

Canadian drift chamber laboratory activities

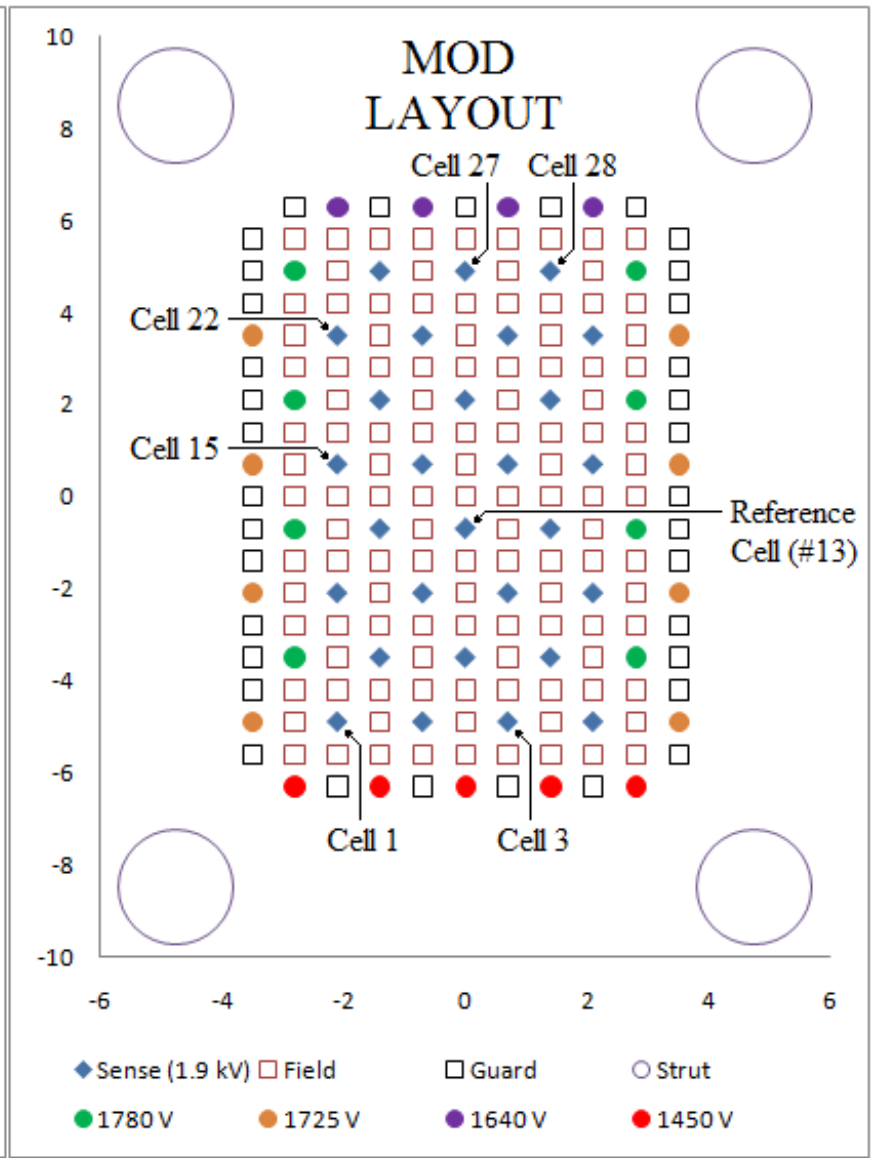
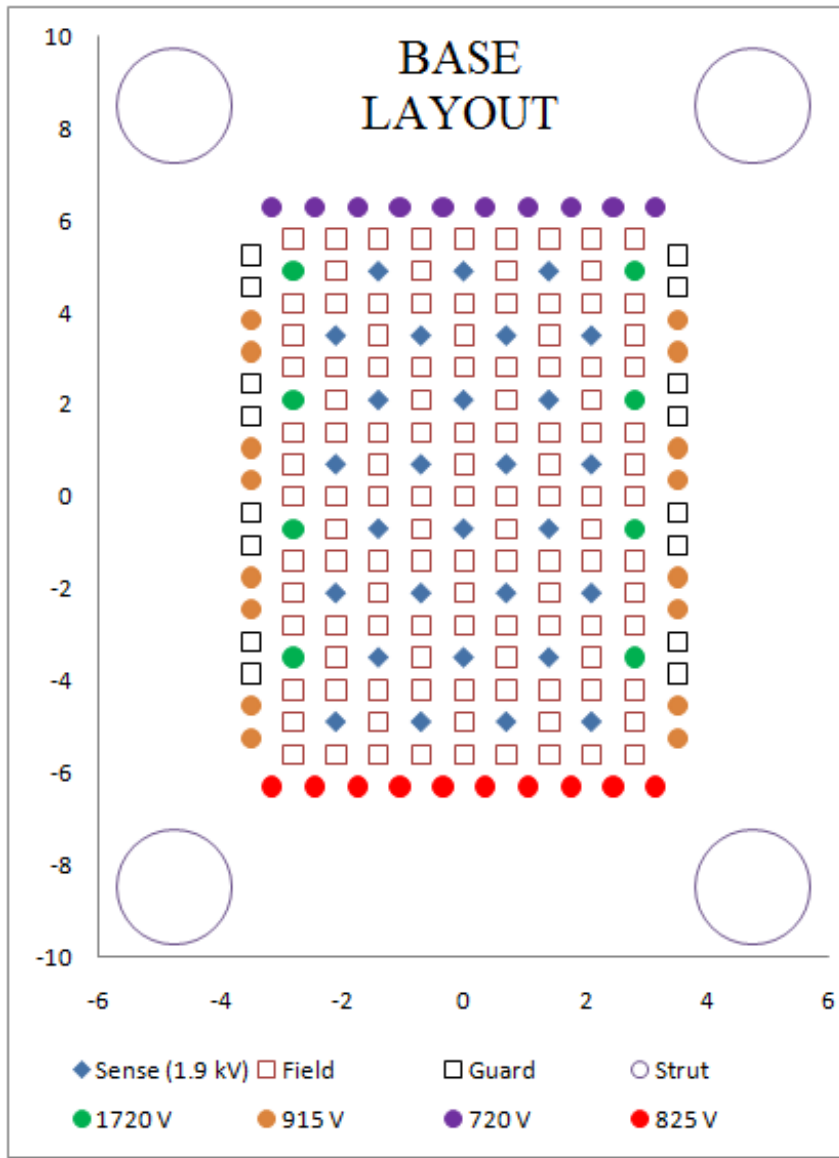
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15-Dec-2010

