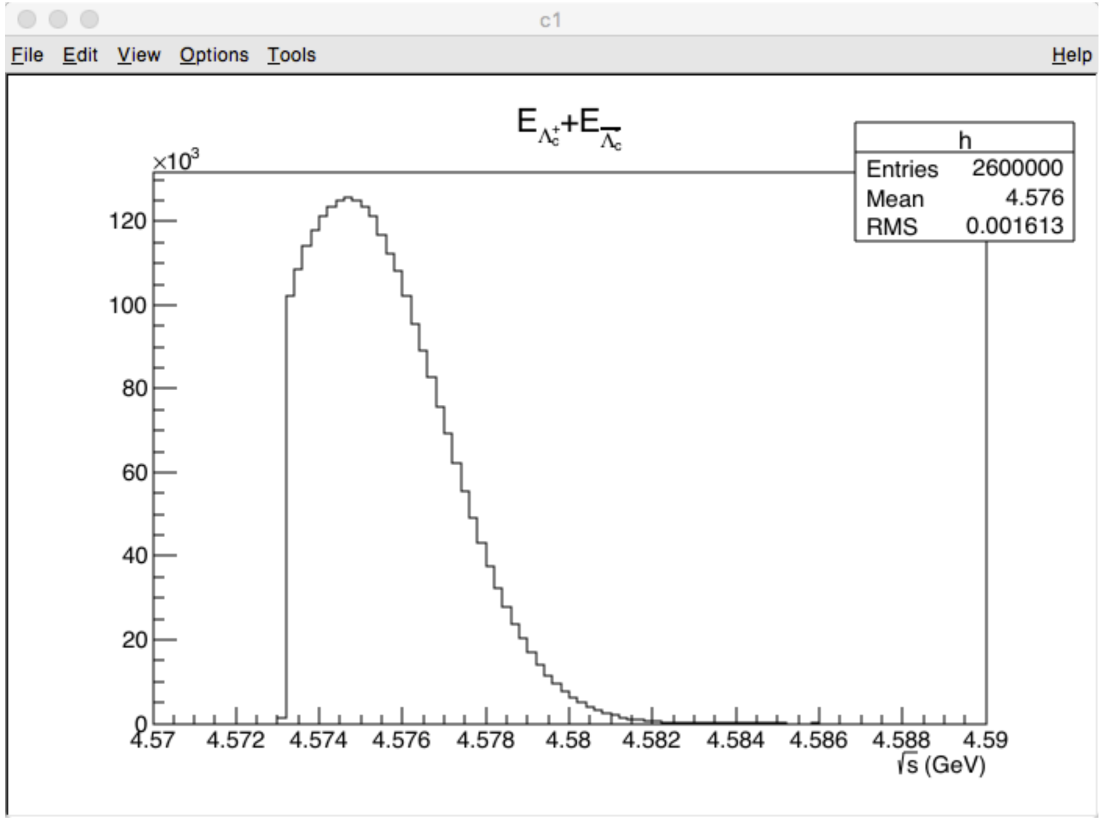
Energy spread with $\Lambda_c^+ + c.c.$

Introduction

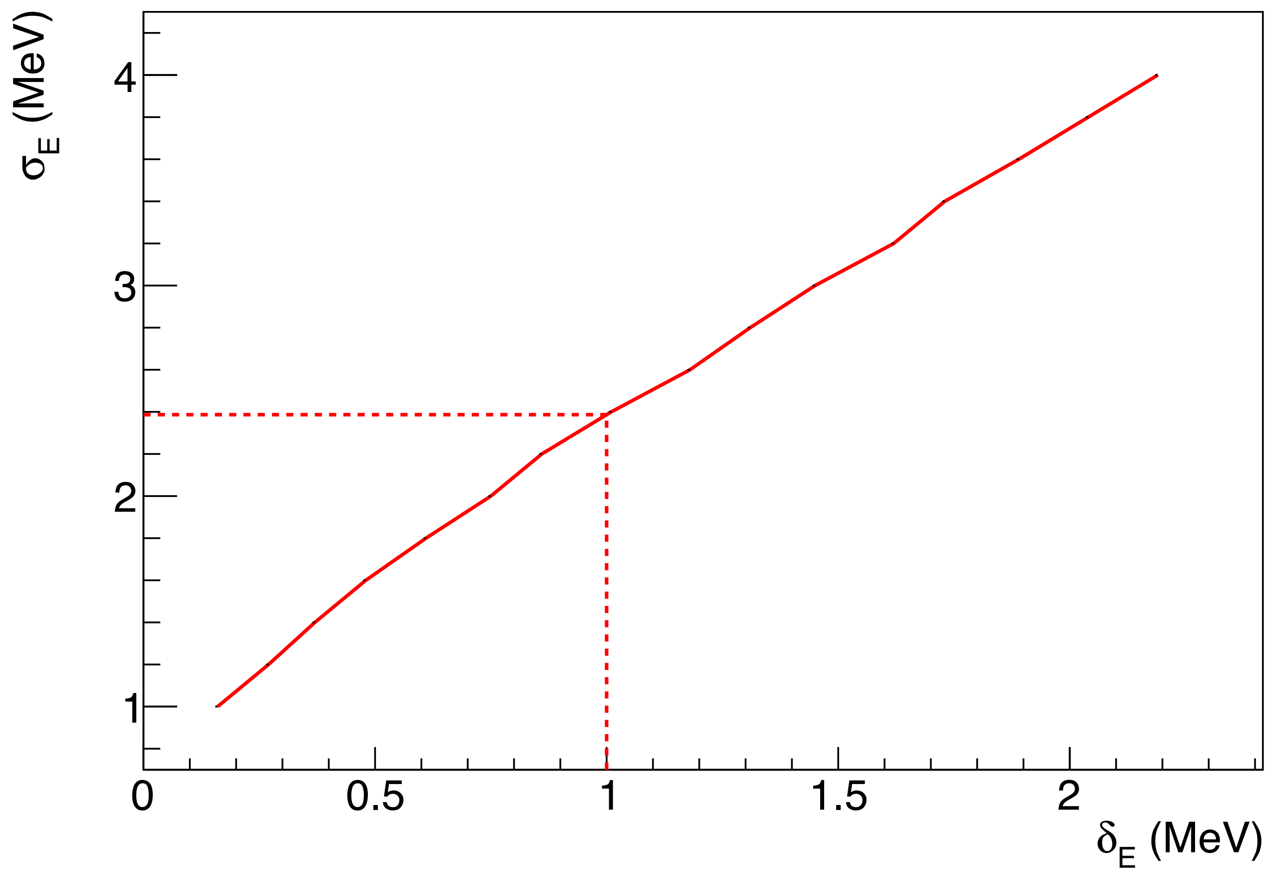
- Generally, $< E_{cm} > = < M(X) >$, X is all the particles in final state, like $\mu\mu$, KK, or $\Lambda_c^+ + c.c.$
- if E_{cm} is very close to threshold of X, then $< E_{cm} > \neq < M(X) >$ due to energy spread. since only collisions with Ecm > Eth can generate X.



