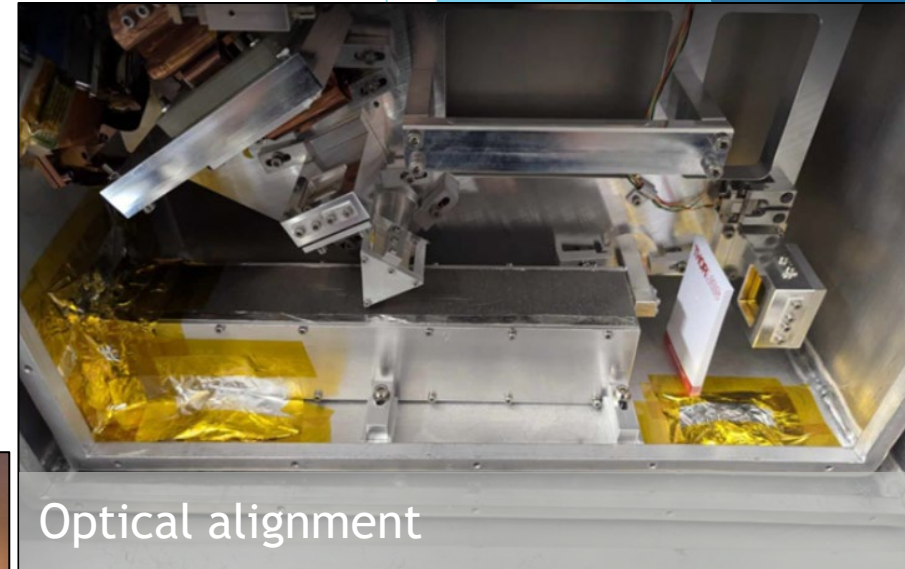
Apr 2025: installation of FOURIER, the MROI's first science combiner



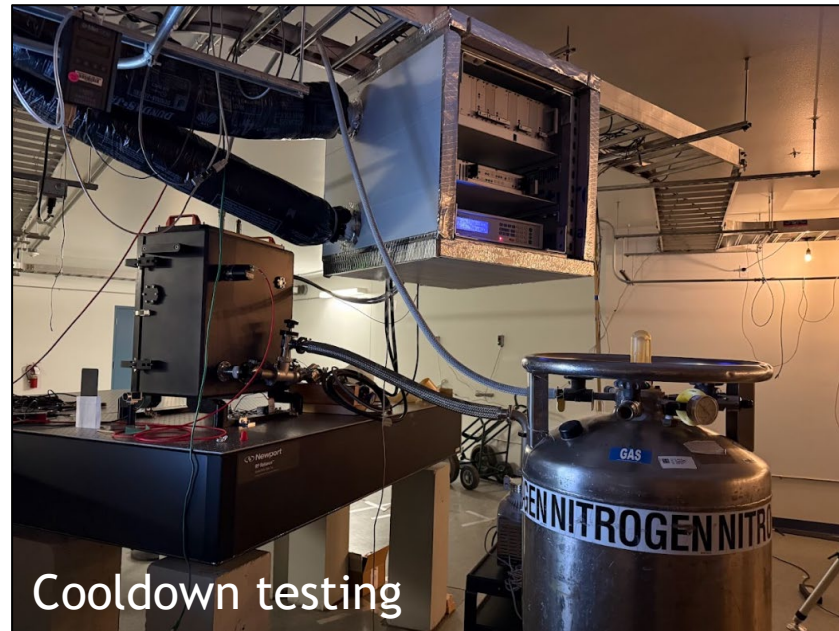
Apr - May 2025: FOURIER site acceptance testing



