The CHARA Array
Near Term Plans for Upgrades

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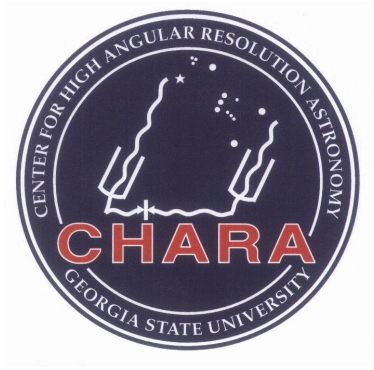
Mount Wilson Observatory

View from the mountain – September 2009



The CHARA Consortium

Georgia State University

NSF

NOAO

THE UNIVERSITY OF MICHIGAN
ARTES · SCIENTIA · VERITAS
1817

SYDNEY UNIVERSITY STELLAR INTERFEROMETER
SUSI
AUSTRALIA

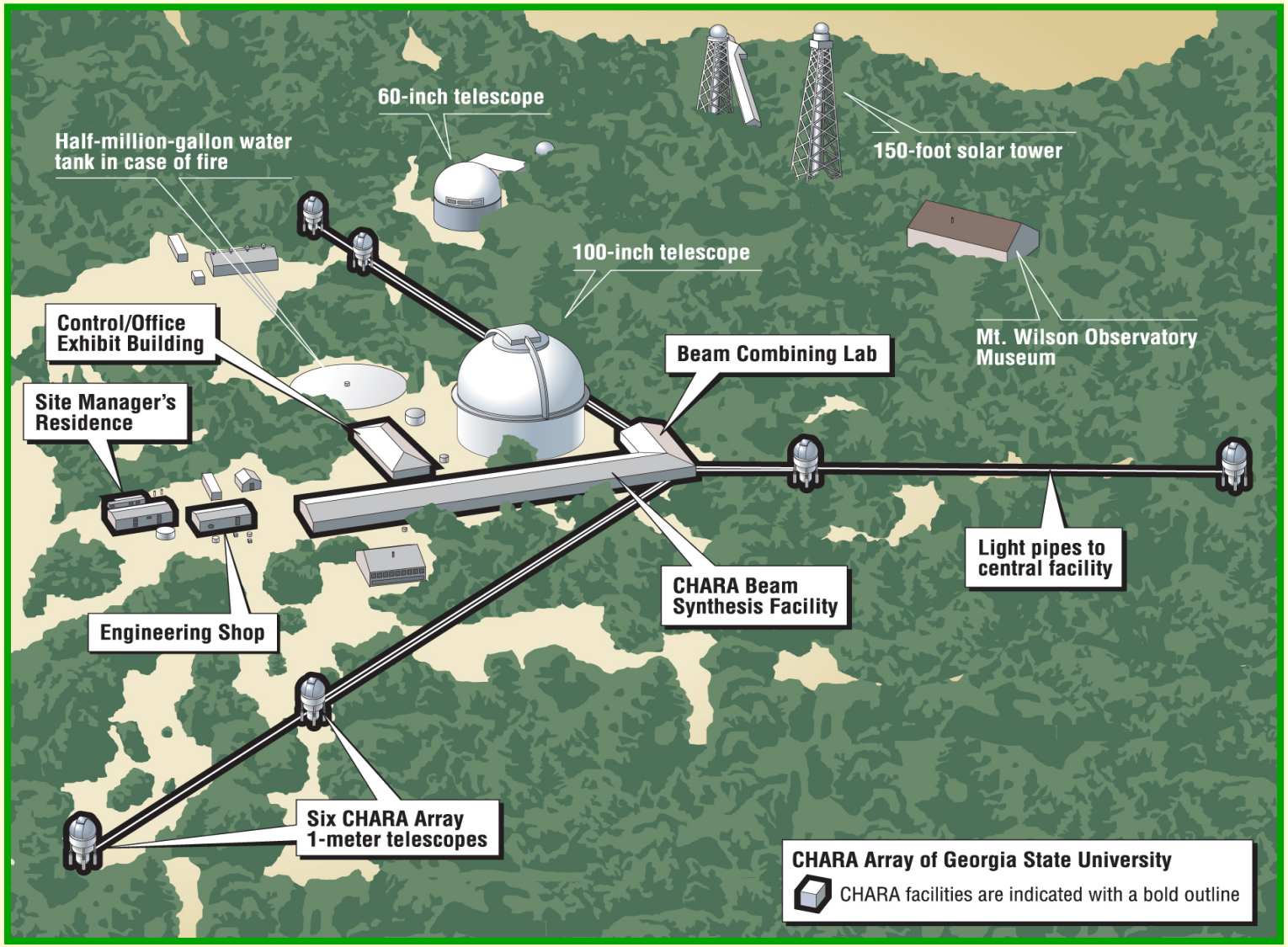
l'Observatoire de Paris | LESIA

Observatoire de la CÔTE d'AZUR

Max-Planck-Institut für Radioastronomie

NExScI
NASA Exoplanet Science Institute

Layout of the CHARA Array



Telescopes

CAD by Laszlo Sturmann

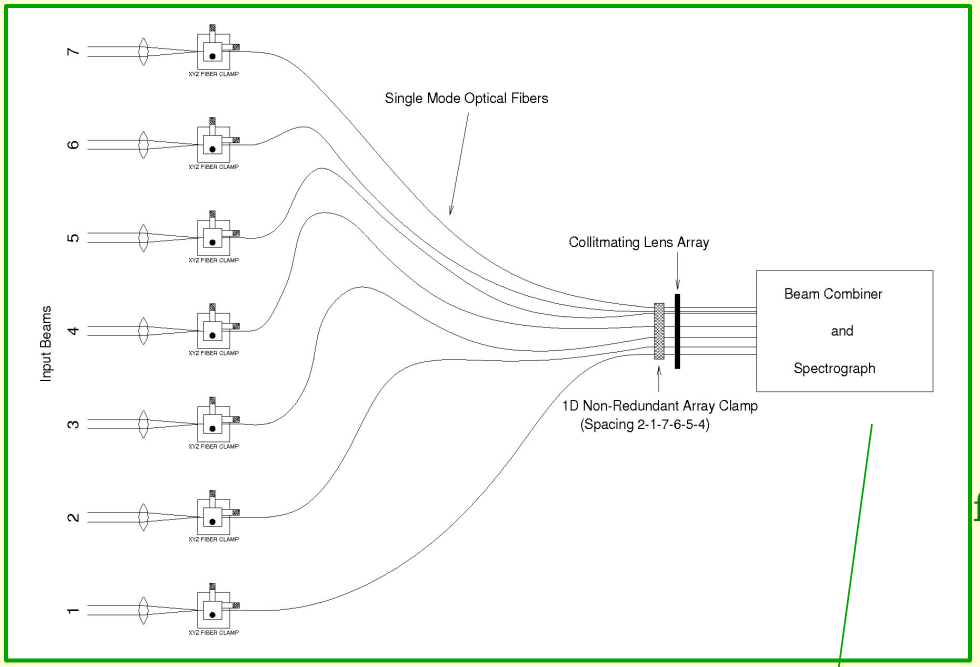
Photo by Steve Golden

The 30 second CHARA tour.

