New results on EMC charged particle assignment

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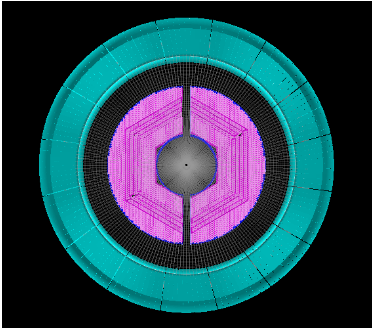
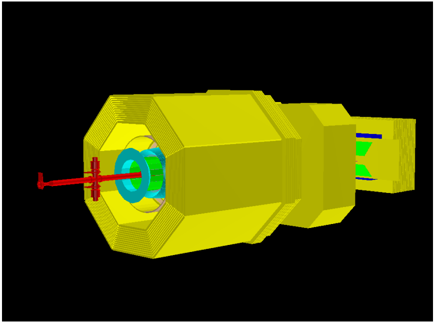
Research Problem and Motivation



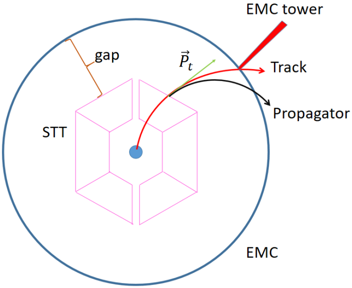
PANDA framework



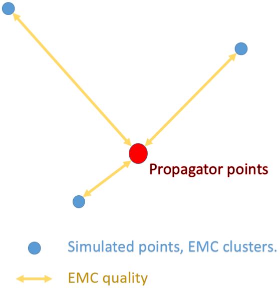
Staws Tube Tracker and Electromagnetic calorimeter

- There're gap between STT and EMC.
- GEANE propagation takes long CPU time.

Helix propagator and EMC quality



Helix propagator, constructed by Christoph and Thanachot

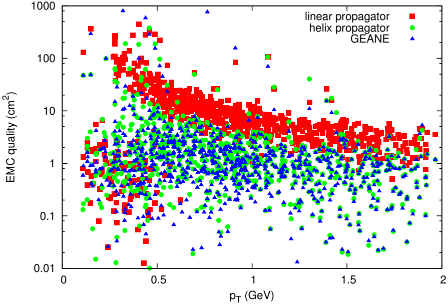


EMC quality

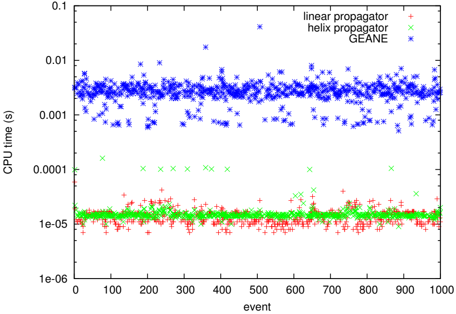
- Magnitude of distance between simulated points and propagator points

$$EMC_{quality} = (Simulated_{Hits} - Propagator_{Points})^2$$

Results of Helix propagator



EMC quality vs. transverse momentum



Comparison of taking CPU time

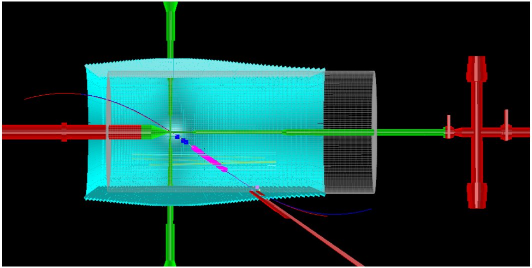
- Helix can replace GEANE propagator.
- We don't know whether tracks and clusters are matched correctly.

Research Objective

- Reconstruct charged particle track between STT and EMC.
  (This part's done by Christoph and Thanachot.)
- Define ”EMC cut” function.
  EMC cut is limitation range of EMC quality to match propagator points with EMC clusters.
- Find checking algorithm to comfirm results of ”EMC cut”.

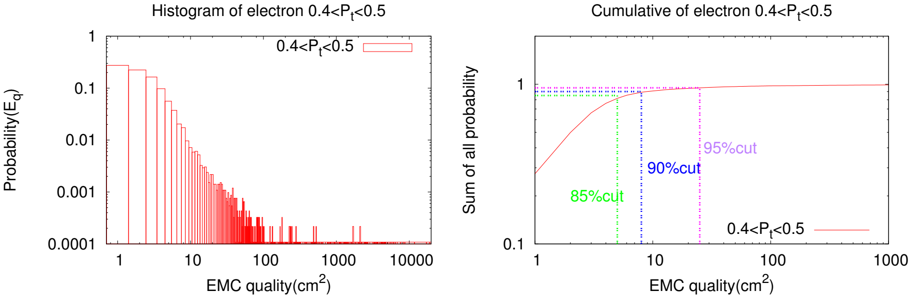
Setting simulation

- Boxgenerator
  Particle species : electron, proton, muon, kaon, pion.
  Number of entry particles : 1 particle.
  Transverse momentum : 0.3 - 5 GeV/c.
  Number of events : 10,000 times.
  Theta range of angle : 20 - 80 degrees.
  Phi range of angle : 0 - 360 degrees.



