

Aging Studies and Gain Measurements

Rocky So

Supervisor: Christopher Hearty
University of British Columbia, Canada
rockyso@physics.ubc.ca

SuperB DCH Detector R&D Meeting
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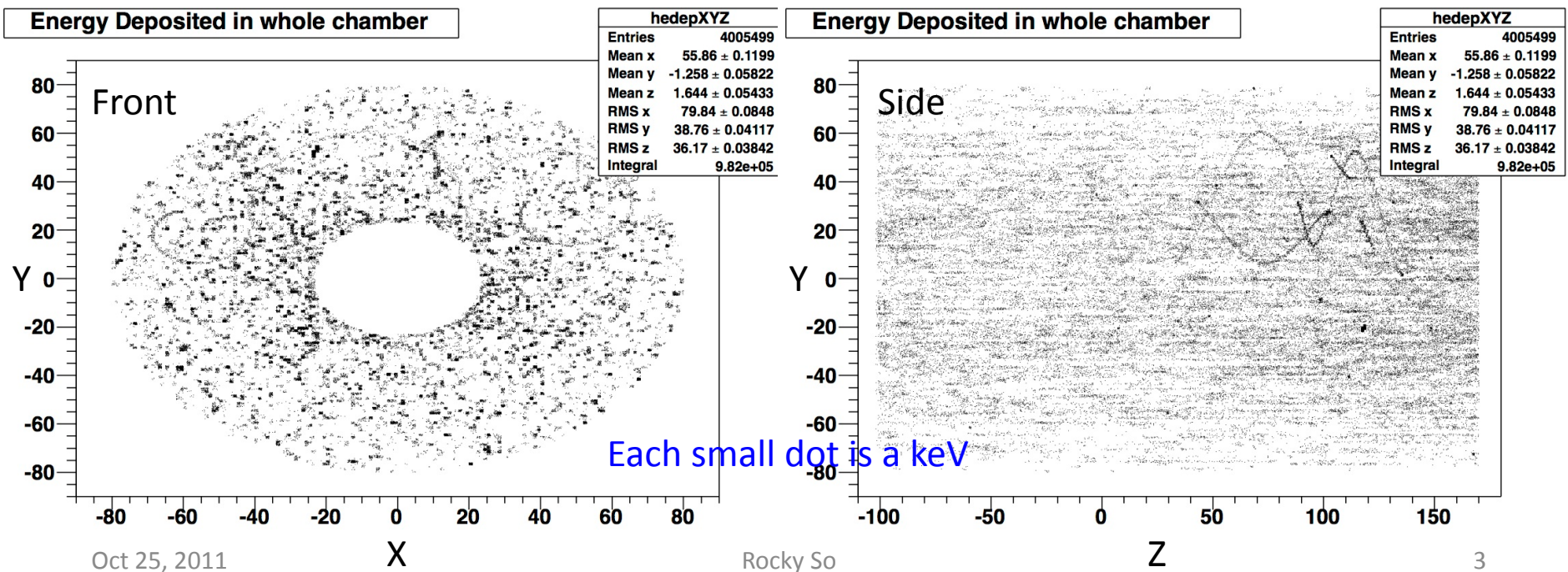


Recap

- Use FullSim to get energy deposited in DCH over the lifetime of SuperB at different parts of DCH
- Winter 2010 data analysis
- Zero angle Bhabbas $e^+e^- \rightarrow \gamma e^+e^-$
- $\text{edep} > 0$

