

# First look at $e^+e^- \rightarrow \text{HA} \rightarrow \text{b}\bar{\text{b}}\text{b}\bar{\text{b}}$ study



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- Aim is cross-section measurement for  $e^+e^- \rightarrow HA \rightarrow bbbb$  first at  $\sqrt{s} = 500$  GeV.
- Generated sample of  $HA \rightarrow b\bar{b}b\bar{b}$  signal using Whizard  
 $m_H = m_A = 200$  GeV,  
 $\tan\beta = 10$   
x-section:  $\sqrt{s} = 500$  GeV 13.47 fb

## Today:

- Signal study for  $m_H = m_A = 200$  GeV at  $\sqrt{s} = 500$  GeV
- 4 jets selection
- Mass reconstruction of  $m_H$  and  $m_A$ .

## Two methods can be used:

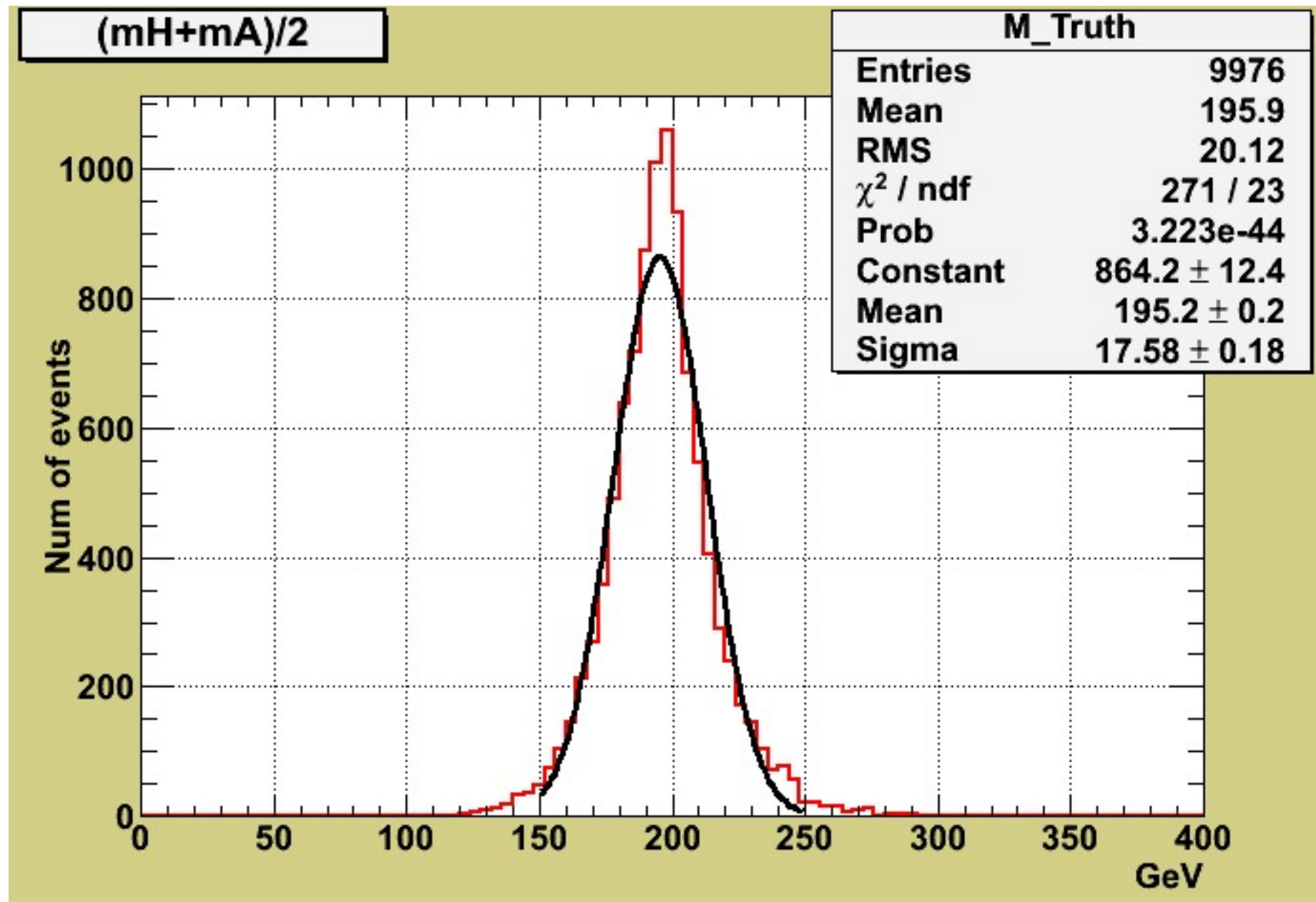
- Reconstruction using truth-matching

- associate the reconstructed jets to generated b-quarks from H/A decays using minimum  $\Delta R$  between the jet and parton.
- in case of duplication, next minimum  $\Delta R$  is selected.

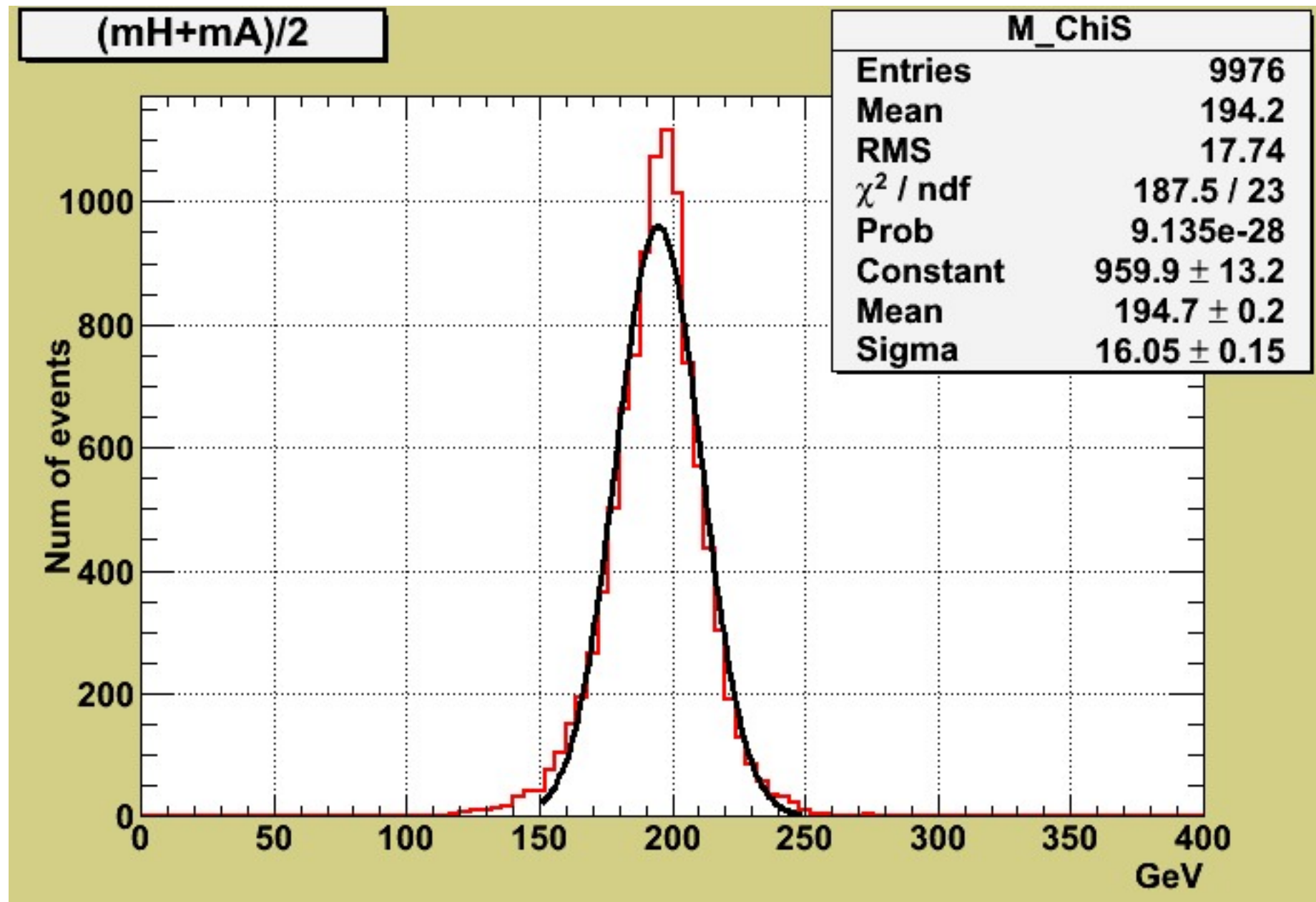
- Reconstruction using ChiSquare minimization

$$\chi^2 = \sum \frac{(m_H - M_{ij})^2}{\sigma_H^2} + \frac{(m_A - M_{kl})^2}{\sigma_A^2}$$

