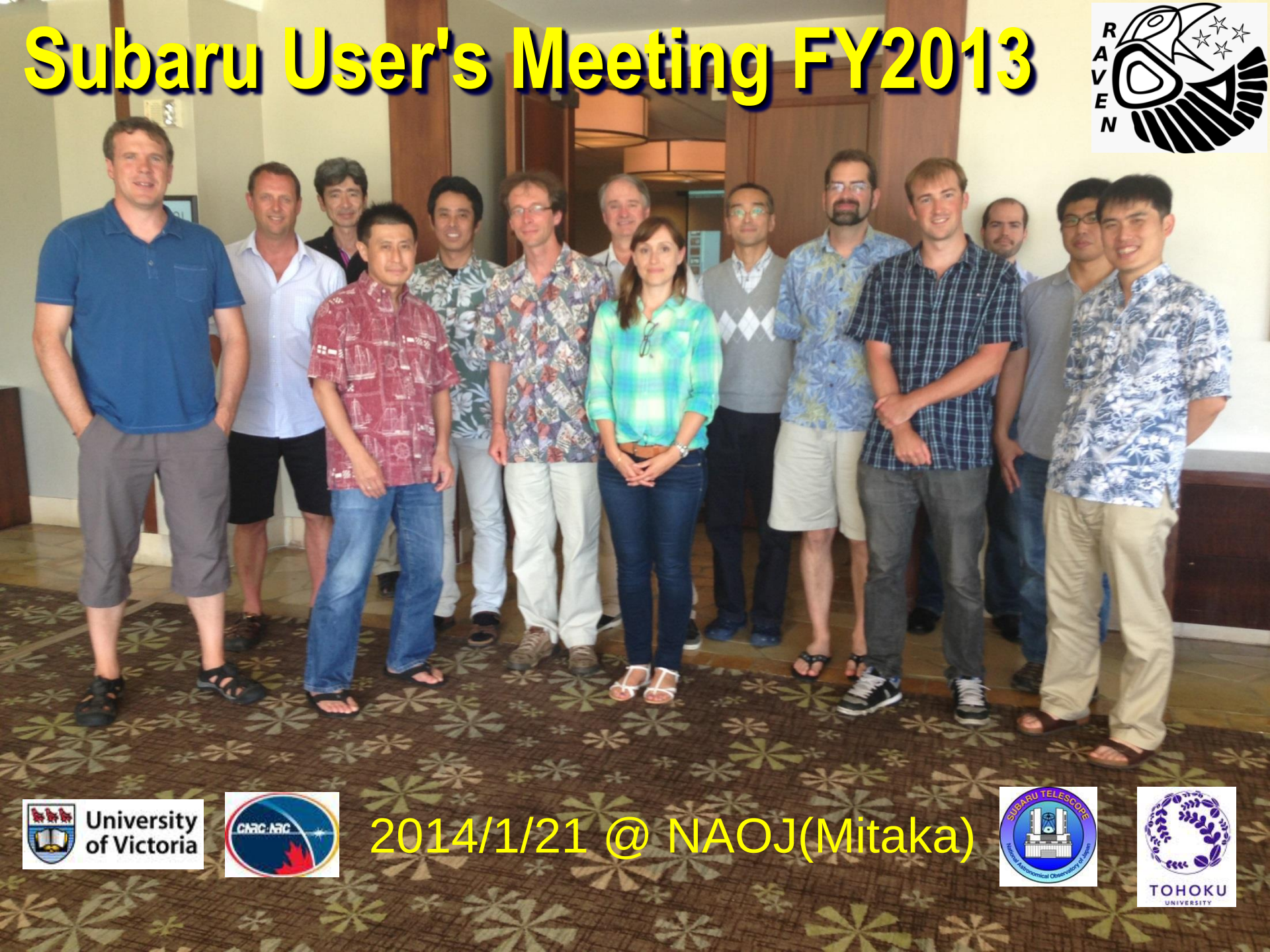
Subaru User's Meeting FY2013



2014/1/21 @ NAOJ(Mitaka)

Overview of RAVEN Project

- MOAO demonstrator (targeting 1st on 8m class)
  - Experiment in laboratory room
  - On-sky engineering & science verification
- Canadian group project
  - 6M CAD by BCKDF/CFI Leading Edge Fund
  - University of Victoria (UVic)
  - Herzberg Institute for Astronomy (HIA)
- Supported by Japanese group
  - Subaru Tel. (infra/manpower, researcher exchange, M.Ito)
  - Tohoku Univ. (basic experiment in laboratory, Y.Ono)
- Schedule
  - 2014: Test in Sim.Lab (Jan-Apr); 1st Eng.Obs. in May
  - 2nd Eng.Obs in S14B?

