



DM Studies in $\mu\mu$ monohigg $\rightarrow b\bar{b}$

By: Philip Bjorklund

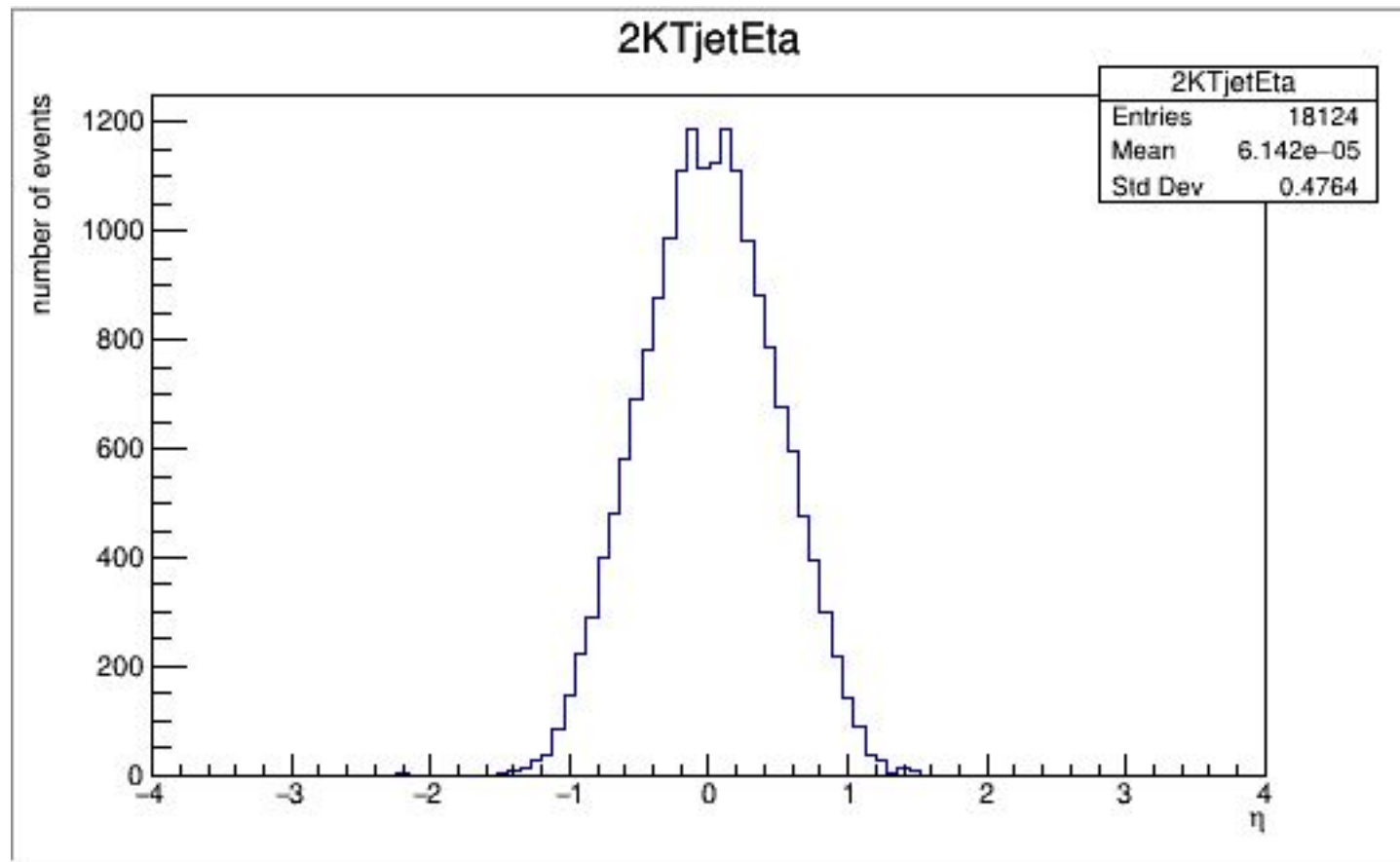
Simulation

- Model: Zp2HDM
- Signal: $\mu^+ \mu^- \rightarrow a_0 h / z, a_0 \rightarrow n_1 n_1^{\sim}, h \rightarrow b b^{\sim}$
- Background: $\mu^+ \mu^- \rightarrow w j j, w \rightarrow l \nu_l$
 - $\mu^+ \mu^- \rightarrow w^+ w^- z$
 - $\mu^+ \mu^- \rightarrow z z$
 - $\mu^+ \mu^- \rightarrow t t^{\sim}, t \rightarrow w^+ b, t^{\sim} \rightarrow w^- b^{\sim}$
 - $\mu^+ \mu^- \rightarrow w b t^{\sim}, w \rightarrow l \nu_l$
 - $\mu^+ \mu^- \rightarrow z j j, z \rightarrow \nu_l \nu_l^{\sim}$
 - $\mu^+ \mu^- \rightarrow z b b^{\sim}, z \rightarrow \nu_l \nu_l^{\sim}$
 - $\mu^+ \mu^- \rightarrow z j j, z \rightarrow l^+ l^-$
- Ebeam1: 1500 Mass a_0 : 300 GeV
Ebeam2: 1500 Mass X ($n_1/n_1^{\sim}$): 100 GeV
 Mass Z_p : 1 TeV
- Cross Section: $3.196 \cdot 10^{-12}$ pb

