

# Constant Instantaneous Luminosity Over Time

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# Idea

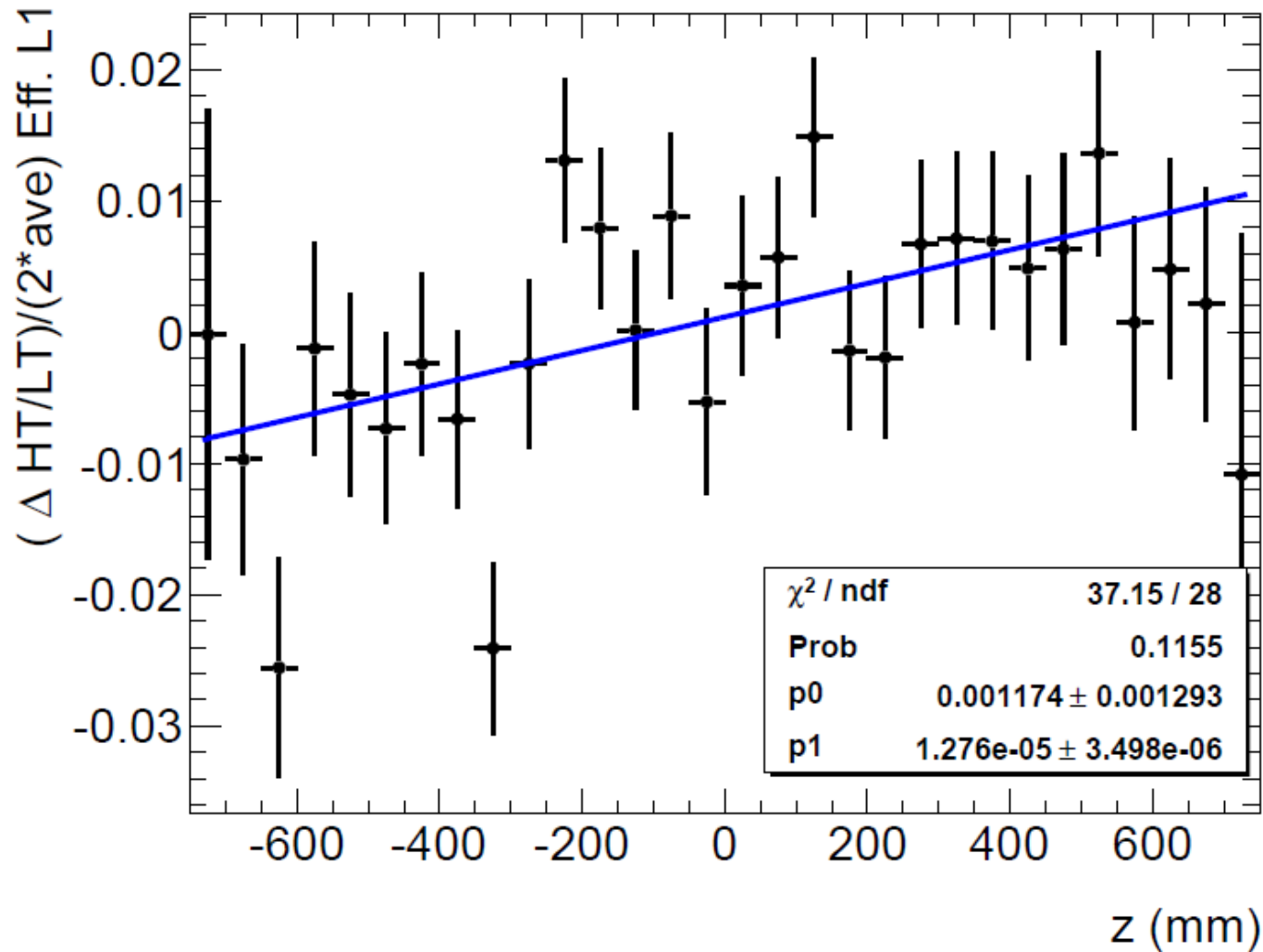
- Ozone production should be related to the instantaneous luminosity.
- There are two ways to test this:
  - Compare high/low instantaneous luminosity within a single data period to see if the measured effect is greater for high instantaneous luminosity.
  - Look at the same instantaneous luminosity for multiple data periods and see if the effect worsens over time.

# Method

- In this study we will look at a constant instantaneous luminosity for multiple data periods.
- We will approximate instantaneous luminosity with  $\langle\mu\rangle$  and look at the range  $14 \leq \langle\mu\rangle \leq 16$ .
- If the effect worsens over time, then there is an aging effect building up. If it remains constant, the effect could be due to ozone production and not aging.

# **PERIOD M 2011 DATA**

# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 1 Long

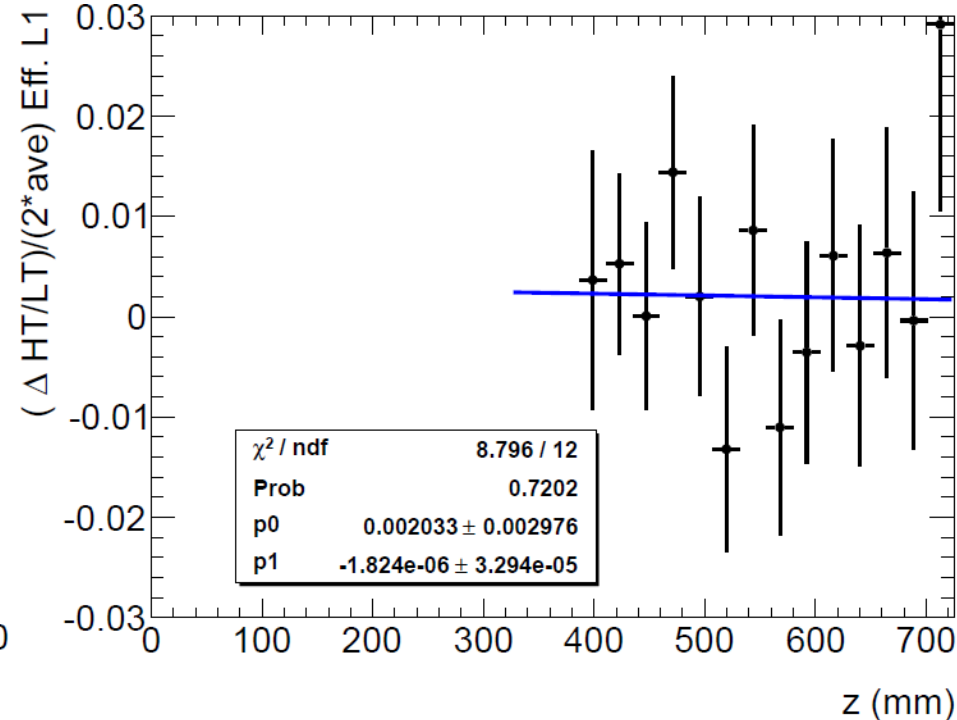
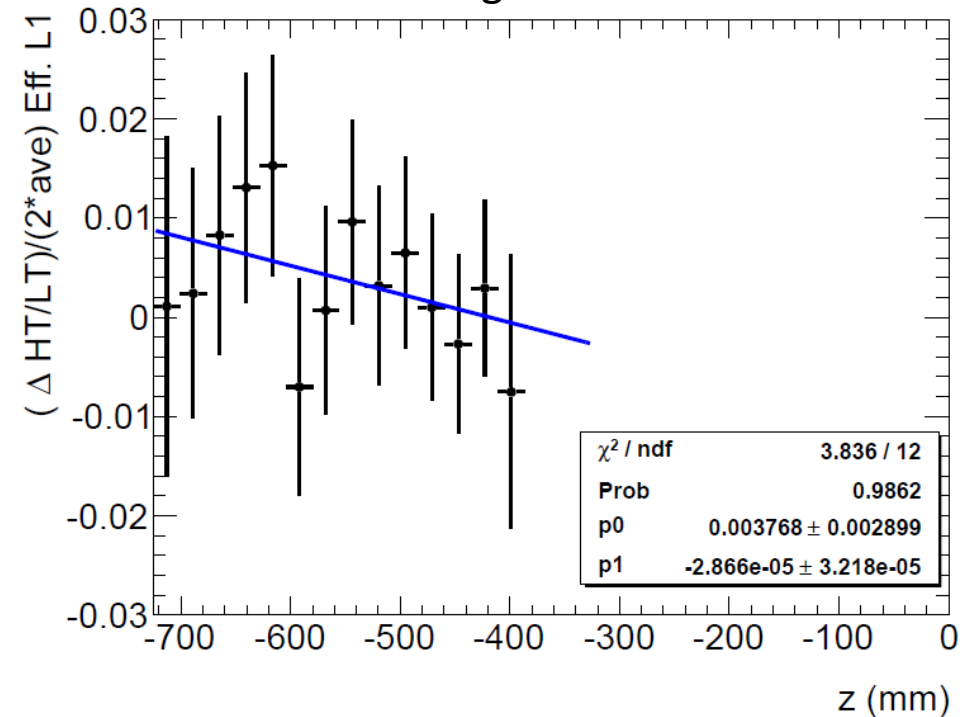


