

# GLAO & MOAO

## A possible experiment with MOIRCS Upgrade Project

9/8-9/11 ngAOWS at Osaka

Tetsuo Nishimura

# Talk Contents

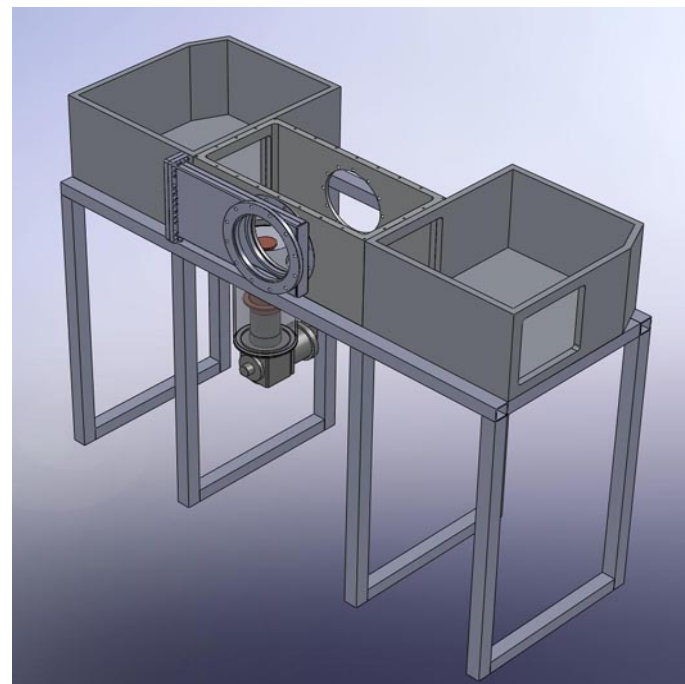
- “nuMOIRCS” project
- GLAO and MOAO
- “nuMOIRCS” and beyond

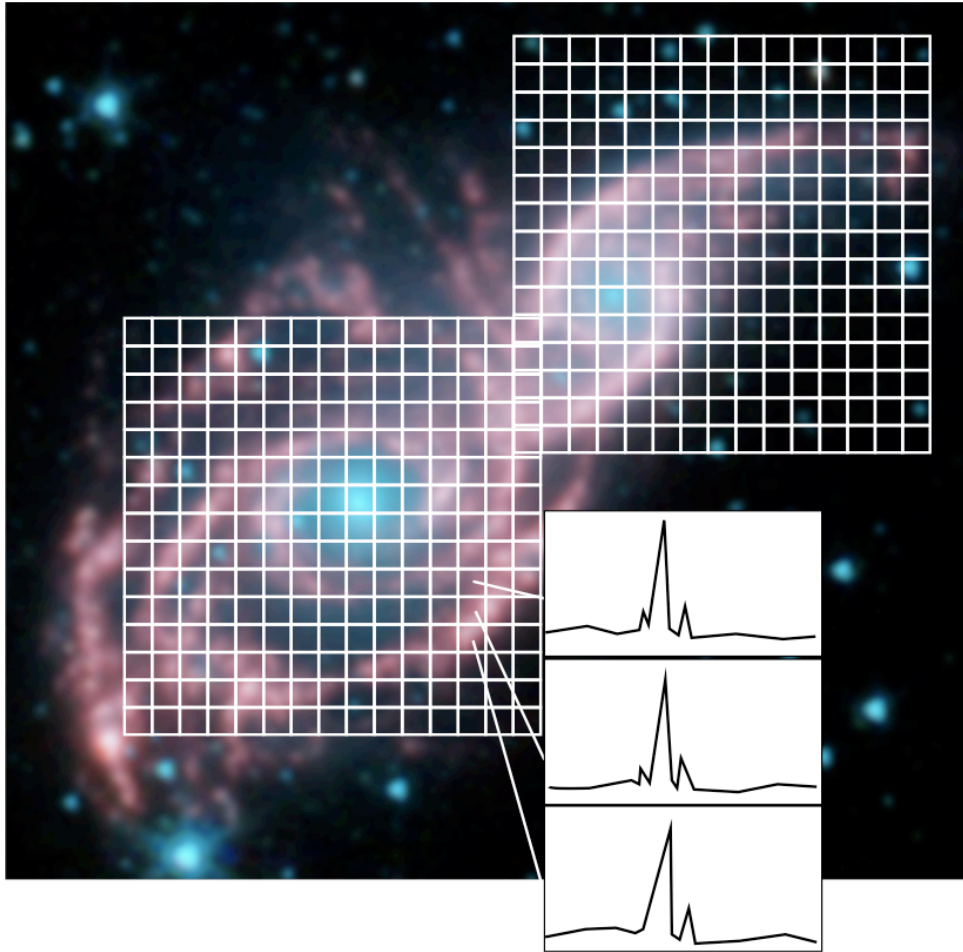
# An approach to ngAO... ...with MOIRCS?

