Progress at the Magdalena Ridge Observatory Interferometer

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On behalf of the NMT and Cambridge Teams

Magdalena Ridge Observatory

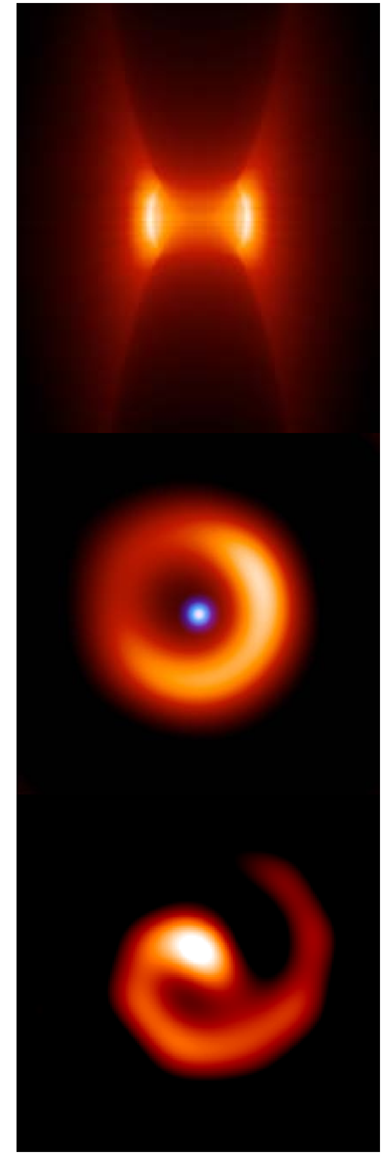
Magdalena Ridge Observatory

- Federally funded since 2000
- EIS completed in 2003
- Two facilities at MRO
  - Fast-tracking 2.4m
  - NIR/Optical 10-element interferometer
- 2.4m scope started full operations Aug, 2008
- 75% NASA/DoD funded

- MROI is 10 1.4m movable afocal telescopes in equilateral Y configuration
- Optical and near-IR operation
- Baselines from 7.5 to 340m
- Minimized reflections
- Design optimized for imaging mission

MROI Key Science Mission

