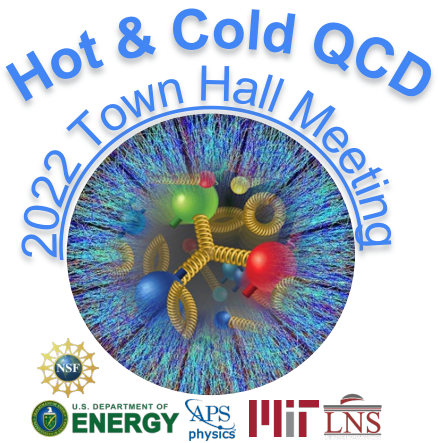
QCD Town Hall Meeting

Draft Recommendations and Initiatives
+ Survey results

September 25, 2022



255 Survey Responses!

37 incomplete responses
(people who did not hit submit)

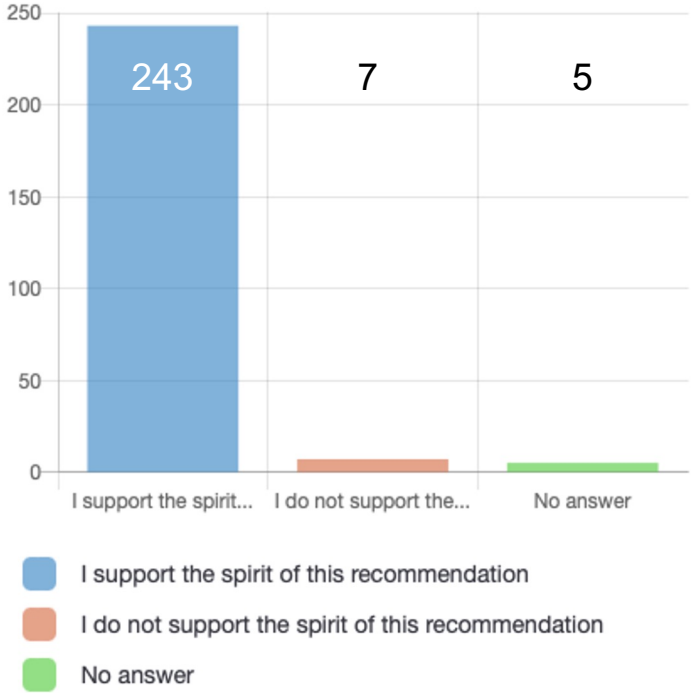
- The following results will serve as a discussion starting point.
- We will make changes to the recommendations and initiatives as required based on the discussion today, and send a new (concluding) survey by end of tomorrow.
- The results of the town hall concluding survey will be presented in the QCD white paper and will serve as the basis for the recommendations and initiatives included in it.
- White paper plan: organizing committee turns into a writing committee. Will be inclusive and call on community members to help. Expect to present a draft to the community, collect comments, and finalize by early February (NSAC deadline).

  All members of the QCD community will be able to endorse the white paper and sign on to its author list.

Survey Results

[not last word from the Town Hall; just discussion starting point]

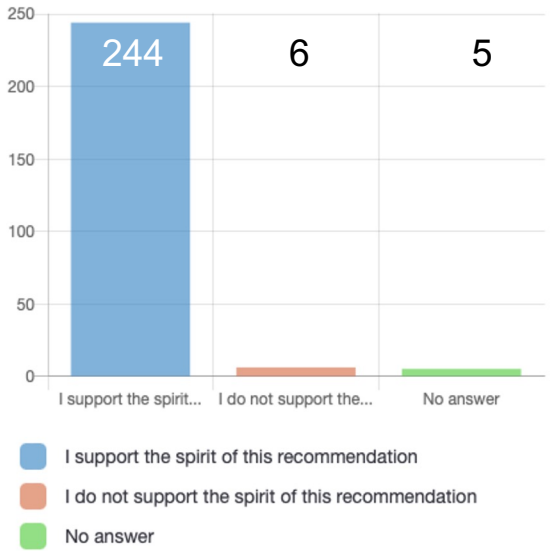
Recommendation 1: Capitalizing on past investments



