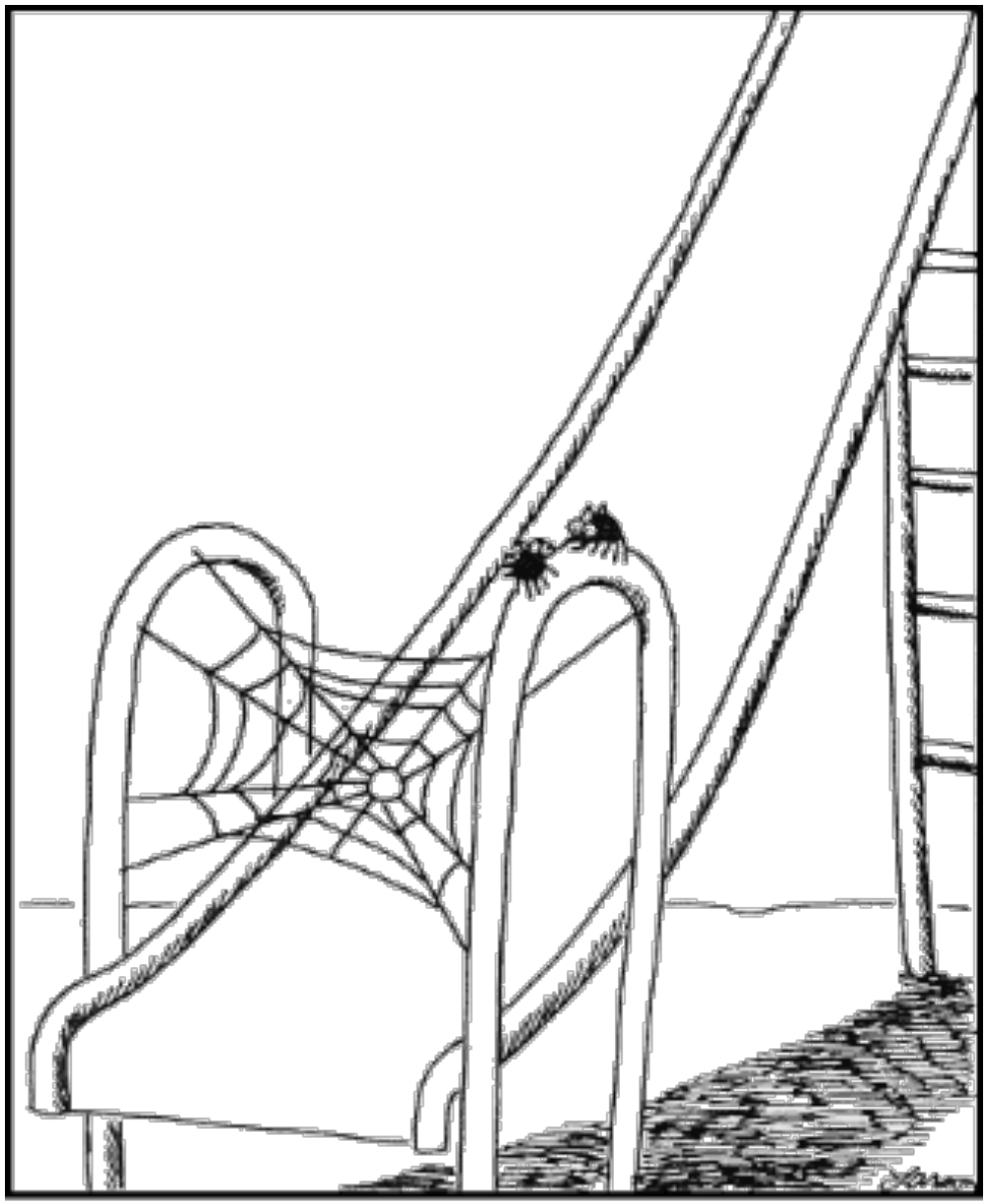
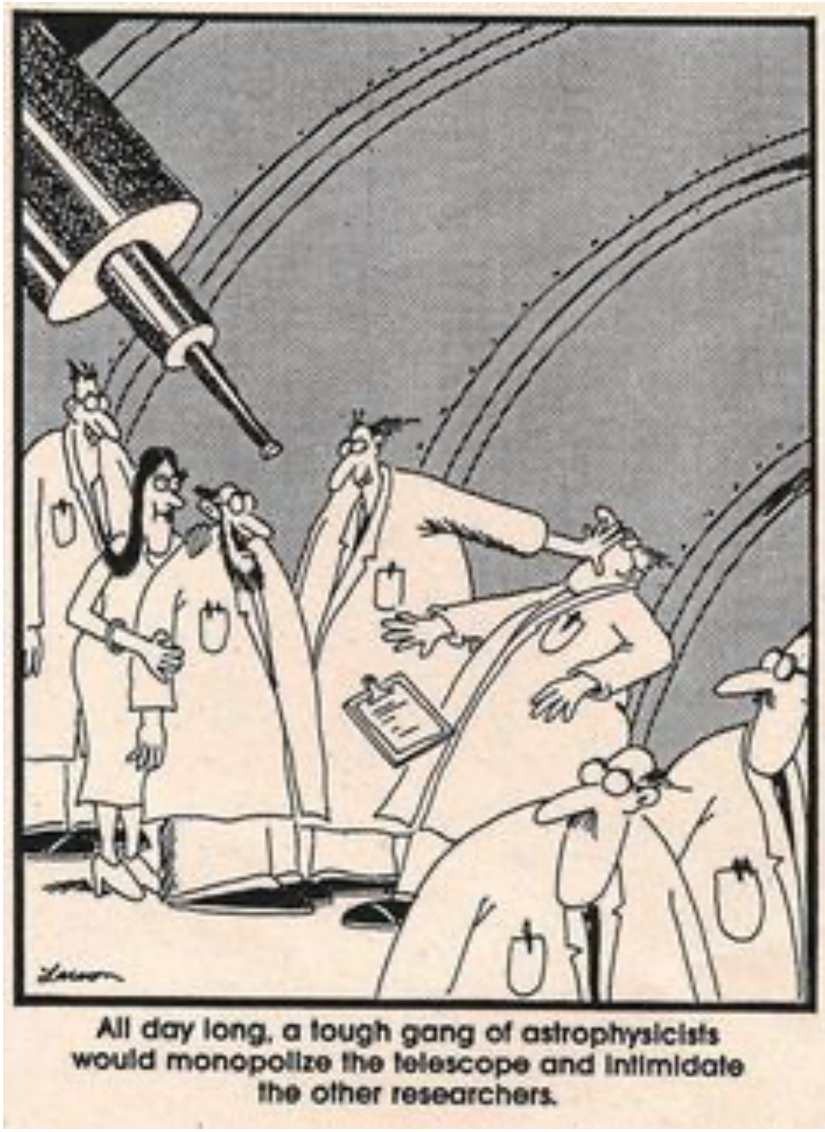


