Performance after TPC clustering fix

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Introduction

We have been trying to understand for some time now why we have been seeing an efficiency of only ~ 85% when clustering in the TPC.

This was found to be caused by not taking into account the effect of the GEM gain when doing the signal digitization, leading to some of the cells being assigned a signal of zero, which sometimes caused the TPC cluster fitting to fail.

Carlos modified the clustering to introduce a GEM gain of 2000 (so far without gain fluctuations included) before clustering, and then the code converts the clustered signal to energy.

Here are some performance plots made after this fix.

What is simulated?

The events consist of:

100 pions with

- Flat p_T distribution from 0.1 to 20.0 GeV/c
- $-1.0 < \eta < 1.0$
- Flat vertex distribution covering -5.0 cm $< Z <$ 5.0 cm

and

1 Y(1S) with

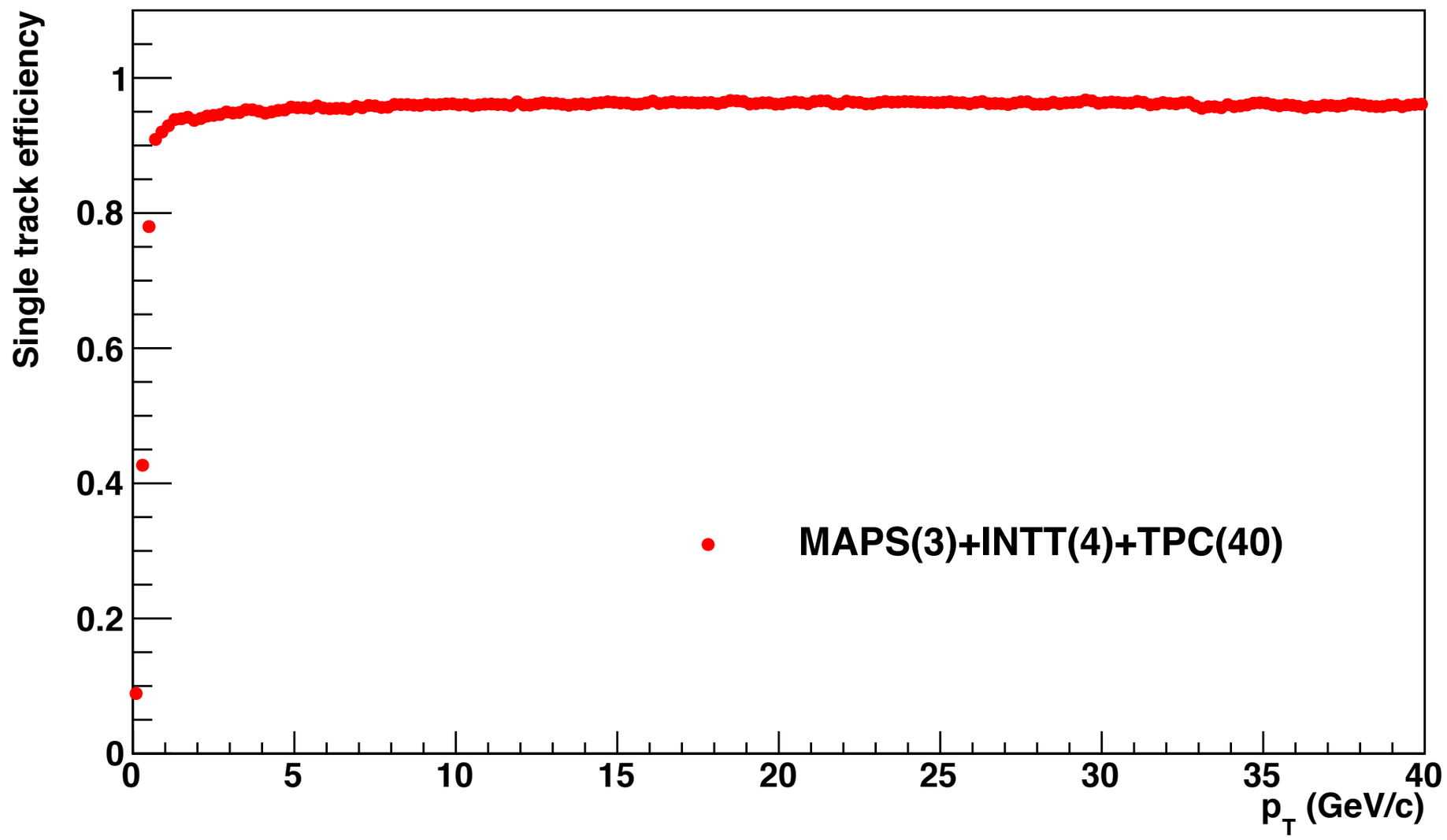
- Realistic p_T distribution
- $-1.0 < y < 1.0$
- Vertex inherited from 100 pion event

