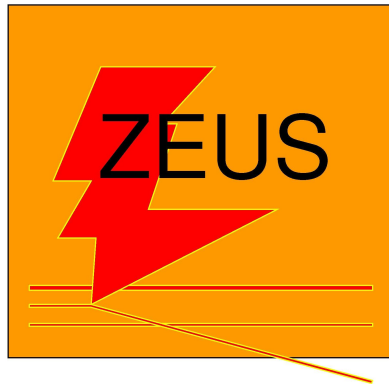


Status of Polarisation Measurement w/ Cavity



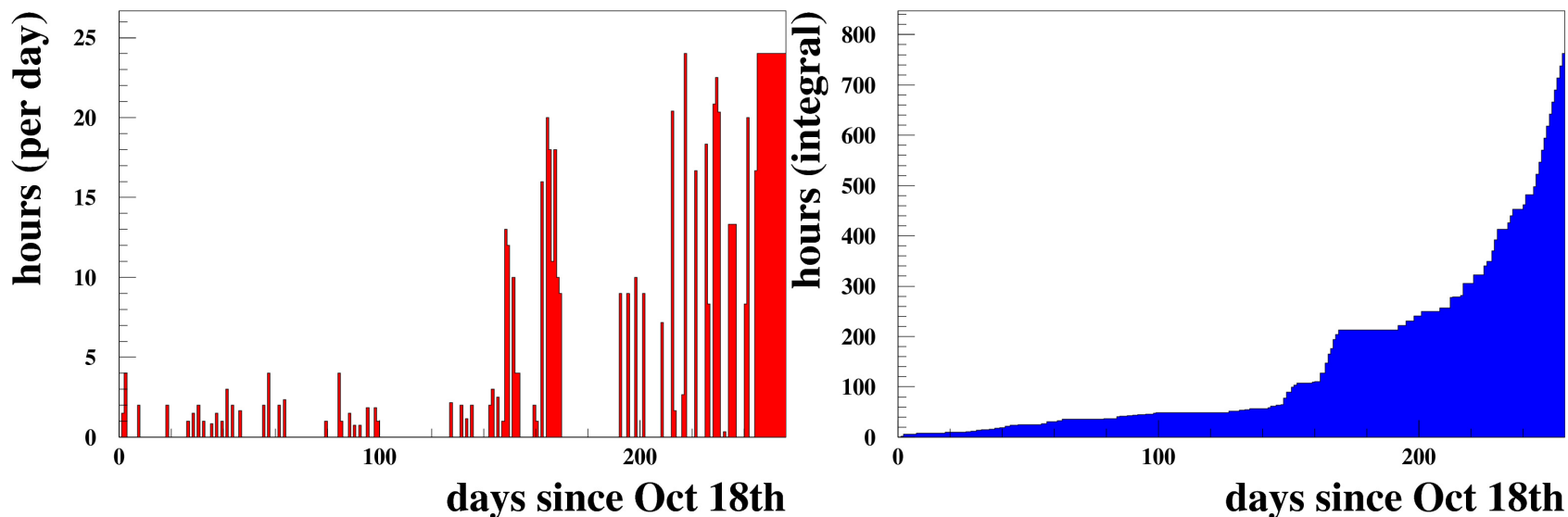
Nicola Coppola
02.09. 2008
PolTask force meeting
(on Behalf of Cavity)



Outline

- Status data processing⇐
- Comparison vs LPOL/TPOL⇐
- Syst error determination⇐
- Rise time curves (status)
- SLICK machine MC (status)
- Conclusions⇐
- Few words on TPOL "focus" determination

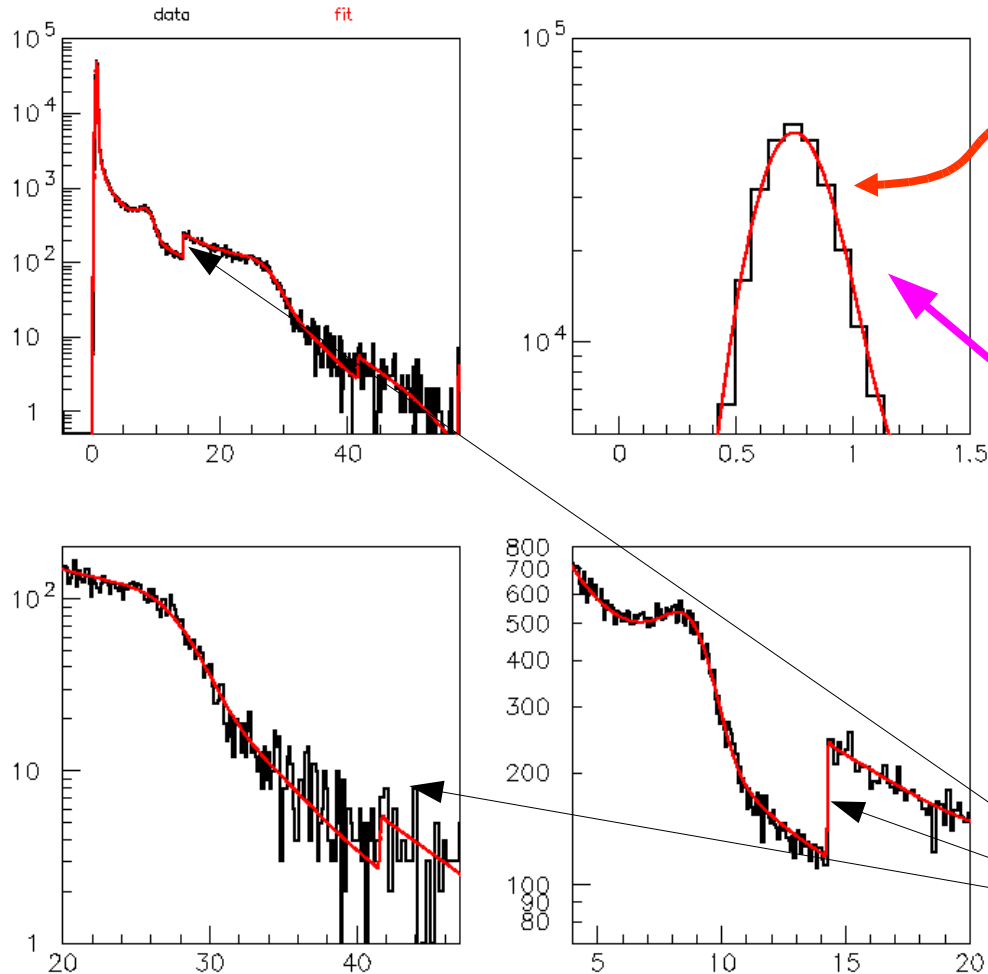
Time on beam



Main source of loss of data taking:

- Laser Controller 2x
- Cavity locking tune-up (much less)

