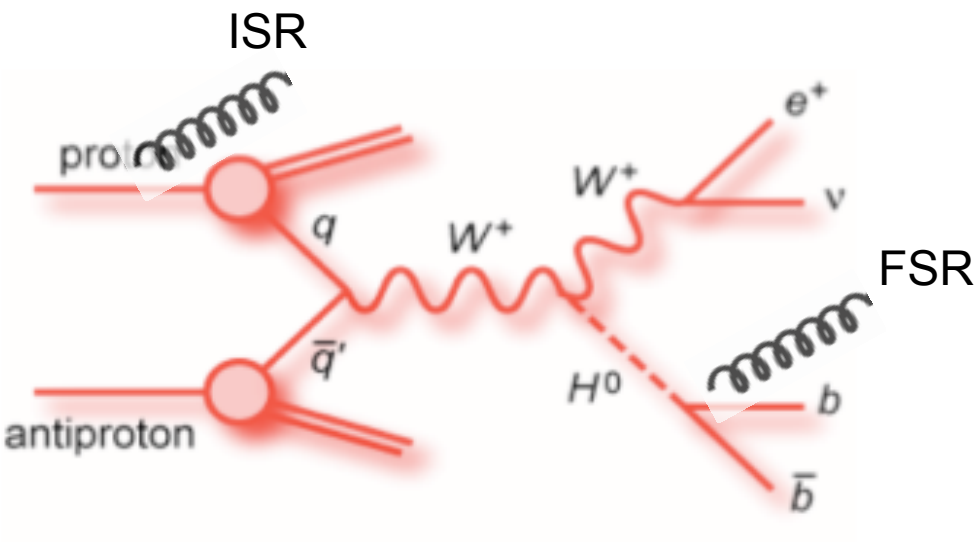
WH 3 jets analysis - Radiation recovery

Florian MICONI

Institut Pluridisciplinaire Hubert Curien

Dø France 31/05/2011

ISR vs FSR

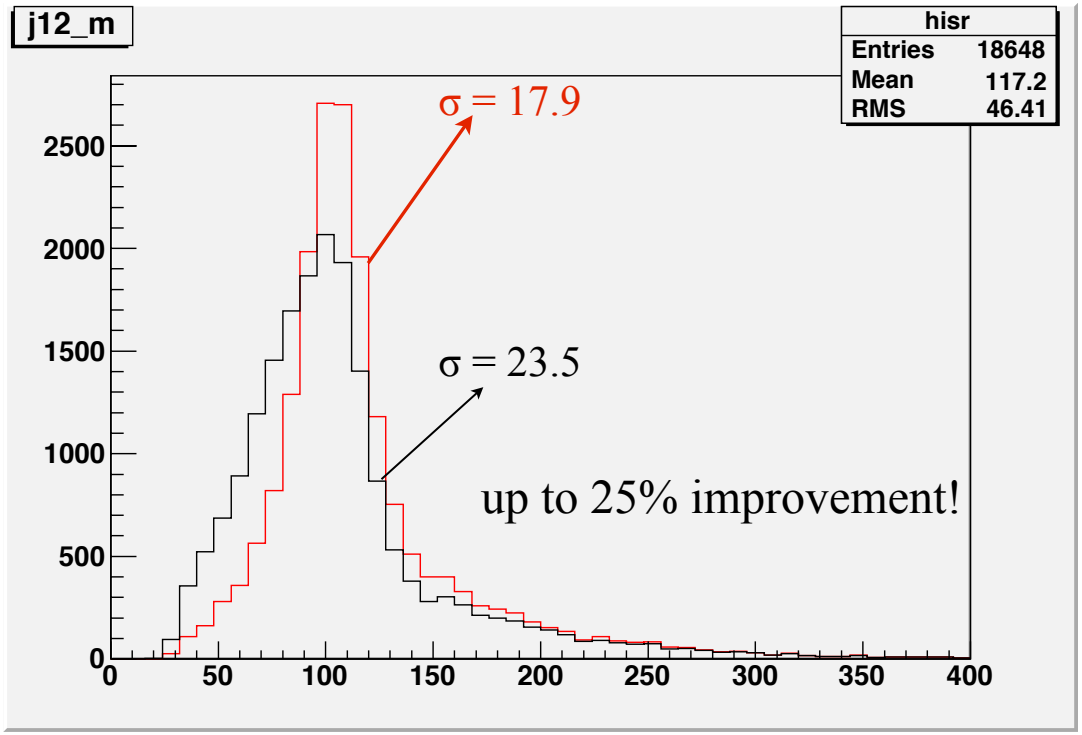


In the 3 jets analysis, we have to choose the best jets combination to reconstruct the most accurate Higgs invariant mass.

→ In order to do that we have to be be able to differentiate ISR from FSR jets.