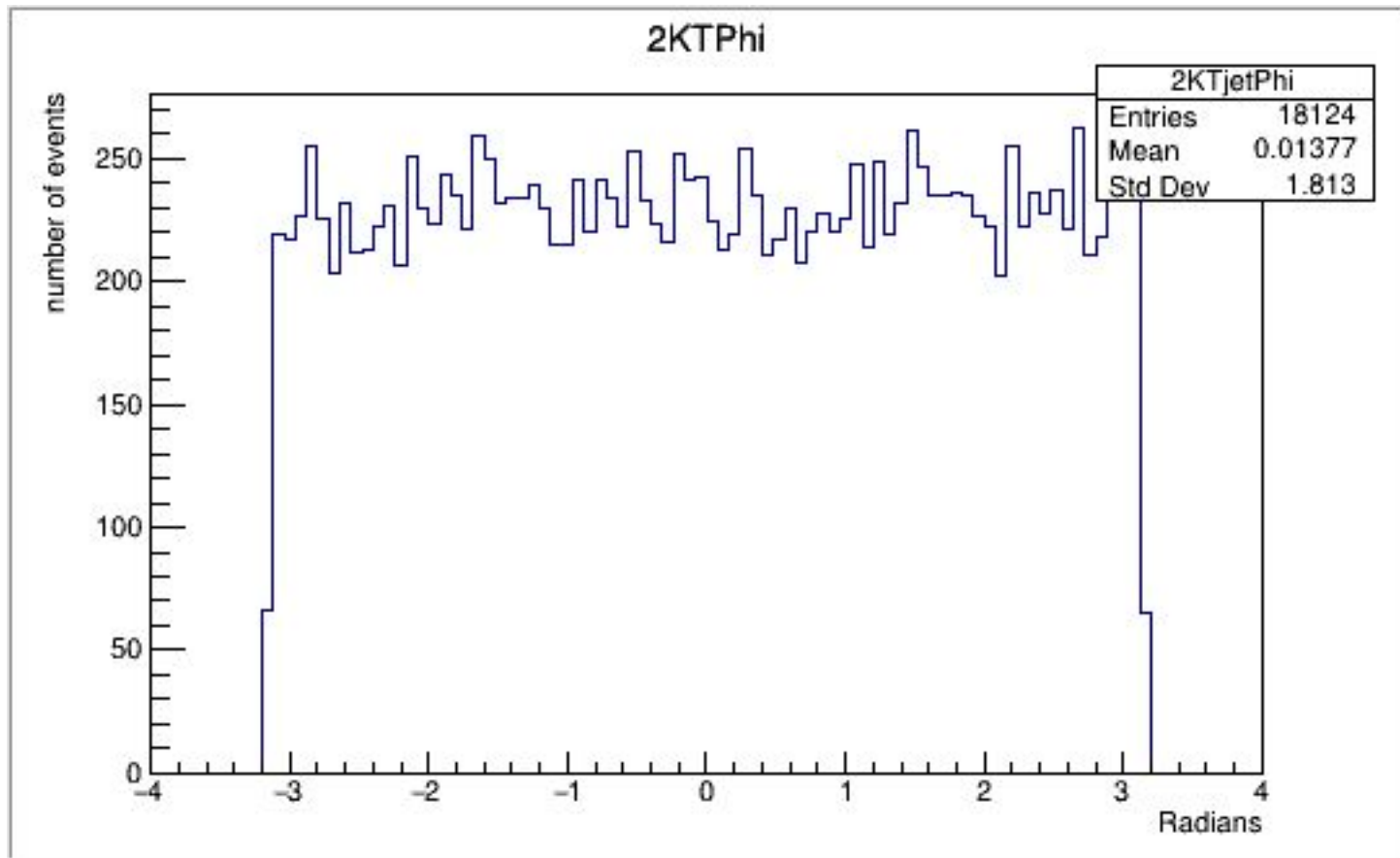
KTjets

- KT jets are now analyzed, as opposed to generator-level events
- Still working on B-tagging for KT jets, so I am selecting only events that contain exactly 2 KT jets for now

