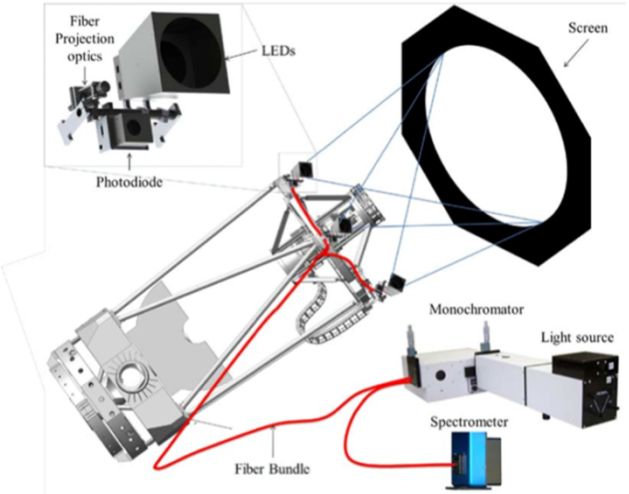
DECal scans update

DARK ENERGY SURVEY

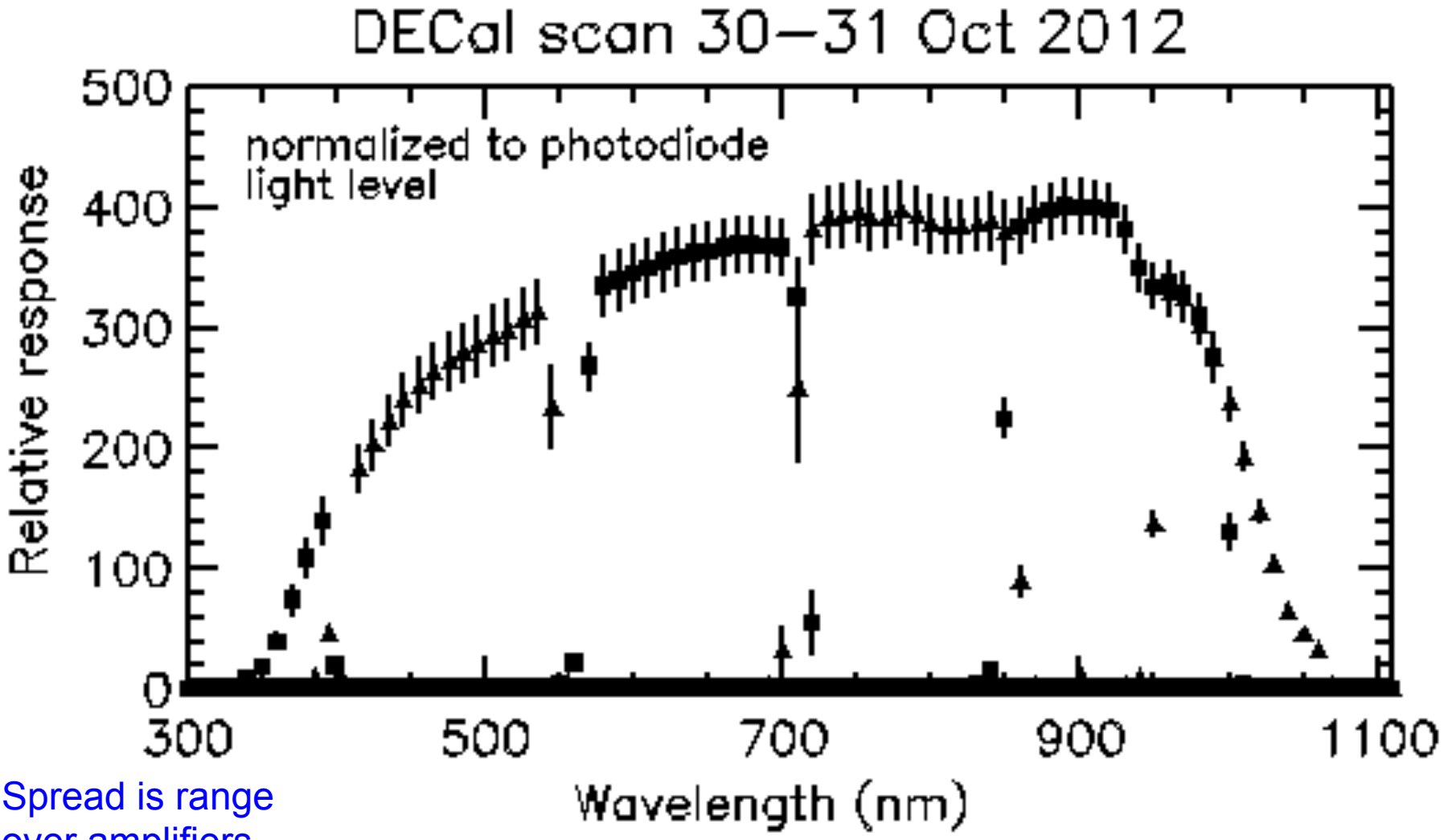
- The DECal flat field system is capable of generating system response maps by scanning projected light of known wavelength and intensity onto a flat screen



Point telescope at the flat field screen
Start loop
Set monochromator wavelength
Turn on monochromator output to illuminate screen
Begin taking photodiode "light" data
Take DECam image
Simultaneously take spectrum with spectrometer
Reduce spectrometer output in real time and record median wavelength and reduced spectrum to disk
Turn off monochromator output
Begin taking photodiode "dark" data
Take DECam dark image (if necessary)
Change monochromator output to next wavelength
End loop

- These scans will be taken on a ~monthly basis during engineering or bad weather time. Scans taken at the end of October and November. DES-doc-6885 (Collaboration Meeting talk has details).
- (1) Monitor changes in throughput (2) Provide system response curves

