

tyq Round table

Ying AN, Hugo Becerril, Abideh Jafari, Maria Aldaya, Andreas Meyer

12 Mar. 2024

Object selection

Good Muon

- Cut-based-tight muon ID and isolation
- $p_T > 30$ GeV for $|\eta| < 2.4$
- Muon rochester correction

Good Electron

- Cut-based-medium electron ID
- $p_T > 35$ GeV for $|\eta| < 2.5$ (remove gap)
- Energy scale and smearing

Veto Lepton

- Muon is with loose ID and loose isolation
- Electron is with veto ID
- $p_T > 15$ GeV and $|\eta| < 2.5$

MET

- MET $p_T > 20$ GeV

Good Photon

- Cut-based-medium photon ID
- Pixel seed veto
- $p_T > 20$ GeV for $|\eta| < 2.5$ (remove gap)
- Energy scale and smearing

Jet

- PF AK4CHS Jets, tight jet ID
- $p_T > 30$ GeV and $|\eta| < 4.7$
- JES & JER correction
- Loose pileup jet ID (for $p_T < 50$ GeV)

b-jet

- $|\eta| < 2.5$
- Medium deepjet working point

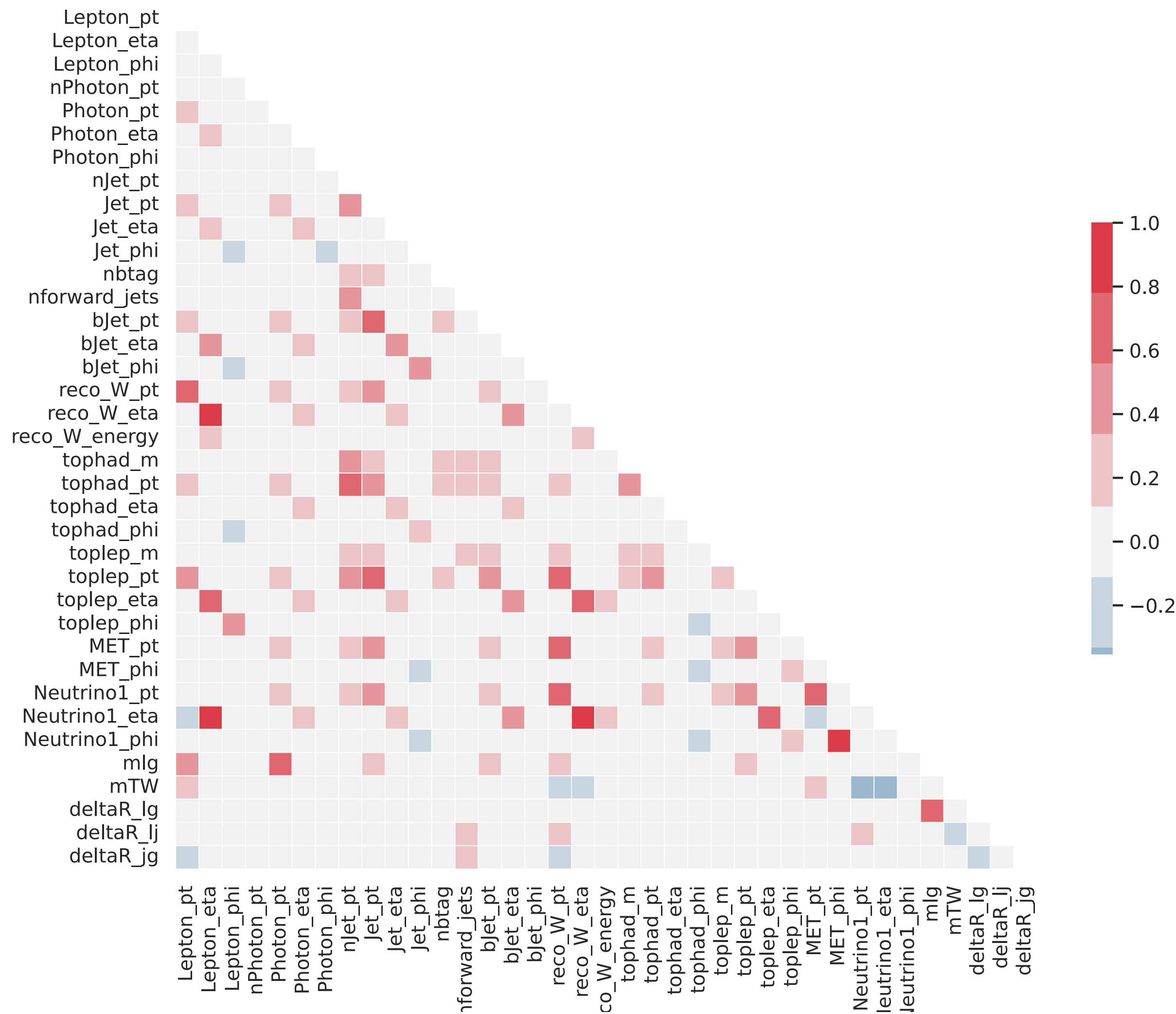
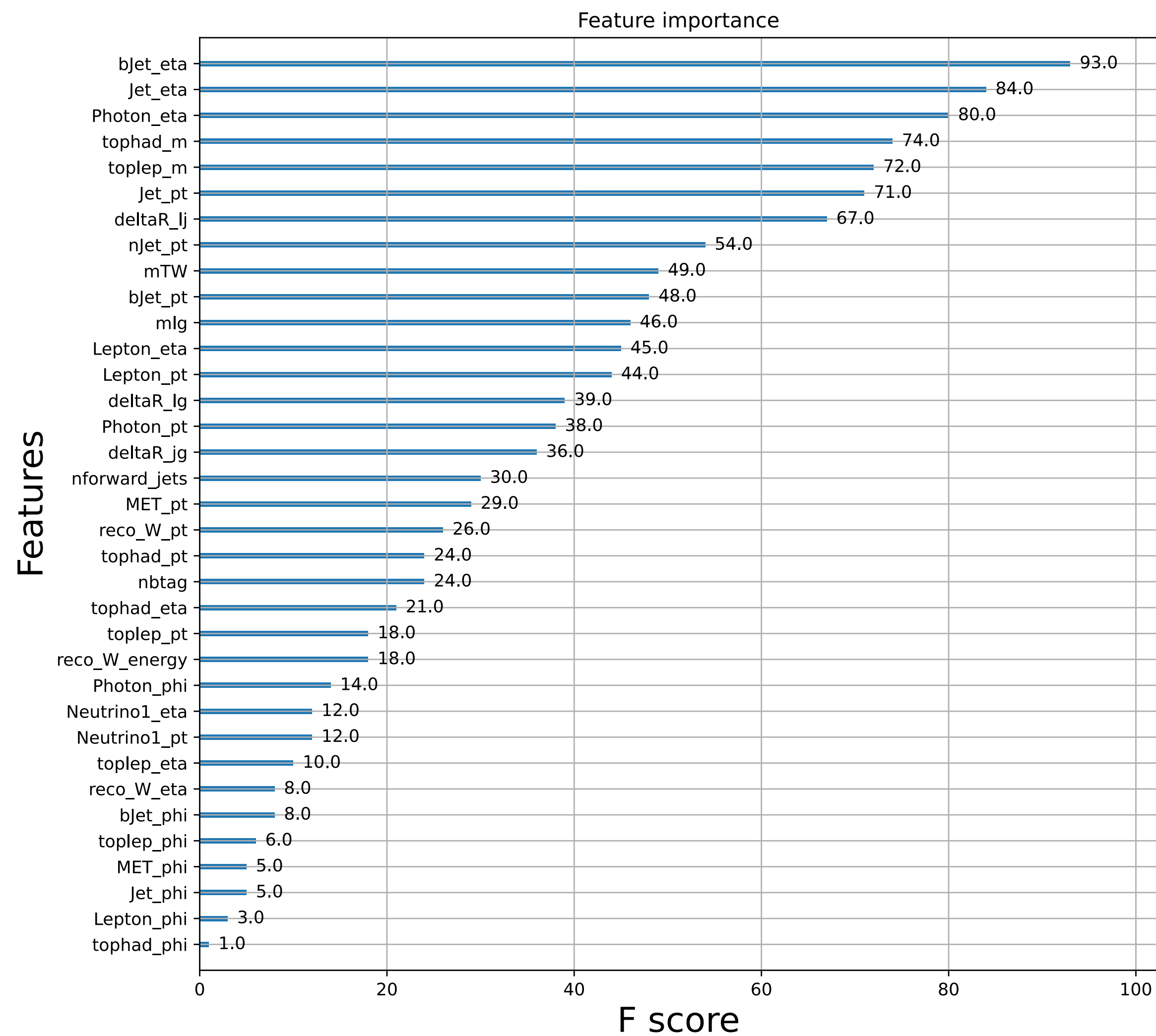
Correction

