THE TRACK TRD ASSOCIATION PROBLEM

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The TRD variables are important to remove secondaries generated in the interaction with the detector. They have been included in the analysis to add them in the selection.

This standard selection has been applied before we look in the TRD variables:

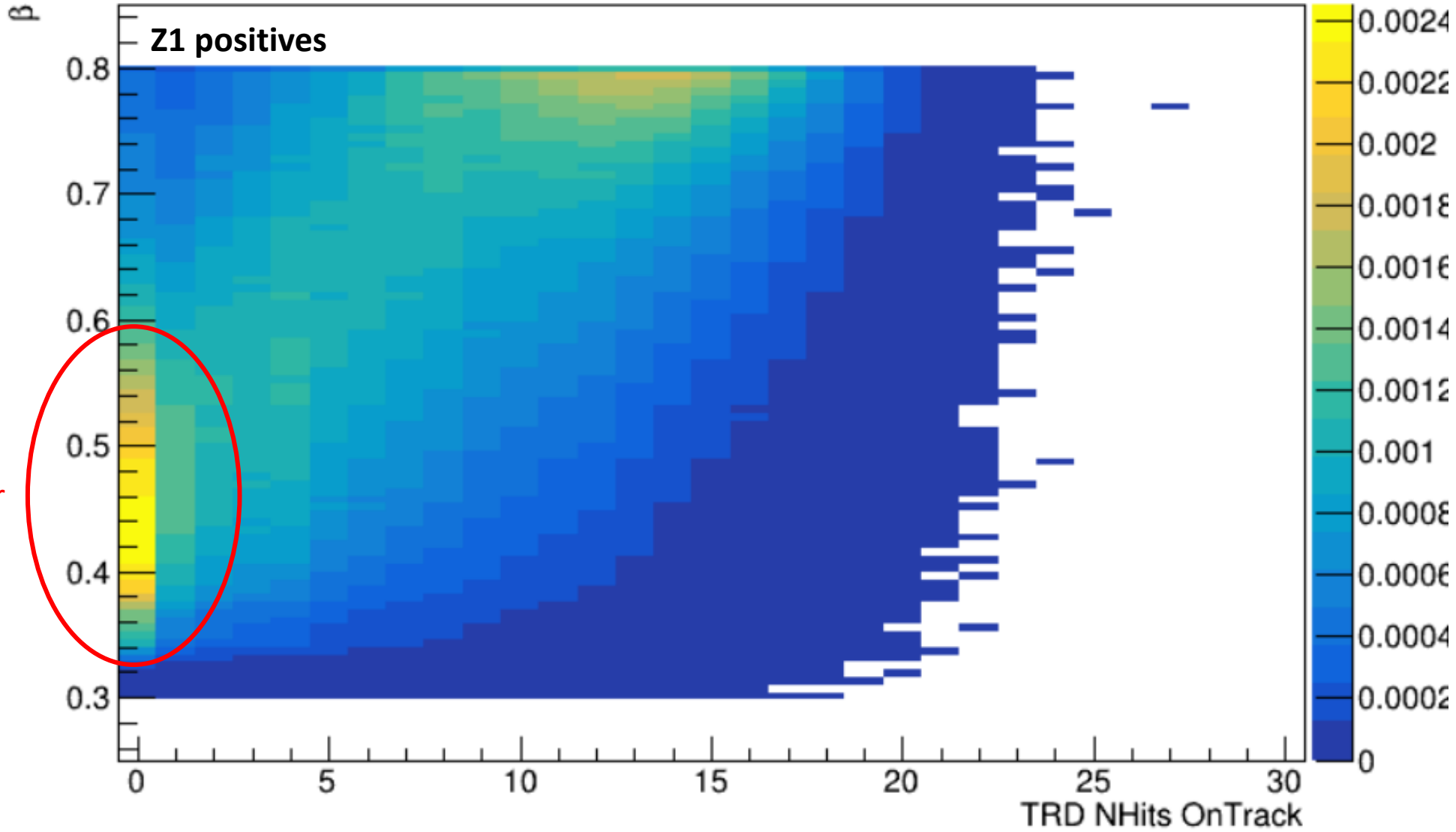
TOF:
Nhits TOF = 4
$\chi^2_{Coo} < 4$
$\frac{|Z_{utof} - Z_{ltof}|}{Z_{utof}} < 0.2$

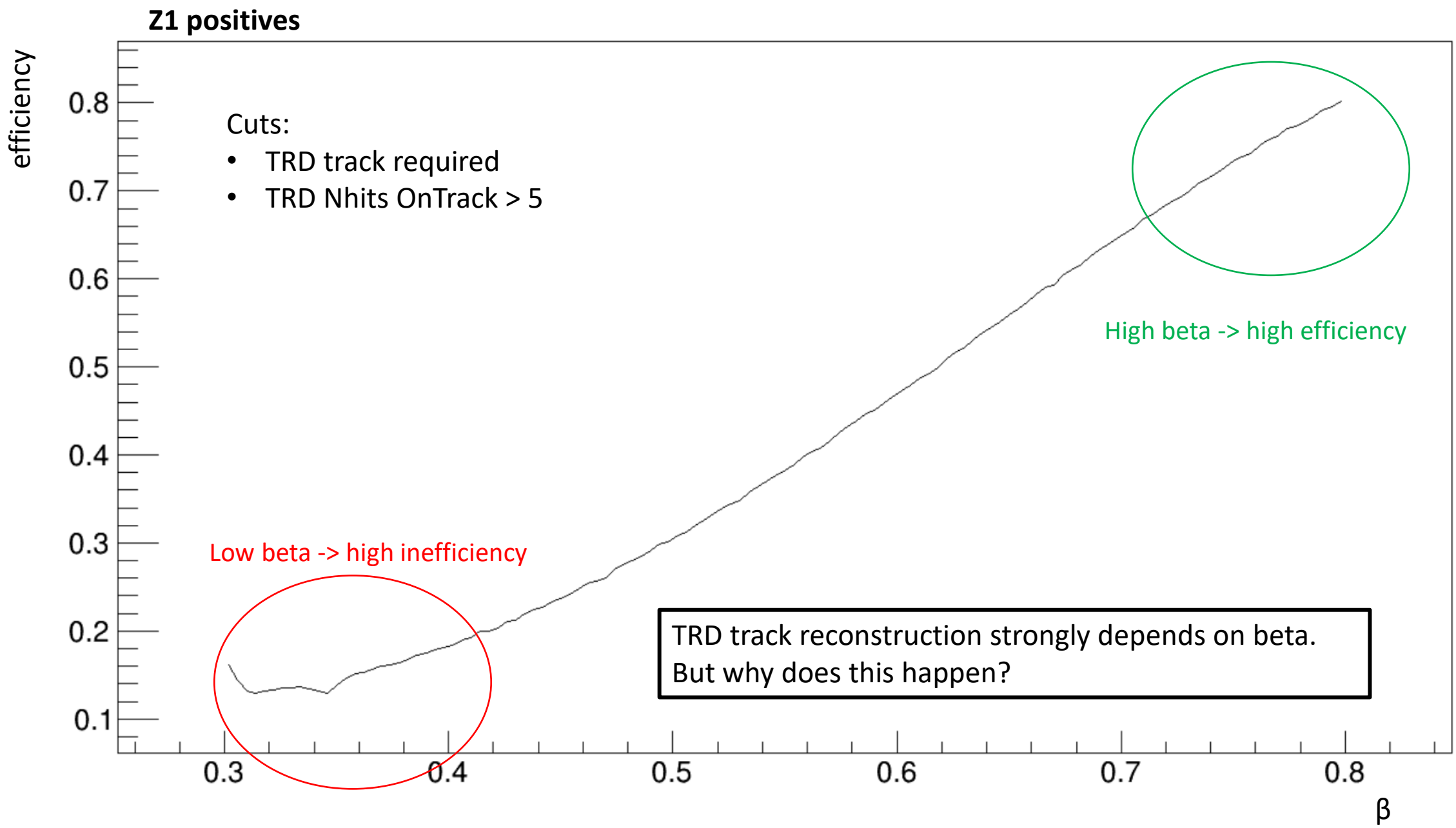
Inner Tracker (L2 to L8):
PATTERN Y L2 & (L3 || L4) & (L5 || L6) & (L7 || L8)
$\chi^2_Y < 10$
$\frac{\sigma_Z}{Z} < 0.1$

Physics trigger ON

The track of an event is reconstructed in the **NAIA version 1.0.0** starting from the tracker. The reconstructed track is then compared with the single hits in the TRD: the Nhits OnTrack variable of the TRD is the number of Hits that match the reconstructed track. Otherwise the hits in the TRD are OffTrack.

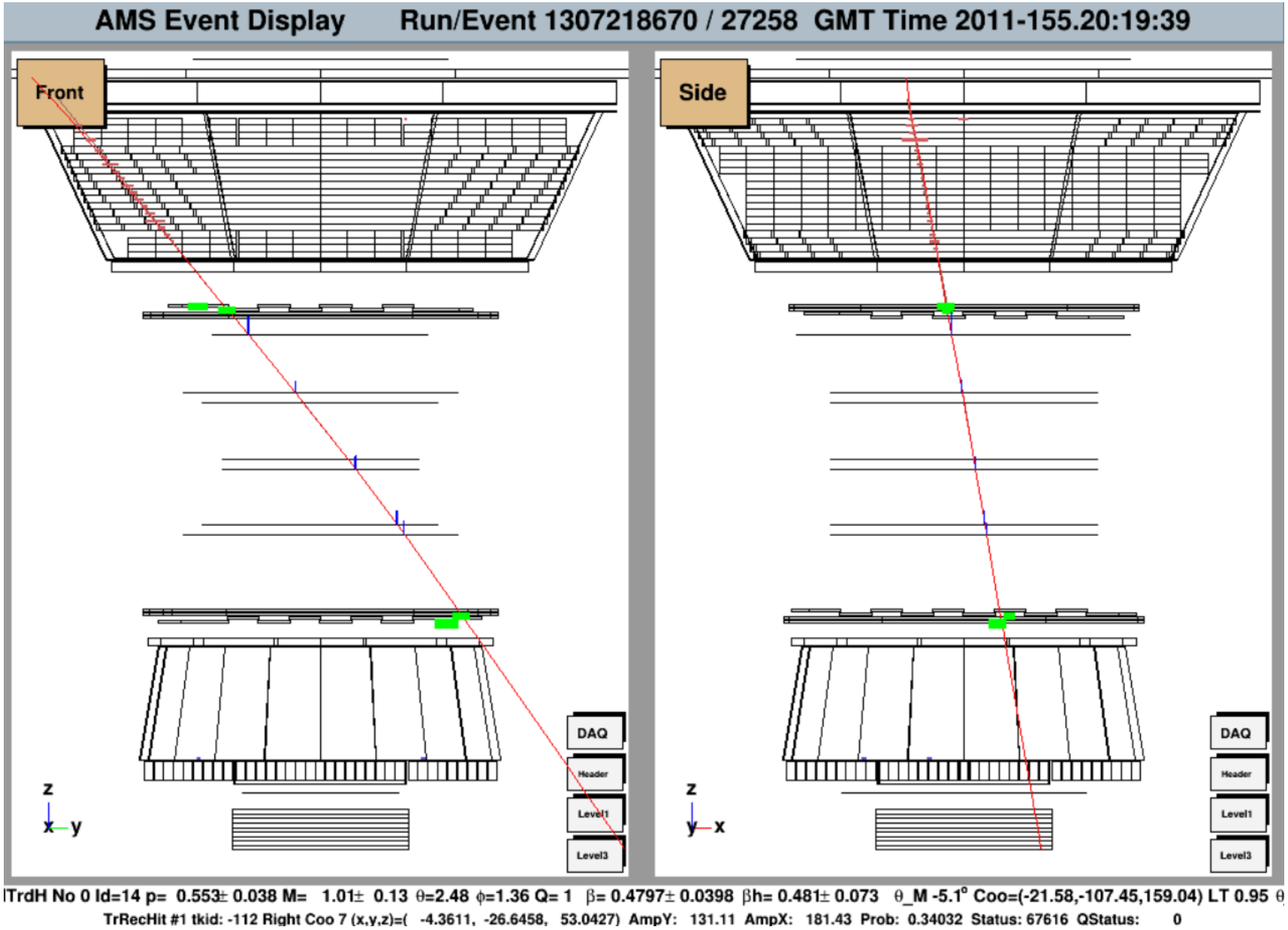
At low beta most of the tracks have low number of TRD Hits OnTrack




Z1 positives
efficiency
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Cuts:
• TRD track required
• TRD Nhits OnTrack > 5
High beta -> high efficiency
Low beta -> high inefficiency
TRD track reconstruction strongly depends on beta.
But why does this happen?
0.3
0.4
0.5
0.6
0.7
0.8
β

