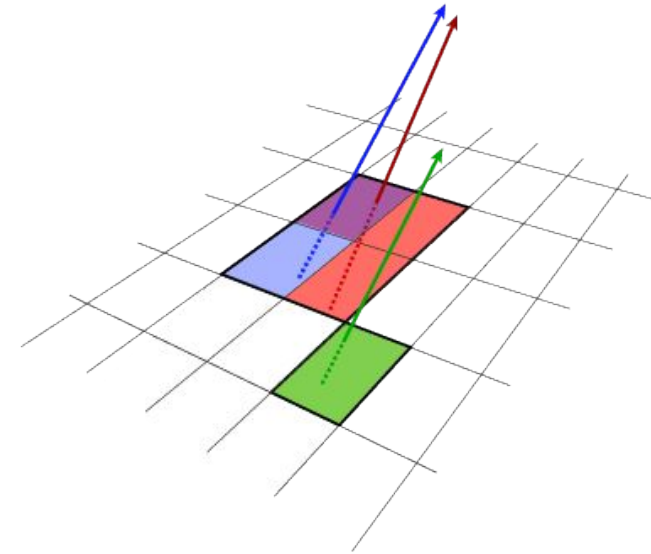


Tracking In Dense Environments for the ATLAS ITk Strip Detector

for the HL-LHC Upgrade

Akhilesh Tayade
Hamburg, March 2022



ITk Strip Detector

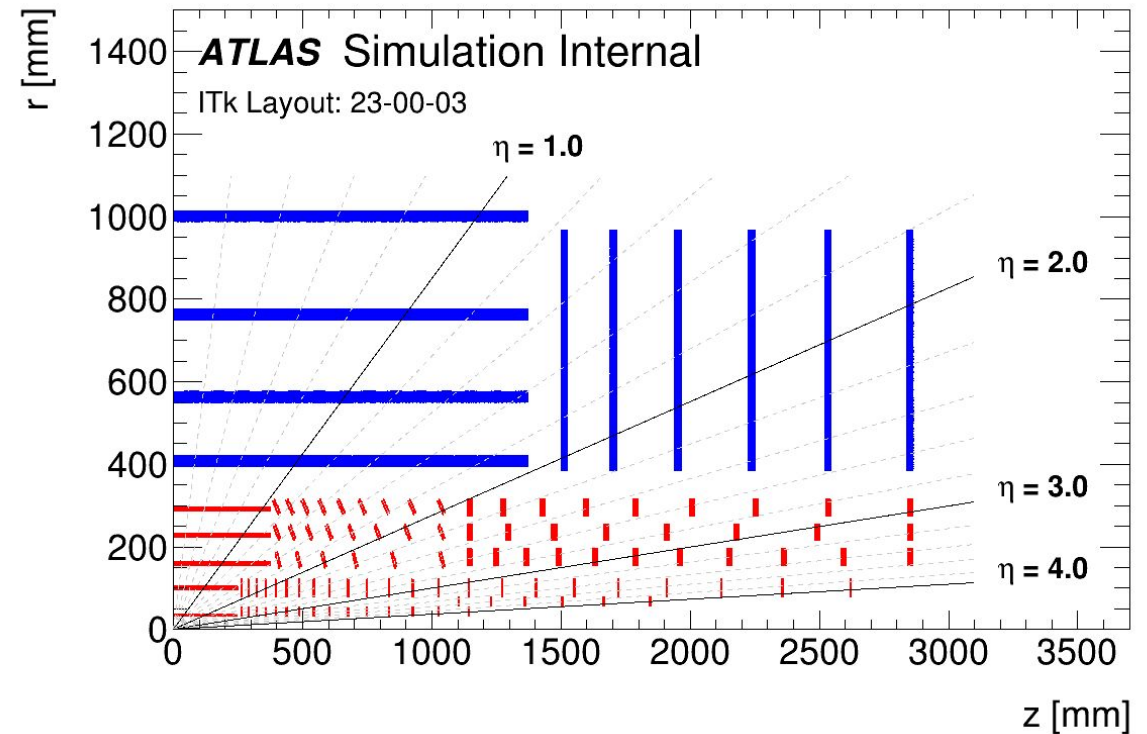
- **ITk Pixel:**

25 μm ×1000 μm /50 μm ×50 μm
39mm - 271mm

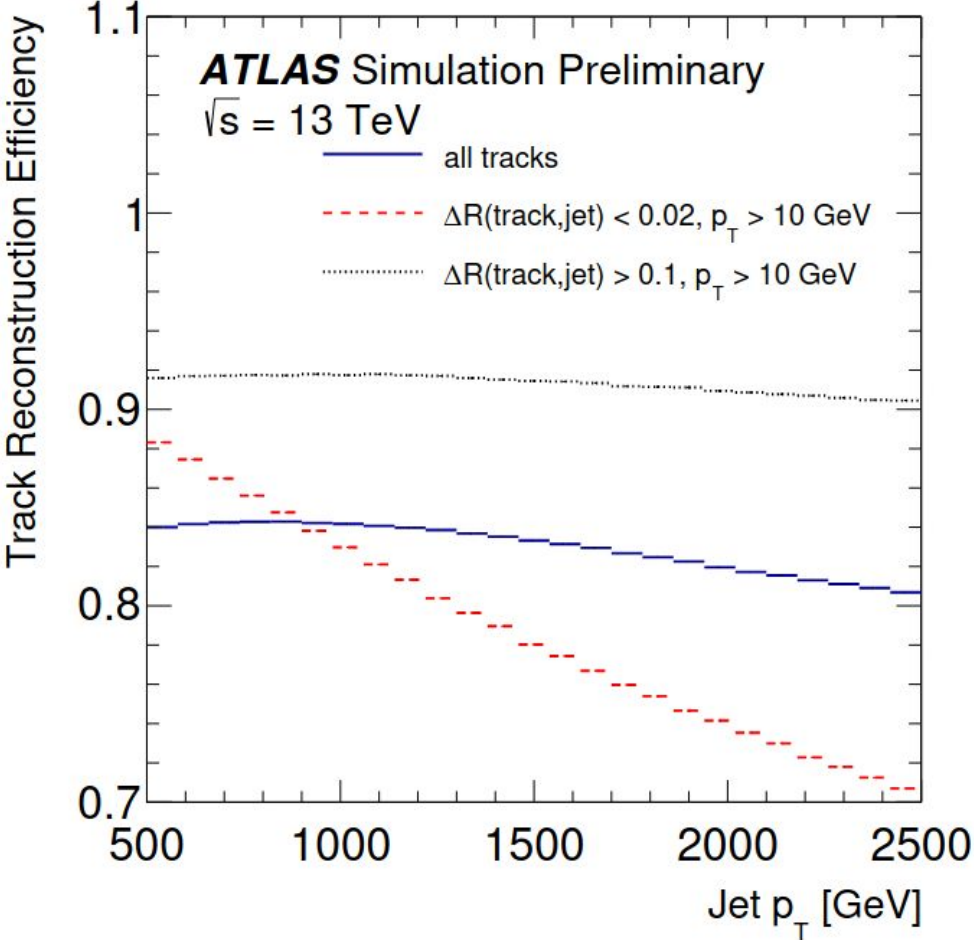
- **ITk Strip:**

69/75 μm
405mm – 1000mm

Does ITk Strip really matter?

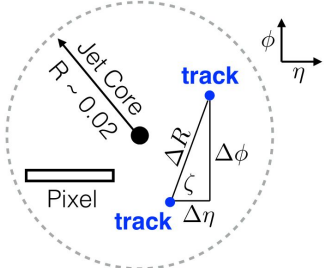


ITk Strip Detector



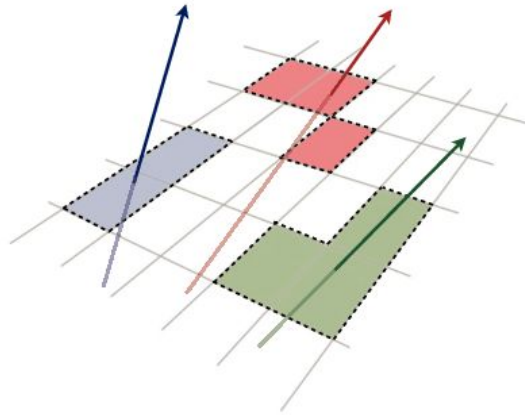
Why bother?

