



Top FCNC at FCC-he



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collaboration with LHeC / FCC-he top physics group

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TOP QUARK FCNC INTERACTIONS

- The top quark FCNC interactions would be a good test of new physics at present and future colliders. These interactions can be described by the effective Lagrangian

$$\mathcal{L}_{FCNC} = \sum_{q=u,c} \frac{g_s}{2m_t} \bar{q} \lambda^a \sigma^{\mu\nu} (\zeta_{qt}^L P^L + \zeta_{qt}^R P^R) t G_{\mu\nu}^a - \frac{1}{\sqrt{2}} \bar{q} (\eta_{qt}^L P^L + \eta_{qt}^R P^R) t H -$$

$$- \frac{g_W}{2c_W} \bar{q} \gamma^\mu (X_{qt}^L P_L + X_{qt}^R P_R) t Z_\mu + \frac{g_W}{4c_W m_Z} \bar{q} \sigma^{\mu\nu} (K_{qt}^L P_L + K_{qt}^R P_R) t Z_{\mu\nu} +$$

$$+ \frac{e}{2m_t} \bar{q} \sigma^{\mu\nu} (\lambda_{qt}^L P_L + \lambda_{qt}^R P_R) t A_{\mu\nu} + H.c.$$

scaled to
top mass

- *J.A.A-S, NPB812(2009)181*

Madgraph:
model topFCNC_UFO
from FeynRules

LHEC : DELPHES SIMULATION WITH FCCEH CARD

*Example diagrams
for signal*

($p e^- \rightarrow e^- w^+ b$)

Physics process:

$p e^- \rightarrow e^- w w b b$

($ww = w^+ w^-$ and $bb = b b^{\sim}$) (incl. S+B)

Energy setup: 50000 GeV x 60 GeV

► **Event generation:**

MadGraph5_aMC@NLO version 2.5.2

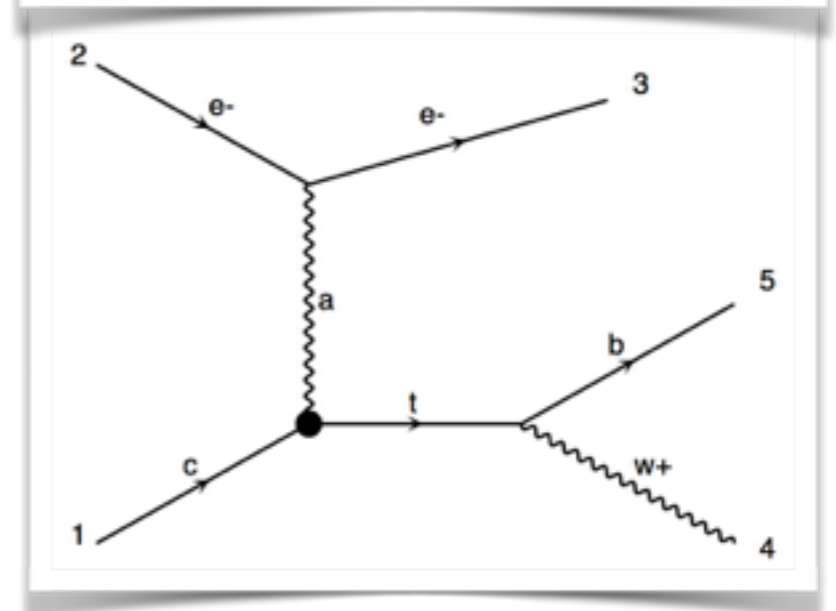
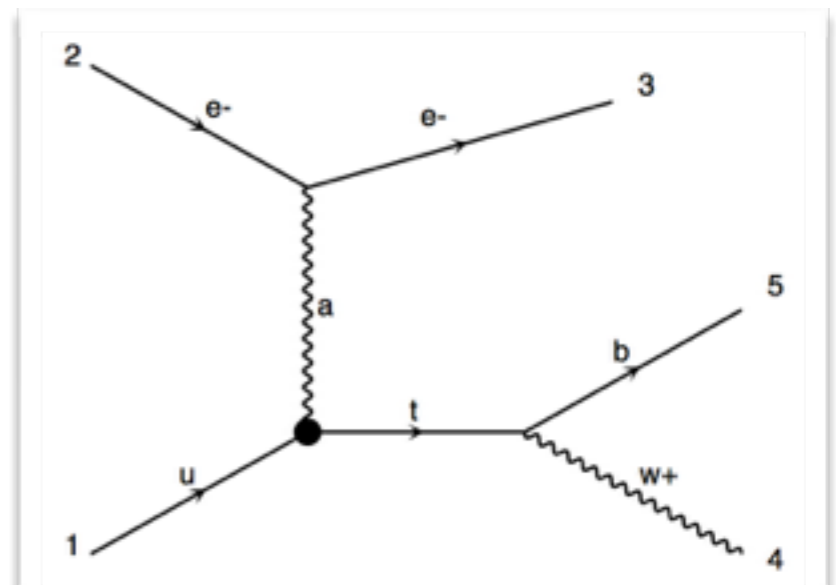
► **Hadronization:** Pythia6

