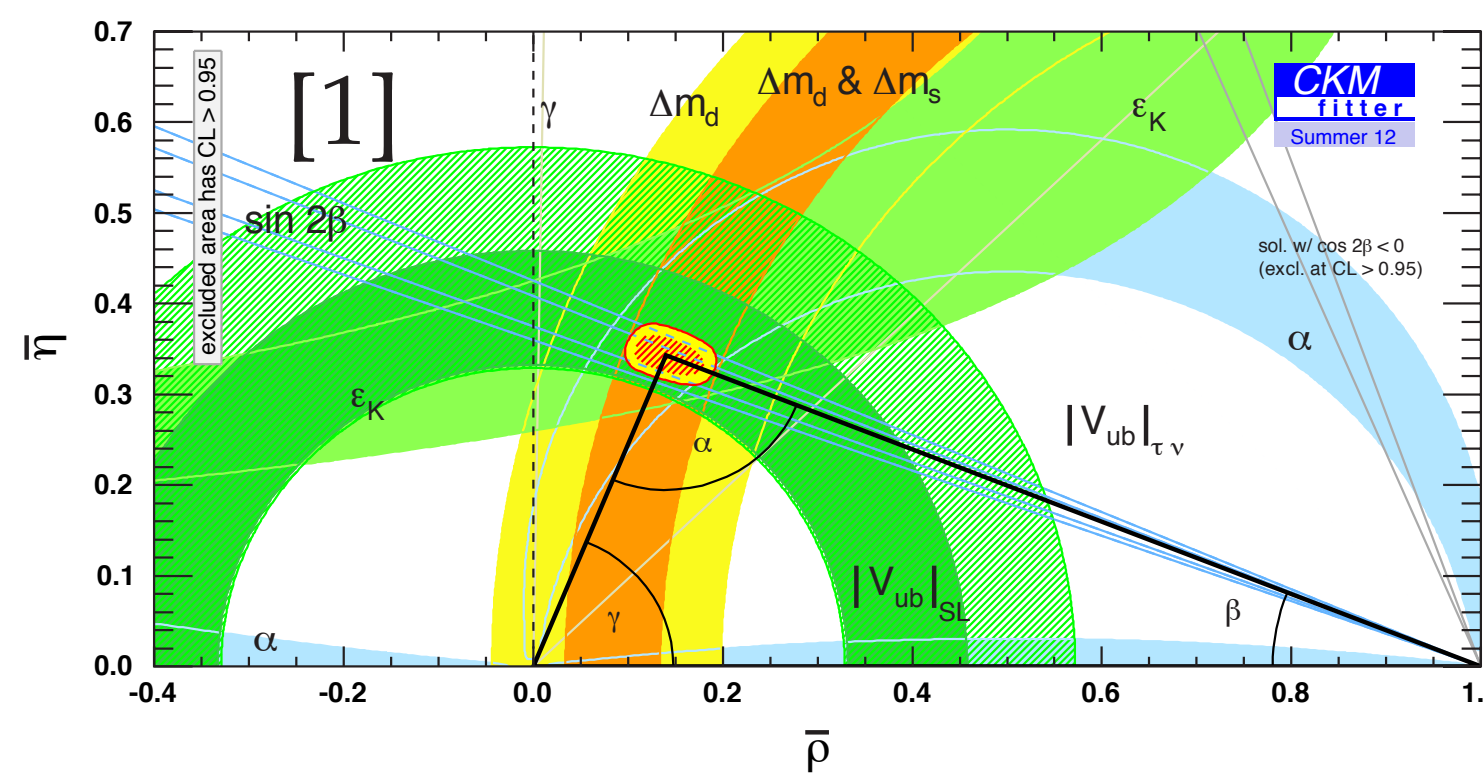
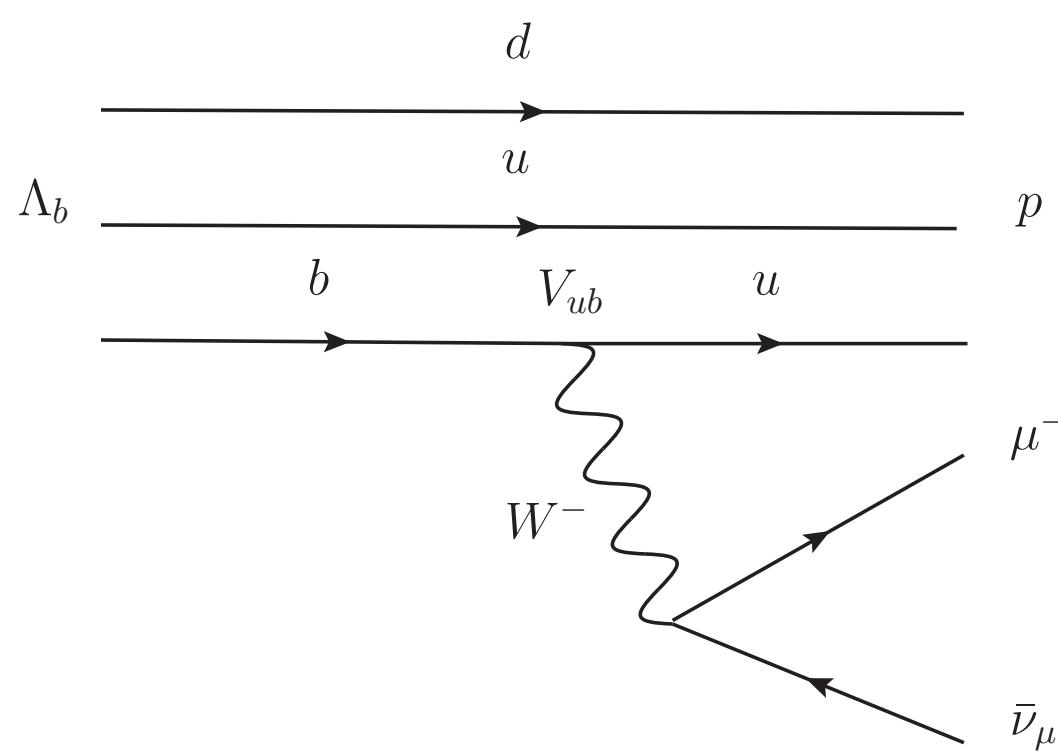