CHARA Infrastructure Upgrades

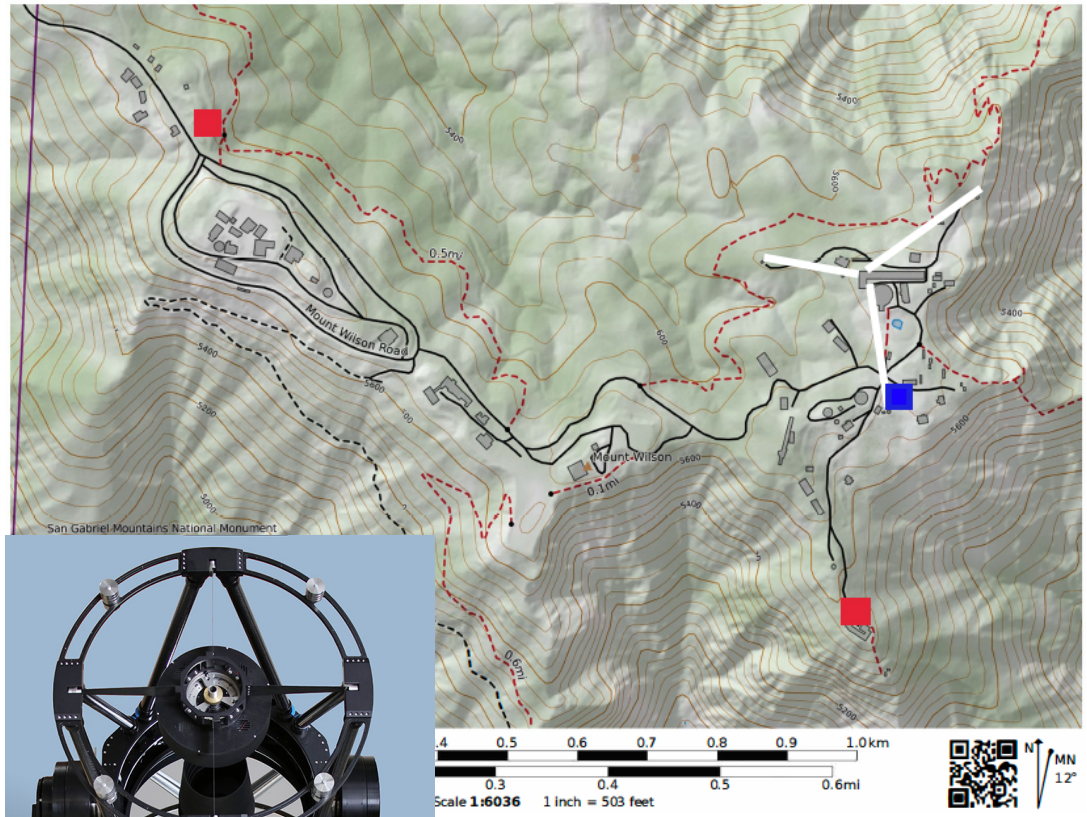
Theo ten Brummelaar

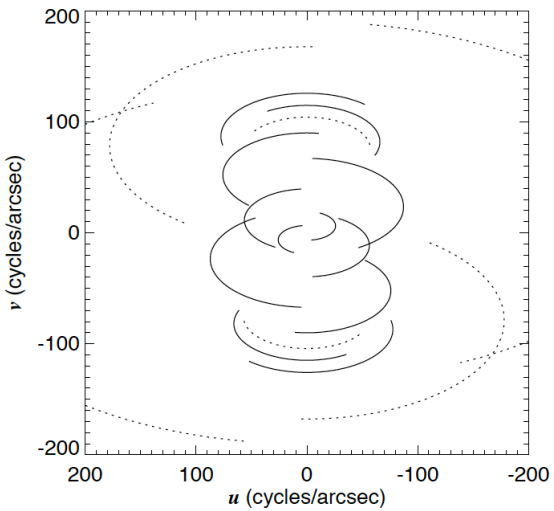
There are lots of things going on, and some others soon to start:

