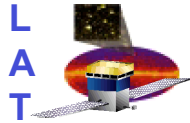


MC Study Result of Tracker Tower Alignment

**Hiro Tajima
Stanford Linear Accelerator Center**

**April 28, 2003
GLAST analysis meeting**

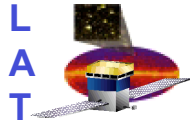


TKR Tower Alignment MC Studies

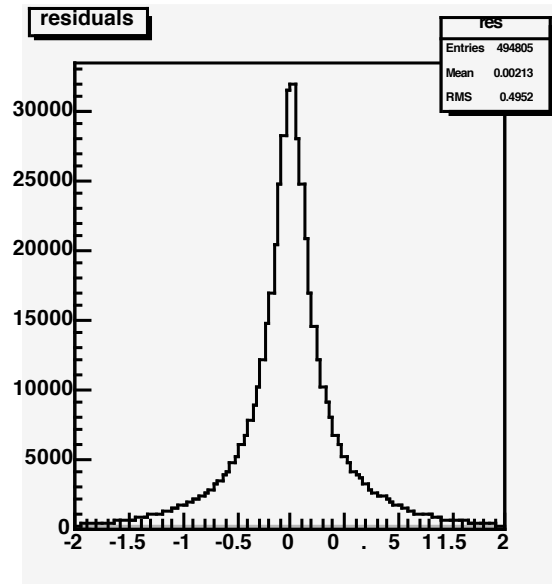
- **Data sample.**
 - 5 million events generated by GlastRelease-v2r1 (~90 min.)
 - Sea level cosmic muon events.
- **Procedure.**
 - Reconstruct single track in each tower. (Straight line fit.)
 - Save track pairs in tower 6 and its neighbors (2,5,7,10): 45K track pairs.
 - Randomly generate misalignment parameters ($\Delta x, \Delta y, \Delta z, \Delta x, \Delta y, \Delta z$).
 - Move cluster position according to the above parameters.

$$x_{\text{new}} = x_{\text{old}} + \Delta x + \Delta z \Delta y + \Delta x (\Delta z + \Delta x \Delta y + \Delta y x)$$

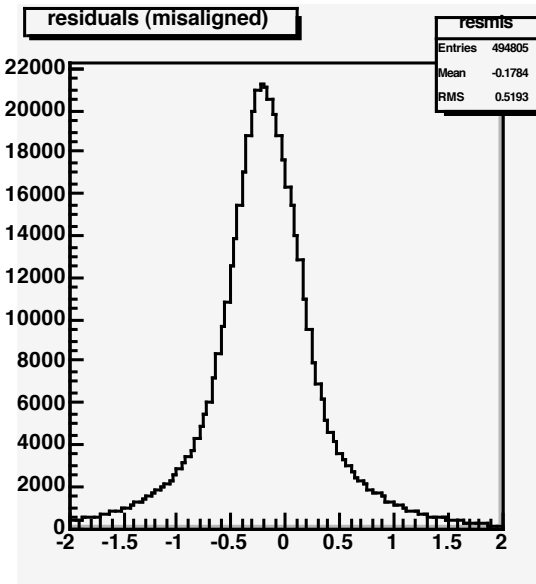
$$y_{\text{new}} = y_{\text{old}} + \Delta y + \Delta z \Delta x + \Delta y (\Delta z + \Delta x \Delta y + \Delta y x) \quad \Delta x, \Delta y, \Delta z, \Delta x, \Delta y, \Delta z$$
 - Refit the track using the misaligned clusters.
 - Remove outliers: residual(hit position - track position) > 2.58 σ
 - Obtain temporary alignment parameters by minimizing χ^2 (constant error)
 - Remove outliers using temporary alignment parameters
 - Obtain final alignment parameters.
 - Repeat the process with different misalignment parameter sets.



