



The Snowmass 2021 Community Planning Process

An attempted orientation

Graham W. Wilson

University of Kansas

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Snowmass 2021: The Basics

Every 5-10 years, the **DPF** (Division of Particles and Fields) of the **APS** (American Physical Society), undertakes a “decadal survey”. This is an opportunity for the HEP community to come together to identify and document a **vision** for the future of particle physics. There is a focus on particle physics in the US, but very much in the broader context of the opportunities available also in collaboration with international partners.

Recent History

- Snowmass 1996
- Snowmass 2001
- (ILC focused meeting at Snowmass in 2005)
- Snowmass 2013
- Now **Snowmass 2021**

Prior to 2013, these were 3-week summer workshops in Snowmass, Colorado. In 2013 and also this time around, this is more of a 12-18 month ongoing workshop.

The emphasis of the Snowmass process overseen by the DPF is a “Community Study”, with the opportunity for everybody to present and develop their **aspirations**. There are 10 **frontiers** (eg. Energy, Instrumentation, Accelerator), and each frontier has several topical groups (Energy has 10!).

You can and should advocate for your project - such as ILC. But you should be careful not to be overly critical of competing approaches. Fair comparisons are helpful.

In the context of ILC, the main emphasis likely needs to be on the physics case that helps secure the project. This can be surveys of existing work or new studies: ideally both. There is also scope to get involved in detector and accelerator related working groups.

The actual “strategy” part of the process is **P5** (Particle Physics Project Prioritization Panel). The Snowmass reports are used to develop recommendations and to advise DOE and NSF through HEPAP (HEP Advisory Panel) and produce another report (likely in 2022).

Energy Frontier Groups (EF01-EF10)

These topics are divided into the following 3 categories that comprise of 10 topical groups with two or three convenors each:

- **EW Physics** (including EW gauge bosons, Higgs, top)
 1. Higgs Boson properties and couplings (incl. self-coupling)
 2. Higgs Boson as a portal to new physics
 3. Heavy flavor and top quark physics (top, bottom, charm)
 4. EW precision physics and constraining new physics (VV, VVV, VBF, and VBS signatures, precision fits of EW+Higgs+top+... observables: EFT, specific models, experimental and theoretical correlations)
- **QCD and strong interactions**
 1. Precision QCD (jets, jet substructure, higher-order effects, alphas, quark masses, PDF, W/Z bosons, improving the accuracy of MC event generators)
 2. Hadronic structure and forward QCD (incl. generalized PDF, hadron spectroscopy)
 3. Heavy ions
- **BSM Physics**
 1. Model-specific explorations (SUSY, composite models, extended scalar sectors, FCNC, rare top decays, rare H decays, ...)
 2. More general explorations (MET signatures, new bosons, new fermions, long-lived particle searches, EFT)
 3. Dark Matter (at colliders).

In addition, we foresee strong liaisons with other frontier groups, such as computing, cosmic, theory, accelerator, instrumentation, and rare processes and precision measurements.

I signed up for EF-general, EF01, EF03, EF04.

Select frontier.

Snowmass Frontiers

ENERGY FRONTIER

NEUTRINO PHYSICS FRONTIER

RARE PROCESSES AND PRECISION

COSMIC FRONTIER

THEORY FRONTIER

ACCELERATOR FRONTIER

INSTRUMENTATION FRONTIER

COMPUTATIONAL FRONTIER

UNDERGROUND FACILITIES

COMMUNITY ENGAGEMENT FRONTIER

Topical Groups Example (energy/ewk)

EF04: EW Precision Physics and constraining new physics

- co-Conveners: Junping Tian, Alberto Belloni, Ayres Freitas
- Email list: SNOWMASS-EF-04-EWK_CONSTRAINTS@FNAL.GOV
 - For instructions how to join an Email list refer to [Energy Frontier/Communications](#)

Description

The dominant theme of topics covered in this topical group is constraining new physics by performing precision fits of standard model (SM) observables. The ingredients of the fit are electroweak observables, which are a direct component of the mandate of this group, and Higgs and top observables, which establish a tight link between this group and other EF topical groups (in particular, EF01, EF03, and EF05). The mandate of this group includes the study of multi-boson signatures, and vector-boson fusion and scattering processes. Constraints to the SM are obtained within the EFT framework, and specific SM-extension models that are of particular relevance to electroweak precision physics. This group also investigates the impact of correlations among experimental and theoretical uncertainties, and discusses state-of-the-art theoretical modeling of EW and QCD uncertainties, and their combination.

Meetings

1. Kick-off meeting with community, 8:00-9:00AM EDT, April 30 <https://indico.fnal.gov/event/24218/>
2. Topical Group community meeting, 10:00-11:00AM EDT, May 15 <https://indico.fnal.gov/event/43221/>

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- EF04: EW Precision Physics and constraining new physics
 - Description
 - Meetings

Communication channels: E-mail, slack, calendar (see Energy Frontier general page at <https://snowmass21.org/energy>)

Instrumentation Frontier (instrumentation)