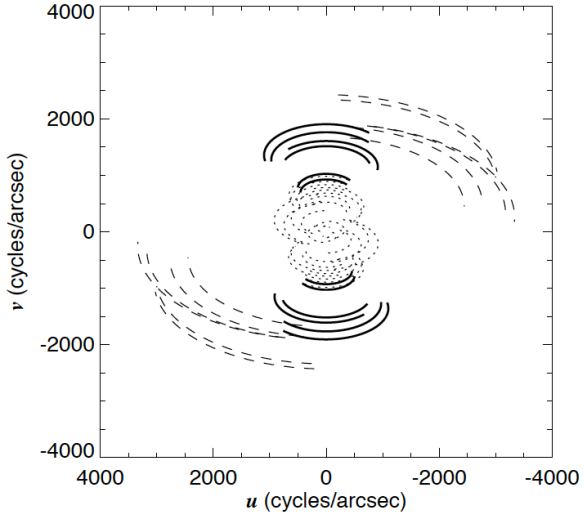
- 7th Telescope (NSF/MRI).
- Reference Camera (GSU).
- Tiptilt Camera (GSU).
- LDC Glass replacement and expansion (NSF/ATI/Nice).
- SPICA (Nice).
- MYSTIC (Michigan).
- ALOHA and Optical Fibers (Limoges).
- OPLE Control System (NSF/MSIP).
- CHARA Office Exhibition Space (NSF/ATI).
- Vacuum System/Coating Facility (NSF/MSIP).
- Telescope Drives (NSF/MSIP).
- MWI Exhibition Space (NSF/MSIP).
- CLASSIC++ (NSF/ATI).



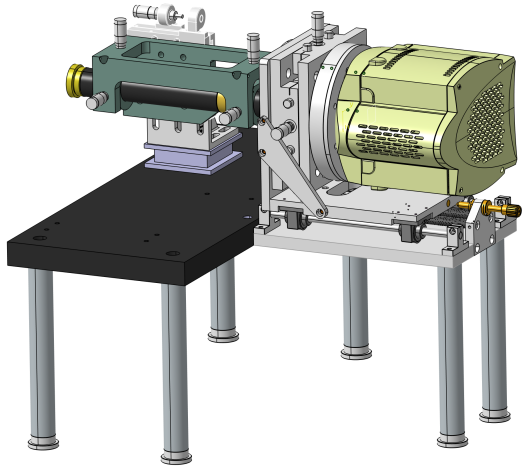
A Seventh, Portable, 1m Telescope for CHARA NSF/MRI

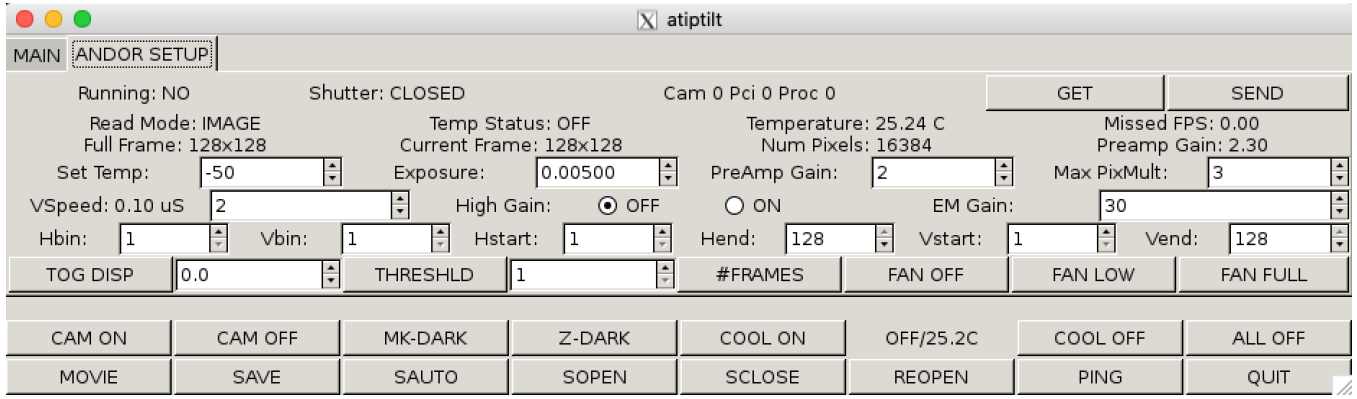






The New Tiptilt System will provide a Starlight Bore-Sight in the Lab.