Fit quality and energy calibration



Syn-rad peak **must be** determined with precision ~ 10 MeV

NEED to re-simulate calorimeter response for scale calibration

32-int histogramming

Change of bin width

Data reprocessing

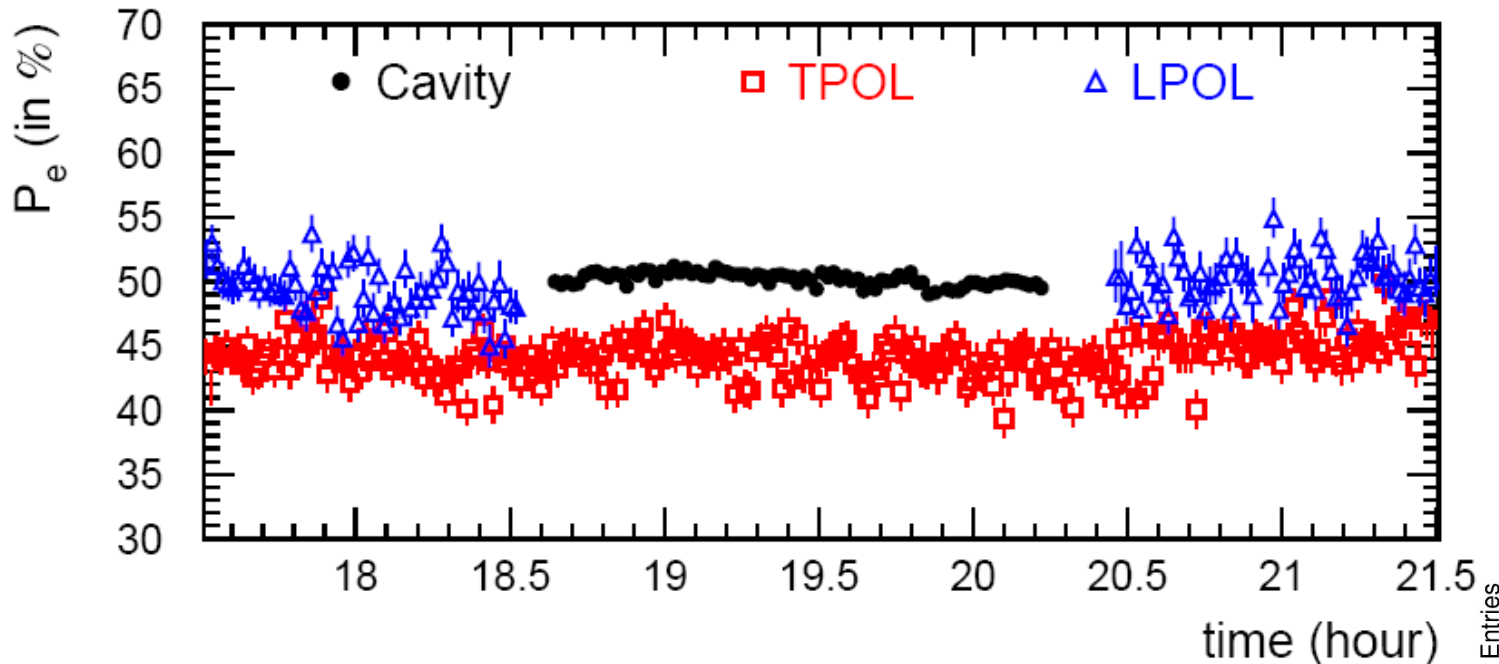
In May/June discovered **limit** in computational precision of **covariance matrix determination** (since then everything in double precision)

- discovered using different Linux-flavours and compiler options
- now program is (**slower** and) **too large to run on GRID**
- Jacquet has made **detailed studies** on two data sets of e.g. the polarization dependence on **radscut**, and **fit options** (detector response tcalo 1-4) using fit version v42 and earlier.
- **Almost all data** (from Oct 6. 2006, ie 32- and 16-bit int) have been reprocessed with "standard" program (v48, Gang)
- Still **some internal discussion** going on about the fit **convergence**

→ **example**

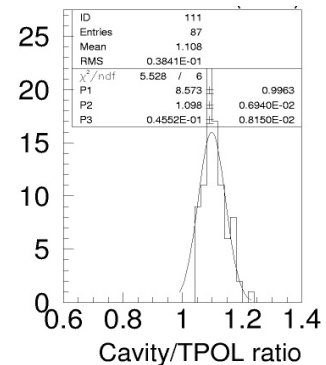
Comparison with TPOL

data of May 18 2007



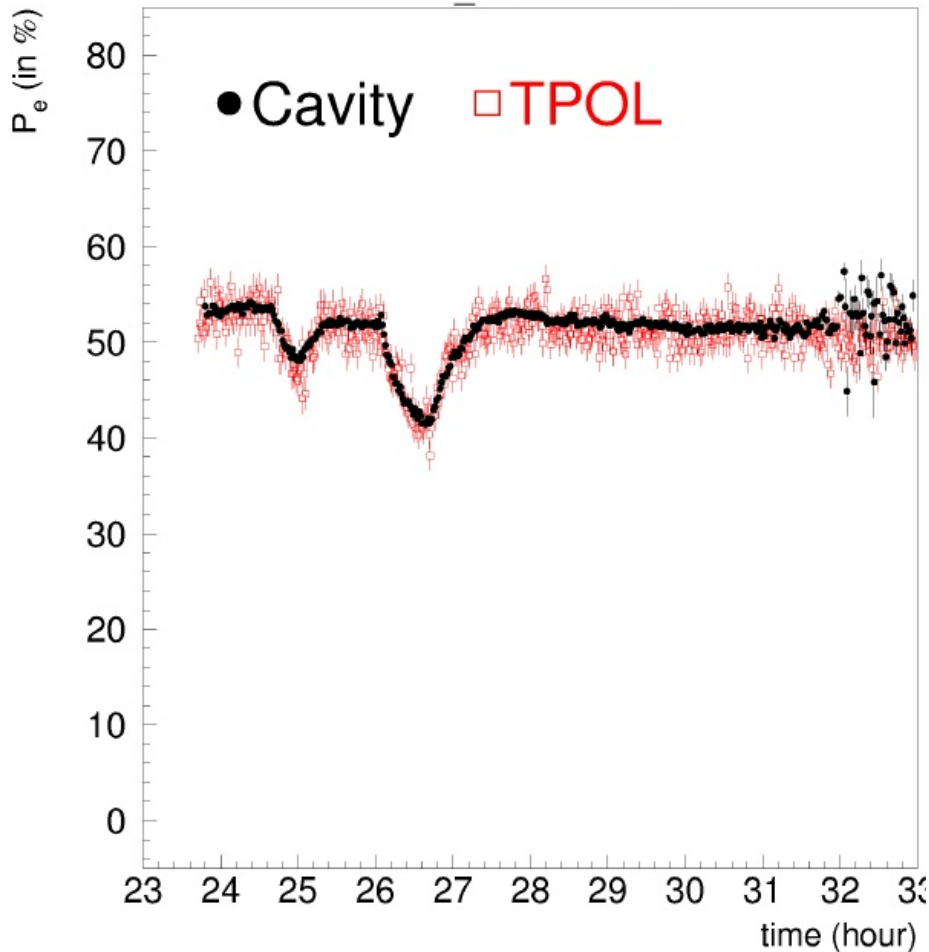
this is **not** the only case of interleaved dataset(s), but it is the **only case w/o polarisation "changes"**