Dijet mass reconstruction

Optimal case



Usual dijet mass

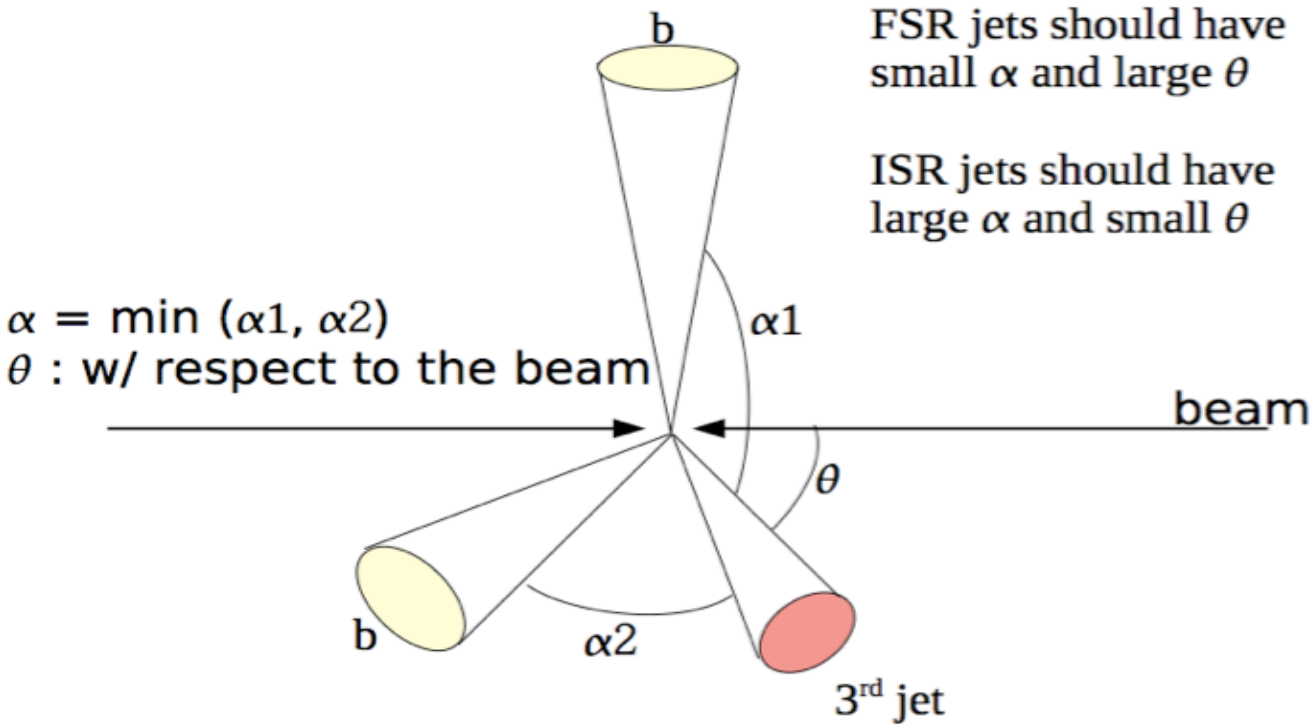
Radiation Recovery

Usual dijet mass : compute mHiggs always with 1st and 2nd leading jet Pt

Radiation recovery : Add the 3rd jet when it's tagged as FSR (MC truth).

