

Snowmass'21

CompF2: Theoretical Calculations and Simulation Accelerator Modeling

J.-L. Vay, A. Huebl, J. Qiang (LBNL), C. Ng (SLAC), D. Sagan (Cornell U.), E. Stern (FNAL)

Computational Frontier Workshop

August 10-11, 2020

Accelerator Frontier @ Snowmass21

- AF1: Beam Physics and Accelerator Education
- AF2: Accelerators for Neutrinos
- AF3: Accelerators for EW/Higgs
- AF4: Multi-TeV Colliders
- AF5: Accelerators for PBC and Rare Processes
- AF6: Advanced Accelerator Concepts
- AF7: Accelerator Technology R&D
 - RF
 - Magnets
 - Targets/Sources

All these activities
rely on computation
at some point,
sometimes requiring
massively parallel
supercomputing.



SciDAC
Scientific Discovery through
Advanced Computing



EXASCALE
COMPUTING
PROJECT

“Task force” on Accelerator & Beam Modeling

- J.-L. Vay., A. Huebl, J. Qiang (LBNL); C. Ng (SLAC); D. Sagan (Cornell U.); E. Stern (FNAL)
- Two meetings in July
- Creation of *Accelerator & beam physics modeling* interest group
 - Mailing list: AccBeamModelSnowmass21@lbl.gov
 - Website: <https://snowmass-compf2-accbeammodel.github.io/index.html>
 - (created on github by A. Huebl)

Accelerator & beam physics modeling interest group

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Accelerator & Beam Physics Modeling

This is the homepage of the *Accelerator & beam physics modeling* interest group in the topical group [Theoretical Calculations and Simulation \(CompF2\)](#). CompF2 is part of the [Computational Frontier \(CompF\)](#) in the [Snowmass 2021](#) process organized by the Division of Particles and Fields (DPF) of the American Physical Society.

Every half-decade or so the *US high energy physics community* engages in a **planning process** that looks ahead five to ten years to prioritize possible future directions and projects. There used to be a meeting lasting several weeks in Snowmass, Colorado for this exercise. Although we no longer have a long meeting there, the name Snowmass has stuck. The previous plan was called Snowmass 2013, and we are now working on **Snowmass 2021**, which will culminate with a large meeting **July 11-20, 2021** in Seattle and a report later that Fall.

The planning is organized by “Frontiers,” and we are part of the [Computational Frontier \(CompF\)](#). It is important that experiments and groups doing large scale computations be well represented in the Computational Frontier.

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☐ Mailing list

Current people in the list:

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Mailing list

If you want to be included, removed or suggest additional names, please send an e-mail to AccBeamModelSnowmass21@lbl.gov.

Current people in the list:

(* indicates individuals who have been invited to the mailing list but have yet to accept)

- Andreas Adelman*
- James Amundson*
- Thomas Antonsen*
- Mei Bai
- Gabriele Bassi
- Carlo Benedetti
- Martin Berz*
- Oleksii Beznosov

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If you would like to propose changes, additions or comments, please send an e-mail to [<mailto:AccBeamModelSnowmass21@lbl.gov>](mailto:AccBeamModelSnowmass21@lbl.gov).

As the *Accelerator & beam physics modeling* interest group in the [Theoretical Calculations and Simulation \(CompF2\)](#) topical group in the [Computational Frontier](#) our topics of interest include:

- **Modeling of**
 - Specific types of accelerators (leptons, hadrons, gamma, mix)
 - Injectors
 - High power targets
 - Linacs
 - Rings (multi-bunch injection, etc.)
 - Recirculating systems
 - Energy recovery systems
 - Fixed field accelerators (FFAGs, etc.)

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- **Crosscutting topics**

- Commonalities in comp. needs
- EVA (End-to-end Virtual Accelerator)
- Design optimization
- HPC / Exascale / programming
 - GPUs; future hardware
 - higher order methods/numerical linear algebra to make efficient use of GPUs
 - computing hardware independent implementation e.g. Kokkos/RAJA/Alpaka/AMReX
 - Mixed precision: half (various), single and double
 - Tensor cores
- Standardization of output data, input scripts (openPMD, ...)
- Data management & data reduction
- Online modeling
- AI/ML
- Open Science
- Resources, training
- Cloud computing
- Software sustainability
- Resources for code support and user support
- Integration of accelerator and detector (for radiation studies) codes
- Mesh refinement
- Synergies with non-HEP science

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Snowmass 2021 Letters of Interest (LOI) are informal documents intended to be useful in the first stages of the Snowmass study. They will help Snowmass conveners to prepare the Snowmass Community Planning Meeting that will take place early November 2020 virtually. LOIs could include opinions, interests and proposals that could further be studied. They should contain a maximum of 2 pages of text, plus relevant bibliography. Please make these as simple and easy to read as possible. Authors of the letters are welcome to make a full writeup for their work as a contributed paper and submit it to the Snowmass proceedings. However, a contributed paper is not required.

LOIs should be contributed until August 31, 2020.

For our interest group, we propose to use a simple template to simplify the process:

Proposed Template

We suggest to use the following template for LOIs:

- Topic and status.
- Current and future challenges.
- Advances needed to meet challenges.

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Proposed

Proposed topics for LOIs derive from our [topics](#).

To propose additions, modifications or provide comments, send an email to AccBeamModelSnowmass21@lbl.gov.

- Develop accelerator toolkit - *David Sagan, Axel Huebl, Jean-Luc Vay*.
 - Integration, interfaces, tooling, continuous testing.
 - Compatibility and extensibility of large, complex simulation software (Similar to [ECP xSDK](#) but for acc. modeling)
- EVA (End-to-end Virtual Accelerator) - *Jean-Luc Vay, David Sagan*.
- Develop/integrate data standards & start-to-end workflows - *Axel Huebl, Jean-Luc Vay, David Sagan*.
- Aspiration for Open Science (why and how; demystify misunderstandings) - *Axel Huebl*.
- Machine learning and surrogates models for simulation-based design optimization - *Remi Lehe*.
- Summary of the “Modeling and simulation tools, fundamental theory and applied math” working group

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Submitted

- LOI 1
- LOI 2
- ...

📌 Note

We rely on the community (you) to inform us about proposed and submitted LOIs by sending emails to AccBeamModelSnowmass21@lbl.gov.

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Snowmass 2021

These are the central resources of the Snowmass 2021 process.

- homepage: <https://snowmass21.org>
- Indico page: <https://indico.fnal.gov/category/1098/> (Computational Frontier, Early Career)

All communication types are [explained here](#).

Mailing Lists

Our interest group and community organizes in the following ways:

- Snowmass e-mail server: `listserv@fnal.gov` ([help](#))
- Snowmass e-mail list: `snowmass@fnal.gov` ([SNOWMASS](#))

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Accelerator & beam physics modeling interest group

Calendar

Accelerator Frontier

Meetings and Calendar

Computational Frontier

Indico events (.ical link)

Topical Group: Theoretical Calculation

Snowmass21 Accelerator & Beam Modeling Interest Group Events

Today | August 2020 | Print | Week | Month | Agenda

Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	31	Aug 1
2	3	4	5 1pm Snowmass21	6	7	8
9	10	11	12 1pm Snowmass21	13	14	15
16	17	18	19 1pm Snowmass21	20	21	22
23	24	25	26 1pm Snowmass21	27	28	29
30	31	Sep 1	2 1pm Snowmass21	3	4	5

Events shown in time zone: Pacific Time - Los Angeles

Google Calendar

Thank you for your attention.