The HERA polarimeters

status report

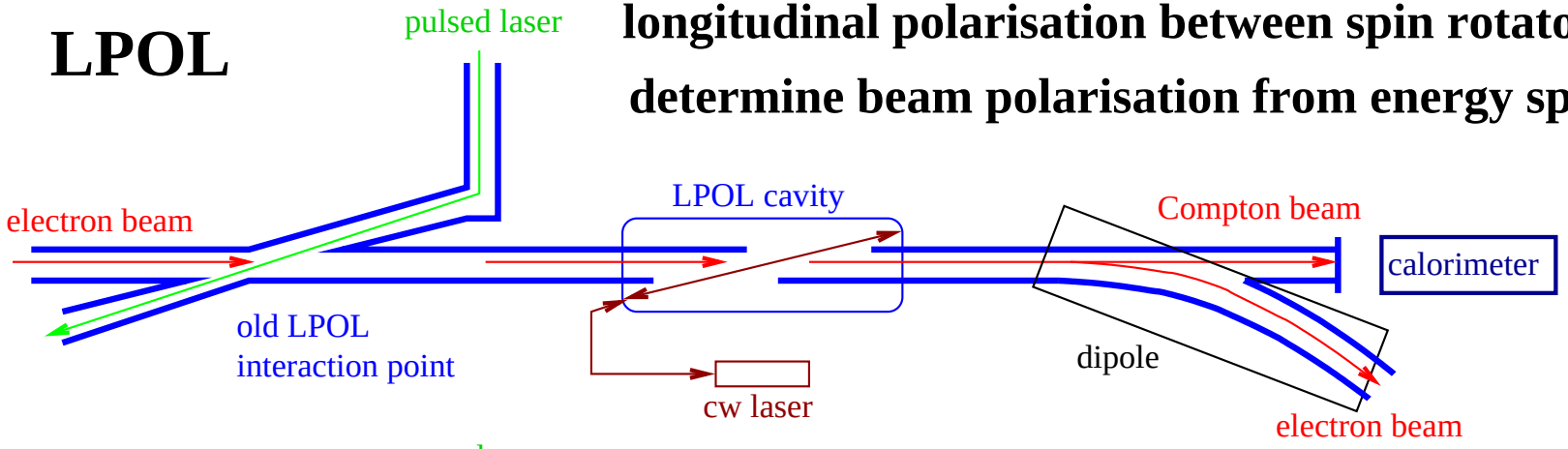
- The Polarimeters
- Polarimeter data-quality monitoring
- The LPOL/TPOL ratio
- Polarimeter offline analysis
- Polarimeter data flow