- Pileup reweighing
- Lepton energy correction → muon Rochester and electron energy scale/smearing
- Lepton ID/ISO/RECO/HLT scale factors
- Photon energy scale/smearing
- Photon ID/Pixel Seed Veto scale factors
- Jet energy correction
- ~~Jet pileup ID scale factors~~
- b-jet ID scale factors

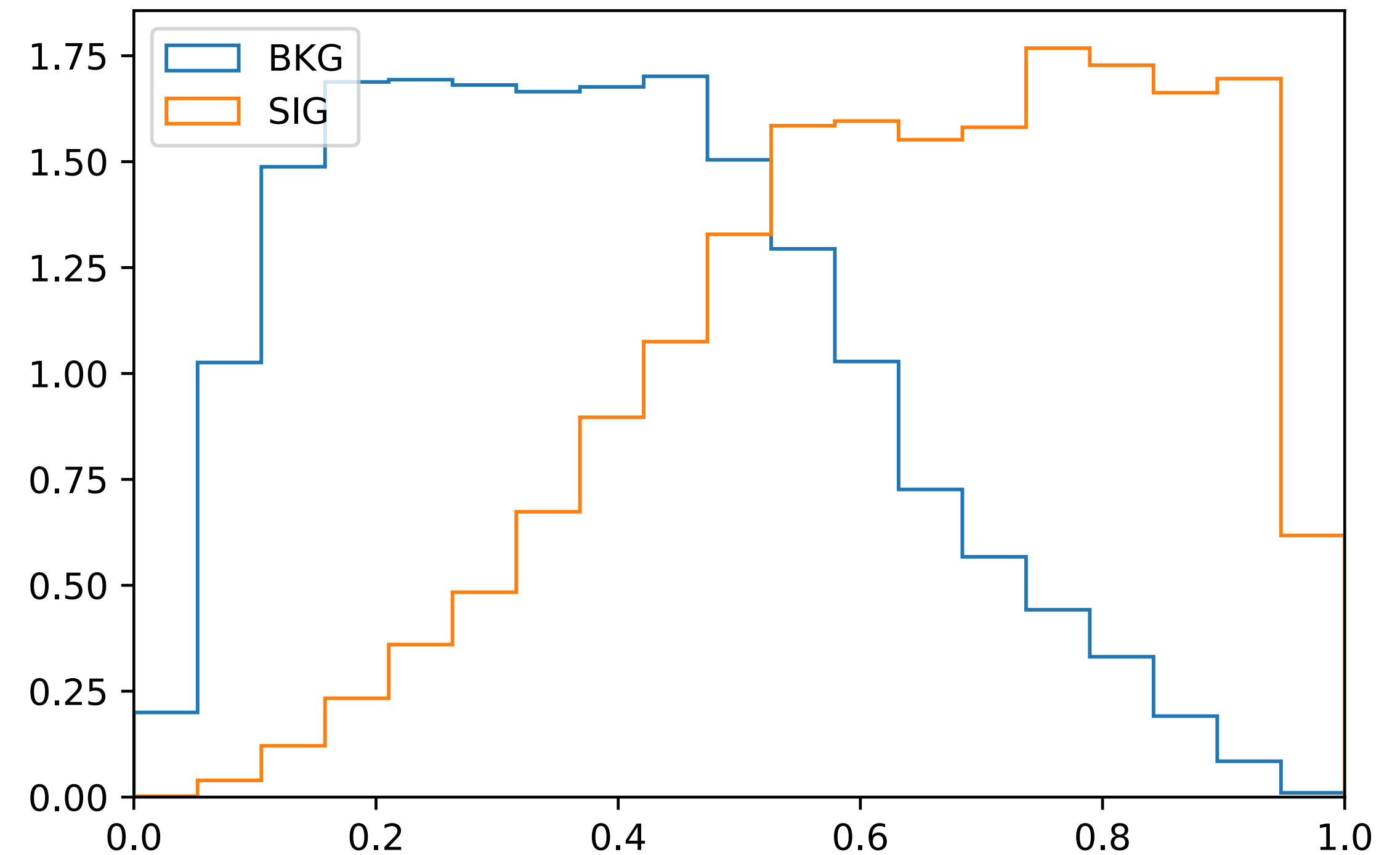
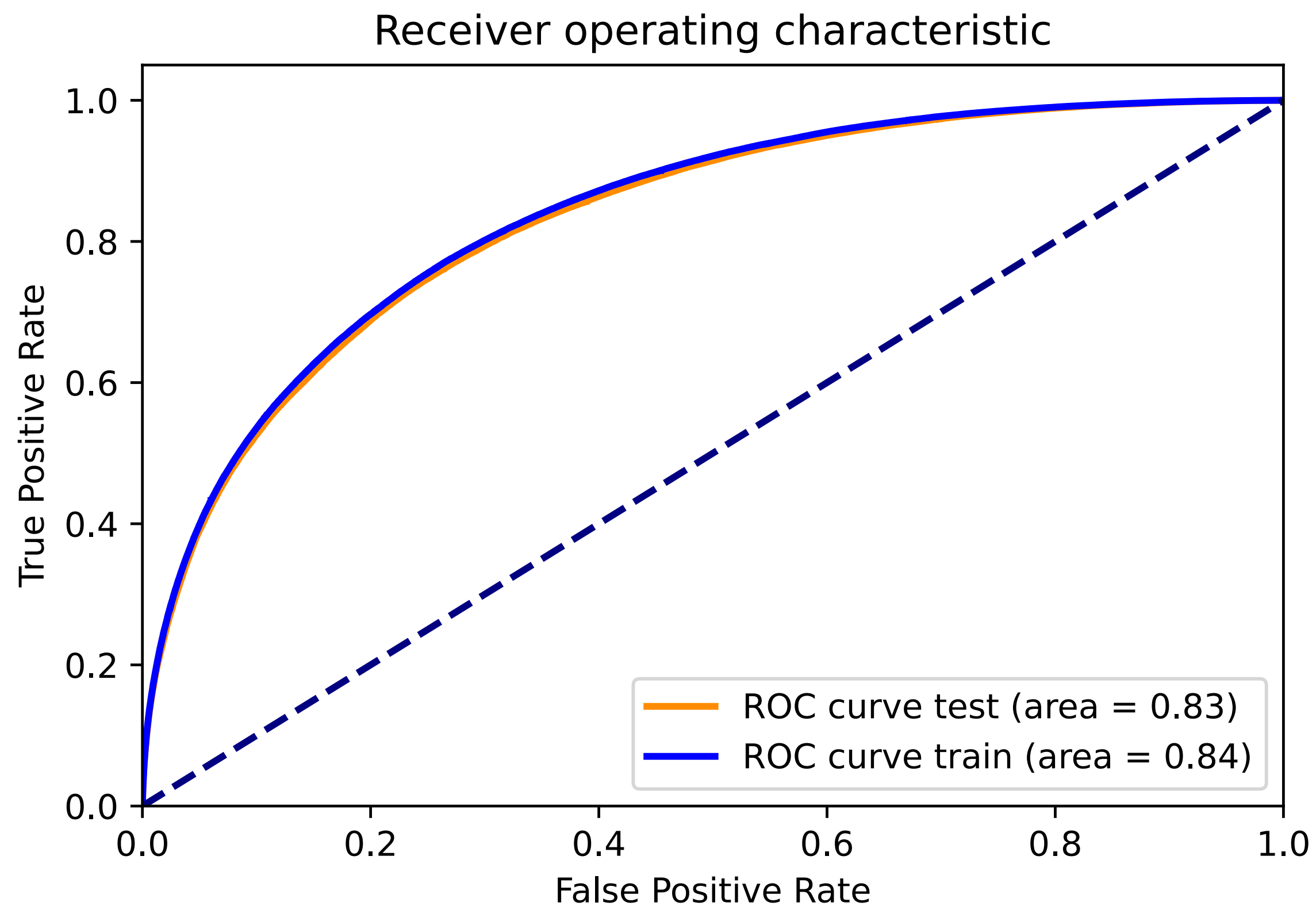
Event selection

