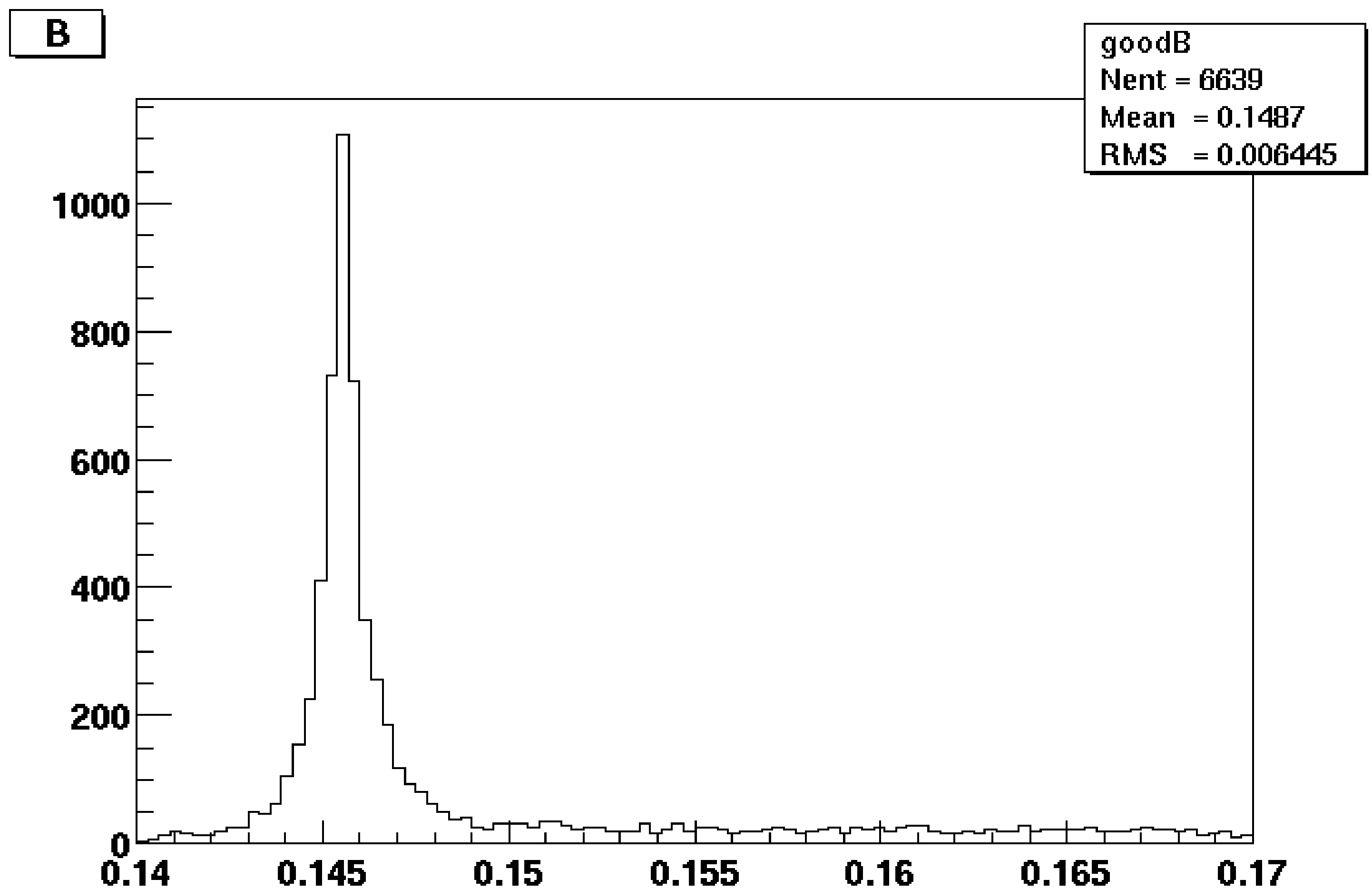
MC Study of D0–>kpipi0

There is clearly a problem with the MC associator when dealing with pi0's. A clear peak can be seen in events the associator calls bad in the kpipi0 mode.

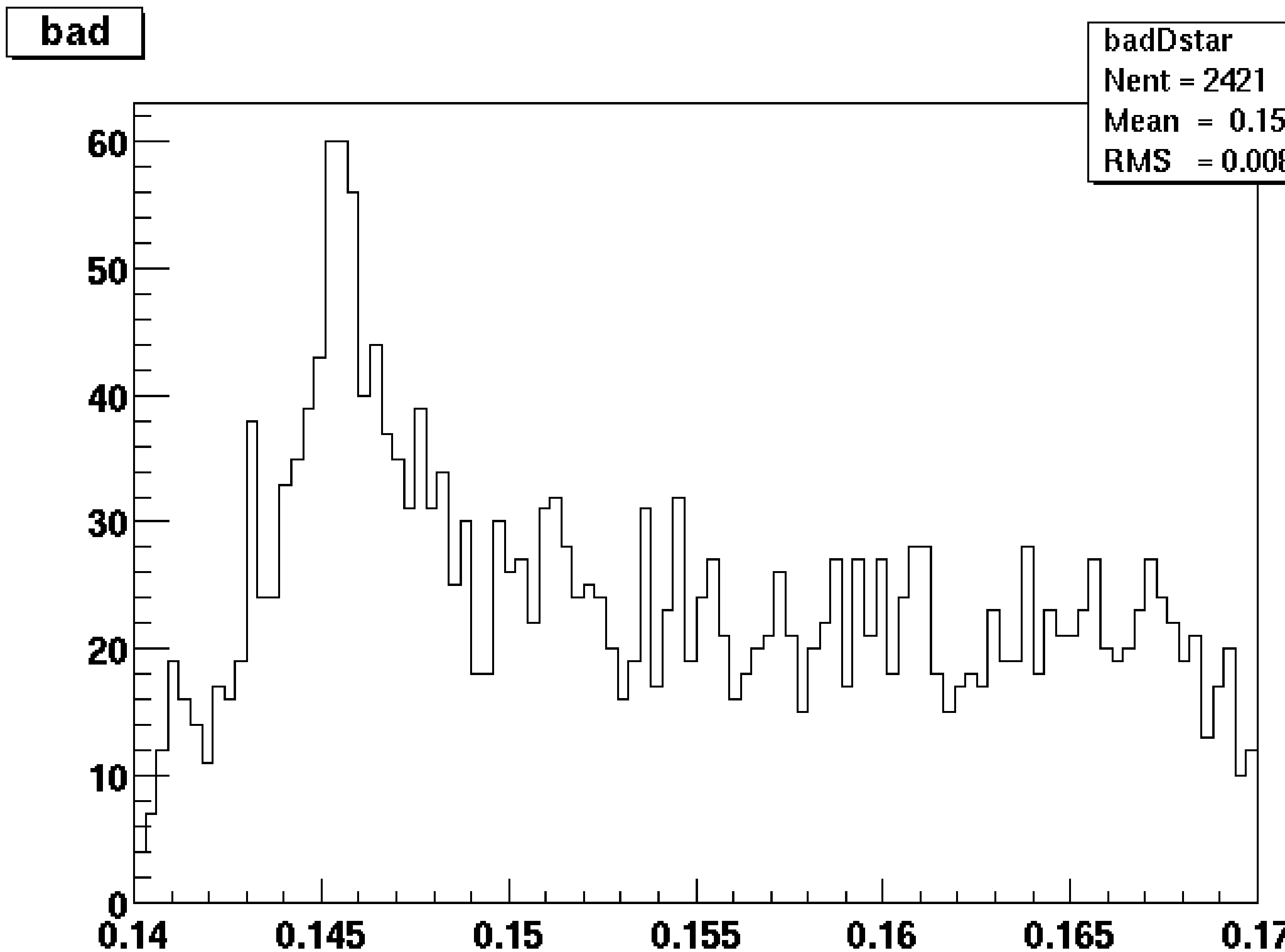
Not having MC truth for the kpipi0 mode hinders our ability to really investigate problems with that mode.

The next two plots show the events that pass all our cuts,and the ones the MC associator declares as bad.

