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CMS Full Simulation: Evolution Toward the 14 TeV Run

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The total amount of Monte Carlo events produced for CMS in 2012 is about 6.5 billion. In the future run at 14 TeV larger datasets, higher particle multiplicity and higher pileup are expected. This is a new challenge for the CMS software. In particular, increasing the speed of Monte Carlo production by a significant factor without compromising the physics performance is a highly-desirable goal. In this work we present the current status of the CMS full simulation software and perspectives for improvements.

The CMS full simulation is based on the Geant4 toolkit. For the production in 2012 Geant4 9.4 was used. In this work we report on the physics performance of the new Geant4 9.6 version, currently in development. Comparisons between 2012 data and Monte Carlo predictions will be shown, and validation software will be discussed.

Several methods have been studied that might allow a significant increase in speed of the CMS full simulation: fast mathematical libraries, GFlash, and Geant4 biasing options. In this presentation effects of these methods will be discussed and validation results will be presented. The most significant CPU improvement comes from the Russian roulette method in the new Geant4, which will be described in detail.

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