The Polarimeters

LPOL

longitudinal polarisation between spin rotators

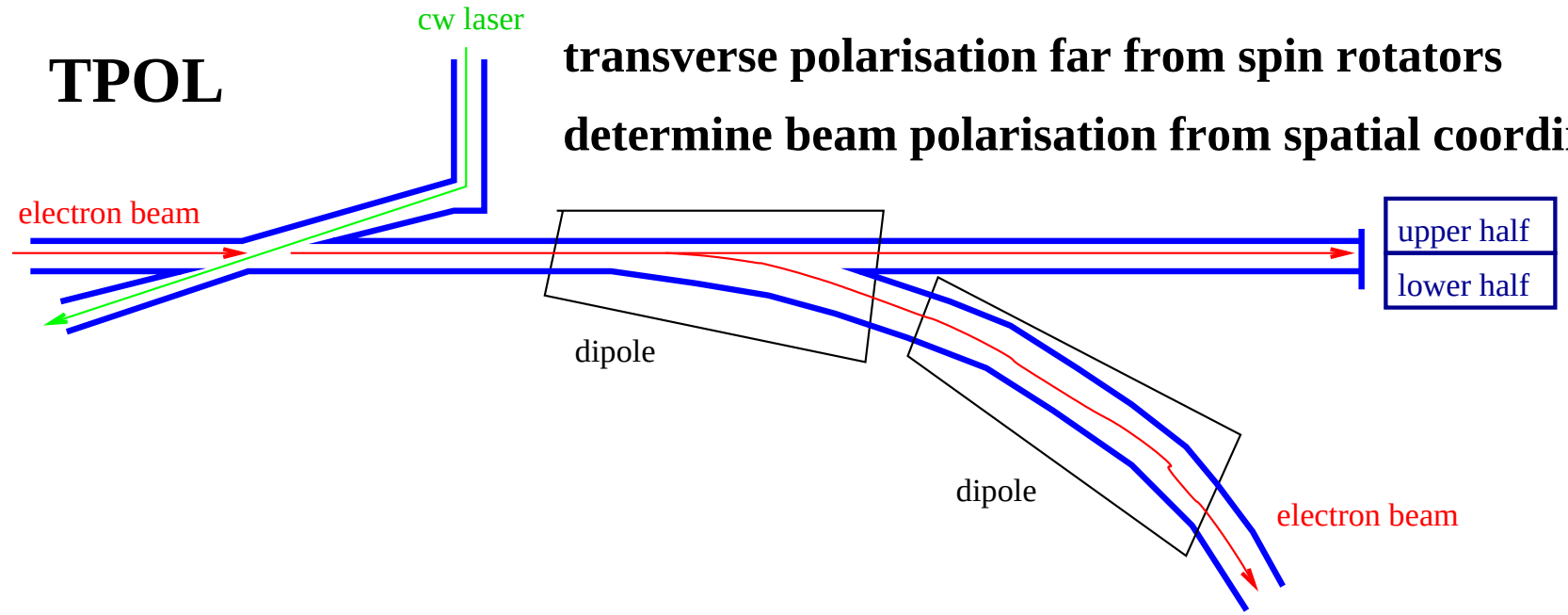
determine beam polarisation from energy spectra