Garfield Studies

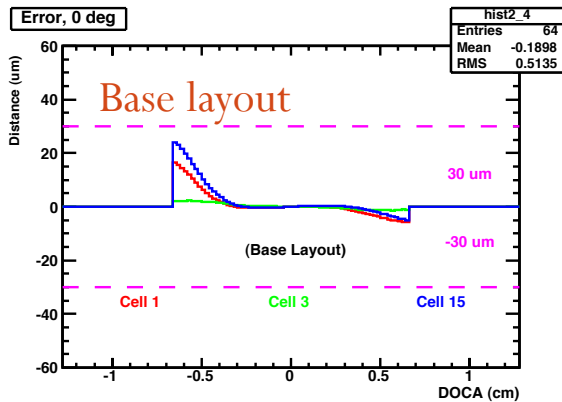
- Philip Lu has been doing Garfield studies for large LNF prototype, starting from model created by Giuseppe.
 - 14 mm square cells; 25 μm sense wires, 80 μm field wires.
 - This study uses He:Iso 90:10 with 3000 ppm water, $B = 0$.
- Idea is to select guard wire locations and voltages to minimize reconstruction errors. Specifically, look at the error incurred by using the nominal time-to-distance relationship (cell 13) for all other cells.



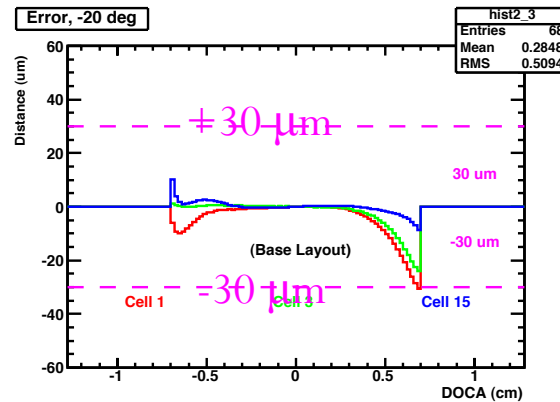
- In the modified layout, the guard wires follow the same pattern as the nominal layout, but with different voltages.

