UPDATE ON $H \rightarrow \tau\tau$ JET TAGGING
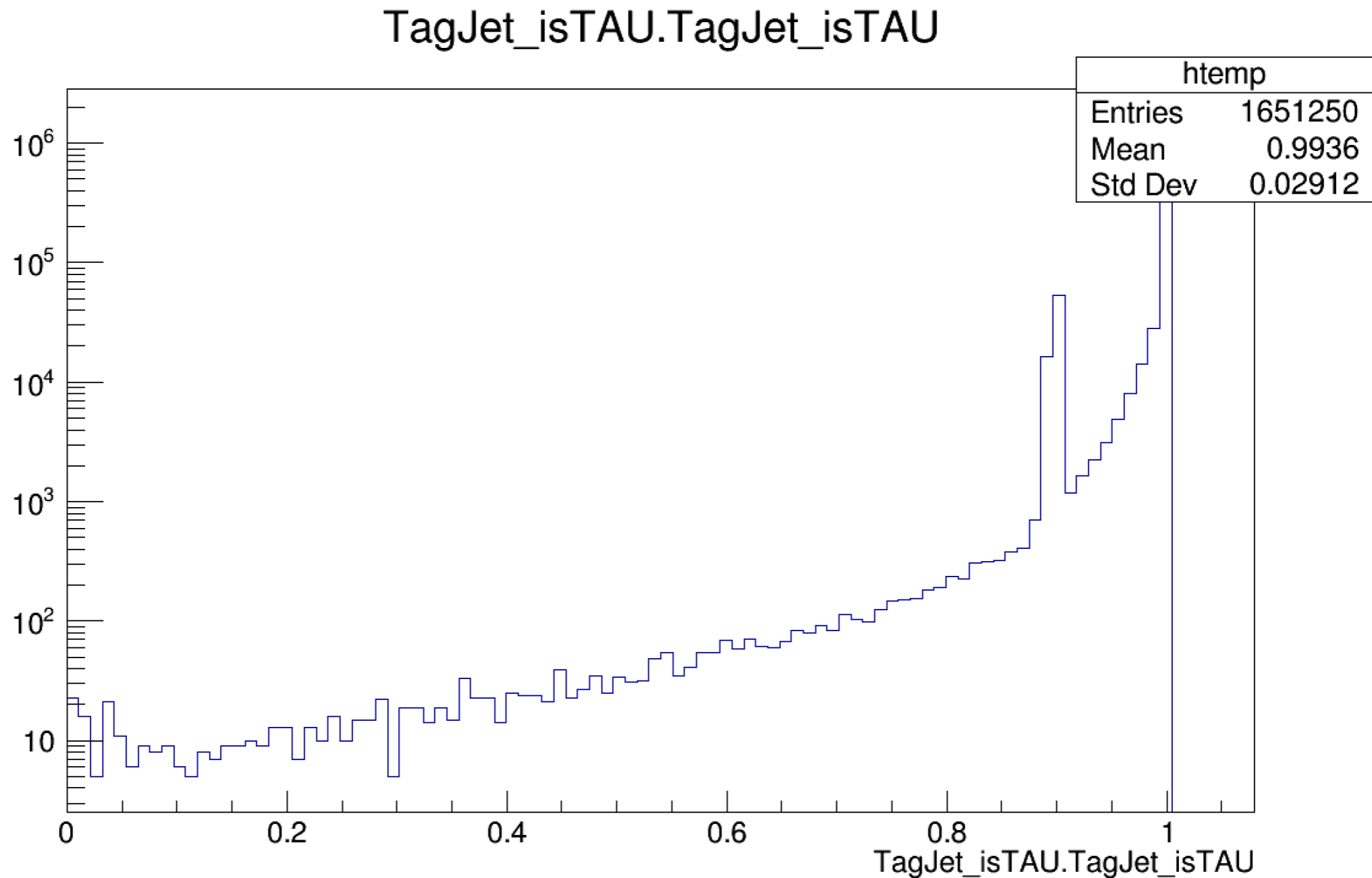
Sofia Giappichini, Matteo Presilla, Aaron Wiedl, Xunwu Zuo