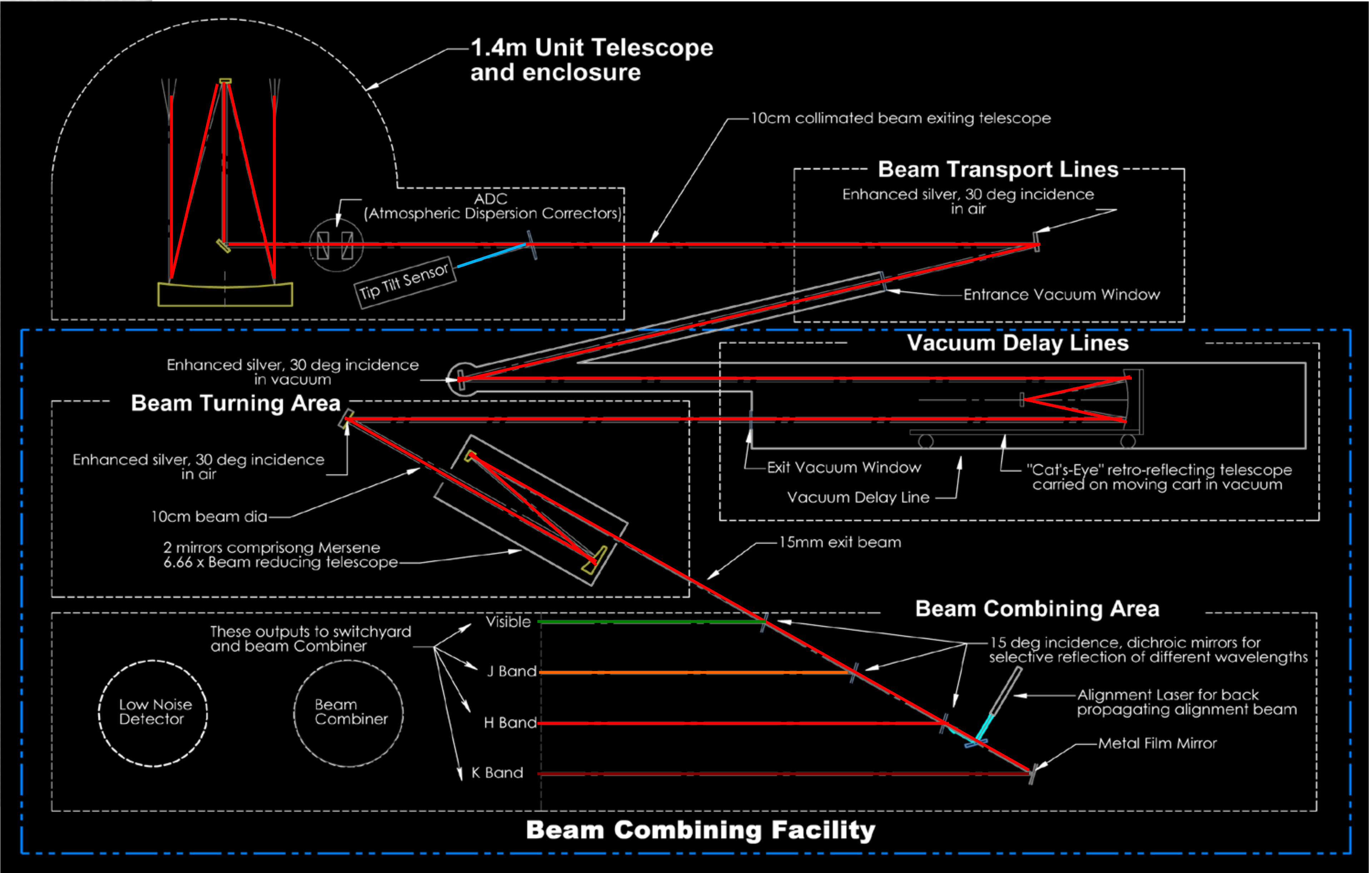
- AGN:
  - Verification of the unified model
  - Determination of nature of nuclear/extra-nuclear starbursts
  - H =14 gives >100 targets.
- Star and planet formation:
  - Protostellar accretion, imaging of dust disks, disk clearing as evidence for planet formation
  - Emission line imaging of jets, outflows and magnetically channeled accretion.
  - Detection of sub-stellar companions.
- Stellar accretion and mass loss:
  - Convection, mass loss and mass transfer in single and multi-star systems
  - Bipolarity and collimation of circumstellar material, wind and shock geometries.
  - Pulsations in Cepheids, Miras, RV Tauris, etc.