Tracking error vs drift distance for cell 1, cell 3, and cell 15

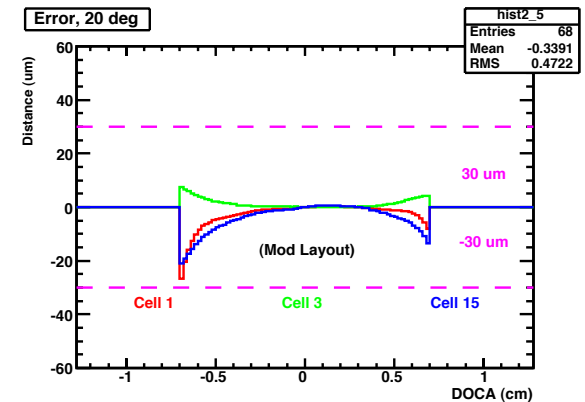
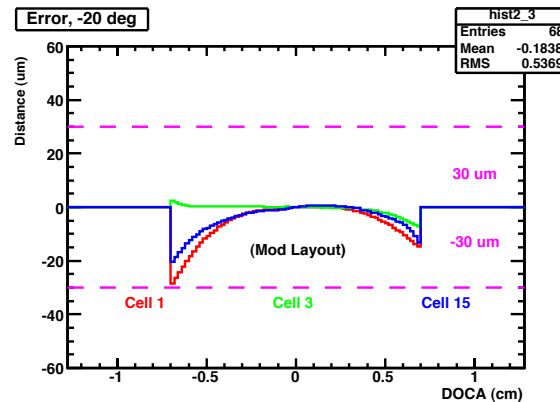
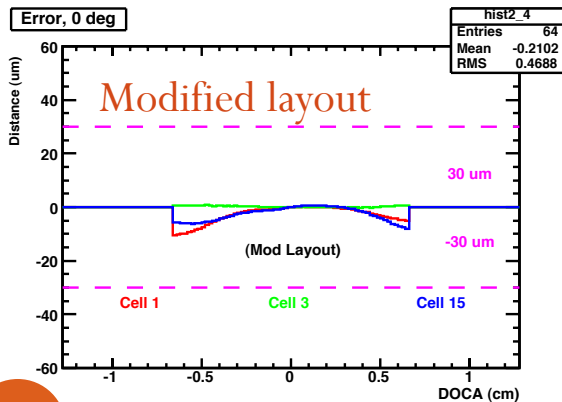
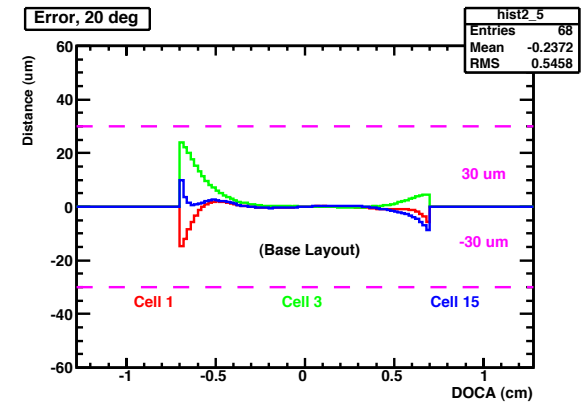
Entrance angle = 0