ETP FCC meeting
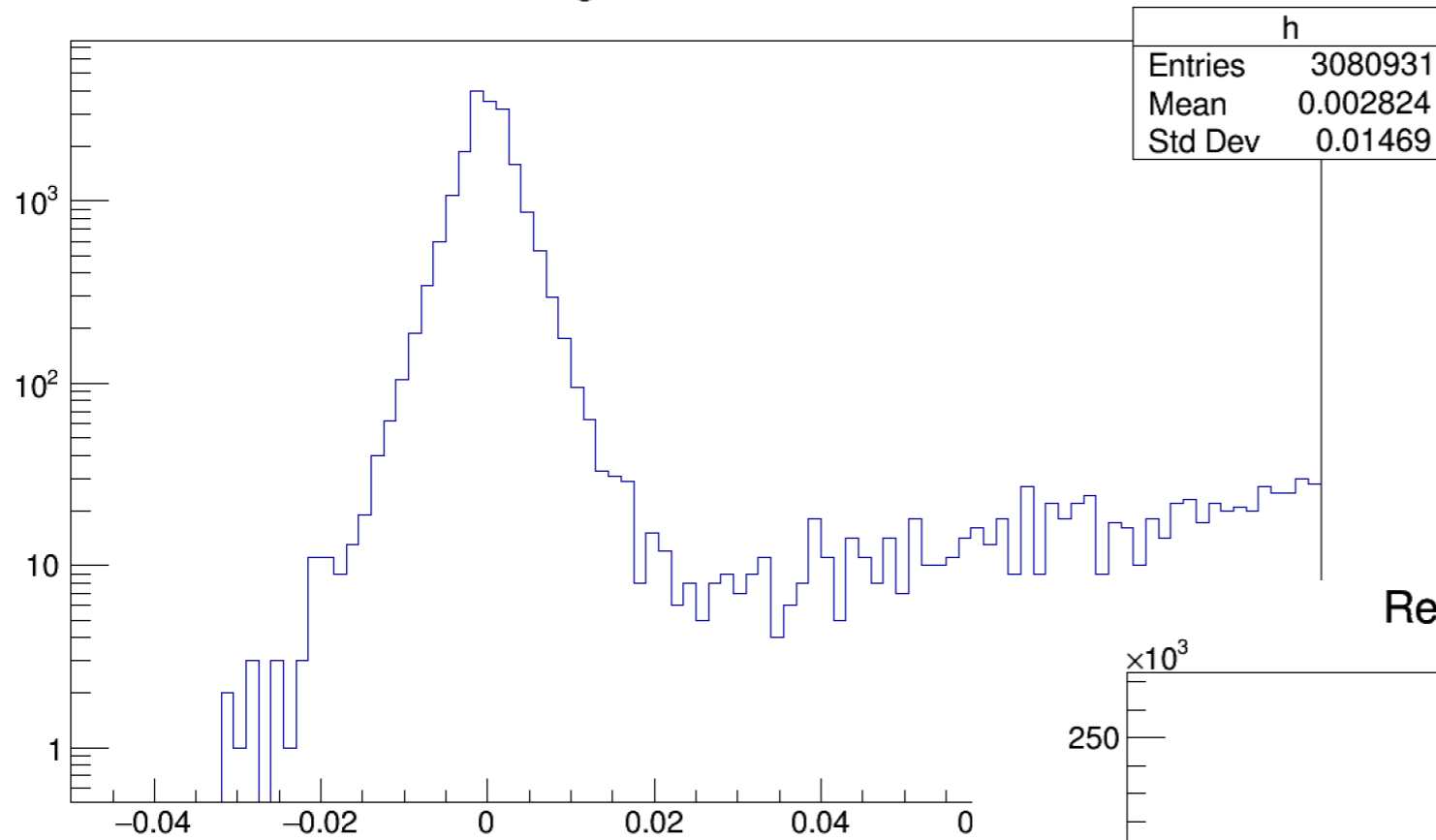Oct. 24, 2024

TagJet_isTAU.TagJet_isTAU
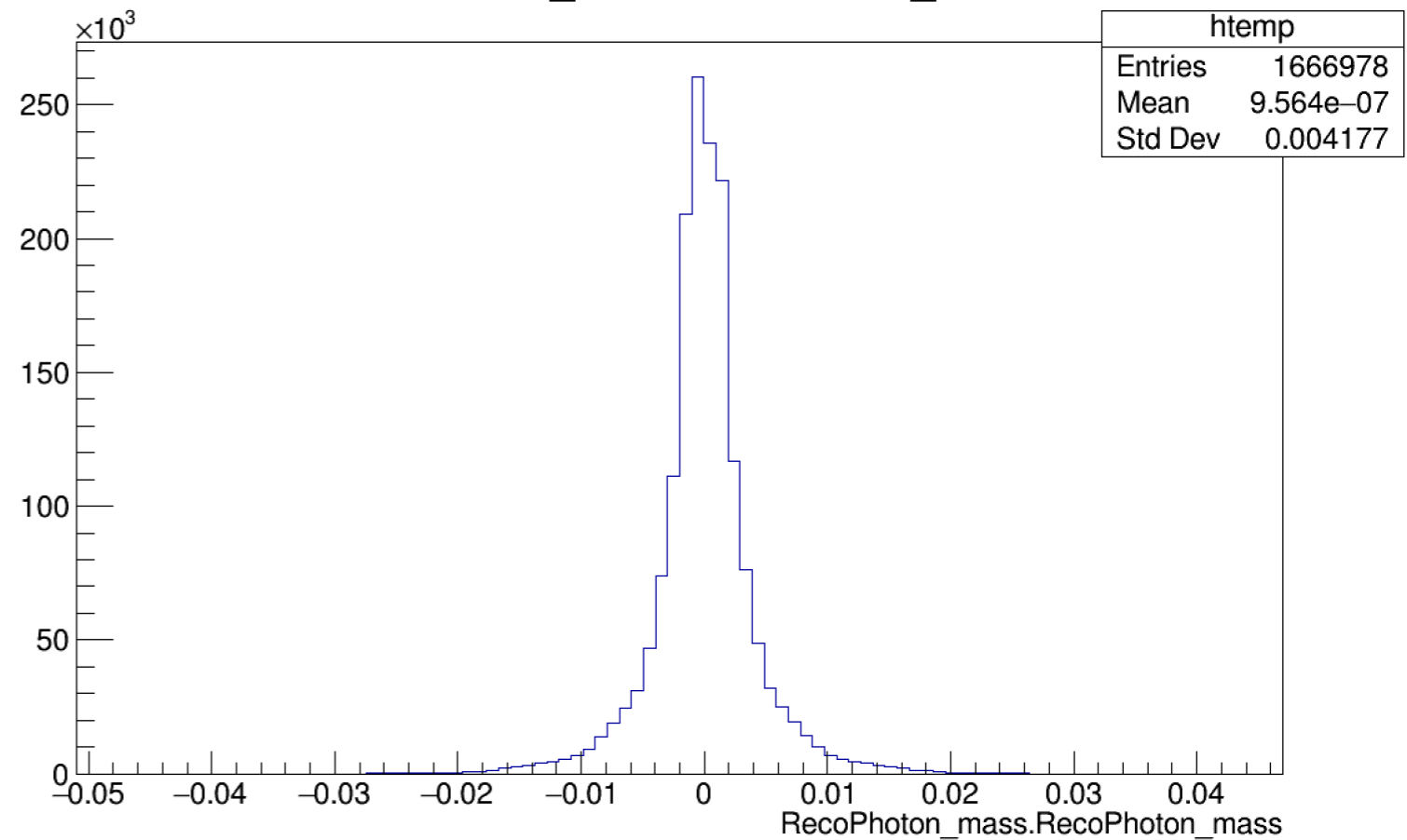
htemp	
Entries	1651250
Mean	0.9936
Std Dev	0.02912

