

IEA-GAN for the Fast Simulation of PXD Background at Belle II

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The pixel vertex detector (PXD) is the newest and the most sensitive subdetector at the Belle II. Data from the PXD and other sensors allow us to reconstruct particle tracks and decay vertices. The effect of background processes on track reconstruction is simulated by adding measured or simulated background hit patterns to the hits produced by simulated signal particles which originates from the processes of interest. This model requires a large set of statistically independent PXD background noise samples to avoid a systematic bias of reconstructed tracks. However, the fine-grained PXD data requires a substantial amount of storage. As an efficient way of producing background information for fast simulation, we introduce the idea of an on-demand PXD background generator with Intra-Event Aware GAN (IEAGAN), conditioned over the number of PXD sensors in order to produce sensor-dependent PXD images by approximating the concept of an "event" in the detector as these PXD images share both semantic and statistical features that makes it extremely hard for even the state-of-the-art GANs to mimic these exact properties. As a result, we developed IEAGAN model which tries to capture these dependencies by imposing relational inductive bias over the batch space.

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