PROGRAM ANNOUNCEMENT
TO DOE NATIONAL LABORATORIES

U. S. Department of Energy
Office of Science
High Energy Physics (HEP)

Quantum Information Science Enabled Discovery (QuantISED)
For High Energy Physics

DOE National Laboratory Announcement Number: LAB FY-1893
Announcement Type: Amendment 2

To correct typographical errors.

Issue Date:	**02/28/2018**
Letter of Intent Due Date:	**03/26/2018 at 5 PM Eastern Time**
Proposal Due Date:	**04/16/2018 at 5 PM Eastern Time**

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REGISTRATIONS

A. DOE Office of Science Portfolio Analysis and Management System (PAMS)

The DOE Office of Science performs many functions for DOE national laboratory proposals in the Portfolio Analysis and Management System (PAMS), which is available at https://pamspublic.science.energy.gov.

There are many activities that you can perform in PAMS, and more functionality will be added throughout the near future. DOE national laboratories will submit pre-proposals, letters of intent, and proposals directly into PAMS.

You must register in PAMS to submit a pre-proposal, letter of intent, or DOE national laboratory proposal.

To access PAMS, you may use the Internet Explorer, Firefox, Google Chrome, or Safari browsers.

Notifications sent from the PAMS system will come from the PAMS email address <PAMS.Autoreply@science.doe.gov>. Please make sure your email server/software allows delivery of emails from the PAMS email address to yours.

Registering to PAMS is a two-step process; once you create an individual account, you must associate yourself with ("register to") your institution. Detailed steps are listed below.

1. CREATE PAMS ACCOUNT:

To register, click the "Create New PAMS Account" link on the website https://pamspublic.science.energy.gov/.
- Click the "No, I have never had an account" link and then the "Create Account" button.
- You will be prompted to enter your name and email address, create a username and password, and select a security question and answer. Once you have done this, click the "Save and Continue" button.
- On the next page, enter the required information (at least one phone number and your mailing address) and any optional information you wish to provide (e.g., FAX number, website, mailstop code, additional email addresses or phone numbers, Division/Department). Click the "Create Account" button.
- Read the user agreement and click the "Accept" button to indicate that you understand your responsibilities and agree to comply with the rules of behavior for PAMS.
- PAMS will take you the "Having Trouble Logging In?" page. (Note: If you reviewed for or were listed as PI on a prior submission to the Office of Science but have not previously created an account, you may already be linked to an institution in PAMS. If this is the case, PAMS will take you to the PAMS home page.)

2. REGISTER TO YOUR INSTITUTION:

- Click the link labeled "Option 2: I know my institution and I am here to register to the institution." (Note: If you previously created a PAMS account but did not register to an institution at that time, you must click the Institutions tab and click the "Register to Institution" link.)
- PAMS will take you to the "Register to Institution" page.
- Type a word or phrase from your institution name in the field labeled, "Institution Name like," choose the radio button next to the item that best describes your role in the system, and click the "Search" button. A "like" search in PAMS returns results that contain the word or phrase you enter; you need not enter the exact name of the institution, but you should enter a word or phrase contained within the institution name. (Hint: If your institution has an acronym, such as ANL for Argonne National Laboratory or UCLA for the Regents of the University of California, Los Angeles, you may search for the acronym under "Institution Name like." Many institutions with acronyms are listed in PAMS with their acronyms in parentheses after their names.)
- Find your institution in the list that is returned by the search and click the "Actions" link in the Options column next to the institution name to obtain a dropdown list. Select "Add me to this institution" from the dropdown. PAMS will take you to the "Institutions – List" page.
- If you do not see your institution in the initial search results, you can search again by clicking the "Cancel" button, clicking the Option 2 link, and repeating the search.
- All DOE National Laboratories have established profiles in PAMS, so please keep searching until you find your laboratory.

For help with PAMS, click the "External User Guide" link on the PAMS website, https://pamspublic.science.energy.gov/. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free) or (301) 903-9610, Email: sc.pams-helpdesk@science.doe.gov. All submission and inquiries about this DOE National Laboratory Announcement should reference **LAB 18-1893.**

UPDATES AND REMINDERS

RECOMMENDATION

The Office of Science encourages you to register in all systems as soon as possible. You are also encouraged to submit letters of intent and proposals before the deadline.

DATA MANAGEMENT PLAN

The Office of Science has published a Statement on Digital Data Management, published at http://science.energy.gov/funding-opportunities/digital-data-management/, which governs applications submitted under this Announcement, and is detailed in Part IV of this Announcement.

ACKNOWLEDGMENT OF FEDERAL SUPPORT

The Office of Science published guidance about how its support should be acknowledged at http://science.energy.gov/funding-opportunities/acknowledgements/.

Section I – DOE NATIONAL LABORATORY OPPORTUNITY DESCRIPTION

GENERAL INQUIRIES ABOUT THIS ANNOUNCEMENT SHOULD BE DIRECTED TO:
Technical/Scientific Program Contact:

Dr. Lali Chatterjee, High Energy Physics
301 903 0435
lali.chatterjee@science.doe.gov

SUMMARY

The High Energy Physics (HEP) program in the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving interdisciplinary proposals for open scientific research on Quantum Information Science (QIS) Enabled Discovery (QuantISED), for public benefit within the Congressionally-authorized mission space of HEP to understand how the universe works at its most fundamental level [1].

The QIS thrust within HEP has been developed over the last few years [2-4] and is aligned with a broader Office of Science initiative in QIS and coordinated with various national and interagency programs [5] in QIS, including quantum computing and QIS technology. Transcending the traditional frontiers and thrusts of the HEP program, the QIS thrust exploits the interdisciplinary nature of QIS and associated partnerships for exploratory, early stage research for high impact discovery along HEP science drivers, foundational QIS, and the national QIS enterprise.

Submitted proposals must follow ALL the guidelines and criteria provided in the supplementary information below and the following sections.

SUPPLEMENTARY INFORMATION

Program Objectives:

The U.S. particle physics community's current vision for the future is embodied in the Particle Physics Project Prioritization Panel (P5) report [6] that presents a strategy for the next decade centered on five intertwined science drivers. Developing and deploying forward-looking computational techniques and technology and exploring innovative concepts and emerging experimental methods and tools are key to the success of this vision and to contributions of the HEP program within its role in the Office of Science, Department of Energy, and broader science and technology ecosystem.

The Computational High Energy Physics Program (Comp HEP) within HEP has co-sponsored several roundtables and reports in the areas of intersection [2-4] between particle physics, QIS, quantum computing, and QIS technology. Cross fertilization of ideas and expertise across these intersecting research areas has contributed to the confluence of research on black hole physics, information theory, holographic correspondence, computational complexity, and quantum error

corrections leading to new understanding of the quantum universe and potential quantum technology. Further, these HEP-QIS intersections have provided the intellectual stimulus for entanglement-based field theory models, tensor networks, and innovative techniques for addressing de-coherence.

Most qubits and qubit systems under development have potential to further scientific discovery in HEP through computational and foundational studies as well as instrumentation and controls. For example, some of these devices can serve as effective quantum sensors utilizing superposition, entanglement, and/or squeezing, expanding the discovery range for the dark sector as well as for new interactions and physical principles. They can serve as QIS laboratories for analog simulations and/or as entanglement-based emulators of physical processes and particle physics events. Physical qubits can also be used for teleportation experiments for foundational research such as connecting black hole physics to quantum error correction and scrambling.

Quantum computing and annealer platforms that have become available over the last few years also provide new windows to address HEP data analysis and computing challenges. Quantum simulators available on traditional supercomputers provide additional resources to develop and test quantum algorithms that can advance HEP research.

HEP-QIS Objectives

The HEP QIS Thrust is intended to forge new routes to scientific discovery along the HEP mission and P5 science drivers [1,6], invoking interdisciplinary advances in the convergent field of QIS, and their intersection with expertise, techniques, and technology developed within the HEP community. The goals of the HEP QIS Thrust include developing interdisciplinary consortia that positively impact both HEP and QIS fields.

