

ID Systematics

Manual & Plots

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ID Systematics...

- In analogy to the Energy estimation, one can try to determine if there are similar effects for the electron/gamma separation.
 - It should be easier, since the ID output is continuous (0..1), but the final decision is binary (either Type A or B).
 - So the Question is:
 - **How „stable“ is the ID algorithm w.r.t. to variations in the environment (whatever that is) ?**

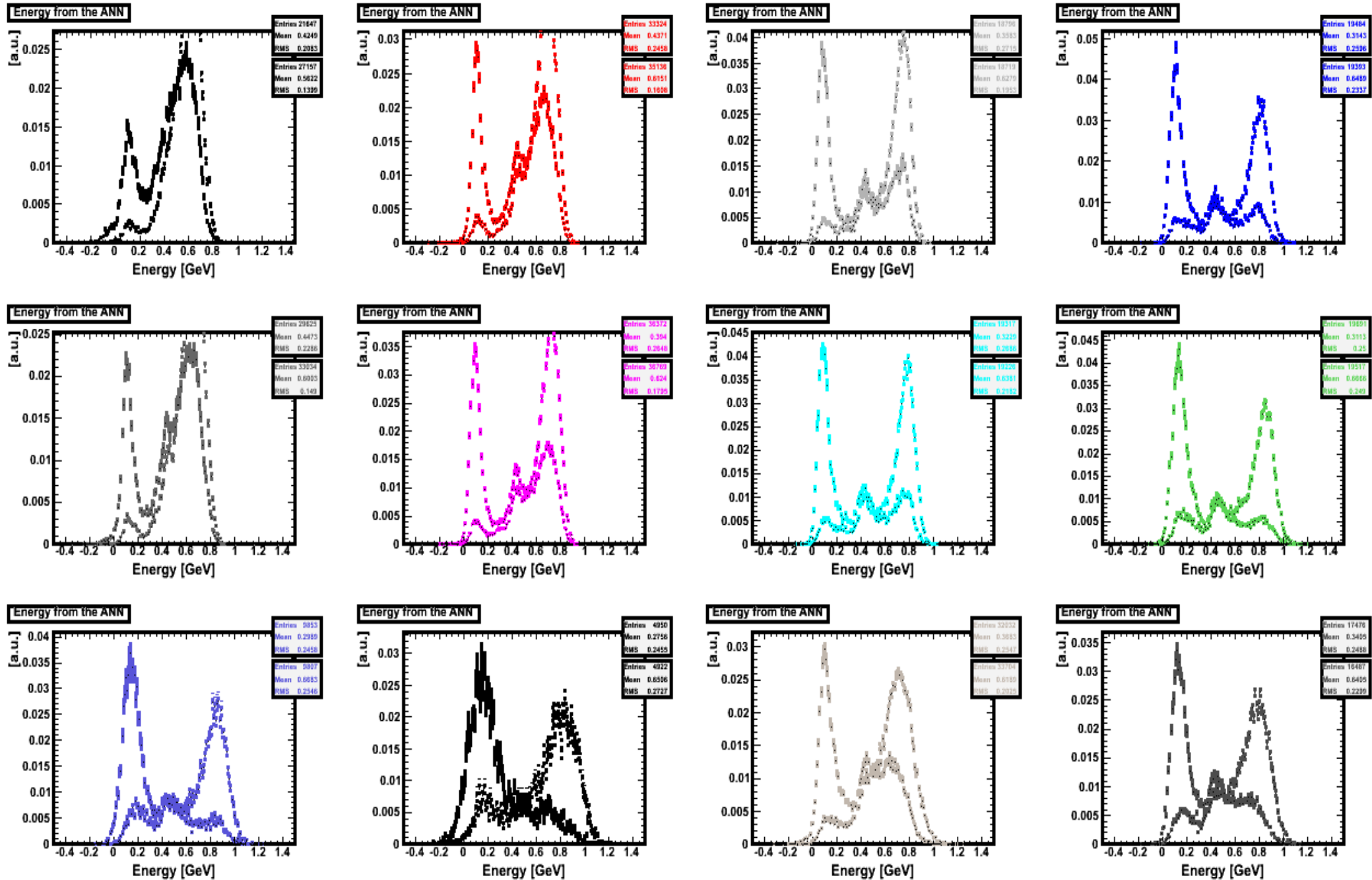
Procedure:

- For the ID algo, we are using the same input variables as for the energy
- We have different separation modes:
 - Electron - Pion
 - Electron – Gamma
 - Gamma – Pion
-

Procedure:

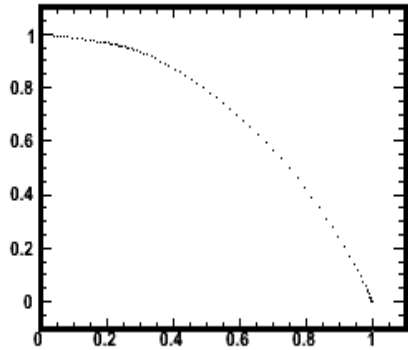
- And we test all it for
 - Different number of plates reconstructed and
 - Different scanning efficiencies
 - Different trainingsfiles
 - Different cut modes
 - Different shape recognition modifiers
 -
- But we wont go into more details as for the BG systematics, the information gain is limited.

Exampleplots ... distributions

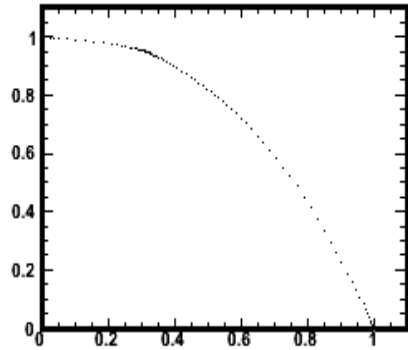


Exampleplots ...eff`s and cont`s

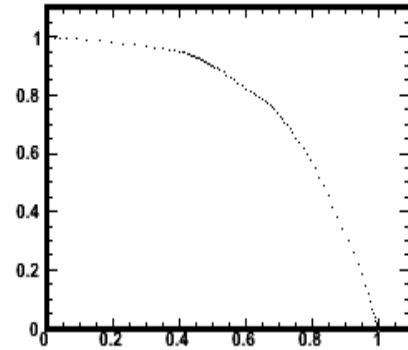
Graph



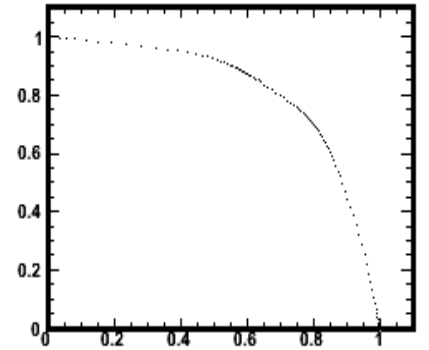
Graph



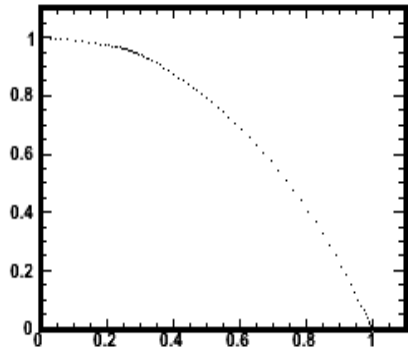
Graph



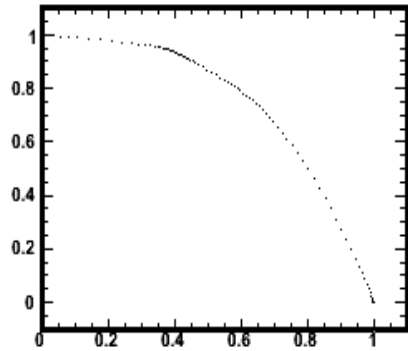
Graph



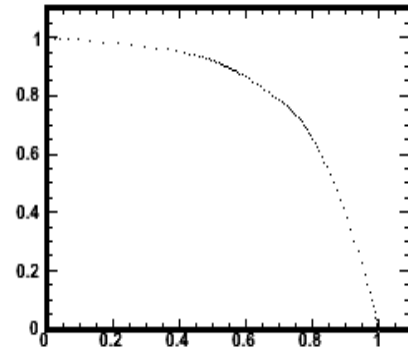
Graph



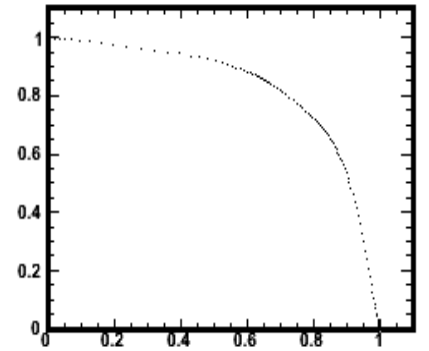
Graph



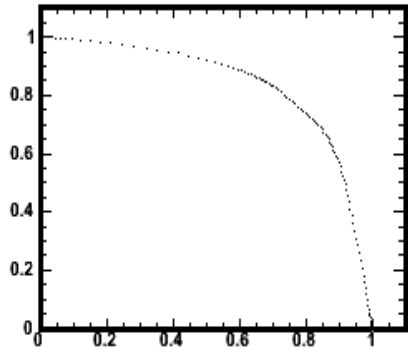
Graph



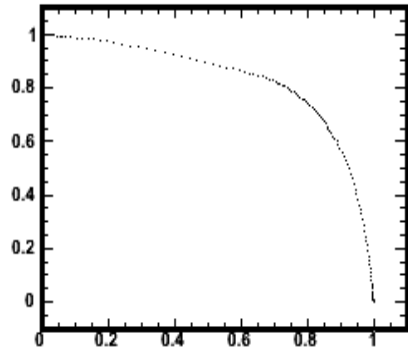
Graph



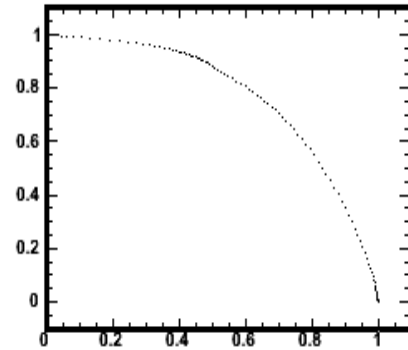
Graph



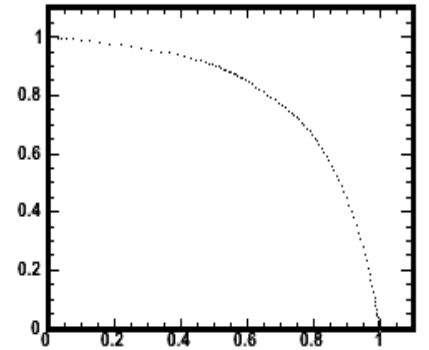
Graph



Graph



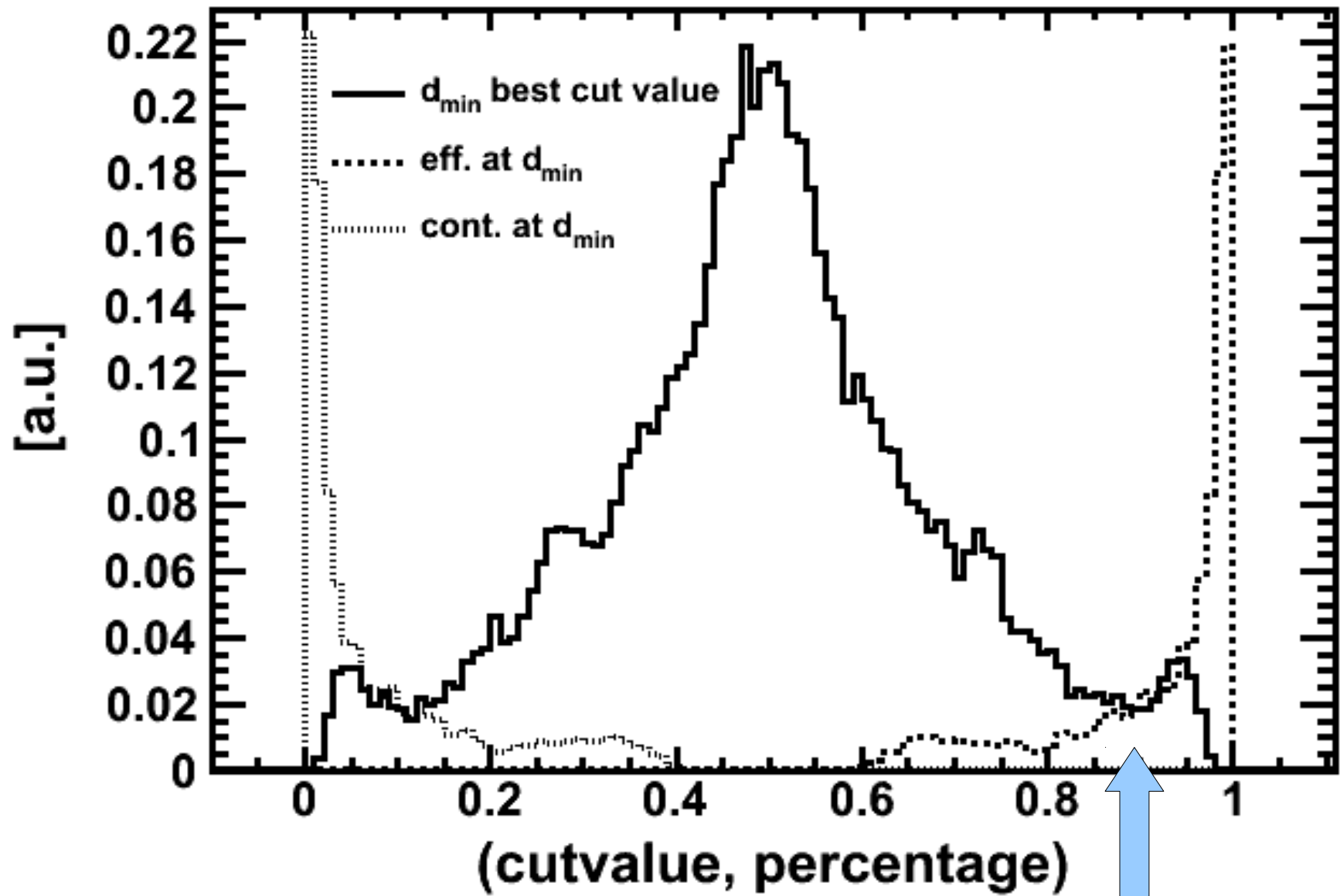
Graph



Cutvalues

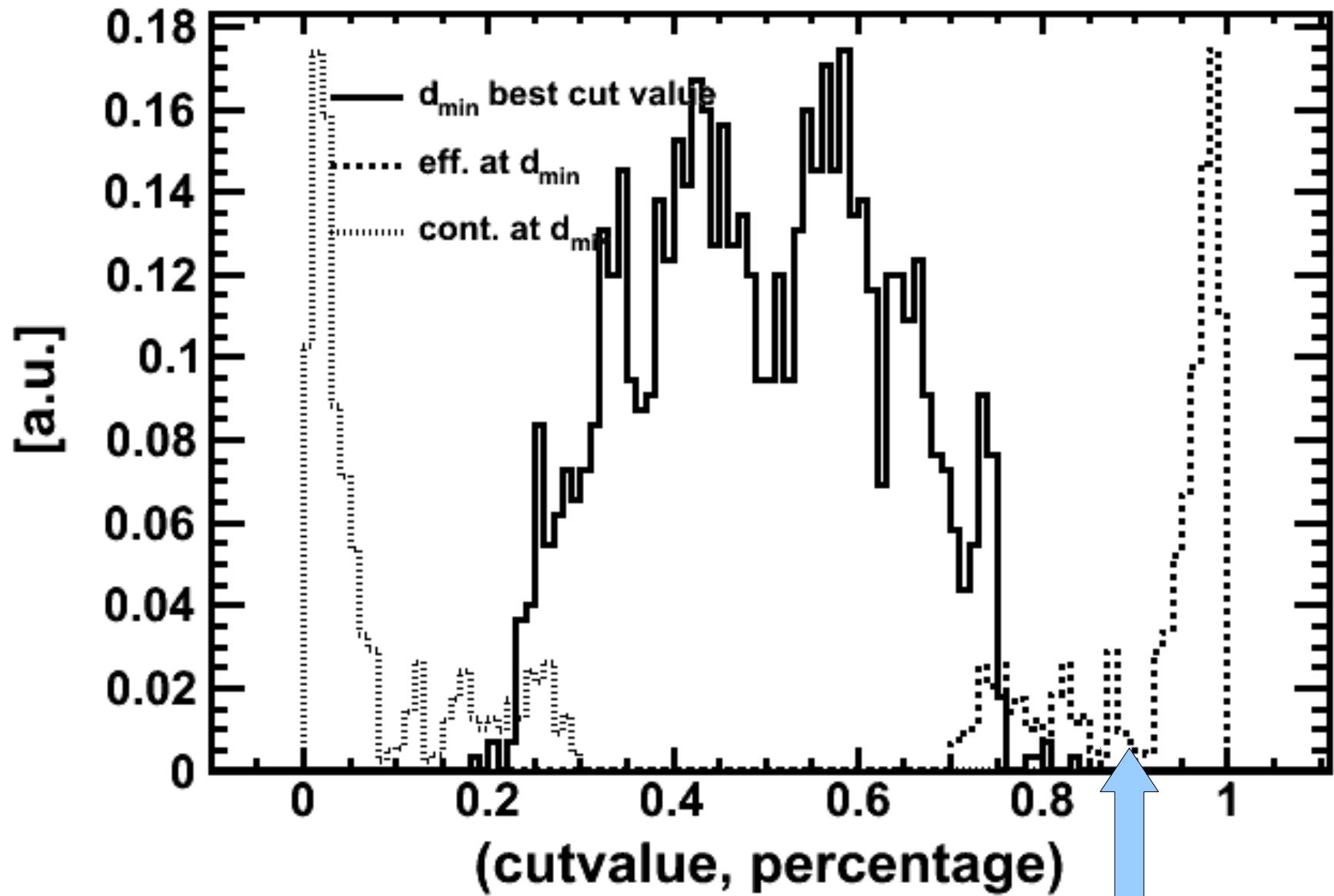
- Now it is shown the distribution
- Of the best `dmin_cut` to point (1/1) (which means perfect separation)
- For different shower shape analysis
- And also for the different energies
 - The negative point for the energy values is a sample of continuous energy distribution.

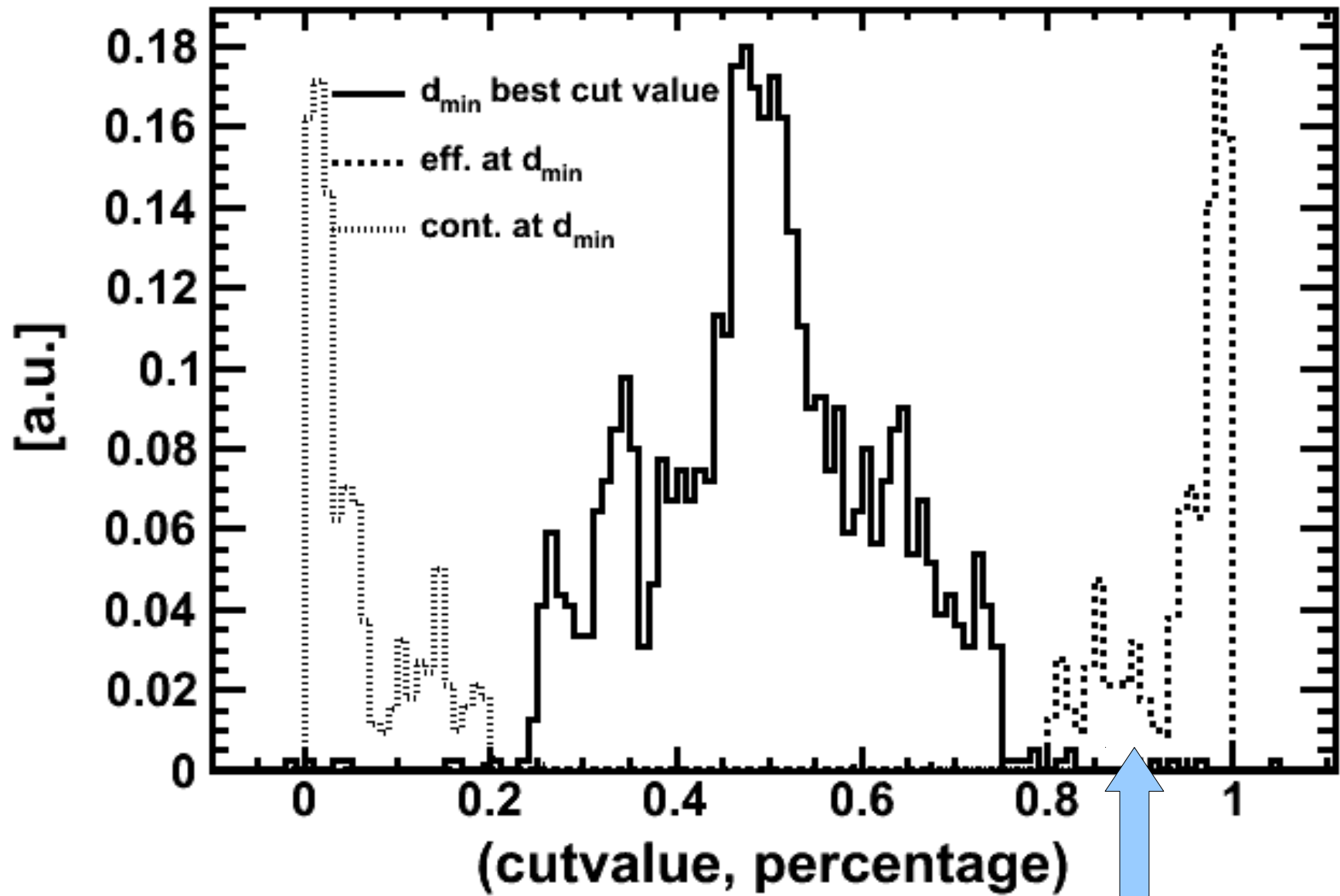
All Energies, All Shapes, All Plates

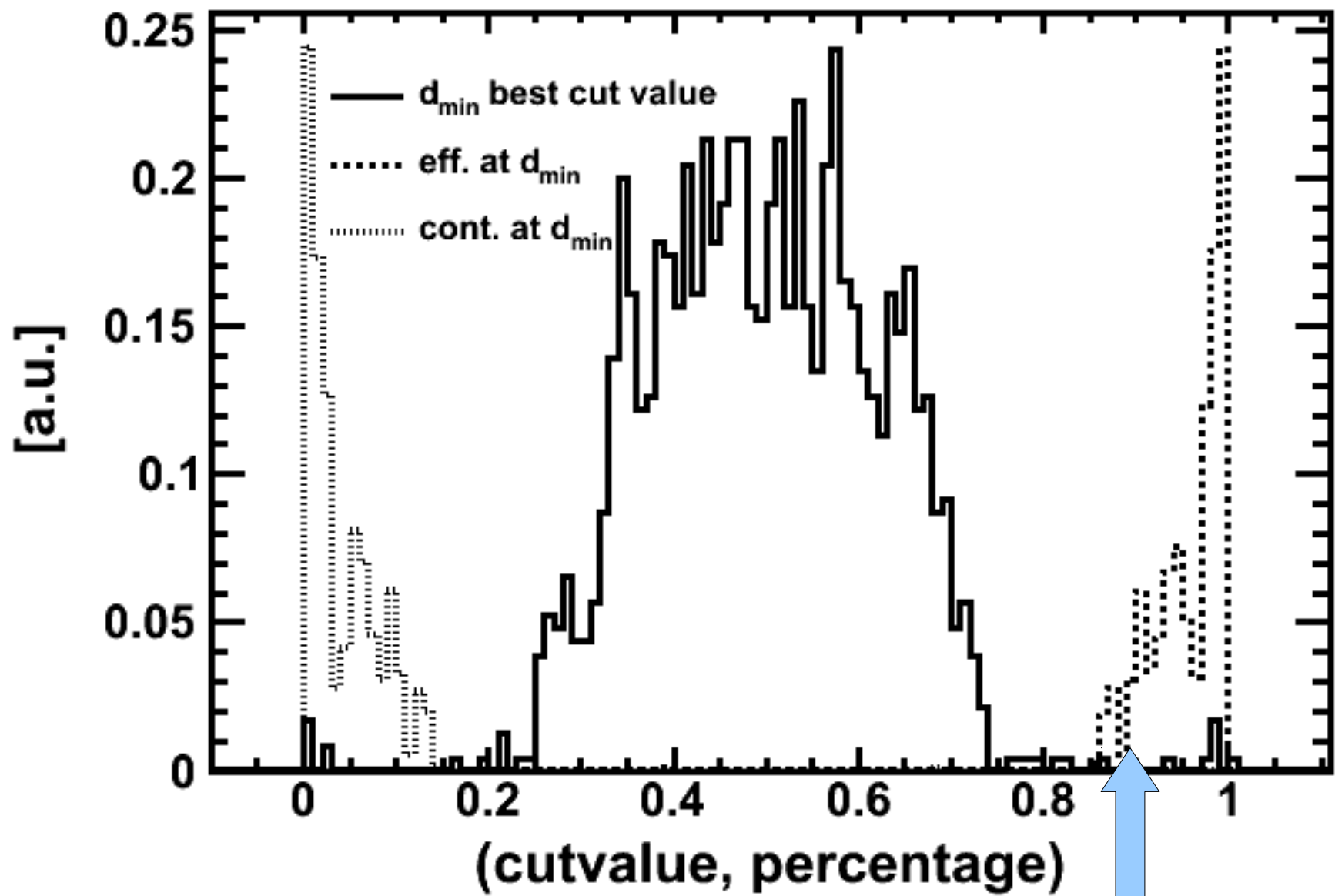


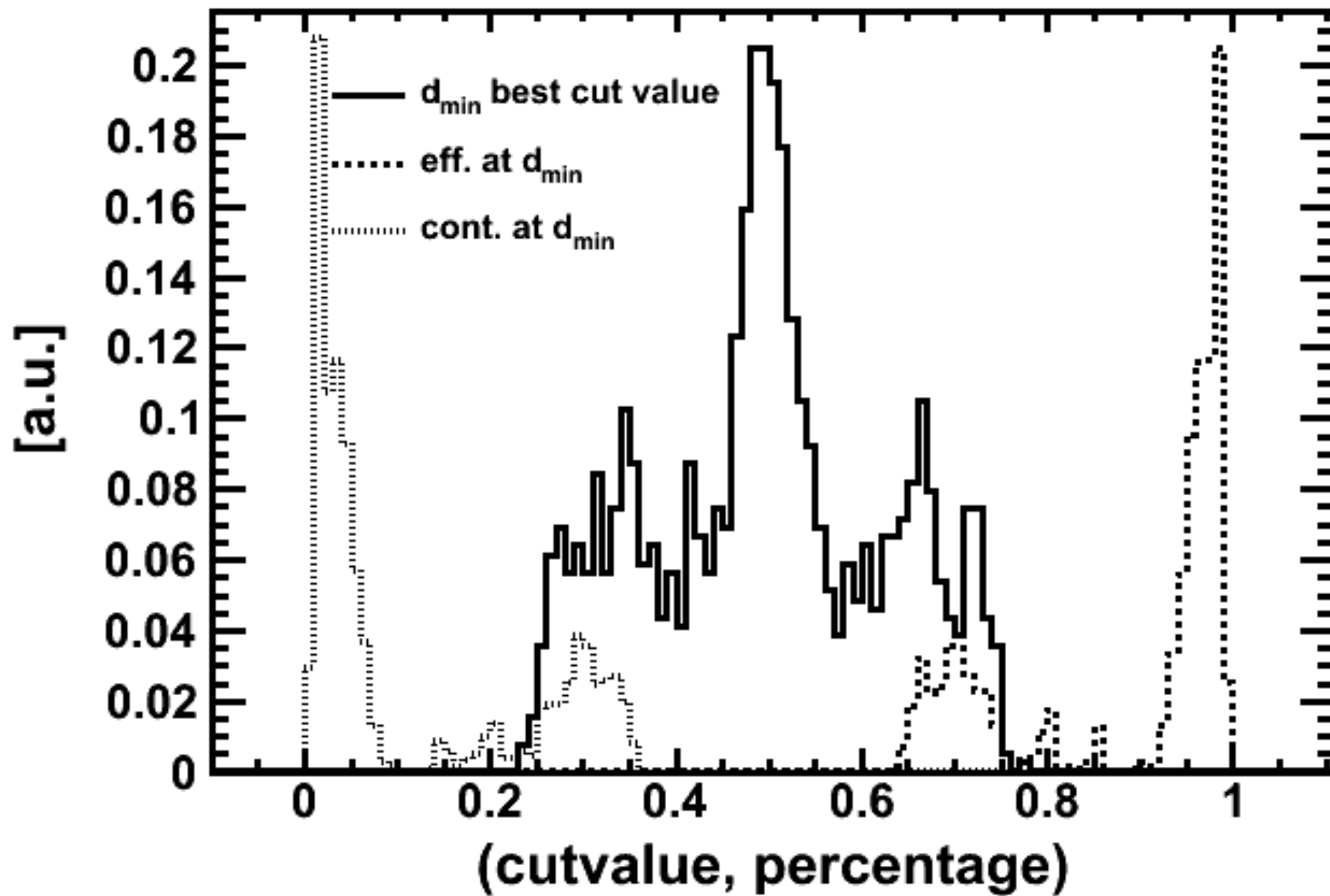
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Note the shift to better values here!