History

2009 Sep 24,25: Face-to-face Meeting @ Victoria

2010 Mar 16,17: Kick-off Meeting @ Victoria

May 1-3: 1st Interface-meeting @ Hilo

2011 Mar 7,8: Conceptual Design Review @ Victoria

Dec 15: Subaru Internal Review @ Hilo

2012 Nov 20,21: 1st Science Meeting @ Sendai

2013 Jul 25: 2nd Science Meeting @ Kona

Nov 26: Pre-shipping Meeting @ Victoria

2014 Jan 6: Delivery to Hilo

Status Update: ~every 6 months

Interface Control Document: frequent update, based on e-mail discussion

Why MOAO?

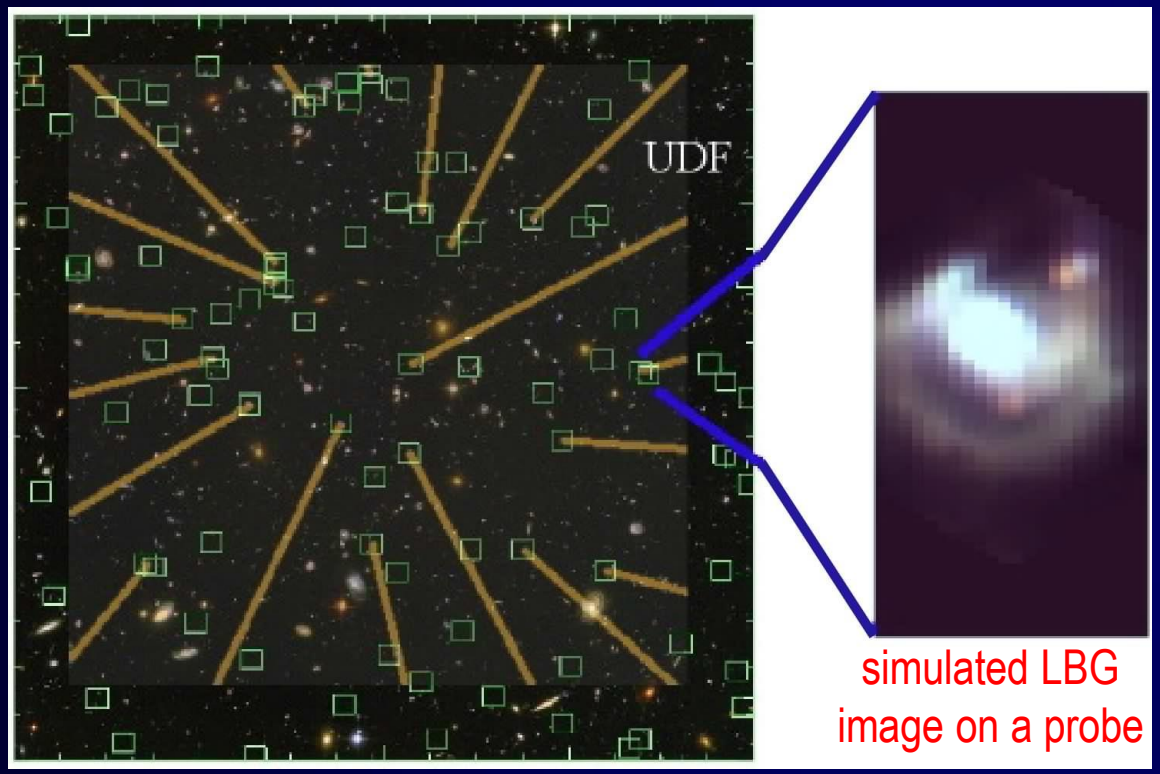
Why AO unit is prepared for each object?