Examples of long term goals include (but are not limited to):

- Answers to fundamental questions in HEP and QIS that emerge via theoretical, computational, and/or experimental research at the intersecting space of quantum information theory, AdS/CFT holographic correspondence, quantum gravity, computational complexity, black hole physics, emergence of space time, quantum error correction and qubit systems coherence;
- Emerging formulations of field theory and tensor networks exploiting entanglement and quantum information theory that have the potential to better describe particle physics phenomena and target use of future quantum computing systems;
- Pioneering scientific discovery for P5 science drivers, foundational QIS, and/or tests of string theory, holographic correspondence, and quantum gravity by exploring novel concepts and ideas for new experiments, analog simulations, or quantum emulators;
- New tools and techniques for instrumentation, detectors, data transfer, and quantum communications that exploit QIS including superposition, entanglement, and/or squeezing for HEP experiments including expanding the range for exploring the dark universe and new physics;
- Quantum computational tools and methods encompassing quantum simulations, algorithms, data analysis, machine learning, and other topics relevant for HEP that can exploit emerging

and future quantum computing and hybrid systems;

- Notable contributions to the understanding of QIS and its foundations, and potential technology, using concepts, techniques, expertise, and knowledge developed within HEP;
- Strengthening collaboration and networking between HEP, QIS, and other closely related disciplines and providing opportunities for younger researchers to work with established teams.

The HEP QIS thrust recognizes that there is complementary and synergistic research supported by other SC programs and other agencies, and that coordination across such inter-office and inter-agency efforts will strengthen QIS at the national and international level. HEP QIS activities are expected to advance the HEP mission scope and science drivers as well as contribute to QIS research and technology for public benefit. Applications proposing or expanding on coordinated/collaborative activities with non-HEP efforts, with clear delineations of the scope of the proposed HEP work, are encouraged.

Applicants are expected to use qubit systems or quantum annealers or test beds that are available at their own or collaborating institutions, or available elsewhere.

All applications must demonstrate relevance for the HEP-QIS Objectives outlined above, impact on P5 science drivers, and QIS.

All proposals for funding must demonstrate their public benefit through increasing knowledge and understanding.

Please note that this Announcement is only for opportunities within the QIS Thrust in HEP and is distinct from HEP's routinely issued Announcements for research and development in HEP and Accelerator Stewardship.

The following topics and subjects are outside the scope of this Announcement. Applications dedicated to these items will be considered nonresponsive and may be declined without merit review:
- General quantum computing algorithms or computing hardware
- Requests for basic research within the mission space of other SC programs
- Purchase of equipment or instruments exceeding 10 % of the total project or $20,000 whichever is less

Research Topics responsive to this Announcement are divided into categories A and B:

Topic A: High Energy Physics and QIS Research

(i)   Theoretical, Computational, and/or experimental research exploiting recent convergence of developments in quantum gravity, computational complexity, AdS/CFT holographic correspondence, quantum information theory, emergence of space-time, quantum error correction, black hole physics, scrambling, and qubit system thermalization;

(ii)   Foundational field theory techniques, gauge symmetries, and tensor networks

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invoking quantum information and entanglement concepts that advance knowledge including description of scattering, bound state problems, and advanced gauge theories;

(iii) Analog simulations/quantum emulators/teleportation experiments that advance HEP and QIS, including tests of fundamental string theory and other particle physics models in qubit systems;

(iv) Novel experiments probing HEP science drivers using QIS technology and tools exploiting superposition, entanglement, and/or squeezing with goals for near term science goals and/or steps to scientific discovery

(v) HEP relevant instrumentation, data transfer and quantum communication tools using QIS concepts and QIS technology exploiting superposition, entanglement, and/or squeezing that produce new experimental methods for HEP;

(vi) Foundational and/or technological advances in QIS by incorporation of techniques, tools, and physical principles from particle physics

Topic B: Quantum Computing for HEP on current or future quantum computing systems

(i) Quantum field theory algorithms and simulations including quantum chromodynamics and electrodynamics, accelerator modeling codes, and computational cosmology relevant to HEP science drivers and P5 projects and experiments;

(ii) Quantum machine learning and data analysis techniques and tools that can enhance efficiency or analysis methods for HEP applications. Applications using available annealer platforms are within scope and so are use of quantum computers simulated classically;

(iii) Developing quantum computing simulators and/or frameworks for HEP applications to be developed on existing computers or hybrid systems.

Applications may follow one of two TRACKS but cannot combine Tracks.

Track 1: **Pioneering Pilots (open to Topics A or B)**
1-2-year pilots (expected to be pioneering efforts and may be speculative):

- Propose novel concepts, models, test problem, or re-analysis of existing data for exploratory research in topics A or B to be developed via the proposed work;
- Propose ideas or design studies for new high impact QIS based HEP experiments exploring P5 science drivers along with costing and timeline estimates;

Track 1 applications should focus on one of the sub topics in A or B and the sub topic should be identified. Sub topics may be combined if such combination can be justified as important to add value to the work and its impact.

Proposals in this track can be from a single institution or they can be multi-institutional. If multi-institutional, they must be submitted by a lead institution as a consortium (prime applicant and proposed subawardee) application.

Partnerships or coordinated activities with researchers funded from other sources, including other SC programs or other Federal agencies, are encouraged. The scope of the work requesting HEP funding must be clarified for such coordination or partnership.

Track 2: **HEP-QIS Consortia (open to Topic A only)**
*Note***: Laboratories are strongly encouraged to engage universities and other institutions/industry when developing consortia**

2-3-year multi institutional, interdisciplinary, consortium applications that satisfy one or more of the following:

- Aim to answer one or more fundamental questions pertaining to the P5 Science drivers focusing on one of the sub topics in A;
- Propose experiments within Topic A with detailed costing that can completed in the time frame of the proposal
- Early stage research aiming to produce, implement, and characterize novel HEP relevant instrumentation, data transfer and quantum communication tools as per Topic A;
- Early stage research intended to make notable contributions to QIS and related technology, using expertise, knowledge, and technology developed within HEP

Track 2 proposals must have clear milestones and deliverables and should focus on individual subtopics defined in Topic A. Sub topics may be combined if such combination can be justified to be as important to add value to the work and its impact.

Applications should also submit metrics for evaluation and risk assessments.

Applications on this track must be multi-institutional consortium (prime applicant and proposed subawardee) applications submitted via the lead Laboratory.

Partnerships or coordinated activities with researchers funded from other sources, including other SC programs or other Federal agencies, are encouraged. The scope of the proposed HEP work must be clarified for such coordination or partnership.

Table Summarizing Tracks and Related Guidelines (For * See Section II)

						Topic A: HEP and QIS Research	Topic B: Quantum Computing for HEP
Track	**Work Scope**	**Eligibility**	Floor* $	Ceiling*$	Duration*$		
Track 1 Pioneering Pilots	Novel concepts, test problems, design studies (TRL 1)	All domestic institutions; single-PI OK consortium	100,000	500,000	1-2 years	**Yes**	**Yes**

		proposals OK					
Track 2: HEP-QIS Consortia	Answer P5 Questions, small experiments, early stage research on tools (TRL 1-2)	Multi-institutional consortia **only;** Must include DOE Labs	FOA 500,000 Lab Ann: 1,000,000	FOA 2,000,000 Lab Ann: 4,000,000	2-3 years Labs strongly encouraged to engage universities and other institutions	**Yes**	**No**

Multi Institutional Applications and Sub-awards

- Proposals may be submitted by either a single institution or a multi-institutional consortium for Track 1.
- Only multi-institutional consortia may apply for Track 2.
- All multi-institutional proposals (Track 1 or Track 2) must be submitted as consortium proposals (prime applicant and proposed subawards) via the lead institution.
- Multi-institutional consortium proposals must include the complete budgets and tasks for each institution involved as well as letters of institutional commitment. The research plan and its associated budget(s) should leave no confusion about which institution will do which parts of the research. The lead institution's budget must include all subaward budgets, including any DOE National Laboratory subawards.

