Commissioning of the new GMOS-N Hamamatsu CCDs

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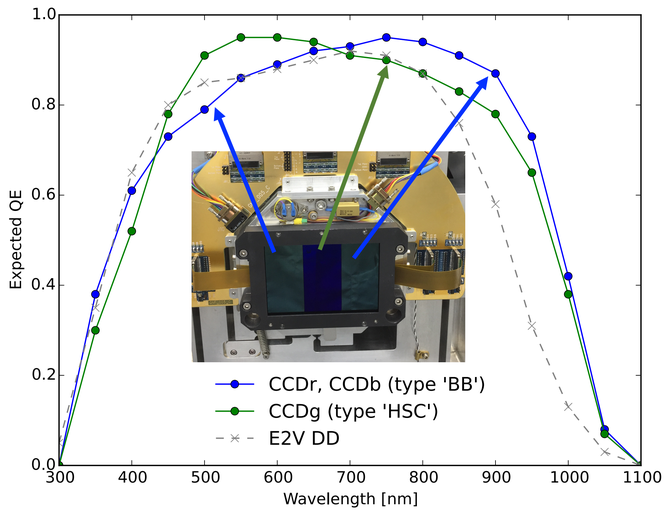
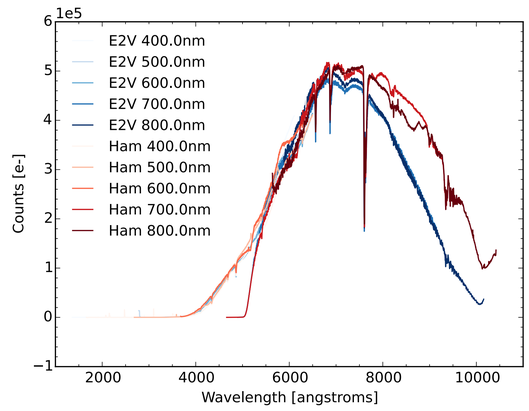
The GMOS-N E2V deep depletion detectors were upgraded with Hamamatsu fully-depleted CCDs during February/March 2017. The new detector array has been used for first science observations since March 26. Both GMOS instruments at Gemini North and South are now operated using Hamamatsu CCDs.

Hamamatsu detector array

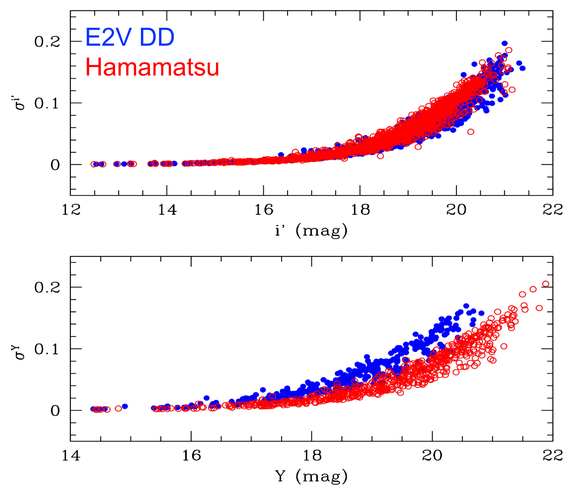
- Three Hamamatsu 2048 x 4176 pix fully-depleted CCDs
- Two chip variants, arranged to optimize QE for spectral dispersion direction
- 0.0807”/pix (15 µm pixel size)
- Spectral response: ~360-1030 nm
- Read noise ~4.1 e- rms in standard science mode (slow read/low gain)
- Chip gap width: 67 pix = 1.005 mm (~100 pix effective width of unusable region due to bright columns at either side of the gaps)
- 12 amplifier read-out



Improved red sensitivity

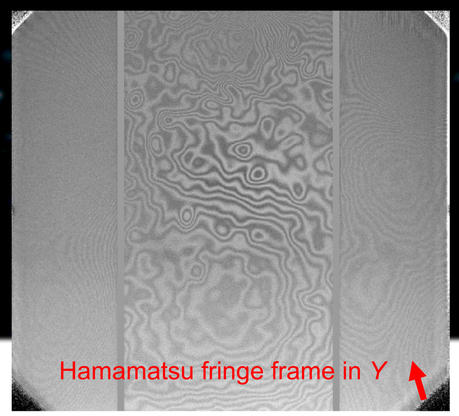


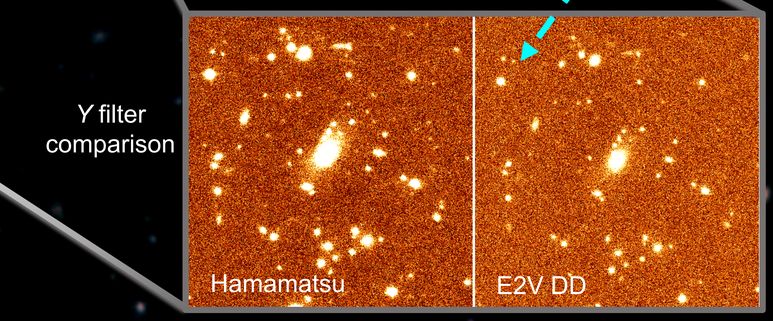
Preliminary comparison of the relative spectroscopic throughput of the E2V DD and Hamamatsu detector array. The plot shows spectra of the spectrophotometric standard star Feige 34 observed with the R400 grating using different central wavelength settings.



