

# Forming the Coordinating Panel for Software and Computing

The Formation Task Force

October 2024

Commissioned by the Executive Committee of the  
Division of Particles and Fields,  
American Physical Society

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# 1 Introduction

This document presents the proposal of the Formation Task Force (FTF) which is charged by the Executive Committee (EC) of the Division of Particles and Fields (DPF) of the American Physical Society (APS) to define the role and governance of a Coordinating Panel for Software and Computing (CPSC) to be hosted by DPF.

## 1.1 Background

The central recommendation from the Computational Frontier (CompF) of the Snowmass 2021 Community Planning Process was

“... the creation of a standing CPSC under DPF, mirroring the Coordinating Panel for Advanced Detectors (CPAD) established in 2012. *Purpose: Promote, coordinate, and assist the High Energy Physics (HEP) community on S&C, working with scientific collaborations, grassroots organizations, institutes and centers, community leaders, and funding agencies on the evolving HEP S&C needs of experimental, observational, and theoretical aspects of the HEP programs. The scope should include research, development, maintenance, and user support.*”

The CompF Snowmass Summary Report [1] provides additional details of the community vision for the CPSC (working name only<sup>1</sup>), which includes career and workforce development, recognition of accomplishments in S&C, and topics of diversity, equity, and inclusion (DEI).

The DPF Executive Committee (DPF EC) agreed to undertake the creation of the CPSC as a standing committee of the DPF. A small ad hoc exploratory committee consisting of the three Snowmass CompF conveners and a past chair of the DPF <sup>2</sup> was formed to develop a plan to establish the CPSC. They presented their plan and a proposed timeline to the DPF EC for accomplishing this and the DPF EC approved this plan at its May 2022 monthly meeting. The plan called for the appointment of this task force, the FTF, which is an ad hoc committee reporting to the DPF EC, to write this report, which will serve as a formal mandate and governance plan for the CPSC.

Since the CPSC will be a standing committee of the DPF and will report to the DPF EC, it must work within the mandate of the APS/DPF and its bylaws. Its main goal is to facilitate communication among S&C stakeholders, help identify issues and problems, and coordinate responses among subgroups of the HEP computing ecosystem. It is not a funding agency with a budget. However, if asked by an agency or organization to advise on funding or to administer funds for a specific purpose, this would be acceptable, subject to approval by the DPF EC, and any restrictions imposed by APS. It is not a provider of computing or software services. It does not itself execute projects, although it might help assemble or convene a group to do one or more of them. It does not, by itself, select among competing projects or approaches or directly make decisions or recommendations. If directly asked for advice by an organization or funding agency, it can respond directly or, more likely, arrange

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<sup>1</sup>CPSC is only a temporary name for this panel. Once the panel is announced, there will be a competition for the most suitable permanent name.

<sup>2</sup>The members of the exploratory committee were from CompF Daniel Elvira, Steven Gottlieb, Benjamin Nachman and from DPF Joel Butler.

for a task force or committee to produce a response. The CPSC can sponsor activities that aid in communication or coordination, such as workshops, meetings, or schools, and it can help promote similar activities sponsored by other organizations. It can undertake initiatives that advance S&C and that fall within the mission of the DPF.

Establishing the CPSC will be done in the same open and transparent manner by which the Snowmass process was carried out and will borrow from the successful deployment in 2012 of CPAD, which is also sponsored by DPF. The CPSC must operate within the parameters described above, which define in a general way the appropriate scope for the DPF-sponsored Panel. The FTF shall not redefine the Panel in a manner that would be inconsistent with its sponsorship by DPF.

## 1.2 Specific Charge to the FTF

The FTF is requested to address and define:

- the scope of the CPSC and its charge
- the general areas of engagement, including the people, organizations, and forums with whom they are likely to interact
- the proposed organization of the Panel, namely the size, selection process for members, method for selecting chairpersons, terms and term limits for members and chairpersons, etc.
- a possible initial set of working groups
- the types of initial activities that it should promote
- the ways of communicating and being available as a resource to the HEP S&C and associated communities

The FTF should propose ways in which the DPF can help advertise the work of the Panel (when we use the word Panel starting with uppercase “P” we are referring to the CPSC) and promote S&C in the DPF/HEP community. The CPSC will be expected to respond to requests from DPF, HEP Advisory Panel (HEPAP), or the HEP funding agencies when they wish to make use of the expertise of the CPSC or the expertise that the CPSC can access. The CPSC should also take the initiative to launch studies when its members think there are important issues that must be examined and to publicize their findings.

The FTF members were chosen in January of 2024. The initial FTF was chosen from a list of nominations by a small subcommittee, which included members of the DPF EC. The members were chosen to reflect the viewpoints and experiences desired in the eventual CPSC.

