
TRIUMF laboratory studies

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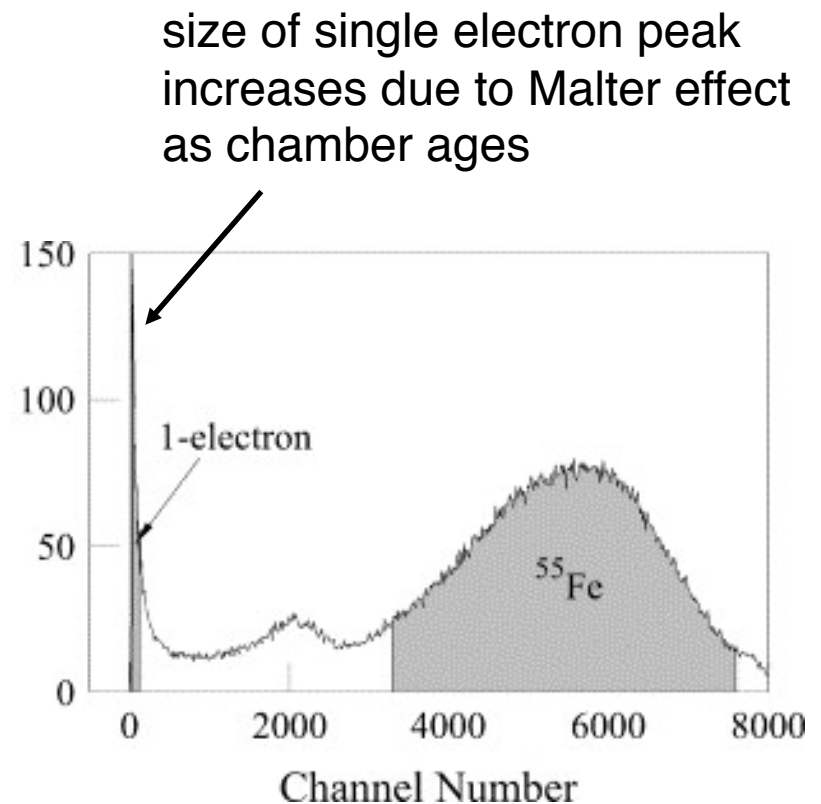
27-Sep-2010

Outline

- Aging
- Single cell cluster counting
- Large prototype

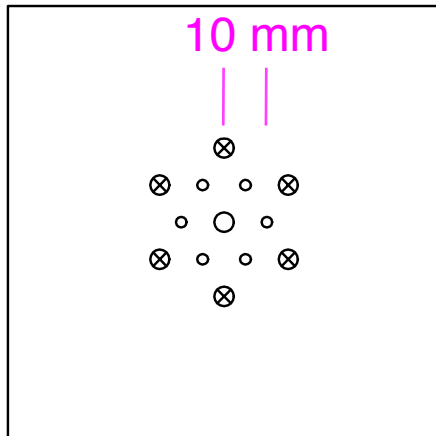
Wire Aging Tests

- Goal is to verify that the chamber will survive the SuperB lifetime.
- Test proposed materials using single cell, as per Boyarski.
e.g. bare Al wire.
- Primarily a test of Malter effect (field wire aging).
- Uses ^{55}Fe both to age the wires and to characterize performance.



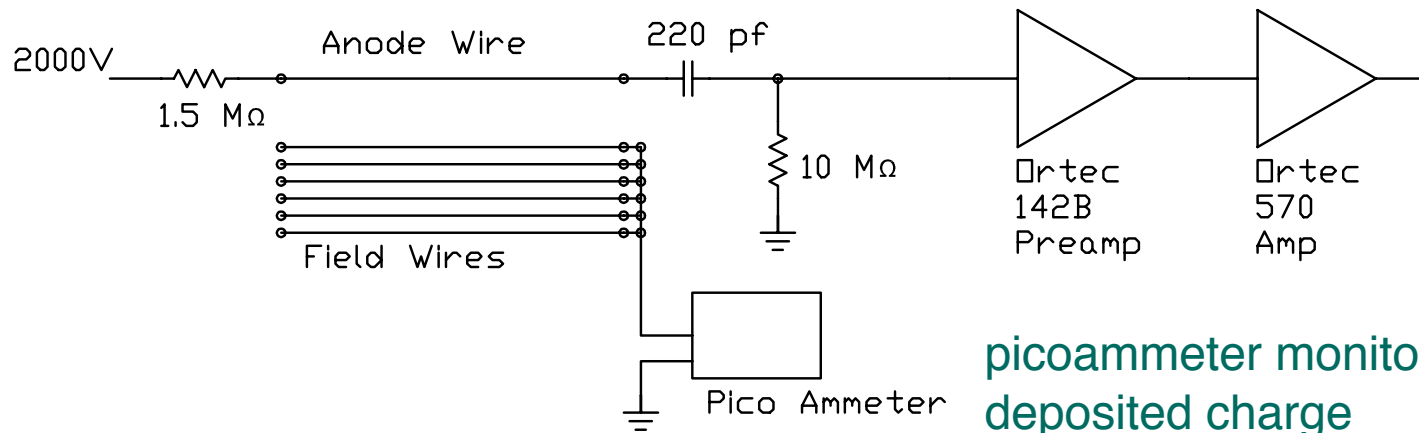
A. M. Boyarski, Nucl. Instr. Meth. A 535, 632 (2004)

Schematic



- Anode Wire 20 μ gold-plated tungsten sense wire
- Field Wires, bussed together and grounded
120 μ 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. J.
INSTRUMENT: TRUMP
RADIATION WARNING