References:

1. https://www.energy.gov/about-us; https://science.energy.gov/about/ ; http://science.energy.gov/hep/about ; and http://science.energy.gov/hep/research/
2. HEP-ASCR Study Group Report, Grand Challenges at the Interface of Quantum Information Science, Particle Physics, and Computing, 2015, https://science.energy.gov/~/media/hep/pdf/files/Banner%20PDFs/QIS_Study_Group_Report.pdf
3. HEP-BES roundtable report, "Common Problems in Condensed Matter and High Energy Physics", 2015, https://science.energy.gov/~/media/hep/pdf/Reports/HEP-BES_Roundtable_Report.pdf
4. HEP-ASCR QIS roundtable report, "Quantum Sensors at the Intersections of Fundamental Science, QIS and Computing", 2016, http://science.energy.gov/~/media/hep/pdf/Reports/DOE_Quantum_Sensors_Report.pdf
5. OSTP interagency QIS working group report, "Advancing Quantum Information Science: National Challenges and Opportunities", 2016,

https://www.whitehouse.gov/sites/whitehouse.gov/files/images/Quantum_Info_Sci_Report_2016_07_22%20final.pdf

6. Particle Physics Project Prioritization Panel (P5) report
    http://science.energy.gov/hep/hepap/

ADDITIONAL REQUIREMENTS:

Data Management Plan:

All proposals must contain a Data Management Plan (DMP) as described in Section IV.

Section II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT

DOE anticipates awarding laboratory work authorizations under this DOE National Laboratory Program Announcement.

Any awards made under this Announcement will be subject to the provisions of the contract between DOE and the awardee National Laboratory.

B. ESTIMATED FUNDING

It is anticipated that approximately $18,000,000 maybe available over the entire period for all awards made under this Announcement, subject to availability of funds. Within this amount, up to $7,000,000 may be available in FY 2018. These amounts do not include amounts designated for the companion FOA.

The number, duration and size of awards will depend on the number of selected awards and available funds in FY2018. The number and amounts of awards will depend on the number and quality of applications received in each track.

DOE is under no obligation to pay for any costs associated with preparation or submission of applications. DOE reserves the right to fund, in whole or in part, any, all, or none of the applications submitted in response to this Announcement.

C. MAXIMUM AND MINIMUM AWARD SIZE

The award size will depend on the number of meritorious applications and the availability of appropriated funds.

Ceiling

Total award values (for all years of the request, and including all subawards) will not exceed:

Track 1: $500,000 per award, and
Track 2: $4,000,000 per award.

Floor

Total award values (for all years of the request, and including all subawards) will not be less than:

Track 1: $100,000, per award, and
Track 2: $1,000,000 per award.

D. EXPECTED NUMBER OF AWARDS

The exact number of awards will depend on the number of meritorious applications, the results of the merit review, the program policy factors, and the availability of appropriated funds.

E. ANTICIPATED AWARD SIZE

The award size will depend on the number of meritorious applications, the results of the merit review, the program policy factors, and the availability of appropriated funds.

F. PERIOD OF PERFORMANCE

(See B. Estimated Funding section above.)
The period of performance will depend on the number of meritorious applications, the results of the merit review, the program policy factors, and the availability of appropriated funds.

The period of performance varies by Track:
- Track 1 applications must be for a period of performance between 1-2 years,
- Track 2 applications must be for a period of performance between 2-3 years.

Continuation funding (funding for the second and subsequent budget periods) is contingent on: (1) availability of funds appropriated by Congress and future year budget authority; (2) progress towards meeting the objectives of the approved application; (3) submission of required reports; and (4) compliance with the terms and conditions of the award.

G. TYPE OF PROPOSAL

DOE will accept new DOE National Laboratory Proposals under this DOE National Laboratory Announcement. Please only submit a PAMS lab technical proposal in response to this Announcement; do not submit a DOE Field Work Proposal (FWP) at this time. The Office of Science will request FWPs later from those selected for funding consideration under this Announcement.

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Section III – ELIGIBILITY INFORMATION

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A. ELIGIBLE APPLICANTS AND TOPICS

This is a DOE National Laboratory-only Announcement. FFRDCs from other Federal agencies are not eligible to submit in response to this Program Announcement.

B. COST SHARING

Cost sharing is not required.

C. ELIGIBLE INDIVIDUALS

Eligible individuals with the skills, knowledge, and resources necessary to carry out the proposed research as a Lead Principal Investigator/Principal Investigator are invited to work with their organizations to develop a proposal. Individuals from underrepresented groups as well as individuals with disabilities are always encouraged to apply.

Section IV – PROPOSAL AND SUBMISSION INFORMATION

A. ADDRESS TO REQUEST PROPOSAL PACKAGE

Proposal submission instructions are available in this Announcement on the DOE Office of Science Portfolio Analysis and Management System (PAMS). Screenshots showing the steps in DOE National Laboratory proposal submission are available in the PAMS External User Guide, accessible by navigating to https://pamspublic.science.energy.gov and clicking on the "PAMS External User Guide" link.

Proposals submitted outside of PAMS will not be accepted.

B. LETTER OF INTENT AND PRE-PROPOSAL

1. Letter of Intent

LETTER OF INTENT DUE DATE
March 26, 2018

A Letter of Intent is required and must be submitted by 5 P.M. Eastern Time, March 26, 2018.

The LOI is to help in planning the review and the selection of potential reviewers for the proposal. For this purpose, the LOI must include the following:
- A cover sheet containing the name and mailing address of the sponsoring institution; the planned title of the research proposal; the name, e-mail address, and telephone number of the Principal Investigator, additional Senior Investigator(s), and Senior/Key personnel expected to be involved in the planned proposal.
- A concise summary of the proposed work and intended track and topic.
- For multi-institutional consortium proposals, the LOI must list expected participating institutions and PIs.
- The LOI must not exceed 4 pages including all information

The LOI must be submitted electronically through the DOE Office of Science Portfolio Analysis and Management System (PAMS) website https://pamspublic.science.energy.gov/. It is important that the LOI be a single file with extension .pdf, .docx, or .doc. The Principal Investigator (PI) and anyone submitting on behalf of the PI must register for an account in PAMS before it will be possible to submit a letter of intent. **All PIs and those submitting LOIs on behalf of PIs are encouraged to establish PAMS accounts as soon as possible to avoid submission delays.**

You may use the Internet Explorer, Firefox, Google Chrome, or Safari browsers to access PAMS.

Registering to PAMS is a two-step process; once you create an individual account, you must associate yourself with ("register to") your institution. Detailed steps are listed below.

Create PAMS Account:
To register, click the "Create New PAMS Account" link on the website
https://pamspublic.science.energy.gov/.
- Click the "No, I have never had an account" link and then the "Create Account" button.
- You will be prompted to enter your name and email address, create a username and password, and select a security question and answer. Once you have done this, click the "Save and Continue" button.
- On the next page, enter the required information (at least one phone number and your mailing address) and any optional information you wish to provide (e.g., FAX number, website, mailstop code, additional email addresses or phone numbers, Division/Department). Click the "Create Account" button.
- Read the user agreement and click the "Accept" button to indicate that you understand your responsibilities and agree to comply with the rules of behavior for PAMS.

PAMS will take you the "Having Trouble Logging In?" page. (If you have been an Office of Science merit reviewer or if you have previously submitted a proposal, you may already be linked to an institution in PAMS. If this happens, you will be taken to the PAMS home page.

Register to Your Institution:
- Click the link labeled "Option 2: I know my institution and I am here to register to the institution." (Note: If you previously created a PAMS account but did not register to an institution at that time, you must click the Institutions tab and click the "Register to Institution" link.)
- PAMS will take you to the "Register to Institution" page.
- Type a word or phrase from your institution name in the field labeled, "Institution Name like," choose the radio button next to the item that best describes your role in the system, and click the "Search" button. A "like" search in PAMS returns results that contain the word or phrase you enter; you do not need to enter the exact name of the institution, but you should enter a word or phrase contained within the institution name. (If your institution has a frequently used acronym, such as ANL for Argonne National Laboratory or UCLA for the Regents of the University of California, Los Angeles, you may find it easiest to search for the acronym under "Institution Name like." Many institutions with acronyms are listed in PAMS with their acronyms in parentheses after their names.)
- Find your institution in the list that is returned by the search and click the "Actions" link in the Options column next to the institution name to obtain a dropdown list. Select "Add me to this institution" from the dropdown. PAMS will take you to the "Institutions – List" page.
- If you do not see your institution in the initial search results, you can search again by clicking the "Cancel" button, clicking the Option 2 link, and repeating the search.
- If, after searching, you think your institution is not currently in the database, click the "Cannot Find My Institution" button and enter the requested institution information into PAMS. Click the "Create Institution" button. PAMS will add the institution to the system, associate your profile with the new institution, and return you to the "Institutions – List" page when you are finished.

