

Quality of the Step 4 Beam Transport

C Hunt, J Lagrange, J Pasternak

8th February 2015. CM41



Quality of Transported Beam

We need to:

1. Determine the sensitivity of our key measurements to misalignments in magnetic fields and detectors.
2. Determine if we can measure and account for any discrepancy.
3. Help provide an accurate and efficient set of methods for commissioning the cooling channel.
4. Make some damn fine plots!



Requirements

Analyse muon trackpoints at all 3 planes for all 5 stations in both trackers - Because we can!

- Compare mean beam position and momentum.
- Compare beam emittance and beta functions.
- What deviations can we measure?
- What deviations can we deduce?
- What deviations are unknown systematic errors?



The Script

This is made and very nearly tested.

- Selects track points randomly for each track so that each plane contains data from a completely unique set of tracks so we avoid measurement bias.
- Using reconstruction data only - no knowledge of Monte Carlo.
- Calculates emittances, beta functions, position and momentum means and spread.
- Can compare different geometries to see what happens to our measurement variables.

Still need to implement the reverse calculation. i.e. Can we deduce what causes our shift in emittance/beta function?



Simulation Plan

Designed to be representative of what we want to deduce from data.

1. AFC Translations
2. AFC Rotations
3. SSD Translations
4. SSD Rotations
5. Combined AFC & SSD Translations
6. Combined AFC & SSD Rotations

Each simulation will have 3 deviation magnitudes, each with 100 simulations at a gaussian distribution of deviations.

This should provide an estimate of our sensitivity to such effects.



DISCLAIMER

No significant data sets have been produced owing to a recently discovered bug in the simulation software.

(Approx 3 Days ago. . .)

The running scripts are implemented and tested.

The analysis is nearly finished and well tested.

As soon as the bug is fixed we can flood the Imperial Batch System and produce our datasets. Approx 1 week.



Example Data Set

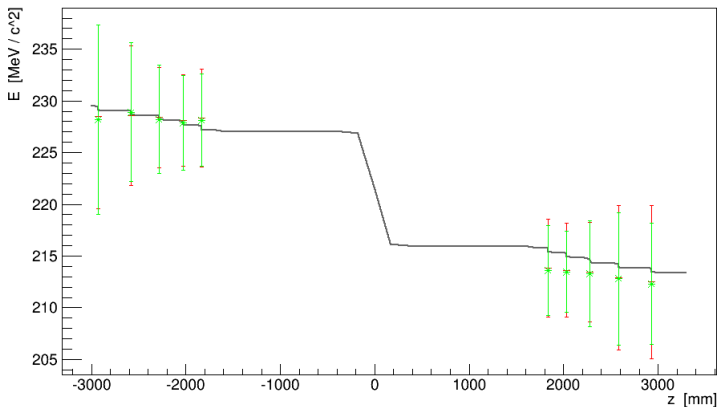
Only have one simple data set as an example:

- AFC Rotation about X-axis by 5 Degrees
- Compared with Virtual Planes Reconstruction and the Base Reconstruction (no rotation)
- **RED** points are from the unrotated geometry
- **GREEN** points are from the rotated geometry

Composed of approx 15000 muons for each dataset.



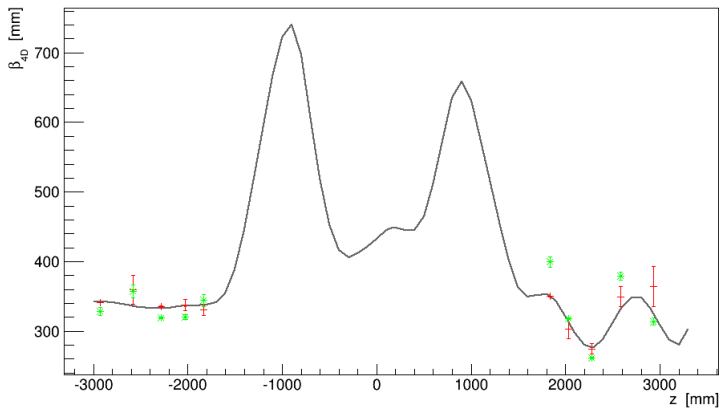
Energy



Preliminary



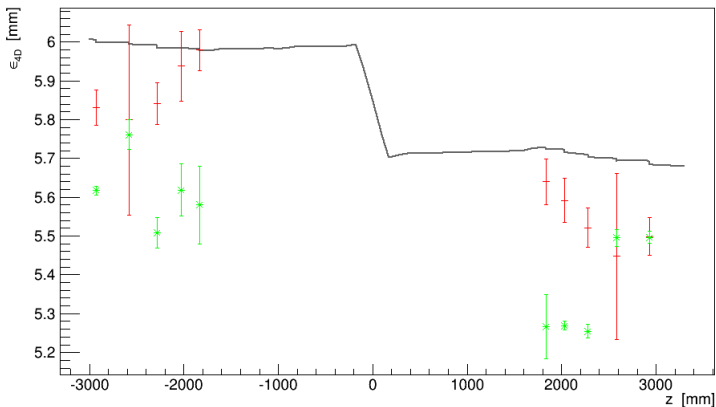
Beta Function



Preliminary



Emittance



Preliminary



Data Required

Tracker alignment will orient our trackers with respect to each other. So we may guess what (if any) deviations the magnetic field will have.

Its likely that we will only need 1-2 beam settings to compare with the simulation.

However part of the commissioning may also include individual magnet pertubations. Something else we can compare with simulation.

