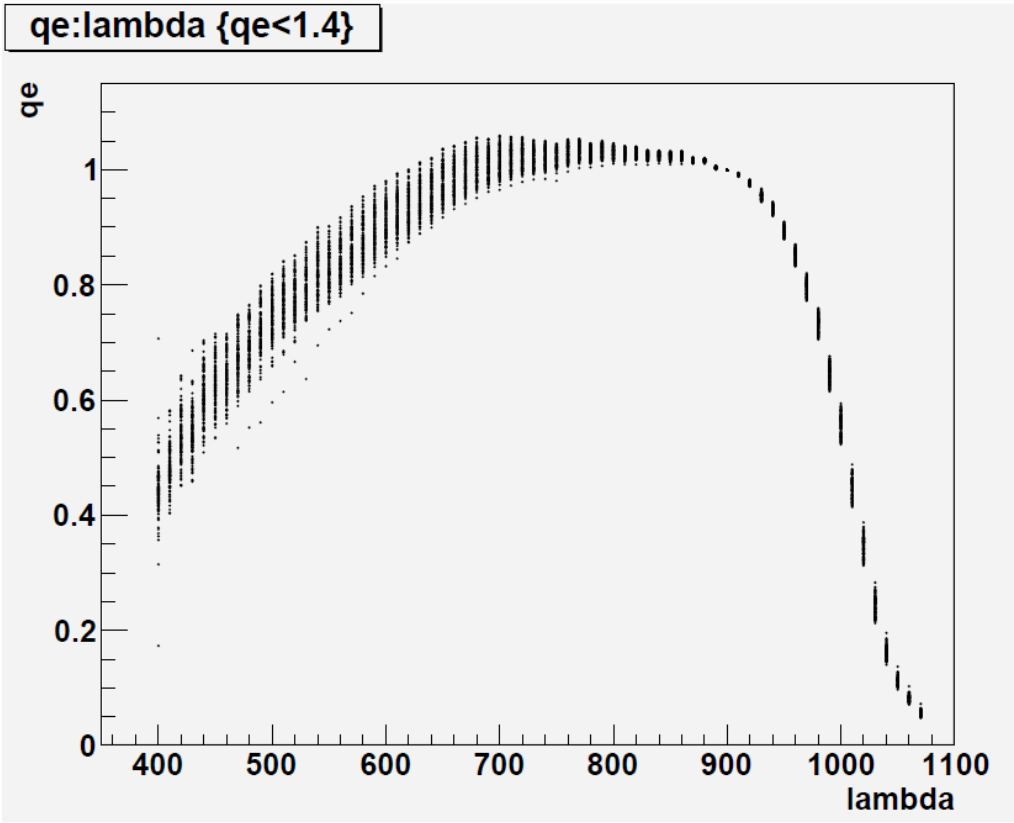
QE Results Compilation

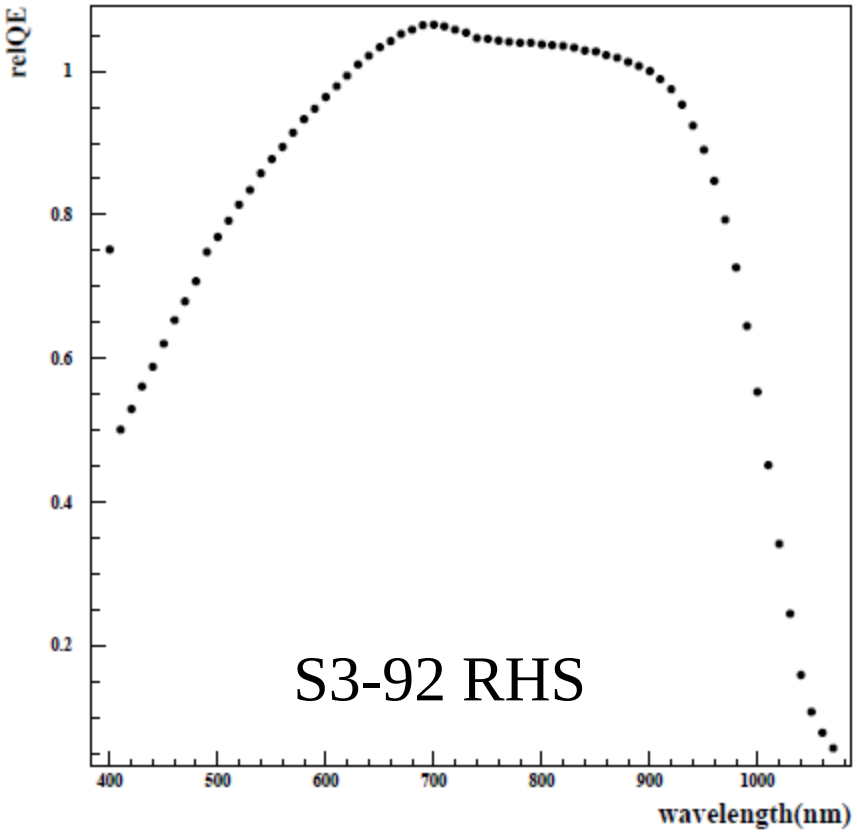


Tom Diehl & Wyatt Merritt

4/5/11

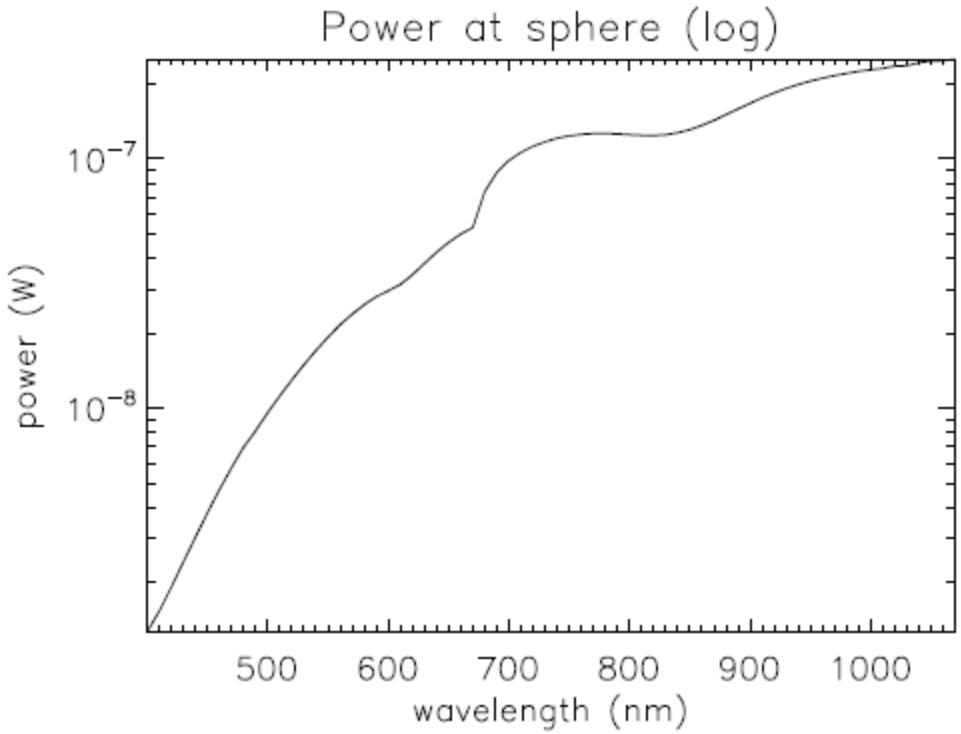
QE Results

- Relative QE measurements were made as part of the Stage 1 tests.
- Stage 1 report has RHS QE. See example on right.
- For the Stage 1 reports relative QE is corrected for measured pin diode power and the k-factor, and normalized at 900 nm.
- There are also intermediate files (qe.dat) that went into making that plot.

