Top p_T Differential Distribtion

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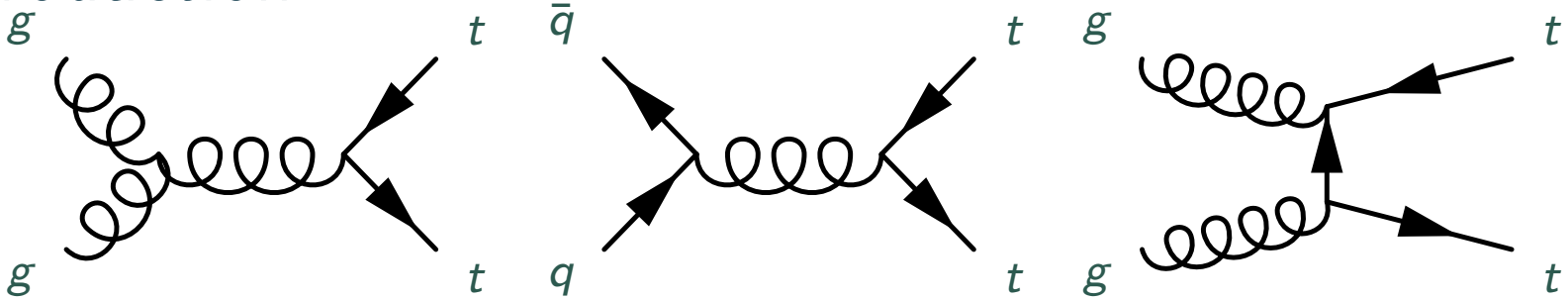
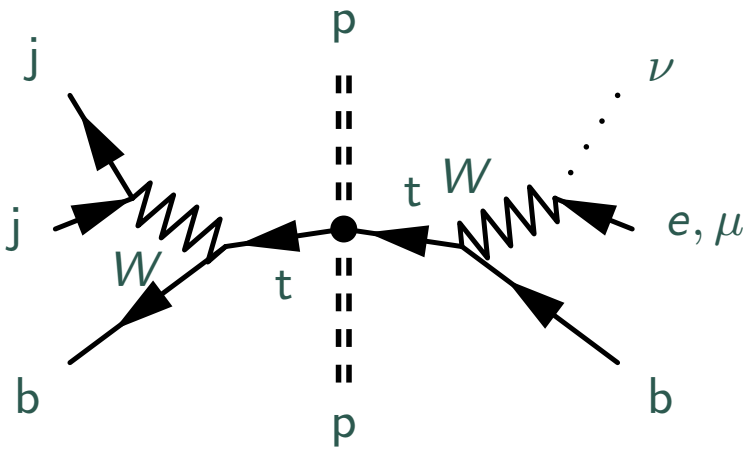
Introduction

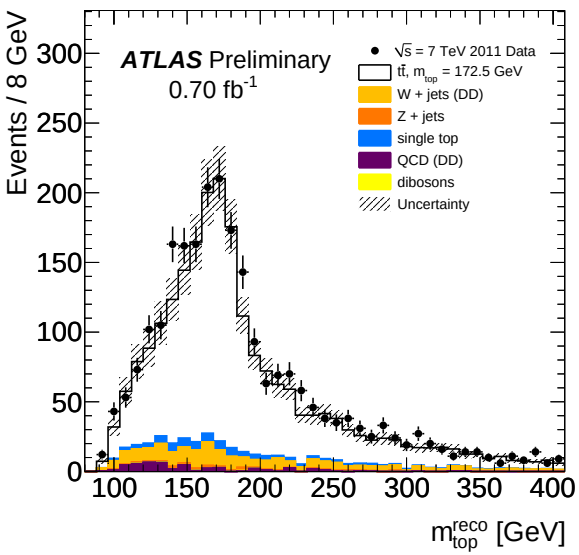


- Top quark is the newest (fundamental) member of the standard model (1995)
- Top also the heaviest (link to EWSB?)
  - Only quark to decay before hadronization
  - Chance to study a bare quark
- LHC is a top factory
  - Tevatron $\sigma \approx 7.5$ pb
  - LHC $\sigma \approx 170$ pb
- Differential distrbutions are an important probe of the top
  - Test of perturbative QCD
  - Hints/understanding of new physics can show up as deviations
- Here, top p_T distribution in semileptonic top pair decays

Reconstructing Top Quarks in ATLAS

- We use semi-leptonic tops w/standard ATLAS top id:
  - trigger on a high p_T e or μ
  - require exactly one good (offline) lepton
  - ask for a large E_T^{miss} (neutrino)
  - ask for 4 or more jets
  - ask for a b-tagged jet
- Backgrounds
  - QCD fakes (estimate by data-driven methods)
  - W+jets
- Use likelihood to assign physics objects to top