Entrance angle = -20 deg

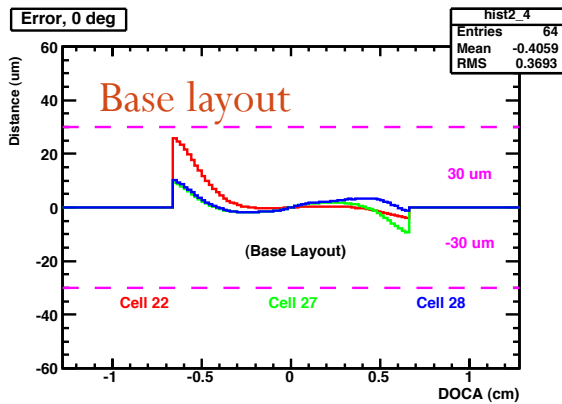


Entrance angle = +20 deg

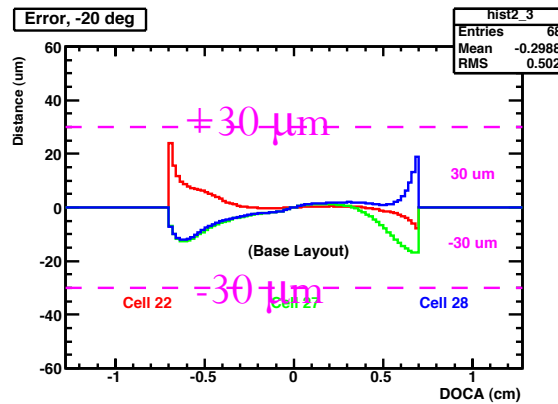


Tracking error vs drift distance for cell 22, cell 27, and cell 28

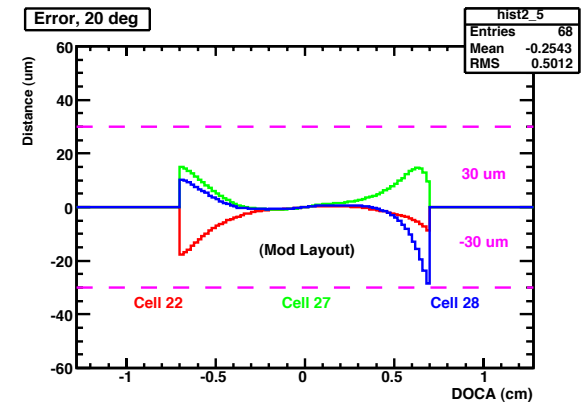
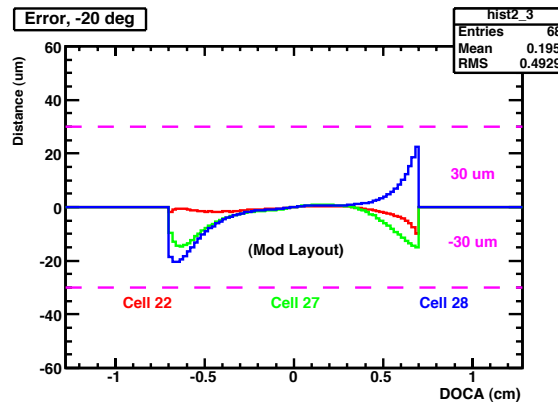
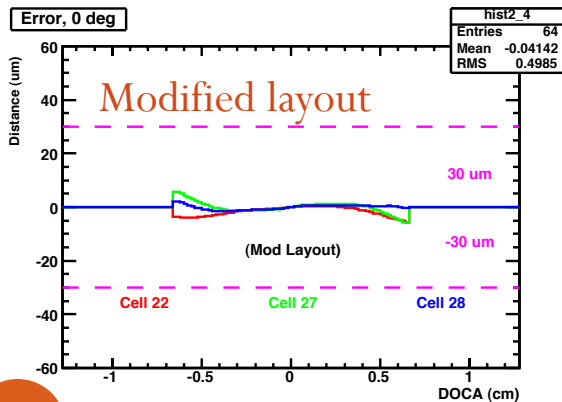
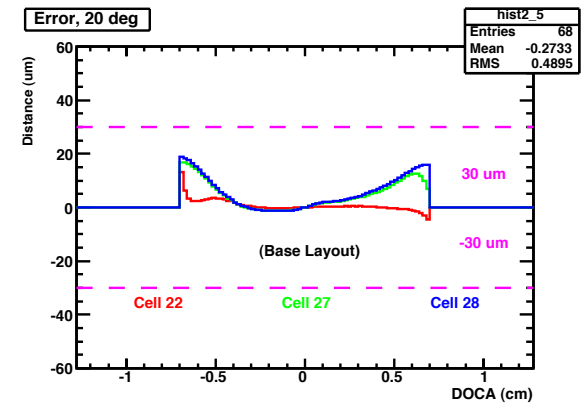
Entrance angle = 0