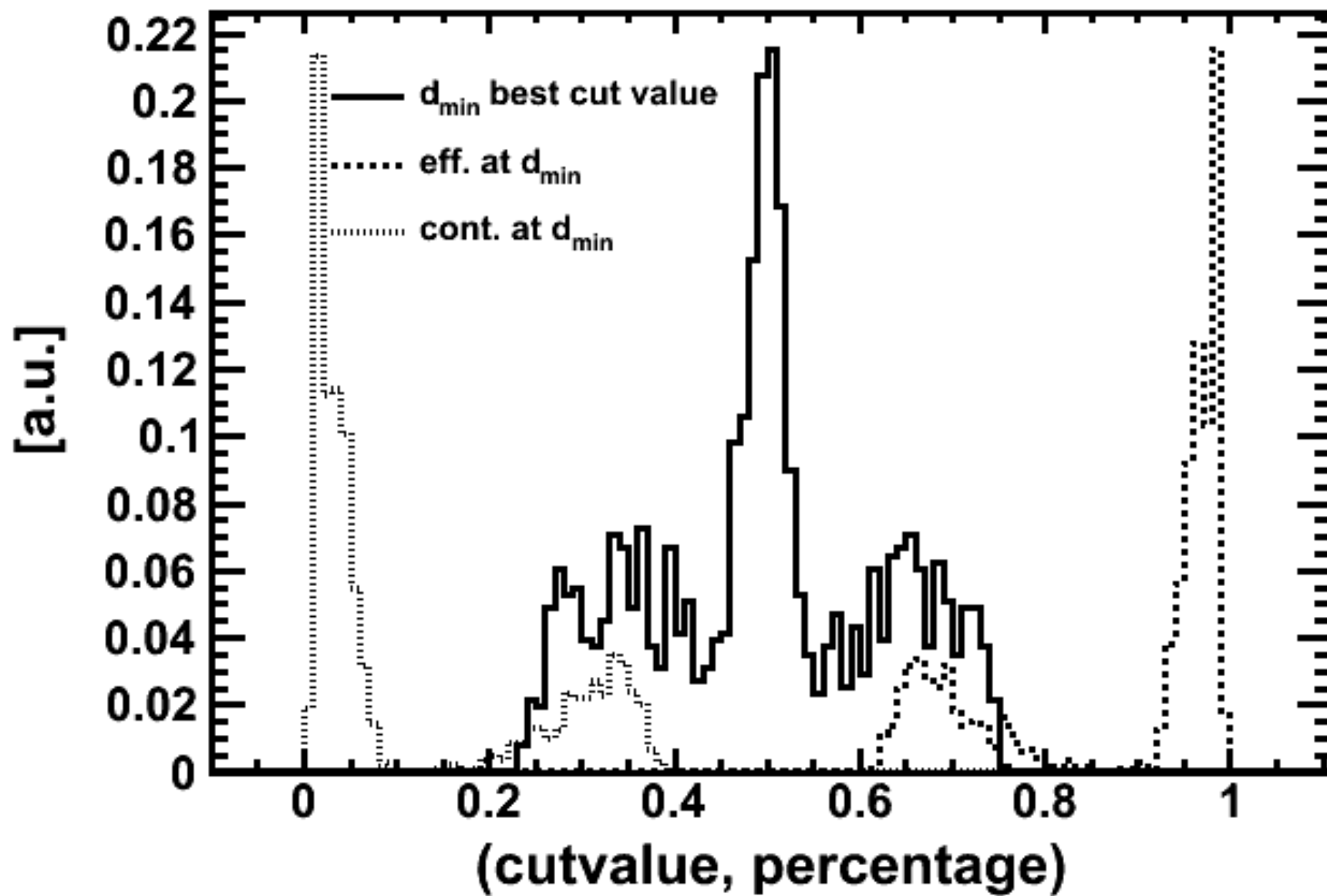








Without first two plates, result is ok,
But not as good anymore as before.



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But not as good anymore as before.

Dependency

- Dependency on Single Energies
- Dependency on the Number of Plates Reconstructed

Shower Shape Only

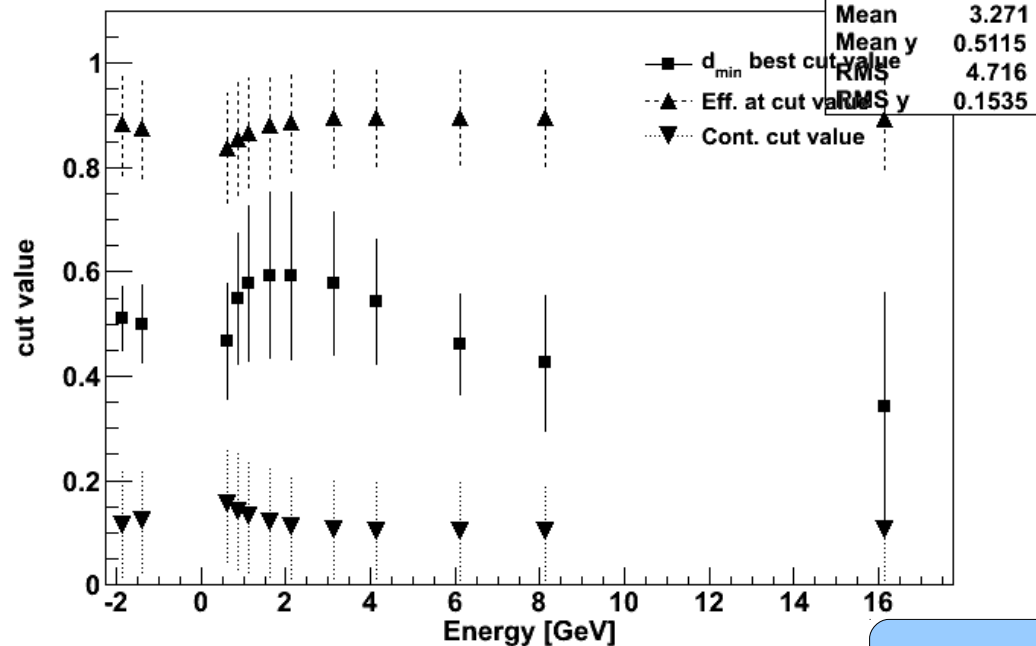
Shower Shape + VtxIP

Nota bene: the errors on the profile plots
are the sigma of the corresponding distribution,
and not the error on the mean.

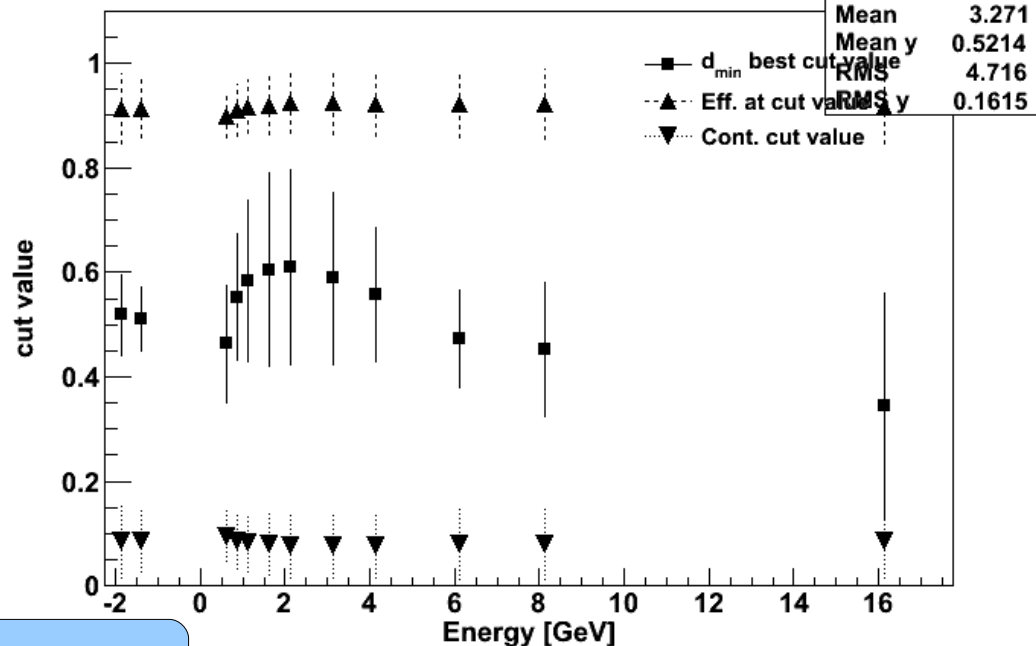
Shower Shape + VtxIP + VtxDZ

Shower Shape without plate 1&2
(double BT effect)

prof_minsquaredDistToOneOnePotion

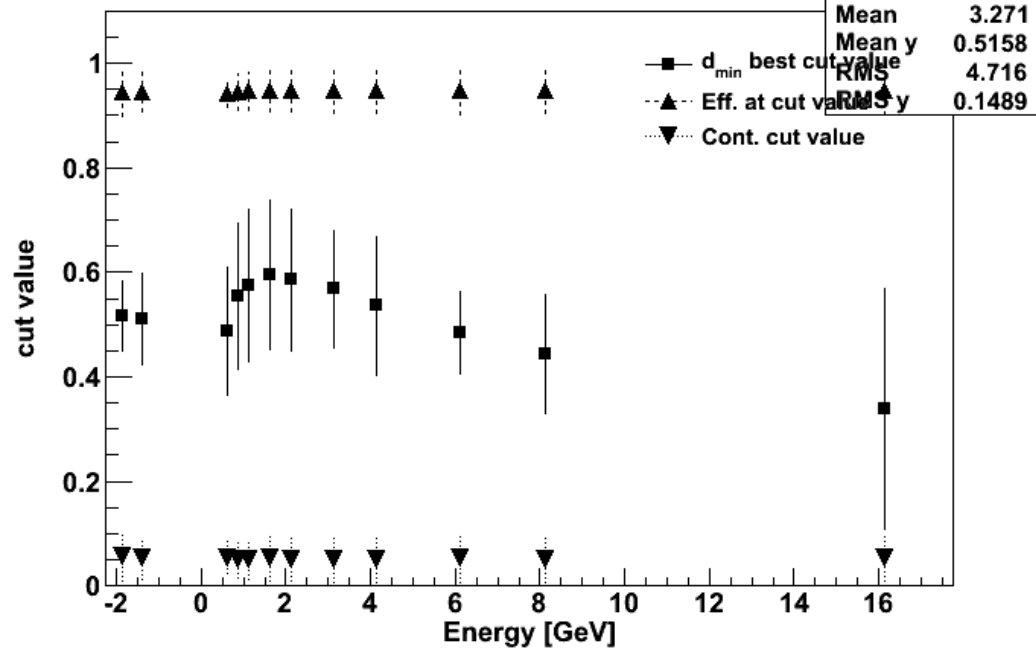


prof_minsquaredDistToOneOnePotion

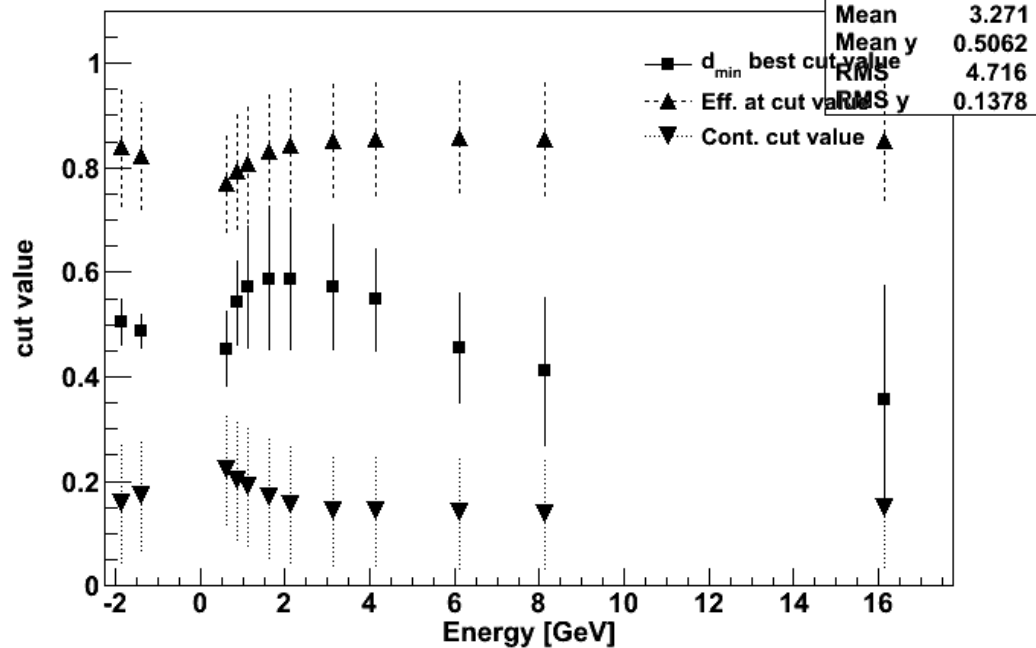


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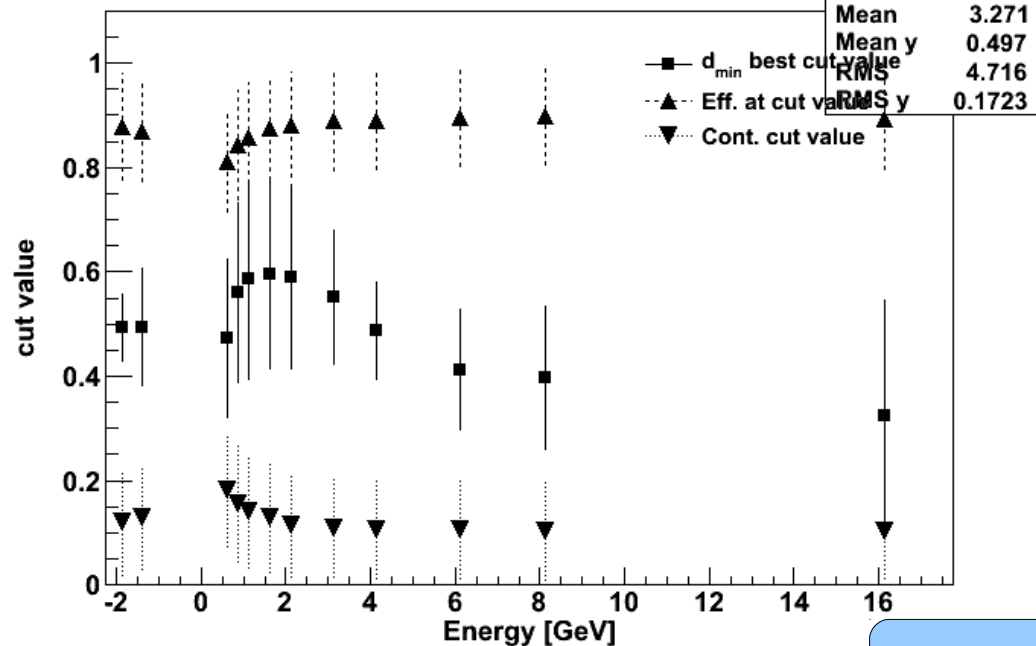
prof_minsquaredDistToOneOnePotion



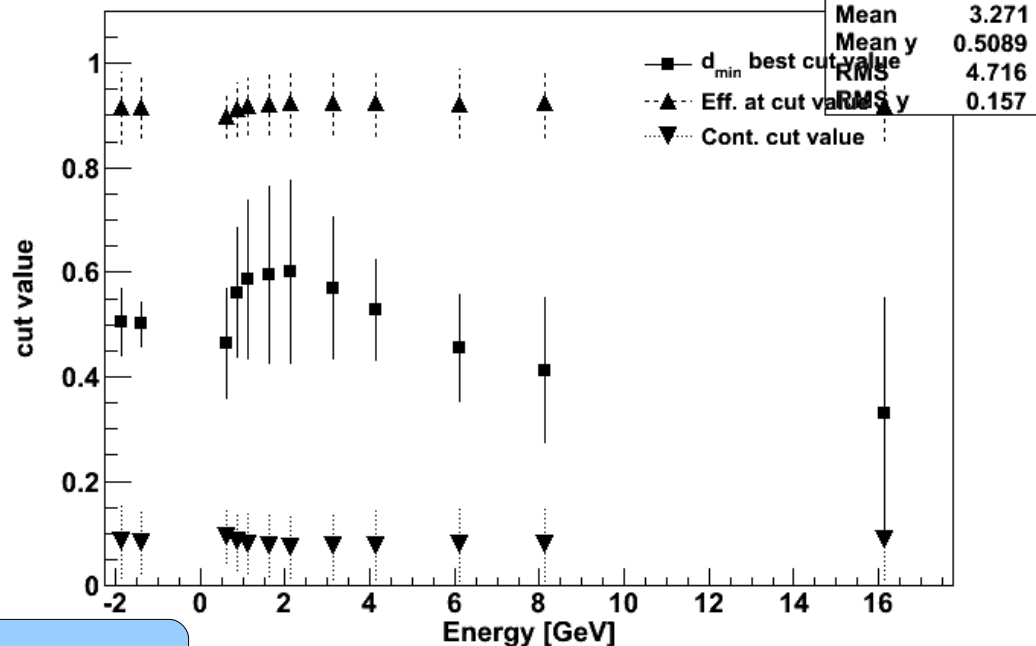
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

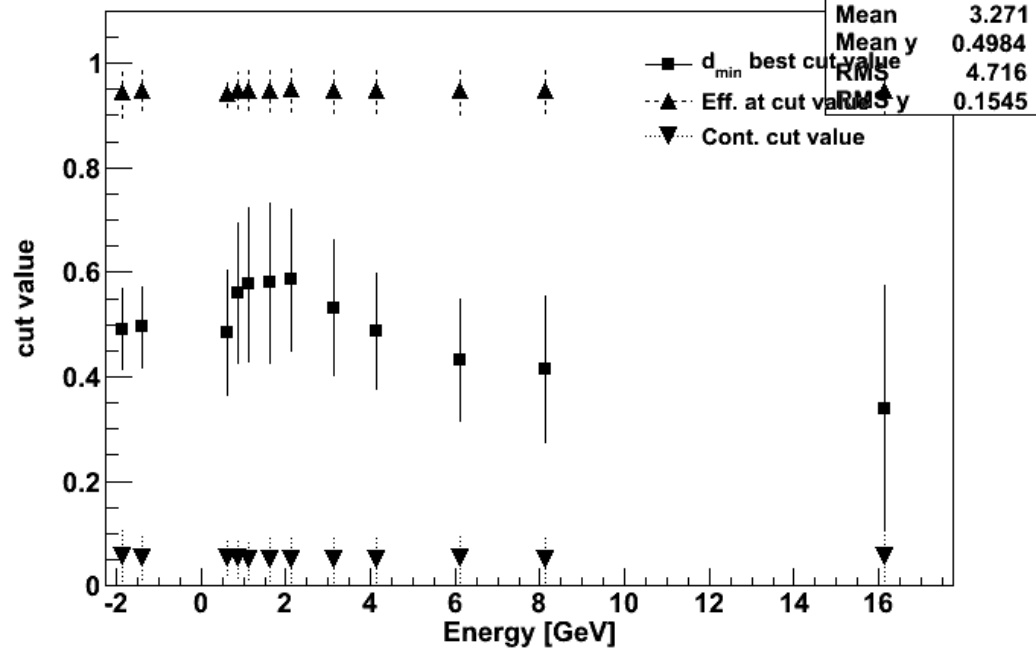


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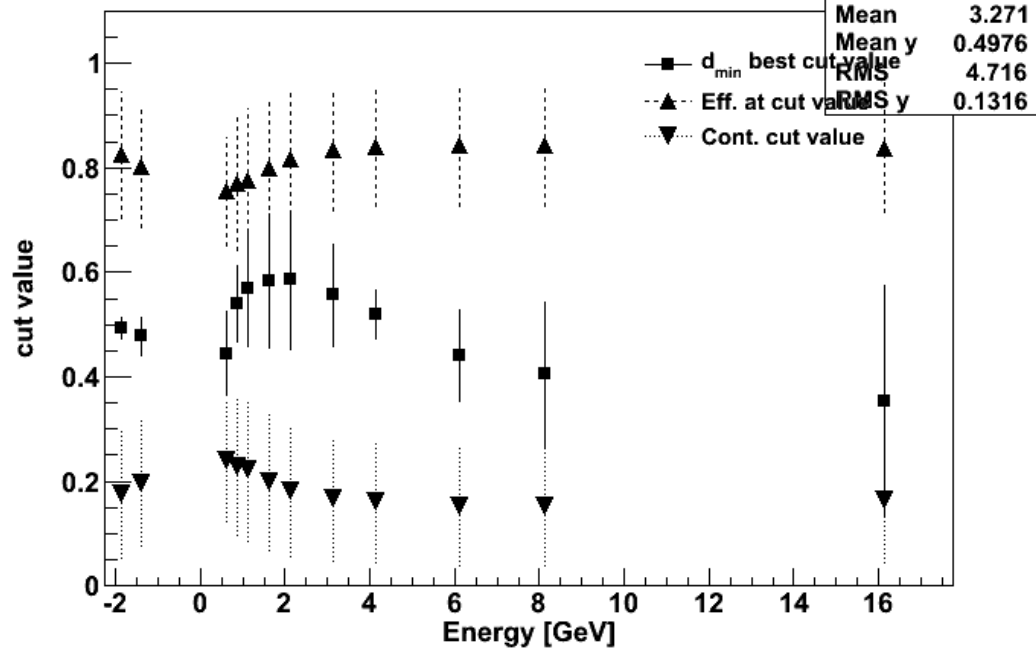


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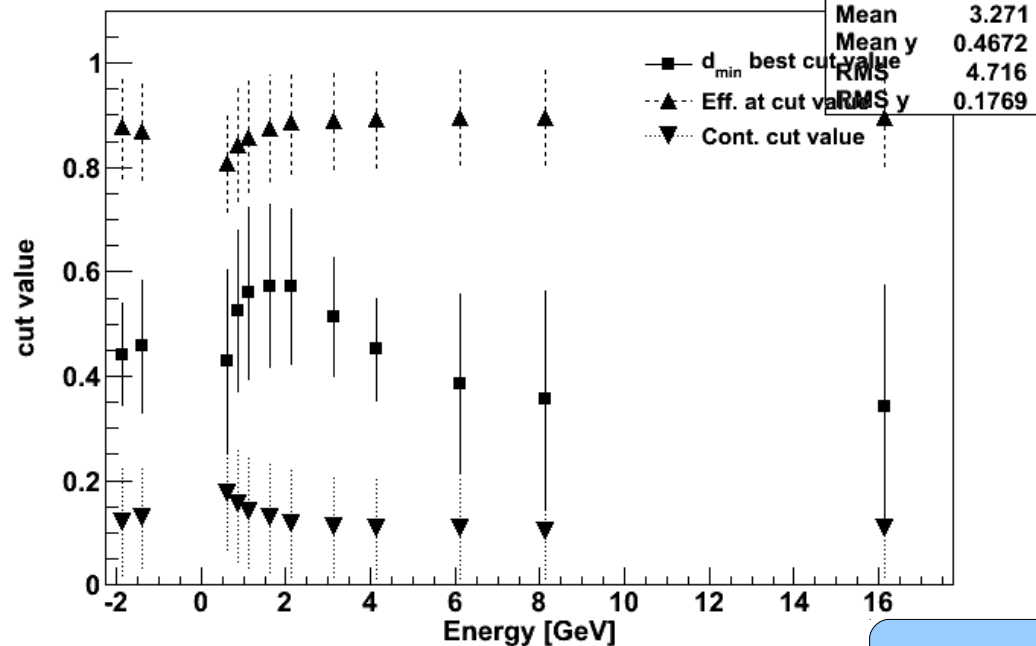
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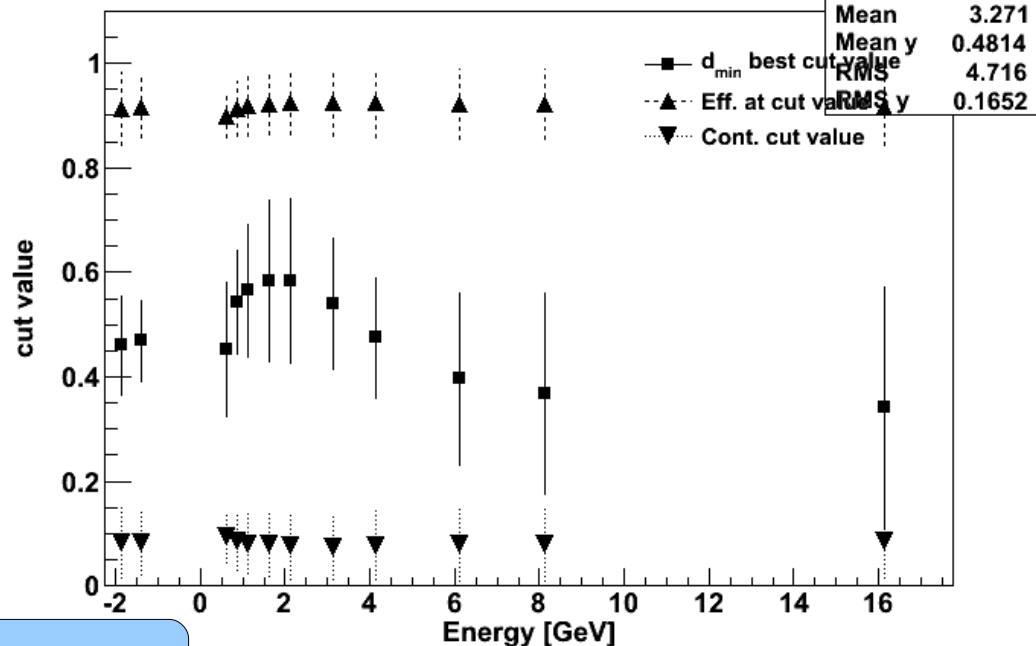
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

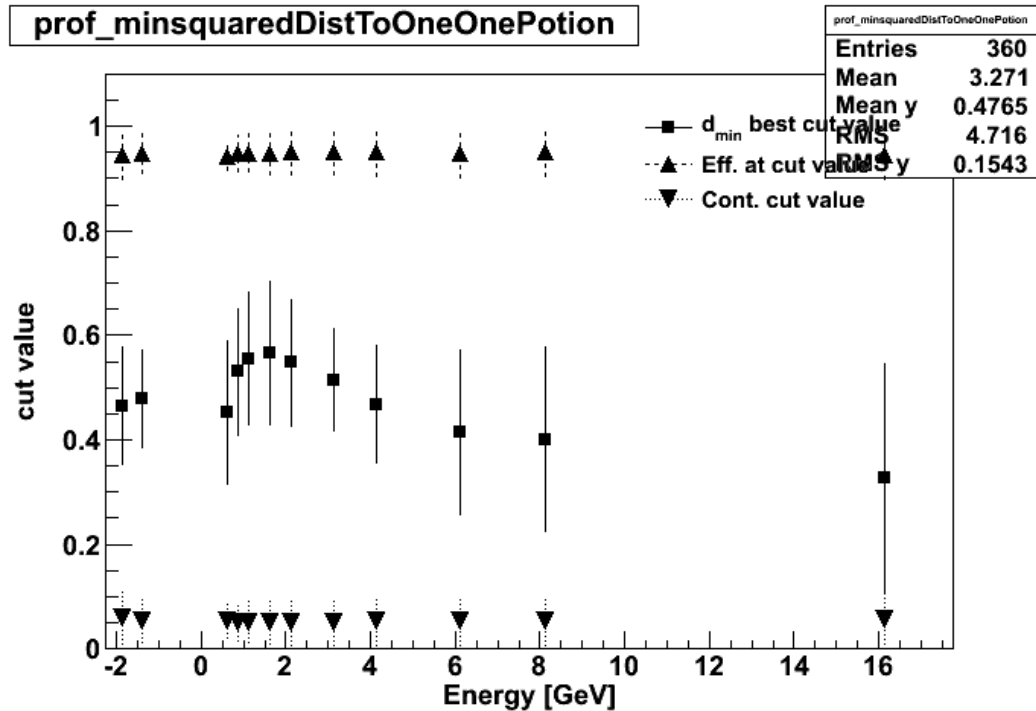


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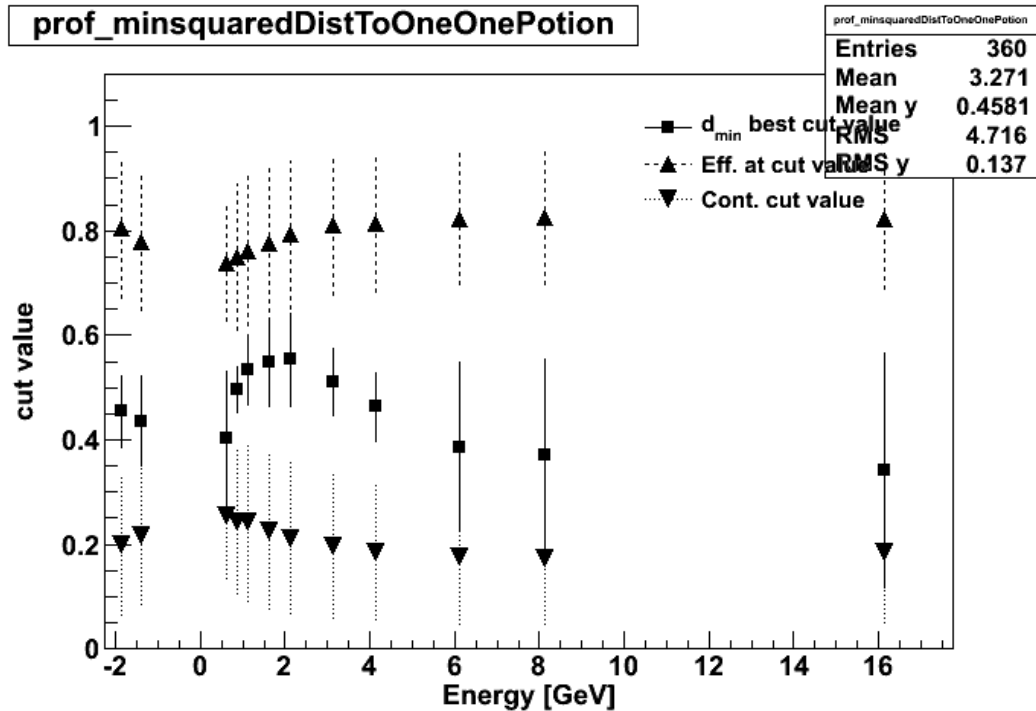


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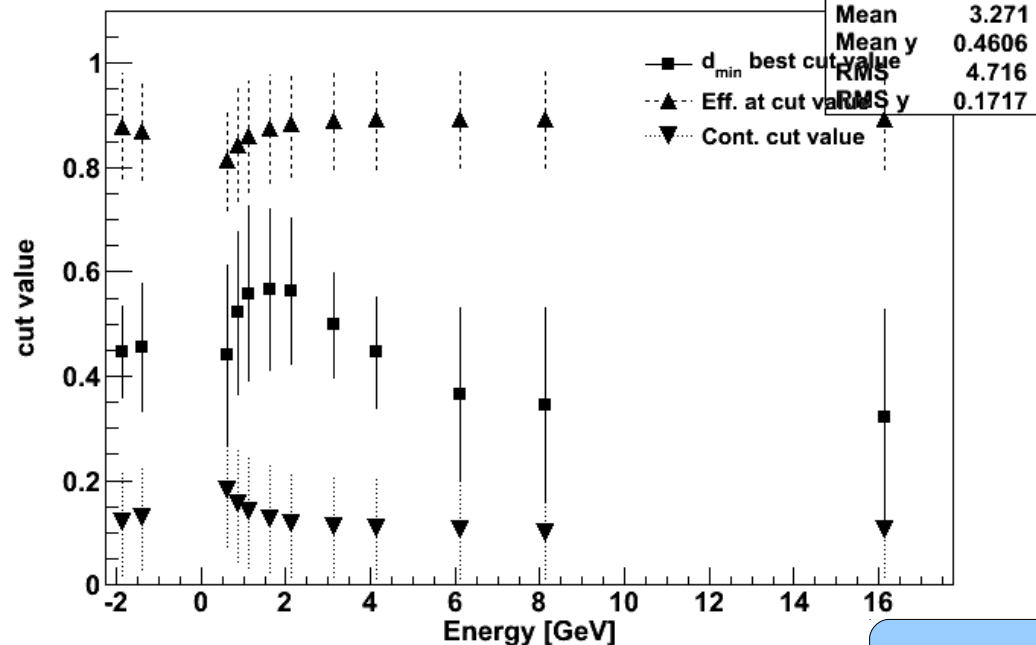
prof_minsquaredDistToOneOnePotion



