A NIR MOAO MOS for MK?

(A near-IR multi-object adaptive optics multi-object spectrograph for Mauna Kea)

Richard Dekany

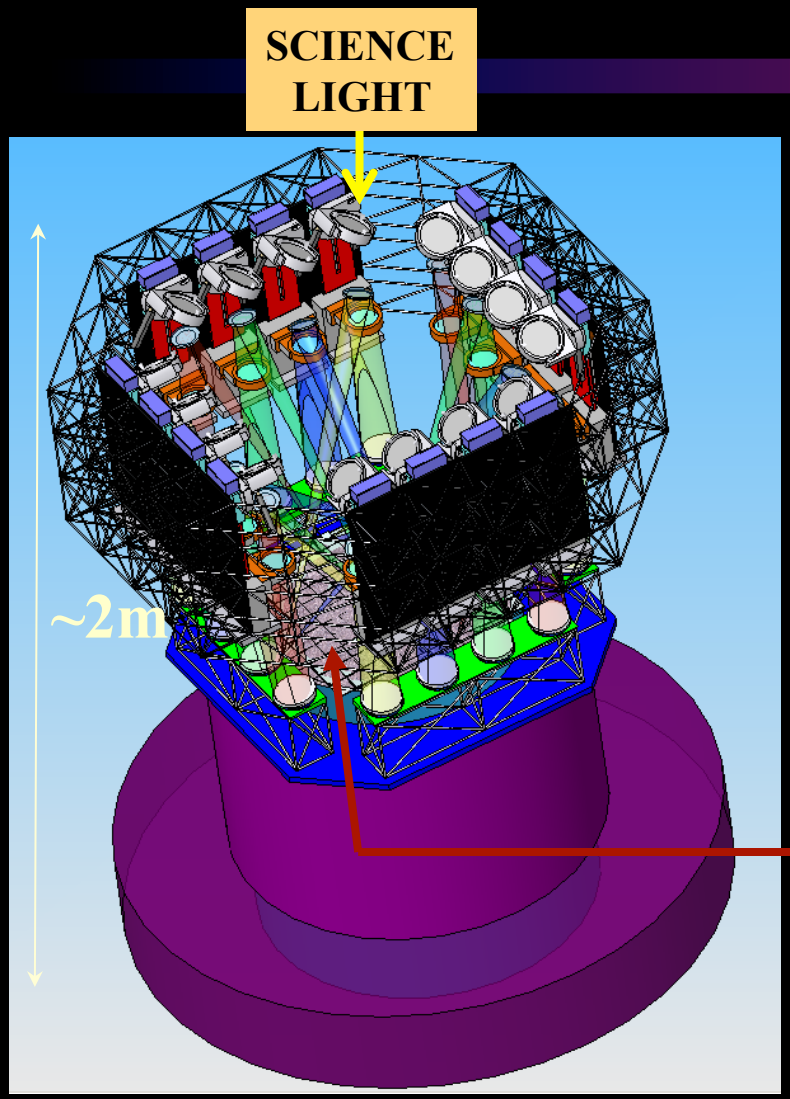
Caltech Optical Observatories
California Institute of Technology

