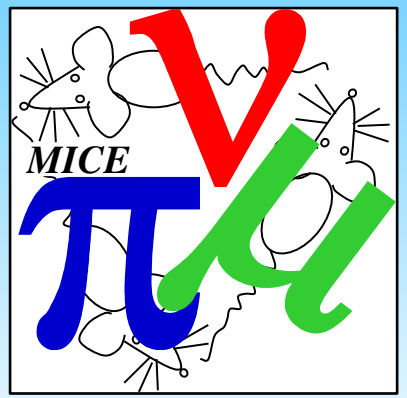


Tracker Alignment, Efficiency and Resolutions.

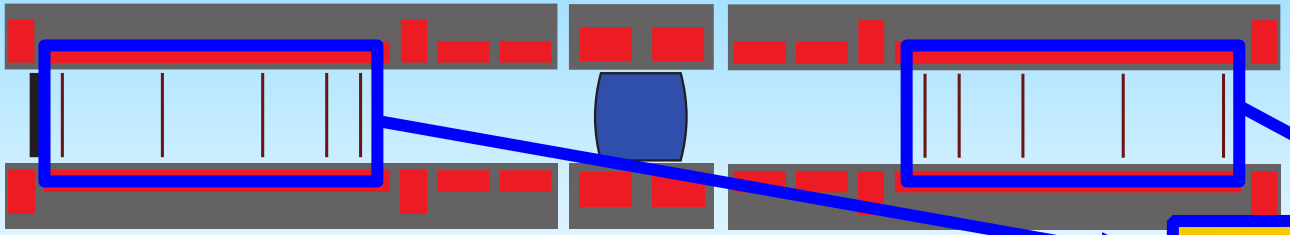
C. Hunt, P. Kyberd, E. Overton, C. Heidt, J. Nugent
+ many others!

christopher.hunt08@imperial.ac.uk

Contents

An overview of the tracker comissioning and reconstruction activities since the last CM.

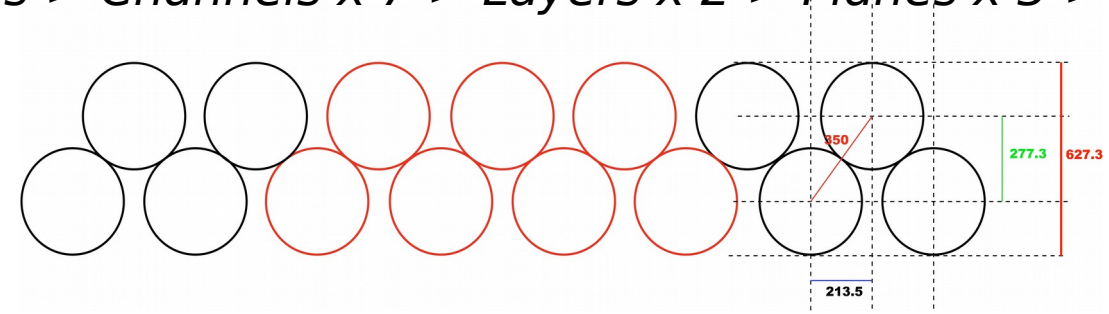
The MICE Trackers

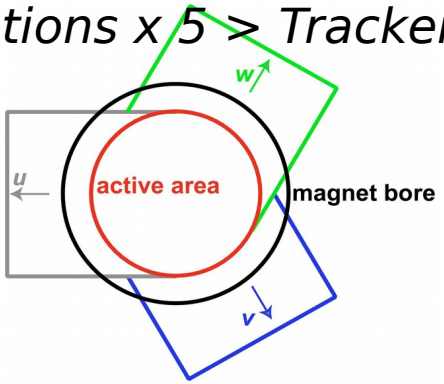


The critical measuring device in the emittance reconstruction.

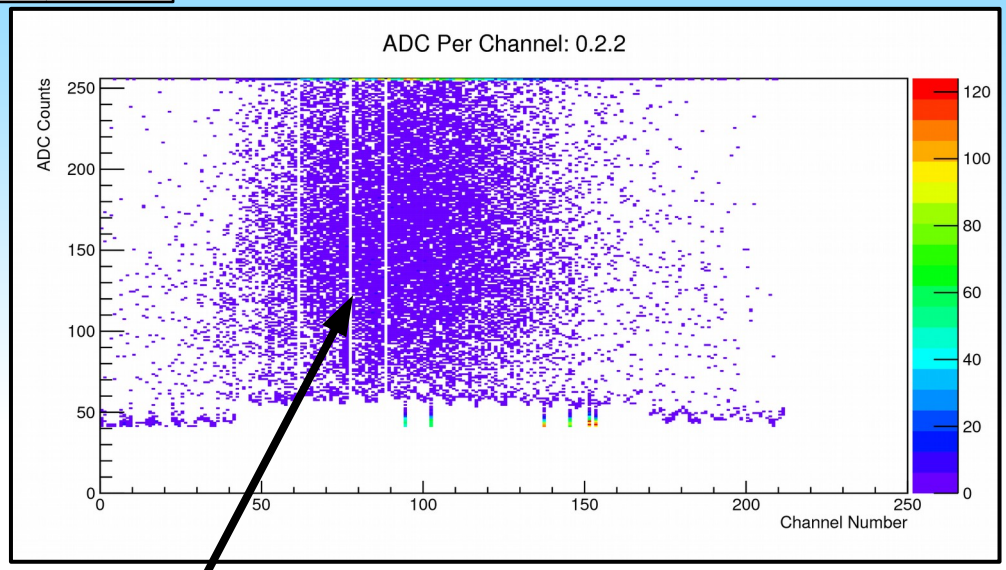
Now installed, cabled, calibrated and working!

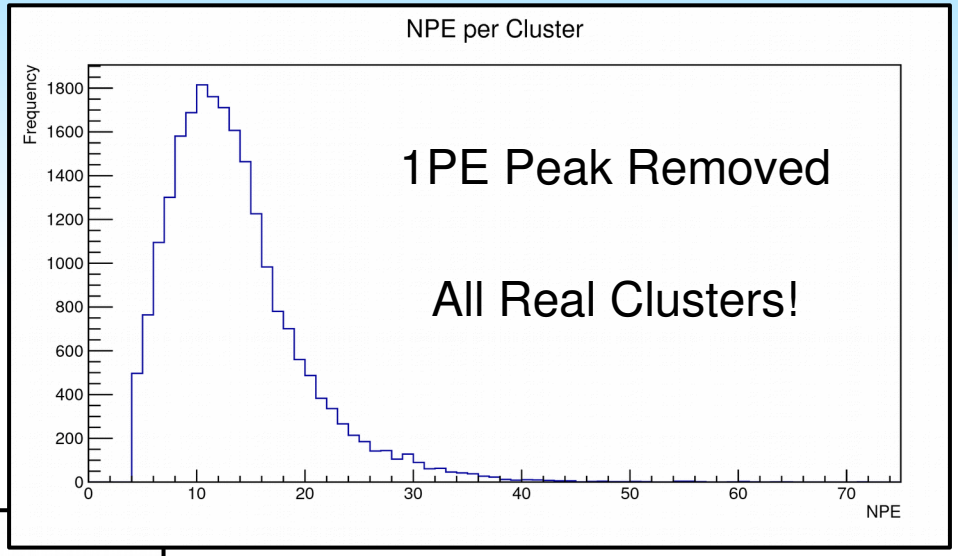
Fibers > Channels x 7 > Layers x 2 > Planes x 3 > Stations x 5 > Trackers x2

