Update on HVStripV1 analysis

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Current Situation

- MB01, MB03 and MB06 had the big capacitor removed
  - More than 60V bias applied
- MB03 and MB06 irradiated at Birmingham at about 10^{15} n_{eq}

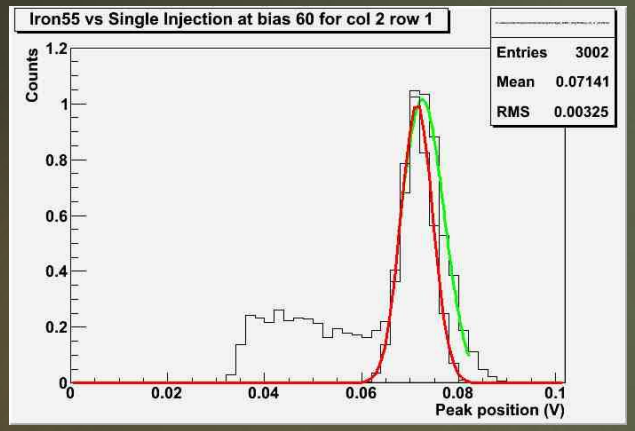
- MB03 and MB06 in freezer at Oxford
- MB06 to be sent to Glasgow

Single Injection

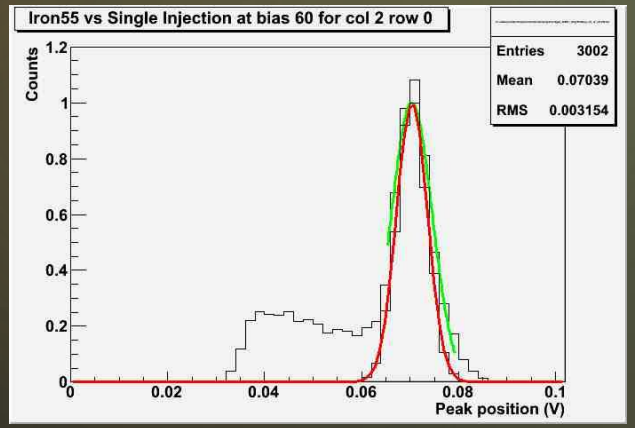
- Fe^{55} peak reproduced with injection at a fixed voltage (calculated from the number of electrons produced by the Fe^{55} X-ray)

Peak should be in the same position, Fe^{55} sigma should be higher due to statistical fluctuations

(2,1)



(2,0)

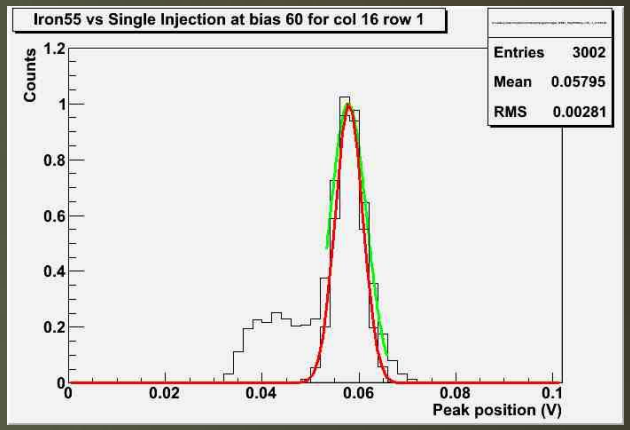


4 Pixels scanned
Bias 60V

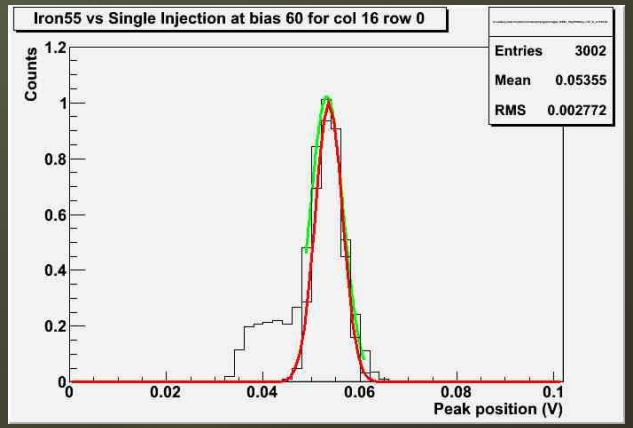
Green: Iron55 **Red: single injection**

- Peak positions match within 10%
- Noise due to statistics goes as square root of number of electrons (~1680) and must be subtracted in square
- Given that, Fe^{55} noise is 20% higher than injection

(16,1)

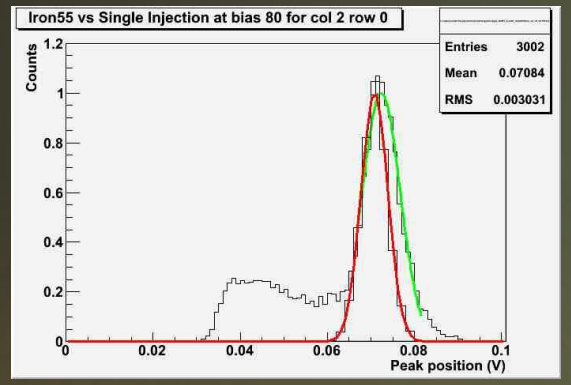


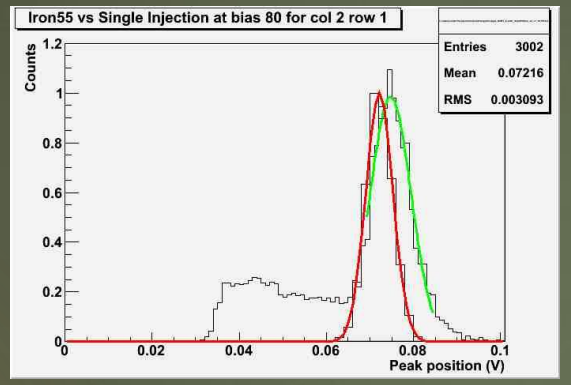
(16,0)

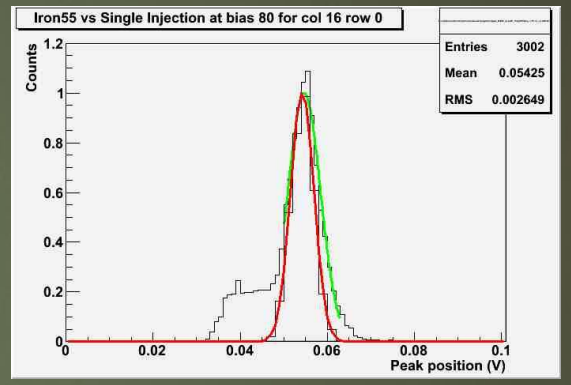


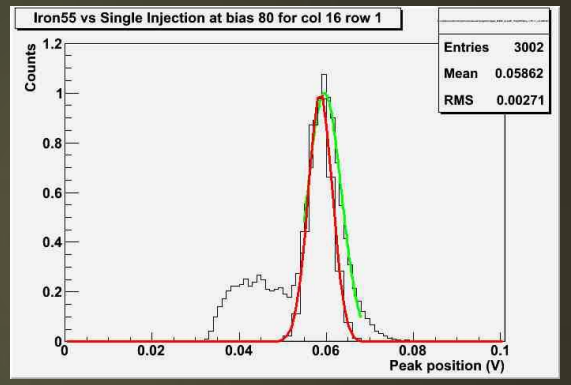
Single Injection at higher bias

Bias 80V (2,0) (2,1) (16,0) (16,1)