TPOL

transverse polarisation far from spin rotators

determine beam polarisation from spatial coordinate

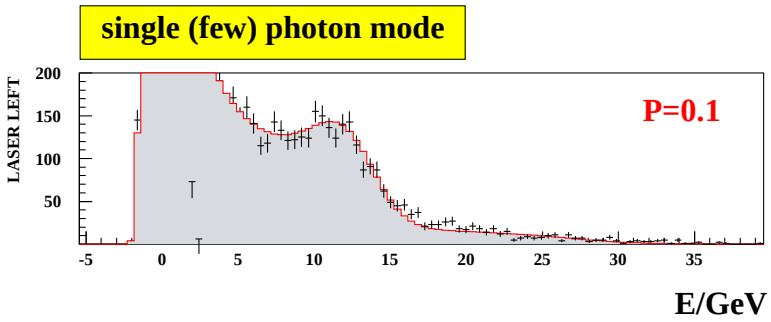


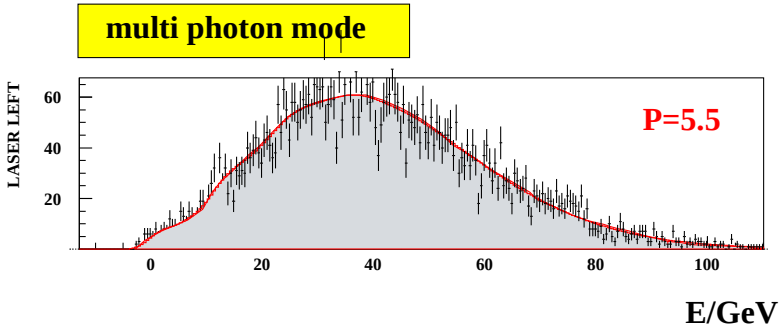
The LPOL

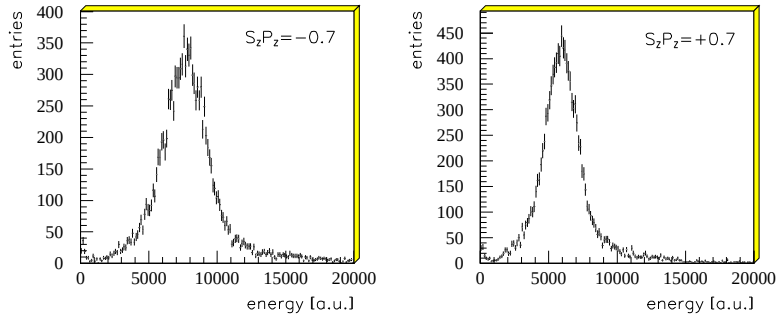
- Long. beam polarisation changes $\frac{d\sigma}{dE}$
- Pulsed high-intensity laser: multi-photon mode
- Calorimeter integrates 1000 photons
  Measure: $I = \int E \frac{d\sigma}{dE}$
- Flip laser helicity
- Polarisation

$$P = \frac{1}{A}(\langle I_L \rangle - \langle I_R \rangle)$$

- A depends on calorimeter linearity



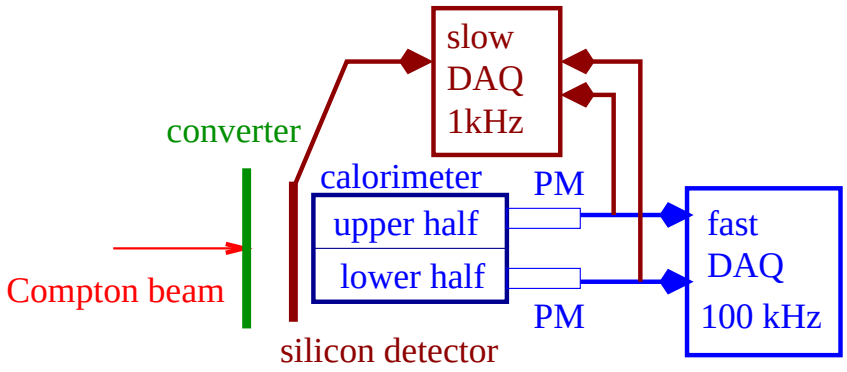




LPOL cavity: measure $\frac{d\sigma}{dE}$, single photon mode, high statistics (high laser intensity)

