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A measurement of the $D^* \to \pi(K\pi\pi^0)$ decay channel as pertaining to the production of a W boson in association with a charm quark in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS Detector

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The measurement of the production of a W boson with a c quark (termed ''$W+c$ analysis") is studied with the ATLAS detector using the full Run 2 dataset of pp collisions at $\sqrt{s} = 13$ TeV. This measurement is crucial in obtaining increasingly precise values of the s and $\bar{s}$ parton distribution function (PDF) of the proton, as well as studying the physics of the charm quark. One of the decay modes through which $W + c$ analysis can be performed is the so-called "Satellite" mode, where a D^* decays according to: $D^* \to \pi D^0 \to \pi(K\pi\pi^0)$, and a W boson decays leptonically. We present the measurement of the cross section of $W^+ + D^{*-}$,$W^- + D^{*+}$, and the ratio of these cross sections $R_c^{\pm}(WD^*)$ using the Satellite mode in pp collisions at $\sqrt{s} = 13$ TeV. Specifically, we measure the scaling factor μ (which scales Standard Model predictions to observed data) for each charged lepton channel to be: $\mu(e^-) : 1.15 \pm 0.07$, $\mu(e^+) : 1.08 \pm 0.07$, $\mu(\mu^-) : 1.11 \pm 0.07$, and $\mu(\mu^+) : 1.06 \pm 0.09$. Additionally, we calculate a first pass value of $R_c^{\pm}(WD^*)$ to be 0.92, and we bound the uncertainty on this ratio to be $\sigma(R_c^{\pm}(WD^*)) < 0.06$.

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Primary author: KARUR, Rohith Anand (Lawrence Berkeley National Lab. (US))

Co-author: GRAY, Heather (UC Berkeley/LBNL)

Presenter: KARUR, Rohith Anand (Lawrence Berkeley National Lab. (US))

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