Irradiations of Hamamatsu SCT Series Detectors

Dave Robinson, Cambridge, SCT Week 29/9-04/10 2002

We typically irradiate ~0.5% of Hamamatsu series detectors delivered to the UK.

These irradiations are performed to ensure consistency of post-irradiation electrical behavior between detectors and in comparison to the qualification detectors.

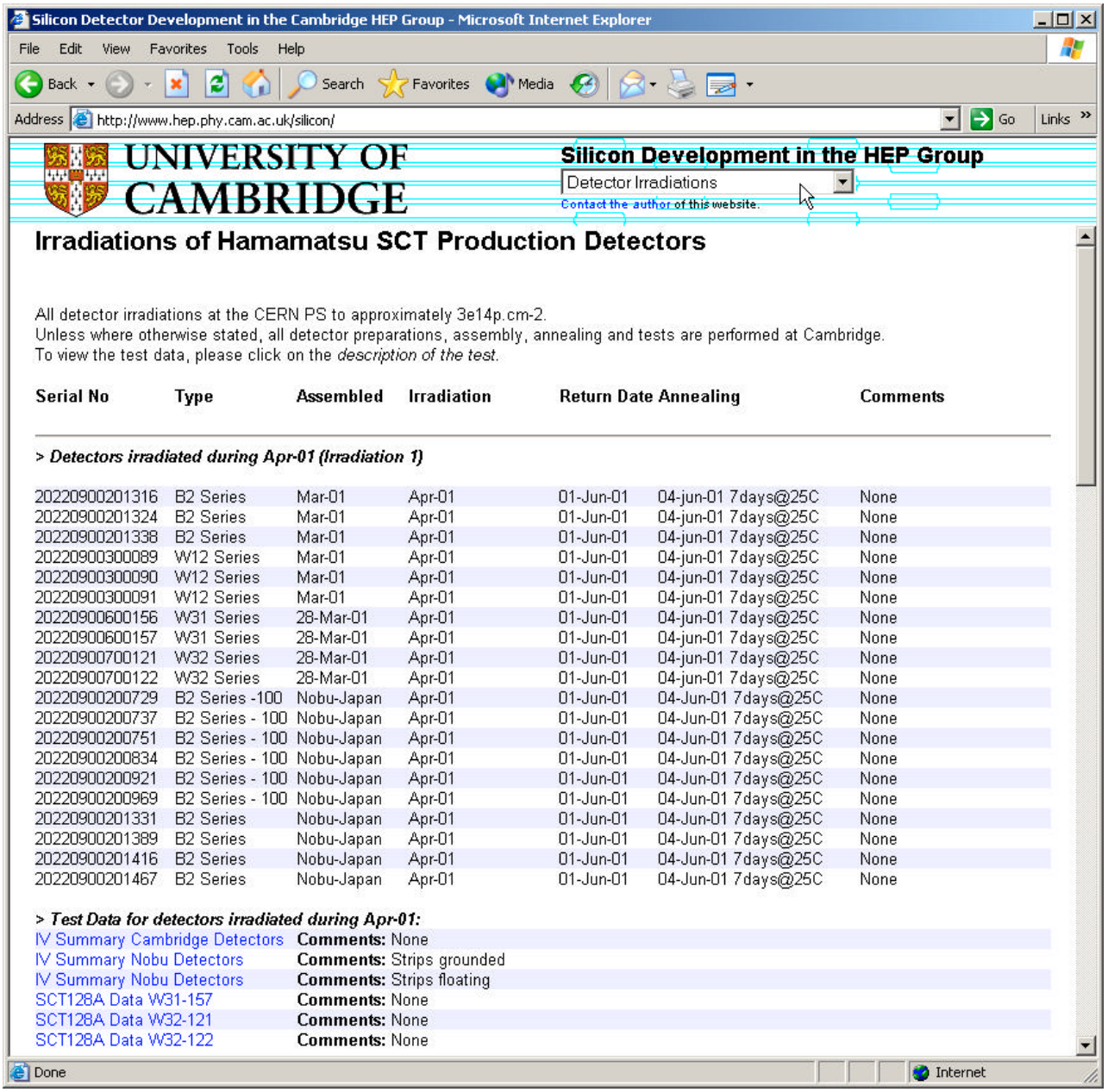
Post irradiation measurements comprise:

- Leakage Currents (every detector)
- Signal vs Bias, using SCT128A (sample)

Detector preparations, assembly, post-irrad annealing and testing are performed at Cambridge.