- Event pass high-level trigger $HLT_IsoMu24$ for muon channel and $HLT_Ele32_WPTight_Gsf$ for electron channel
- Exactly one lepton
 - Reject events containing extra leptons with veto lepton requirement
- At least one photon
- At least one jet
- At least one b-jet
- $\Delta R(\ell, \gamma) > 0.4, \Delta R(\ell, j) > 0.4, \Delta R(\gamma, j) > 0.4$

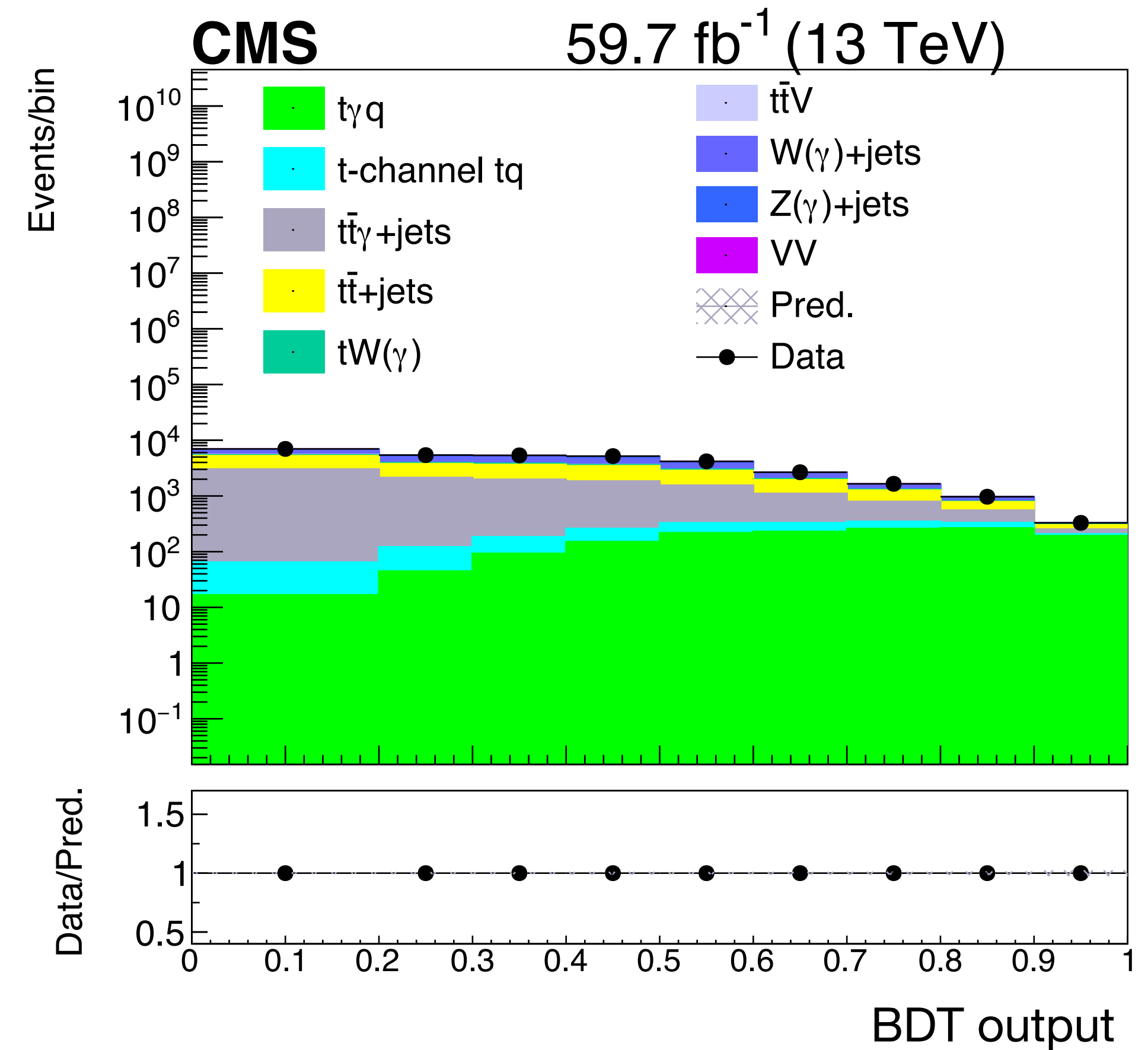
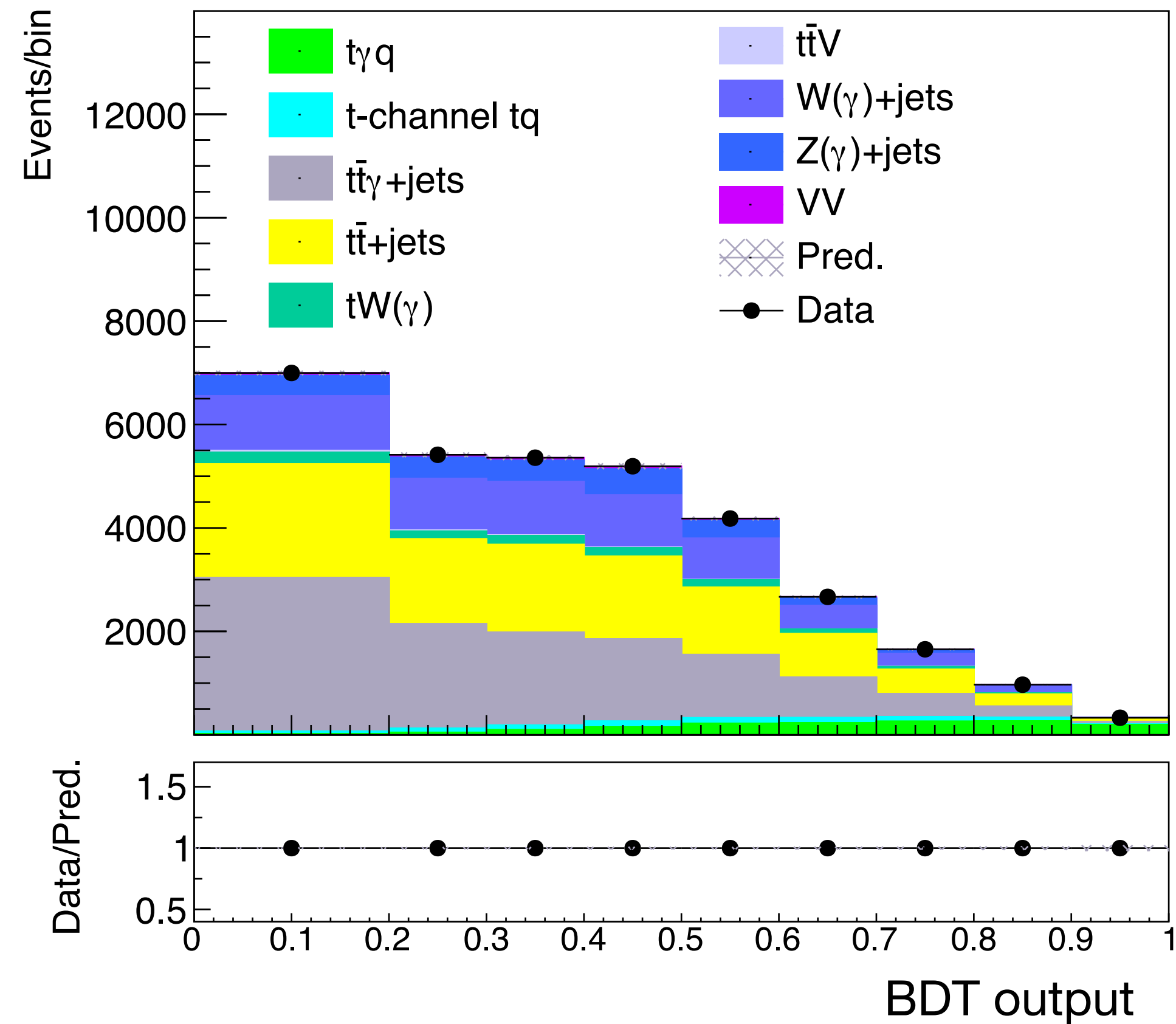
XGBoost training in SR (μ channel)