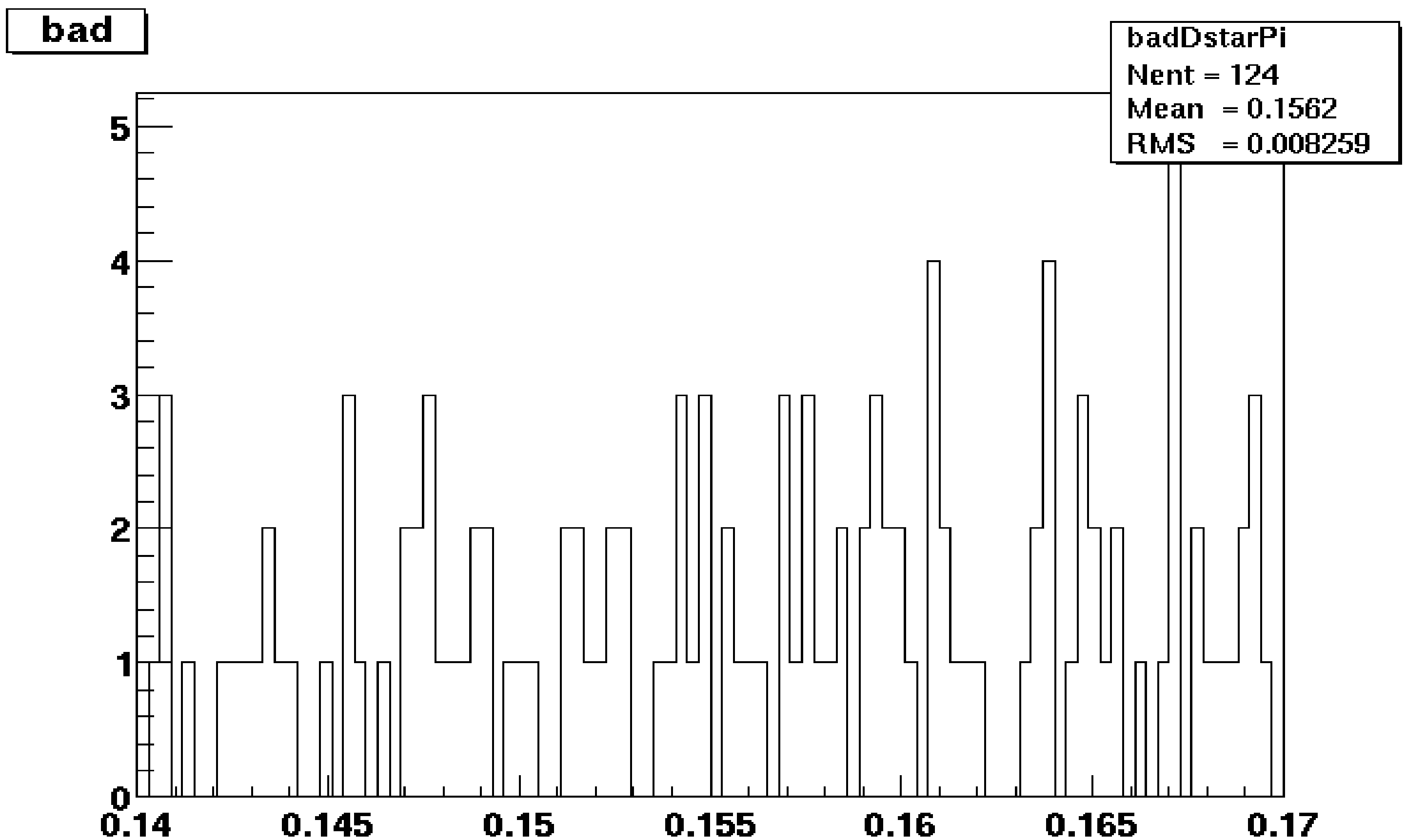
D*−D0 mass plot for all events passing our cuts, including very tight lepton id.
All plots use generic MC (B0B0 + B+B−)



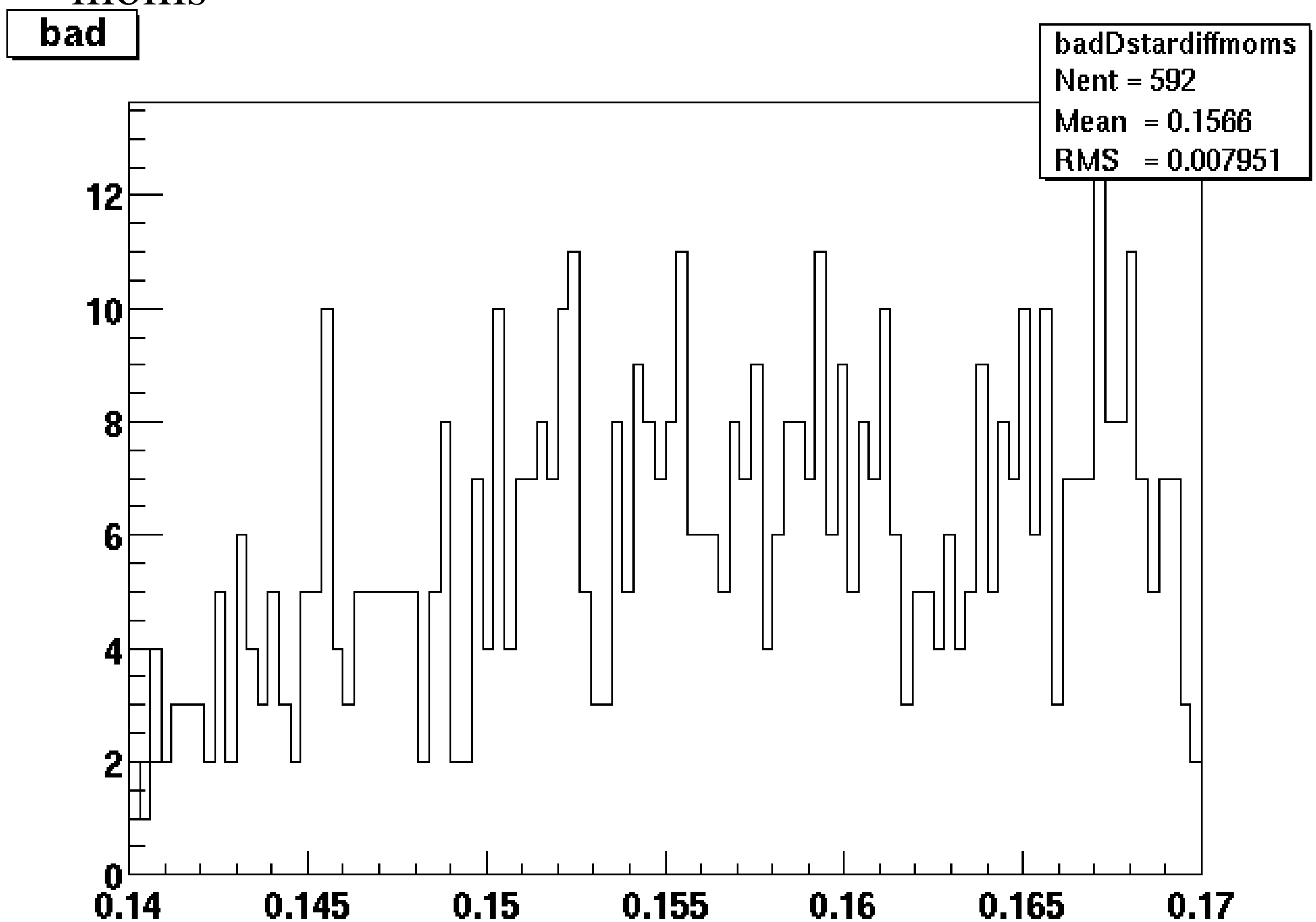
Events from previous plot that fail the MC associator as a bad D*



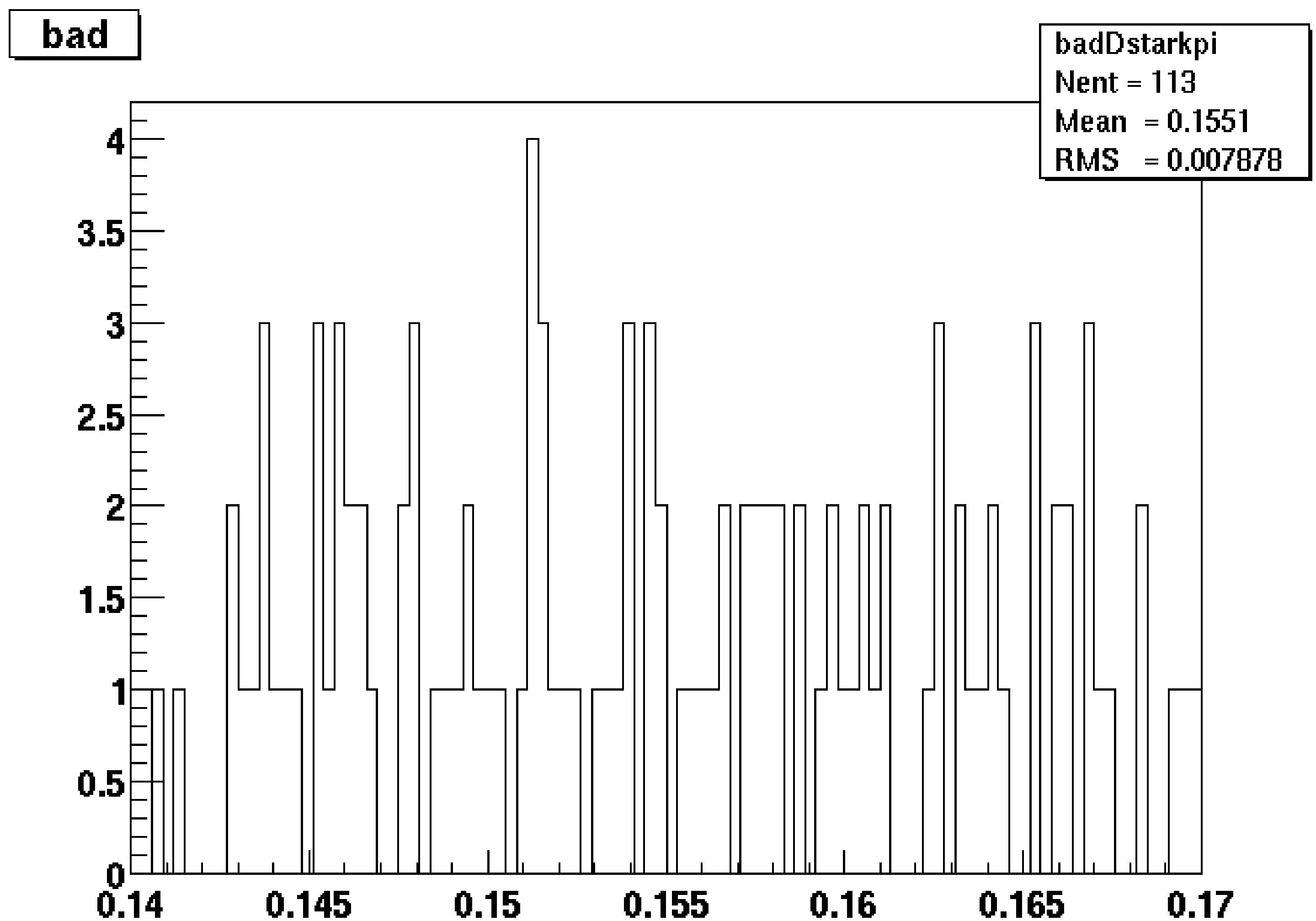
The Dstar can fail in 3 ways, the slow pion could be wrong, the D0 could be wrong or you could have a good D0 with a good pion that come from different moms.
The first suspect would be the slow pion being bad, but this isn't the case as shown below.