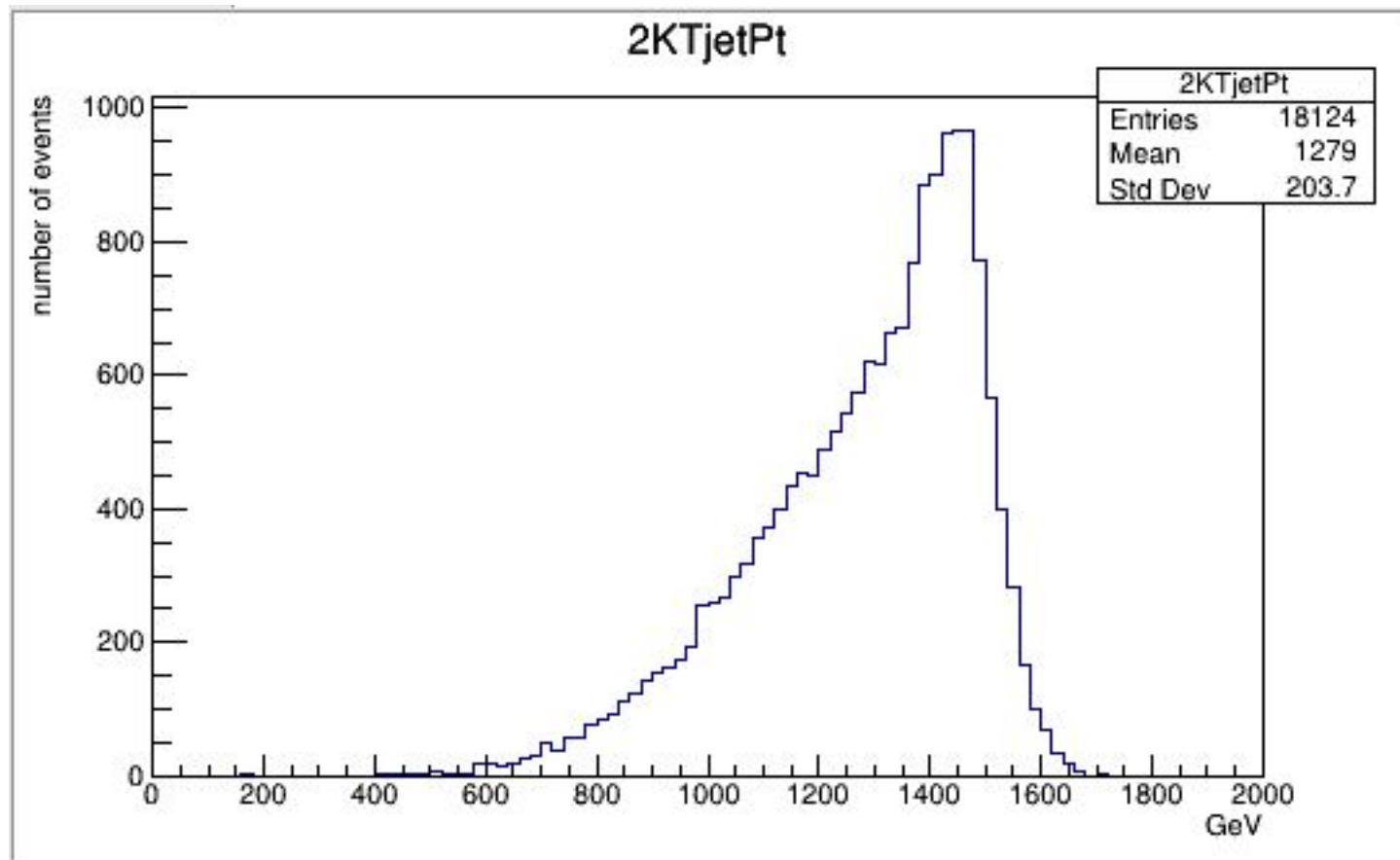
Eta



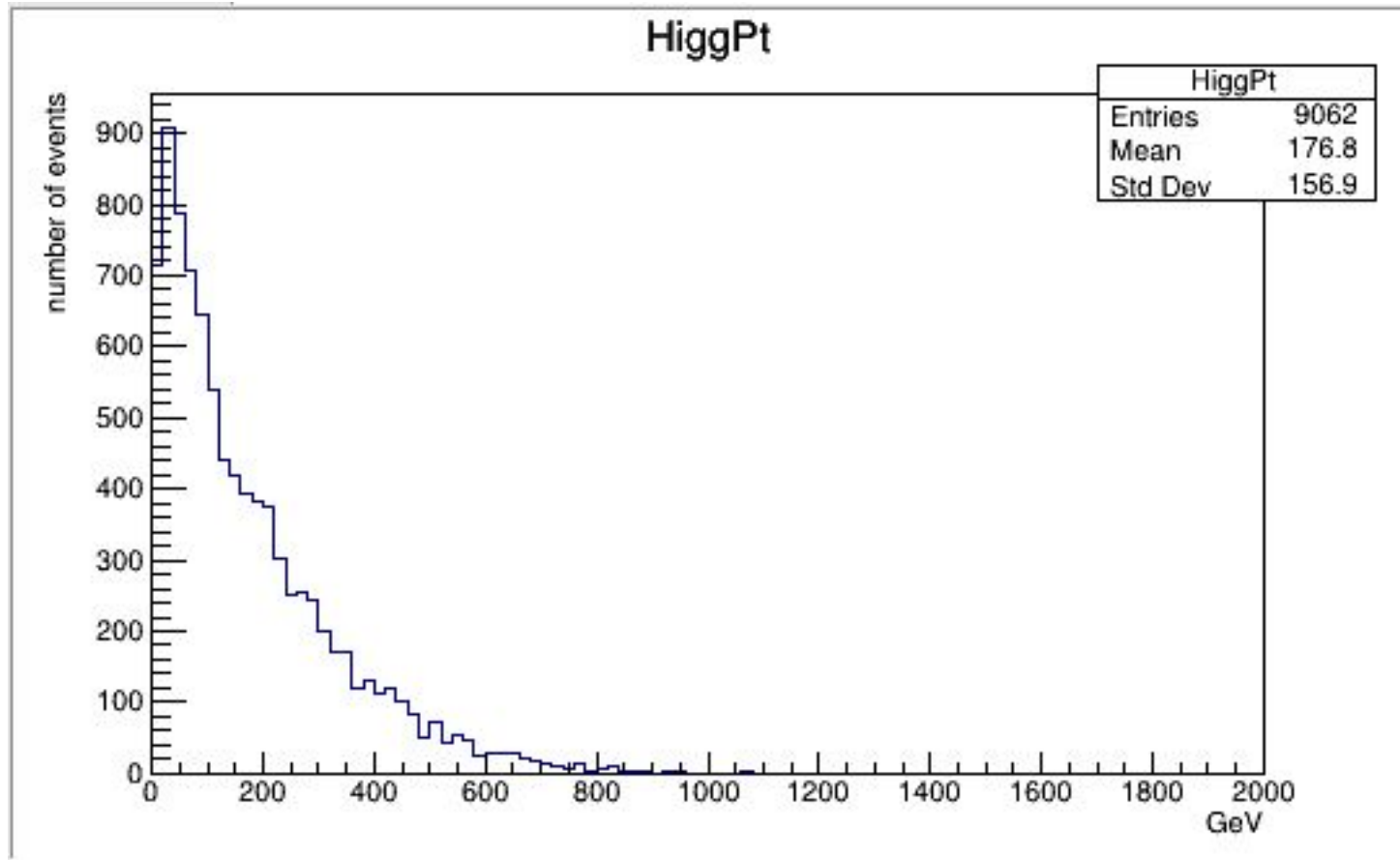
Phi



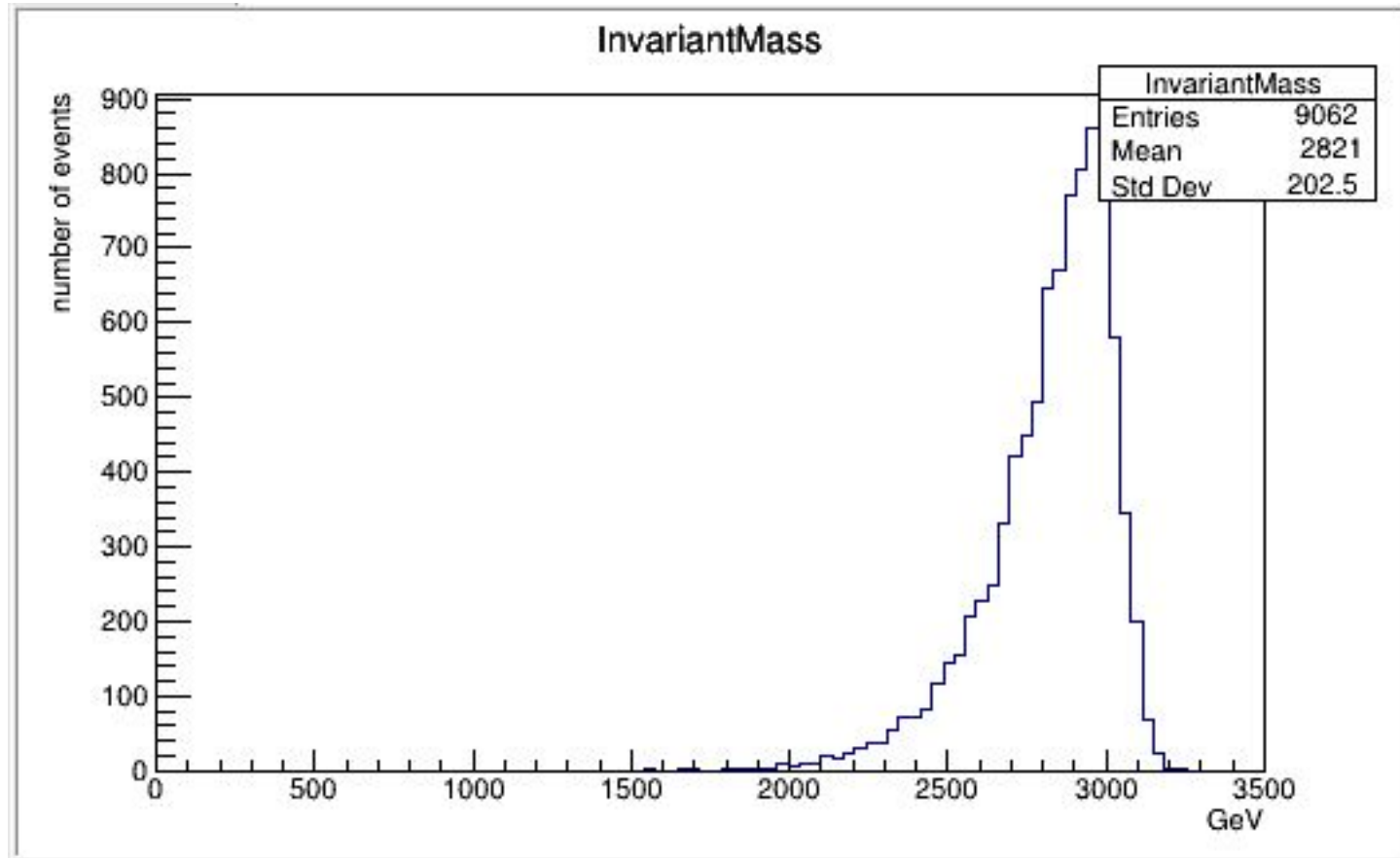
Pt



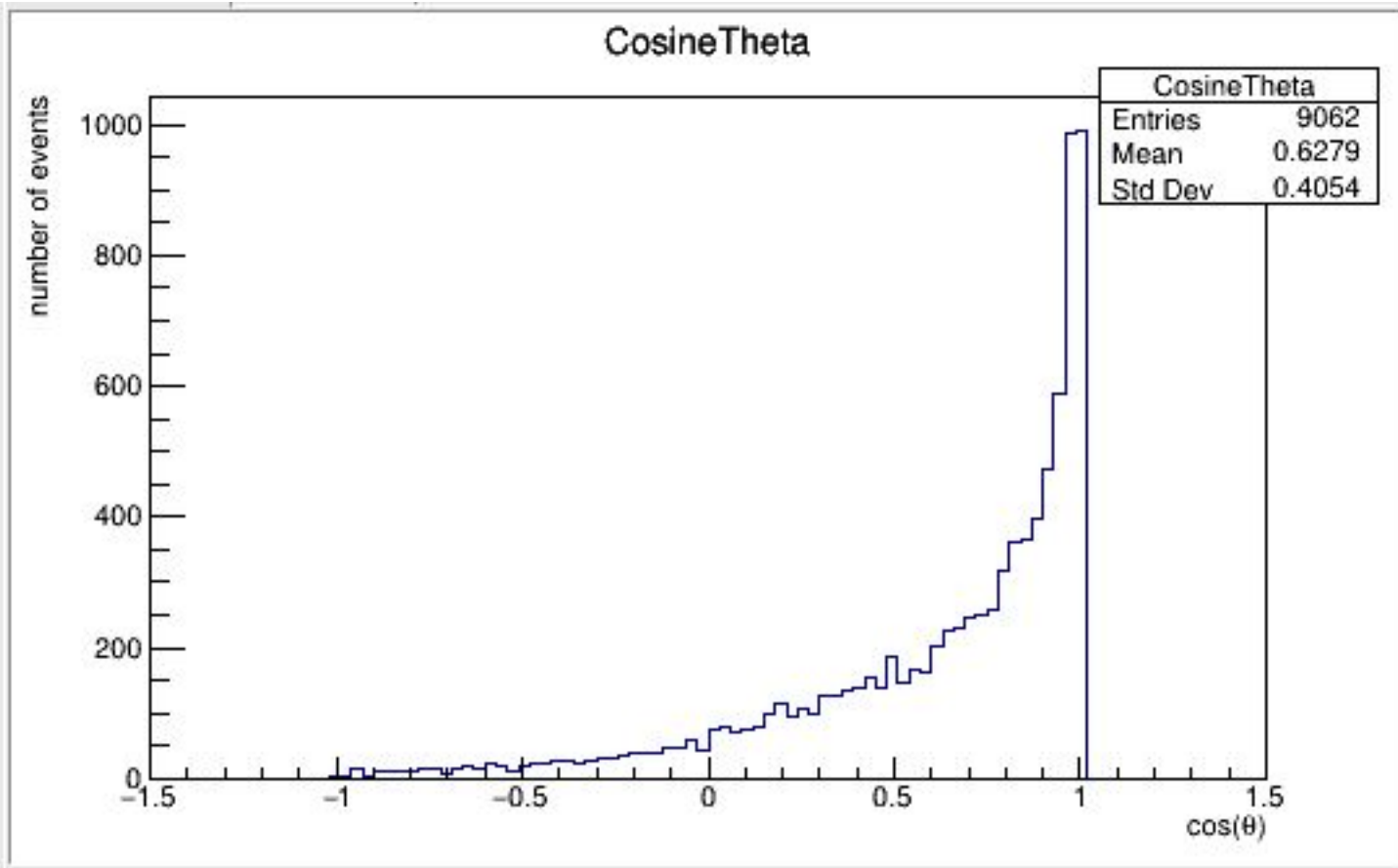
Reconstructed HiggPt



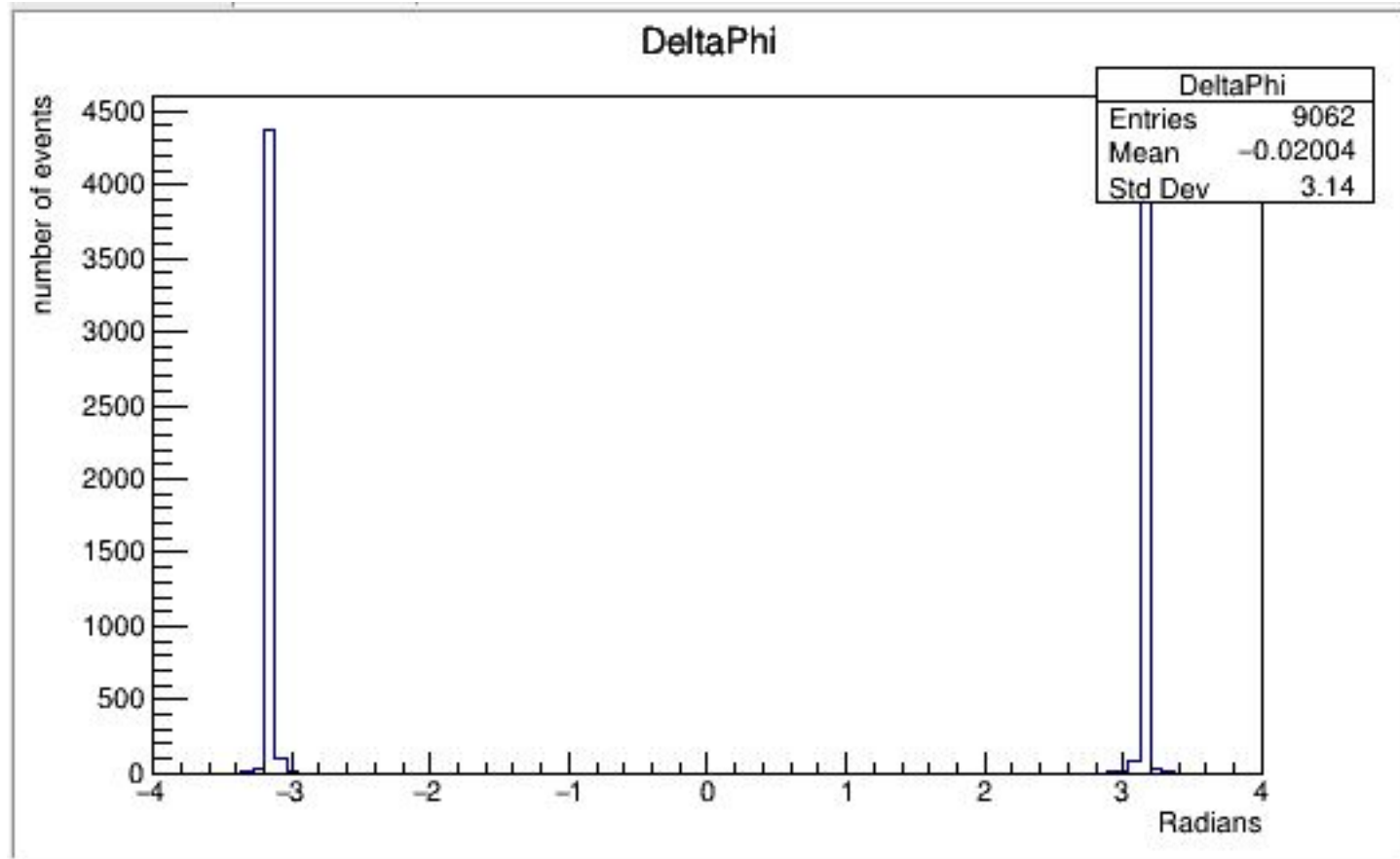
Reconstructed Invariant Mass



Cos(θ) between Higgs and MET



