

SPIRE CQM Test Results

- **By Sarah Leeks on behalf of**
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- **[Viewgraphs – modified from Bruce Swinyard's IQR presentation]**

General Comments

- I'll give an overview of what CQM was supposed to do in terms of verification
- Then go on to give edited highlights of test results
- Two test programmes – termed CQM1 and CQM2 before and after cold vibration test
- During CQM1 we found out how to operate the instrument for the first time - didn't really do thermal tests as not configured properly
- For CQM2:
 - thermal configuration was nearer to flight
 - were able to integrate EM PSU
 - had upgraded OBS and DPU hardware problems were fixed

SPIRE CQM Performance Tests

- **Overview**
- **Tests split into three types:**
 - **Closed cryostat tests on detector performance**
 - “Dark” testing with CBB off
 - “Loaded” testing with CBB on
 - **Open cryostat “optical tests”**
 - **HBB with one arm of FTS blocked**
 - **HBB + FTS**
 - **Laser**
 - **Non standard configuration tests using external equipment**
 - **JFET-BDA harness tests**
 - **Microphonics tests**

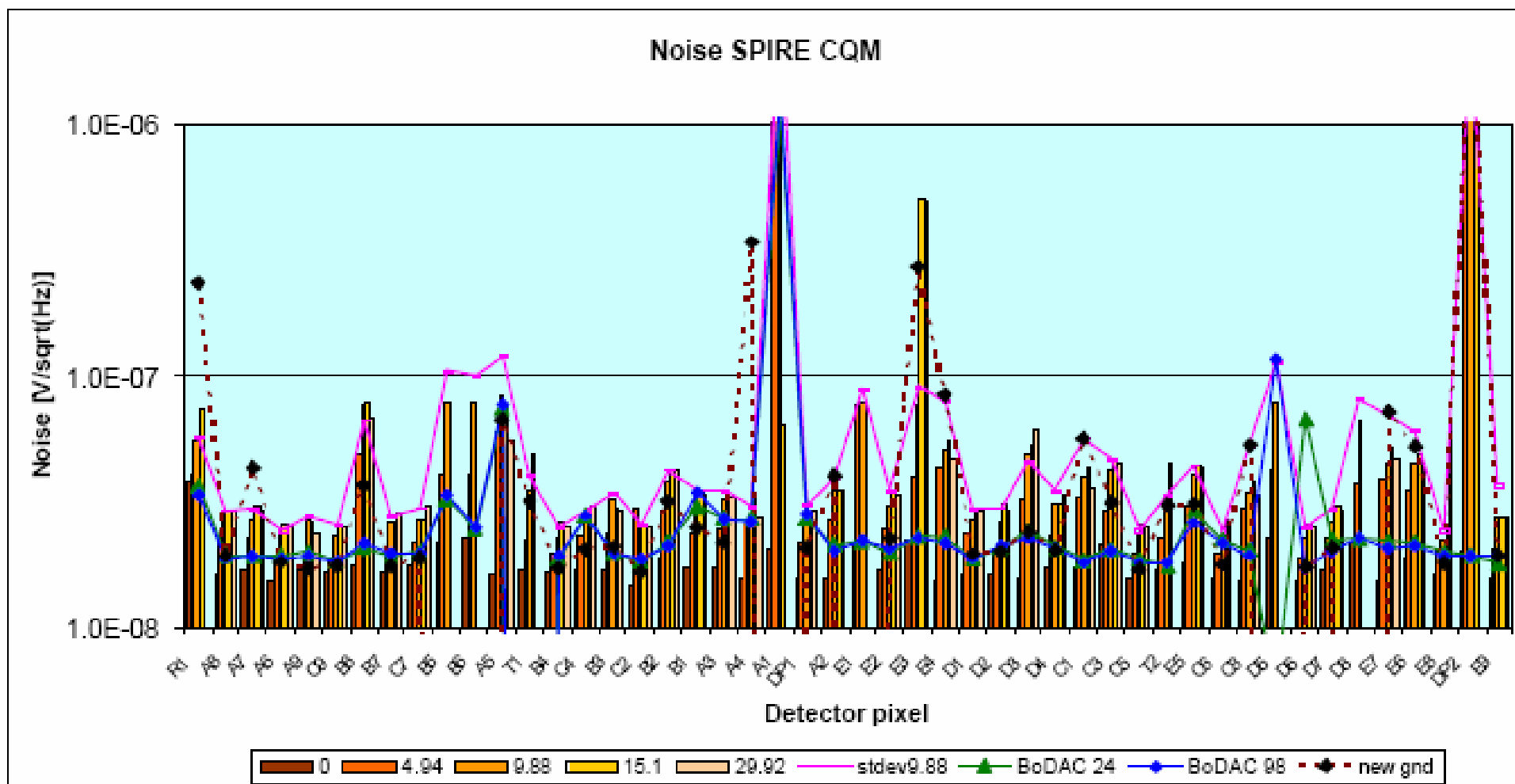
Detector Characterisation

- **Photometer JFET shorted input tests**
- **Biased Detector Noise**
- **Shorted Noise Tests on Spectrometer STM-JFETs**
- **Loadcurves**
- **Optical Efficiency**
- **Frequency Response Test**
- **Linearity**

Noise

- Detectors at operating temperature
 - Noise is reduced when extra outer shield is in place
 - No new noisy pixels cf JPL – no change before/after vibe

Operating Detectors



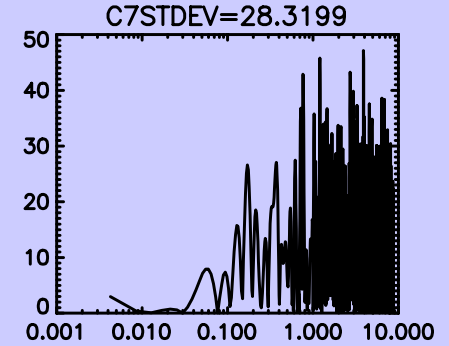
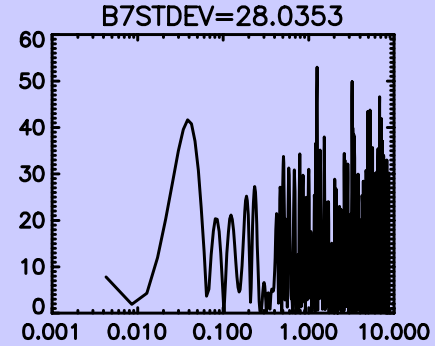
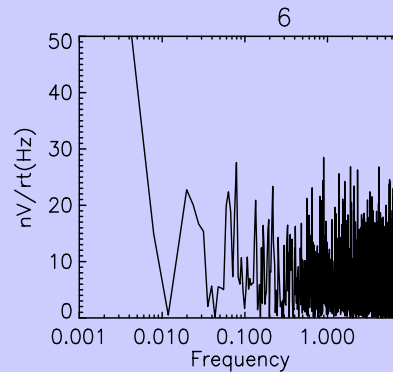
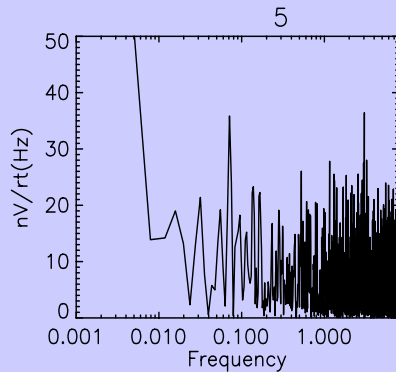
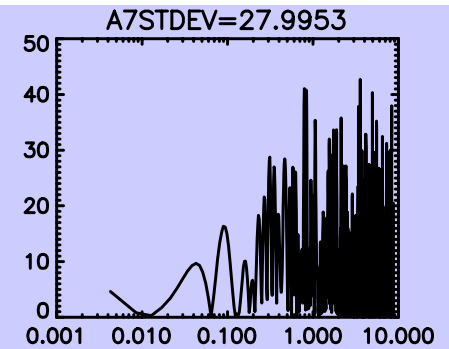
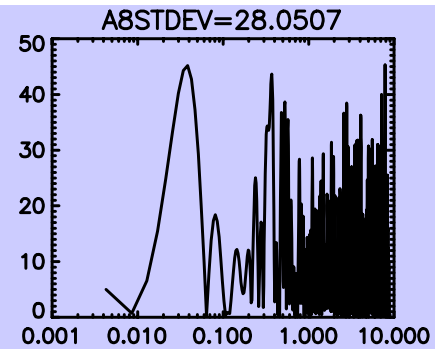
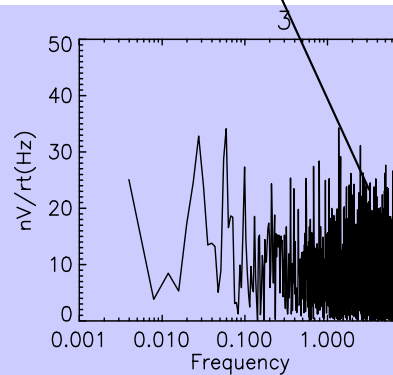
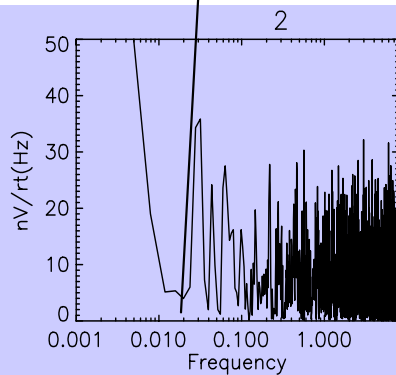
Noise Spectra

