



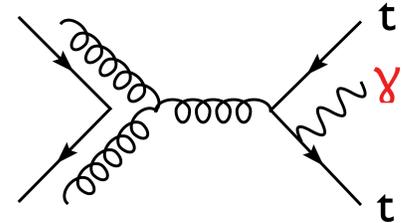
Measurement of the Inclusive Top-quark Pair + Photon Production Cross Section



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on behalf of the CMS Collaboration

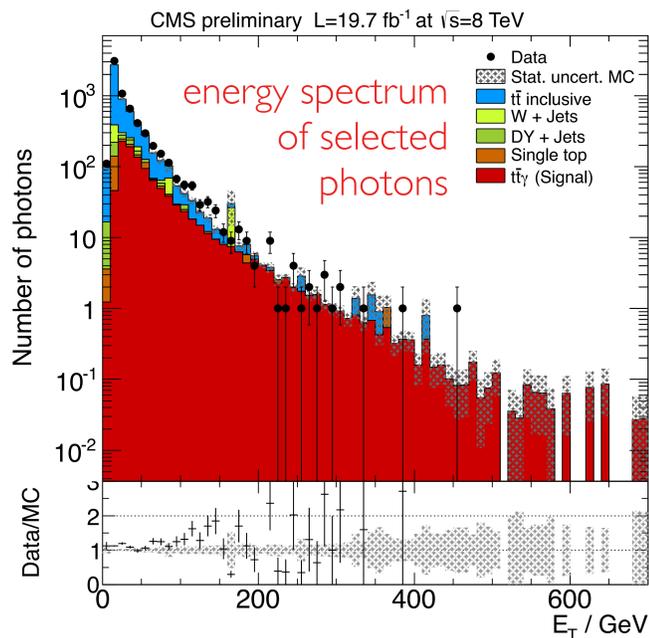
CMS-PAS-TOP-13-011

<http://cds.cern.ch/record/1644573>



- First measurement of top pair + photon process at 8 TeV
- Direct measurement of top quark couplings
 - towards new standard model tests
 - interesting for new physics searches
- Analysis outline:
 - μ +jets channel of top quark pair decay
 - main background from mis-identification of jets as photons
 - dataset: 19.7 fb⁻¹ @ 8 TeV

signal region:
(incl. γ from W, b, ISR)
 $pp \rightarrow (W^+b)(W^-\bar{b})\gamma$
 $E_T(\gamma) > 20 \text{ GeV}$
 $\Delta R(\gamma, b) > 0.1$
 $\sigma_{t\bar{t}+\gamma}^{\text{NLO}} = 1.8 \pm 0.5 \text{ pb}$



$$R \equiv \frac{\sigma_{t\bar{t}+\gamma}}{1} \cdot \frac{1}{\sigma_{t\bar{t}}} \propto \frac{N_{t\bar{t}+\gamma}}{1} \cdot \frac{1}{N_{t\bar{t}}}$$

$$\sigma_{t\bar{t}+\gamma} = R \sigma_{t\bar{t}}^{\text{CMS}}$$

- Preselection ($t\bar{t}$)
 - 1 isolated muon
 - 4 jets (at least one jet b-tagged)
 - veto electrons
- Selection (+ γ)
 - $p_T > 25 \text{ GeV}$ and $|\eta| < 1.4$ (CMS ECAL barrel)
 - Particle Flow isolations
- Template fit to estimate yield of real photons
 - isolation-distribution of charged hadron candidates

- Template fit
 - signal template (real) from MC
 - background template (fake) from data sideband
- Systematic uncertainty
 - largest contribution from background shape: estimated using comparison from signal region to sideband (in simulation)

Result

$$R = (1.07 \pm 0.07(\text{stat.}) \pm 0.27(\text{syst.})) \cdot 10^{-2}$$

$$\sigma_{t\bar{t}+\gamma} = 2.4 \pm 0.2(\text{stat.}) \pm 0.6(\text{syst.}) \text{ pb}$$

