Pixel Cosmic Analysis Update

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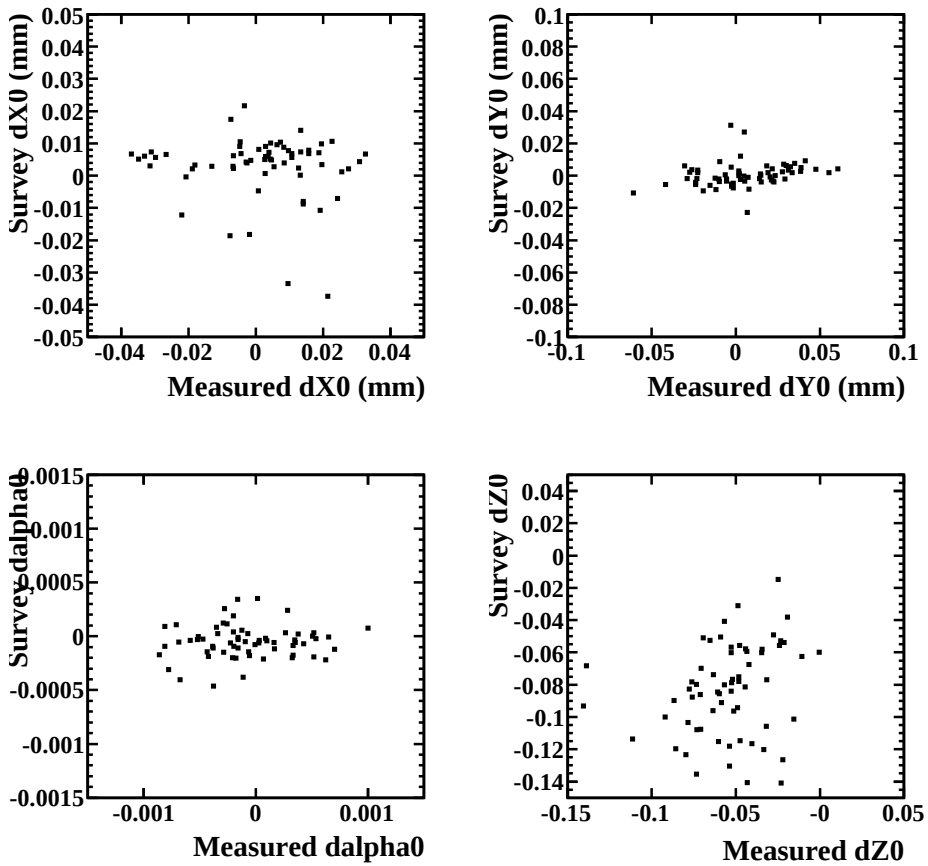
LBNL ID Software Meeting, 3/6/2007

- Alignment vs Survey comparison after a bug fix
- Pixel clustering studies
- Plans for Pixel Offline Analysis note (Outline)

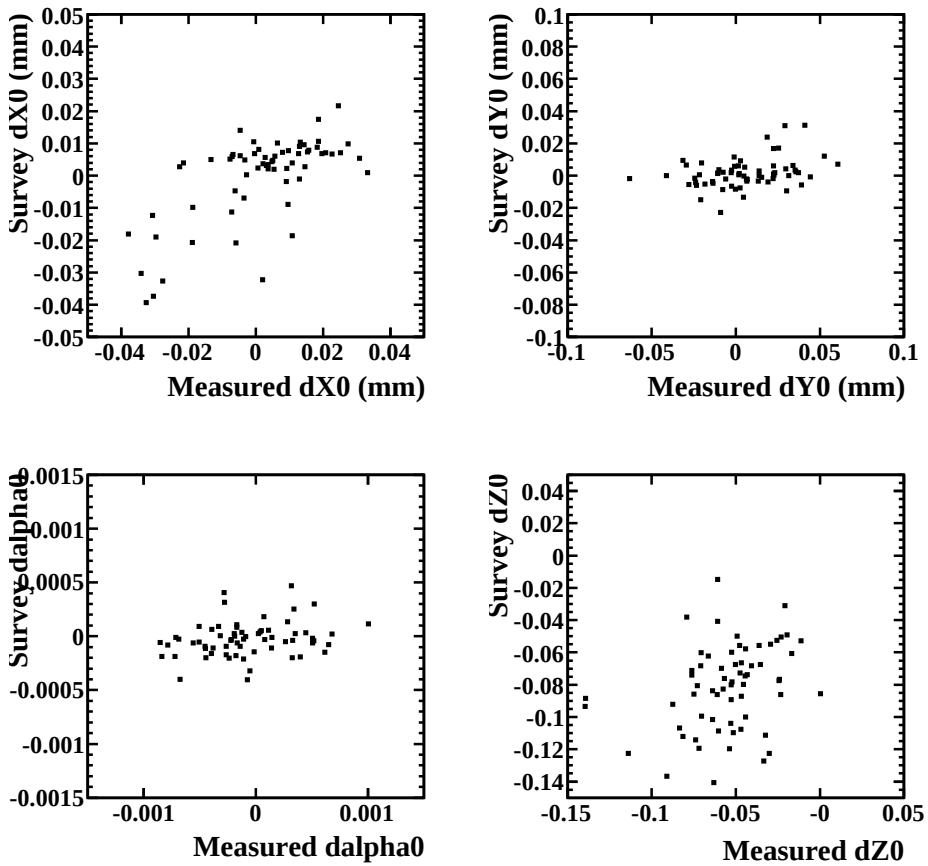
Survey vs Alignment (Old)



