Neutron Detection Efficiency of Crystal Ball and TAPS

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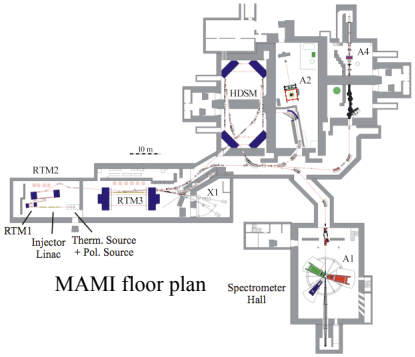
Beam Properties

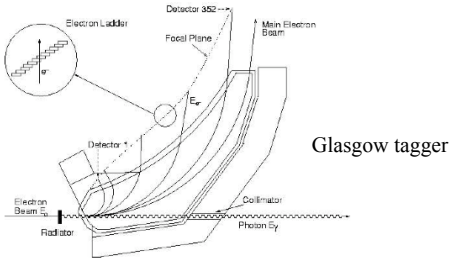
The photon beam is an ideal probe to investigate nucleons because of its well understood properties. The 100% duty factor MAMI electron beam is converted to a photon beam via the Bremsstrahlung process in a thin radiator. The photons are energy-tagged by the Glasgow Photon Tagger.

MAMI Energy	≤ 1557MeV
Current	**≤ 100μA**
Energy Resolution	≤ 400keV



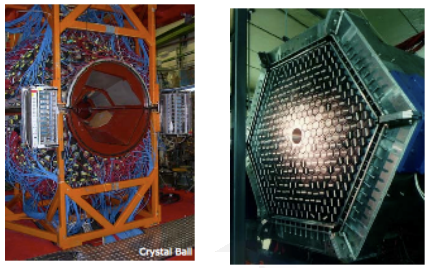
MAMI floor plan

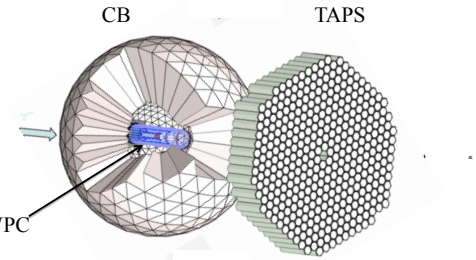
Photon Beam	
Energy Resolution	≤ 4MeV
Circular Polarization	up to 85%
Linear polarization	up to75%



Glasgow tagger

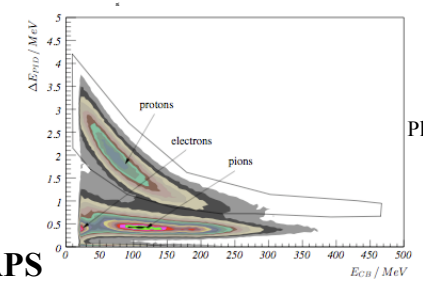
Crystal Ball and TAPS





CB

- 672 NaI Crystals
- Charged particles tracked with MWPC
- Particles identified by ΔE,E using the Particle Identification Detector (plastic scintillator barrel)



Plot of ΔE,E

TAPS

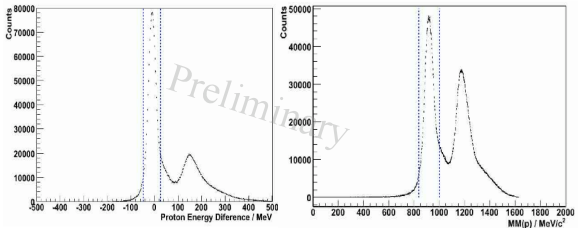
- 364 BaF_2 Crystals
- Particles identified by:
  - Plastic vetos using ΔE,E method
  - time of flight (TOF)
  - BaF_2 pulse shape analysis

Neutron Efficiency Analysis

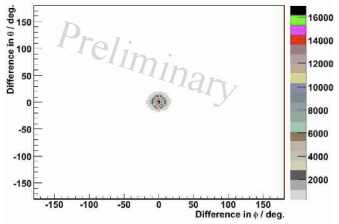
The aim of this project is to accurately measure the neutron detection efficiency of the Crystal Ball. The result is important in determining cross sections and testing the accuracy of simulations for channels such as double π^0 and π^0 η production on the neutron.

Efficiency Determination

- Select kinematically over-determined reactions: d(γ,p)n and d(γ,p, π^0)n.
- Base event selection on proton (and π^0) information alone.



- Determine in which of those events neutrons are actually detected.



- Neutron Efficiency = events with neutron detection / all selected events
- Efficiency determined as a function of neutron energy, theta and phi.