



Week Update 5 & 6

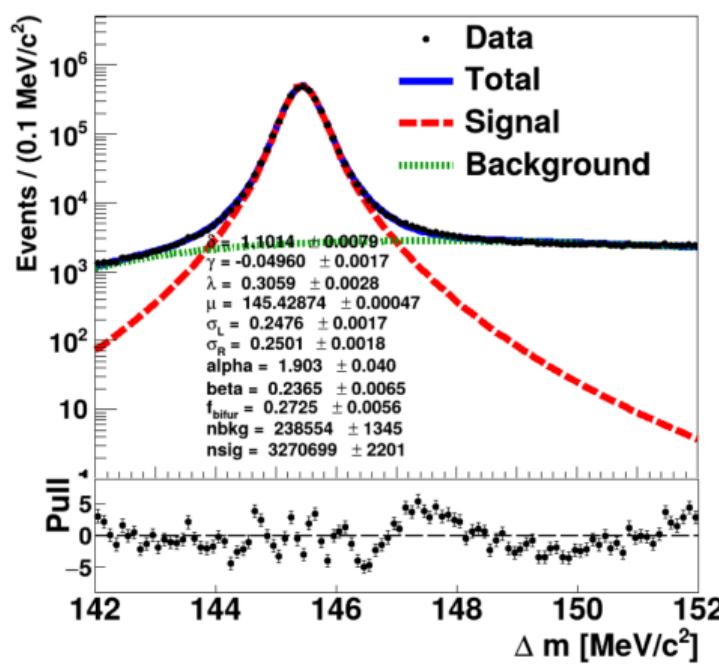
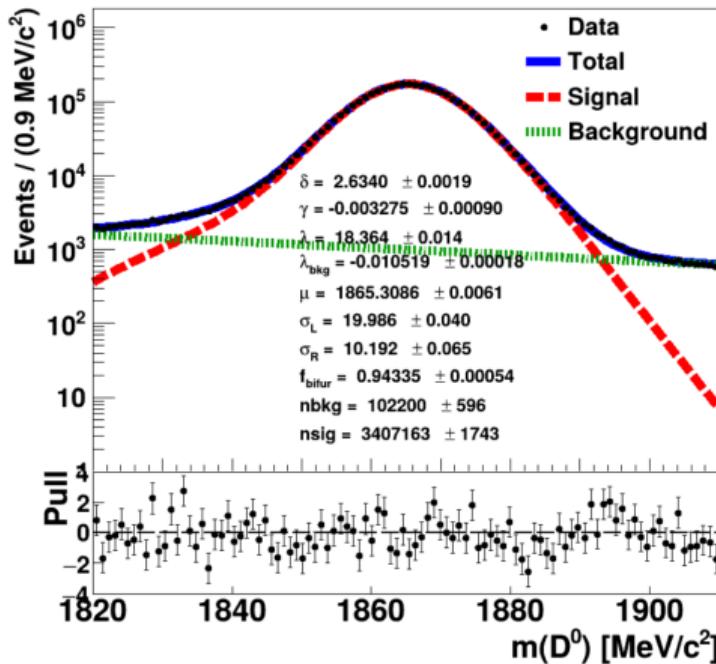
Edward Wardell

12th February - 19th February 2025

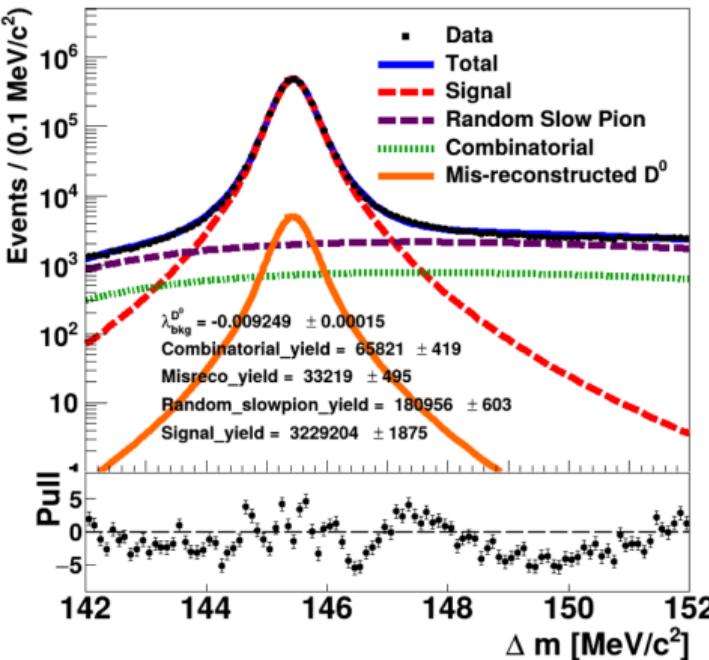
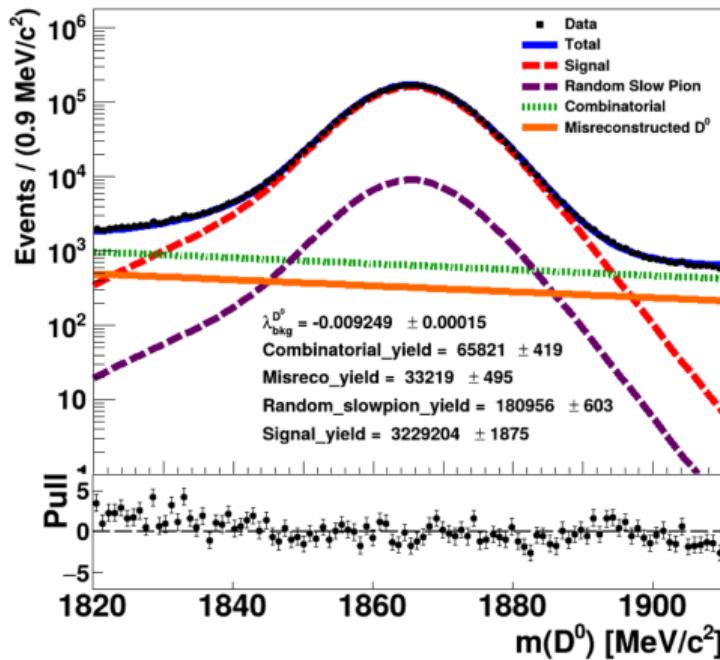
Tasks Undertaken

- ▶ Final RS Mass fit performed to obtain sWeights.
- ▶ Looked at removing Misreconstructed- D^0 background in the 2D fit.
- ▶ Compared RS and WS variables that had bad agreement before D^0 IPCHI2 cut to see if the fitting/agreement between RS and WS variables improves.
- ▶ Trained BDTs on 2015 MagDown dataset for 1D-Classifier and 2D-Classifier, comparing the significance for applying cut then BDT, BDT then cut, just BDT and finally significance from standard cut method.
- ▶ The control sample to compare these results was the 2015 MagDown sample without the D^0 IPCHI2 cut.
- ▶ Maximum significance is found for these cases by loosening and tightening this IPCHI2 cut.