Event N°2

0.3 < beta < 0.5

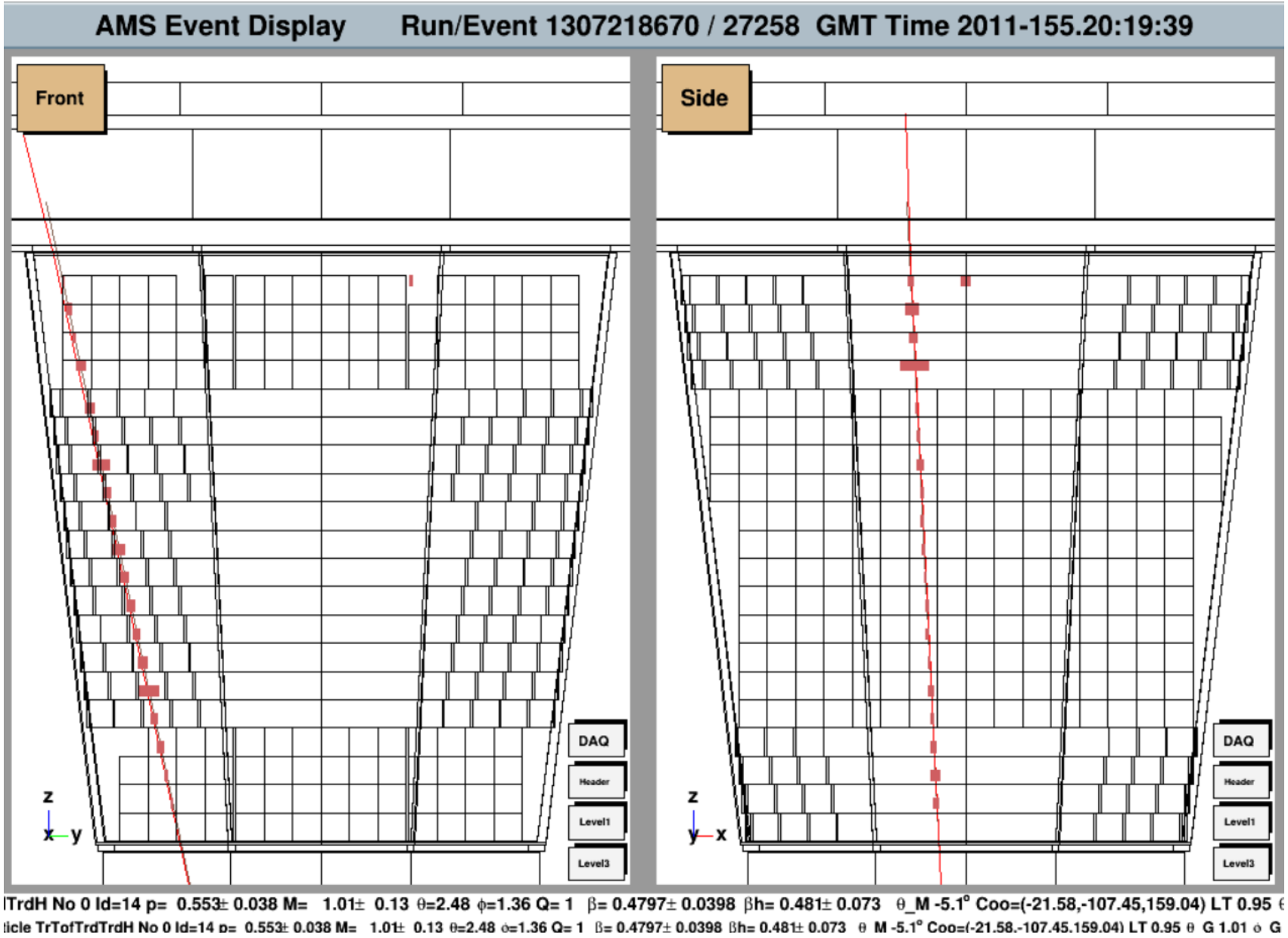


Reconstruction, tracker independent, 21 Hits associated to the TRD track

Current reconstruction, tracker dependent, 3 Hits associated to the TRD track

Event N°2

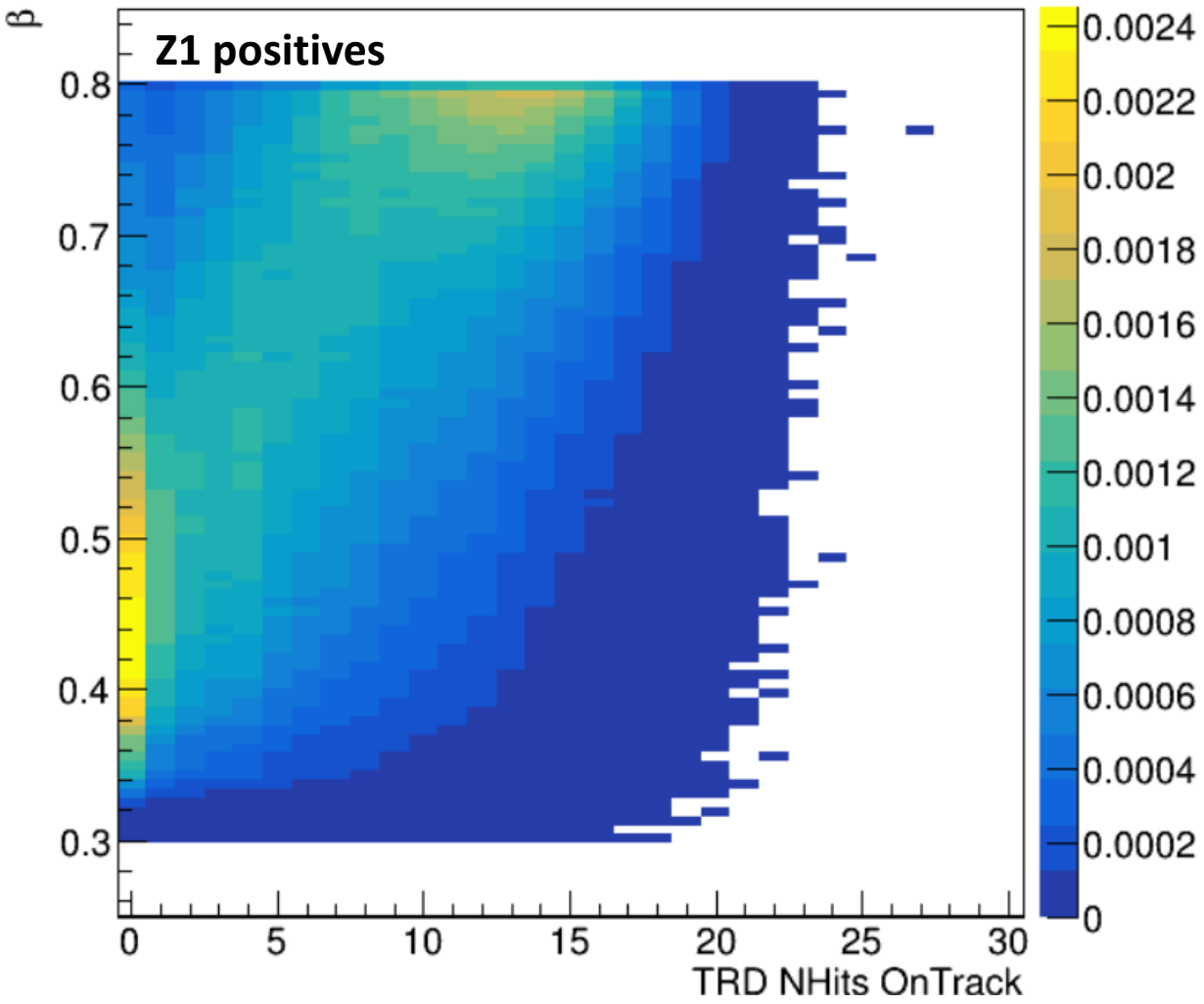
0.3 < beta < 0.5



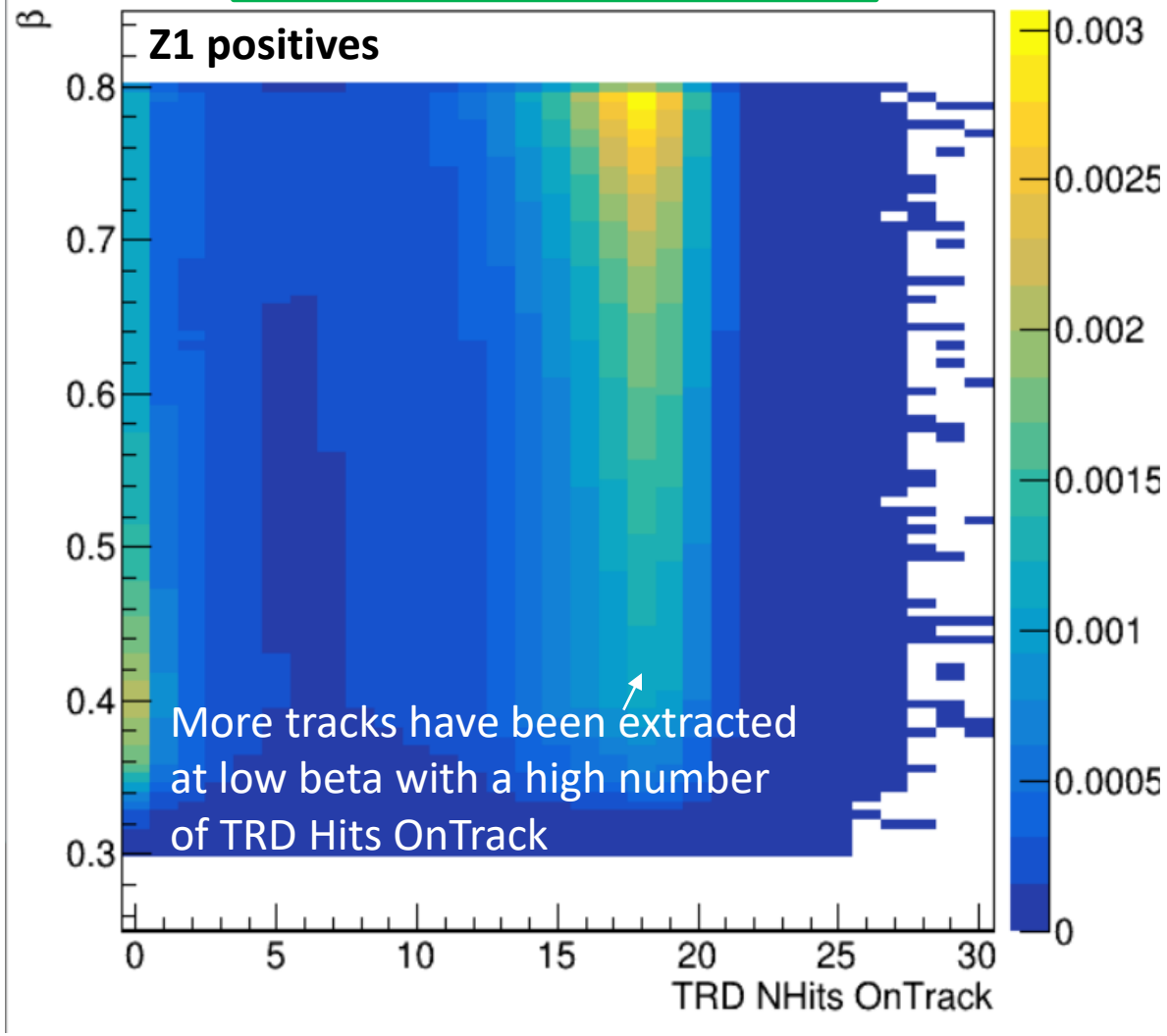
Reconstruction, tracker independent, 21 Hits associated to the TRD track