toy MC study

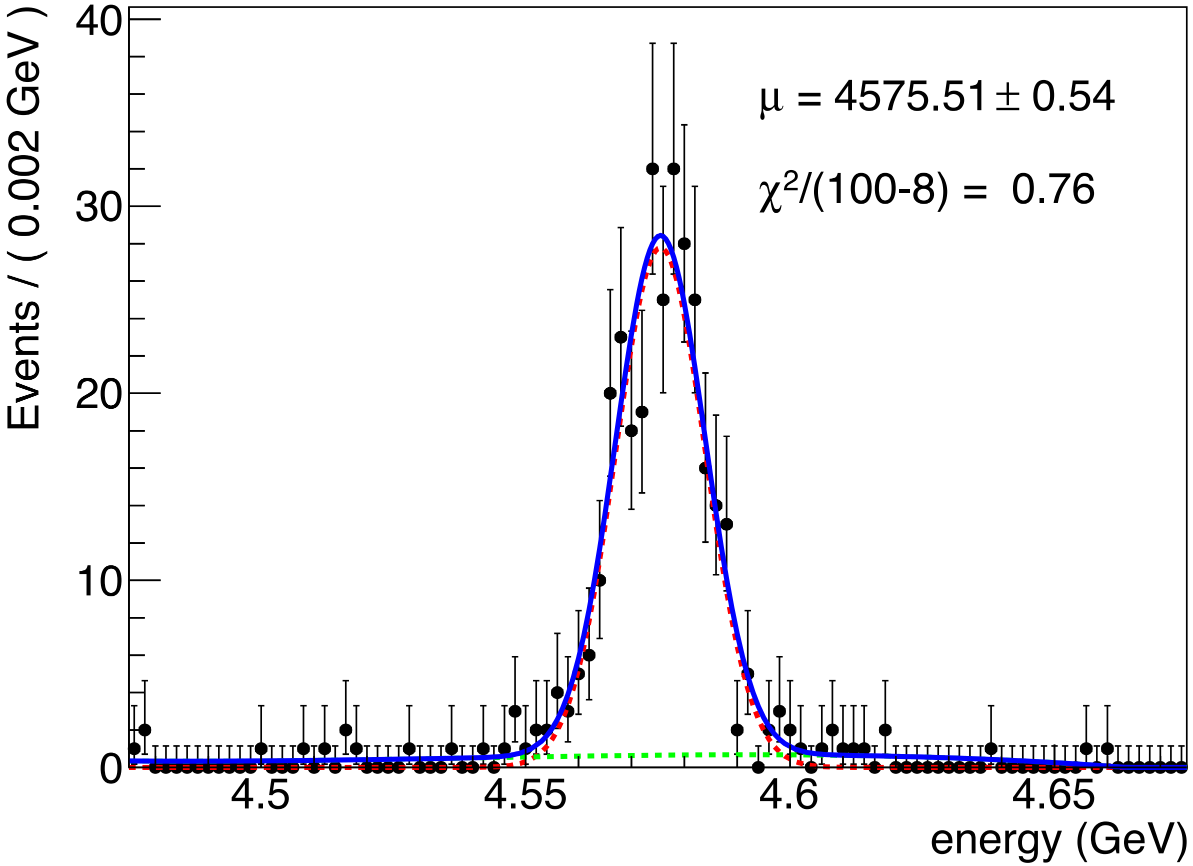
$\delta E = M(X) - Ecm$

σE is the c.m. energy spread



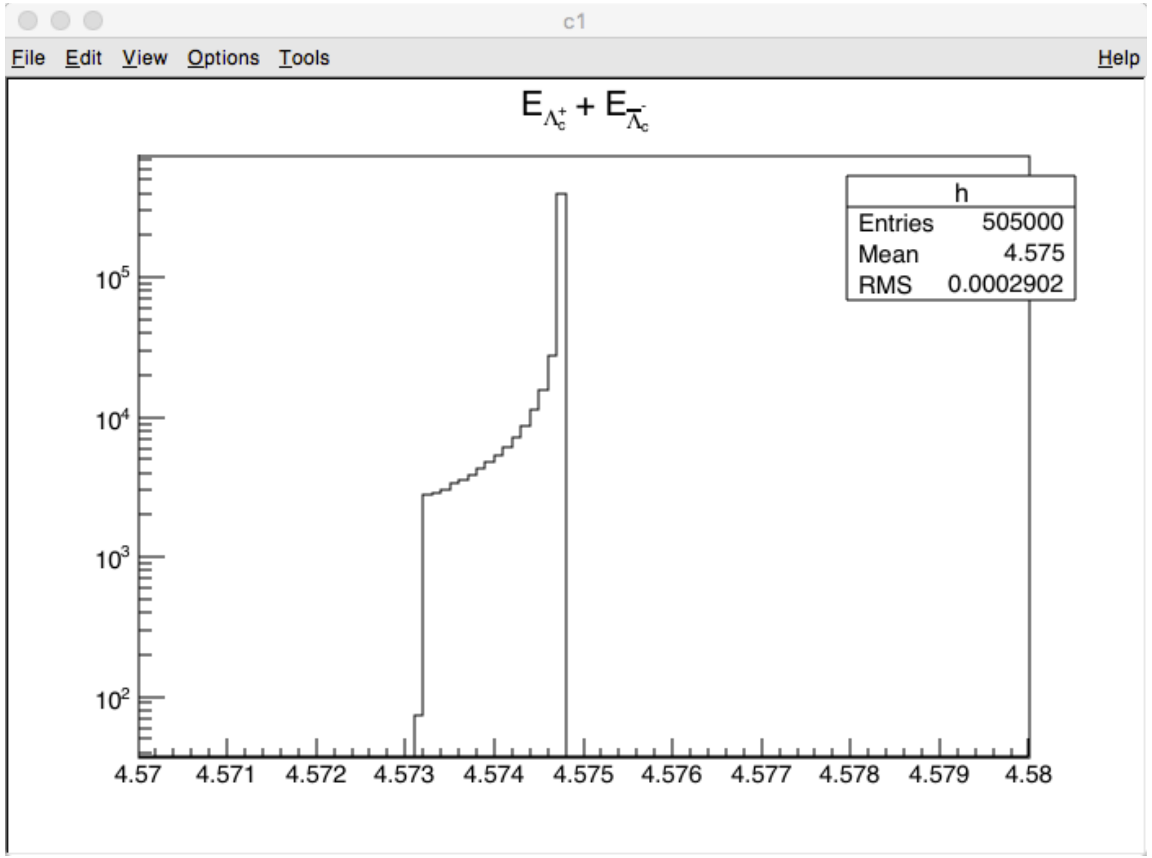
data $M(\Lambda_c^+ \overline{\Lambda}_c^-)$