RS - 1D Mass fits

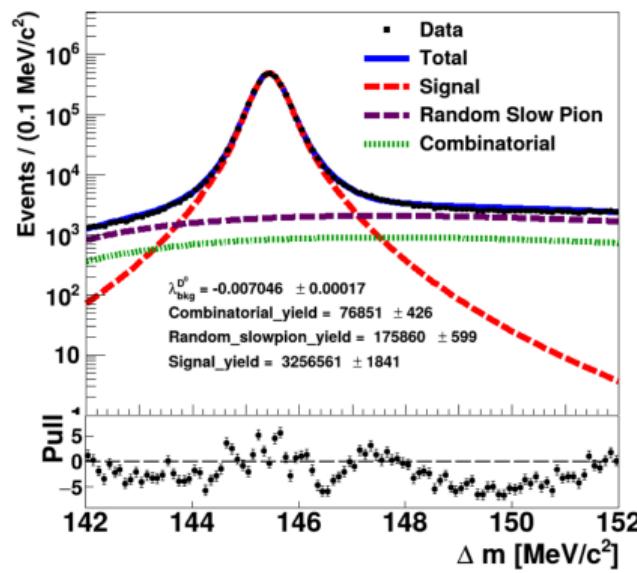
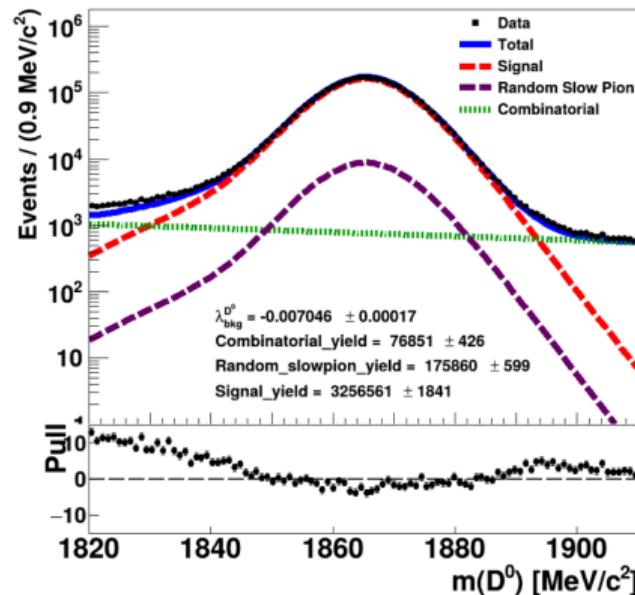


RS - 2D Mass fit - These are the fits that I use to obtain the sWeights for the RS sample to train the BDT



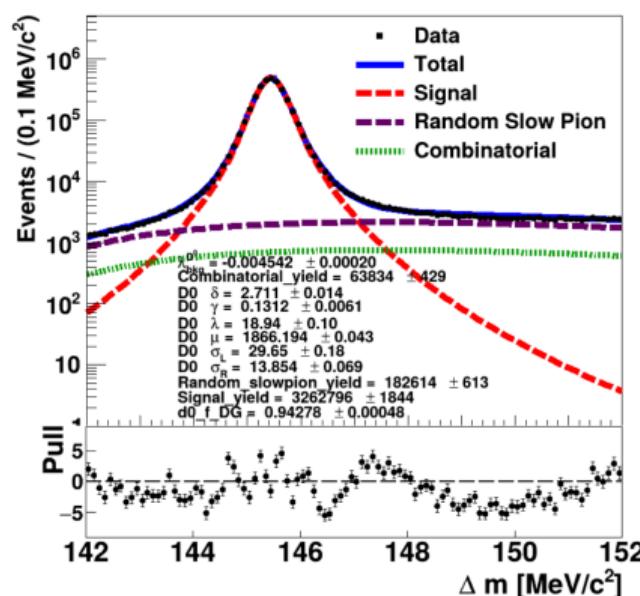
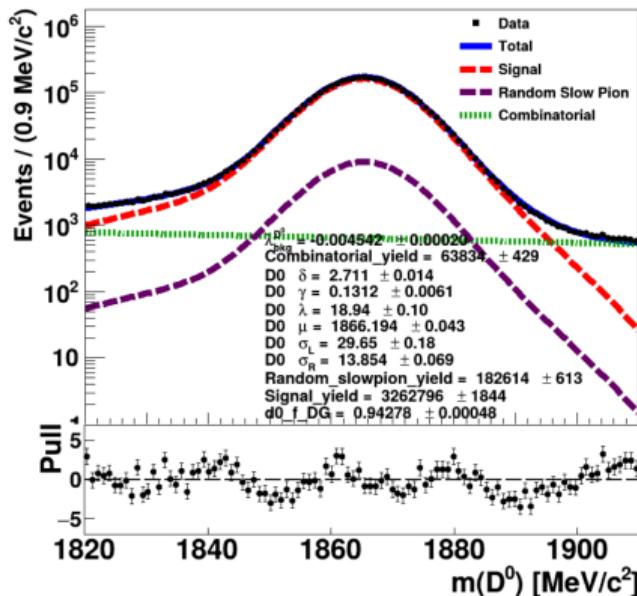
Can we improve the RS - 2D Mass fit?

- We start by removing Misreco background from the fit.



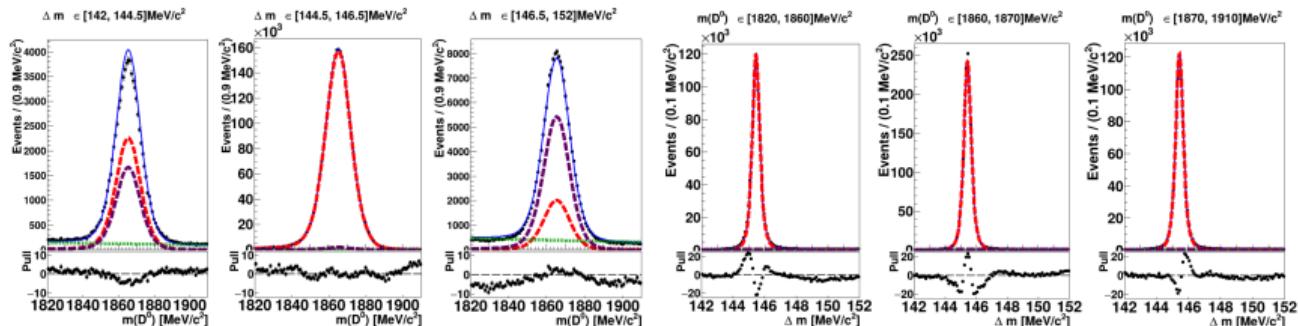
Can we improve the RS - 2D Mass fit?

- We fit $m(D^0)$ variables with misreco-background still removed.

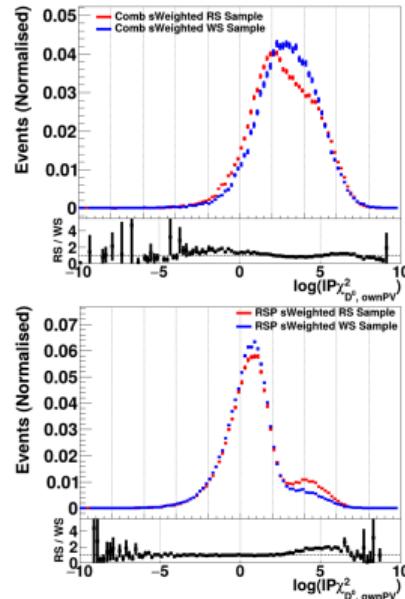


Mass Projections for the removed Misreco-background and $m(D^0)$ parameters

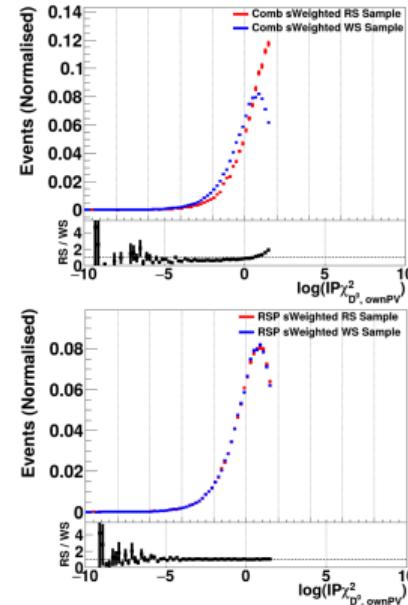
- We fit $m(D^0)$ variables with misreco-background still removed.



Comparing RS and WS variables before and after IPCHI2 cut.

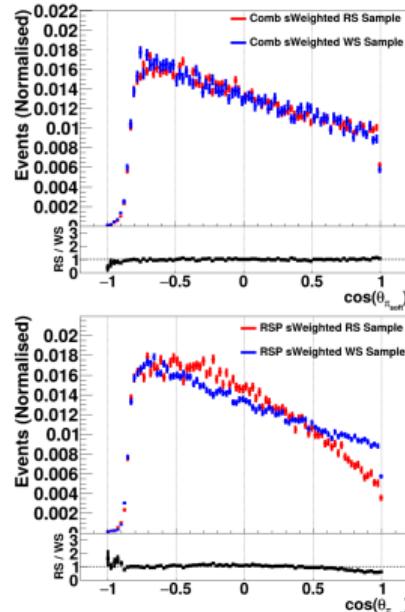


(a) Before cut

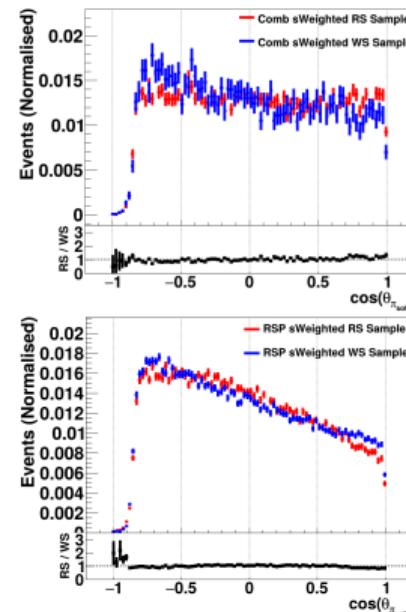


(b) After cut

Comparing RS and WS variables before and after IPCHI2 cut.

