Investigating the Correlation of the Xbb tagger Output with bb jet mass

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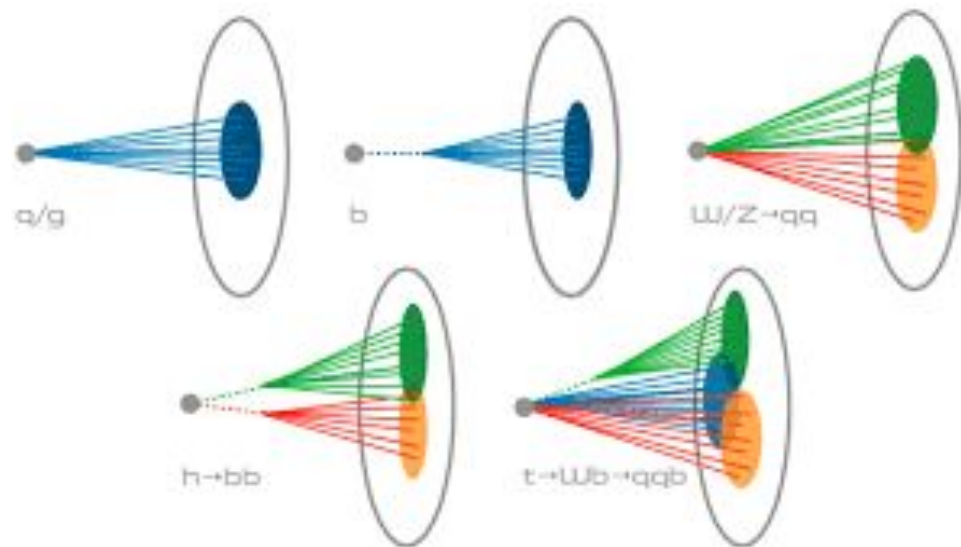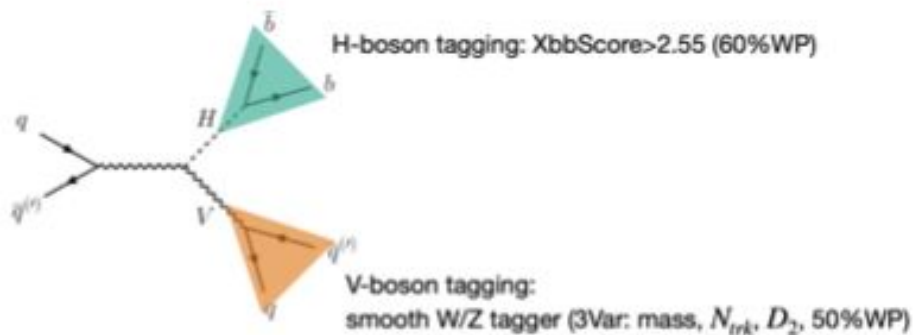SLAC

Background

- VH analysis and Jet substructure [3] [7]

H-boson tagging: XbbScore>2.55 (60%WP)

V-boson tagging:
smooth W/Z tagger (3Var: mass, N_{trk}, D_2, 50%WP)
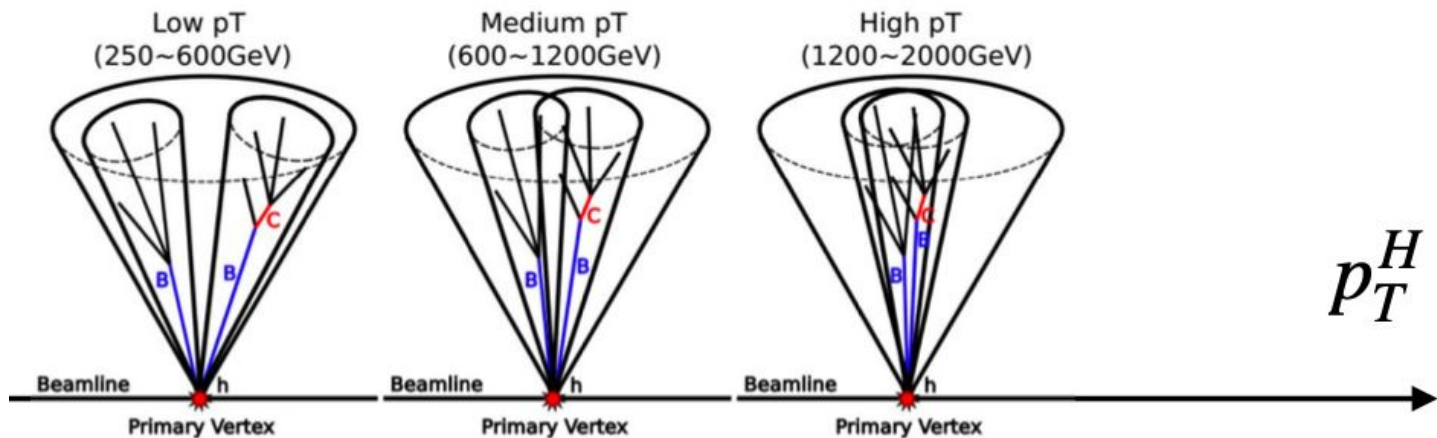
q/g