Requirements Flowdown

- Telescope diameter of 1.4 m
  - H magnitude = 14 for group delay tracking limit
- Spatial scales of 0.3 to 30 mas
  - Baselines from 8 to 350 m (for 0.6-2.4 microns)
- Moderate-to-high spectral resolutions
  - Separate fringe tracking and science cameras
- High throughput to achieve sensitivity limit
  - Fifteen reflections from primary to detectors
  - Optimized coatings for 0.6-2.4 microns
- Large number of telescopes
  - Optimized for model-independent imaging

Walk through the Optical Path

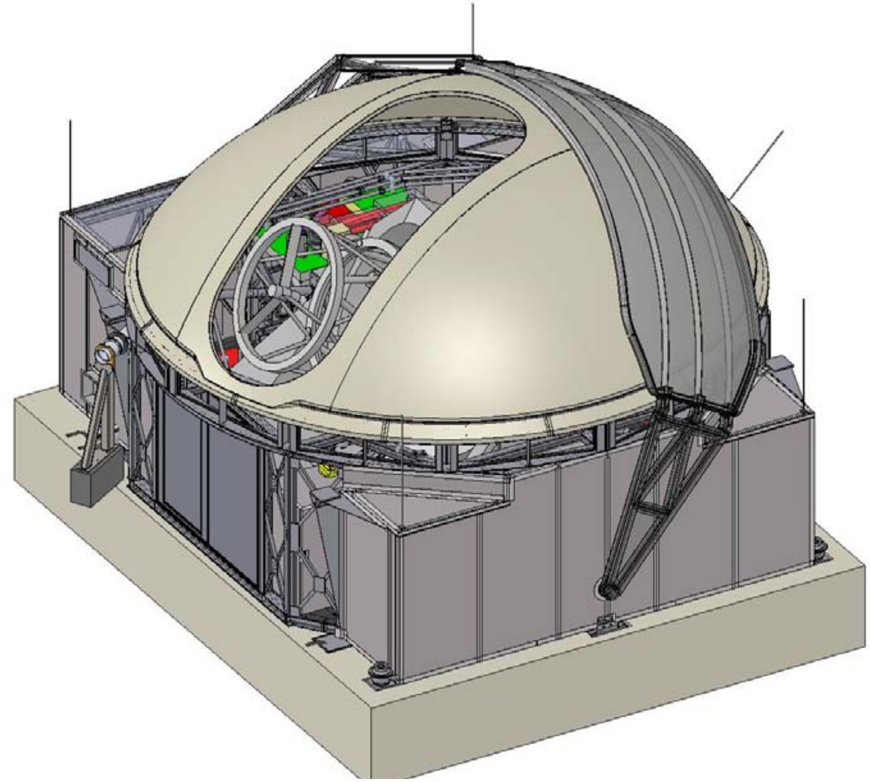


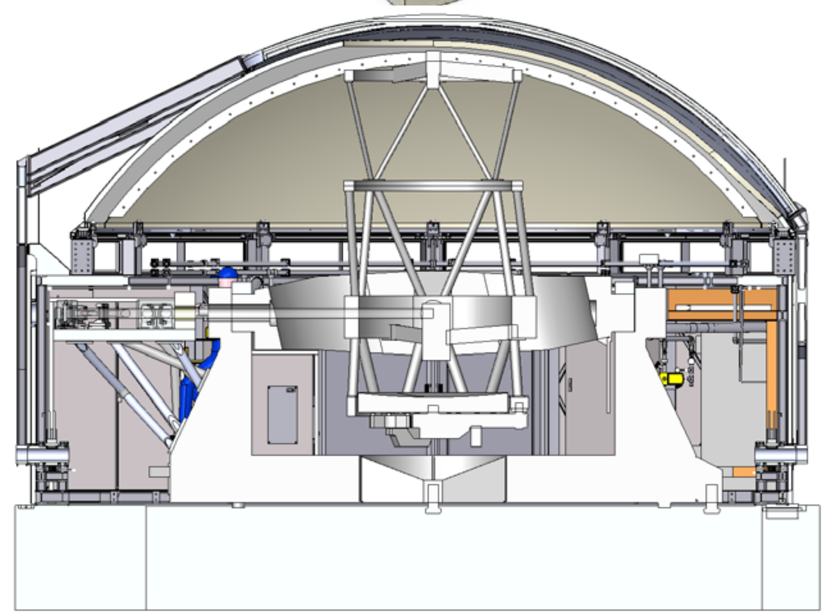
Unit Telescopes

- Designed/built by AMOS
  - 1.4m aperture
  - afocal alt-alt design
  - polarization preserving
  - 62 nm rms wavefront
  - UT1 completed factory acceptance testing
  - UT2-3 ordered

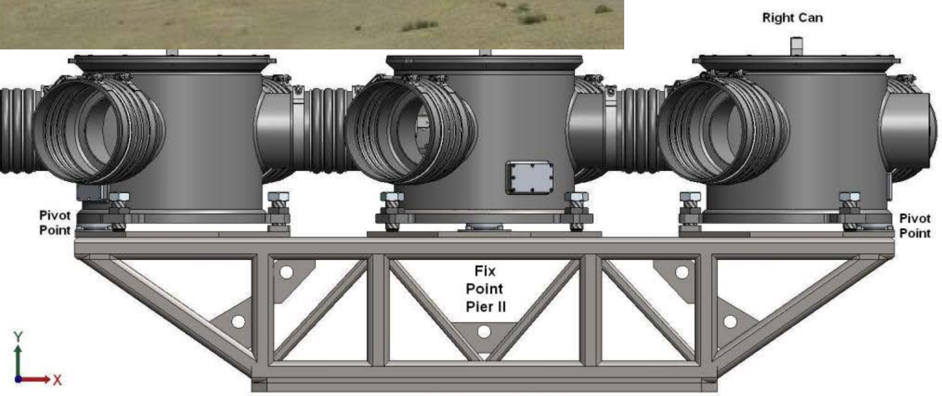
UT Enclosures

- Designed by EIE
- Build in "award"
- Houses and transports UTs
- Allows close-packed configuration to 30 deg elevation without vignetting for 6 hour tracks





