

Prad Calibration Update

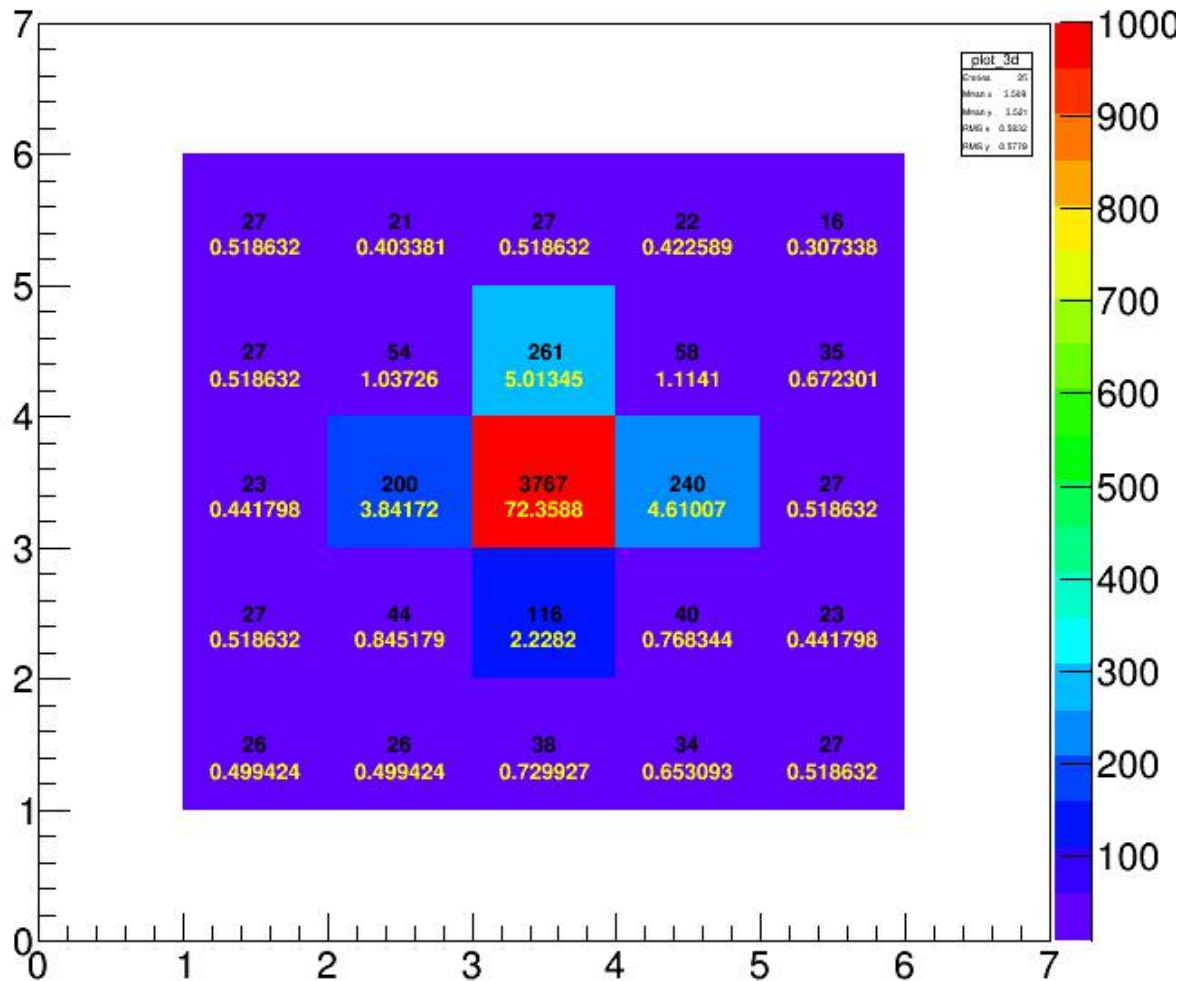
PRad weekly meeting

Li Ye

Mississippi State University

2016-11-11

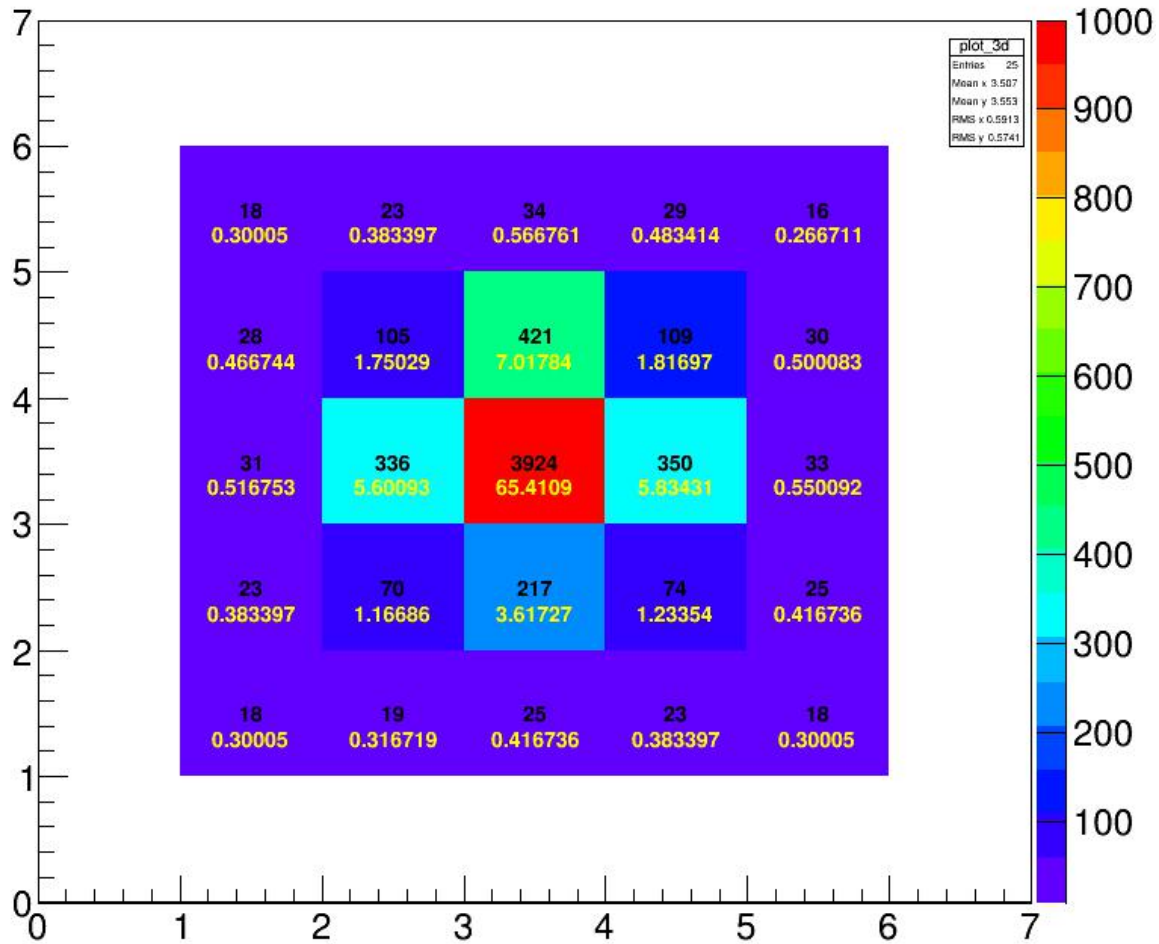
G65 cluster ADC distribution 900 MeV



