Measurements of the Hardness Factor for Proton Beams of Various Energies.

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October 12 2018

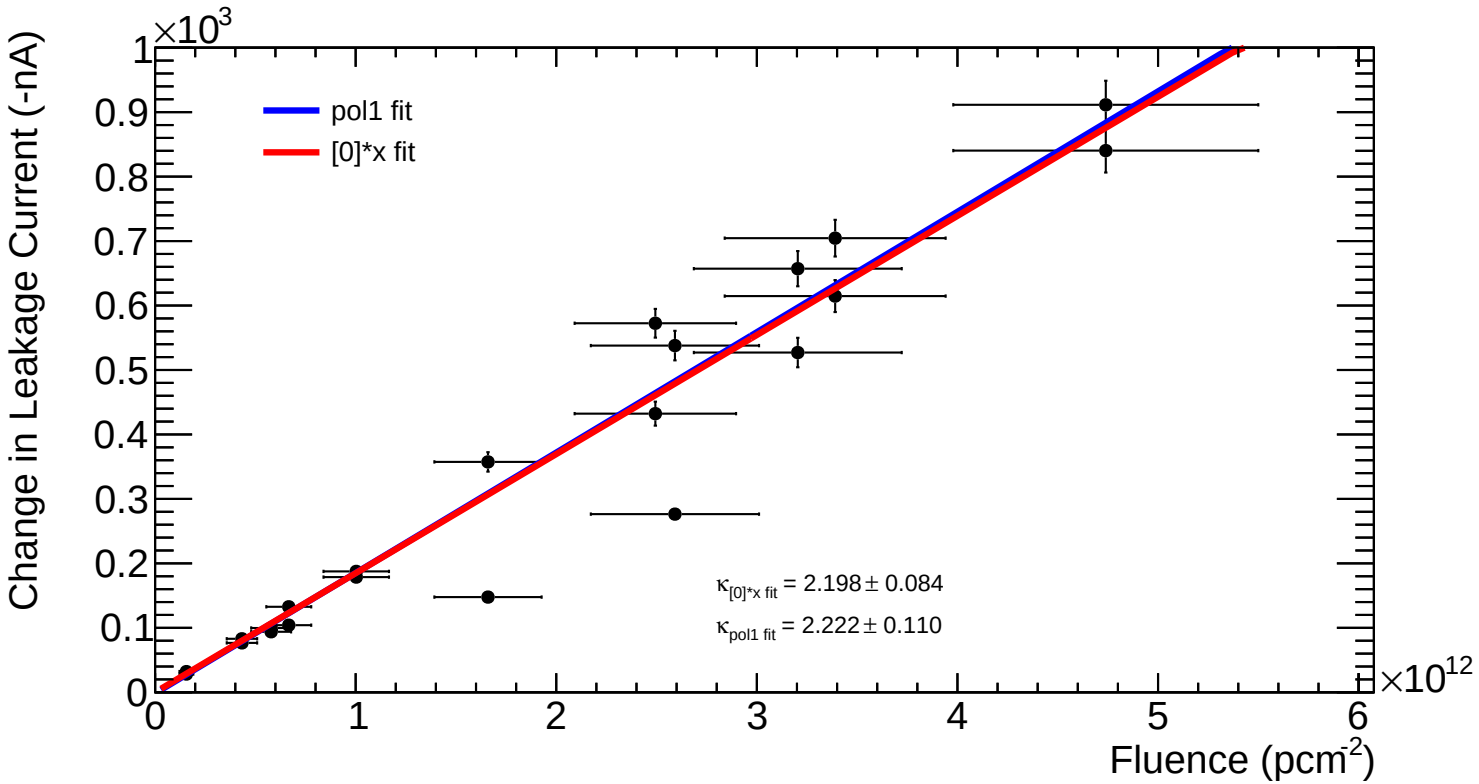
Outline

The hardness factor (κ) of three different proton beams has been measured:

- MC40 Cyclotron (25 MeV)
- IRRAD Cyclotron (24 GeV)
- KIT Cyclotron (24 MeV)

