Descope Resolution Analysis

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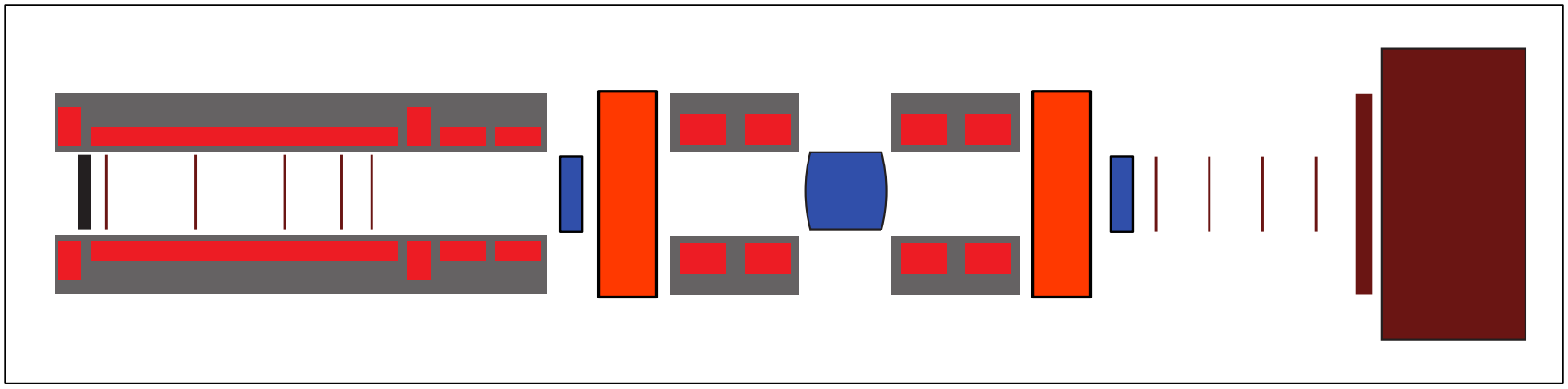
What We Have



- Upstream reconstruction performed with Upstream Tracker
- Downstream reconstruction performed with Downstream Tracker + EMR
- TOF calculations may be used to improve momentum reconstruction