Submit Your Letter of Intent:
- Create your letter of intent outside the system and save it as a file with extension .docx, .doc, or .pdf. Make a note of the location of the file on your computer so you can browse for it later from within PAMS.
- Log into PAMS and click the Proposals tab. Click the "View / View / Respond to DOE National Laboratory Announcements" link and find the current announcement in the list. Click the "Actions/Views" link in the Options column next to this announcement to obtain a dropdown menu. Select "Submit Letter of Intent" from the dropdown.
- On the Submit Letter of Intent page, select the institution from which you are submitting this LOI from the Institution dropdown. If you are associated with only one institution in the system, there will only be one institution in the dropdown.
- Note that you must select one and only one Principal Investigator (PI) per LOI; to do so, click the "Select PI" button on the far right side of the screen. Find the appropriate PI from the list of all registered users from your institution returned by PAMS. (Hint: You may have to sort, filter, or search through the list if it has multiple pages.) Click the "Actions" link in the Options column next to the appropriate PI to obtain a dropdown menu. From the dropdown, choose "Select PI."
- If the PI for whom you are submitting does not appear on the list, it means he or she has not yet registered in PAMS. For your convenience, you may have PAMS send an email invitation to the PI to register in PAMS. To do so, click the "Invite PI" link at the top left of the "Select PI" screen. You can enter an optional personal message to the PI in the "Comments" box, and it will be included in the email sent by PAMS to the PI. You must wait until the PI registers before you can submit the LOI. Save the LOI for later work by clicking the "Save" button at the bottom of the screen. It will be stored in "My Letters of Intent" for later editing.
- Enter a title for your letter of intent.
- Select the appropriate technical contact from the Program Manager dropdown.
- To upload the LOI file into PAMS, click the "Attach File" button at the far right side of the screen. Click the "Browse" (or "Choose File" depending on your browser) button to search for your file. You may enter an optional description of the file you are attaching. Click the "Upload" button to upload the file.
- At the bottom of the screen, click the "Submit to DOE" button to save and submit the LOI to DOE.
- Upon submission, the PI will receive an email from the PAMS system <PAMS.Autoreply@science.doe.gov> acknowledging receipt of the LOI.

You are encouraged to register for an account in PAMS at least a week in advance of the LOI submission deadline so that there will be no delays with your submission.

For help with PAMS, click the "External User Guide" link on the PAMS website, https://pamspublic.science.energy.gov/. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free) or (301) 903-9610, email: sc.pams-helpdesk@science.doe.gov. All submission and inquiries about this Laboratory Announcement should reference LAB 18-1893

may not be submitted through grants.gov or www.FedConnect.net.

C. CONTENT AND PROPOSAL FORMS

Proposal Due Date

04/16/2018 AT 5:00 PM EASTERN TIME

Files that are attached to the forms must be in Adobe Portable Document Format (PDF) unless otherwise specified in this announcement. Attached PDF files must be plain files consisting of text, numbers, and images without editable fields, signatures, passwords, redactions, or other advanced features available in some PDF-compatible software. Do not attach PDF portfolios.

RESUBMISSION OF PROPOSALS

Proposals submitted under this Announcement may be withdrawn from consideration by using the Office of Science's PAMS website at https://pamspublic.science.energy.gov. Proposals may be withdrawn at any time between when the Laboratory submits the proposal and when DOE makes the proposal available to merit reviewers. Such withdrawals take effect immediately and cannot be reversed.

After a proposal is withdrawn, it may be resubmitted, if this Announcement is still open for the submission of proposals. Such resubmissions will only count as one submission if this Announcement restricts the number of proposals from an applicant.

The Office of Science will usually consider the last submission, according to its timestamp, to be the intended version. Please consult with your program manager to resolve any confusion about which version of a proposal should be considered.

IMPROPER CONTENTS OF PROPOSALS

Proposals submitted under this Announcement will be stored in controlled-access systems, but they may be made publicly available if an award is made, and they will be made available to merit reviewers. As such, it is critical that Laboratories follow these guidelines:
- Do not include information subject to any legal restriction on its open distribution, whether classified, export control, or unclassified controlled nuclear information.
- Do not include sensitive and protected personally identifiable information, including social security numbers, birthdates, citizenship, marital status, or home addresses. Pay particular attention to the content of biographical sketches and curriculum vitae.
- Do not include letters of support from Federal officials.
- Do not include letters of support on Federal letterhead. Letters that are not letters of support (such as letters confirming access to sites, facilities, equipment, or data; or letters from

cognizant contracting officers) may be on Federal letterhead.
- Clearly mark all proprietary or trade-secret information.

Letters of concurrence of collaboration must be provided by each institution participating in multi institutional consortium applications and these should be attached in this section. Other general letters of support are not necessary and discouraged unless it is critical for review of the proposed work.

1. Summary of Proposal Contents and Information about PAMS

Each DOE National Laboratory proposal will contain the following sections:

- Budget, entered into PAMS as structured data using the PAMS budget form
- Abstract (one page), entered into PAMS as a separate pdf
- Budget justification, entered into PAMS as a separate pdf
- Proposal, combined into a single pdf containing the following information:
    - Proposal Cover Page
    - Table of Contents
    - Project Narrative (main technical portion of the proposal, including background/introduction, proposed research and methods, timetable of activities, and responsibilities of key project personnel – 25 page limit)
    - Appendix 1: Biographical Sketch(es)
    - Appendix 2: Current and Pending Support
    - Appendix 3: Bibliography and References Cited
    - Appendix 4: Facilities and Other Resources
    - Appendix 5: Equipment
    - Appendix 6: Data Management Plan
    - Appendix 7: Other Attachments (optional)

SUBMISSION INSTRUCTIONS

Completed proposals must be submitted into the DOE Office of Science Portfolio Analysis and Management System (PAMS). For help with PAMS, click the "External User Guide" link on the PAMS website, https://pamspublic.science.energy.gov/. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9:00 AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free number) or (301) 903-9610, Email: sc.pams-helpdesk@science.doe.gov. All submissions and inquiries about this Program Announcement should reference **LAB 18-1893.** Full proposals submitted in response to this Program Announcement must be submitted to PAMS no later than **April 16, 2018**, at 5:00 PM Eastern Time.

All PIs and those submitting on behalf of PIs are encouraged to establish PAMS accounts as soon as possible to ensure timely submissions. To register, click "Create New PAMS Account" on the website https://pamspublic.science.energy.gov/ and follow the instructions for creating an account.

The following information is provided to help with proposal submission. Detailed instructions and screen shots can be found in the user guide. To find the user guide, click the "External User Guide" link on the PAMS home page. Onscreen instructions are available within PAMS.