shown 1M events of $e^+e^- \to ZH, Z \to \nu\nu, H \to \tau\tau$

same behavior in backgrounds

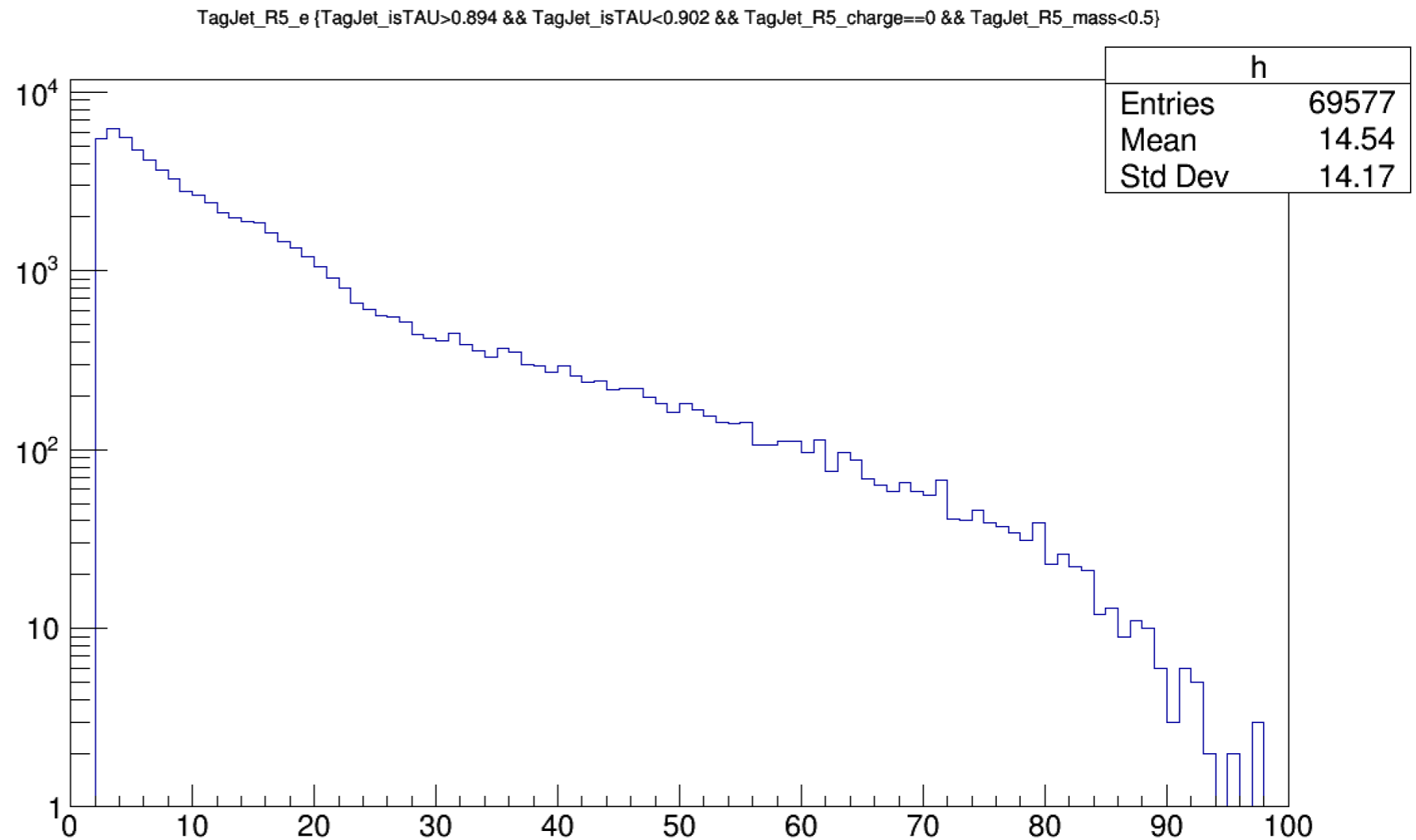# JET MASS

JET CONSTITUENTS - 2ND PEAK

TagJet_R5_constituents {TagJet_isTAU>0.894 && TagJet_isTAU<0.902 && TagJet_R5_charge==0 && TagJet_R5_mass<0.5}

h	
Entries	69577
Mean	1
Std Dev	0

TagJet_R5_e {TagJet_isTAU>0.894 && TagJet_isTAU<0.902 && TagJet_R5_charge==0 && TagJet_R5_mass<0.5}

