PMT Testing - Ringing in Shaper

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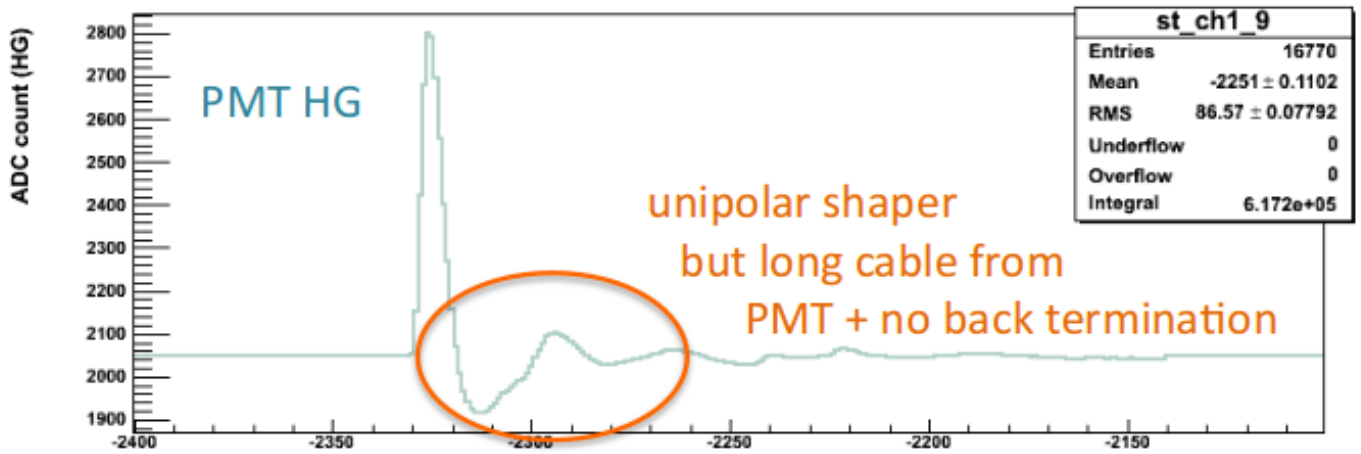