Entrance angle = -20 deg



Entrance angle = +20 deg

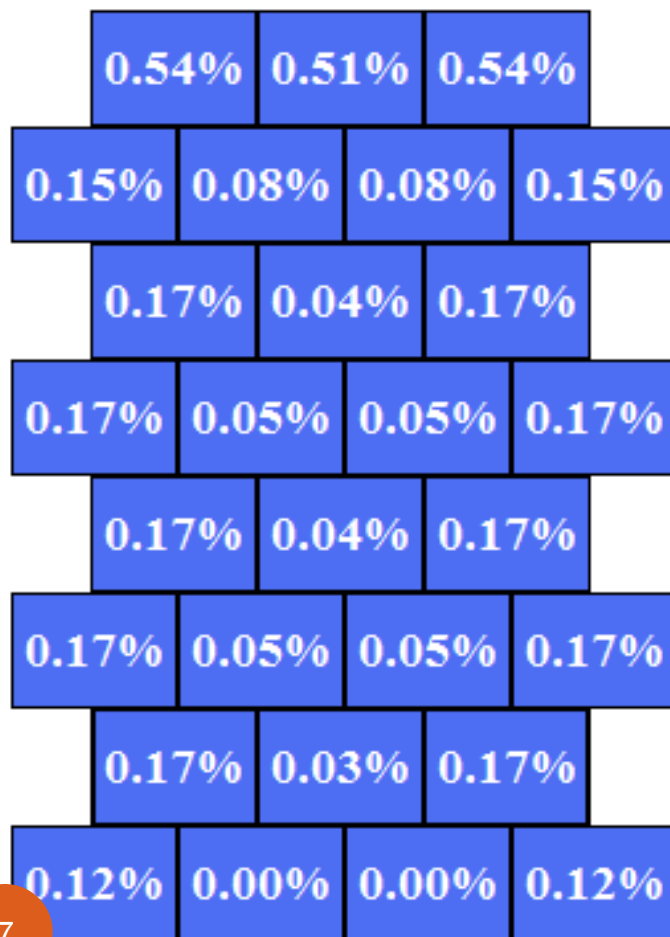


Results for large LNF prototype

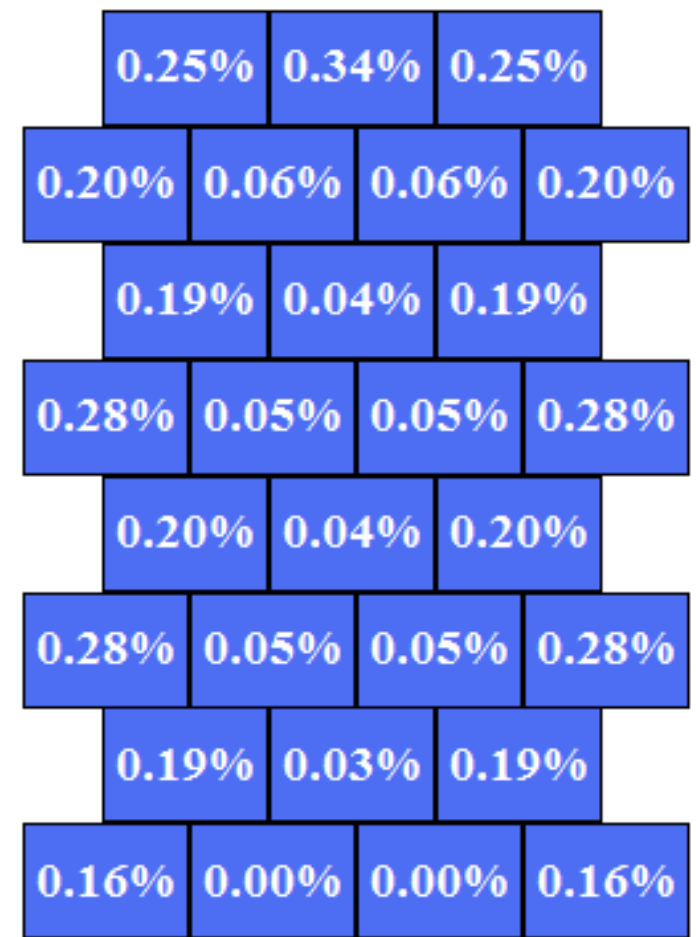
- Tracking errors $< 30 \mu\text{m}$ for either layout. Negligible for standard tracking; maybe not so negligible for cluster counting.
- Next step is to look at gain variation. Overall, gain looks low compared to BaBar.

Variations in linear charge density

Baseline layout



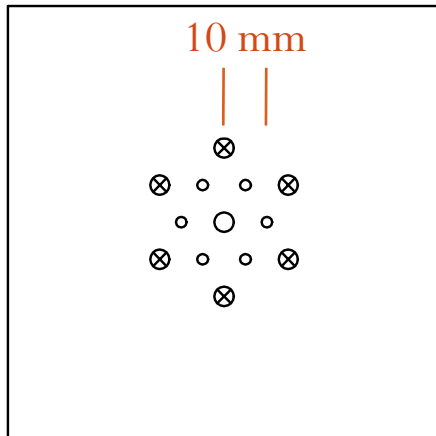
Modified layout



Aging studies

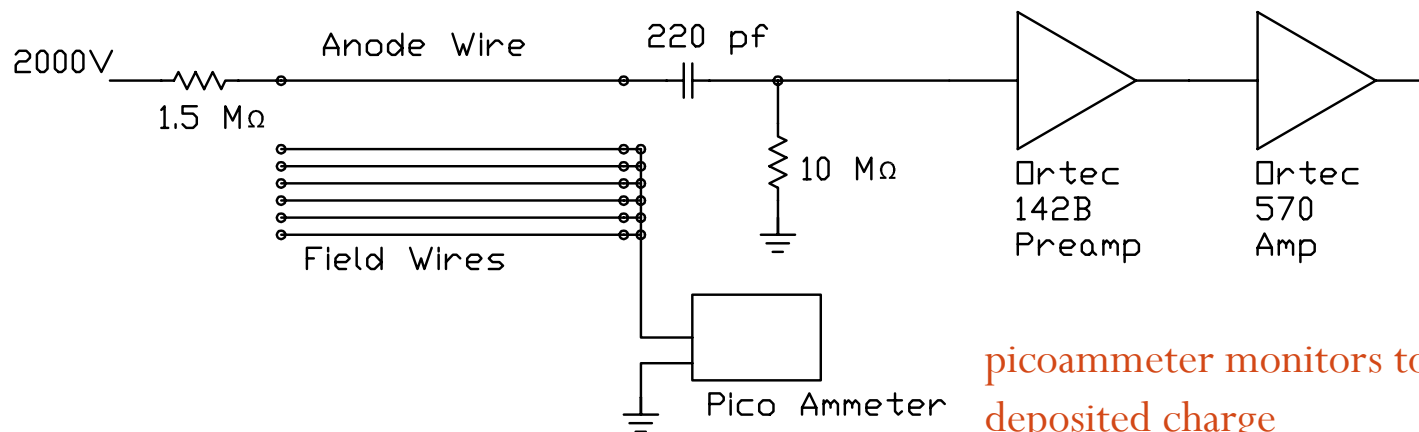
- Aging studies are underway. Currently testing BaBar set up:
 - 120 μm gold-coated aluminum field wires
 - 20 μm gold-coated tungsten sense wires
 - He:Isobutane 80:20 (but no water)
- Age chamber with a 100 mCi ^{55}Fe source; measure ^{55}Fe spectrum with a low-intensity source.
- Monitor current, ^{55}Fe peak location (gain), and ratio of small pulses to ^{55}Fe interactions.
 - Number of small pulses increase as Malter effect sets in.