CONTEXT AND MOTIVATION

In the Standard Model the decay $\Lambda_b^0 \rightarrow p\mu^-\bar{\nu}_\mu$ occurs at tree-level via the weak charged current interaction. A measurement of the differential rate for this decay together with theoretical form factor predictions allows a determination of $|V_{ub}|$, which is least known of the CKM elements.



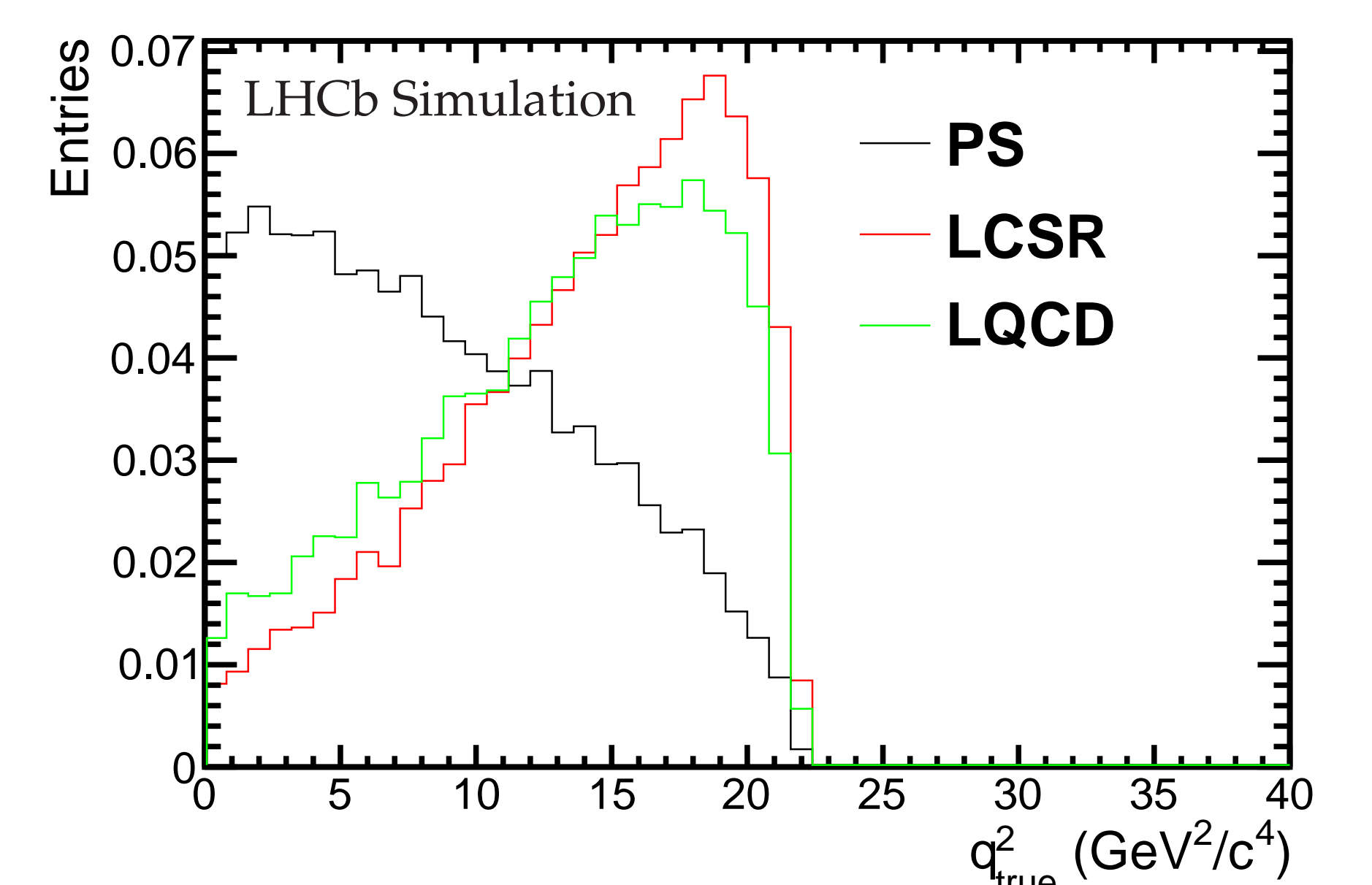
THEORETICAL CHALLENGE

The hadronic matrix element, H_ν , for this decay may be parametrised in terms of six form factors:

$$H_\nu = \langle N^+(p', s') | \bar{u} \gamma_\nu (1 - \gamma_5) b | \Lambda_b^0(p, s) \rangle$$

$$= \bar{u}_N(p') [F_1^V \gamma_\nu + F_2^V v_\nu + F_3^V v'_\nu - (F_1^A \gamma_\nu + F_2^A v_\nu + F_3^A v'_\nu) \gamma_5] u_{\Lambda_b}(p)$$

Theoretical predictions for these form factors can be made using non-perturbative techniques such as Light Cone Sum Rules (LCSR) [2] and Lattice QCD (LQCD) [3].

