



U.S. DEPARTMENT OF
ENERGY

Office of
Science

DOE Accelerator Stewardship report to HEPAP

**Accelerators
and Beams**
Tools of Discovery

Office of High Energy Physics
Office of Science
U. S. Department of Energy

Eric R. Colby

June 6, 2017

Program Manager: Eric.Colby@Science.DOE.GOV

Background image courtesy of Oak Ridge National Laboratory

Origin of Accelerator Stewardship

- Historically, High Energy Physics has provided the most aggressive technical goals and the strongest sustained funding for long-term accelerator R&D in the U.S.
 - This sustained investment has yielded a wealth of accelerator technology that drives not only discovery science, but industrial, medical, energy, environmental, and security applications
- HEP began a process to formalize this role in 2009
 - HEP sponsored *Accelerators for America's Future* to elaborate how accelerators were being used, and requirements for future applications
 - In 2011 the Senate asked DOE for a 10-year plan to address the challenges described by the AfAF workshop report
 - In 2012 DOE responded with a plan
 - In 2013 the first two Basic Research Needs Workshops took place to define topics
- In 2014, Accelerator Stewardship was first authorized by Congress
 - HEP hosts Accelerator Stewardship on behalf of the Office of Science



erations at the Homestake Mine in South Dakota.

Within the funds for High Energy Physics, the Committee also recommends \$20,000,000 for Accelerator Stewardship. The Committee recognizes the critical role accelerator technology can play in addressing many of the economic and societal issues confronting the country. The Committee supports the Office of Science's efforts to make unique test facilities available to U.S. industry to accelerate applications of accelerator technology. Testing accelerator technology, such as at beam facilities, is the only, unambiguous way to demonstrate the operational efficacy of a new technology and represents the final step in validating a design concept.

NUCLEAR PHYSICS

FY2014 Energy and Water Development Appropriations Bill
S. 1245, (June 27, 2013)

N.B. Accelerator Stewardship funded at \$9,931,000 in the final appropriation.

The First Four Years At-a-Glance

- **FY 2014, (PBR: \$10M, Appr: \$10M), Accelerator Stewardship's initial year:**
 - Consulting with BES & NP HEP GARD grants picked to be the initial Stewardship cohort
 - BNL-ATF named as a dedicated Accelerator Stewardship test facility
 - BNL-ATF Stage 1 upgrade was approved and funding began
- **FY 2015, (PBR: \$19.2 M, Appr: \$10M):**
 - Prior-year grant obligations
 - **6 Awards fund under first Accelerator Stewardship FOA**
 - BNL-ATF operated as dedicated SC User Facility under Stewardship
 - *Basic Research Needs Workshop: Energy & Environmental Applications of Accelerators*
 - BNL-ATF Stage 1 upgrade funding continues
 - **Accelerator Stewardship Test Facility Pilot Program launches**
- **FY 2016, (PBR: \$14M, Appr: \$10M):**
 - Prior-year grant obligations
 - **6+3 Awards fund under second Accelerator Stewardship FOA**
 - *NAS Study on Opportunities in S&T of Ultraintense Lasers begins (joint with NNSA, DOD)*
 - BNL-ATF operated as dedicated Accelerator Stewardship test facility
 - BNL-ATF Stage 1 upgrade funding continues
- **FY 2017, (PBR: \$13.4M, Appr:\$13.1M)**
 - Prior-year grant obligations
 - **FY 2017 Stewardship FOA issued**, incorporating the AS Test Facility Program
 - BNL-ATF operated as dedicated Accelerator Stewardship test facility
 - BNL-ATF Stage 1 upgrade funding continues



Accelerator Stewardship Program Elements

- **Research Program**
 - [Accelerator Stewardship Solicitations](#)
 - “FY 20XX Research Opportunities in Accelerator Stewardship”
 - Use-Inspired and Long-Term Basic R&D
 - [SBIR/STTR Solicitations \(Some topics tailored to dovetail with AS program\)](#)
 - High power rf sources and ultrafast laser technology
- **Accelerator R&D Test Facilities**
 - [Brookhaven Accelerator Test Facility](#)
 - SC User Facility, time awarded via competitive proposal process and PAC review
 - [Accelerator Stewardship Test Facility Program](#)
 - Program to facilitate access to lesser-known SC accelerator capabilities
- **Program Planning**
 - New Stewardship thrusts, added through [RFIs, studies, and workshops](#)
 - Basic Research Needs Workshops to define high impact applications, R&D roadmaps

R&D Program: High-Impact Applications outside HEP

The research program has two principal aims:

- ***Solve high impact problems confronting society***
 - Specifically, bring technology up to TRL* 3-4 such that an applied agency or industry is willing to carry the ball forward
 - **Track 1: Use-Inspired Basic R&D (“Applied R&D”)**
 - Focused R&D aimed at solving a specific accelerator application problem in a specific area. The desired end goal is a working prototype technology after 1-2 grant cycles.
 - Eligibility: all domestic organizations. Teaming and cost-sharing are *expected*.
- ***Lay the foundations for future accelerators***
 - Invest in a range of foundational and applied R&D
 - **Track 2: Basic Accelerator R&D**
 - Long-term foundational accelerator R&D aimed at improving the theory, computational tools, and fundamental physical and technical understanding of accelerator science.
 - Eligibility: domestic academia only. Teaming and cost-sharing are encouraged.



FY 2016 FOA Topics



Track 1: Applied R&D

Particle Therapy Beam Delivery Improvements

- Less massive and more compact beam delivery systems capable of delivering ion beams
- Technology that can provide for rapid (seconds) scanning of the beam over a tumor
- Beam diagnostic technologies for ion beam therapy

Ultrafast Laser Technology Program

- Ultrafast gain materials capable of very high average power,
- Increased robustness and reduction in size of optical components,
- Innovations in laser architectures
- Wavelength extension further into the infrared
- Improvements in laser quality

Ultrafast lasers drive:

- Plasma accelerators
- HHG X-ray generators
- Pump-Probe experiments
- ...