► **Detector simulation:** Delphes 3.4.0

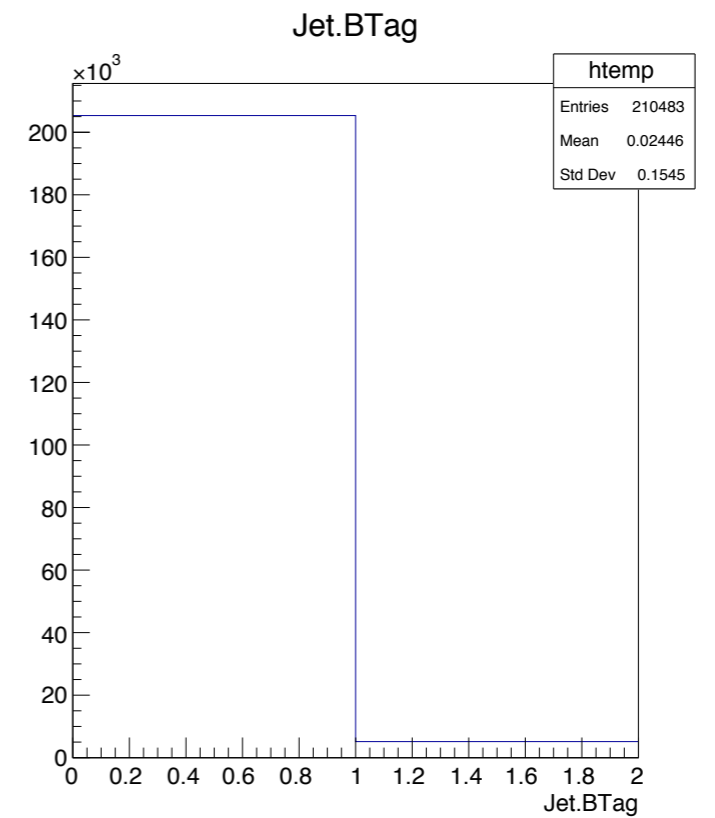
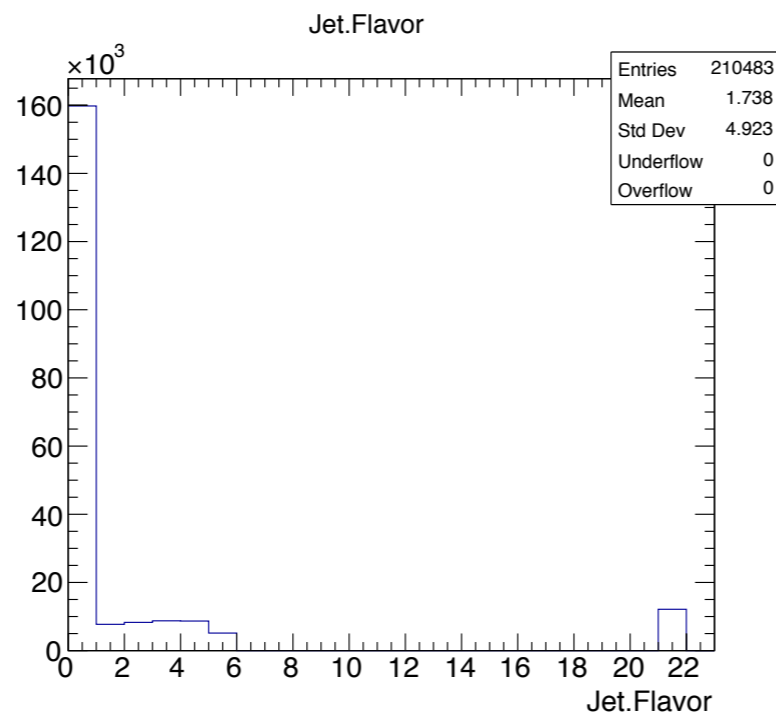