Slope:  $1.276 * 10^{-5}$   
 $\pm .3498 * 10^{-5}$

# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 1 Short

Negative

Positive

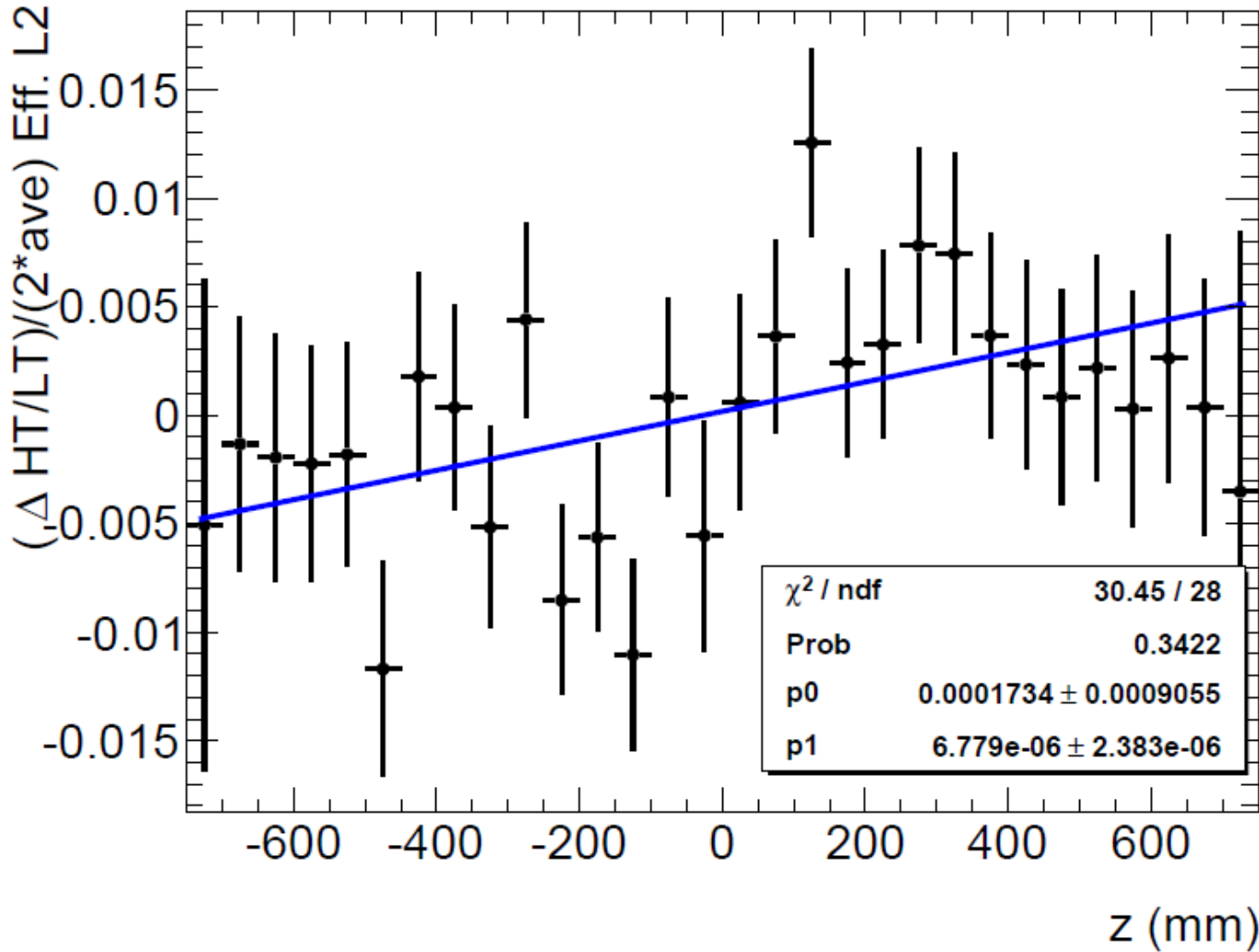


Neg. Slope :  $-2.866 * 10^{-5} \pm 3.218 * 10^{-5}$

Pos. Slope :  $-.1824 * 10^{-5} \pm 3.294 * 10^{-5}$

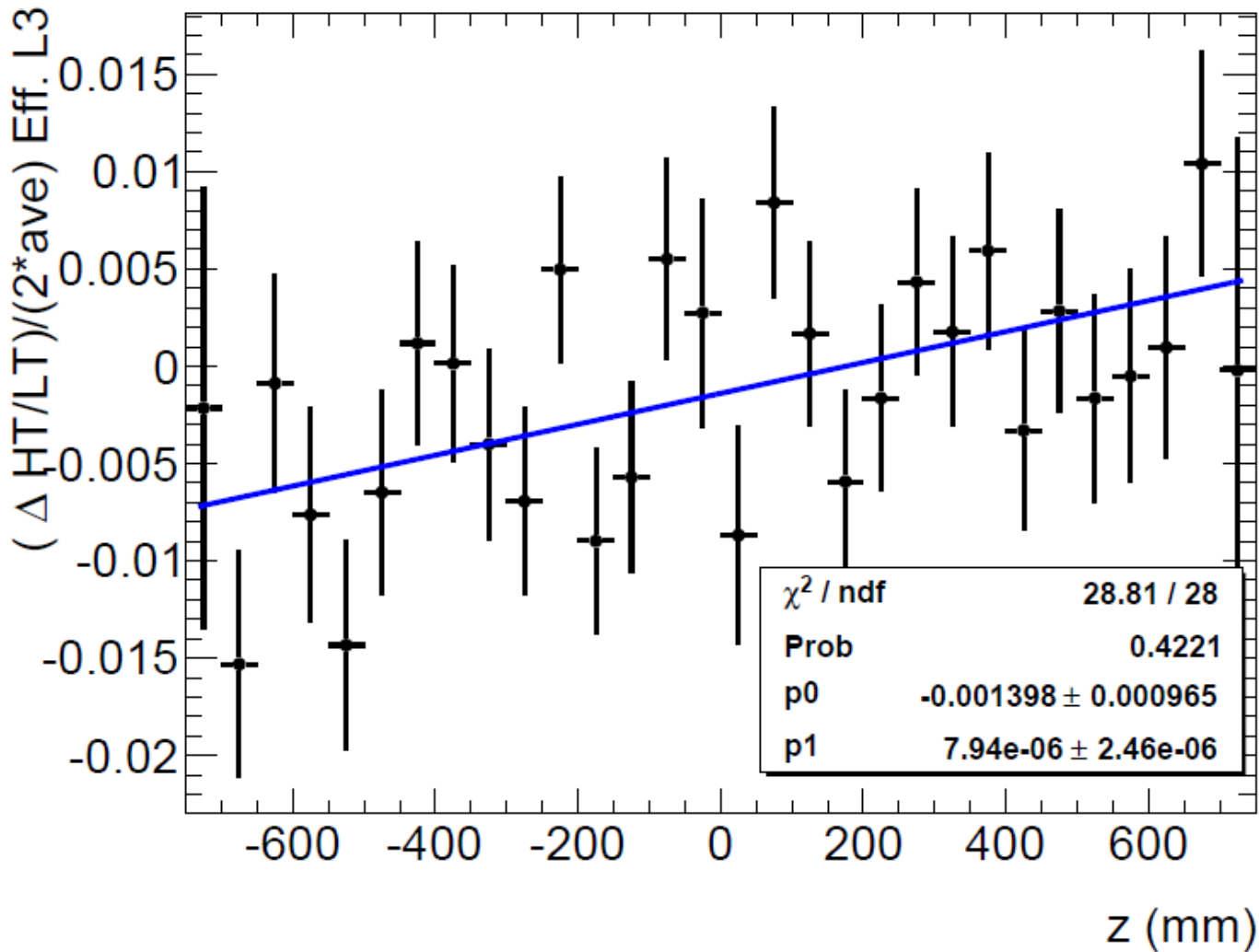
Long Straw Slope:  $1.276 * 10^{-5} \pm .3498 * 10^{-5}$

# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 2



Slope:  $.6779 * 10^{-5}$   
 $\pm .2383 * 10^{-5}$

# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 3

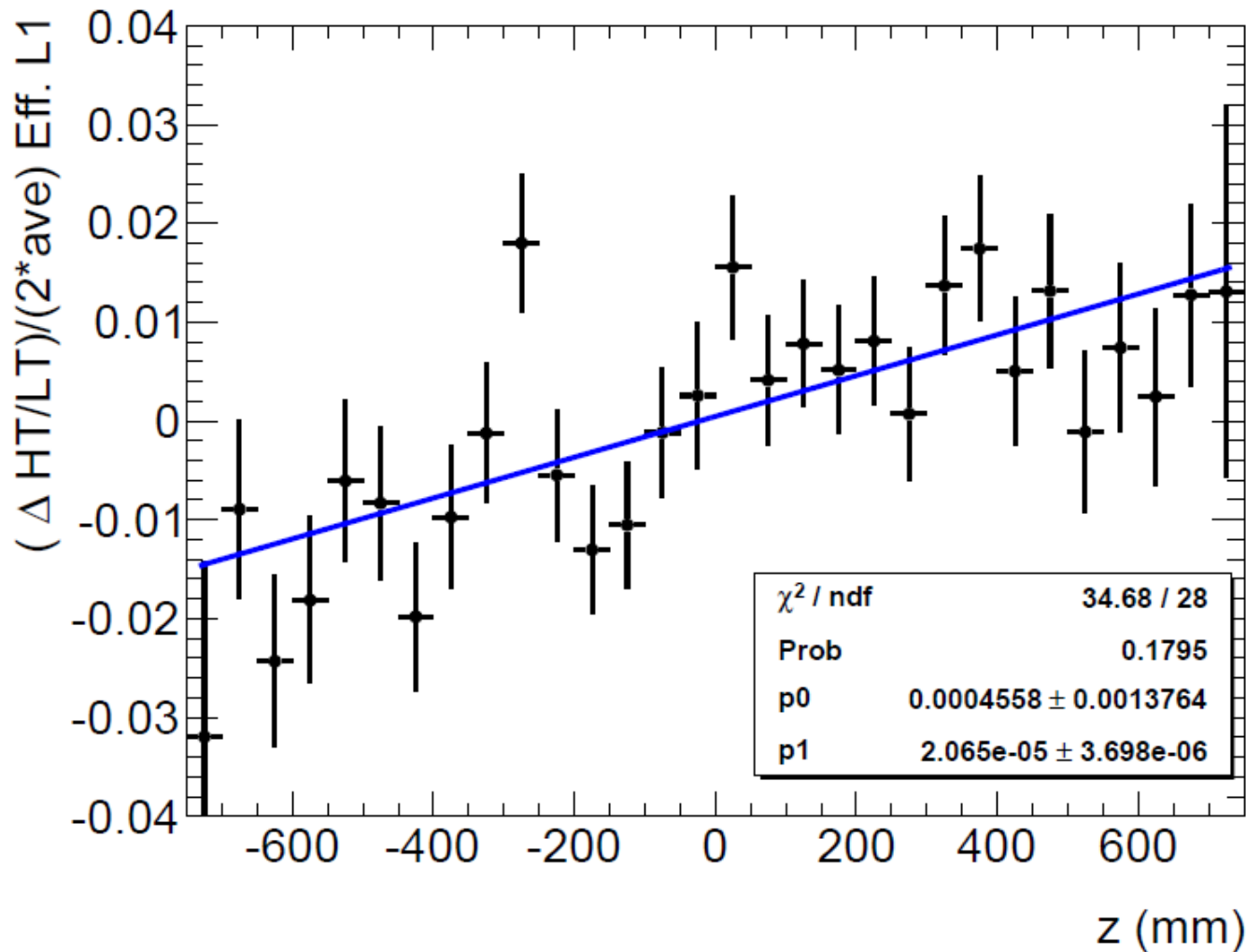


Slope:  $.794 * 10^{-5}$   
 $\pm .246 * 10^{-5}$



# **PERIOD A 2012 DATA**

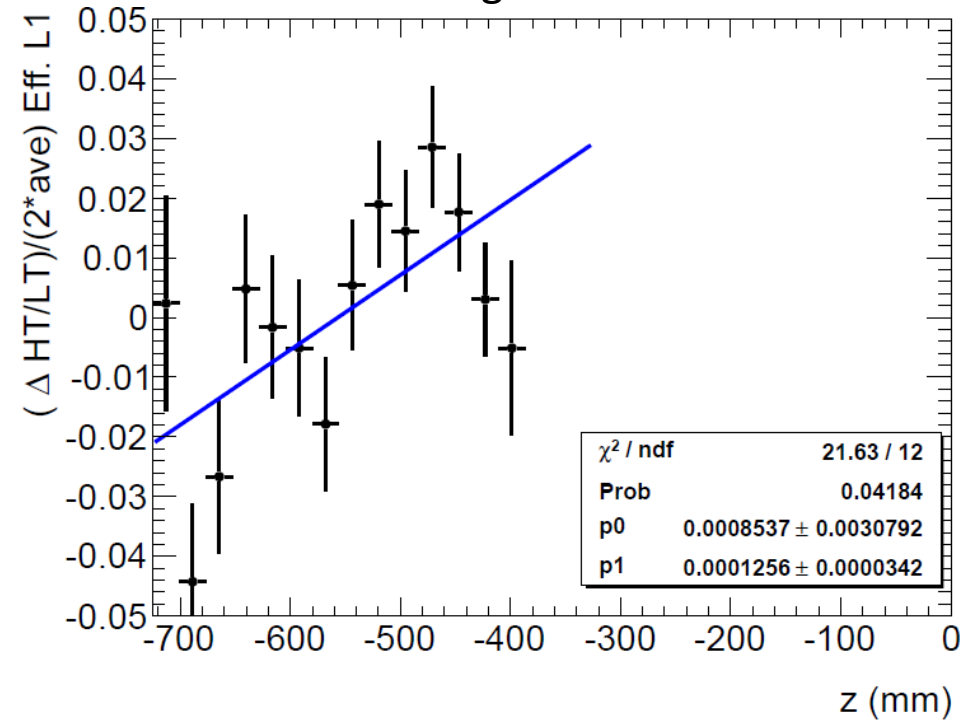
# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 1 Long



Slope:  $2.065 * 10^{-5}$   
 $\pm .3698 * 10^{-5}$

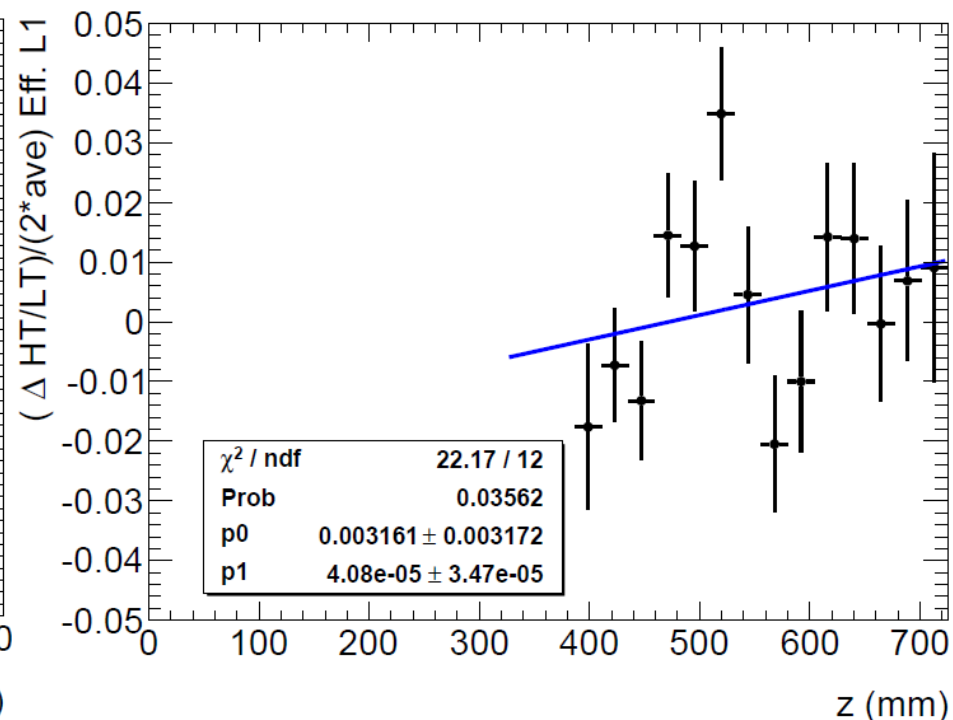
# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 1 Short

