Novel methods and expected Run II performance of ATLAS track reconstruction in dense environments

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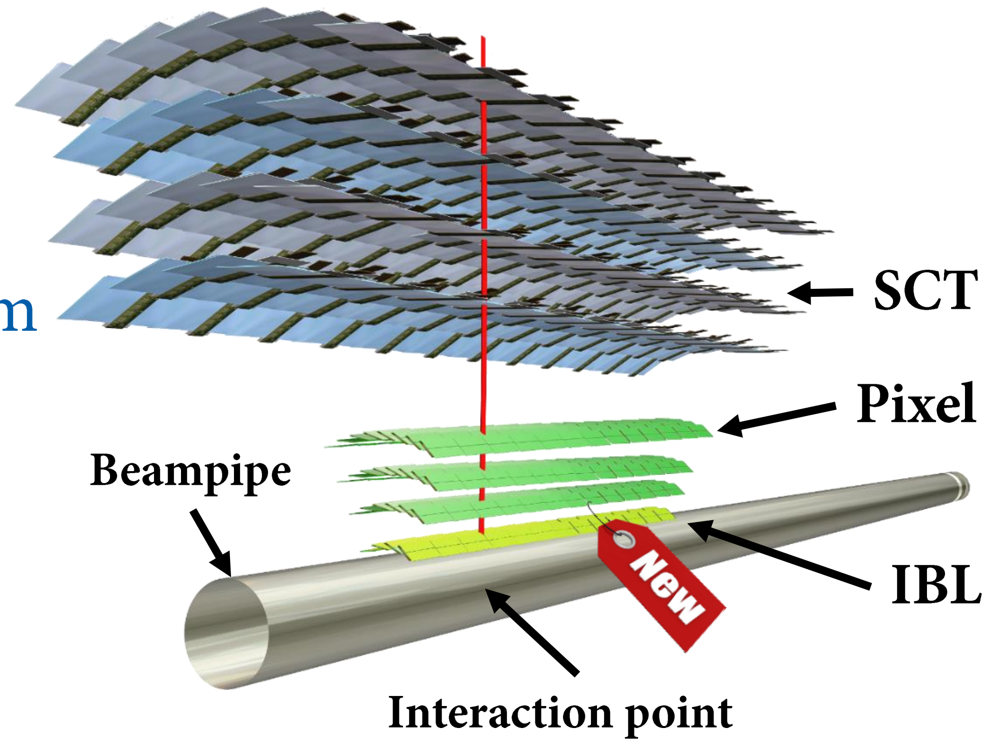
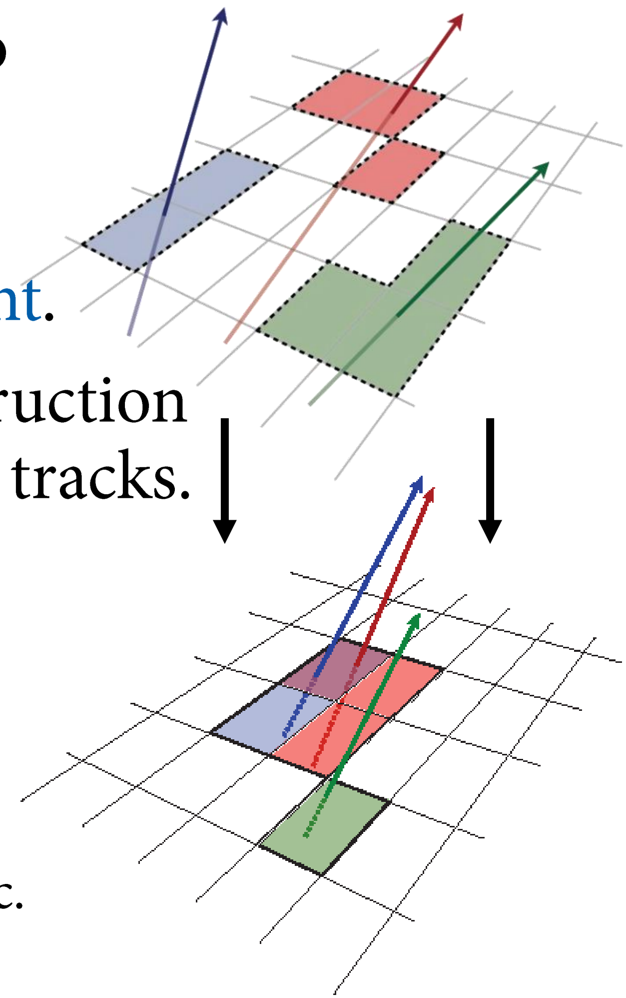
The ATLAS Inner Detector