Energy & Environmental Applications of Accelerators

- Design **studies** for megawatt-class accelerators
- R&D on megawatt-class rf power sources

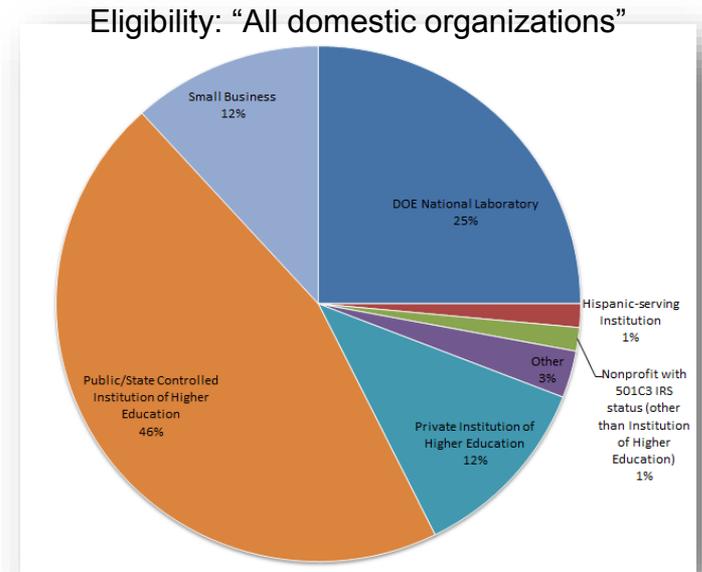
Track 2: Basic R&D

- **Significant increases in accelerator performance** (flux, brightness, polarization, coherence, stability, reliability, flexibility) and **decreases in cost** (construction cost, operating cost, physical size, complexity) are sought.

FY16 Call brought a very strong response from a diverse community

- **68 Letters of Intent (LOIs) received, totaling \$74M !**

- By Call (LAB and FOA)
 - 15 responded to LAB call
 - 53 responded to FOA call
- By Track and Topic
 - Track 1 / Applied R&D
 - Ion Beam Therapy: 8
 - U/F Laser R&D: 11
 - Energy efficiency: 15
 - Track 2 / Basic R&D: 34



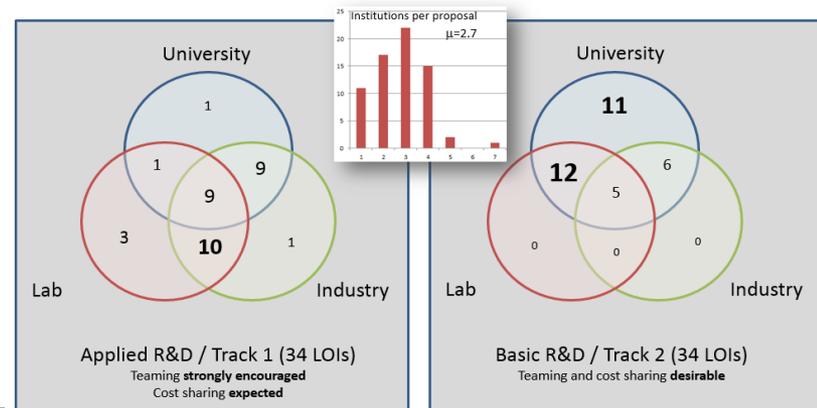
- **LOI Responses**

- Encouraged: 46 (\$54M)
- Discouraged: 22 (\$20M)
 - 4 were referred to the HEP CR FOA

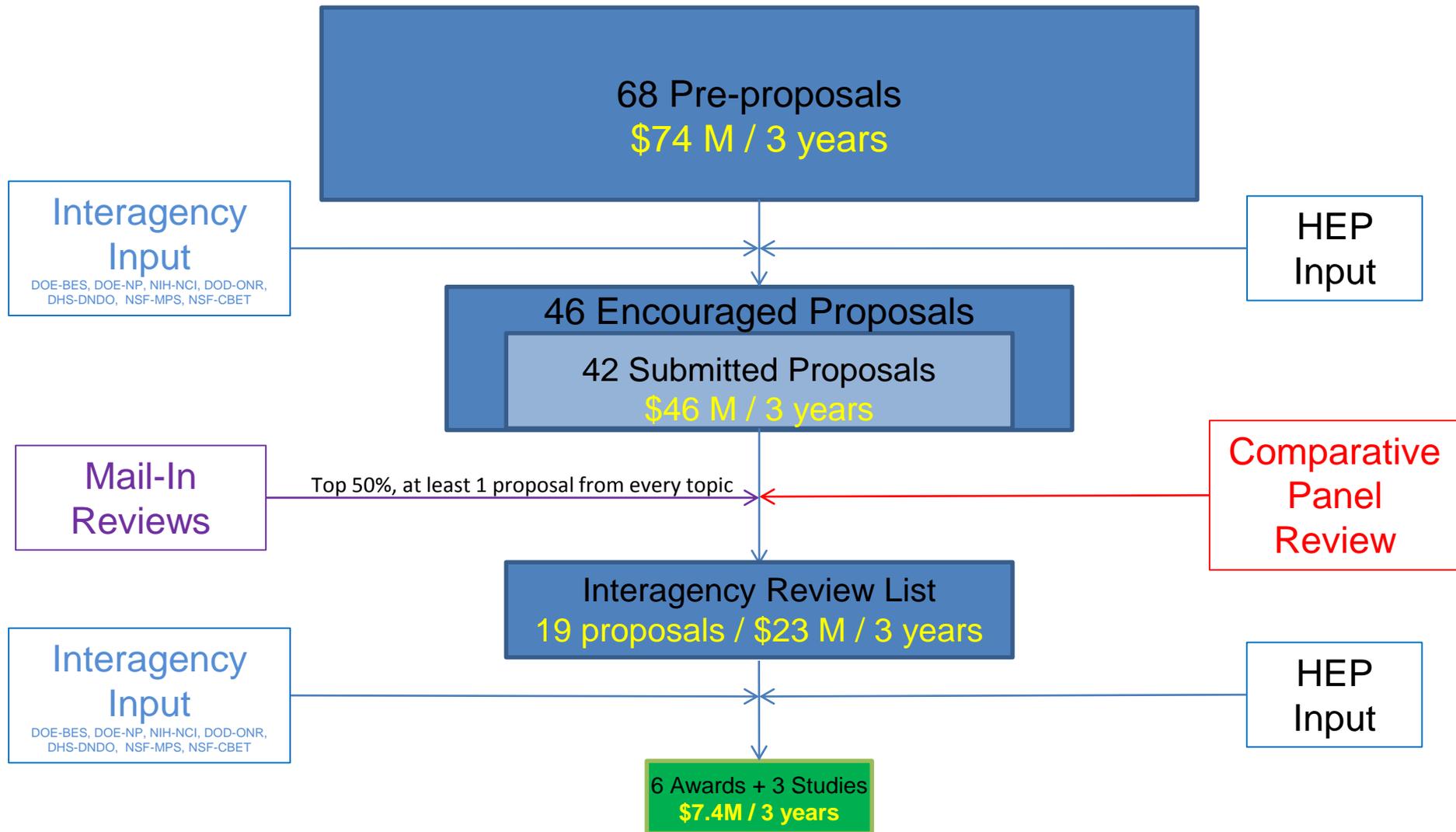
- **42 Full Proposals Submitted by the deadline**

