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Track Reconstruction in the ALICE TPC using GPUs for LHC Run 3

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In LHC Run 3, ALICE will increase the data taking rate significantly to 50 kHz continuous read out of minimum bias Pb-Pb collisions.
The reconstruction strategy of the online offline computing upgrade foresees a first synchronous online reconstruction stage during data taking enabling detector calibration, and a posterior calibrated asynchronous reconstruction stage.
We present a tracking algorithm for the Time Projection Chamber (TPC), the main tracking detector of ALICE.
The reconstruction must yield results comparable to current offline reconstruction and meet time constraints like in the current High Level Trigger (HLT), processing 50 times as many collisions per second as today.
It is derived from the current online tracking in the HLT, which is based on a Cellular automaton and the Kalman filter, and we integrate missing features from offline tracking for improved resolution.
The continuous TPC read out and overlapping collisions pose new challenges: conversion to spatial coordinates and application of time- and location dependent calibration must happen in between of track seeding and track fit while TPC occupancy increases five-fold.
The huge data volume requires a data reduction factor of 20, which imposes additional requirements: the momentum range must be extended to identify low-Pt looping tracks and a special refit in uncalibrated coordinates improves the track model entropy encoding.
Our TPC track finding leverages the potential of hardware accelerators via the OpenCL and CUDA APIs in a shared source code for CPUs, GPUs, and both reconstruction stages.
Porting more reconstruction steps like the remainder of the TPC reconstruction and tracking for other detectors will shift the computing balance from traditional processors to GPUs.
We give an overview of the status of Run 3 tracking including track finding efficiency, resolution, treatment of continuous read out data, and performance on processors and GPUs.

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