h	
Entries	69577
Mean	14.54
Std Dev	14.17

NEUTRAL JETS
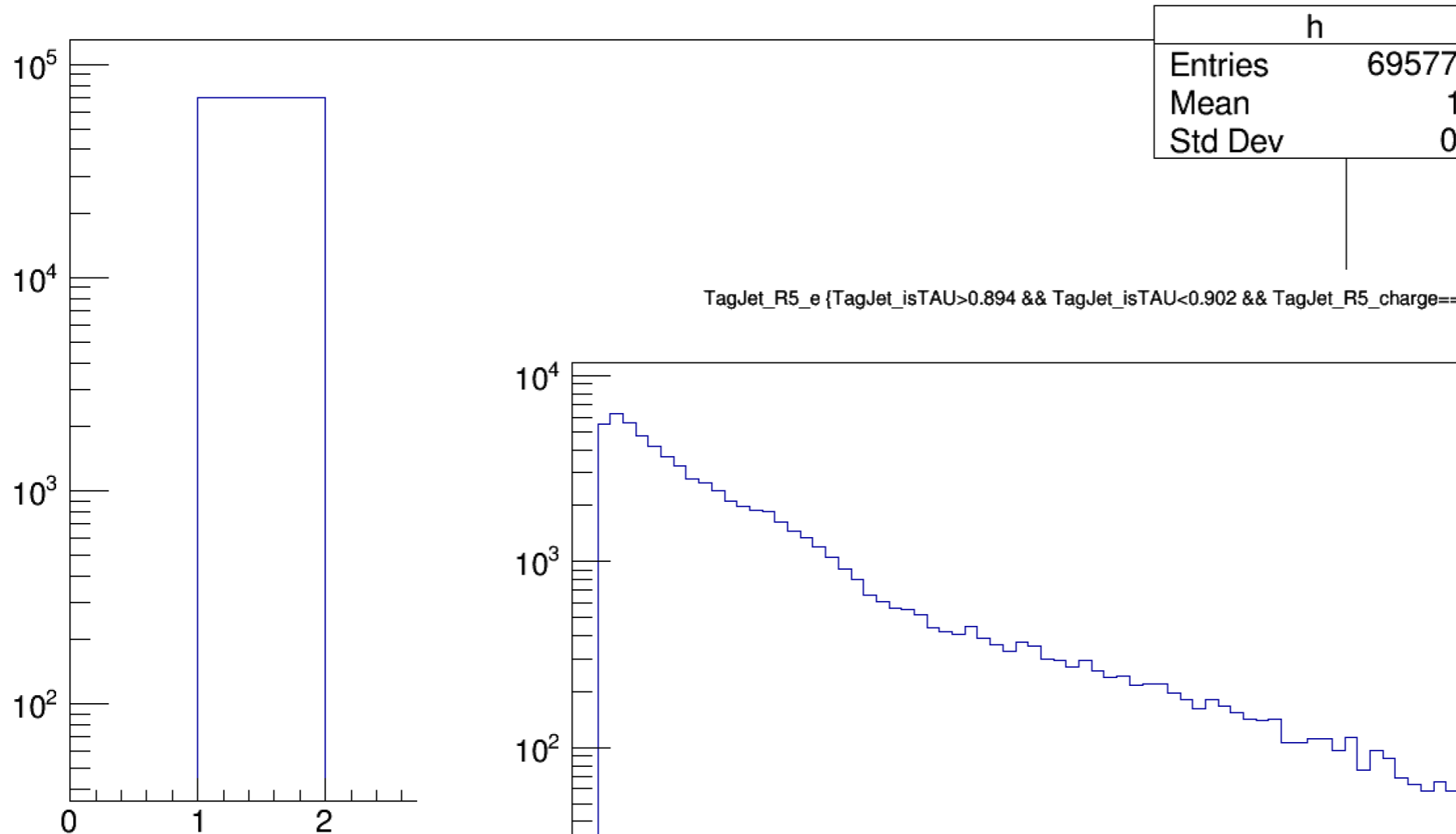