- For AO, it is difficult to realize both of "wide-field" and "correction performance".
- Suitable for 30m telescopes
  - large focal plane
    - the size of conventional AO will be too large
    - reasonable size if divided for each object
  - Field-of-Regard (pick-up field size) increases with the telescope diameter

Future MOAO example

from feasibility study of TMT-IRMOS by UF/HIA

~20 objects (~2"ϕ each) over ~5'ϕ

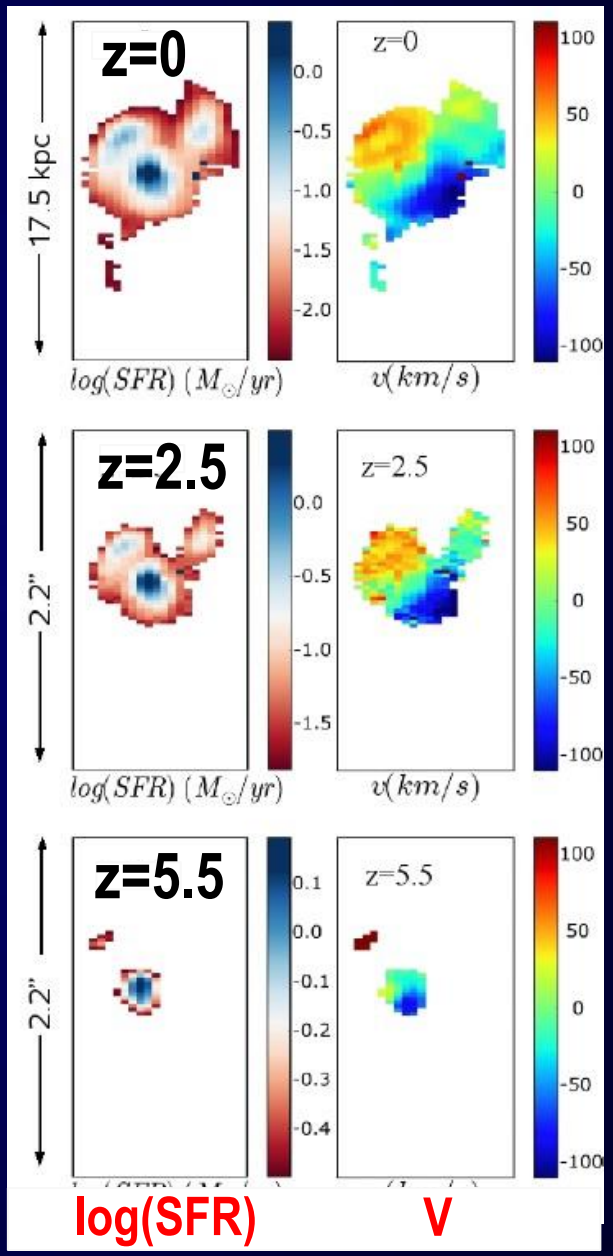


□: LBG candidates in Hubble UDF (z = 2~6)

