

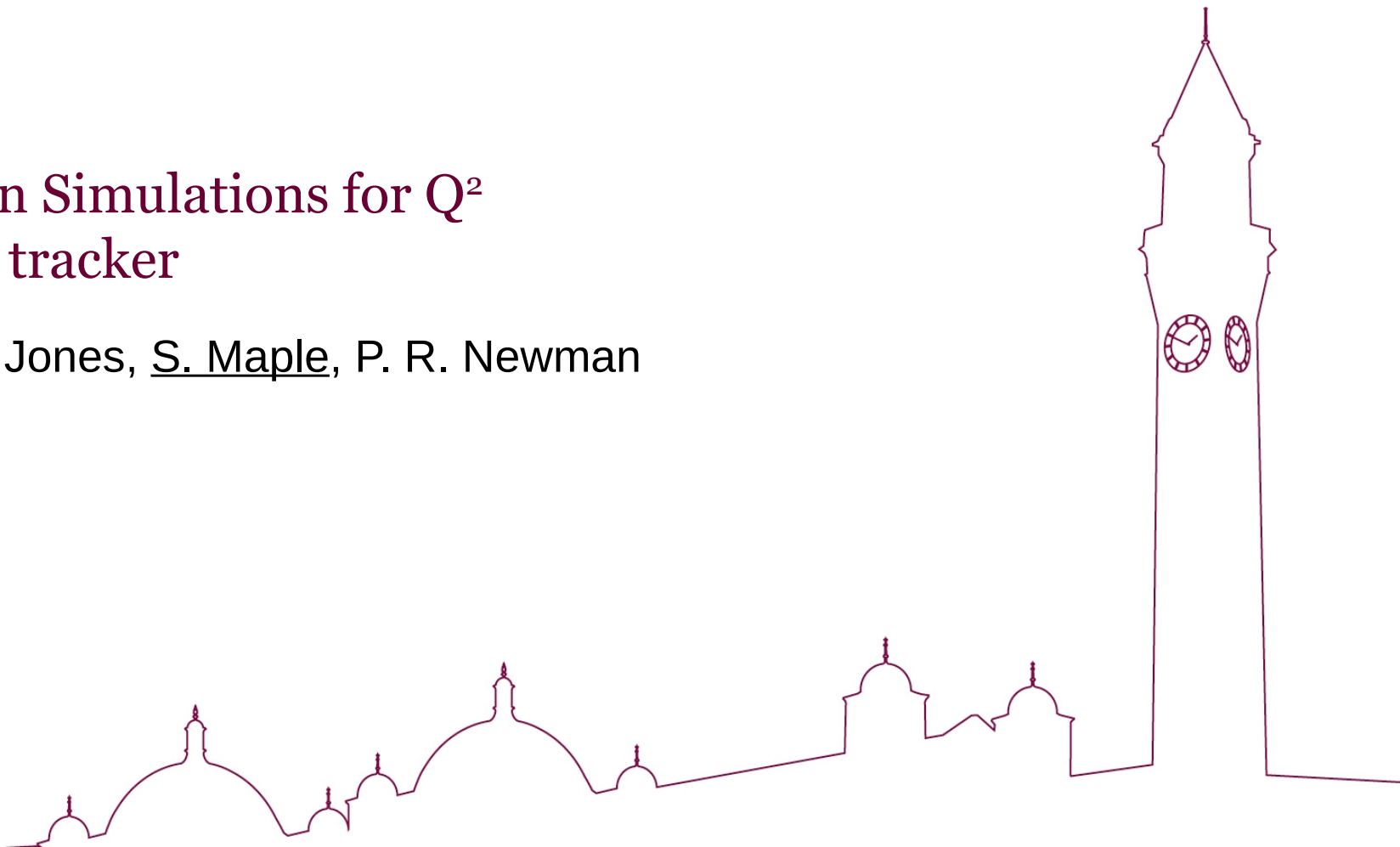


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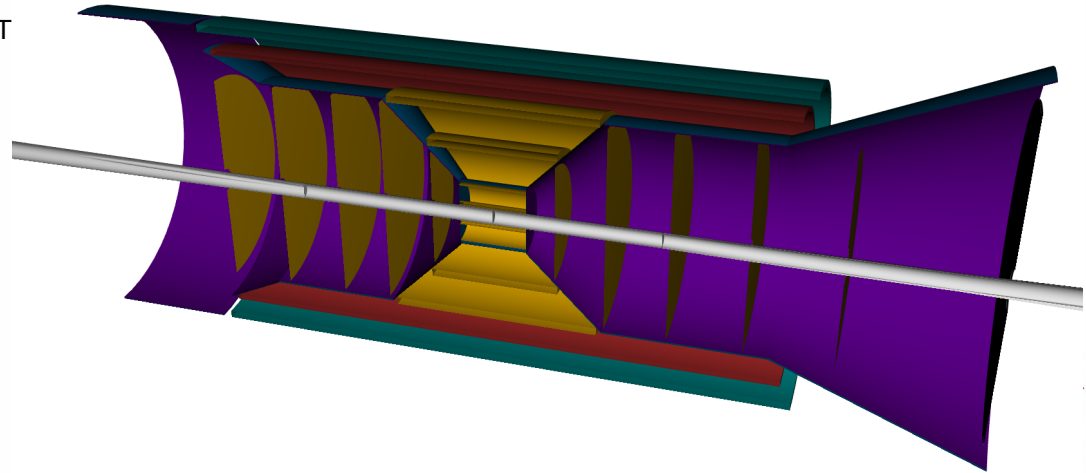
Single Electron Simulations for Q^2 Acceptance of tracker

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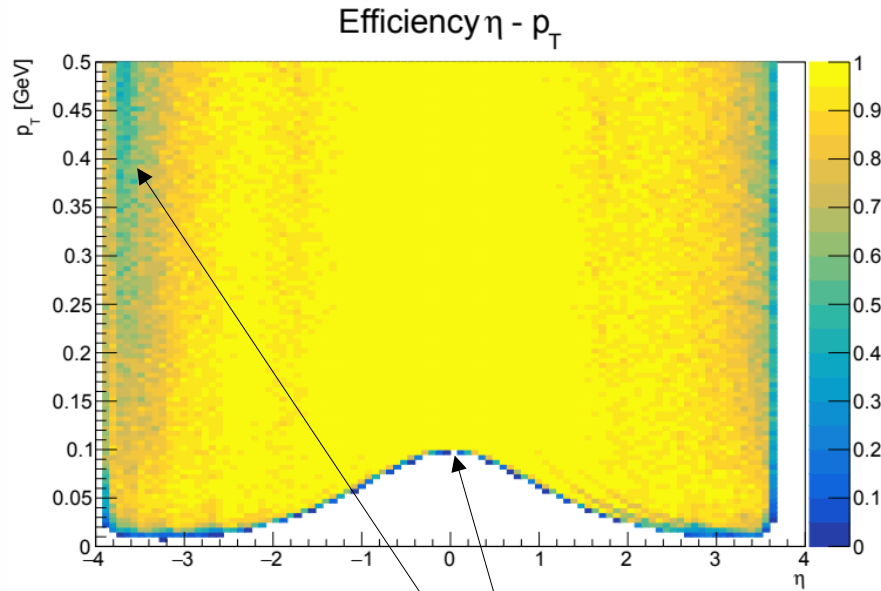
Simulation setup

- Concern that ePIC is developing a hole in its Q^2 coverage:
 - A simplified evaluation of the coverage offered by the tracker alone is performed using single electron events passed through the DD4hep tracking geometry
- 1M electrons generated uniformly in p_T and η for $-4 < \eta < 4$ and $0 < p_T < 0.5$ GeV
 - A further 1M for $0.5 < p_T < 1.5$ GeV
- Events passed through geometry and reconstructed with EICrecon