- **Boosted Objects -> High pT -> Collimated Tracks -> Jet Core**
- **Boosted Objects -> BSM Physics (eg. Di-Higgs)**

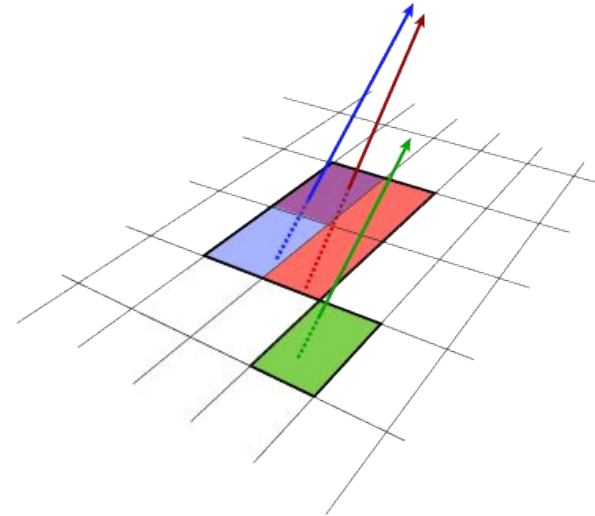


CTIDE

Clustering and Tracking in Dense Environments



Non - Merged Clusters



Merged Clusters

Dense Environment = Jet Core + High Pt + Merging

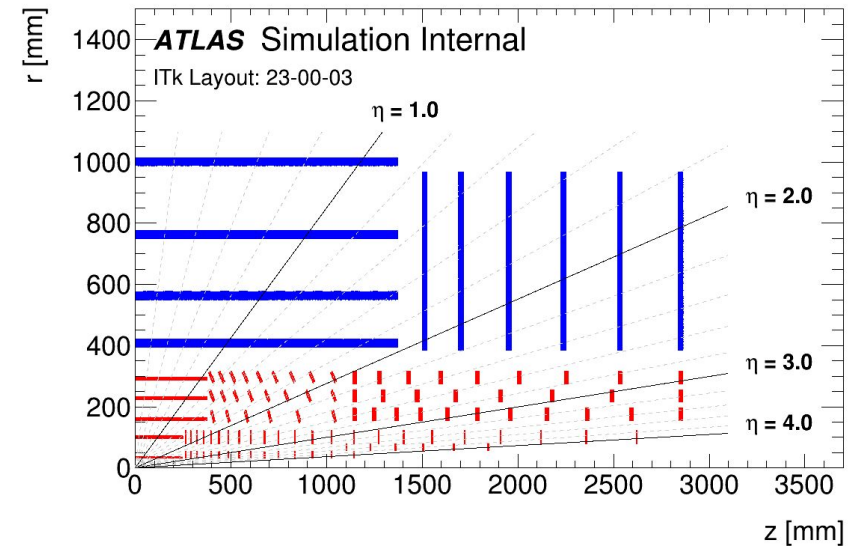
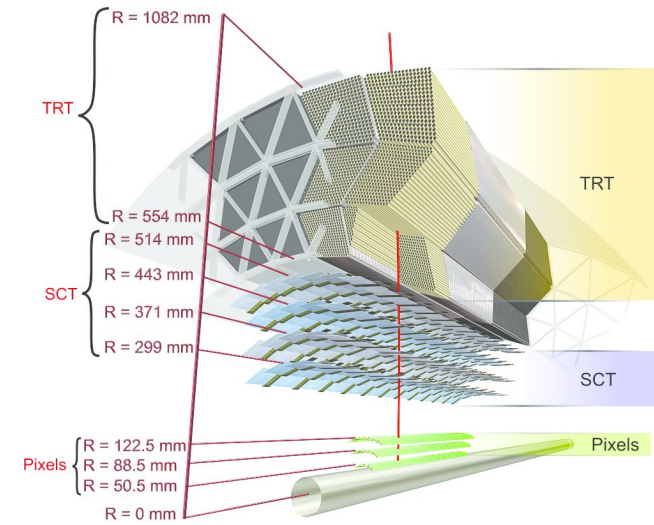
Reconstruction Algorithm Punishes Shared Strip Cluster

The Future is Luminous (HL-LHC)

