# Calibration of the Tagger Detectors with GlueX Commissioning Data


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Tagger Microscope

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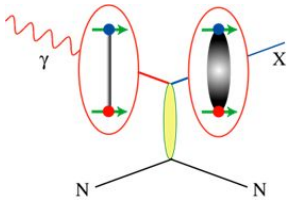
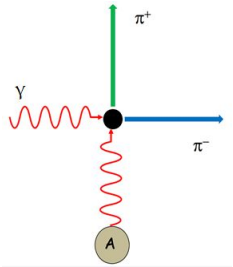
# Outline

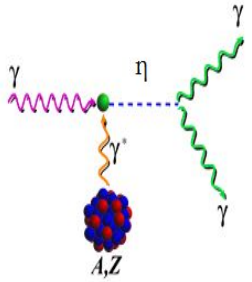
- Hall D experimental program
- Photon beamline overview
- Tagging detector calibrations

# Hall-D Experimental Program

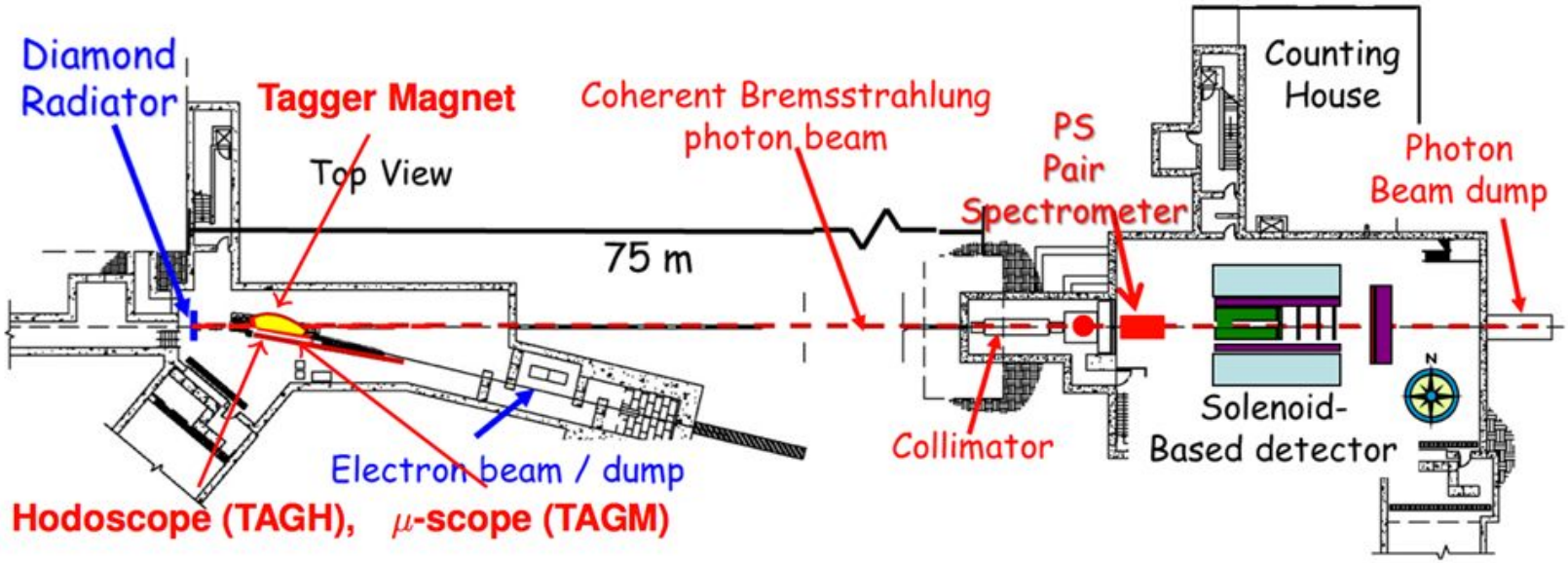
- Search for hybrid mesons, resonances with gluonic field excitations (GlueX)
  - Gluon acts as a constituent particle
  - Exotic $J^{PC}$ states possible ($0^{--}$, $0^{+-}$, $1^{-+}$, $2^{+-}$)
  - Exotic states provide unambiguous signal
- Charged π polarizability ($\gamma\gamma \rightarrow \pi^+\pi^-$)
  - $\alpha_\pi$ - Electric polarizability, $\beta_\pi$ - Magnetic polarizability
  - Measure ($\alpha_\pi - \beta_\pi$)
  - $\sigma(\gamma\gamma \rightarrow \pi^+\pi^-)$ from Primakoff production
- $\Gamma(\eta \rightarrow \gamma\gamma)$ from Primakoff method
  - Determine light quark mass ratio
  - Measure η - η' mixing angle



