

# Updated track measurement cuts in EICRecon

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# Impact of cut on number of measurements used for track fitting

- When beam-induced backgrounds are present, multiple simulation studies have shown that good tracking and vertexing performance requires that we have a minimum of **four good measurements** (i.e., fit points) for a reconstructed track. See [here](#), [here](#), [here](#), [here](#), [here](#), and [here](#) for details.
- In addition, the Combinatorial Kalman Filter (CKF) that we use for simultaneous track finding and fitting is not really designed to work with only three measurements.
- Because of this, as well as due to some additional studies from the PWGs, we decided to implement the requirement that  $n_{meas.} \geq 4$  directly inside the CKF in EICRecon: <https://github.com/eic/EICrecon/pull/2590>.
  - The upshot of this change is that all saved tracks (and therefore everything written into the *ReconstructedChargedParticles* collection) will now have  $n_{meas.} \geq 4$  starting in the April campaign.
  - This directly removes most fake tracks associated with background hits. These fake tracks are also no longer used as input in downstream EICRecon algorithms such as the primary vertexing and the jet reconstruction.

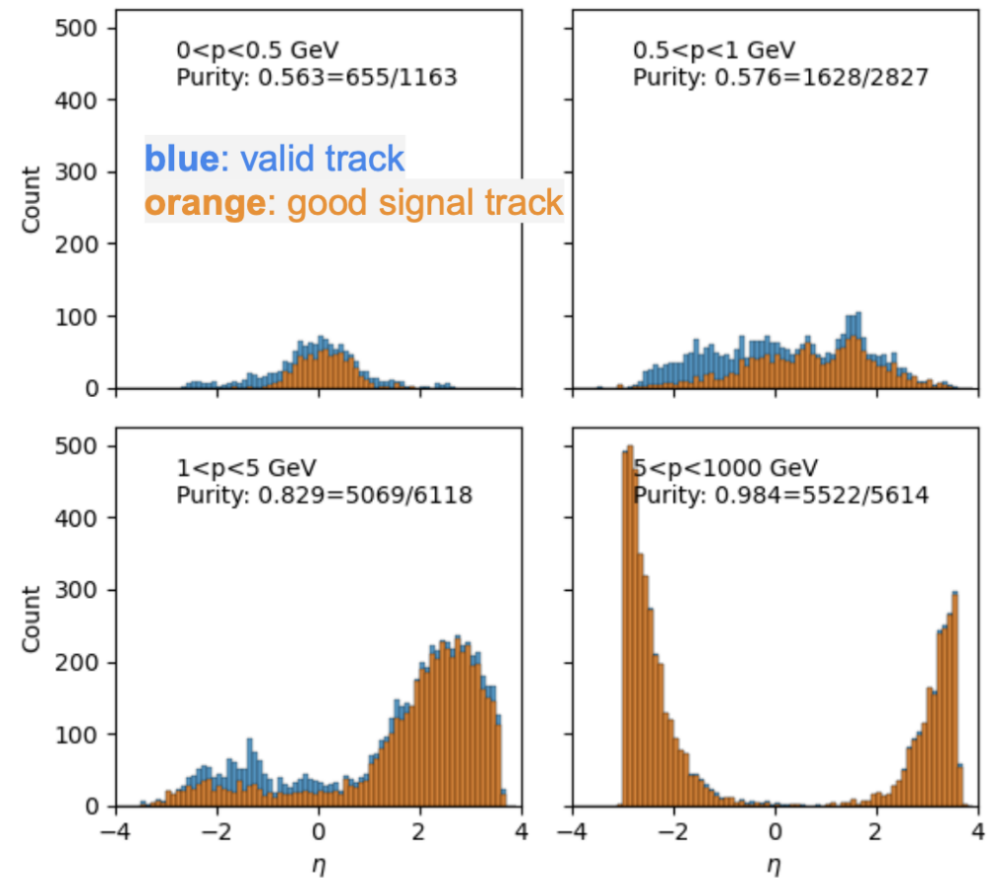
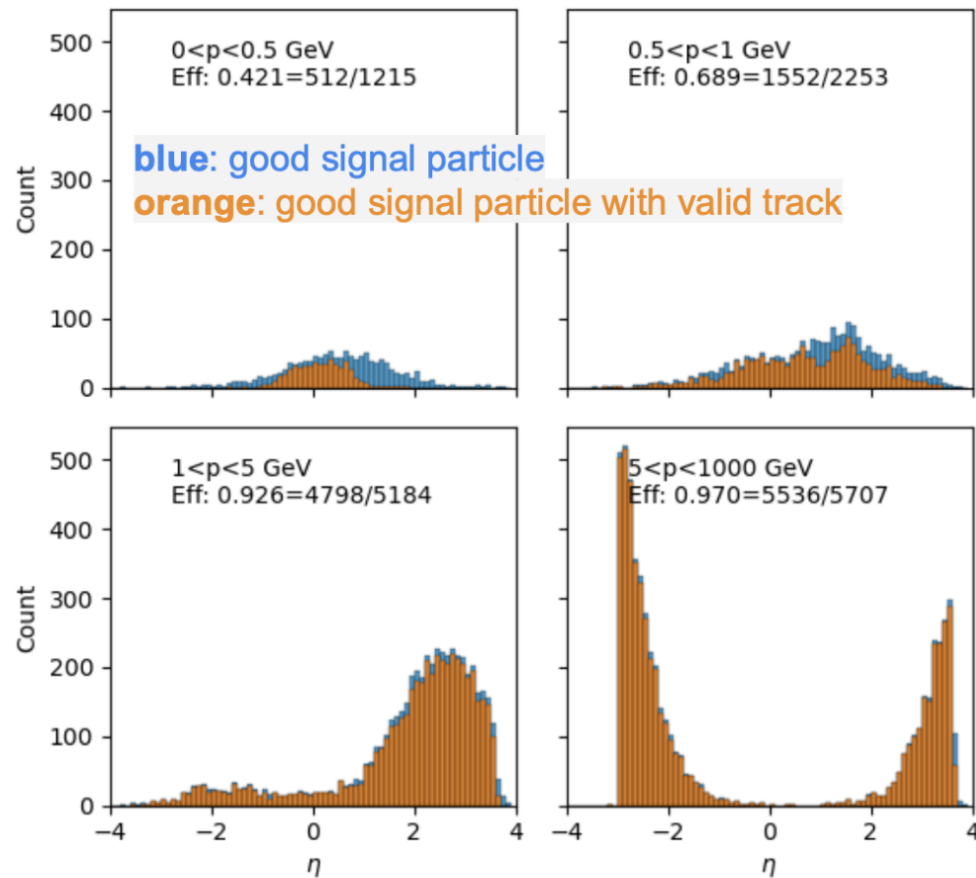
# Overview of tracking performance

