

APS DPF plans for Snowmass 2021

Young-Kee Kim
University of Chicago

Fermilab PAC Meeting, Jan. 15, 2020

Priscilla Cushman (DPF Past Chair)
Young-Kee Kim (DPF Chair)
Tao Han (DPF Chair-Elect)
Joel Butler (Vice Chair)

U.S. Strategic Planning Process for Particle Physics

~year-long process

Snowmass Community-Wide “Science” Study

Organized by Division of Particles and Fields (DPF) of APS



Input to P5

~year-long process

P5 (Particle Physics Project Prioritization Panel)

formulate a 10-year plan (20 year vision) within funding constraints

Subpanel of HEPAP, High Energy Physics Advisory Panel for DOE/NSF funding agencies

Long-Range Plan for Nuclear Science (n-less double beta decay)
Decadal survey on Astronomy and Astrophysics (dark energy, CMB)
HEPAP Accelerator R&D Subpanel Report

Snowmass: Planning (Fall 2012) – Summer Study (Summer 2013)

Year-long Snowmass Study

- Snowmass Planning Meeting at Fermilab, October 2012
- Various frontier workshops in multiple locations
- Snowmass Summer Study at Minnesota (July/August 2013)



Workshop at Minnesota (July 29 – August 6, 2013)

- Snowmass Report (December 2013)

Snowmass: Planning (Fall 2012) – Summer Study (Summer 2013)

The planning process included more than a year of workshops. It presented a status of the field and exciting opportunities going forward. It did NOT prioritize.

Snowmass on the Mississippi (July 29 - August 6, 2013)



Archive of video streaming during the snowmass

Charge: *The American Physical Society's Division of Particles and Fields is initiating a long-term planning exercise for the high-energy physics community. Its goal is to develop the community's long-term physics aspirations. Its narrative will communicate the opportunities for discovery in high-energy physics to the broader scientific community and to the government.*

Charge

- The final reports were completed in about 6 months
- P5 (Particle Physics Project Prioritization Panel) takes the scientific input from Snowmass and formulates a strategic plan to address the science within specified funding constraints
- A successful Snowmass process results in community buy-in, even when hard budgetary decisions need to be made

Snowmass 2013 topics led to P5 Science Drivers

Snowmass 2013 Report

- Frontiers
 - Energy Frontier
 - Intensity Frontier
 - Cosmic Frontier
- Cross-Cutting
 - Facilities (Underground and Accelerator)
 - Instrumentation
 - Computing
 - Theory
 - Communication

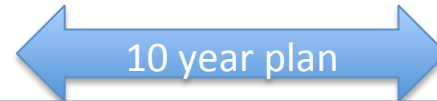
P5 2014 Report

Five intertwined scientific Drivers were distilled from the results of a yearlong community-wide study:

- Use the Higgs boson as a new tool for discovery
- Pursue the physics associated with neutrino mass
- Identify the new physics of dark matter
- Understand cosmic acceleration: dark energy and inflation
- Explore the unknown: new particles, interactions, and physical principles