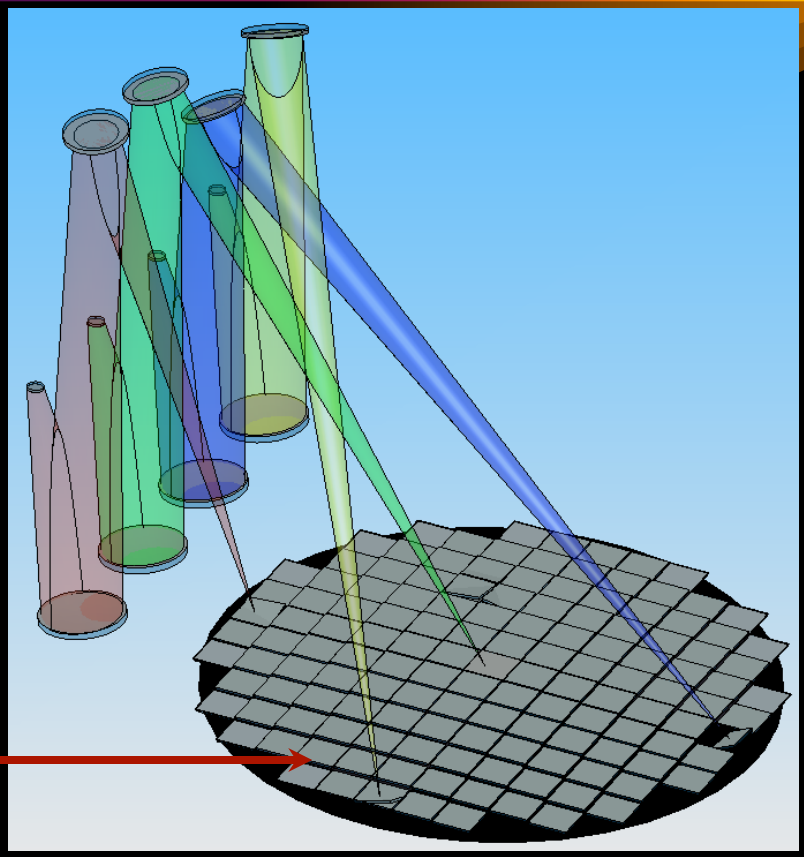
Caltech GLAO Workshop
September 14-15, 2014

A NIR MOAO IFU spectrograph concept

- Global AO provided by ASM or e.g. Offner relay
- Optical Specifications
  - FoV 8’ diameter
  - Number of Spectrograph / IFU channels: 16 – 20
  - Wavelength pass-bands: (I), J, H, K
  - R = 3000-5000
- Integrated MOAO correction
  - Uses small stroke MEMS in open-loop for individual field correction
    - Corrects anisoplanatism only: typically a couple hundred nm
  - Individual FoV: 4.5”
  - Spatial sampling: 0.15” (50% of the flux in one pixel)

