Event selection

• 1 isolated muon ($p_{\rm T} > 26 \text{ GeV}$) or electron ($p_{\rm T} > 35 \text{ GeV}$) • 2 or 3 anti- k_{T} jets ($p_{T} > 40$ GeV, $|\eta| < 4.7$) • based on 2016 pp collision data set at 13 TeV (35.9 fb^{-1}) top quark candidate reconstructed in signal region (2 jets, 1 b-tag) using W boson mass constraint control regions: 2 jets, 0 b-tags (W+jet enrichted) & 3 jets, 2 b-tags (tt enriched)

Matthias Komm (CERN)



Measurement strategy

 multijet background estimated from data sideband region • signal t & \overline{t} yields estimated through fit to $m_T(W)$ & 2 BDTs: - BDT_{t-ch} trained to separate signal from all backgrounds – $BDT_{t\overline{t}/W}$ trained to distingush between $t\overline{t}$ & W+jets only • experimental systematic uncertainties profiled in the fit • resulting signal yields \vec{y} & covariance matrix V_y passed to TUnfold to determine cross sections at the parton & particle level $\chi^2 = \left(\vec{y} - \boldsymbol{R}\boldsymbol{\epsilon}\vec{x}\right)^{\mathrm{T}}\boldsymbol{V}_y^{-1}\left(\vec{y} - \boldsymbol{R}\boldsymbol{\epsilon}\vec{x}\right) + \tau^2 \left\|\boldsymbol{L}(\vec{x} - \vec{x}_0)\right\|^2 + \lambda \sum_i \left(\vec{y} - \boldsymbol{R}\boldsymbol{\epsilon}\vec{x}\right)_i$ regularisation

35.9 fb⁻¹ (13 TeV) 35.9 fb⁻¹ (13 TeV) CMS CMS 60000 - $(\mu^{\pm}, e^{\pm}) + 2j1b$ • Data $(\mu^{\pm}, e^{\pm}) + 2j1b$ Data $m_T(W) > 50 \text{ GeV}$ $m_T(W) > 50 \text{ GeV}, BDT_{t-ch} < 0$ t channel t channe 40000



Cross sections

 absolute & normalised cross sections at the parton & particle level • observables: top quark $p_{\rm T}$ & rapidity; charged lepton $p_{\rm T}$ & rapidity; W boson $p_{\rm T}$; polarisation angle (= angle between charged lepton and spectator quark momenta in top quark rest frame) • largest uncertainties: parton shower & color reconnection modelling, data statistics, PDF, jet energy scale & resolution data described well by predictions in the 4 flavour scheme (FS)

Charge ratios

 calculate from differential t and t+t cross sections sensitive to valence quark composition of the proton correlations accounted for by unfolding t and t simultaneously results well in agreement with predictions





Top quark polarisation

300

• foward-backward asymmetry $A = (N_{\uparrow} - N_{\downarrow})/N_{tot}$ of $\cos \theta_{pol}^{\star}$ sensitive to $\mathcal{L}_{Wtb} = \bar{b} (\gamma_{\mu} - \gamma_{\mu} \gamma_5) W^{\mu} t$ coupling structure ($A_{Powheg}^{SM} = 0.436$) VA

• asymmetry estimated from $d\sigma/d\cos\theta_{\rm pol}^{\star}$ through linear χ^2 -fit:

 $A = 0.440 \pm 0.031 \text{ (stat+exp)} \pm 0.063 \text{ (theo)}$ $= 0.440 \pm 0.070$

