Subject: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by David Pohl on Thu, 18 Nov 2010 10:48:27 GMT
View Forum Message <> Reply to Message

Hallo everybody,

at the moment I do some tracking tests with the Lhe package.
The parameters are:
 - tracking detectors: MVD+TPC+GEM
 - 1 pion per event
 - theta=60, phi=0..360
 - ideal track finder
 - kalman task after helix prefit with pion particle hypothesis
 - current PndRoot version: trunk, revision 10322
 - only primary tracks are taken into account

for momenta down to 200MeV/c everything works great; but for
a momentum of pt = 100MeV/c even the simple helix prefit is better.
You can see that in the following plots:

works fine:

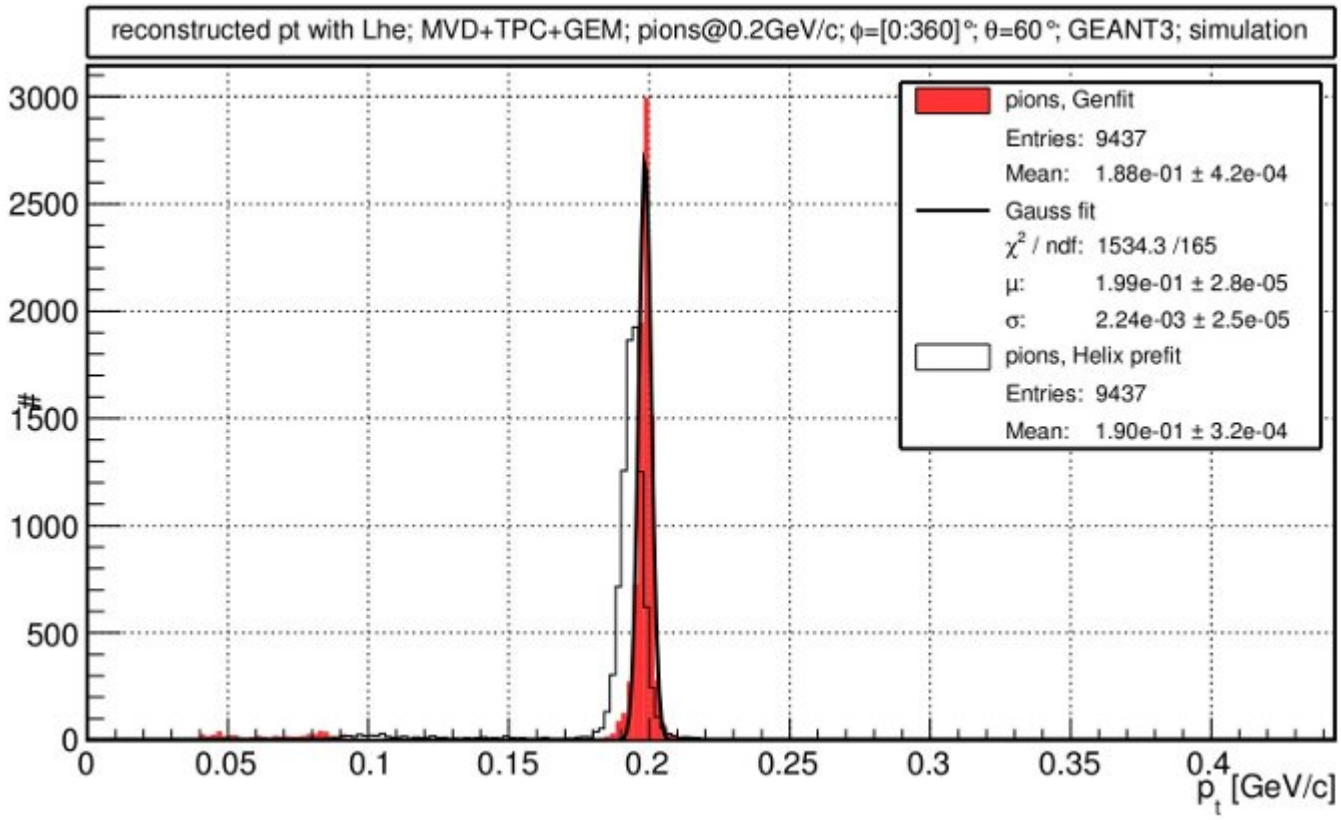
strange:

So I would like to ask the people who have more experience with
tracking what the reason is or could be.