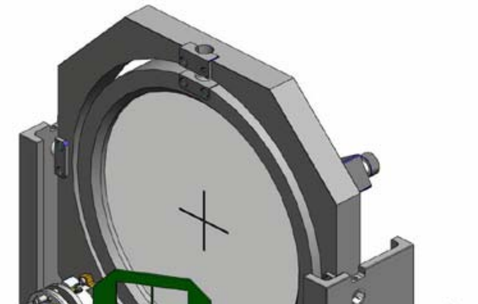
Foundations and Beam Transport

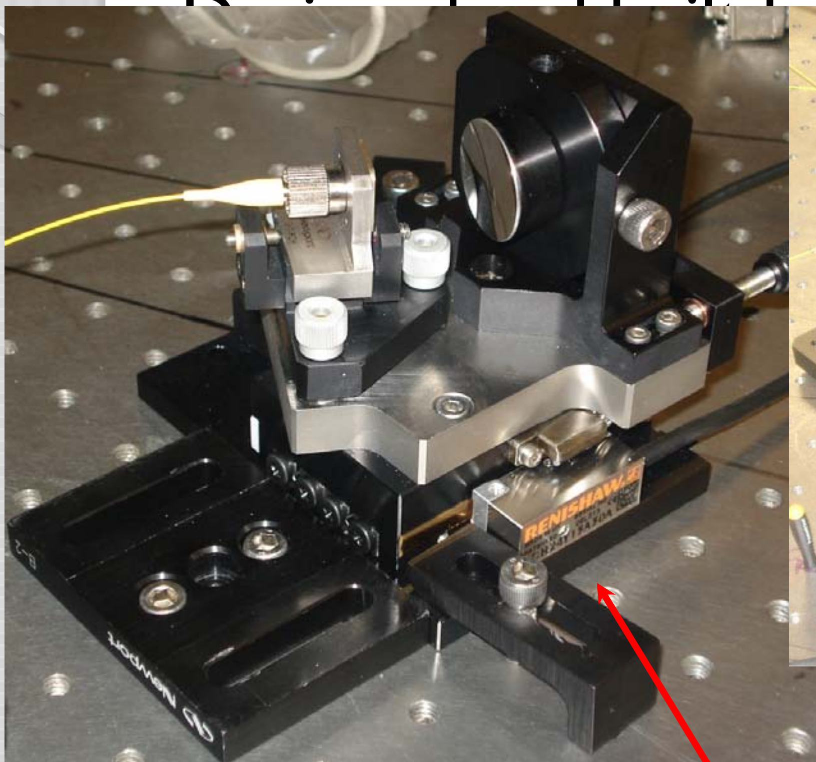


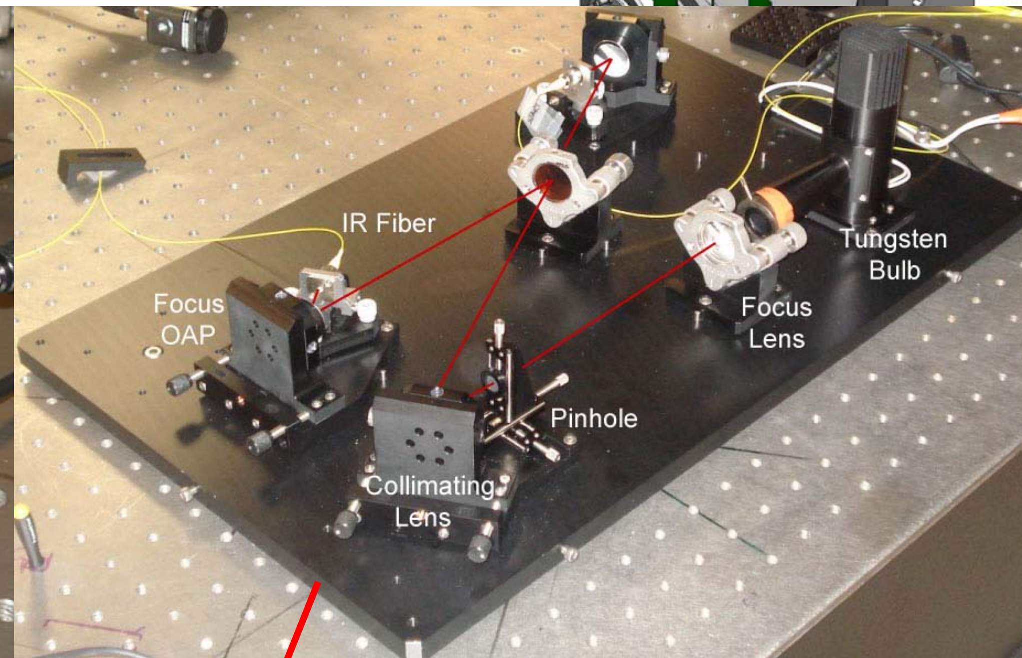
- Designed M3 and built by MRO
- Supports 3 UTs per beamline with 0.5 mbarr vacuum from UT to BCA
- Install for piers for inner array began this past summer
- Houses all components of automated alignment system