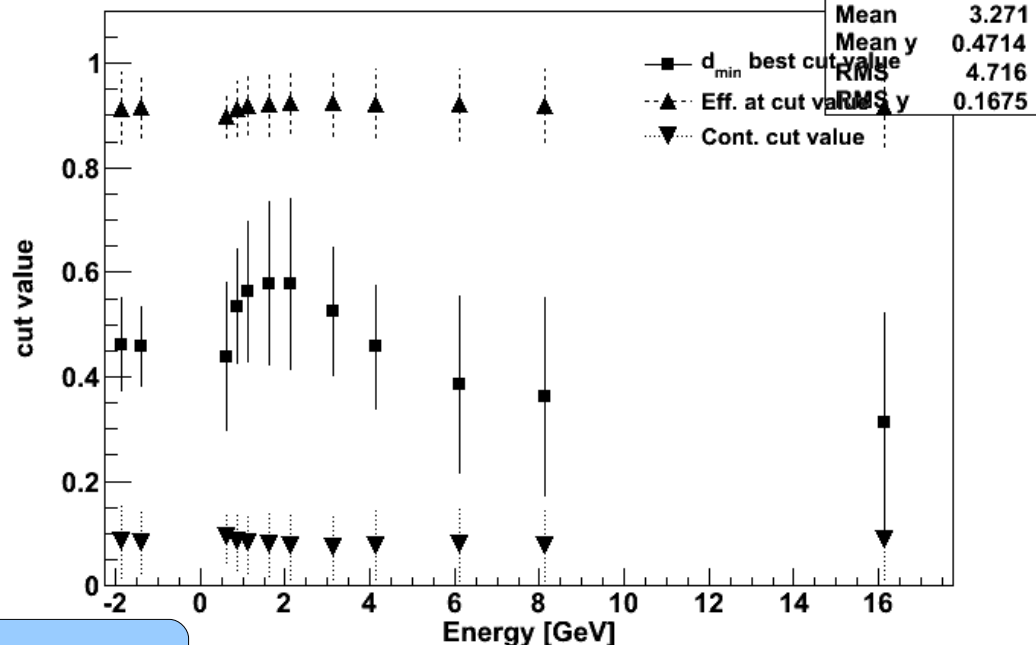
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

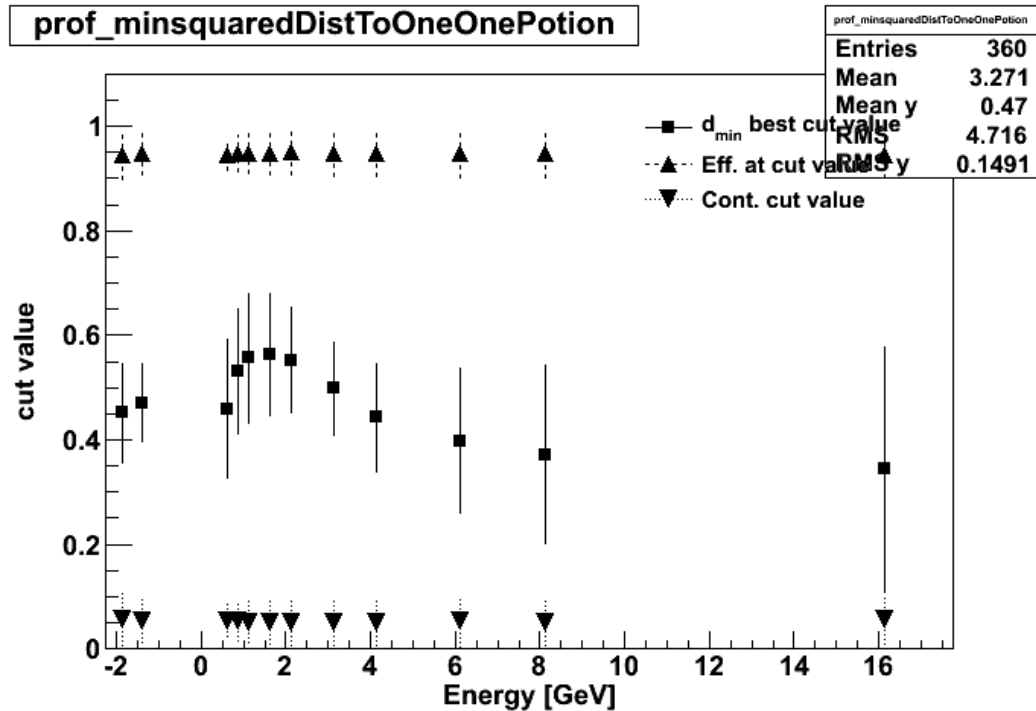


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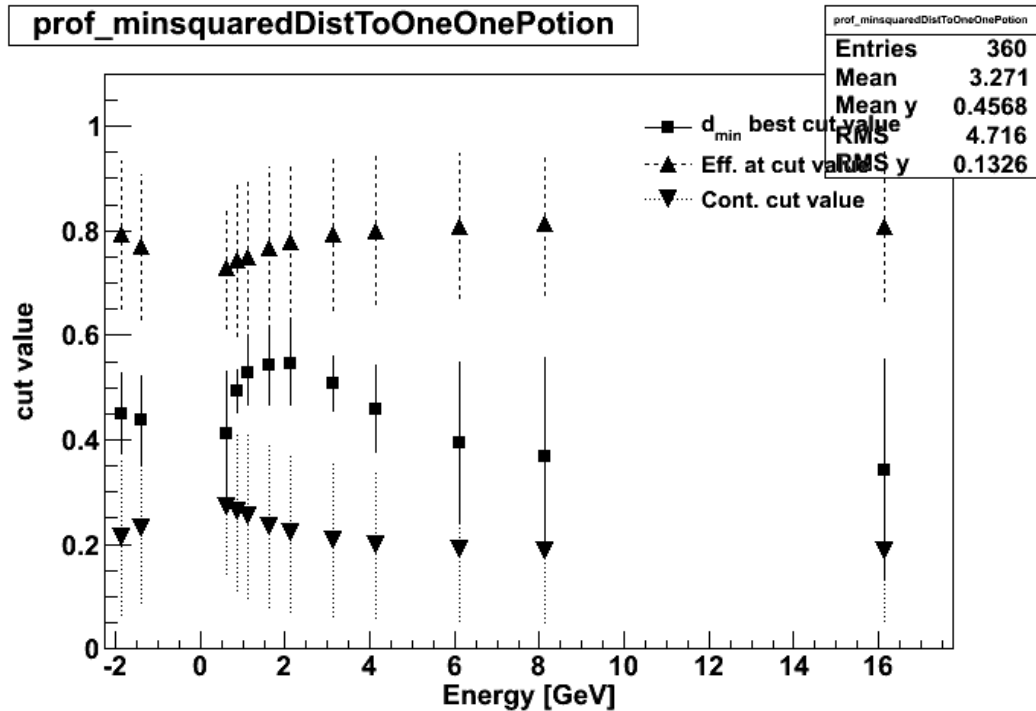


Npl=23

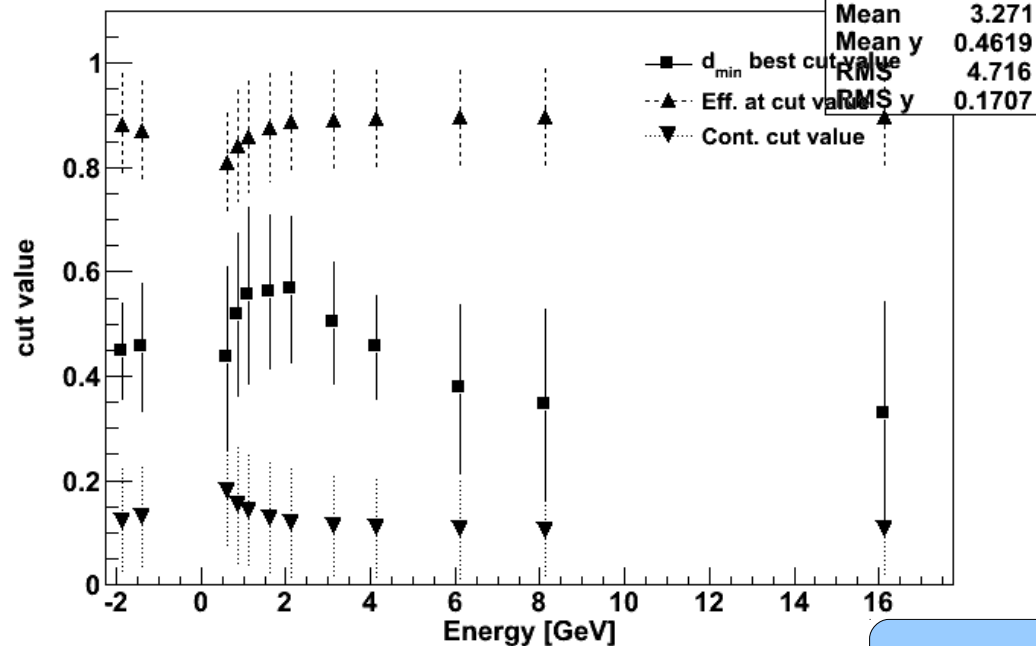
prof_minsquaredDistToOneOnePotion



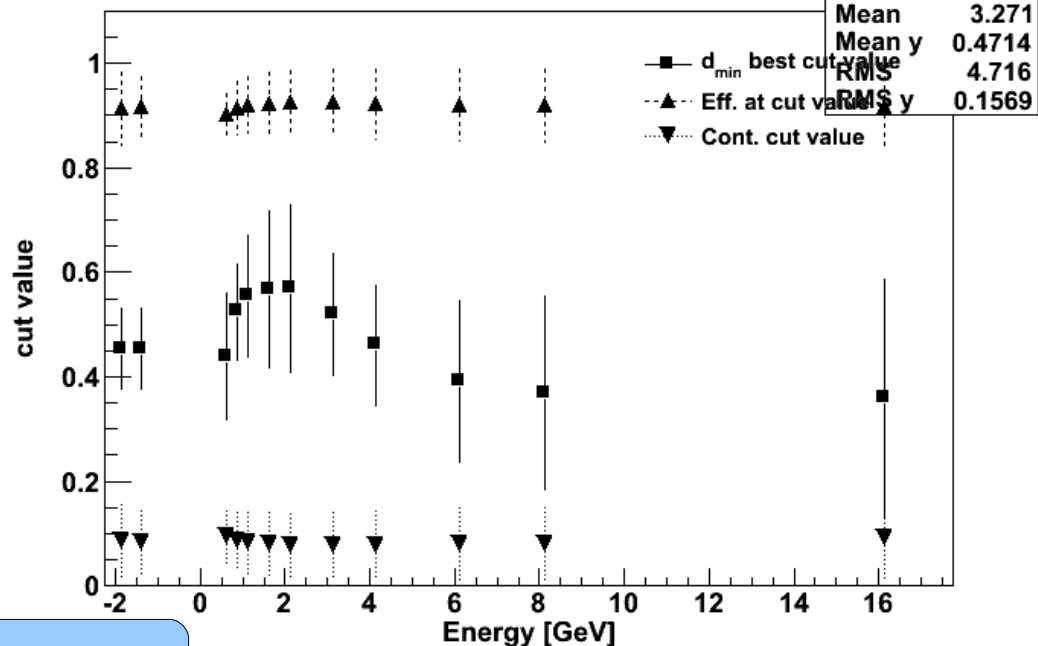
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

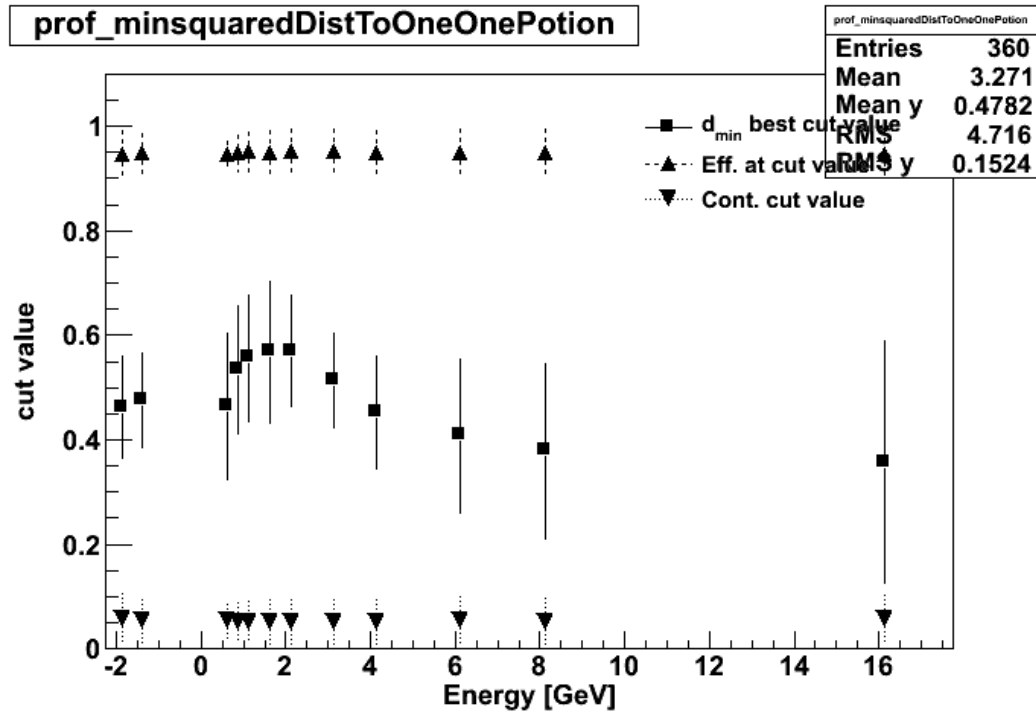


prof_minsquaredDistToOneOnePotion

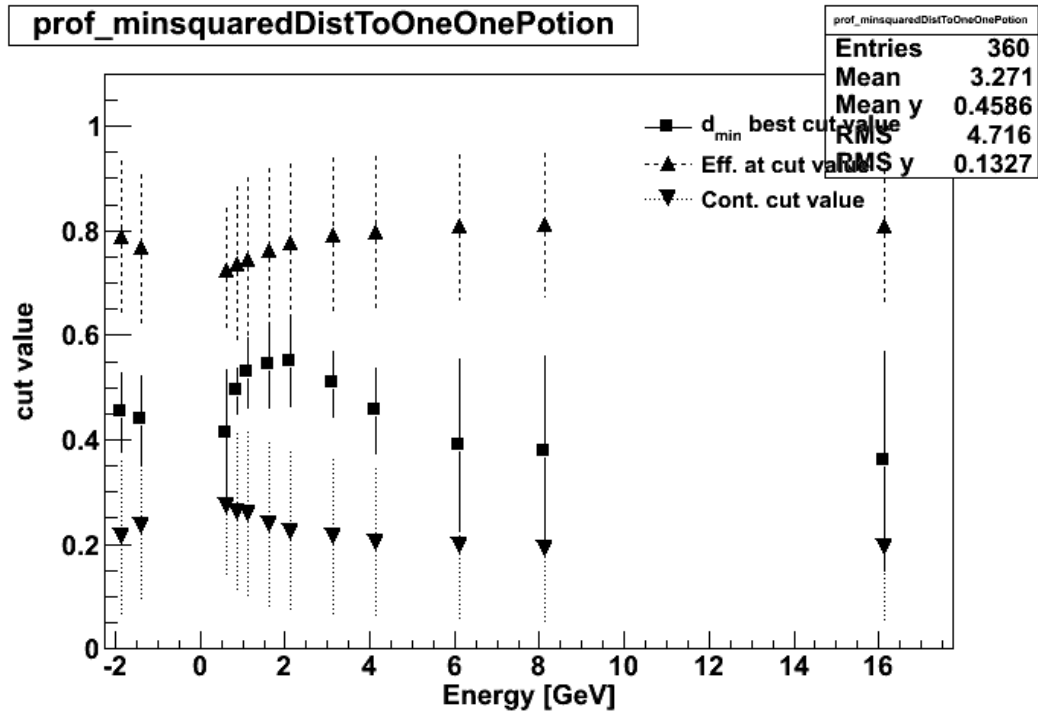


Npl=26

prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion



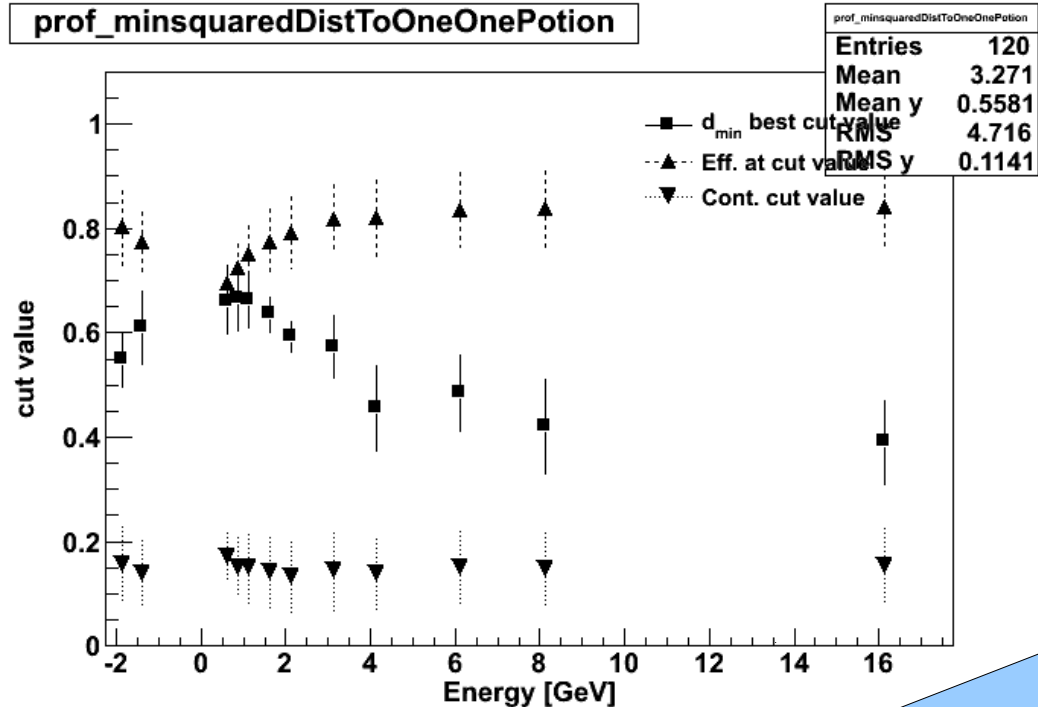
Now separated ID plots for:

Gamma-Electron
Electron-Pion
Pion-Gamma

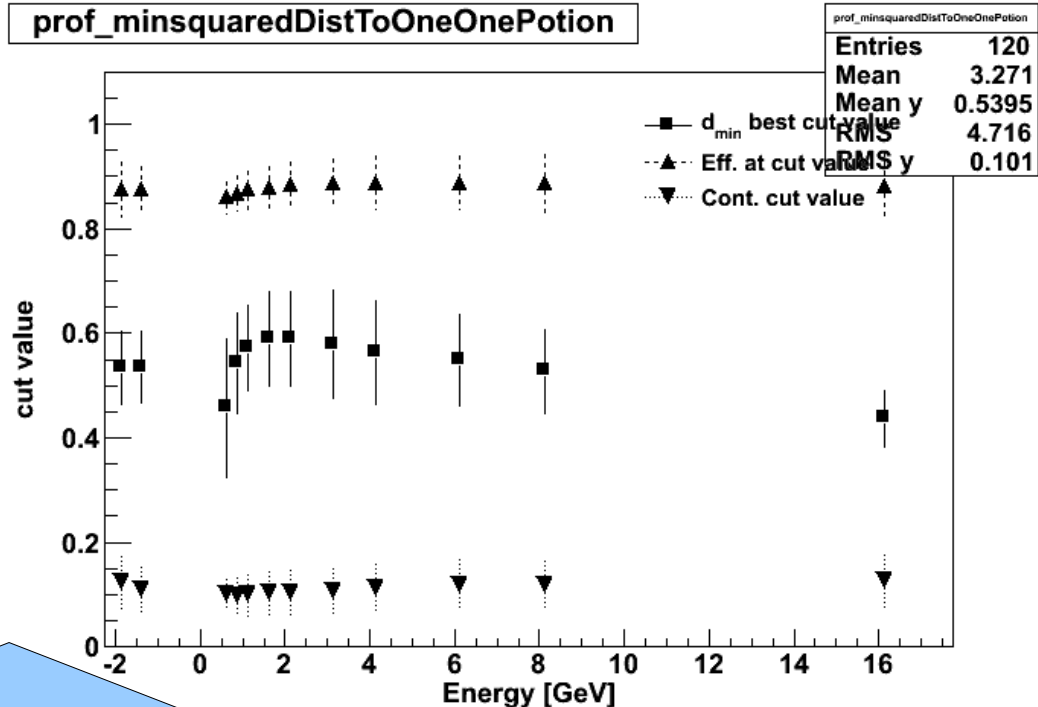
N.B.: dmin cutvalues for separation on e_g, pi_e, g_pi are obtained by substituting dmin: $dmin(e_g) = 1 - dmin(g_e)$

Now
gamma_electron

prof_minsquaredDistToOneOnePotion

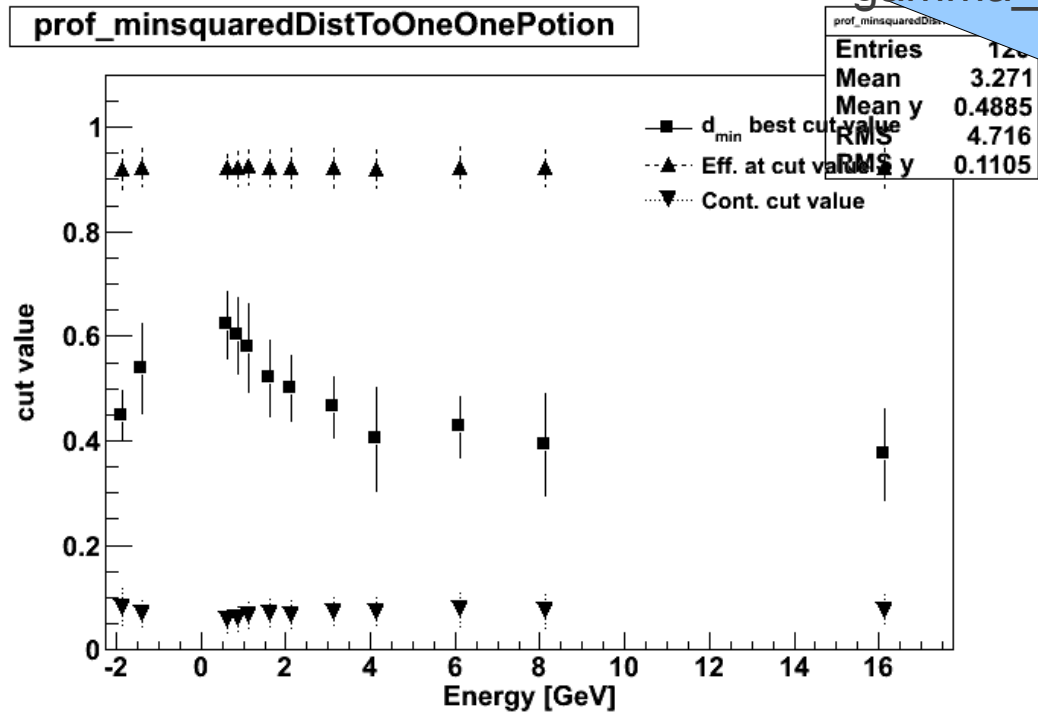


prof_minsquaredDistToOneOnePotion

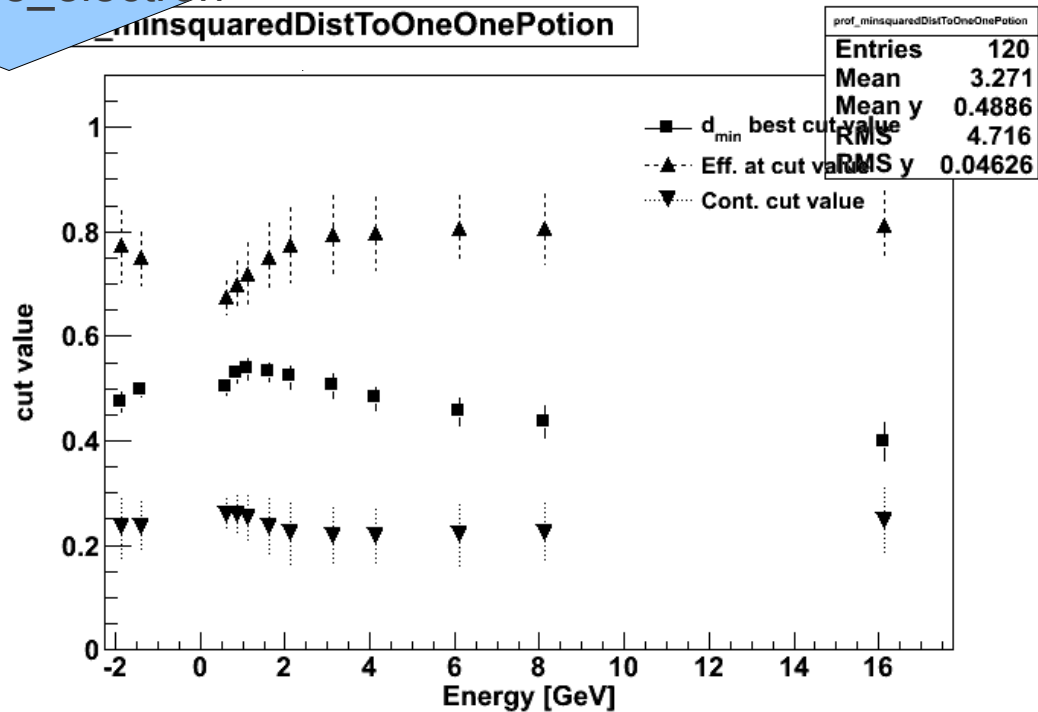


Npl=10
gamma_vs_electron

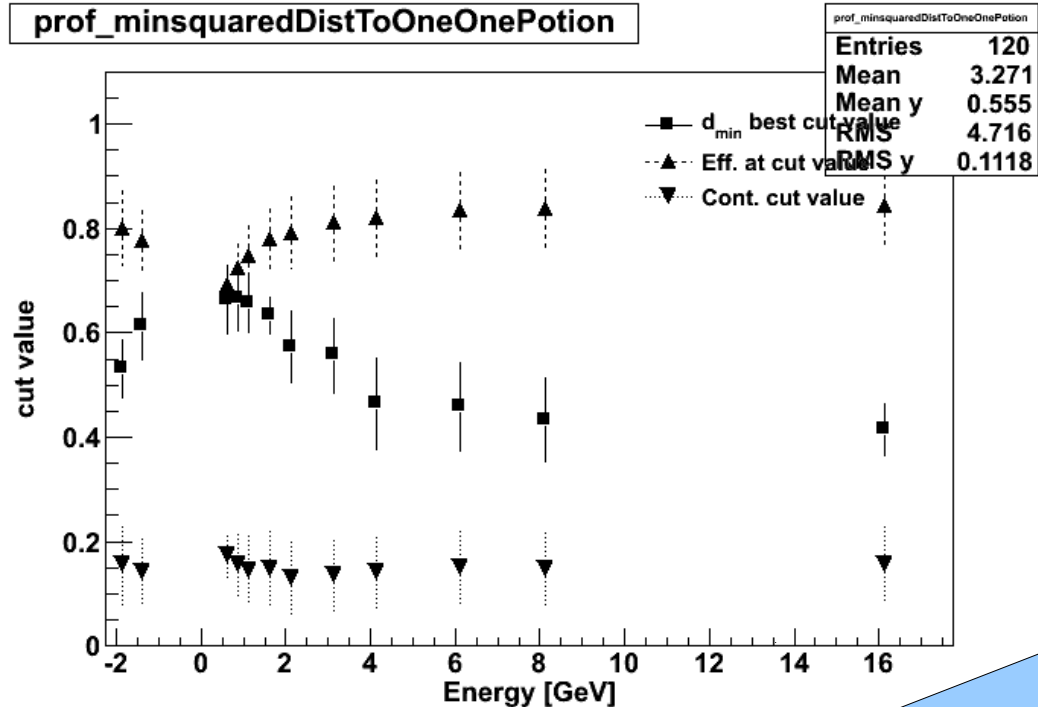
prof_minsquaredDistToOneOnePotion



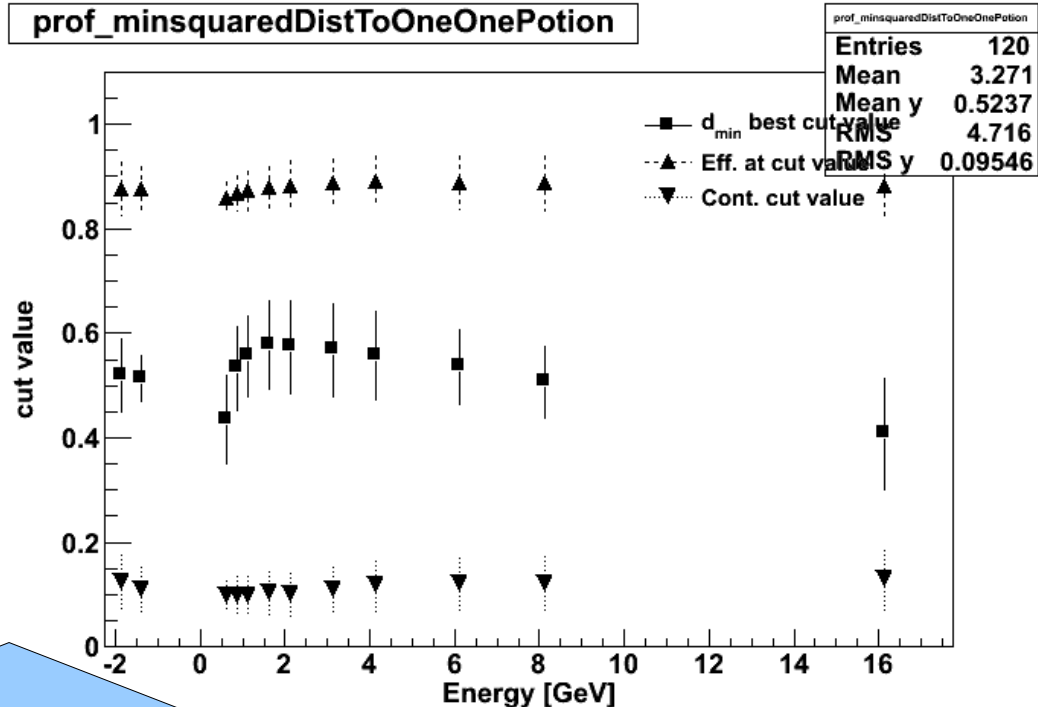
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