Vacuum sealing

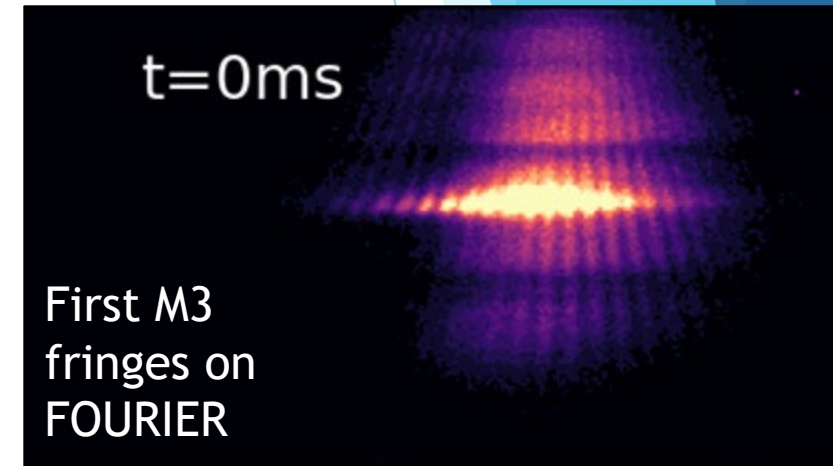
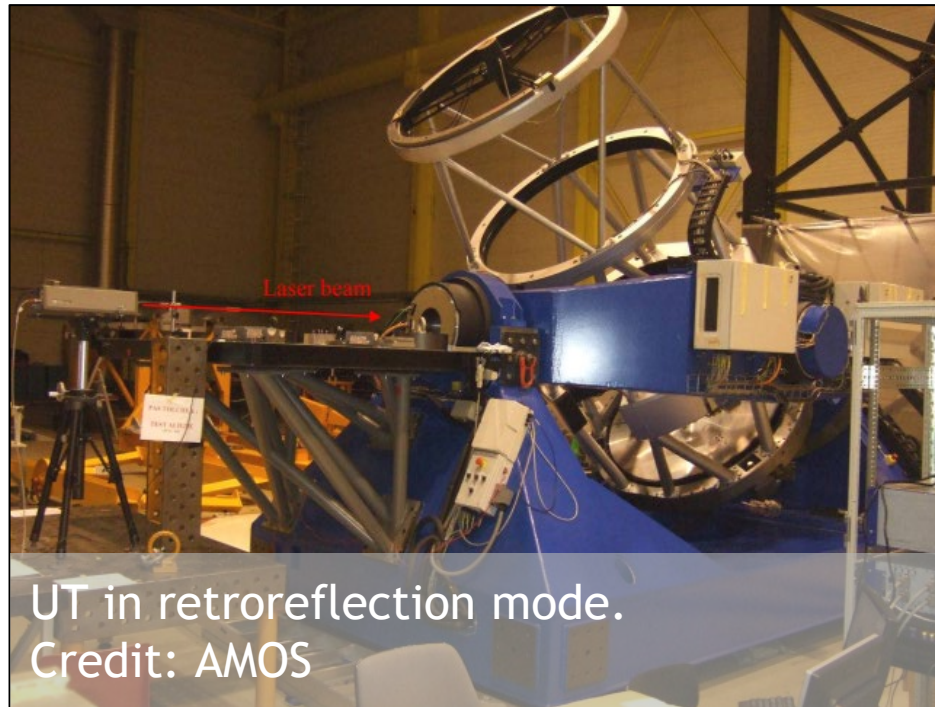