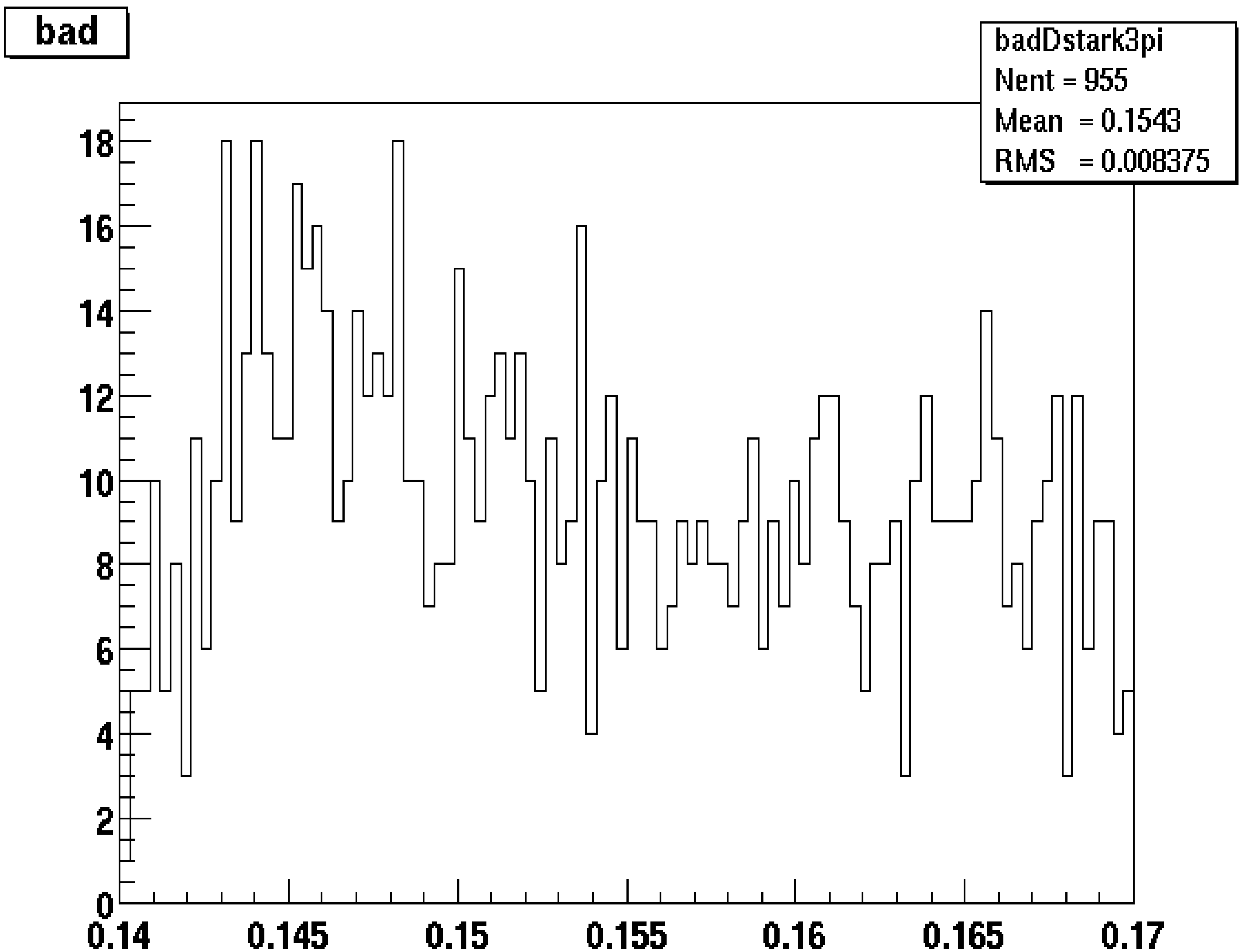
Dstar plot for events where the D0 is good, the slow pion is actually a pion, but they come from different moms