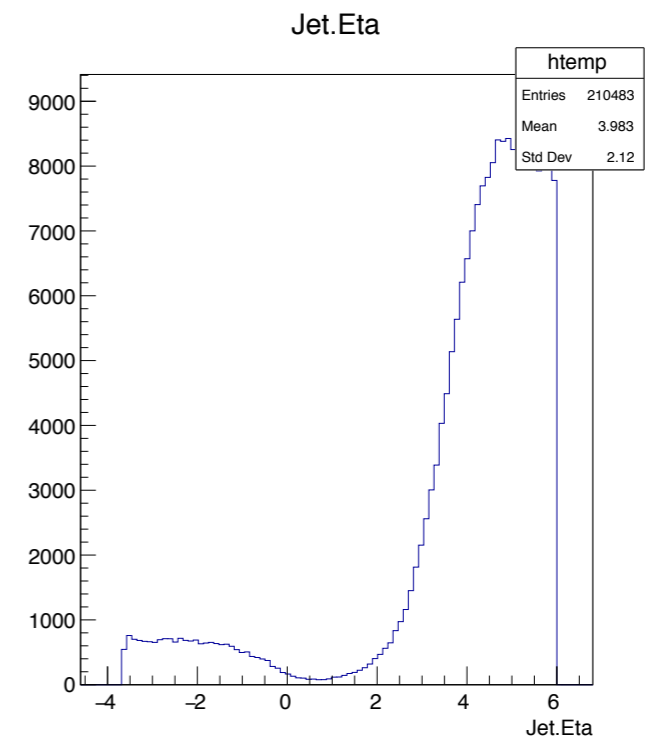
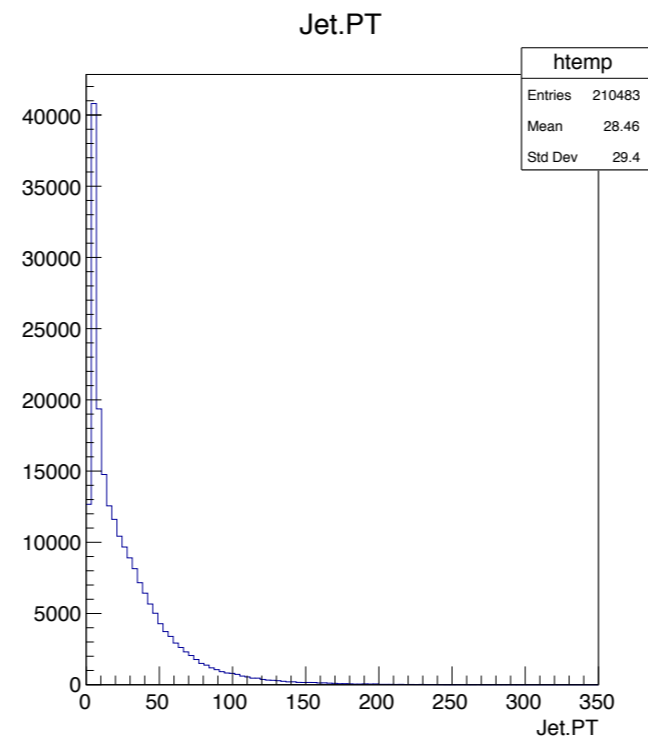
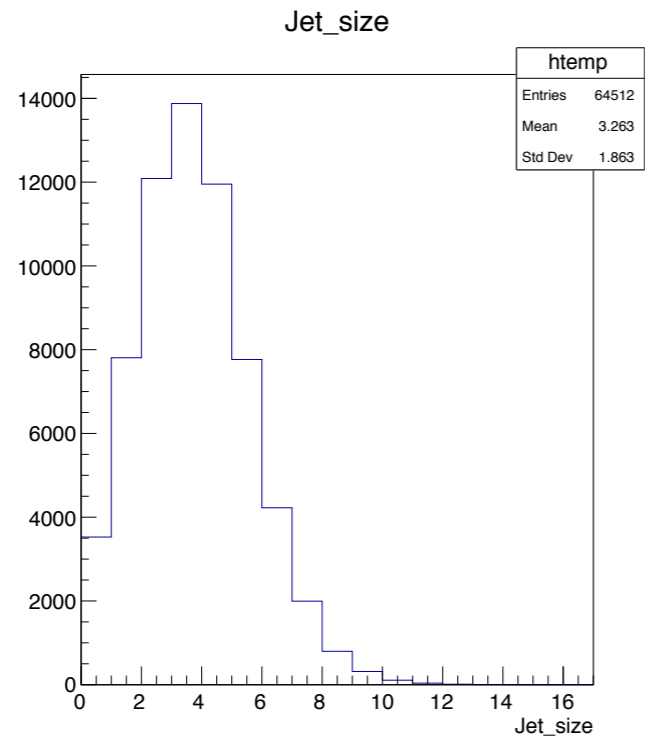
► **Detector card:**

