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Porting Reconstruction Algorithms to the Cell Broadband Engine

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On-line processing of large data volumes produced in modern HEP experiments requires using maximum capabilities of the computer architecture. One of such powerful feature is a SIMD instruction set, which allows packing several data items in one register and to operate on all of them, thus achieving more operations per clock cycle. The novel Cell processor extends the parallelization further by combining a general-purpose PowerPC processor core with eight streamlined coprocessing elements which greatly accelerate vector processing applications.

In order to investigate a possible speed up of the reconstruction stage of data processing, we have ported a track fitting package based on the Kalman filter to the Cell processor. The overall speed up in 120000 times has been obtained on a Cell Blade computer compared to the initial scalar implementation on a Pentium 4 machine. Major steps of the porting procedure (memory optimization, numerical analysis, vectorization with inline operator overloading, and optimization using the Cell simulator) are presented and discussed.

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