Run II $\langle \mu \rangle = 40$

Run IV $\langle \mu \rangle = 140$

All Silicon Inner Tracker(ITk)
2.5 times luminous
~ Year 2027



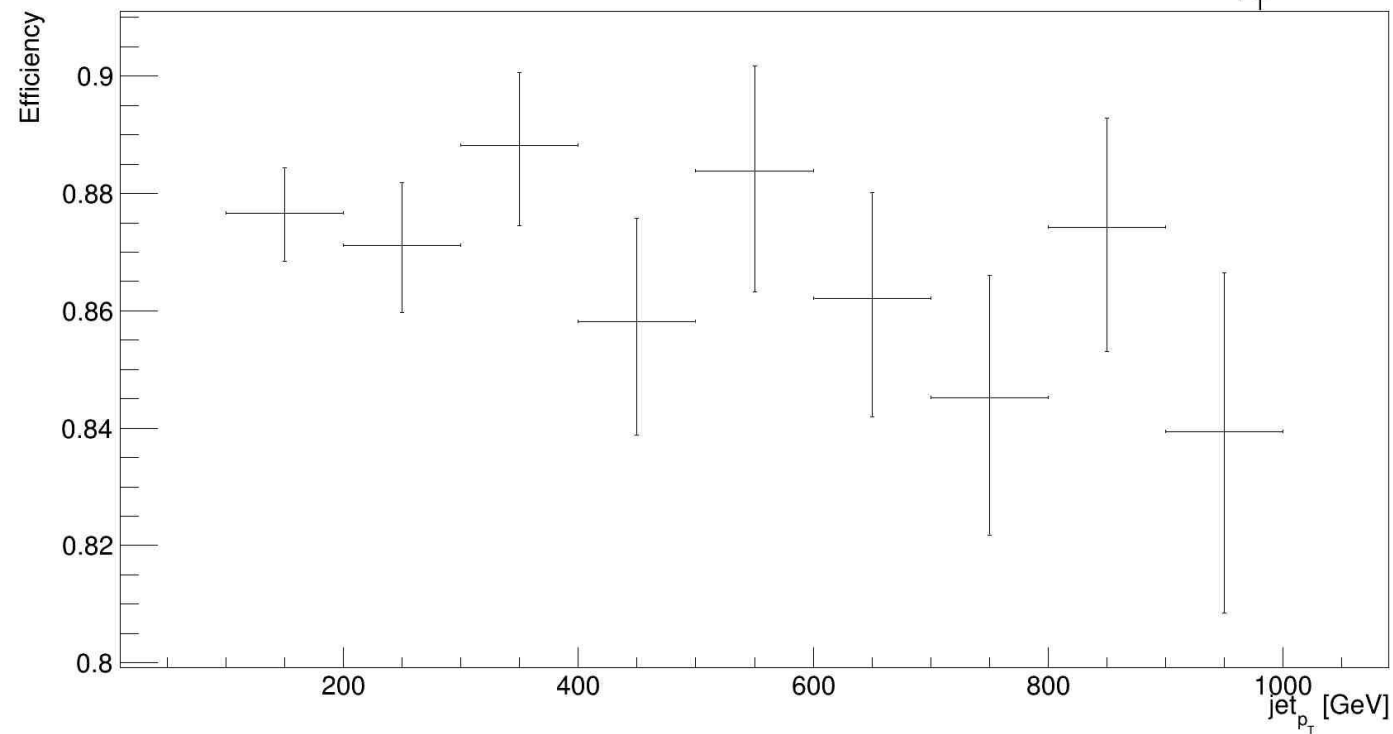
Analysis

Sample

qq -> Z' -> Hadrons
PU0

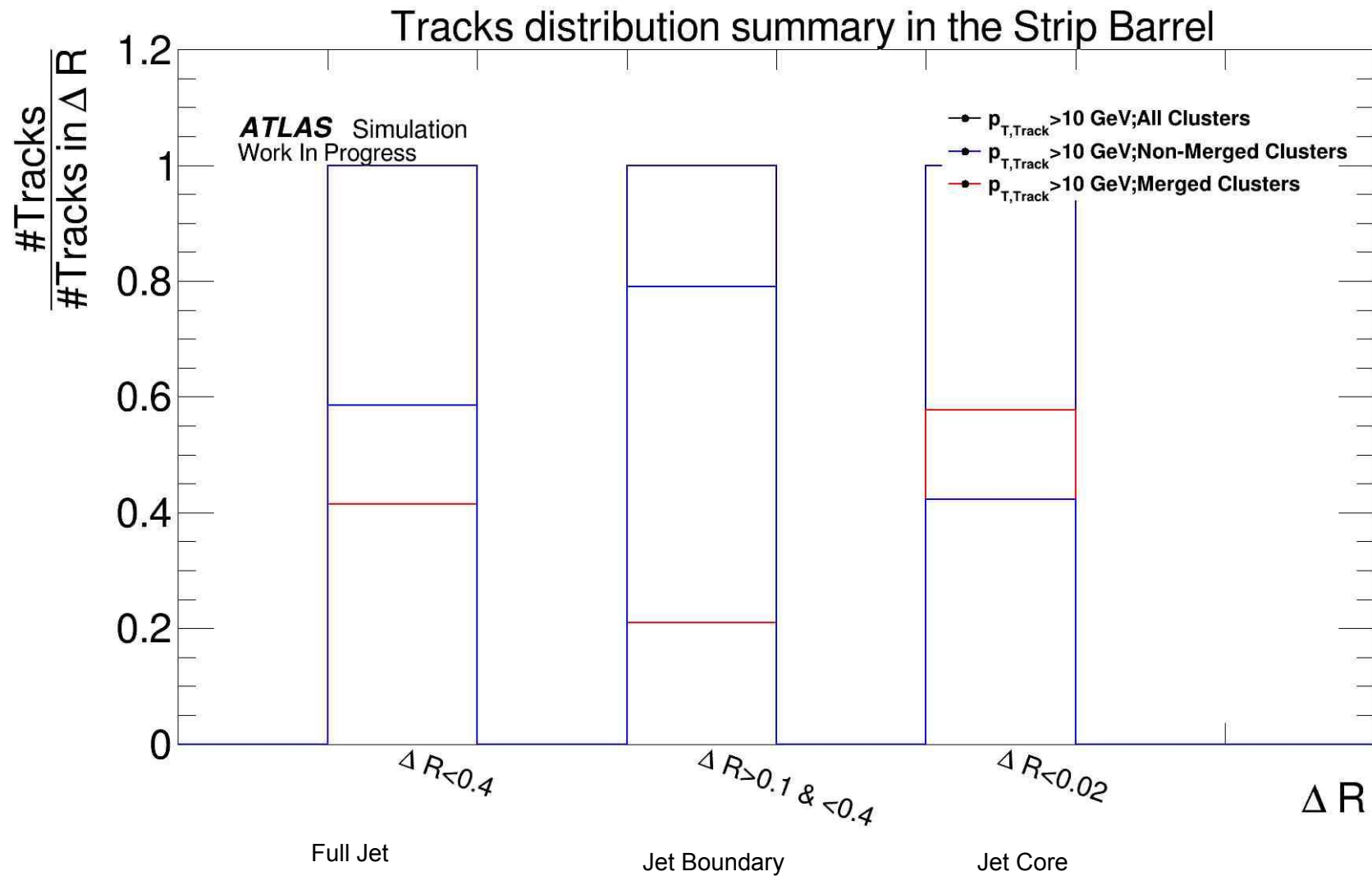
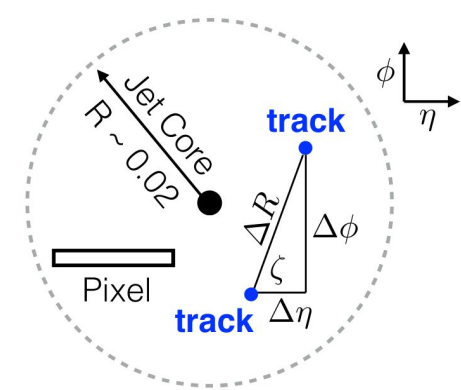
Anti-Kt 4 for Jets

Fraction of reco-matched truth track versus jet p_T



Analysis

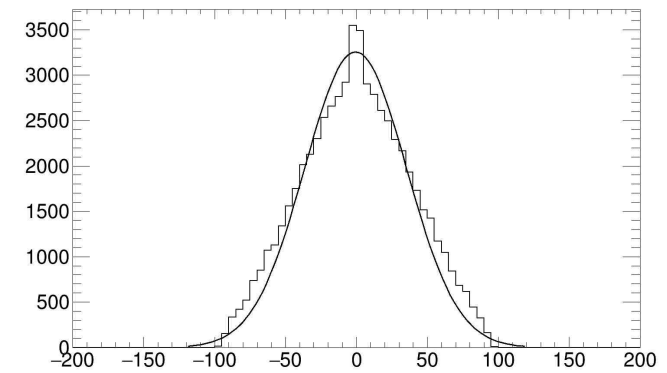
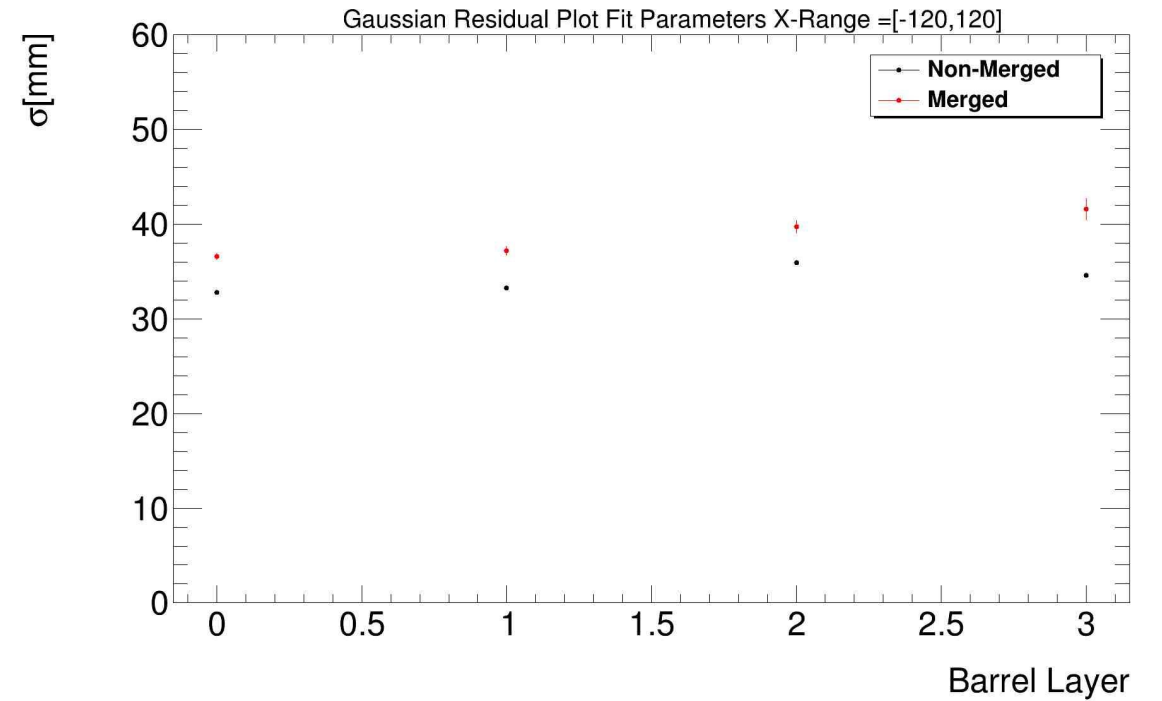
Jet-level



