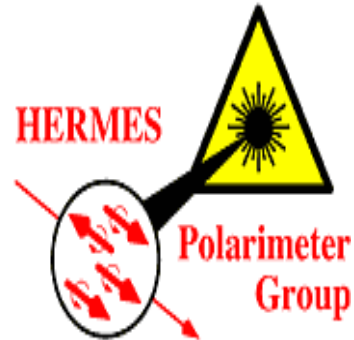


LPOL Offline Analysis

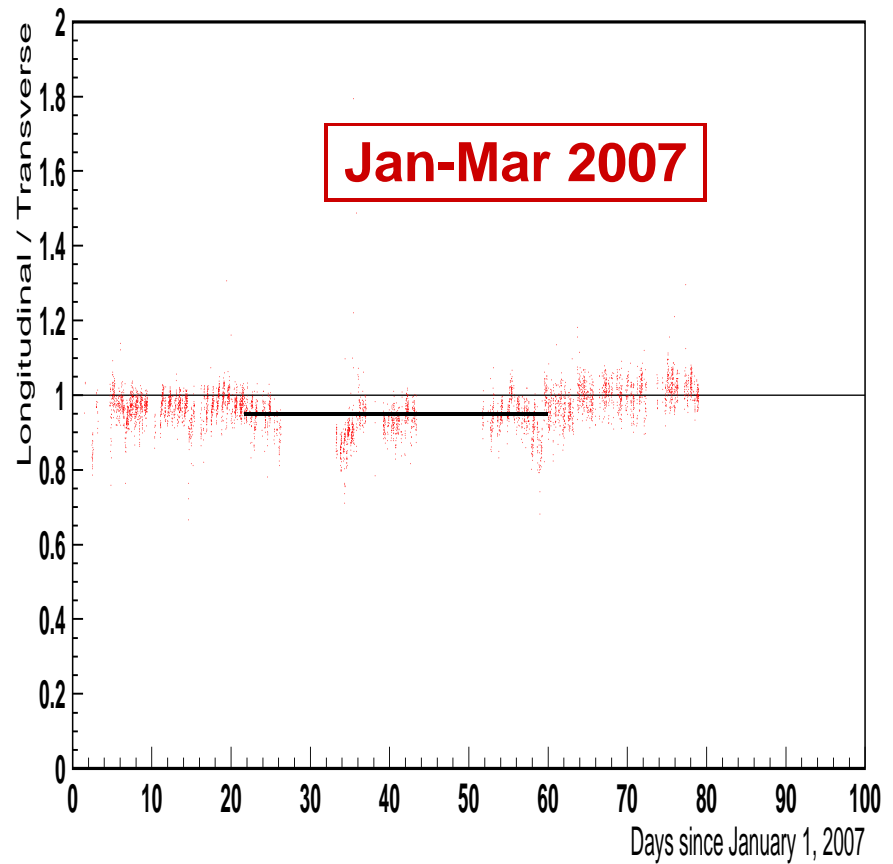
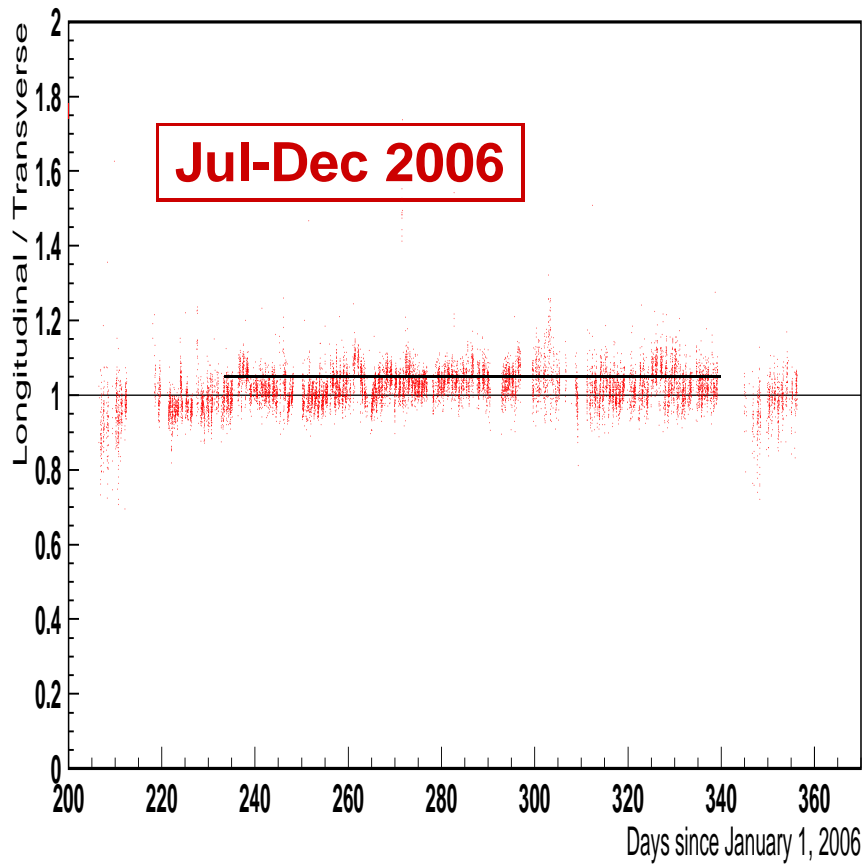
Riccardo Fabbri (DESY-Zeuthen)



On behalf of the LPOL Group

-
- Refresh of the issue
 - The LPOL polarization code steps
 - Corrections introduced by the analysis steps
 - Investigation of possible 10% effects:
 - ⇒ Some Correlations
 - Conclusions and Future Plans