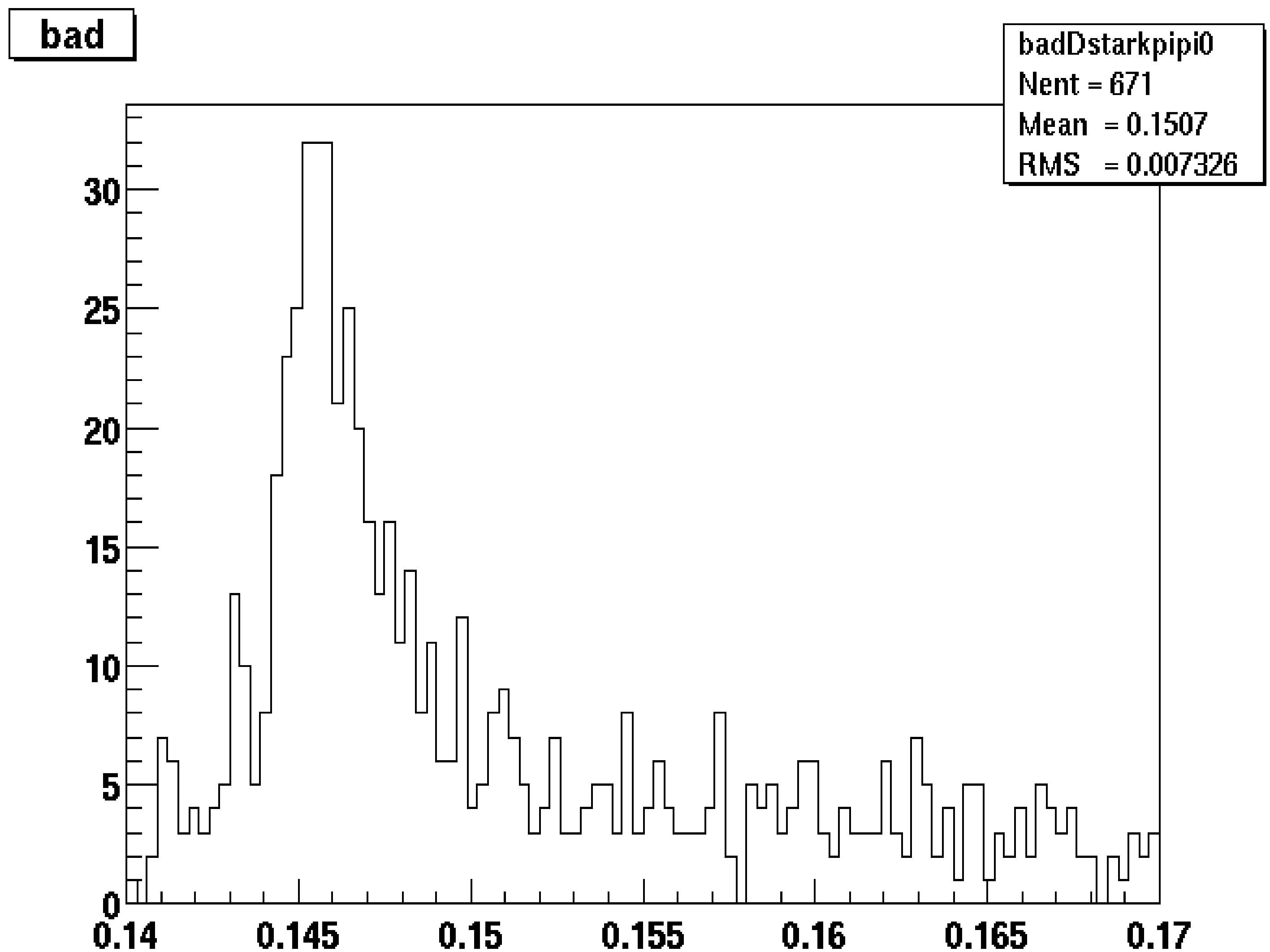
Bad Dstars, kpi mode



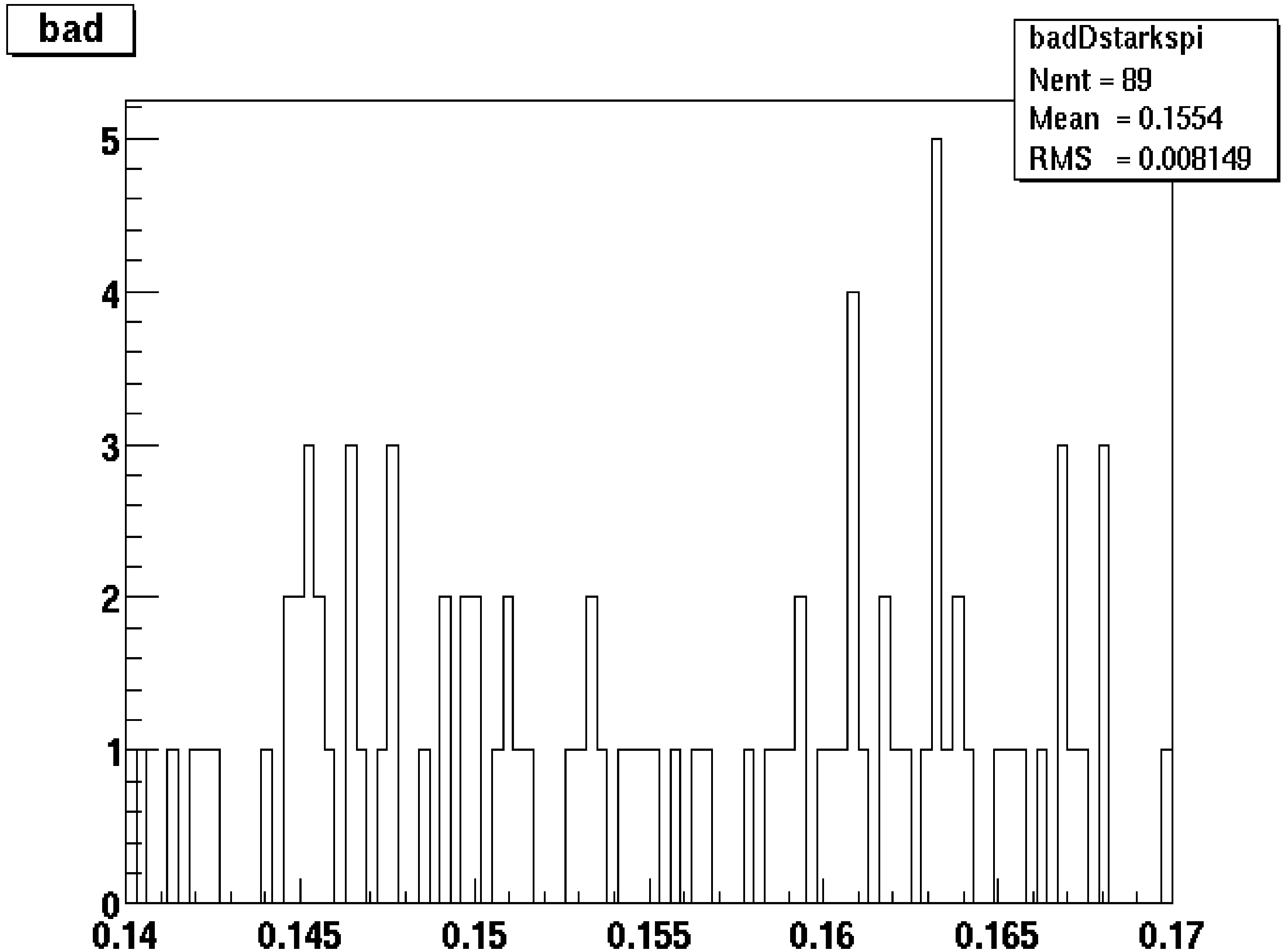
Bad Dstars from k3pi mode



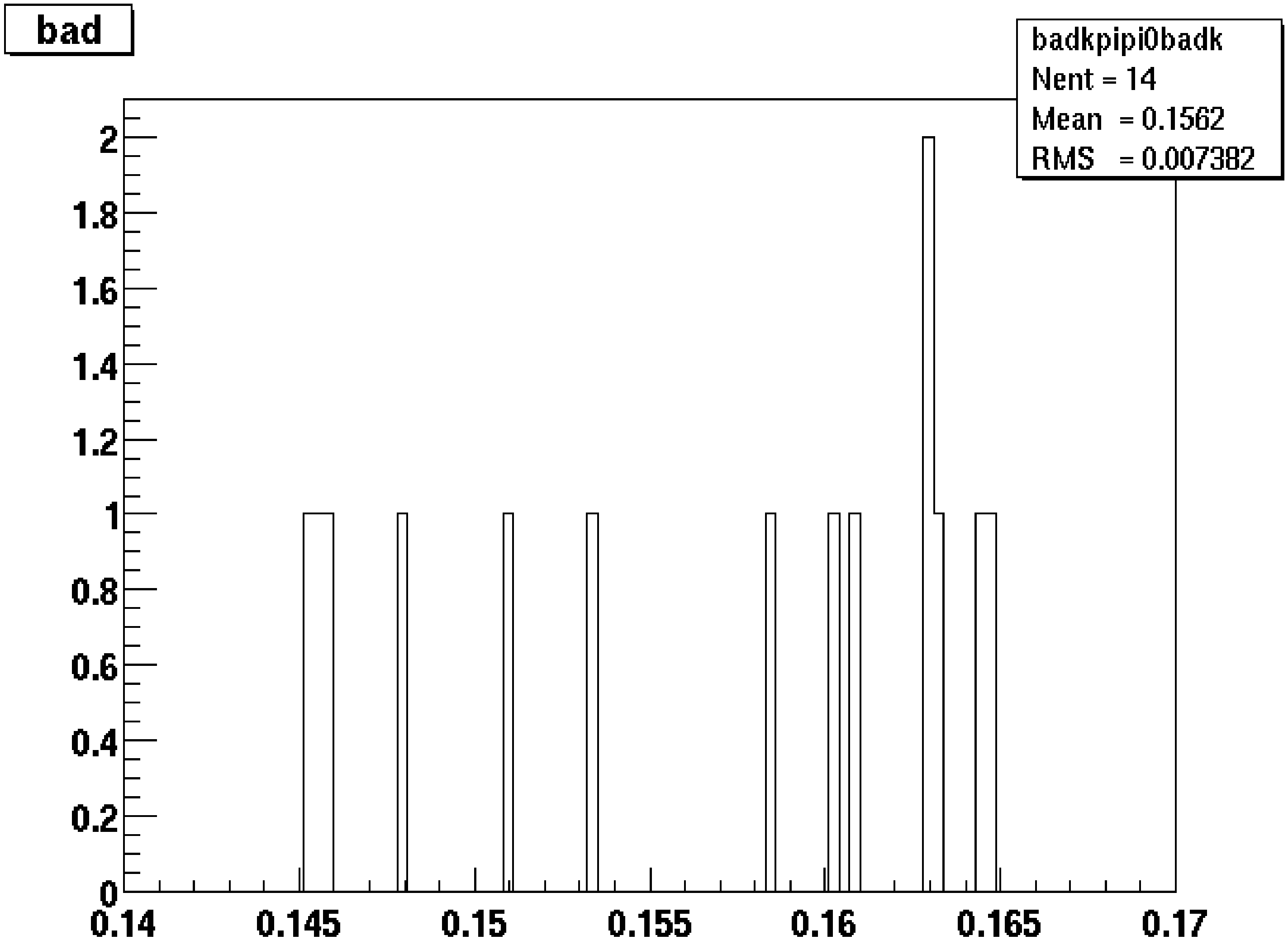