Black number is ADC value of module

Yellow number is percentage of Cluster ADC value

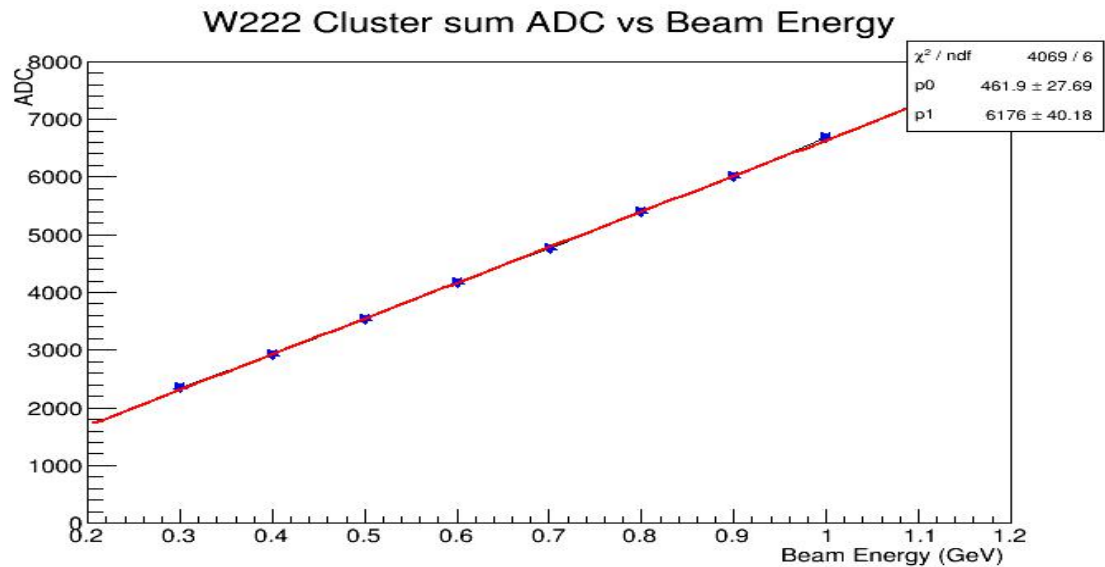
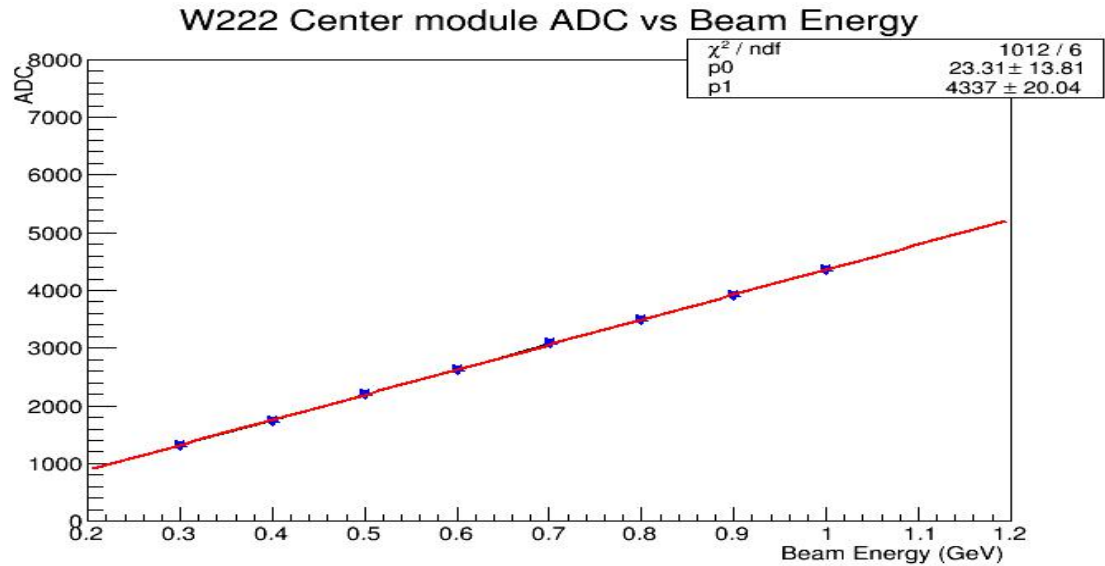
W222 cluster ADC distribution 900 MeV