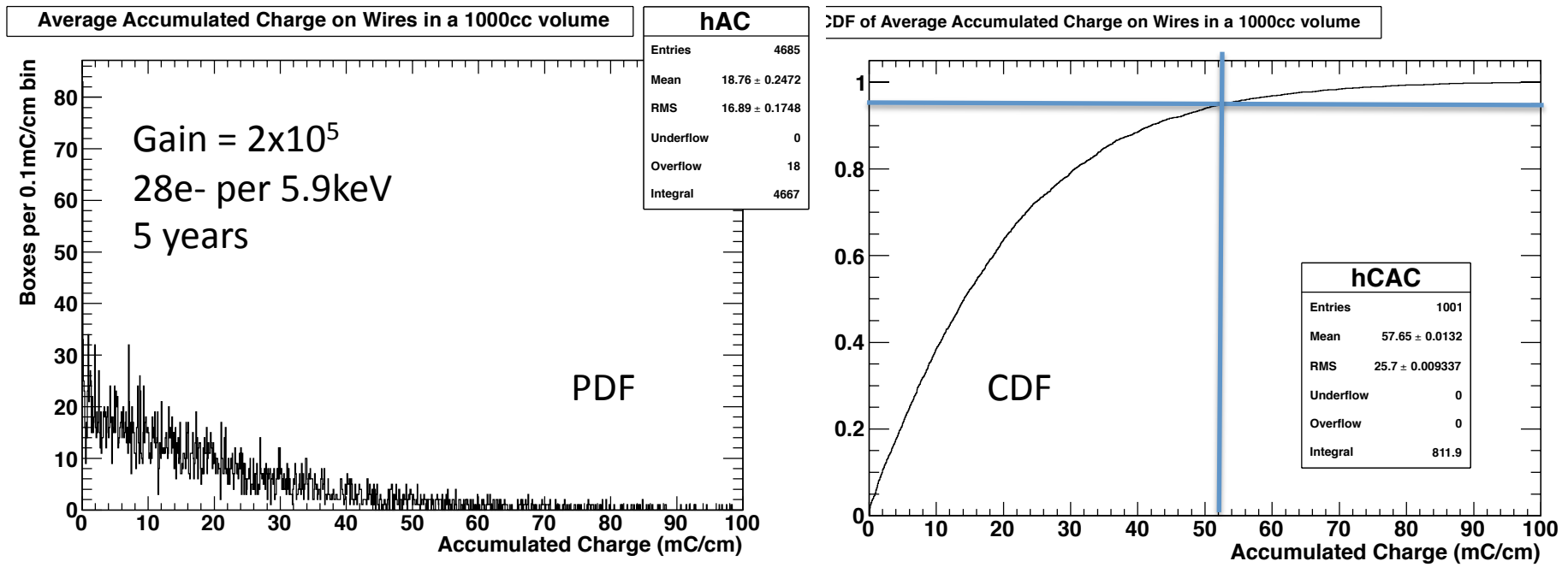
Energy Deposited in Chamber

- FullSim ntuples doesn't hit all parts of DCH
- Add up energy deposited in $(10\text{cm})^3$ voxels
- Divide energy evenly into each cm of wire



PDF and CDF of Accumulated Charge

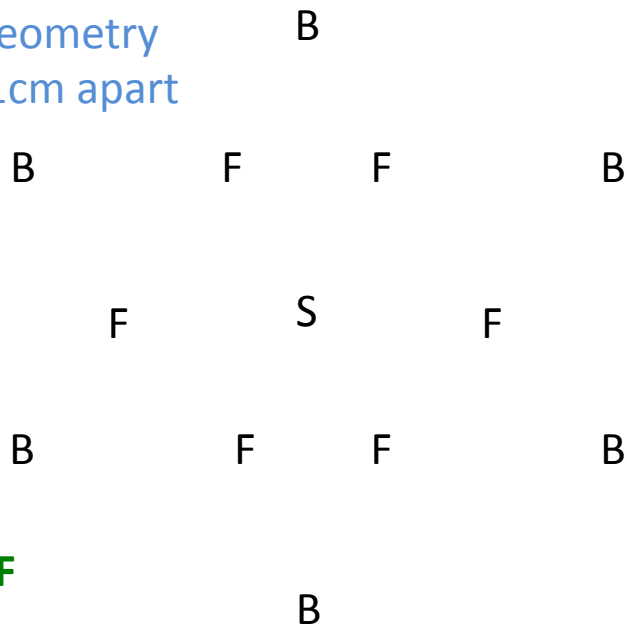
- Only non-zero edep voxels plotted
- ~5% of the voxels receive more than 50mC/cm
- Using 3 as the ratio of field wire to sense wires



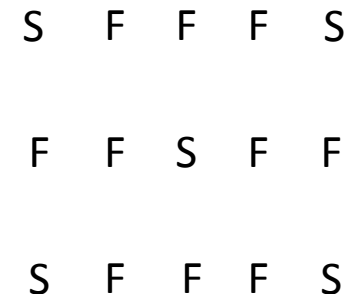
Field Wire to Sense Wire Ratio

- Need a factor of ~ 2 to really make sense of accumulated charge on aging chamber