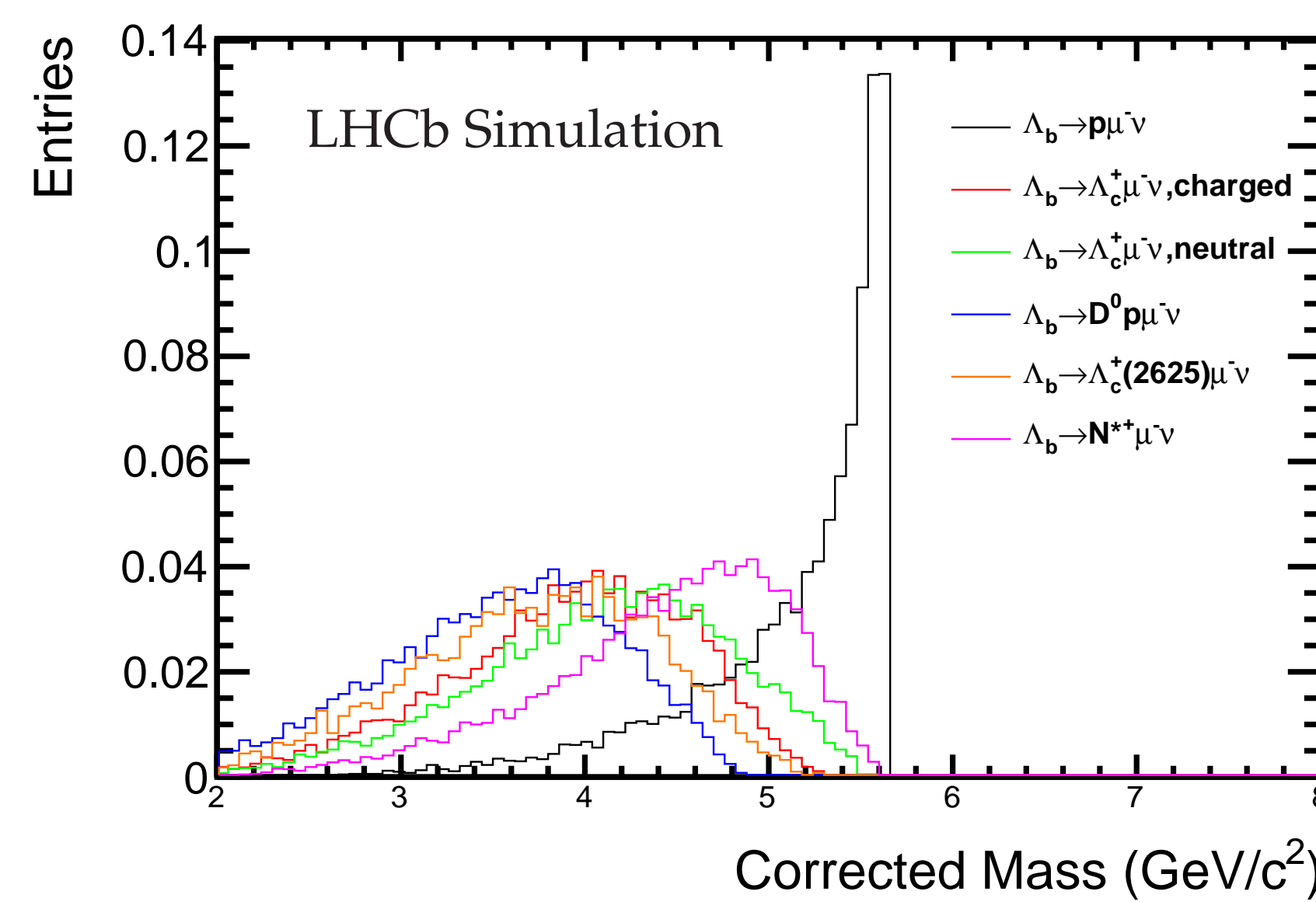