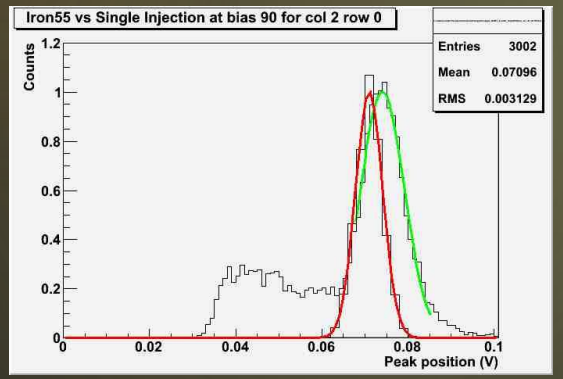


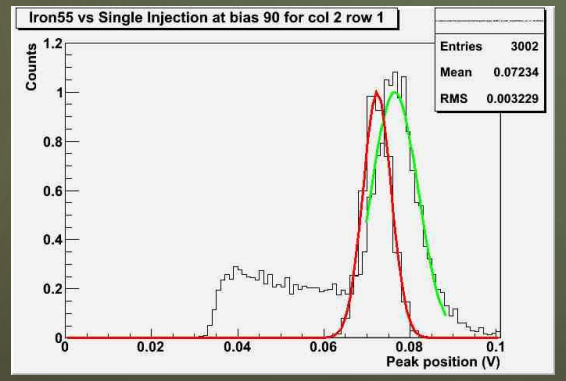


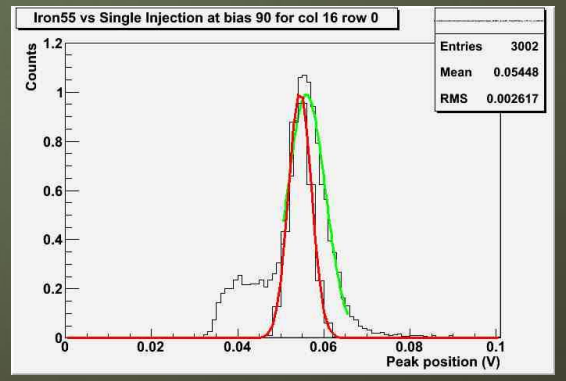




Bias 90V



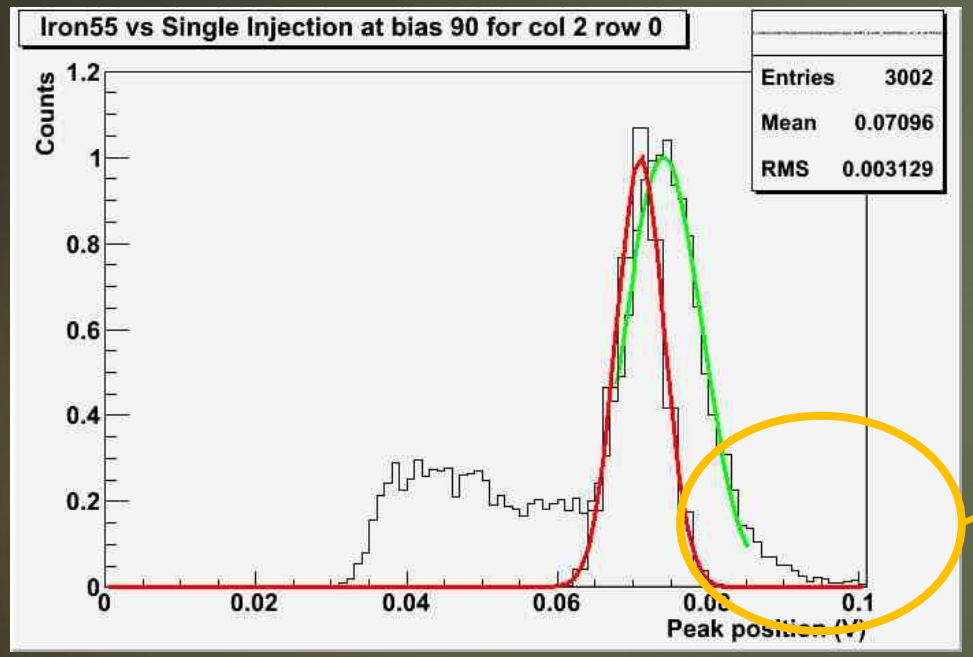


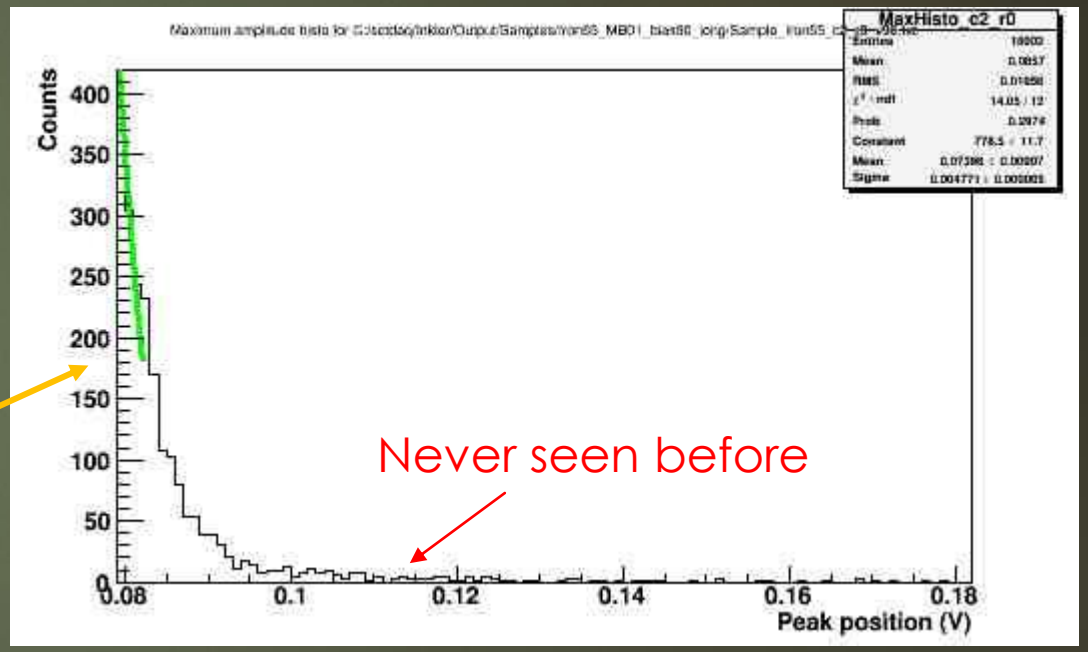


Fe^{55} shifts to higher value with respect to single injection

Single Injection at higher bias

Other noticeable fact: a tail appears at bias 90:

