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Adopting new technologies in the LHCb Gauss simulation framework

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The increase in luminosity foreseen in the future years of operation of the Large Hadron Collider (LHC) creates new challenges in computing efficiency for all participating experiment. These new challenges extend beyond the data-taking alone, because data analyses require more and more simulated events, whose creation already takes a large fraction of the overall computing resources. For Run 3 of the LHC, the LHCb collaboration needs to simulate about two orders of magnitude more Monte Carlo events to exploit the increased luminosity.
Therefore, the LHCb simulation framework (Gauss) will go through a significant renovation, mostly driven by the upgraded core software framework (Gaudi) and the availability of a multithreaded version of Geant4. The upgraded Gaudi framework replaces single-threaded processing by a multithreaded approach, allowing concurrent execution of tasks with a single event as well as multiple events in parallel. A major task of the required overhaul of Gauss is the implementation of a new interface to the multithreaded version of Geant4. Furthermore, in order to implement fast simulation options for different sub-detectors, this interface needs to be designed as modular as possible to allow seamless customisation of the detector simulation and a different treatment based on particle type.
In this talk, we will give an overview of the whole plan and discuss the status of the project , as well as the lessons learned facing the challenges above. Furthermore, we present the work on Gaussino, a new Gaudi-based core simulation framework which forms the basis of Gauss for Run 3. Gaussino is a cross-experiment simulation framework with no dependency on LHCb software and provides an ideal testbed for the implementation of future technologies such as GeantV.

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