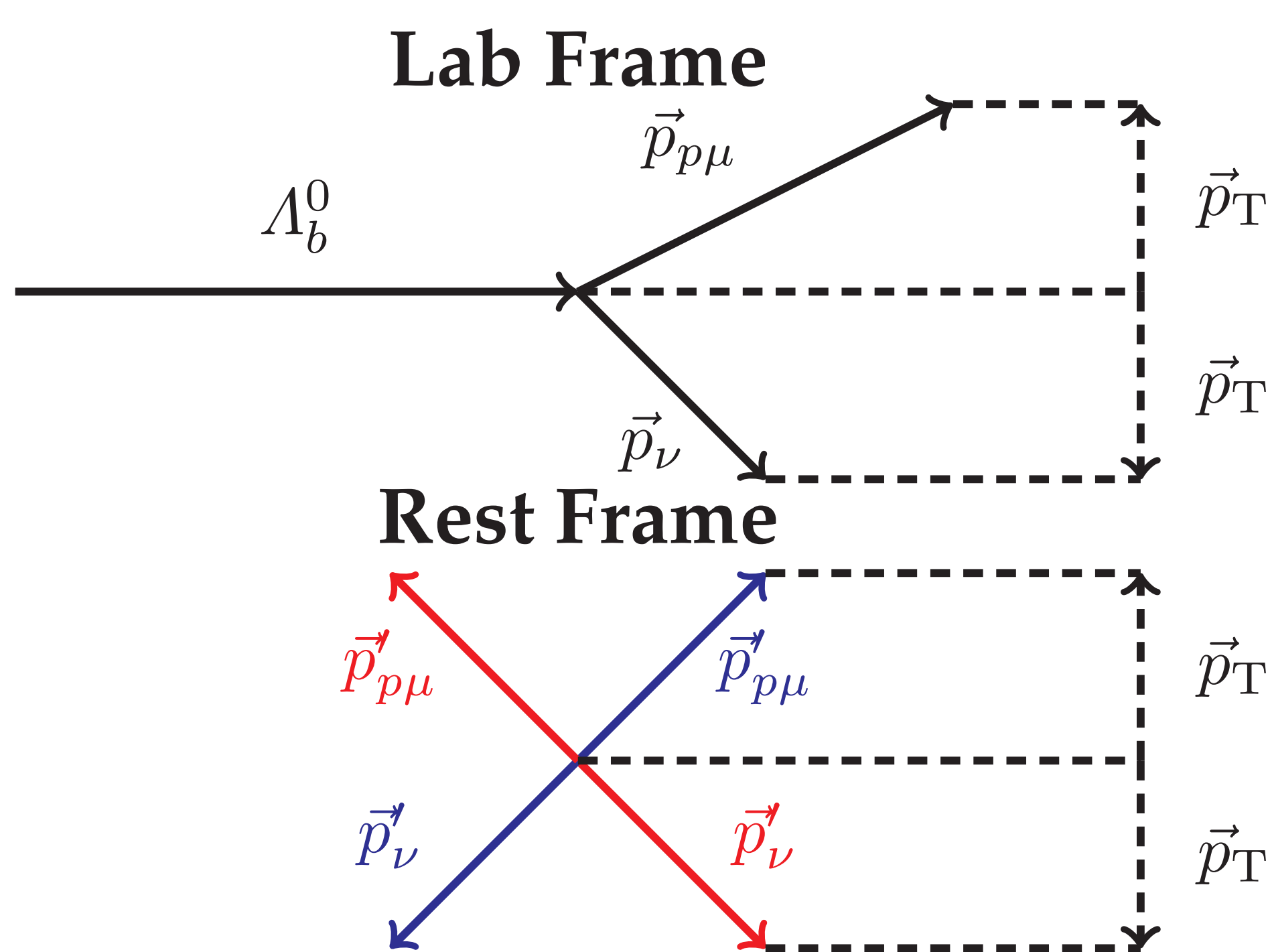