- Interesting to see how well the alignment compares to the survey for modules with > 50 overlap hits.

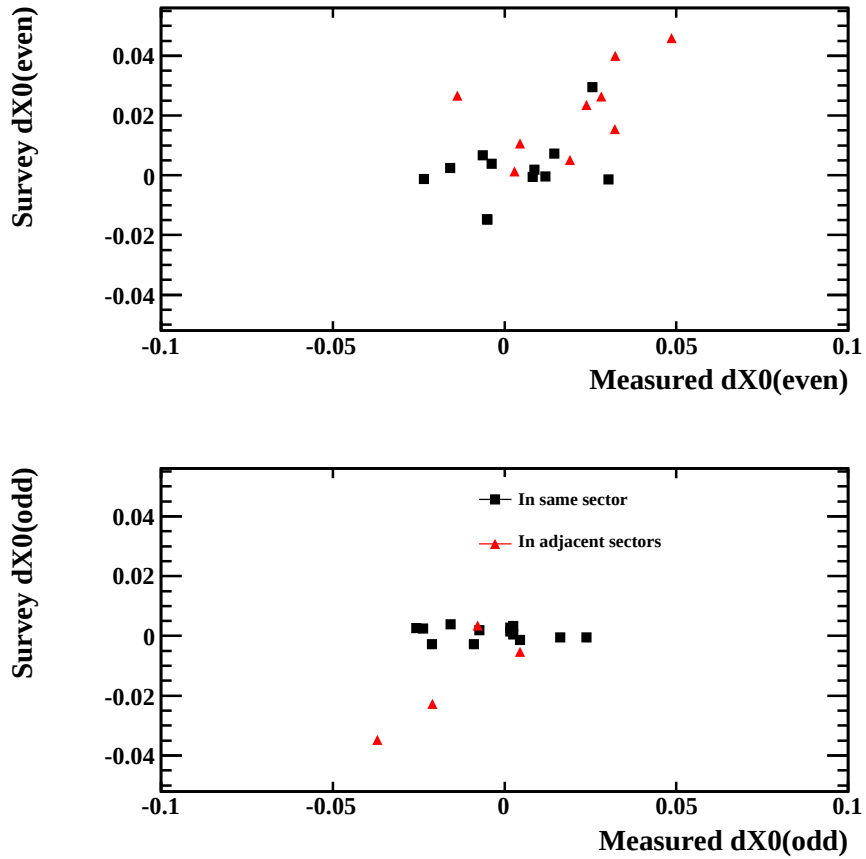
- The correlation does not seem strong, but there are some in δY_0 and δZ_0.

Survey vs Alignment (New)