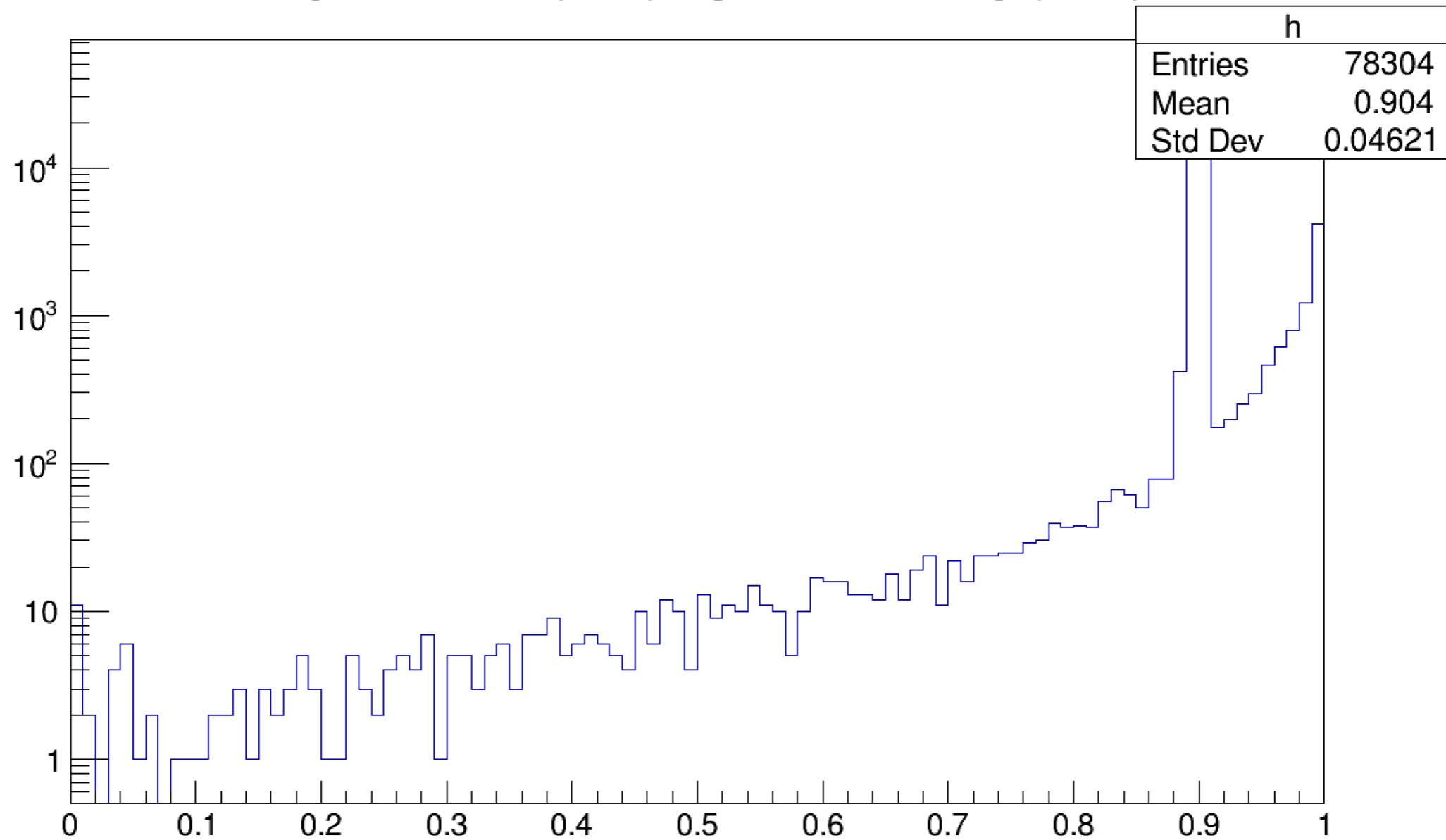
jet charge means the sum of the constituents' charge