Analysis

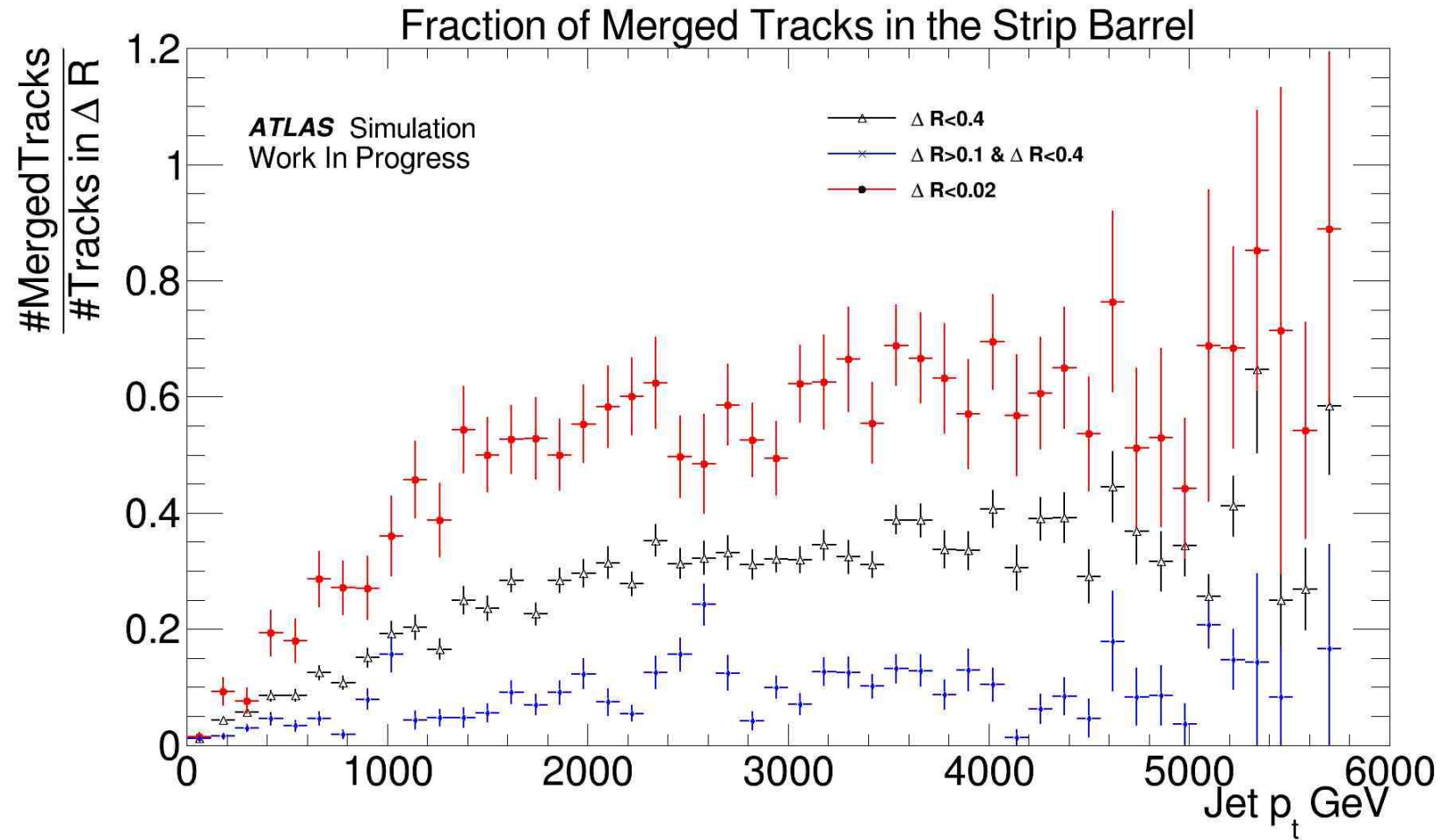
Residuals

- Residual (on a surface) = Truth position - Reconstructed Position
- Fit Gaussian and Obtain σ



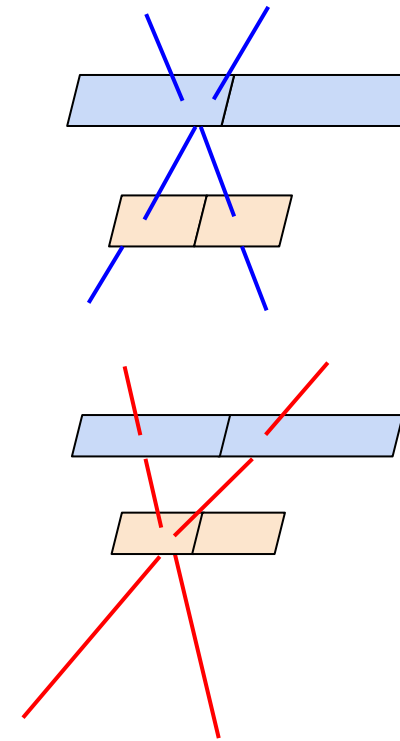
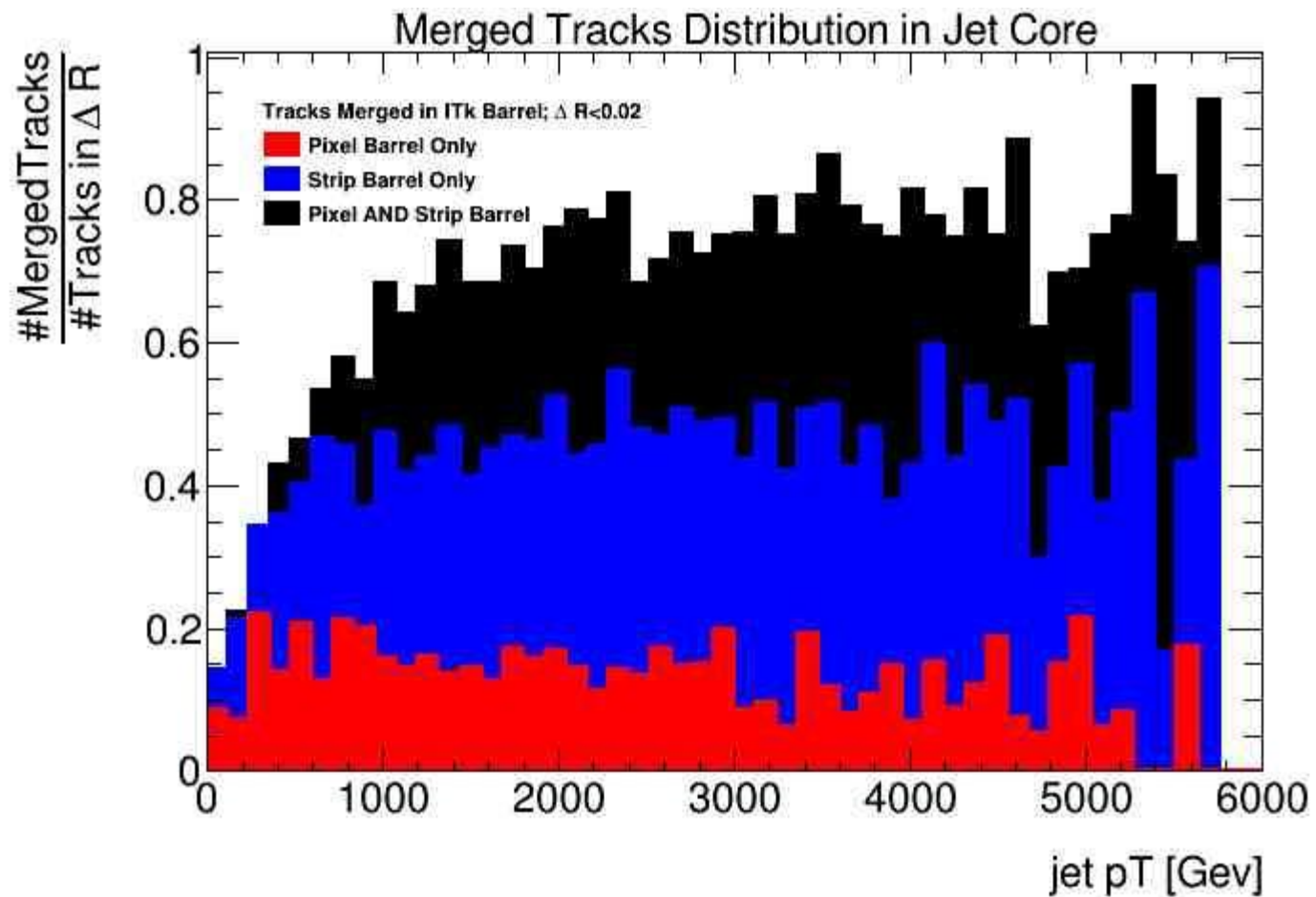
Analysis