Refresh of the issue

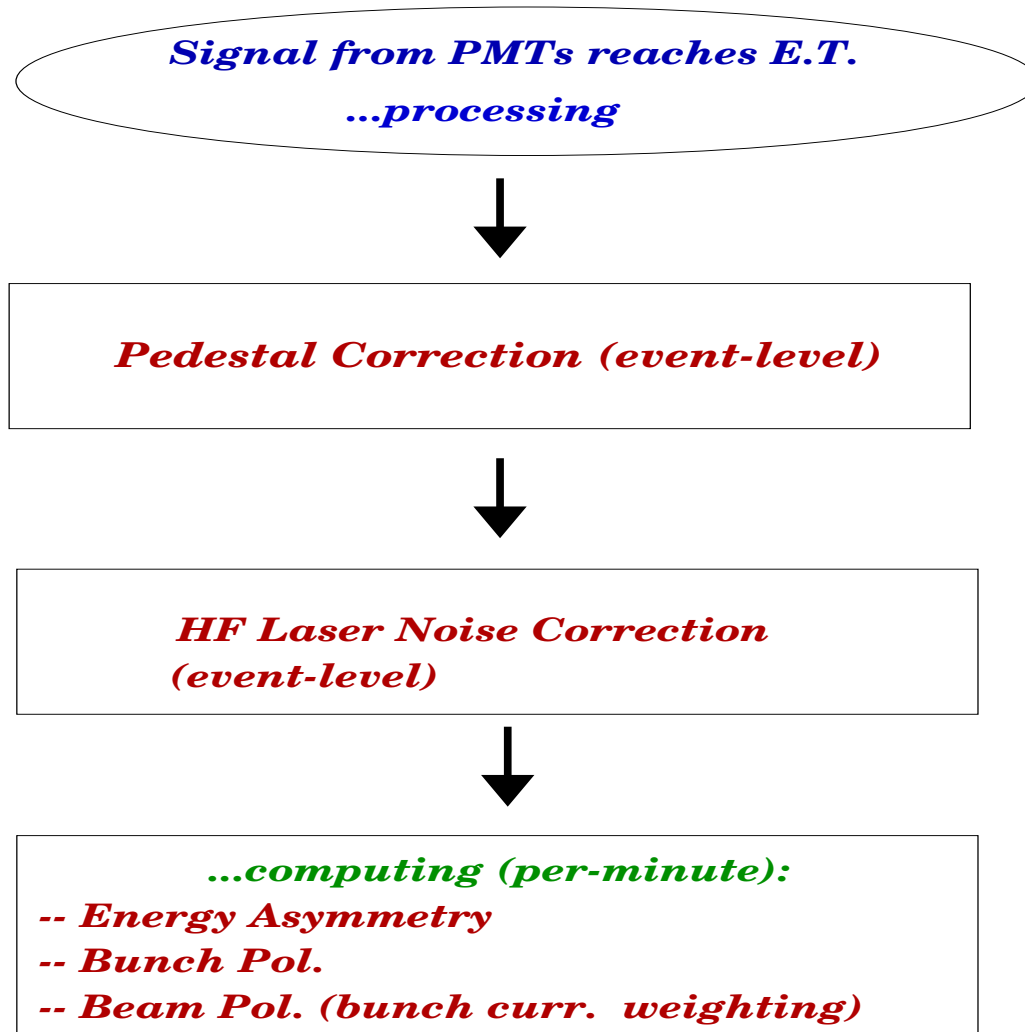


☞ **Observed excursion of L/T above 1.05 & below 0.95! (10% of data in 06)**

⇒ **also within a fill**

☞ **Combined cited LPOL & TPOL syst. not accountable for them**

Basic Flowchart

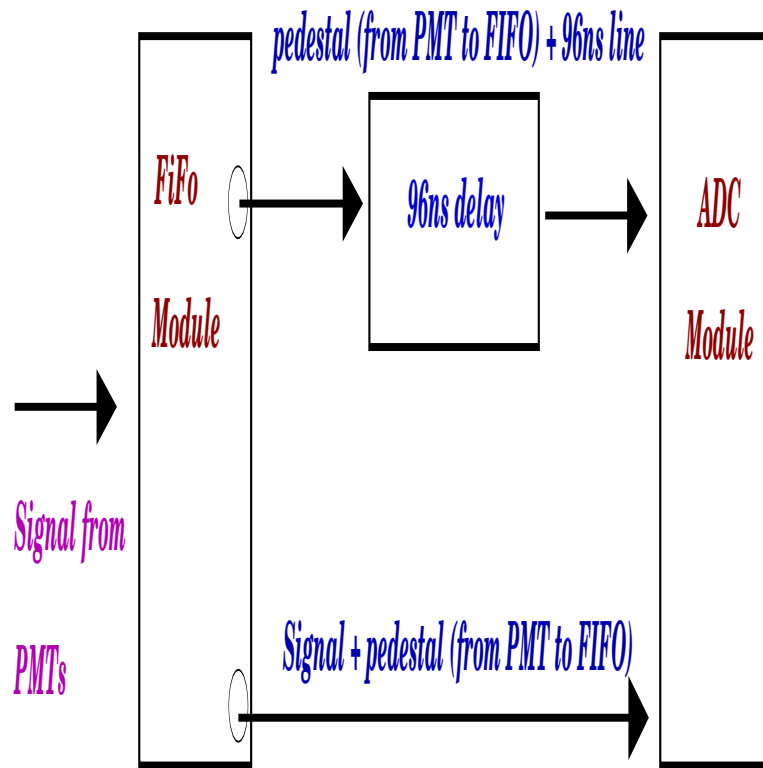


Pedestal Evaluation

☞ Each PMT signal splitted

extra component delayed:

⇒ out of gate



☞ In principle, at event level:

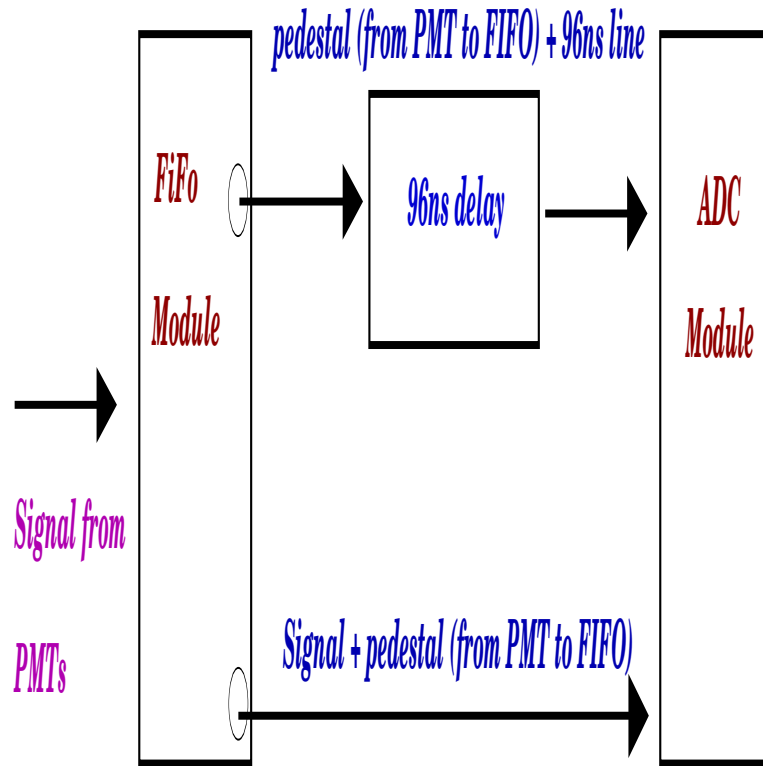
$$ADC_{ped.corr.} = ADC_{InGate} - ADC_{OutOfGate}$$