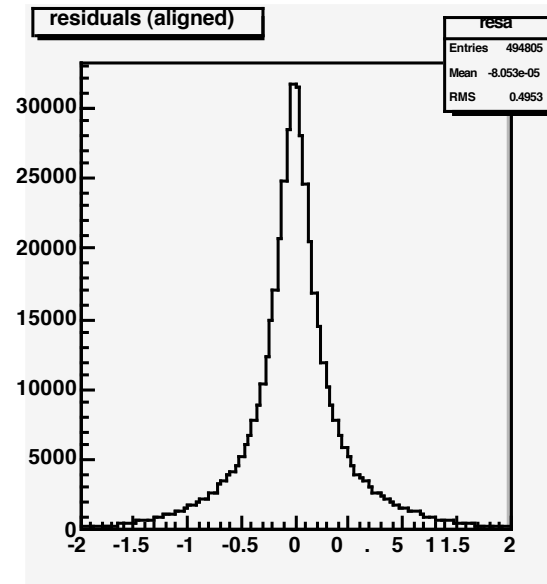
Residual



RMS: 0.495 mm

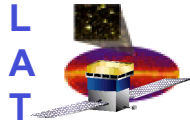


RMS: 0.519 mm

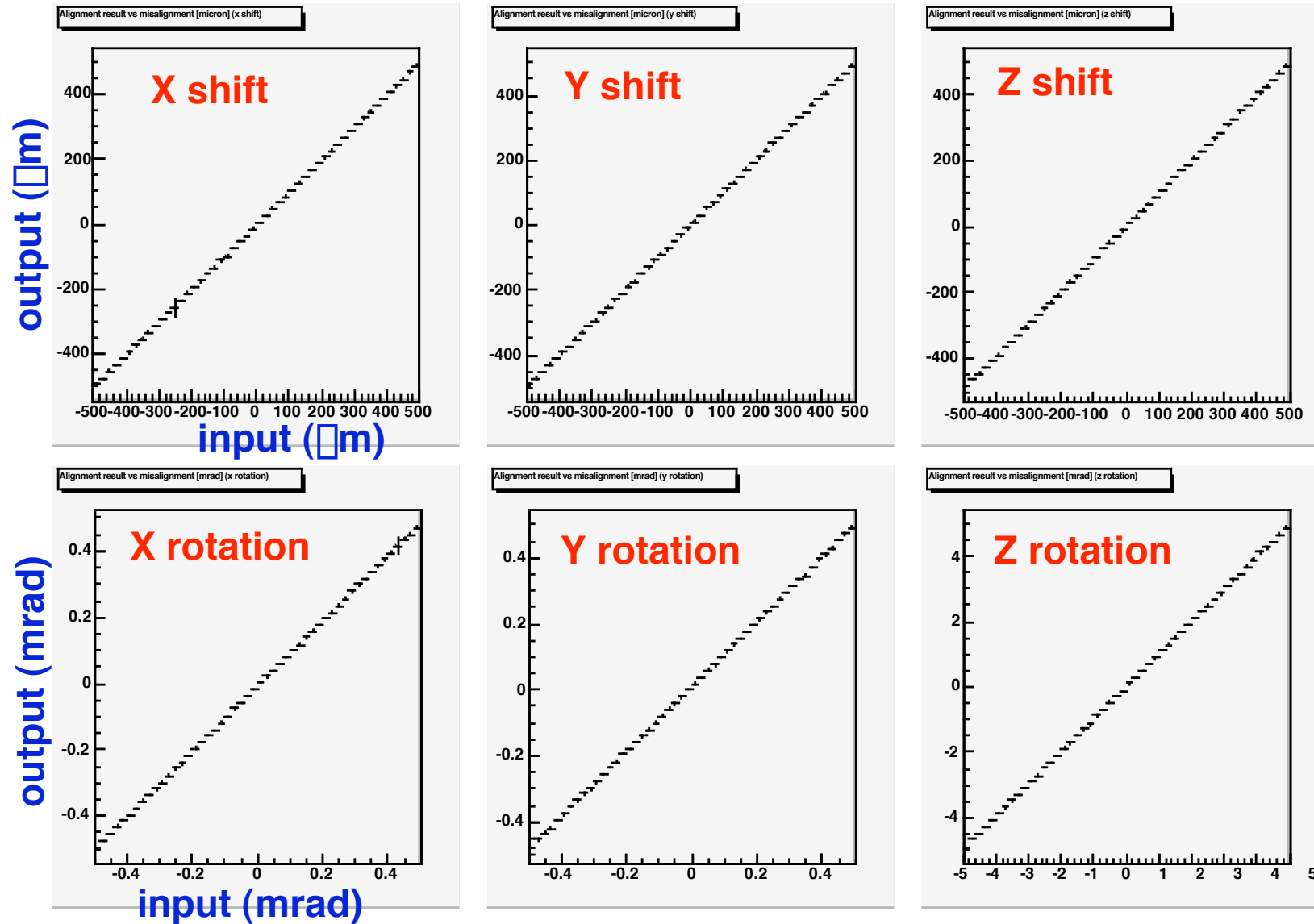


RMS: 0.495 mm

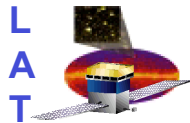