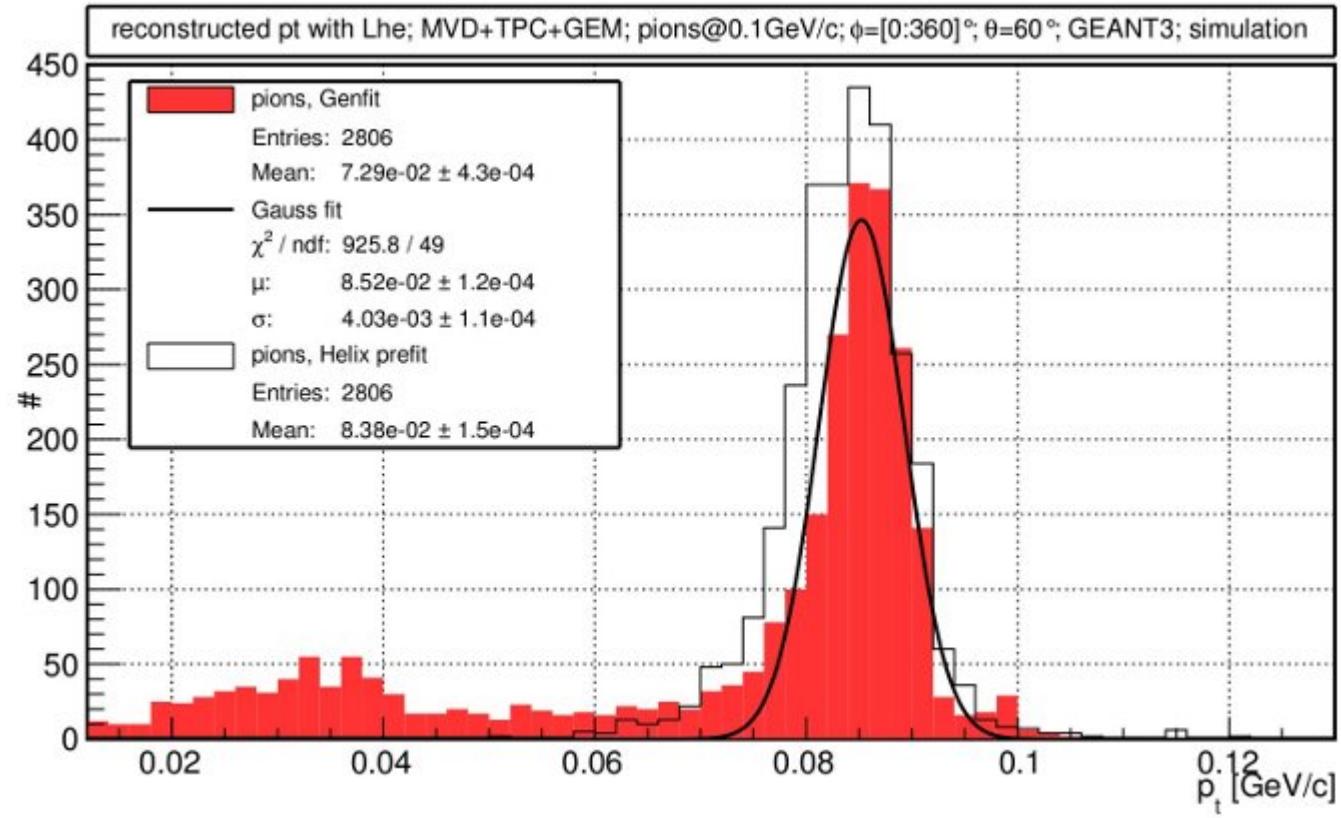
greetings
David

File Attachments

1) pt_reco_tpc_200.jpg, downloaded 1248 times



2) pt_reco_tpc_100.jpg, downloaded 1178 times



Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by Felix Boehmer on Thu, 18 Nov 2010 11:08:17 GMT

View Forum Message <> Reply to Message

Hi David,

which TrackRepresentation are you using - GEANE or the RKTrackRep?