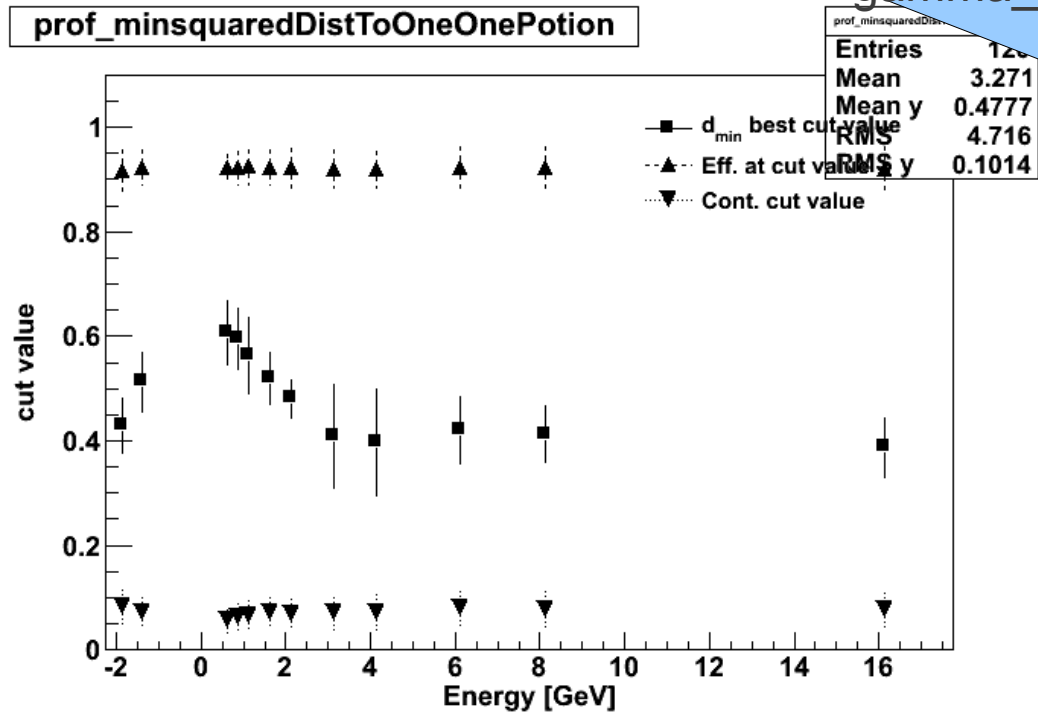


prof_minsquaredDistToOneOnePotion

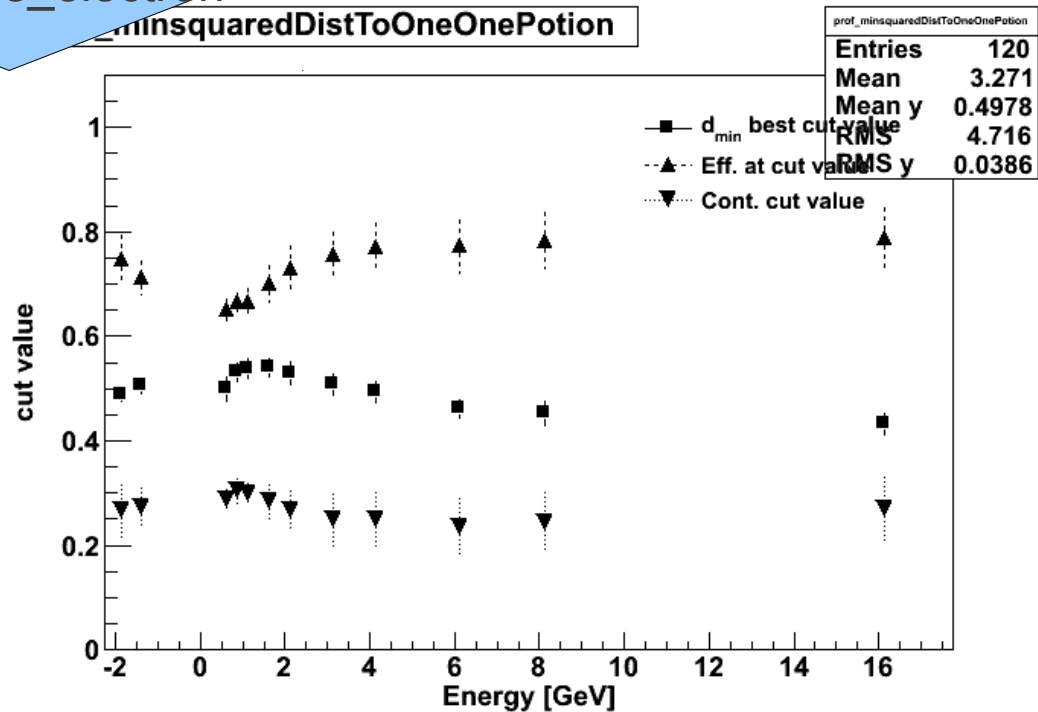


Npl=14
gamma_vs_electron

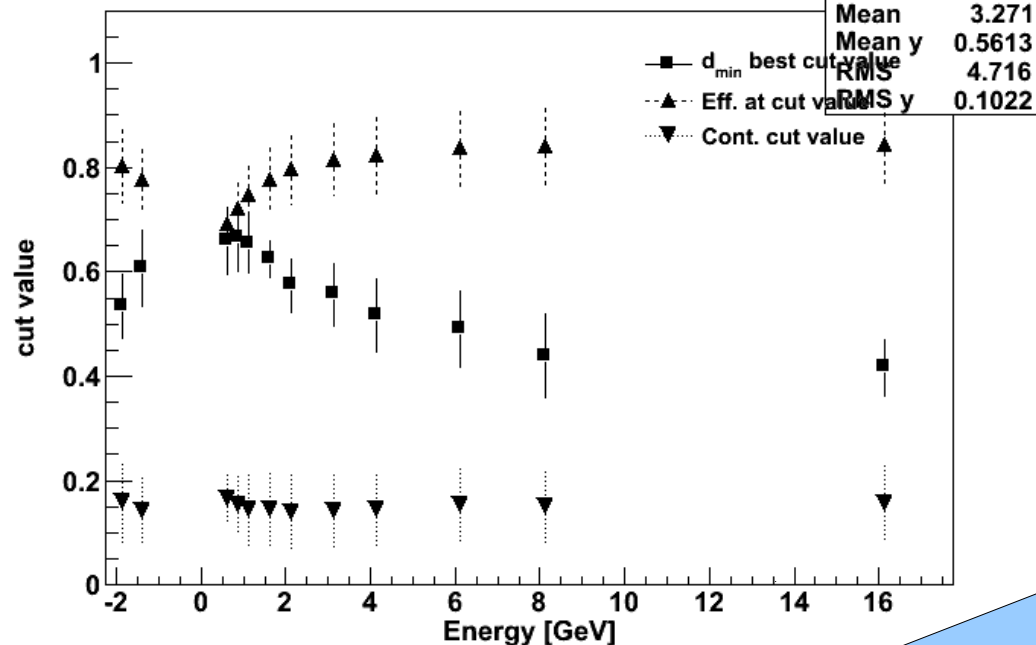
prof_minsquaredDistToOneOnePotion



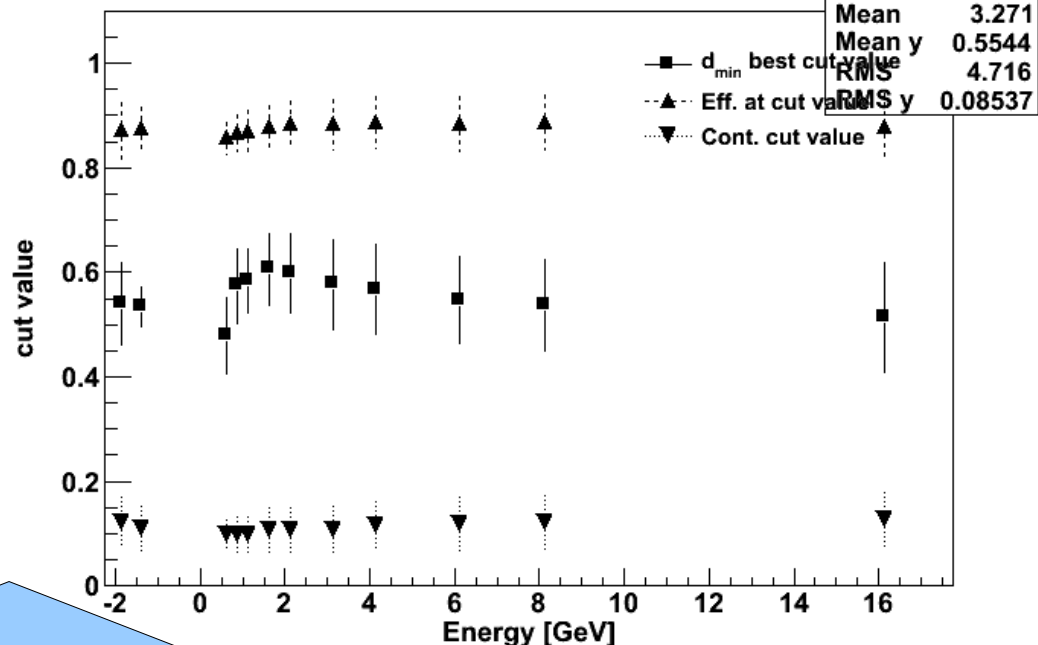
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

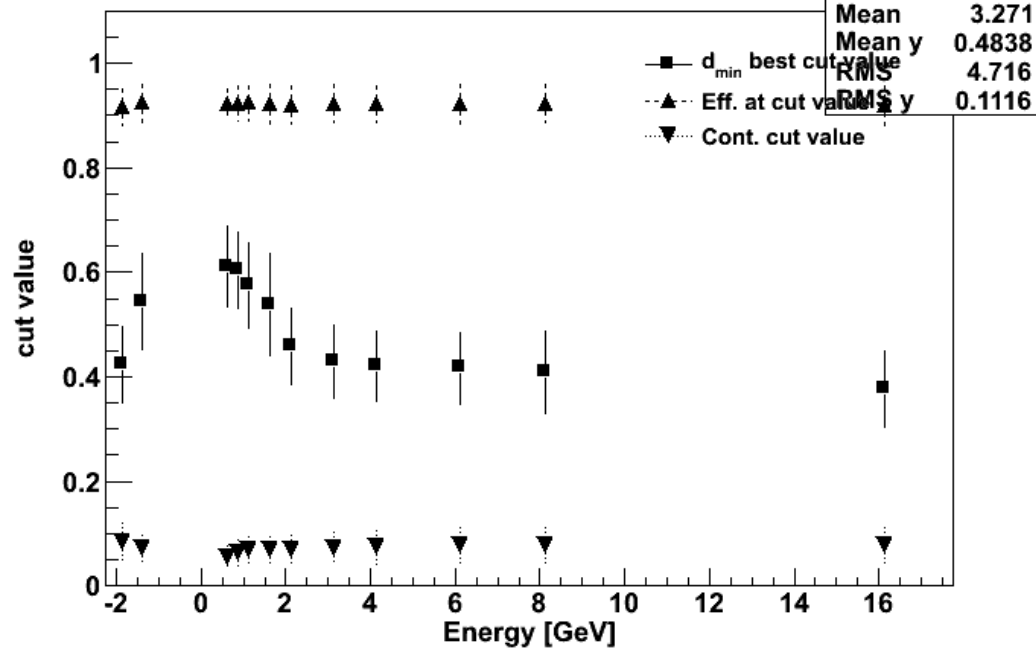


prof_minsquaredDistToOneOnePotion

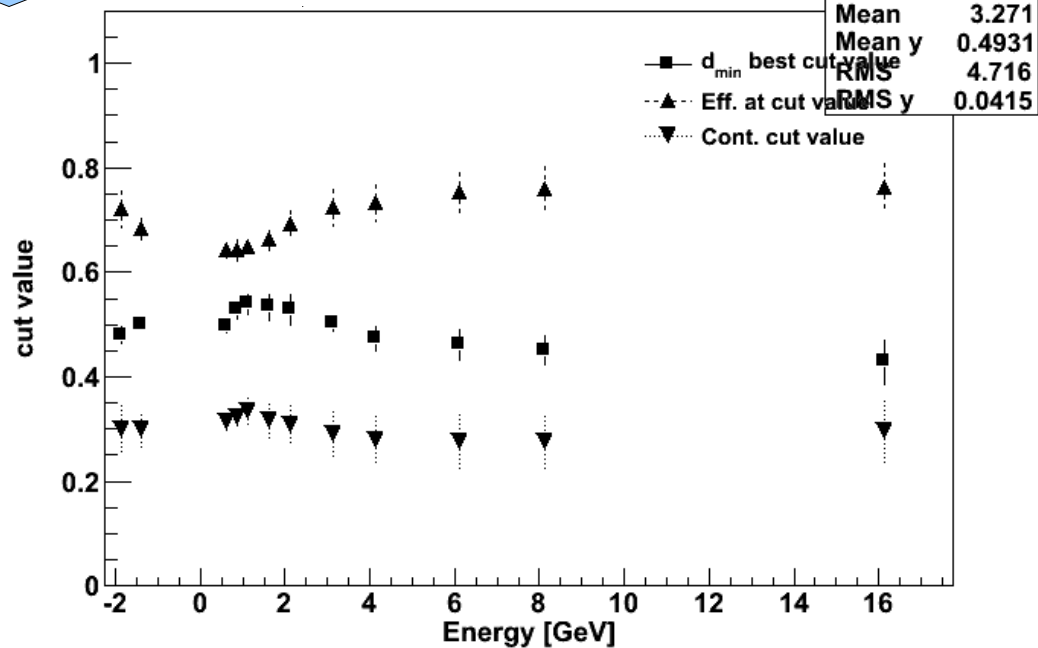


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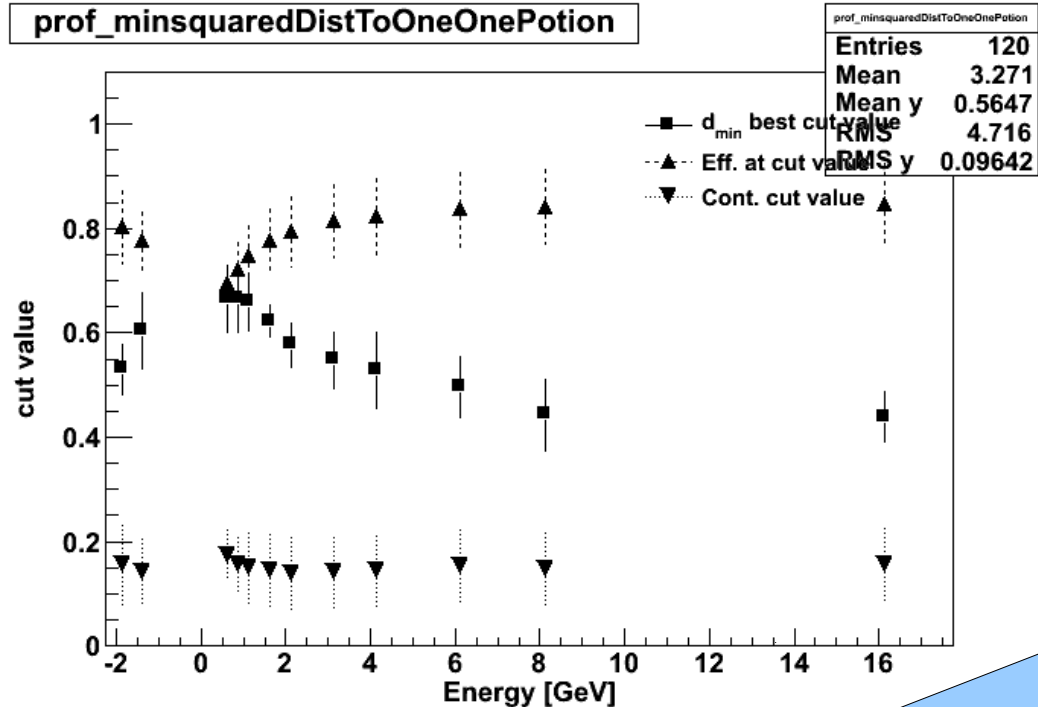
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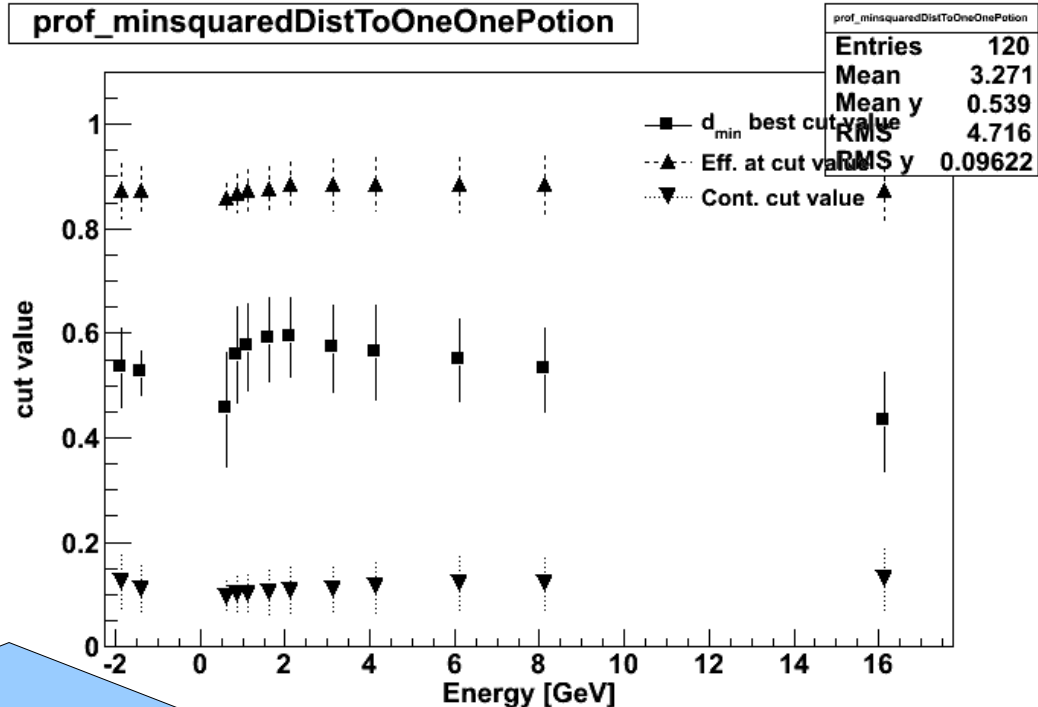
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

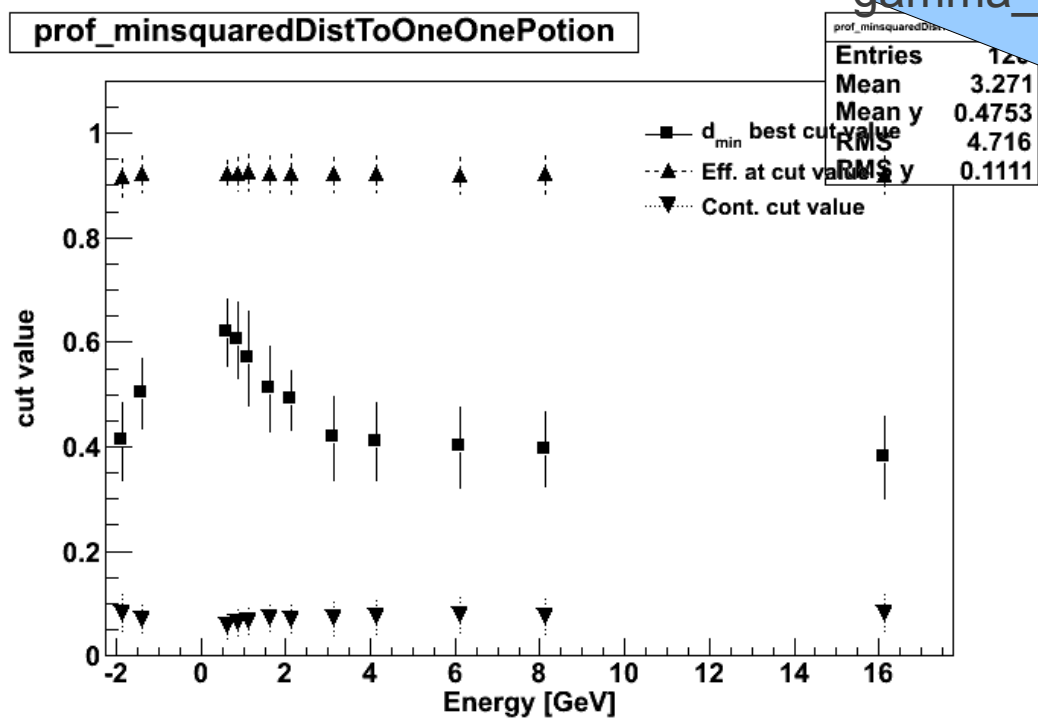


prof_minsquaredDistToOneOnePotion

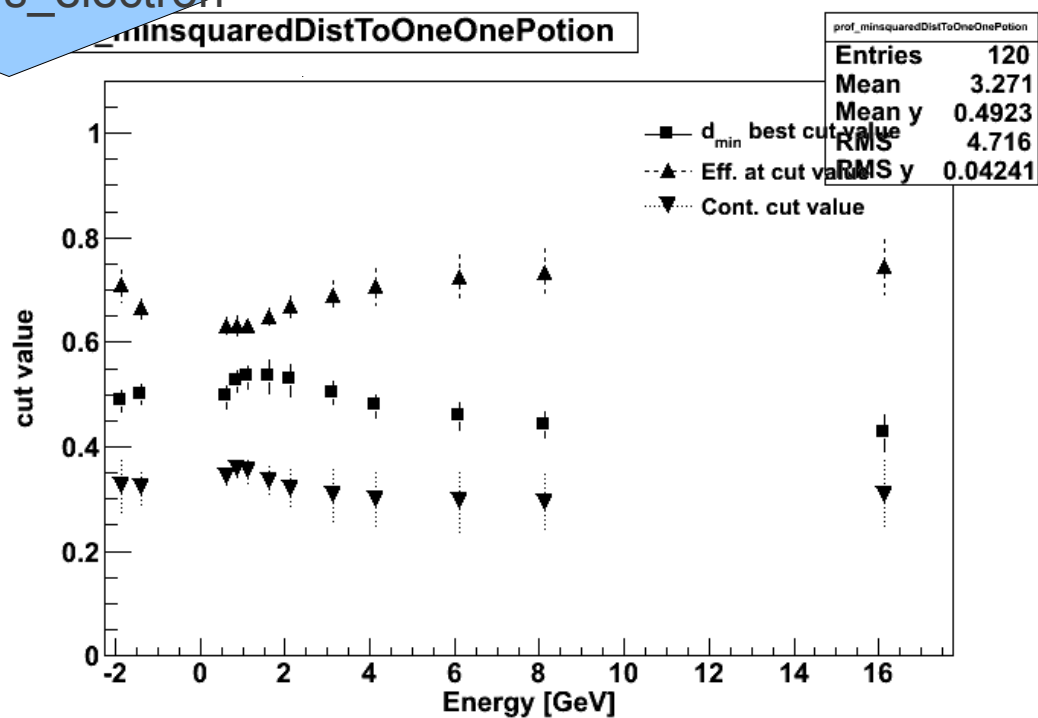


Npl=23
gamma_vs_electron

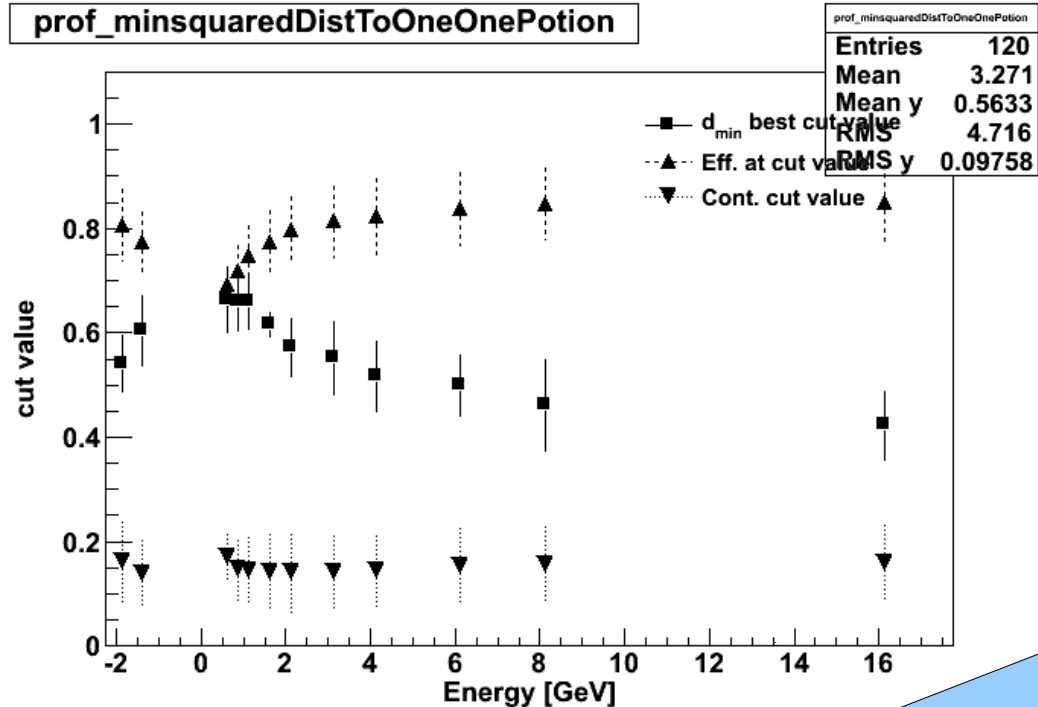
prof_minsquaredDistToOneOnePotion



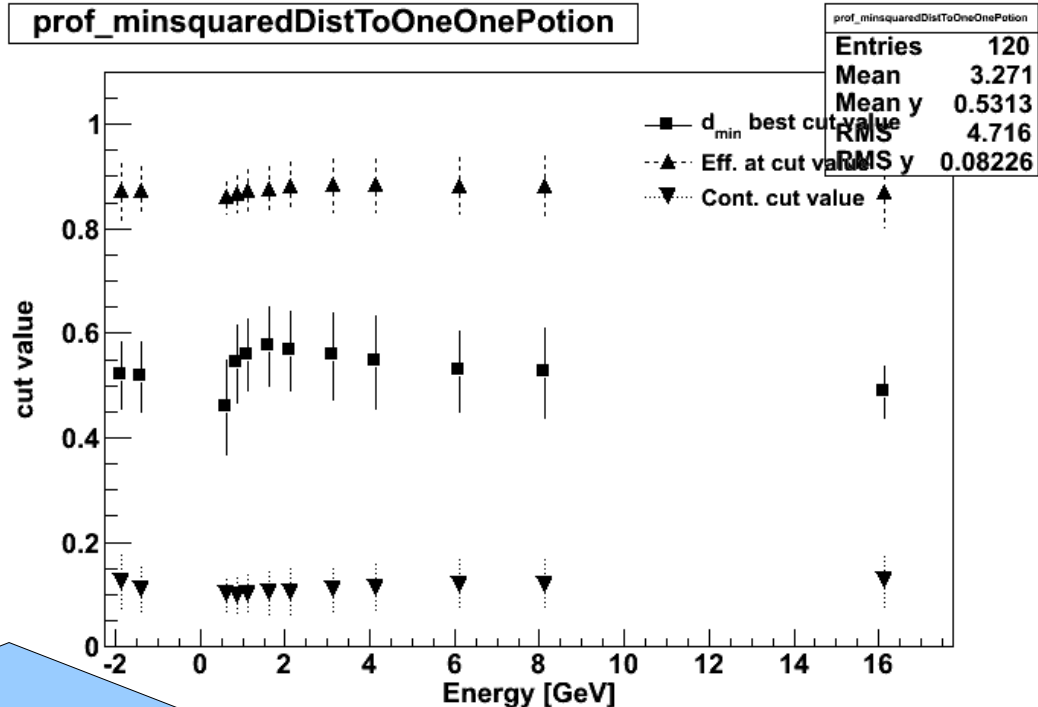
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