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Alignment parameters, output vs. input

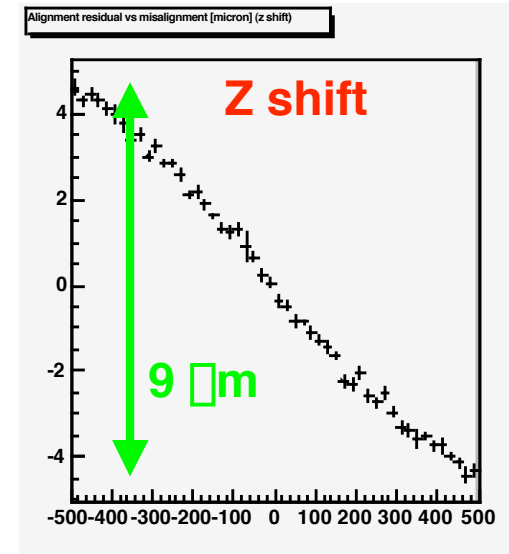
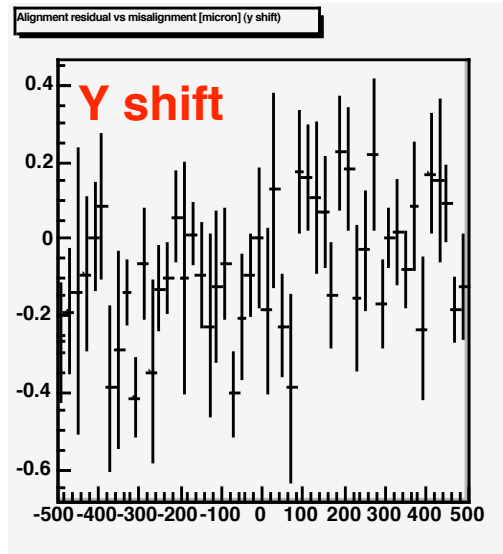
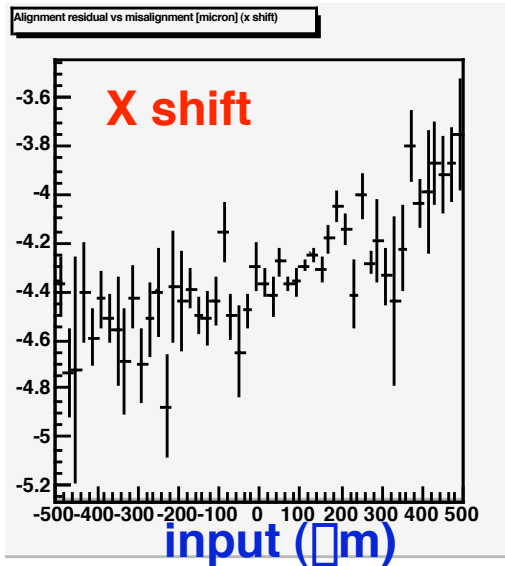


