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H1 collaboration meeting

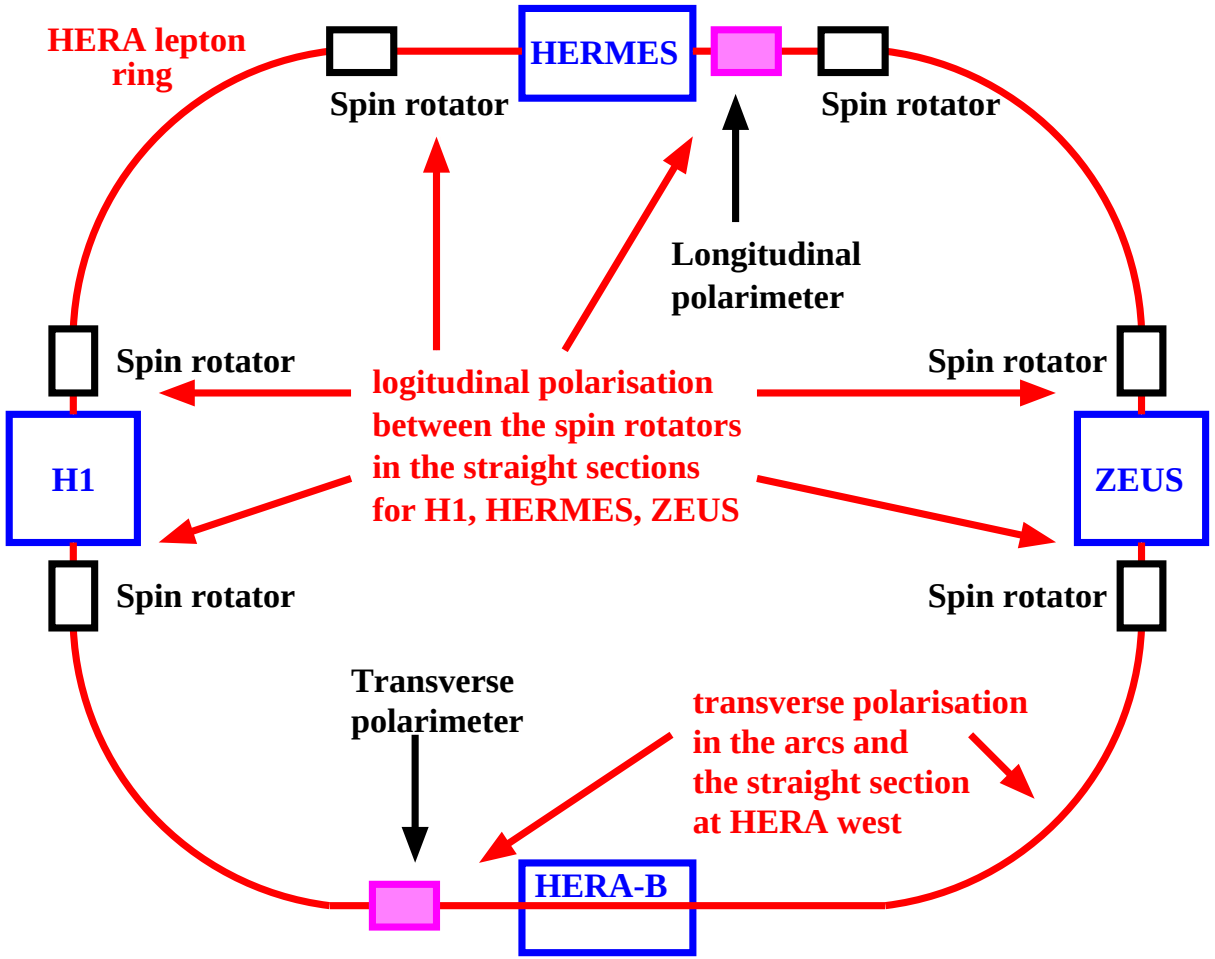
June 25, 2003

Polarimeters at HERA: overview

- Introduction
- The transverse polarimeter (TPOL)
- The longitudinal polarimeter (LPOL)
- The LPOL cavity

