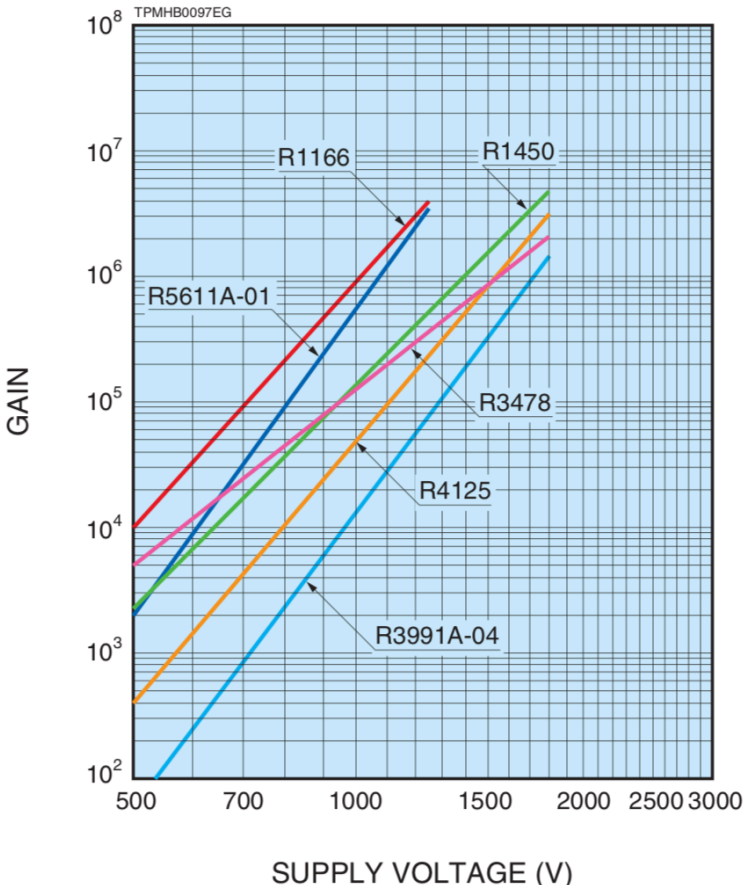
Comments related to some ERR slides

Rolf Ent and Bogdan W

June 6, 2019 meeting

R4125 gain and anode current

● **19 mm (3/4") Dia. types**



Energy flow 1 rad/s ?? use 0.1 rad/s /per 1 uA

0.1 rad/s => 10^{-6} J/s/g => 10^{-4} J/crystal
⇒ 10^{15} eV/s => 10^{6} GeV/s

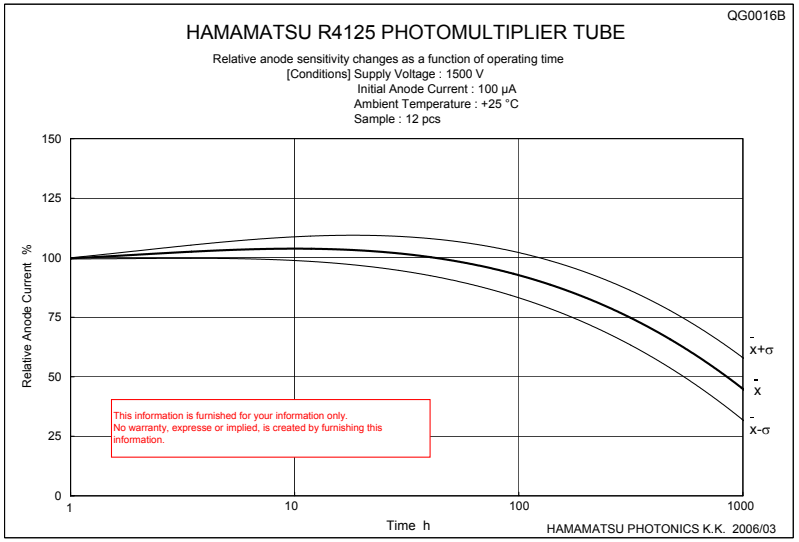
signal has 15 ph.e./MeV for NPS scintillator