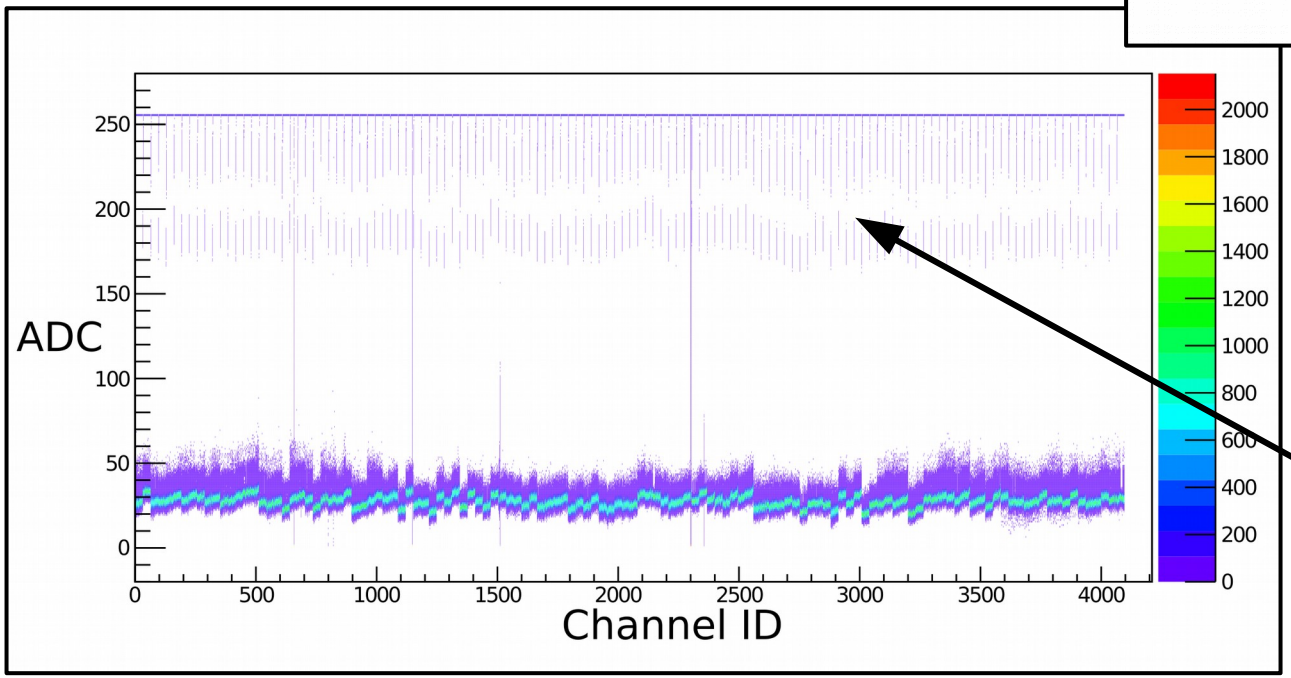




Front End Comissioning



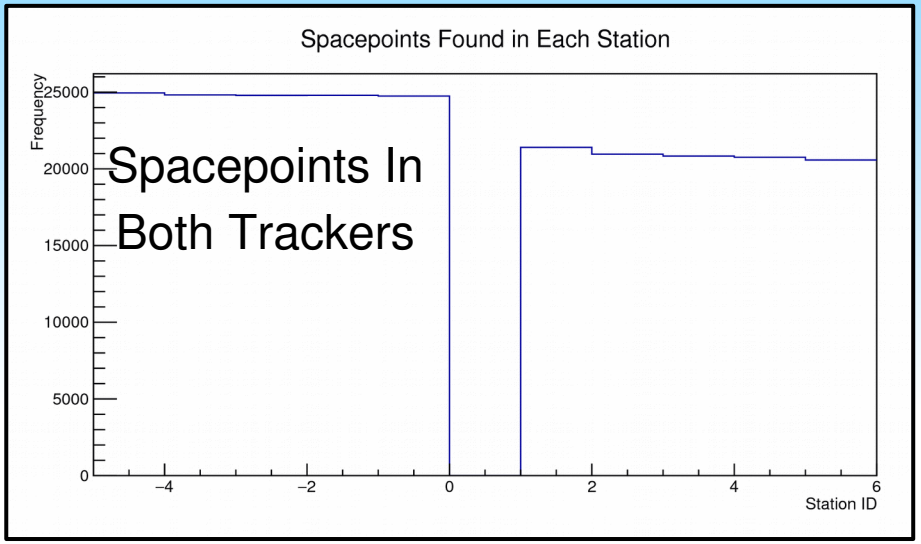


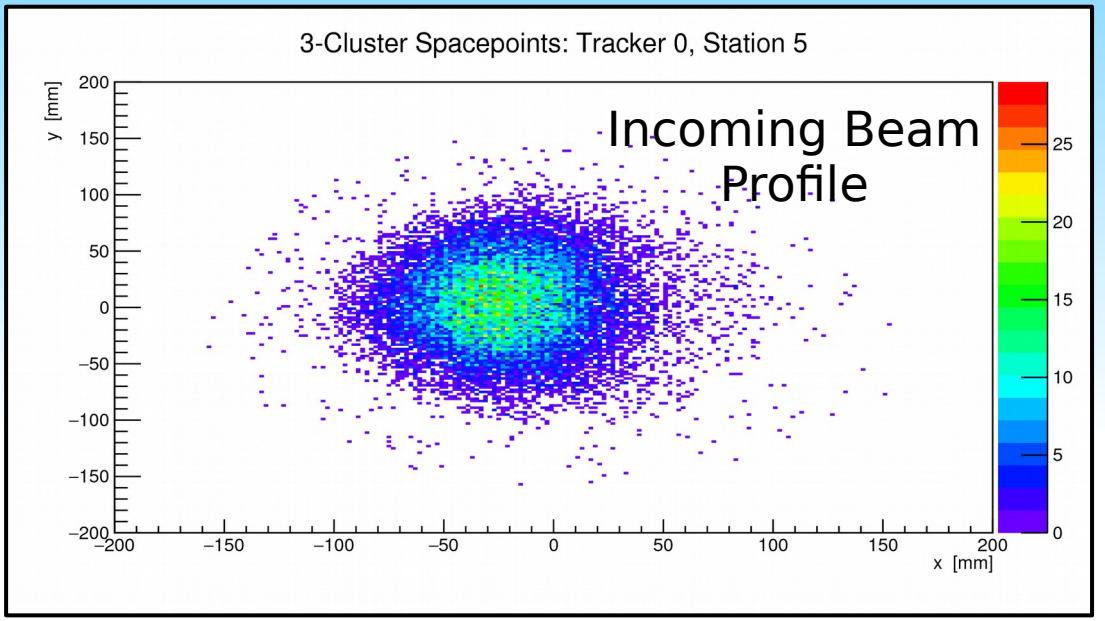


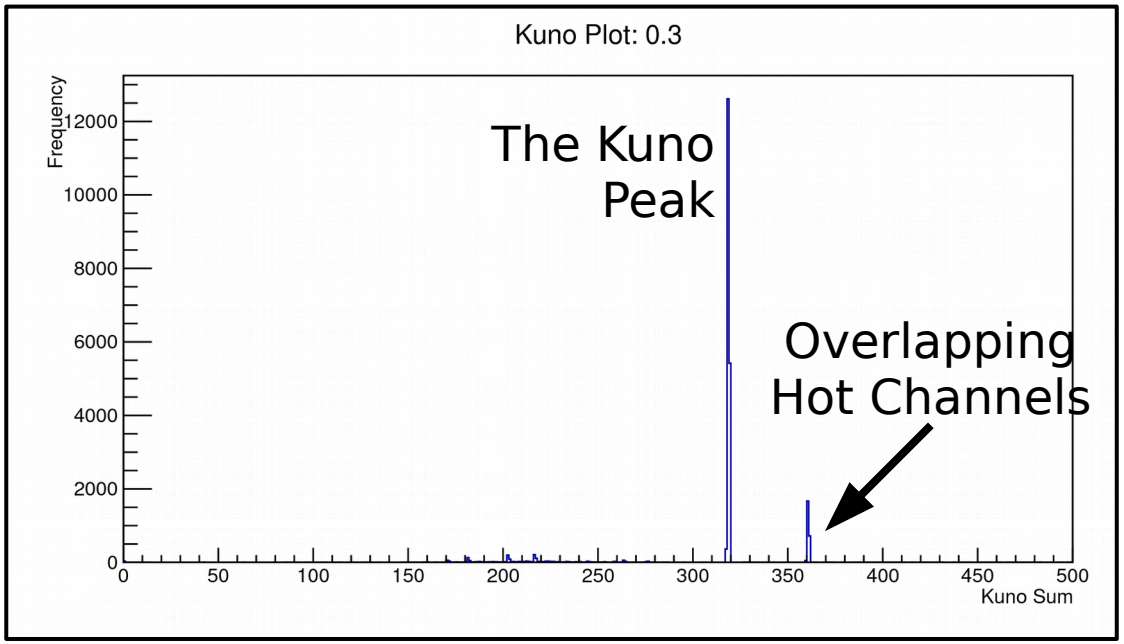
One Tracker's worth of channels!

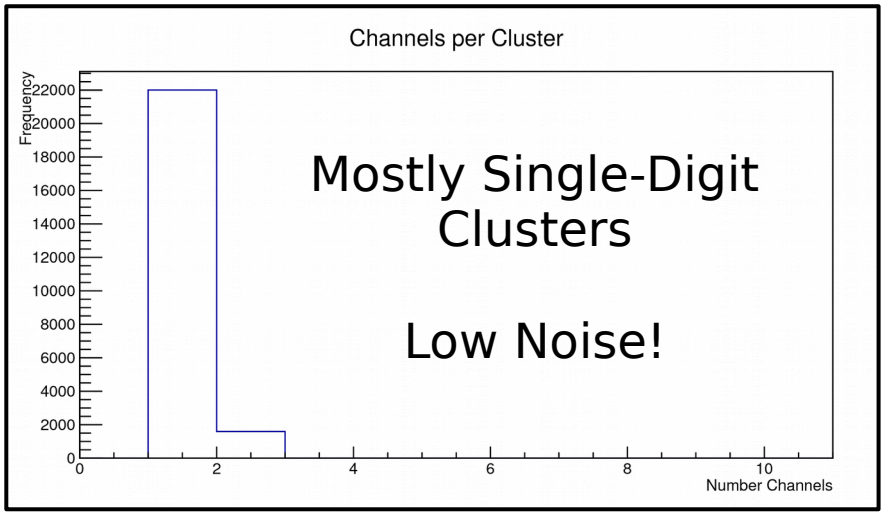