<https://snowmass21.org/instrumentation/front>

SnowMass2021

WELCOME PAGE
ANNOUNCEMENTS
ALL SNOWMASS CALENDAR

Organization

SNOWMASS ADVISORY GROUP
SNOWMASS STEERING GROUP
FRONTIER CONVENERS
APS DPF SNOWMASS PAGE

Snowmass Frontiers

ENERGY FRONTIER
NEUTRINO PHYSICS FRONTIER
RARE PROCESSES AND PRECISION
COSMIC FRONTIER
THEORY FRONTIER
ACCELERATOR FRONTIER
INSTRUMENTATION FRONTIER
COMPUTATIONAL FRONTIER
UNDERGROUND FACILITIES
COMMUNITY ENGAGEMENT FRONTIER

Community Contributions

LETTERS OF INTEREST
CONTRIBUTED PAPERS

HELP

Communication Types and Access

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INSTRUMENTATION FRONTIER

Frontier Conveners

Name	Institution	email
Phil Barbeau	Duke University	psbarbeau[at]phy.duke.edu
Petra Merkel	Fermi National Accelerator Laboratory	petra[at]fnal.gov
Jinlong Zhang	Argonne National Laboratory	zhangjl[at]anl.gov

Description

The Instrumentation Frontier group is geared to discussing detector technologies and R&D needed for future experiments in collider physics, neutrino physics, intensity physics and at the cosmic frontier. It is divided into more or less diagonal sub-groups with some overlap among a few of them. The sub-groups are Calorimetry, Cross Cutting and Systems Integration, Electronics/ASICs, Micro Pattern Gas Detectors, Noble Elements, Photon Detectors, Quantum Sensors, Solid State Detectors and Tracking, and Trigger and DAQ. Synergies between the different sub-groups, as well as with other Frontier groups and research areas outside of HEP will be paid close attention to.

Topical groups

- IF1: Quantum Sensors
- IF2: Photon Detectors
- IF3: Solid State Detectors and Tracking
- IF4: Trigger and DAQ
- IF5: Micro Pattern Gas Detectors
- IF6: Calorimetry
- IF7: Electronics/ASICs
- IF8: Noble Elements
- IF9: Cross Cutting and Systems Integration

Accelerator Frontier (accelerator)

https://snowmass21.org/accelerator/start

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Snowmass Frontiers

ACCELERATOR FRONTIER

Frontier Conveners

Name	Institution	email
Steve Gourlay	Lawrence Berkeley National Laboratory	sagourlay[at]lbl.gov
Tor Raubenheimer	SLAC National Accelerator Laboratory	tor[at]slac.stanford.edu
Vladimir Shiltsev	Fermi National Accelerator Laboratory	shiltsev[at]fnal.gov

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Topical groups and References

- **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**

Some dates/relevant events

- April APS Meeting. Town hall (1.5 hours on April 18th).
- (US mini workshop on future e^+e^- colliders).
<https://indico.cern.ch/event/896263/>
- Energy Frontier Kick-off Workshop, May 21, 2020 (video).
- Energy Frontier Workshop, July 9-10, 2020 (video)
- 2-page Letters of Interest, April 1 – Aug 31st, 2020.
- Early September. Virtual Town Hall 2.
- American Linear Collider Workshop? August or October?
- November 4-6, 2020, **Planning Workshop**, Fermilab.
- July 11-20, 2021, **Summer Study**, Univ. of Washington, Seattle, WA.
- Contributed papers submitted from April 1, 2020 – July 31, 2021 (white papers etc.)
- P5 forms and convenes in Fall 2021? Report likely Spring 2022.

Letters of Interest

The purpose of letters of interest is to allow Snowmass conveners to see what proposals are coming and to encourage the community to begin studying them. Letters of Interest should give brief descriptions of the proposal and cite the relevant papers to study. These letters will help conveners to prepare the Snowmass Planning Meeting that will take place on November 4-6, 2020 at Fermilab.

The letters should be up to 2 pages not including bibliography and should be uploaded by authors ****HERE**** between April 1, 2020 and August 31, 2020. An index of submitted letters can be viewed ****HERE****. The letters will be stored permanently in the Fermilab archive Doc.db shortly after August 31, 2020.

Authors of the letters are encouraged to make a full writeup for their work and submit it to the Snowmass proceedings according to the instructions ****HERE****.

We should submit letters on ILC! This is not necessarily just one per project. It can easily also be mini-proposals on envisaged scope of work by a few individuals.

Some comments/questions/opinions

- If we were definitively in the **very green** light phase for ILC, we could use Snowmass to further develop items associated with moving the project forward, such as preparations towards the detector program.
- But we are not there yet, and need due diligence to ensure that ILC is well perceived as well as understood as more realistic. We likely need to focus on the physics/accelerator part of the project.
- With the reduction in reticence to higher energies we should take advantage of this in discussion of eventual physics scope, especially in the aspirational part of Snowmass.
- How best to engage a wider community in the US is an open question. With long-standing funding issues - there can be no instant phase-change in response to what are seen from the outside as mixed signals to date.
- That being said, we can expect that many of the broader LHC community, that are very involved in Snowmass, are open to considering what really are the best ways forward for our field.
- Given the substantial preparation over many years we are well placed to highlight the opportunities with ILC and in particular ILD.

- The Snowmass process is getting underway in the US. (The ESG was supposed to be finished by now ...)
- Opportunities to educate and engage the broader community on the ILC project.
- Opportunity to study some new questions.
- We need to engage with the relevant conveners. Coordination is ongoing with the LCC Physics Working Group.
- How best to be productive on the detector front?