



# SciDAC Projects

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SCD Projects Meeting  
15 Sept 2022

# Scientific Discovery Through Advanced Computing (SciDAC)

- Overall program: <https://www.scidac.gov/>
  - DOE Program managers are Jeremy Love and Randall Lavolette
  - Combines ASCR and domain science programs
- Five HEP projects
  - **ComPASS4: Accelerator Science and Simulation** (Jim Amundson)
    - Conventional Beam Dynamics, Plasma-based acceleration
  - Accelerating HEP Science - Inference and Machine Learning at Extreme Scales (Salman Habib)
    - Focus areas: Cosmology, Stats/ML at Scale, Accuracy
    - <https://press3.mcs.anl.gov/cpac/projects/scidac>
  - HEP Data Analytics on HPC (Jim Kowalkowski)
    - Accelerate HEP analysis on HPC platforms with help from ASCR FASTMath and RAPIDS
    - <https://computing.fnal.gov/hep-on-hpc/>
  - **HEP Event Reconstruction with Cutting Edge Computing Architectures** (Giuseppe Cerati)
    - Accelerate HEP event reconstruction using modern parallel architectures
  - Event Generation on HPC (Stefan Hoeche)
    - Short-distance cross section calculations on HPC



# Accelerator Modeling developments

- Finite difference solver with boundary conditions is working but an issue of unnecessary data communication between host and device memory is slowing the algorithm down for GPUs.
- SciDAC-5 CAMPA project is funded with FWPs submitted.
  - This is a multi-institution collaboration led by Jean-Luc Vay at LBNL.
  - The Fermilab share is about 0.18 FTEs for three people (of which we only have two at the moment.)
  - The DOE announcement will be Sept. 21 and work will commence in October.

# HEPReco project

- SciDAC project is winding down: FNAL money fully used, some carryover in partner institution (UOregon)
  - Would be great to discuss with management how to continue FNAL involvement in some of these activities, and in particular MkFit.
- Deployment of mkFit in offline CMS reconstruction
  - MkFit focused on track building so far, leading to significant speedups where applied, so that track fit becomes the most time consuming step of iterations where mkFit is used in building.
  - Investigating potential for speedup of track fit with mkFit: currently exploring which features are key to the track fit physics performance and how much time/CPU they take. This may lead to speedups even before using MkFit.
- Portability studies (p2z and p2r)
  - Preliminary takeaways from p2z performance on Summit node (V100 GPU), being added to paper:
    - CUDA version provides best performance, as expected. Portability with compiler directives (OpenACC and OpenMP4) or libraries (Alpaka and Kokkos) achieve similar performance as CUDA, provided the implementations use the same features as CUDA and a performant compiler such as OpenARC is used for the compiler directives.
- LArTPC reconstruction and ICARUS HPC workflow
  - Suboptimal utilization of Theta nodes for slow workflow steps not optimized by our project (e.g. Geant4) have significant impact on overall workflow performance. Internal discussions are ongoing on how to move forward.
  - Organizing a meeting between Icarus software conveners and FNAL Spack team to discuss adoption of Spack for central icaruscode builds.