TAU JETS

TagJet_isTAU {abs(TagJet_R5_charge)==1}

h	
Entries	1571821
Mean	0.9971
Std Dev	0.0232

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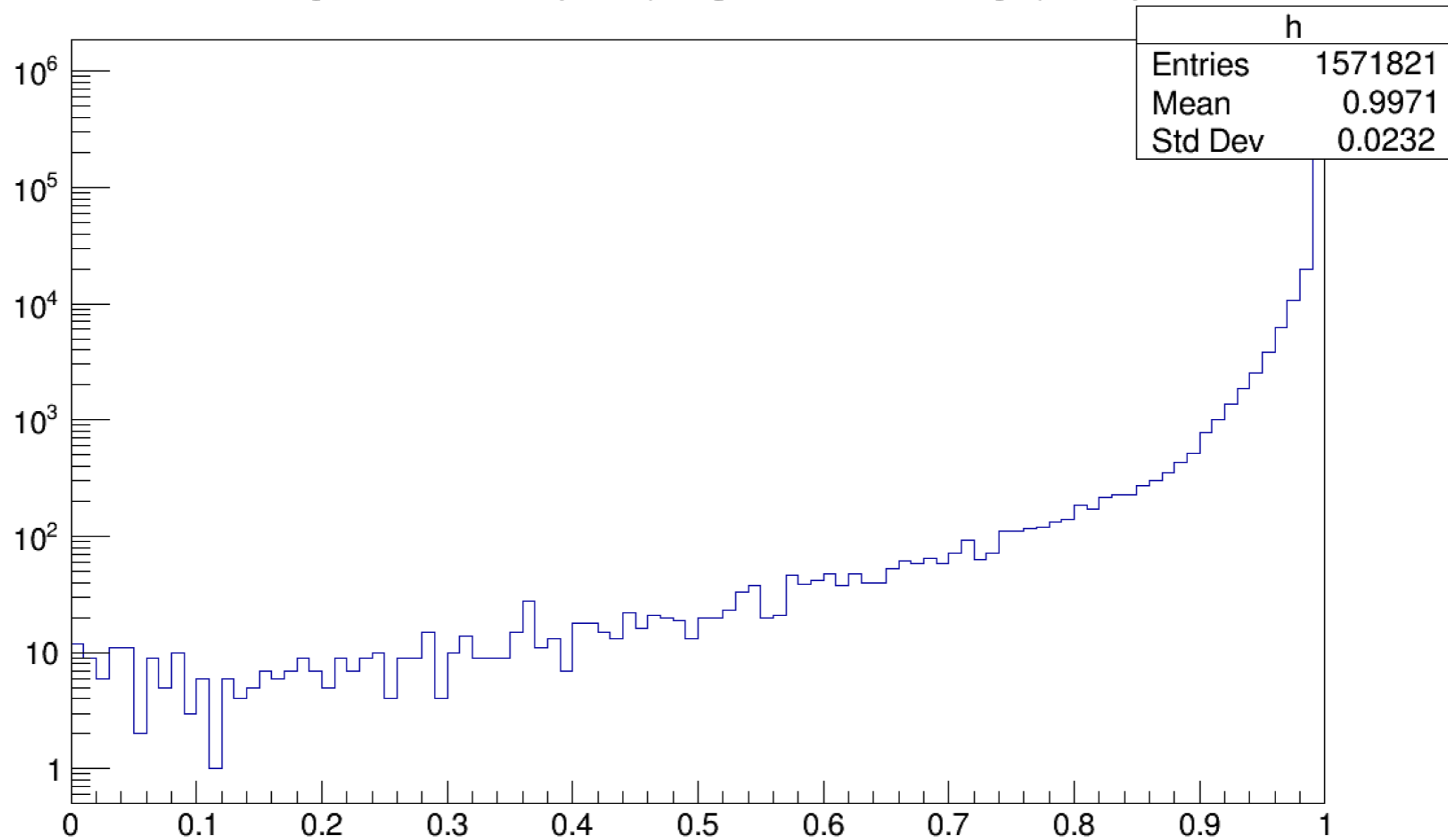
TAU MASS