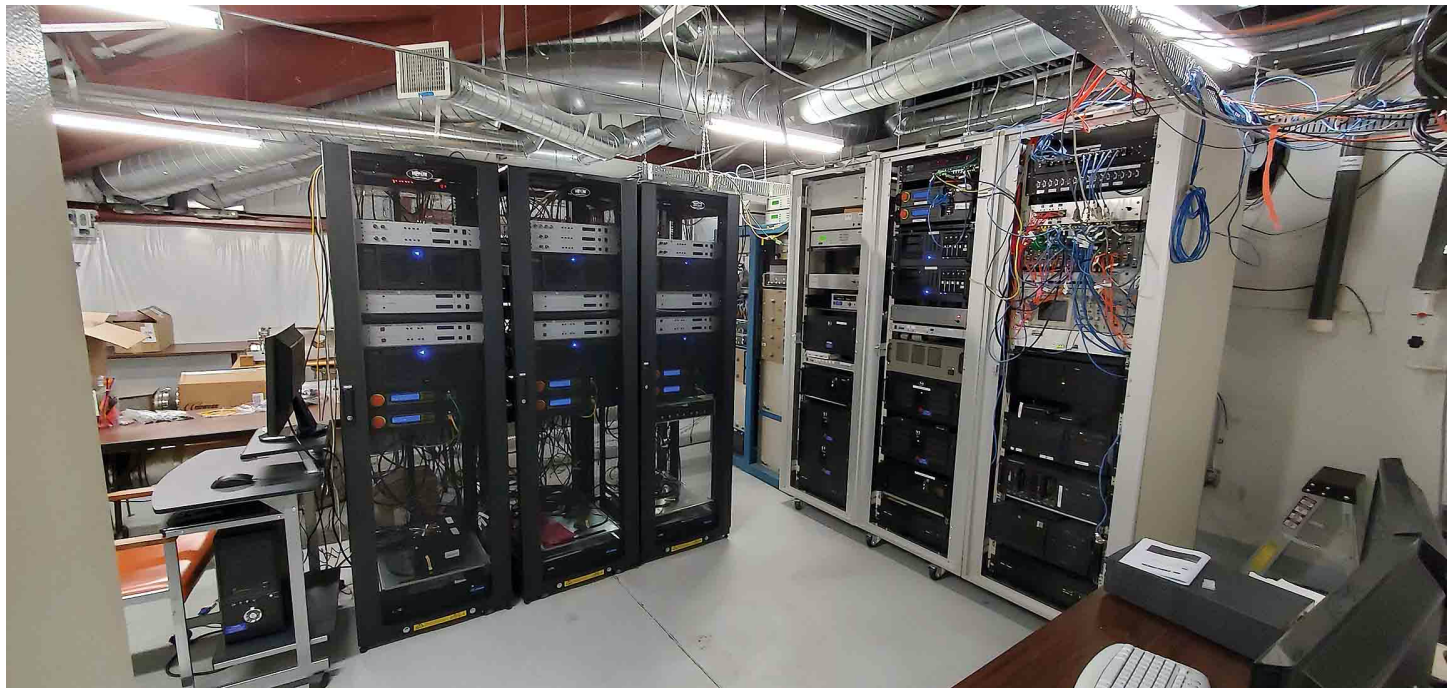


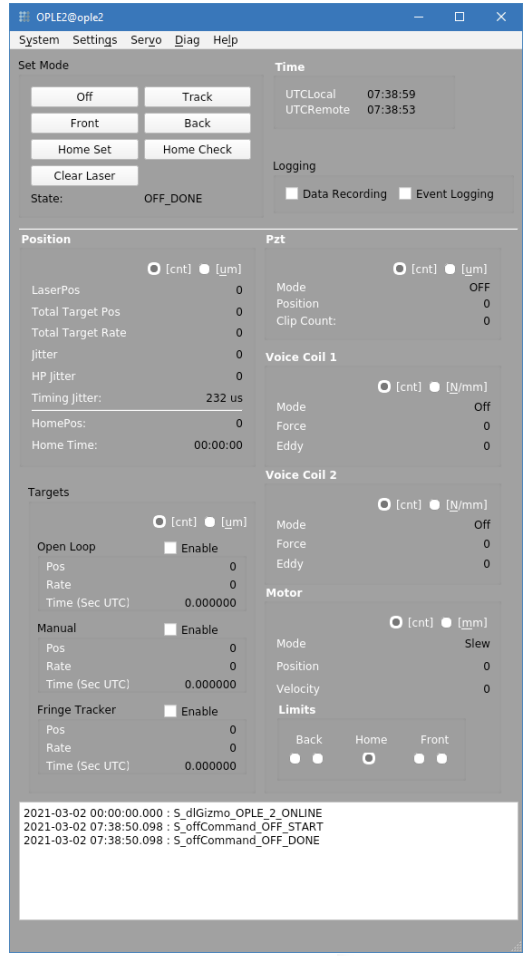


- Uses an Andor EMCCD originally purchased during PAVO development.
- It then spent some years in Australia but is now back here in LA.
- The software is very similar to the WFS system.
- While it can still be used to close the Tiptilt loop it will also provide a reference position in the lab for both the Telescope red beacon, and for starlight.
- It will be possible to close the M7 control loop on starlight rather than on the beacon.
- We are hoping that this will help solve the beam motion issues.

OPLE Control System.

- This $250k project was funded by the previous NSF/MSIP grant and is nearing completion.
- The control hardware was designed and built by AZ Embedded Systems in Flagstaff while the software was ported from VME/VxWorks to Linux by Brad Hines (who led the original software team at JPL) of Planet A Energy.
- Control of one cart has been demonstrated and we expect to test operation with all six carts in late April, with the change over to happen early May.





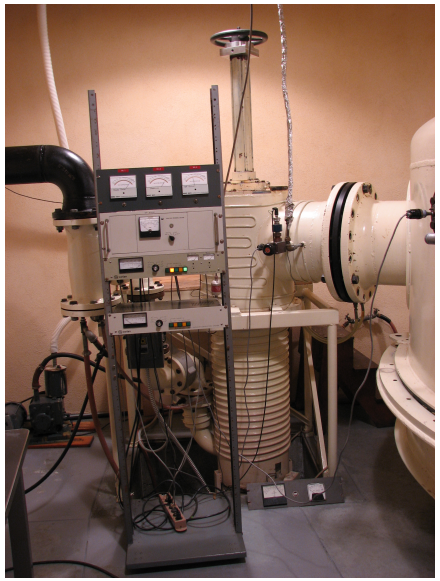
Public Exhibition Spaces

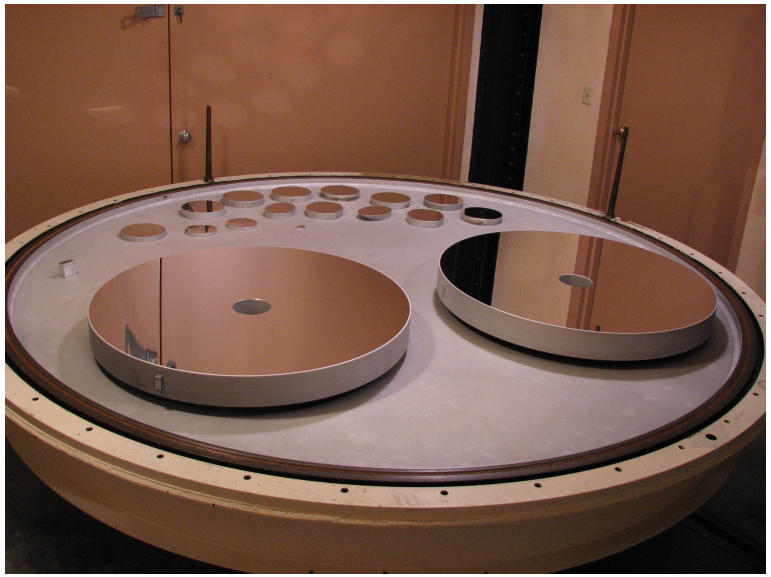
- The $50k upgrade of the CHARA exhibition space was funded by the Nation Science Foundation CLASSIC++ program as part of the public outreach efforts of CHARA and WMI.
- This includes updating the light boxes to large screens, an upgrade of the flooring and ceiling, installation of acoustic tiles, and will later include installing a laser interferometer in the beam itself.
- Content is being led by Robert Klement with help from Norm Vargas.