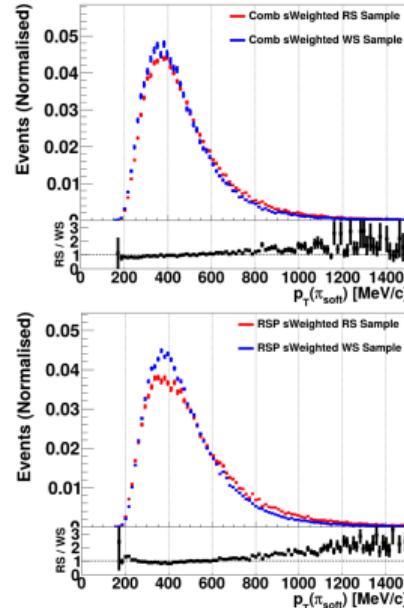


(a) Before cut

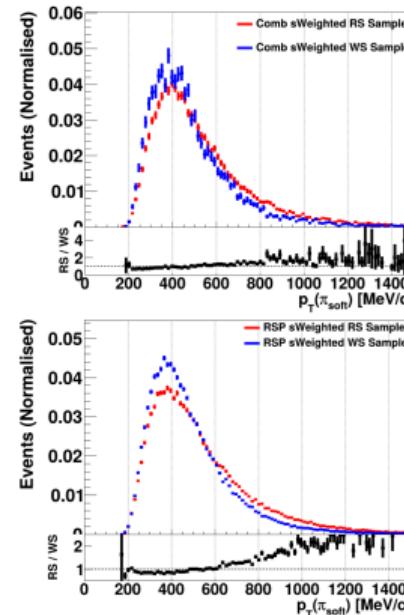


(b) After cut

Comparing RS and WS variables before and after IPCHI2 cut.

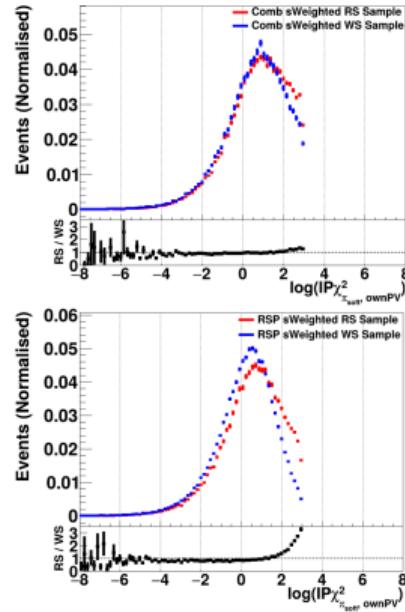


(a) Before cut

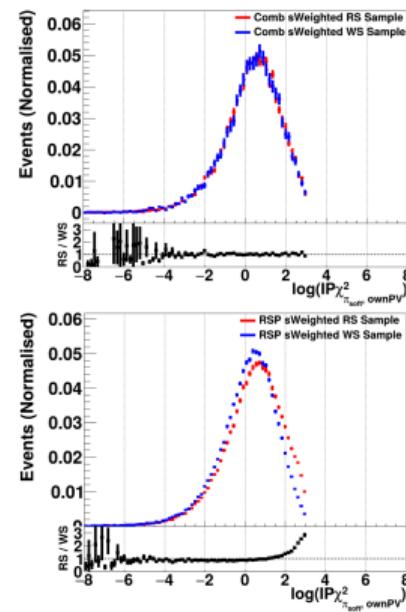


(b) After cut

Comparing RS and WS variables before and after IPCHI2 cut.



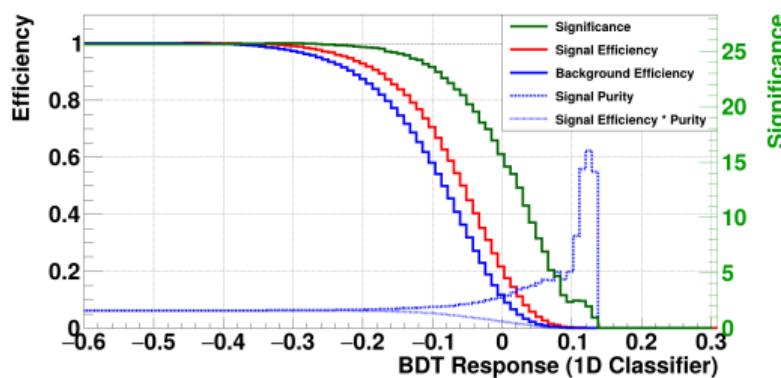
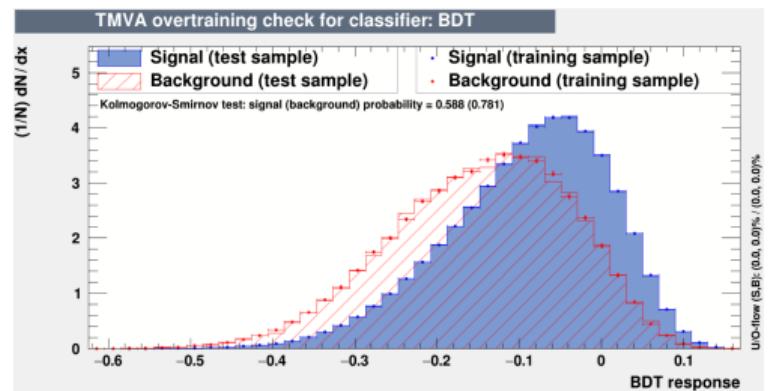
(a) Before cut



(b) After cut

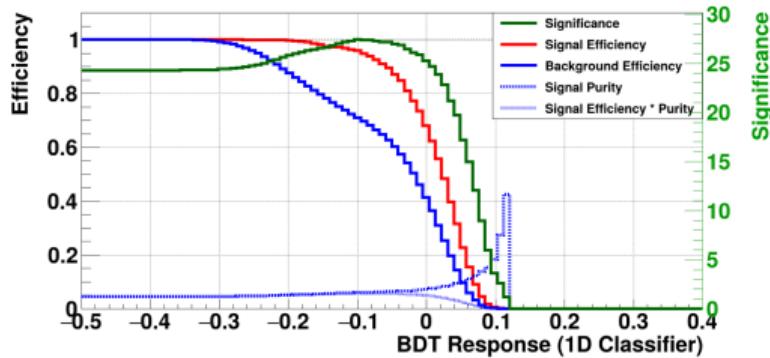
Training the BDT on RS dataset and comparing the cut taken before or after the BDT training.

1D Classifier BDT response - cut at (-0.31) - IPCHI2 cut taken before training.

