Offline Investigation of LPOL Polarization Measurement

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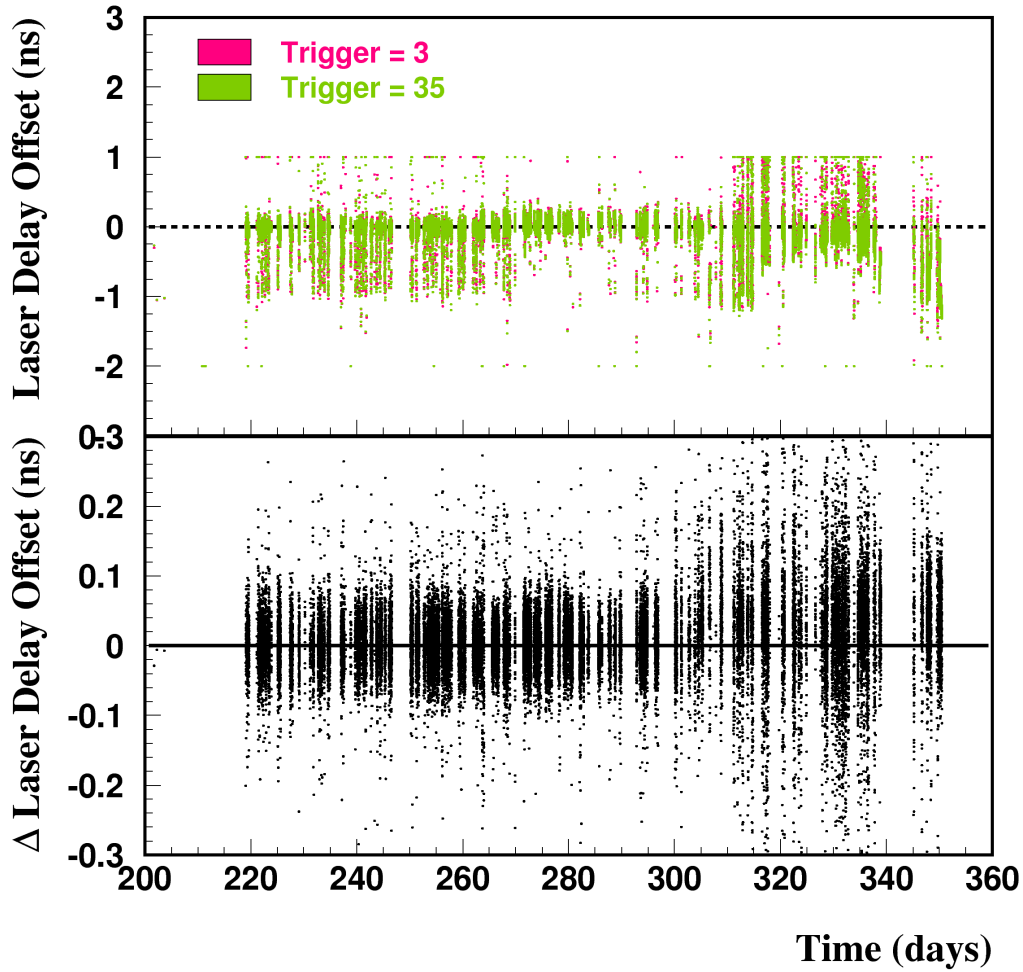
Offline Analysis with Reprocessed Data

- The reprocess of LPOL data allows to perform an offline analysis considering the information from (so far) 178 variables
- Variables combined together in HBOOK files from different database sources
- Variables synchronized to LPOL polarization values recalculated out of raw data each $10K$ events (≈ 1 min of data taking)
  - synchronization might fail for missing data in processed time window
  - data should be always checked $\Longrightarrow$ no blind analysis!
- Here we investigate 2006 data
  - investigate possible false asymmetries induced by misalignement of laser pulses in opposite helicity states
  - Lpol/Tpol ratio investigated wrt variables related to laser beam profile

Misalignment Effects on Laser Delay Offset

- Values extracted during entire 2006 (online DQ cut applied)

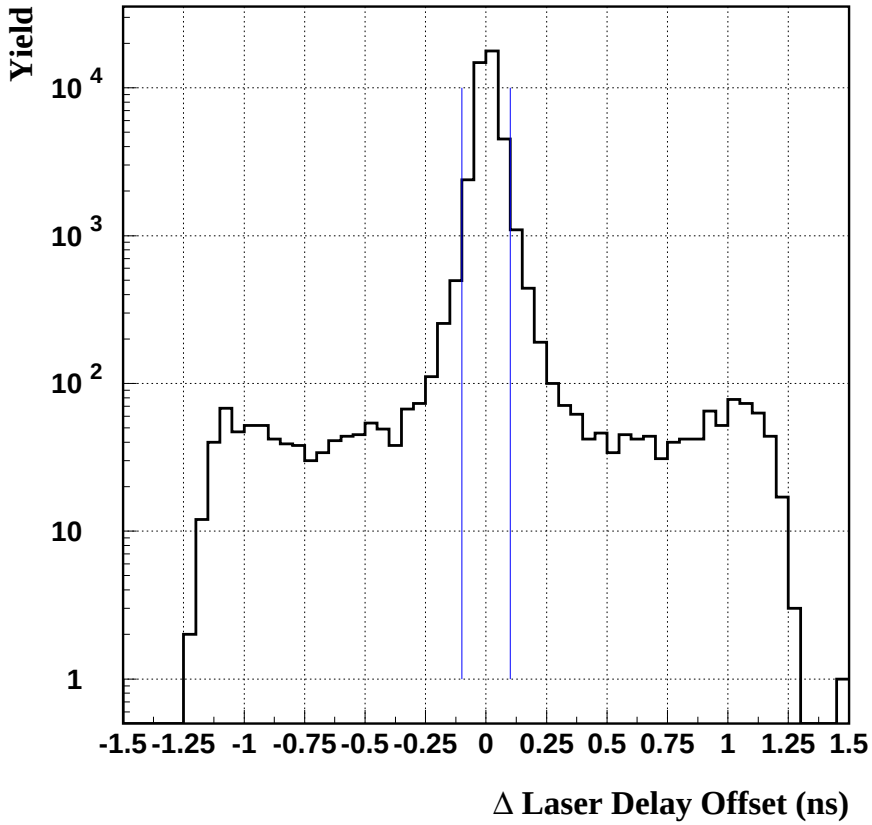


Note enlarged difference between two helicity states

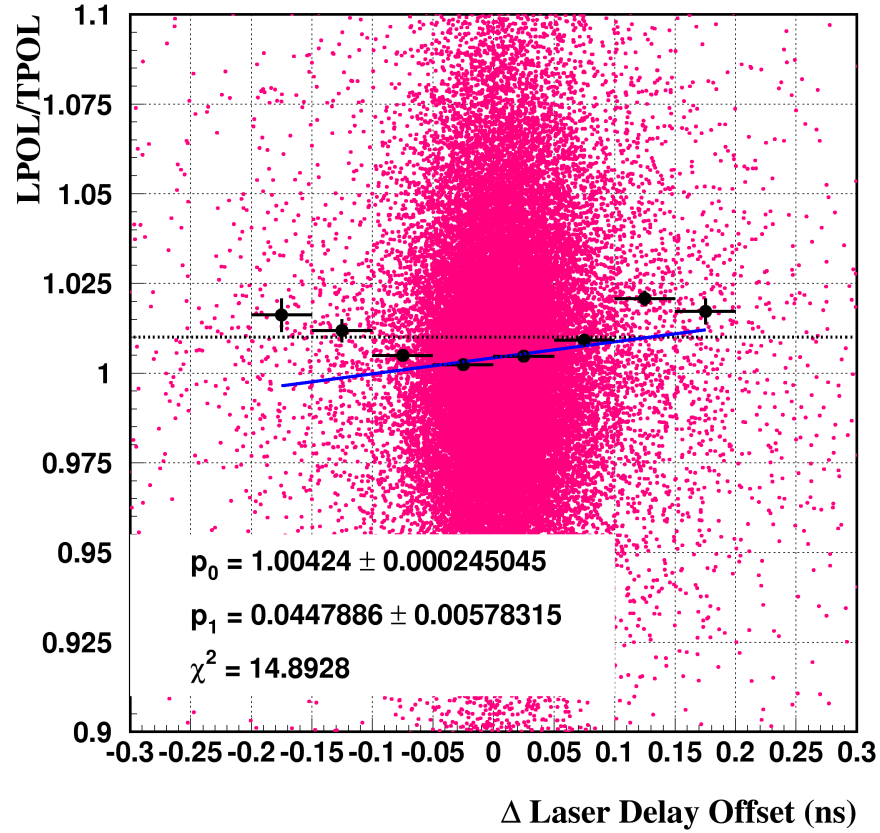
Misalignment Effects on Laser Delay Offset

All 2006 data: Online DQ bit applied

- Distribution of values for both trigger states and of their difference



- Correlation with Lpol/Tpol ratio

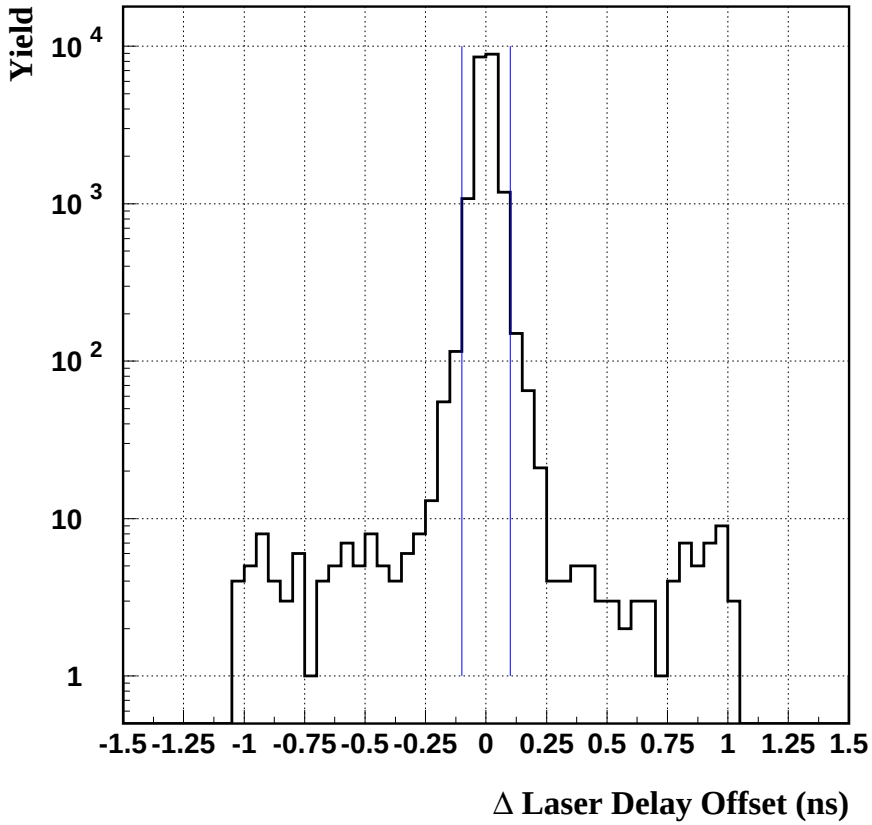


Correlation observed? Compare summer and fall data

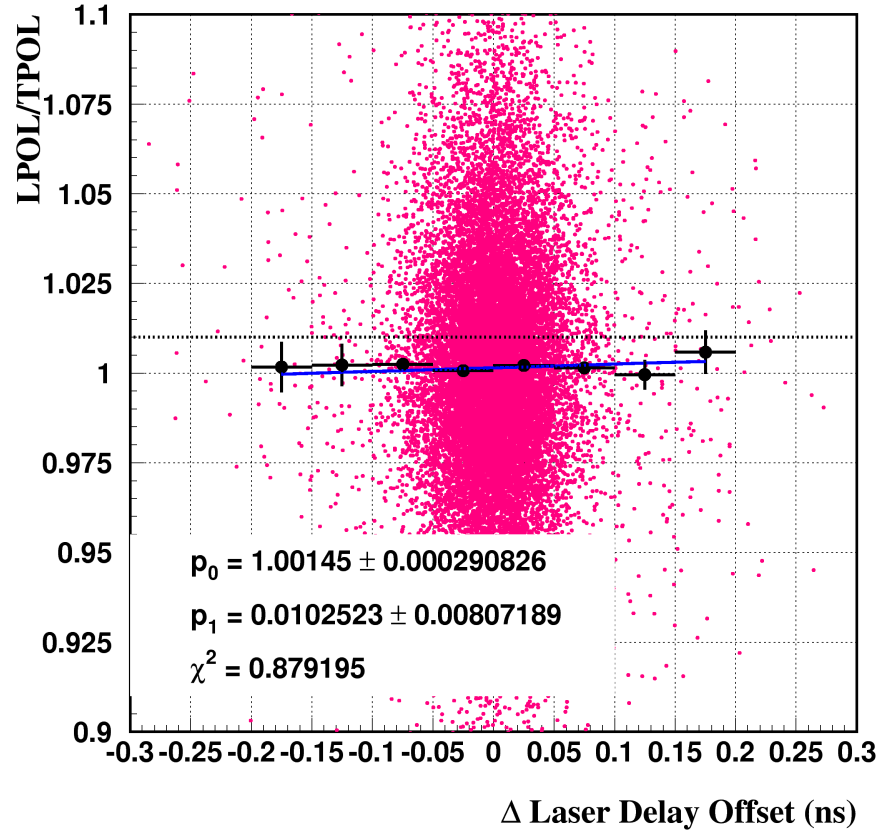
Misalignment Effects on Laser Delay Offset

Summer 2006 data: **Online DQ bit applied**

- **Distribution of values for both trigger states and of their difference**



- **Correlation with Lpol/Tpol ratio**

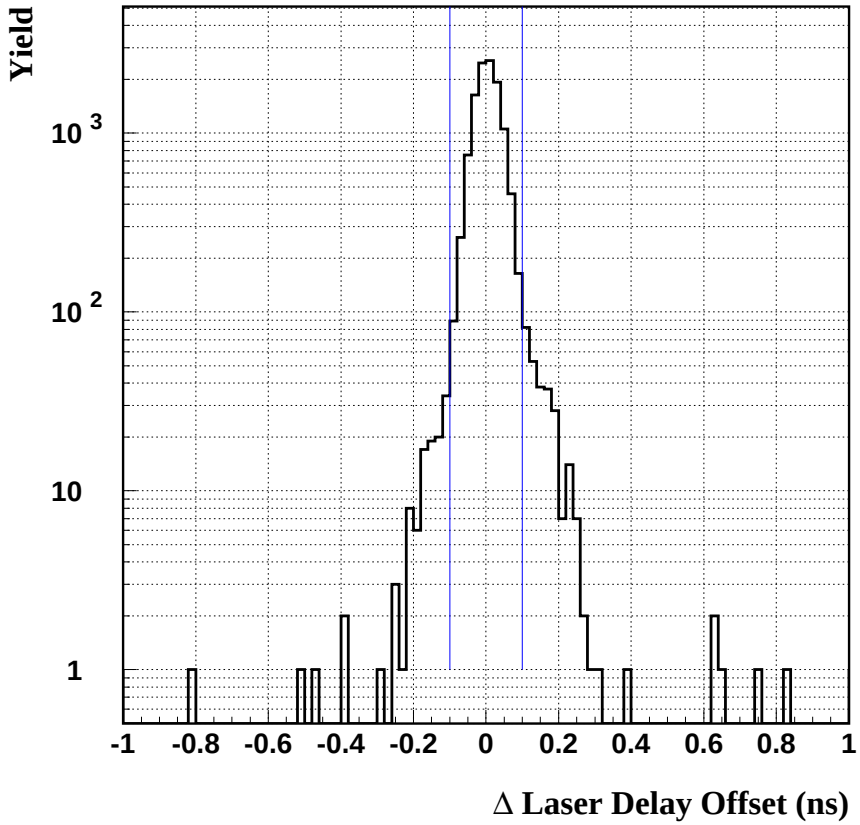


No specific dependence observed

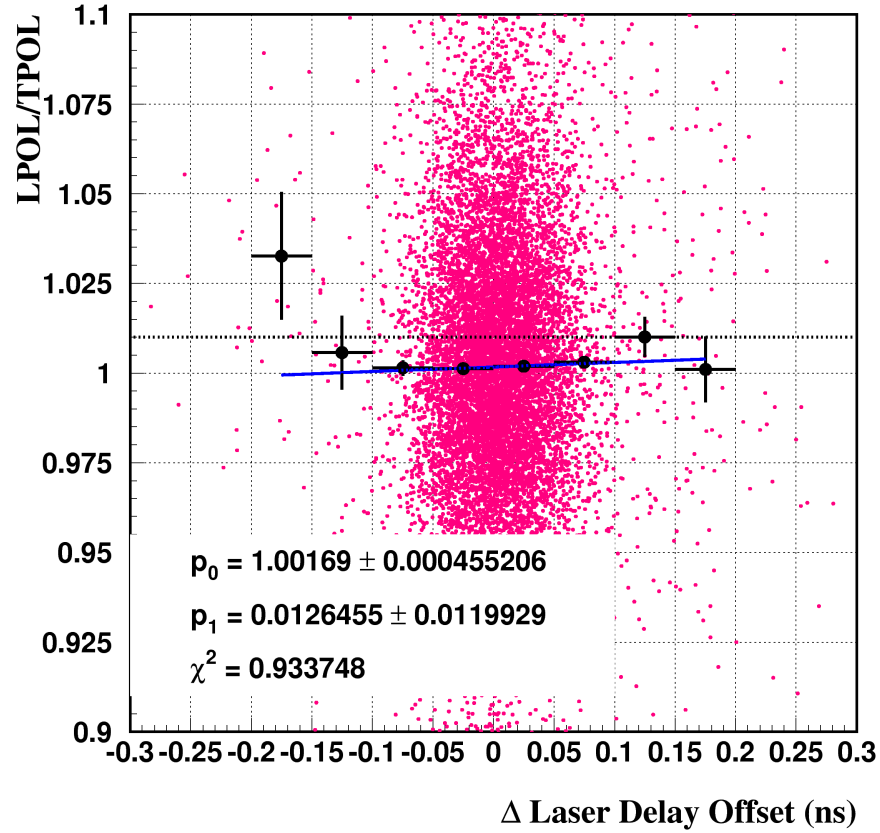
Misalignment Effects on Laser Delay Offset

