DPF Meeting at Northeastern University
August 1, 2019

Discussions and comments on the current Snowmass Planning Process
2013 Physics Groups and Cross-cutting Groups

Energy
- Higgs Boson
- Precision Study of Electroweak Interactions
- Quantum Chromodynamics and the Strong Force
- Fully Understanding the Top Quark
- New Particles, Forces, and Dimensions
- Flavor Mixing and CP Violation at High Energies

Intensity
- Neutrinos
- Baryon Number Violation
- Charged Leptons
- Quark Flavor Physics
- Nucleons, Nuclei, and Atoms
- New Light Weakly Coupled Particles

Facilities
- Theory
- Cross-cutting
- Communication with
  - the General Public
  - Policy Makers
  - the Science Community
  - Teachers and Students

Cosmic
- WIMP Dark Matter Direct Detection
- WIMP Dark Matter Indirect Detection
- Non-WIMP Dark Matter
- Dark Matter Complementarity
- Dark Energy and CMB
- Cosmic Probes of Fundamental Physics

Computing for the Cosmic Frontier
- Computing for the Energy Frontier
- Computing for the Intensity Frontier
- Computing for Accelerator Science
- Lattice Field Theory
- Computing for Perturbative QCD
- Distributed Computing and Facilities Infrastructure
- Networking
- Software Development, Personnel, and Training
- Storage and Data Management

Hadron Colliders
- Lepton Colliders
- High Intensity Secondary Beams from Protons
- High Intensity Electron and Photon Beams
- Electron-Ion Colliders
- Accelerator Technology Development

Instrumentation for the Energy Frontier
- Instrumentation for the Intensity Frontier
- Sensors
- Integrated Circuit Design in U.S. High Energy Physics
Physics Groups and Cross-cutting Groups

Our first task is to determine a complete set of physics and cross-cutting topics. The new topics define the working groups and final summary papers (in ArXiv) as well as generating multiple white papers.

We need to be broader than Funding Agency boundaries. P5 can always draw a stricter boundary after we have done our work.

- e.g. $0\nu\beta\beta$, gravitational waves, gamma ray astrophysics.
- DPF will be joined by subsets of DAP, DPP, DNP, DGRAV, DCOMP
- Important to define the science overlap that is specific to particle physics.

2013 was organized according to Energy, Cosmic, Intensity Frontier.

We need continuity, but we can evolve.

- e.g. Intensity may split into 2 groups and $0\nu\beta\beta$ might join neutrinos
- P5 can always package them together later if needed.

New cross-cutting groups and new computational categories.

Theory will have its own frontier, but phenomenology will be unified with experiment and liaisons between the two identified.
DPF Program committee is currently reviewing the old topics
https://www.aps.org/units/dpf/governance/committees/program.cfm

Late August: Begin the process of community involvement on new draft topics
Call for site selection proposals for summer 2021

October: Finalize topics and cross-cutting categories.
  DPF Exec will establish detailed job descriptions for co-conveners
  Program Committee will accept nominations, collate recommendations
  and submit to DPF Exec for convener selection
  Sub-conveners will also be selected by DPF exec, after convener nomination

Spring 2020: Secure funding for workshops and overall plan
  Choose 2021 site, date, and duration

Spring 2020 – Spring 2021: Conduct workshops, prepare initial white papers

Summer 2021: Snowmass Summer Study Final Collation

Report due by December 2021
Physics Topics and Cross Cutting Topics and Capabilities

The program committee is going to come up with a first draft
Slack + google sheet will provide community input

Decided to evolve slowly - stay partially with the “Frontiers”
Other organizational themes were also explored (we can look at them if you like)

Venn diagram idea – Energy, Cosmic, and Intensity should have overlap regions and
the subtopics can live in that overlap region

Intensity gets split into Neutrinos and ”we-didn’t-come-up-with-a-good-name topic”

Get DAP, DNP, DPP, DGRAV involved from the beginning.