PANDA framework

Histogram and Cumulative plot

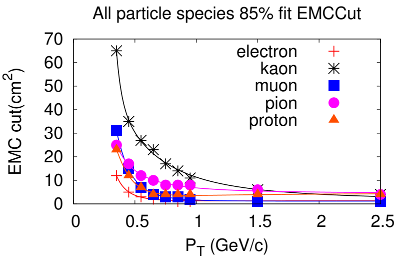


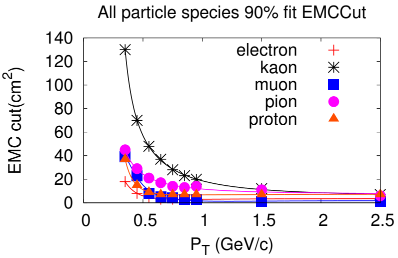
- We defined EMC cut by determination range of EMC quality that provide acceptable percentage of total probability.(such as 0.85, 0.90, 0.95)

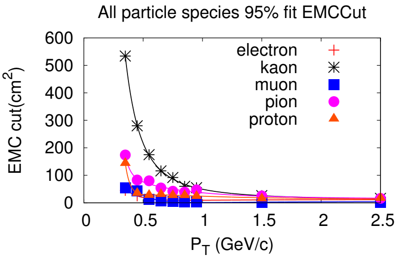
EMC cut function

- Define EMC cut depend on Pt by fitting-curve with even polynomial equation.

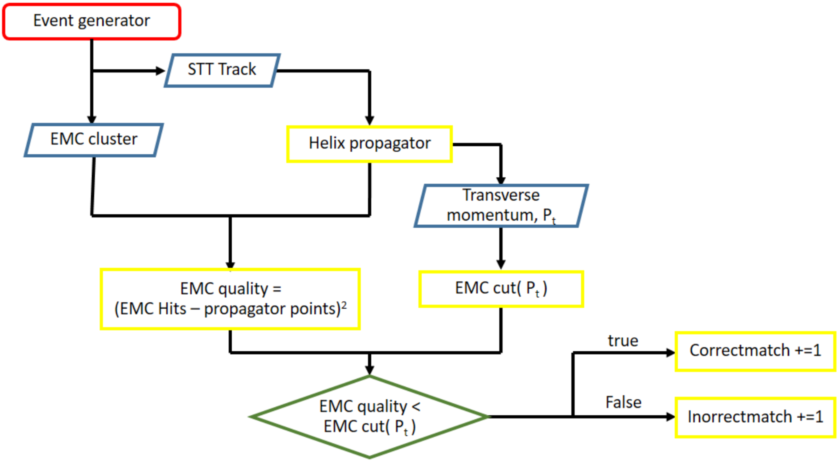
$$f(x) = a_0 + \frac{a_1}{x^2} + \frac{a_2}{x^4} + \frac{a_3}{x^6}$$





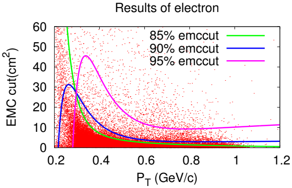


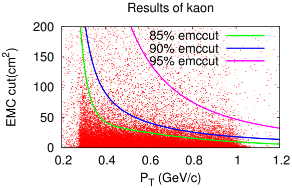
Flow chart

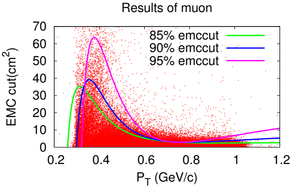

Event generator
STT Track
EMC cluster
Helix propagator
Transverse momentum, P_t
EMC quality = (EMC Hits – propagator points)^2
EMC cut(P_t)
EMC quality < EMC cut(P_t)
true
Correctmatch +=1
False
Inorrectmatch +=1

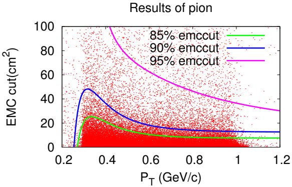
EMC quality and EMC cut

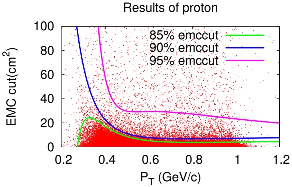
- Generate events with Pt range = 0.3-1.0 GeV/c