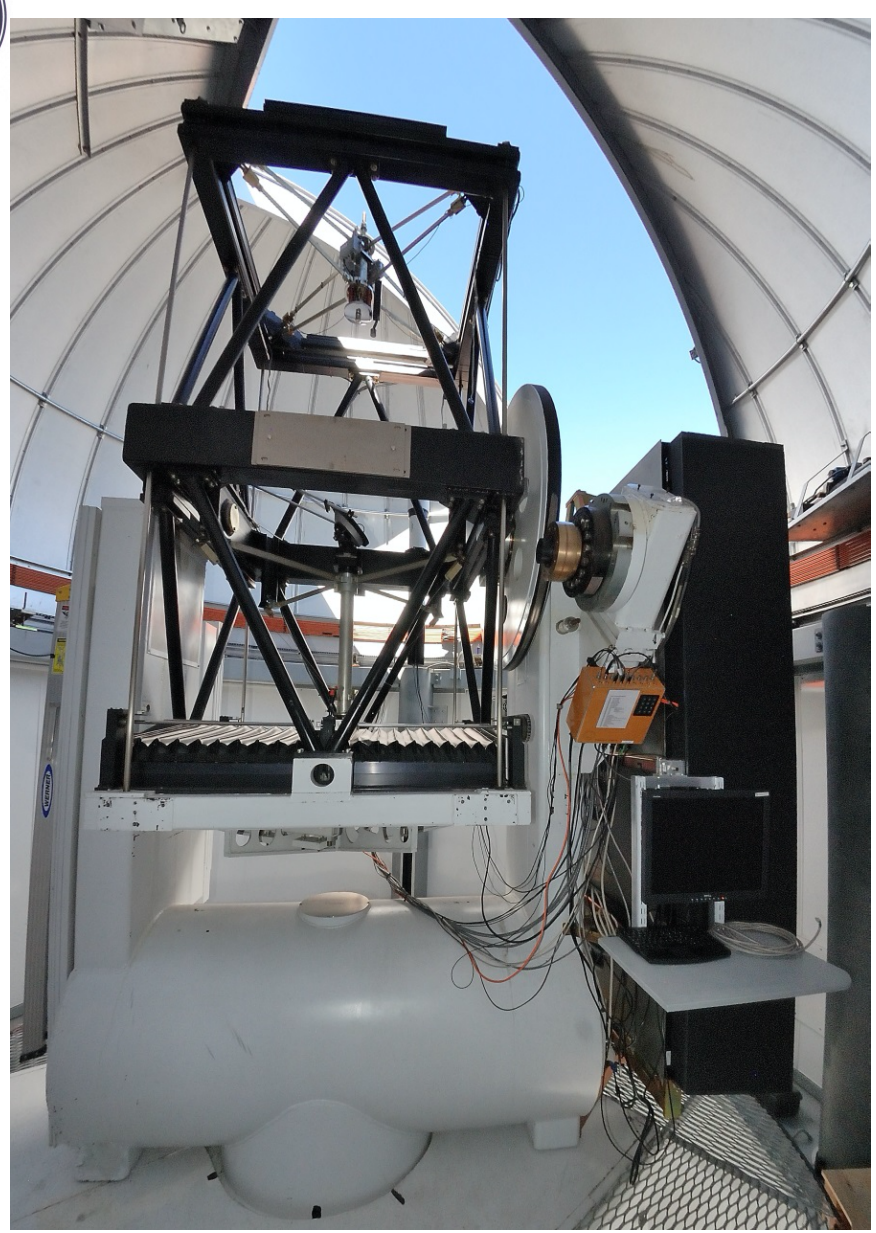
- We are expecting another $100k from the renewal of the NSF/MSIP for similar upgrades to the main MWI museum and meeting space.
- This will include installing modern video projection and other presentation equipment, upgrading the restrooms and other building issues including electrical systems.

Vacuum System and Aluminizing Chamber.

- As part of the renewal of the MSIP program we have ~$100k to upgrade the MWI Aluminizing system.
- This project will be led by Larry Webster.
- The 108 inch aluminizing vacuum tank was built at the Caltech shops c.1935.
- We will be replacing its 1935 red rubber main seal as part of the rebuild.
- The current system uses an oil c.1960's diffusion pump and we will be replacing this with a more efficient model. Note that we decided to stay with a diffusion pump since a turbo pump of this size was quite expensive and we didn't really need the added complexity of a completely new turbo system rebuild.
- On right we show the CHARA mirror set after re-aluminizing.







Telescope Drives.

- The telescope drives had issues from the beginning and despite a great deal of work over the years continue to cause tracking problems.
- Some of the drive issues are due to poor balance, or less than perfect implementation of the original design, but slow oscillations at the arcsecond level have always been present, intermittent, and hard to remove.
- These oscillations can be made to come and go by changing the tuning of the Compumotor controllers. These units require different tuning for slew and tracking speeds and the entire system is very temperature dependent.
- The renewal of the NSF/MSIP grant contains ~$250k to upgrade these drives to more modern systems. The current systems are now over 25 years old.

