# Prospects for Measuring the Top Charge Asymmetry at LHCb

**Anna Phan**

Syracuse University

On behalf of the LHCb Collaboration

Implications at the LHC of BSM interpretations
of CDF's ttbar forward-backward asymmetry

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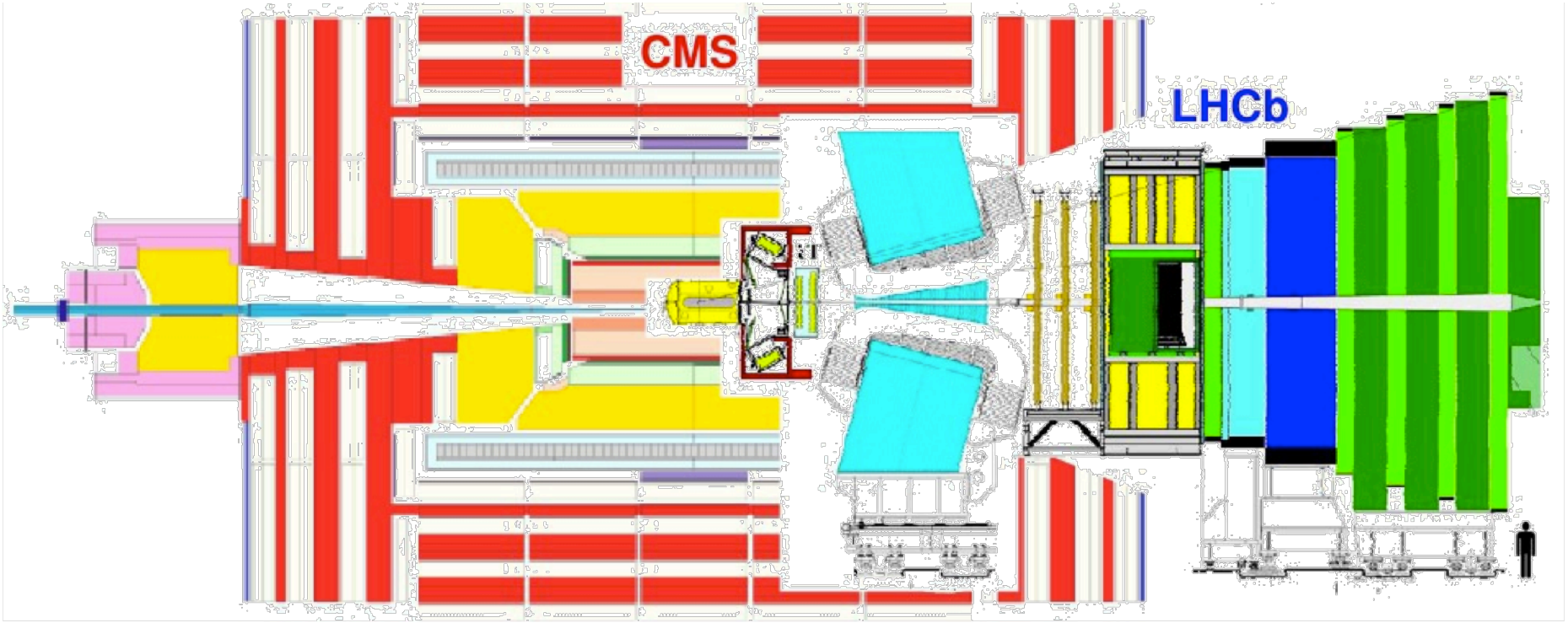
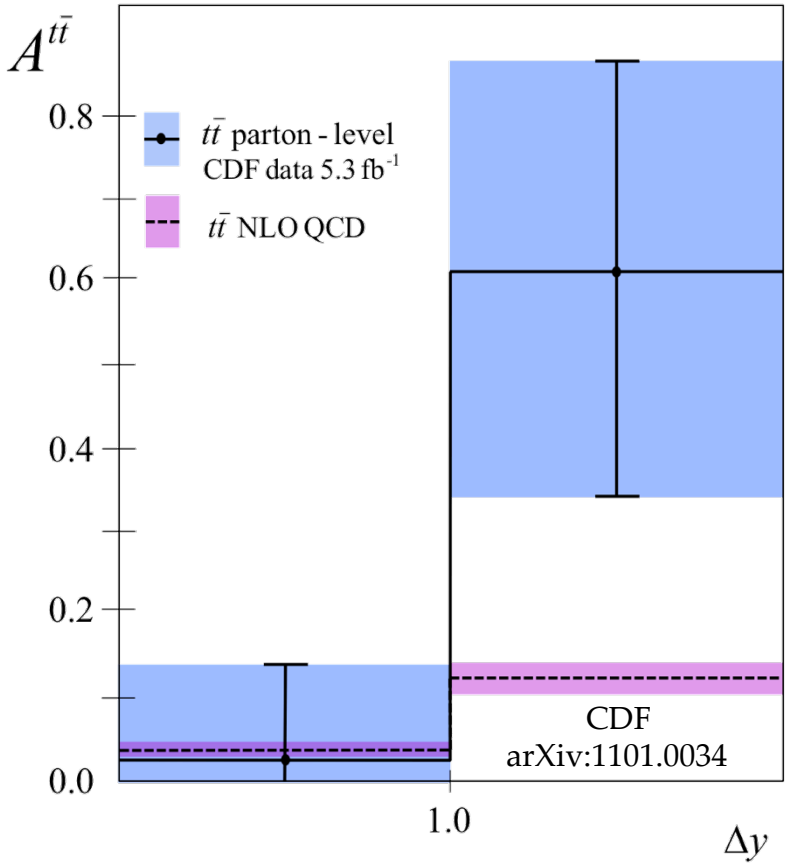
# LHCb: A forward physics experiment