$\Delta\Phi$ between Higgs and MET



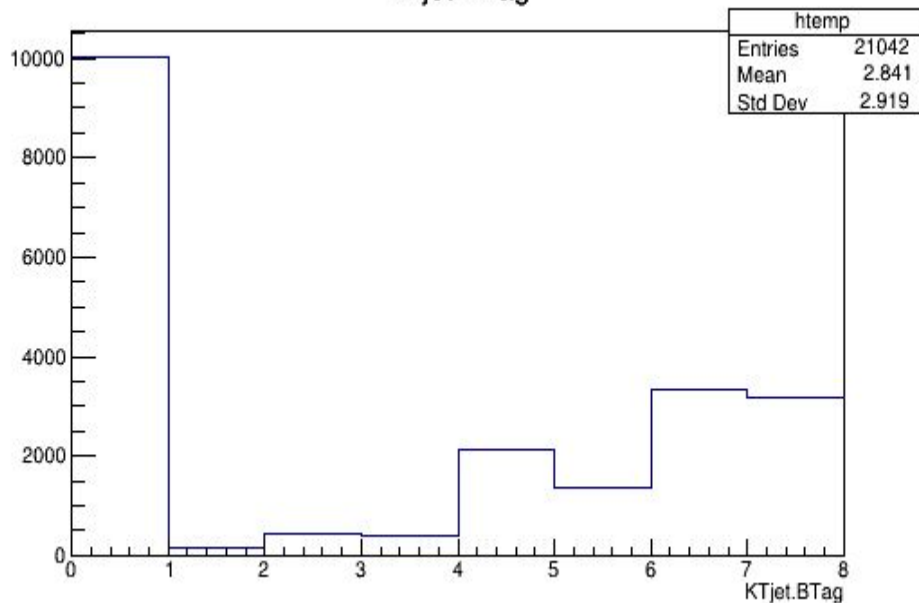


BTagging

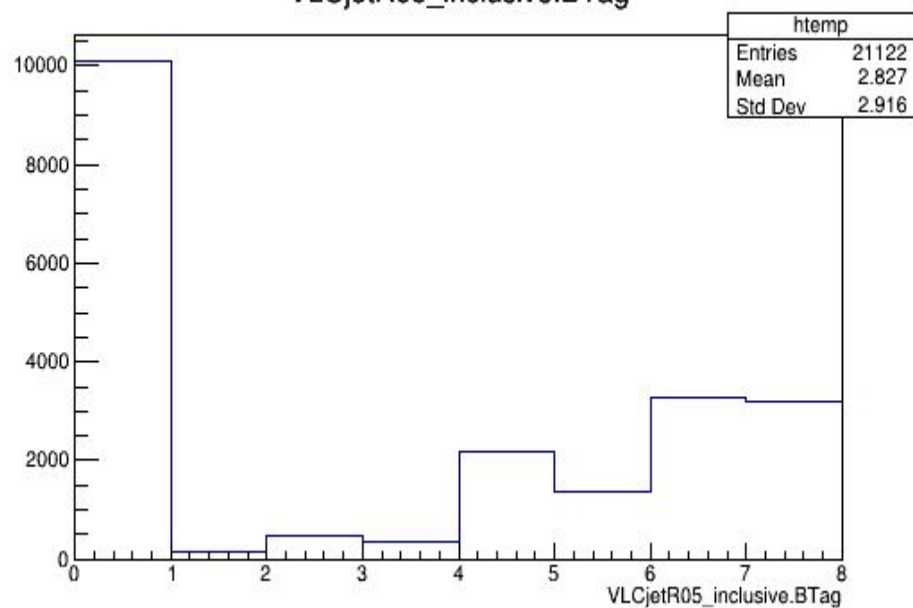


BTagging

KTjet.BTag



VLCjetR05_inclusive.BTag

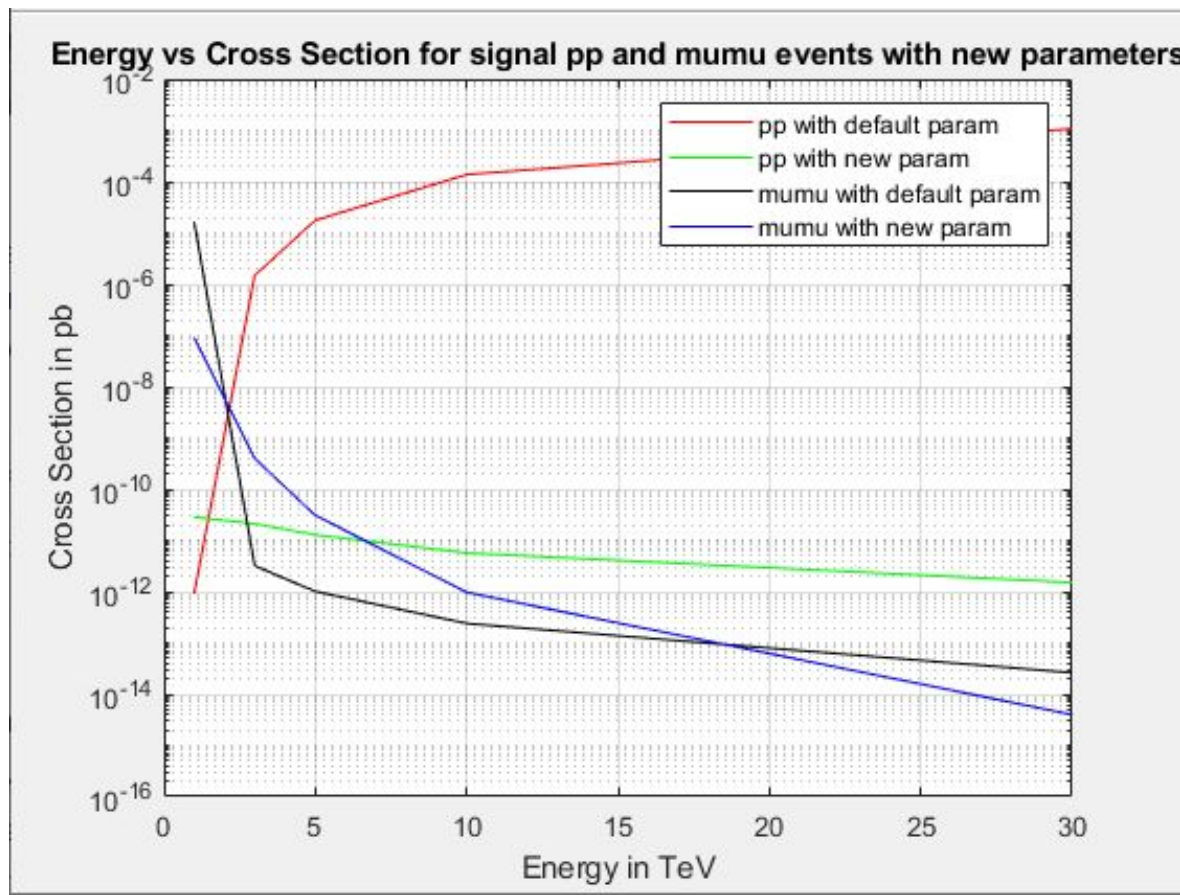




Cross Sections

pp events compared to mu mu

- Problem with initial state couplings



Cross Sections: Signal and Background

wjjlv: $\mu^+ \mu^- \rightarrow w j j, w \rightarrow l \nu$

wwz: $\mu^+ \mu^- \rightarrow w^+ w^- z$

zz: $\mu^+ \mu^- \rightarrow z z$

ttwb: $\mu^+ \mu^- \rightarrow t \bar{t}, t \rightarrow w^+ b, \bar{t} \rightarrow w^- b^-$

