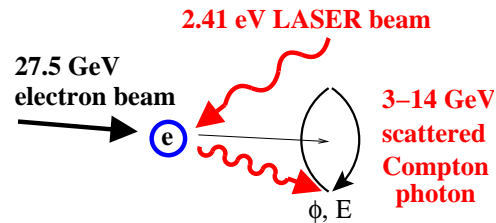Stefanm Schmitt

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Transverse Polarimeter (TPOL): calibration of the absolute polarisation scale

- Online polarisation measurement

- Offline polarisation measurement

- Plans
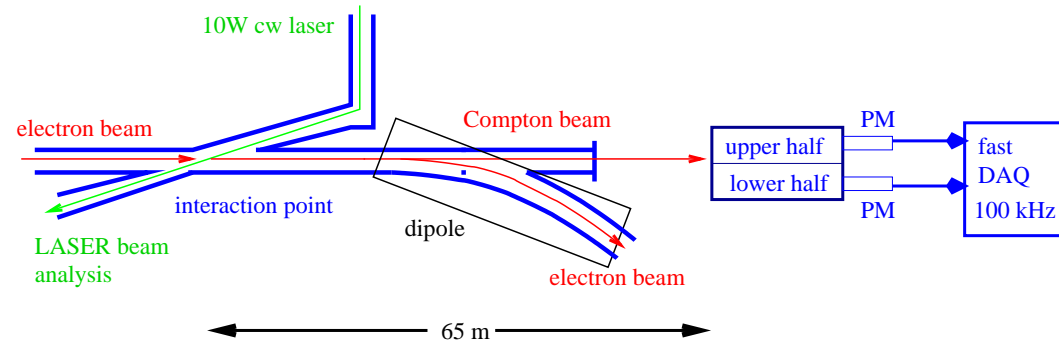
Online polarisation measurement

Double-diff. cross-section for scattered Compton photons

$$\frac{d^2\sigma}{dE\,d\phi} = \Sigma_0(E) + S_1\Sigma_{S,1}(E)\cos(2\phi) + S_3 P_y \Sigma_{Y,2}(E)\sin(\phi) + S_3 P_z \Sigma_{Z,2}(E)$$

Detector at distance $d = 65\,\mathrm{m}$. Photons of energy E are scattered on rings of radius $r(E) = d * \sin(\theta E)$.

Calorimeter divided into two halves (up U and down D). Measure energy E and asymmetry $\eta = \frac{U-D}{U+D}$.

Asymmetry depends on vertical position $\eta = \eta(y)$, $y = r\sin(\phi)$

Flip laser helicity $(-S_3)$ and $(+S_3)$ to control systematic uncertainties

Beam polarisation: proportional to mean asymmetry $\langle\eta\rangle$ at intermediate energies

$$P_y = \frac{\langle\eta\rangle_L - \langle\eta\rangle_R}{A}, \text{ where } A: \text{ "Analyzing power" } (A \approx 0.1)$$

Present polarisation scale calibration

- $A = 0.090 \pm 0.008$ from MC studies in 1993

- $A = 0.09608 \pm 0.00106$ from rise-rime calibrations in 1994 (spin rotators off) and 1997 (spin rotators on)

LPOL/TPOL agreement in 2000: about 2%

- During 2000 shutdown: install silicon detector and converter.
  $A = 0.09608 \times \frac{A^{\mathrm{MC}}_{\mathrm{conv.}}}{A^{\mathrm{MC}}_{old}} = \frac{0.09608}{1.0779}$

- First data in 2002/2003: apply offline fit, calculate new analyzing power to match offline and online analysis.
  $A = 0.09608 \times \frac{P^{\mathrm{offline}}}{P^{\mathrm{online}}} = \frac{0.09608}{1.0372}$

TPOL online measurement at present is calibrated to agree with offline fit-based analysis . . . but offline analysis is not yet fully understood.

LPOL/TPOL do not agree anymore, absolute scale differs by 10%. TPOL is lower. Wrong analyzing power (NB: detector and beam parameters changed).

TPOL Plans

- Understand offline analysis

- Use silicon detector to calibrate ($\eta - y$ transformation), feed back to offline analysis

- Do absolute calibration using rise-time method to verify offline analysis and have direct calibration of online analysis

- Detailed Monte Carlo studies (understand calorimeter response to converted and non-converted photons), feed back to offline analysis

- Re-analyze full winter 2003 and spring 2004 dataset, once offline analysis is established