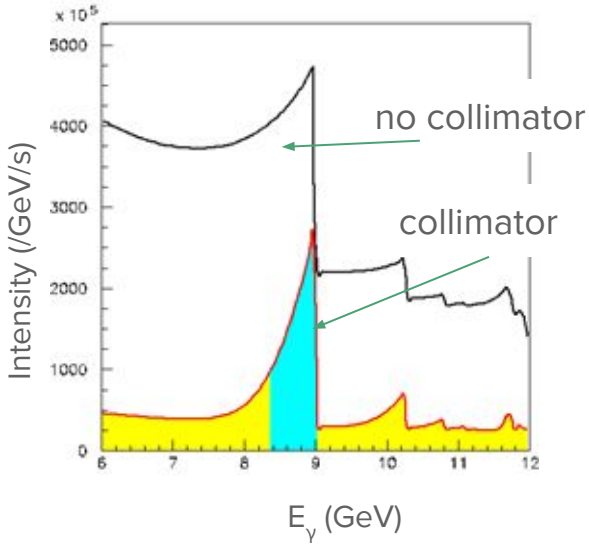



# Photon Beam

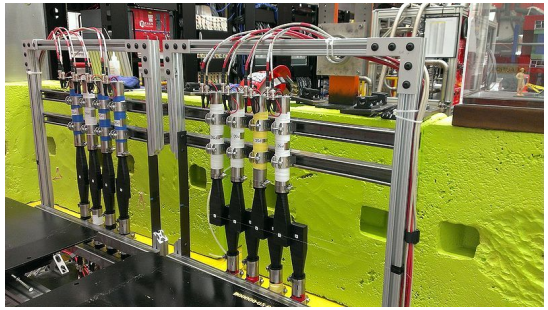


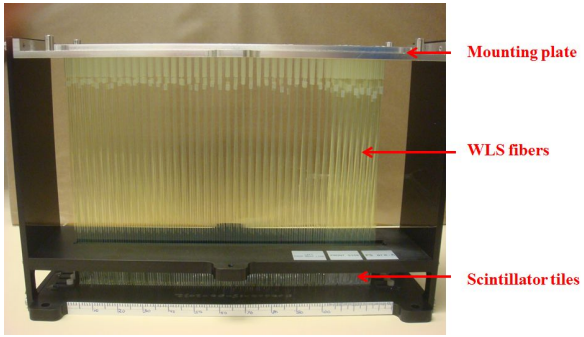

- 12 GeV $e^-$ beam
- Coherent bremsstrahlung from 20 μm diamond wafer
- Coherent peak: 8.4 - 9.0 GeV, 40% linearly polarized
- 3.4 mm collimator 75 m downstream from radiator
- Magnet bends $e^-$'s into tagger detectors (3.0 - 11.8 GeV)



