Progress: CHARA Michelson Array Pathfinder (CMAP)

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Goals of the Project

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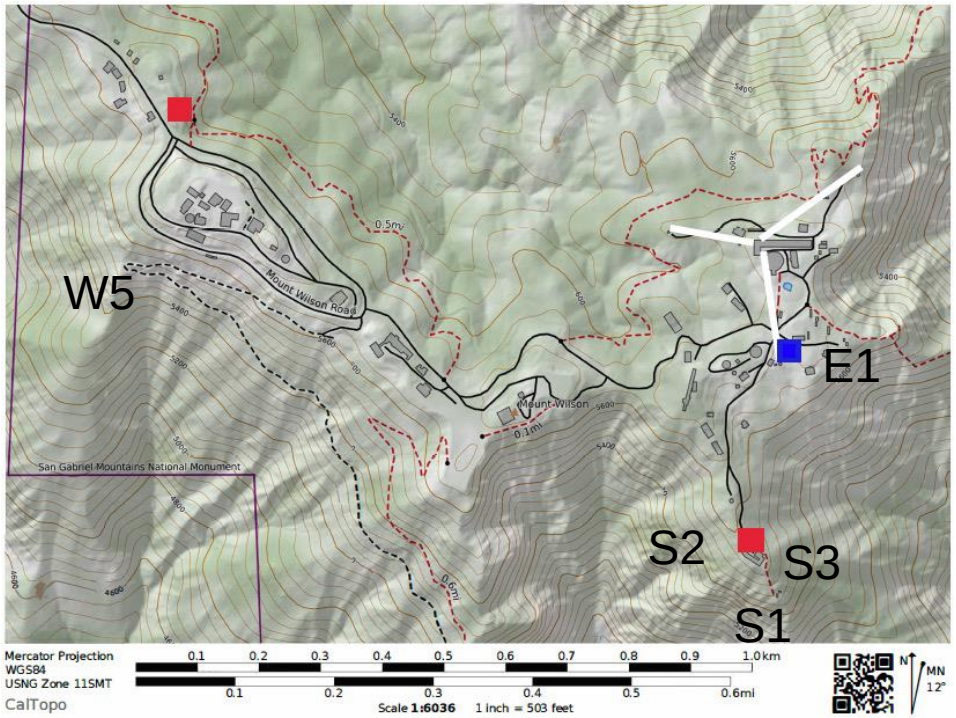
1. To show the capability to use fibers as the mode of transport for science by getting consistent fringes that can be calibrated for science use.
2. Build a mobile telescope with fiber transport to allow baseline flexibility to extend our capabilities.
    - S1-S2-S3 baselines: ~ 20 m
    - E1-S4 baseline: ~ 600 m
    - E1-W5 baseline: ~ 1100 m



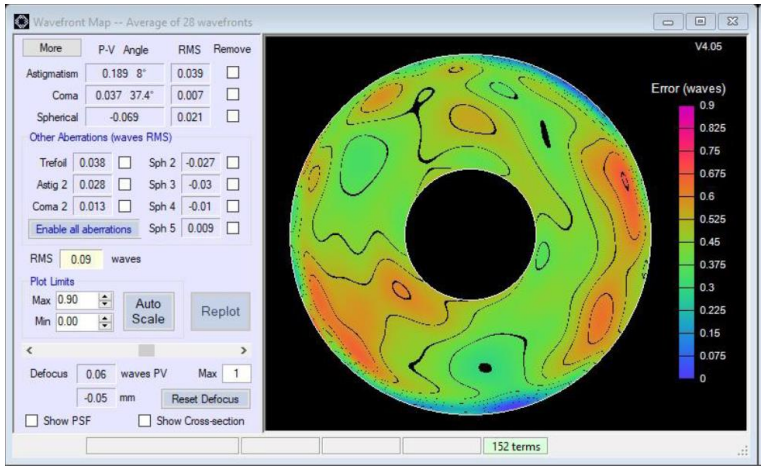
Topo map of CHARA

Major Aspects of the Project

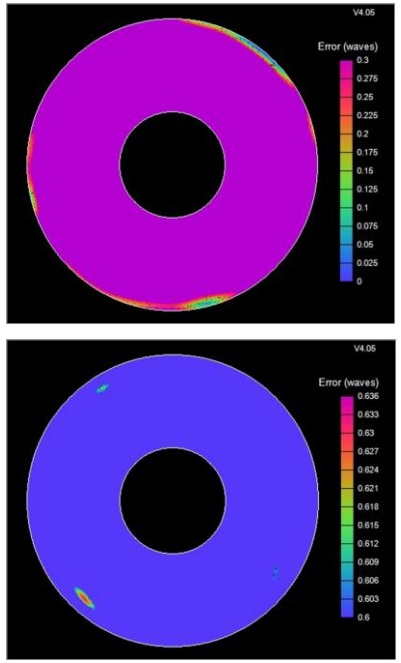
1. Mobile Telescope, instrument bench, enclosure, and sites
2. Fiber transport- Injection/transport/collimation
3. Control software
4. Fiber zero path stabilization