Regards

Felix

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by StefanoSpataro on Thu, 18 Nov 2010 11:33:52 GMT
View Forum Message <> Reply to Message

Answering to Fekix, GeaneTrackRep is the standard track representation in panda in the RecoKalmanTask. It would be nice that somebody would test intensively also RKTrackRep, to compare it with GeaneTrackRep, before putting it as standard.

Answering to David... no idea.
Could it be that "bad" errors play an important role for low momentum particles? I know only that errors are not properly tuned (if you check chi2/ndf distribution, this is not peaked at 1), at least in TPC combined mode.
I leave the world to kalman experts...

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by Jens Sören Lange on Thu, 18 Nov 2010 12:53:52 GMT
View Forum Message <> Reply to Message

Hi David,

first question: can you check, which SVD geometry are you using? with cables etc.? (so maybe it even becomes worse).

Then, as a possible explanation:
The TPC is split into 2 parts, left and right, by the target beam pipe. At pT<=100 MeV, tracks are so curved, that, if they are in one part of the TPC, they can also enter the other part, and produce there a 2nd, short track (for higher pT this is impossible). Can you maybe check that? (e.g. number of hits per fitted track should be small).

Soeren

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by StefanoSpataro on Thu, 18 Nov 2010 13:51:46 GMT

View Forum Message <> Reply to Message

Jens Soeren Lange wrote on Thu, 18 November 2010 13:53Hi David,

first question: can you check, which SVD geometry are you using? with cables etc.? (so maybe it even becomes worse).

Then, as a possible explanation:
The TPC is split into 2 parts, left and right, by the target beam pipe. At pT<=100 MeV, tracks are so curved, that, if they are in one part of the TPC, they can also enter the other part, and produce there a 2nd, short track (for higher pT this is impossible). Can you maybe check that? (e.g. number of hits per fitted track should be small).

Soeren

But then I cannot understand why the helix fit seems better...

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by Jens Sören Lange on Thu, 18 Nov 2010 14:11:18 GMT
View Forum Message <> Reply to Message

Yeah, so, "helix fit is better" means, that "no energy loss correction at all is better than energy loss correction in genfit", but only for pT=100 MeV. I really don't know. Maybe at theta=60^o particles the path length in the MVD material is so extended that they are loosing almost all their energy (helix phase is short so maybe passing a few times through material).

In addition, pT=100 MeV is already in the highly rising Bethe-Bloch part, so maybe the dE/dx correction (which the Kalman is trying to do) is not correct. The error is large.

Anyway, you can see that tracking efficiency from pT=200 GeV/c to pT=100 GeV/c drops by factor ~2 (~9000 -> ~3000) so I think it is also another effect, maybe short tracks.

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by Lia Lavezzi on Thu, 18 Nov 2010 15:25:23 GMT
View Forum Message <> Reply to Message

Hi David,
did you cut on the PndTrack flag that says whether the Kalman was ok or not, before filling the histograms?
You should check that the PndTrack that comes from the Kalman procedure (LheGenTrack) has not a flag < 0 (the function is GetFlag()). If it is < 0 it means that either the Kalman calculation failed or the NDF are 0 or the adapter failed, in a word something has gone wrong.
Cheers,
Lia.

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by David Pohl on Thu, 18 Nov 2010 16:00:25 GMT
View Forum Message <> Reply to Message