ISR vs FSR

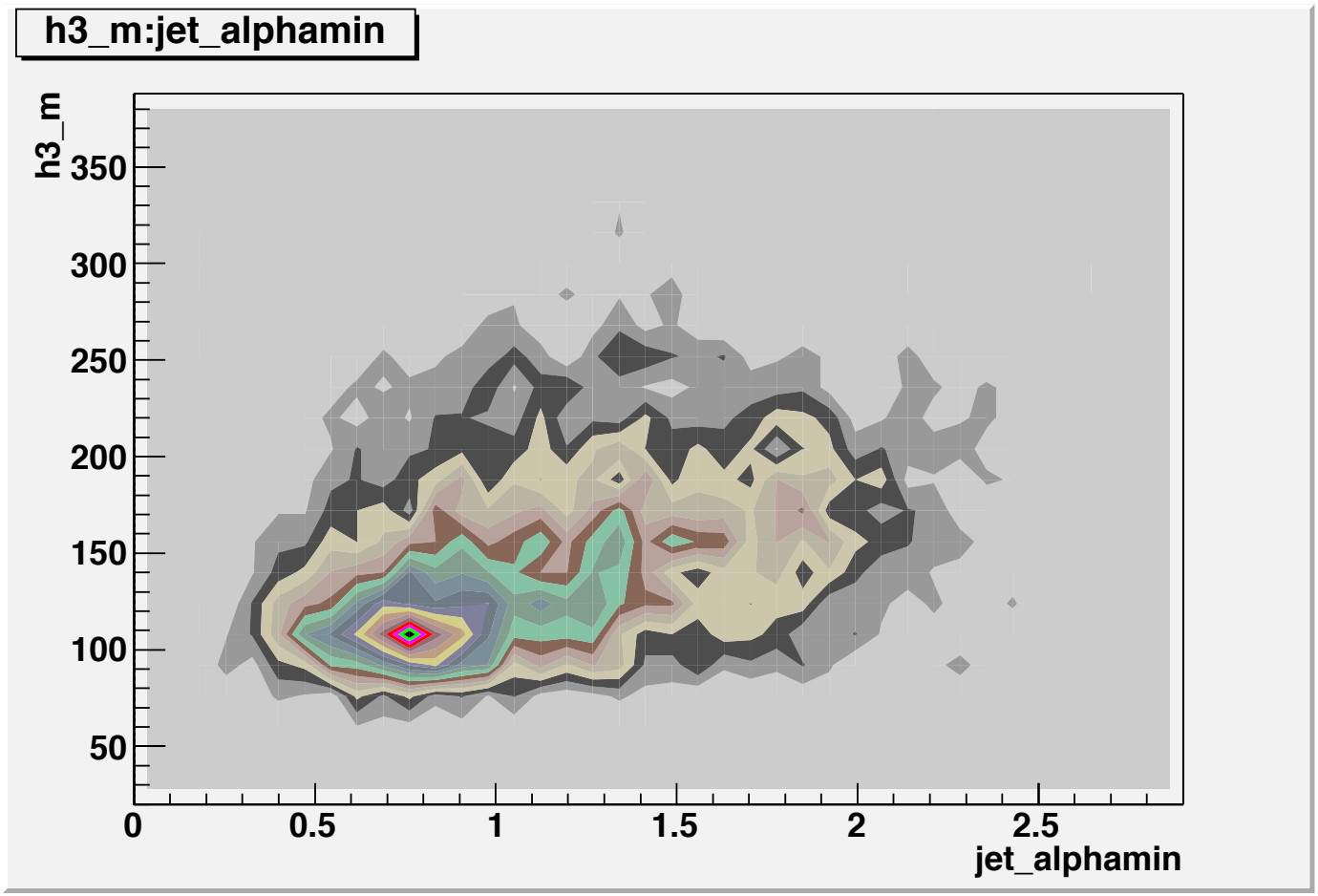
Some definitions



Samuel Calvet - 2 Dec. 2008

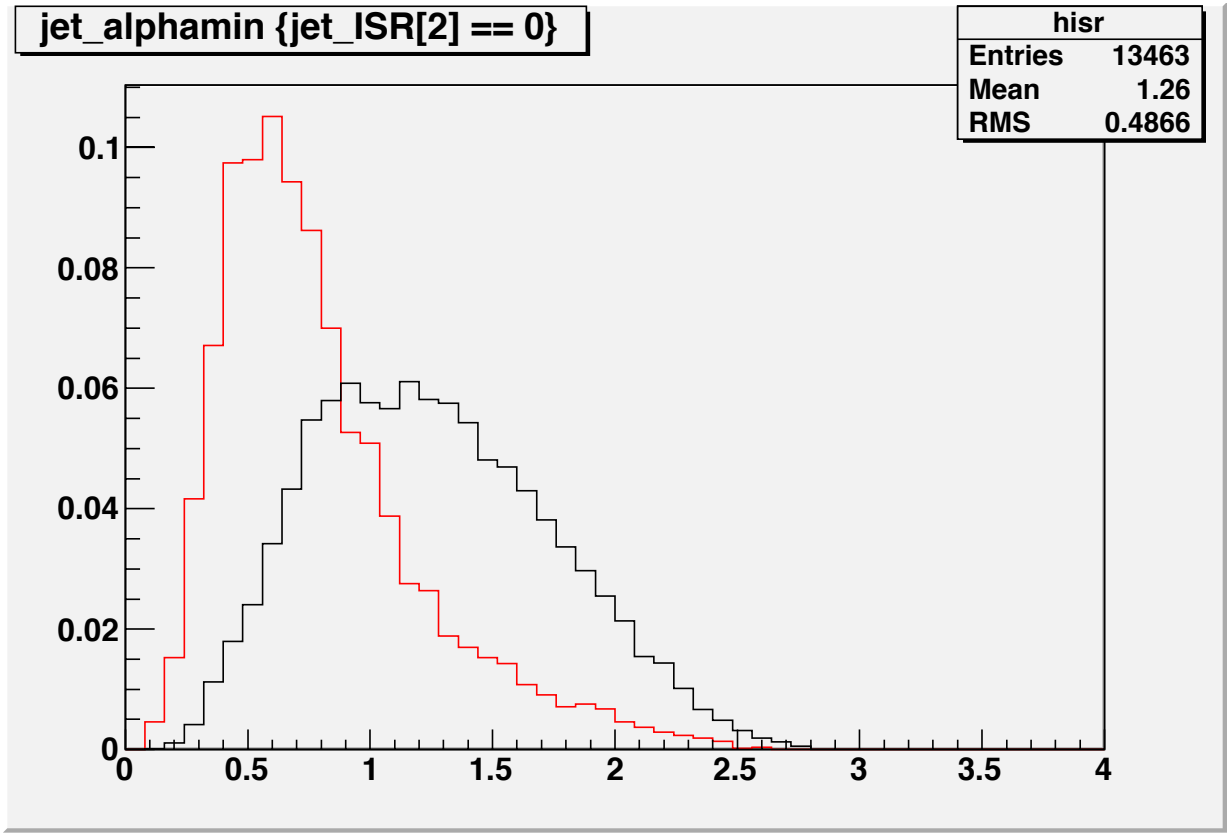
Invariant mass studies 7

3 jets mass vs alphamin



Alphamin cut

Alpha minimal (wh 115 MC sample)