Readout Window bug identified and fixed!

Low Level Reconstruction





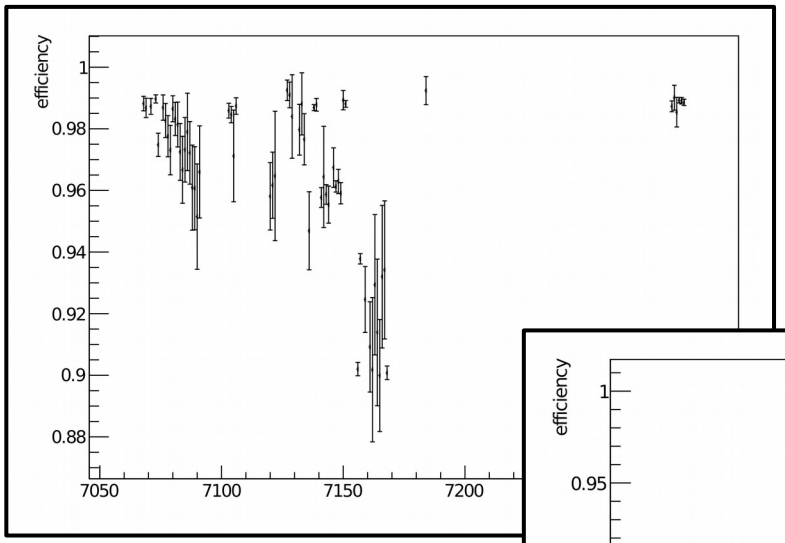




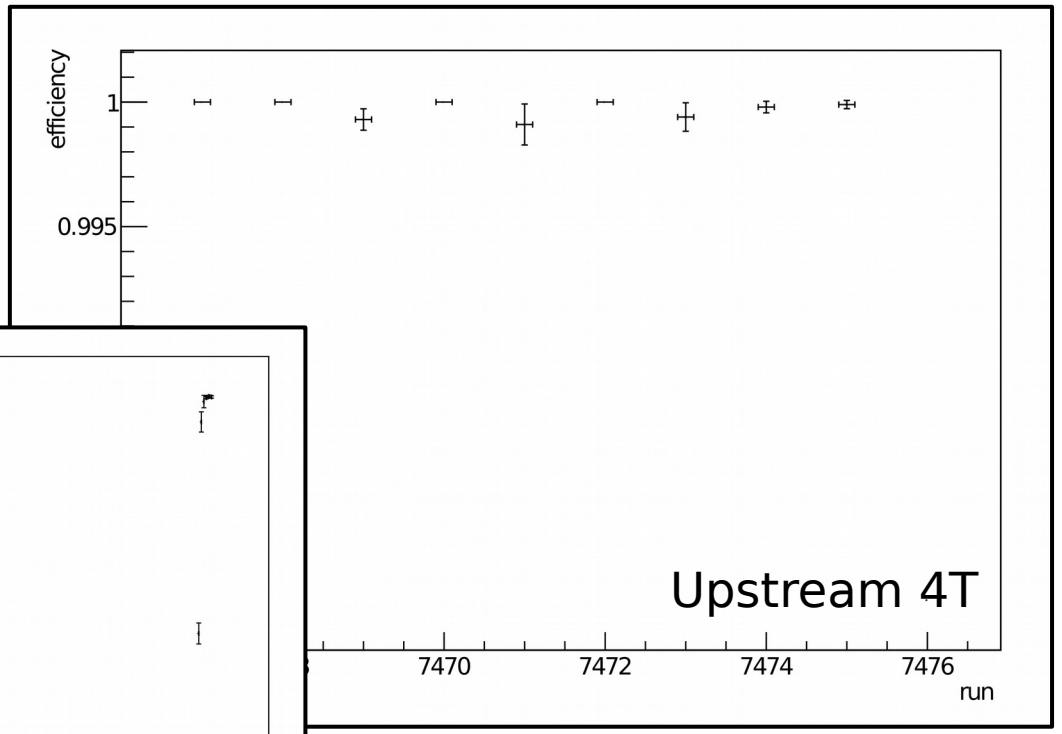
Efficiency Calculations

MC estimates of ideal track finding and reconstruction efficiency being produced.