Current reconstruction, tracker dependent, 3 Hits associated to the TRD track

BEFORE – NAIA v 1.0.0

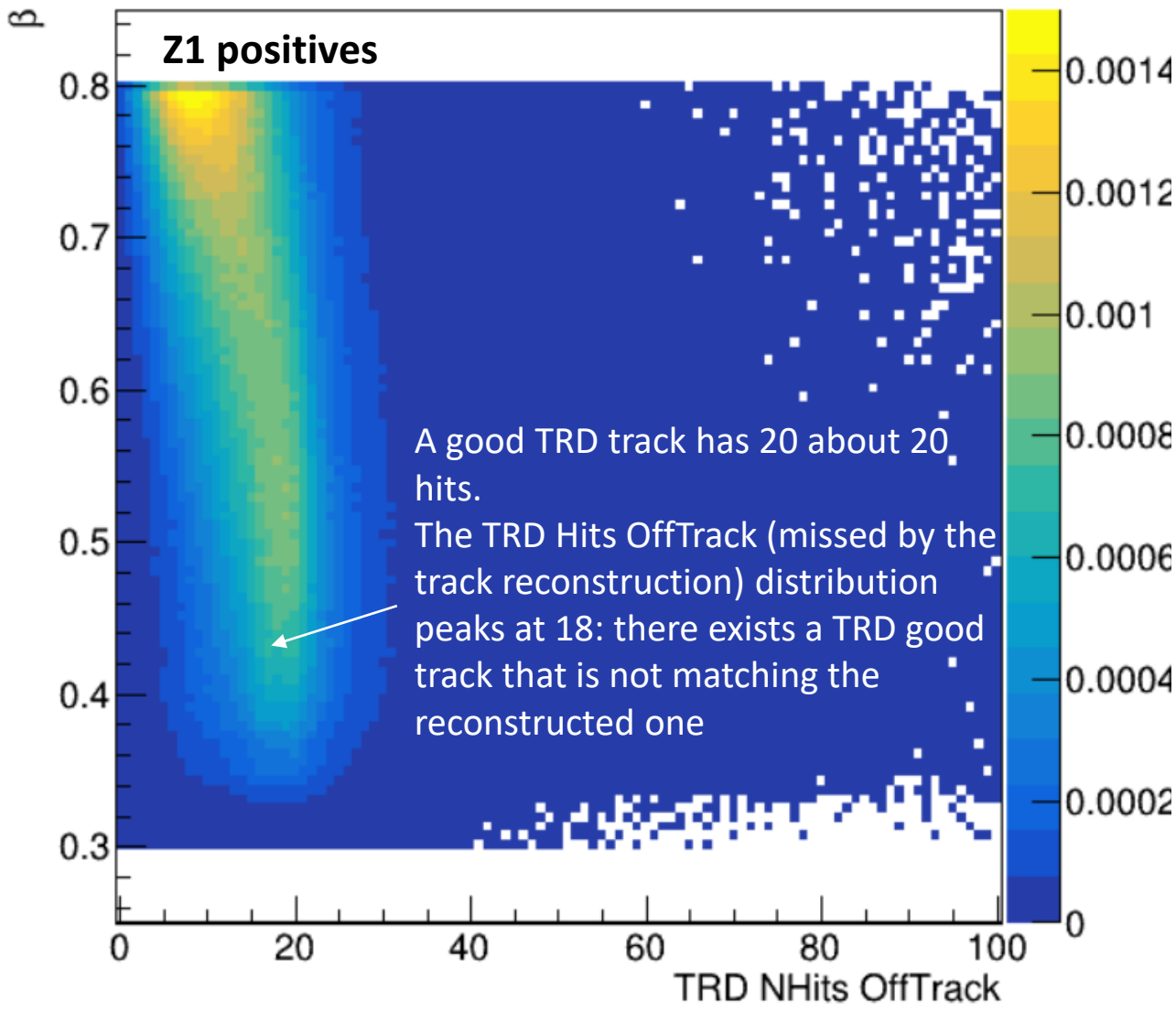


AFTER – NAIA v 1.1.0

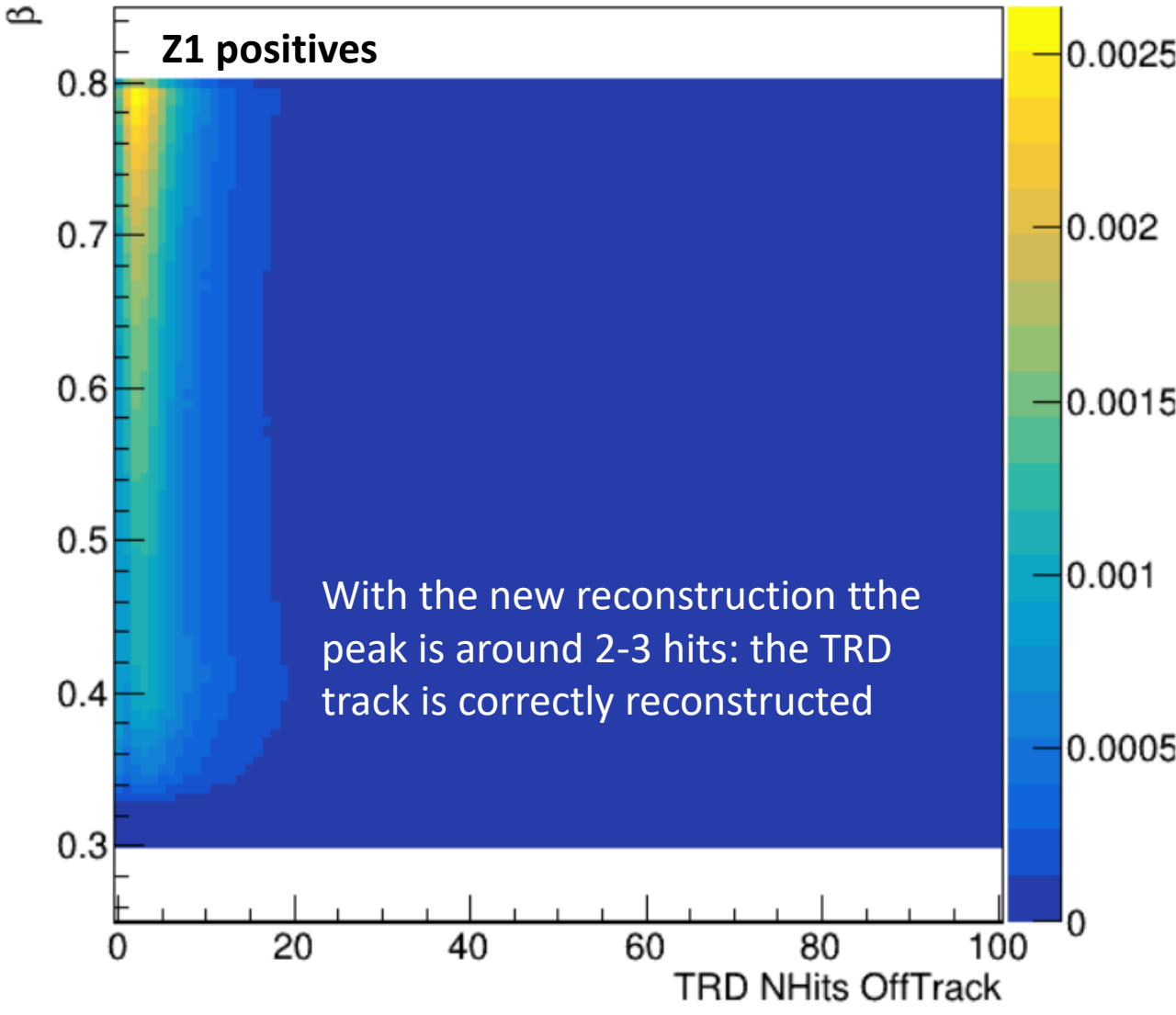


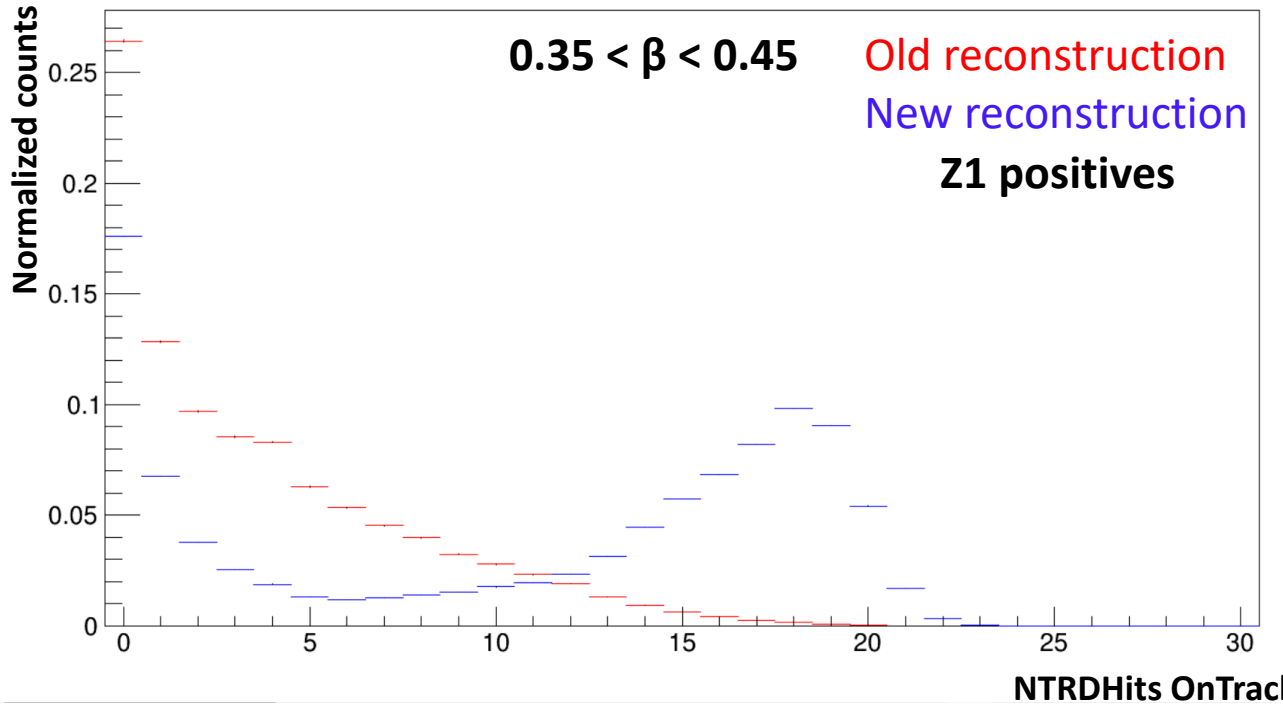
About 12000 Ntuples processed with the NAIA v 1.1.0 have been looked.

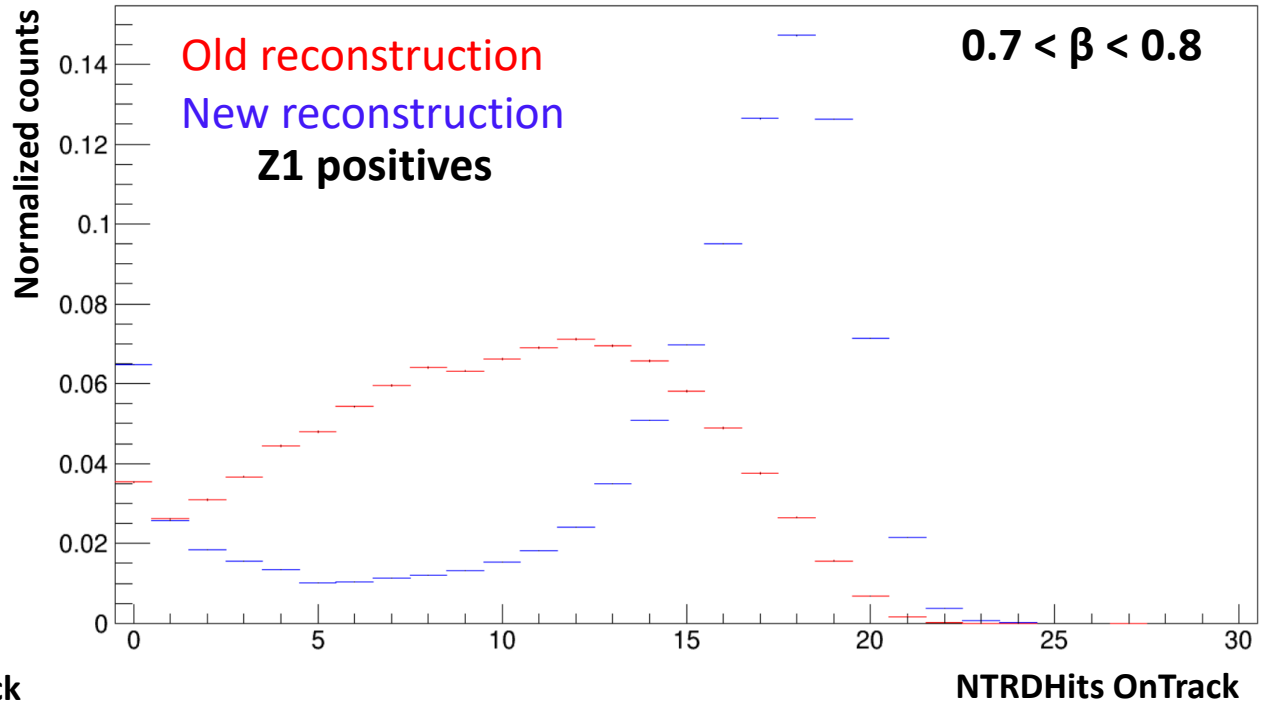
BEFORE – NAIA v 1.0.0

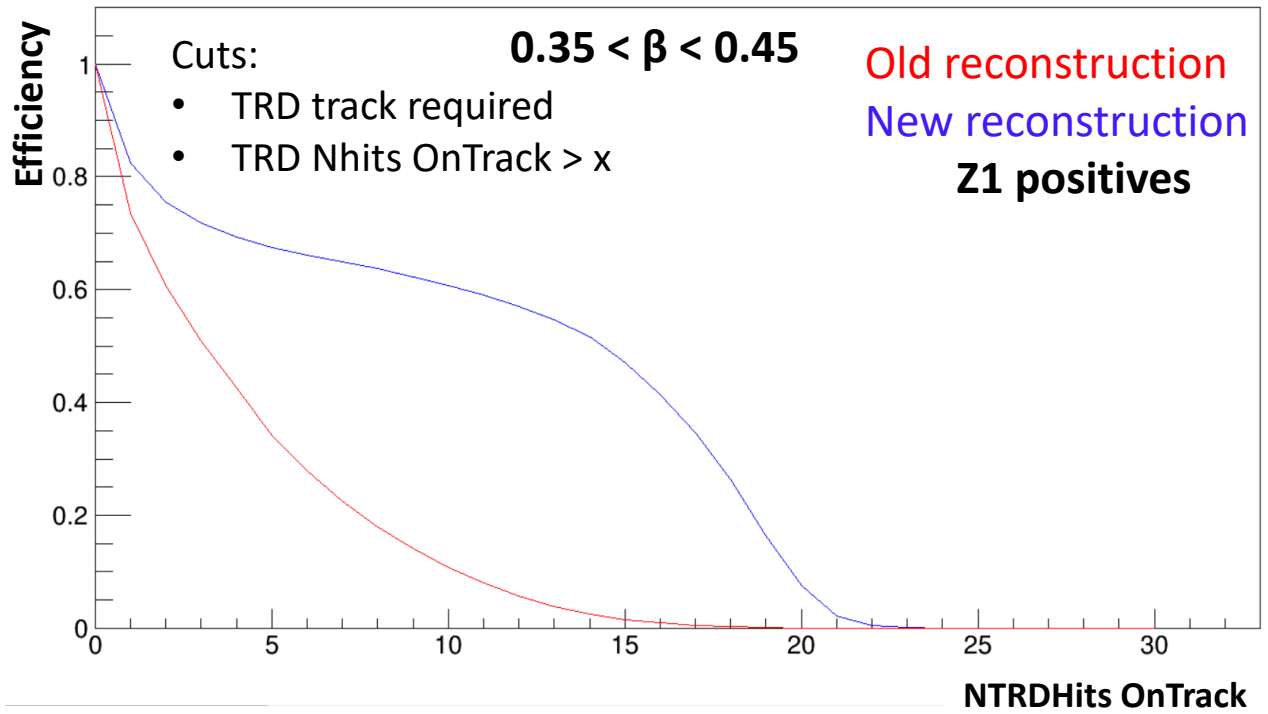


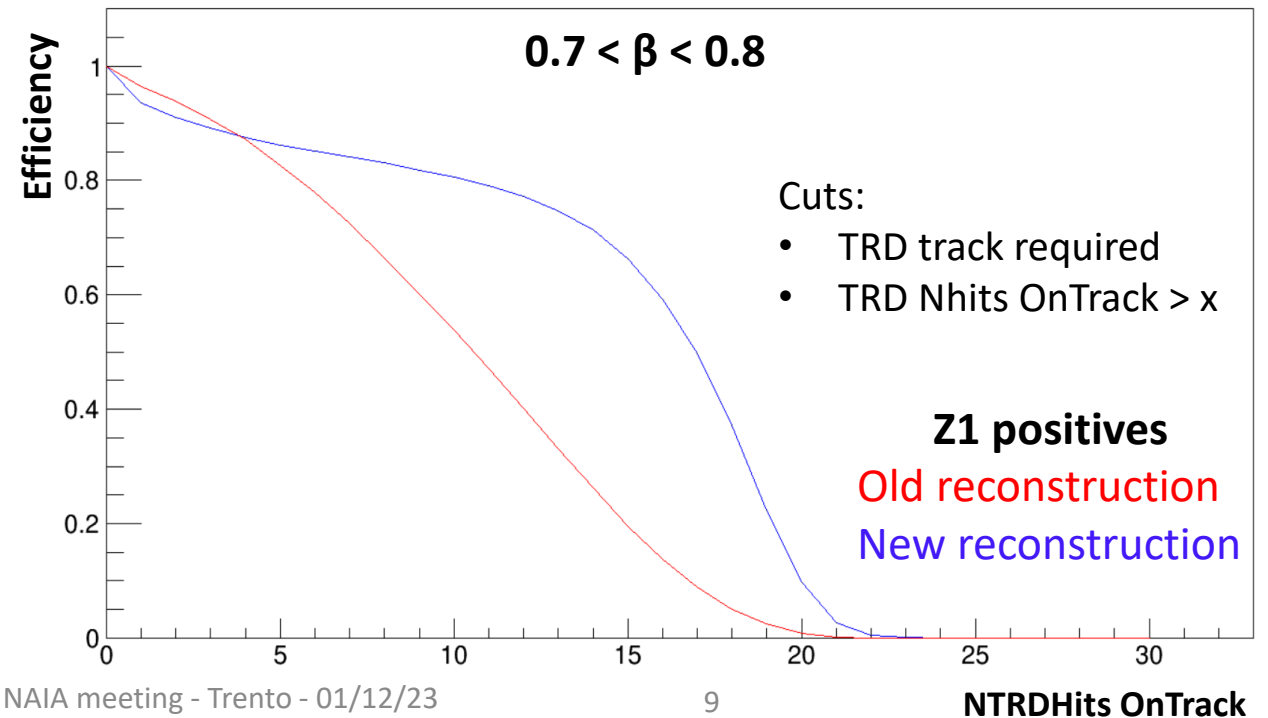
AFTER – NAIA v 1.1.0




Normalized counts
0.35 < β < 0.45
Old reconstruction
New reconstruction
Z1 positives
NTRDHits OnTrack


Normalized counts
Old reconstruction
New reconstruction
Z1 positives
0.7 < β < 0.8
NTRDHits OnTrack


Efficiency
Cuts:
• TRD track required
• TRD Nhits OnTrack > x
0.35 < β < 0.45
Old reconstruction
New reconstruction
Z1 positives
NTRDHits OnTrack


Efficiency
0.7 < β < 0.8
Cuts:
• TRD track required
• TRD Nhits OnTrack > x
Z1 positives
Old reconstruction
New reconstruction
NTRDHits OnTrack