The FTF is charged with drafting the initial instructions to the CPSC, but recognizes that the challenges and focus areas will evolve in time. An initial proposal for the makeup of the Panel and its interactions with the DPF is given in the Membership and Governance section. The sections that follow outline activities where the CPSC could contribute to improving the S&C environment and the status of the people who work in it. Each section

has a set of high-level objectives, which are seen as long-term and persistent challenges. There are also a series of recommendations and suggestions, which are ideas for the CPSC to make progress on those challenges. The recommendations and suggestions are not an exhaustive list and should evolve as the CPSC matures.

## 2 Committee Membership and Governance

### 2.1 Selection of Members

The Panel is an administrative body and will consist of 15 (fifteen) members who coordinate the activities of a broad community people interesting in computing and software. There will be a broad call for nominations from the community for 3-year terms (see below for initial implementation). The call will extend to the DPF membership, the available mailing lists from the Snowmass Computational Frontier, other prominent computing organizations, and experimental and theory programs. Prospective panel members do not need to be members of the DPF, nor do they need to be supported by the DOE or NSF. To encourage broad representation and a variety of viewpoints, nominations may be sought from academia, industry, and researchers with non-traditional support. The Panel members will be appointed to a 3-year term, with the possibility to be re-nominated and selected for and serve a second consecutive 3-year term. After a second consecutive term, the former Panel member can be nominated and, if selected, serve again, but only after a “waiting period” of at least 3 years.

For the first year, the DPF EC will set up a small, representative selection committee to call for nominations, verify the willingness of nominees to serve for the full 3 years, collect, in a standardized format, information regarding their qualifications and associations pertinent to S&C, and propose from among them a chairperson and fourteen regular panel members for endorsement by the full DPF EC. After the first year, the CPSC chairperson and the DPF EC will form a joint “selection commission” of no more than six representatives drawn from the CPSC and the DPF EC to solicit nominations and choose the five new Panel members each year. The Commission shall make a written description of the duties of Panel members available to the public and follow best practices for selecting the Panel members and the chairperson.

These terms will be staggered so that a third (i.e., 5) of the positions will be up for nomination each year after the first year. For the first selection, the CPSC chairperson will conduct a lottery of all Panel members (except the chairperson, who will serve for three years) to choose five of the members to serve for one year, five for two years, and four, in addition to the chairperson, to serve for three years. After the first year, a third of the members will be selected each year to replace those members whose terms have expired. All initial members are eligible to be considered for reappointment for a second term, which will be for a full three years.

If a member finds that they cannot carry out their responsibilities and withdraws from the Panel, the chairperson will propose a replacement from the list of the most recent year’s nominees or solicit further nominations for concurrence by the DPF EC. The new member will serve out the remainder of the vacated term and can be nominated, and if selected continue for a full term. If the partial term is less than one year, it will not count against the

two-consecutive-term limit. Additionally, any committee member, including the chair, can be removed for cause by a two-thirds vote of the DPF Executive Board. The EC will appoint a new chair from the current CPSC panel members, in case of expulsion of the chair, and in case of the removal of an ordinary panel member, the chairperson will propose a replacement following the same process as used for voluntary separations.

## **2.2 Selection of Chairperson and Deputy**

The chair of the CPSC will be selected and confirmed from eligible Panel members by the DPF EC for a three-year term. A member may serve as CPSC chairperson for one term only.

The chairperson has the primary responsibility for the functioning of the Panel. The chairperson's responsibilities include setting the agenda of regular and exceptional meetings, scheduling them, ensuring that there are minutes, recording all decisions and action items such as new initiatives, and periodically reviewing the progress of projects and activities. The chairperson provides information to the DPF EC and works with it to conduct selections of new members and chairpersons.

The Chairperson, in consultation with the DPF EC, will choose from among the Panel members a deputy whose main responsibility is to substitute for the chairperson if they become unavailable and to otherwise assist in tasks delegated to him/her by the chairperson. The deputy serves at the pleasure of the chairperson, and their mandate expires when the chairperson's term of service ends.

## **2.3 Guidance for the Selection of CPSC Members**

The S&C community has a large, multidisciplinary set of stakeholders including computational scientists, engineers, and computing professionals in universities, national laboratories, and industry as well as experimental and theoretical physicists working on many projects in HEP and associated fields. It will be a challenge for a panel of only 15 members to represent all these communities, but will hopefully reach a balance over time.

When choosing members for the CPSC it should be remembered that within the overall field of scientific S&C there are many more common needs for communication, training, community, career advancement, and the need to improve the diversity of viewpoints than there are sub-field-specific needs. It is desirable to have representatives from many areas in the program, but the commonality in concerns should allow support of constituencies across the community. The DPF EC and the chairperson, with the help and advice of the Panel membership, should ensure the committee is composed of people who have broad viewpoints, connect to more than one constituency, are transparent about affiliations that could impact their performance on the Panel, and can avoid representing too narrowly their own professional interests.