TagJet_R5_mass {abs(TagJet_R5_charge)==1 && TagJet_isTAU>0.9}
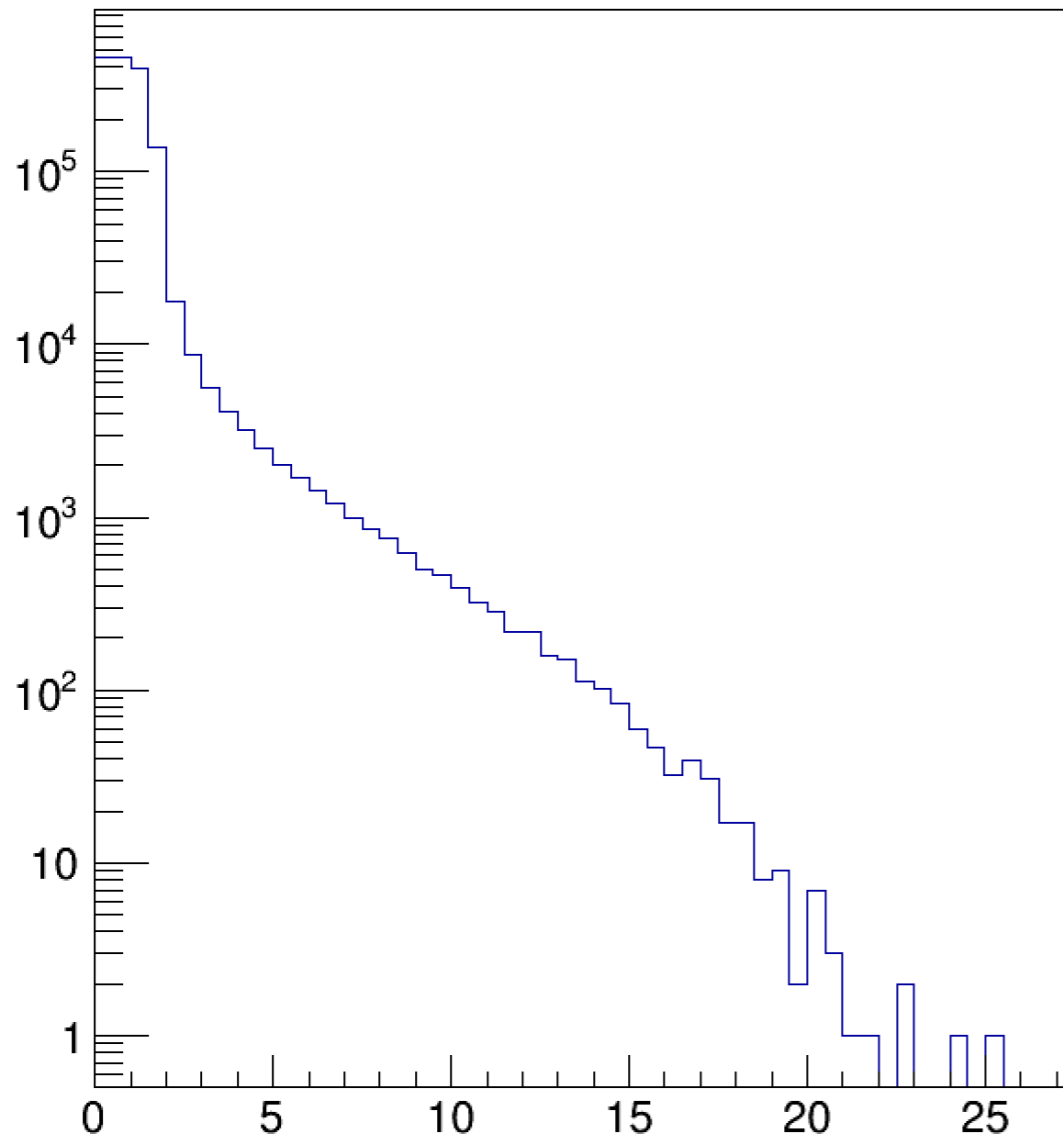
h	
Entries	1566555
Mean	0.9089
Std Dev	0.9373