Summary plot – all filters plotted



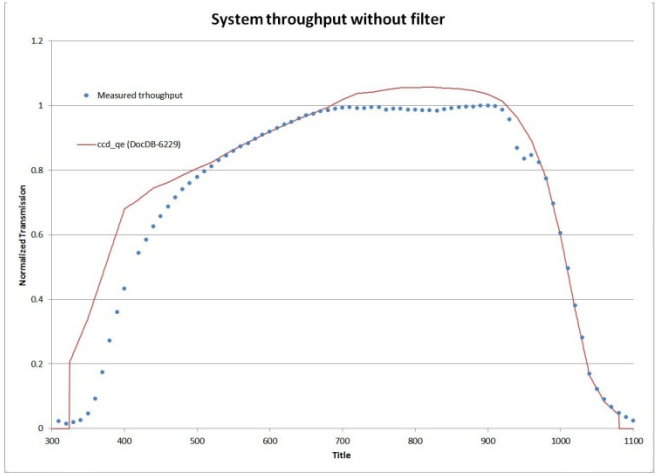
Spread is range over amplifiers

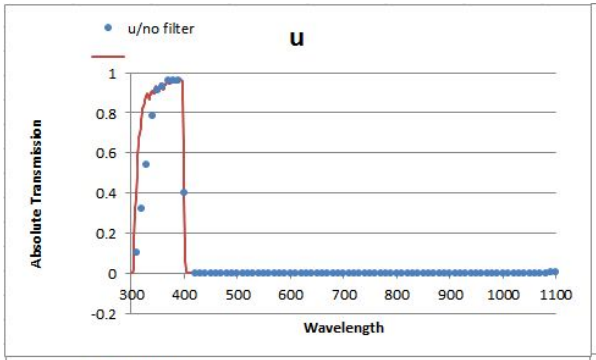
Filter measurements

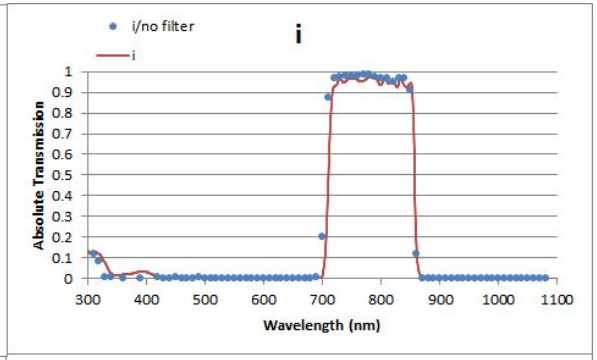
DARK ENERGY SURVEY

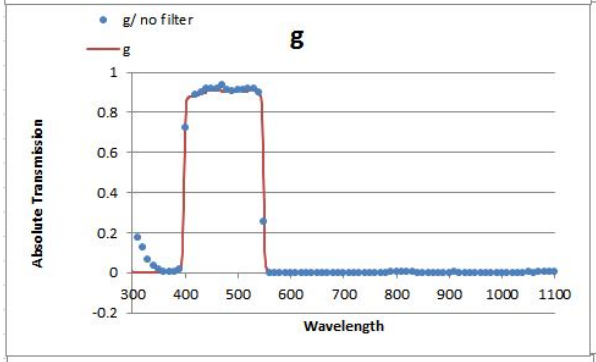
- Take the "none"-Filter scan and correct the measured throughput to get a measurement of the filter throughput.

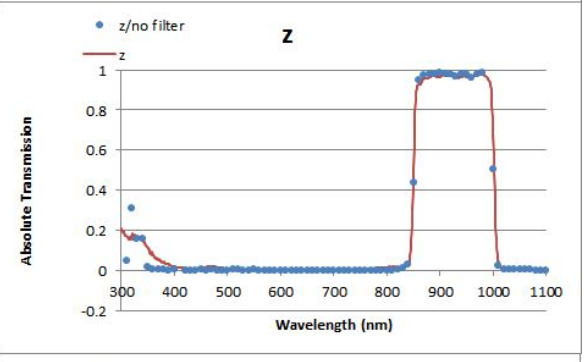
Initial study for the center of one of the center CCDs.

