Tracker-Field Systematics

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Contents

Studying the magnitude and significance of the effect of field misalignment and non-uniformity on the reconstruction.

What do expect on a track-by-track basis, and what will happen to the emittance reconstruction.

- How are we going to do it?
- What are the current results?
- What comes next?

Field Misalignment

This is the easier of the two effects. We can make MC models and arbitrarily move the tracker around.

We assume that the field uniformity is approximately correct and examine reconstruction parameters as a function of the angle of rotation.

Currently have two methods:

1. Reconstruct beam emittance and Compare with the true MC emittance,
2. Reconstruct individual tracks and compare the χ^2 distributions between Data, MC and a rotated MC.

Field Uniformity

This is slightly trickier - "uniformity" is not a well defined, injective function.

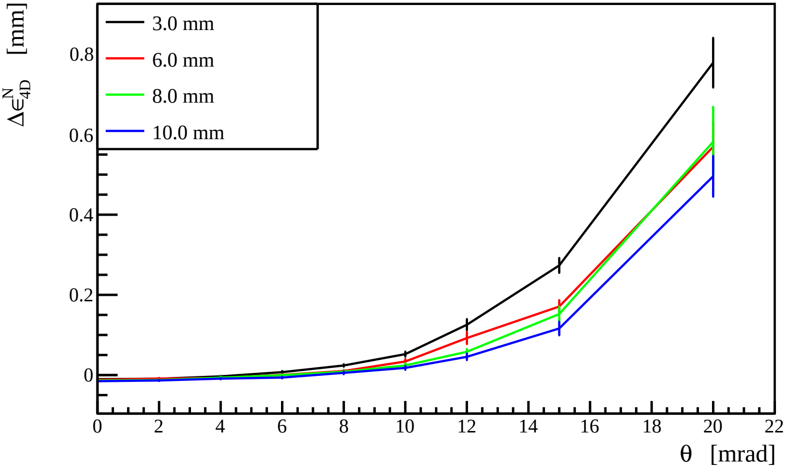
We may consider different field map models that are approximately similar to the real fields and plot how the reconstructed emittance changes for different beams.
This gives us an estimate for the magnitude of the systematic effect on the emittance calculation.

By using the results of Joe Langlands analysis within the misalignment estimation, we will hopefully be able to identify a field map that closely reproduces the real data reconstruction.

We can then use MC to provide estimates to correct tracks or amplitudes.

MC Study: Field Misalignment

Rotate the tracker and reconstruct the emittance difference.



MC-Data: Study Field Misalignment

Produce MC using CDB fields with rotated trackers and compare with the 8681 Data reconstruction.

DATA

Requiring the following:

- $34 < ($ TOF $0 \rightarrow 1$ time $) < 39$ ns
- Only upstream tracker
- No momentum selection
- No requirements on χ^2 or P-Value

MC

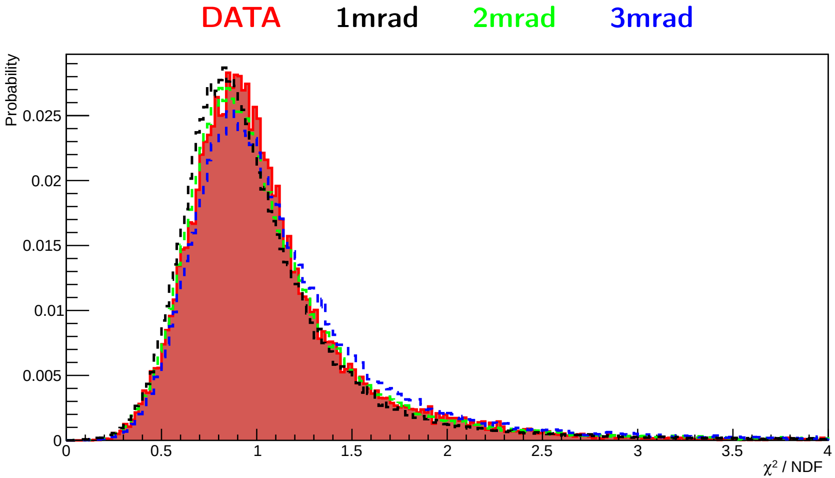
MC using CDB geometry was performed focussed on the tracker.

4 Different Beams used: 3, 6, 8, and 10 mm.

Tracker rotated by 1-2 radians per step

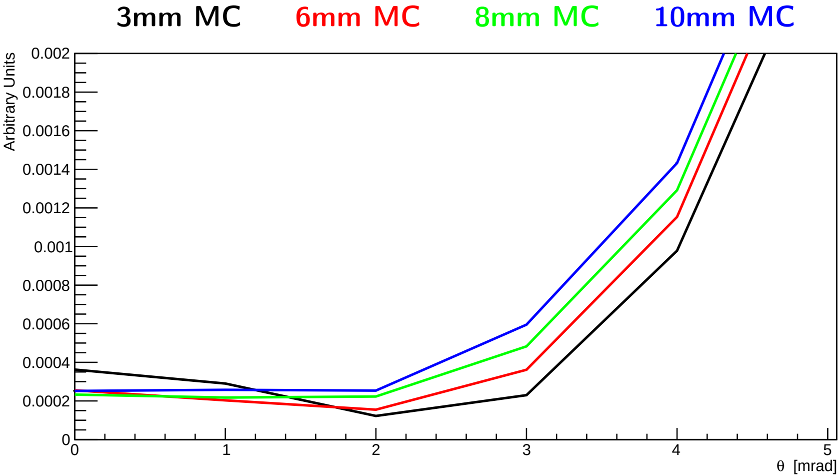
MC-Data: Study Field Misalignment

A Comparison of χ^2 values for a 3mm MC Beam



MC-Data: Study Field Misalignment

We can quantifiy the difference between the Data and each MC data set with an unweighted χ^2 summation.



Summary of Results

- Currently no sensitivity to field uniformity,
- χ^2 comparisons indicate that the upstream field-tracker alignment is better than 3mrad,
- There are still systematics to consider however:
  - Field map will change χ^2 distributions
  - Momentum selection may also change χ^2 distribution
  - Appears to be an amplitude dependence on the χ^2 distribution
- Good first attempt, can be extended to additional data sets as they are reconstructed.

Next Steps

- Need input from Joe - improved field maps.
- Compare Joe's field map to in-situ Hall Probe Measurements.
- Consider scaling factors to account for PRY? Maybe.
- Repeat the rotation analysis with different field maps.
- Perform MC bracketing field estimates - for maximum observable effect due to the field.
- Use MC to estimate a correction/systematic error based on the field field configuration.

Also need to look at pulls - possible direct measurement of field alignment.