Calibration factor for Ion and Scintillator chambers

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March 5, 2014

Ion Chamber Factor

For an ion chamber, the basic equation for dose is as follows:

$$(Charge - background) \times K_{t,p} \times ChamberFactor = Dose \tag{1}$$

Two background measurements were performed, to

Run	Charge(nC)	Time (s)
1	-0.22	600
2	-0.23	600

$K_{t,p}$ is the correction factor for temperature and pressure, and is as follows:

$$K_{t,p} = \frac{273 + T}{295} \times \frac{760}{P} \tag{2}$$

On February 14, 2015 the temperature was 18.0 °C, and the pressure was 732.4 mm-Hg.

The Ion chamber's cal factor was determined by comparing the relative output of Loma Linda's T1 ion chamber and the Farmer chamber. This was done in Gantry 1, with both chambers at center of modulation (60 mm modulation profile), using 149 MeV with 13 cm aperture at 100% intensity.

LLU's T1 chamber	-4.728 nC	301.7 MU
pCTs Farmer chamber	-14.836 nC	86.01 MU

Using equation 1, normalizing charge to MUs, and using the Standards chamber factor of 61.83 cGy/nC, the calibration factor for the pCTs Farmer style chamber is 5.605 cGy/nC. The calibration certificate for ^{60}Co (P=760.0, T=22.0 °C) is 5.391×10^7 Gy/C.

Two does runs were done with the ion chamber, the second run had better timing.

1st ion chamber run. -2.22 pC in 60seconds. 0.0120 cGy/min.
2nd ion chamber run. -2.57pC in 60 seconds, 0.0146 cGy/min.

Scintillator Chamber Factor

For the scintillator's calibration factor, Runs 19 and 21 were compared. The sum of the signals in the scintillator's profile was -200715740, with 13,633,572 events. The events counted for the ion chamber run 16,257,850.

We're getting the distribution with Pier's program, taking raw data of run.

1. Evaluate pedestal
2. Subtract pedestal
3. Calculate area excluding pedestal + pedestal area

$$ADC = CalibrationFactor \times Dose_{p^+} + Pedestal \tag{3}$$

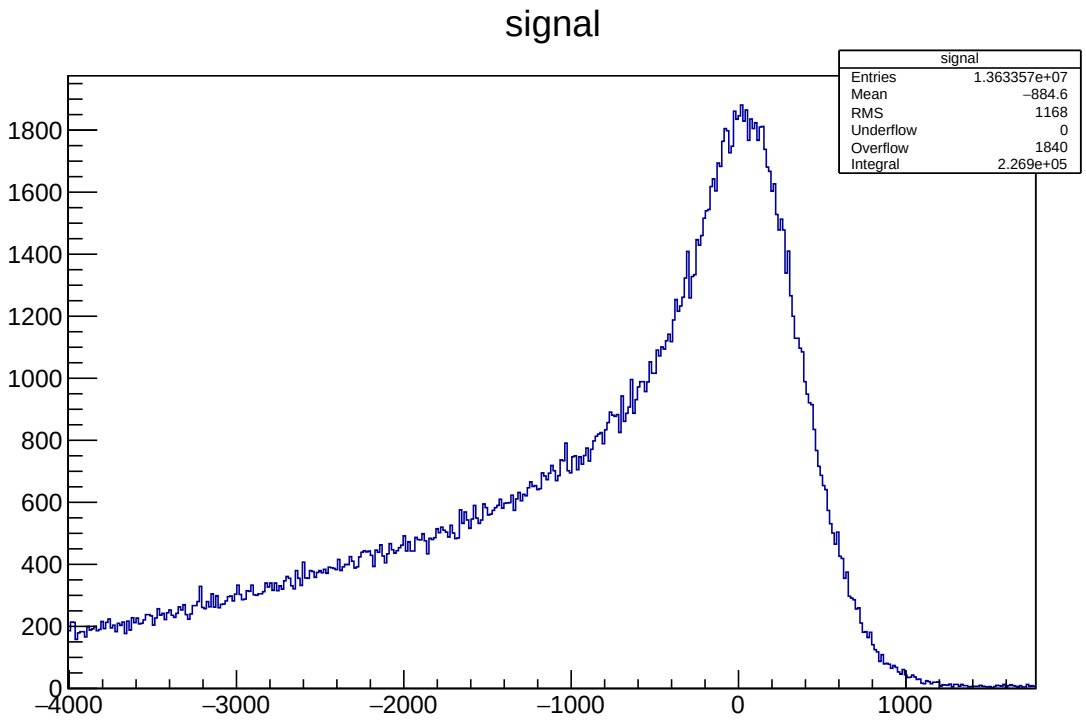
$$Dose_{p^+} = (ADC - pedestal)/CalibrationFactor \tag{4}$$