Preliminary results,
March

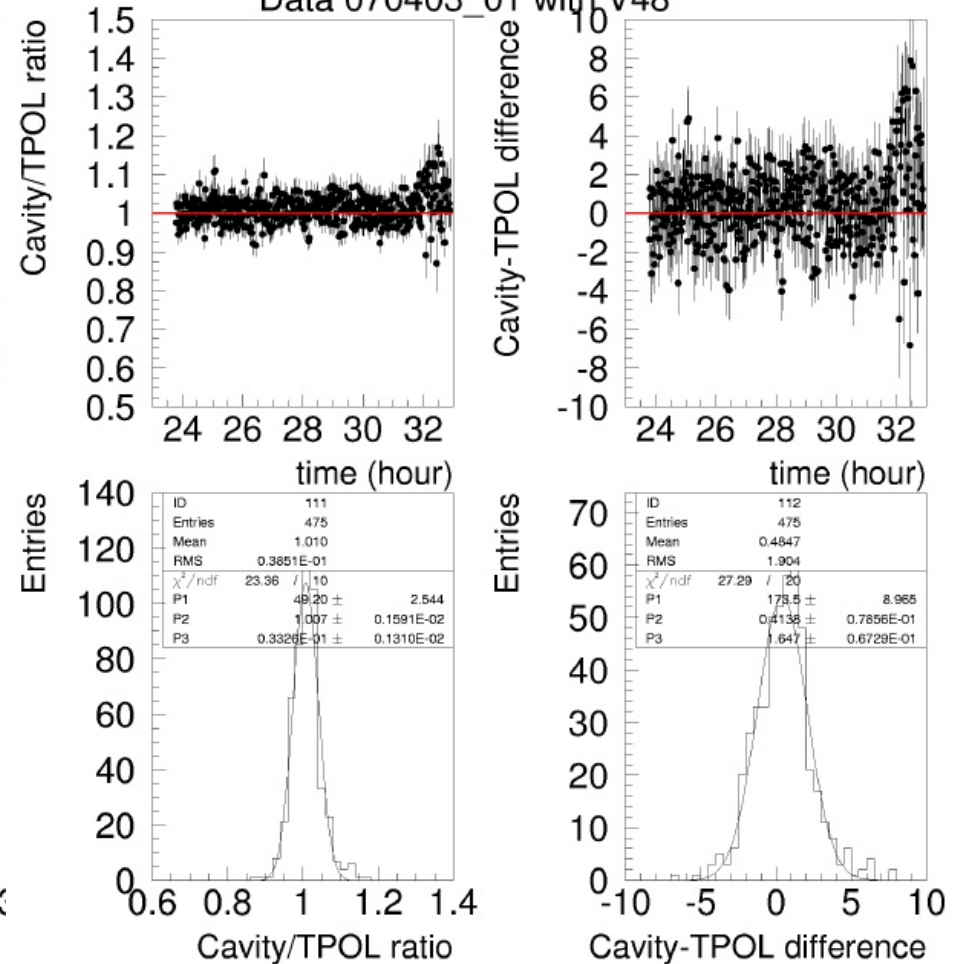


Results (example)

Data 070403_01 with V48

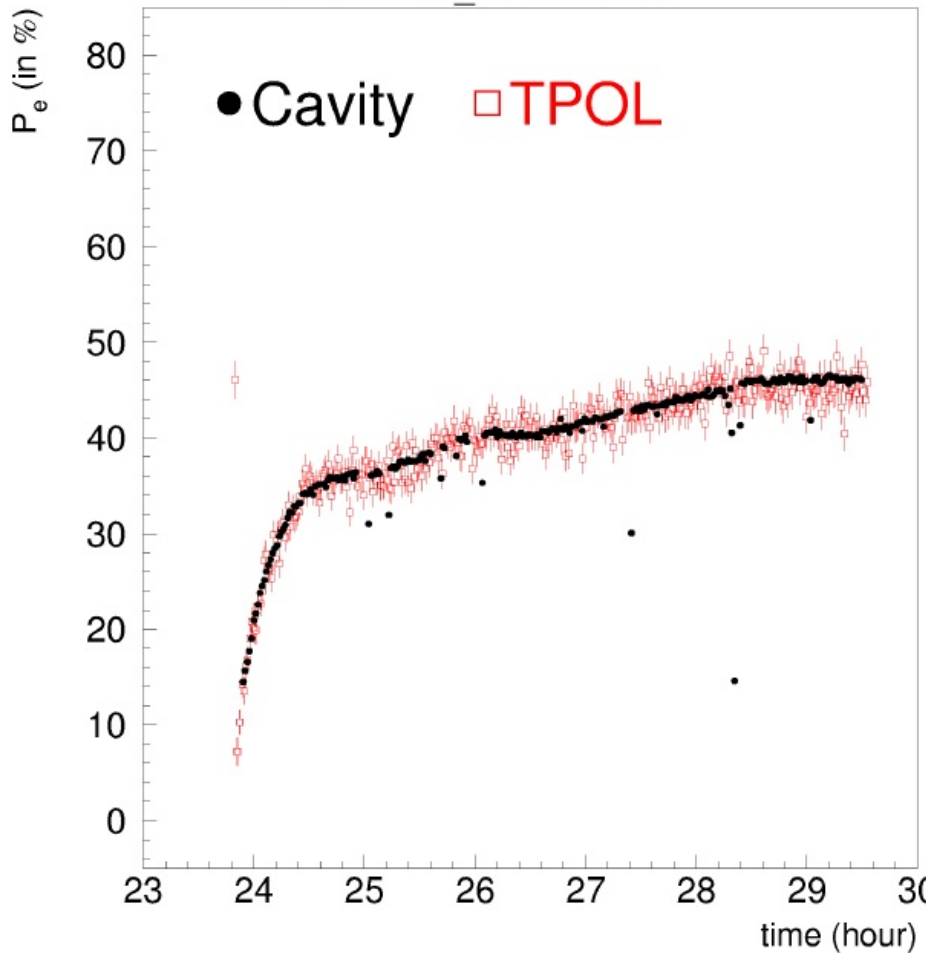


Data 070403_01 with V48

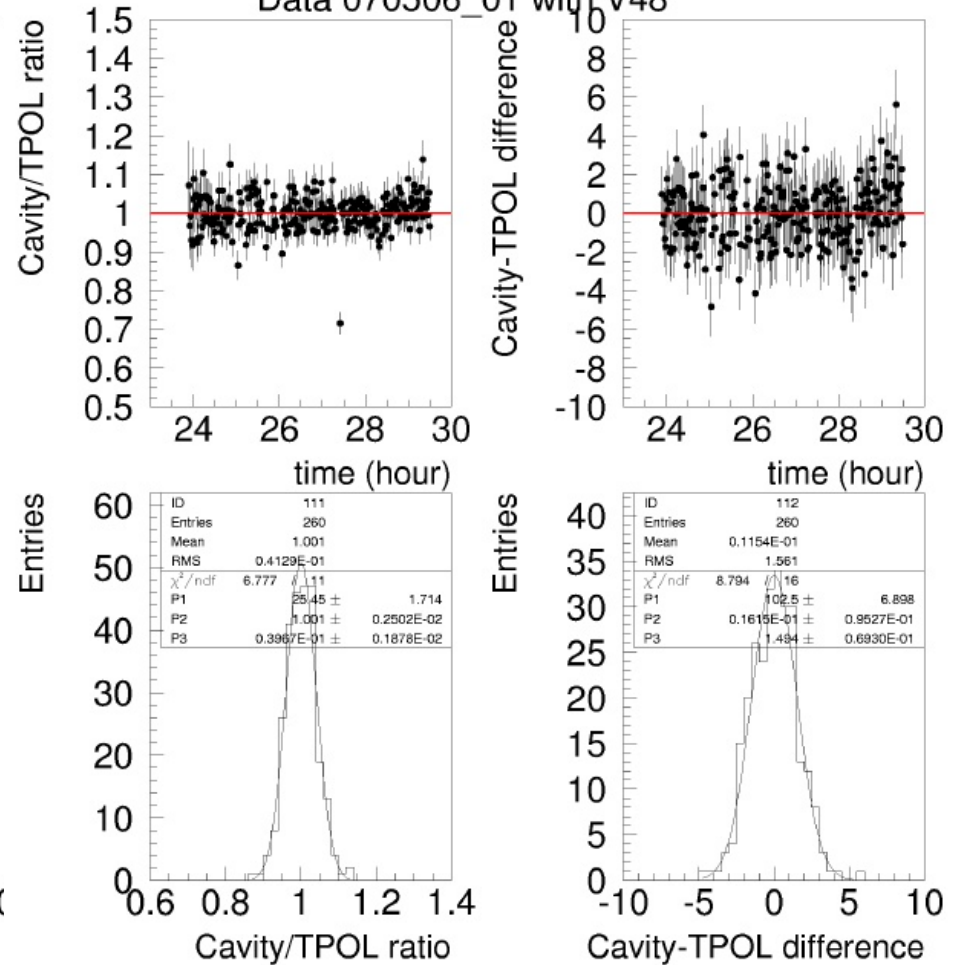


Results (example, 2)

Data 070506_01 with V48



Data 070506_01 with V48



Syst error determination

In the last a few days:

decided to select about 12 subsamples (500 files each, i.e. 1.5 h) covering different features of data taking (different DAQ options, largest and smallest variations in Compton, Bremstr. and syn rates...)