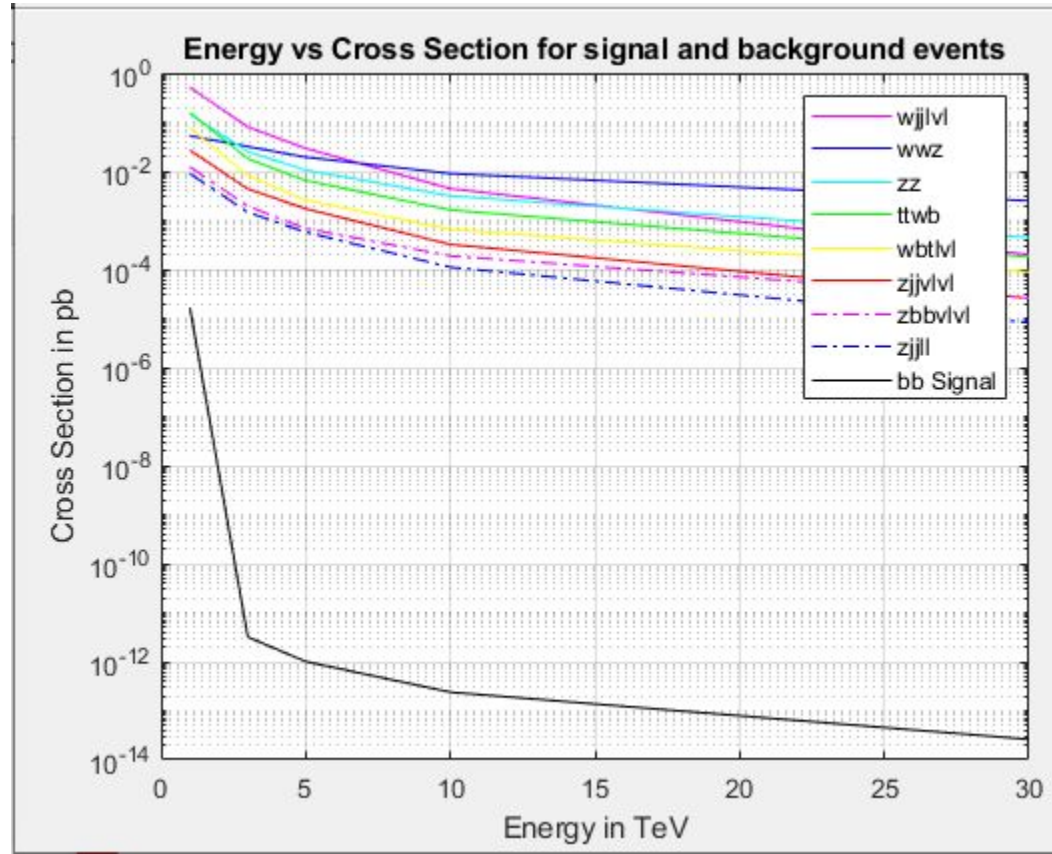
wbtvl: $\mu^+ \mu^- \rightarrow w b t, w \rightarrow l \nu$

zjjlv: $\mu^+ \mu^- \rightarrow z j j, z \rightarrow \nu \bar{\nu}$

zbbvl: $\mu^+ \mu^- \rightarrow z b \bar{b}, z \rightarrow \nu \bar{\nu}$

zjll: $\mu^+ \mu^- \rightarrow z j j, z \rightarrow l^+ l^-$

bb signal: $\mu^+ \mu^- \rightarrow a_0 h / z, a_0 \rightarrow n_1 n_1^-, h \rightarrow b \bar{b}$



