Light Guide Tests at Mainz

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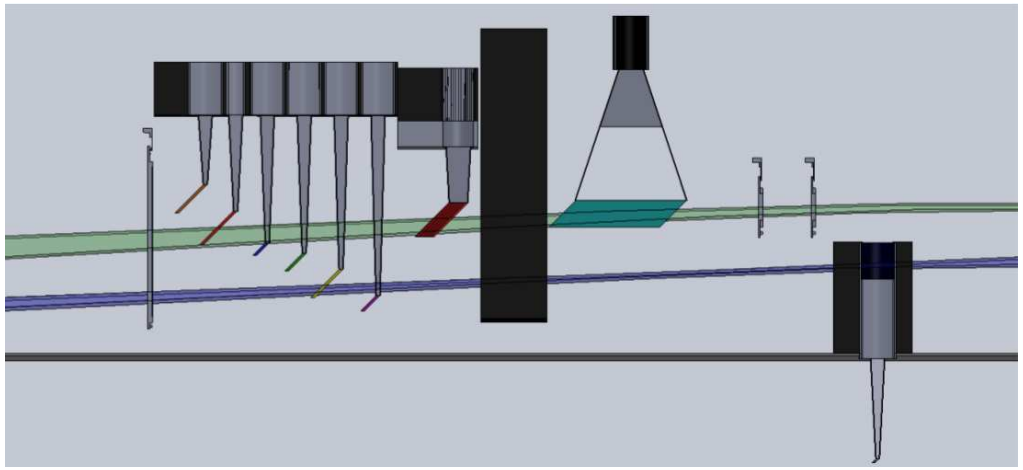
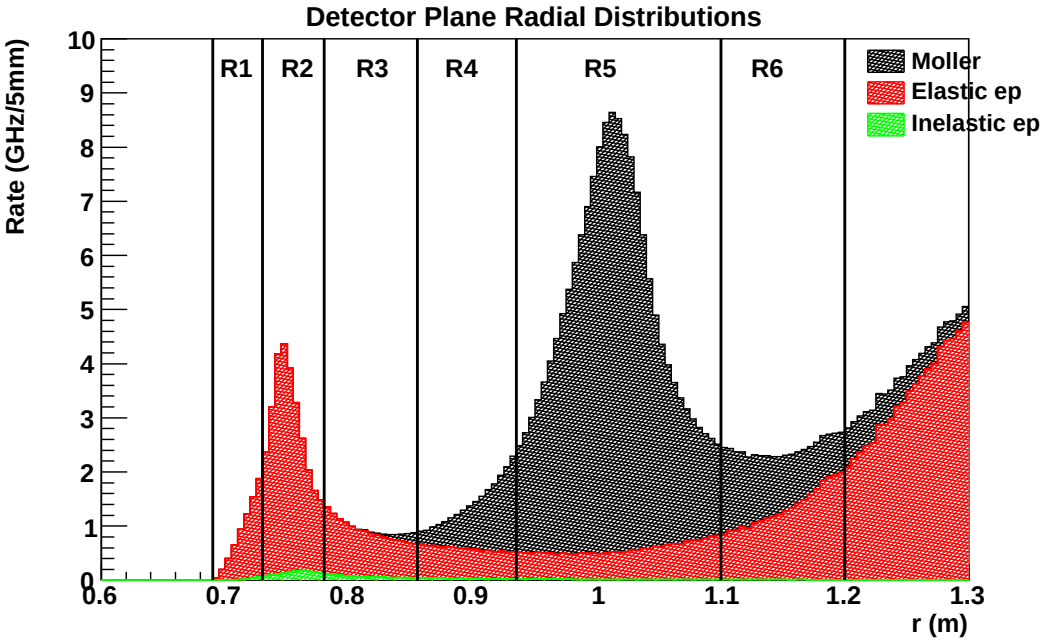
Why Light Guide Beamtests are Important

