

Jet substructure for Snowmass 2021

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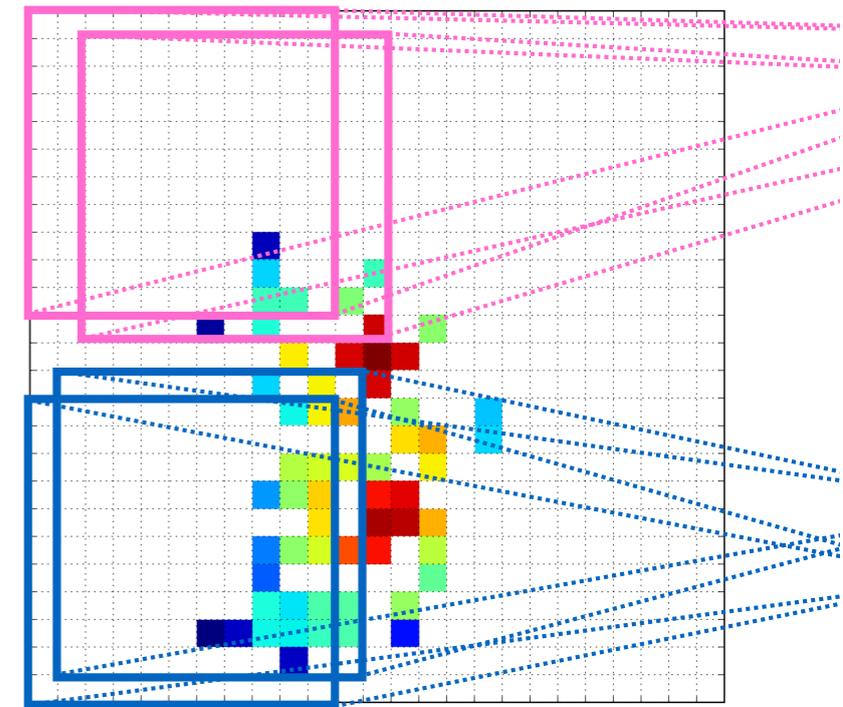
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**BERKELEY
EXPERIMENTAL
PARTICLE
PHYSICS**



BOOST

July 24, 2021



The Particle Physics Community Planning Exercise (a.k.a. “Snowmass”) is organized by the Division of Particles and Fields (DPF) of the American Physical Society. Snowmass is a scientific study. It provides an opportunity for the entire particle physics community to come together to identify and document a scientific vision for the future of particle physics in the U.S. and its international partners. The P5 (Particle Physics Project Prioritization Panel) will take the scientific input from Snowmass and develop a strategic plan for U.S. particle physics that can be executed over a 10 year timescale, in the context of a 20-year global vision for the field.

- <https://snowmass21.org>

Plan for today:

- Complete a letter of interest
- Develop a plan for completing a white paper
 - Could be the “proceedings” activity of this year’s BOOST. Timescale: ~1 year.

Snowmass



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This will be interactive! At the very least, you will have a chance to enter your name in the letter of interest. Please also consider contributing to the discussion!

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Jet Substructure at the Energy Frontier

Letter of Interest for Snowmass 2021

The BOOST community¹

Jet substructure (JSS) has emerged as a unique context for studying the Standard Model (SM) and provides a key set of tools for probing nature at the highest energy scales accessible by terrestrial experiments [1-6]. While not an experimental or

<https://docs.google.com/document/d/1bbunwSYY3-dtSNwaNCVDS0k5RKNYEAcKUSU8qg8mYI0/edit>

“...The focus will be on qualitatively new capabilities...”

We should try to keep a focused scope to the extent possible.

White paper plan



5

- Everyone is busy so it would be good to carefully consider what to say and what new studies (if any) are actually need to make our case.
- Remember, our ultimate goals are to influence the decision on the choice of the next energy frontier machine, influence the decision of the detectors (and other expensive resources like trigger/computing) at said machine and the EIC, and to make a case for funding research / training programs in jet substructure (P5 driver?).

White paper plan proposal



- A few working groups, where we collect existing studies and make projections for the future. I think it may be possible to craft such a report without extensive MC studies:
- **Theory precision**
 - Standard model parameters (α_s (including running), m_{top} , etc.)
 - Unique tests of fundamental physics
 - General-purpose Monte Carlo generators
- **Experimental precision**
 - Detector optimization (e.g. calorimeter granularity)
 - Low-level calibration
 - Online algorithms
- **Enhancing sensitivity**
 - Uncovered scenarios (e.g. LLP/complex dark sectors)
 - New observables (track-based, ...)
 - Machine learning



- If people agree with the plan, I am happy to help lead. I would propose to make an egroup / slack channel to coordinate activities.
- We can then make an overleaf where an outline can naturally evolve and we can attach names to sections.
- Would be great to have contributions from anyone who wants to participate (and anyone should be able to sign), but should have a smaller coordinating / editing group.

Discussion



- First, let's go over the LOI
- Then, let's discuss the white paper plan