—: MOAO probe

z = 0: observed

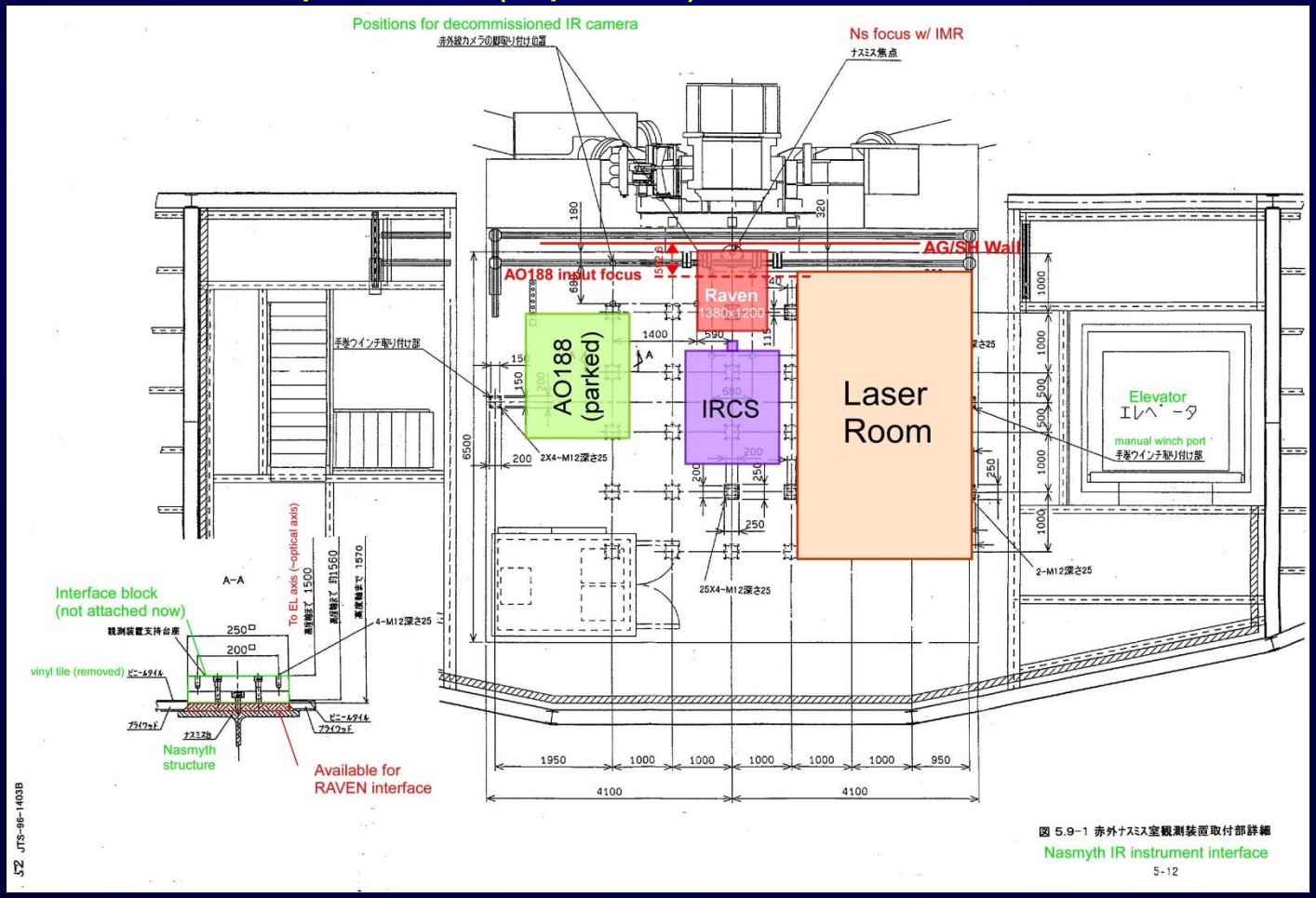
z>0: simulated



At Subaru Telescope

- treated as a carry-in instrument
- installed on NsIR; science instrument is IRCS

Subaru NsIR platform (top view)



System Specifications

Number of Science CH	2 (= number of DM)
WFS	3 NGSs +1 LGS / 10x10 SH (R<14)
DM	11x11 (ALPAO 97)
Field size	FoR: 3.5' for NGS (2' Φ full for Sci) FoV: 4" each channel
Wavelength range	Sci: 0.9-4um ; WFS: 0.6-0.9um
Science instrument	IRCS (Imaging, Grism, Echelle)
Ensqured Energy	> 30% in 140mas slit (0.75" seeing)
System Throughput	> 80% of AO188

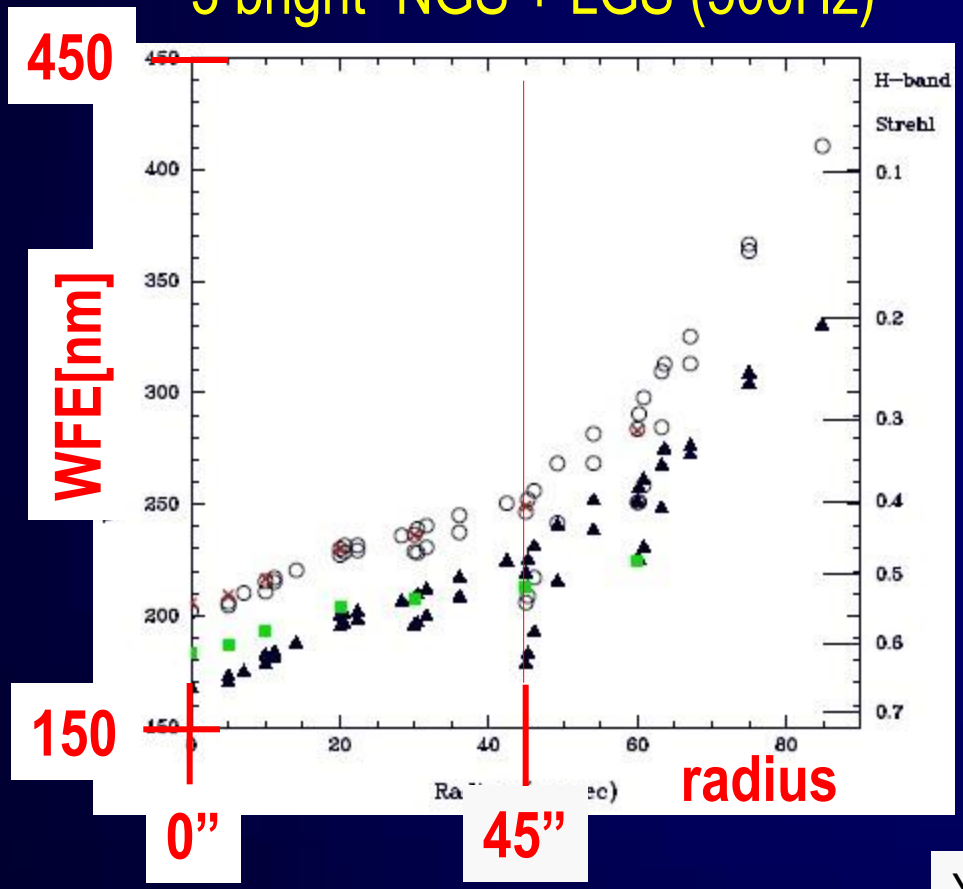
2 NGS + 1 LGS is also possible; i.e., at least 2 NGSs are necessary in 3.5'Φ