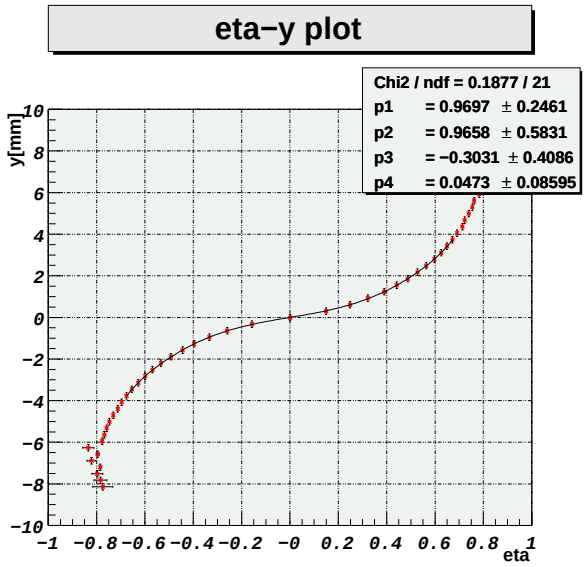
The TPOL

Store events for calibration analysis



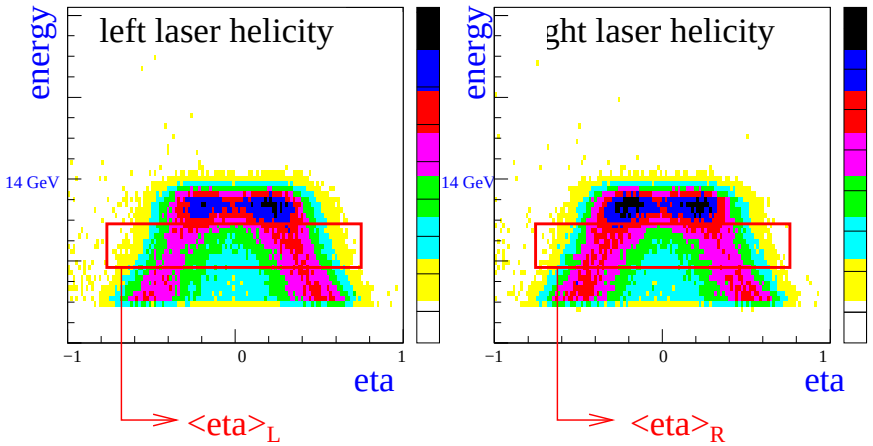
Store histograms
for polarisation analysis

- Calorimeter measures
  $E = U + D$ and $\eta = \frac{U-D}{U+D}$
- Silicon measures coordinates x, y of converted photons



Silicon
detector
analysis

Calorimeter data (1 minute)



Online analysis: $P = \frac{1}{A}(\langle \eta_L \rangle - \langle \eta_R \rangle)$

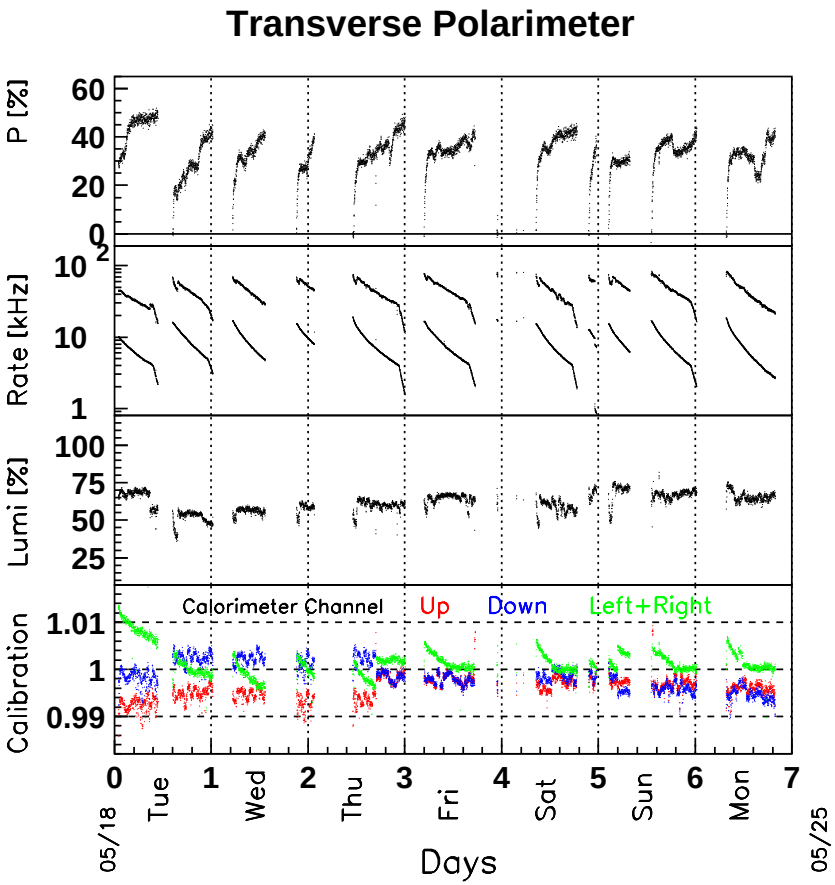
A depends on $\eta - y$ transformation, beam size

