Status of the HVStripV1 testing

Luigi Vigani
University of Oxford

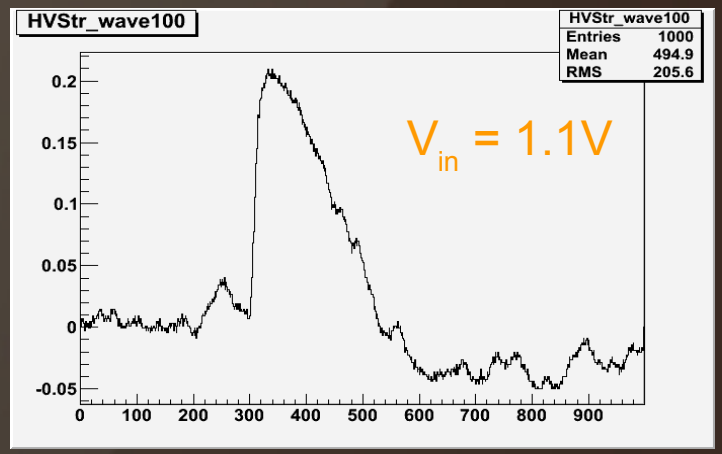
University of Glasgow

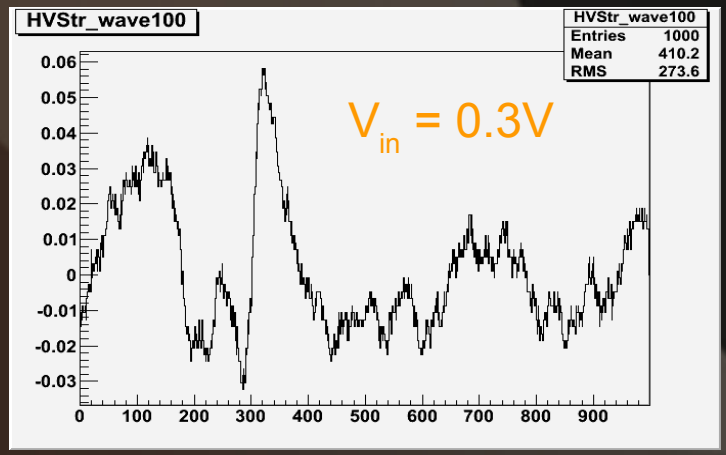
Irradiation at Birmingham

- Two devices successfully irradiated:
  - MB03 at 7.63×10^{14} n_{eq}/cm^2
  - MB04 at 8.77×10^{14} n_{eq}/cm^2
- Chips transported cold to Oxford and kept in a freezer
- Data taken in Oxford inside an environmental chamber
  - Injecting pulses
  - Fe^{55} spectra

Injection on MB03

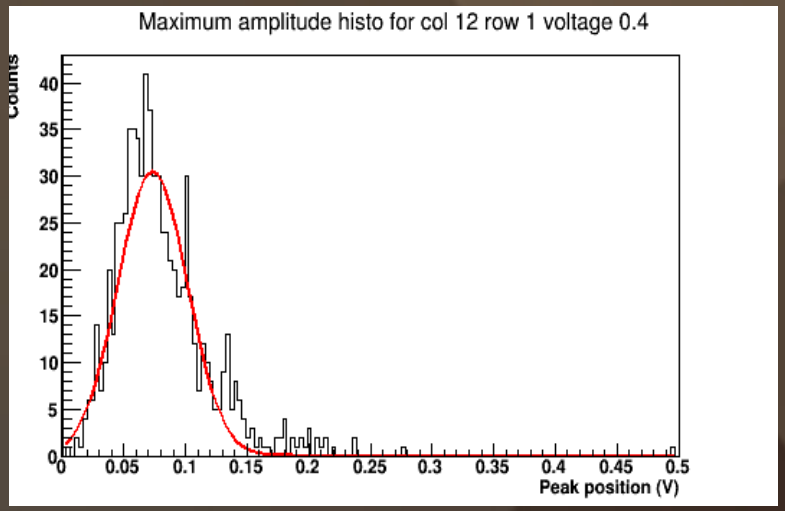
- "Usual" injection study, -10°C:
  - Inject voltage in
  - Read voltage out
  - Plot mean signal height vs voltage in
  - Fit with straight line
- Fact: output seems very noisy now:

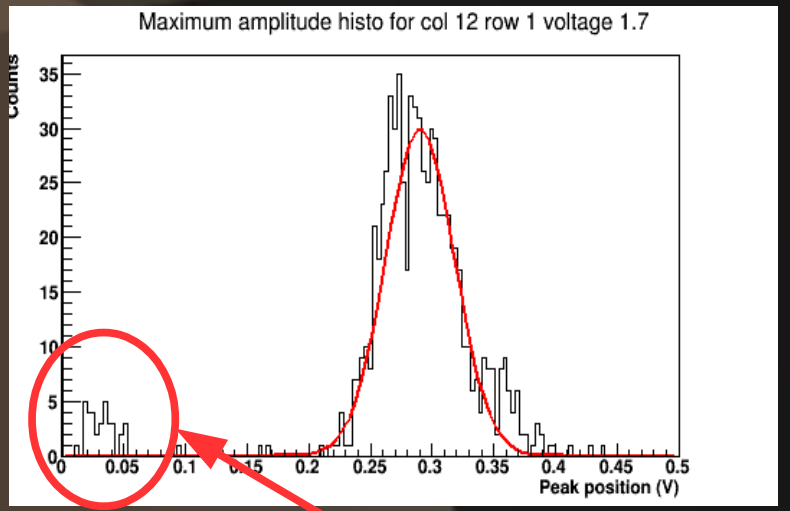




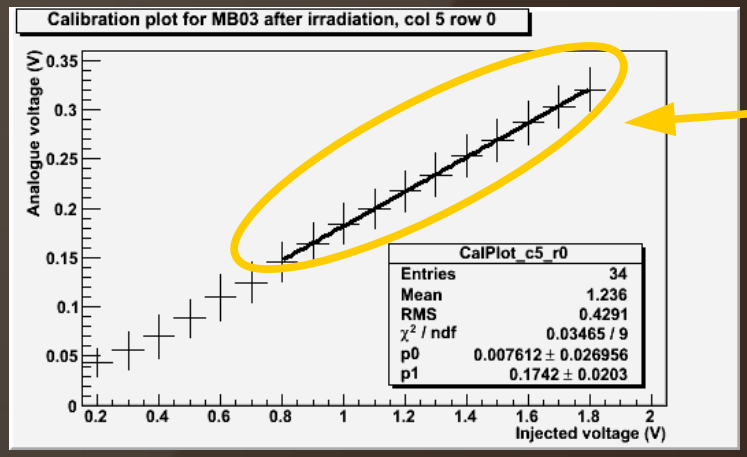
Injection on MB03

The resulting peak height distributions look like these:





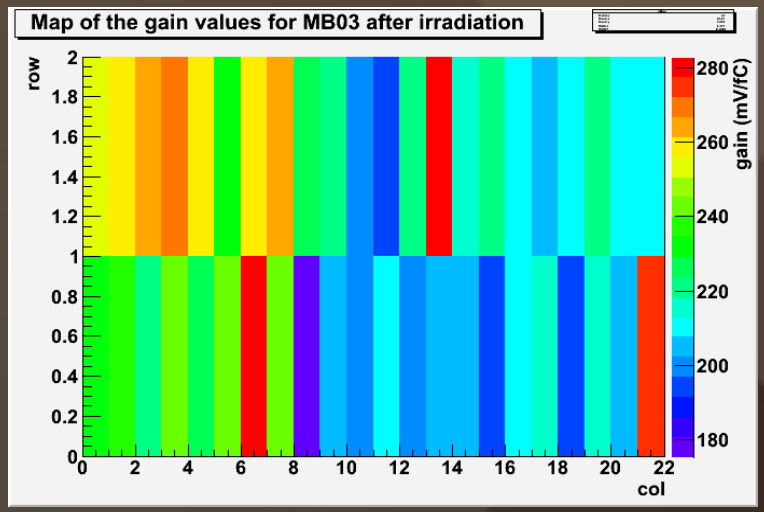
Fitting with a straight line:



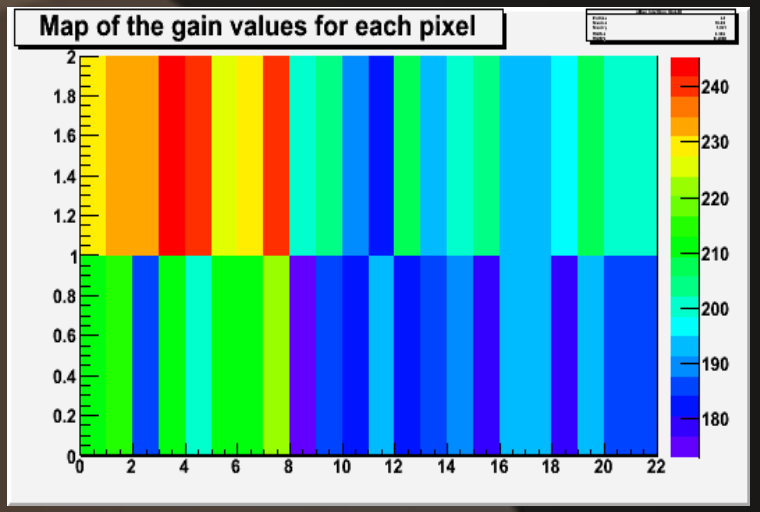
Note: the fit has been restricted due to the presence of a little peak in the low signal region that could affect the Gaussian fit.

Injection on MB03: gain

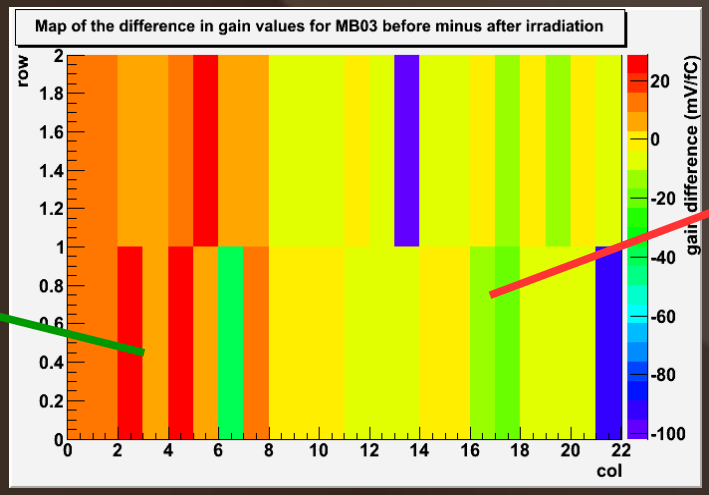
The gain map could be produced:



Recalling the gain map before irradiation:



This is the difference between the two:

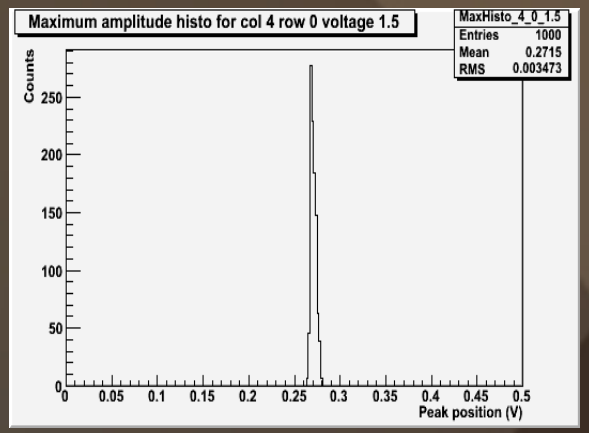


Gain decreased

Gain increased (?)