Negative



Neg. Slope :  $12.56 * 10^{-5} \pm 3.42 * 10^{-5}$

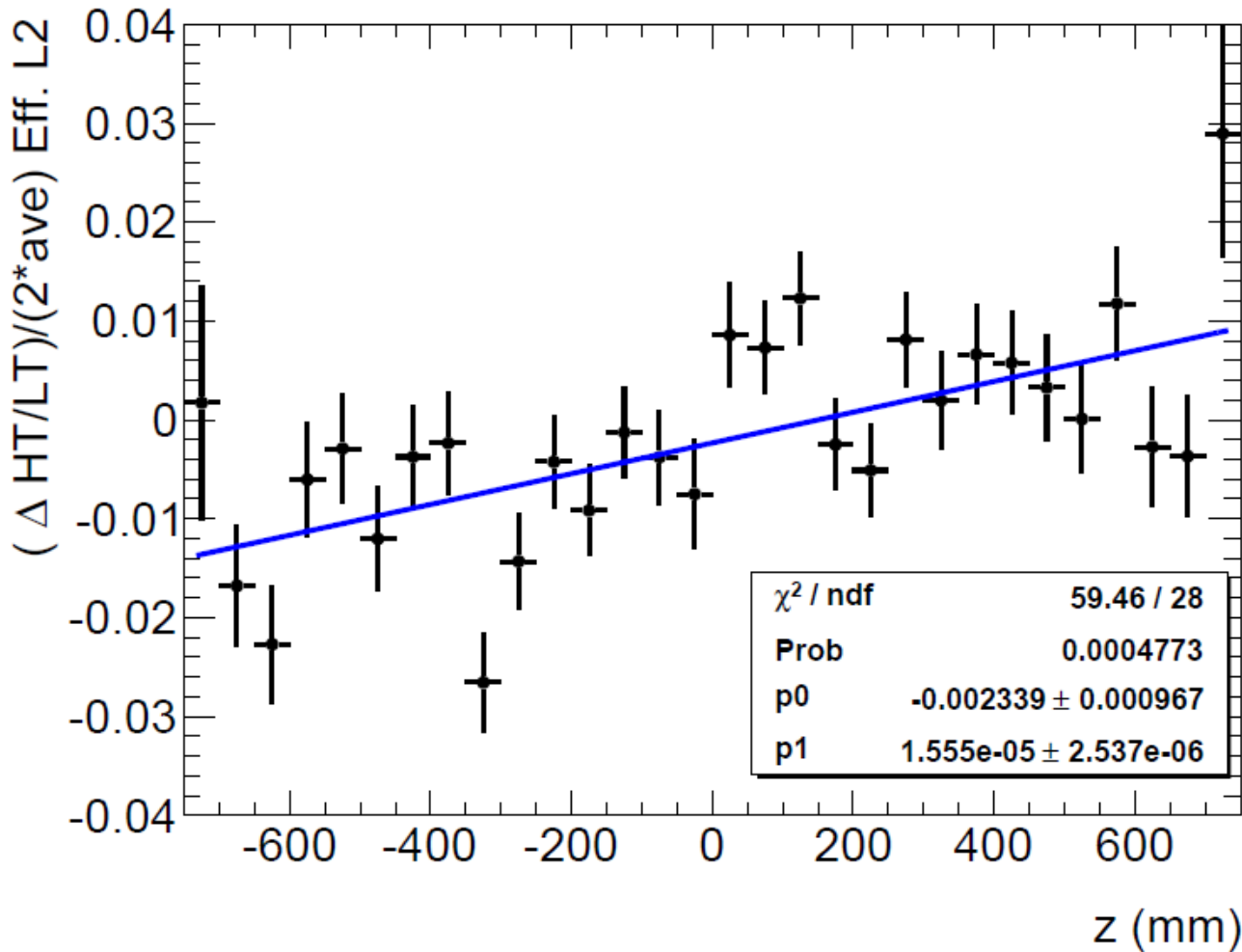
Positive



Pos. Slope :  $4.08 * 10^{-5} \pm 3.47 * 10^{-5}$

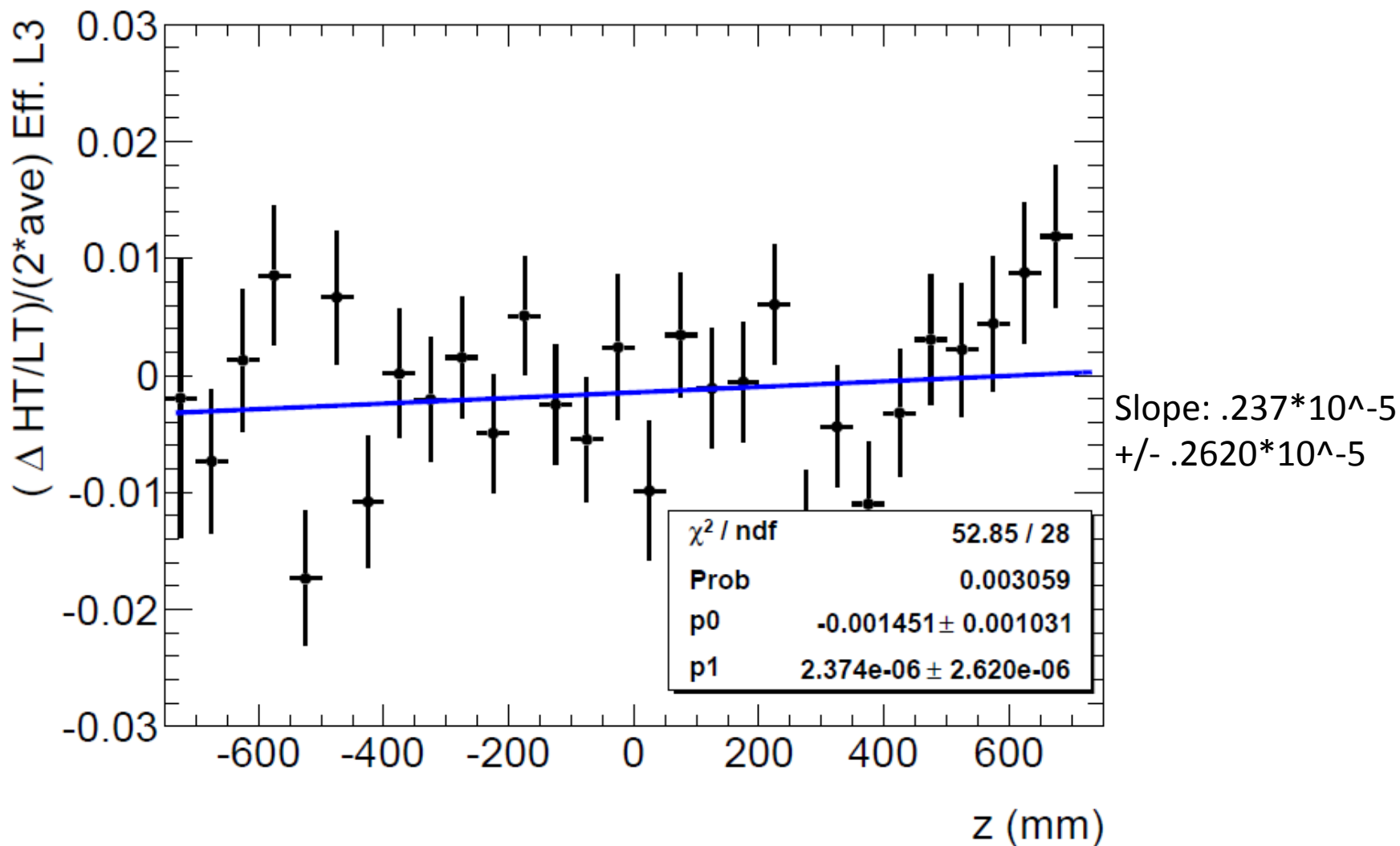
Long Straw Slope:  $2.065 * 10^{-5} \pm .3698 * 10^{-5}$

# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 2



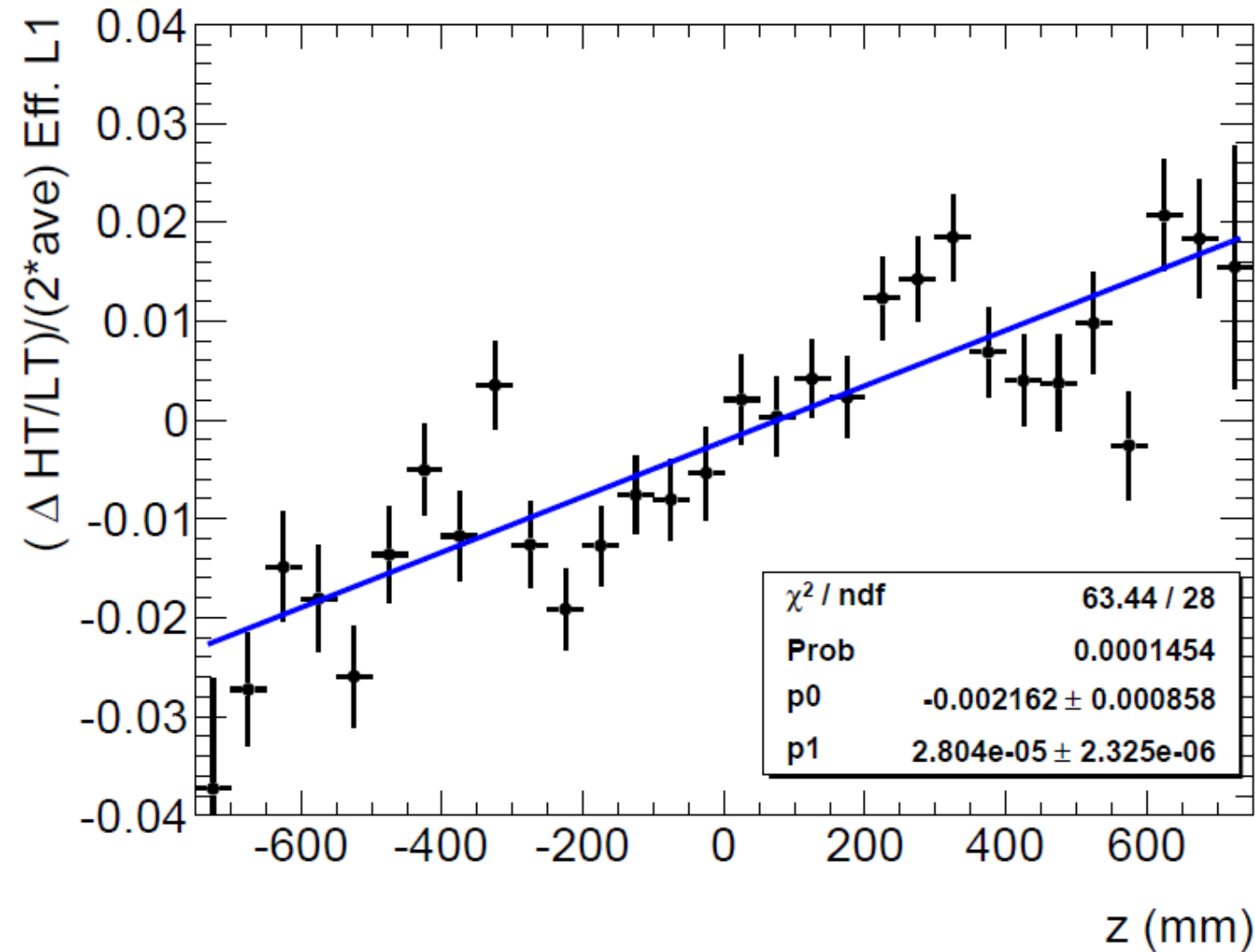
Slope:  $1.555 * 10^{-5}$   
 $\pm .2537 * 10^{-5}$

# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 3



# **PERIOD B 2012 DATA**

# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 1 Long

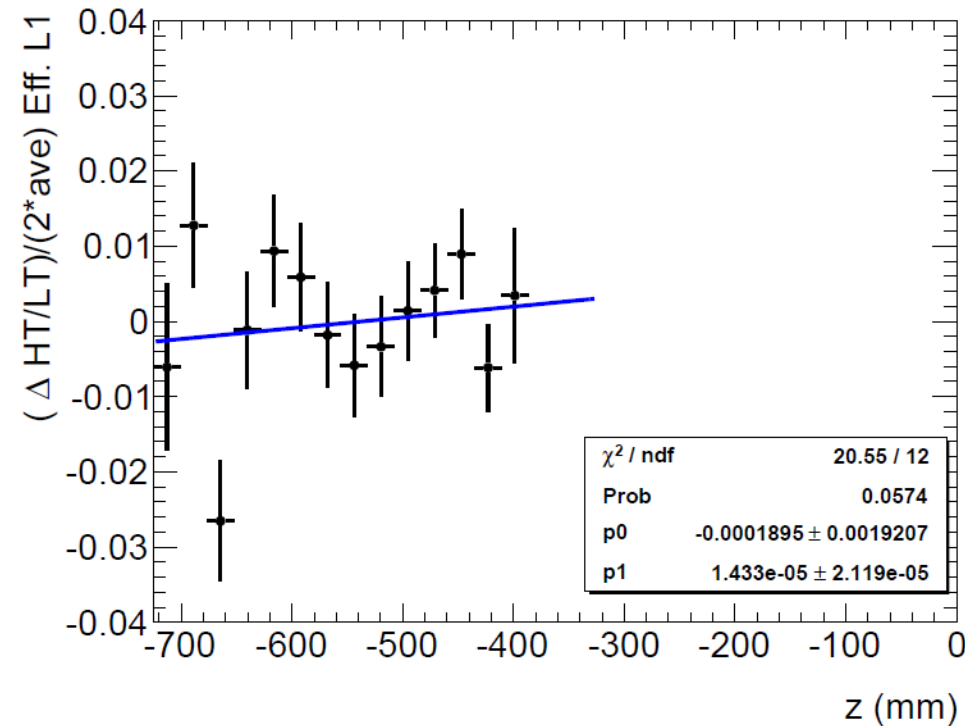


Slope:  $2.804 * 10^{-5}$   
 $\pm .2325 * 10^{-5}$

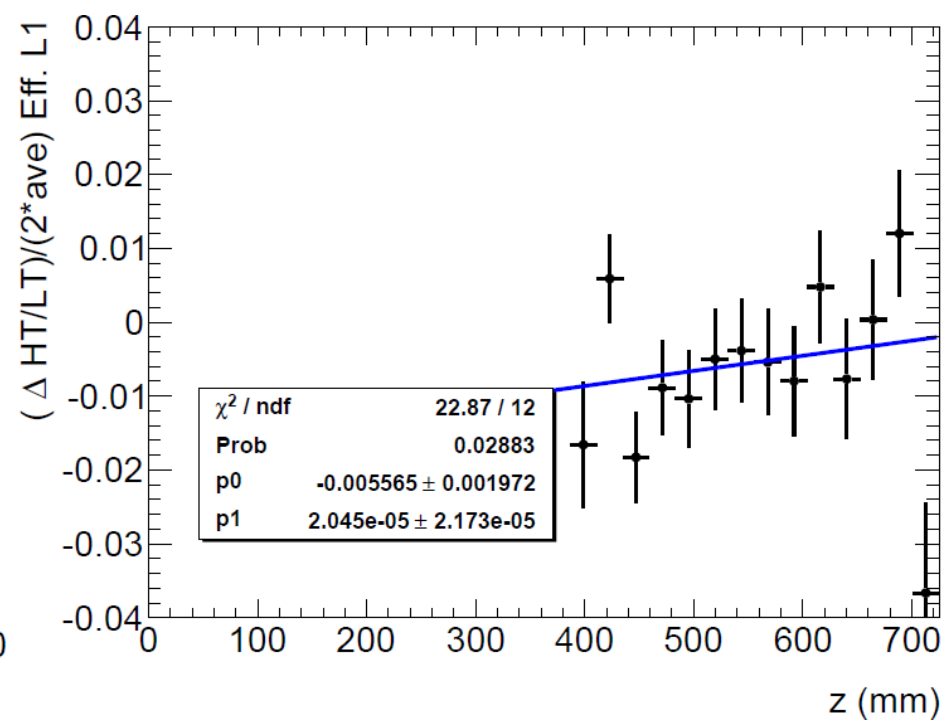
# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 1 Short

