

Track reconstruction with 1D hits

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Alignment and track reconstruction

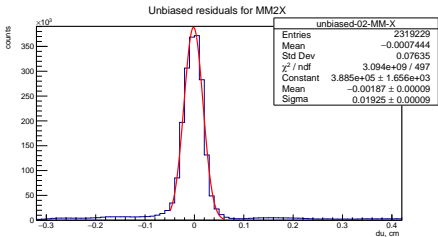
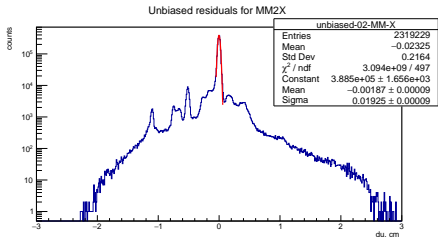
Two different straightforward tracking schemes were involved:

1) Linear interpolation of the form $k \cdot z + a = x$ where z, x correspond to hits on MM1X,3X (*pivots*). Used to center MM2X wrt pivots based on its unbiased residuals

$$dx = x_{MM2X,interp} - x_{MM2X,measured}.$$

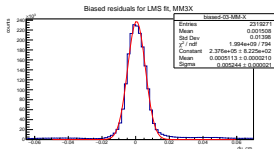
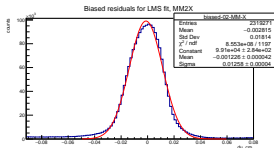
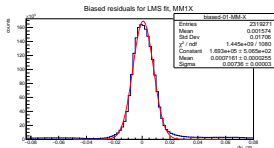
2) Linear approximation of the same linear model, but k, a were found with LMS (Eigen3's QR decomposition). Used to obtain more stable track approximation based on MM1X,2X,3X and extract unbiased residuals on STs.

Linear fit and unbiased alignment



- A rather rough alignment can be done by manual adjustments of the MM2X plane position guided by the unbiased residuals plot.
- This is *NOT* a statistically-reliable procedure, but with current level of cluster reconstruction should provide a precise enough estimation of the plane position
- Expected resolution should be $250\mu\text{m} / \sqrt{12} \simeq 70\mu\text{m}$

LMS fit and biased residuals



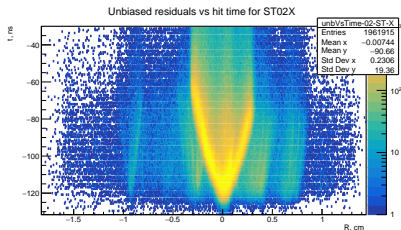
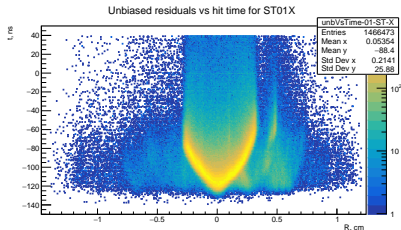
- Three planes provide *over-determined* system
- LMS fit is equivalent to Kalman filter (with LMS optimizer)
- LMS fit by 3 planes provides more reliable estimation of the track
- Biased residuals on MM planes confirms the alignment in general, yet false clusters still distort the picture

Methods

Linear fit
LMS fit

Results

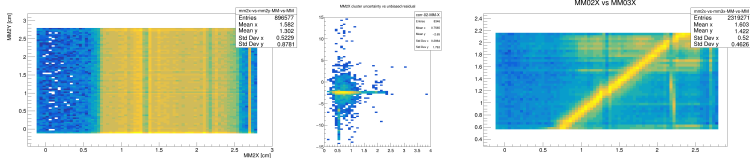
Conclusion



Representative $R(T)$ estimation can be then obtained as unbiased residual on STs *without* R built vs. time provided by hit. One can perform rough alignment of STs if guided by $R(T)$'s "tip" (T_0).

- Presence of side wings => false tracks reconstructed on false MM clusters;
- Not evenly populated L/R wings => misalignment by Z
- Presense of

Ways to improve



- False (ghost) tracks can be eliminated track finding. But at least realistic $R(T)$ is strongly required. Improvement on clustering would also greatly improve results;
- Improvement on uncertainty estimation should provide an opportunity for weighted LMS (impact is unclear);
- Y projection is required for angular and Z alignment.

Open questions

- Impact of m field?
- Pile-ups?
- Anisotropic smearing by T ?
- Time interlacing (probably, a binning artifact after float/int/float conversion).