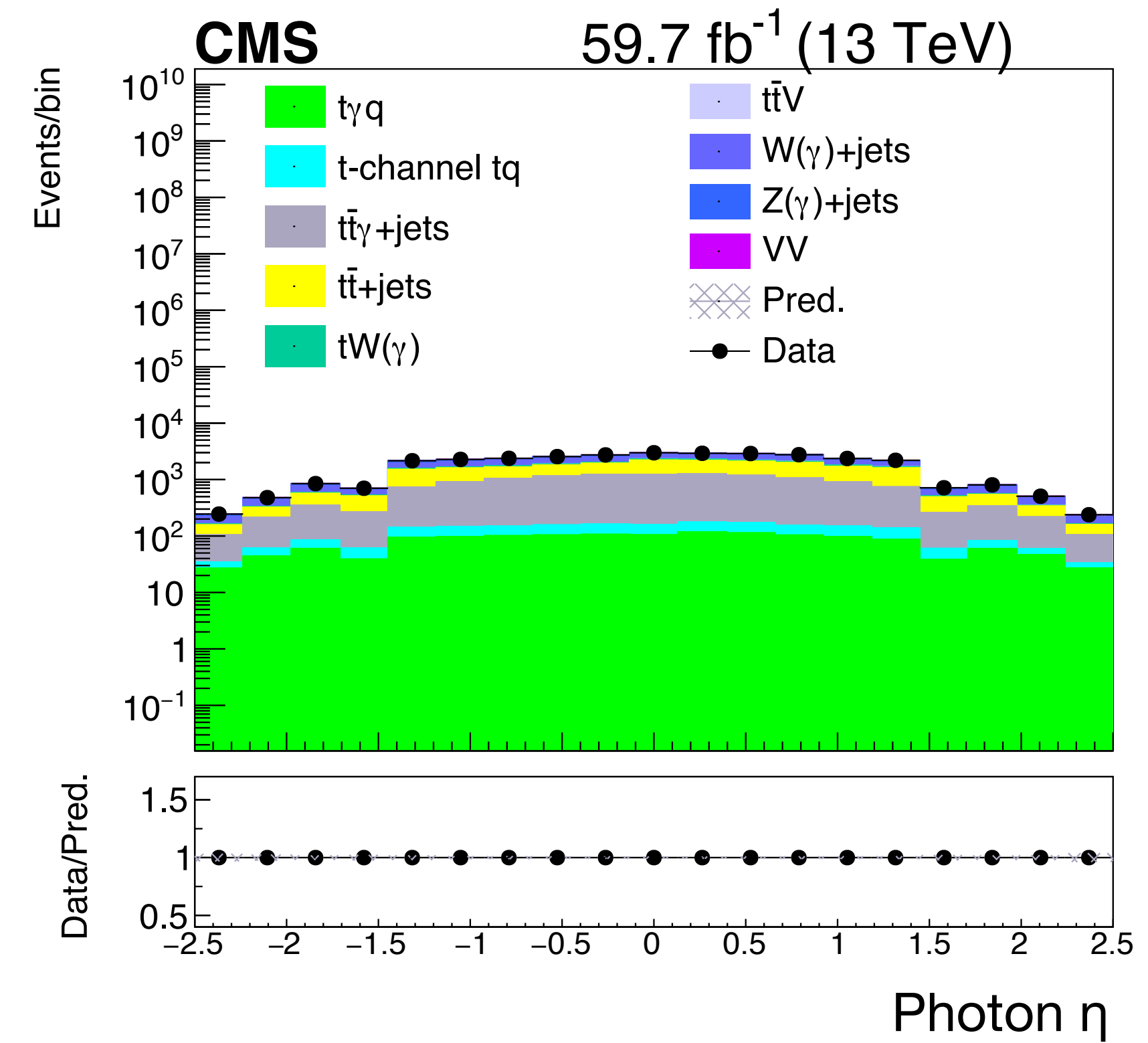
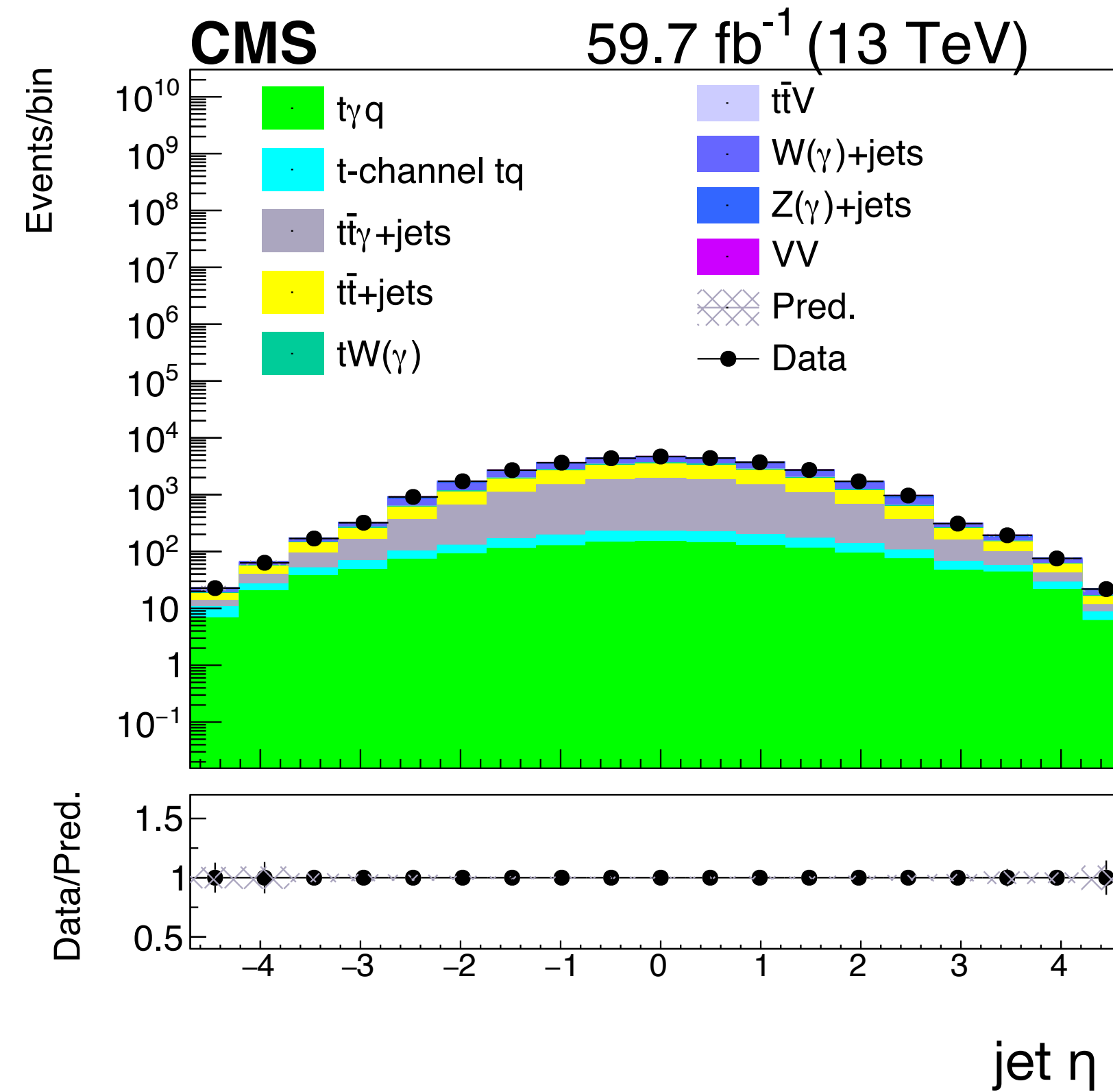