CAUTION



CALIBRATION SOURCE
IN USE

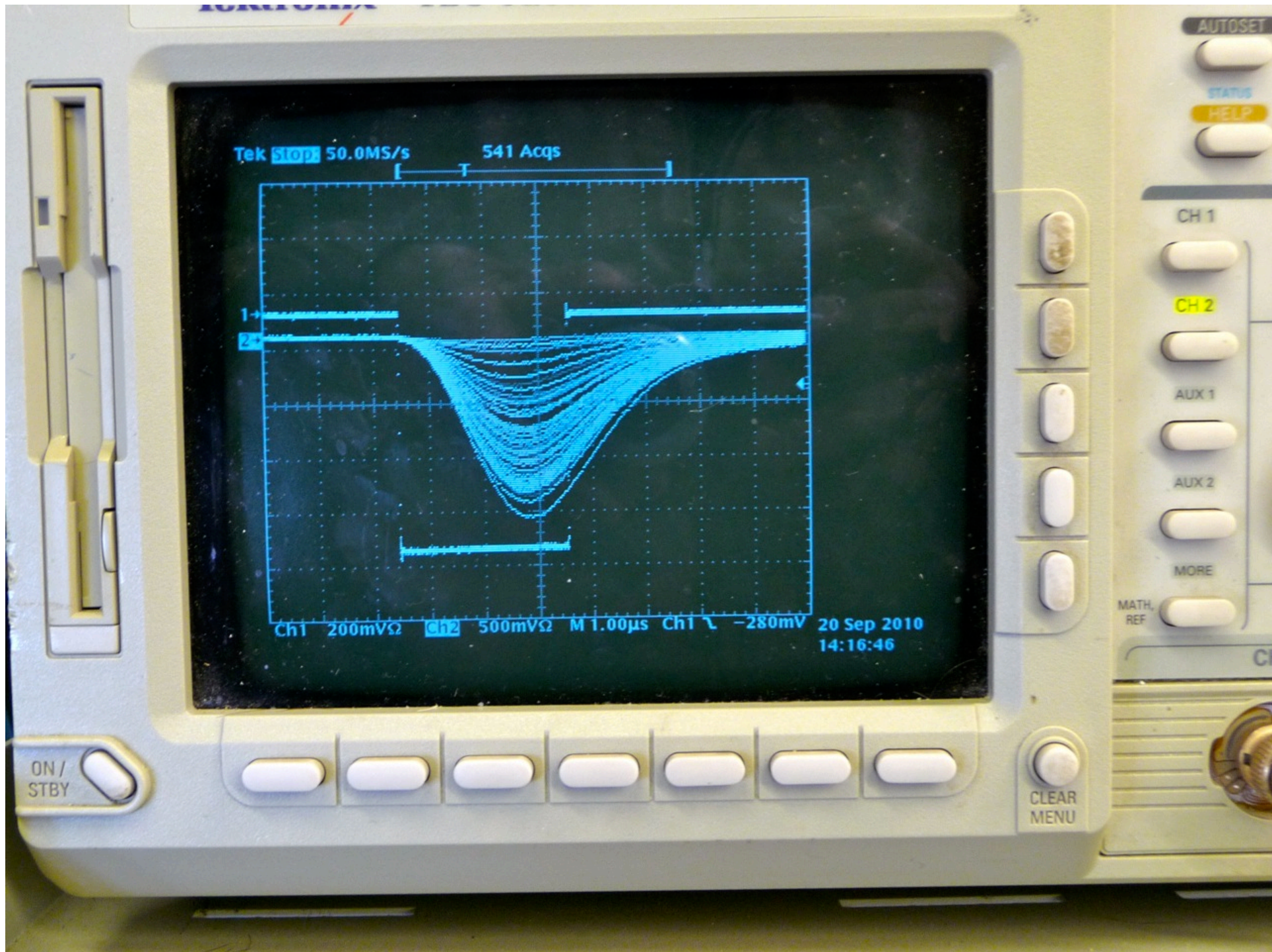
isotope(s) ^{252}Cf
neutron $\mu\text{Sv/h}$
gamma $\mu\text{Sv/h}$
total $\mu\text{Sv/h}$
AT meters
DATE:

Top section of the left rack containing a silver and black electronic module with a digital display and various control knobs and switches.

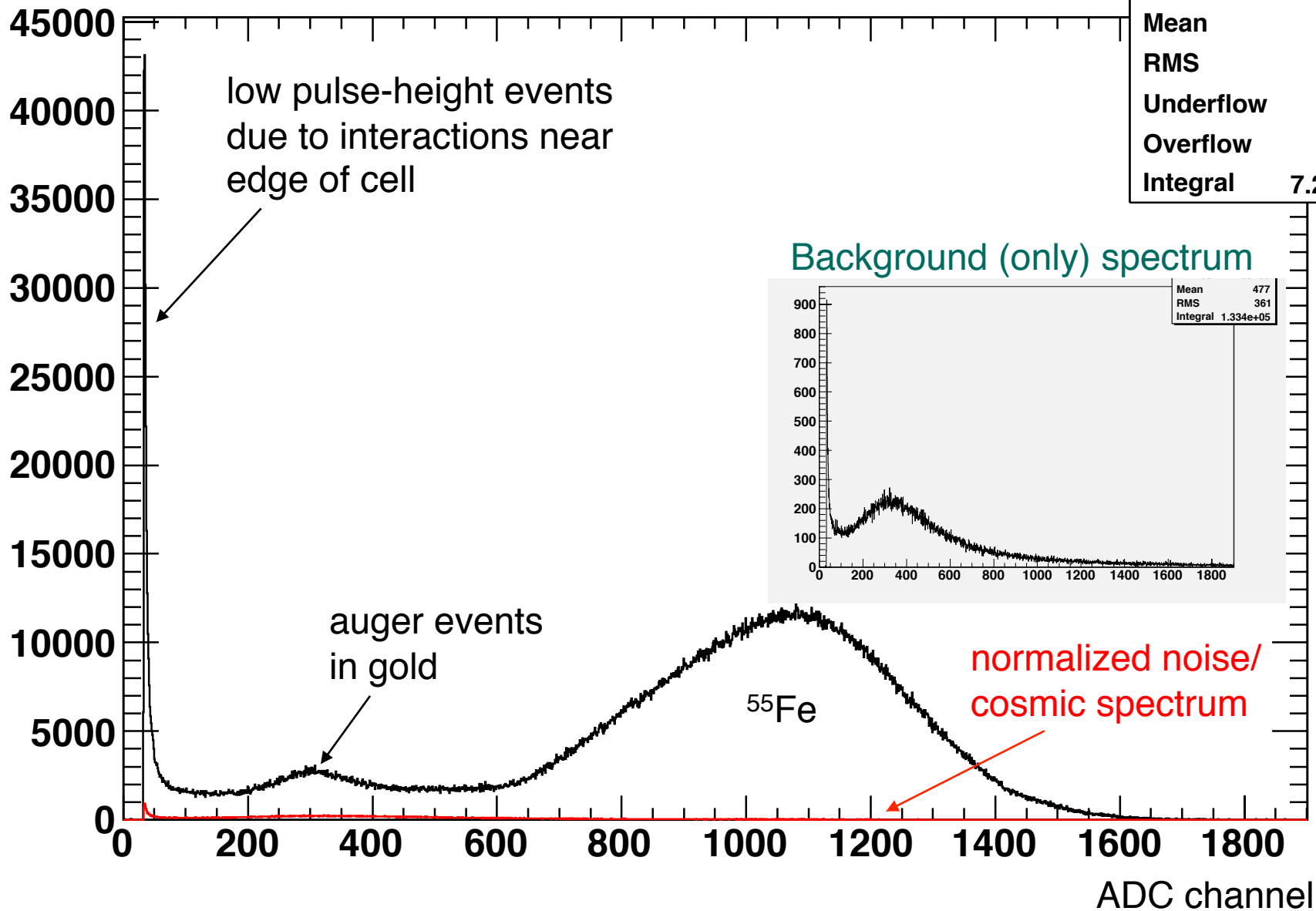
Bottom section of the left rack containing a blue and red electronic module with multiple analog meters and control knobs.

Top section of the right rack containing a red and silver electronic module with a gauge and several control knobs.