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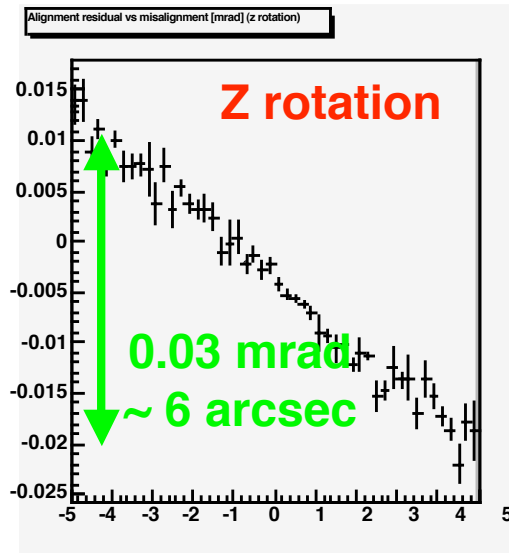
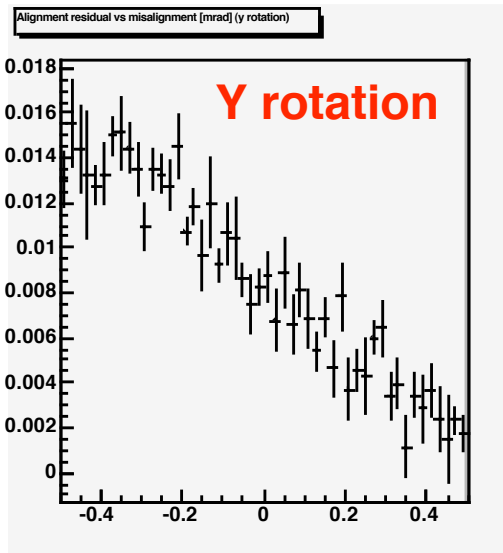
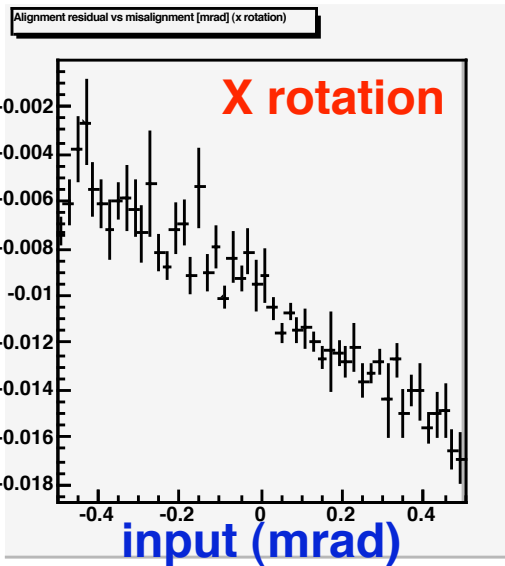


Alignment Residual vs. Misalignment

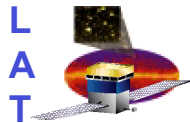
Output-inout (μm)



Output-inout (mrad)