Details are available at: http://web.uvic.ca/~ravenmoa/index.html

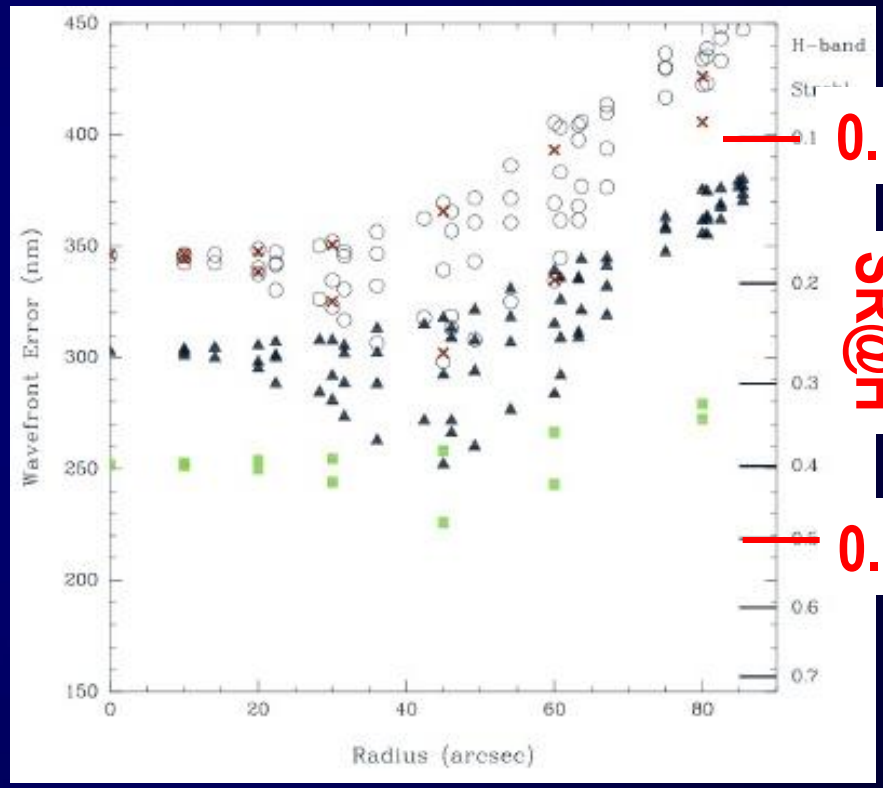
Expected Performance

- 3 NGS (r=45”) + LGS (center) @ 0.75" seeing (FoR:2’～3’)
- element # :10x10 (WFS: 10x10 SH, DM: 11x11)

3 bright NGS + LGS (500Hz)



3 faint (R=14.5) NGS (180Hz)