Optical alignment



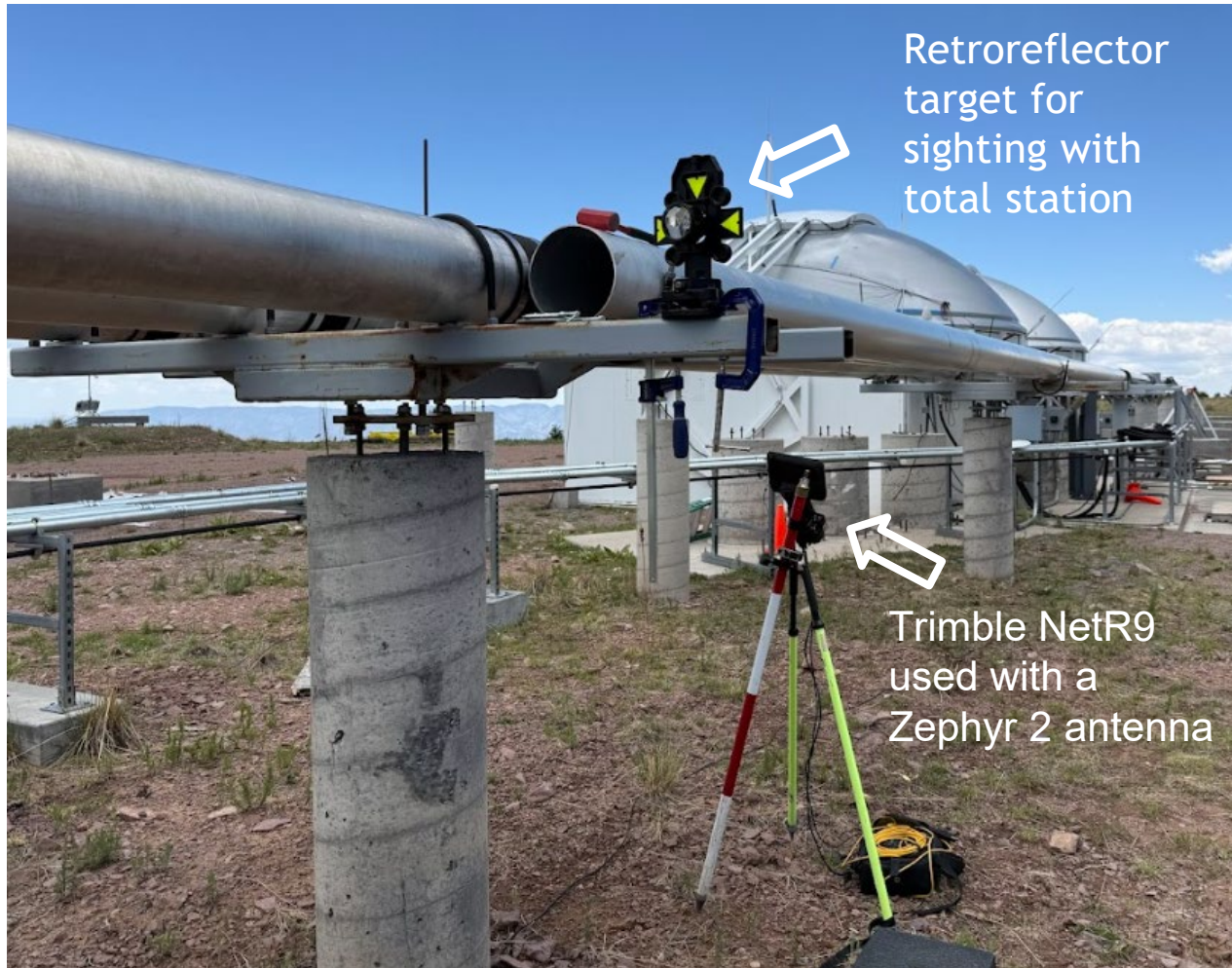
Cooldown testing

Jun 2025: internal white light fringes



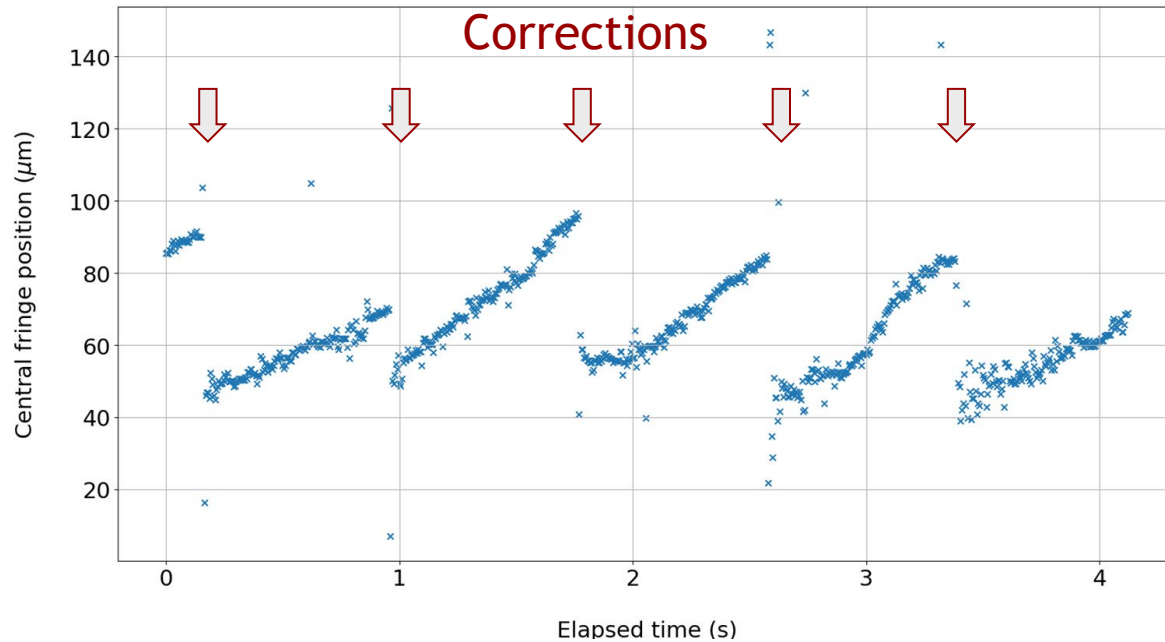
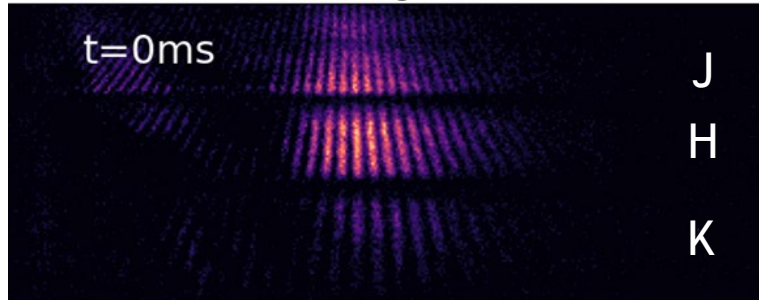
Beams path-matched from the telescopes' M3 to the beam combination plane with mm-level accuracy.