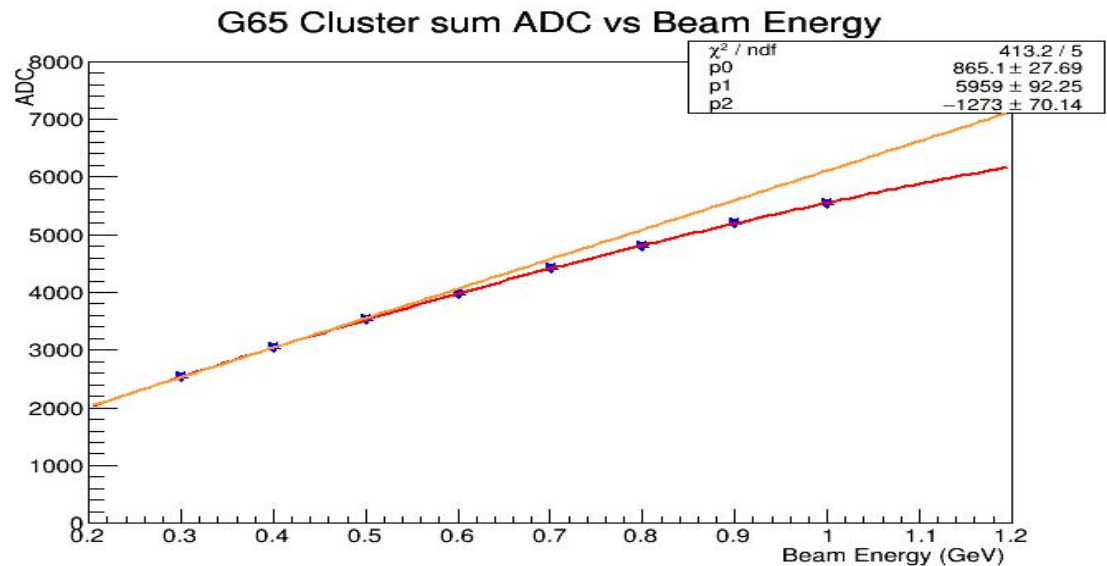
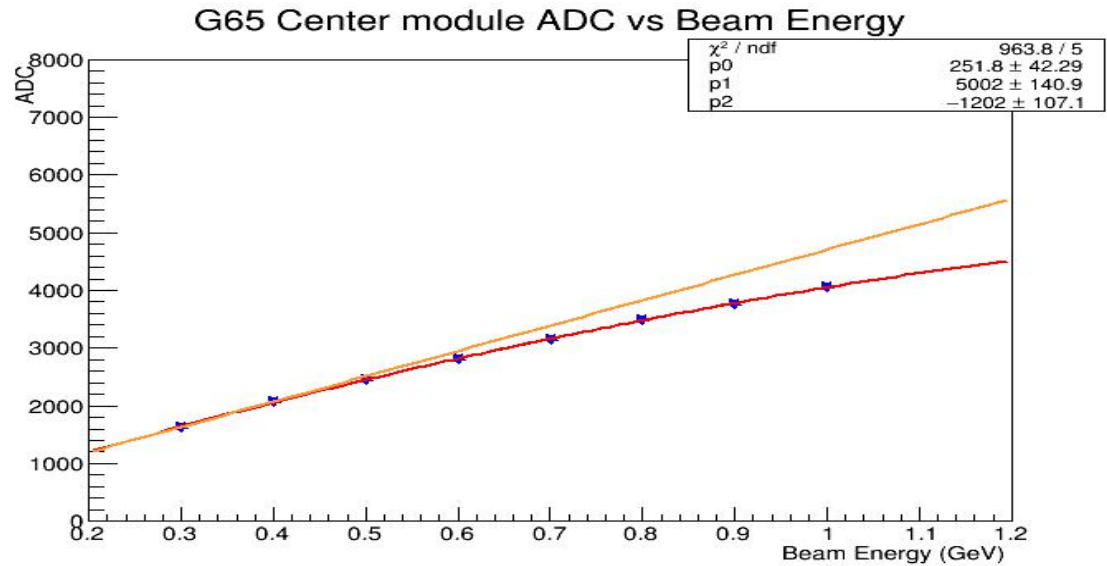
Black number is ADC value of module