Aging Chamber
Wire Geometry
Wires 1cm apart



SuperB Chamber
Wire Geometry
Wires 0.75cm apart

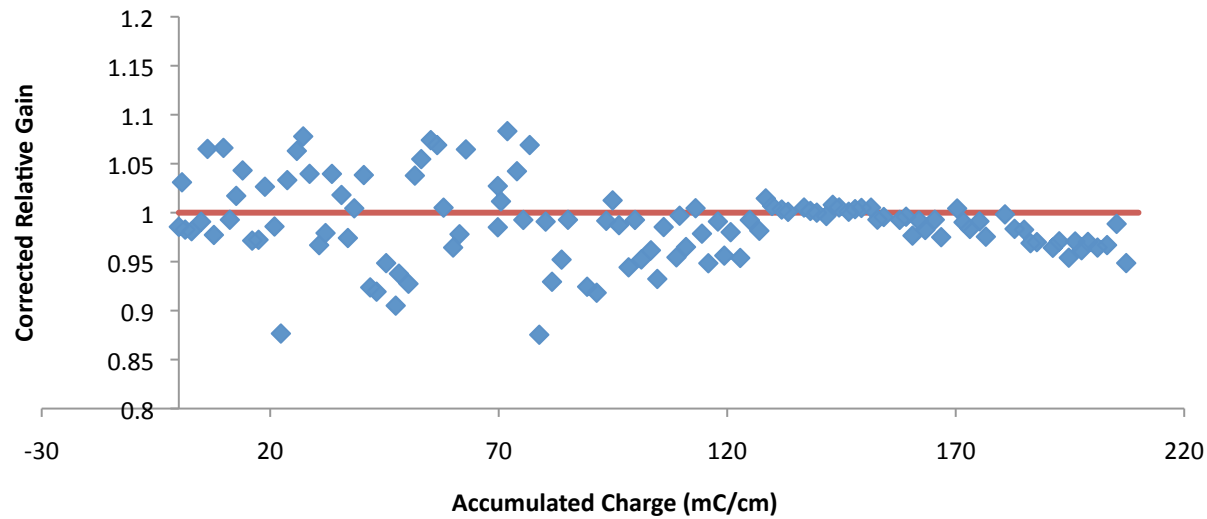
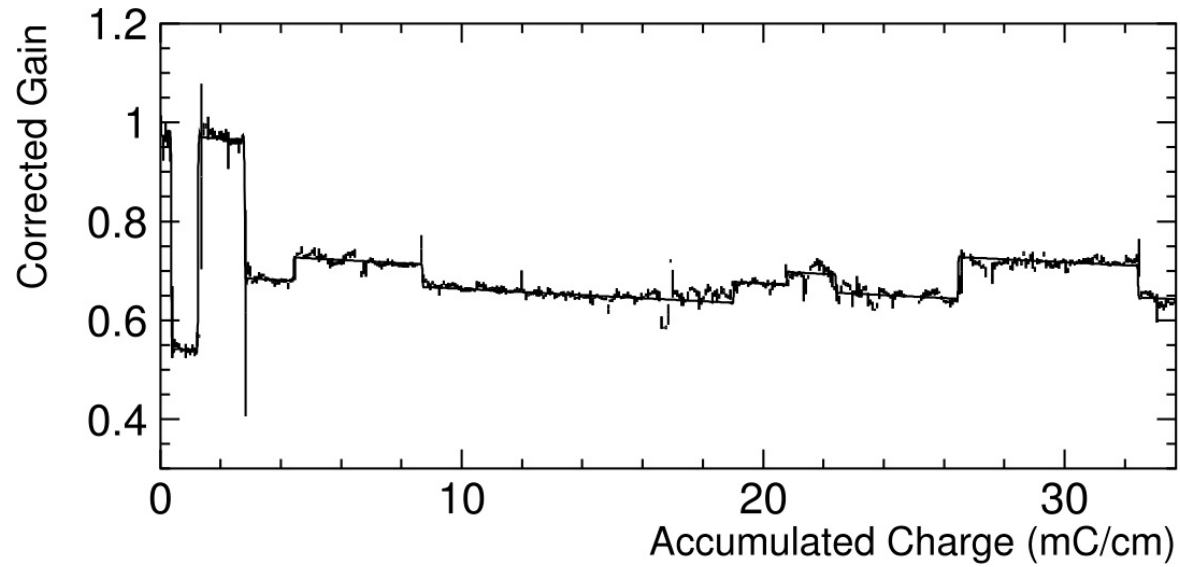


Not to scale

1S to 3F
therefore, field wires age
twice as much as aging chamber
but different for square and rectangles

DCH Gain May 1999 - Feb 2008

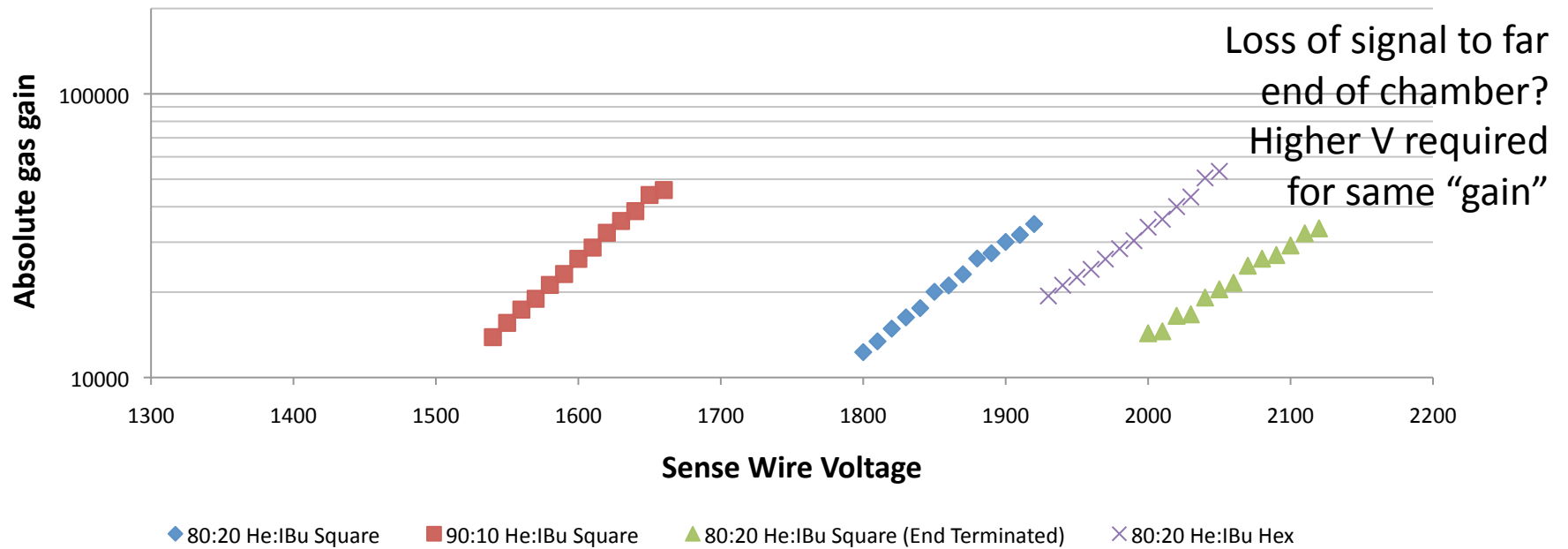
Aging rate: -0.337 ± 0.006 %/(mC/cm) over 33.69 mC/cm



5% gain loss?

