

Problem with Muon ID

University of Iowa

No Muon in the output list

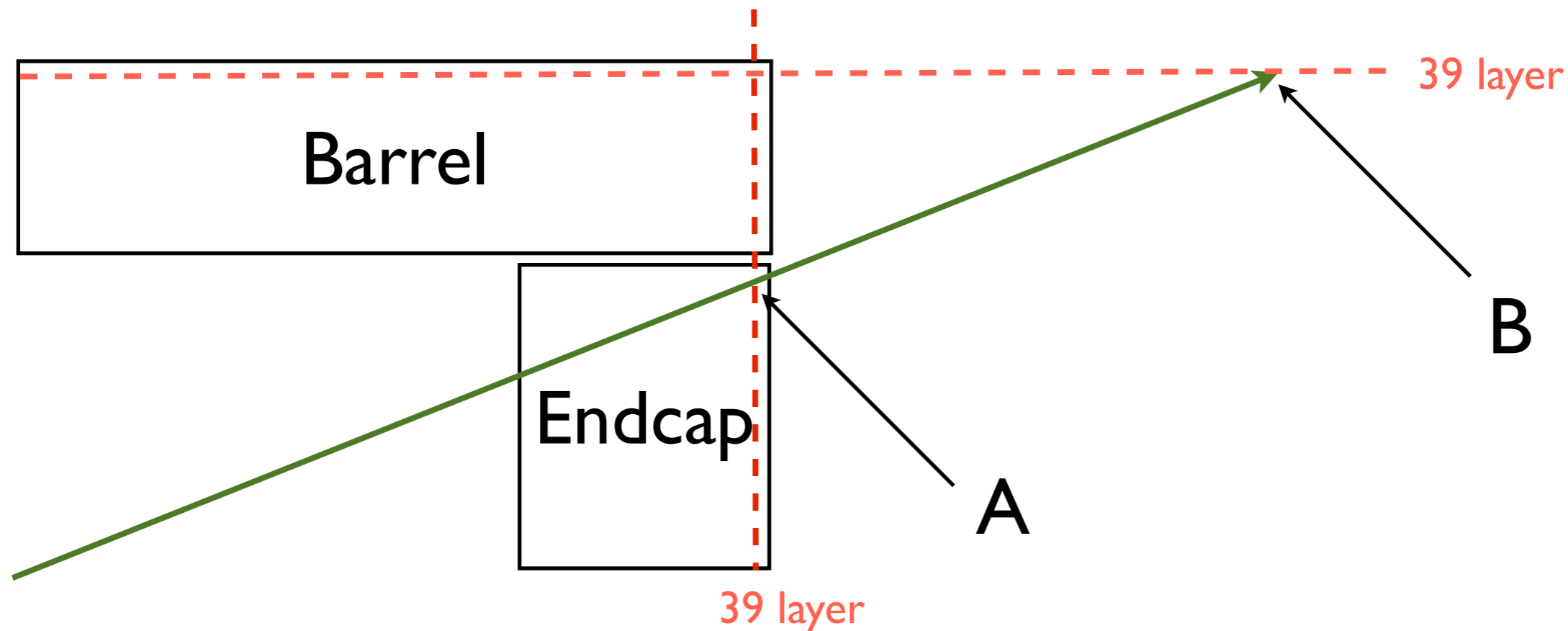
- In the main code TrackHelixPlusHitExtrapolator is used as track extrapolator.
- In MuonFinder LocalHelixExtrapolator was used separately.
- LocalHelixExtrapolator doesn't know how to deal with real track list so it gives null.
- That resulted in no reconstructed muon.
- Now it is fixed.

Extrapolator

- TrackHelixPlusHitExtrapolator behaves differently when extending the track to calorimeter.
- LocalHelixExtrapolator gave null if the track is extrapolated out of Barrel or Endcap. But TrackHelixPlusHitExtrapolator doesn't have the condition so it extends the track as much as input is given.
- This behavior is not compatible with MuonFinder algorithm.
- This conflict resulted in wrong muon efficiency in Endcap.
- It is fixed by using TrackHelixPlusHitExtrapolator in the same way as LocalHelixExtrapolator was used.