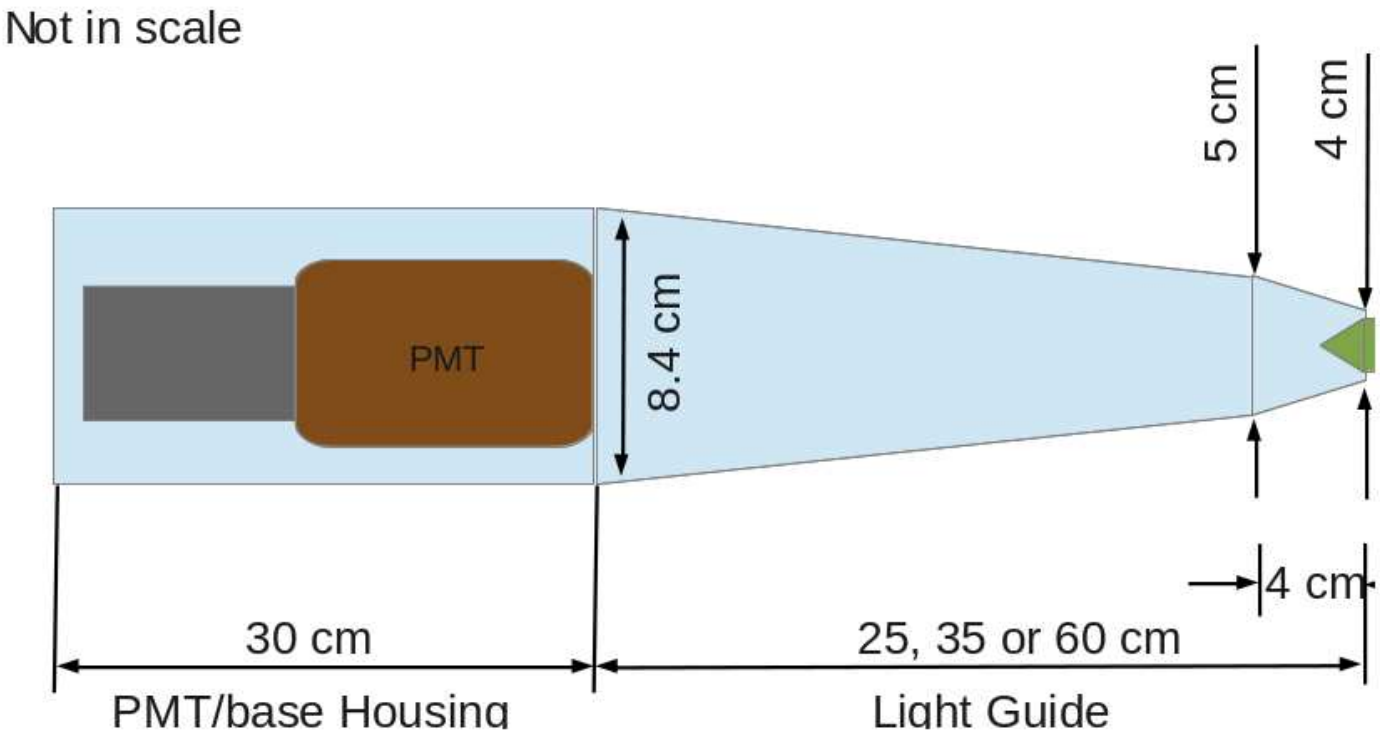




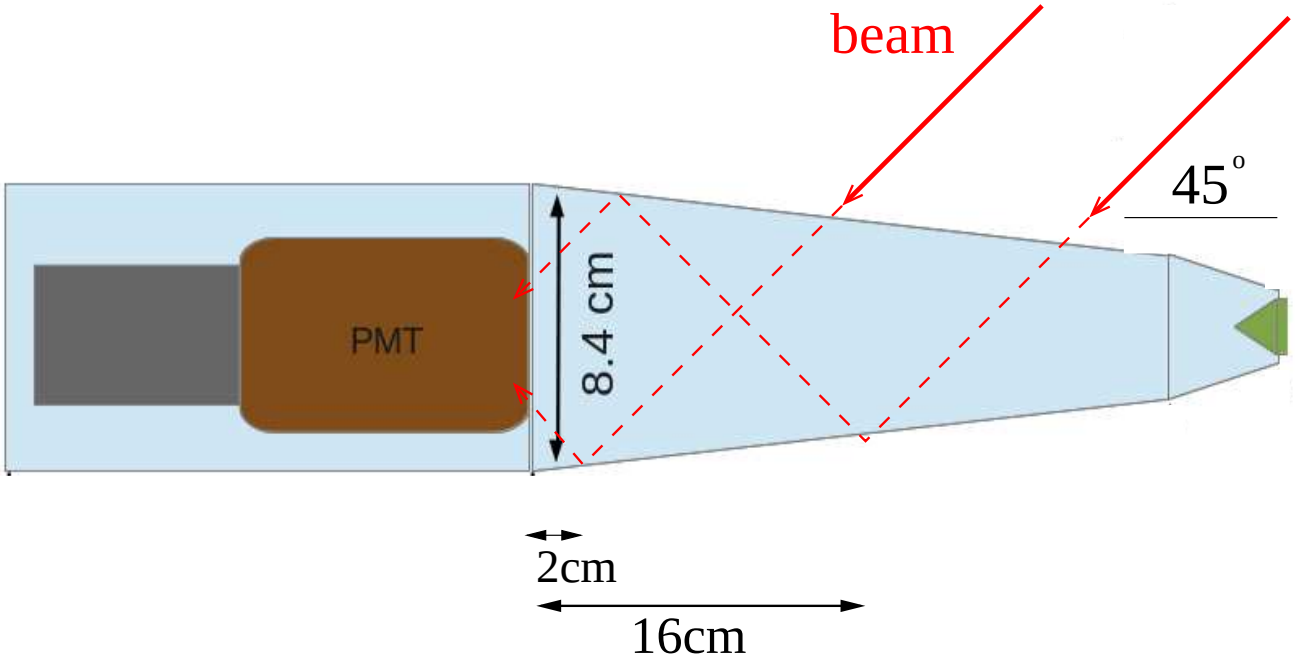
Light Guide Tests: Strategy

- Used Manitoba 60cm Miro-Silver light guide with 3inch "Electron Tubes 9305KFL" pmt SN:509 – Quartz window, standard bi-alkali Cathode, high QE
- Establish pmt HV which allows single PE peak to emerge from pedestal (for unamplified spectra with 0.2pf ADC sensitivity)
- Scan light guide through beam at three different orientations: 45°, 90°, and 135°
- Determine rate of light guide events per incident electron for each configuration

Manitoba Light Guide Geometry (60 cm) Tested (from Peiqing)

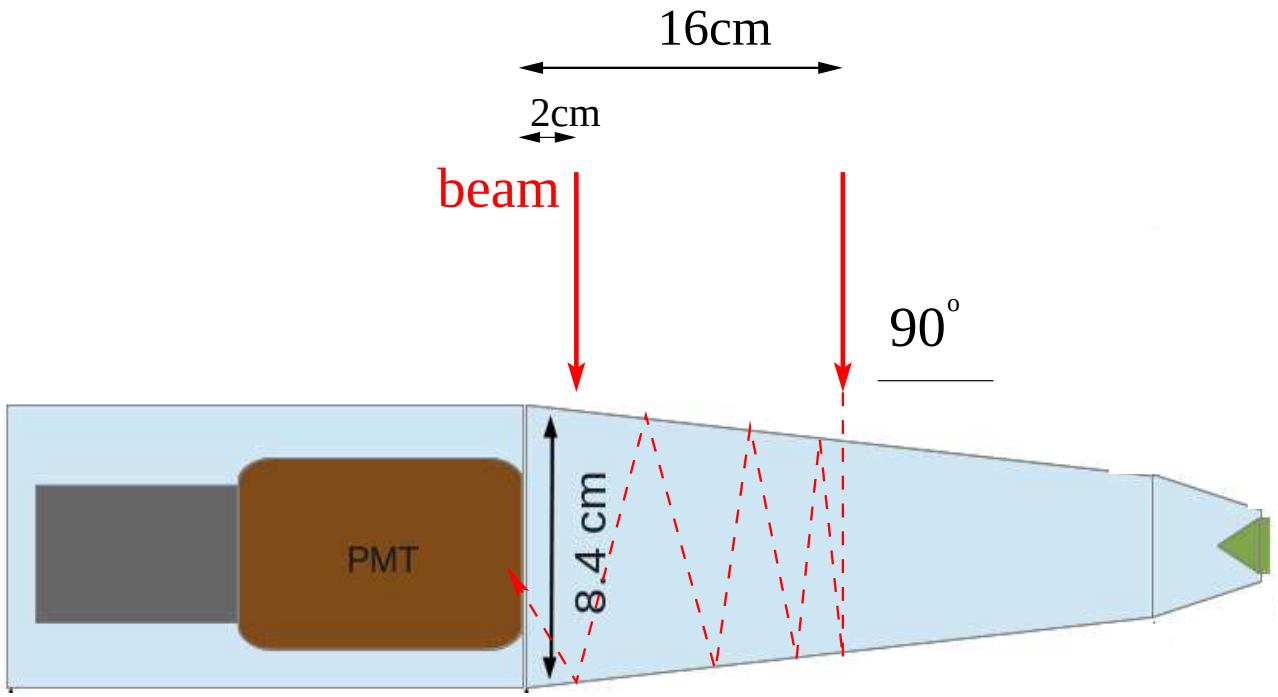


45 Degree Scan Configuration



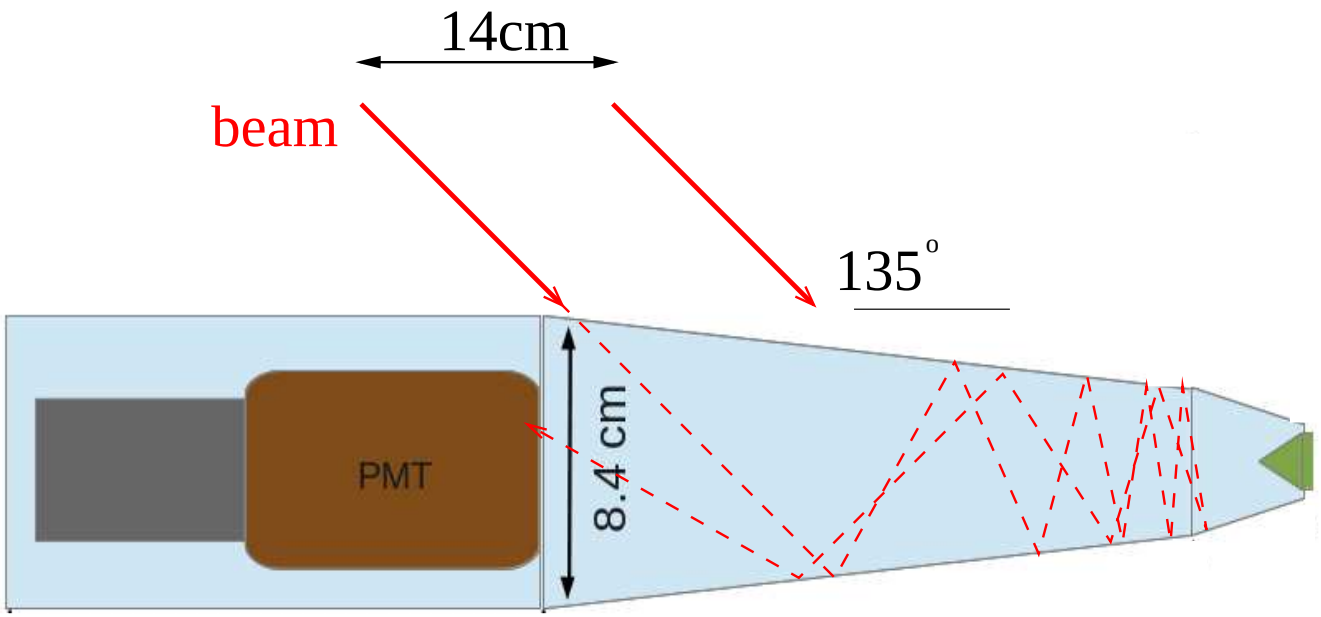
- This configuration gives most direct path for Cerenkov light in air (at 1 atm, $n = 1.0003$)