Jet-level



Analysis

Jet-level

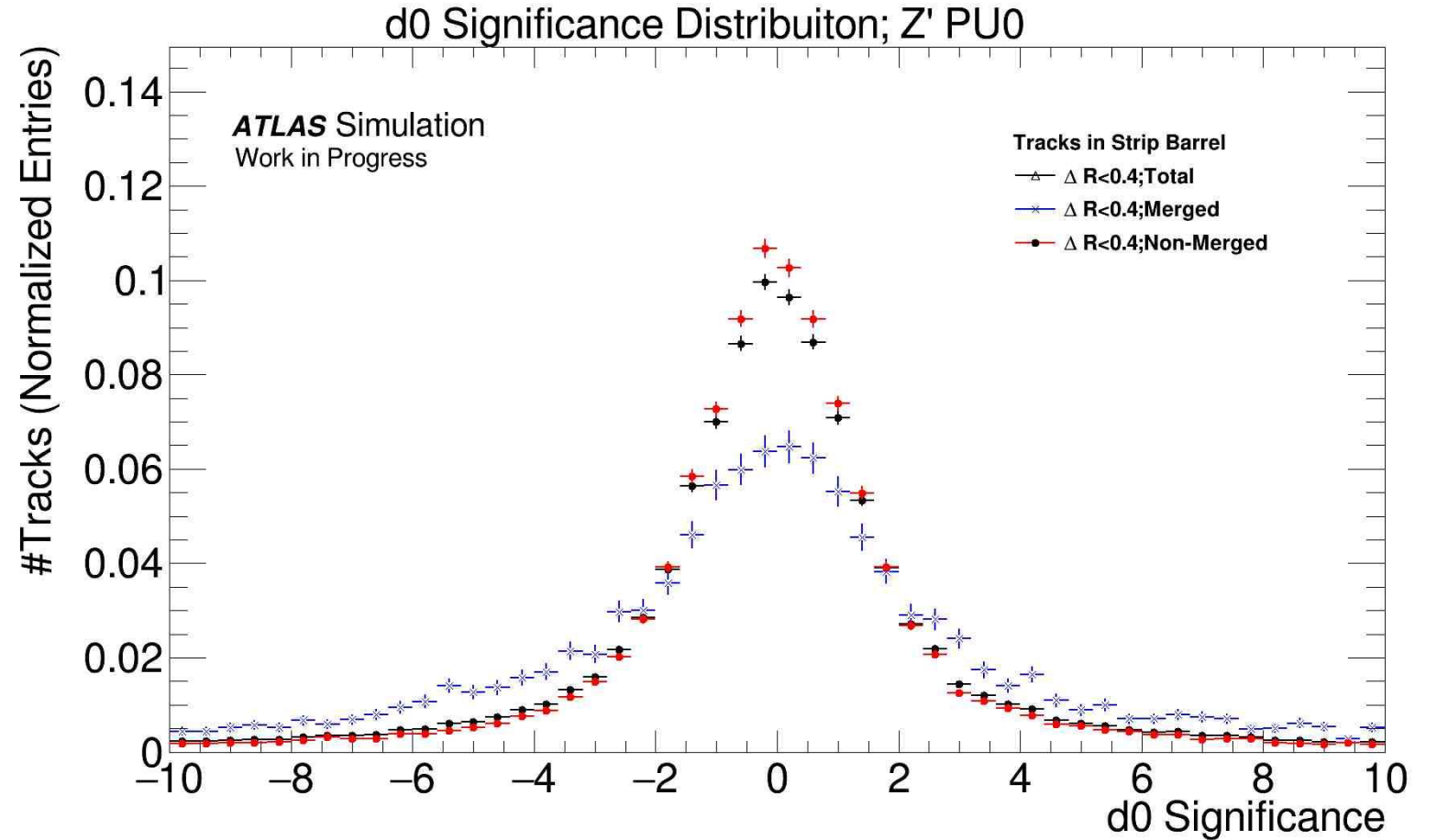


Analysis

Jet-level

d_0 = Transverse Distance of the track from the IP

Significance = Measurement/Error

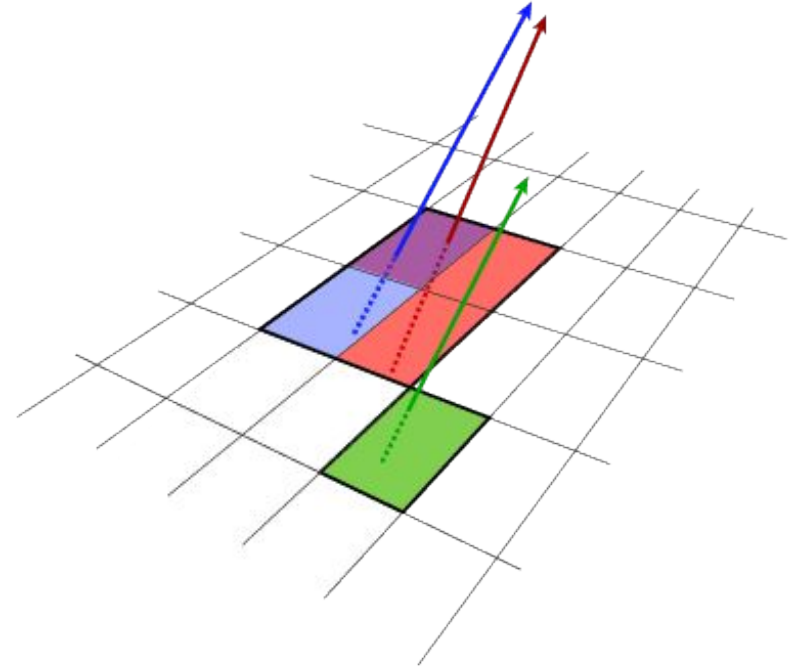


Back to the Future

Next Steps

Truth Based Splitting

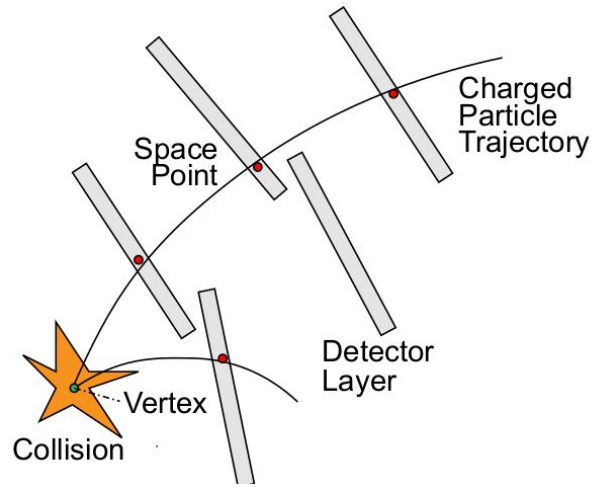
Improvements



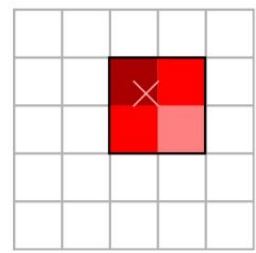
Thank You!
Questions?