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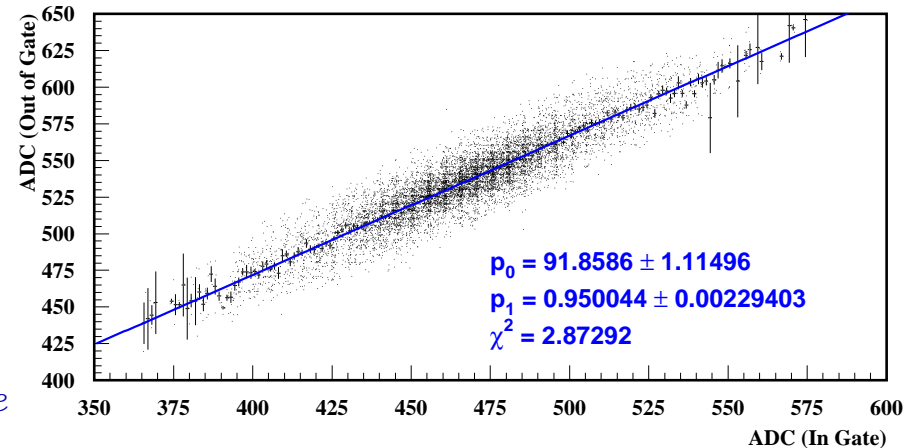
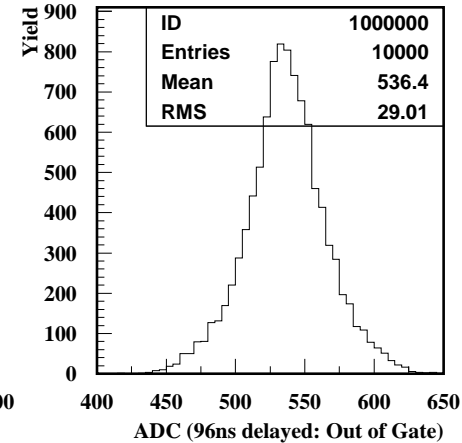
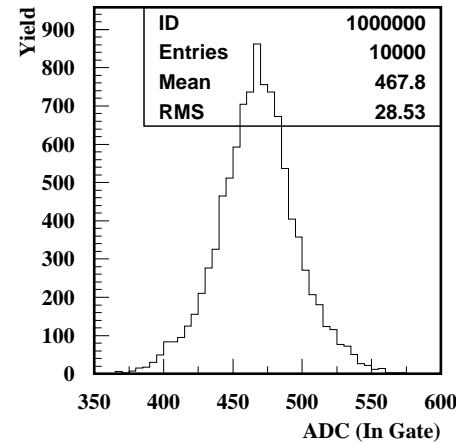
$$ADC_{ped.corr.} = ADC_{InGate} - ADC_{OutOfGate}$$

➡ $ADC_{OutOfGate}$ should be corrected!

⇒ different ADC line

➡ Via linear fit (each minute!)

Considering Laser_Off - Bunch_On events



Laser HF noise Evaluation

👉 Noise from Laser Power Supply propagates to E.T.

⇒ might affect the Comptons *ADCs*

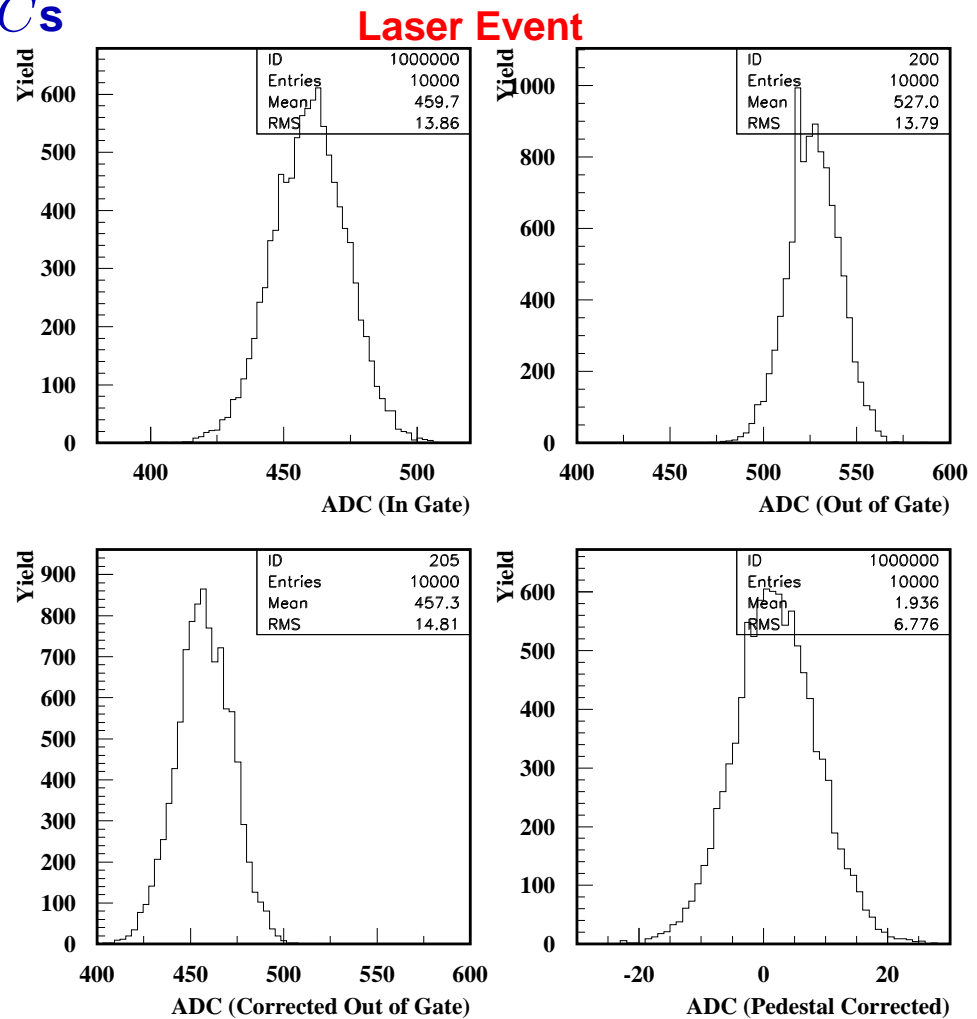
👉 Consider *ADCs* for

Laser_On - Bunch_Off events

(pedestal corrected)

$$ADC_{laser\ noise} =$$

$$ADC_{InGate}^{laser\ event} - ADC_{OutOfGateCorr}^{laser\ event}$$



Polarization Computation

From accumulated (per-minute!) ped. & laser noise corrected
Comptons ADC s per bunch b :

$$\Rightarrow A_b = \frac{\langle I_b^{35} \rangle - \langle I_b^3 \rangle}{\langle I_b^{35} \rangle + \langle I_b^3 \rangle}$$

