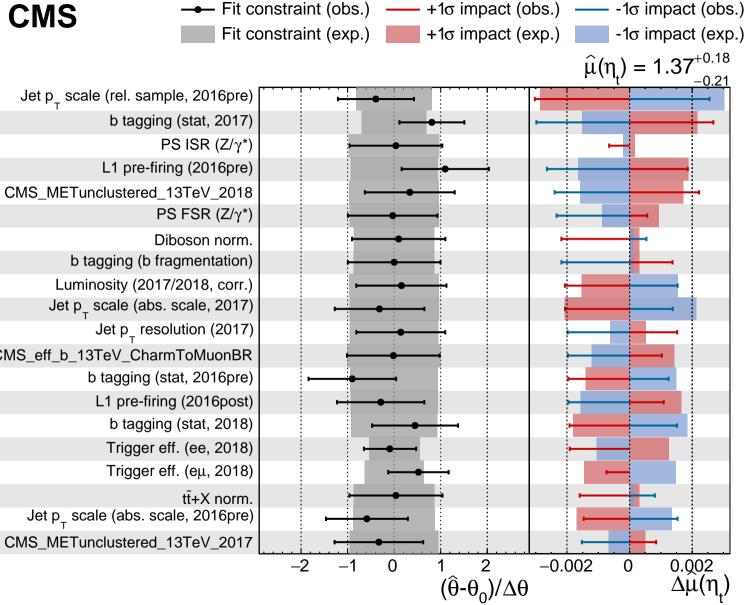
## Fit constraint (obs.) $+1\sigma$ impact (obs.) **CMS** -1σ impact (obs.) Fit constraint (exp.) $+1\sigma$ impact (exp.) -1σ impact (exp.) $\hat{\mu}(\eta_{L}) = 1.37^{+0.18}$ bb4l ( $t\bar{t} + tW$ ) PS FSR (tt) Top quark mass (QCD MC) Top quark Yukawa coupling Pythia vs Herwig (tt) b tagging (light/charm ratio) PS FSR (η) Color reconnection (QCD-inspired) EW correction scheme Luminosity (all years, corr.) b tagging (gluon splitting) Luminosity (2016, uncorr.) **PDF** Jet p<sub>\_</sub> scale (rel. sample, 2018) tW norm. Electron ID eff. Luminosity (2017, uncorr.) Jet p<sub>\_</sub> scale (abs. scale, corr.) Jet p<sub>\_</sub> scale (b flavor response) -2 -0.1 - 0.050.05, 0.1

Fit constraint (obs.)  $+1\sigma$  impact (obs.) -1σ impact (obs.) **CMS** Fit constraint (exp.) +1σ impact (exp.) -1σ impact (exp.)  $\hat{\mu}(\eta_{_{\scriptscriptstyle +}}) = 1.37^{+0.18}$ PDF  $\alpha_s$ Jet p<sub>\_</sub> scale (rel. balance, corr.) hdamp (tt) ME  $\mu_{\rm D}$  (Z/ $\gamma^*$ ) b tagging (relative muon pT) Trigger eff. (μμ, 2016post) Jet p<sub>r</sub> resolution (2016pre) ME  $\mu_{\scriptscriptstyle \square}$  (Z/ $\gamma^*$ ) Trigger eff. (μμ, 2016pre) Jet p<sub>\_</sub> scale (abs. scale, 2018) Jet p<sub>\_</sub> scale (non-b flavor response) PS ISR (tt) b tagging (AwayJetTag) econnection (Early resonance decays) Trigger eff. (µµ, 2018) b-tag misidentification (corr.) Trigger eff. (eµ, 2016pre) Pileup b tagging (particle lifetime) b tagging (charm template) 0.01 Δμ̂(η, -2 -0.01

## Fit constraint (obs.) +1σ impact (obs.) -1σ impact (obs.) **CMS** Fit constraint (exp.) $+1\sigma$ impact (exp.) -1σ impact (exp.) $\hat{\mu}(\eta_{L}) = 1.37^{+0.18}$ L1 pre-firing (2017) Jet $p_{_{\rm T}}$ scale (rel. sample, 2016post) ME $\mu_{E}$ (t+X) Trigger eff. (µµ, 2017) CMS eff b 13TeV MuonDeltaR $ME \mu_{r} (t\bar{t})$ Muon isolation eff. (syst) Electron reconstruction eff. Trigger eff. (eµ, 2016post) PS ISR (η) Trigger eff. (ee, 2016pre) $Z/\gamma^*$ norm. $ME \mu_{D} (t\bar{t})$ Trigger eff. (ee, 2016post) Trigger eff. (ee, 2017) Trigger eff. (eµ, 2017) b-tag misidentification (2018) Luminosity (2018, uncorr.) b tagging (b template) $ME \mu_{L}(\eta_{L})$ 0.005 -2 -0.005



## CMS

Fit constraint (obs.)  $-1\sigma$  impact (obs.)  $-1\sigma$  impact (obs.) Fit constraint (exp.)  $+1\sigma$  impact (exp.)  $-1\sigma$  impact (exp.)  $\widehat{\mu}(\eta_t) = 1.37^{+0.18}_{-0.21}$  b tagging (stat, 2016post) ale (abs. scale, 2016post) PS ISR (t+X) clustered\_13TeV\_2016pre

Jet p<sub>\_</sub> scale (abs. scale, 2016post) MS\_METunclustered\_13TeV\_2016pre Jet p<sub>resolution</sub> (2018) Jet  $p_{\scriptscriptstyle \perp}$  scale (BBEC1, 2016post) b-tag misidentification (2017) Muon ID eff. (syst) b-tag misidentification (2016post) b tagging (pileup) CMS eff b 13TeV JEC Jet  $p_{_{\rm T}}$  scale (BBEC1, 2017) t-channel single-top norm. b tagging (charm fragmentation) Jet p<sub>\_</sub> scale (BBEC1, 2018) Muon isolation eff. (stat, 2017) Muon ID eff. (stat, 2018) Jet p<sub>\_</sub> scale (BBEC1, 2016pre) PS tune Muon ID eff. (stat, 2016pre) 0.001 0.002 -2 2 -0.002-0.001

- Fit constraint (obs.) —— +1σ impact (obs.) —— -1σ impact (obs.) **CMS** Fit constraint (exp.)  $+1\sigma$  impact (exp.) -1σ impact (exp.)  $\hat{\mu}(\eta_{\star}) = 1.37^{+0.18}$ Muon isolation eff. (stat, 2016post) Muon ID eff. (stat, 2017) S METunclustered 13TeV 2016post Muon isolation eff. (stat, 2016pre) Muon ID eff. (stat, 2016post) b-tag misidentification (2016pre) CMS\_eff\_b\_13TeV\_JPCorrection PS ISR (A/H int.) PS ISR (A/H res.) CMS\_eff\_b\_13TeV\_MuonPt EWK const ME  $\mu_{\scriptscriptstyle E}$  (A/H int.) ME  $\mu_{\scriptscriptstyle E}$  (A/H res.) ME  $\mu_{\scriptscriptstyle D}$  (A/H int.) ME  $\mu_{_{\!R}}$  (A/H res.) b tagging (VzeroParticles) PS FSR (A/H int.) PS FSR (A/H res.) Jet p<sub>\_</sub> scale (rel. sample, 2017) s-channel single-top norm. -2 -0.5