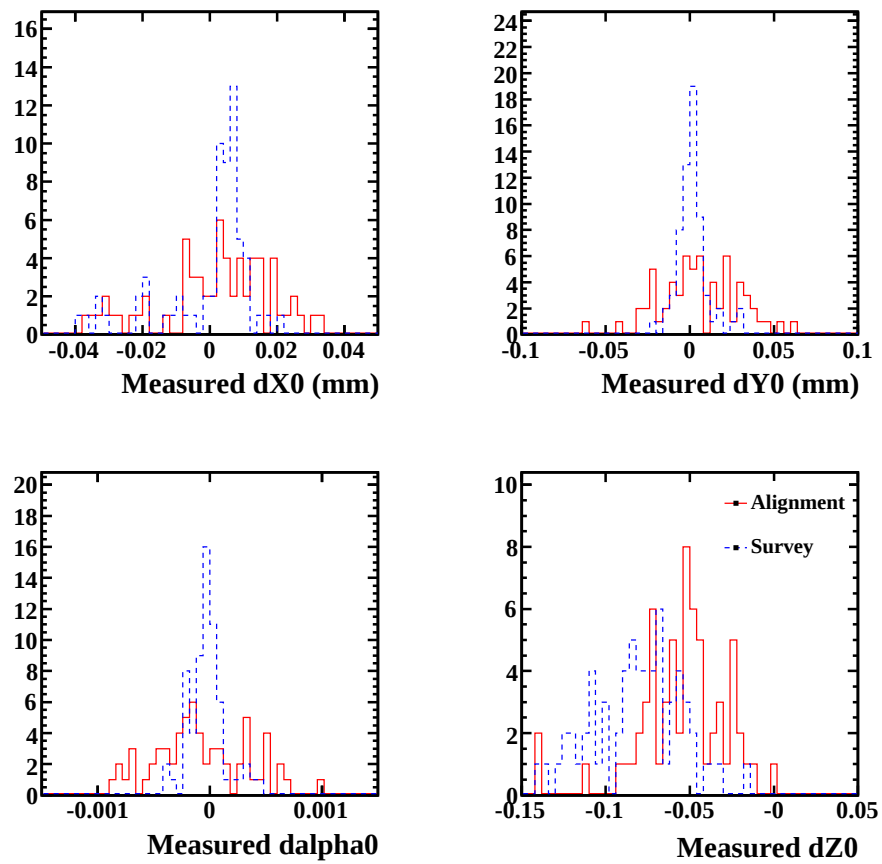
- A bug was found in interpolating alignment constants in which side of even module.
- After the fix, the correlation between the alignment and survey seems evident.

Relative Alignment Between Neighbor Modules



- Top is for even modules and bottom is for odd modules.
- Again, the correlation is evident.

Comparison: Survey vs Alignment (Projection)



- Projection in red for data and in blue for survey.
- There seems data prefer a shift of $\delta Z_0 = 50\mu m$, instead of 80 μm from survey.

Pixel Clustering Studies

- Because of the bug, it makes us to think harder on tracking, clustering, and survey systematic.

- For example, the k factor used in pixel endcap clustering seems wrong for the cosmic data (Marian).

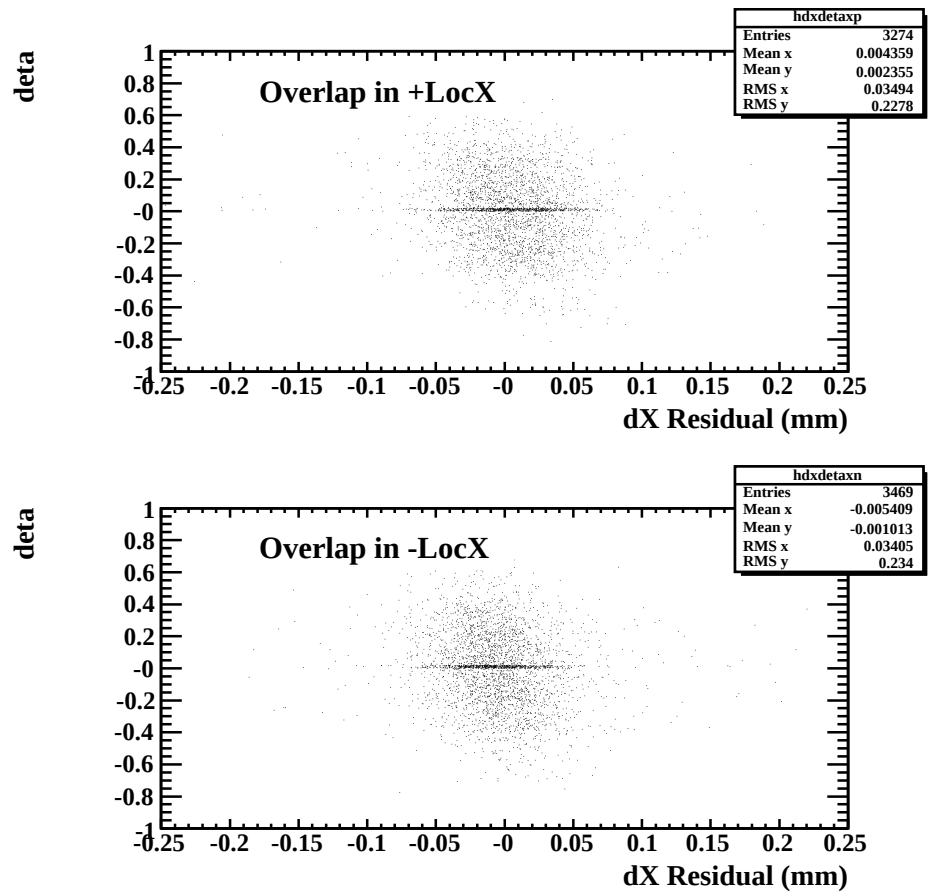
- $x_{ana} = x_{dig} + k \cdot (\eta - 0.5)$, where $\eta = q_{max}/(q_{min} + q_{max})$.

