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Performance Evaluation of Forward Muon Track Matching in ALICE Run 3

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In preparation for the LHC Run 3, which will provide collisions at higher luminosity and center-of-mass energy, the ALICE experiment has introduced new detectors in addition to upgrading the existing detectors. As a part of this upgrade, a new silicon pixel tracking detector named Muon Forward Tracker (MFT) with an excellent positional resolution is installed in the forward rapidity region. By combining this new detector with the existing ALICE forward muon detectors, the accuracy in determining a muon production point and a momentum vector, which have been a limitation so far, will be dramatically improved. In order to optimize this performance, it is necessary to correctly combine and match the tracks reconstructed by the new detectors with those reconstructed by the existing detectors. However, since thousands of charged particles are produced in high-energy heavy-ion collisions, the number of possible combinations of tracks is enormous. Especially in the low (transverse) momentum region, it is challenging to combine the tracks correctly because of the effect of multiple scattering in the hadron absorber placed between the two detector sets. Since the physics occurring in the low transverse momentum region is one of the fundamental subjects of interest in the ALICE experiment, we need to improve the efficiency and purity in connecting the tracks in the low transverse momentum region.
In this study, we will tackle this challenging task by using machine learning with simulations and we will present the solution for track matching even if there is large amount of material between trackers.
We have confirmed that the performance of our method achieves a significantly better track matching (or performance) than methods without machine learning, which was initially proposed in the ALICE experiment and mimicked the Kalman filter. We will discuss various inputs and methods for this machine learning application and evaluate the corresponding performance evolution.

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