Comments from DOE

Eric R. Colby*

Senior Technical Advisor, Office of High Energy Physics

Acting Director, Office of Accelerator R&D and Production

Office of Science, U.S. Department of Energy

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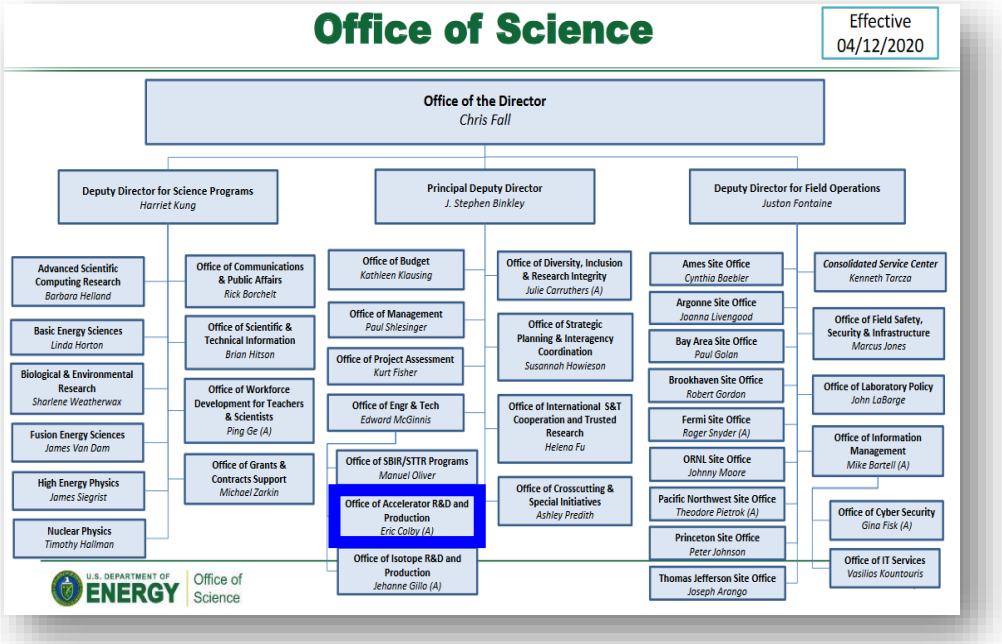
*Eric.Colby@Science.DOE.GOV (301)-903-5475

U.S. DEPARTMENT OF ENERGY | Office of Science

Reorganization
Office of Accelerator R&D and Production (ARDAP)

- ARDAP (SC-24.2) was established April 12, 2020 in recognition of the central importance of accelerators and related technologies to the current and future scientific capabilities stewarded by SC programs.



- ARDAP activities will be tightly integrated with those in BES, FES, HEP, and NP, and will help coordinate accelerator R&D across SC, including the Strategic Accelerator Technology Initiative
  - Accelerator Stewardship will move from HEP to ARDAP with the FY 2021 Appropriation.

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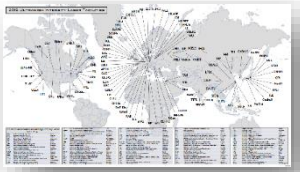
ARDAP Mission

…is to coordinate and make accelerator R&D and production investments that are aimed at addressing Accelerator Science & technology (AS&T) gaps to help ensure that future U.S. accelerator-based physical science R&D priorities will be met.

- ARDAP will fulfill its mission by:
  - Maintaining a strategic picture of AS&T needs and worldwide competition;
  - Facilitating coordination of Programmatic AS&T R&D investments across SC;
  - ATF Investing in selected cross-cutting AS&T areas;
  - Providing a system engineering perspective for SC facility projects;
  - ATF Supporting workforce development, when needed;
  - Maturing key AS&T technologies and developing capable U.S. vendors;
  - ATF Transitioning accelerator technology to broader uses.



Objective: Ensure a robust pipeline of next-generation AS&T to support physical sciences research while providing technology advances and industrial strength that position the U.S. to lead the world for decades to come.

Goals of the Accelerator Stewardship Program

- **Enhance the accelerator technology capabilities of U. S. industry** by engaging the U. S. accelerator R&D ecosystem in a manner that also enhances the ability of the DOE Office of Science and other federal agencies to carry out their missions
- **Facilitate access to the accelerator R&D capabilities at the DOE Office of Science National Laboratories**
- **Drive a limited number of specific accelerator applications towards practical, testable prototypes in a 5-7 year timeframe**
- **Foster collaboration** between developers of accelerator technology and experts who apply accelerator technology
- **Support basic R&D,** necessary for sustained innovation across a broad range of accelerator applications

The Accelerator Stewardship Program
2014-present

- **Research: Applied and Basic Accelerator R&D** (~$52M since 2014)
  - Funded through annual Funding Opportunity Announcements (FOAs)
    - Institutionally diverse: **41 institutions=21 universities, 10 DOE Labs, 10 Industrial Companies**
    - Highly competitive: **4:1** request:funding rate
    - Skin-in-the-game: averaging **20% cost sharing** (voluntary)
    - Highly productive: **16 patents, 321 journal pubs, 351 conf pubs, 45 PhDs, 1 book+10 chapters,…**
- **Facilities: Open access to a wide range of accelerator capabilities** (~$33M since 2014)
  - BNL-Accelerator Test Facility
    - Provided **>15,800 hours to users**
    - Currently supports **22** active experiments
    - Aggressive upgrade profile: **~20%** of budget is for facility upgrades (**2:1** request:approval rate)
    - **46** journal pubs, **59** conf pubs and technical reports, **12** PhDs
  - A.S. Test Facility Program
    - Facilitates access to most Office of Science lab accelerator capabilities; sponsors "Open House" events
    - Since 2015: **3** patents+**1** SB follow-on, **1** journal pub, **8** conf pubs…

Under reported?

