

B-Hadron Reconstruction in early ATLAS Run-3 Data

The ATLAS Collaboration



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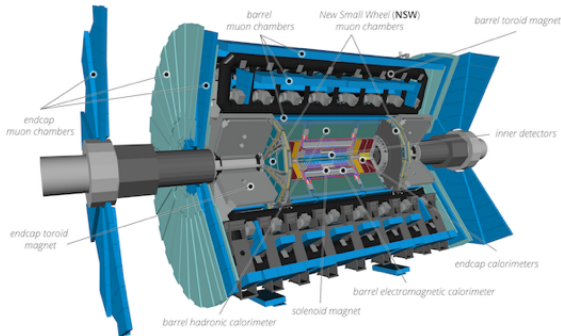
Introduction

Introduction &
Detector

Contents:

- 1 Introduction & Detector
- 2 Run 3 & Tracking
- 3 Tracking & Vertexing
- 4 Mass Reconstruction
- 5 Performance & Conclusion

- B -physics program has been evolved to exploit Run 3 performance improvements.
- Advent of multiple developments require a recommissioning of the reconstruction and analysis chain.



- A cylindrically forward-backward symmetric detector with 4π sr coverage in solid angle.
- 4 Main detector subsystems - Inner Detector (ID), Electromagnetic Calorimeter, Hadronic Calorimeter, Muon Spectrometer (MS).

Run 3 & Tracking

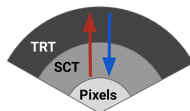
Run 3 & Tracking

Contents:

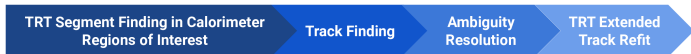
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- LAr Trigger Electronics, resolution and efficiency improvements, topological L1 trigger.
- Fast tracking, full event tracking for HLT.
- New small wheels & precision offline tracking.

ATLAS Primary Tracking



ATLAS Back-Tracking



- Tracking algorithms in ATLAS run inwards \rightarrow outwards, then in reverse, and discovered tracks passed to the vertexing process.

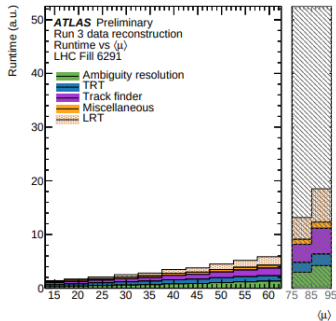
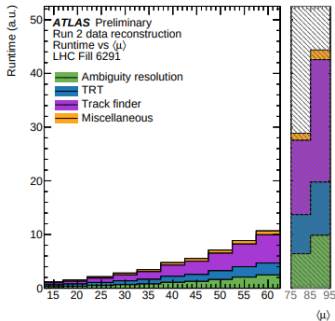
Tracking

Tracking & Vertexing

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- Tracks are seeded from pixel and SCT detectors, tracks built from estimated trajectories.
- Duplicates and fakes removed with ambiguity resolution procedure, refit is performed when extending the track to TRT.
- The procedure is then conducted in reverse using seeds selected from the TRT using RoI's generated from the EM Calo.



- Multiple Run 3 Improvements to track reco, aborts earlier, higher standards for track candidates.
- Old Run 2 Vertexing algorithm upgraded to adaptive multi-vertex finder.

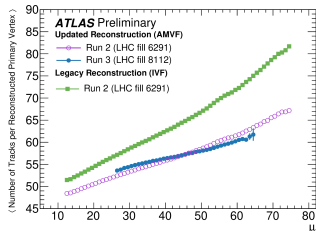
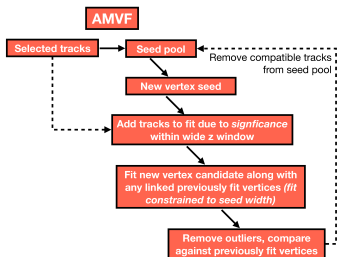
Vertexing and Track Efficiency

Tracking & Vertexing

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- For vertexing, use gaussian track seed finder for tracks unassigned to vertex candidates to find most likely PV.
- Tracks are then fit to vertices. Any new fits to a vertex prompt a full refit, which propagates to all other vertices sharing tracks.



- Vertices are then accepted or rejected based on enhanced criteria.
- This provides marked improvements in track performance in Run 3.

Mass Reconstruction

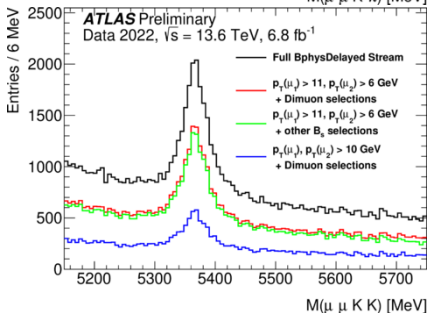
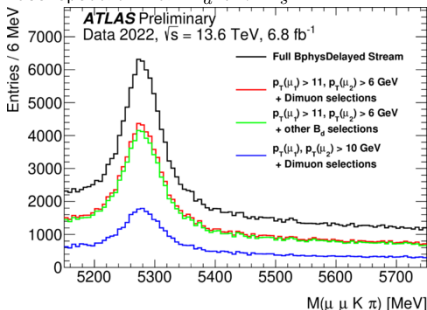
Mass Reconstruction

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- New Run 3 methods have been applied to reconstruction of B -Hadrons.

Reconstructed mass spectrum for B_d and B_s

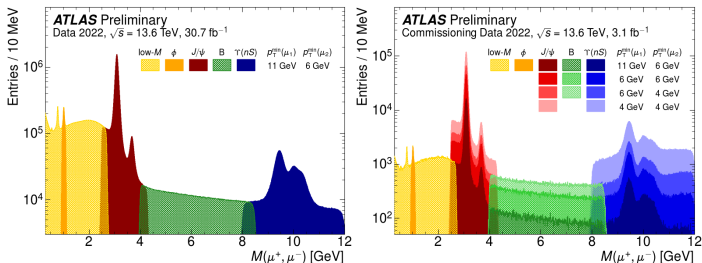


Performance & Conclusion

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- This covers di- μ trigger performance for all regions of interest to ATLAS B -physics.

References

- Software Performance of the ATLAS Track Reconstruction for LHC Run 3, ATL-PHYS-PUB-2021-012
- Development of ATLAS primary vertex reconstruction for LHC Run 3, ATL-PHYS-PUB-2019-015
- ATLAS Bphysics Trigger Public Results