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Impact of Detector Simulation in Particle Physics Collider Experiments

Monday 9 July 2018 14:00 (15 minutes)

Detector simulation has become fundamental to the success of modern high-energy physics (HEP) experiments. For example, the Geant4-based simulation applications developed by the ATLAS and CMS experiments played a major role for them to produce physics measurements of unprecedented quality and precision with faster turnaround, from data taking to journal submission, than any previous hadron collider experiment. The material presented here add to a recent review on the impact of detector simulation in collider particle physics experiments published in Ref. [1]. Most recent examples illustrate the application of simulation to detector design and optimization, software development and testing of computing models, detector commissioning and data calibration studies, as well as physics signal and background estimations utilized in data analysis for physics measurements. The cost and economic impact of simulation in the CMS experiment are also discussed. Future experimental programs present new challenges for increasingly sophisticated detectors, events, and data samples. The presentation finishes with a short discussion on potential solutions to mitigate the impact of this new environment on computing performance, given that physics accuracy needs to be preserved or improved. They are based on re-engineering detector simulation software using modern software and computing techniques to run on emerging hardware architectures.

[1] Physics Reports 695 (2017) 1-54, arXiv:1706.04293

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