

# Fast online reconstruction of short-lived particles with KF Particle Finder in the CBM experiment

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The future heavy ion experiment CBM at the FAIR facility will study the QCD phase diagram in the region of high baryon chemical potential at relatively moderate temperatures, where a complex structure is predicted by modern theories. In order to detect possible signatures of these structures, the physics program of the experiment includes comprehensive study of the extremely rare probes like charmed particles, dileptons, multi-strange particles and their antiparticles. Thus, the operation scenario assumes extremely high interaction rates of up to  $10^7$  collisions per second. Having no clear signatures for the hardware trigger, CBM will perform the full event reconstruction online including the stage of short-lived particles reconstruction.

The KF Particle Finder package was developed to solve this task. The package searches for more than 100 decay channels covering signals from most of the physics cases of the CBM experiment: strange particles, strange resonances, hypernuclei, low mass vector mesons, charmonium, and open-charm particles. The package provides rich functionality for reconstruction of short-lived particles including reconstruction of decay trees. Based on the Kalman filter mathematics, it allows to estimate not only the parameters, but their errors as well.

For fast operation the algorithms for particle reconstruction were optimised with respect to speed keeping the same reconstruction quality and efficiency. The KF Particle Finder package was fully SIMDised and parallelised. For better utilisation of the computational power of modern processing units all calculations were implemented in single precision. Also, tools for track fitting to prepare the input data were SIMDised and parallelised. The performance of KF Particle Finder on many-core computing architectures is presented and discussed.

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