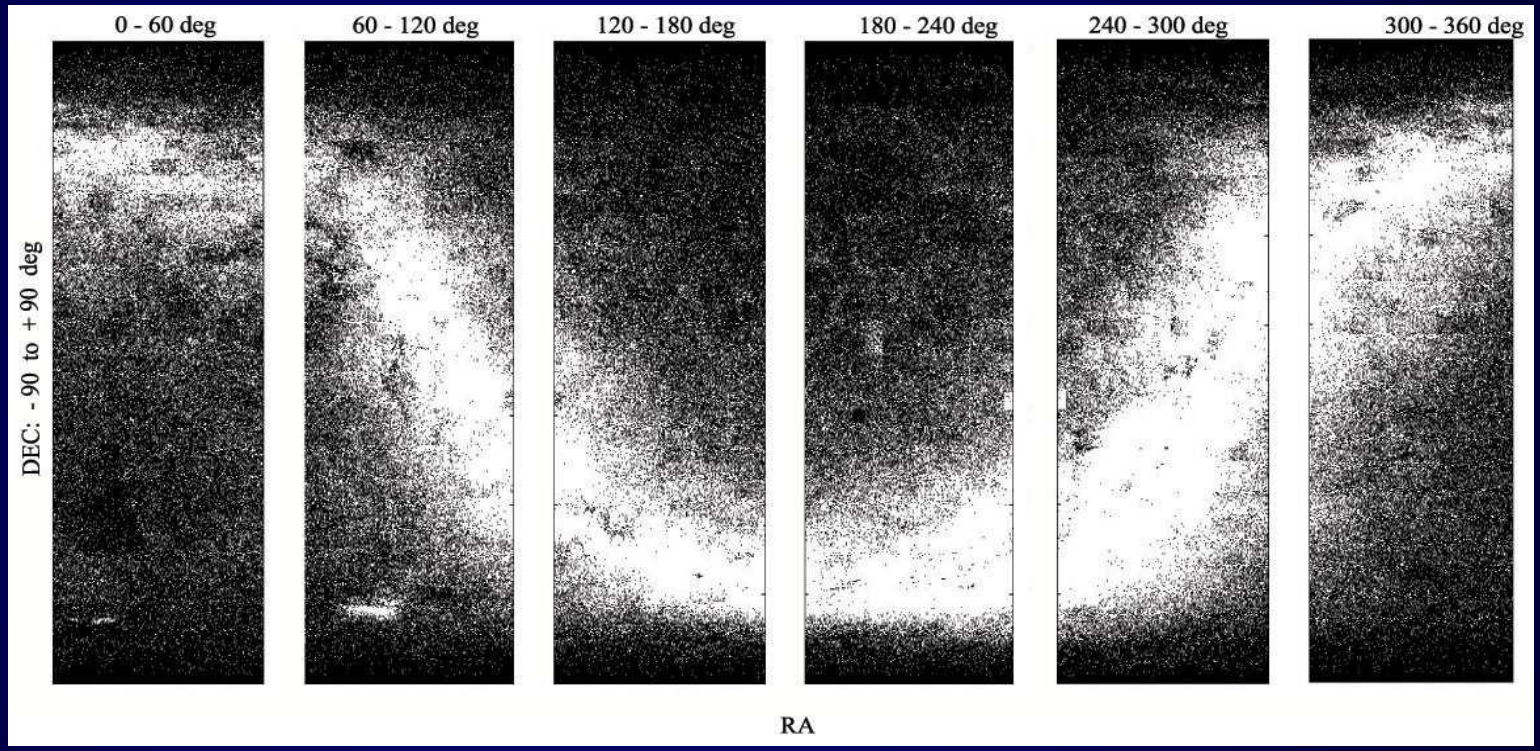


X-axis: separation form the center of FOV in arcsec
Y-axis left: WFE in nm: ○ all modes; ▲ TT removed
right: SR ×; ■ EE (140mas)

by D. Andarsen

Sky Coverage

3 NGSs (R<14mag) within 2.7’ φ



RA [deg]	0 - 60	60 - 120	120 -180	180 - 240	240 - 300	300 - 360
Sky Cov [%]	8.6	24.2	19.5	18.8	40.3	21.1