Sorry for the late reply. Thursday is "meeting" day

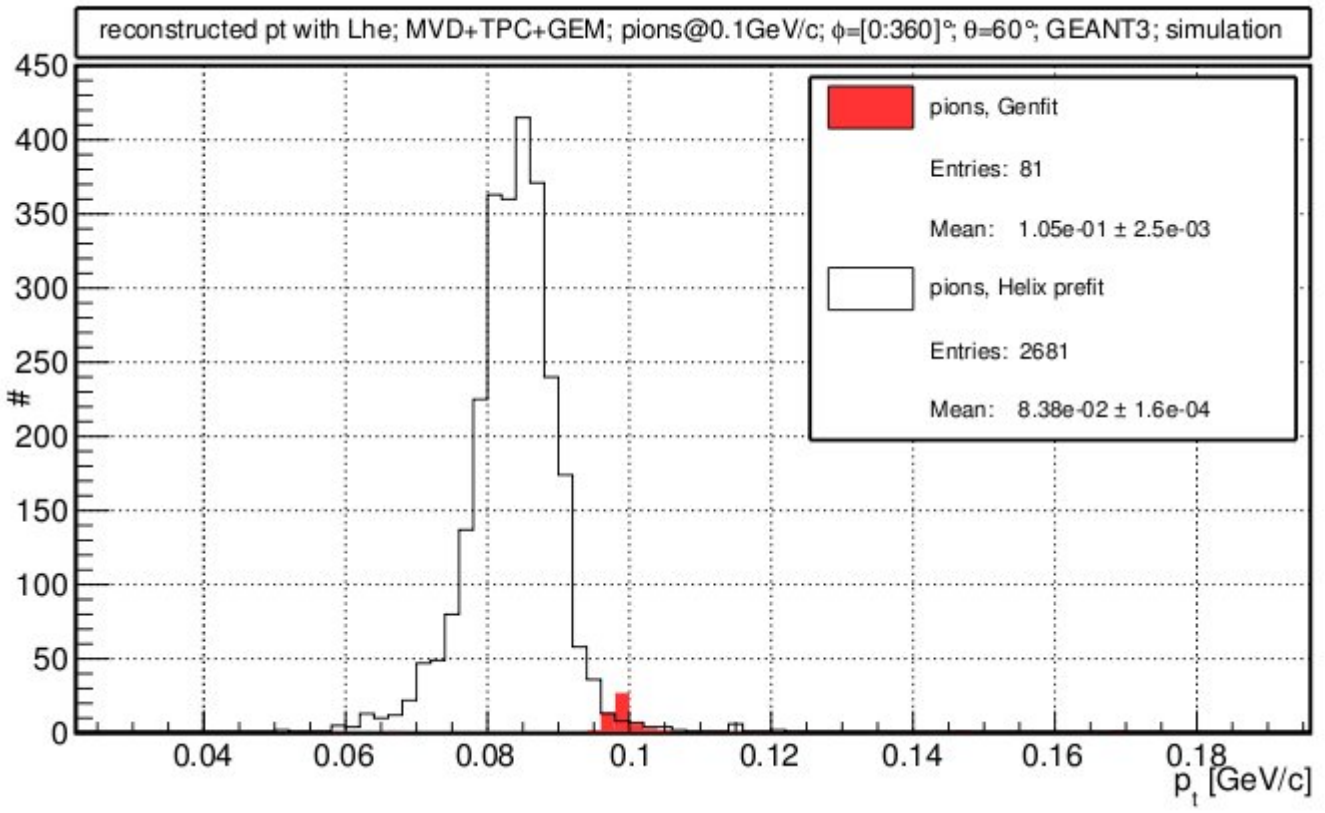
@Jens: I think you mean the MVD geometry? It's the new one: Mvd-2.1_AddDisks_FullVersion. The track efficiency is not that worse. I simulated only 3e3 events for the 100MeV/c and 1e4 events for the 200MeV/c case. I forgot to say that.

@Lia: That was the right hint I think. I have not checked if an error occured. With the check one can see, that the Kalman failed:

greetings
David

File Attachments

1) Kalman_fails.jpg, downloaded 941 times



Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by Lia Lavezzi on Thu, 18 Nov 2010 16:05:23 GMT
View Forum Message <> Reply to Message

Can you please post a plot of the flag values? ...just to understand which kind of error occurs...
Thanks,
Lia.

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by Lia Lavezzi on Fri, 19 Nov 2010 15:22:08 GMT
View Forum Message <> Reply to Message

Hi David and all others,
I made some tests and I really think the problem is the cut in GeaneTrackRep for low momentum particles: though your starting momentum is not too low (the limit is 100 MeV/c of total momentum), the particle loses energy and often falls in that exception at a certain point.