- *GLAO* w/ DM-M2 for wide field...  
... needs a new NIR-WF camera in the future,  
... but MOIRCS, for now...
- MOIRCS upgrade “nuMOIRCS” w/ IFU
- IFU benefits from *MOAO*

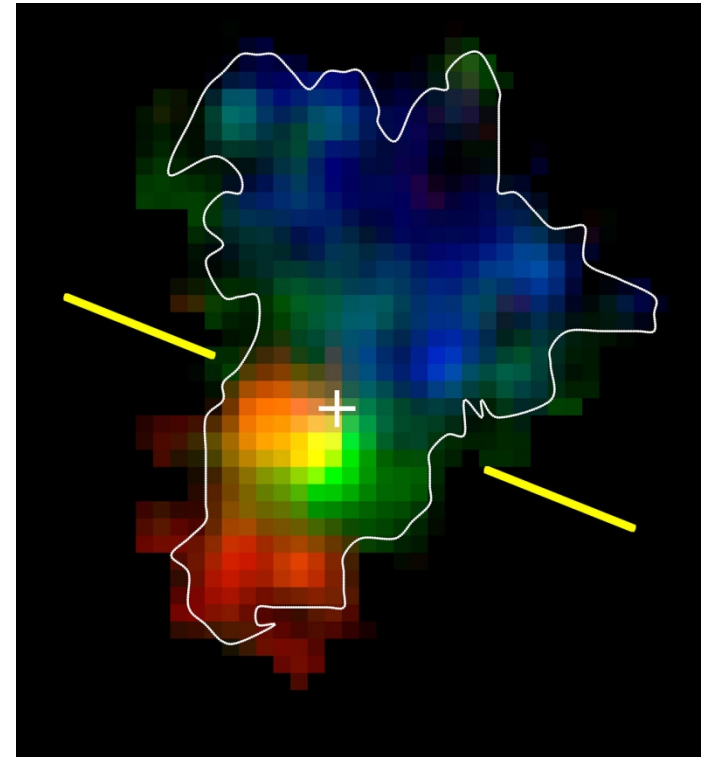
# Origin & Evolution of Galactic Morphology Study Using IFU... GiA P.I. Prof. Arimoto

- 2011-2012 nuMOIRCS design, fabrication and testing by “Mini-Lab”
- 2013 Upgrade installation during a MOIRCS downtime
- 2014 Science observations
- 2015- Beyond?



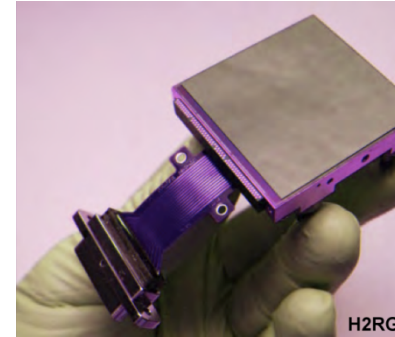
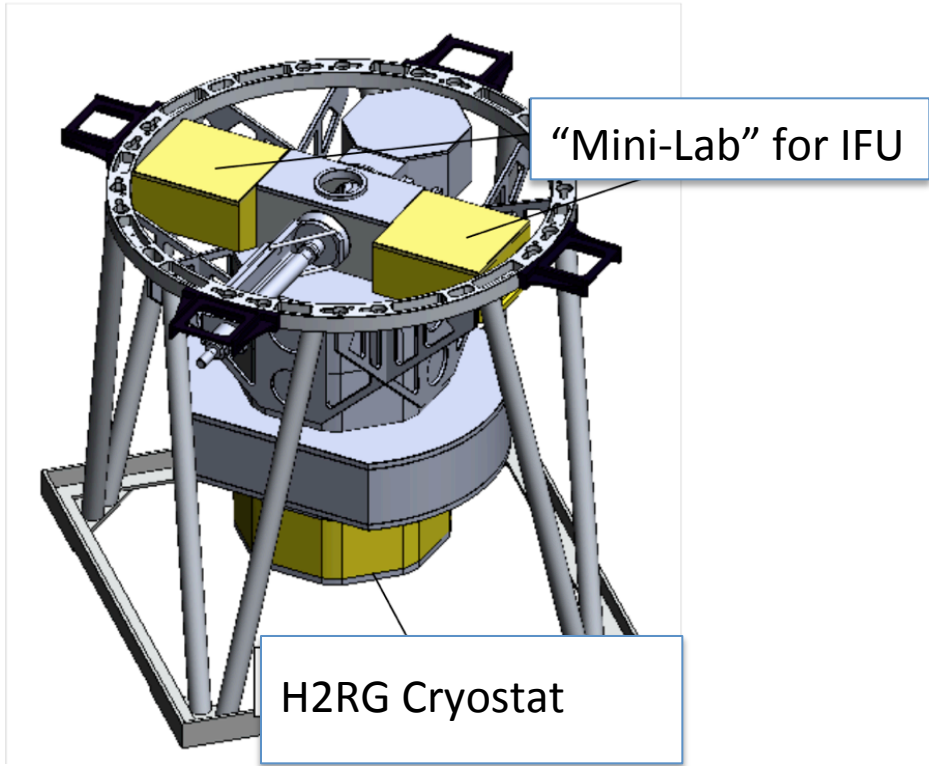