90 Degree Scan Configuration



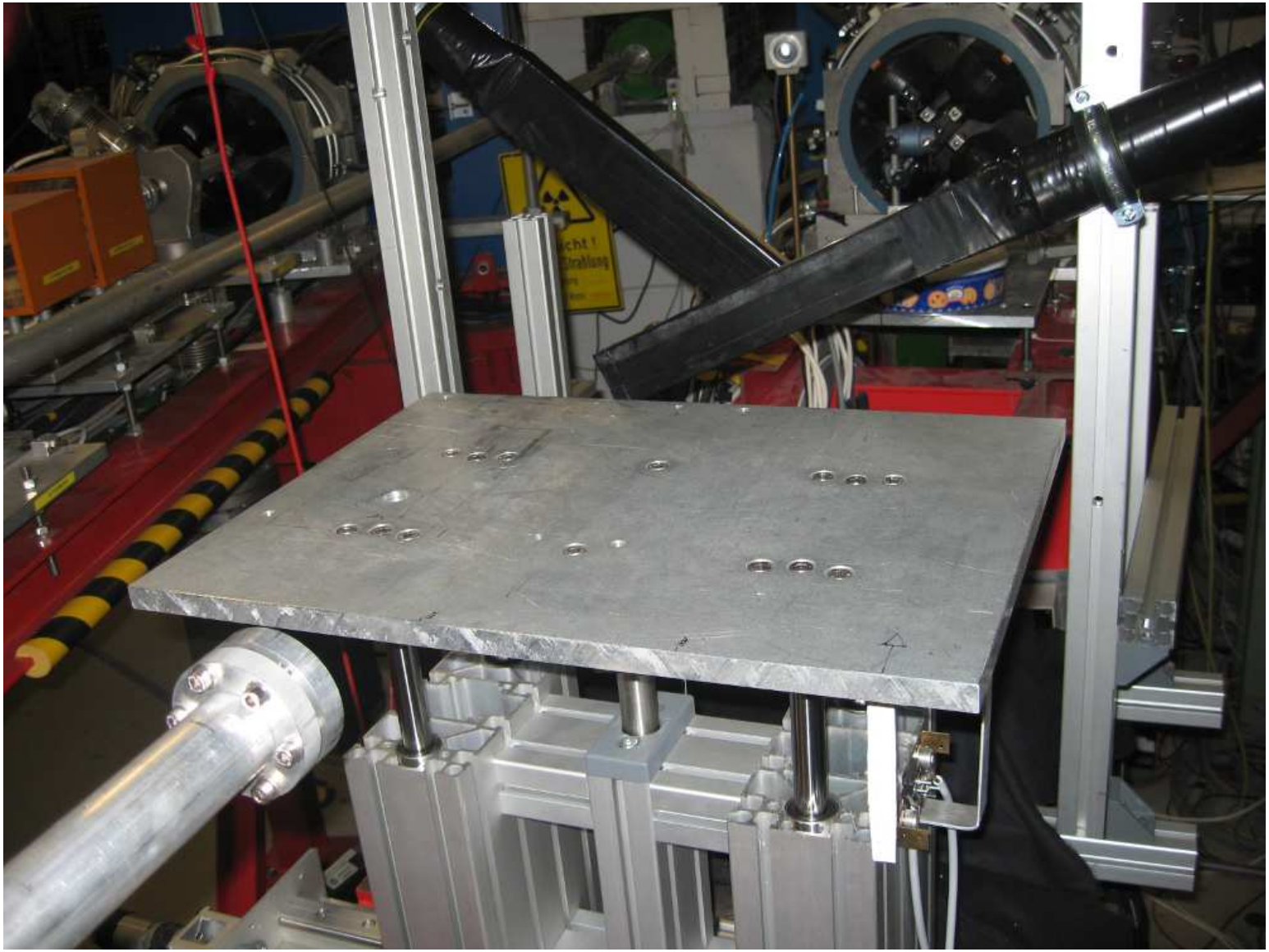
- Configuration closely matches experimental conditions shown in page 1 schematic where electrons traverse light guides from $\sim 87.6^{o} - 88.6^{o}$

135 Degree Scan Configuration

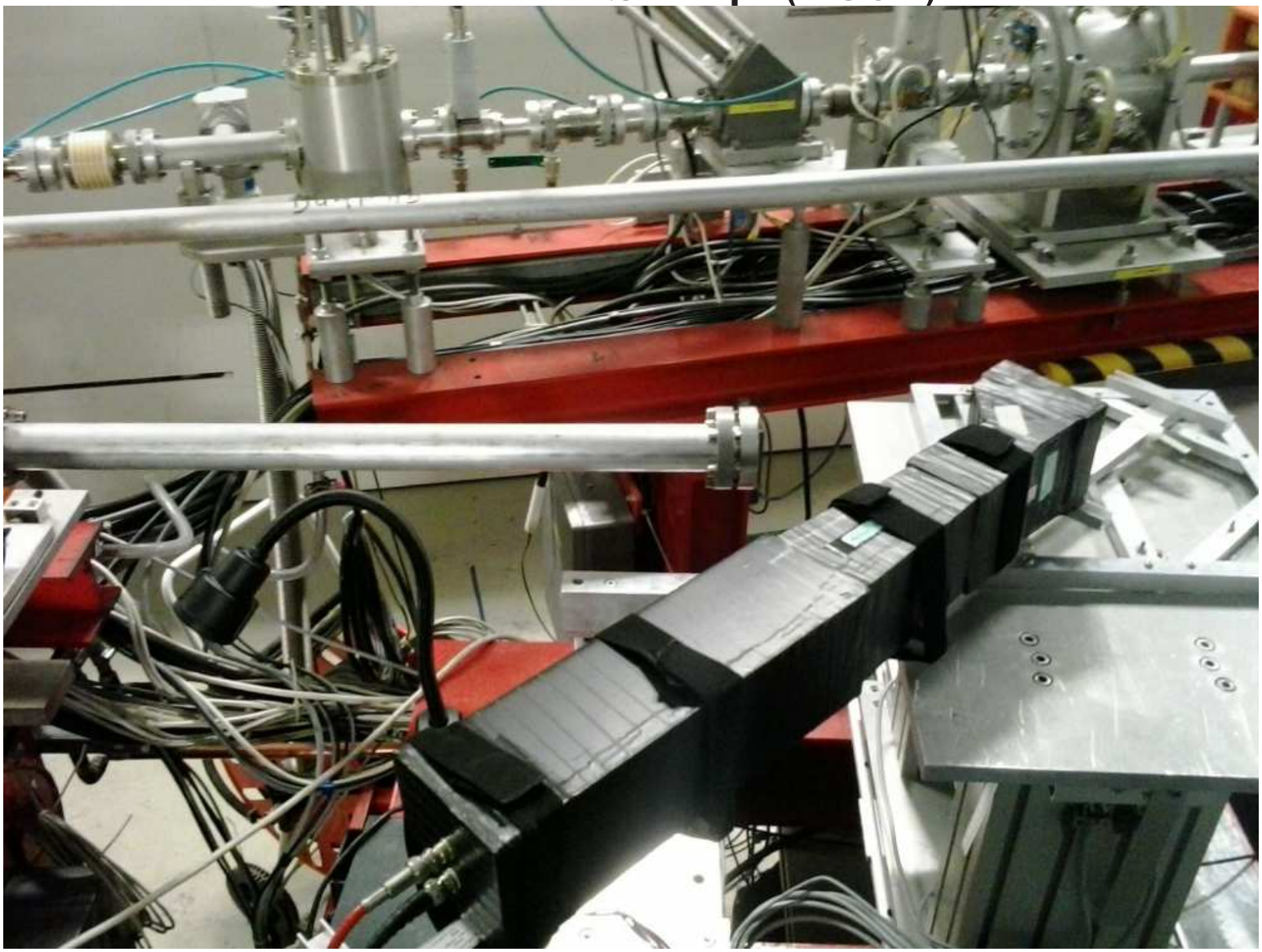


- This configuration expected to have least sensitivity to Cerenkov light and relatively more sensitivity to scintillation light; also would match alternate experimental setup (133.6° - 134.6°)