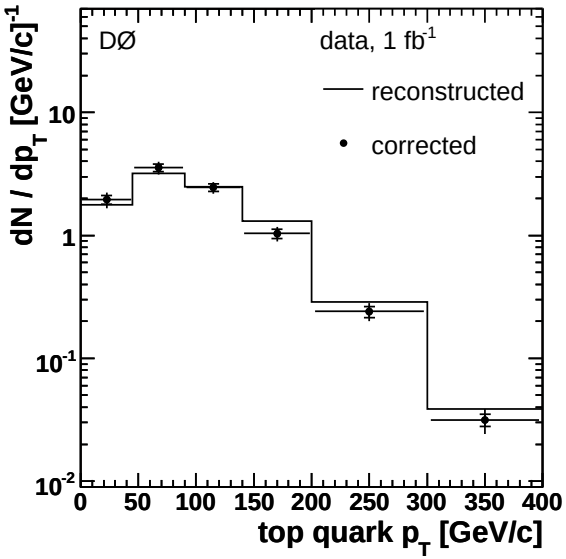


$$L = BW(m(j_1 j_2)|m_W, \Gamma_W)\ BW(m(l\nu)|m_W, \Gamma_W)\ BW(m(b_1 l\nu)|m_t, \Gamma_t)$$

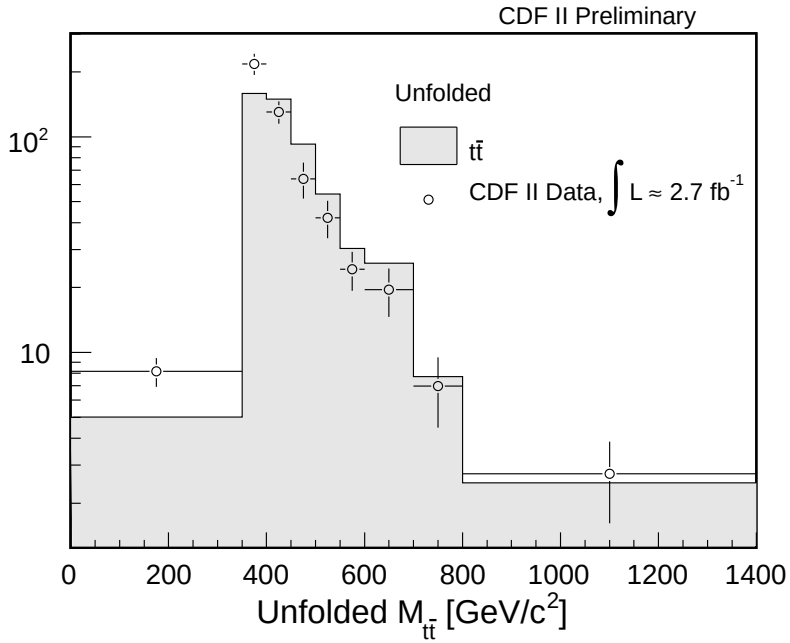
$$BW(m(b_2 j_1 j_2)|m_t, \Gamma_t) \prod_{i \in objects} W(E_i|E_{i,reco})$$

Unfolding p_T spectrum

a)

