Long Range Plan Process

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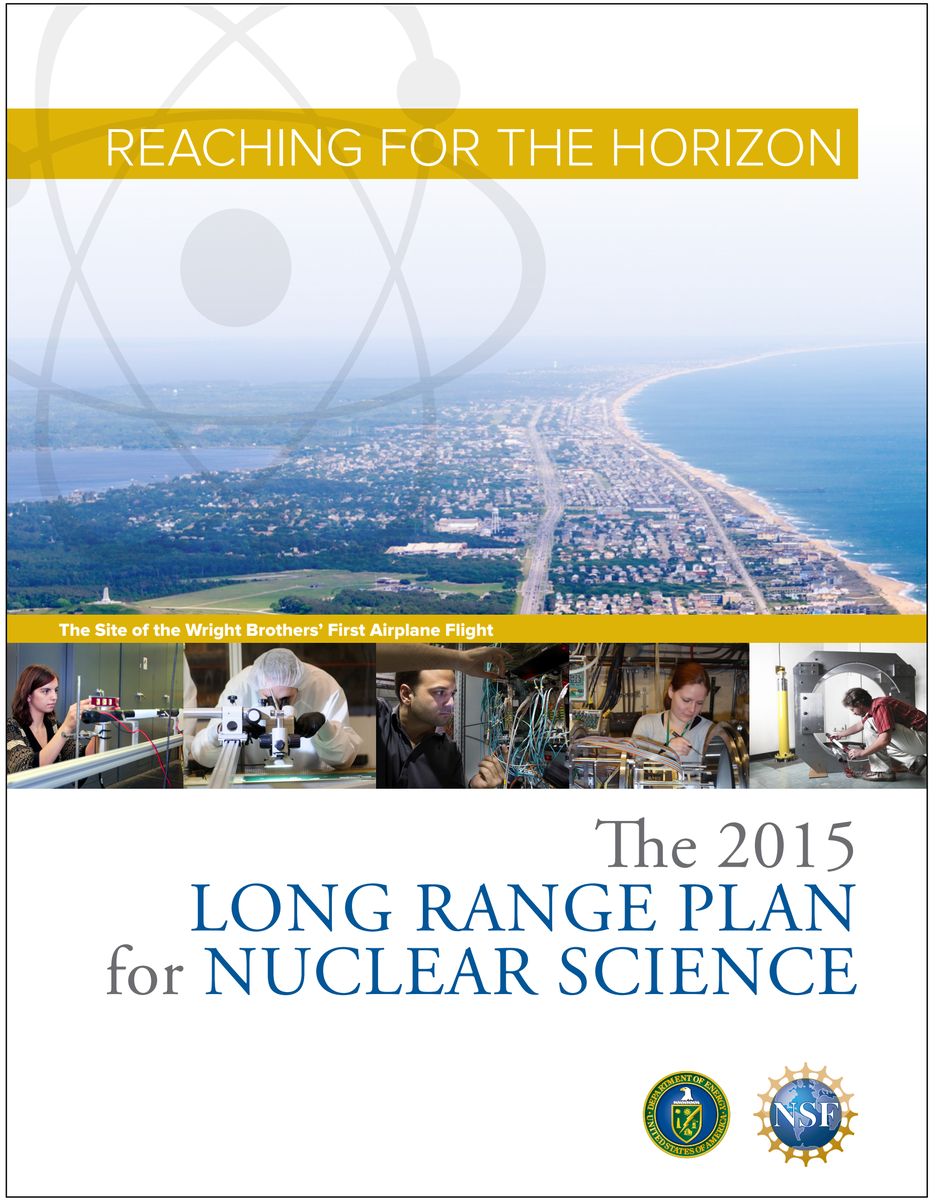
How a Long Range Plan is Formed

- goal: produce a document outlining the Nuclear Physics Community's priorities over the next several years