P5 2014



Scientific Drivers



We are here ■ Construction ■ Expected Physics

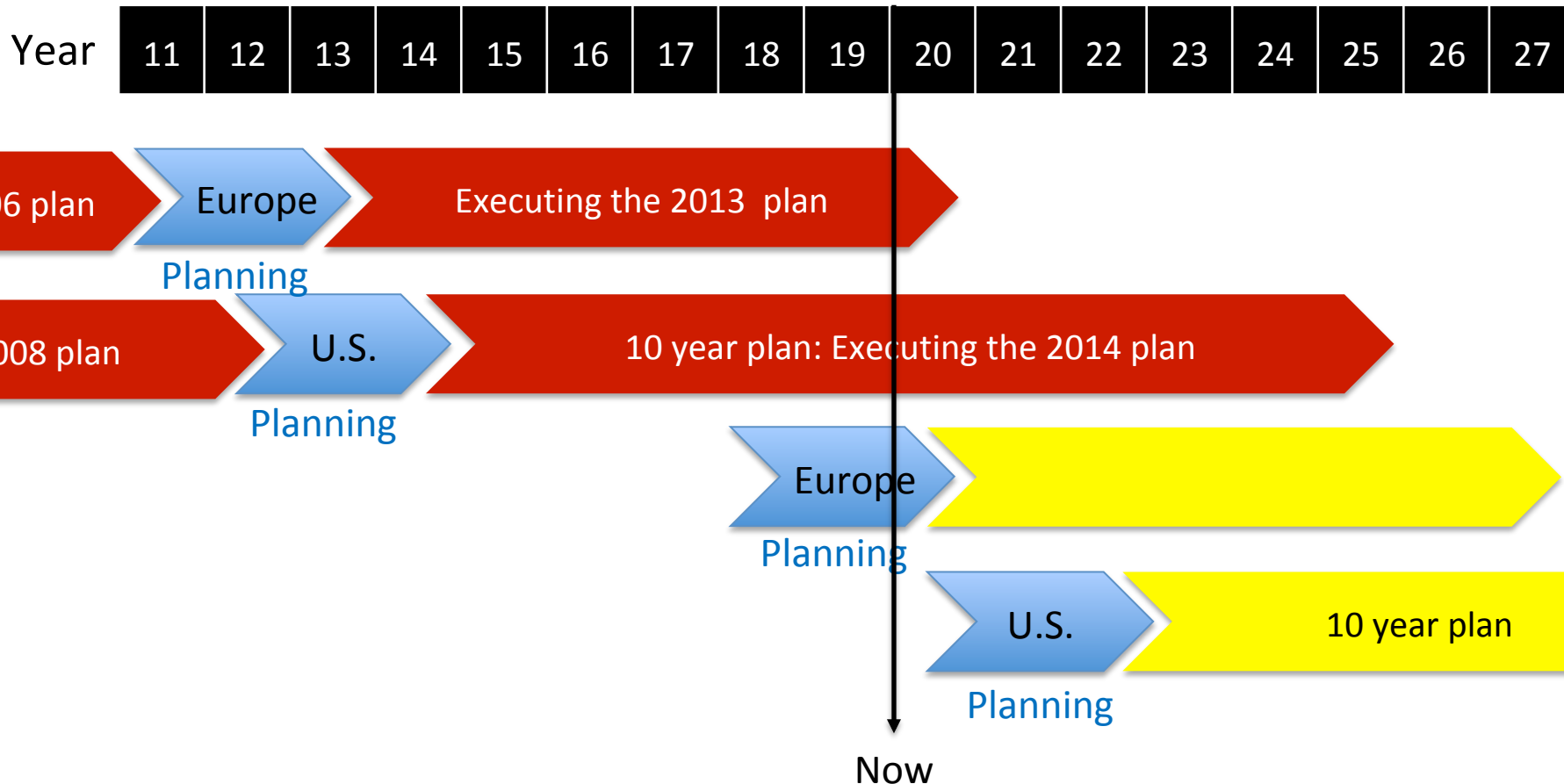
Particle Physics is Global

Europe and U.S.

- Frequency: 7 years (Europe), ~8 years (U.S.)
- Process: ~2 years in total (~ 1 year on science by the community + ~ 1 year priorities)

Snowmass (U.S.)

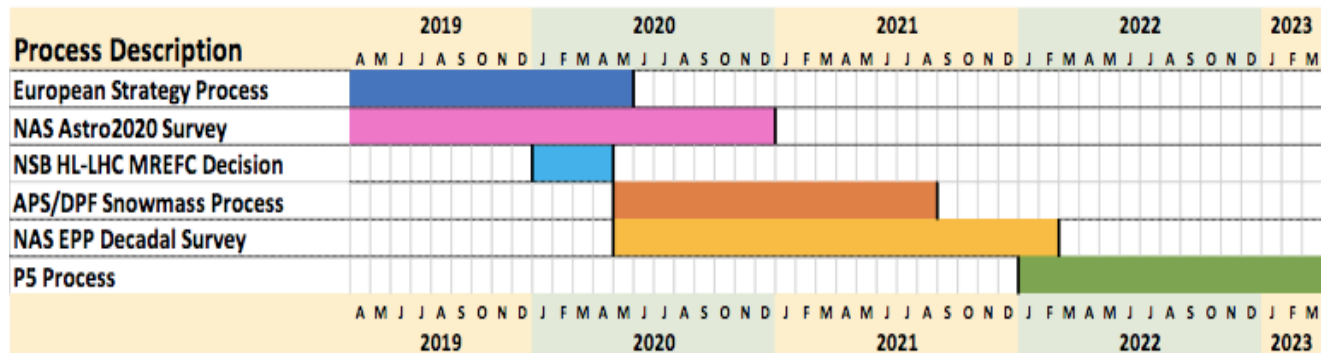
P5 (U.S.)