In 2019 we received a $1.2M grant from NSF/ATI to upgrade the CLASSIC/CLIMB beam combiners: CLASSIC++

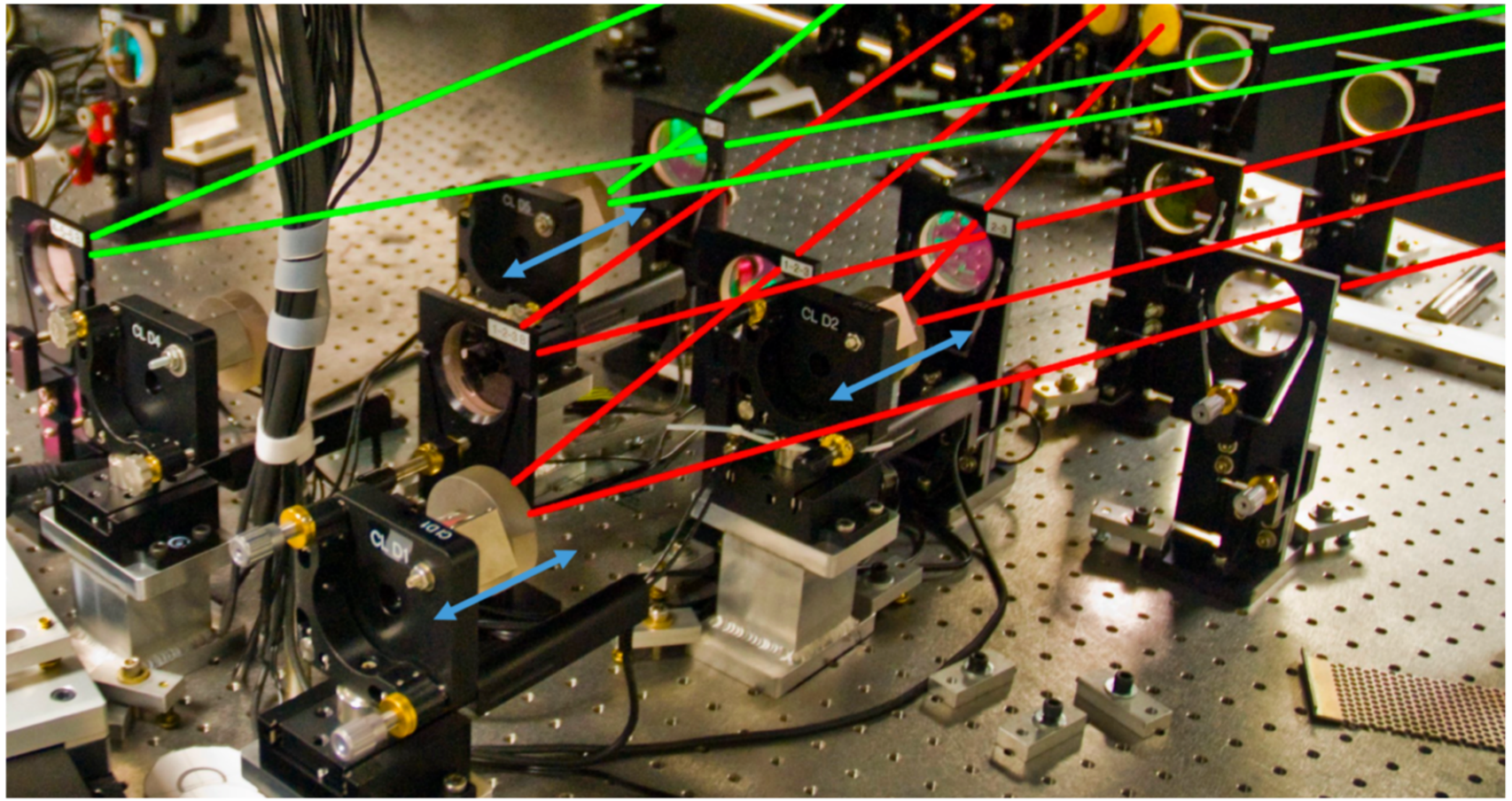
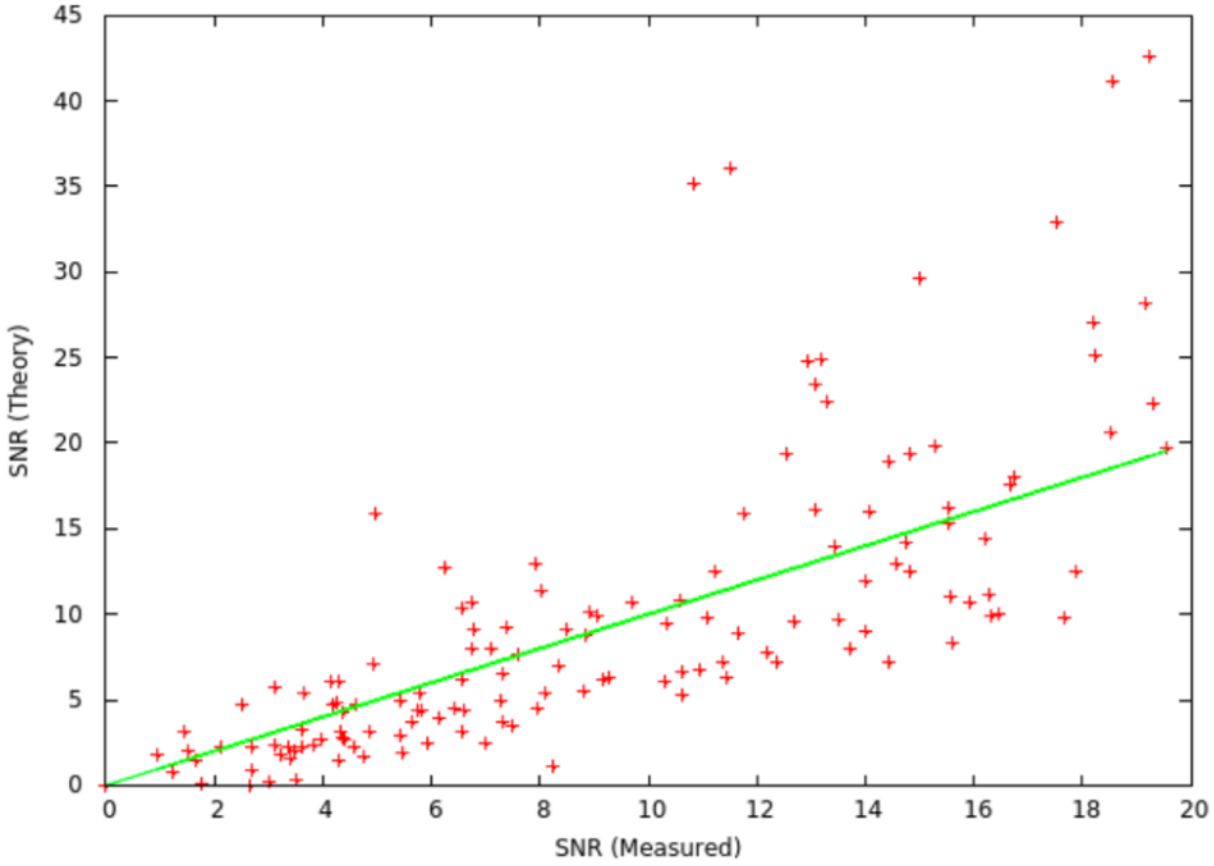


