

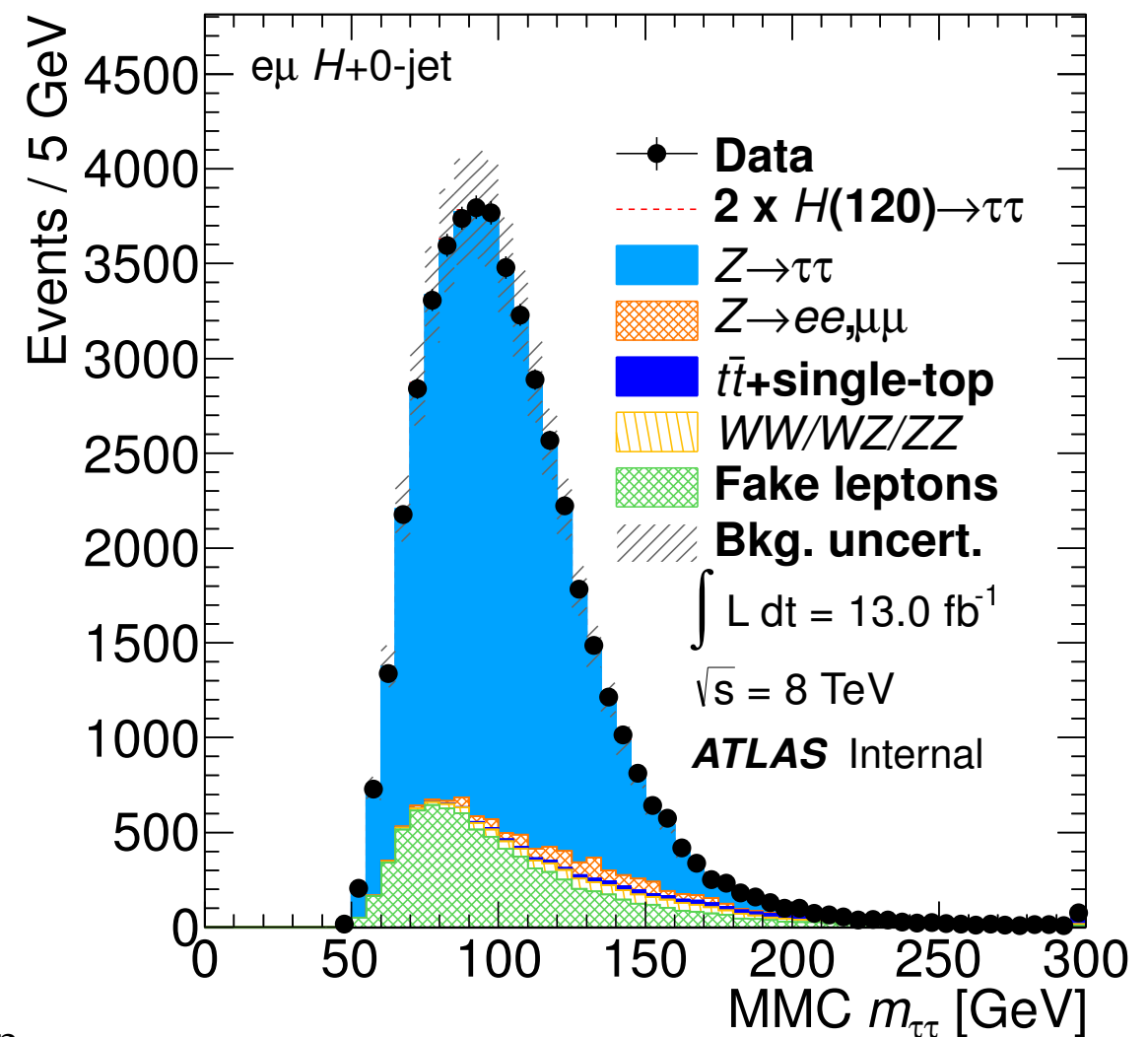
LHC-ATLAS実験における $H \rightarrow \tau\tau \rightarrow \ell\ell$ を用いた Higgs粒子の探索



森永真央

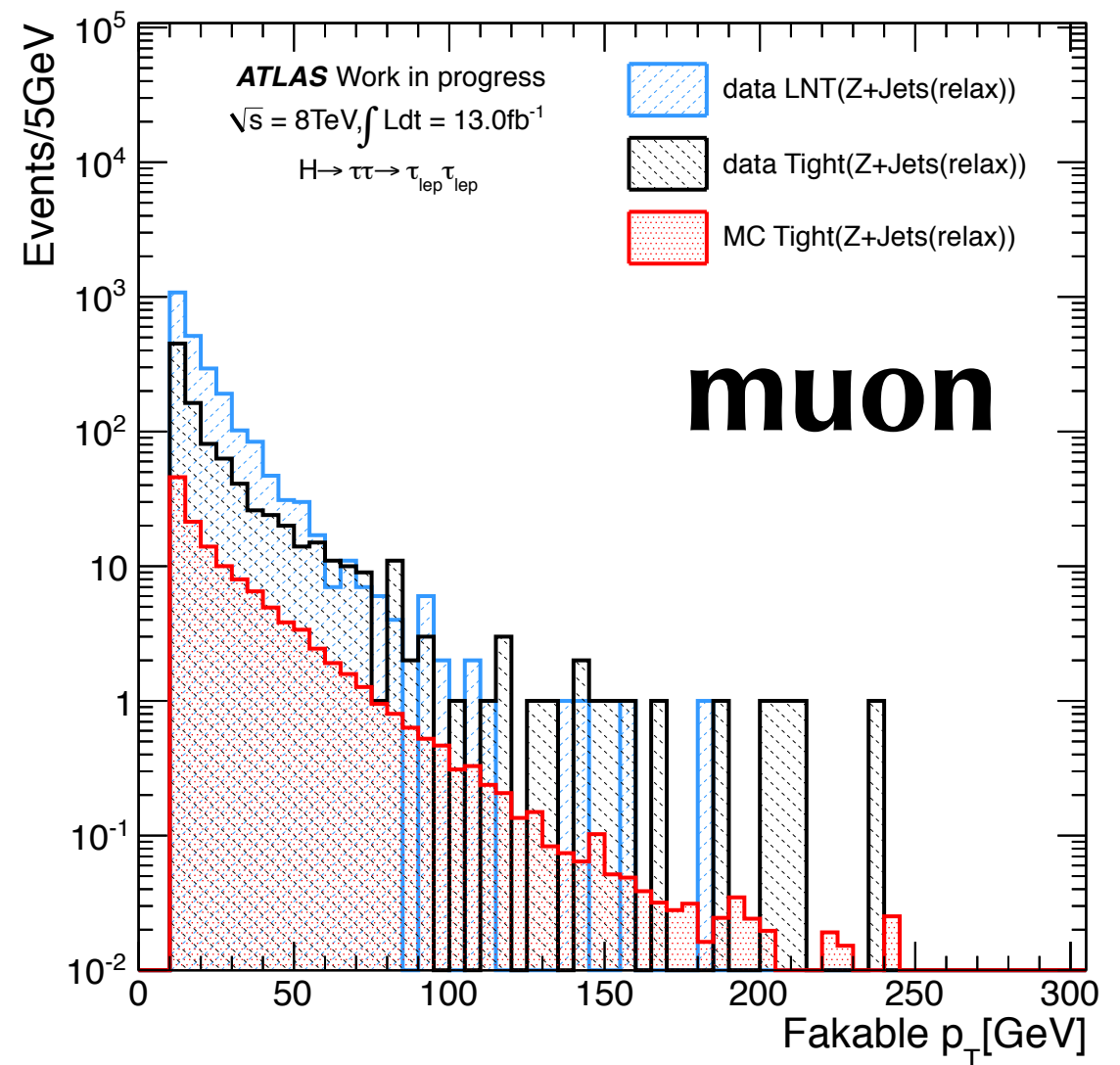
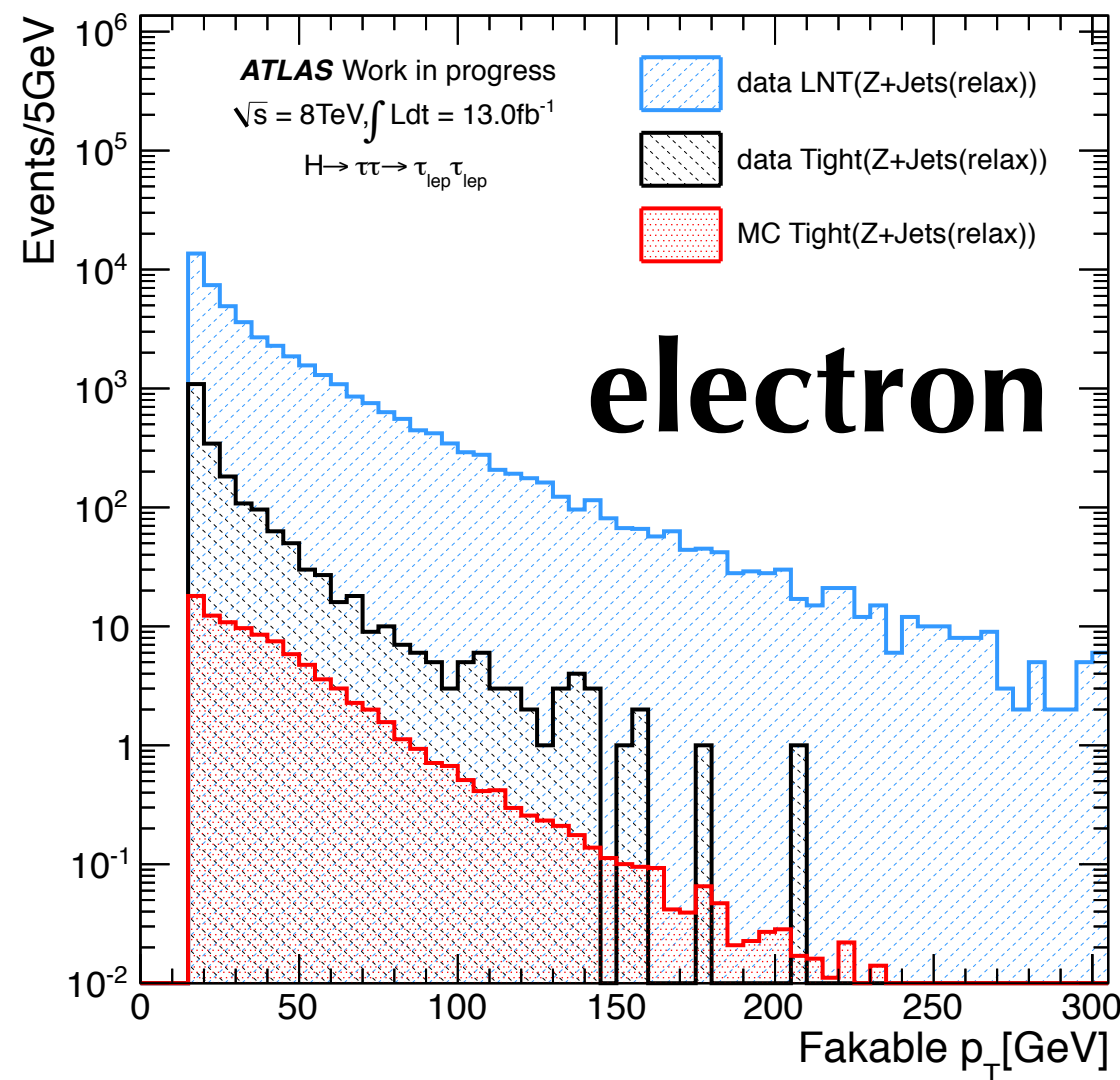
Fake Factor

- lelepは0jetが合っていないので0jetはdropした
- みんなEmbeddingのtrigger SFが怪しいいうけれども、実はFakeじゃないかと疑う
- とりあえず、デフォルトのTemplateの方法
 - iso,anti-isoのイベントを取る,Jetとanti-iso leptonのoverlapを解かない、もしくは微妙に解く
 - Template fitを p_T^{L2} で行う
- Fake Factorで確認
 - Fake factor自体を13/fbにupdate
 - same sign validation



Fake Factor at 13/fb

- multi-jetイベントはtrigger等が怖いのでおいといて、Z+jetsで見てみた
- $|m_{\ell\ell}-m_Z| < 15\text{GeV}, m_T < 30\text{GeV}, \text{MET} < 30\text{GeV}$ のjet

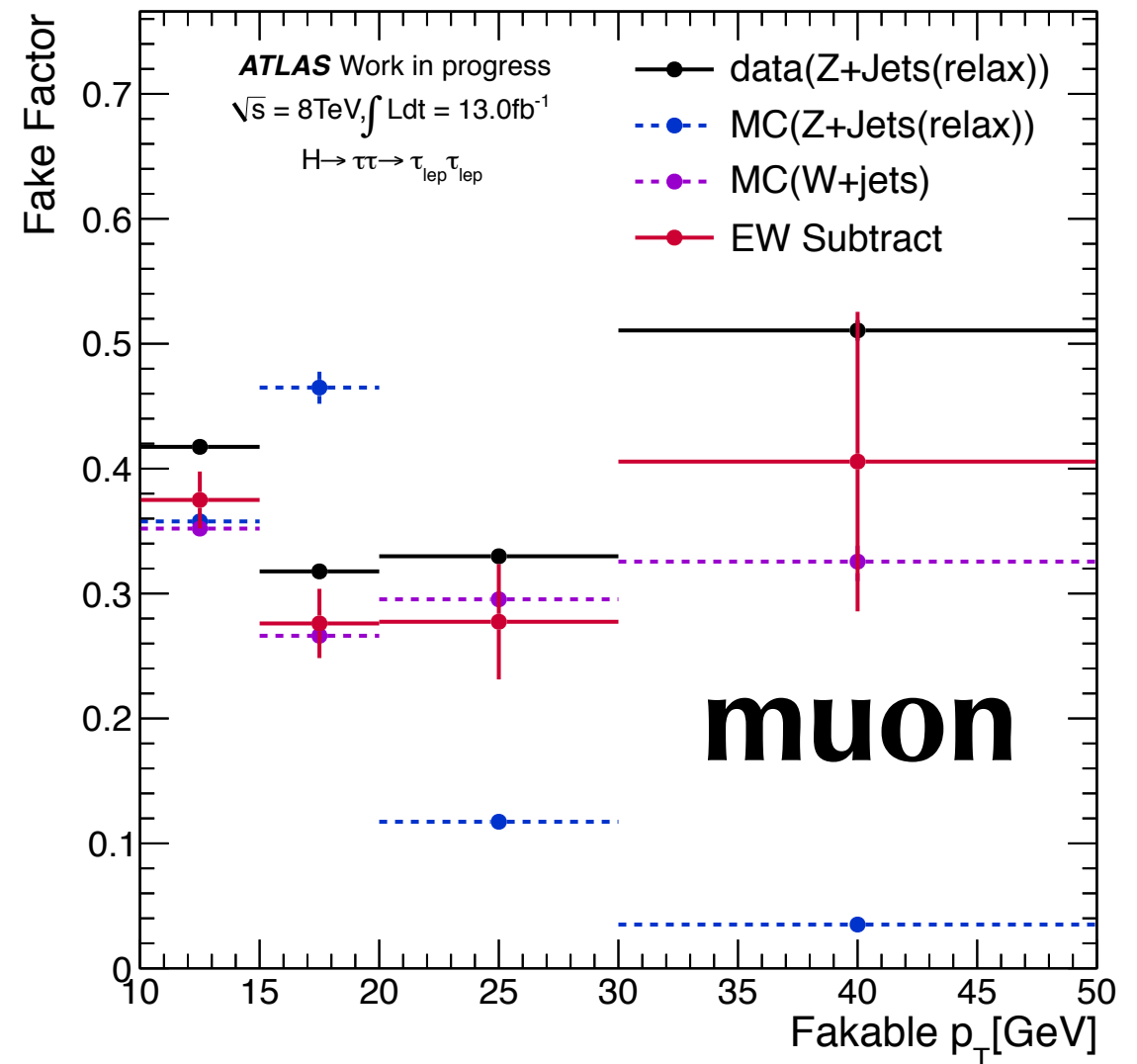
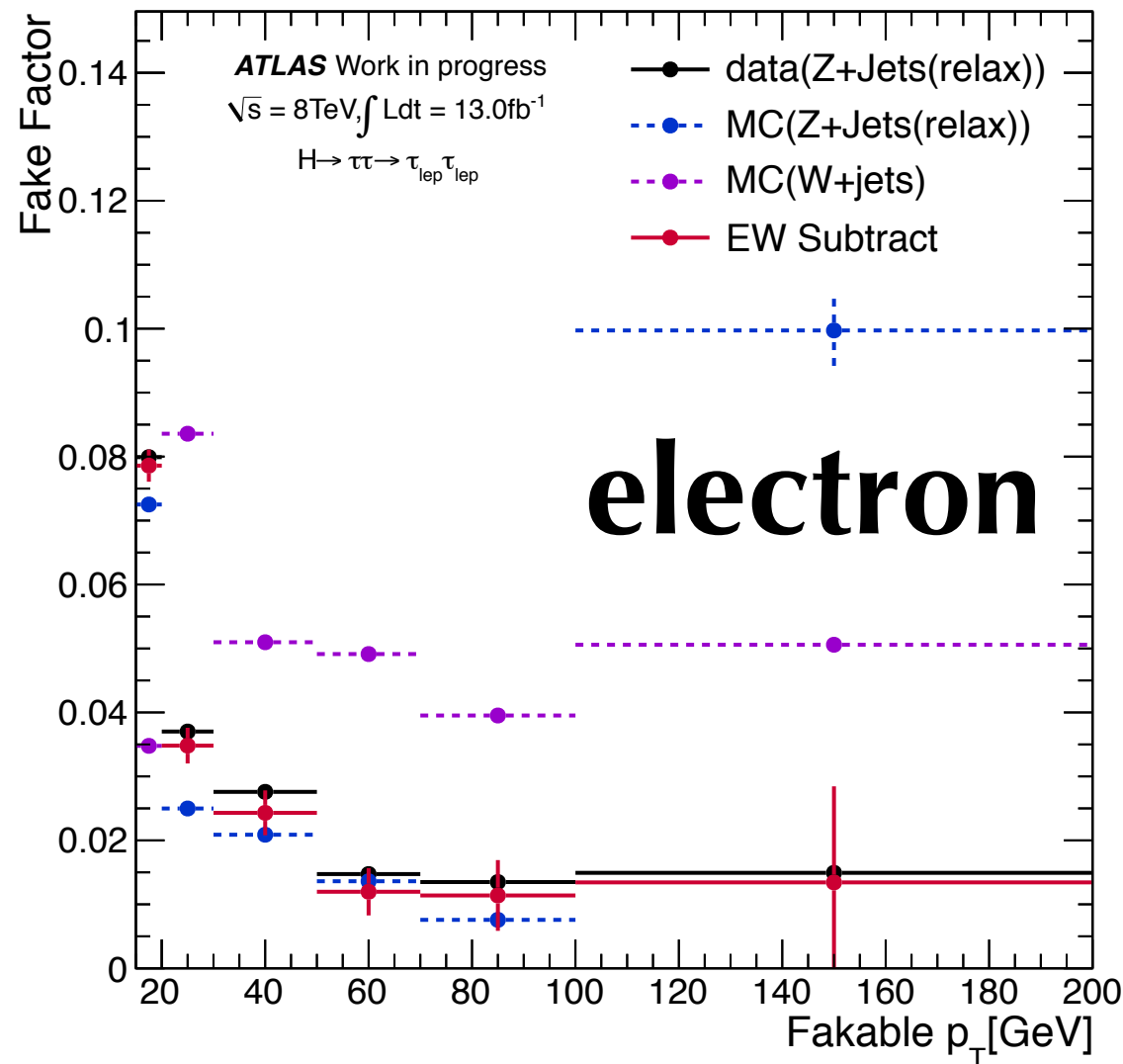


Fake Factor at 13/fb

- ラフなFake factor

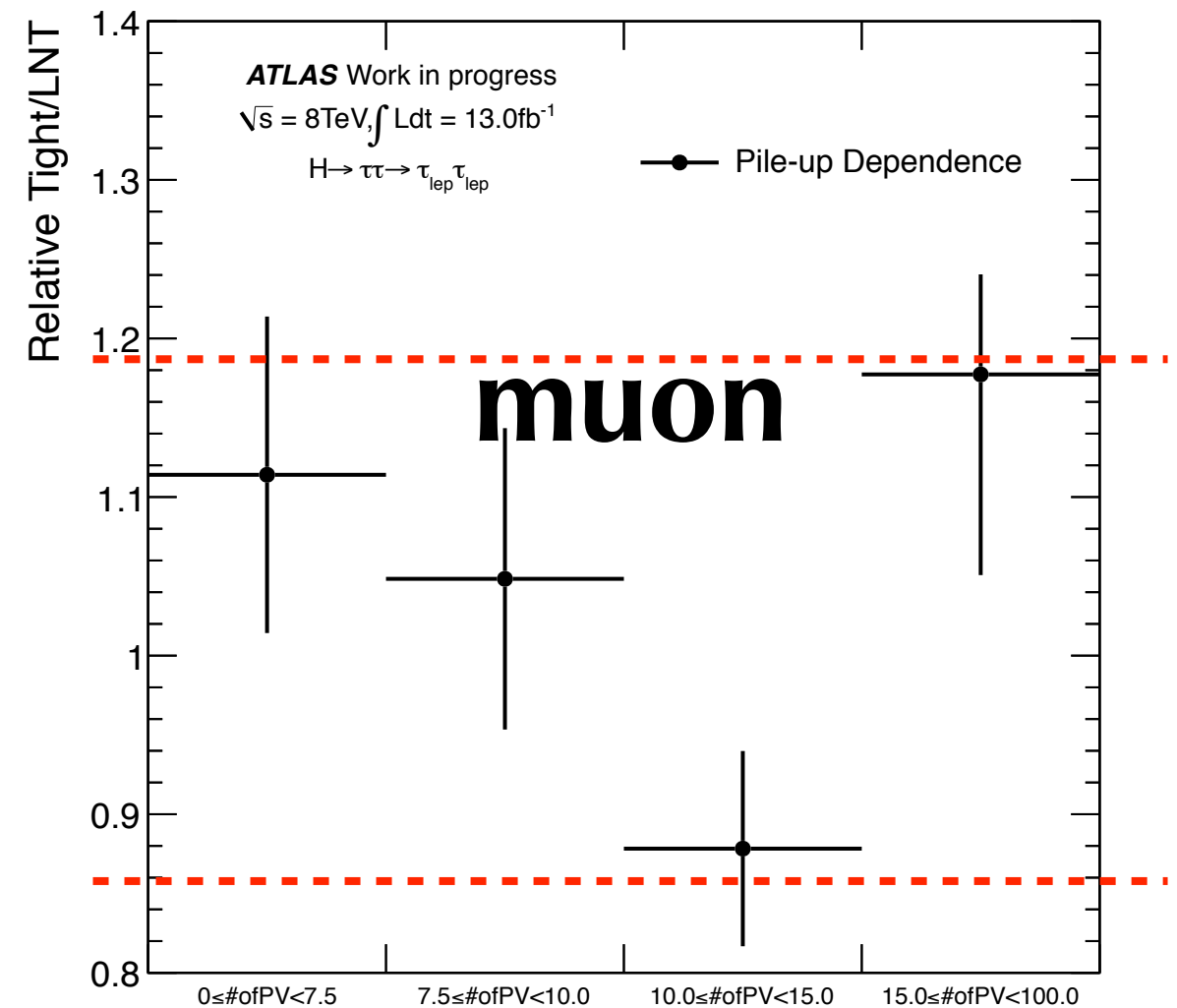
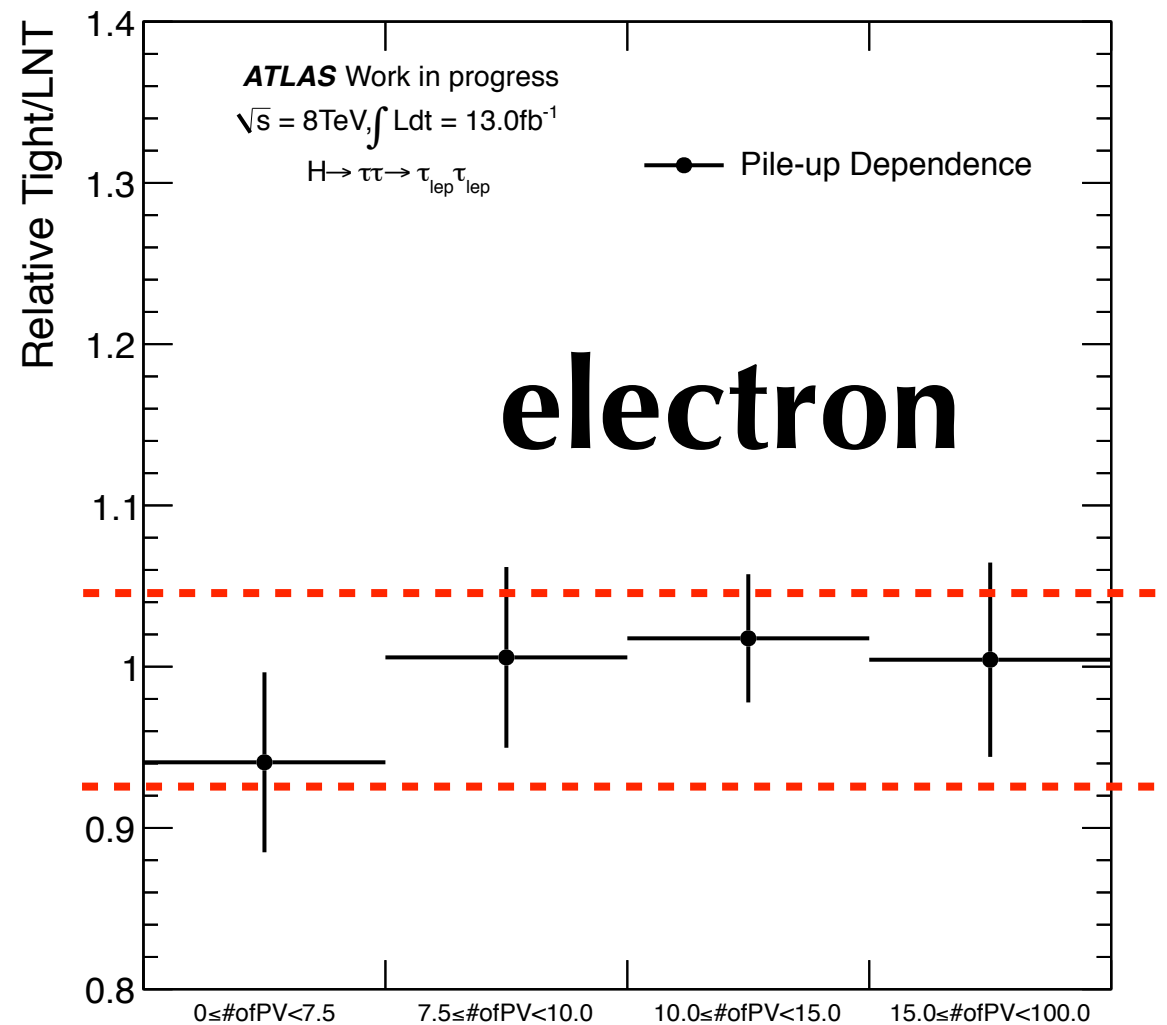
$$F.F. = \frac{\# \text{of Tight fakable}}{\# \text{of LNT fakable}}$$