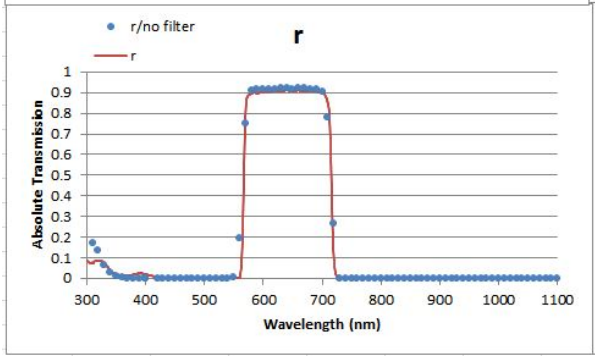


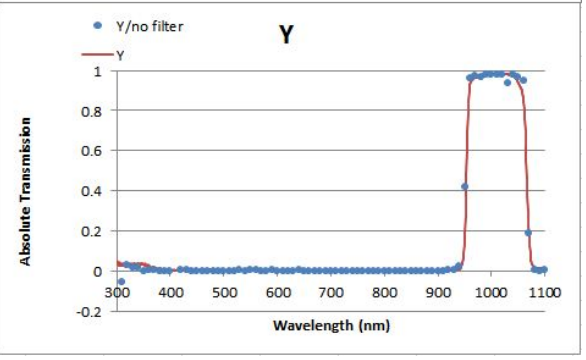








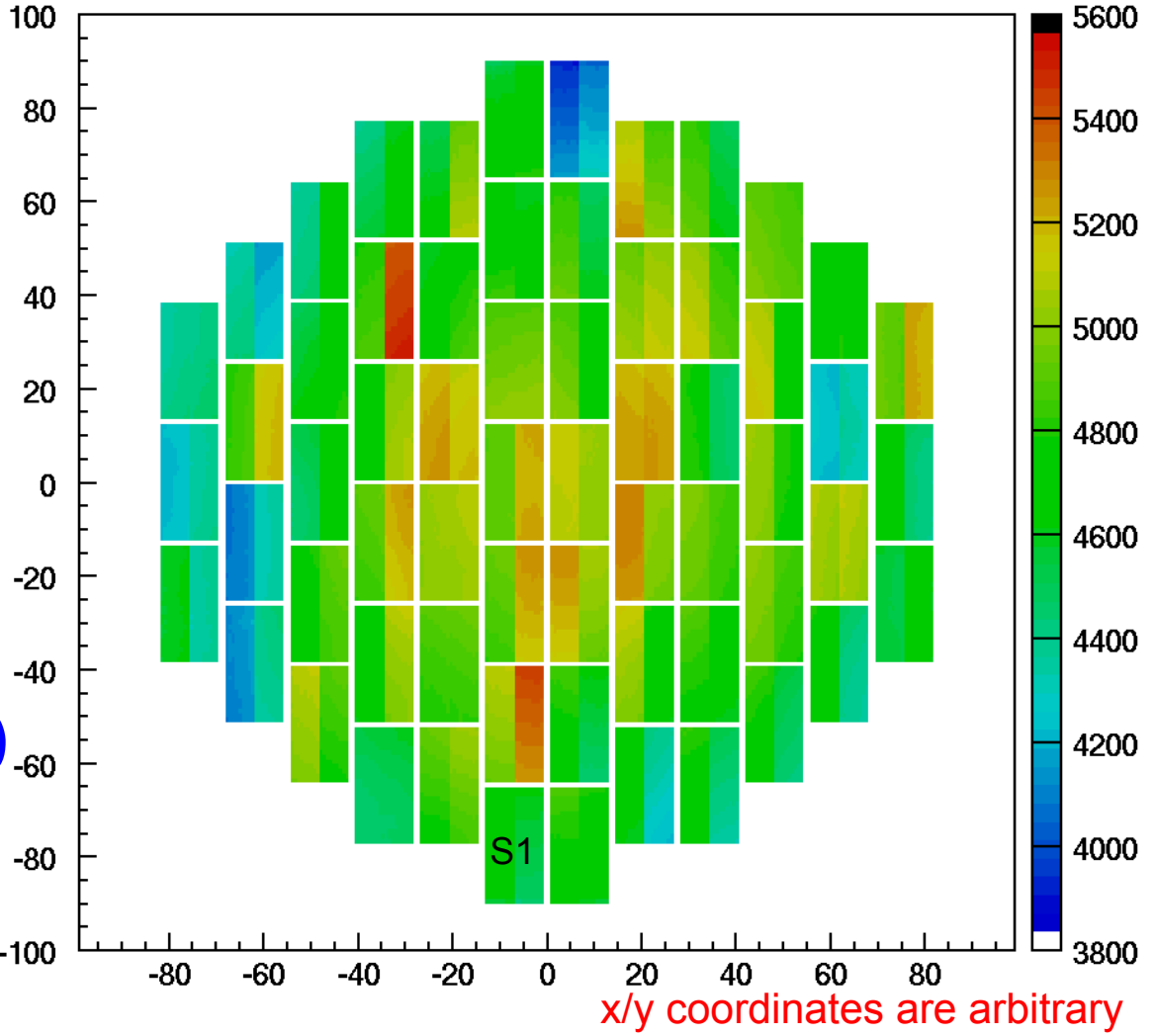




Study system response vs focal plane position

DARK ENERGY SURVEY

- No filter, 700nm, ON – OFF with an overscan correction
- More counts towards center, but no QE nor gain corrections
- Each CCD is divided into boxes 18 col and 25 rows (110x162 or 17820 pixels per box) edge pixels excluded
- Plot the <ON-OFF> for the middle 68.2%