"Beam Combiners are us"

- CHARA CLASSIC – 2 way open air J, H & K
- CHARA CLIMB – 2x3 way open air J, H & K
- FLUOR – 2 way fiber based K band
- MIRC – 6 way fiber based imager J, H & K
- VEGA – 4 way open air V,R,I R=30000
- PAVO – 3 way aperture plane V,R,I
- CHAMP – 6 beam fringe tracker J, H & K

Diagrams from SPIE 1994



Sometimes you actually build what you plan to build

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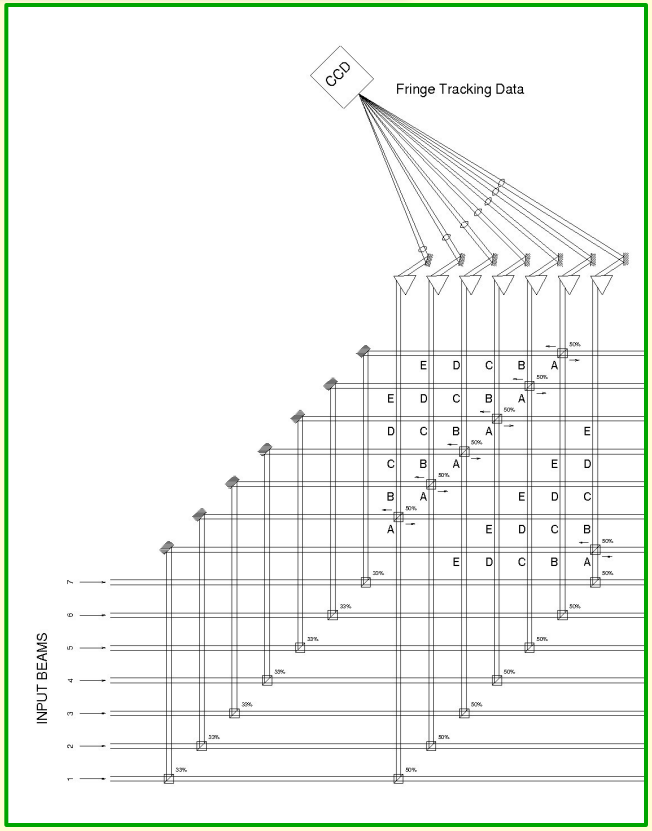
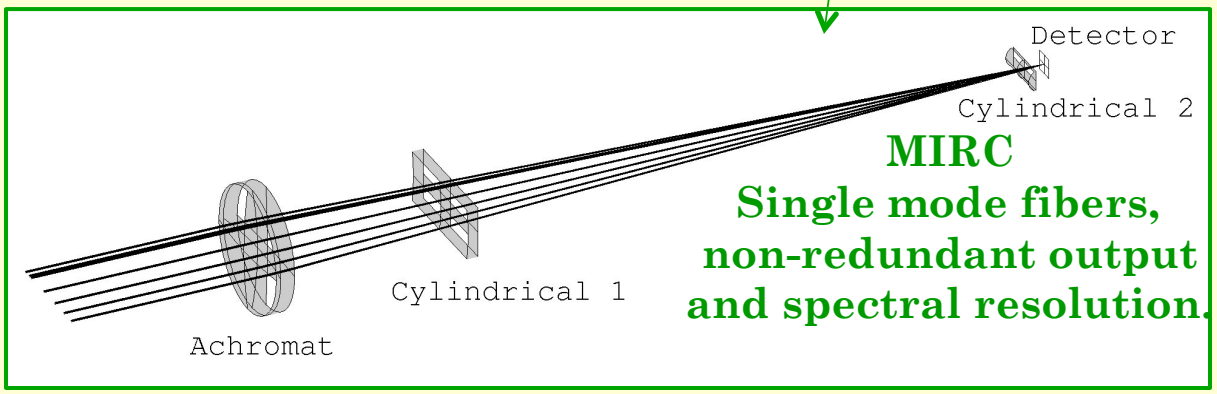
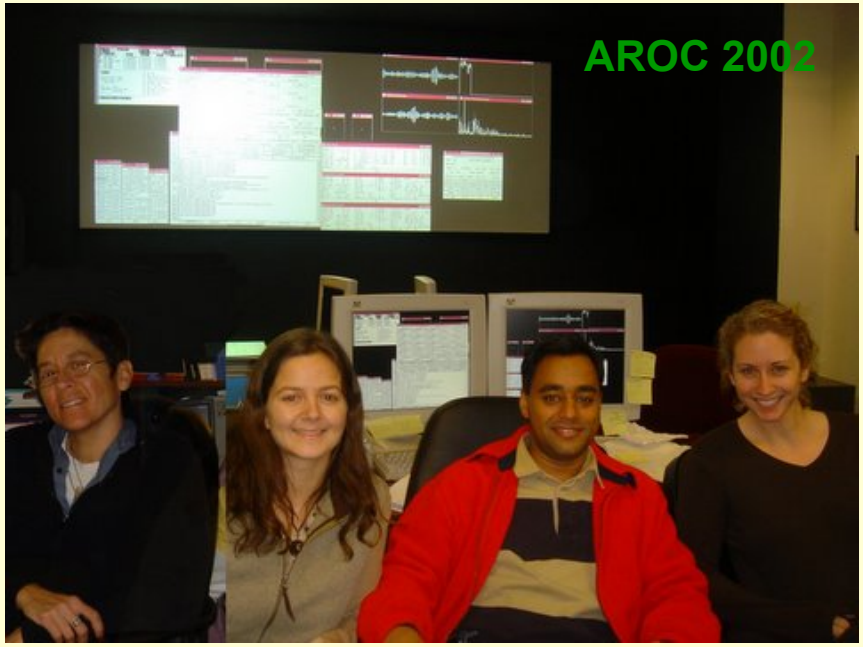