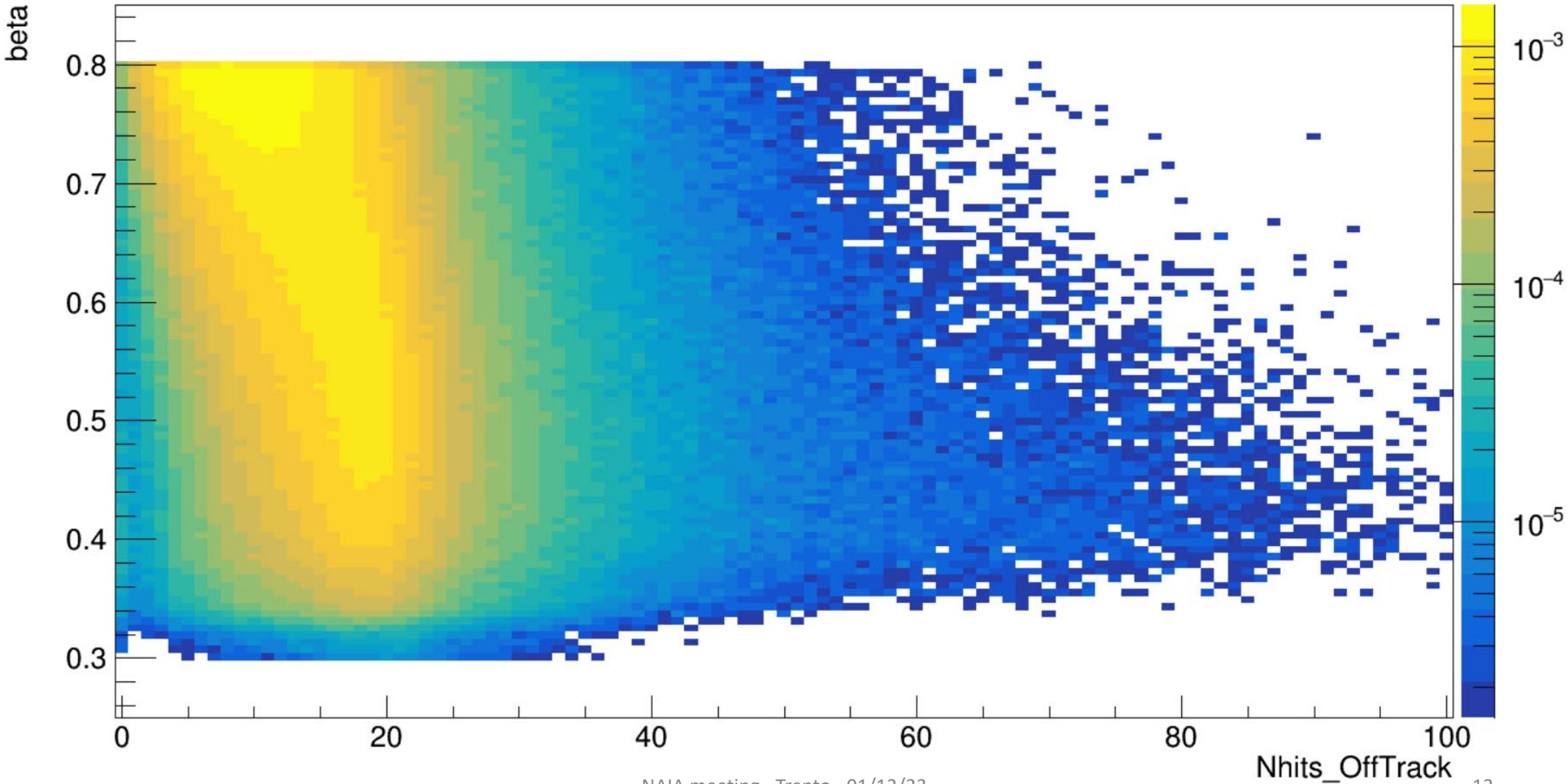
CONCLUSIONS

With the new NAIA version (v1.1.0) the TRD reconstruction is able to correctly extract the TRD tracks with a high number oh hits better than the previous versions.

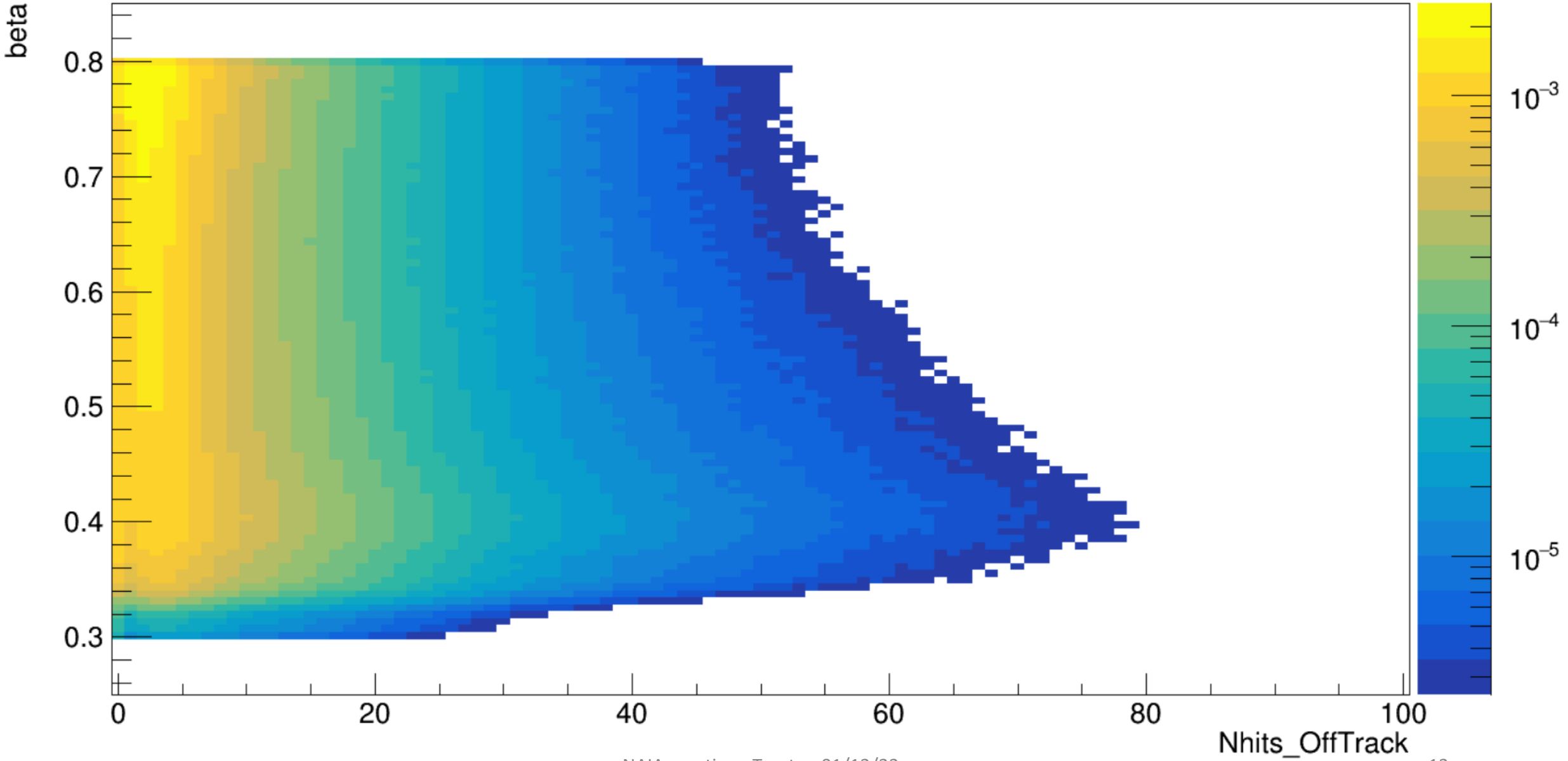
The efficiency of the TRD reconstruction (example in the #TRDHits OnTrack variable) , especially at low beta, is now increased.

BACKUP

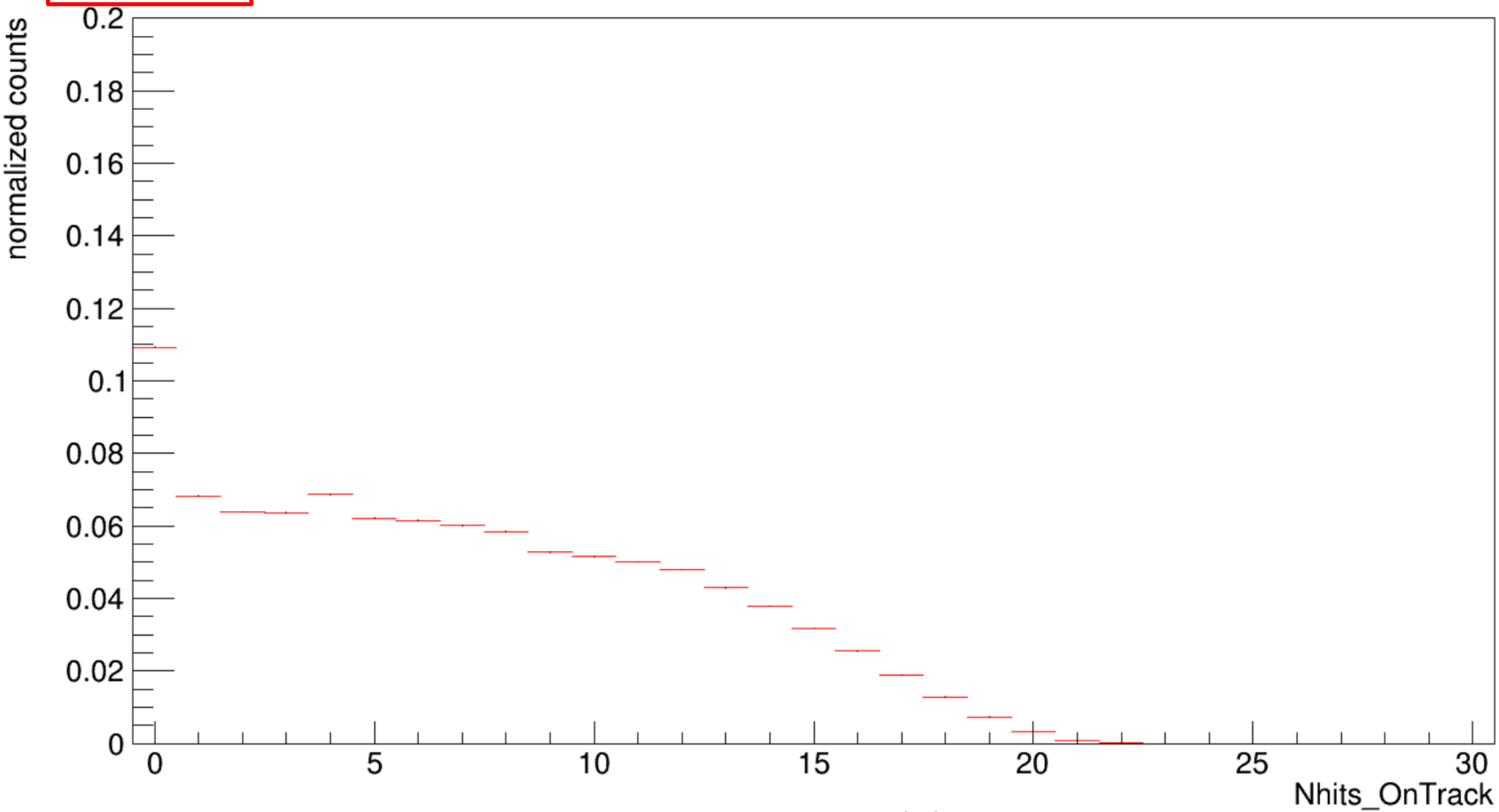
BEFORE


beta
0.8
0.7
0.6
0.5
0.4
0.3
0
20
40
60
80
100
Nhits_OffTrack
10^{-3}
10^{-4}
10^{-5}

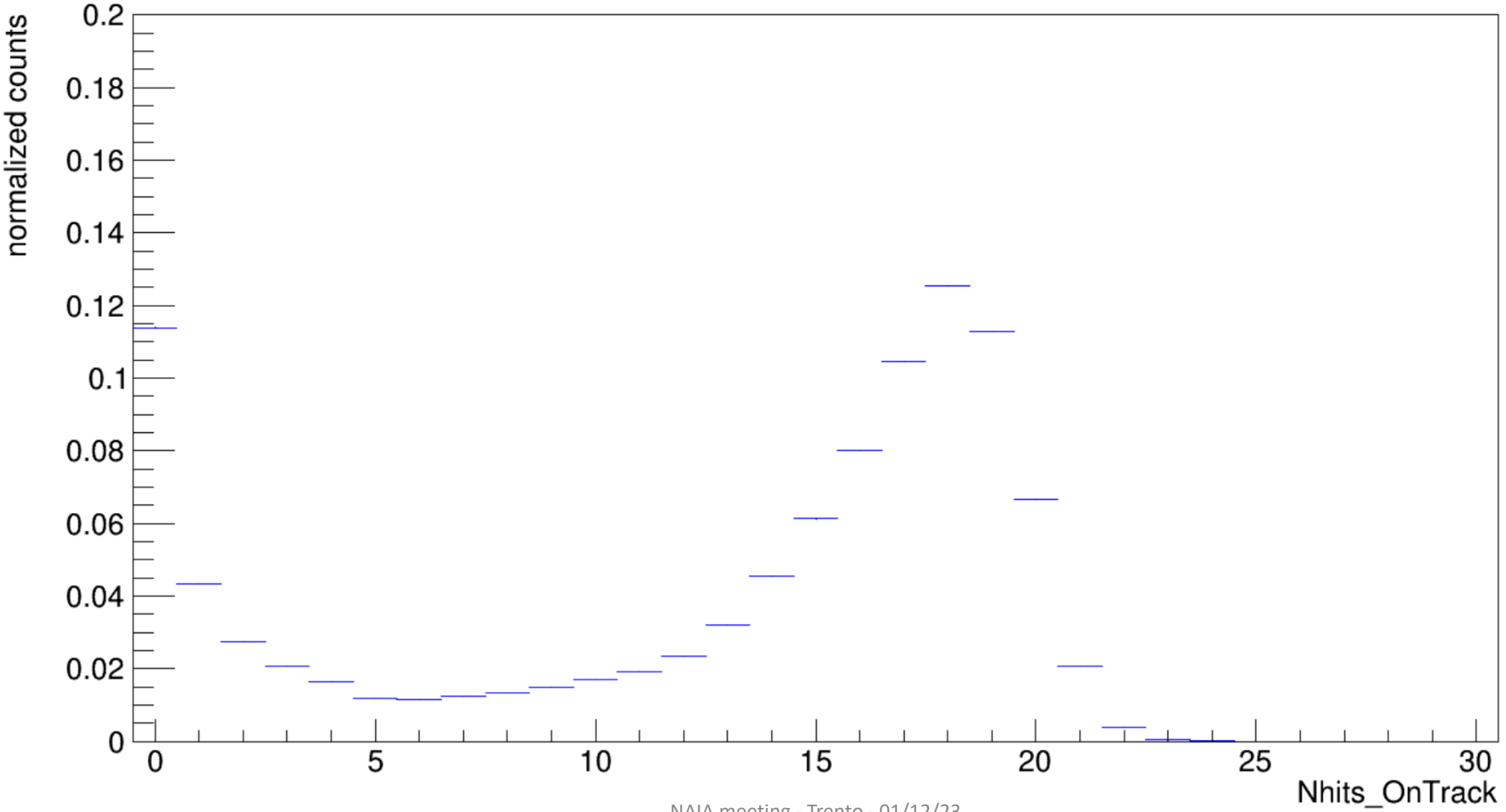
AFTER


beta
0.8
0.7
0.6
0.5
0.4
0.3
0
20
40
60
80
100
Nhits_OffTrack
10^{-3}
10^{-4}
10^{-5}