- Log into PAMS. From the proposals tab, click the "View DOE National Laboratory Announcements" link and find the current announcement in the list. Click the "Actions/Views" link in the Options column next to this Announcement to obtain a dropdown menu. Select "Submit Proposal" from the dropdown.
- Note that you must select one and only one Principal Investigator (PI) per proposal; to do so, click the "Select PI" button on the far right side of the screen. Find the appropriate PI from the list of all registered users from your institution returned by PAMS. (Hint: You may have to sort, filter, or search through the list if it has multiple pages.) Click the "Actions" link in the Options column next to the appropriate PI to obtain a dropdown menu. From the dropdown, choose "Select PI."
- If the PI for whom you are submitting does not appear on the list, it means he or she has not yet registered in PAMS. For your convenience, you may have PAMS send an email invitation to the PI to register in PAMS. To do so, click the "Invite PI" link at the top left of the "Select PI" screen. You can enter an optional personal message to the PI in the "Comments" box, and it will be included in the email sent by PAMS to the PI. You must wait until the PI registers before you can submit the proposal. Save the proposal for later work by selecting "Save" from the dropdown at the bottom of the screen and then clicking the "Go" button. It will be stored in "My Proposals" for later editing. As a minimum, you must complete all the required fields on the PAMS cover page before you can save the proposal for the first time.
- The cover page, budget, and attachments sections of the lab proposal are required by PAMS before it can be submitted to DOE.
- Complete the sections in PAMS one at a time, starting with the cover page and following the instructions for each section.
- Click the "+View More" link at the top of each section to expand the onscreen instructions. On the budget section, click the "Budget Tab Instructions" link to obtain detailed guidance on completing the budget form.
- Save each section by selecting either "Save" (to stay in the same section) or "Save… and Continue to the Next Section" (to move to the next section) from the dropdown menu at the bottom of the screen, followed by clicking the "Go" button.
- If you save the proposal and navigate away from it, you may return later to edit the proposal by clicking the "View My Existing Proposals" or "My Proposals" links within PAMS.
- You must enter a budget for each annual budget period.
- You must also enter a budget for each proposed sub-award. The sub-award section can be completed using the same steps used for the budget section.

- In the attachments section of the lab proposal, the abstract, the budget justification, and the proposal narrative are required and must be submitted as separate files.
- You must bundle everything other than the budget, abstract, and budget justification into one single PDF file to be attached under "Proposal Attachment."
- Do not attach anything under "Other Attachments."
- To upload a file into PAMS, click the "Attach File" button at the far right side of the screen. Click the "Browse" (or "Choose File" depending on your browser) button to search for your file. You may enter an optional description of the file you are attaching. Click the "Upload" button to upload the file.
- Once you have saved all of the sections, the "Submit to DOE" option will appear in the dropdown menu at the bottom of the screen.
- To submit the proposal, select "Submit to DOE" from the dropdown menu and then click the "Go" button.
- Upon submission, the PI will receive an email from the PAMS system <PAMS.Autoreply@science.doe.gov> acknowledging receipt of the proposal.
- The proposal will also appear under My Proposals with a Proposal Status of "Submitted to DOE."

Please only submit a PAMS lab technical proposal in response to this Announcement; do not submit a DOE Field Work Proposal (FWP) at this time. The Office of Science will request FWPs later from those selected for funding consideration under this Announcement.

For help with PAMS, click the "External User Guide" link on the PAMS website, https://pamspublic.science.energy.gov/. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9:00 AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free number) or (301) 903-9610, Email: sc.pams-helpdesk@science.doe.gov. All submissions and inquiries about this Program Announcement should reference **LAB 18-1893.**

2. Detailed Contents of the Proposal

BUDGET AND BUDGET EXPLANATION

The budget must be submitted into PAMS using the PAMS budget form. Research proposed under this Announcement may only have one annual budget period.

PAMS will calculate the cumulative budget totals for you.

A written justification of each budget item is to follow the budget pages. The budget justification should be placed in a separate, single pdf document and attached on the appropriate screen in PAMS. Further instructions regarding the budget and justification are given below and in the PAMS software.

PROJECT SUMMARY/ABSTRACT (NO MORE THAN ONE PAGE)

The project summary/abstract must contain a summary of the proposed activity suitable for

dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the Principal Investigator (PI), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (i.e., benefits, outcomes). This document must not include any proprietary or sensitive business information as the Department may make it available to the public. The project summary must not exceed 1 page when printed using standard 8.5" by 11" paper with 1" margins (top, bottom, left and right) with font not smaller than 11 point. The one-page project summary/abstract should be placed in a separate, single pdf document and attached on the appropriate screen in PAMS.

The abstract may be used to prepare publicly accessible reports about DOE-supported research.

DOE COVER PAGE
(PART OF PROJECT NARRATIVE)

The following proposal cover page information may be placed on a plain page. No form is required. This cover page will not count in the project narrative page limitation.

- The project title:
- Applicant/Institution:
- Street Address/City/State/Zip:
- Postal Address:
- Administrative Point of Contact name, telephone number, email:
- Lead PI name, telephone number, email:
- DOE National Laboratory Announcement Number: **LAB 18-1893**
- DOE/Office of Science Program Office: **High Energy Physics (HEP)**
- DOE/Office of Science Program Office Technical Contact: Lali Chatterjee
- PAMS Letter of Intent Tracking Number**:**
- Research area (site) identified in Section I of this Announcement

Multi- Institutional proposals must be submitted as SINGLE consortium proposals by the lead laboratory. Consortium applications must include a table modeled on the following chart providing summary budget information from all collaborating institutions. Provide the total costs of the budget request in each year for each institution and totals for all rows and columns.

	Names	Institution	Year 1 Budget	Year 2 Budget	Year 3 Budget	Total Budget
Lead PI						
Co-PI						
Co-PI						
Co-PI						
Total Combined Budget						

Example budget table ($ in thousands)

Applications requesting less than three years funding should write in zero for NA years.

The project narrative **must not exceed 25 pages** of technical information, including charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right). The font must not be smaller than 11 point. Merit reviewers will only consider the number of pages specified in the first sentence of this paragraph. This page limit does not apply to the Cover Page, Budget Page(s), Budget Justification, biographical material, publications and references, and appendices, each of which may have its own page limit.

Do not include any Internet addresses (URLs) that provide supplementary or additional information that constitutes a part of the proposal. Merit reviewers are not required to access Internet sites; however, Internet publications in a list of references will be treated identically to print publications. See Part VIII.D for instructions on how to mark proprietary proposal information. To attach a Project Narrative, click "Add Attachment."

The Project Narrative comprises the research plan for the project. It should contain enough background material in the Introduction, including review of the relevant literature, to demonstrate sufficient knowledge of the state of the science. The narrative should contain appropriate scientific technical information to enable reviewers to assess the merits according to the review criteria provided in Section V.

Suggested sections should include:

Project Objectives: This section should identify the Topic/subtopic(s) being addressed and state clearly the specific objectives of the proposed work along with its intended impact on HEP and QIS.

Background/Introduction: Explanation of the importance and relevance of the proposed interdisciplinary work and review of the relevant literature including contributions of the applicant's team are appropriate for this section. The need and potential for the proposed pioneering pilot or HEP-QIS consortia should be emphasized.

Proposed Research and Methods: This section should describe the scientific and technical challenges, unique approach(es), and anticipated technical solutions in the topical area that will be addressed. Innovation and exploratory parts of the research should be explained and comparison with other ongoing research efforts provided. Sufficient technical details should be provided for each sub task and deliverable to allow reviewers to assess the proposed work.

Timetable of Activities: This section should provide a table outlining, year-by-year, all the important activities or phases of the project, including any activities planned beyond the project period. Responsibilities and deliverables of each institution and investigator must be noted for multi institutional consortium applications and multi-investigator applications.
Successful applicants must use this project timetable to report progress.

Project Team and Interdisciplinary Expertise:
Multi institutional consortium applications and single institution multi-investigator applications must make a compelling case that the appropriate interdisciplinary expertise is available within the team and justify the need for each investigator. The interdisciplinary expertise must be established even for single investigator proposals.

Institutional Commitment: Applicants **are strongly encouraged** provide evidence of their commitment to the proposed activity. This commitment may take the form of uncompensated effort; the provision of surplus materials, supplies, or equipment; the provision of access to facilities at no or reduced cost; voluntary cost sharing; mentoring, training, or coaching of personnel; the provision of release time for teaching faculty; the provision of scholarship support for students; or other methods of involving the applicant in the proposed activity. Institutional commitment is **not** a form of cost-sharing: It is intended to ensure that the applicant institution is leveraging existing resources and capabilities to further the public benefit of groundbreaking scientific discovery.