Autumn 2006 data: **Online DQ bit applied**

- **Distribution of values for both trigger states and of their difference**



- **Correlation with Lpol/Tpol ratio**

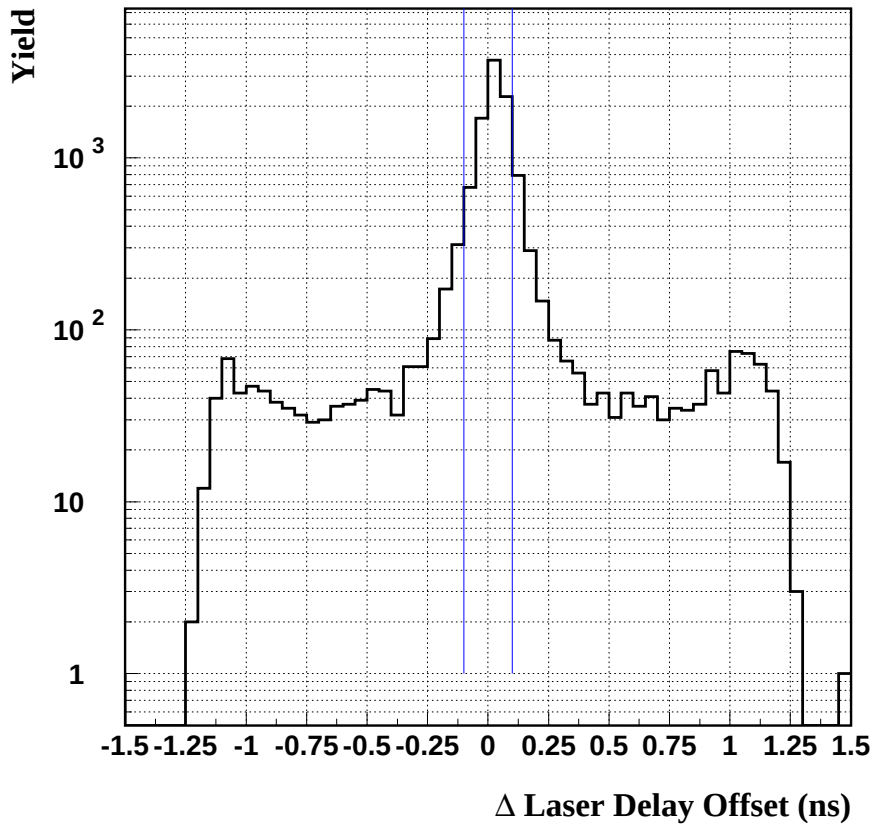


No specific dependence observed

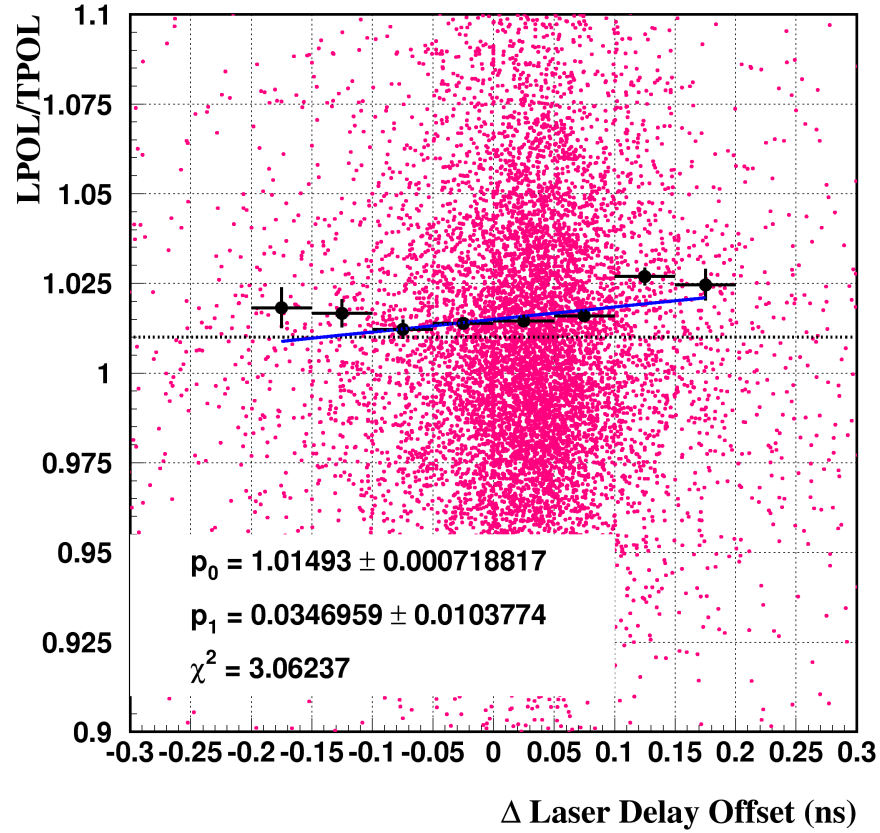
Misalignment Effects on Laser Delay Offset

Fall 2006 data: **Online DQ bit applied**

- **Distribution of values for both trigger states and of their difference**



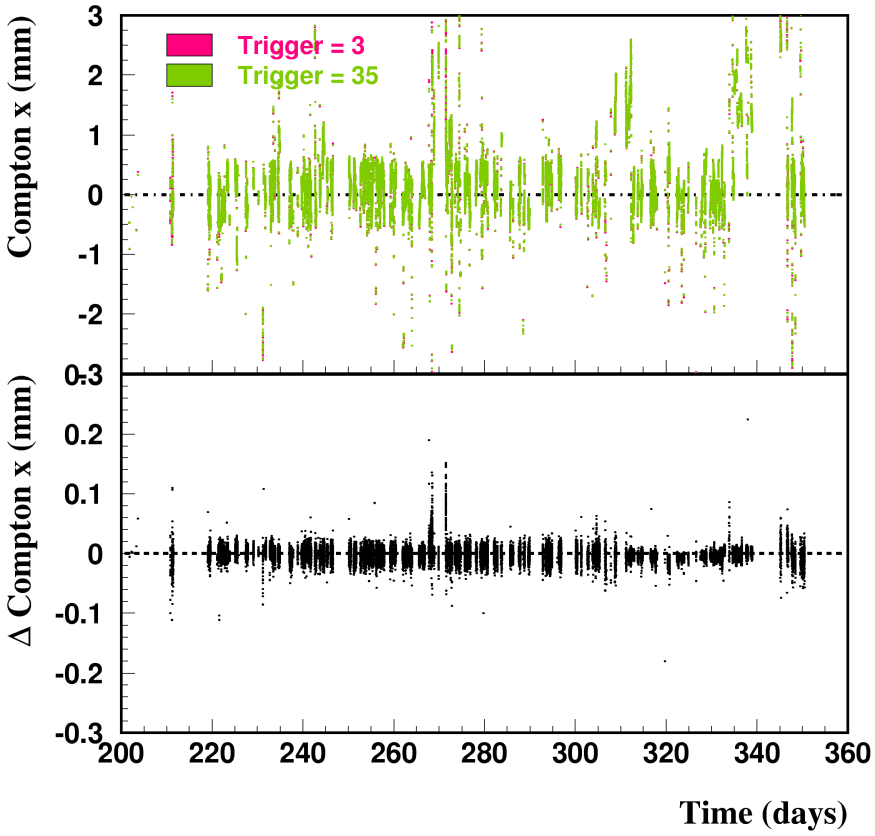
- **Correlation with Lpol/Tpol ratio**

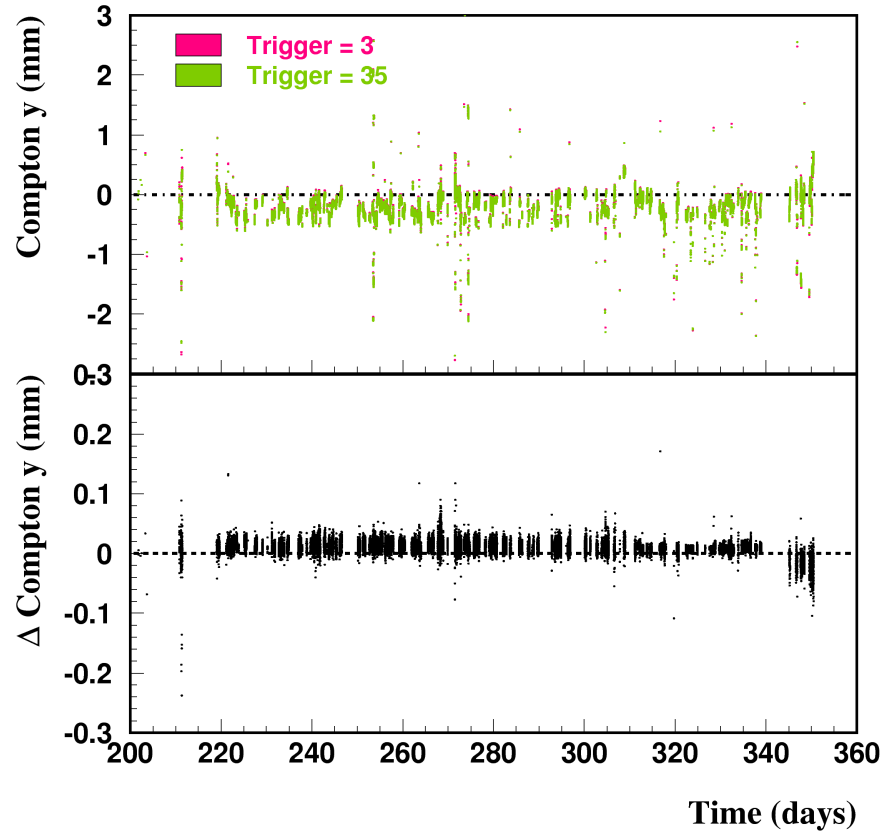


No sizable dependence observed

Misalignment Effects on Compton Cone X/Y

- Values extracted during entire 2006 (offline DQ cut applied)



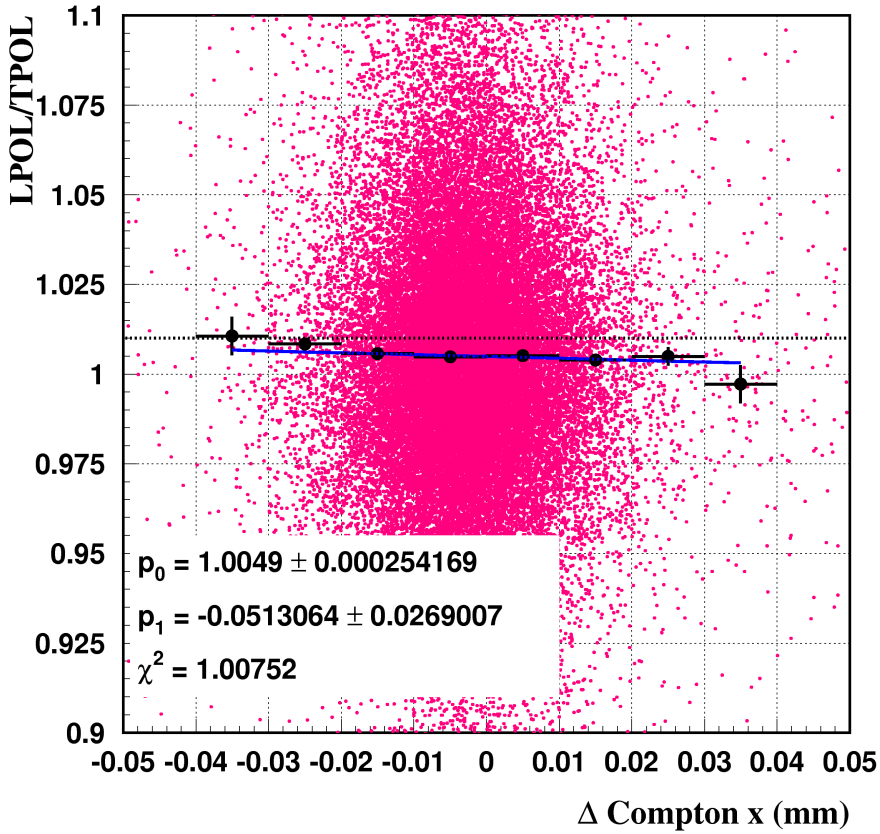


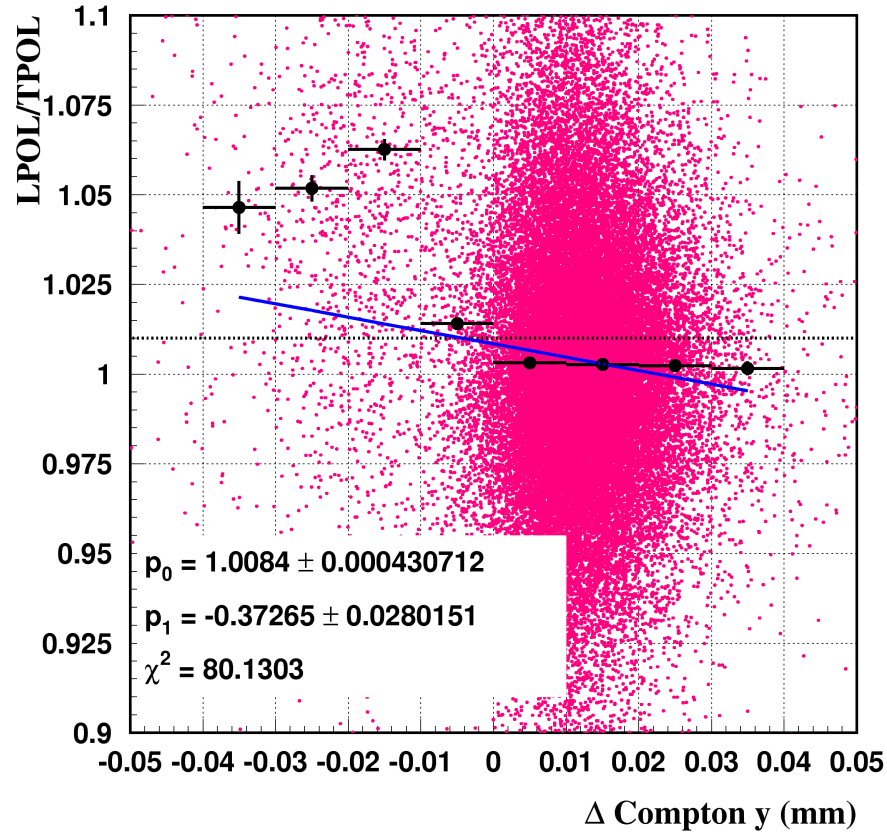
Note negative difference (in Y) between two helicity states in fall