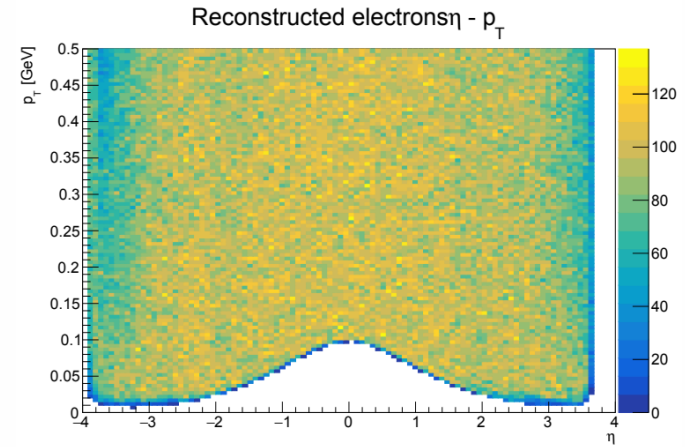
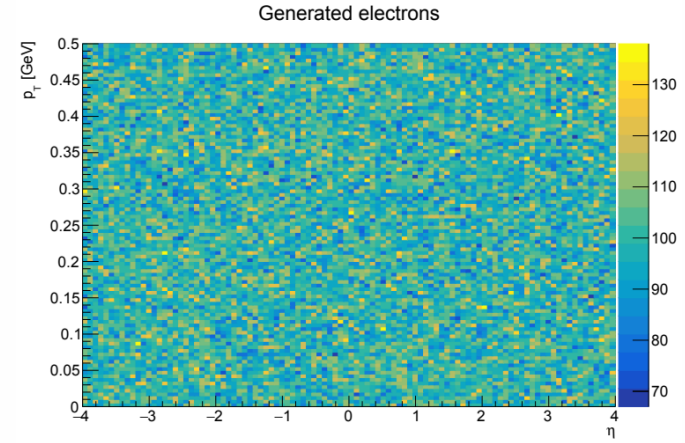


Reconstruction efficiency in p_T vs η

- Efficiency is fraction of tracks in a given η - p_T bin that was successfully matched to a truth track during association → **does not require reconstruction to be in the same bin**



Some interesting features are seen



White region

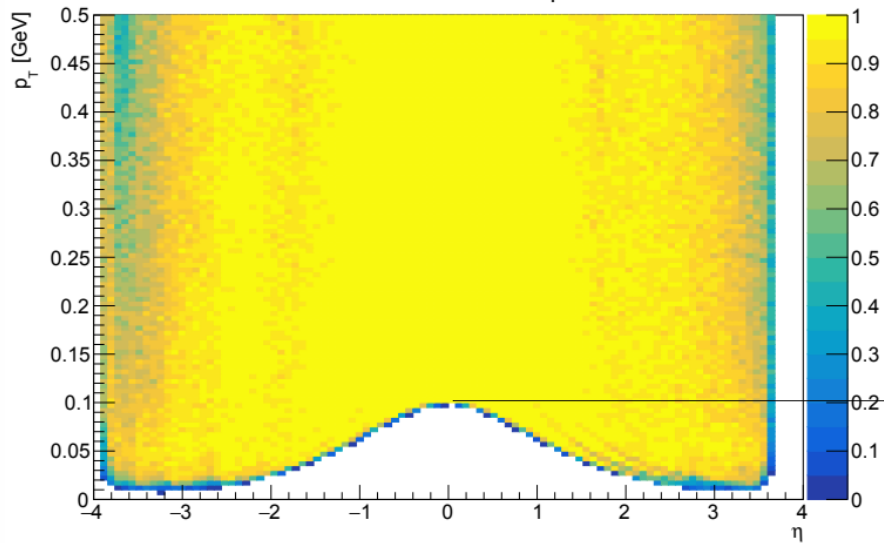
- White region below peak is a result of minimum momentum allowed by truth seeding
→ $p < 0.1$ GeV tossed out

