



MODS Optics Progress

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MODS Progress Review – 2004 April 22

Outline

Instrument Optics overview

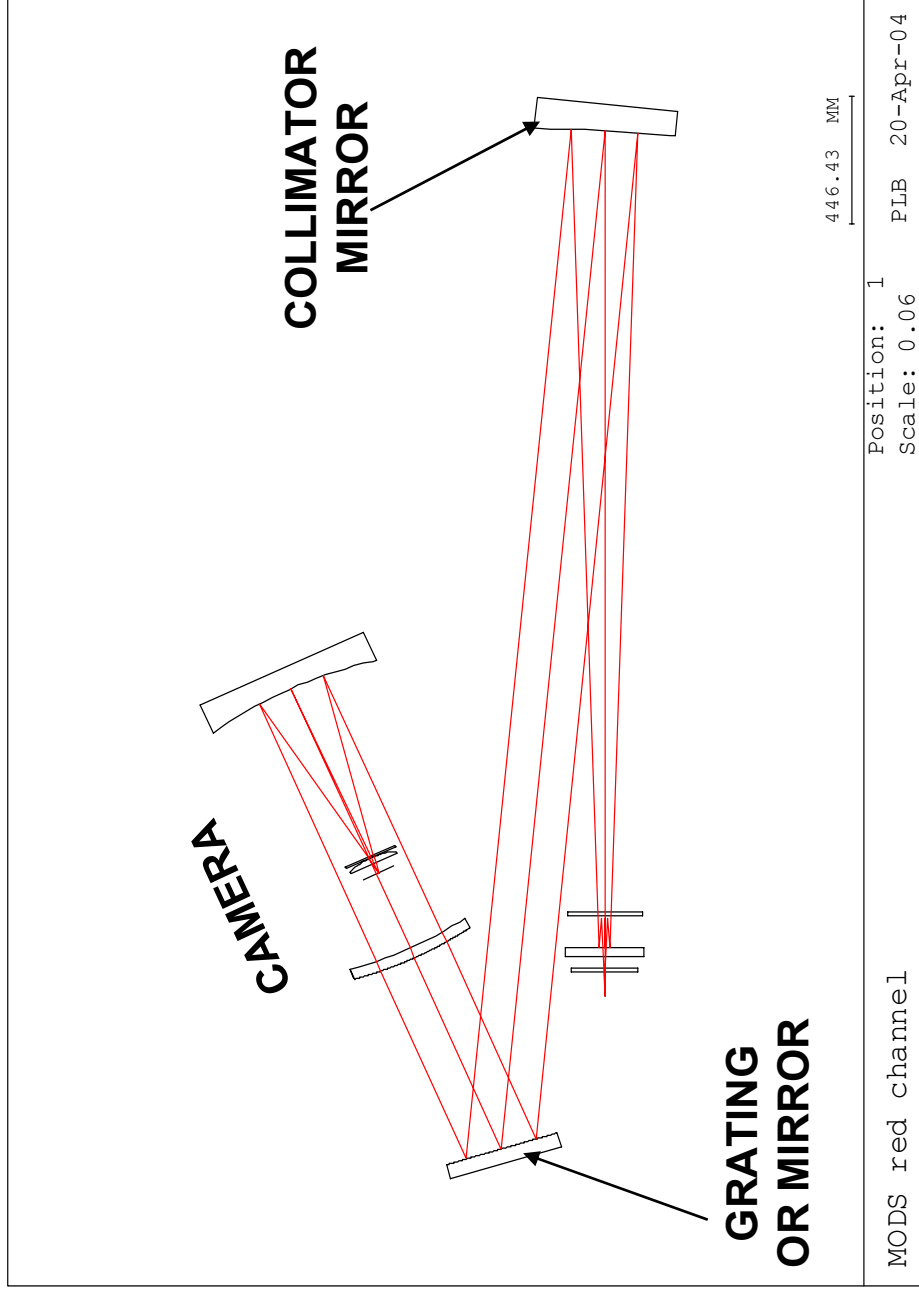
Optics procurement Status

Evaluation of Optics

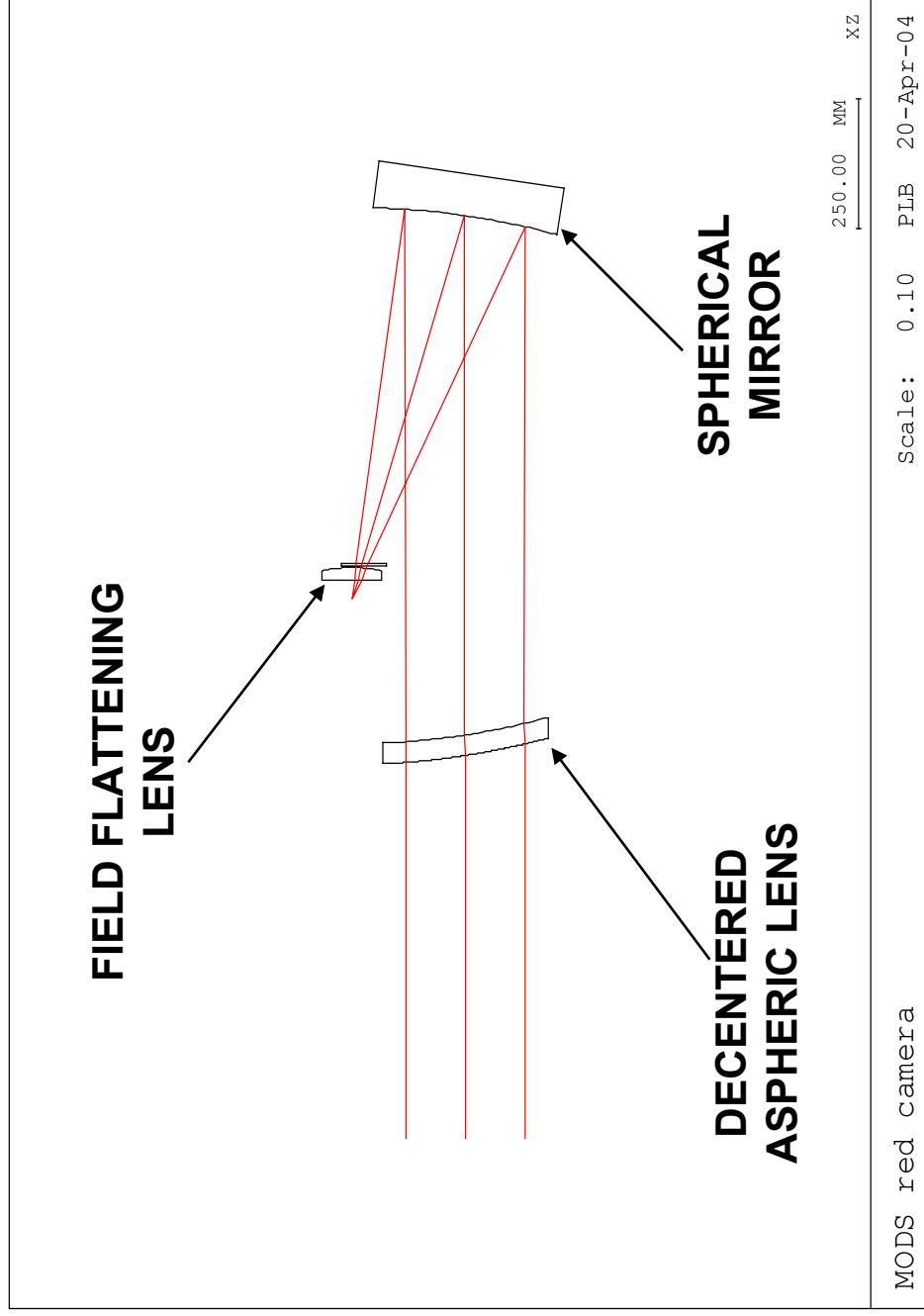