# Tagger Hodoscope

# Tagger Microscope

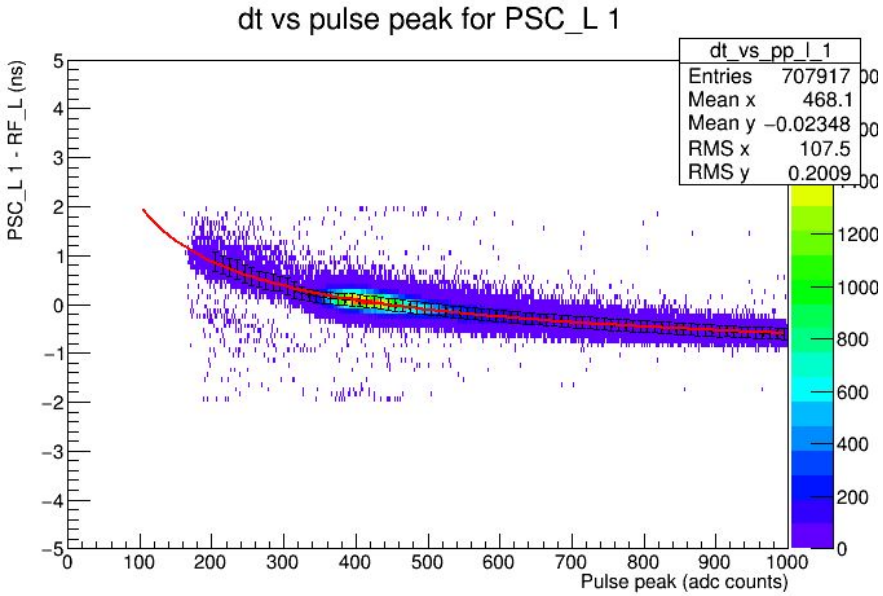


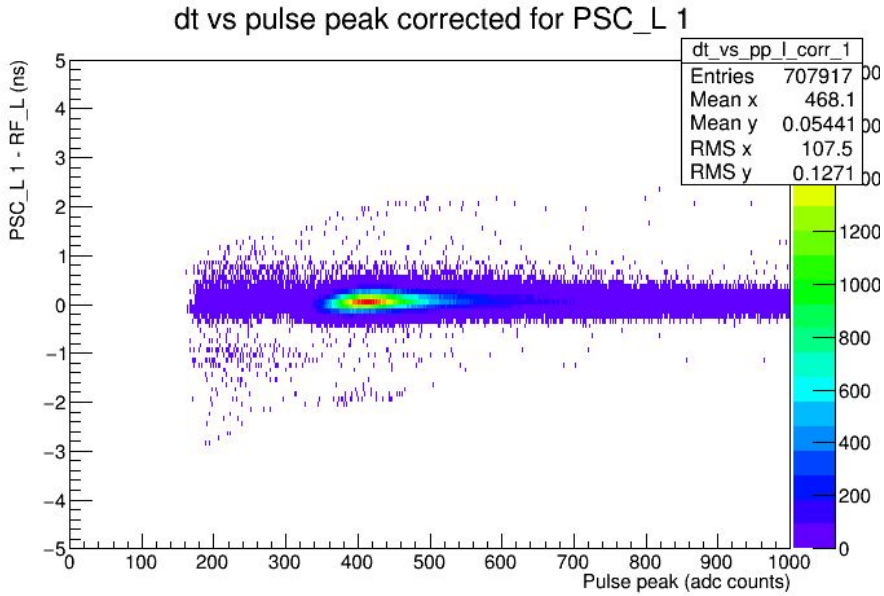




# Pair Spectrometer

# Pair Spectrometer (PS) Time-walk

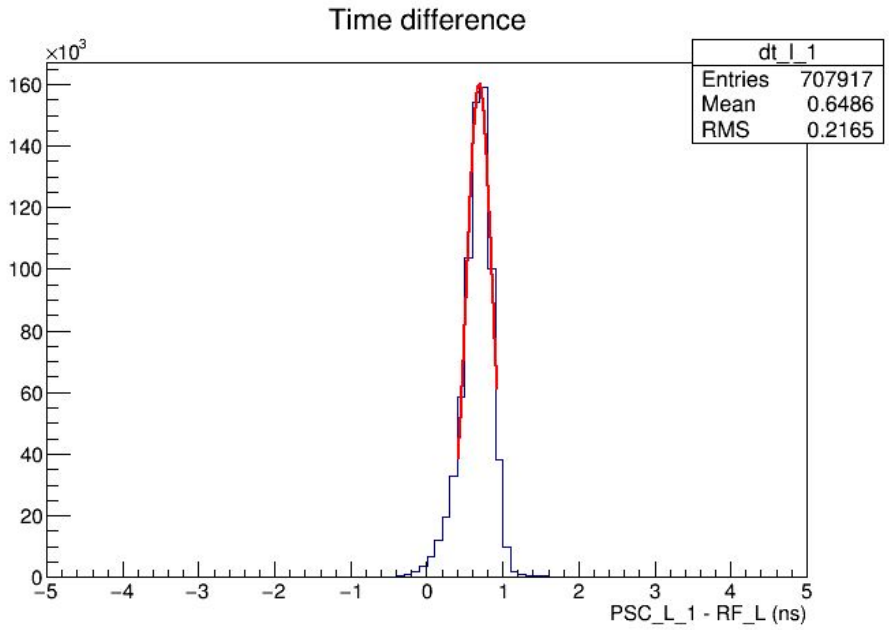