All details including test measurements are available publicly on the Cambridge Silicon website:

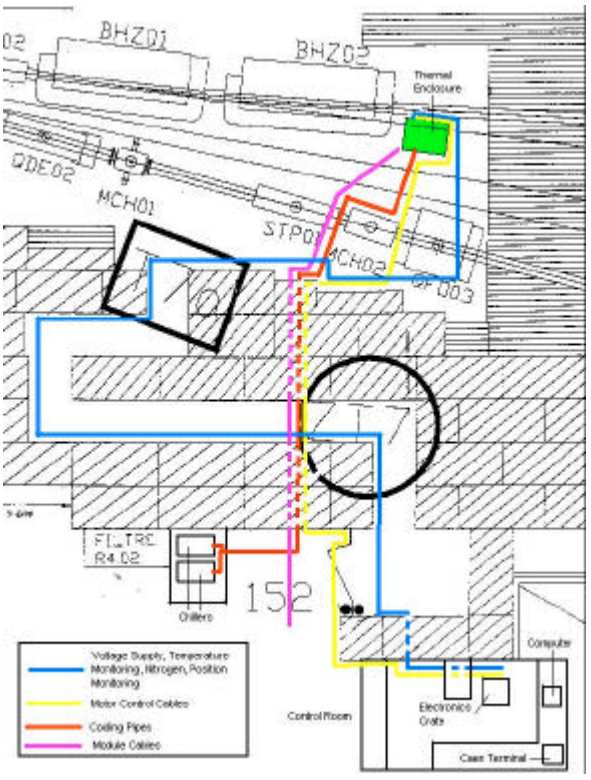
http://www.hep.phy.cam.ac.uk/silicon



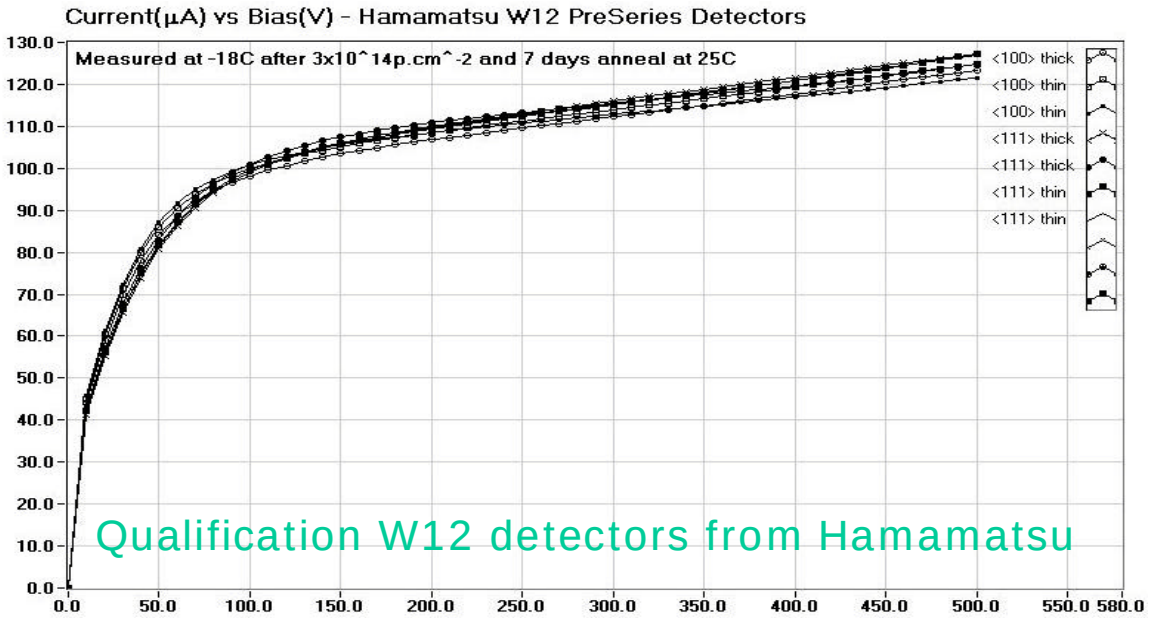
Irradiation Conditions

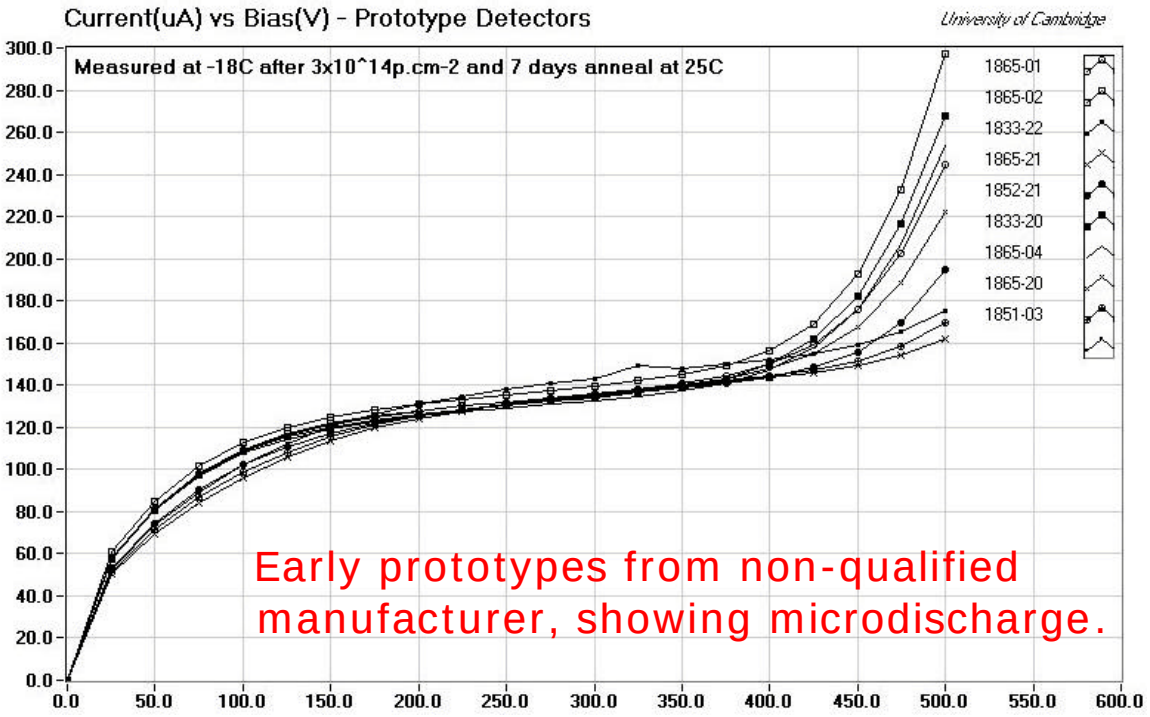
The detectors are irradiated with 24 GeV/c protons to $3x10^{14}p.cm^{-2}$ at the T7 irradiation facility under the following conditions:

- Temperature -8°C
- Strips grounded
- Post irradiation annealing at 25°C for 7 days