Inner Array Install

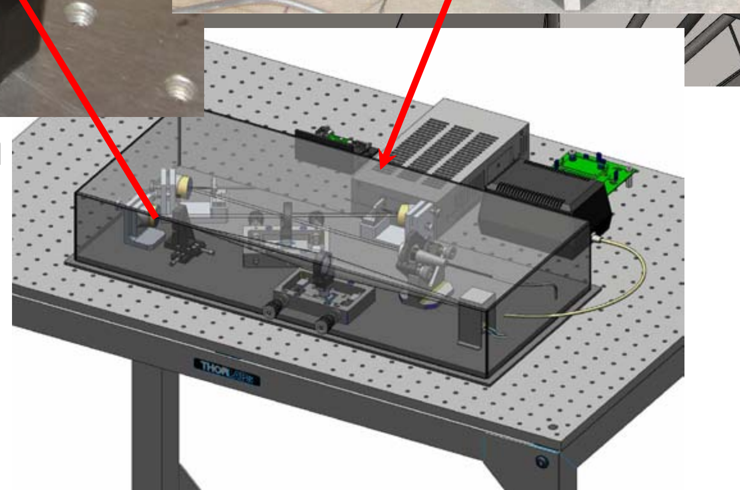
Automated Alignment System

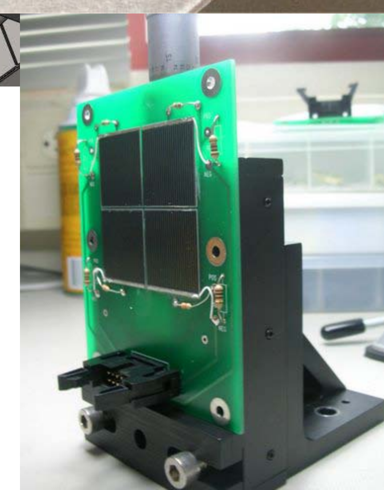






cells and beam injection via fibers





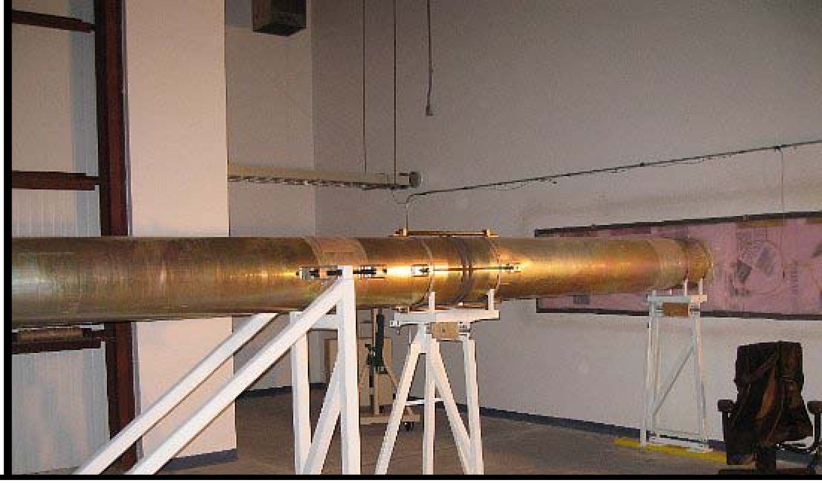
Beam Combining Facilities

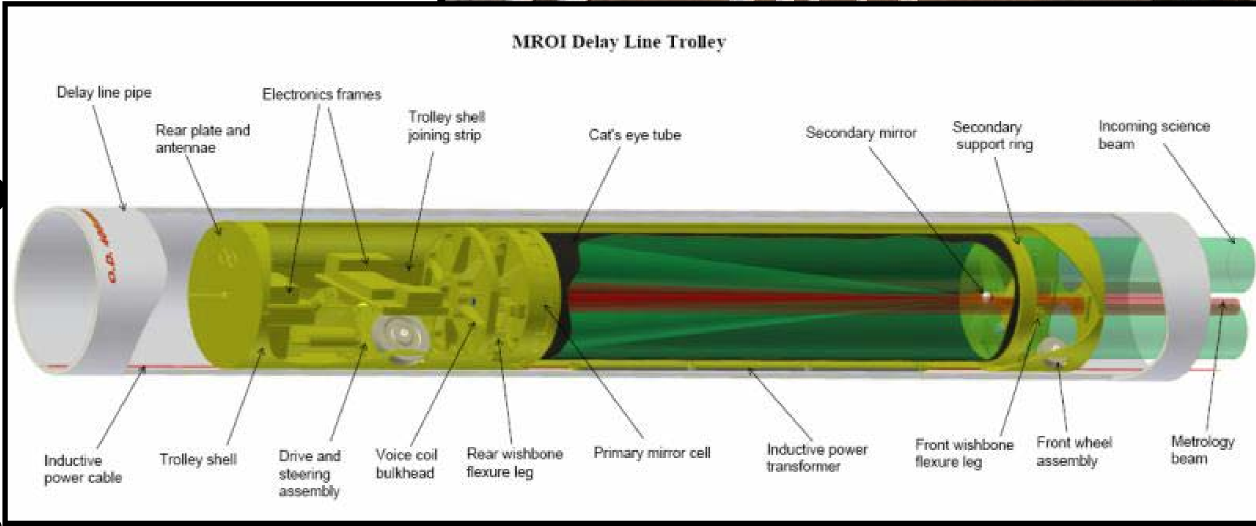
- Design by M3/built KL House – delivered in 2008
- Thermal & vibrational stability
- Supports full array
- Single-pass DL section 190 m long
- Equipment install started 2010