delphes_card_FCCeh_PK_final.dat

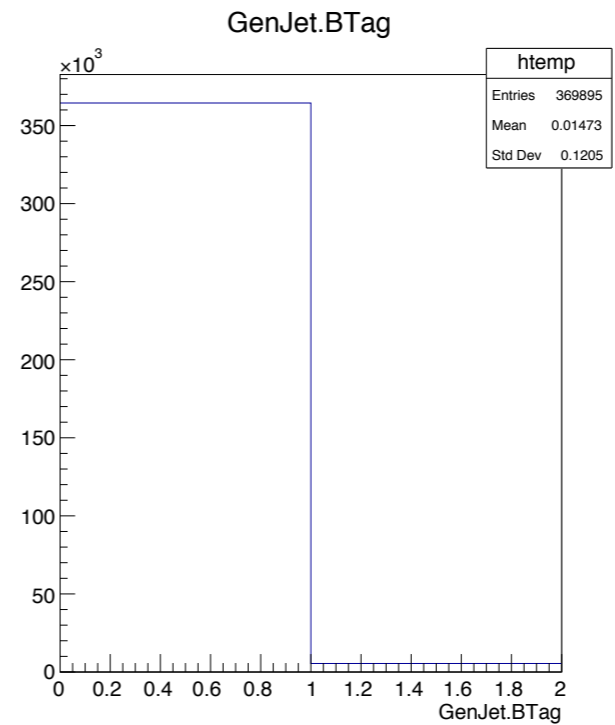
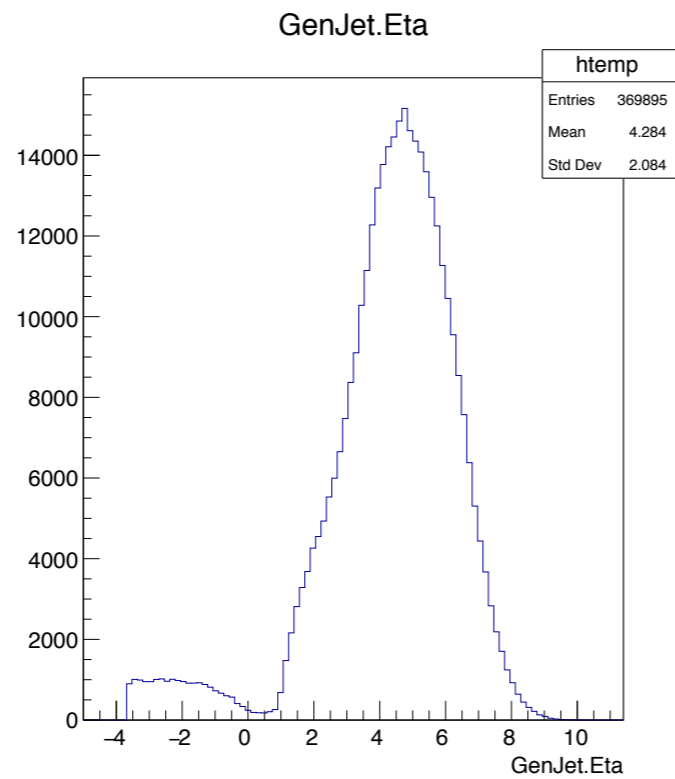
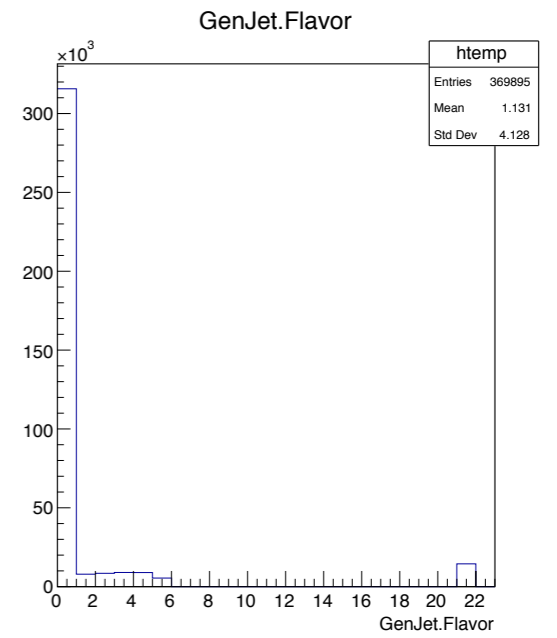
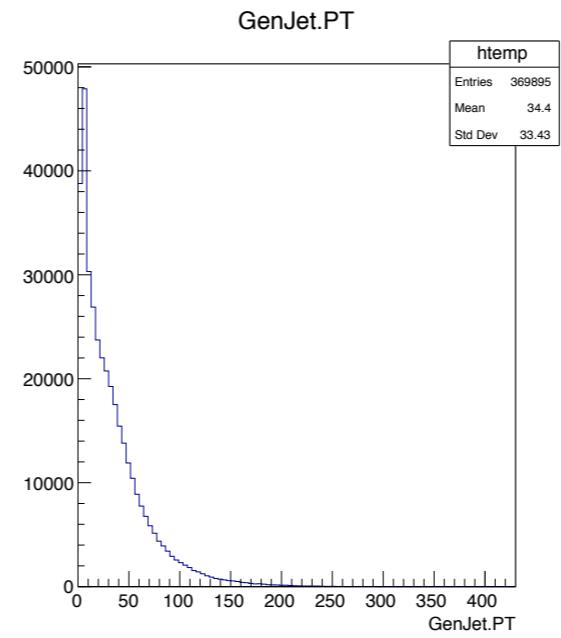
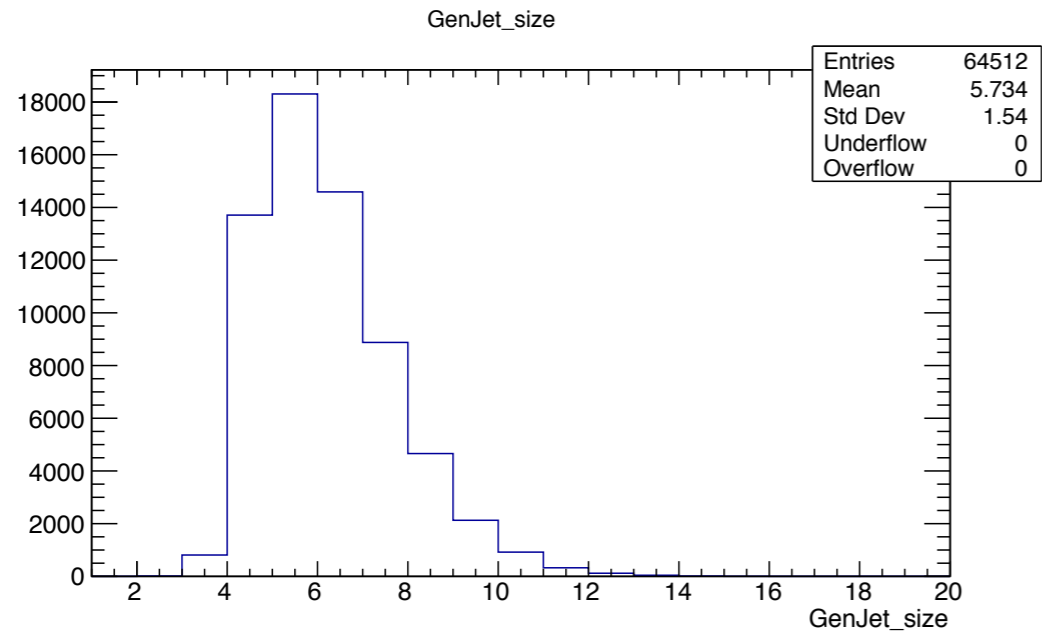
► **Analysis:** Root6



