Status of Hall C
Compton Polarimeter Project

Mark Dalton
University of Virginia
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Overview

Aim: to produce a Compton polarimeter for Hall C, initially for the QWeak experiment.

- Resonant cavity "photon target", up to 1 kW intensity.
- Photon energy or electron dispersion distance.

Diagram:
- Electron Beam
- Magnetic Chicane
- Electron detector
- Photon detector
- Resonant cavity "photon target", up to 1 kW intensity.
Laser System

High power laser (10 Watts)

low gain cavity (~100)

Routinely obtain >700 Watts in interaction region
Laser System Installation

Very quick installation

2009 March: Final decision on project parameters
2009 July: Laser arrives and set up at UVa
2010 July: Install laser system in Hall C
Mode Matching

Final profile, design and measurement

Thermal lensing effects
Laser System Feedback

Frequency response of feedback system

Lock quality indicator

Visual indication of laser in cavity
Laser System Polarisation

one state \( \sim 99.8\% \)
other state \( \sim -99.0\% \)

Difference due to birefringence from strain in mirror substrate.
Transfer Function

Measurement of polarisation in cavity region

Produce well defined polarisation for measuring transfer function
Photon Detector

30 x 10 x 10 cm CsI crystal
Hamamatsu R4885 3” PMT
Flash ADC integrating DAQ
Photon Detector Data
Photon Detector Cumulative

Asymmetry vs Run Number: Best Fit -0.627 +/- 0.016%

"goodrunlog.txt" using 1:2:3

Run Number

Asymmetry
Electron Detector

- Diamond strip detector
- 4 planes
- 96 strips per plane
Electron Detector
Electron Detector Data

1.7 cm from beam
1.5 cm from beam
1.3 cm from beam
Future Developments

• Increase signal size ⇒ cavity laser power ⇒ replace mirrors (higher reflectivity)

• Unlock other polarisation state ⇒ upgrade mirror mounts

• Increase mechanical stability and ease of working ⇒ Upgrade gimbal mounts

• Convert to absolute device ⇒ Measure response function ⇒ combine DAQs OR big simulation effort

• Electron detector: add 4th plane, replace vacuum signal cables, amplifier discriminator cards
Summary

The Compton polarimeter is a working relative device.

Significant development is still required but the roadmap is clear.