

WHAT IS QWSSI?

Quad-camera

- Four cameras make use of almost all photons collected by telescope

Wavefront-sensing

- Photons not used for speckle imaging provide assessment of blurring function of atmosphere & enable next-gen image processing

Six-channel

- Four channels in the visible (577, 658, 808, 880nm) and two in the near-IR (J-short, and J-long or H-short)

Speckle

- Rapid-frame imaging freezes out atmospheric blurring
- No deformable mirror or other expensive control loops

Imager

- Diffraction-limited imaging at the 4.3-m DCT

Exoplanet Hosts with QWSSI

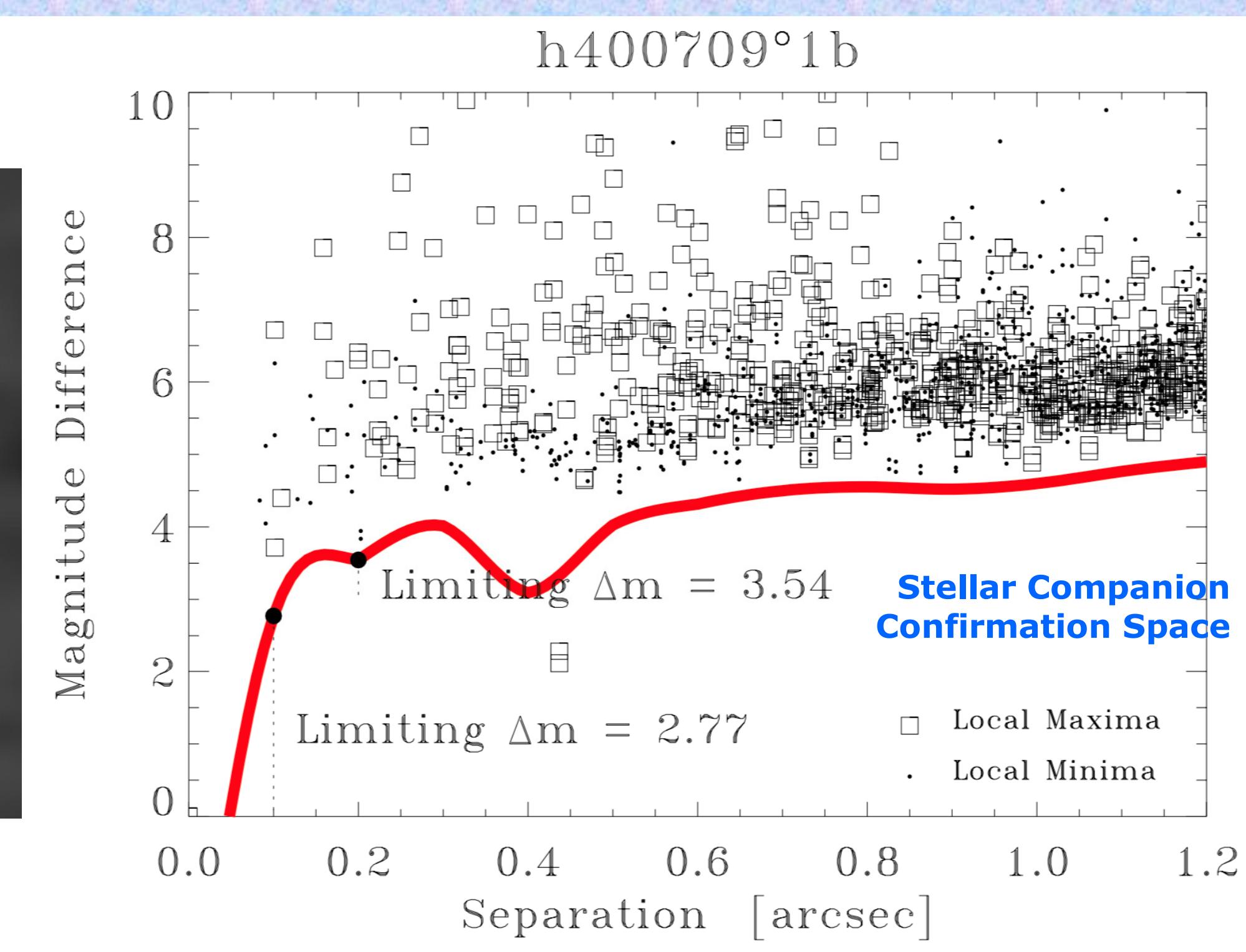
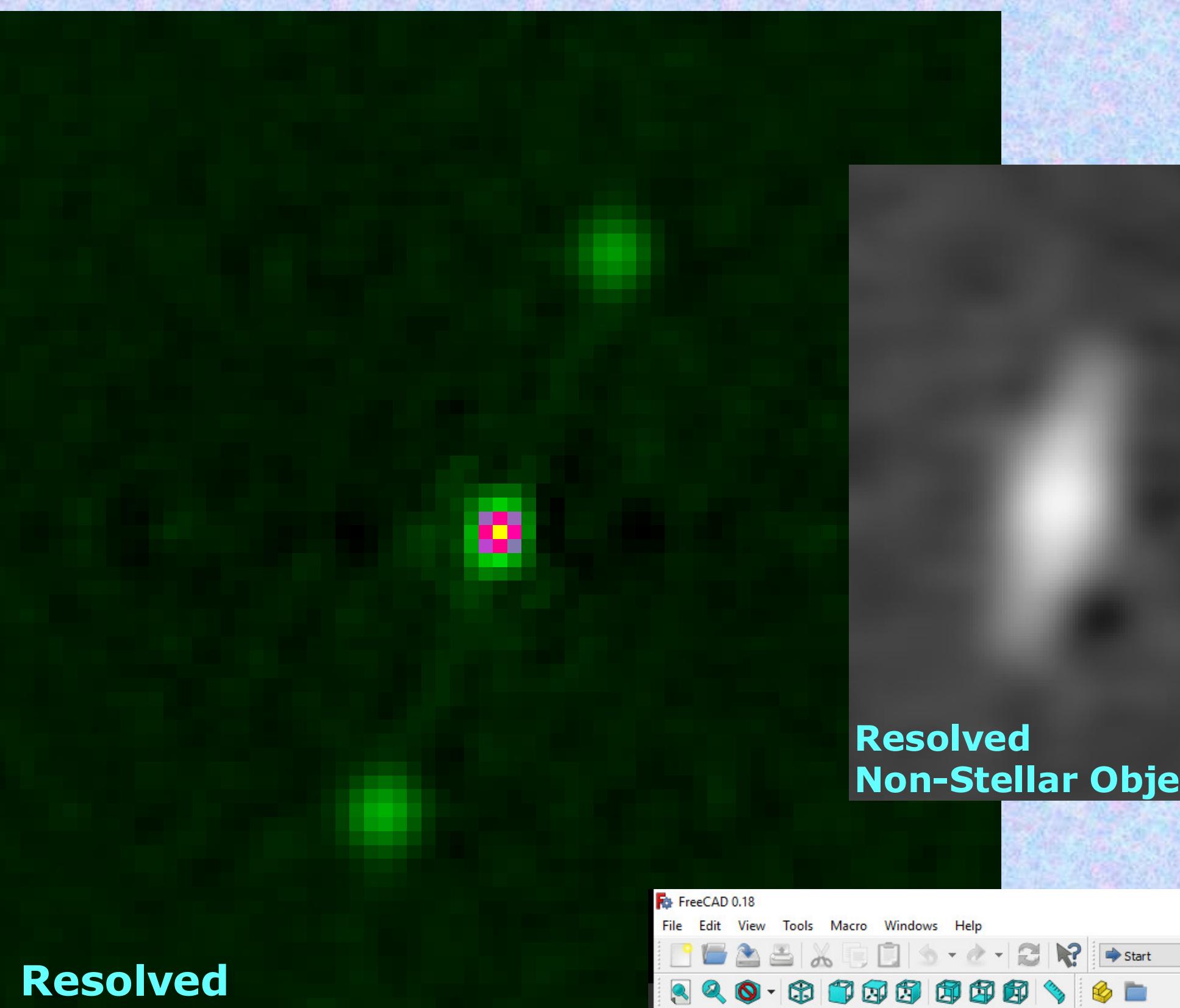
Screening for / Detection of Multiplicity