- Track 1
 - Ion Beam Therapy: 7
 - U/F Laser R&D: 5
 - Energy & Environment: 12
- Track 2
 - Basic R&D: 18

Fostering Collaborative Accelerator Research Teams is a central aim of Accelerator Stewardship

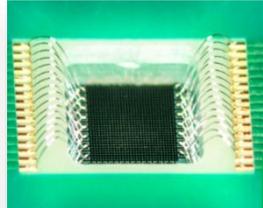


FY 2016 Stewardship Selection Process



FY 2016 Stewardship Awards

Diamond Beam Detectors for Cancer Therapy



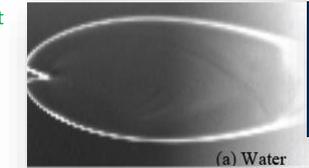
Effort Cost Sharing

High-Efficiency High Power Ultrafast Laser R&D



168k Cost Sharing

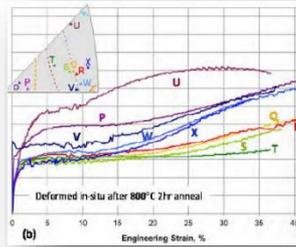
Advanced High Power Laser Control



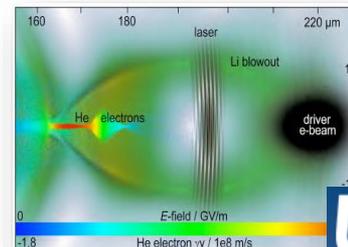
(a) Water



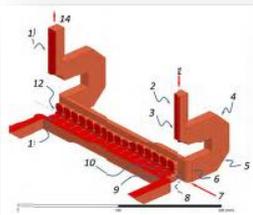
Fundamental Studies of Superconductors (2 awards)



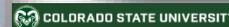
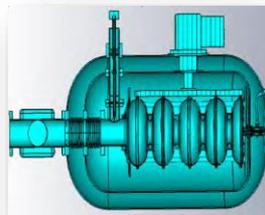
New Sources of Particles and Radiation



Concept Studies of Accelerators for High Power Electron Accelerators for Energy & Environmental Applications



RF Accelerators for E&E Applications



Effort Cost Sharing

SRF Accelerators for Water Treatment



SRF Accelerators for Flue Gas and Wastewater Treatment



U.S. DEPARTMENT OF ENERGY

Office of Science

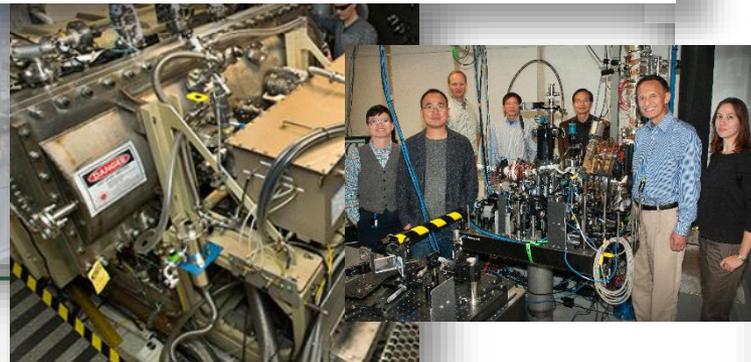
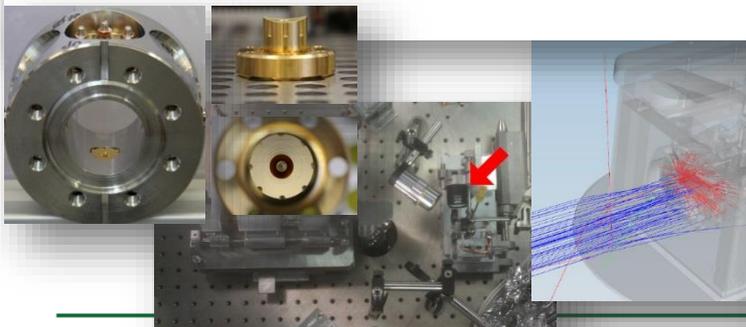
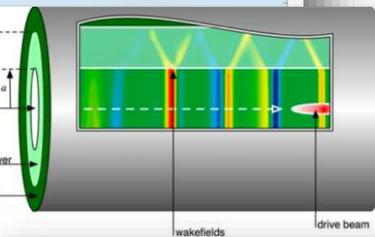
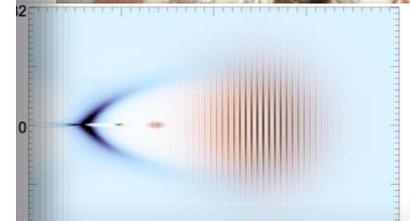
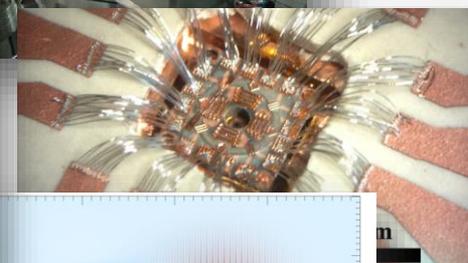
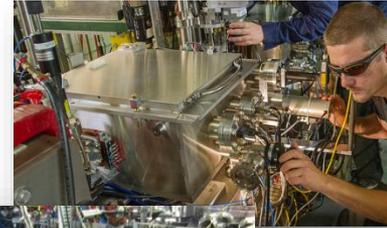
Two Major Program Elements:

- **Brookhaven Accelerator Test Facility (“ATF”)** is operated as an **Office of Science User Facility** dedicated to **Accelerator Stewardship**
- **Accelerator Stewardship Test Facility Program (“ASTFP”)** makes **lesser-known SC accelerator R&D infrastructure** more accessible