TagJet_isTAU {abs(TagJet_R5_charge)==1 && TagJet_R5_mass<3}
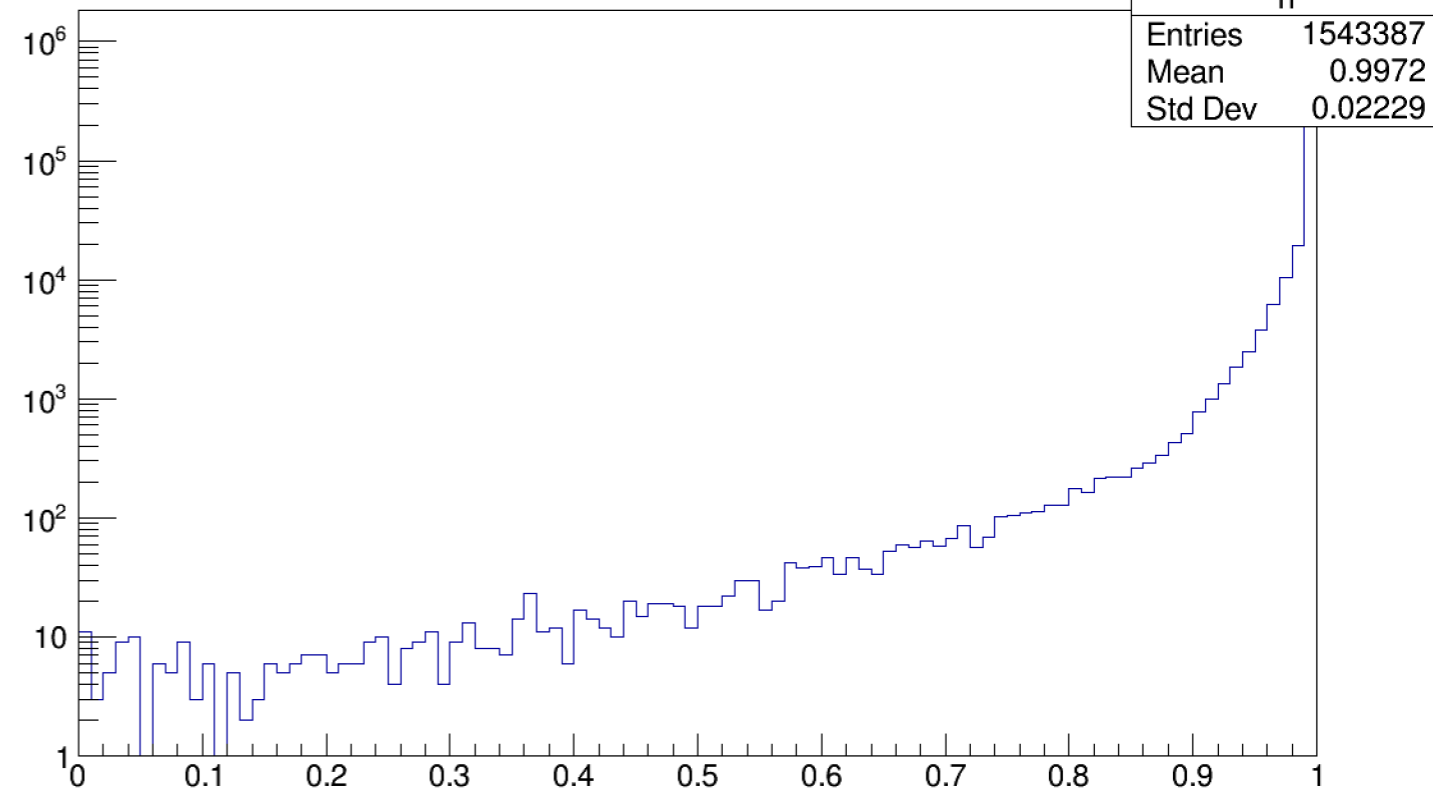
h	
Entries	1543387
Mean	0.9972
Std Dev	0.02229

in Maria's function mass<3 GeV

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- looked at optimizing the significance $S/\sqrt{B}$ and purity $S/(S + B)$ for:

  - jet mass: between a cut on 3 GeV and no cut there is not much difference but both figures prefer a cut around a few GeV

  - jet tau score: optimal value would be 0.99 but 0.9 is close enough with best significance at 0.93 for $\nu\nu\tau_h\tau_h$

NEXT STEPS

- compare number of hadronic taus from jet tagger and Maria's function to gen taus

- add information on neutral and charged jet constituents and use it in the BDT for reco taus

- maybe use the tau "type" (tag score + electron or muon decay) in the BDT, sort of a mode of decay

- see if cut-based analysis can be loosened

- train again BDTs

- get results with jet tagger and compare with the ones we got previously