Ecm measured with μμ
is 4574.50 +/- 0.72 MeV

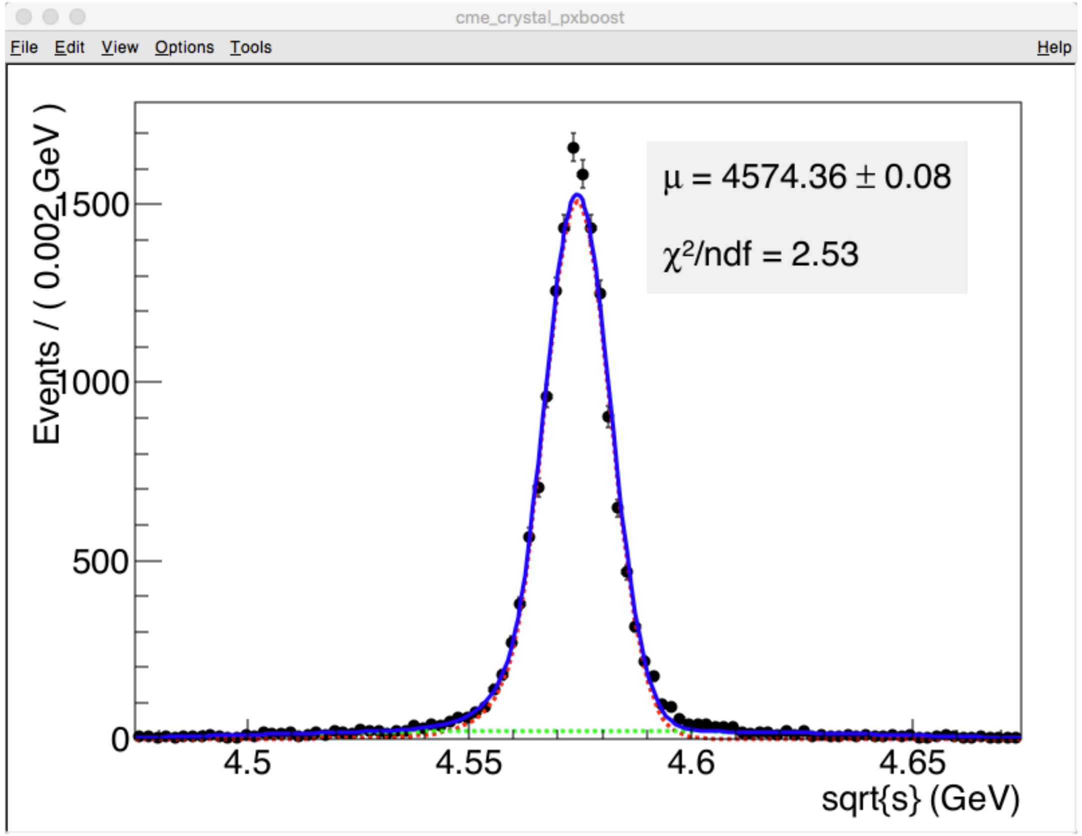


mc check without energy spread

- truth $E_{\Lambda_c^+} + E_{\overline{\Lambda}_c^-}$