**IFU to for 400 NIR independent spectra sampled  
in a 4 arcseconds x 4 arcseconds FoV**

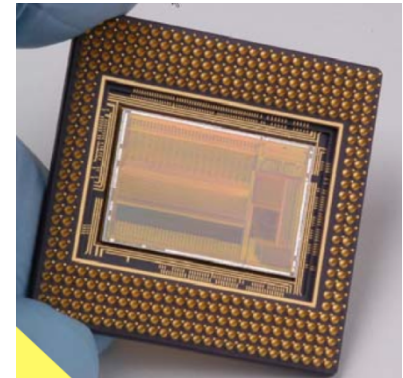


**Rotating Disk of BzK-15504 at  
Z=2.38 observed H $\alpha$  emission  
line, Genzel, Arimoto et al  
(2006) Nature 442, 786**

# MOIRCS upgrade: “nuMOIRCS”



HAWAII2RG



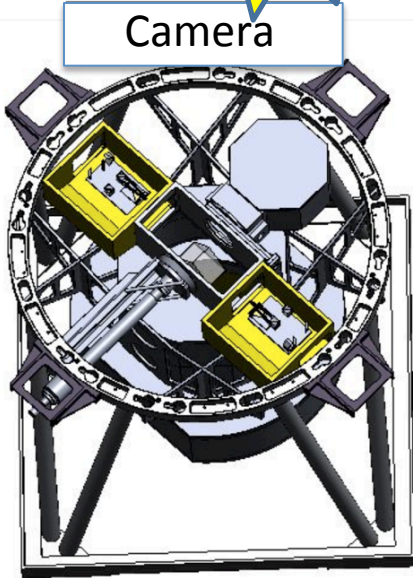
Sidecar ASIC

Classic H2 to H2RG  
Cryogenic Sidecar ASIC for  
array control and readout

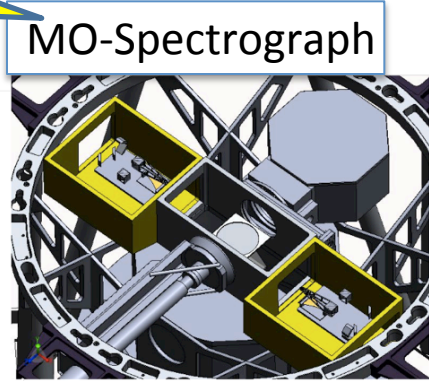
**Faster frame rate with 32 channel outputs**  
**Better noise environment**  
**Higher observation efficiency**