Mobile Telescope (T7) 1 of 2

- RC, CA 1 meter, F/12.2, central obscuration < 28%
- By now, the telescope has arrived at Mount Wilson and is to be installed on 3/19.
- It did not meet the WFE error requirement of less than 0.3 waves at zenith; Planewave confident will be less then 0.6 waves @ 635 nm to 20 degrees.



Map of the areas below 0.3 waves



Map of the areas above 0.6 waves

Mobile Telescope (T7) 2 of 2

Enclosure and Sites

- High risk item minimized;
  - Transportation to S3 was smooth
- For a similar price to the Astrohaven
  - Wind protection
  - Ash dome is same as current domes
  - Robust transport system for the campus

Nasmyth instrument Bench Mount

Designed by Nic Scott and Tim Hilliard

Two mounts made so we can install an additional table on the other side of the fork.

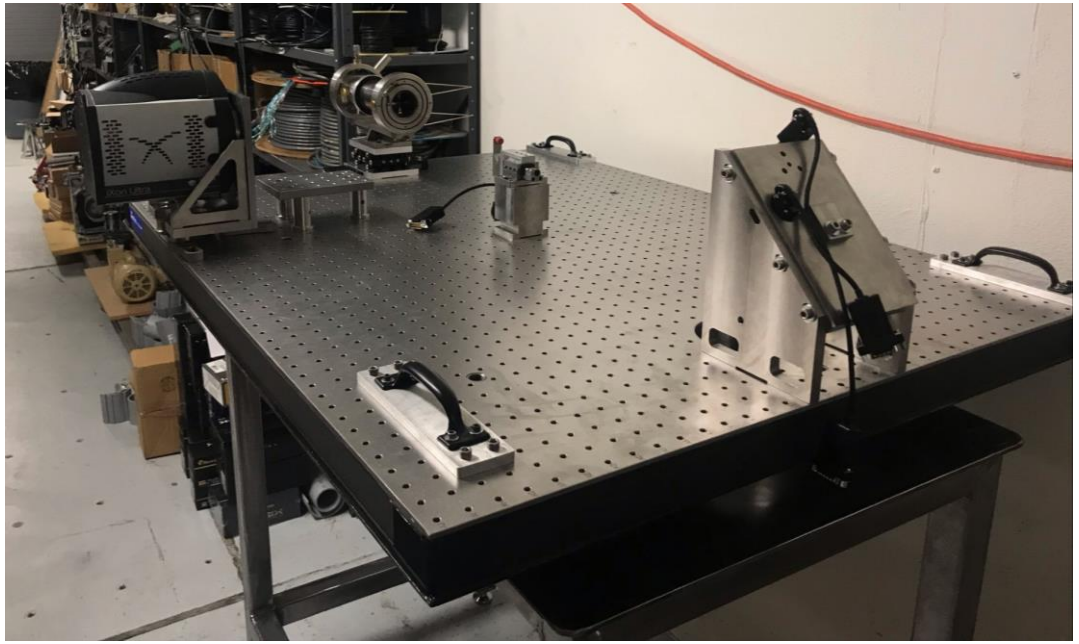
Will install this unit onto the telescope to work on telescope control

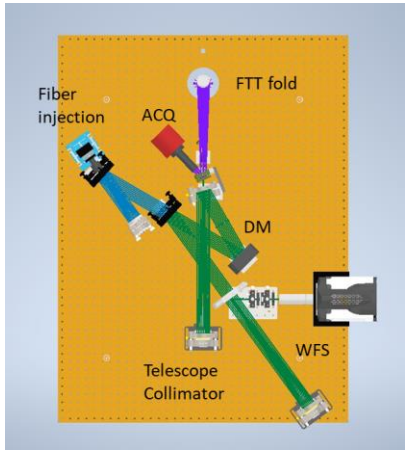
Ball socket with x/y translation

Side to side rotation

2nd and 3rd point with in/out rotation
Over constrained by spring to hold table against pads