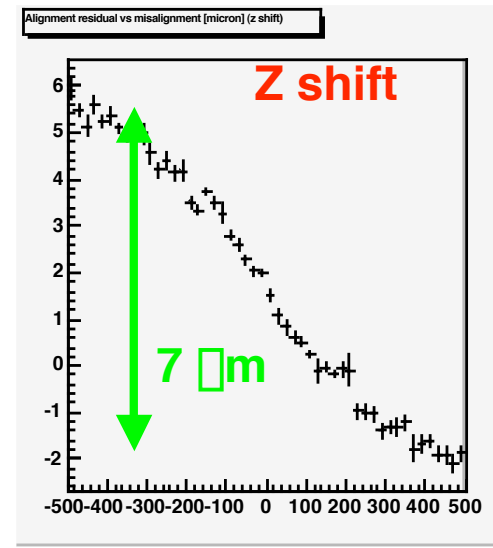
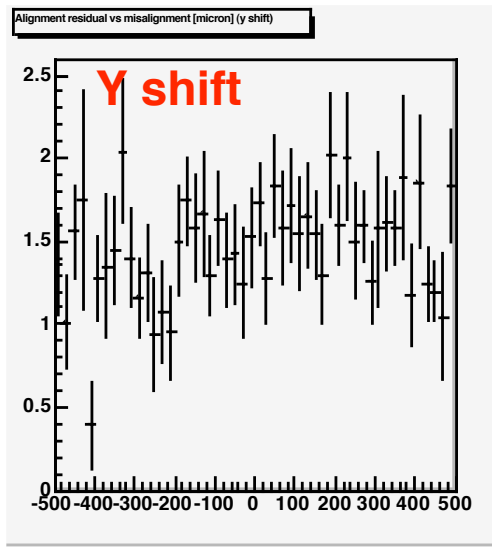
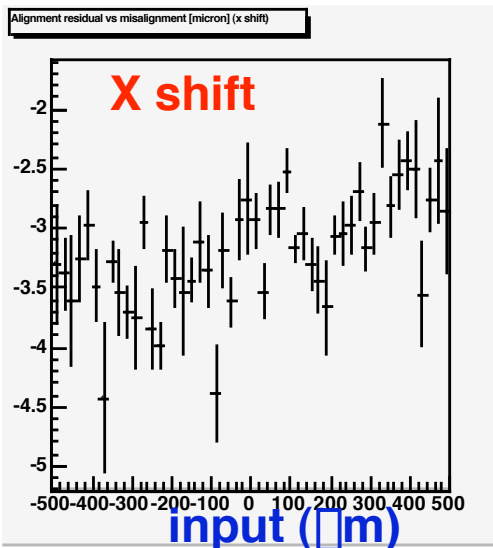


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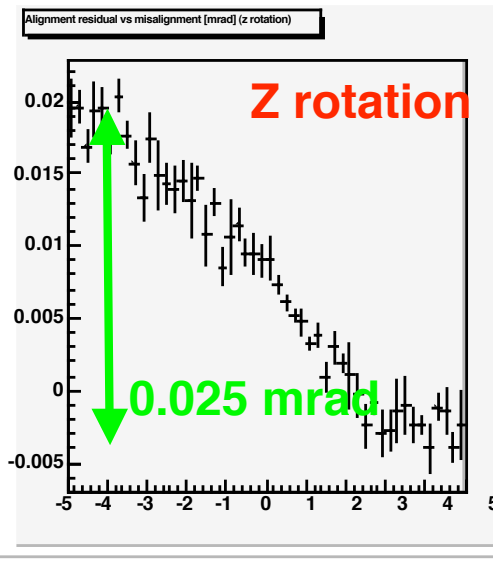
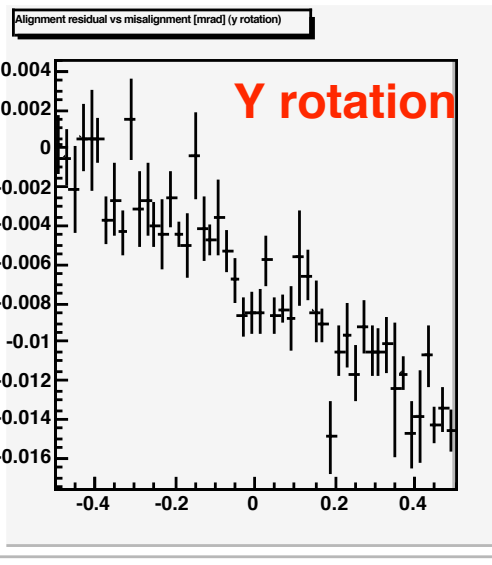
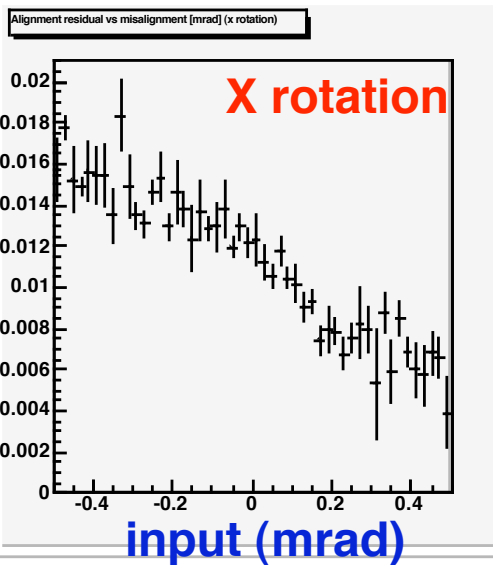