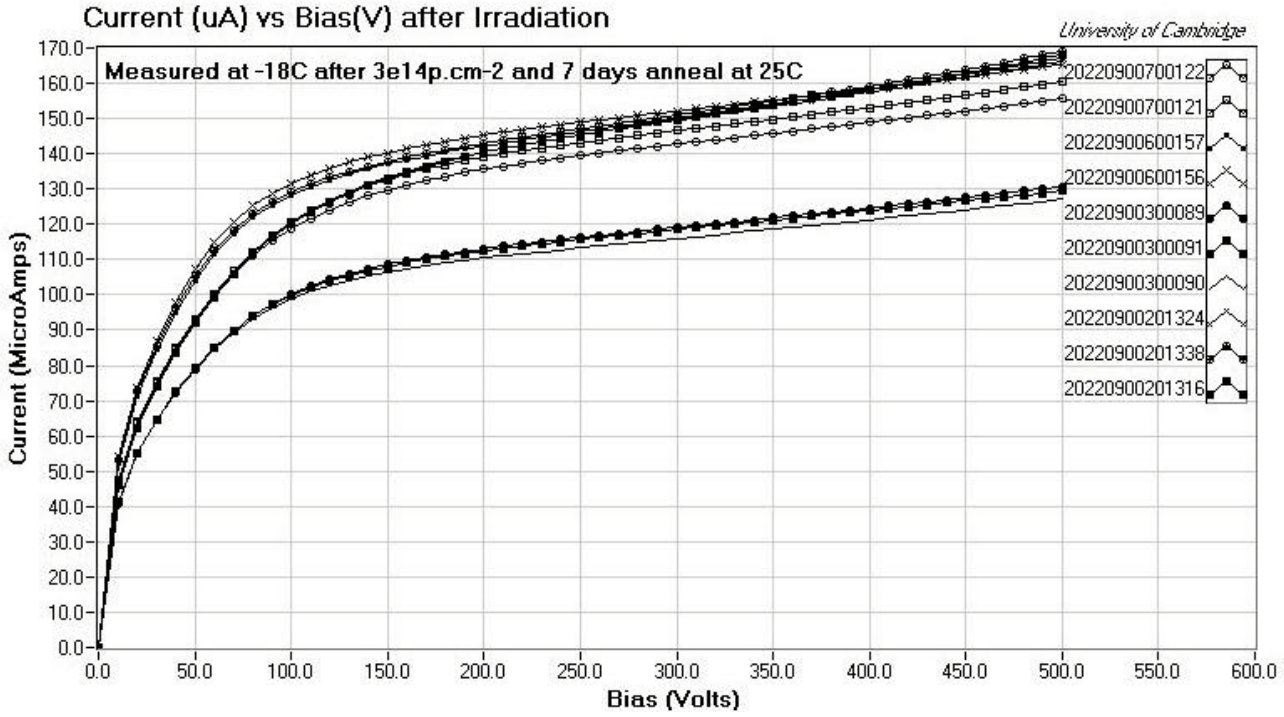


Post-Irradiation leakage current measurements are our main diagnosis tool

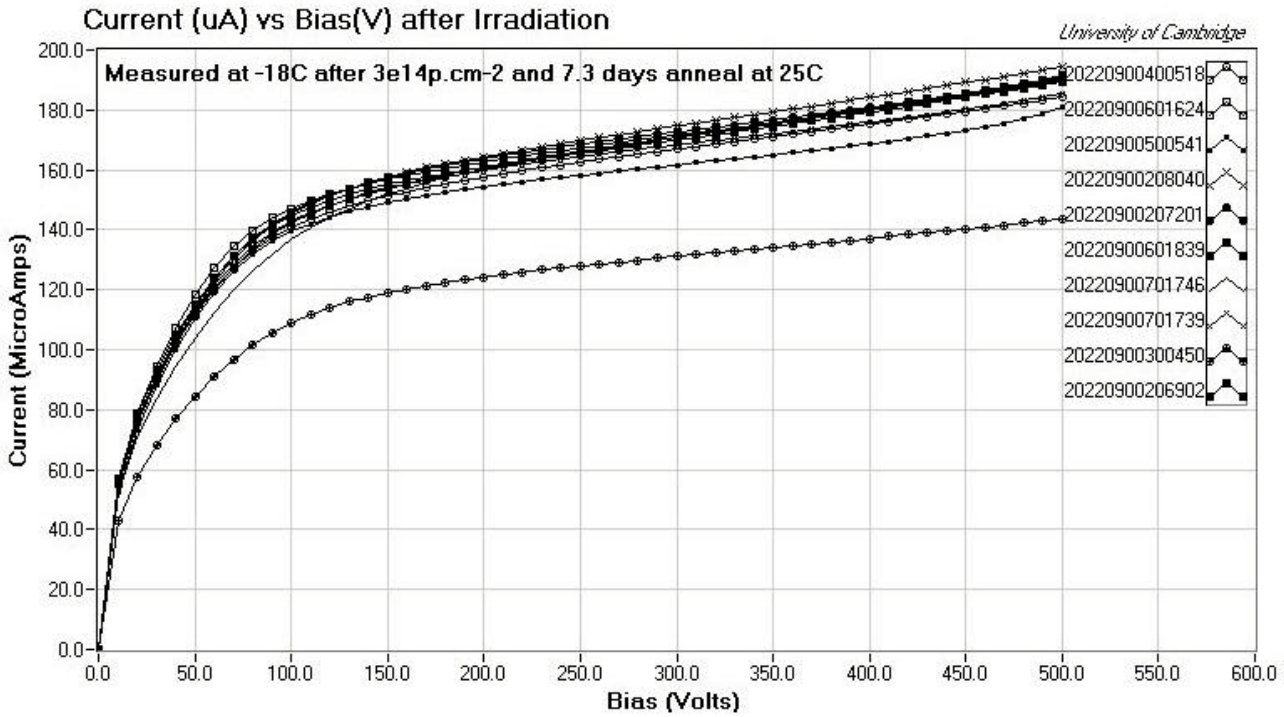




April 2001 Irradiation, various shapes.



May 2002 Irradiation, various shapes.