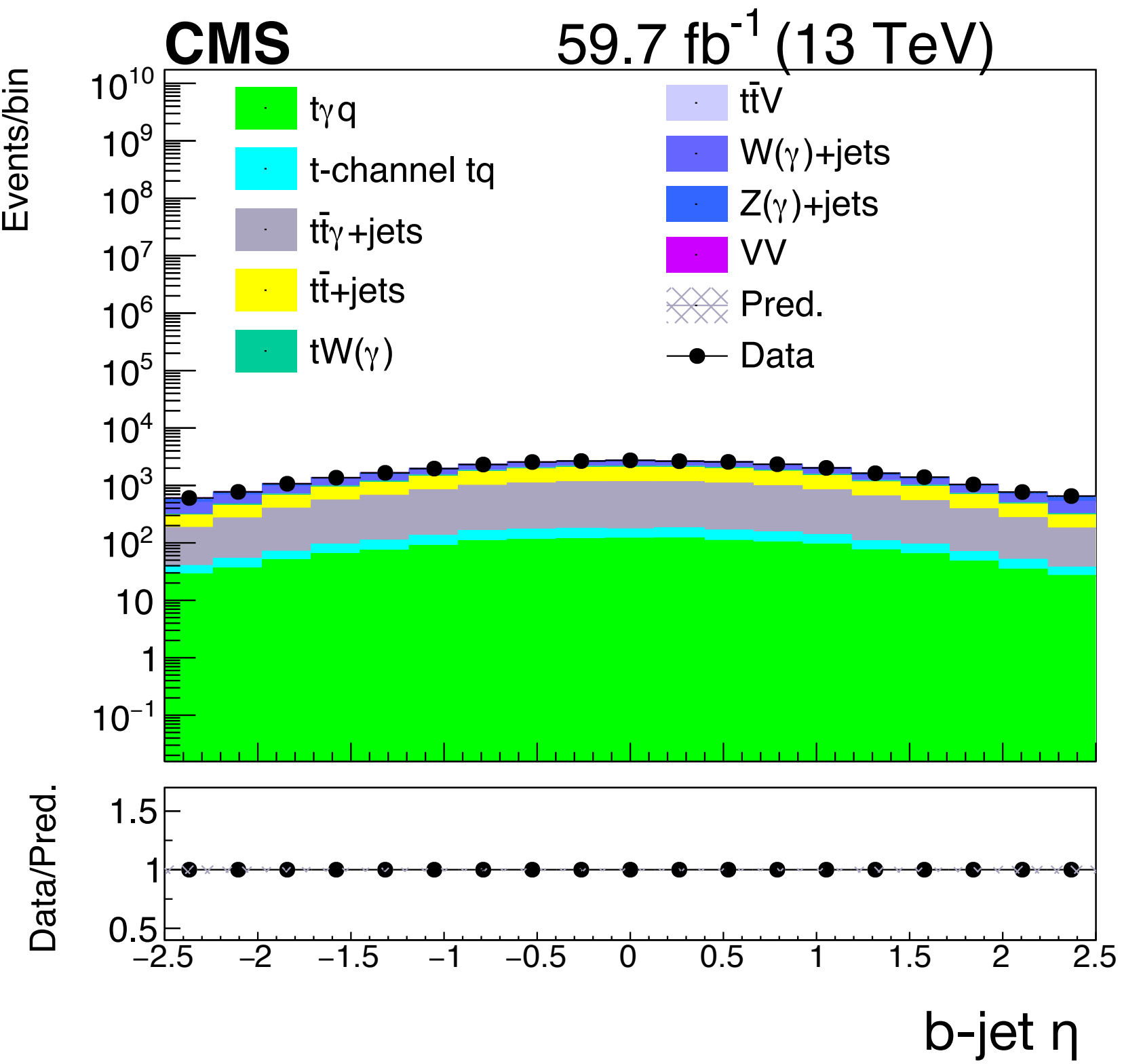
XGBoost training in SR (μ channel)