EXPERIMENTAL CHALLENGE

- No mass peak to fit due to neutrino in decay.
- Large backgrounds from $b \rightarrow c$ transitions as $|V_{cb}|^2/|V_{ub}|^2 \approx 100$.

However, using knowledge of the Λ_b^0 direction:

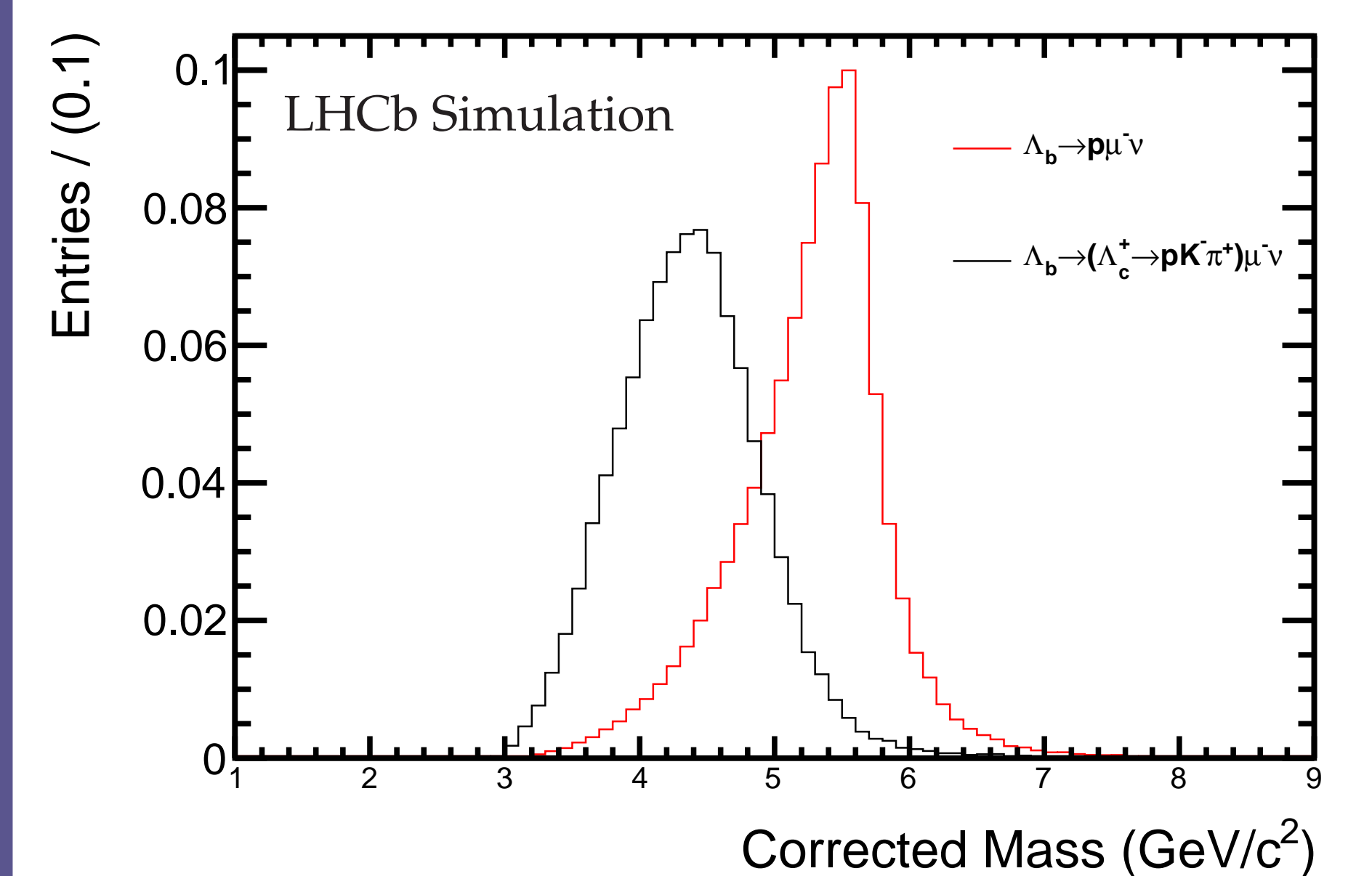
- Can reconstruct the momentum transfer squared, q^2 , up to a 2-fold ambiguity.
- Can form a corrected mass variable, $M_{corr} = p_T + \sqrt{p_T^2 + M_{p\mu}^2}$.



