MEASUREMENT OF *W* BOSON ANGULAR DISTRIBUTIONS IN EVENTS WITH HIGH P_T JETS WITH ATLAS AT 8 TEV

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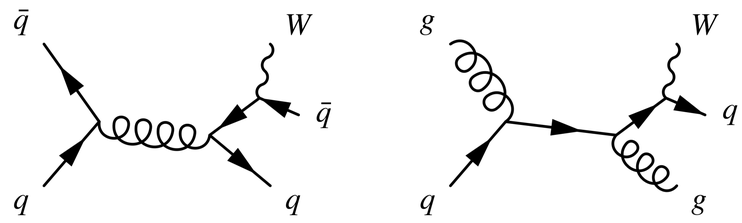
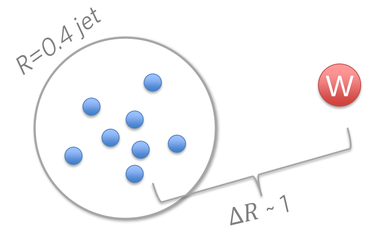


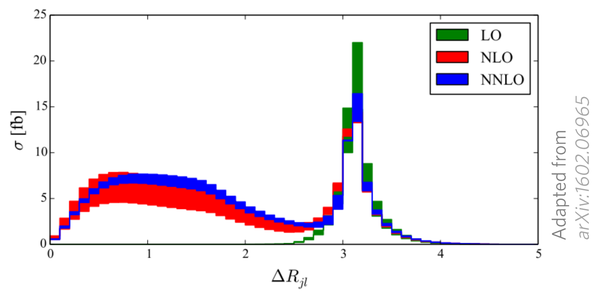
Example Feynman diagrams for collinear *W* production



Example illustration of *W* emission from a jet

Introduction

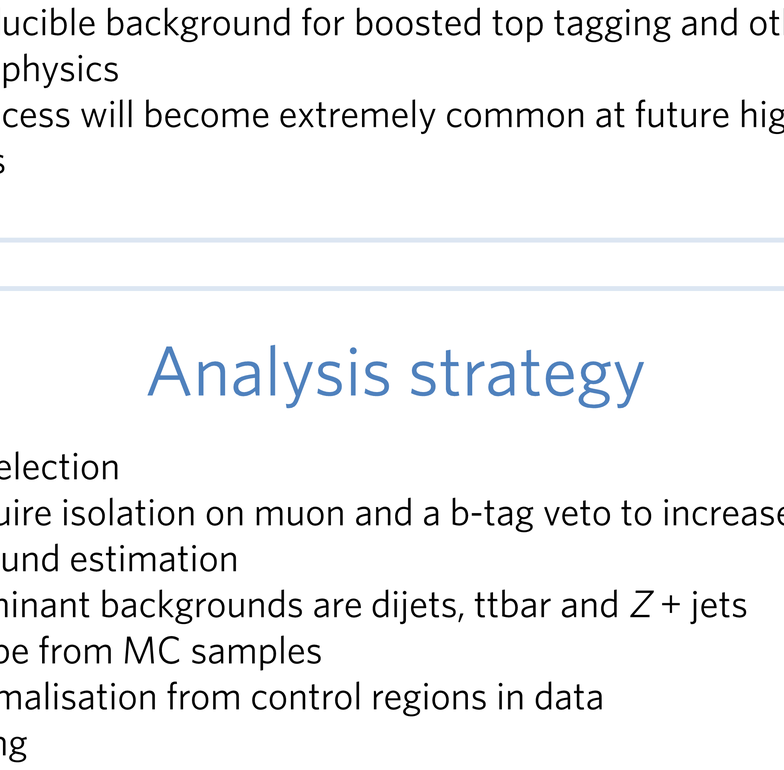
- High p_T jets can emit a real *W* collinearly
  - Since the *W* is massive, they are emitted at a small but non-zero angle relative to the jet
  - Never been directly measured before
- By looking at the angular distance between the *W* and the jet, one can explicitly focus on the collinear emission process
- Very large corrections to LO in collinear region



- Active area of interest amongst theorists with different approaches providing significantly different predictions
  - Weak showering
  - Multi-leg matrix elements for *W* + jets
  - NNLO calculation of *W* + ≥ 1 jet
- An irreducible background for boosted top tagging and other searches for new physics
- This process will become extremely common at future higher energy colliders