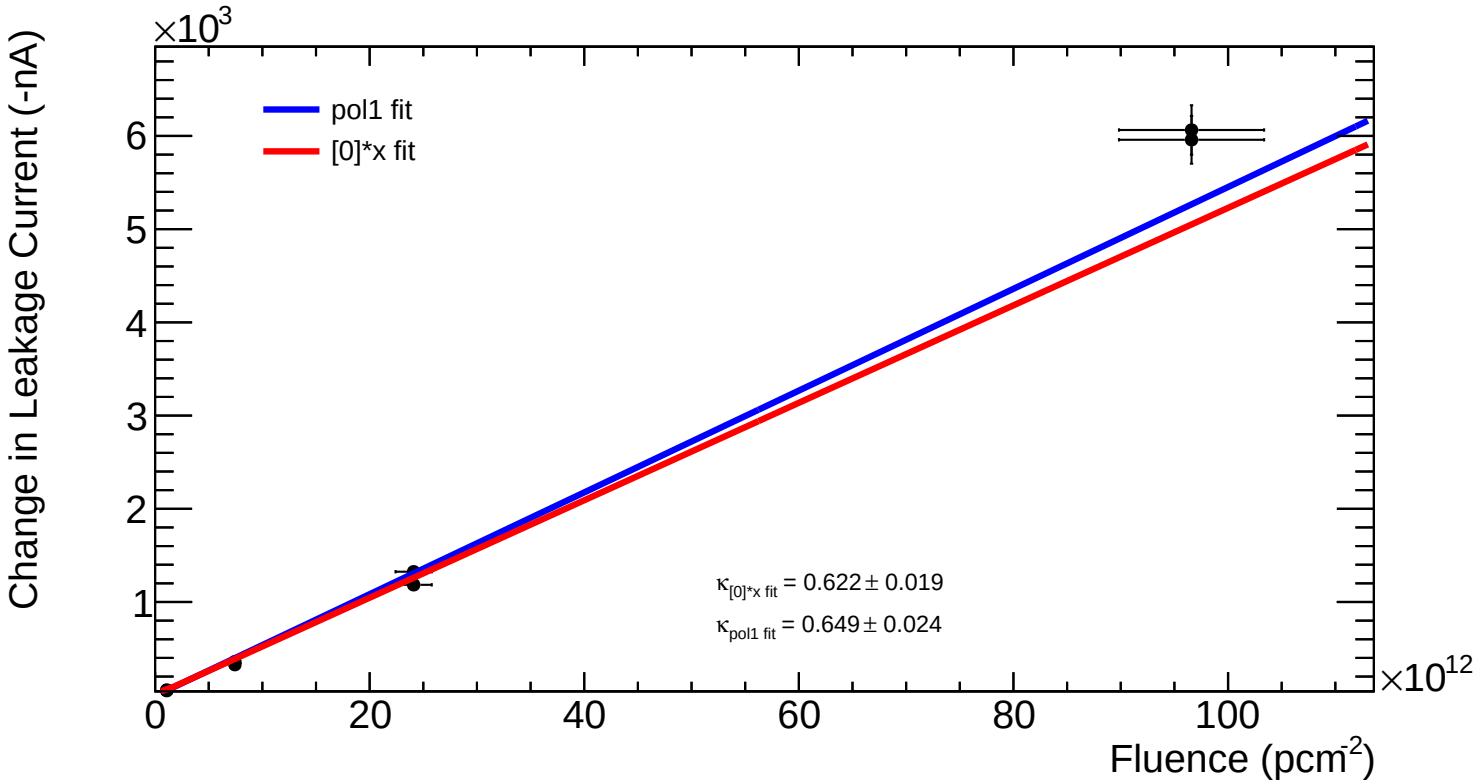
MC40 Cyclotron Results

For the MC40 cyclotron, all data taking and analysis was done in Birmingham. A universal maximum depletion voltage value of -91V was used.