⇒ 1.5 10^{10} ph.e./s in PMT gain of 10^{5}

⇒ average anode current = 250 uA

It is 2 times exceed the specs of R4125

R4125 gain and anode current



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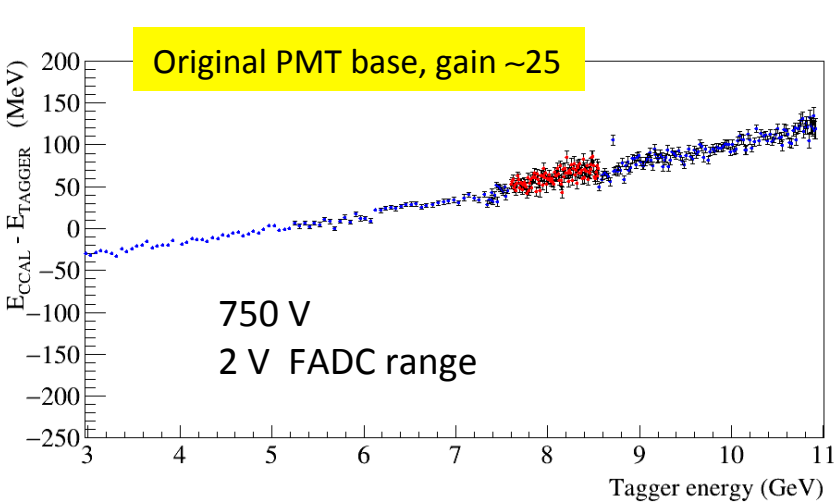
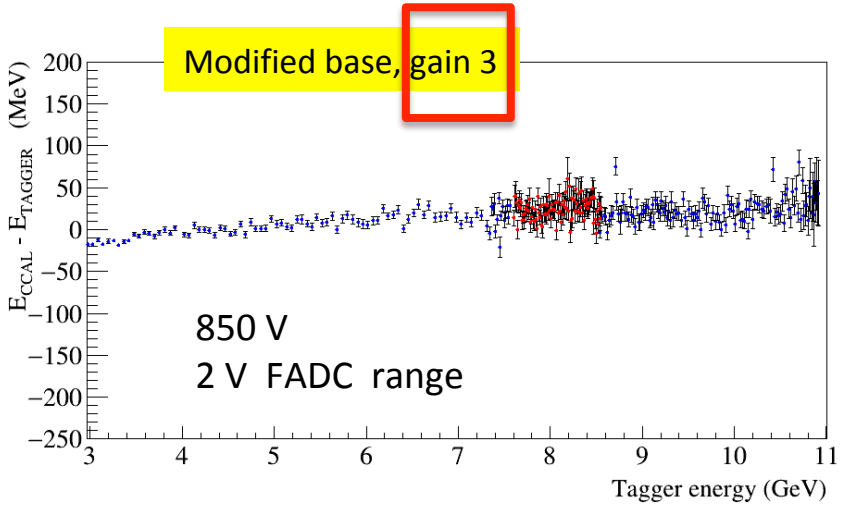
Linearity

Linearity of the FADC peak amplitude





Amplifier circuit is designed on discrete high frequency transistors and it is similar to previously published at [2] circuit. Amplifier gain is about 10 and maximum linear pulse output amplitude is about 5V on 50Ω load. This amplifier serve to compensate gain reduction at lower PMT operating voltage and allowed system operation with 10 times lower anode current without loss of overall gain and output amplitude see.

Some differences with this paper

New Photomultiplier Active Base for Hall C Jefferson Lab Lead Tungstate Calorimeter

[1]Vladimir Popov, [2]Hamlet Mkrtchyan

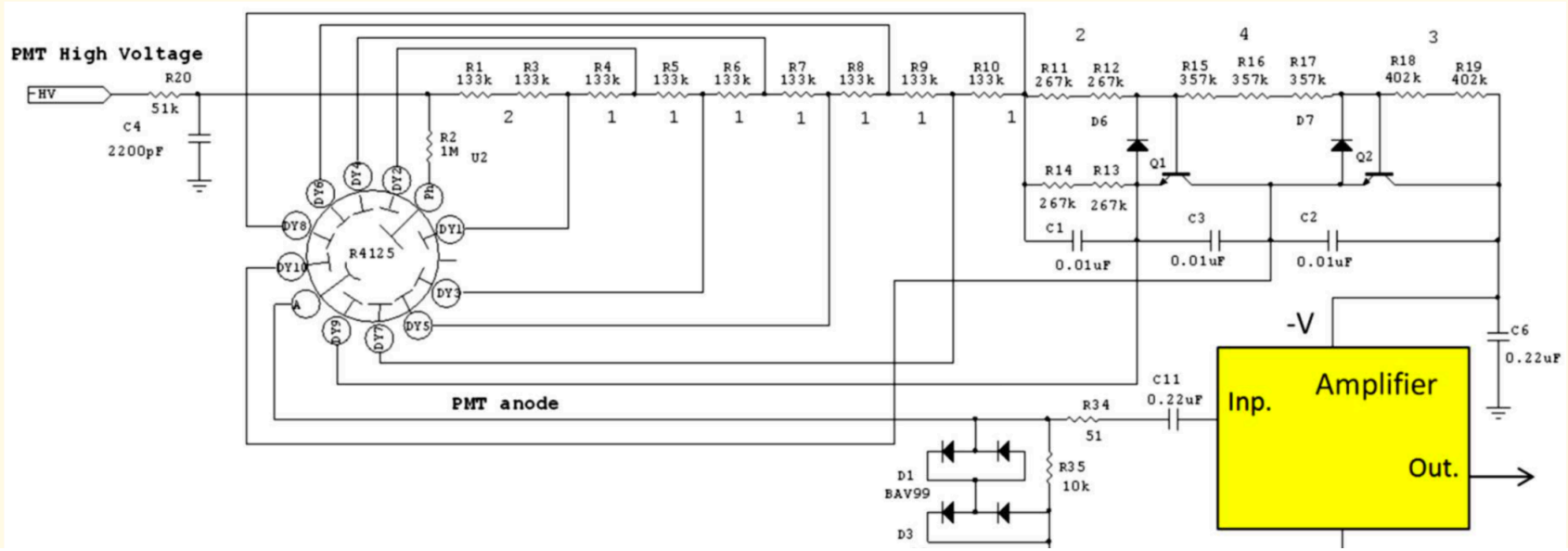
Conclusions +

- HV divider is not obvious
- Total linearity is a concern
- The anode current is a concern