Since the cut was put there when GEANE was unstable, but now several fixes have been added, I think we could get rid of it.
I uploaded a version of GeaneTrackRep with that cut commented out, so that, if we see that it still crashes, it will be easily restored.

I tried a run without that cut and everything worked fine. Now the Kalman filter is better than the Helix, so I am confident that we can keep GeaneTrackRep without the cut.

Can you please update your GenfitTools and retry to run the events to confirm/deny my results?

Have a nice week end,
Lia.

File Attachments
1) momtransv.ps, downloaded 331 times

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by David Pohl on Sat, 20 Nov 2010 13:25:52 GMT
View Forum Message <> Reply to Message

Hi Lia and everybody,

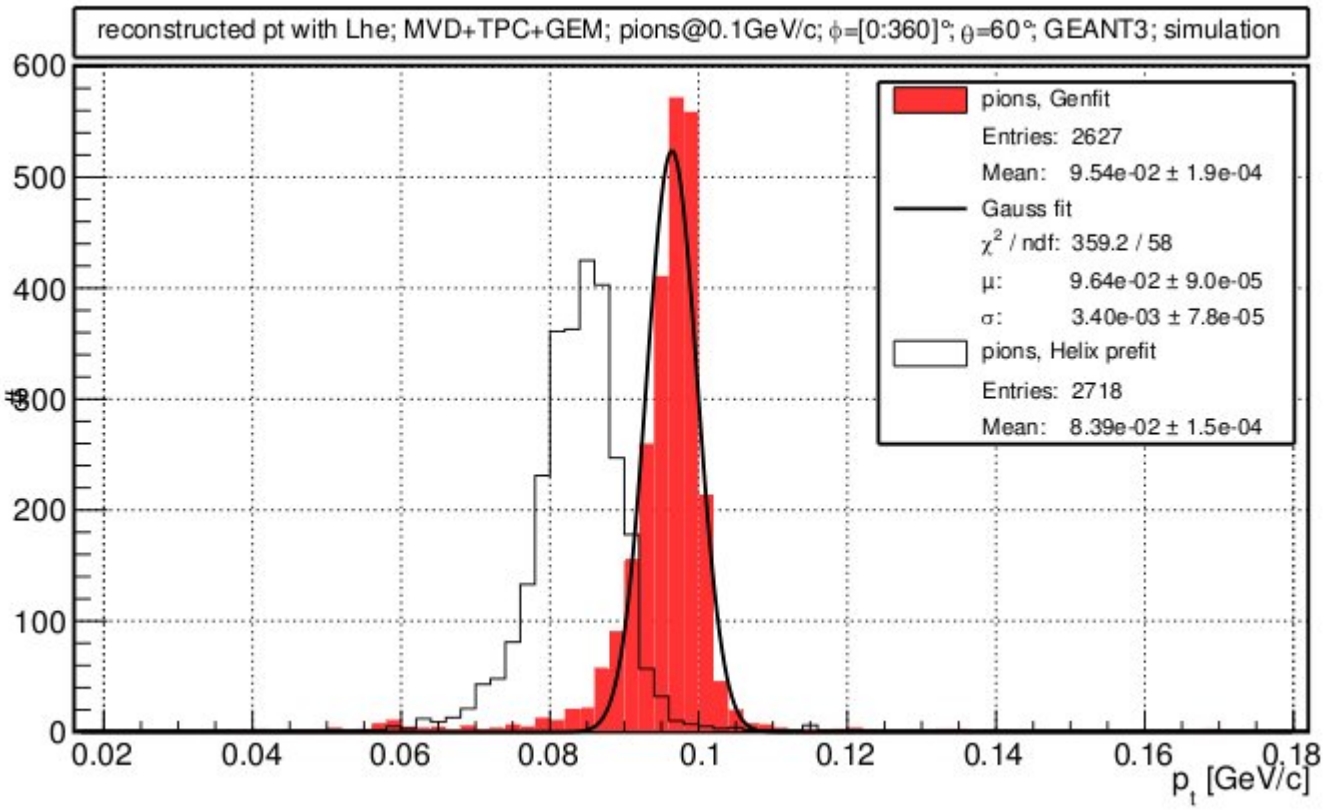
very nice. I can confirm your results. For a simulation with 1e3 primary pions@100MeV/c pt from vertex (0,0,0)
I have 2627 tracks in the output.