- LHCb covers forward region: $1.9 < \eta < 4.9$
  - Unique rapidity range



# Top Physics at LHCb

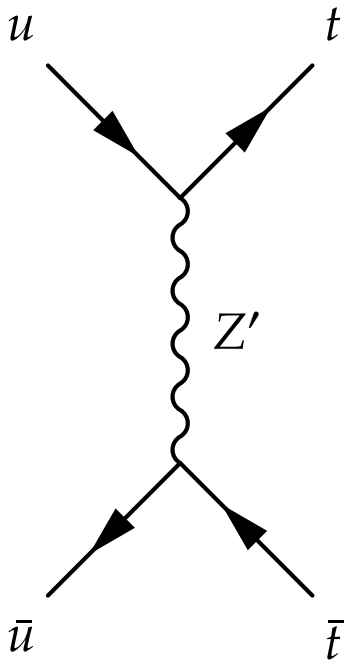
- CDF top pair forward backward asymmetry measurement suggests an anomaly
- Observed top pair forward backward asymmetry is η dependent and increased in the forward direction




$$A^{t\bar{t}}(|\Delta y < 1.0|) = 0.026 \pm 0.118$$
$$A^{t\bar{t}}(|\Delta y \geq 1.0|) = 0.611 \pm 0.256$$

# Top Physics at LHCb

- New physics models with t-channel exchange of light particles predict forward peaking of $A^{t\bar{t}}$