Misalignment Effects on Compton Cone X/Y

- **Correlation with Lpol/Tpol ratio**

All 2006 data: **Online DQ bit applied**



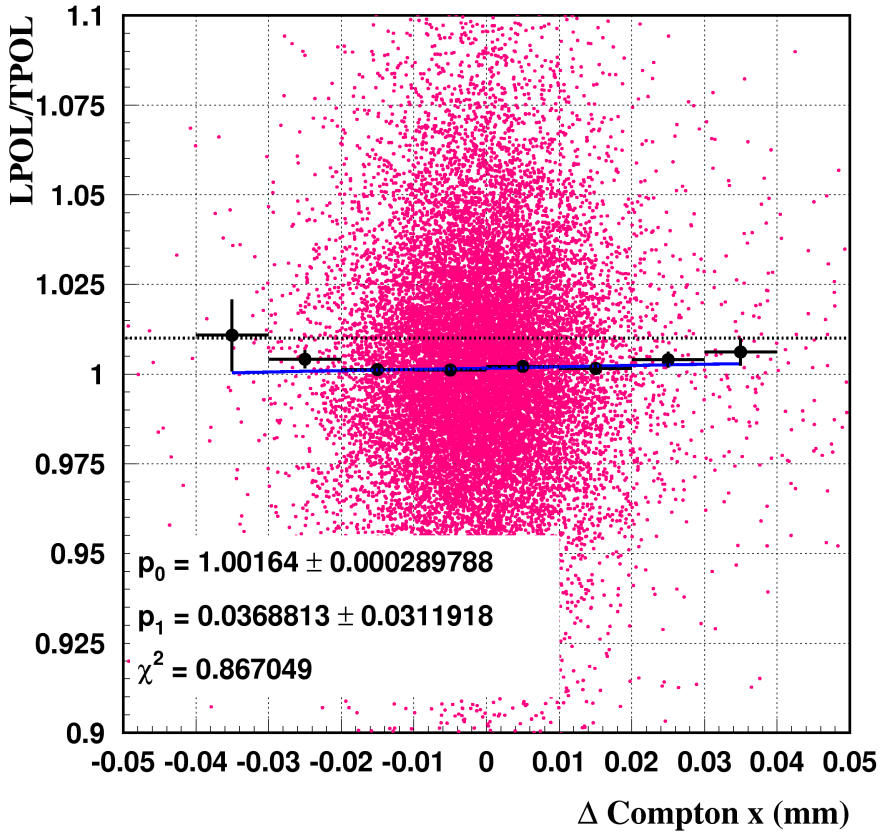


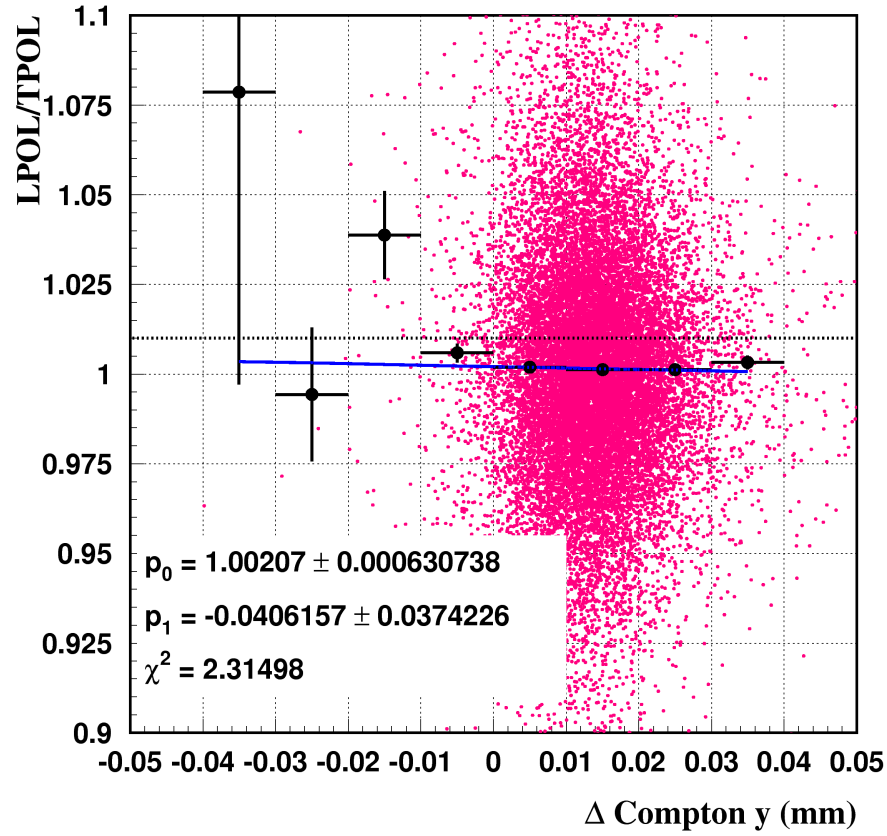
Correlation observed? Compare summer and fall data

Misalignment Effects on Compton Cone X/Y

✦ Correlation with Lpol/Tpol ratio

Summer 2006 data: **Online DQ bit applied**



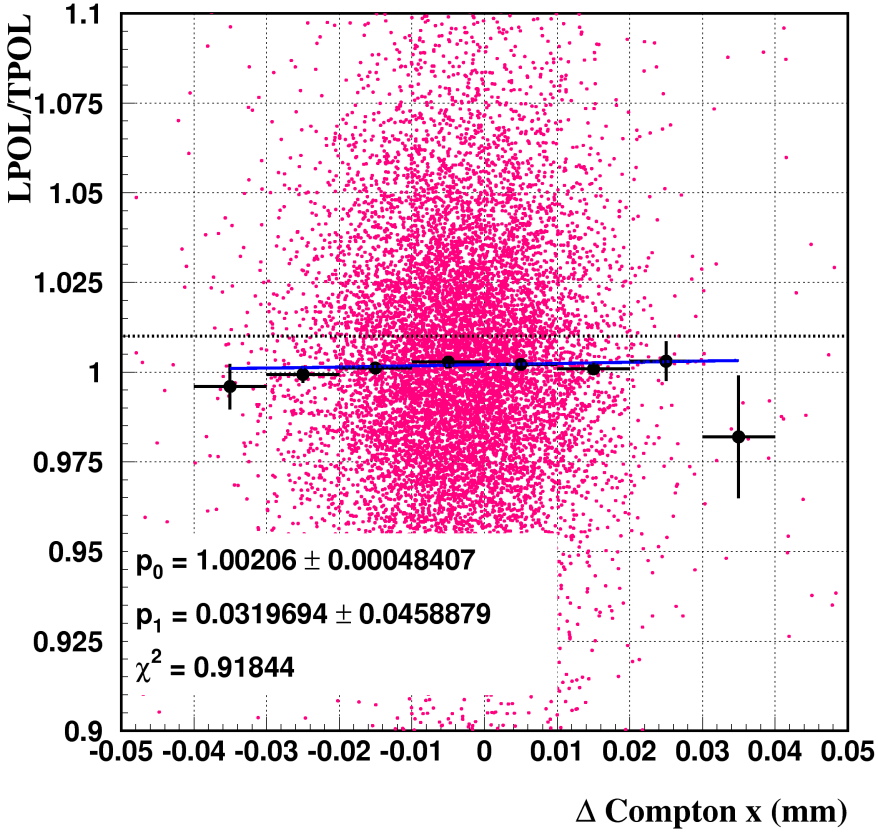


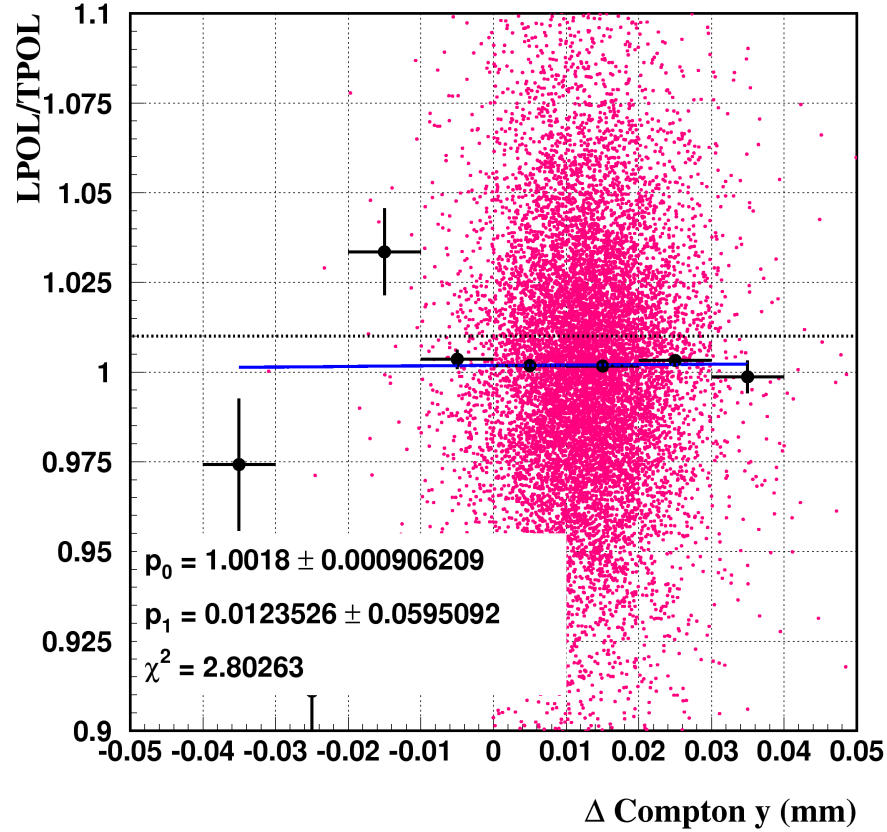
No sizable correlation observed

Misalignment Effects on Compton Cone X/Y

✦ Correlation with Lpol/Tpol ratio

Autumn 2006 data: **Online DQ bit applied**



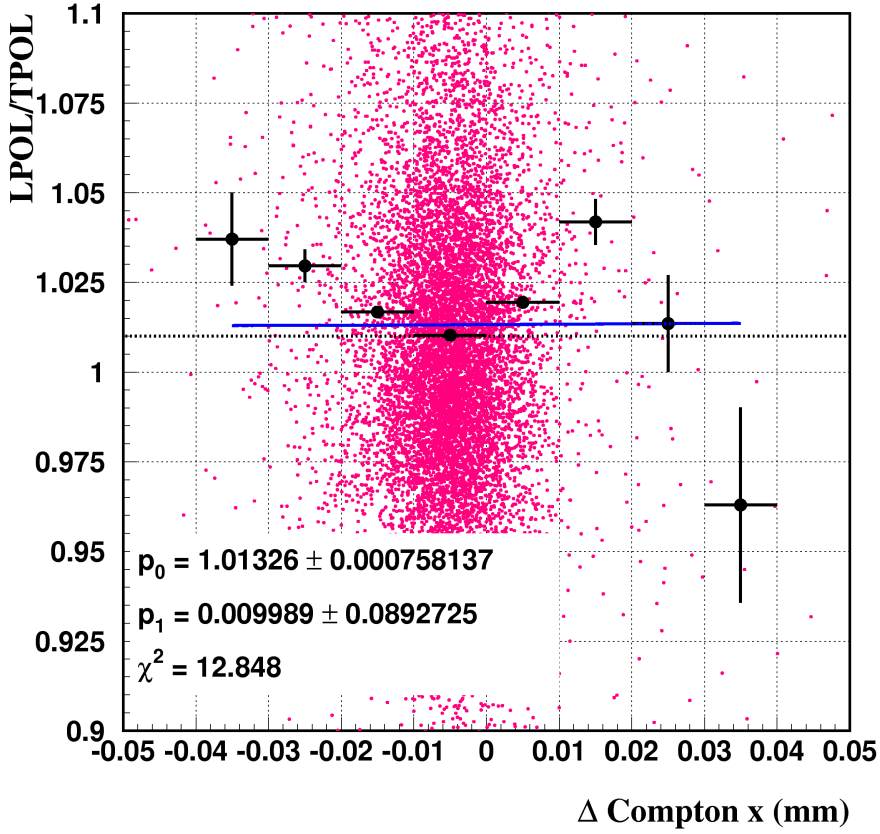


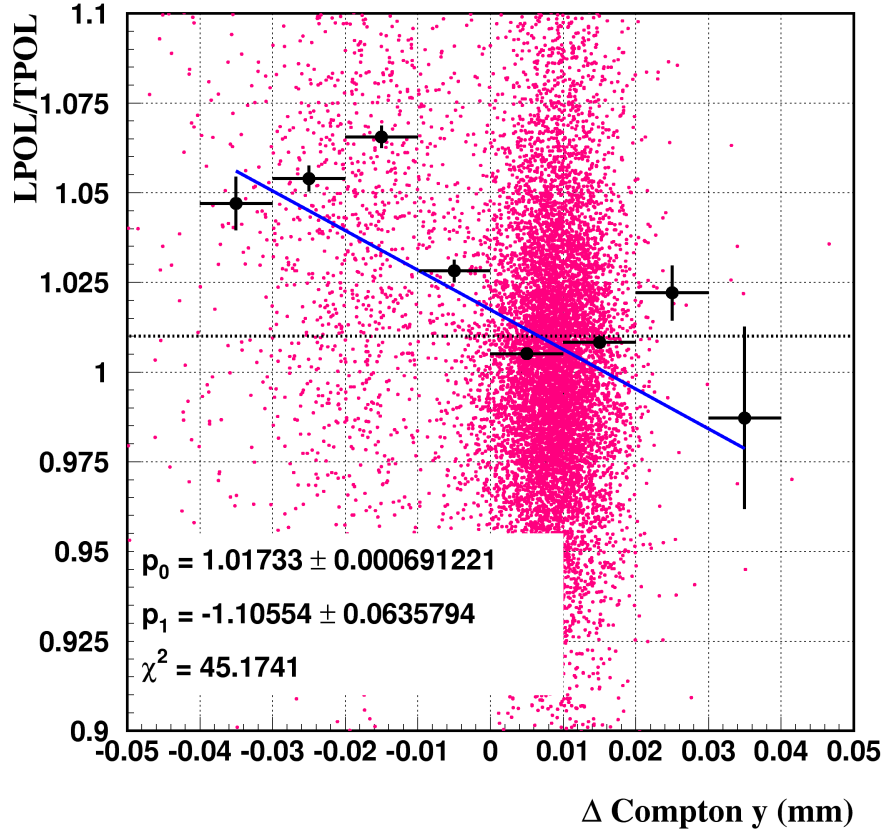
No sizable correlation observed

Misalignment Effects on Compton Cone X/Y

- **Correlation with Lpol/Tpol ratio**

Fall 2006 data: **Online DQ bit applied**





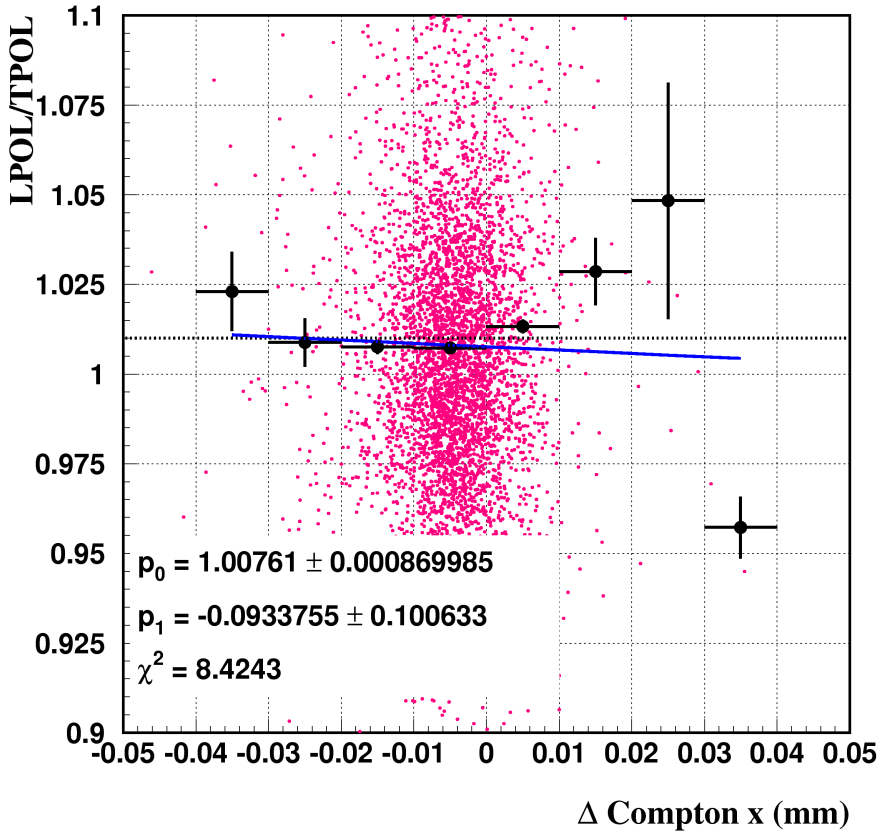
Effects visible. What about released data?