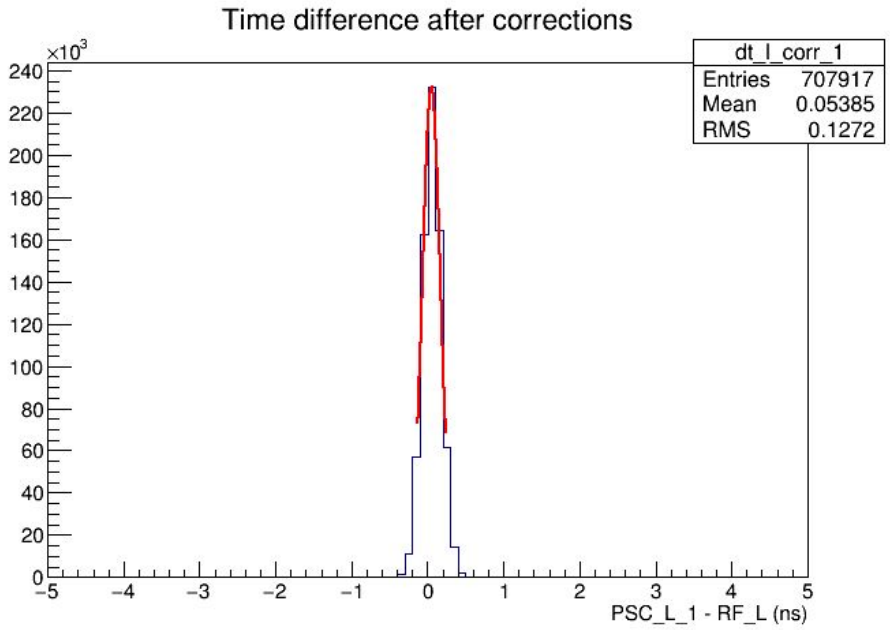




$$f = a + b\left(\frac{P}{T}\right)^{c}$$

f is the fit function where a, b, and c are fit parameters, P is the pedestal subtracted pulse height, and T is the adc threshold