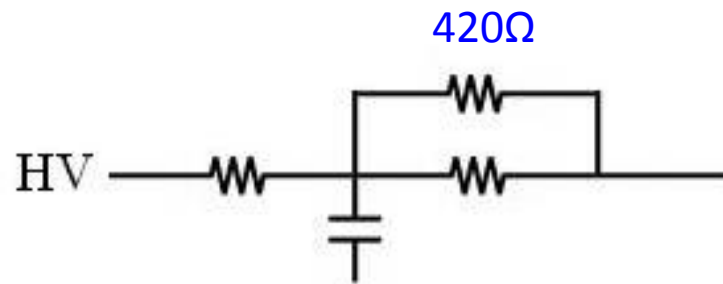
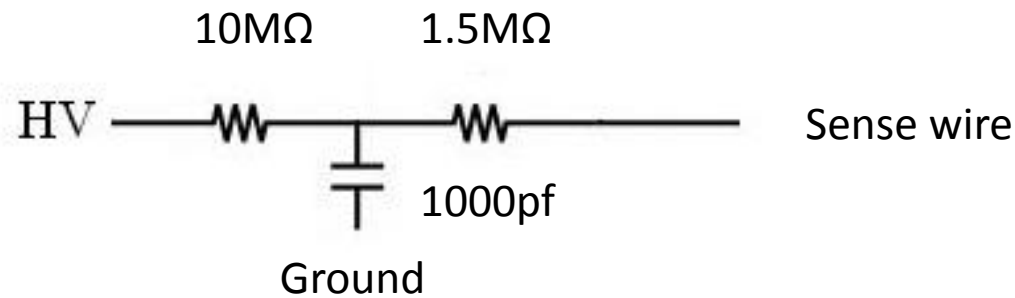
Long Chamber at TRIUMF

- Beam scheduled Nov 17 to Dec 5
- Measured gain variation with voltage
- Extrapolate to gain of 2×10^5
 - 1800V for 90:10
 - 2100V for 80:20
- Measurements limited by our preamp
- Would be nice to be able to go up to 4×10^5



HV side termination on sense wire

Not terminated (signal can bounce)

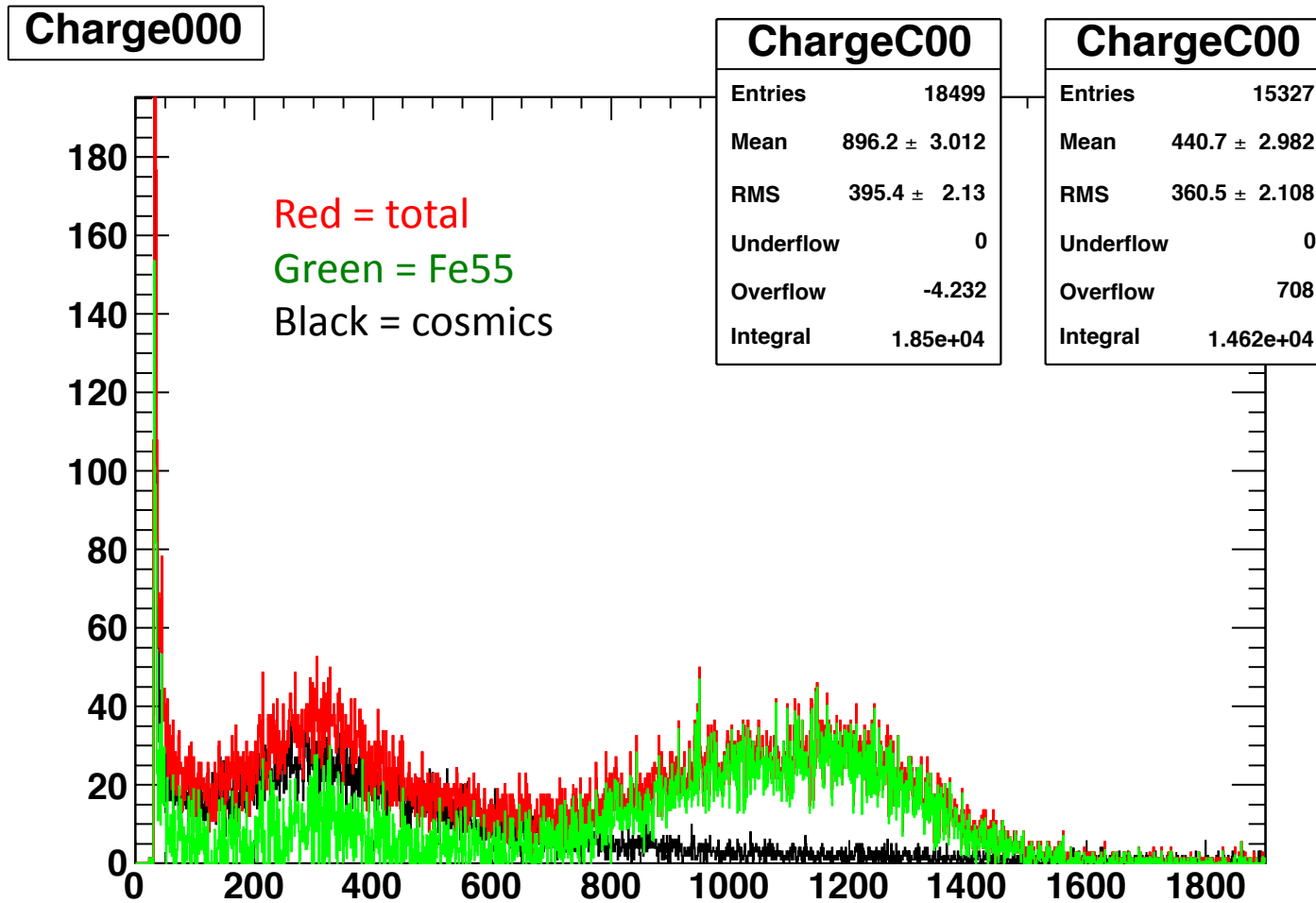


Terminated (signal can't bounce)