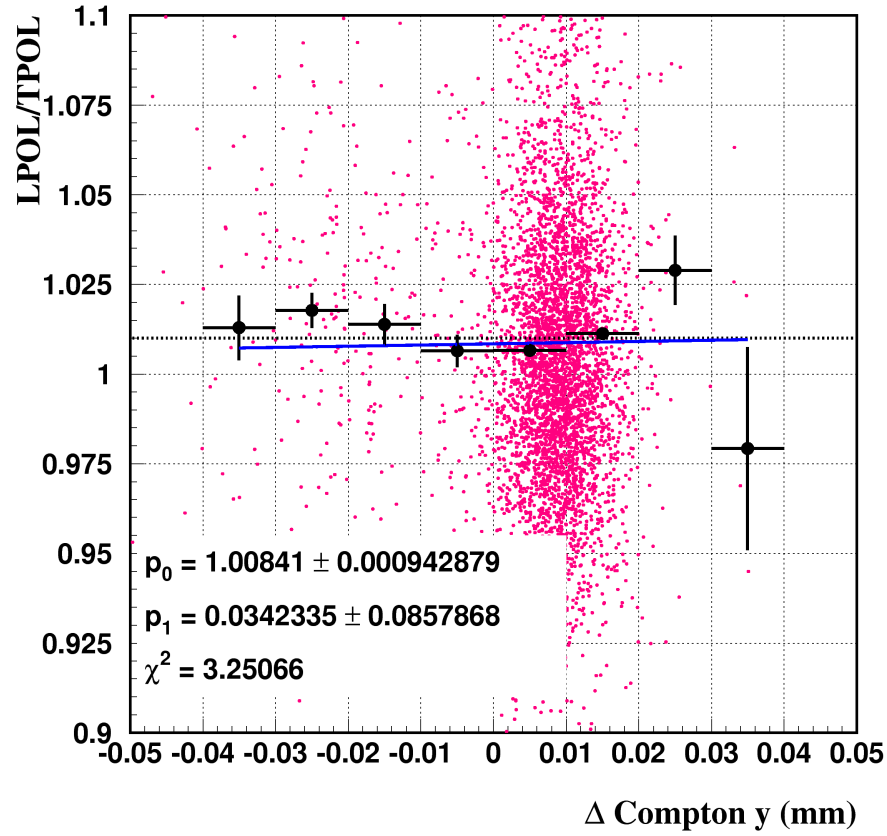
⟹ **It should be taken care by offline DQ bit; reprocess HBOOKs including it**

Misalignment Effects on Compton Cone X/Y

- **Correlation with Lpol/Tpol ratio**

Fall 2006 data: **Offline DQ bit applied**





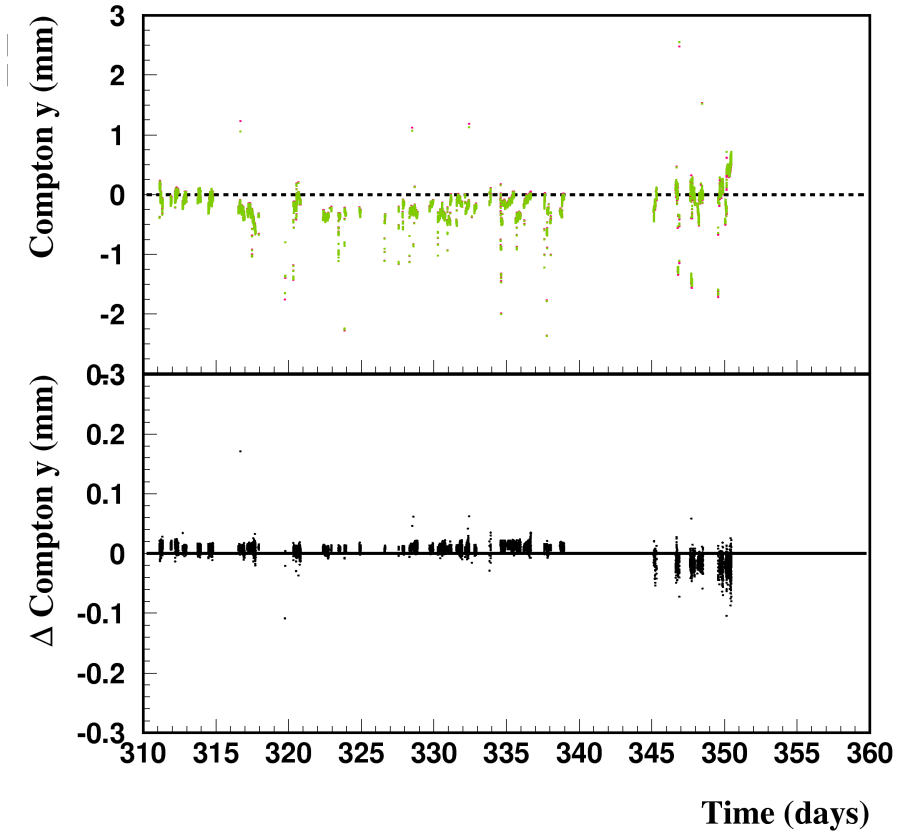
Effects sizably reduced

$\Longrightarrow$ **Where are mainly located bad DQ bit data?**

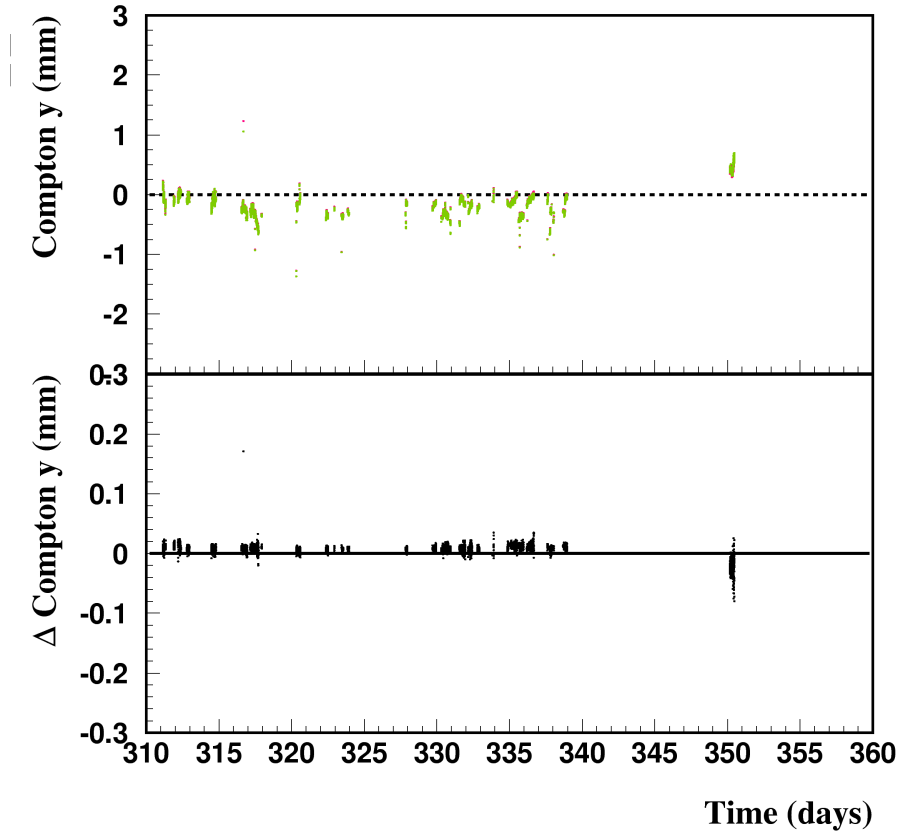
Misalignment Effects on Compton Cone X/Y

Fall 2006 data:

W/O Offline DQ bit



With Offline DQ bit

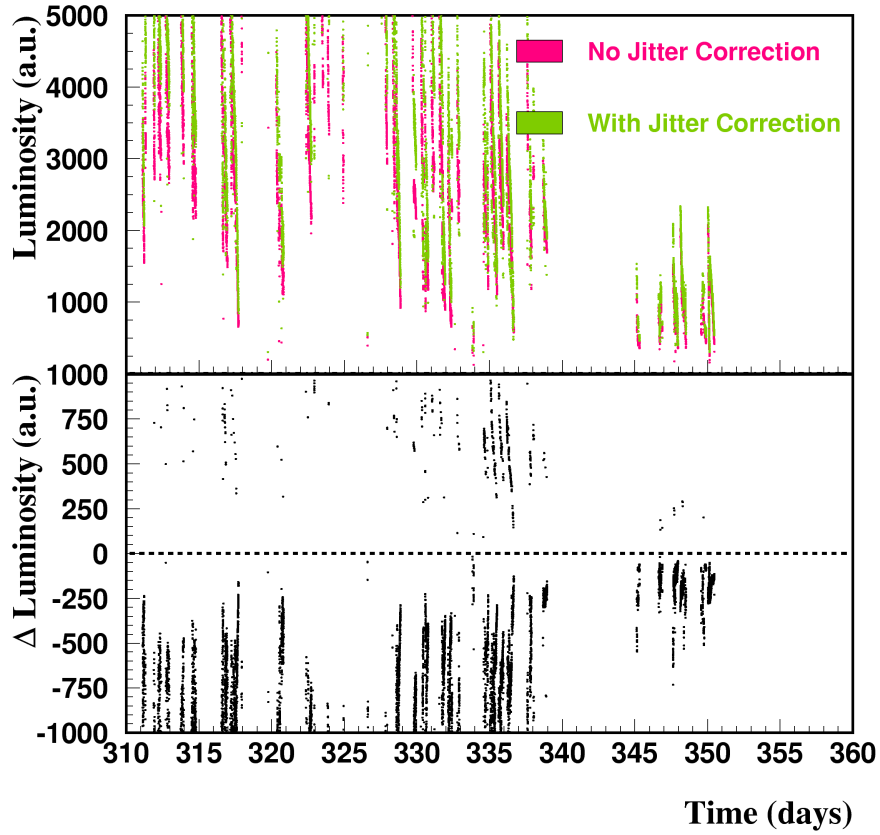


Sizable discard of data from logrun analysis (offline DQ cut)

Which feature have (part of) discarded data at end 2006?

Example of Data Discarded by Offline DQ Analysis

Fall 2006 data: **Only Online DQ bit applied**



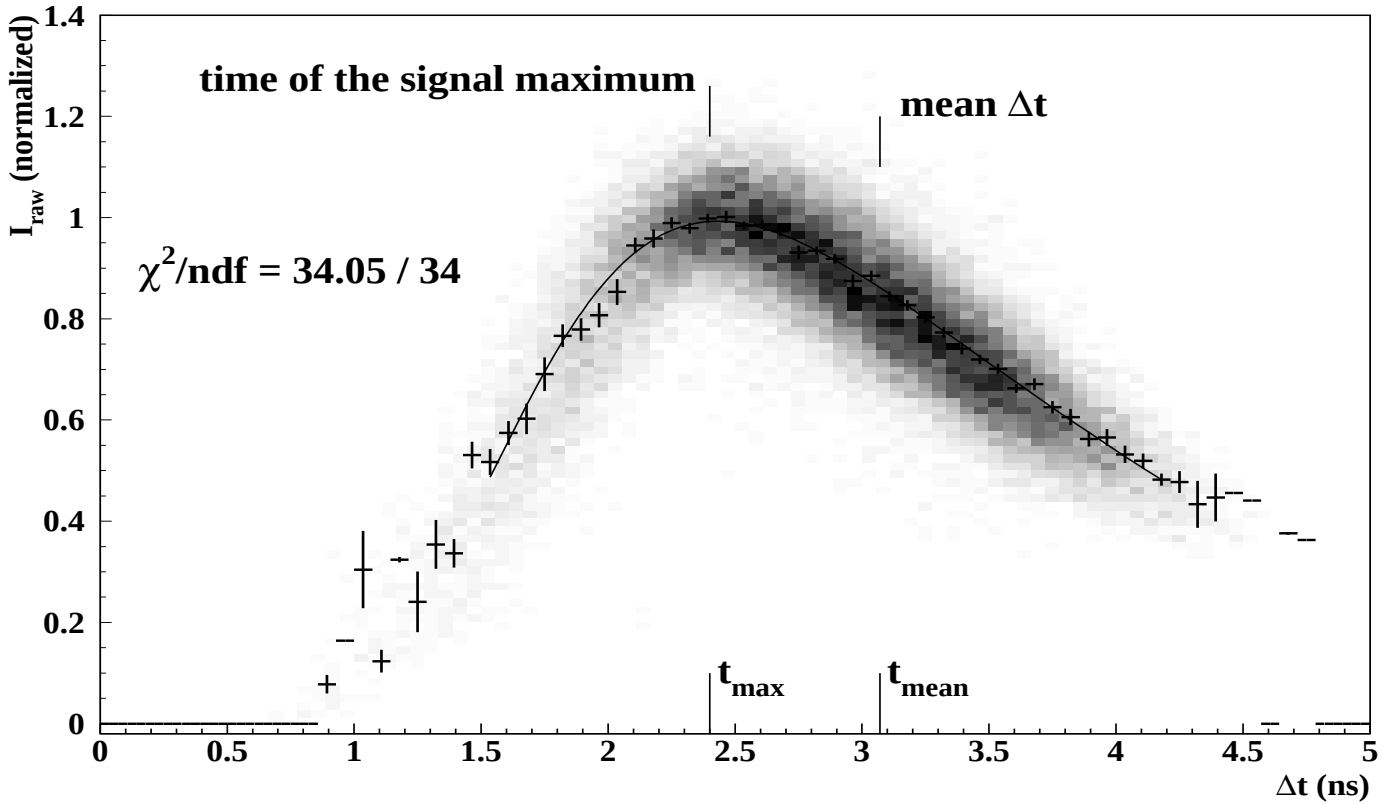
Mostly low luminosity events are involved

In this period spot on Pockels Cell window found: data discarded

The Laser Pulse Profile

- A feature of the LPOL is the non uniform pulse profile

  $\Longrightarrow$ due to ± 1.5 trigger jitter)



- Correction (normalization to max) needed
- Investigation of goodness of fit performed

Laser Pulse Profile Determination

- **Profile function used to correct ADC is**

$$l(\Delta t) = N \cdot exp\Big(- \frac{\tau^2}{\Big[x_5 + \sigma\Big(1 + atan(2\tau \cdot x_4)/\pi\Big)\Big]^2}\Big)$$

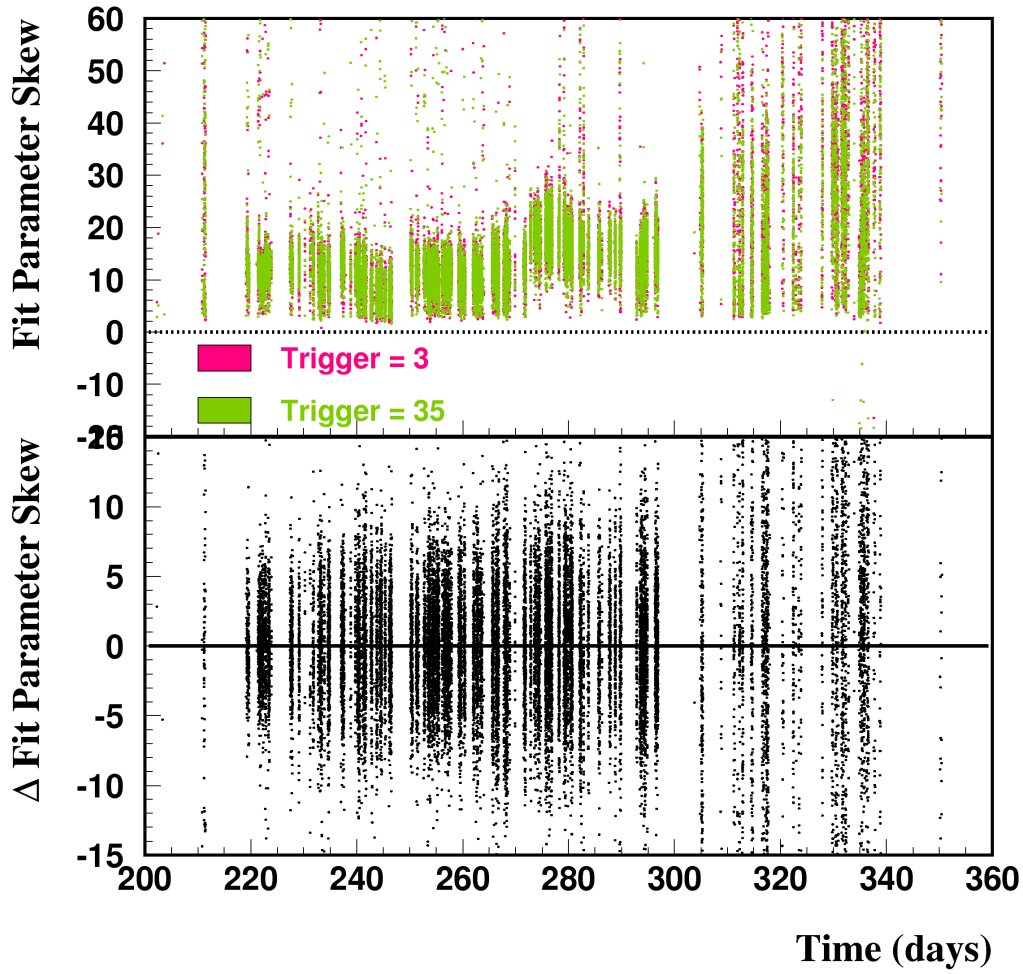
  - $\tau = \Delta t / t_{max} - 1$
  - x_4 **= Skewness,** x_5 **= LWidth,** σ **= Width**
  - N**,** σ**,** τ**,** x_4 **&** x_5 **extracted from fit**