Dark detectors – CQM test 1
no ground short

Dark detectors – CQM test 2
ground short with RF pick up

10 mHz

5 Hz

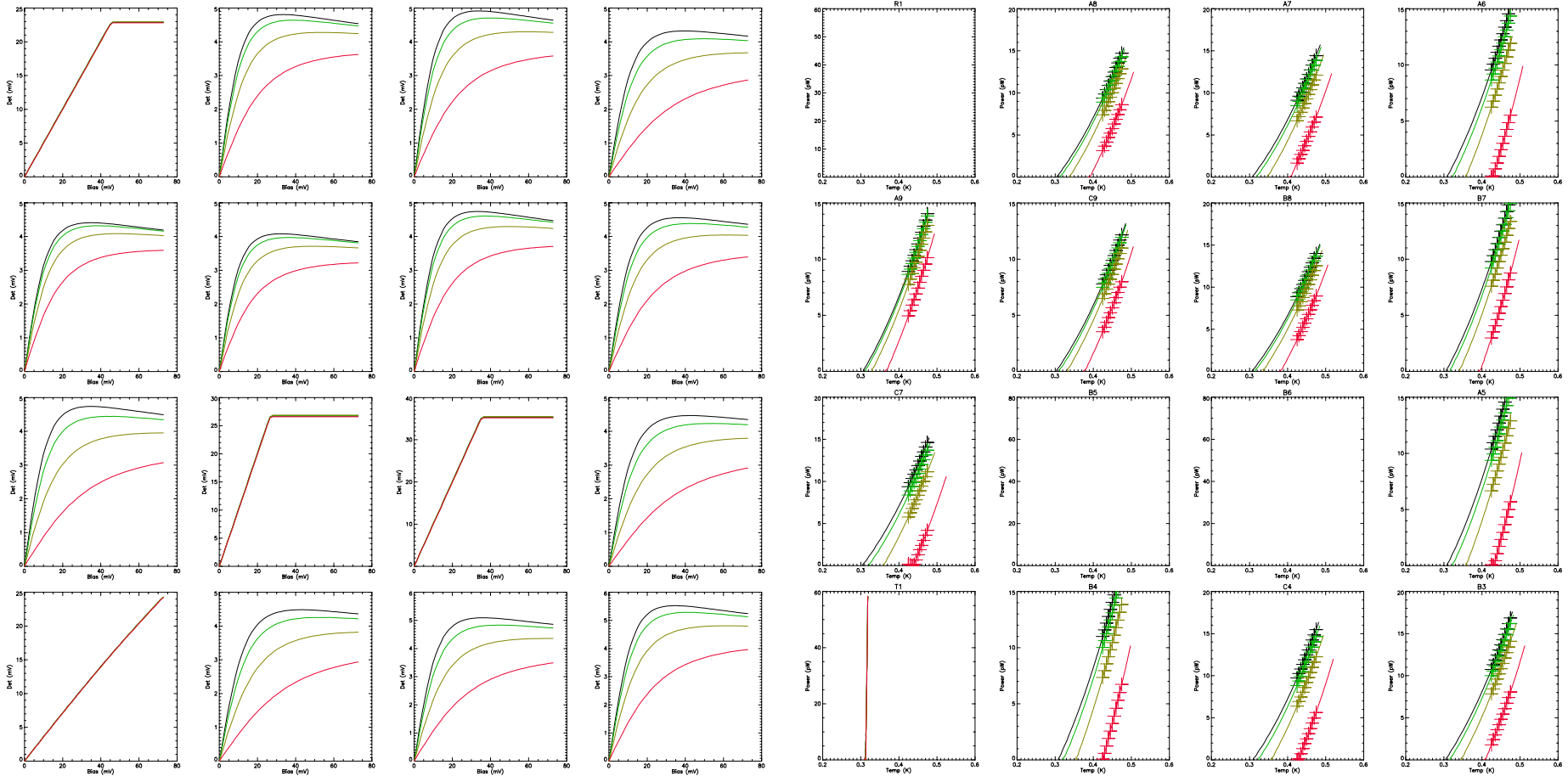


Loadcurves

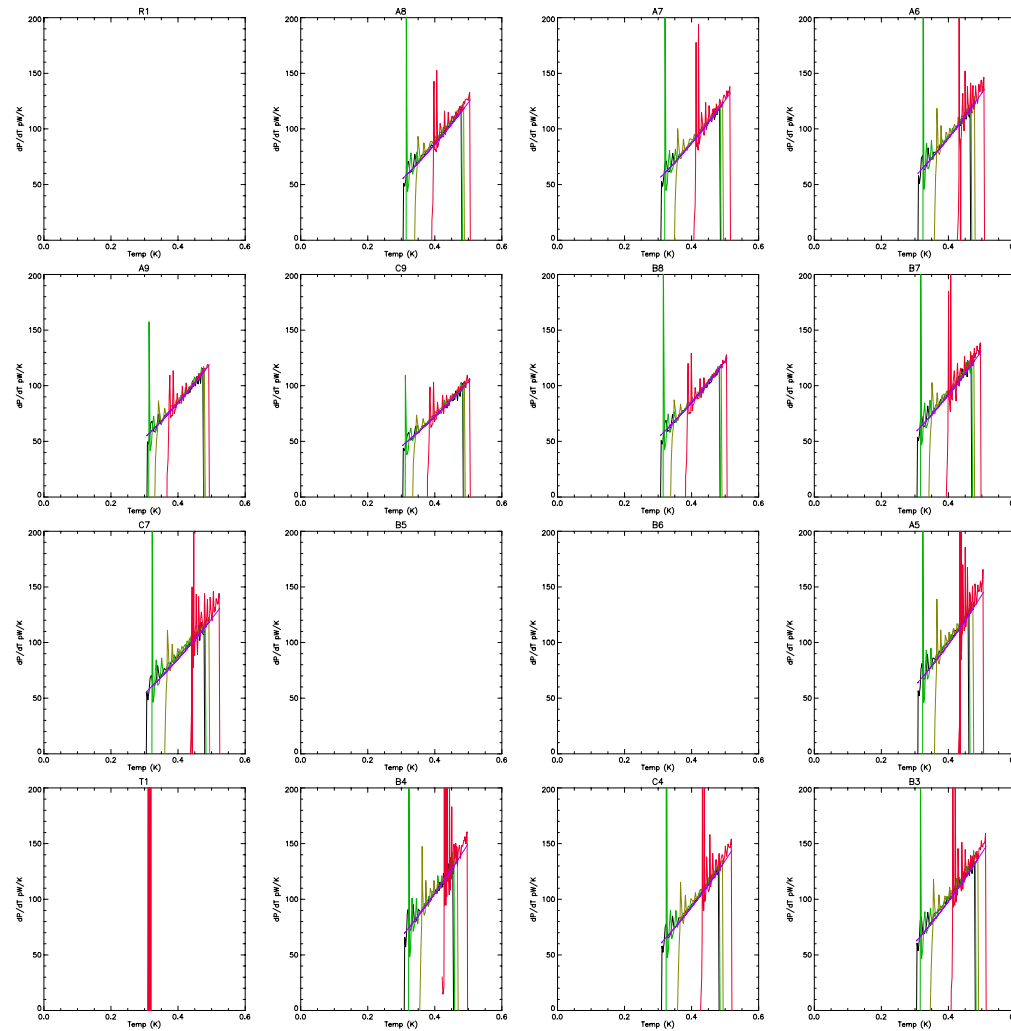
- **Loadcurves – power vs temperature measurements were made on the detectors under different bias and optical load conditions**
- **CQM loadcurves are done with AC bias only during CQM1 and with AC and DC**
- **Comparison with JPL loadcurves is tricky but DC data from CQM2 do seem to agree**