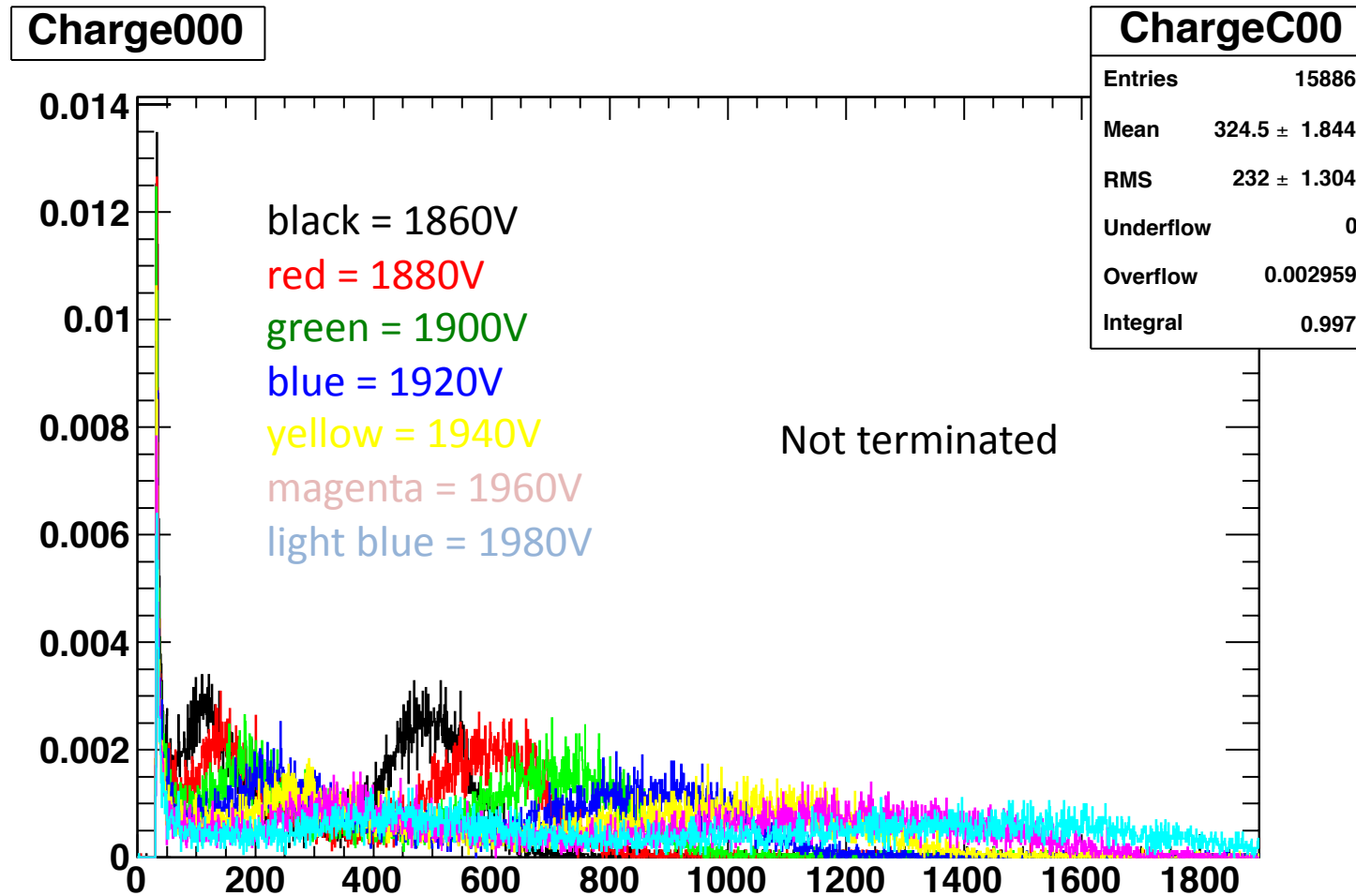
Chamber Noise

- Important to avoid ground loops
- Currently, noise of our long chamber and aging chamber are both 1.2mV RMS at low electronic gain, 2.8mV at high electronic gain
- After terminating, this becomes 3mV and 15mV!
 - Need to isolate the HV grounds