Standard configuration of MVTX ladders, INTT ladders and 40 layer TPC.

Tracking efficiency

100 pions + 1 Y
into |η| < 1.0

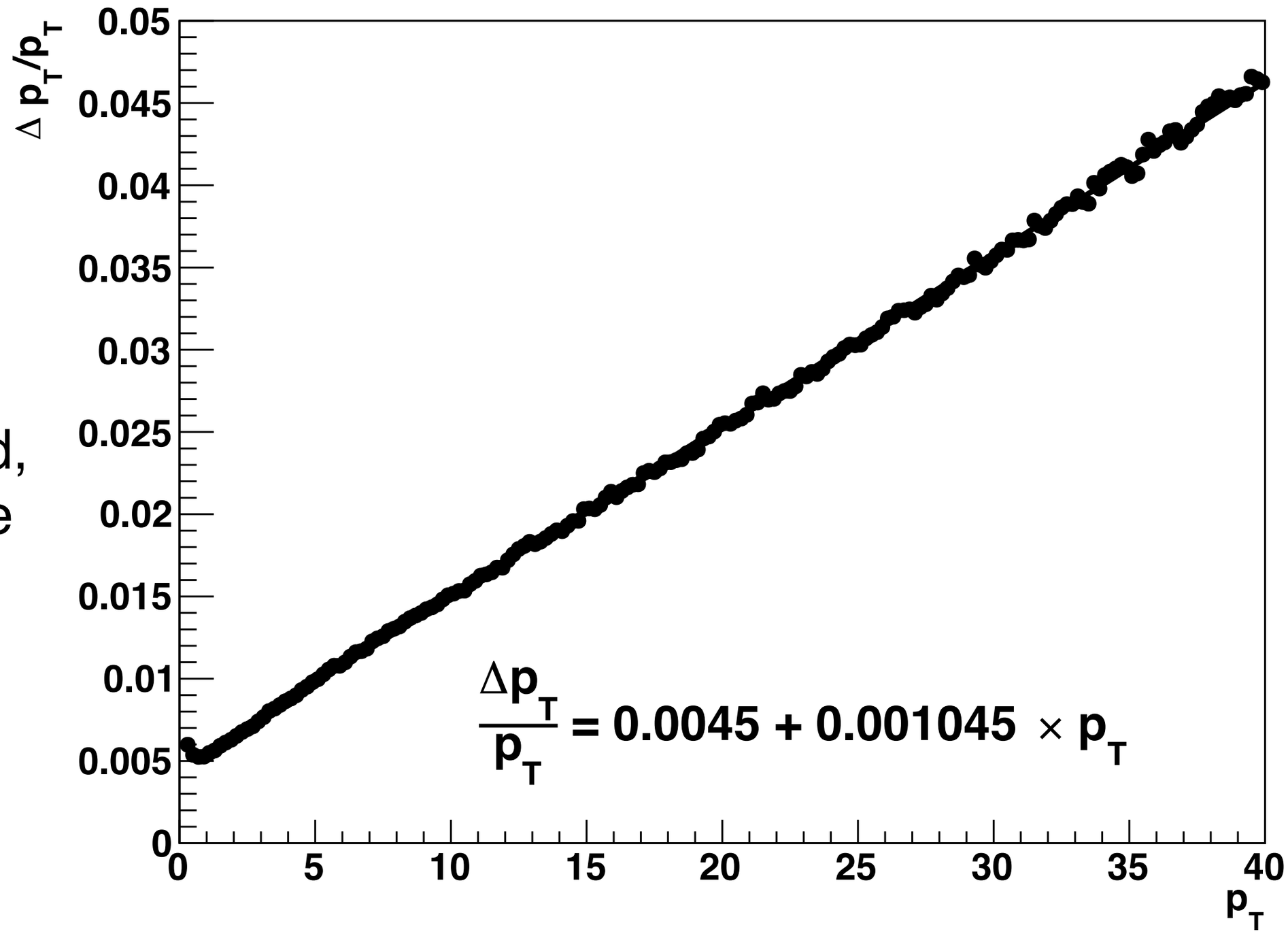
Track efficiency:
96% at high p_T
92% at 1 GeV/c



