Understanding the Momentum Dependence of the π^0 Mass Resolution at GlueX

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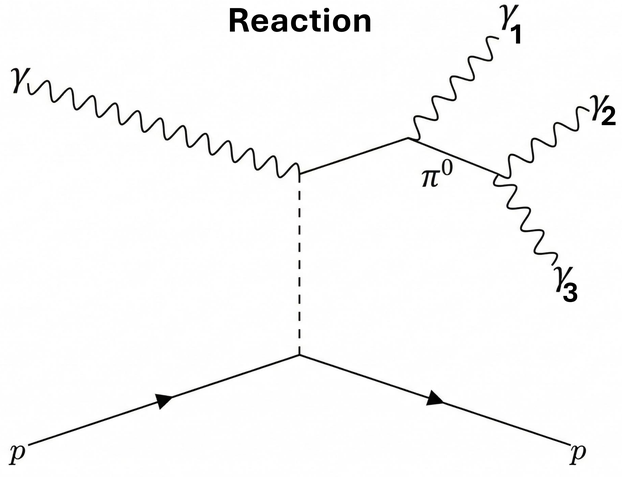
References

Introduction

- The GlueX experiment, located at the Thomas Jefferson National Accelerator Facility, has the goal of detecting hybrid mesons
- The Forward Calorimeter (FCAL) and Barrel Calorimeter (BCAL) detect signals from photons
- The reaction analyzed is $\gamma p \rightarrow \gamma p \pi^0$; $\pi^0 \rightarrow \gamma\gamma$
- The π^0 is produced abundantly in GlueX, and it is present in many other analyses
- Understanding the effect of the detectors' resolution when reconstructing the π^0 improves the quality of the analyses and simulations that include this particle

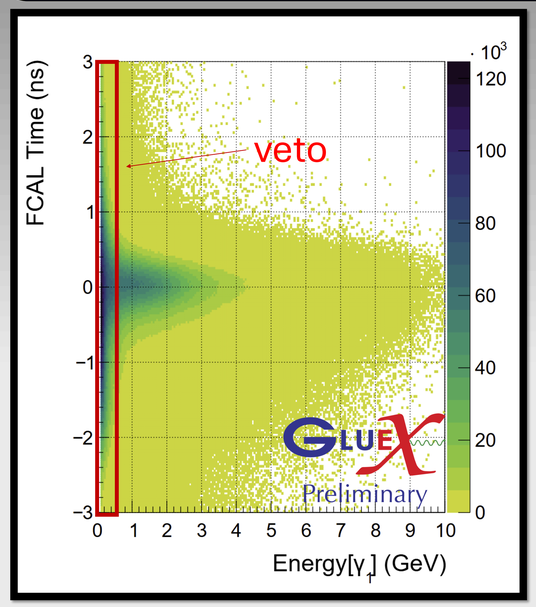
π^0 Analysis

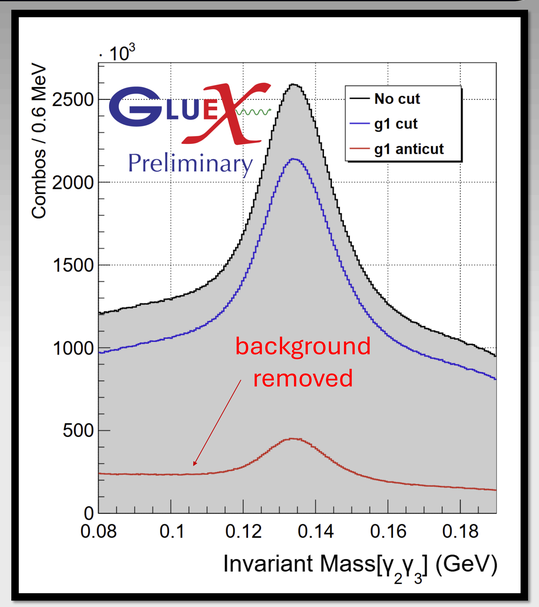
$\gamma p \rightarrow \gamma p \pi^0$; $\pi^0 \rightarrow \gamma\gamma$ Reaction



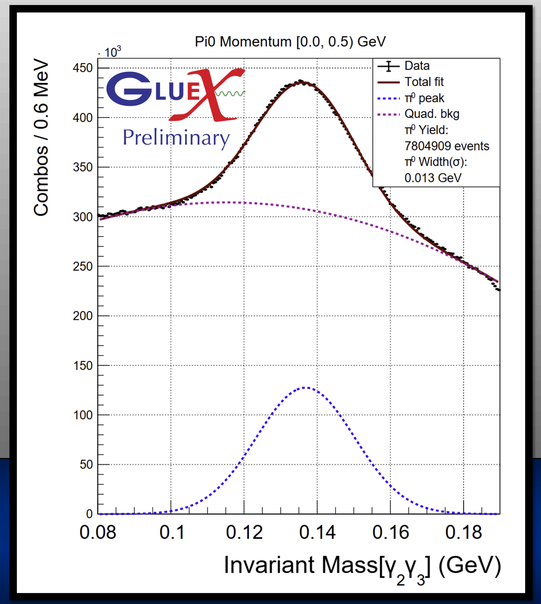
- Reaction data from three photons is selected, but background noise is present
- γ_2 and γ_3 are selected to be the π^0 candidates
- The goal is to remove as much background as possible before determining the resolution

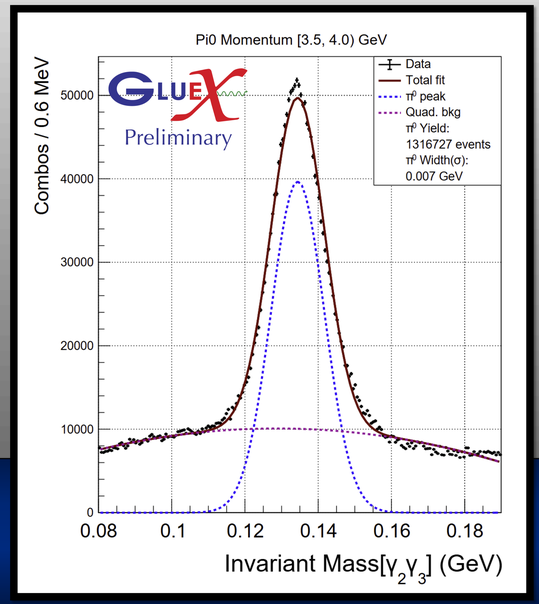
- High concentration of low energy photons from FCAL is a source of background noise so they are vetoed
- The veto shows that the signal-to-background ratio is close to 1 for these events, so other parameters might be needed to help preserve the signal





- The π^0 mass is divided into different momentum ranges to study how momentum affects the detectors' resolution
- The π^0 signal is modeled using a Gaussian curve and a 2nd order polynomial is used for the background
- The width (σ) extracted from the fit is a measurement of the resolution, where a smaller width means a higher resolution





Results

- Preliminary studies show that the π^0 properties change with momentum
- Extraction of the π^0 resolution is in progress
- The signal-to-background ratio and π^0 mass resolution increase at higher momenta

Future Research

- Different variables will be used to isolate the background for FCAL photons with energies less than 0.5 GeV
- The efficiency and π^0 yield will be calculated
- Different model selections will be tested if needed and systematic uncertainties of π^0 will be determined
- The study will be performed again on Monte Carlo simulations

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http://gluex.org/thanks

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