Backup Slides

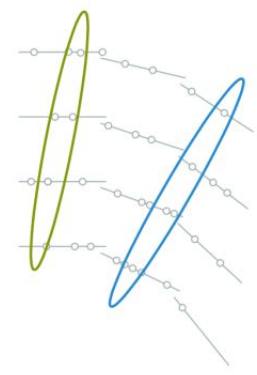
Tracking Overview



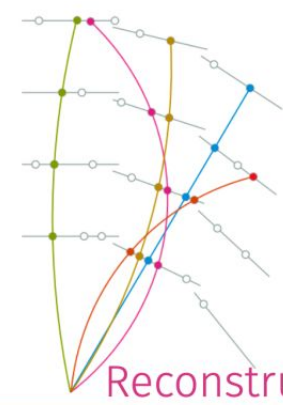
Ambiguity Solver: Punish Shared Strip Cluster



Local Reco
Bits to hits,
clustering



Track Finding
Group hits to tracks

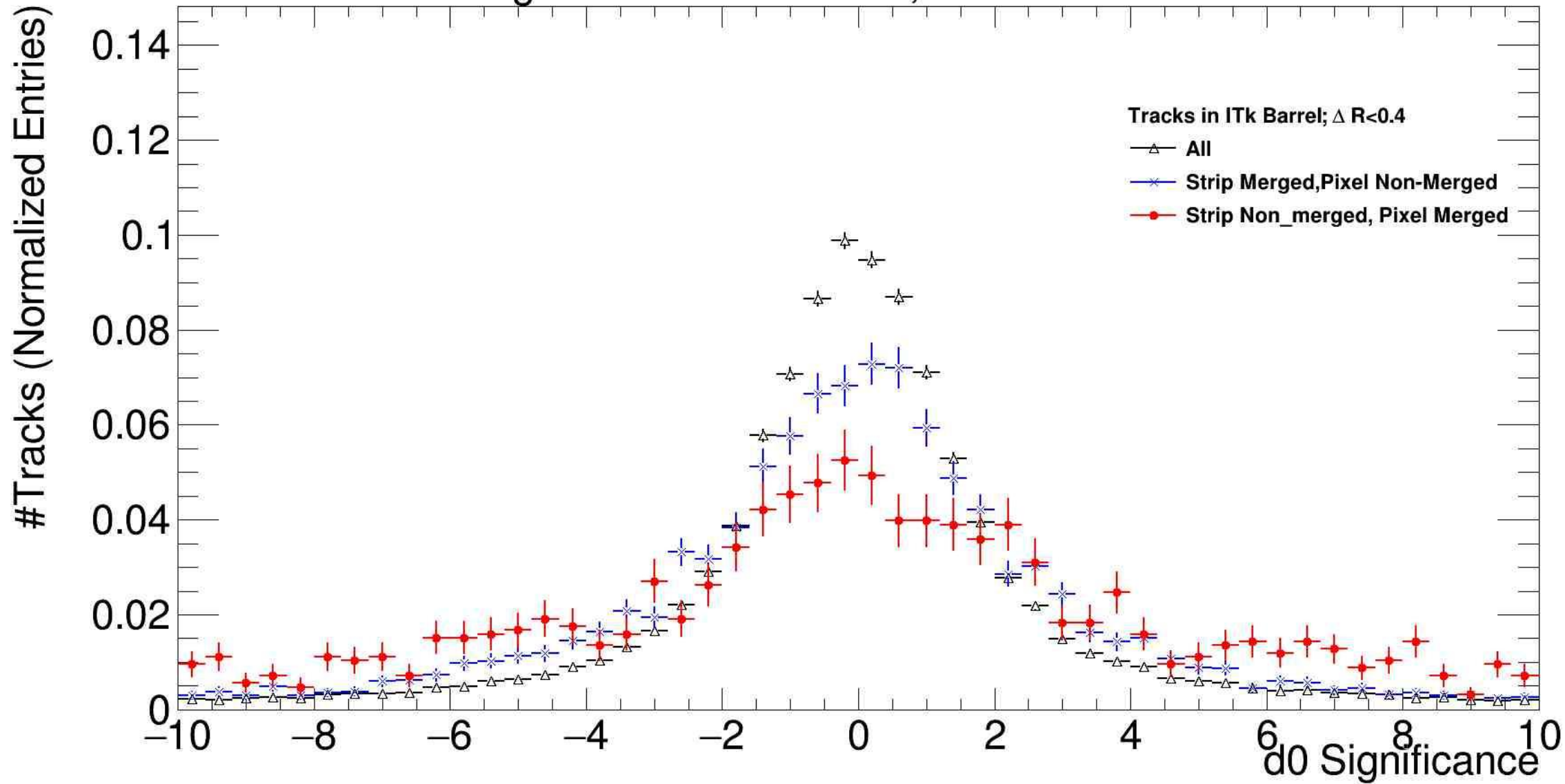


Track Fitting
Estimate parameters

Analysis

Reconstruction

d0 Significance Distribution; Z' PU0



Presentation Title

Subtitle of Presentation

Name Surname
City, Date

HELMHOLTZ



Contents

01 The future is Luminous

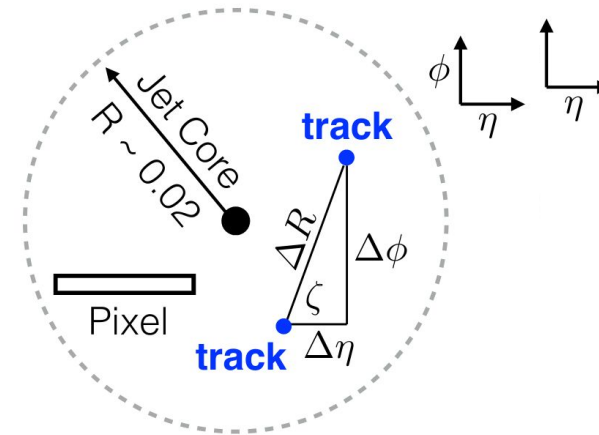
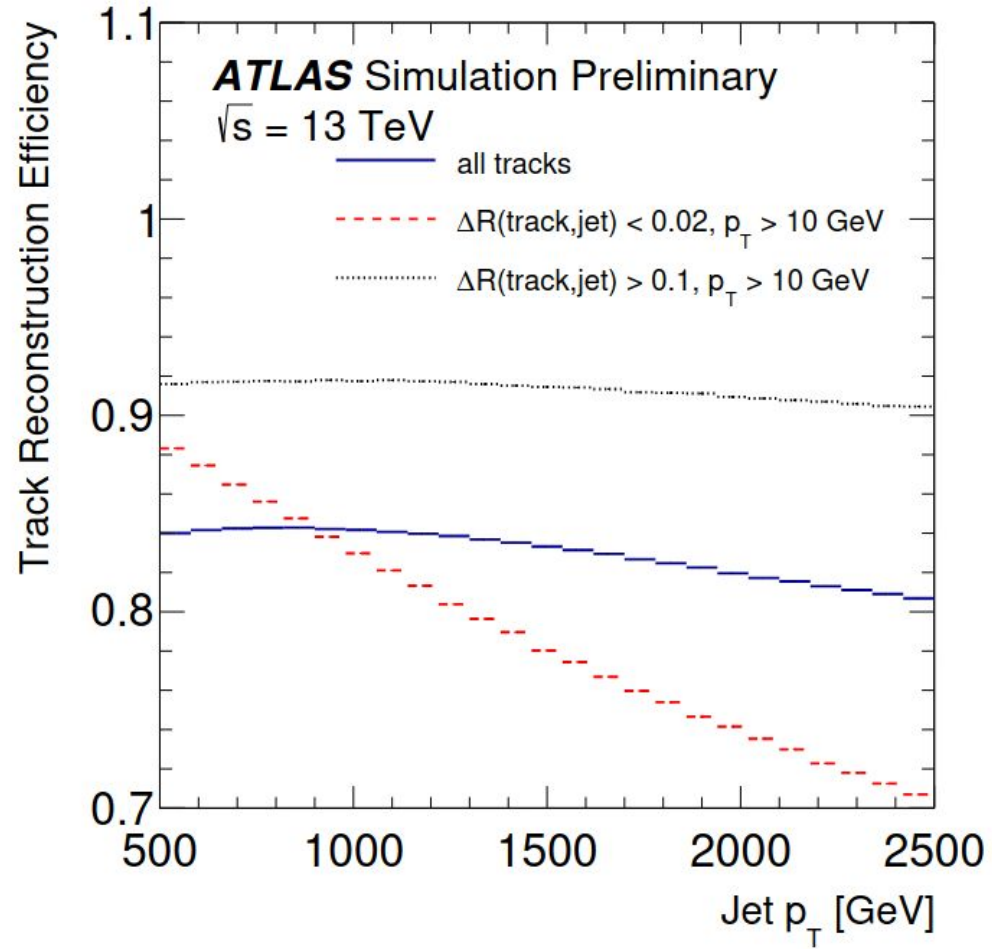
02 Tracking Overview

