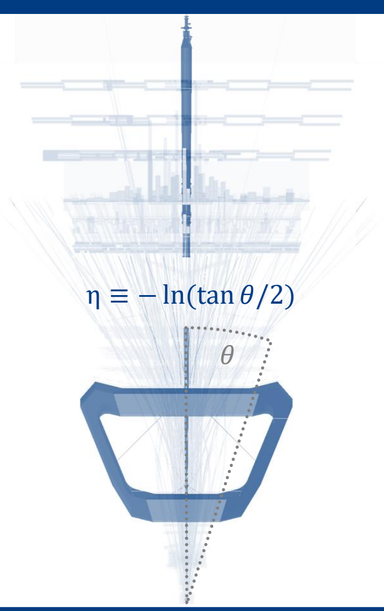
TOP CHARGE ASYMMETRY

TOP PHYSICS

Cornerstone of the Standard Model
- Heaviest known fundamental particle, m ≈ 170 GeV/c^2
- Sensitive to EW symmetry breaking and BSM physics

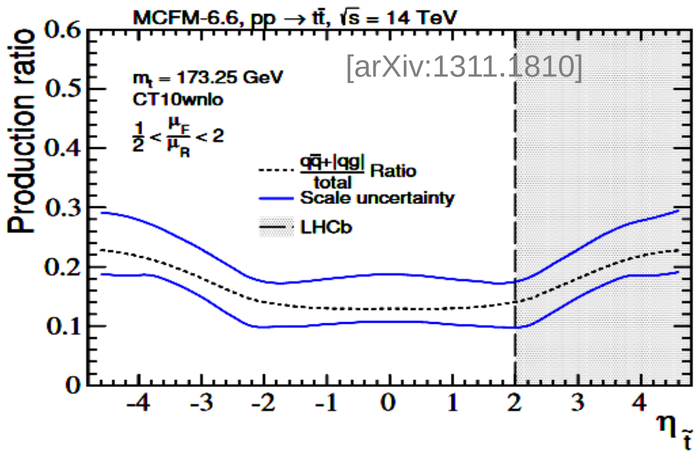
Drive for precision measurement
- Behaviour to higher order well predicted by theory [1]
- Top data to constrain effective field theory operators [2]

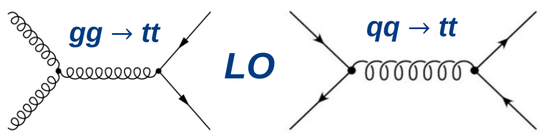


LHCb TOP DATA

Forward top production
- LHCb provided first observation in Run I data [3]
- 13 TeV fiducial cross-section 10 fold increase [4]

The LHCb detector
- Unique coverage, 2 < η < 5, for tracking & PID
- Low pile-up environment, 1-2 interactions pbc.



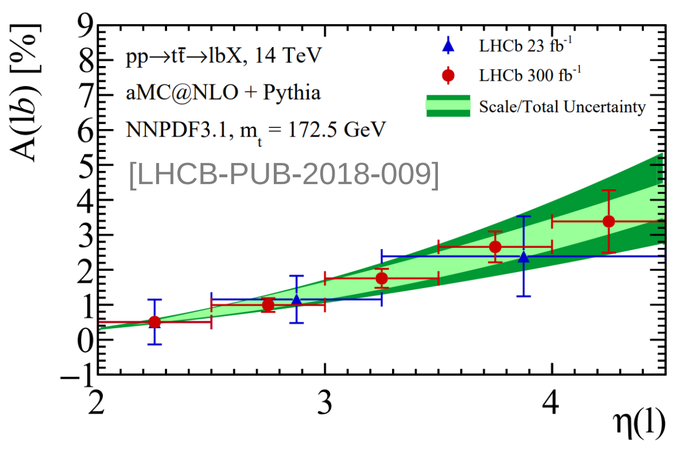


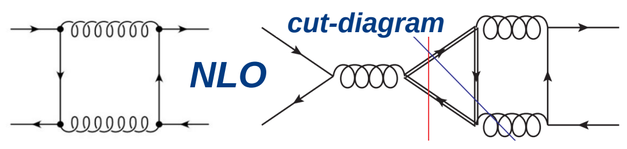
CHARGE ASYMMETRY

Higher order processes
- Asymmetry results from NLO interference
- Only in quark initiated top pair production

