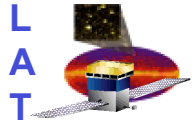


Status of Tracker Tower Alignment

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July 15–18, 2003
GLAST Ground Software Workshop



MC Study of TKR Alignment Precision

- **Objectives**

- Establish TKR tower alignment procedure
- Evaluate alignment precision as a function of # of tracks.

- **MC samples used.**

- 16 million events generated by GlastRelease-v3r1 (~6 hours.)
- Sea level cosmic muon events.

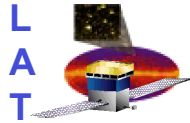
- **Procedure of MC studies.**

- Select tracks that penetrate two adjacent towers.
- “Misalign” one of the towers.
 - Misalignment parameters are generated randomly within 0.5mm for x,y,z shift, x and y rotation within 1.5 arcmin, and z rotation within 15 arcmin.
 - Hit strips are recalculated according to the misalignment.
- Align the misaligned tower.

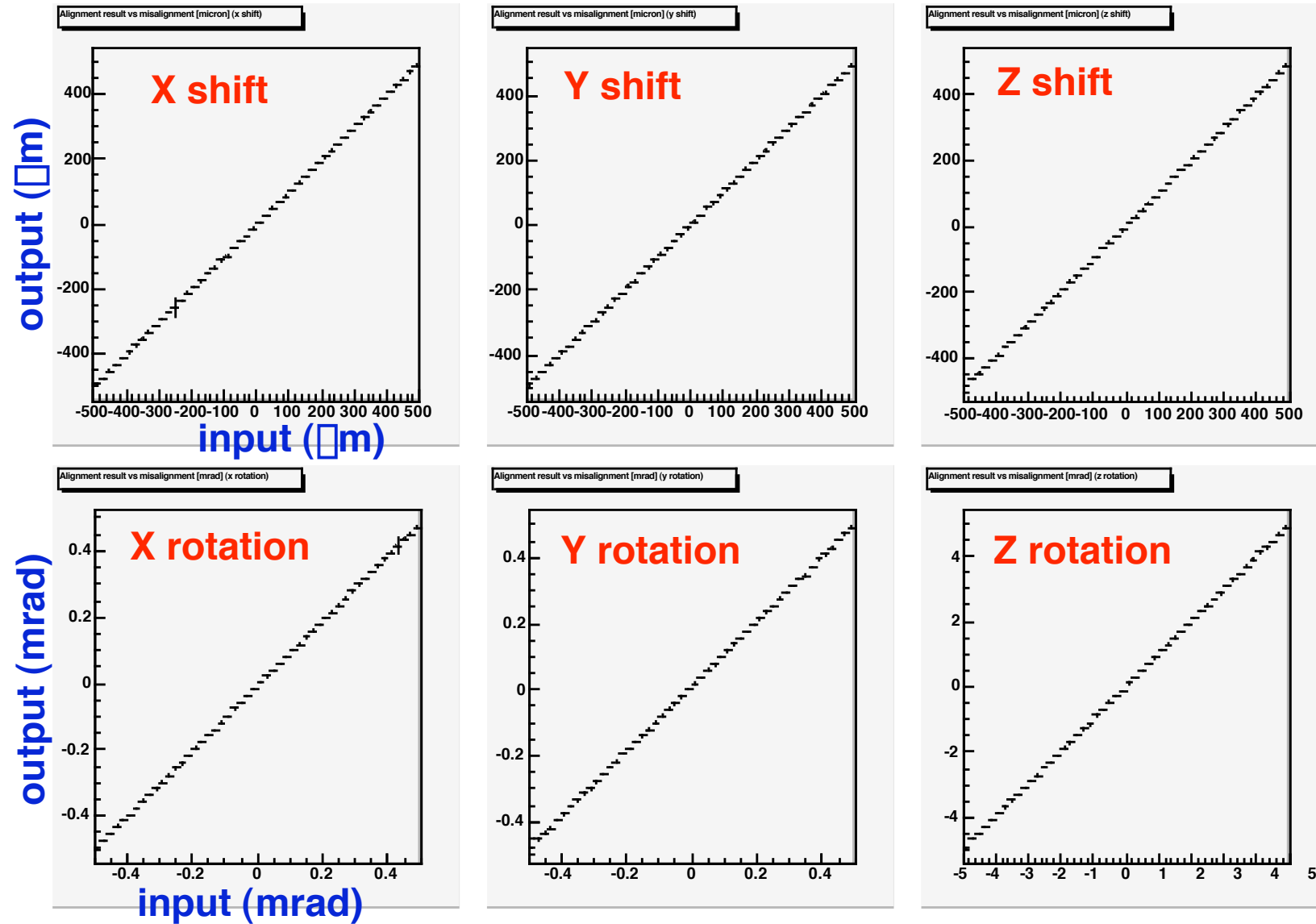
- Minimize
$$\chi^2 = \sum_i \frac{(x_{\text{cluster}}^i - x_{\text{track}}^i)^2}{\sigma_x^i} + \sum_j \frac{(y_{\text{cluster}}^j - y_{\text{track}}^j)^2}{\sigma_y^j}$$

- Error is calculated from track fit rms, angle and distance of the cluster from the sidewall.
- Look at alignment residual (output minus input).

