τ reconstruction and cell NN

- hadronic τ's come in three types:
  single π,$\pi^{\pm} + \pi^0$ and $3\pi + x\pi^0$
- cellNN tries to reconstruct seperate particles inside a jet
- $\rightarrow$ use CellNN to reconstruc the π^0's?
- compare to current method of a NN algorithm on EM3 cells

Samples and "Method"

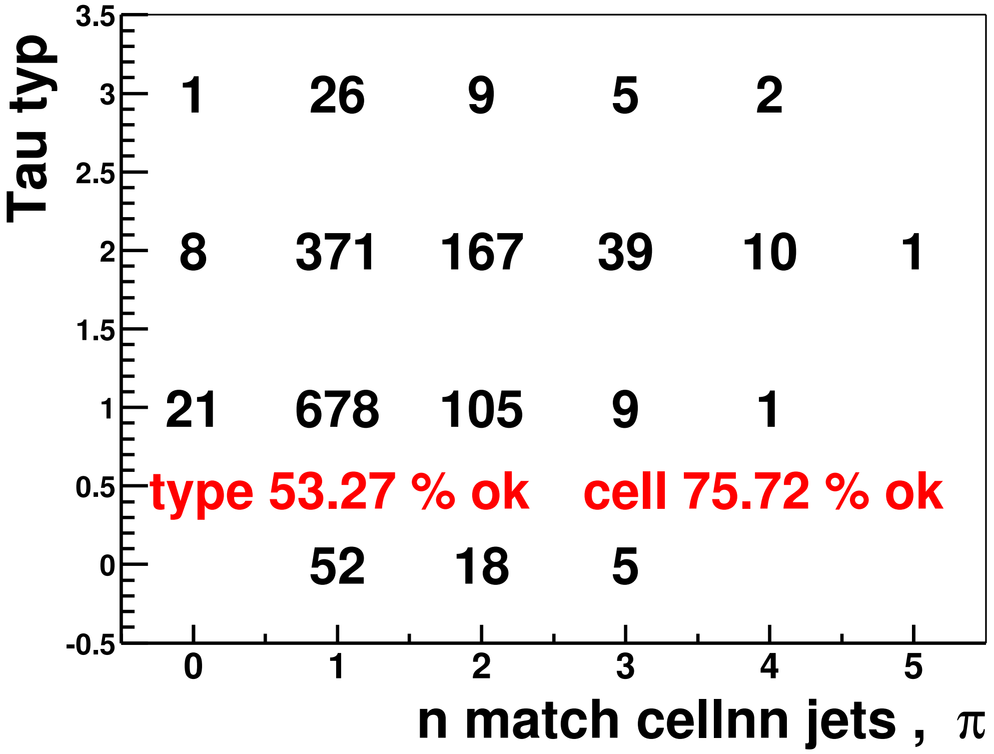
use the NP $Z \to \tau\tau$ sample with 15.000 events (name like "p10.11.00_nikhef_pythia_npv00+03+09+z-tautau-KinMassGt-60.0+KinMassLt-130.0")

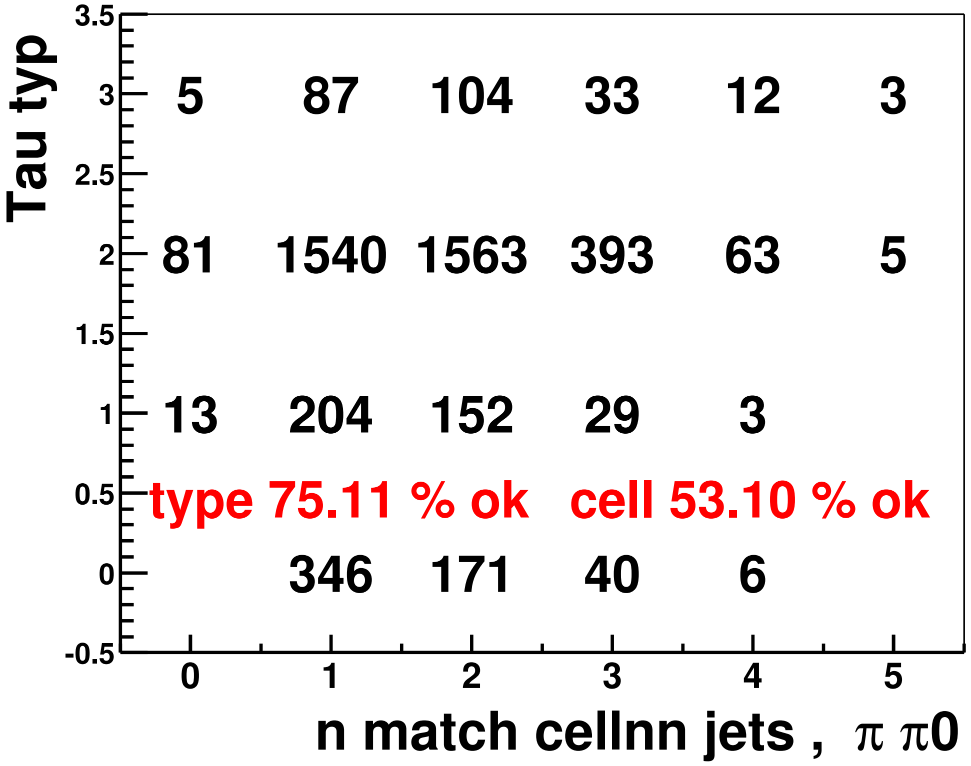
loop over reconstructed τ's and use only object with a matched MC τ decying into π or $\pi + x\pi^0$
keep CellNN jets within a radius of 0.5 in $\eta - \phi$ space

look at :

- # of CellNN objects
- the angular+pT resolution wrt the π's
- the efficiencies of the "type" definitions versus the $\pi\pi^0$ angle, the τ EMF