Christian prepared the steering files (Friday 29/8),

Gang started to run jobs on these new data samples, ~600 hours CPU:

- studying the "leakage",
- different calorimeter options,
- polarization dependence on: Compton, Brem and syn rate variation and on the detector parameter variations etc.

"We are aiming for a first set of results by Sept. 10 to be in time for the H1 collaboration meeting i.e. one week after." (Zhang)

GEANT energy calibration

Re-simulate with GEANT W-Sandwich calorimeter

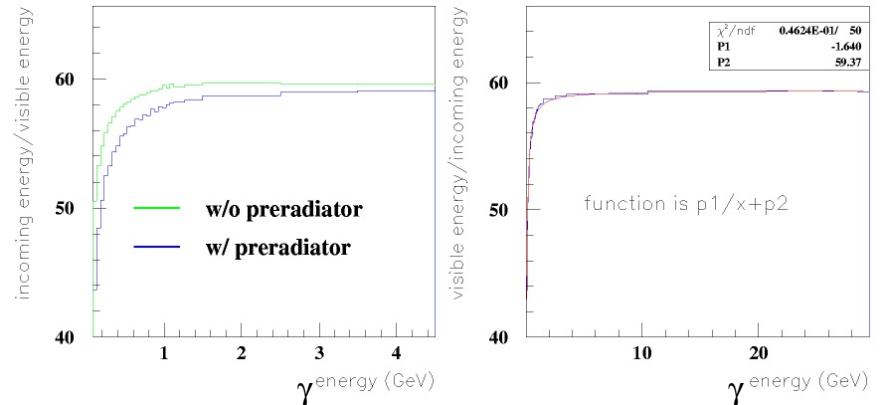
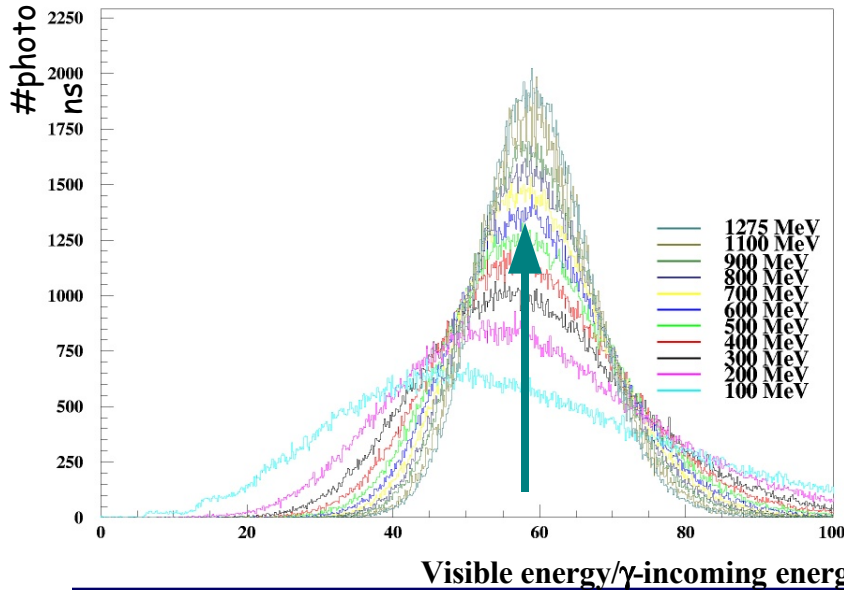
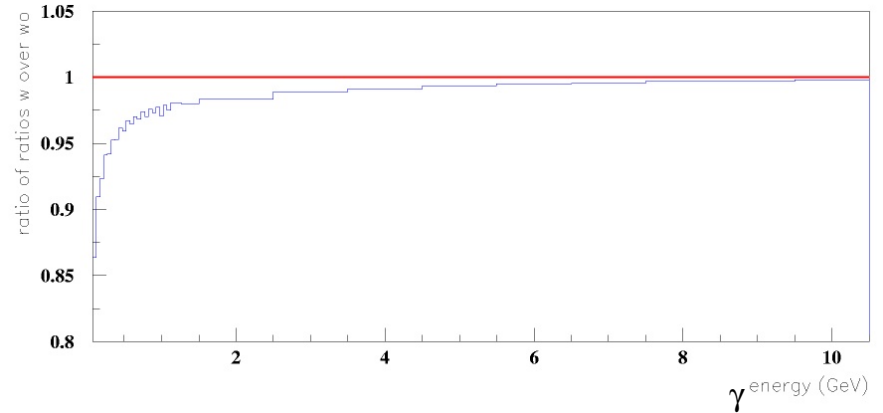
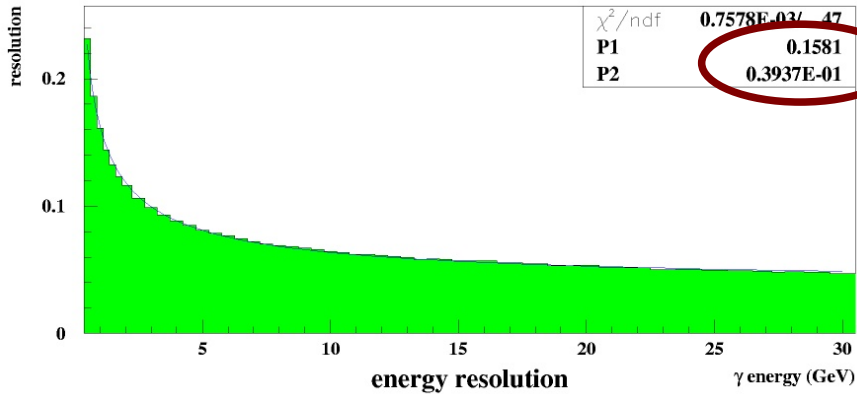
Checked results published in a HERMES internal note, plus:

- introduced new optics (HERA II)
- “few” geometries simulated (w/ and w/o W-radiator, different tile sizes)
- photons equally distributed along y-coordinate (homog.-response)
- introduced tilt(s) of photon beam
- single energy photons energies from 150 keV up to 300 GeV, but also Compton-like spectrum
- nice energy resolution $\sim 16\%/E^{1/2}$
- and good linearity from $E_{\gamma} > 2 \text{ GeV}$

below 2 GeV strong W-radiator influence

→ new energy parametrization

GEANT energy calibration (2)