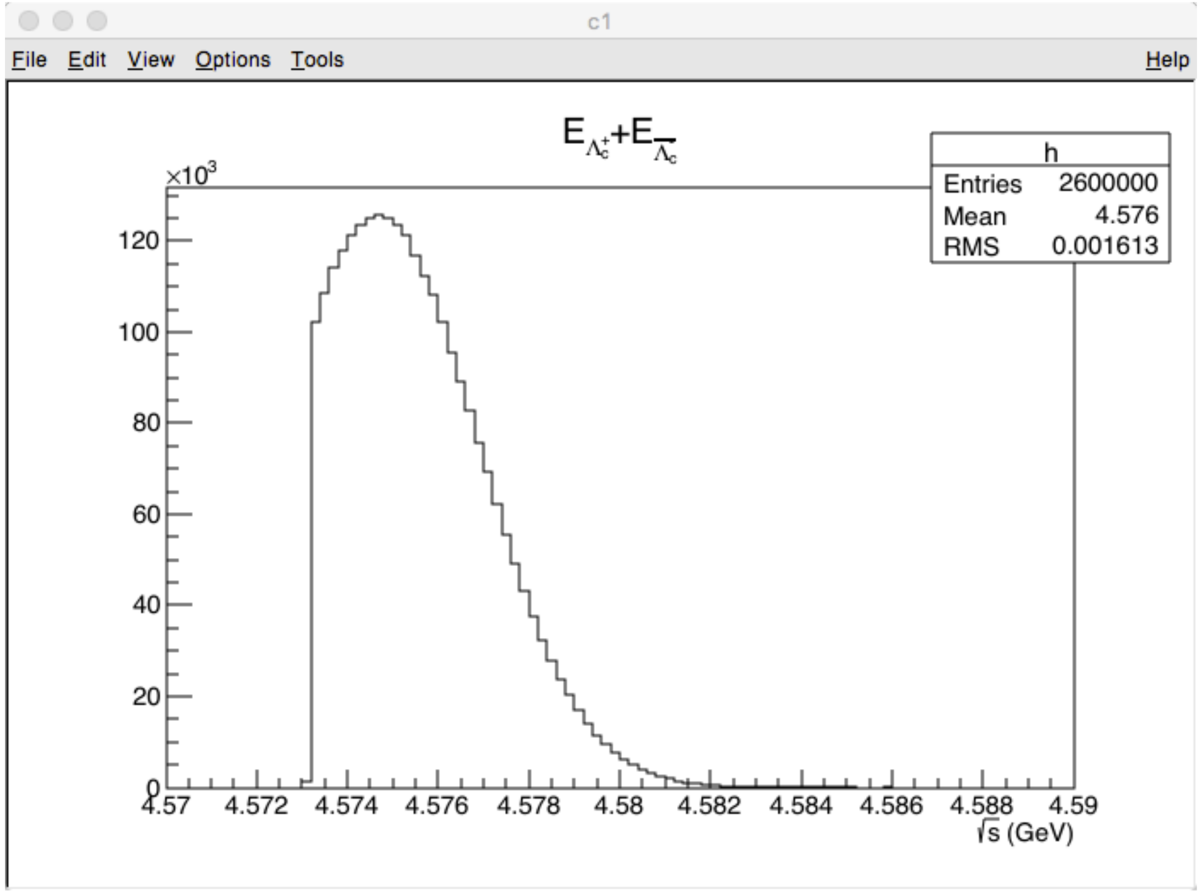


- $M(\Lambda_c^+\overline{\Lambda}_c^-)$

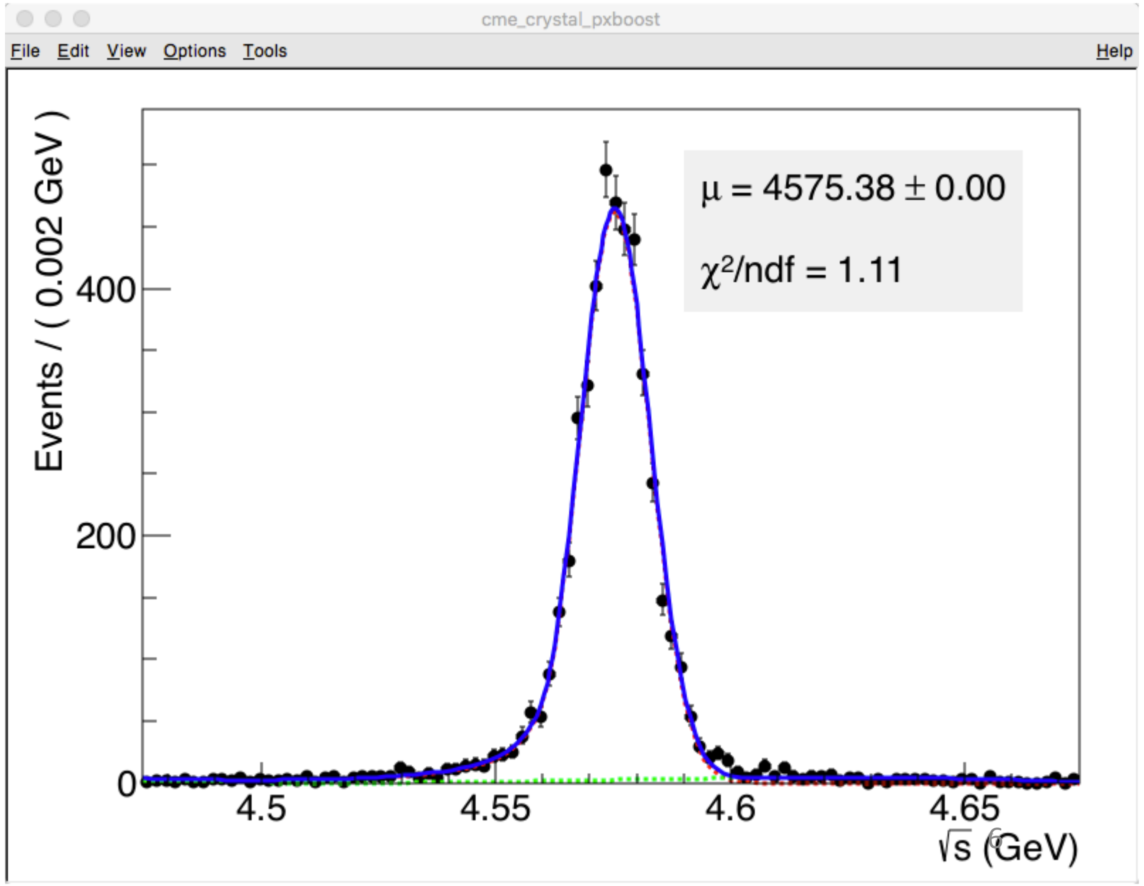