- Essential for confirmation of exoplanet candidates from Kepler, K2, TESS
- Follows on proven techniques from DSSI, NESSI, Alopeke, Zorro

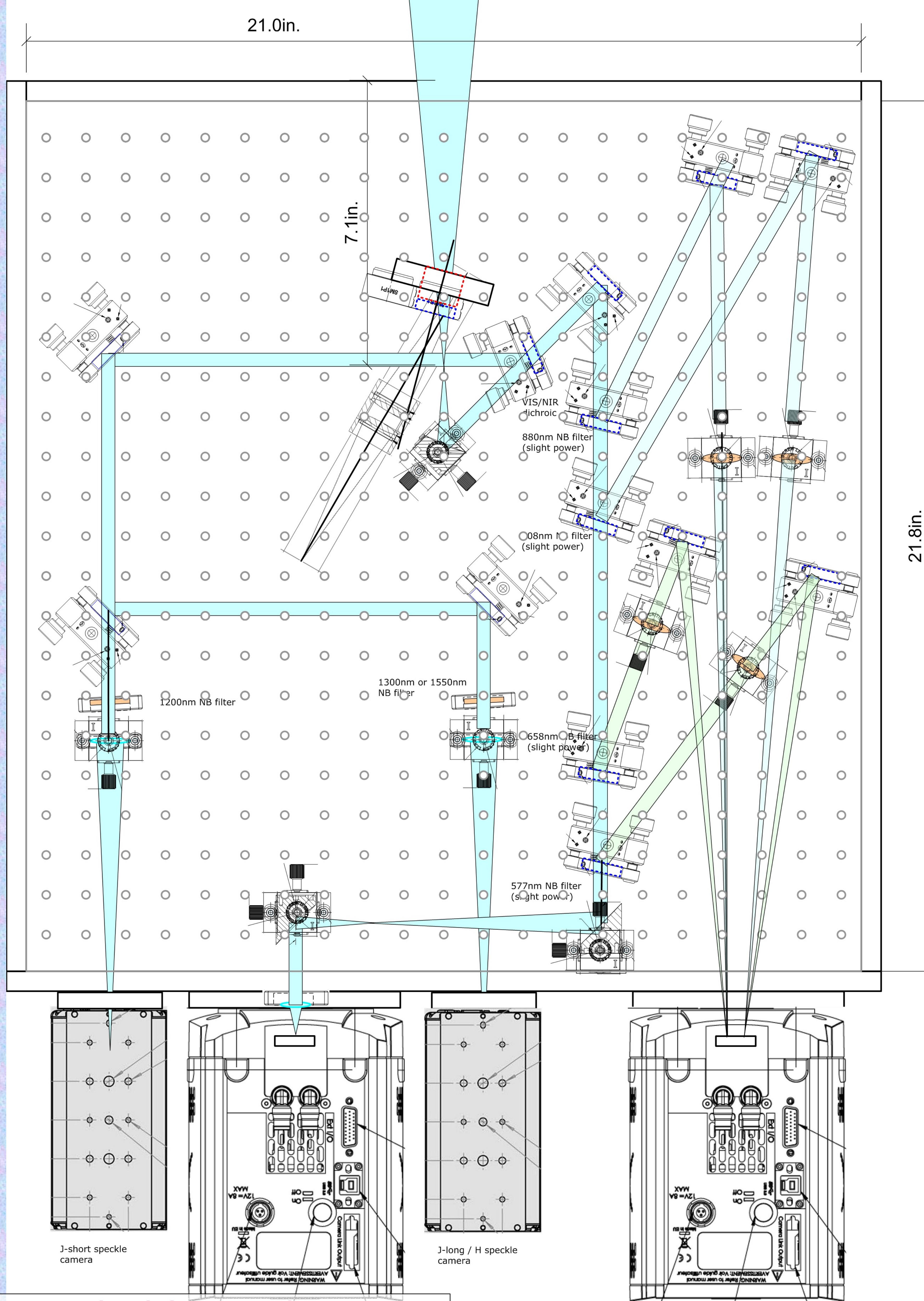
Optimization for M-dwarfs

- Filter selection
- Near-IR channel expands detection space for companions

Exploit proven next-gen image reconstruction routines



21.0in.