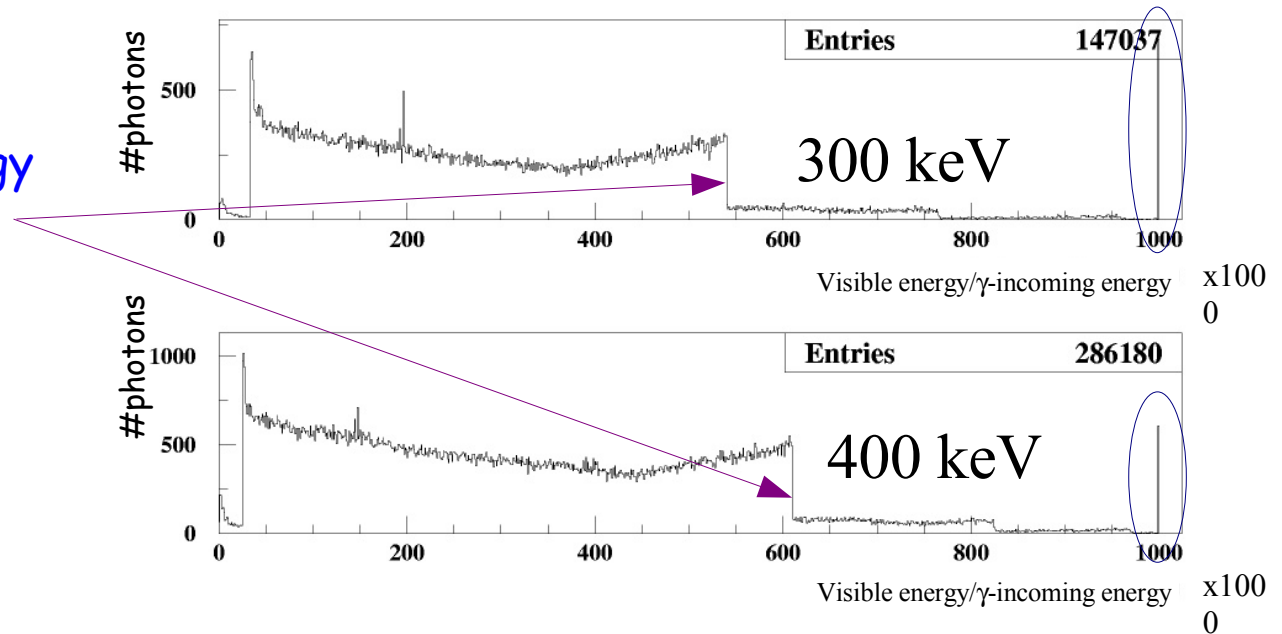
Such parametrisation now explicitly inserted in fit program

GEANT energy calibration (3)

For energy much less than 100 MeV calorimeter behaviour different than "usual", introduce a new parametrization for synchrotron contribution: ($E_c = 20 \div 40$ keV) 50 up to 500 O(200 keV) energetic photons simultaneously entering the calorimeter

step position energy dependent,

peak "importance" energy dependent

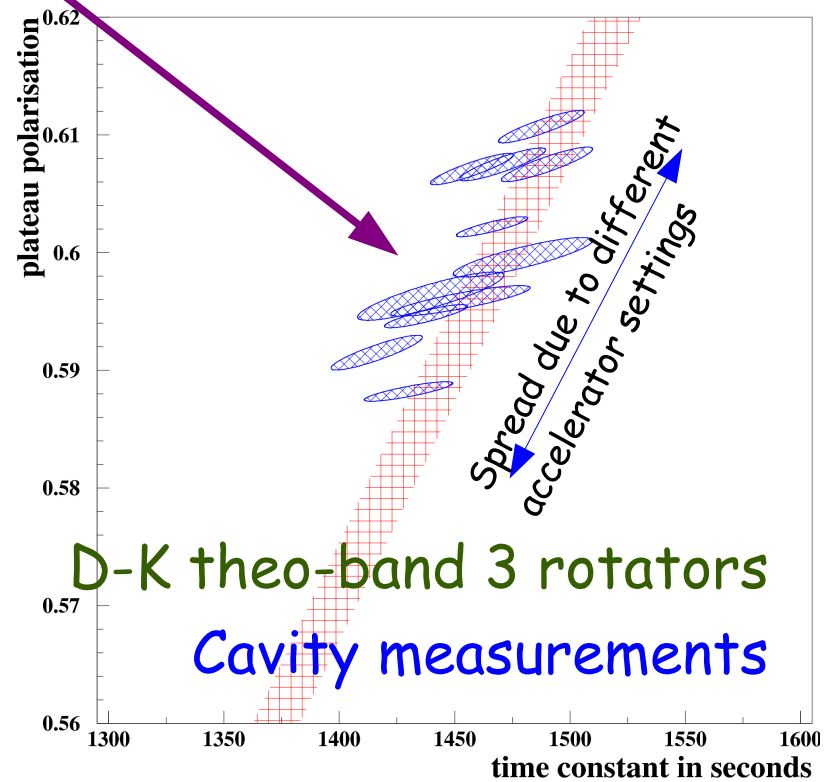
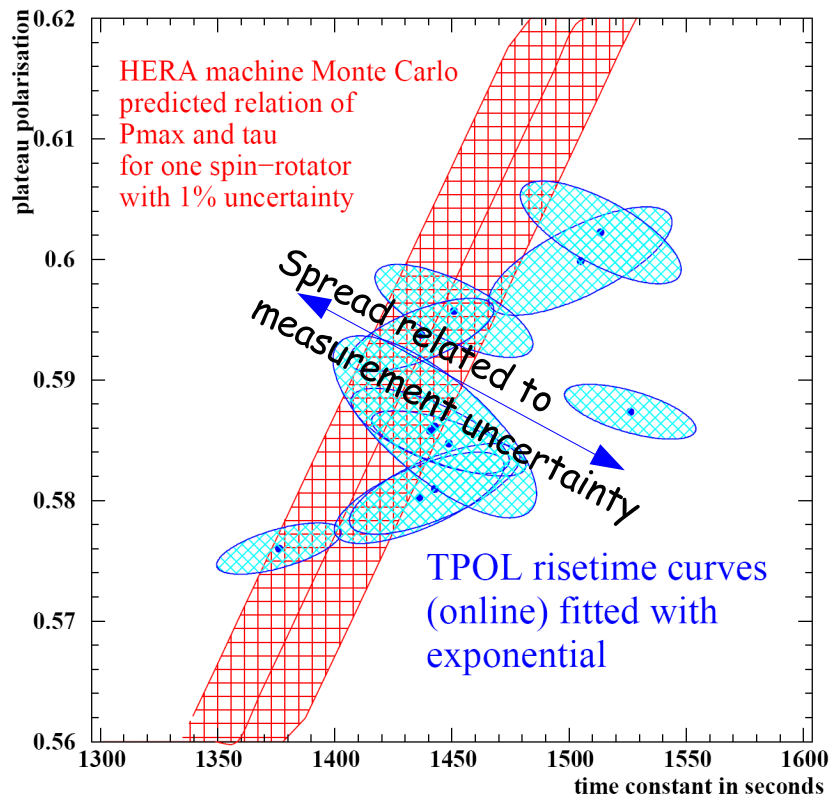


Systematic studies

Source	δP_c (%)
Laser polarization uncertainty	<p>Most of the errors are conservatively estimated.</p> <p>Some of the error sources are redundant (e.g. calo position scan with beam position scan).</p> <p>Error reduction is expected in the future with improved fitting program.</p>
Laser circularity [MOCO position scan]	
Laser power variation	
Electronic Noise	
Detector parameters	
Calorimeter position scan in x & y	
Synchrotron radiation cut	
Blackbody temperature	
Beam position scan	
e beam energy uncertainty	
Total (absolute)	≤ 1.2