Remaining Optics Procurement

Calibration Optics

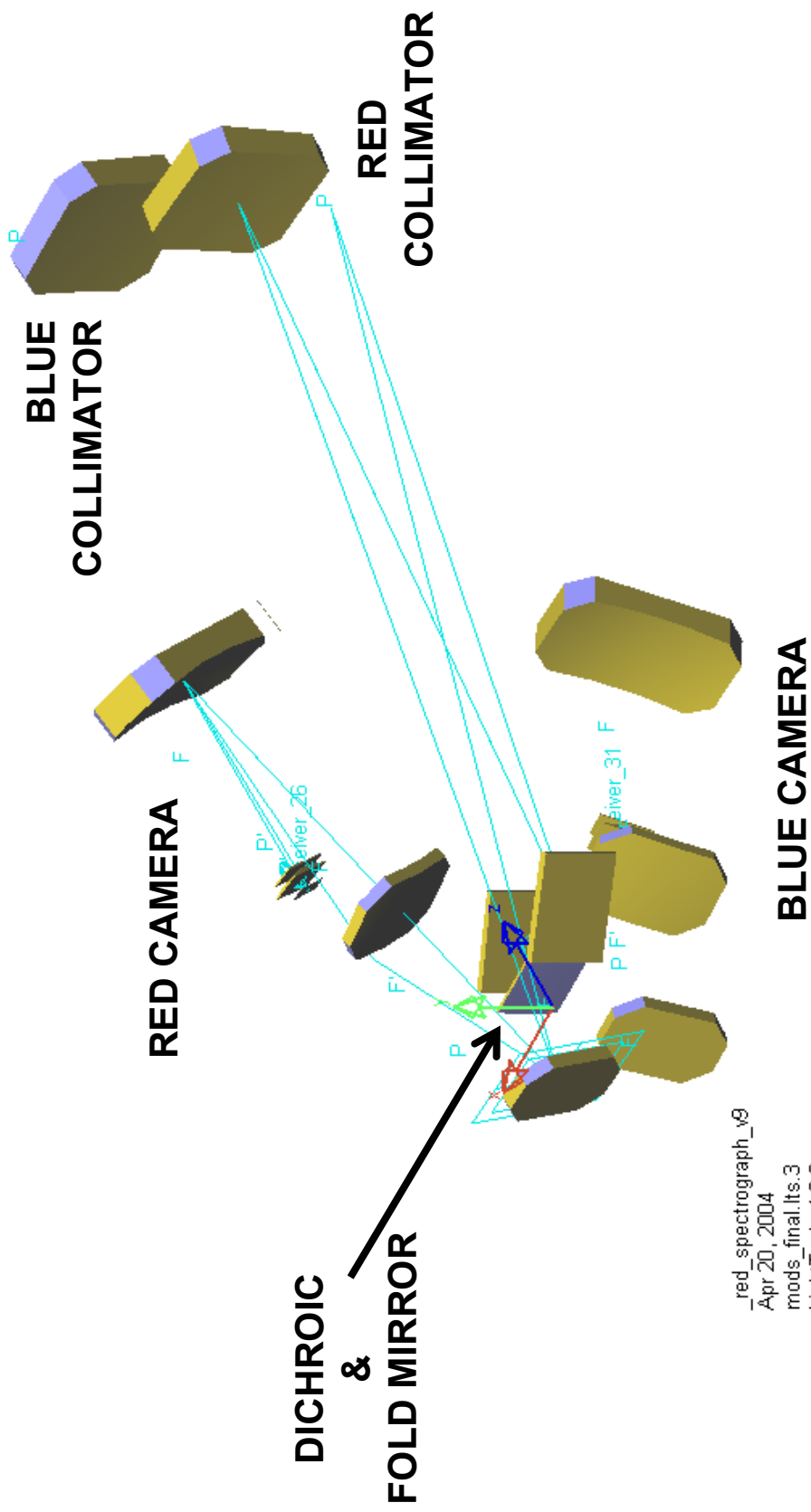
MODS Red channel



MODS Red Camera



MODS both channels shown



_red_spectrograph_v8
Apr 20, 2004
mods_final.Its.3
LightTools 4.0.0

Large Optics Procurement

Large optics for both MODS purchased together.

