Computational Frontier 2: Theoretical Calculations and Simulation

Agenda

- Overview [15 min]

- Routes to letters of interest
    - Event Generators   [10 minutes]
    - Accelerator modelling [10 minutes]
    - Detectors/Beam modelling [10 minutes]
    - Theoretical calculations (Lattice Field Theory) [10 minutes]
    - Theoretical calculations (Perturbative) [10 minutes]
    - Cosmic Frontire simulations   [10 minutes]

- Areas requiring more engagement [10 minutes]

Overview

Snowmass Background

Working Group Co-Conveners

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- Functional areas
  - Theoretical calculations (high-order perturbative calculations and lattice field theory)
  - Detector simulations (Geant, …)
  - Particle accelerator modelings
  - Event generators
  - Cosmic frontier simulations
  - Utilization of CPU, accelerator hardware and what comes next in 5-10 years

- Mandate
  - Describe theoretical calculations, detector simulations, accelerator modelings, event generators that are or will be used by the stakeholders
  - What are the processing resource needed to execute theoretical calculations and simulations
  - What is the technology evolution of processing resources?
    - Coordinate with theoretical calculations and simulations working group
  - How will stakeholders be able to design and write physics algorithms for these processing resources?
    - Coordinate with theoretical calculations and simulations working group
  - How can coding standards and performance standards be used?
    - Coordinate with theoretical calculations and simulations working group, and Collaboration and Ecosystem working group
  - How are the solutions used by the community embedded derived from solutions from industry/other science domains
    - Connections with ML (accelerating calculations, more efficient phase space sampling, lattice QCD, …)

Timeline covered by white paper : 10-15 years ahead

- Opportunities for the DOE to fund computational programs
- What are your needs?
    - Problems that need solved and programs that need funded?
- Initially express these through LOI

Examples:

- How should HEP software tools evolve in 10-15 years?
- Can these use GPUs and other HPC accelerators?
- Can these make use of Machine Learning, AI?
- Do they need different computing solutions?
- Do codes need to be rewritten?
- Are new algorithms required?
- Is additional person-power effort required to get there?
- **Answers may differ from problem to problem and community to community**

Timeline

- Letters of Interest (submission period: April 1, 2020 – August 31, 2020)
- August 10th Computational Frontier virtual workshop
- 2020 Snowmass Planning Meeting (Nov. 4 - 6, 2020 at Fermilab)
- 2021 Snowmass Summer Study (July 11 - 20, 2021 at UW Seattle)
- Contributed Papers (submission period: April 1, 2020 – July 31, 2021)
- Report/ from this working group - in good time for Summer Study?
  - Feed into Whitepaper from this Frontier.

Our goals

1. Establish contact with the communities with broad representation
   - How are we doing?

2. Would like communities to commit to self organise Letters of Interest
   - Ensure these will come: please tell us how you are self organising & invite us
     - Snowmass is inclusive - unsolicited LoI positively encouraged
   - If you know of planned submissions please ask them to tell us?

3. Identify any areas where more engagement required while there is time to act

4. Bring forward LoI's as base material for working group report
   - Establish working group membership

5. Bi-weekly meetings going forward

- Routes to letters of interest

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- Areas requiring more engagement [10 minutes]

- Event Generators

Minutes

- Possible LOIs

- Who will organise

- Next steps

- Accelerator modelling

Minutes

- Possible LOIs

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