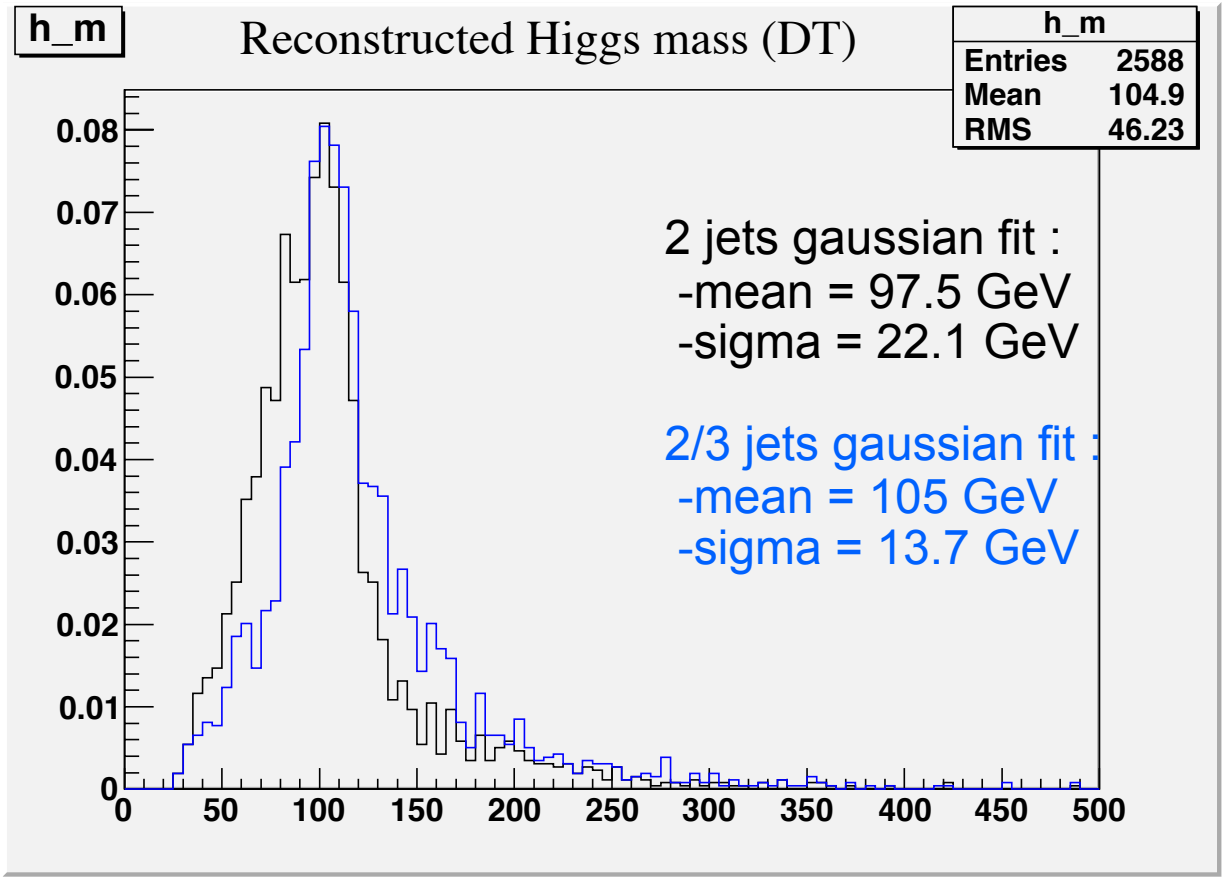


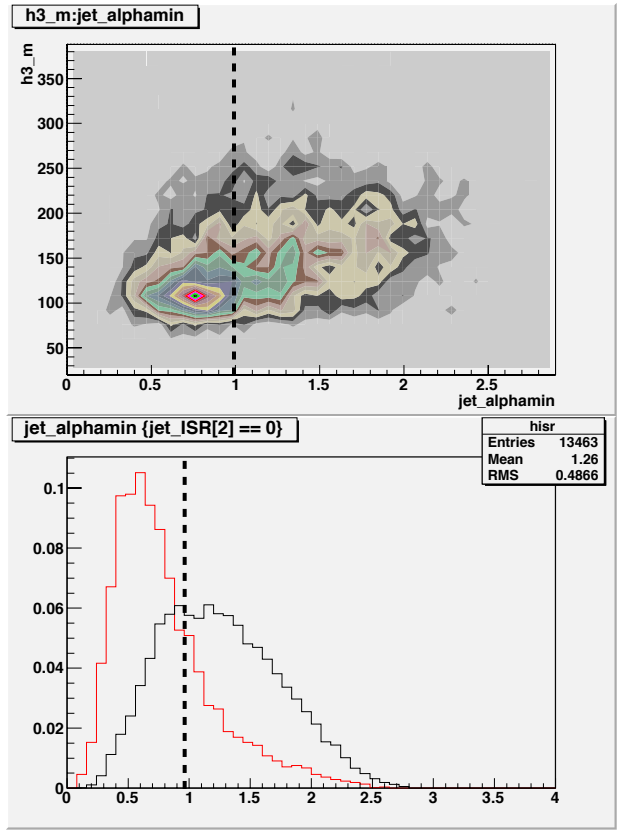
ISR jets

FSR jets

Alphamin cut

Alpha minimal

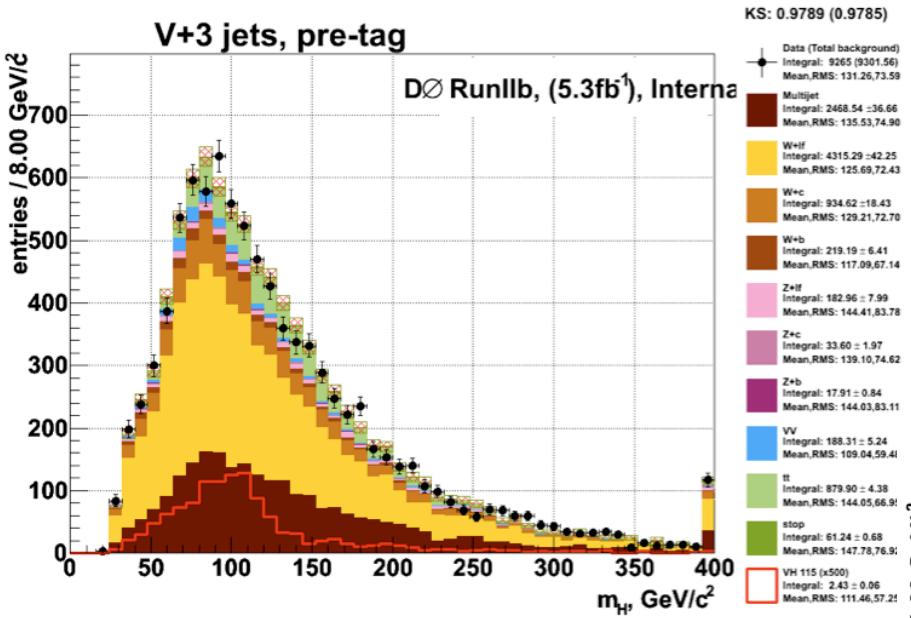




→ If alphamin <1. then jet = jet+jet3

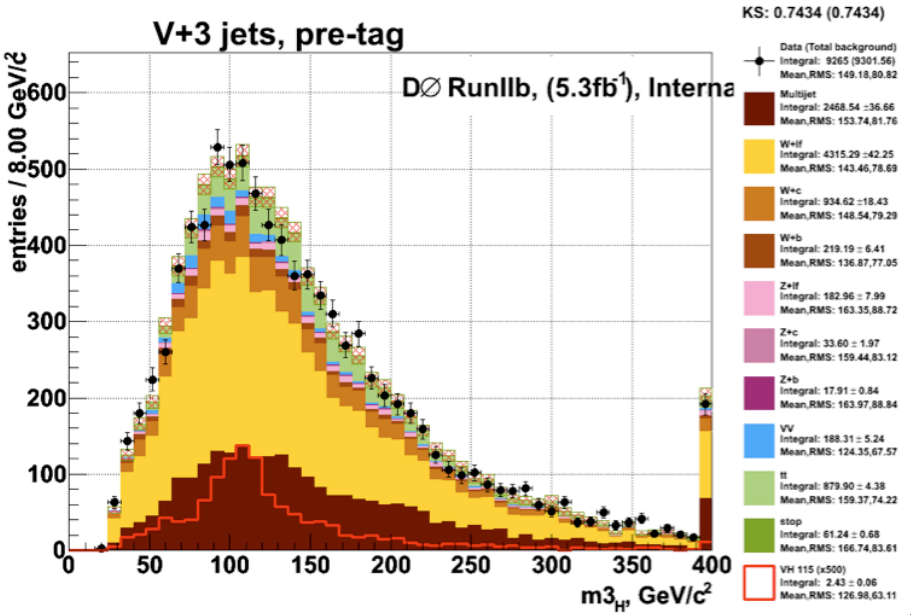
→ Usual dijet mass reconstruction.

DataVsMc Standard vs Radiation recovery



Standard

Radiation recovery (alphamin <1)



Collie

- Collie results on dijet mass only (electron channel, continuous L6 double tag, higgs:115)

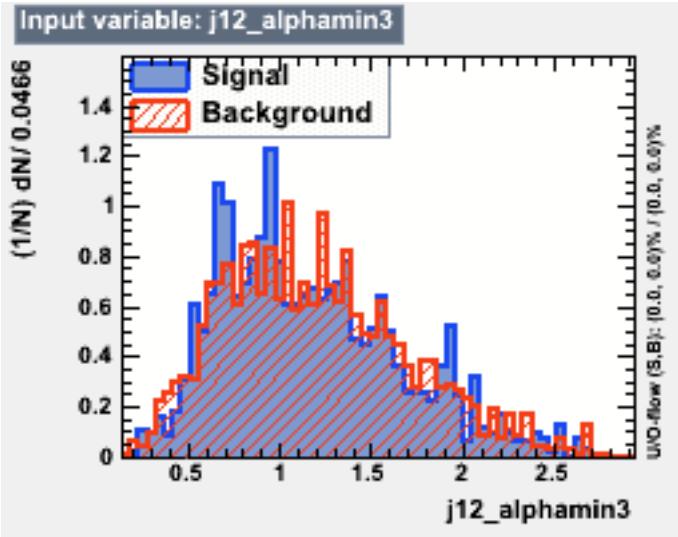
	Usual dijet mass	Radiation recovery (alphamin cut)
Collie expected limit	49.9982	48.006

⟶ about 4% improvement.

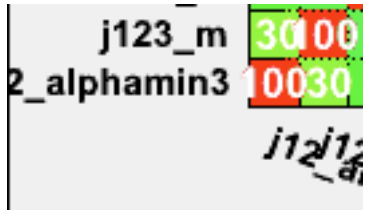
Alphamin

as input of the final MVA

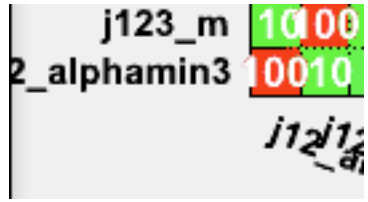
We can also feed the variable in the final MVA and let it do the work.