# MOIRCS upgrade “nuMOIRCS”

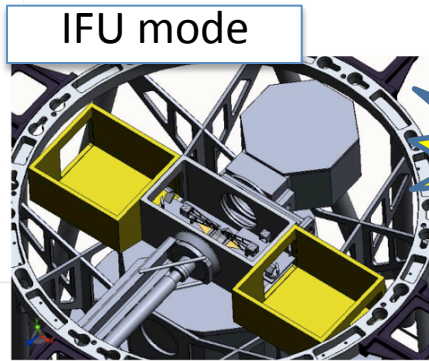
**Upgrade**



Camera

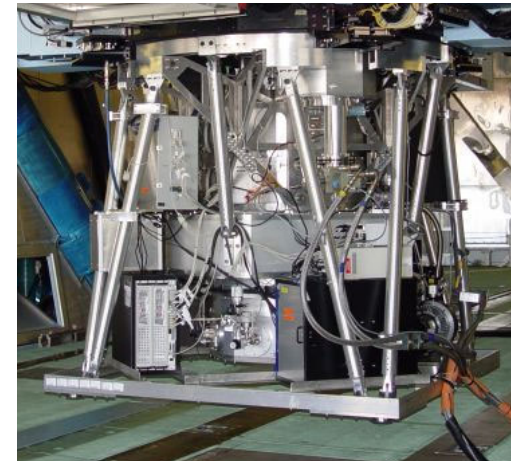


MO-Spectrograph



IFU mode

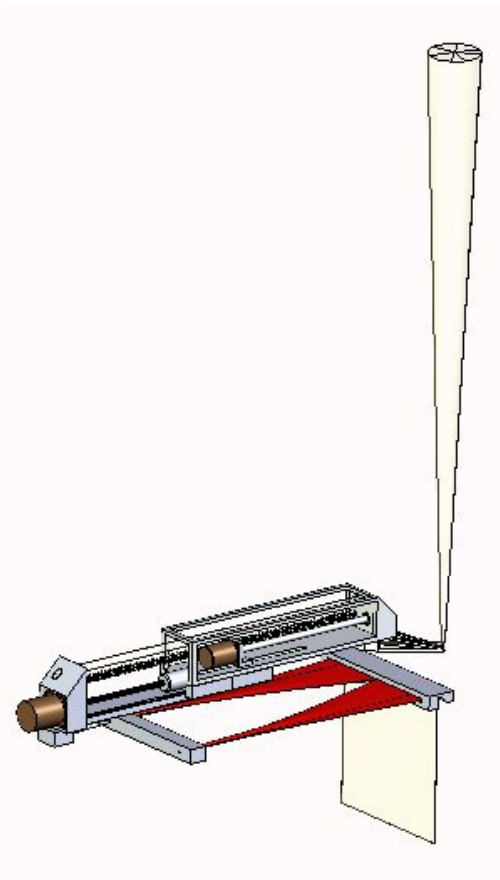
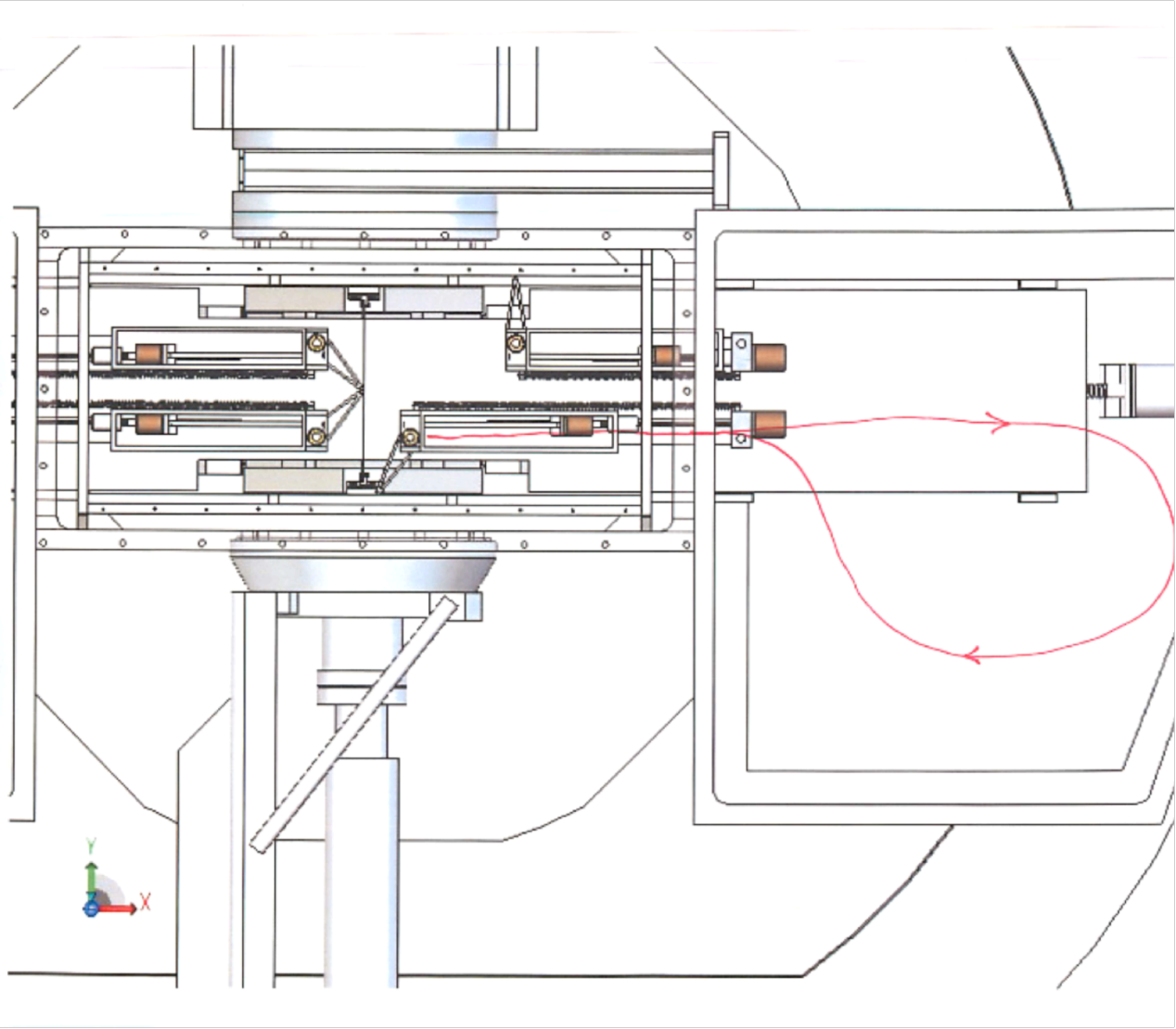
**New**



Add new IFU mode to the two modes  
IFU scheme TBD

- Option 1: Fiber Re-formatter + MLA
- Option 2: Image slicer
- Option 3: MLA

# Horizontal View with Large Loop





# GLAO merits MOIRCS and nuMOIRCS

- GLAO w/ MOIRCS
- GLAO w/ nuMOIRCS
  
- Future...
- w/o GLAO but w/nuMOIRCS “Shoebox” MOAO
- GLAO + nuMOIRCS w/ “Shoebox” MOAO...  
...Tandem AO?!