Bottom section of the right rack containing a blue LeCroy Model HF4032A High Voltage Power System with a digital display and control panel.

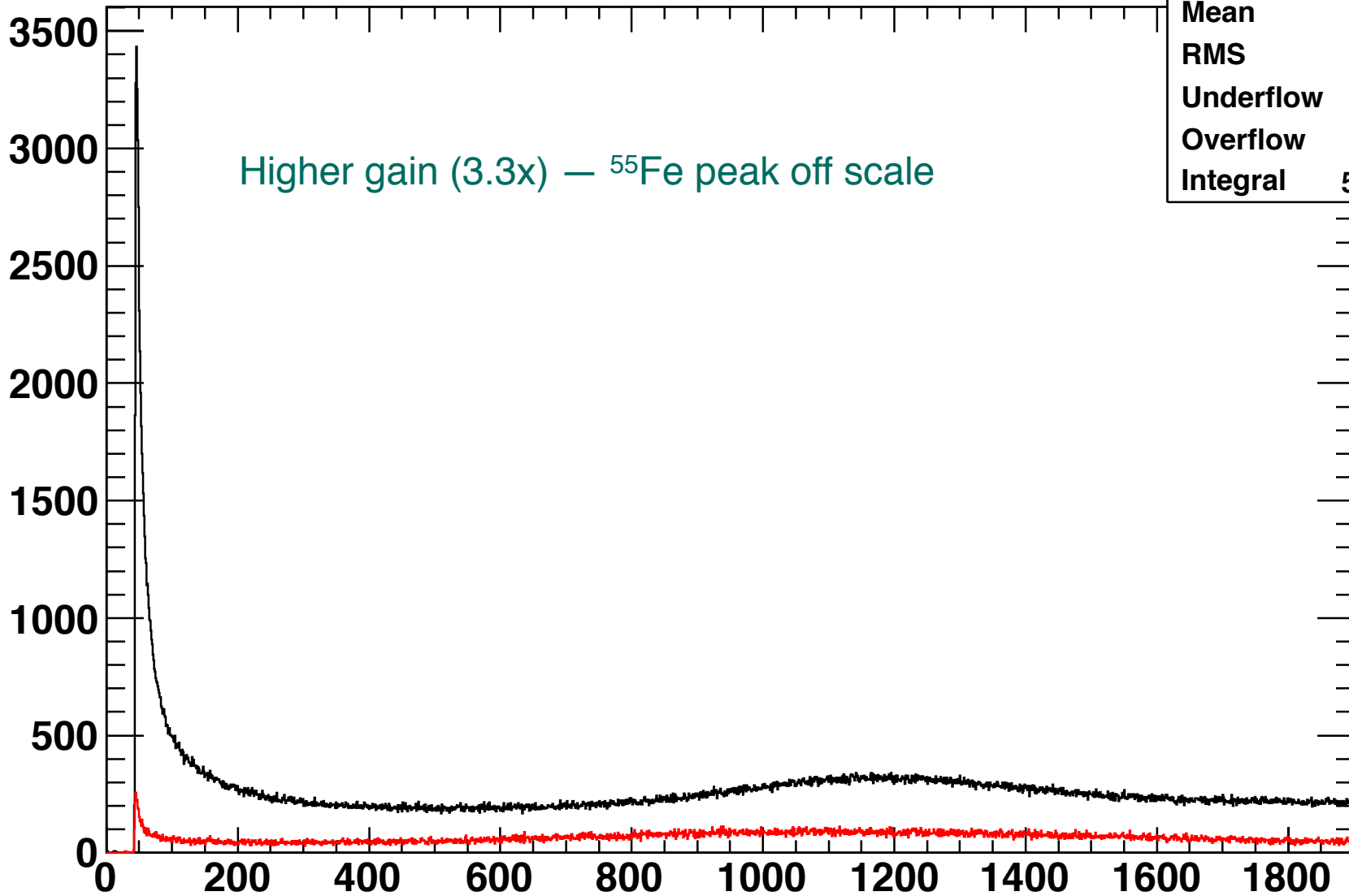


Charge collected by aging chamber in ^{55}Fe events



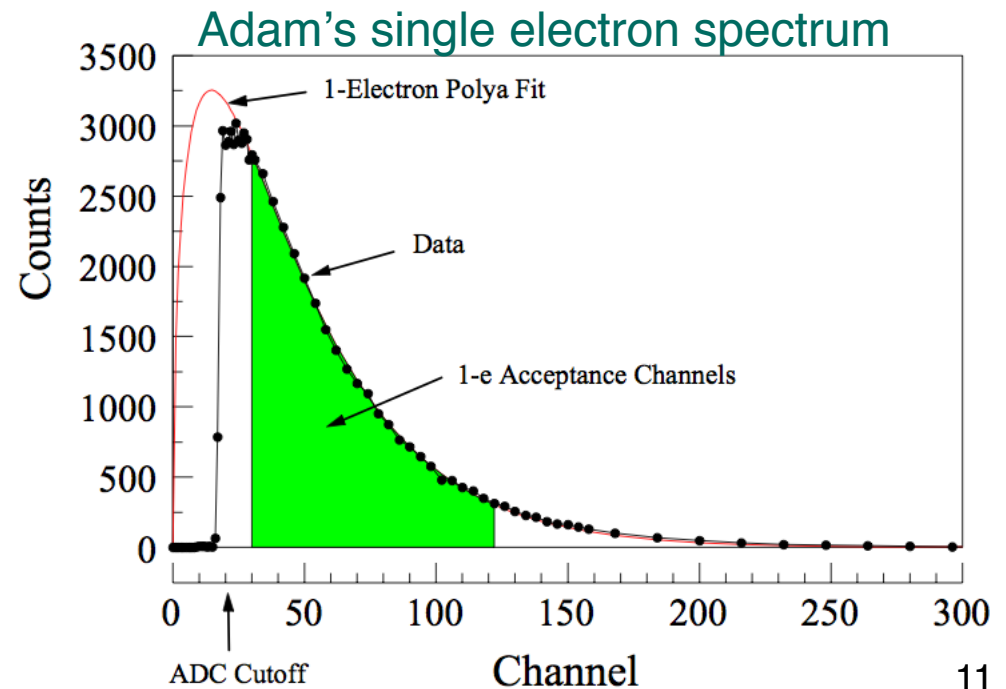
Charge collected by aging chamber in ^{55}Fe events

High Gain	
Entries	3338531
Mean	880.9
RMS	576.7
Underflow	0
Overflow	0
Integral	5.12e+05



