

Fast simulation of Time Projection Chamber response at MPD using GANs

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NICA accelerator complex is currently being assembled in JINR (Dubna) to perform studies of heavy-ion collisions and explore new regions of the QCD phase diagram. Located at one of the two interaction points of the facility, the Multi-Purpose Detector (MPD) will utilize the Time-Projection Chamber (TPC) as the main tracker of the detector's central barrel. TPC consists of a gas-filled detection volume in a uniform electric field with a 2D position-sensitive electron collection system. Combining the 2D position information with the drift time information, TPC allows to reconstruct the 3D coordinate of the original electron clusters and hence measure the charged particle's trajectory.

Accurately simulating TPC is computationally heavy. A typical heavy-ion collision event is expected to take about 25 seconds to simulate with the available resources. In this work we propose a fast-simulation model based on a Generative Adversarial Network (GAN) to generate raw TPC signals. Preliminary studies show that our model can produce high-fidelity results in under one second per collision.

Primary authors: MAEVSKIY, Artem (National Research University Higher School of Economics (RU)); RATNIKOV, Fedor (Yandex School of Data Analysis (RU))

Co-author: ZINCHENKO, Alexander (Joint Institute for Nuclear Research (RU))

Presenter: MAEVSKIY, Artem (National Research University Higher School of Economics (RU))

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