b

W/Z→qq

h→bb

t→Wb→qqb

Background

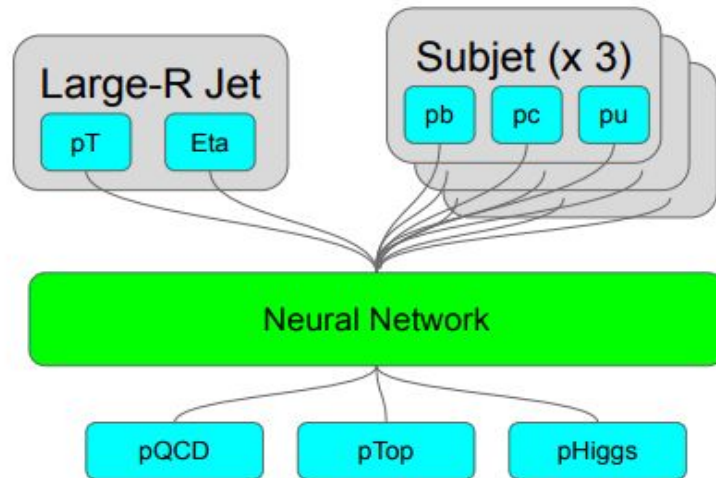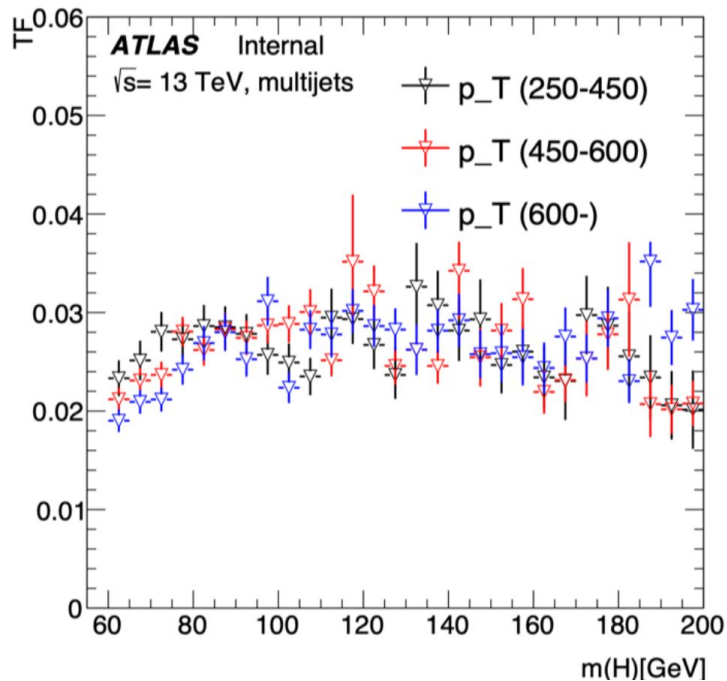- Difficult to extract signal [6]

Background

- Why do we have the Xbb tagger?
  - Boosted regime [1]