DC loadcurves

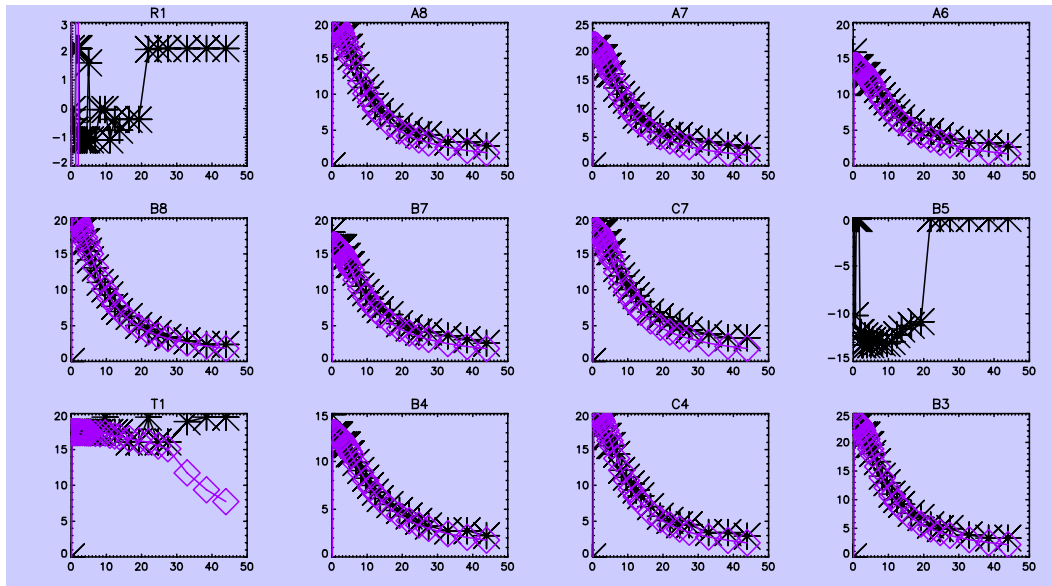
Volts versus volts – converts to P vs T



DC loadcurves And to dP/dT vs T



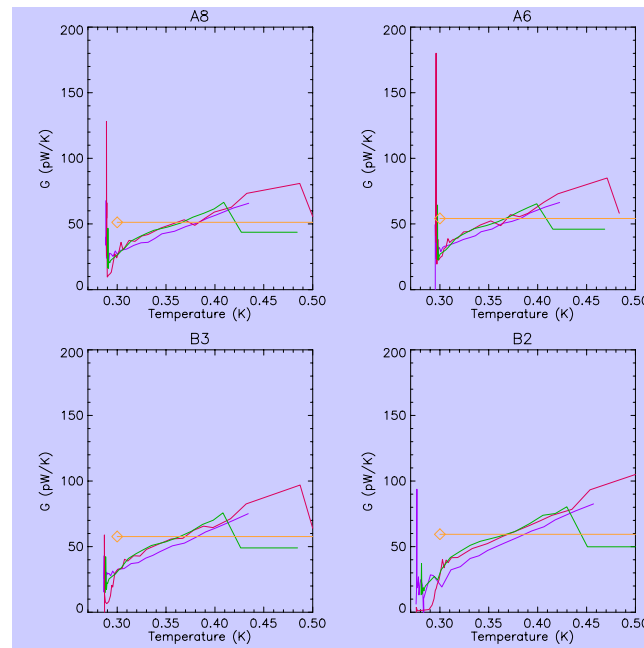
AC vs DC loadcurves



Using AC in and out of phase can convert phase to predicted R and compare to R calculated from JPL unit test calibration

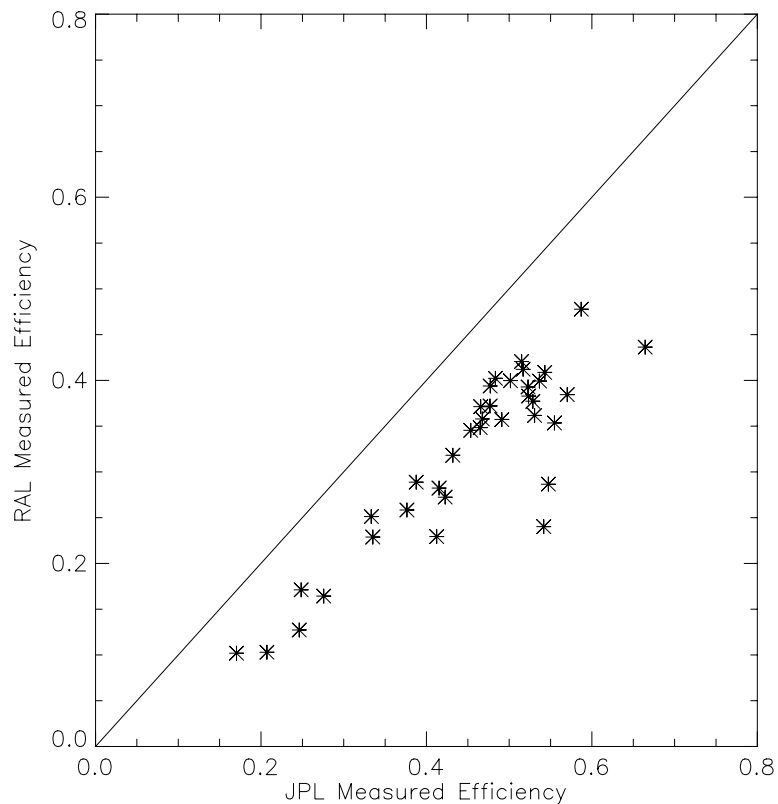
But AC still doesn't quite stack up?