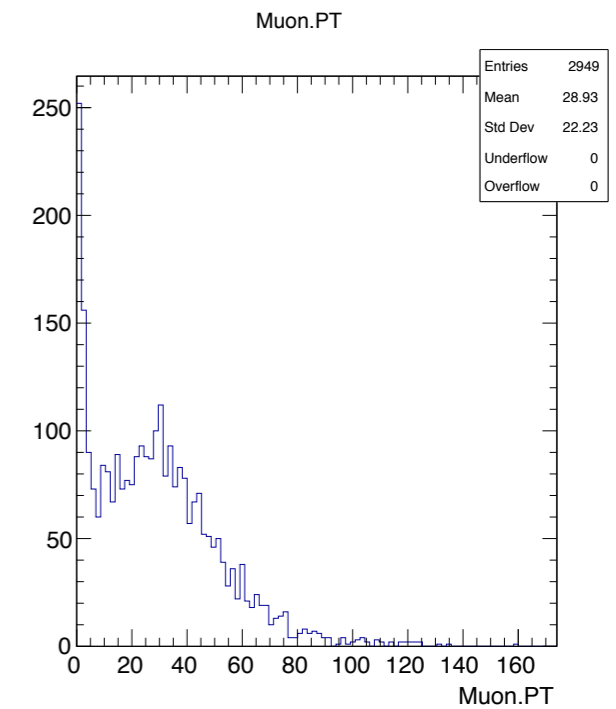
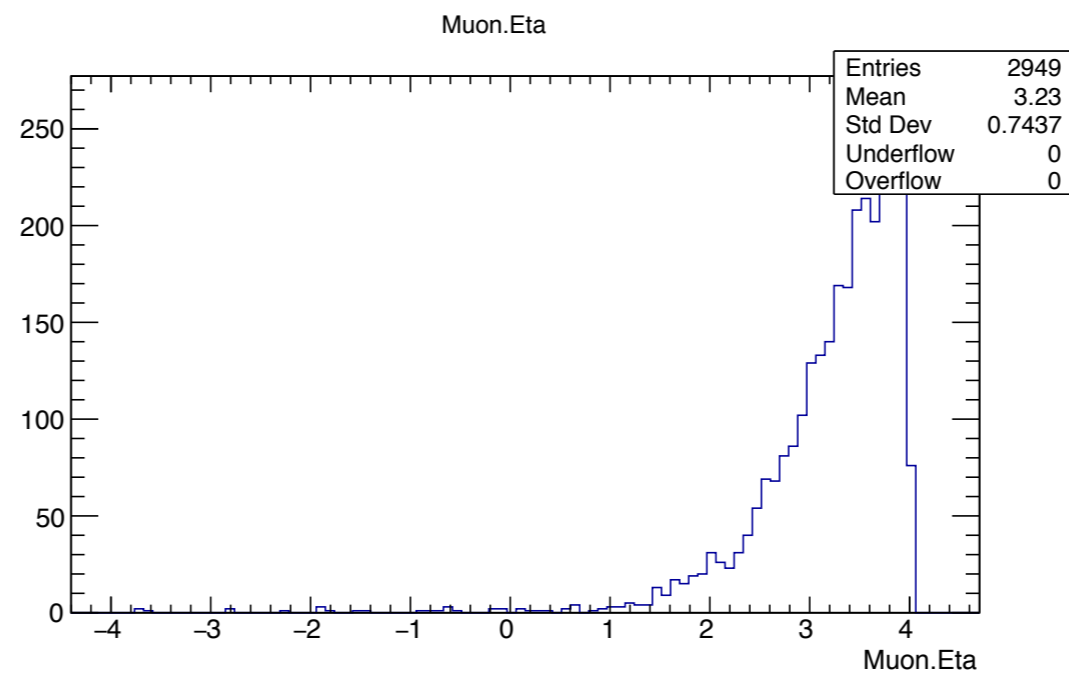
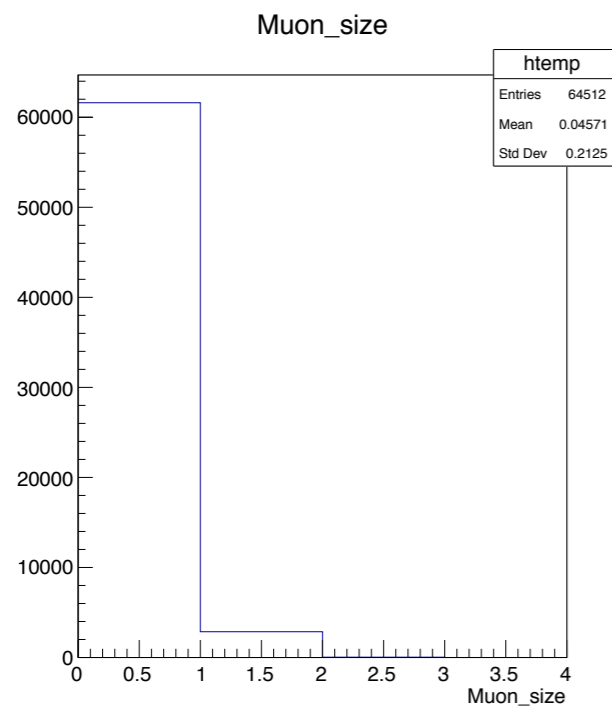
