2004 CfAO Workshop on Analysis Modeling and Simulation of Adaptive Optics for Extremely Large Telescopes

U.C. Santa Cruz
April 5-6, 2004

Understanding adaptive optics system behavior through the use of analytical, semianalytical, and simulation tools is crucial to the design efforts for large adaptive optics projects such as those for the next generation of "extremely large" (≥ 30-meter) telescopes. The Analysis Modeling and Simulation project, sponsored by the CfAO under Theme 2 (AO for ELTs), has goals to develop valid analytic and simulation models for MCAO system behavior and to produce a viable point design for an MCAO system on an ELT.

Significant progress has been made in the critical research areas identified two years ago at the first workshop. This workshop will be oriented around these topics, including

- Accurate and feasible MCAO reconstruction algorithms
- An understanding of the cone effect with multiple laser guide stars
- Techniques for mitigating sodium laser guide star elongation
- AO optical relay designs for laser guide star MCAO

Additional topics could include

- Optimality and stability of closed-loop MCAO reconstructors
- Alternative wavefront sensor concepts
- Alternative wavefront sensor data analysis algorithms (centroiders, off-null operation)
- Massively parallel simulations and real-time implementations
- Models for the atmospheric index and wind variations
- Hybrid laser guide star arrangements (Rayleigh + Sodium)
- Number of NGS needed to break LGS tilt ambiguity, Higher order WFS for NGSs, etc.
- Models for sky coverage and NGS star counts
- Astrometric accuracy in the MCAO field
- Models for thermal emissivity of the AO system and sky background

A portion of the workshop agenda will include planning for proposals for CfAO year 6.

Workshop organizer:

Donald T. Gavel
UCO Lick Observatory
UC Santa Cruz
(831)-459-5464
gavel@ucolick.org
http://www.ucolick.org/~gavel/ams2004/

CfAO Analysis, Modeling, and Simulation Workshop
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Agenda

Day 1: Monday 5 April

8:30 Continental Breakfast

9:00 *Welcome and introduction*

9:30 *Status updates*
Thirty Meter Telescope – Nelson, Ellerbroek, Gavel
ExAOPI – Macintosh
Laboratory for Adaptive Optics – Gavel

10:30 Break

11:00 *Optical layout, system architecture*
Options for MCAO and MOAO – Ellerbroek, Gavel, Dekany

Deformable mirrors
Technology status – Gavel, Nelson
Modeling – Baker, Wyberg, Yang

12:30 Lunch

1:00 *Tomography*
Wavefront reconstruction and tomography – Ellerbroek, Gavel
Optimal and predictive control – Wyberg

2:00 *Tomography (continued)*
Closed loop stability – Ellerbroek, Gavel
Fast algorithms – Vogel, Gilles

3:00 Break

3:15 *Natural guide stars*
LGS ambiguous modes problem
IR detectors

Break-out session: Simulations software planning (Britton, Ahmadia, Milovich)

~5:30 Adjourn day 1

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Day 2: Tuesday, 6 April

8:30 Continental Breakfast

9:00 *Wavefront sensing*
Sensor technology status – Nelson
Optimal centroiders – Poyneer
Spatial filtering – Poyneer

10:30 Break

11:00 *Wavefront sensing (continued)*
Alternative techniques – Ammons, Gavel, Yang

12:30 Lunch

1:00 Roadmap discussion
Proposal planning

3:00 Break

3:15 Followup, Open discussion

~5:00 Adjourn day 2

NOTE: The meeting room will also be available on Thursday, April 8 for further follow-up discussions if there is interest. (Wednesday April 7 is the date of the CfAO planning meeting)

CfAO Analysis, Modeling, and Simulation Workshop

INVITEES:

Ahmadia, Aron, Gemini aahmadia@gemini.edu
Ammons, Mark, UCSC ammons@astro.ucolick.org
Baker, Gary, Lockheed g.j.baker@lmco.com
Breakwell, John, Lockheed john.breakwell@lmco.com
Britton, Matthew, Caltech mbritton@gps.caltech.edu
Christou, Julian, UCSC christou@ucolick.org
Dekany, Rich, Caltech rgd@astro.caltech.edu
Flanagan, Mike, Montana State U. flanagan@math.tamu.edu
Gilles, Luc, Michigan Tech. U. lgilles@mtu.edu
Hennessy, Bryan, UCSC nack408@aol.com
LeLouarn, Miska, ESO lelouarn@eso.org
Lloyd Hart, Michael , U Arizona mhart@as.arizona.edu
Macintosh, Bruce, LLNL bmac@igpp.ucllnl.org
Max, Claire, UCSC max@ucolick.org
Milovich, Jose, LLNL milovich1@llnl.gov
Nelson, Jerry, UCSC jnelson@ucolick.org
Palmer, Dave, LLNL palmer25@llnl.gov
Poyneer, Lisa, LLNL poyneer1@llnl.gov
Ren, Hongwu, Caltech hren@astro.caltech.edu
Reinig, Marc, UCSC mreinig@ucolick.org
Troy, Mitch, JPL mtroy@jpl.nasa.gov
Tyler, Glenn, tOSC glenn.a.tyler@tosc.com
Van Dam, Marcos, LLNL mvandam@igpp.ucllnl.org
Vogel, Curt, Montana State U vogel@math.montana.edu
Wang, Zhenrong, UCSC zwang@soe.ucsc.edu
Wiberg, Don, UCSC Don_Wiberg@hotmail.com
Yang, Qiang, Montana State U qyang@mtu.edu
Xu, Bing, UCSC zbxu@ucolick.org