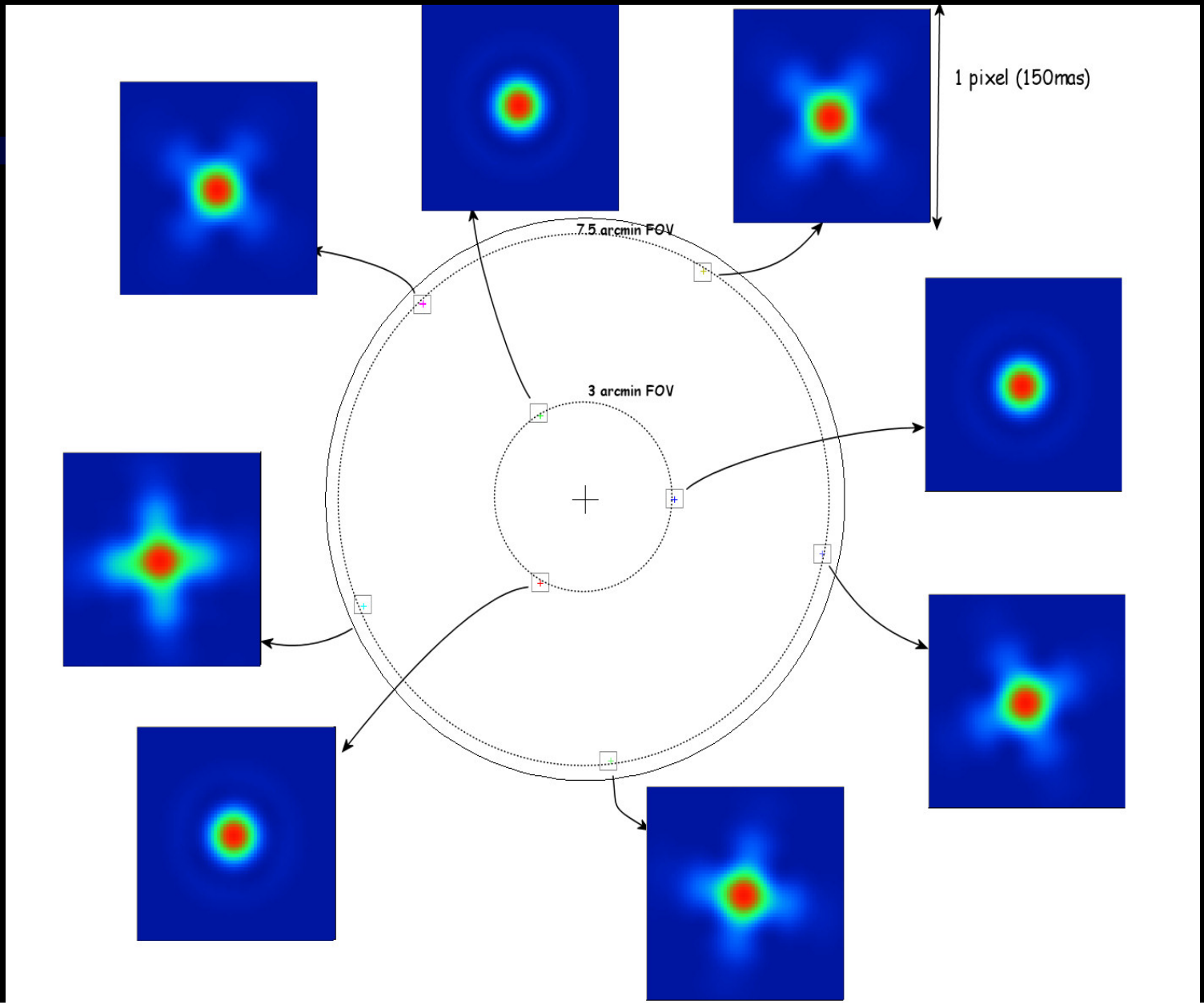
Object selection mechanism concept (from TMT)