Bad Dstars from kpipi0 mode



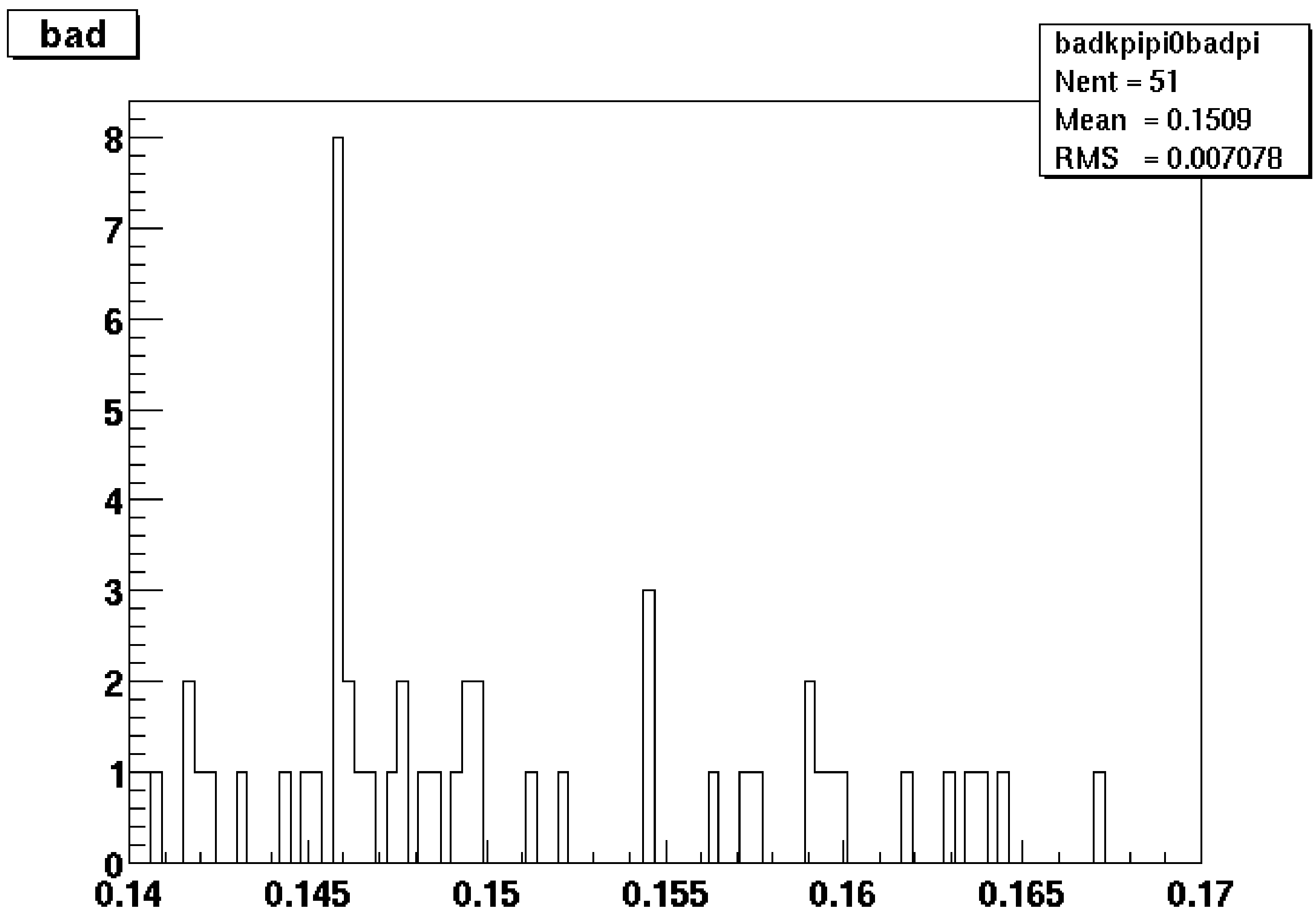
Bad Dstars from kspipi mode



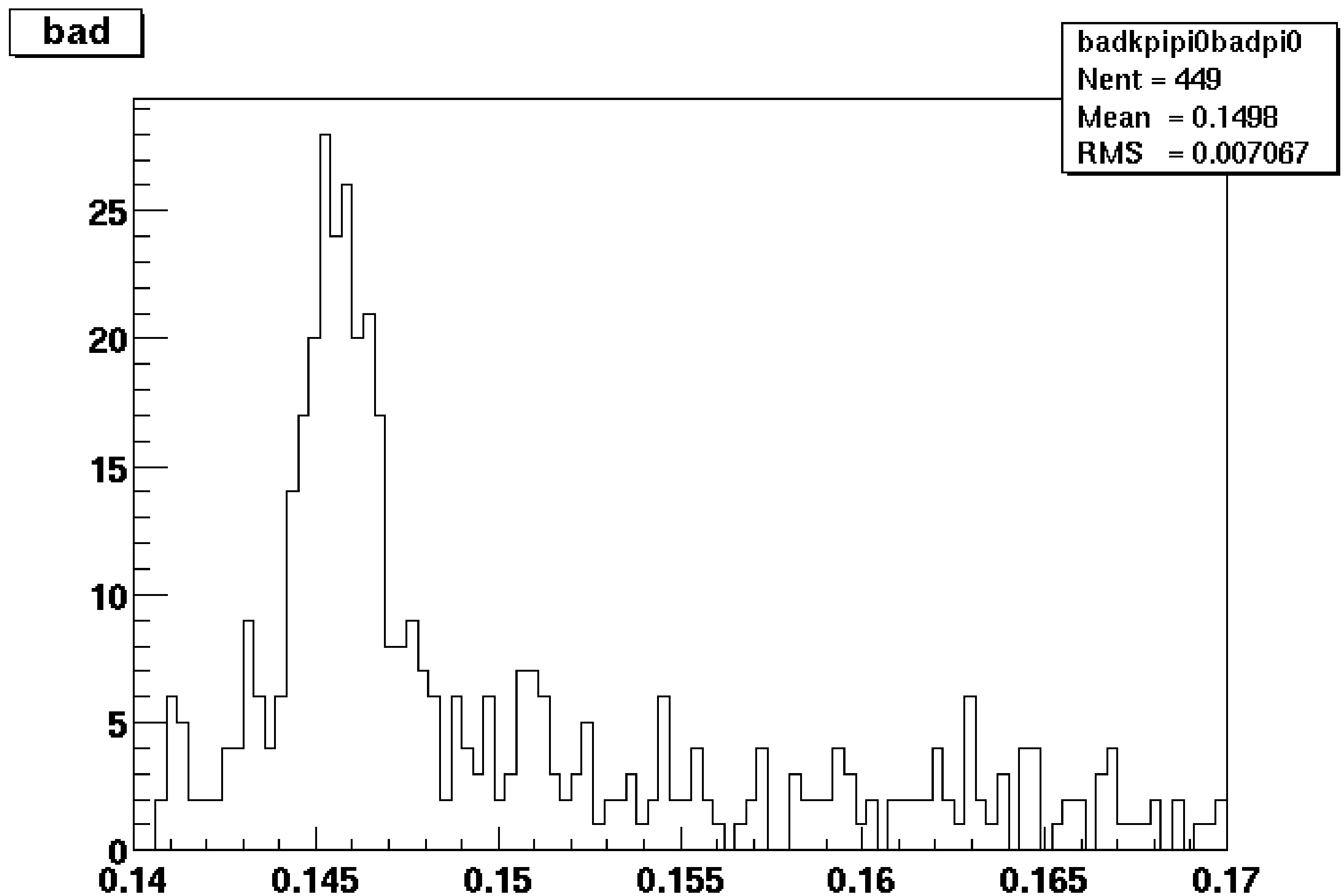
Bad Dstars due to D0 daughter kaons
in kpipi0 mode