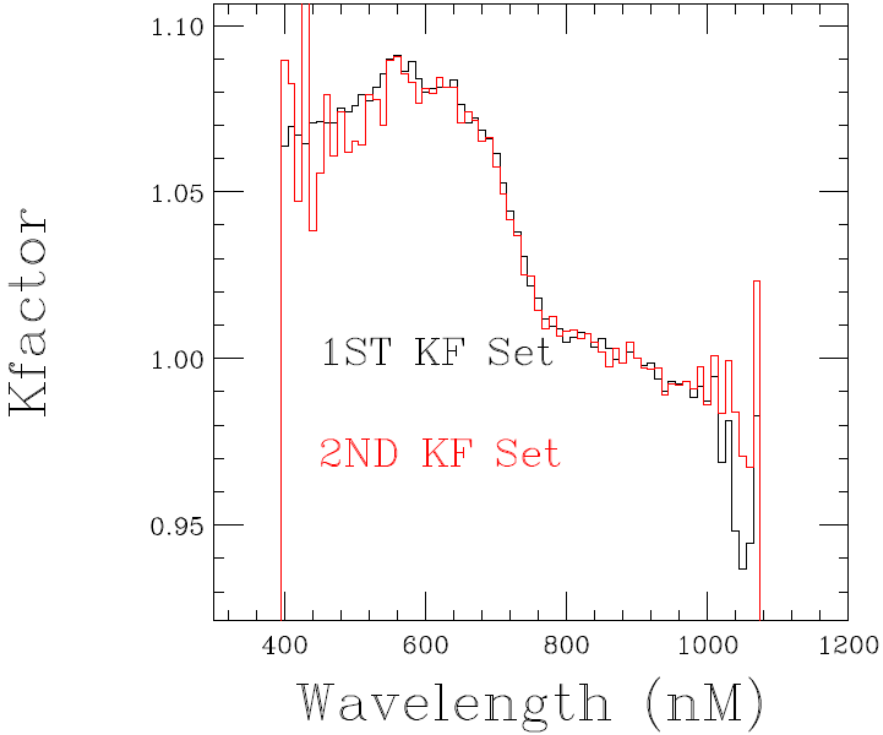


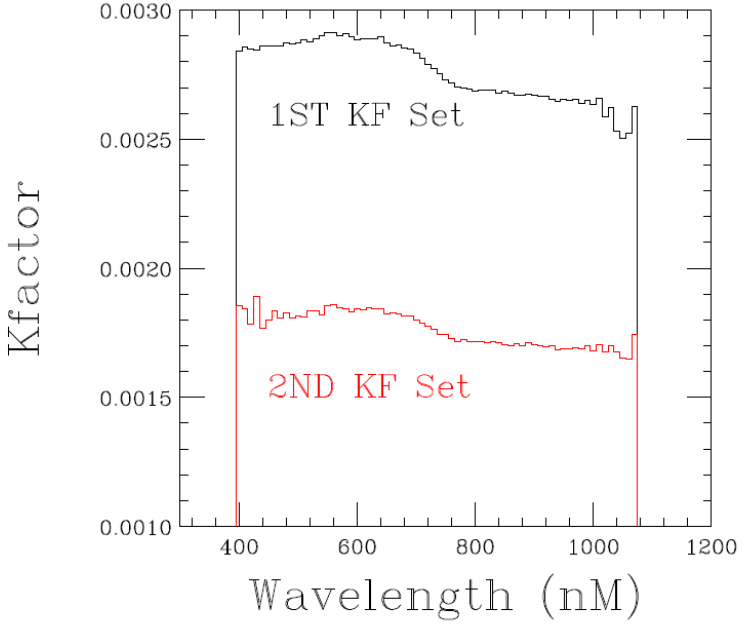
Typical Power Plot

- e.g. S3-92, to right



The two KFactor Sets





Above: the two sets.
Left: Each normalized to 1 at 900 nm.

QE Results

- Donna's qe.dat files are corrected for the measured pin diode power but not the other steps.
- We found 123 of 124 of them and accumulated them in one spot (except s3-109, which doesn't have the QE report).
- We reproduced the QE curves. That required knowing which of two "k-factor" files is associated with the data.
- The process is fairly straightforward. Look back at Vic's docdb 529 & Donna's 2728, for example.
- We put them in a root-tuple, with an additional field containing the CCD name.