mc with energy spread 2.2 MeV

- truth $E_{\Lambda_c^+} + E_{\overline{\Lambda}_c^-}$



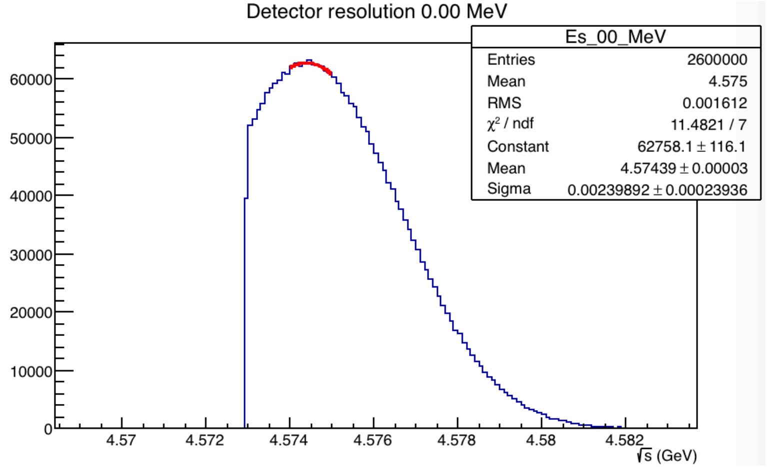
- $M(\Lambda_c^+\overline{\Lambda}_c^-)$