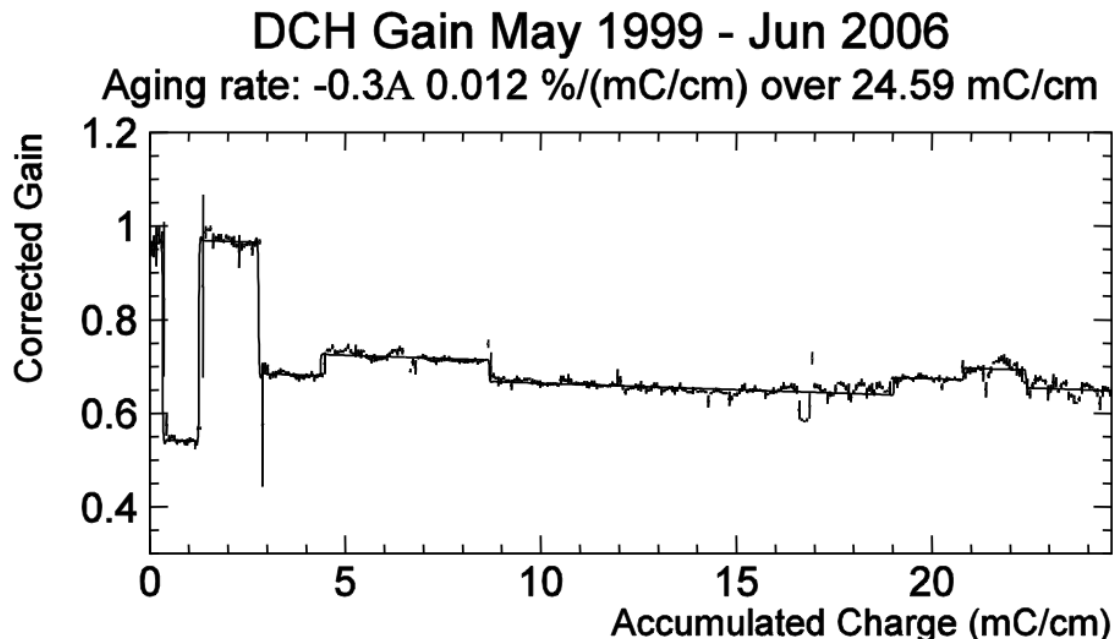
Status

- Read out is working
- Need to add picoammeter
- Do we need a lower gas flow?
- Most important: use light to produce a single e^- (only) spectrum. Requires some mechanical modifications.



Plans - I

- Adam has tested BaBar materials and gas (inc. water) to 80 mC/cm with no signs of Malter effect. Lu (Princeton) has gone to 230 mC/cm.
 - » some gain drop seen in actual chamber.

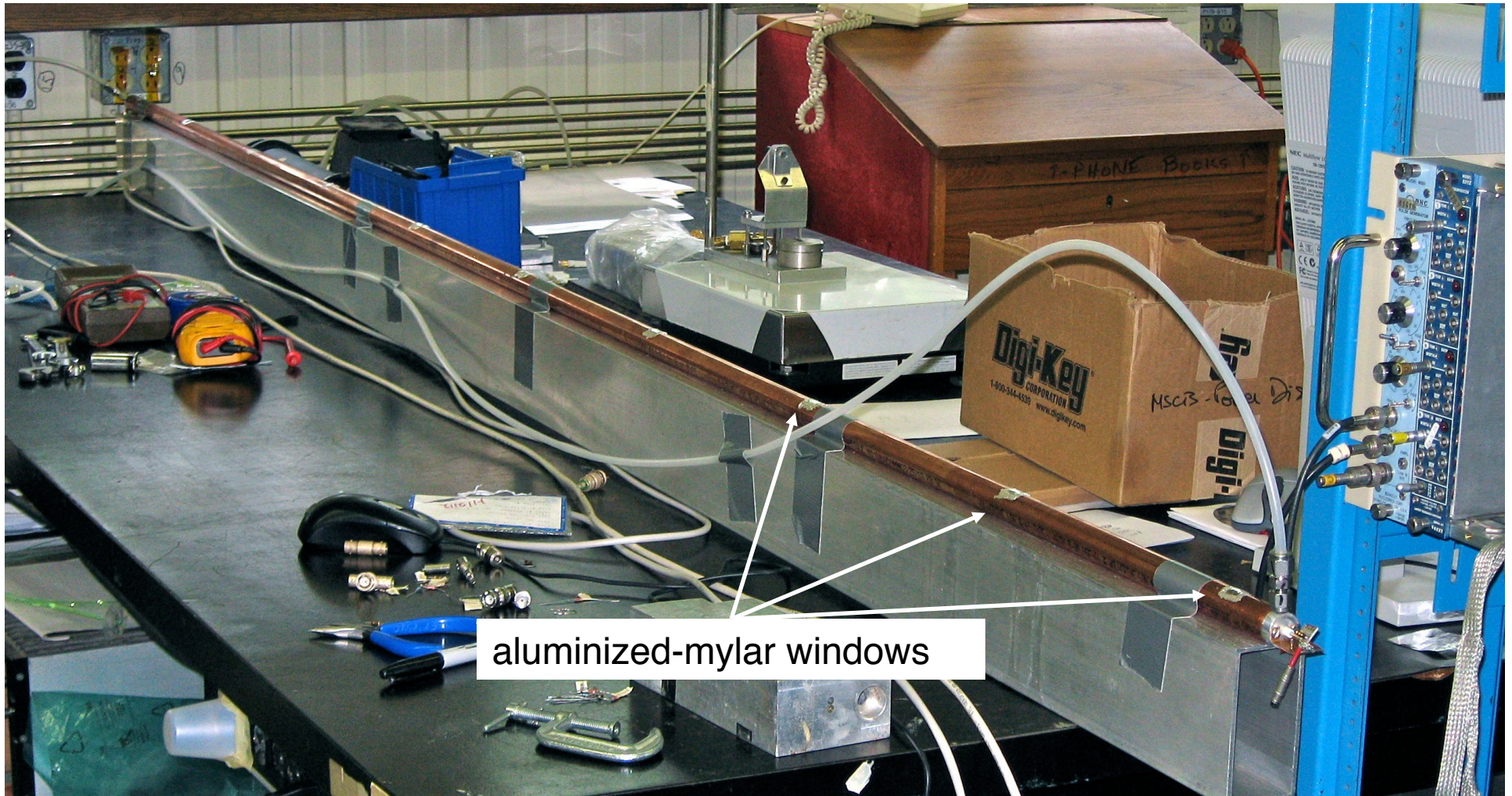


Plans - II

- Is it reasonable to track absolute gain?
 - » Adam normalized ^{55}Fe peak to bin 5500 in all cases
 - » But small drop in gain is not particularly a concern.
- Each test takes ~2 months. Test to 3x SuperB charge? 10x?
 - » do we have an estimate of the expected charge?
- Start with BaBar materials and gas.
 - » need to add a water bubbler. Or no water initially to get bigger effect?
- Then bare aluminum wire and SuperB gas.

