

# TPOL Analyzing Power

March 12<sup>th</sup>, 2025



# Purpose

Determine how the analyzing power and integrated cross section of TPOL depends on the incident energy

# Energies

Generated 100 million polarized photon events at energies:

- 1 GeV
- 6 GeV
- 9 GeV (as a check)

# TPOL

- The TPOL detects the recoil electron from pair production off an atomic electron
- We use a 75 micron thick beryllium converter

# Cross section

- The total cross section is fairly stable over the energy range

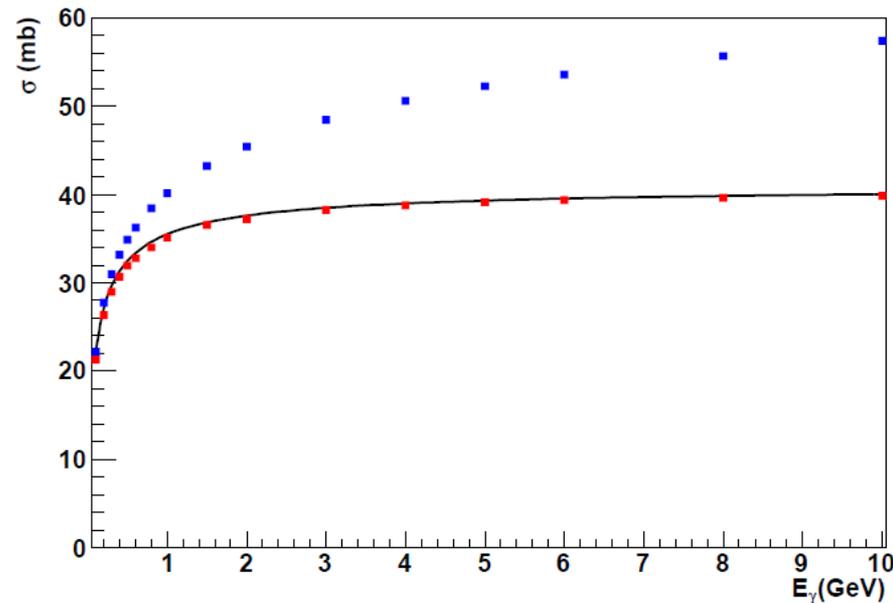
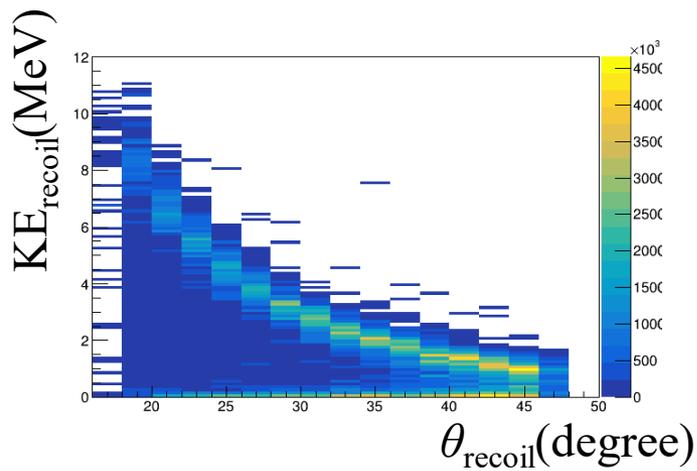
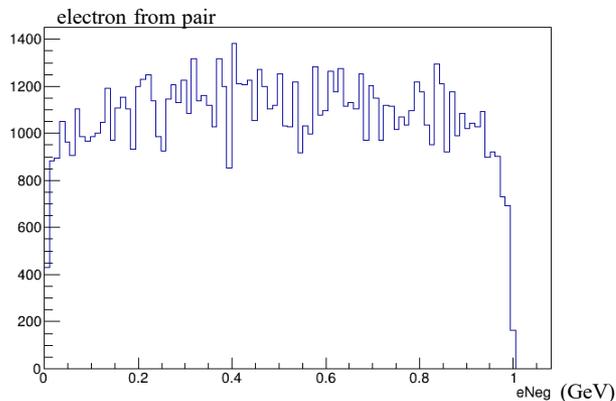