p_T resolution

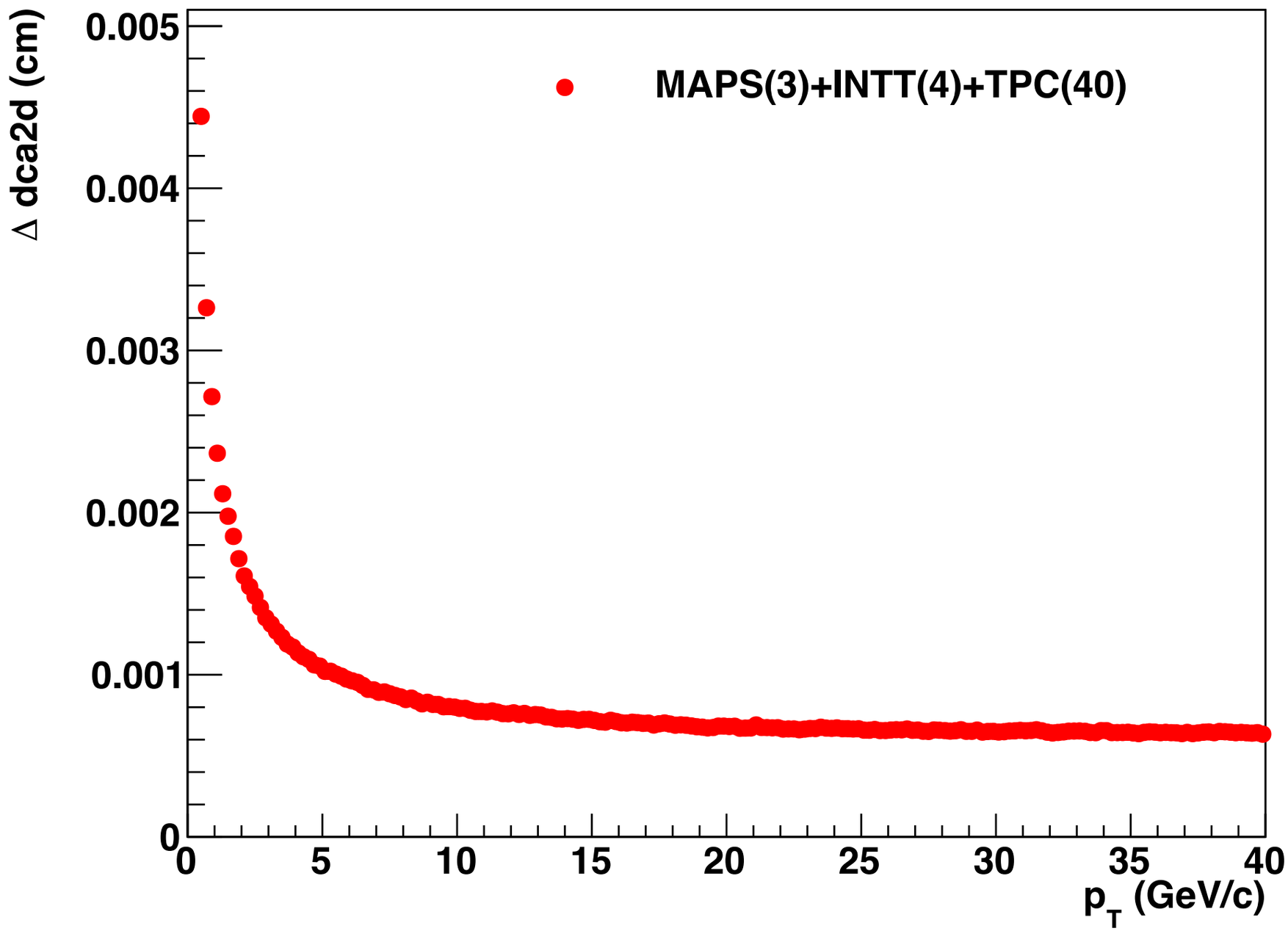
100 pions + 1 Y
into $|\eta| < 1.0$

Slightly improved, probably just due to more clusters in the track.