- dataのみ、MC Z+jetsのみ、MC W+jetsのみ、Dibosonを引いたもの



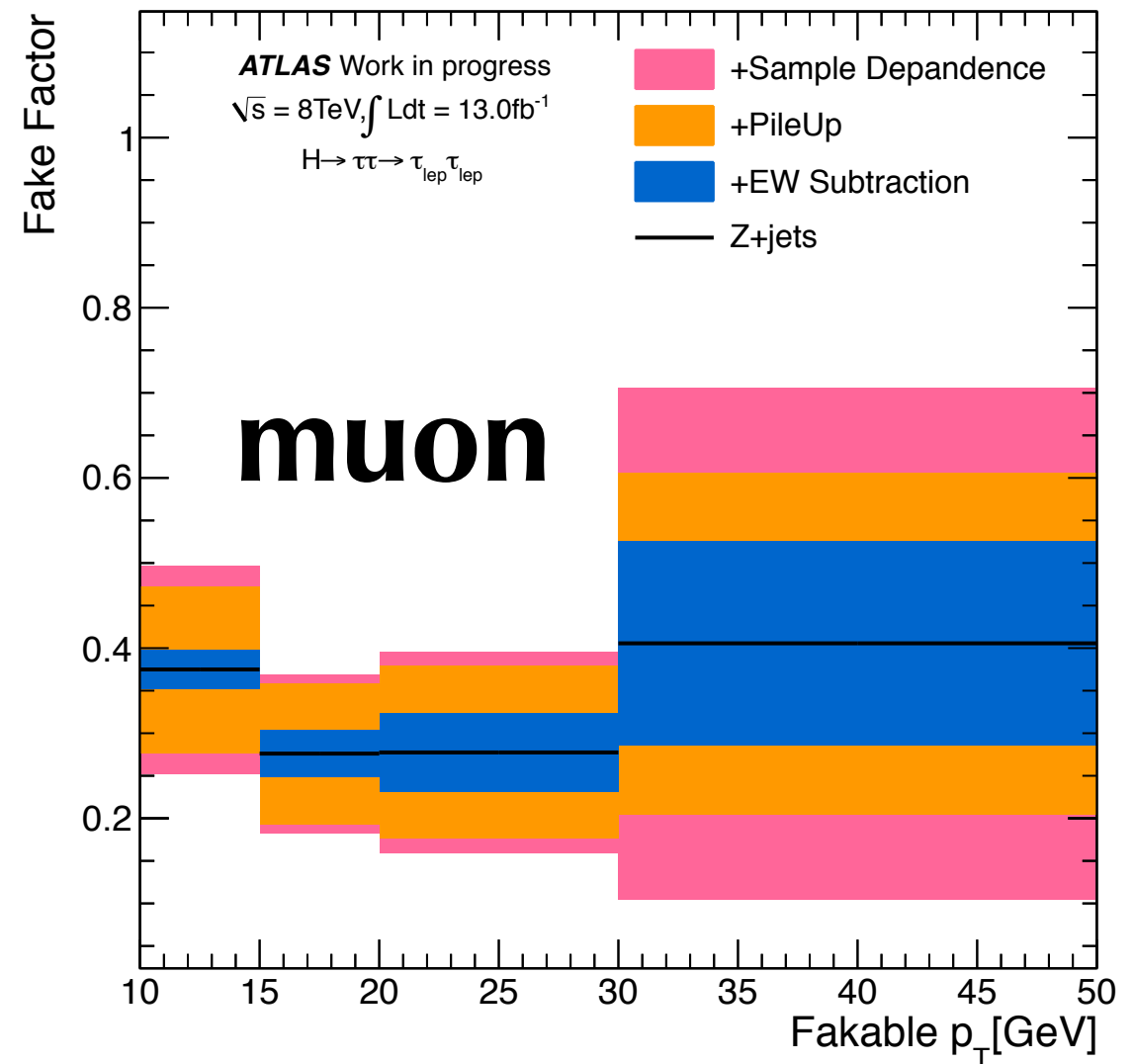
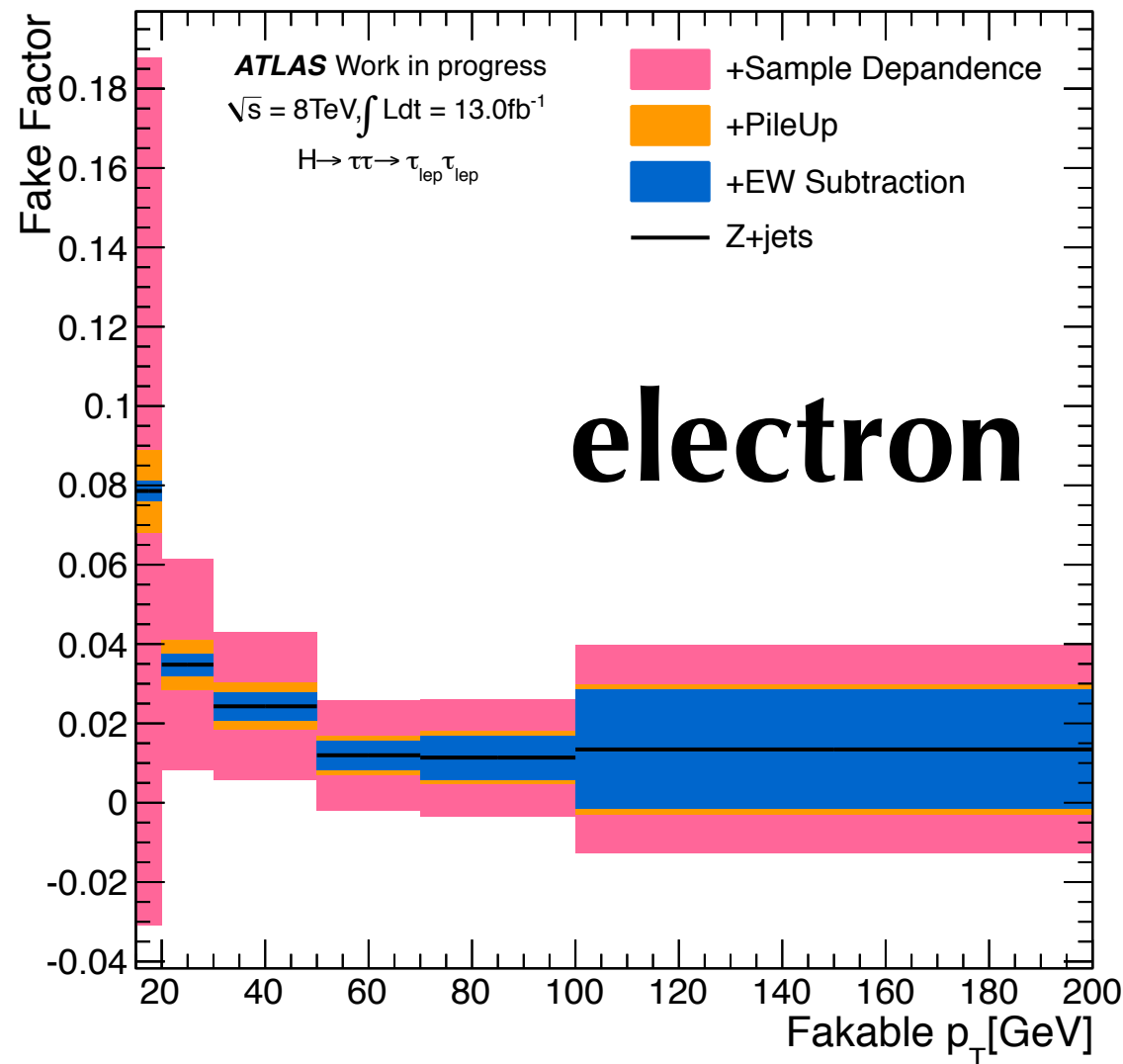
Pile-up dependence

- #of Primary vertexの依存性もみた
- electronでは~5%, muonでは~20%程度



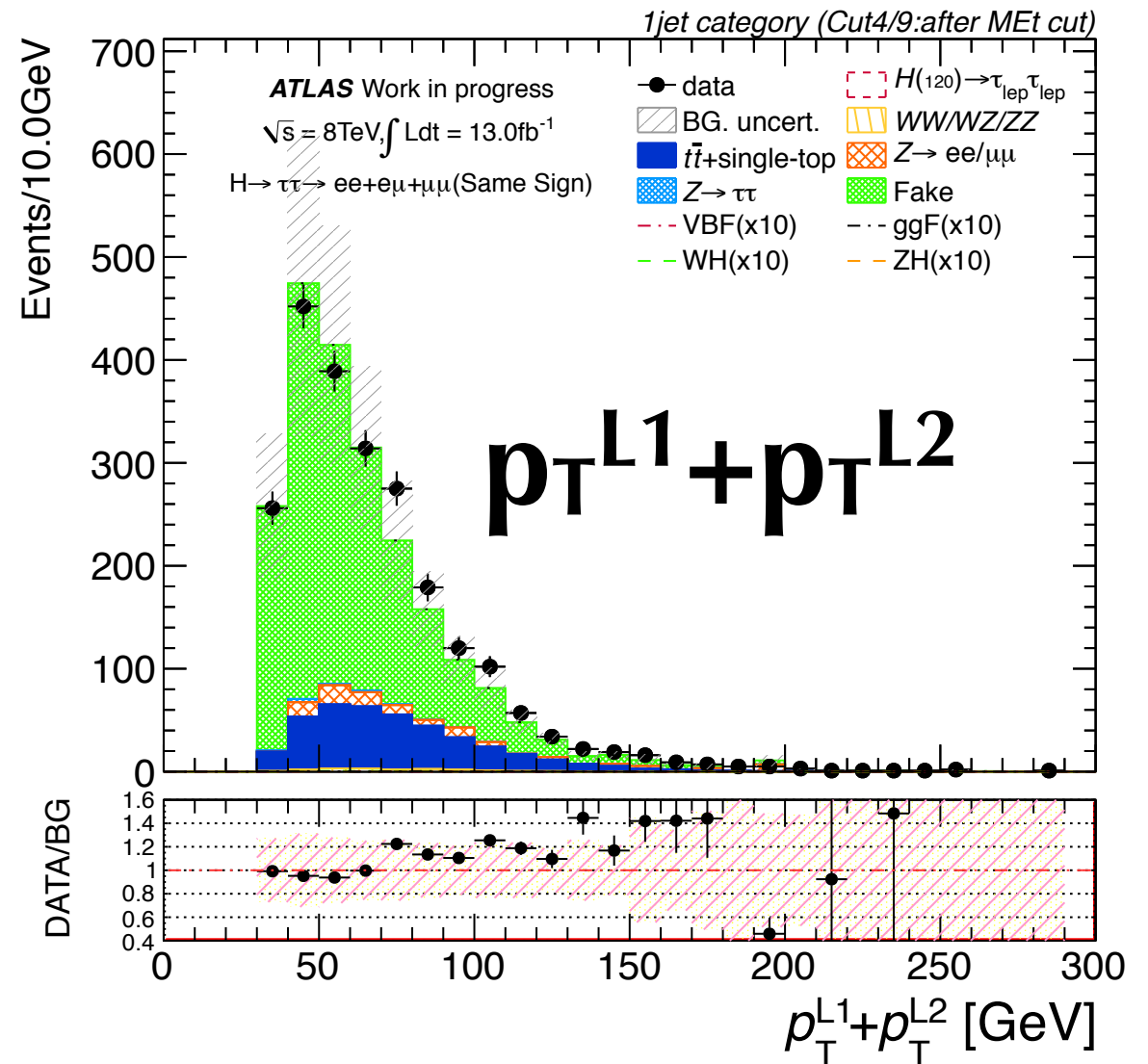
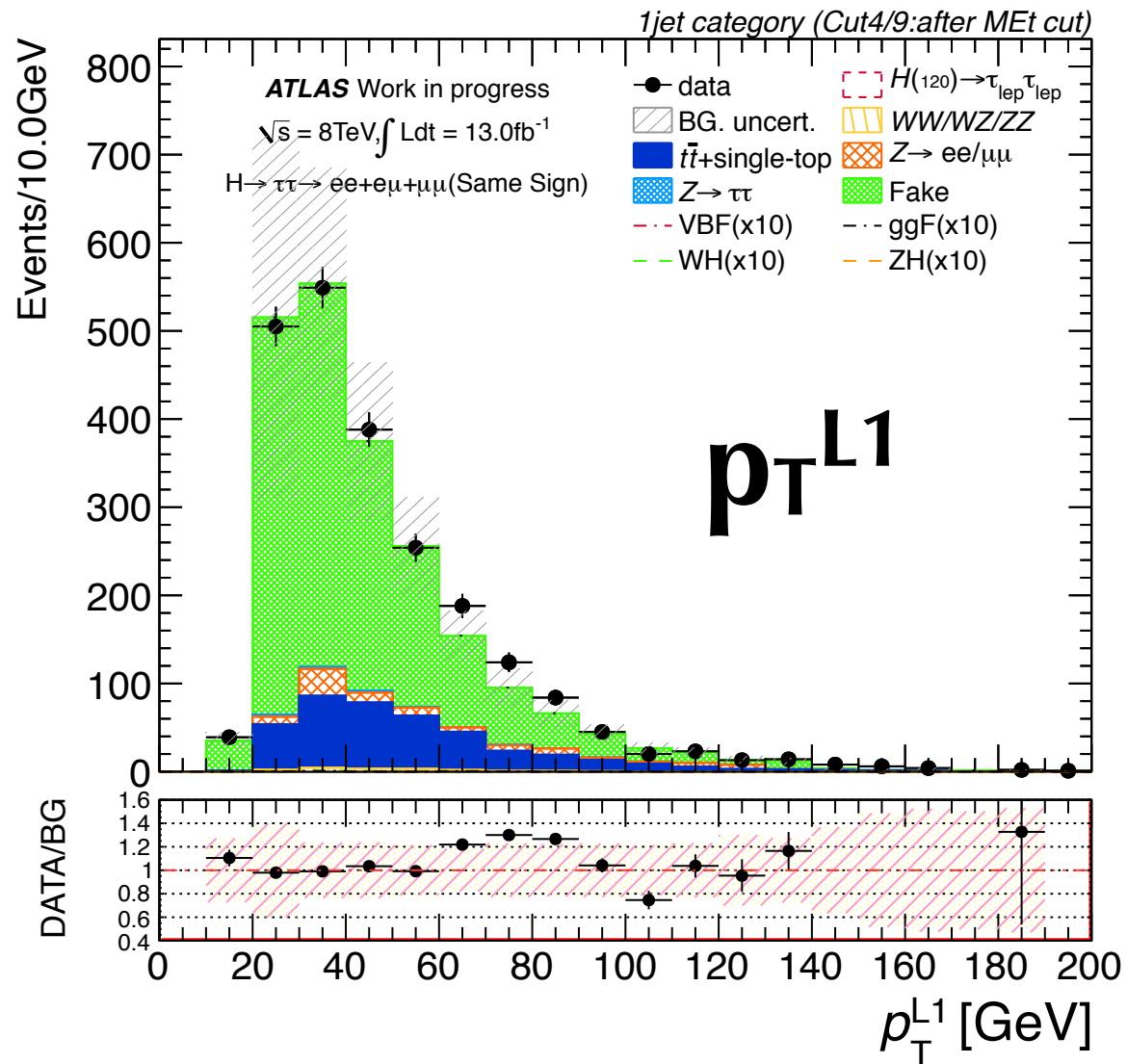
Fake Factor

- Pile-upとEW subtractを合わせてcenter valueとsystematicsを出す



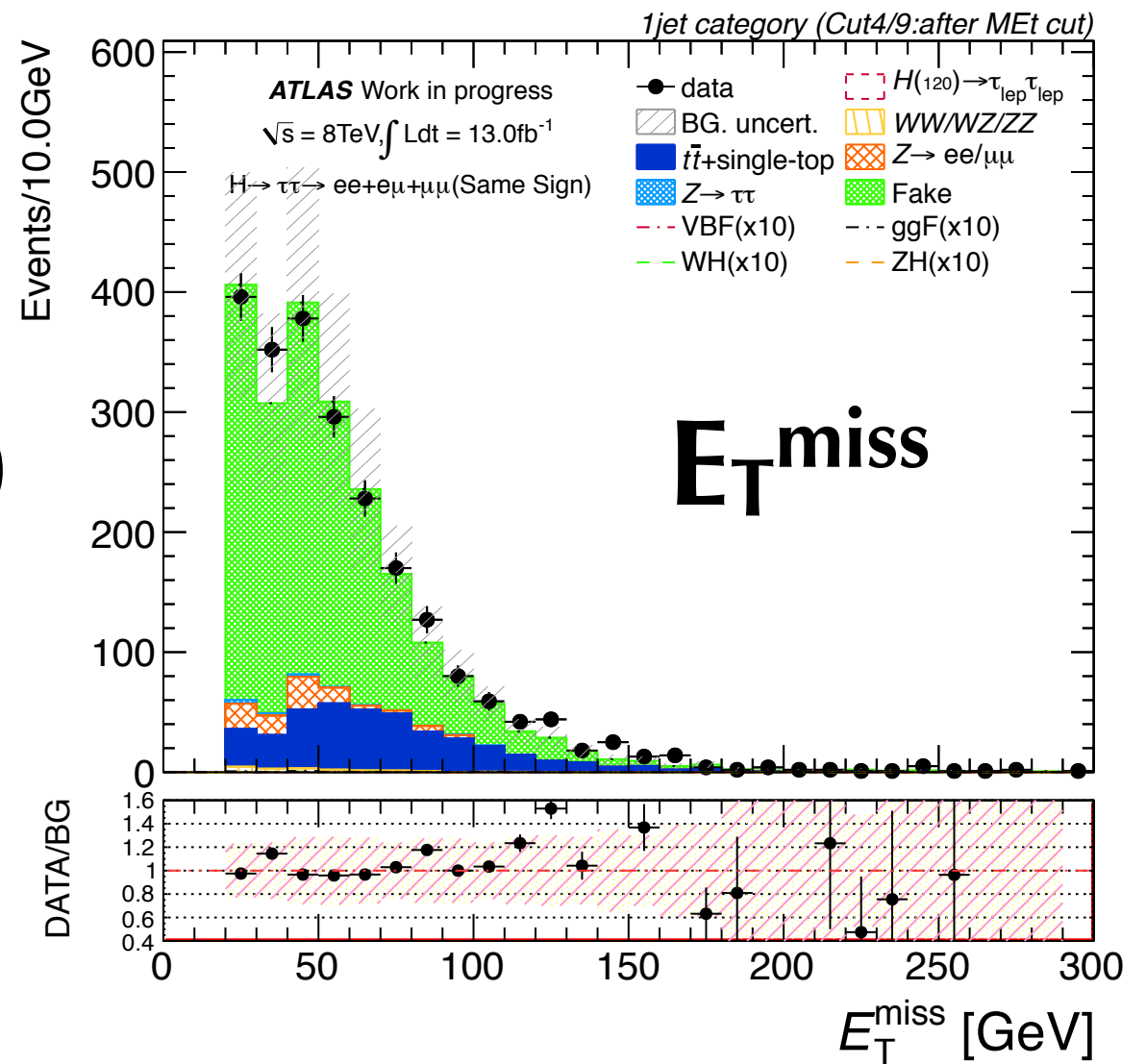
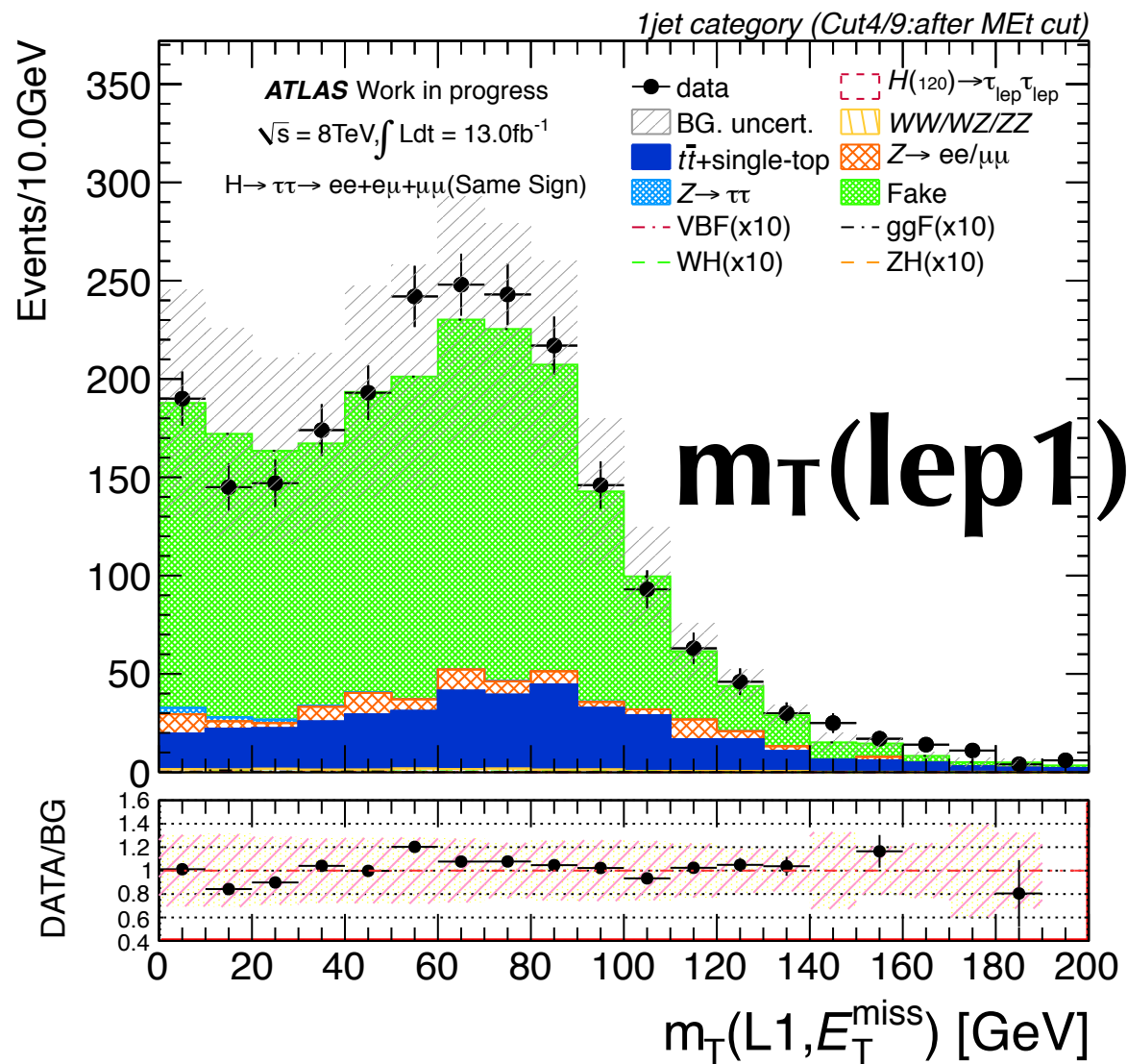
Same Sign