Decentered aspheric camera correctors fabricated 2 at a time from a single parent optic.

Cost savings for Collimators & Camera Mirrors when ordered in quantities of 4 each.

Large Optics Procurement Status

Item	Substrate	Optical work	status
Collimators	Hextek	Sagem	4 of 4
Camera Mirrors	Hextek	SOML	1 of 4
Blue corrector	Corning fused Si	SOML	In final figuring
Red Corrector	Ohara S-BSL7	SOML	Generated & fine ground

Additional finished optics received from SOML

2 field lenses one for each copy of MODS

2 fused silica field-flatteners for the blue channels

2 field-flatteners for the red channels

- Red flatteners are made of Schott NZK7 glass to avoid ^{40}K β -emission on the CCD.

Gratings & Imaging Flats Purchased

Red and Blue R=2000 reflection gratings from Richardson Grating Labs.

Two imaging flats with protected Aluminum coatings from JML for MODS blue channel.

Two imaging flats with enhanced silver coatings from JML for MODS red channel.

Status Of Blue Correctors

Both correctors are generated from a single parent

- The aspheric front surface is machined on a FADAL NC mill, fine ground with loose abrasive. Tested on the CMM machine
- Polished and tested in double-pass against a sphere using a null-lens

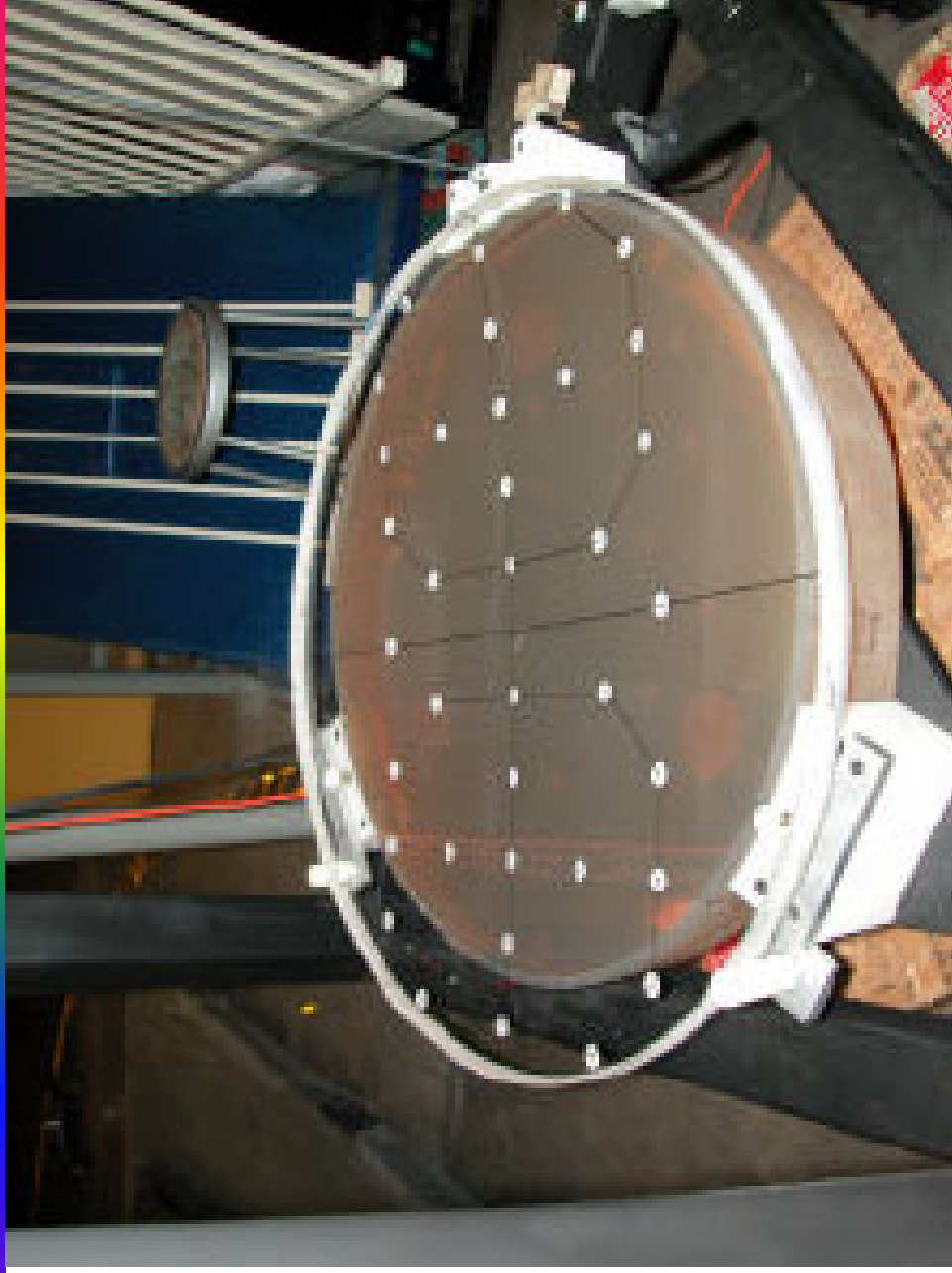
Current figure:

- Needs to be improved by a factor of 3

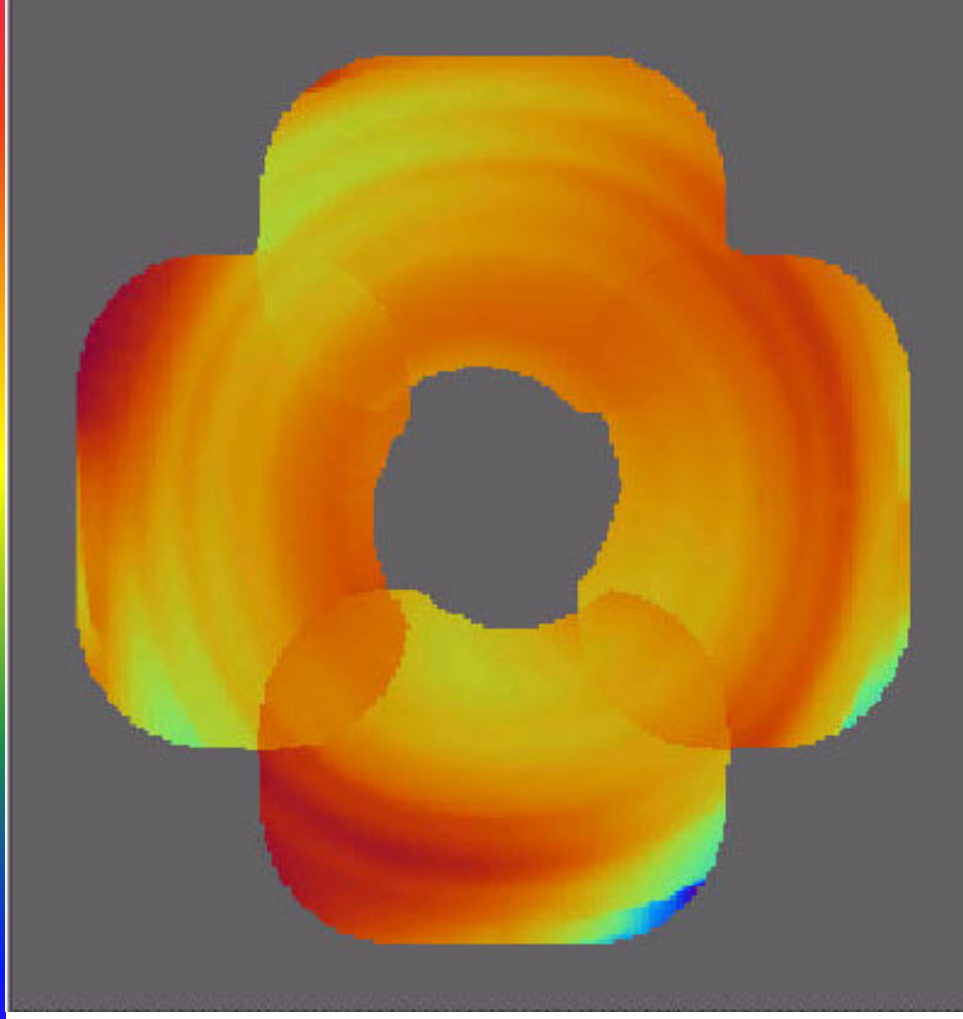
Blue Corrector on CMM



Blue corrector and test sphere set-up for Null-lens test at SOML

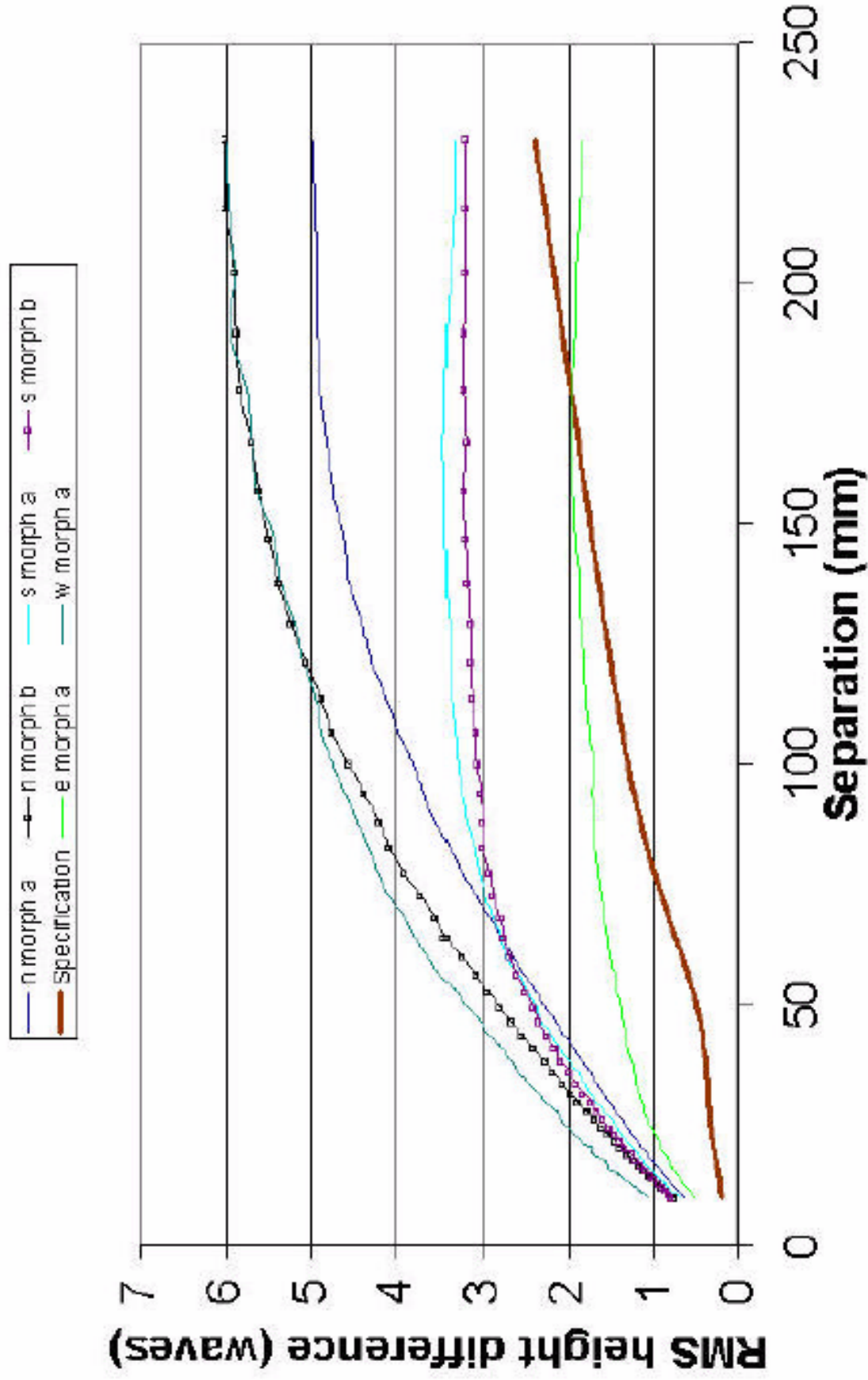


Current Null-lens test results



Current structure function

040413



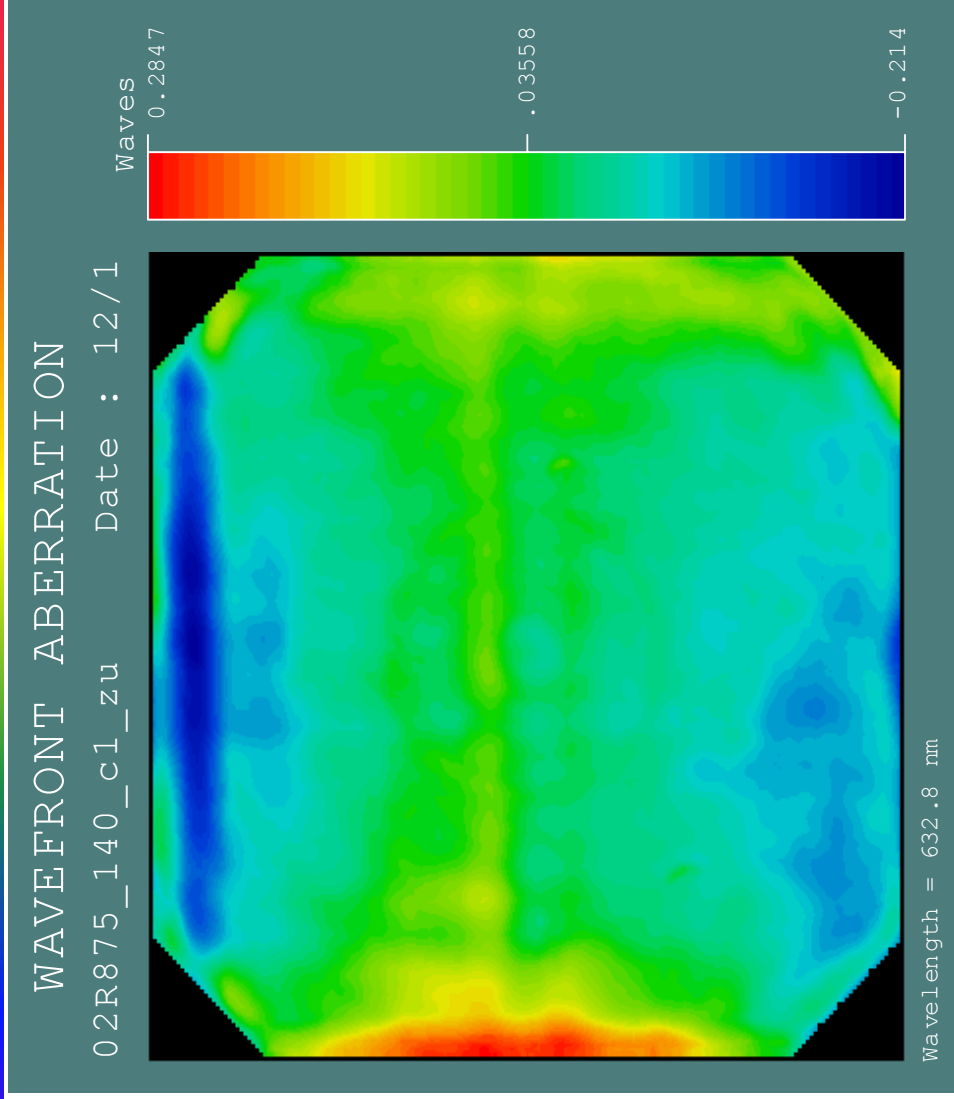
Evaluation of Optics

All the received optics are accompanied by test reports from the vendor.

The large optics reports are accompanied by digital surface or wave front maps.

These maps will be incorporated into the Code-V design to predict the actual imaging performance of the optics.