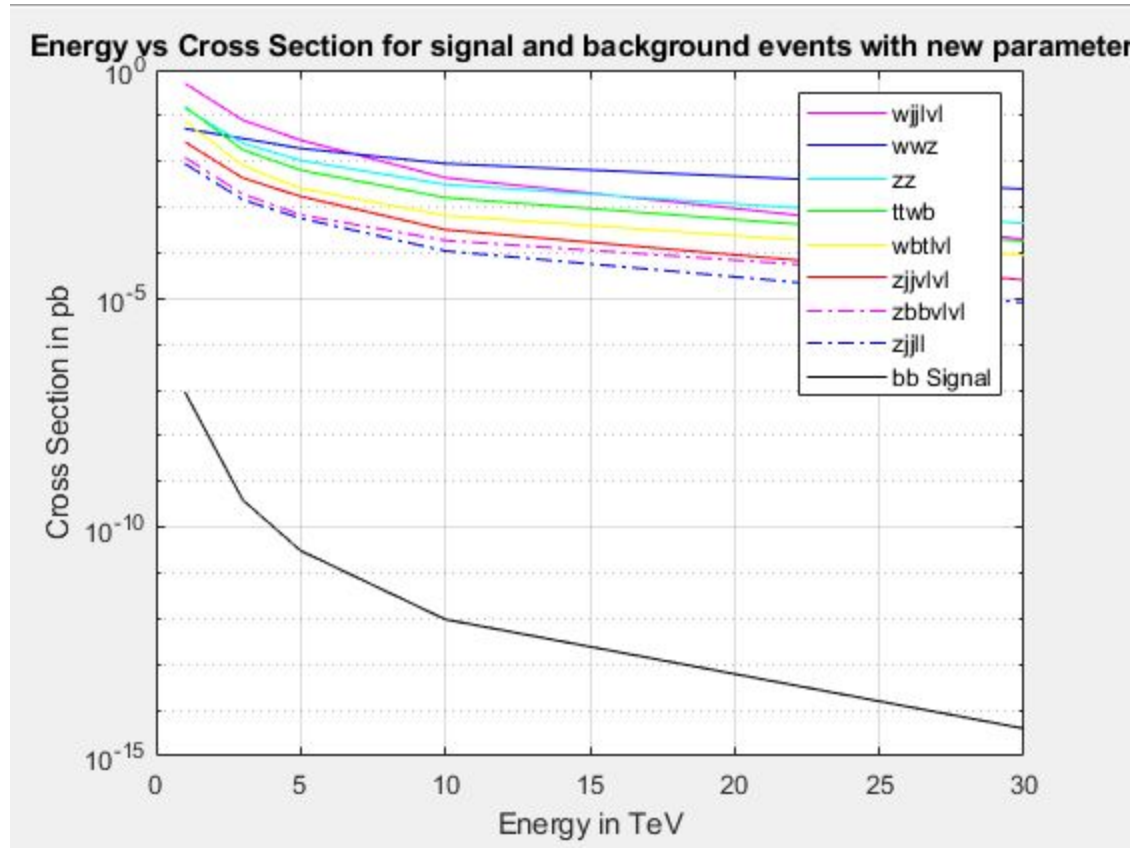
Parameter adjustments

MA0: $0.4 * \text{COM}$

Mn1/n1~: 1 GeV

MZp: $1.1 * \text{COM}$

gz: 0.4



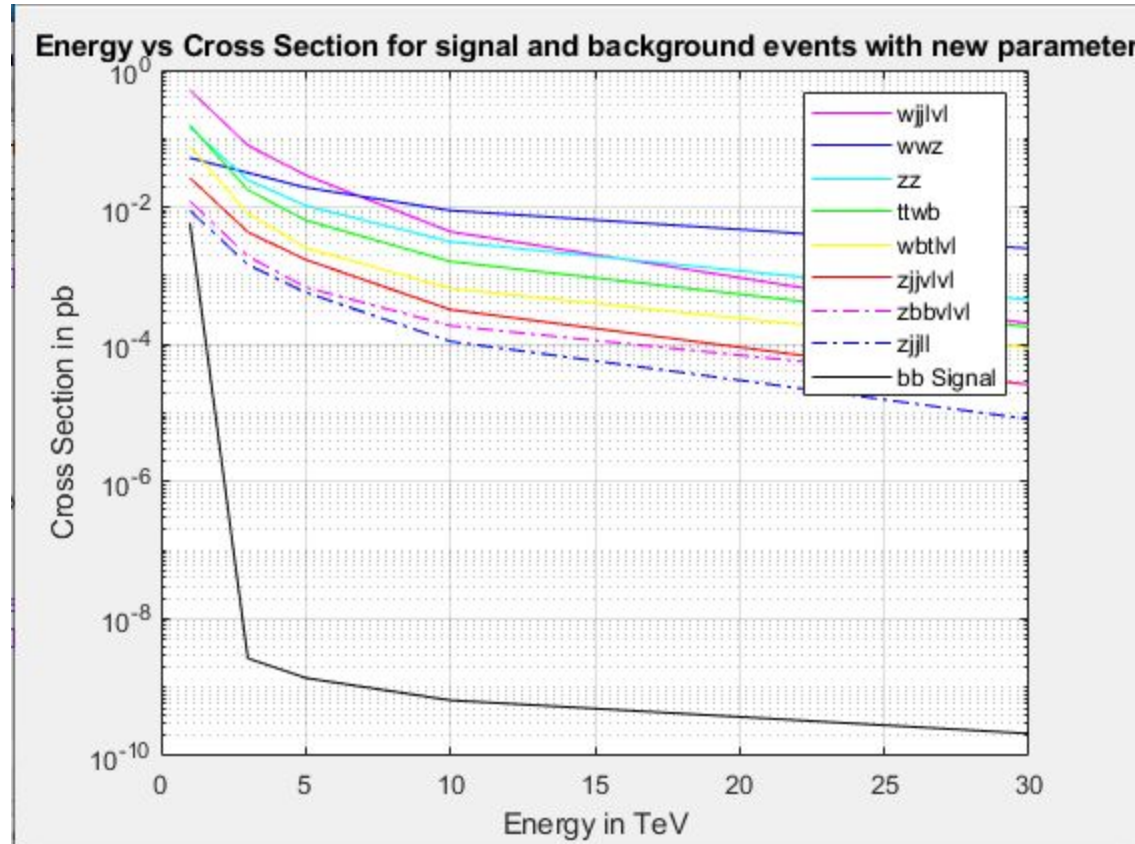
MZp held at 1000 GeV

MA0: 1200 GeV

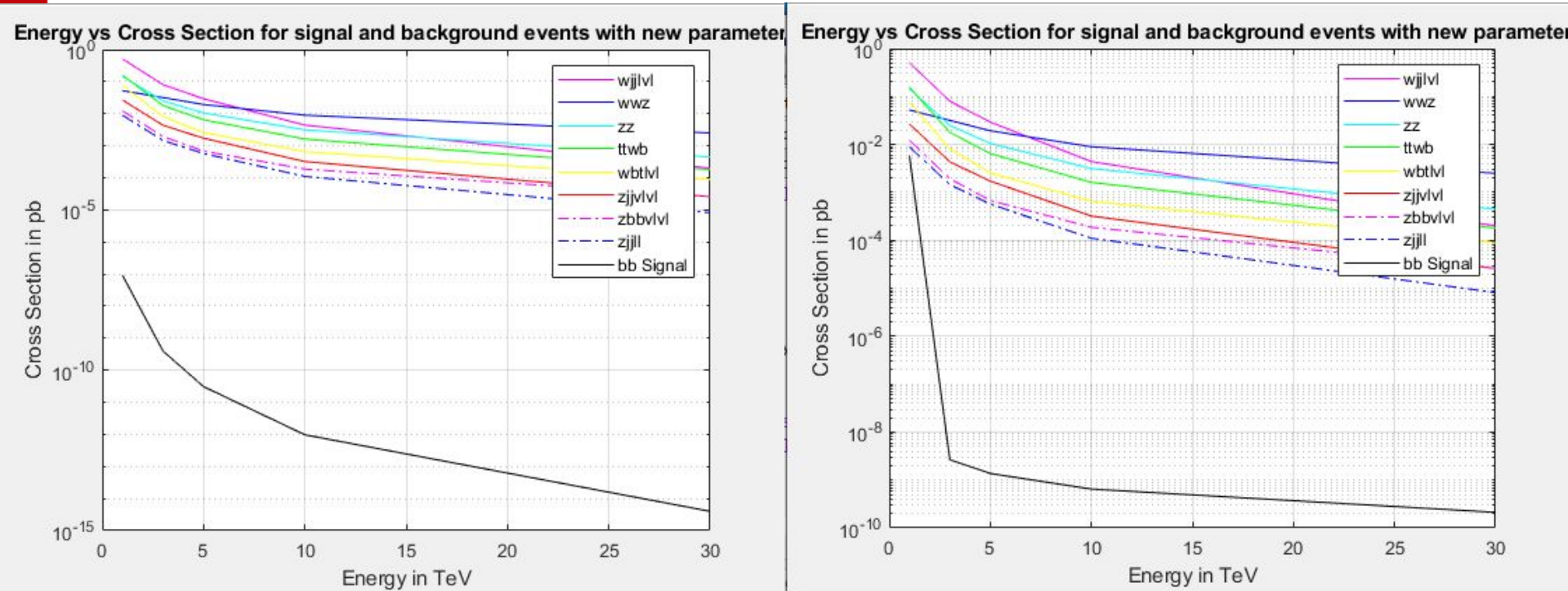
Mn1/n1~: 1 GeV

MZp: 1000 GeV

gz: 0.4



Comparison between fixed MZp and variable



Cross Sections: Background

wjjlv: $\mu^+ \mu^- \rightarrow w j j, w > l \nu$

wwz: $\mu^+ \mu^- \rightarrow w^+ w^- z$

zz: $\mu^+ \mu^- \rightarrow z z$