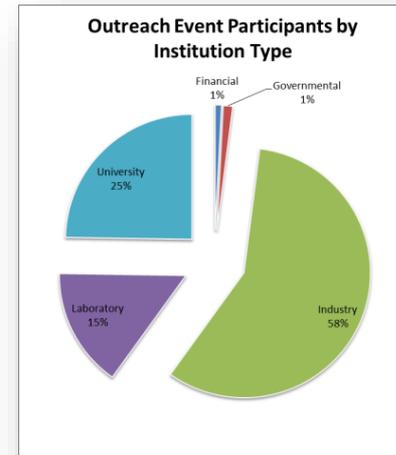
Brookhaven Accelerator Test Facility

- **The ATF is an Office of Science User Facility, providing beam time free of charge to non-proprietary users.**
 - More than 25 years of R&D for science and industry
 - ATF currently supports 25 experiments, 7 feasibility studies
 - Roughly one-half support long-term R&D that is predominantly of interest to BES, NP, DARPA, NASA, DND & others
 - Roughly one-fifth are from industry
 - Rich tradition of training accelerator physicists
 - >2000 hrs/year of e-beam, laser, and UED study time
- **The ATF is an Accelerator Stewardship facility**
 - ATF has been designated an Office of Science User Facility
 - Time awarded by scientific *and/or technical merit*
 - Two new capabilities added: X-band Deflector, UED apparatus
 - Significant CO2 laser upgrades are underway



Accelerator Stewardship Test Facility Program

- **Broaden public awareness** of the broad range of accelerator R&D capabilities at the DOE National Labs.
- **Facilitate access** to SC National Laboratory accelerator R&D infrastructure
- In the pilot year (2015-2016):
 - 450 participants came to events at 6 national labs
 - >58% were from industry
 - A web portal was developed to publicize available capabilities
 - Average 300 hits/year
 - >30 partnership opportunities were identified
 - 7 partnerships were seed-funded
 - lab/university and lab/industry partnerships
- Has been formalized as “Track 3” of the annual solicitation



Fermilab National Accelerator Laboratory and Argonne National Laboratory present
Accelerator Stewardship Test Facility Pilot Program

Use accelerator technology development and testing facilities. Special with...

Accelerator technologies are used to create energy from a variety of sources, including nuclear, solar, and wind. The DOE Office of Science research, development and testing facilities are available for use at the Fermilab National Accelerator Laboratory and Argonne National Laboratory. This enables the scientific community to develop and test new technologies and equipment. For more information, please contact the program manager at stewardship@slac.stanford.edu. You can also visit the program website at www.slac.stanford.edu/stewardship.

Join us for this exciting new program.

Argonne National Laboratory | Fermilab

You are cordially invited to a
Facilities, Equipment, and Expertise Showcase

Hosted by Jefferson Lab
 Part of the DOE ACOE Stewardship Pilot

ATAP
 ACCELERATOR TECHNOLOGY & APPLIED PHYSICS DIVISION

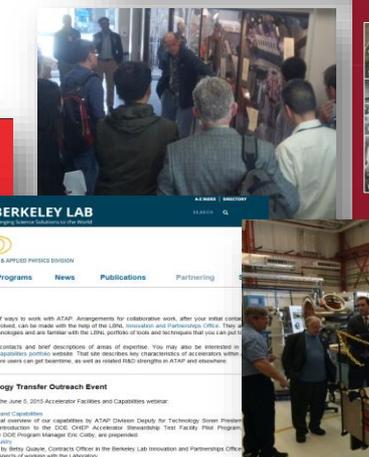
May 4, 2015
 5:30-8:30 PM

Boathouse at Rockett
 4708 E Old Main St
 Richmond, VA 23298

Please RSVP to dowd@lab.org

Applying Forward! Technological Jefferson Lab and other national American innovation

There are a wide variety of ways to work with ATAP. Arrangements for collaborative work, after your initial contact questions and inquiries received. Call for more info at the top of the LBNL Innovation and Partnerships Office. This is the way of existing technologies and are familiar with the LBNL portfolio of tools and techniques that you can put to use. There are already used contacts and brief descriptions of areas of expertise. This may also be interested in accelerator facilities and capabilities portfolio website. This site structure and characteristics of accelerators within other divisions of LBNL, where users can get downloads, as well as related DOE strategy in ATAP and elsewhere.



Boundary Conditions: What is Accelerator Stewardship and what is **GARD**?

- DOE-HEP has a separately funded, separately managed program in accelerator R&D specifically aimed at supporting its mission called “**GARD**” = **General Accelerator Research & Development**.
- Accelerator R&D targeted at one end use is often useful for others (e.g. beam dynamics, material science of superconductors, rf/laser sources...)
- The difference, stated simply, is:

| | |
|---------------------------------------|--|
| GARD | predominantly impacts the HEP R&D mission |
| accelerator stewardship | impacts both HEP and non-HEP uses, but no clear stakeholder (beyond HEP) exists |
| <u>Accelerator Stewardship</u> | predominantly impacts non-HEP applications, and a clear stakeholder exists beyond HEP |



Boundary Conditions: “Stewardship Customer’s Needs” vs. “synergy with HEP”

- **DOE-HEP funds a program with a distinct mission. As such, HEP-funded activities must be defensible within the context of the mission:**
The mission of the High Energy Physics (HEP) program is to understand how our universe works at its most fundamental level.
 - Particle accelerators play a key enabling role in HEP experiments.
 - Higher energy and intensity, and lower cost are the primary R&D goals.
- **Two questions** must be answered in the affirmative for work to qualify for the Stewardship program:
 1. Is there a clear non-HEP customer for the work, and does the proposed work have a potentially *strong impact* on the customer’s needs?
 2. Will conducting the activity likely result in a *positive impact* on HEP’s ability to conduct its mission?

“*strong impact*” – is defined by the Stewardship Customer.

“*positive impact*” – can include: enhancing a competence, improving a facility, or developing an industry capability that one day will prove useful to the HEP mission.



Concluding Thoughts

- **Accelerator Stewardship has made significant progress on the ambitious goals enumerated in *Accelerators for America's Future*¹:**
 - **Create large-scale demonstration and development facilities**
 - As a basic R&D program, Stewardship seeks out applied R&D champions that can take on the applied R&D phase
 - The Brookhaven ATF and the AS Test Facility Program facilitate access to a wide variety of SC accelerator capabilities
 - **Improve interagency, inter-program, and industry-agency coordination**
 - 4 Offices of Science and 6 federal agencies actively coordinate accelerator R&D programs
 - Consult on FOAs & awards; reciprocal participation in workshops & reviews
 - Solicitations specifically and strongly encourage collaboration with industry
 - **Expand training and education of accelerator scientists and engineers and the recognition of accelerator science as a scientific discipline**
 - Accelerator Stewardship contributes to this goal by funding R&D
 - ***NSF's Accelerator Science program plays a critical role***
 - **Address the most pressing needs of R&D for accelerators in the five areas**
 - Grants awarded through competitive FOAs are funding high-impact R&D in these areas
 - 6 patents, ~20% cost sharing, >100 journal publications, 23 dissertations completed,...
 - >10 federal entities are coordinating on the common goal of advancing accelerator technology



FY 2017 Accelerator Stewardship FOA

- **DE-FOA-0001779 and LAB 17-1779, posted June 1, 2017**

- Up to \$3M in FY2017 funding for new and renewal awards
- **Note the highly accelerated deadlines**

- **Track 1: Use-Inspired Basic R&D**

- **Eligibility: All domestic institutions**
- **Topic Areas:**
 - Particle Therapy Beam Delivery Improvements
 - Ultrafast Laser Technology Program
 - Energy & Environmental Applications of Accelerators

- **Track 2: Basic R&D**

- **Eligibility: All domestic accredited academic institutions or non-profits**
- **R&D leading to significant increases in accelerator performance and/or decreases in cost**
 - Must address a Stewardship Customer's identified R&D need.

