POL2000 group: Status Report

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27/5/04
PRC Open Session

On behalf of POL2000 group:
DESY, H1, HERMES, ZEUS

• Introduction
• Physics Motivation
• TPOL Studies
• LPOL vs. Synchrotron
• Conclusions
**LPOL**: measure longitudinal polarization between HERMES’ spin rotators

**TPOL**: measure transverse polarisation far from spin rotators

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Compton scatter laser light off pol. electron beam

- **Measure vertical asymmetry of compton photons** $\eta(y)$:
  \[ \eta = \frac{E_{\text{upper}} - E_{\text{lower}}}{E_{\text{upper}} + E_{\text{lower}}} \]

- **Continuous laser** (1–2 compton $\gamma$’s in 200 bunch crossings)

- **In–situ measurement of $\eta(y)$ from Si strip and scintillating fibre**

- **Measure energy dependence of compton photons**

- **Pulsed laser** (high power, low rate)

- **Measure multi–$\gamma$ spectrum**
  \[ \Rightarrow \text{New 1W laser + Fabry–Perot cavity} \]

- **Measure ’Few–$\gamma$’ spectrum**

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Continuous, reliable operation

However, discrepancy between LPOL and TPOL
  - Time dependent
  - Ratio discrepancy
    ~ 5–15%
Polarised Charged Current

- First pol. CC measurements presented at spring conferences
- 2000 pol. (HERMES) error
  \[ \frac{\Delta P_{LPOL}^{2000}}{P_{LPOL}} = 1.9\% \quad \frac{\Delta P_{TPOL}^{2000}}{P_{TPOL}} = 3.4\% \]
- 2004 (conservative) pol. error
  \[ \frac{\Delta P_{LPOL}^{2004}}{P_{LPOL}} = 5\% \quad \frac{\Delta P_{TPOL}^{2004}}{P_{TPOL}} = 10\% \]
- LPOL measurement used in preference
  - H1: \( \sigma_{CC}^{P} = 34.67 \text{ pb} \pm 5.6\%(\text{stat.}) \pm 4.8\% \text{ (sys.)} \)
  - ZEUS: \( \sigma_{CC}^{P} = 38.1 \pm 2.9\text{(stat.)} \pm 0.8\text{(sys.)} \pm 0.2\text{(lumi.)} \pm 0.8\text{(pol.)} \text{ pb} \)

\( \Rightarrow \) Aim to minimise pol. error
LPOL Systematic Studies

- Study existing LPOL
- Possible systematics investigated (Winter 2003–Spring 2004) including:
  - Laser energy (figure)
  - Position of Compton cone in calorimeter
  - Laser noise correction
  - False asymmetry
- No dependence of polarisation measurement observed
- LPOL appears consistent with 2000 performance (~2% sys. error)
Components running successfully

Examing offline analysis:

- compare measurements of $\eta+y$

$\eta = \frac{E_{\text{upper}} - E_{\text{lower}}}{E_{\text{upper}} + E_{\text{lower}}}$

- use both Si and fibre position detectors
TPOL Analysis: systematics

- Studies into systematic errors ongoing:
  - Hints of correlations (eg. focus of Compton cone)
Status of the Cavity LPOL

- Allows fast and precise polarisation measurement
- Cavity installation in spring/summer 2003
  - LPOL cavity DAQ system working fine
- New calorimeter
  - Calorimeter design updated (crystal calo. not radiation hard enough)
  - New calorimeter (quartz fibres) installation by end of 2004

10^5 photons/s  10^7 photons/s
Synchrotron Radiation Problem

HERMES Target Field

Cavity LPOL
(Laser controller damaged)

Calorimeter
(hole in Pb shield)

2.45kW!

Laser Crossing Points
(z = 52 m & z = 62 m)

0.26 kW
0.96 kW

-1.571 mrad

0.02 kW
0.54 mrad

0.52 kW
2.70 mrad

z(m)
Actions Taken Against Radiation

- New absorber being designed (cooled Cu, OR 53m) – Installation after shut down
- Improved lead shielding
- Radiation monitoring – dosimeters – PM’s
- Reinstall electronics after results of dosimeter analysis
Conclusions

- Continuous, reliable measurements from both polarimeters
  - First measurements of polarised CC sent to spring conferences with conservative polarisation error (5%)
- LPOL appears consistent with 2000 performance ⇒ ~2% error
- TPOL offline analysis ongoing
- LPOL cavity installed + DAQ working
- Updated LPOL calorimeter design ⇒ Installation by end of 2004
- LPOL cavity electronics suffered from intense synchrotron radiation
  - New shielding in place
  - Constant monitoring of radiation doses
  - Reinstall electronics and continue commissioning
  - New absorber in progress