# GLAO and/or MOAO

- For MOAO, Laser Tomography (LTAO) is a MUST
- Even we BUY DM-M2, we may NEED to work on tomography

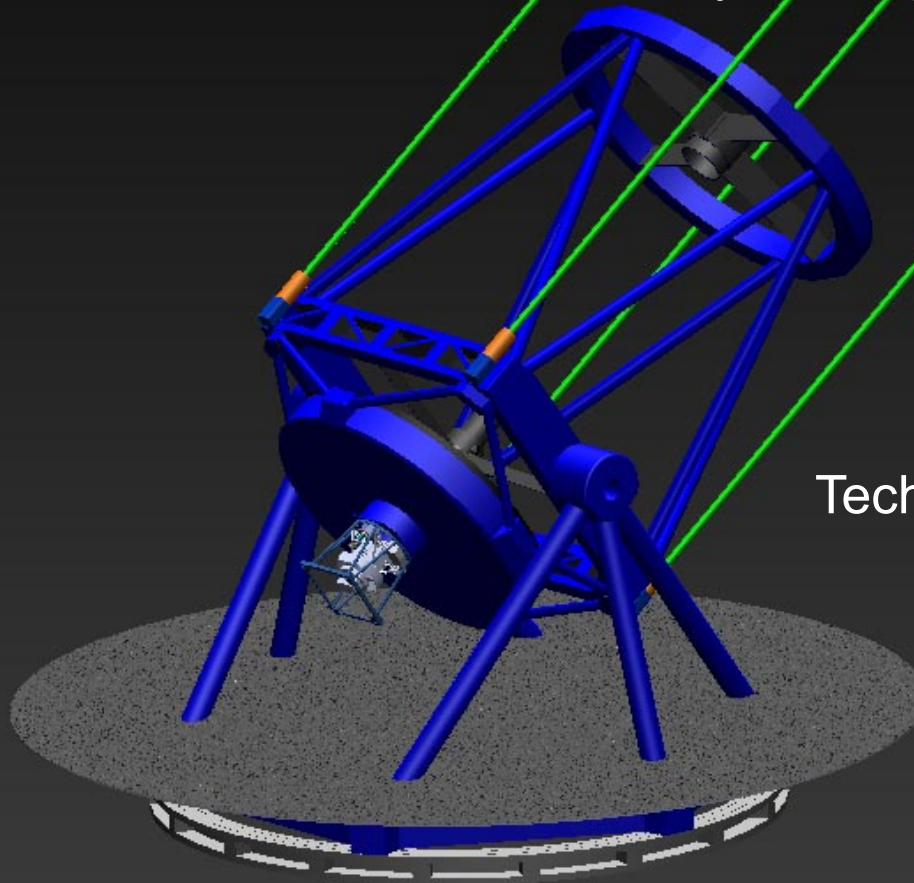
Probing with Rayleigh laser for tomography

Rayleigh laser may have advantages for

Tomography approach for Shoebox MOAO

Powerful laser said to be cheaper,

and may not require high performance as Na-laser



Technical issues to address...

Probing and modeling methodology

Loop separation?

NGS?

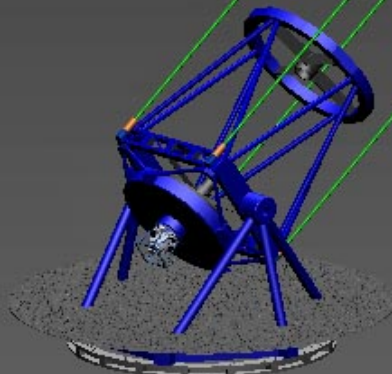
Practical issues, laser type/power,

## Probing with Rayleigh laser for Tomography Model

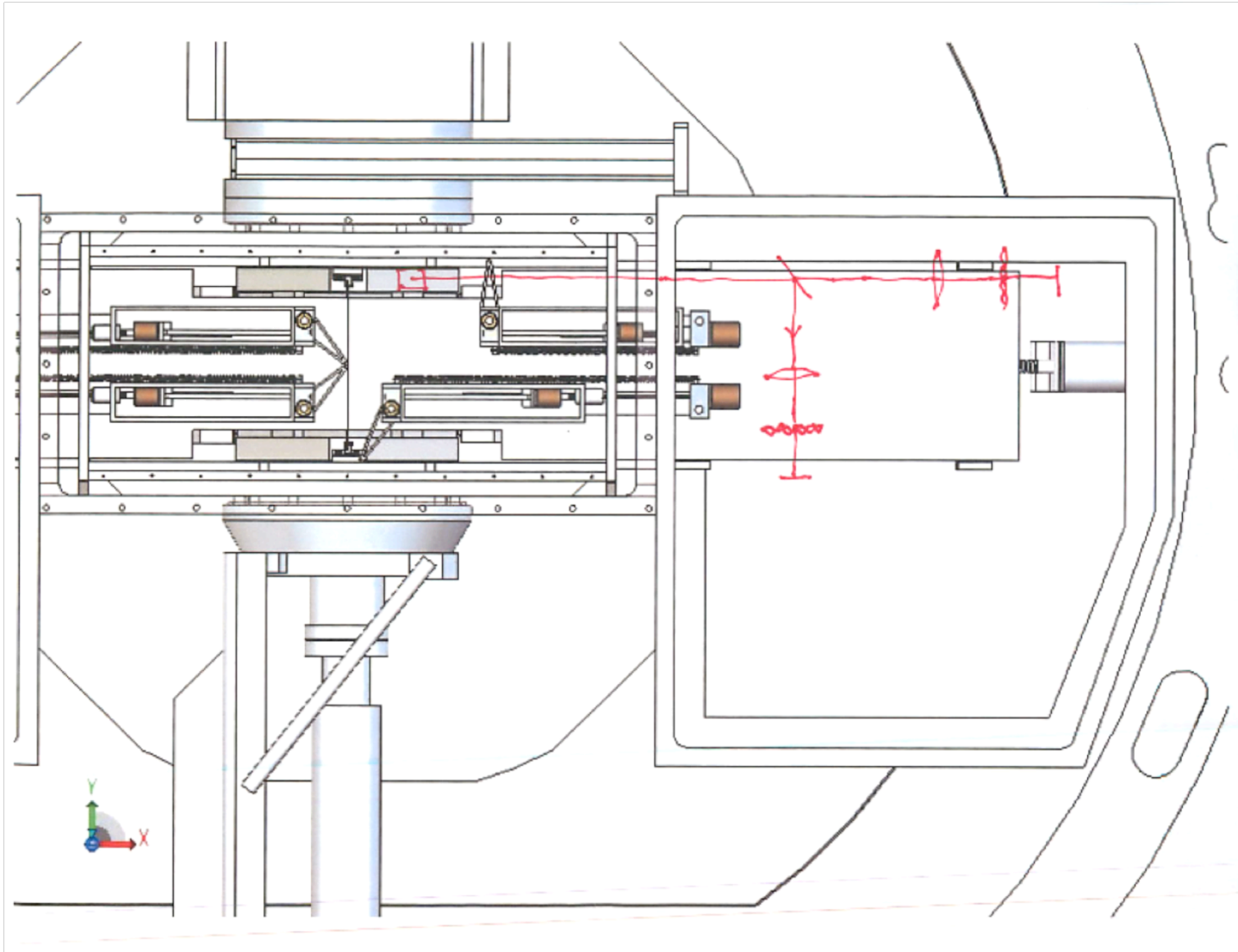
Model: 3-D matrix representing cell refractive index