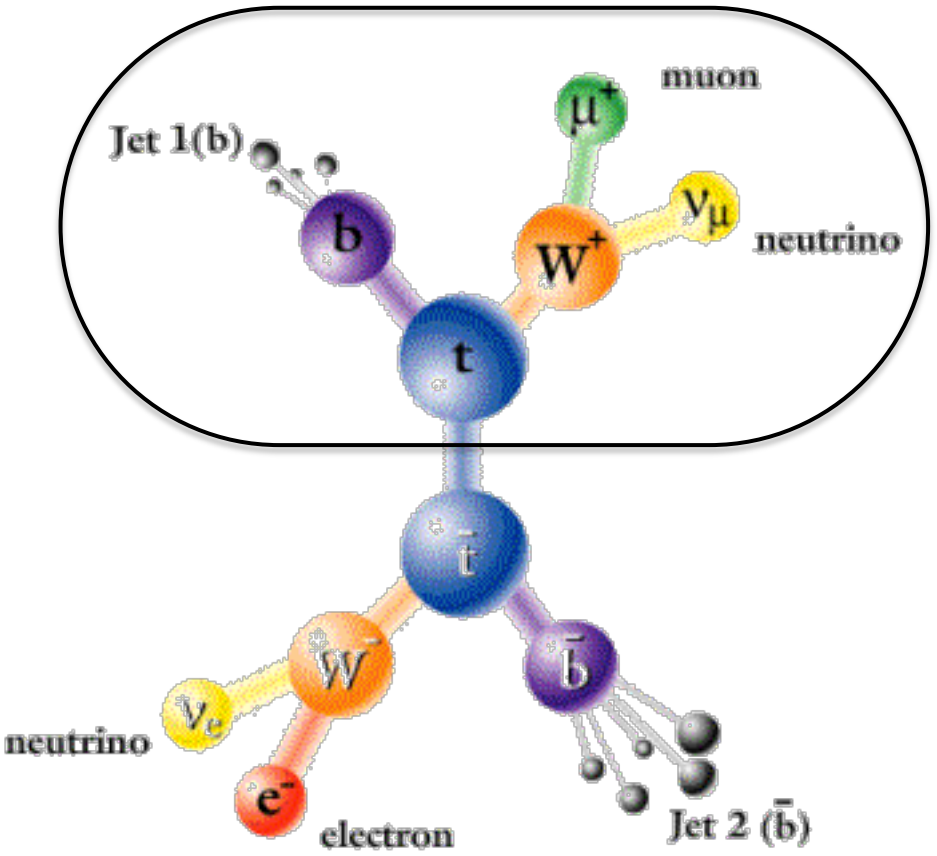



$$\alpha \quad \frac{1}{1-\cos\theta}$$

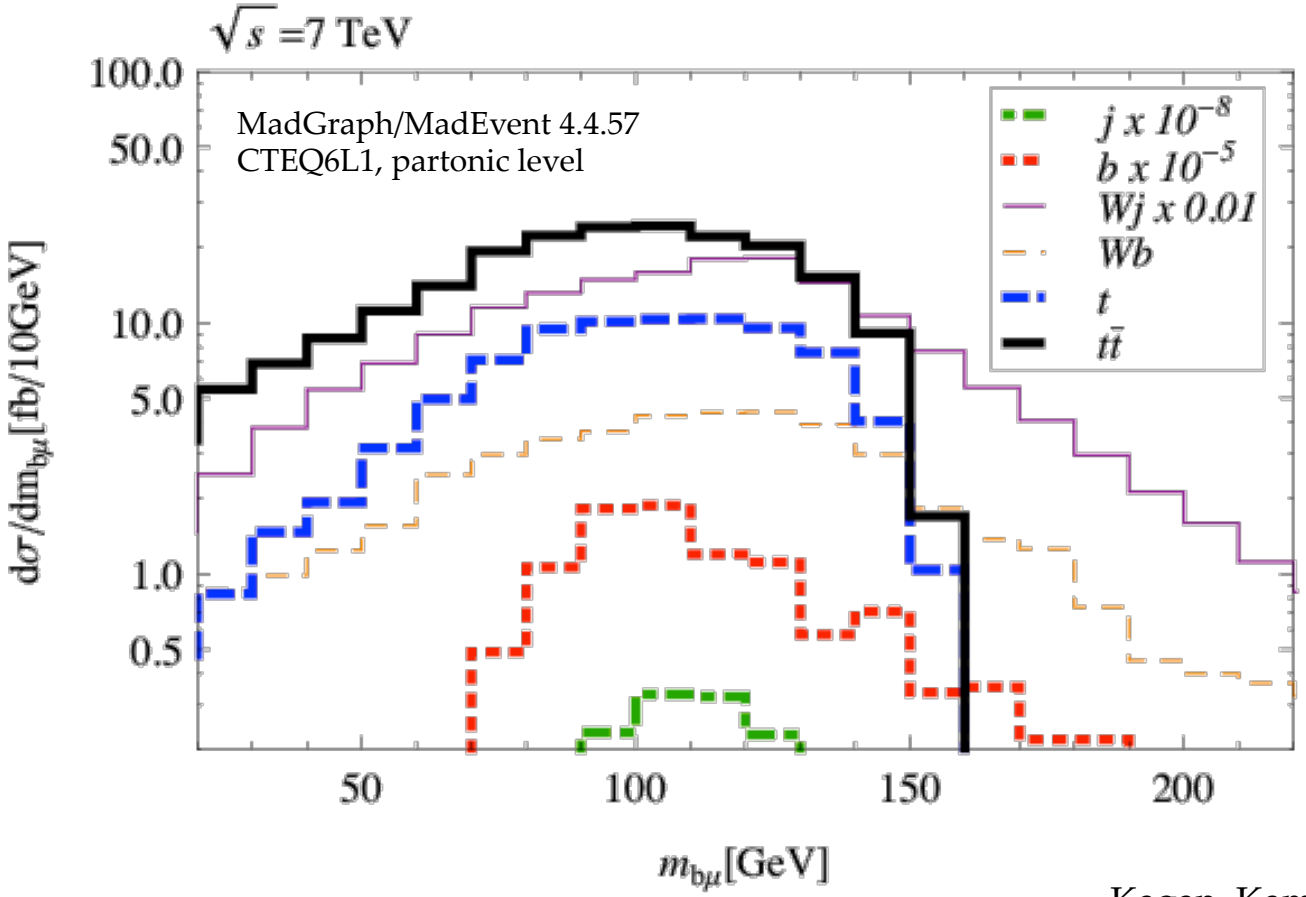
Jung et al,
Phys Rev D81, 015004 (2010)
arXiv: 0907.4112

# Top Signal at LHCb

- Due to the geometry of LHCb, only half of the top pair decay will be visible in most events
- Due to backgrounds, LHCb can only detect the leptonic decays of the W boson, and here I concentrate on muons



