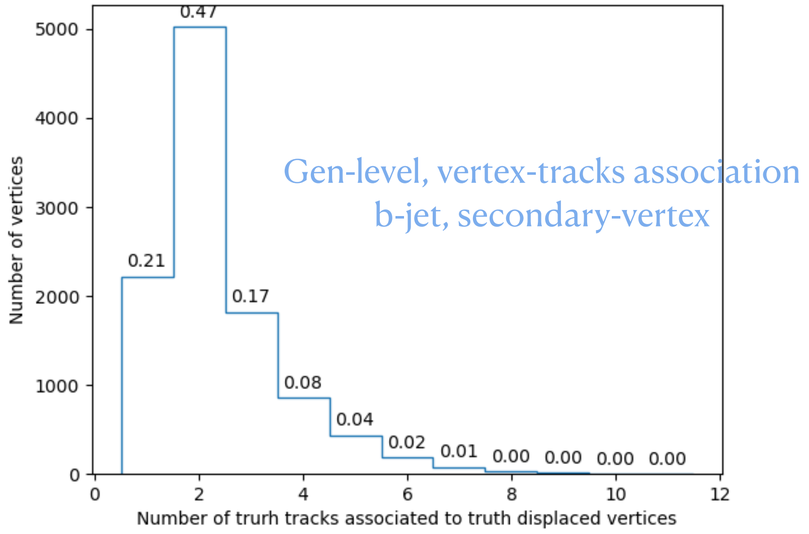
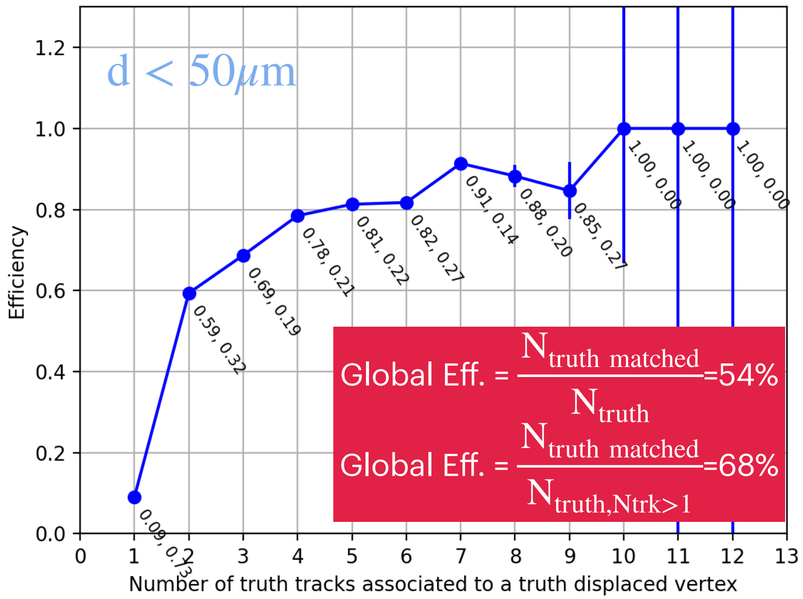
Trk, PID, Vtx