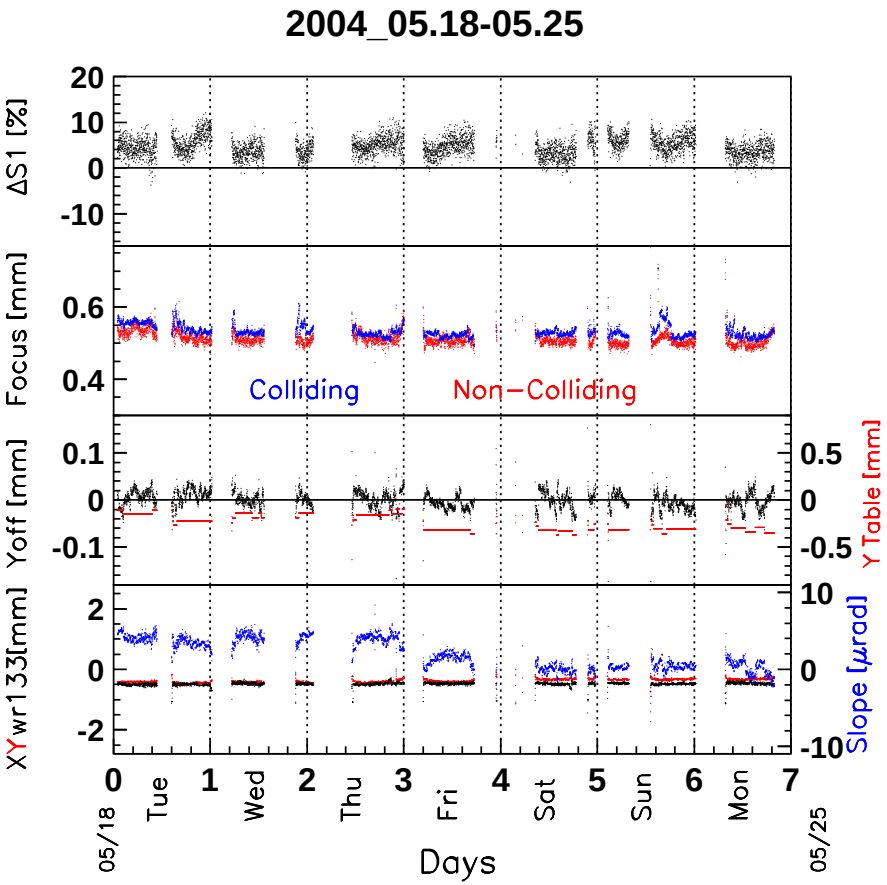
Offline analysis: multi-parameter fit

Data quality monitoring

Weekly polarimeter meeting, Tuesday 15:00 1d/11

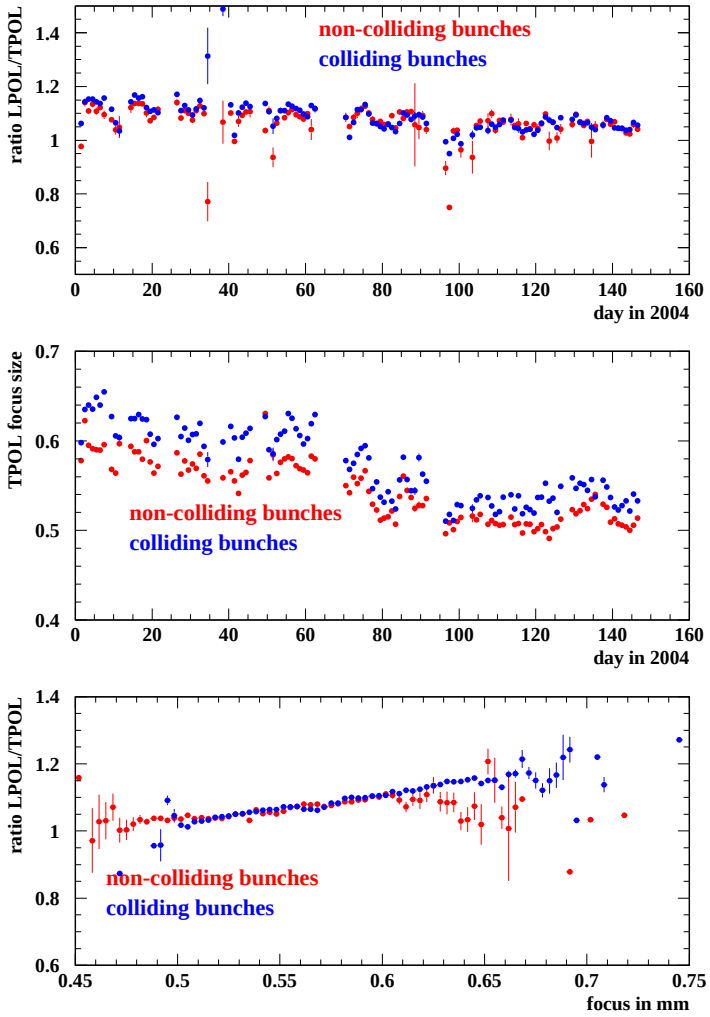
Example: TPOL data quality plots, first page