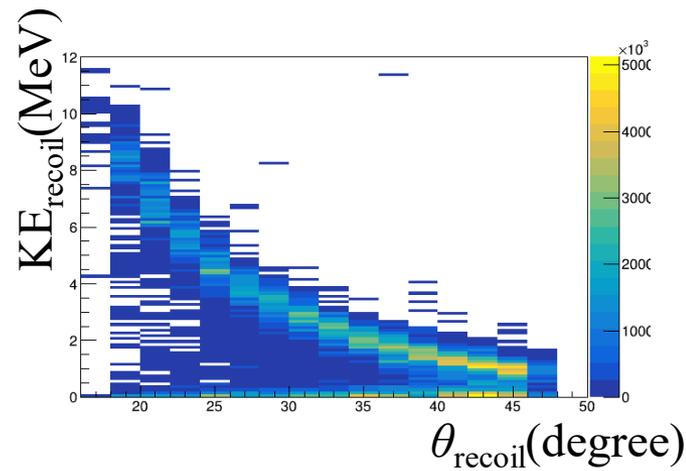
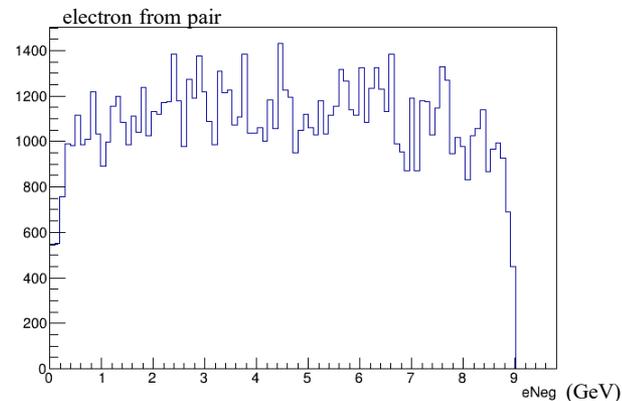
Figure 2: The total cross section for triplet photo-production for beryllium as a function of incident photon energy. The red (blue) squares represent generator results with (without) screening. The solid black line represents the NIST values.

# Some kinematic comparisons

$$E_{\gamma} = 1 \text{ GeV}$$



$$E_{\gamma} = 9 \text{ GeV}$$



- $KE_{\text{recoil}}$  vs.  $\theta_{\text{recoil}}$  is remarkably stable from 1-9 GeV

# PS energies

- The pair spectrometer determines the range of energies detected for the electron and positron from the produced pair
- The energy difference between the  $e^-$  and  $e^+$  influences the analyzing power (measured beam asymmetry  $\Sigma$ )

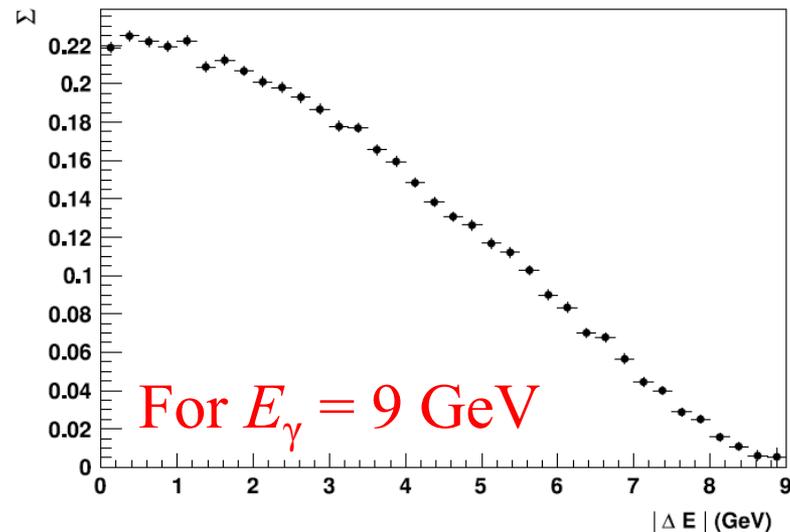


Fig. 6. Dependence of the beam asymmetry  $\Sigma$  on  $|\Delta E|$ , the difference between the kinetic energies of the produced  $e^+$  and  $e^-$ .