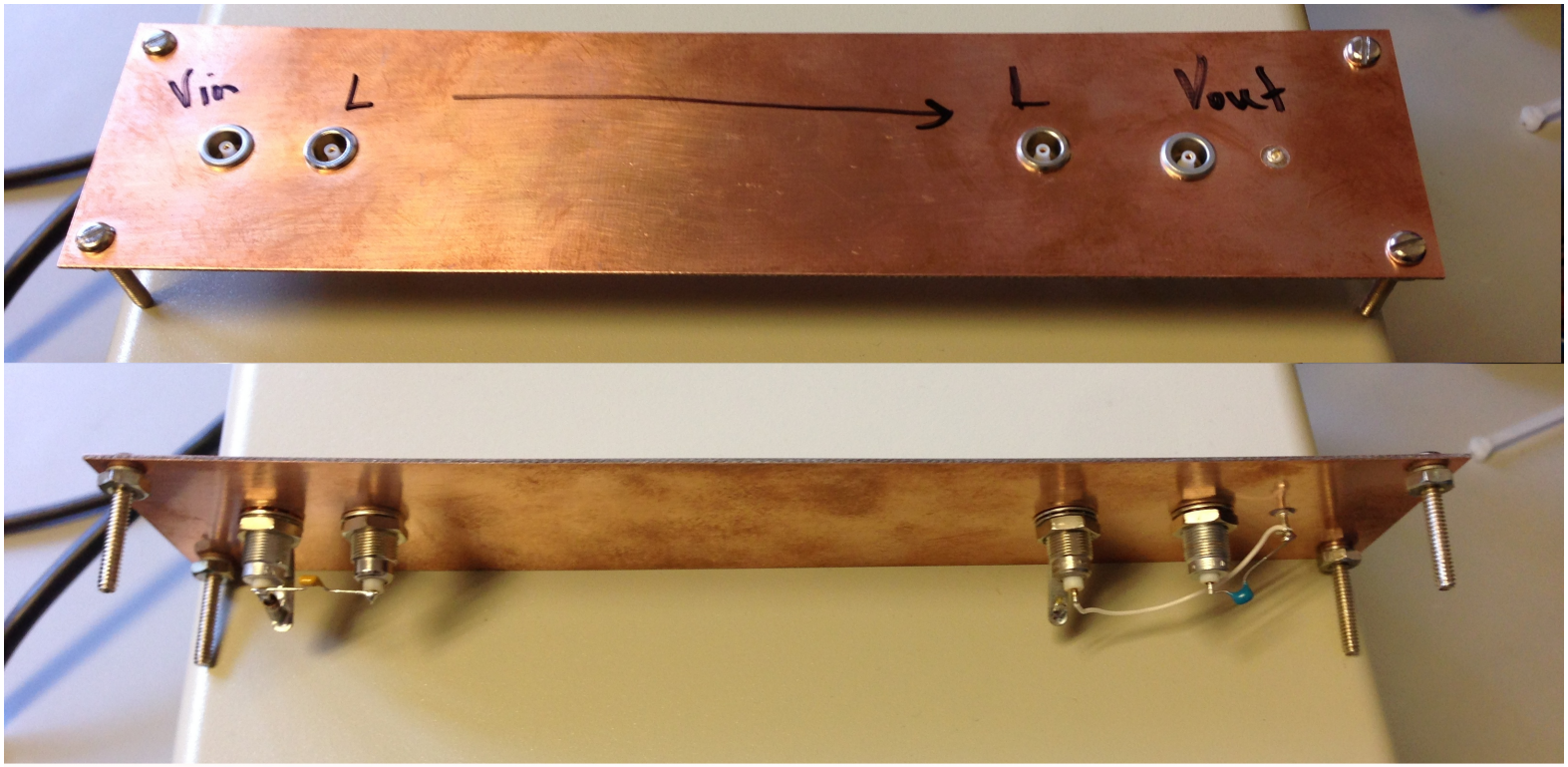
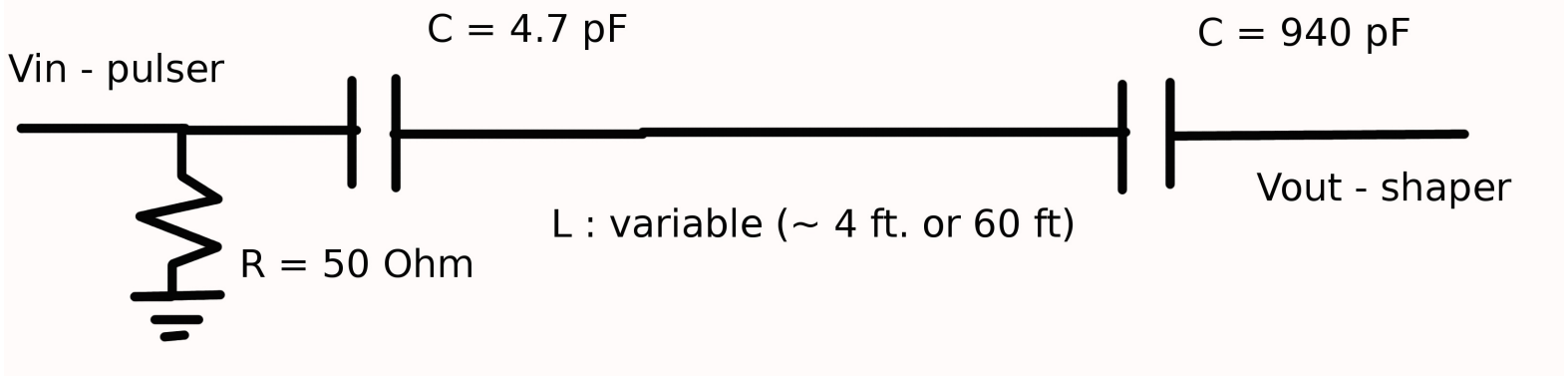
Motivation

