

### How wide is the top quark?

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## Objectives

- Develop an algorithm to identify and discriminate the charge of b-jets
- Use the method to identify the charge of experimental b-jets
- Determine the top-quark width based on the b-jet charge asymmetry in W+b events



## Algorithm used (1<sup>st</sup> approach)

 Jet charge is weighted mean of track charges (transverse momentum)

$$Q_{jet} = \frac{1}{\sum_{j} (p_T^j)^k} \sum_{i} q_i \cdot (p_T^i)^k \quad k = 1.1$$

 Formula applied with different restrictions to obtain various variables

#### Results (1<sup>st</sup> approach)





ch {g\_bld>0}



#### Results (1<sup>st</sup> approach)



## Algorithm used (2<sup>nd</sup> approach)

- Jet charge is weighted using also  $p_{T}^{\ \rm rel},$   $p_{T}^{\ \rm lon}$  and  $d_{0}$
- Muon charge also weigthed

#### Results (2<sup>nd</sup> approach)







# Results (2<sup>nd</sup> approach)



#### • BDT:



• Fisher:



• Likelihood:





## What to do next?

- Try to improve the discrimination (more variables, more advanced MVA methods)
- Test the discriminator on experimental data
- Determine top quark width

# Bibliography

• *TMVA4 Users Guide* http://tmva.sourceforge.net/docu/

TMVAUsersGuide.pdf

 Pier Paolo Giardino and Cen Zhang: Probing the top-quark width using the charge identification of b jets

#### https://arxiv.org/abs/1702.06996

• The Atlas Collaboration: A new tagger for the charge identification of b-jets

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