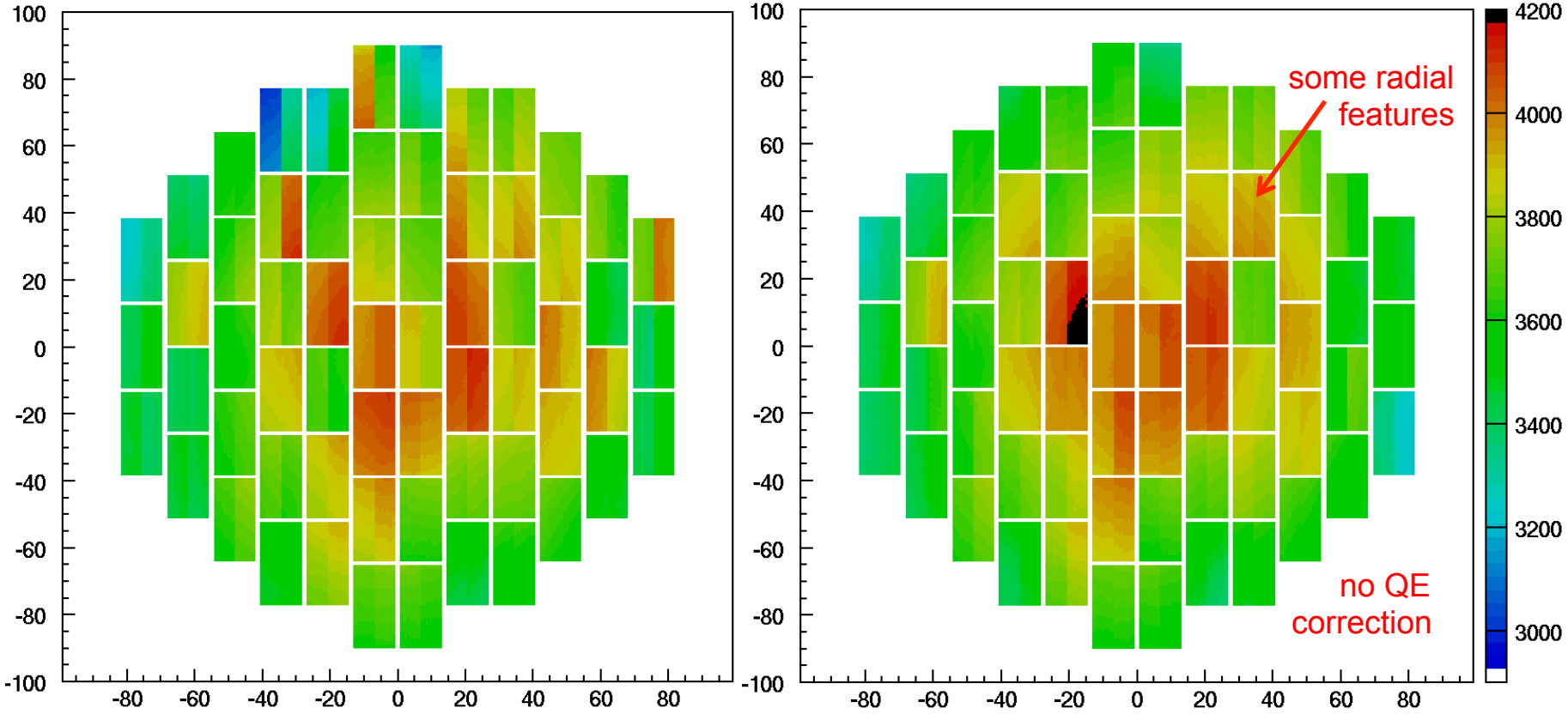


Header gain vs gain from photon transfer curves

DARK ENERGY SURVEY

Header quantities GAINA, GAINB

Gain from PTC study (Jiangang Hao)

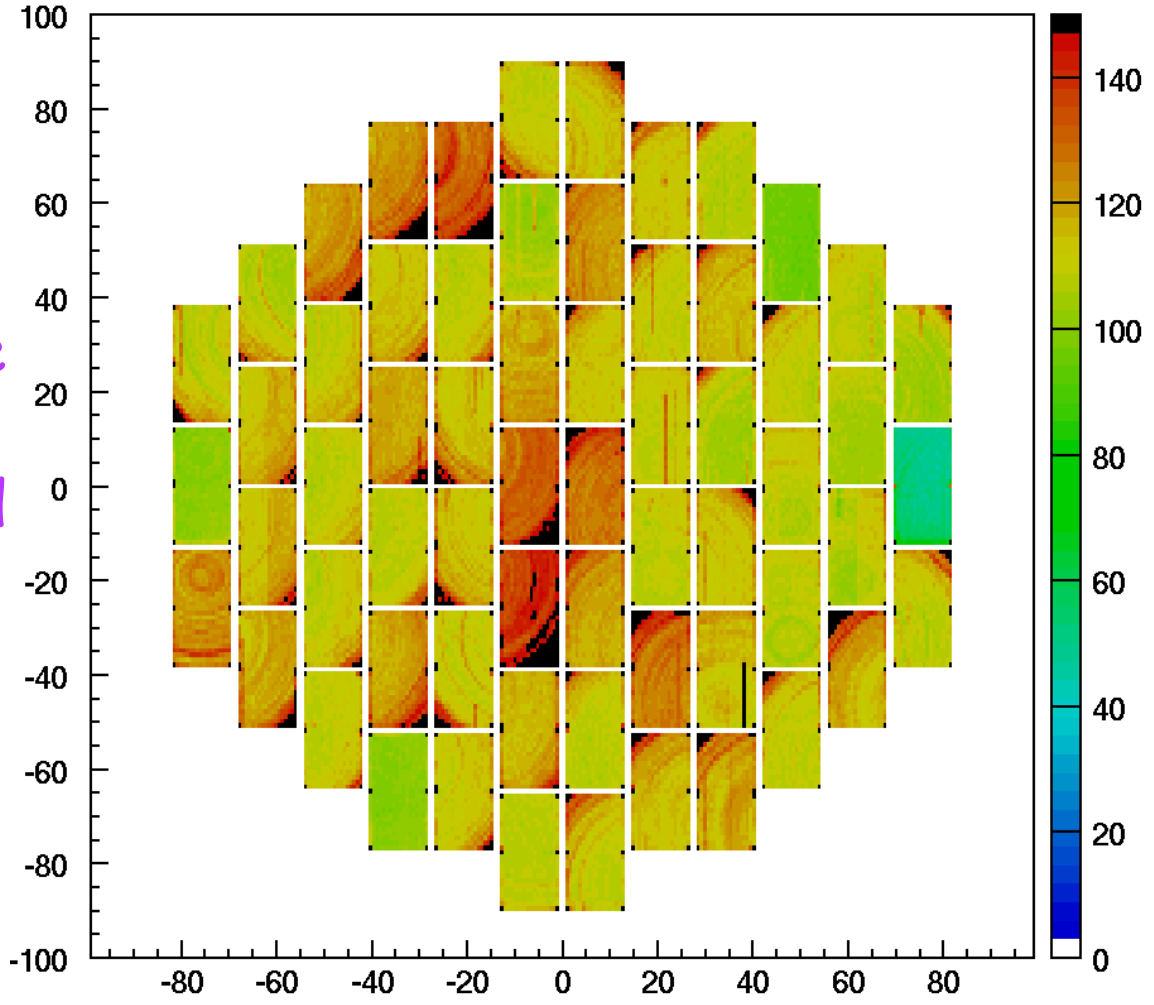


Neither is perfect, but the PTC study numbers show less obvious differences between the two amplifiers. Expect the QE to be the same for the entire CCD. Here vertical Is arbitrary with a correction for the light intensity measured by the DECal photodiode.