Linear correlation :



Signal



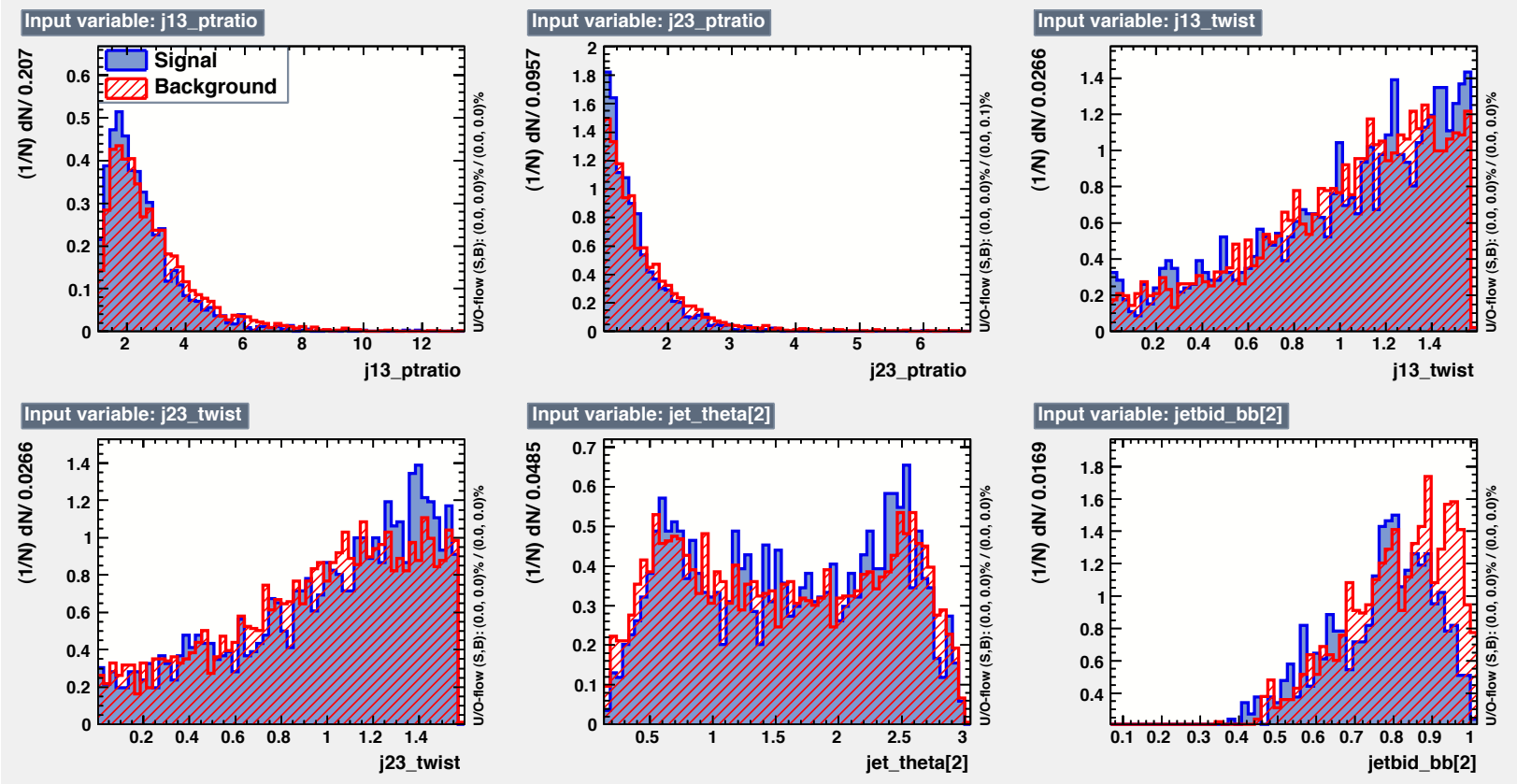
Background

→ The relevant information is the correlations between this variable and the others.