All backgrounds included.  
Highest background rates  
at 10 GeV

10x275, 10 $\mu$ m gold coating, at least 4 hits per track: OK efficiency, OK purity

Efficiency (4 hits) | 10x275, 10 $\mu$ m | total=0.863 (12398/14359)

Purity (4 hits) | 10x275, 10 $\mu$ m | total=0.819 (12874/15722)



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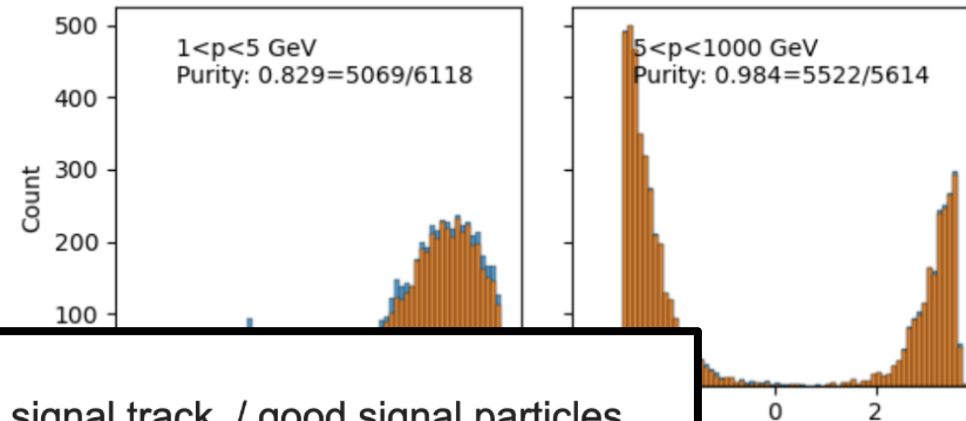
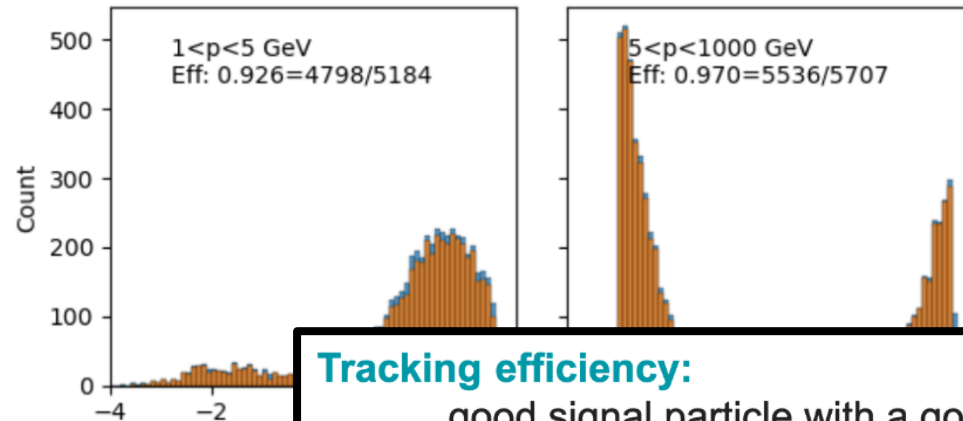
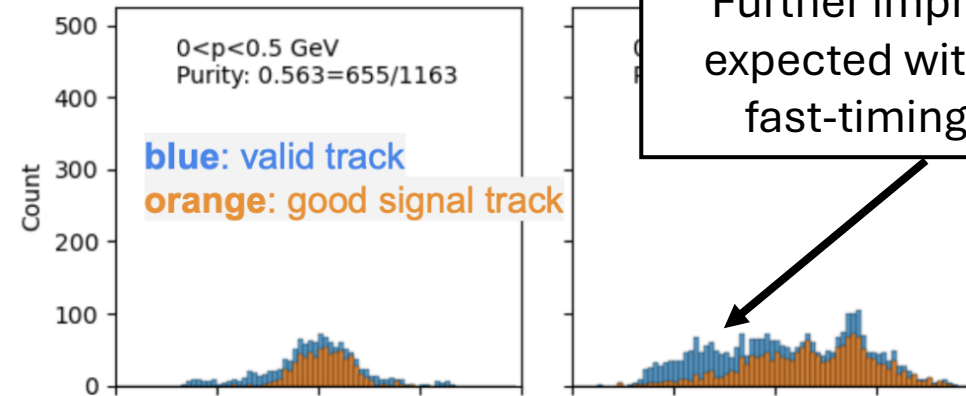
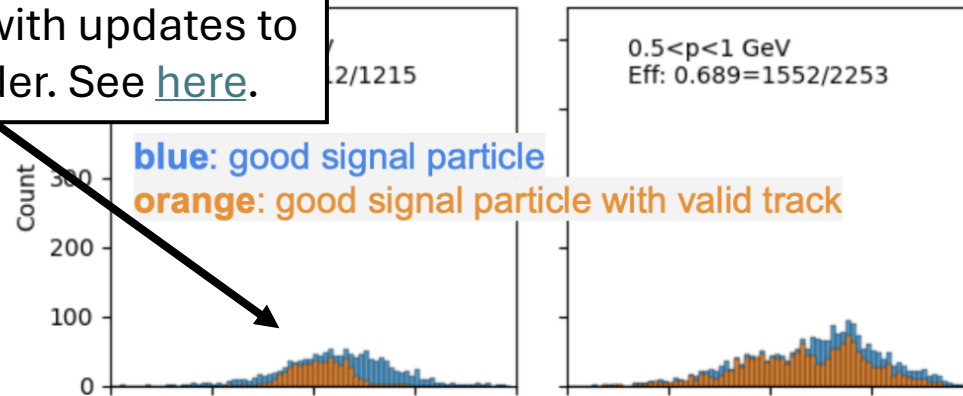
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Further improvement expected with updates to seed finder. See [here](#).

Further improvement expected with cuts on fast-timing layers.



**Tracking efficiency:**  
good signal particle with a good signal track / good signal particles

**Tracking Purity:**  
good signal tracks / valid tracks

# Overview of tracking performance: 4 vs. 5 measurements

4 hits → 5 hits cut: lower efficiency, higher purity

| <b>≥ 4 hits per track</b> |        | <b>≥ 5 hits per track</b> |        |
|---------------------------|--------|---------------------------|--------|
| Efficiency                | Purity | Efficiency                | Purity |
| 0.863                     | 0.819  | 0.822                     | 0.982  |

**Tracking efficiency:**  
good signal particle with a good signal track / good signal particles

**Tracking Purity:**  
good signal tracks / valid tracks

# How to apply more stringent track cuts in analysis

- If using the *ReconstructedChargedParticles* collection, for every event, this array is currently synced with the arrays in the various track collections. So, array element [0] in one collection corresponds to array element [0] in the other collection, etc...
  - See [here](#) and [here](#) for an example.
- For the *ReconstructedParticles* collection (which also includes neutrals), it is probably best practice to use the PODIO classes to get the associated track for a given *ReconstructedParticle*.
  - See [here](#) for an example.