Extrapolator interface

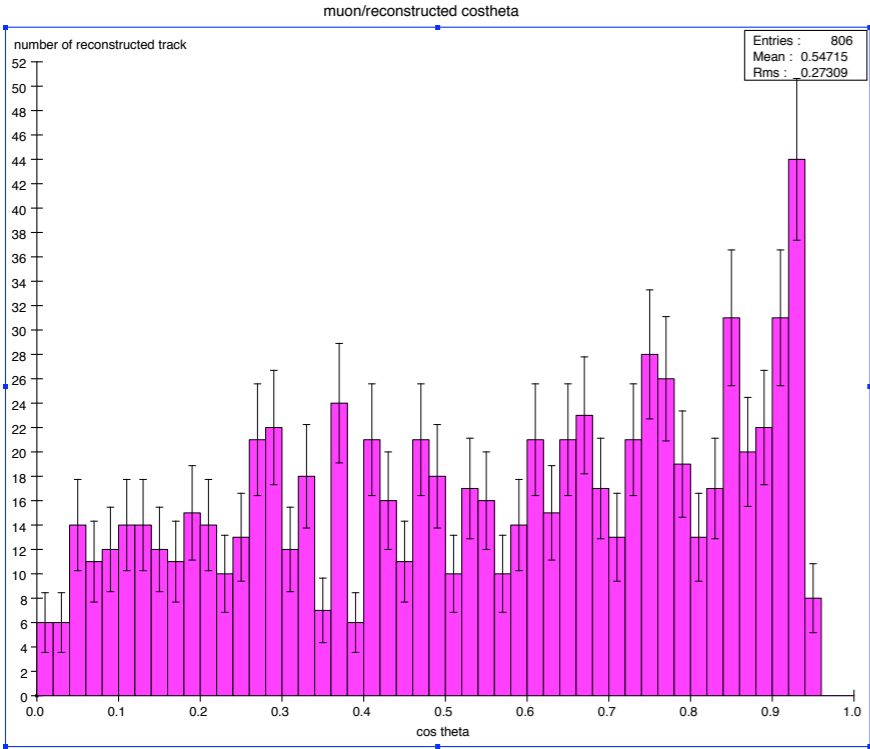
	LocalHelixExtrapolator	TrackHelixExtrapolator
extendToBarrelLayer	null	B
extendToEndcapLayer	A	A



- Now fixing interface does not affect other thing?
 - This interface is being used to find the tangent vector at showering point. Fixing interface should give right result.