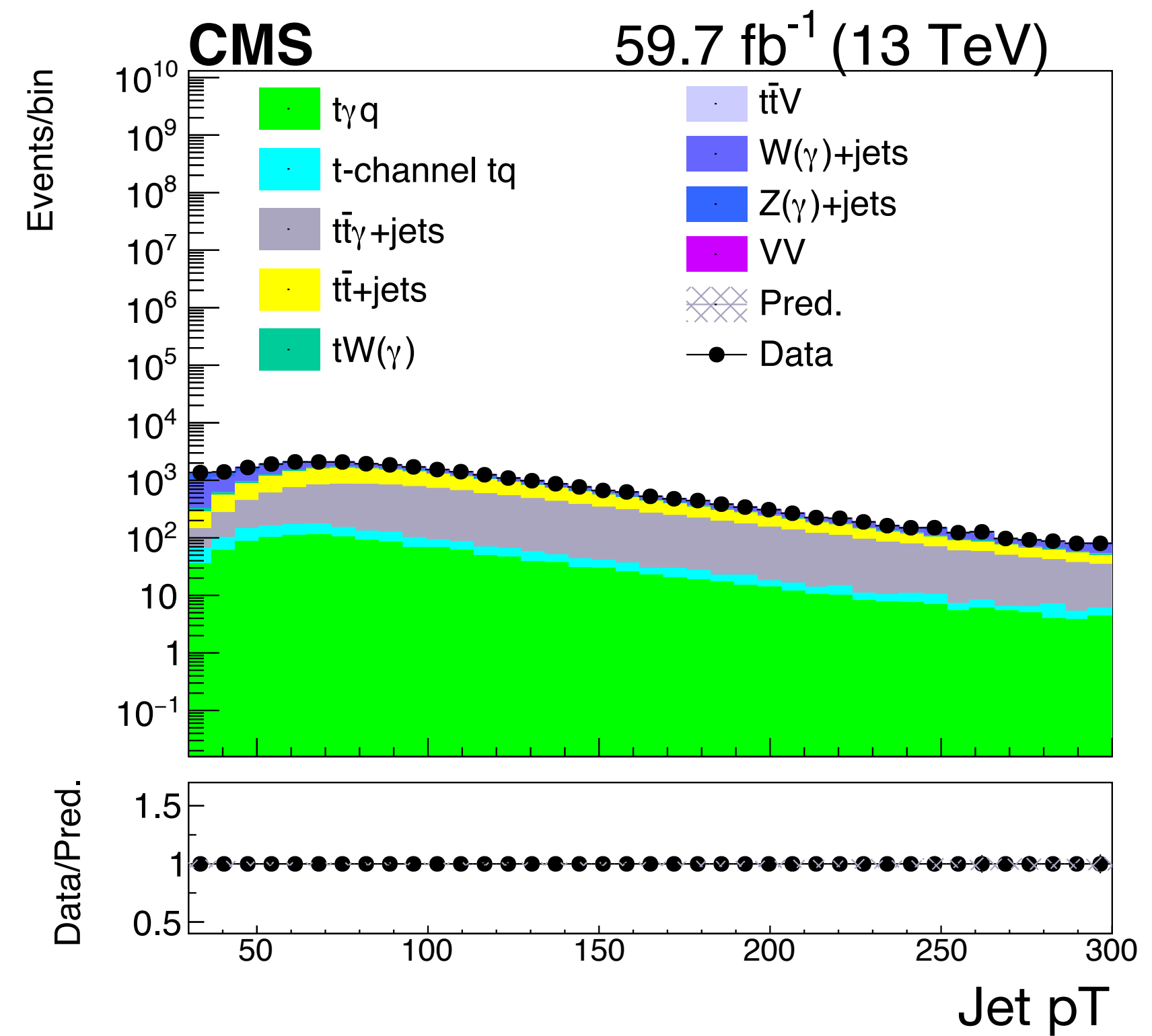
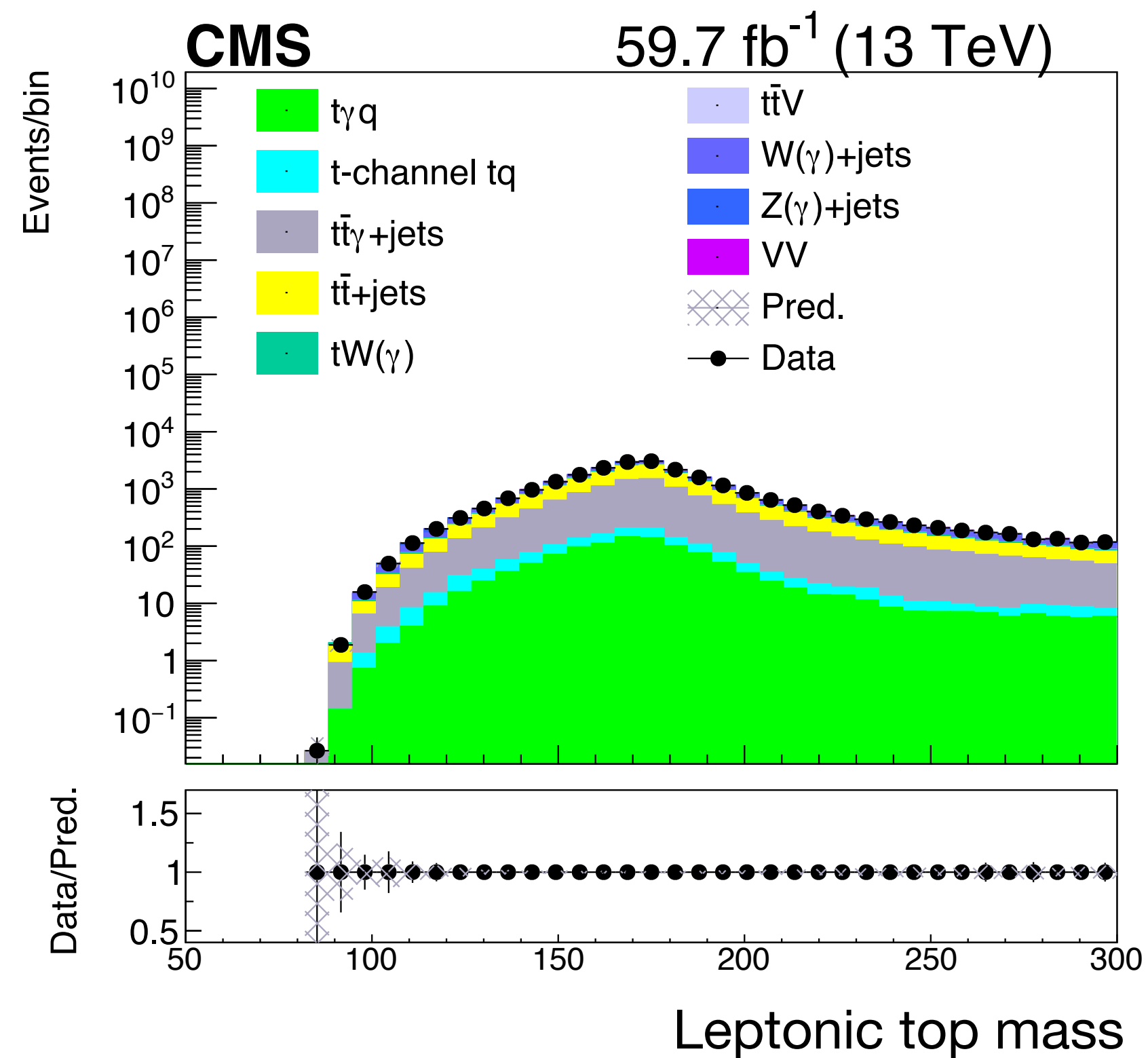
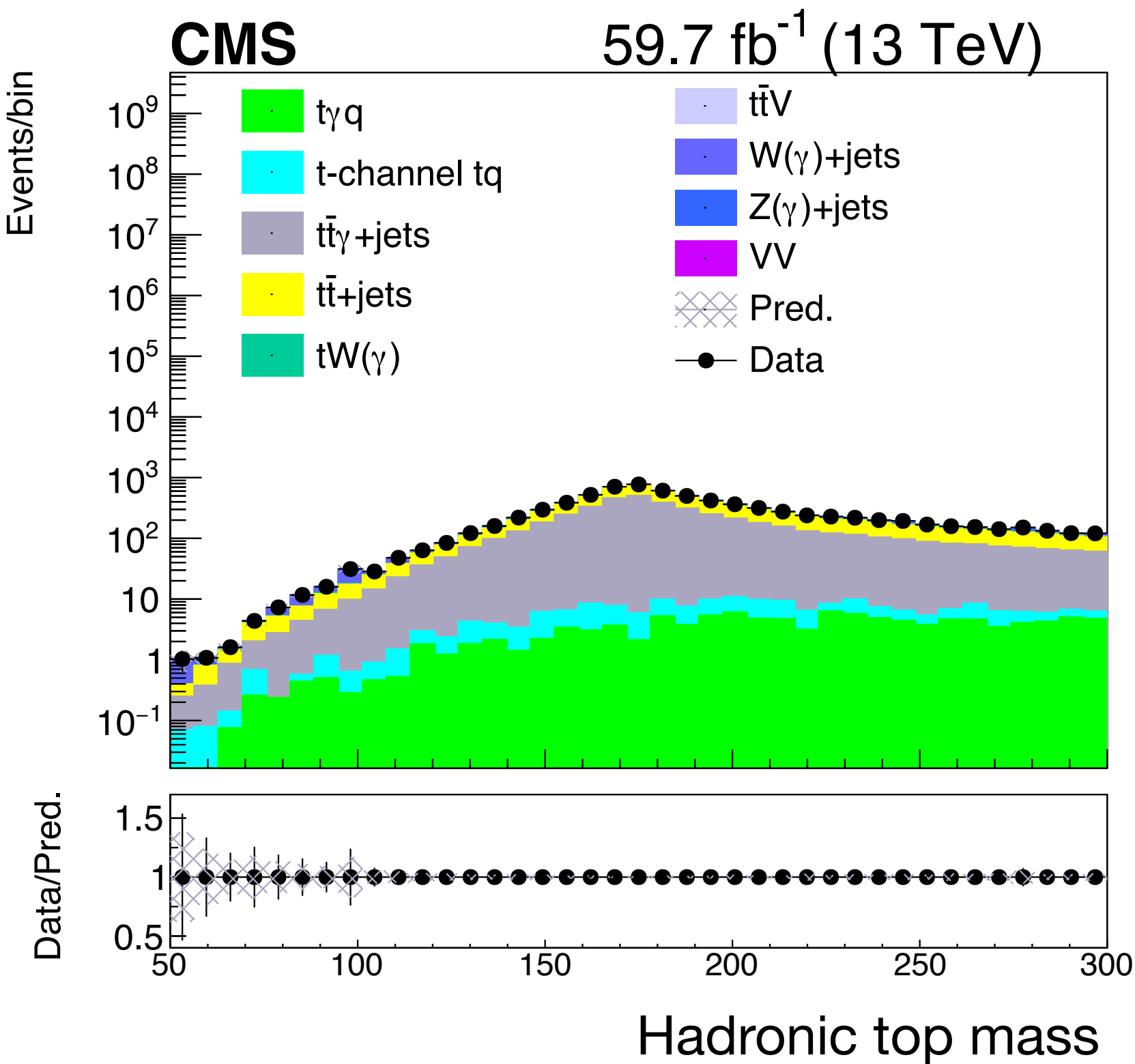
Plots in SR (μ channel)



