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GNN-Based Tracking Reconstruction for the Fermilab Muon g-2 Experiment

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The Fermilab Muon g-2 Experiment recently released its Run2-3 findings with a precision of 0.2 ppm, consistent with previous Run1 and BNL results. As a key component of the data reconstruction and analysis, tracking reconstruction provides essential beam dynamics parameters and muon weighting parameters, and determines the precision of muon EDM measurements. This presentation introduces the latest tracking reconstruction development within the experiment, particularly the graph neural network (GNN)-based approach. Leveraging message-passing mechanisms and the Louvain algorithm, the GNN method efficiently identifies tracks. Preliminary studies on synthetic and experimental data demonstrate promising results, indicating the significant potential of the GNN-based method in tracking reconstruction.

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