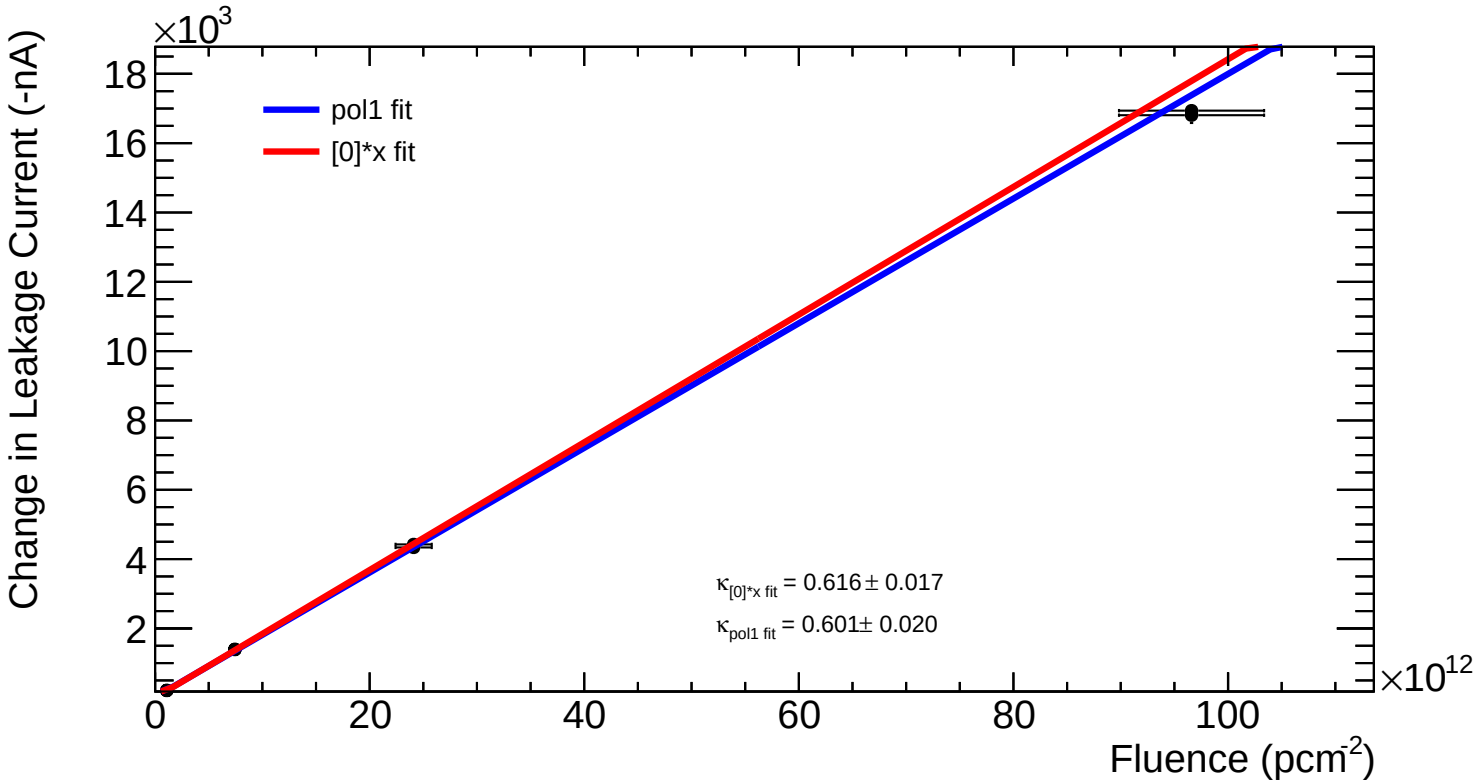
IRRAD Results

For IRRAD, all of the analysis was done in Birmingham, but the diodes were irradiated at IRRAD. As with the MC40 cyclotron, a universal maximum depletion voltage value of -91V was used.