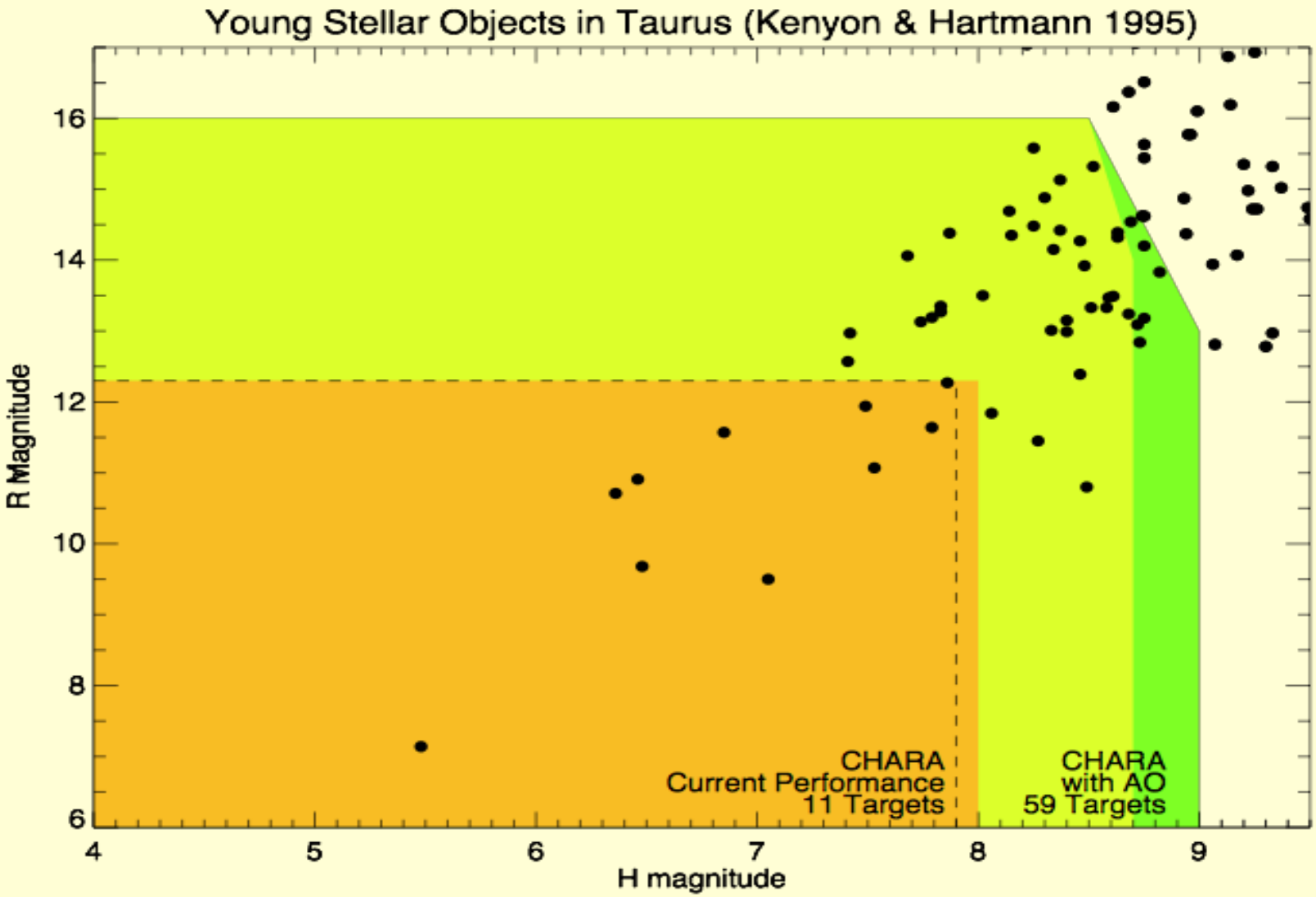
MIRC
Single mode fibers, non-redundant output and spectral resolution.

CHAMP
Separation of science beam combiner from fringe tracker.