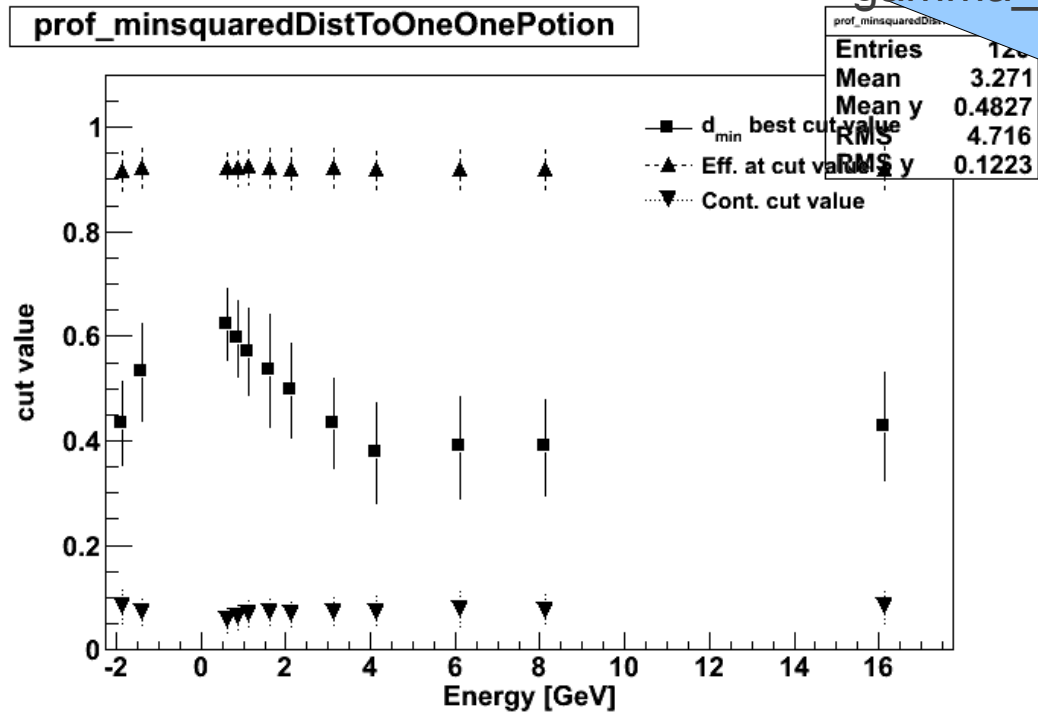


prof_minsquaredDistToOneOnePotion

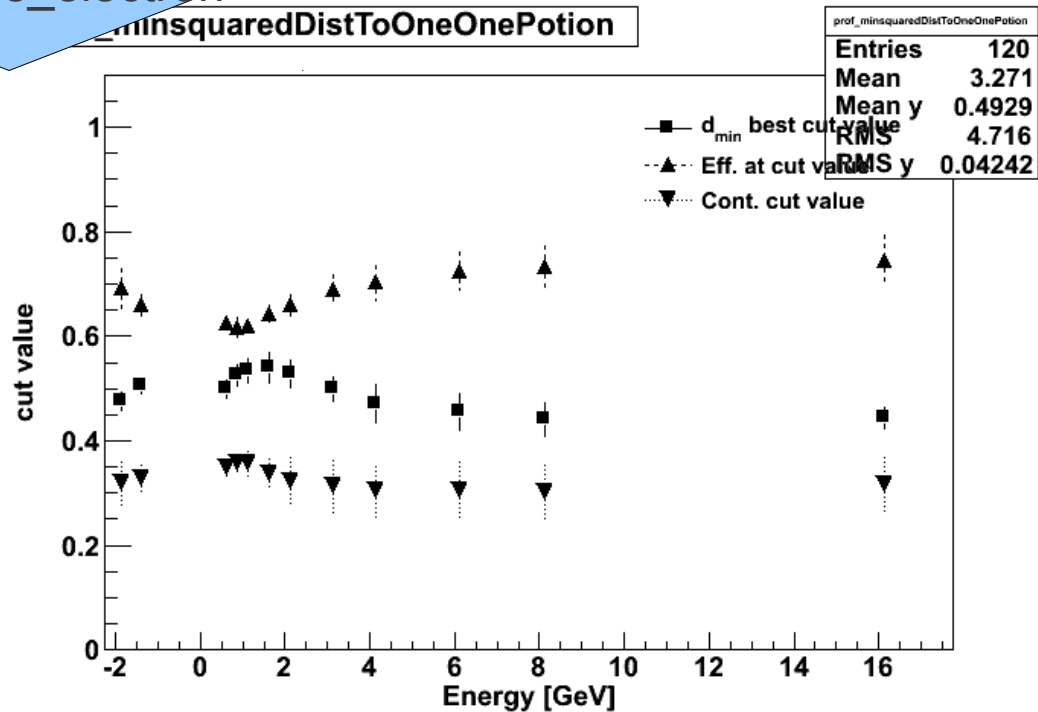


Npl=26
gamma_vs_electron

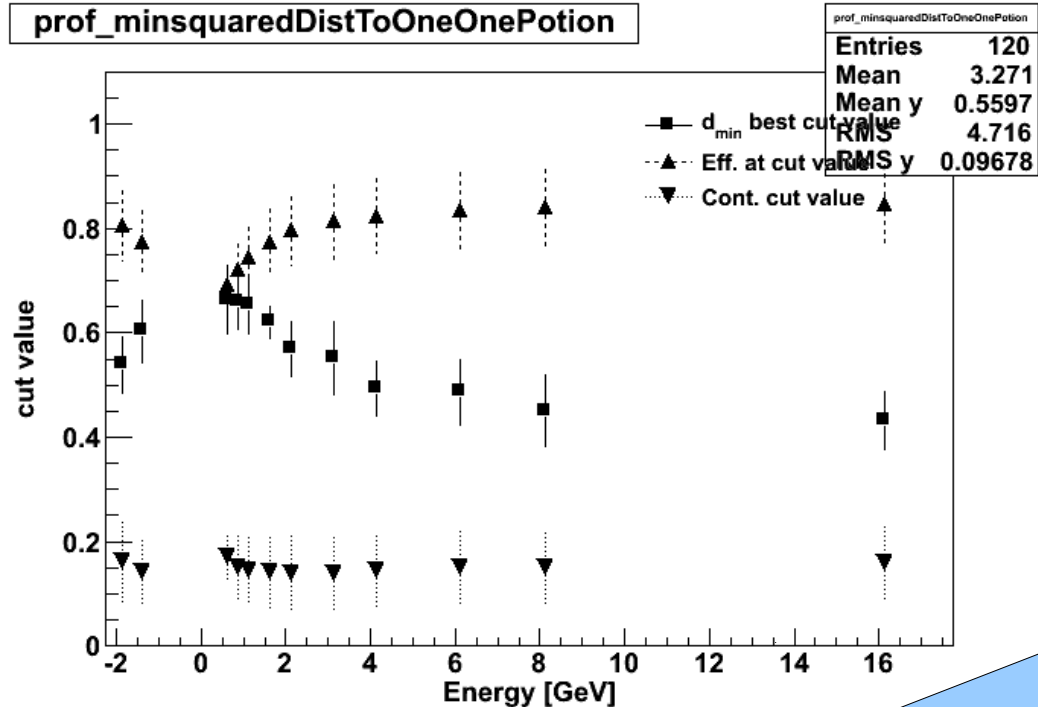
prof_minsquaredDistToOneOnePotion



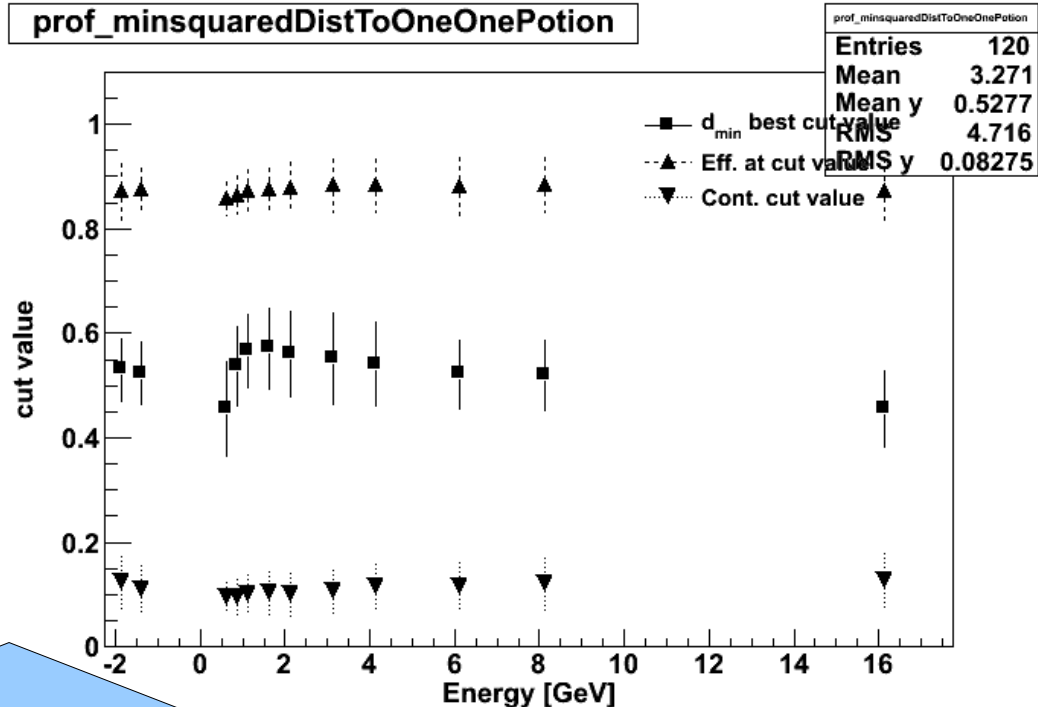
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

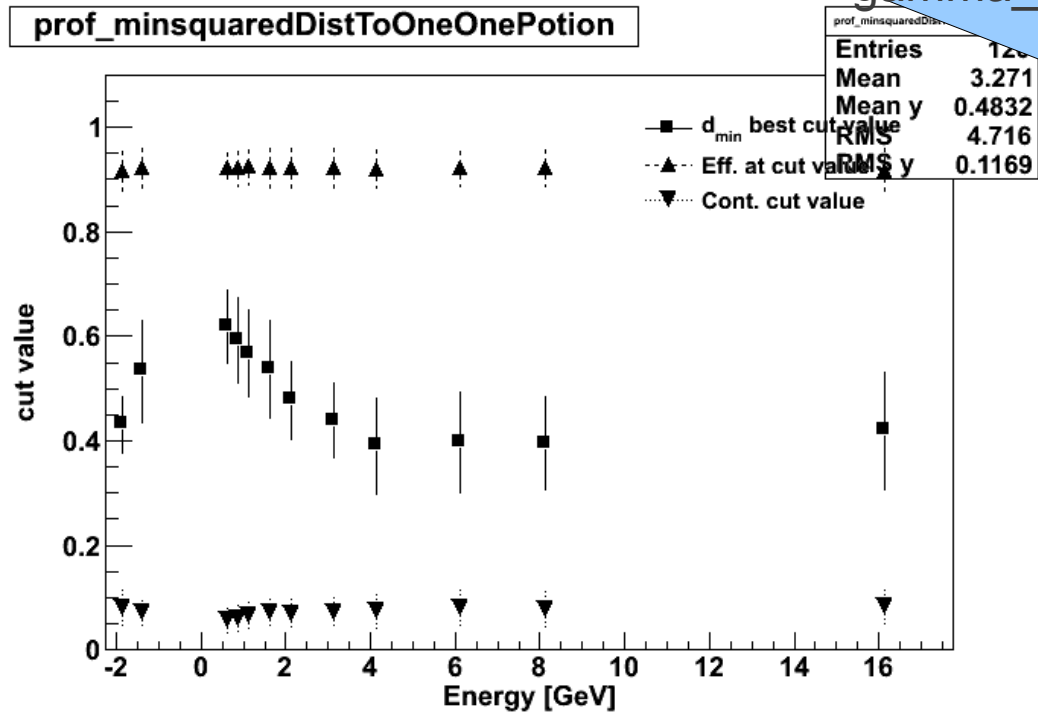


prof_minsquaredDistToOneOnePotion

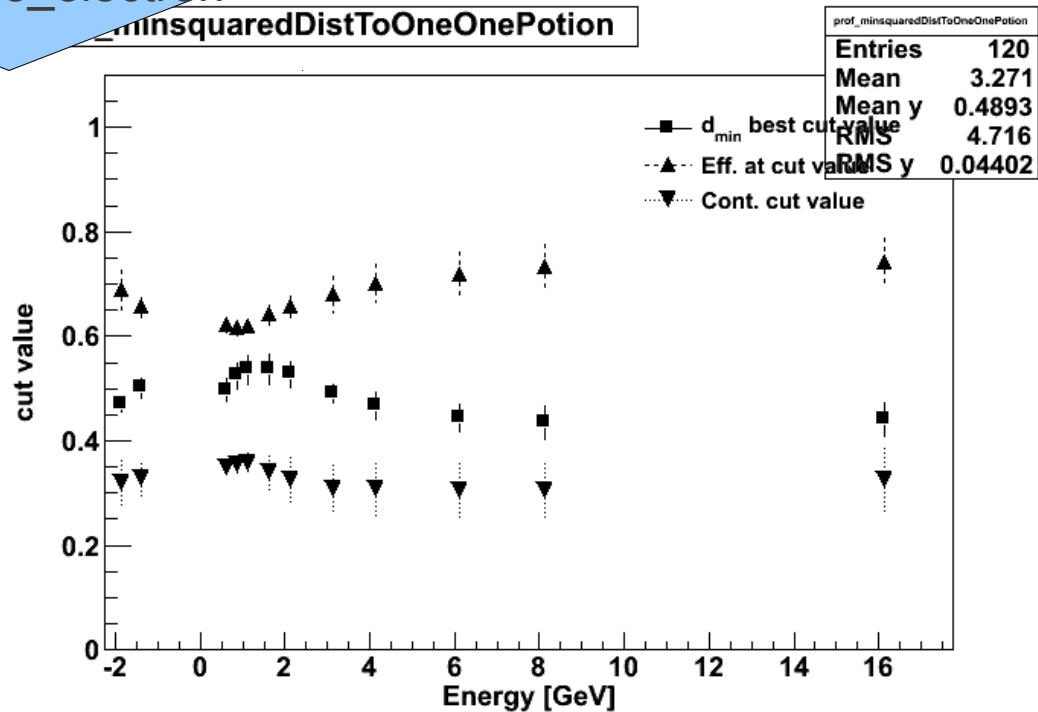


Npl=29
gamma_vs_electron

prof_minsquaredDistToOneOnePotion

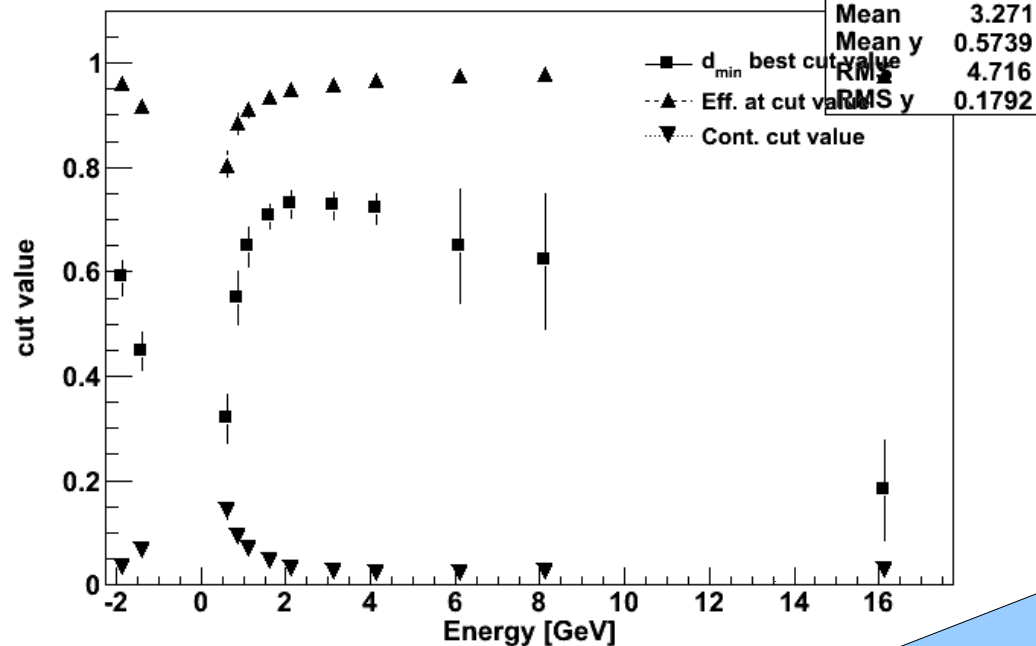


prof_minsquaredDistToOneOnePotion

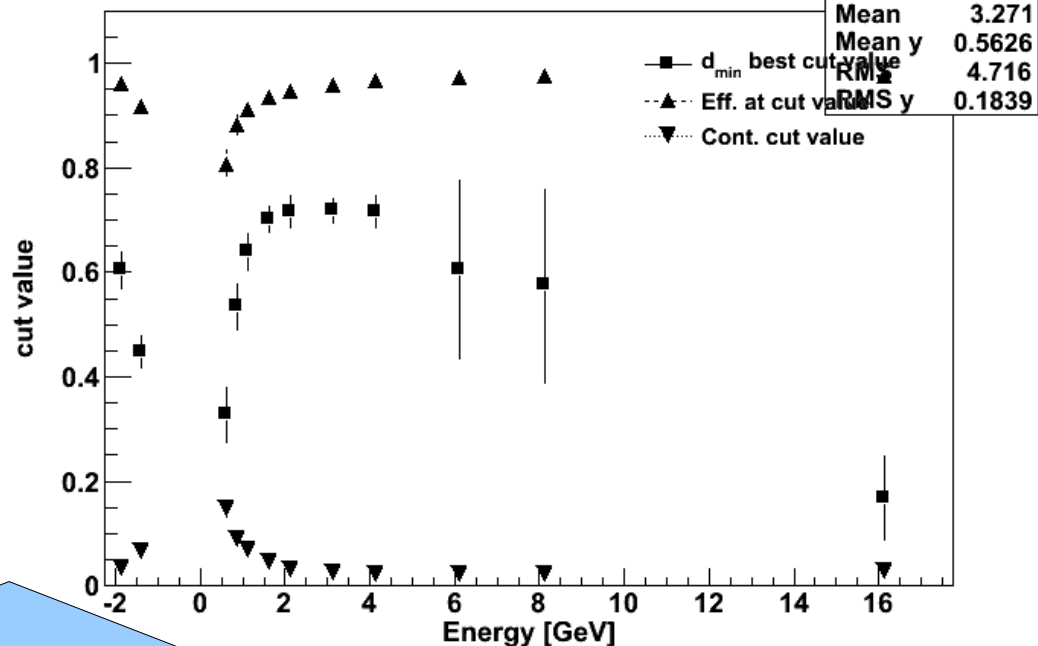


Now
electron_pion

prof_minsquaredDistToOneOnePotion

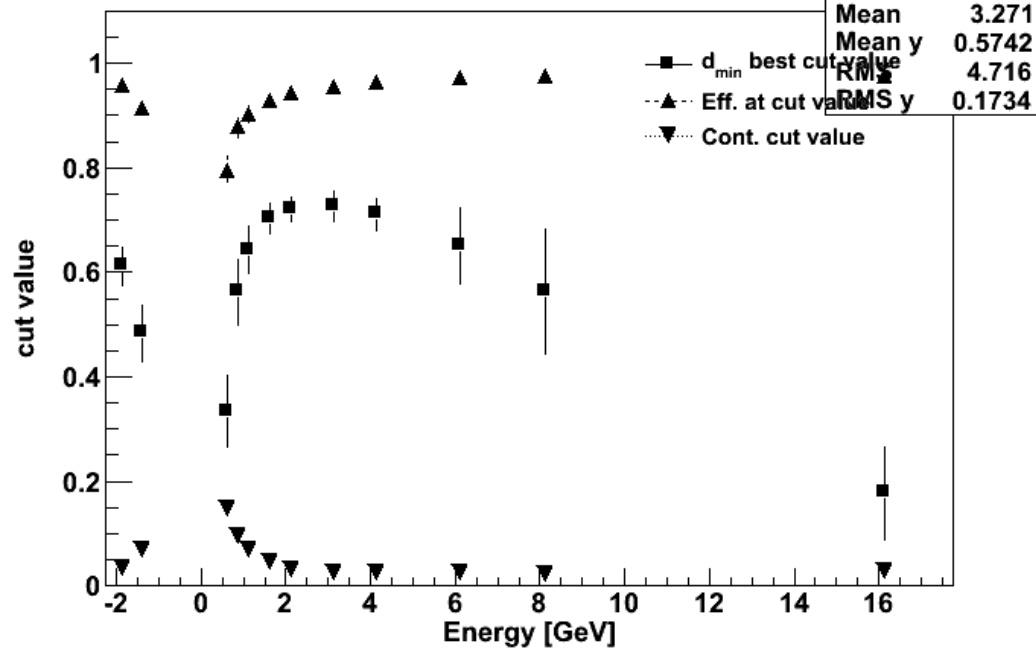


prof_minsquaredDistToOneOnePotion

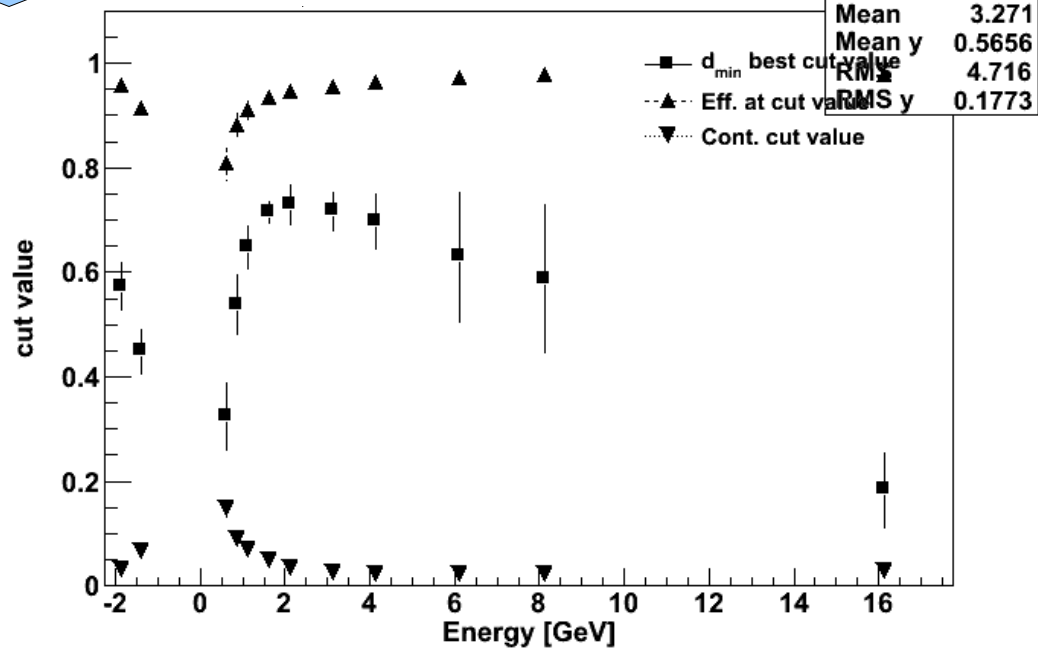


Npl=10
electron_vs_pion

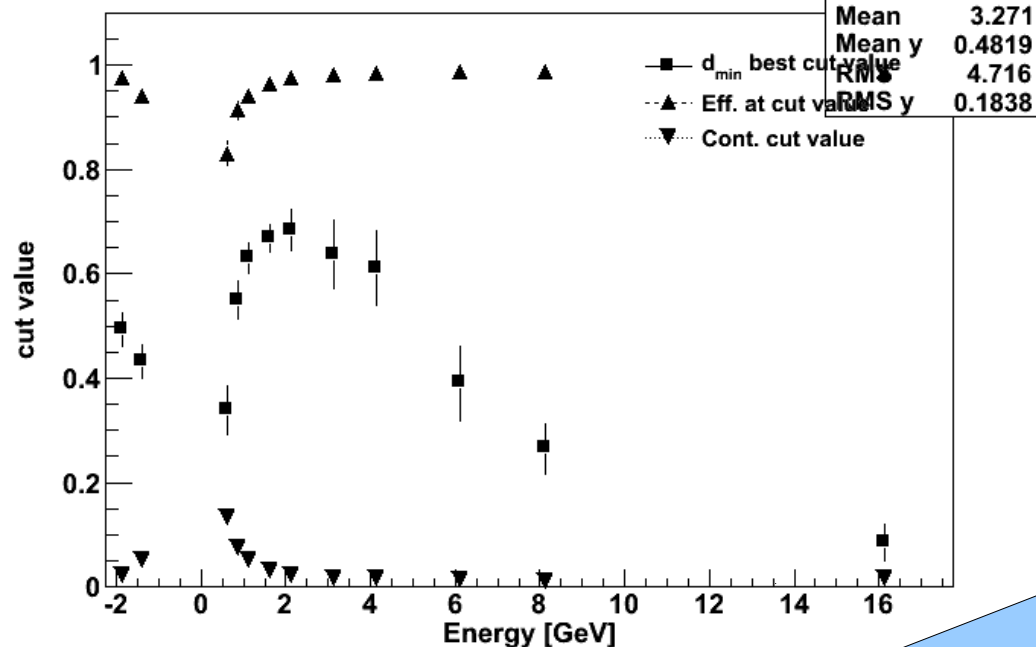
prof_minsquaredDistToOneOnePotion



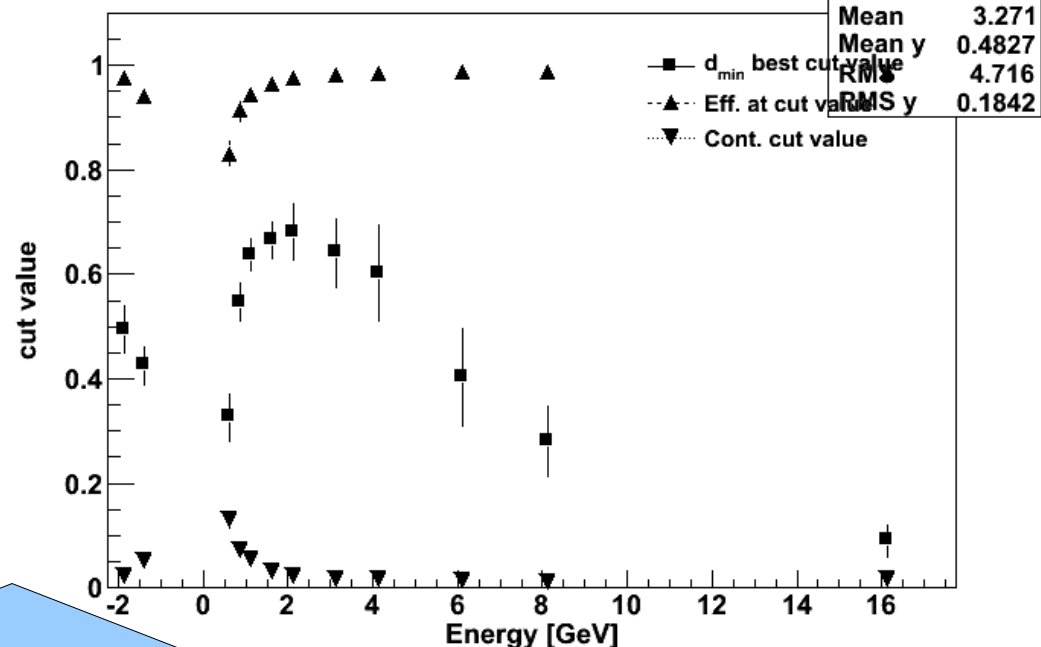
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

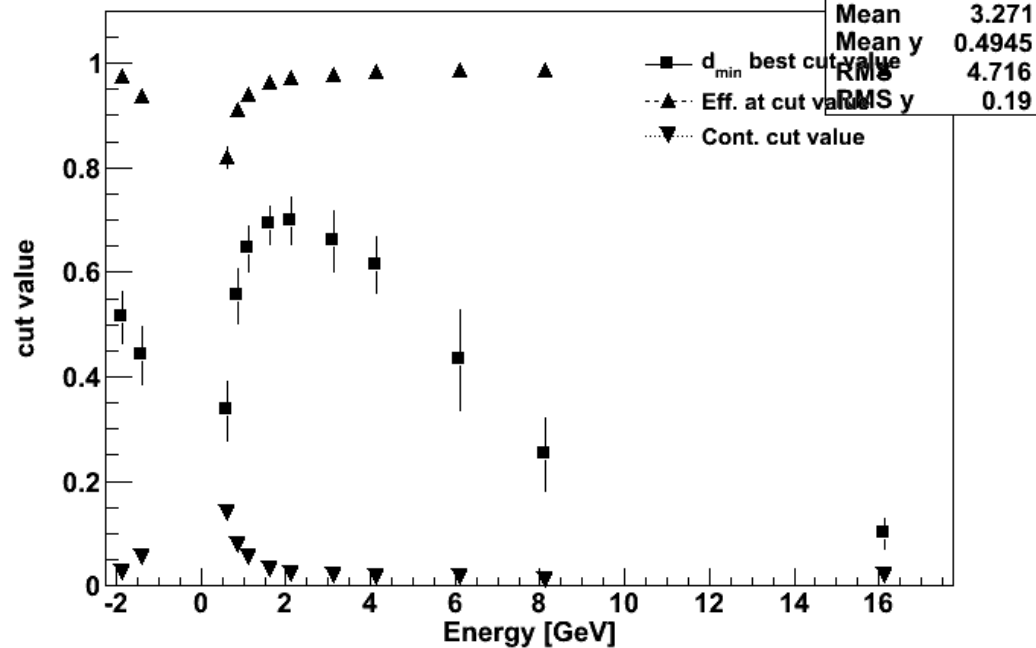


prof_minsquaredDistToOneOnePotion

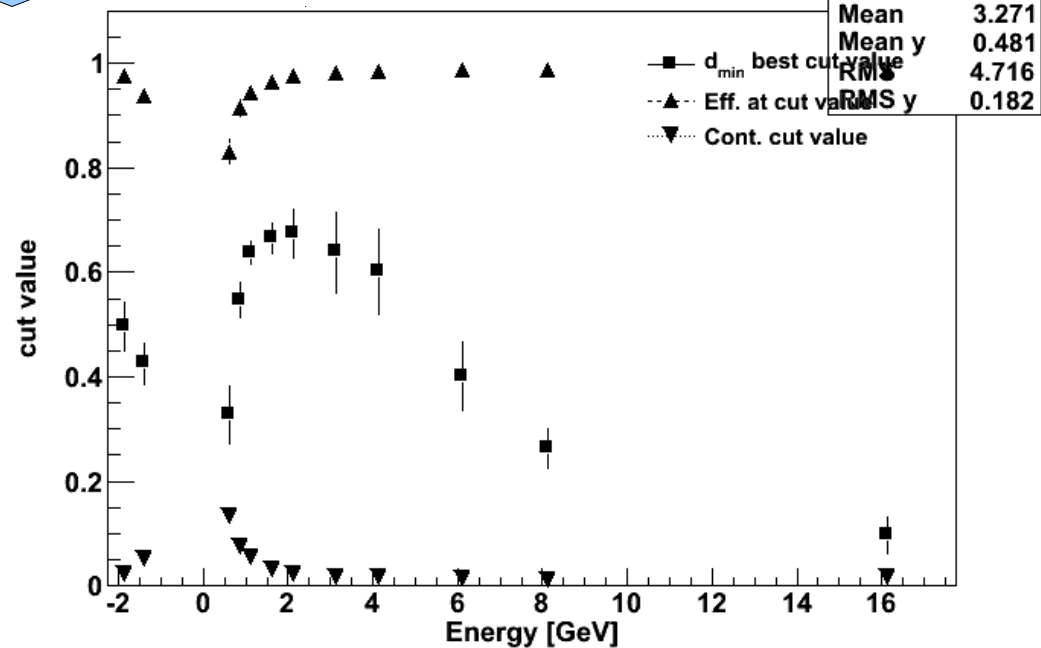


Npl=14
electron_vs_pion

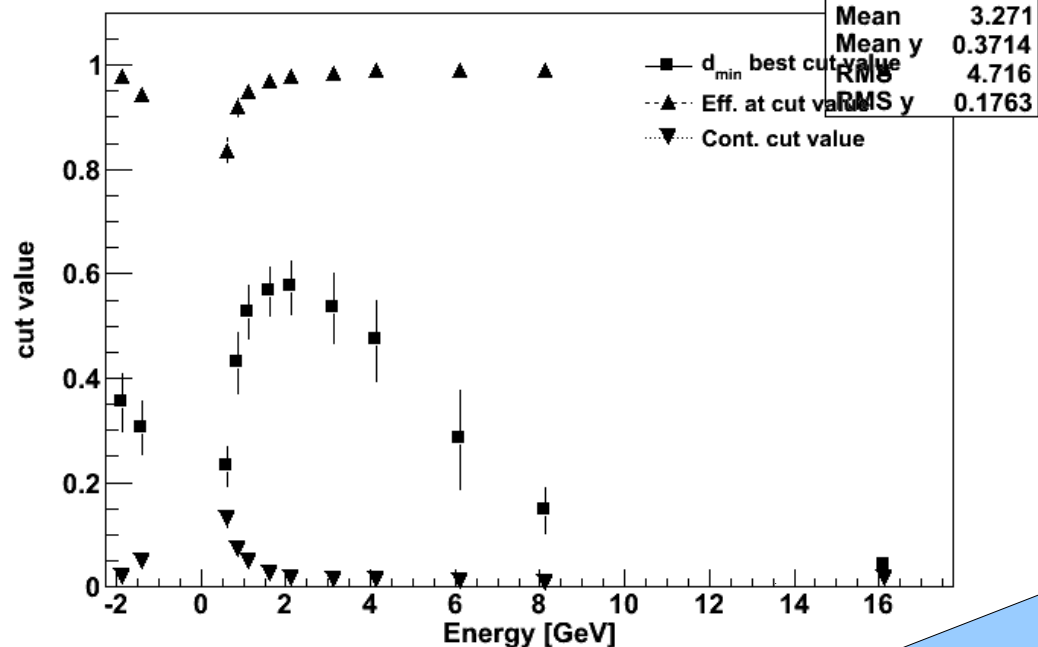
prof_minsquaredDistToOneOnePotion



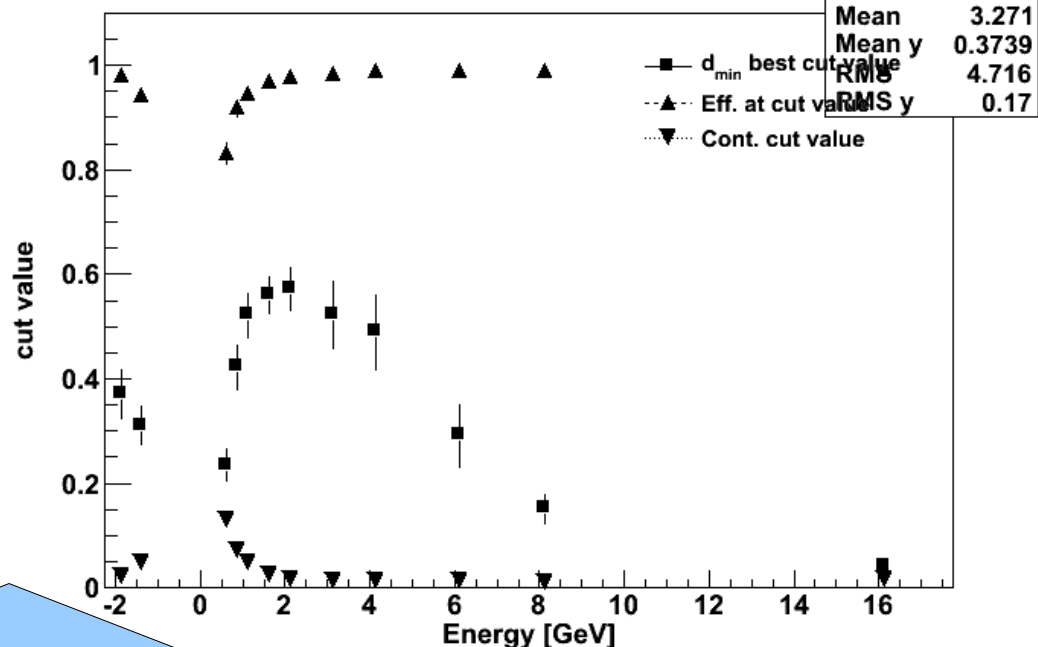
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