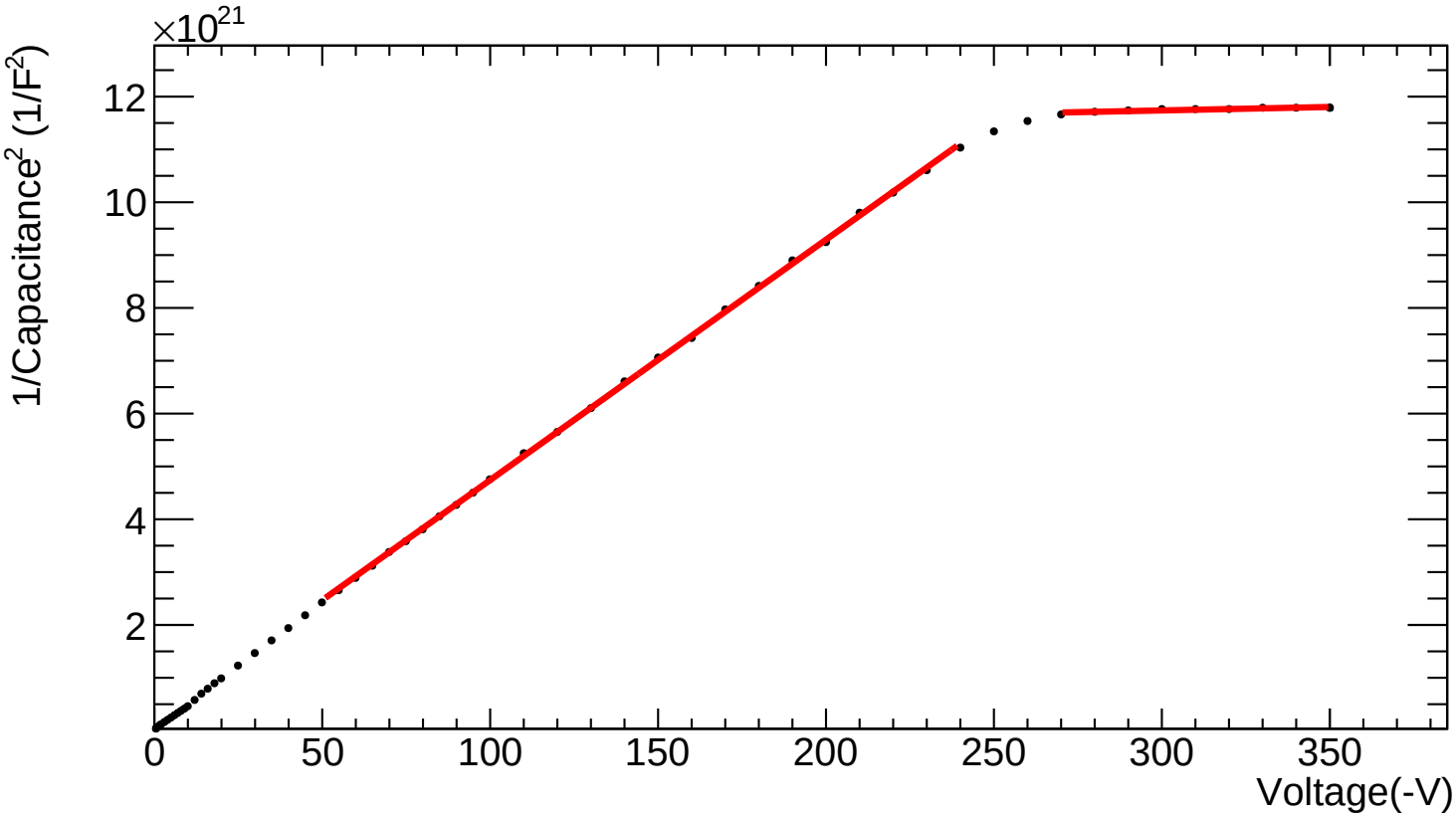
Isidre's Results

Isidre's data were taken completely independently for the IRRAD cyclotron, producing a value of $\kappa = 0.631$. The data were then re-analysed in Birmingham as a cross check. The maximum depletion voltage in this case was individual for each data point.