The reconstructed τ object

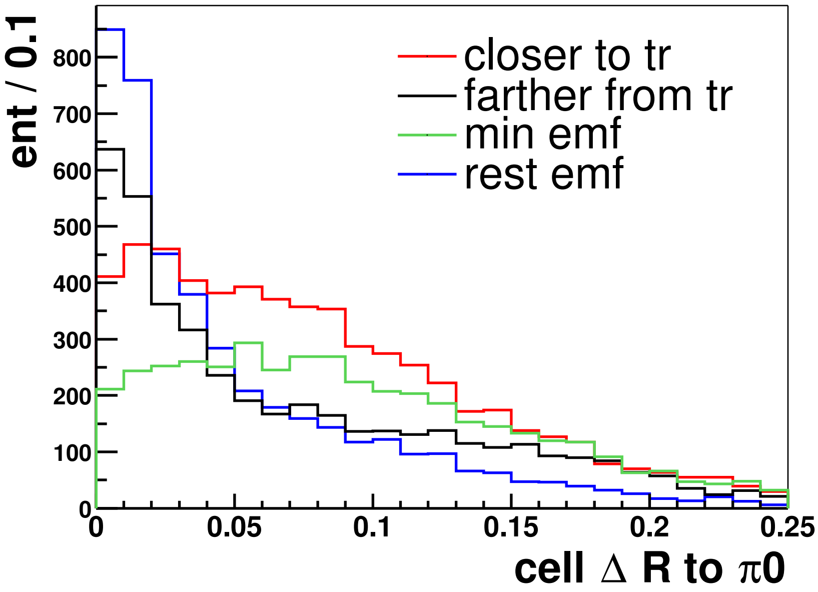


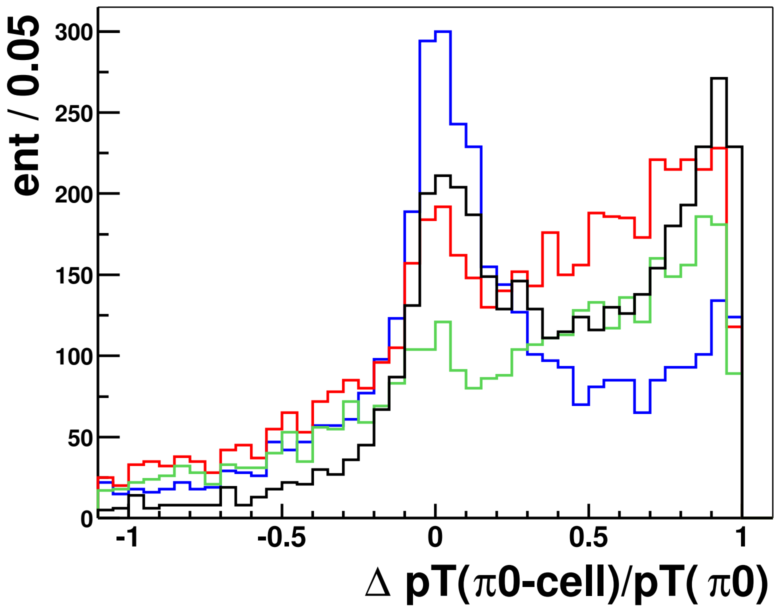


in general: less “EM3” objects using CellNN

Assign CellNN clusters to π^0

in $\pi\pi^0$ decay with two reconstructed CelNN clusters
use A) distance to track
or B) lowest EM fraction



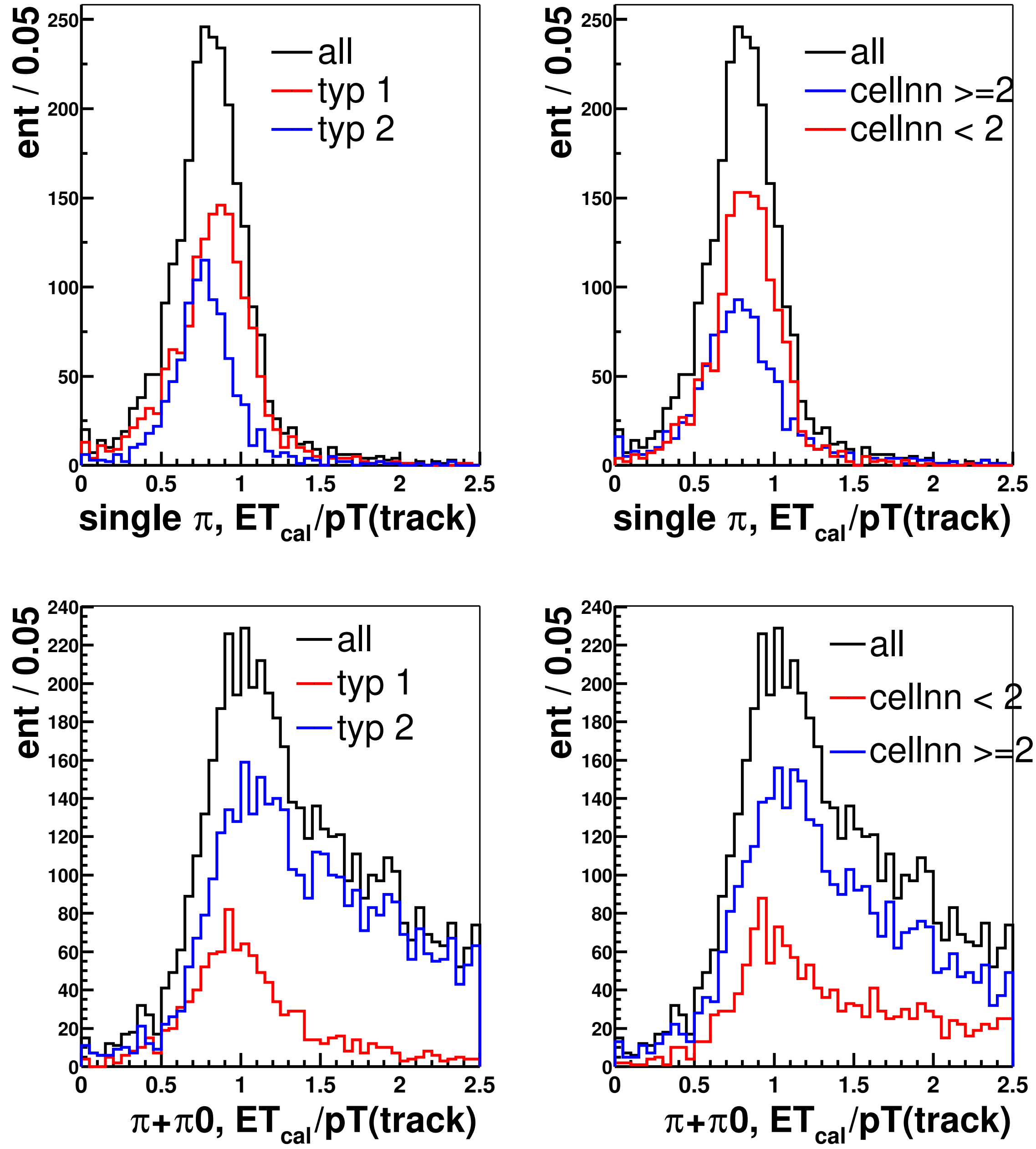


using the CellNN object with the highest EM fraction
as π^0 gives better results for the pT resolution