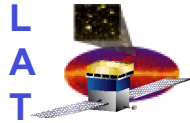
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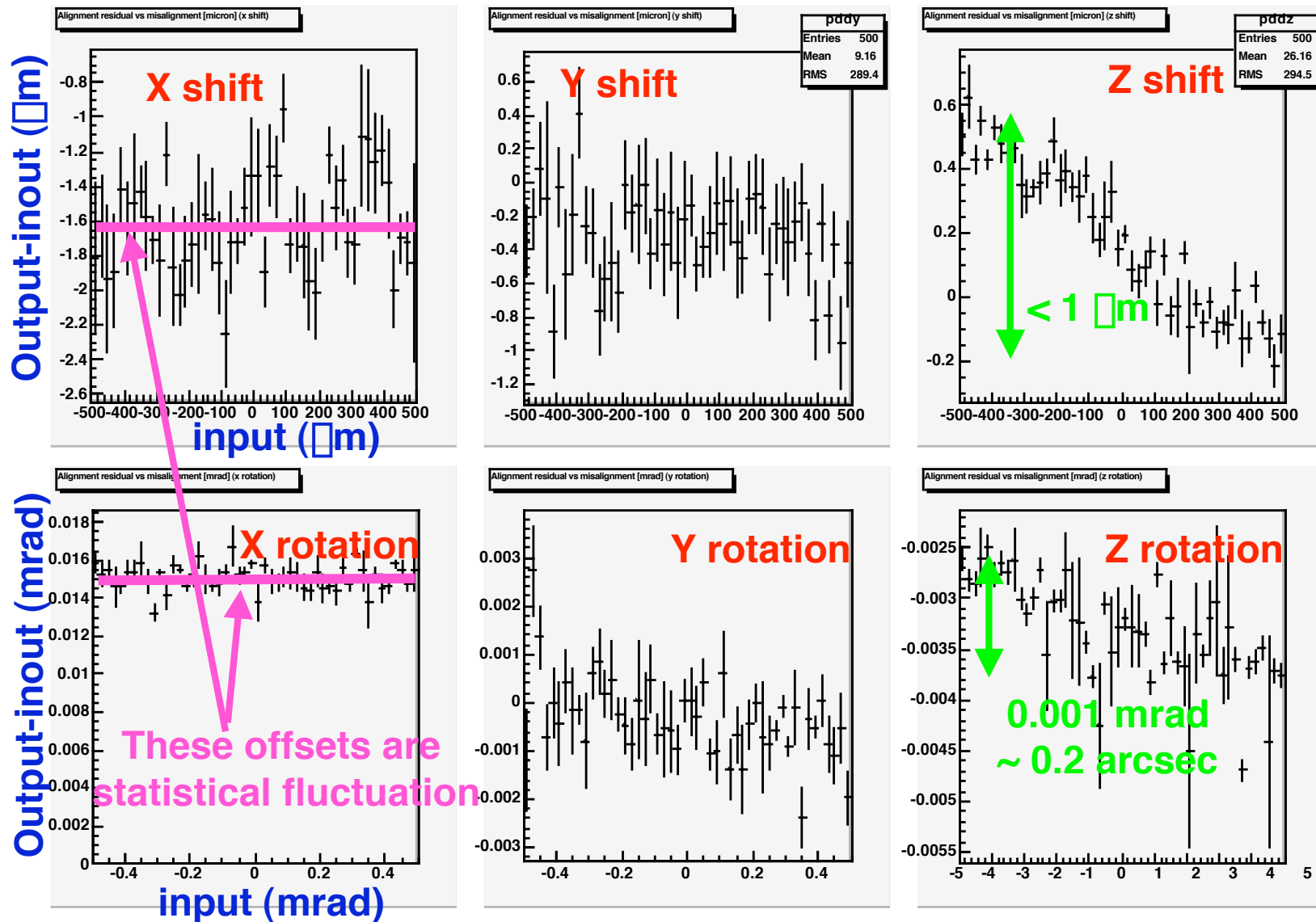
Alignment parameters, output vs. input



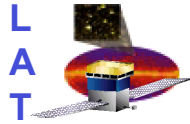
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Alignment Residual vs. Misalignment