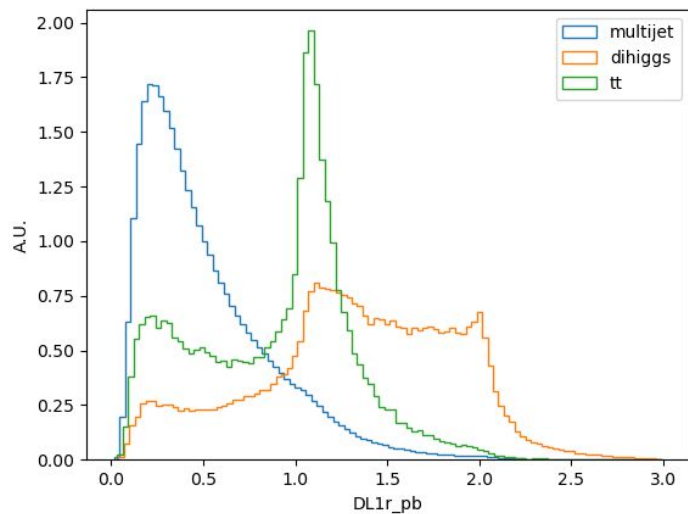# Room for Improvement with the Xbb Tagger

- Jet mass correlation within tagger [2]
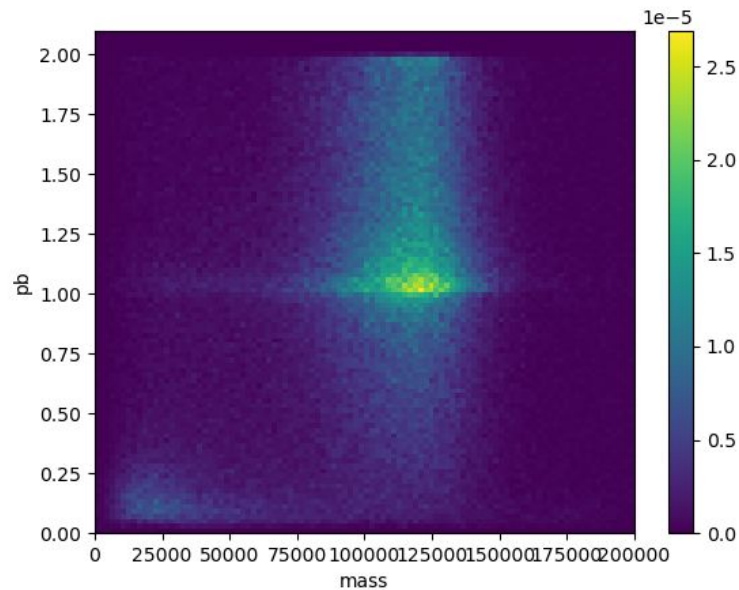
TF = event passing Xbb / event fail Xbb

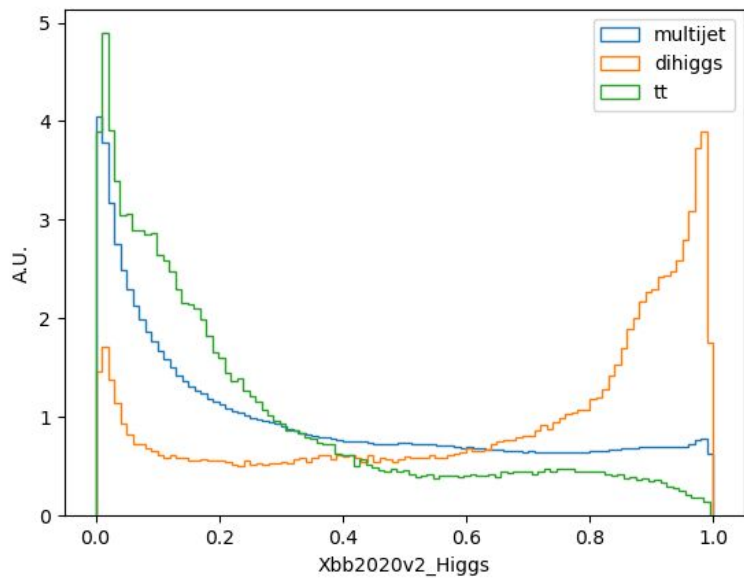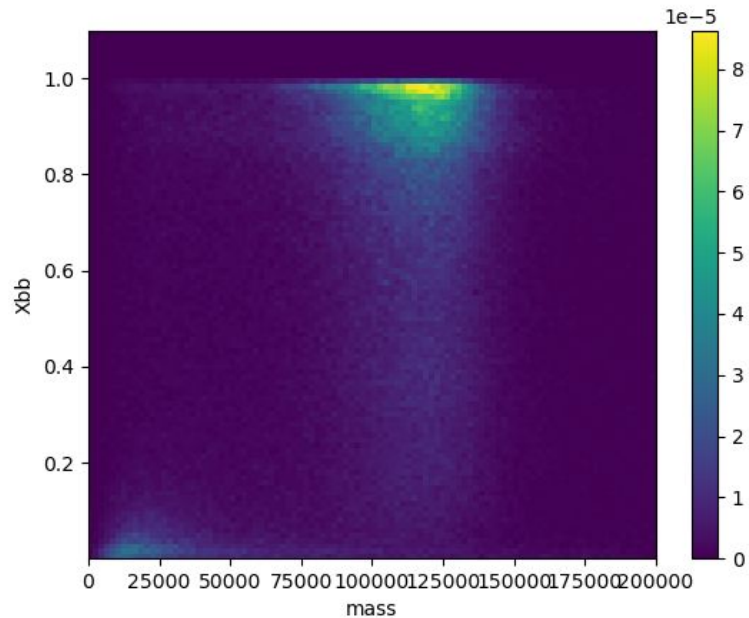# Current Work: pb