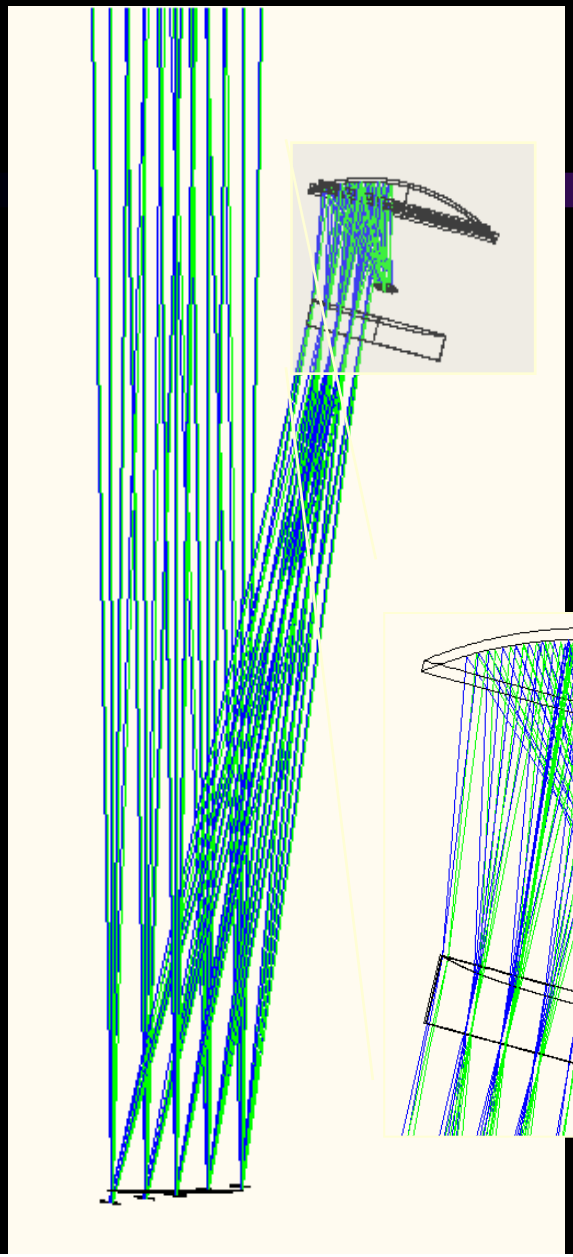


Tiled focal plane steers 16-20
science objects to individual MOAO spectrographs

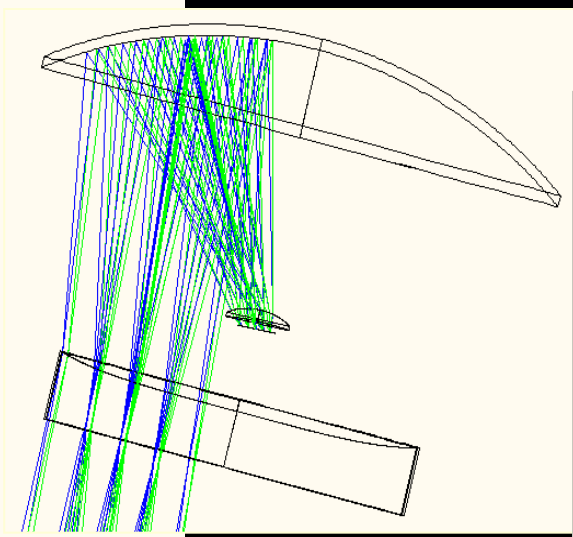
Image quality over the Keck pathfinder FOV

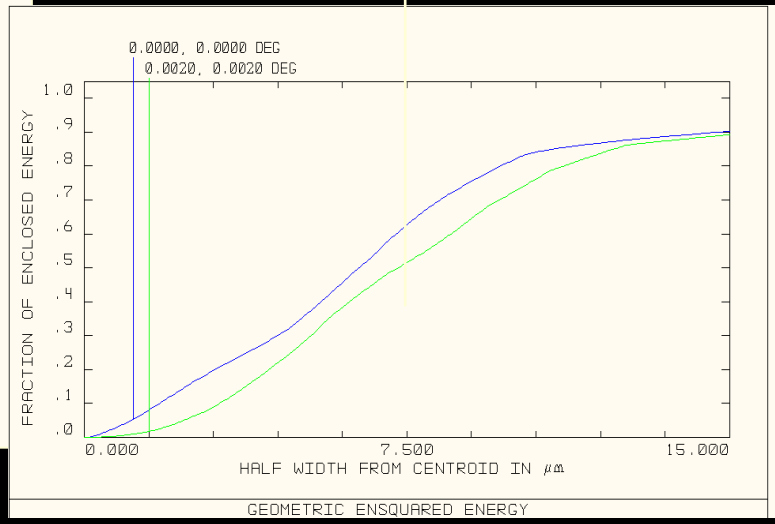


IRMOS pathfinder acquisition/GLAO camera



- Proof of concept for large FoV imager
  - Half of a Schmidt camera (to preserve the full pupil)
  - 2k x 2k detector (15µm): 0.2”/pix
- Image quality:
  - 30 to 50% EE in one pix
  - 70 to 90% EE in two pix





Conclusions

- An IRMOS pathfinder at Keck
  - Technically feasible; benefits from ASM
  - May be scientifically compelling to investigate
    - Maintains Keck competitiveness through multiplex and field of regard
- Cost effective?
  - Utilizes existing TOPICA laser
  - Ensquared energy goal is technically easier than precision wavefront correction
  - Instrument development cost share with TMT?