

Parallelization for HEP Event Reconstruction

Tuesday, 28 July 2020 18:10 (20 minutes)

We report on developments targeting a boost in the utilization of parallel computing architectures in HEP reconstruction, particularly for LHC experiments and for neutrino experiments using Liquid Argon Time-Projection Chamber (LArTPC) detectors. Key algorithms in the reconstruction workflows of HEP experiments were identified and redesigned: charged particle track reconstruction for CMS, and hit finding for LArTPC detectors such as ICARUS and MicroBooNE. These algorithms are some of the most time-consuming steps of the event reconstruction, and optimizing their computational performance is key to defining the computing needs for the reconstruction software of the next-generation HEP experiments. With the use of advanced profiling tools and development techniques, the algorithms have been rewritten so that they can take full advantage of multi-threading and vectorization on modern multicore CPUs, while at the same time satisfying physics performance goals. On a single thread, the modified versions are faster than the original algorithms by a factor ranging from 6 to 12x, depending on the application, and both the track reconstruction and hit finder algorithms have been integrated into the experiments' reconstruction software. Portable implementations of the algorithms for usage at supercomputers and with heterogenous platforms have been explored.

I read the instructions

Secondary track (number)

Primary authors: BERKMAN, Sophie (Fermi National Accelerator Laboratory); CERATI, Giuseppe (Fermi National Accelerator Lab. (US)); KORTELAJNEN, Matti (Fermi National Accelerator Lab. (US)); REINSVOLD HALL, Allison (Fermilab); WANG, Michael (Fermi National Accelerator Lab. (US)); GRAVELLE, Brian (University of Oregon); NORRIS, Boyana (University of Oregon); ELMER, Peter (Princeton University (US)); WANG, Bei (Princeton University (US)); LANTZ, Steven R (Cornell University (US)); REID, Michael (Cornell University (US)); RILEY, Daniel Sherman (Cornell University (US)); WITTICH, Peter (Cornell University (US)); MASCIOVECCHIO, Mario (Univ. of California San Diego (US)); KRUTELYOV, Slava (Univ. of California San Diego (US)); TADEL, Matevz (Univ. of California San Diego (US)); WUERTHWEIN, Frank (Univ. of California San Diego (US)); YAGIL, Avi (Univ. of California San Diego (US))

Presenters: CERATI, Giuseppe (Fermi National Accelerator Lab. (US)); REINSVOLD HALL, Allison (Fermilab); CERATI, Giuseppe (Fermi National Accelerator Lab. (US))

Session Classification: Computing and Data Handling

Track Classification: 14. Computing and Data Handling