- 1st lepton pT and sum of lepton pT after ETmiss cut



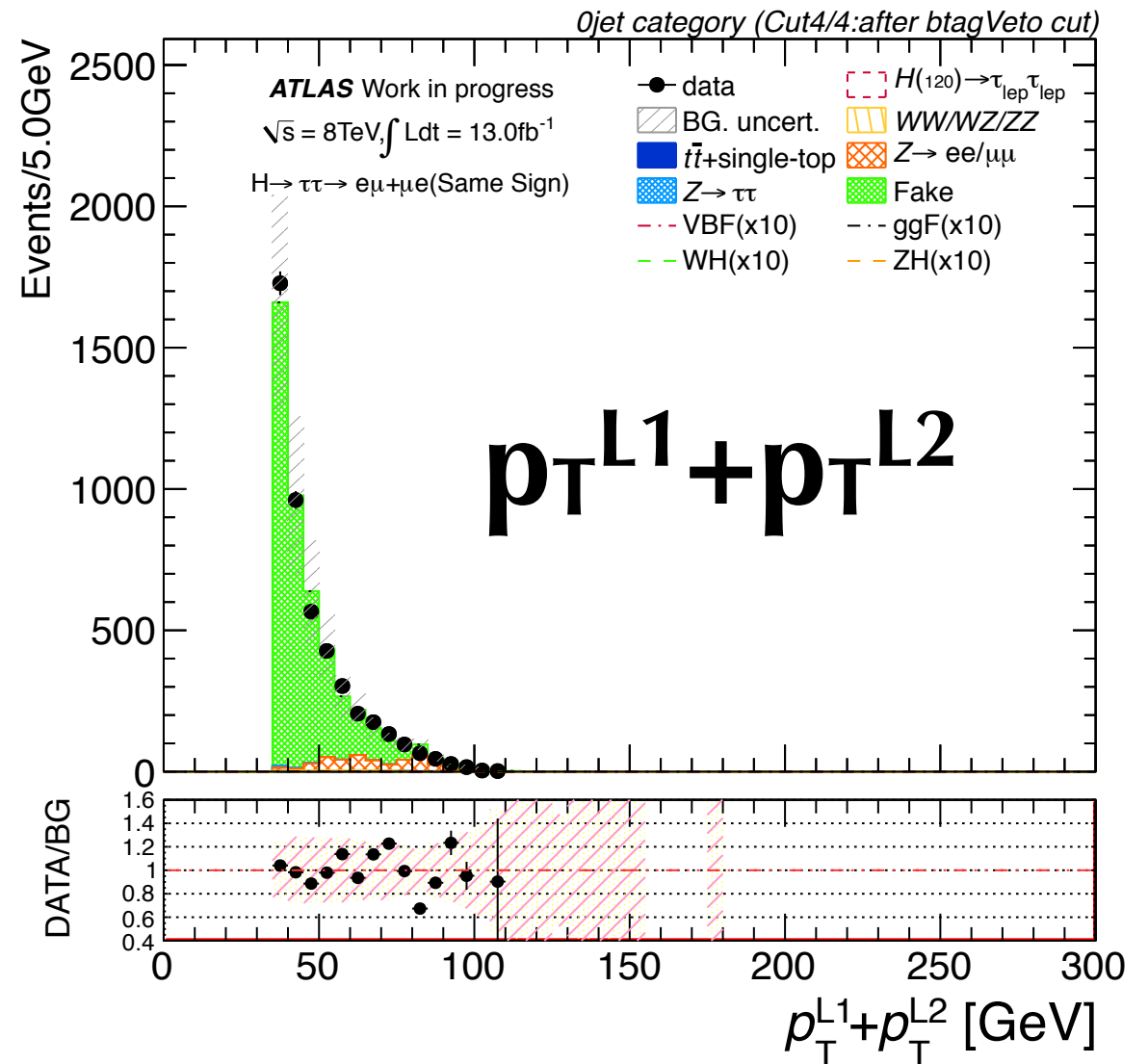
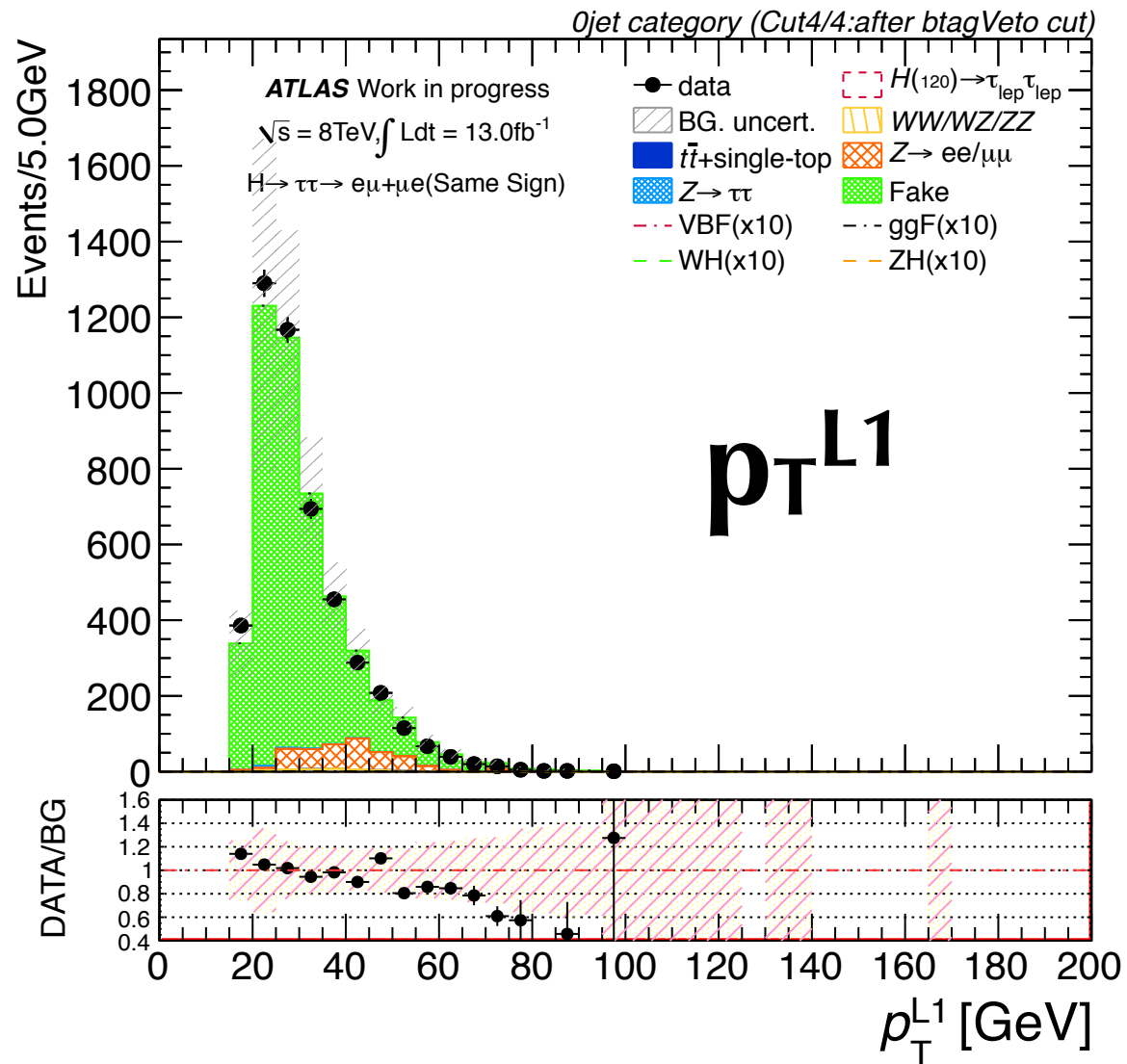
Same Sign

- m_T and E_T^{miss} after E_T^{miss} cut



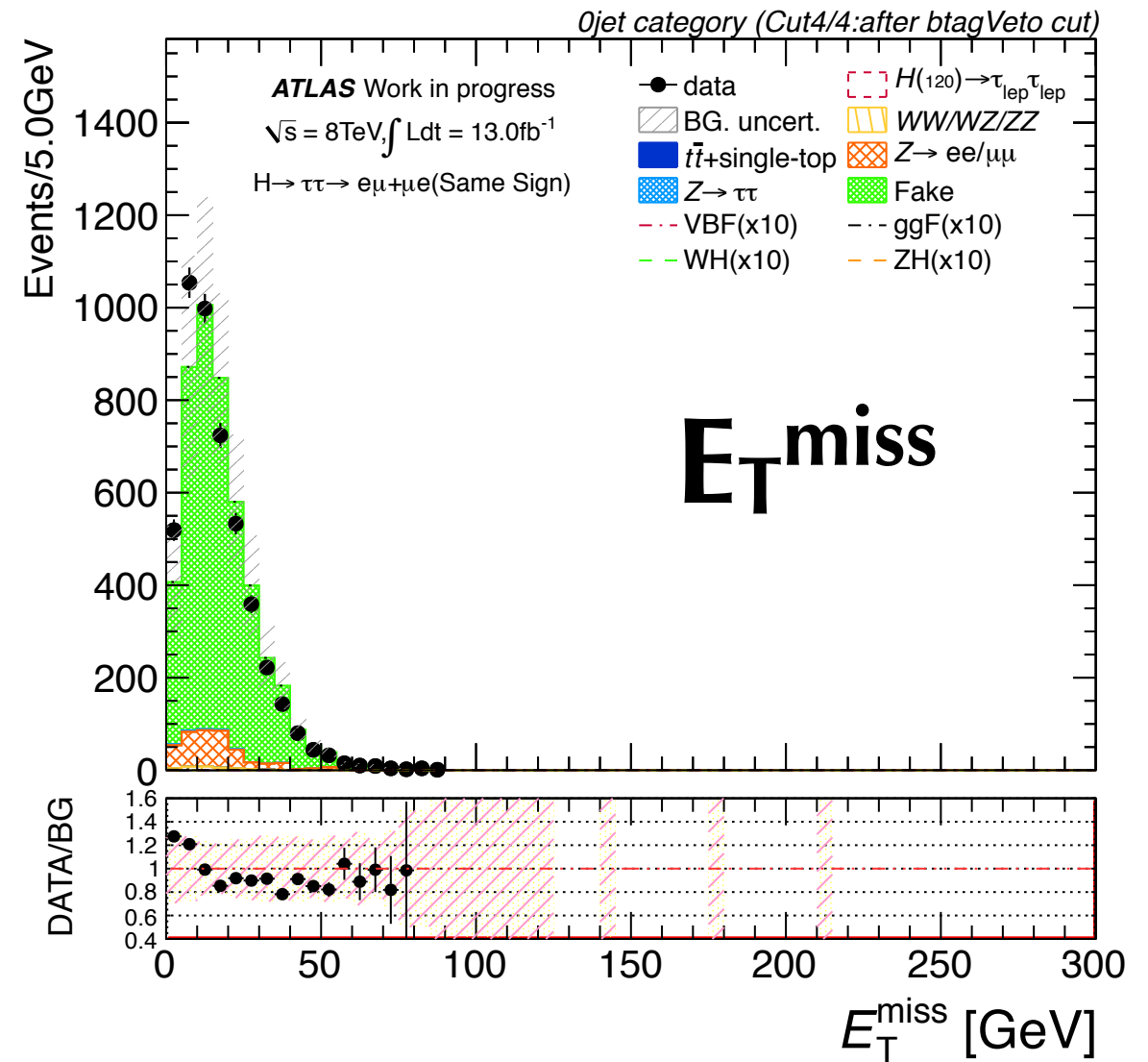
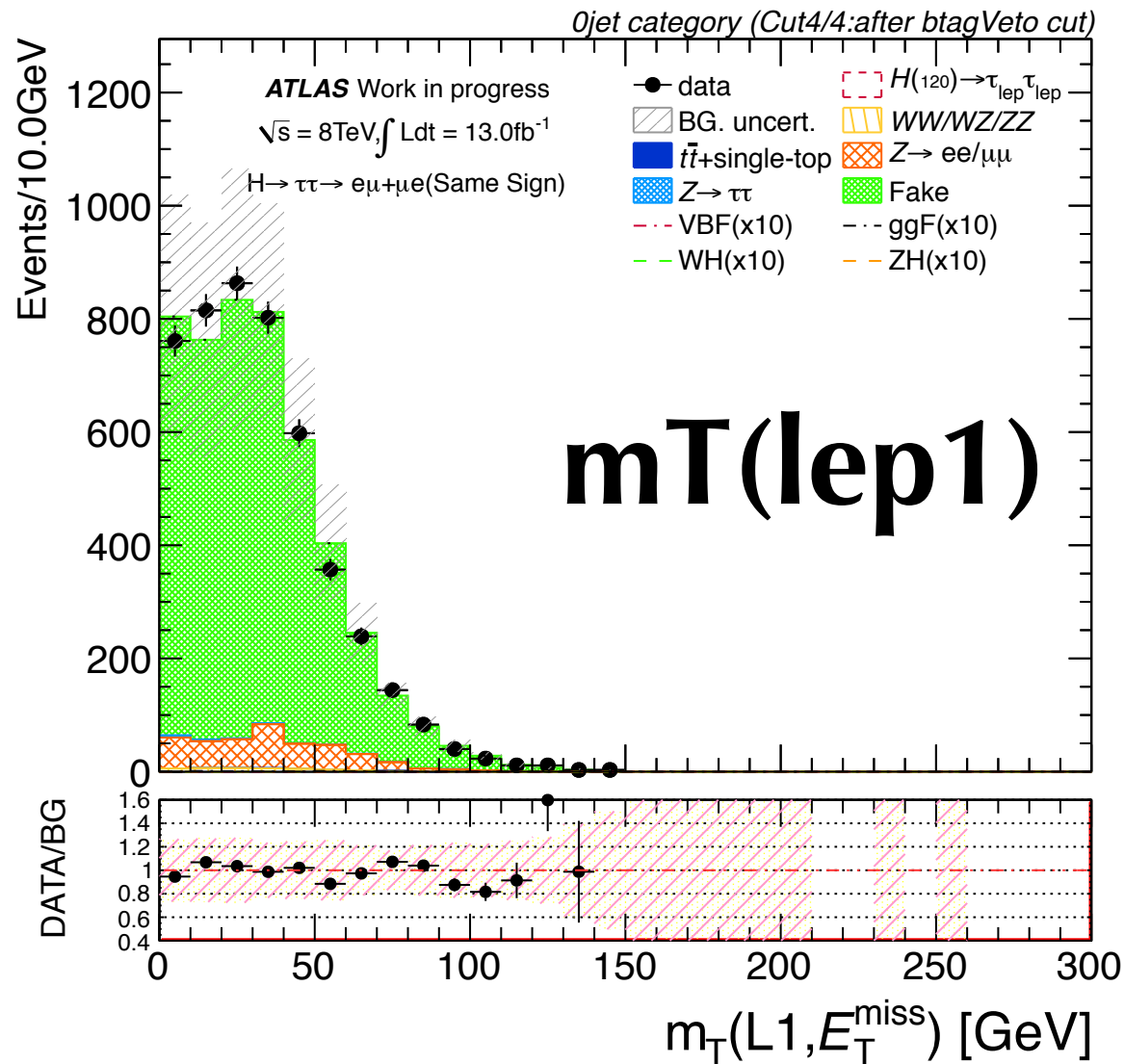
Same Sign 0jet

- 1st lepton pT and sum of lepton pT in 0jet after b-tagged jet veto



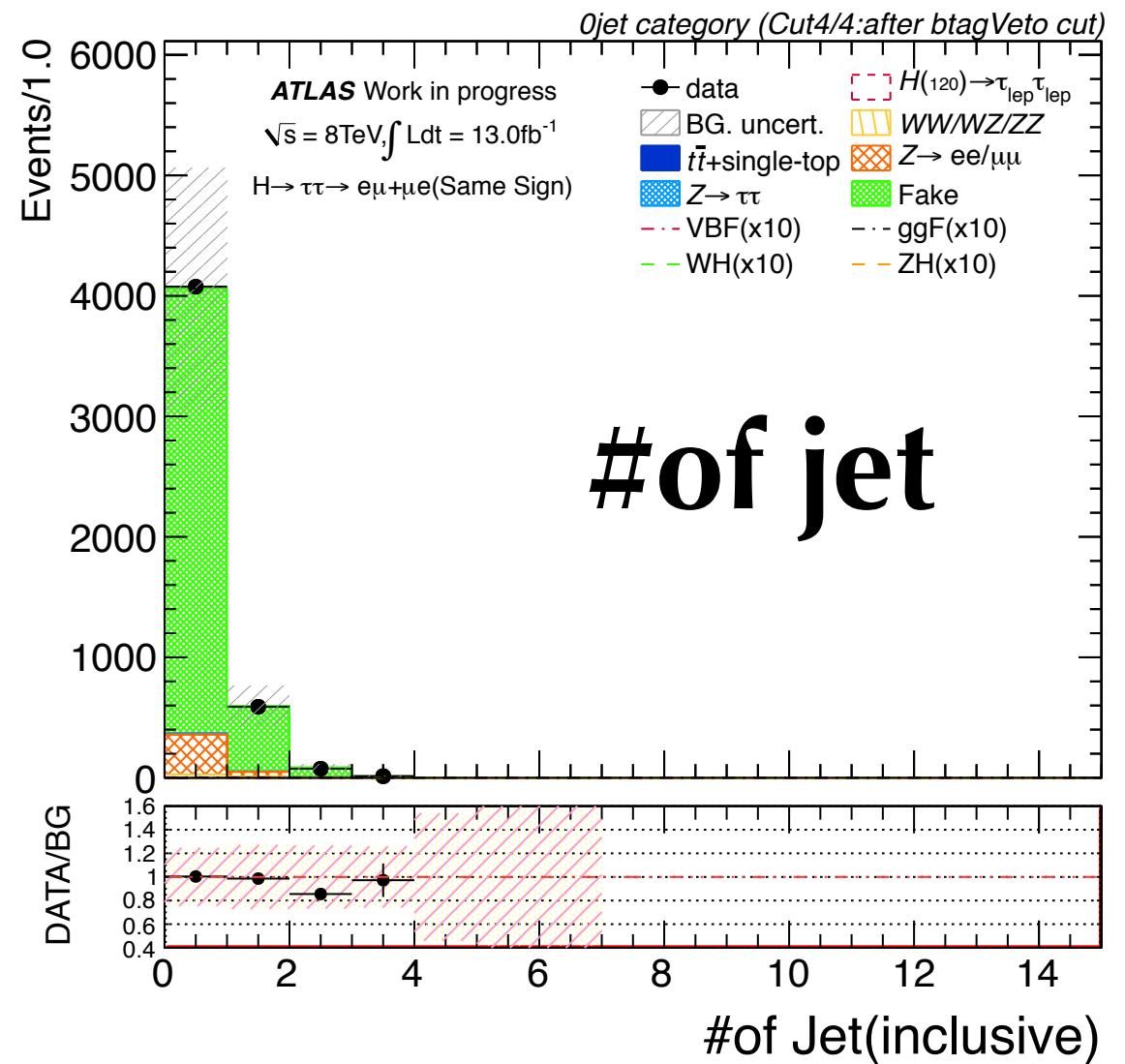
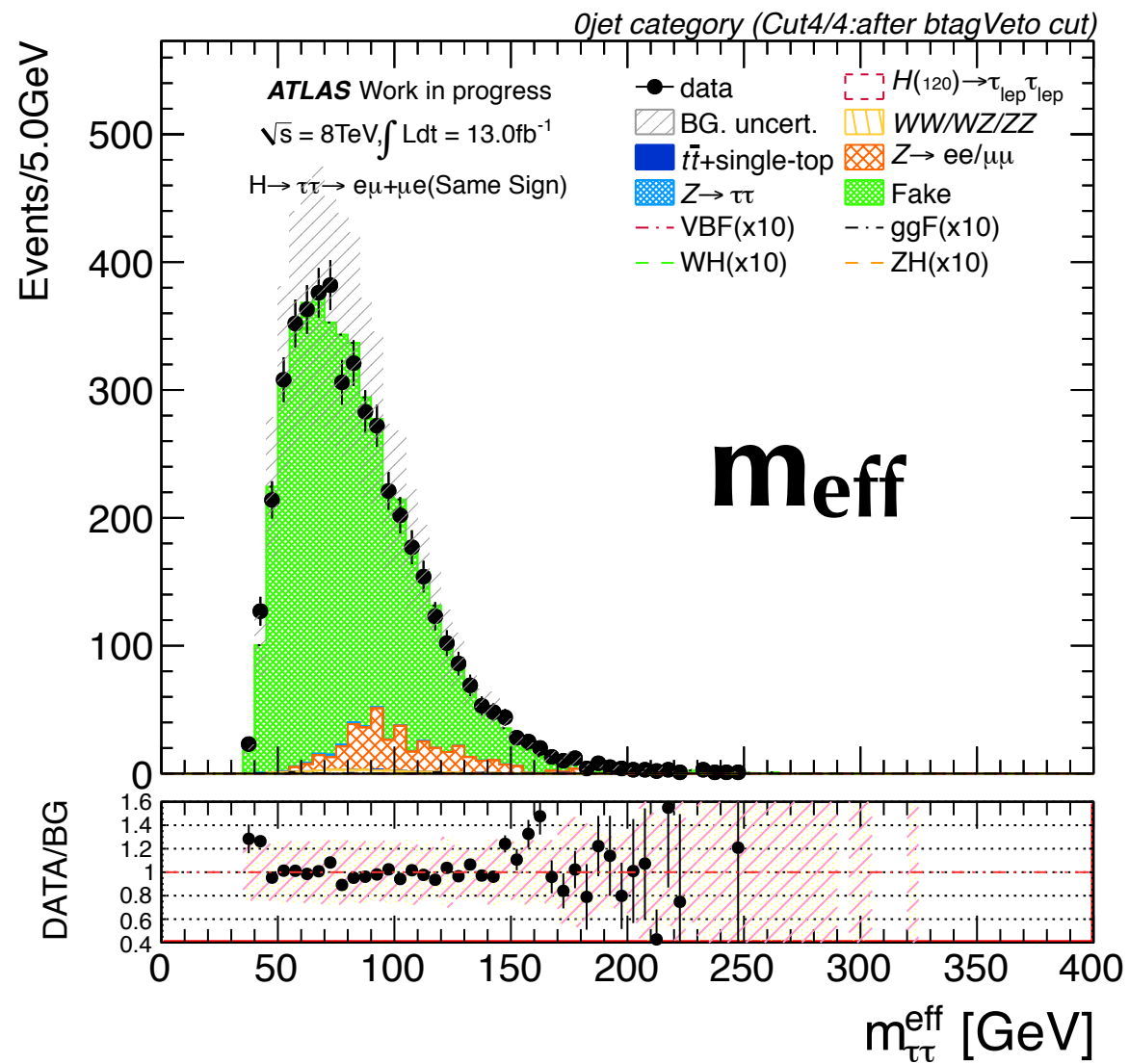
Same Sign 0jet

- m_T and E_T^{miss} in 0jet after b-tagged jet veto



Same Sign 0jet

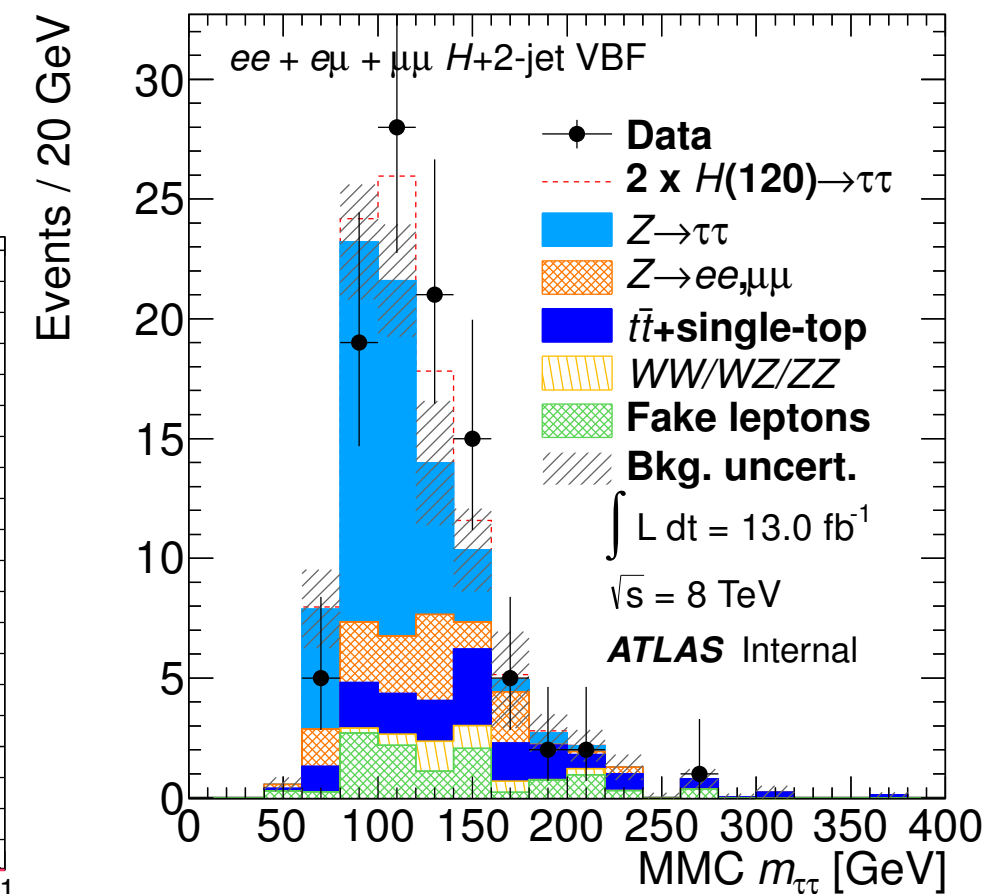
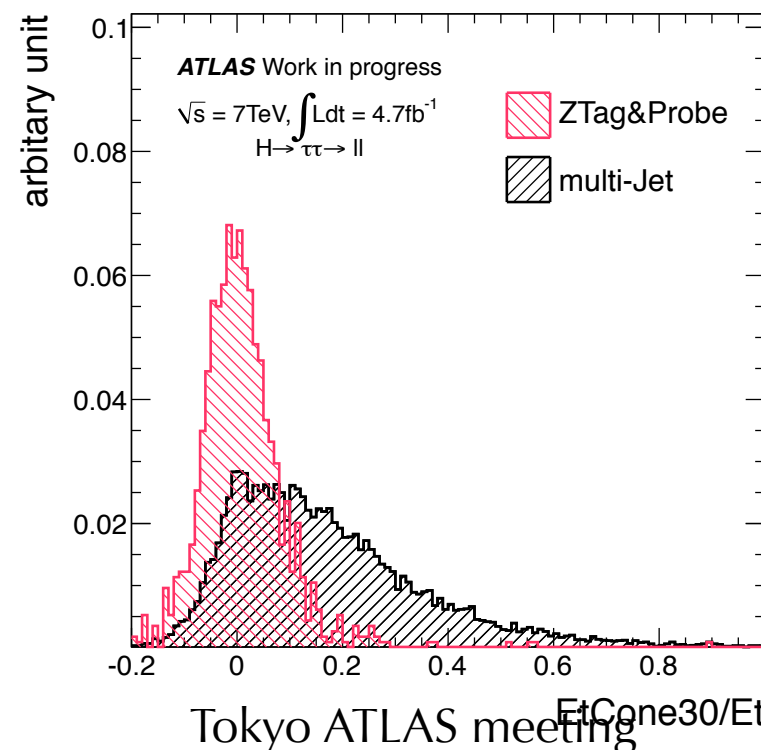
- Effective mass and #of jet(inclusive) in 0jet after b-tagged jet veto



