LArSoft 2019 Summer Workshop 2019 day 2 overview

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LArSoft 2019 Summer Workshop

Day 2: Advanced topics in LArSoft

Today's discussion will focus on two topics with deep solution space connections

- Addressing certain problems of resource utilization on existing grid resources
- Implications of the evolving computing landscape on LArSoft / software in general

Day 2: Advanced topics in LArSoft

The current problem of resource utilization

- Memory consumption per job often exceeds per core allocation
- Reserving multiple slots as a mitigation -- a common practice -- leads to significant CPU under-utilization
- Also not utilizing SIMD capabilities of existing grid resources
  - Completely lost cycles for algorithms that can be vectorized
  - Waveform and signal processing phases come to mind

This morning, will examine multi-threading and vectorization as a means to address these problems, and provide an introduction to using these techniques in LArSoft

Day 2: Advanced topics in LArSoft

The on-going evolution of the computing landscape

- Expect grid-based resources similar to those available today to go away in the not very distant future
- Current developments in computing hardware point to a future with architectures optimized for highly parallel computations, and heterogeneous computing resources with hardware accelerators targeting specific types of problems
- Expect multi-threading and / or vectorization to be significant part of the solution

This afternoon, will discuss the nature of the evolution in computing, the problems posed by that evolution for the existing software, and ideas for how to proceed.

Day 2 agenda

Morning session 9:00 am to noon

09:00 - 12:00 Multi-threading and vectorization

- 09:00 **Overview of day** *10′*
  Speaker: Dr. Erica Snider (Fermilab)
- 09:10 **Introduction to multi-threading and vectorization** *45′*
  Speaker: Matti Kortelainen
- 09:55 **Discussion** *20′*
- 10:15 **Making code thread-safe** *20′*
  Speaker: Dr. Kyle Knoepfel (Fermilab)
- 10:35 **Discussion** *10′*
- 10:45 **break** *15′*
- 11:00 **Multi-threading in art** *20′*
  Speaker: Dr. Kyle Knoepfel (Fermilab)
- 11:20 **Discussion** *10′*
- 11:30 **Experience learning to make code thread-safe** *20′*
  Speaker: Dr. Michael Wang (Fermilab)
- 11:50 **Discussion** *10′*

12:00 - 13:30 Lunch

On your own

Day 2 agenda

Morning session 9:00 am to noon

13:30 - 17:00 **Long-term vision for LArSoft**

- 13:30 **Overview** *10'*
  Speaker: Dr. Adam Lyon (Fermilab)
- 13:40 **Computing in the time of DUNE; HPC computing solutions for LArSoft** *30'*
  Speaker: Giuseppe Cerati (Fermilab)
- 14:10 **Data management and workflow solutions needed** *30'*
  Speaker: Dr. Michael Kirby (FNAL)
- 14:40 **Discussion** *20'*
- 15:00 **Break** *30'*
- 15:30 **DUNE perspective** *30'*
  Speaker: Dr. Thomas Junk (Fermilab)
- 16:00 **ICARUS perspective** *30'*
  Speaker: Tracy Usher (SLAC)
- 16:30 **Discussion** *30'*

The end