By the way the track reconstruction (1e3 events,ideal track finding,helix fit,Genfit) took 35min. on a 3GHz core.
329 have a PndTrack Flag < 0. 204 have -1 and 125 have -2.

Have a nice weekend, too.

greetings
David

File Attachments
1) pt_reco_tpc_100.jpg, downloaded 889 times



Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by Lia Lavezzi on Mon, 22 Nov 2010 12:47:02 GMT
View Forum Message <> Reply to Message

Hi David,
good that it works, but I don' t understand a thing on efficiencies... how many events did you simulate?
I got 990 entries in the histogram (~850 if you want the integral of the peak region) out of 1000 single track events (pion, theta 60 deg, random phi, 0.1 GeV/c pt, LHE ideal and Kalman with pion hypo).
Lia.

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by David Pohl on Mon, 22 Nov 2010 17:00:09 GMT
View Forum Message <> Reply to Message

Hi Lia,

I tried to understand why my reconstruction efficiency is about 87,5% instead of your 99%.
From a reconstruction with the params mentioned in my first post I have for:

1000 events:

- 48 with no Kalman track: I think this is due to the minimum hits required for a track

- 62 with failed Kalman filter: flag < 0

- 2 events omitted where I was not able to find the MC track from the reco track

How do you check if the reconstructed track is the primary MC track? So far as I know one cannot take the getMcTrackId() function of the track candidate class? Or does this work by now?
I loop over the Lhe Tracks. Then over the Lhe Hits, take one MVD reco hit and check if this hit belongs to the primary MC track.
Do you use the new MVD geometry?

greetings
David

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by StefanoSpataro on Mon, 22 Nov 2010 17:27:52 GMT
View Forum Message <> Reply to Message

I supose David is using the "real" track finder, therefore he has a lower efficiency.
If he uses PndLheTrackFinderIdeal, he should have the same efficiency of Lia (almost 100%).

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by David Pohl on Mon, 22 Nov 2010 17:45:26 GMT
View Forum Message <> Reply to Message

No I use the ideal track finder. When you sum up the events without a track (4,8%) and the events with a failed Kalman fit
(6,2%) (I mentioned this numbers in the message before) then I wonder how one can achieve 99% track reconstrucion efficiency.

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by Lia Lavezzi on Mon, 22 Nov 2010 18:30:46 GMT
View Forum Message <> Reply to Message

Sorry, I was counting all the tracks, not only primary ones!

Now I filled the histo only with primary tracks and I have 880 entries (88%), so we are fine

For the track association to the MCtrack, you can use the PndTrackID:
```
// genfit track
PndTrack *gtrk = (PndTrack*) gentrackarray->At(itrk);
// corresponding helix track
PndTrack *ltrk = (PndTrack*) recotrackarray->At(gtrk->GetRefIndex());
// with corresponding track ID
PndTrackID *ltrkID = (PndTrackID*) recotrackidarray->At(gtrk->GetRefIndex());
```

```
// from it you can get the MC track ID:
int mcTrackID = ltrkID->GetTrackID();
```
Cheers,
Lia.

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by David Pohl on Mon, 22 Nov 2010 19:56:15 GMT
View Forum Message <> Reply to Message

Hi Everybody,

I found some cases where the helix prefit is still better than
the kalman fit. Again I used the same parameters but different
particles.

