Status: Tracking performance of EPIC

Berkeley EIC meeting

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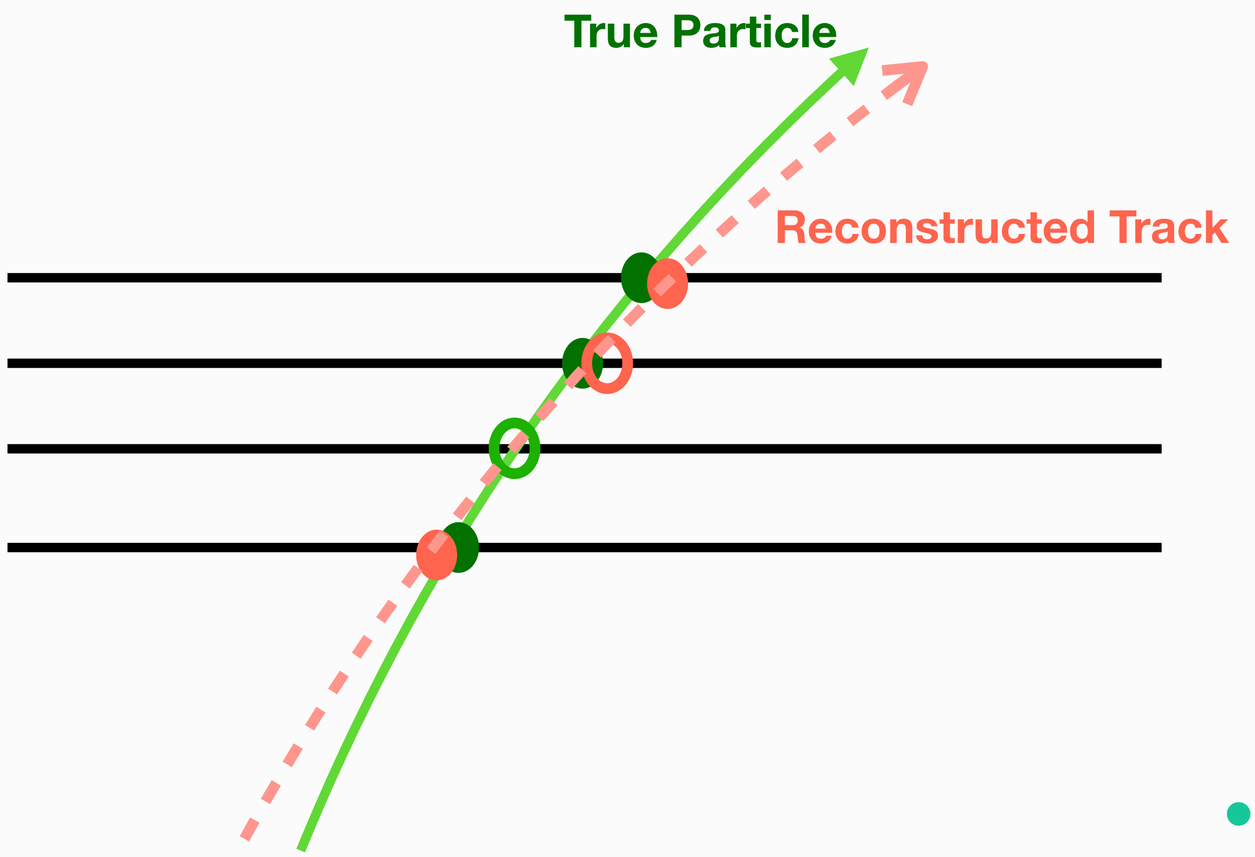
Tracking performance study @ Berkeley