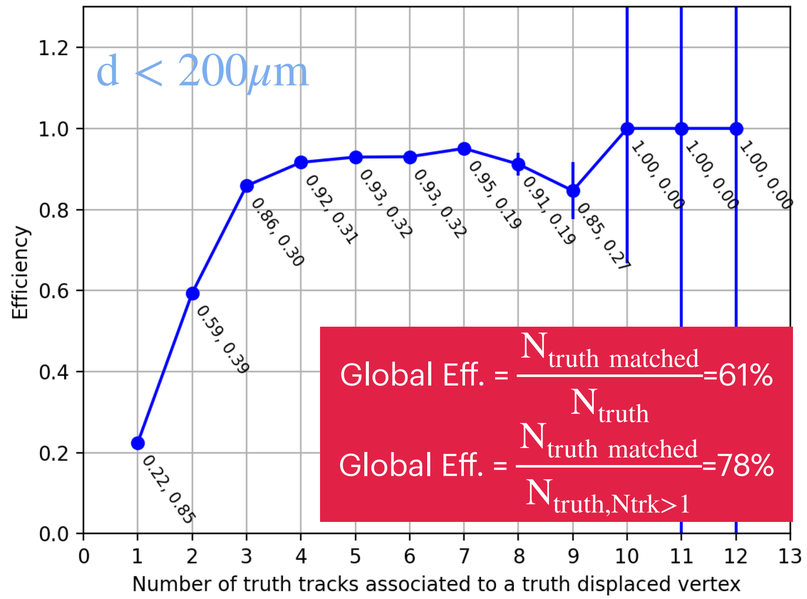
C.Zhang/07Jan2025

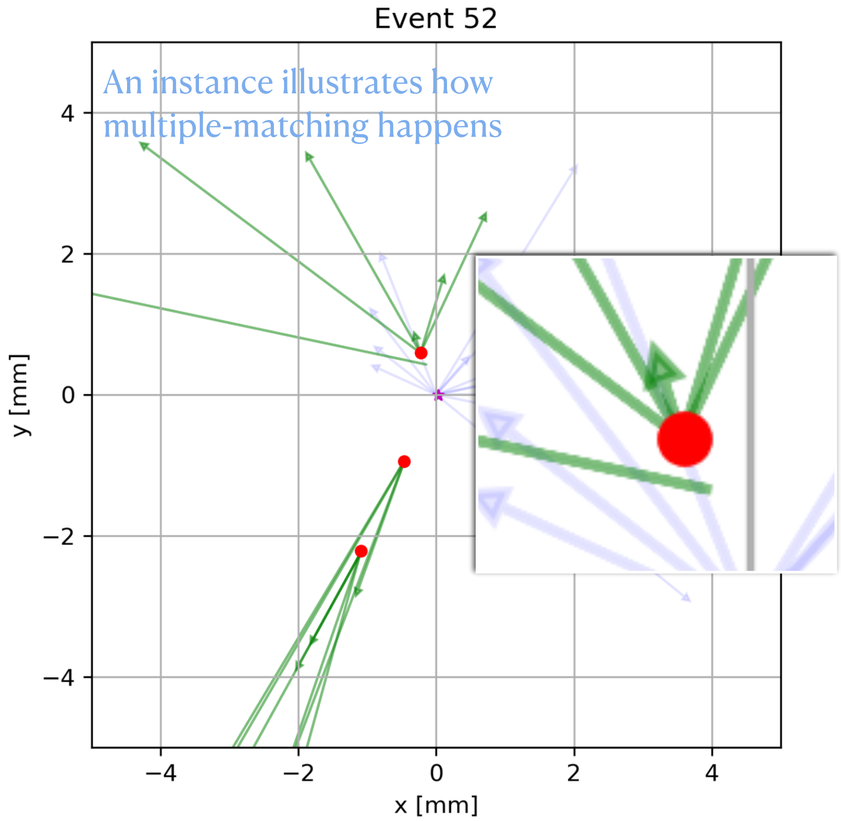
Vertex

- Tests of secondary vertex algorithm using E91_bb events
- Gen-Rec matching based on the transverse distance d < 50/200μm
  - Special care for vertices with Ntrk=2
    - The distance between these vtx. to the IP (R), if R < 10 mm, ask d < 0.3mm; if R > 10 mm, ask d < 4 mm
  - Note the multiple-counting in the definition: one reconstructed vertex can match to more truth vertices if they are close
  - Blue points on the plots below, $\frac{N_{\text{truth matched with a reco.}}}{N_{\text{truth}}}, \frac{N_{\text{matched truth shares reco. with others}}}{N_{\text{truth matched with a reco.}}}$



