HEP Data Analytics on HPC: Interactions with HEP Community

SBND

- Feldman-Cousins algorithm rewritten with vectorization & MPI, Increasing performance more than 300x.

NOvA

- Extensive work on the Feldman-Cousins analysis on HPC architectures. Adopted as primary technique for oscillation results.
- Tools for producing HDF5 analysis formats for physics applications as alternative data format for use in HPC facilities and ML tools.
- Developed Pandana framework for highly scalable event filtering

ICARUS

- Parallel production workflow defined for event processing using art & LArSoft frameworks coupled to HEPnOS and DIY usable designed for HPC systems

ATLAS analysis

- Enabled H->μμ analysis using HPC systems and our scalable software technology to generate billions of background events

CMS & ATLAS

- Working to integrate Pythia HDF5 tools into CMS infrastructure

DUNE

- Adopted Feldman-Cousins software based on NOvA work

SciDAC: HPC Framework for Event Generation at Colliders

- Developed new event generator framework for unprecedented accuracy, tying Sherpa and Pythia8 together by means of HDF5 and DIY
- Explored application of Machine Learning for Monte-Carlo simulations with Sherpa.

HEP Event Reconstruction with Cutting Edge Computing Architectures

- Partner project in the design and use of the ICARUS workflow.

Theory and Phenomenology

- Leverage closed form solutions to neutrino oscillation problem from FNAL and BNL theory to accelerate computation
- Assisted with Dark Matter Direct detection phenomenology studies
- Helped conduct reinterpretation of ATLAS data to constrain new physics models
- Enabled early-universe research through technical assistance with complex differential equation solving

FASERnu

- Our expertise in generator tuning helped in the successful proposal of the "Fasernu“ experiment to be built at CERN shortly