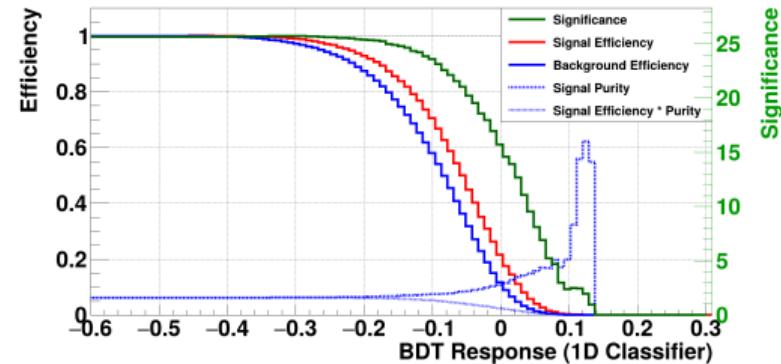




1D-Classifier Significance scan from BDT response - BDT trained before or after IPCHI2 cut

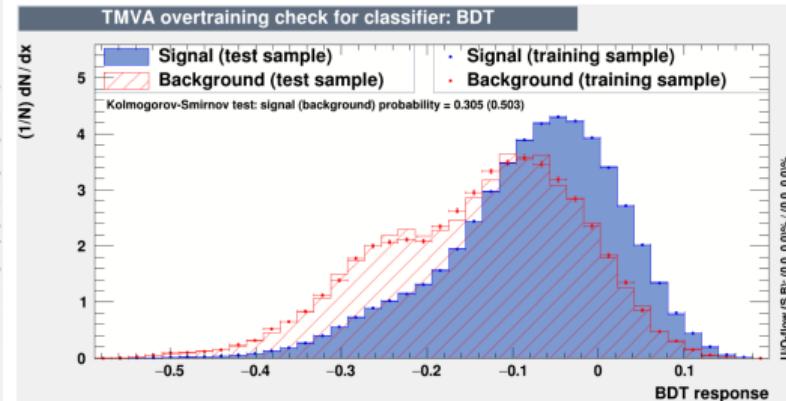
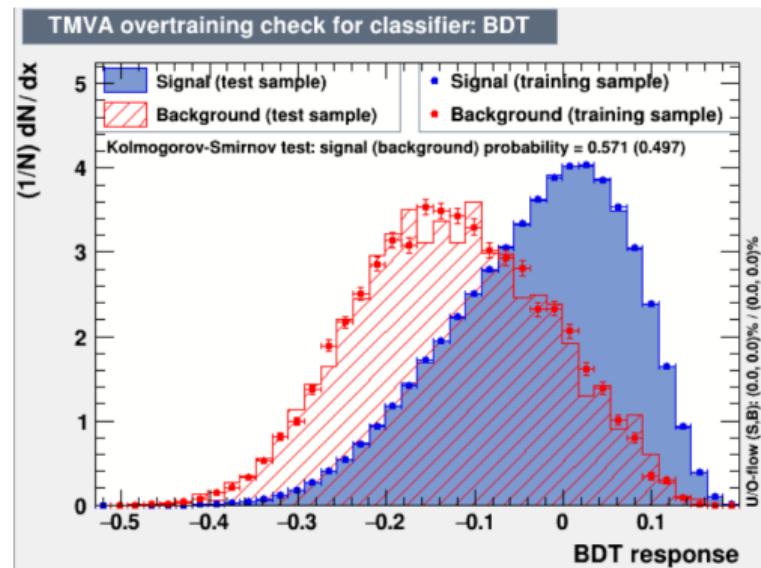


(a) Trained before IPCHI2 cut - Max Significance at (-0.1)



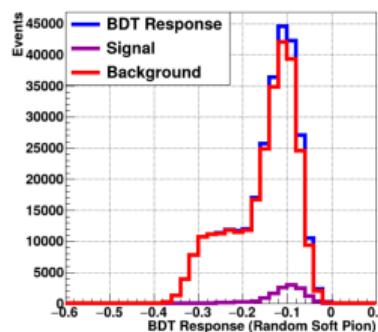
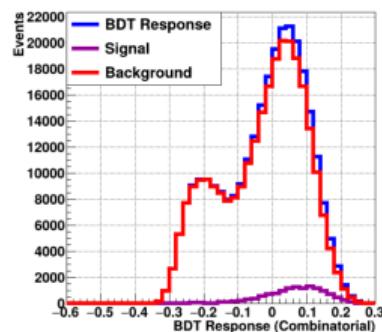
(b) Trained after IPCHI2 cut - Max Significance at (-0.31)

2D Classifier BDT response - comb trained BDT (left), RSP trained BDT (right)

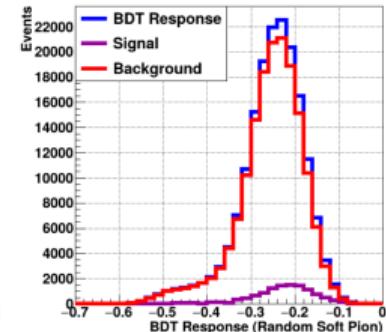
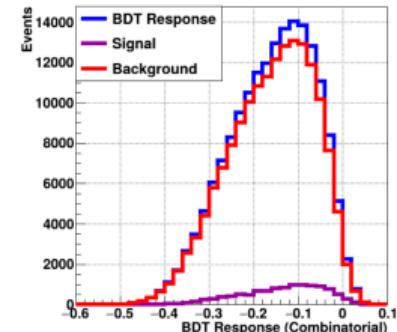




BDT responses before and after IPCHI2 cut



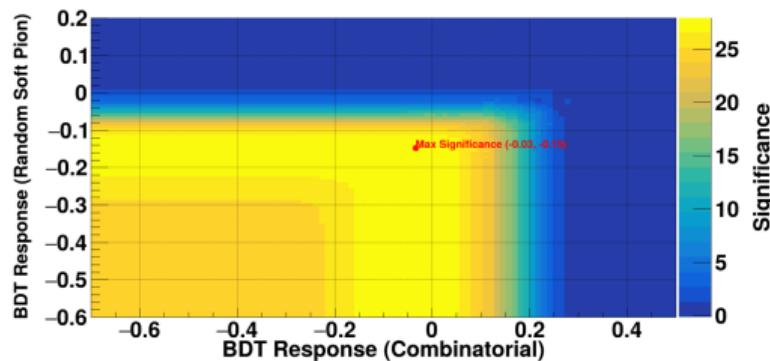
(a) BDT trained before cut



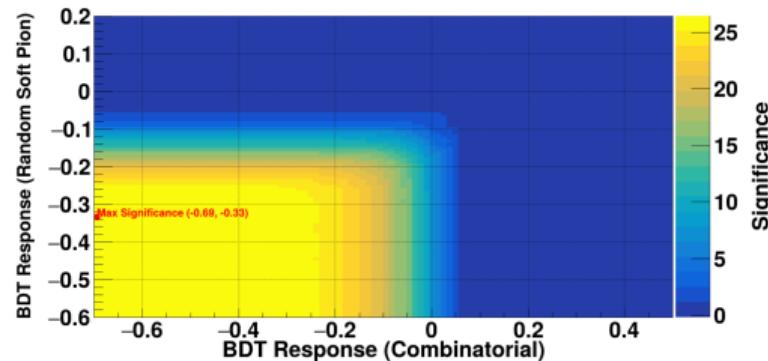
(b) BDT trained after cut



2D Significance scan - before and after IPCHI2 cut.



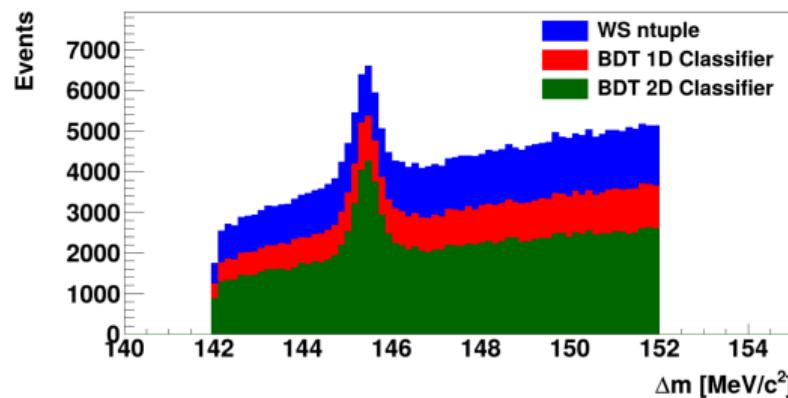
(a) BDT trained before cut



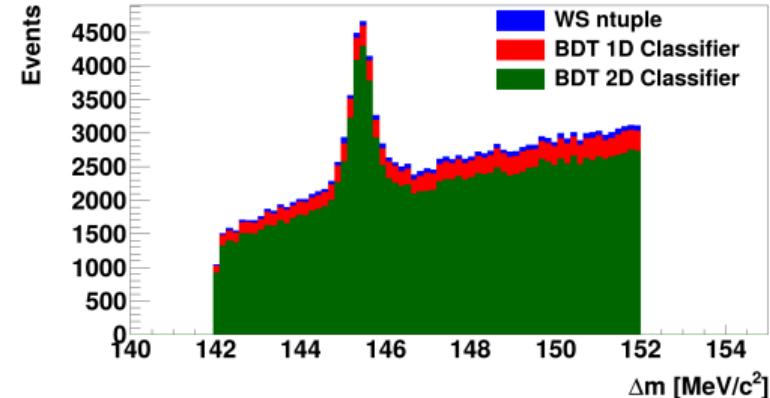
(b) BDT trained after cut



WS Δm with different classifier cuts, with IPCHI2 cut applied either before or after BDT training.



