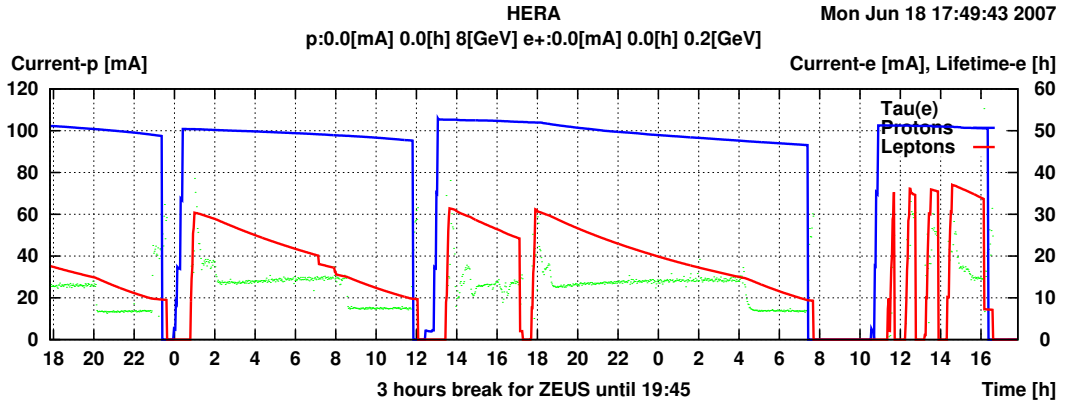
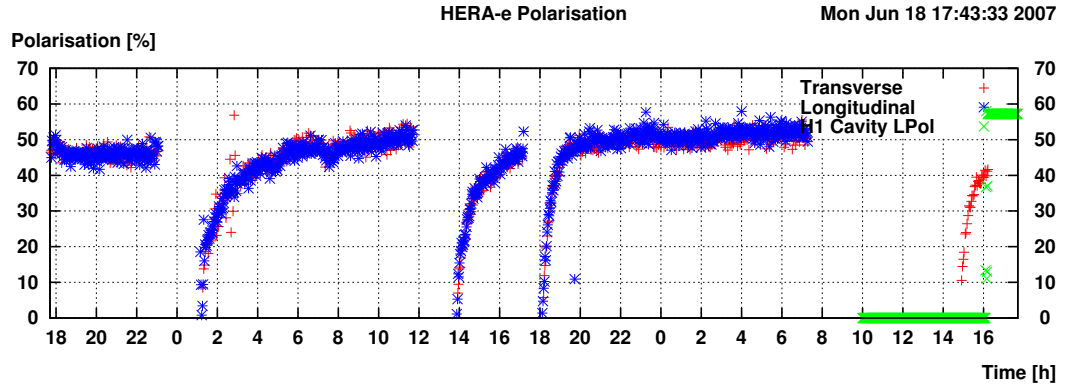
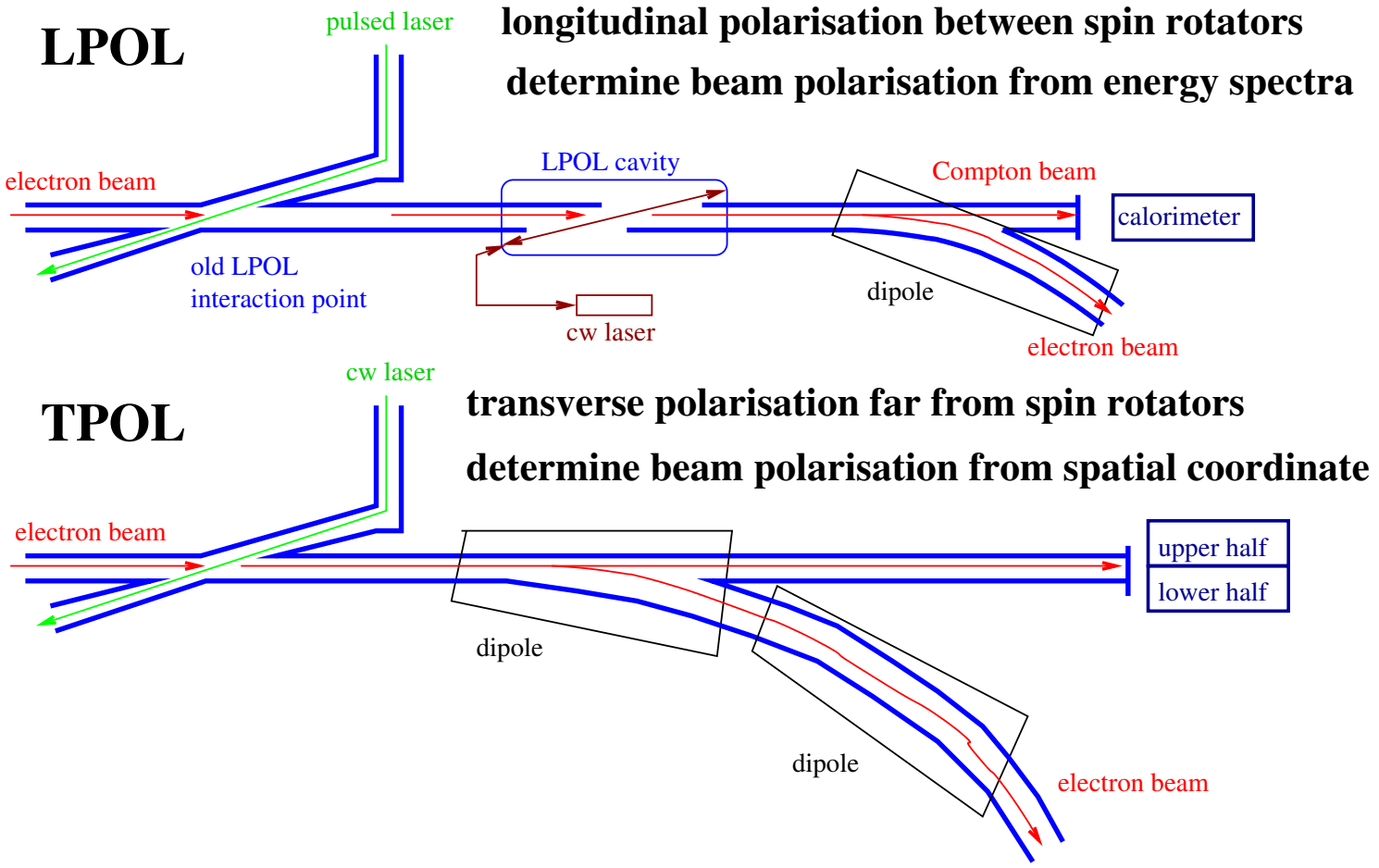
HERA beam polarimeter status