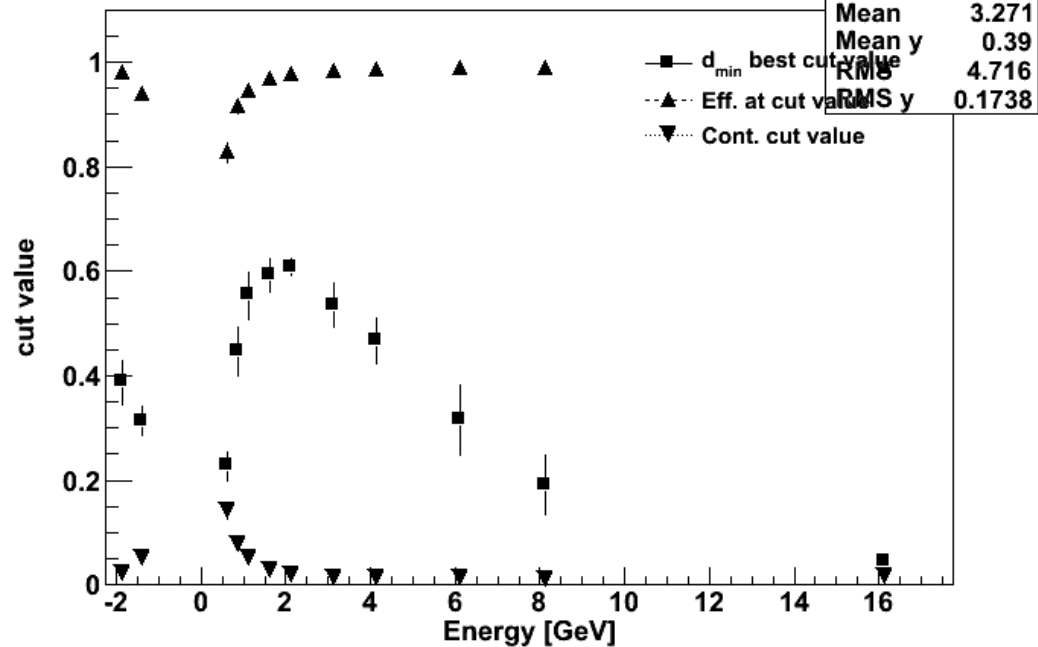


prof_minsquaredDistToOneOnePotion

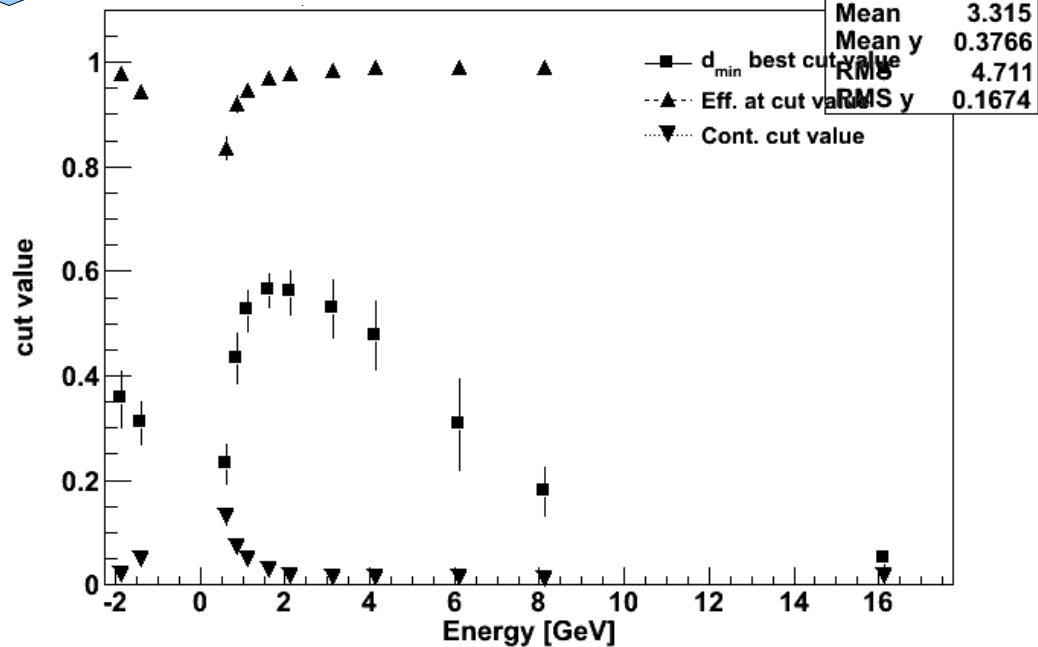


Npl=18
electron_vs_pion

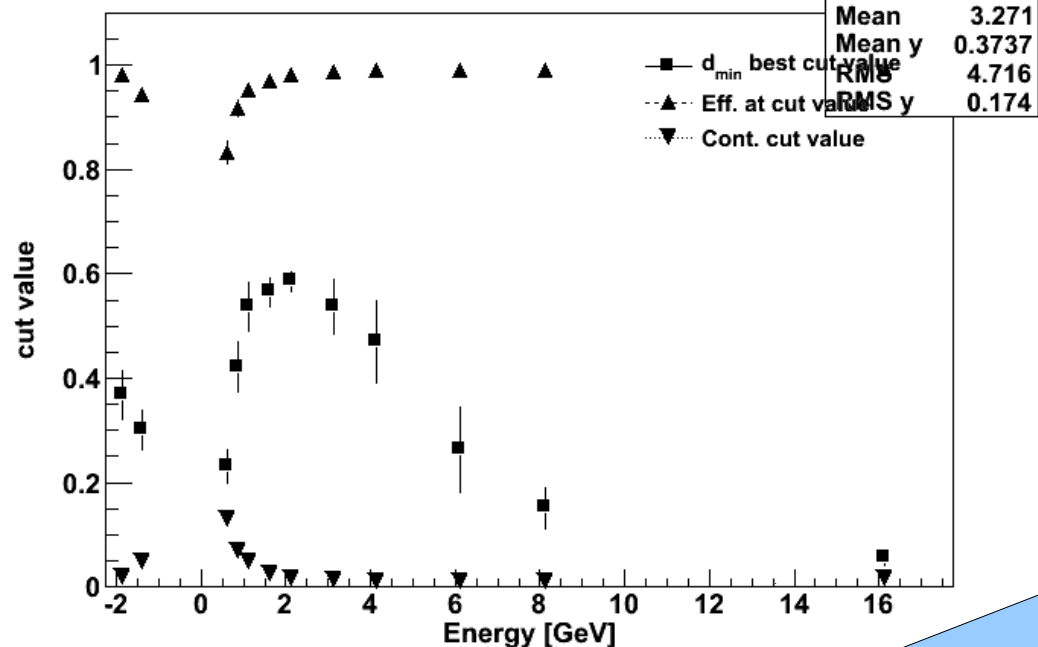
prof_minsquaredDistToOneOnePotion



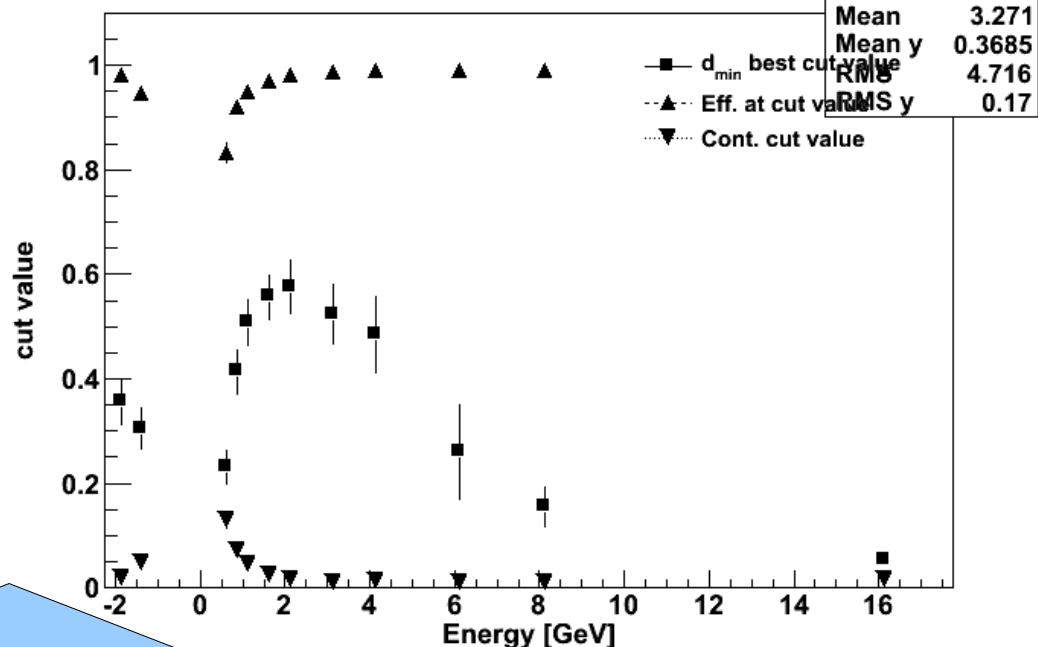
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

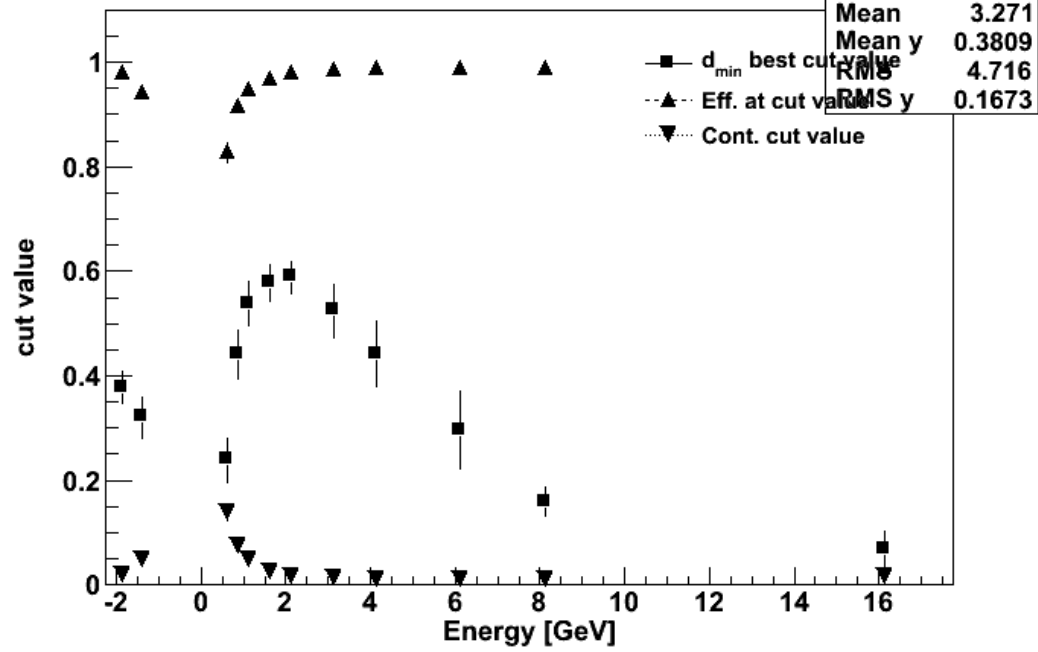


prof_minsquaredDistToOneOnePotion

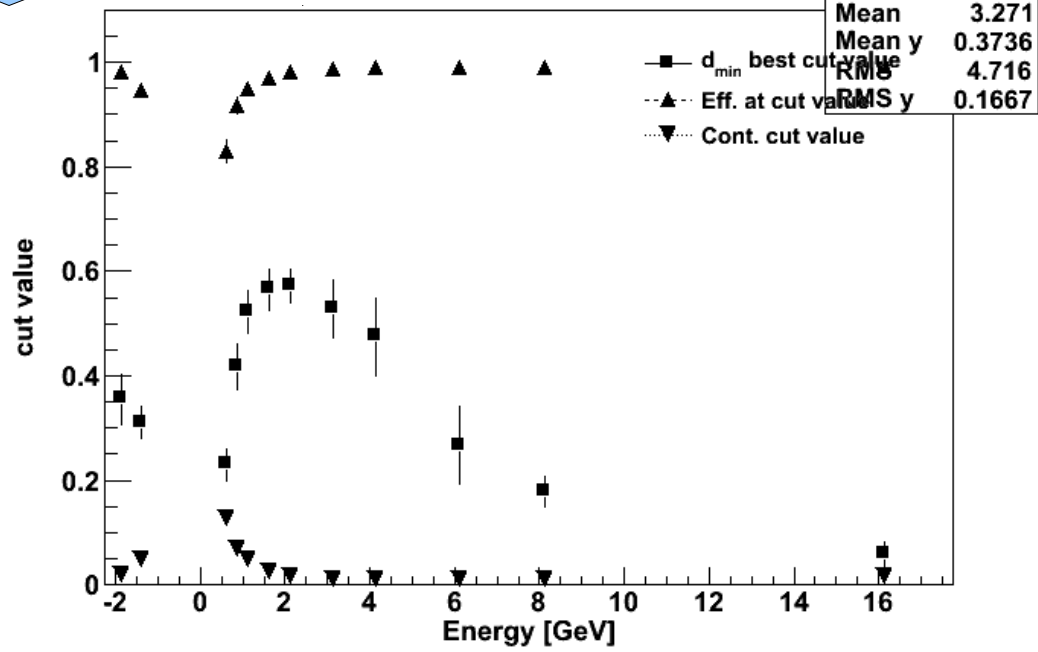


Npl=23
electron_vs_pion

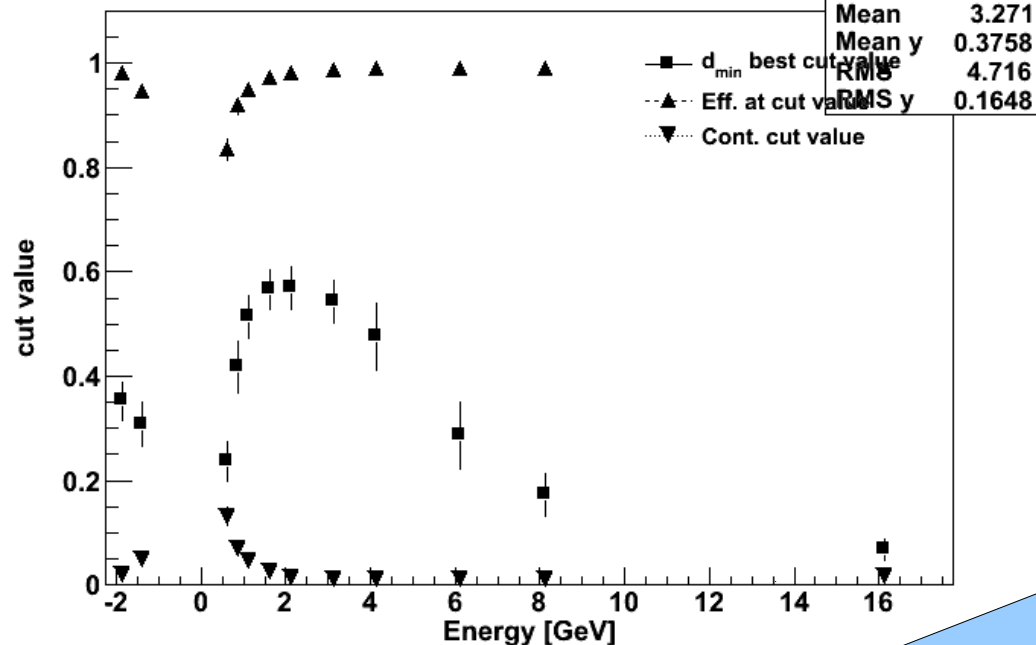
prof_minsquaredDistToOneOnePotion



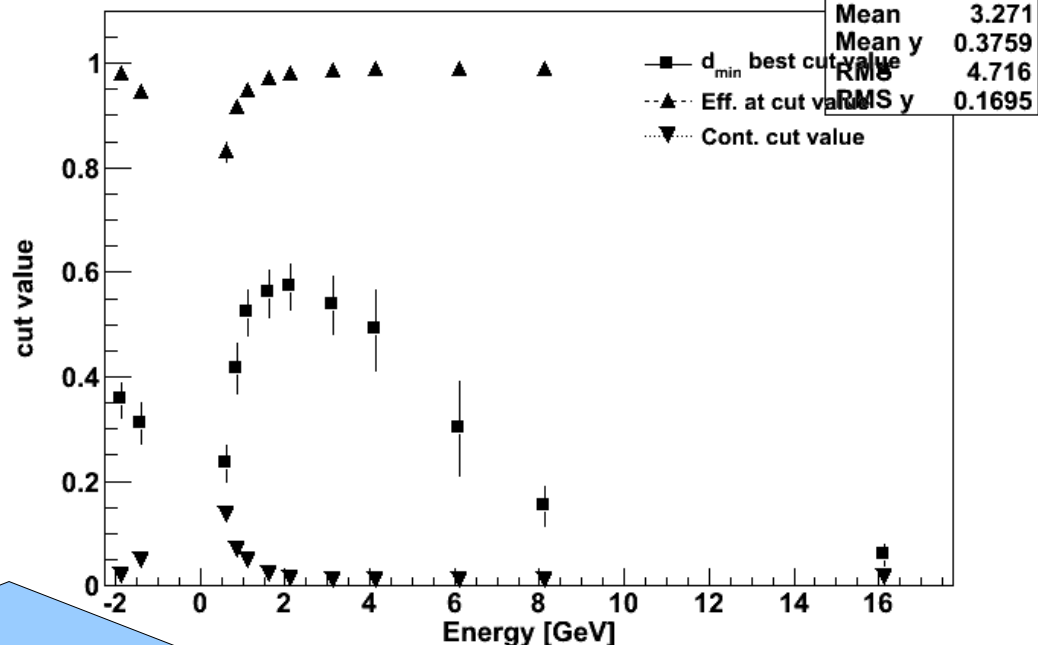
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

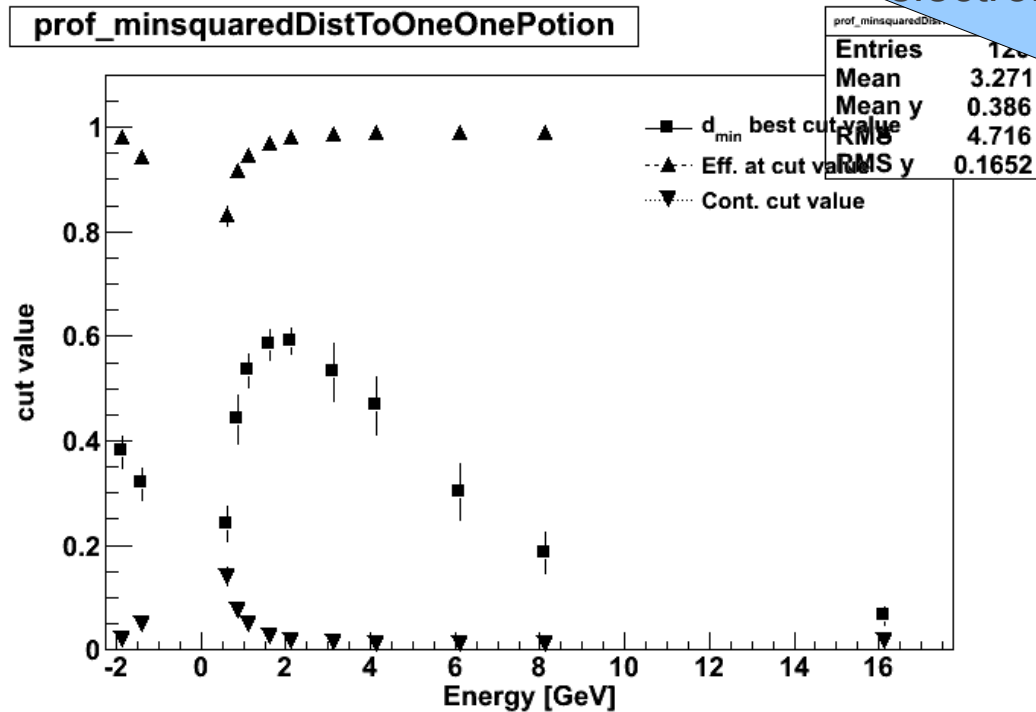


prof_minsquaredDistToOneOnePotion

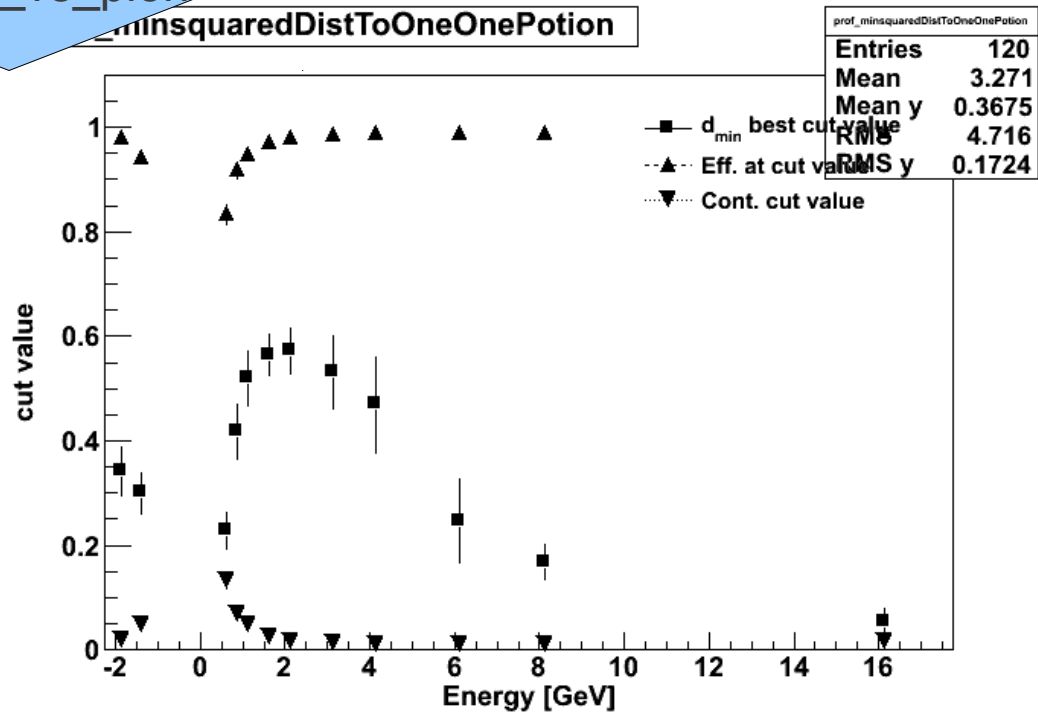


Npl=26
electron_vs_pion

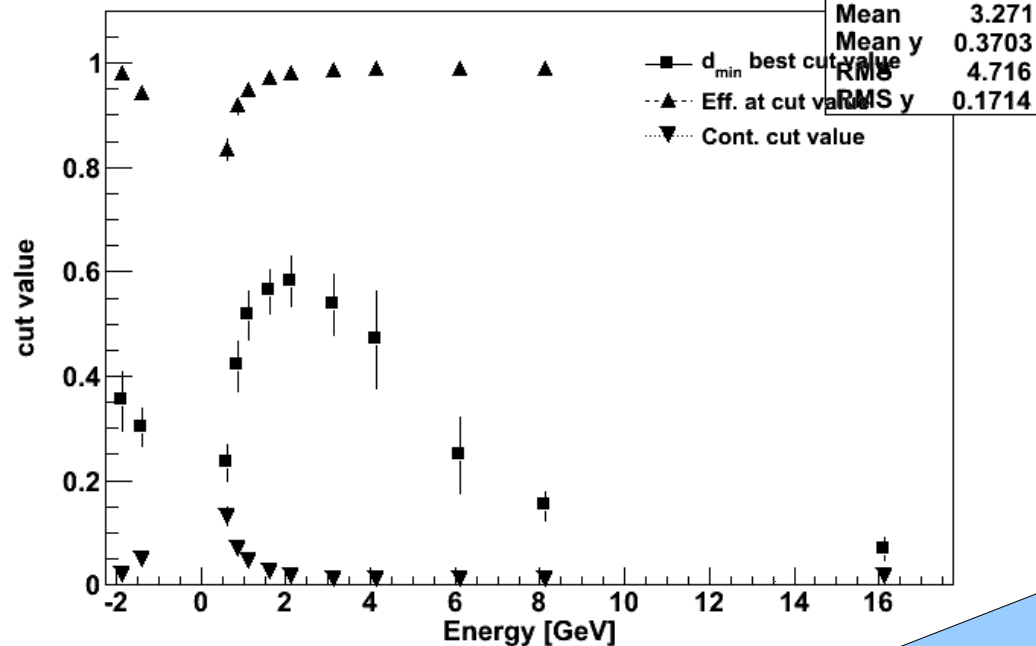
prof_minsquaredDistToOneOnePotion



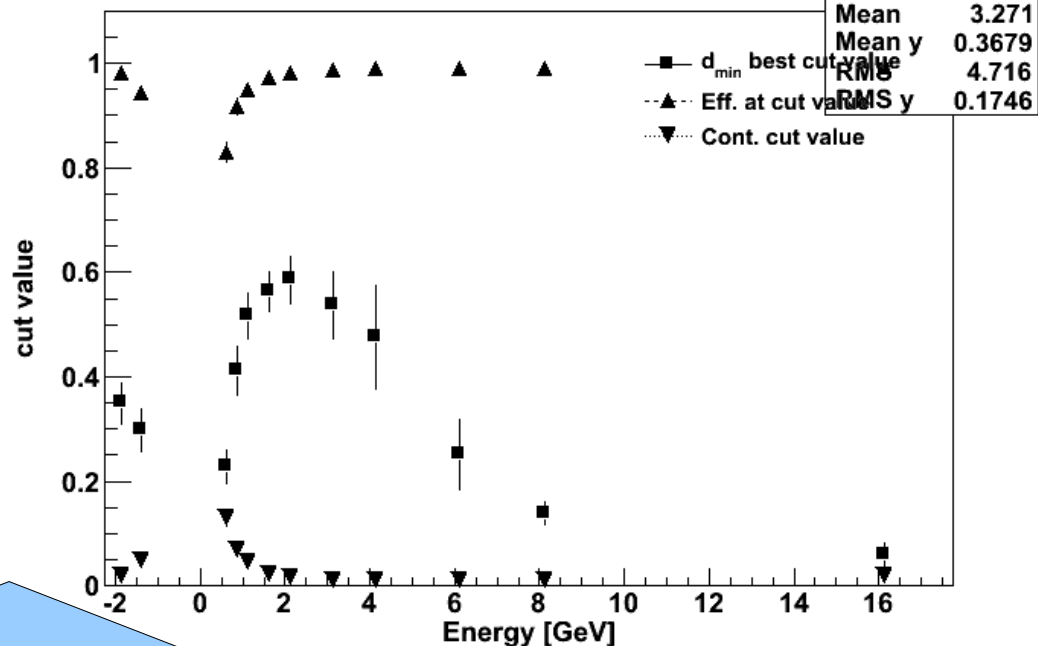
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