- **Track 3: Accelerator Stewardship Test Facility Program**

- **Eligibility: All domestic institutions, except DOE labs**
- ≤12 month non-renewable award to use accelerator R&D infrastructure at SC Labs
- Note: a Collaborative Proposal is required

- **Please read the FOA/LAB and FAQs carefully**

- **It is incumbent on the PI to identify the Stewardship Customer and provide evidence of the Customer's support for their work**
 - "Customer" and "evidence" are both defined in the FOA
- **Topic descriptions are specific for a reason** - Please contact Eric Colby and discuss if clarification is needed
- **A Pre-application (2 pages) is required**
- **Teaming and cost-sharing are strongly encouraged**

DE-FOA-0001779 &
LAB 17-1779

Pre-Applications DUE
June 15, 2017 (10 days!)
The pre-application is mandatory

Encourage/Discourage Response:
June 23, 2017

Applications DUE:
July 17, 2017 (24 days!)

Award Notifications:
By Sept 30, 2017

New!



Supplementary Materials



Formulating a National Accelerator Stewardship Program

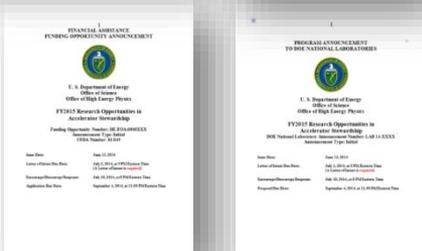
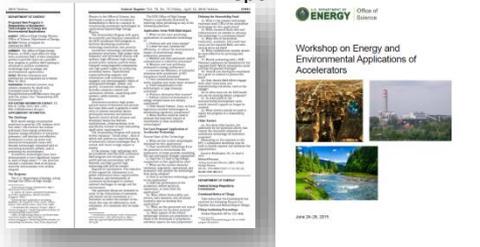
Task Force on Accelerator R&D established by the Director,
Assistant Director High Energy Physics, Office of Science

Office of High Energy Physics
Accelerator R&D Task Force
Report



Reports & RFI responses available at:

<http://science.energy.gov/hep/research/accelerator-stewardship/workshop-report/>



2012 Accelerator R&D Task Force

- Identified initial stewardship opportunities and potential impediments

2013 Ion Beam Therapy Workshop (with NIH)

- Identified the role of accelerator technology and facilities in further cancer therapy

2013 Laser Technology for Accelerators Workshop

- Identified high average power “ultrafast” lasers as key enabling technology for discovery and applied sciences

2014 Congress authorizes Accelerator Stewardship for first time

FY2015 Funding Opportunity Announcement

- 98 LOIs → 50 proposals → 6 awards

2014 RFI and 2015 Energy & Environment Workshop

- RFI and workshop identified key accelerator R&D needed to advance energy and environmental applications of accelerators

Accelerator Stewardship Test Facility Pilot Program

- 450 visitors → >30 joint activity proposals → 7 seed-funding awards

2015 DNDO Workshop on Active Interrogation

- Identified the R&D needed for security applications

FY2016 Funding Opportunity Announcement

- 68 LOIs → 42 proposals → 9 awards

FY 2017 Funding Opportunity Announcement



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Merit Criteria for Accelerator Stewardship Proposals

(in addition to the usual 10CFR605 criteria)

QUALITY OF THE ACCELERATOR R&D STEWARDSHIP OPPORTUNITY

In the questions that follow, the term “**Stewardship customer**” is used broadly to refer to the entity (other than HEP) whose mission or research objectives encompass the proposed work. The Stewardship customer can be another Office of Science (e.g., BES, NP, FES), another DOE program office (e.g., NNSA, EERE, ARPA-E) another federal agency (e.g., NIH, DoD), or industries that use accelerator technology.

1. Does the proposed work require significant scientific or technical **advances in accelerators or accelerator-related technology**? (Accelerator-related technology includes such things as: superconducting magnets and RF cavities, RF and magnet power systems, specialized laser systems, specialized diagnostics and controls, and so on.)
2. Will the proposed work result in substantial **impact on the Stewardship customer’s needs** and result in some **synergy with the HEP mission**? (synergies might include: developing additional expertise or facilities relevant to present or future HEP-supported work).
3. For the primary participating institution(s), is the activity reasonably **consistent with the institution’s primary mission**? (e.g., if a National Laboratory is involved, is the activity consistent with that Laboratory’s primary mission?)
4. Is the PI/collaboration arguably **the best performer/provider for the Stewardship activity**? Are other entities capable of providing a substantially similar (or superior) capability?
5. What evidence is there that the **Stewardship customer endorses the goal**? Does this proposal address issues that have been identified in writing (e.g., advisory committee reports, workshop reports, white papers, roadmaps) by the Stewardship customer? Does the Stewardship customer participate substantially and materially in this effort (e.g., by co-funding, cost-sharing, in-kind donation or equipment, donation of effort)?