Schematic



- Anode Wire $20\ \mu$ gold-plated tungsten sense wire
- Field Wires, bussed together and grounded
 $120\ \mu$ gold-plated aluminum field wires
- ⊗ Bias Wires, bussed together and at +1450 Volts

Bias wires @ 1450V gives same field as an infinite BaBar chamber



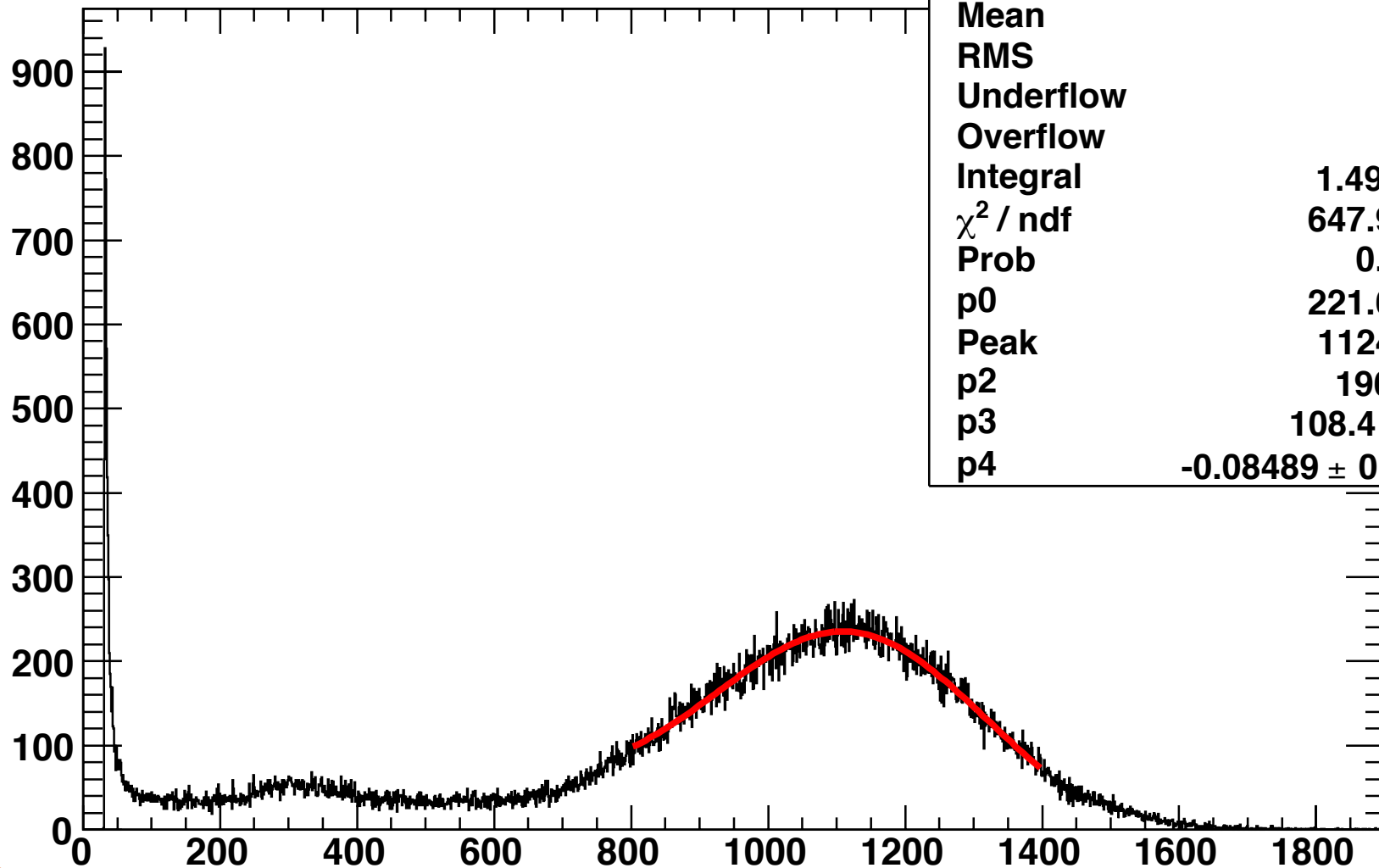
picoammeter monitors total deposited charge