- Introduction
- LPOL status and systematics
- TPOL status and systematics
- LPOL cavity status
- LPOL/TPOL ratio
- Summary





Introduction



- TPOL: single photon mode, measure Compton cross-section $\frac{d^2\sigma}{dEd\phi}$
- LPOL: multi-photon mode, measure $\langle E \rangle \sim \int EdE$
- LPOL cavity: few photon mode, measure Compton cross-section $\frac{d\sigma}{dE}$

Default operation: TPOL and LPOL

Systematic studies and calibration: TPOL and LPOL cavity (since 2006)

LPOL status

- Early 2007: laser at the end of its lifetime, intensity problems (now fixed).
- First half of 2006: mirror mounted in wrong direction, data unusable
- Summer 2004: calorimeter damaged by synchrotron radiation, crystals replaced

LPOL systematics errors

Source	$\frac{\Delta P}{P}$
Analyzing power	0.012
- response function	(0.009)
- single to multi photon	(0.008)
Long term stablity	0.005
gain mismatch	0.003
laser light polarisation	0.002
pockels cell misalignment	0.004
interaction region	0.008
Total error HERA I	**0.016**
Total error HERA II	**0.02**

- Response function determined in 1997 CERN testbeam
- Summer 2004: calorimeter repair, increased systematic error because calorimeter has not been in test-beam
- Online monitoring: use sampling calorimeter, believed to be perfectly linear. Agreement with crystal calo on the 1% level
- Ongoing work: systematic studies, cross-check complete analysis chain, etc

TPOL status

- TPOL laser Tube exchange in 2007: ~ 1 week without data
- TPOL mirror ageing: bad laser light polarisation since spring 2007. Fixed 1 week ago. Impact on systematics for 2007 yet to be evaluated.
- Other than that: overall rather stable operation

TPOL systematics (preliminary)