Accelerator Stewardship Test Facility Pilot Program Awards

Seven seed-funding awards made September 2015

- Duration: ≤12 months, Average award: \$190k
- **“Development of High-Gradient Accelerating Structures for Ion Beam Therapy”**
 - Who: Radiabeam Technologies, LLC with Argonne National Laboratory
 - What: Uses RF test stand, and beam optics design capability of lab
- **“Ultra-Nanocrystalline Diamond Cathode Testing in an SRF gun”**
 - Who: Euclid Techlabs, LLC with Brookhaven National Laboratory
 - What: Uses SRF gun and operating experience of lab
- **“Basic Materials for Conduction Cooled SRF”**
 - Who: PAVAC Energy Corp. with Fermi National Accelerator Laboratory
 - What: Uses materials analysis and SRF engineering expertise of lab
- **“High Reliability, High Power Coupler Development”**
 - Who: Euclid Techlabs, LLC with Fermi National Accelerator Laboratory
 - What: Uses SRF design and fabrication expertise of lab
- **“Fiber Laser Based Coatings and Surface Activation Facility for Accelerators”**
 - Who: Demaray LLC with Lawrence Berkeley National Laboratory
 - What: Uses lasers and laser-PVD expertise of lab
- **“Electromagnetic Modeling of Human Body Using High Performance Computing”**
 - Who: Simmetrix, Inc. and Stanford University with SLAC National Accelerator Laboratory
 - What: Uses RF design and HPC modeling expertise of lab
- **“Elliptical Twin Cavity for Accelerator Applications”**
 - Who: Old Dominion University with Thomas Jefferson National Accelerator Facility
 - What: Uses SRF design and fabrication expertise of lab

Partner Color Code

Business

University



“One-Stop Shopping” for finding Accelerator R&D Capabilities at the DOE Office of Science National Laboratories

<http://www.acceleratorsamerica.org>

>300 page hits per year*!

ACCELERATORS
FOR AMERICA'S FUTURE

HOME

WORKING WITH THE NATIONAL LABORATORIES

WORKSHOPS

RESOURCES

REPORTS



About Accelerators for America
The Accelerators for America website grew out of

and design and construct new accelerator facilities

Accelerator Test Facility

With the demand for higher energy particle accelerators, facilities such as the Accelerator Test Facility (ATF) at Brookhaven are becoming increasingly important. The ATF provides experimenters with the equipment necessary for the advancement of accelerator technologies, with a view to develop smaller machines and more cost-effective methods of particle acceleration.

The facility provides a very-high brightness electron beam to four beam lines. The beam can be manipulated in the transport line to deliver it to one of the experimental locations in the experimental hall. There are more than 40 quadrupoles along 4 transport lines to tailor the beam to particular experiments.

The carbon dioxide laser installed at the ATF is the only tera-watt picosecond laser available in the world for users. When the laser interacts with matter or particle beams, new strong-field physics phenomena are revealed and have been successfully exploited for electron and ion acceleration and x-ray generation. Such experiments have many applications in physics and other areas such as medicine and materials science.

[Details](#) | [Contact: \(631\) 344-4381](#)

U.S. DEPARTMENT OF
ENERGY

ACCELERATORS
FOR AMERICA'S FUTURE

HOME

WORKING WITH THE NATIONAL LABORATORIES

WORKSHOPS

RESOURCES

REPORTS

Working with the National Laboratories

Particle accelerators are useful tools for defense and security, energy, the environment, industry and medicine as well as for discovery science. National laboratories make facilities available for the development of accelerator-based technology for a wide variety of applications for science and society.

The Department of Energy's Office of Science operates a number of accelerator-based user facilities across the United States. Besides facilitating scientific discovery, these facilities serve as resources for universities, private industry, and other centers for science and technology research and development. In addition, the national laboratories have considerable accelerator-related infrastructure, such as radio-frequency technology and magnet test stands, and beam physics expertise that can serve as resources to the broader community. Learn more about the laboratories' accelerator and accelerator-related facilities and partnering possibilities below.

Argonne National Laboratory

The Argonne Accelerator Institute is the focal point for using Argonne's extensive accelerator resources, enhancing existing facilities, determining the future of accelerator development and construction, and overseeing a dynamic and acclaimed accelerator physics portfolio.



Brookhaven National Laboratory

Brookhaven National Laboratory, operator of several accelerator complexes, has a global reputation for advancing the frontiers of accelerator technology and accelerator-based science. Brookhaven's state-of-the-art facilities are available to industry for research and development in many fields.



Fermi National Accelerator Laboratory

At Fermilab's Illinois Research Center, scientists and engineers from Fermilab, Argonne and Illinois universities will work side by side with industrial partners to research and develop breakthroughs in accelerator science and translate them into applications for the nation's health, wealth and security.



Jefferson Lab

Jefferson Lab is recognized as a world leader in accelerator science as a consequence of planning, building, maintaining and operating the Continuous Electron Beam Accelerator Facility. CEBAF was the first large-scale application of superconducting radiofrequency technology in the world. Operating and maintaining CEBAF requires a sophisticated computer system to control hundreds of thousands of hardware components, including complex cryogenic, microwave, vacuum and magnet systems. The Lab also pursues a broad program of theoretical and experimental research in accelerator and beam physics.



Lawrence Berkeley National Laboratory

Particle accelerators have come a long way since Ernest Orlando Lawrence invented the cyclotron and founded the laboratory that now bears his name. Today, accelerators are vital to answering a wide range of questions, from "What is the underlying structure of matter?" to "How do you quickly check a cargo container for explosives?" On this site you can learn about our core programs and the larger world of accelerators and their uses.



SLAC National Accelerator Laboratory

Thousands of scientists from all over the world use our cutting-edge accelerator facilities each year. SLAC National Accelerator Laboratory is developing the next generation of accelerator technology for science, medicine, industry and homeland security, and we collaborate with industry on research aimed at developing useful products.



Copyright © 2010 U.S. Department of Energy

U.S. DEPARTMENT OF
ENERGY

Office of
Science

* Thanks to Leah Hesla @ FNAL for analysis and upkeep of this page!

Accelerator Stewardship Program Accomplishments

• R&D

- >2.5M\$ in informal cost sharing attracted (averaging 20% across all Stewardship Program Awards so far)
- 6 Patents (1 international)
- 23 Dissertations completed (10 UCLA, 10 Indiana U, 3 FSU)
- 105 Journal Publications, 99 Conference Presentations, 1 book and 6 book chapters

• Facilities

- Brookhaven ATF
 - Provided an average of over 2000 user-hours per year of support on electron and laser beam experiments
 - free of charge for academic use
 - Supported work by BES, NP, DARPA, DNDO, and small businesses
 - Hosted >50 users and 22 user experiments
 - Completed 7 experiments in the 2013-2015 timeframe
- Office of Science National Laboratory Accelerator R&D Infrastructure
 - >450 visitors attended lab “open houses” to learn about their capabilities
 - 33 new “outside uses” of labs were identified, 7 were seed-funded

• Coordination & Communication

- 8 Offices and Agencies outside HEP coordinate on accelerator R&D
- Conducted Basic Research Needs Workshops and an RFI to map out the complex application space and develop R&D roadmaps
 - 3+1 workshops, co-sponsored with NIH, DNDO, and attended by BES, NP, DOD-ONR, FES, NSF, NIH, EPA, and the CRS
- Co-funding an NAS study on Science Opportunities with Ultraintense Lasers (funded jointly with DOE-NNSA, DOD-ONR, and DOD-AFOSR)
- **Publicity:** a Whitehouse article, 2 Physics Today articles, 10 invited plenaries (6 from outside HEP {AMS, AAAS, NAAPT, ANS, TTWG, CAARI}), a trade magazine article, 2 talks to industrial groups, 2 general public lectures,....