Bad Dstars from charged D0 daughter pion
in kpipi0 mode



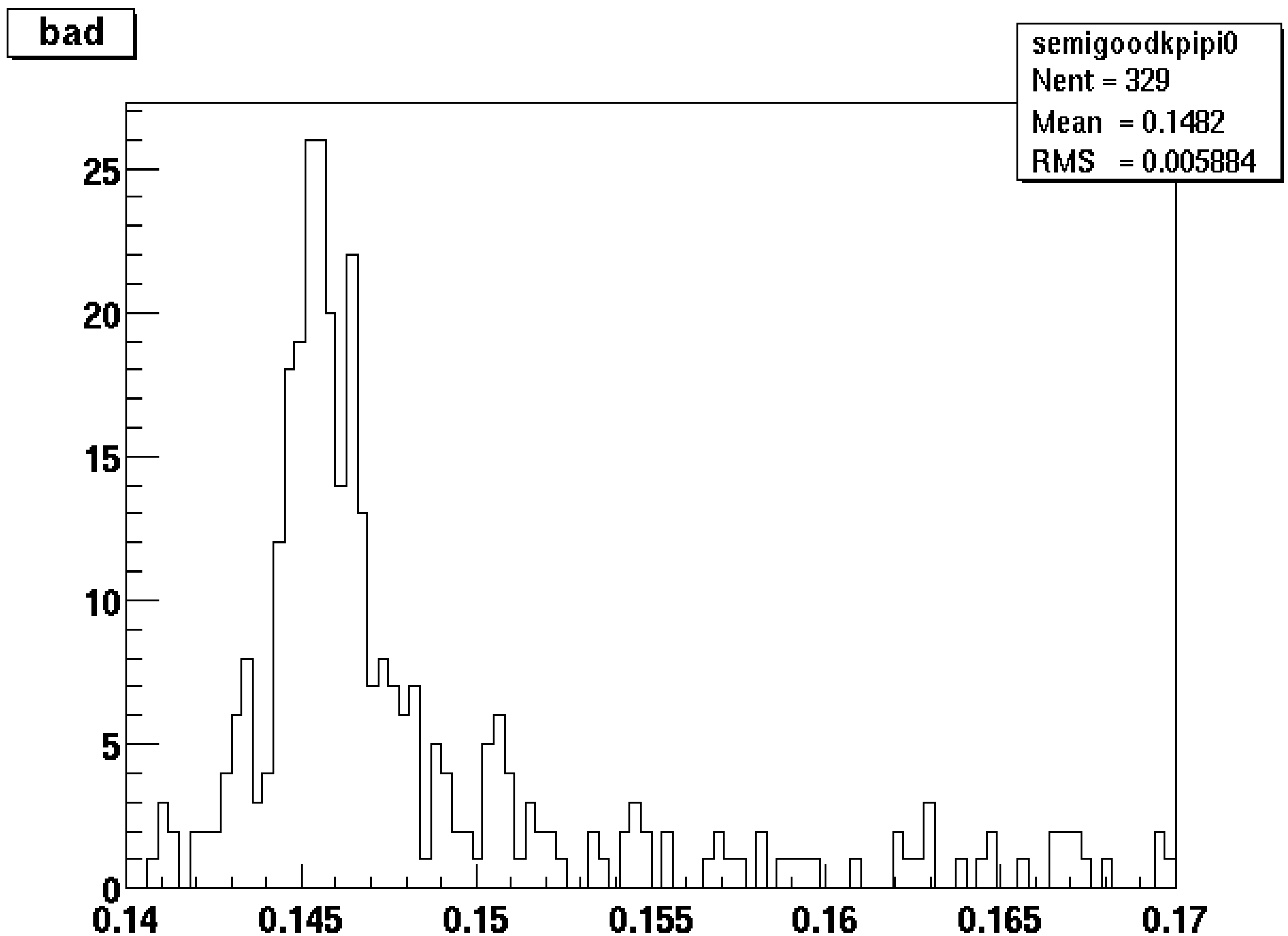
Bad Dstars due to bad pi0s
in kpipi0 mode



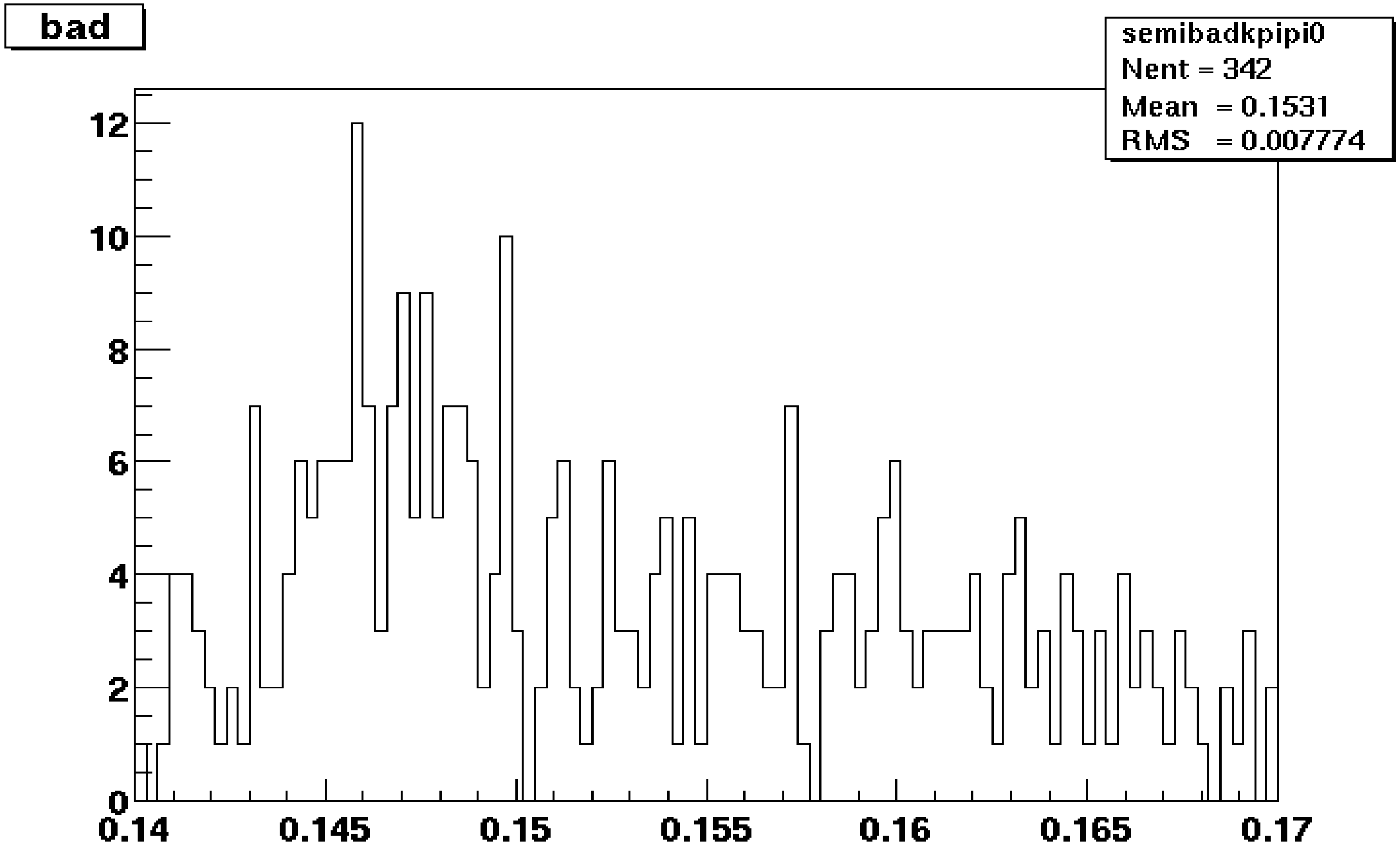
MC study of D0–>kpipi0

- Thus the root of the problem is the MC associator not finding a match for the pi0s.
- I developed a new definition for D0’s to pass as good D0–>kpipi0.
- If the kaon match a MC kaon, the pion match a MC pion and the two MC particles come from the same mother which was a D0 that decayed as a D0–>kpipip0, the reco D0 is called "semigood".