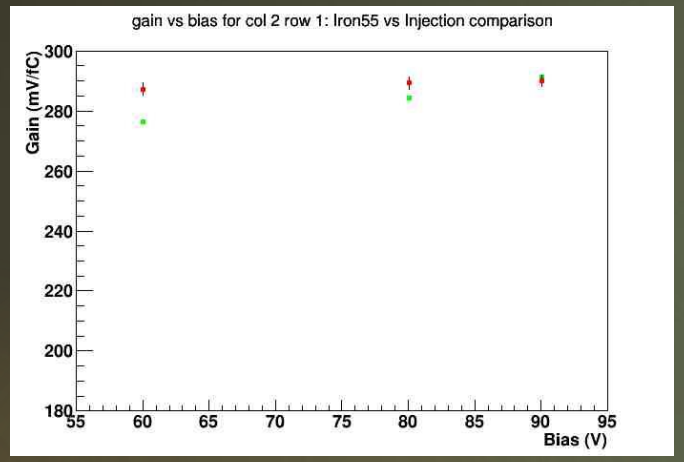


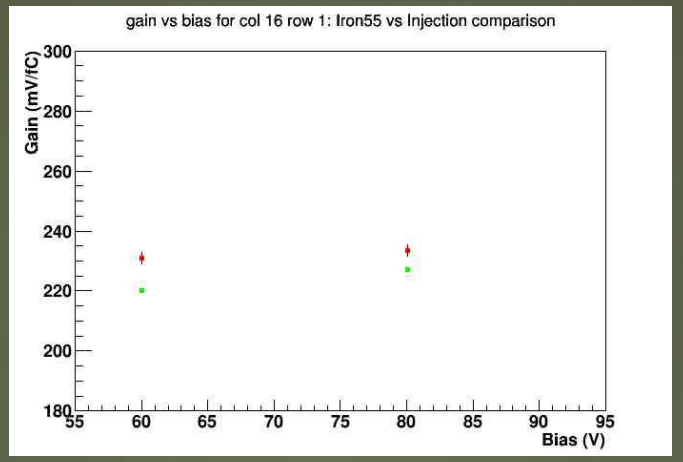


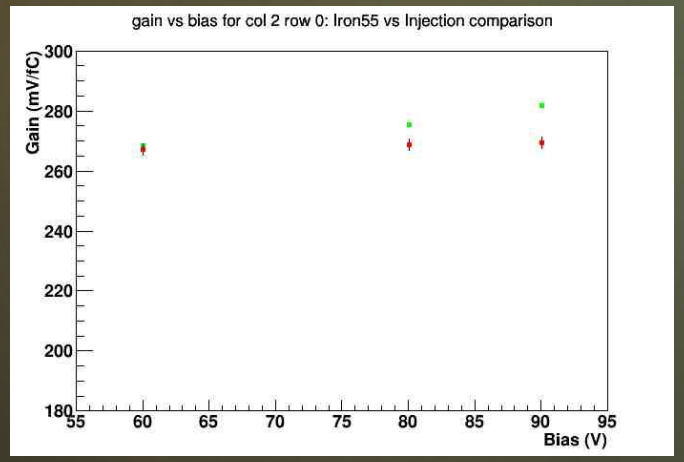
In addition: at 90V leakage current was already getting higher (about 80 nA)

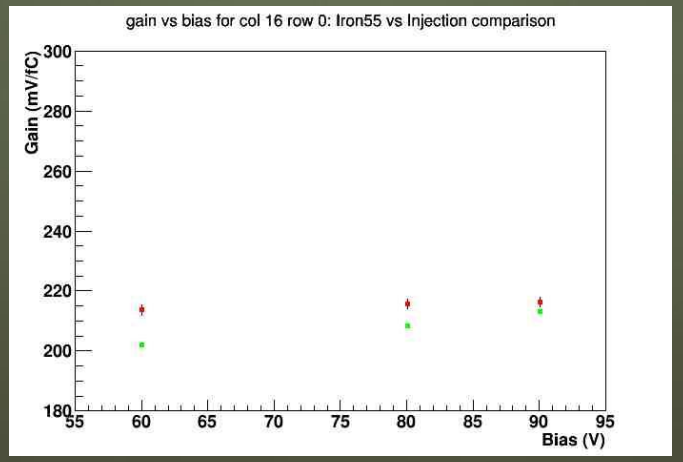
Bias scan on MB01: gain

Comparison between the two usual ways of calculating the gain (Fe^{55} and multiple injections)





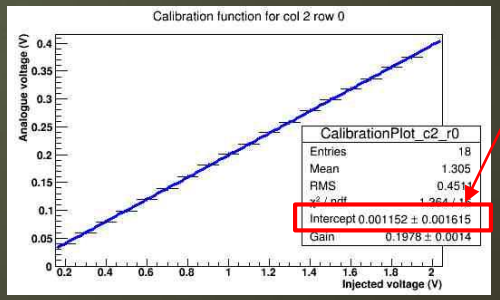




Green: Iron55 Red: injection

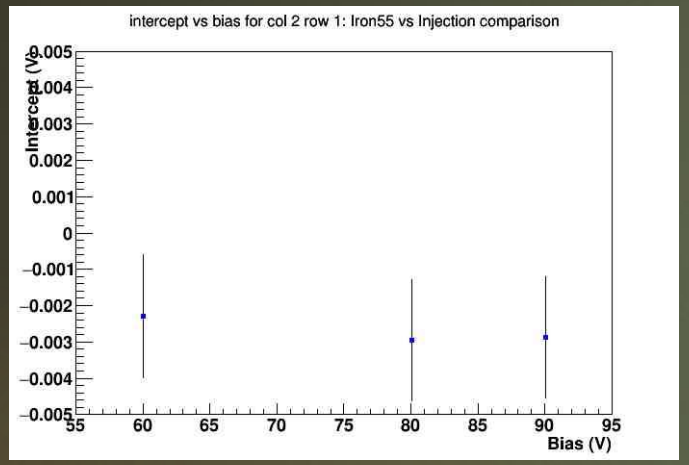
- Slight difference between Fe^{55} and injection
- Fe^{55} increases faster than injection

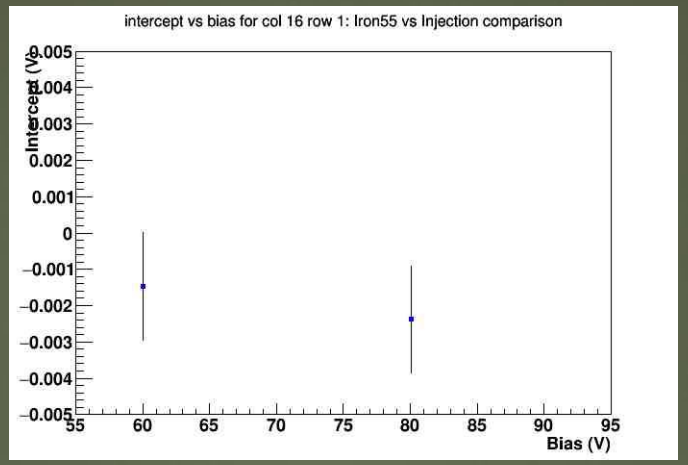
We have to take into account the intercept in the gain fit with injection:

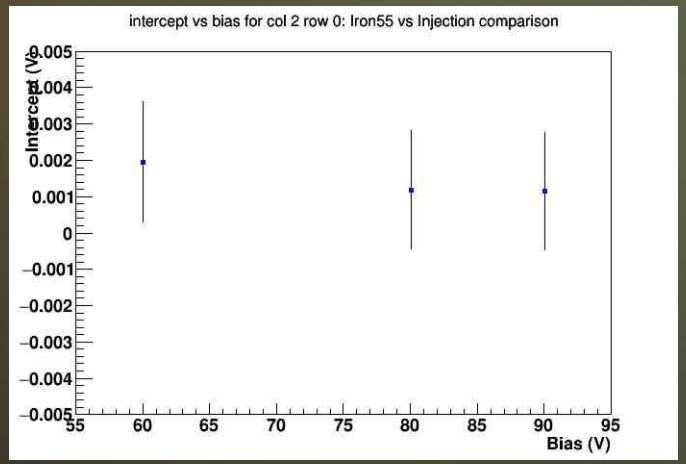


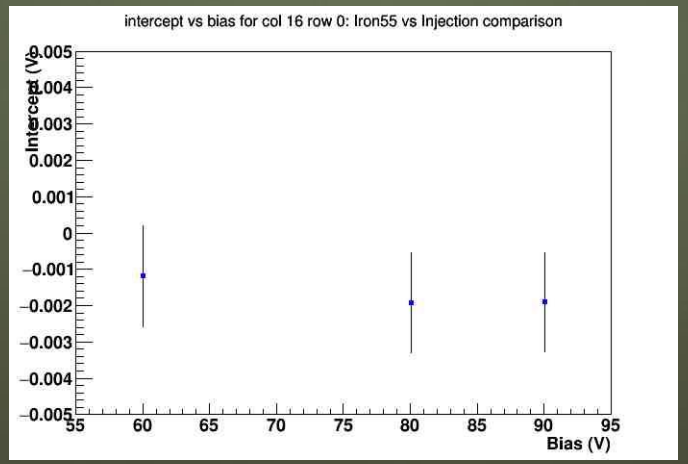
Bias scan on MB01: gain intercept

Intercept parameter as a function of bias voltage





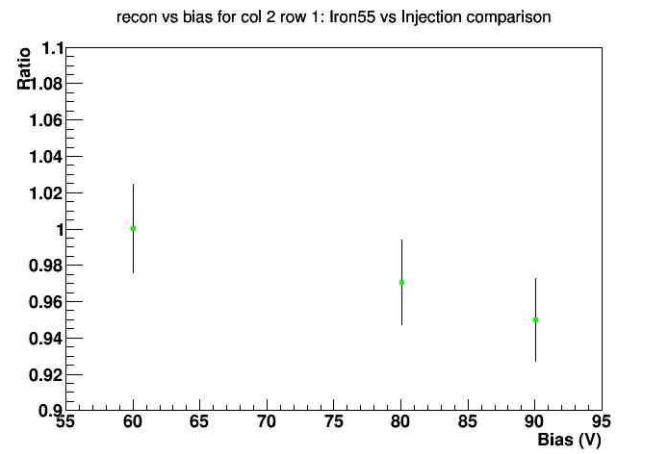


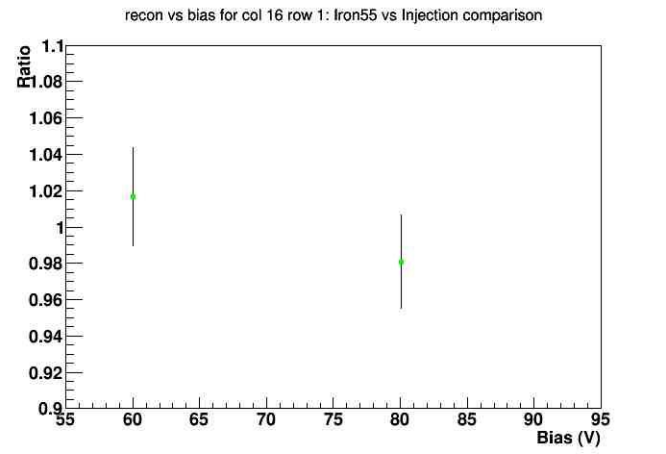


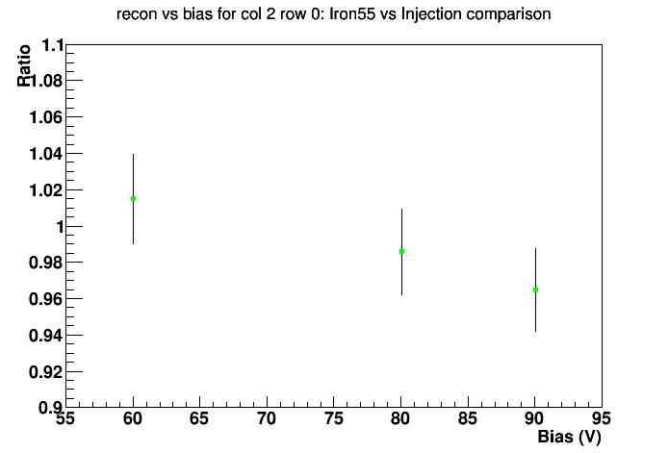
A slight variation:

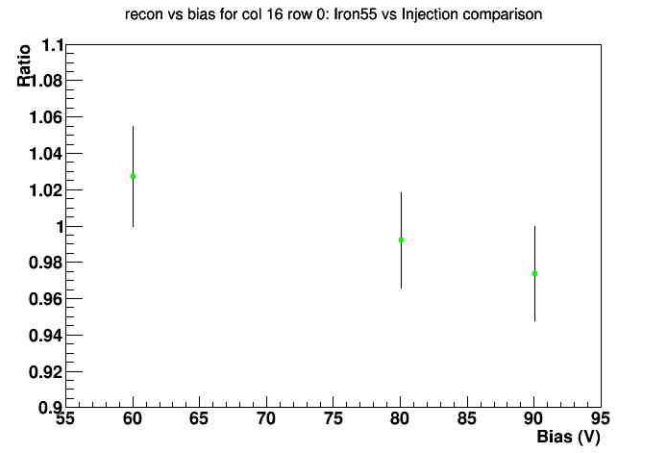
- Calculate the expected injection voltage that reproduces the Fe^{55} peak (as in slide 3)
- Predict the output
- Divide it with the observed one (real source)
- This value should be 1…