- **Program Planning** (~$1.7M since 2014)
  - 4 Workshops, 2 RFIs, 1 NAS Study
    - Considering PI Meetings in Washington DC to promote contact with other Federal Agencies
    - Coordinated with DHS, DOD, DOE-BES, DOE-FES, DOE-NP, DOE-NNSA, NIH-NCI, and NSF-MPS

Three Principal Aims for Accelerator Stewardship R&D

- ***Solve high impact problems confronting society***
  - Specifically, bring technology up to ~TRL-4 such that an applied agency or industry is willing to carry the ball forward
  - **Track 1: Early-Stage Applied Accelerator 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*.
    - Topics defined by workshops: https://science.osti.gov/hep/research/accelerator-stewardship/workshop-reports/

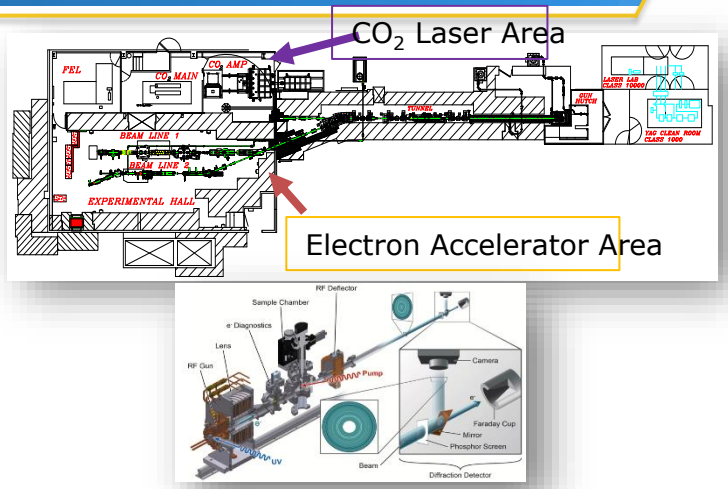
- ***Provide the fundamental building blocks of new technological advances***
  - Invest in a range of high impact broadly applicable R&D
  - **Track 2: Basic Accelerator R&D**
    - Long-term foundational accelerator R&D aimed at improving the theory, computational tools, and fundamental physical and technical understanding of accelerator science.
    - ***Eligibility:*** domestic academia only. Teaming and cost-sharing: encouraged.

- ***Facilitate access to DOE Accelerator R&D Capabilities***
  - Short-term funding for non-DOE entities to engage the facilities and competences of the DOE National Labs
  - **Track 3: Accelerator Stewardship Test Facility Program**
    - Short-term (12 months or less), non-renewable awards to facilitate access to unique DOE accelerator R&D capabilities
    - ***Eligibility:*** all domestic organizations except DOE labs.

*TRL = Technology Readiness Level

Facilitating Access to Accelerator R&D Facilities

- **Brookhaven Accelerator Test Facility ("ATF") is operated as a dedicated National User Facility**
  - Free access for non-proprietary R&D uses, via a merit-reviewed process
    - 80 MeV high brightness electrons, 1 TW CO2 laser pulses, and femtosecond diagnostics
    - Ultrafast Electron Diffraction Facility
  - https://www.bnl.gov/atf/

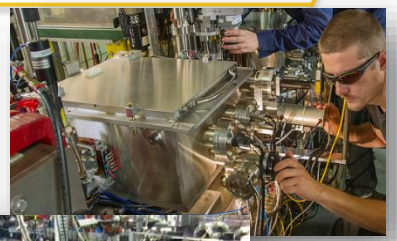
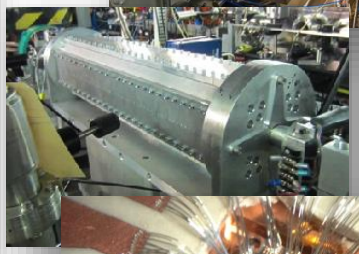
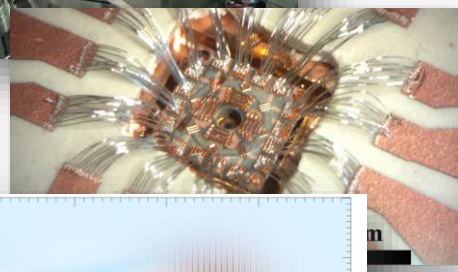