Fake Factor

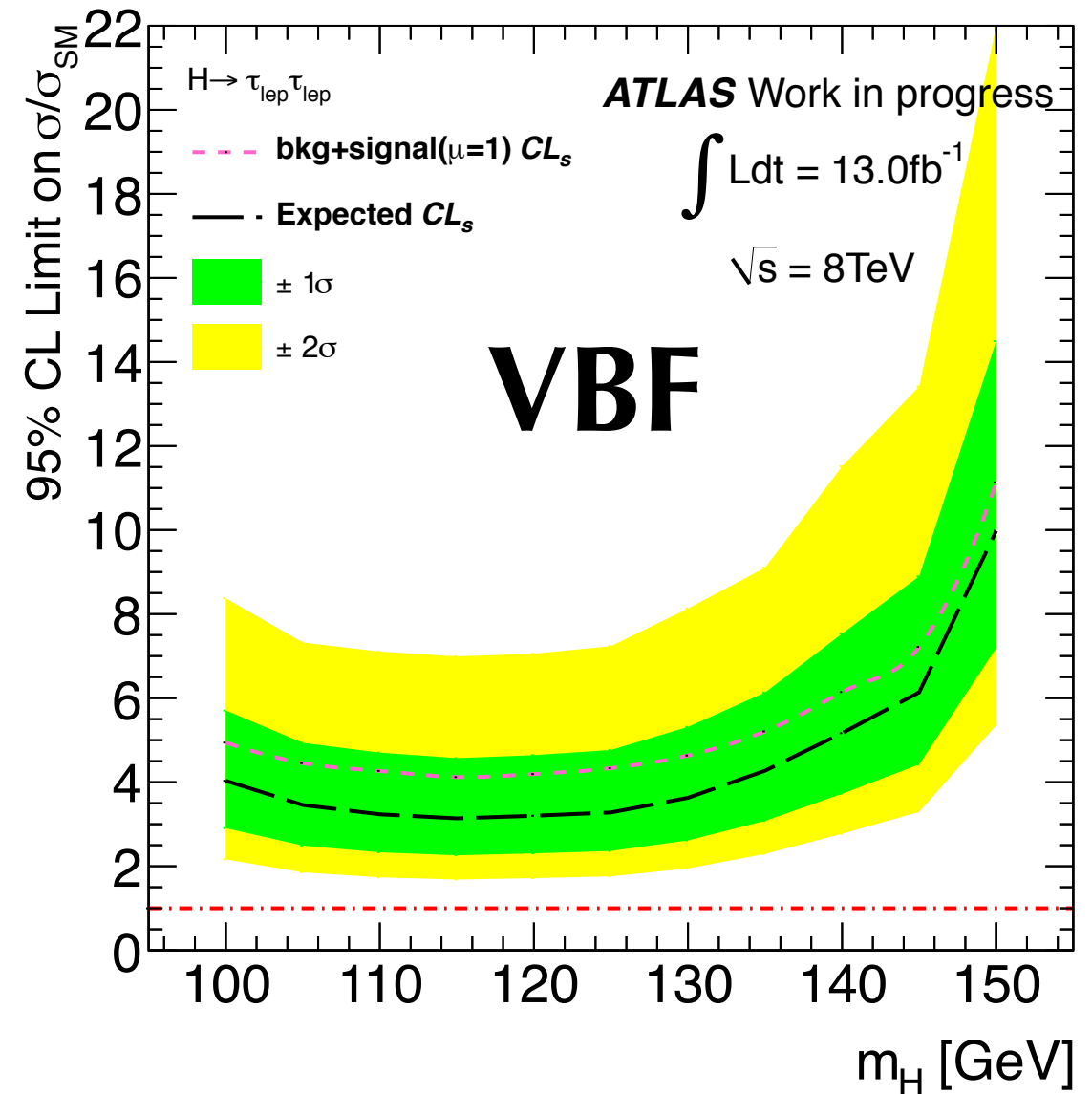
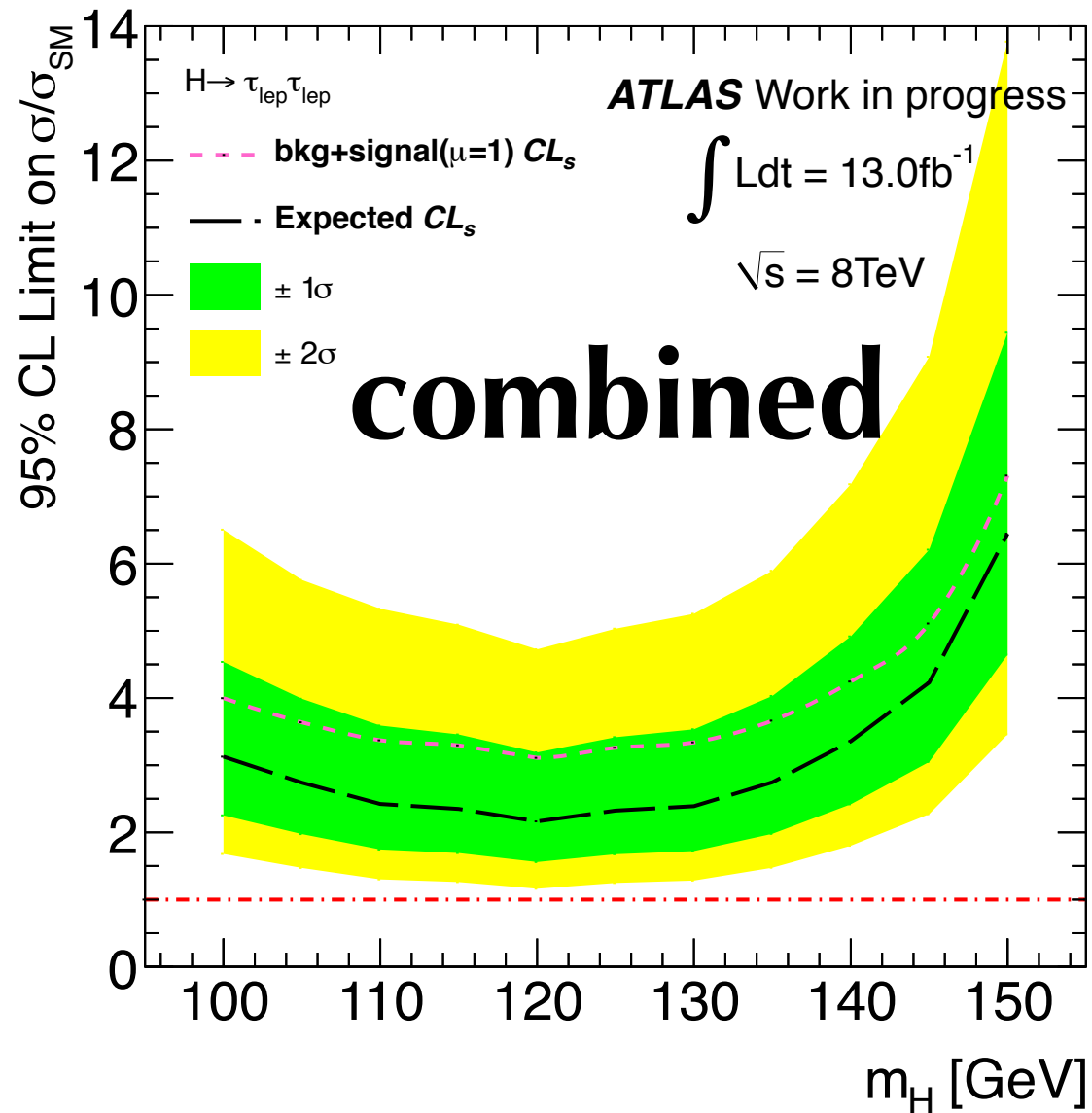
- これからやること

- Template fitは再現しているのでFF basedと比べる→絵作っている最中
- Same Signでvalidation→絵作っている最中
- MMC recoして0jetの原因をしらべる→時間かかりそう...
- gluon/quark jet ratioを何とかして見積もらないといけない...
 - ➡ multi-jet使う、triggerどうするか
- VBFでTemplate fitを乗っ取る→いけそう
- isolation optimization??



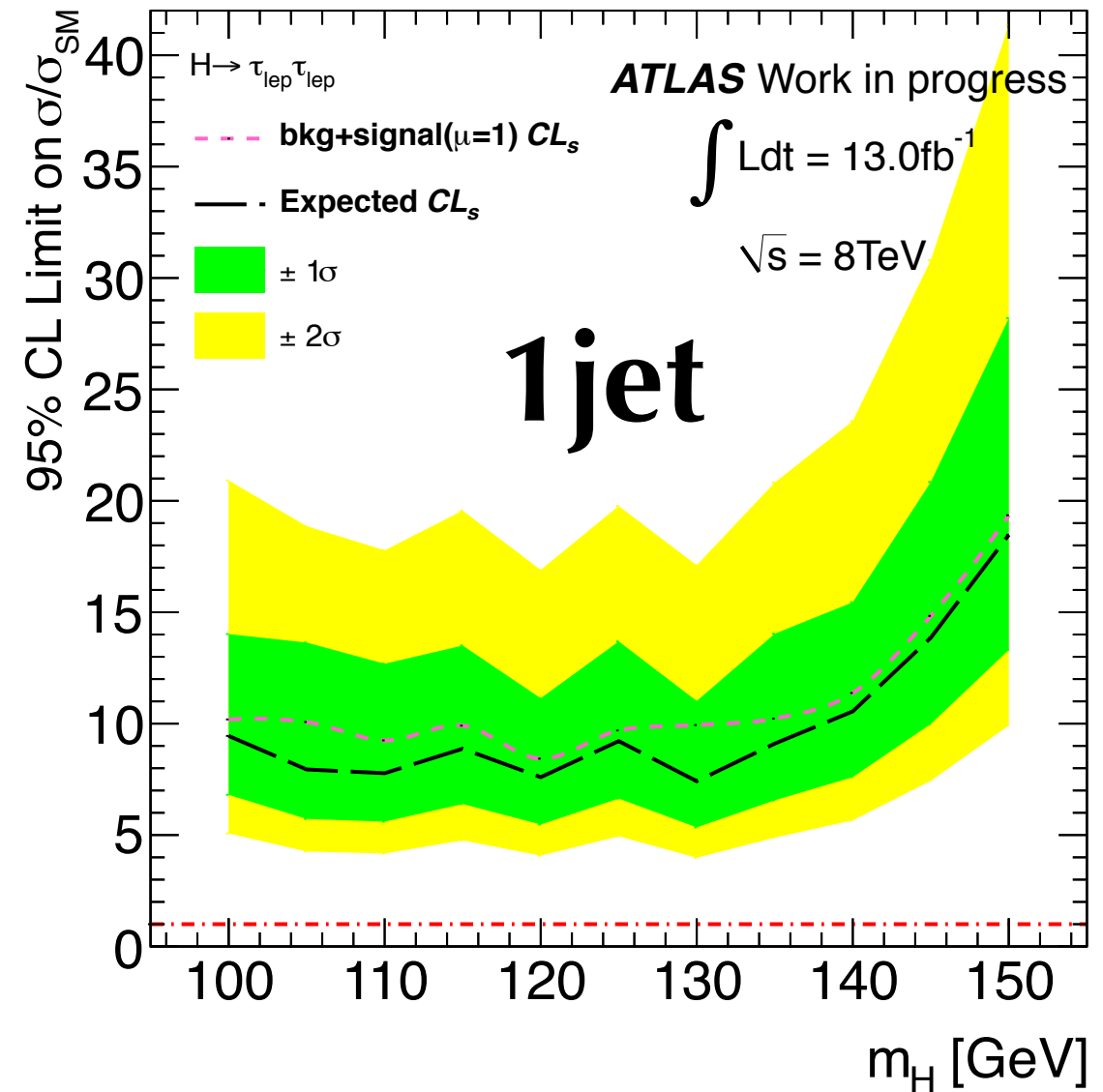
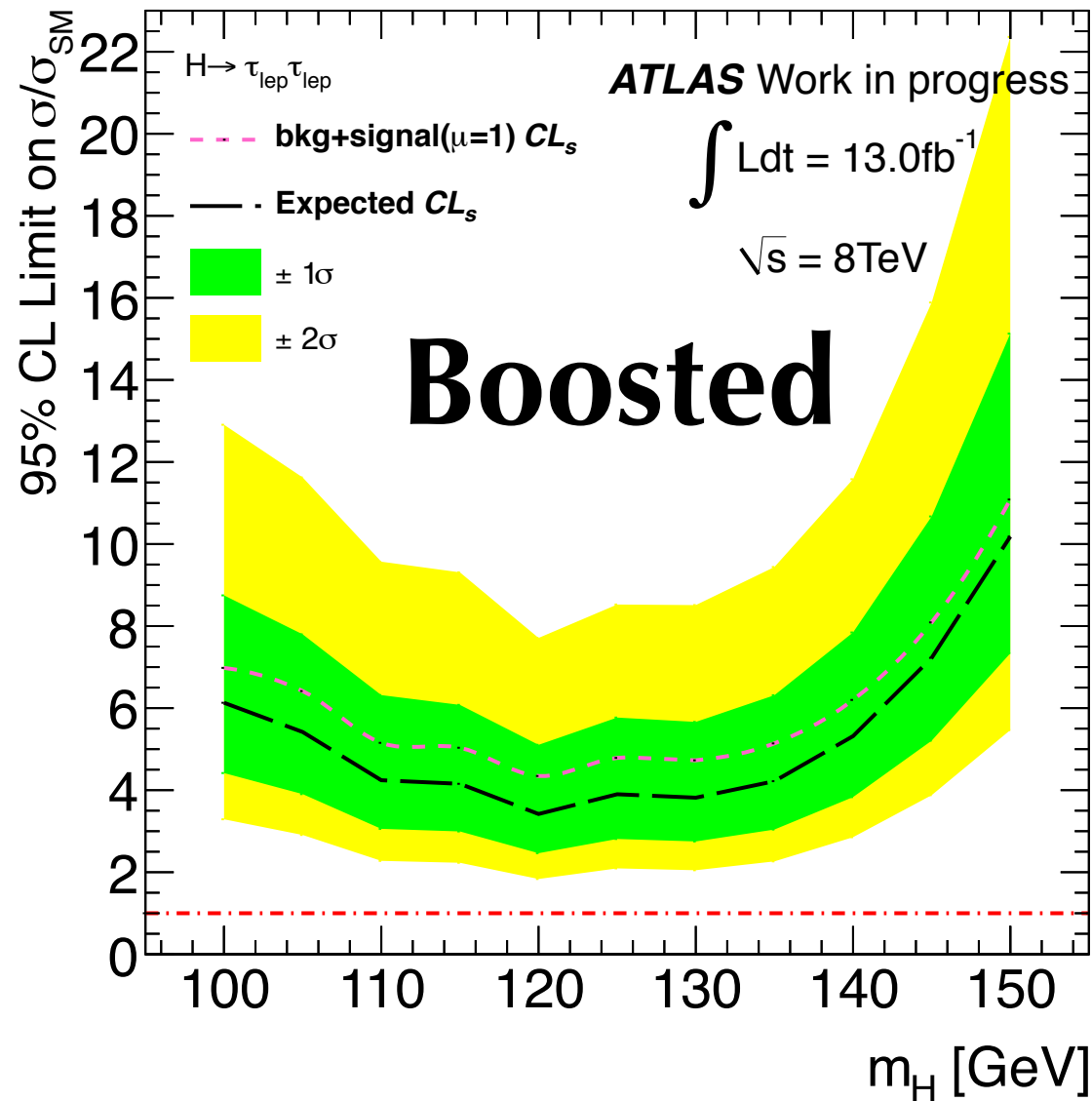
limit

- データは微妙に揃っていないので expected がきちんと出るか遊んだ



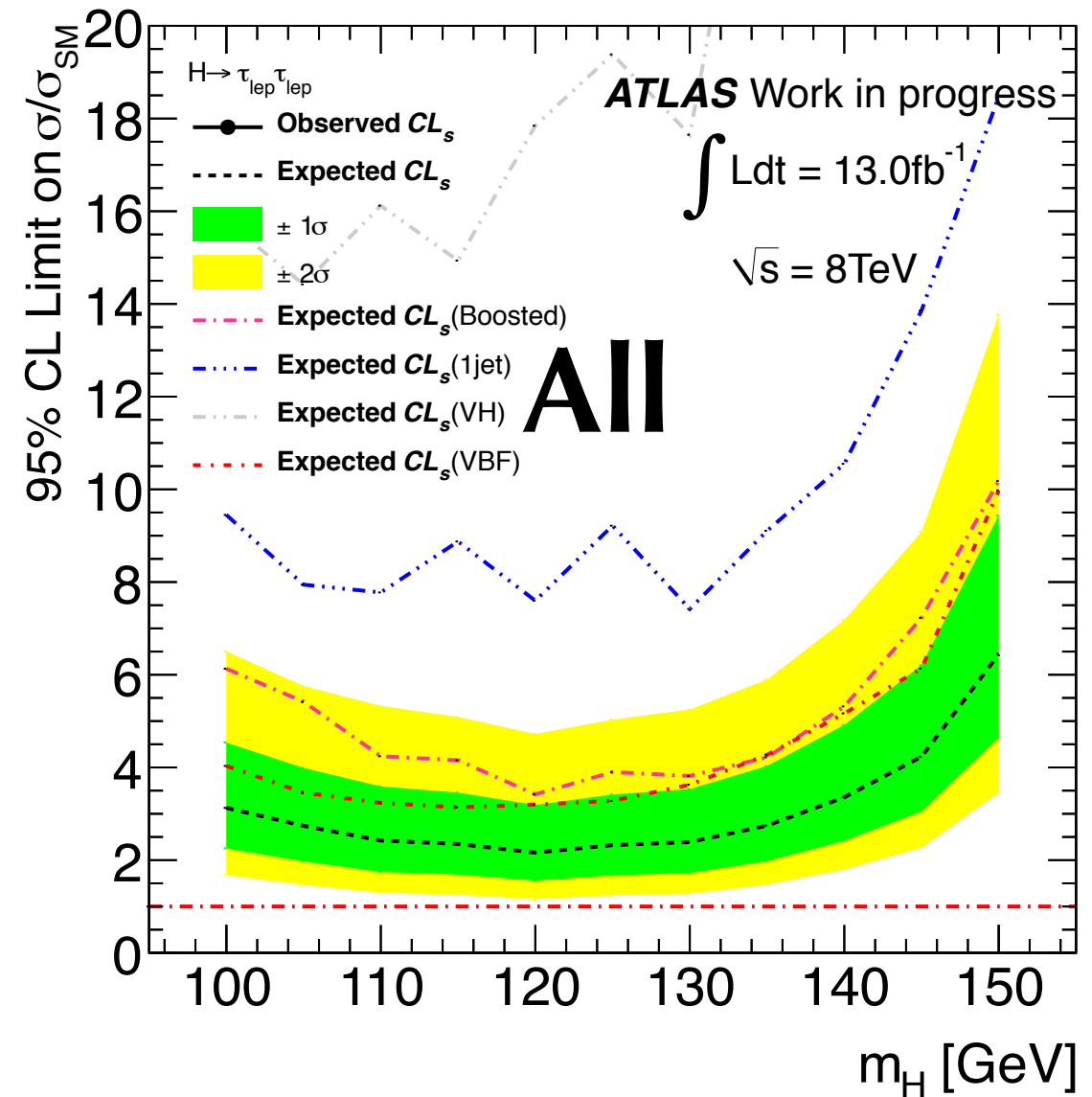
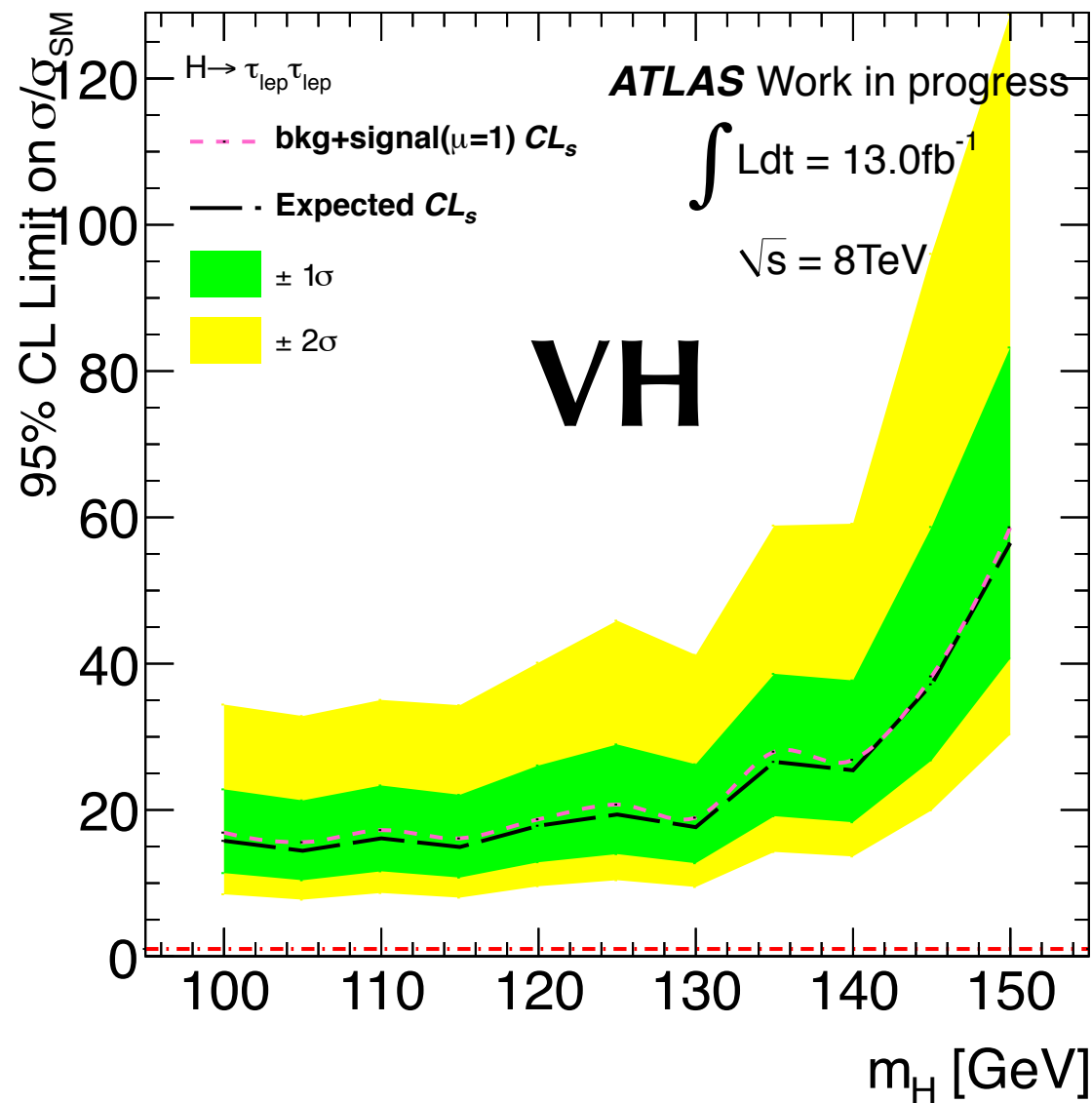
limitとか