Here is predicted G0

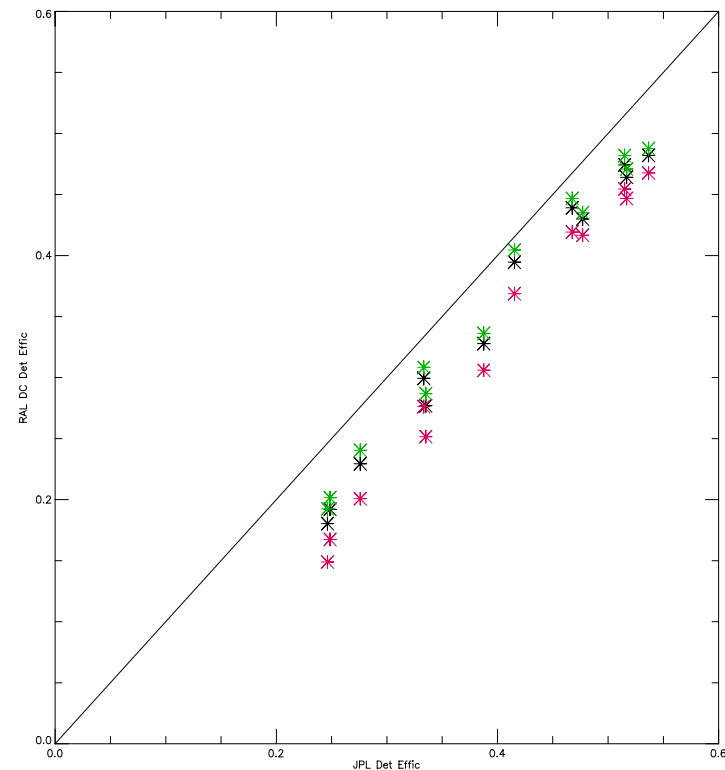


Optical Efficiency

- Comparing difference between optical load with 11.5 and 8 K CBB during CQM1 to deduce optical efficiency of BDA
- Comparison with JPL shows similar pattern across array but offset amounting to ~20%
- During CQM2 we used higher temperatures and DC rather than AC curves – differential less than 10% of JPL measurement

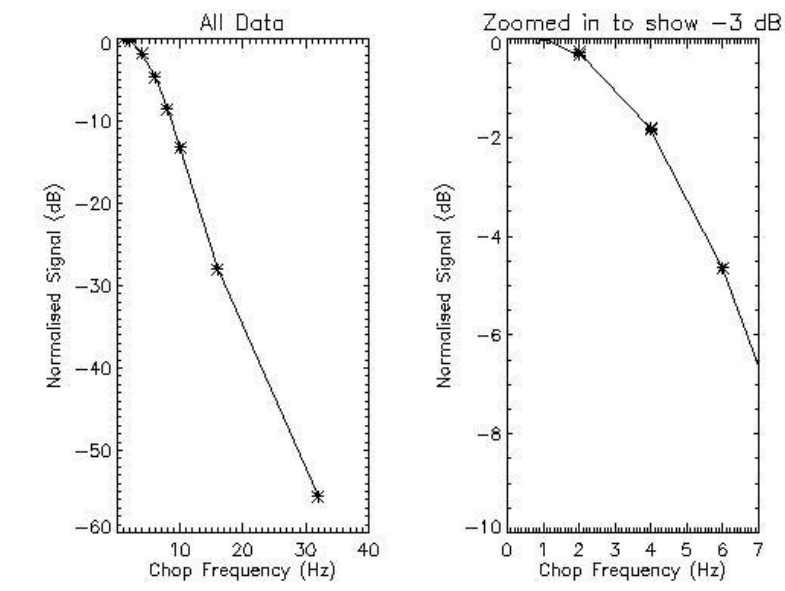


CQM Programme



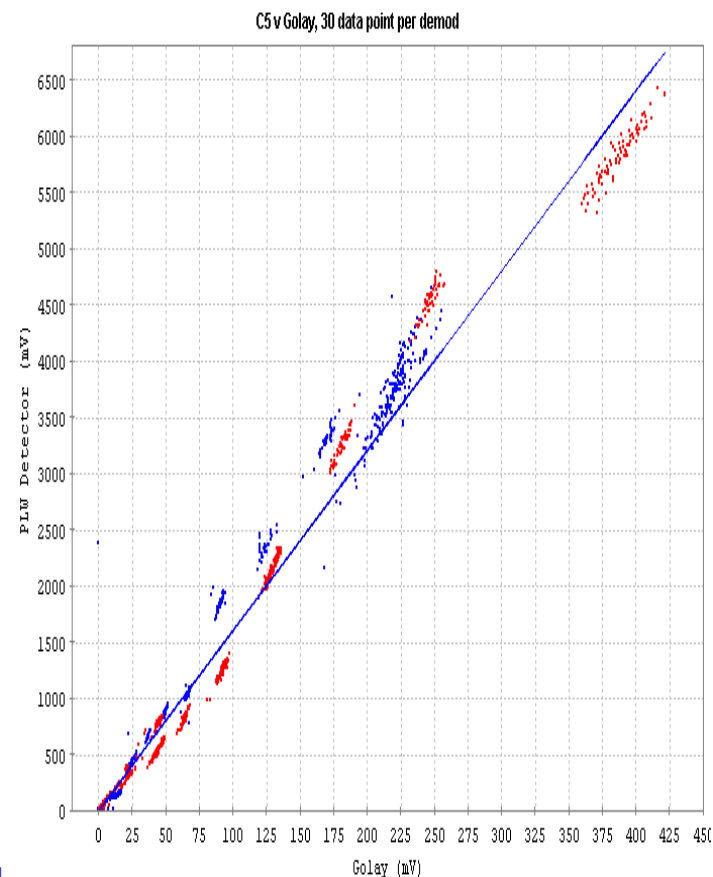
Sarah Leeks

Frequency response and linearity



Optical frequency response checked using external chopper – looks about where expected? Detailed comparison to model now needed

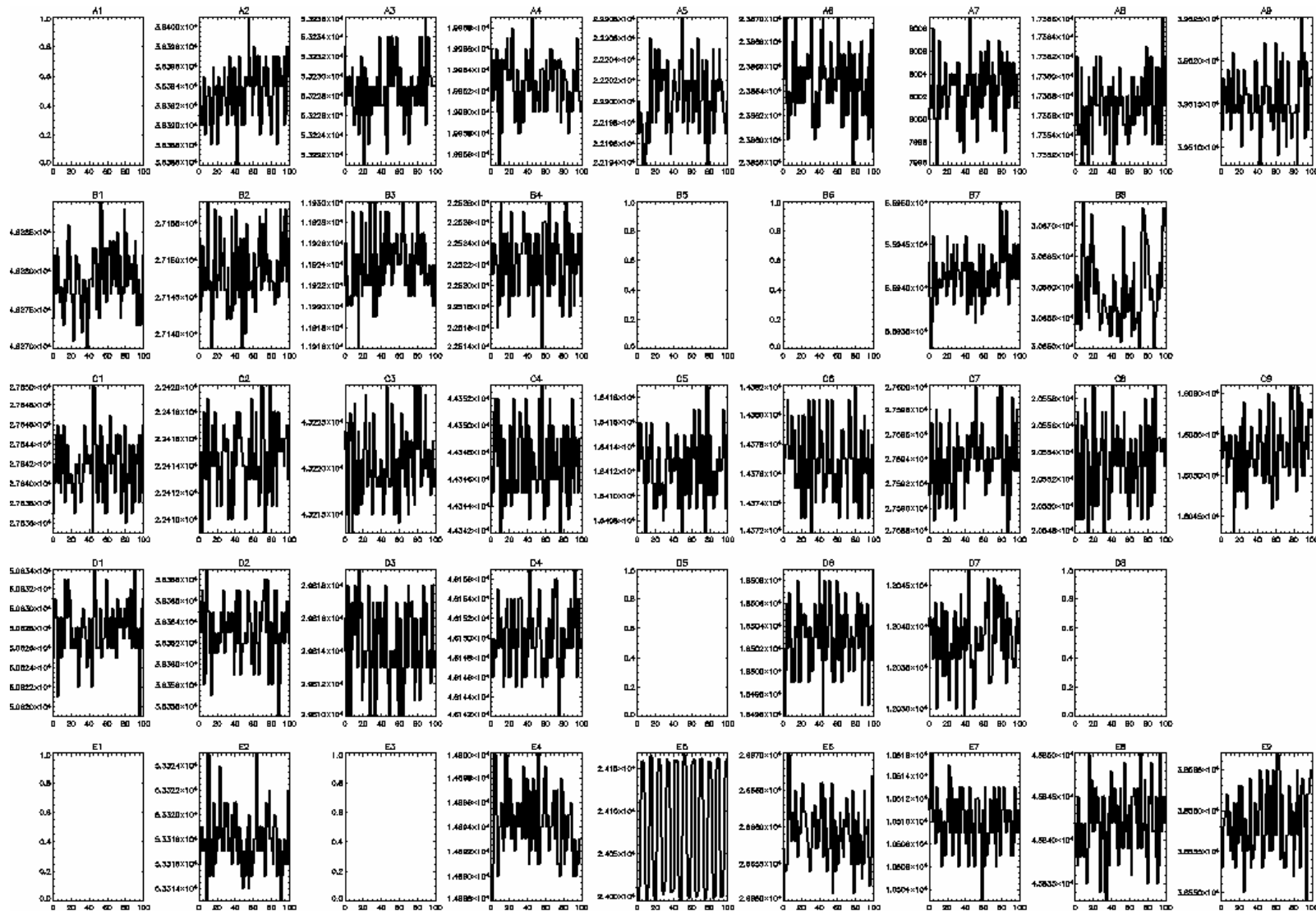
Linearity check carried out with too much power during CQM1 – repeated during CQM2 but linearity not clear. Next test will be improved with the lessons learnt from previous data.