Integrated Modeling Approach

Visio

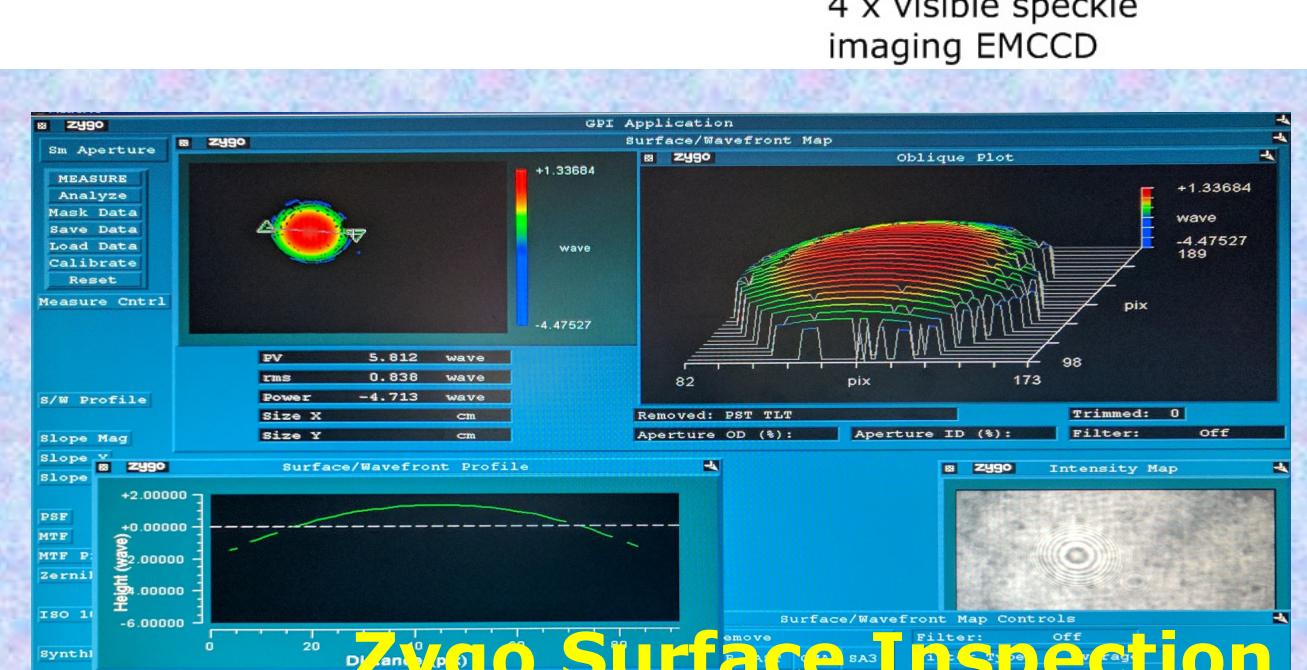
- 2D sketching software
- Rapid layout assessment
- Included as part of MS Office suit site license

FreeCAD

- 3D modeling software
- Downloadable CAD files from vendor
- Instead of SolidWorks: no expensive license fee, free

BeamFour

- Ray-tracing software
- Detailed assessment of spot
- Wavelength dependence tracking
- Extensive glass library available
- Downloadable optical prescriptions from vendor
- Instead of Zemax: no expensive license fee, free