Role of larger APS in all this
Choosing Conveners: Some Principles

A Clear Job description must first be prepared by the DPF Exec

Co-conveners (one senior and one junior) can include younger researchers from the start

Nomination procedure in order to access the broader population

Program committee represents all subfields - they can serve as nominating committee

DPF Exec is an elected body – and so should be the final selection authority

Second nomination process for sub-topics prevents inbreeding. Nominations come from the co-conveners and include previous convener nominations
Choosing the Site

Call for proposals soon – assume 10-day summer study in 2021

DPF Exec calls for the proposals, DPF Exec makes final decision
Perspectives on the 2012-13 Snowmass and 2014 P5 Rollout Campaign
(+ Summary of 2019 Fermilab Scientist Retreat)

Pushpa Bhat
Fermilab
Previous Snowmass and P5

• The backdrop for the 2012-13 Snowmass and P5
  – Monumental discovery of the Higgs boson, U.S. long base neutrino program being shaped, programs in precision measurements, dark matter, dark energy; frontier facilities being studied and designed
  – Particle Physics as a “truly” global enterprise

  – 1st Community Planning Mtg. at Fermilab, Oct. 11-13, 2012
  – Workshops, subgroup meetings at various locations 2012-13
  – Compelling science questions, experimental approaches, technology
  – Final Meeting, “Snowmass on the Mississippi, at the University of Minnesota, July 29 – Aug. 6, 2019
    • First Community town-hall for P5 buy-in organized and moderated (by PB) at the Minnesota Snowmass meeting during a lunch break
    • Jim Siegrist, Andy Lankford made remarks and answered questions for over an hour; ~350 people attended
    • P5 Chair named on the last day of the meeting (Steve Ritz)
  – See Andy Lankford’s talk at the APS April meeting on the P5 process
What worked well, What to improve

- The format of studies spread over a year worked quite well
  - More time and more opportunities for studies and interactions
- The topical workshops in different locations were also productive and fruitful
- For the P5 process, community buy-in from the beginning was very important and so was the role of the P5 Rollout campaign in holding the community together.
- At the final meeting, where the reports came together, there could be a more deliberative process
- It would be good to have a Call for nominations for Working Group Conveners. Should nominations be from institutions?
- THE US HEP community should be launching long-range planning of major HEP facilities that could be hosted in the U.S. Who should be the driver of such efforts?
Effective Outreach vital to Success

• HiggsFest on the Hill
  – Celebrating Higgs discovery and the leading role of US scientists in the discovery on Capitol Hill
  – Idea brewed at a “coffee chat” in Bldg. 40 (Shipsey, PB)

• Outreach Working Group during Snowmass
  – In-reach across HEP frontiers and outreach to broader science community, to policy makers and decision leaders

• P5 Rollout Campaign
  – Multi-faceted campaign after the P5 report

• Continuing campaign since P5, by various entities
  – DPF, Users’ Executive Committees, …
As P5 conducted its work we organized: DPF Community Visit to Capitol Hill to celebrate the Higgs boson discovery and other recent discoveries in particle physics to apprise Congress of the leading role of US scientists in the Higgs discovery at the LHC, the ongoing Snowmass/P5 process & the exciting opportunities that lie ahead for the field.
HiggsFest on the Hill

Multiple parallel congressional visits by US HEP community members during the day
An evening Reception in Rayburn Office Building Foyer

Pre-event:
Beautiful Artwork on Plexiglass from Xavier Cortada (FIU) and an invitation for the reception delivered by D.C. area grad students and postdocs to all 435 House offices and most of the Senate offices

On November 20, 2013, physicists from 38 institutions participated in congressional visits and the reception.