Yellow number is percentage of Cluster ADC value

- Both center module ADC value and Cluster sum ADC value have linear relation with beam energy, indicate that the gain factor is a constant for PbWO4 modules.



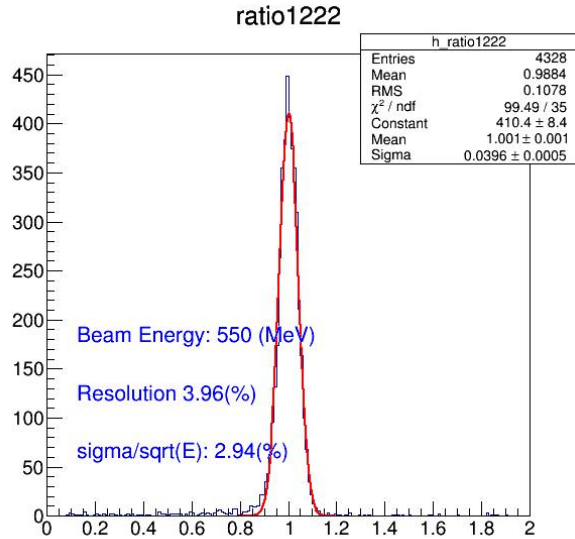
- Both center module ADC value and Cluster sum ADC value have non-linear relation with beam energy, indicate that the gain factor is not a constant for Lead Glass modules.



Non-linearity in Calibration Run (PbWO4)

ratio = E_{rec} / E_{beam} ,

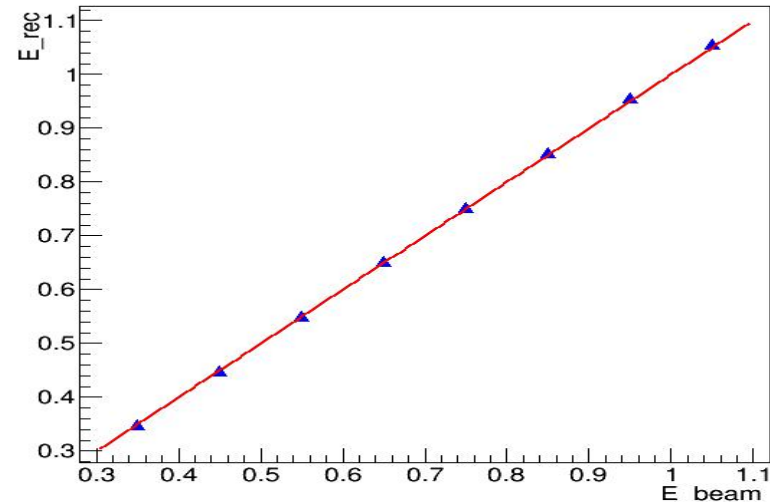
where E_{rec} is HyCal reconstruct energy



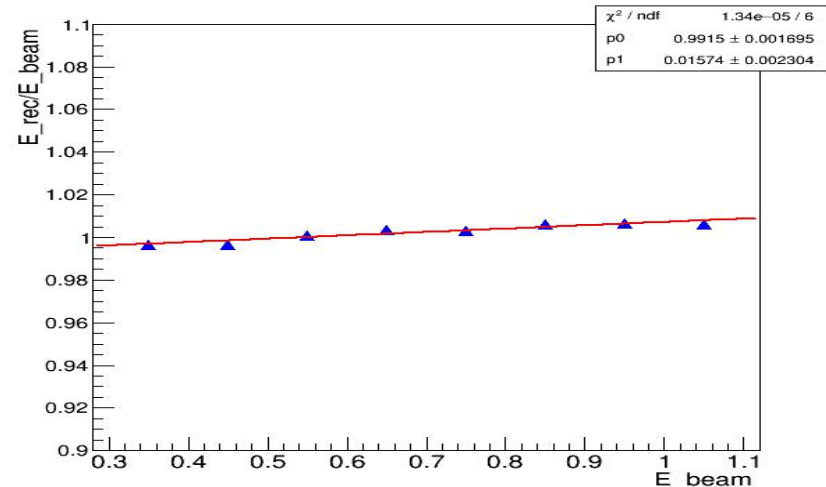
Example of PbWO4 (W222)