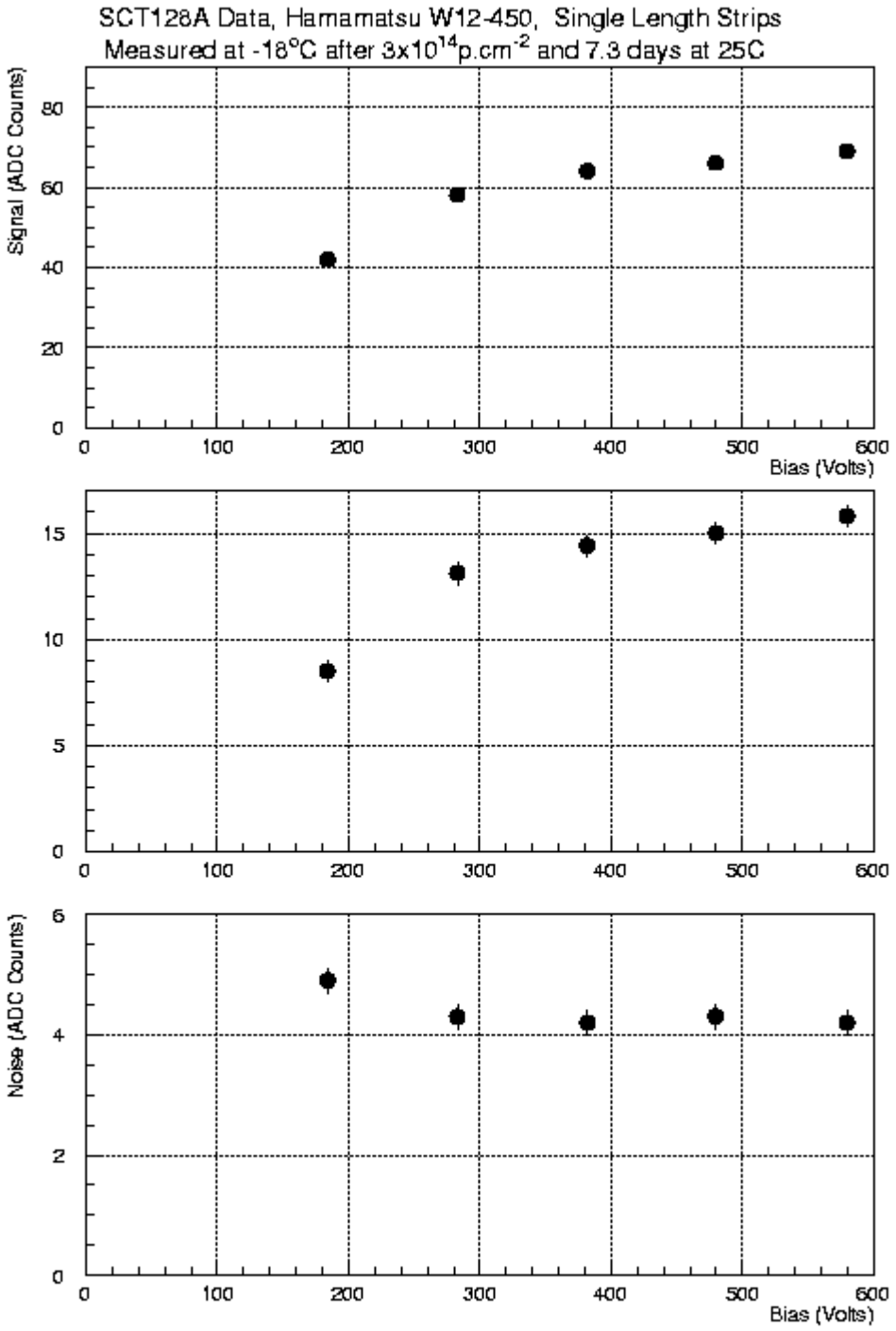
Analogue Readout using SCT128A

128 strips are bonded to a SCT128A chip via a series of re-useable pitch adaptors.