“HiggsFest on the Hill” organizing committee
Tom Abel (Stanford/SLAC), Drew Baden (Maryland), Michael Barnett (BNL), Pushpa Bhat (co-Chair, FNAL), Jim Brau (Oregon), Sally Dawson (BNL), Dmitri Denisov (FNAL), Jonathan Feng (BNL), Bonnie Fleming (Yale), Howard Gordon (BNL), Kevin Lesko (BNL), Joe Lykken (FNAL), Harvey Newman (Caltech), Rob Roser (FNAL), Ian Shipsey (co-Chair, Purdue), Michael Tuts (Columbia), Nikos Varelas (UIC), Harry Weerts (ANL), Herman White (FNAL)

Sponsors: APS President, DPF, URA, FRA
Hosted by: House Science & National Labs Caucus
Headline talks: Joe Incandela CMS & Dave Charlton ATLAS
Congressman Hultgren (IL), Foster (IL), Holt (NJ), Fattah (PA), Nunelee (MS). All
spoke enthusiastically about particle physics and science in general. Non-speaking:
Capps CA; Swalwell (CA), DeFazio (OR), Yoho (FL) McNerney (CA).
Philip Rubin, Principal Assistant Director for Science at OSTP in the executive office
of the President, communicated congratulations from the President.
Master of ceremonies: Pushpa Bhat
HiggsFest on the Hill
Building for Discovery: P5 Rollout

• P5 Rollout Campaign Committee formed in April 2014
  – Community letter of support for the P5 plan sent to Energy Secretary Moniz and NSF director Cordova;
    • online signing at web-site at MSU (thanks to Chip Brock and his team)
    • Mobilizing by contacting HEP Pis at institutions
    • Widespread exchanges with members
    • 2331 signatures total; 2095 in one week!
  – Individualized “Contact Congress” letters from physicists
  – Visits to congressional members in home districts
  – Organized Senate Briefing on the P5 Plan (June 5, 2014)
  – (House Hearing separately organized (Congressman Hultgren))

Committee Membership:

Daniel Akerib, Robert Bernstein, Pushpa Bhat (Co-Chair), Edward Blucher, James Brau, Raymond Brock, Sally Dawson, Robin Erbacher, Yuri Gershtein, Howard Haber, Nick Hadley, JoAnne Hewett, Harvey Newman, Nicola Omodei, Laura Reina, B. Lee Roberts, Jonathan Rosner, Sally Seidel, Ian Shipsey (Co-Chair), Michael Tuts, Breese Quinn, Michael Sokoloff, Nikos Varelas, Hendrik Weerts.
Senate Briefing sponsored by Committee on Energy and Natural Resources:
P5 Plan by Steve Ritz and Q&A
Brief Remarks by Jon Bagger, Bob Wilson, Drew Baden
Organized and moderated by Pushpa Bhat

Image Credit: Herman White
Dear Secretary Moniz,

We write as members of the US Particle Physics Community to inform you that the P5 report has an unprecedented level of support in our community.

Recently the Division of Particles and Fields of the American Physical Society and the Users Organizations of Fermilab, SLAC and US LHC prepared a letter in support of the P5 report from the U.S. Particle Physics Community. We then contacted the community, asked them to read the P5 report if they had not already done so, and if they agreed with the report (and if they are affiliated with a U.S. institution) to read and sign the letter. In the following seven days 2,095 members of our community signed.

The letter is here:


Best regards,

Ian Shipsey Puspha Bhat Chip Brock Nick Hadley

For the HEP Community P5 Rollout Organizing Committee

Daniel Akerib, Robert Bernstein, Pushpa Bhat (Co-Chair), Edward

Community Letter sent to the Secretary of Energy & NSD Director June 23, 2014

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Thanks to the excellent work of the US HEP Community during and after the Snowmass, thanks to the P5 panel, HEPAP, and the agencies, the Rollout and its acceptance was tremendously successful! This is a model for the next round!