- Efficiency and purity studies for different physics cases
  - Minjung - Vector meson photoproduction (focusing on handling duplicate trks)
  - Beatrice - high Q^2/Jet-Jet events
  - Ben- DIS+Background
- To-Do:
  1. Set-up common working framework for tracking study on Perlmutter: installing my version of EIC-recon and share some macros for plotting (Minjung) 1 - 2 days
  2. ***Make common checklist for the basic performance of tracking and study for different event classes:*** purity and efficiency as a function of pseudo-rapidity, pT,… what else? 2 - 3 weeks
  3. Integration to standard EICrecon: Make factory or plugin for standard eicrecon for removal of duplicates + tracking QA 1 week + α
  - Possible extensions:
    - impact of additional tracking sources (MPGD, TOF,..), clustering in tracker (is it necessary?), usage of timing information?, …..
    - Update physics projection plots relying on tracking performance

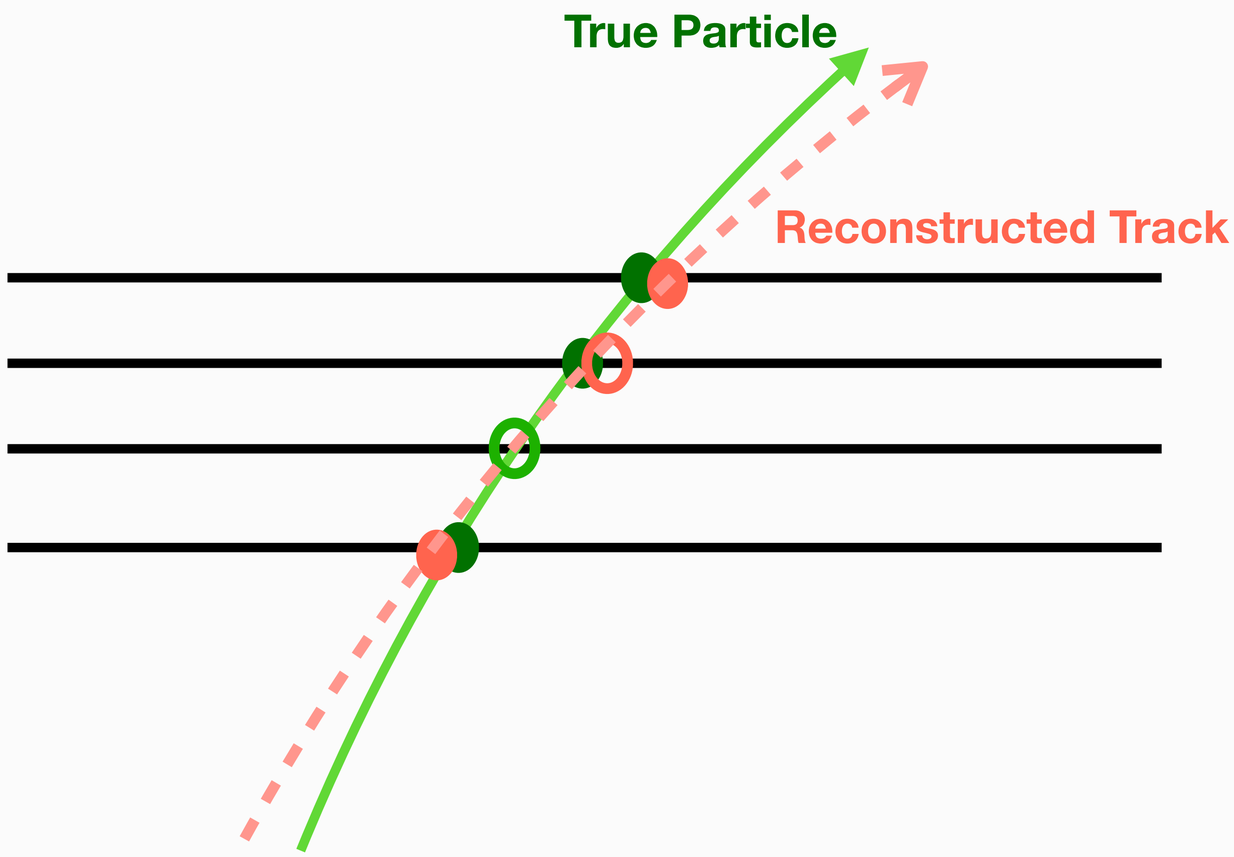
backup

Status and outlook



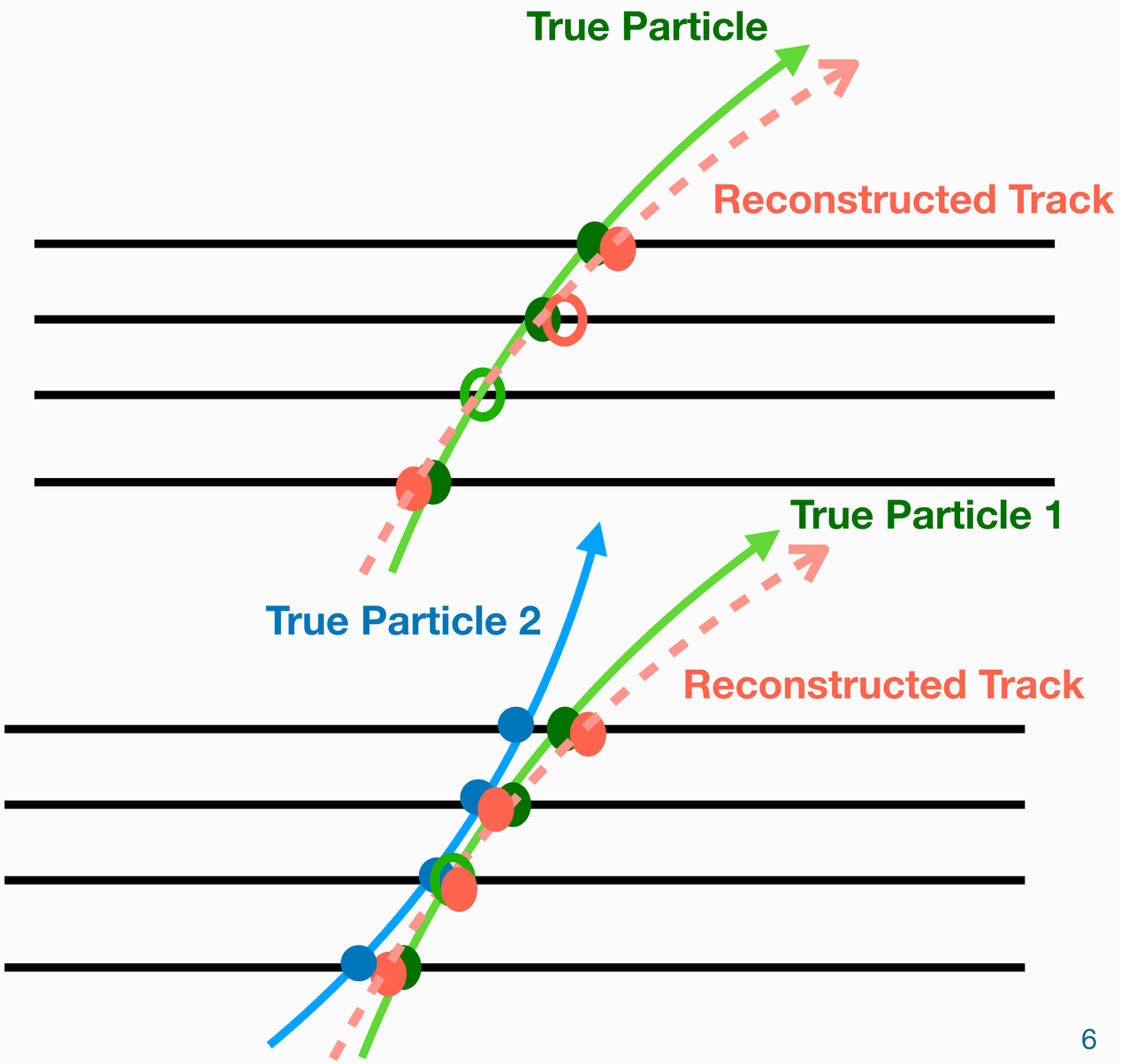
- Missing information in standard “EICrecon” output:
  - Link between generated hits and true particle trajectory
    - ➡ Available in npsim output; hard wiring to EICrecon output
  - Link between measured hit and reconstructed track
    - ➡ Private modification of EICrecon (parallel to Shujie’s update) without modification of data models
- Solving duplicate track issue (ambiguity resolution) + tracking performance study including efficiency