[src/algorithms/tracking/TrackParamTruthInitConfig.h](#)

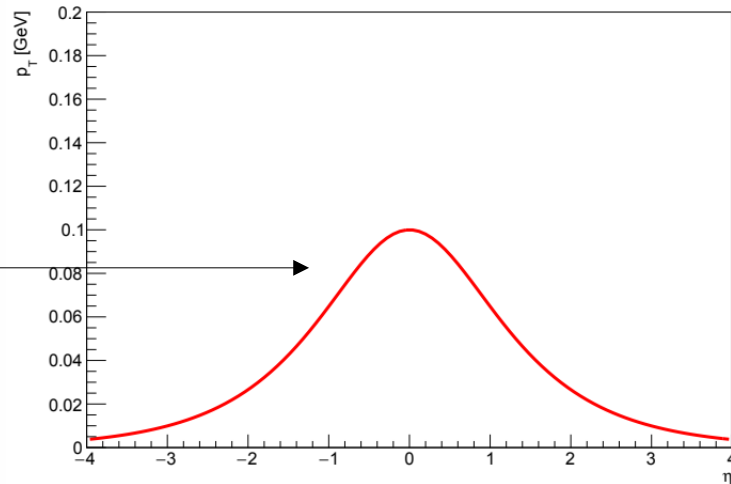
```
13     double m_maxVertexY    = 80 * Acts::UnitConstants::mm;  
14     double m_maxVertexZ    = 200 * Acts::UnitConstants::mm;  
15     double m_minMomentum    = 100 * Acts::UnitConstants::MeV;
```

● C++ Showing the top match Last indexed 3 weeks ago

Efficiency η - p_T



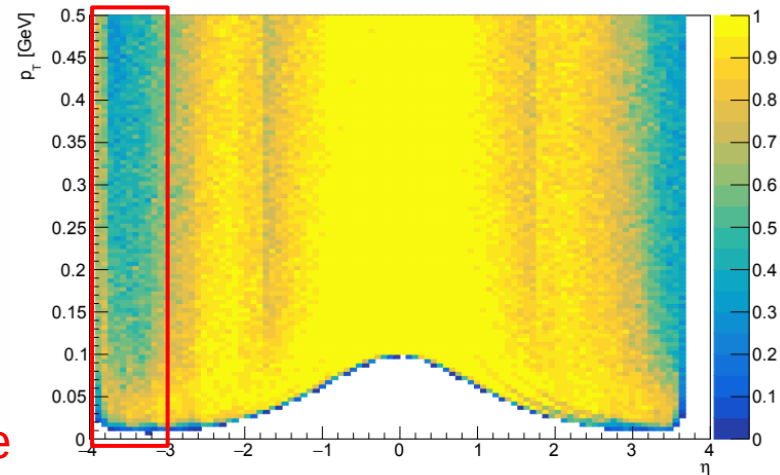
$p = 0.1$ GeV



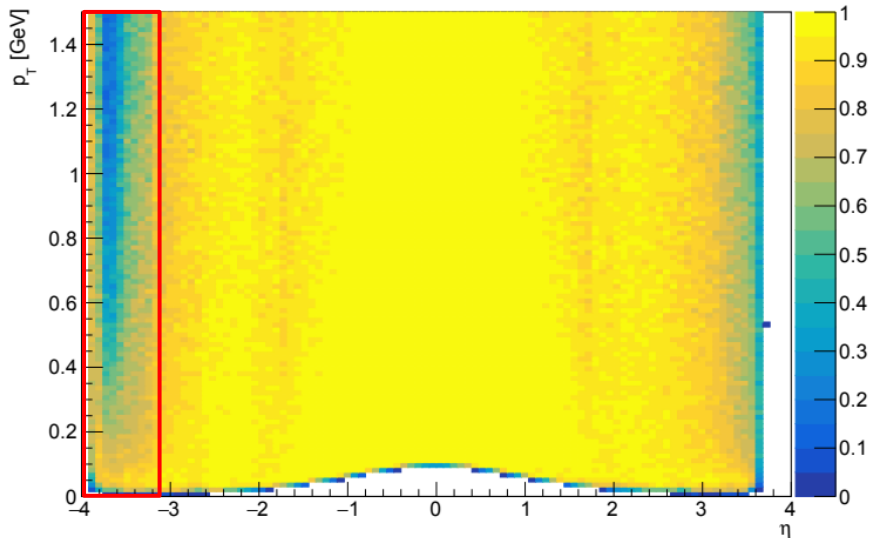
Successful reconstruction at $\eta < -3.5$

