System-Level and Optics RFAs from CDR

1. Q: An internal calibration system would be highly desirable. The savings in overhead time may well justify the cost, and would streamline procedures for checking out the instrument. Also, it was mentioned that F-P observers would do 2-hour white light cubes in the A.M. at the end of a night, but current APO ops procedures preclude leaving instruments mounted on the scope and unattended.
   - A: An internal calibration system would be desirable but is out of the budgetary scope for this instrument. Ample room is available in the front end of the dewar if such a system is required. Imaging modes will use sky flats. F-P modes can wavelength-calibrate on OH sky lines, and a white light cube can be obtained to flat-field datasets. We plan to spend a significant portion of commissioning runs obtaining suitable calibration data. The frequency with which such data need to be obtained is TBD.
2. Q: What is the path to obtain science filters? How does this trade off against upgrades such as the 2kx2k chip?
   - J, H, and K-short have been procured from Barr. ARC CIF funds will be used to procure one or more z-band filters. A Y-band filter and large selection of narrow-band filters were part of a proposal to the NSF ATI program. If the NSF proposal is successful, we will be able to fill the filter wheels with filters. If not, then we may need to request CIF funds to do so, or encourage others in the ARC community to include funds for filters in subsequent grant proposals. The 2k upgrade is probably more sensible after at least 1 year of NIC-FPS operations and plans are made to institute tip/tilt corrections on the tertiary.
3. Q: Can we utilize NSO ISOON spare etalon controllers?
   - Discussions with NSO and Queensgate (now IC Optical Systems) suggest their CS-100 etalon controllers are not configured to control cryogenic etalons.
4. Q: Details on I&T plans sketchy. Flesh out for 1-year review (e.g., how will optical performance of instrument be verified in lab?)
   - Optical performance of lenses will be checked by vendor (Janos). Optics will be delivered aligned in mounts. The optics+mounts will be integrated onto the optical bench during I&T and the cold performance will be tested. The test set-up will likely involve a fiber optic cable mounted on an x,y translation stage at the position of the telescope focal plane that transmits in-band light with an f/10 input beam. The spot will be scanned across the field of view to check image performance. Related I&T procedures will be discussed at the 1-year progress review.
5. Q: Find out how much new test plates would cost before changing design.
   - Lens radii now match Janos test plates and deliver high-quality system imaging performance.
6. Q: Need detailed treatment of internal baffling for optics.
   - Baffling arrangements are being considered, especially for the area near the entrance window. The optics are mounted in separate collimator and camera tubes which should mitigate stray light entering the system. The FPA is

mounted close to the camera tube and cannot "see" the rest of the dewar. Detailed baffling design will be undertaken after the optics are delivered.

7. Q: Consider fused silica with AR coating and maybe a wedge or tilt for the entrance window.
   - Materials and tilt were investigated. It was decided to stay with a 14 mm thick CaF_2 window, AR coated, mounted perpendicular to the beam. The window has been moved out on a dewar snout 5 inches toward the telescope focal plane away from the lenses. Checks with Zemax suggest that ghosting is not expected to be significant. The reflection off the first collimator lens expands by 16 inches and this ghost is grossly out of focus. Internal reflections within the window could also create a ghost, but is expected to be several orders of magnitude below the primary image.
8. Q: Lyot stop needs to be smaller than image of primary, including cat-eye edge mask.
   - OK. We will request an image of the primary mirror from ARC, if one can be obtained at nasmyth port 2.
9. Q: Pupil lateral position may be changed by tertiary or other telescope adjustments. Please consider this.
   - OK. See above.
10. Q: Should check out Coastal Optical Systems for optics manufacturing.
    - Coastal responded to our optics bid, but could not provide suitable references for previous cryogenic optics work, nor did they bid to supply the optics mounts. Janos was selected as the optics vendor.
11. Q: Check into using the APO shack-hartmann sensor for use to align the optics.
    - We can discuss this at the 1-year progress review.

Thermal and Mechanical RFAs from CDR

12. Q: Need to consider moving or adding getters to protect FPA… or use FPA heater
    - A: Will have FPA heater and cold zeolite getter (possibly charcoal plus zeolite) which does not release water or contaminants. Need to define warm-up process so that the FPA is warmer than surrounding media. Back-to-nature failure is very slow (many days) and the getter materials will still be active during the warming process
13. Q: Look into having small getter mounted to the FPA.
    - A: see previous
14. Q: Need a guide for the cable wrap…
    - A: Warm section has such a guide in the inset of the access hole pattern. If this proves insufficient during I&T, will beef up the guides by adding feature(s) to cover plates for the five openings.
15. Q: Issues related to heat dissipation—need a vent to exhaust to mid-level.
    - A: We have not yet determined the heat loads for the instrument controller(s), etc. When we have this data, will determine the heat dissipation requirements, both when the instrument is on the telescope (hard) and when it is on the cart (easy).
16. Q: Optical bench cantilever "travel" brace.

17. A: Have designed a set of hard braces for protecting the instrument during its trip to APO. The LN2 tank will be hard-mounted with 4 S.S. plates substituted for G-10 plates, two or more thermal straps will be replaced by hard brackets to support the bench cantilever, thermal shield will be hard attached instead of floating, and critical optical components (e.g., filters) may be removed and transported in separate packaging.
18. Q: LN2 slosh…
    - A: The configuration of our charging connection is similar to GRIMII and we have added a tube that extends into the middle of the tank where "slosh" should be minimal. Otherwise, after watching the telescope deck process of LN2 filling, our instrument should be as safe to fill and move as any of the current designs and operational practices.
19. Q: Does the instrument have an estimated shock limit (in G's)?
    - A: Nothing has yet been defined.
20. Q: If forget to fill the instrument w/ LN2, does it warm gracefully…
    - A: Basically, the instrument all warms together, but the biggest thermal mass is the bench/beams/cold standoff (which all will remain within a degree or so of each other). With the amount of thermal mass that will start out cold, the warm up will occur over several days, during which the getters will actively adsorb water and "contaminants." Additionally, the FPA has its own heater, so it may be programmable to actively warm a certain minimum amount over ambient—we don't have sufficient info on this control system to determine this definitely.