Nasmyth Instrument Bench



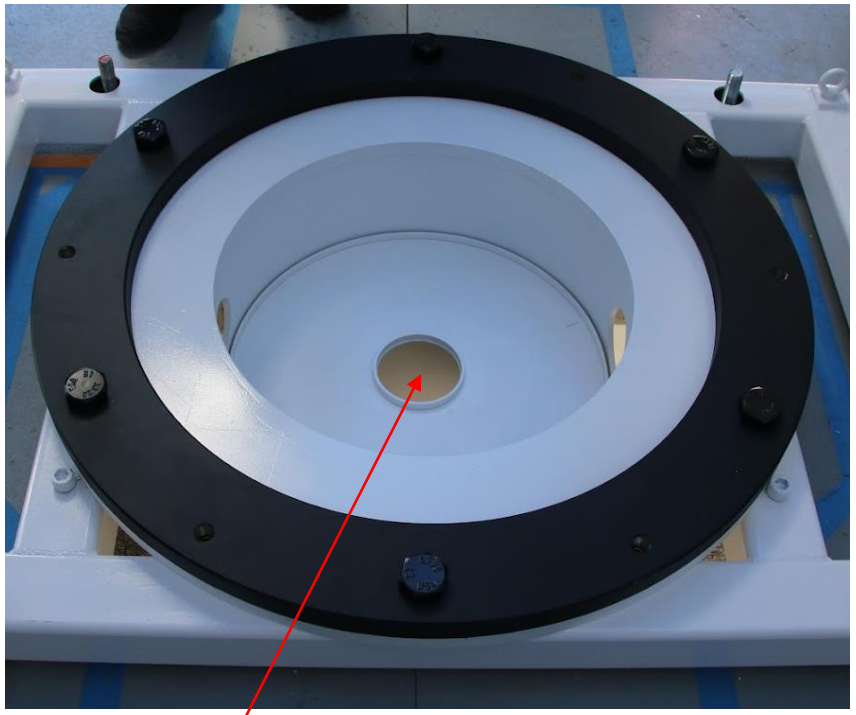


- Since the meeting last year, focus moved to the injector/collimators required for getting light from S2 and S1 using the ALOHA fibers.
- The only large items that are not ready are the DM and wfs camera- use zwo for initial testing
- Awaiting last parts from GSU machine shop to start building the bench

Fiber Transport

- Before-
  - Conduit- cost vs. budget
  - Highly insulated pipe above ground with added
  - Shield from the sky
  - Trench? Deep or just below surface?
  - Ability to be expanded to further locations
- Now
  - Trench at about an 18 inch depth for thermal stability
  - Insulated pipe where burial not feasible

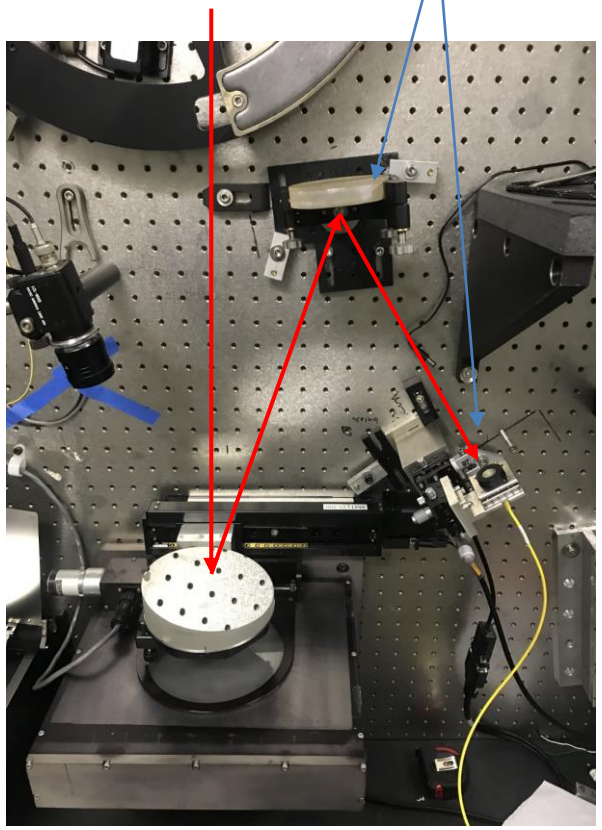
Current fiber conduit for ALOHA
Runs along ground