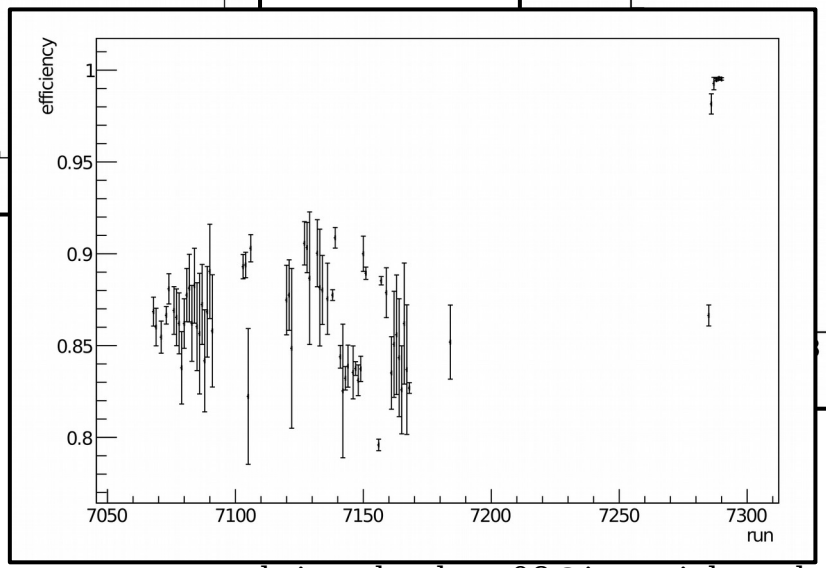
P. Kyberd looking at data-driven efficiency calculations.



Upstream No Fields



Upstream 4T



Downstream No Fields

PRELIMINARY

Tracker Comissioning

So where are we?

- Hardware is in, and in good shape
- The DAQ is working and very nearly complete
- Comissioning needs finishing
  - *Validate calibrations*
  - *Validate “bad channel” treatment*
  - *Finish data comissioning*
- Software is being developed
  - *Many powerful scripts and analyses*
  - *Currently being combined, focussed and centralised*
  - *Jobs are known and a schedule is being finalised*

A lot of work from the tracker group and Melissa has gone into the organisation and management of the remaining tasks

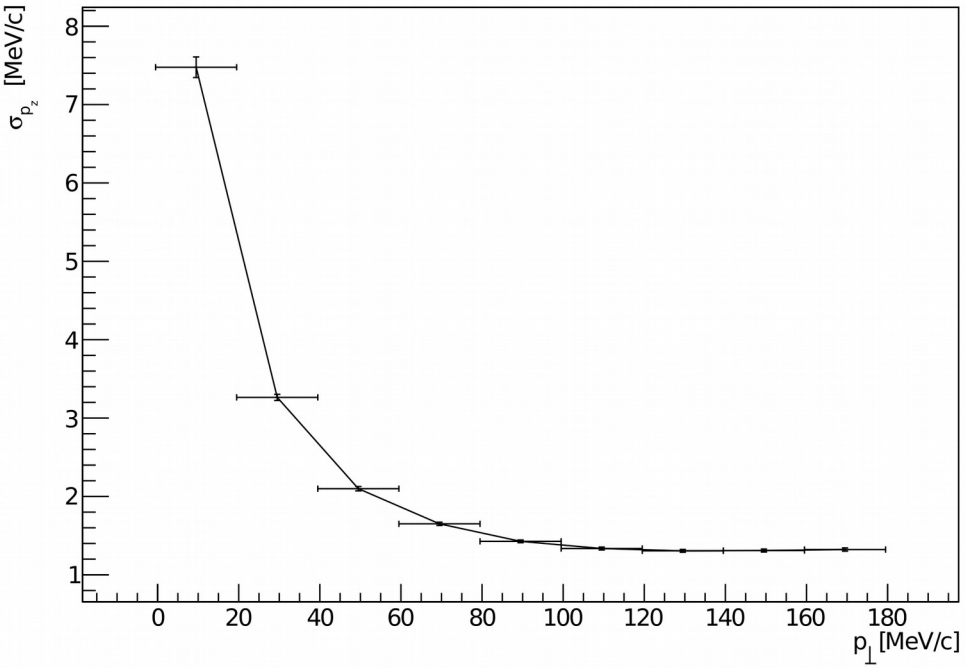
Tracker Resolutions

Monte Carlo Studies of Ideal Tracker Geometries with perfect fields.

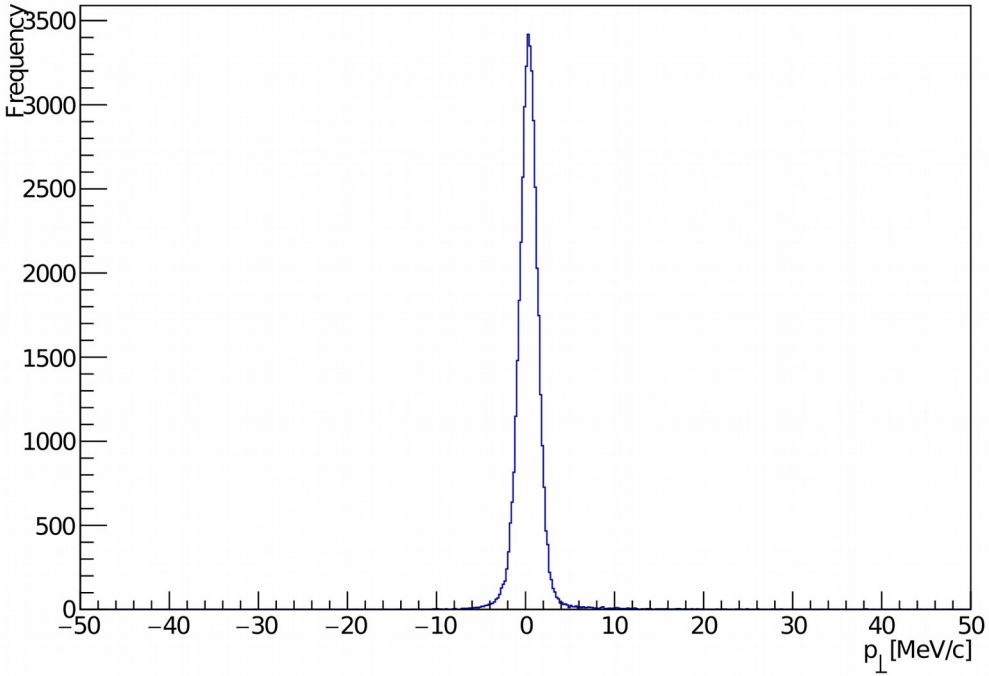
For Perfect Baseline (4T Fields) the results are in!