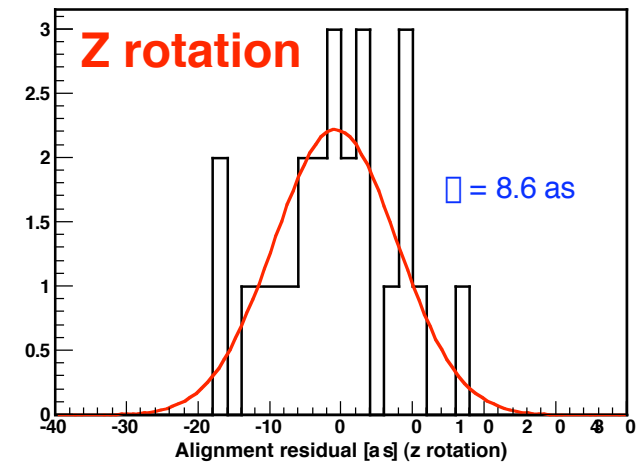
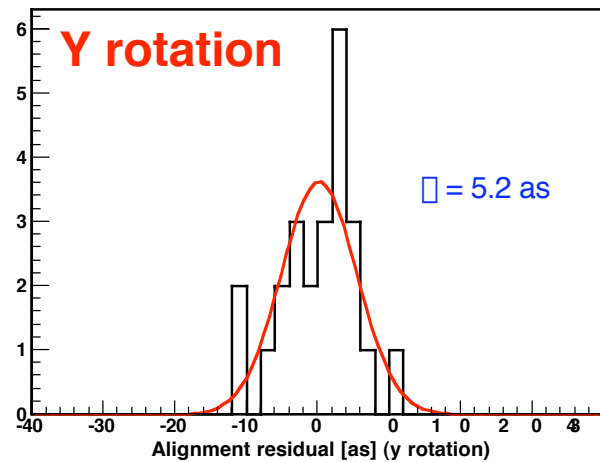
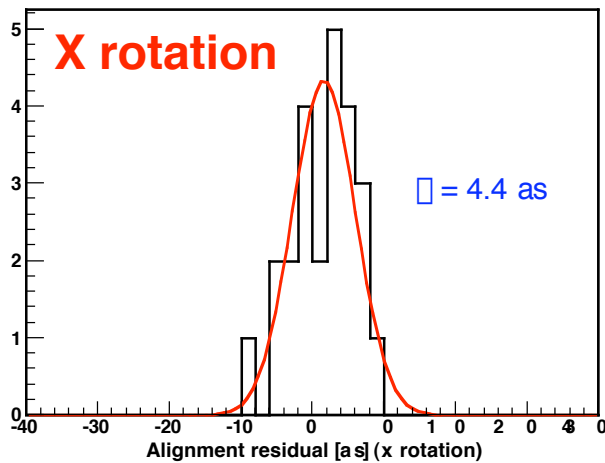


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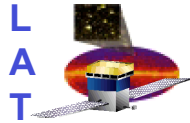


Evaluation of Alignment Precision

- **Alignment precision.**
 - Subdivide the sample into 2 samples. (~3 hours/sample)
 - Each sample contain 12 tower pairs.
 - Obtain alignment precision by the scatter of the alignment residual.
 - Resulting precision is better than expected from analytical calculation by a factor of ~3 for x rotation.



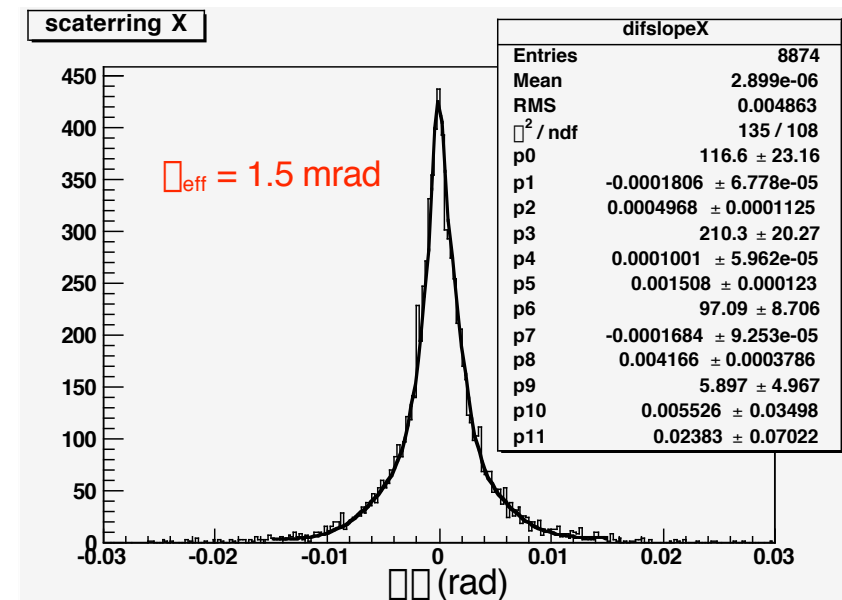
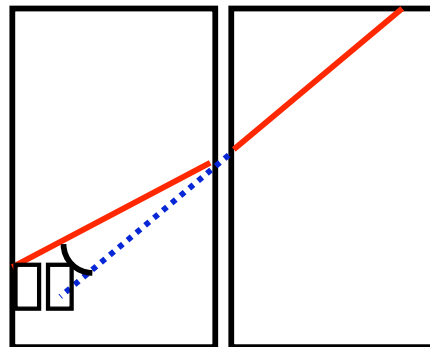
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Comparison with Analytical Calculation