Comparison between samples

Mass vs. pb of dihiggs sample

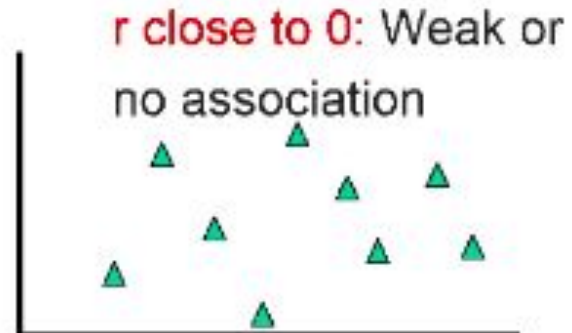# Current Work: Xbb output score

Comparison between sample

Mass vs. Xbb tagger Higgs score

Future Work

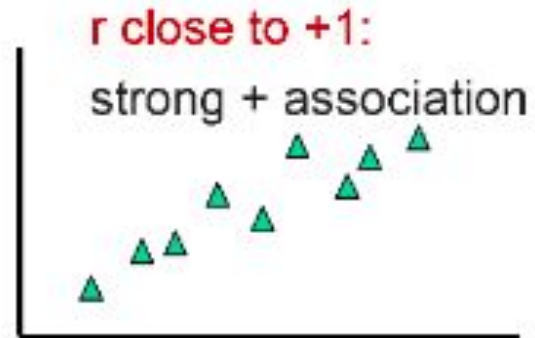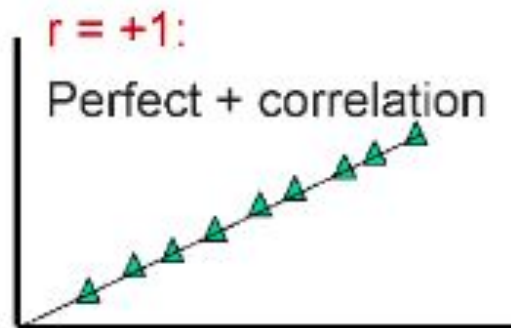- Continue graph comparisons
- TMVA [5]

r = +1:
Perfect + correlation

r close to +1:
strong + association

r close to -1:
strong - association

r close to 0: Weak or no association

References

1. Boosted Xbb Tagging. (2022, April 27). In Twiki.
   https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/BoostedHiggsToBBTagging#Introduction
2. Gonski, J. (20212–07-27). X→bb Tagging at ATLAS vs. CMS: Approaches Ideas [Slides]. Indico.
   https://indico.cern.ch/event/1062132/contributions/4463977/attachments/2288203/3889574/ 0727 jgonski xbbAtlasCMS.pdf
3. Looking inside jets: an introduction to jet substructure and boosted-object phenomenology. (2022). arXiv.
   https://arxiv.org/pdf/1901.10342.pdf
4. The Correlation Coefficient (r). (2021). Sphweb.
   https://sphweb.bumc.bu.edu/otlt/MPH-Modules/PH717-QuantCore/PH717-Module9-Correlation-Regression/PH717-Module9
   -Correlation-Regression4.html
5. ROOT Team. (2021). Machine learning with. ROOT. https://root.cern/manual/tmva/
6. Constraints on Higgs boson production with large transverse momentum using $H \rightarrow b\bar{b}$ decays in the ATLAS
   detector. (2021). Atlas Web. https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/HIGG-2021-08/
7. Jet Toplogy. (2021). [Slides]. Indico.Cern.Ch.
   https://indico.cern.ch/event/971970/contributions/4145389/attachments/2171888/3666942/Slides_Topo.pdf