The Simulations

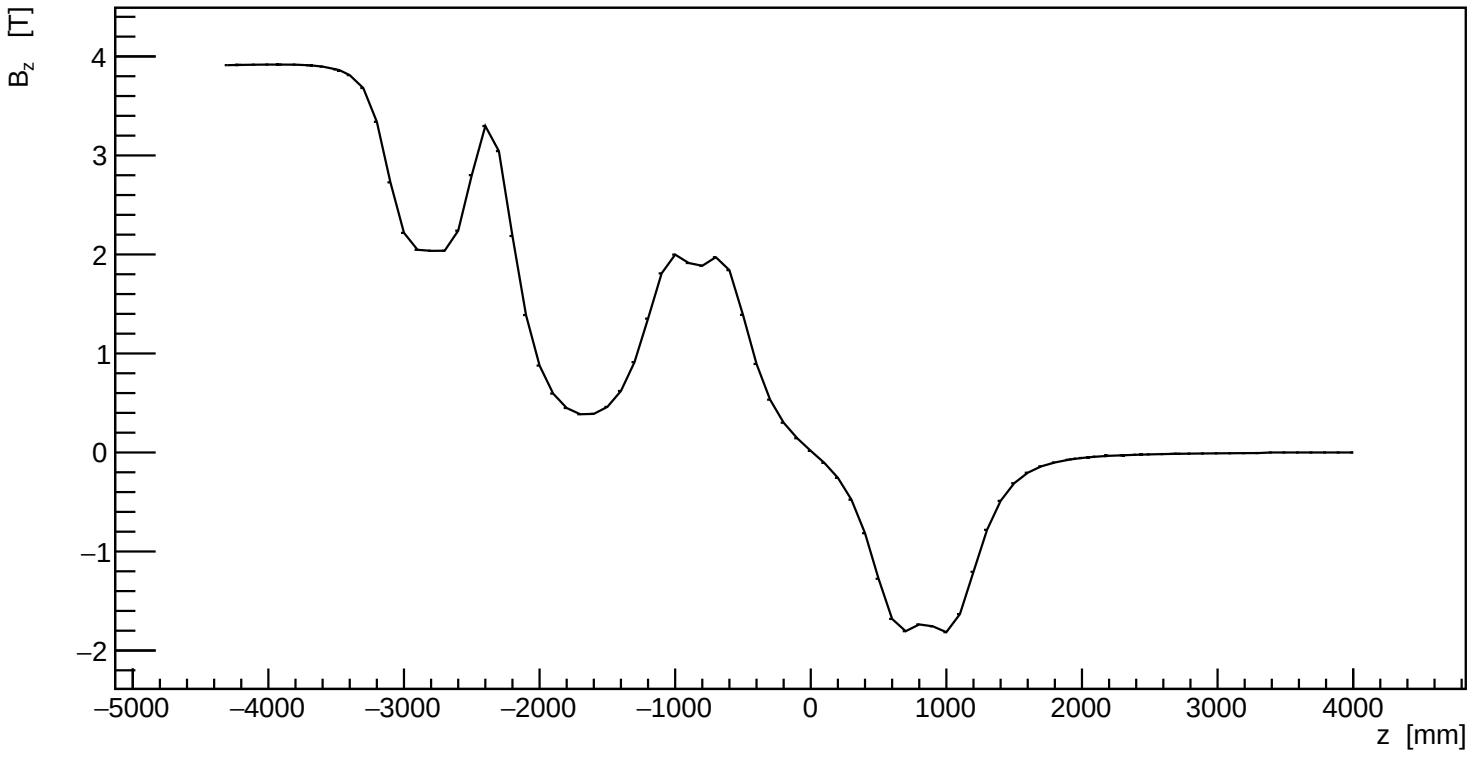
Test Runs

- Geometry straight from Chris R - new tracker + good estimates for module placement.
- Pencil beam with $p = 200$ MeV/c
- 4mm Transverse Emittance