Rise time measurements very preliminary results

τ_{\max} and P_{∞} values highly correlated



Spread maybe due to differently tuned machine

Machine MC

Theoretical advances: simulate a number of HERA machines, with realistic assumptions, and realistic imperfections (SLICK)

Do reasonable energy scan like performed in reality

each time spin rotators are changed $O(100 \text{ MeV})$

Rescale "errors" such that max polarisation $\sim 58\%$

According to ST formula

$$P_y \propto \oint (\mathbf{B} \cdot \mathbf{n}) ds \text{ (just nominator)}$$

DK add a kinetic polarisation term

$$P_{\text{Kin}} \propto \oint (\mathbf{B} \cdot \partial \mathbf{n} / \partial \delta) ds \text{ (to nominator)}$$

Present if the machine is not flat (spin rotators or solenoids, or imperfections)

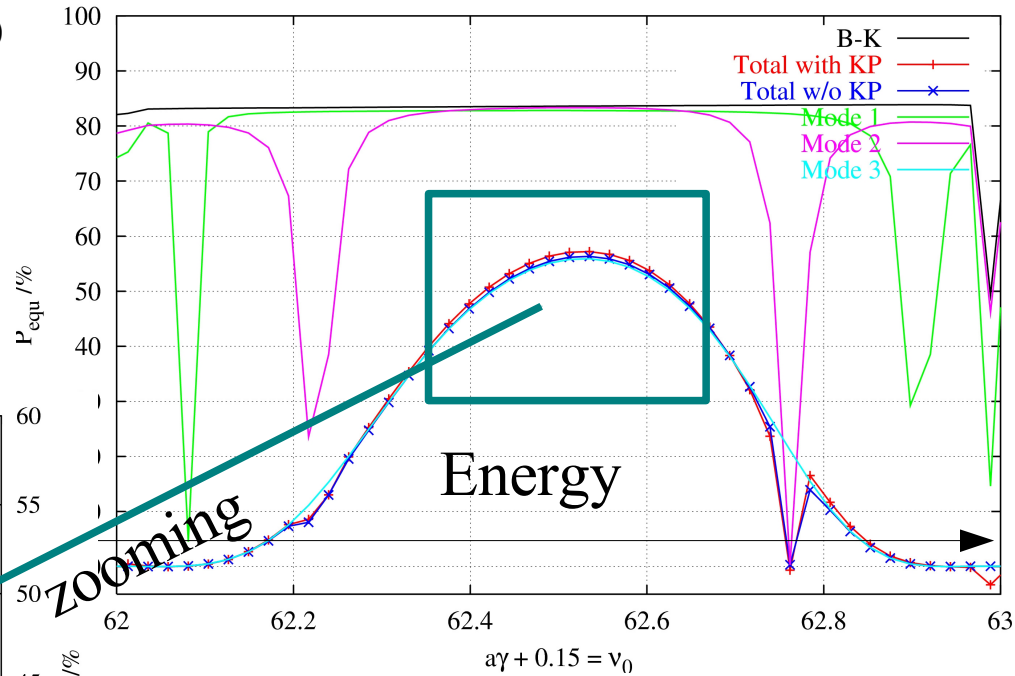
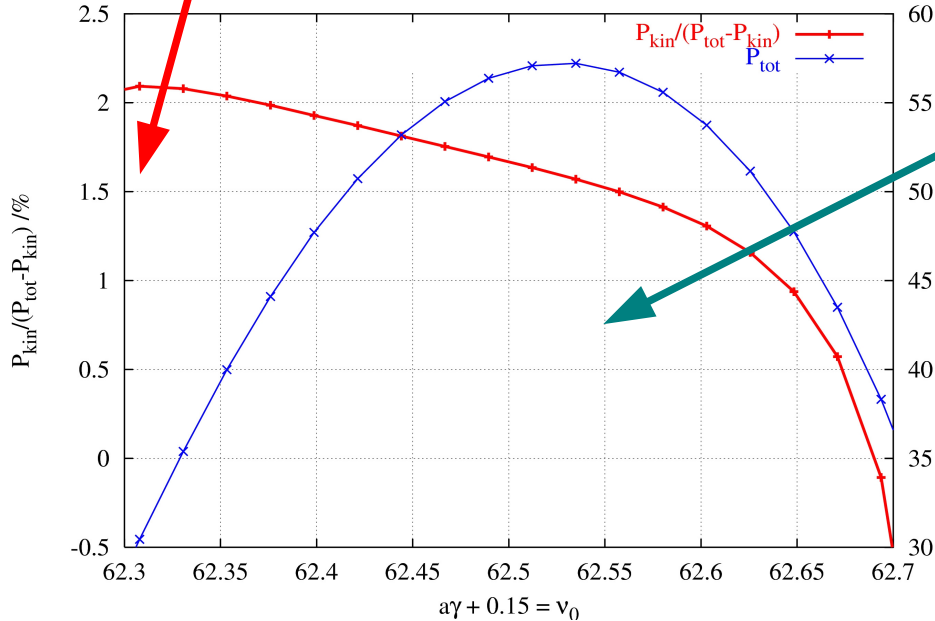
Enters only the polarisation formula NOT the rise time one

Machine MC

D. Barber, M. Vogt (M)
S. Schmitt, N. Coppola (POL2000)

holum6bse Se020 Sc0065

in this case ~1.5%
on the average ~1%



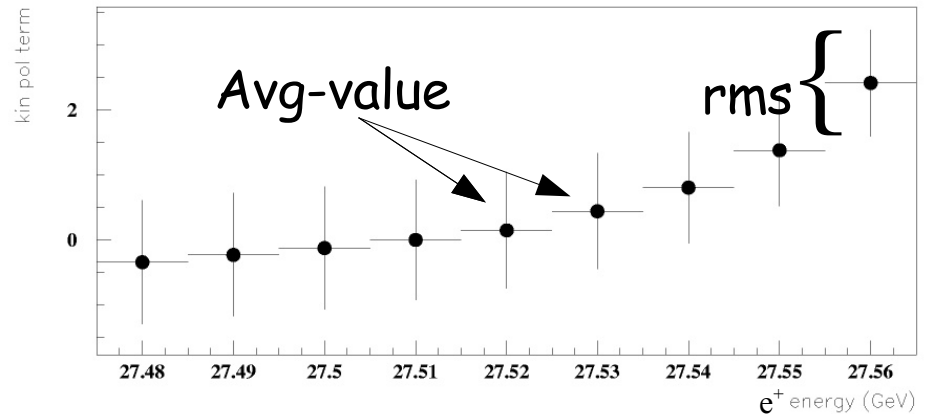
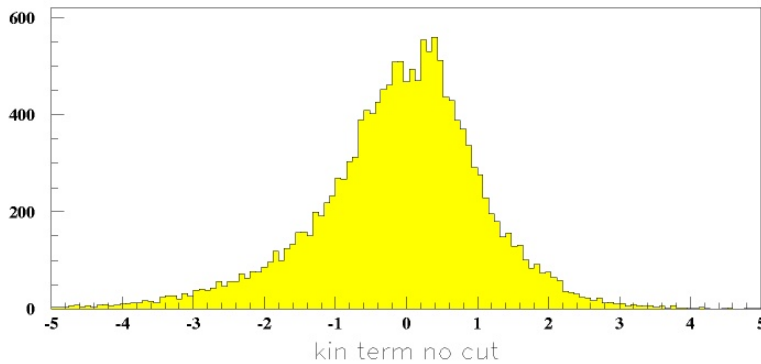
Full analysis still ongoing!!!