$$\text{– with } \langle I_b^{35/3} \rangle = \sum_{k_b=1}^{N_b^{35/3}} ADC_{k_b}^{35/3} \cdot \frac{1}{N_b^{35/3}}$$

$$\Rightarrow P_b = \frac{1}{A.P.LPOL.\bar{S}_3} \cdot A_b$$

– δP_b via propagation error formula from A_b equation

$$\text{– } \delta \langle I_b^{35/3} \rangle = RMS(I_b^{35/3}) / \sqrt{(N_b^{35/3} - 1)}$$

$$\Rightarrow P_{beam} = \frac{\sum_b P_b \cdot w_b}{\sum_b w_b}$$

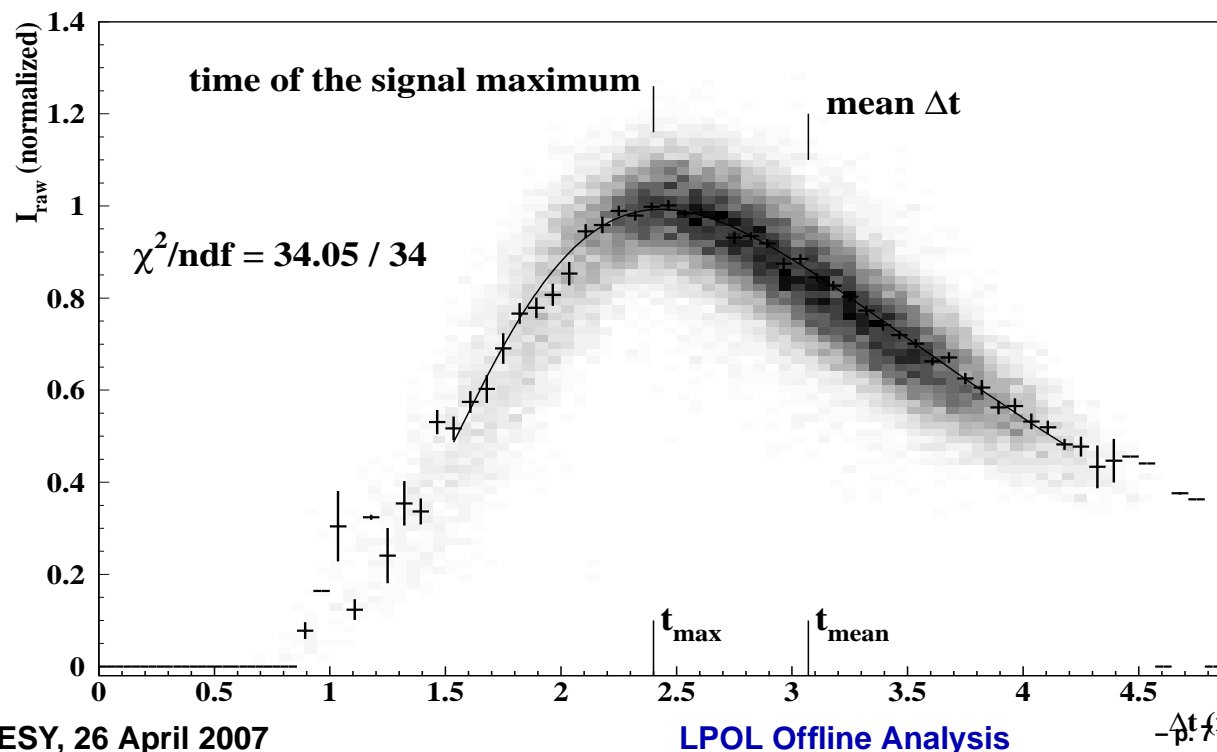
– with $w_b = \langle i_b \rangle / \langle i \rangle$

Timing Correction to *ADCs*

- ➡ Internal laser electronic jitter is $\pm 1.5ns$
- ➡ laser pulse ($3ns$ long) has non-constant lumi-profile
- ➡ due to jitter, sampling is at different lumi-profile “slides”
 - ⇒ *ADCs* should be lumi-corrected to get physical asymmetries
- ➡ via TDC determine $\Delta t = t_{laser_firing_trigger} - t_{laser_fired}$
- ➡ 1-min data fitted with pulse profile function
 - ⇒ *ADC*-corr. factor
 - to max.signal provided
- ➡ fit by considering only one helicity state
- ➡ fit results used to correct next 1-min events before (!) the polarization calculation

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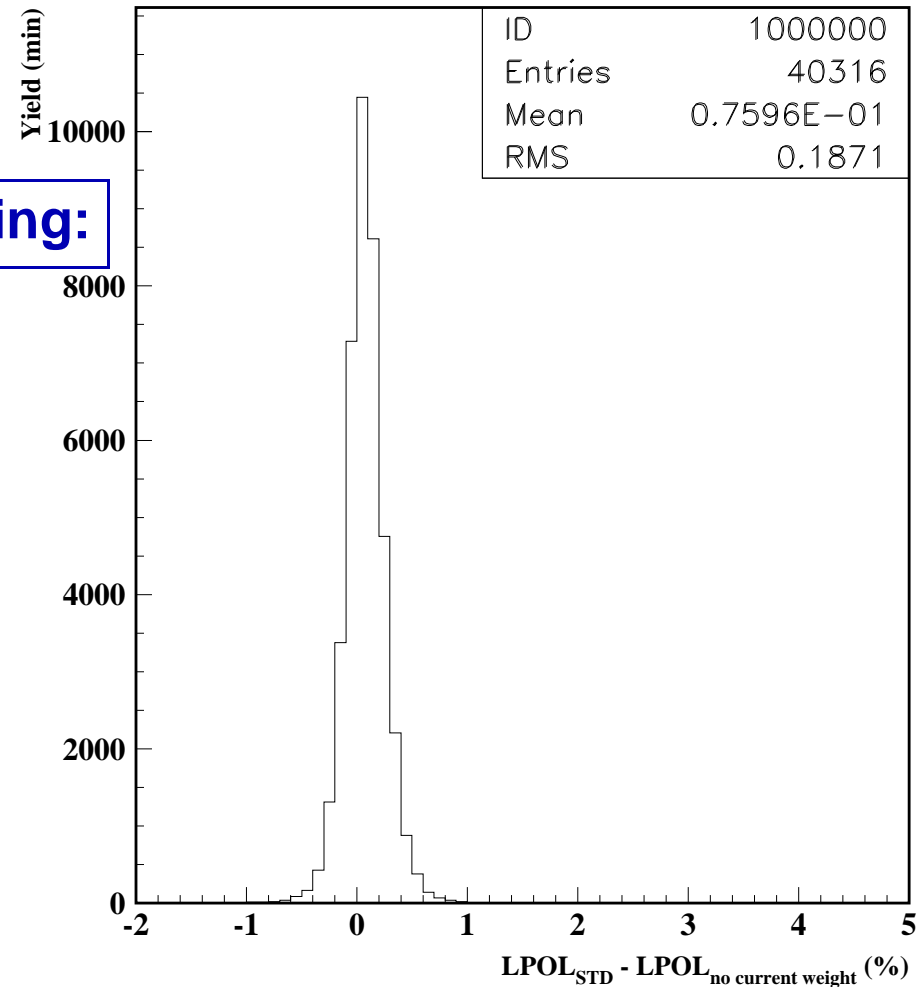


Corrections to Raw data

☞ Some preliminary results for 2007 data are shown...

