

Quadrupole/TOF Alignment

Background & Motivation

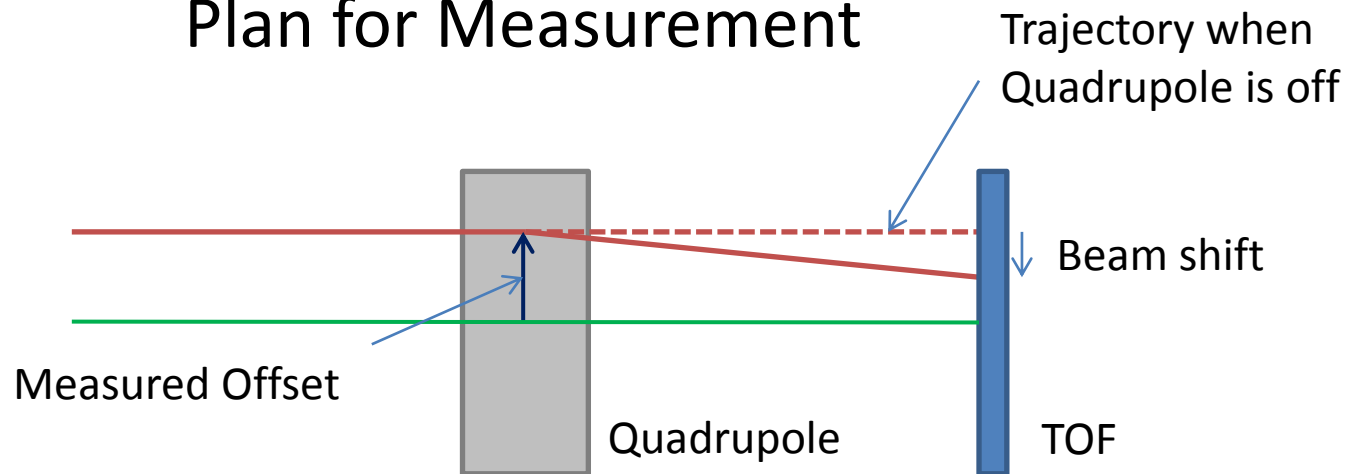
I have been looking for a study using pre-taken data to help improve my understanding of the Step I beam line which would also be of use to MICE.

Studying the alignment of the alignment of our quadrupoles has been on the wish list for some time, but needs a willing volunteer (me).

The quadrupoles were already aligned and surveyed (Note: 216) to better than 0.2mm but it would be nice to verify this using beam data...

Chris R has helped point me towards some data / a half baked plan from Step 1 running.

Plan for Measurement



If the beam is not aligned to the quadrupole, then on average it will receive a transverse kick proportional to the quadrupole current.

By varying the quadrupole current and monitoring how the beam position changes in a TOF then the size of the kick can be calculated. This will enable the position of the quadrupole to be calculated relative to the beam position.

Based on the beam size, distance to quadrupole and current scan size, it should be possible to measure the offset to a few mm. Note: Not as good as survey!

This procedure will need to be done for each quadrupole needing to be measured.

Plan for Beam Measurement



To measure the offset of the magnet in the real world, the position of the beam must also be known.

This can be done by turning off the quadrupoles and reconstructing the beam assuming the two TOF's are aligned. Meaning the study will now be relative to an axis defined by the two TOF counters.

From this data, it will be possible to estimate the position of the beam as it enters each quadrupole and therefore allow the quadrupole position to be found relative to this axis.

Things I'm Worrying about (so far):

1. TOF Position Resolution: Hopefully use Marks code to improve this.
2. Beam size: Its quite large, so will need a large number of particles to measure the centre well.
3. Momentum Spread: Need to keep this under control to understand position shift at TOF. Using Cuts will adversely effect #2.
4. Want to focus on centre of beam, more cuts.
5. Need to expand method to also include angular misalignment of Quadrupole.
6. Expanding study to Q456: Available data is mainly for Q789 (Runs 2796-2834 Summer 2010).

Next Steps:

- I want to try and setup some MC to help check my logic on the previous slides.