Machine MC

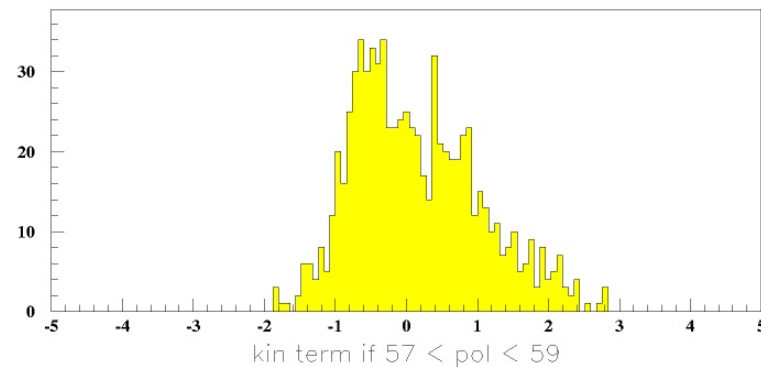
All the machine configurations where simulated

D. Barber, M. Vogt (M)
S. Schmitt, N. Coppola (POL2000)

27.52 GeV



Looks promising, but
more studies are needed



Conclusions (Cavity)

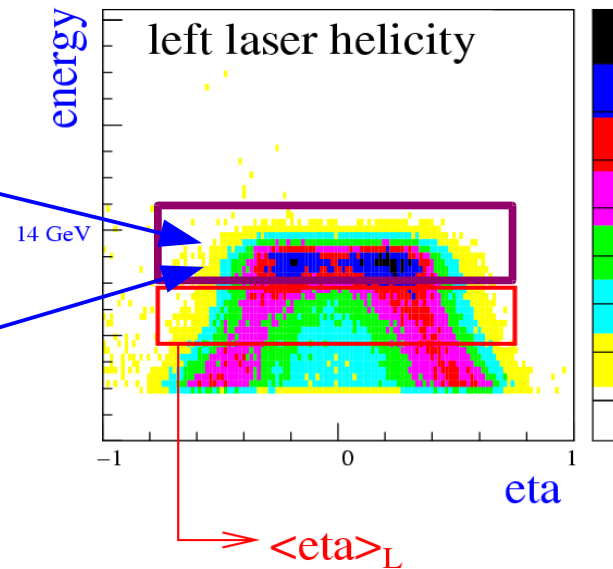
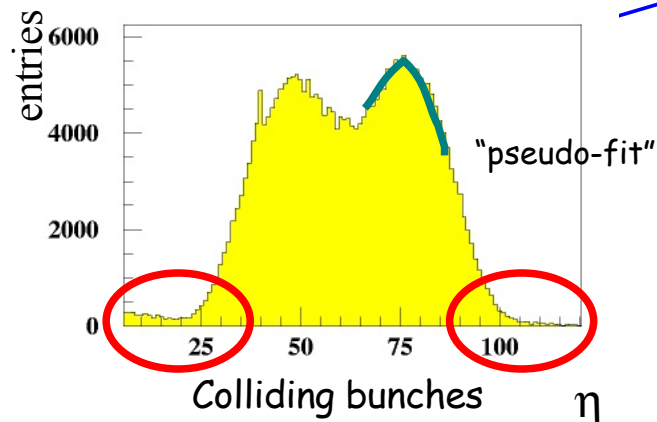
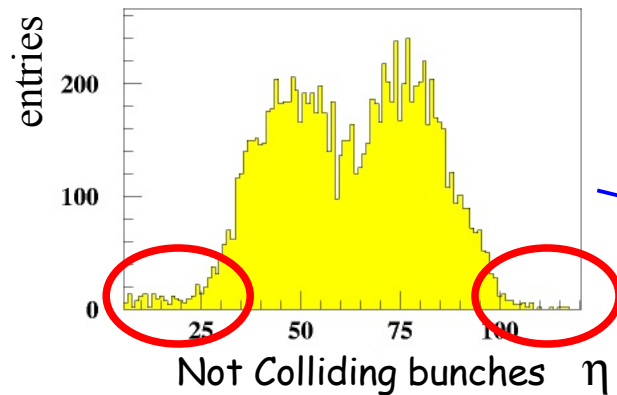
- Still a lot of activities
- Almost all datasets **reprocessed**, still some internal discussion going on
- Final determination of Syst. error, to be expected soon
- Analysis of the **rise time** curves: Barber "proposed" to have a meeting, I am still "waiting for one"...

TPOL data analysis

Focus and spot determination

• Integrate $d\sigma^2/dE_\gamma d\eta$ over sensitive region in E_γ and η

• Focus algorithm based on magenta E, η area (to be tuned w/ help of Blanka MC)



- 1) reduce η range (and/or E)
- 2) split up/down
- 3) pseudo-fit

Offline TPOL reprocessing

All that **has to be** re-inserted, together with a **coherent and homogeneous focus-correction** treatment, to create new software to offline **reprocess** all the TPOL data

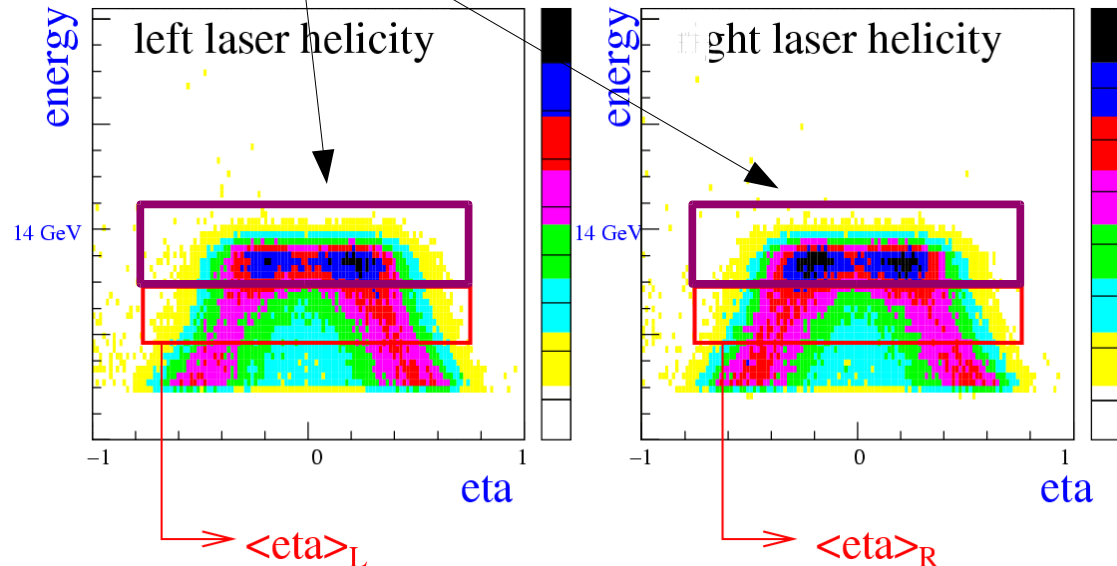
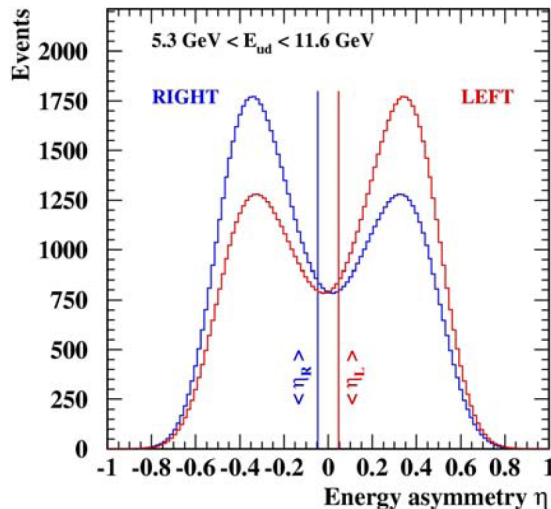
Few algorithm envisaged need to tune them and evaluate the "best" among