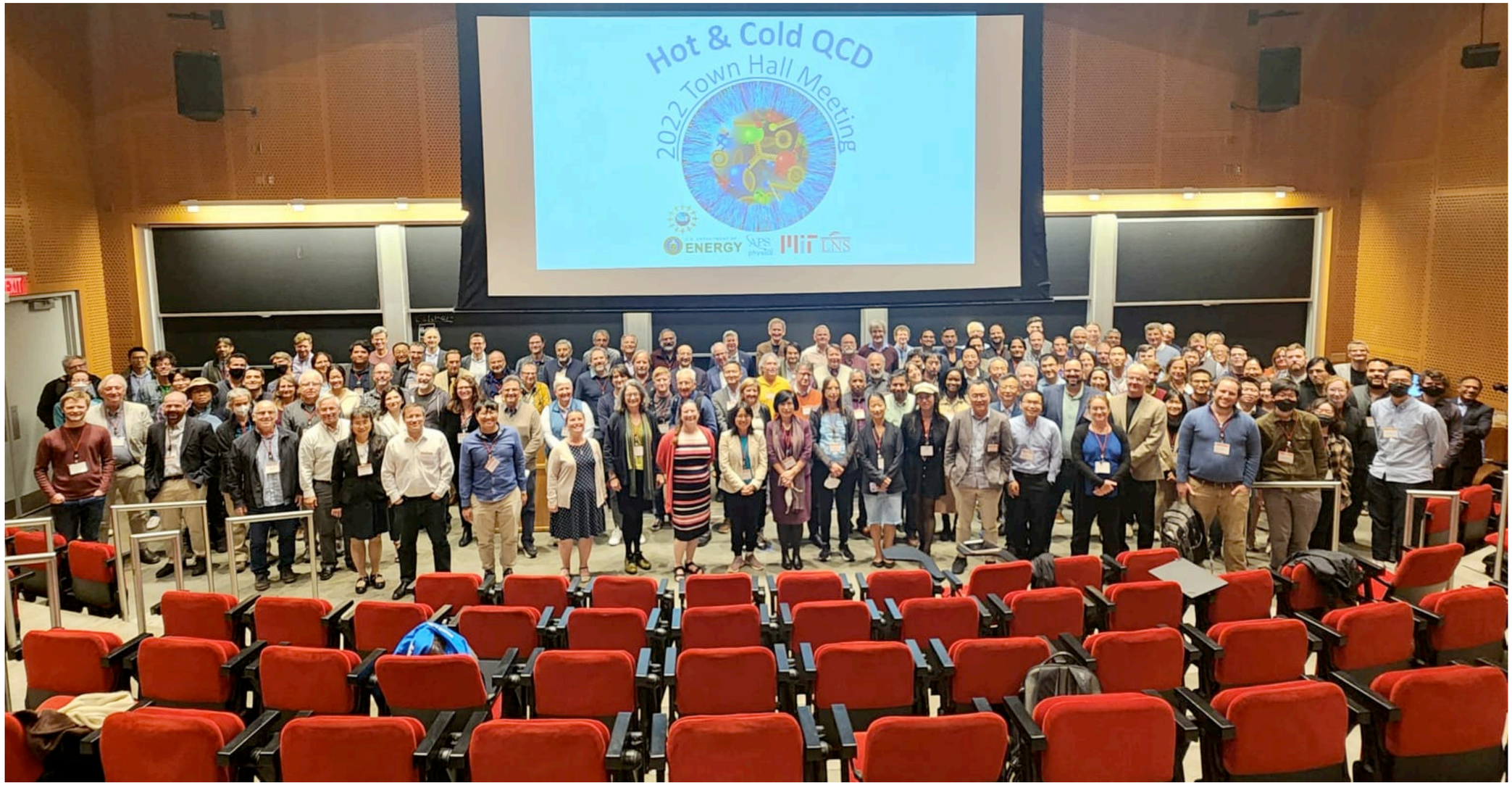
- this plan acts as a guide to the agencies and the community



2023 Long Range Plan

- July 2022: charge issued to Nuclear Science Advisory Committee (https://science.osti.gov/-/media/np/nsac/pdf/202207/Hallman2_LRP_NSAC_202207.pdf)
- September 2022: QCD Town Hall Meeting (https://indico.mit.edu/event/538/)
- September 2022: LRP Writing Committee Named (https://science.osti.gov/-/media/np/nsac/pdf/202209/Dodge_LRP_Update_NSAC_202209.pdf)
- November/December 2022: Fundamental Symmetries and Nuclear Structure Town Halls
- February 2023: White papers written by the wider community finalized as input for the LRP Writing Committee

QCD Town Hall



plus many virtual participants…

QCD Town Hall

- plenary talks covering the broad range of QCD (including the EIC) plus separate parallel sessions on Hot and Cold QCD

- all sessions also included an “open mic” to allow input directly from the community

Conveners (alphabetic order):

- Bjoern Schenke (BNL)
- Anne Sickles (Illinois)
- Feng Yuan (LBNL)
- Xiaochao Zheng (UVA)

Organizing Committee (alphabetic order):

- Ian Cloet (ANL)
- Or Hen (MIT)
- David Lawrence (JLab)
- Wei Li (Rice)
- Swagato Mukherjee (BNL)
- Bjoern Schenke (BNL)
- Anne Sickles (Illinois)
- Ramona Vogt (LLNL & UCD)
- Feng Yuan (LBNL)
- Xiaochao Zheng (UVA)

Outcome

- four recommendations with broad support from the community
- several initiatives with varying degrees of support
- full text of recommendations & initiatives are here: https://indico.mit.edu/event/538/contributions/1254/attachments/602/1022/QCD%20Town%20Hall%20Final%20R%26I.pdf
- a summary white paper is being prepared, led by the organizing committee of the meeting

Recommendation 1: Capitalizing on past investments

The highest priority for QCD research is to maintain U.S. world leadership in nuclear science for the next decade by capitalizing on past investments. Maintaining this leadership requires recruitment and retention of a diverse and equitable workforce. We recommend support for a healthy base theory program, full operation of the CEBAF 12-GeV and RHIC facilities, and maintaining U.S. leadership within the LHC heavy-ion program, along with other running facilities, including the valuable university-based laboratories, and the scientists involved in all these efforts.