- The k factor is sensitive to track incident angle, charge diffusion, and radiation damage
  - k = 0.01 for normal incident angle (endcap in collision)
  - k = 0.03 for barrel region or cosmic data

- On average, $\bar{x}_{ana} = \bar{x}_{dig}$, independent of incident angle, but x_{ano} should have a better resolution.

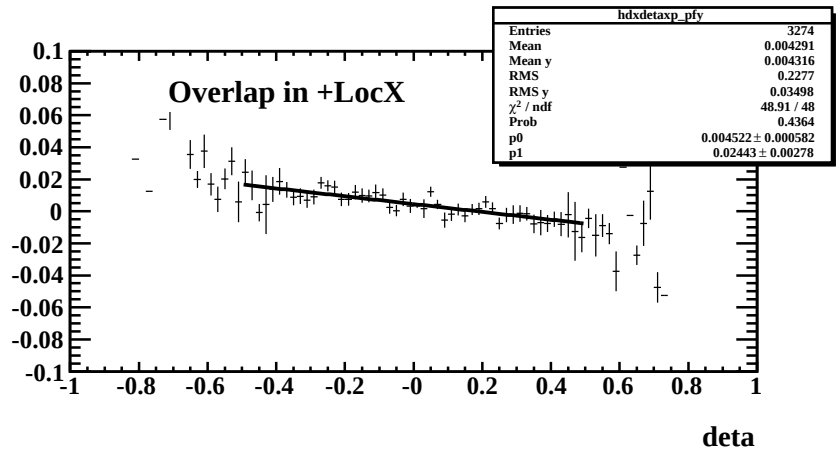
- In fact, it can be measured with cosmic overlap hits: Δx_{ana} vs $\Delta\eta$

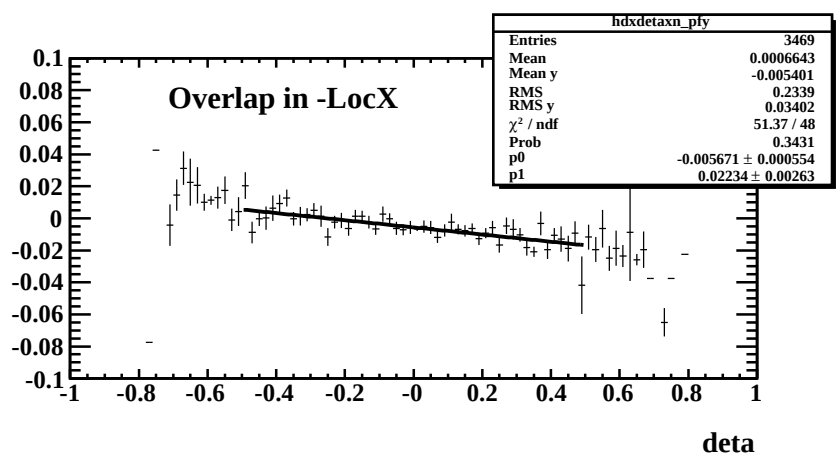
Overlap Residual vs $\Delta\eta$



- Overlap residual vs $\Delta\eta$ (top in +LocX, bottom in -LocX)
- There are lots of overlap clusters with $\Delta\eta = 0$

Determination of k factor





- Profiling residual gives a slop of about 25 μm, which gives k about 35 μm
- Interesting, there is 5 μm offset, but opposite sign for +LocX and -LocX.
- Will work on this more once two new students up to the speed.

Pixel Offline Analysis for EndcapA Cosmic Data

- Introduction – Attilio
- EndcapA Cosmic Setup – Marian/SuDong
  - Hardware, trigger and realistic Monte Carlo
- Tracking Studies – Weiming/Marian
  - Tracking algorithm, Data and Monte Carlo studies
- Noise Studies – Ariel/Christoph/Georges/Daniel
- Pixel Clustering Studies – Tommaso/Weiming
- Alignment with Overlap Residuals – Weiming
  - Techniques, Results, Comparison with Survey
- Lessons Learned and Future Improvements – Attilio
- Conclusion