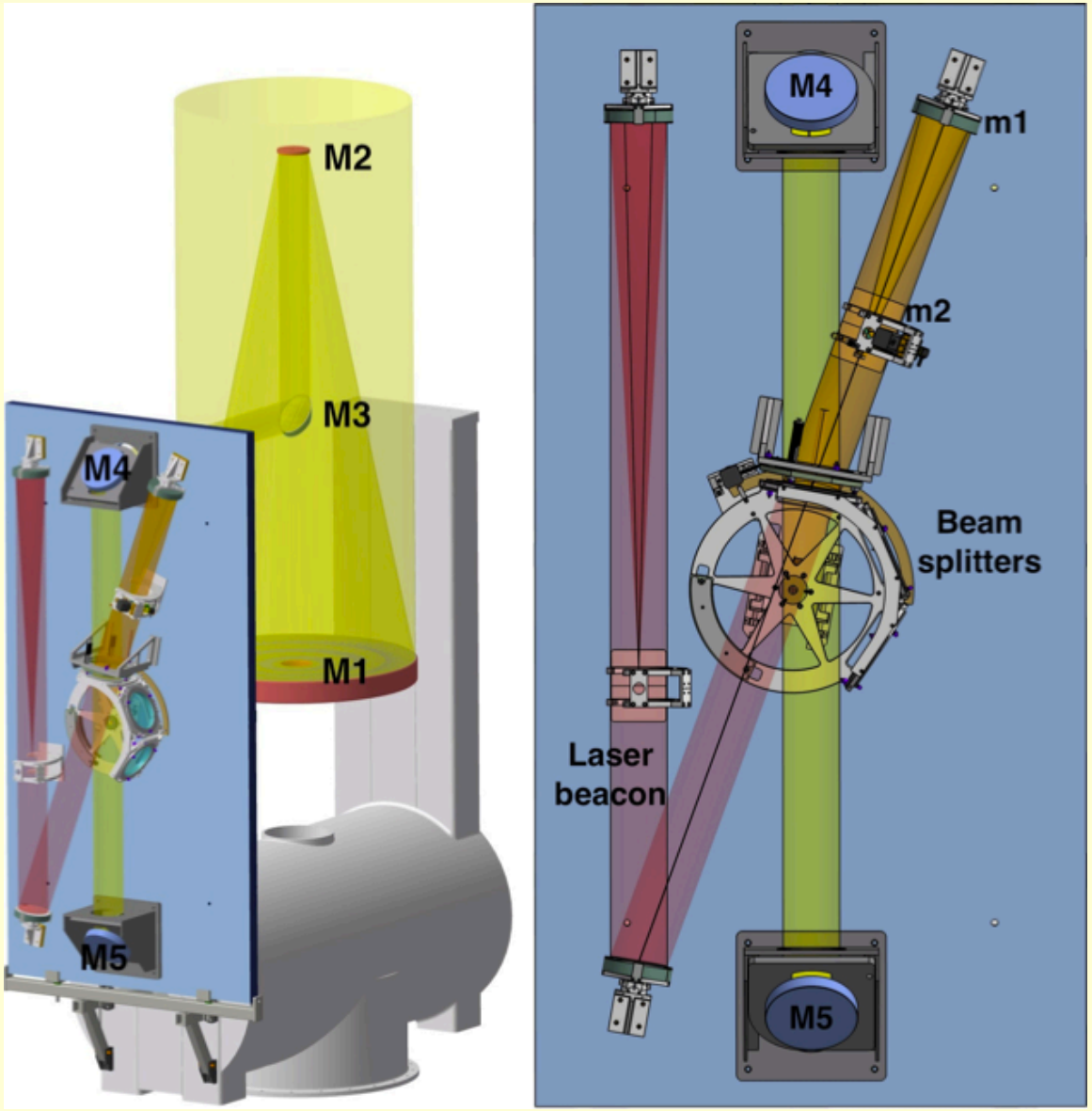
ROCMI 2006



CHARA-AO Program



CHARA-AO Program



CHARA-AO Program

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