News

Computational Frontier Convener Meeting @ Snowmass2021

Steve Gottlieb / Ben Nachman / Oliver Gutsche

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Welcome Liaisons

Liaisons

Software and Computing are used by most of the SnowMass2012 frontiers. We setup liaisons to keep in close contact:

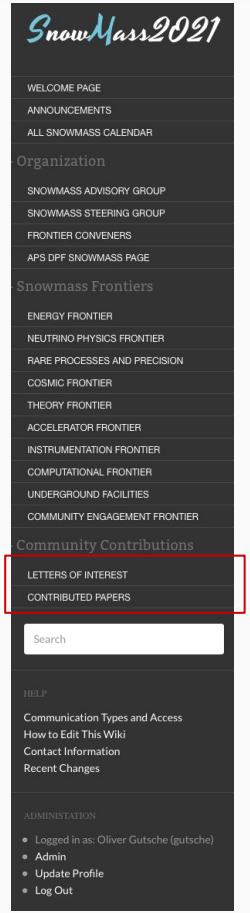
Frontier	Liaison
Energy Frontier	Daniel Elvira (FNAL)
Neutrino Physics Frontier	Alex Himmel (FNAL)
Rare Processes and Precision	Stefan Meinel (Arizona)
Cosmic Frontier	
Theory Frontier	Steven Gottlieb (Indiana)
Accelerator Science/Technology	Ji Qiang (LBL)
Instrumentation Frontier	Darin Acosta (Florida)
Community Involvement	

Workshops

- Attach to other Frontier's workshops
  - <make list of what is happening>
- Organize our own workshop (virtual of course)
  - Proposal: August 10-11 - one week after ICHEP
    - Check your calendars
  - Discussion: Pros/Cons
  - We should cross check with others
    - Other Frontiers, HSF, IRIS-HEP, WLCG, OSG, etc. (we checked https://hepsoftwarefoundation.org/future-events.html)
    - Liaisons, can you check for conflicts?

Documents

- Start documenting material
  - Contributed papers / Letters of interest ➜ Own wiki pages
  - Additional documents from the community not specially written for Snowmass ➜ Need to discuss where: topical group wiki pages? central pages?
    - Poll!!!



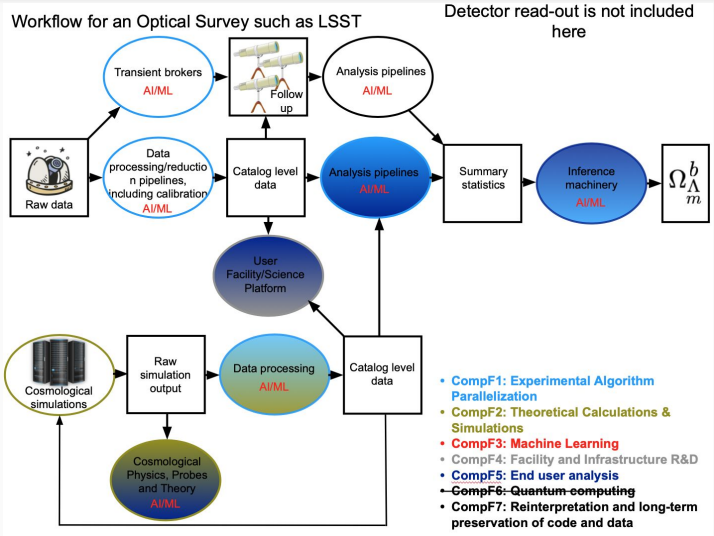
Funding agencies

- Want close communication with funding agencies
- Question to them: How can we make the Snowmass2021 report most relevant?
- Inviting NSF/DOE representatives to come to our convener meeting and talk with us:
  - NSF: Bogdan Mihaila
  - DOE: Lali Chatterjee

Workflows

Scientific Workflow	Experiment/Community	Short Description	Volunteer
Lattice Gauge Theory	Theoretical Particle Physics	Path integral of SU(N) gauge theory is importance sampled by Markov Chain Monte Carlo. Lagrangian is discretised on 4D Cartesian space time grid. Typical problem sizes may have 10^11 degrees of freedom. Gauge covariant Dirac equation is repeatedly solved when evaluating probability weight (and its gradient) as the gauge field is sampled. Structured grid PDE solvers are key for this, and majority of time is spent in a classic massively parallel halo-exchange PDE problem. Recent algorithmic improvements include adaptive multigrid methods. Machine learning is of interest but no proven use. Jobs are run on massively parallel message passing supercomputers (using MPI) such as at ORNL, NERSC, Argonne, etc..	Peter Boyle
Neutriono Beamline Simulation	Neutrinos	Typically runs in Geant4 to simulate primary protons hitting the production target and followed through until mesons decay to produce neutrinos. Files are produced with an entry per neutrino parent, and rejection sampling is used to transfer these "weighted" simulations to "unweighted" downstream simulation.	
Production MC Generation (of neutrinos)	Neutrinos	Large-scale processing to produce simulation (typically generator, then geant4, then detector simulation). Typically the generator is fast and G4 and the detector simulation are slow. One special case is the simulation of optical photons, which often requires dedicated pre-simulation campaigns to allow fast simulation when running at large scale. Runs primarily on HTC, though the use of HPCs are being explored (though it is not clear how good of a fit it is). Simulation often requires large amounts of input data in the form of "flux files" (previous simulation of the neutrino beam) or "overlays" (data or simulation of coincident particles in the detector along with the neutrino).	
Production Reconstruction (of neutrinos)	Neutrinos	Large-scale procesing to reconstruct higher-level physics objects (3D hits, tracks, showers, particle ID, etc) from low-level detector information. Often uses a mix of bespoke tools, common algorithms (e.g. Kalman filter), external frameworks (e.g. Pandora, Wirecell), and deep learning frameworks (e.g. TensorFlow, PyTorch). Runs primarily on HTC, though the use of HPCs are being explored, with the biggest challenges being related to performant IO and software distribution.	
LAr Signal Processing	Neutrinos	The first-stage processing of raw data from liquid argon experiments (which takes the form of digitized waveforms) presents a particular processing challenge, especially with a detector as large as DUNE. It is not possible or deisreable to have all of the waveforms from the whole detector in memory simultaneously, but conversely processing cannot be a single channel at a time since there can be correlated noise and signal across wires. So, the signal processing needs to occur in "regions" of the detector which can be loaded inot and out of memory. Exploration is underway on the proper computing infrasstructure for this task.	

- https://docs.google.com/spreadsheets/d/1VgZw95-YiY8cdPt6lC38YkunAvDAHMdfrtvwAph1o3Q/edit?usp=sharing
- 16 entries so far, only one volunteer
- Need to start thinking about meeting and how to converge.



- Katrin put together a drawing and is trying to see which topical group is covering which part of the workflow
- https://docs.google.com/presentation/d/1Y7z1GjU6dz-WMAndOyQ8Q72EFHBoIT2QJcx85Hh4jFM/edit#slide=id.g77a09a376e_2_121