Figure 4. The CLASSIC (Top) and CLIMB (Bottom) beam combiners. The beam locations are drawn in green and red, respectively. The "dither mirrors" modulate the path-length of one beam by up to 150 μm as indicated by the blue directional arrows. The two beam CLASSIC can be reconfigured to form a second three-way CLIMB combiner.



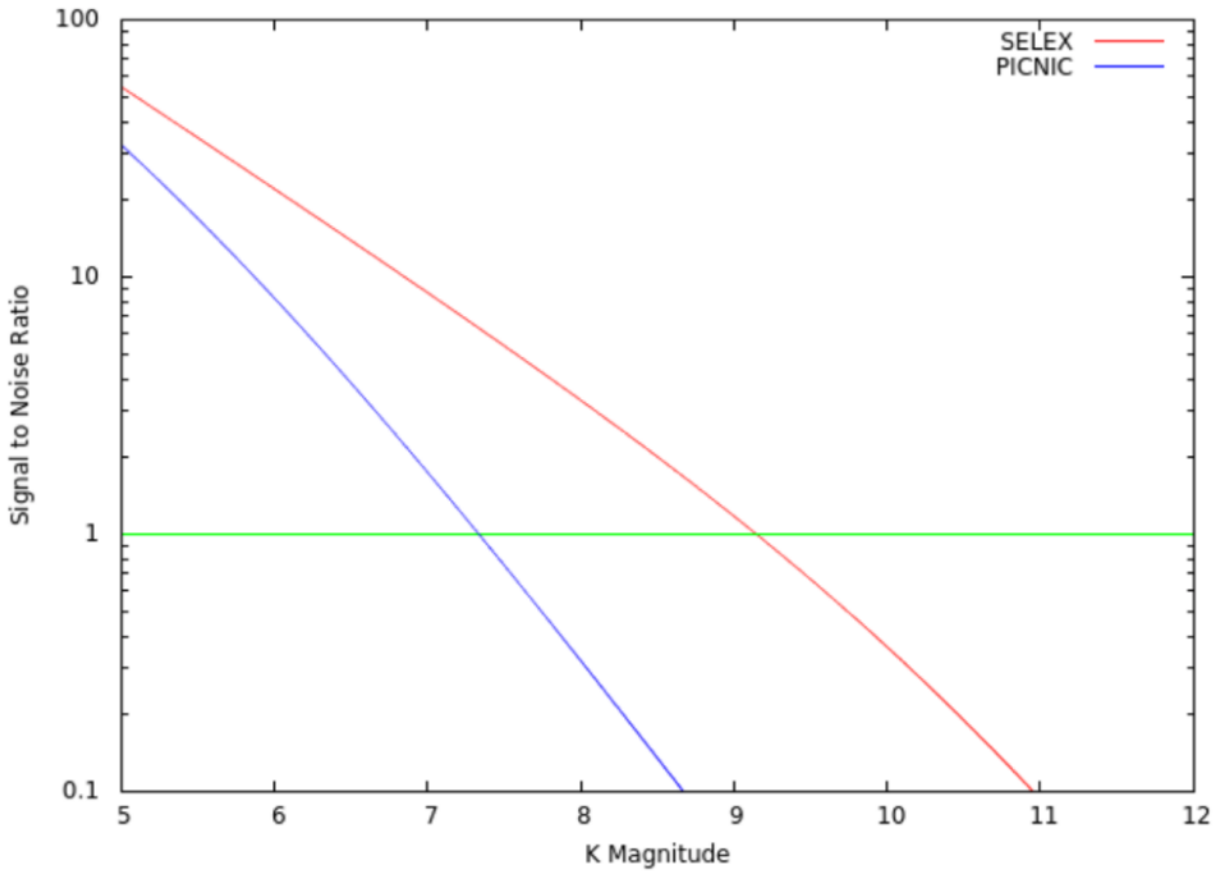
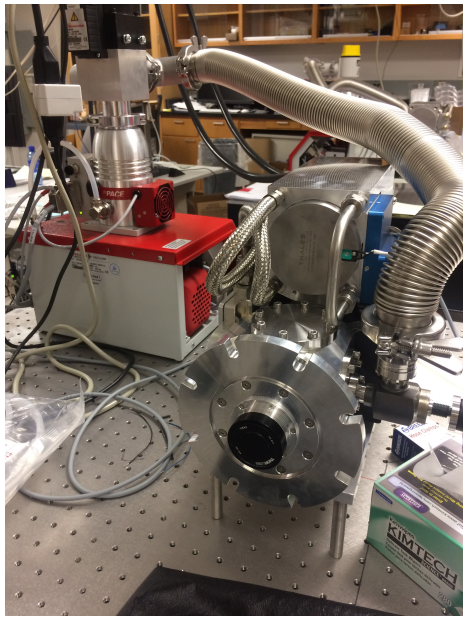


Figure 5. *Left:* Model versus measured SNR of V^2 measurements along with a line showing a 1:1 ratio (green). *Right:* Modeled SNR for H Band in good seeing conditions for the PICNIC and SELEX Cameras. A SNR of 1.0 or greater means that fringes are visible in single scans and the data can be easily calibrated and used for science.