03 CTIDE

04 Analysis

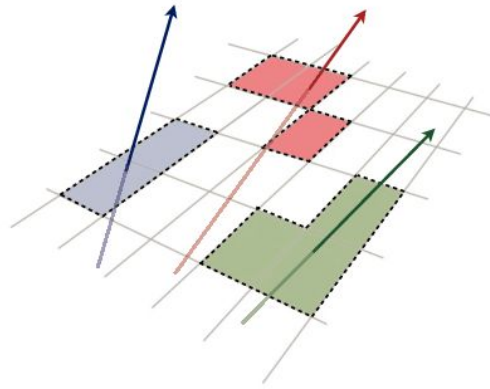
05 Back to the Future

BUT

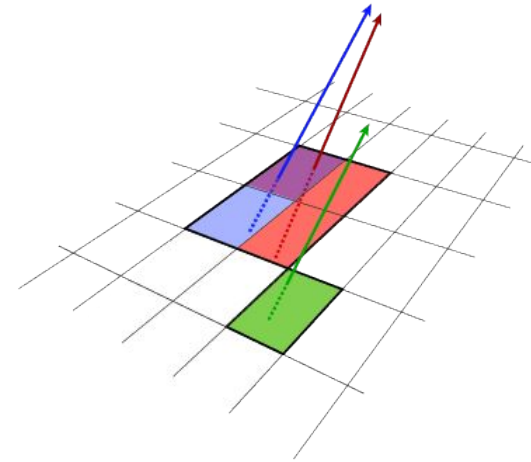


Tracking Overview

Clustering



Non - Merged Clusters



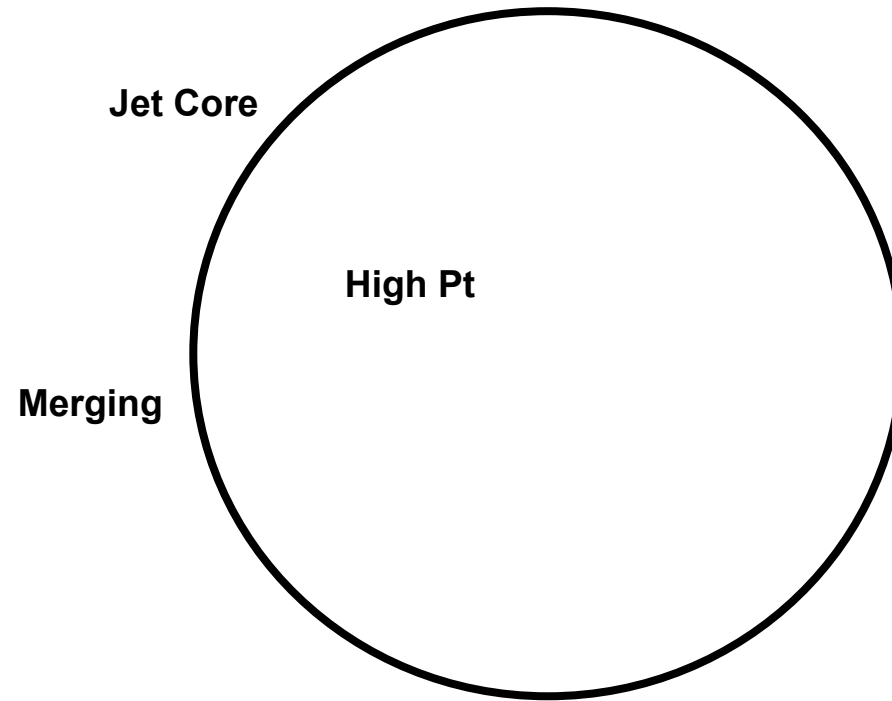
Merged Clusters

CTIDE = JET

CTIDE

Clustering and Tracking in Dense Environment

Dense Environment =



CTIDE

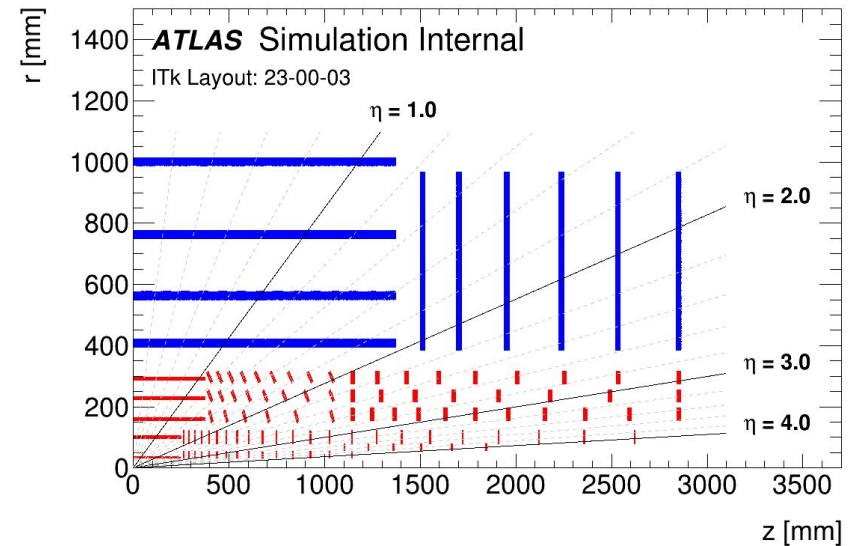
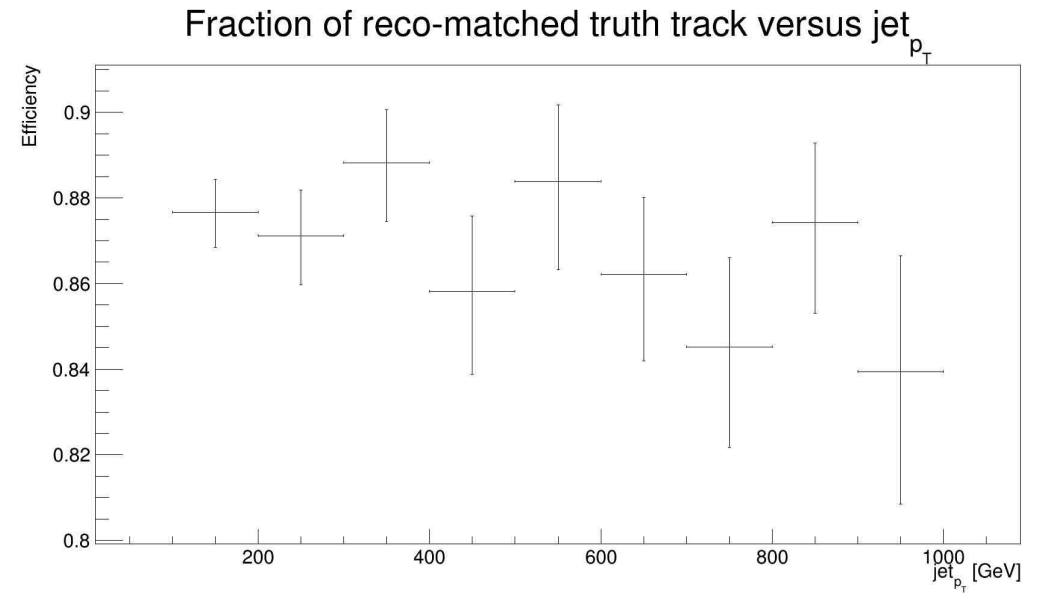
Clustering and Tracking in Dense Environment

Katharina Behr's Group

- How bad is the Problem?
- What are the relevant variables?
- How much room for Improvement?
- How to improve?