Cluster Counting

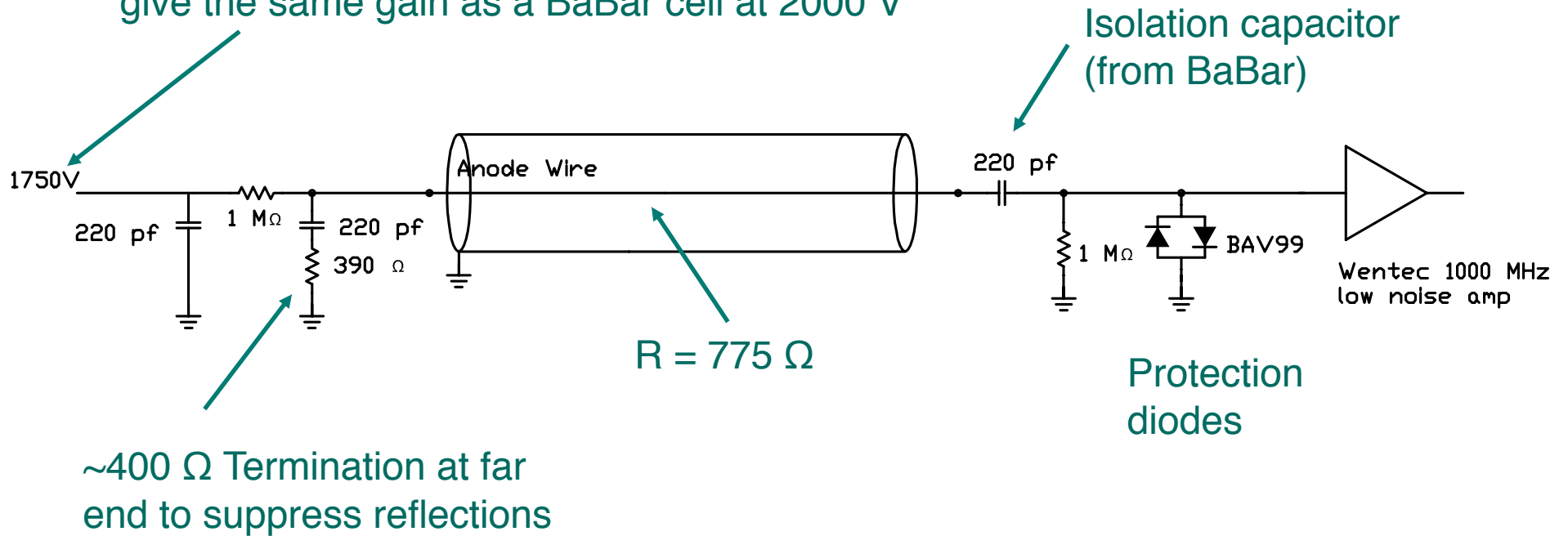
- Use a single-cell 2.7m long drift tube to test the feasibility of detecting individual clusters as they drift to the sense wire.
 - » dispersion and attenuation as a function of distance from the preamp.
- Start with ^{55}Fe , ~ 170 e $^{-}$ in BaBar gas (He:Iso 80:20, no water).



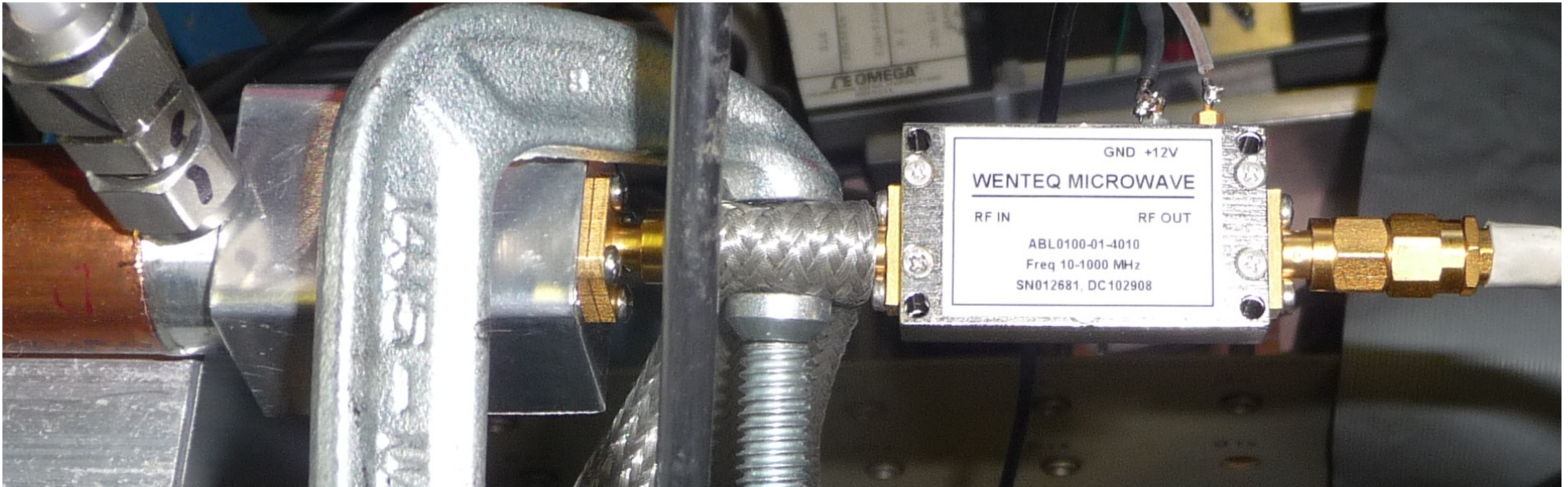
2700 mm long 19-mm diameter copper tube strung with 20 μ m gold-coated tungsten wire (Luma).

Schematic

Garfield studies (Philip Lu) indicate that 1750V should give the same gain as a BaBar cell at 2000 V