Survey Results

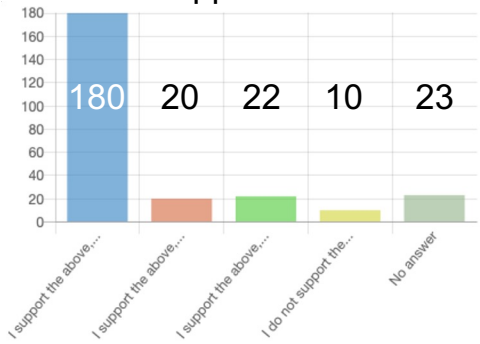
[not last word from the Town Hall; just discussion starting point]

Recommendation 2: EIC Project



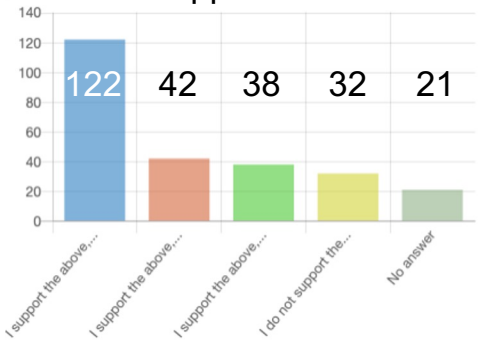
ePIC Research Groups Support

222 support



EIC Theory Alliance

202 support



I support the above, and think it should be integrated with Recommendation #2 as a sub bullet.

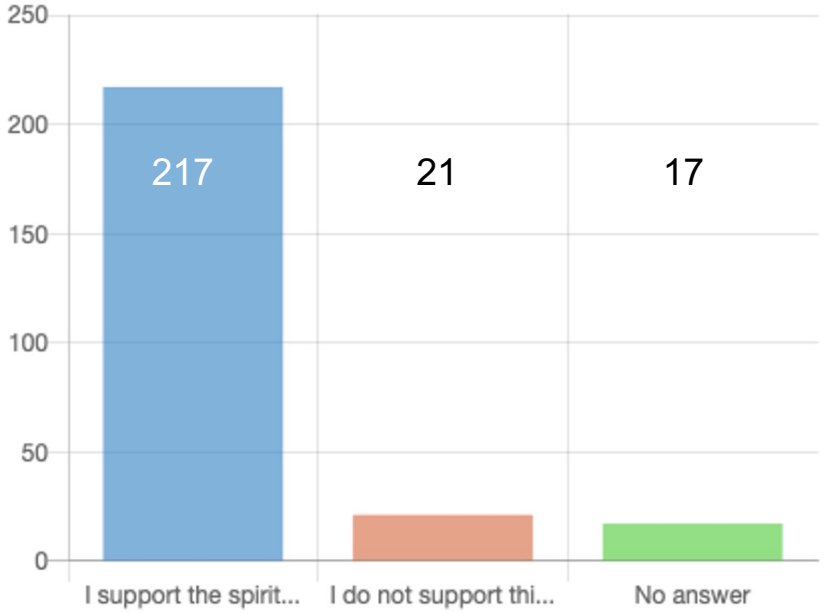
I support the above, and think it should be a separate recommendation