Study RMS vs focal plane position

DARK ENERGY SURVEY

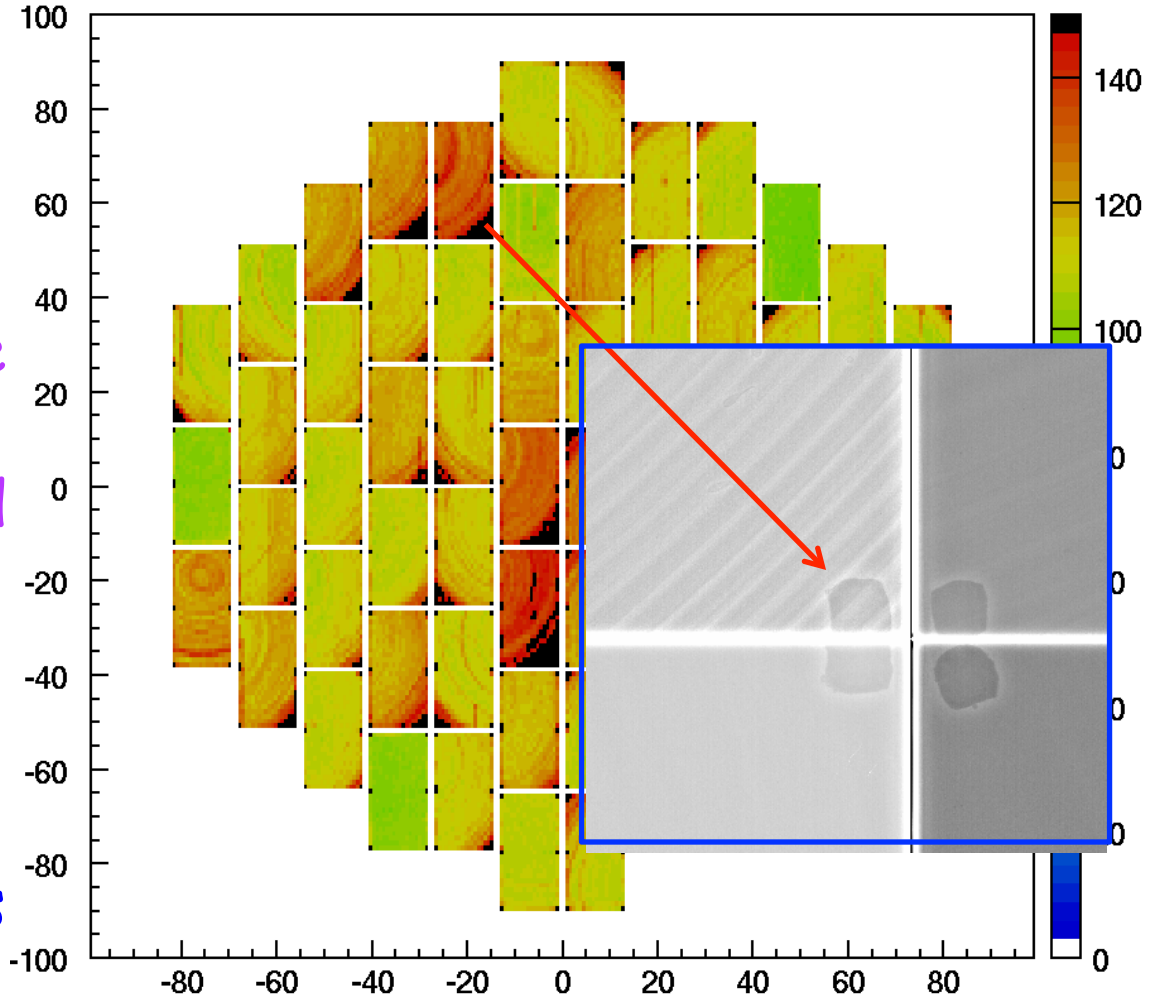
- Gain corrected RMS in each "box"
- Some interesting features including "corners" where there typically 40 counts RMS spread compared with other devices with RMS ~20 counts
- Not exactly sure of the importance or implications.



Study RMS vs focal plane position

DARK ENERGY SURVEY

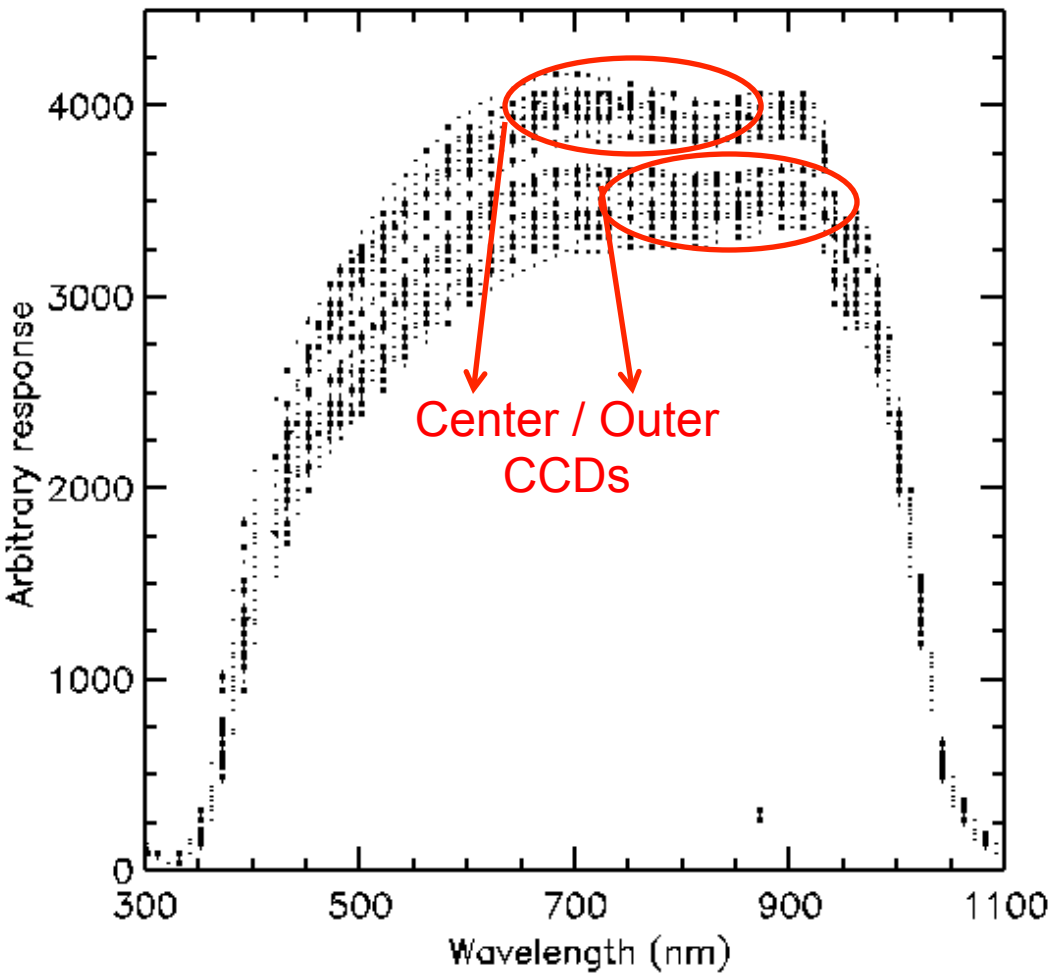
- Gain corrected RMS in each "box"
- Some interesting features including "corners" where there typically 40 counts RMS spread compared with other devices with RMS ~20 counts
- Not exactly sure of the importance or implications. Stable as tape bumps?