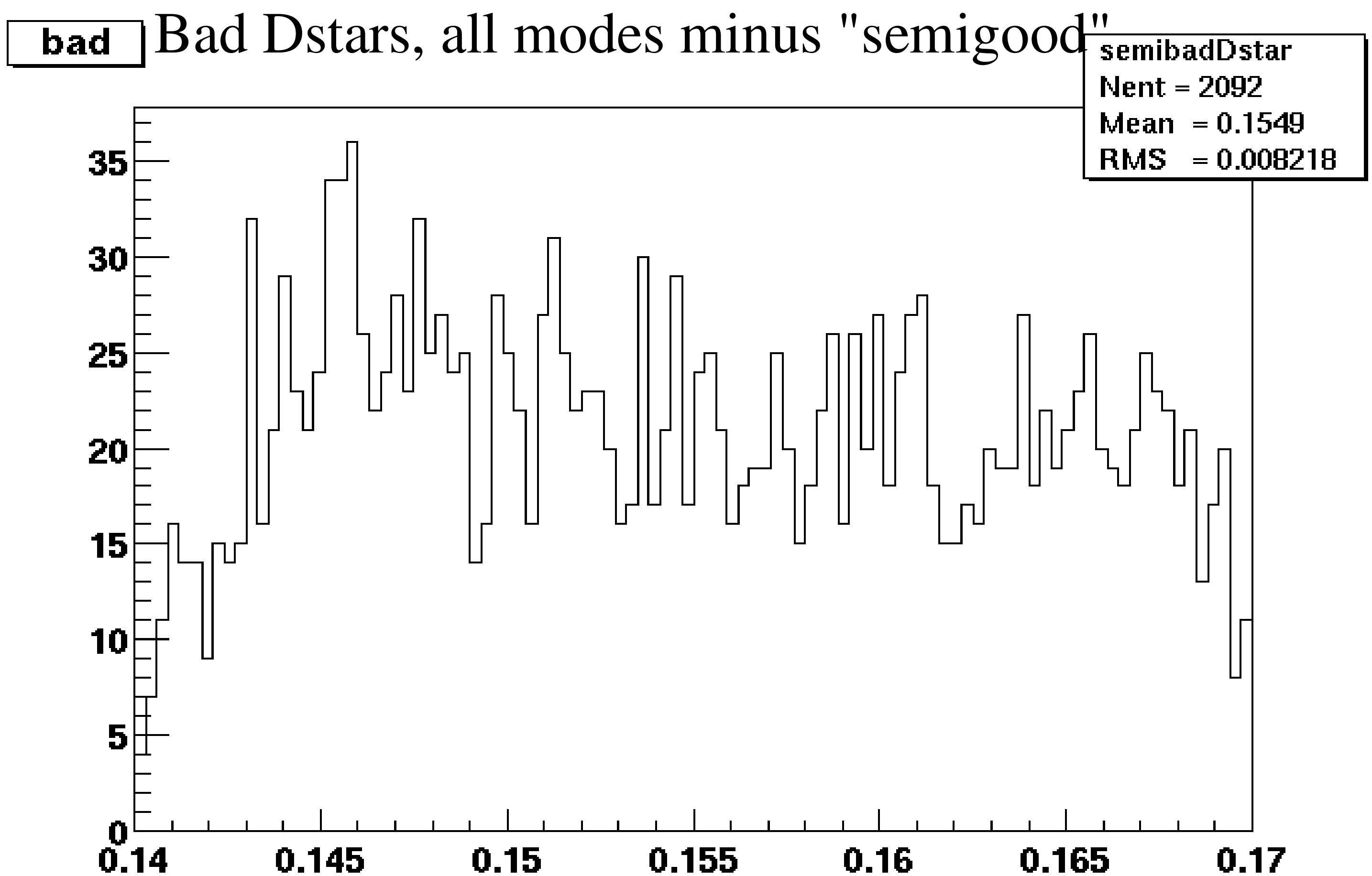
Kpipi0 events which pass semigood



Bad kpipi0s minus the "semigood" events

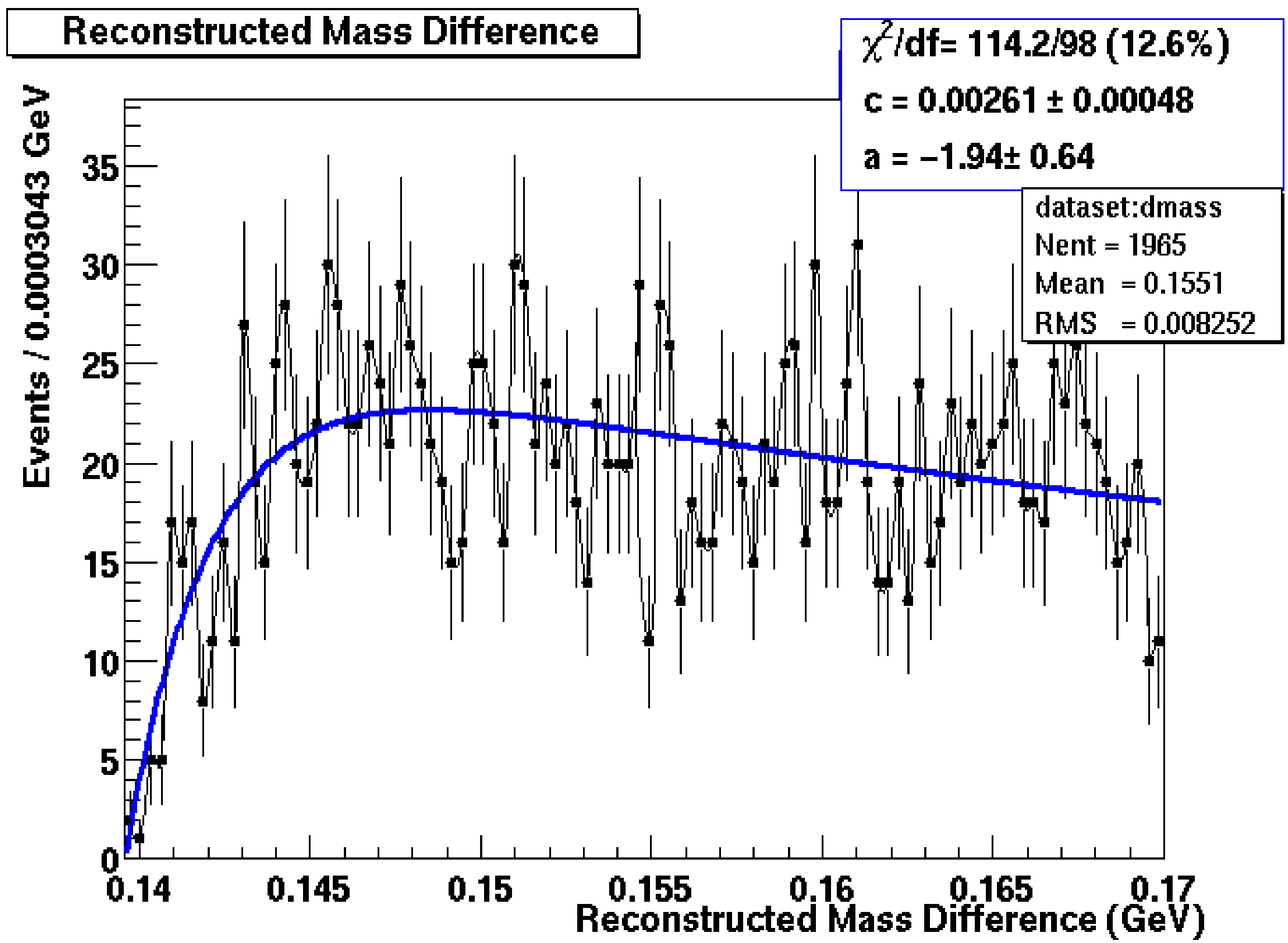


There are still some significant peaking backgrounds in the kpipi0 mode, but for the most part I think this is an accurate picture of whats happening in the kpipi0 mode.

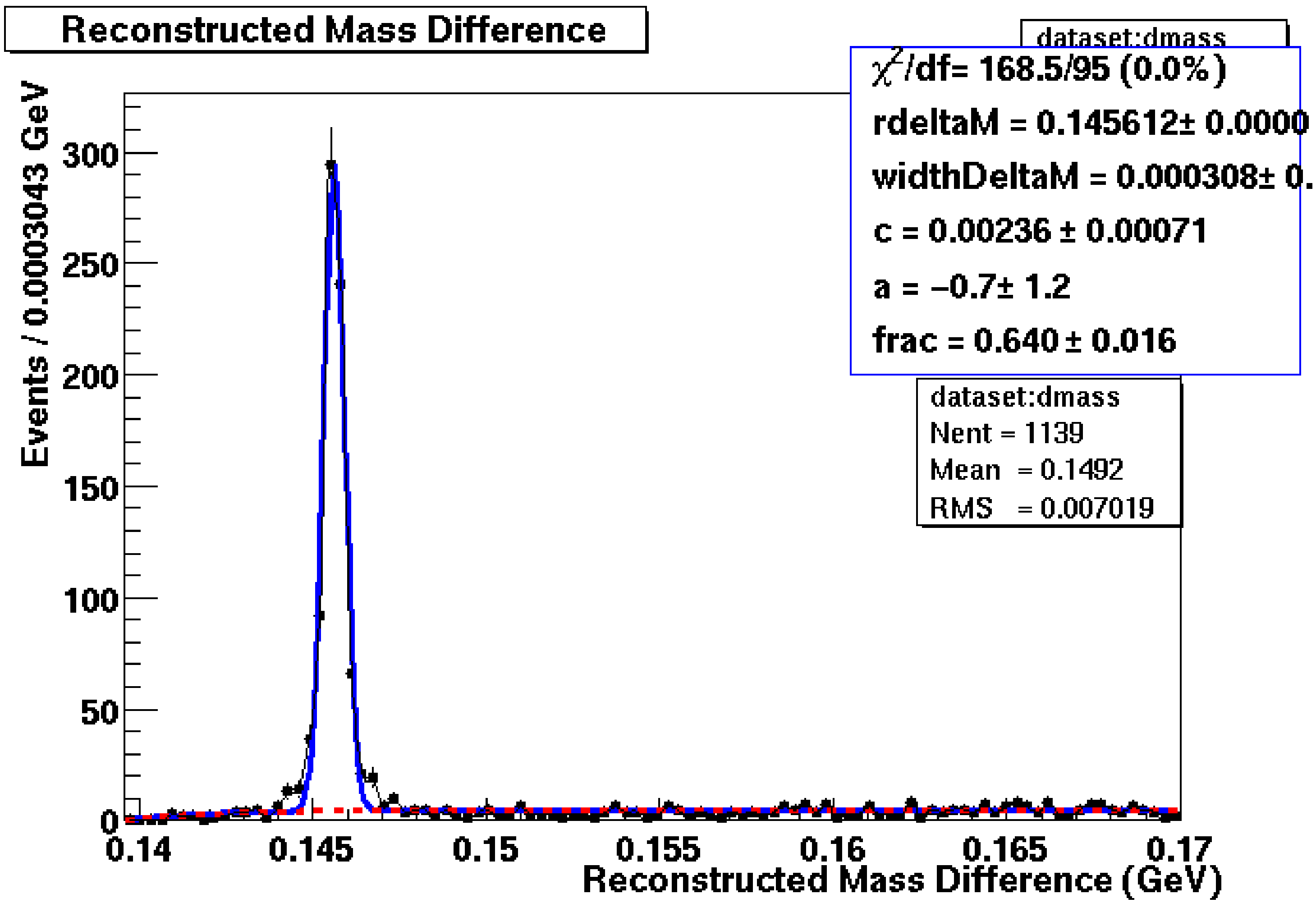


We can now see the effect of removing semigood D0's from the plot of bad Dstars. We can now use kpipi0 MC events and get the information we need – was the event good, index numbers, daughters, etc...