Specific Guidance for Tracks 1 and 2

TRACK 1: PIONEERING PILOTS (1-2 years duration)

- Applicants are encouraged to emphasize innovation and bold concepts along with risks appropriate for this track;
- Any speculative plans should be justified;
- Design studies proposed for this track must include costing as noted in the Supplementary Information;
- Note that while the 25-page upper limit applies to proposals submitted under Track 1, applicants are encouraged to keep the narrative shorter for this track unless the full 25 pages are needed.

TRACK 2: HEP-QIS CONSORTIA (2-3 years duration) applications should include:

- A section outlining how project metrics will be assessed and identifying any major technical risk elements, with corresponding mitigation plans;
- Justification for the holistic work of the consortia and individual members;
- A management plan for how the collaboration and the work will be managed;
- Clear deliverables and milestones;
- Proposed experiments or technology development must provide and justify complete cost estimates and schedules for completion of the proposed work;
- Participating DOE Labs should delineate resources and expertise at the Lab and how the proposed work fits into their Lab programs.

Do not include any Internet addresses (URLs) that provide supplementary or additional information that constitutes a part of the proposal. Using Internet sites in an attempt to avoid

page limits will fail: The content of those sites will not be reviewed. See Part VIII.D for instructions on how to mark proprietary proposal information.
Appendix 1: Biographical Sketch

Provide a biographical sketch for the project director/principal investigator (PD/PI) and each senior/key person as an appendix to your technical narrative. As part of the sketch, provide information that can be used by reviewers to evaluate the PI's potential for leadership within the scientific community. Examples of information of interest are invited and/or public lectures, awards received, scientific program committees, conference or workshop organization, professional society activities, special international or industrial partnerships, reviewing or editorship activities, or other scientific leadership experiences. The biographical information (curriculum vitae) must not exceed 3 pages when printed on 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right) with font not smaller than 11 point and must include the following:

Education and Training: Undergraduate, graduate and postdoctoral training; provide institution, major/area, degree and year.

Research and Professional Experience: Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

Publications: Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically. Patents, copyrights and software systems developed may be provided in addition to or substituted for publications. An abbreviated style such as the Physical Review Letters (PRL) convention for citations (list only the first author) may be used for publications with more than 10 authors.

Synergistic Activities: List no more than 5 professional and scholarly activities related to the effort proposed. Coordinated or partnership work with other agencies or other SC programs can be noted here with clarification of scope of work proposed to HEP.

Identification of Potential Conflicts of Interest or Bias in Selection of Reviewers: Provide the following information in this section:
- **Collaborators and Co-editors**: List in alphabetical order all persons, including their current organizational affiliation, who are, or who have been, collaborators or co-authors with you on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of this proposal. For publications or collaborations with more than 10 authors or participants, only list those individuals in the core group with whom the Principal Investigator interacted on a regular basis while the research was being done. Also, list any individuals who are currently, or have been, co-editors with you on a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of this proposal. If there are no collaborators or co-editors to report, state "None."
- **Graduate and Postdoctoral Advisors and Advisees**: List the names and current organizational affiliations of your graduate advisor(s) and principal postdoctoral sponsor(s).

Also, list the names and current organizational affiliations of your graduate students and postdoctoral associates.

Personally Identifiable Information: Do not include sensitive personally identifiable information such as a Social Security Number, date of birth, or city of birth. Do not include information that a merit reviewer should not consider.

This appendix will not count in the project narrative page limitation.

APPENDIX 2: CURRENT AND PENDING SUPPORT

Provide a list of all current and pending support (both Federal and non-Federal) for the Project Director/Principal Investigator(s) (PD/PI) and senior/key persons, including subawardees, for ongoing projects and pending applications. List all sponsored activities or awards requiring a measurable commitment of effort, whether paid or unpaid.
For every activity, list the following items:
- The sponsor of the activity or the source of funding
- The award or other identifying number
- The title of the award or activity
- The total cost or value of the award or activity, including direct and indirect costs. For pending proposals, provide the total amount of requested funding.
- The person-months of effort per year being dedicated to the award or activity

Provide the Current and Pending Support as an appendix to your project narrative. Concurrent submission of an application to other organizations for simultaneous consideration will not prejudice its review.
- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 3: BIBLIOGRAPHY & REFERENCES CITED

Provide a bibliography of any references cited in the Project Narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. For research areas where there are routinely more than ten coauthors of archival publications, you may use an abbreviated style such as the Physical Review Letters (PRL) convention for citations (listing only the first author). For example, your paper may be listed as, "A Really Important New Result," A. Aardvark et. al. (MONGO Collaboration), PRL 999. Include only bibliographic citations. Applicants should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the proposal. Provide the Bibliography and References Cited information as an appendix to your project narrative.
- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 4: FACILITIES & OTHER RESOURCES

This information is used to assess the capability of the organizational resources, including subawardee resources, available to perform the effort proposed. Identify the facilities to be used (Laboratory, Animal, Computer, Office, Clinical and Other). If appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Describe other resources available to the project (e.g., machine shop, electronic shop) and the extent to which they would be available to the project. For proposed investigations requiring access to experimental user facilities maintained by institutions other than the applicant, please provide a document from the facility manager confirming that the researchers will have access to the facility. Please provide the Facility and Other Resource information as an appendix to your project narrative.
- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 5: EQUIPMENT

List major items of equipment already available for this project and, if appropriate identify location and pertinent capabilities. Provide the Equipment information as an appendix to your project narrative.
- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 6: DATA MANAGEMENT PLAN

Provide a Data Management Plan (DMP) that addresses the following requirements:
1. DMPs should describe whether and how data generated in the course of the proposed research will be shared and preserved. If the plan is not to share and/or preserve certain data, then the plan must explain the basis of the decision (for example, cost/benefit considerations, other parameters of feasibility, scientific appropriateness, or limitations discussed in #4). At a minimum, DMPs must describe how data sharing and preservation will enable validation of results, or how results could be validated if data are not shared or preserved.
2. DMPs should provide a plan for making all research data displayed in publications resulting from the proposed research digitally accessible to the public at the time of publication. This includes data that are displayed in charts, figures, images, etc. In addition, the underlying digital research data used to generate the displayed data should be made as accessible as possible to the public in accordance with the principles stated in the Office of Science Statement on Digital Data Management (http://science.energy.gov/funding-opportunities/digital-data-management/). This requirement could be met by including the data as supplementary information to the published article, or through other means. The published article should indicate how these data can be accessed.
3. DMPs should consult and reference available information about data management resources to be used in the course of the proposed research. In particular, DMPs that explicitly or

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implicitly commit data management resources at a facility beyond what is conventionally made available to approved users should be accompanied by written approval from that facility. In determining the resources available for data management at Office of Science User Facilities, researchers should consult the published description of data management resources and practices at that facility and reference it in the DMP. Information about other Office of Science facilities can be found in the additional guidance from the sponsoring program.

4. DMPs must protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security; recognize proprietary interests, business confidential information, and intellectual property rights; avoid significant negative impact on innovation, and U.S. competitiveness; and otherwise be consistent with all applicable laws, regulations, and DOE orders and policies. There is no requirement to share proprietary data.

DMPs will be reviewed as part of the overall Office of Science research proposal merit review process. Applicants are encouraged to consult the Office of Science website for further information and suggestions for how to structure a DMP: http://science.energy.gov/funding-opportunities/digital-data-management/

- This appendix should not exceed X pages including charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right)

- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

APPENDIX 7: OTHER ATTACHMENT

If you need to elaborate on your responses to questions 1-6 on the "Other Project Information" document, please provide the Other Attachment information as an appendix to your project narrative. Information not easily accessible to a reviewer may be included in this appendix, but do not use this appendix to circumvent the page limitations of the proposal. Reviewers are not required to consider information in this appendix.
- Do not attach a separate file.
- This appendix will not count in the project narrative page limitation.

3. Detailed Instructions for the Budget

Budgets are required for the entire project period. A budget form should be completed for each budget period of the award, and a cumulative budget form for the entire project period will be populated by PAMS. A detailed budget justification narrative should be included after the budget pages. The justification should cover labor, domestic travel, equipment, materials and supplies, and anything else that will be covered with project funds.