→ It improves the final MVA discriminating power by ~5%

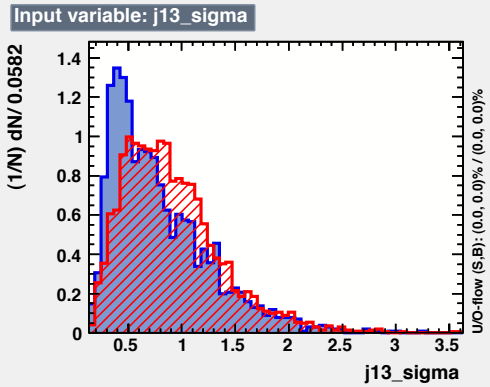
MVA ISR vs FSR approach

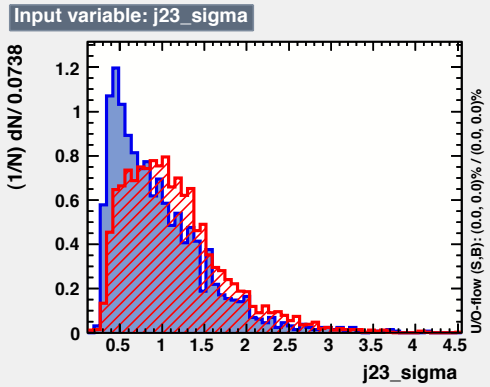
Input variables

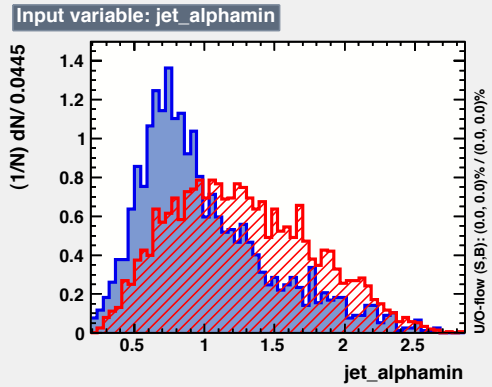


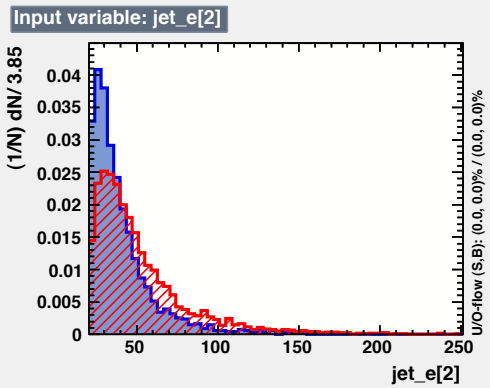
MVA approach

Input variables





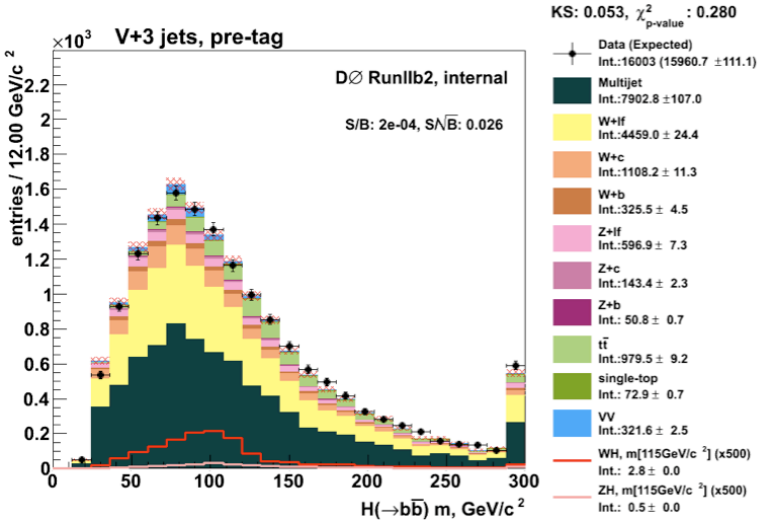




MVA approach

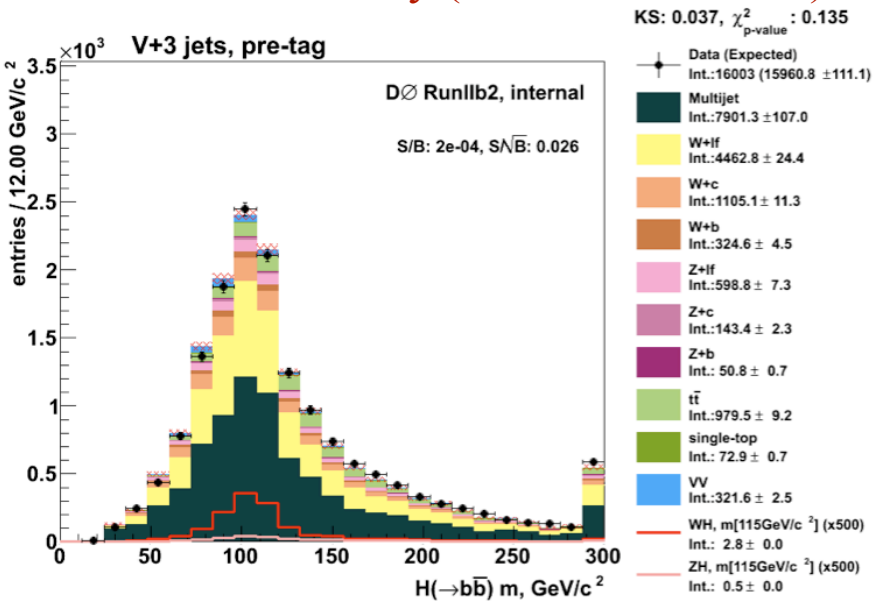
Performances

→ Unfortunately the MVA resulting in the combination of these variable bias the analysis, it improves the resolution on the dijet mass a great deal, but it makes the background peaks under the signal. This lead to a degradation on the collie limit.



Usual dijet mass

Radiation recovery (loose cut on MVA)

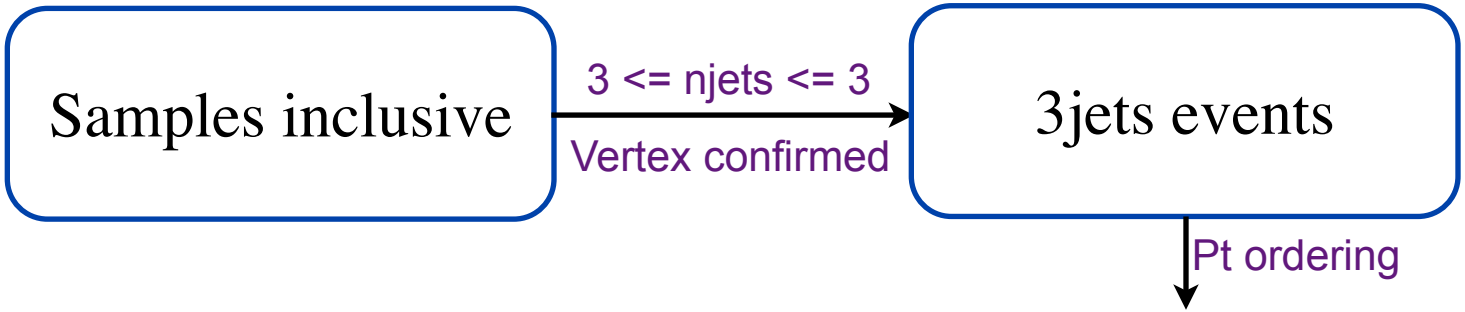


Collie summary

- Run collie on dijet mass only (electron channel, continuous L6 double tag, higgs:115)

	Usual dijet mass	Radiation recovery (alphamin cut)	Radiation recovery (MVA)
Collie expected limit	49.9982	48.006	49.398

BID ordering vs Pt ordering



used for the calculation of Higgs properties (Dijet-mass...)

Pt1 > Pt2 > Pt3

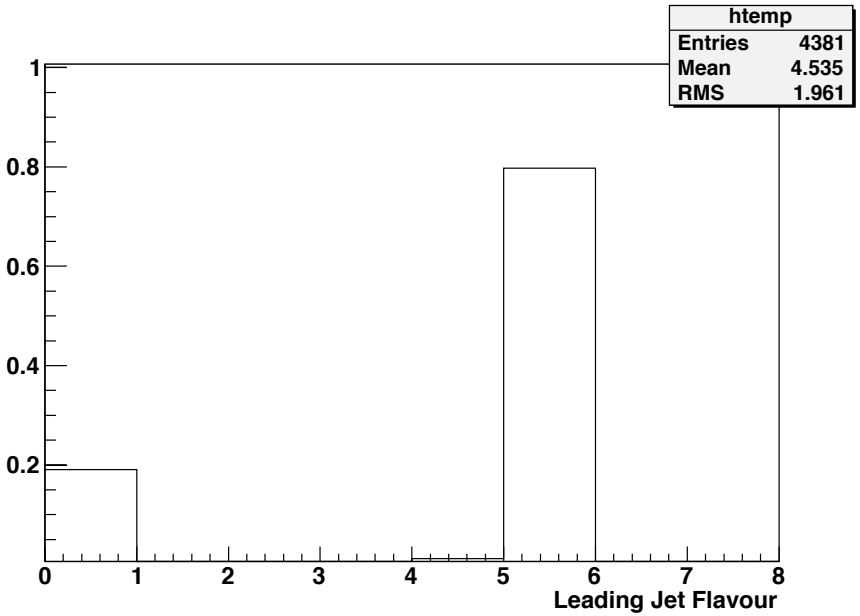
Leading Jet | Second Leading Jet | Third Jet

Taking the 2 jets with the highest Pts is consistent but not optimal.
The idea is to use a better criteria : an ordering based on the output of the BID MVA output.