Response (no filter) vs focal plane position

DARK ENERGY SURVEY

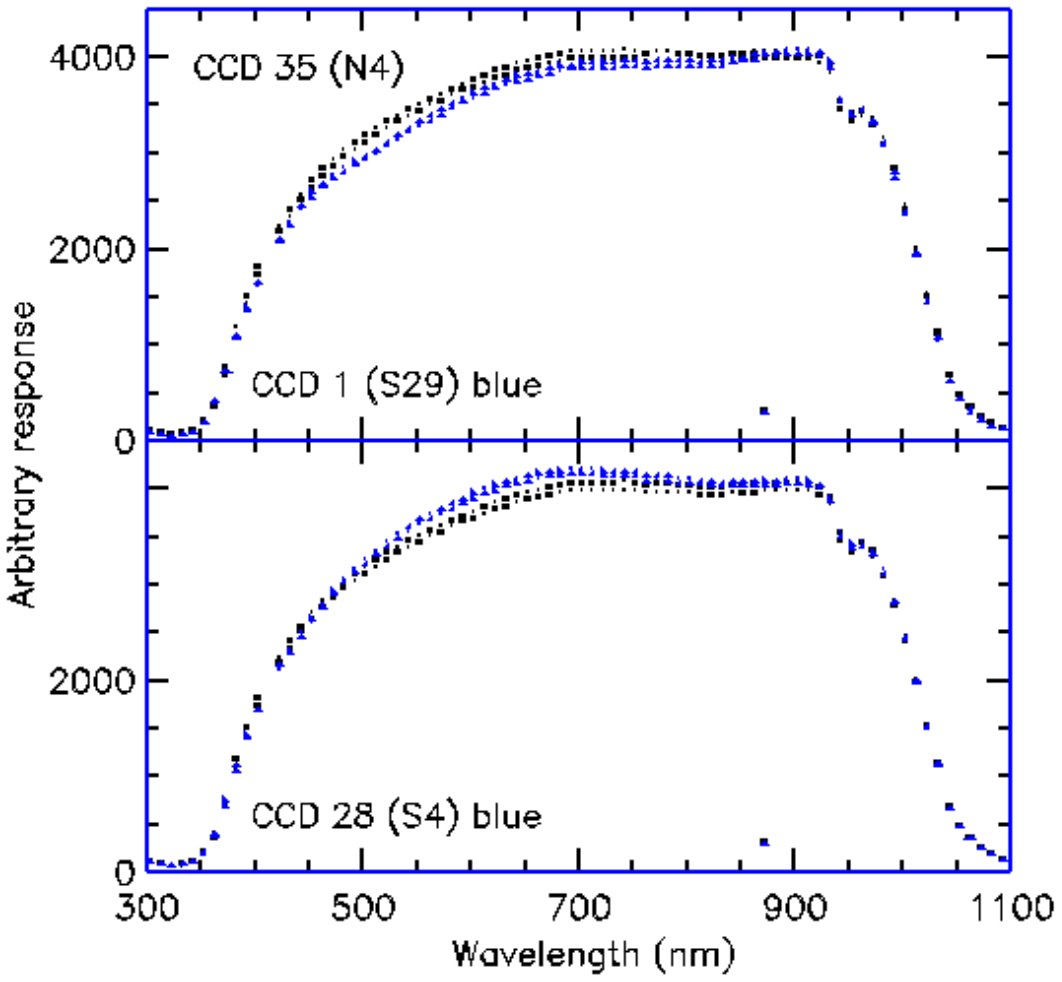
- Calculate the truncated average of ON-OFF (overscan, gain, and intensity corrected) for median "box" for each wavelength (1 point per amplifier)
- Use 22 CCDs either near the center or towards the edge (total of 44 response curves)



