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An FPGA-based tracking system for accelerating event reconstruction at LHCb

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Studying physics at high intensity is requiring HEP experiments to continuously push the frontier of data acquisition. With ever increasing data rates, reconstruction and trigger systems need to be reconsidered up to their fundamental architectures and new solutions have to be sought after. The "Artificial Retina"architecture answers this call, offering a high-parallelised tracking system implemented on FPGAs, exploiting their low latency response, low power consumption and high bandwidth capability.

LHCb, with its bandwidth outputted by the front-end being the highest in the field, is planning to implement such system for the upcoming LHC Run 4. The aim is offering, before the event-building, pre-reconstructed tracks (primitives) from the SciFi subdetector to the trigger system. As of consequence, time and resources required for event reconstruction are saved up and can be redirected to more complex tasks.

The feasibility of the Retina system is supported by results yielded both by a real-size demonstrator, reconstructing a portion of a LHCb subtetector, and in-depth studies of the physics performance and resource gains reachable with its embedding into the LHCb DAQ system. Alongside these results, its linear scalability w.r.t. the instantaneous luminosity is presented as well, showing its appeal for future HL-LHC and possibly beyond.

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