BID ordering

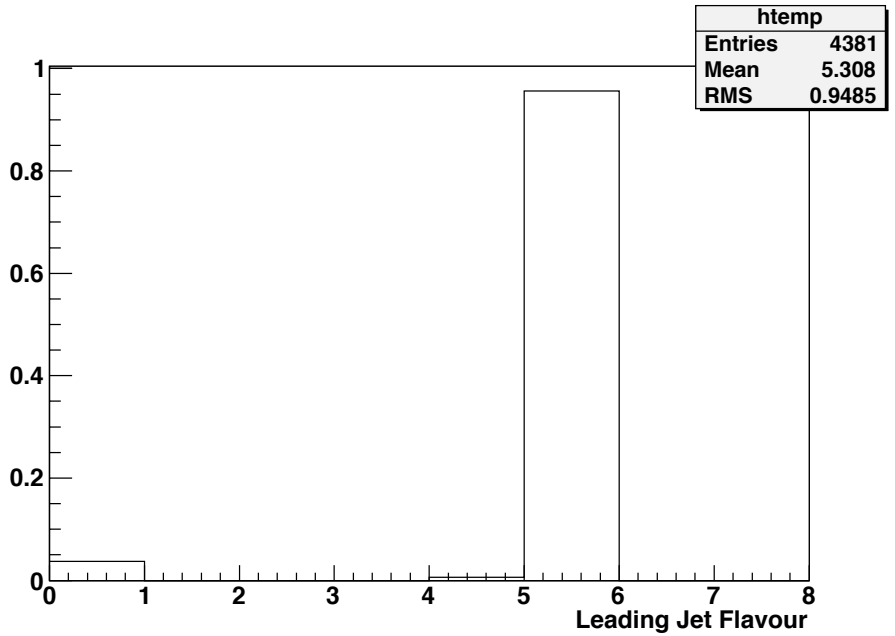
1st Leading Jet (Higgs 115Gev)

Pt ordered



light jets ~20%
b jets ~80%

BID ordered

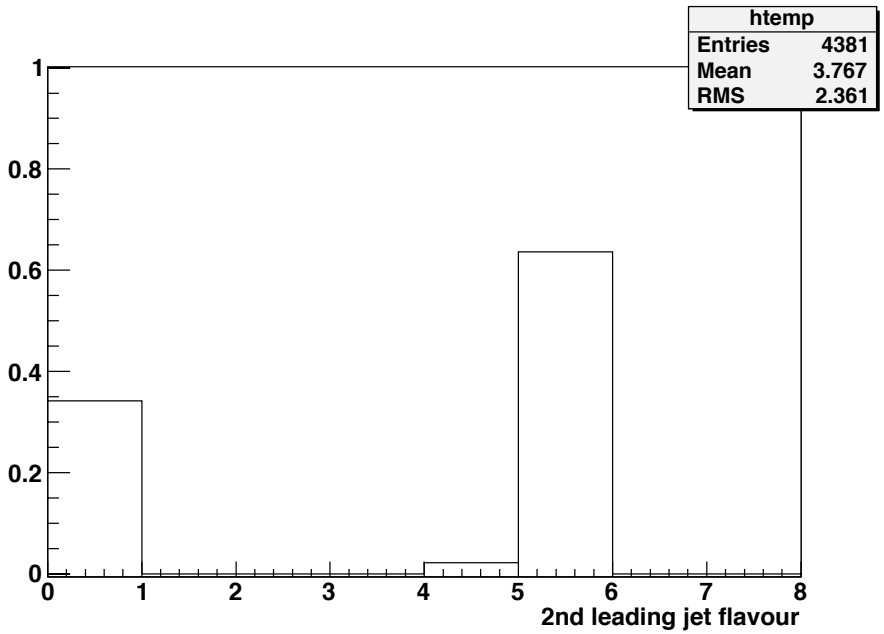


light jets ~5%
b jets ~95%

BID ordering

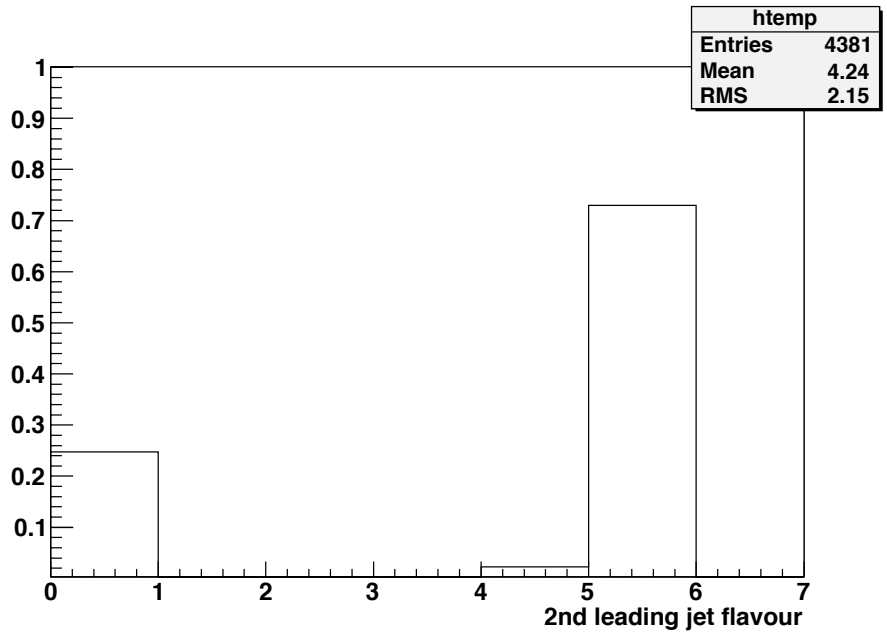
Second Leading Jet (Higgs 115Gev)

Pt ordered



light jets ~35%
b jets ~65%

BID ordered

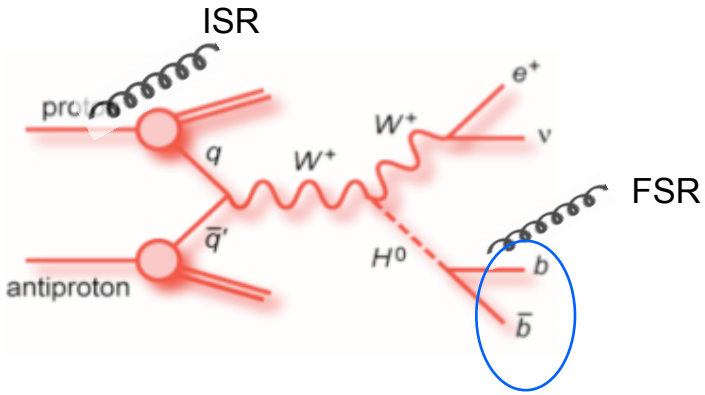


light jets ~25%
b jets ~75%

Best radiation recovery algorithm

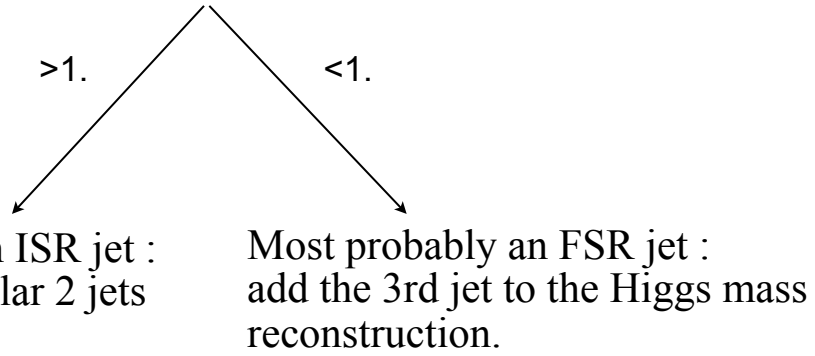
(so far...)