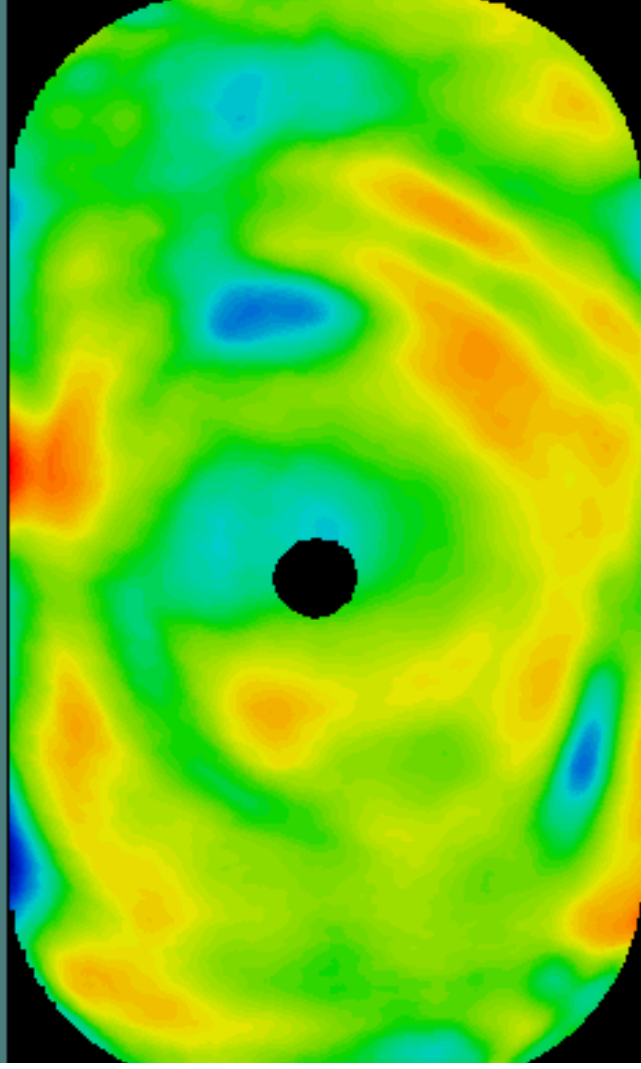
Collimator Mirror Wavefront Error



Camera Mirror #1 Surface Error

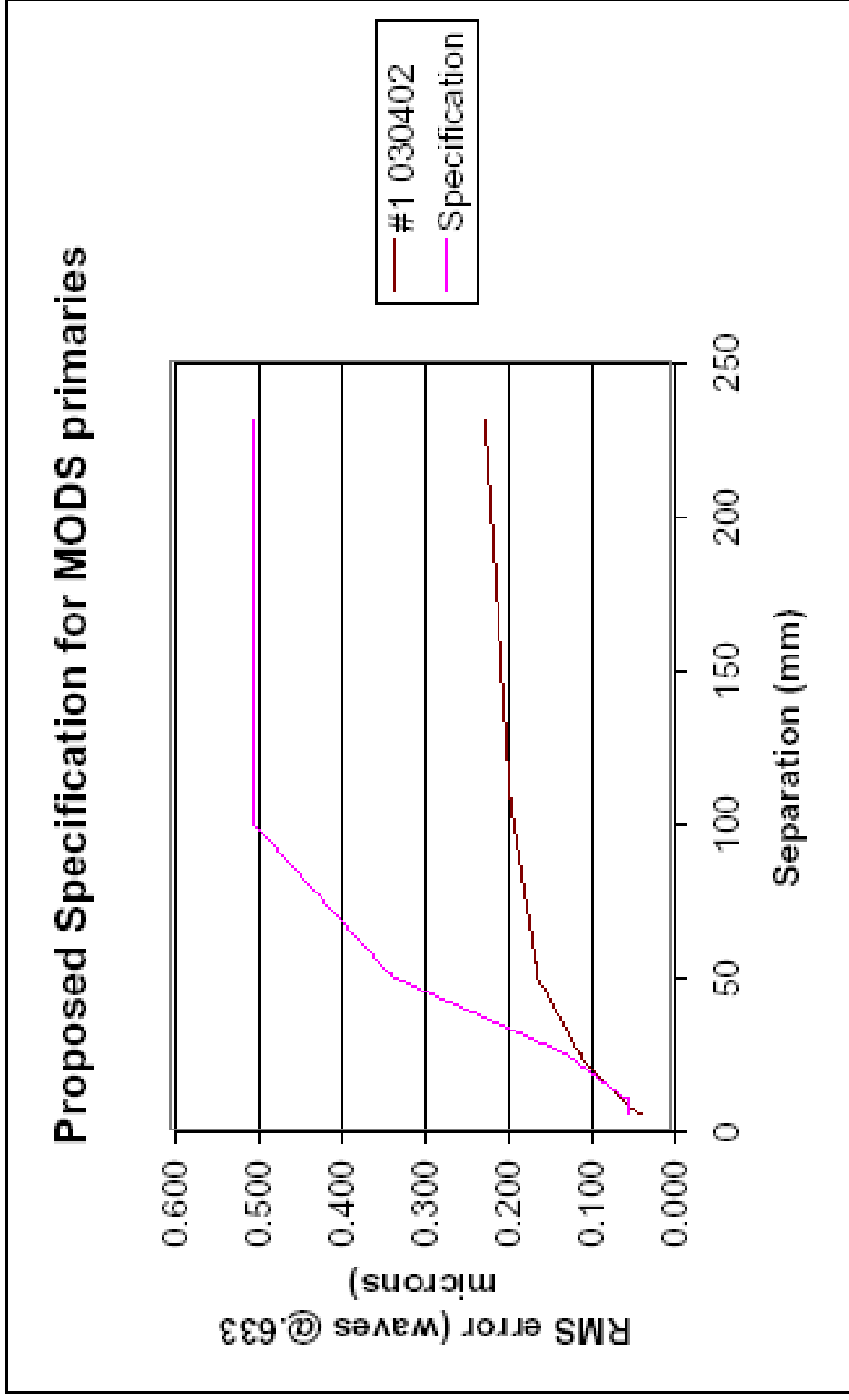
SURFACE DEFORMATION

Code V surface from Phase MOSAIC



wavelength = ***** nm

Camera Mirror Structure Function



Calibration System

12-in integrating sphere with 4-in exit port,
with center stop to model telescope pupil.
Lens in front of slit mask or aperture images exit
port on grating or imaging flat.

Illumination in sphere:

Three (3) 10W Quartz Halogen Lamps

Up to 5 “PenRay” Lamps (Hg, Ne, Ar, Kr, Xe)