Effects from Bunch-Current Weighting:

Effect within 1%! ✓



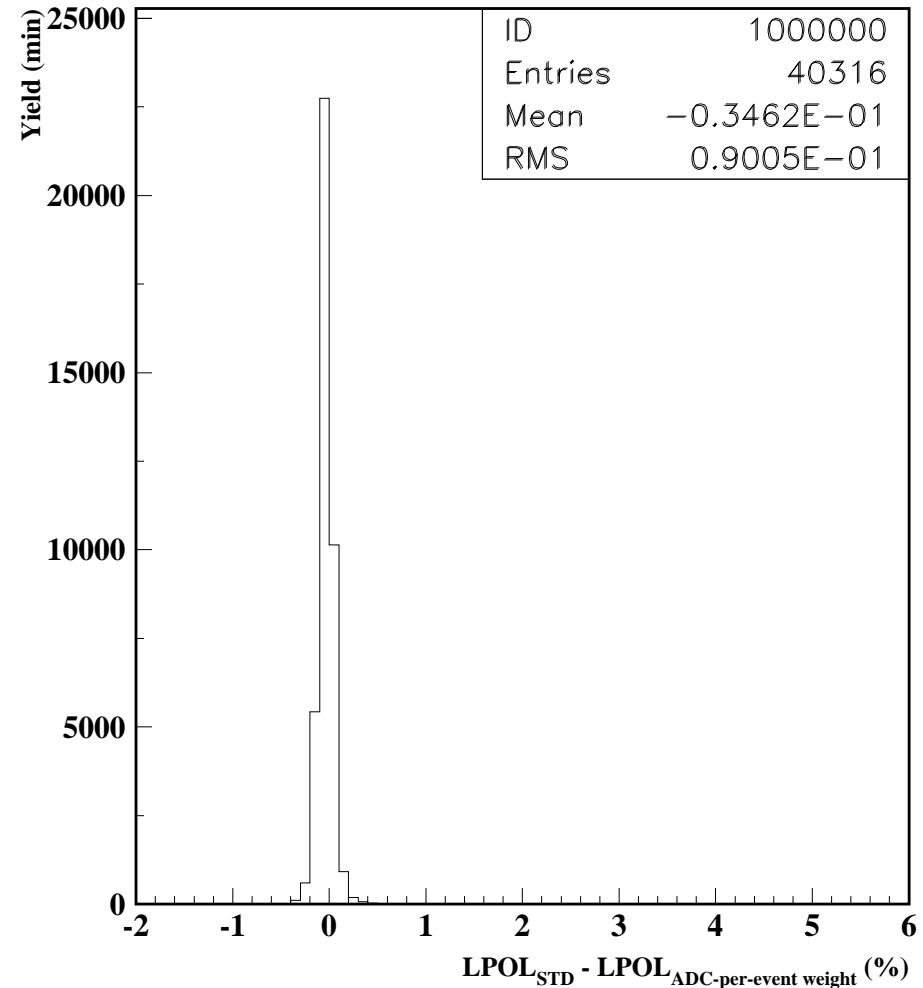
Corrections to Raw data

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ADC-event Weighting:

⇒ instead of Bunch-Current Weighting

Effect within 1%! ✓

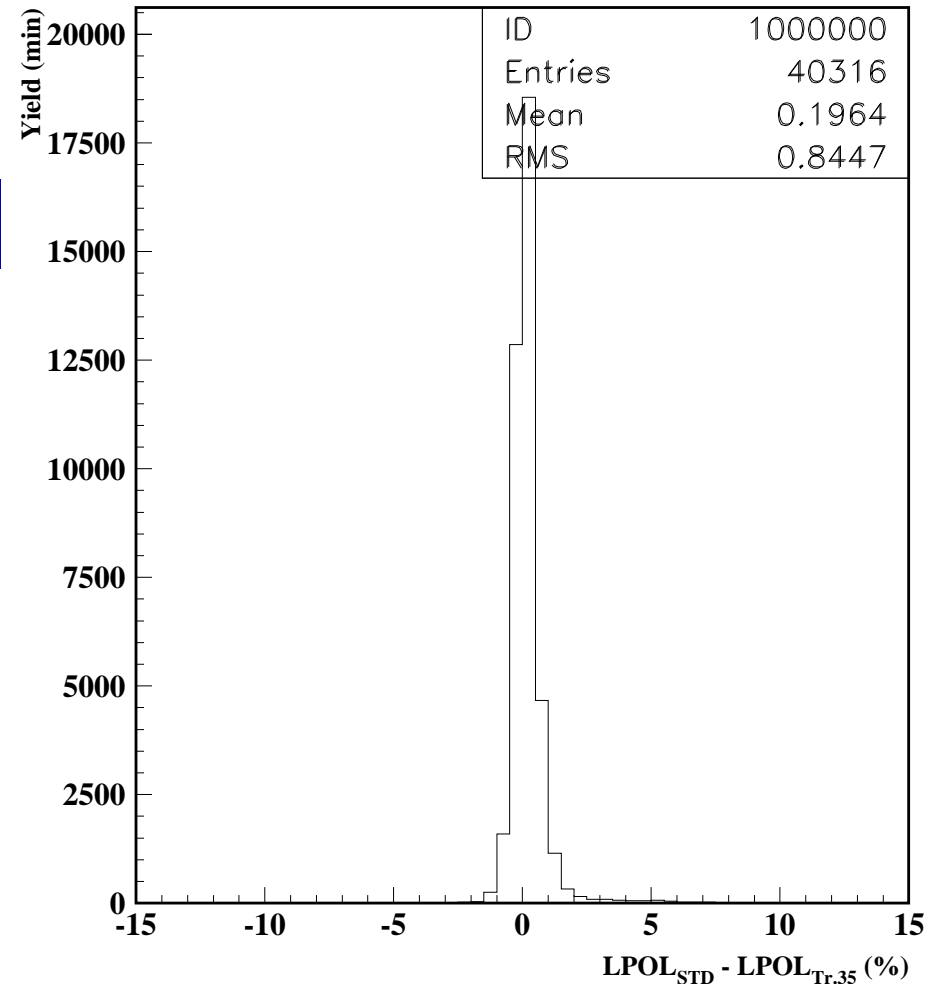


Corrections to Raw data

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Trigger Effects in Jitter Correction:

Effect within 1%! ✓

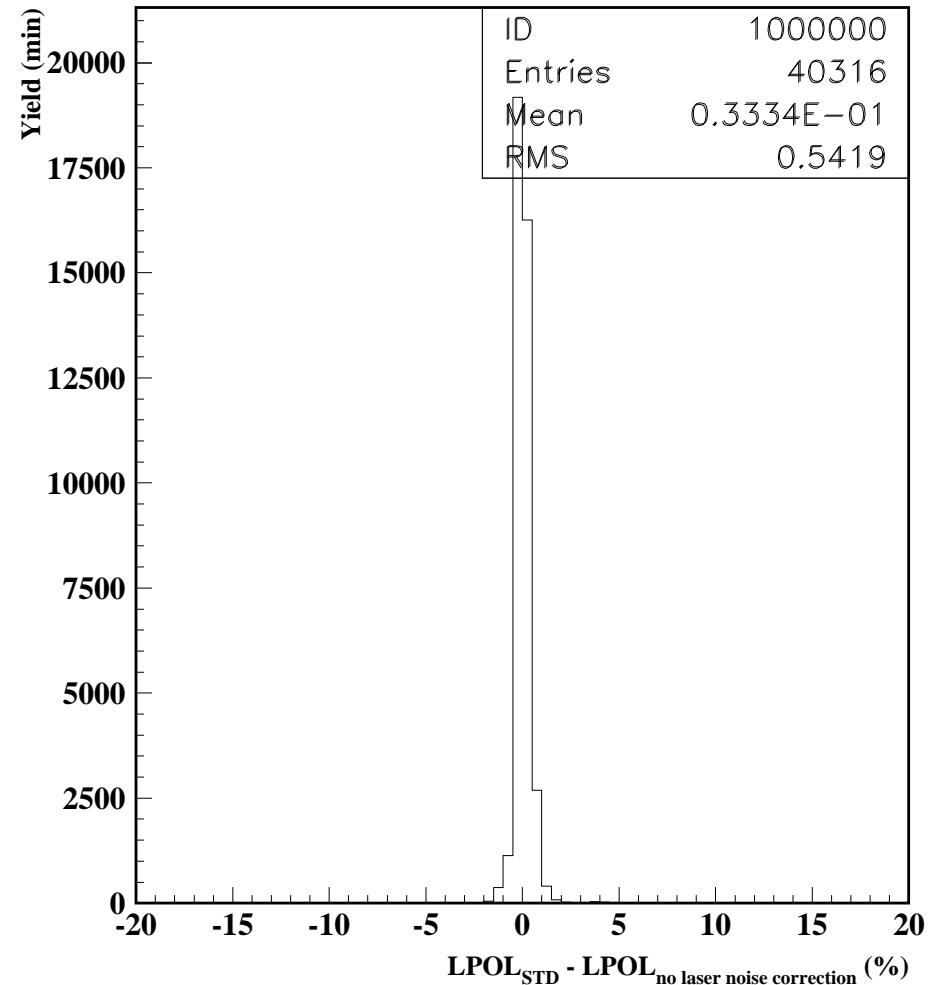


Corrections to Raw data

☞ Some preliminary results for 2007 data are shown...

No Laser Noise Correction:

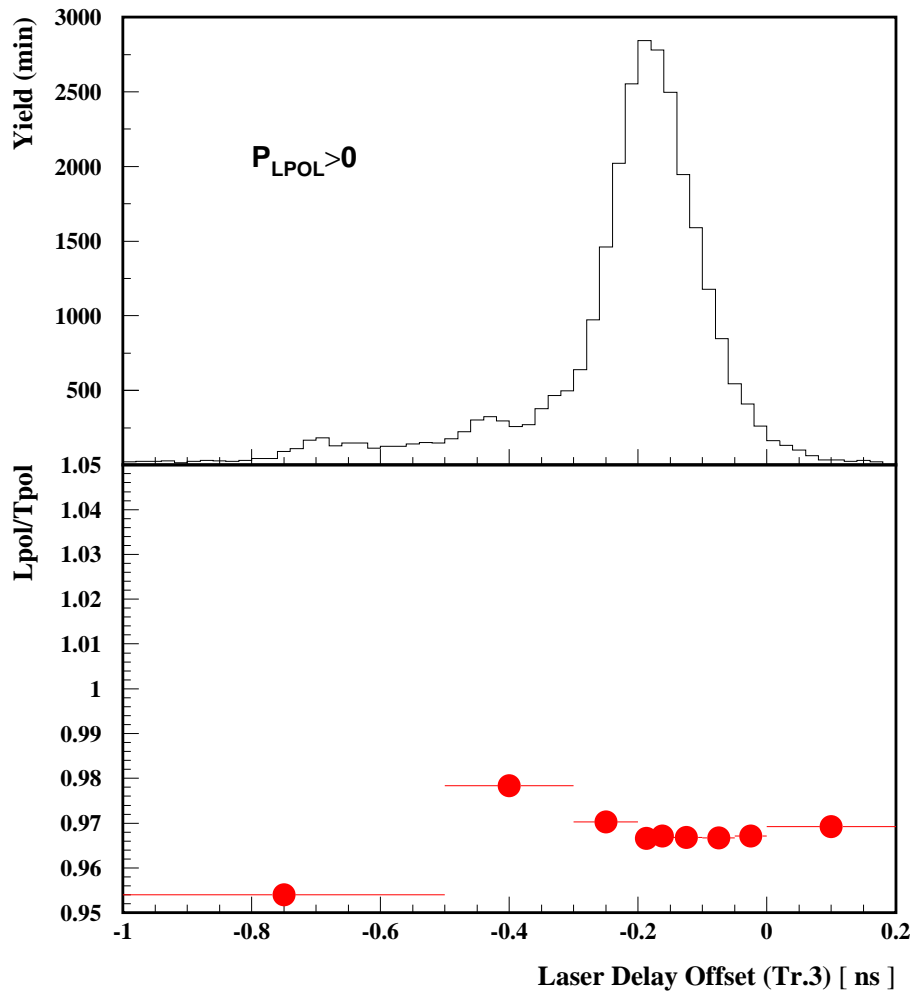
Effect within 1%! ✓



Correlations Investigation

👉 Some preliminary results for 2007 data are shown...