Test Beam Table

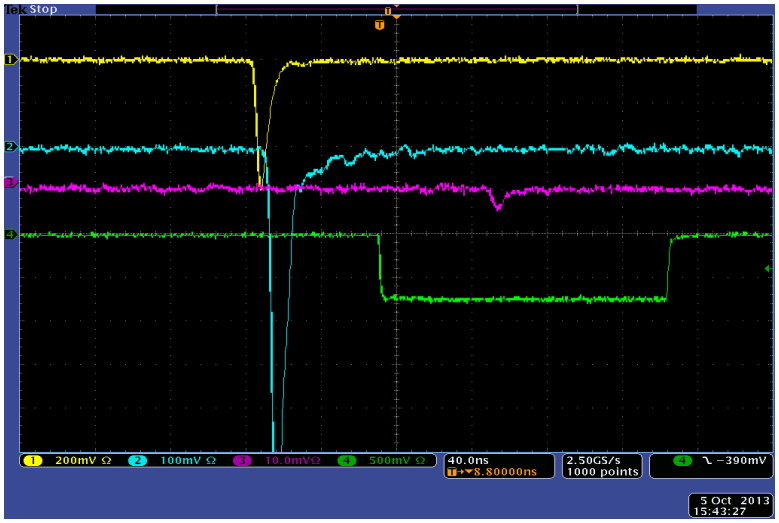


Manitoba Setup (135°)