While there are broad commonalities across scientific activities, there are specific challenges, viewpoints, and needs in areas like professional environment, stage of career, portability of skills, and degree of inclusion and belonging. To ensure these cross-cutting viewpoints are represented, when choosing committee members it will be particularly important to have balanced representation across the following areas:

- Duration and stability of position (laboratory staff, university research staff, faculty, soft money, project supported)
- Stage of career, including early career
- Technical skills and expertise
- While no targets are provided, the DPF EC is expected to choose members that broaden the diversity of the panel beyond the current composition of the field, with a goal of evolving to foster a more diverse and inclusive environment moving forward.

To ensure that the CPSC represents the interests of the entire S&C HEP community, it will be necessary to achieve broad participation. While no quotas or “slots” are specified, the DPF EC and the CPSC chair should ensure that averaged over time there is a balance in the following scientific and technical areas:

- Proportionate numbers of lab and university-employed members
- Proportionate fractions of experimental and theoretical computation developers

And encourage representation from

- Each of the major experimental programs in roughly equal numbers, covering all experimental frontiers and including at least one representative from small experiments
- All major theoretical and experimental computation areas.

The CPSC shall keep statistics on the panel membership and nominations, seek feedback from the community, and work with the DPF EC to correct the membership representation if there are areas that are systemically underrepresented.

There is nothing in the above selection criteria that prevents the nomination and selection of international CPSC members. Nevertheless, it is expected that since much of the panel work will focus in building the US community, strengthening communications within the US, and providing guidance to US funding agencies, that the vast majority of CPSC panel members will come from the US community.

## 2.4 Observers, Consultants, and Affiliates

To be more representative and to accomplish its full scope of work, the CPSC may want to appoint advisors, consultants, observers, or affiliates. These could help the CPSC communicate with its broad community. These individuals could also include international consultants or advisers. These positions also have the potential to ensure continuity and institutional memory by providing a defined default role for the outgoing chair.

In all cases, the role of each individual should be defined and a term of service should be specified. The Panel is advised to periodically review the list of people involved and make sure that each is still needed.



## 2.5 Interactions Between the CPSC and DPF

The DPF sponsorship of the CPSC will include facilitating the formation and subsequent operations of the Panel, connecting it to researchers who are members of DPF and more broadly of APS, and monitoring and providing gentle management oversight of its activities.

Specific activities that will be carried out by DPF and the CPSC chairperson working together are

- encouraging and gathering nominations for the Panel and selecting the final members
- appointing any prize committees and monitoring the process of determining the awardees according to APS DPF rules
- ensuring that the DPF/ APS community is informed of CPSC activities. This includes providing information about CPSC activities in the monthly DPF Newsletter and in the APS Newsletter and making timely announcements of other information through the DPF and APS mailing lists.
- ensuring that all activities are conducted according to the APS Code of Conduct [2].

The CPSC, through its chairperson, will keep the DPF EC informed about its activities and plans by

- providing an annual report to the DPF EC
- making brief updates at least twice a year at a monthly DPF EC meeting, and more frequently if necessary, by request or by invitation of the EC chair.
- informing the DPF EC chairperson of any major issues as needed.

The formal relationship between the CPSC and the DPF EC will be specified in the DPF bylaws. Since it takes some time to receive final approval from APS for modifications to the bylaws, the CPSC will begin to operate as soon as the DPF EC approves the bylaw changes and submits them to the APS.

At the request of the DPF EC, a very preliminary version of the modifications to DPF bylaws is provided in Appendix A to help initiate its discussion.

## 3 Communications and Partnership

The increasing role of S&C across all sciences and the growing demand for off-the-shelf solutions to problems specific to particle physics put a high demand on the CPSC to facilitate communication and partnerships effectively. We believe that the CPSC can improve communication in the area of S&C within the HEP community, between science communities with similar challenges, and with external partners. We envision multiple complementary objectives for coordinating communications and partnerships.

- Encourage and facilitate strategic partnerships with computing research institutions, industry, and other scientific communities.

- Improve internal communication between different programs within and across funding agencies.
- Make CPSC a valuable resource for the community and funding agencies through workshops, working groups, and consensus building.
- Strengthen interactions with industry to help HEP benefit from technology advancements and best practices.
- Advocate for the support and development of public data and software repositories to make HEP research more accessible.
- Promote direct communication and forums for discussion between community areas and the funding agencies.

A primary recommendation is that the CPSC organize an annual workshop focusing on community building, technology and skill transfer, career development issues and networking, and to showcase the Panel’s activities. The workshop should be open to all its stakeholders and potential new partners and be aimed at broad communications across the entire S&C ecosystem.

### **3.1 Enhance Partnerships for Exchange of Expertise**

Even within the HEP community, there is diversity in expertise and experience with different solutions and problems. For example, the lattice QCD community has a strong background in parallelism and HPC, while the LHC community has been focusing on high throughput computing and software solutions related to large international collaborations. The CPSC should reach out to HEP, Nuclear, and Astrophysics experiments, as well as other data-intensive sciences, to create connections between experts in all S&C technologies of interest to the HEP community. Activities could include

- Organizing birds of a feather (BOF) meetings at HEP, astrophysics, and AcNP-centric workshops
- Organizing forums on relevant technical topics
- Convening expert panels on topics that span across technical areas, such as career development, software life cycles and modernization, and technological advances.

