NIC-FPS Critical Design Review

Opto-Mechanical Components

Mark B. Vincent

(CU-CASA)

26 July 2002

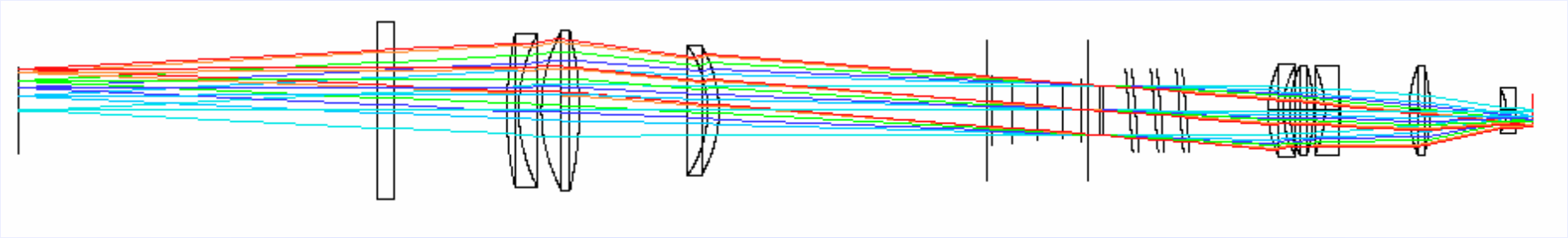
CASA-ARL

Boulder, CO

NIC-FPS Critical Design Review

Opto-Mechanical Components Include:

- Window – CaF_2 140 mm diameter, 14 mm thick, no wedge, no AR on exterior surface
- Lens mounts – Collimator w/ 3 lenses, Camera w/ 5 lenses
- Etalon Actuator – Linear translator
- Lyot Stop – Stationary once aligned
- Filter Wheels – Three 7 slot wheels
- FPA Mount – Supplied by Rockwell



Lens Mounts

- Collimator and camera in separate Al tubes
- Collimator-camera alignment tolerances ~1 mm offset, ~ 1’ tilt
- Warm up and cool down rates determined by contact area with bench

- Individual lenses are held in collet fingers mounts based on the Ohio State University Imaging Sciences Laboratory’s (ISL) design
- Collet fingers have decenter and tilt tolerances of < 50 µm which is sufficient for the NIC-FPS optics
- Prototype lens mount provided by University of North Carolina

- Lens spacing set by spacers between the collet fingers

Etalon Actuator

- Will use a cryogenic linear translator of ~ 90 mm travel
- Wiring is flexible at 77 K – will flex our cable extension
- Limited to 20 mm maximum depth
- Three options:
  1. Commercially manufactured – available, but insufficient travel
  2. O'Brien (ISL) has a design that has worked without failure for a number of years in OSIRIS
  3. Design one in-house
- Etalon is mounted perpendicular to beam
- Etalon itself is mounted by six m4 bolts, three on each face
  These bolts are the sole thermal contacts

Lyot Stop

- Cold Lyot stop used to minimize radiation from beyond the primary mirror reaching the FPA
- Pupil is 40 mm diameter with 4.6 mm central obstruction
- Recommend undersizing the primary and oversizing the central obstruction by 175 µm. This is 0.9% by diameter and 1.8% by area
- Lyot stop is a mask deposited onto a 50 mm diameter, 3 mm thick fused silica or CaF_2 substrate
- Zemax runs suggests that once the stop is aligned to the optical axis, no further alignment is necessary to compensate for telescope-instrument misalignments
- Alignment made by changing shims

Filter Wheels

- Three 7 slot filter wheels for 17 filters, 1 blank, 3 opens (one in each wheel)
- Arranged in a pair and single on opposite sides of the bench
- Direct drive cryo stepper motor in contact with gear around the circumference of the wheel, gear ratio ~ 23:1
- Three microswitches provide direct position readout, one microswitch on detent
- Wheel, detent, direct position readout and bearings based on ISL highly successful design

Integration & Testing

- Request for quotes on optics placed next week
- Order optics in September
- 4-5 month lead time on optics – arrive by February 2003
- Design optomechanical & fab components August 2002 – February 2003

- Final lens spacings will not be determined until the as-built optics specs are in. We will work closely with the vendor to minimize the impact of fabrication tolerances on image quality and element spacings.
- Final pupil position is not known until the as-aligned optics are in house

- Ron Probst and Jay Elias of NOAO will provide a tour of their facility and discuss optical alignment
- May visit Tom O'Brien at OSU to see the upgrade of TIFKAM