- **Correction-factor per** Δt **bin =** $1/l(\Delta t)$

- **We are here interested to see effects of Skewness, Width, LWidth for both laser helicity states on Lpol/Tpol ratio**

Fit Parameter Skewness

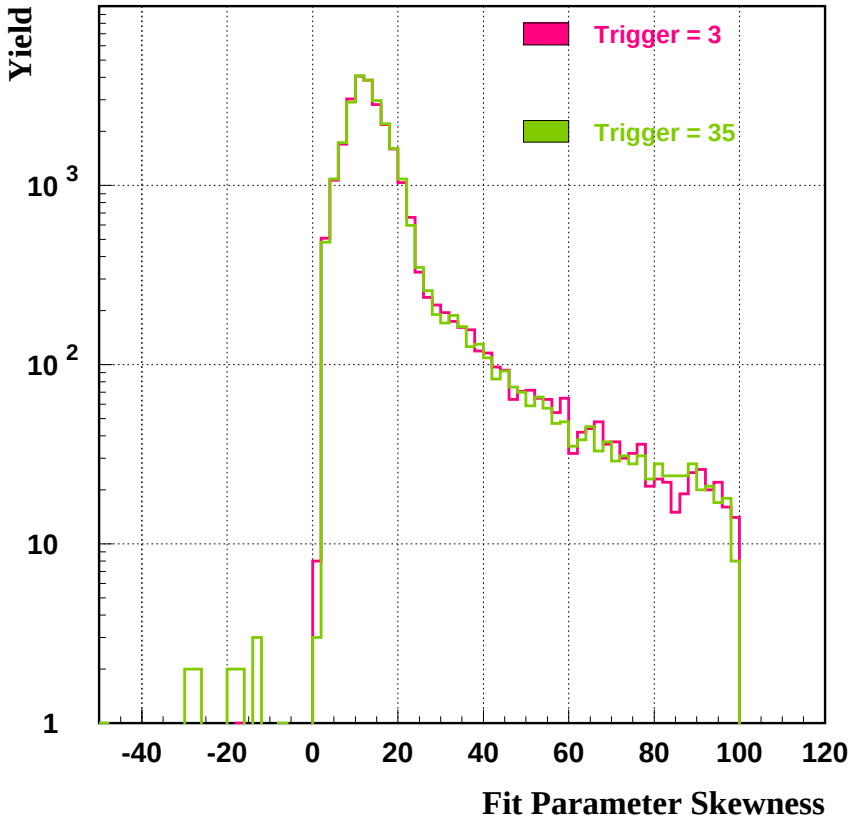
- Values extracted during entire 2006 (offline DQ cut applied)

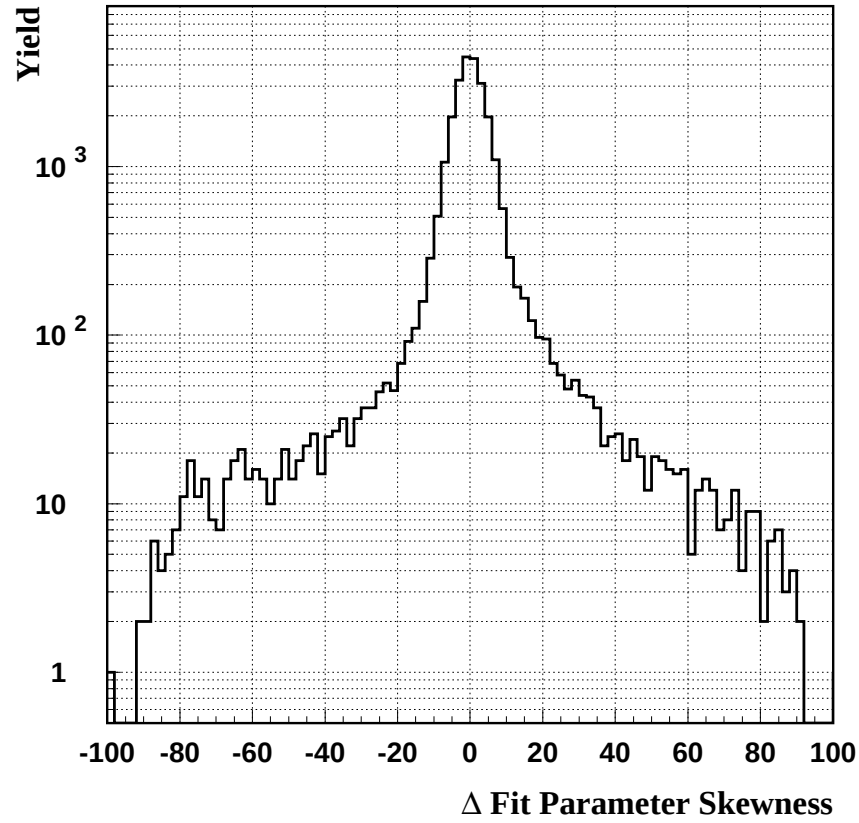


Note fluctuations at the end of 2006

Fit Parameter Skewness

- Distribution of values for both trigger states and of their difference



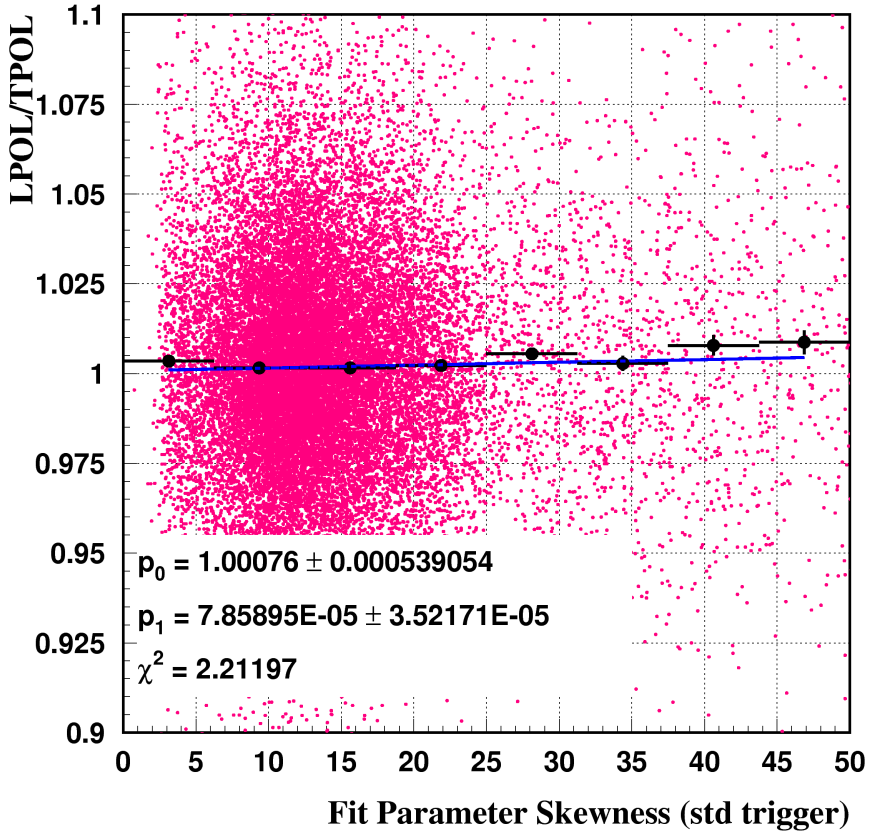


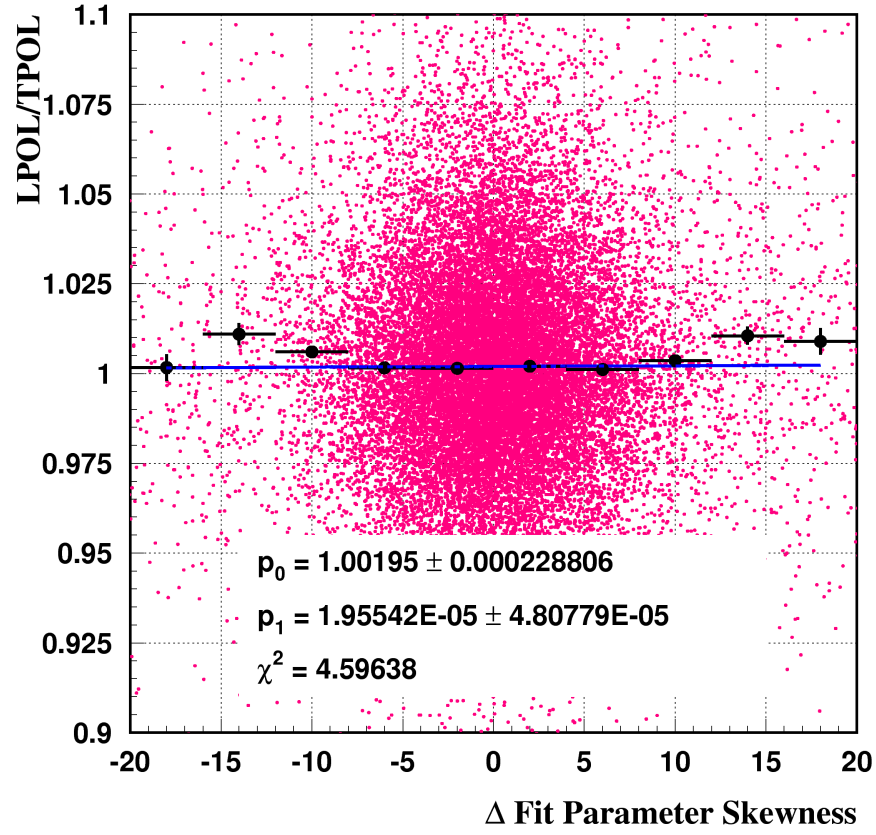
Which is effect from tails?