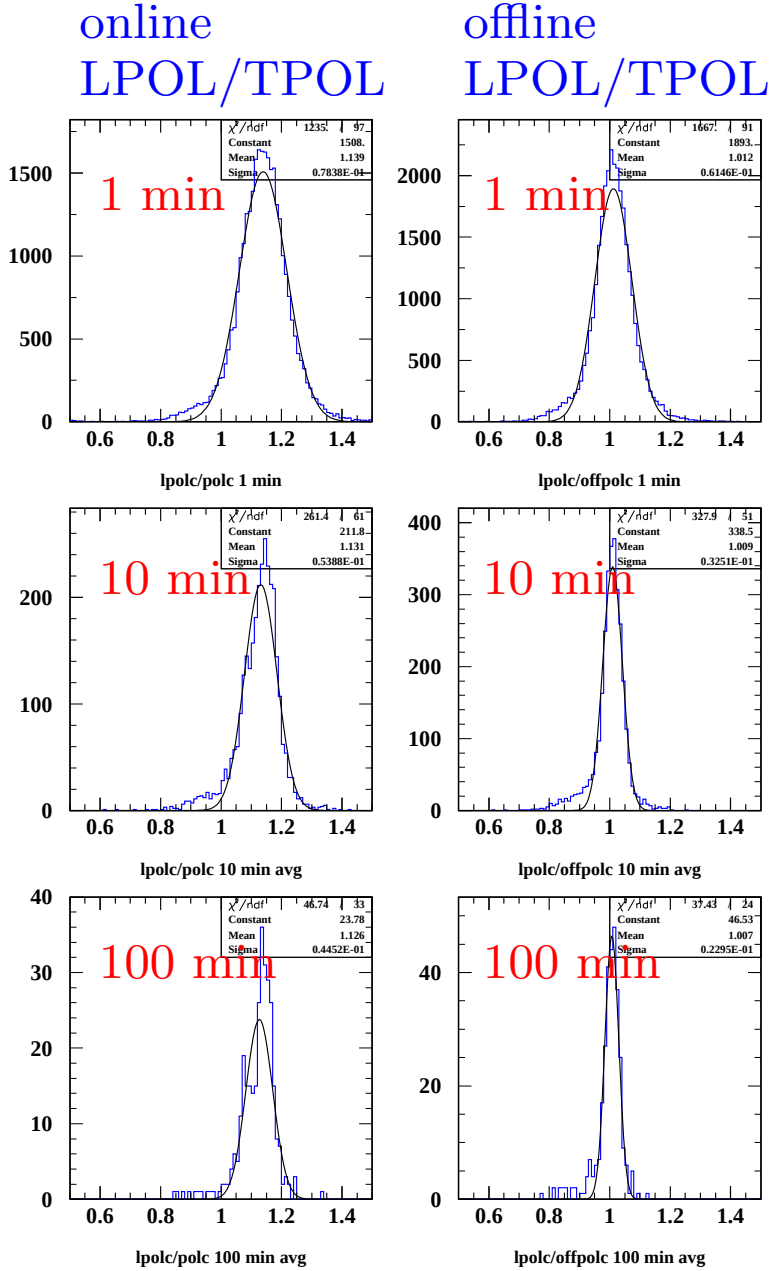
The LPOL/TPOL ratio

- Polarisation is constant around HERA
- LPOL and TPOL should agree
- Monitor $\frac{\text{LPOL}}{\text{TPOL}}$ to spot polarimeter problems
- HERA I: agreement on 2% level
- HERA II: disagreement $5 - 15\%$
- Main source: beam size ("focus") at TPOL calorimeter
- HERA II e^+ beam seems to be less stable than at HERA I (emittance, tilt)

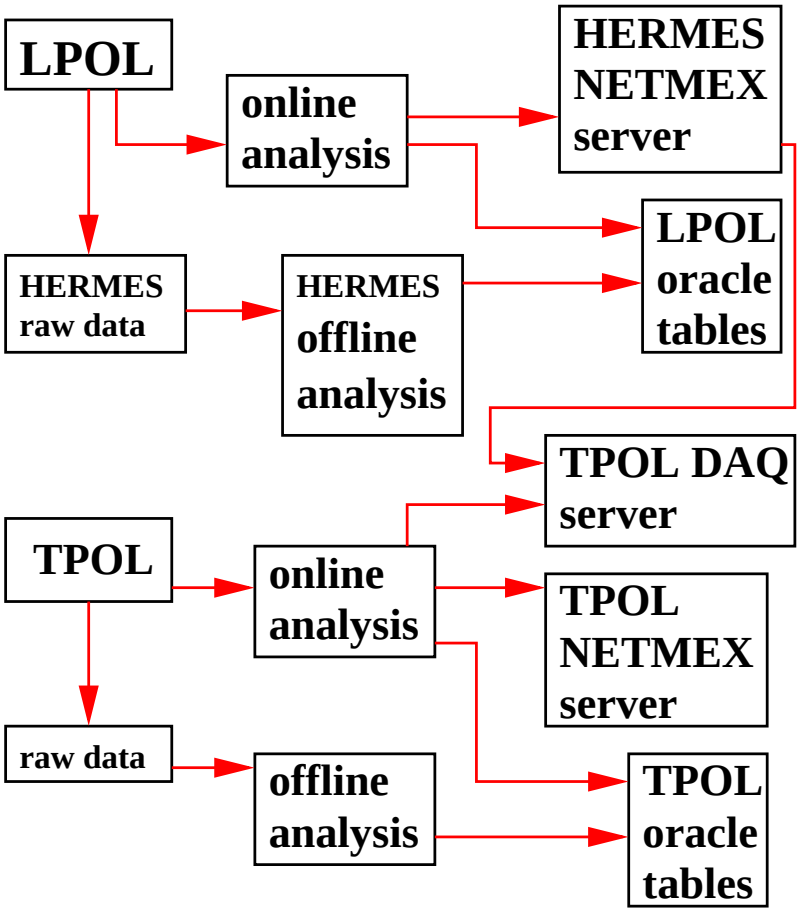


Polarimeter offline analysis

- LPOL: offline corrections are small
- TPOL at HERA I: small offline corrections.
  Focus dependence not corrected
- TPOL at HERA II: new multi-parameter fit. First results look encouraging, but...
  - Fit is slow (takes 1 minute to fit data of 1 minute)
    → Need to have well-defined fit procedure before reprocessing all data.
  - Systematic uncertainties not yet defined
    Interested co-workers please contact David South



Polarimeter data flow



Access LPOL online

Access LPOL offline

Access TPOL and LPOL online

Access TPOL online

Access TPOL offline

LPOL online data:

- **all bunches avg per minute**
- **single bunch per 5 minutes**

TPOL online data

- **colliding bunch avg**
- **non−colliding bunch avg**
- **single bunch**
- **calculated each minute**