Introduction: Polarisation and polarimeters at HERA

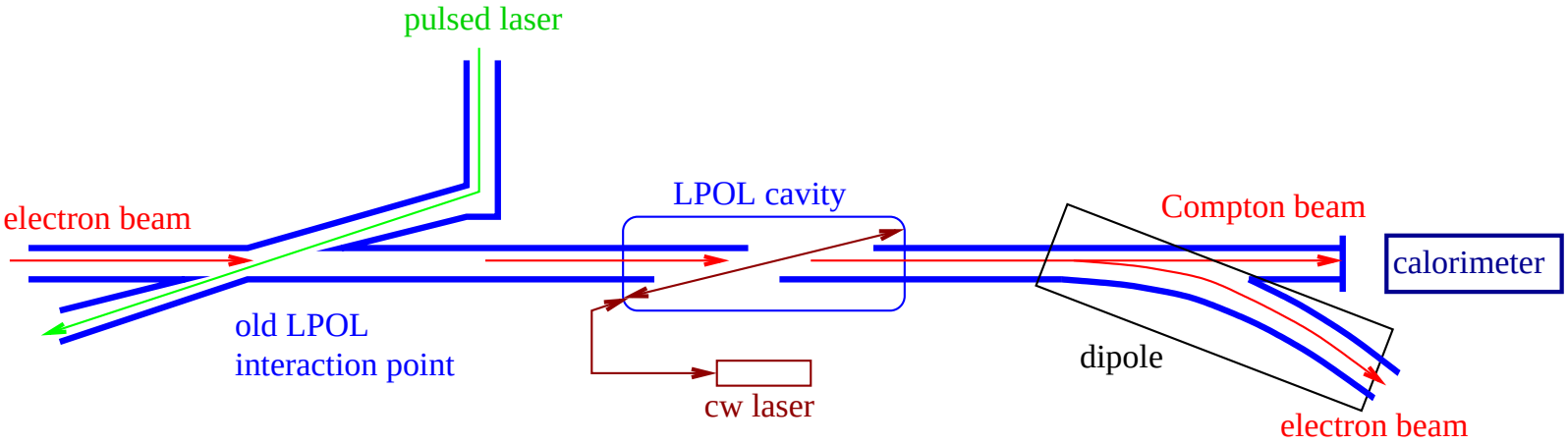
- Built-up of polarisation in ≈ 30 min (Sokolov-Ternov effect)
- Transverse polarimeter (TPOL) is located near HERA-B
- Longitudinal polarimeter (LPOL) is located between HERMES spin rotator
- LPOL Fabry-Perot cavity successfully installed during shutdown