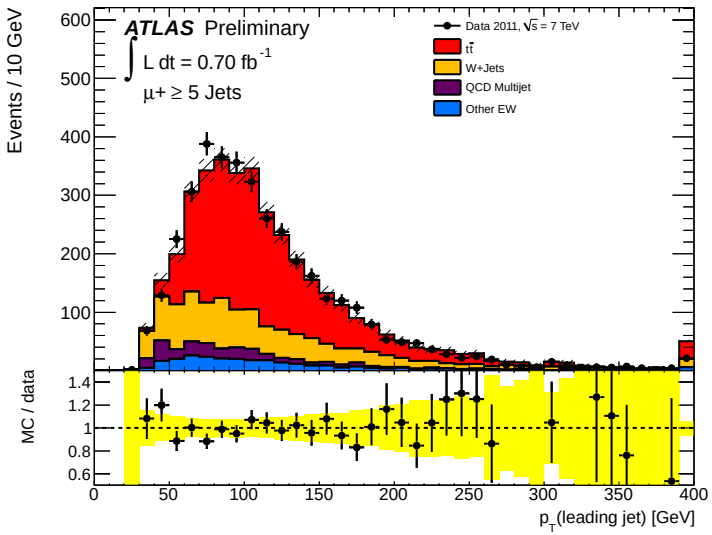


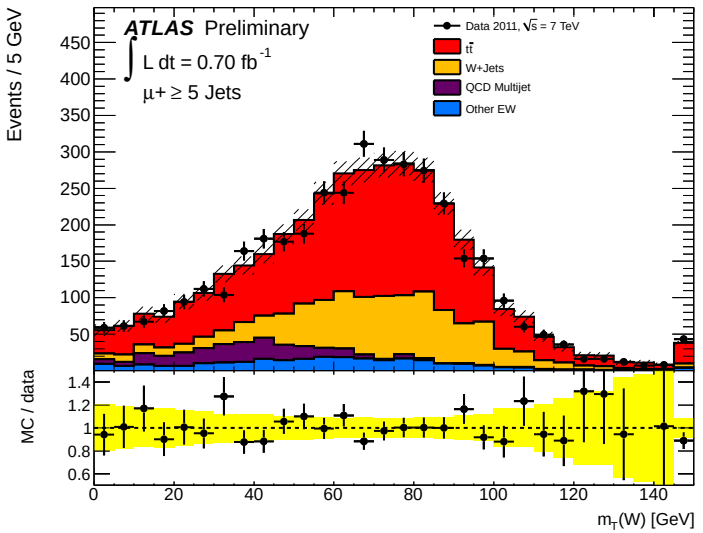
b)



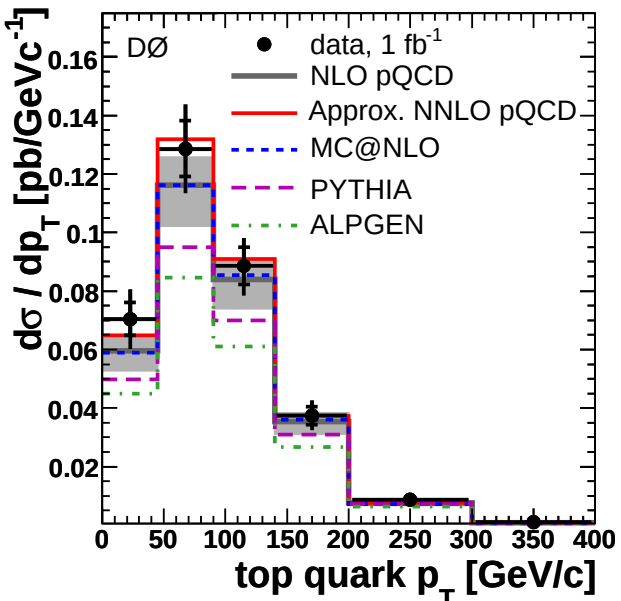
- Cf'ing experiment to theory complex
- We **unfold** the p_T spectrum to account for detector effects
  - Construct w/MC **response matrix**, Aij, s.t. $x_i^{reco} = A_{ij} x_j^{gen}$
  - Then unfold data: $x_i^{truth} = A_{ij}^{-1}(x_i^{data} - b_i^{est.})$
- Systematics need to be carefully propagated
- Appropriate binning needs to be selected
- Examples shown from Tevatron: (left) top p_T at DØ, (right) $m_{t\bar{t}}$ at CDF

Results





- No (public) results finalized
- (UP) leading jet p_T/M_T^W in μ channel w/5-jets @ .7fb^{-1}
  - Nb. no b-tagging
- $M_T^W = \sqrt{2p_T^l p_T^\nu (1 - cos\Delta\phi)}$
- (RIGHT) DØ results for unfolded top p_T (2010)



BACKUP

Semileptonic Top Analysis Overview

- Basic Analysis strategy
  - Select events likely to have tops
  - Subtract background events
  - Unfold detector effects
  - Final result: p_t distribution comparable with theory
- Use the 2 fb^{-1} selection now, aim for full 2011 dataset

Electron channel

- Trigger: EF_e20_medium, EF_e22_medium for Period K
- Primary vertex with >= 4 tracks
- One good electron ($p_T > 25$ GeV)
- No good muons ($p_T > 20$ GeV)
- Electron matches the trigger
- $E_T^{miss} > 35$ GeV
- $M_T^W > 25$ GeV
- At least 4 jets ($p_T > 25$ GeV)

Muon channel

- Trigger: EF_mu18, EF_mu18_medium for periods J,K
- Primary vertex with >= 4 tracks
- One good muon
- No good electrons
- **No** trigger matching
- $E_T^{miss} > 20$ GeV
- $M_T^W + E_T^{miss} > 60$ GeV
- At least 4 jets