Plot before fixing

10GeV muon sample
1000 events

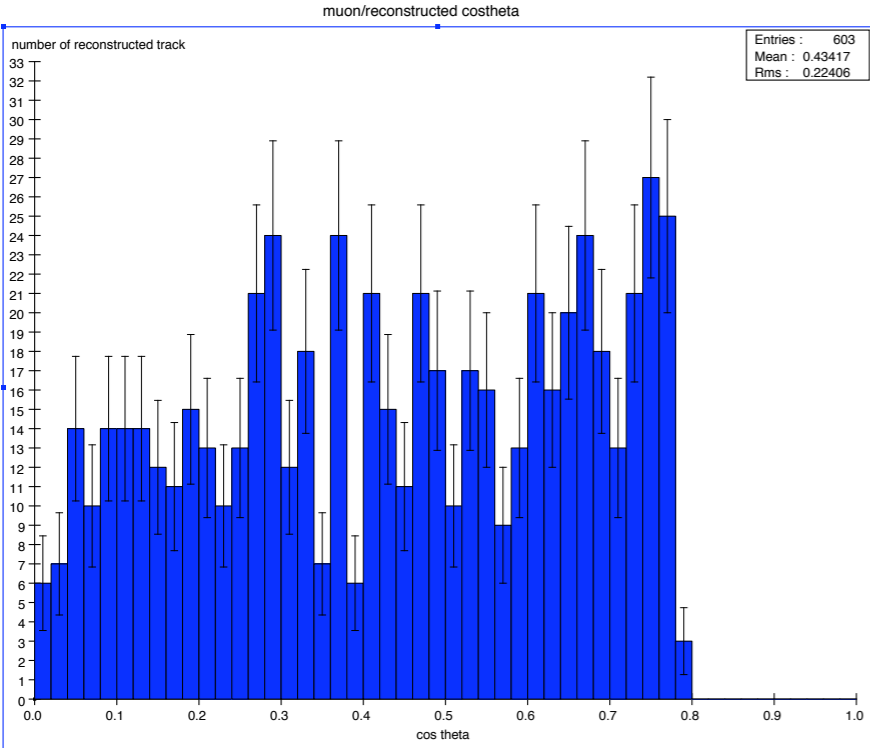


cheating track +
LocalHelixExtrapolator

real track +
LocalHelixExtrapolator

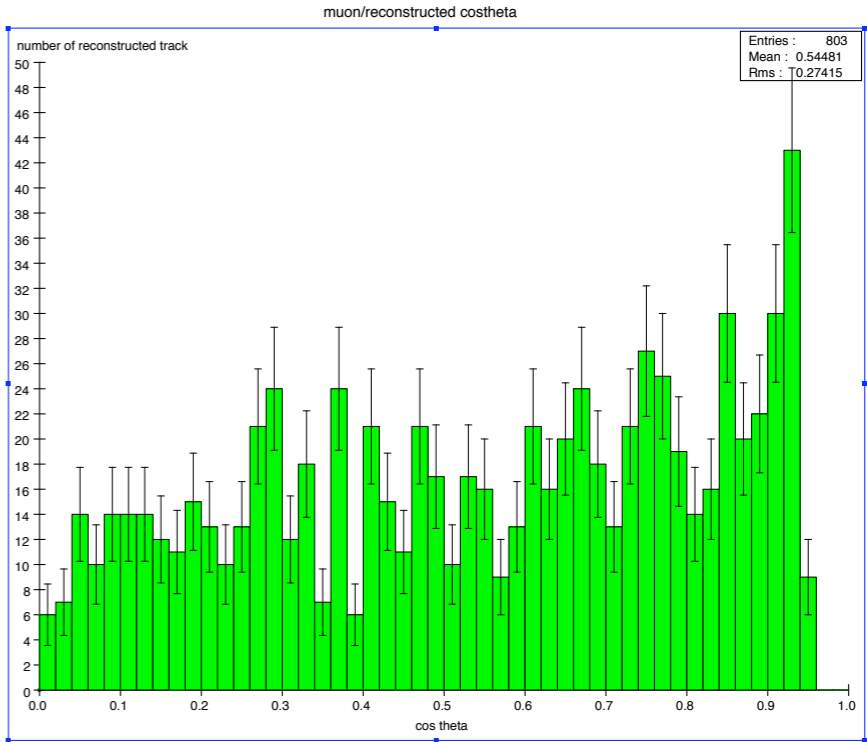
No Muon Found !

real track +
TrackHelixPlusHitExtrapolator
(After fixing interface)