Active base paper

II. ACTIVE BASE CIRCUIT OVERVIEW

R4125 is a round shape, 19mm in diameter Hamamtsu photomultiplier tube. With gain about 8.7E+5 at 1.5kV max. anode voltage, and rise time 2.5ns. New photomultiplier base is designed with the same as PrimEx experiment base voltage distribution ra-



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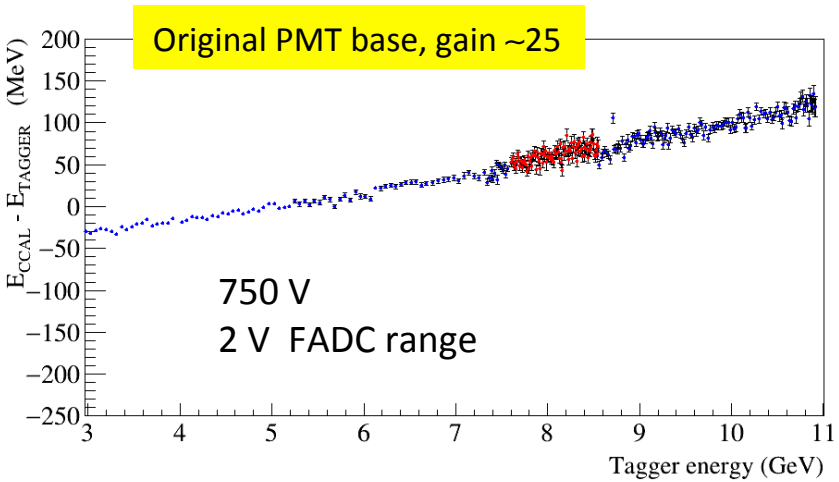

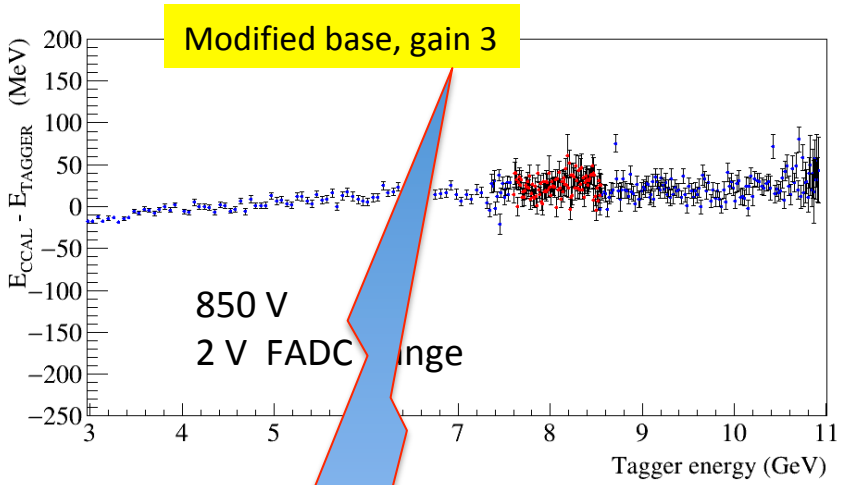

- Some non-linearities on the level of 2 – 3 % in the calorimeter respons ere observed for the original PMT base for both the peak amplitude and pulse integral

  - PMT was operated at relatively small HV, recomme HV is about 1 kV

- The linearity can be improved by reducing the amplifier gain and incr ng HV. Some tuning of the PMT base may be required

Is it a low gain amplifier. Why to use it?

PMT handbook

The Photomultiplier Handbook

A. G. Wright

13.8.4 Shorting dynodes

Shorting dynodes is considered when it is discovered that light levels are higher than expected and a given PMT has too many stages. The possible consequences of operating at low gain, and hence low interdynode voltages, are a sluggish time response, gain that is sensitive to small changes in HV, and poor linearity. The best advice is to replace the PMT with one of fewer stages; the alternative is to short a set of consecutive dynodes to the anode. This may prove to be the only option, since the available choice of PMTs with fewer than six stages is very limited.

The configuration in Fig. 13.31(a) is customarily adopted, although it is the least desirable way of reducing the number of active dynodes, regarding linearity and speed of response. The arrangement in Fig. 13.31(b) attempts to mimic a

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