### **3.2 Promote Strategic Links with External Entities**

HEP has been a trailblazer in many areas of S&C, particularly when it comes to the handling of large data sets. Other scientific fields are starting to get into domains that overwhelm their current workflows. Establishing an exchange with experts in other scientific fields ensures that new developments and lessons learned can be brought into the HEP community. Promoting successes that originated or were demonstrated in HEP is a powerful tool to increase the visibility of HEP researchers. Initial activities that could further these goals include

- Creating a directory of potential partners across industry, academia, and other research fields with interests aligned to HEP S&C challenges.
- Using the CPSC annual meeting to facilitate communications with potential partners and to inform the community of developments in new areas.
- Hosting meetings, as needed, to explore collaborative opportunities, showcase ongoing projects, and discuss emerging technologies.
- Developing a proposal template and support a mechanism for HEP researchers seeking to initiate partnerships.

### 3.3 Enhance Communication Within the HEP Community

It is important to retain the connections within the HEP S&C community forged in the Snowmass process. For over 10 years the HEP Software Foundation (HSF) [3] has facilitated cooperation and common efforts in HEP S&C internationally. It has expanded to include members of the intensity and nuclear physics communities but has so far not succeeded in engaging the cosmic frontier. Thanks to funding for projects like National Science Foundation (NSF)’s Institute for Research and Innovation in Software for High Energy Physics (IRIS-HEP) [4, 5, 6] and volunteer HSF efforts, a road map for development in S&C was published in 2018. It documented community agreed-upon areas that needed attention and has been tracking those areas ever since. The HSF has a well-established organization dedicated to community building. However, the fully volunteer nature of HSF, and its lack of a formal institutional home, put it at the risk of eventually having to disband. The CPSC could partner with the HSF to help address some of these shortcomings while in return getting a head start in achieving its communication and community-building goals. The following activities could be considered:

- Implement a centralized communication platform (e.g., a dedicated website or forum) for updates on programs, funding opportunities, and research outcomes.
- Organize quarterly webinars or newsletters to share updates from different HEP S&C initiatives. This should increase the transparency of the Panel and enable members of the community to check that their interests are being represented.
- Establish a liaison role within CPSC to facilitate communication between funding agencies and the HEP community.

### 3.4 Leverage Industry Interactions

HEP is no longer at the cutting edge of computing technology as it was 30 years ago. This means that in the future computing will be driven by industry needs and we will have to purchase the computing equipment and software from what is available in the commercial sector and adapt it to our needs. It is imperative that the community track industry trends and train our next generation of leaders in the S&C technologies of the future. The CPSC should leverage the already existing relationships that we have through the Department of

Energy (DOE) HEP - Center for Computational Excellence (HEP-CCE) [7] project and CERN’s Openlab [8]. A few potential initial activities include

- Establishing an industry engagement board to provide insights into technological trends and opportunities for collaboration.
- Organizing hackathons and innovation challenges in partnership with industry to solve HEP-specific computing problems.
- Facilitating internships and exchanges for researchers and students to gain experience with industry tools and methodologies.

### 3.5 Facilitate Workshops and Working Groups

To facilitate interactions across different experiments and to enhance the exchange of topical experts, workshops aimed at low-level technical discussions are indispensable. The Panel should help find support for coordinators of topical workshops to ensure appropriate representation across experiments and communities. When needed, the Panel should convene Working Groups comprised of expert community members, e.g., to advise funding agencies or multiple experiments on “hot” technical topics. These workshops and working groups should follow the implementation recommendations outlined in Sections 4.4 and 6.1.

- Identify key themes and topics where CPSC can contribute significant value through workshops or working groups.
- Organize workshops and meetings, as required, to address these themes, inviting participation from across the HEP community and relevant external partners.
- Produce white papers or consensus reports on critical issues, offering recommendations and highlighting community needs to funding agencies.

### 3.6 Support for Public Data and Software Initiatives

Public data has long been a part of the astroparticle community ecosystem. Starting with the Sloan Digital Sky Survey in the 1990s, embargo and public data release policies have been shown to maximize scientific impact for well-curated datasets. In the 2010s LHC experiments started releasing public data with the help of the CERN Open Data Release portal project [9]. These efforts rely on host laboratory support and without it, there is no data preservation. Despite the requests from both DOE and NSF to have a data management policy for any funded proposal, there are a limited number of public datasets. To improve the situation moving forward, the following activities are recommended:

- Collaborate with existing public data and software initiatives to identify support needs and opportunities for growth.
- Work with funding agencies to highlight the importance of public data and software for the advancement of HEP and secure dedicated funding.