Response (no filter) vs focal plane position

DARK ENERGY SURVEY

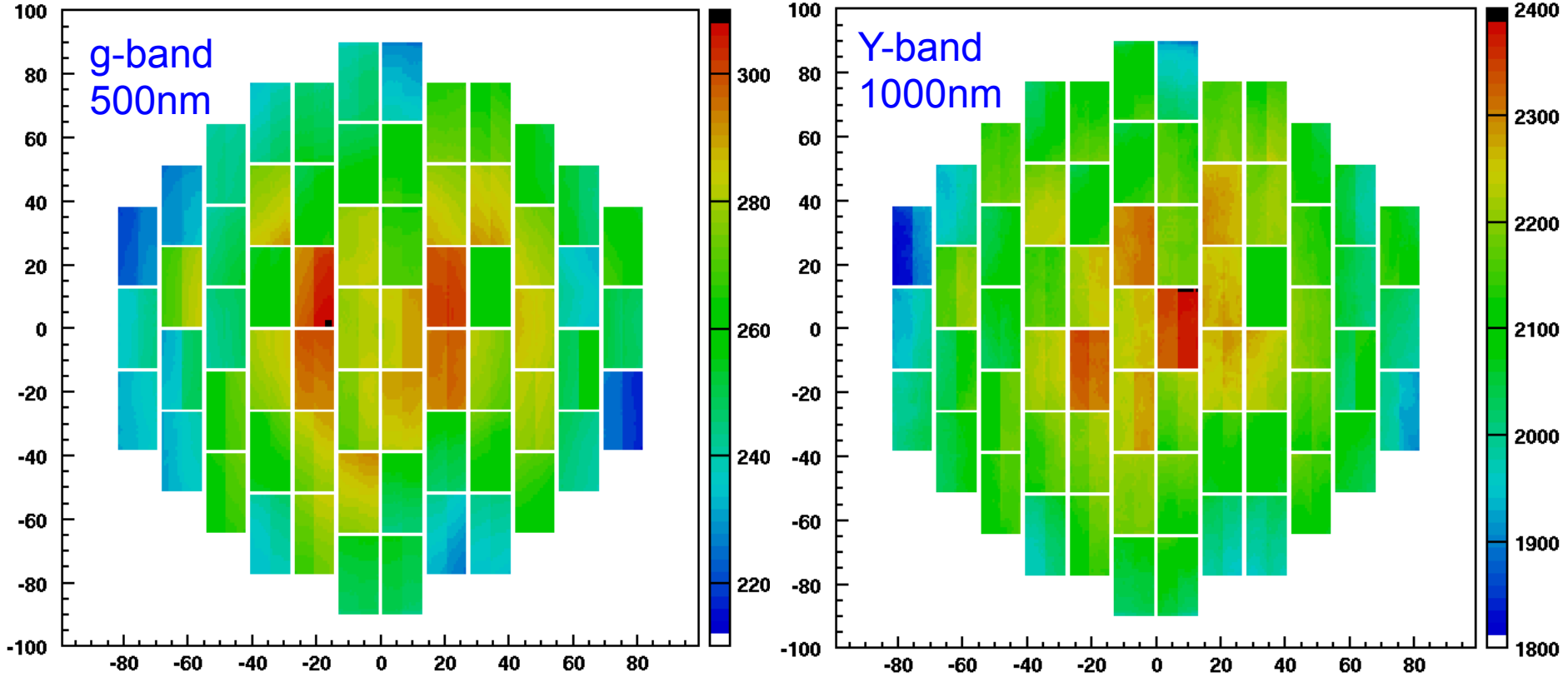
- Normalize the response of the center CCD (N4) at 900nm with an edge CCD (S29).
- Similar difference as when two center CCDs are compared (N4 and S4).
- This is just a first look. Need to figure out how to best quantify (e.g. normalize to N4?).



Initial look at filter scans as a function of focal plane position

DARK ENERGY SURVEY

Truncated average response (overscan, gain, intensity corrections)