Fiber to be coiled on the shelf in three loops allowing
Expansion and constriction of the loops as the telescope rotates
Then propagation on the outside of the pier to the ground
Power and communication goes through middle hole

Fiber Injection for CHARA Scopes

T/T fold and focus stage - zaber control



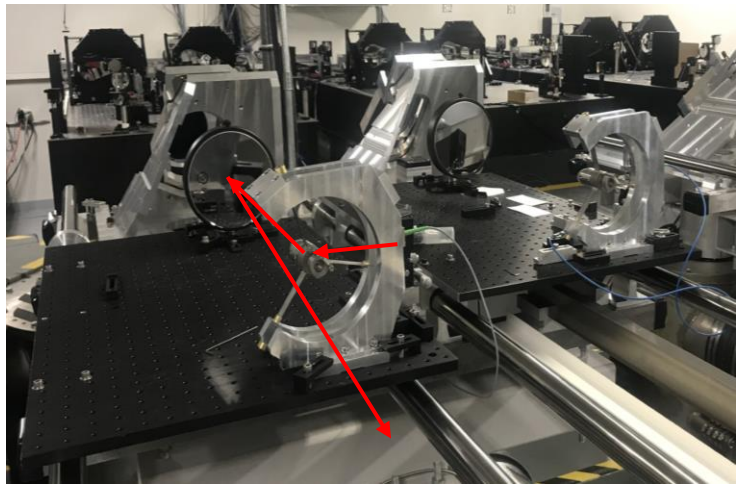
Progress:

While waiting for h band fibers, we have started to use the ALOHA fibers to do initial testing

- Design allows the fold mirror to remain during other modes of the telescope
- Initial alignment- coupling still poor
- Hampered by beacon thermal focus changes
- Required 350 ms exposure on Sirius; will need to reduce that by a factor of 20 or so
- Estimate 100 pixels for 0.1 um in separation for our green and red lasers, we get a longitudinal coherence length of about 0.4 mm. very good for searching but might cause us to not have enough sensitivity
- Hband fibers coming soon

Immediately seen when DM loop closed.
T/T was not enough.
Good alignment between cal source and beacon

Fiber Collimation 1 of 2



Collimators on S1 and S2 OPLE rails

On-axis parabola: Edmund Optics 610 mm fl
Central obscuration 23%- 10% flux loss
CA of DL 135 mm- 10% flux loss