- Organize training sessions and workshops on best practices for developing, sharing, and maintaining public HEP software and datasets.
- Consider partnering with a new sub-panel within the International Committee for Future Accelerators, the Panel on the Data Lifecycle [10].
- Use the CPSC Annual meeting to promote public data and software initiatives.

## 4 Career Development

Helping to improve the career prospects of researchers who devote their efforts to computational sciences in physics should be a priority for the CPSC. Evolving the culture of a field is a long process that involves engagement at many levels. To initiate this process, the CPSC should focus on recognition, training, and assessment. The overall objective is to improve the recognition that S&C contributions are critical to the success of the physics program, that computational science contributions are valued and respected, and that there are career trajectories and opportunities for professional growth. The Panel should

- Develop a strategy and concrete steps to increase visibility and recognition of S&C contributions within HEP.
- Campaign to increase the number of stable positions at universities and research institutions for individuals specializing in S&C within HEP.
- Help advertise, including to those in academic positions, job opportunities in computer science and industry.
- Provide career resources for jobs in HEP S&C.
- Gather statistics at different career stages, as well as highlight example success stories.
- Facilitate discussions on recruitment, training, retention, and the improvement of opportunities within HEP. Provide arguments and materials for institutes and universities to make the case for hires, such as examples of funding models for scientists.
- Improve the training and education available in S&C skills for emerging scientists.
- Facilitate the community discussion to develop pathways for individuals who have transitioned to industry or other fields to return to academic or research positions in HEP.
- Develop pathways and support connections to industry for those who wish to move beyond academia. Possessing a range of career options is also a good tool to recruit people into S&C.

## 4.1 Establish Recognition and Awards

Awards and recognition are powerful ways of honoring achievements spanning across career stages. They celebrate outstanding contributions and provide visibility to the recipients while motivating and inspiring many others. Potential activities to help recognize achievements include

- Creating a tiered awards system to recognize contributions at various career stages, including graduate students, postdocs, junior faculty, and senior contributors.
- Determining award categories to cover both technical achievements and contributions with broader impacts on society. The specific criteria should be defined and made available in the advertisements and website.
- Exploring the possibility of securing industry sponsorship or an endowment for awards to provide financial incentives while ensuring that recognition remains the primary goal.
- Implementing a follow-up assessment every 5 years to evaluate the impact of awards on recipients' careers.

## 4.2 Promote Career Development Discussions

Discussions related to career development are crucial for recruiting people into S&C, supporting their career growth, and helping them reach their full potential. Sharing of resources, guidelines, and best practices within the community enables knowledge transfer thereby improving the efficiency and cost-effectiveness of the various career development programs and initiatives. Career development discussions enable career growth by highlighting new opportunities and potential collaborations. Such discussions also boost morale by making people feel supported and can thereby help with overall engagement and retention. Some potential initial activities in this area could include

- Organize workshops and forums for sharing best practices in career development, with a focus on integrating S&C skills into physics careers.
- Develop guidelines and resources for training programs in S&C, emphasizing the importance of these skills in modern physics research.
- Encourage the establishment of joint positions or cross-disciplinary tracks that bridge physics and computing/data science, highlighting the mutual benefits of these collaborations.
- Establish mechanisms to encourage networking, including establishing an alumni network, career fairs, panels, etc.

### 4.3 Address Structural Challenges

Development of career pathways often requires addressing structural challenges. This requires a multi-pronged effort that makes the case for supporting the strategic hiring of personnel (e.g., faculty, research scientists, computing professionals, research software engineers) with S&C expertise within particle physics, providing guidelines for hiring and promotion that take into proper consideration technical contributions and expertise, and encouragement of collaboration with other disciplines and industry to provide career opportunities beyond particle physics. The CPSC should pursue activities to

- Engage with funding agencies, universities, and research institutions to highlight the critical role of S&C in advancing HEP research and the need for stable career paths in this area.
- Advocate for changes in hiring and evaluation criteria to recognize and reward contributions in S&C as integral to scientific achievements.
- Collaborate with other scientific disciplines and industries to broaden the career opportunities for those with expertise in S&C within physics.

### 4.4 Enhance Training and Education

Given the growing needs of particle physics experiments and the rapidly evolving computing landscape, training programs dedicated to S&C are essential for creating the next generation of S&C experts. These programs should address the needs of different groups of people — from absolute beginners to people with some prior experience. Sharing knowledge between different programs can maximize their impact and enable resources to be spent on important goals such as broadening participation and reducing barriers to entry. Potential activities in this area include

- Creating a centralized repository of training materials, workshops, and courses related to S&C in HEP.
- Promoting and supporting diversity in training programs, aiming to increase participation from underrepresented groups in the field. One avenue is to establish connections with Minority Serving Institutions (MSIs), including Historically Black Colleges and Universities (HBCUs), Tribal Colleges and Universities (TCUs), and other institutions with significant underrepresented groups.
- Working with academic institutions to incorporate S&C skills into physics curricula, emphasizing their importance for modern scientific research.