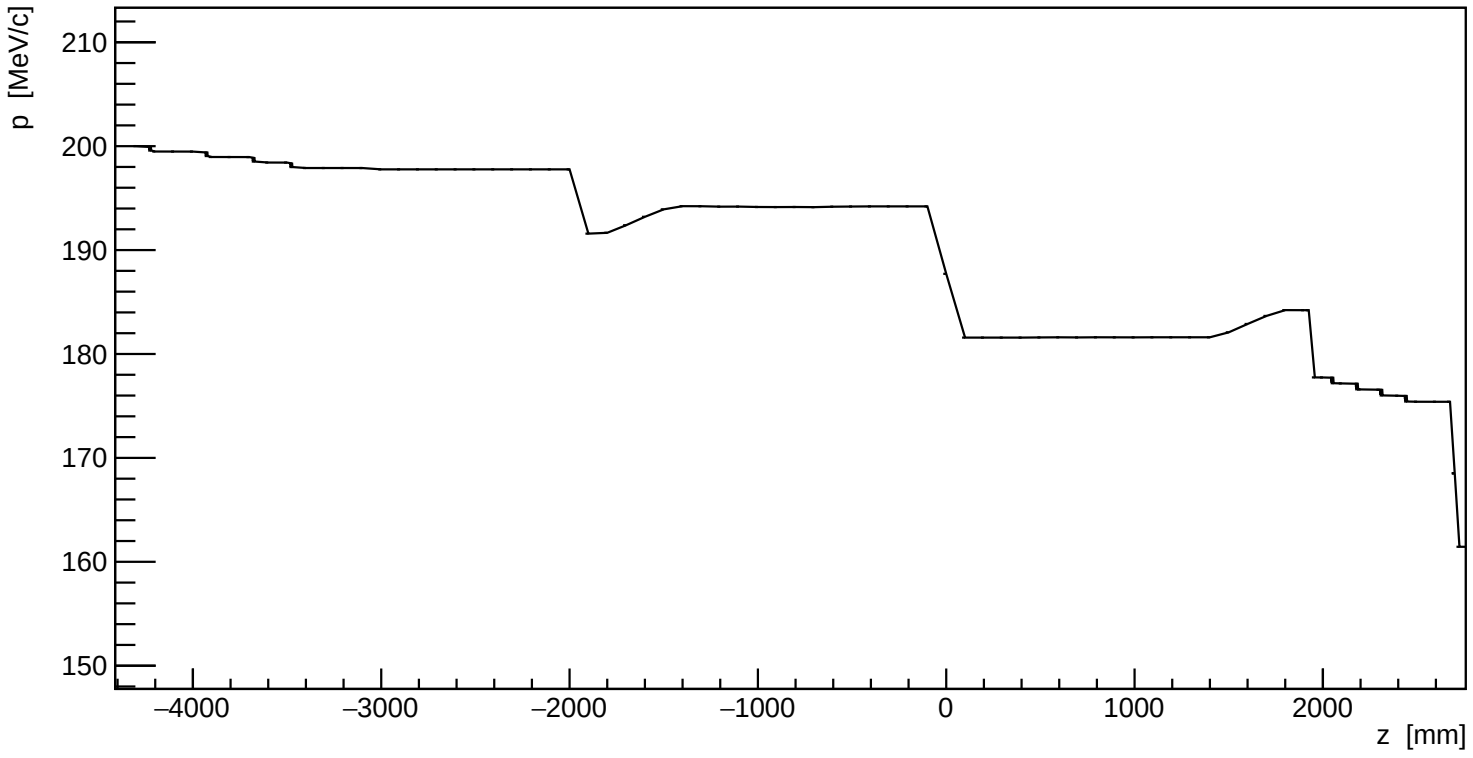
Systematics Studies

- Same geometry
- Beam with uniform distirbution in momentum (140-260 MeV/c) (I think?)
- 4mm Emittance Transverse components - Optics don't matter for this bit!