Amplifier / DAQ



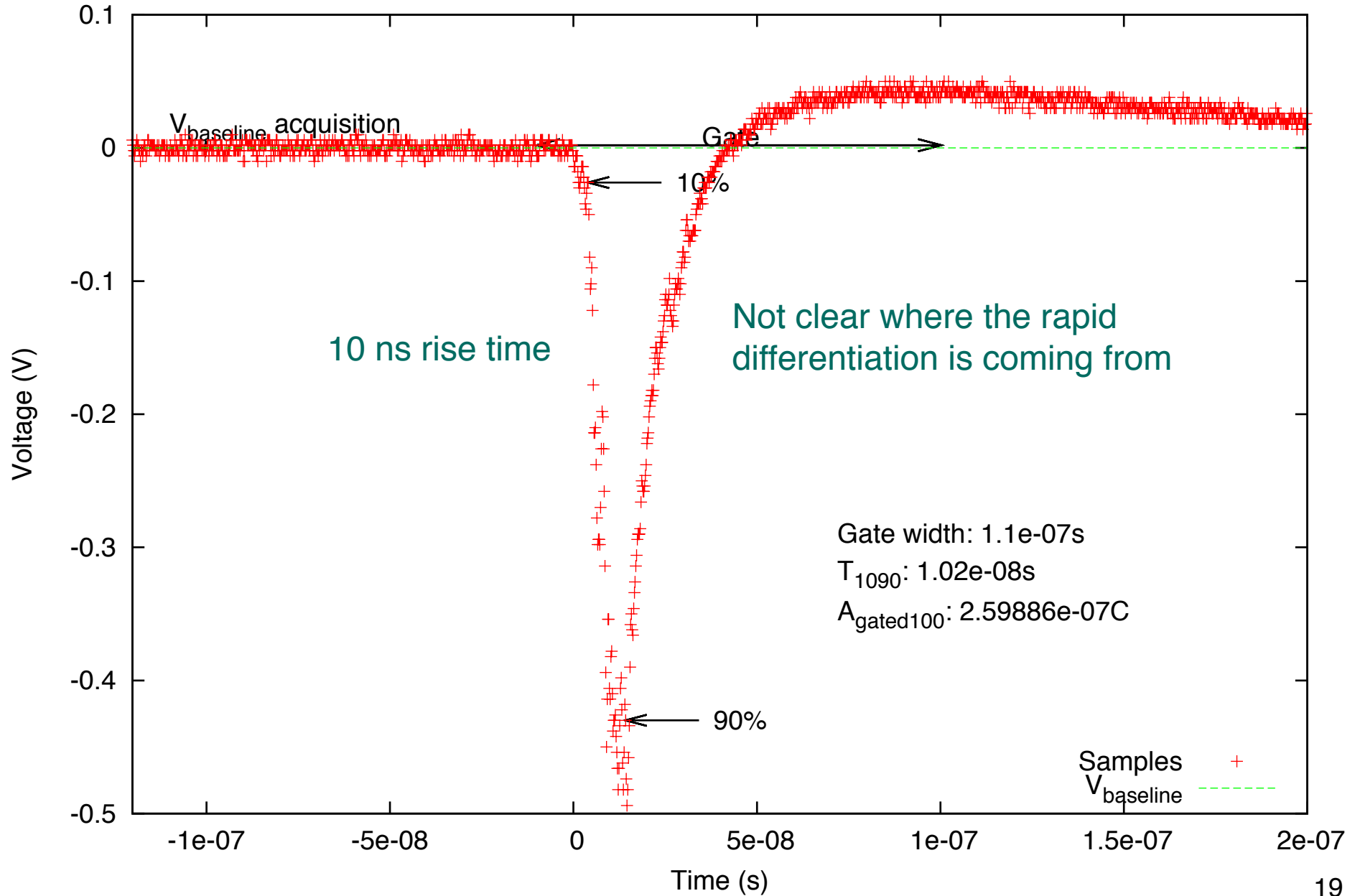
- Wenteq ABL-0100-01-4010 10–1000 MHz bandwidth, 40 dB power gain
 - » otherwise, don't really know its properties
- DAQ is 1 GHz / 4 Gs scope. 1 channel for triggering, 1 channel for readout.

Status

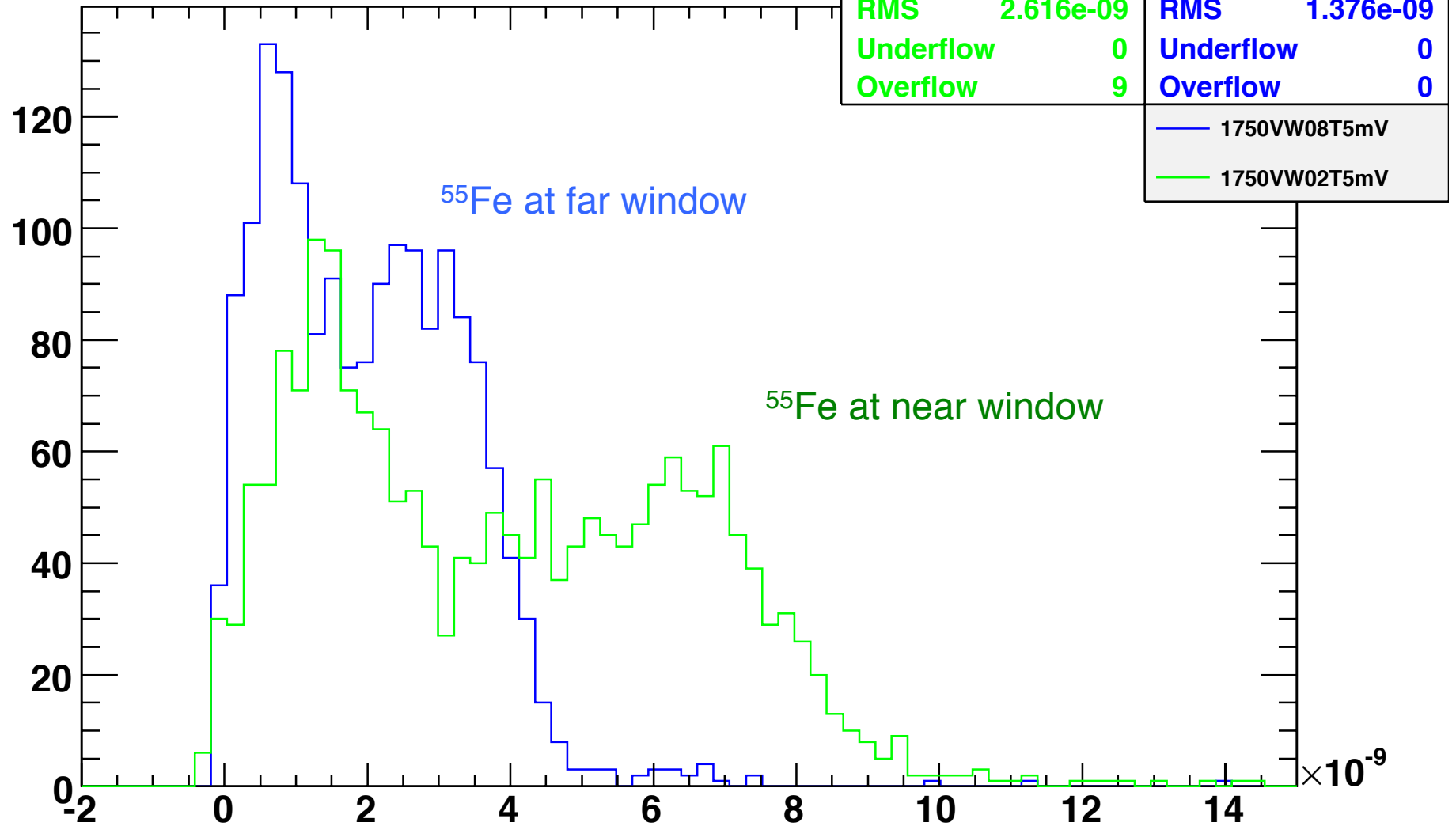
- Progress has been slow.
- It has been difficult to get a trigger / DAQ system that is adequate. We do not have a preamp designed for this purpose.
- Noise is not adequately controlled – still sensitive to environmental pickup, despite the tube being solid copper.

