

HEP Data Analytics on HPC: SciDAC Intstitute Interactions

RAPIDS

DIY

- Used extensively for data parallelism and wrapping MPI in our C++ applications
- Integrated directly into existing analysis applications for scaling

HEPnOS

- Distributed memory object store designed for use at HPC facilities, using Mochi
- Developed for accessing and storing HEP physics objects with an API that matches access patterns in end-user analysis, production data processing, and simulation applications

HDF5

- Working in collaboration with the Northwestern University group to optimize use of parallel HDF5 in HEP applications.
- Parallel and scalable concatenation procedure from ensemble of grid-generated HDF5 files usable at HPC facilities.

Workflows with DECAF and PYCOMPSS

- Explorations of workflow automation with feedback loop using several MPI-capable physics applications for high-level parameter optimization.
- Includes Pythia event generation, Rivet, and Apprentice

FASTMath

Numerical optimization expertise

- Provided expert advice on use of state-of-the-art optimization techniques
- Introduced the project team to using AMPL solvers
- Introduced constrained optimization techniques

Robust and Bi-level optimization

- Produced software packages and tools together with the HEP project team
- Automated data selection (choosing relevant observables) for numerical minimization
- Automates a labor-intensive, manual procedure carried out by domain scientists

Surrogate optimization

- Created a novel multi-variate pole-free rational approximation algorithm targeted specifically at problem facing the HEP application space.
- Demonstrated superior performance and quality compared to pure polynomial approximation techniques together with the HEP project team