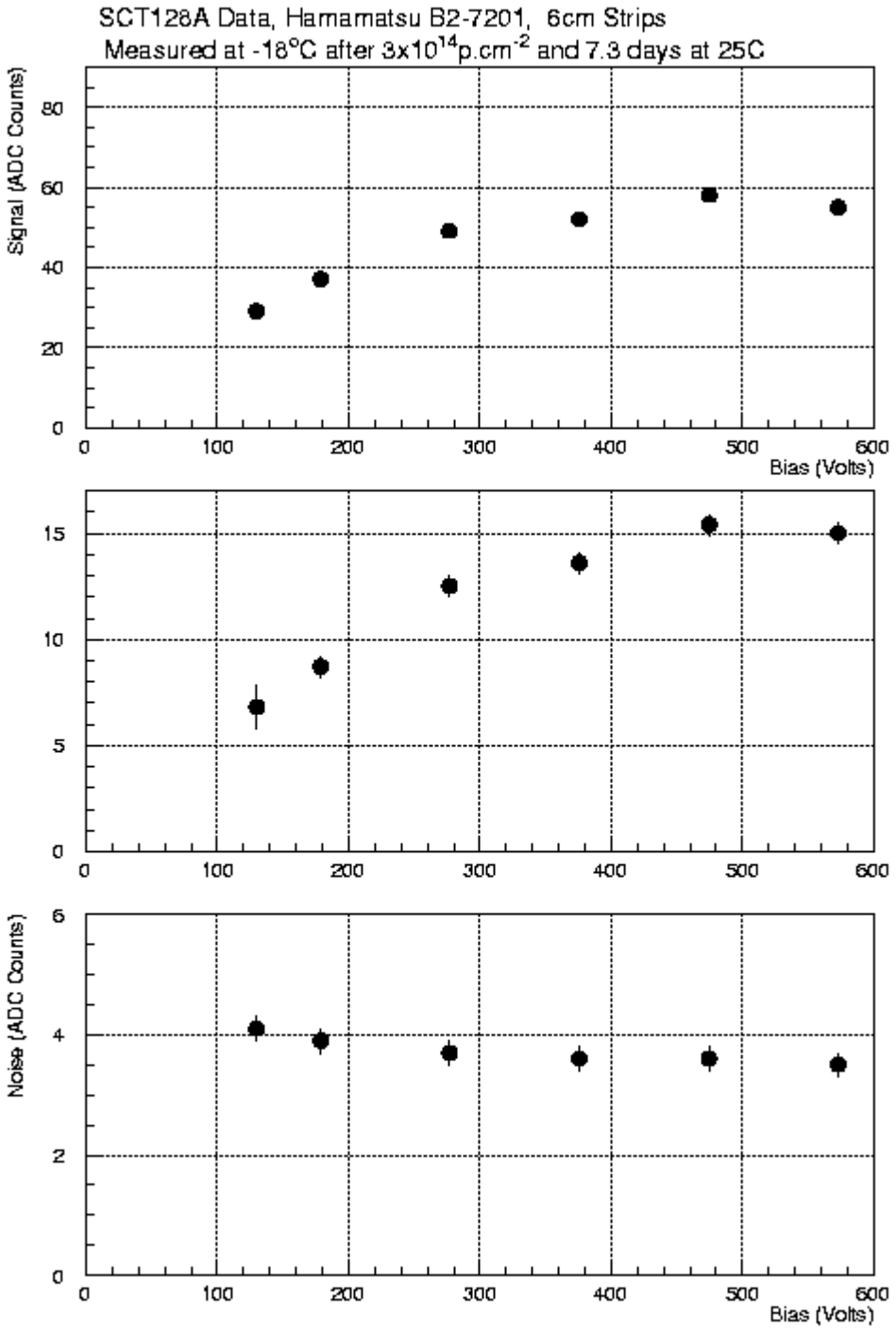
Measurements of signal vs bias are made with a Ru^{106} ?-source positioned ~1cm above the detector surface, and a scintillator ~1cm below the detector.