To edit a section on the budget, click the edit icon ( ) for each section on the page. Remember to save all budget periods before moving on to the next section. You can save the budget periods

by selecting "Save All Budget Periods" from the dropdown on the lower right corner of the PAMS budget entry screen and then clicking the "Go" button. You can also save any data entry page in PAMS using the blue diskette icon (💾) in the floating toolbar on the bottom of the screen.

Section A. Senior/Key Person (Required)
For each Senior/Key Person, enter the appropriate information. List personnel, salary funds, and the number of months that person will be allocated to the project. Also include a written narrative in the budget justification that fully justifies the need for requested personnel.

Section B. Other Personnel
List personnel, salary funds, and the number of months that person will be allocated to the project. Also include a written narrative in the budget justification that fully justifies the need for requested personnel.

Section C. Equipment Description
For the purpose of this budget, equipment is designated as an item of property that has an acquisition cost of $5,000 or more and an expected service life of more than one year. (Note that this designation applies for proposal budgeting only and differs from the DOE definition of capital equipment.) List each item of equipment separately and justify each in the budget justification section. Allowable items ordinarily will be limited to research equipment and apparatus not already available for the conduct of the work. General-purpose office equipment, such as a personal computer, is not eligible for support unless primarily or exclusively used in the actual conduct of scientific research.

Section D. Travel
In the budget justification, list each trip's destination, dates, estimated costs including transportation and subsistence, number of staff traveling, the purpose of the travel, and how it relates to the project. Indicate whether travel cost estimates are based upon quotes from travel agencies; upon past experience of similar number of trips to similar travel destinations; or something else (describe). To qualify for support, attendance at meetings or conferences must enhance the investigator's capability to perform the research, plan extensions of it, or disseminate its results.

Section E. Participant/Trainee Support Costs:
If applicable, submit training support costs. Educational projects that intend to support trainees (precollege, college, graduate and post graduate) must list each trainee cost that includes stipend levels and amounts, cost of tuition for each trainee, cost of any travel (provide the same information as needed under the regular travel category), and costs for any related training expenses. Participant costs are those costs associated with conferences, workshops, symposia or institutes and breakout items should indicate the number of participants, cost for each participant, purpose of the conference, dates and places of meetings and any related administrative expenses. In the budget justification, indicate whether trainee cost estimates are based upon past experience of support of similar number of trainees on similar projects; past experience of support of similar number of participants attending similar conferences/workshops/symposia; or something else (describe).

Section F. Other Direct Costs:
Enter Other Direct Costs information for each item listed.

- **Materials and Supplies:** Enter total funds requested for materials and supplies in the appropriate fields. In the budget justification, indicate general categories such as glassware, and chemicals, including an amount for each category (items not identified under "Equipment"). Categories less than $1,000 are not required to be itemized. In the budget justification, indicate whether cost estimates are based upon past experience of purchase of similar or like items; quotes/catalog prices of similar or like items; or something else (describe).
- **Publication Costs:** Enter the total publication funds requested. The proposal budget may request funds for the costs of documenting, preparing, publishing or otherwise making available to others the findings and products of the work conducted under the award. In the budget justification, include supporting information. In the budget justification, indicate whether cost estimates are based upon past experience of purchase of similar or like items; vendor quotes of similar publication services; or something else (describe).
- **Consultant Services:** Enter total funds requested for all consultant services. In the budget justification, identify each consultant, the services he/she will perform, total number of days, travel costs, and total estimated costs. In the budget justification, indicate whether consultant cost estimate is based upon previous experience/quotes for similar or like services; or something else (describe).
- **ADP/Computer Services:** Enter total funds requested for ADP/Computer Services. The cost of computer services, including computer-based retrieval of scientific, technical and education information may be requested. In the budget justification, include the established computer service rates at the proposing organization if applicable. In the budget justification, indicate whether cost estimates are based upon quotes/past experience of purchase of similar computer services; established computer service rates at the proposing institution; or something else (describe).
- **Subawards/Consortium/Contractual Costs:** Enter total costs for all subawards/consortium organizations and other contractual costs proposed for the project. In the budget justification, justify the details.
- **Equipment or Facility Rental/User Fees:** Enter total funds requested for Equipment or Facility Rental/User Fees. In the budget justification, identify each rental/user fee and justify. In the budget justification, indicate whether cost estimates are based upon past experience with similar or like items; vendor quotes of similar items; or something else (describe).
- **Alterations and Renovations:** Enter total funds requested for Alterations and Renovations.
- **In the budget justification**, itemize by category and justify the costs of alterations and renovations, including repairs, painting, removal or installation of partitions, shielding, or air conditioning. Where applicable, provide the square footage and costs.
- **Other:** Add text to describe any other Direct Costs not requested above. Enter costs associated with "Other" item(s). Use the budget justification to further itemize and justify.

Section G. Direct Costs
This represents Total Direct Costs (Sections A thru F) and will be calculated by PAMS.

Section H. Other Indirect Costs
Enter the Indirect Cost information for each field. Only four general categories of indirect costs are allowed/requested on this form, so please consolidate if needed.

Section I. Total Direct and Indirect Costs
This amount will be calculated by PAMS (Sections G + H)

D. SUBMISSIONS FROM SUCCESSFUL APPLICANTS

If selected for award, DOE reserves the right to request additional or clarifying information.

E. SUBMISSION DATES AND TIMES

1. Letter of Intent Due Date

March 26, 2018, at 5 PM Eastern Time

You are encouraged to submit your Letter of Intent well before the deadline.

2. Pre-proposal Due Date

Not applicable

3. Proposal Due Date

April 16, 2018, at 5 PM Eastern Time.

You are encouraged to transmit your proposal well before the deadline.

4. Late Submissions

Delays in submitting letters of intent, pre-proposals, and proposals may be unavoidable. DOE has accepted late submissions when applicants have been unable to make timely submissions because of widespread technological disruptions or significant natural disasters. DOE has made accommodations for incapacitating or life-threatening illnesses and for deaths of immediate family members. Other circumstances may or may not justify late submissions. Unacceptable justifications include the following:
- Failure to begin submission process early enough.
- Failure to provide sufficient time to complete the process.
- Failure to understand the submission process.
- Failure to understand the deadlines for submissions.

- Failure to satisfy prerequisite registrations.
- Unavailability of administrative personnel.
- An upper respiratory infection (a "cold") the week of the deadline.

You are responsible for beginning the submission process in sufficient time to accommodate reasonably foreseeable incidents, contingencies, and disruptions.

Applicants must contact the Program Office/Manager listed in this Funding Opportunity Announcement to discuss the option of a late submission. Contacting the Program Office/Manager after the deadline may reduce the likelihood that a request will be granted.

DOE notes that not all requests for late submission will be approved.

F. FUNDING RESTRICTIONS

Funding for all awards and future budget periods are contingent upon the availability of funds appropriated by Congress and the availability of future-year budget authority.

G. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS

1. Where to Submit

Proposals must be submitted through PAMS to be considered for award.

Please only submit a PAMS lab technical proposal in response to this Announcement; do not submit a DOE Field Work Proposal (FWP) at this time. The Office of Science will request FWPs via the Searchable FWP system later from those selected for funding consideration under this Announcement.

2. Registration Process

ONE-TIME REGISTRATION PROCESS

You must complete the one-time registration process (all steps) before you can submit your first proposal through PAMS. Registration instructions appear in the front matter of this Announcement.

For help with PAMS, click the "External User Guide" link on the PAMS website, https://pamspublic.science.energy.gov/. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free) or (301) 903-9610, Email: sc.pams-helpdesk@science.doe.gov. All submission and inquiries about this DOE National Laboratory Program Announcement should reference **LAB 18-1893.**

3. Proposal Receipt Notices

Upon submission, the PI will receive an email from the PAMS system <PAMS.Autoreply@science.doe.gov> acknowledging receipt of the proposal.

4. Viewing Submitted Proposals

Upon submission, the proposal will appear under My Proposals for the PI and the Submitter with a Proposal Status of "Submitted to DOE."