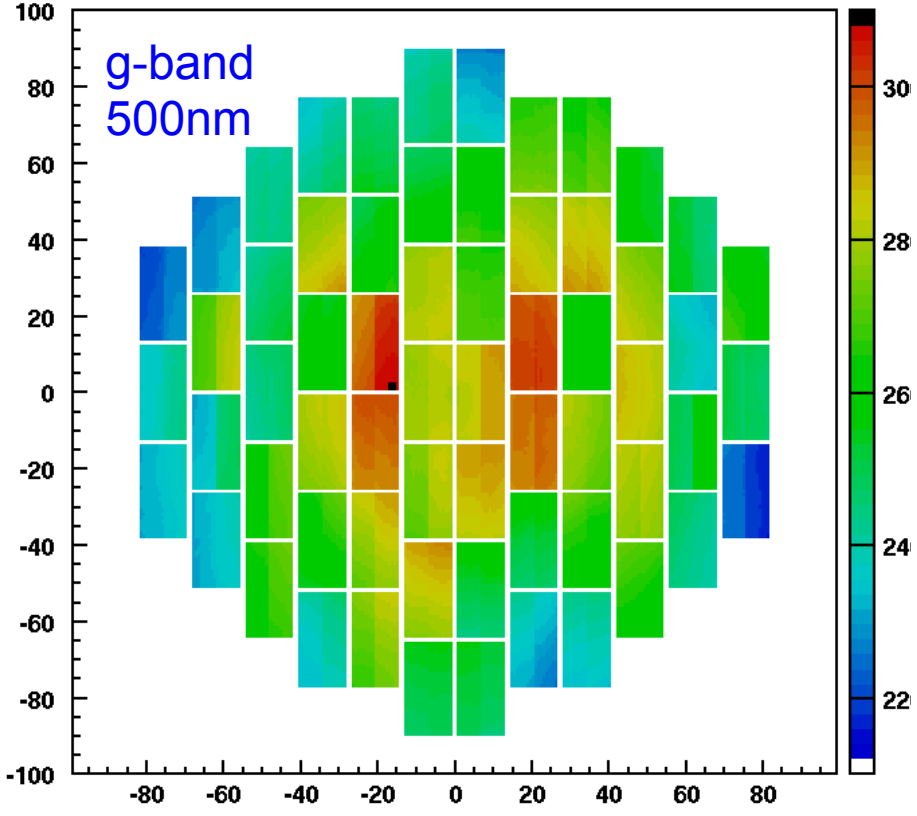


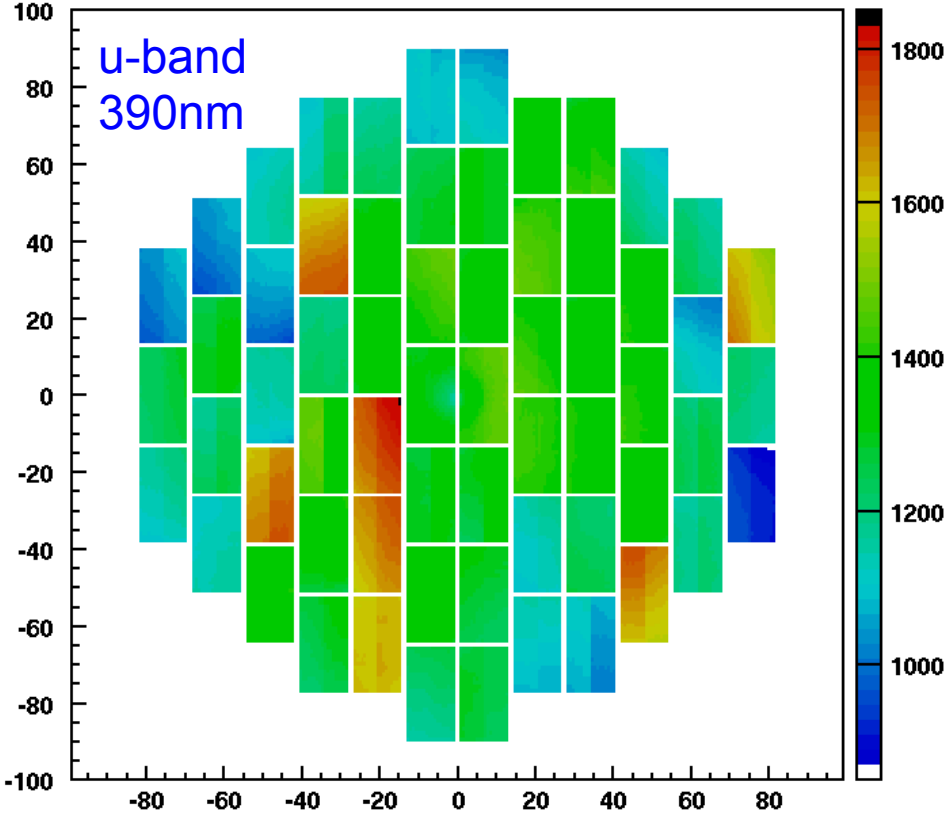
General features comparing CCD to CCD seem to hold but not exactly.
(You do have to be careful as color scale is not normalized to mean)

Initial look at filter scans as a function of focal plane position

DARK ENERGY SURVEY

Truncated average response (overscan, gain, intensity corrections)



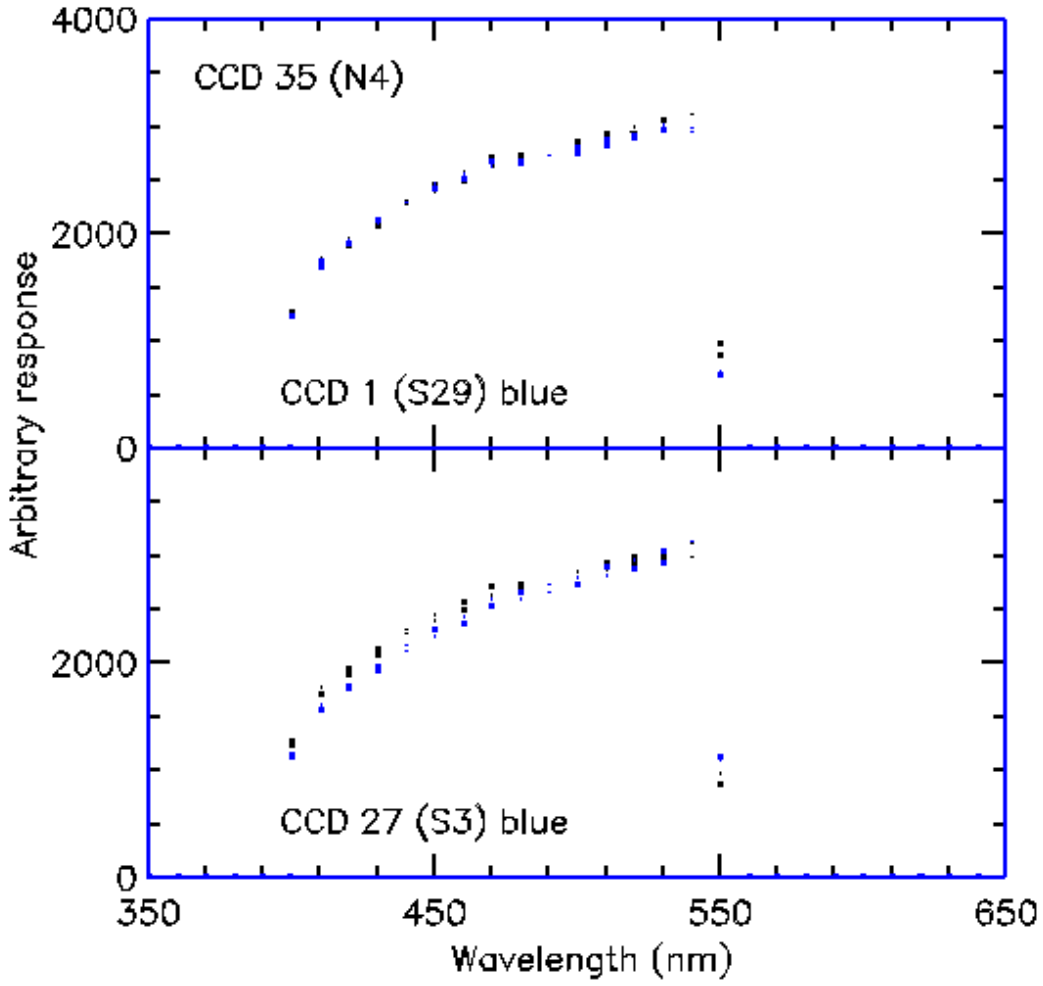


Maybe u-band is a bit different. Note: each CCD has different QE's

Response (g filter) vs focal plane position

DARK ENERGY SURVEY

- Normalize the response of the center CCD (N4) at ~530nm with an edge CCD (S29) and a center CCD (S3).
- Larger difference comparing nearby devices
- This is just a first look.



DARK ENERGY SURVEY

Summary and Next steps

- Tools exist for looking at DECal data as a function of the focal plane position. Even see polishing/tape marks.
- Gain corrections do a good job removing differences between the two amplifiers on a CCD. It is thought that quantum efficiency variations account for most of the CCD to CCD variation (a next step is to include these).
- For no filter, a first look shows no gross systematic variations in the throughput versus focal plane position
- The focal plane looks a bit different at different wavelengths through the appropriate filters when comparing CCD to CCD.
- For g-filter, a first look also shows no gross systematics in the throughput as a function of focal plane position.