I support the above, and think it should be a separate initiative

I do not support the above

No answer

Recommendation 3 Computing

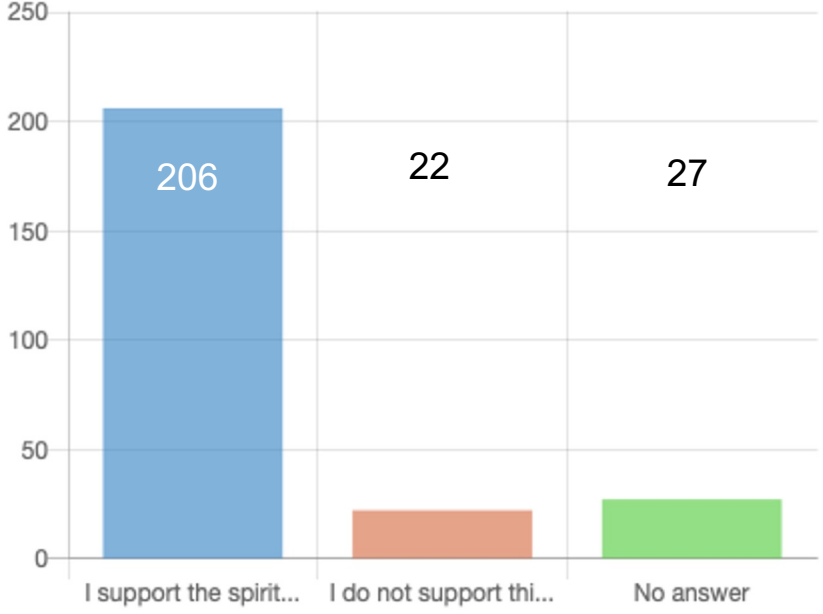


I support the spirit of this recommendation

I do not support this recommendation

No answer

