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## Traditional Tracking with Kalman Filter on Parallel Architectures

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Power density constraints are limiting the performance improvements of modern CPUs. To address this we have seen the introduction of lower-power, multi-core processors, but the future will be even more exciting. In order to stay within the power density limits but still obtain Moore's Law performance/price gains, it will be necessary to parallelize algorithms to exploit larger numbers of lightweight cores and specialized functions like large vector units. Example technologies today include Intel's Xeon Phi and GPGPUs.

Track finding and fitting is one of the most computationally challenging problems for event reconstruction in particle physics. At the High Luminosity LHC, for example, this will be by far the dominant problem. The need for greater parallelism has driven investigations of very different track finding techniques including Cellular Automata or returning to Hough Transform techniques originating in the days of bubble chambers. The most common track finding techniques in use today are however those based on the Kalman Filter. Significant experience has been accumulated with these techniques on real tracking detector systems, both in the trigger and offline. They are known to provide high physics performance, are robust and are exactly those being used today for the design of the tracking system for HL-LHC. We report the results of our investigations into the potential and limitations of these algorithms on the new parallel hardware.

**Primary authors:** YAGIL, Avi (Univ. of California San Diego (US)); Dr RILEY, Daniel Sherman (Cornell University (US)); WUERHWEIN, Frank (Univ. of California San Diego (US)); CERATI, Giuseppe (Univ. of California San Diego (US)); MACNEILL, Ian (Univ. of California San Diego (US)); MCDERMOTT, Kevin (Cornell University (US)); TADEL, Matevz (Univ. of California San Diego (US)); Dr ELMER, Peter (Princeton University (US)); WITTICH, Peter (Cornell University (US)); Dr LANTZ, Steven (Cornell University)

**Presenter:** ABDURACHMANOV, David (Vilnius University (LT))

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