- Should not be getting 3+ hits for $\eta < -3.5$
 - Efficiency is lost after $\eta = -3.5$ but increases again towards $\eta = 4$
 - Band of efficiency still present after restricting to events with within 5% of the true momentum and within 0.1 of true $\eta \rightarrow$ **any inputs on this are welcome**

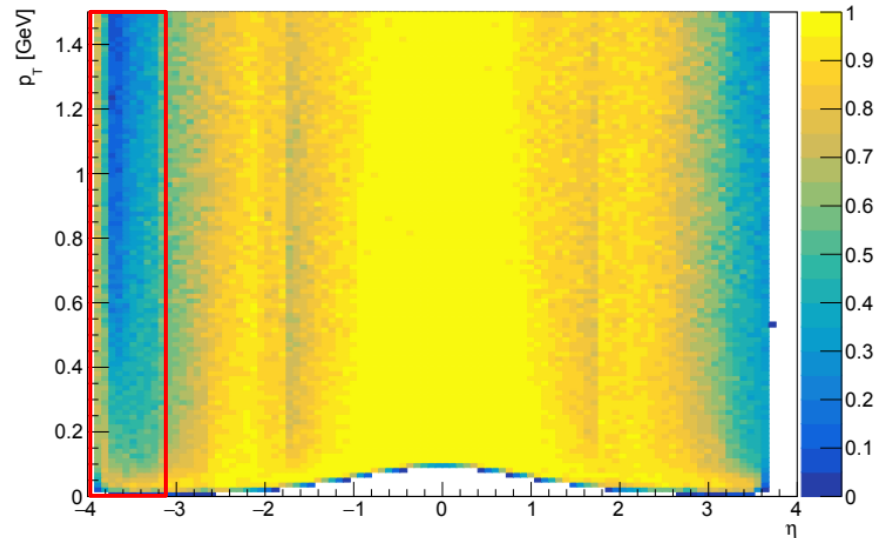
Fraction reconstructed with p within 5% and η within 0.1 of generated



Efficiency $\eta - p_T$



Fraction reconstructed with p within 5% of generated



Electron Kinematics

Slide borrowed From P. Newman

<https://indico.bnl.gov/event/18190/contributions/72551/attachments/45759/77265/Q2-acceptance.pdf>

$$Q_e^2 = 2E_e E'_e (1 + \cos \theta) \quad y_e = 1 - \frac{E'_e}{E_e} \sin^2 \frac{\theta}{2}$$

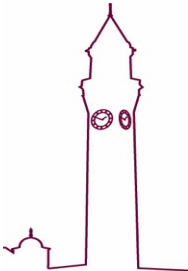
As $Q^2 \rightarrow 0$, $\vartheta \rightarrow 180^\circ$, in kinematic peak ($y \rightarrow 0$) region,

$$Q^2 \rightarrow 2E_e^2 (1 + \cos \theta)$$

Strong correlation between Q^2 and θ

Weaker correlation between y (or x) and θ

Note that these correlations only depend on the electron beam energy (proton energy is irrelevant)