Type definition for π

Aim: get object where E/p is a useful quantity (and the EM fraction in layer 1+2)

possible assignment: use "default" type, use N cellNN objects or a combination

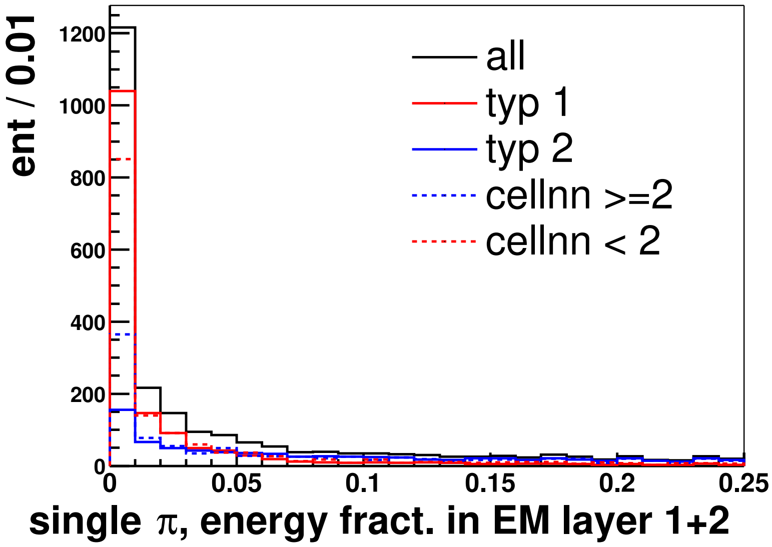


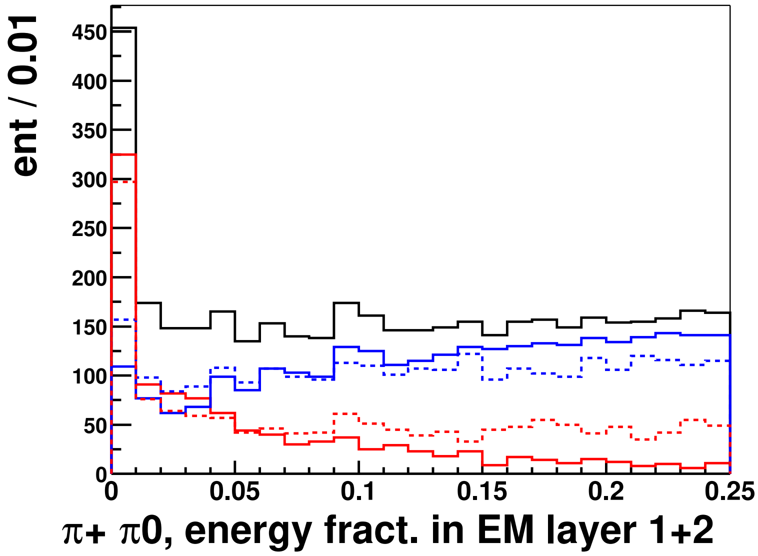
Type definition for π - (II)

For true type I objects E_t/p_t is a useful quantity in any case

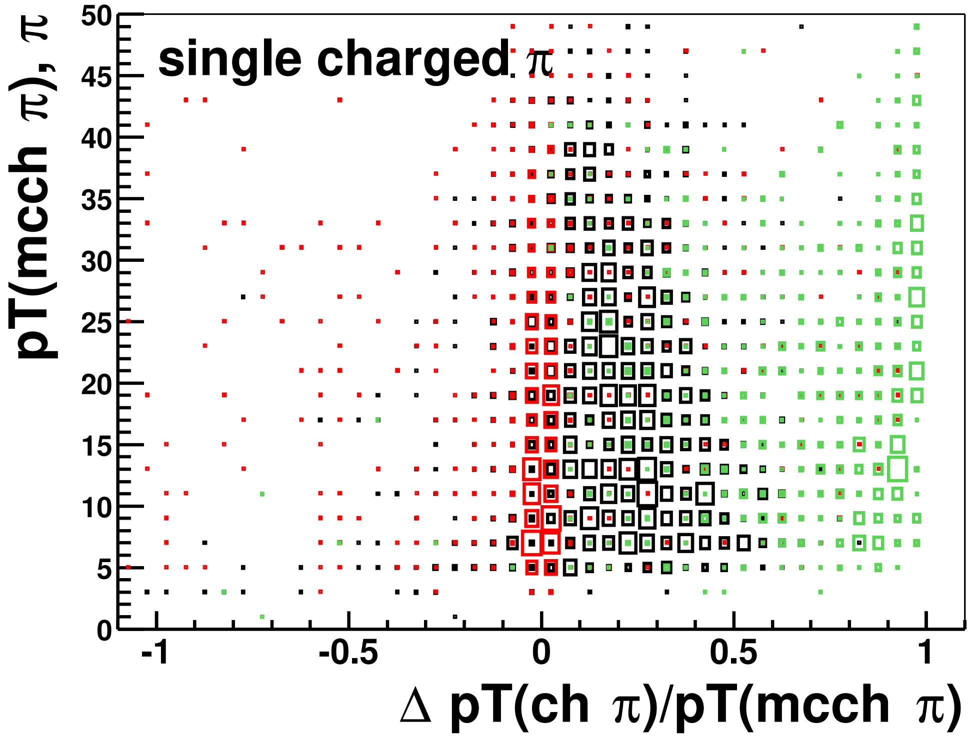
for type II reconstructed and object with more than 1 cellNN object, the calorimetric energy is a bit lower

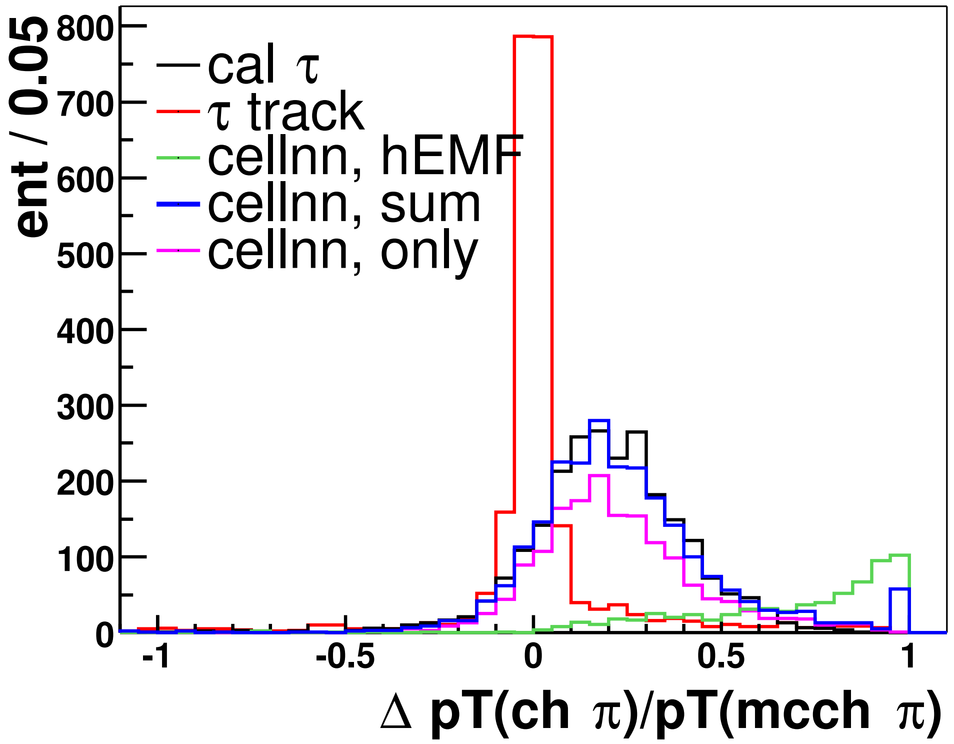
For true type II τ's where the EM cluster was not reconstrued by the τ-id algorithm, E_T/p_T is still a good quantity to cut on