- If shower depth is larger for higher energy, it has higher light collection efficiency.
- Gain factor based on 550MeV, so 1GeV E_{rec} will be larger than E_{beam} , opsite for 0.3GeV case.
- Alpha constant (slope of ratio vs E_{beam}) will be positive.

E_{rec} vs E_{beam}



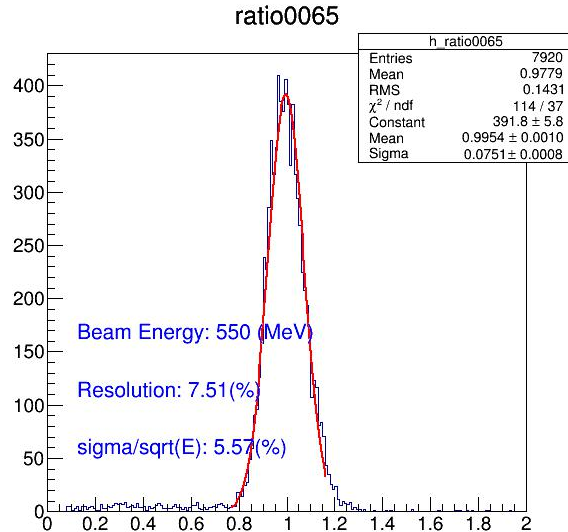
E_{rec}/E_{beam} at different energies



Non-linearity in Calibration Run (Lead Glass)

ratio = E_{rec} / E_{beam} ,

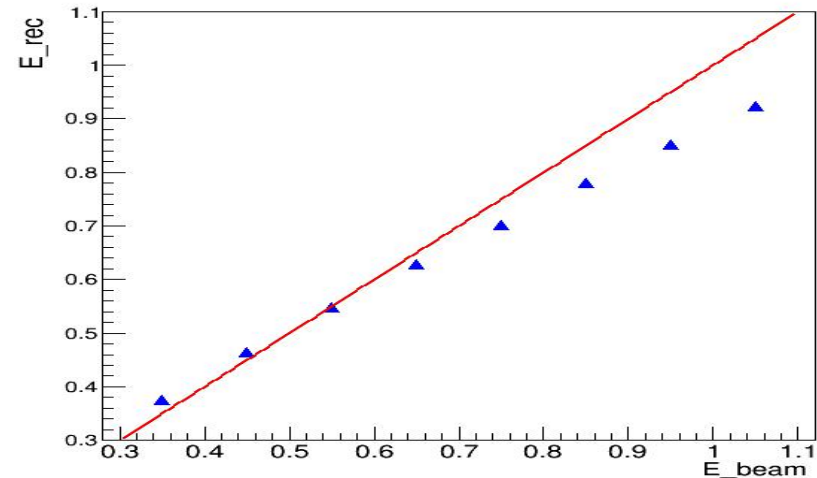
where E_{rec} is HyCal reconstruct energy



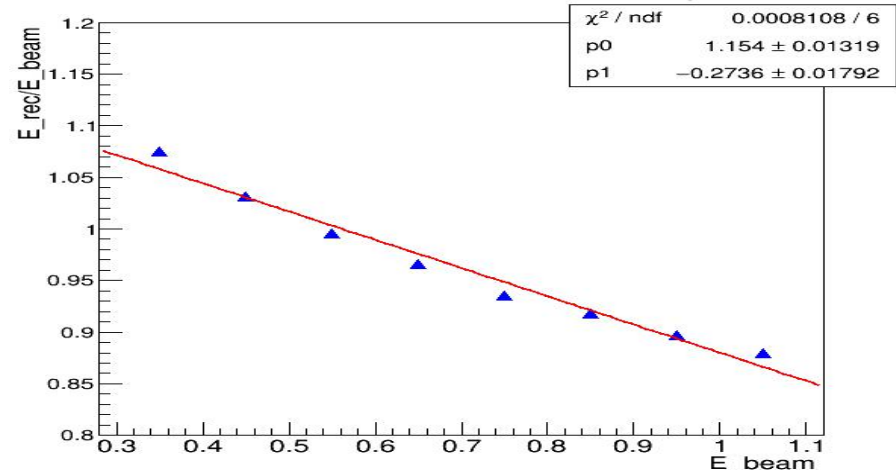
Example of Lead Glass (G65)

