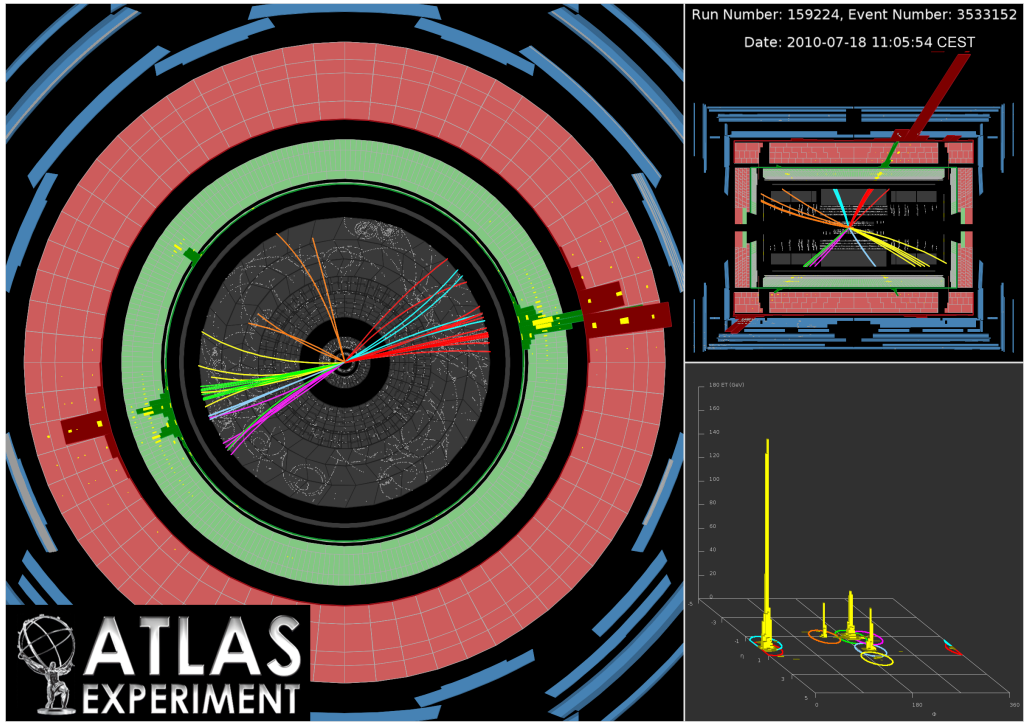

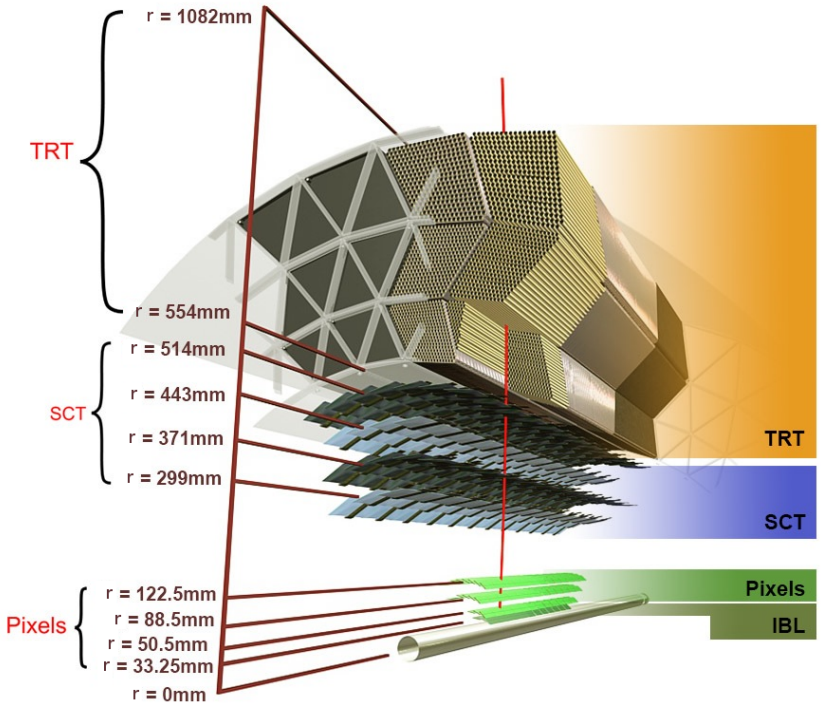

Tracking inside dense environments in ATLAS

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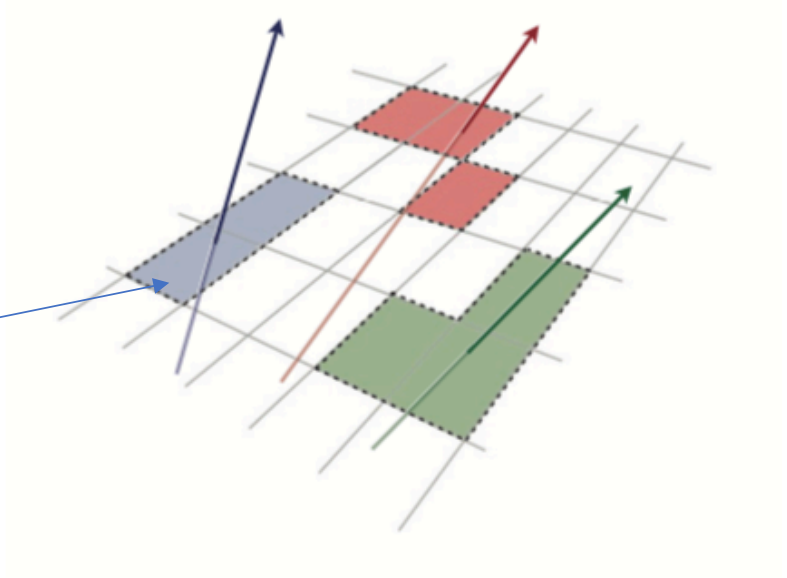
Tracking: How can you see a particle?

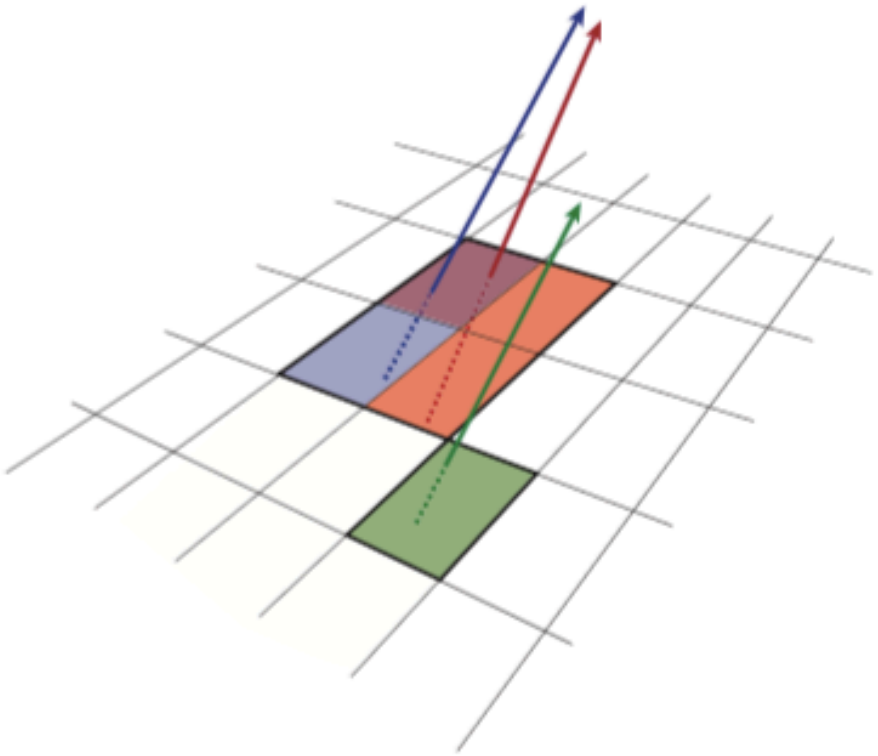
- **Charged particles** make electron/hole pairs in silicon
- This means **electronic signals**!
- So make a detector of silicon pixels and strips
- Charge collected in adjacent pixel/strips grouped together as a **cluster**
- Clusters = **Space Points**
- Space Points -> **Track Seeds**
- Track seeds -> **Track Candidates**



(a) Single-particle pixel clusters

What happens in dense environments*?