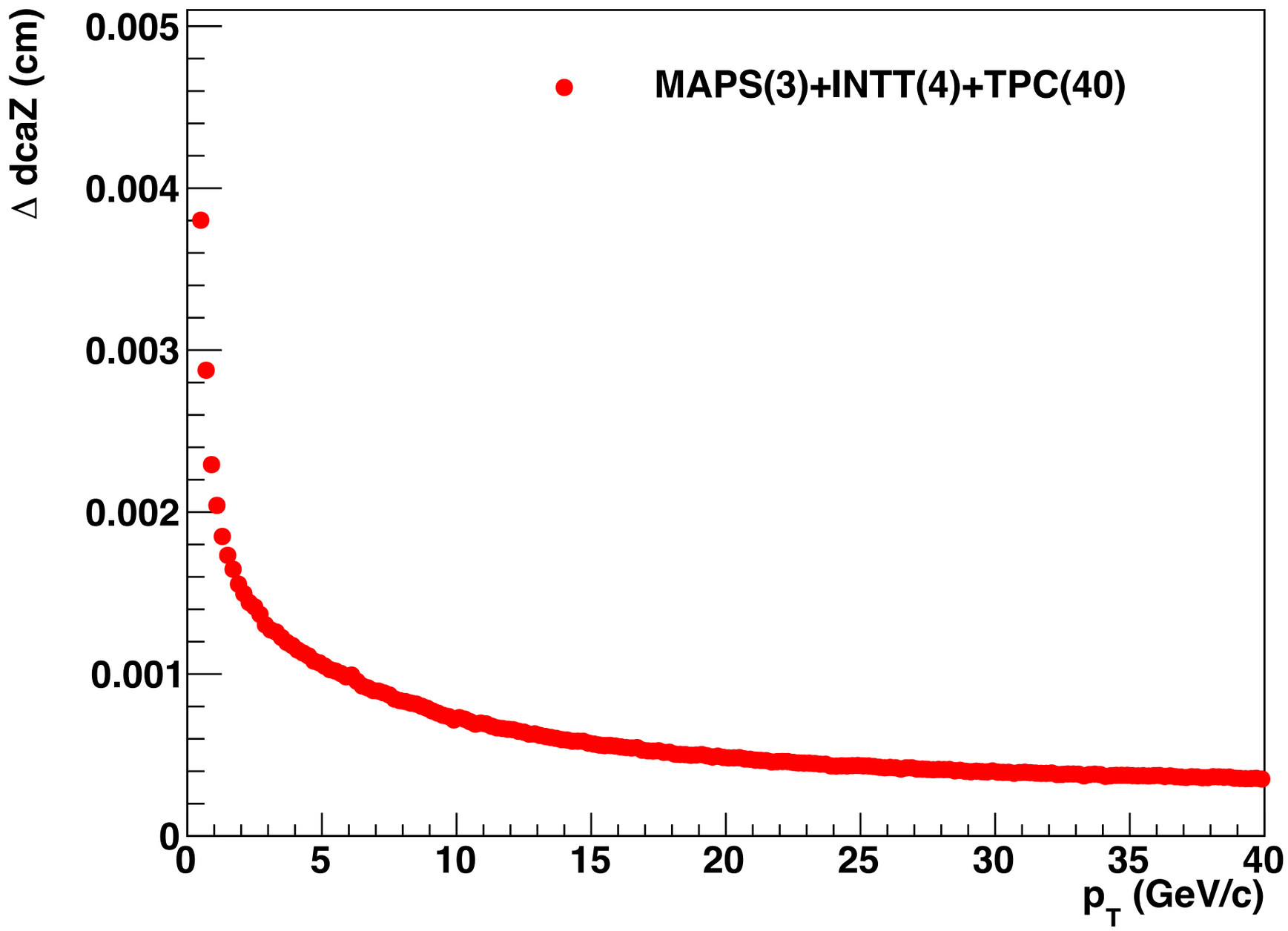
dca2d resolution

100 pions + 1 Y
into |η| < 1.0



dcaZ resolution