- データは微妙に揃っていないのでexpectedがきちんと出るか遊んだ



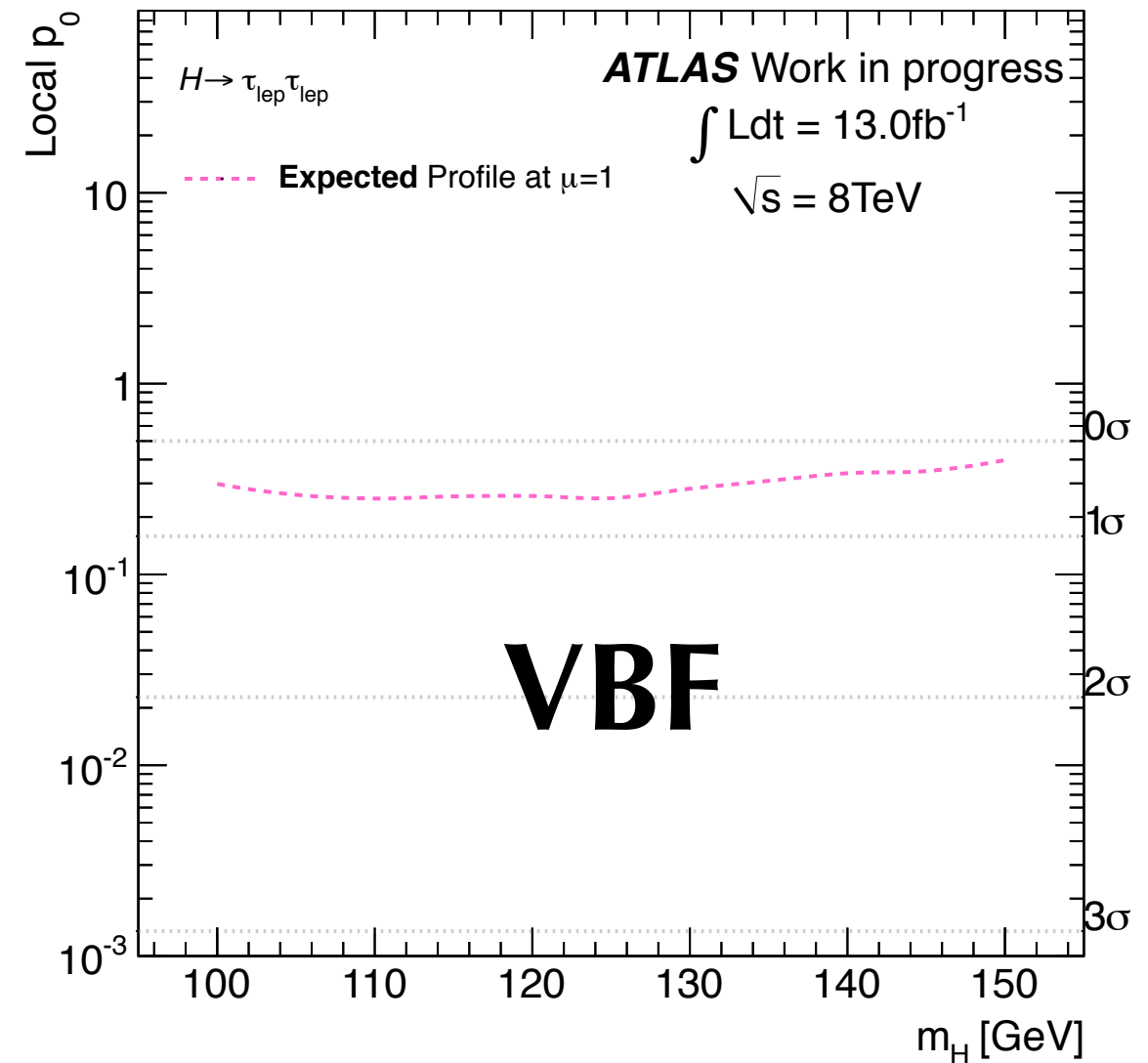
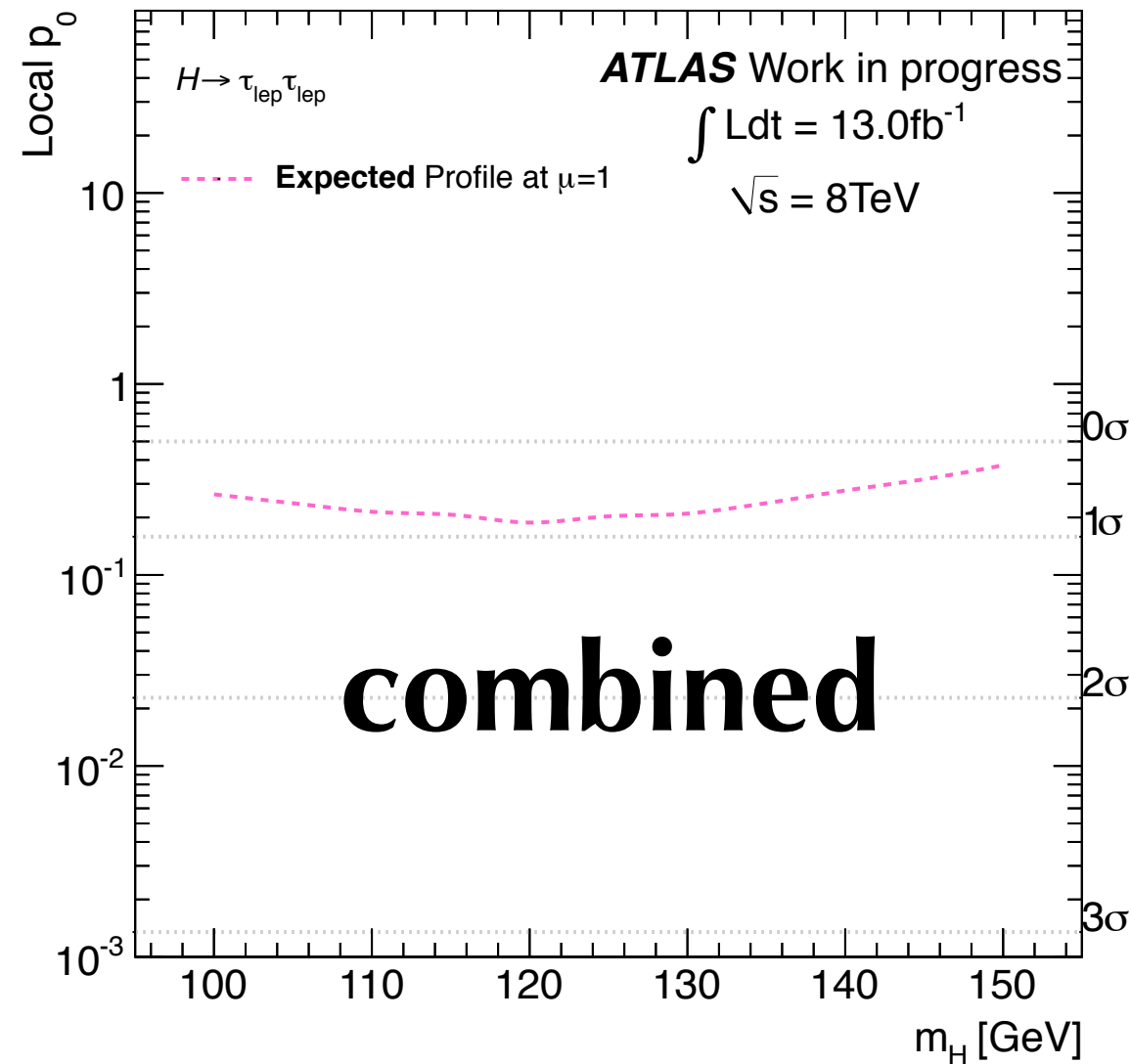
limitとか

- データは微妙に揃っていないのでexpectedがきちんと出るか遊んだ



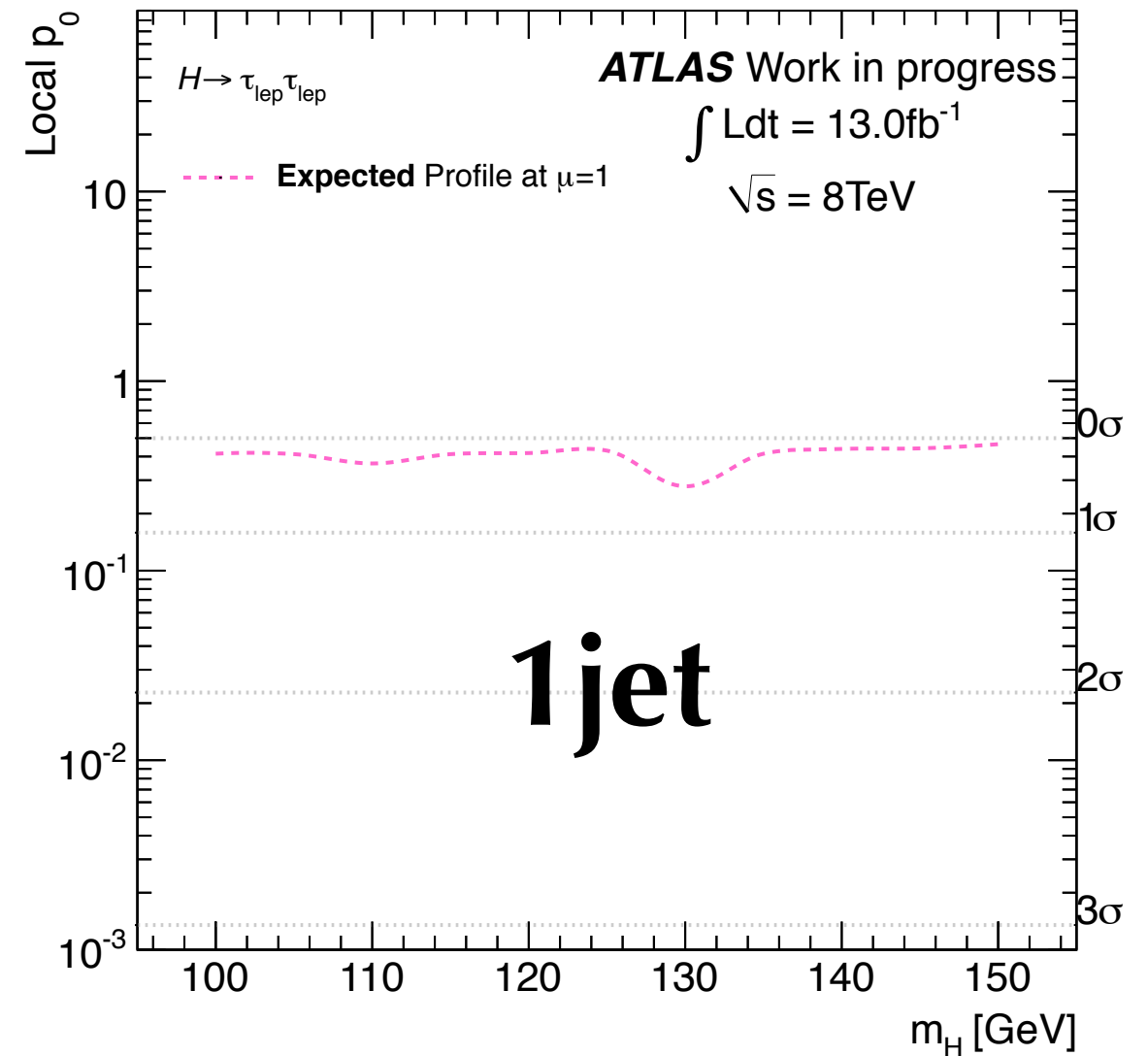
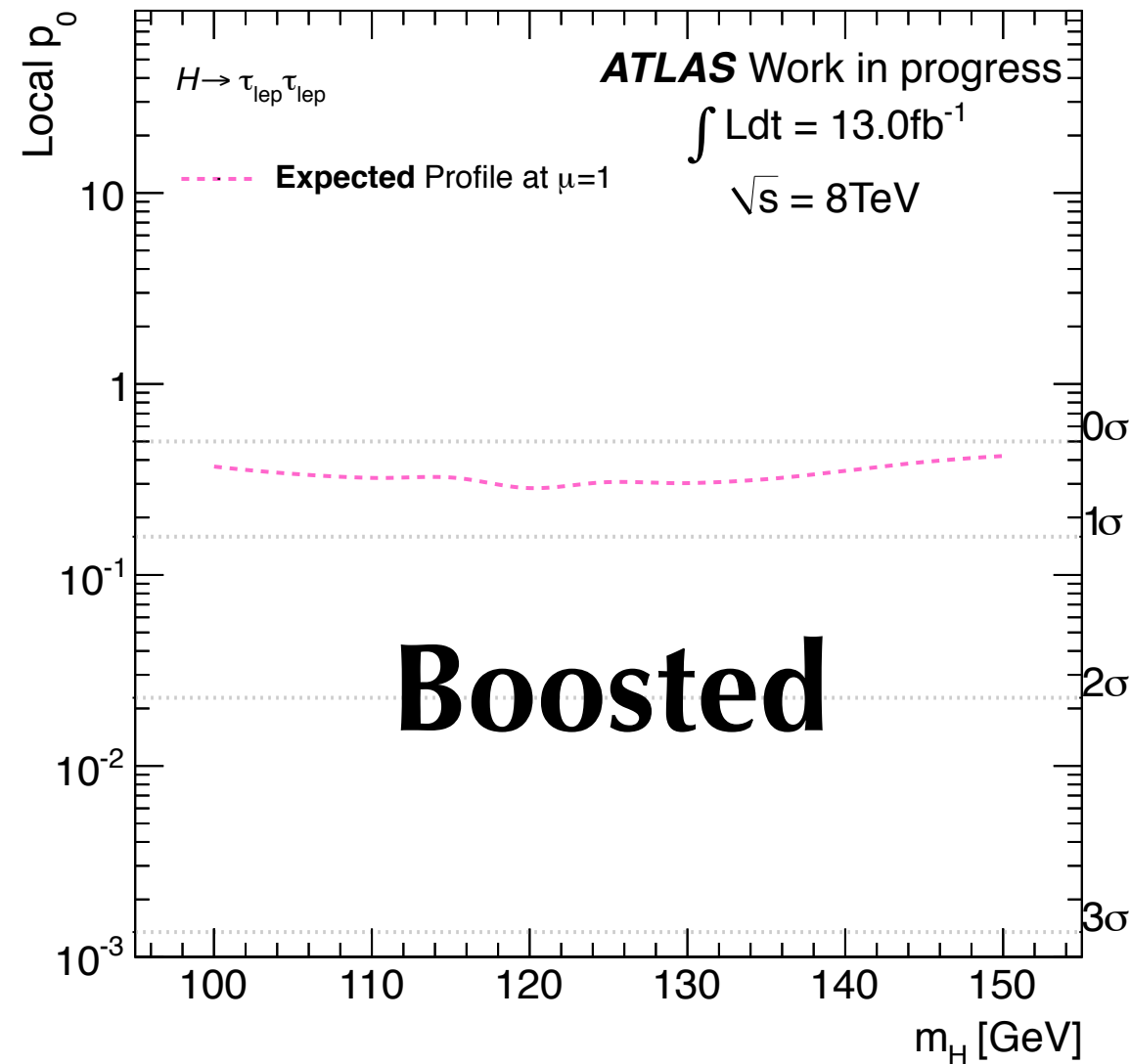
limitとか

- データは微妙に揃っていないのでexpectedがきちんと出るか遊んだ



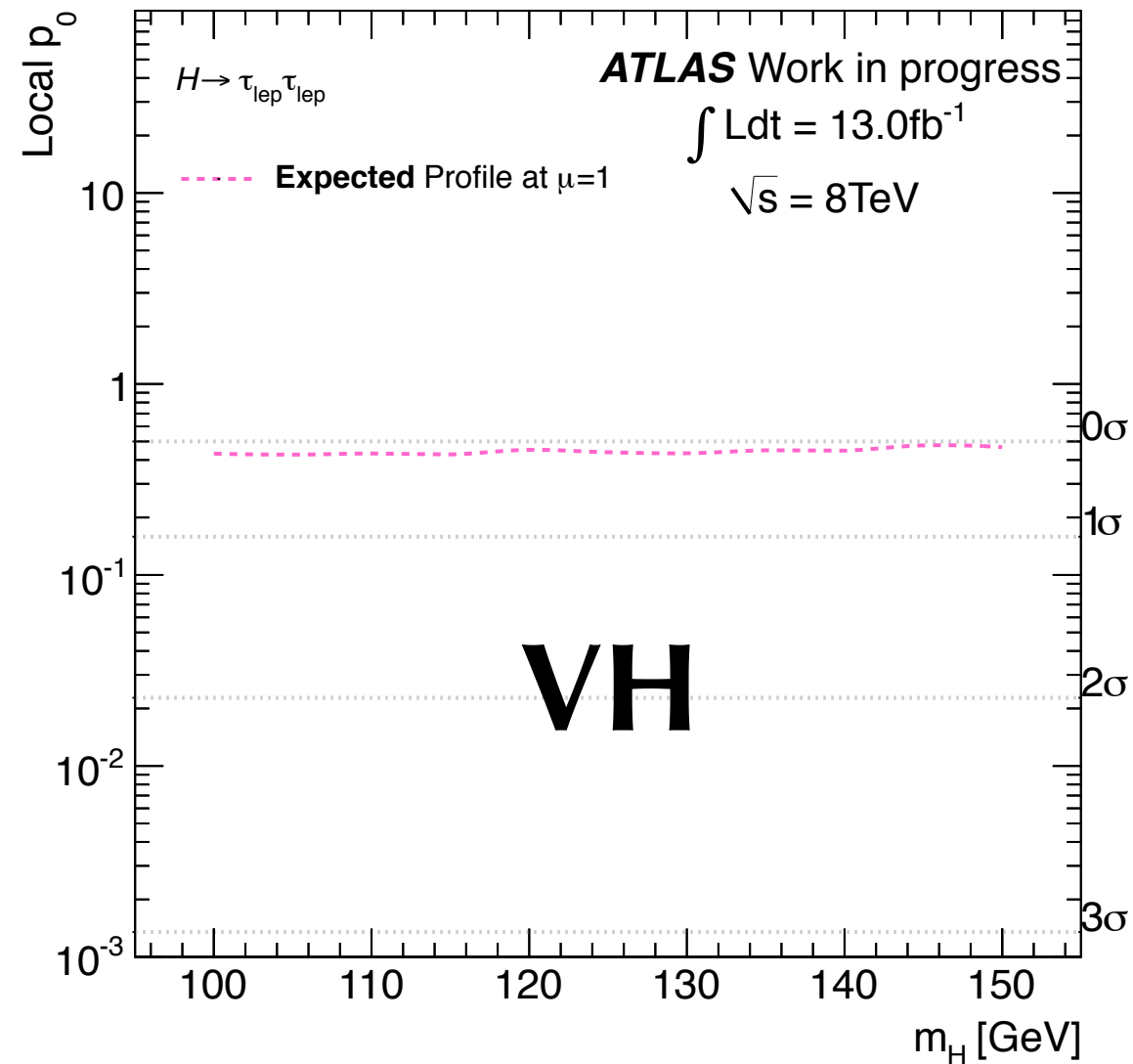
limitとか

- データは微妙に揃っていないのでexpectedがきちんと出るか遊んだ



limitとか

- データは微妙に揃っていないのでexpectedがきちんと出るか遊んだ



lelep MVA for Moriond

- We, HSG4, have to do a MVA based analysis for Moriond 2013.
- But there are anyone to investigate MVA based for lelep analysis.
- After categorization, calculate score of BDT v.s. each bkg source training.
- Combine all BDT score into combined BDT training.

Category	Categorization	MVA input
VBF	$m_{jj} > 250 \text{ GeV}$ $\Delta\eta_{jj} > 2.5$	$Z\tau\tau, \text{Top, Others}$ $\rightarrow \text{Combined}$
Boosted	VBF failed $p_T^H > 100 \text{ GeV}$	$Z\tau\tau, \text{Top, Others}$ $\rightarrow \text{Combined}$
1jet	Boosted failed	$Z\tau\tau, Z\ell\ell, \text{top, Others}$ $\rightarrow \text{Combined}$

MVA for VBF

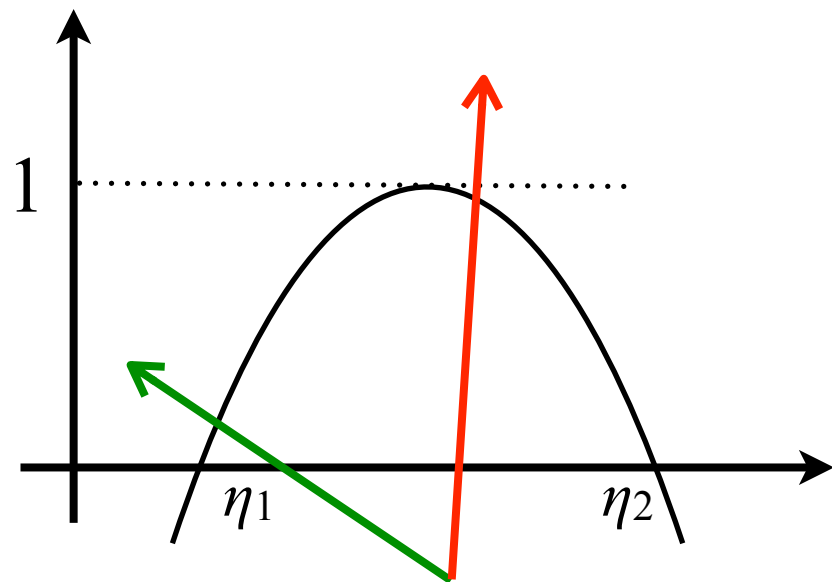
- VBF category was performed cut base by b-tag veto and OLV, CJV.
- Adding new variables:
 - Lepton Centrality
 - min of jet eta/phi from diLep system.

bkg	MVA input	Test/Train
Z$\tau\tau$	$m_{jj}, \Delta\eta_{jj}, p_T^{L1}, p_T^{j1}, p_T^{j2}, p_T^{Total}, H_T, m_{HJ}, \eta^{j1} * \eta^{j2}, \Delta\Phi_{jj},$ $C_{j1j2_L1}, C_{j1j2_L2}, \min(\Delta\eta_{LLj}), \min(\Delta\phi_{LLj})$	Embedd/ Alpgen
Top	$m_{jj}, \Delta\eta_{jj}, p_T^{L1}, p_T^{j1}, p_T^{j2}, p_T^{Total}, H_T, m_{HJ}, \eta^{j1} * \eta^{j2}, \Delta\Phi_{jj},$ $C_{j1j2_L1}, C_{j1j2_L2}, \min(\Delta\eta_{LLj}), \min(\Delta\phi_{LLj}), n_{JetPt25}$	Even/Odd
Other	$m_{jj}, \Delta\eta_{jj}, p_T^{L1}, p_T^{j1}, p_T^{j2}, p_T^{Total}, H_T, m_{HJ}, \eta^{j1} * \eta^{j2}, \Delta\phi_{jj},$ $C_{j1j2_L1}, C_{j1j2_L2}, \min(\Delta\eta_{LLj}), \min(\Delta\phi_{LLj}),$	Even/Odd

- Finally input three BDT score into combined BDT training.
- Test/Train: Embedding+Even/Alpgen+Odd.

Lepton Centrality

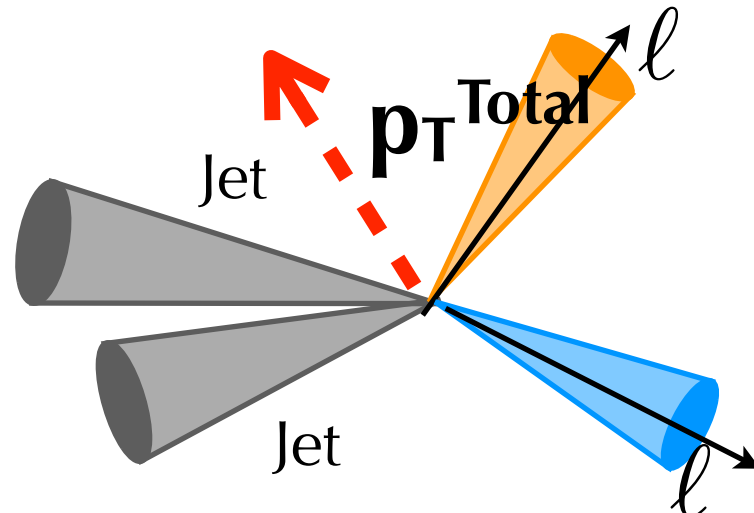
- Lepton should not be in outside of VBF jets.
- The centrality of lepton is presented by following variable,



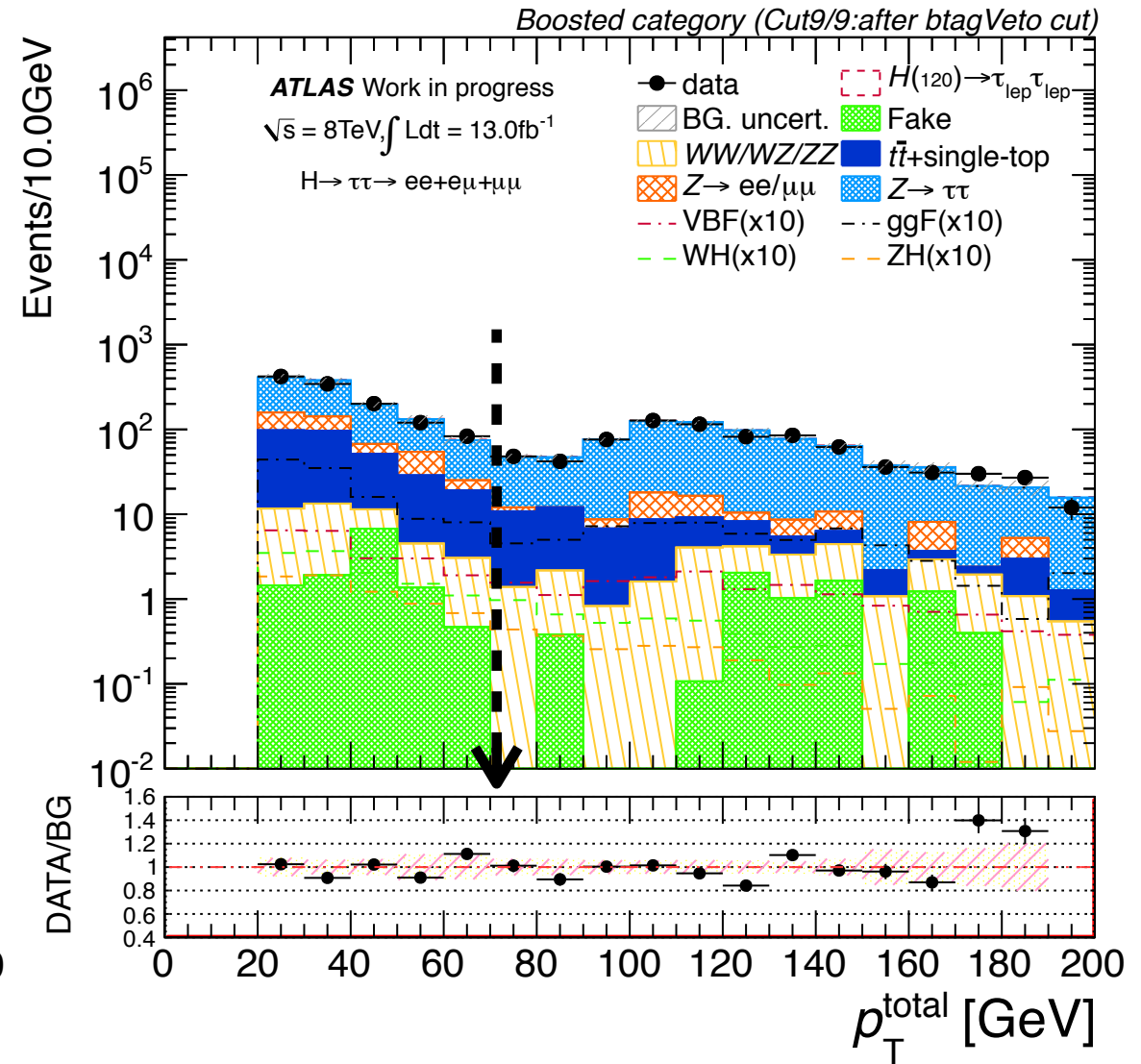
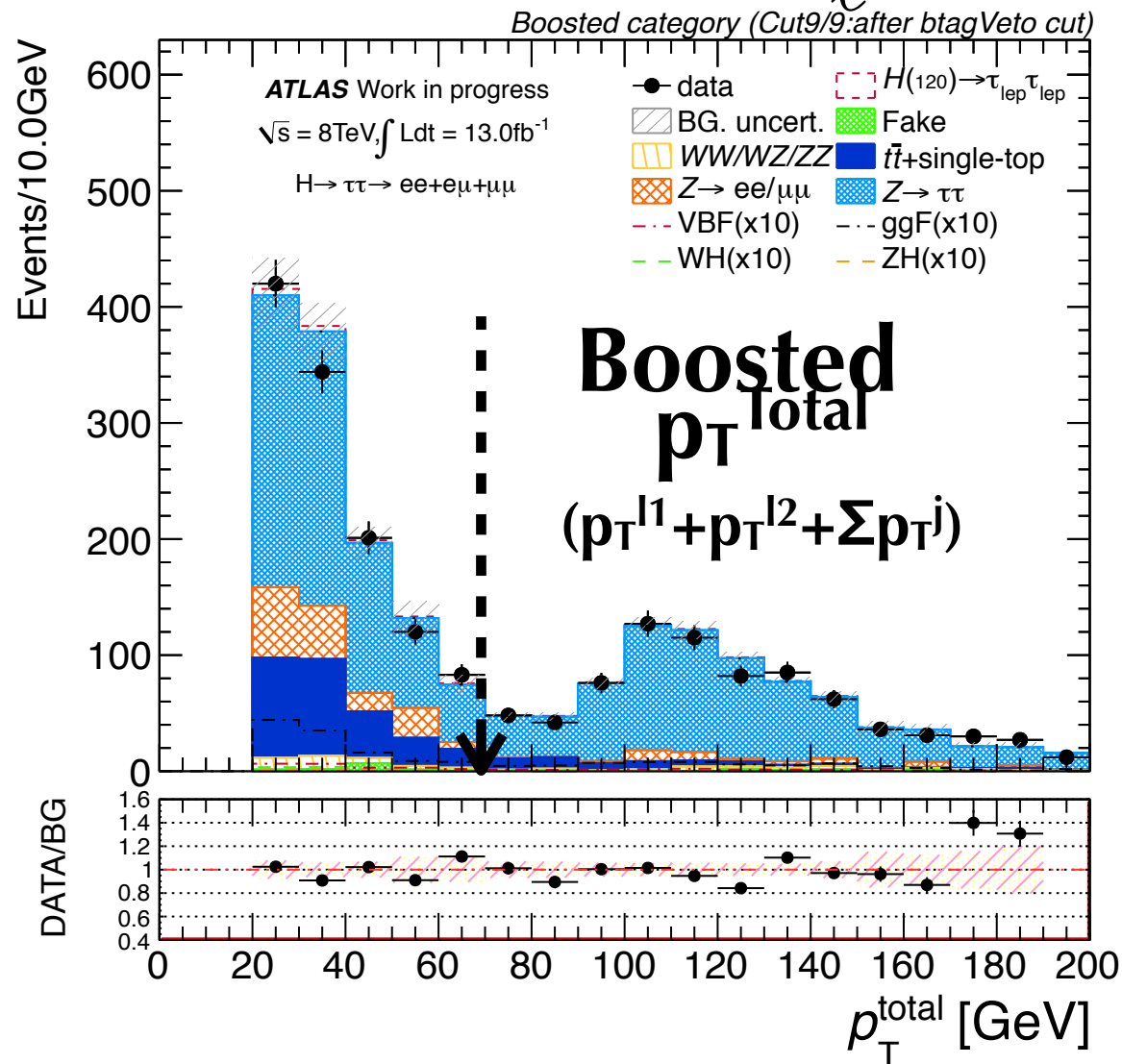
$$C_{\eta_1 \eta_2}(\eta) = \exp \left(\frac{-1}{(\eta_1 - \eta_2)^2} \left(\eta - \frac{\eta_1 + \eta_2}{2} \right)^2 \right)$$