- Lead Glass modules have large negative Alpha constant
- Shower depth can not explain that
- A possible explanation: No Booster supplies for Pb Glass modules

E_{rec} vs E_{beam}

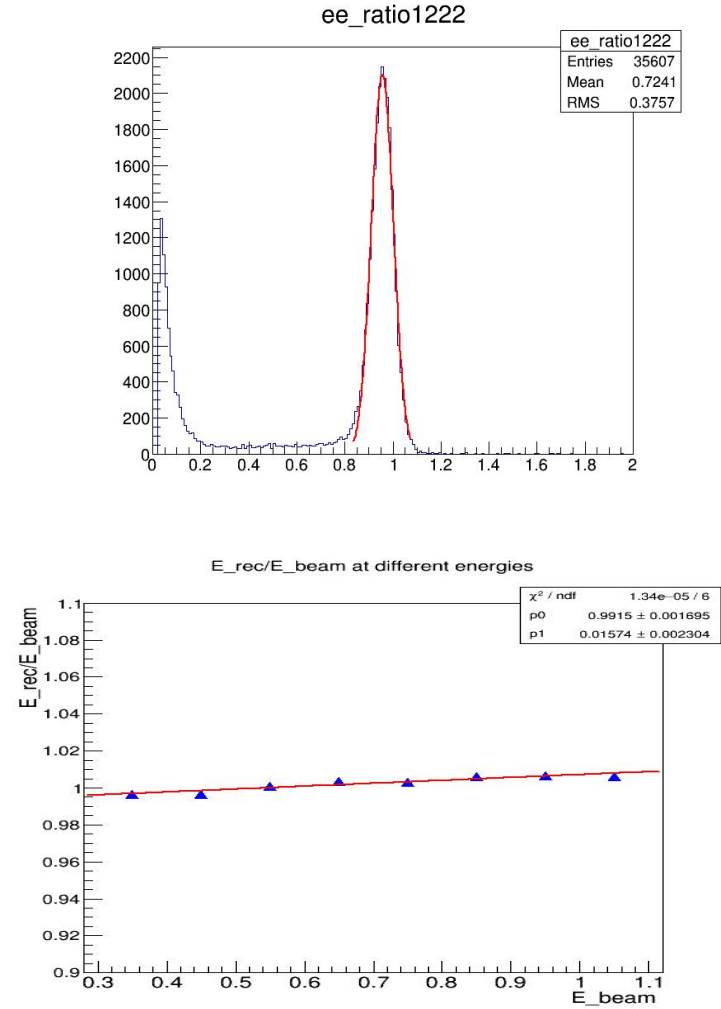
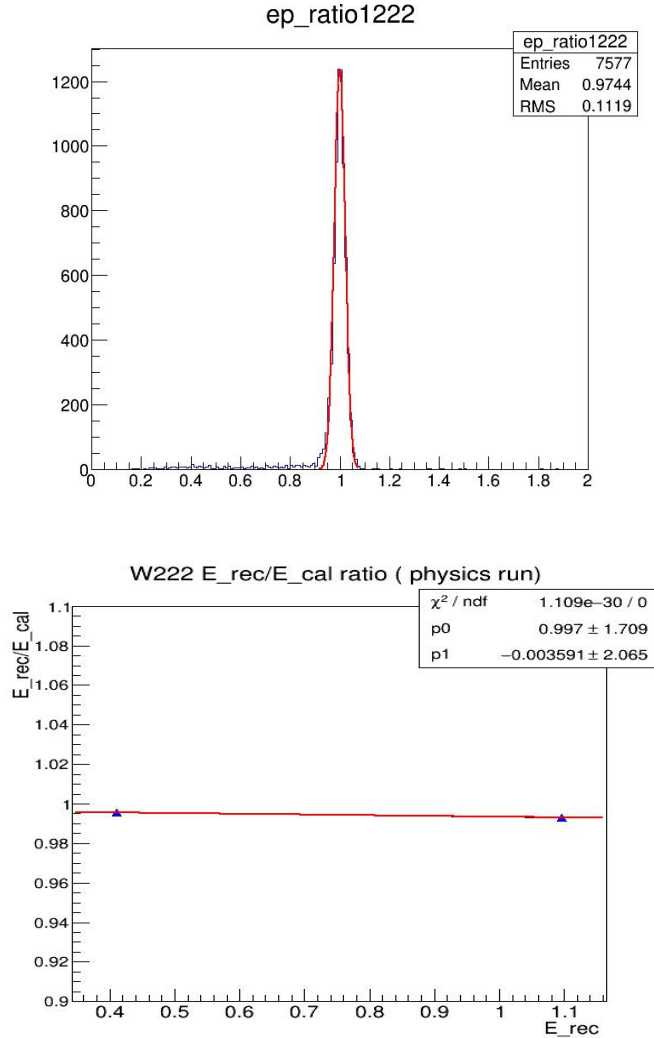