Bias scan on MB01: predicted over observed



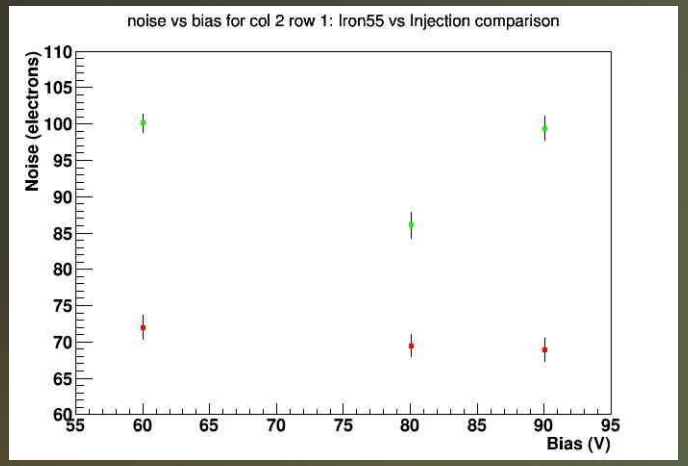


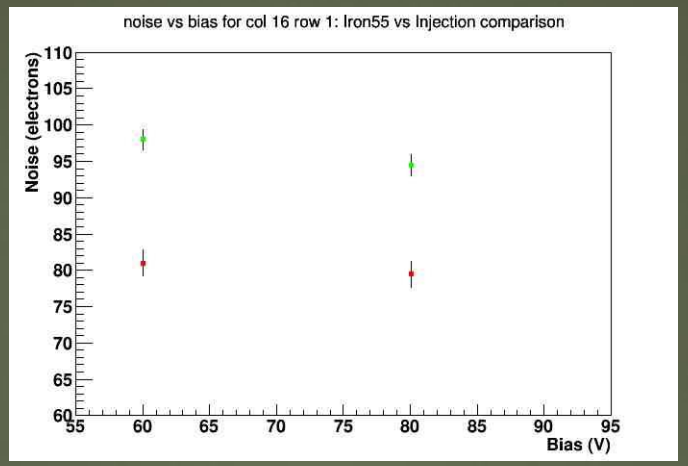


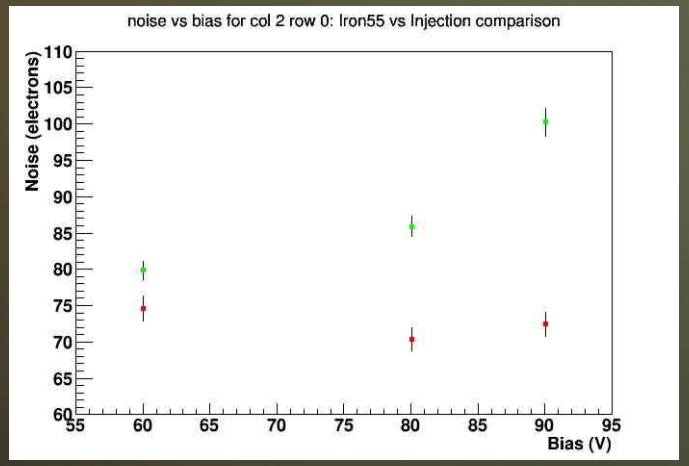


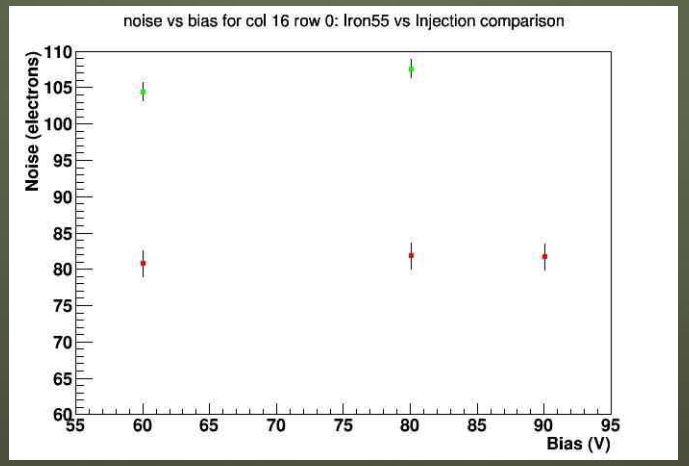
- It is about 1 for 60 and 80V bias
- It decreases as the bias increases (extra charge production?)
- It is significantly below 1 at 90V bias

Bias scan on MB01: noise









- Fe^{55} noise significantly higher, even after subtracting the statistical contribution
- Injection noise can be considered flat

Green: Iron55 Red: injection

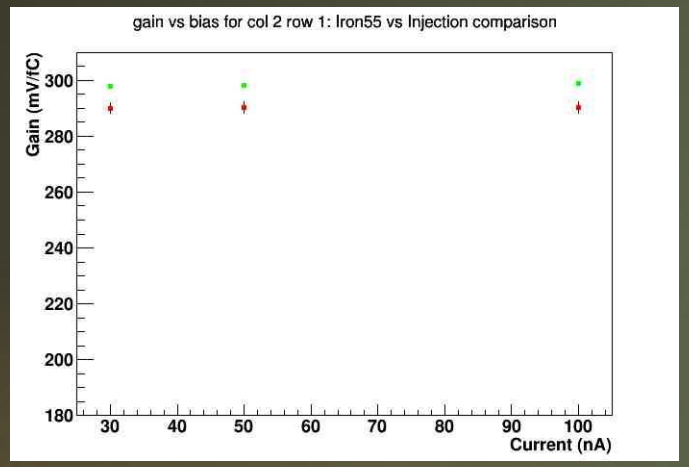
Current scan

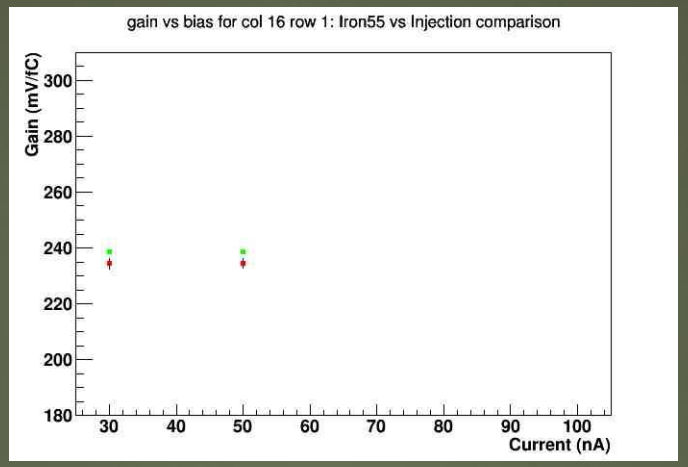
- For higher biases: HV supply in current mode:

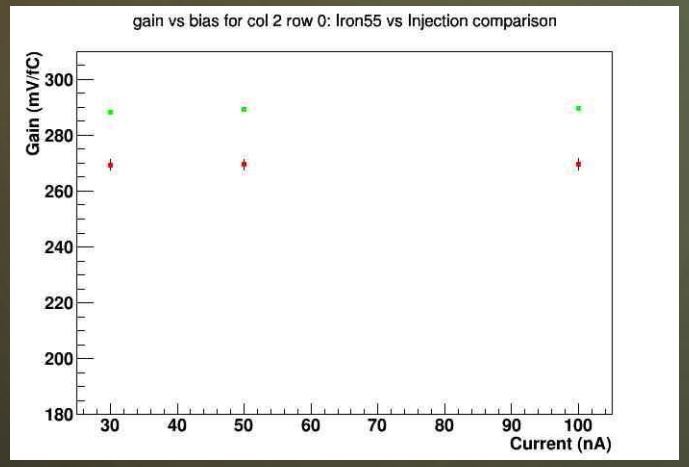
Leakage Current	Bias
-30 nA	-93.9V
-50 nA	-94.7V
-100 nA	-95.7V

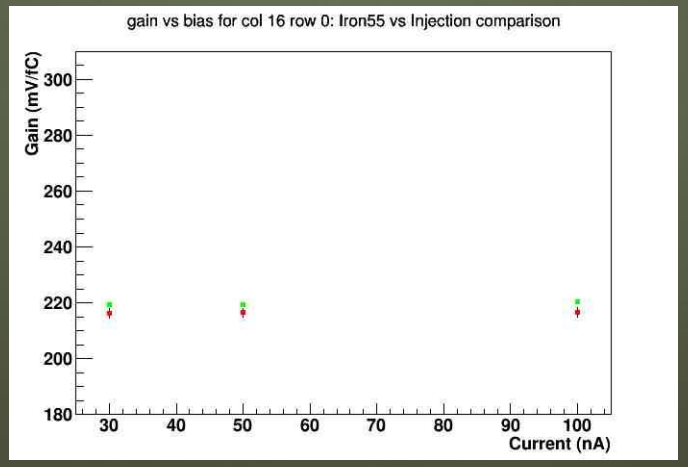
Current scan on MB01: gain

Comparison between the two usual ways of calculating the gain (Fe^{55} and multiple injections)