- Some background info: DocDC 2600 (Georgia)
- In short: Bo sees "ringing" in the PMT output from the shaper.
- Possible reason: output cable length too long $\rightarrow$ Bill's simulation points to this and we verified it with a "toy" circuit.



Our Setup


Vin
L
L
Vout


C = 4.7 pF
C = 940 pF
Vin - pulser
Vout - shaper
L : variable (~ 4 ft. or 60 ft)
R = 50 Ohm

What Are We Looking For?

The capacitor + resistance (50 Ω for both lengths) forms an RC circuit. This sets the timescale for voltage variations:

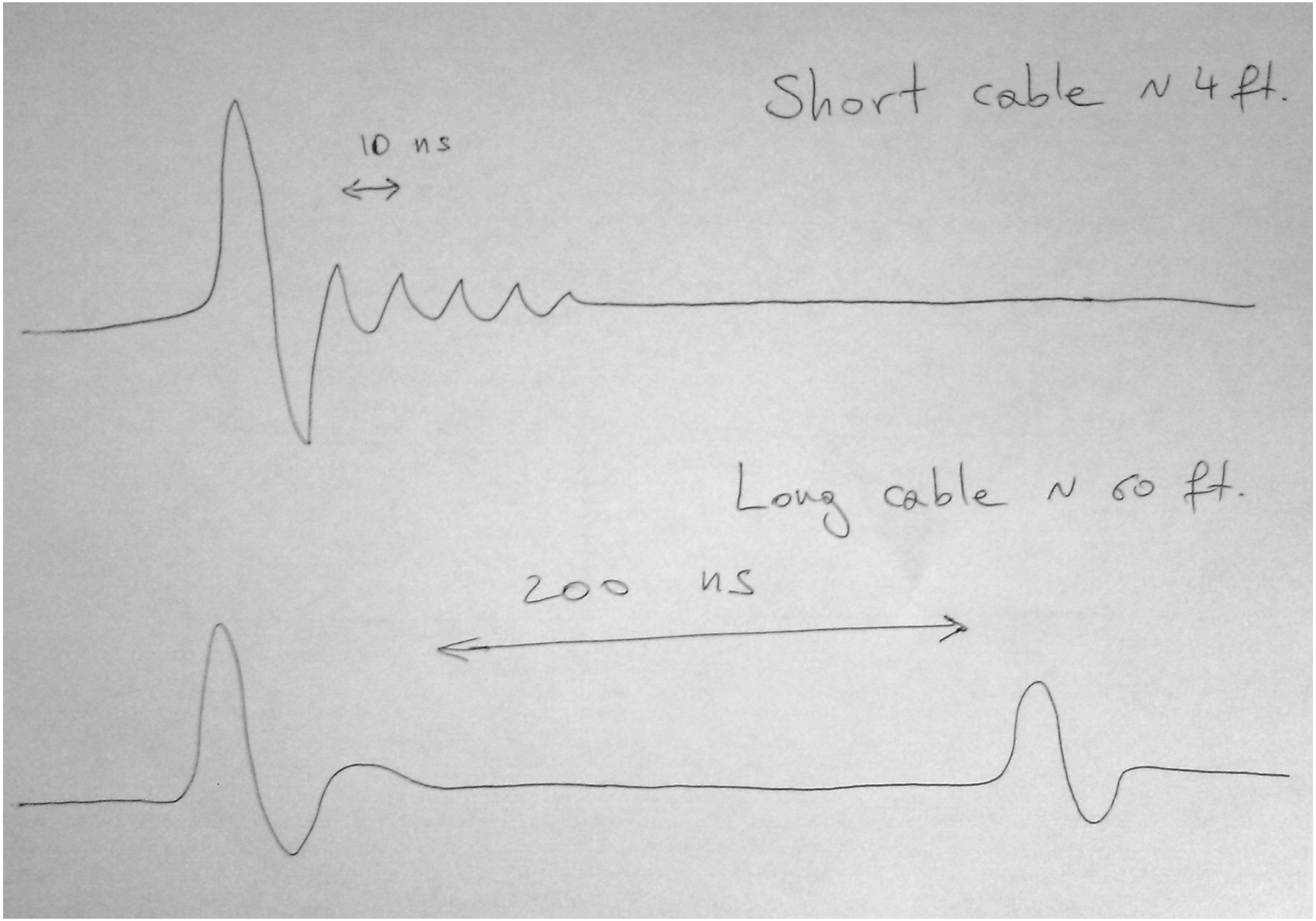
$$\tau_{\mathrm{circuit}} = \mathrm{RC} = 50\,\Omega\,940\,\mathrm{pF} = 47\,\mathrm{ns} \tag{1}$$

This time need to be compared with the time-scale for ringing in the circuit, i.e. how long does it take the signal to bounce back and forth in the wire?