- If $C(\text{eta of lepton})$ is 1.0: lepton is right in middle of VBF 2jets.
- IF C is close to 0: lepton is nearly to jet.

pT Total

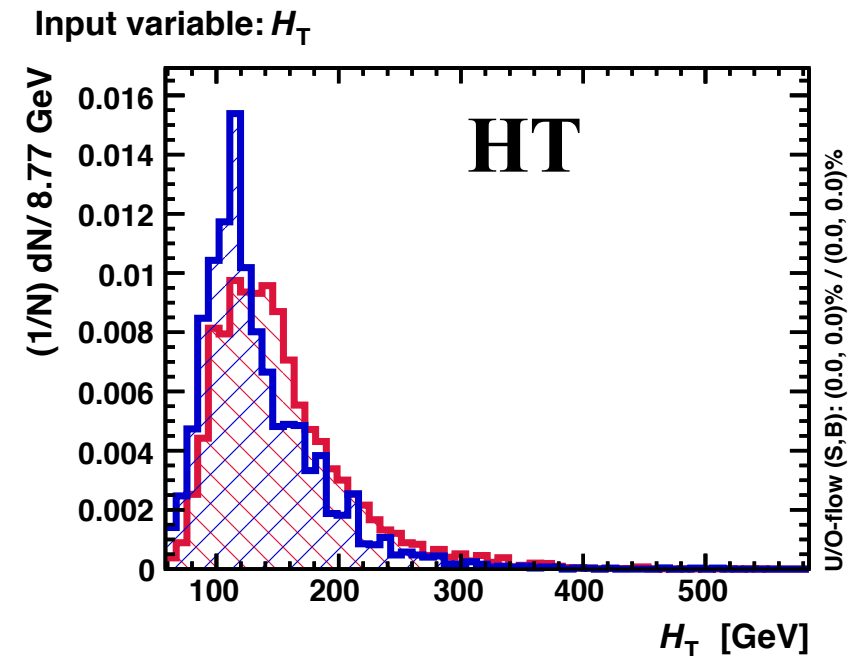
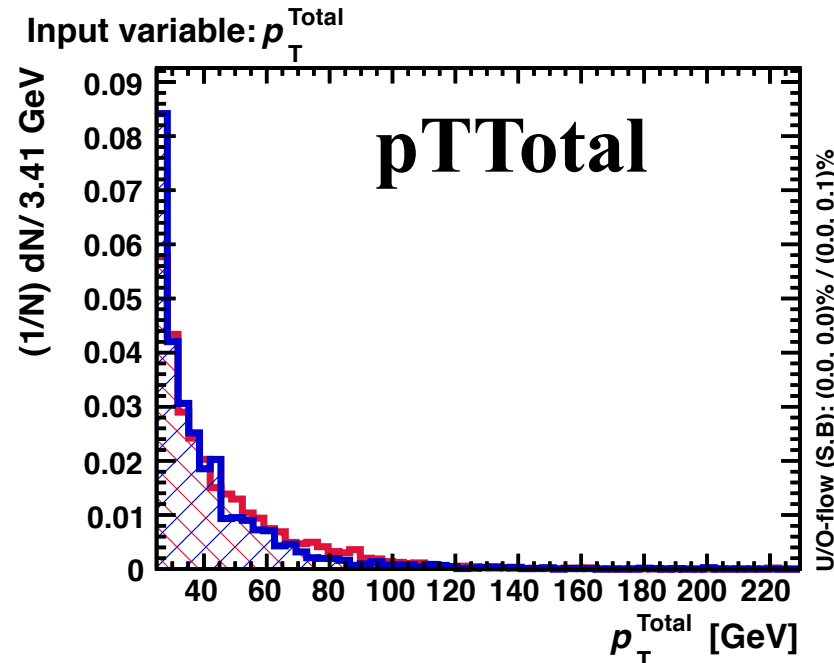
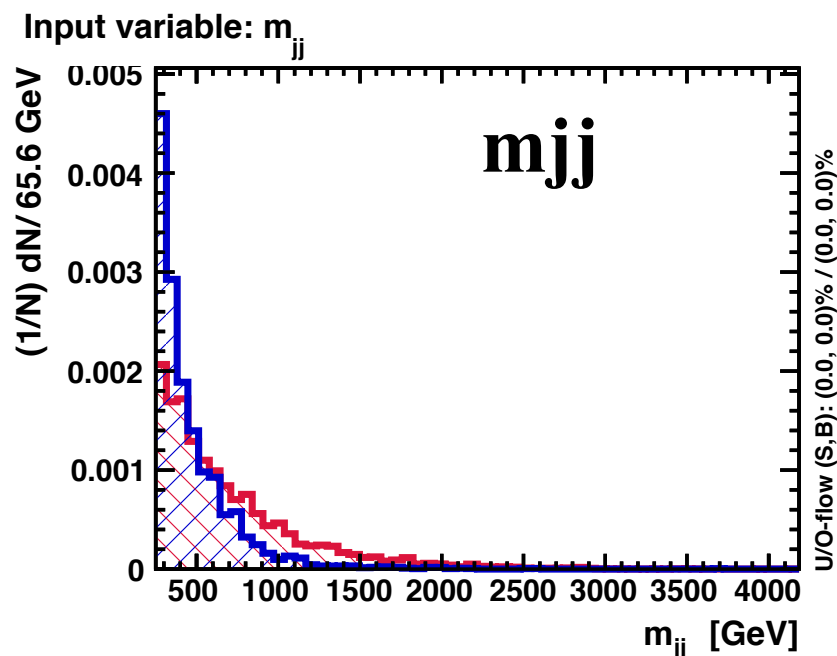
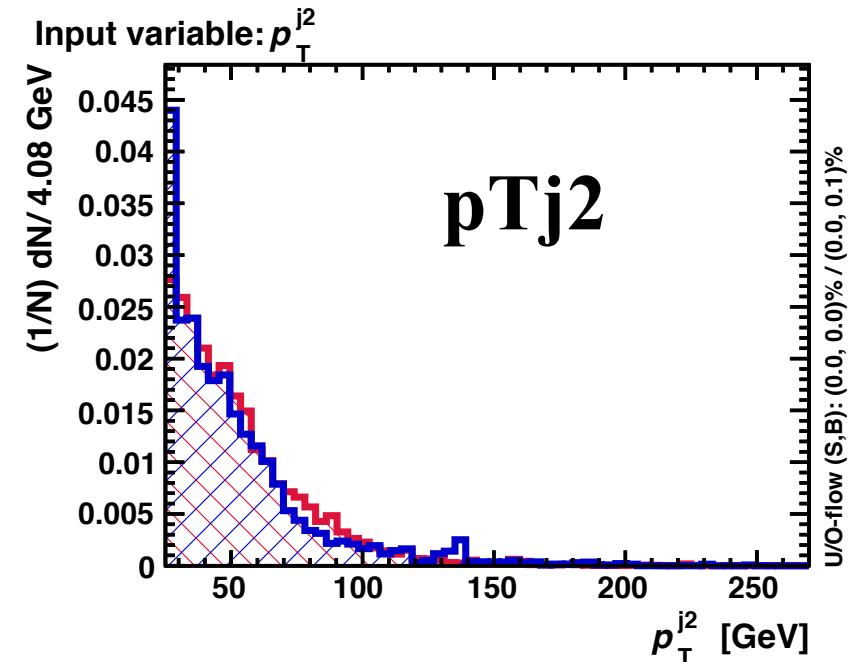
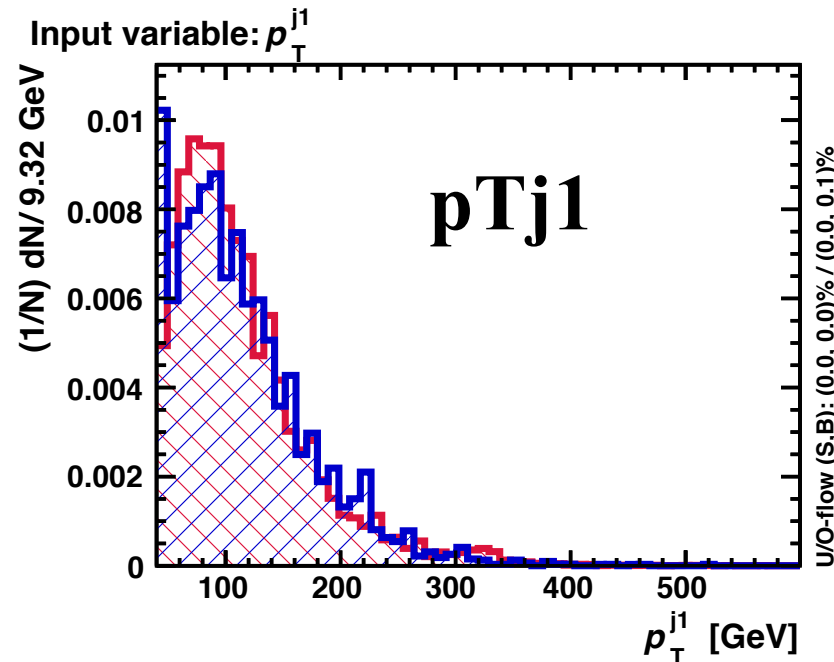
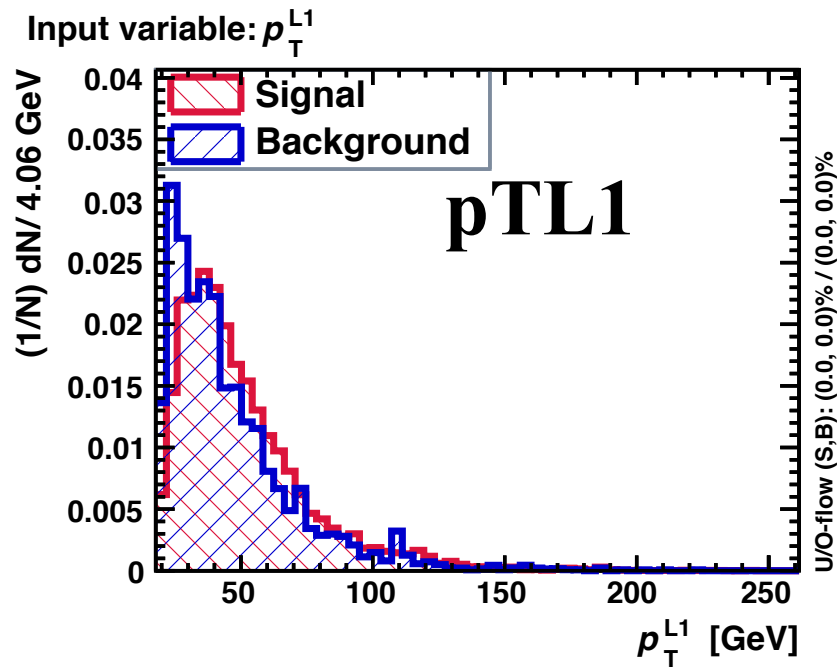


$$\vec{p}_T^{\text{Total}} = \vec{p}_T^{\ell 1} + \vec{p}_T^{\ell 2} + \sum \vec{p}_T^{\text{jet}}$$



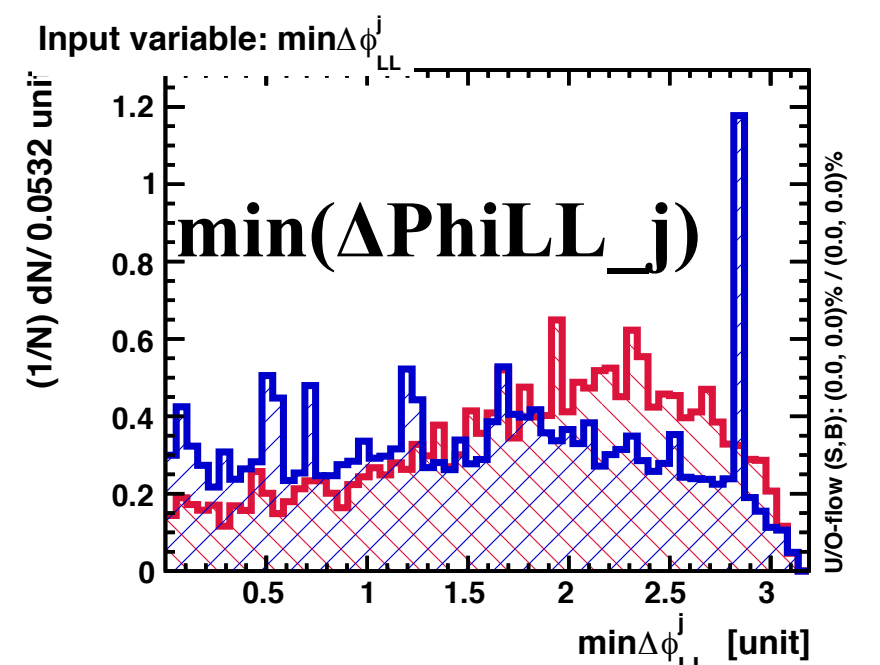
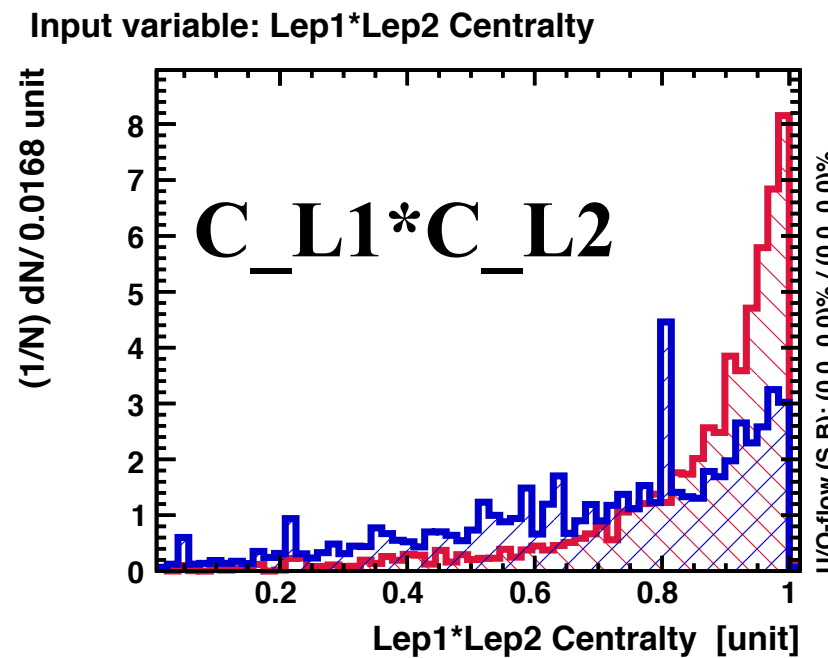
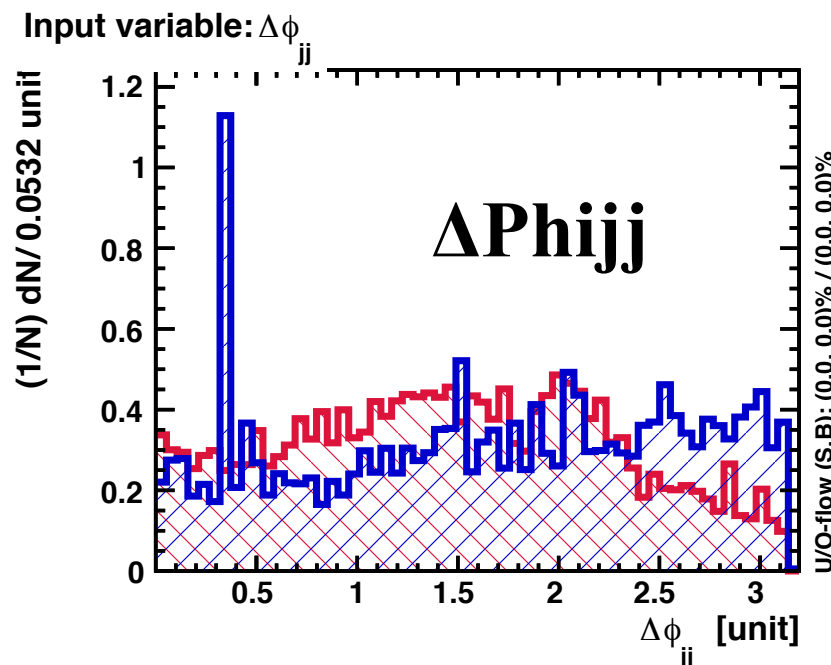
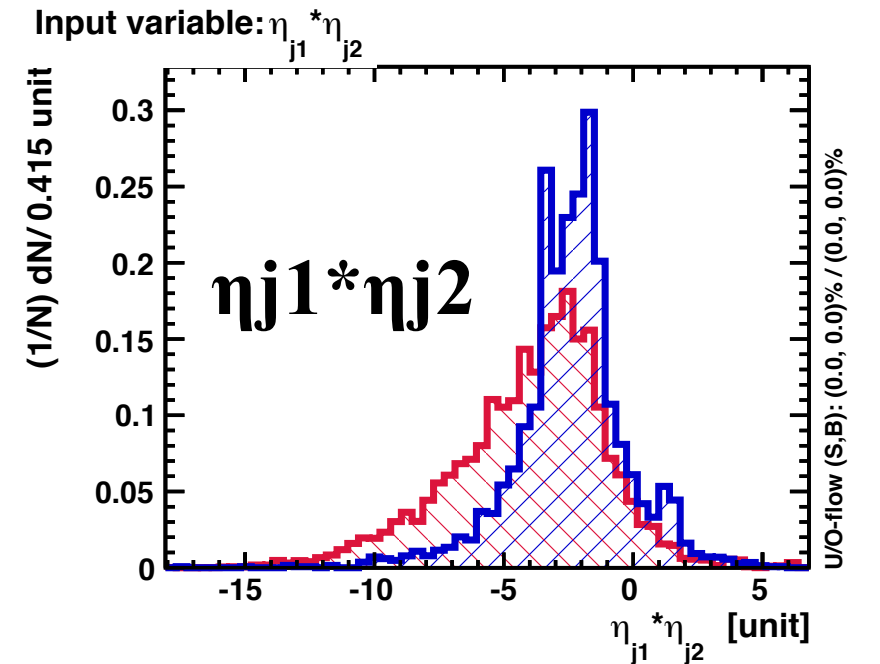
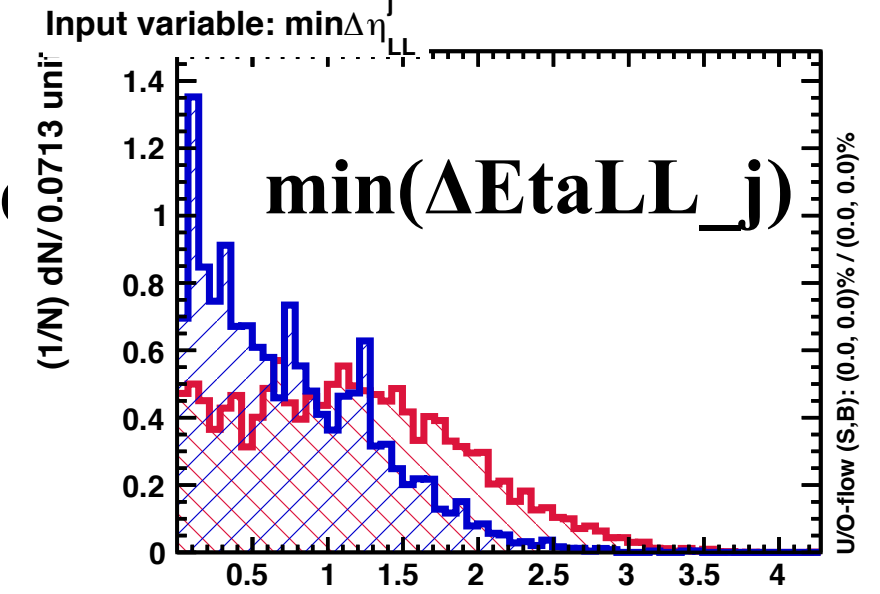
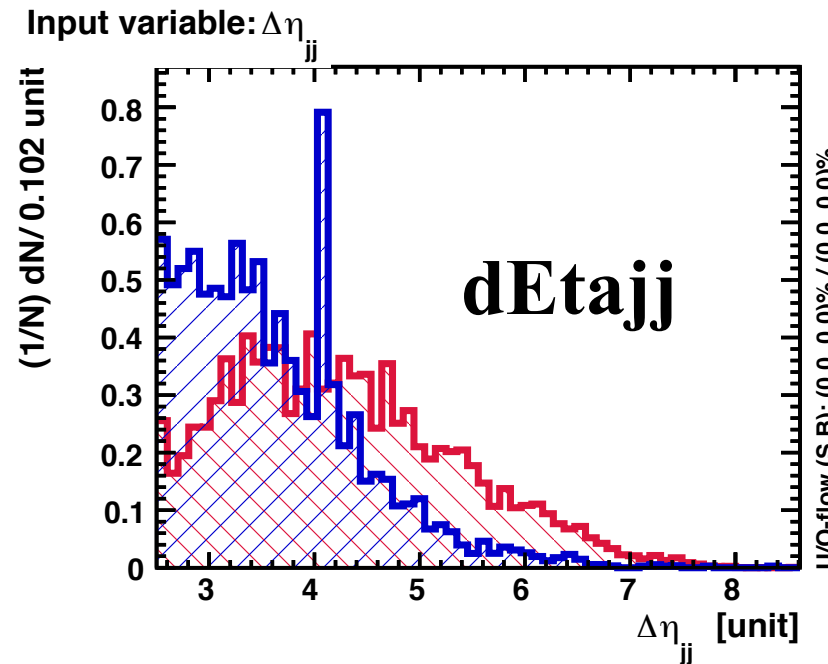
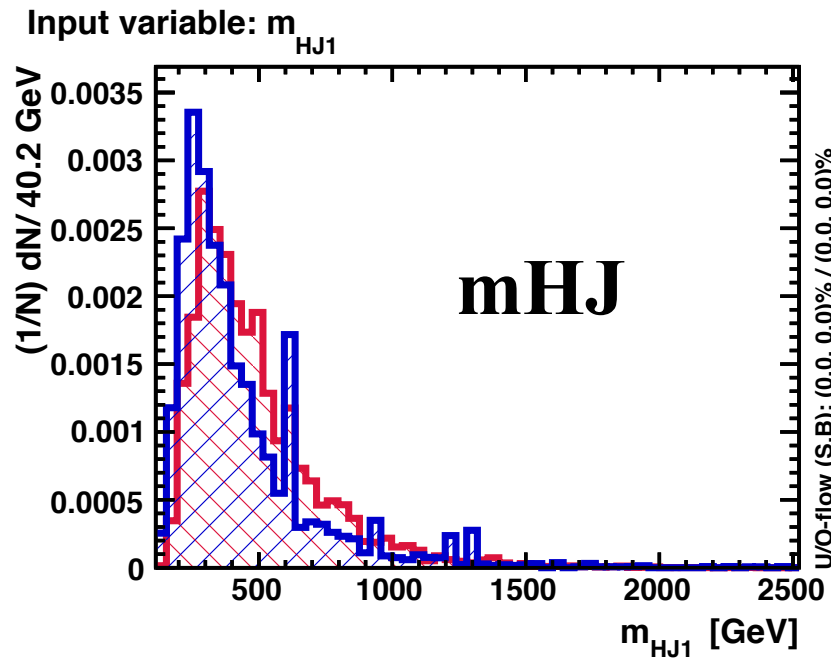
VBF MVA v.s. Ztautau