- combination of 4 jets with minimum ChiSquare is selected.
- $\sigma_{H/A}$  from truth matching reconstruction is used.



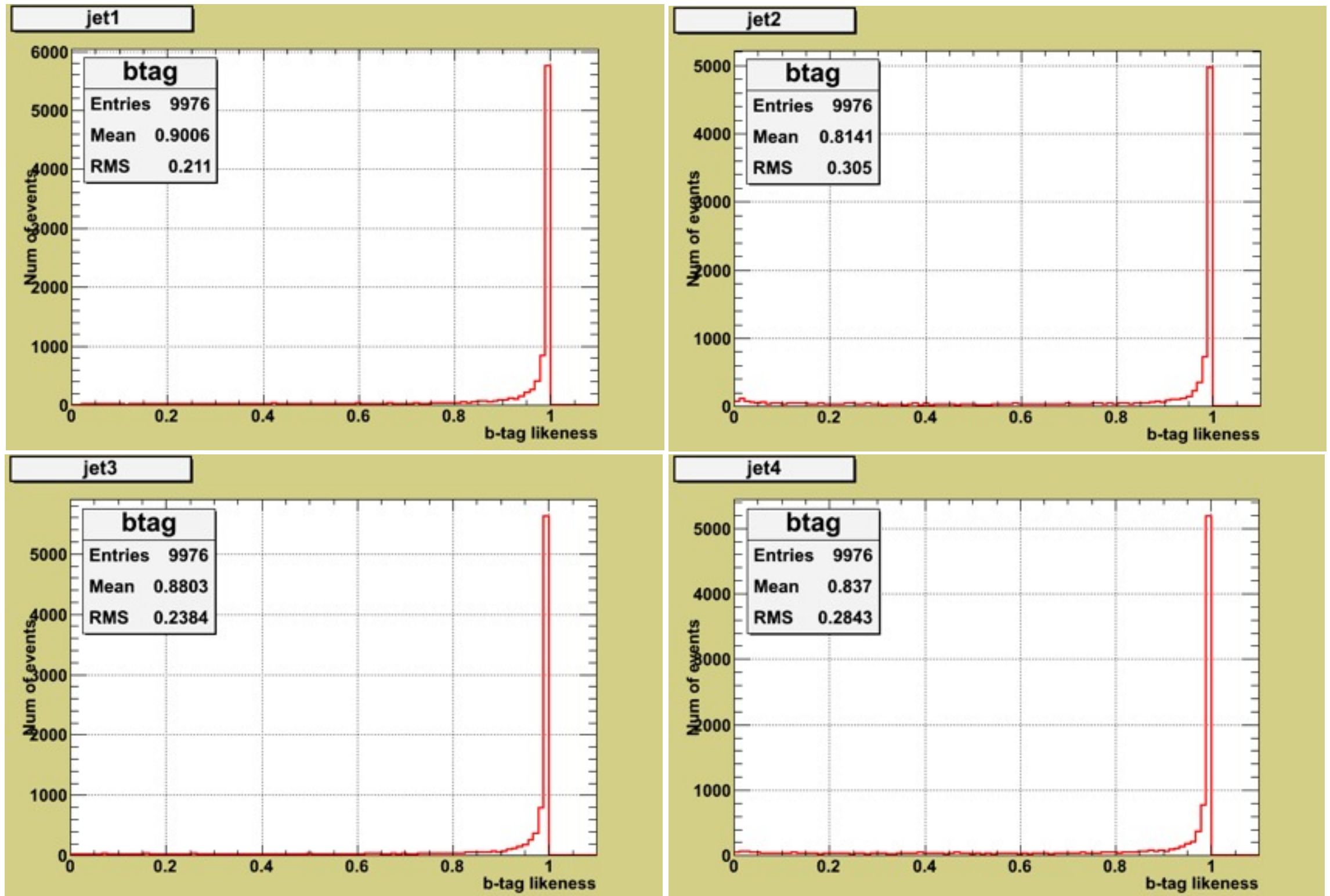
Mass	$195.2 \pm 0.2$
Gaussian width	$17.58 \pm 0.18$