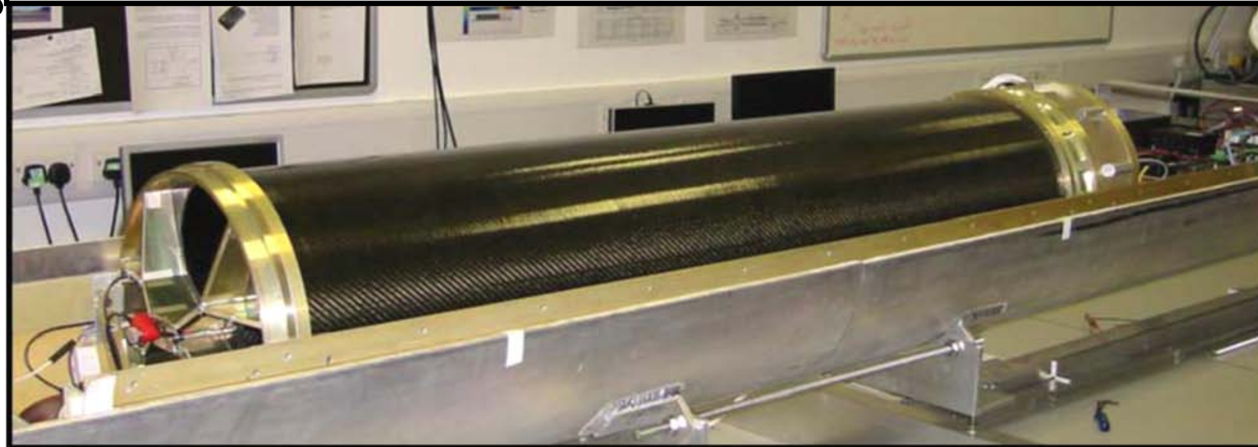
Magdalena Ridge Observatory

Delay Lines

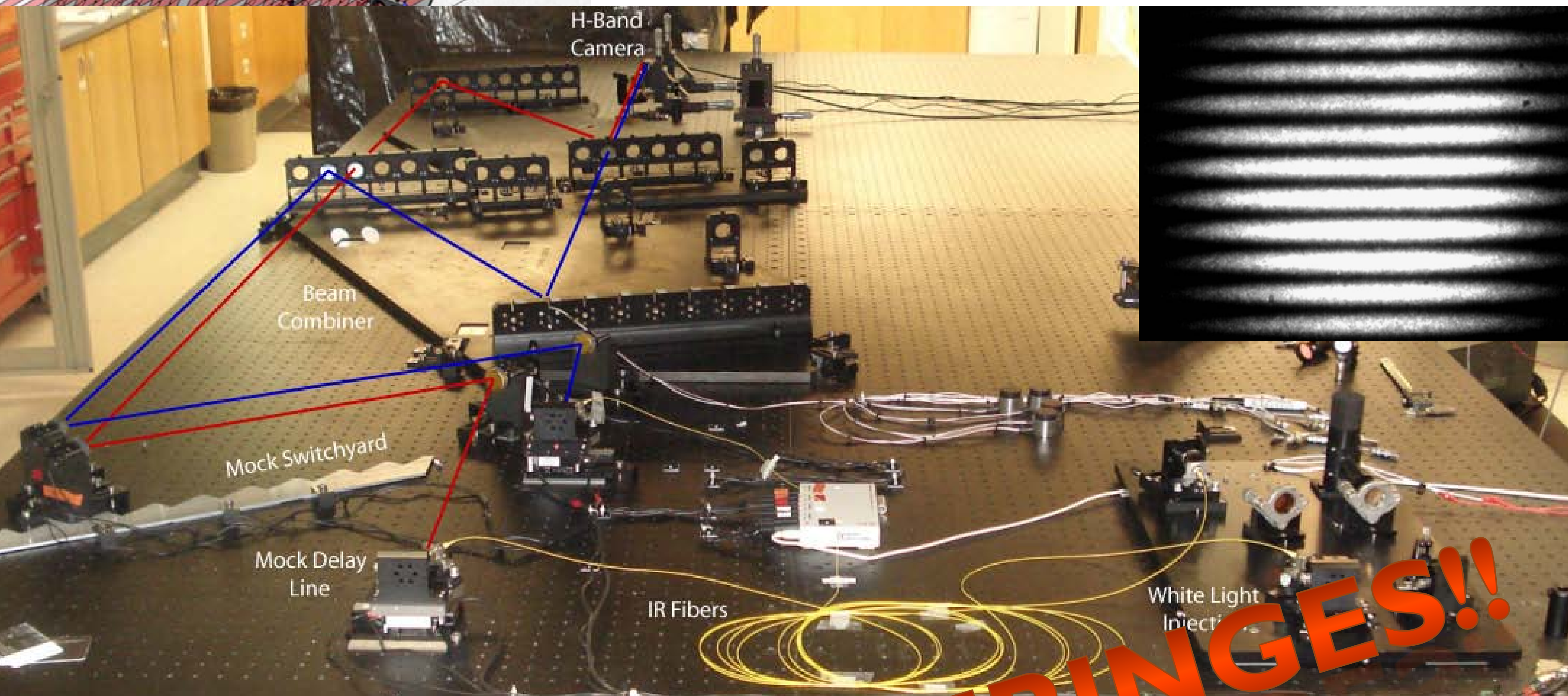
- Designed/built Cambridge
- Innovative approach
- Inductive pick-up & wireless communications
- Install begins this month