Plots in SR (μ channel)

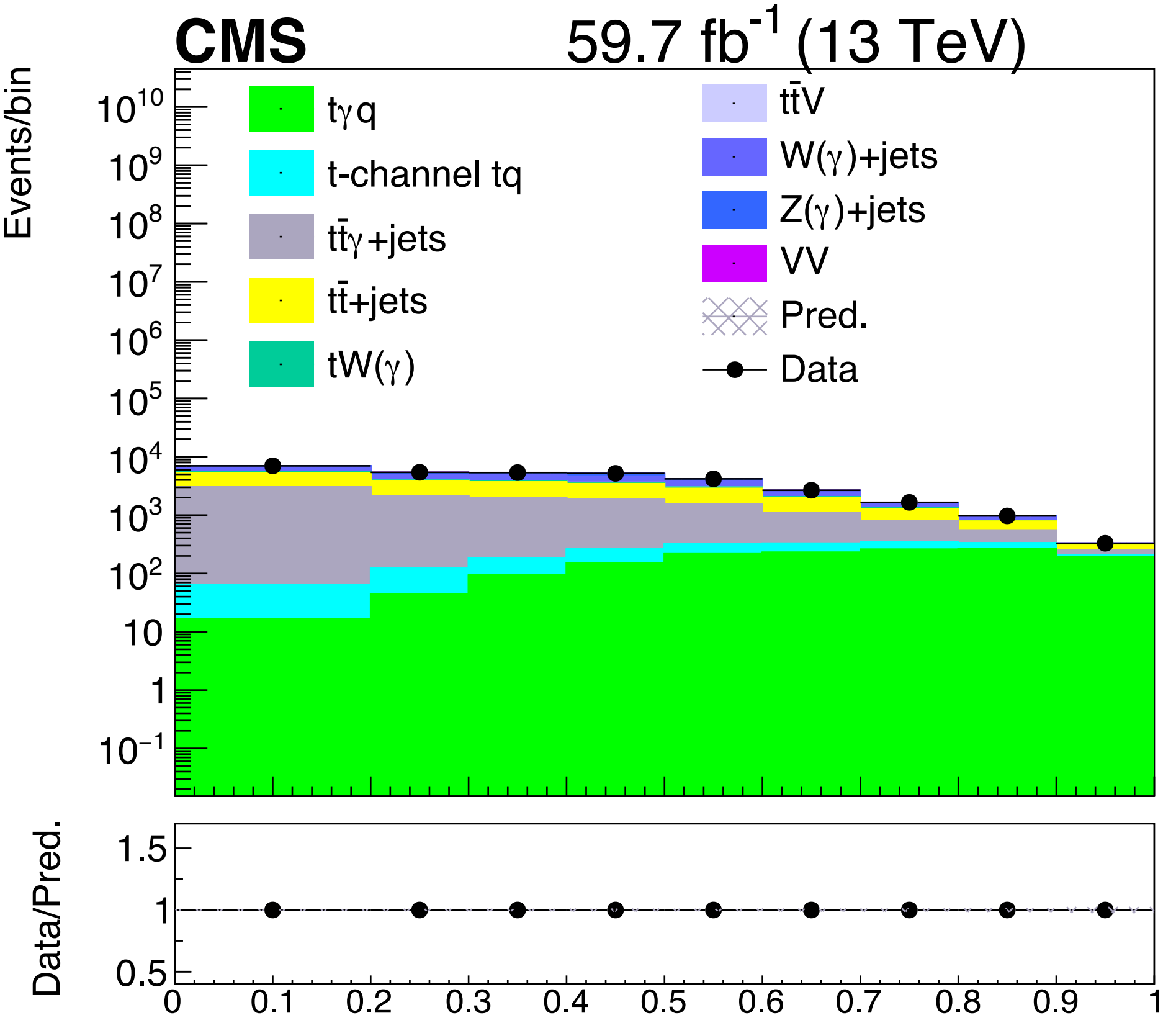


Plots in SR (μ channel)



Likelihood fit in the SR (μ channel)

Theoretical uncertainties (PDF, PS, renormalisation and factorisation)



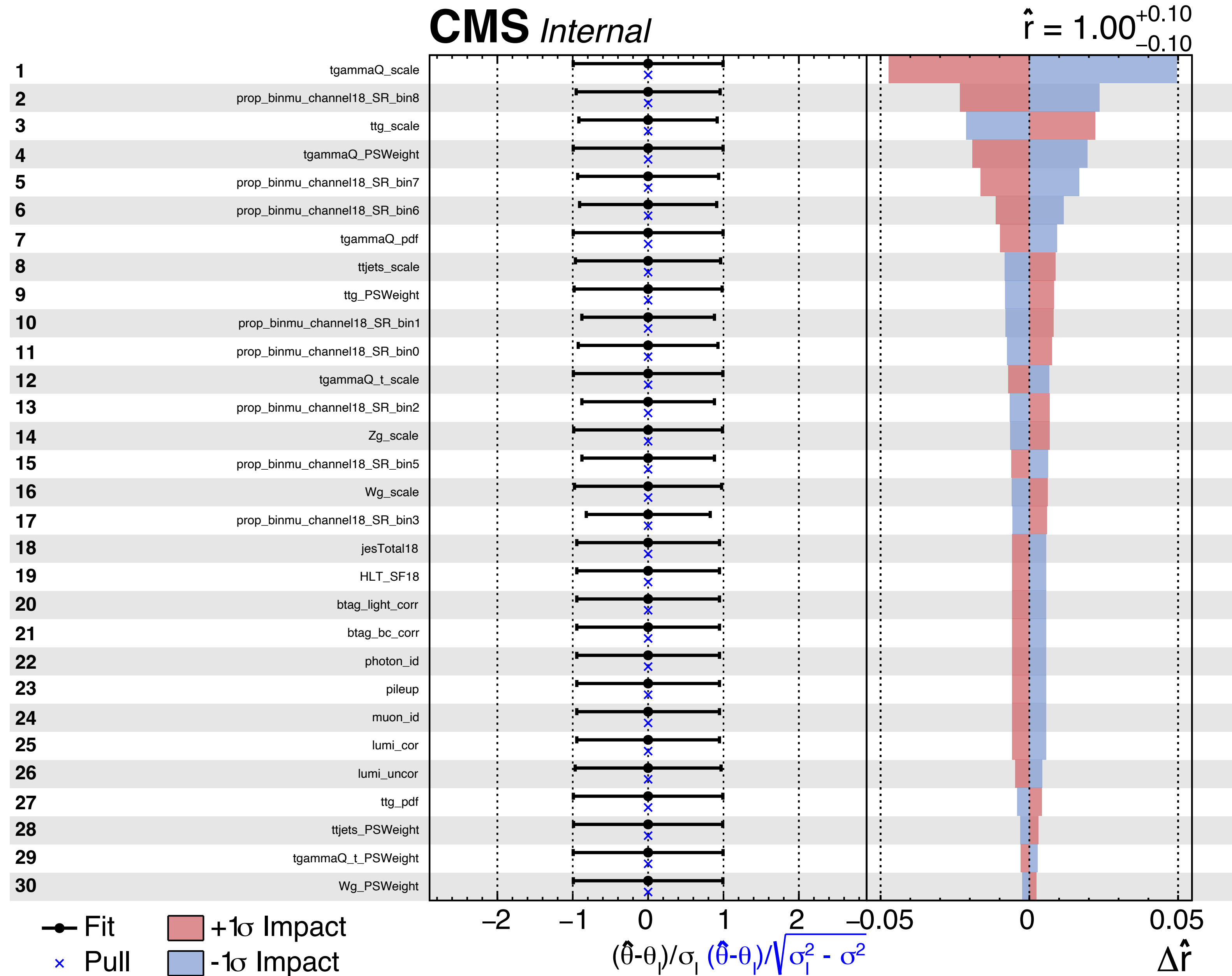
tgammaQ_PSWeight	tgammaQ_pdf	tgammaQ_scale
tgammaQ_t_PSWeight	tgammaQ_t_pdf	tgammaQ_t_scale
ttg_PSWeight	ttg_pdf	ttg_scale
ttjets_PSWeight	ttjets_pdf	ttjets_scale
tWg_PSWeight	tWg_pdf	tWg_scale
ttV_PSWeight	ttV_pdf	ttV_scale
Wg_PSWeight	Wg_pdf	Wg_scale
Zg_PSWeight	Zg_pdf	Zg_scale
VV_PSWeight	VV_pdf	VV_scale
1%	2%	5%