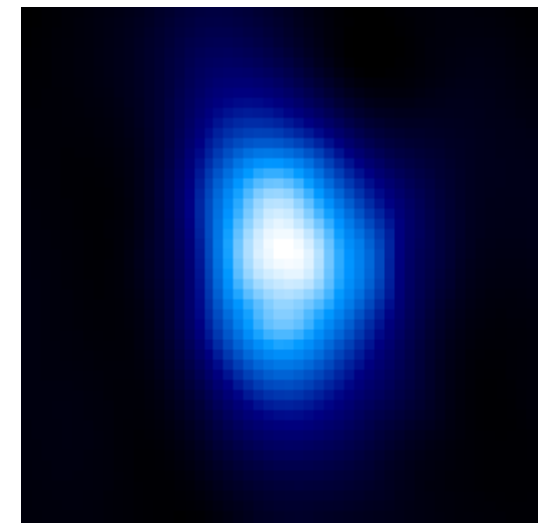
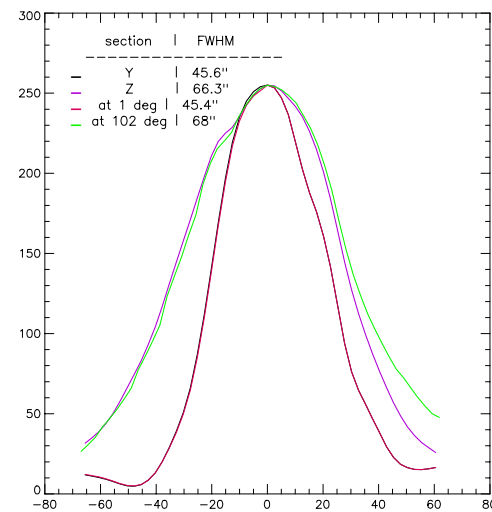
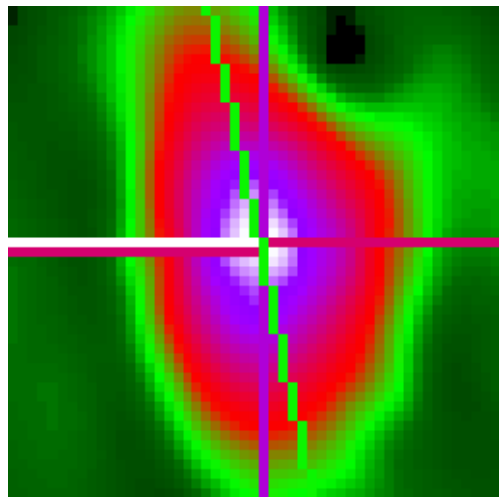
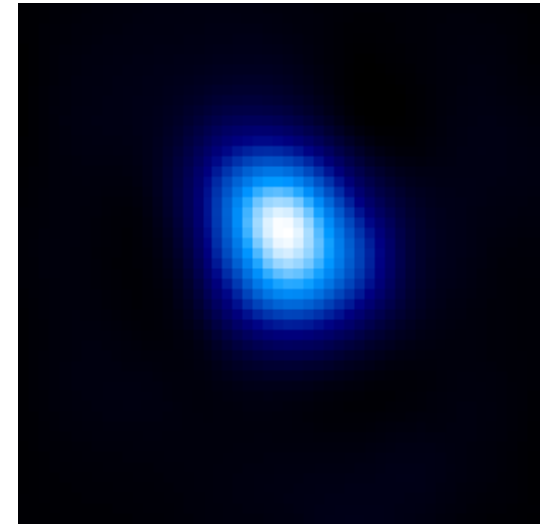
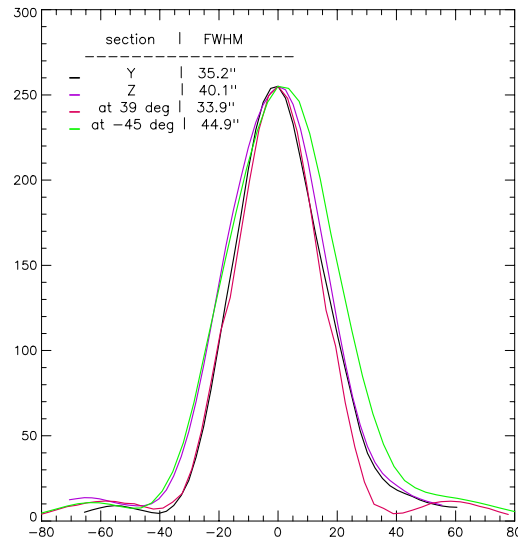
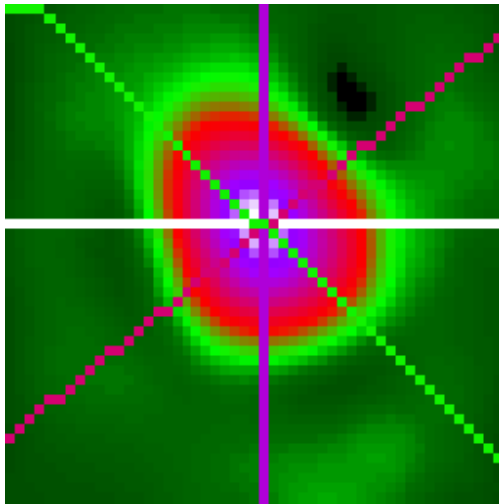
Optical Tests

- **Optical Cross Talk Test**
- **Pixel Centre**
- **PSF Test**
- **Focus Test**
- **Pupil Test**
- **Spectral Response**
- **Polarisation**