Negative

Positive



Neg. Slope :  $1.433 * 10^{-5} \pm 2.119 * 10^{-5}$

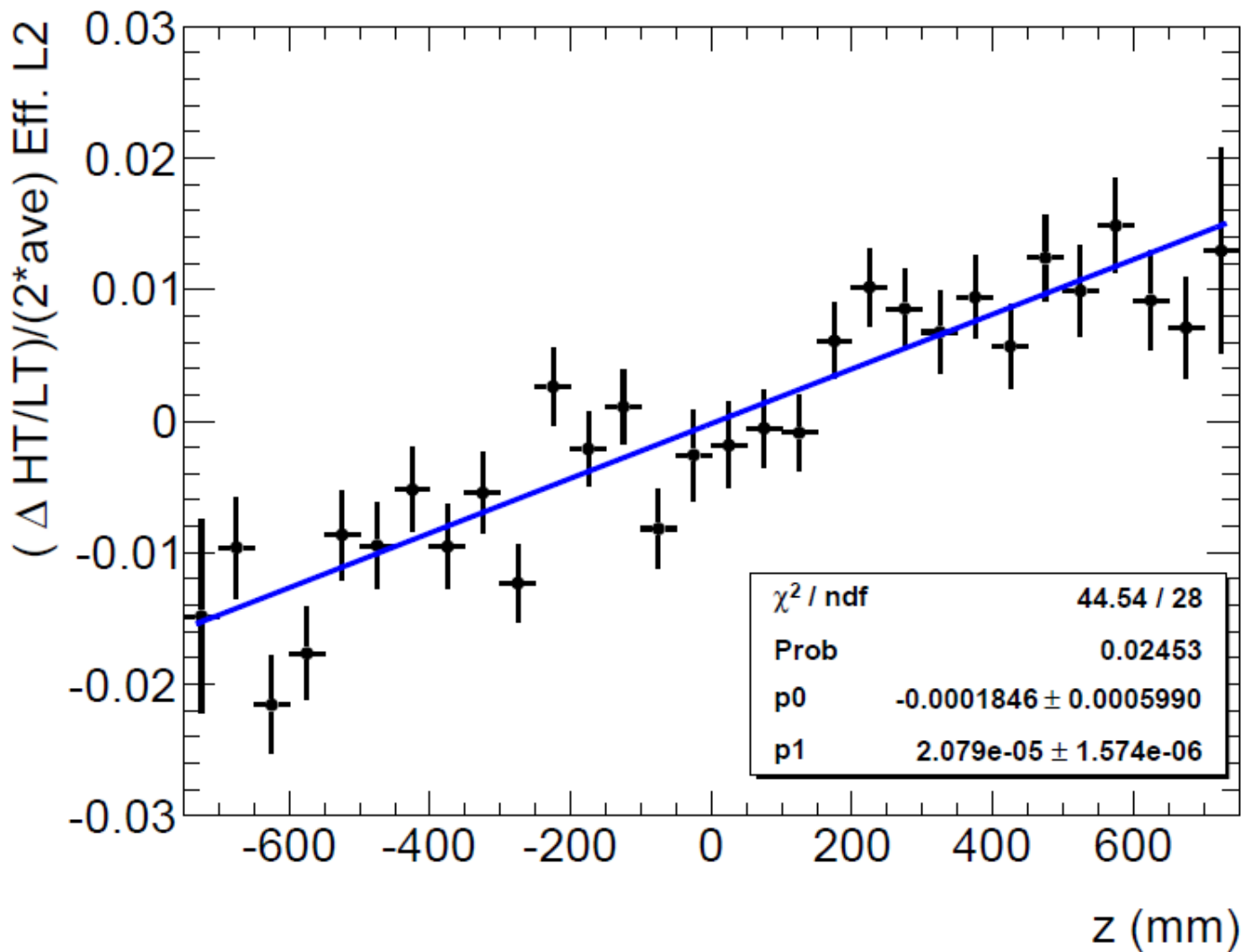


Pos. Slope :  $2.045 * 10^{-5} \pm 2.173 * 10^{-5}$

Long Straw Slope:  $2.804 * 10^{-5} \pm .2325 * 10^{-5}$

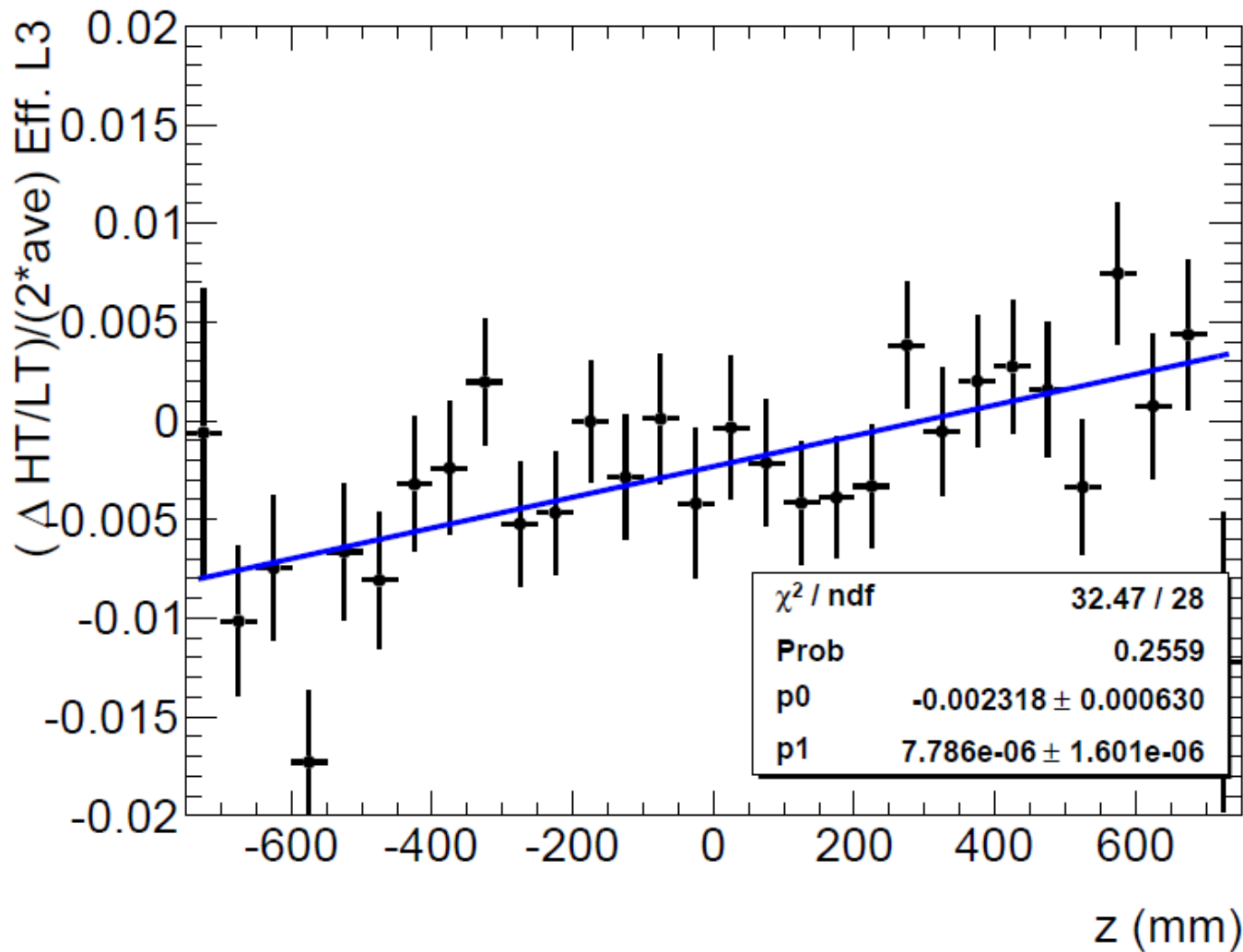


# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 2



Slope:  $2.079 * 10^{-5}$   
 $\pm .1574 * 10^{-5}$

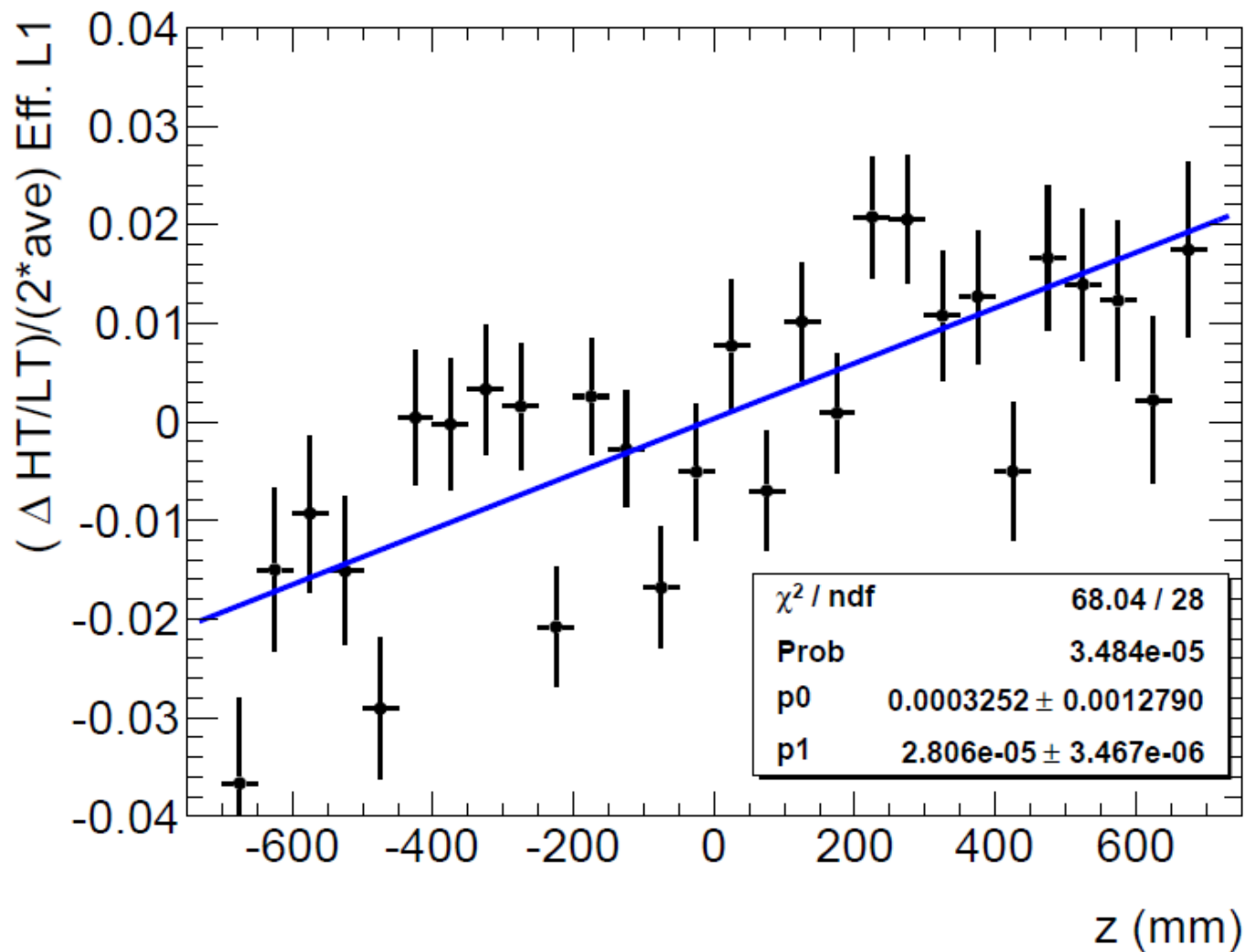
# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 3