by C. Blain

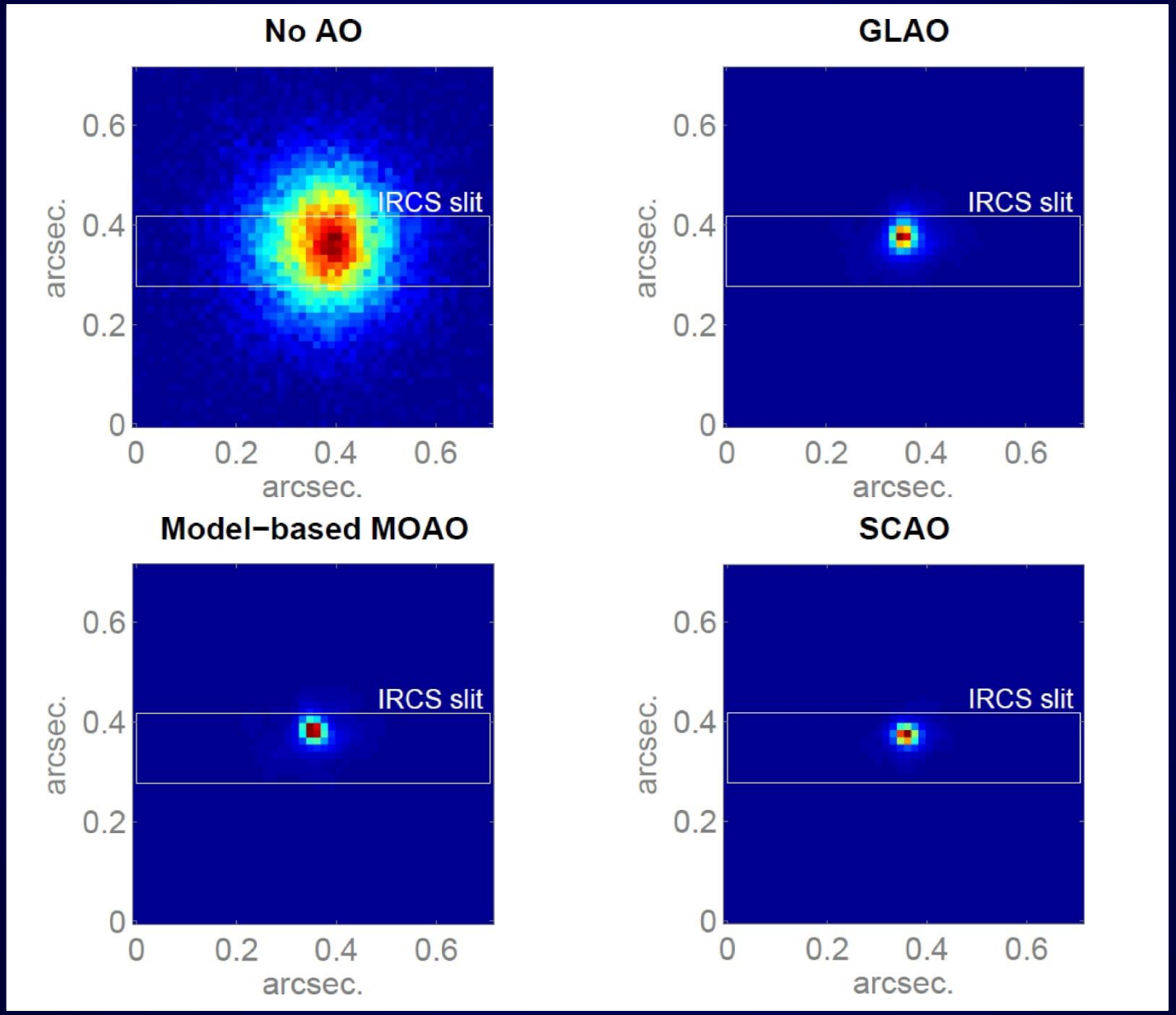
Science Cases

- Merit

  Multiplicity and/or Simultanetiy
- Proposed ideas in the science meetings
  - Galactic
    - Bulge (metal poor stars, globular cluster)
    - Galactic Center (young star cluster candidates)
    - Atmosphere (protoplanet, exoplanet)
  - Extragalactic
    - Nearby Galaxies (stellar population, globular clusters)
    - Super Star Clusters
    - Kinematics (galaxy asymmetries, lensed galaxies)
    - QSO host galaxies

Slides are available at: http://web.uvic.ca/~ravenmoa/meetings.html

Resent Status: UVic Lab.