Mass	$194.7 \pm 0.2$
Gaussian width	$16.05 \pm 0.15$

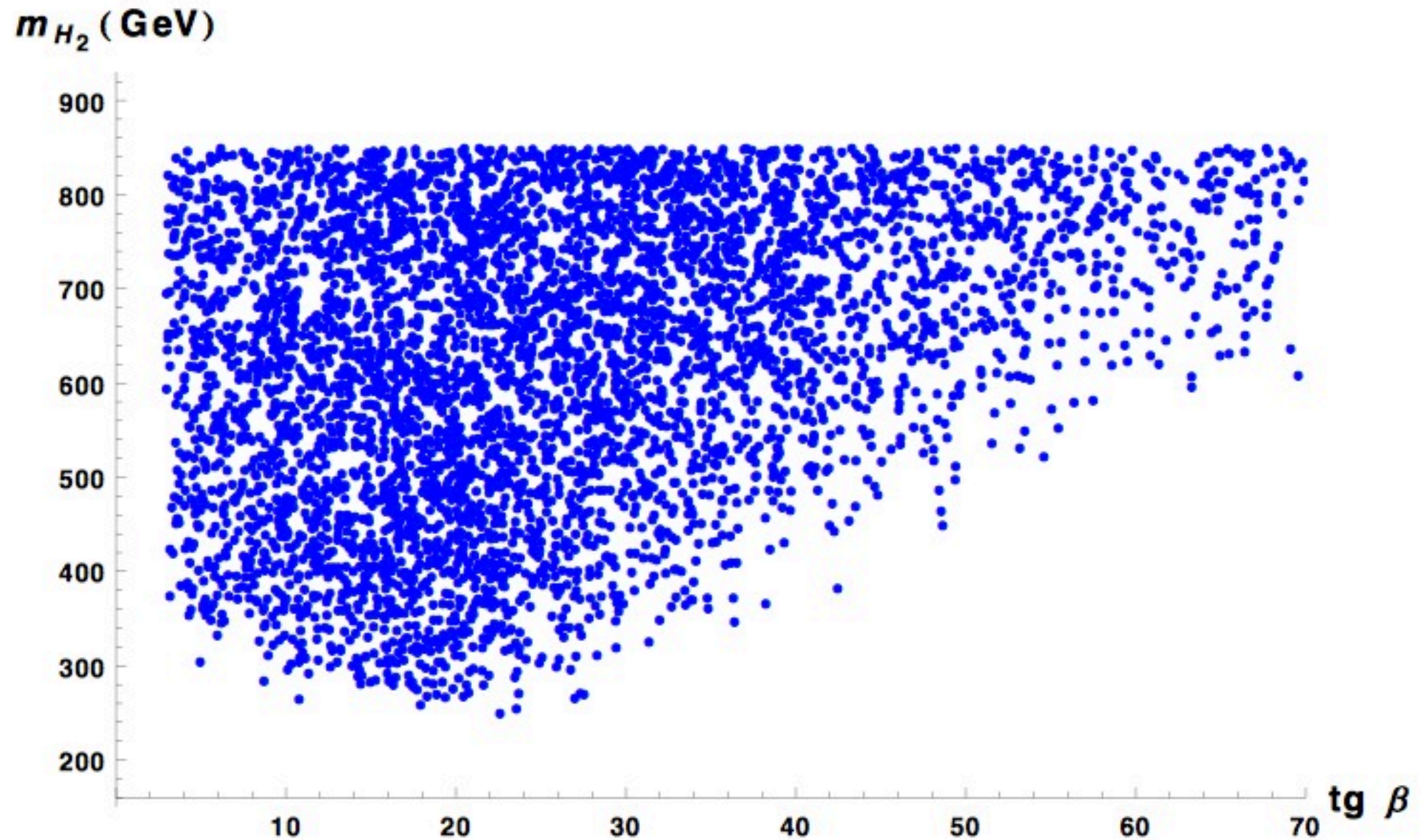


b-tag likeness for ChiSquare selected jets.