# Top Signal at LHCb



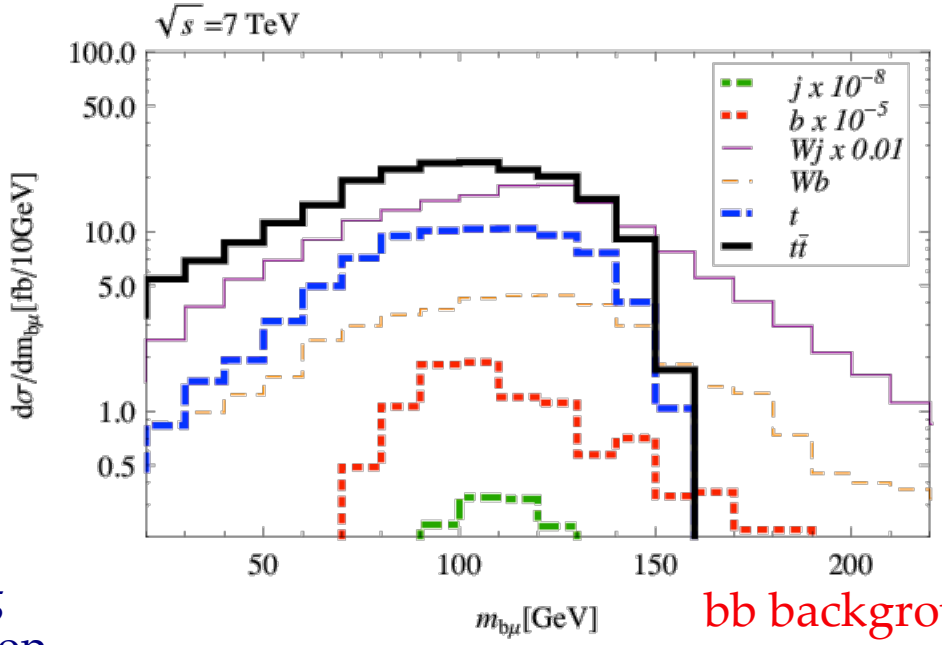

Kagan, Kamenik, Perez, Stone
arXiv:1103.3747

# Top Signal at LHCb

Top pair production selected using:

- b-jet with $p_T > 50$ GeV,
  - FastJet employed for jet reconstruction using the anti-$k_t$ algorithm with R = 0.4
- muon with $p_T > 20$ GeV

Single top background is subdominant




W + j background can be reduced with 1:100 light jet rejection

W + b background is subdominant

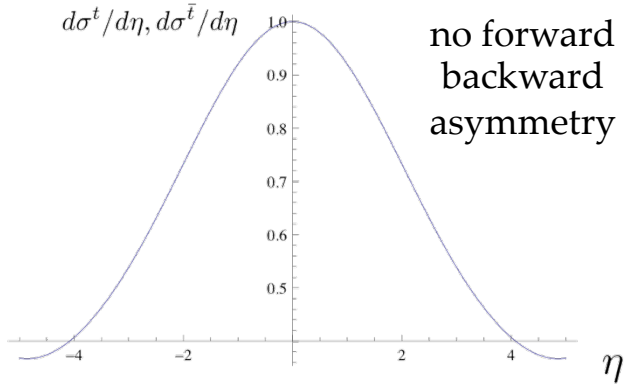
Currently studying differences between top pair and single top events for further reduction

jj background is easily contained

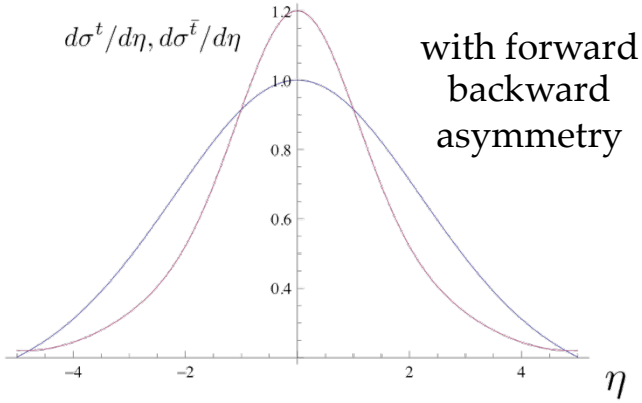
bb background can be removed using isolation around the muon

# Top Asymmetry at LHCb

- LHC is symmetric and full event reconstruction is not possible in LHCb
- However, a measureable rate asymmetry is induced from the forward backward asymmetry
- This results in a different number of tops to antitops in LHCb