Nominally: Pt Resolution = 1 MeV/c Pz Resolution = 1-3 MeV/c

Upstream Pz Resolution



Upstream Pt Resolution



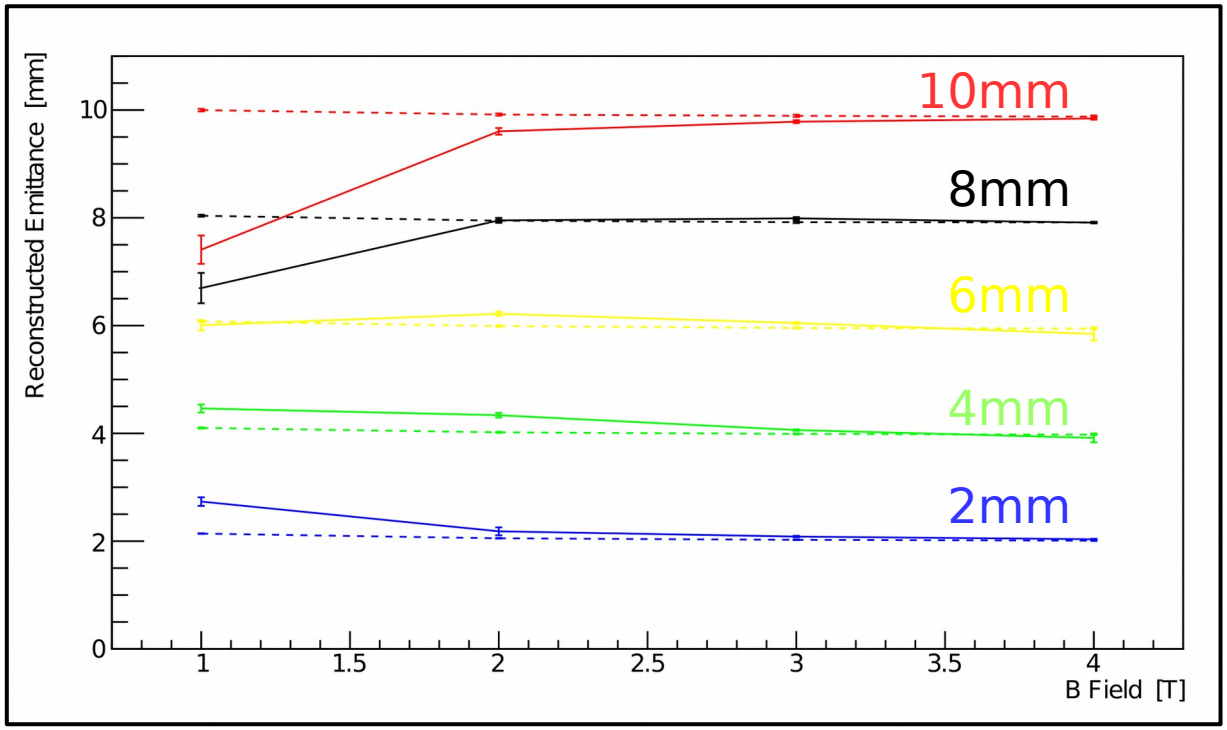
Tracker Resolutions

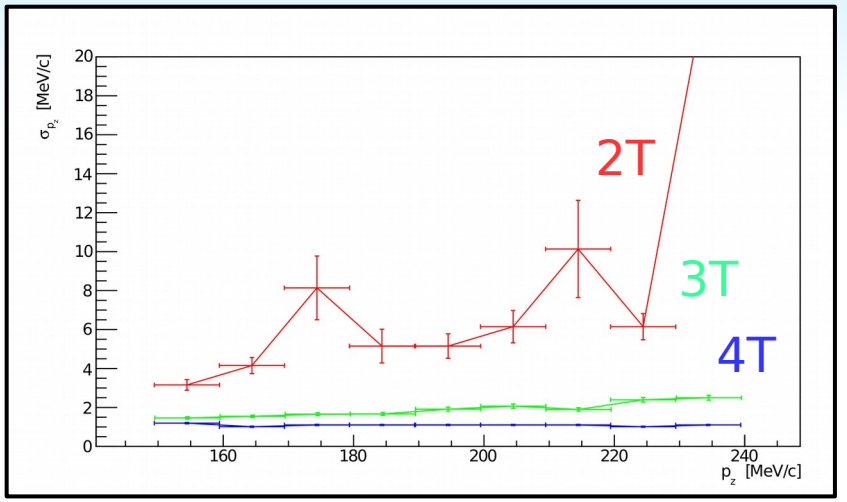
Different optics may require different field strengths.

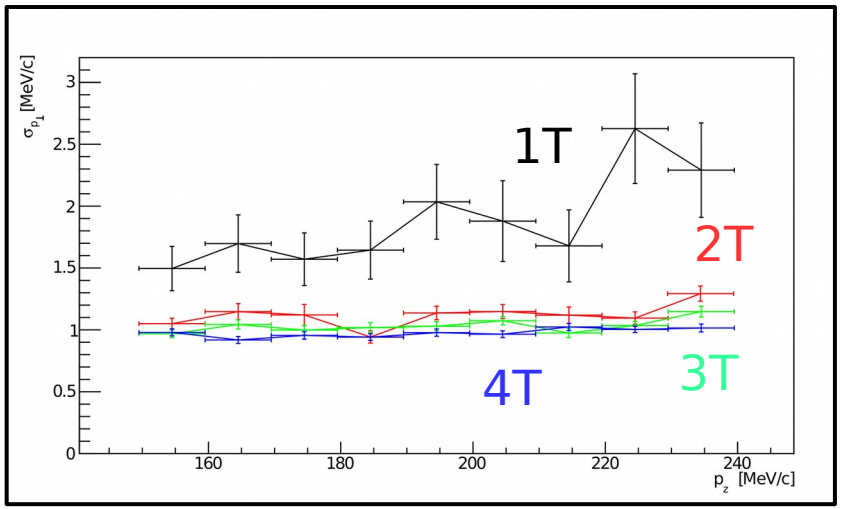
Studies already underway!

- Pt Resolution remains good
- Pz Resolution becomes terrible
- Complex effects on emittance to investigate

PRELIMINARY







Straight Track Alignment

Two parallel methods currently being used.