Jul 2025: GPS measurements to estimate the baseline angle



Jul 2025: First fringes!

HIP 102488, H mag 0.2

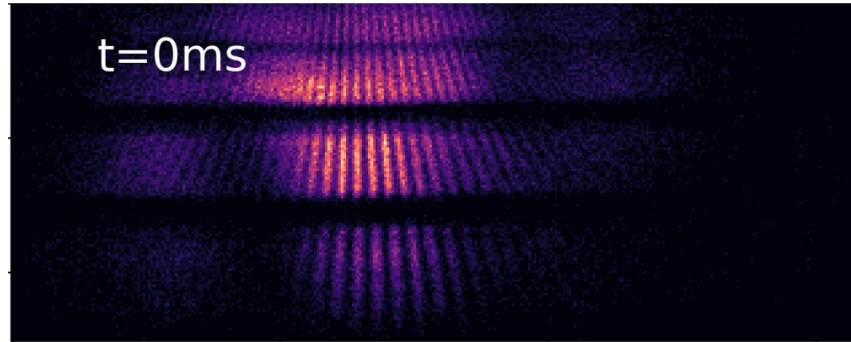


Piston drifted as much as $60 \mu\text{m/s}$.

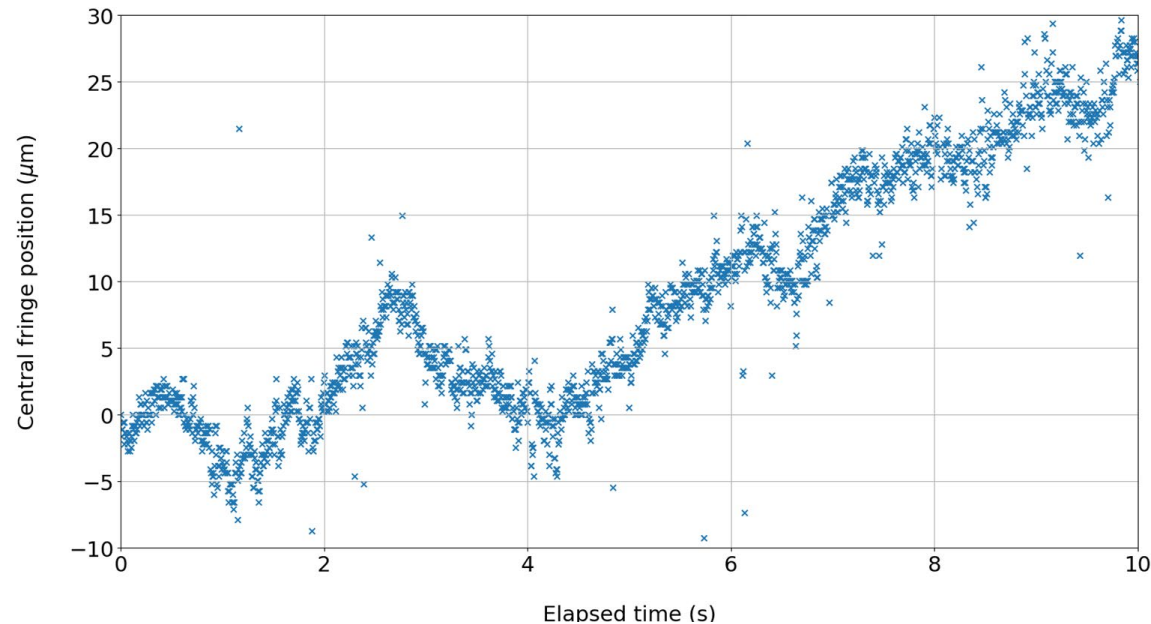
Aug 2025: Second fringes

After first success, we failed to find fringes again on several nights.