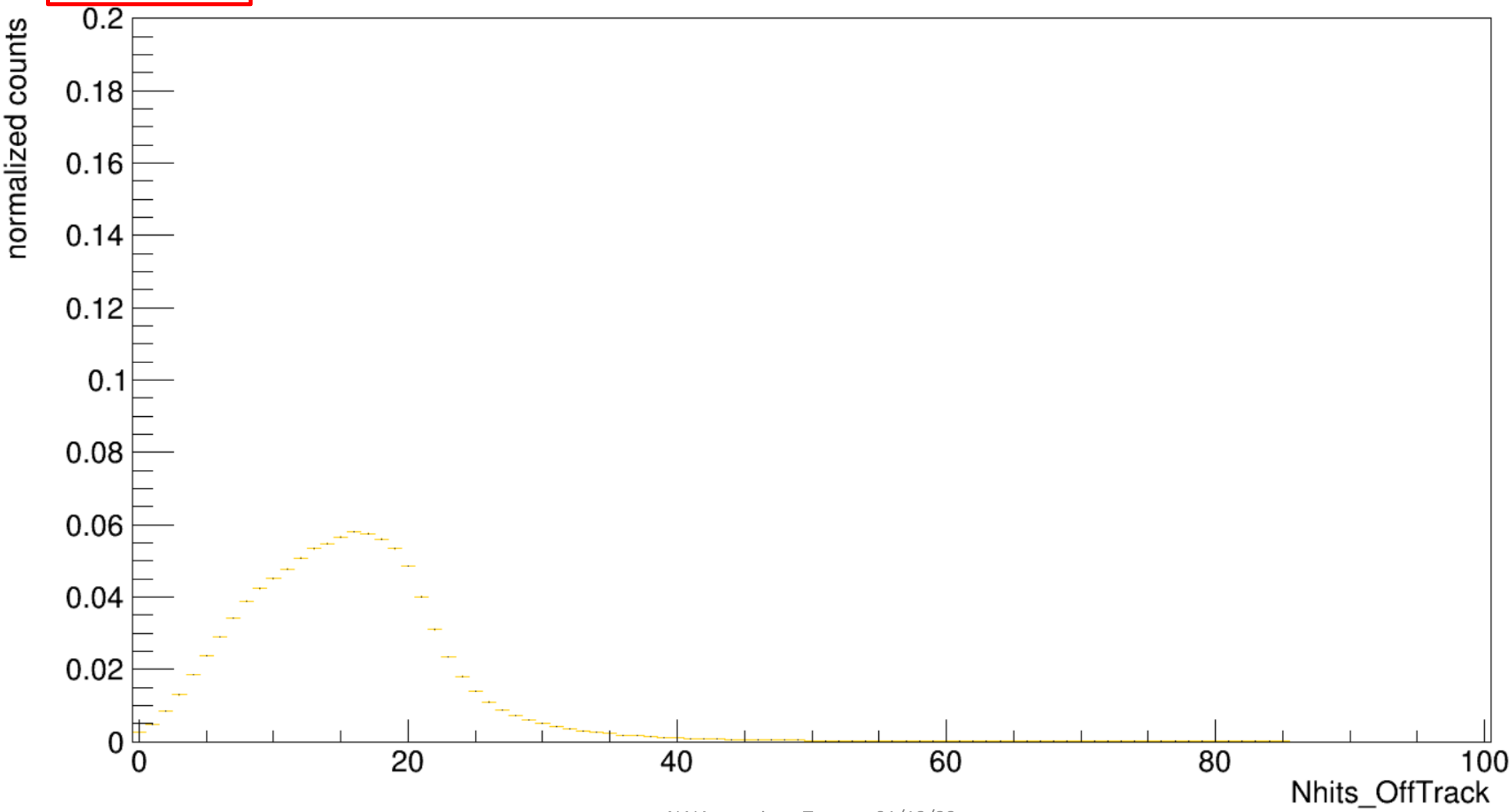
BEFORE


normalized counts
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
5
10
15
20
25
30
Nhits_OnTrack

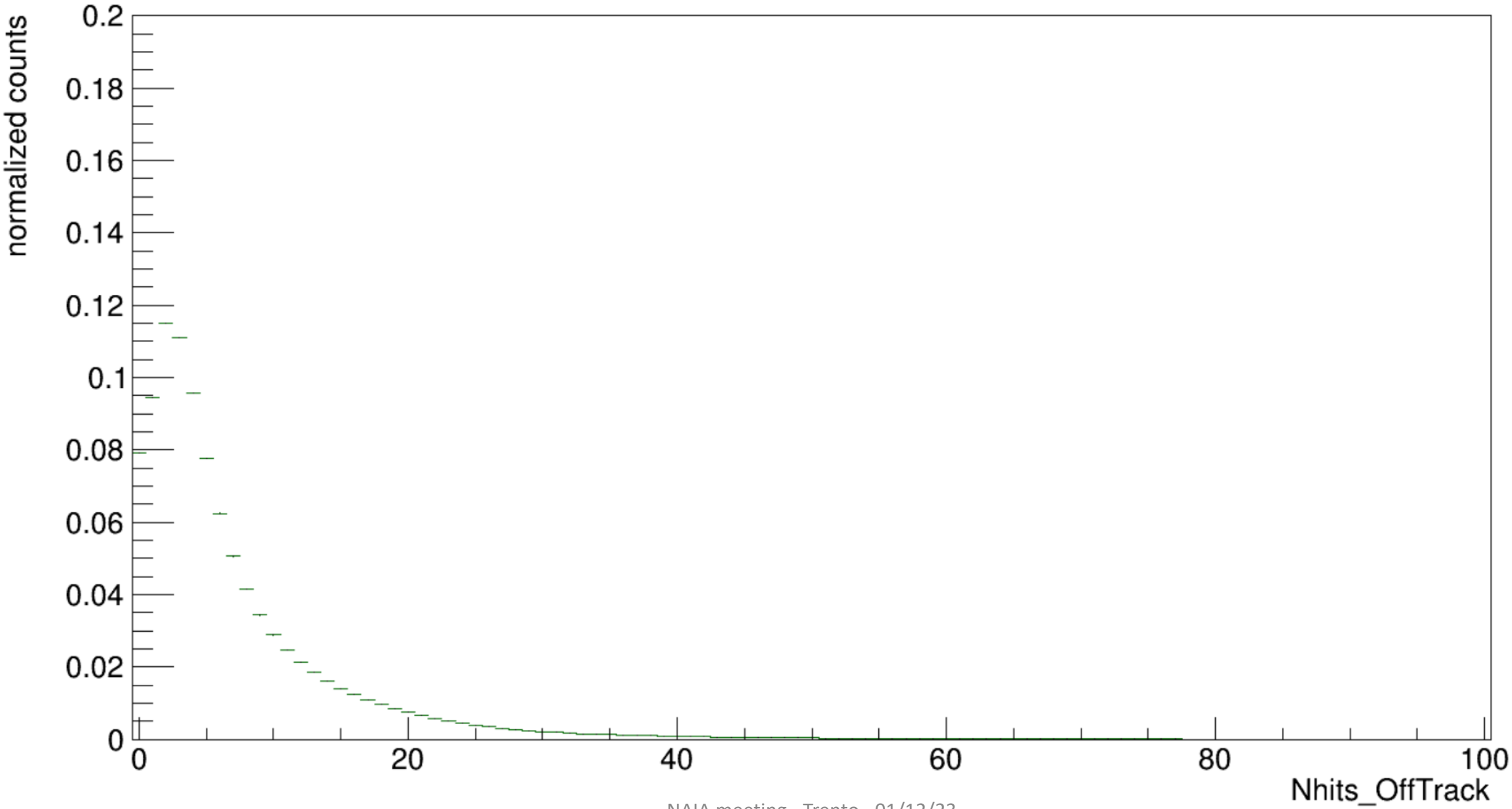
AFTER


normalized counts
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
5
10
15
20
25
30
Nhits_OnTrack

BEFORE


normalized counts
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
20
40
60
80
100
Nhits_OffTrack

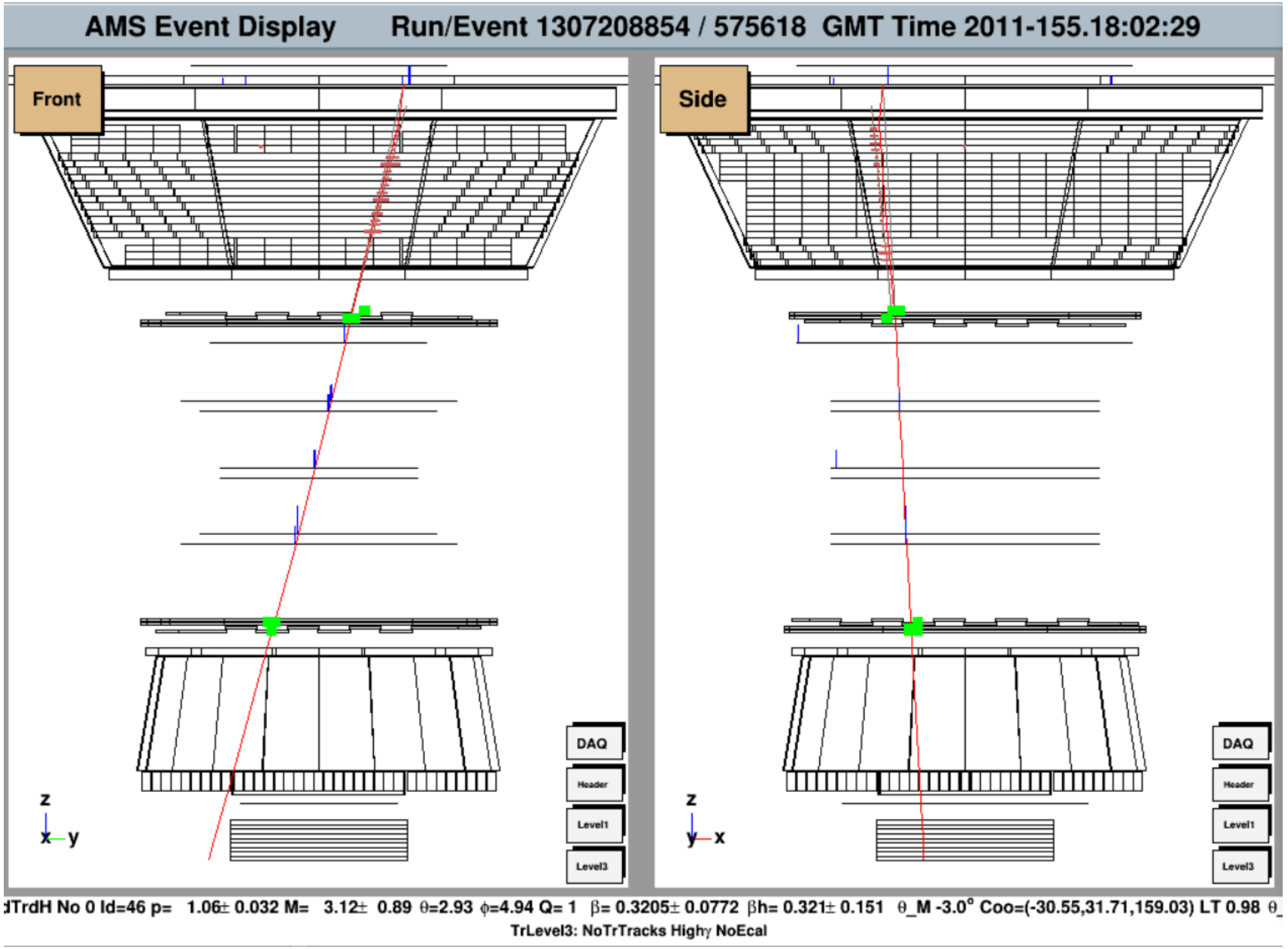
AFTER


normalized counts
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
20
40
60
80
100
Nhits_OffTrack

Event N°1

0.3 < beta < 0.5

The Track reconstructed from tracker is slightly shifted with respect to the TRD track alone