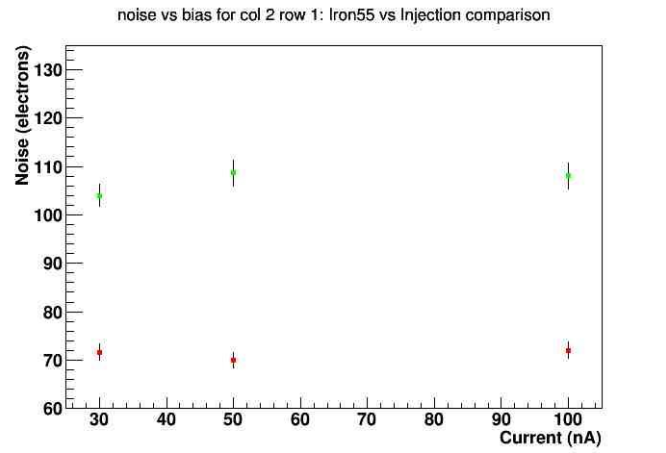


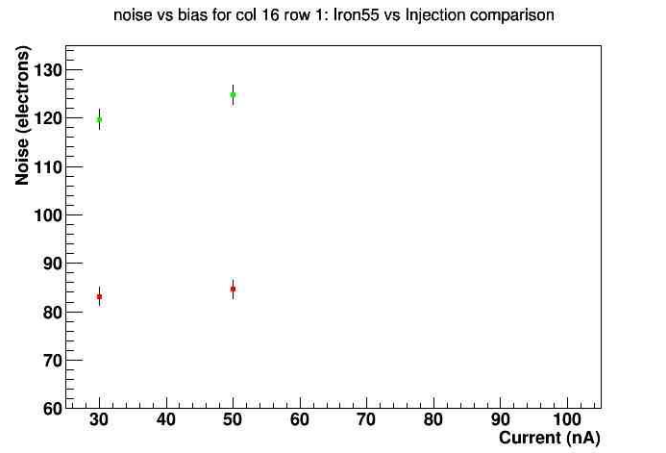


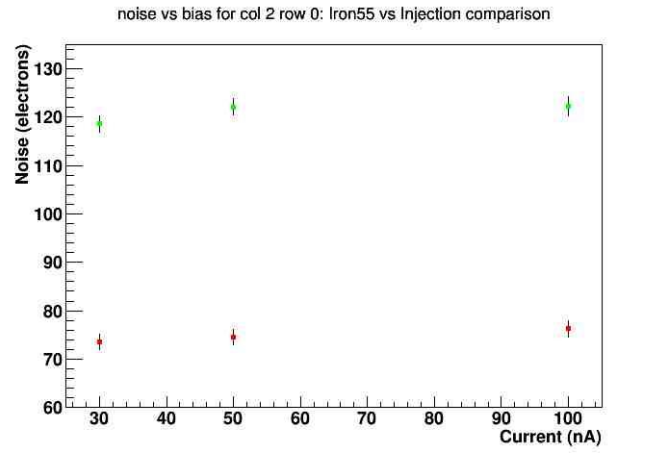
- Fe^{55} flatter
- Closer distributions

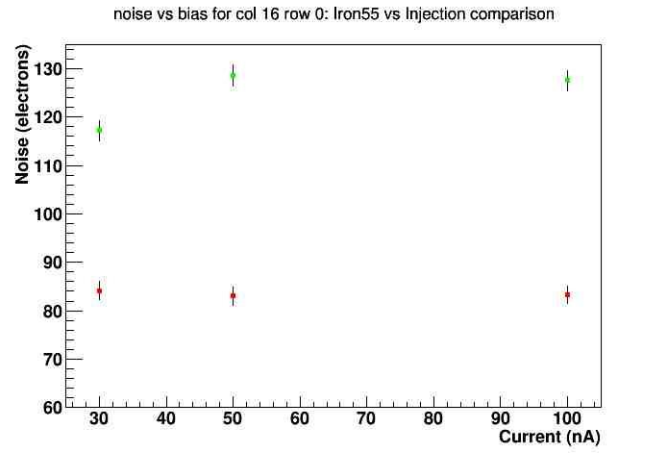
Green: Iron55 Red: injection

Current scan on MB01: noise







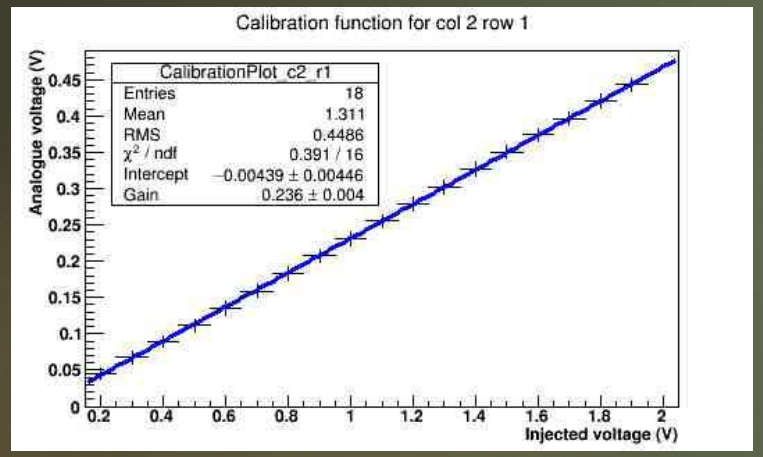


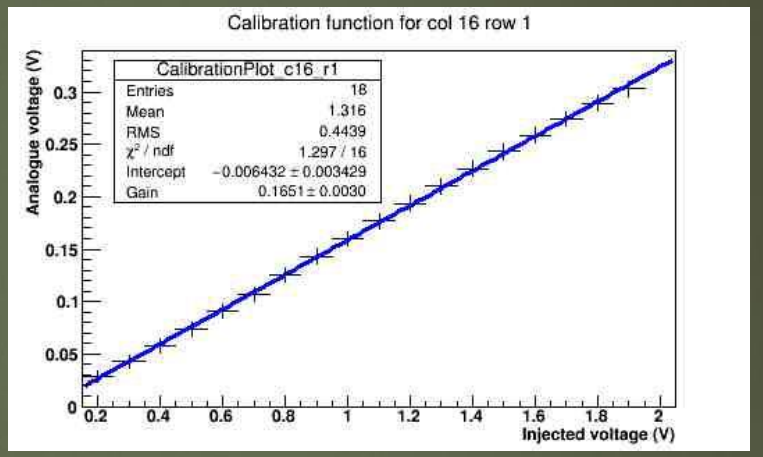
- Fe^{55} noise significantly higher
- Injection noise can be considered flat
- Fe^{55} noise almost flat

Some data on irradiated MB06

Good news: leakage current at -40°C is less than 10 nA (HV supply's resolution)

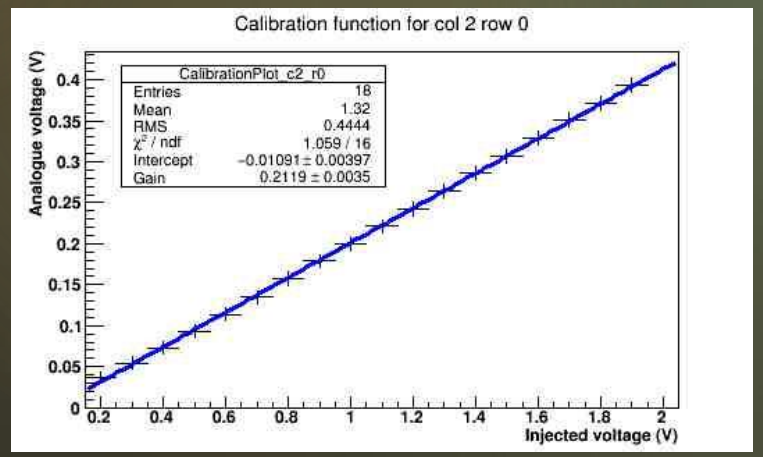
Calibration with injection taken at 60V bias.