Calibration Optics

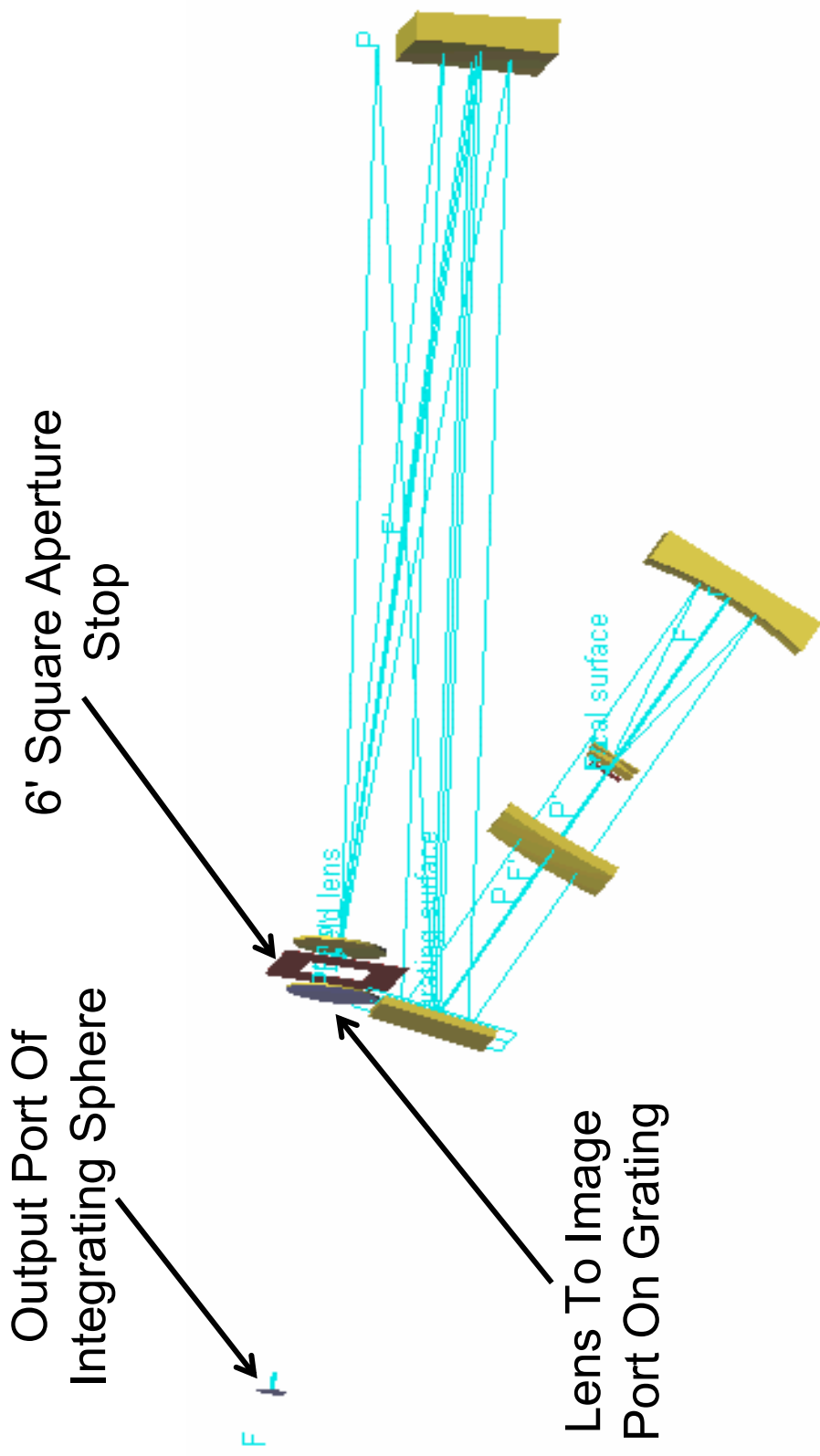


Image of 4" output port of 12" Integrating Sphere on MODS imaging flat

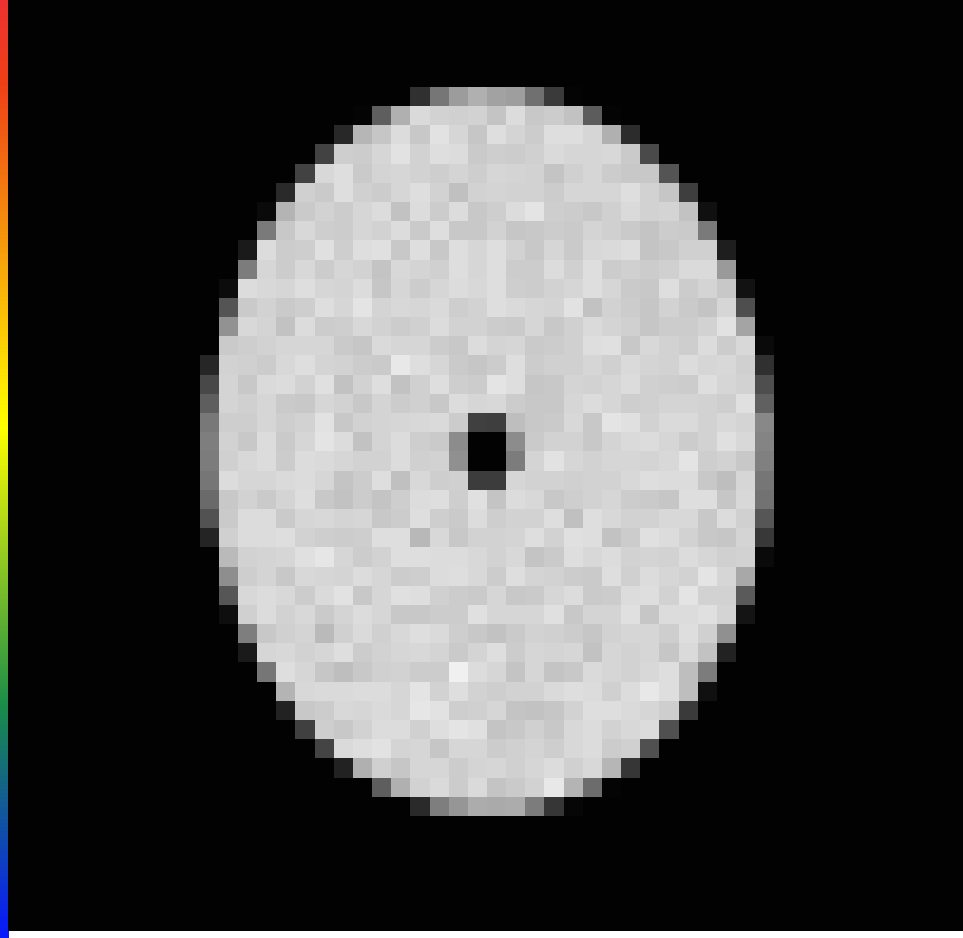
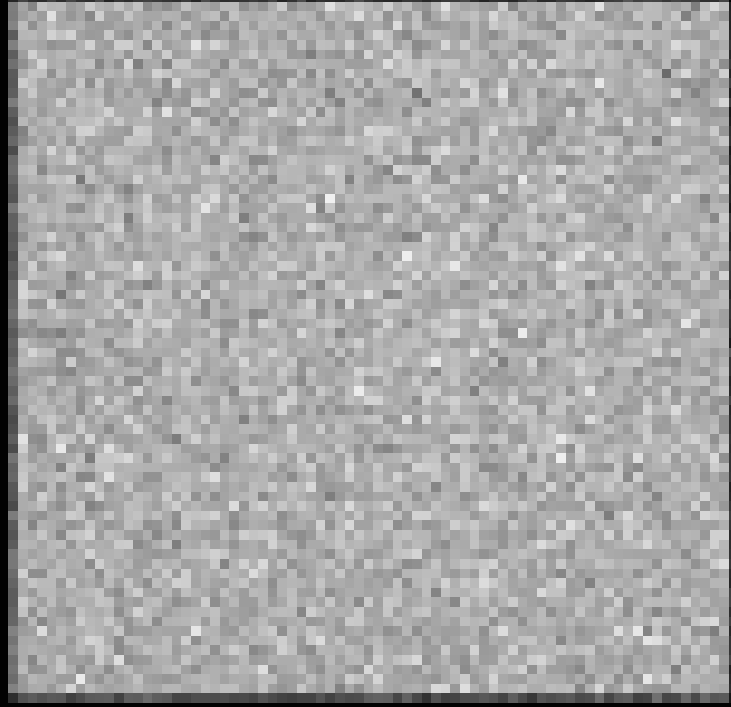