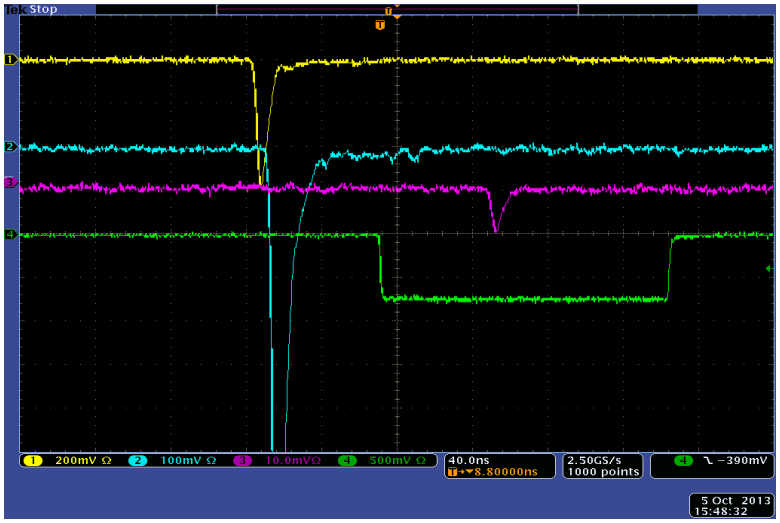


HV scans: Scope Traces

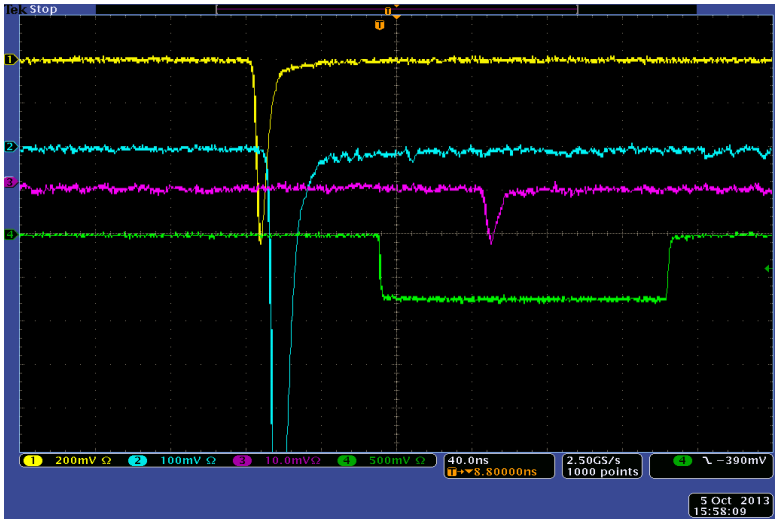
1290 V



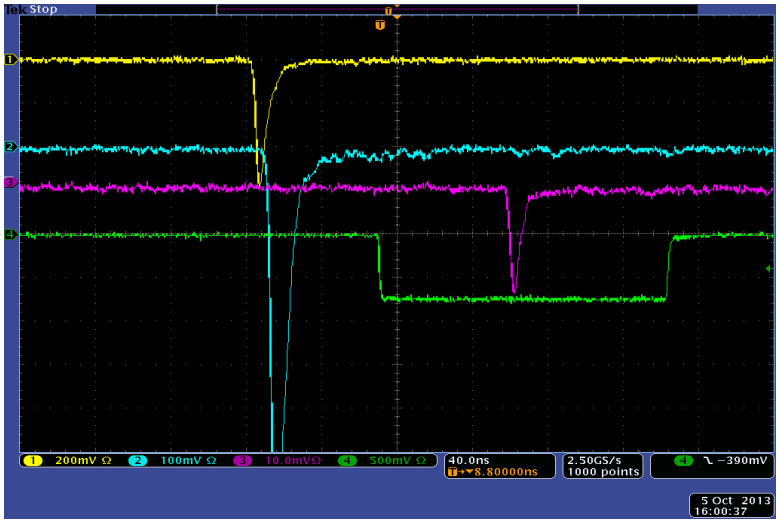
1400 V



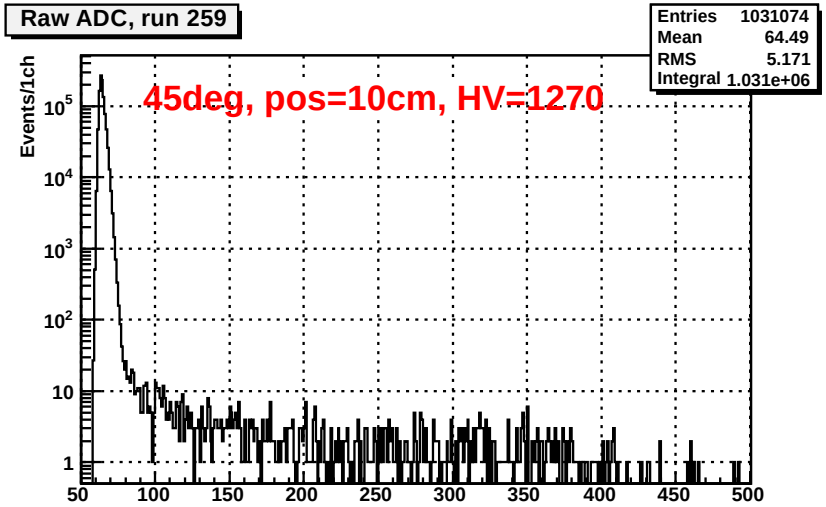
1500 V

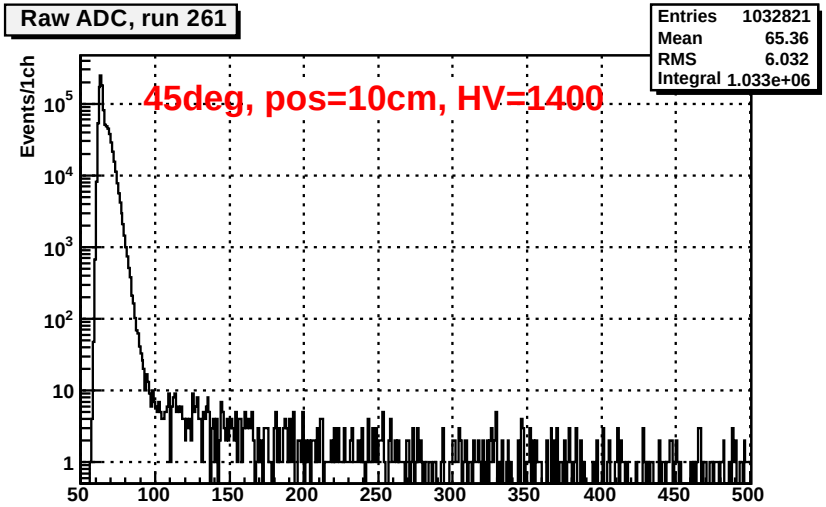


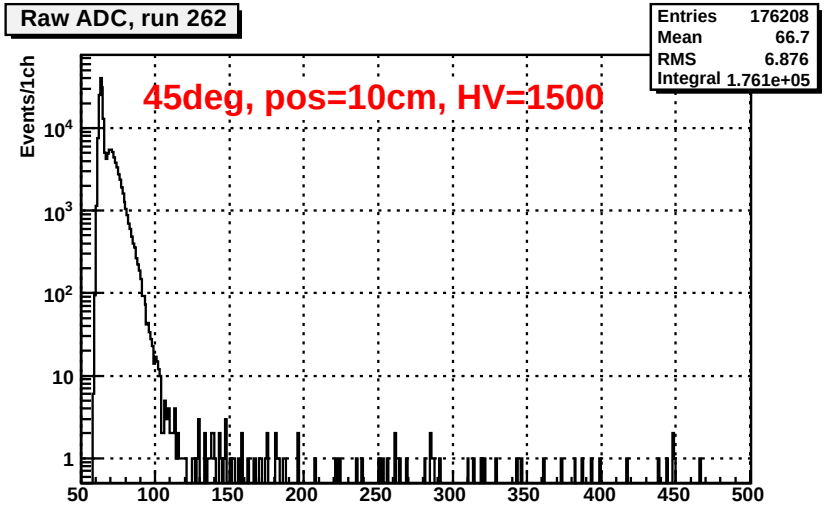
1700 V

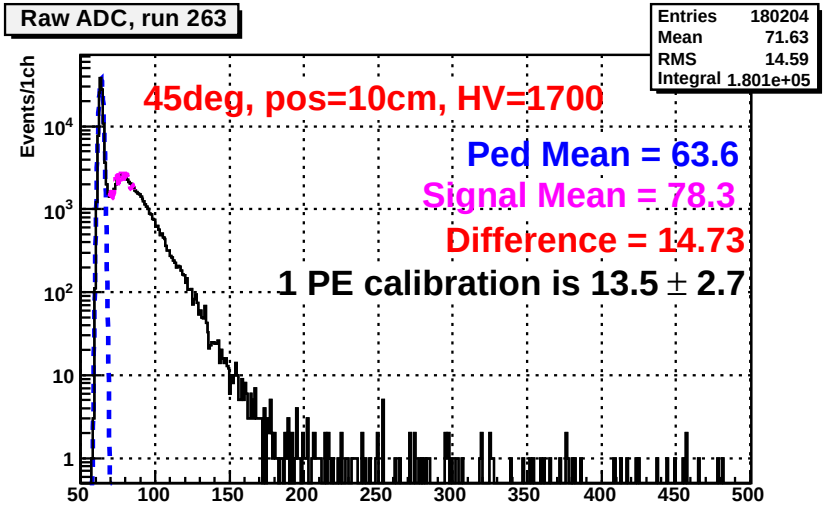


HV Scans: Spectra

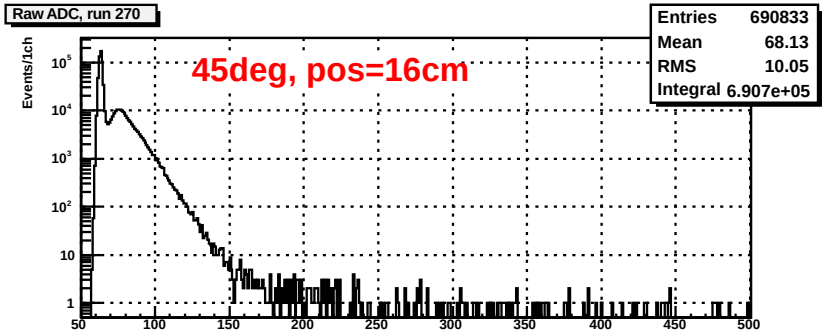


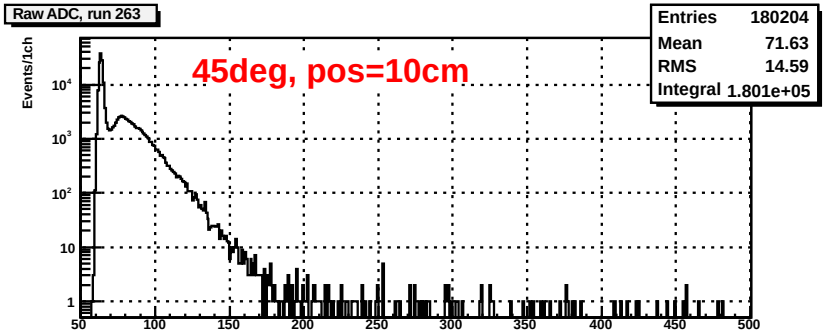


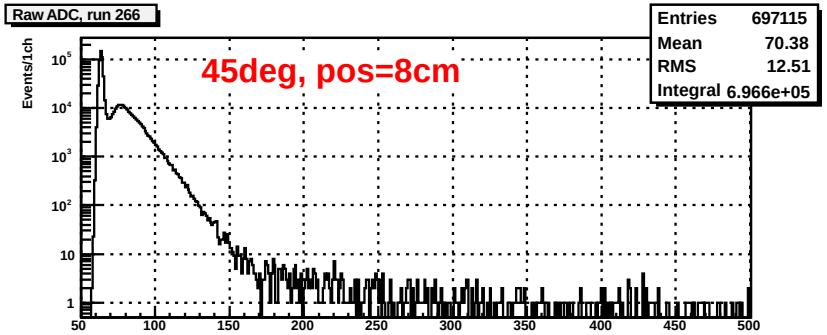


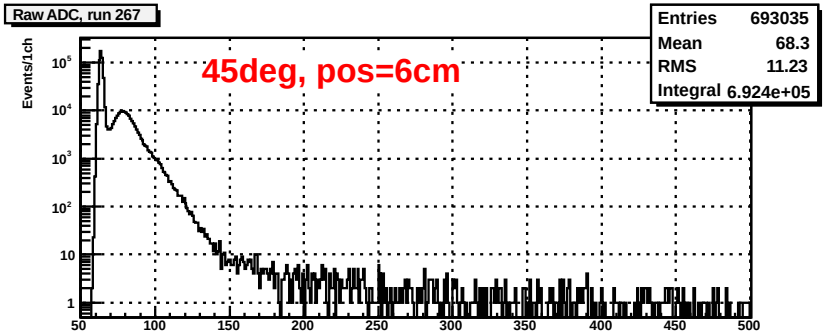


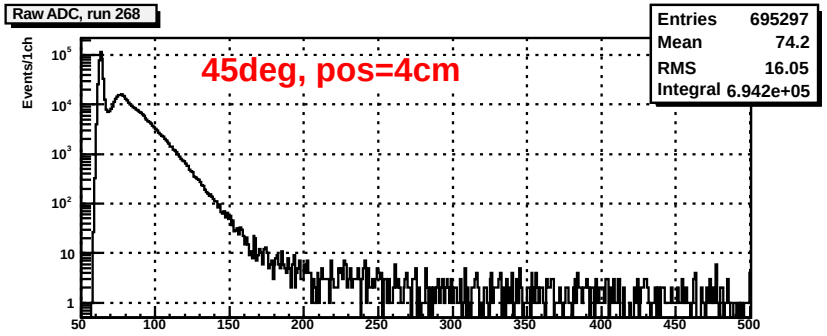
45° Scan Results: Spectra

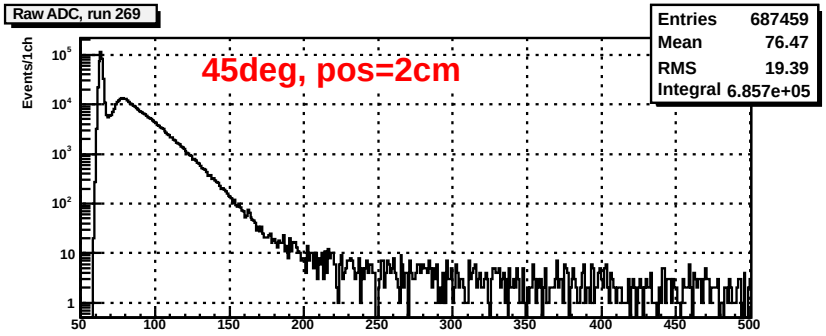




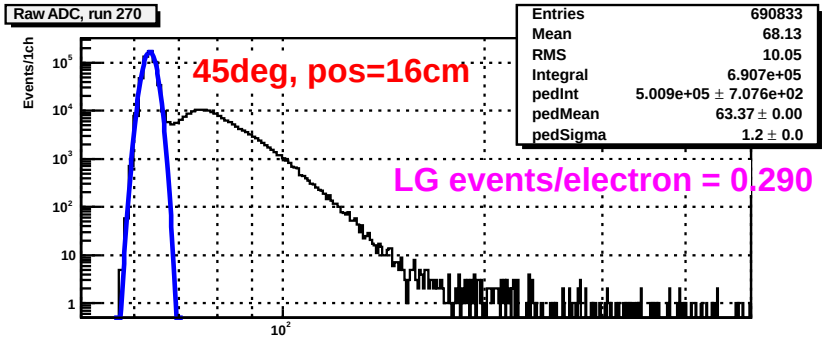


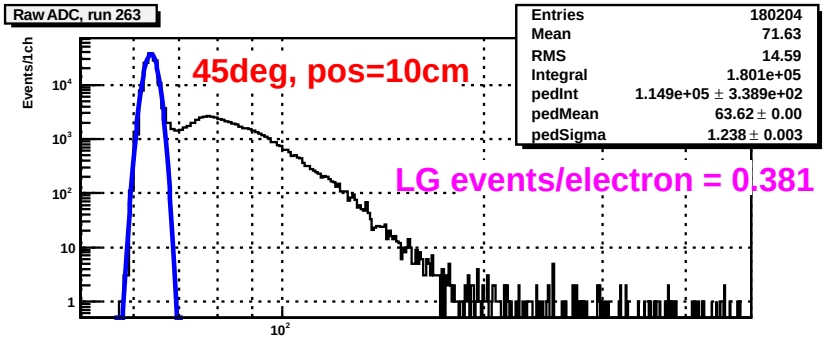


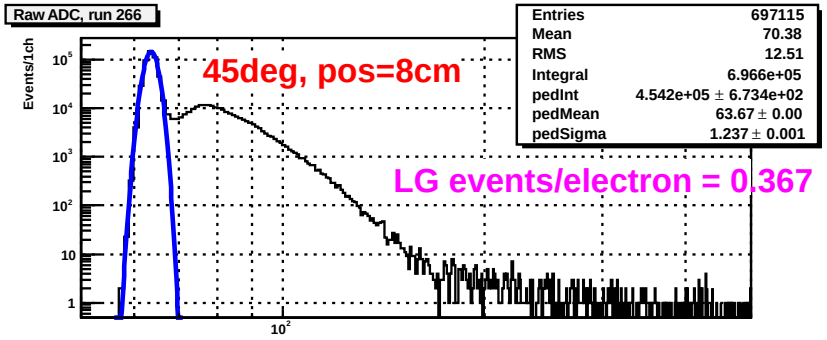