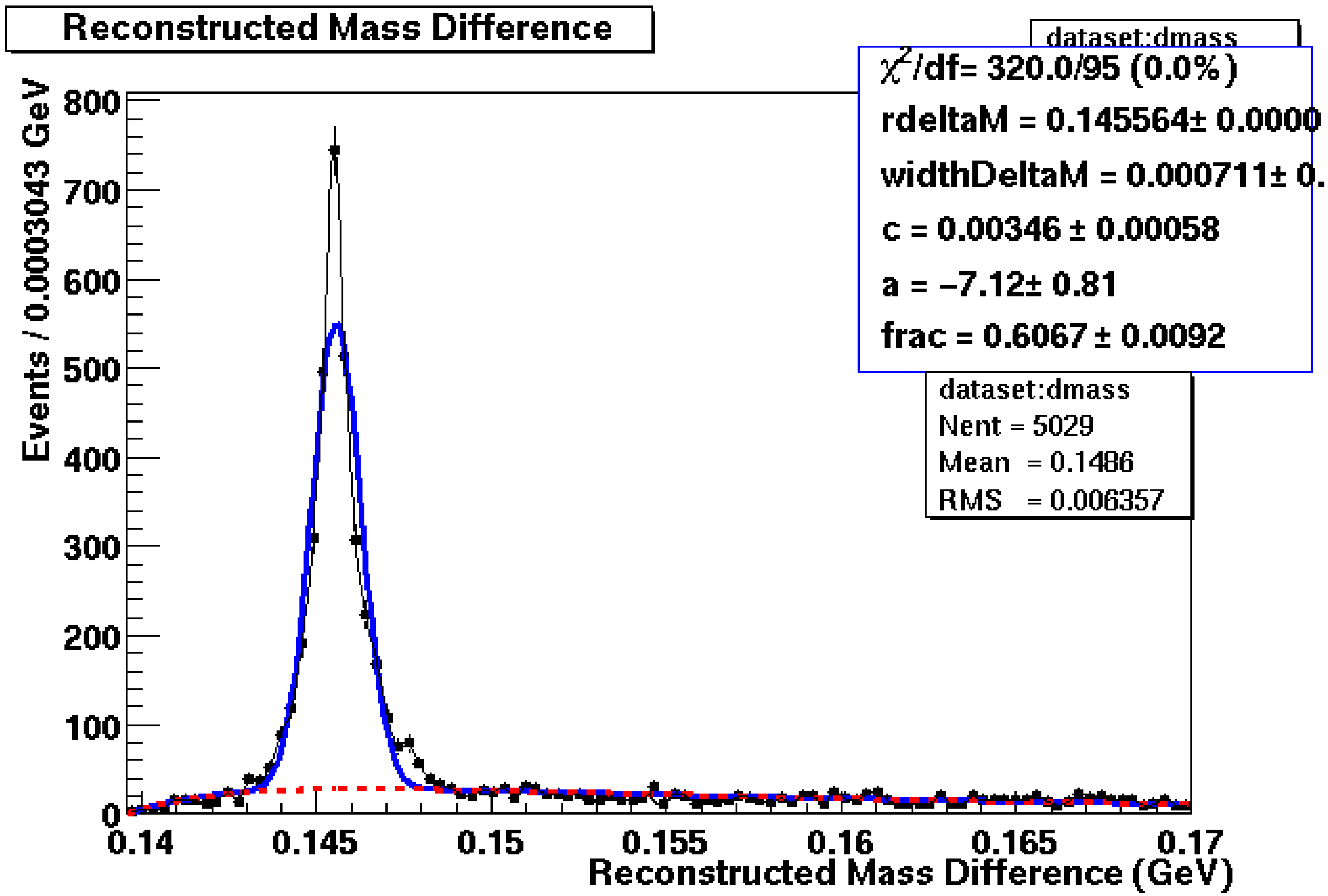
Here is a fit of the background using Chih–hsiang's power law modification to RooFitTools Dstar background function



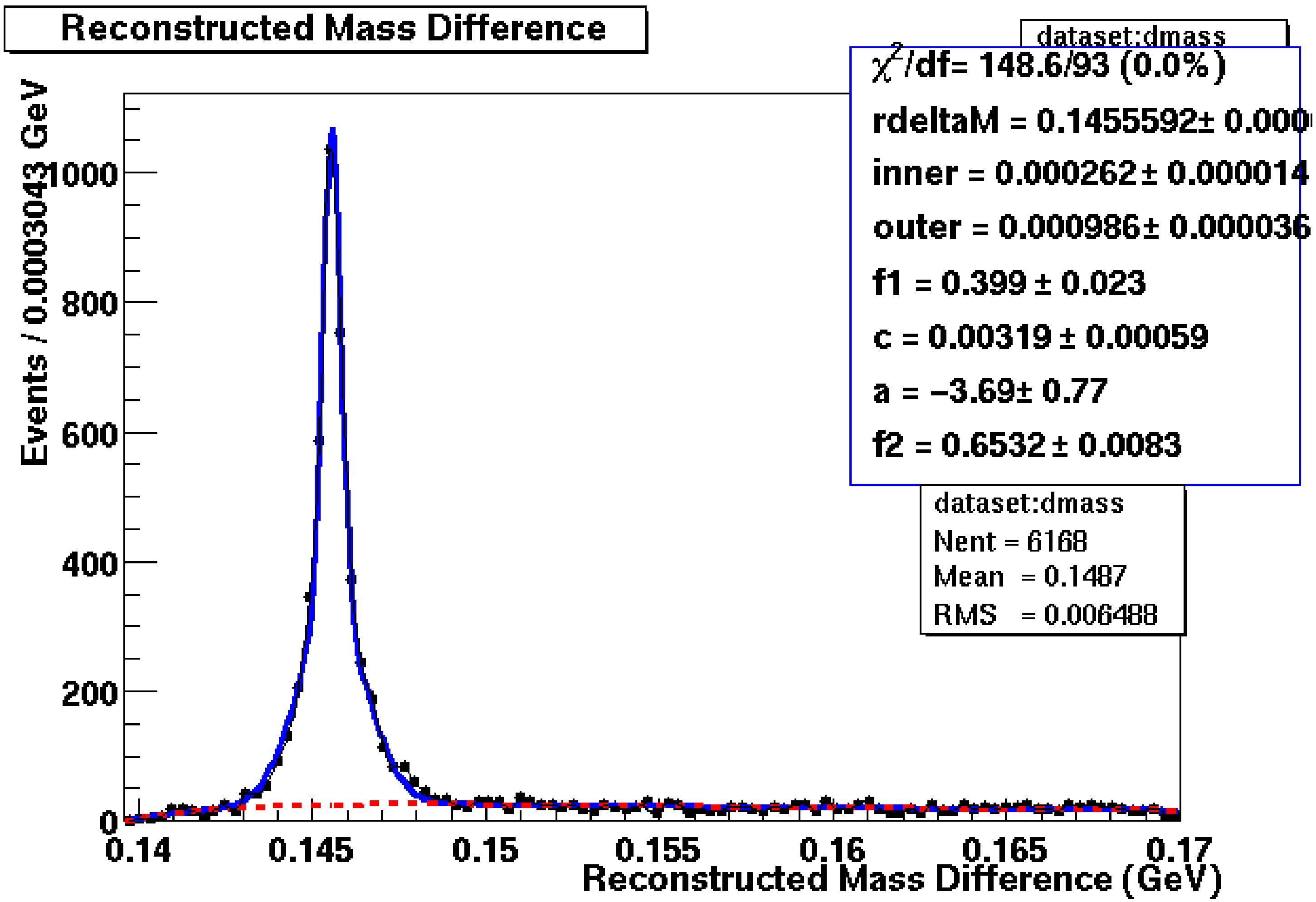
First fit for events with >5DCH hits on slow pion



Next I fit for outer gaussian, but this sample clearly isn't fit by a single gaussian. Only the inner fit proves useful.



I use the fit from the inner width to constrain the inner gaussian, the outer width floats without constraint.



Conclusions for Fitting Deltam

- Fitting inner width gives a very good constraint for final fitting, the outer width doesn't help

Here are some number from calculating sig/back from the plots and MC Truth

	All Modes	Kpi	K3pi	Kpipi0	Kspipi	Sum
Signal events	4001	1471	1222	1229	109	4031
Back fraction	0.093	0.042	0.131	0.085	0.136	0.086
MC events	4019	1482	1204	1226	107	4019
Back fraction	0.089	0.036	0.144	0.087	0.151	0.089
$\chi 2$	149	111	127	104	114	
Prob	0.00%	9.10%	1.00%	21.20%	7.00%	