Tracking performance evaluation



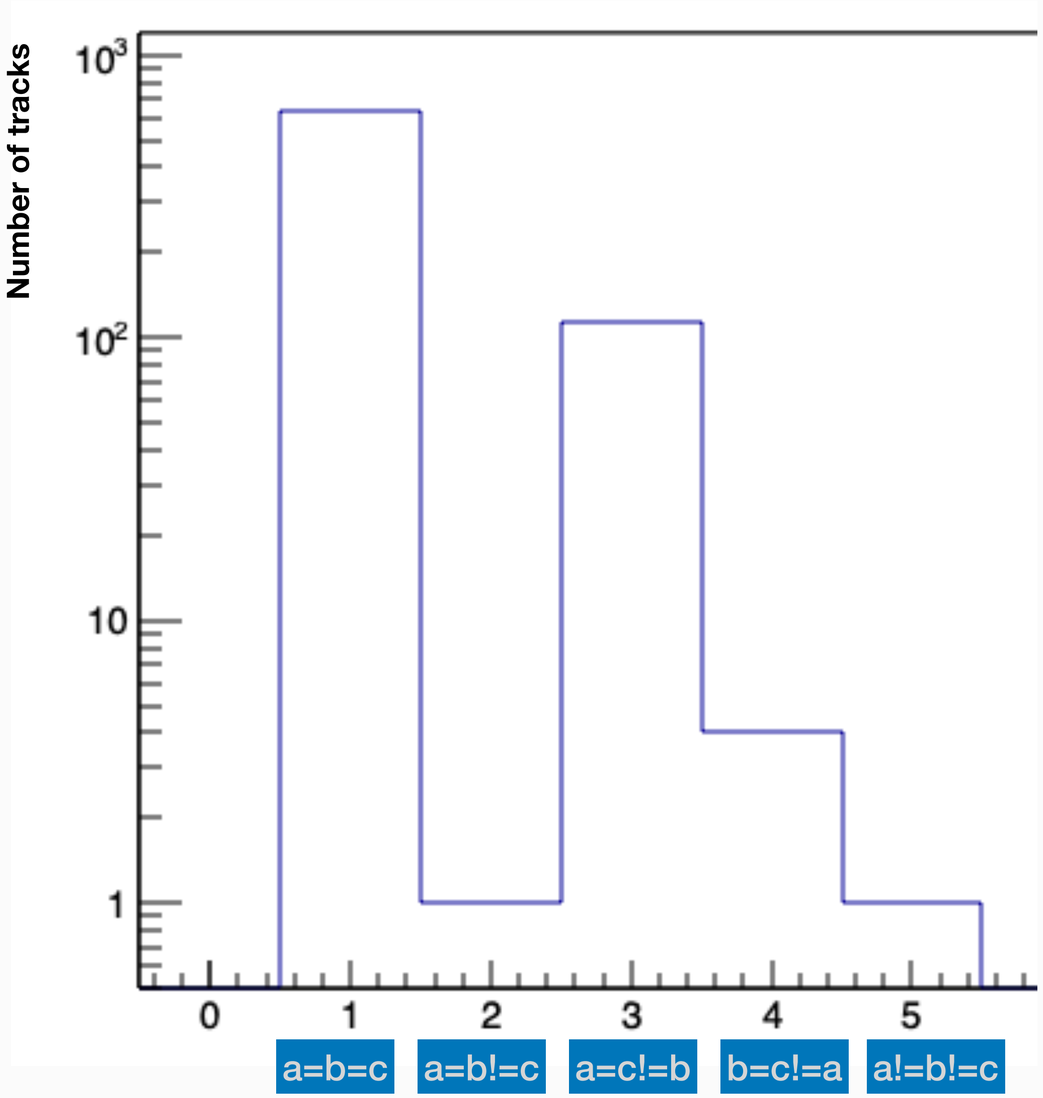
- From true particle (signal):
  - Generated hits
  - Particle trajectory represented by track parameters
- Track reconstruction:
  - Reconstructed (measured) hits
  - Reconstructed track from reconstructed (measured) hits
- Questions:
  - How many generated hits reconstructed (measured)?
  - How good does reconstructed track reproducing true particle?
  - How to distinguish the best track out of a set of duplicate tracks?