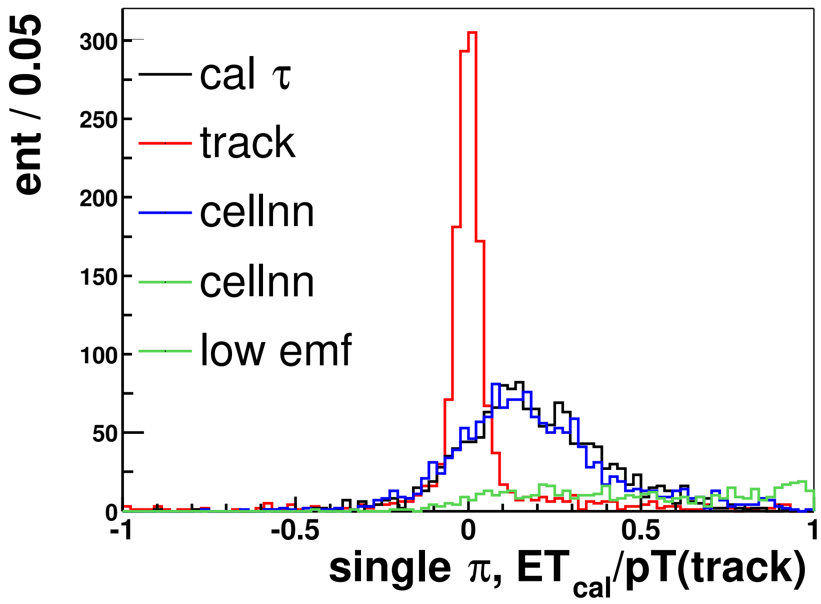
The pT resolution in the $\tau \to \pi$ decay

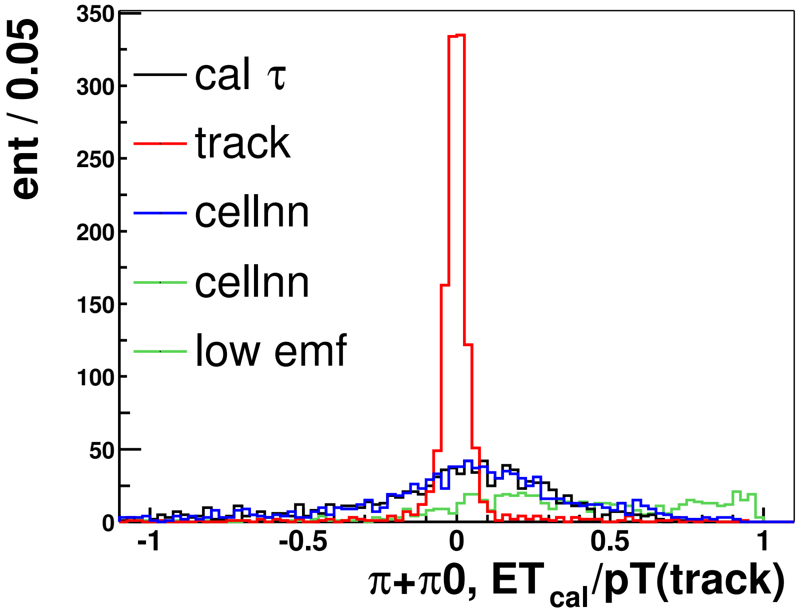




The pT resolution has no strong dependence on the visible τ momentum - thus for rest use 1-d plots

The pT resolution of tau τ in the type I decays





In both cases is the track pT a good measure of the τ momentum

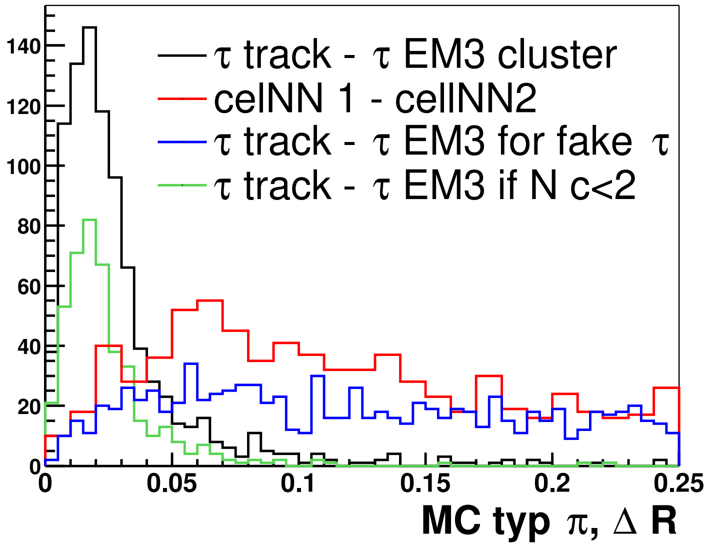
thus: use track momentum (at least for momenta in Z sample) and current type I definition

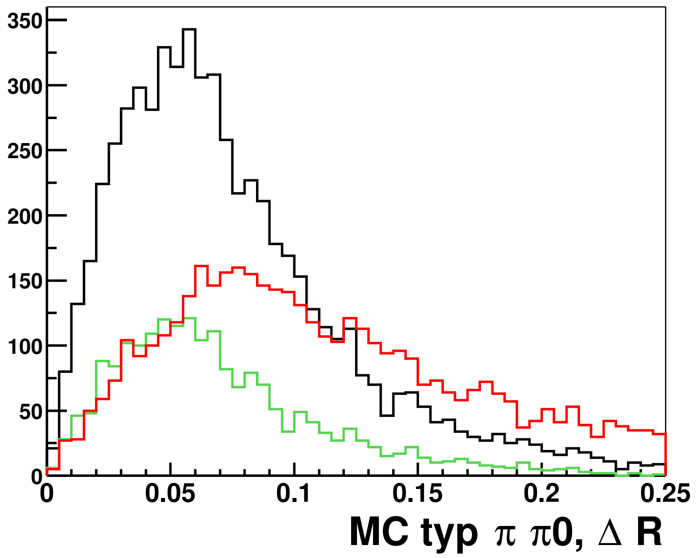
Type definition for $\pi\pi^0$

Aim: Use invariant mass of the two object as cut use the energy of both object in a combination for a better τ energy resolution