# Pair Spectrometer (PS) Time-walk



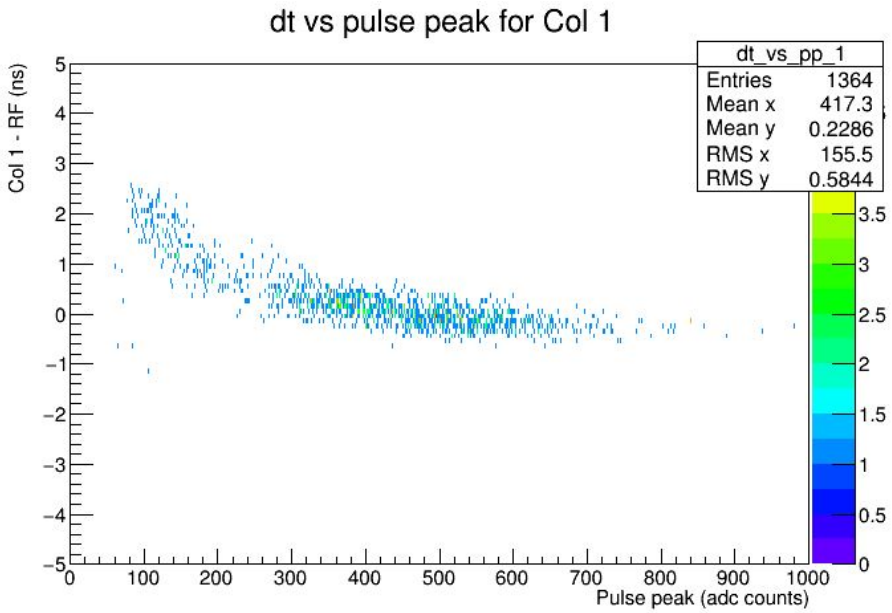




Before
Sigma = 167 ps

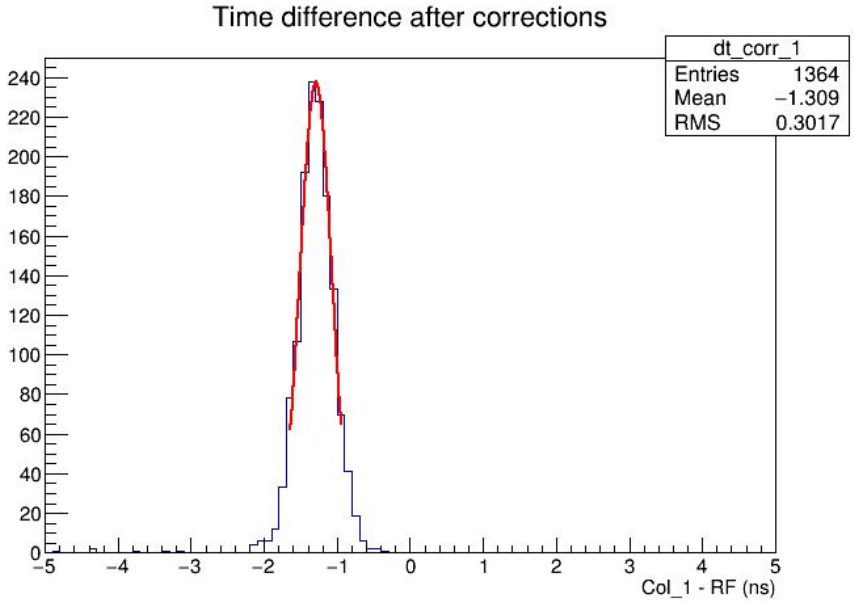
After
Sigma = 119 ps

Average sigma for all 16 modules is 120 ps

# Tagger Microscope (TAGM) Time-walk

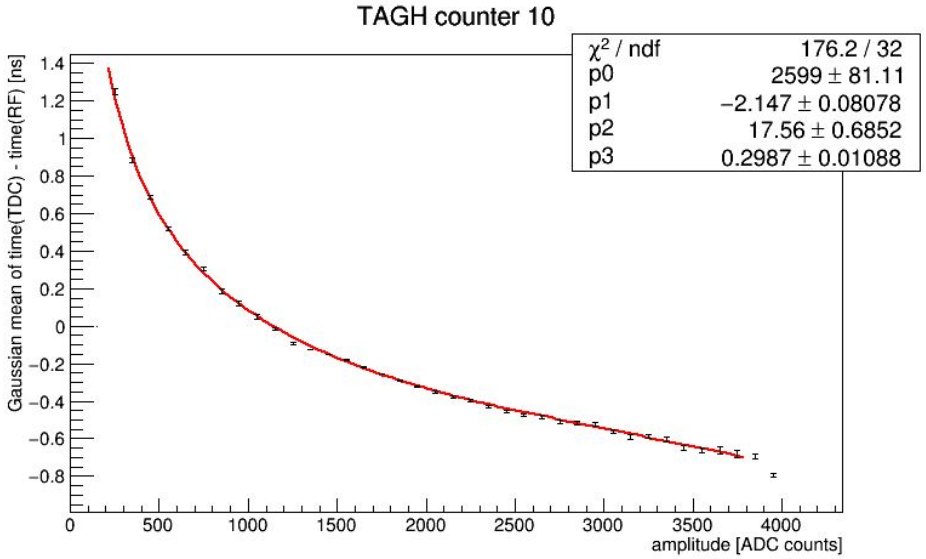


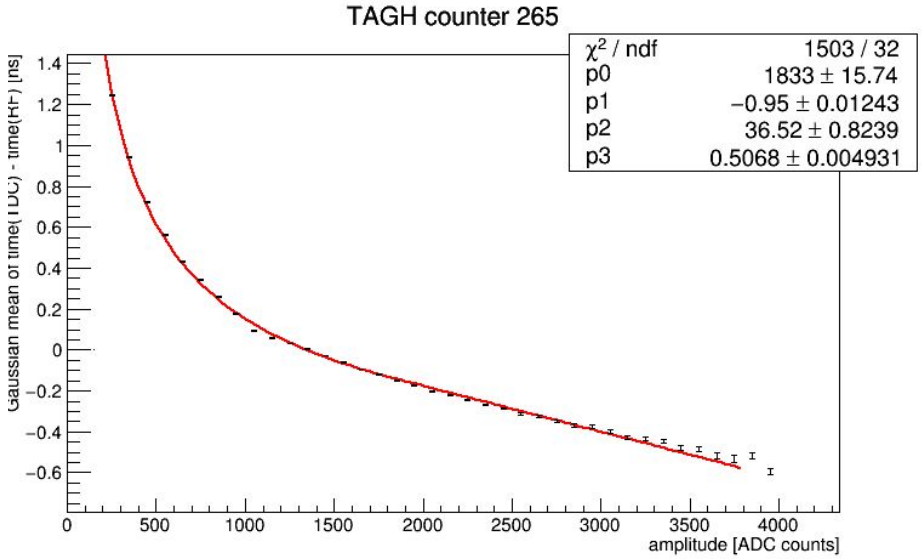

Initial dt vs pulse peak plot for a typical single channel




Corrected time difference distribution for a typical channel, sigma = 215 ps

# Tagger Hodoscope (TAGH) Time-walk



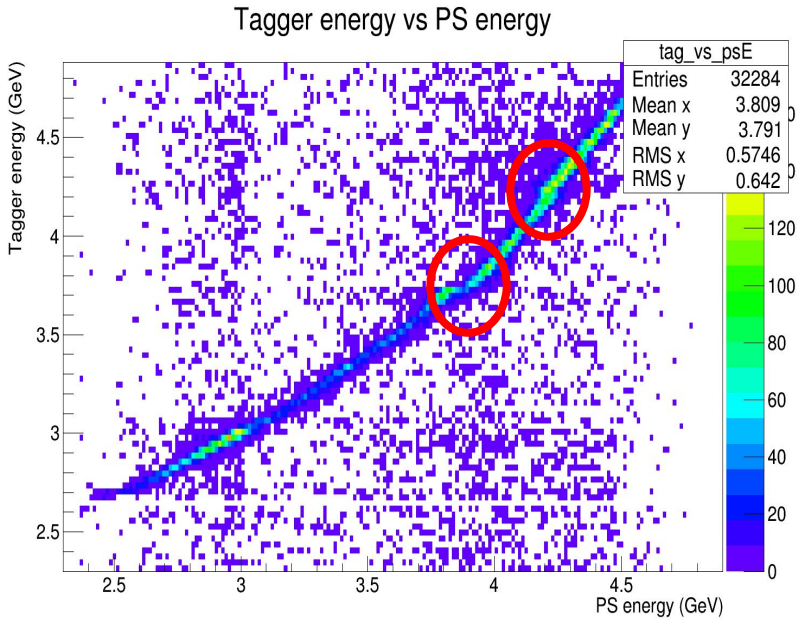



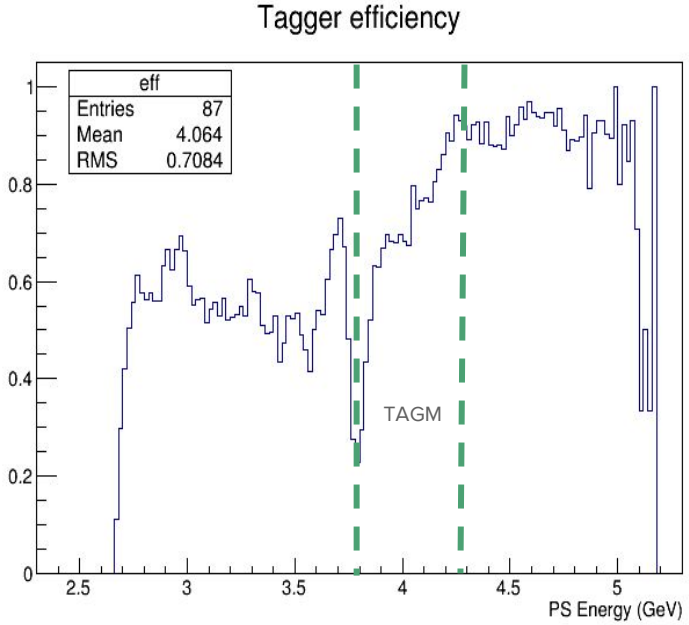

Typical time-walk curves for the tagger hodoscope

Average sigma for all channels is 180 ps

# Tagger Efficiency

- The tagger efficiency is the fraction of events that are seen by both the tagger and PS compared to all of the events seen by the PS
- Due to a physical shift in the TAGM, there is a dip in the efficiency



# Summary

- GlueX has successfully collected commissioning data
- These data have been used in calibrating the tagging detectors
- The timing resolution of the PS and tagger detectors are at or near design resolution
- The efficiency of the tagger detectors is near design efficiency
- Commissioning/opportunistic physics data will be taken spring 2016 at 12 GeV