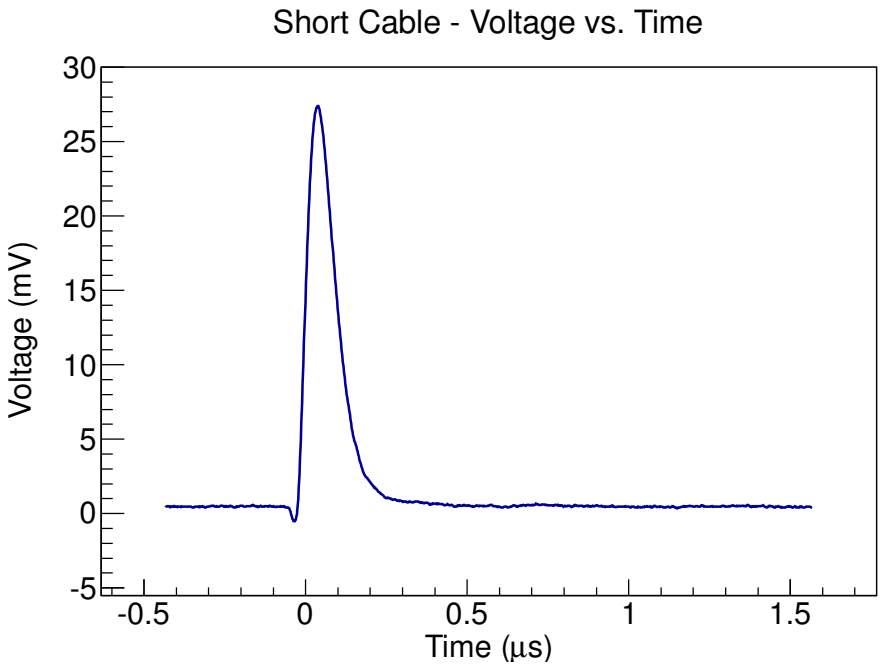
$$\mathrm{v}_{\mathrm{signal}} = 150\,\mathrm{ns}/100\,\mathrm{feet} \rightarrow \tau_{\mathrm{short}} = 6\,\mathrm{ns} \;\; \tau_{\mathrm{long}} = 90\,\mathrm{ns} \tag{2}$$

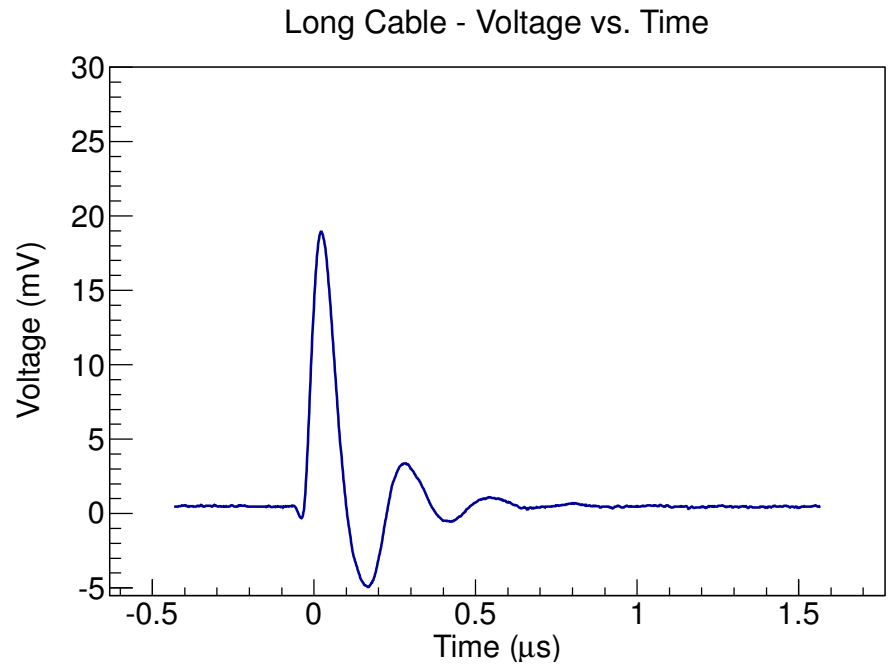
No ringing for $\tau_{\mathrm{circuit}} \gg \tau_{\mathrm{wire}}$