Section V - PROPOSAL REVIEW INFORMATION

A. CRITERIA

1. Initial Review Criteria

Prior to a comprehensive merit evaluation, DOE will perform an initial review to determine that (1) the applicant is eligible for the award; (2) the information required by the Program Announcement has been submitted; (3) all mandatory requirements are satisfied; (4) the proposed project is responsive to the objectives of the Program Announcement, and (5) the proposed project is not duplicative of programmatic work. Proposals that fail to pass the initial review will not be forwarded for merit review and will be eliminated from further consideration.

2. Merit Review Criteria

Proposals will be subjected to scientific merit review (peer review) and will be evaluated against the following criteria, listed in descending order of importance.

- Scientific and/or Technical Merit of the Project;
- Appropriateness of the Proposed Method or Approach;
- Competency of Applicant's Personnel and Adequacy of Proposed Resources; and
- Reasonableness and Appropriateness of the Proposed Budget.

Merit reviewers will be asked to evaluate one additional criterion:

• Relevance of the proposed research to the HEP-QIS Objectives (as outlined in Section I).

The evaluation process will also include program policy factors such as the relevance of the proposed research to the terms of the DOE National Laboratory Announcement and the agency's programmatic needs, the balance of activities within the program, and the utility of the proposed activities to the broader scientific community. Note that external peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Both Federal and non-Federal reviewers may be used, and submission of a proposal constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

The questions below are provided to the merit reviewers to elaborate the criteria:

SCIENTIFIC AND/OR TECHNICAL MERIT OF THE PROPOSED RESEARCH

- What is the scientific innovation of proposed research?
- How does the proposed work compare with other efforts in its field, both in terms of scientific and/or technical merit and originality?
- What are the unique contributions of this research?
- Is the Data Management Plan suitable for the proposed research and to what extent does it support the validation of research results?

APPROPRIATENESS OF THE PROPOSED METHOD OR APPROACH
- Does the scope of the work conform to the appropriate areas identified in the FOA?
- Does the proposed research employ innovative concepts or methods?
- Do the proposed methods use concepts/ techniques/ tools from both HEP and QIS?
- How logical and feasible are the research approaches?
- Does the applicant recognize significant potential problems and consider alternative strategies?
- If the proposal has been submitted to Track 1, how likely is it to yield novel concepts and break through ideas for HEP discovery?
- If the application has been submitted to Track 2:
  Are the methods appropriate for successful deliverables?
  Are the metrics and risk assessment suitable?
  Is the proposed management plan suitable for achieving the deliverables?

COMPETENCY OF APPLICANT'S PERSONNEL AND ADEQUACY OF PROPOSED RESOURCES

- What is the past performance and potential of the Principal Investigator (PI)?
- How well qualified is the research team to carry out the proposed research?
- Are the research environment and facilities adequate for performing the research?
- Does the proposed work take advantage of unique facilities and capabilities?
- Does the team (or individual PI) have the necessary expertise in HEP and QIS to carry out the proposed research?
- Does any proposed institutional commitment increase the likelihood of groundbreaking scientific discover?

REASONABLENESS AND APPROPRIATENESS OF THE PROPOSED BUDGET

- Are the proposed budget and staffing levels adequate to carry out the proposed research?
- Is the budget reasonable and appropriate for the scope?
- Have applicants for Track 2 appropriately estimated the costs, schedules, and other factors relevant for successful deliverables?
- Have Track 2 applications described the risks and metrics appropriately?

RELEVANCE OF THE PROPOSED RESEARCH TO THE HEP-QIS OBJECTIVES

  Will the proposed research advance the HEP-QIS Objectives?
- Will the proposed goals of this research contribute to the P5 science drivers?
- Will the proposed work advance the broader QIS field?
- Please add any other comments pertaining the relevance and impact for HEP and QIS.

Please use this section for any comments not addressed in the questions above.

B. REVIEW AND SELECTION PROCESS

1. Merit Review

Proposals that pass the initial review will be subjected to a formal merit review and will be evaluated based on the criteria above.

2. Program Policy Factors

The Selection Official may consider any of the following program policy factors in making the selection, listed in no order of significance:

- Availability of funds;
- Relevance of the proposed activity to SC priorities;
- The advice of other federal agencies with specific expertise and interest in the topics listed in this solicitation;
- Expertise in HEP and QIS research and/or technology;
- Degree to which the proposed work is synergistic with, but not duplicative of, existing awards;
- Ensuring an appropriate balance of activities within SC programs;
- Performance under current awards;
- Relevance to HEP QIS program objectives, P5 Science Drivers, and QIS;
- Other available advice and information.

3. Selection

The Selection Official will consider the findings of the merit review and may consider any of the Program Policy Factors described above.

4. Discussions and Award

The Government may enter into discussions with a selected applicant for any reason deemed necessary. Failure to resolve satisfactorily the issues identified by the Government will preclude award to the applicant.

C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES

It is anticipated that the award selection will be completed by July 15th 2018. It is expected that awards will be made in Fiscal Year2018.

DOE is interested in seeing projects supported under this Announcement begin work by September 1, 2018.

Section VI - AWARD ADMINISTRATION INFORMATION

A. AWARD NOTICES

1. Notice of Selection

Selected Applicants Notification: DOE will notify applicants selected for award. This notice of selection is not an authorization to begin performance.

Non-selected Notification: Organizations whose proposals have not been selected will be advised as promptly as possible. This notice will explain why the proposal was not selected.

2. Notice of Award

A work authorization/contract modification issued by the contracting officer is the authorizing award document.

B. REPORTING

Annual progress reports from the award investigator will be required and will be due 90 days before the end of each budget year.

Section VII - QUESTIONS/AGENCY CONTACTS

A. QUESTIONS

For help with PAMS, click the "External User Guide" link on the PAMS website, https://pamspublic.science.energy.gov/. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free) or (301) 903-9610, Email: sc.pams-helpdesk@science.doe.gov. All submission and inquiries about this DOE National Laboratory Program Announcement should reference **LAB 18-1893.**
Please contact the PAMS help desk for technological issues with the PAMS system.

Questions regarding the specific program areas and technical requirements may be directed to the technical contacts listed for each program within the DOE National Laboratory Program Announcement or below.
Please contact the program staff with all questions not directly related to the PAMS system.

B. AGENCY CONTACTS

PAMS Customer Support	855-818-1846 (toll-free) 301-903-9610 sc.pams-helpdesk@science.doe.gov
Program Manager Scientific Contact	Dr. Lali Chatterjee, 301-903-0435 lali.chatterjee@science.doe.gov

Section VIII - OTHER INFORMATION

A. MODIFICATIONS

Notices of any modifications to this DOE National Laboratory Announcement will be posted on the Grants and Contracts website (http://science.energy.gov/grants/).

B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE

DOE reserves the right, without qualification, to reject any or all proposals received in response to this DOE National Laboratory Announcement and to select any proposal, in whole or in part, as a basis for negotiation and/or award.

C. COMMITMENT OF PUBLIC FUNDS

The Contracting Officer is the only individual who can make awards or commit the Government to the expenditure of public funds. A commitment by other than the Contracting Officer, either explicit or implied, is invalid.

D. PROPRIETARY PROPOSAL INFORMATION

Patentable ideas, trade secrets, proprietary or confidential commercial or financial information, disclosure of which may harm the applicant, should be included in a proposal only when such information is necessary to convey an understanding of the proposed project. The use and disclosure of such data may be restricted, provided the applicant includes the following legend on the first page of the project narrative and specifies the pages of the proposal which are to be restricted:

"The data contained in pages _____ of this proposal have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes."

To protect such data, each line or paragraph on the pages containing such data must be specifically identified and marked with a legend similar to the following:

"The following contains proprietary information that (name of applicant) requests not be released to persons outside the Government, except for purposes of review and evaluation."

E. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its proposal, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign conflict of interest and non-disclosure agreements prior to reviewing a proposal. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

F. AVAILABILITY OF FUNDS

Funds are not presently available for this award. The Government's obligation under this award is contingent upon the availability of appropriated funds from which payment for award purposes can be made. No legal liability on the part of the Government for any payment may arise until funds are made available to the Contracting Officer for this award and until the awardee receives notice of such availability, to be confirmed in writing by the Contracting Officer.