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The core software framework for the LHCb Upgrade

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The LHCb experiment will be upgraded for data taking in Run 3 and beyond and the instantaneous luminosity will in particular increase by a factor five. The lowest level trigger of the current experiment, a hardware-based trigger that has a hard limit of 1 MHz in its event output rate, will be removed. and replaced with a full software trigger. This new
trigger needs to sustain rates up 30 MHz for the inelastic proton-proton collisions and will thus process 5 Tb/s of data, which is over two orders of magnitude larger than the rate processed by the current LHCb experiment, all this to be achieved within the same costs of the current data processing and without compromising the physics performance. For this purpose, the Gaudi framework currently used in LHCb has been re-engineered to enable the maximally efficient usage of vector registers and of multi- and many-core architectures. In particular, a new scheduler and a re-design of the data structures were needed in order to make the most efficient usage of memory resources and speed up
access patterns.
This contribution presents these and other critical points that had to be tackled as well as the current status and an outlook of the work program that will address the challenges of the software trigger in the LHCb Upgrade.

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