8/1/19

Pushpa Bhat
Summary of
Fermilab All Scientist Retreat (2019)
Fermilab Strategic Planning (2019)

• Fermilab’s Scientist Advisory Council (SAC) holds an “Annual Scientist Retreat” to discuss physics priorities of Fermilab scientists and opportunities for future directions.
  – This year’s Retreat held on June 14, 2019; focused on post-2026 era.
• The Retreat preceded by a few months of Strategic Planning exercise by various science and technology working groups.
  – Energy Frontier, Neutrino science, Precision measurements, cosmic frontier, accelerator science & technology, detector technology, scientific computing, quantum science
• The goal for the exercise, which is a part of the Lab’s internal planning process, was to gain understanding of the projects Fermilab scientists are most interested in pursuing and has the ability to contribute, and to provide input to the development of long-range planning at the Lab.
• About 180 scientists attended the Retreat. The outcome of working group exercise, conclusions were presented and discussed.
• Propose to host a pre-Snowmass workshop next year at Fermilab instead of the Annual Scientist Retreat
Summary from Working Groups (1)

• Neutrino Science:
  – A lot of excitement for future neutrino program at Fermilab
  – Strong interest in stopped pion program at PIP-II (dark matter, sterile nu, coherent nu scattering, etc.), next generation neutrinoless double beta decay

• Cosmic Science:
  – Recent strategic planning exercise for DOE HEP used
  – Plan stretching to ~2030; dark matter searches, CMB and cosmic surveys

• Precision Science:
  – Strong interest in Mu2e-II and CLFV/lepton universality tests; fixed target dark matter searches
  – Other areas such as eta factory, storage ring EDMs, ..etc.
Summary from Working Groups (2)

• Energy Frontier:
  – Significant interest in Energy Frontier; committed to contributing strongly to world-wide efforts
  – Critical to the future are the Higgs factory and a pp collider beyond LHC (>25 TeV) colliders (ILC, FCC-ee/hh, HE-LHC, …)
  – Also propose to study and develop conceptual designs for an intermediate scale energy frontier collider which can be realized on a 15-20 year timescale and with modest cost (pp or ee)
  – Support High field magnet R&D, 16 T (Nb3Sn), >20 T (HTS and Fe-based superconductors; Novel and innovative designs for accelerator magnets and lattice design necessary. Continue support SCRF R&D.

• Accelerator Science & Technology:
  – SC RF, SC magnets, high power targets, accelerator and beam physics, accelerator ancillaries
  – Survey strongly favor increasing investment in R&D

Energy Frontier and Accelerator S&T groups worked closely.
Summary from Working Groups (3)

• Quantum Information Science:
  – Evolving program; Components: Applications of quantum sensors, superconducting quantum systems, applications of quantum computing, quantum simulations

• Scientific Computing:
  – Meet challenges of the future – meet needs of the experiments; address demands of changing computing landscape; support physicists’ use of new computing ideas and techniques; advance collaborations with DOE and world-wide community

• Detector R&D:
  – Identified future technical challenges for each frontier group and mapped specific detector R&D projects to those challenges.
  – Also concluded that we could benefit from more education and advocacy on R&D needed for future experiments.

All of the working groups look forward to fully engage in the DPF Snowmass and develop options for the U.S. HEP program
Backup Slides
July 4, 2012: Discovery!
October 8, 2013: Nobel Prize!

Groups from across the United States played critical roles in the design and construction of the experiments and the teasing out of the Higgs Boson from the data.

The Higgs Boson was the single missing piece in the 40-year-old Standard Model of Particle Physics. Its confirmation reveals it to be a real particle with mysterious properties.