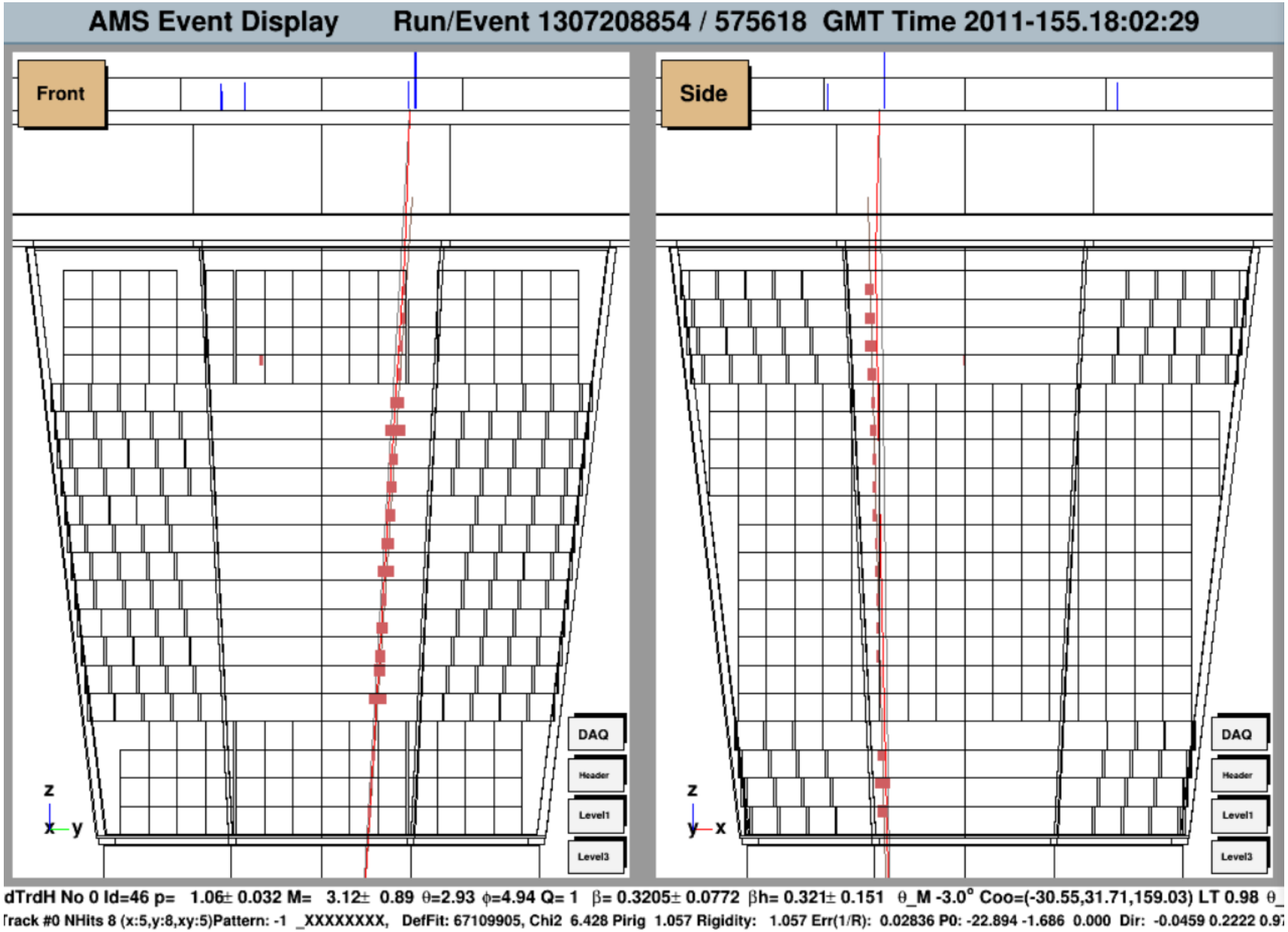
TRD ON TRACK STANDALONE = 10

TRD ON TRACK = 0

Event N°1

0.3 < beta < 0.5

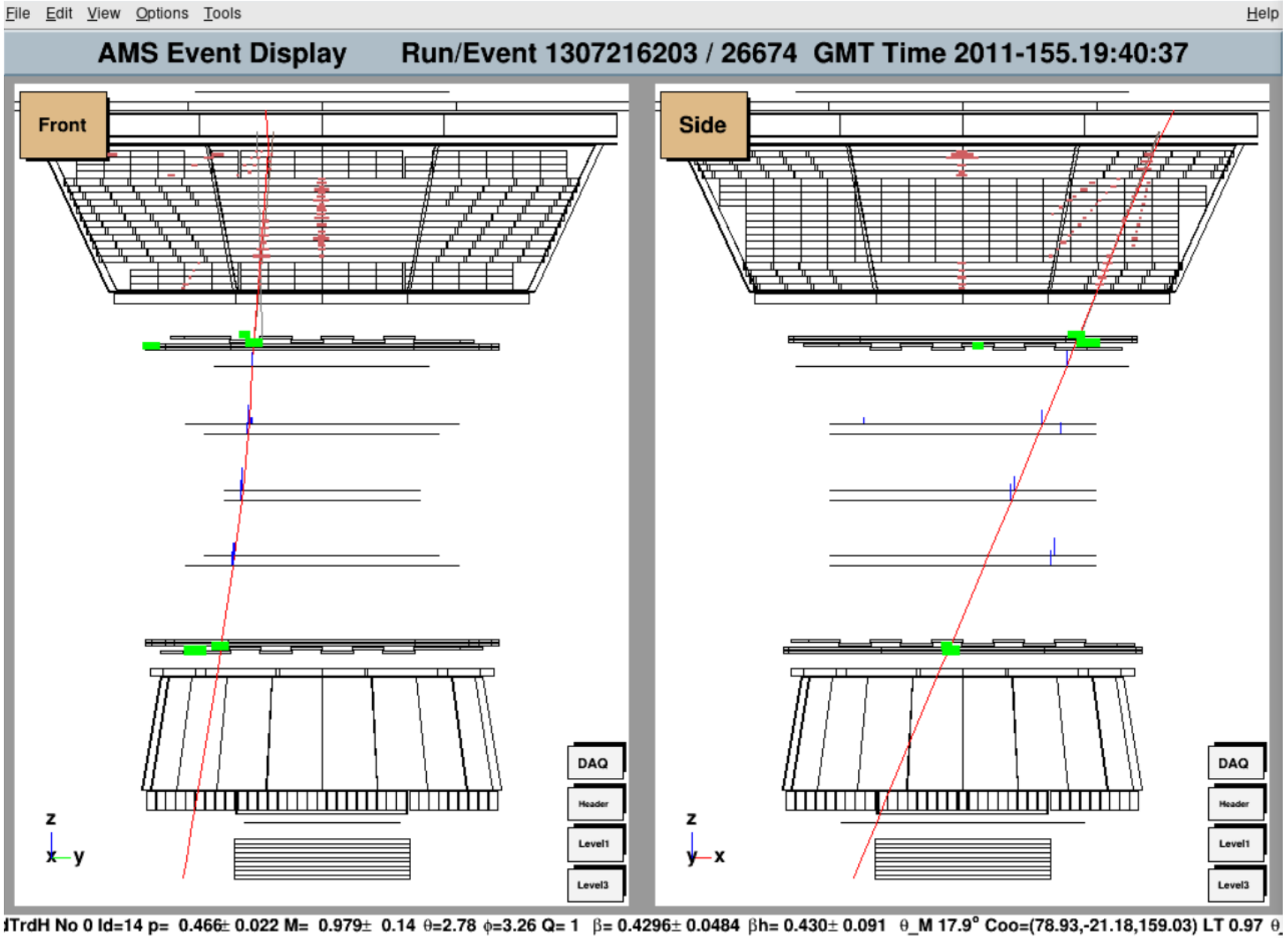
The Track reconstructed from tracker is slightly shifted with respect to the TRD track alone



Event N°3

0.3 < beta < 0.5

TRD OnTrack is slightly shifted with respect to the standalone one



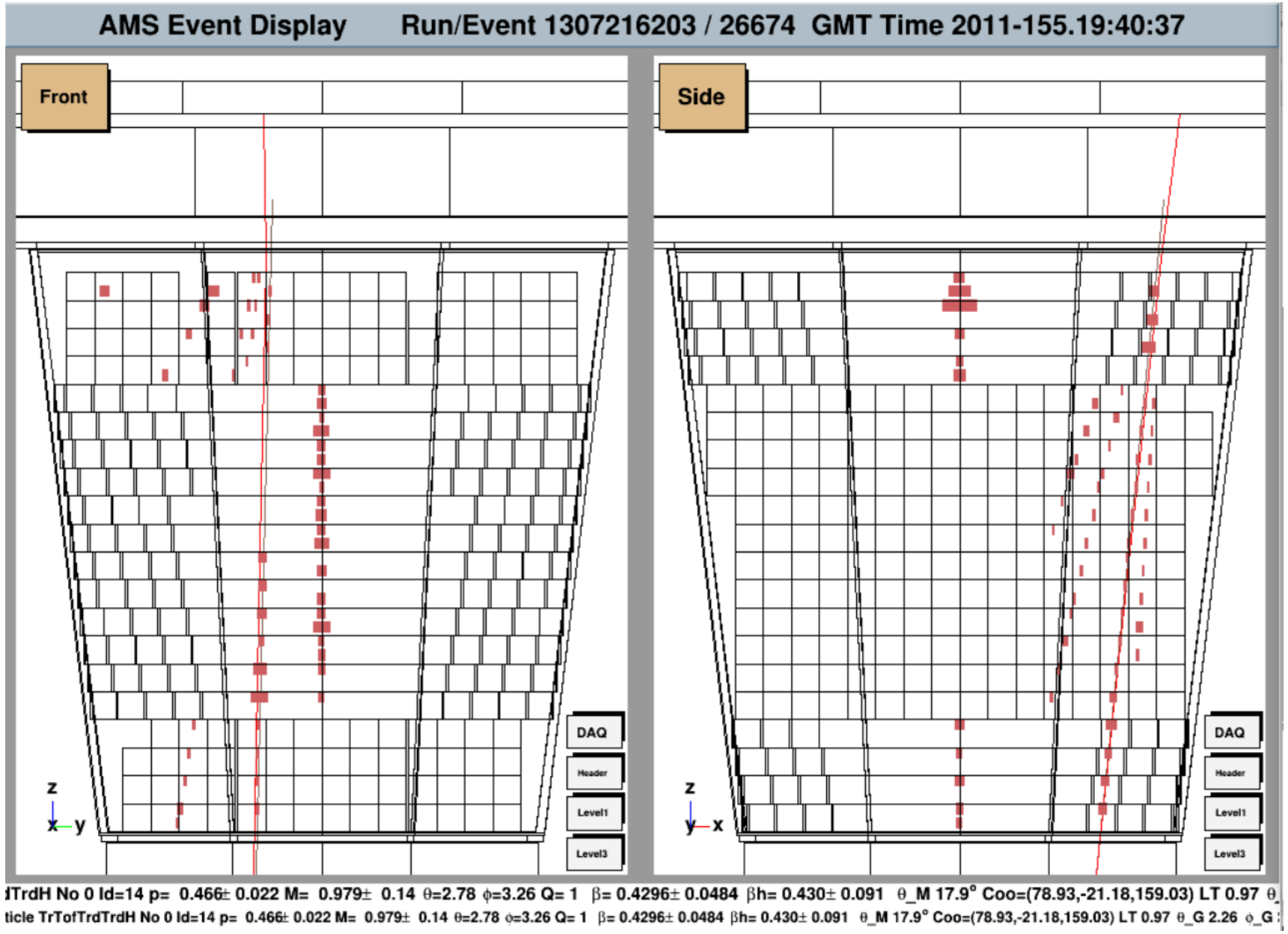
TRD ON TRACK STANDALONE = 18

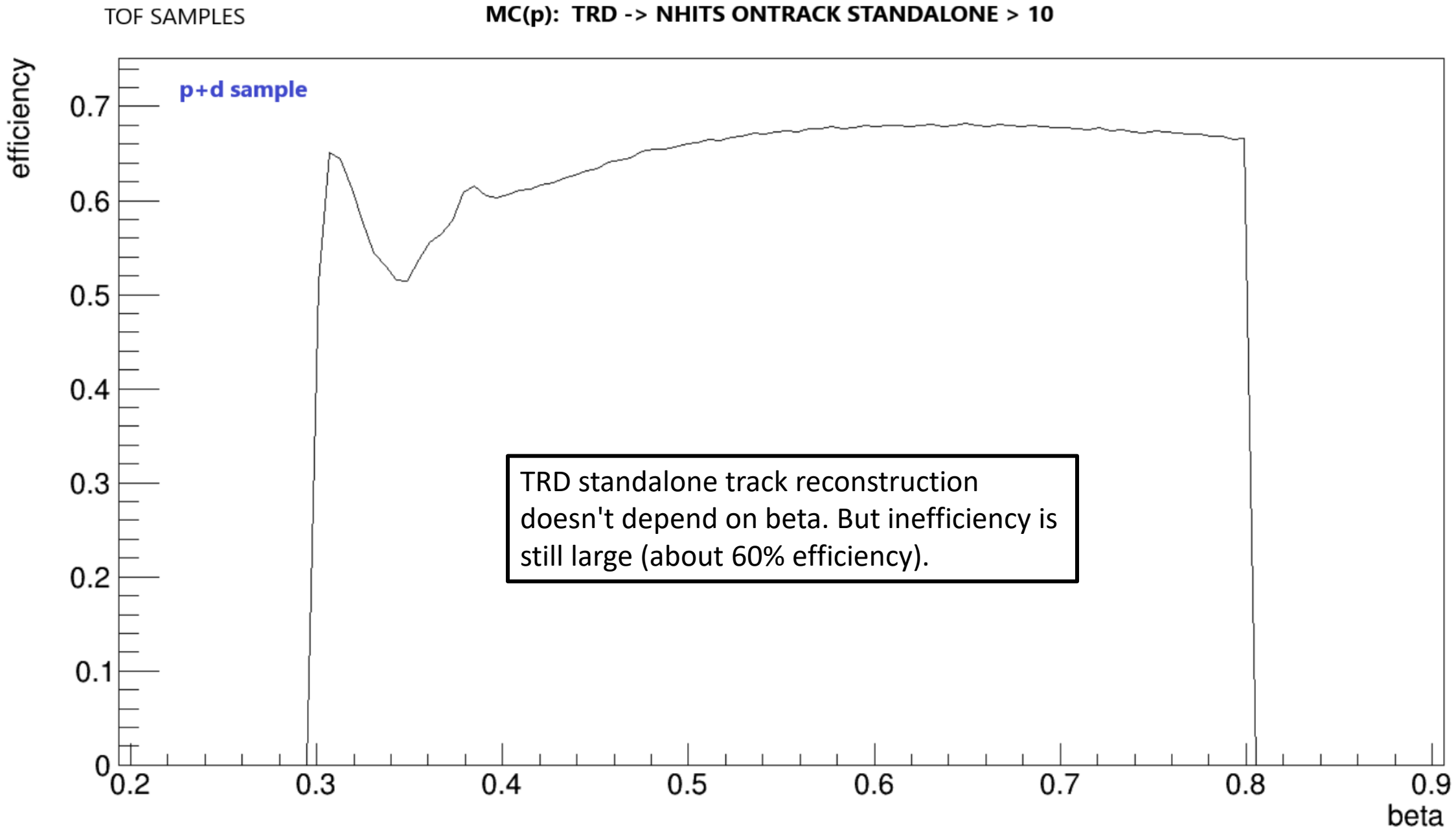
TRD ON TRACK = 0

Event N°3

0.3 < beta < 0.5

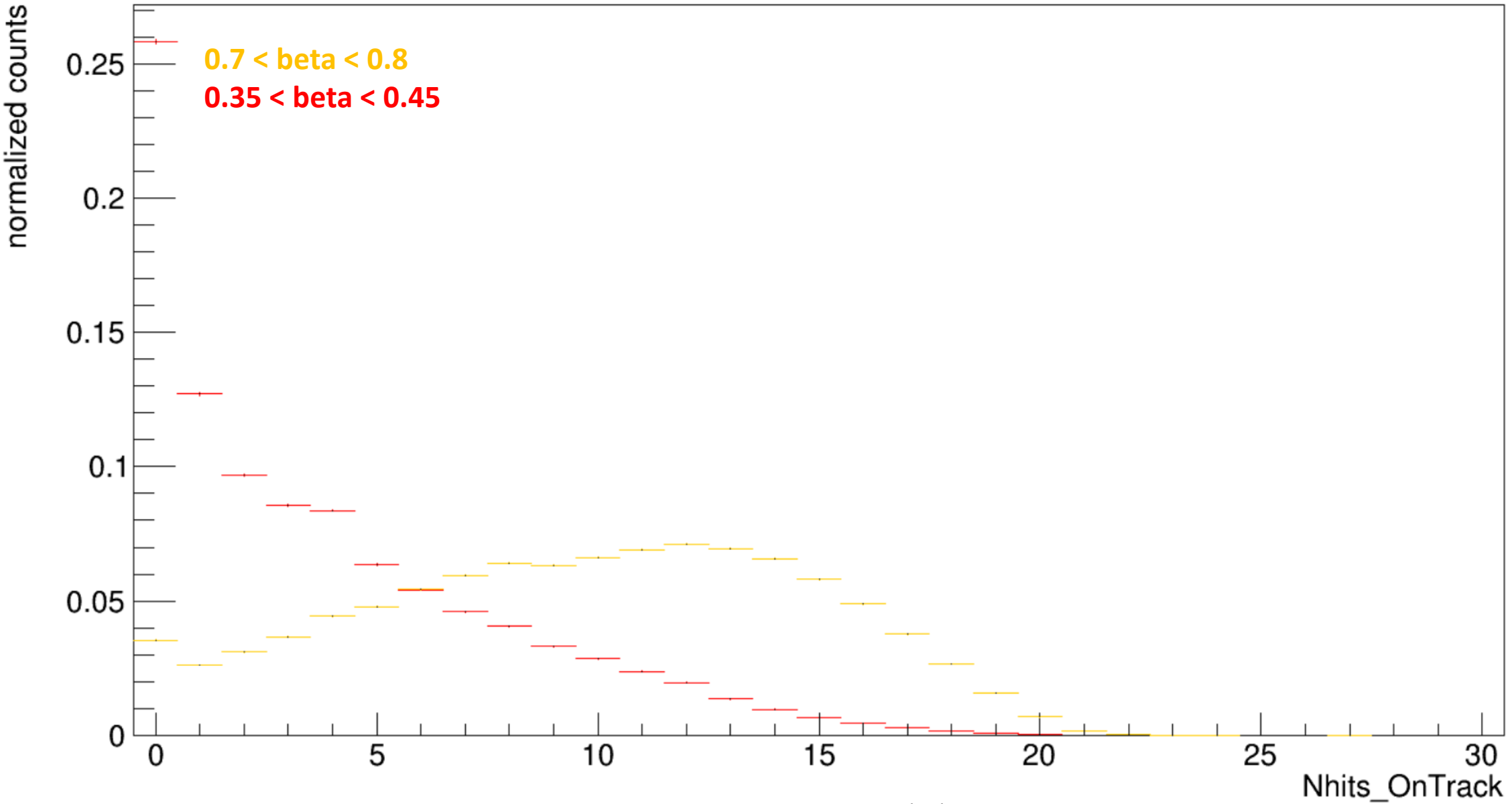
TRD OnTrack is slightly shifted with respect to the standalone one