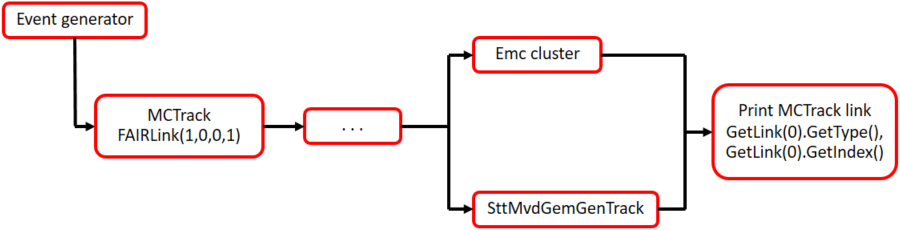




FAIRLink

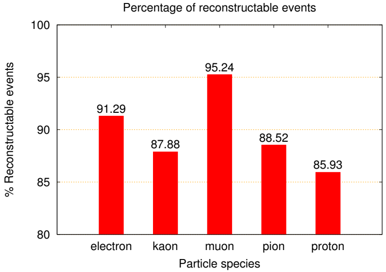
- FAIRLink contained set of five number use to link previous configuration.

FAIRLink(FileID, EventID, BranchID, Index, Weight)

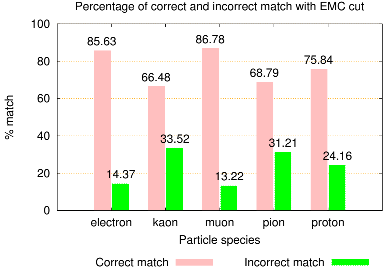


Results

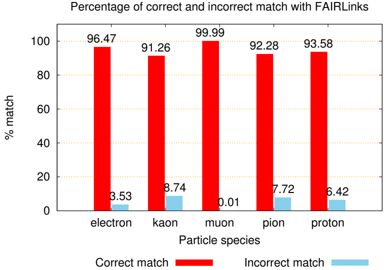
- Test the 90%EMC cut with 10,000 events each five particle species.
- Reconstructable events mean the event that have both track and EMC cluster



(1)

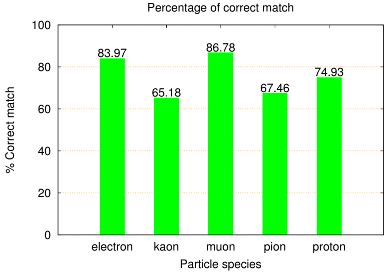


(2)

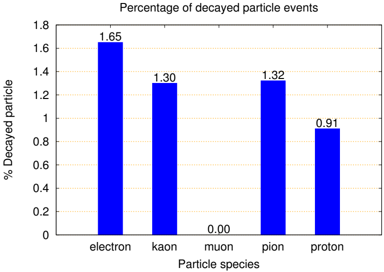


(3)

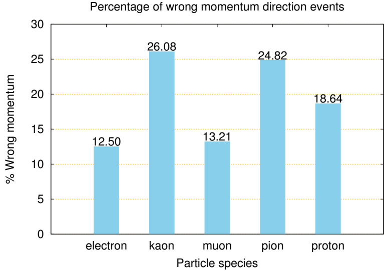
Results



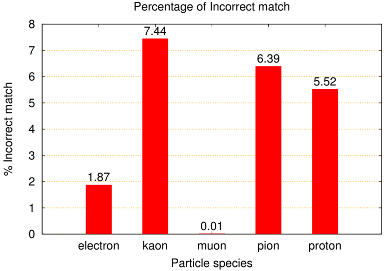
(1) Correct match with both EMC cut and FAIRLink.



(2) Correct match with EMC cut but incorrect match with FAIRLink.



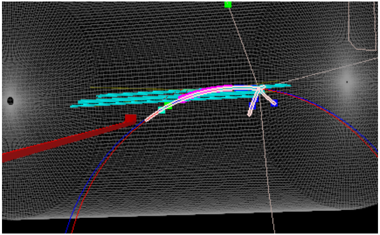
(3) Incorrect match with EMC cut but correct match with FAIRLink.



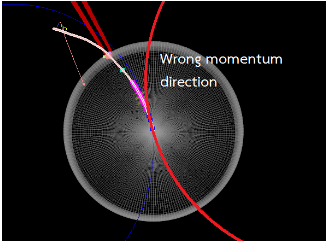
(4) Incorrect match with both EMC cut and FAIRLink.

Summary

- The most effective reason why they provided high EMC quality is they have wrong momentum direction.
- Mostly results of 90%EMC cut could work but should try with other cut.
- FAIRLink is exactly way to check EMC cut.
- FAIRLink can distinguish type of events.



Decayed particles



Red line is direction of momentum

Outlook

- Find reason why we have wrong momentum direction and modify the events generator that occur the wrong direction or improve data without wrong momentum direction.
- Test the EMC cut with many particle entries and generate event without using boxgenerator.
- Test different EMC cut(85% and 95%) and find the best acceptable percentage of total probability that provide the EMC cut.

Acknowledgement

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Development and Promotion of Science and Technology Talents

Suranaree University of Technology

Thank you