Recommendation 4 Workforce

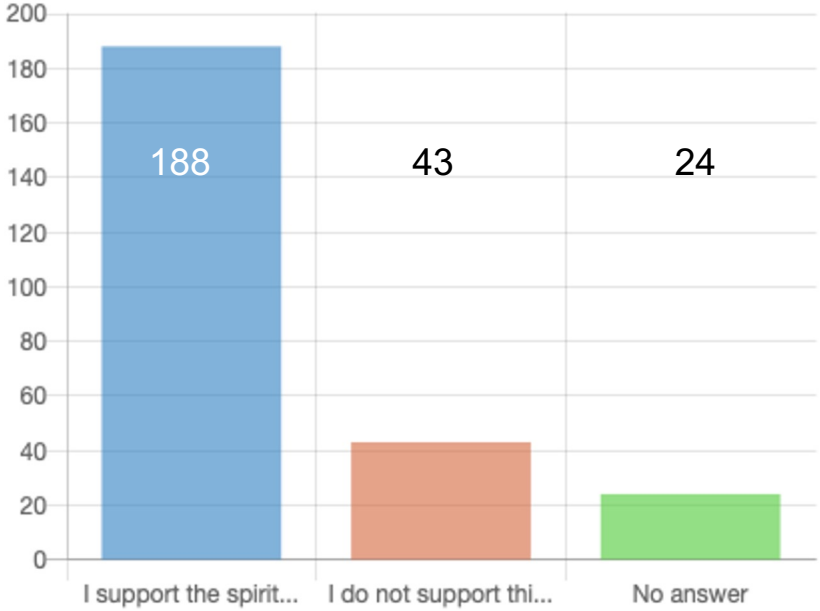


I support the spirit of this recommendation

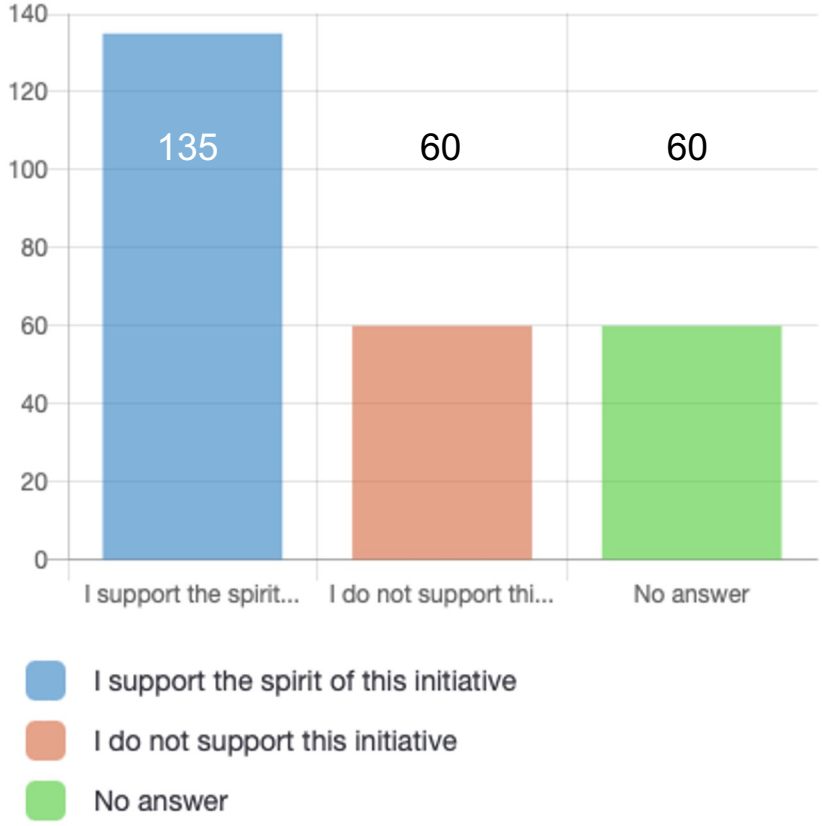
I do not support this recommendation

No answer

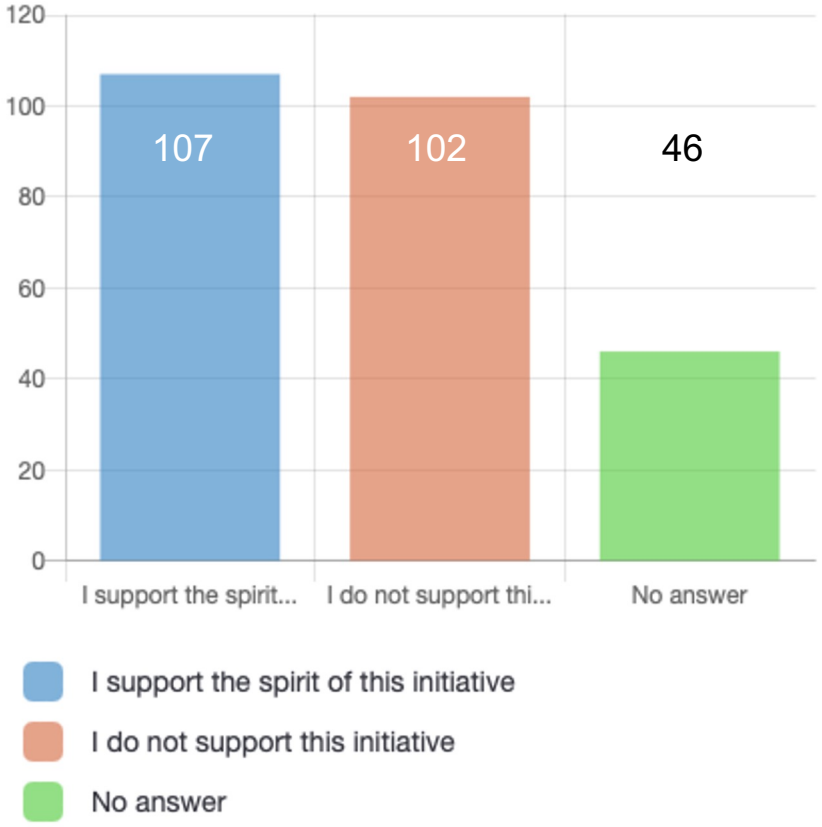