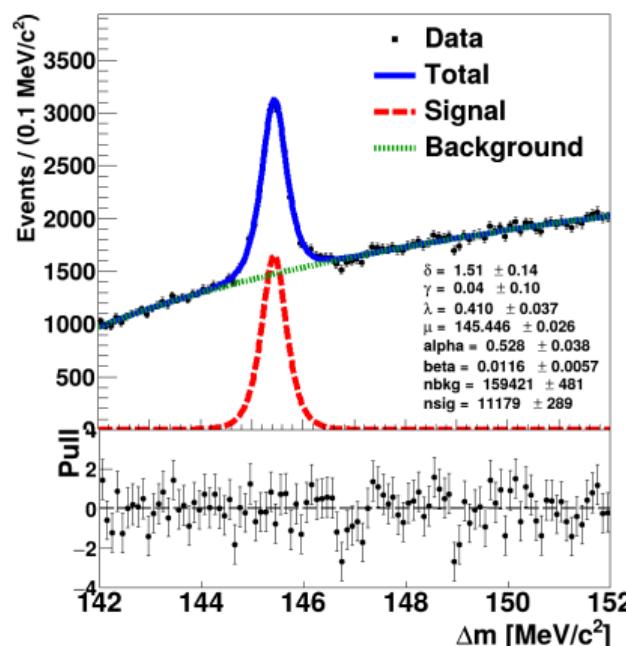
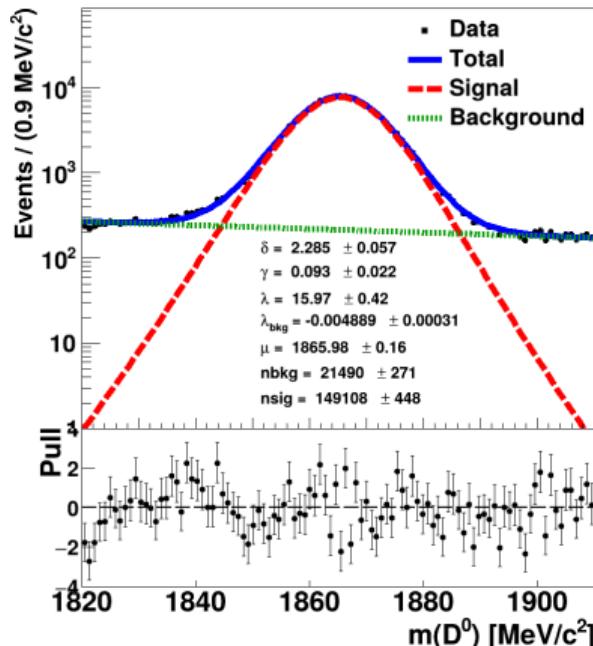
(a) BDT trained before cut



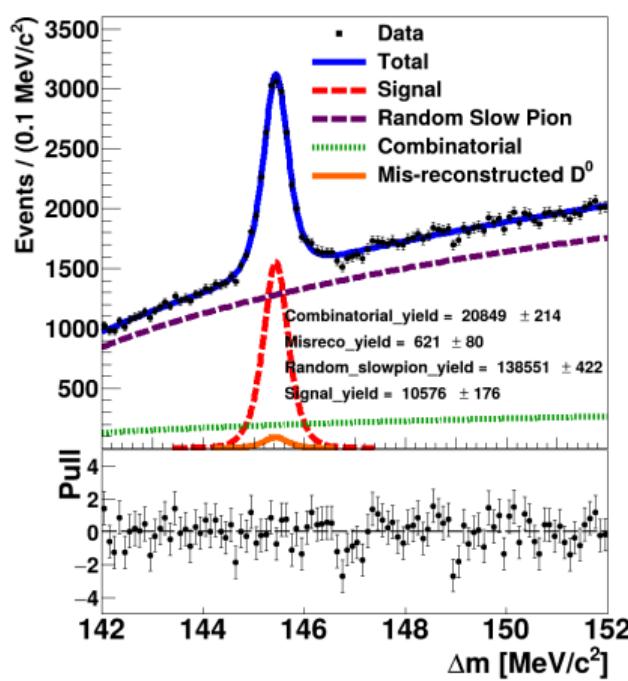
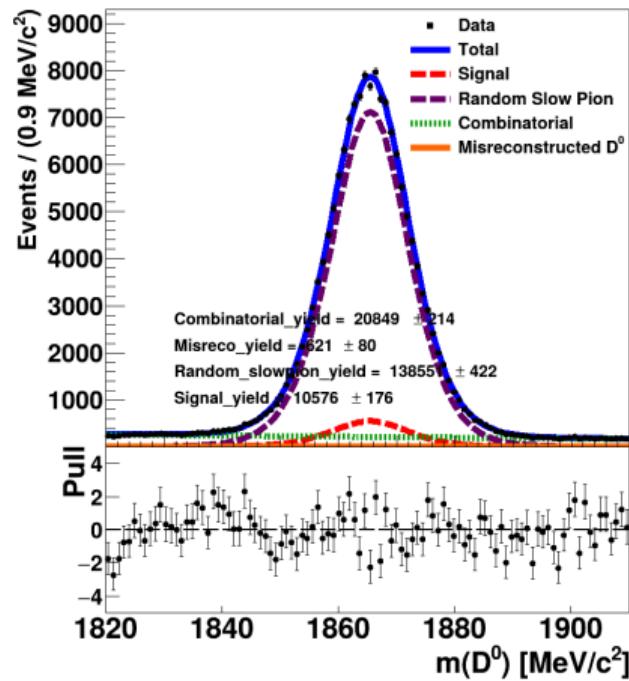
(b) BDT trained after cut

Mass Fits with IPCHI2 cut taken first, then BDT trained after cut. The following are the results of both 1D and 2D Classifiers.

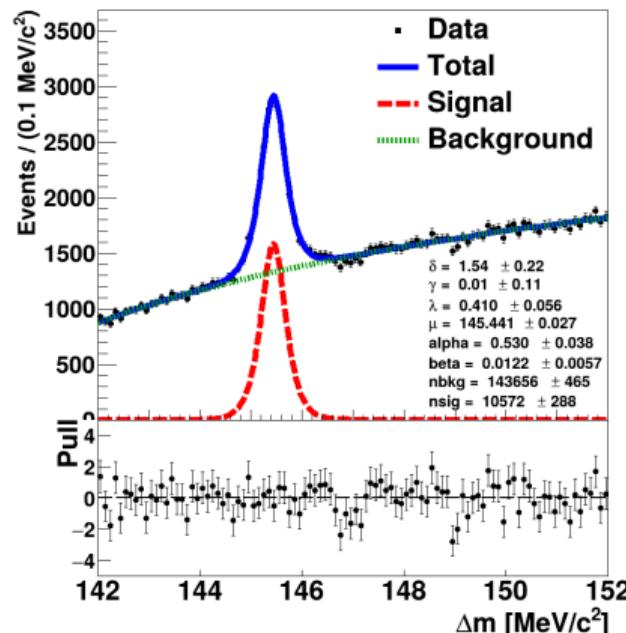
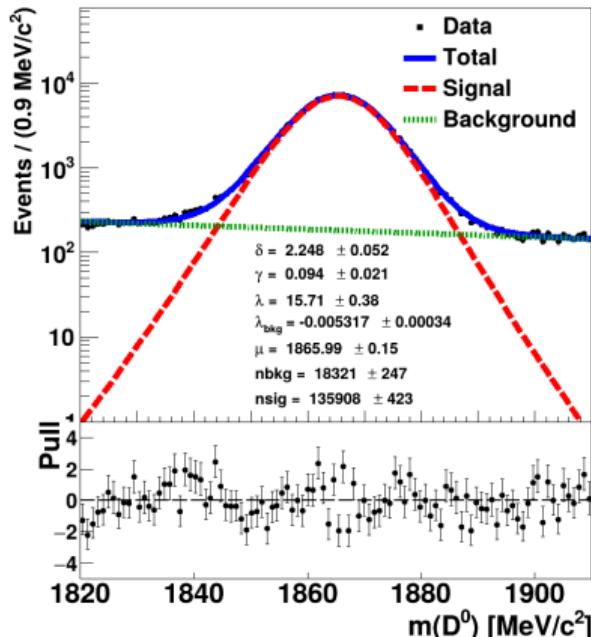
WS - 1D Mass fits with 1D - Classifier cut



