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Second Generation Machine Learning based Algorithm for Long-lived Particles Reconstruction in Upgraded LHCb Experiment.

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Large Hadron Collider- beauty (LHCb) is one of the four large experiments operating currently at Large Hadron Collider(LHC) it is designed to study New Physics phenomena in the heavy flavor quarks sector and perform precise measurements of CP symmetry violation in beauty and charm quarks sector. At present, the detector is undergoing a major upgrade with respect to its original design. In order to filter out the data produced by each proton-proton interaction, it requires a robust trigger system. In the upgraded system, the hardware trigger that worked based on information from Calorimeters and Muon Systems is completely removed instead a flexible fully-software trigger will be used. Machine Learning based Long-lived particle reconstruction algorithm is a part of this new upgraded system. It will apply a cascade of filters to remove fake tracks and improve both the efficiency and purity of the final track samples. The machine learning models make the decisions based on the data. The performance of the data pipeline will be highly optimized without the limitations of having a Hardware Trigger System. LHCb experiment collected during Run 1 and Run 2 a data sample corresponding to integrated luminosity of 9 fb-1, whilst after Run 3 and Run 4 the integrated luminosity should reach at least 50 fb-1. Thus this approach is vital for the upgrade to remove rigid cuts on measurable parameters, avoid the limitations of hardware degradations and replacements by making the entire system more complex and help us understand the Physics that we never knew before.

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