WHO found the Higgs Boson?
In the US, 1500 faculty, scientists, and students from 90 universities and labs:

- University of Alabama
- Argonne National Laboratory
- University of Arizona
- Baylor University
- Boston University
- Brandeis University
- Brookhaven National Laboratory
- Brown University
- University of California, Berkeley
- University of California, Davis
- University of California, Irvine
- University of California, Los Angeles
- University of California, Riverside
- University of California, San Diego
- University of California, Santa Barbara
- University of California, Santa Cruz
- California Institute of Technology
- California State University, Fresno
- Carnegie Mellon University
- University of Chicago
- University of Colorado
- Columbia University
- Cornell University
- Duke University
- Fairfield University
- Fermi National Accelerator Laboratory
- University of Florida
- Florida Institute of Technology
- Florida International University
- Florida State University
- Hampton University
- Harvard University
- University of Illinois at Chicago
- University of Illinois at Urbana-Champaign
- Indiana University
- University of Iowa
- Iowa State University
- Johns Hopkins University
- University of Kansas
- Kansas State University
- Lawrence Berkeley National Laboratory
- Lawrence Livermore National Laboratory
- Louisiana Tech University
- University of Maryland
- University of Massachusetts, Amherst
- Massachusetts Institute of Technology
- University of Michigan
- Michigan State University
- University of Minnesota
- University of Mississippi
- University of Nebraska-Lincoln
- University of New Mexico
- State University of New York at Albany
- State University of New York at Buffalo
- State University of New York at Stony Brook
- New York University
- Northeastern University
- Northern Illinois University
- Northwestern University
- University of Notre Dame
- Ohio State University
- University of Oklahoma
- Oklahoma State University
- University of Oregon
- University of Pennsylvania
- University of Pittsburgh
- Princeton University
- University of Puerto Rico
- Purdue University
- Purdue University Calumet
- Rice University
- University of Rochester
- Rockefeller University
- Rutgers University
- SLAC National Accelerator Laboratory
- University of South Carolina
- Southern Methodist University
- University of Tennessee
- Texas A&M University
- University of Texas at Austin
- Tufts University
- Vanderbilt University
- University of Virginia
- University of Washington
- Wayne State University
- University of Wisconsin-Madison
- Yale University

Three-fold made for the Capitol Hill Community Visit
1500 U.S. faculty, scientists, and students participated in the discovery of the Higgs boson.

- University of Alabama
- Argonne National Laboratory
- University of Arizona
- Baylor University
- Boston University
- Brigham Young University
- Brandeis University
- Brown University
- University of California, Berkeley
- University of California, Davis
- University of California, Irvine
- University of California, Los Angeles
- University of California, Riverside
- University of California, San Diego
- University of California, Santa Barbara
- University of California, Santa Cruz
- California Institute of Technology
- California State University, Fresno
- Carnegie Mellon University
- University of Chicago
- University of Colorado
- Columbia University
- Cornell University
- Duke University
- Fairfield University
- Fermi National Accelerator Laboratory
- University of Florida
- Florida Institute of Technology
- Florida International University
- Florida State University
- Hampton University
- Harvard University
- University of Illinois at Chicago
- University of Illinois Urbana-Champaign
- Indiana University
- University of Iowa
- Iowa State University
- Johns Hopkins University
- University of Kansas
- Kansas State University
- Lawrence Berkeley National Laboratory
- Lawrence Livermore National Laboratory
- Louisiana Tech University
- University of Maryland
- University of Massachusetts, Amherst
- Massachusetts Institute of Technology
- University of Michigan
- Michigan State University
- University of Minnesota
- University of Mississippi
- University of Nebraska-Lincoln
- University of New Mexico
- State University of New York at Albany
- State University of New York at Buffalo
- State University of New York at Stony Brook
- New York University
- Northeastern University
- Northern Illinois University
- Northwestern University
- University of Notre Dame
- Ohio State University
- University of Oklahoma
- Oklahoma State University
- University of Oregon
- University of Pennsylvania
- University of Pittsburgh
- Princeton University
- University of Puerto Rico
- Purdue University
- Purdue University Calumet
- Rice University
- University of Rochester
- Rockefeller University
- Rutgers University
- GSI National Accelerator Laboratory
- University of South Carolina
- Southern Methodist University
- University of Tennessee
- Texas A&M University
- University of Texas at Arlington
- University of Texas at Austin
- University of Texas at Dallas
- Texas Tech University
- Tufts University
- Vanderbilt University
- University of Virginia
- Virginia Commonwealth University
- University of Washington
- Wayne State University
- University of Wisconsin-Madison
- Yale University

The US CMS and US ATLAS programs are supported by the Department of Energy (DOE) Office of Science and the National Science Foundation.