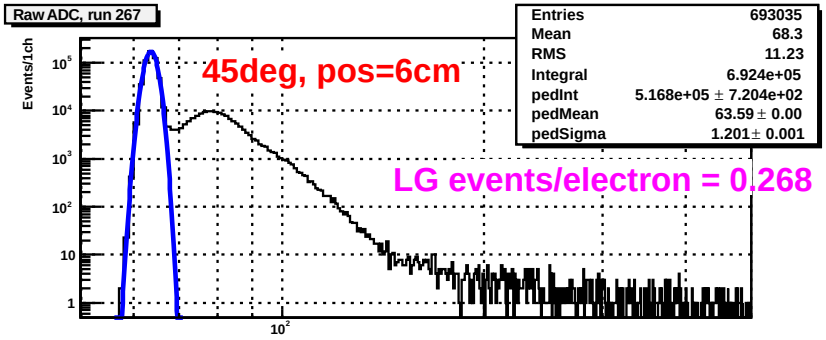


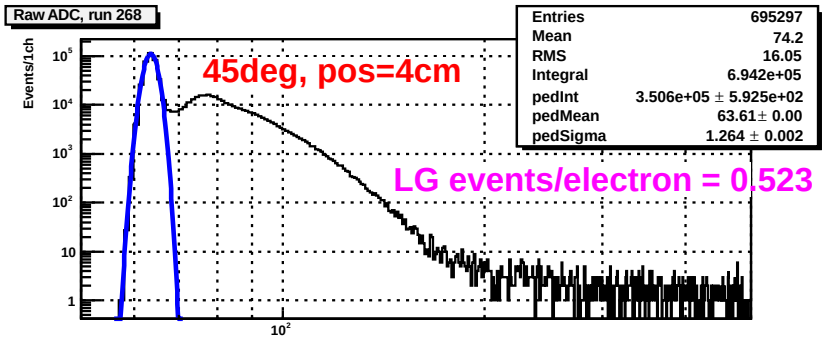
45° Scan Results: Rates

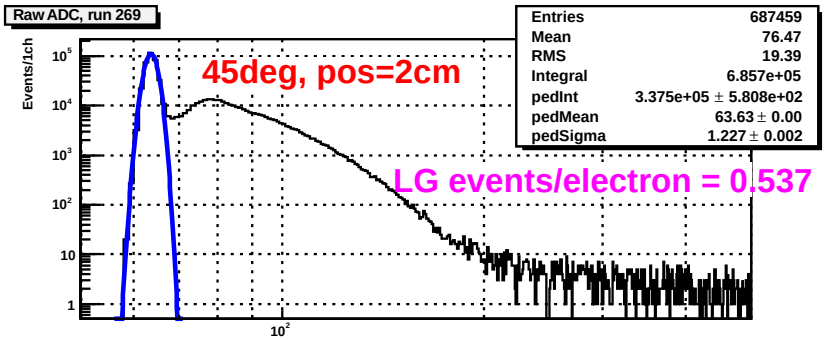




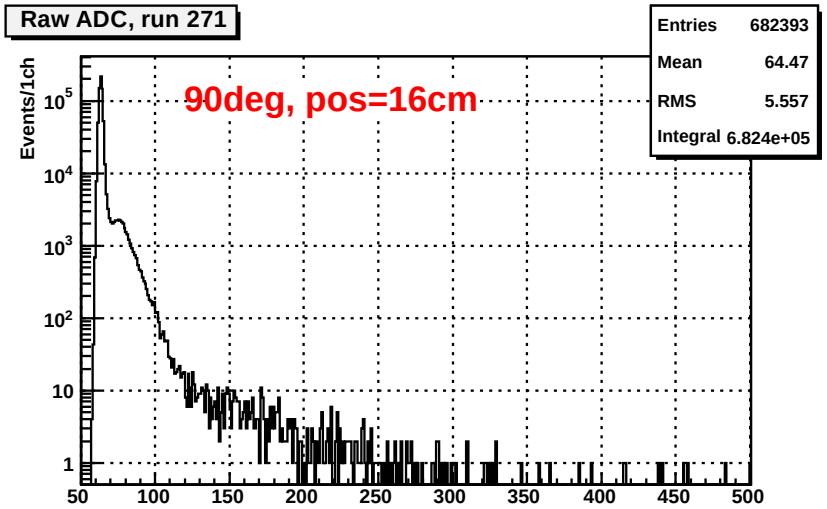


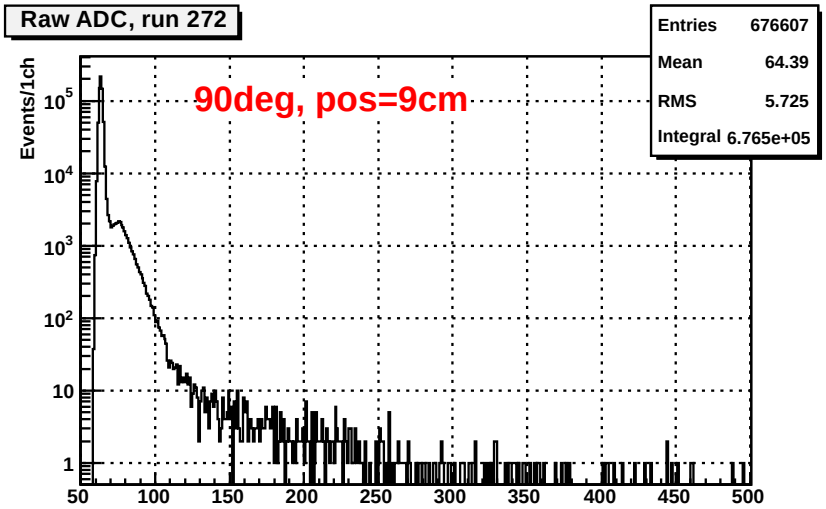


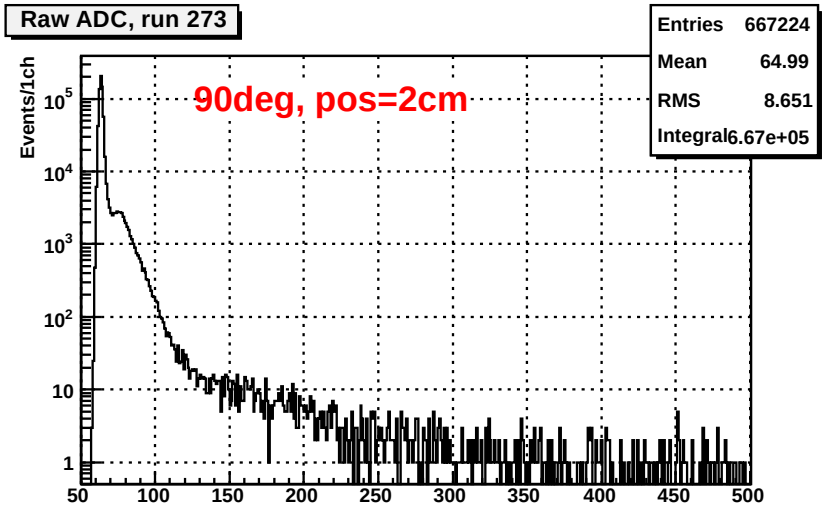




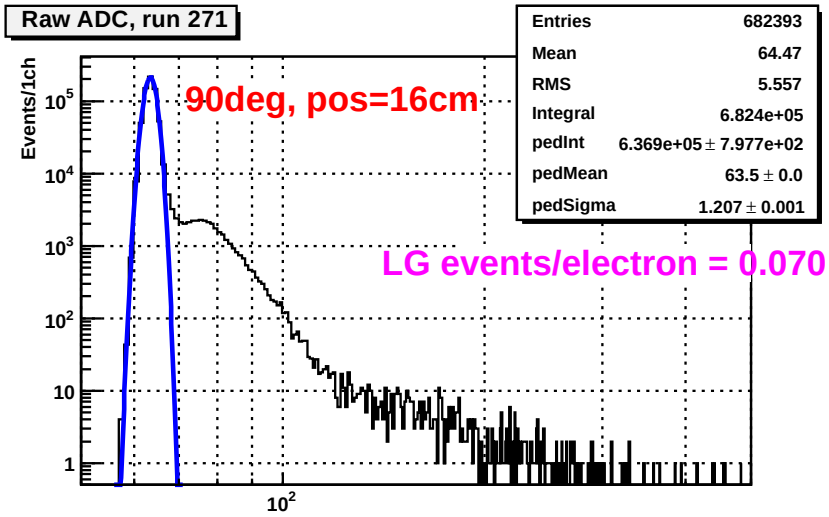
90° Scan Results: Spectra

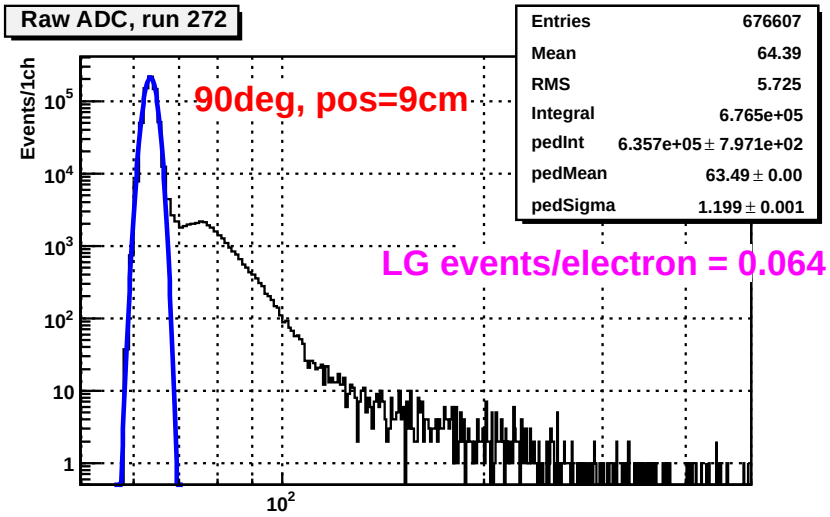


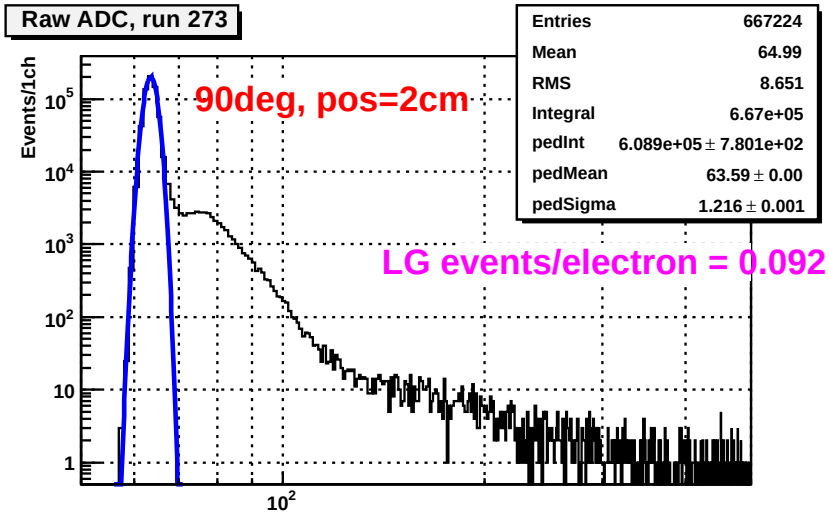




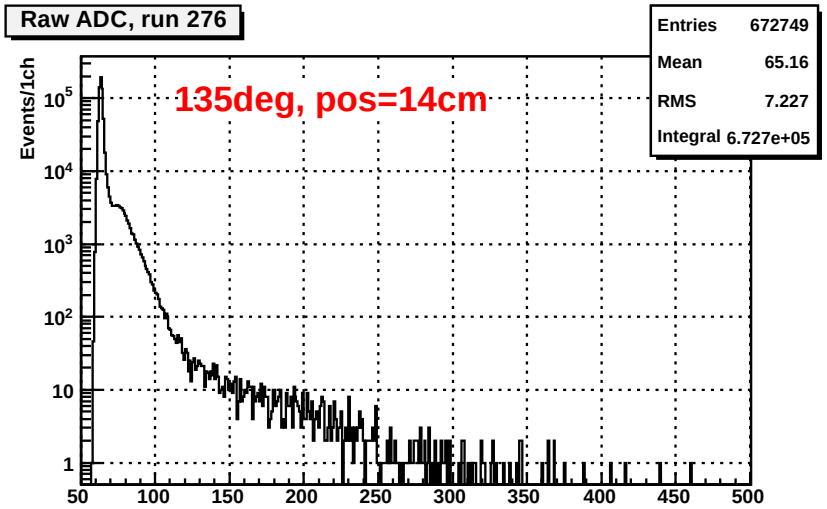
90^{o} Scan Results: Rates

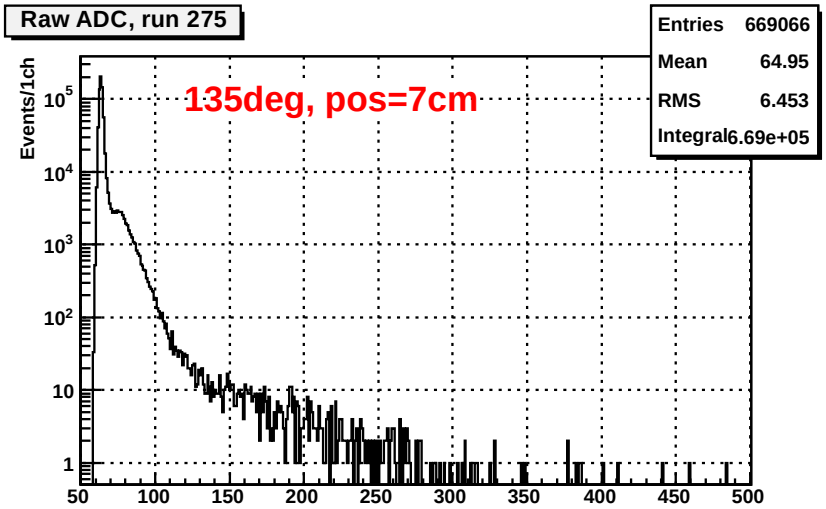


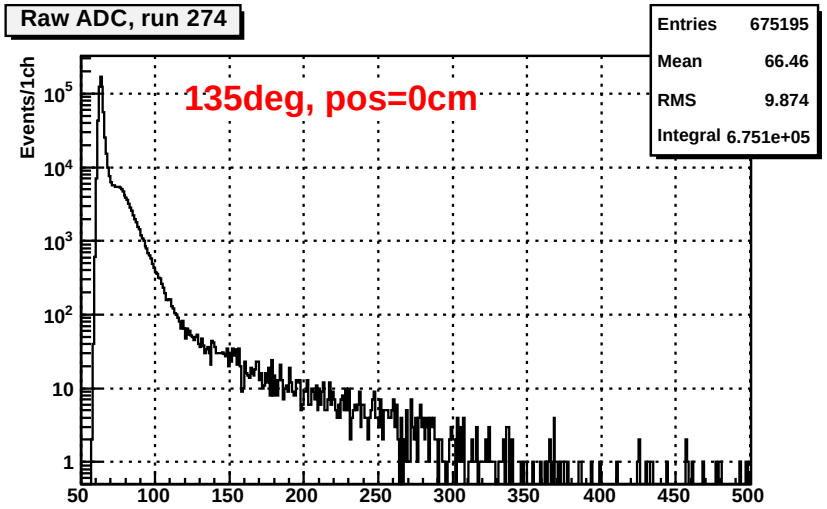




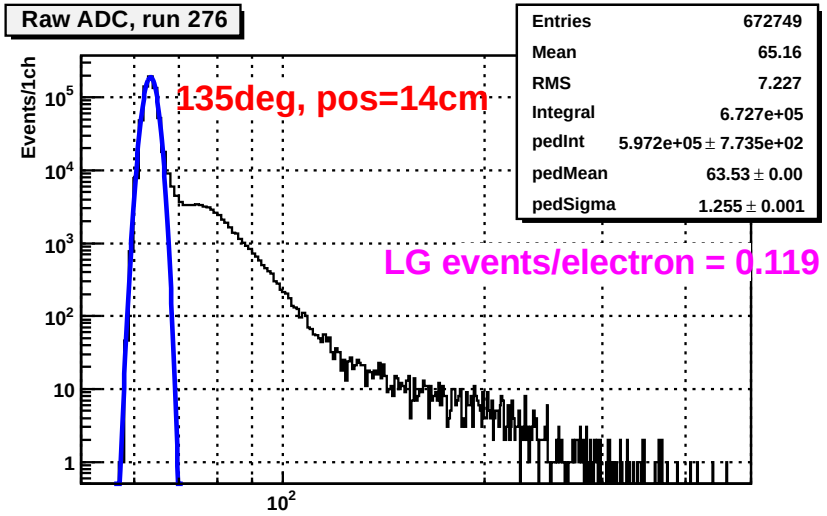
135° Scan Results: Spectra

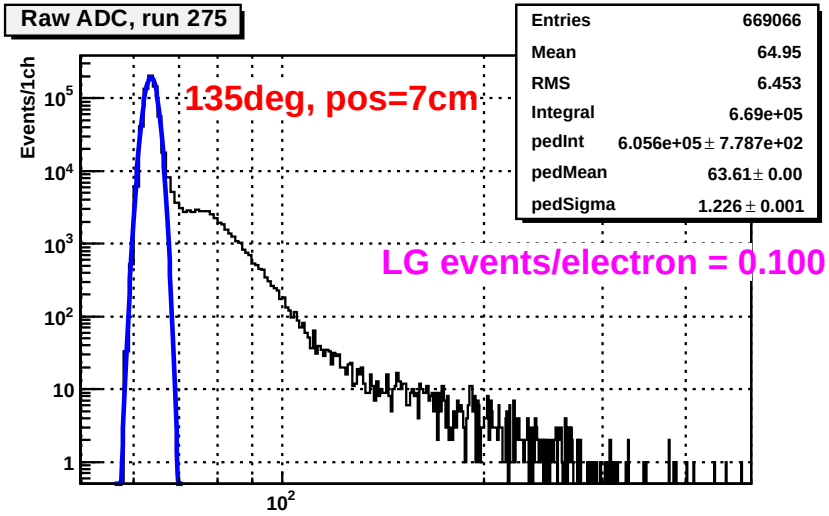


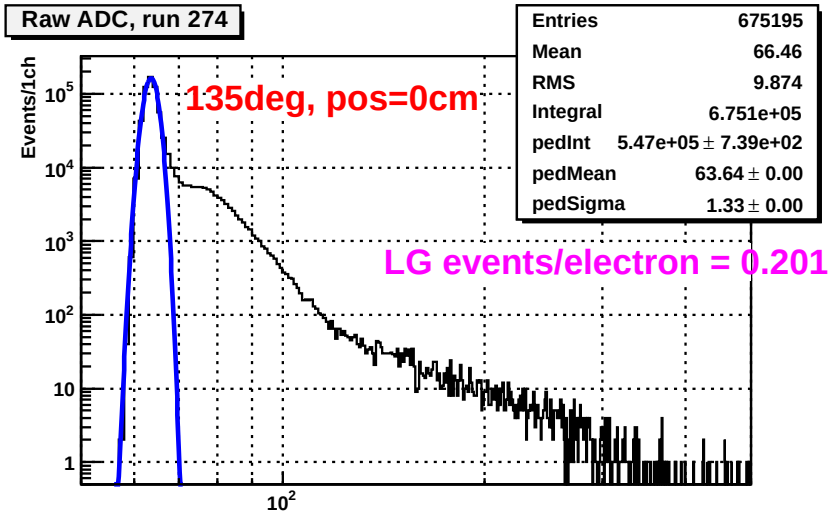