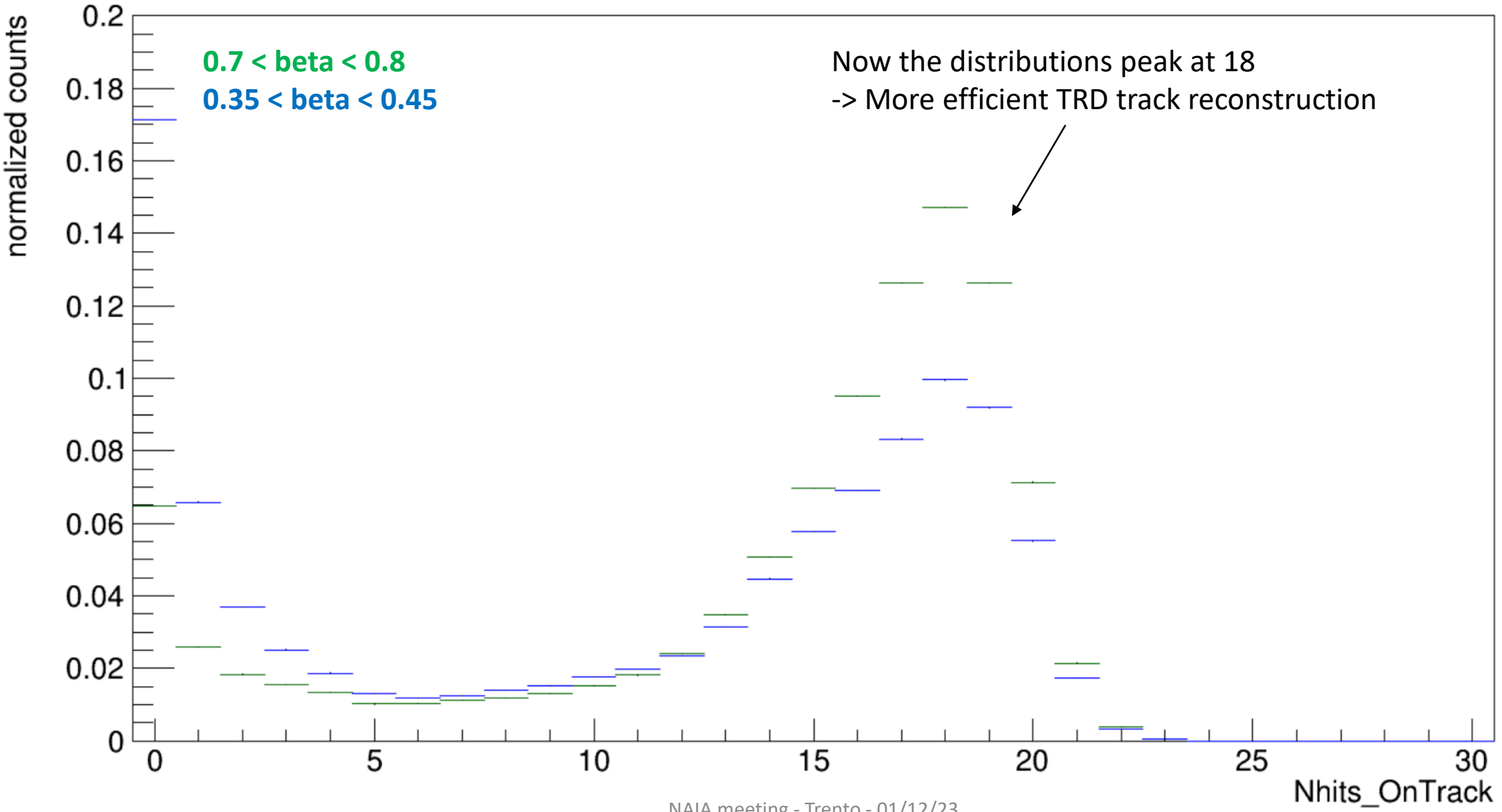

MC(p): TRD -> NHITS ONTRACK STANDALONE > 10
p+d sample
efficiency
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
beta
TRD standalone track reconstruction doesn't depend on beta. But inefficiency is still large (about 60% efficiency).