Four US laboratories participate in the LHC Accelerator Construction and Research Program supported by the DOE Office of Science: Brookhaven National Laboratory, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, and Oak Ridge National Laboratory.

Poster made for the Capitol Hill Community Visit
More comments on HiggsFest on the Hill

The Rayburn Foyer was overfull, very positive and enthusiastic atmosphere: congressional staffers, particle physicists, Agency leaders from DOE and NSF. Bill Colglazier, Science Advisor to the Secretary of State, and Norm Neureiter of AAAS, Nobel Laureate John Mather of NASA, Jerry Guralnik and Carl Hagen, high schools students and their physics teacher from the QuarkNet program.

Michael Turner, APS President -

"Congratulations! The event you put on last night was a huge success. The Rayburn Foyer was cramped with people with enthusiasm and energy. This event made HEP, physics, the DPF and APS look good and that much focus on science in the Capitol was a very good thing for science as well. We can all be proud of last night."

Kate Kirby, APS Executive Officer -

"You and your organizing team are to be congratulated on a truly wonderful event on Capitol Hill yesterday! It was a great day for particle physics, and I hope just the beginning of increased attention from supporters of basic science in Congress. We need to continue to build on this event and to broaden our base of support.

Thank you to the entire High Energy/Particle Physics community, who, turned out in full force."
The Honorable Ernest Moniz  
Secretary  
U.S. Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585

Dear Mr. Secretary:

During the late summer of 2013, the DOE and NSF charged the High Energy Physics Advisory Panel (HEPAP) to constitute a new Particle Physics Project Prioritization Panel (P5) with a goal of developing a 10-year strategic plan for U.S. particle physics in the context of a 20-year global vision. P5 recently completed its work and its report was unanimously endorsed by HEPAP on May 22, 2014. As scientists, engineers, and students from 144 U.S. universities and laboratories, we write to express our strong support for the P5 Report. This plan describes a world-leading program of discovery and we urge that it be incorporated into the plans of the DOE and the NSF.

The report proposes a compelling and balanced strategy of exploration and discovery. The funding profile is realistic. By following it, we will maintain our historic position as a global leader and reliable international partner in this exciting science. The plan invests in the strengths of the US Particle Physics Community, optimizing our resources to address the five critical and intertwined science drivers identified by P5: to exploit the Higgs boson as a new tool for discovery; to pursue the physics associated with neutrino mass; to identify the physics of dark matter; to understand cosmic acceleration, dark energy and inflation; and to explore the unknown, new particles, new interactions, and the principles that govern them.

The P5 report relies on the work of an extensive community study (“Snowmass”) commissioned by the Division of Particles and Fields of the American Physical Society, our professional society of particle physics. Over the course of a year a thousand members of our community, organized in dozens of far-flung working groups, considered the scientific opportunities in depth covering all areas of our field. This work culminated in a 10-day meeting in August 2013 where the comprehensive documentation for P5’s deliberations was completed. Then over the subsequent nine months, P5 held multiple face-to-face and virtual community meetings, and maintained an active website for community input. The resulting P5 report distilled the accumulated wealth of scientific opportunities into those that best serve the science drivers, while also making hard choices among many outstanding scientific programs. Support among our community has solidified behind this exciting report as witnessed by our attached **2095 signatures gathered in seven days**: we stand behind the P5 plan.

Now that our community has reached consensus, we look to you for the necessary support to execute this plan that will enable us to maintain and enhance our position as global leaders in this exciting program of discovery science and technological innovation.

Sincerely,  
Pushpa Bhat  
The U.S. Particle Physics Community