May 2013 Update on APO Imager Proposal

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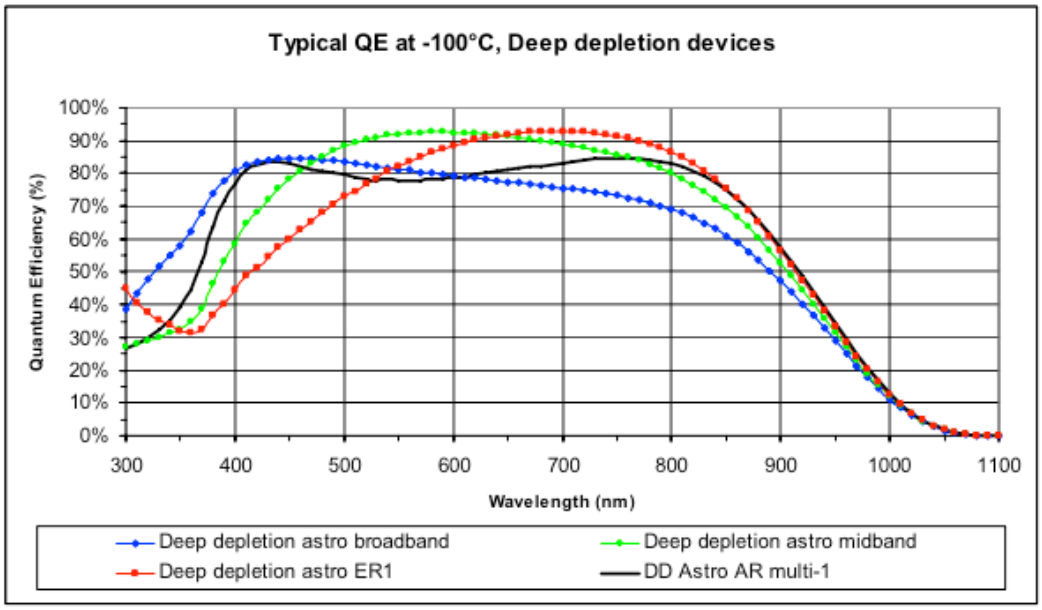
In March 2013, a proposal for an imager on the APO 3.5m telescope was presented to the users committee. This proposal outlined several options for a general-purpose optical imager to replace the aging and hard to maintain SPICam. Feedback and discussion over the last couple months has allowed us to make some design decisions. From this feedback it was determined that the most important properties of this imager should include good throughput, good spatial resolution, fast readout, and capability to use narrow band filters (both existing and new). Many institutions felt that the proposed widest field option (~12'x12' FOV) would not present a significant scientific advantage compared to the increased cost of the detector. We have incorporated the user comments into the following proposed properties for the APO Imager and are presenting them here for final approval by the committee.

The detector will be an e2v CCD231, 4Kx4K, 60mm device with 15 micron pixels. The broadband coating will give good response well into the blue (see figure below). The CCD allows many binning modes but 2x2 or 3x3 is expected to be used in normal operation. To increase the science capability, one quadrant of the CCD (1K x 4K region) will have the option of being readout separately. Subframing of any region of the CCD will also allow a short readout time, less than 1 second, on a smaller region of sky. The readout electronics will use a Leach controller, similar to others in use at APO. Cooling will be accomplished with the same cryotiger system currently used by other 3.5m instruments. Both the controller and cooling options improve the maintainability of the instrument at APO. A three-element f/7 focal reducer will yield a FOV of ~ 8.5'x8.5' on the CCD, almost 3 times larger in area than the current 5'x5' FOV delivered by SPICam. The new imager will be mounted on the NA2 port to save the significant cost and effort of rotator and guider development that would be necessary at a side (TR) port. The proposed field will not be obstructed by the M2 or M3 baffles, but the NA2 baffle will vignette the field beyond 6.1 arcminutes, so we will have to modify the NA2 baffle to accommodate the larger proposed field. Studies of baffling and scattered light will be conducted to ensure that the new imager will deliver good photometric performance. Two filter wheels are envisioned, to hold full size 4.5 inch filters that will cover the entire field, as well as the current host of 2 inch and 3 inch specialty filters which will be useful over a narrower field (e.g. 5' FOV in the case of the 3 inch filters).

Imager Properties:

CCD:	e2v CCD231 w/ fringe suppression
CCD coating:	DD Astro Broadband (blue curve in plot below)
electronics:	Leach controller
pixel size:	15 microns
plate scale:	0.126"/pixel (with f/7 focal reducer)
readout time:	5 seconds full frame with no binning
readnoise:	~2 electrons
dark current:	3 electrons/pixel/hour at -100C
optics:	3 element focal reducer
focal ratio:	f/7
field:	8.5'x8.5' FOV
mounting:	NA2 port
filters:	4.5inch full field; can accommodate 3inch and 2inch over smaller field
cooling:	cryotiger system


Typical QE at -100°C, Deep depletion devices
Quantum Efficiency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
300
400
500
600
700
800
900
1000
1100
Wavelength (nm)
Deep depletion astro broadband
Deep depletion astro midband
Deep depletion astro ER1
DD Astro AR multi-1