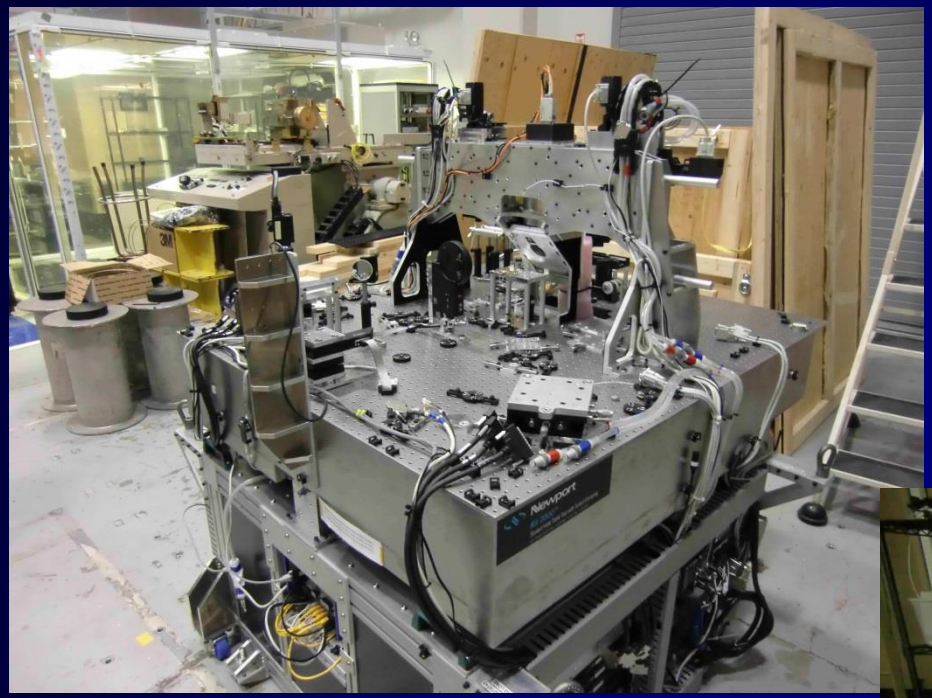


Nov 26, 2013

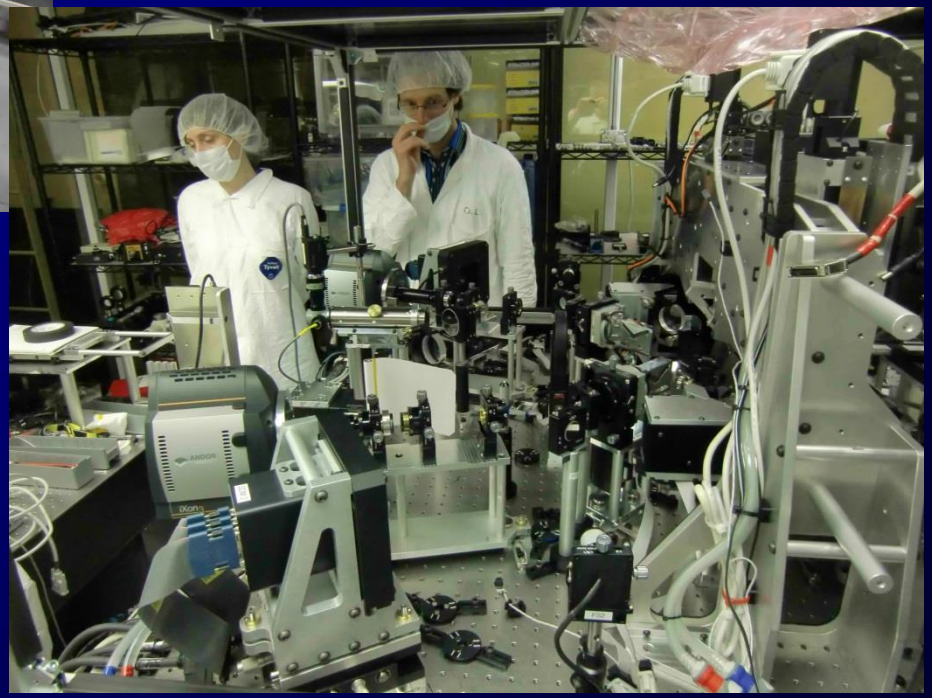
Resent Status: Delivery

Jan 6, 2014

Resent Status: SimLab



Jan 7, 2014



Jan 17, 2014

Alignment has been done

Summary

- MOAO demonstrator
  - collaboration between Canada and Japan
  - project scale: 6M CAD / 3yr + α
  - targeting the 1st on 8m class telescope
- At Subaru Telescope
  - carry-in instrument; uses IRCS @ NsIR + LGS
  - 2014～(2015) Hilo/summit; 1st Eng.Obs. in May
  - tomography, open-loop control & calibration
  - on-sky science verification
- Observation condition
  - 2 objects over 2'φ + α FoR
    3(2) NGS (R<14) over 2.7'φ FoR + LGS (center)
  - best SR@H=0.5 (3 bright NGS+1 LGS @ 500Hz)
    =0.17 (3 faint NGS @ 180Hz)