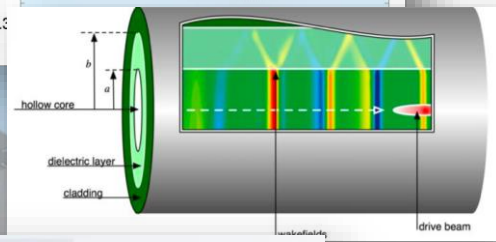
- **Accelerator Stewardship Test Facility Program ("ASTFP") facilitates access to a wide array of DOE National Laboratory Accelerator R&D capabilities**
  - By merit-reviewed proposals to "Track 3" of the Accelerator Stewardship FOA (next call is early 2021)
  - Up to $300k and 12 months to complete a collaborative R&D task at a DOE lab
  - http://www.acceleratorsamerica.org/working-with-labs/index.html

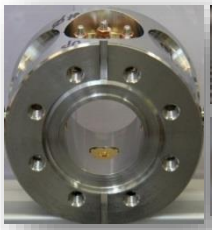
Argonne NATIONAL LABORATORY | BROOKHAVEN NATIONAL LABORATORY | Fermilab | Jefferson Lab EXPLORING THE NATURE OF MATTER | BERKELEY LAB Bringing Science Solutions to the World | OAK RIDGE National Laboratory | SLAC NATIONAL ACCELERATOR LABORATORY

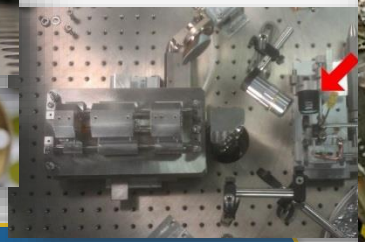
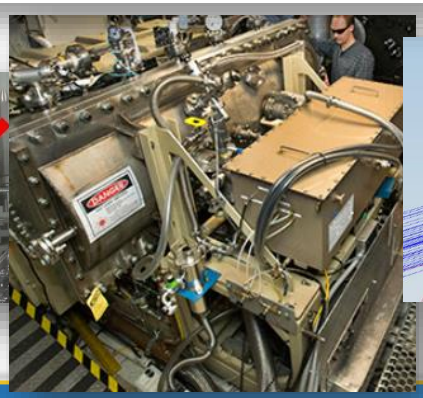
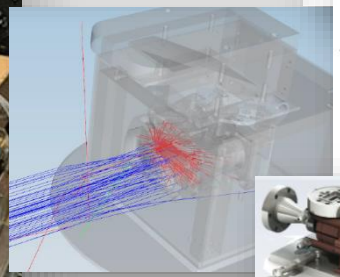
Brookhaven Accelerator Test Facility

- **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 supporting 22 experiments, roughly half support long-term R&D that is predominantly of interest to BES, NP, DOD, DHS & others
  - Serves a broad user population: laboratory, university, industry
  - Rich tradition of training accelerator physicists
- **The ATF is an Accelerator Stewardship facility**
  - Use is free to non-proprietary users
  - Time awarded by scientific and/or technical merit
  - Significant facility upgrades are underway; more are planned






BNL-ATF Facility Upgrades and Extensions

- **Upgrades since 2014**
  - X-band Deflector
  - Stand-alone Ultrafast Electron Diffraction Facility
  - CO_2 isotope upgrade
  - CO_2 compressor upgrades
  - CO_2 optical isolator
  - CO_2 vacuum transport

  } Within reach of Multi-TW delivery!

  - Reworked beamlines and vault layout to increase efficiency and versatility
  - UED LLRF stability, pulse repetition rate, and laser upgrades
  - First CAMAC to VME controls crate upgrade, part of a full control system upgrade
  - NIR laser systems and transport for two-color experiments
  - Legacy equipment replacement and spares (new klystron, pump lasers, computer equipment, power supplies, HVAC upgrades,…)
- **Upgrades of the ATF continue**
  - Strong field laser system
  - CO_2 vacuum transport system
  - CO_2 beam manipulation and control improvements
  - CO_2 power upgrades, including NLPC, BRA, and optical pumping
  - CO_2 rep rate upgrades
  - All-optical electron injector
  - …

What's Next?

DOE is committed to cost-effective operation of the ATF and to pursuing upgrades that maximize its scientific output

- **Cost effective**
  - It is critical that the User community make effective use of the facility and publish its results
  - ***Please make sure to tell the ATF staff about your publications, patents, inventions, graduations, and progress!***

- **The right upgrades at the right time**
  - Expand the science reach & enhance productivity
  - ***Participate in the Science Needs Workshops***

Take-Home Message

- **Accelerator Stewardship supports accelerator R&D of broad use to many sciences and applications by:**
  - Funding basic and applied R&D programs
  - Making the BNL-ATF available as a User Facility
  - Facilitating access to >50 accelerator capabilities across the DOE complex
  - Sponsoring workshops, RFIs, and studies to draw the accelerator and application communities together

- **ATF plays an important role in the Stewardship program by providing support for accelerator science, first-of-kind technical demonstrations, and workforce training**
  - I and the ATF staff always welcome your feedback on ways to improve
  - We count on you to do world-class science and report your findings
  - We count on you to suggest new facility capabilities