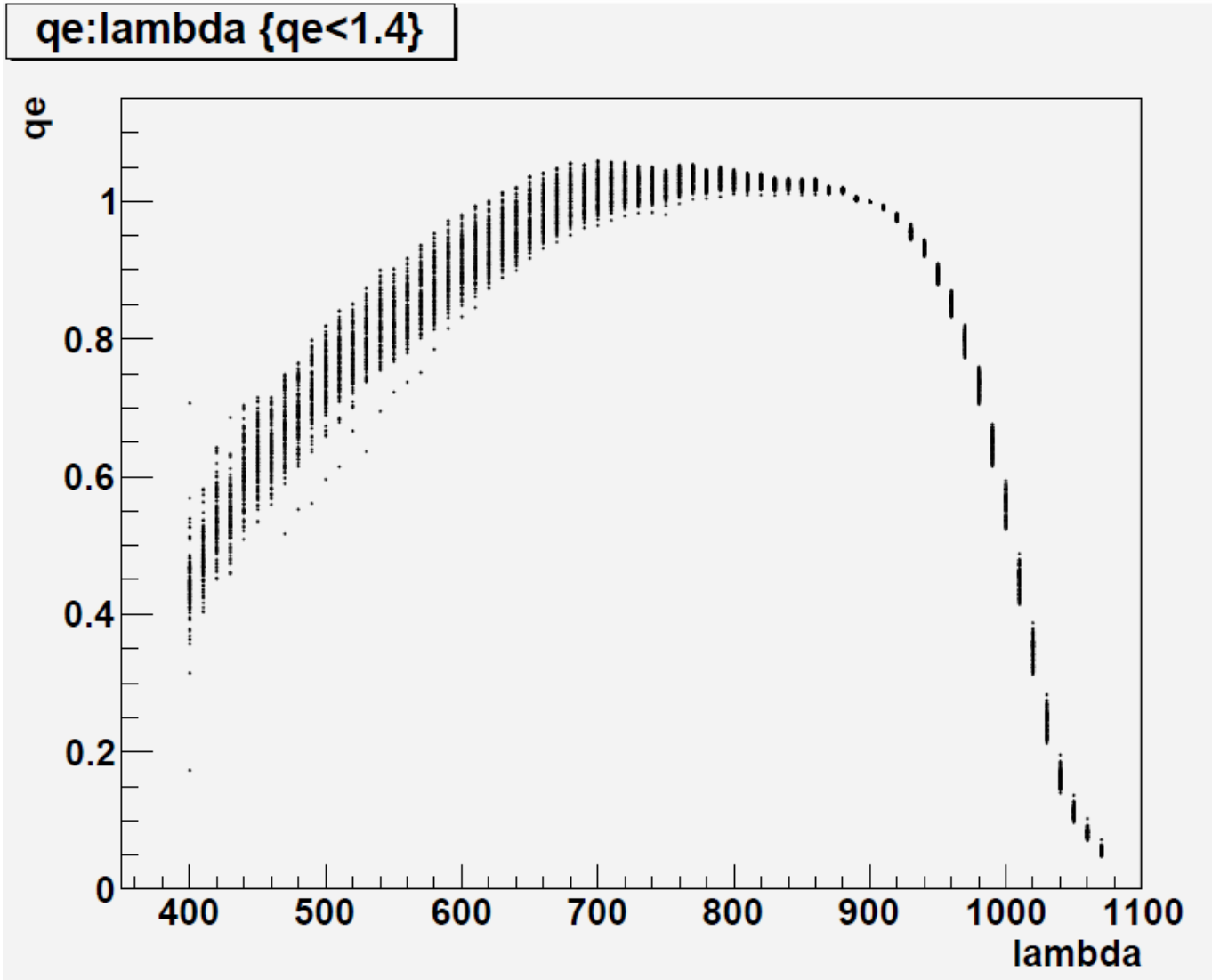
Data Format

Counts before k-factor correction?

CCD(s3-)	λ	QE	~~Power~~
05	400	0.173022985	59469000.
05	410	0.50970602	176140000.
05	420	2.04141474	703750016.
05	430	0.685895145	235930000.
05	440	0.546619773	189080000. … etc …