Data acquisition and analysis all performed using LabView.

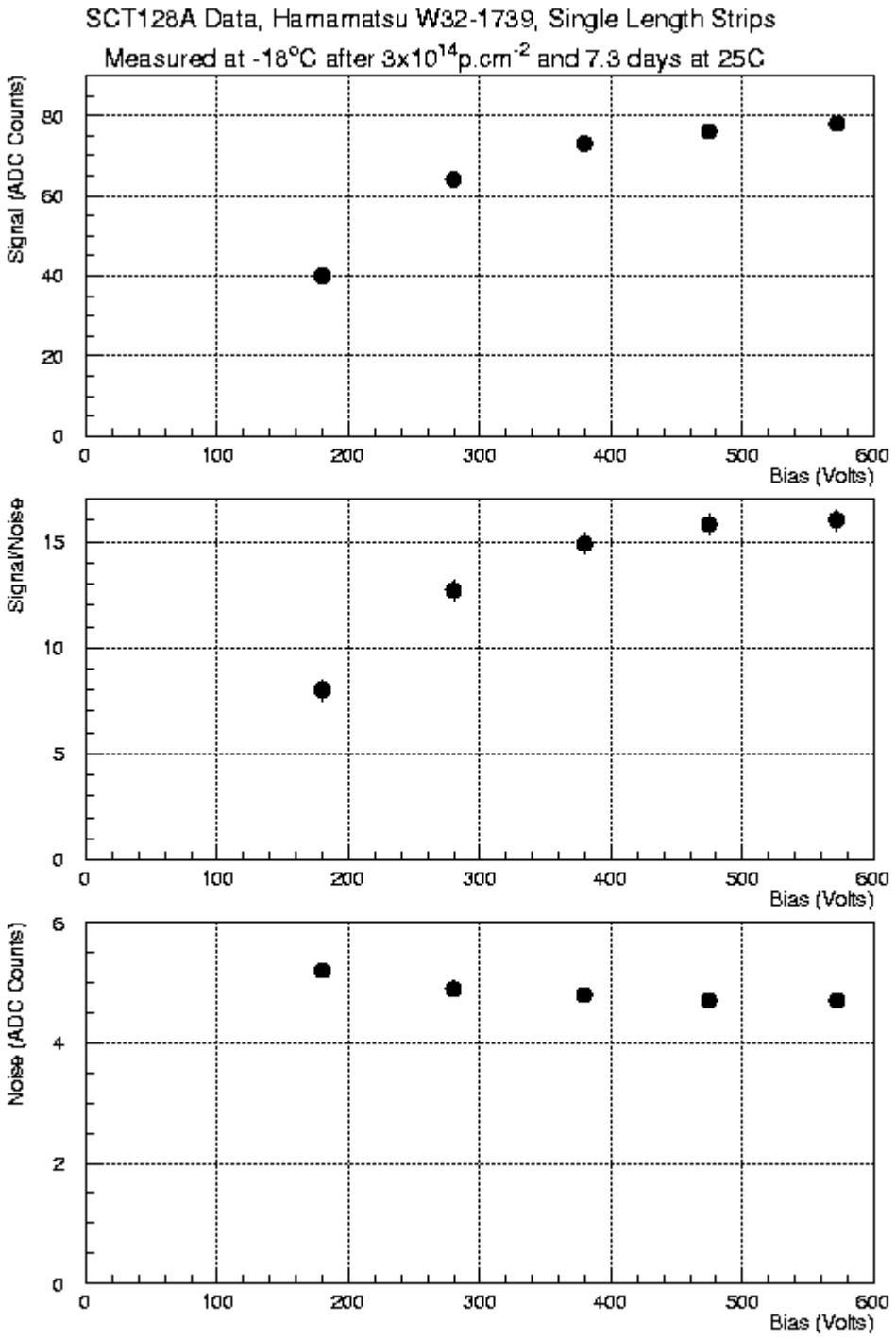
SCT128A Data - W12 20220900300450



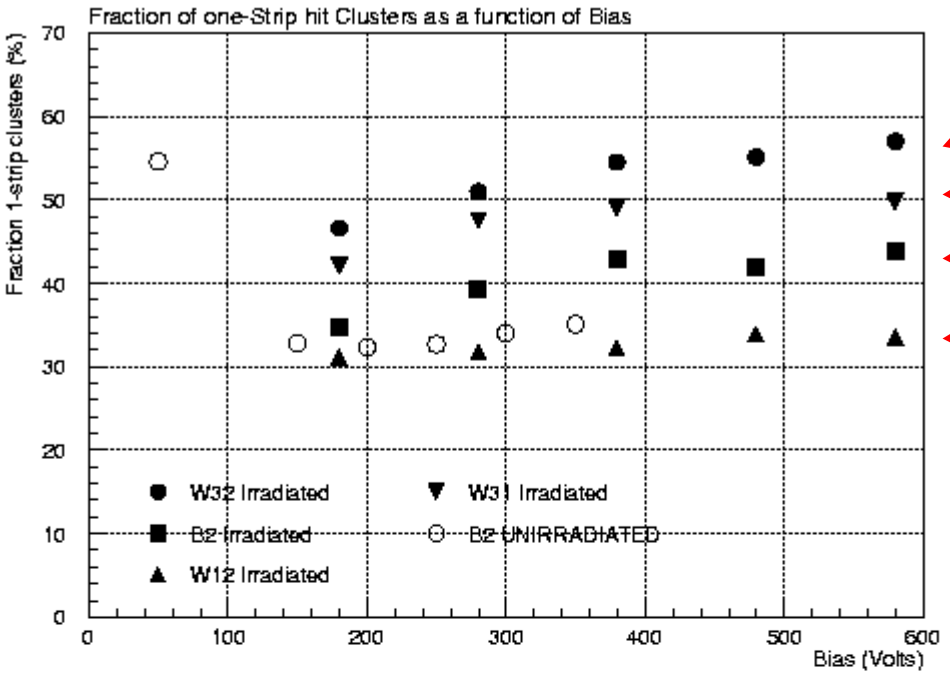
SCT128A Data - B2 20220900207201



SCT128A Data - W32 20220900701739



“Binary” Analysis of SCT128A Data



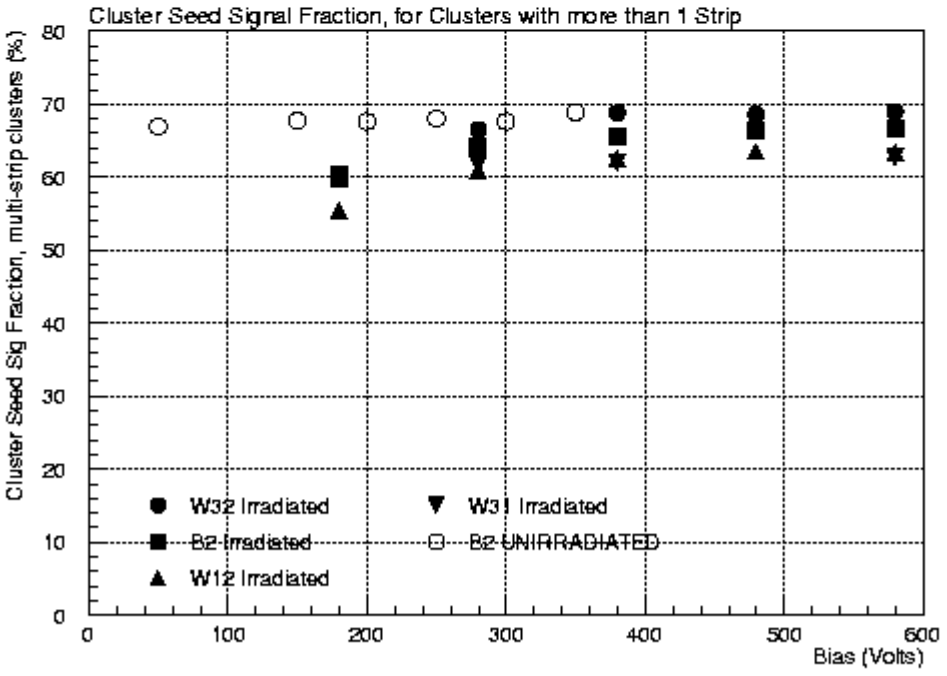
Strip Pitches

88?m

75?m*

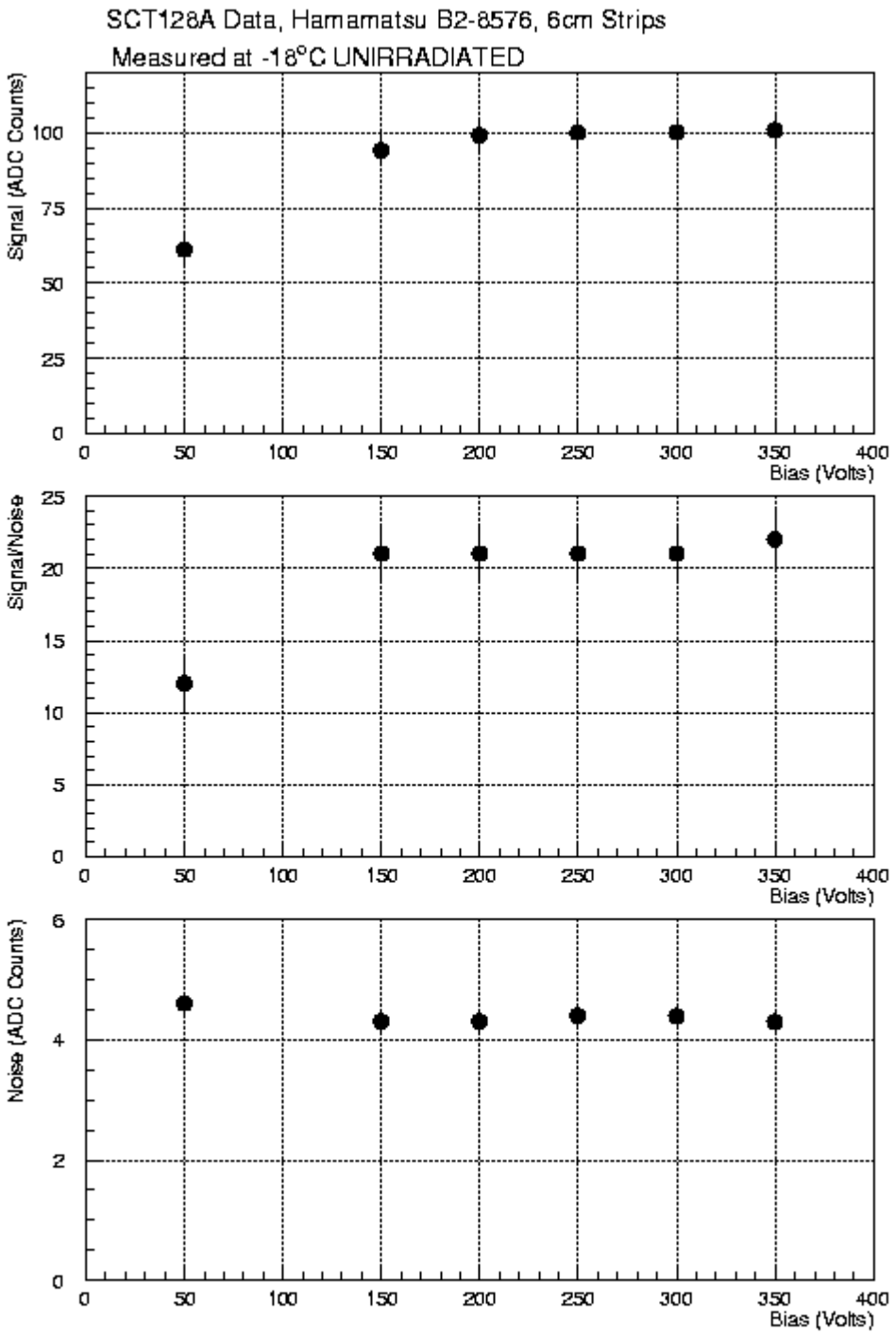
80?m

63?m



(*The W31 data was taken with the wrong time bucket)

SCT128A Data - Unirradiated Barrel



Summary

• Throughout production of the SCT detectors, we have been regularly irradiating small representative samples of detectors of all shapes.

• The motivation has been to identify undesirable changes in post-irradiation behavior (such as microdischarge or any change in the signal vs bias) compared to qualification detectors.

• We have so far irradiation ~30 barrels and 4-6 of each wedge shape.

• So far all post-irradiation behavior has been consistent with qualified detectors and with other irradiated detectors

• No evidence so far of any differences between wedge and barrel detectors in their post-irradiation behavior