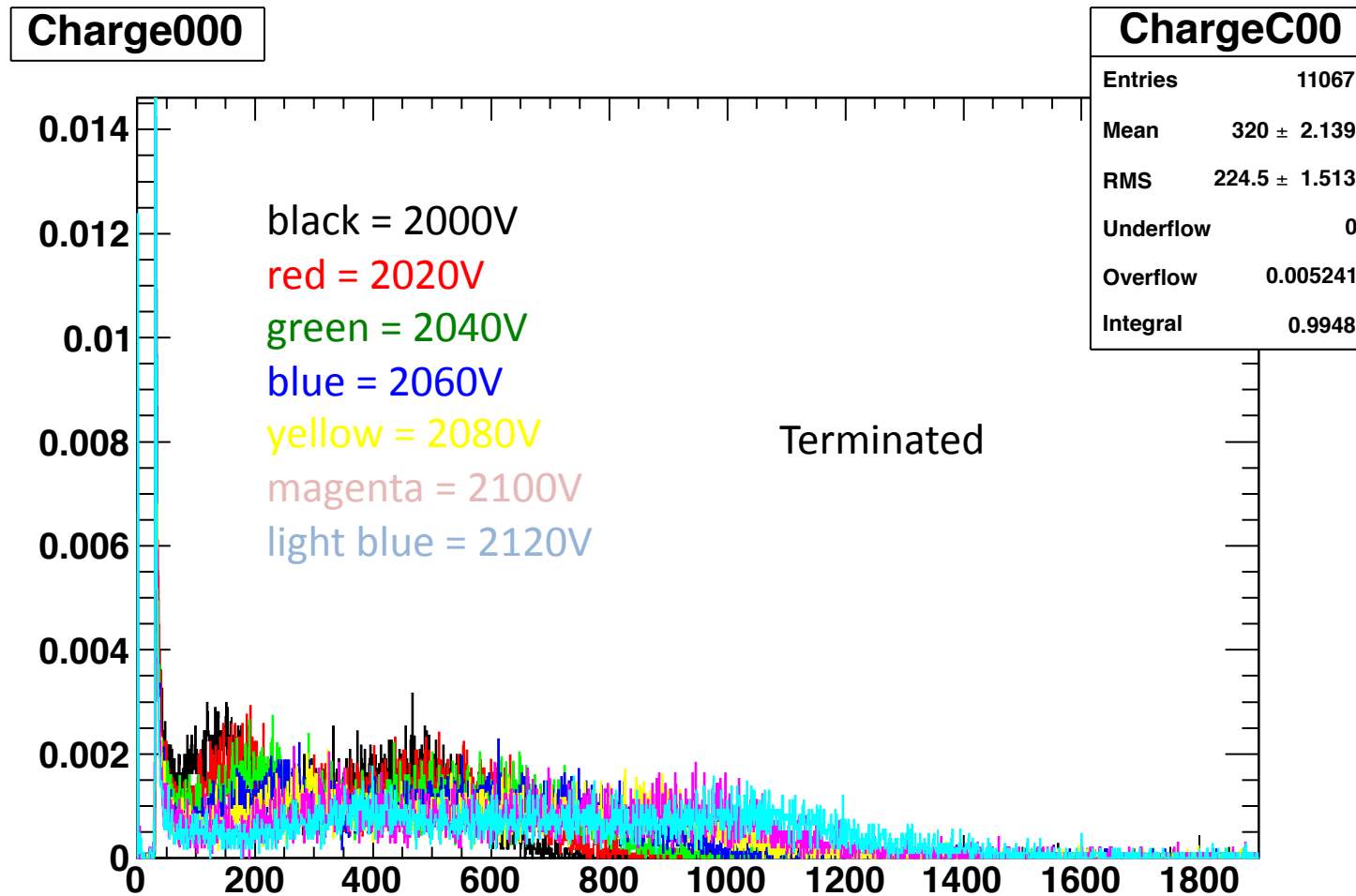
Cosmics spectrum



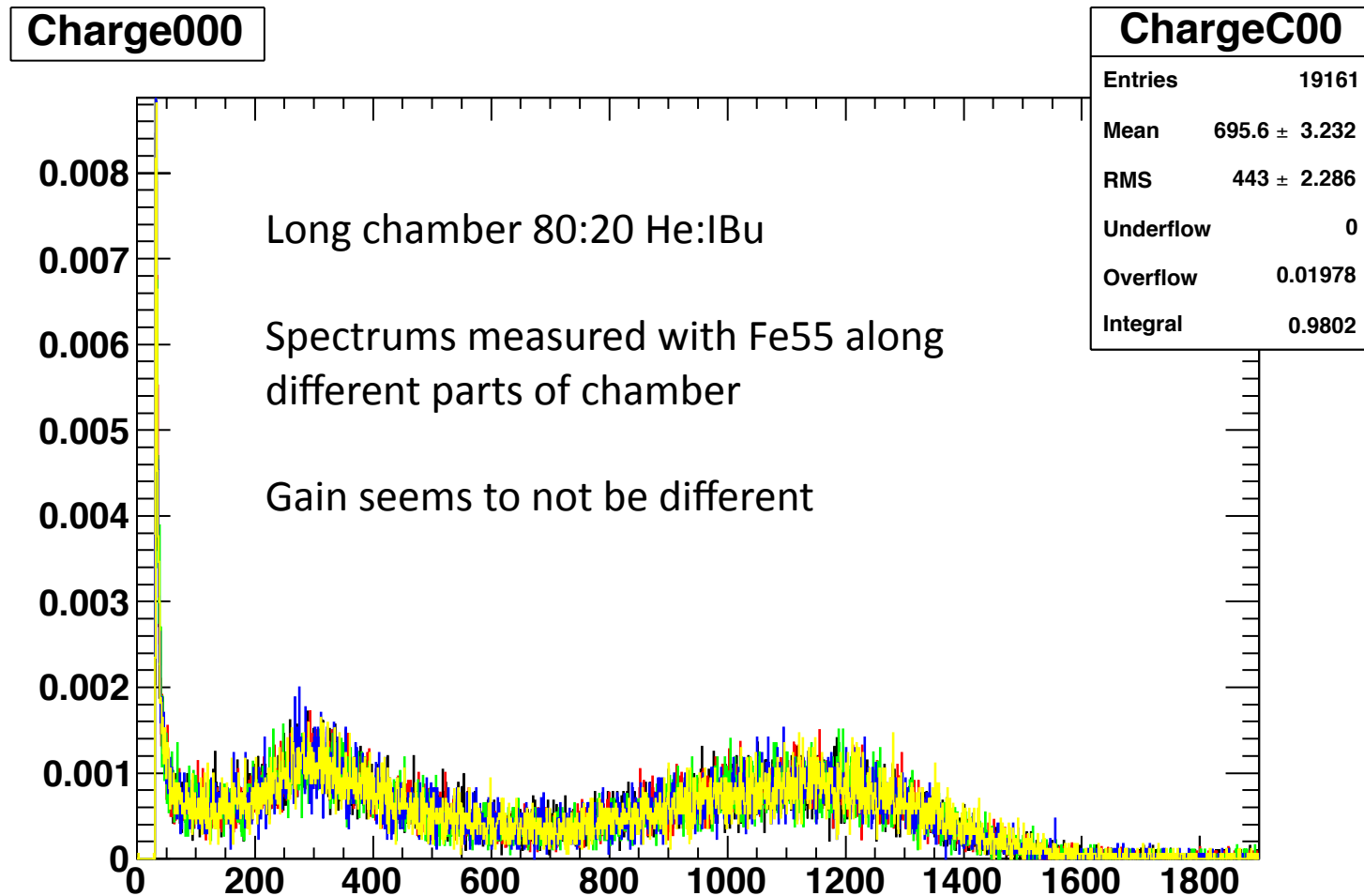
Fe55 spectrums at different Voltages



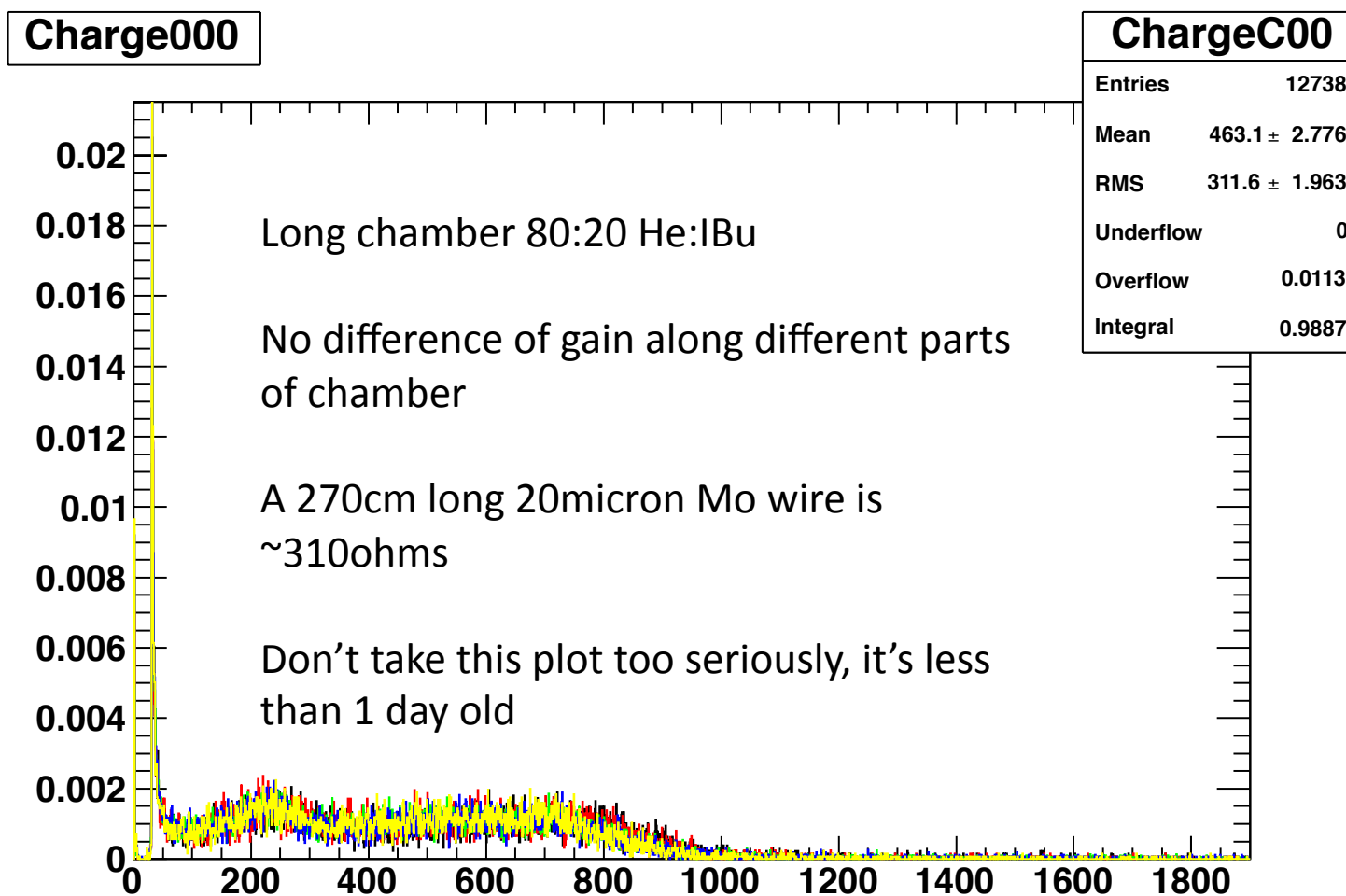
Fe55 spectrums at different Voltages



Gain along chamber not terminated



Gain along chamber terminated



Extra Slides

Gas Gain Calculation