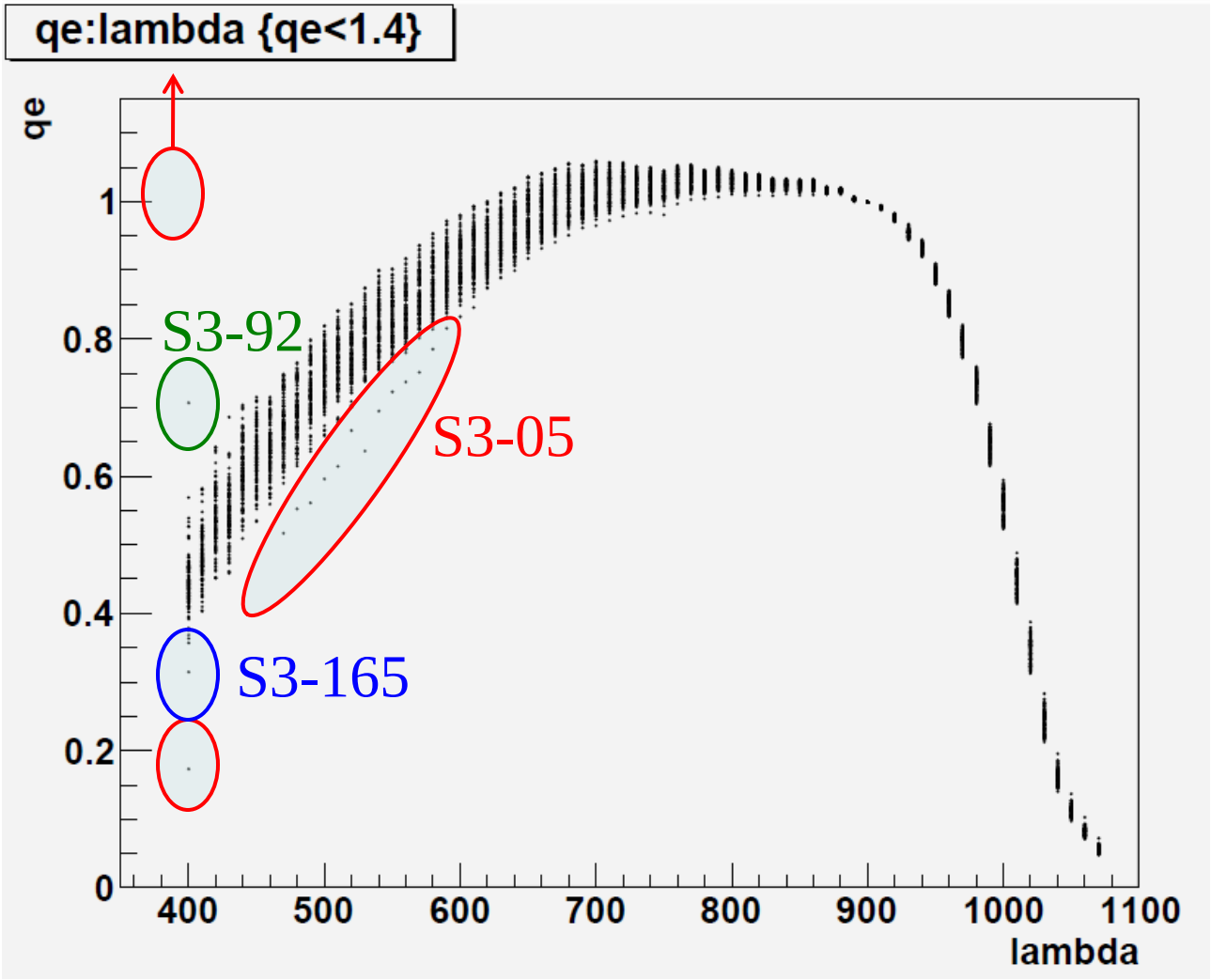
DES cluster:
/home/s1/diehl/DES/ccd_index/qetuple
Files newfile.root or qe_summary.txt

Relative QE Curves of 123 CCDs



Problems with individual CCDs

- Color-coded
- S3-109 is missing
- S3-05 is very problematic
- S3-92 & S3-165 are outliers at 400 nm



Things to check

- Check how measurements of two or more CCDs from one wafer compare with two random CCDs
  - Informs about the nature of the width of the QE plot variations
- Look for Lot-to-Lot (or SubLot) variations
- other

Summary

- The QE data for 123 of 124 CCDs has been compiled into a selectable table.
- Relative QE's are generally uniform.
- The spread is thought to be measurement uncertainty rather than the QE differences in the CCDs themselves.
- There are some QE results that are probably reflect the data quality rather than the CCD itself.
- There are other things worth checking

Explanation

- Huan Lin noticed that the “Lamp Power” in previous versions of this plot are inconsistent with the FITS header.
- Nobody had previously correctly remembered what was in the 3rd column of the qe.dat files. It’s probably not the lamp power.
- Plots of “Lamp Power” are nonsense.