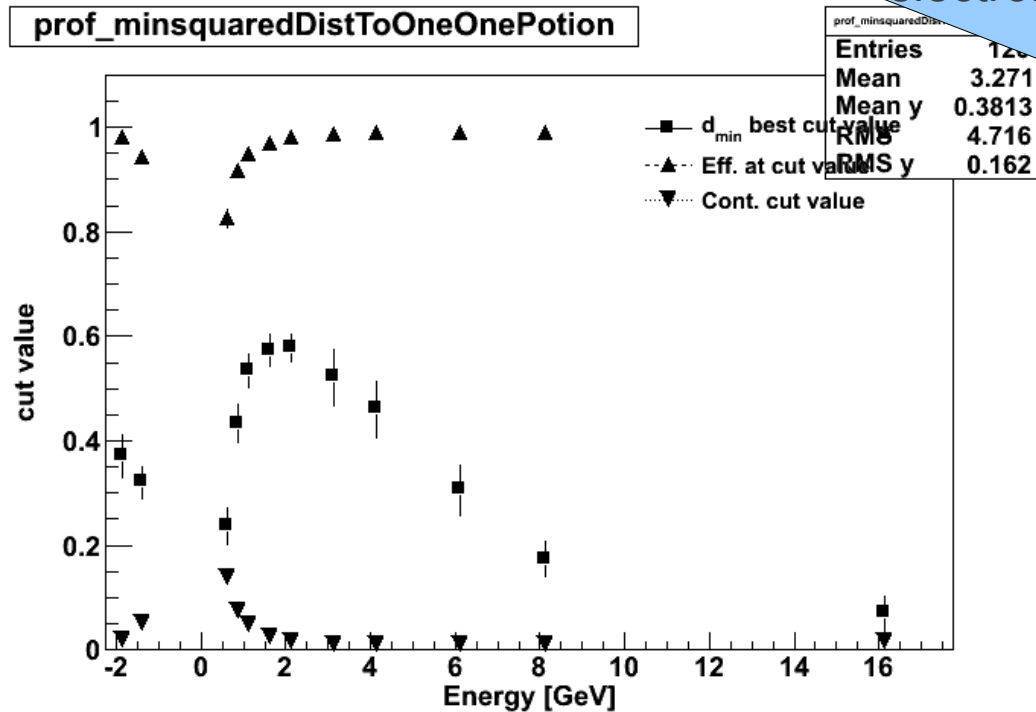


prof_minsquaredDistToOneOnePotion

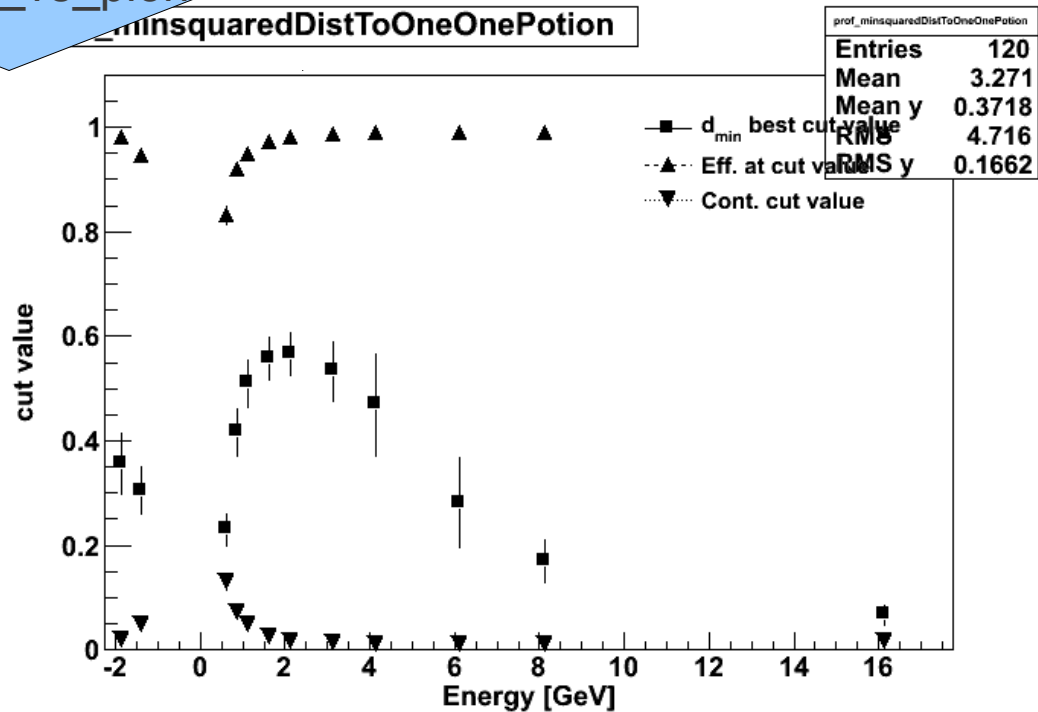


Npl=29
electron_vs_pion

prof_minsquaredDistToOneOnePotion

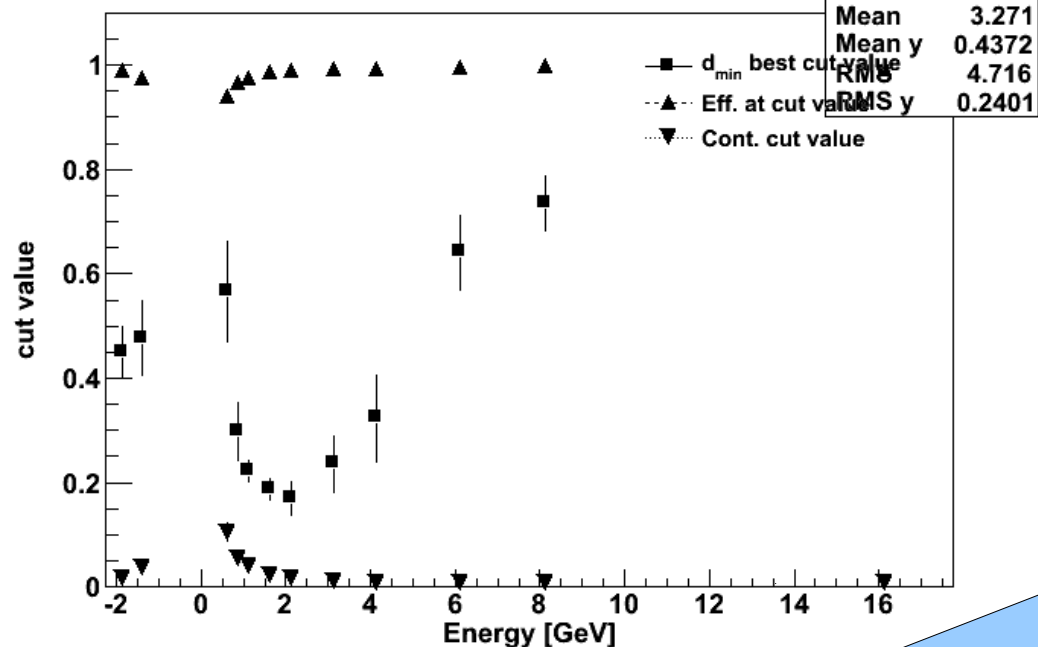


prof_minsquaredDistToOneOnePotion

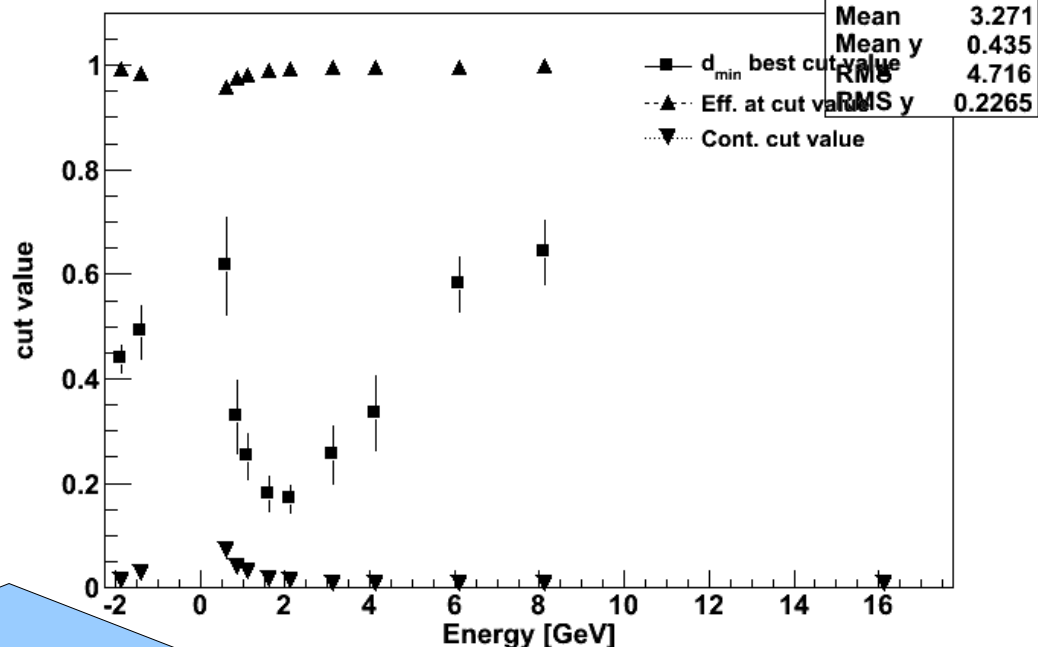


Now
pi_gamma

prof_minsquaredDistToOneOnePotion

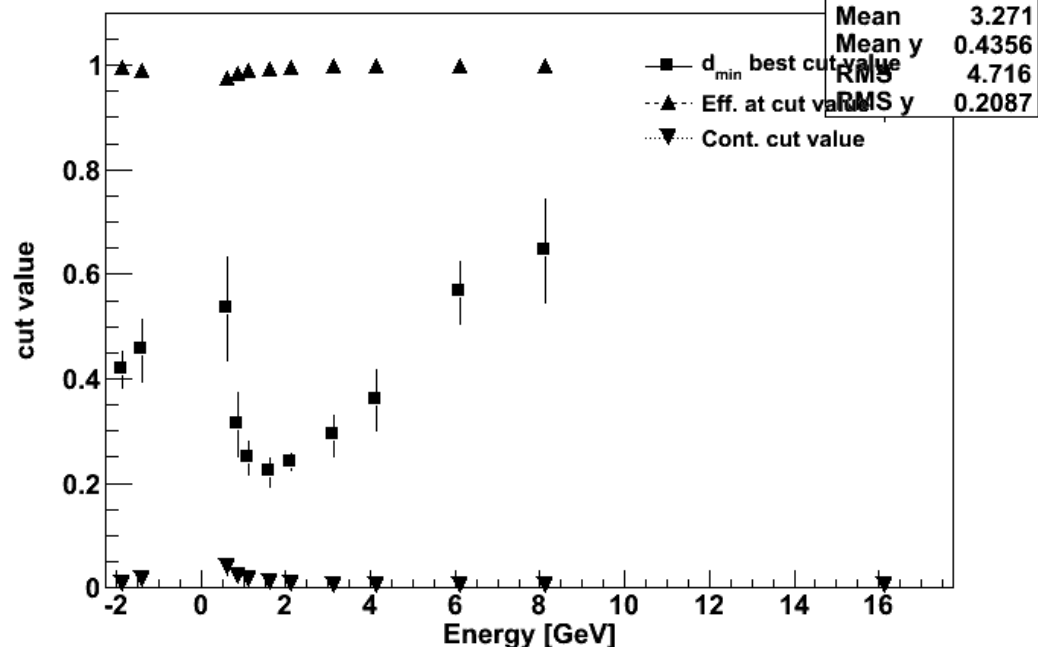


prof_minsquaredDistToOneOnePotion

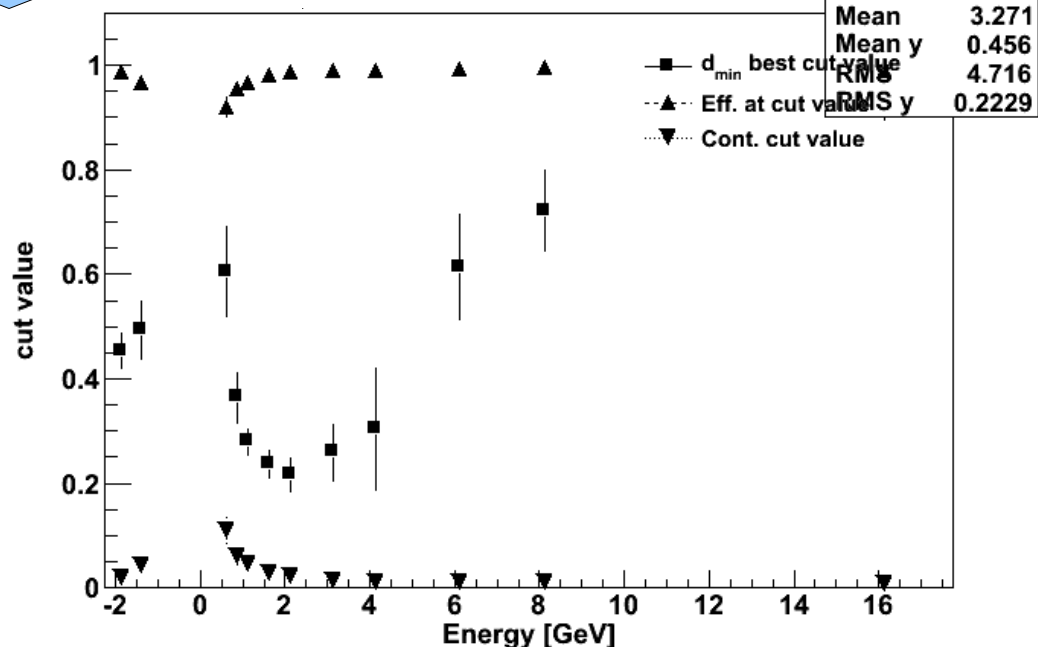


Npl=10
pion_vs_gamma

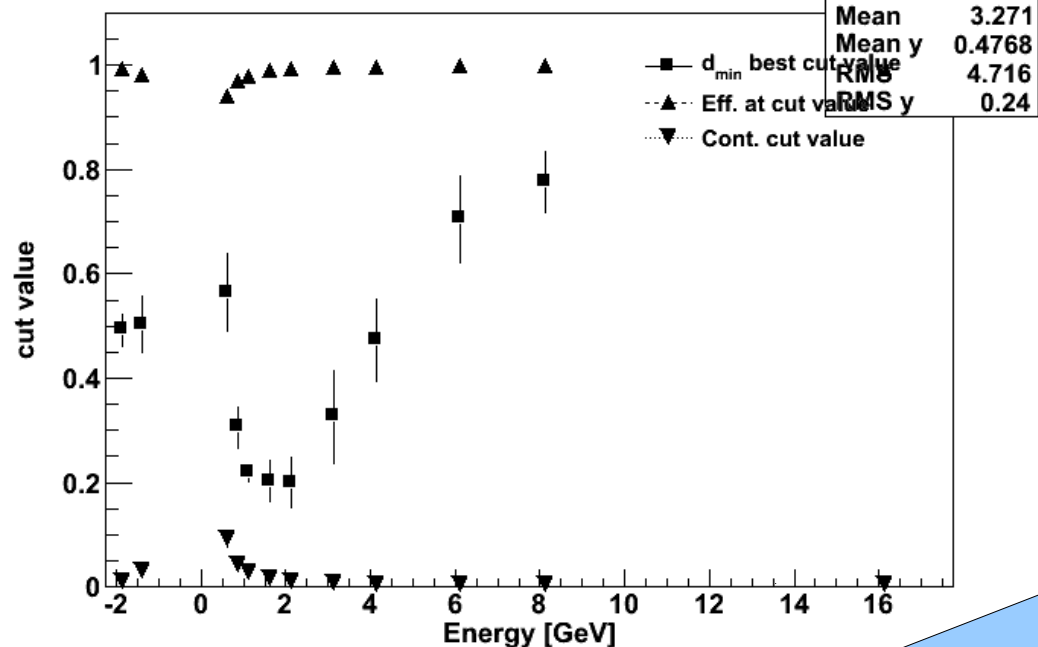
prof_minsquaredDistToOneOnePotion



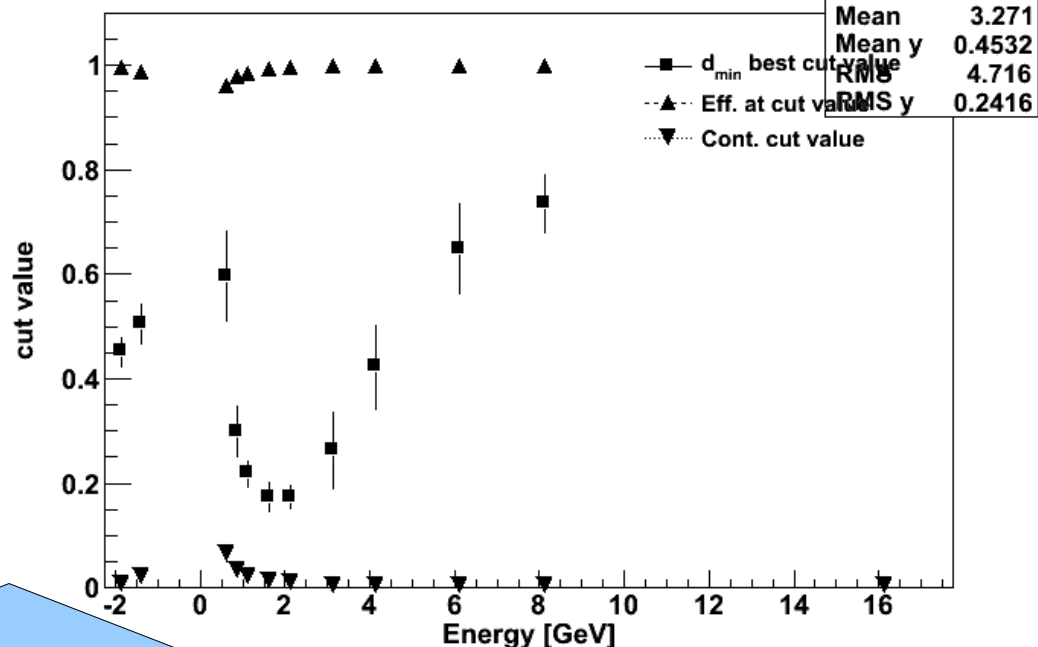
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

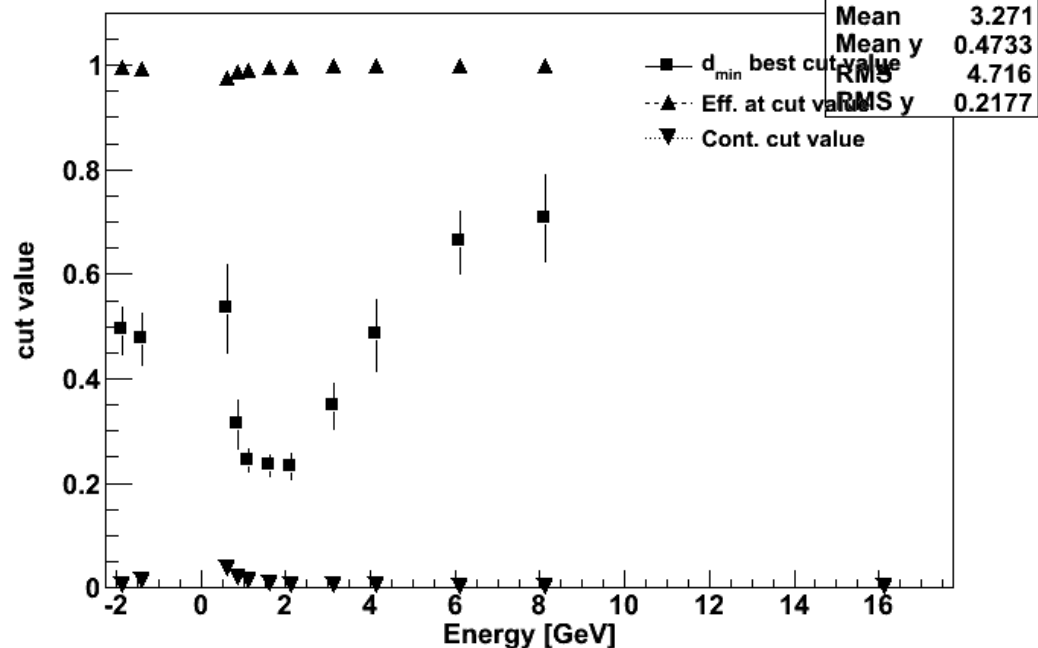


prof_minsquaredDistToOneOnePotion

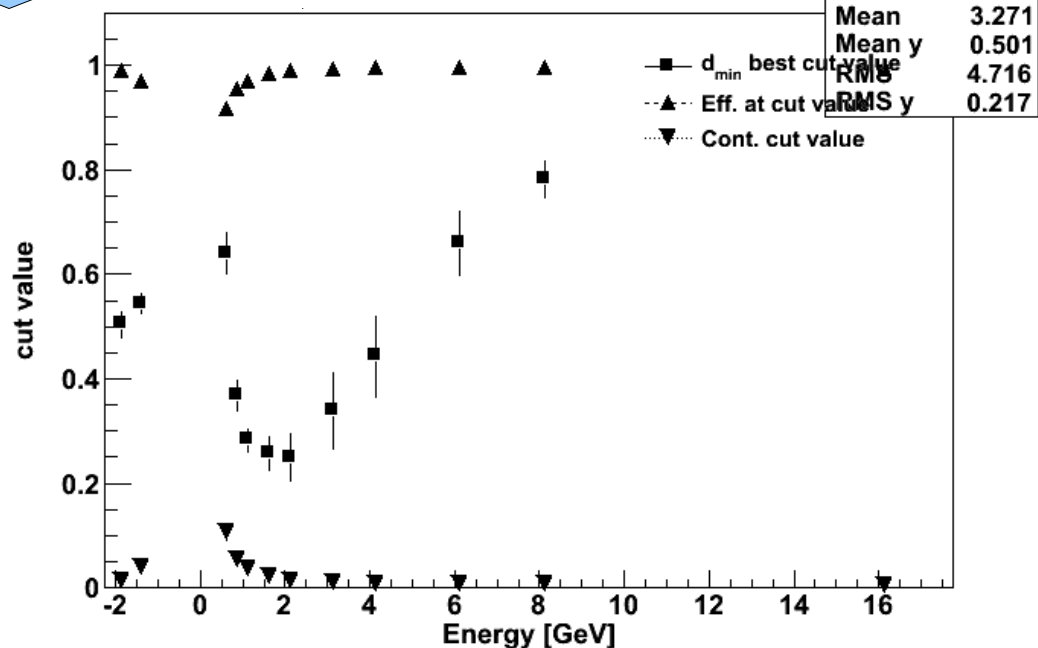


Npl=14
pion_vs_gamma

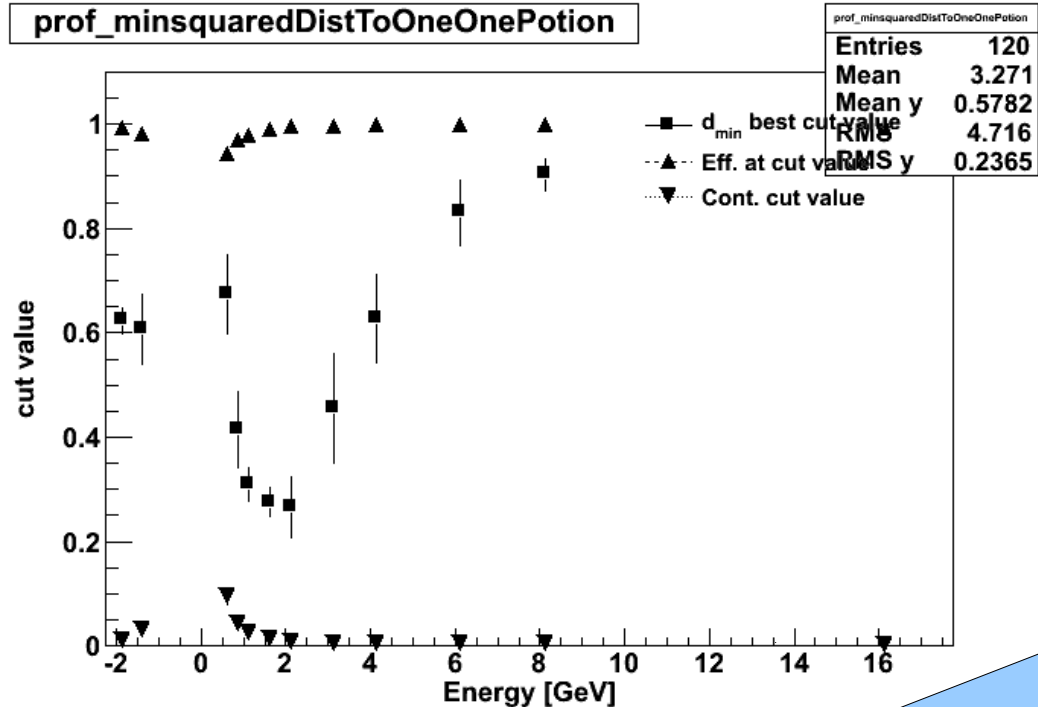
prof_minsquaredDistToOneOnePotion



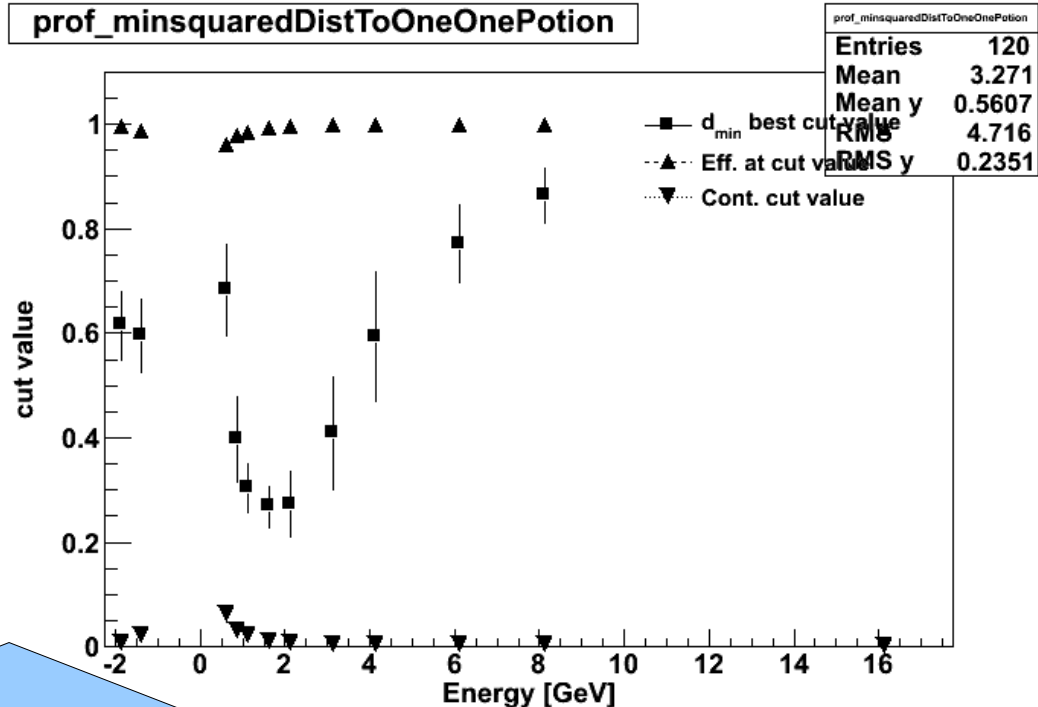
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