Dr. Cyprien Lanthermann



Previous experience

- Instrumentation:
  - PhD at IPAG (Grenoble, France): Characterization of the MIRC-X + MYSTIC C-RED 1 cameras
  - 1 year Postdoc (KU Leuven, Belgium): Study of the early-stage project MARVEL

- Astrophysics:
  - Multiplicity of massive stars (mostly O-type stars)

- CLASSIC/CLIMB++:
  - Finalization of the optical design following Laszlo, Peter and Marc-Antoine's work
  - Implementation and testing of the new design with an engineering camera on bright stars
  - Characterization and implementation of the C-RED 1 camera
  - Aid in the development of the observation software and data reduction pipeline.
  - On sky testing

- NOIRLab observations:
  - MIRC-X observations only for now

- Astrophysics:
  - Collaboration with Doug, Gail, and Robert on massive stars:
    - Multiplicity of various spectral type, from B-type stars to WR
    - Orbital and mass characterization

The proposal spoke to upgrading the PICNIC based NIRO detector with a First-Light CRED-ONE detector system but keeping the temporal fringe encoding scheme.

This is no longer our plan…..

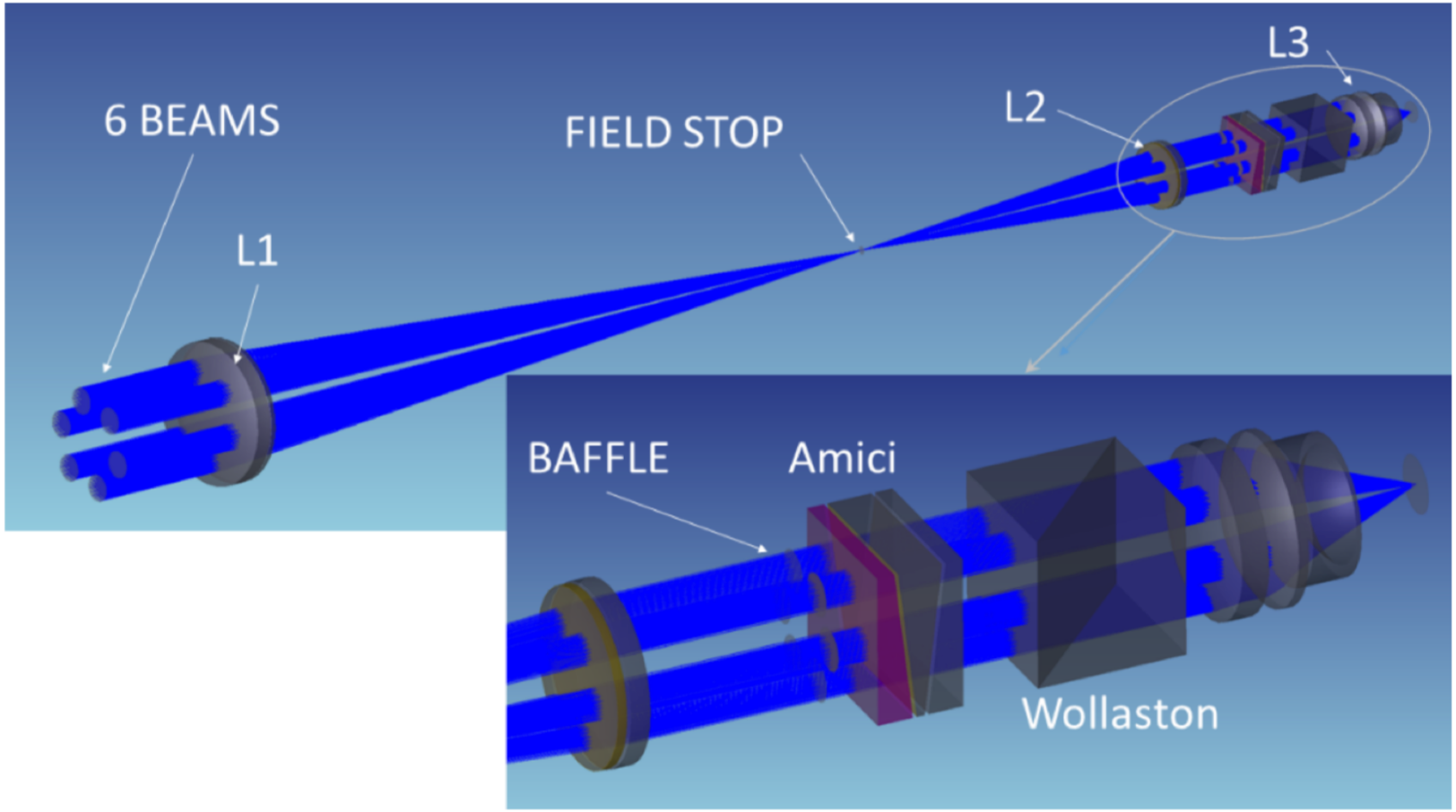


Figure 11. ZEMAX model of the optical design. L1 is part of the existing system, while the remaining cold optics are part of this proposal.