Accelerator Stewardship In the Press

(last 26 months)



Accelerating interest: Program launches outreach efforts

Submitted posted: 4/23/2015 3:10 PM



Argonne National Laboratory and Fermilab invite potential industrial partners to learn more about the Accelerator Stewardship Program at a daylong launch on Tuesday, April 28. A job may be created in Illinois as a result of industrial development.

Submitted by Fermilab
On Tuesday, April 28, Argonne National Lab presented the Midwest launch of the Accelerator Stewardship Program.
The launch is part of a national effort by the Office of Science to increase outreach to partners in the goal of advancing particle accelerator science.



DOE announces new accelerator stewardship funding opportunities

The US Department of Energy (DOE) made available an estimated \$4 million in grants on October 13 with a Funding Opportunity Announcement (FOA) for research opportunities associated with its Accelerator R&D Stewardship Program. Submitted proposals must either cover one of three topical areas identified by the Office of Science High Energy Physics (HEP) or address long-term generic accelerator R&D.
According to the FOA, topical research areas include particle therapy beam delivery improvements, ultrafast laser technology and energy and environmental applications of accelerators. Generic topics include beam physics, advanced computational methods for accelerator design and analysis, beam diagnostics and feedback control, new superconducting materials, new materials and coatings for accelerator components, novel power sources for accelerators, new particle sources, novel magnet designs, novel lattice designs and novel technologies for secondary beam production.
Research funded under this FOA could lead to advances in high energy physics (HEP), but the grants are primarily directed toward industry partners interested in leveraging accelerator technology toward non-HEP applications. In fact, OHP created the stewardship program in an effort to transfer technology it developed while pursuing basic energy sciences, high energy physics and nuclear physics into other industries. "So in a nutshell, take advanced technologies with superconductors and compact accelerators and try to put them for use in medicine, security, defense, industrial, energy and environmental applications," says Eric Colby, program manager for accelerator stewardship.
OHP's research parameters were drawn from responses it received to a Request for Information issued in April 2014 and subsequent workshops and open house meetings with industry. In June 2015, for example, the Office of Science held a workshop on energy and environmental applications of accelerators. "The participants at the workshop illustrated quite clearly that electron beam technologies at very high power, meaning megawatt class beam powers, really open the door to a number of environmental applications," says Colby. Examples include sanitizing sewage so it can be used as fertilizer on farm fields, removing chemical toxins and pathogens from drinking water, cleaning up flue gas pollutants, remediating spilled oil products and sterilizing medical waste.



PHYSICS TODAY

DOE: Let's move accelerator technologies to commercial markets

Toni Feder

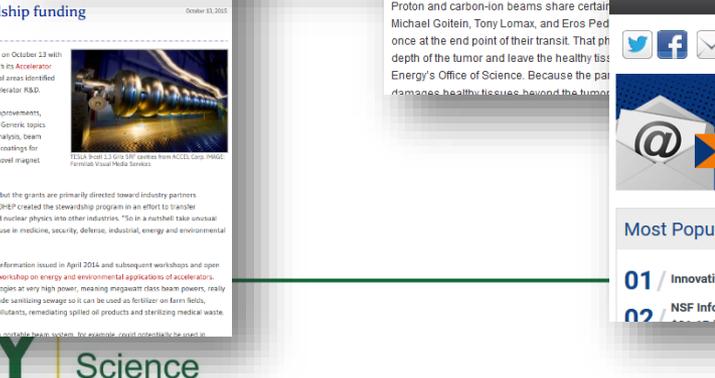
July 2015, page 18

Accelerator-based technologies are used in the production and handling of...
Six US Department of Energy national labs have been on the make of late better, too. Representatives from the six labs have held events, attended industry, academia, and other national labs who want to learn about and...
Accelerator Stewardship Test Facility Pilot Program. A 28 April launch...

PHYSICS TODAY

Carbon-ion cancer therapy shows promise

Proton and carbon-ion beams share certain...
Michael Golfein, Tony Lomax, and Eros Pedone at the end point of their transit. That path of the tumor and leave the healthy tissue...
Energy's Office of Science. Because the path...
damages healthy tissue beyond the tumor...



EurekAlert!
U.S. Department of Energy RESEARCH NEWS ENERGY Office of Science
Home Labs Multimedia Resources News Releases Feature Stories Library Contacts RSS Feed
SLAC partners with Palo Alto firm to make klystrons much more efficient
New "GREEN-IRF" technology recycles energy that would otherwise go to waste in accelerating particles for science, medicine, industry.
Researchers at the Department of Energy's SLAC National Accelerator Laboratory are working with a major manufacturer to make klystrons - big vacuum tubes that generate microwaves for accelerating particles - much more energy efficient.
The new technology, called GREEN-IRF, could dramatically cut the cost of operating both big research accelerators, like the 2-mile-long behemoth at the heart of SLAC, and smaller commercial versions used in medicine, communications, industry and defense. It does this by capturing the energy wasted in generating one pulse of microwaves and recycling it to help generate the next pulse.
With a \$2 million DOE grant, SLAC is working with Communications & Power Industries (CPI) to apply the technology to two klystrons: a 3.5-megawatt CDF tube and a 45-megawatt S-DL SLAC tube, the type used for large-scale physics experiments.
A Dramatic Leap in Efficiency
The researchers estimate that the technology could increase klystron efficiency from 45 percent today to 70 percent or more. This could translate to hundreds of thousands of dollars in savings per year for enormous accelerators and X-ray light sources, which can eat up 40-45 percent of a laboratory's power budget. Such a big leap in efficiency could help national labs meet the goal of reducing greenhouse gas emissions from federal research facilities to 28 percent below 2008 levels by 2020.
But for now the project is primarily aimed at improving the efficiency of commercial...
E's Accelerator Stewardship program, which supports...
not just for basic science, but for society as a whole...
grants in use around the world in medicine, industry, energy and environmental