assignment: “default” τ type works fine, cellNN less efficient

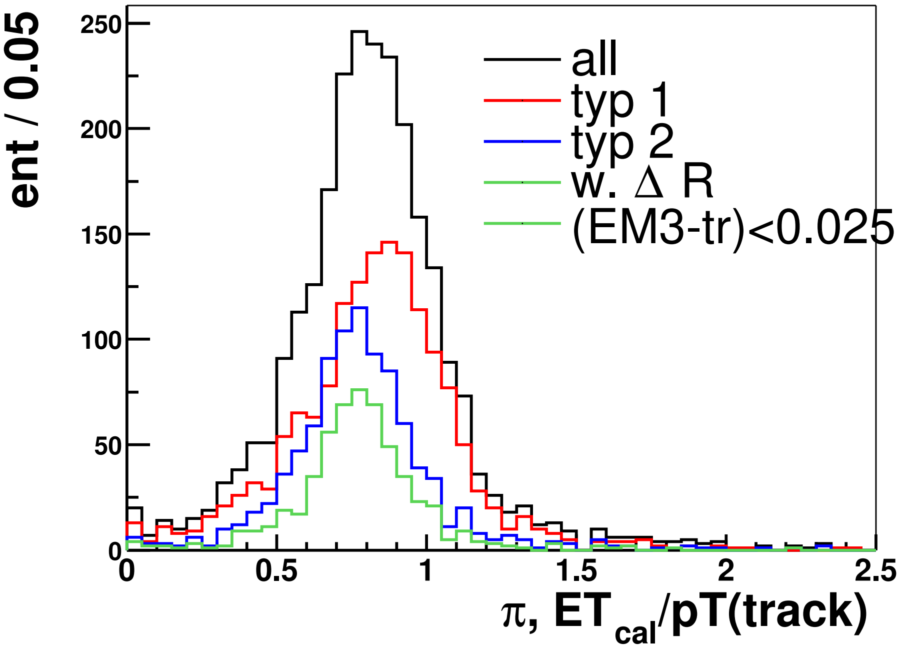
wrong identified π decays: angle between the track and the EM3 object

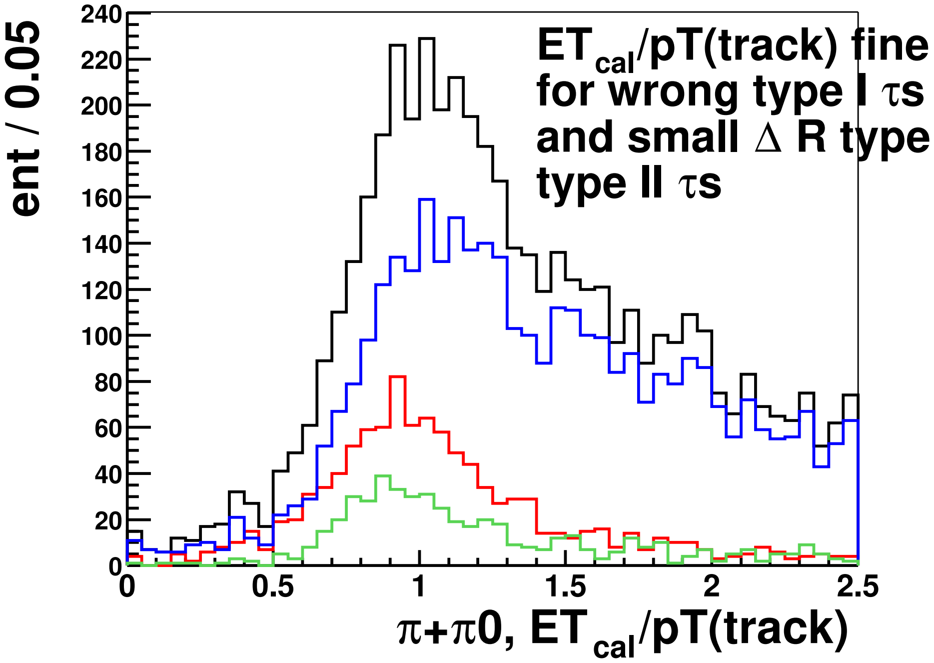




Type definition for $\pi\pi^0$ - (II)

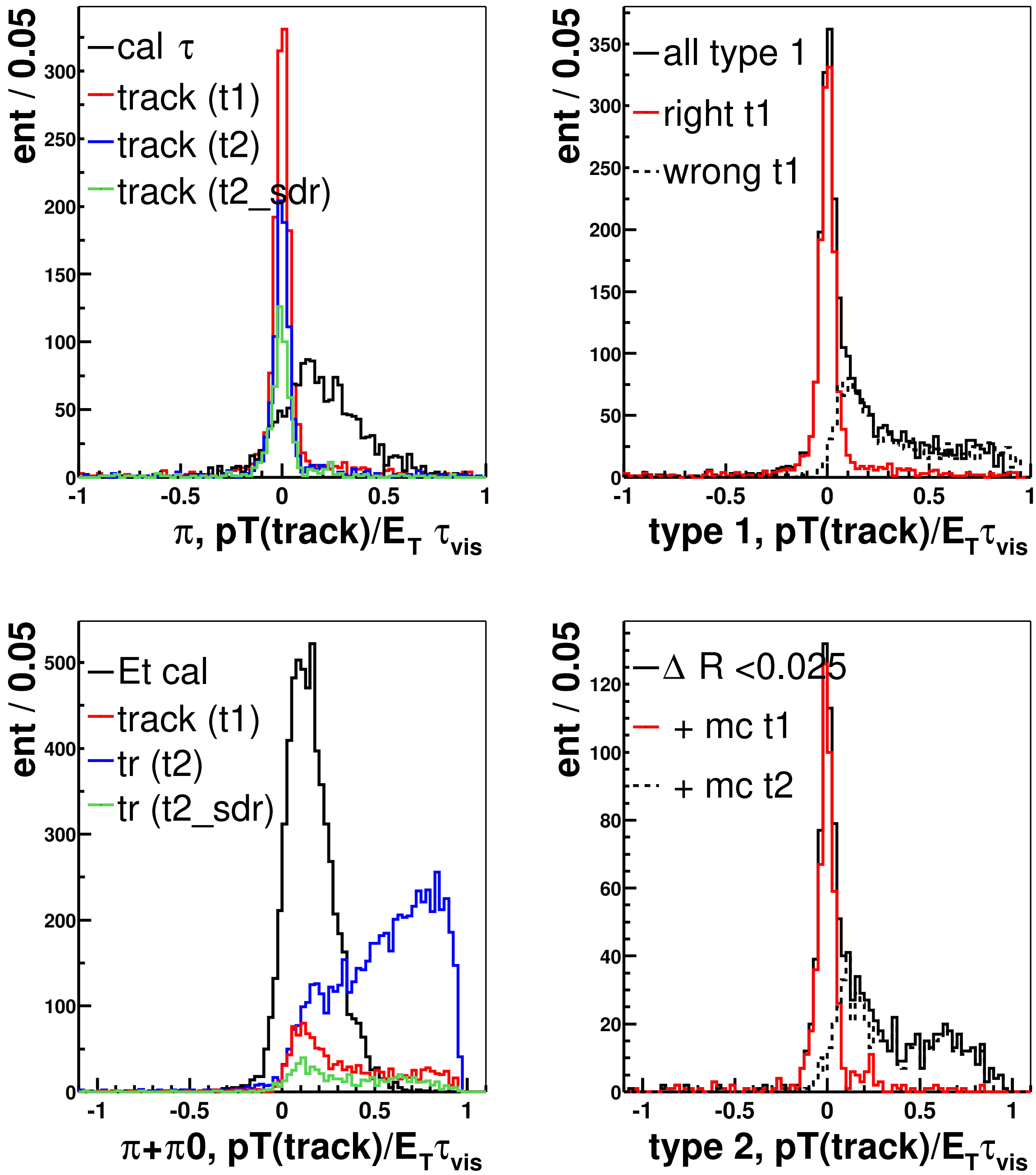
look at objects with small angles (< 0.025 in ΔR) - put back as type I objects?