PRESELECTION

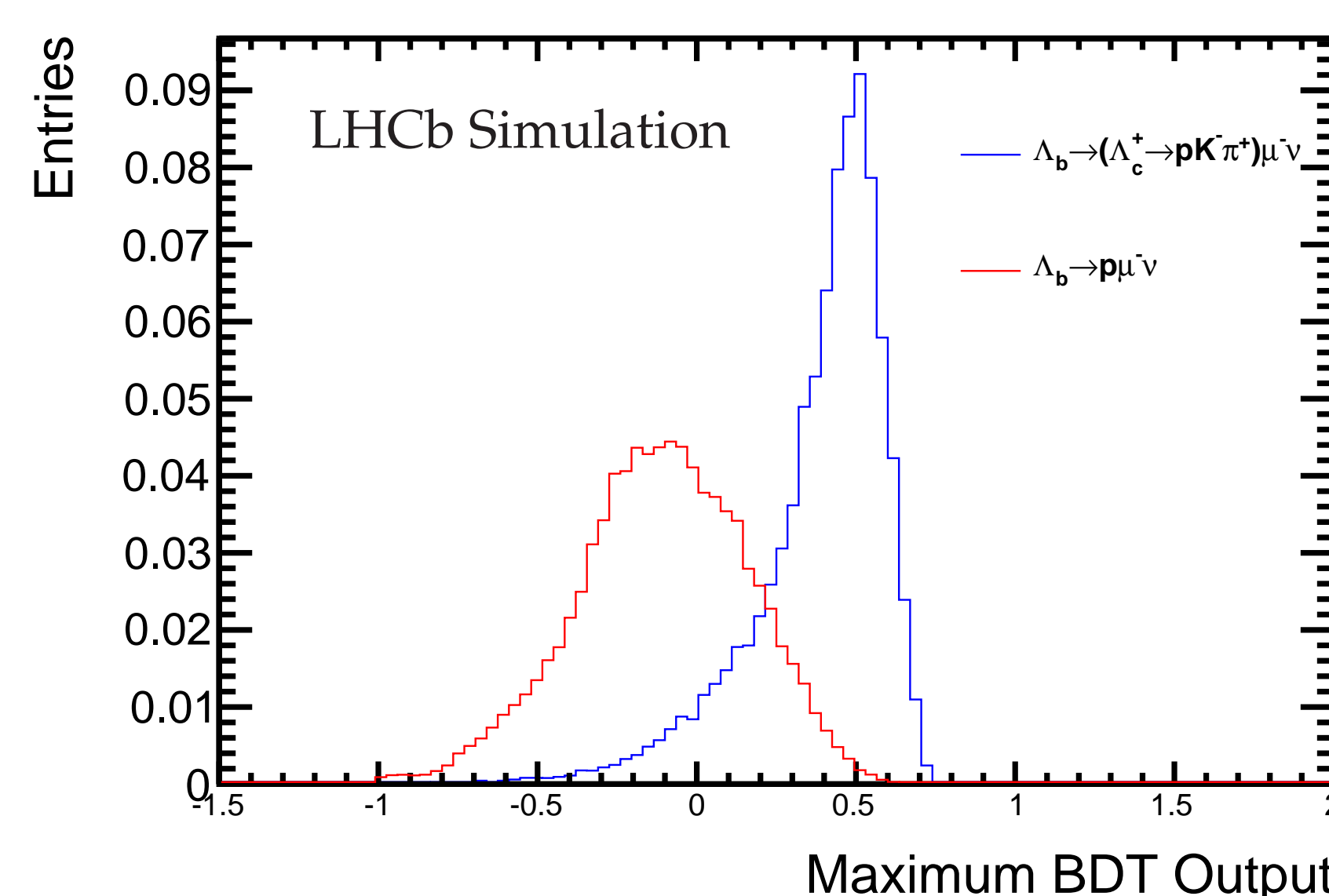
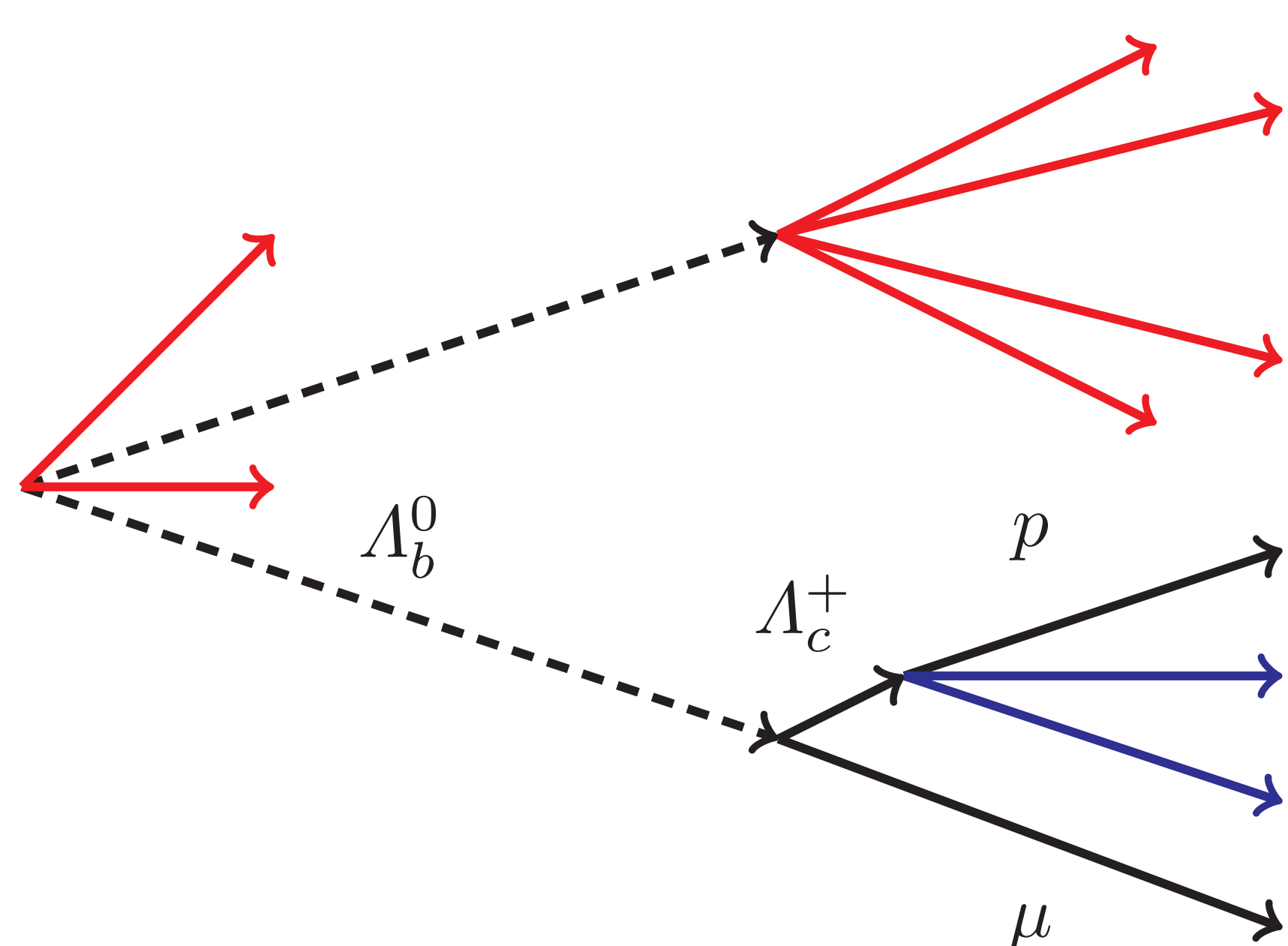
A preliminary cut-based selection is applied to select candidate protons and muons; this includes cuts on the following:

- Muon and proton $|\vec{p}|$ and p_T .
- Track and vertex qualities.
- The opening angle between the Λ_b^0 and $p\mu$ directions.
- Proton PID variables and Muon ID
- The Λ_b^0 flight distance χ^2 .
- The $p\mu$ invariant mass $M_{p\mu}$.



ISOLATION

- A Boosted Decision Tree (BDT) is trained to distinguish **additional tracks** from **random tracks**.
- The BDT is run on all tracks in each event.
- The maximum BDT output can be used as a criteria for isolation.



REFERENCES

- [1] CKMfitter Group, J. Charles *et al.*, Eur. Phys. J. C **41**, 1-131 (2005)
- [2] A. Khodjamirian, C. Klein, T. Mannel and Y.-M. Wang, arXiv:1108.2971 (2011)
- [3] W. Detmold, C.-J. Lin, S. Meinel and M. Wingate, arXiv:1306.0446 (2013)

Outlook

- A measurement of $\mathcal{B}(\Lambda_b^0 \rightarrow p\mu^-\bar{\nu}_\mu)$ in bins of q^2 would allow for an exclusive determination of $|V_{ub}|$.
- A search for $\Lambda_b^0 \rightarrow p\mu^-\bar{\nu}_\mu$ with the full 2011+2012 LHCb dataset is underway.