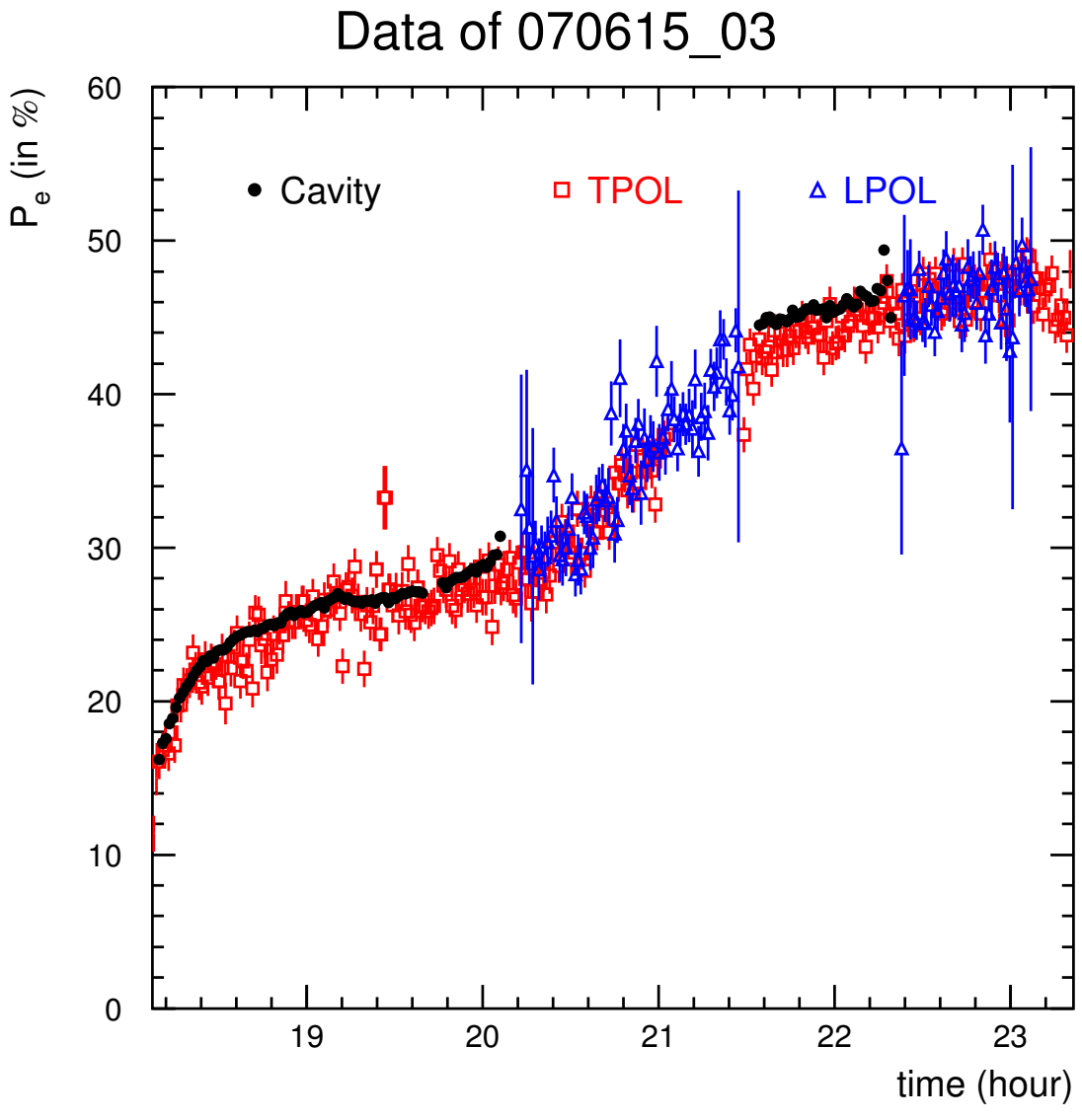
Source	$\frac{\Delta P}{P}$
Electronic noise	< 0.001
Calorimeter Calibration	< 0.001
Background subtraction	< 0.001
Light Polarisation	$0.00025 \times \Delta S_1$
Focus correction	0.01.04
Compton beam centering	0.004
Interaction region	0.0035
Interaction point	0.021
Absolute scale	0.017
Total	**0.029**

Open points:

- Largest error source: IP distance
  Recent data analysis: IP distance reconstructed from data, correction possible
  Rough estimate: reduce to < 0.01
- Second largest error source: Absolute scale
  From 1997 risetime calibration + Monte Carlo
  Risetime calibration next week: hope to reduce this error to < 0.01.
- Ongoing analyses: multi-parameter fit, silicon detector, Monte Carlo, etc