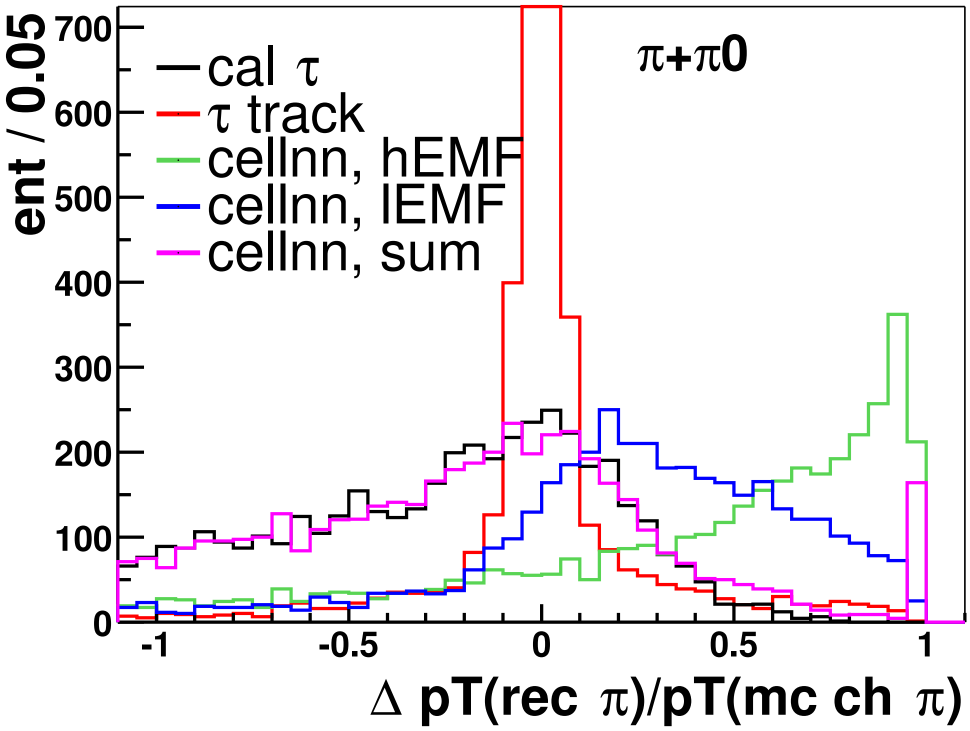
an e/p cut would not not be a problem

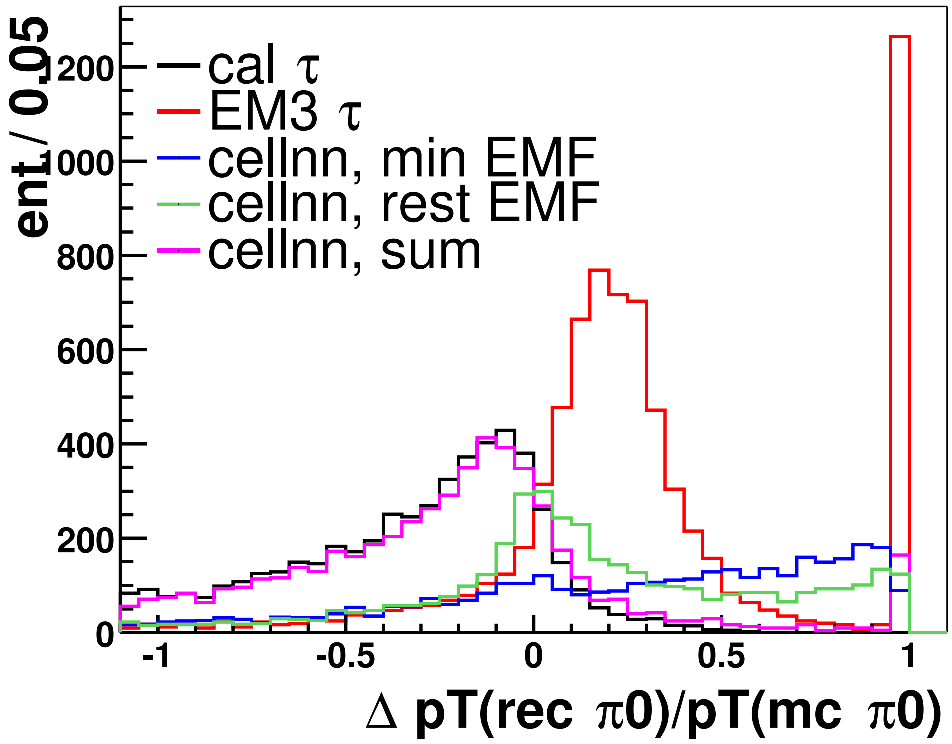
Type definition for $\pi\pi^0$ - (III) - Energy Resolution



The energy resolution achieved using the track is degraded by the wrong type I identifications. Type II object with a small ΔR between track and EM3 cluster behave the same way.

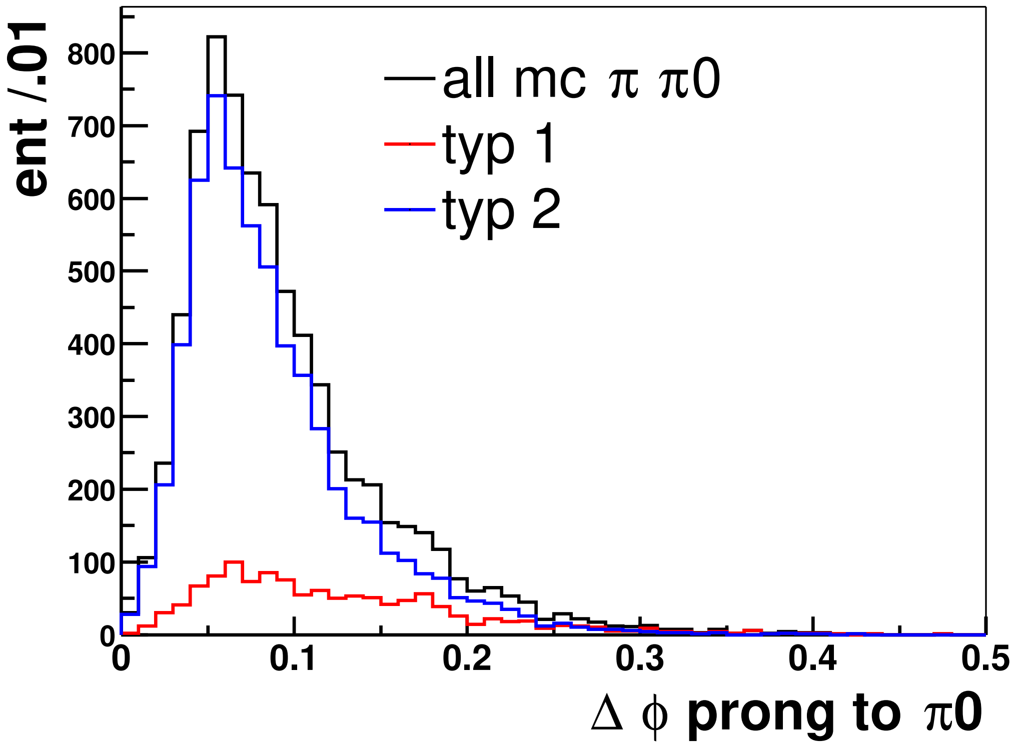
The pT resolution in the $\tau \rightarrow \pi\pi^0$ decay