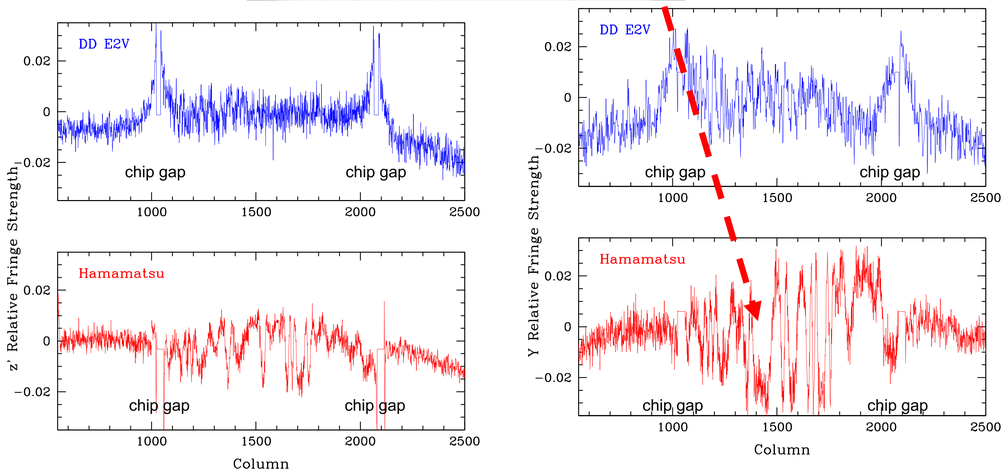
Comparison of the E2V DD and Hamamatsu CCDs based on *i'*/*Z*/*Y* images of the same field (see poster background). The Hamamatsu CCDs reach a fainter detection limit in *Y* than the E2V DD devices, while the detection limit in *i'* is similar for both detector arrays.

Background image: *i'*/*Z*/*Y* red/green/blue color composite of z~0.5 galaxy cluster taken with the new Hamamatsu detectors





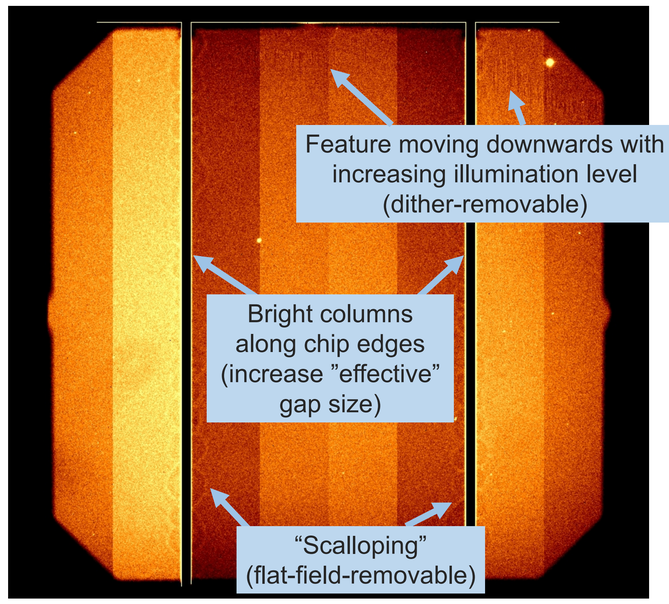
Fringing



Observations taken through the *z'* and *Y* filters show stronger fringing for the Hamamatsu detectors than for the E2V DD detectors, because they cover longer wavelengths with the Hamamatsu detectors than they did previously. (Note that *z'* is a long-pass filter.) In the *z'* and *Y* filters fringing is seen at ~1% and 2% of the background level, respectively. Fringing is negligible for observations taken through the *i'* and *Z* filters. The fringing properties of the GMOS-N and GMOS-S Hamamatsu detectors are very similar.

Practical information

- Data format: 12 fits extensions (one for each amplifier)
- Recommended dither size to cover inter-chip region:
  - → Spatially: >~10 arcsec
  - → Spectrally (grating-dependent):
    - >20 nm (R150); >7.5 nm (R400);
    - >5 nm (B1200, B600, R831)
- Imaging dithers can be advantageous for removing fringing and detector artefacts
- Recommended max. exposure time: 1200s due to cosmic ray rate
- Data reduction updates at: http://www.gemini.edu/sciops/data-and-results/processing-software/announcements



Further information: http://www.gemini.edu/sciops/instruments/gmos