Kaons (efficiency loss, background):

Protons (efficiency loss, worse result):

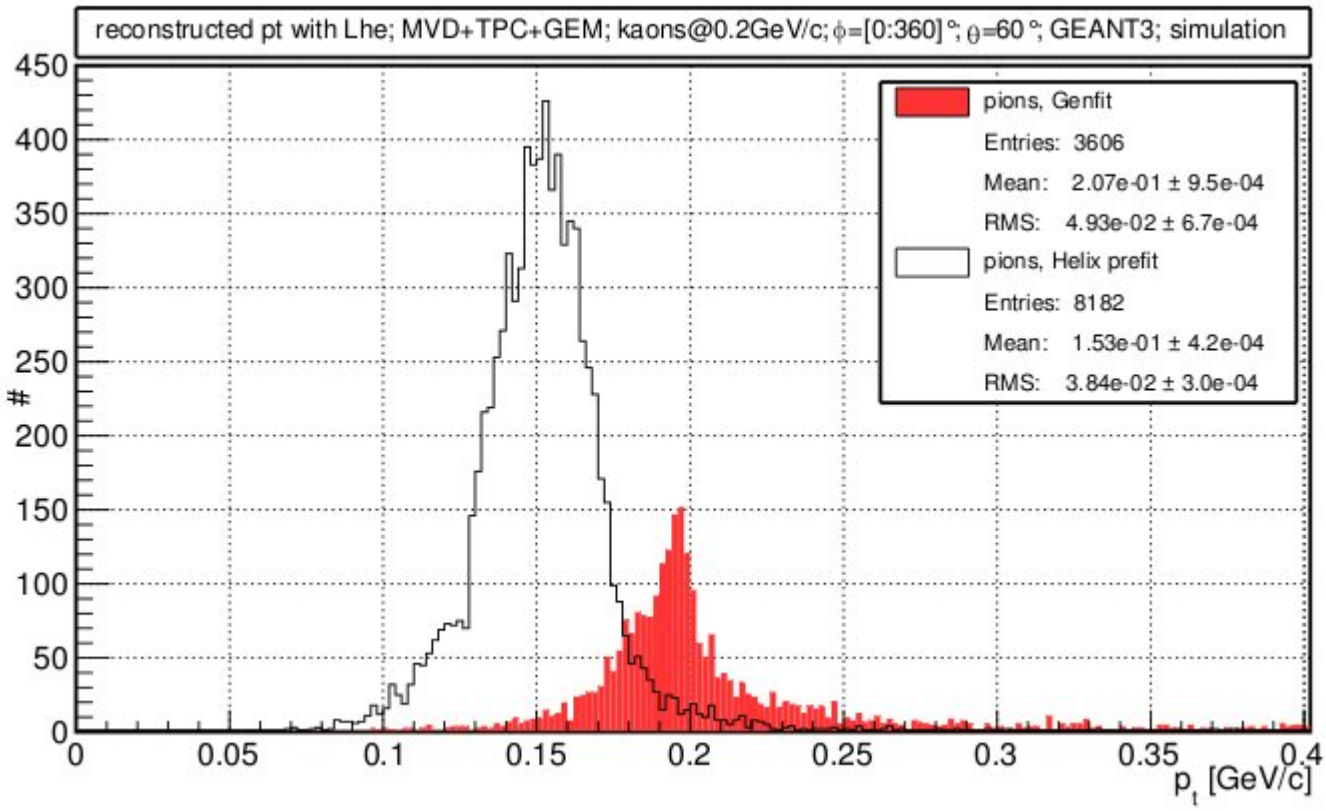
The flags for the failed Kalman fits are in both cases:
90%: -1
10%: -2