Visio Sketch

INNOVATIVE ELEMENTS

Use of 3D Printing for Test Fixtures, Optical Mounts

Rapid prototyping

- Typical print time is 5-15 hours

Direct design-to-fit

- FreeCAD drawings can be matched to available space, optical elements

COTS Approach

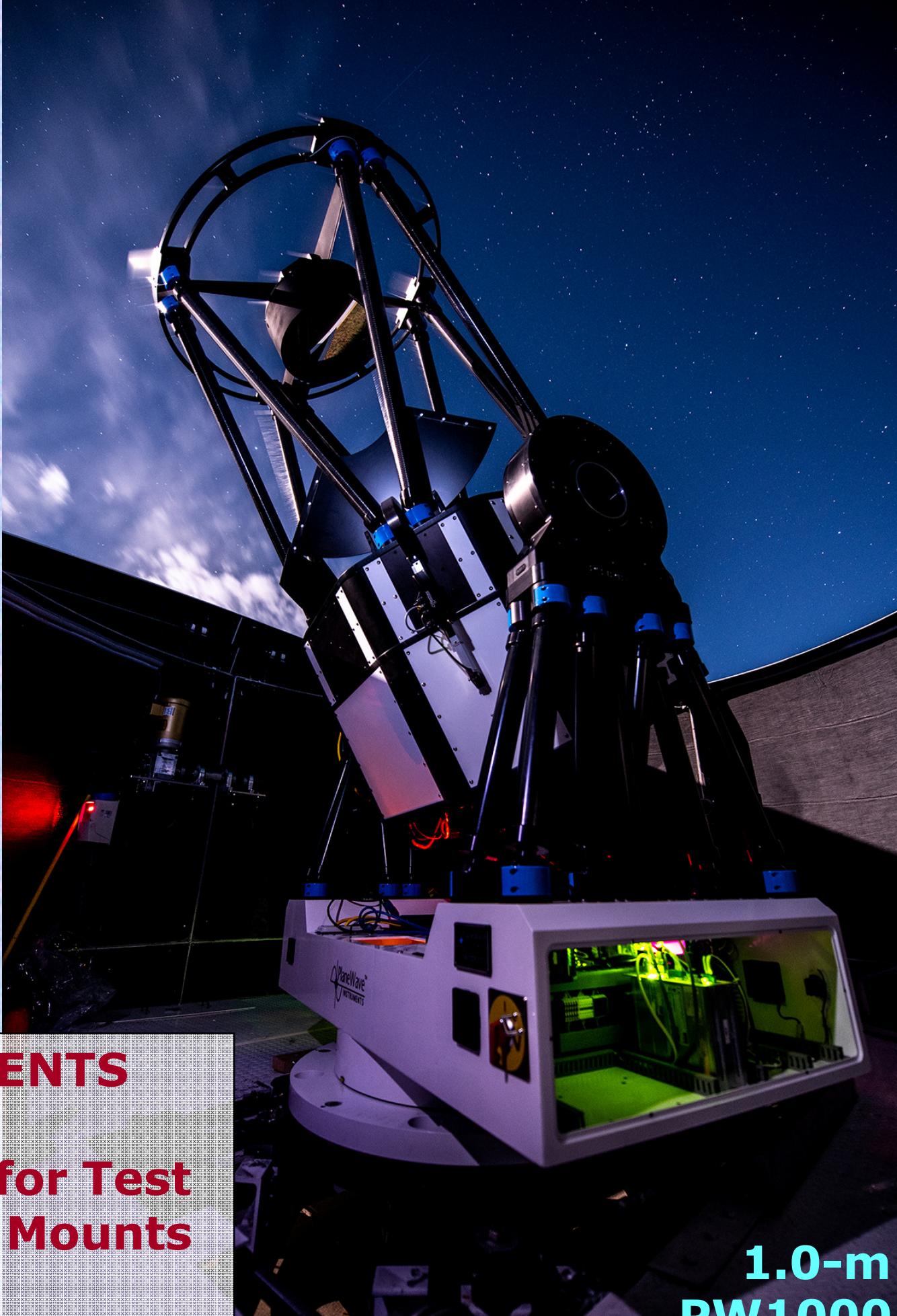
No custom optics

- Rapidly available (~1 week)
- Low cost (10x – or more – lower than custom)

Zygo Testing of Optics

Assessment of low-cost elements

- Surface assessment at the fraction of a wavelength level
- Allows characterization, use of low-cost COTS filters