TRUMP
DATE: 12/15/11
OPERATOR: J. J. ...
INSTRUMENT: ...
LOCATION: ...
RADIATION WARNING

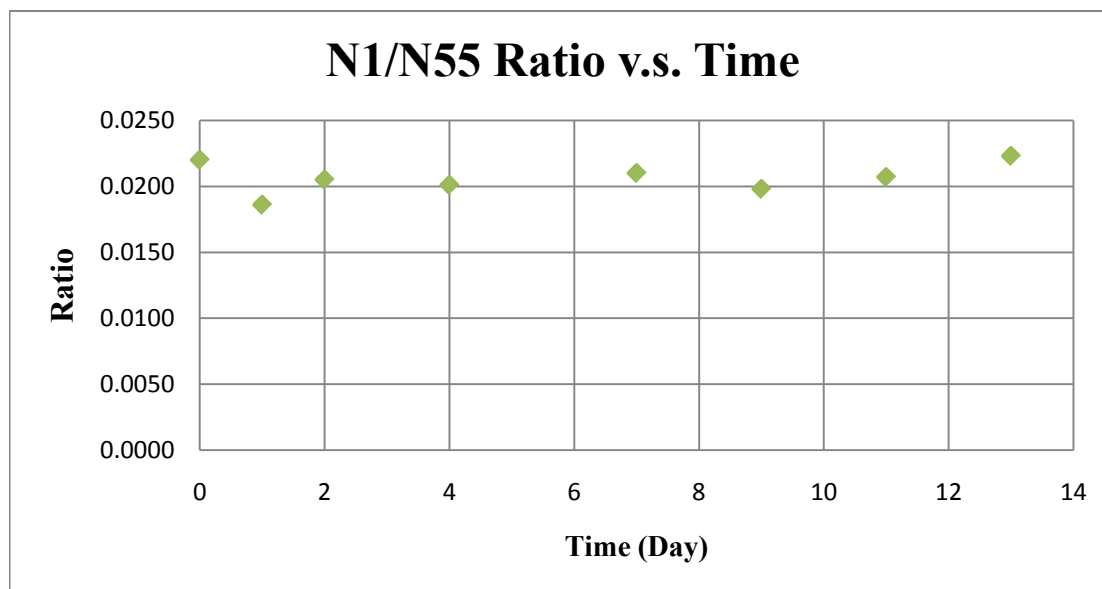
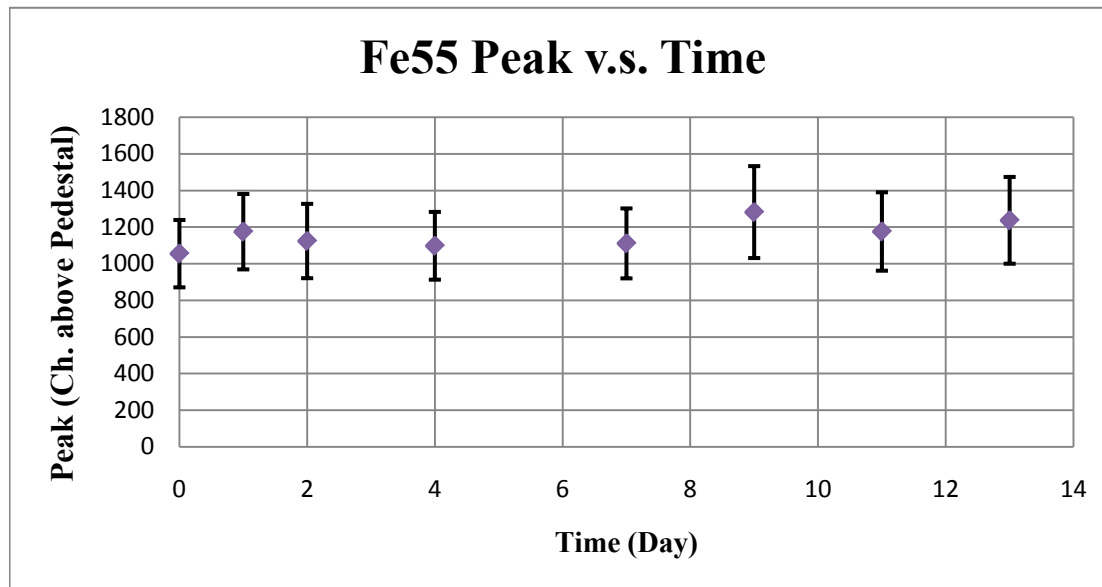
^{55}Fe spectrum, $V = 2000\text{ V}$; low gain on amplifier