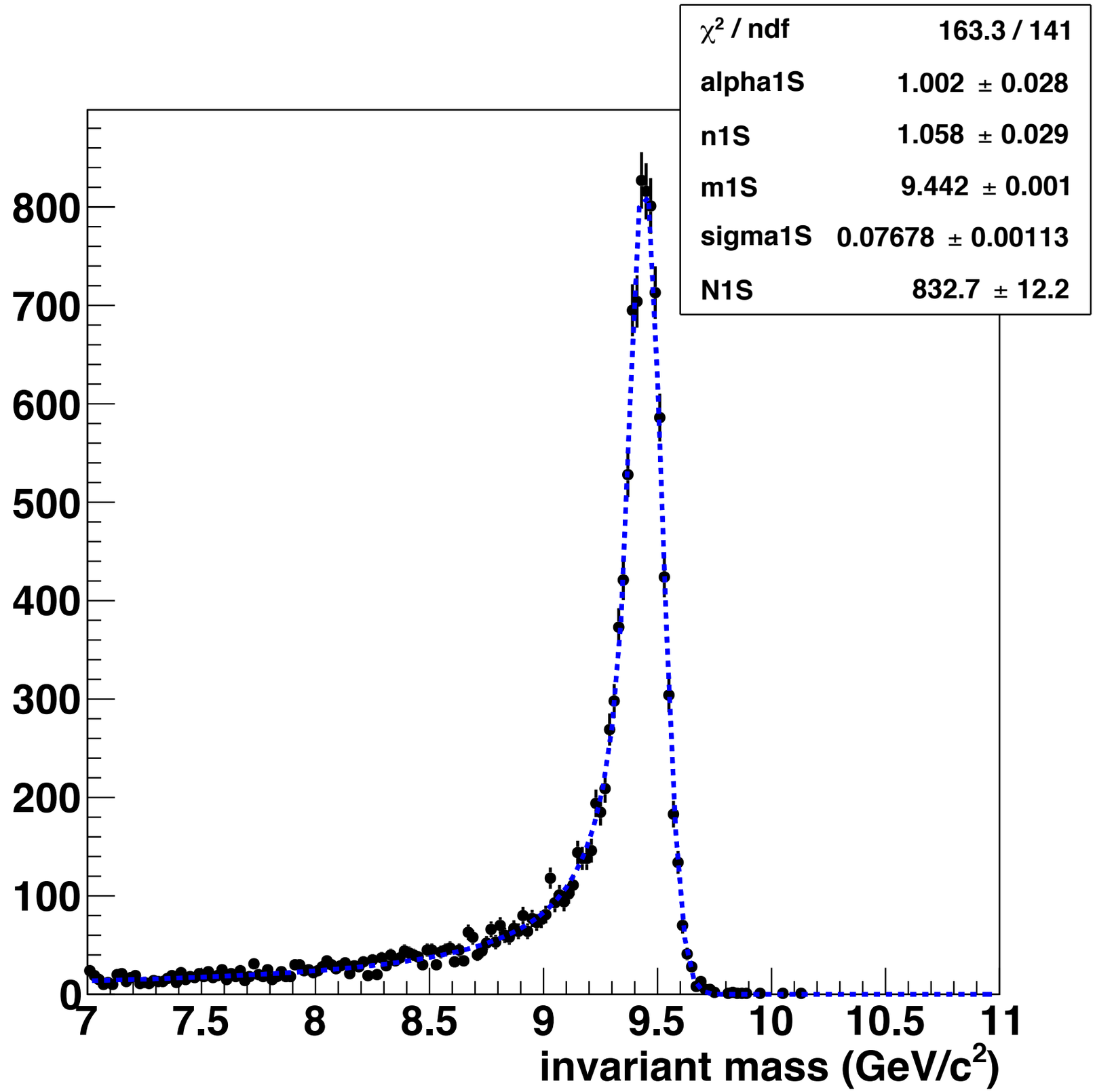
100 pions + 1 Y
into |η| < 1.0



Υ mass spectrum

100 pions + 1 Υ