$$\begin{aligned} & 5.9 \text{ keV per Fe55 photon} \\ \times & \text{ 28e- per keV in 80:20 He:IBu gas} \\ = & 165\text{e- per Fe55 photon} \end{aligned}$$

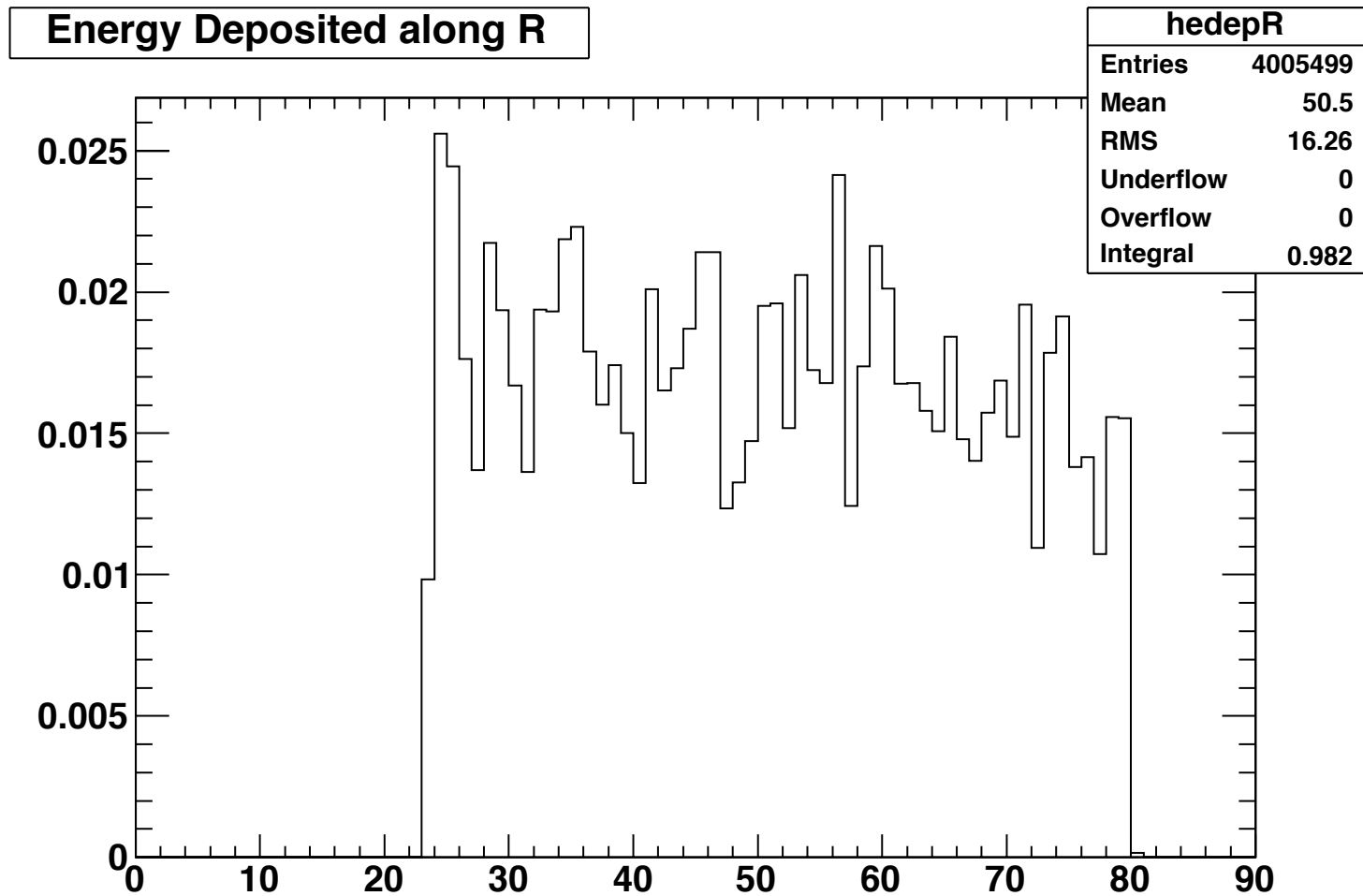
$$\begin{aligned} & 1\text{pf (calibration capacitor in preamp)} \\ \times & \text{ 0.48V test pulse} \\ = & 0.48\text{pC} \end{aligned}$$

0.48 pC gives 1190 ADC counts
1 ADC $\approx$ 2500e-

Integration efficiency of shaping amp $\sim$ 50%

$$2500(\text{e- per ADC}) / (165\text{e-} / 50\%) = 30 \text{ (1 ADC count corresponds to a gas gain of } \sim 30)$$

Energy along radius of chamber



Energy along length of chamber