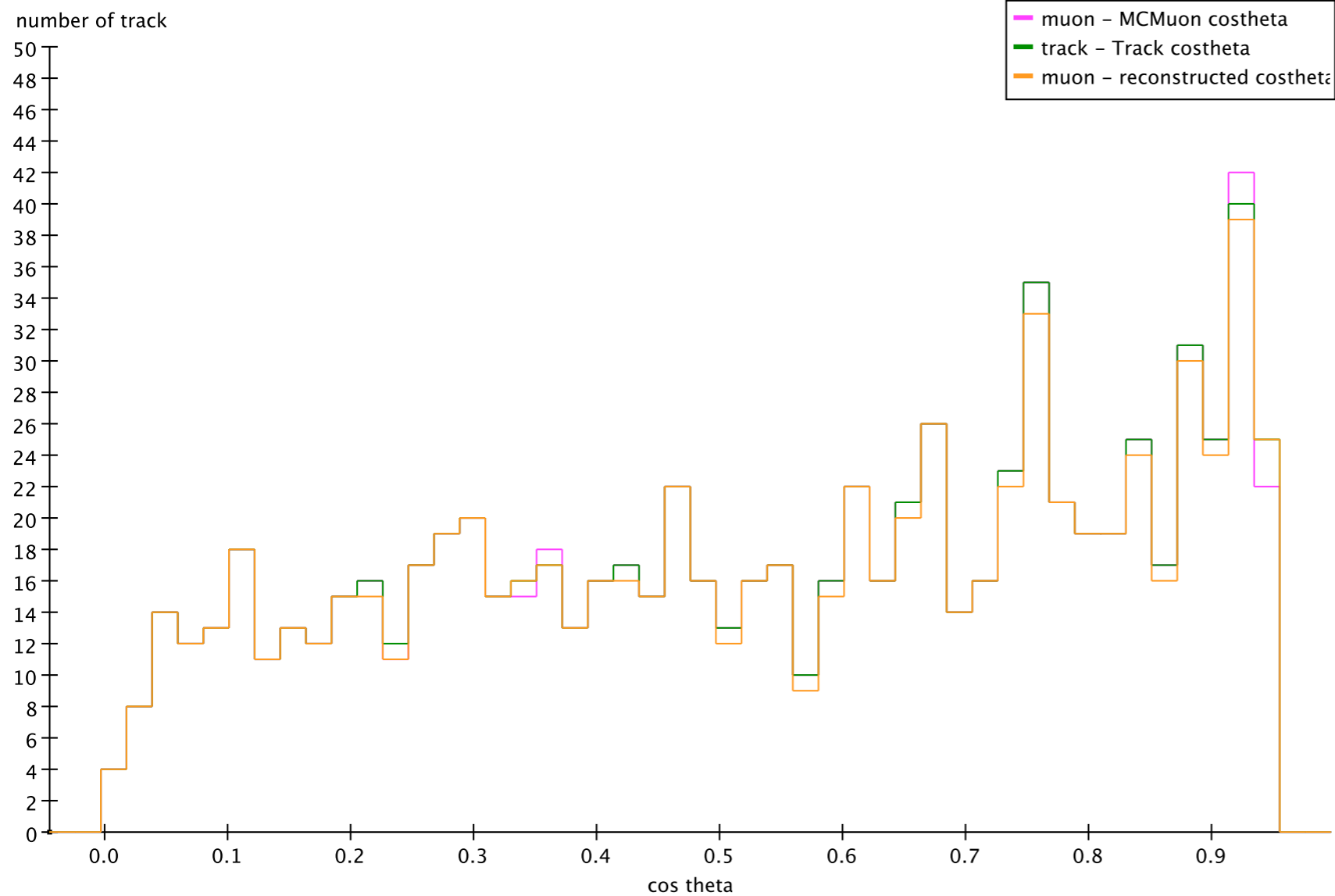
real track +
TrackHelixPlusHitExtrapolator
(Before fixing interface)

Low efficiency &
Missing above ~0.8



Plot after fixing

defaultInstance.aida



Sample:

10GeV Muon

1000 events.

Preselection :
 $\cos(\theta) < 0.95$

MC Muon 816

Full Track 818

RecoMuon 803

Effi. = 98%

di-jet sample comparison

Barrel ($0 < \cos(\theta) < 0.8$)

	Before	After
qq100	3.7%	3.6%
qq200	3.0%	2.9%
qq500	3.5%	3.4%
ZZ	4.7%	4.7%

Endcap ($0.8 < \cos(\theta) < 0.95$)

	Before	After
qq100	3.8%	3.6%
qq200	3.2%	3.1%
qq500	3.3%	3.2%
ZZ	3.9%	3.8%

Summary

- This issue would not affect di-jet samples.
(ZZ, qq100, qq200 and qq500)
- It might affect benchmarking samples which have many muons.
- We have three options (Mat and Ron suggested)
 - Ideally, we would re-run and have proper muon ID.
 - But if not, we can assign a flat muon efficiency of $\sim 98\%$ for high momentum track. (Analysts will have to check truth PID of tracks.)
 - Run Muon driver over the reconstructed sample independently just to replace pion by muon.