- Order the jets by decreasing MVA BL output - Consider the 2 leading jets.



This is most probably the 2 b quarks from the Higgs

- Look at the minimal angle between these two jets and the 3rd one.



Conclusion and outlook.

Conclusion

- Great improvement on the dijet mass resolution possible if we can differentiate ISR from FSR jets.
- 1D and MVA approaches looks good on MC.
- With the use of alphamin variable we're able to get ~4% improvement.

  ⟶ to be confirm with the collie limit on the final MVA.

Outlook

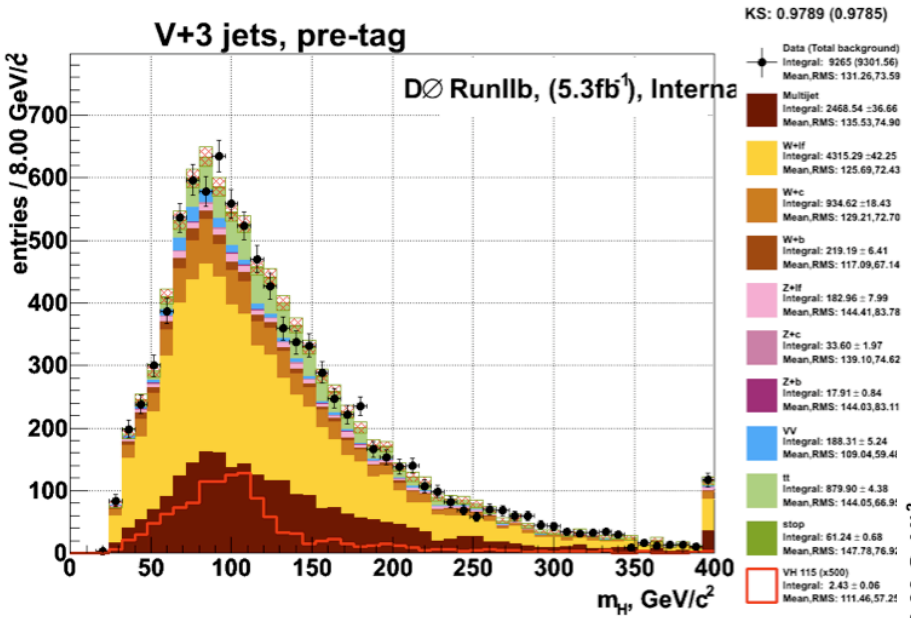
- Still looking at new MVA approach to get rid of the bias.

  ⟶ Geometrical info only as input of the MVA.

  ⟶ Sample inclusive training.

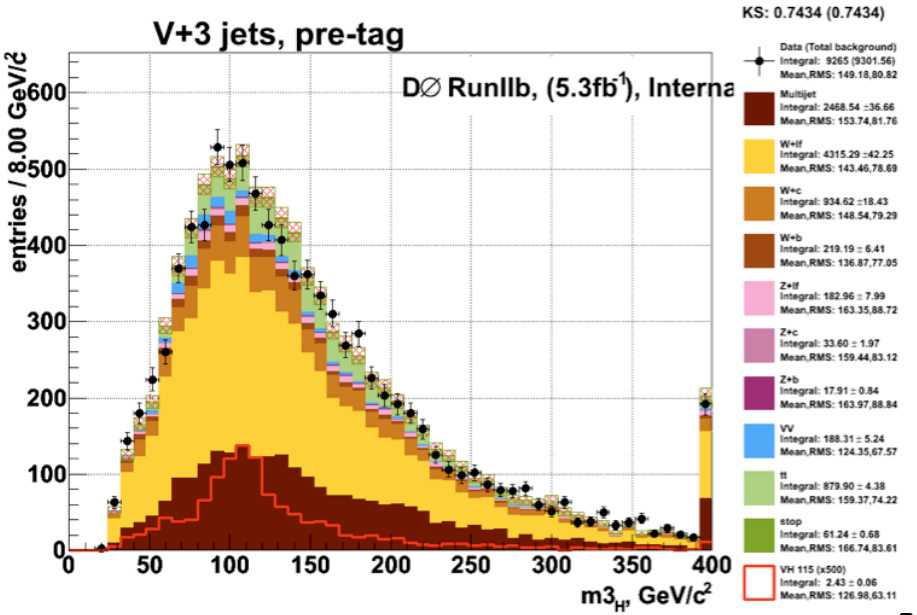
Backup

DatavsMc - Pretag - Pt ordering

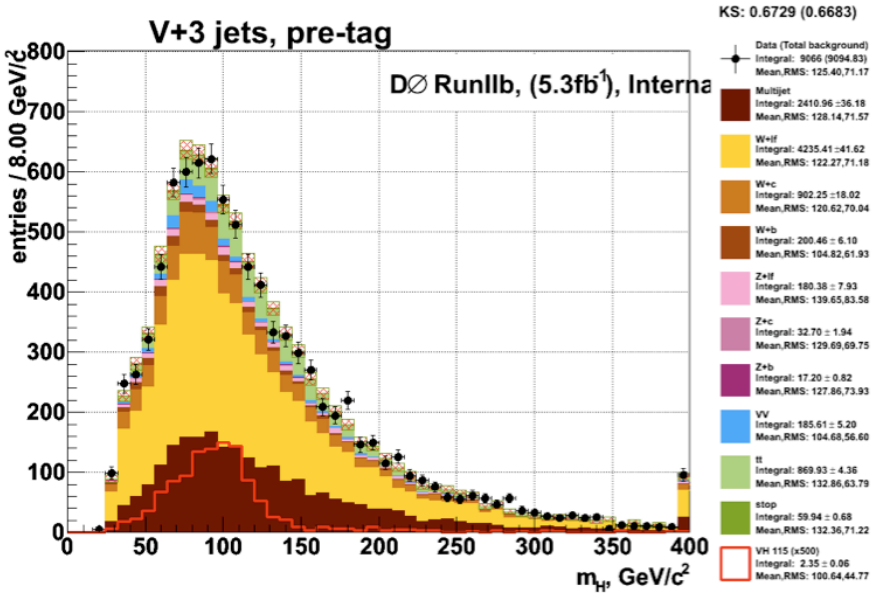


Standard

Radiation recovery



DatavsMc - Pretag - BID ordering



Standard

Radiation recovery