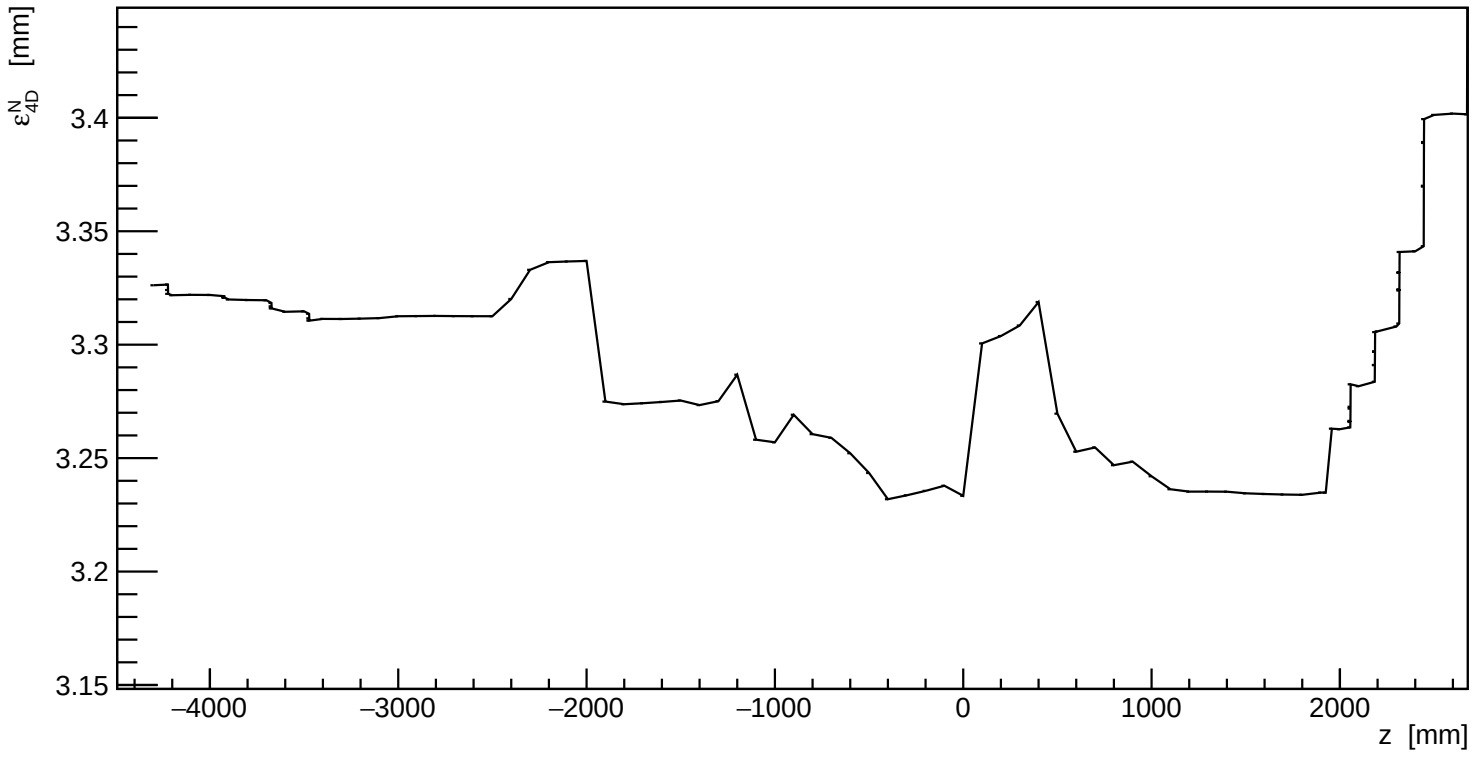
Magnetic Field



Momentum


p [MeV/c]
210
200
190
180
170
160
150
−4000
−3000
−2000
−1000
0
1000
2000
z [mm]

Emittance


ε_{4D}^{N} [mm]
3.4
3.35
3.3
3.25
3.2
3.15
–4000
–3000
–2000
–1000
0
1000
2000
z [mm]

The Reconstruction

Upstream Reconstruction is the standard helical track reconstruction.
We know what that looks like.

Downstream reconstruction was a little trickier:

- EMR provides total momentum, way downstream of tracker
- Tracker on provies a gradient reconstruction
- Two measure must be combined to form p_x and p_y estimates.