E_{rec}/E_{beam} at different energies



Alpha = - 0.27 / GeV

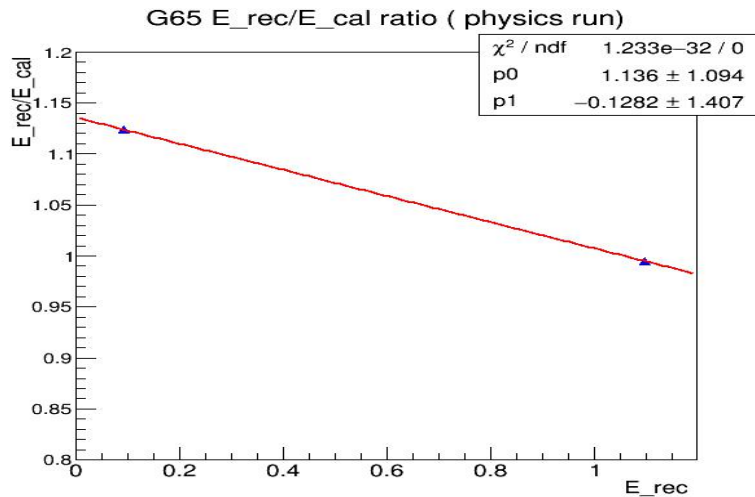
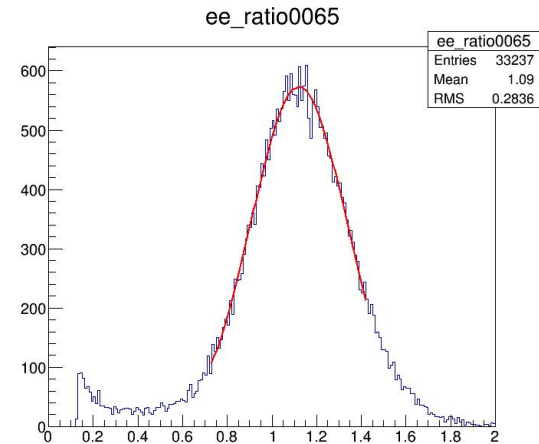
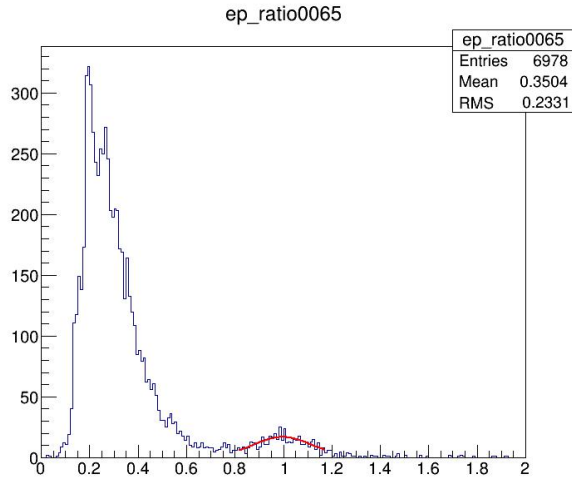
Non-linearity in Physics Run (PbWO4)



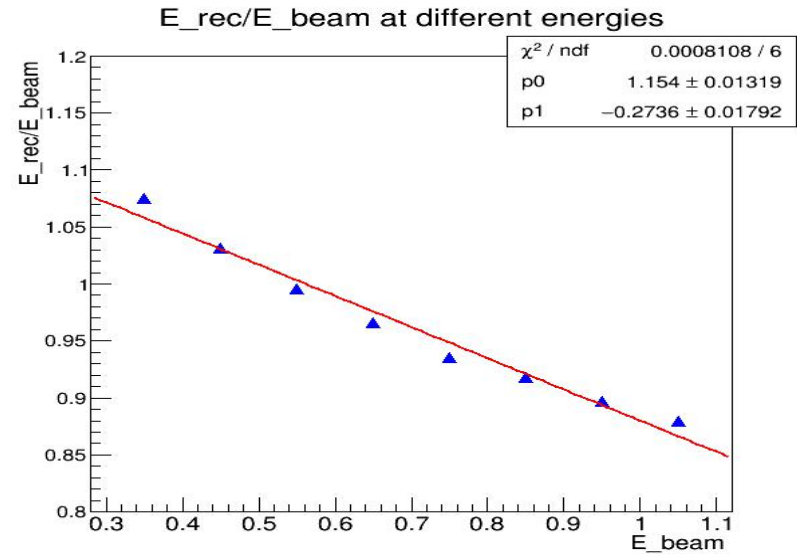
Alpha = - 0.004 / GeV for physics run

Alpha = 0.016 / GeV for calibration run

Non-linearity in Physics Run (Lead Glass)