Sample ^{55}Fe trace, window close to amplifier

scopefiles/1750VW02T7mV/tek0400CH1.csv.gz



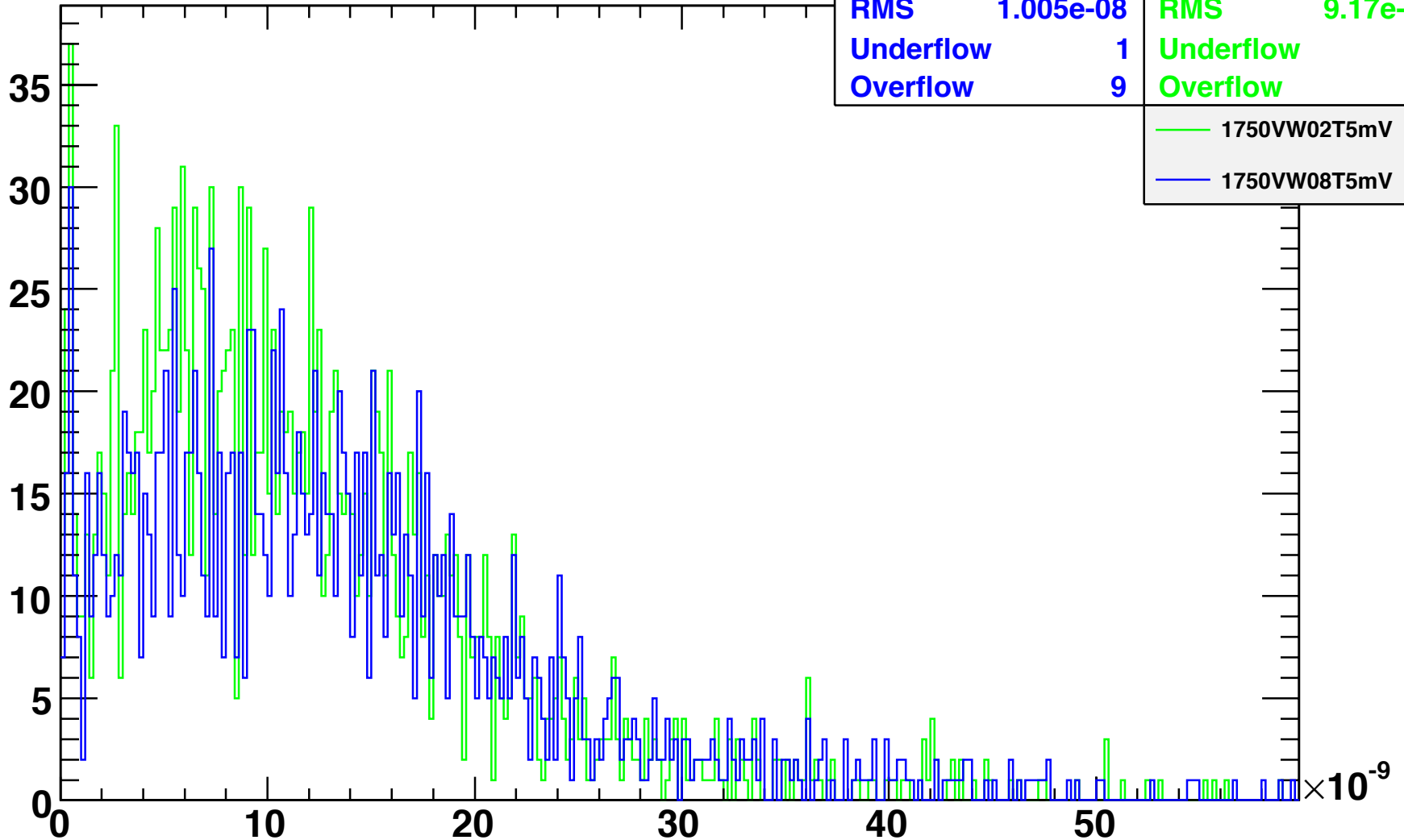
Charge in negative part of signal



- Spectrum is not what we would expect for ⁵⁵Fe.
- Attenuation is $\sim 2x$ over length of tube

Rise time from earliest 90% to earliest 10% fro

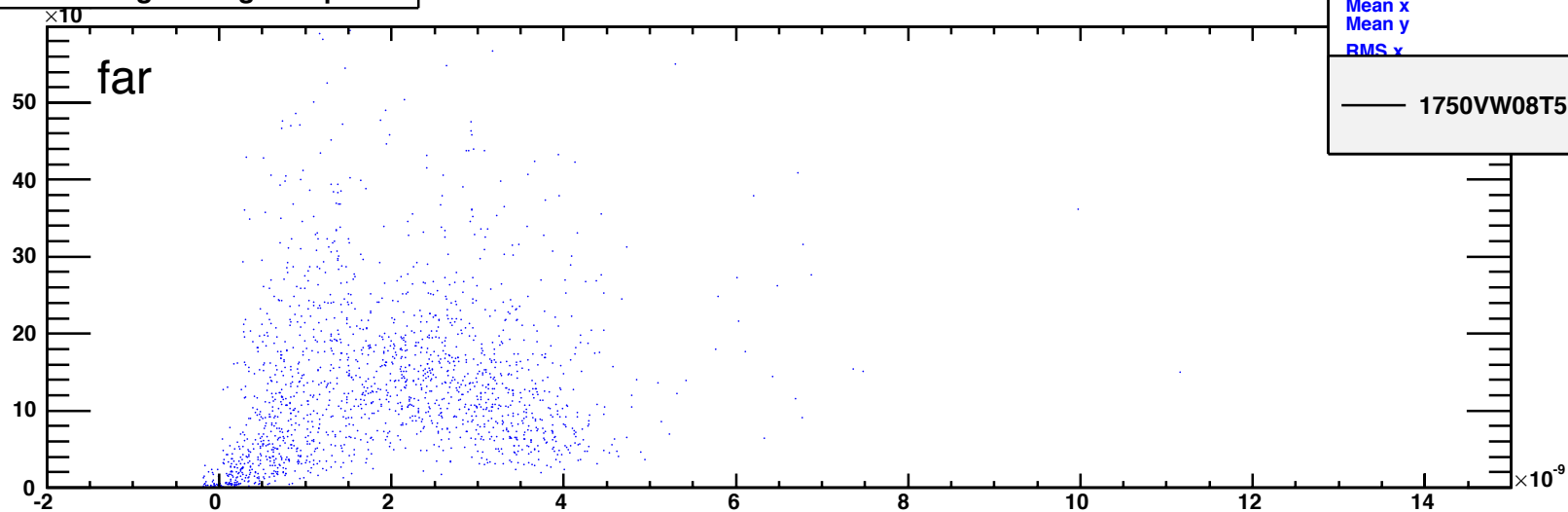
Entries	1718	Entries	1972
Mean	1.374e-08	Mean	1.216e-08
RMS	1.005e-08	RMS	9.17e-09
Underflow	1	Underflow	0
Overflow	9	Overflow	7
— 1750VW02T5mV			
— 1750VW08T5mV			



- Rise time of signal does not depend distance from amplifier. May be dominated by dispersion in arrival time at sense wire.