	Gleam	Analytical
Trigger Rate	4.0 Hz	4.6 Hz
Angular resolution per track	1.5 mrad*	1.9 mrad
Alignment precision in 3 hours	4.4 as	12 as

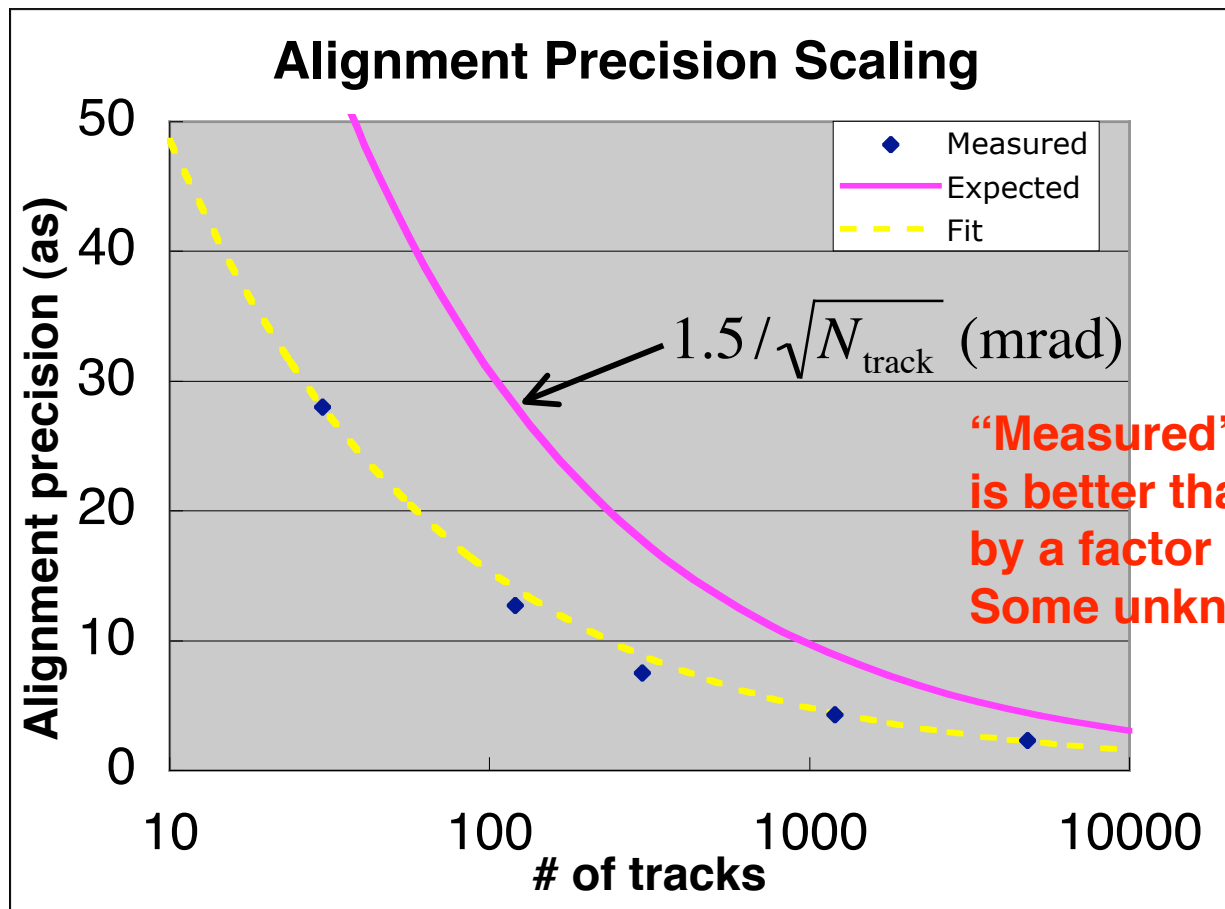
*Angular resolution is Gleam appears better due to track selection bias



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Scaling of Alignment Precision

Alignment precision for x rotation as a function of number of track used in the fit. (Other parameters are fixed at the correct alignment parameters.)



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