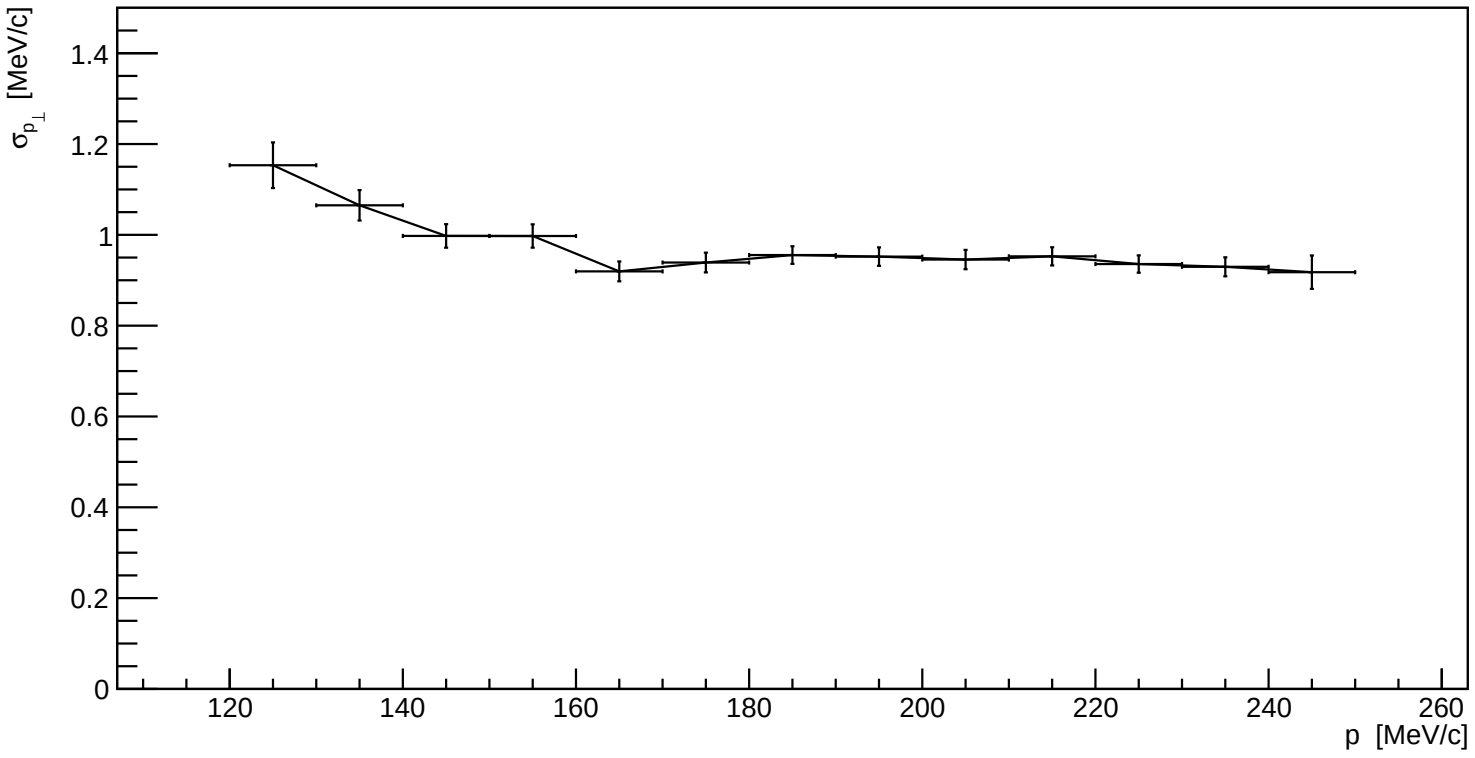
The Reconstruction

How I did it:

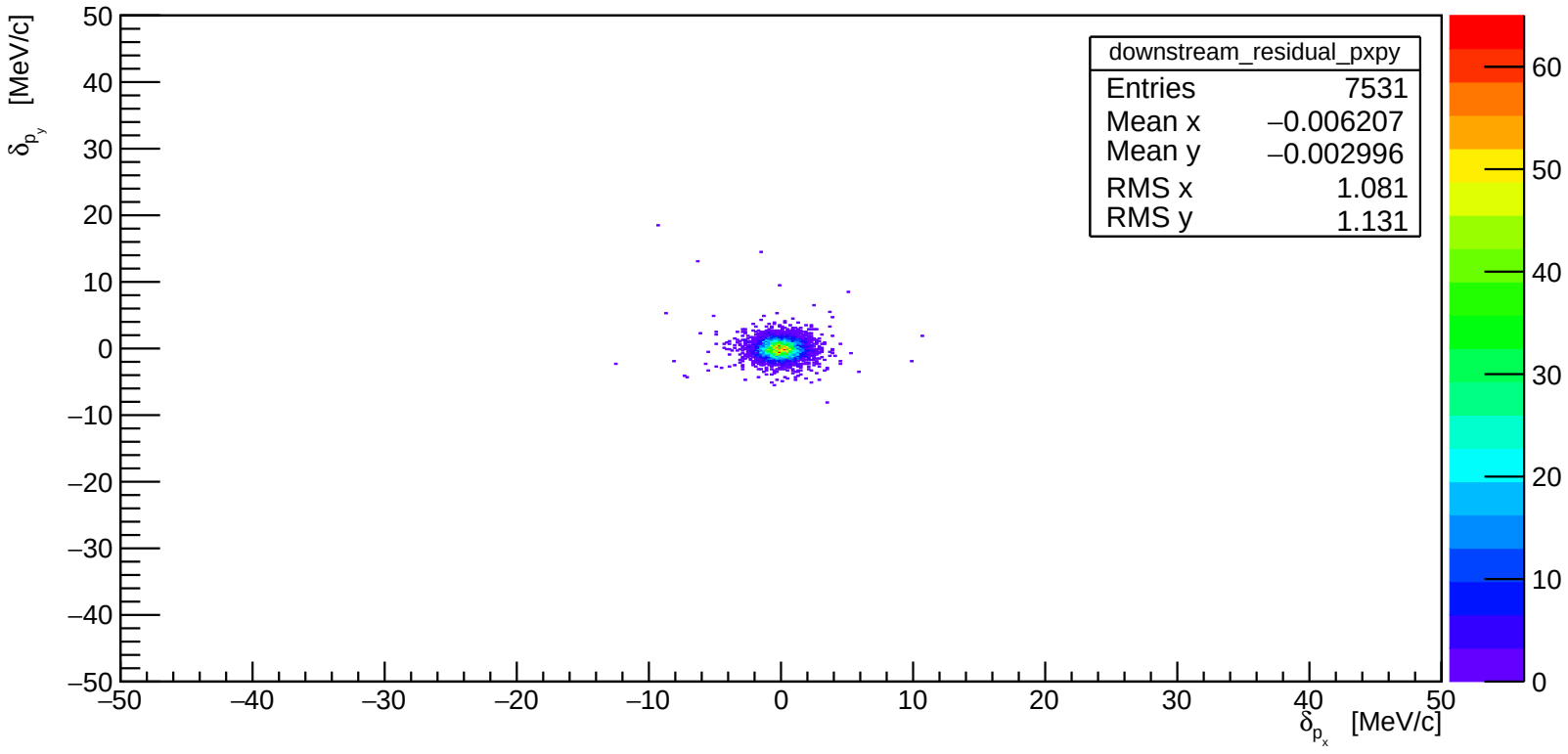
1. Ignore the TOFs. In the real experiment we will use a global track fit to propagate from EMR to tracker. But that was a little tricky!