EIC Detector-2 Initiative



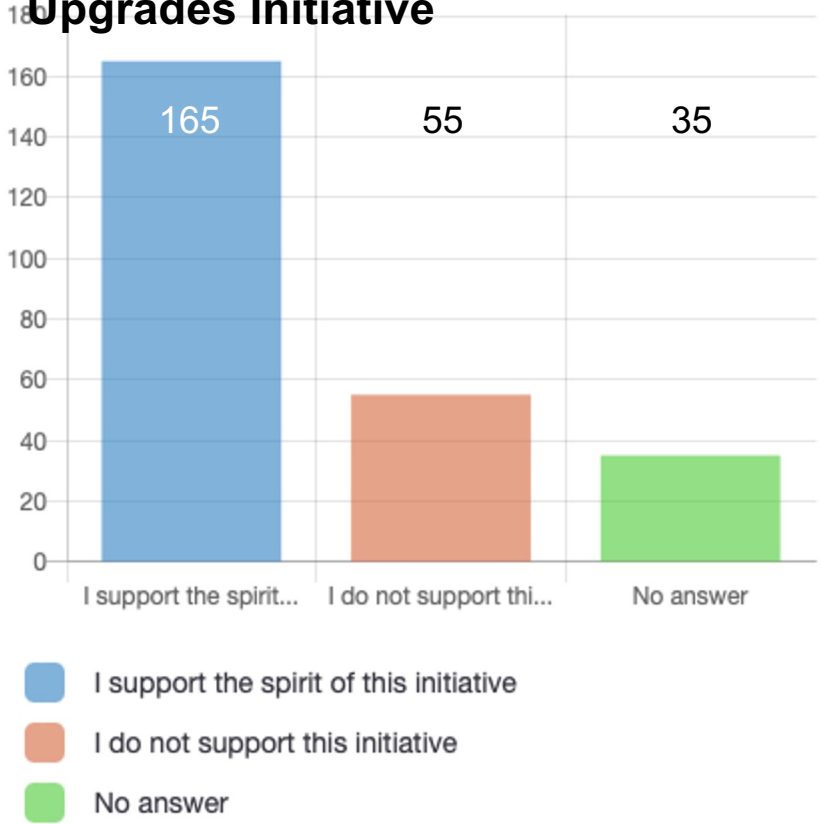
CEBAF Positron Program Initiative



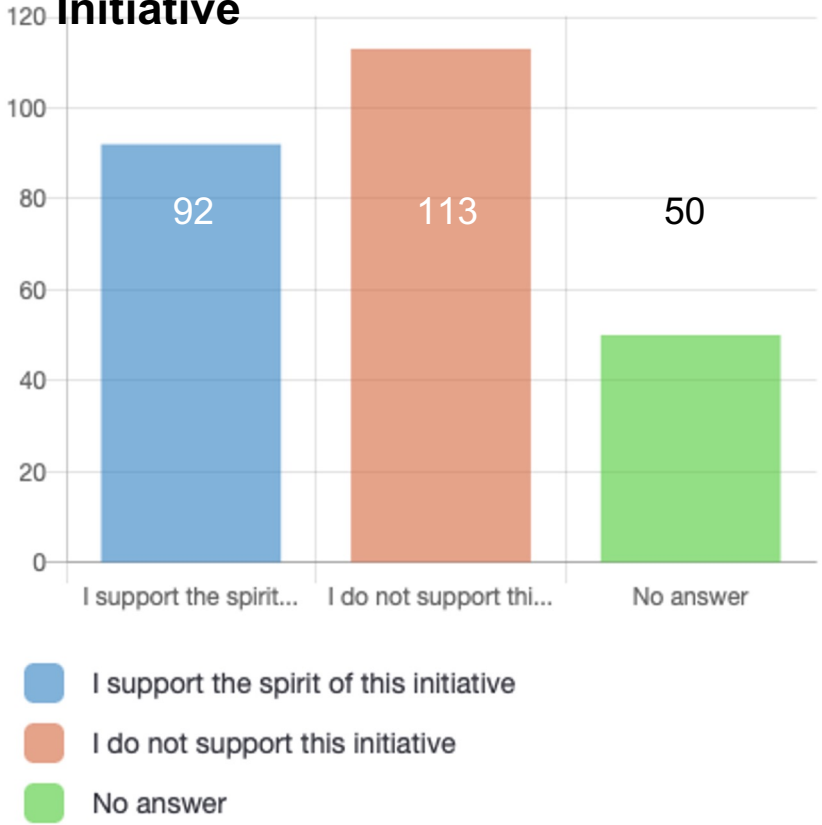
CEBAF Energy Upgrade Initiative



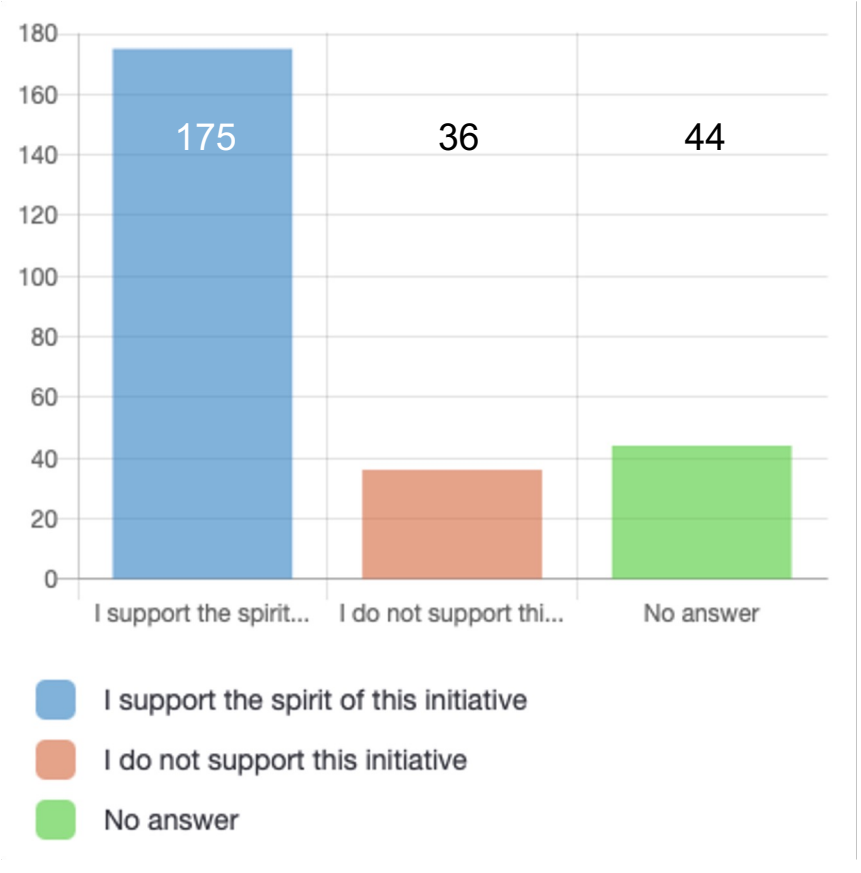
US Participation in LHC Detector Upgrades Initiative