Tight Track Quality Selection

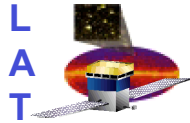
Output-inout (μm)



Output-inout (mrad)

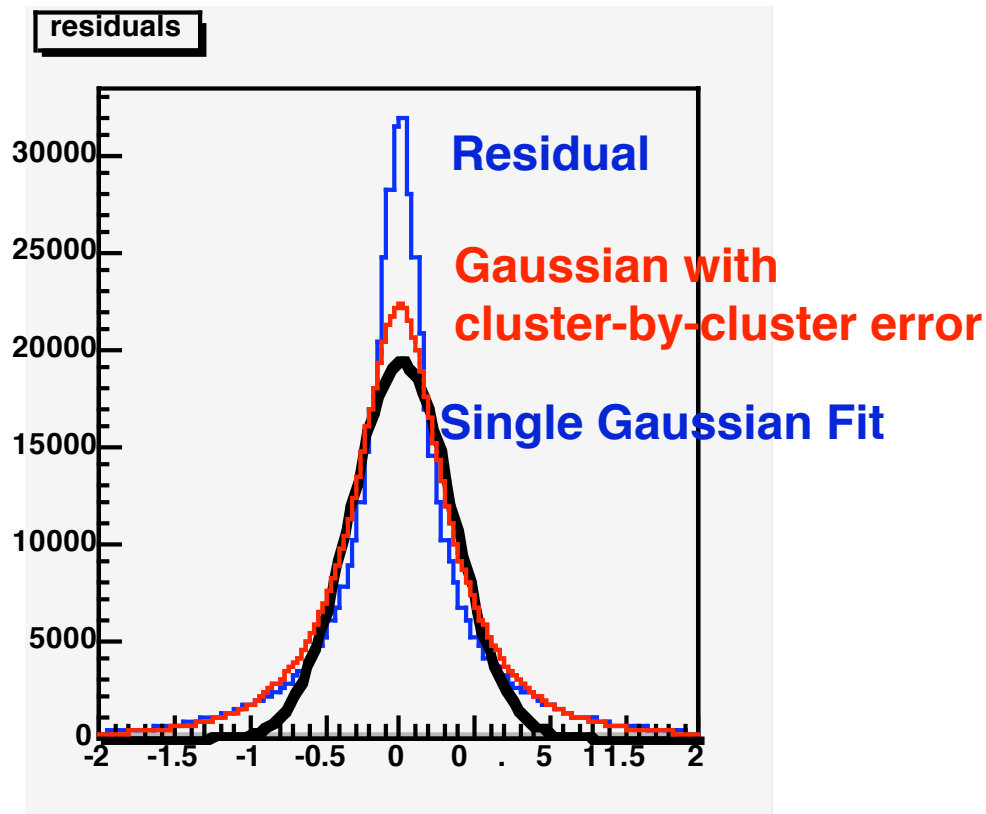


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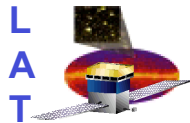