- Centrepiece for reconstructing tracks from charged particles.
- Si detector delivers ~8 measurements (hits) per particle.
- ATLAS offline software creates tracks out of collection of these (numerous) hits.
- Track reconstruction = correctly assigning all hits & fitting track.
- New IBL only ≈33 mm from interaction point.
- Small pixel size: 50μm x 400/250(IBL)μm.



Dense Environments

- Close hits create one big hit, a cluster.
- Track with small spatial separation lead to merging of these clusters.
- Collimated tracks have merged clusters on consecutive layers → dense environment.
- Shared hits are penalized in track reconstruction → degraded performance ↔ loss of hits & tracks.
- But crucial in many areas:
  - » b-tagging (esp. at high p_T)
  - » jet calibration
  - » 3-prong tau identification
  - » numerous physics signals, e.g. H→bb, SUSY, etc.



Improving the Performance

- Run I used neural network (NN) to identify merged clusters → improved tracking performance, but not optimal usage
- Used single particle gun samples (high momentum ρ's, τ's, B's) to study performance in close-by tracks → then made improvements!
- Example: Using NN later* with information from track candidates improves performance → moved it!

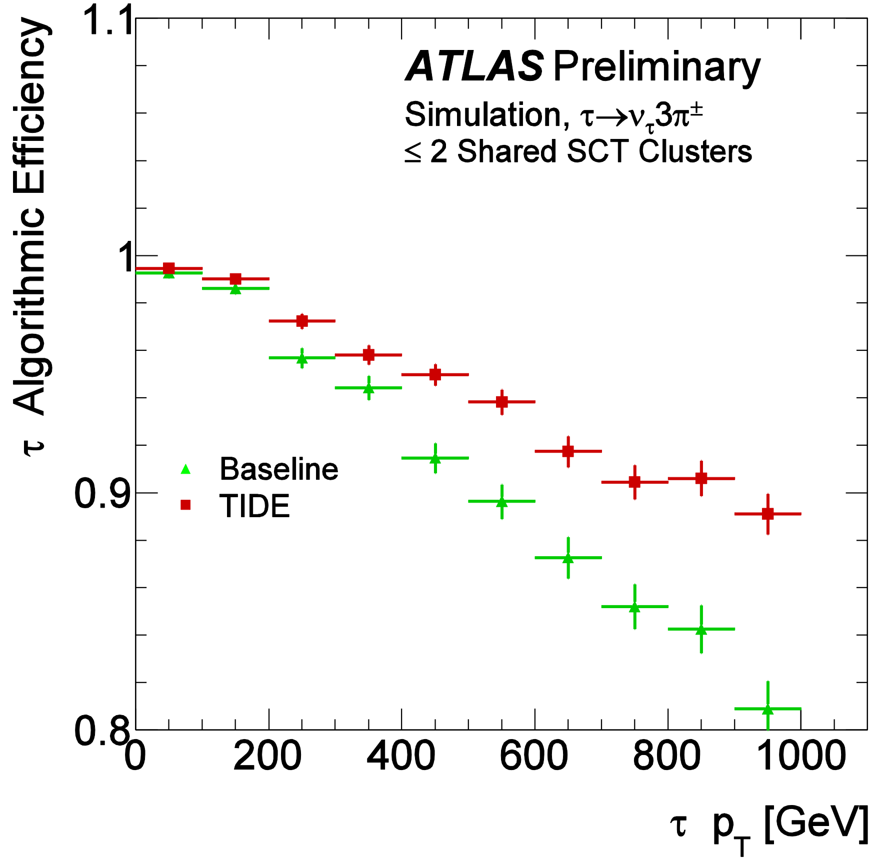
\+ A lot of fine tuning, fiddling, optimizations and so on helped as well*.

*if you want to know what any of this means: see the poster!

Results (it worked!)

- Improved track measurements in dense environements (number of hits per track, impact parameter resolution, τ reconstruction efficiency, b-tagging efficiency)!

Teaser*:



*more: see the poster!