Slope:  $.7786 * 10^{-5}$   
 $\pm .1601 * 10^{-5}$

# **PERIOD E 2012 DATA**

# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 1 Long

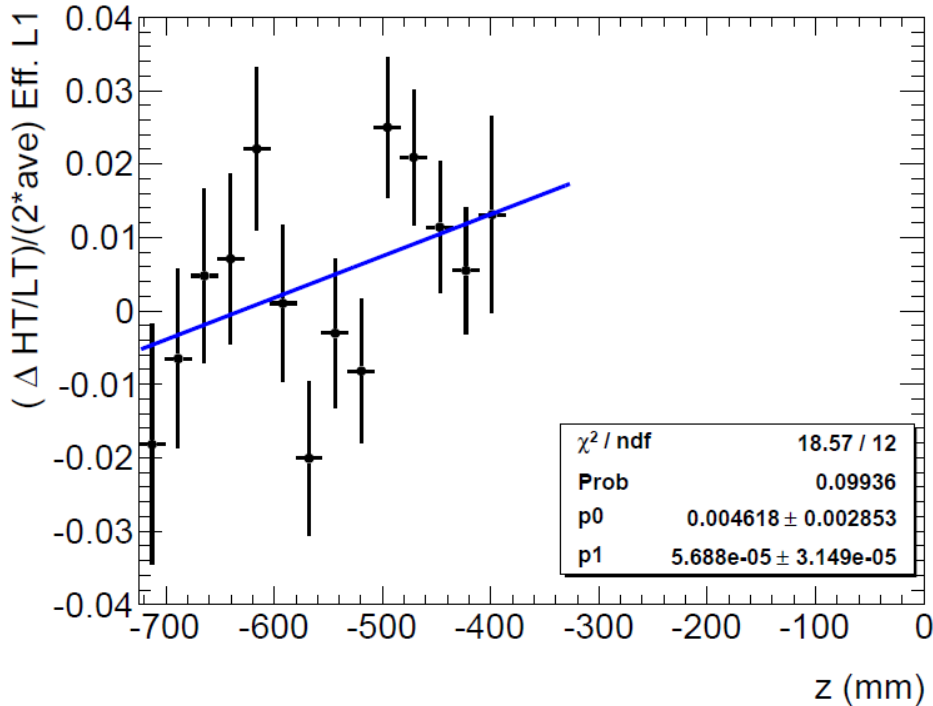


Slope:  $2.806 * 10^{-5}$   
 $\pm .3467 * 10^{-5}$

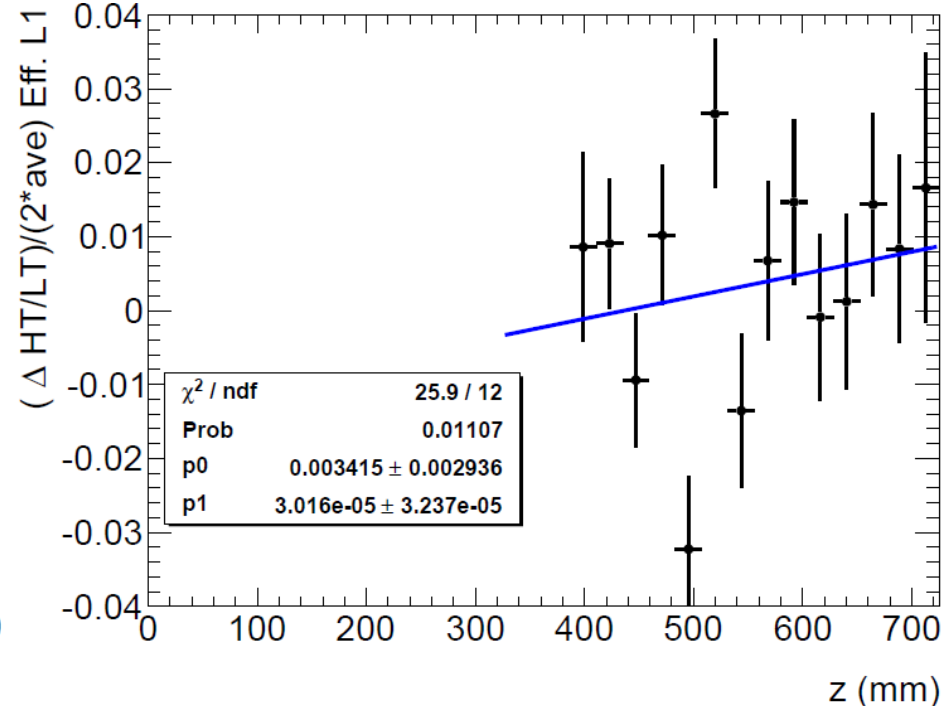
# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 1 Short

Negative

Positive



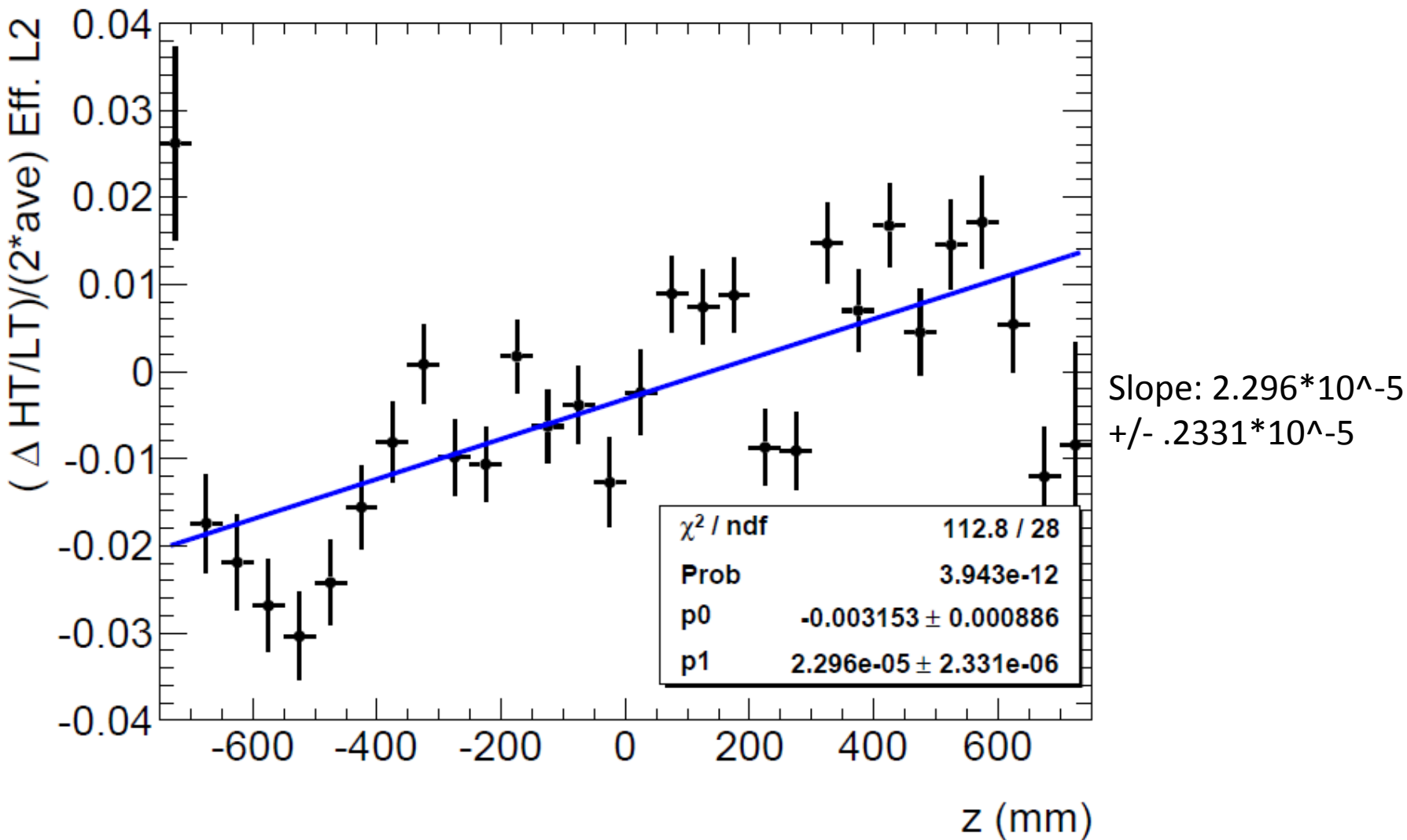
Neg. Slope :  $5.688 * 10^{-5} \pm 3.149 * 10^{-5}$