- VBF BDT input variable v.s. Z to tautau



VBF MVA v.s. Zt

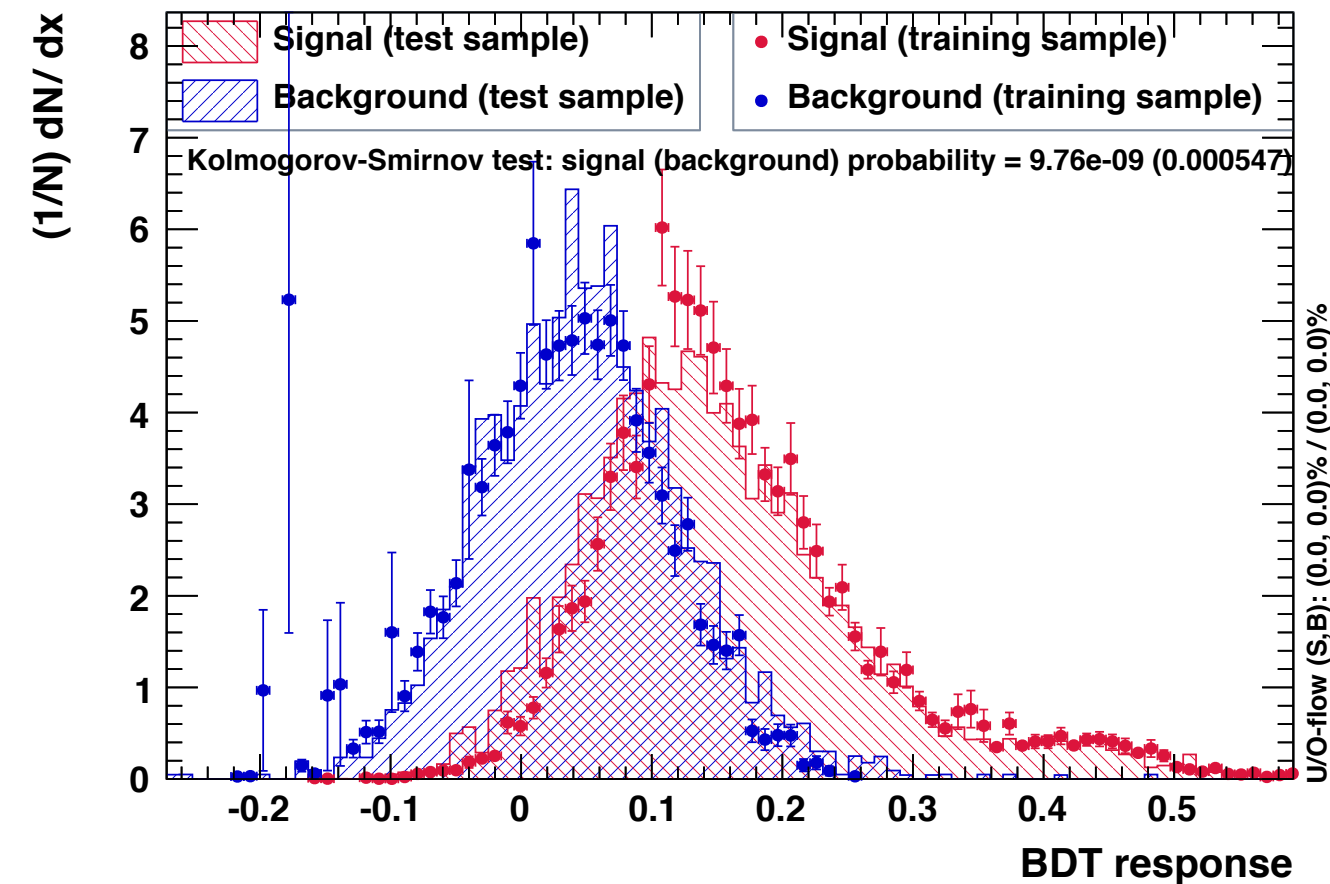
- VBF BDT input variable v.s. Z to tautau



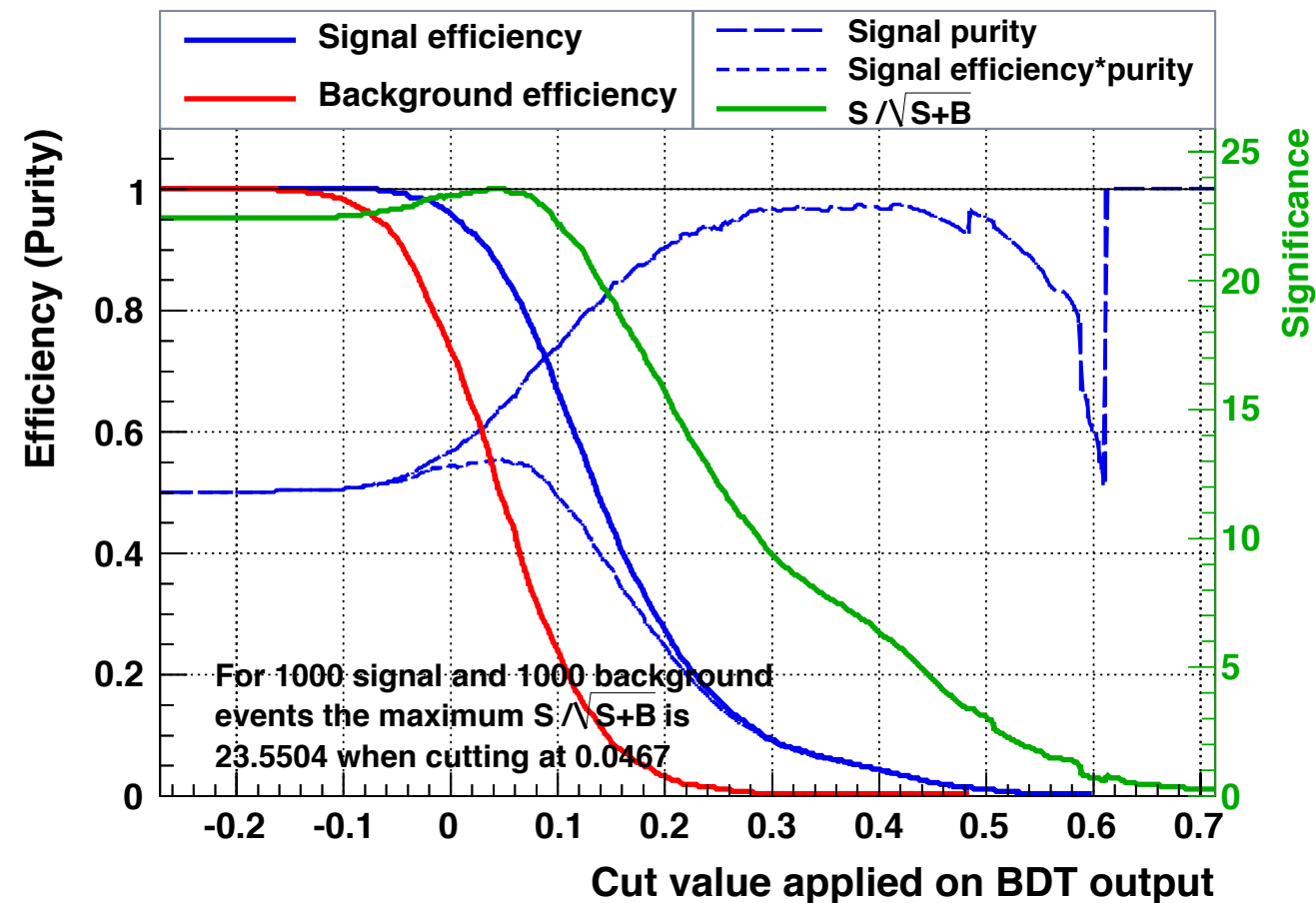
VBF MVA v.s. Ztautau

- Training & Test sample comparison.
- Score cutting efficiency.

TMVA overtraining check for classifier: BDT

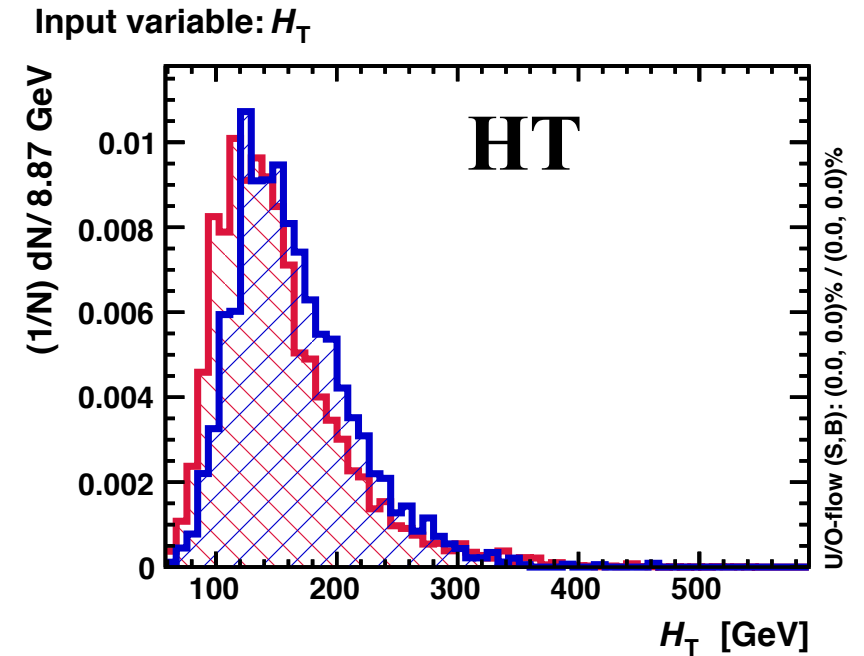
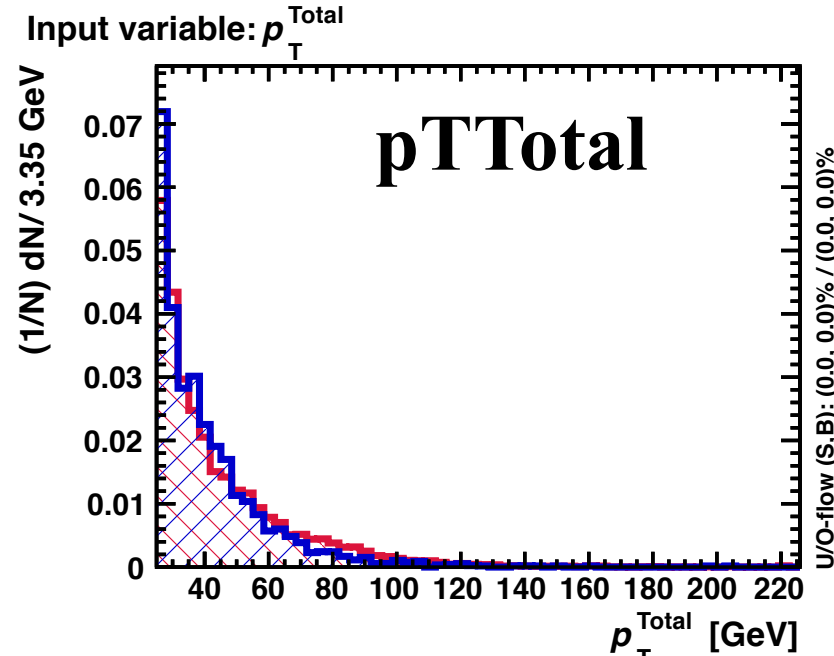
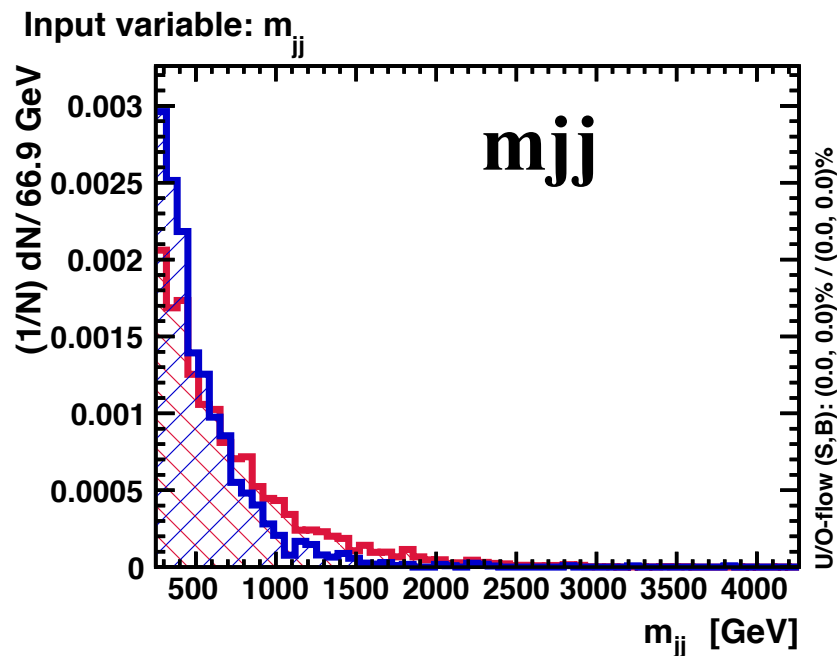
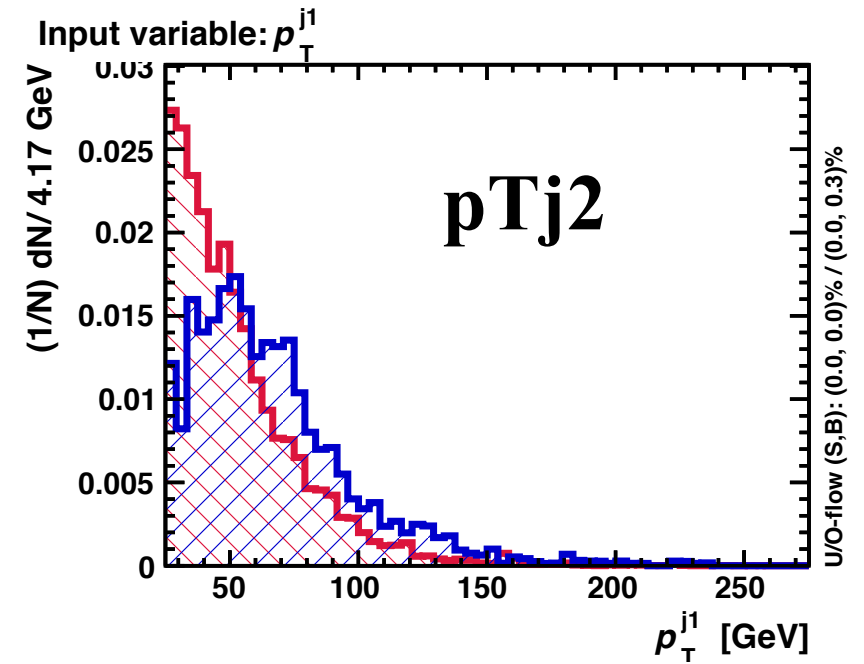
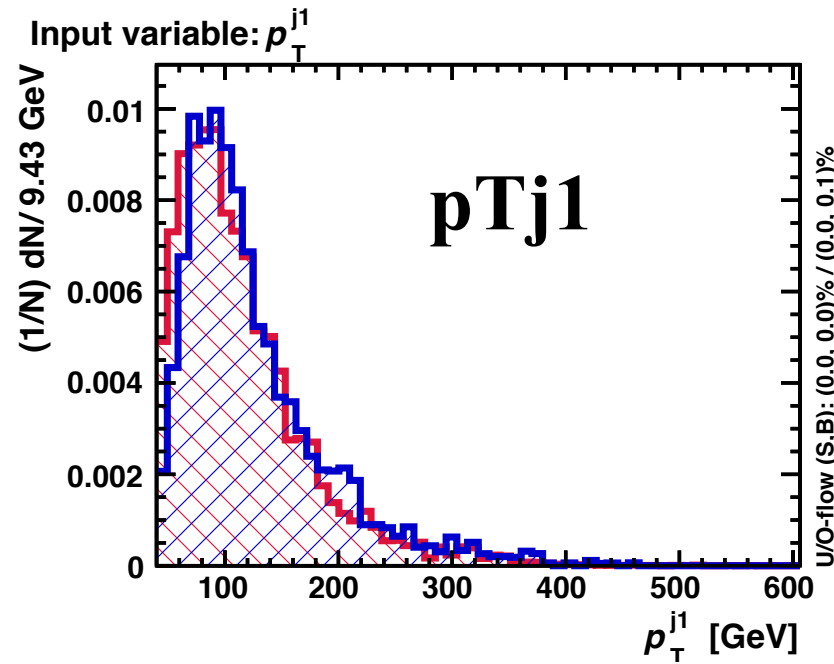
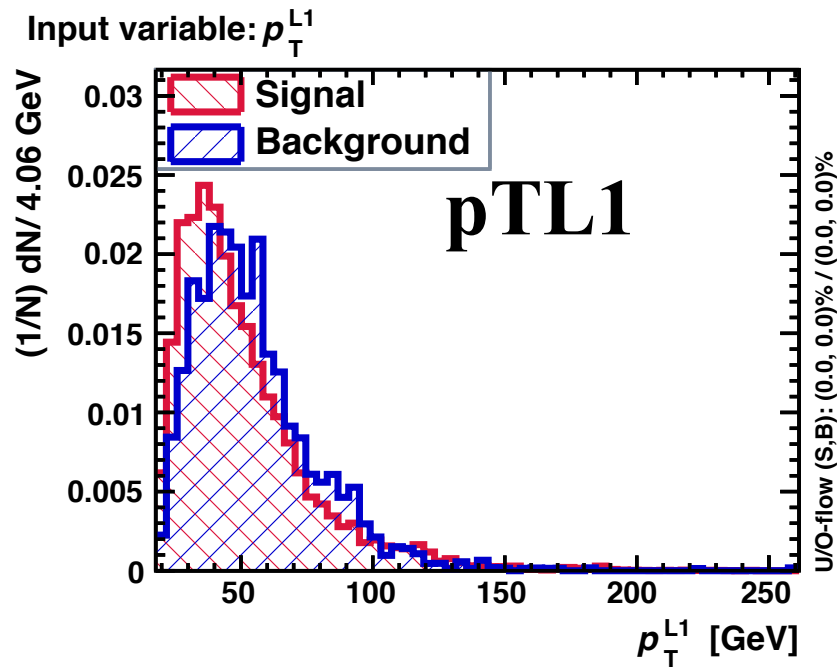


Cut efficiencies and optimal cut value



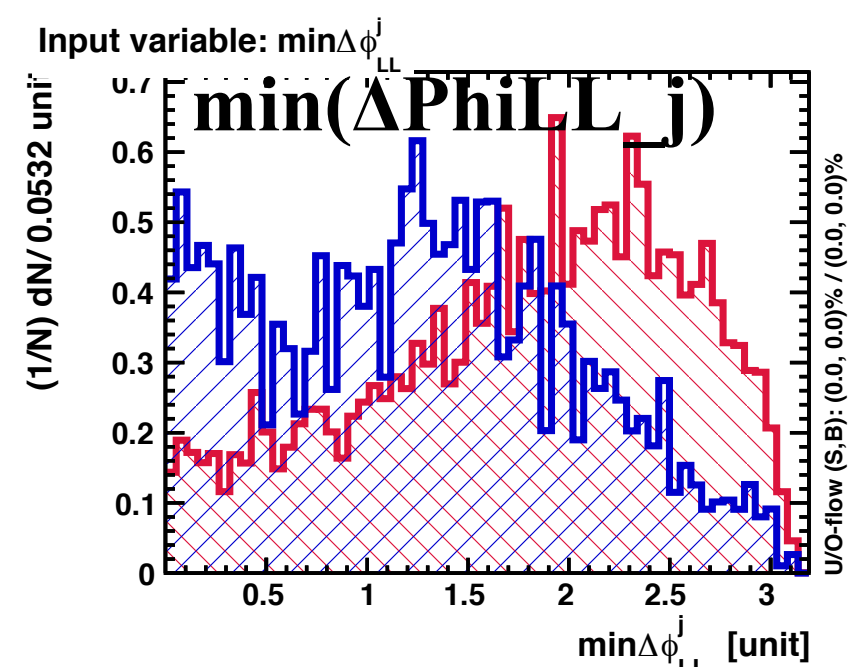
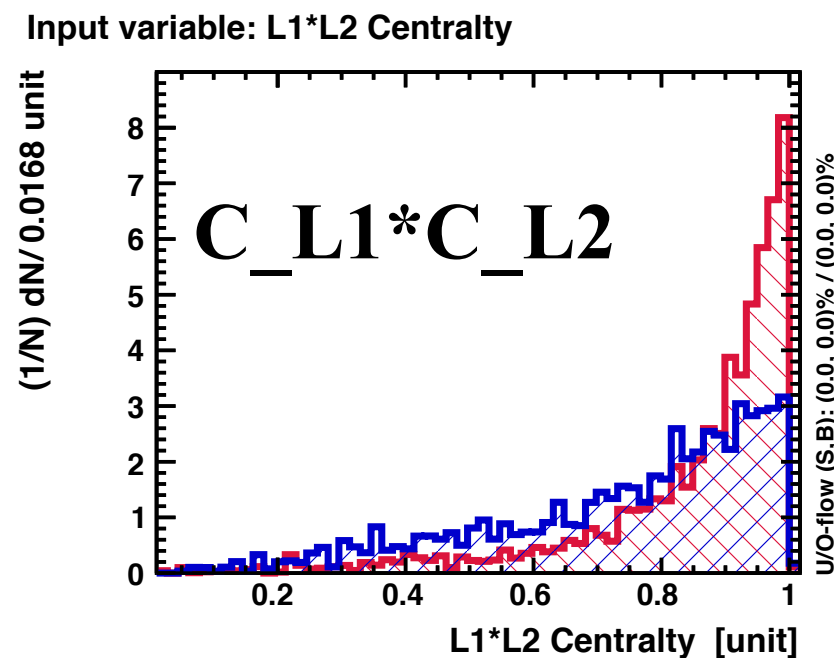
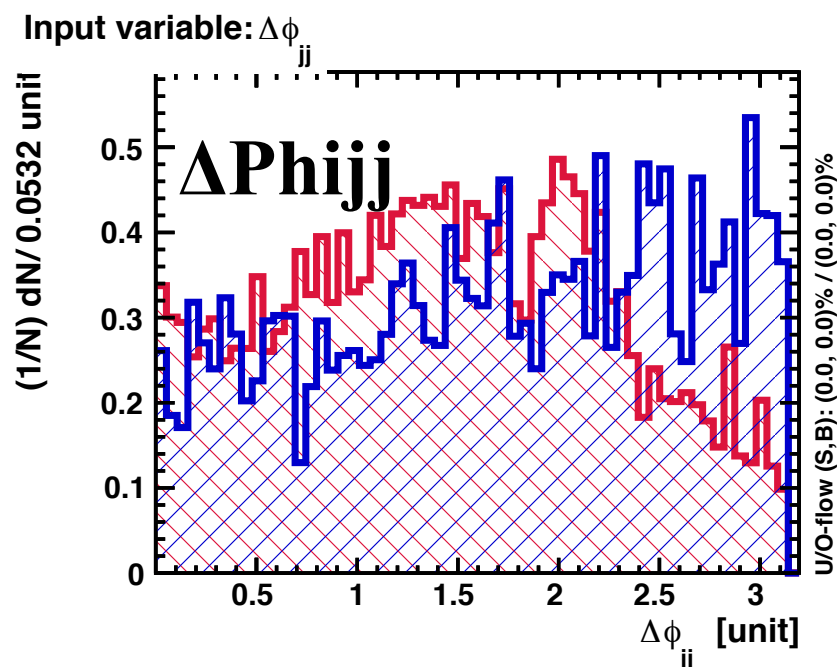
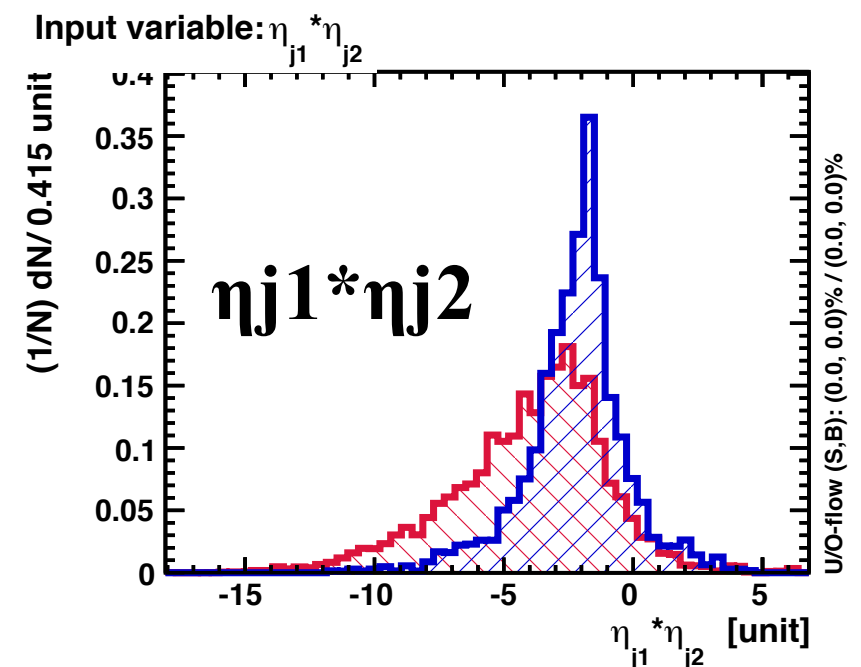
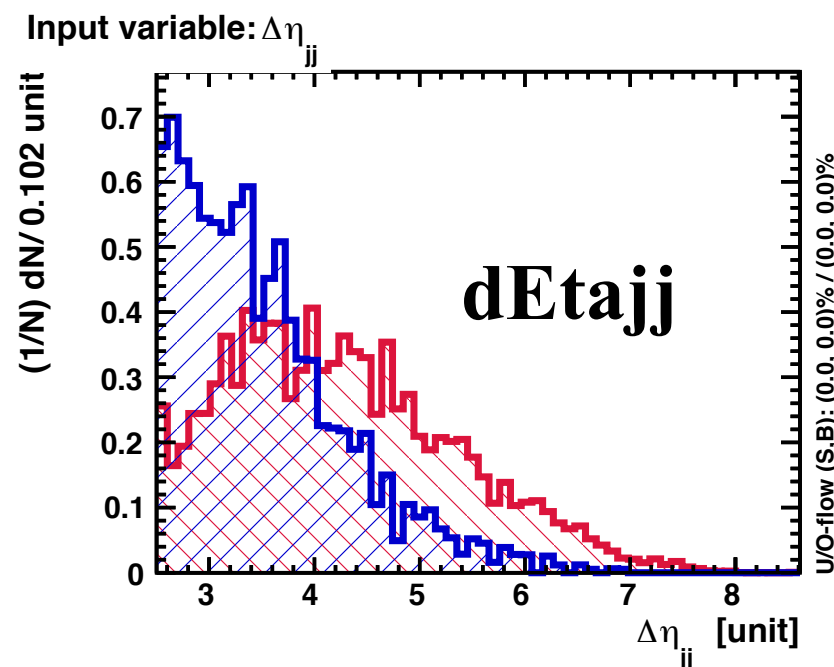
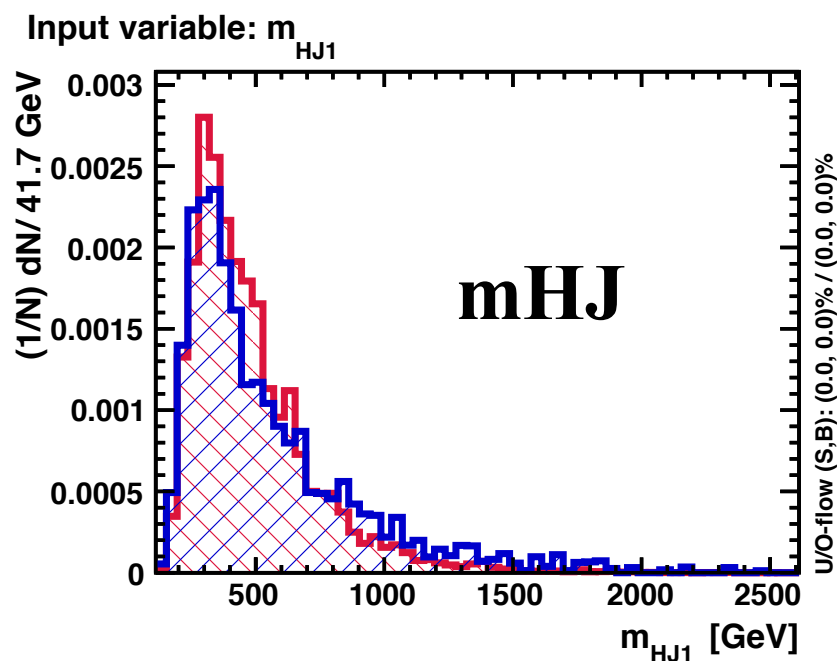
VBF MVA v.s. Top

