FW Extensions & Tracking

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Framework extensions

- Resumed Gaudi DataHandle rework

  - Relevant merge requests finally accepted in Gaudi

  - Incompatibilities with recent FW changes were taken care of

  - Next step: Customize Python properties associated w/ data handles (expose target store, R/W access mode)

- Status tracked @ https://gitlab.cern.ch/gaudi/Gaudi/merge_requests/462/

Tracking status

- Figured out an alternate strategy for integrating the outcome of Nicolas Loizeau's internship in ACTS

- Analyzed the performance of Belle 2 tracking
  - Slides @ https://indico.desy.de/indico/event/19363/contribution/1/material/slides/0.pdf
  - Geant4-based geometry is by far the biggest bottleneck
  - Magnetic field handling comes next
  - Suspiciously deep call chains with limited inlining, hard to assess the performance impact with a profiler

Belle 2 plans

- Help the compiler generate better code
  - Profile-guided and link-time optimization
  - Tune shared library perimeters (an optimization barrier!)
  - Apply manual devirtualization and inlining where useful

- Understand the geometry bottleneck
  - Look for structural improvements (e.g. better layer layout)
  - Try newer VecGeom-enabled Geant4 (faster implementation)

- Integrate freshly optimized ACTS magnetic field handling?

Long-term ACTS plans

- Study ACTS' numerical stability using the Verrou[1] tool

  - Good for validation: Do we compute a sensible result?

  - Good for optimization: Where can we use reduced precision?

- Evaluate alternate implementations of ACTS components:

  - Custom geometry classes vs VecGeom

  - GSoC: Eigen vs xtensor[2] (+ interoperability of Eigen)

  - GSoC: Possible use of Kokkos[3] (hardware portability layer, supporting device-specific data layout adaptations)

[1] https://github.com/edf-hpc/verrou
[2] http://quantstack.net/xtensor
[3] https://github.com/kokkos/kokkos

Questions? Comments?