Next Snowmass and P5

Possible Strategic Planning Timeline

- ▶ To provide timely input to the FY25 budget formulation, the next P5 report will be required by March 2023
- ▶ U.S. Community considering Snowmass process with major meeting occurring in summer 2021
- ▶ Potential timeline for the next NAS EPP Decadal Survey could be mid-2020 through early-2022
 - ▶ Overlap with Snowmass could enable synergy with Snowmass processes and delivery of report as P5 process begins



U.S. DEPARTMENT OF
ENERGY

Office of
Science

May 2019

HEP Program Status

25

Snowmass 2021

Frontiers

1. Energy Frontier
2. Frontiers in Neutrino Physics
3. Frontiers in Rare Processes and Precision Measurements
4. Cosmic Frontier
5. Theory Frontier
6. Underground Facilities and Infrastructure
7. Accelerator Science and Technology Frontier
8. Instrumentation Frontier
9. Computational Frontier
10. Community Involvement

Snowmass 2013

Intensity Frontier

Facilities

Communication

Snowmass 2021

Topical Groups under the Frontiers (tentative)

– Energy Frontier

- Higgs Physics
 - Properties (mass and width)
 - Decay channels
 - Production processes (VBF, associated etc.)
- Top Quark physics
- BSM: new bosons, new fermions
- BSM: SUSY and MET
- Accelerator Searches for DM and long-lived particles
 - ATLAS & CMS
 - Dedicated experiments
- Electroweak: W = production, mass and Z Production processes
- QCD: Pdf measurements,
 - Precision X-section measurements
 - Use of QCD and Lattice in extraction of CKM elements and pseudoscalar decay constants
- Heavy Ions
- Hadron spectroscopy: light meson, b \bar{b} , c \bar{c} , exotic tetraquark, pentaquark states

– Neutrino Frontier

- Neutrino mass
- Neutrino cross sections
- Neutrinoless Double-Beta Decay
- CEvNS
- 3-Flavor Oscillations
- Neutrino Physics from Astrophysical Sources (Solar, Atmospheric, Supernova, Extra-galactic)
- Sterile neutrinos and other BSM candidates
- Geo neutrinos, tomography and other practical applications

Snowmass 2021

Topical Groups under the Frontiers (tentative)

– Theory Frontier

Field Theory Techniques and Scattering Amplitudes

(EFT, CFT, bootstrap method, amplitudes, formal connections)

Quantum Gravity, Blackholes, and String Theory (incl. connection with geometry, CM and QIS)

Astro-particle Theory and Cosmology

Inflationary models, EFT for cosmology, dark energy (DAP, DGRAV connections)

Lattice gauge techniques and applications

BSM model building: SUSY GUTs, composite models, string models

Cross-cutting: organizational group of liaisons to Cosmic, Neutrino, Rare/Precision, Energy

– Community Involvement (not just outreach)

Applications & Industry

Physics Education

Public Policy and Government Engagement

Public Education and Outreach

Diversity & Inclusion

Career Pipeline & Development

Create a transparent and inclusive process

- This is NEW and also ahead of the curve compared to last time
- Announcements sent to APS members and posted in labs and universities
- General call for frontier & topical convener nominations (closed Nov 15)
 - ~3 co-conveners for each of the 10 Frontiers
 - Self-nominated, by peer, or by a small group
- Frontier co-conveners
 - Chosen by the Snowmass 2021 Steering Committee (elected representatives: DPF Executive Committee + Chair-line from DAP, DNP, DPB, DGRAV), based on balance: senior and junior; theory and experiment; gender; region; labs and universities
 - Will choose their topical group leaders from all the compiled nominations + others (the Steering Committee will approve topical nominations)
 - Will optimize the topics and working groups
- Enrich and strengthen Snowmass-Young (SNOWMASS-YOUNG@LISTSERV.FNAL.GOV)
- Engage DAP, DNP, DPB, DGRAV in the process from the beginning (2019 APS April meeting)

Timeline (near future)

- Nov. 15, 2019
 - Deadline to submit proposals for the summer study site
 - Deadline to nominate conveners
- End December, 2019
 - Decision on the summer study site
 - Finalize co-conveners for the frontiers
- January 2020
 - About to announce frontier co-conveners and 2021 Snowmass site (DPF Newsletter)
 - Provide guidelines for finalizing topical groups (first draft exists) and for nomination of topical group conveners

Timeline (near future)

- February – March 2020
 - All frontier conveners meetings
 - Finalize
 - Charge of Snowmass
 - Topical groups and topical group conveners
 - Outline workshops
 - Snowmass Planning Workshop (all community): Fall 2020
 - Frontier & topical workshops (Fall 2020 – Spring 2021) at universities and labs around the world
 - Snowmass Summer Study (all community): July 2021
- 2020 APS April meeting
 - In-person meeting of all frontier conveners
 - Town Hall meeting to present the outline to the community / receive feedback from the community (the community can attend remotely via ZOOM)

Snowmass in 2021

- Summer Study Workshop
 - Modeled after the successful Snowmass 2013
 - Much of the work is done via workshops throughout the previous year
 - Lessons learned
 - Dates
 - Start Sunday July 11 afternoon
 - Possible early arrival (Sat-Sun) for Frontier conveners
 - Covers one full weekend, ends Tuesday, July 20
 - Avoids CIPANP, WIN 2021, LP 2021, July 4, ...
- Snowmass Report
 - End 2021