## M. L. López Ibáñez, MSSM

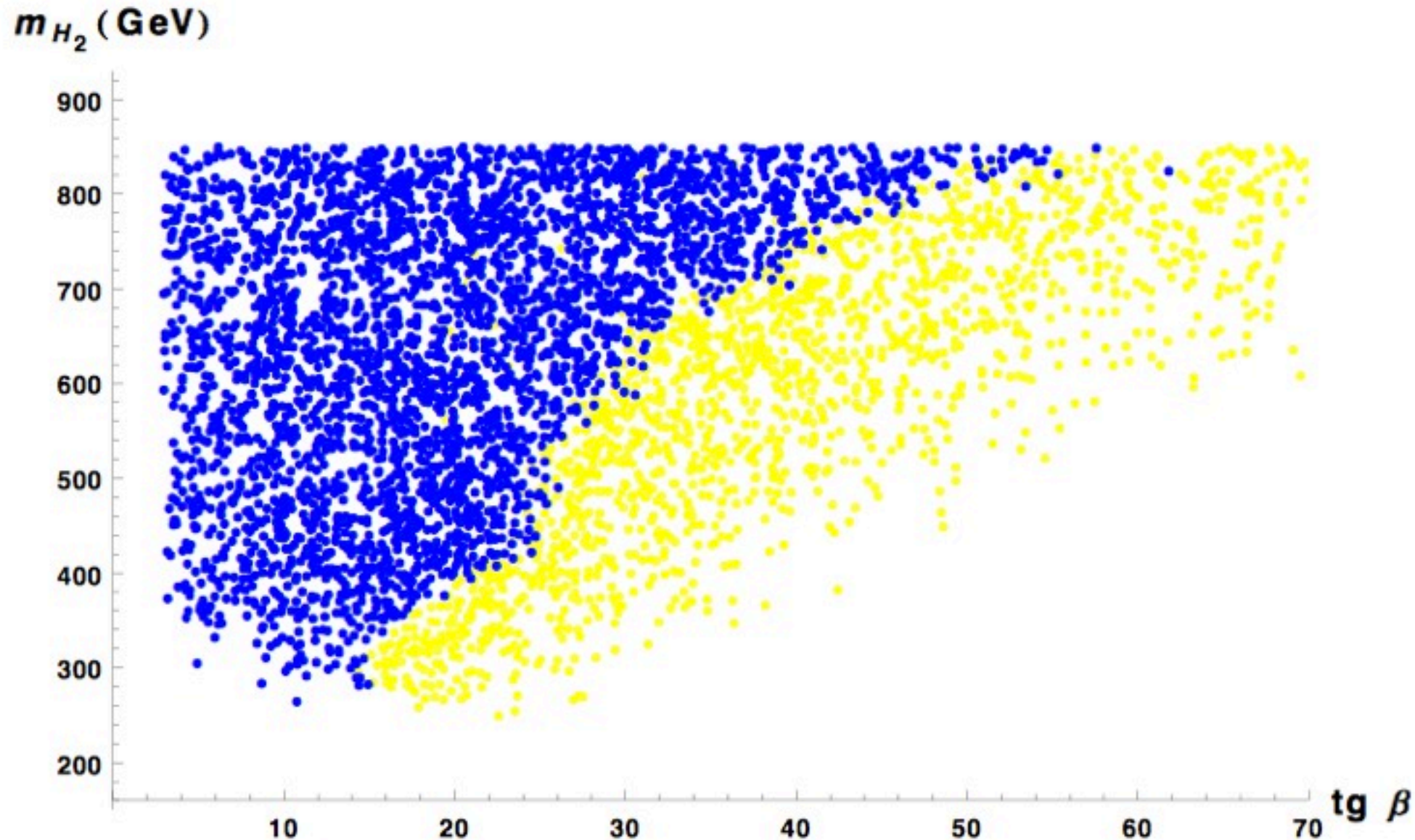
This plot shows how constrained is the parameter space when  $\tau\bar{\tau}$  ATLAS searches up to 500 GeV, with  $4.8\text{fb}^{-1}$  at  $\sqrt{s} = 7$  TeV, are used.