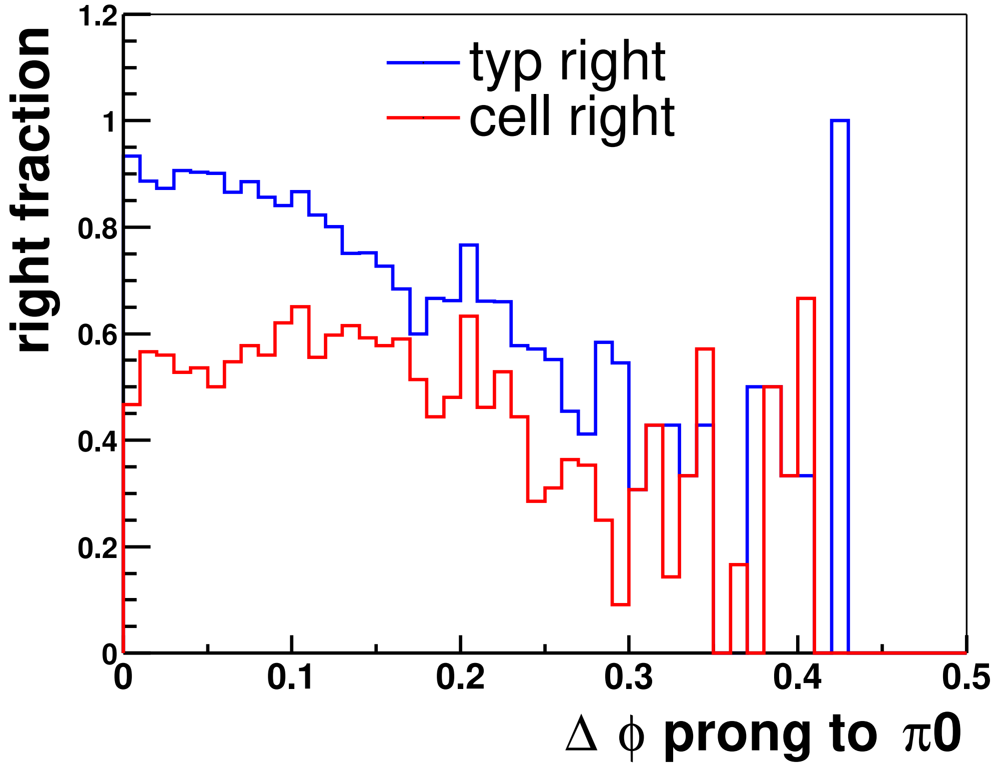




(to do: look at differences for type1/type 2/N cellNN identified taus)

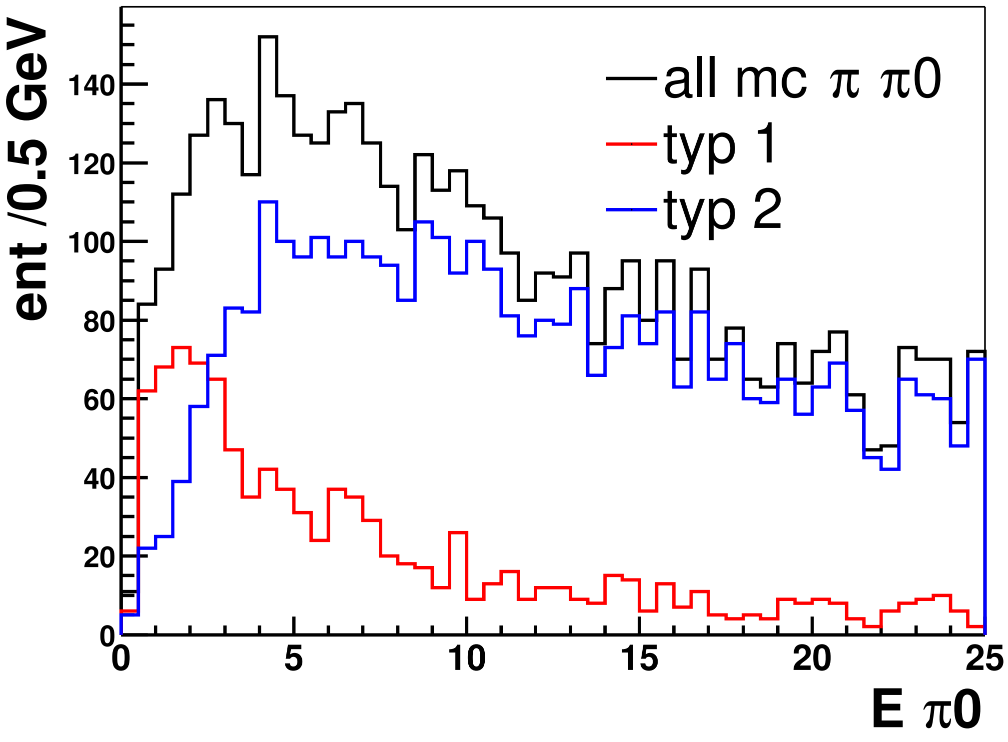
π^0 rec. efficiency versus $\Delta R(\pi\pi^0)$