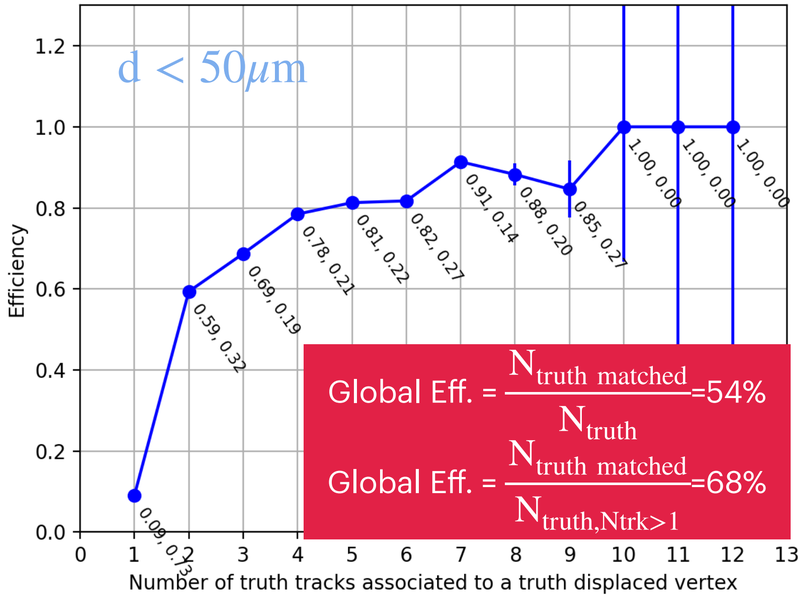


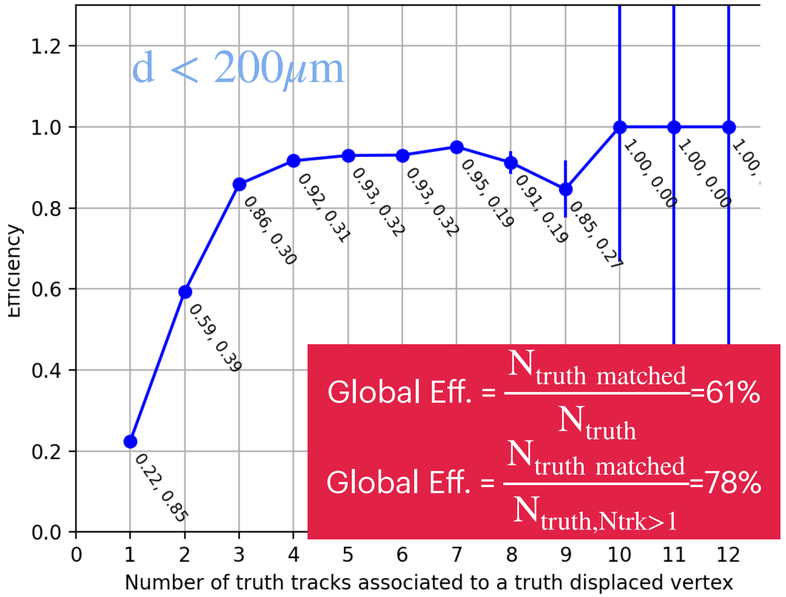


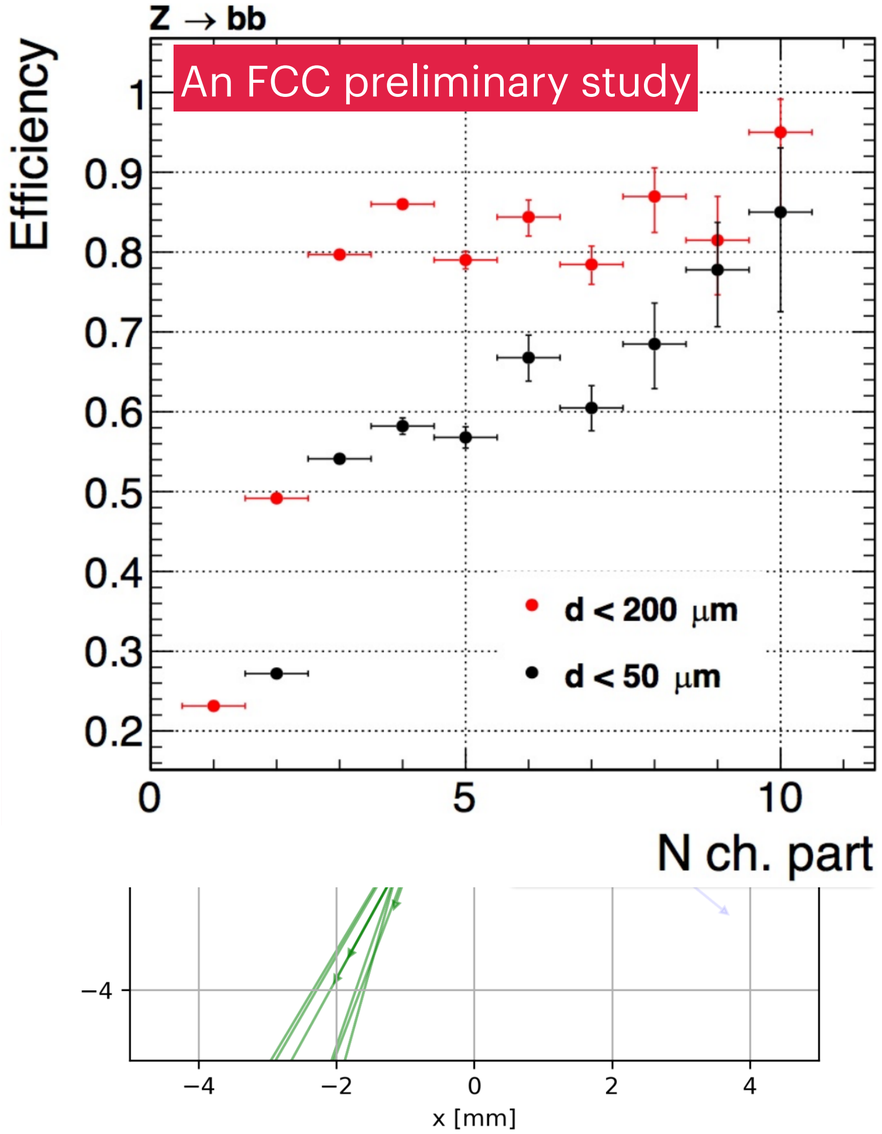


Vertex

- Summary & Todo
  - Vertices with Ntrk=2 suffer from errors in vertex-seeding (track pairs), looking for improvement (track ambiguity plays a role there)
  - Compared with an FCC preliminary result, it should enable a reasonable performance on jet tagging using traditional way