Ascending paths and path (cone) to the M1 considerably different

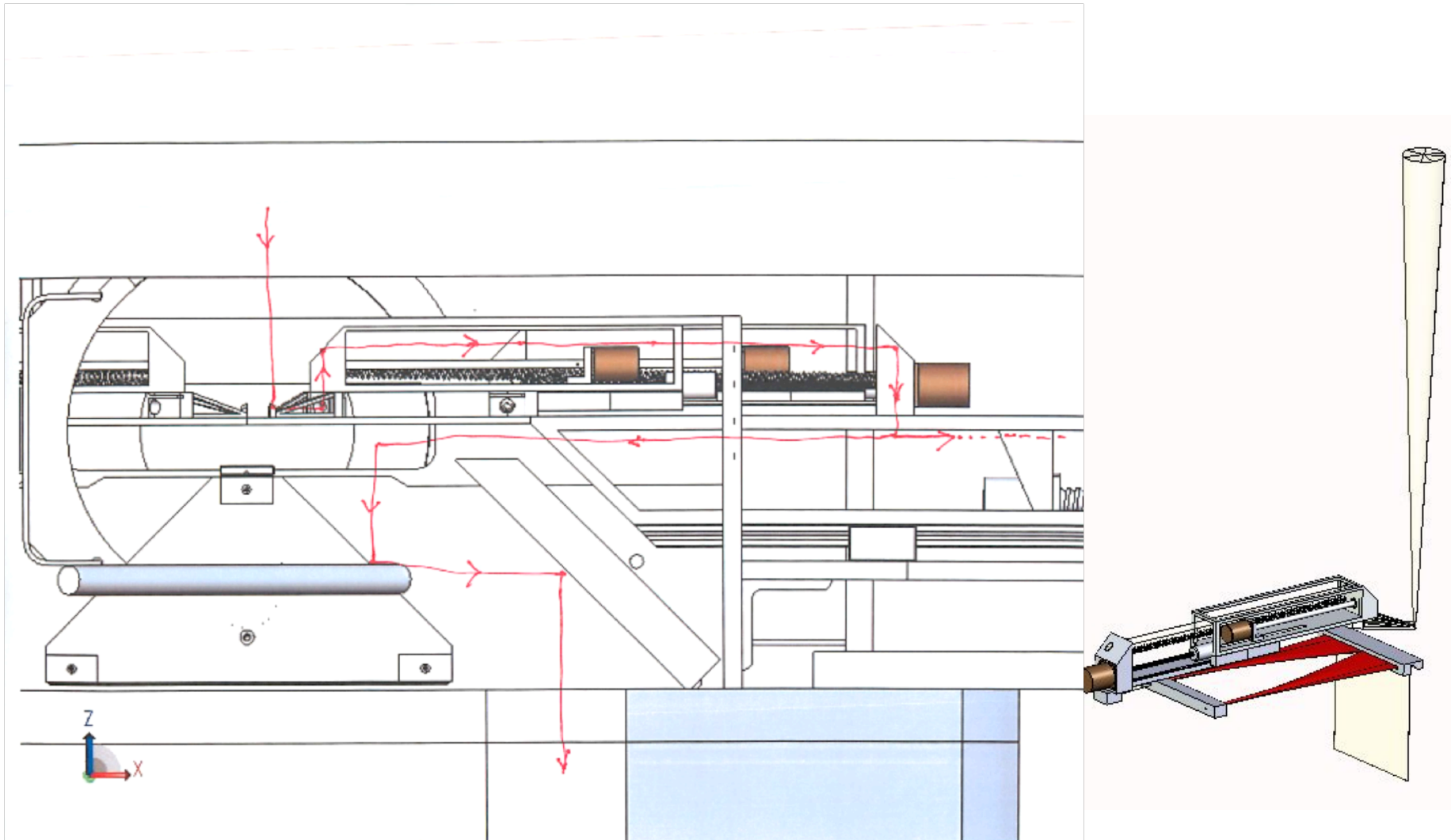
Simultaneous direct imaging of ascending beam may produce additional data