Cross talk check

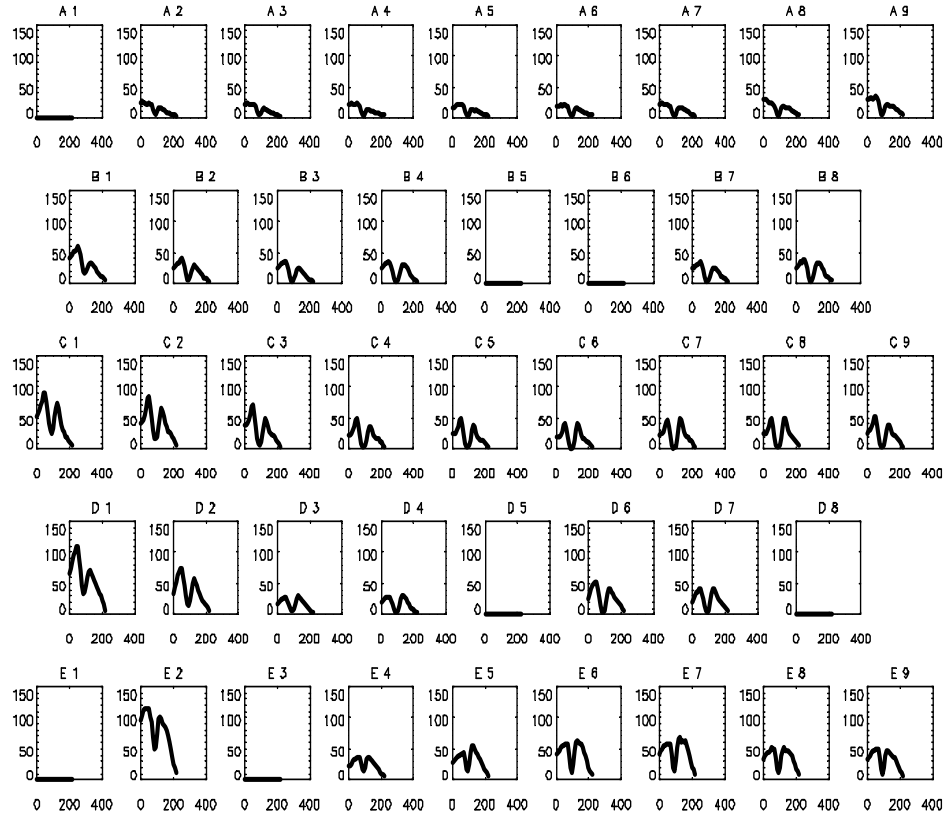


Beam Scans with laser



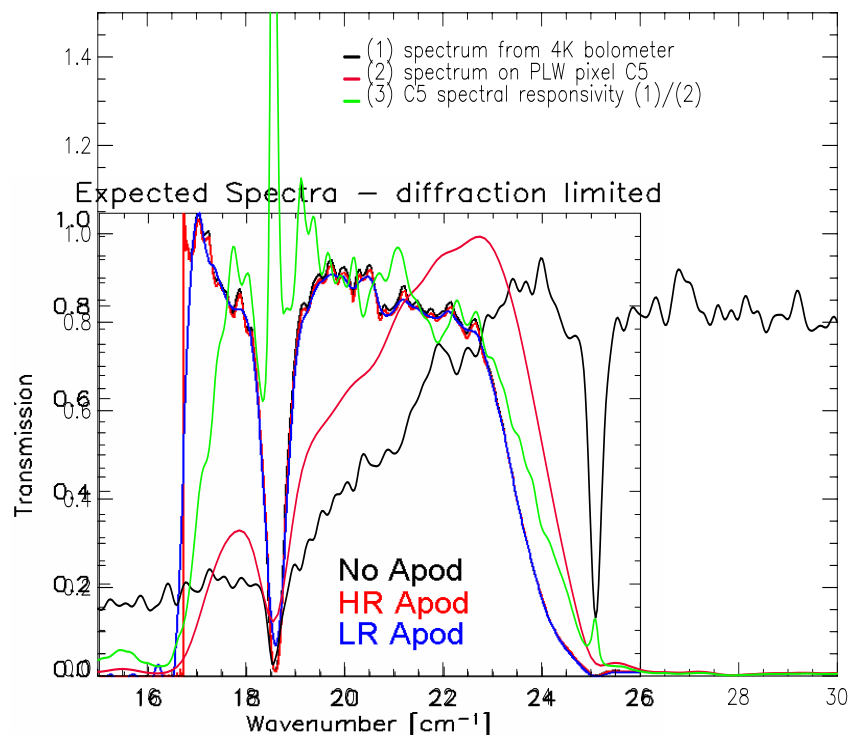
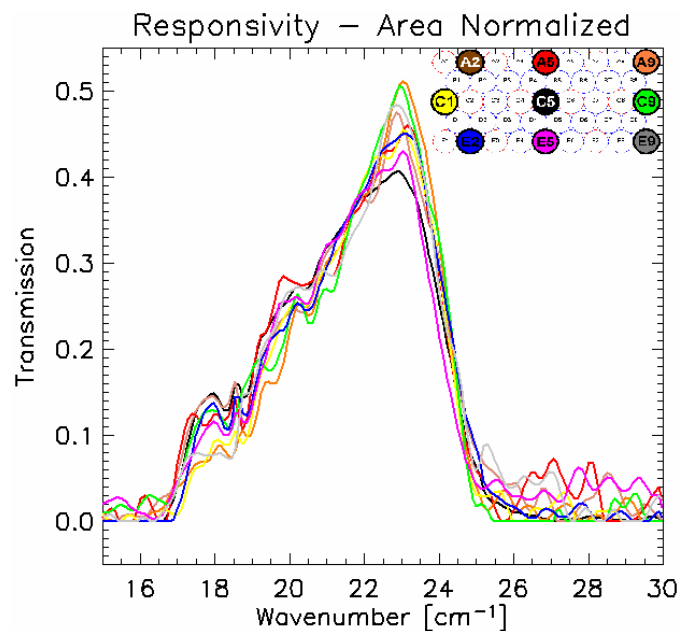
Pupil test

- The one disappointment of the test campaign
- Combination of not knowing what to expect and not properly aligning telescope simulator for this specific test
- No better during CQM2 – alignment procedure needs to be tightened up



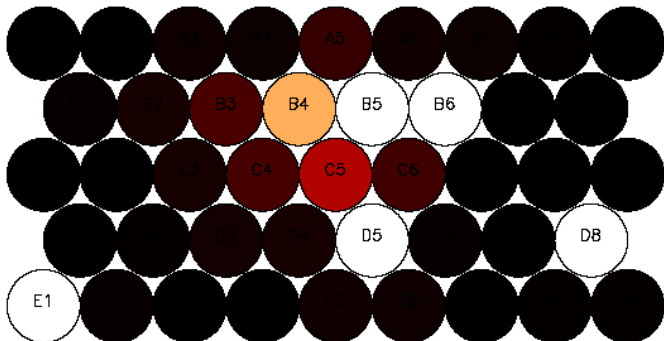
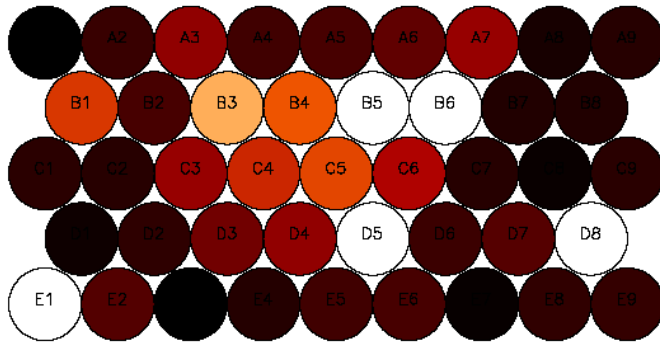
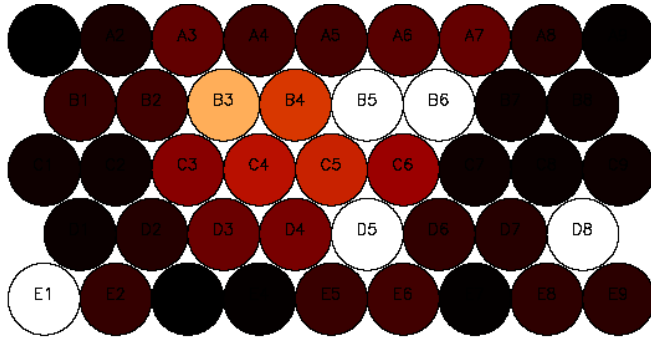
Spectral response

- Test FTS worked very well – air path not dry enough or stable enough during CQM1 – much better during CQM2
- Stand alone tests using test detector show strange shape is not associated with SPIRE