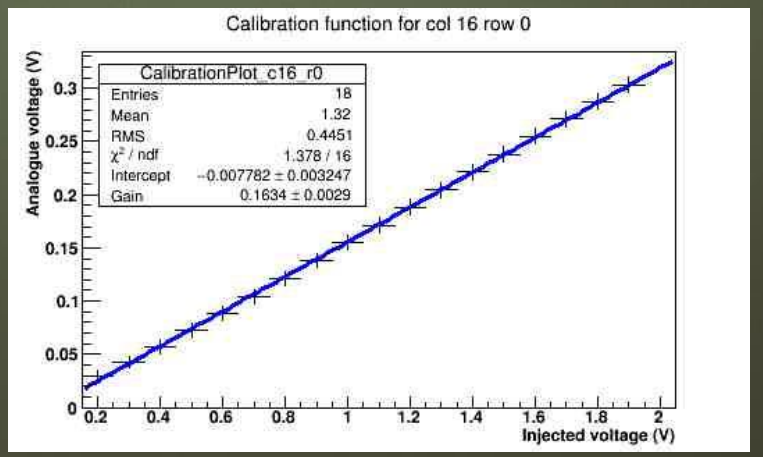




DAC 6 set to 5: lower s/n ratio

Regular behavior

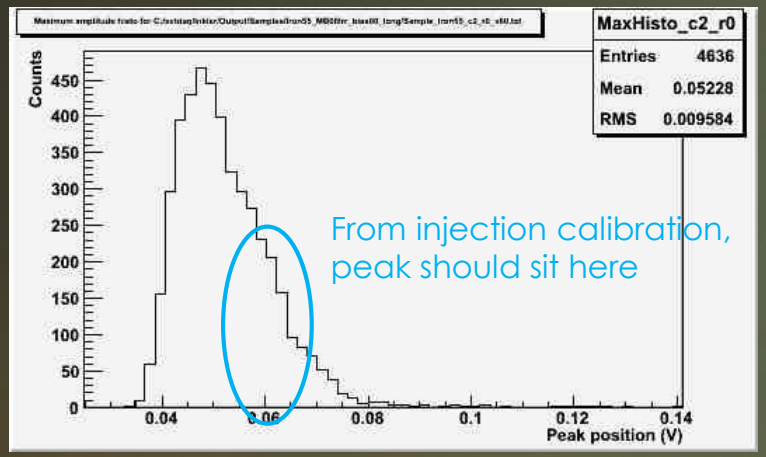




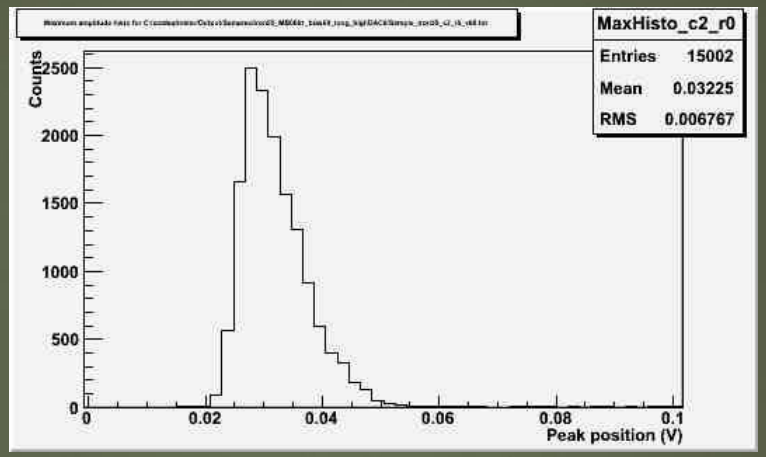
Some data on irradiated MB06

Bad news: still no Fe^{55} peak visible.

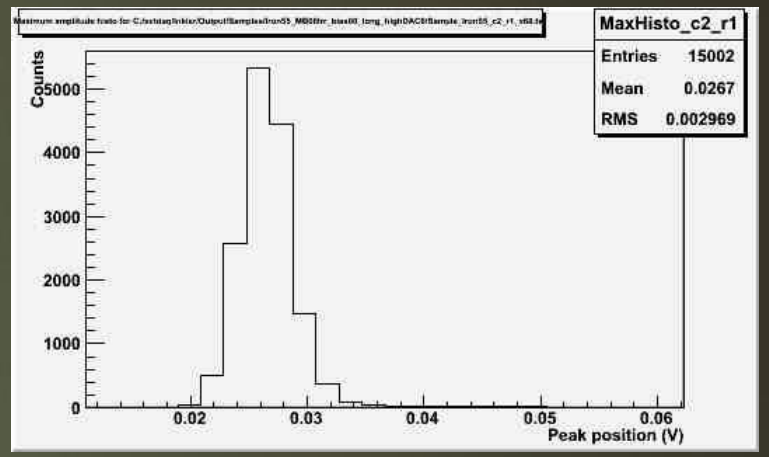
(2,0) with DAC6 set to 5



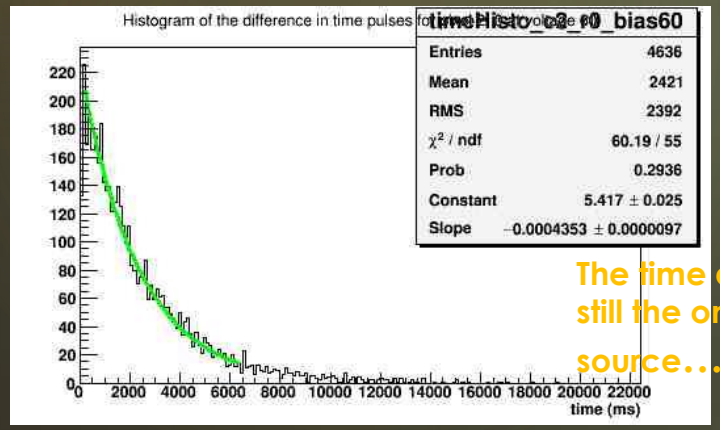
(2,0) with DAC6 set to 60



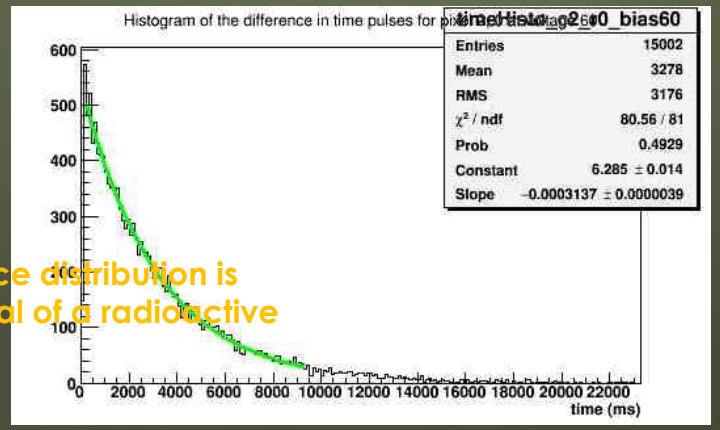
(2,1)

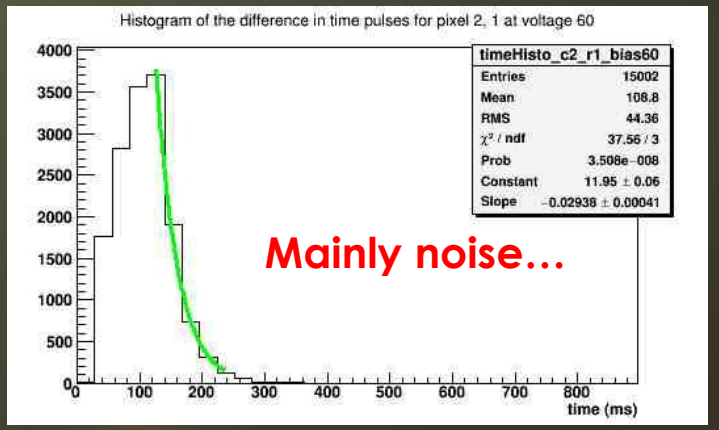


Distributions of time difference between one event and the next one:



The time difference distribution is still the one typical of a radioactive source…