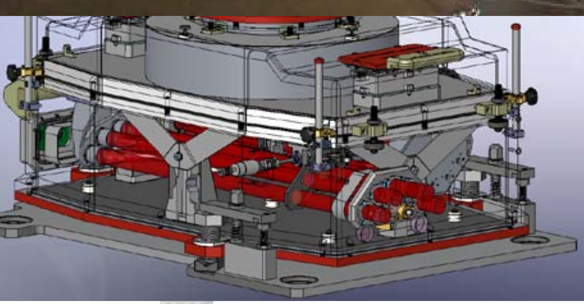






Fringe Tracker

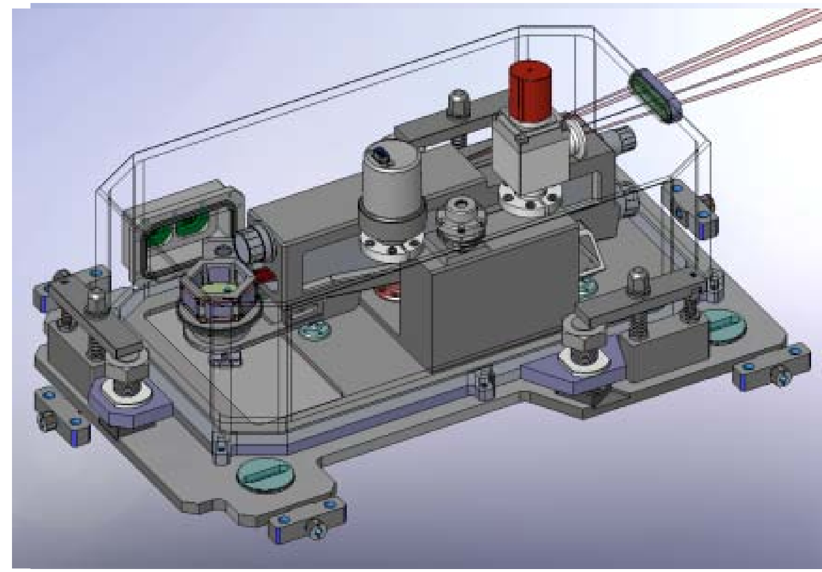


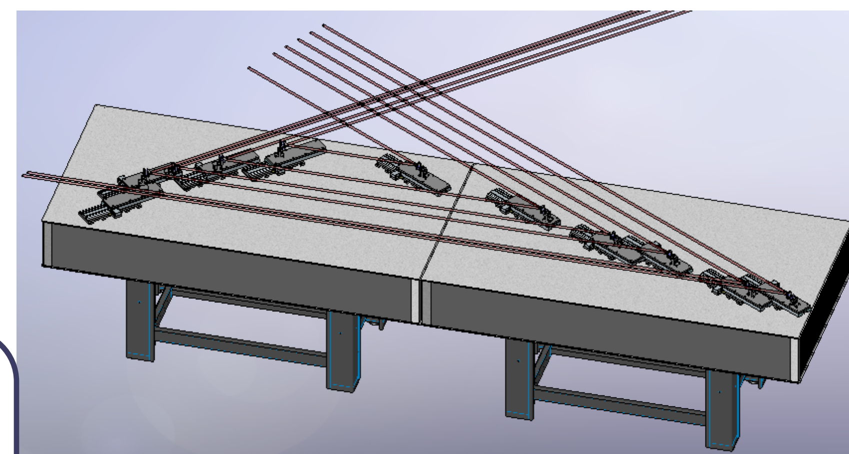


FIRST FRINGES!!