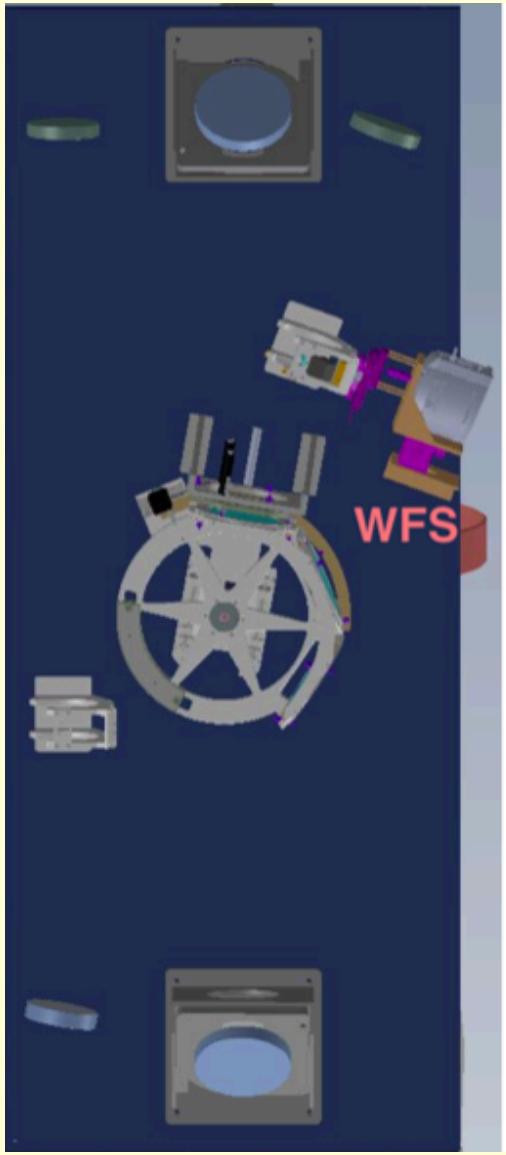
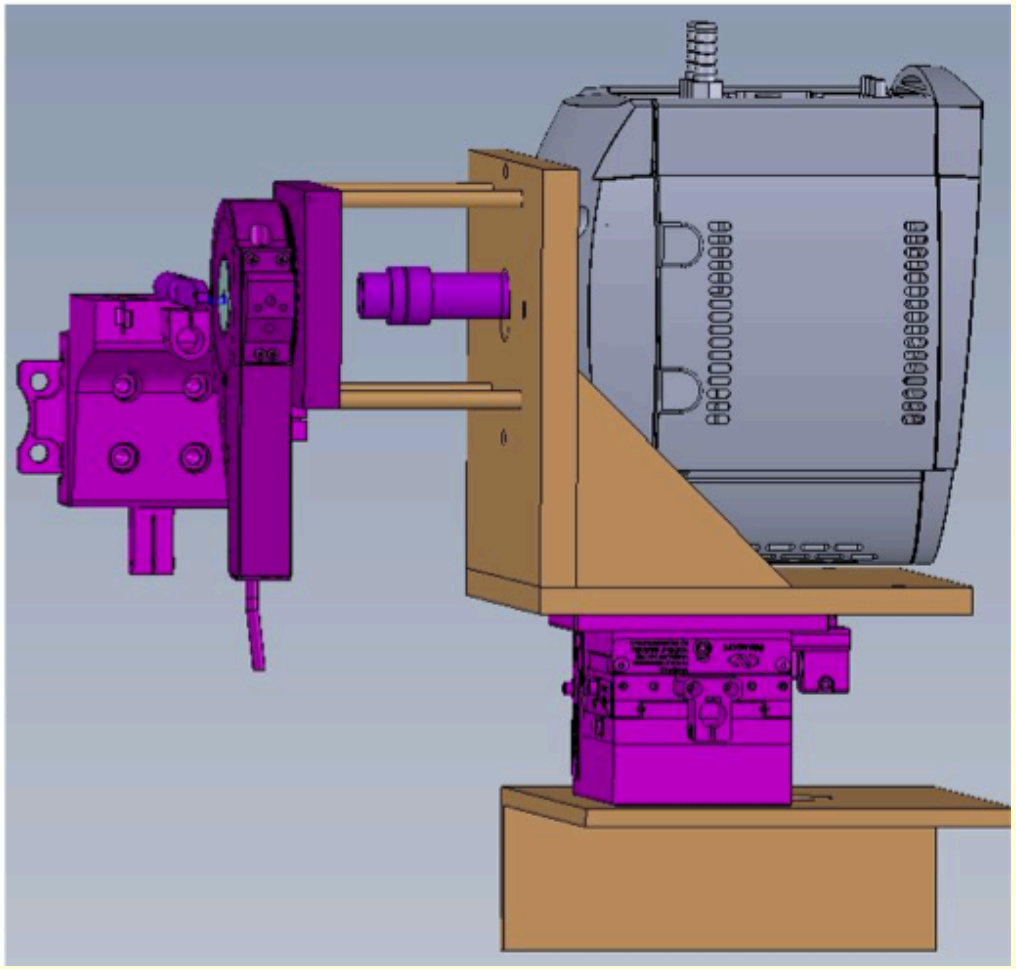
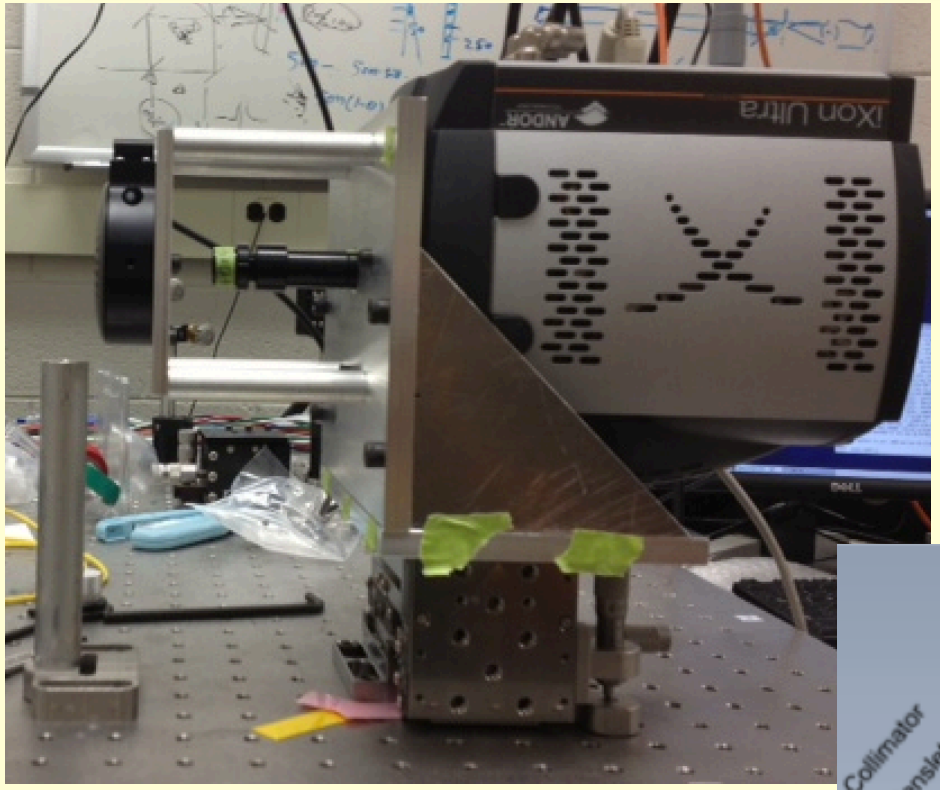
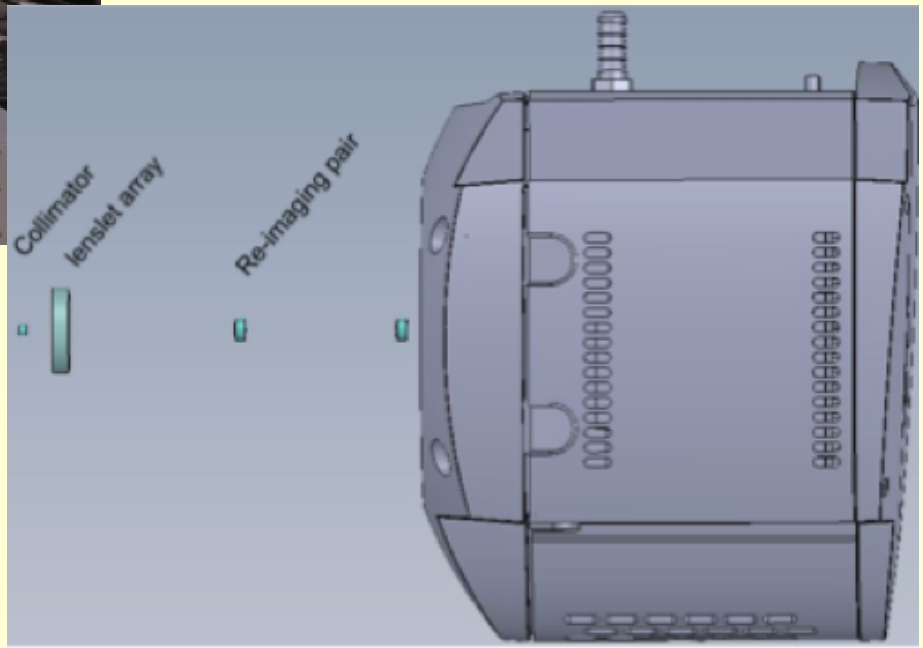