U.S. Participation in CBM/FAIR Initiative



Nuclear Data Initiative



Recommendation 1

Survey: Yes 243 / No 7 / No Answer 5

The highest priority for QCD research is to maintain the U.S. world leadership in nuclear science for the next decade by capitalizing on past investments. We recommend continued support of full operations 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 university-based laboratories, and the scientists involved in 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 Solenoid 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

Survey: Yes 244 / No 6 / No Answer 5

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 a 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.

Recommendation 2 EIC Project
(continued)

ePIC Research Groups Support

- Building on the recent EIC project CD-1 approval, and the community-led Yellow-Report and detector proposals development, the QCD research community is committed to continue supporting the timely realization of the EIC and the development of its first detector by the recently formed ePIC collaboration. We recommend supporting research work on ePIC from base funding.

Survey:

Support, as a sub bullet of Recommendation #2	**180**
Support, as a separate recommendation	**20**
Support, as a separate initiative	**22**
Do not Support	**10**
No answer:	**23**

Recommendation 2 EIC Project
(continued)

EIC Theory Alliance

- We recommend new investments to establish a national EIC theory alliance to enhance and broaden the theory community needed to advance EIC physics goals and the experimental program. This theory alliance will develop a diverse workforce through a competitive national EIC theory fellow program and tenure-track bridge positions, including appointments at minority serving institutions.

Survey:

Support, as a sub bullet of Recommendation #2: **122**
Support, as a separate recommendation: **42**
Support, as a separate initiative : **38**
Do not Support: **32**
No answer:

Recommendation 3 Computing

Survey: Yes 217 / No 21 / No Answer 17

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, such as the USQCD, and to expand access to leadership computing facilities.
- Advanced computing is an interdisciplinary field. We recommend establishing programs to support the development and retention of such a diverse multi-disciplinary workforce in high-performance computing and AI/ML.

Recommendation 4 Workforce

Survey: Yes 206 / No 22 / No Answer 27

Nuclear physics has an important role to play 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 development of a diverse, equitable workforce.

- Part of recruiting and maintaining a diverse workforce requires treating all staff with respect and dignity. We therefore recommend that the funding agencies require establishing enforceable codes of conduct (community agreements) in both experimental and theoretical collaborations, as well as conferences, workshops and at user facilities.
- 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 staff at universities and national laboratories through bridge positions, traineeships, and other incentives.

The Six Initiatives Shown Next Are Not Ordered

Survey: Yes 188 / No 43 / No Answer 24

EIC Detector-2 Initiative

We recommend targeted efforts to enable the timely realization of a second, complementary detector at the Electron-Ion Collider

The EIC is a transformative accelerator that will enable studies of nuclear matter with unprecedented precision. The EIC encapsulates a broad physics program with experimental signatures ranging from exclusive production of single particles in ep scattering to very high multiplicity final states in eA collisions. Two detectors will expand the scientific opportunities, draw a more complete picture of the science, and mitigate the inherent risks that come with exploring uncharted territory by providing independent confirmation of discovery measurements. High statistical precision matched with a similar or better level of systematic precision is vital for the EIC and this can only be achieved with carefully optimized instrumentation. A natural and efficient way to reduce systematic errors is to equip the EIC with two complementary detectors using different technologies. The second detector effort will rely heavily on the use of generic detector R&D funds and accelerator design effort to integrate the detector into the interaction region. The design and construction of such a complementary detector and interaction region are interwoven and must be synchronized with the current EIC project and developed in the context of a broad and engaged international EIC community.

Survey: Yes 135 / No 60 / No Answer 60

CEBAF Positron Program Initiative

We recommend the allocation of necessary resources to implement high duty-cycle polarized positron beams at CEBAF.