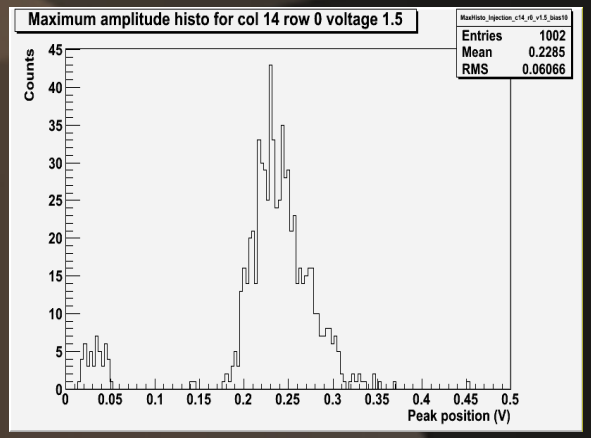
Injection on MB03: noise

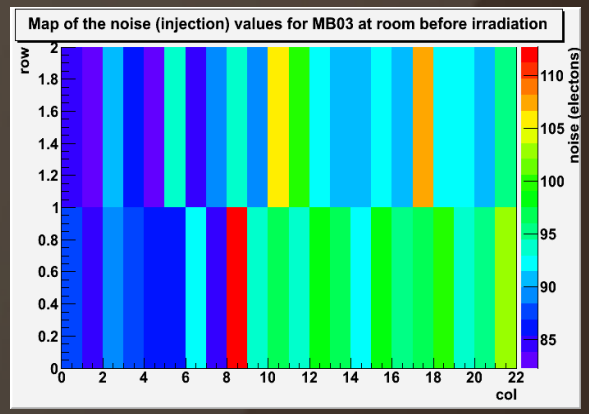
Before irradiation:



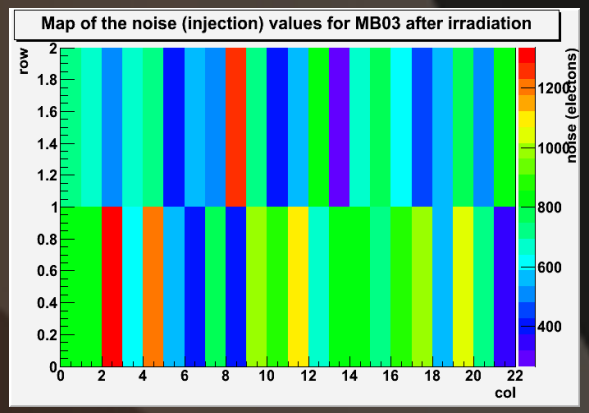
Example of a distribution

After irradiation:





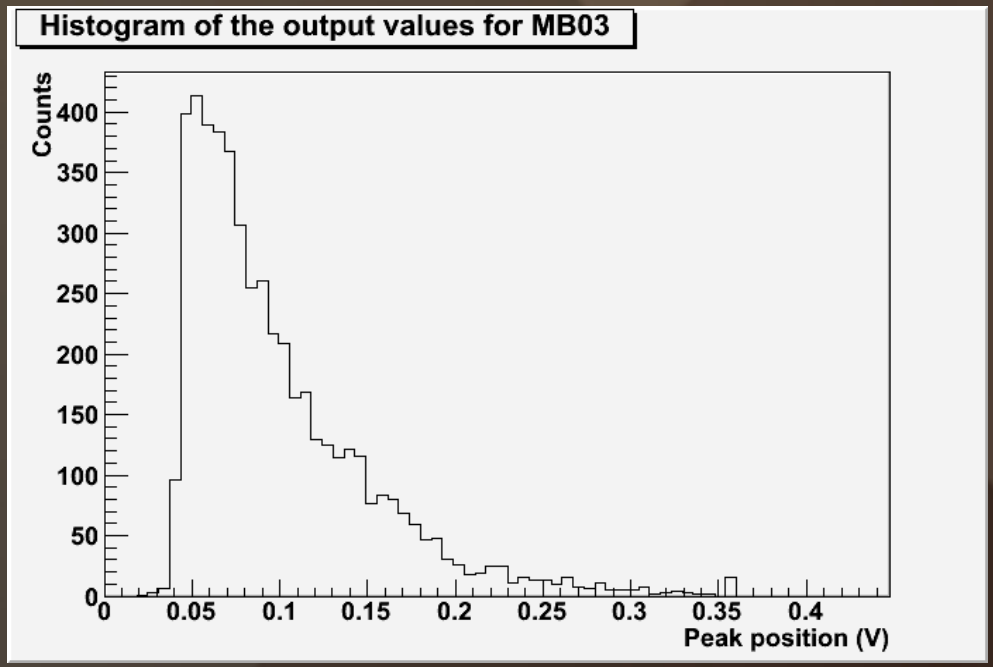
Map of the RMS values



Huge increase in noise!

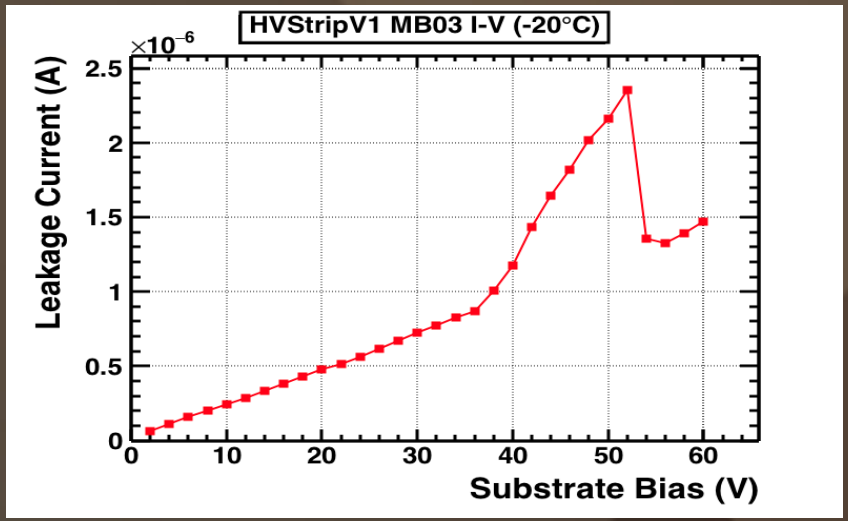
Iron55 on MB03

We tried to check the gain with an Iron55 source as well, but given the high noise we couldn't see anything, even at -20°C:

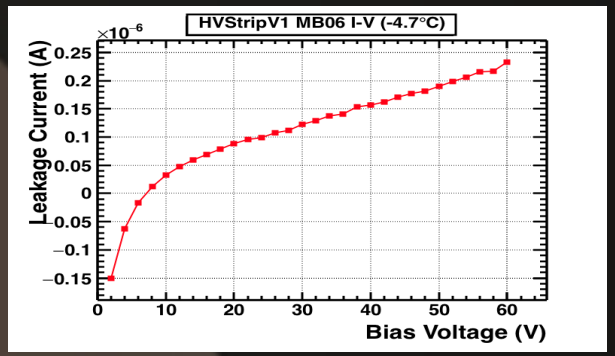


Triggering on the output signal gives us a lot of background, we couldn't get rid of it.

I-V for MB03

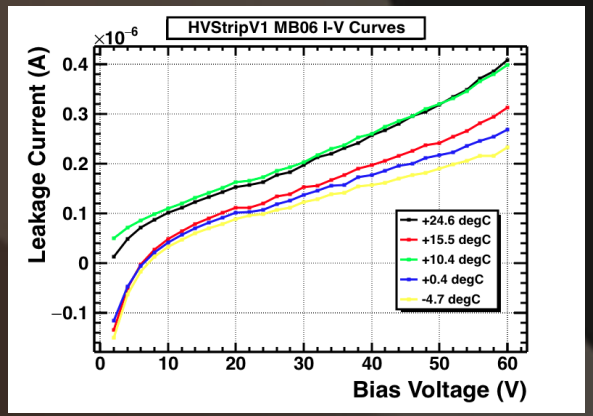


Really strange behavior, especially if compared with an unirradiated chip:



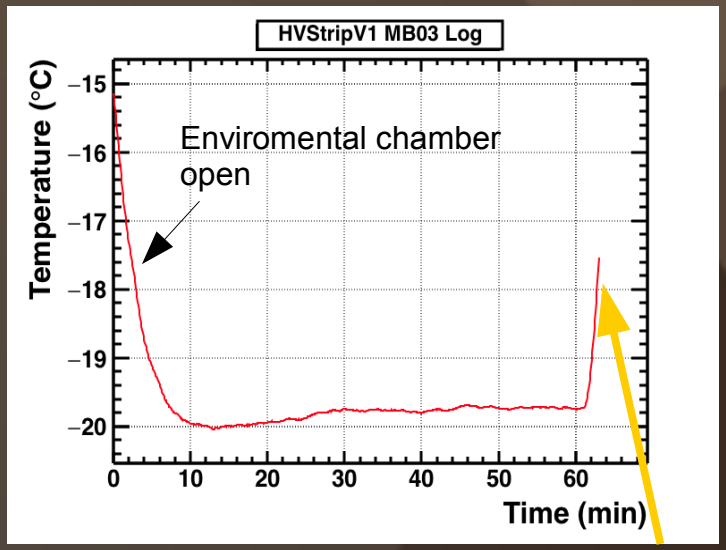
It could be also the case that we didn't wait enough at each step before the leakage current got stable.

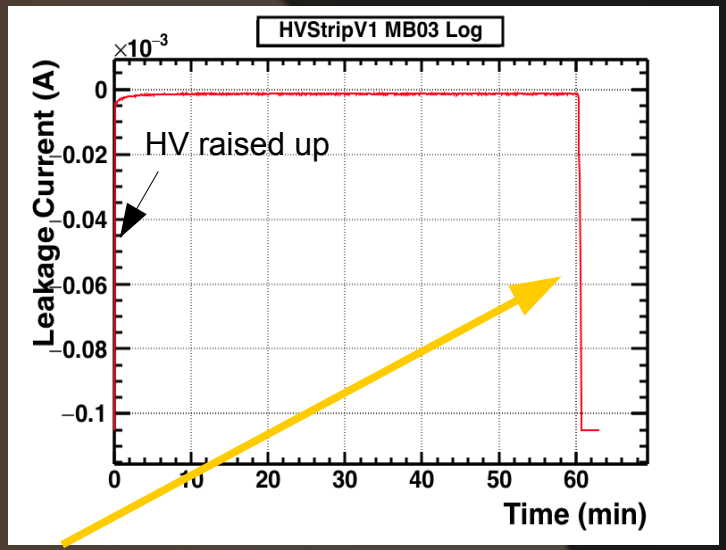
Also, on the unirradiated device, the changes in the curve on increasing temperature are not regular: environmental chamber working badly?



MB03 Failure

- While measuring the passive element characteristics on MB03 (PMOS structure, using a Keithley machine) the device stopped working:





Temperature and leakage current increased (up to compliant) at the same time

Unfortunately it seems to be impossible to recover...

MB03 Failure

Possible causes:

- Since HV was on, could be HV circuit failure (it wasn't necessary, but it shouldn't affect the measurement)
- Loose connections on Keithley machine (after unscrewing and screwing back some components it got back working)
- Condensation: humidity not kept low enough (need for Nitrogen bottles)
- Some combination of the three above.

Conclusions

- Two devices irradiated and kept cold
- Some studies performed on them, strange post-irradiation behavior
- Unfortunately, the one studied had a break-down and it's not working any more.

Next steps:

- Improve the working conditions for the devices
- Study MB04 and improve the Iron55 calibration
- Use Strontium90 source (better signal)
- Annealing
- Test beam at DESY