Matching between particle and track



- Matching can be complicated for the with high multiplicity events (having many signal particles)
- Matching using geometrical properties, i.e. eta and/or phi might be not enough
- Hit level matching: Association of reconstructed (measured) hits to generated hits: Matching with the particle giving largest contribution of hits for given track

Consistency between different matching methods

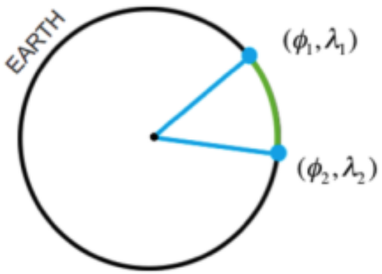


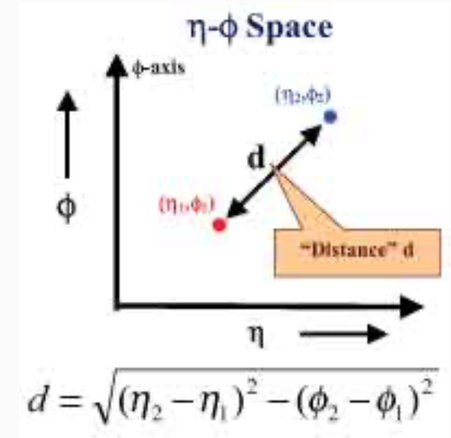
- Three different matching methods used:

  a) Hit level matching: check the source of hits in the track and matching to the particle giving maximum contribution

  b) pT based matching: matching reconstructed track with the particle having the closest value of pT