Using the 12 GeV CEBAF and capitalizing on positron source innovations at the Jefferson Lab, high duty cycle polarized electron and positron beams, together with the outstanding capabilities of Jefferson Lab detectors, will enable a unique science program at the luminosity and precision frontier. It will comprise the mapping of two-photon exchange effects as well as essential measurements of the 3D structure of hadrons. It will also offer new opportunities to investigate electroweak physics and the physics beyond the standard model.

Survey: Yes 107 / No 102 / No Answer 46

CEBAF Energy Upgrade Initiative

Capitalizing on recent science insights and US-led accelerator science and technology innovations, we strongly recommend the allocation of resources to develop a cost-effective energy upgrade of CEBAF, and its construction in a timeframe compatible with the EIC construction. This will enable a worldwide unique nuclear science program at the luminosity frontier.

The last decade has provided multiple science surprises such as the discovery of exotic states in the charmonium sector at facilities worldwide, the so-called “XYZ” states. Studies of the 3D structure of hadrons and hadronization provided deeper access to quark-gluon dynamics and opened new opportunities to understanding QCD in its full complexity. In addition, mysteries of the visible matter around us remain unsolved, such as a small enhancement of partons found in nuclei at the interface of the quark- and gluon-dominated regions, the so-called “anti-shadowing” region, that to date lacks explanation and can only be further studied at the luminosity frontier.

Capitalizing on recent innovations enabled by accelerator science and technology, a cost-effective energy upgrade of the 12-GeV CEBAF at Jefferson Lab to a 22 GeV facility has become feasible. Such an upgrade would permit a worldwide unique nuclear science program with fixed targets at the luminosity frontier, roughly five decades above that possible with a collider. Beyond its nuclear science opportunities, this will further steward best-in-class accelerator technology within the US.

Survey: Yes 165 / No 55 / No Answer 35

US Participation in LHC Detector Upgrades Initiative

The LHC will remain as the energy frontier of QCD and nuclear physics in the coming two decades. Detector upgrades enabled by novel technologies will maximize the potential of the planned high luminosity upgrade, and open new opportunities in QCD research. Targeted detector R&D and upgrades to the LHC experiments that provide unique capabilities to the nuclear physics program should be explored and supported. These projects also provide an excellent opportunity to train next-generation nuclear physicists in the US on cutting-edge technologies.

Survey: Yes 92 / No 113 / No Answer 50

U.S. Participation in CBM/FAIR Initiative

In order to complete the Beam Energy Scan (BES) physics program, including the search for the QCD critical point, the extraction of the hyperon-nucleon interaction, and the determination of constraints on the nuclear matter equation of state at high baryon density, active US participation in the international collaboration of the Compressed Baryonic Matter (CBM) experiment at FAIR is scientifically necessary and cost effective.

Survey: Yes 175 / No 36 / No Answer 44

Nuclear Data Initiative

Nuclear data play an essential if sometimes unrecognized role in all facets of nuclear physics. Access to accurate, reliable nuclear data is crucial to the success of important missions such as nonproliferation and defense, nuclear forensics, homeland security, space exploration, and clean energy generation, in addition to the basic scientific research underpinning the enterprise. These data are also key to innovations leading to new medicines, automated industrial controls, energy exploration, energy security, nuclear reactor design, and isotope production. It is thus crucial to maintain effective US stewardship of nuclear data.

- We recommend identifying and prioritizing opportunities to enhance and advance stewardship of nuclear data and maximize the impact of these opportunities.
- We recommend building and sustaining the nuclear data community by recruiting, training, and retaining a diverse, equitable and inclusive workforce.
- We recommend identifying crosscutting opportunities for nuclear data with other programs, both domestically and internationally, in particular with regard to facilities and instrumentation.

Next steps

- We will make changes to the recommendations and initiatives as required based on the discussions we just had, and send a new (concluding) survey by end of tomorrow.
- The results of the town hall concluding survey will be presented in the QCD white paper and will serve as the basis for the recommendations and initiatives included in it.
- White paper plan: organizing committee turns into a writing committee. Will be inclusive and call on community members to help. Expect to present a draft to the community, collect comments, and finalize by early February (NSAC deadline).

  All members of the QCD community will be able to endorse the white paper and sign on to its author list.

Thank you for a successful Town Hall Meeting.