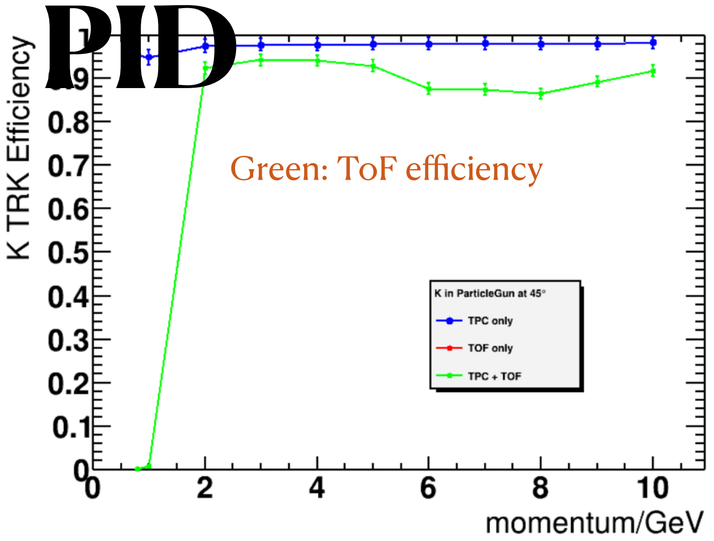


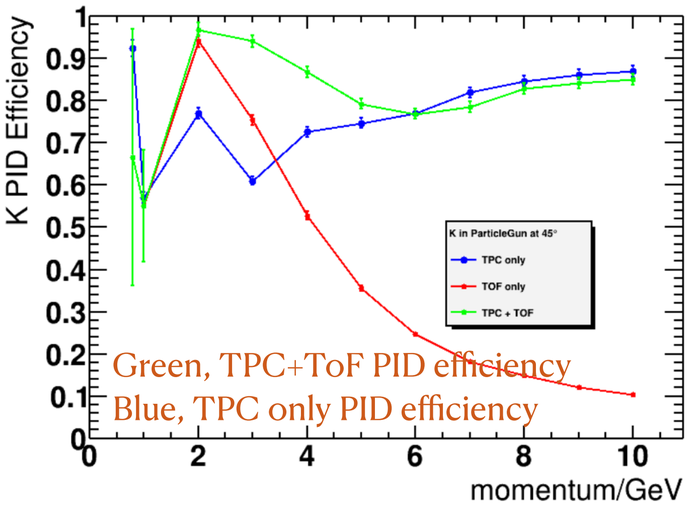


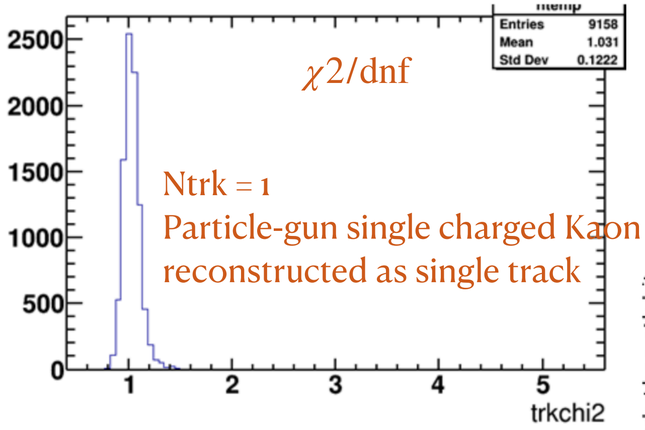
Xiaotian Ma

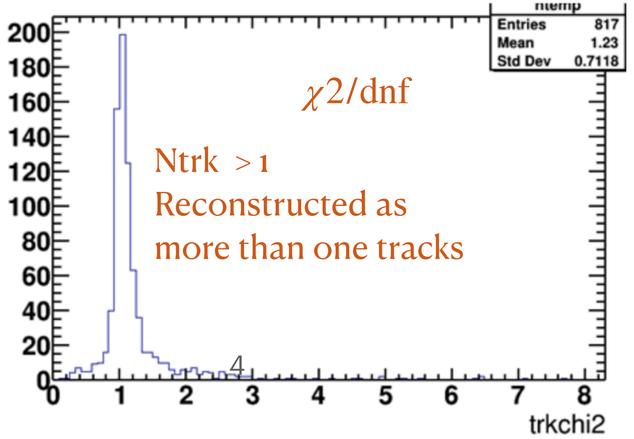
PID

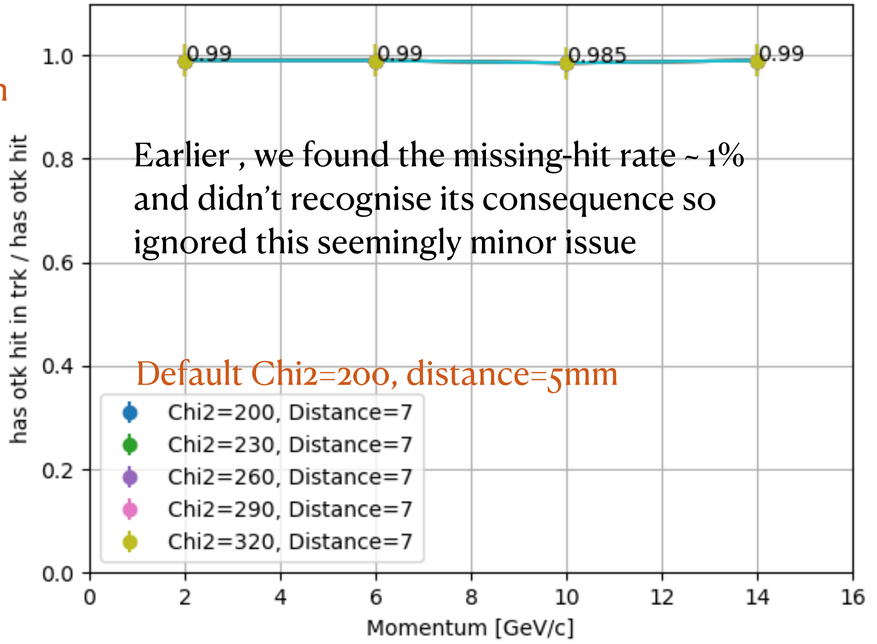
- Overall performance of Kaon efficiency and purity ~70/70%, waiting for SW's updates for the target ~90%
- Issues need to be understood
  1. ToF efficiency is worse than expectation
     - One particle can be reconstructed as multiple tracks, some of them don't have ToF hit and involve into the denominator of the efficiency
     - Can not remove the issue by track quality criteria χ^2/ndf, all them are ~ 1
     - To-do: A study for track ambiguity is needed, either as a mandatory for vertexing
  2. Combined PID worse than TPC only in some areas
     - Track-seeding finds a ToF hit, timing info. get in to the PID reconstruction
     - Track-fitting removes this ToF hit, report a inner endpoint w.r.t the ToF hit
     - Mis-matching between trajectory-length and time-of-flight results in a wrong χ^2
     - To-do: Optimisation for the cuts of χ^2, distance used by tracking











Trk

CMS-TDR

6.4.4 Ambiguity resolution

Ambiguities in track finding arise because a given track may be reconstructed starting from different seeds, or because a given seed may result in more than 1 trajectory candidate. These ambiguities, or mutually exclusive track candidates, must be resolved in order to avoid double counting of tracks.

The ambiguity resolution is based on the fraction of hits that are shared between 2 trajectories. For any pair of track candidates, this fraction is defined in the following way:

$$f_{\text{shared}} = \frac{N_{\text{shared}}^{\text{hits}}}{\min(N_1^{\text{hits}}, N_2^{\text{hits}})},$$

where N_1^{hits} (N_2^{hits}) is the number of hits in the first (second) track candidate. If this fraction exceeds a value of 0.5, the track with the least number of hits is discarded, or, if both tracks have the same number of hits, the track with the highest χ^2 value is discarded.

The ambiguity resolution is applied twice: the first time on all track candidates resulting from a single seed, and the second time on the complete set of track candidates from all seeds.

- Interface to analysis user for ambiguity is under developing