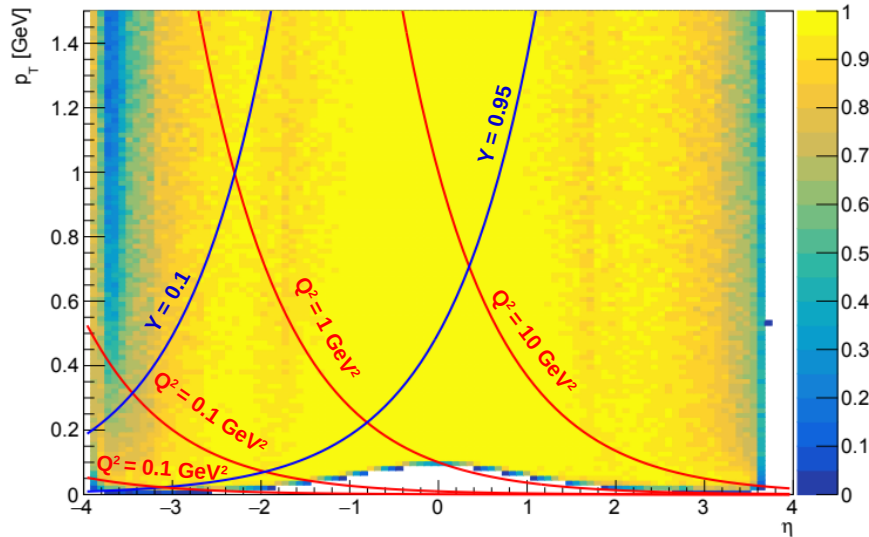


Coverage in Q^2 and y

- We want as much of the possible events to be in yellow as possible!
 - Mostly the case for $Q^2 > 0.1 \text{ GeV}^2$, $y > 0.1$ for 5 GeV beam energy
 - Similarly the case for 18 GeV beam energy for $Q^2 > 1 \text{ GeV}^2$

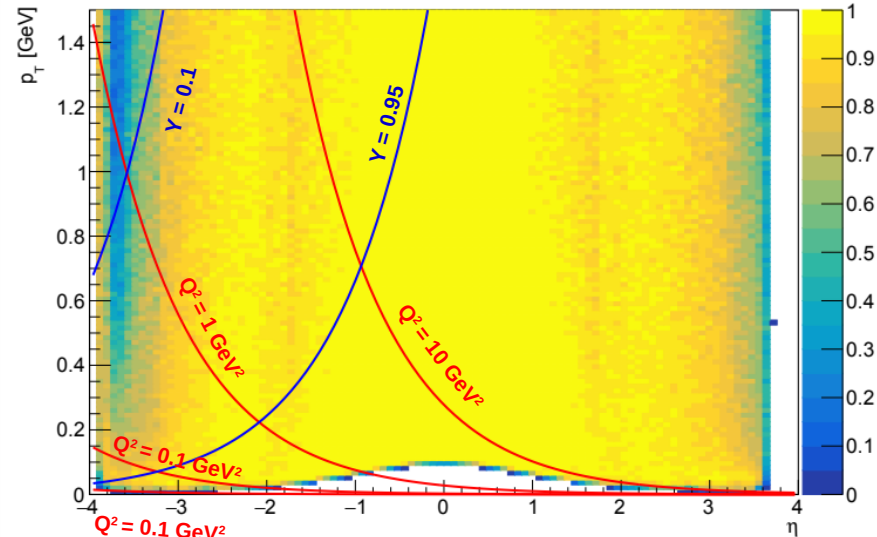
5 GeV electron beam

Efficiency η - p_T



18 GeV electron beam

Efficiency η - p_T



Summary

- Performed simulations with single electrons to study Q^2 coverage of tracker
 - Features of η - p_T plot investigated → some understood, further investigation required for far backwards reconstruction
- General Q^2 coverage of tracker looks good for $Q^2 > 1\text{GeV}^2$