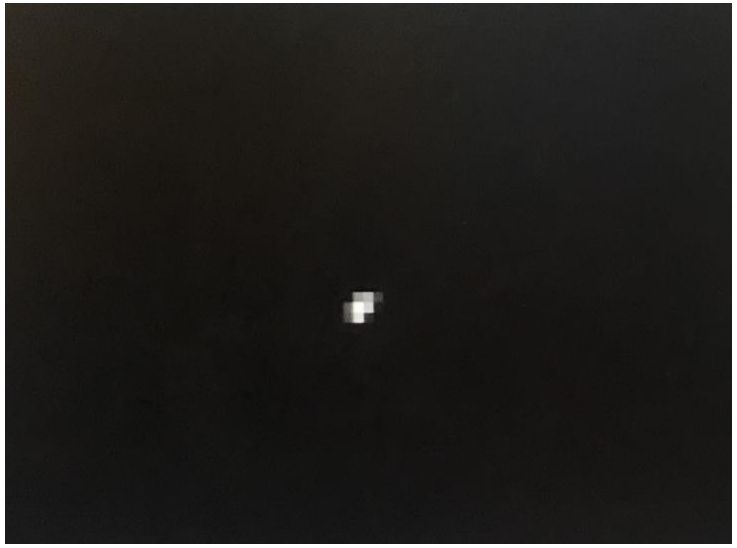
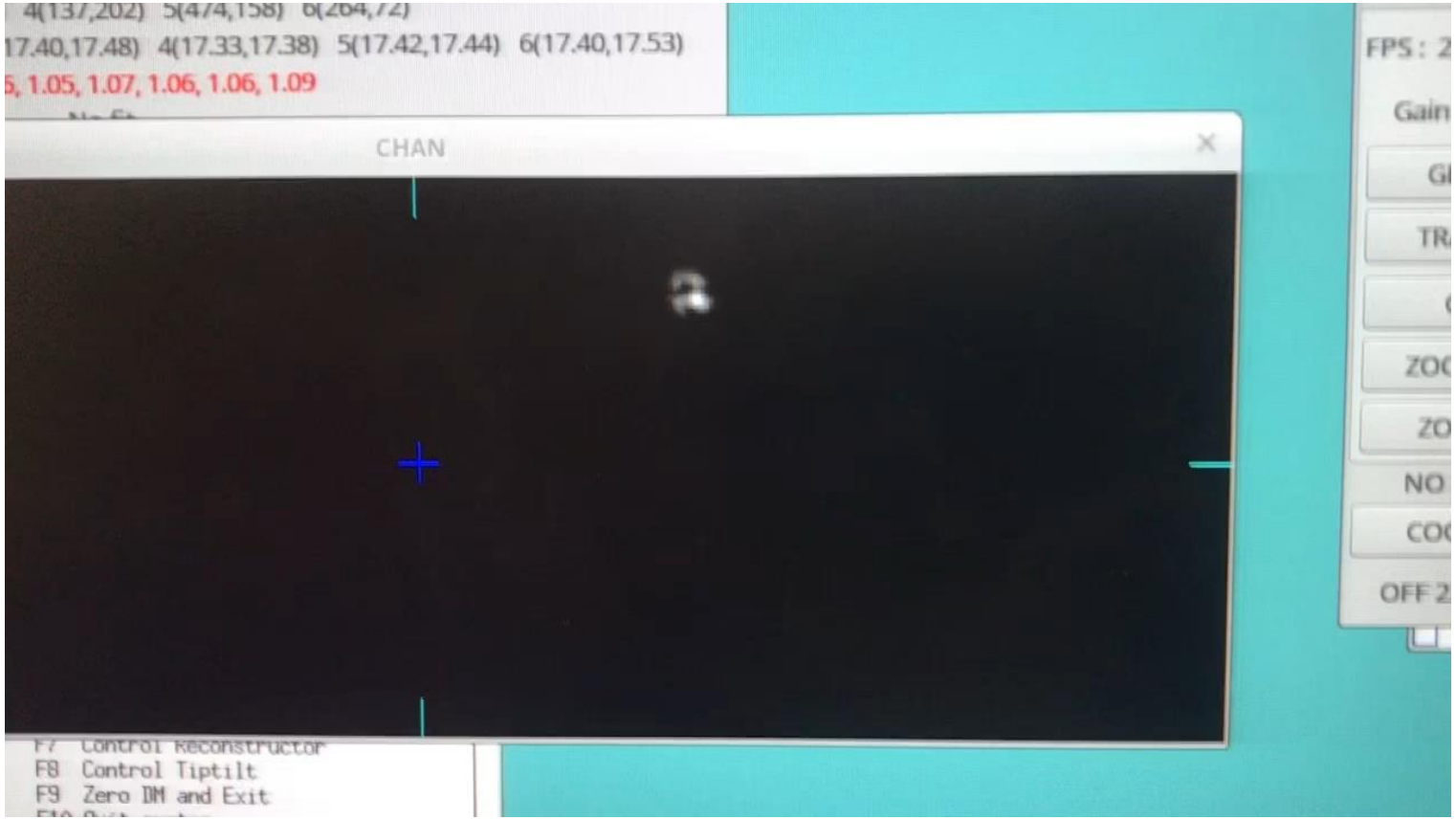


Image on chancam: labao set to default defined in non fiber mode

Fiber Collimation 2 of 2

Start: open servo with a saved flat; end with closed loop
Seems to be some lab seeing before the labao wfs



Software

1. Fiber injection current telescopes- zaber tip/tilt and focus; simple spiral search capability
2. Chara servers for controlling planewave telescope and dome

Fiber Zero Path Stabilization

- To follow ALOHA design
- Current designs for the injector and collimator have room for modifications to include pick offs for the metrology beam
- Hopefully not needed initially for two telescopes
- For three telescopes in near future, control between two scopes.

Summary/Future Work

- Enclosure built
- 1 meter telescope from PlaneWave has been delivered; install 3/19
- Nasmyth instrument bench components almost all in
- Fiber transport design almost mature
- Initial fiber injection/coliimators built

What do we have left? Lots

- Iron out fiber metrology system design
- Experiments on fiber stability- Ongoing
- Installation of the fiber conduit
- Build, test, and integration of the nasmyth instrument bench on the mobile telescope
- Continued work on the control software
- Fringes
- Then the tough work begins