2. Assume 1 track in EMR and 1 track in Downstream Tracker,
3. Find a rough estimate for the mean change in momentum between Tracker and EMR (around 16MeV/c Δp @ 200 MeV/c),
4. Extract the reconstructed track gradients in tracker reference plane,
5. Mulitply the track gradients by the momentum (weighted correctly to calculate p_z),
6. Use new values for p_x, p_y and p_z in the existing resolution analysis.

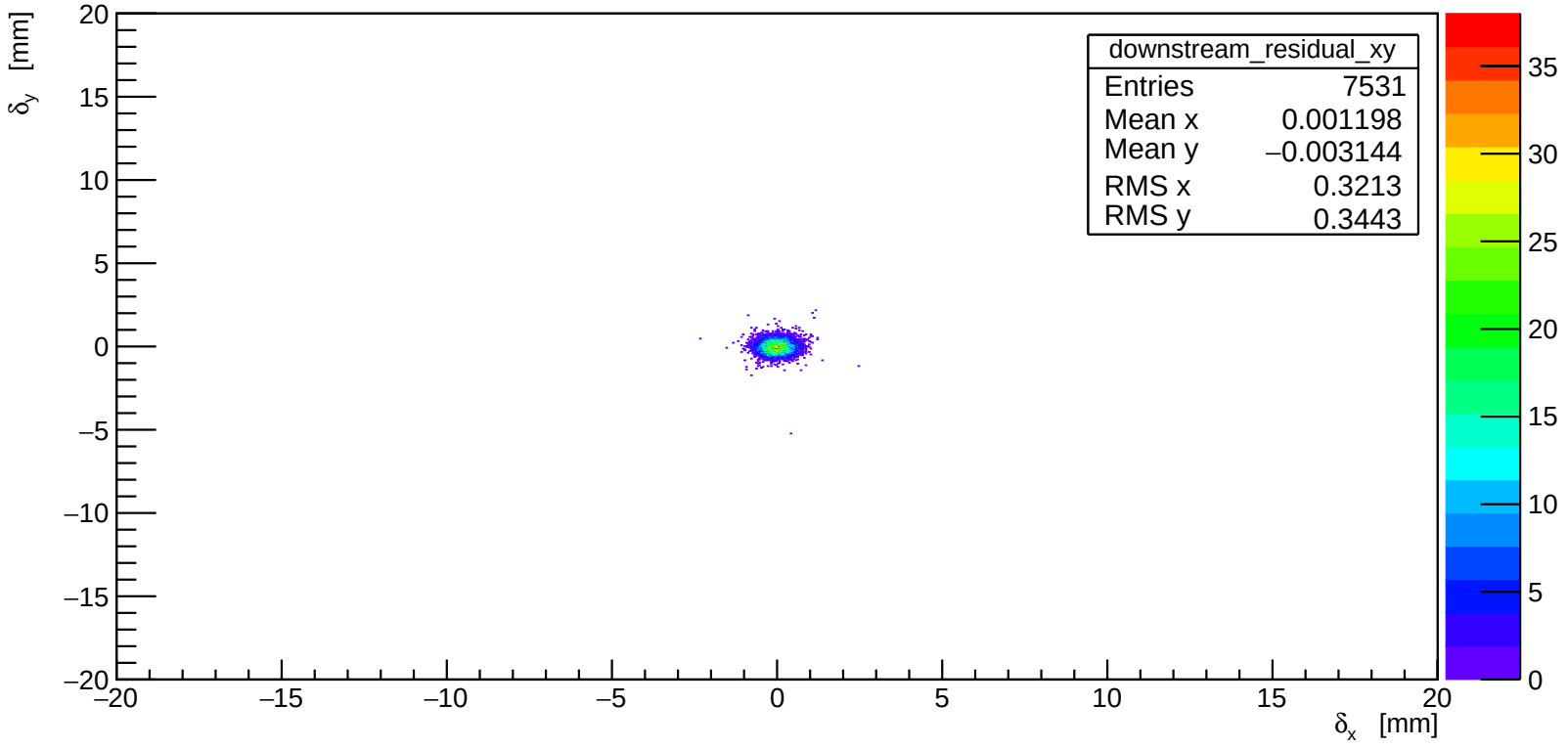
Transverse Momentum Resolution



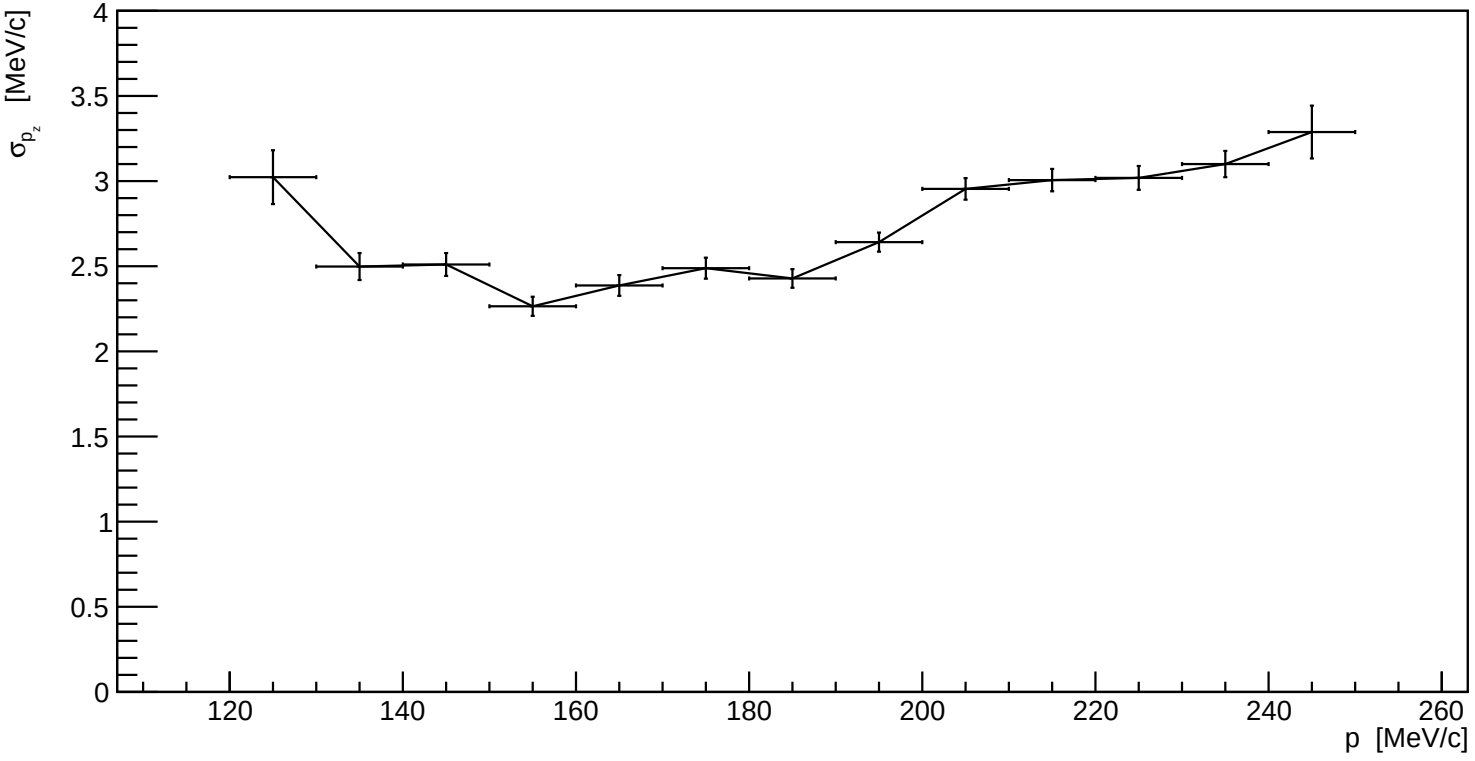
Transverse Momentum Residuals



Transverse Position Residuals



Longitudinal Momentum Resolution



Conclusions

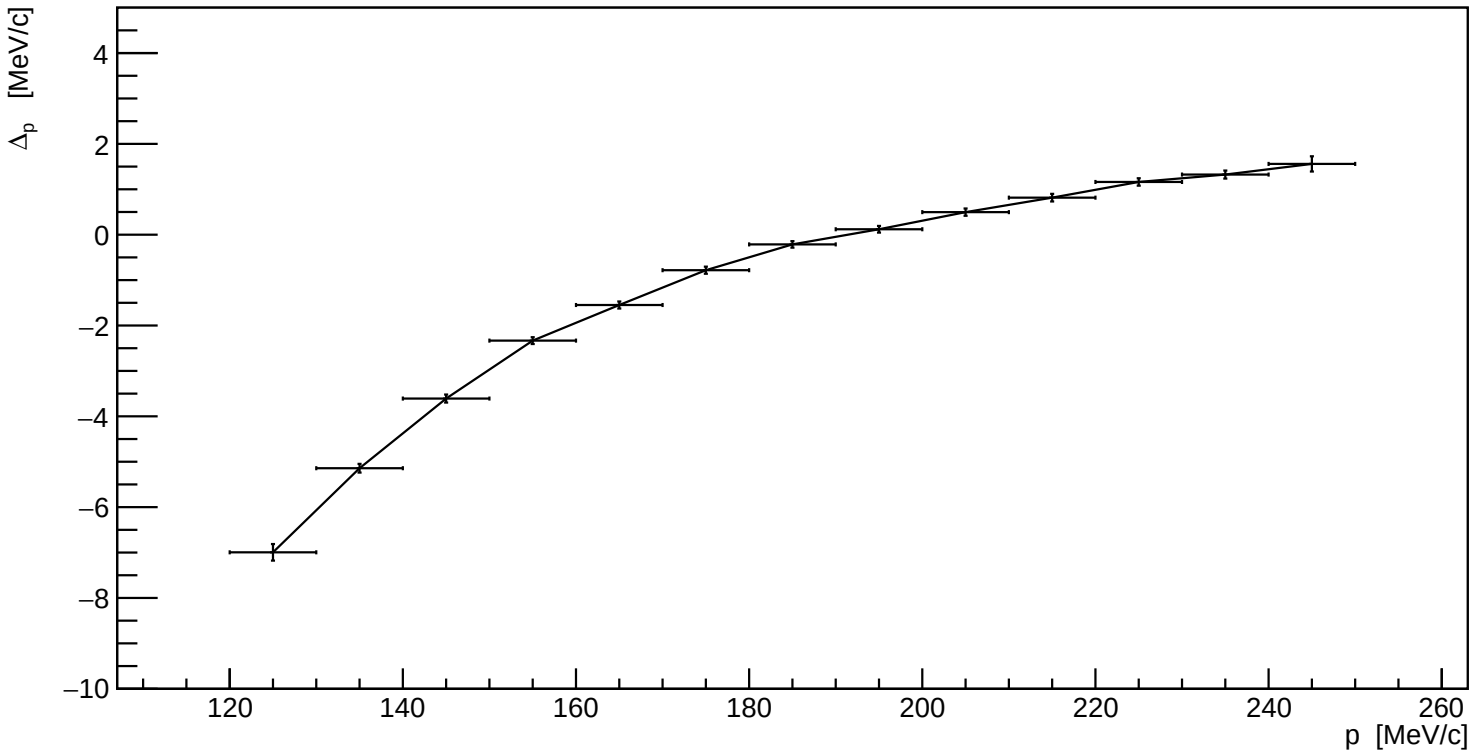
- Very simple algorithms providing very good results. Descope Demo can definitely reconstruct at the required precision.

  But. . .

- This assumes a perfect reconstruction - *No Noise!*
- It will require global track fitting.
- Efficiency calculations and noise rejection still needed in more detail.
- We will need to study the systematics very carefully. . .

Conclusions

Total Momentum Bias



Conclusions

Transverse Momentum Bias