Science Instrument

- MRO conceptual design
- SIRCUS – J,H,K with R~30 and 300
- 4-way image plane combination with fast-switching to combine 6 beams in ~100 sec



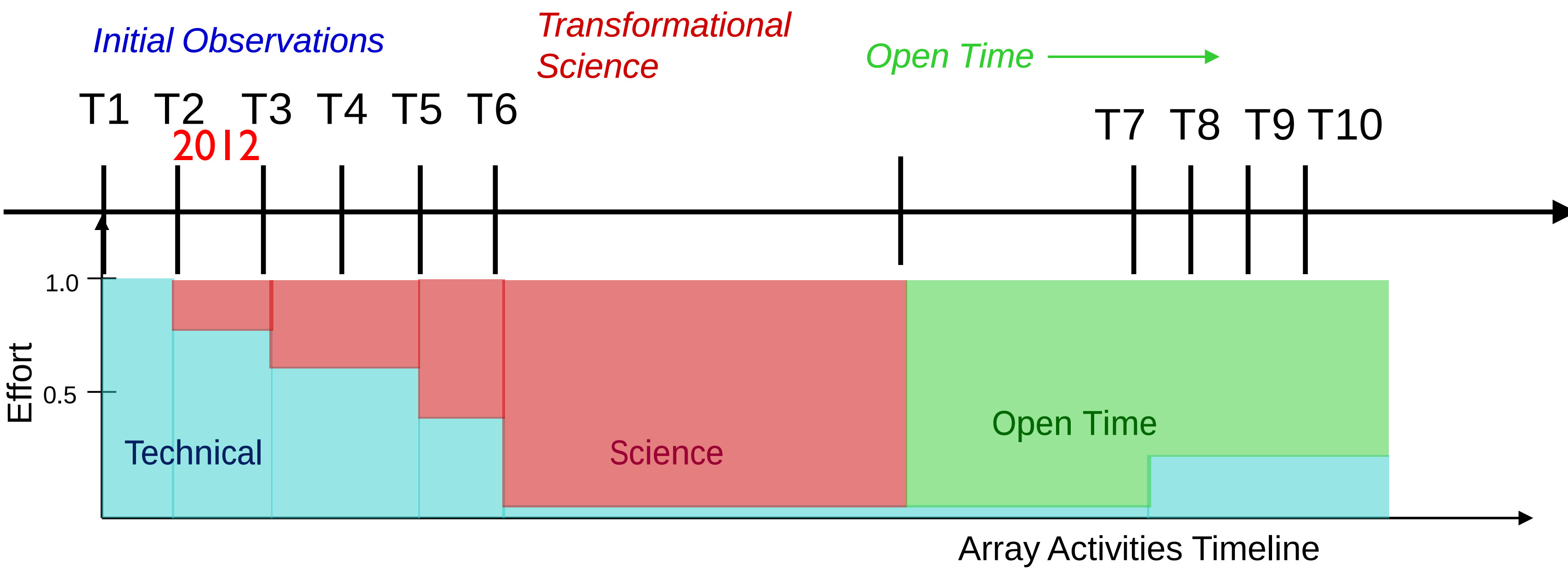


Mag	J	H	K
13	0.45	0.54	0.53
11	17.6	20.8	18.4
9	195	207	159

Performance:
SNR per spectral channel in 100 sec at R~30 with 0.7" seeing and RN=5e-

Scientific Schedule for MROI

- Technical Phase – Key observations that quickly demonstrate technical competencies
- Science Phase – Scientific observations that produce transformational changes to understanding of astrophysical phenomena
- Open Time Phase – Release of facility to broader community through public funding



Interferometry Workshop in NM

- MRO/NOAO/LANL/USIC co-sponsors
- March 28-31, 2011 in Socorro
- Wide variety of science topics presented and discussed over 4 days
  - Invited speakers including:
    - C. Haniff, R. Genzel, A. Speck, J. Monnier, D. Segransan, T. Storchi-Bergmann, M. Delbo, T. Metcalfe, J. Eisner, G. Torres, J. Aufdenberg, P. Young
  - Poster sessions, tour of MROI, Conference Proceedings
  - Website: www.mro.nmt.edu/workshop

Thank you for your attention!

- PI: Van Romero
- Deputy PI: R. Cervantes
- Advisor: D. Westpfahl
- Prog. Director: I. Payne
- System Architects: C. Haniff, D. Buscher
- Proj. Scientist: M. Creech-Eakman
- Proj. Manager: R. Selina

- NMT Team: V. Alvidrez, C. Anderson, M. Apodaca, L. Archuleta, D. Brown, A. Farris, E. Iker, S. Jimenez, C. Jurgenson, R. King, D. Klinglesmith, T. McCracken, J. Murphy, K. Nyland, A. Olivares, J. Pino, M. Richmond, C. Salicido, J. Sanchez, J. Sandoval, F. Santoro, J. Seamons, A. Shtromberg
- Cam. Team: R. Boysen, J. Coyne, M. Fisher, B. Seneta, D. Sun, D. Wilson, J. Young

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