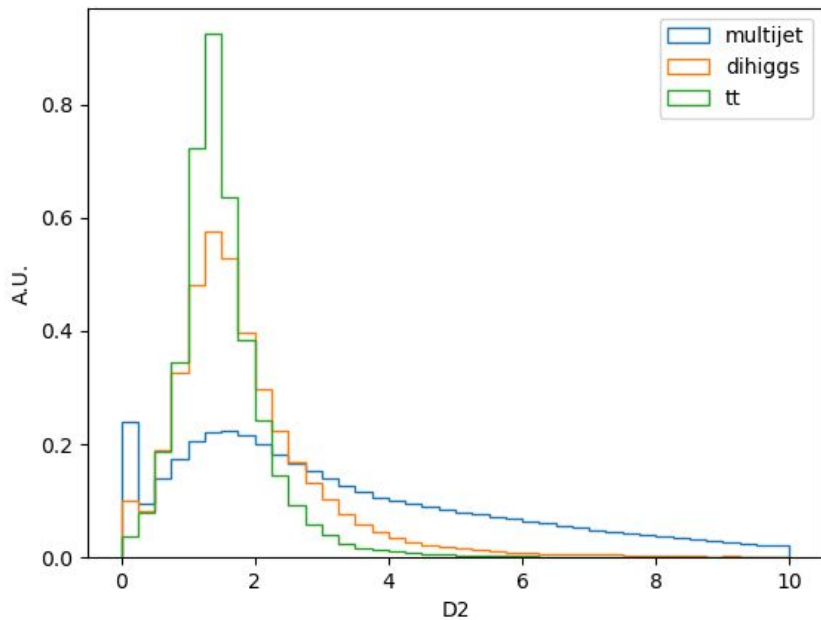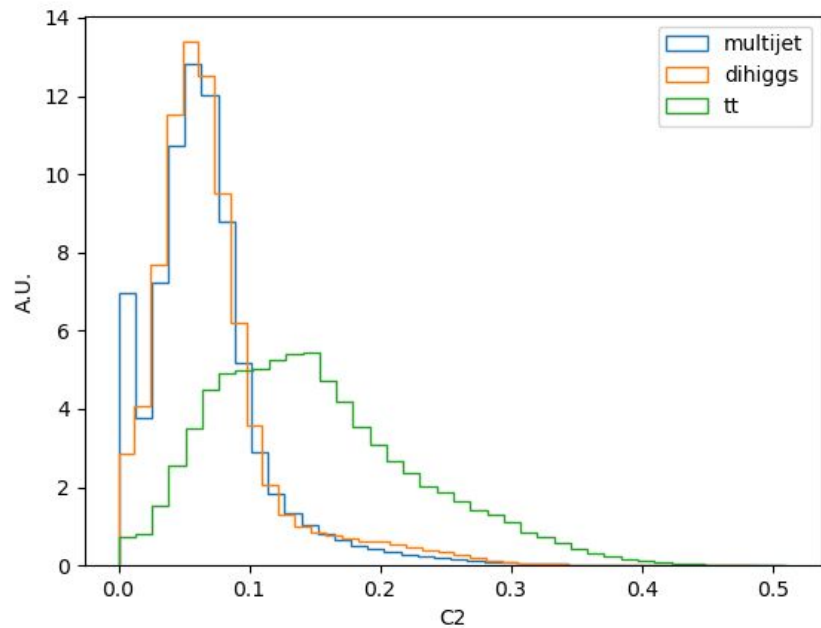Using this data set for analysis by **Dan Guest**:
https://gitlab.cern.ch/atlas-boosted-xbb/xbb-datasets/-/blob/master/p4258/mc16a-h5-datasets.txt

Thank you!

Backup Slides

And graphs

Current Work: C2 and D2

[Full range](#)

[Set range](#)

[subjet](#)