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This plot shows how constrained is the parameter space when CMS searches in the  $\tau\bar{\tau}$  channel, with  $4.9\text{fb}^{-1}$  at  $\sqrt{s} = 7$  TeV and  $19.7\text{fb}^{-1}$  at  $\sqrt{s} = 8$  TeV, are used to restrict the parameter space. Yellow points satisfy all the constraints except CMS recent  $\tau\bar{\tau}$  data while blue points fulfil also the recent CMS constraints at 95% C.L.

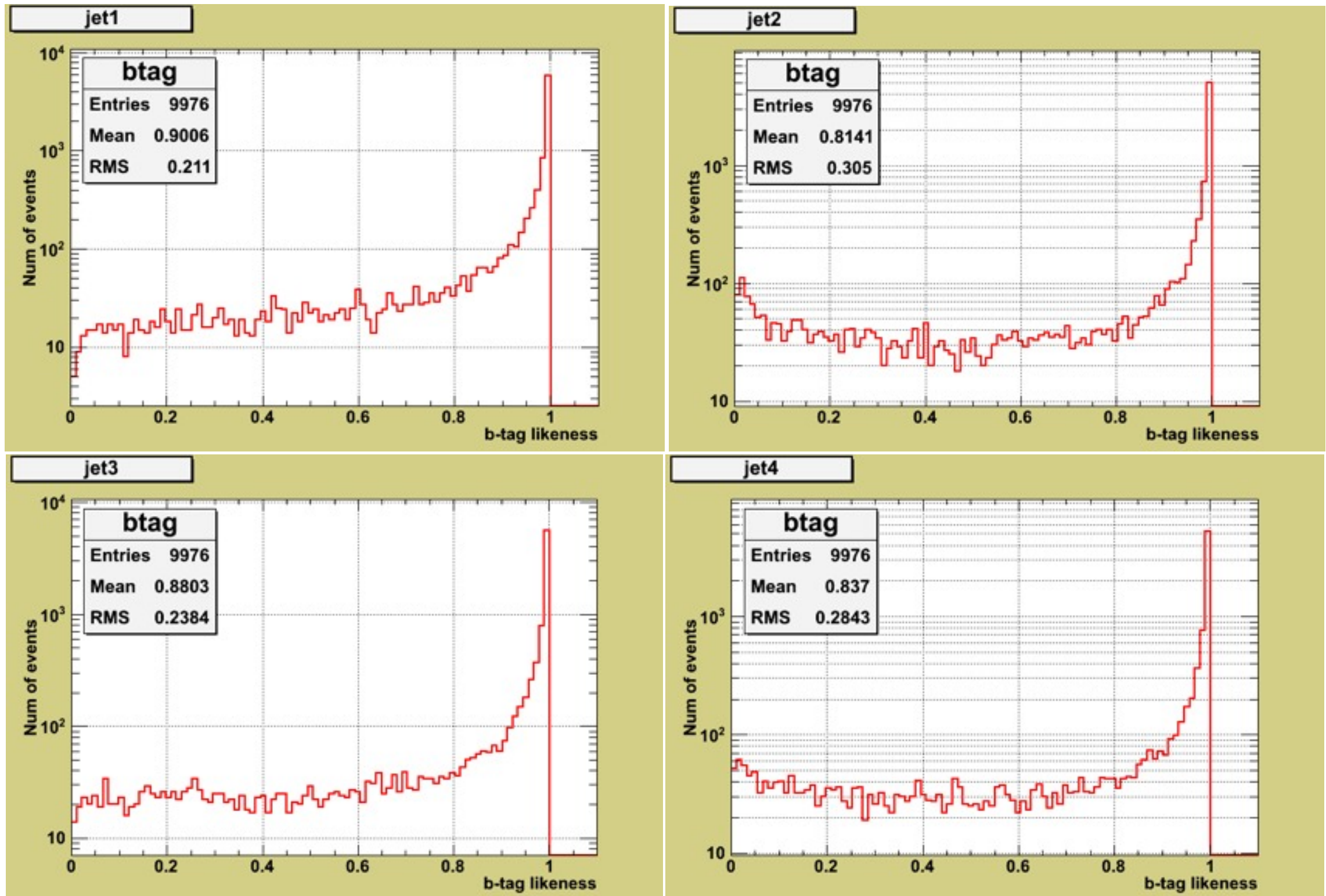




- Signal sample is generated.
- ChiSquare selection of 4 jets is not good, will run FastJet.
- Will start looking into background.