### 4.5 Foster Re-entry Pathways

Facilitating the ability to return to academic science can expand the experienced workforce. Potential activities to help enable this process include

- Expand opportunities for people who have voluntarily left academia to care for children. Foster training and reentry positions.
- Collaborate with industry partners to establish fellowships or sabbatical positions that allow professionals to contribute to HEP projects while maintaining their industry roles.
- Advertise and/or provide advice on how to advertise jobs to external communities.
- Highlight success stories of individuals who have made significant contributions to HEP after returning from time away, to serve as models for potential re-entry programs.

## 4.6 Monitoring and Reporting

Monitoring progress in the area of career development is critical for the success of the overall effort. It helps increase the effectiveness of the program by identifying potential areas of improvement and ensuring a proactive, adaptive response. The CPSC should

- Establish a task force within CPSC to monitor the implementation of the career development action plan, ensuring progress is made toward the outlined objectives.
- Provide annual reports on the status of initiatives, challenges encountered, and success stories to maintain transparency and foster continuous improvement.
- Survey the field and provide outcomes on the website.

## 5 Broaden Representation in S&C

The most innovative solutions are developed by teams with diverse viewpoints. S&C has the potential to be among the best-represented sub-area in HEP in terms of diversity in viewpoints and backgrounds. There are more opportunities for participation across universities and the cost of entry is lower and requires less specialized equipment than detector development. Despite the potential advantages, currently, S&C activities have on average poorer presentation among some groups compared to other areas of physics. The activities of the CPSC in the area of increasing representation should be intended to make progress in this area.

The CPSC should foster a diverse, equitable, and inclusive environment within the CPSC and the broader computational science and software development community in HEP to ensure the most innovative problem-solving teams and to maximize the participation of the entire potential workforce.

- **Broaden Representation:** Ensure the CPSC and computational roles within HEP represent diverse backgrounds, including race, gender, first-generation scientists, immigrants, and socioeconomic backgrounds.



- **Promote Equity:** Improve the pipeline to address systemic barriers and inequities that limit participation and advancement in computational roles and encourage broad representation at the earliest opportunity, reaching out to potential community members in formative career stages at the graduate and undergraduate level.
- **Enhance Inclusion:** Create an environment where all members feel valued, included, and empowered to contribute to their fullest potential.

Improvements in inclusion are the responsibility of the entire community and the entire community benefits from more creativity and innovation, but the CPSC is well-positioned to survey the whole field of S&C in HEP, establish metrics, and track progress. The CPSC can also influence training and access to engage the full potential workforce.

## 5.1 Conduct a Comprehensive Survey

The information on the current status and concerns of the entire community is not readily available. The CPSC should

- Develop and distribute a survey to gather detailed demographics of the computational community within HEP, across the entire professional cycle, to understand the current situation.
- Repeat this survey periodically to capture changes and trends.

## 5.2 Work to Address Systemic Barriers

- Improve access to training and data. S&C activities have a lower barrier of investment because basic local resources needed to participate are modest and available at nearly all institutions. Specialized resources are available to the entire collaboration through remote access, which opens up effective participation by new communities including rural and underserved areas.

Despite the potential advantages in S&C to level the field, systemic barriers remain. Lack of training, lack of experience with computers, and lack of mentors all lead to a reduced pipeline of new talent. Concentrated effort to improve early access to training and experience would help.

## 5.3 Promote Remote Work and Flexibility

- Emphasize, document, and publicize the concept that S&C is a sub-field that can be effectively performed with remote teams. This increases participation for individuals with caregiving responsibilities, mobility challenges, or those living in remote areas. It is necessary to continue to develop tools to allow effective participation, but also to evolve the culture to equally value remote participants as fully contributing collaboration members.

## 5.4 Develop Education and Training Programs

- Encourage the development of training programs that enhance computational skills across the entire professional cycle, including initiatives at the high school and undergraduate levels, to increase the overall technical competence of the community and to improve the pipeline of talent into computational roles.
- Work to ensure training and development programs are universally available.

## 5.5 Encourage Use of Public Data and Software

- Promote the availability of public data and software to make computational science more accessible worldwide, following models like NASA’s approach to data sharing and training.

## 5.6 Identify Increasing Representation as Both a Collective Responsibility and a Community Opportunity

- Ensure the efforts to improve representation are embedded in all of the CPSC’s work and not siloed into a sub-committee. This involves integrating improvements in representation into all projects, discussions, and decision-making processes.
- Increase participation and commitment to improving representation across all members and stakeholders, actively seeking volunteers and contributors to initiatives to prevent the burden from falling on those directly affected by inequities.

## 5.7 Monitoring and Reporting

CPSC activities should seek to increase representation by addressing systemic barriers and fostering a culture of innovation that recognizes the value of diverse viewpoints and experiences. Through targeted actions and ongoing evaluation, the CPSC should aim to make computational roles in HEP more accessible and welcoming to a diverse range of talents and backgrounds. The CPSC should

- Establish regular review cycles to assess progress towards representation, including bi-annual surveys and reports.
- Collaborate with efforts of the experiments, computing conferences and workshops, community software and computing projects, and the labs and the universities to work toward common goals of increasing representation.