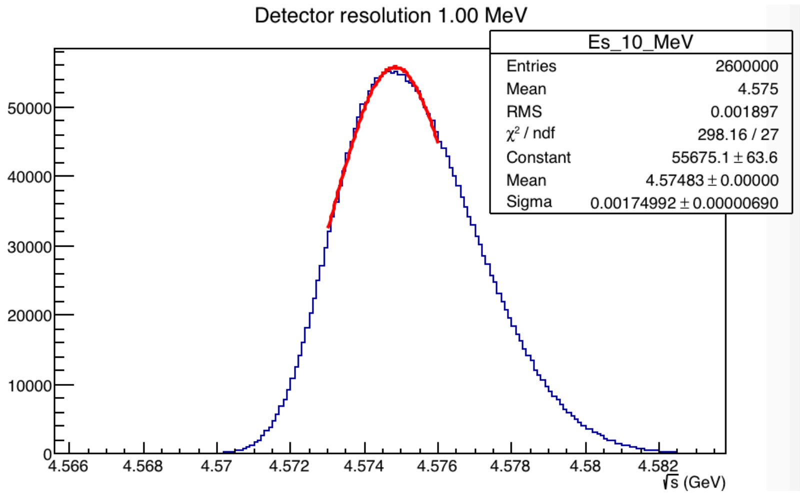


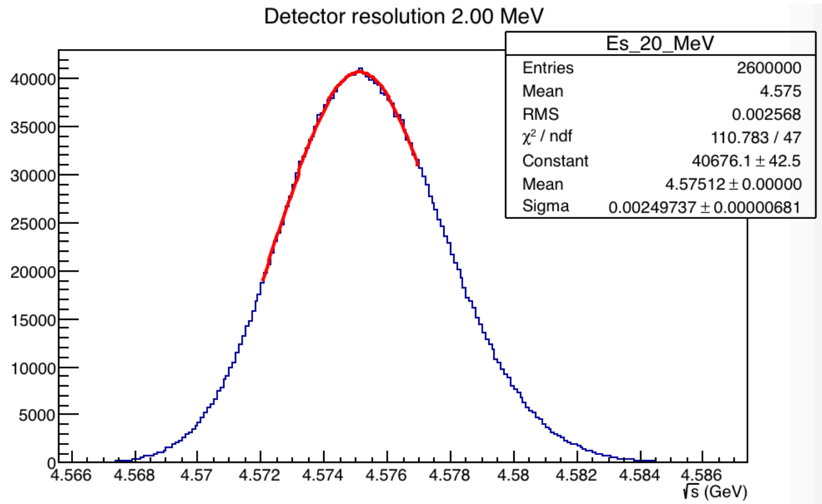
problem from group meeting

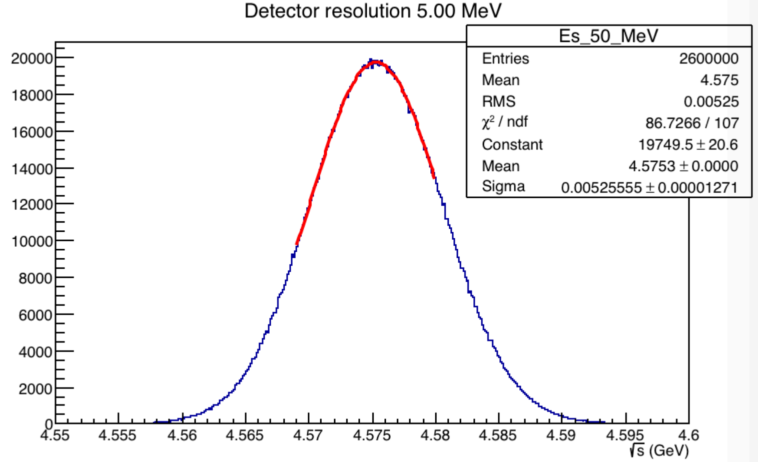
- Is the peak value from the fit suitable for the calculation of δE (δE = M(X) - Ecm)?
- To check the problem, I use MC truth smeared with gaussian function(simulating the detector resolution) to check the peak of M(X). The peak is extracted with a gaussian to fit the spectrum of M(X) near the peak. The result shows if the resolution of detector is much larger than energy spread, δE can be described by