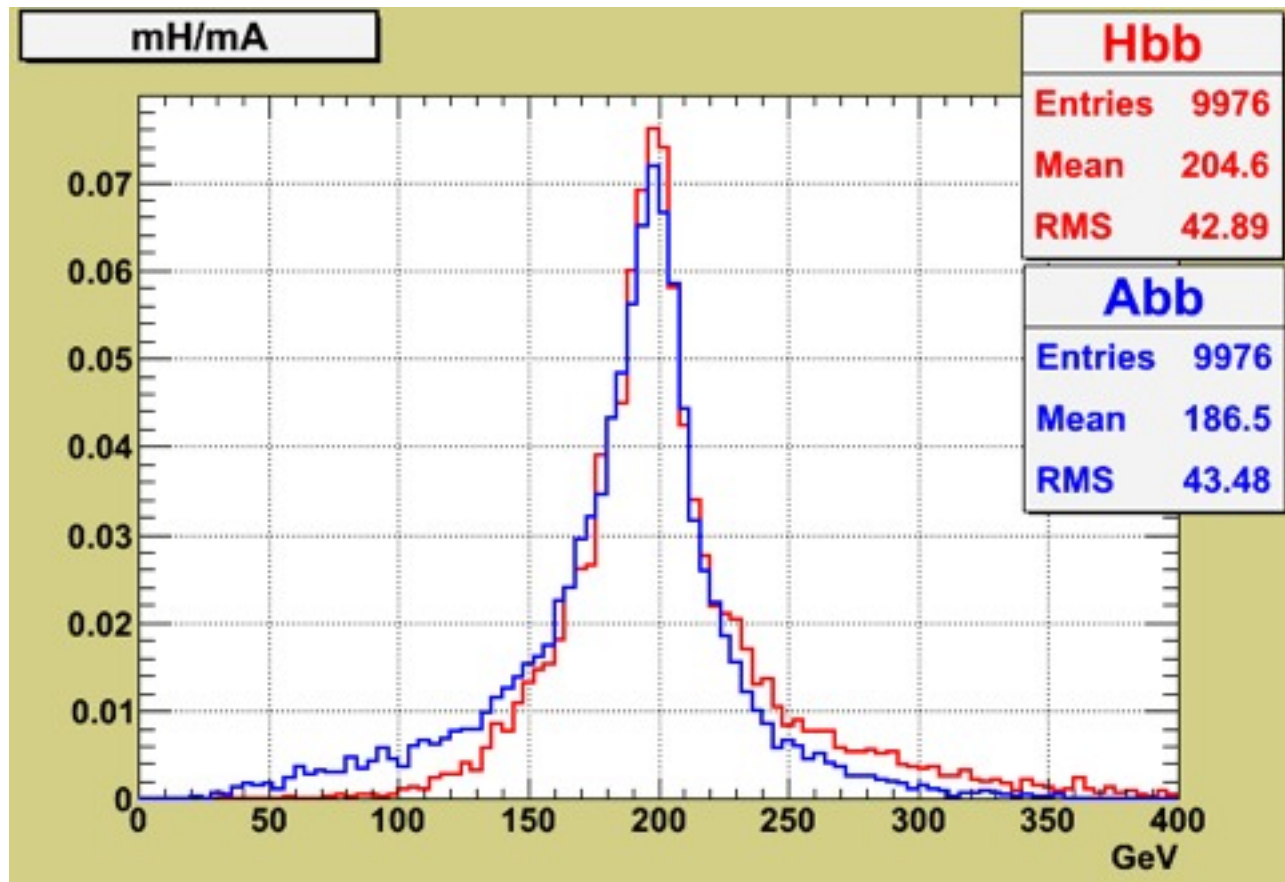
# BACKUP

b-tag likeness for ChiSquare fit selected jets.





## Truth Matching



## ChiSquare