1.0-m PW1000



4.3-m DCT

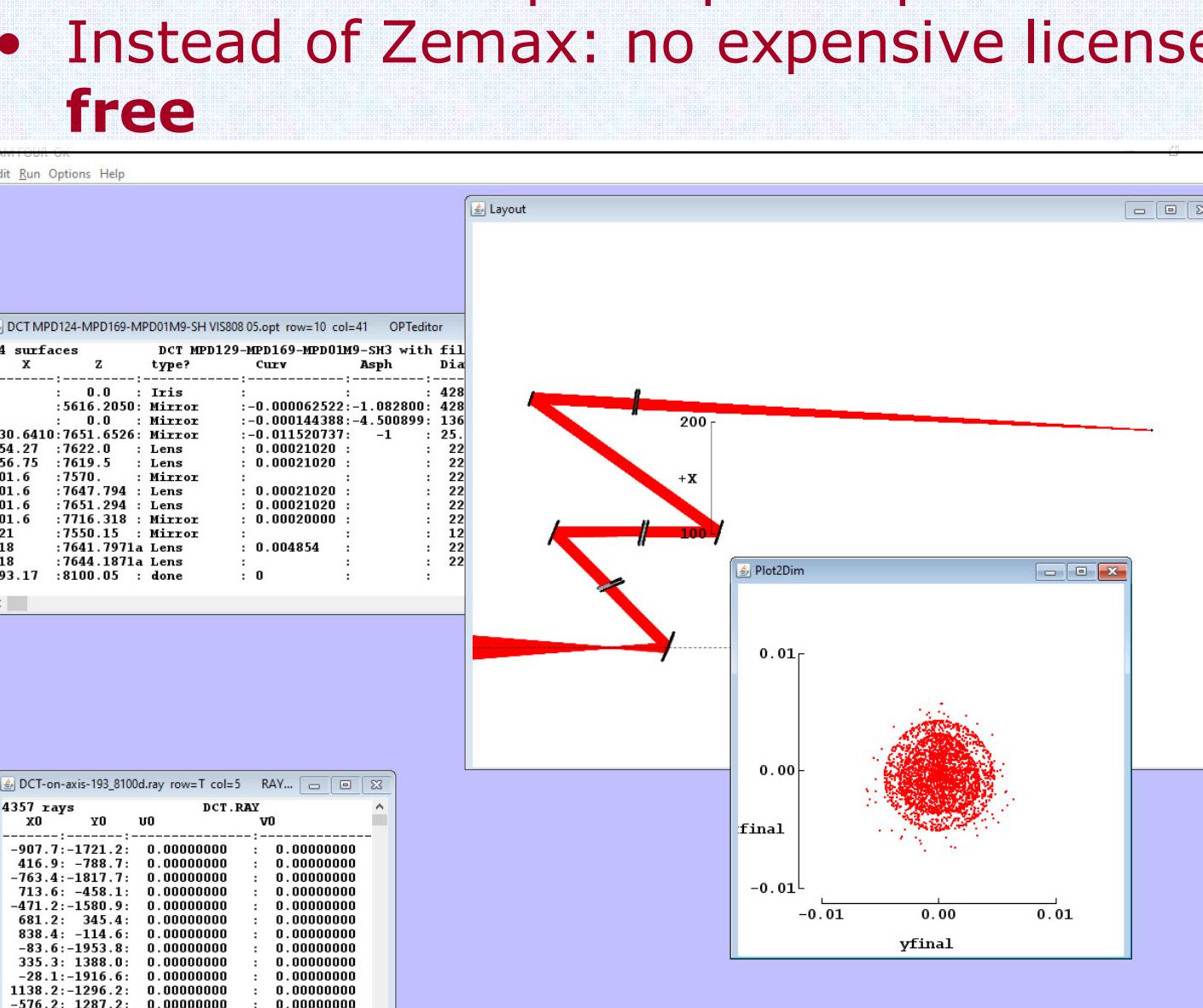
Timing Module

Synchronization

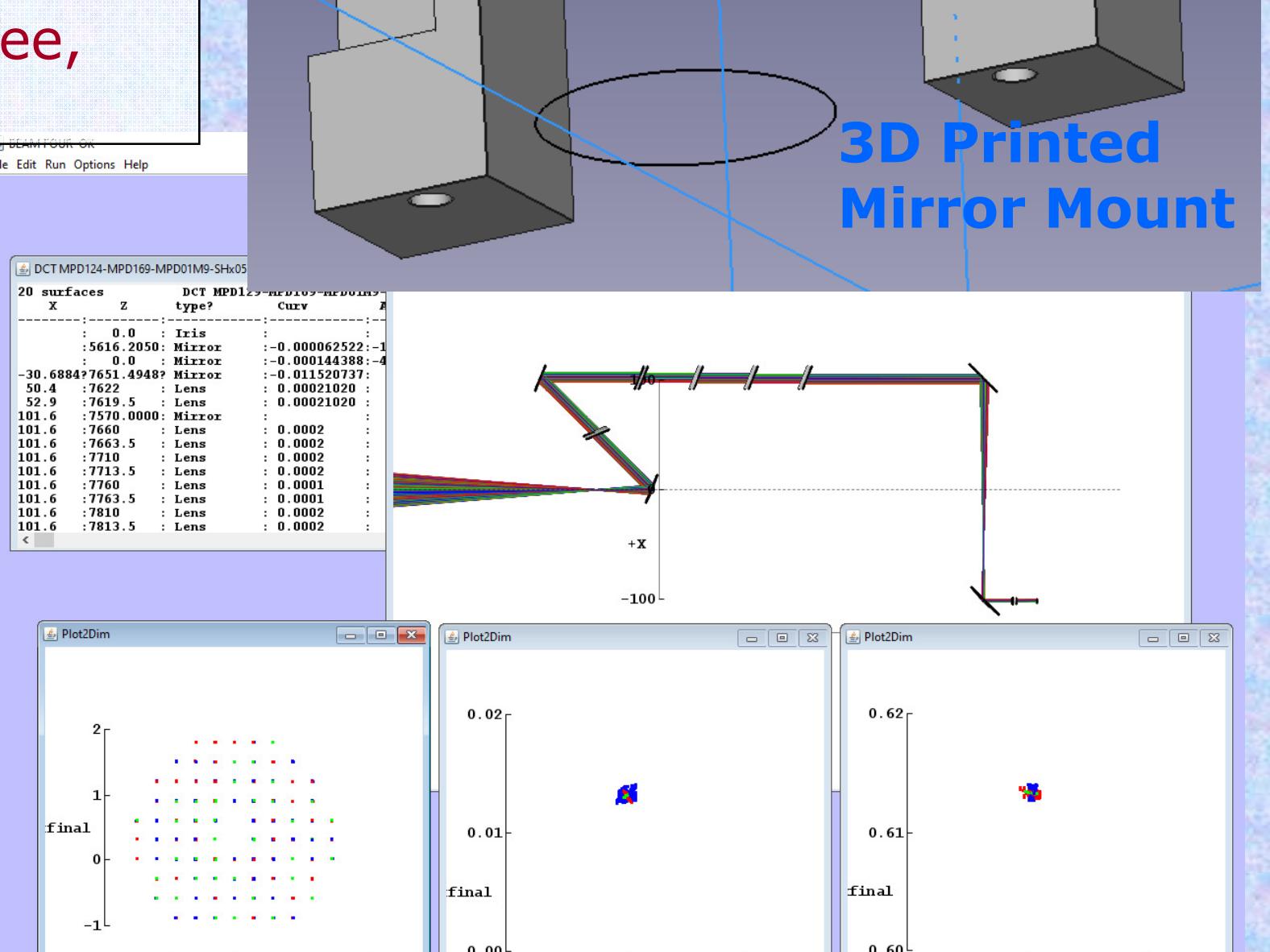
- All detectors will run in lock-step with each other
- Good for 2 EMCCDs, 2 InGaAs detectors

Staggered cadence for WFS

- Can sample multiple WFS frames for each speckle frame



BeamFour Modeling



Acknowledgements:

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ONLINE RESOURCES

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