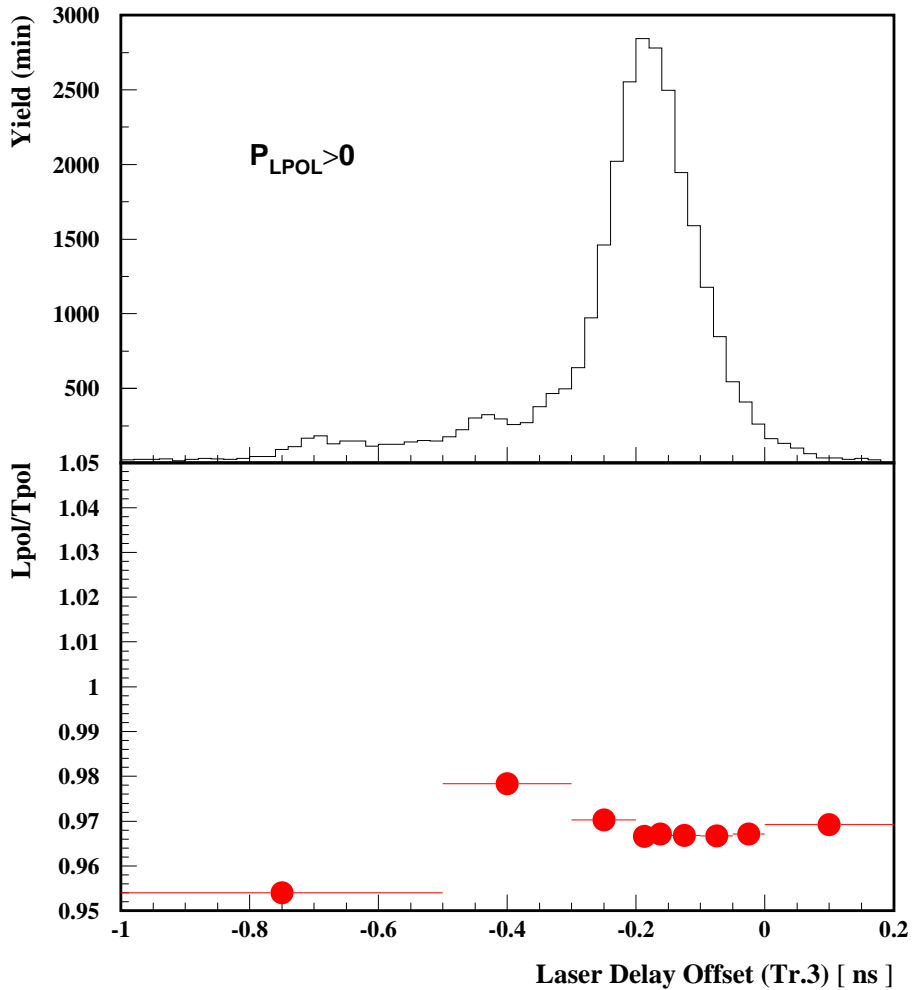
Effects of fitted laser pulse shape:



Correlations Investigation

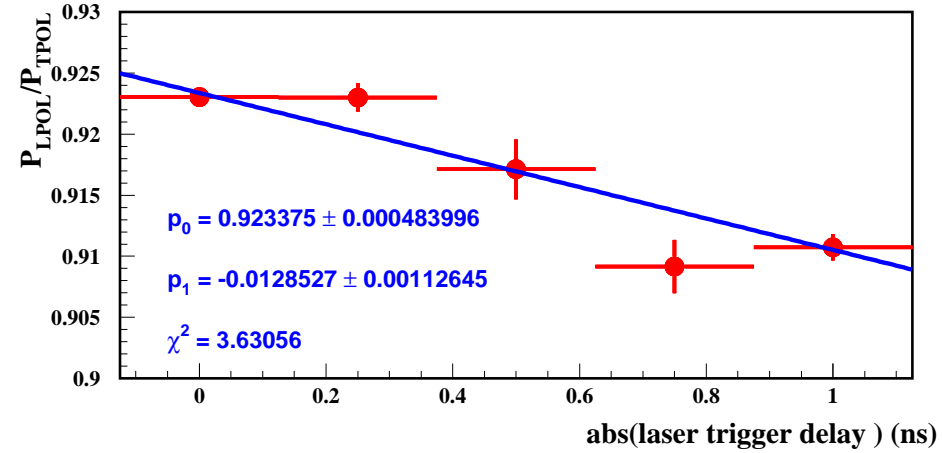
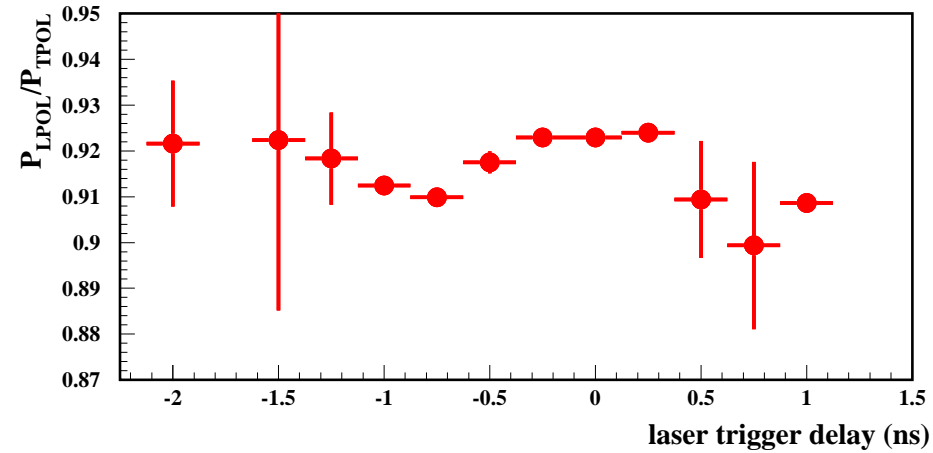
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Effects of fitted laser pulse shape:



$\approx 2\%$ consistent with reported analysis:

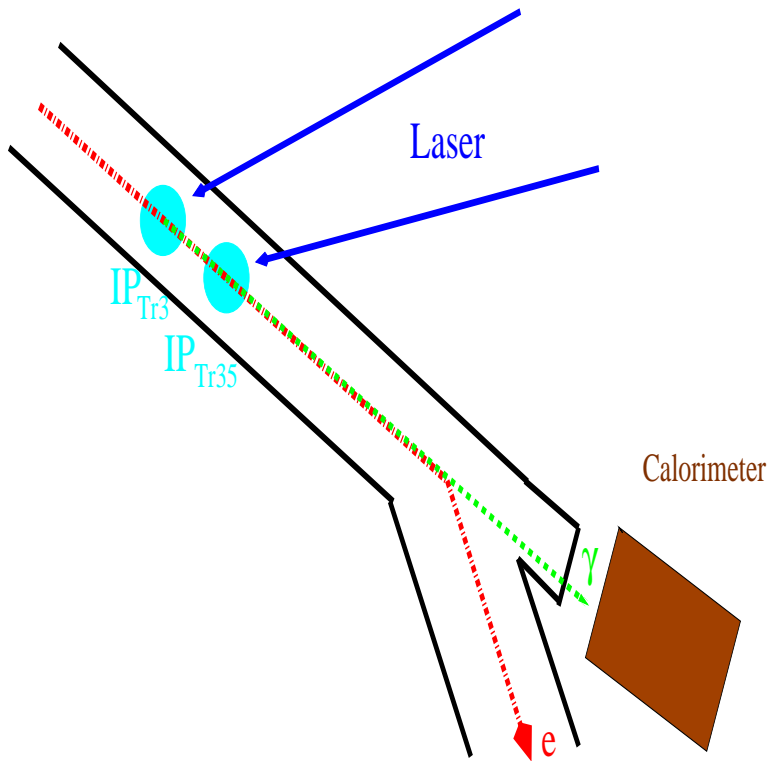
HERMES-IR-05-047



Correlations Investigation

☞ Some preliminary results for 2007 data are shown...