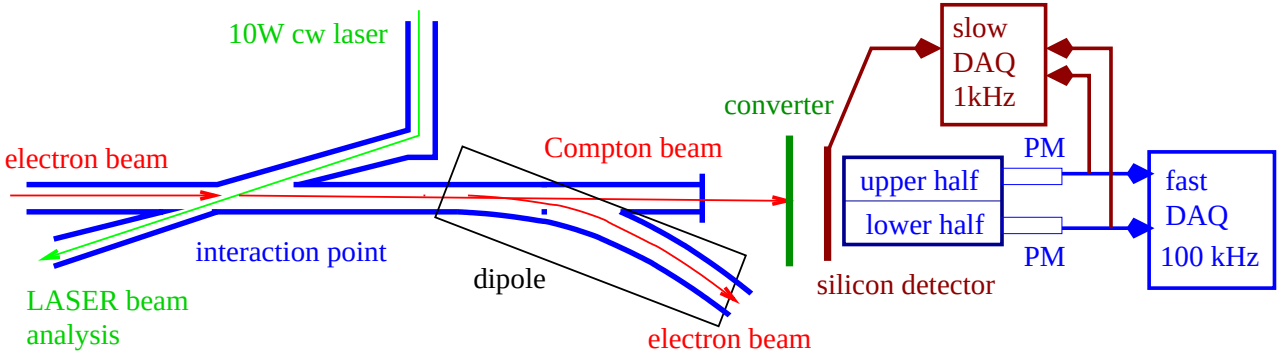
The HERA polarimeters

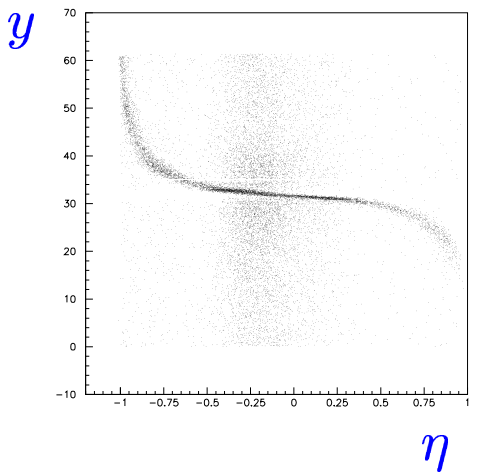
Two polarimeters are running in parallel (redundancy, syst. checks)

1. Near HERA-B: the transverse polarimeter (TPOL)
   $\Delta P = 1\% \oplus 3\%$ per minute, avg over all bunches
2. Near HERMES:
   (a) either the "old" logitudinal polarimeter (LPOL)
   $\Delta P = 1\% \oplus 2\%$ per minute, avg over all bunches
   (b) or the new laser cavity, built by Orsay (LPOL cavity)
   $\Delta P = 1\%$ per minute per single bunch



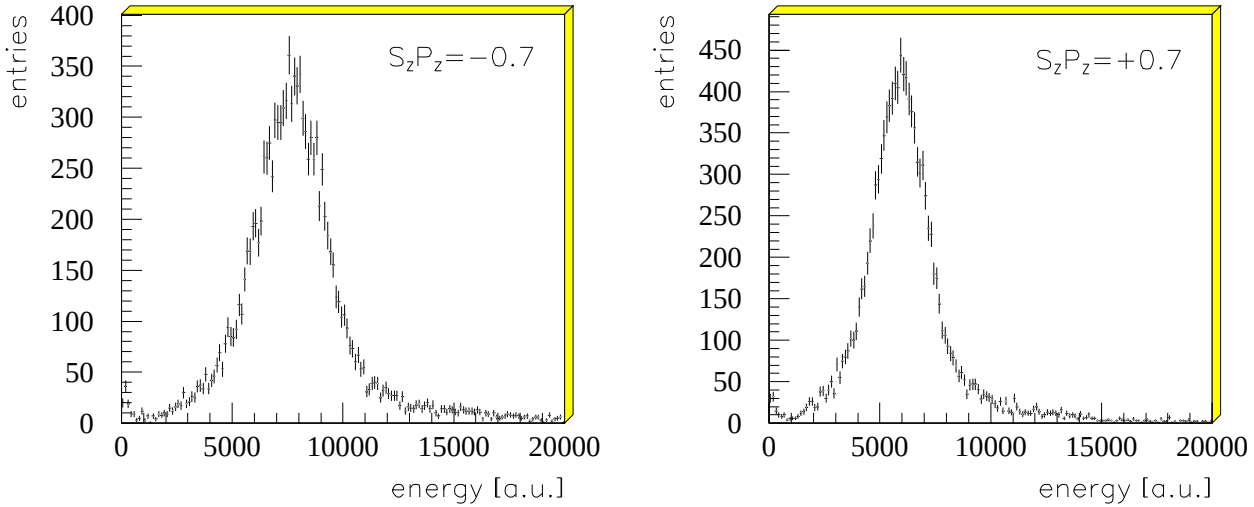
The transverse polarimeter (TPOL)