BEFORE

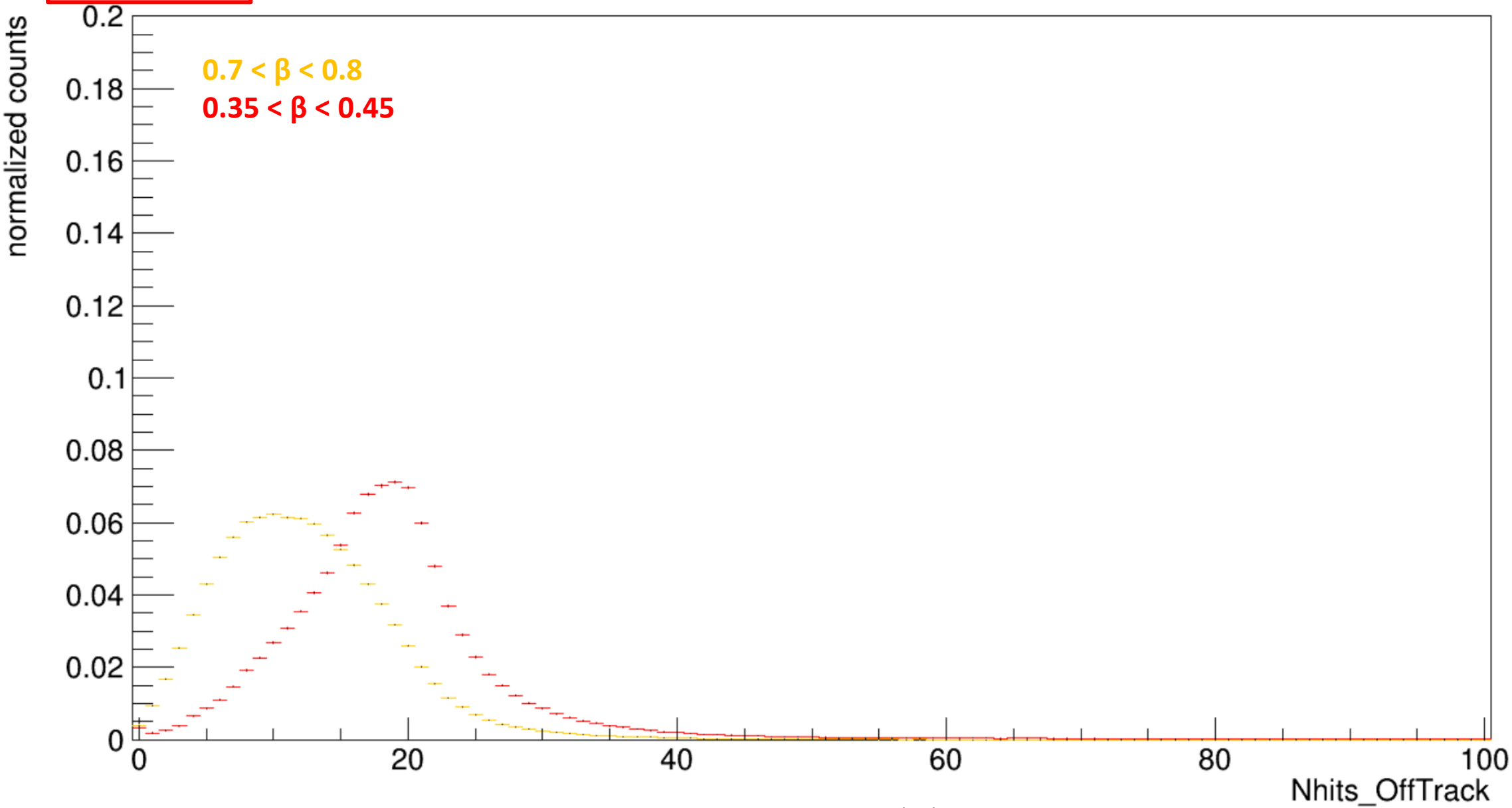
0.7 < β < 0.8



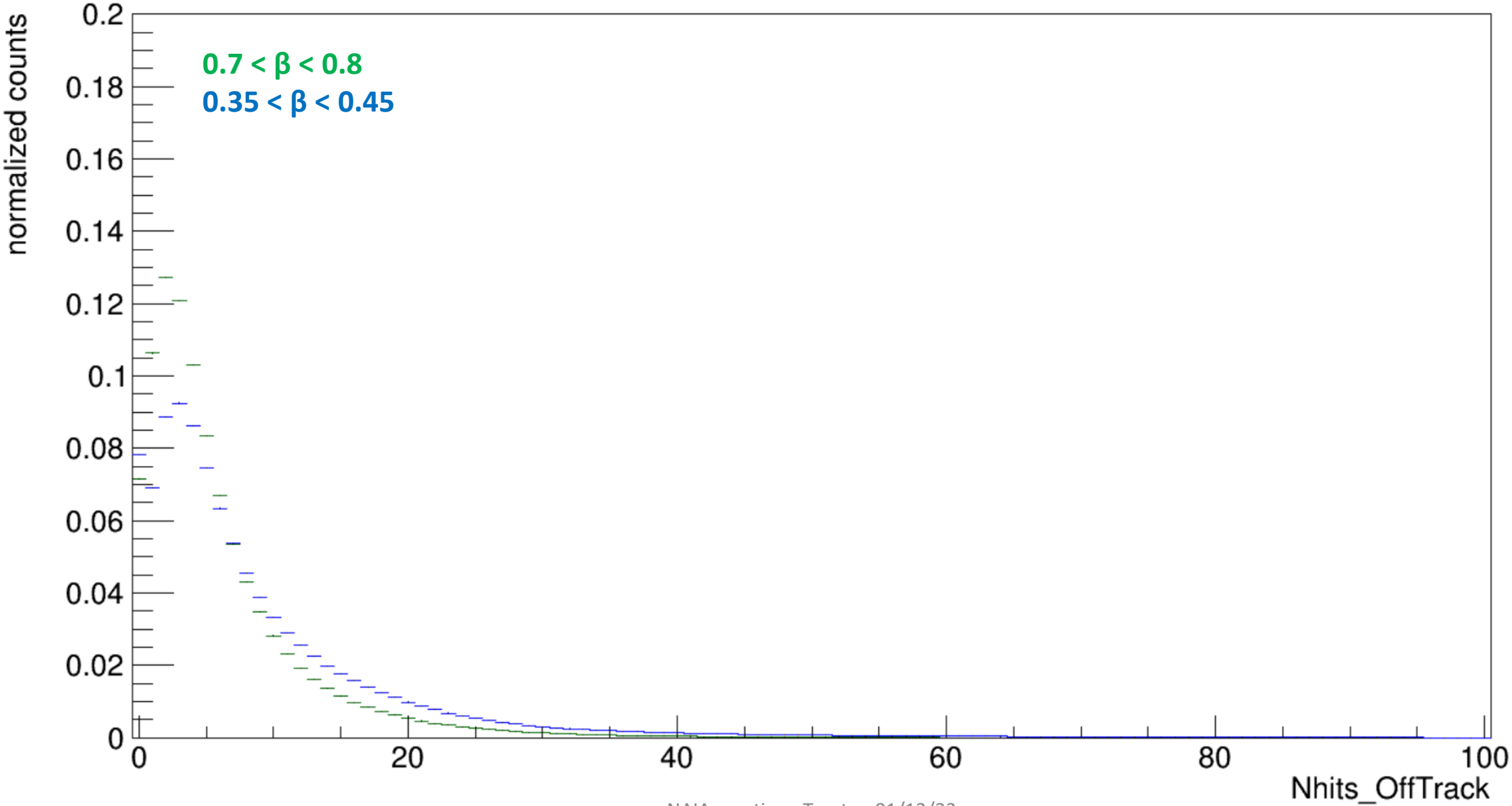
AFTER

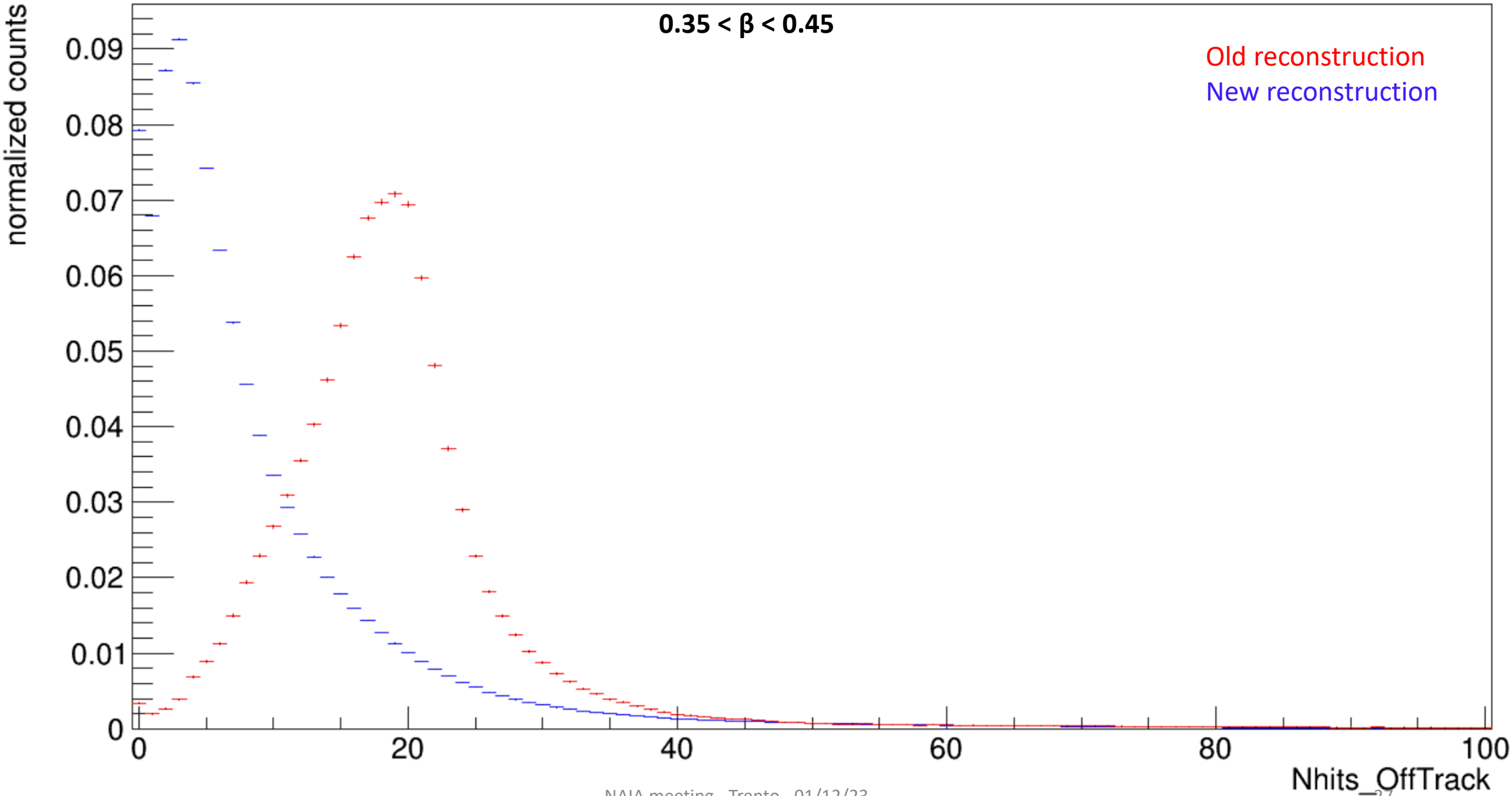

0.7 < beta < 0.8
0.35 < beta < 0.45
Now the distributions peak at 18
-> More efficient TRD track reconstruction
normalized counts
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
5
10
15
20
25
30
Nhits_OnTrack

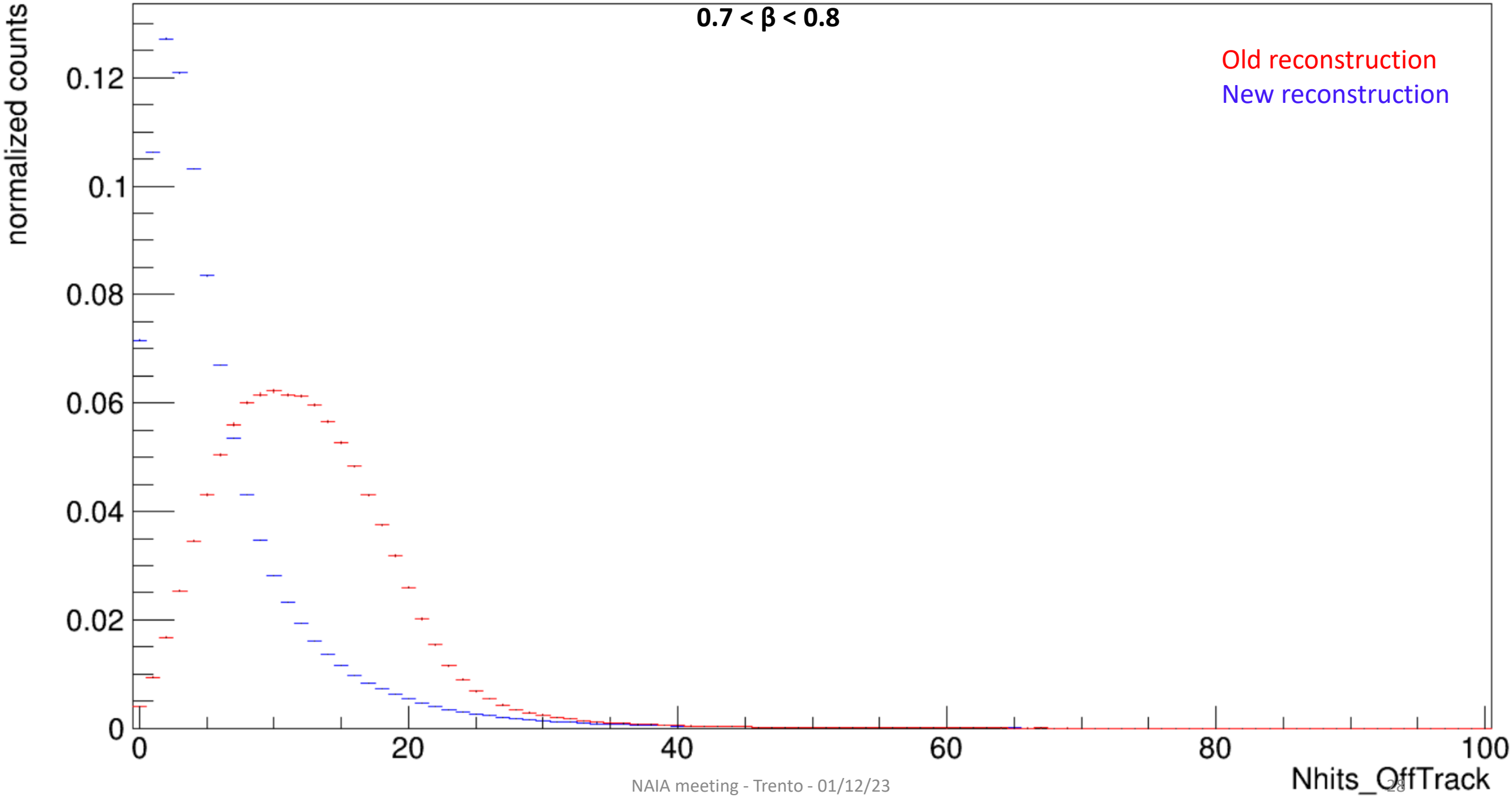
BEFORE

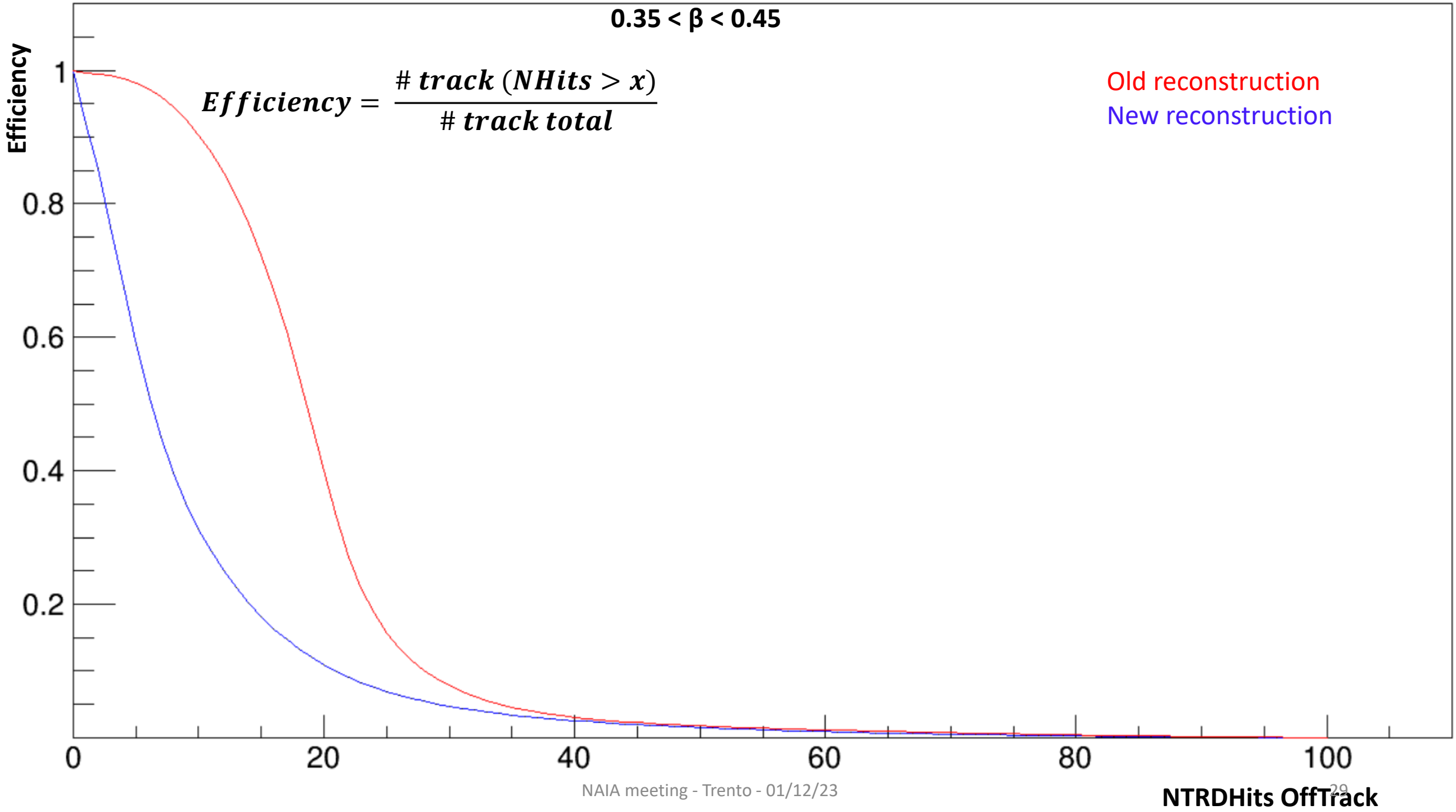

0.7 < β < 0.8
0.35 < β < 0.45
normalized counts
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
20
40
60
80
100
Nhits_OffTrack

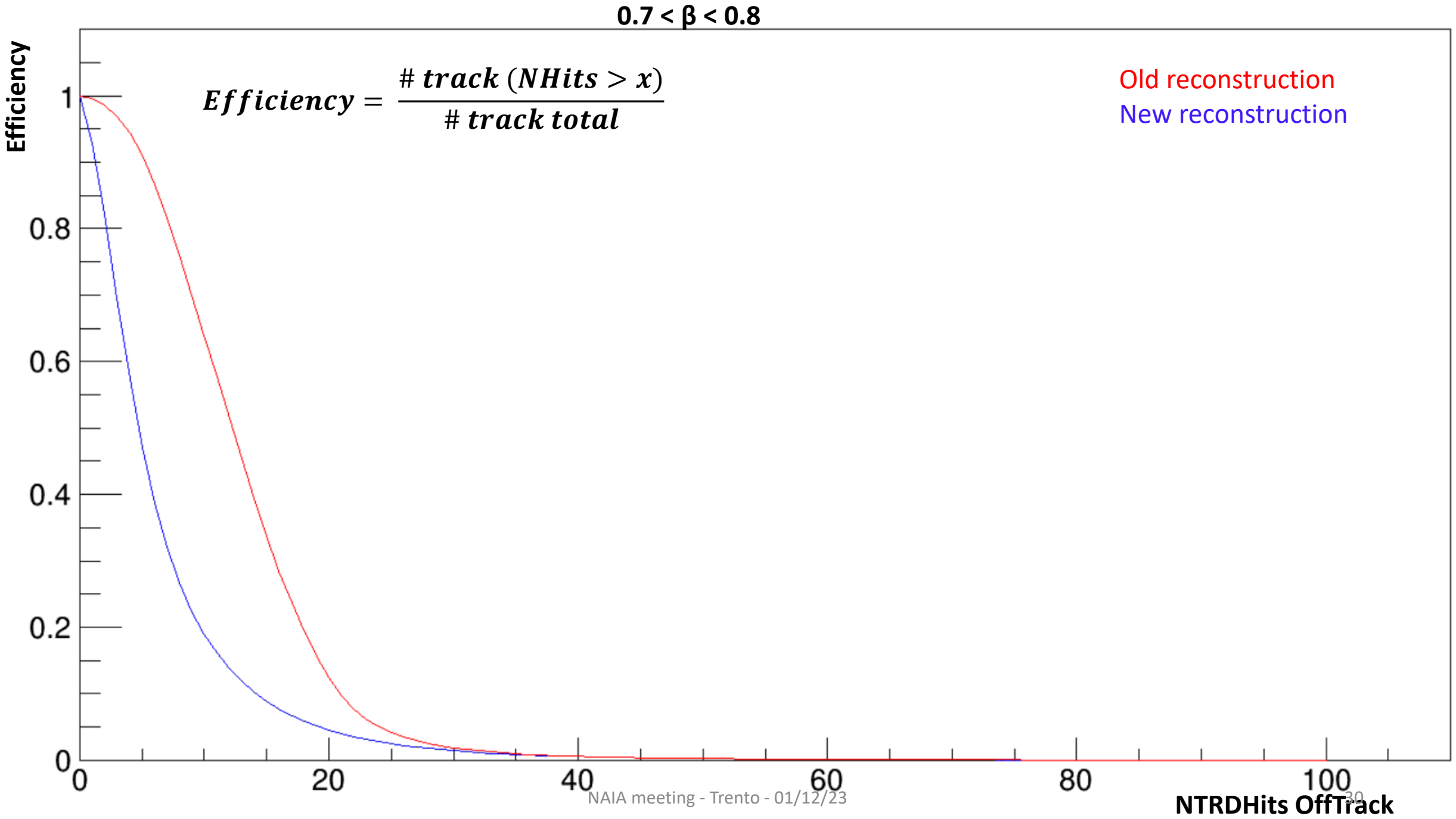
AFTER


normalized counts
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0.7 < β < 0.8
0.35 < β < 0.45
0
20
40
60
80
100
Nhits_OffTrack


0.35 < β < 0.45
Old reconstruction
New reconstruction
normalized counts
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
20
40
60
80
100
Nhits_OffTrack


0.7 < β < 0.8
Old reconstruction
New reconstruction
normalized counts
0.12
0.1
0.08
0.06
0.04
0.02
0
0
20
40
60
80
100
Nhits_OffTrack


0.35 < β < 0.45
Efficiency
$Efficiency = \frac{\#\ track\ (NHits > x)}{\#\ track\ total}$
Old reconstruction
New reconstruction
1
0.8
0.6
0.4
0.2
0
20
40
60
80
100
NTRDHits OffTrack


0.7 < β < 0.8
Efficiency
$Efficiency = \frac{\#\ track\ (NHits > x)}{\#\ track\ total}$
Old reconstruction
New reconstruction
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
NTRDHits OffTrack