Rise time vs charge for far and near windows

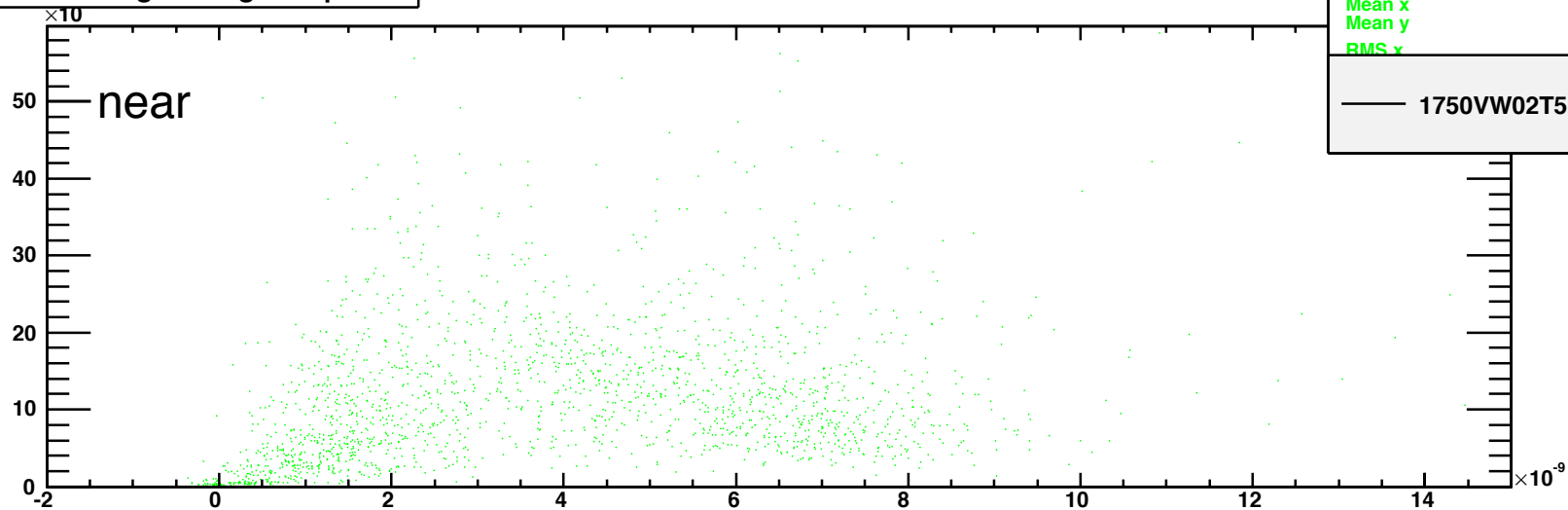
Rise time and charge in negative pulse



Entries	1718
Mean x	1.993e-09
Mean y	1.374e-08
RMS x	1.343e-09

— 1750VW08T5mV

Rise time and charge in negative pulse



Entries	1972
Mean x	3.924e-09
Mean y	1.21e-08
RMS x	2.615e-09

— 1750VW02T5mV

Next steps

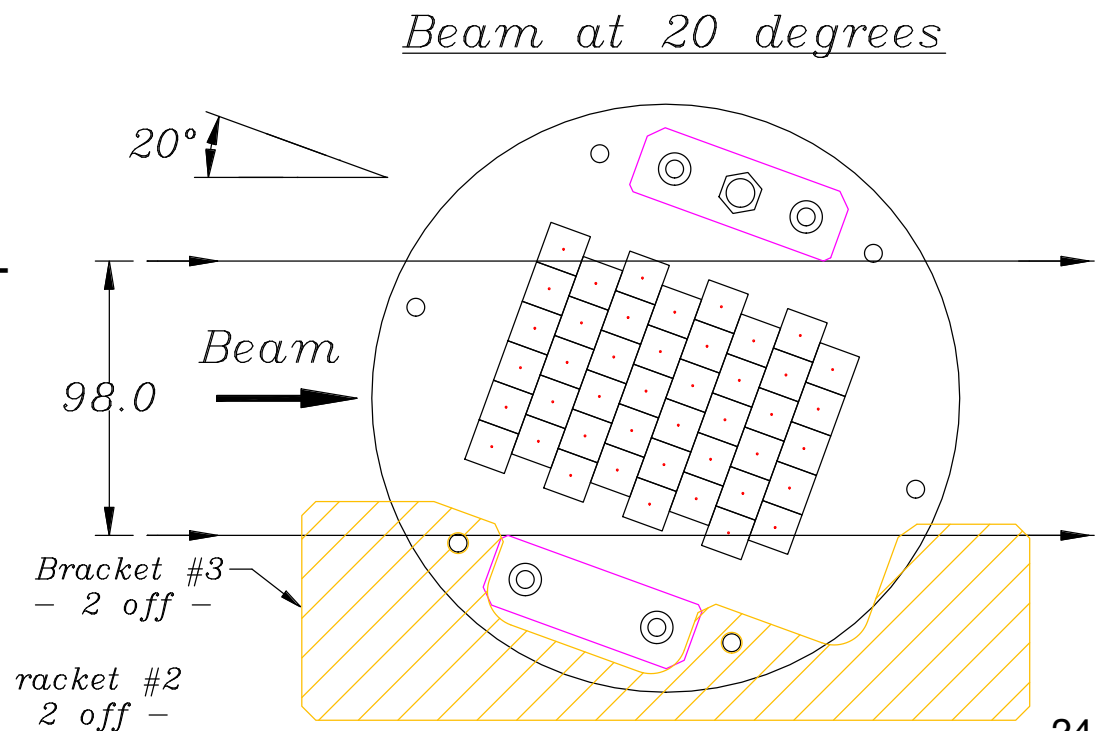
- We are building a similar tube for Mike Roney at Victoria for preamp studies.
- We need to understand amplifier properties. A preamp built for this purpose would be great.
- In the long run, move towards using a UV laser to generate pulses. Allows for small pulses and provides an external trigger.

Large Prototype

- 2.7 m long; 44 square cells, 15 mm square, 3 field wires per sense wire, plus surrounding cells for field shaping.

Drawings by R. Henderson

<http://bblab.triumf.ca/~hearty/Super-B-DCH/Prototype/Prototype-1h.dwg>



Status

- On hold
 - » our grant request for capital was not funded
 - » await cluster counting results from single drift tube
- We had tentatively requested test beam time this fall, but have released it.
- If cluster counting does not seem feasible, we may still want a large prototype with final cell design for testing front-end electronics.
 - » like BaBar proto-II
- We have required materials and tools in hand.