Fit Parameter Skewness

- **Correlation with Lpol/Tpol ratio**

All 2006 data: **Offline DQ bit applied**



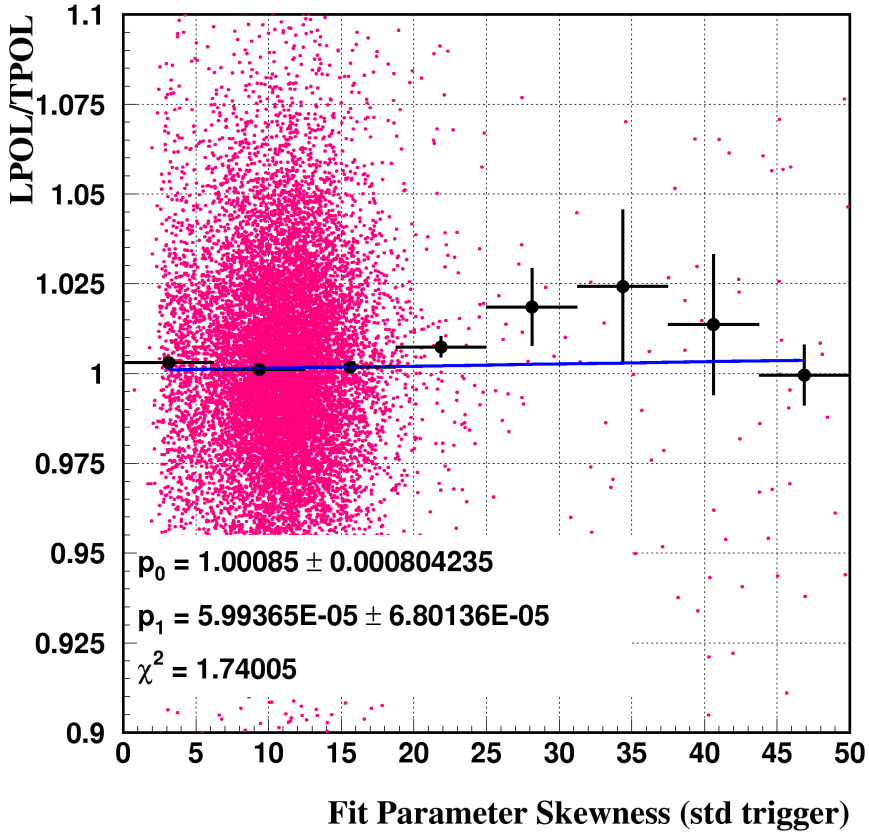


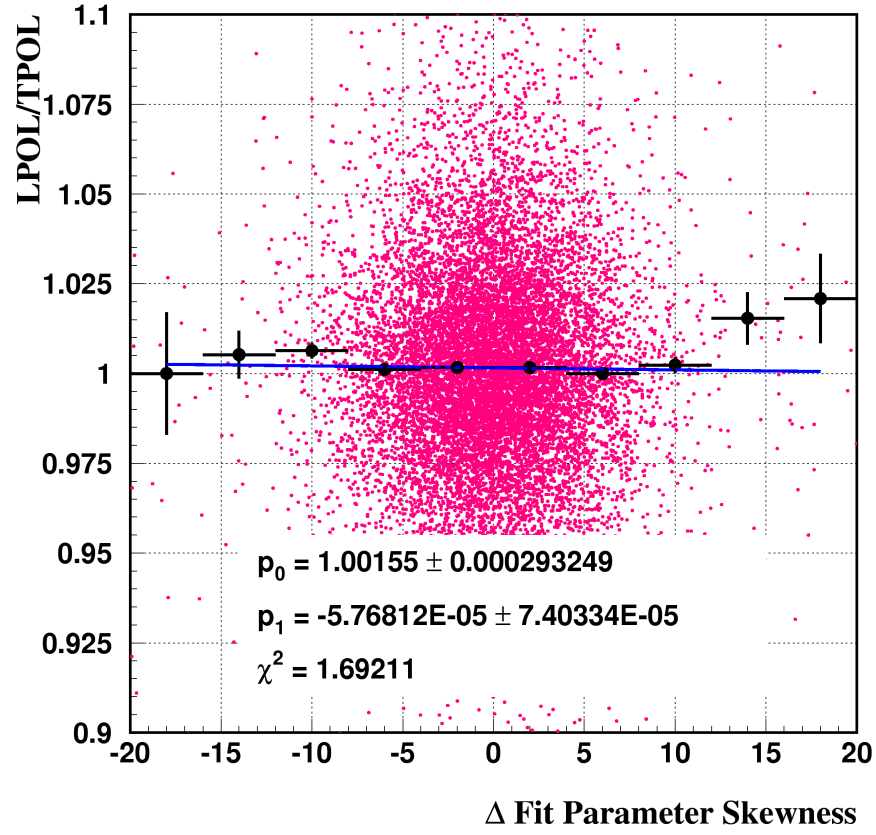
No specific dependence observed

Fit Parameter Skewness

- **Correlation with Lpol/Tpol ratio**

Summer 2006 data: **Offline DQ bit applied**



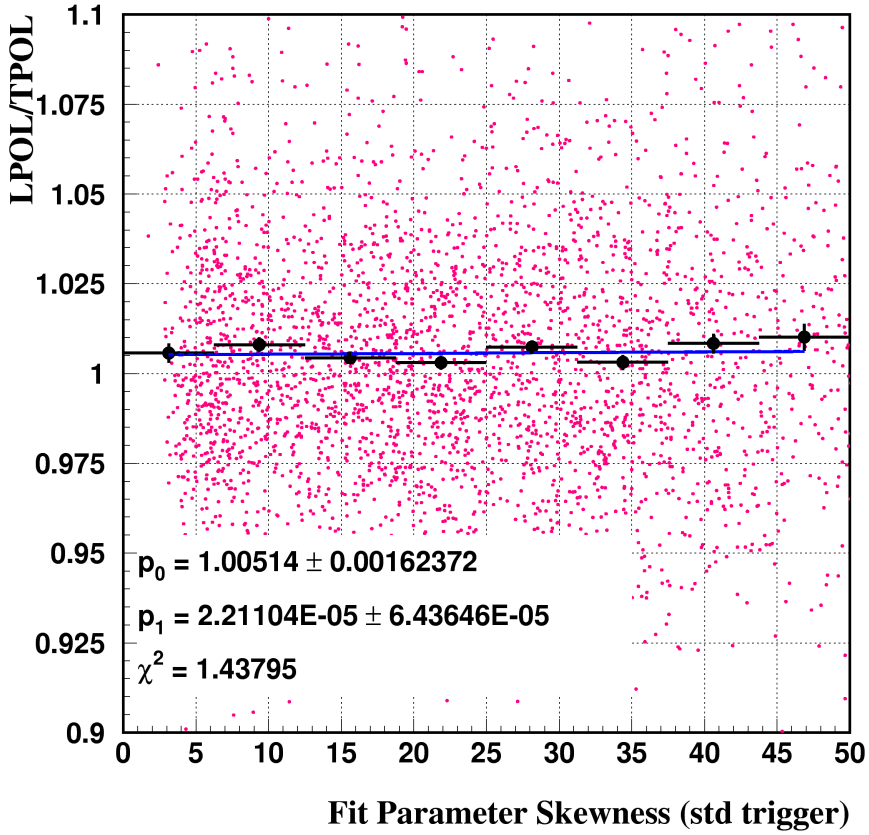


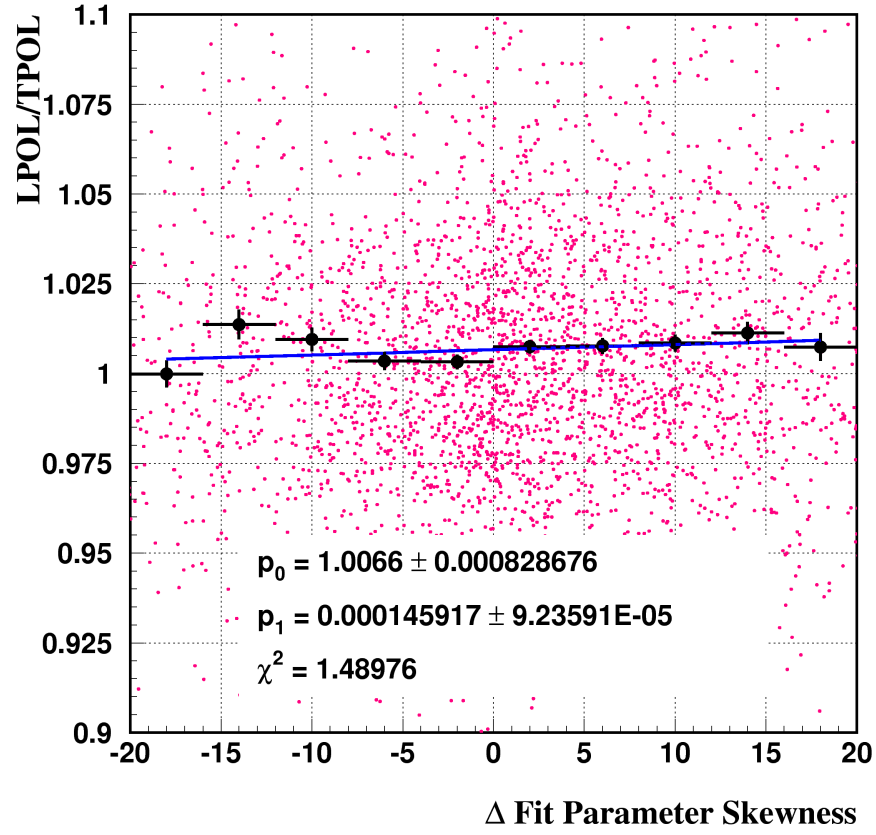
No specific dependence observed

Fit Parameter Skewness

- **Correlation with Lpol/Tpol ratio**

Fall 2006 data: **Offline DQ bit applied**



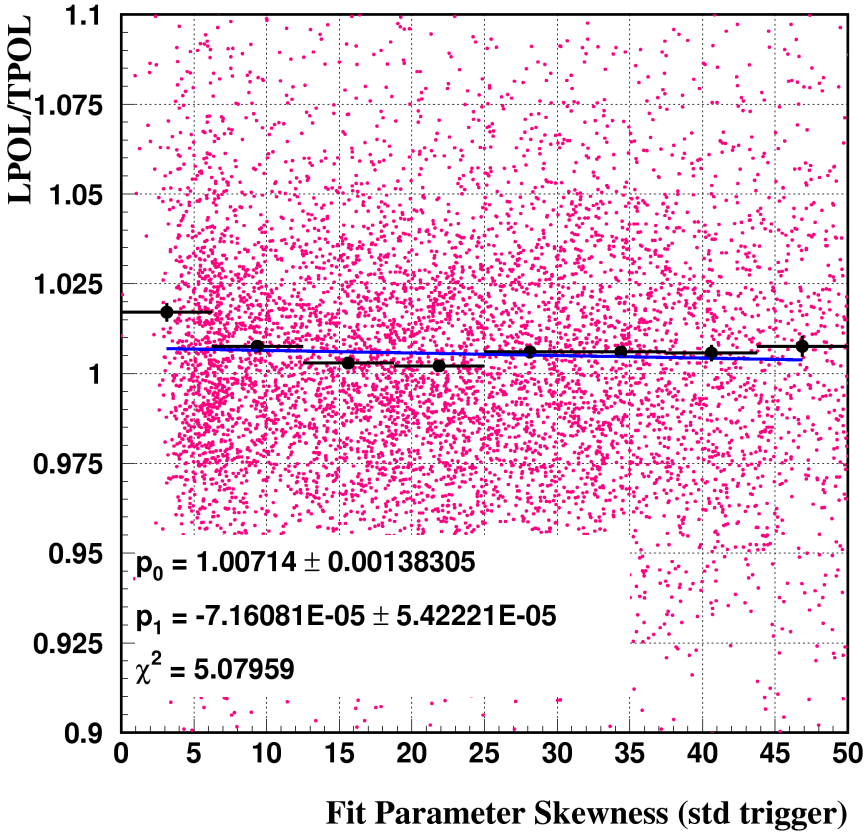


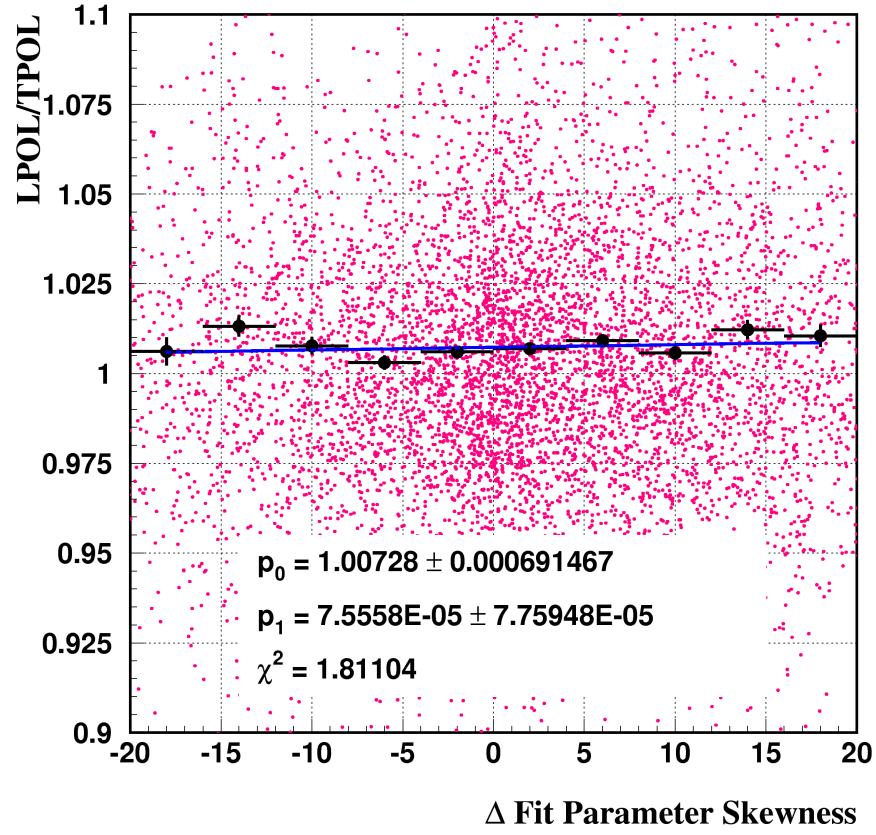
No specific dependence observed

Fit Parameter Skewness

✥ Correlation with Lpol/Tpol ratio

Fall 2006 data: **Offline DQ bit NOT applied**



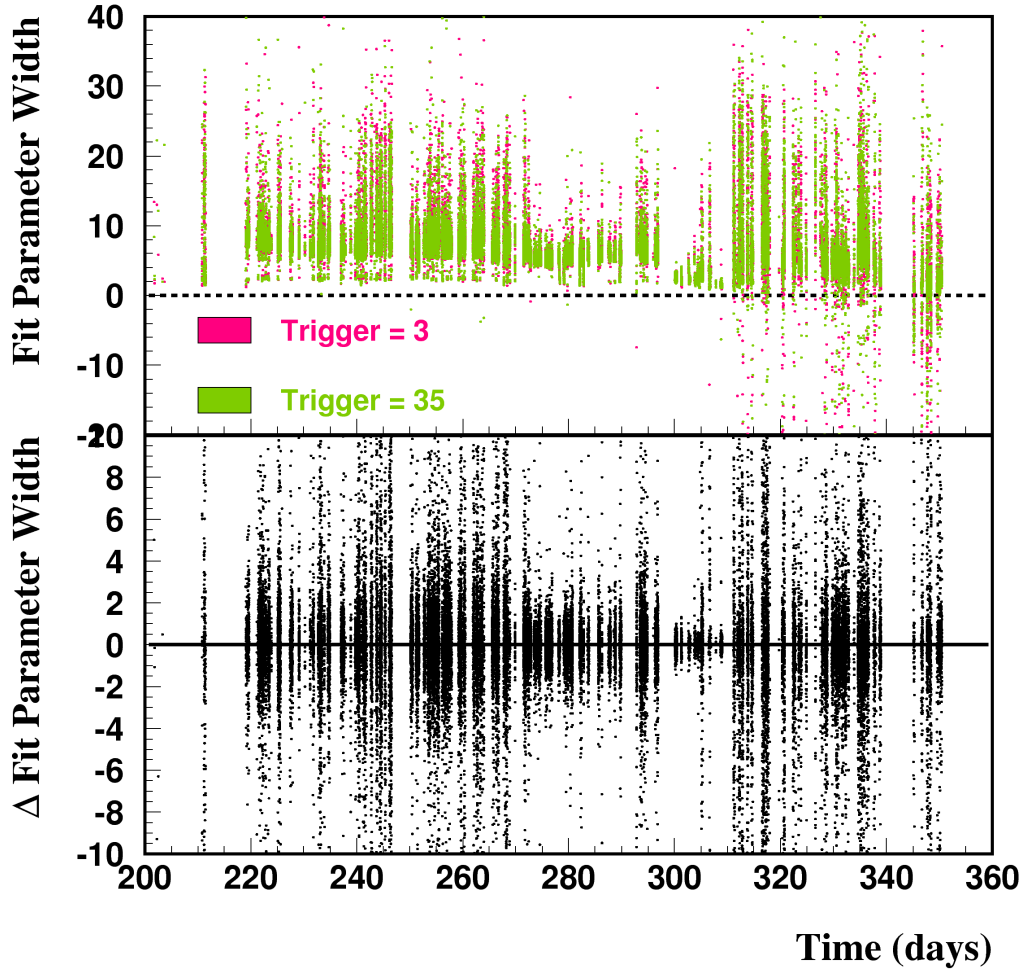


No specific dependence observed

$\Longrightarrow$ **Hdw problems did not affect determination of skewness**

Fit Parameter Width

- Values extracted during entire 2006 (only online DQ cut applied)

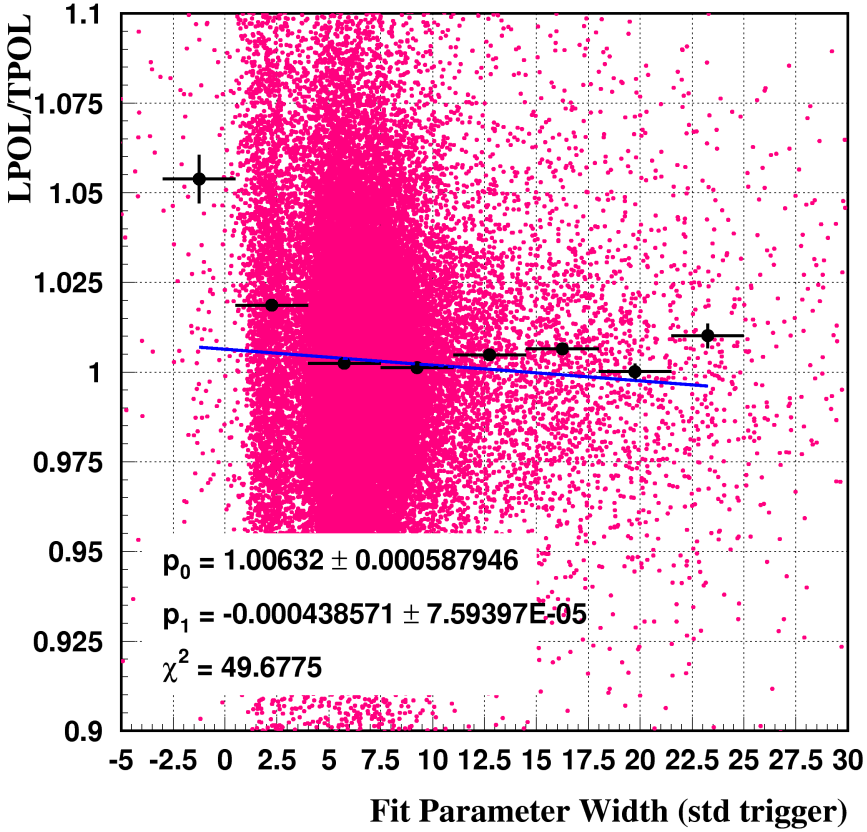


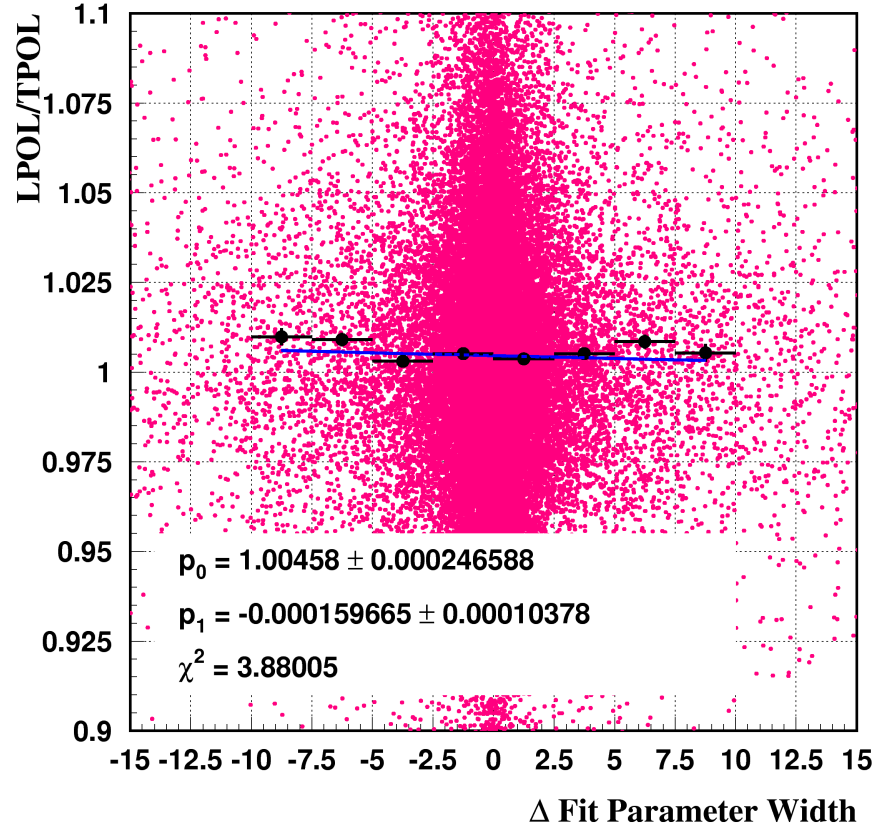
Note decrease of values at the end of 2006