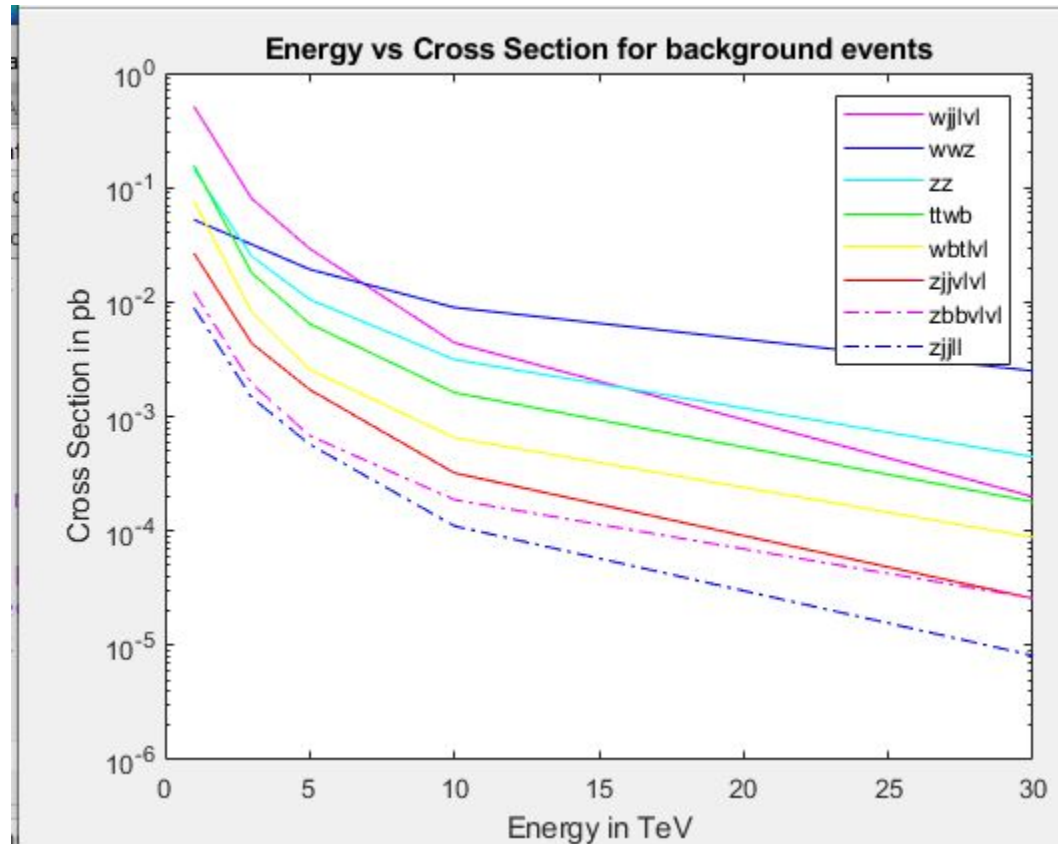
ttwb: $\mu^+ \mu^- \rightarrow t \bar{t}, t > w^+ b, \bar{t} > w^- b^-$

wbtlv: $\mu^+ \mu^- \rightarrow w b t, w > l \nu$

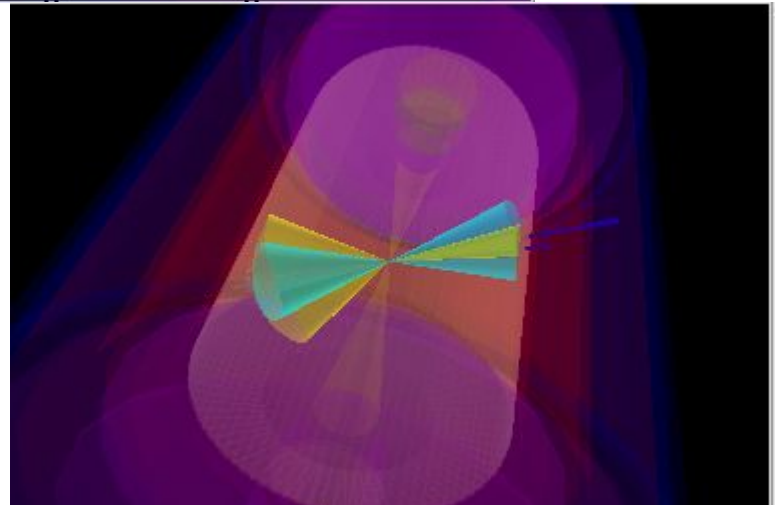
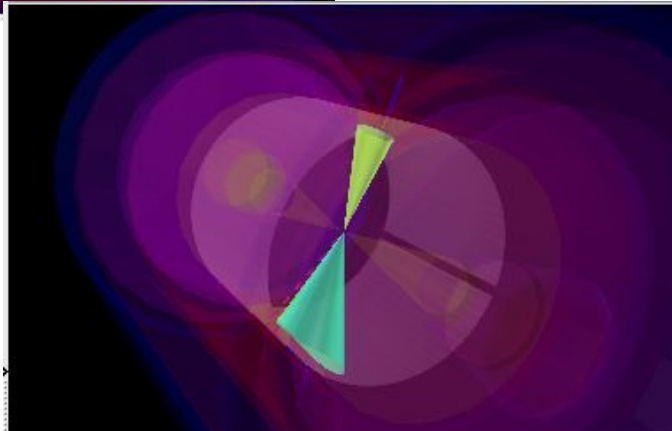
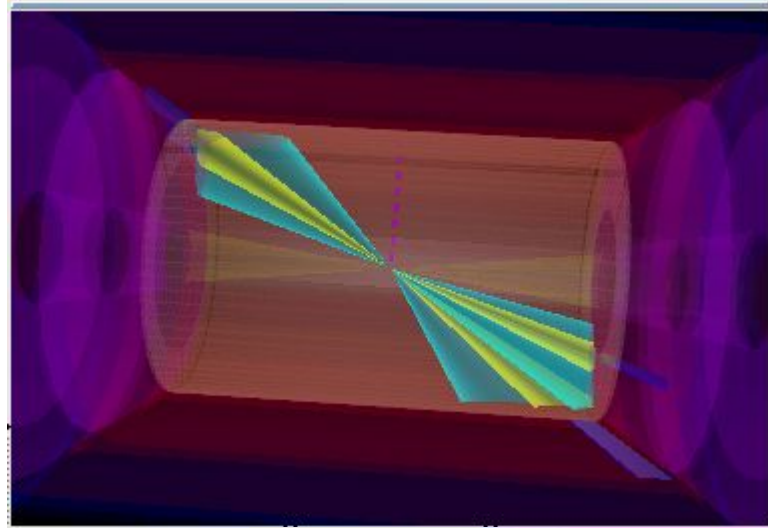
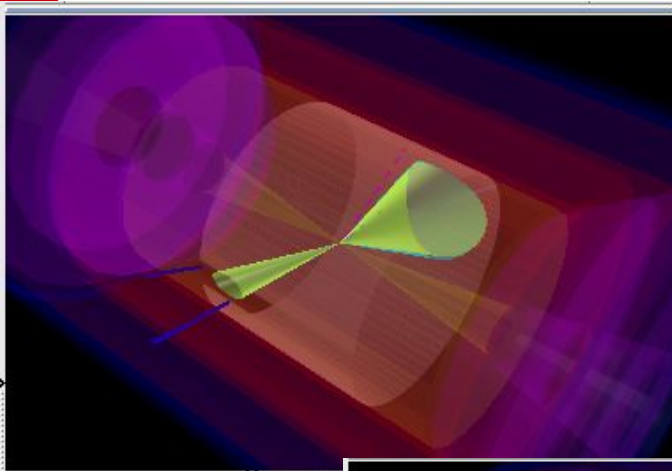
zjjlv: $\mu^+ \mu^- \rightarrow z j j, z > \nu \nu$

zbbvl: $\mu^+ \mu^- \rightarrow z b \bar{b}, z > \nu \nu$

zjll: $\mu^+ \mu^- \rightarrow z j j, z > l^+ l^-$



Event Displays



Next Steps

- Btagging
- Cuts