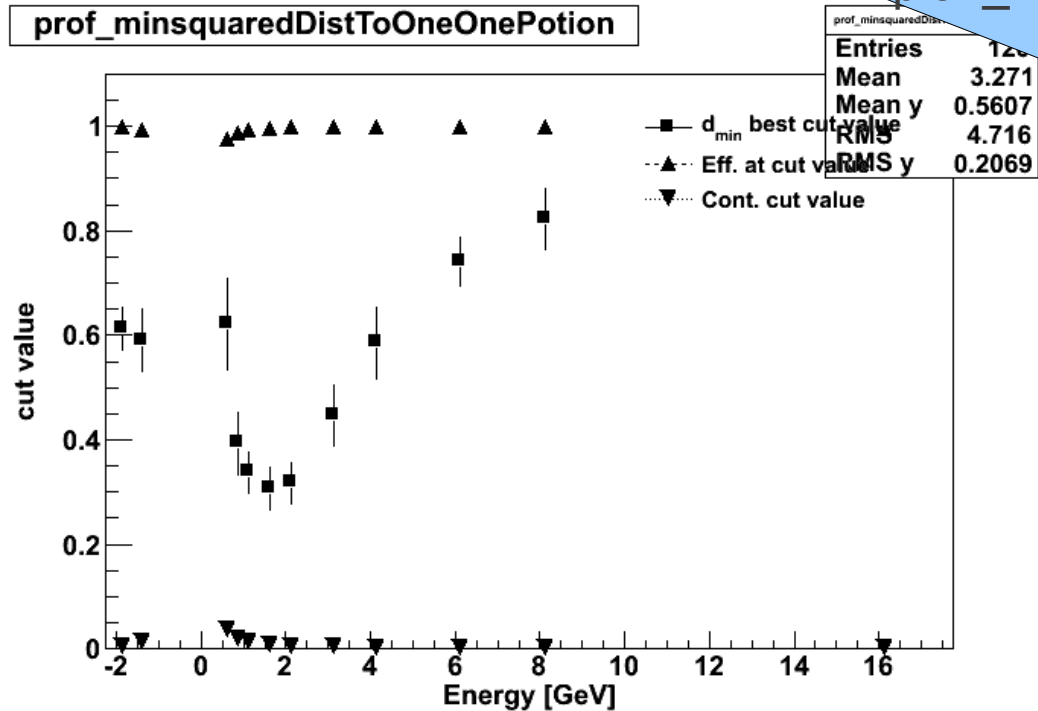


prof_minsquaredDistToOneOnePotion

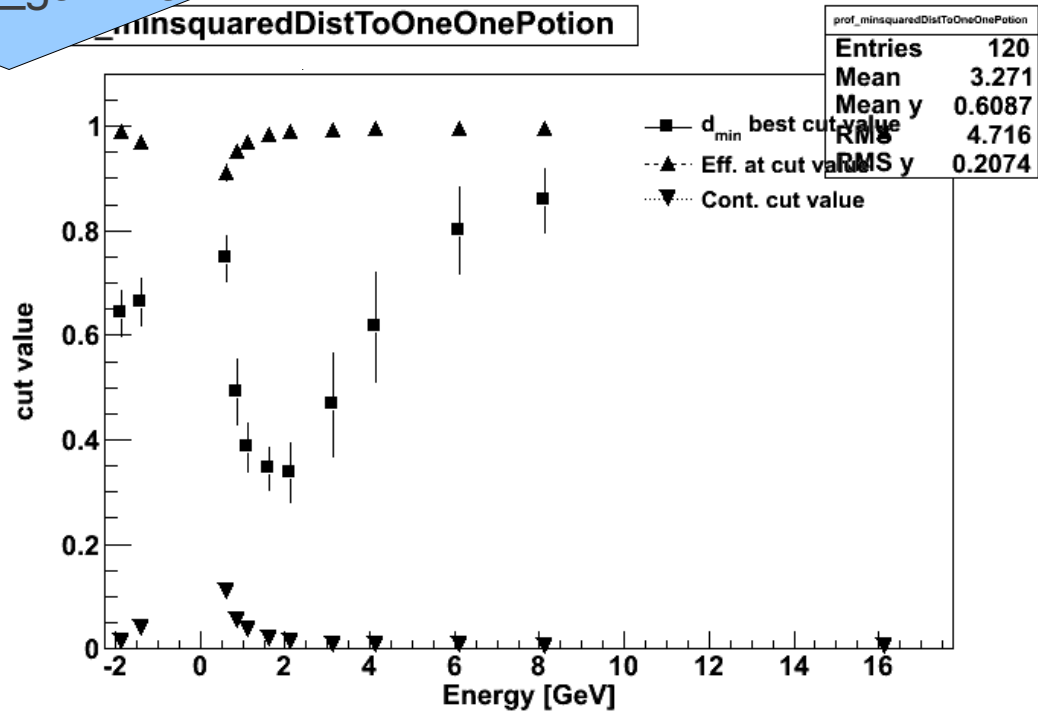


Npl=18
pion_vs_gamma

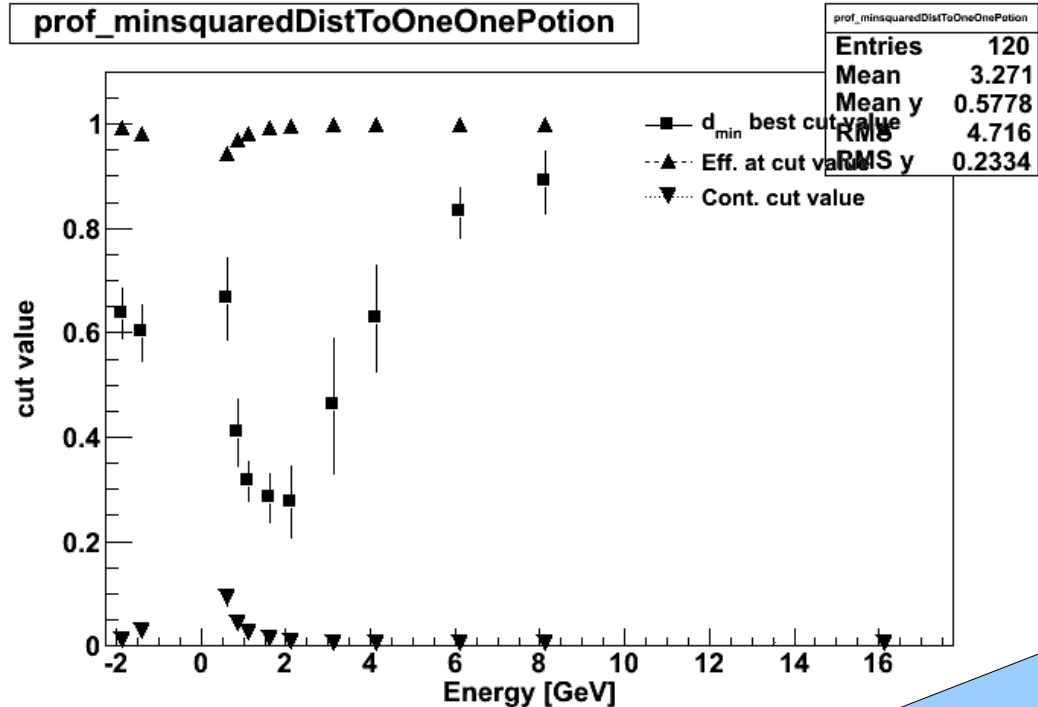
prof_minsquaredDistToOneOnePotion



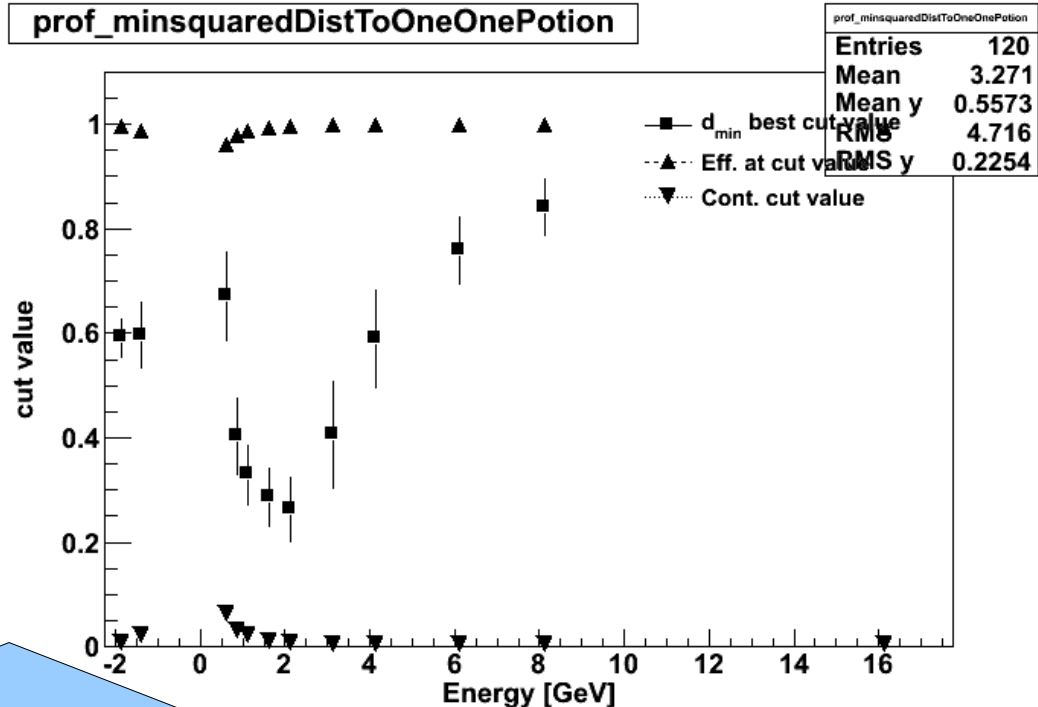
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

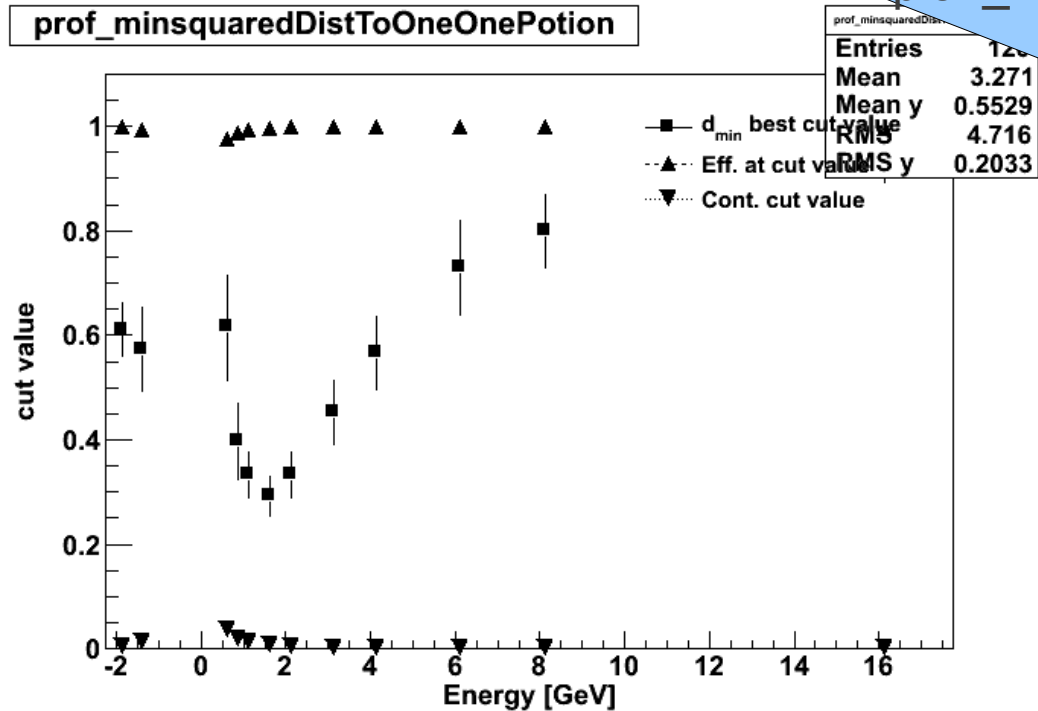


prof_minsquaredDistToOneOnePotion

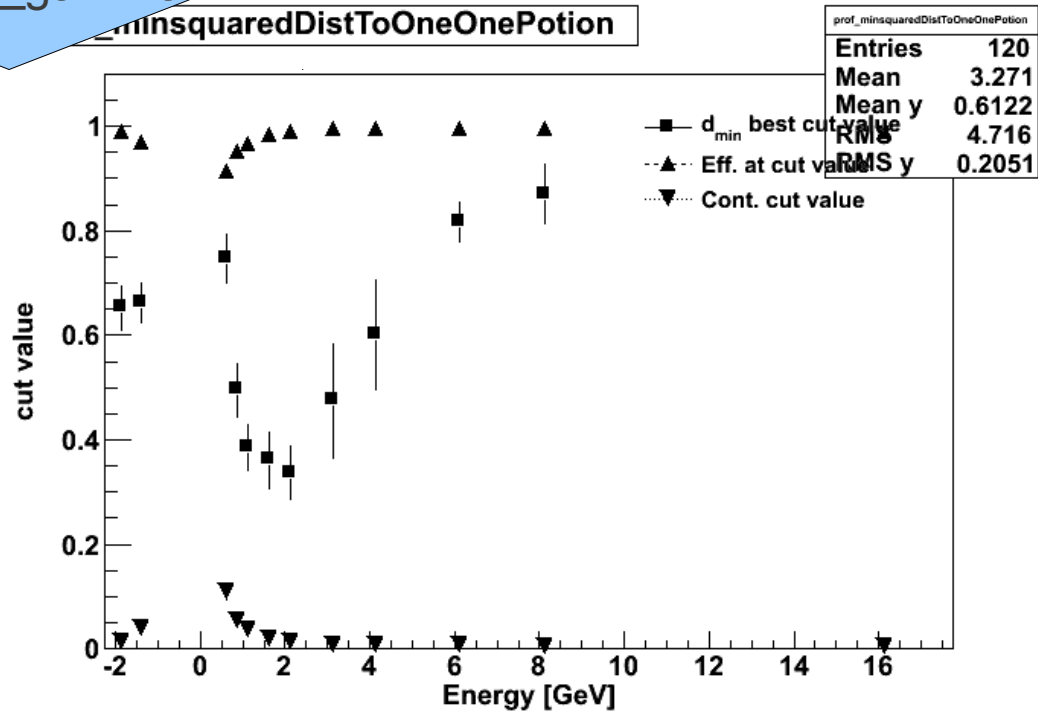


Npl=23
pion_vs_gamma

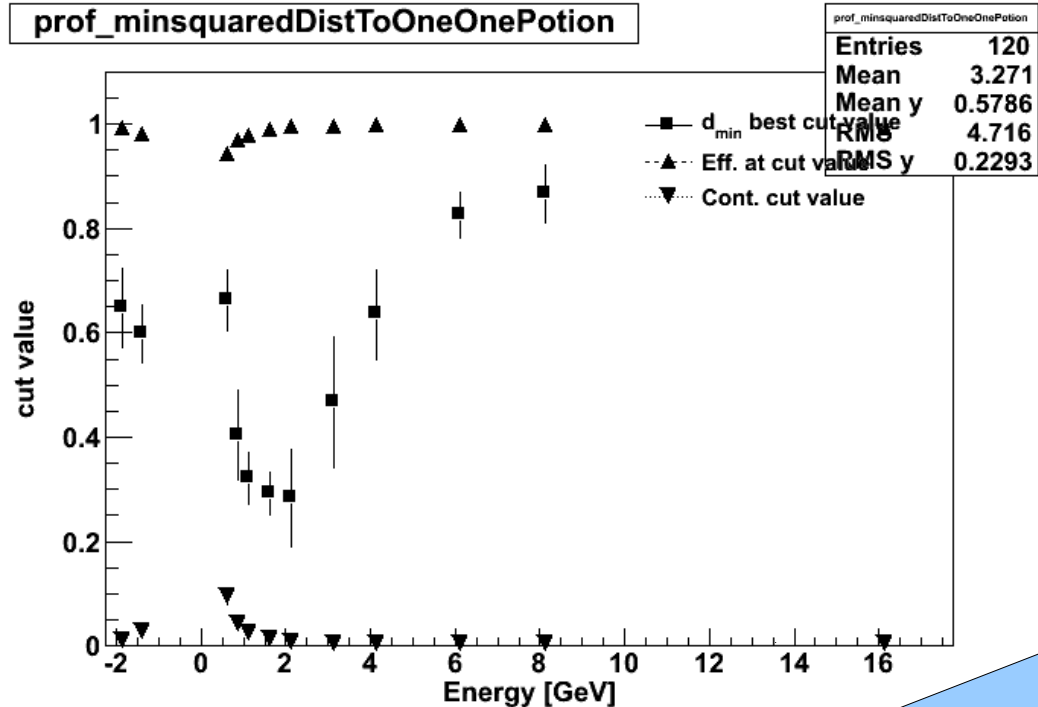
prof_minsquaredDistToOneOnePotion



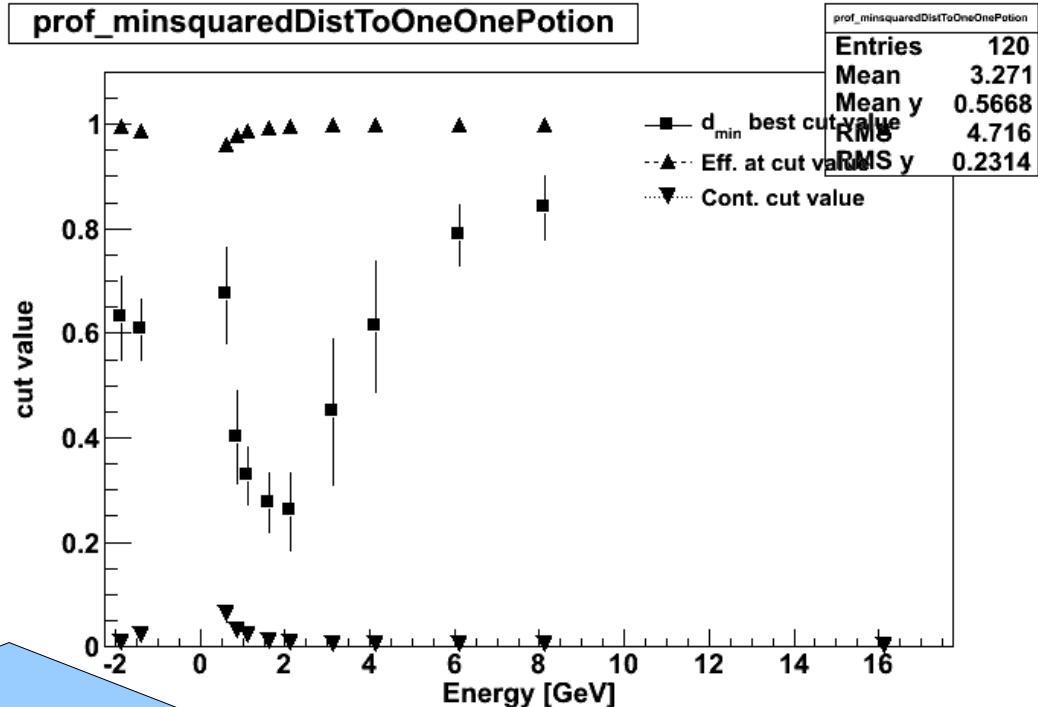
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

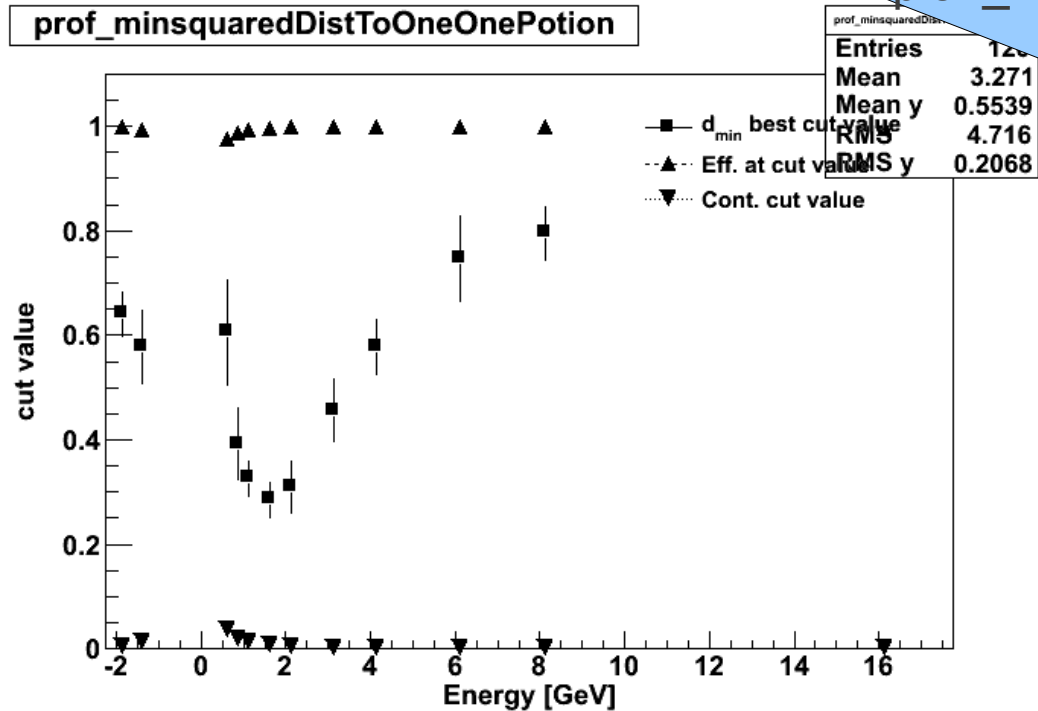


prof_minsquaredDistToOneOnePotion

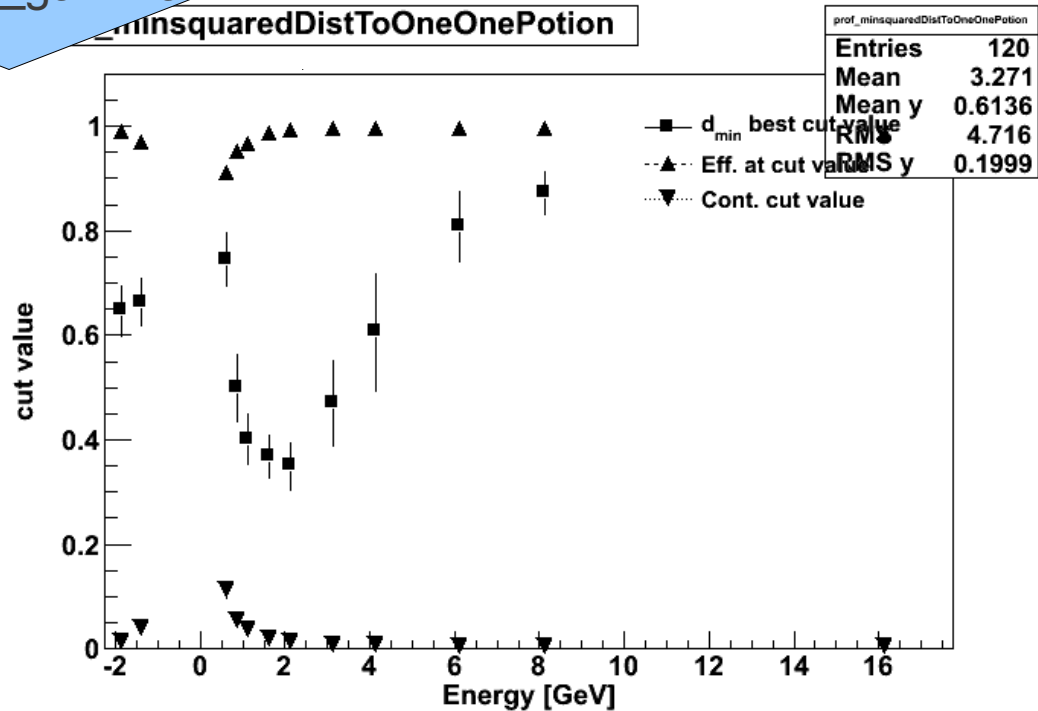


Npl=26
pion_vs_gamma

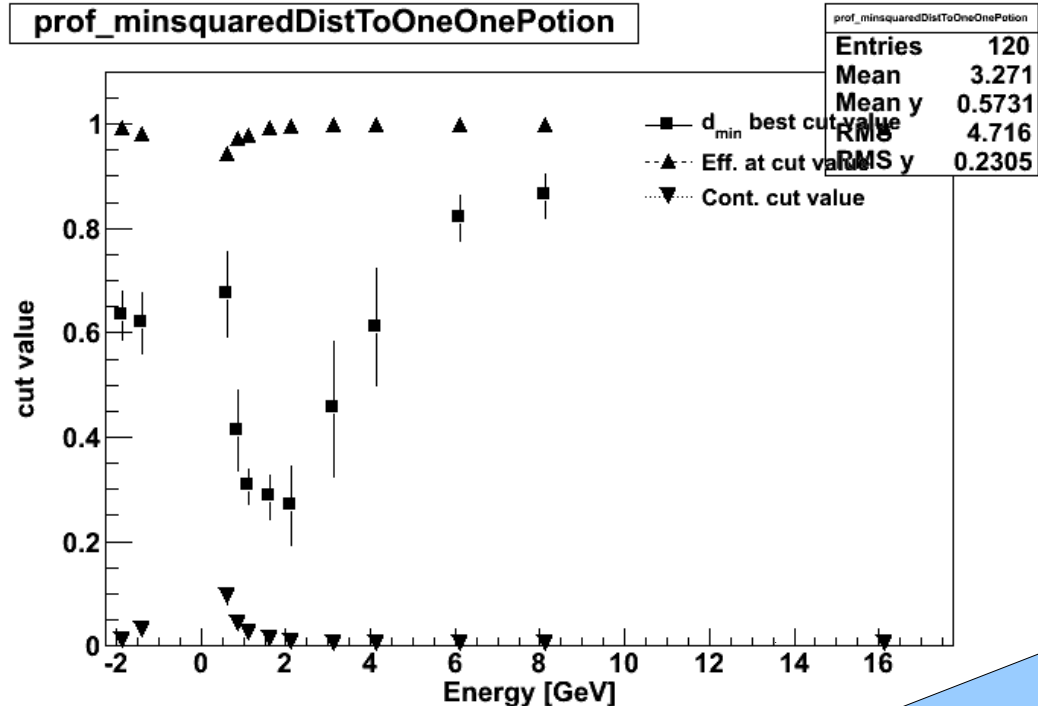
prof_minsquaredDistToOneOnePotion



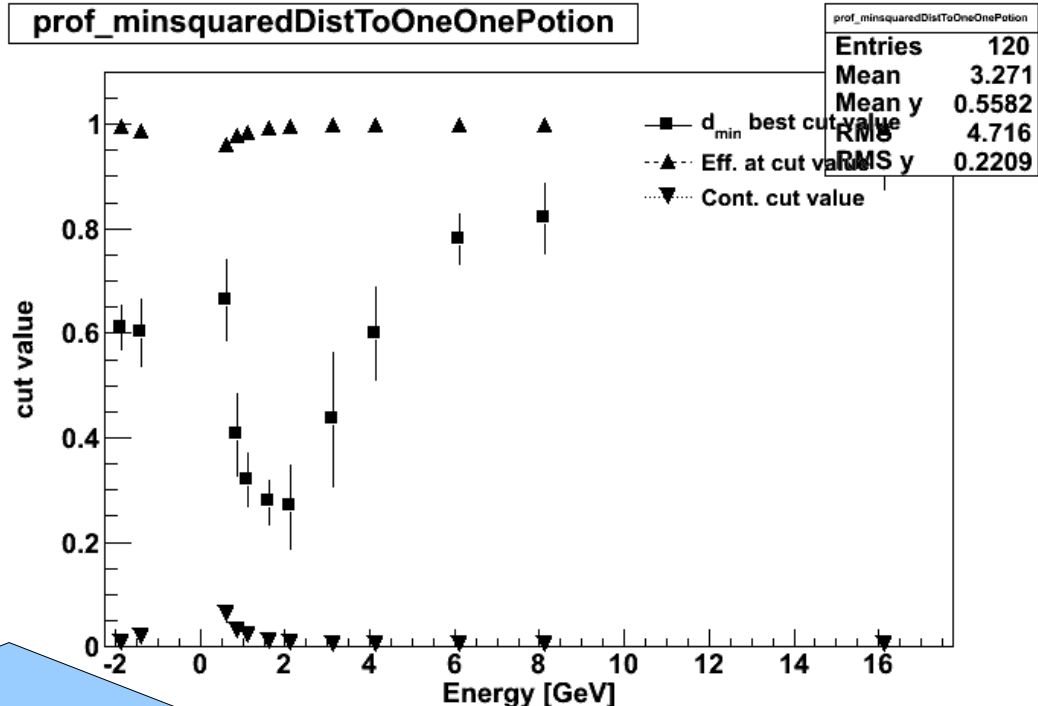
prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion

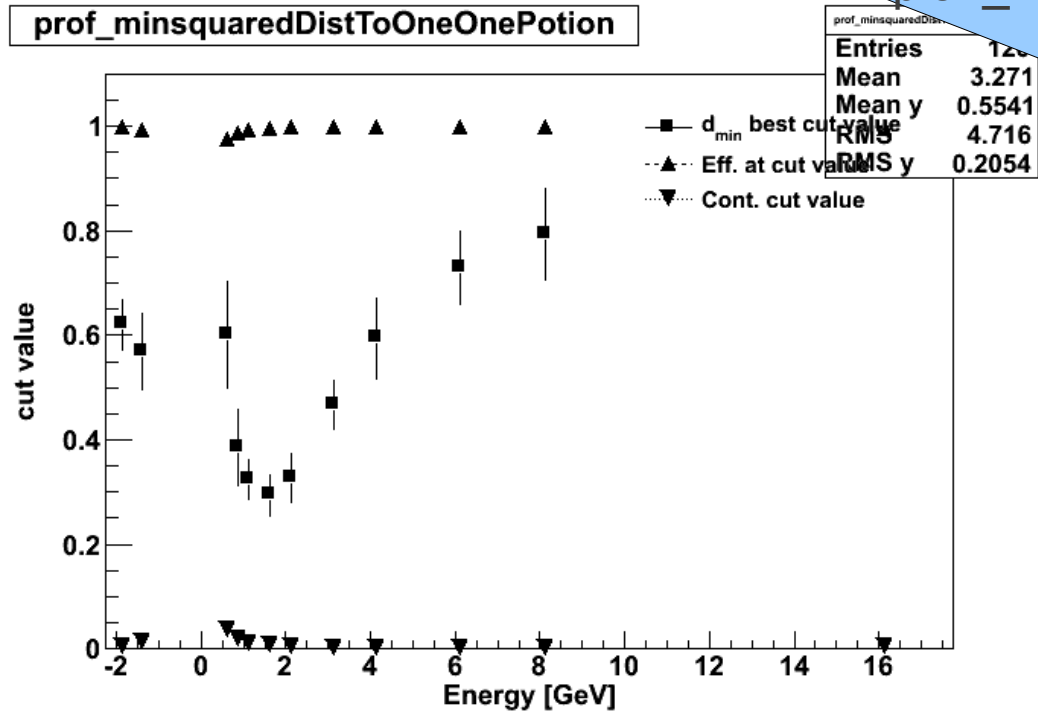


prof_minsquaredDistToOneOnePotion

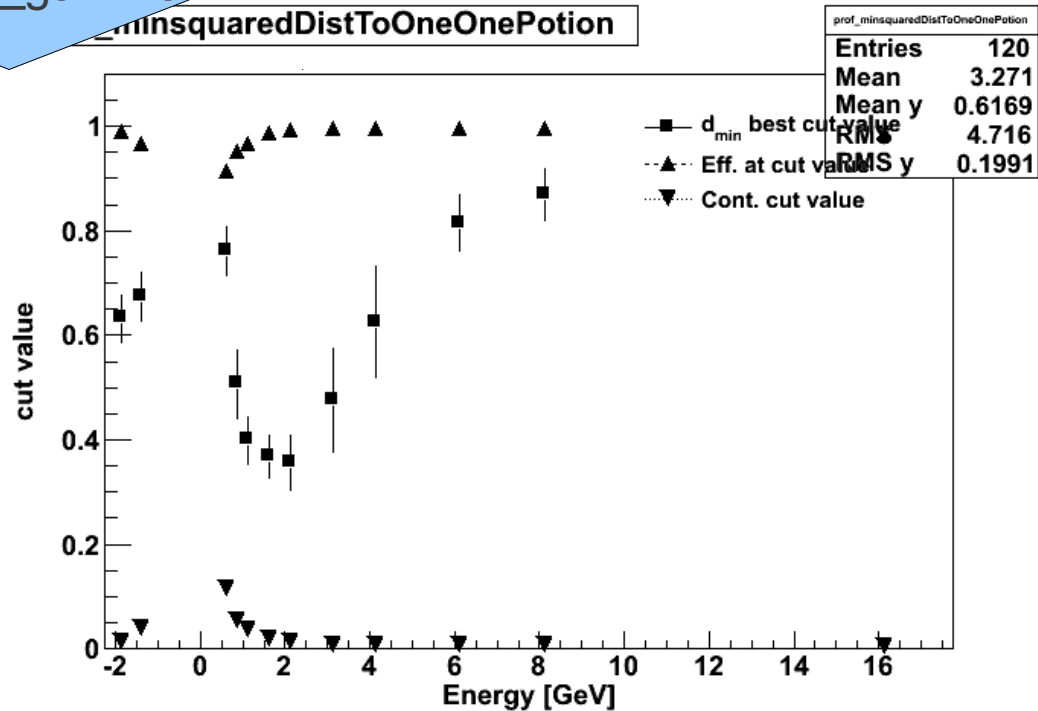


Npl=29
pion_vs_gamma

prof_minsquaredDistToOneOnePotion



prof_minsquaredDistToOneOnePotion



**Now we run the ID estimations with these adapted cutvalues.
See if its better**

- The d_{\min} cut is almost independent on number of plates for e_{γ} . But strongly dependendt for $electron_{\pi}$ and $gamma_{\pi}$
- It changes for the type of separation one uses
- It changes for the energy
 -
- Cut depending on separation method is easy to implement.
- An energy dependent cut is a priory not possible, just in a second run, after the energy estimation

Used cuts in the routines:

Npl	Separation	ShapeOnly	AndVTXIP	AndVTXDeltaZ	ShapeWOPL12
all	gamma_electron	0.58	0.55	0.50	0.50
<=10	electron_pion	0.58	0.55	0.50	0.50
<=14	electron_pion	0.45	0.45	0.45	0.45
<=18	electron_pion	0.35	0.35	0.35	0.35
>18	electron_pion	0.35	0.35	0.35	0.35
<=10	pion_gamma	0.45	0.45	0.45	0.45
<=14	pion_gamma	0.58	0.58	0.58	0.58
<=18	pion_gamma	0.6	0.6	0.6	0.6
>18	pion_gamma	0.6	0.6	0.6	0.6

Now we run the ID estimations with these adapted cutvalues.
See if its better

Summary

- The best min_dist cut is very well suited for general purpose ID tagging. It delivers both high efficiency and low contamination.
- Nevertheless, it does not seem to be a constant fixed value, especially around 2-4GeV, so it cannot be hardcoded in.
- But one could implement a double routing of
 - ID-Energy-ID-Energy estimations.
- In this case (not complicated to code into libShowRec) results can be improved.

Nota bene.

- These (MC)-results (with many plots and many separate listings), will also be put into the Internal Note of the energy note.