Fit Parameter Width

- **Correlation with Lpol/Tpol ratio**

All 2006 data: **Offline DQ bit NOT applied**



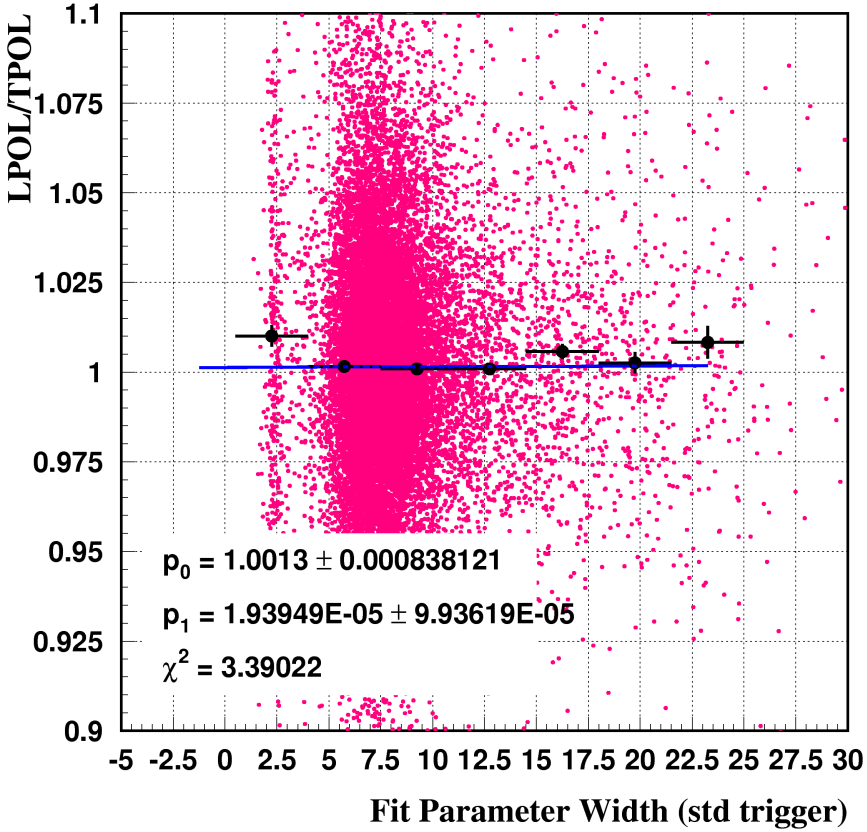


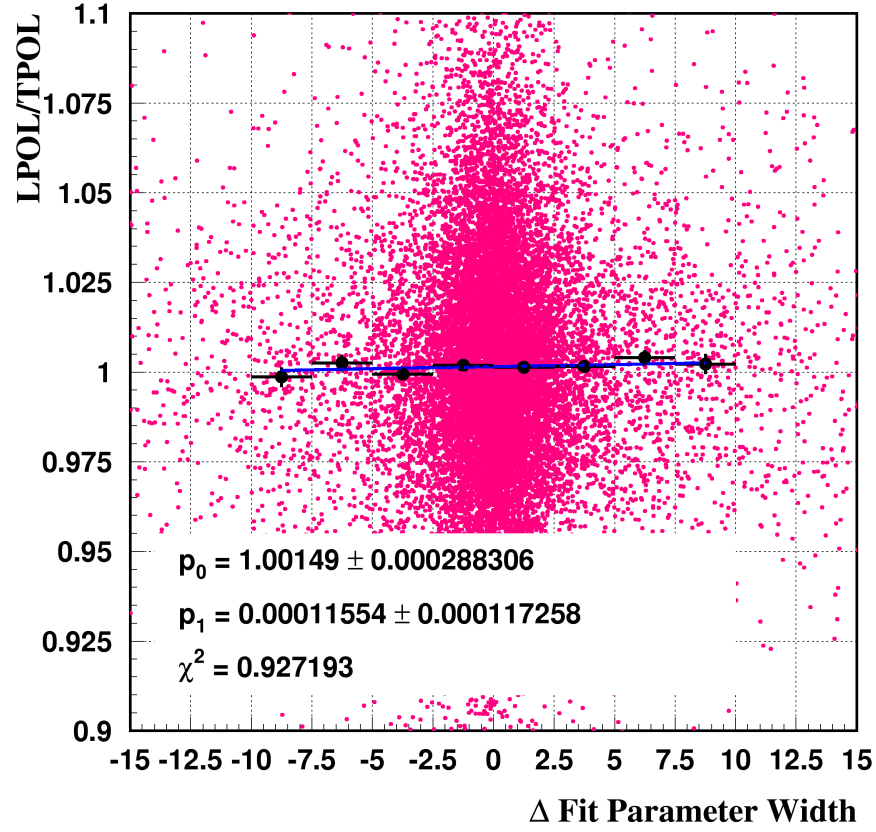
A possible dependence? Compare summer and fall data

Fit Parameter Width

- **Correlation with Lpol/Tpol ratio**

Summer 2006 data: **Offline DQ bit NOT applied**



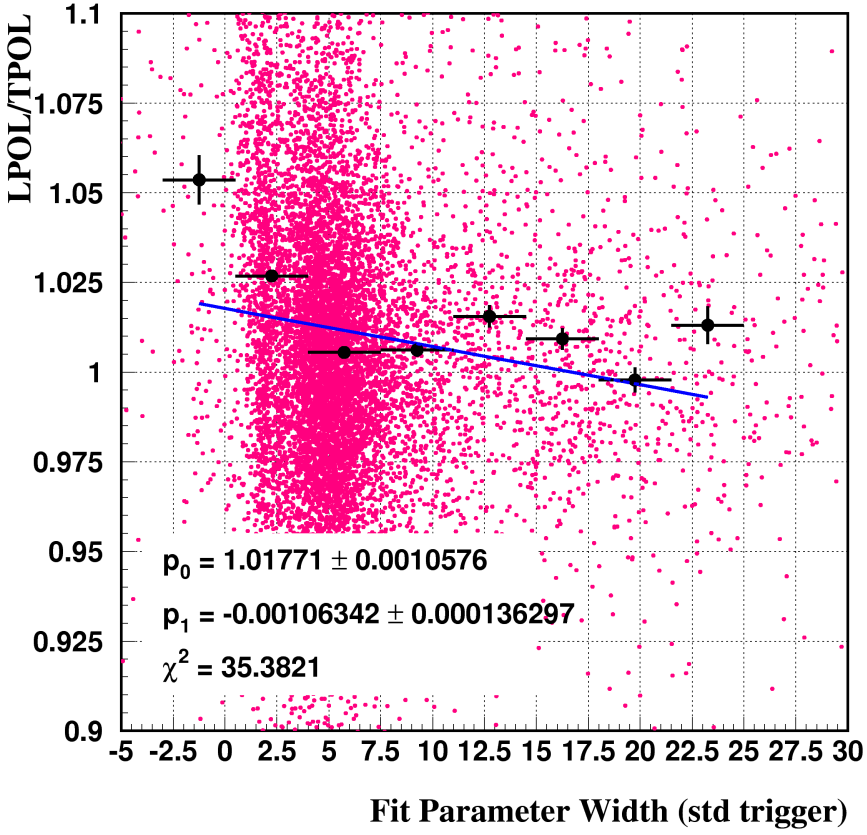


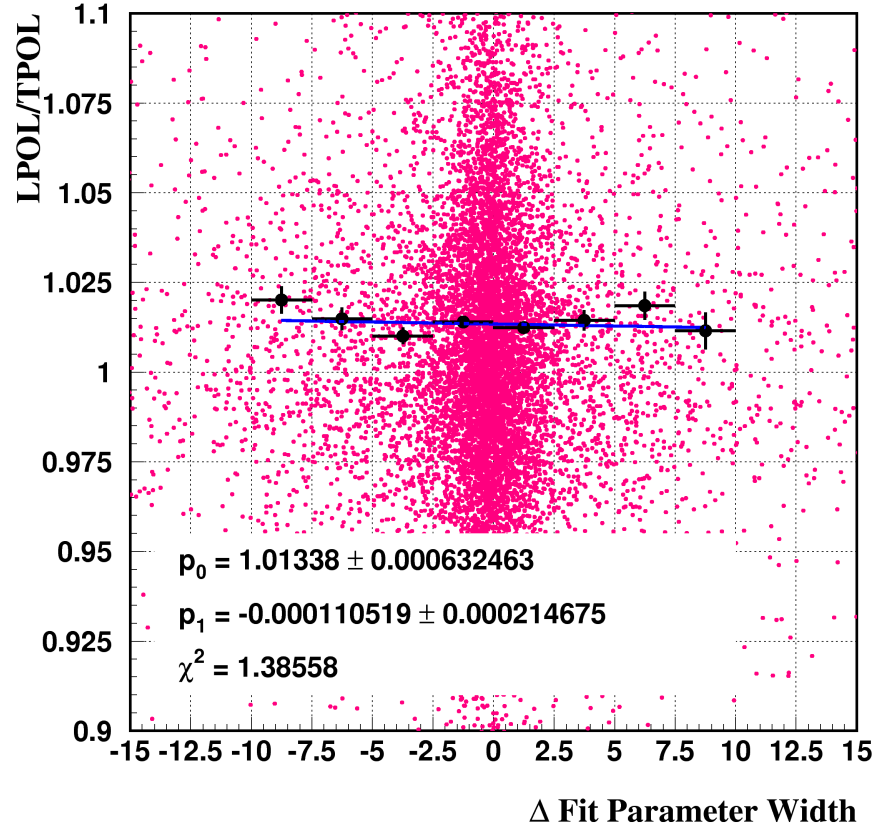
No specific dependence observed (similarely for Autumn)

Fit Parameter Width

- **Correlation with Lpol/Tpol ratio**

Fall 2006 data: **Offline DQ bit NOT applied**



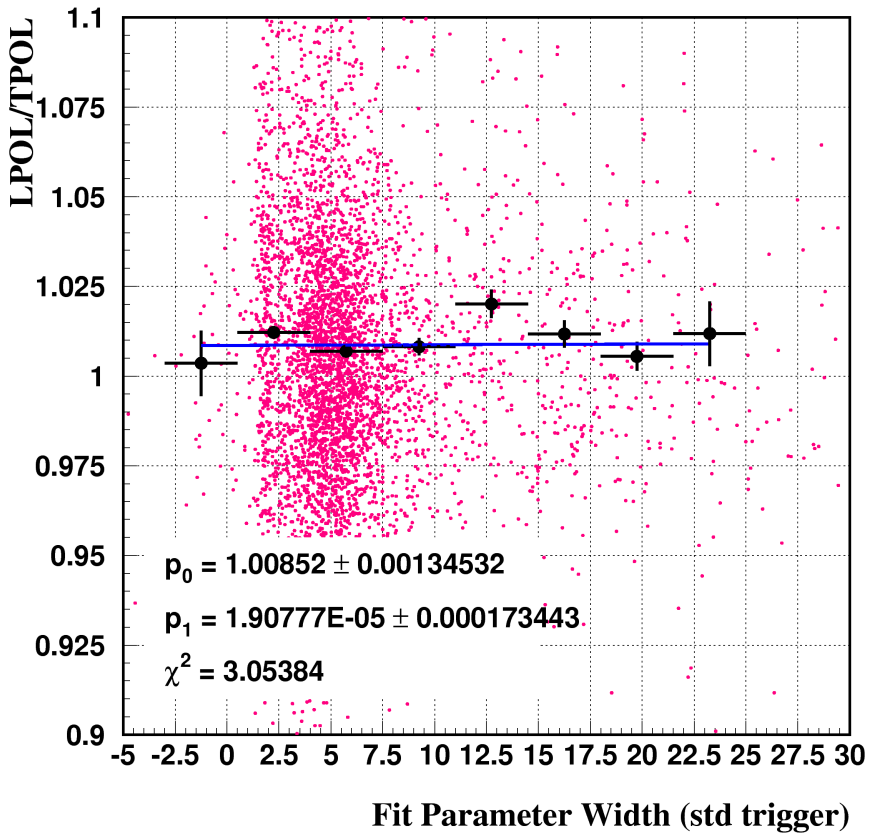


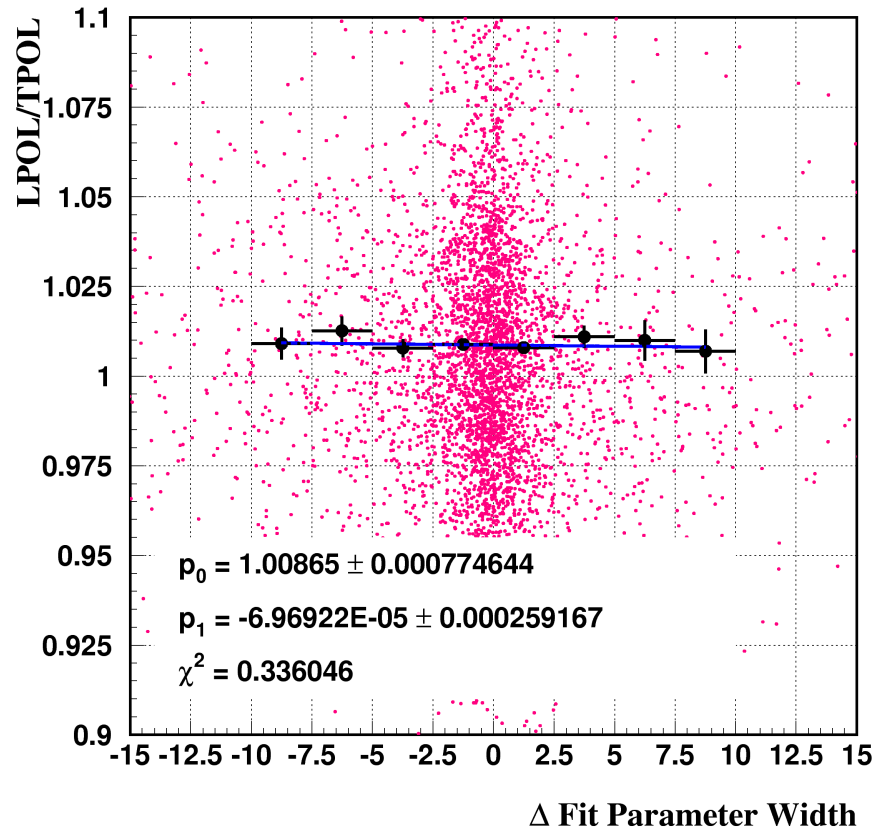
Dependence observed (w/o offline DQ bit)