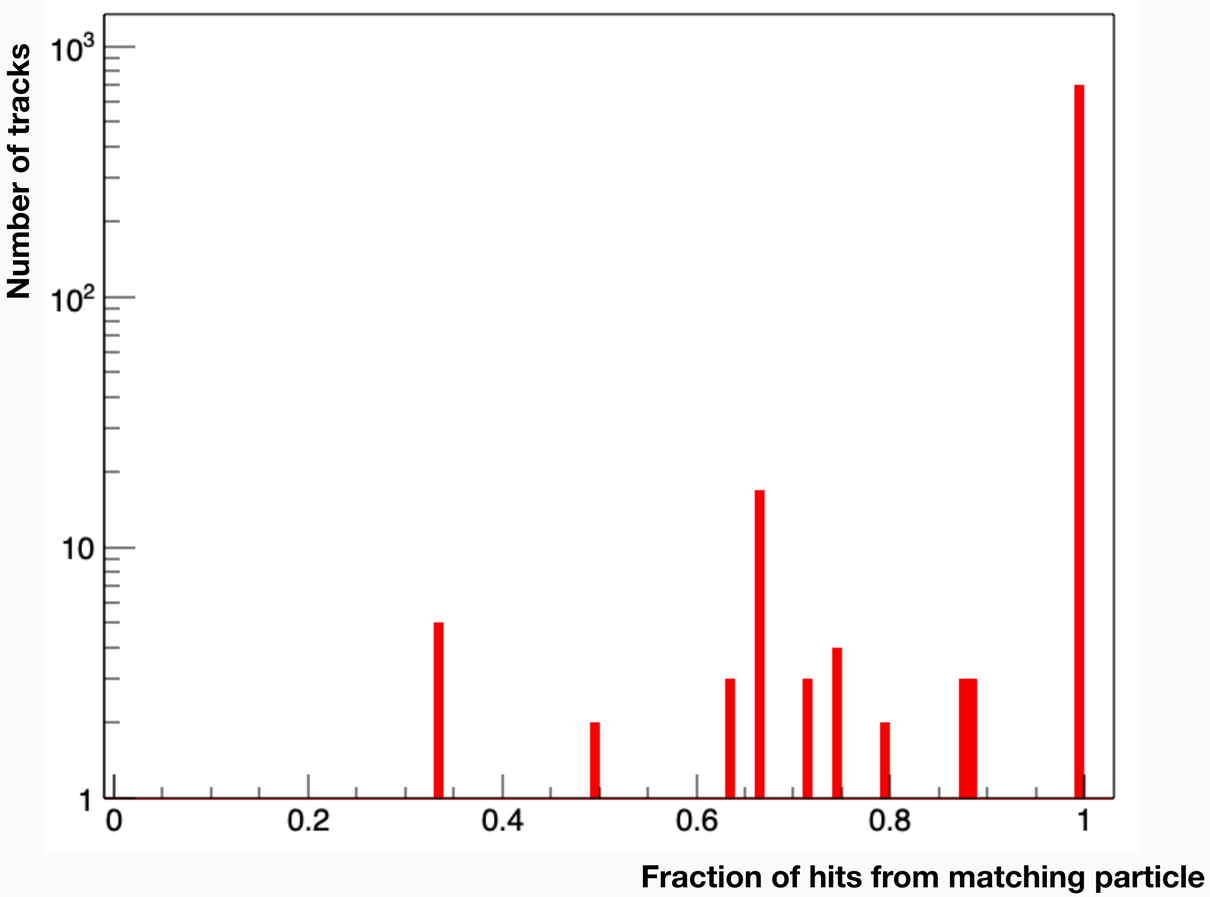
$$\text{haversine}\left(\frac{d}{r}\right) = \text{haversine}(\phi_2 - \phi_1) + \cos(\phi_1)\cos(\phi_2)\text{haversine}(\lambda_2 - \lambda_1)$$



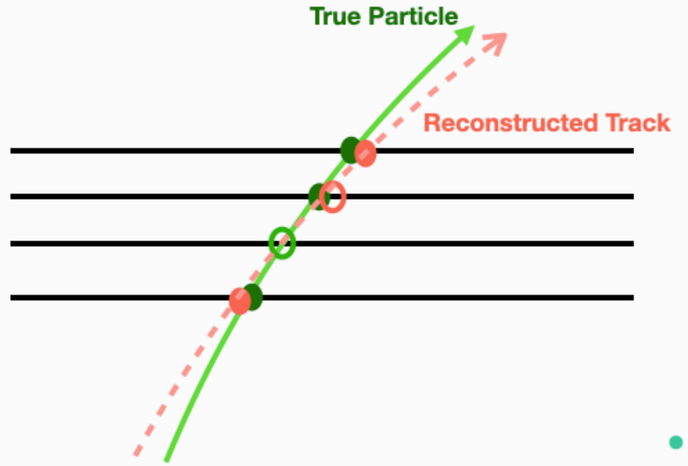


- Angular distance based matching gives more than 98% consistent result with hit level matching

Fraction of hits from matching particle



- Most of tracks from one matching MC particle
- interesting to see how it is in more complicated events (i.e. high Q^2 DIS)
- Hit reconstruction efficiency, as well as track reconstruction efficiency should be accessed in other direction, from MC particle to reconstructed track



Duplicated tracks