Possible Pockels Cell misalignment effects?



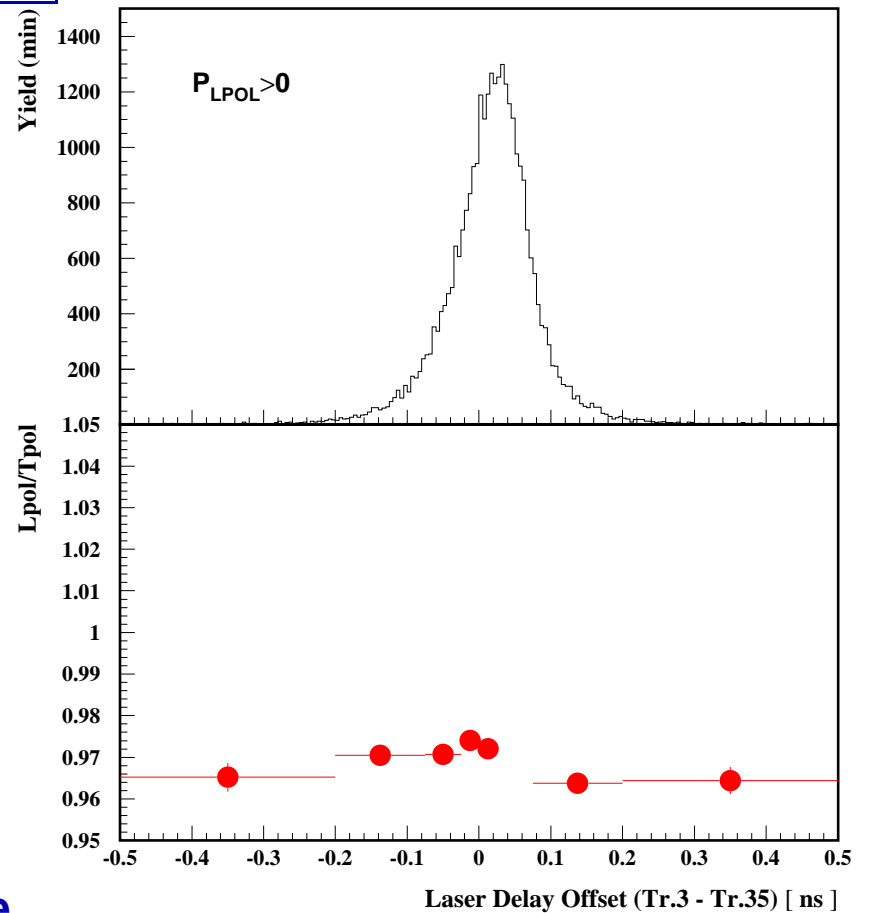
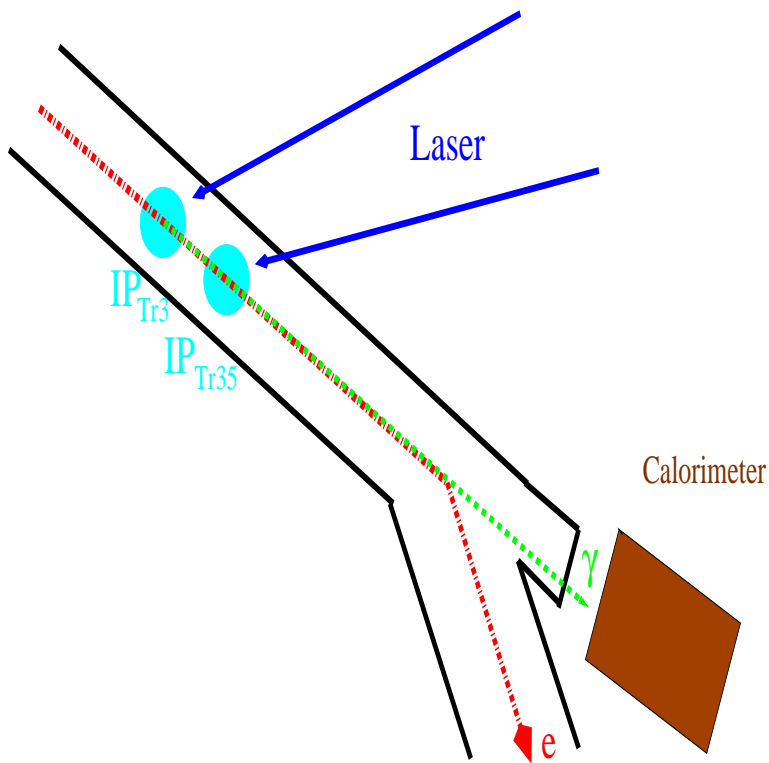
❖ Displacement in HERA z -coord. might be revealed in different time-profile for two triggers!

Correlations Investigation

☞ Some preliminary results for 2007 data are shown...

Possible Pockels Cell misalignment effects?

Possible false asymmetry induced?



❖ Displacement in HERA z -coord. might be revealed in different time-profile for two triggers!

Effect within 2%! ✓

Conclusions and Future Plans

☞ **LPOL algorithm was reported**

⇒ **different corrections to raw ADC shown**

☞ **Preliminary results of offline analysis for 2007 data shown**

◆ **– Some effects from corrections analyzed**

– **Inclusion/Exclusion of bunch current/ADC weighting**

– **Laser noise**

– **Jitter correction from different helicity triggers**

◆ **Effect from laser profile investigated**

◆ **PC misalignment investigated**

– **resulting in a possible time-profile different for each trigger**

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– **resulting in a possible time-profile different for each trigger**

☞ **LPOL/TPOL issue has not been understood yet! :-)**

☞ **Lots to investigate at LPOL side:**

– **Laser Pulse shape deterioration / PC misalignment in X-Y / Energy resolution**

– **Stability of pedestals / Effects from Brem/Synchr ?**