the peak value just as what the mean value of M(X) do. Next slide shows some plots of Ecm after considering detector resolution.

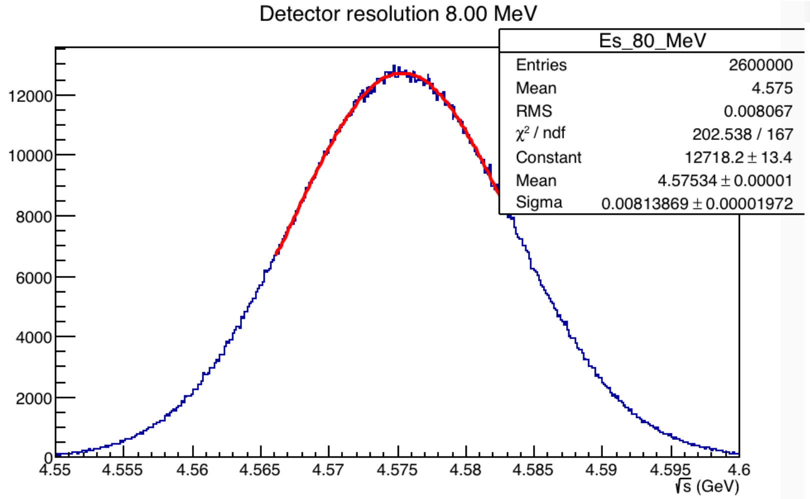
problem from group meeting

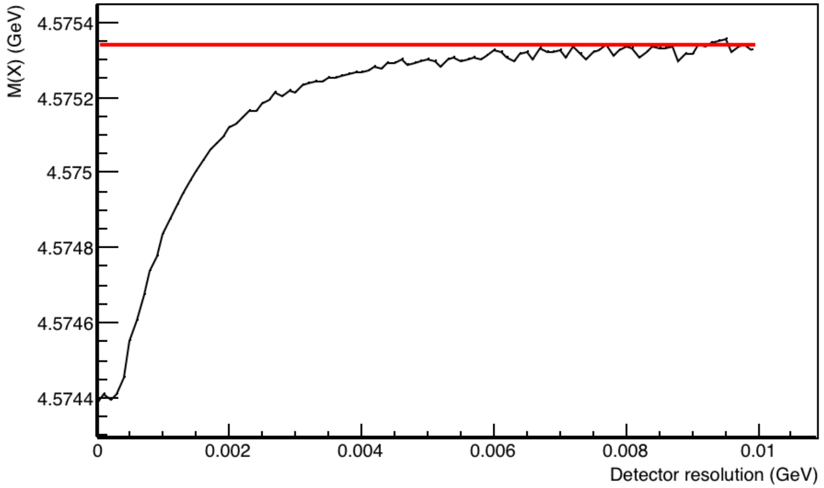












The first 5 plots shows M(X) with different detector resolution, from 0 to 8 MeV.

The last plot shows the relation between M(X) and detector resolution. red line shows the average Ecm with threshold effect.

In our case, detector resolution is more than 5 MeV. the peak of M(X) is very close to average Ecm.