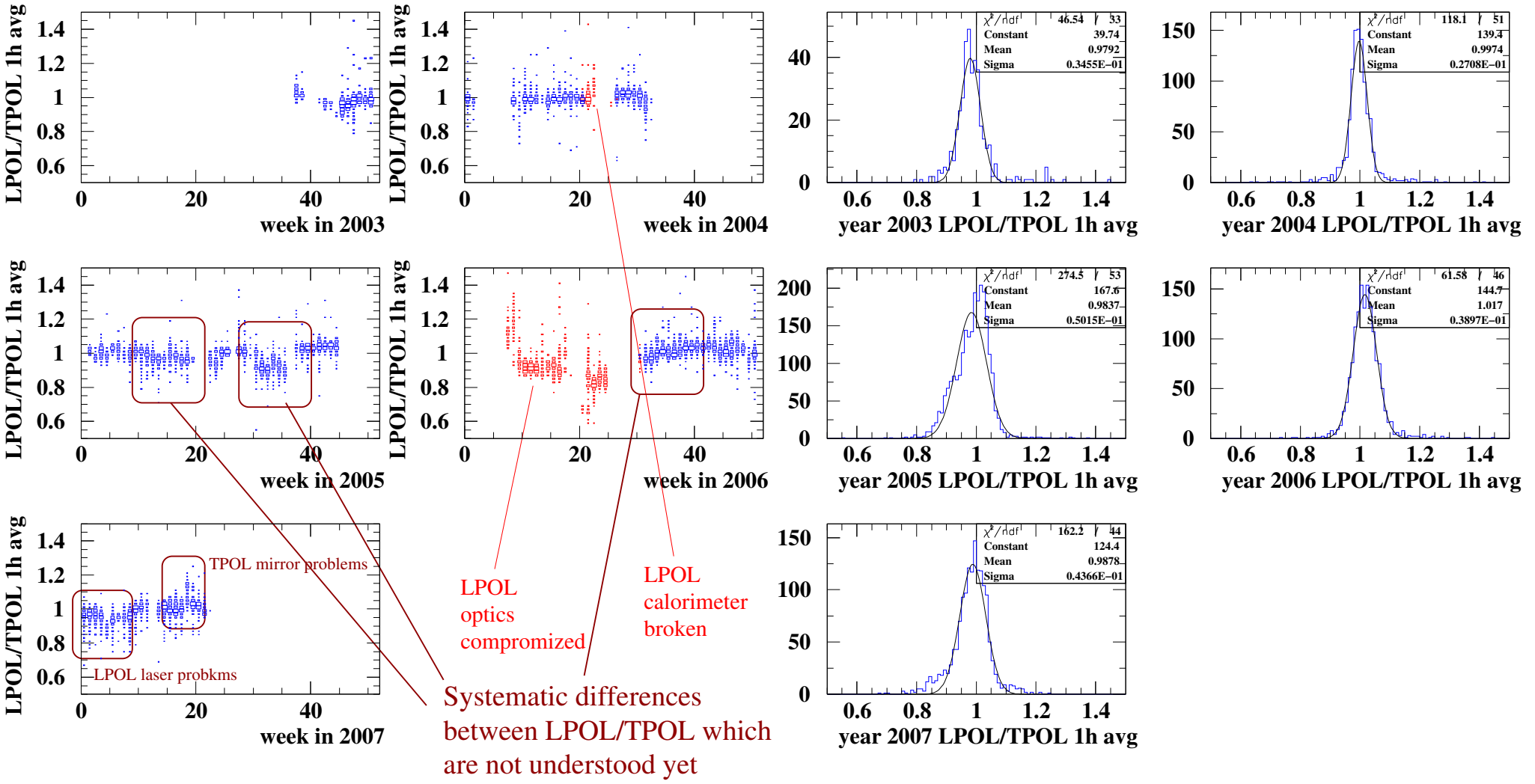
LPOL cavity status

- Cavity was built by LAL
- Regular operation since end of 2006. Main advantage: very good statistical precision.
- But: LPOL cavity can not be operated together with the "normal" LPOL.
- Now: Cavity operated from time to time, whenever conditions are stable, and during HERMES deuterium fills.



Offline analysis well advanced (see plot).
Systematic studies ongoing.
Final goal: independent polarisation measurement and calibration of the other polarimeters.

LPOL/TPOL ratio



Ratio LPOL/TPOL has width of order 4%. This is not covered by the known LPOL and TPOL systematics

Ad−hoc solution: introduce additional systematic uncertainty of 4% from unknown source.

Ongoing work: check all types of correlations to LPOL/TPOL operational parameters.
No smoking gun found (yet).

Summary

- LPOL and/or TPOL operational, with ageing hardware
- LPOL and TPOL analyses ongoing, including re-evaluation of systematic uncertainties
- LPOL cavity operational, offline analysis and LPOL/TPOL comparison ongoing
- Biggest puzzle: LPOL/TPOL ratio jumping outside expected LPOL, TPOL systematics
- Planned for next week: Risetime calibration for the polarimeters

  $\rightarrow$ requires machine operation without protons at high electron current for 2 days.

  $\rightarrow$ independent calibration of the polarimeters

- Preliminary systematic error for summer conferences:

TPOL alone	$3\% \oplus 4\%$
LPOL alone	$2\% \oplus 4\%$
4/13*TPOL+9/13*LPOL weighted avg	$1.7\% \oplus 4\%$

- All numbers in this talk are preliminary!!!

  Write-up for summer conferences in preparation