into |η| < 1.0

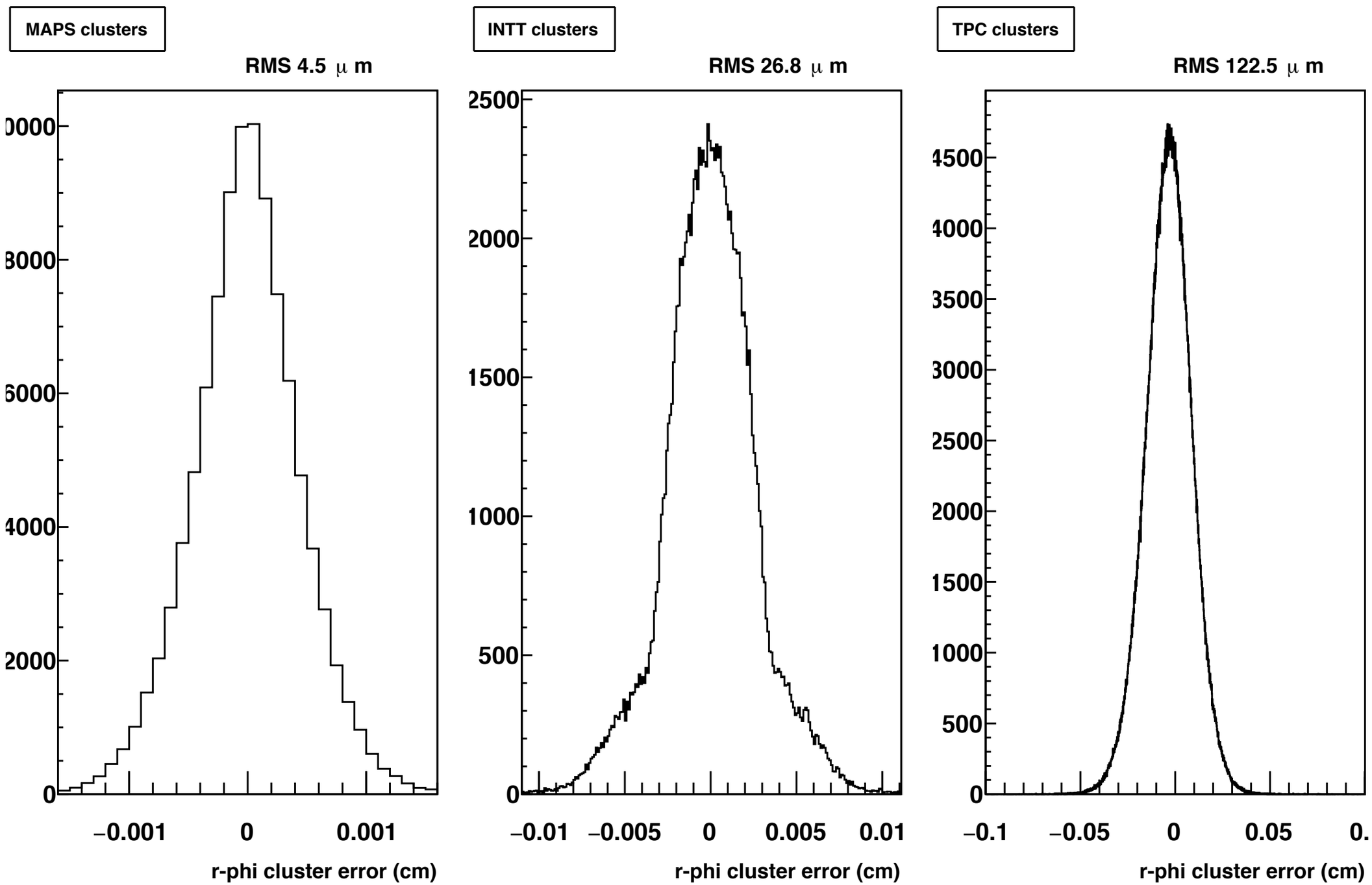
Mass resolution
77 +/- 1.1 MeV,
improved over
~ 84 MeV



