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Study of the semileptonic decay $\Lambda_b^0 \to \Lambda_c^+ \tau^- \bar{\nu}$ with the LHCb experiment

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Semileptonic B decays with a τ-lepton are a very interesting tool to probe the Physics beyond Standard Model. Besides its precise theoretical predictions due to lepton flavor universality it has been a hot topic since the evidence of a slight disagreement between BaBar, Belle and LHCb measurements and the SM expected value of $R(D^*)$. This gives us a chance to detect the presence of New Physics such as a charged Higgs boson, $H^{\pm}$ or to put major constraints on models including such particles.

Studying $\Lambda_b^0 \to \Lambda_c^+ \tau^- \bar{\nu}$ with the decay of the tau in three charged pions allows a precise reconstruction of the τ vertex and thus, permits the reconstruction of the Λ_b^0 and τ momenta. The analysis is possible thanks to a new method called "vertex inversion" which permits to distinguish signal events from prompt $\Lambda_c^+ 3\pi$ events.

This ananlysis will lead to the first measurement of $BR(\Lambda_b^0 \to \Lambda_c^+ \tau^- \bar{\nu})$, a measurement of the ratios of branching ratios with a tau and with a muon : $R(\Lambda_c)$.

The feasibility of this analysis is now demonstrated and the implementation of analysis tools such as isolation against neutral and charged tracks or partial reconstruction of the background is under study.

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