low_gain



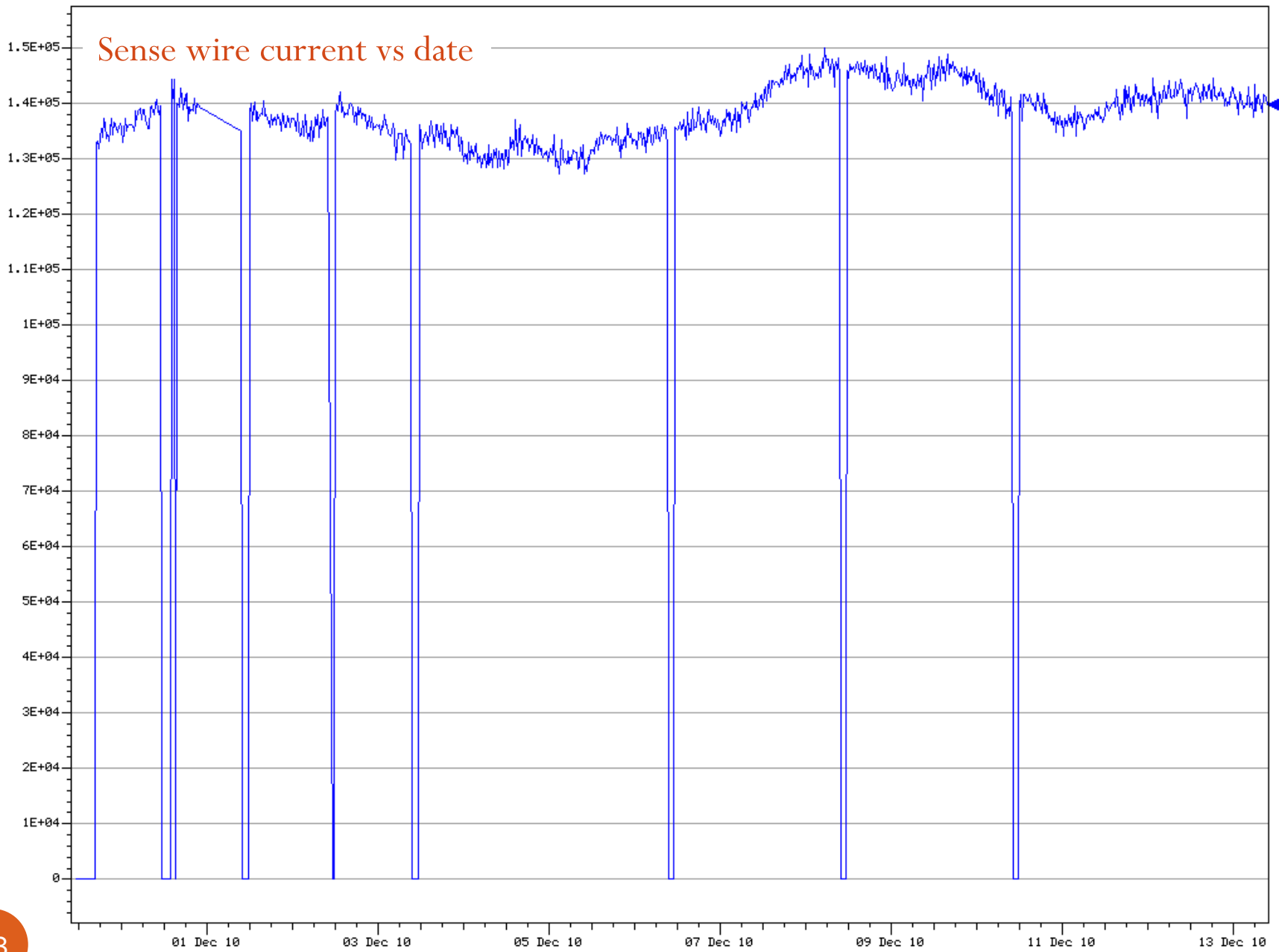
low_gain	
Entries	1901
Mean	933.7
RMS	374.8
Underflow	0
Overflow	174
Integral	1.495e+05
χ^2 / ndf	647.9 / 595
Prob	0.06569
p0	221.6 \pm 9.5
Peak	1124 \pm 3.2
p2	196 \pm 7.3
p3	108.4 \pm 10.8
p4	-0.08489 \pm 0.00962

- error bars = width of distribution
- no density corrections so far



- No signs of aging so far

Sense wire current vs date



First test

- This is the second test we have done. First chamber failed quickly. Useful for developing tools and techniques, but not so useful for aging studies:
- We were operating it far above nominal voltage.
- No current monitoring.

Next steps

- Giuseppe has sent us some 120 μm bare aluminum. Try that next, probably with BaBar gas, no water.
- In the longer run, try SuperB gas, with and without water.
- Compare results to background calculations.