Cluster-by-Cluster Error Estimation

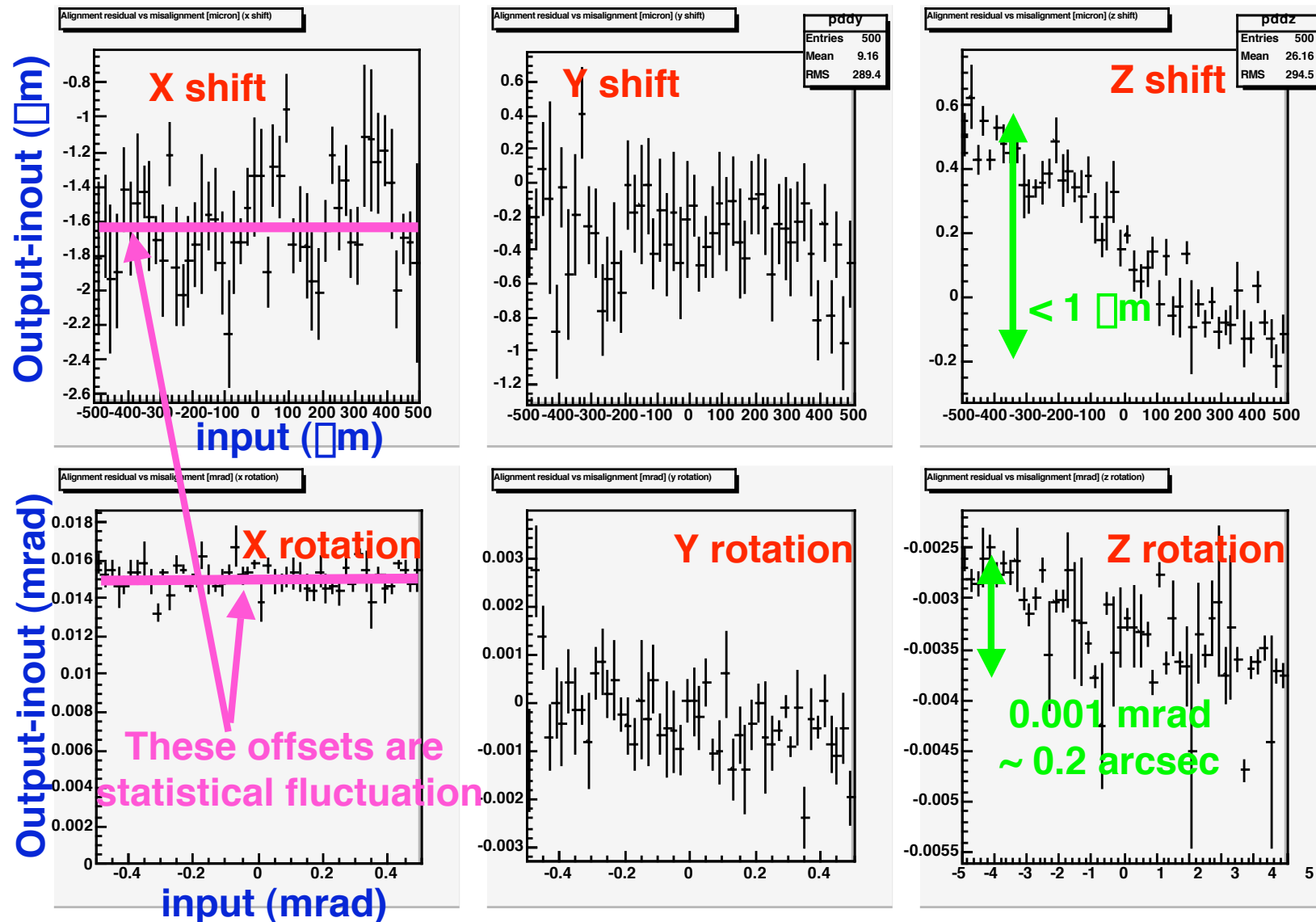
- **Estimate residual error using:**
 - RMS of reference track. (depends on track momentum and angle)
 - Track slope.
 - Distance between cluster and side-wall along track trajectory.



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Alignment Residual with Better σ^2



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