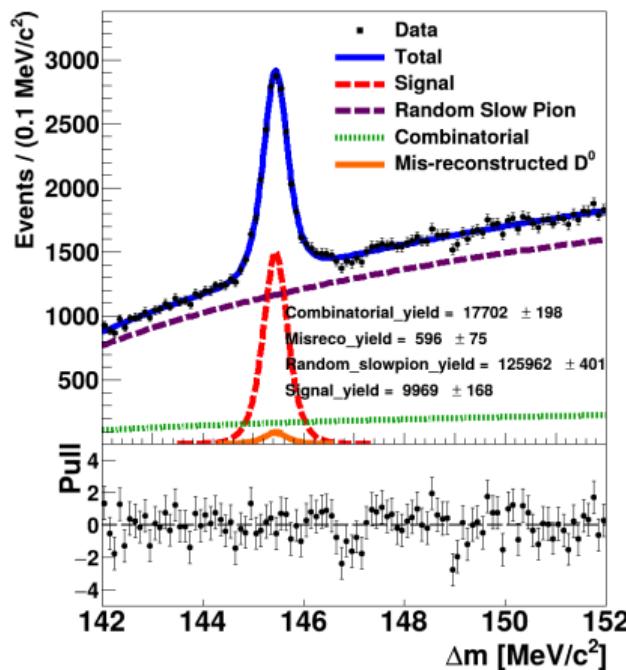
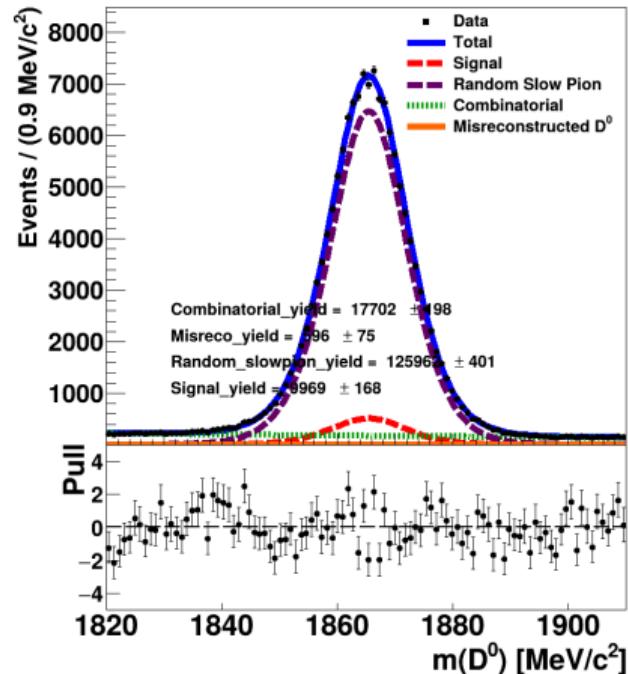
WS - 2D Mass fits with 1D - Classifier cut



WS - 1D Mass fits with 2D - Classifier cut

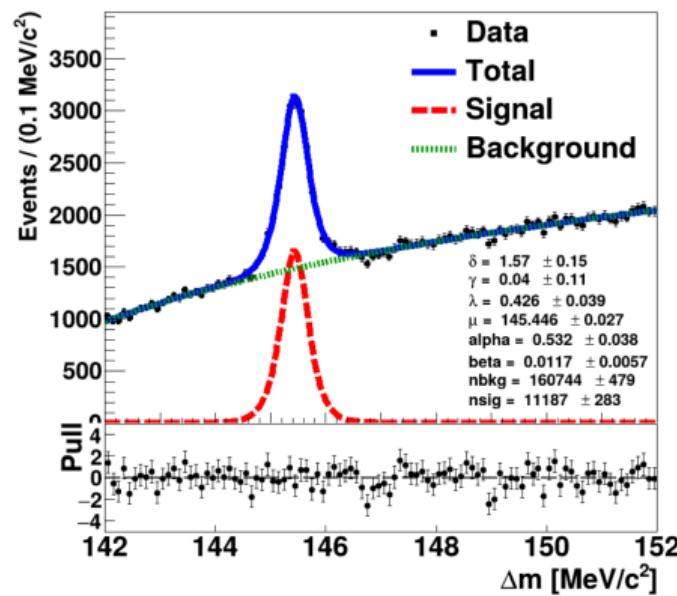
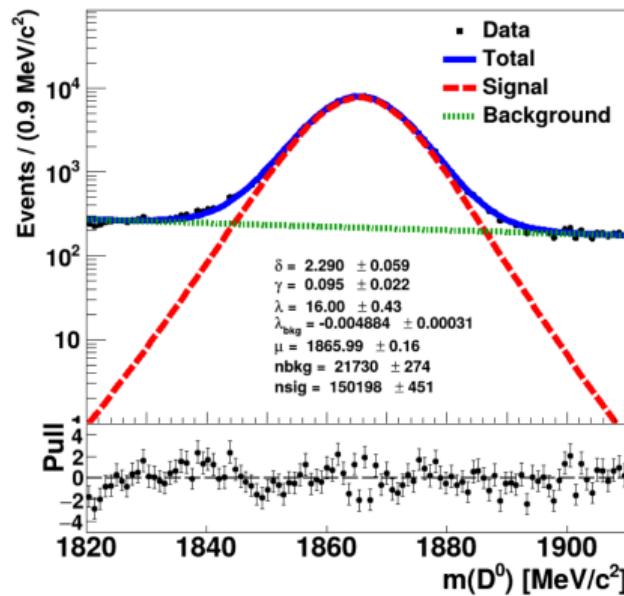


WS - 2D Mass fits with 2D - Classifier cut

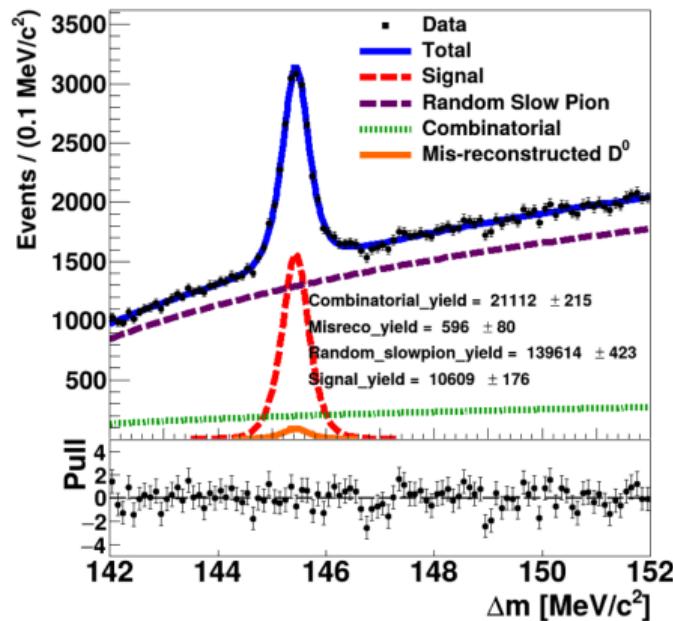
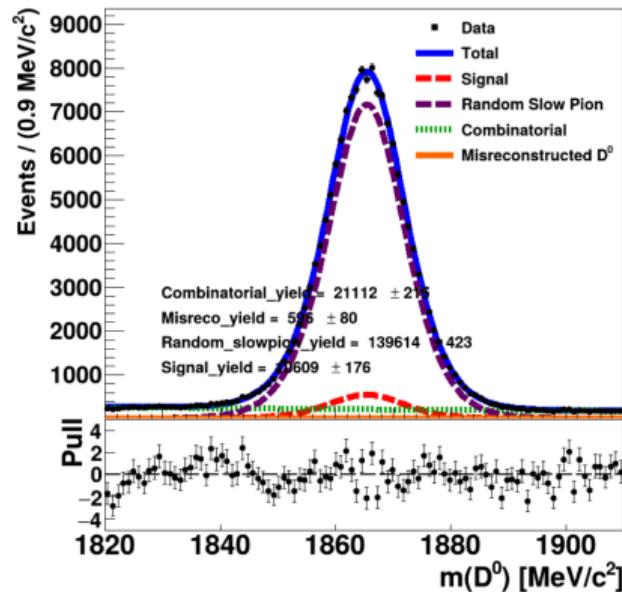


Mass Fits with BDT trained first, then IPCHI2 cut taken. This is for both 1D and 2D Classifiers.