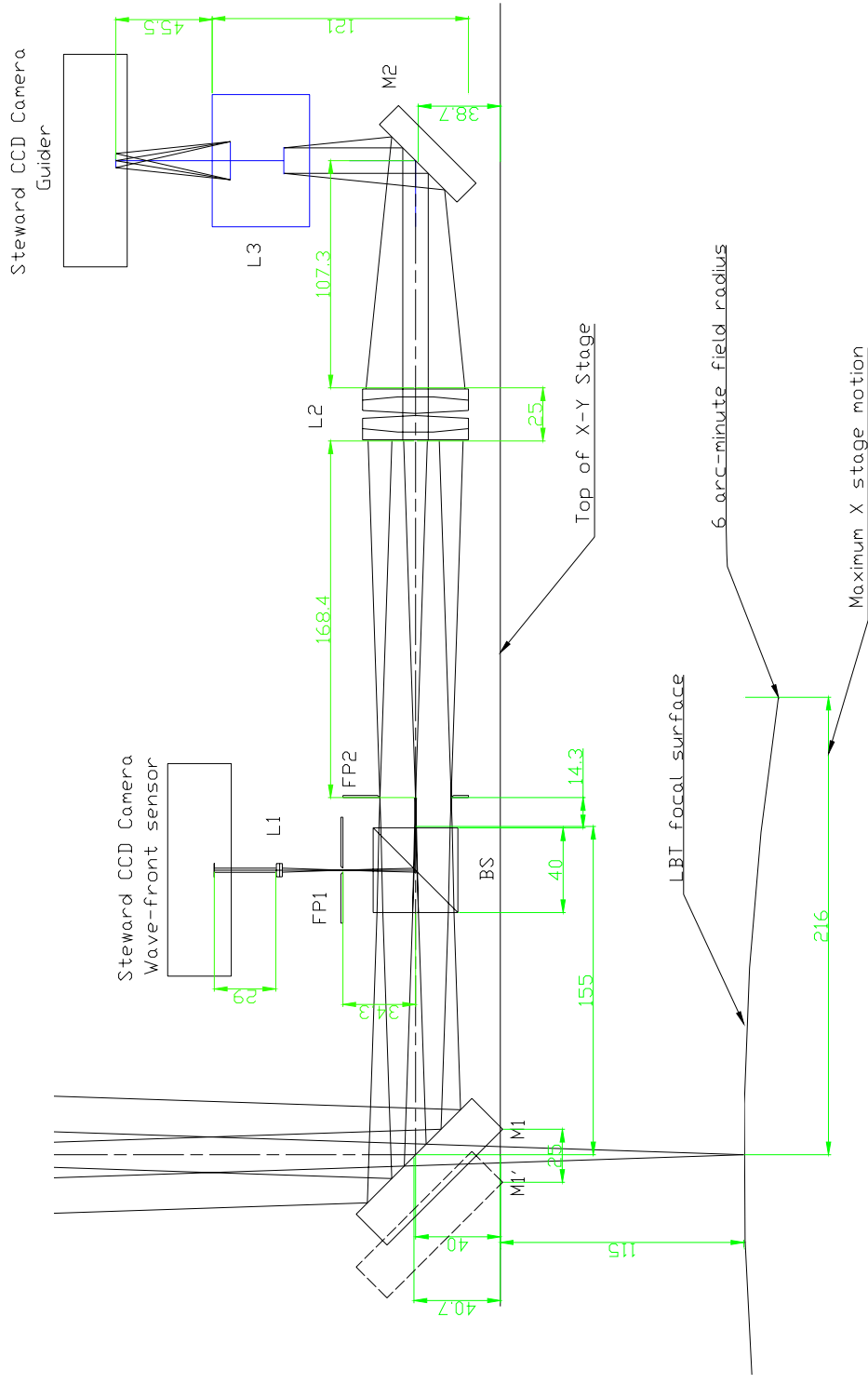
Image of aperture stop on the MODS focal surface



Guider & Wavefront Sensor

- Collimator/re-imaging design using commercial optics
- Wavefront sensor uses Steward Observatory provided camera with integral lenslet array and CCD
- Guider camera uses Steward Observatory camera to image a 1 arc-minute square field

Guider and WFS Optics



Remaining Optics Procurement

Folding flat mirrors and Dichroics

- Currently out for bids.

Pupil imaging lens for calibration system

- Currently out for bids.

Reflective and BBAR coatings on red and blue collimator and camera optics

- Bids received and under review.