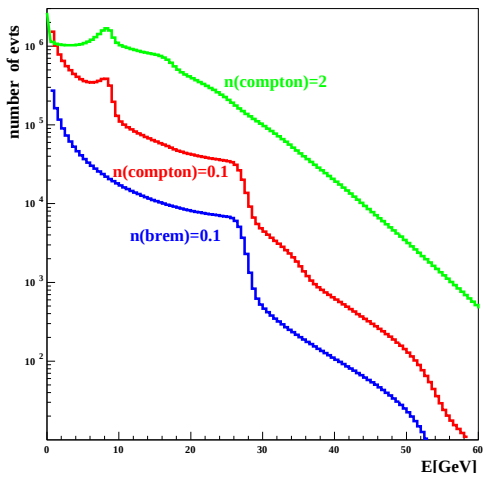
- DAQ upgrade in 2000–2001 (new H1 lumi electronics)
- Measure double-differential cross-section $\frac{d^2\sigma}{dydE}$
  Online-analysis: use mean $\langle y \rangle$ at a fixed energy
- Position y measured from energy asymmetry $\eta = \frac{U-D}{U+D}$
- Systematics limited by non-linear $\eta - y$ transf.
- Converter and silicon, fiber detector for online-cal. of $\eta(y)$
- New offline analysis: calibration from the calorimeter data alone

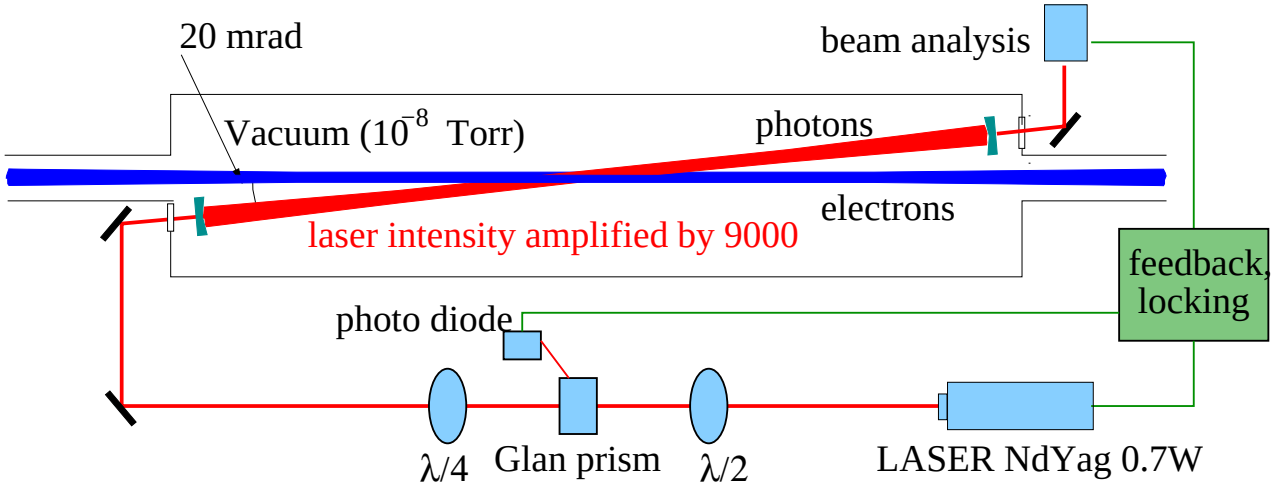
The longitudinal polarimeter (LPOL)



- Longitudinal polarisation influences $\frac{d\sigma}{dE}$
- Multi-photon mode: pulsed high-intensity LASER, energy of 1000 photons add up to $\langle E \rangle$ seen in the calorimeter
- Polarisation determined from $\frac{\langle E \rangle_L - \langle E \rangle_R}{\langle E \rangle_L + \langle E \rangle_R}$
- Systematics limited by calorimeter linearity, laser timing

The LPOL cavity





- Measure $\frac{d\sigma}{dE}$ with high precision
  statistical error negligible, good control of syst. uncertainties
- Amplify 1W Laser in a Fabry-Perot resonator (cavity) to increase probability of Compton scattering
- Read calorimeter and fill histogram at 10.4 MHz
- Offline analysis: fit spectra. Possible online analysis: use $\langle E \rangle$