Standard tracks:

- Uses full Kalman fit
- Dependent on whole reconstruction chain
- Can test the track fit as well as the alignment
- In house, simple and fast

Millipede:

- Well validated by other experiments
- Very powerful - can align everything in one pass
- No requirement on existing track fit
- Excellent comparison to existing methods

Straight Track Alignment

Straight Track Method

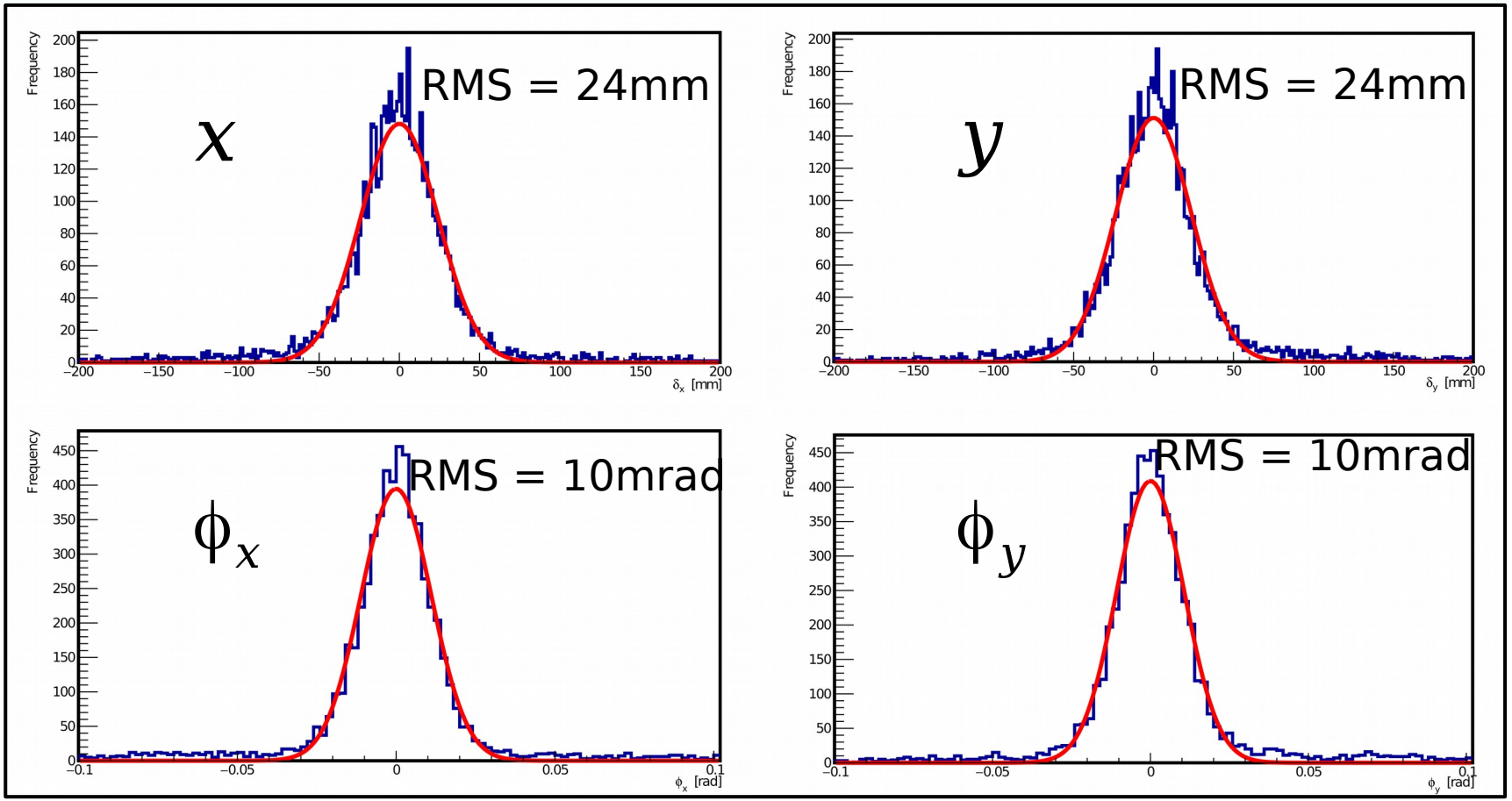
- Note being written
- Agreement with MC

Downstream Reference Plane wrt. Upstream Reference Plane.

$\Delta_x = -5.03 \pm 0.25$ $\Delta_y = 21.33 \pm 0.25$

$\Phi_x = -1.12 \pm 0.12$ $\Phi_y = 2.92 \pm 0.11$

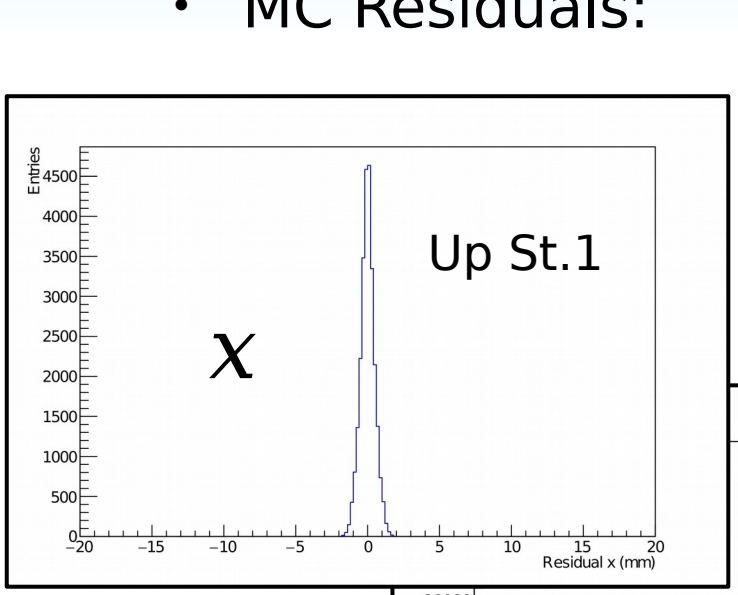
(mm & mrad)