Federal Labs Launch Pilot Program for Accelerator Research Stewardship
April 22, 2015
The Illinois Accelerator Research Center (IARC) is a new research facility for scientists and engineers from Fermilab, Argonne, and Illinois universities to work alongside industrial partners to develop breakthroughs in accelerator science and apply them to areas such as computing, health, industry, and homeland security. Using electromagnetic fields to propel charged particles at high speeds and to contain them in well-defined beams, accelerator technology allows for the investigation of many aspects of particle physics and application in a variety of industries. As an economic development tool, the IARC intends to attract private industry partners to create new high-tech jobs, while simultaneously providing state-

Media attention focused primarily on Stewardship's efforts in

- **Outreach** -- to facilitate tech transfer and make unique accelerator test infrastructure accessible
- **Putting new accelerator technology to work in medicine** – making beam delivery systems faster and smaller

FY 2016 FOA/LAB Process Overview

- **Program Planning**
 - January 2013 – Ion Beam Therapy Workshop & Lasers Technology for Accelerators Workshop
 - May 2014, June 2015 – RFI and Workshop on Energy & Environmental Applications of Accelerators
- **FOA Preparation**
 - August 2015 – FOA written and circulated to SC/BES+SC/NP, NSF/MPS+NSF/CBET, NIH/NCI, DoD/ONR, DHS/DNDO
 - October 13, 2015 – FOA posted
- **Pre-Application Phase**
 - **November 16, 2015, 5:00pm EDT –deadline for Letters of Intent**
 - November 18-24, Pre-Apps reviewed by SC/HEP, then SC/BES+SC/NP, NSF/MPS+NSF/CBET, NIH/NCI, DoD/ONR, DHS/DNDO
 - November 30, 2015—encourage/discourage responses given
- **Merit Review Phase**
 - Early December—ask BES, NP, NSF, NCI, DOD, DNDO for reviewer selection panelist recommendations
 - December, 2015--Reviewer selection panel identifies and confirms mail-in reviewers
 - **December 21, 2015—full applications due**
 - January 4, 2016 to January 25, 2016—mail in reviews
 - February 9-11, 2016—Comparative Panel review meeting
- **Interagency Review Phase**
 - February 15-February 22, 2016—Interagency review with SC/BES+SC/NP, NSF/MPS+NSF/CBET, NIH/NCI, DoD/ONR, DHS/DNDO
- **Decision and Execution**
 - February 28, 2016—award decisions
 - March, 2016—awards announced
 - May or June 2016 – awards funded

Legend

Proposers

Mail-In Reviewers

CR Panel Reviewers

HEP

Broader SC

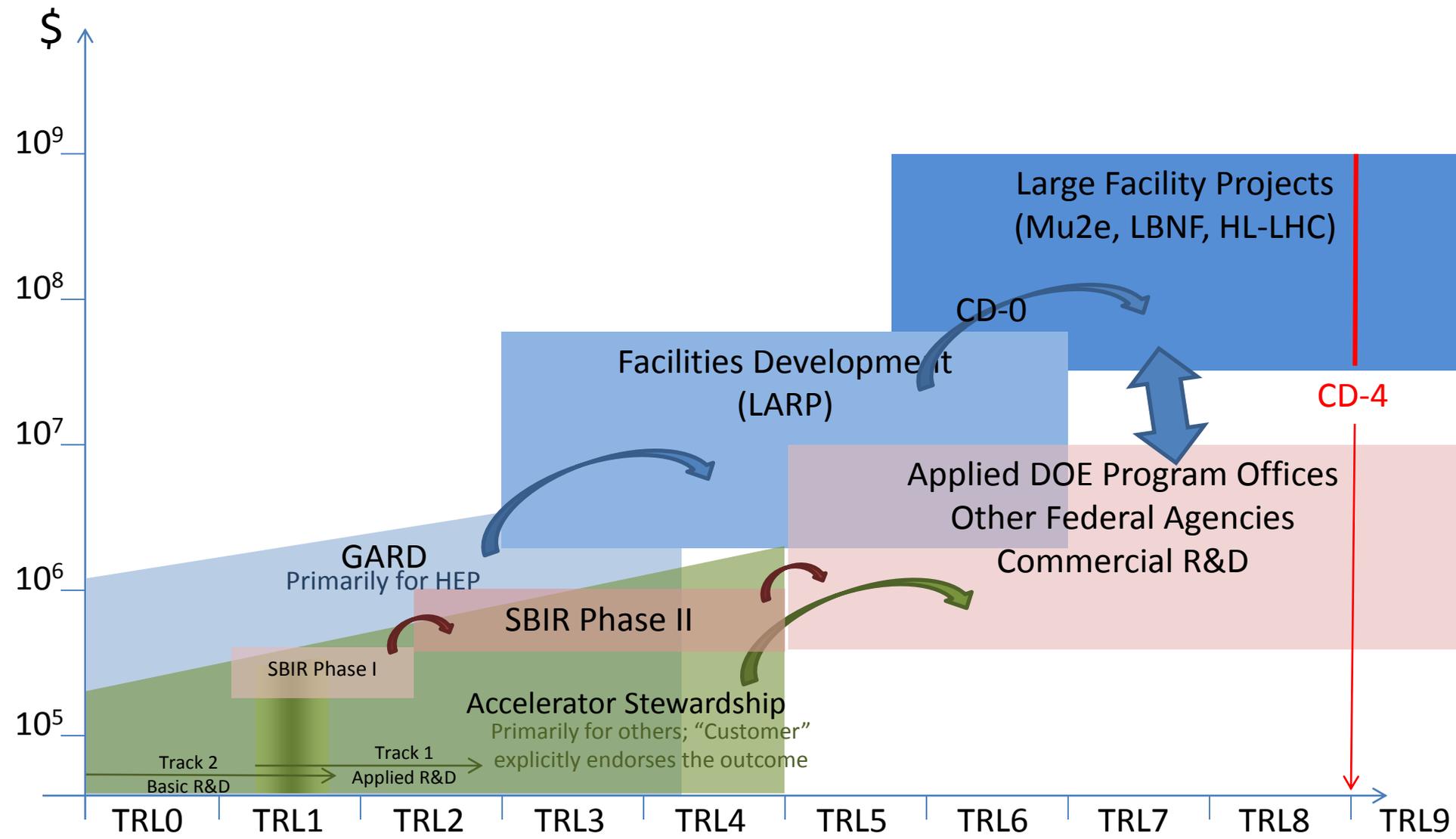
Broader Fed Gov't



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Funding Trajectories of GARD, Stewardship, and SBIR



Synoptic View of the Accelerator Stewardship Program

