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CMS FlashSim: end-to-end simulation with ML

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Detailed event simulation at the LHC is taking a large fraction of computing budget. CMS developed an end-to-end ML based simulation that can speed up the time for production of analysis samples of several orders of magnitude with a limited loss of accuracy. As the CMS experiment is adopting a common analysis level format, the NANO AOD, for a larger number of analyses, such an event representation is used as the target of this ultra fast simulation that we call FlashSim. Generator level events, from PYTHIA or other generators, are directly translated into NANO AOD events at several hundred Hz rate with FlashSim. We show how training FlashSim on a limited number of full simulation events is sufficient to achieve very good accuracy on larger datasets for processes not seen at training time. Comparisons with full simulation samples in some simplified benchmark analysis are also shown. With this work, we aim at establishing a new paradigm for LHC collision simulation workflows in view of HL-LHC.

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