r-ϕ cluster resolution

100 pions + 1 Y into |η| < 1.0

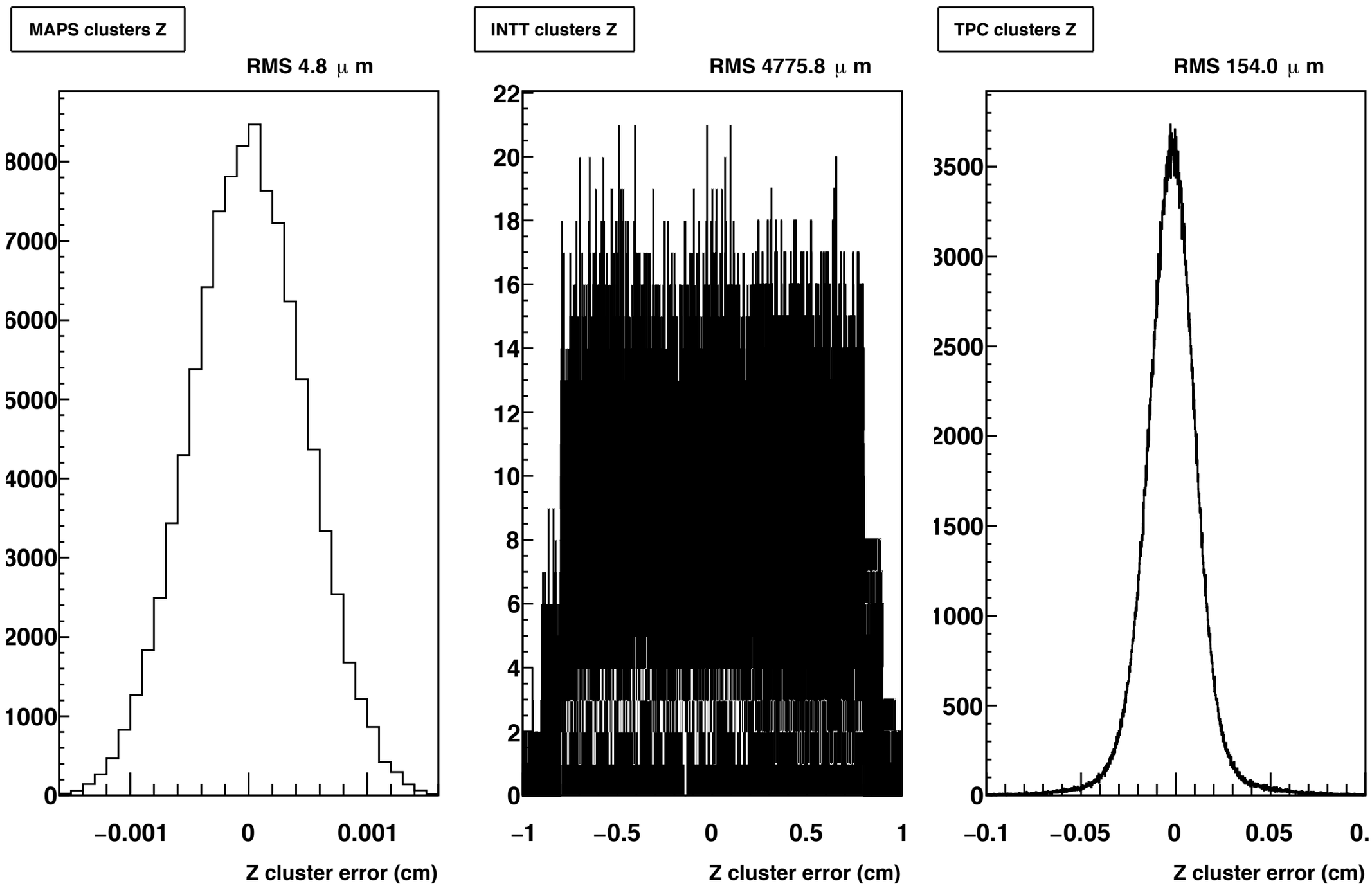
About the same

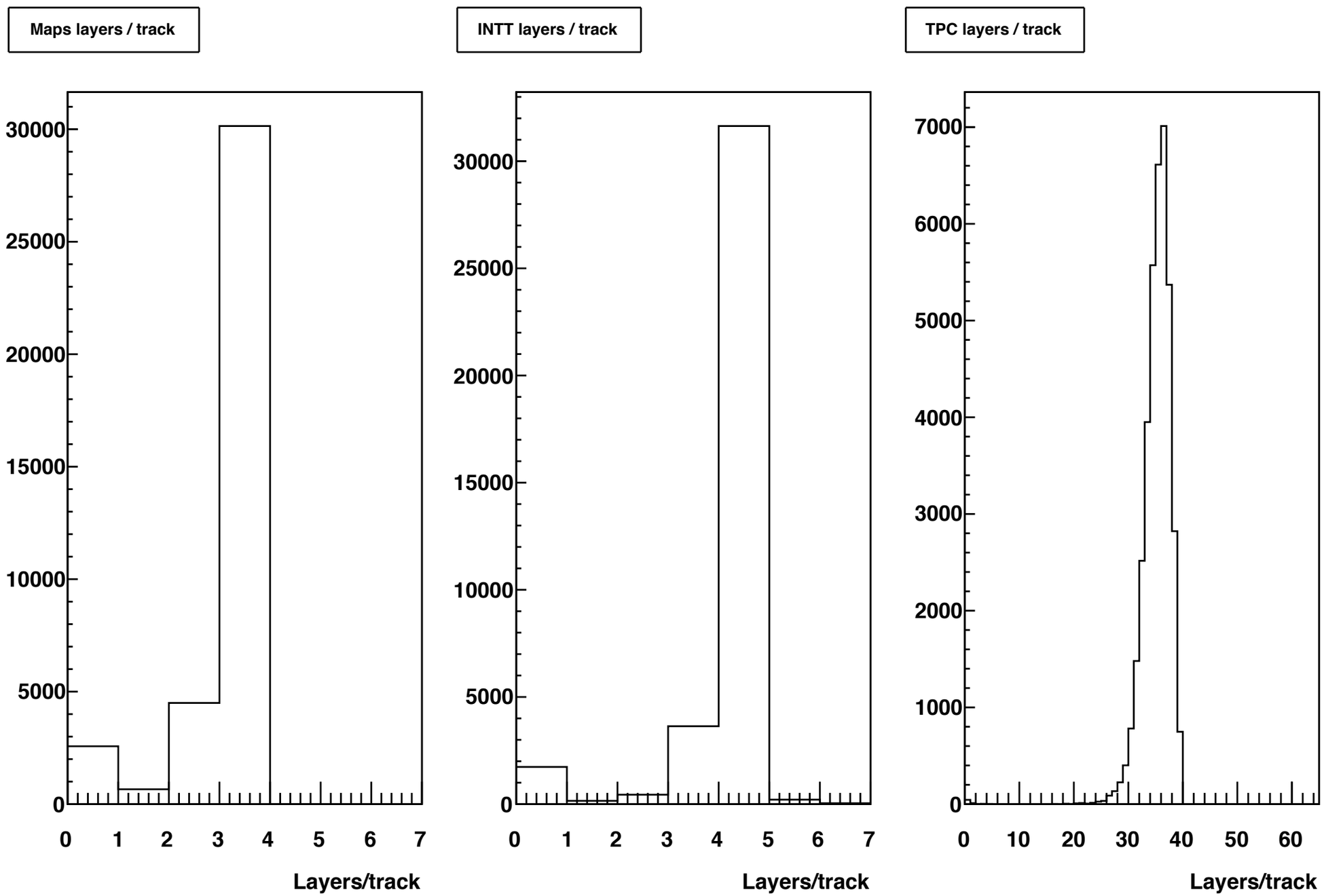


Z cluster resolution

100 pions + 1 Y into |η| < 1.0

About the same



Track hits per layer

100 pions + 1 Y into |η| < 1.0