Circuit Output Signal, Without Shaper



Results





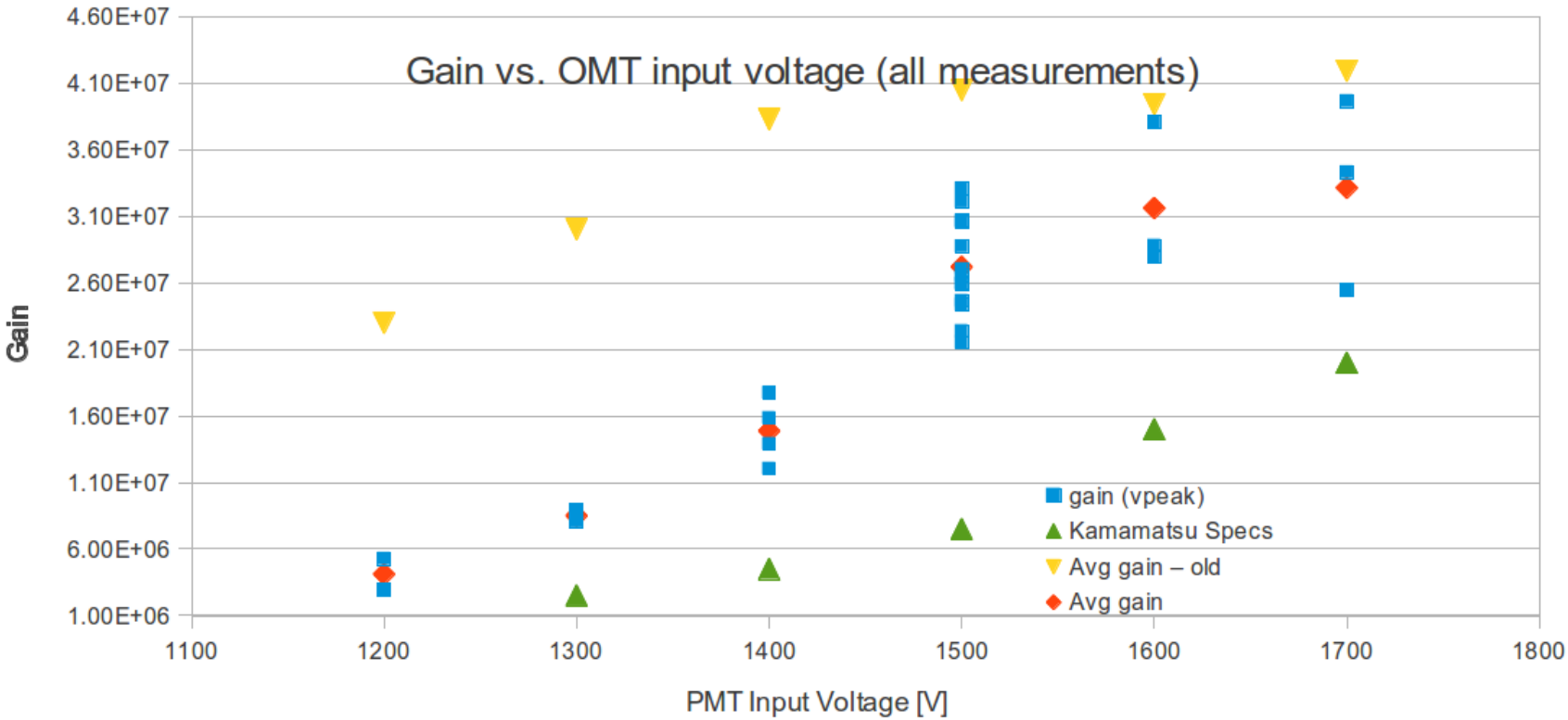
Looking at the output signal from the shaper. This agrees with the idea that the long cable is responsible for the ringing.

Reflections get integrated by shaper and cause wiggles if they do not happen within the pulse (long cable).