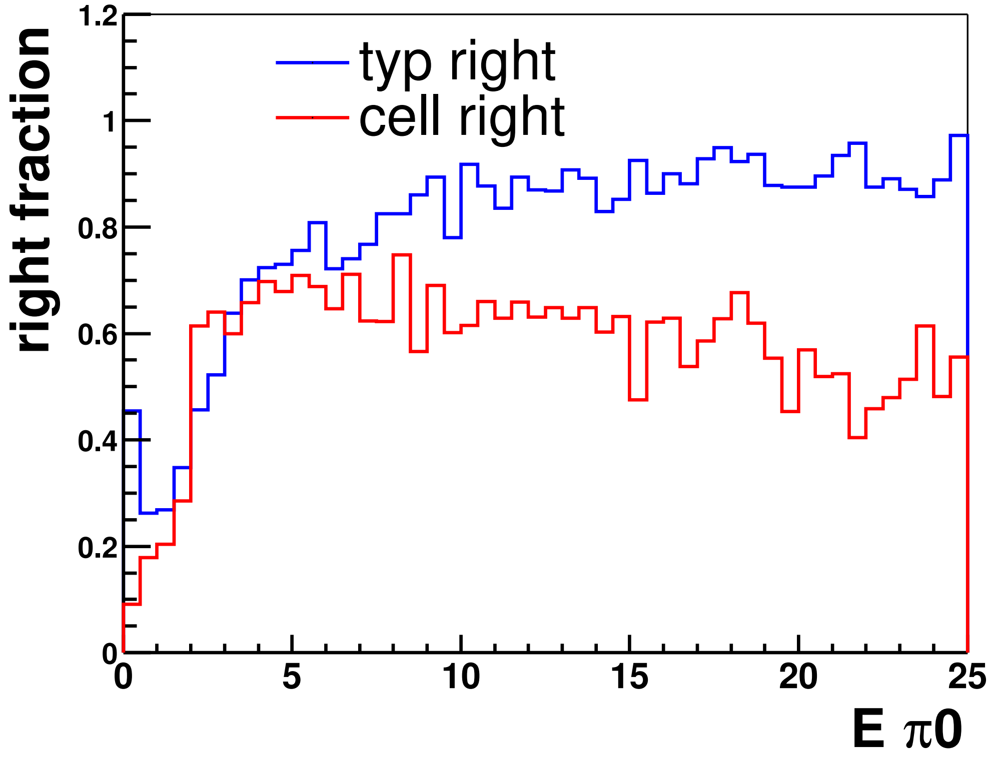




$\rightarrow$ no strong dependence for CellNN (or hidden by staticitics?)

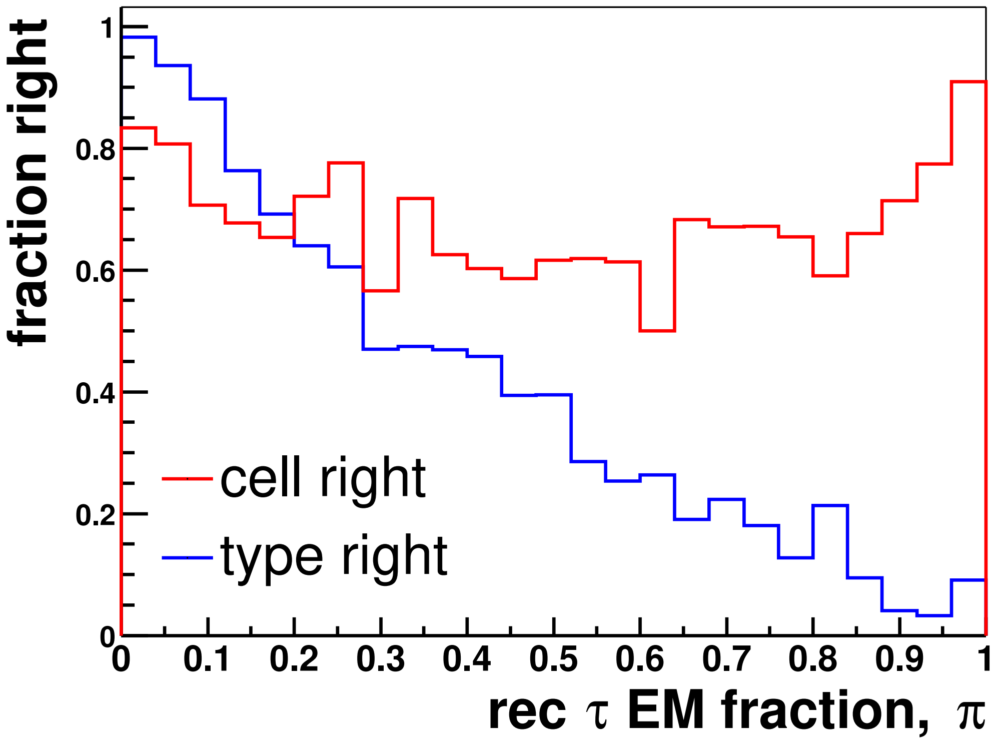
π^0 reconstruction efficiency versus $E\pi^0$

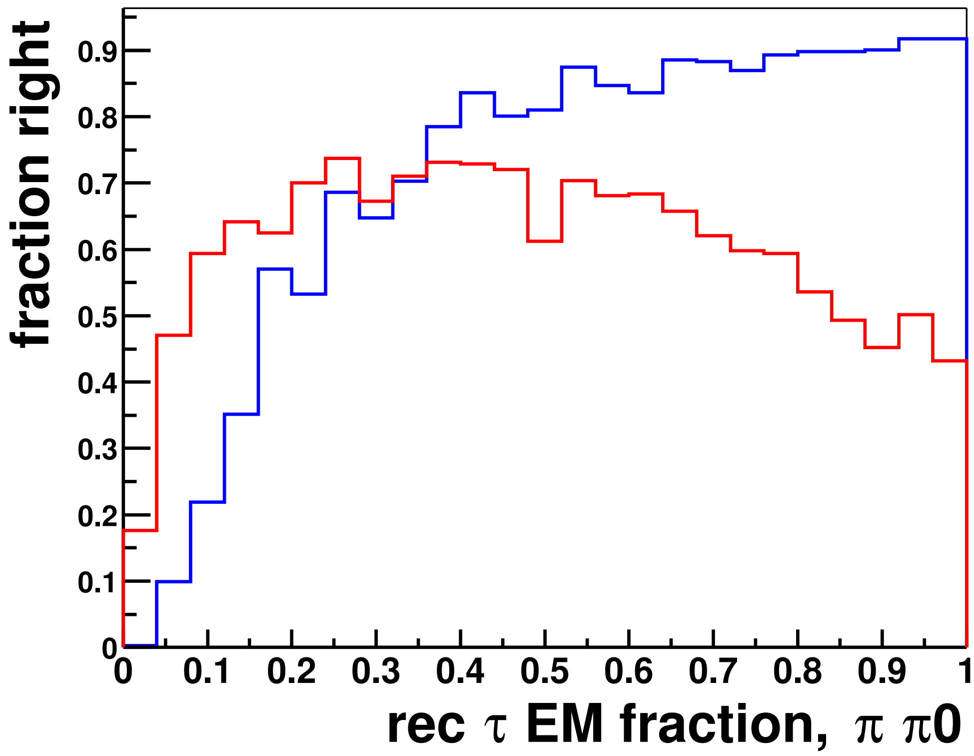




$\rightarrow$ both CellNN and NN need a π^O energy of about 2.5 GeV to become efficient, drop for CellNN(?)

π^0 rec. efficiency versus τ EMF





$\rightarrow$ for NN strong dependence on the τ em-fraction

Conclusions

CellNN works resonably well but reconstructs less Em3 object than a simple NN algorithm on the EM3 layer

But at the same time: less wrong π^0 candidates

overall is the "old" algorithm better as BF($\pi\pi^0$) $>$BF(π)

pT resolution:

for the charged π: use the track (no surprise here)

for the π^0: the energy reconstructed with the NN algo is about 20% to small, the CellNN energy peaks at 0 and has large a tail towards lower energies

for type I objects:

look at Δp_T as function of p_T and $\eta - \phi(cracks)$, correction function?

obtain from MC and "data(track)"