LHC expectations
- Positive asymmetry boosts t forward relative to $\bar{t}$
- Measurement through sign-indicative W decays

Forward sensitivity
- Dilution from gg supressed in LHCb acceptance
- Asymmetry increases with pseudorapidity, η

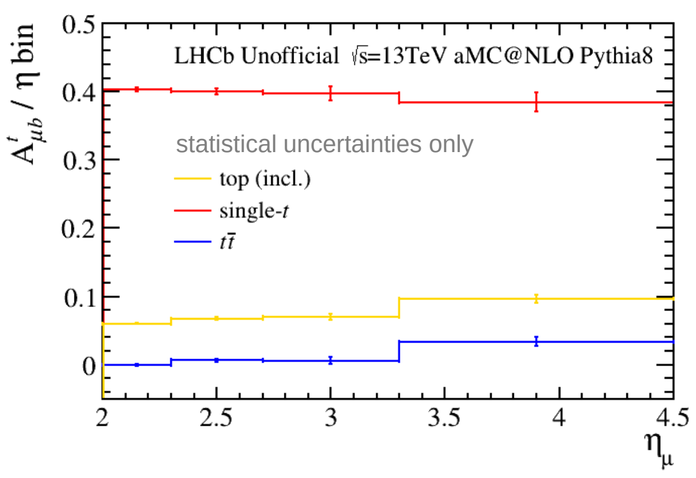


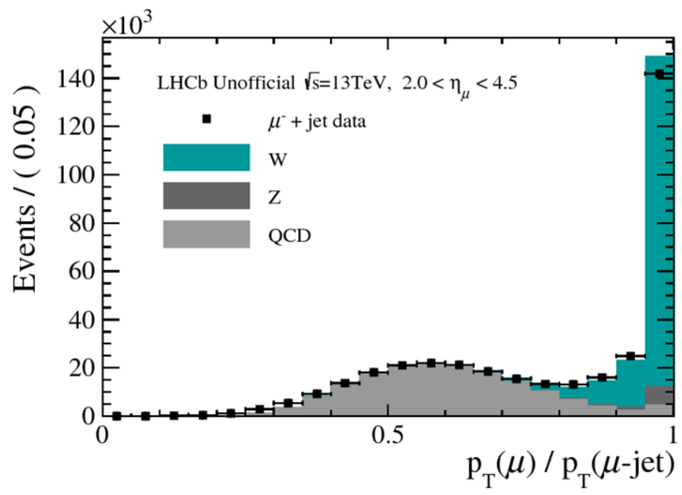


FINAL STATE

$t \rightarrow (W \rightarrow \mu\nu) + b$
- Single, prompt & isolated muon reconstructed
- Signature of EW process vs. di-jet production

Event selection
- Angular separation between muon and jet
- Final state p_T imbalance, proxy for missing E_T
- Higher p_T thresholds select top preferentially