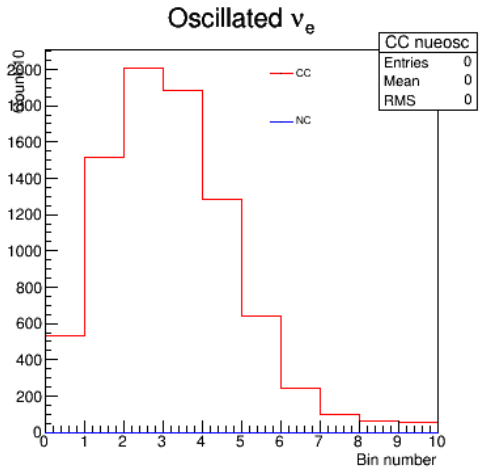
Two solutions: Increase capacitance or shorten cables.

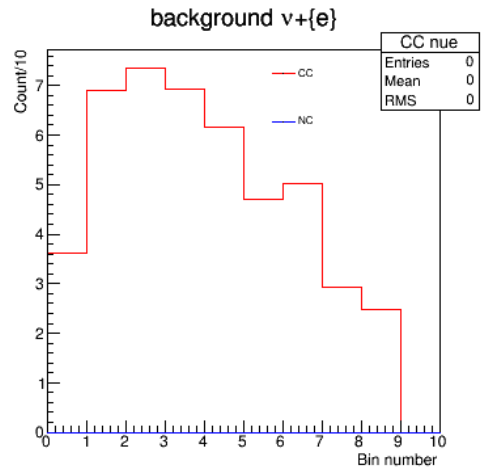
If more evidence needed could look at how the effect changes for various cable lengths.