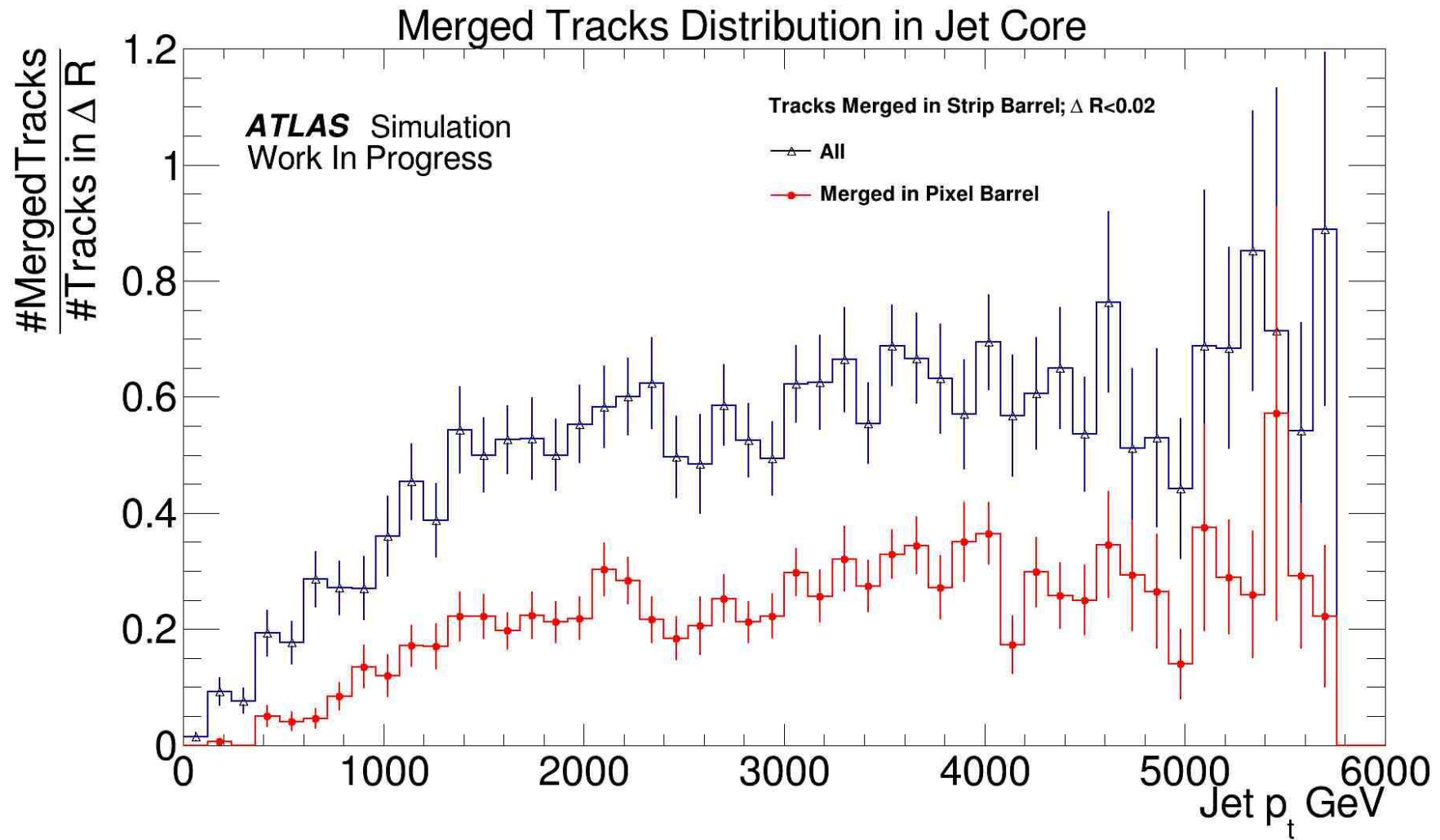
qq -> Z' -> Hadrons
PU0

Anti-Kt 4 for Jets



Analysis

Jet-level



Contact

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Synchrotron DESY

www.desy.de

Akhilesh Tayade
ATLAS
akhilesh.tayade@desy.de

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Chapter

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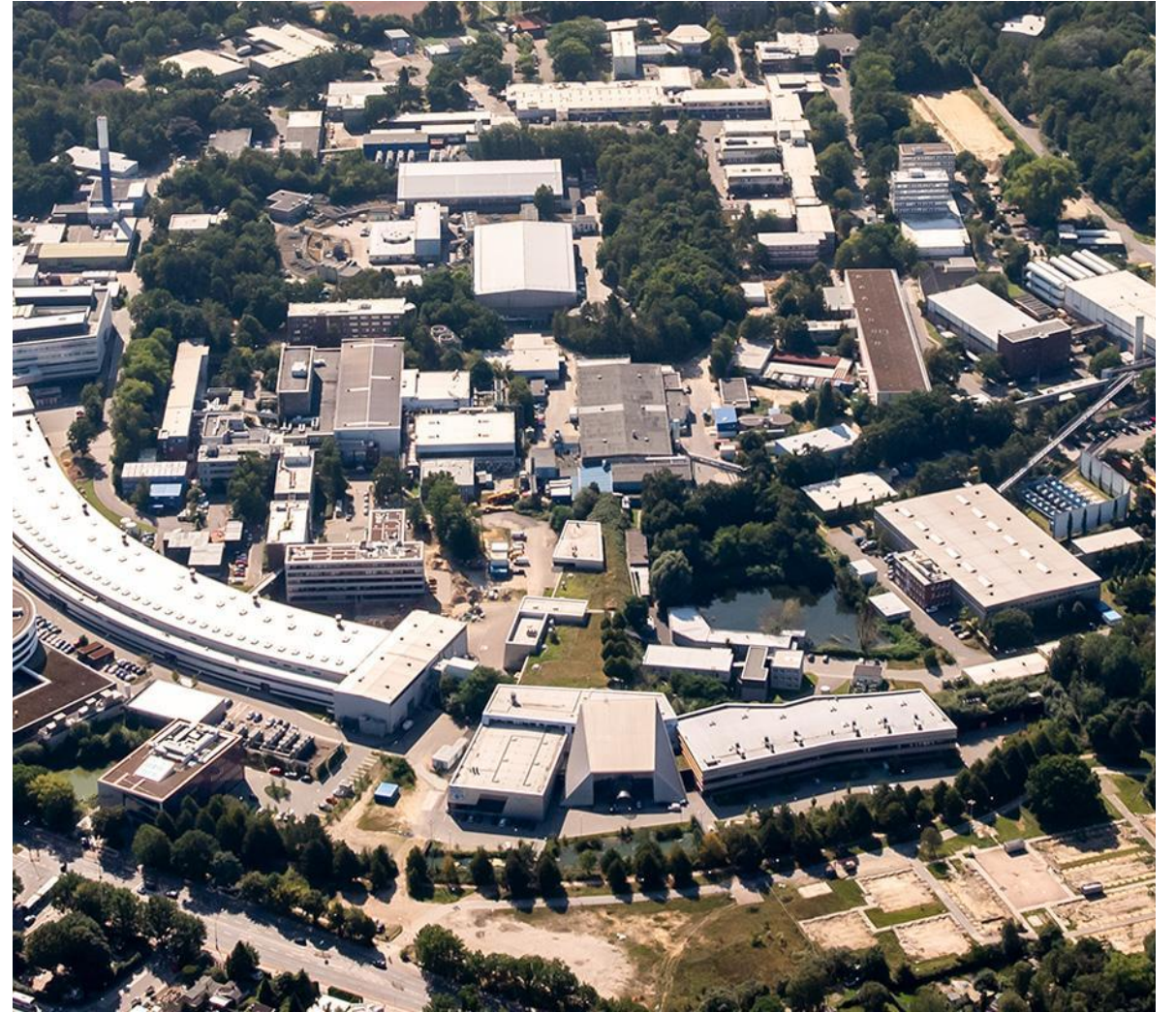
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