

Newly populated e2v GMOS-N focal plane inside the dewar

## Gemini North Multi-Object Spectrograph (GMOS-N) CCDs Upgrade: Project Status and Future Plans

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### Interim Upgrade: e2v Deep Depletion Devices

GMOS-N was upgraded with e2v deep depletion CCDs in October 2011. This upgrade was intended as a quick interim stopgap measure while issues with the Hamamatsu upgrade project were resolved. GMOS-N has been collecting science data in queue with these detectors since November 22. These CCDs have the same electronics, cabling and physical characteristics of the original EEV devices (pixel scale and number of pixels). The only anticipated differences with the new detectors were improved quantum efficiency (QE) at both red (>800 nm) and blue wavelengths, and decreased fringing.

#### A plug 'n play replacement

The actual removal and replacement of the focal plane took place in the instrument lab on the summit of Mauna Kea. Personnel from Gemini and HIA worked together to complete the swap in just a few days, following ESD handling procedures learned from the Hamamatsu project. Following reinstallation, it was realized that a new temperature controller was essential to realize the QE gains. GMOS-N now operates at -100C instead of -125C. Plans to replace the cold heads and clean the "dust bunny" (apparently condensed water spots on the dewar window) were deferred until the Hamamatsu upgrade.

#### What could go wrong?

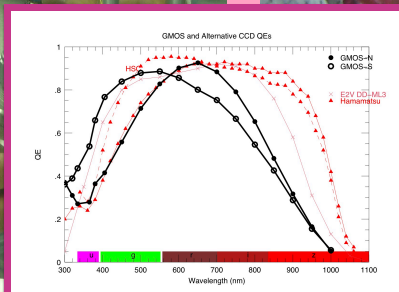
Further problems were encountered once GMOS-N was installed back on the telescope:

- > Inability to reach detector full-well (300ke<sup>-</sup>)
- > Unexplained increased noise

Variation of the detector controller voltages largely addressed the first issue, re-cabling addressed the second. This unfortunately left the detector controller unable to read out using only one amp per CCD. All GMOS-N data are currently obtained using all amps. This has necessitated a huge unanticipated effort to modify the Gemini/IRAF data reduction scripts.



The new e2v detector array, installed in the GMOS-N focal plane and ready to go back in the dewar.



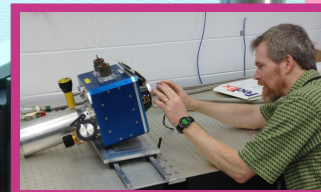
Comparison of expected QE delivered by the current GMOS CCDs (North and South), the e2vDD and Hamamatsu HSC and SC devices.

### Eventual Configuration: Hamamatsu CCDs

Deep Depletion red sensitive devices manufactured by Hamamatsu have been purchased for installation in GMOS-N and incorporated into a new focal plane at HIA. Unfortunately these CCDs have not interfaced well with the ARC controller and we are not able to achieve acceptably low noise levels at high readout rates. In addition, they have proved very susceptible to electrostatic discharge (ESD), with one science detector needing to be replaced. While this project has suffered substantial delays, Gemini is planning to go ahead and implement the upgrade because these devices offer substantial QE improvement in the red, even compared to the interim e2v DD devices.

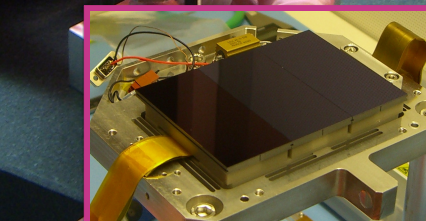
#### Status, Schedule and Lessons Learned

- > e2v DD science commissioning nearly complete (see posters 422.17, 422.18)
- > Data reduction software patch release coming soon
- > Hamamatsu characterization and noise abatement investigations to continue in Gemini instrument lab
- > Replacement Hamamatsu CCD delivery expected by April
- > GMOS-S Hamamatsu upgrade schedule: Nov 2012 - Feb 2013 -OR- March - May 2013
- > GMOS-N Hamamatsu upgrade schedule: June - Aug 2013 -OR- Nov 2012 - Jan 2013
- > Nothing ever goes as planned
- > Schedule decided by late february 2012 (and subject to revision)



#### This just in!

The Hamamatsu focal plane has arrived at Gemini North headquarters in Hilo and was unpacked and inspected by Gemini and HIA personnel January 04. All looks good!



The current Hamamatsu focal plane array consisting of two SC type and one HSC type detectors. Note the darker color of the detector on the left: the improved anti-reflective coating increases the blue response of the CCD while maintaining the red QE.