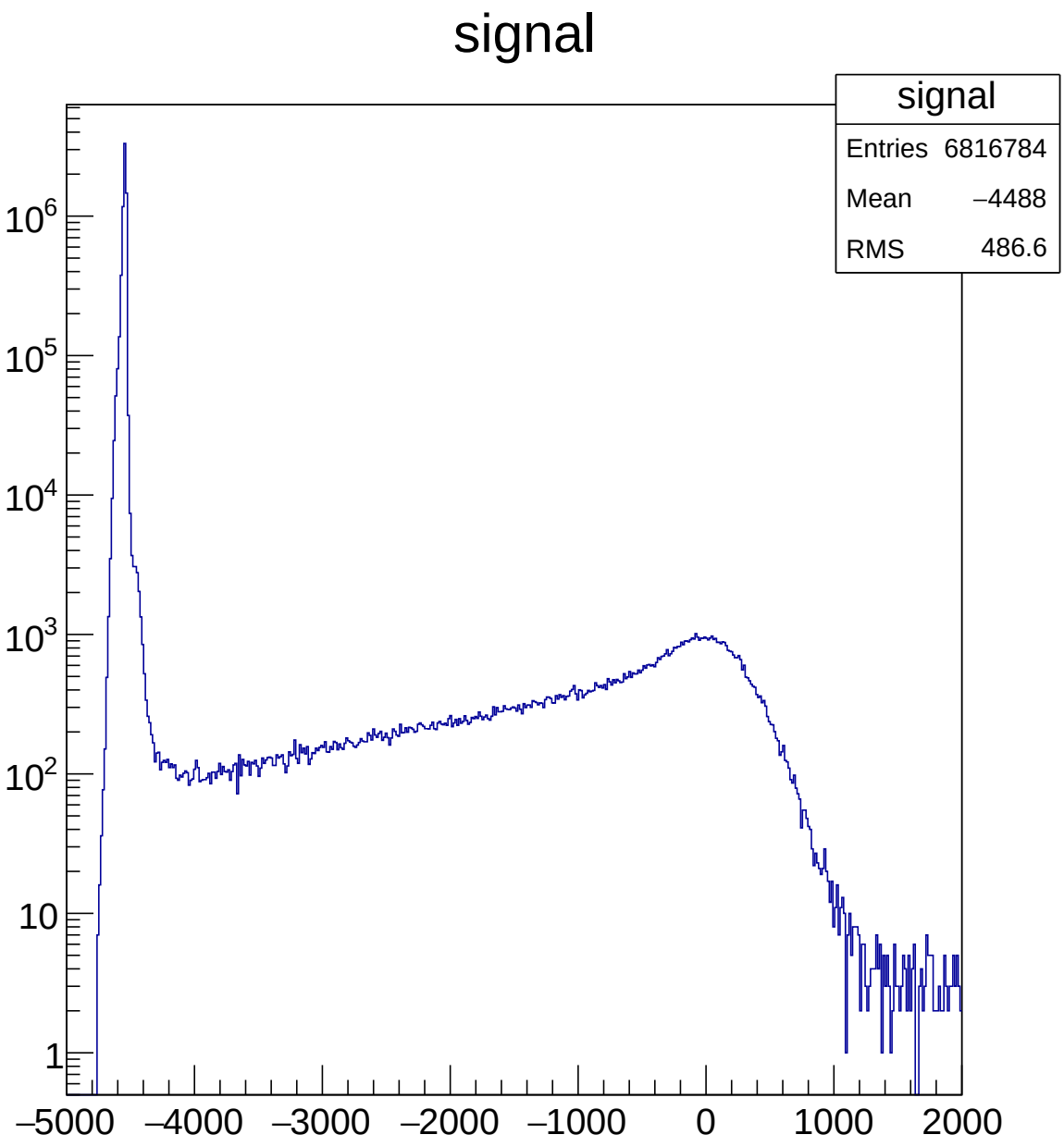
$$Dose_{tot} = \sum_{i=1}^{\#protons} Dose_{p^+} = N_{protons} \times \overline{Dose_{p^+}} \tag{5}$$

Where $\overline{Dose_{p^+}}$ is the average dose deposited per proton.
The dose for the Ion chamber can be expressed similarly:

$$Dose_{IonChamber} = N_{protonsIC} \times \overline{Dose_{p^+}} \tag{6}$$

We know $dose_{tot}$ for ion chamber measurements, and can equate them. The calibration factor for the Scintillator is 6.0998E-011 cGy/signal.





Log plot of ADC signal to show pedestal with Scintillator calibration area.