Not the Lamp Power

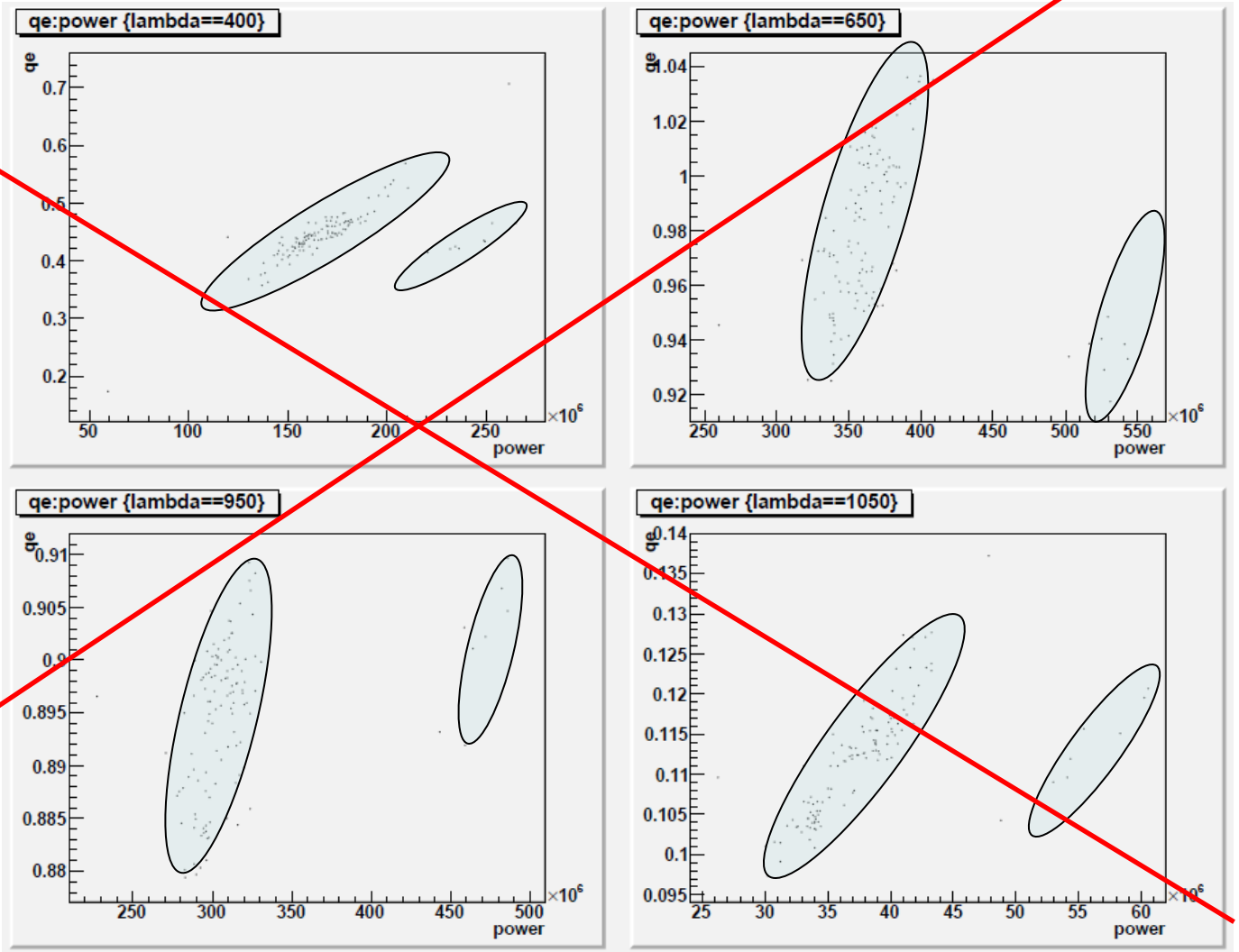
```
<des06.fnal.gov> more 12Jun2009stg1QE_772.fits
SIMPLE  =                    T / file does conform to FITS standard
BITPIX  =                   32 / number of bits per data pixel
NAXIS   =                    2 / number of data axes
NAXIS1  =                 2248 / length of data axis 1
NAXIS2  =                 4146 / length of data axis 2
EXTEND  =                    T / FITS dataset may contain extensions
COMMENT   FITS (Flexible Image Transport System) format is defined in 'Astronomy
COMMENT =     0.1312E-06  @ 850.013
FILENAME= '/data/12Jun2009stg1QE_772.fits'
HIERARCH ccdgetRnumber = 's3-92   '
ILL     = '(       '          / 20.0 )
CMT     =
HIERARCH log_ver_num =       7
DATE    =                 06 / 12/2009
TIME    = '18:40:51'
CUBE    =                    0
READOUT = 'monsoon1'
PAN     = 'snowstorm'
CCD     = 's3-92   '
TEMP    =             +173.00
POWER   =          0.1312E-06 / @ 850.013
HIERARCH illumination = 'flat    '
```