CHARA-AO Program



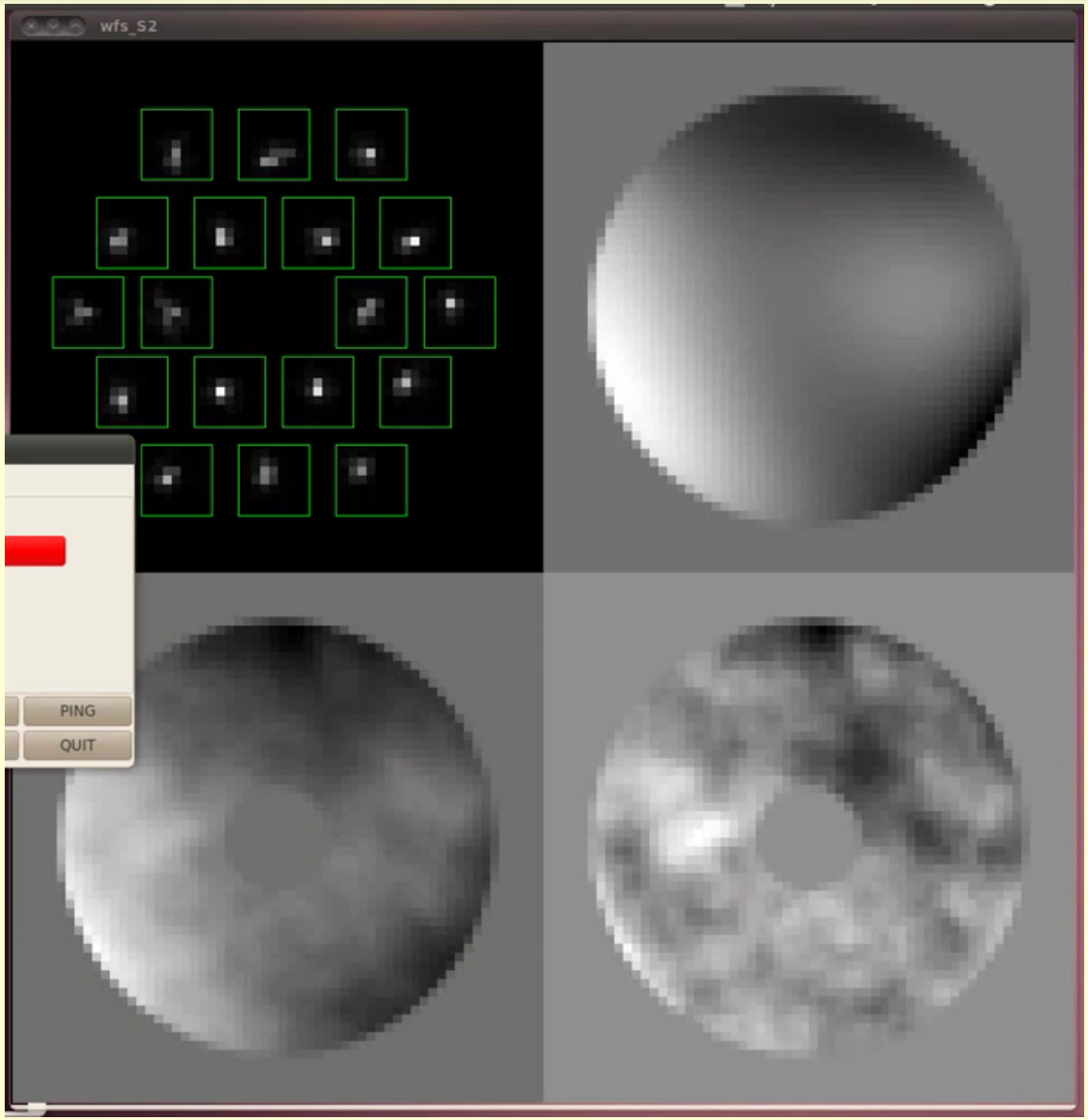


Configurations to be tested

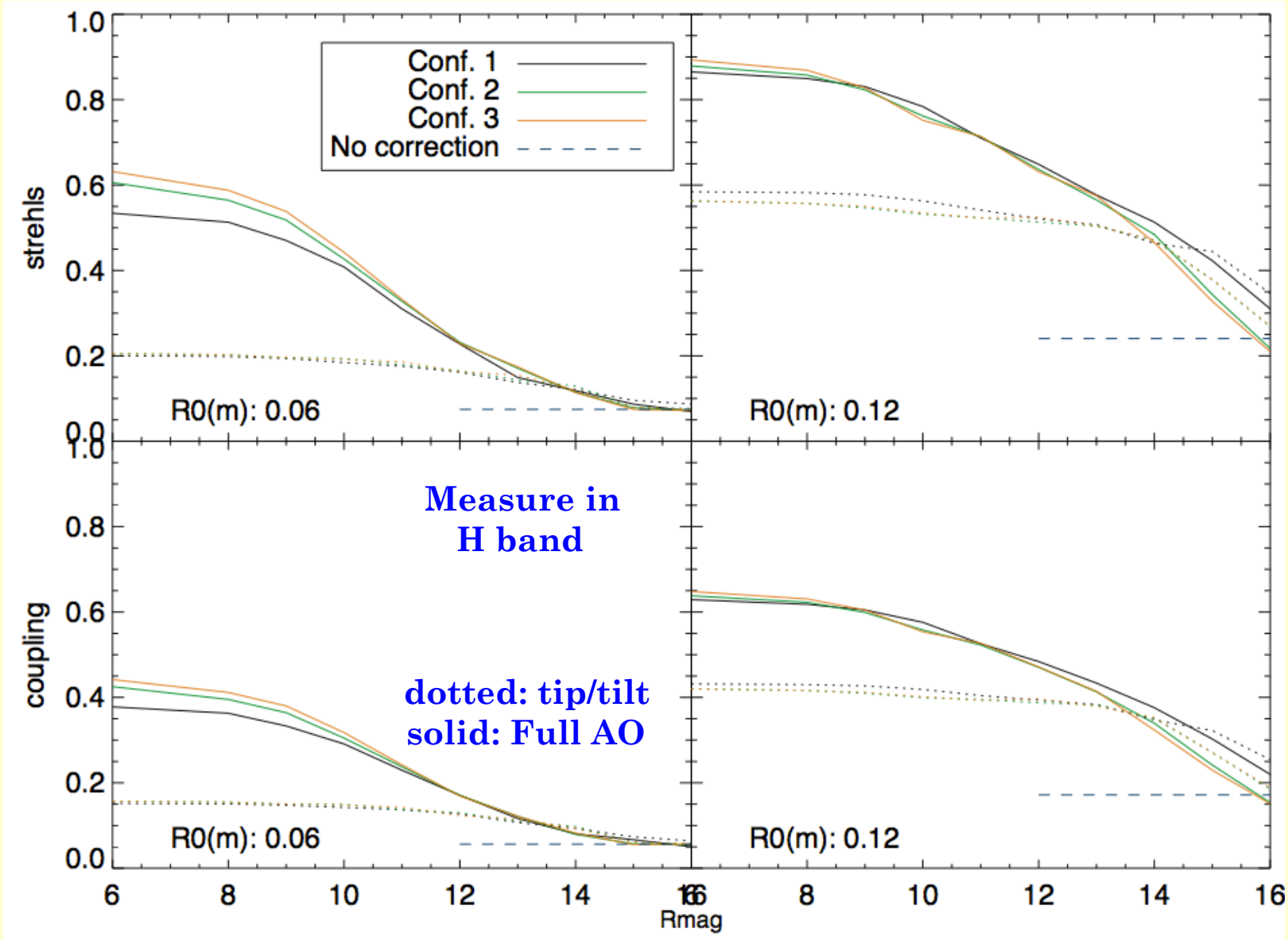
	Pro	Con
More lenslets	Better sampling	Worse SNR
More actuators	Better performance	More expensive

	lenslet configuration	DM configuration
Configuration 1	18-lenslet	31-actuator
Configuration 2	36-lenslet	31-actuator
Configuration 3	36-lenslet	61-actuator

Modeling the full AO system



Simulation Results



Status of the AO Program

- Phase I fully funded by NSF ($1.2M)