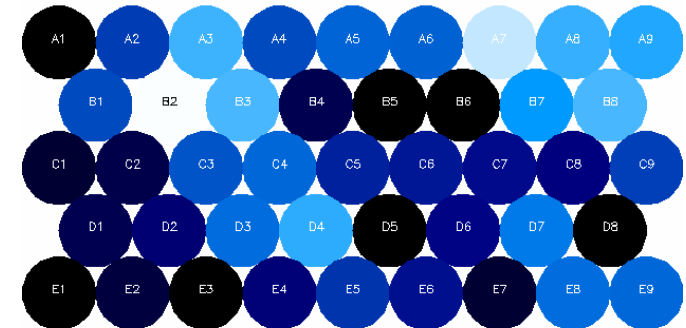
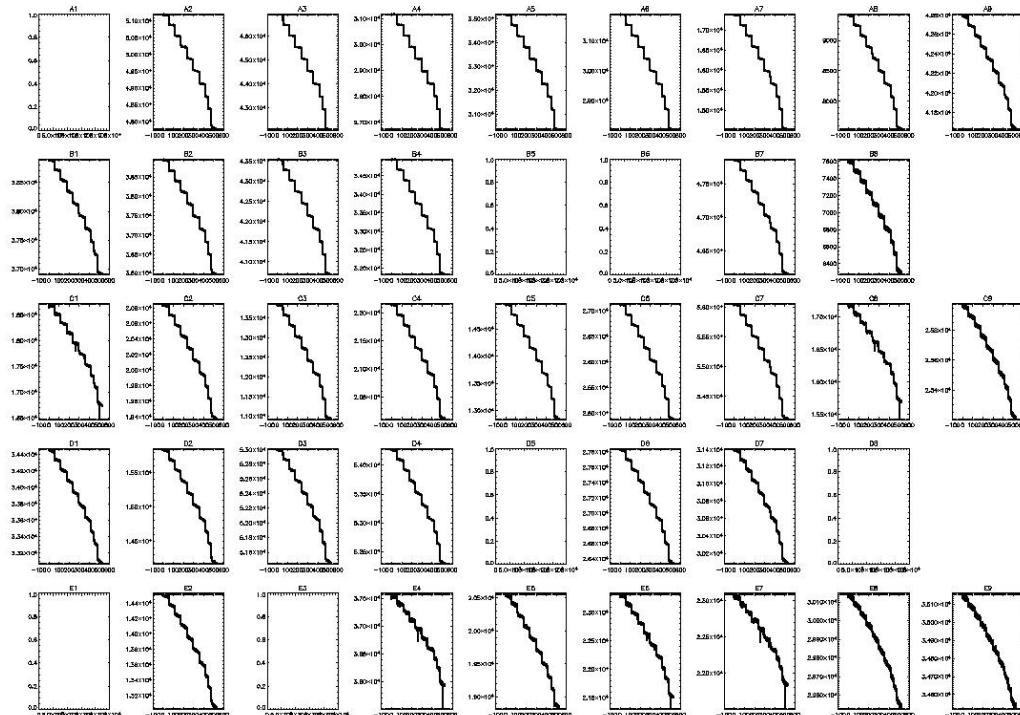
Laser Tests

- During Laser intensity was very much too high
- However test showed up straylight glint



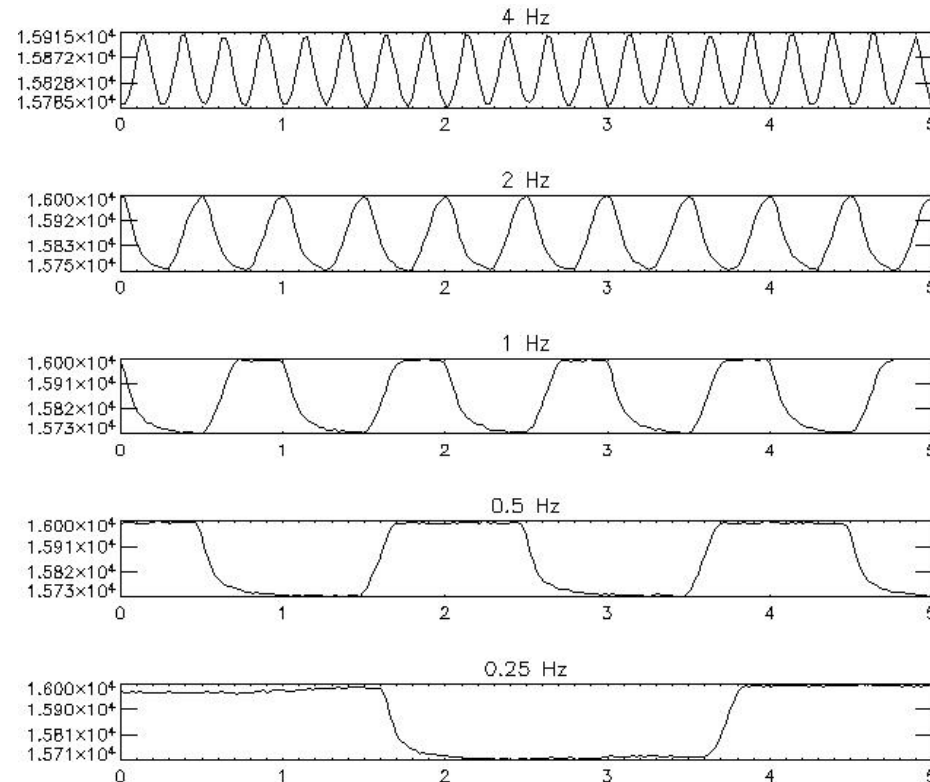
PCAL Tests

- PCAL Level Response check showed entire array does respond and signal level is good
- Flat field looks slightly different to expectation
- CQM2 data still to be fully analysed – basic comparison shows little difference before/after vibe



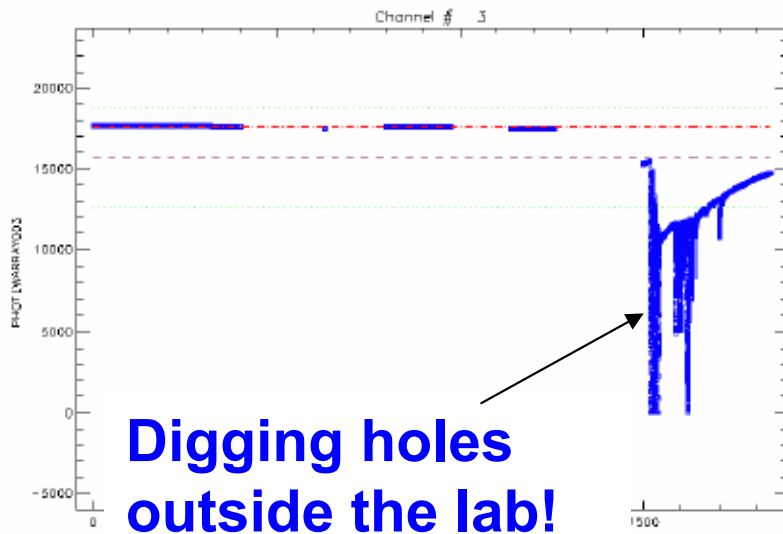
PCAL Tests

- PCAL Frequency Response tested ability to command PCAL in “chop” mode
- Thermal response of CQM PCAL was slower than required for flight as expected



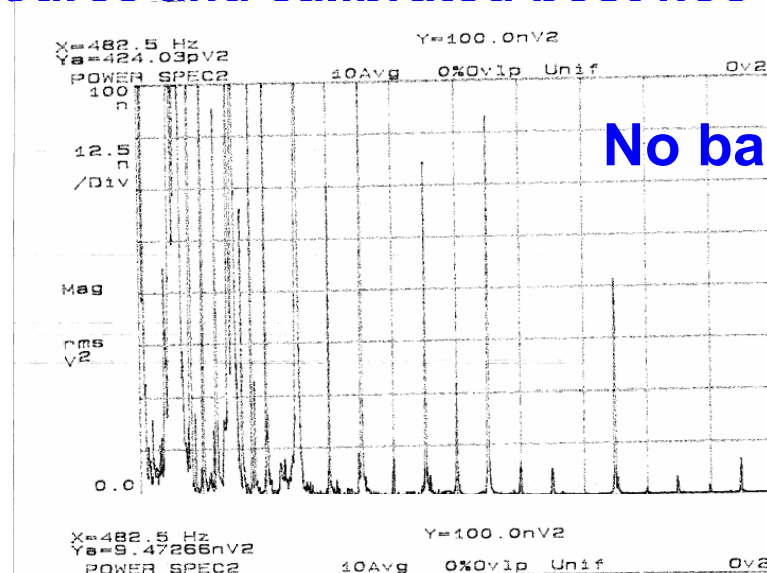
Microphonics Tests

- CQM1 Microphonics test done with DC biased detectors and H-P spectrum analyser with “calibrated mechanical impulse”
- CQM2 repeated using vibration source and calibrated post hoc

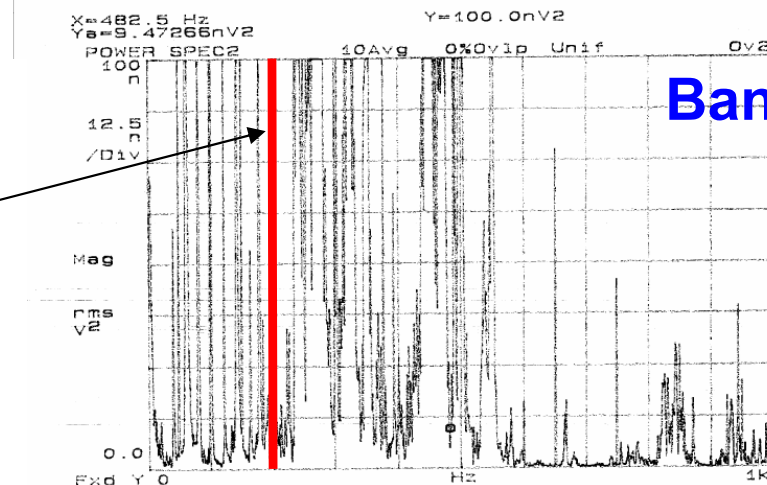


Digging holes outside the lab!