This includes the following, unordered, programs:

- The 12-GeV CEBAF hosts a forefront program of using electrons to unfold the quark and gluon structure of visible matter and probe the Standard Model. We recommend executing the CEBAF 12-GeV program at full capability and capitalizing on the full intensity potential of CEBAF by the construction and deployment of the Solenoidal Large Intensity Device (SoLID).
- The RHIC facility revolutionized our understanding of QCD, as well as the spin structure of the nucleon. To successfully conclude the RHIC science mission, it is essential to complete the sPHENIX science program as highlighted in the 2015 LRP, the concurrent STAR data taking with forward upgrade, and the full data analysis from all RHIC experiments.
- The LHC facility maintains leadership in the (heavy ion) energy frontier and hosts a program of using heavy-ion collisions to probe QCD at the highest temperature and/or energy scales. We recommend the support of continued U.S. leadership across the heavy ion LHC program.
- Theoretical nuclear physics is essential for establishing new scientific directions, and meeting the challenges and realizing the full scientific potential of current and future experiments. We recommend increased investment in the base program and expansion of topical programs in nuclear theory.

Recommendation 2: EIC Project

We recommend the expeditious completion of the EIC as the highest priority for facility construction.

The Electron-Ion Collider (EIC) is a powerful and versatile new accelerator facility, capable of colliding high-energy beams ranging from heavy ions to polarized light ions and protons with high-energy polarized electron beams. In the 2015 Long Range Plan the EIC was put forward as the highest priority for new facility construction and the expeditious completion remains a top priority for the nuclear physics community. The EIC, accompanied by the general-purpose large-acceptance detector, ePIC, will be a discovery machine that addresses fundamental questions such as the origin of mass and spin of the proton as well as probing dense gluon systems in nuclei. It will allow for the exploration of new landscapes in QCD, permitting the “tomography”, or high-resolution multidimensional mapping of the quark and gluon components inside of nucleons and nuclei. Realizing the EIC will keep the U.S. on the frontiers of nuclear physics and accelerator science and technology.

- Building on the recent EIC project CD-1 approval, the community-led Yellow-Report, and detector proposals, the QCD research community is committed to continue the development and timely realization of the EIC and its first detector, ePIC. We recommend supporting the growth of a diverse and active research workforce for the ePIC collaboration, in support of the expeditious realization of the first EIC detector.
- We recommend new investments to establish a national EIC theory alliance to enhance and broaden the theory community needed for advancing EIC science and the experimental program. This theory alliance will contribute to a diverse workforce through a competitive national EIC theory fellow program and tenure-track bridge positions, including appointments at minority serving institutions.

Recommendation 3: Workforce and Conduct

Increasing the U.S. QCD research workforce and participation of international collaborators is vital for the successful realization of the field's science mission. In addition, the nuclear physics research program serves an important role in developing a diverse STEM workforce for the critical needs of the nation. Creating and maintaining an equitable, productive working environment for all members of the community is a necessary part of this development.

We recommend enhanced investment in the growth and development of a diverse, equitable workforce.

- Part of recruiting and maintaining a diverse workforce requires treating all community members with respect and dignity. Supporting the recent initiatives by the APS and DNP to develop community-wide standards of conduct, we recommend that host labs and user facilities require the establishment and/or adoption of enforceable conduct standards by all of the experimental and theoretical collaborations they support. The enforcement of such standards is the combined responsibility of all laboratories, theoretical and experimental collaborations, conference organizers, and individual investigators supported by the nuclear physics research program.
- We recommend development and expansion of programs that enable participation in research by students from under-represented communities at National Labs and/or Research Universities, including extended support for researchers from minority-serving and non-PhD granting institutions.
- We recommend development and expansion of programs to recruit and retain diverse junior faculty and staff at universities and national laboratories through bridge positions, fellowships, traineeships, and other incentives.

Recommendation 4: Computing

High-performance and high-throughput computing are essential to advance nuclear physics at the experimental and theory frontiers. Increased investments in computational nuclear physics will facilitate discoveries and capitalize on previous investments.

- We recommend increased investments for software and algorithm development, including in AI/ML, by strengthening and expanding programs and partnerships, such as the DOE SciDAC and NSF CSSI and AI institutes.
- We recommend increased support for dedicated high-performance and high-throughput mid-scale computational hardware and high-capacity data systems, as well as expanding access to leadership computing facilities.
- Advanced computing is an interdisciplinary field. We recommend establishing programs to support the development and retention of a diverse multi-disciplinary workforce in high-performance computing and AI/ML.