135° Scan Results: Rates







Rates Summary

Configuration	Distance from pmt	Rate
45°	16cm	0.290
45°	10cm	0.381
45°	8cm	0.367
45°	6cm	0.268
45°	4cm	0.523
45°	2cm	0.537
90°	16cm	0.070
90°	9cm	0.064
90°	2cm	0.092
135°	14cm	0.119
135°	7cm	0.100
135°	0cm	0.201

Comments and Disclaimers

- Since Moller ring is at larger radius, it is less susceptible to light guide event backgrounds–but worrying is healthy
- However, if we are serious about clean measurements in the inner rings, we must study this effect and learn how to optimize
- Results agree with simulation claims that air light guide events are at ∼single PE level
- Further analysis needed to better understand spectra–how much double PE events, etc. Also, consider the possiblity that Mainz testbeam has instabilities at 10^{-4} level
- Also try to answer question about how much scintillation versus Cerenkov light is contributing
- Rate calculation used here = (Total Events - PedInt) / (Total Events - PedCorrection), where PedCorrection = 300*RunTime in seconds (from 300Hz Random ped trigger)

Summary and Conclusions

- In general, relative rate trends in the data roughly agree with expectations although there are some curiousities
- LG events per incident electron increase as beam passes closer to pmt and 45° rates > 135° rates > 90° rates
- For 90° and 135°, $\sim 1/10$ of incident electrons produce PE(s)
- Question: Is non-monotonic nature of rate dependence on position real?
- Results seem promising. Future test runs needed for further study