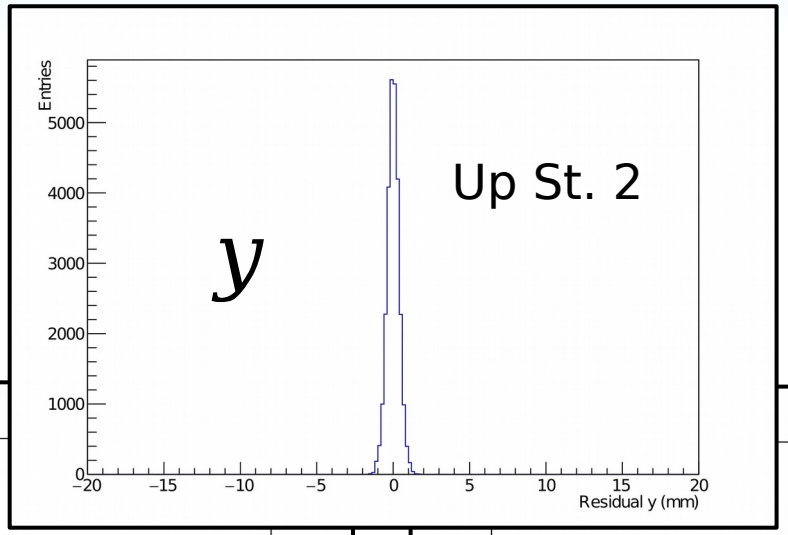


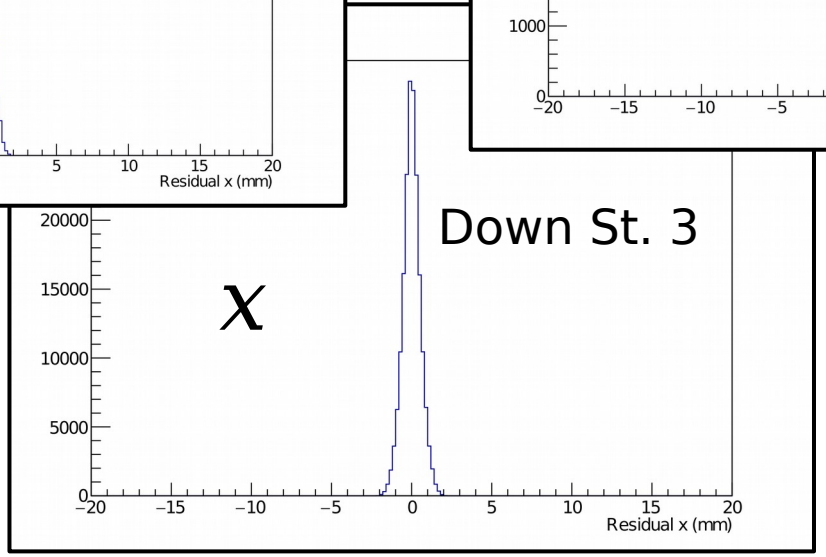
Straight Track Alignment

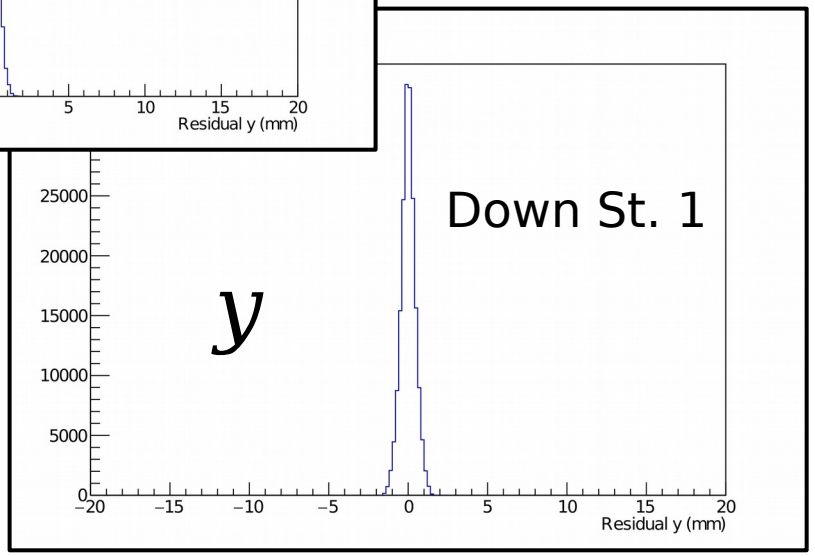
Millipede Method

- Under development by John Nugent
- Currently reproducing the tracker CMM measurements
- MC Residuals:









Straight Track Alignment

Still some issues to address...

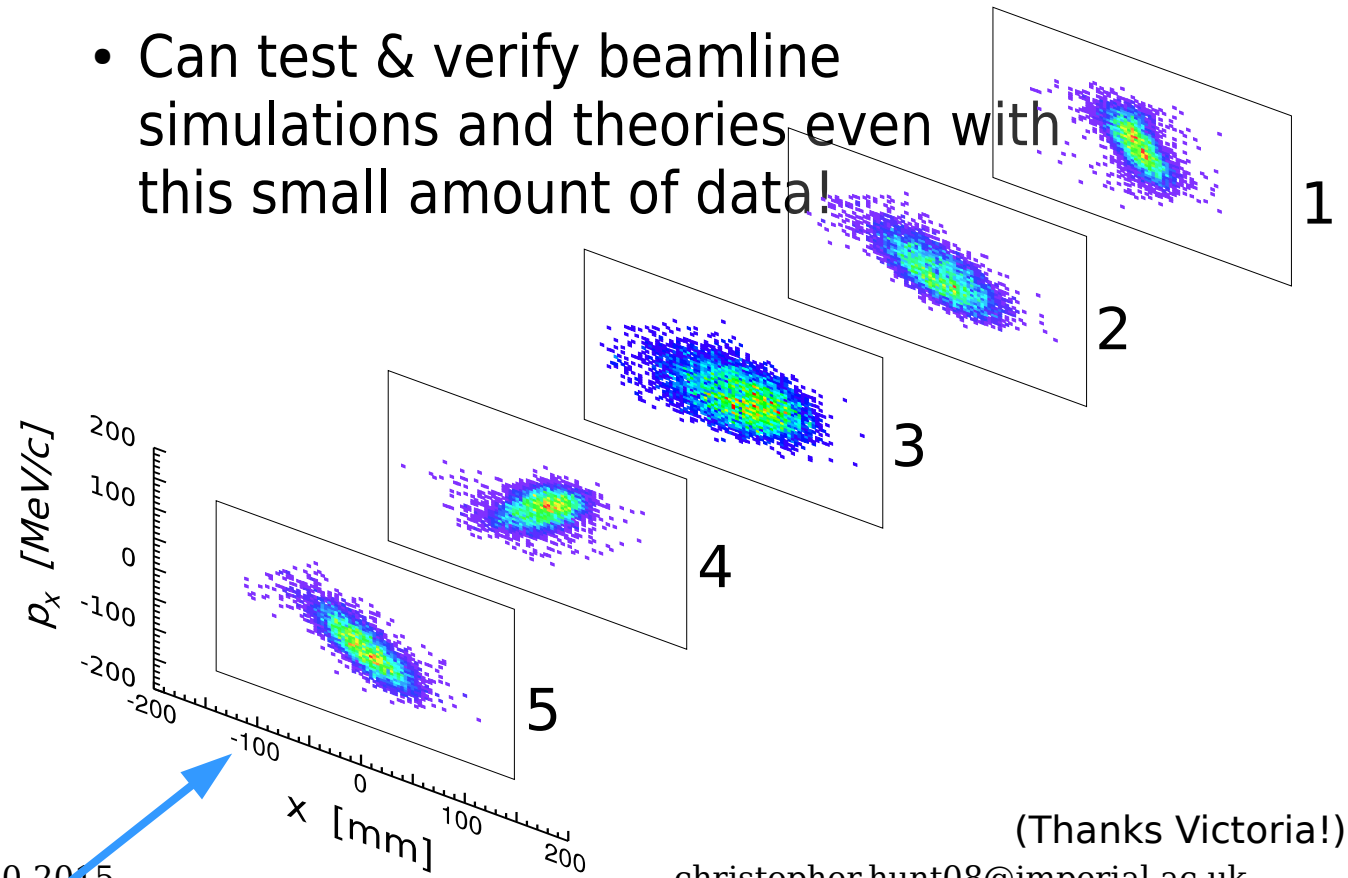
- Millipede:
  - *Downstream Stations 4 & 5 have issues with residuals*
  - *Currently processing data*