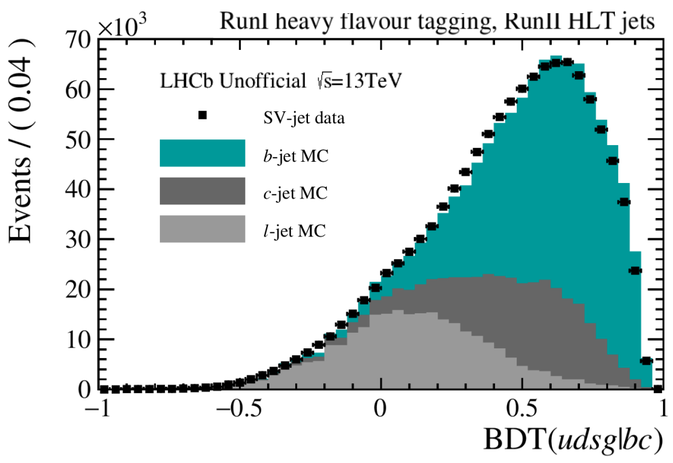


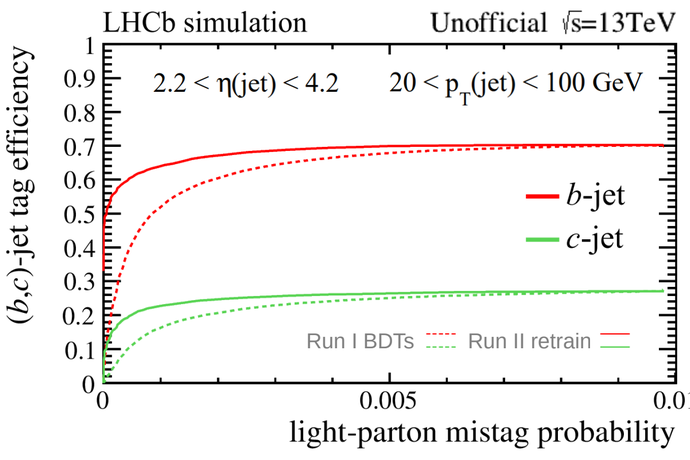


JET FLAVOUR TAGGING

Binary classifiers
- BDTs trained on secondary vertex & jet info.
- Provides excellent light parton mistag rejection
- Limited by dependence on SV-tag efficiency

Flavour template fits
- W+b/W+j from MC normalised to W+j data
- W+c cross check with negligible top contribution



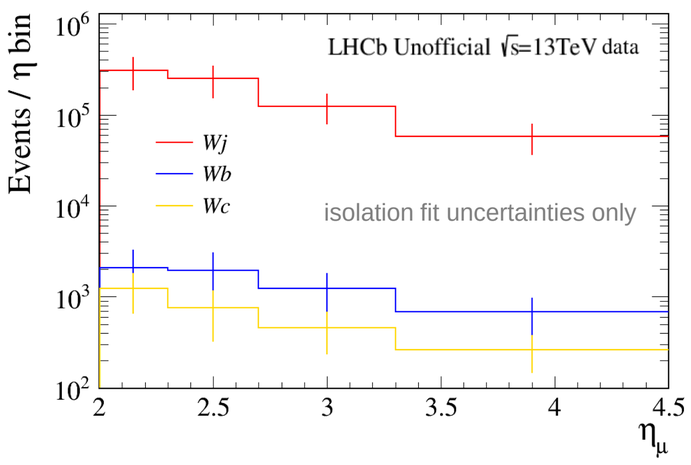


RUN II PROSPECTS

- New samples with NLO Powheg & MadGraph
- Full 6 fb^{-1} $\sqrt{s} = 13$ TeV data set now available

- More efficient jet configuration for Run II
- Updated ML approach to LHCb's flavour tagging

- Intermediate measurements of W+jet, W+c, W+b
- Diff. cross-sections constrain PDF uncertainties



- First top asymmetry measurement at LHCb
- Working towards Run III & IV precision top

[1] A Kagan et al. 'Top LHCb physics' (2011) [arXiv:1103.3747]
[2] C Zhang et al. 'Effective field theory…' (2014) [arXiv:1008.3869]
[3] LHCb collab. 'First observation of top…' (2015) [arXiv:1506.00903]
[4] M Czakon et al. 'Pinning down the…' (2016) [arXiv:1611.08609]
[5] R Gauld. 'Leptonic top quark…' (2013) [arXiv:1409.8631v2]
[6] LHCb collab.. 'Identification of…' (2015) [arXiv:1504.07670]

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