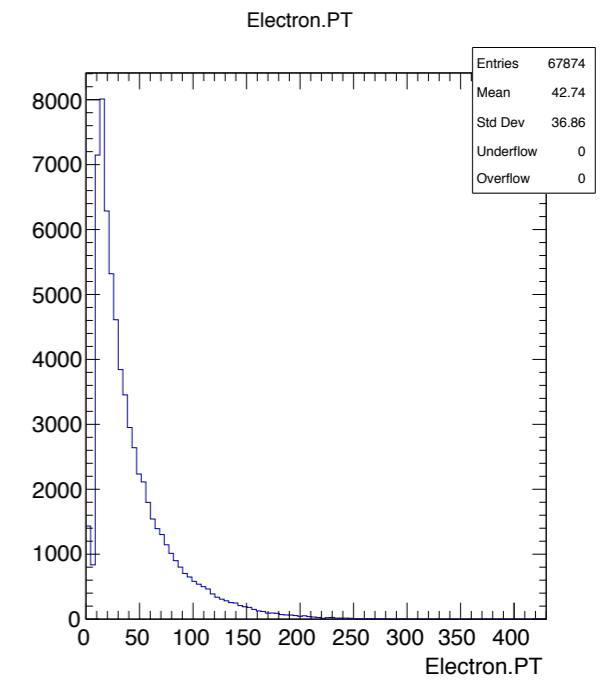
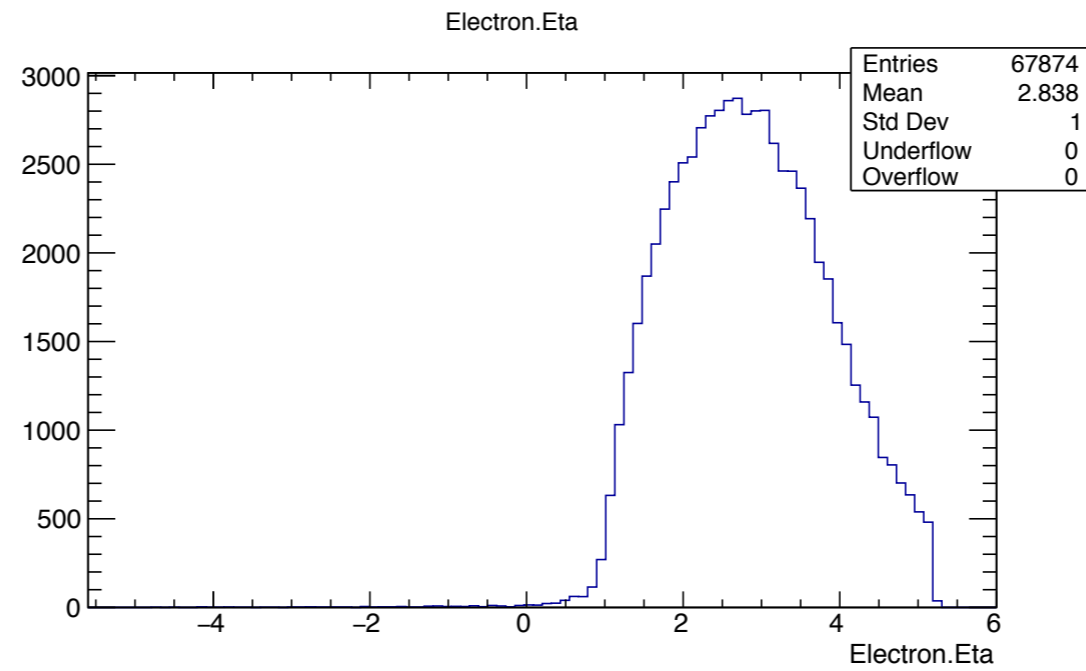
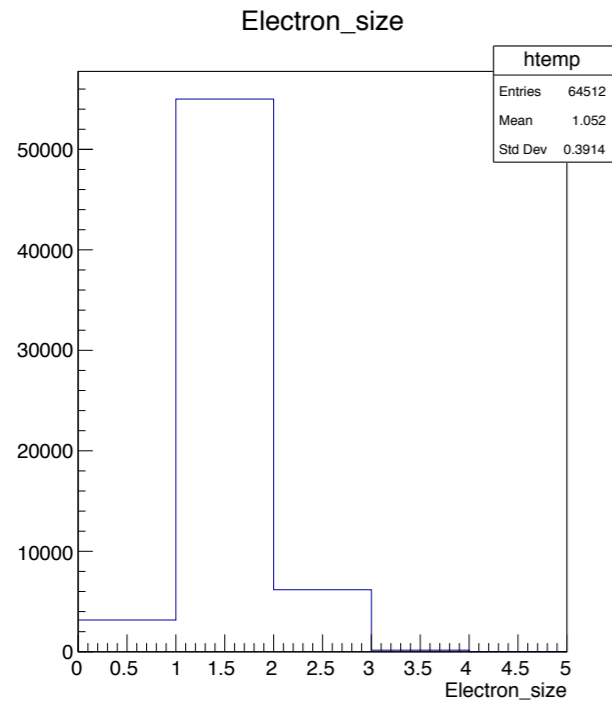