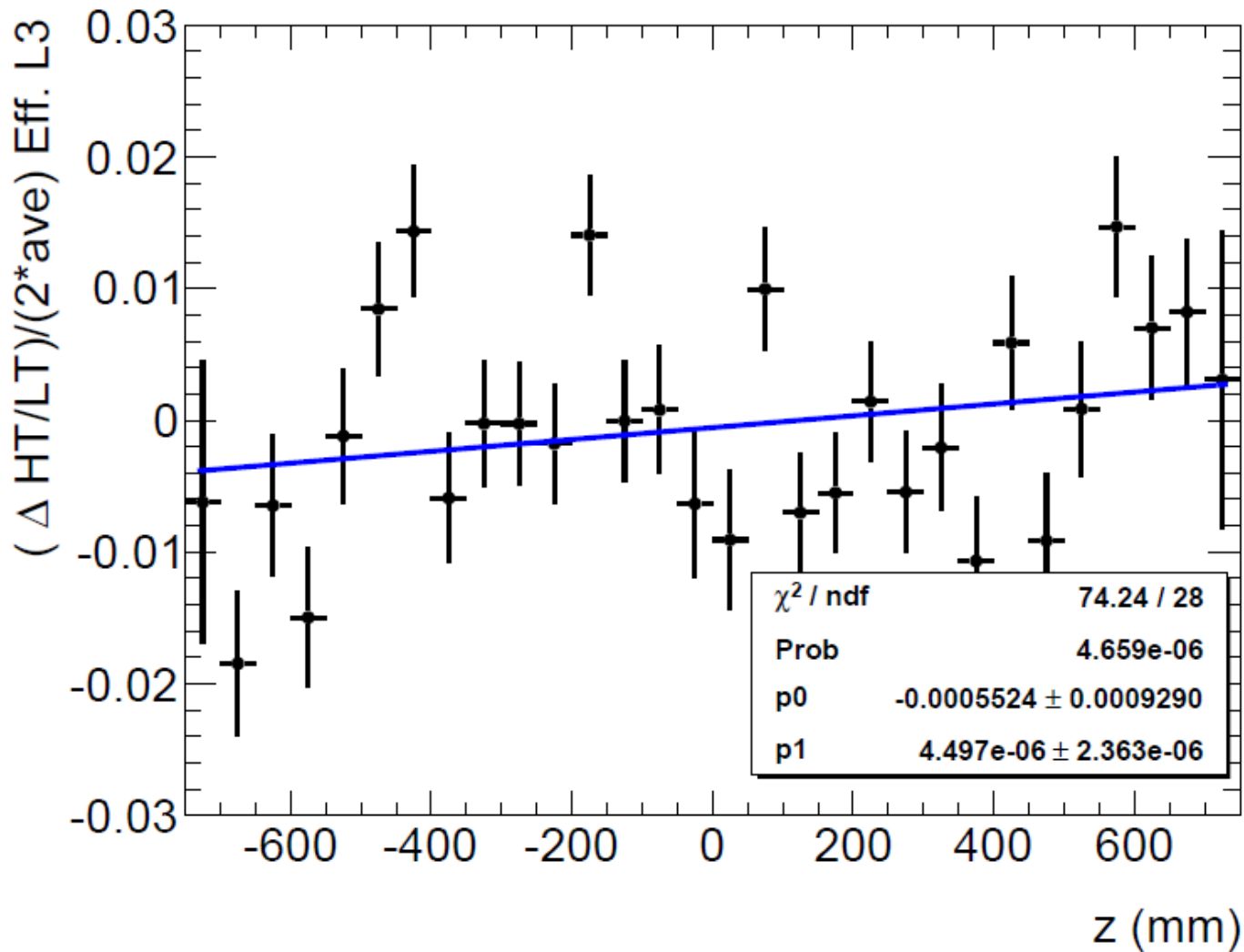
Pos. Slope :  $3.016 * 10^{-5} \pm 3.237 * 10^{-5}$

Long Straw Slope:  $2.806 * 10^{-5} \pm .3467 * 10^{-5}$

# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 2



# $\Delta(\text{HT}/\text{LT})/(2 * \text{Ave}(\text{HT}/\text{LT}))$ Layer 3



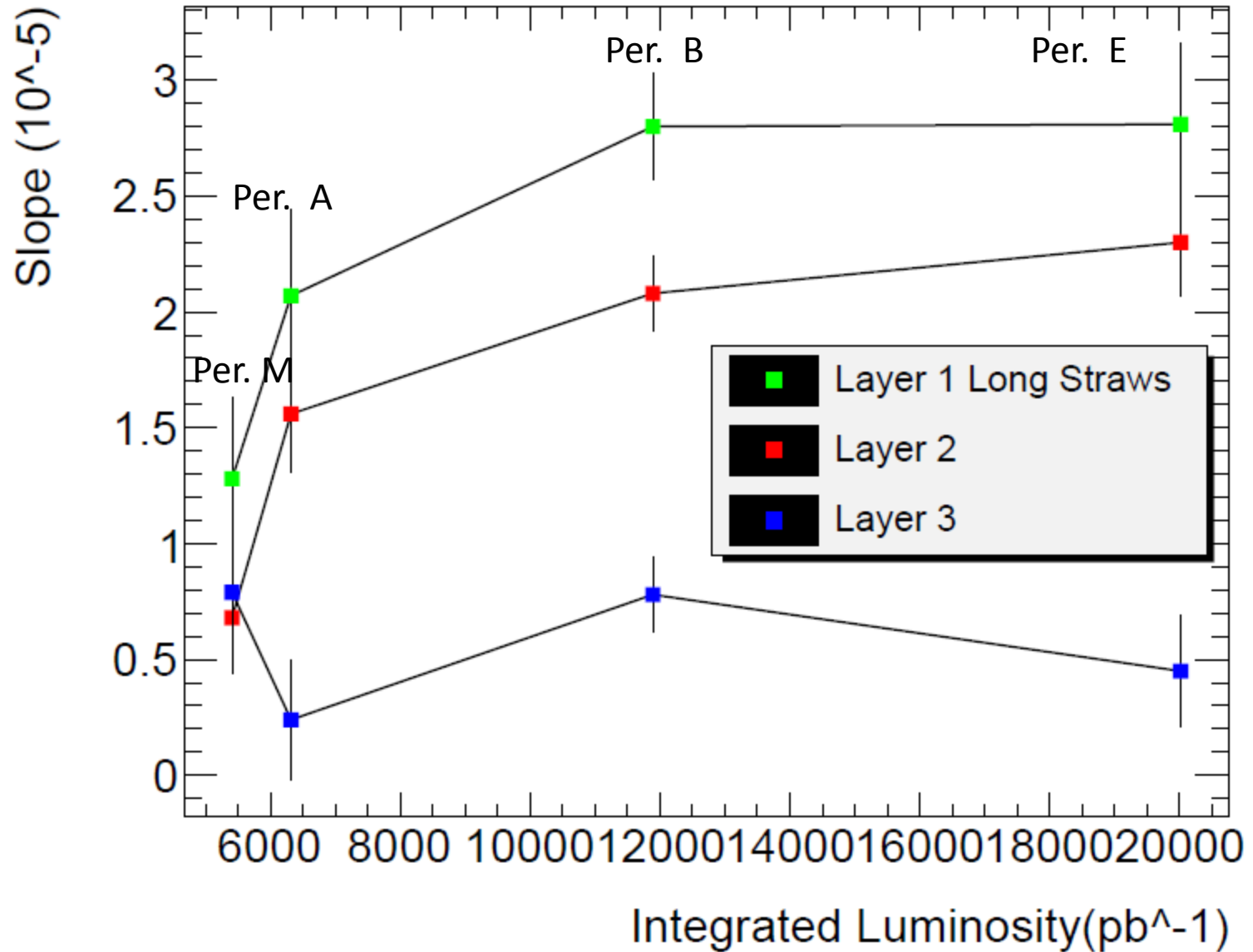
Slope:  $.4497 * 10^{-5}$   
 $\pm .2363 * 10^{-5}$

# Results

	Per M 2011 (10 <sup>-5</sup> )	Period A 2012 (10 <sup>-5</sup> )	Per B 2012 (10 <sup>-5</sup> )	Per E 2012 (10 <sup>-5</sup> )
Layer 1 (Long)	1.28 +/- .35	2.07 +/- .37	2.80 +/- .23	2.81 +/- .35
Layer 1 (short z<0)	-2.77 +/- 3.22	12.56 +/- 3.42	1.43 +/- 2.12	5.69 +/- 3.15
Layer 1 (short z>0)	-.18 +/- 3.29	4.08 +/- 3.47	2.05 +/- 2.17	3.01 +/- 3.24
Layer 2	.68 +/- .24	1.56 +/- .25	2.08 +/- .16	2.30 +/- .23
Layer 3	.79 +/- .25	.24 +/- .26	.78 +/- .16	.45 +/- .24



# Results Plot



# Conclusion

- For layer 1 and layer 2, there does seem to be an increase in the effect from 2011 to 2012.
  - Is this due to less statistics for Period M in the range  $14 \leq \langle \mu \rangle \leq 16$ ?
- For layer 3, there is actually a decrease in the effect over time.
- The effect the in short straws seems to increase, but the uncertainties are large.
- We should look at more data periods to confirm any results.
- Should we pick a different range of  $\langle \mu \rangle$ ?