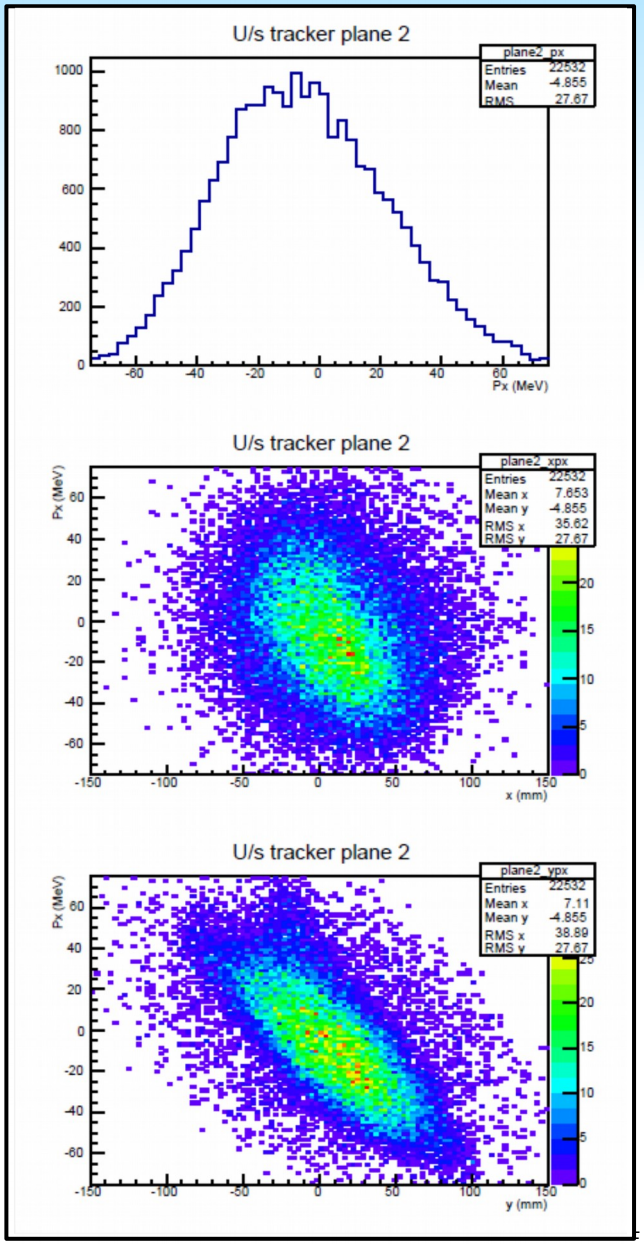
- Kalman Tracks
  - *Errors need validating*
  - *Comparison with other runs shows some discrepancy*
  - *Issues with geometry and other detectors*

Helical Reconstruction

We have helical track reconstruction with Nominal Settings in the upstream tracker.

- Some analysis has been performed
- Bugs have been found and are being fixed
- Can test & verify beamline simulations and theories even with this small amount of data!



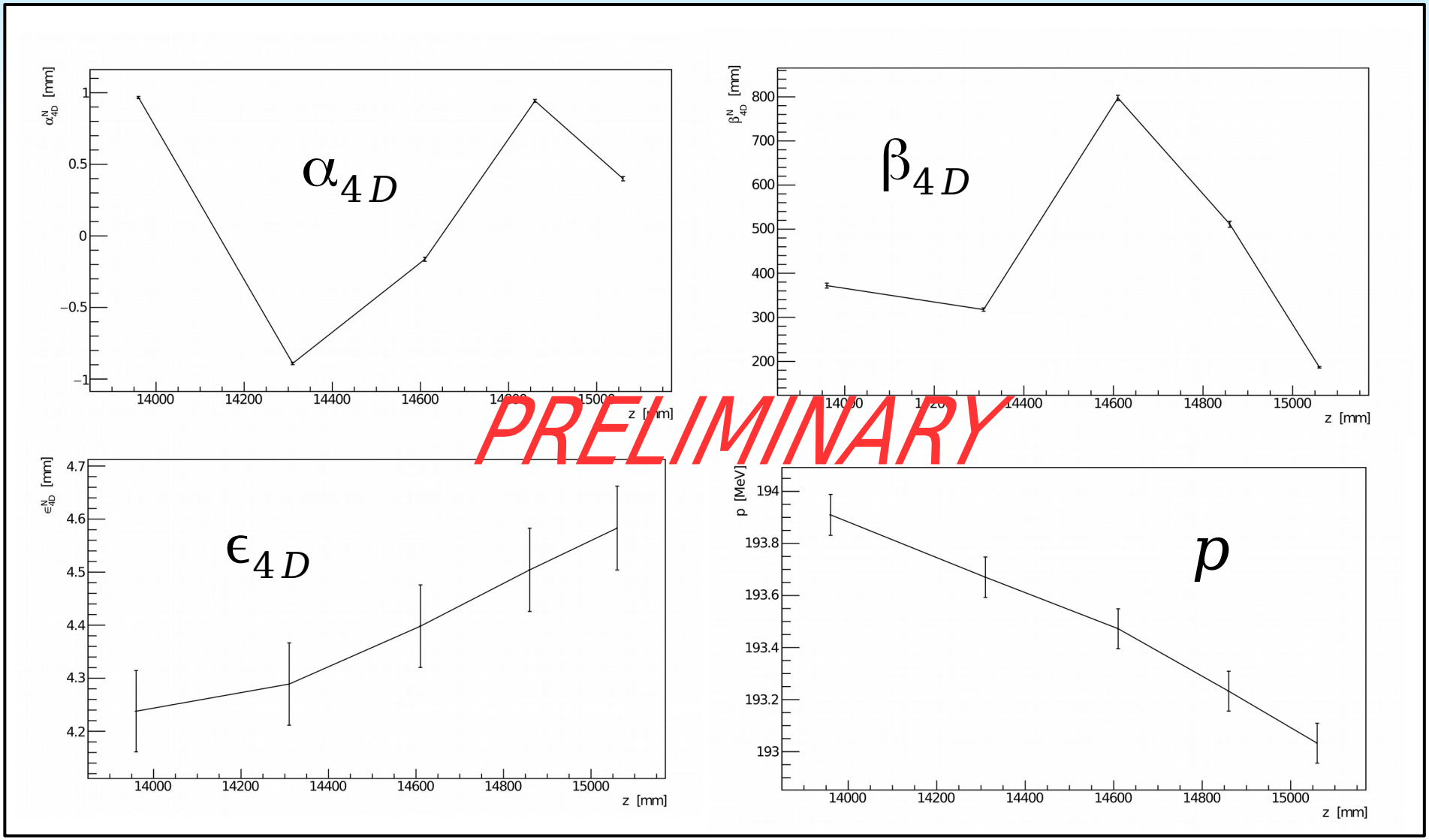


(Thanks Victoria!)

christopher.hunt08@imperial.ac.uk

Helical Track Reconstruction

Some detailed analysis has been attempted. Currently being checked with theory.



Helical Track Reconstruction

There's still a lot to do!

- Kalman Helix Fit isn't finished. This causes a lot of the issues we found
- Still experiencing geometry issues due to lack of man power – but nearly resolved
- Systematic errors still a huge concern
- Comparisons with Theory & Batch MC required

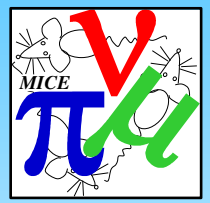
But...

This is a geniune emittance measurement from single reconstructed muons.

In Summary

- Found many bugs and several issues. They are being addressed
- Tracker resolutions are being developed and understood
- Tracker efficiencies are being calculated
- Straight tracks are being used for alignment
- Helical track data has been taken and is being analysed.
- Tracker software paper is acquiring the final plots

The Target: All finished by next CM



Thank you for your attention.

Questions?