TPOL offline analysis

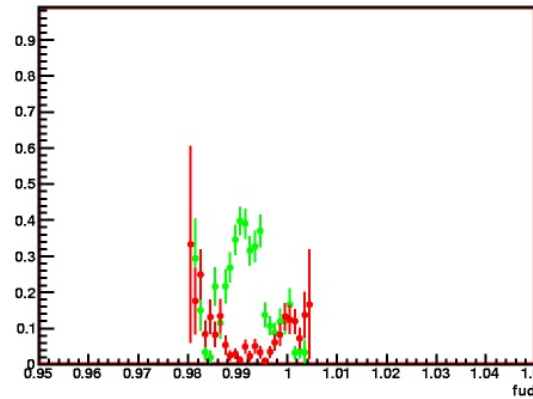
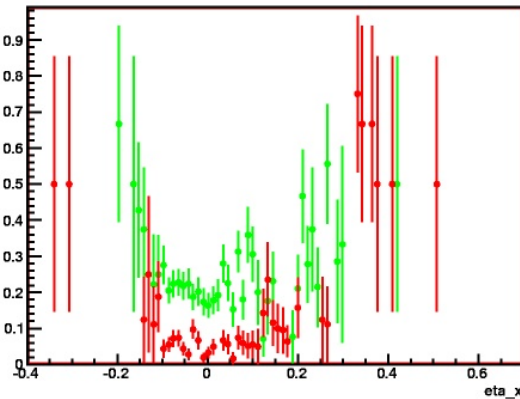
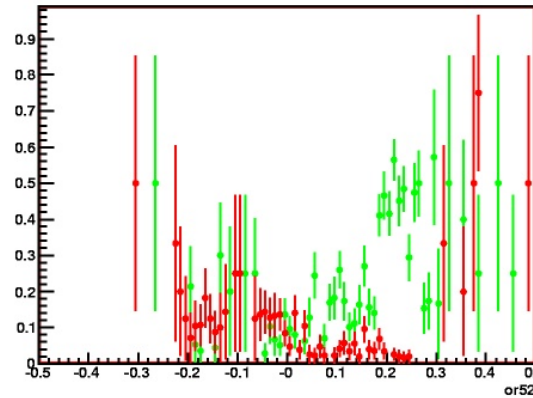
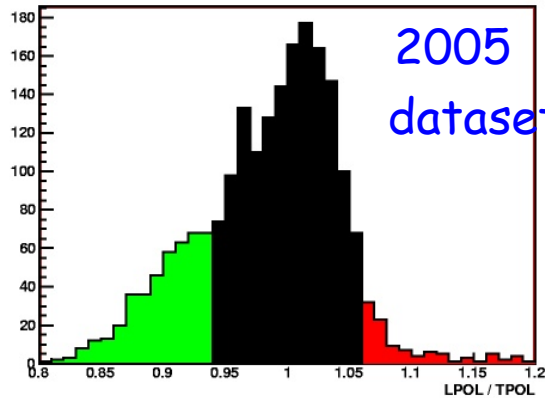
- Integrate $d\sigma^2/dE_\gamma d\eta$ over sensitive region in E_γ and η
- Consider asymmetry

$$\langle \eta_L \rangle - \langle \eta_R \rangle = 2 |S_3| P_y \Pi$$

- Π is the analysing power from rise-time calibration and MC
- S_3 is measured between HERA fills
- Focus algorithm based on these E, η areas (to be tuned w/ help Blanka MC)



TPOL/LPOL ratio "blind" analysis



Look at population of events when $\text{Ratio} > 1.05$ (red) or $\text{Ratio} < 0.95$ (green) using all the possible quantities saved by LPOL and TPOL

⇒ if no "correlation" red and green points should be flat wrt variable examined

example: or52 (BPM x-position)

fud (u-channel, d-channel calibration) TPOL

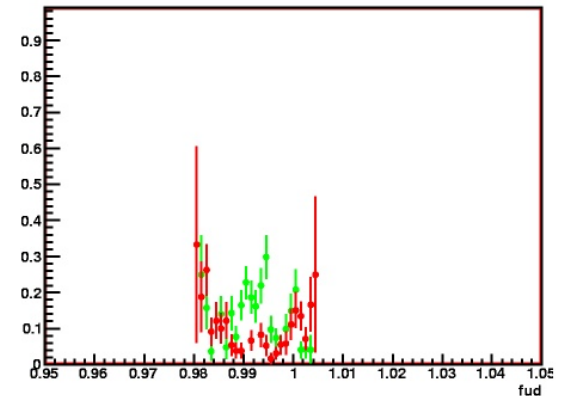
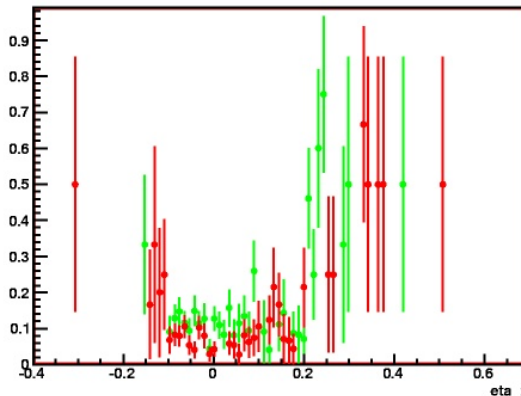
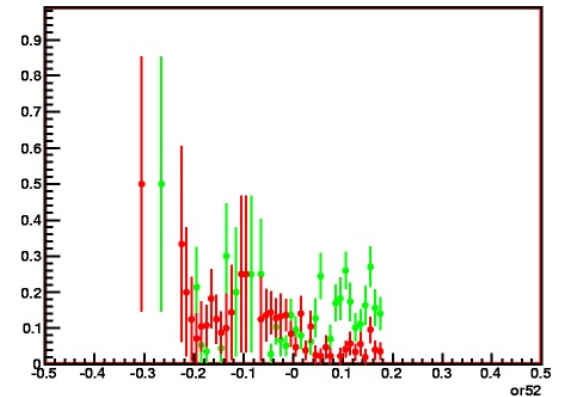
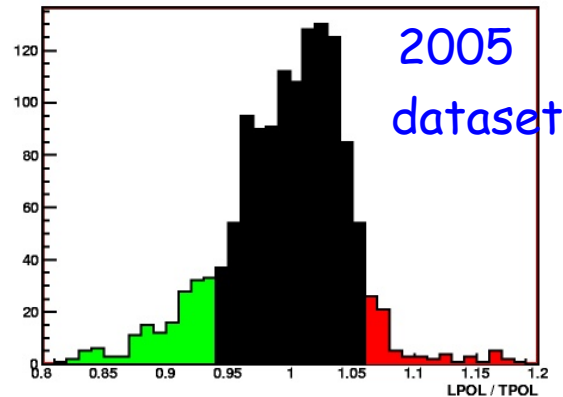
eta_x Compton position in LPOL calorimeter

O. Eyser

TPOL/LPOL ratio "blind" analysis (2)

After cutting
on or_{52}
(BPM x-position)

not final,
to be "extended"
to 2006, 2007!!



O. Eyser