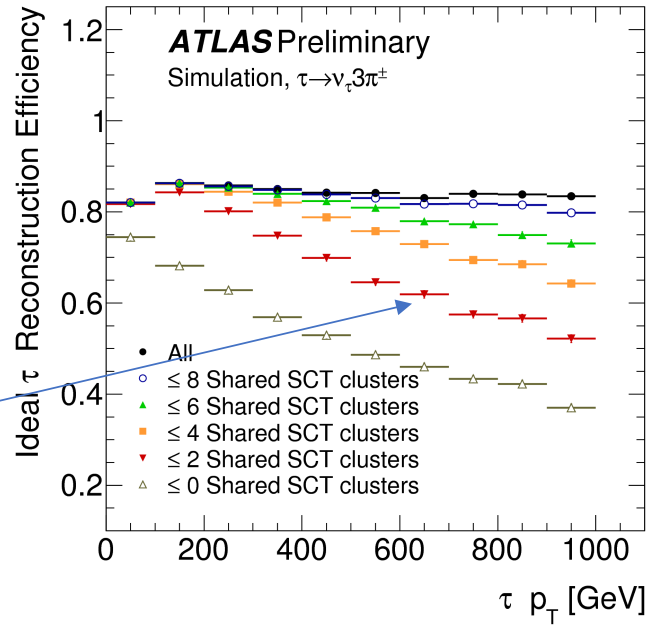
*e.g. high-pT jets, high-pT tau decays

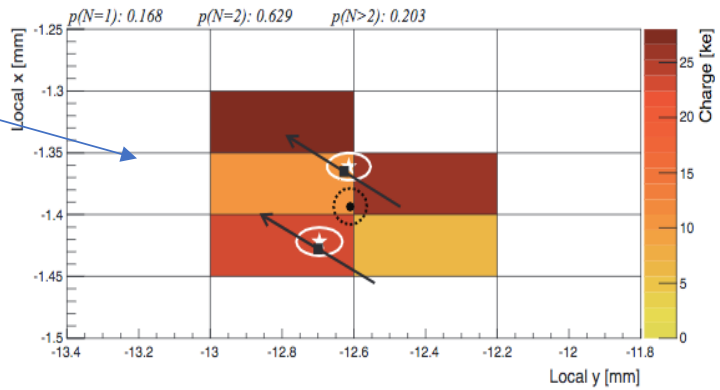


(b) Merged pixel cluster

Why is this a problem?

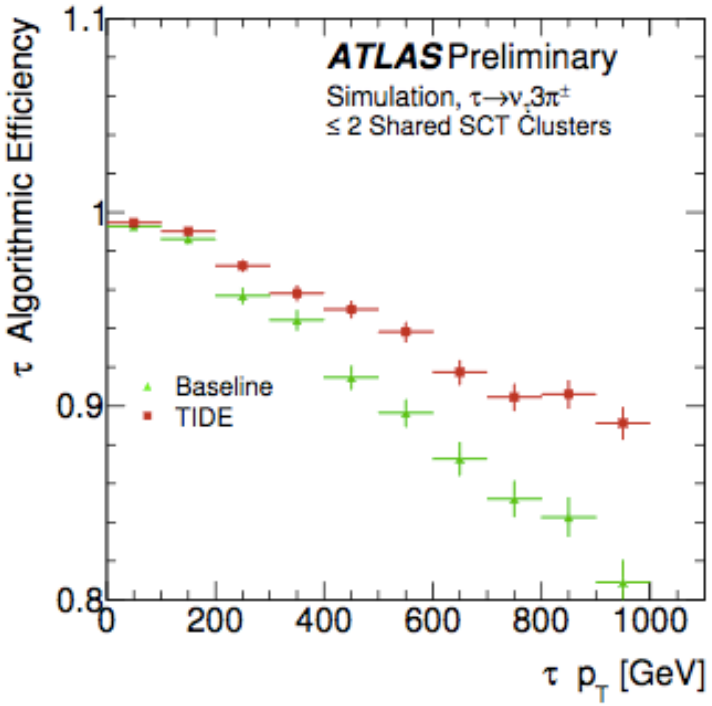
- Track Candidates accepted after ambiguity solving
- Accepted tracks cannot share too many clusters: avoid fakes!
- So highly collimated tracks will be lost!
- **Fix**: Allow clusters to be shared **if appropriate**
  - Look at charge distribution in pixel clusters
  - Compare expected cluster width to actualwidth in strips (SCT)