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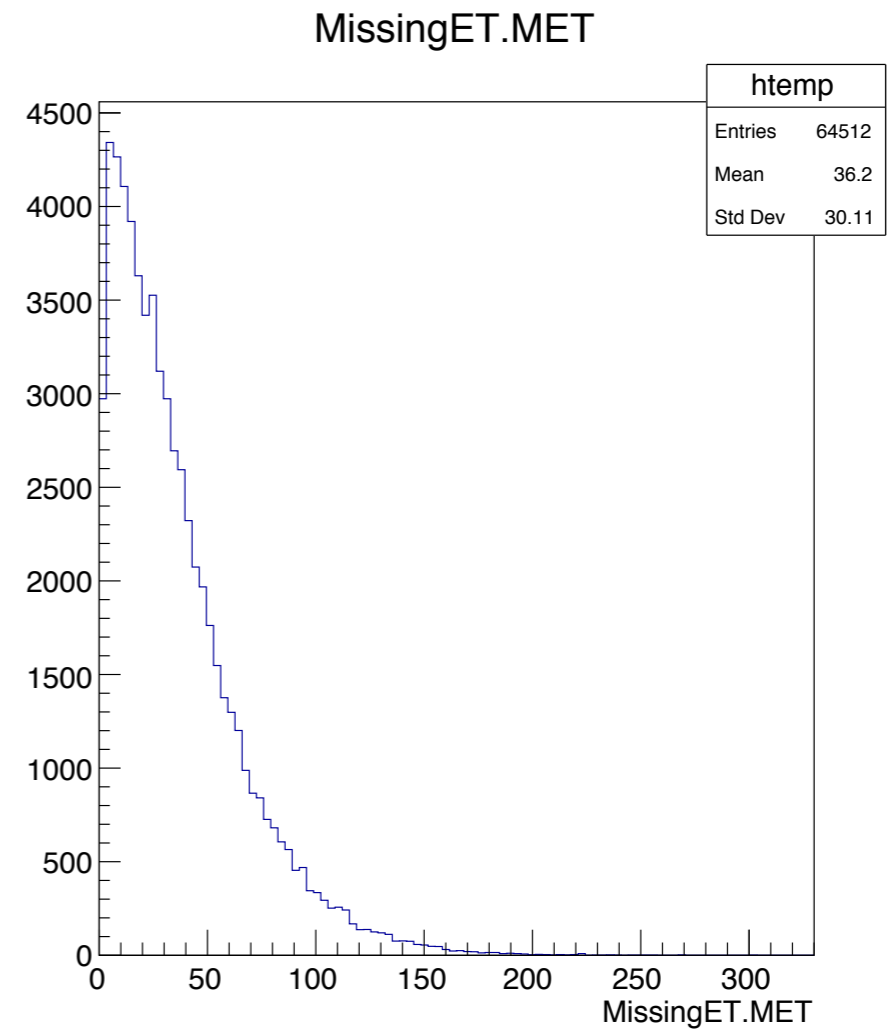
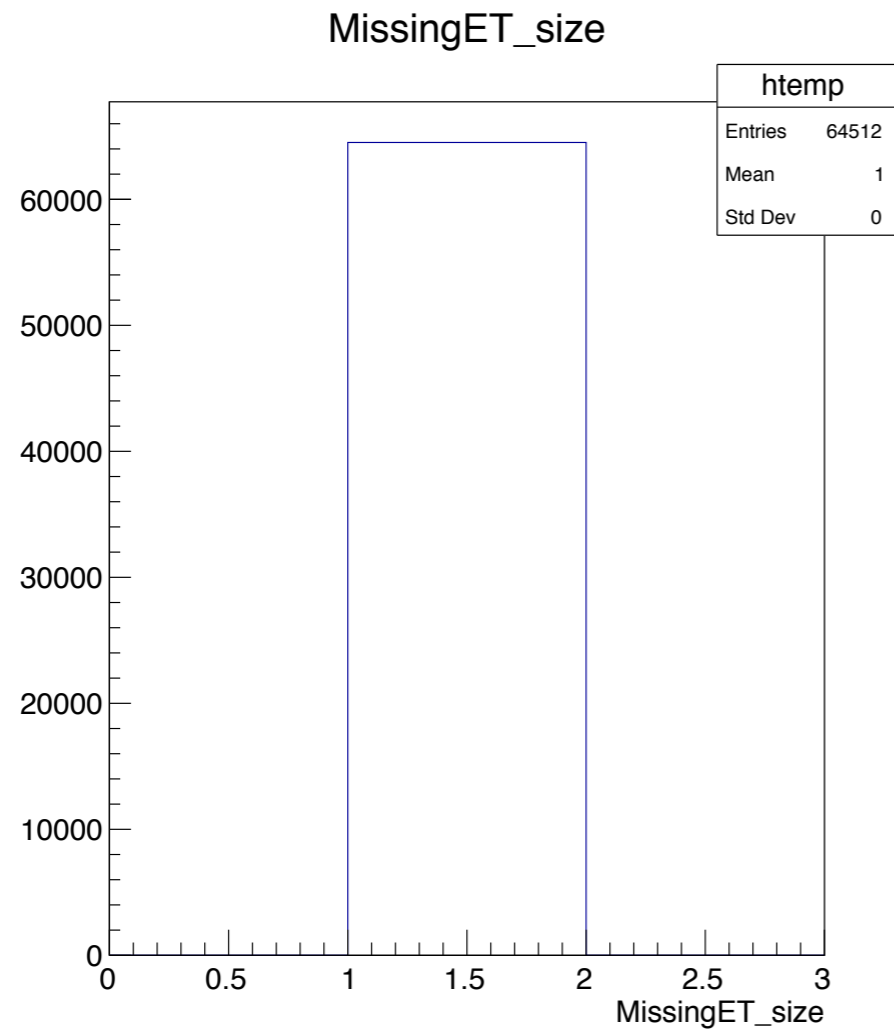
GENJET



