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GPUs in Run 3: a shift in the offline/online processing paradigm for ALICE

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In view of the LHC Run3 starting in 2021, the ALICE experiment is preparing a major upgrade including the construction of an entirely new inner silicon tracker (the Inner Tracking System) and a complete renewal of its Online and Offline systems (O^2).

In this context, one of the requirements for a prompt calibration of external detectors and a fast offline data processing is to run online the reconstruction of tracks in the Upgraded ITS.

To cope with the specification of the O^2 and with the foreseen peak Pb-Pb interaction rate of 50 kHz, the algorithms involved are being implemented exploiting common parallelisation technologies, such as SIMD and multithreading on CPUs and offloading workloads on GPUs, via CUDA, OpenCL and HIP.

Other detectors such as Time Projection Chamber (TPC) and the Transition Radiation Detector (TRD) are moving in the same direction. The target is to have the entire online reconstruction pipeline running on GPUs.

In this contribution I will show the state of the art, the results and the the future developments of the software for the reconstruction in ITS. I will also cover the strategies adopted in writing GPU code in a scenario where vendor lock-in is not an option. Finally, I will also introduce “alidock”, a tool we created, capable to provide consistent, customizable and GPU-aware environment for development and runtime.

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