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ACTS-based reconstruction for a straw-tube forward tracker in MPD

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A straw-tube forward tracking detector is being considered for the second stage of the Multi-Purpose Detector (MPD) at the NICA collider. It would extend the MPD acceptance to forward rapidities and broaden the accessible physics program. In central heavy-ion collisions, high hit density and ghost hits create a large combinatorial background, making robust track reconstruction challenging. We present recent developments of the ACTS-based reconstruction aimed at improving its performance in this environment.

Recent work focused on two stages that were found to limit the reconstruction performance: space-point creation and track seeding. The space-point algorithm combines measurements from stereo-crossed straw layers. Its ambiguity resolution was studied using a graph neural network, and the deterministic selection was subsequently optimized to improve the balance between reconstruction efficiency and background suppression. In parallel, a custom seeding algorithm was developed to exploit space points from all five tracking stations, instead of the three fixed stations used in the previous ACTS-based setup. This makes seed reconstruction less sensitive to missing or ambiguous space points in individual stations.

With these improvements, high reconstruction efficiency for trackable primary pions is achieved in central Au-Au events at $\sqrt{s_{NN}} = 11$ GeV simulated with UrQMD, while maintaining high reconstructed-track purity. Further developments will include matching with the forward TOF detector to study its potential for additional ghost suppression.

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