- VBF BDT input variable v.s. Z to tautau



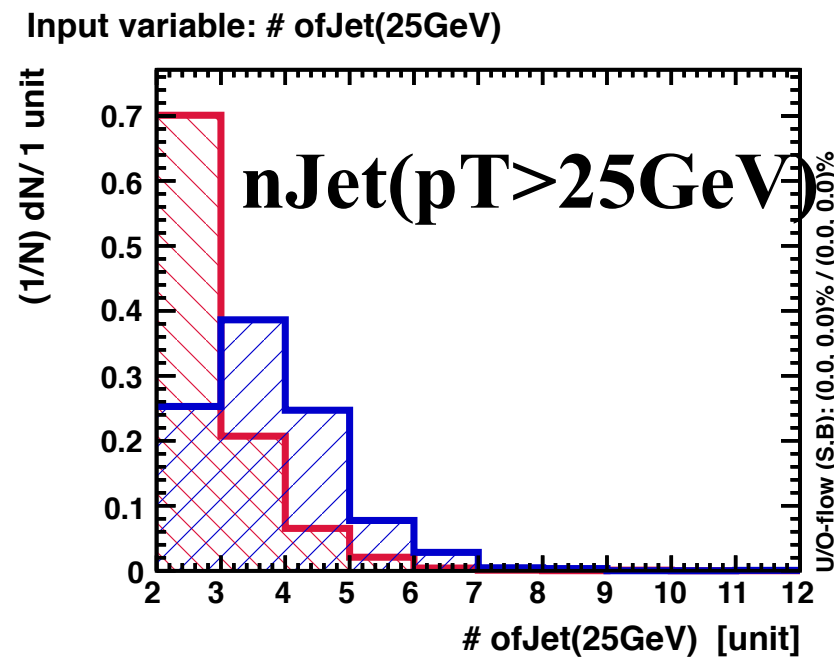
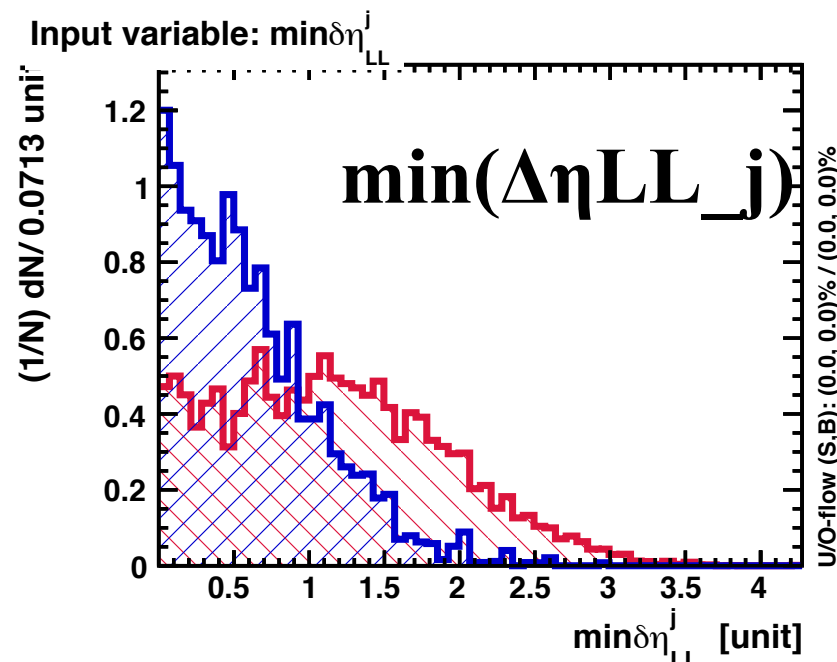
VBF MVA v.s. Top

- VBF BDT input variable v.s. Top



VBF MVA v.s. Top

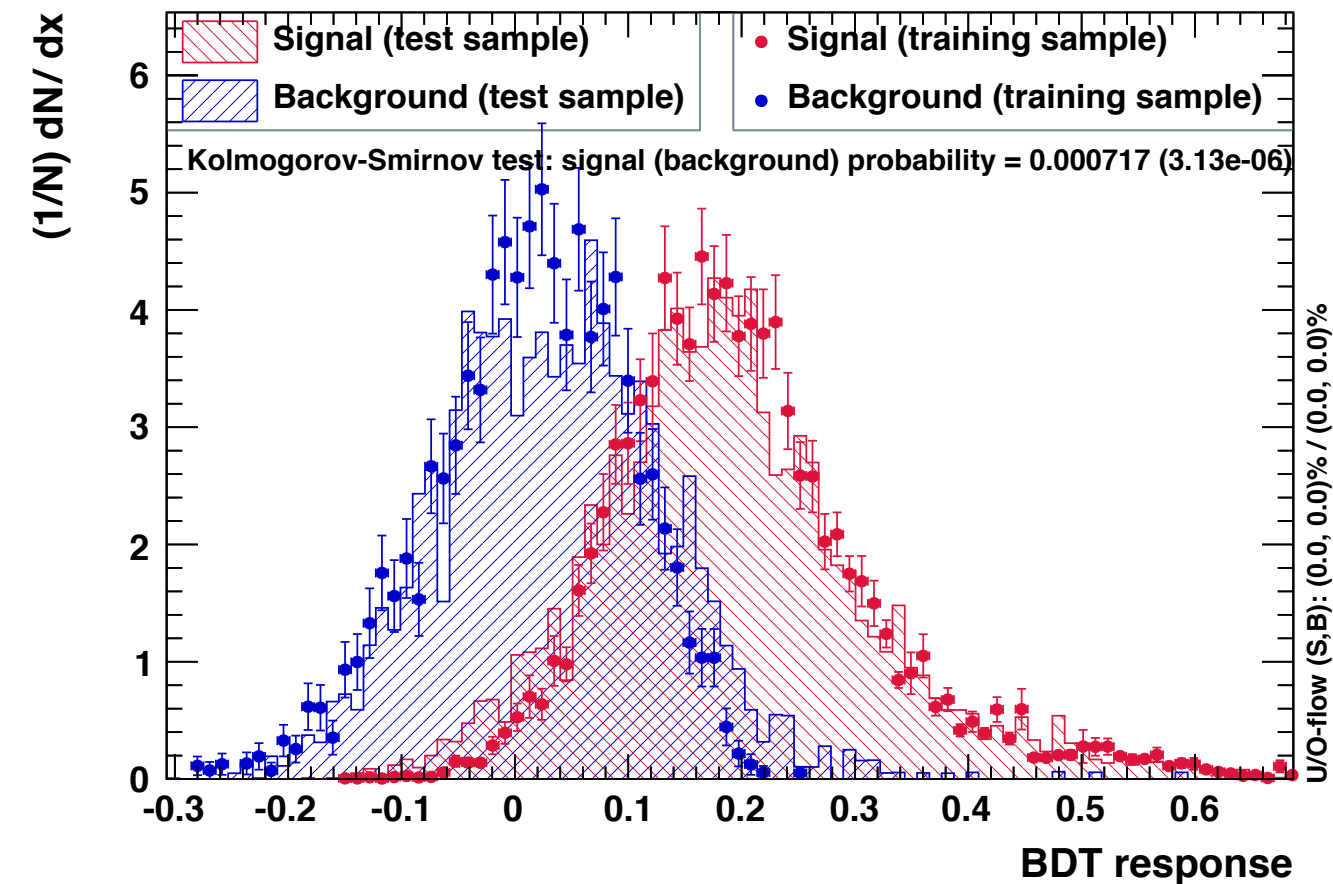
- VBF BDT input variable v.s. Top



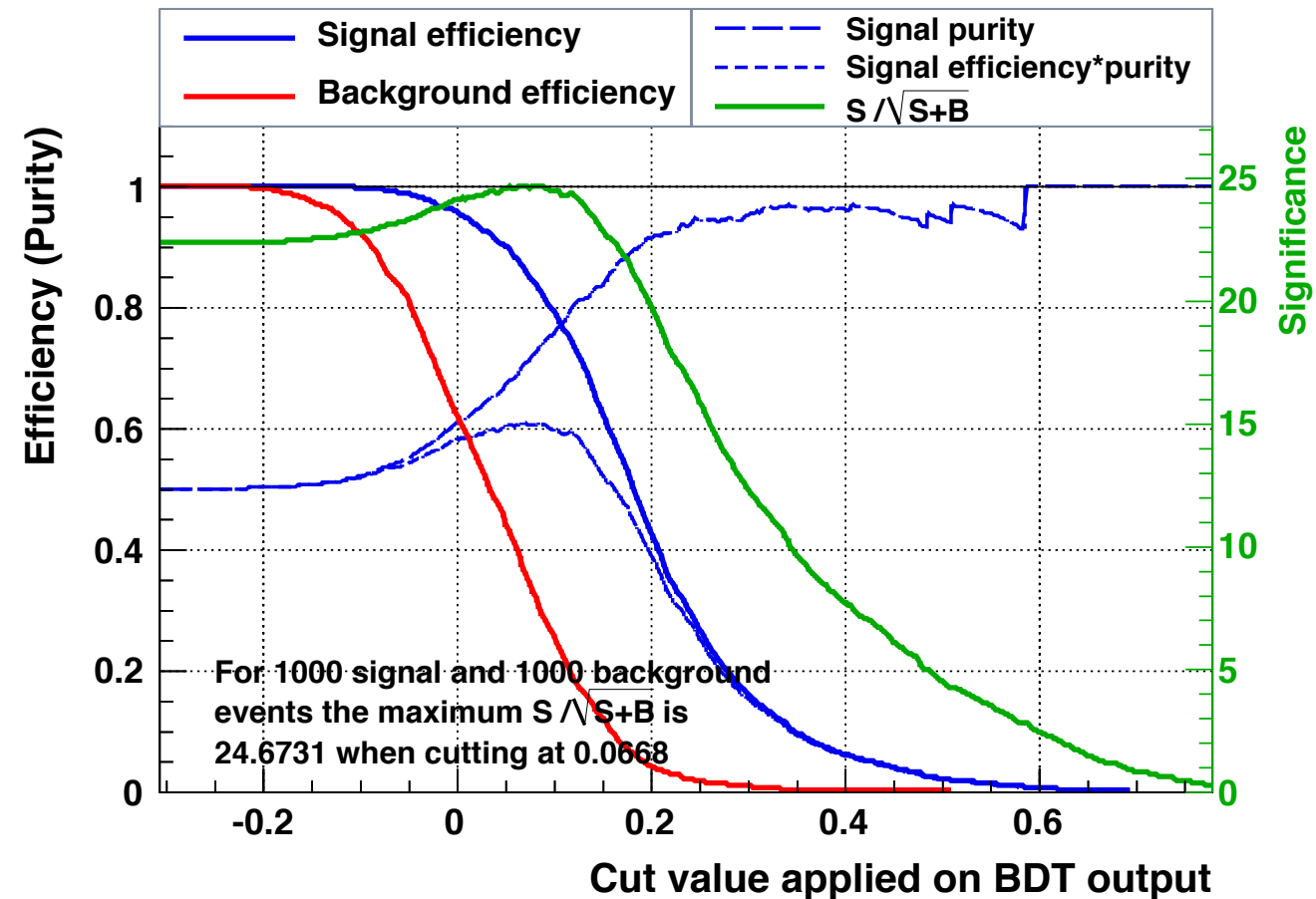
VBF MVA v.s. Top

- Training & Test sample comparison.
- Score cutting efficiency.

TMVA overtraining check for classifier: BDT

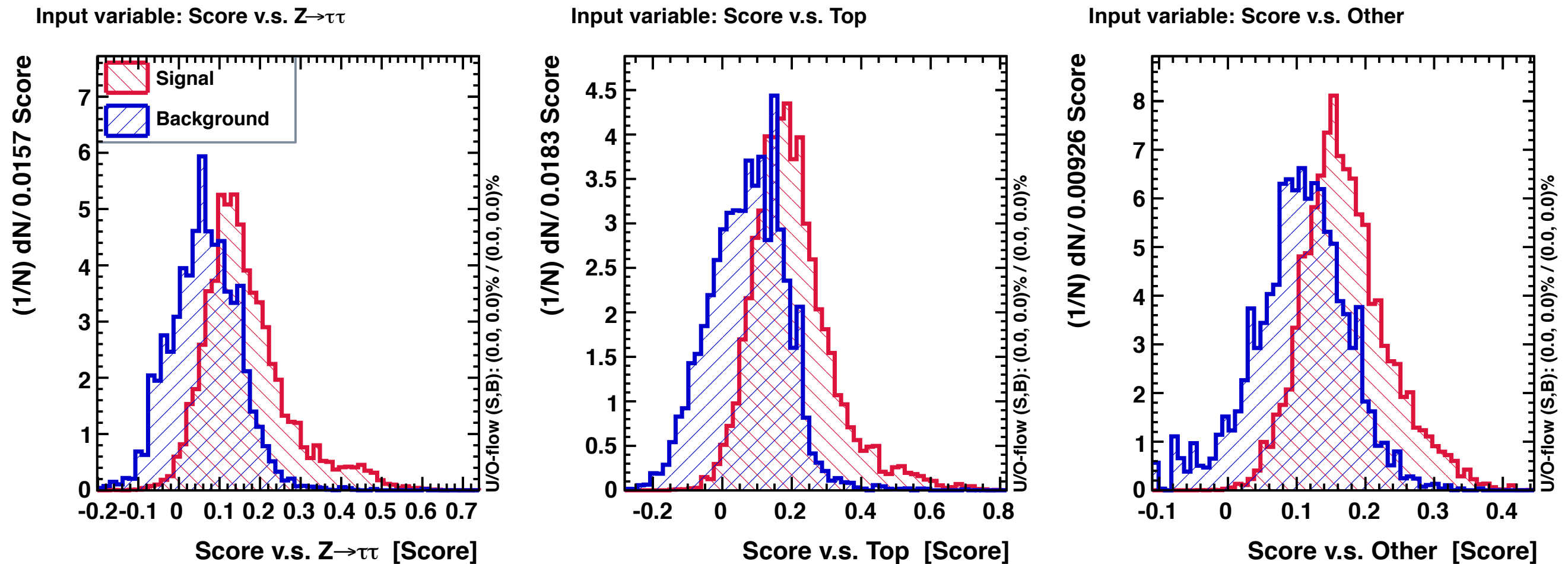


Cut efficiencies and optimal cut value



VBF MVA Combined

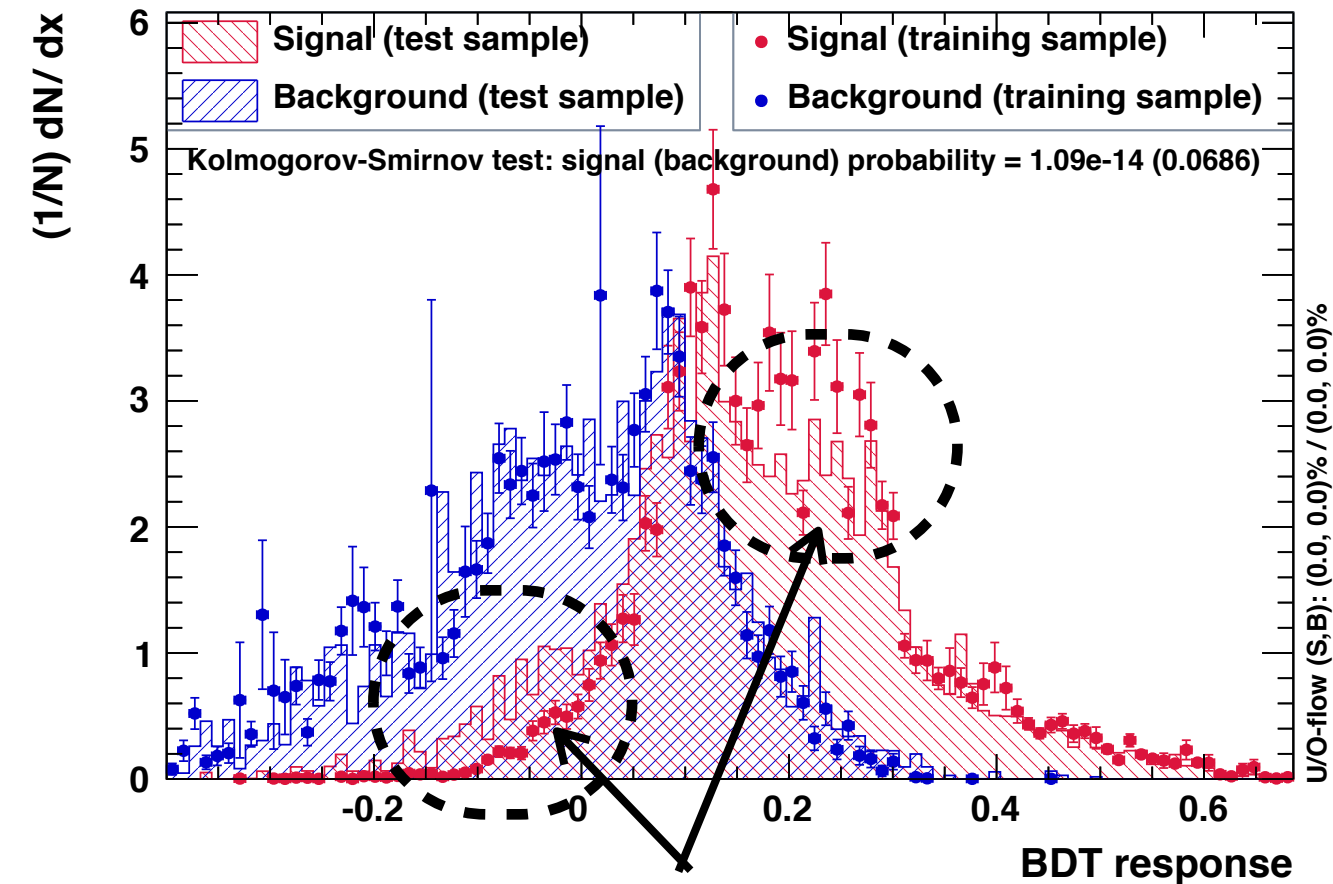
- VBF BDT input variable(three BDT scores)



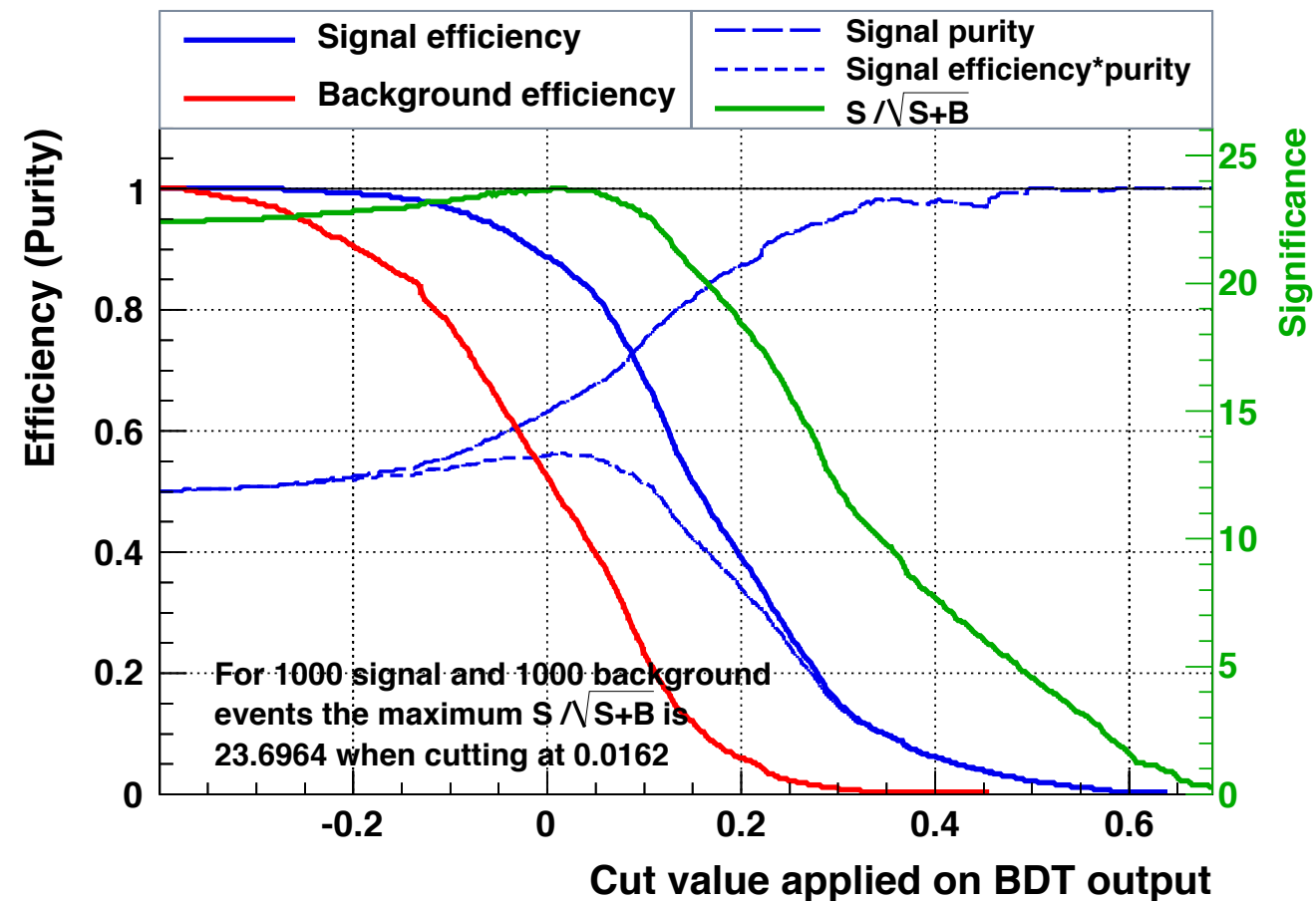
VBF MVA Combined

- Training & Test sample comparison.
- Score cutting efficiency.

TMVA overtraining check for classifier: BDT



Cut efficiencies and optimal cut value



- Not comparison between test and training samples!!

●

Back Up!



The Standard Model

Fermions				Bosons	Force carriers
Quarks	u up	c charm	t top	γ photon	
	d down	s strange	b bottom	Z Z boson	
Leptons	ν_e e neutrino	ν_μ μ neutrino	ν_τ τ neutrino	W W boson	
	e electron	μ muon	τ tau	g gluon	
				H Higgs boson	