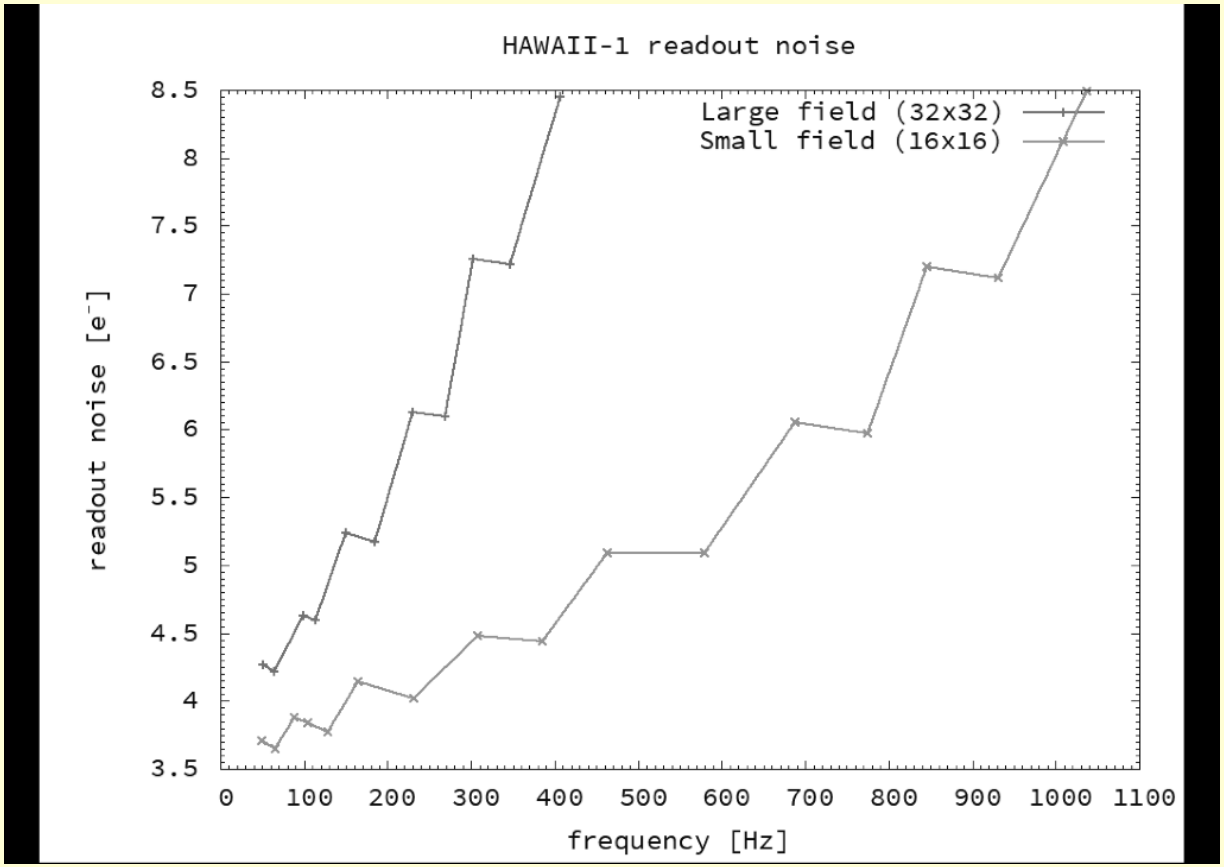
- Phase I includes Wave Front Sensors on all telescopes, ‘Slow’ WFS in lab, and small Deformable Mirrors in the Lab for static corrections.

- Phase II ($1.1M) will consist of adding large DMs at the telescopes and closing the loop.

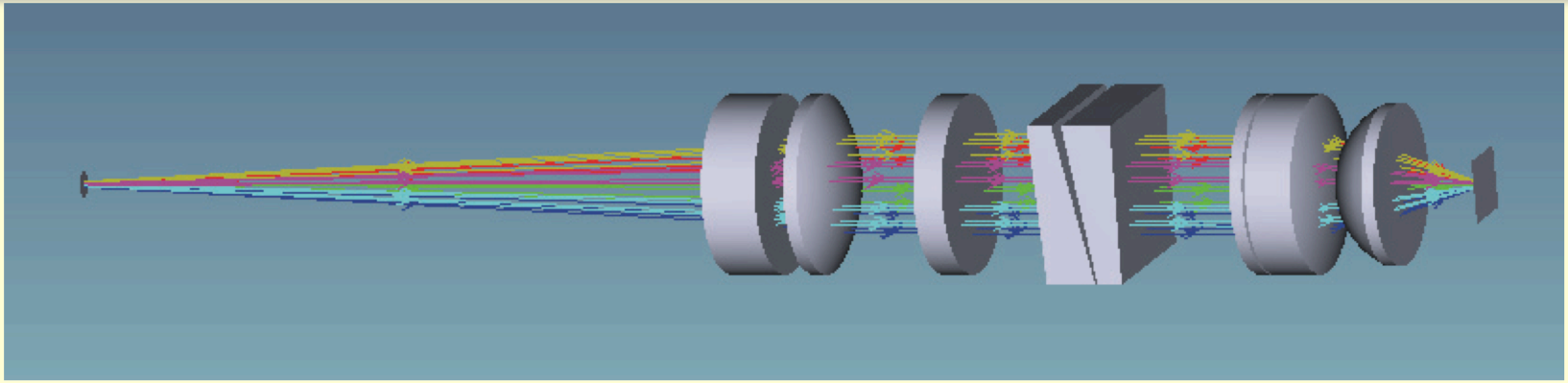
- We will seek Phase II funding once we have had the first science results from Phase I.

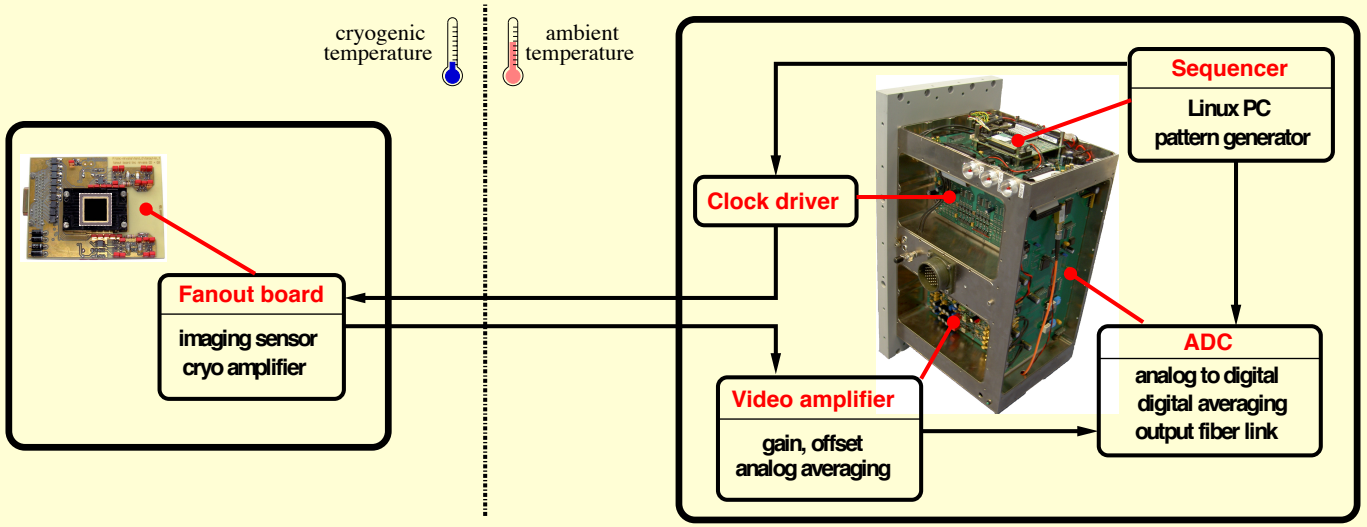
New Detector for CLASSIC/CLIMB

As part of a new collaboration with the Max Planck Institute for Radio Astronomy we are developing a new HAWAII-1 array detector system, new cold optics and non-deviating prism for simultaneous observations in the H and K bands with CLASSIC and CLIMB