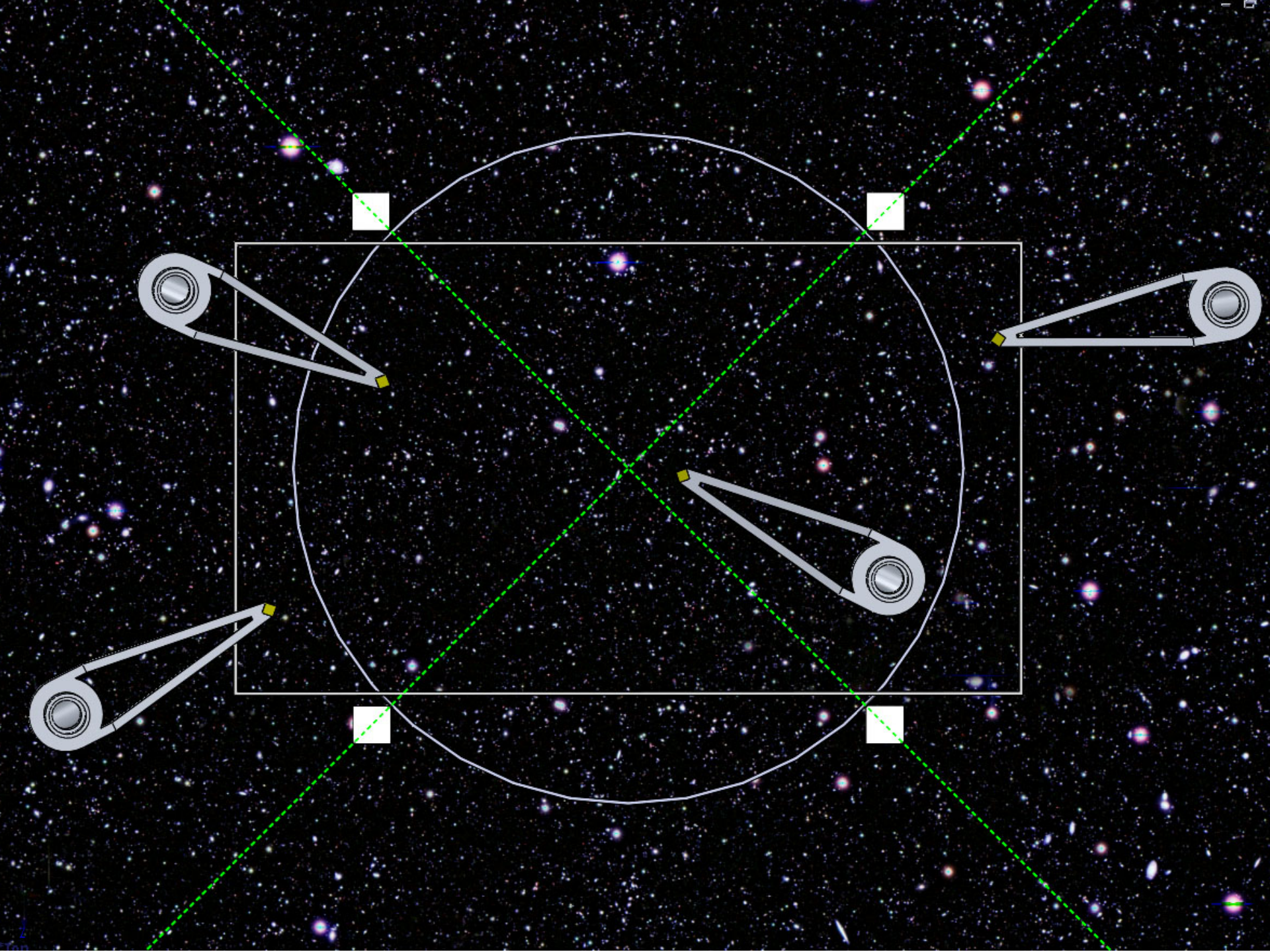


# Horizontal View with AO-WFS

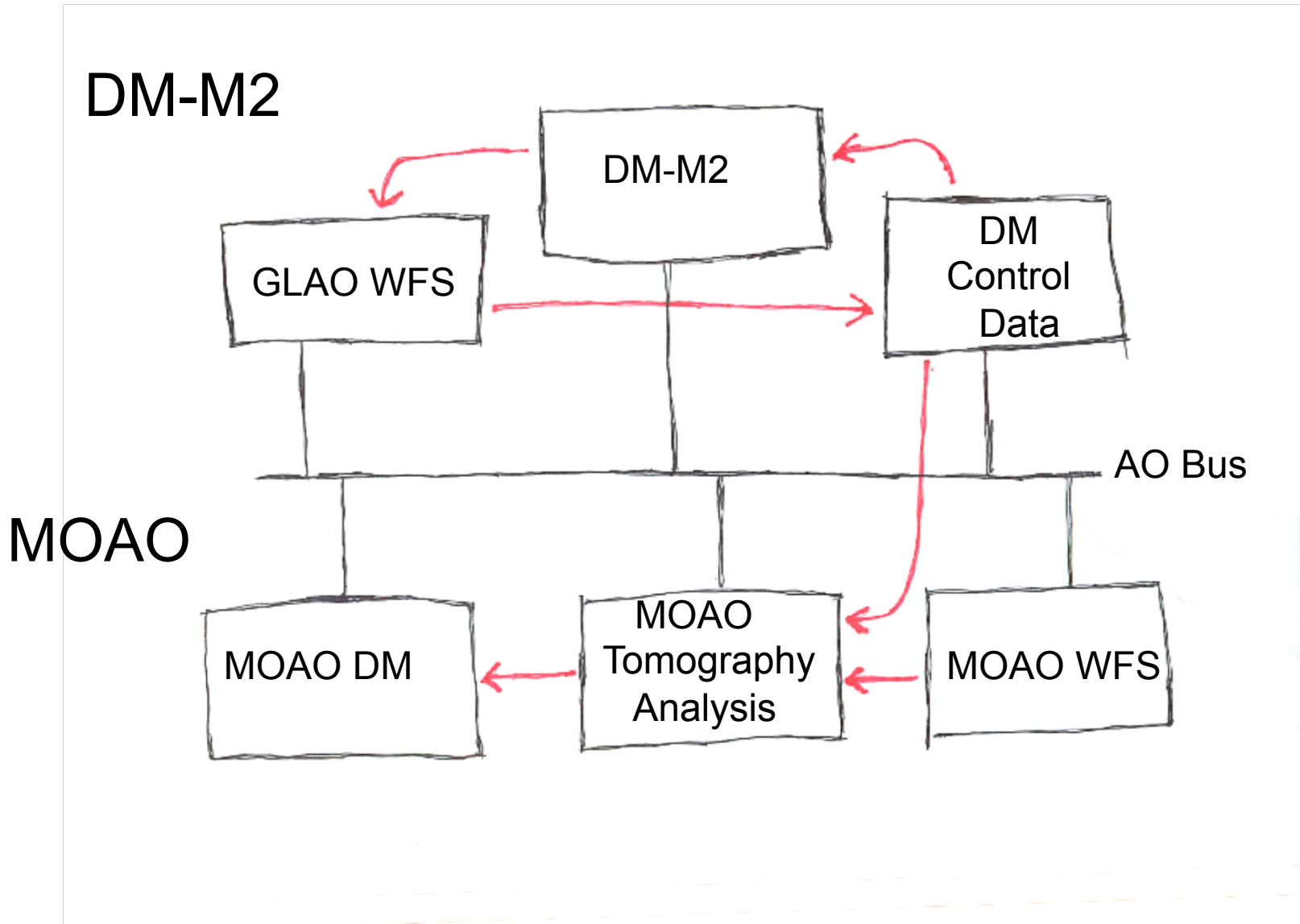


# Sideview with DM possibility with fiber-fan formatter





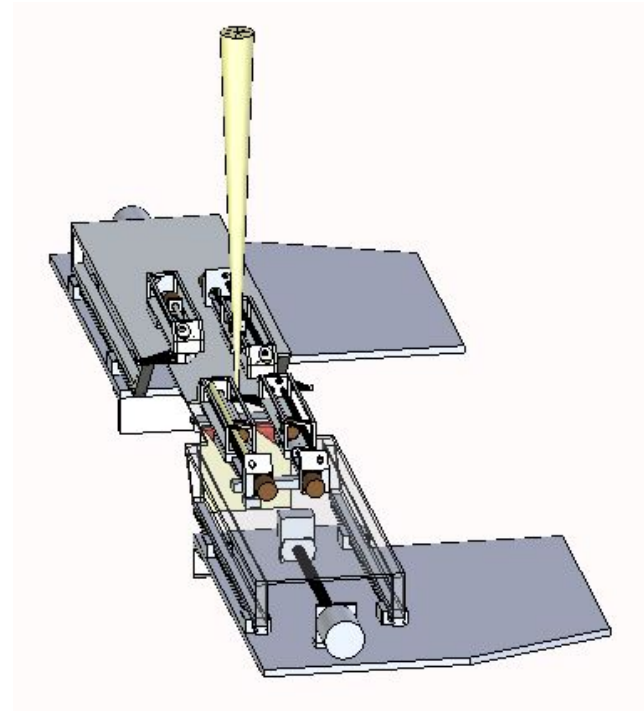
# Loop Architecture?





# “nuMOIRCS” Future Potential

- Pathfinder to...
  - Rayleigh laser
  - Tomography technology
  - Shoebox AO
  - TMT MOAO instrument?



Thank you...