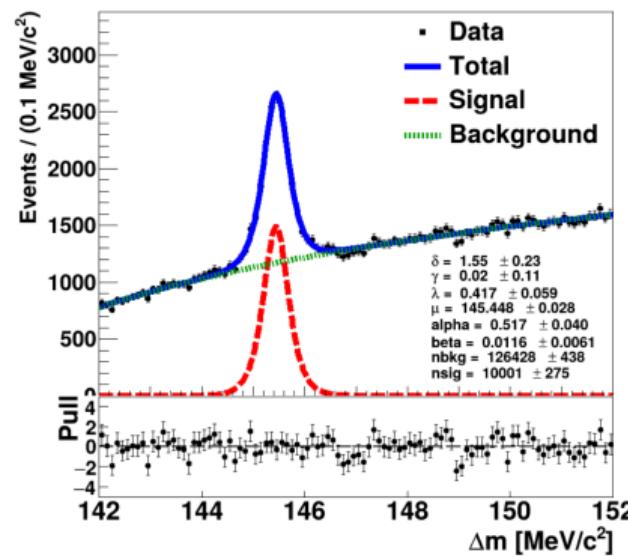
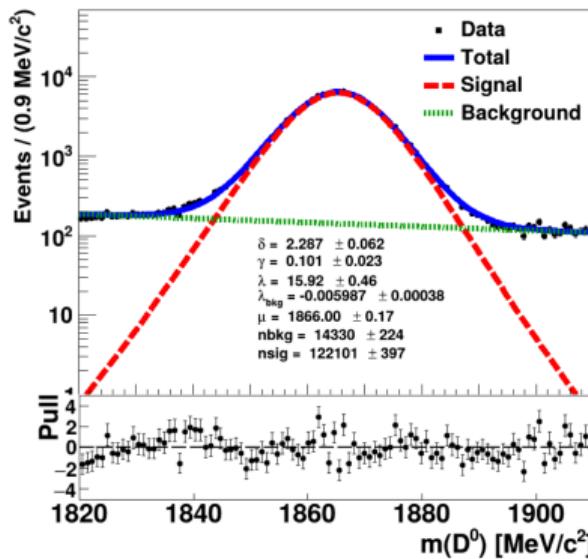
WS - 1D Mass fits with 1D - Classifier cut



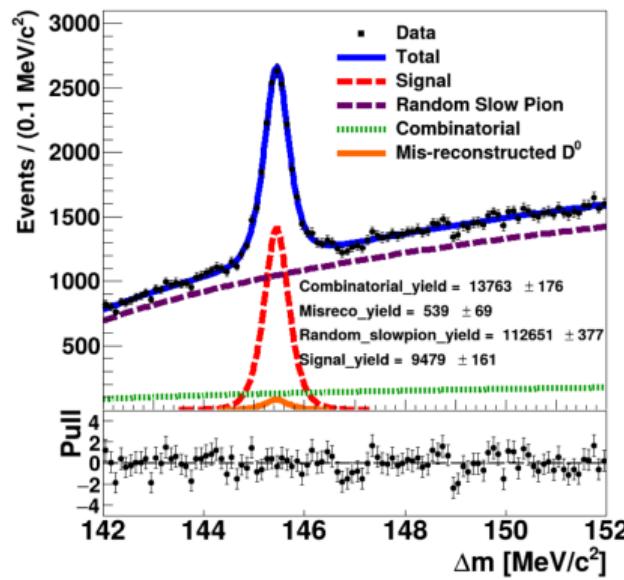
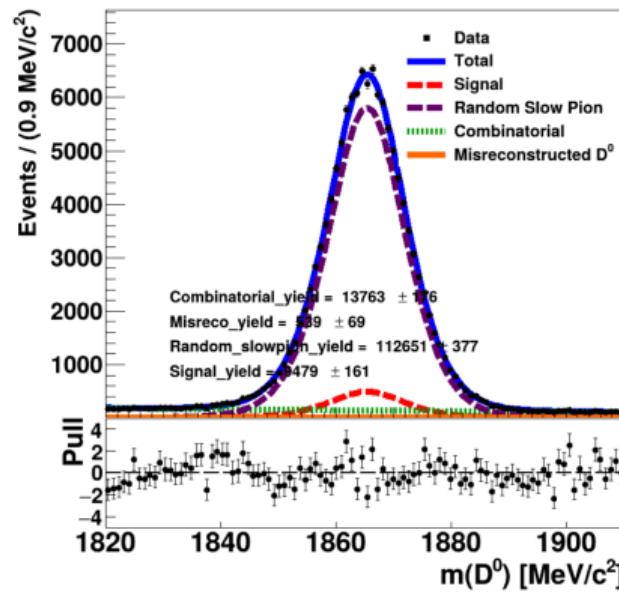
WS - 2D Mass fits with 1D - Classifier cut



WS - 1D Mass fits with 2D - Classifier cut

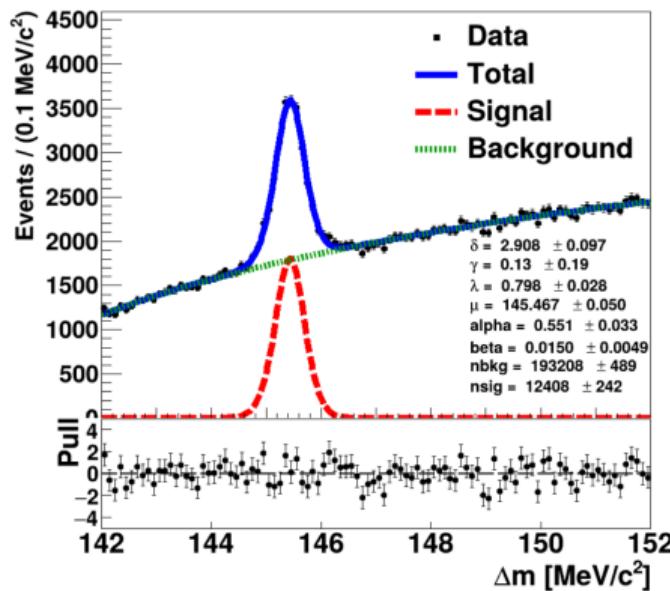
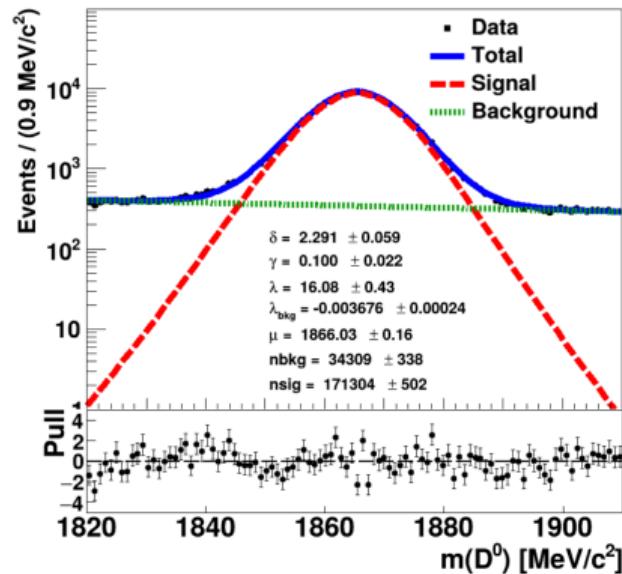