# PS energies

- For normal running, the PS records in the energy range as shown below

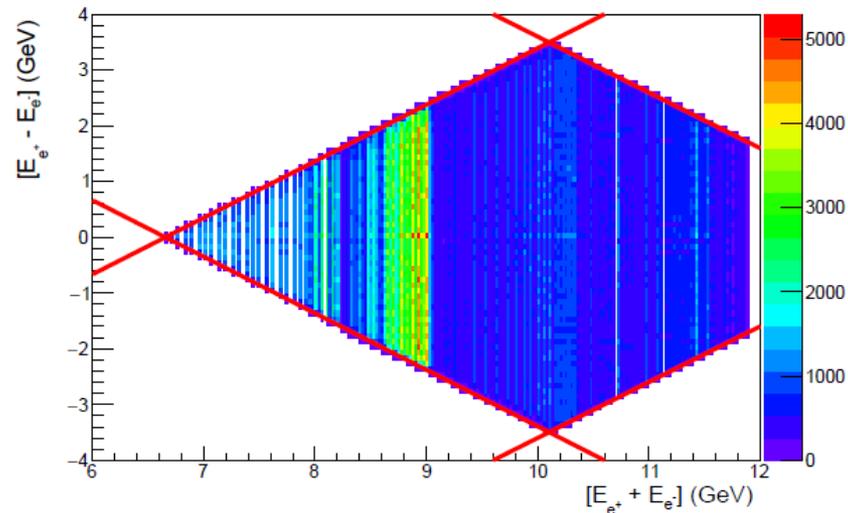
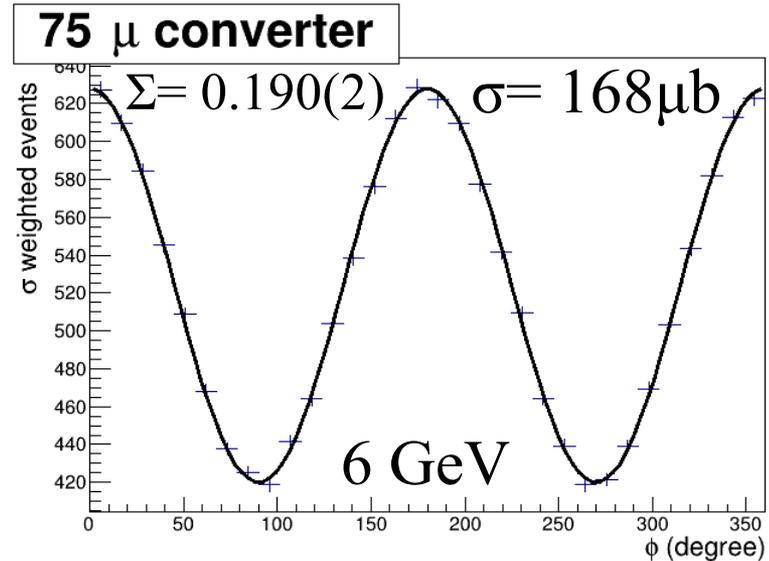
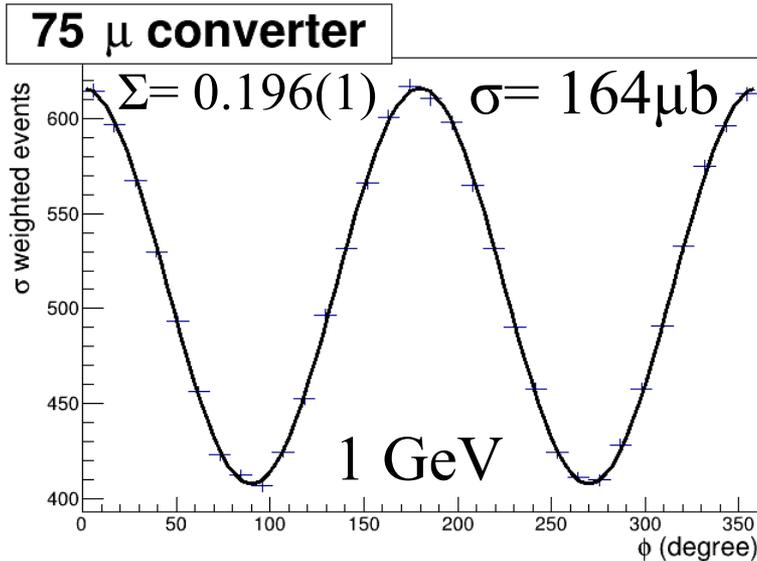


Figure 5: Plot of  $\Delta(E_{\text{pair}})$  versus energy of pair for experimental PS data. The region between the red lines represents the fiducial region.

# PS energies

- For coherent edges at energies well below 9 GeV, I scale the range of the PS by a factor of [coherent edge energy]/9GeV.
- NOTE: Using different PS energy ranges would produce different analyzing powers than what is shown in this document

# Analyzing powers ( $\Sigma$ ) and integrated cross sections ( $\sigma$ )



- The analyzing power and cross sections shown are for events surviving all cuts
- NOTE: PS setting was assumed. A different PS setting would change the results shown here