@Lia: thank you for the short tutorial

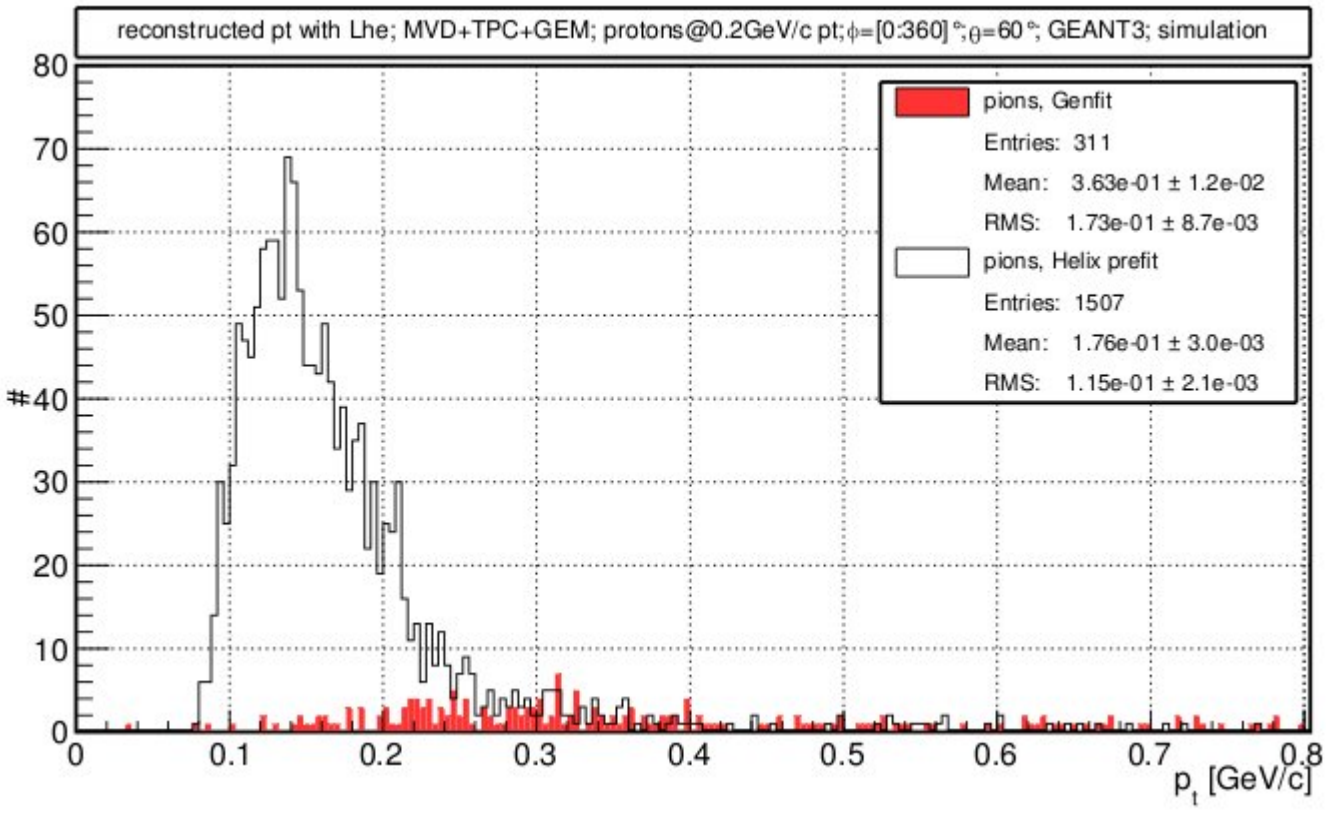
greetings,
David

File Attachments

1) pt_reco_tpc_200_kaons.jpg, downloaded 846 times



2) pt_reco_tpc_200_protons.jpg, downloaded 808 times



Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by StefanoSpataro on Mon, 22 Nov 2010 21:26:11 GMT
View Forum Message <> Reply to Message

Hi,
unfortunately this is a normal behaviour. This comes from the fact that you are using by default "muon" hypothesis for the kalman, because you do not know exactly the pid of the particle.

You could run in your run_reco the PndRecoMultiKalmanTask instead of the PndRecoKalmantask, to run the 5 pid hypothesis, and then compare the results.

Or you could set in your PndRecoKalmanTask the flag SetParticleHypo(Int_t h) in order to use the correct particle hypothesis.

I hope this helps a bit.

Subject: Re: GENFIT for transverse momenta < 200 GeV/c strange?!
Posted by David Pohl on Mon, 22 Nov 2010 21:38:51 GMT
View Forum Message <> Reply to Message

Hi Stefano,
I already used the correct particle hypothesis. All simulation parameters are mentioned in the first message. I just used kaons and protons instead of pions and changed the particle hypothesis accordingly.

greetings,
David