ELECTRONS AND MUONS

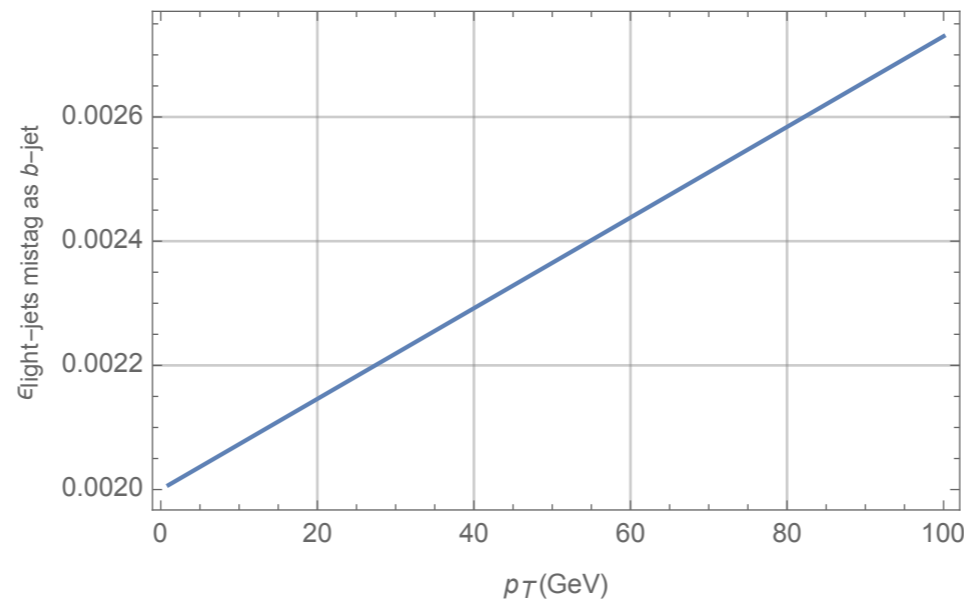
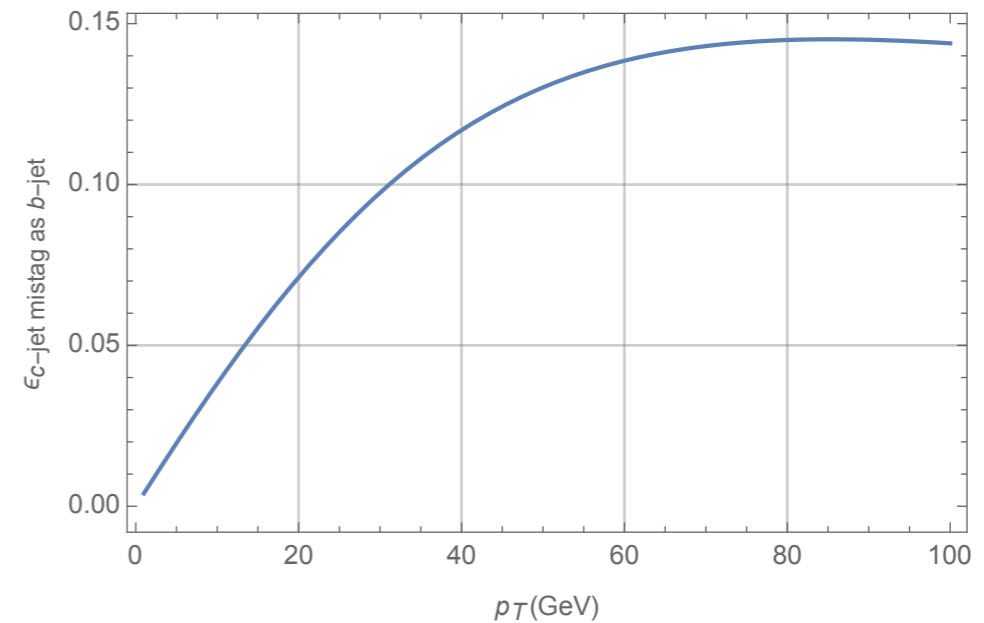
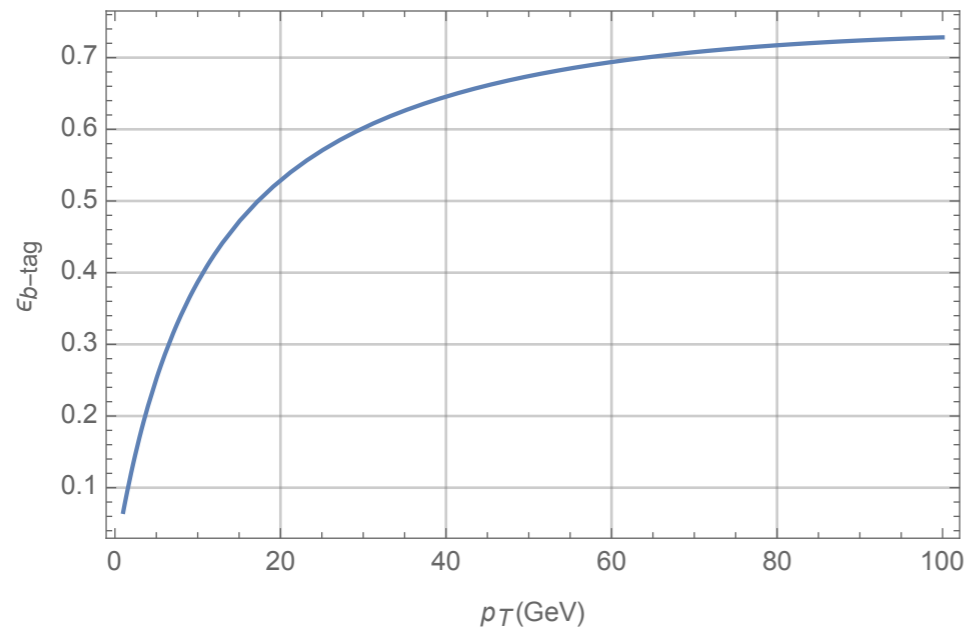


MET



BTAG EFFICIENCY

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- The b-tag efficiency formula can be compared to other detector cards (delphes_card_FCCeh_PK_final card assumes $\epsilon_{b\text{-tag}}=1$, below a comparison with delphes_card_ATLAS.dat, we want to compare (2d) with FCCChh detector card, forward region may be enhanced)



CONCLUSION

We study process: “ $p e^- \rightarrow e^- ww bb$
 $NP=1$ ” (where $ww=w^+ w^-$ and $bb=b\bar{b}$) (includes S+B)

- For FCCeh **detector simulation** we use Delphes with card:
 - `delphes_card_FCCeh_PK_final.dat` (Uta has sent) for FCCeh detector
 - * Distributions for jet size, electron size, p_T , eta, ...
- Jet size is as expected
- BTag size is low

- Muon size is low (expectation from W leptonic decay)
- Photons have very low p_T

Comments:

- Important improvement to previous versions
- EfficiencyFormula can be transverse momentum dependent in some ranges of pseudo rapidity
- Possible to study through validation procedure (available in Delphes version 3.4)

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