# 6 Implementation Strategies

The CPSC can be a resource to help identify and develop consensus on strategic directions in S&C for HEP and to communicate those to the community and the funding agencies.

- **Objectives**

- Identify strategically important technical directions in S&C
- Develop and document consensus through technical road maps
- Communicate with the funding agencies to encourage exploratory R&D

The Panel is expected to organize itself to achieve all its goals. The FTF thinks that S&C moves too fast to specify a fixed organizational structure, an example of which is the CompF scheme of seven topical groups and their subgroups. We outline a more flexible arrangement below, but the implementation choice will depend on many issues and is likely to evolve.

## **6.1 Facilitate the Establishment of Technical Working Groups**

The CPSC should not feel bound by only the efforts of the 15 committee members to execute the mission. Technical Working Groups (TWGs) are a powerful tool to assess the potential of new technologies and to facilitate communication, training, and research and development (R&D) input across labs, university groups, and other relevant entities. It is imagined that the TWGs primarily define interesting strategic technical directions, which are then used to help justify externally supported technical areas. Examples of TWG topics are new computing architectures and techniques, directions in energy usage and efficiency, new programming languages, and life-cycle support of essential software. The CPSC should form TWGs that adhere to the following themes and provide the suggested deliverables:

- **Establishment of Technical Working Groups and Task Forces**

- Formulate focused task forces with specific topics to explore and finalize their findings with a deliverable of a report document. Task forces should be goal-oriented and have limited duration, potentially operating for a maximum of one to two years to influence an R&D direction and strategy.
- Limit the number of simultaneously operating TWGs to maintain manageability and effectiveness. Sunset groups that have accomplished their goals and, if necessary, initiate new groups to move to a next phase. Aim for having about five TWGs operating at any given time.
- Technical topics for these groups should be chosen by the CPSC, with an awareness that these areas are likely to evolve.

- **Communication Strategies**

- Utilize a variety of communication mechanisms such as meetings, town halls, workshops, studies, tutorials, and training sessions to engage with the community effectively.
- Leverage technical working groups as platforms for facilitating communication across different entities and for providing targeted training and help develop community consensus on R&D needs.

- **External Involvement and Advisory Panels** Encourage TWG membership and leadership from outside the CPSC to enrich discussions, the range of inputs, and to augment the capabilities of the CPSC, given the diverse and numerous technical topics the community is interested in addressing.
- **Focus on Actionable Outcomes**
  - Emphasize the creation of focused, goal-oriented task forces that can generate actionable outcomes and clear and concise reports, ensuring a tangible impact on R&D direction and strategy.
  - Task forces should aim to produce documents or recommendations that will assist funding agencies in considering whether to support proposed work and to allocate resources effectively towards critical research areas or discussions.
- **Avoid Duplication of Efforts** Ensure coordination with existing external groups, such as the HEPiX Technology Watch Working Group [11], to leverage their work and avoid redundant efforts. This could involve sharing insights and outcomes to enrich the broader community’s understanding and actions.
- **Special Considerations** As with all aspects of the CPSC, pay attention to the inclusion of diverse perspectives in all technical and advisory groups. Refer to Section 5 for further considerations.

## 6.2 Conduct an Annual Meeting of All Stakeholders in S&C

A meeting of all stakeholders in S&C will be one of the highest-profile activities of the CPSC. There is also an opportunity to advance CPSC activities and engage the community. The annual meeting is an opportunity for

- Networking and Career Development
- Bi-directional communications with the funding agencies in the areas of needs, priorities, and trends
- Highlighting accomplishments by community members and making awards
- Information exchange between subfields
- Training and education

The annual meetings should follow best practices for accessibility of both in-person and remote participants. [12]

## 6.3 Conduct Virtual Town Hall Meetings

Virtual town hall meetings proved themselves to be an inexpensive and accessible way of soliciting feedback from the community during the pandemic. Entirely virtual town hall meetings do not artificially advantage voices who could afford to travel, are easier to schedule, and have a lower carbon footprint. The regular use of virtual town hall meetings when soliciting feedback from the community is especially recommended.

## 6.4 Appoint Advisors and Consultants

The CPSC should not feel bound by only the efforts of the 15 committee members to execute the mission. Advisors and consultants should be engaged whenever the committee decides that additional expertise is needed.

## 6.5 Develop and Support Communication Tools for the S&C Community

These would include websites and communications and discussion forums, such as **Slack** and **Mattermost**, some of which are already provided by DPF.

## 6.6 Create Awards and Prizes to Honor Significant Contributions to S&C

Awards and prizes are an effective way to acknowledge significant contributions, improve morale, and help to retain the strongest people. While awards can provide prestige for free, they often have more impact with even small sums of money. S&C has strong ties to industry and, with the permission of the DPF, the CPSC should investigate external sources of award sponsorship.

