



**WFOS Update
M. Savage
9 January 2018**

To: TMT China Partnership

From: Maureen Savage

As promised, an update on WFOS activities and trade study progress. Since the last update it has become clear that while the slicer concept is innovative with many technically interesting results, the concept has proven challenging to implement. Therefore, the WFOS team has added a third concept to the trade studies work to ensure we have the best chance to evaluate and build the appropriate technical solution for this instrument. This third concept is called 'Xchange WFOS' and will incorporate a standard slit mask design with mask exchanger, using dispersive architecture and cameras similar to the slicer concept. The Xchange WFOS will also require a grating exchanger/rotator and articulating camera design to acquire the full wavelength coverage for WFOS. In December the WFOS team held an informal discussion/review of all three concepts with a group of UCO instrument builders and scientists to get their perspectives, advice, questions and guidance. This one day meeting included discussions of the pros and cons of each concept including risk evaluation, concept costs and flexibility of each design trade as well as suitability of each concept to be compelling in 10 years when on sky at TMT. A report is in development from these discussions but the UCO scientists, engineers and instrument builders recommended that the sky subtraction issue for fibers be documented in more detail and that we pursue additional details on the Xchange WFOS concept if possible prior to down select.

Brief Summary of Xchange WFOS

Exchange-WFOS – Working this concept in January and early February. This is a short time to get the design, cost and risks included in the down select. Most of this work will be done at Caltech as they've completed the design and build of a similar instrument for Keck.

- Determine grating complement and angle articulation requirements
- Re-evaluate full optical layout
- Do all components fit?
- Is a direct imaging mode possible? In both channels?
- First attempt throughput curves
- Integrate Nikon camera designs when they are available and determine final throughput

and image quality (if there's time)

Opto-mechanical design:

- Evaluate any potential packaging challenges given the layout above
- Do the required camera articulation mechanisms exist? Rough cost estimate.
- Sketch of grating exchange mechanism. ROM cost.
- Scaling argument on flexure requirements from OMDR, Keck experience (KCWI analysis as well?)
- Sketch of flexure compensation system (i.e., conservatively how many hexapods?). ROM costs.

Slicer Concept Final Effort

- Settle on a final optical design for the slicer modules ASAP and send this to the Caltech Optical Designer
- Incorporate the slicers into an end-to-end optical design with paraxial cameras.
- First attempt at throughput estimates ASAP
- Integrate Nikon camera designs when they are available towards the end of January
- Prepare the final throughput and image quality analysis.
- Completing work and documentation on slicer mechanics and focal plane system

Fiber-WFOS Status and Final Effort

The technical design, budget, and risks are essentially complete. Some writing up and documentation required, but the primary work remaining is documenting/discussing fiber stability and sky subtraction requirements (a draft has been started!).