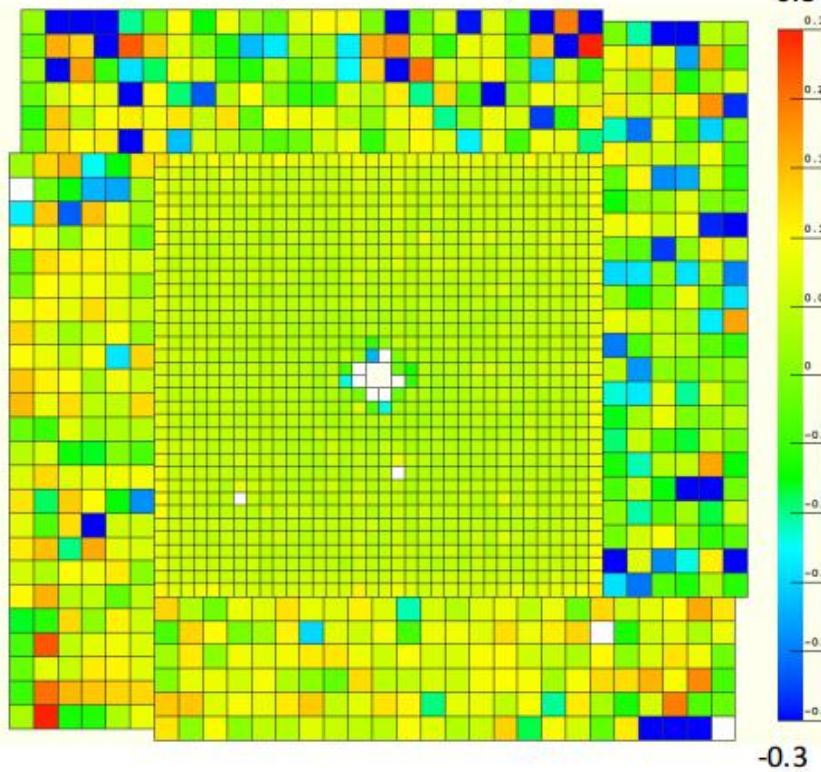
Alpha = - 0.128 / GeV for physics run



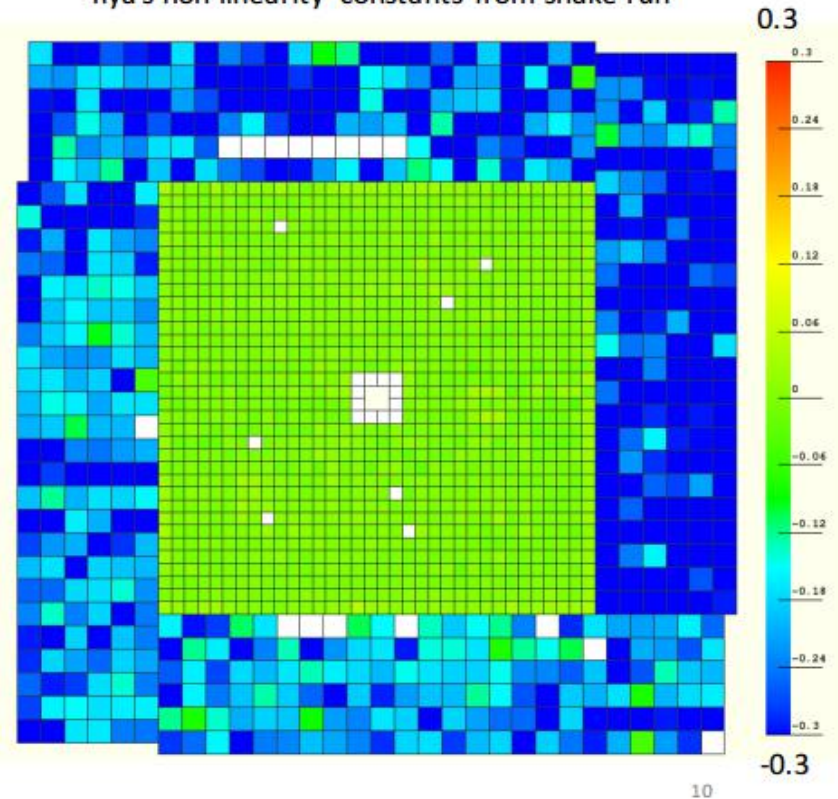
Alpha = 0.274 / GeV for calibration run

Compare Non-linearity Constants

My non-linearity constants from production run



Ilya's non-linearity constants from snake run



- Most Lead-Glass modules back to positive value for Physics run.
- But several of them still have large negative Alpha which can not be explained with the booster supply hypothesis.

Summary

- PbWO4 modules have “normal” behavior in both Calibration run and Physics run, gain factors are stable $\sim 1\%$ (small positive alpha).
- Pb Glass modules have “abnormal” behavior for Calibration run and for several modules even during Physics runs, gain factors are energy dependent $\sim 30\%$ (large negative alpha).
- Beam effect gave unknow factor (see Weizhi's slides).
- LMS information can not correct alpha constant(only 15 modules have the beam-hitting on infomation) .
- Can not apply calibration constant from Calibration run to physics run.