# 7 Concluding Remarks

This document is intended to guide the formation and initial operations of the CPSC. The document contains many potential directions and activities that the authors believe would be beneficial to the S&C community. After the plan is approved the DPF can fulfill its role to populate the inaugural Panel and the important and challenging work of the CPSC can begin. The FTF members wish the CPSC success in their endeavors and hope it will be a force for positive change. The FTF members remain available to participate and/or provide guidance to the CPSC during the startup as needed.

## Acknowledgements

We would like to thank the Computational Frontier of the Snowmass 2021 Community study for proposing the CPSC and giving it a high priority, Particle Physics Project Prioritization Panel (P5) for their support, and the DPF EC for agreeing to host the CPSC, and for their support of this task force. We also thank the HEPAP for their interest in our work. We received excellent advice on the creation and operation of the CPAD from Prof. Ian Shipsey, Oxford, Dr. Marcel Demarteau, Oak Ridge National Lab, and Dr. Petra Merkel, Fermi National Accelerator Laboratory.

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## Acronyms

**APS** American Physical Society. [1](#), [6](#)

**BOF** birds of a feather. [7](#)

**CompF** Computational Frontier. [1](#), [16](#)

**CPAD** Coordinating Panel for Advanced Detectors. [1](#), [2](#), [18](#)

**CPSC** Coordinating Panel for Software and Computing. [1–10](#), [12–18](#)

**DEI** diversity, equity, and inclusion. [1](#)

**DOE** Department of Energy. [8](#), [9](#)

**DPF** Division of Particles and Fields. [1–3](#), [6](#), [18](#), [21](#)

**DPF EC** DPF Executive Committee. [1](#), [3–6](#), [18](#)

**EC** Executive Committee. [1](#)

**FTF** Formation Task Force. [1](#), [2](#), [16](#), [18](#)

**HEP** High Energy Physics. [1](#), [2](#), [4–10](#), [12–15](#)

**HEP-CCE** HEP - Center for Computational Excellence. [9](#)

**HEPAP** HEP Advisory Panel. [2](#), [18](#)

**HSF** HEP Software Foundation. [8](#)

**IRIS-HEP** Institute for Research and Innovation in Software for High Energy Physics. [8](#)

**NSF** National Science Foundation. [8](#), [9](#)

**P5** Particle Physics Project Prioritization Panel. [18](#)

**S&C** software and computing. [i](#), [1–8](#), [10–18](#)

**TWG** Technical Working Group. [16](#), [17](#)

# Appendices

## A Initial thoughts on modification to the DPF bylaws to implement the CPSC

This is slightly modified from the CPAD entry in the DPF bylaws. The FTF was requested by the DPF EC to make an initial proposal for the addition to the bylaws to describe the CPSC. This will appear in the bylaws in the section “Appointed Committees”, which includes brief descriptions of four standing unit committees: Nominating Committee, Program Committee, Fellowship Committee, and the Coordinating Panel for Advanced Detectors. The CPSC will be the fifth standing unit committee.

The Software and Computing Coordinating Panel:

The Coordinating Panel for Software and Computing (CPSC) shall consist of 15 Panel members proposed by an ad hoc election committee of six members chosen from the DPF EC and current CPSC membership after an open call for nominations to the broad S&C community. Self-nominations are encouraged. The ad hoc group will certify the eligibility, interest, and capability of the nominated candidates to serve and will propose the list of Panel members to the DPF Executive Committee for its concurrence. Terms will be for three years and will be implemented with a one year stagger so that five new members will be selected each year (except in the first year when 15 new members will be chosen and the stagger will be implemented by lottery). Panel members shall not serve more than two consecutive terms and are eligible for re-selection after a three year break. Starting in the first year, the election committee will select a chairperson to serve for three years. A chairperson can serve for one term. The chairperson, will propose one member to serve as their deputy to substitute for them if they become unavailable and to otherwise assist them in tasks they may choose to delegate. The CPSC shall promote, coordinate, and assist the HEP community on S&C, working with scientific collaborations, grassroots organizations, institutes and centers, community leaders, and funding agencies on the evolving S&C needs of experimental, observational, and theoretical aspects of the HEP programs. The scope should include research, development, maintenance, and user support. The CPSC shall have the responsibility to promote excellence and sustainability in computing and software to support the national program of particle physics in a global context and to promote communication among the many stakeholders in HEP and related disciplines, industry, academia funding agencies, projects and experiments. Methods for achieving these goals include the organization of the annual topical meeting on software and computing; establishing awards and supervising the nomination and selection of the annual award winners; the establishment of technical working groups to study and make recommendations on directions and solutions to S&C problems; the promotion of educational programs to further the understanding of S&C and for development of the next generation of experts; the organization of multidisciplinary workshops; and the development of any other new activities consistent with its mission.