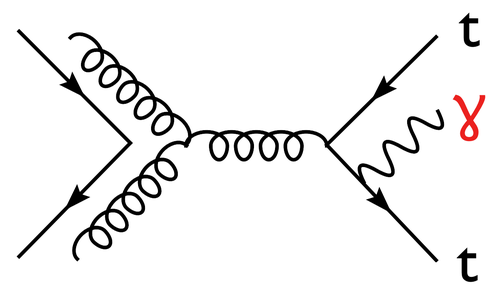
Measurement of the Inclusive Top-quark Pair + Photon Production Cross Section

Till Arndt (DESY) for the CMS Collaboration

CMS-PAS-TOP-13-011
http://cds.cern.ch/record/1644573



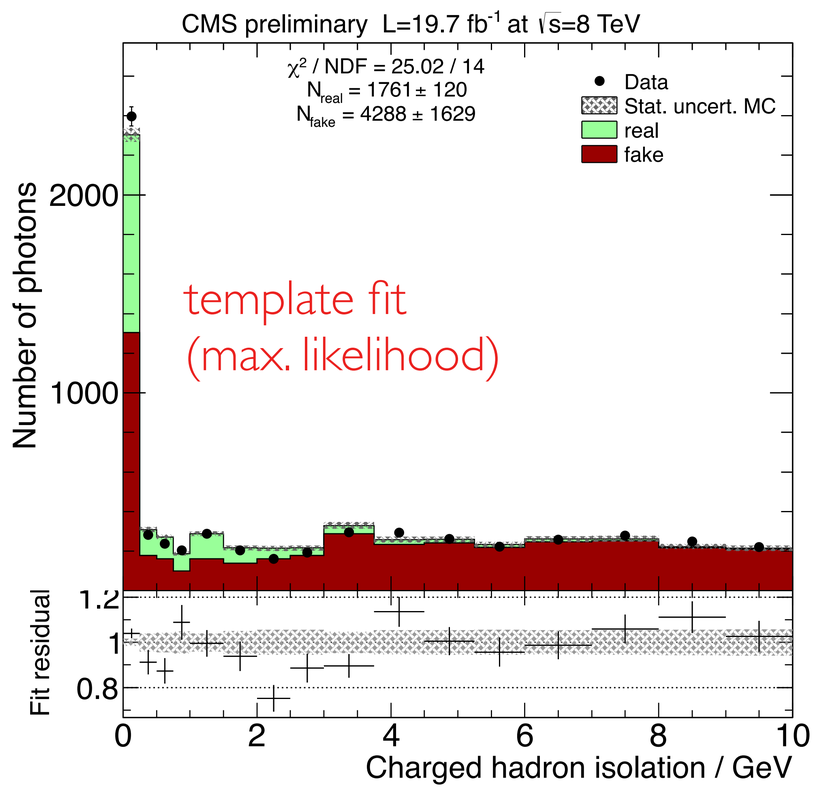
- First measurement of top pair + photon process at 8 TeV
- Towards direct measurement of top quark couplings
  - new standard model tests
  - interesting for new physics searches
- Analysis outline
  - μ+jets channel of top quark pair decay
  - main background from mis-identification of jets as photons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

signal region:
(incl. γ from W, b, ISR)

$$\mathrm{pp} \to (\mathrm{W}^{+}\mathrm{b})\,(\mathrm{W}^{-}\bar{\mathrm{b}})\,\gamma$$

$$E_{\mathrm{T}}(\gamma) > 20\,\mathrm{GeV}$$
$$\Delta R(\gamma, b) > 0.1$$

$$\sigma^{\mathrm{NLO}}_{t\bar{t}+\gamma} = 1.8 \pm 0.5\,\mathrm{pb}$$



- Preselection (tt)
  - 1 isolated muon
  - 4 jets (at least one jet b-tagged)
  - veto electrons
- Selection (+ γ)
  - p_T > 25 GeV and |η| < 1.4 (CMS ECAL barrel)
  - relative isolations of photon
- Template fit to estimate yield of real photons
  - isolation-distribution of charged hadron candidates
  - real photon template taken from MC
  - fake photon template from data sideband
  - dominating sys uncert.: shape of fake photon distr.
- Result

$$\sigma_{t\bar{t}+\gamma} = R\,\sigma^{CMS}_{t\bar{t}}$$

$$R = (1.07 \pm 0.07(\mathrm{stat.}) \pm 0.27(\mathrm{syst.})) \cdot 10^{-2}$$
$$\sigma_{t\bar{t}+\gamma} = 2.4 \pm 0.2(\mathrm{stat.}) \pm 0.6(\mathrm{syst.})\,\mathrm{pb}$$

$$pp \to t\bar{t}\,\gamma \to (bl\nu_l)\,(bjj)\,\gamma$$
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- Future developments on signal definition
  - factorization of production and decay
  - no contamination of non-tt decays
- Future developments on template fit
  - completely data-driven
  - using randomized cone directions
- Combination of decay channels