The Neutron Detector for the Measurement of G_E^n at high \mathbf{Q}^2 Experiment E02-013

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Overview

Technique: Double Polarization exclusive quasi-elastic scattering Neutron Detector:

- Requirements
- Description
- Operation
- Performance
 - Momentum Resolution
 - Neutron Detection Efficiency

Events Summary

Technique: Quasi-Elastic Scattering

We are looking for the neutron, since the problem with using $\overrightarrow{^{3}He}(\overrightarrow{e},e')$ is that the proton is mostly unpolarized, and gives a large contribution to the asymmetry. By looking for the neutron in coincidence with the electron, we can remove this proton contribution through the use of Veto detectors.



Neutron Detector: Requirements

- Efficiency
- Exclusive Neutrons
- Momentum Resolution 250 MeV/c
- High Rate MegaHertz
- Rejection
 - Veto
 - Shielding
- Large to match Big Bite's Acceptance

Neutron Detector: Description

- Is a 83 ton detector.
- Mounted on rails so that the front of the detector could be set at 6 m, 9 m, and 12 m from target, and at angles between 25.4 degrees and 35.2 degrees from the beamline.
- Consists of two veto planes of 48 detectors, and seven neutron planes of between 26 and 45 detectors.
- Includes 4 marker bars, which are situated vertically right after the second veto plane, to give a better calibration.
- Detectors installed in Cassettes to aid in installation.



Neutron Detector: Description



Neutron Detector: Operation

Trigger

- For every two neighboring sets of detectors (Shown here denoted by color), there is one sum channel.
- An OR of all these sum channels, for both sides is then used to set the Neutron Trigger.

F1 TDC

- Multi-hit pipeline TDCs used for the Neutron Detectors.
- Provides .118 ns resolution.

Sums, Vetos, and Markers used 1877s, which have .5 ns resolution. The ADCs used were 1875s.



Neutron Detector: Momentum Resolution

This time resolution of .8 ns corresponds to a momentum resolution of 150 MeV/C for a 1.6 GeV/C proton.



Neutron Detector: Efficiency

Based upon studies done in 2003, we expect a Neutron Detector Effiency of 35%. This will be update in the next couple of weeks.

Events



Summary

- The Neutron Arm was 83 tons.
- The Detection Efficiency for Neutrons was 35
- The achieved Time Resolution was .8 ns.
- I would like to thank the Neutron Team, in particular Rob Feuerbach and Tim Ngo.