Eventually, a bug in the DL sidereal tracking algorithm was identified and fixed. That night we found fringes easily on two stars.



HIP 677
H mag 2.33

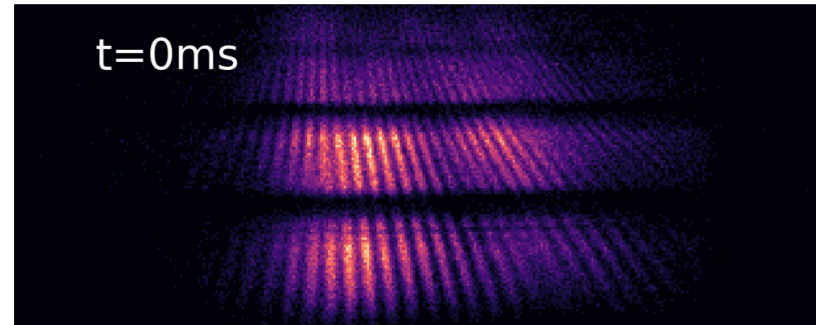


Piston still drifted, but at a slower rate of $25 \mu\text{m/s}$.

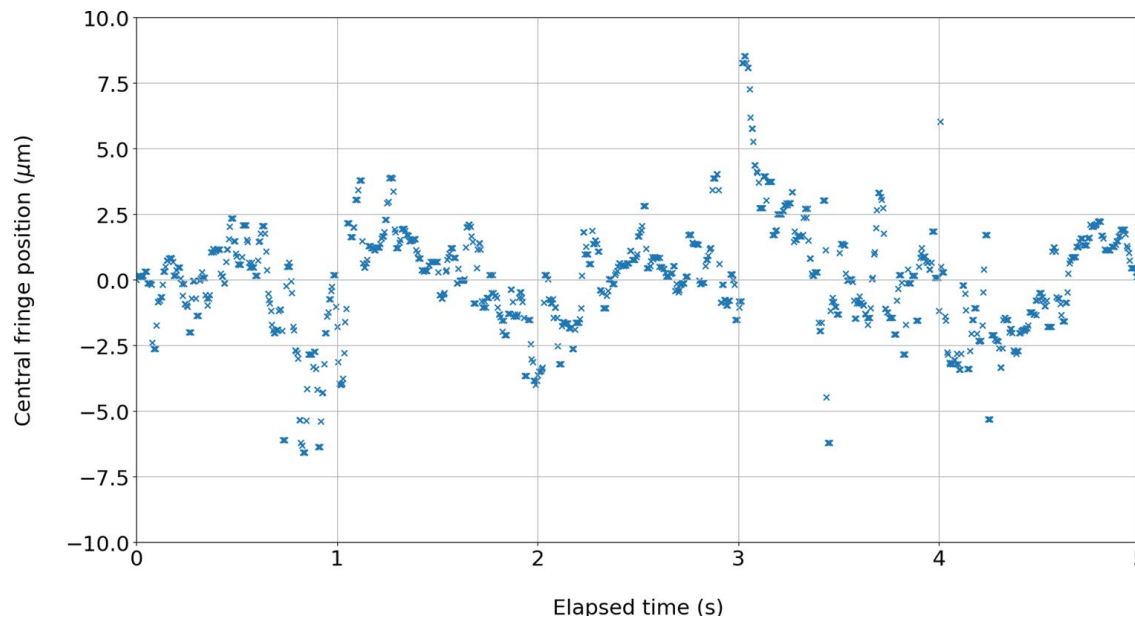
Drift used to refine baseline solution.

Oct 2025: Third fringes

With the refined baseline solution, fringes were found within 2 mm of the nominal delay for stars all over the sky.



HIP 15549
H mag 0.82



Fast drift eliminated by refined baseline.

Focus has now shifted towards measuring and improving sensitivity - see Emma Floyd's talk later this morning.

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