MOTIVATION

- Top quark production in the forward region is sensitive to the gluon parton distribution function (PDF) at large momentum fraction.
- Anomalous charge asymmetry due to enhancement of top pair production at large rapidities via $qq$ or $qg$ relative to $gg$ fusion can indicate physics beyond Standard Model.

75% is due to top pair production ($t\bar{t}$)
25% is due to single-top t-channel production

THE LHCb EXPERIMENT

STRATEGY

Isolation muon variable used in template fit to extract $W^+\text{jet}$

The fit is performed in 4 different bins of $p_T(\mu+b)$ for $\mu^+$ and $\mu^-$

$W^+\text{jet}$ used to constrain $W+b$ background (ratio from theory)

Validation of strategy using $W+c$

RESULTS

An excess of $W+b$ events is found.

- A binned likelihood fit is used to determine the excess significance.
- The top quark distribution and charge asymmetry versus $p_T(\mu+b)$ are obtained from the SM predictions. The total top quark yield is allowed to vary freely.
- Systematic uncertainties are handled as Gaussian constraints. The profile likelihood technique is used to compare the SM hypotheses with and without a top quark contribution.
- The significance obtained using Wilks theorem is 5.4σ, confirming the observation of top quark production in the forward region.

Summary

- 5.4σ observation of forward top production
- Cross-section measurement in agreement with NLO prediction
- Robust data analysis strategy ready to be used in RunII
- Top prediction at RunII: $[l,b] \sim 8300 t\bar{t}$, 5000 t-channel, 600 s-channel and 180 Wt