Main microphonic response above ~200 Hz



No banging



Banging

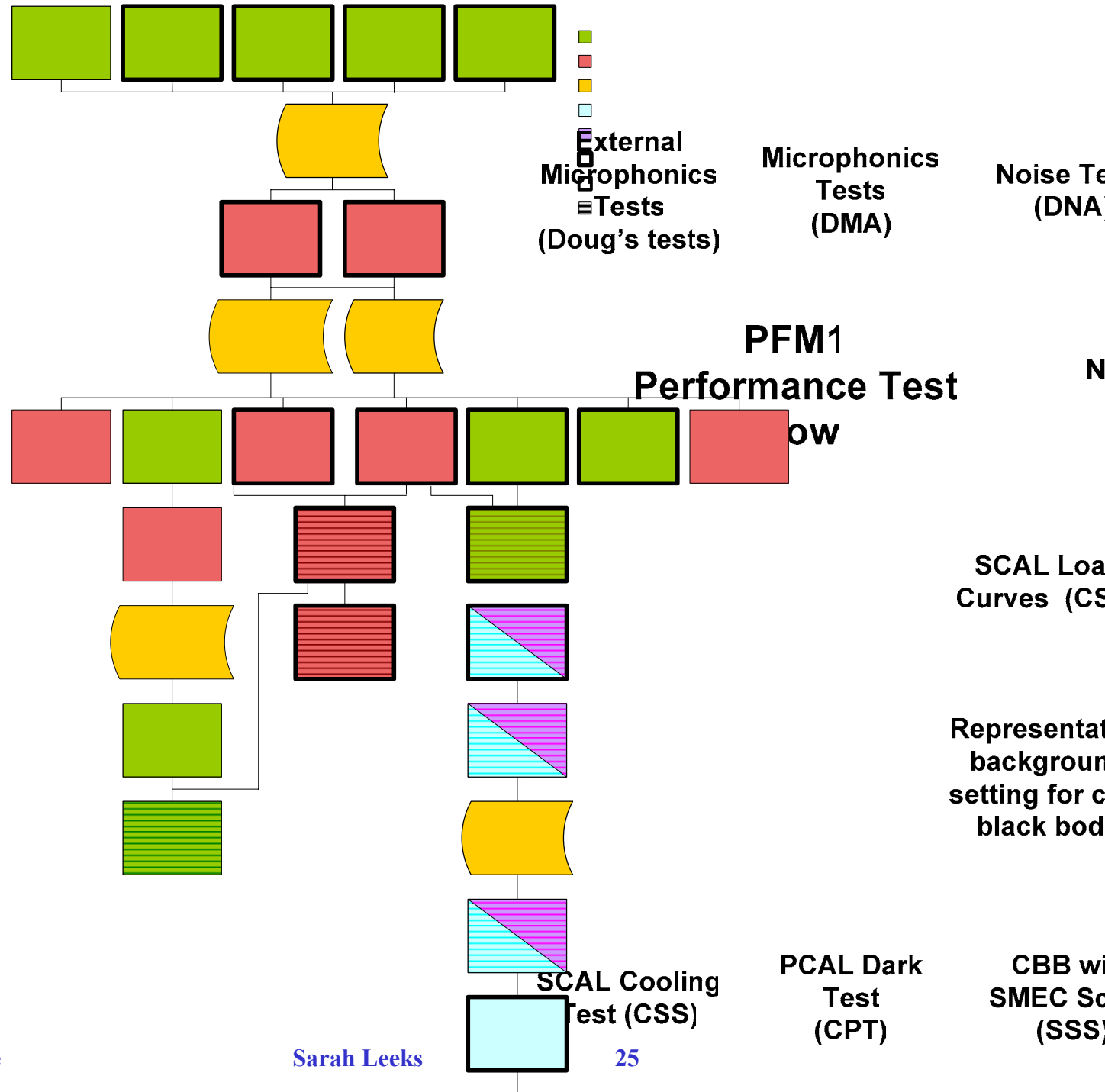
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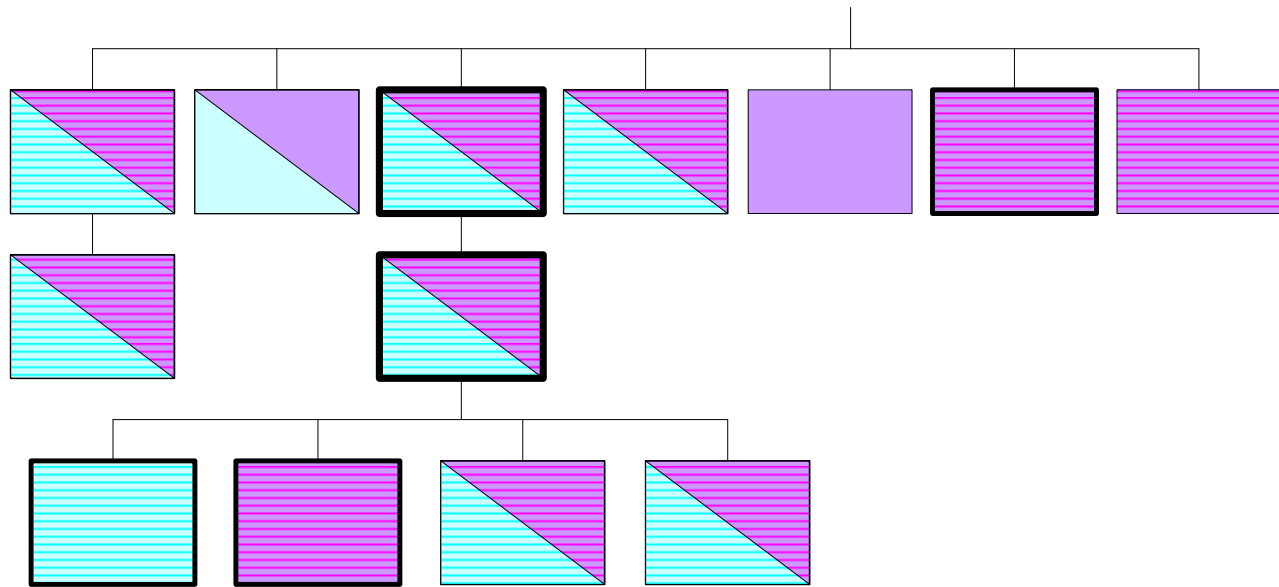
Tests (still) Not Done

- **Straylight Test**
 - **Pupil test still inconclusive below ~10 dB**
 - **Alignment between SPIRE and telescope simulator must be better controlled**
- **All other tests have been at least attempted**

PFM1 –Build and Tests

- **First Spectrometer build (complete with moving mechanism – SMEC).**
- **First build with moving Beam Steering Mirror**
- **Performance tests given on next two slides.**





**Beam Scan
(OSB)**

**Beam
Attenuation
(DRA)**

**BSM
Characterisati
on (BSM)**

**Pupil
(O**