Experimental uncertainties

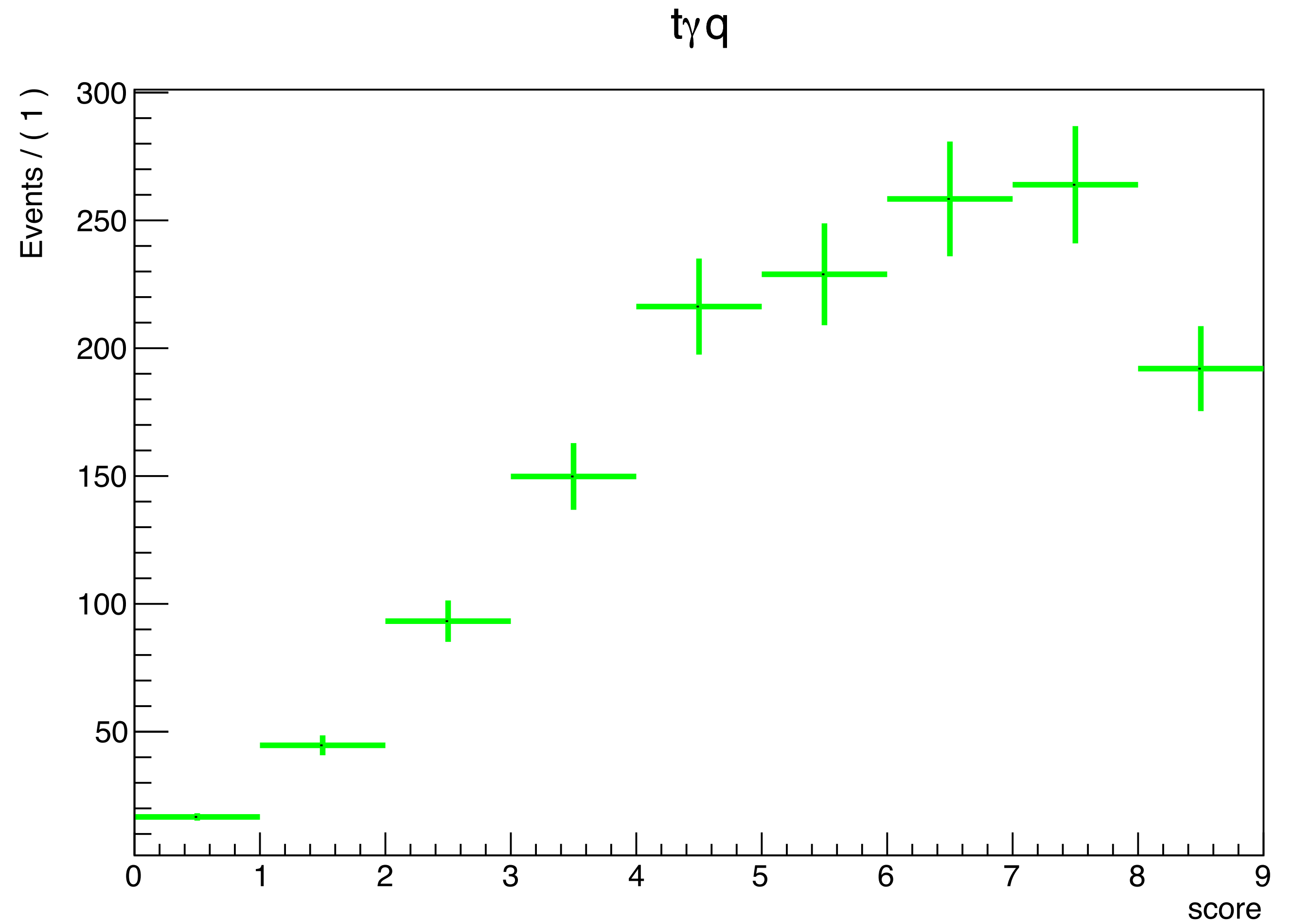
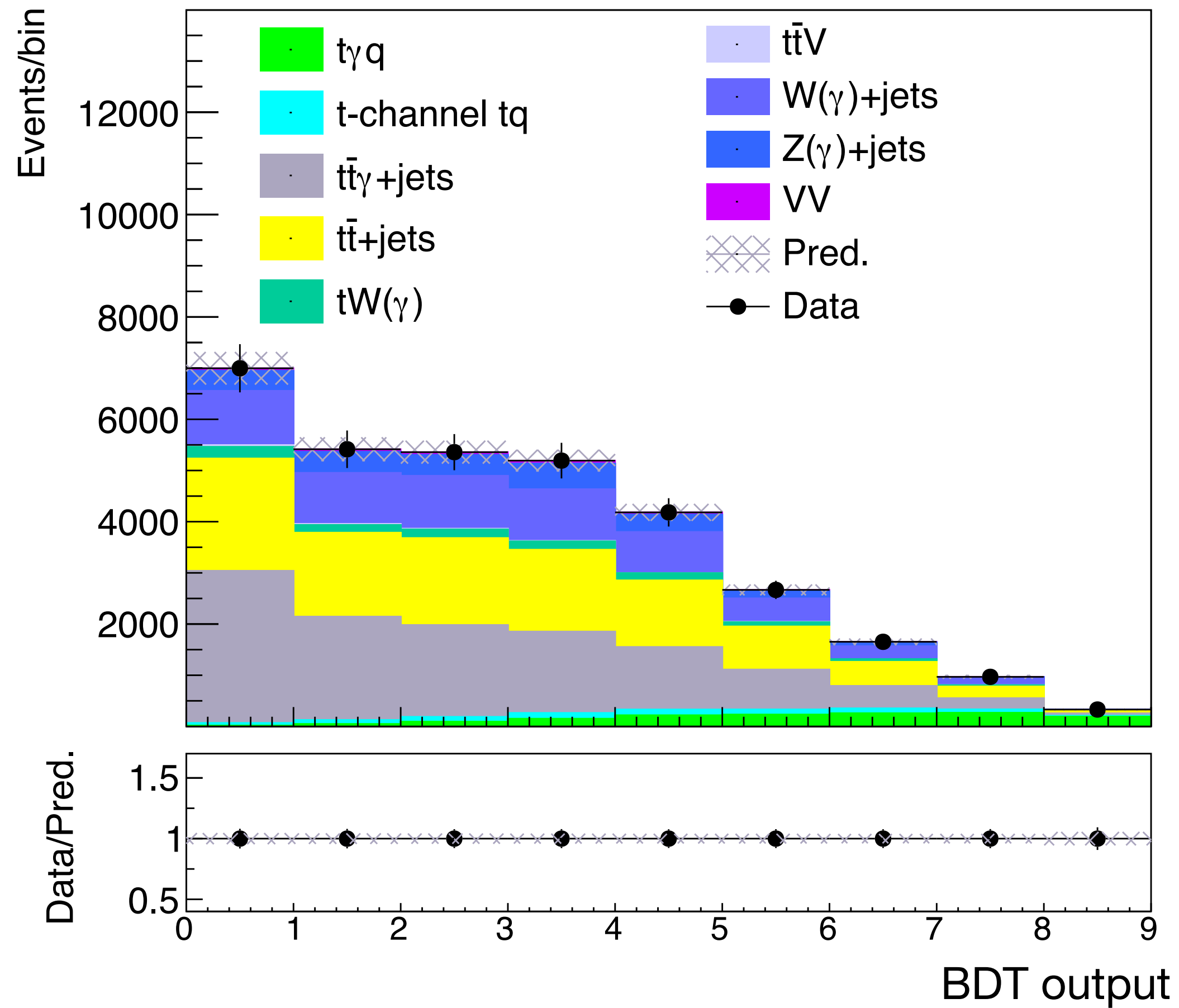
lumi_cor	2%
lumi_uncor	1.5%
pileup	2%
btag_bc_corr	2%
btag_light_corr	2%
muon_id	2%
HLT_SF18	2%
photon_id	2%
jesTotal18	2%

In this BDT distribution and muon channel, all uncertainties are in $\ln N$ style with a flat constant value given, the expected significance is **14.3 σ**

Likelihood fit – impact plot



Likelihood fit — pre-fit plot



Backup

