Polarimeter Group Status Report

David South DESY H1Collaboration Meeting

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The Polarimeters at HERA



- LPOL measures longitudinal lepton polarisation near HERMES
- TPOL measures transverse lepton polarisation far from spin rotators
- Pol. Measurement: Compton scatter laser light off the lepton beam



- Pulsed high intensity laser, operates in multi-photon mode
- Long. pol. leptons: cross section dependent on energy only
- Polarisation is given by energy asymmetry: $P = \frac{1}{A} \frac{\langle E \rangle_L \langle E \rangle_R}{\langle E \rangle_L + \langle E \rangle_R}$ L,R = laser helicity states
- Analysing power, A, determined from calorimeter response (SW, crystal)
- New laser and LPOL cavity installed...



- Continuous laser, operates in single photon mode
- Trans. pol. leptons: cross section dependent on energy and y-position
- Measure the vertical asymmetry of photons: $\eta = \frac{E_{upper} E_{lower}}{E_{upper} + E_{lower}}$
- Polarisation given by $P = \frac{1}{A} (\langle \eta_L \rangle \langle \eta_R \rangle)$
- Analysing power is fixed for the online analysis; offline method uses multi-parameter fits...
- Silicon detector provides x, y position measurement

Polarisation Measurements





- Reliable operation of both polarimeters since October
- However, discrepancy exists between the two measurements
- Relative difference varies between 5 to 15% higher at LPOL. Under investigation..
- LPOL repairs this week (short access)

Polarisation in HERA II Analysis



LPOL Systematic Studies

- Analysis performed on data from winter 2003-spring 2004.
- Search for possible systematic dependences of LPOL measurement
- Examples: laser energy, Compton cone position, table position varied
- No dependencies found: Measurement is compatible with 2000 performance with a systematic uncertainty $\approx 2\%$ (*cf* 5% quoted at DIS 2004).
- Expect official statement on error from LPOL people for the summer



TPOL Systematic Studies



- Main handle on problems is the ratio LPOL/TPOL: should be unity!
- HERA I showed agreement at 2% level, HERA II disagrees 5-15%
- Main source identified as beam size (*"focus"*) at TPOL calorimeter
 - HERA II lepton beam is less stable?



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TPOL Analysis

$$P = \frac{1}{A} \left(\left\langle \eta_L \right\rangle - \left\langle \eta_R \right\rangle \right) \qquad \eta = \frac{E_{upper} - E_{lower}}{E_{upper} + E_{lower}}$$





- Examine relationship between vertical position and energy asymmetry, the "η-y transformation", using calibration data from Silicon and scintillating fibre detectors
- Compared above to output from offline analysis
- Work in progress, but agreement in central (most populous) region
- Store η -y transformation for use in polarisation measurement.

TPOL Offline

Catherine Fry

- First attempt at 2D fitting of the beam ellipse at the silicon detector
- Extract the following:

 $x_0 \& y_0$: coordinates of the beam centre $\sigma_x \& \sigma_y$: width of the beam in x and y α : beam tilt w.r.t. silicon x and y

- Requires 100,000 events with current trigger threshold, equivalent to 250 secs
- Optimisation studies underway to perform this every TPOL run
- Store information about beam parameters for polarisation calculation..



TPOL silicon data

TPOL Offline

Stefan Schmitt

- Results of new fit method
- Best fit obtained using fixed η-y transformation with all other parameters free
- Large data set, Jan-Apr 2004
- Early results look promising, good agreement with LPOL, but full systematic uncertainties...

Systematic effects visible in online TPOL ratio, — but absorbed in offline ratio _



Technical Plenary, 16th June 2004

New TPOL Webpage

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🕺 🖞 Home 🛛 🖞 Bookmarks 🥒 nufc 🖉 google 🦧 moz 🥒 map 🦧 ebay 🦧 lloyds 🥠 db 🥠 bstar 🥠 am.uk 🥠 am.ue 🥠 sun 🥠 bbc 🥠 root		
The Transverse Polarimeter Homepage		
TPOL DAQ Experts and Phone Numbers		
General Information and Documentation		
TPOL Software Document CERN Test Beam Document Polarimeter Email Archives Zeus Polarimeter Page		
Monitoring and Control		
Note that the TPOL software only works on the DESY site, inside the DESY fire wall. Java version 1.1 or higher is needed to run the software. DS: This section needs unpicking from petpol03.		
Download/Start the TpolMonitor Online-manual for the TpolMonitor	Known Problems with the TpolMonitor Version History of the TpolMonitor	TPOL Online Histograms Access the ORACLE Database
New Offline Analysis		
New <u>database</u> coming soon		
Experts		
A Short TPOL Manual Instructions for Operating the TPOL (ps file)	Online Instructions for Experts Weekly Plots (pctpol03)	Available Spare Parts Log Files of TPOL Runs
Old Pages		
The old Polarisation at HERA page can be found <u>here</u> . (some broken links) The old TPOL page can be found <u>here</u> . (all links inside the DESY firewall)		
David South Last modified: Tue Jun 8 19:46:24 MEST 2004		
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- More information now available outside the DESY firewall
- Offline analysis efforts will be coordinated from
 here

http://www.desy.de/~pol2000



- LPOL operation in single photon mode for a more precise measurement: needs continuous high power laser
- Solution: Fabry-Perot cavity, multiplies initial laser power by ~1000
- Installed spring/summer 2003, DAQ operational
- Delays due to radiation damage to electronics...

LPOL Plans



- Improved lead shielding and radiation monitoring installed
- Electronics will be reinstalled after results of dosimeter testing (extended access)
- Hope to see operation before summer shutdown
- Existing LPOL calorimeter cannot stand prolonged operation
- New radiation hard calorimeter (tungsten/quartz) to be built by H1, installation late 2004/early 2005

Summary and Conclusions

- First polarised CC cross sections measured at HERA first left handed data now analysed!
- LPOL systematic studies should improve the quoted error on the LPOL polarisation measurement
- Correlation of LPOL/TPOL ratio with beamsize at TPOL calorimeter observed - attributed to HERA II beam conditions
- TPOL offline analysis active on many fronts: new (very preliminary) fit looks good, but more investigations needed
- New LPOL cavity installed, running soon
- Updated LPOL calorimeter design, installation planned for early 2005
- Much work ongoing in POL2000 group, but still work to do!