From the qe.dat files we find “the lamp power # “
e.g.: 0.85001E+03 0.10273E+01 0.35715E+09
it’s not the same as the fits header, shown on left.

Measurement Uncertainty

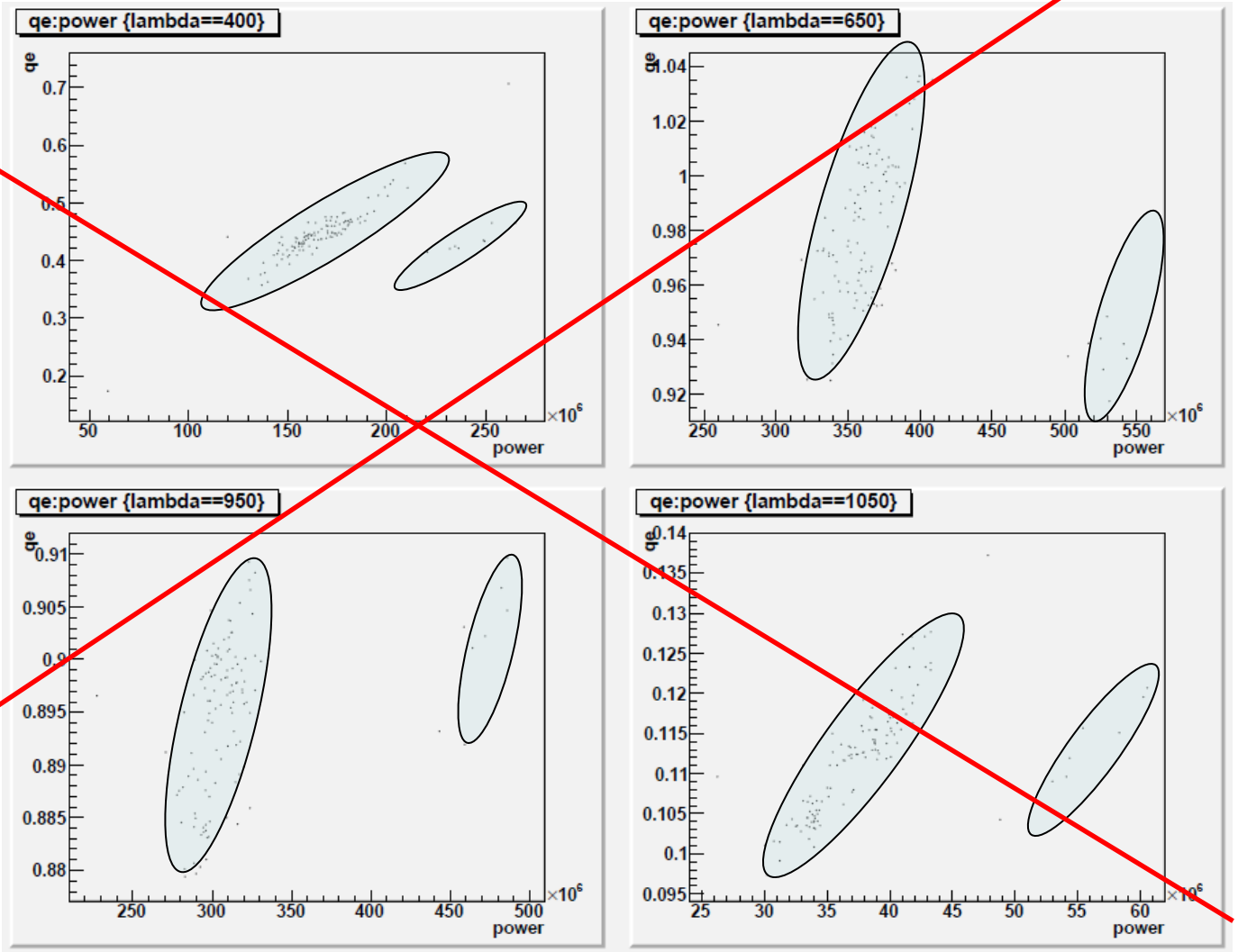
DARK ENERGY SURVEY

- Direct correlation vs. lamp power, even though lamp power is taken out already.
- Two groups are seen, mostly reflecting a division in time.
- These imply the QE variation is mostly due to measurement errors.

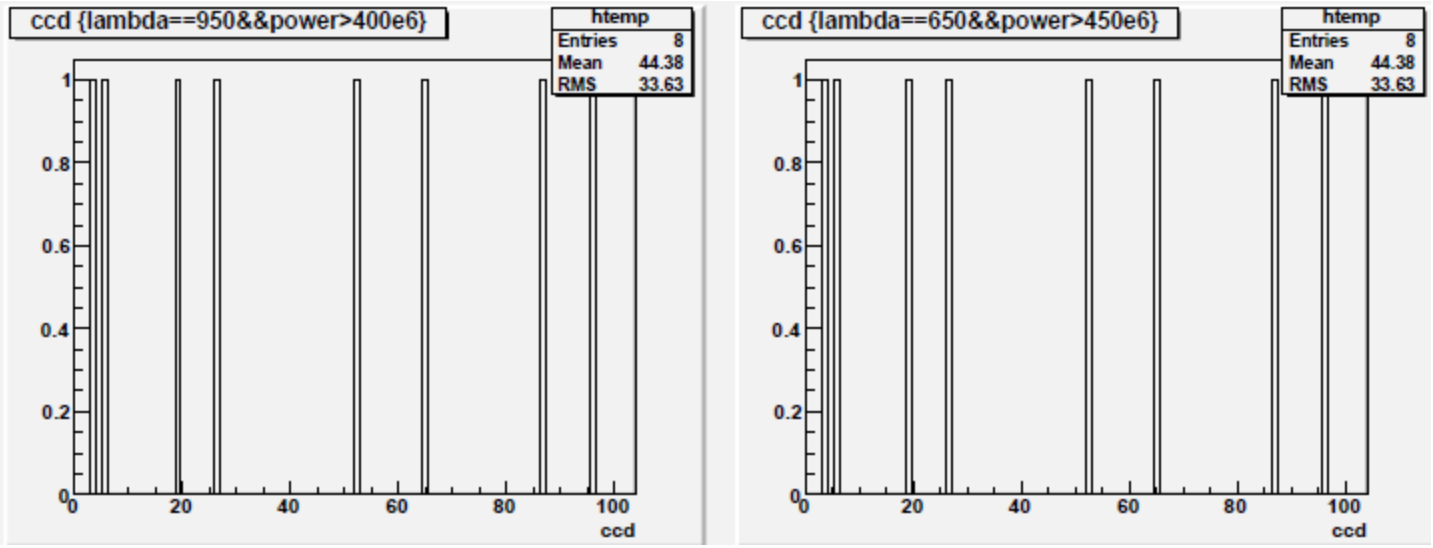


Problems with individual CCDs

- Direct correlation vs. lamp power, even though lamp power is taken out already.
- This suggest a correction is possible that further narrows the measured QE.
- Needs some thought.



The small batch in QE vs. “Not Power”



- The CCDs plotted above are the batch on the RHS of the QE vs “not power plot”.
- It’s always the same ones.
- I don’t think this reflects a problem. It’s just the two different k-factor sets