WS - 2D Mass fits with 2D - Classifier cut

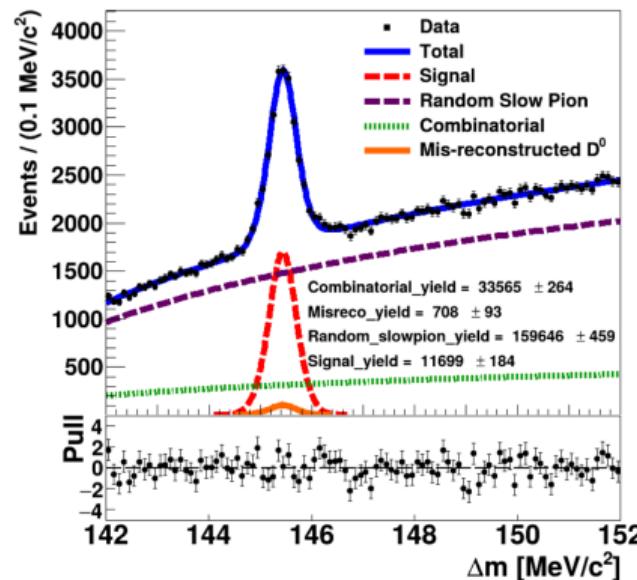
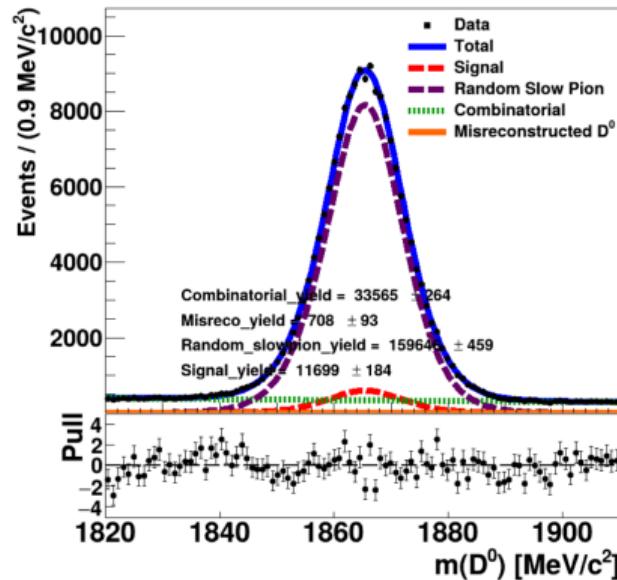


Mass Fits with only BDT trained response (no IPCHI2 cut taken). This is for both 1D and 2D Classifiers.

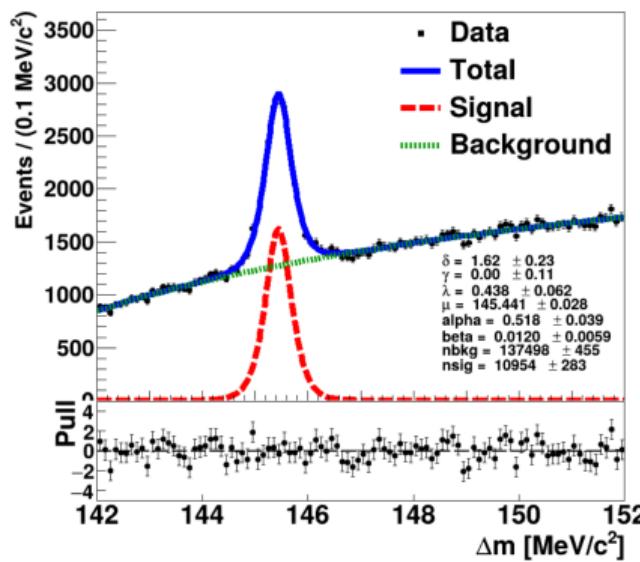
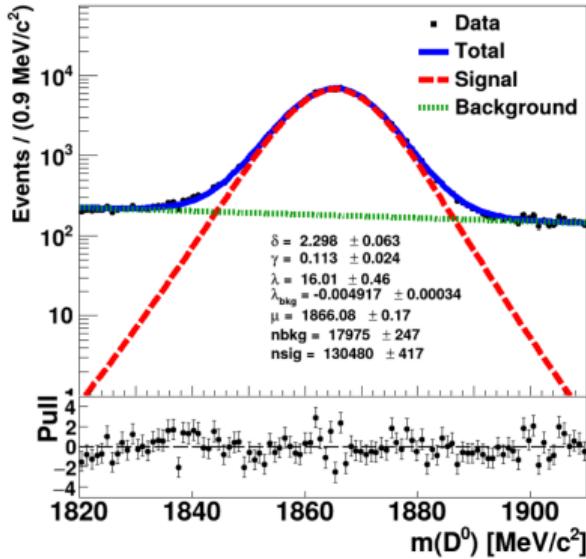
WS - 1D Mass fits with 1D - Classifier cut



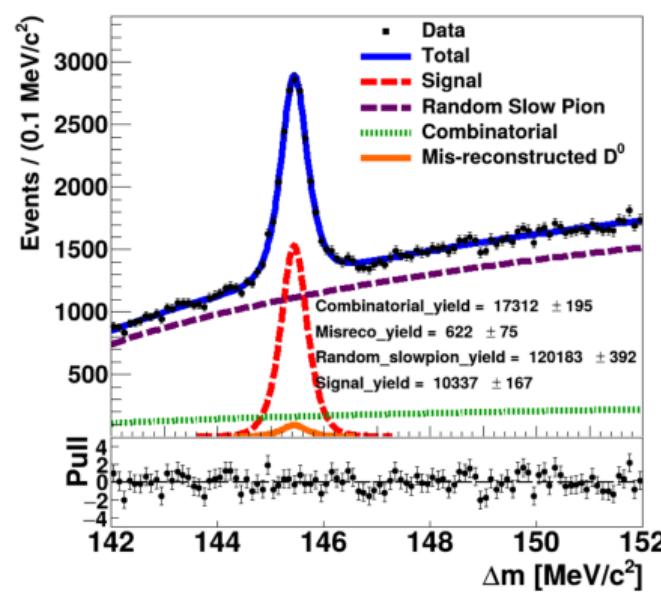
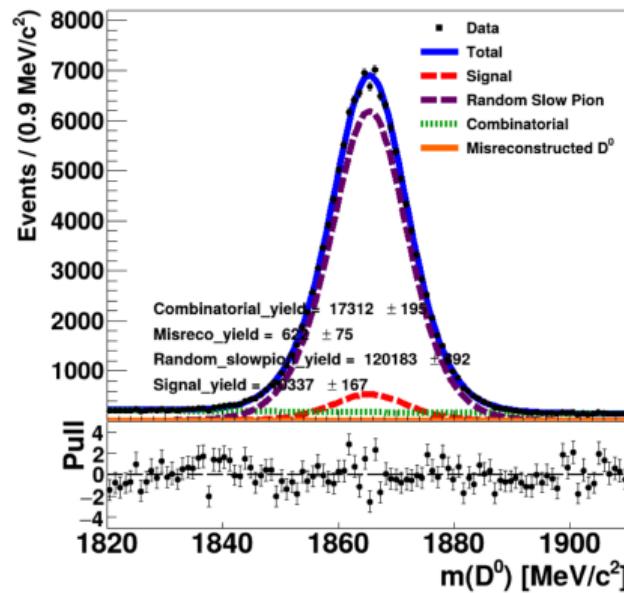
WS - 2D Mass fits with 1D - Classifier cut



WS - 1D Mass fits with 2D - Classifier cut



WS - 2D Mass fits with 2D - Classifier cut



Comparison of different methods, for combinations the order of IPCHI2 cut taken and BDT training.

- ▶ Using the uncut (D^0 IPCHI2) 2015 MagDown dataset. From the 2D mass fit, yields were obtained.
- ▶ Signal events = $S_0 = 12909$, Background events = $B_0 = 274899$
- ▶ Significance = $\frac{\varepsilon_s S_0}{\sqrt{\varepsilon_s S_0 + \varepsilon_b B_0}}$, where ε_s = signal efficiency and ε_b = background efficiency.
- ▶ finding the ε_s and ε_b for different cases we can compare the different methods.

Significance comparison for combinations of BDT and IPCHI2 cut.