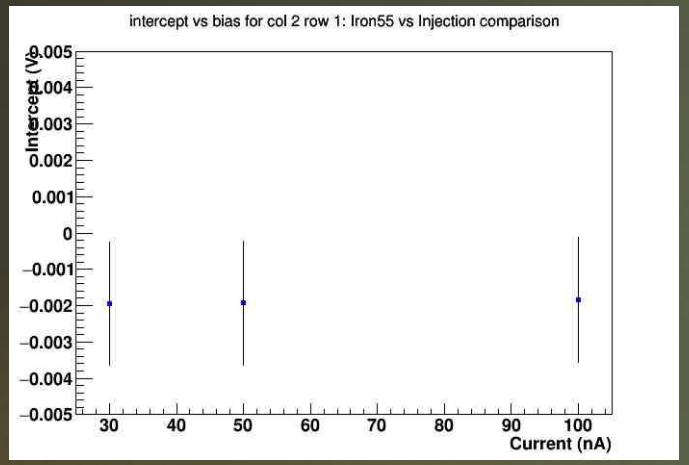
Mainly noise…

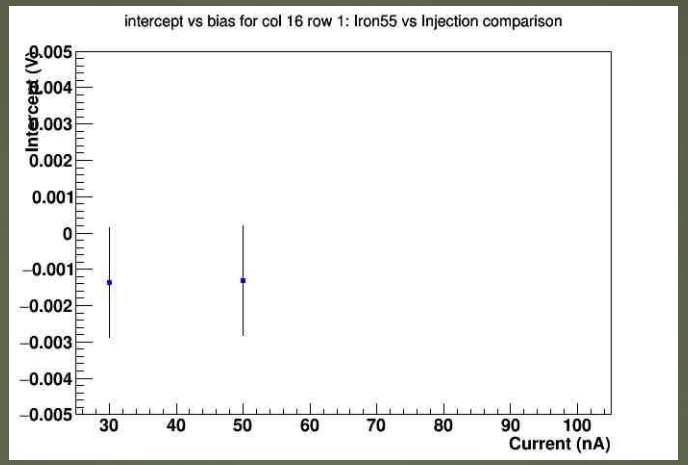
Conclusions

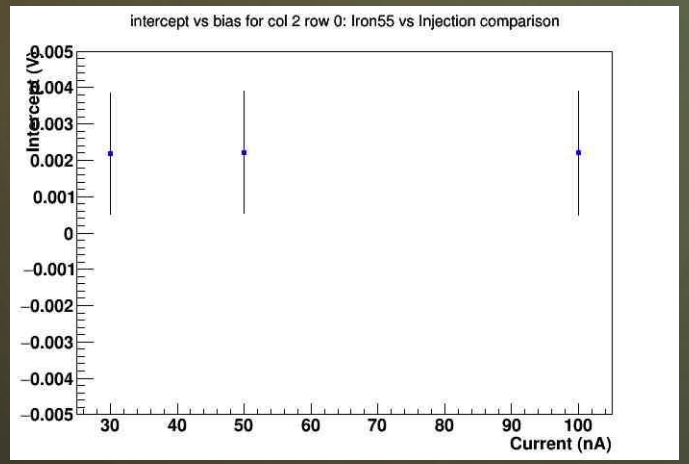
- Fe^{55} spectrum compared with a calibrated single injection
- MB01 analyzed with charge injection and Fe^{55} up to more than 90V bias
- Breakdown at about 95V.
- For higher bias, MB01 analyzed with HV power supply in current mode
- MB06 shows a good calibration profile, but still no Fe^{55} peak.

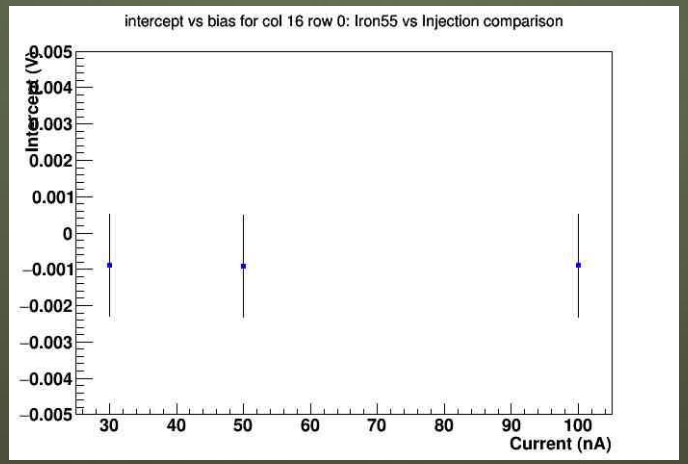
Backup slides

Current scan on MB01: gain intercept

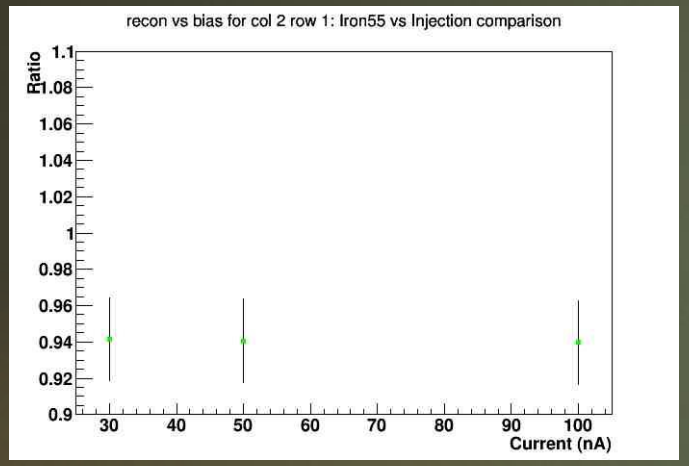


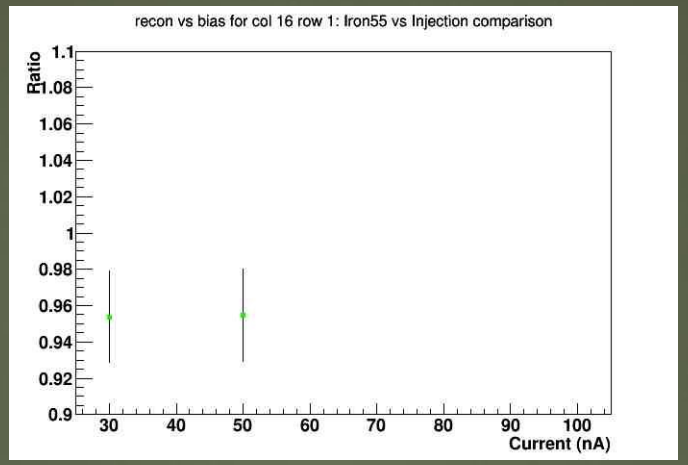


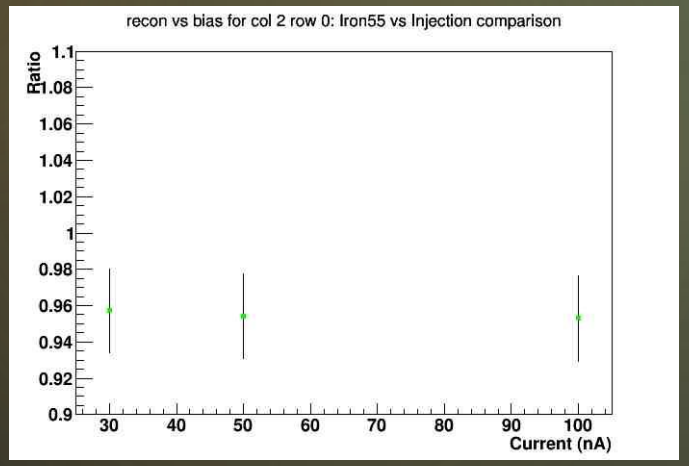


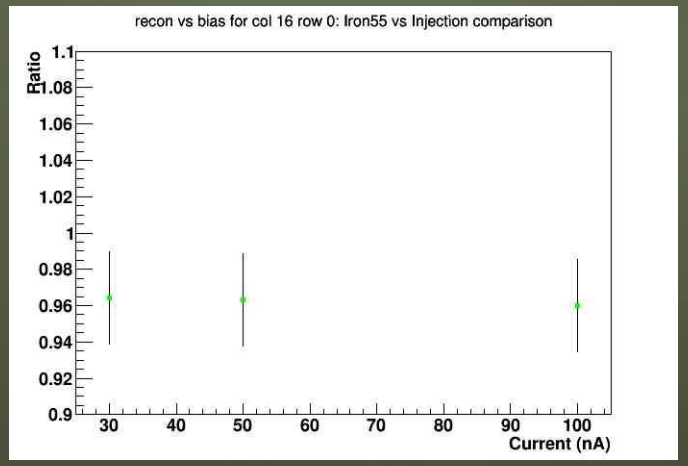


Current scan on MB01: predicted over observed









- Measured value is constantly higher than predicted