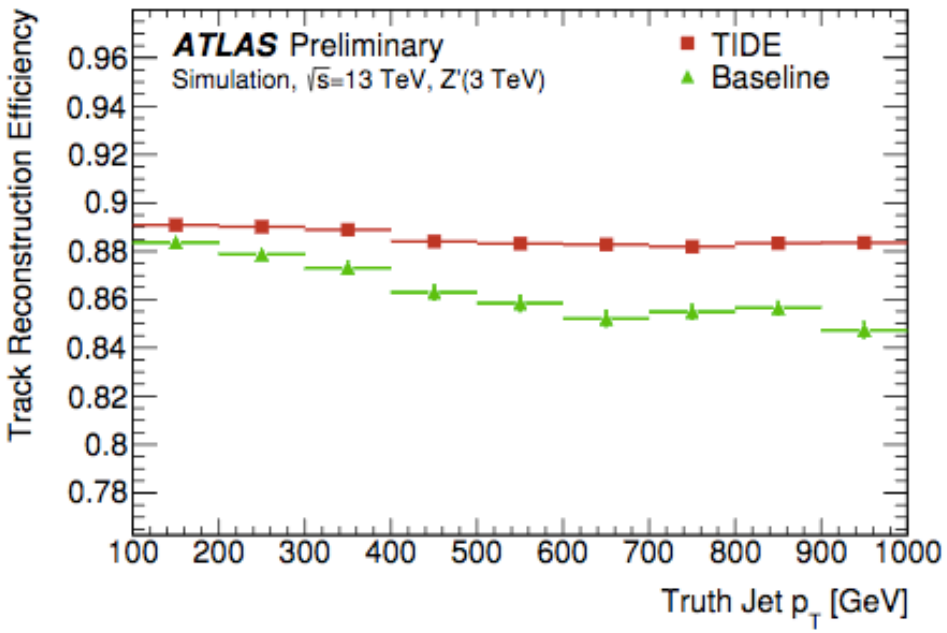




Good Track Hunting

- Currently **Neural Network** based algorithm used to split pixel clusters
- **No SCT-cluster splitting***: tracks cannot share >= 2 SCT clusters





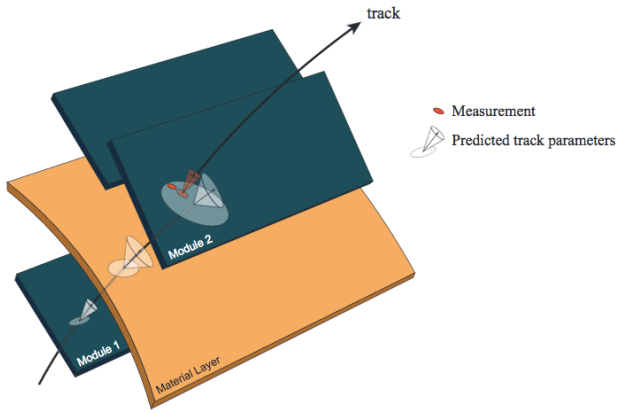
TIDE = optimized tracking with pixel cluster splitting
Baseline = old algorithm

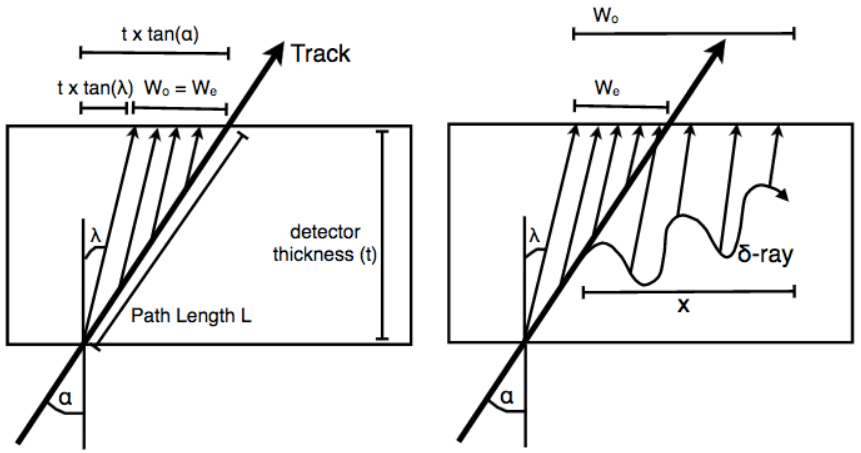
Light Reading

- Optimizing track reconstruction in dense environments: https://cds.cern.ch/record/2002609
- Neural Network for pixel cluster splitting: https://arxiv.org/pdf/1406.7690.pdf

Backup: SCT cluster splitting

- No charge information in SCT clusters
- Splitting discriminants:
  - Difference between expected cluster width (from track candidate) and actual width
  - Number of split pixel clusters on track candidate
  - Track pT
  - SCT layer





Expectation from track alone

Expectation from track with δ-ray