

χ^2 minimization on top reconstruction in $t\bar{t}$ and tX productions

DESY CMS TOP Reconstruction Discussion

Ying AN on behalf of several analyses

July 1st 2025

Overview

Neutrino reconstruction:

$$p_{z,\nu}^{\pm} = \frac{\mu p_{z,l}}{p_{T,l}^2} \pm \sqrt{\frac{\mu^2 p_{z,l}^2}{p_{T,l}^4} - \frac{E_l^2 p_{T,\nu}^2 - \mu^2}{p_{T,\nu}^2}}, \quad \mu = \frac{m_W^2}{2} + \vec{p}_T^{\ell} \cdot \vec{p}_T^{\nu}$$

Imaginary solution: take the real part
Real solution: take the best χ^2

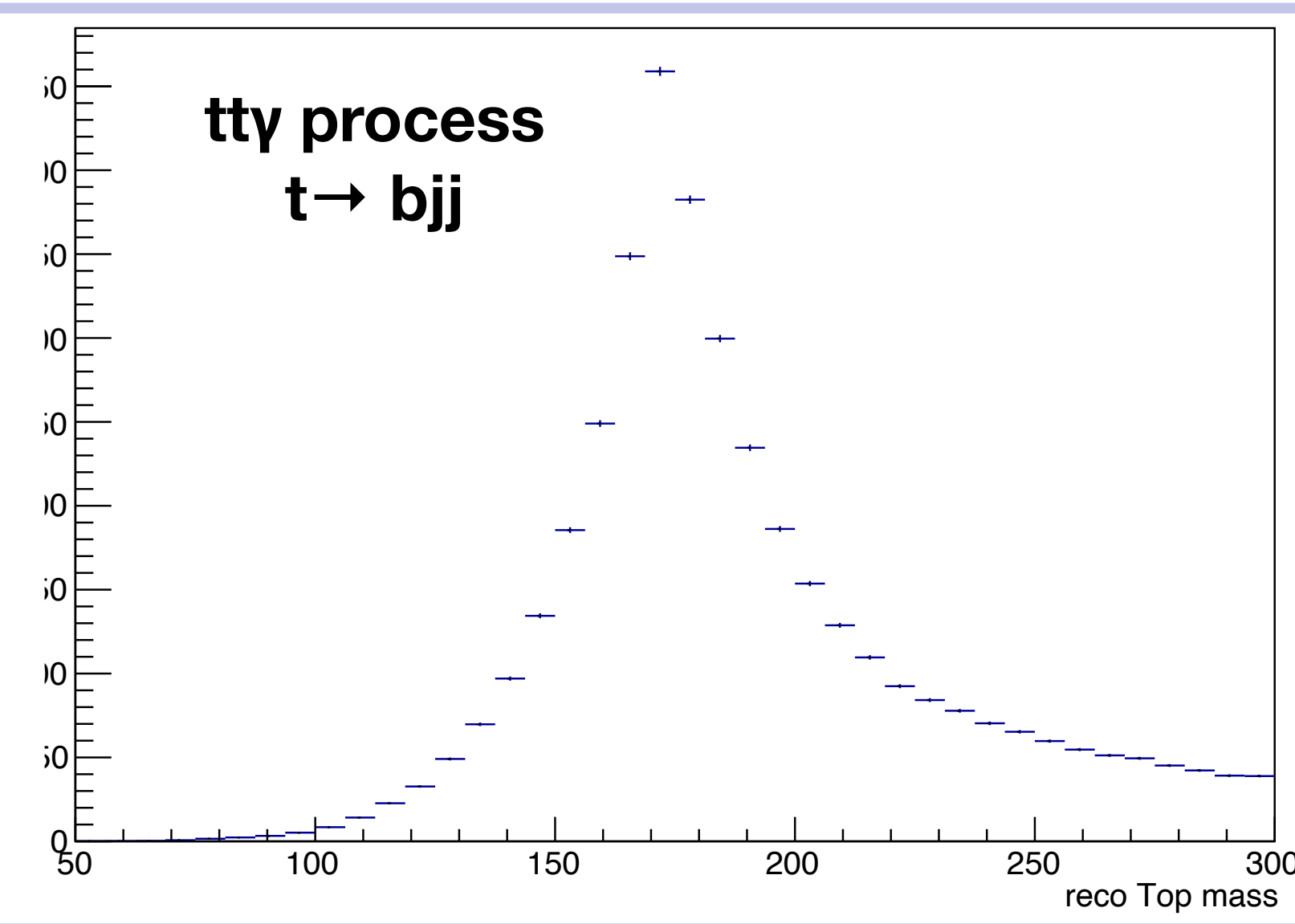
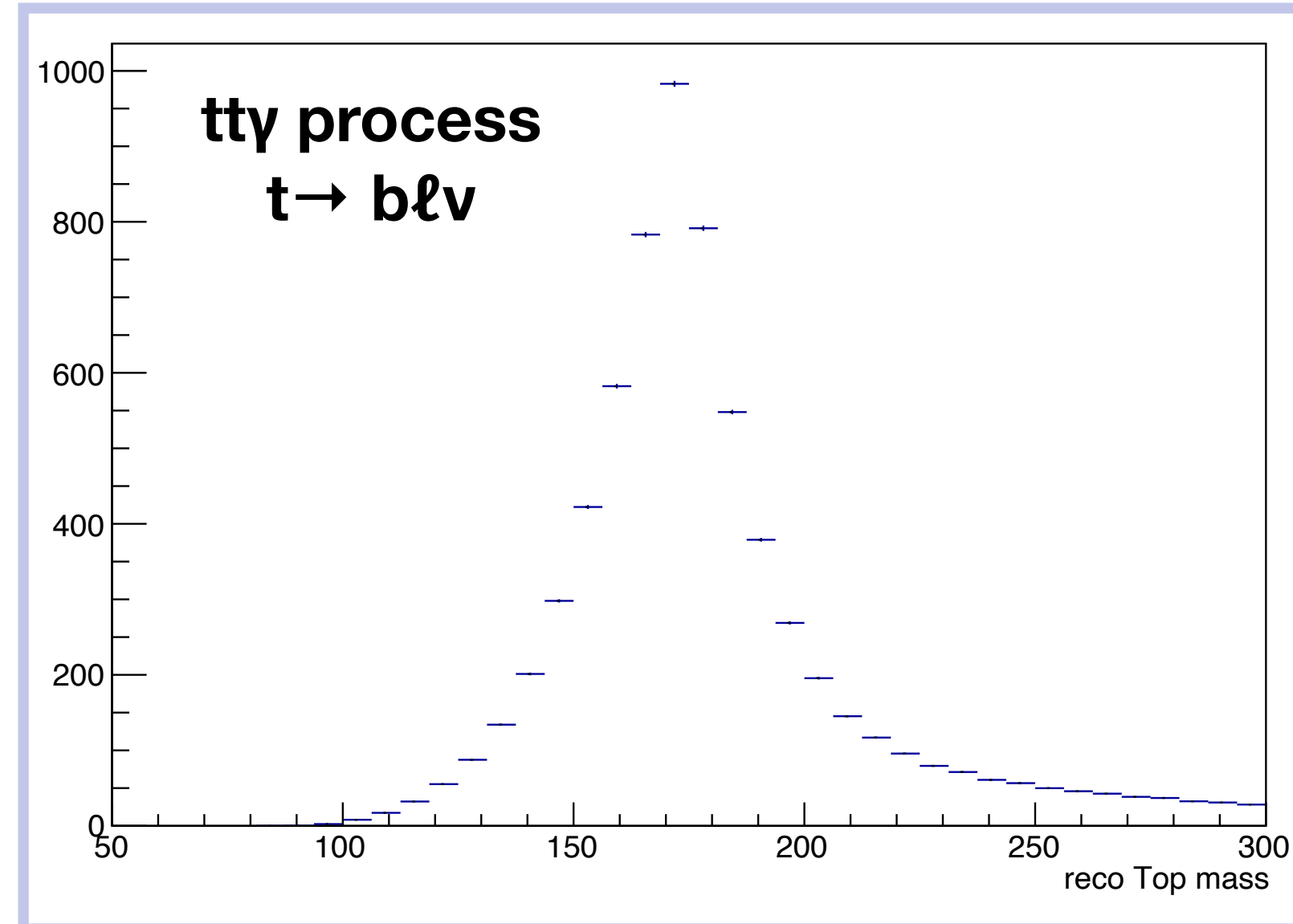
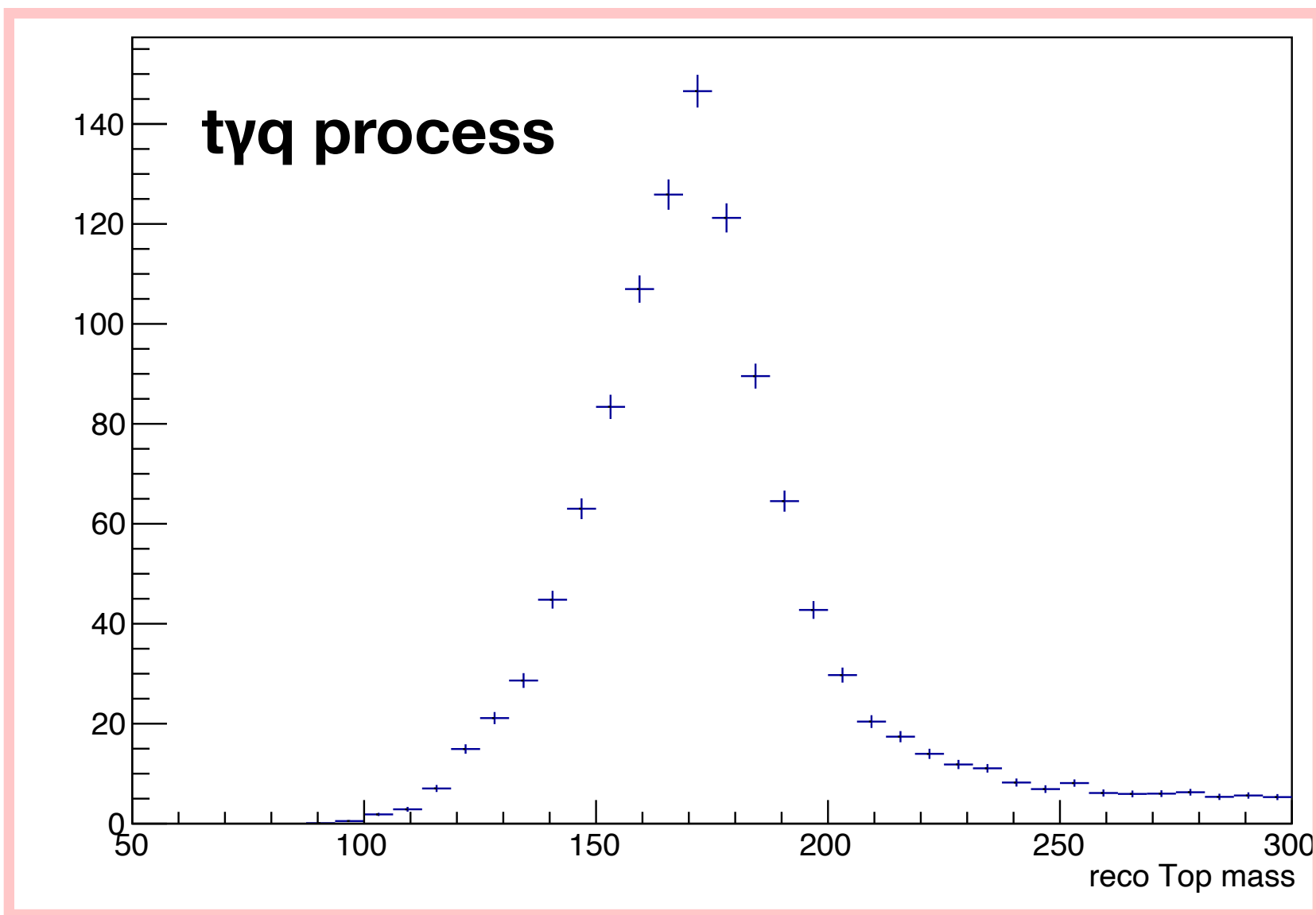
- Leptonic and hadronic top quarks are reconstructed depending on the available objects

$$\chi_{t,\text{lep}}^2 = \left(\frac{m_{\ell\nu b} - m_t}{\sigma_{t,\text{lep}}} \right)^2$$

$$\chi_t^2 = \left(\frac{m_{\ell\nu b} - m_t}{\sigma_{t,\text{lep}}} \right)^2 + \left(\frac{m_{bjj} - m_t}{\sigma_{t,\text{had}}} \right)^2$$

$$\chi_{t,\text{had}}^2 = \left(\frac{m_{bjj} - m_t}{\sigma_{t,\text{had}}} \right)^2$$

Application



- TOP-23-004: Simultaneous measurement of single and pair-production of top quarks in association with a Z boson
- TOP-24-015: Top-quark charge asymmetries in semileptonic tt+jets events at 13 TeV
- TOP-25-003: Simultaneous measurement of tqgamma and ttgamma cross section