no forward backward asymmetry

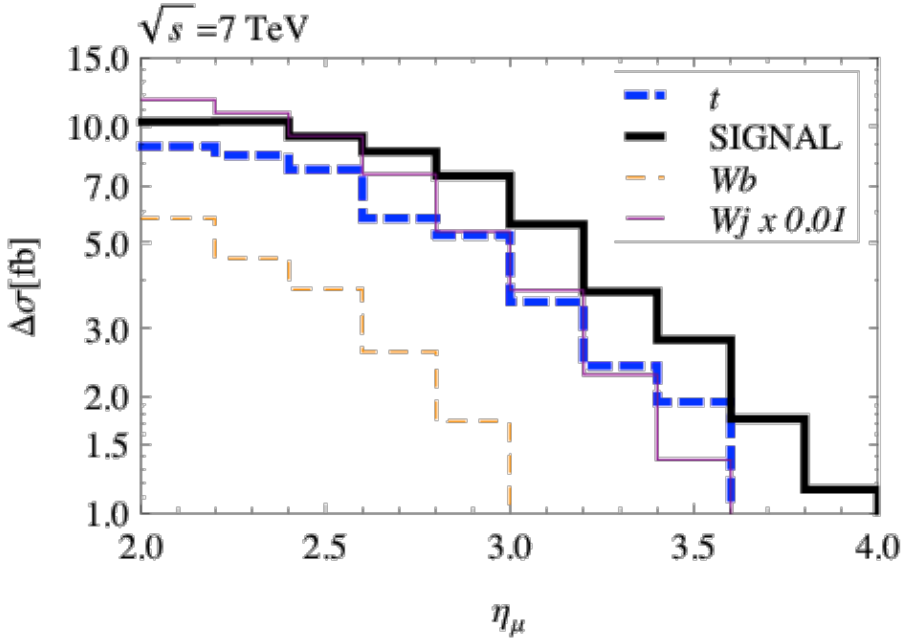


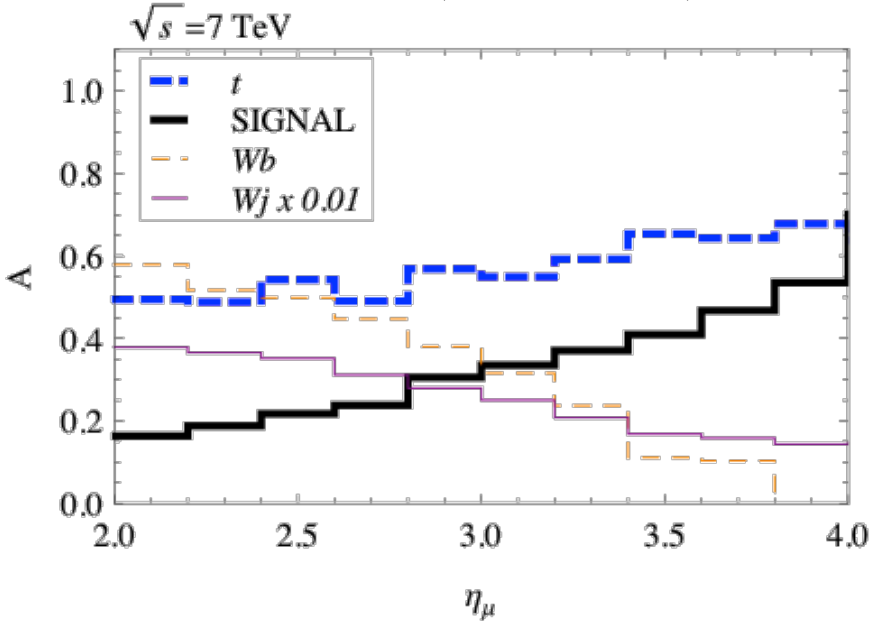

with forward backward asymmetry

# Top Asymmetry at LHCb

$$\Delta\sigma = d\sigma^t/d\eta - d\sigma^{\bar{t}}/d\eta$$

$$A = \left(\frac{d\sigma^t/d\eta - d\sigma^{\bar{t}}/d\eta}{d\sigma^t/d\eta + d\sigma^{\bar{t}}/d\eta}\right)$$




- New physics signal is the t-channel exchange of a Z′ with parameters chosen to yield $A^{t\bar{t}}_{\Delta y>1} = 0.43$ at leading order in QCD
- Currently studying b-jet tagging efficiency and light jet rejection to understand the influence of the underlying W+j production asymmetry

# Summary

- LHCb has a unique possibility to study forward top physics
- May be sensitive to the forward backward top pair asymmetry