Analysis strategy

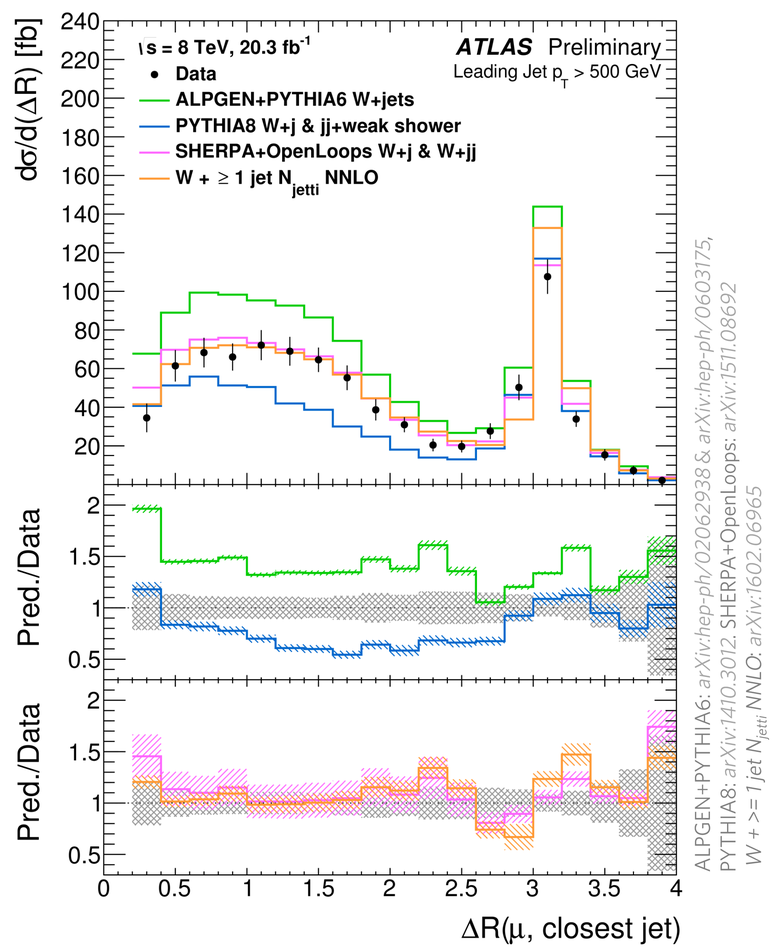
- Signal selection
  - Require isolation on muon and a b-tag veto to increase purity
- Background estimation
  - Dominant backgrounds are dijets, ttbar and *Z* + jets
  - Shape from MC samples
  - Normalisation from control regions in data
- Unfolding
  - Iterative Bayesian unfolding of ΔR distribution
  - Uses simulated MC sample for efficiencies and smearing
- Detector-level distributions from signal and control regions:



Fiducial selection

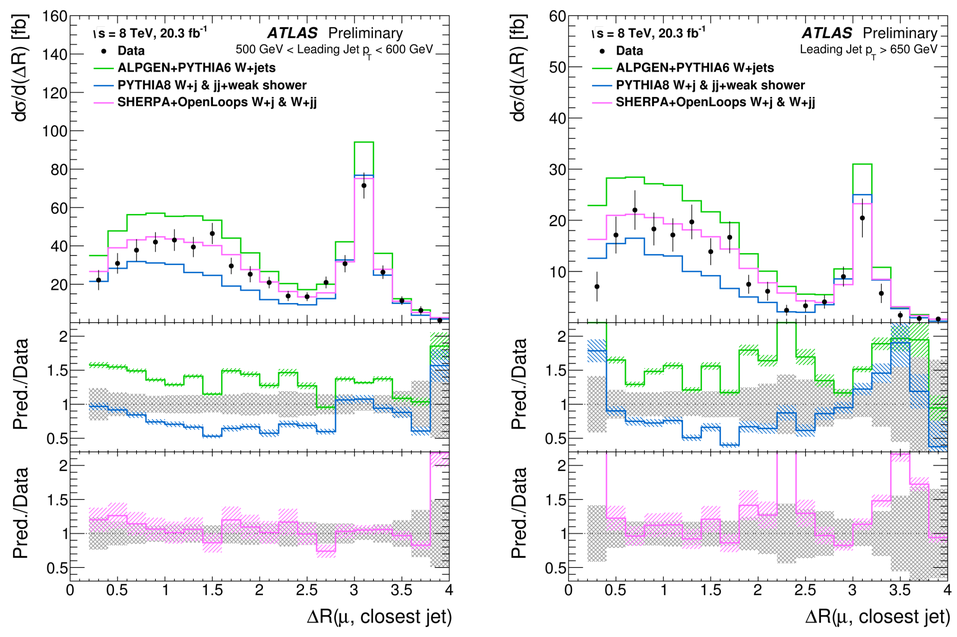
- At least one jet with $p_T > 500$ GeV and $|\eta| < 2.1$
- Exactly one muon with dressed $p_T > 25$ GeV and $|\eta| < 2.4$
- Jet with $p_T > 100$ GeV and $|\eta| < 2.1$ closest to the muon is called 'closest jet'
- Distance between muon and closest jet $\Delta R = \sqrt{(\Delta\eta)^2+(\Delta\phi)^2} > 0.2$

Differential cross-section results



- Compared to theory calculations:
  - ALPGEN+PYTHIA6: *multi-leg LO*
  - PYTHIA8: *includes dijet events with weak showering*
  - SHERPA+OpenLoops: *includes NLO QCD+EW corrections*
  - *W* + ≥ 1 jet N_{jetti} NNLO: *calculation up to* $O(\alpha_s^3)$

- Also looked into differential cross-section for events with a leading jet $p_T > 650$ GeV and for $500\ \text{GeV} < p_T < 600\ \text{GeV}$
- As leading jet p_T increases, collinear fraction increases and collinear peak shifts to lower ΔR:



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