Simultaneous H&K Observing will improve UV coverage as well as the group delay tracking magnitude limit





NOAO open time since 2010

- Prompted in part by USCI activity and an expressed interest from NOAO/ReStar.
- 50-100 Hours of CHARA time allocated per year.
- Time awarded by an independent NOAO TAC.
- Over subscribed by 3.7 in 2010, 4.9 in 2011, and 2.5 in 2012.
- Many proposals came from people already interested in interferometry, less so now.
- Many proposals originated in Europe.

New NSF Mid-Scale Innovations Program in Astronomical Sciences

A combination of the old URO (University Radio Observatories), TSIP (Telescope System Instrumentation Program), and ReSTAR (Renewing Small Telescopes for Astronomical Research) programs.

From $4M to $40M

<u>Anticipated timeline for this MSIP competition:</u>

1. **Solicitation issued mid-June 2013**
2. **Preliminary proposals due September 16, 2013**
3. **Invitations issued and declines informed, December 15, 2013**
4. **Invited full proposals due February 21, 2014**
5. **Reverse Site Visits and Cost, and Management reviews, April - May 2014**
6. **Declines informed and recommended awards announced, June 2014**
7. **Development of cooperative agreements, where appropriate, July 2014**
8. **Anticipated start date of awards, September 1, 2014**

NSF - MSIP

Mid-Scale Science Projects

Self-contained, limited term projects with well-defined construction and science utilization phases.

Mid-Scale Facilities

Construction or operation of stand-alone, long-term, mid-scale facilities.

Development Investments

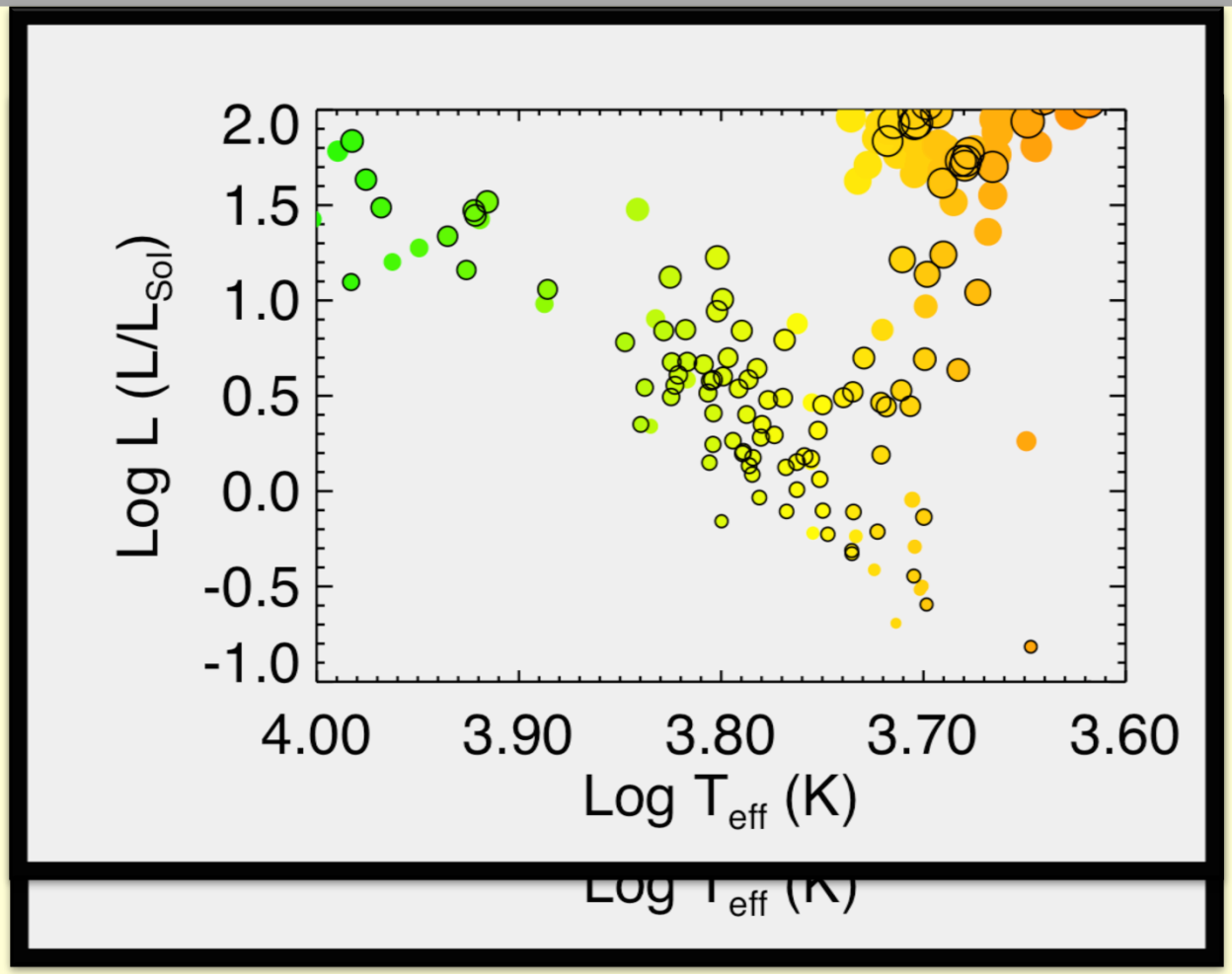
Design and development for future large mid-scale and large-scale facilities.

Open Access Capabilities

1. **New instruments for existing telescopes, both national and private, in return for US community access**
2. **Provision of observing time for US community access on existing telescopes**
3. **Data archiving and data management projects leading to public access to data resources**

An Interferometric HR Diagram: 2009

Compliments of Tabetha Boyajian



***Measurements outlined in black are from the CHARA Array. Does not include new results presented next on K-M dwarfs.**

Some lessons learned along the way

- If you build it, they will come.
- This is a good thing. The more collaborators you have the better off you are.
- Remain as flexible as possible. You have not thought of everything.
- Screw sensitivity – do imaging.
- On the other hand, the idea of having many more telescopes and delays lines scares the willies out of me. Perhaps there is an alternative?