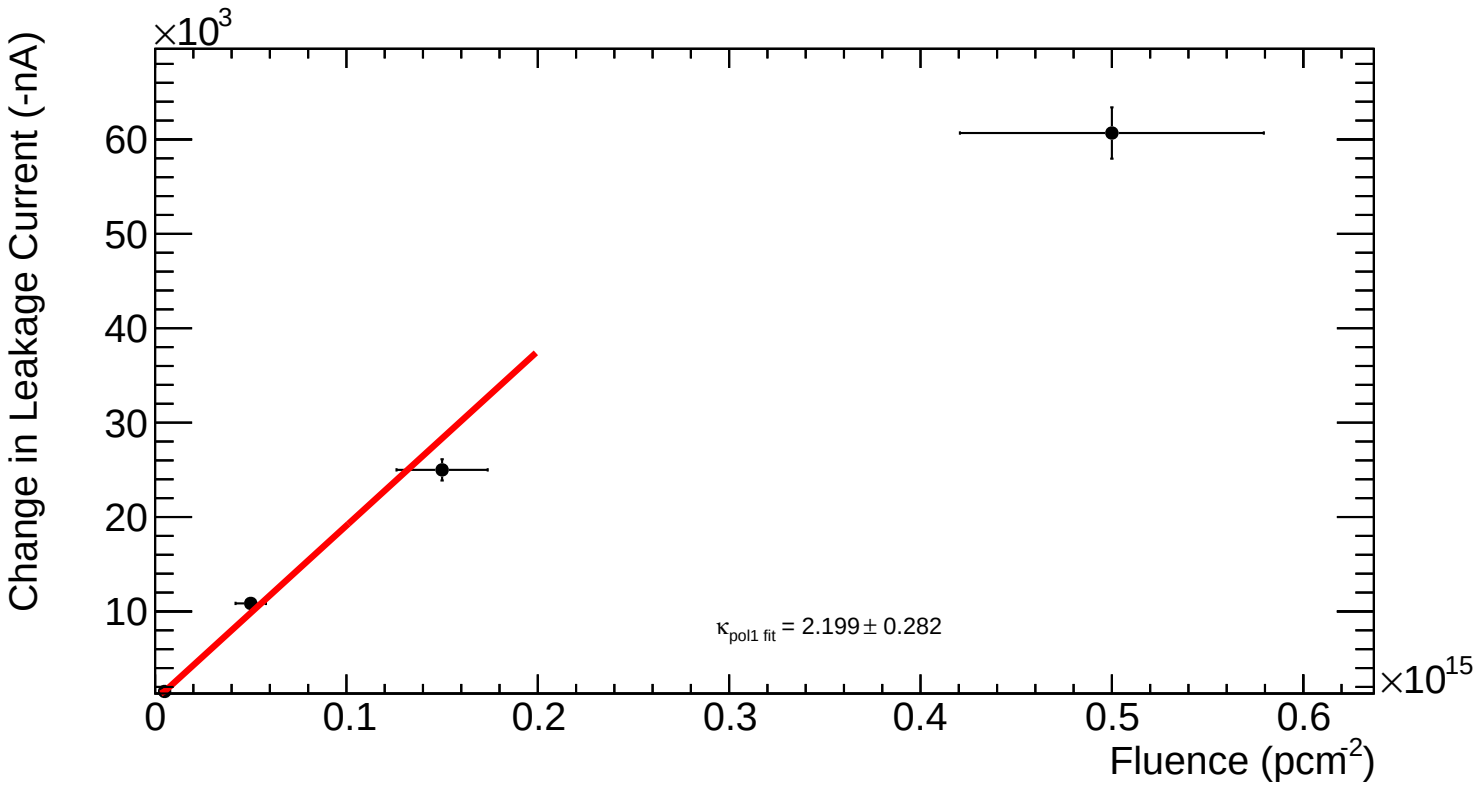
Isidre's Results - CV example

Due to difficulty with fitting, instead of plotting logs, $1/C^2$ was plot against V, and the maximum depletion voltage for each sensor was determined by finding the intersect of the two fits.



KIT Results

For KIT, the diodes were irradiated in Karlsruhe, and then sent here for analysis. The only fit on this plot is a pol1 fit. The non-irradiated case was unknown, and so it was unjustified to force the fit through zero.



Conclusion

All values of κ seem reasonable, and Isidre's results also seem to be in good alignment with ours.

- $\kappa_{MC40} = 2.20 \pm 0.08$
- $\kappa_{IRRAD} = 0.62 \pm 0.02$
- $\kappa_{Isidre} = 0.62 \pm 0.02$ (My analysis)
- $\kappa_{Isidre} = 0.63$ (Isidre's Analysis)
- $\kappa_{KIT} = 2.20 \pm 0.28$

Note: The values taken are from fits forced through zero (excluding the KIT result).