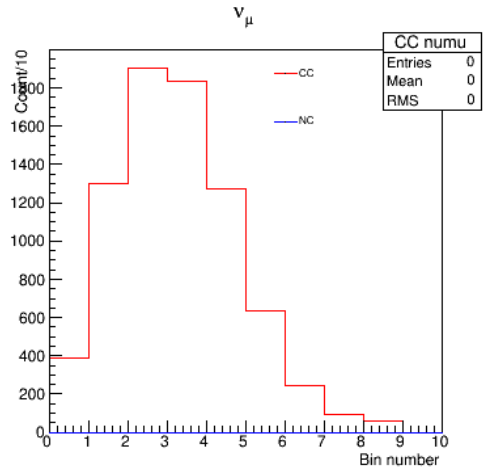
Updates From Last Week: Gain

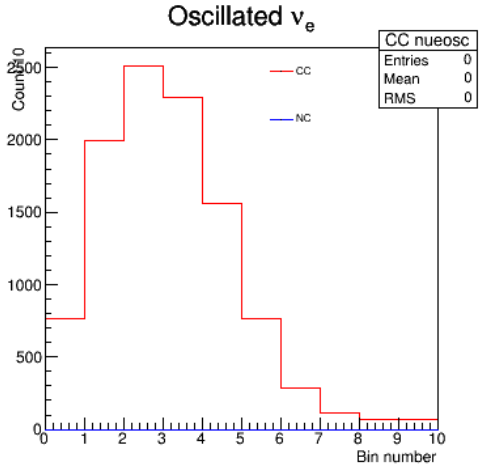


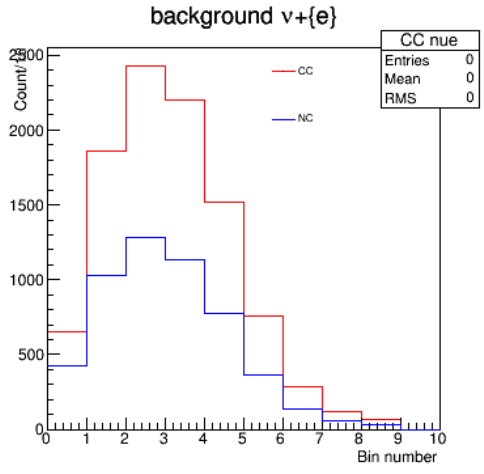
Updates From Last Week: Sensitivity

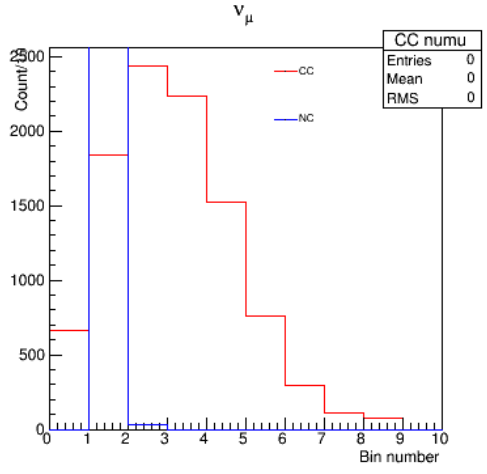




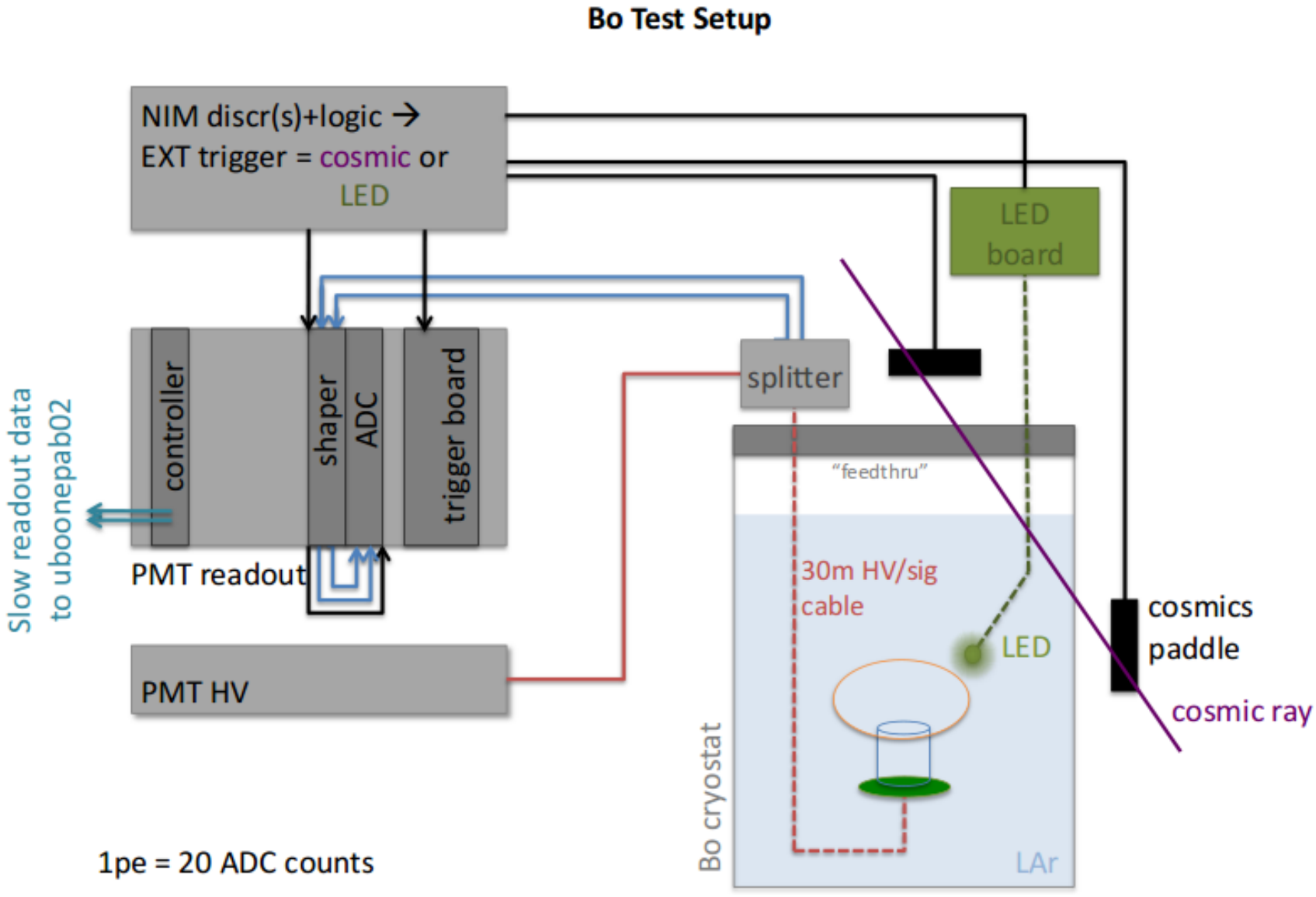








Backup - Bo Test Setup



Backup - Sensitivity Issues