Fit Parameter Width

- **Correlation with Lpol/Tpol ratio**

Fall 2006 data: **Offline DQ bit applied**



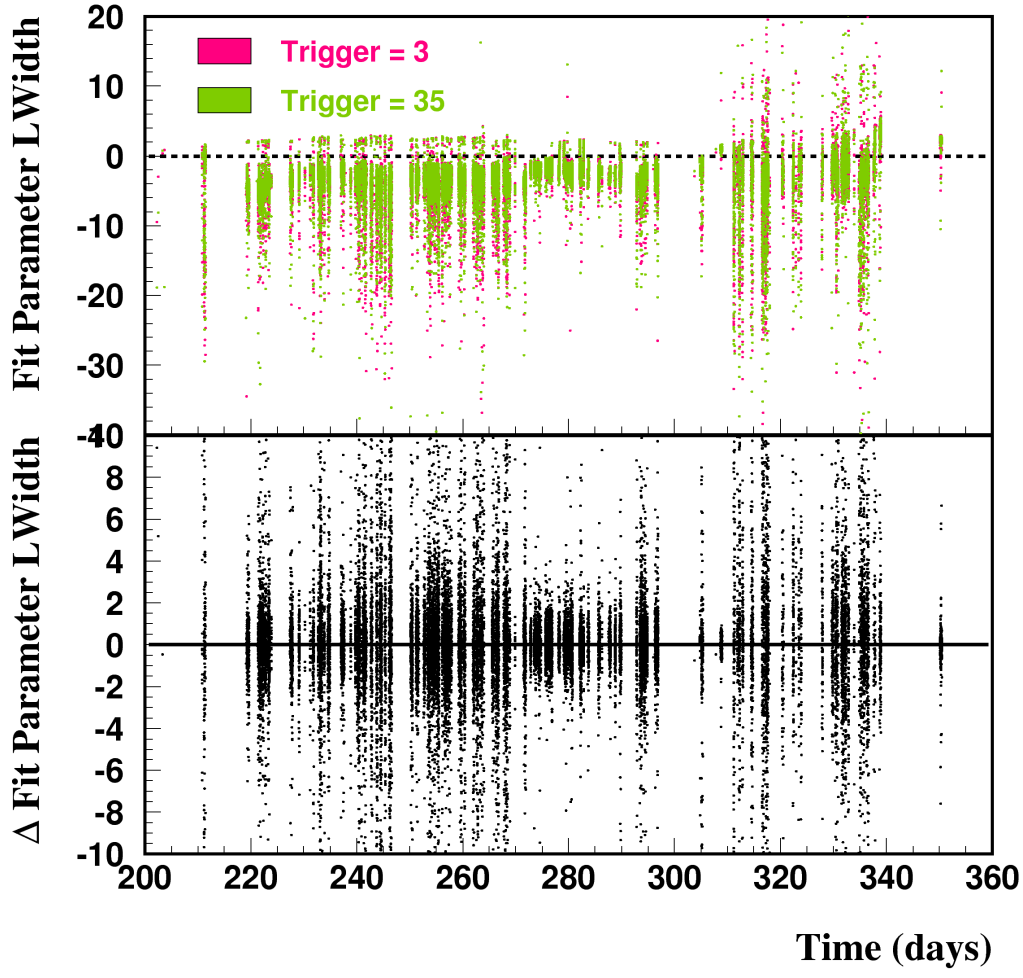


No specific dependence observed

$\Longrightarrow$ **Problems taken care by applying offline DQ bit**

Fit Parameter LWidth

- Values extracted during entire 2006 (only online DQ cut applied)

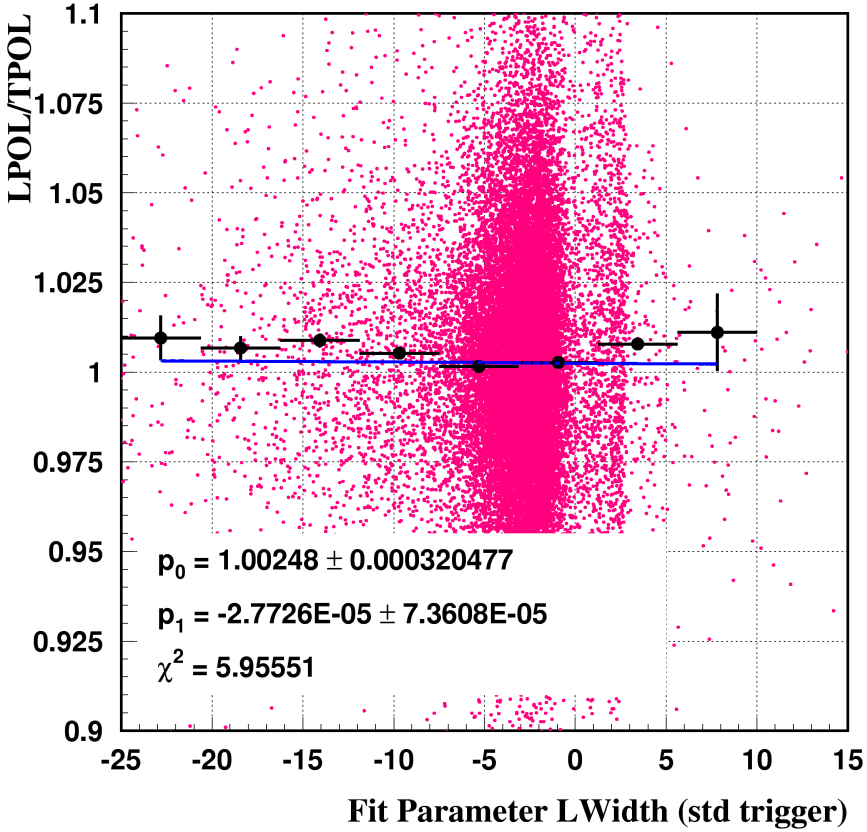


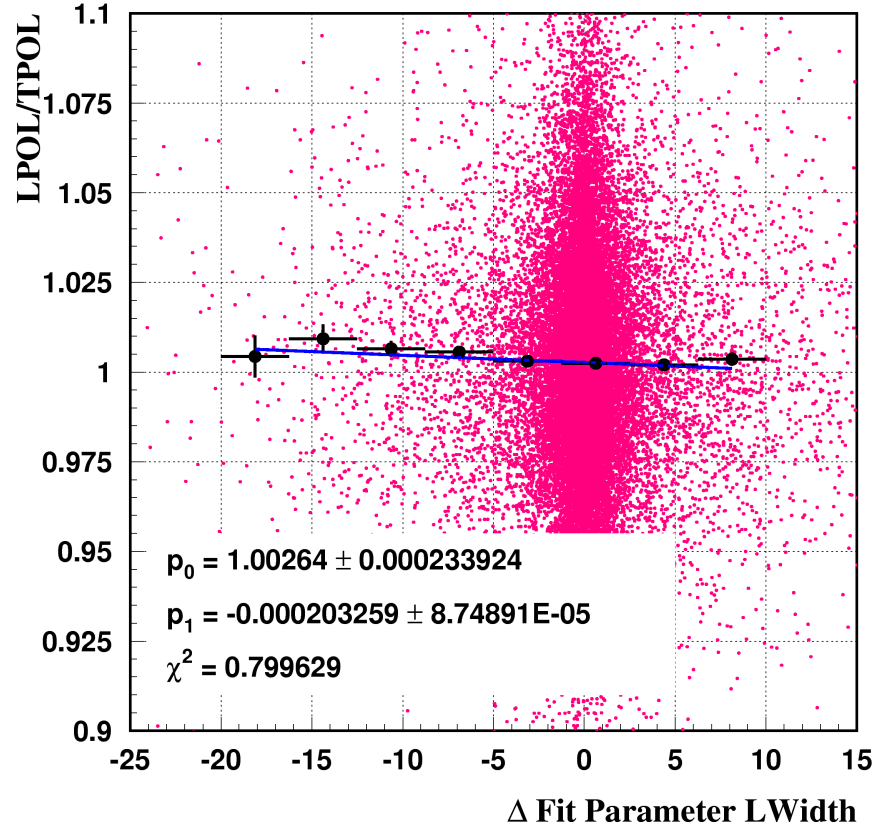
Note escursion to positive values at the end of 2006

Fit Parameter LWidth

- **Correlation with Lpol/Tpol ratio**

All 2006 data: **Offline DQ bit applied**



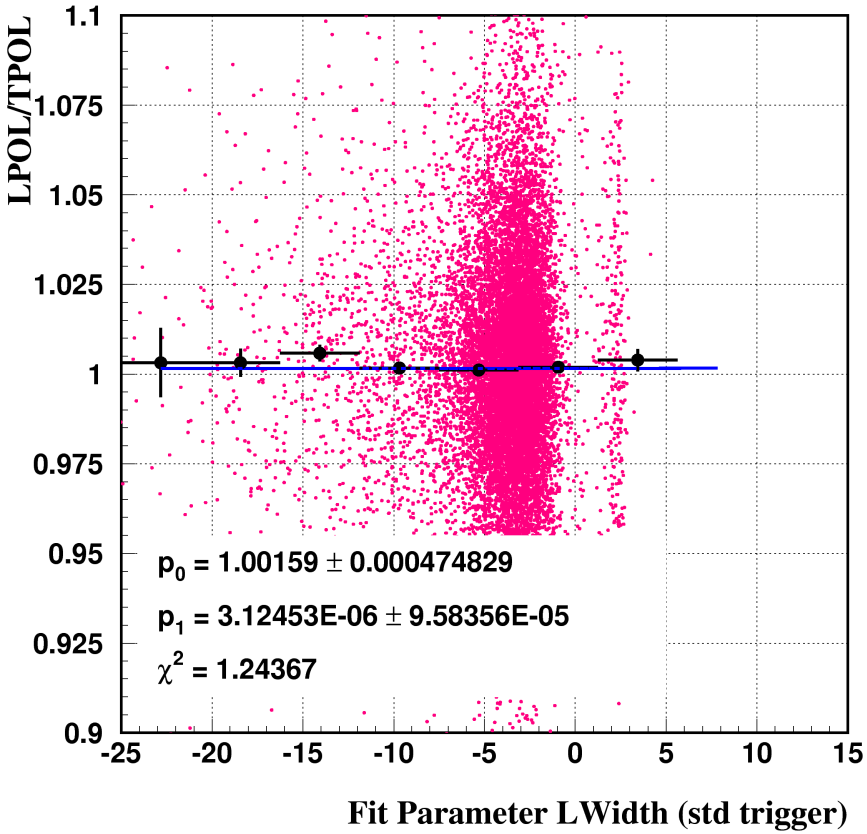


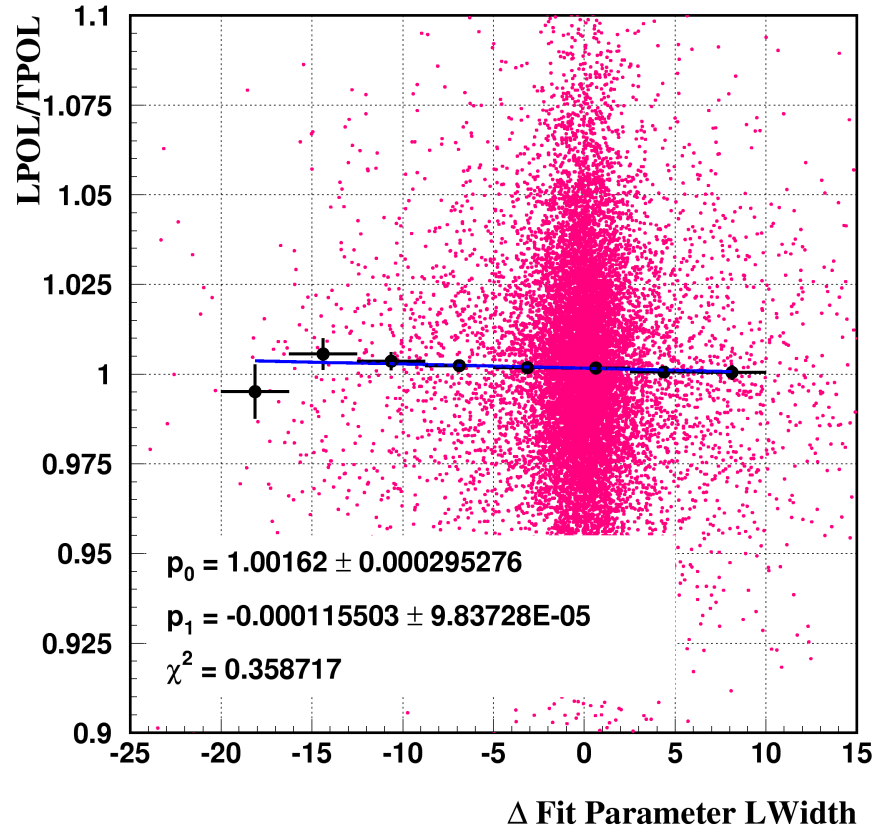
No specific dependence observed

Fit Parameter LWidth

- **Correlation with Lpol/Tpol ratio**

Summer 2006 data: **Offline DQ bit applied**



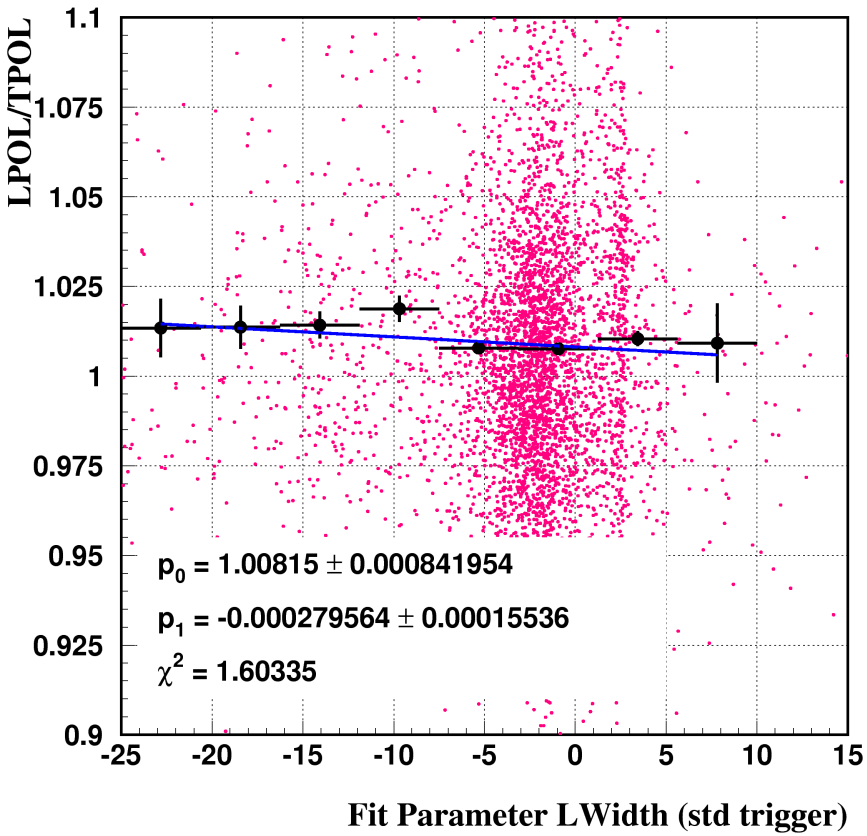


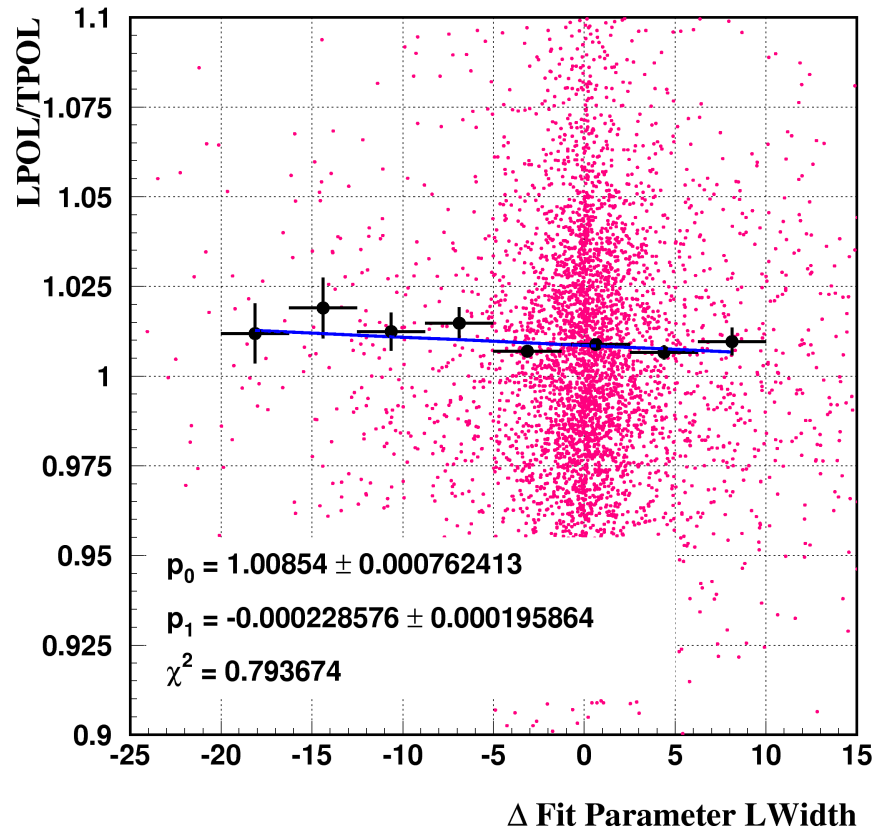
No specific dependence observed (similarely for Autumn)

Fit Parameter LWidth

- **Correlation with Lpol/Tpol ratio**

Fall 2006 data: **Offline DQ bit applied**





No specific dependence observed

$\Longrightarrow$ **Problems taken care by applying offline DQ bit**

Conclusions & Outlook

- Analysis with reprocessed LPOL data presented
- 2006 data analysed
  - possible false asymmetries induced by misalignment of laser pulses in opposite helicity states
  - Lpol/Tpol ratio investigayed wrt variables related to laser pulse profile
- No significant dependence after including offline DQ analysis
- Fit precision and misalignment appear to be not the source of observed sizable Lpol/Tpol mismatch
- Now many more variables are available and waiting for the analysis