

Discussion of Funding Opportunities

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Mu2e-II Workshop, Argonne National Laboratory

December 8th 2017

Mu2e funding sources today

- Mu2e Project
- U.S. base grants (universities)
- Field Work Proposals (Labs: IF Research & Operations)
- Agencies and foundations outside the U.S. program
- US-Japan program (e.g. slow extraction development)
- Student and Fellowship programs (e.g. URA, Fermilab IFF)

Mu2e-II funding sources to pursue...

- Mu2e Project and operations (risk mitigation)
- U.S. base grants (universities)
- Field Work Proposals (Labs: Frontier and R&D Research)
- Agencies and foundations outside the U.S. program
- US-Japan program
- Student and Fellowship programs (IFF, SCGSR, URA)

and:

- Laboratory LDRD
- DOE Early Career Awards
- University and private foundation funding
- SBIR & STTR

Mu2e Project and operations (risk mitigation)

- Fermilab is moving toward encoding risks and managing accordingly
- Project risk example:

“Simulations indicate rates in CRV higher than anticipated”

- Operations risk examples:

“Need to install additional Delivery Ring tunnel shielding”

“Failure of extinction system to sufficiently eliminate out of time beam”

Office of HEP R&D funding opportunities

- Laboratory Detector R&D Field Work Proposals (FWP)s
- Laboratory General Accelerator R&D (GARD) FWPs
- University Detector R&D and GARD FOAs
- Early Career Awards
- Office of Science Graduate Student Research program



HEP DETECTOR R&D PROGRAM

Following ten slides from [Helmut Marsiske's DPF 2017 presentation](#)

HEP Detector R&D Program Goals

- Support research leading to fundamental advances in the science of particle detection, and develop the next generation of instrumentation for HEP
 - Need program **properly balanced** between incremental, near-term, low-risk and transformational, long-term, high-risk R&D
 - Project-oriented vs. Generic/**Blue-Sky** R&D
 - Focus on strategic areas (future promise; U.S. leadership)
- Provide graduate and post-doctoral research training in instrumentation ← next generation of detector experts
- Support “infrastructure”—technical personnel, equipment, “facilities”, and test beams—required for experimental detector R&D and fabrication



P5 Recommendations

- **Recommendation 27: Focus resources toward directed instrumentation R&D in the near-term for high-priority projects. As the technical challenges of current high-priority projects are met, restore to the extent possible a balanced mix of short-term and long-term R&D.**
 - ← **Flavor of R&D has changed: less generic, more project-oriented**
Total R&D funding shrinking because of other, higher-priority initiatives
- **Recommendation 28: Strengthen university-national laboratory partnerships in instrumentation R&D through investment in instrumentation at universities. Encourage graduate programs with a focus on instrumentation education at HEP-supported universities and laboratories, and fully exploit the unique capabilities and facilities offered at each.**
 - ← **Find appropriate laboratory/university balance to optimize overall productivity; foster university instrumentation programs in a challenging budget environment**



Program Funding and Effort and Process

- **Total funding in FY2017 is ~\$23M**
 - Research is ~\$16M
 - 75-80% of research funding to national labs
 - Facilities/test beam operations is ~\$7M
- **Efforts at National Labs and Universities**
 - 7 national labs (60-80 FTEs at ANL, BNL, FNAL, LBNL, LLNL, PNNL, SLAC)
 - ~20 universities (20-30 FTEs)
- **Process to determine funding/effort**
 - National Labs: annual budget briefings, field work proposals (FWPs), and lab comparative review (last in 2016)
 - Universities: annual funding opportunity announcement (FOA) and university comparative review (since 2012)
 - Special solicitations (last in 2011 for Advanced Detector R&D and Collider Detector R&D)



Detector R&D Efforts by Frontier

- **Energy Frontier**
 - LHC phase-II upgrades
 - “Future Colliders” further off into the future
- **Intensity Frontier**
 - DUNE/SBN
 - Liquid Argon TPC, etc
- **Cosmic Frontier**
 - Dark Matter/Dark Energy
 - Cosmic Microwave Background
- **“Instrumentation” Frontier**
 - Large Area Picosecond Photon Detector (LAPPD)
 - **Blue-Sky/Grand Challenges?**

Most R&D efforts also supported out of the corresponding Research Frontier, or out of Operations programs (e.g., LHC operations)



Interim Summary

- **Innovation in Instrumentation historical strength of HEP**
 - Need to preserve and invigorate this core competency
- **Near-term focus is on high-priority P5 projects**
 - LHC phase-II upgrades
 - Long- and short-baseline neutrino program
 - Dark Matter/Dark Energy and CMB
- **Need to restore short-/long-term balance: more Blue-Sky**
- **Stewardship of instrumentation efforts has historically rested with national labs and (some) university groups**
 - Need to establish new, collaborative models to do more with less, and to better engage universities in the R&D enterprise
 - Continue to examine raison d'être of existing detector facilities within the (changing) national HEP program
- **Community plays key role in identifying scientific and technological opportunities and in making them happen**
 - Engaging CPAD for general- and special-purpose Detector R&D workshops



A close-up, high-angle shot of a vast number of US one-cent coins (pennies) scattered across the frame. The coins are illuminated by a warm, golden light, creating a shimmering effect. The perspective is from above, looking down at the coins, which are piled and scattered in various orientations. The background is dark, making the metallic sheen of the coins stand out.

HEP FUNDING OPPORTUNITIES

FY 2018 RESEARCH OPPORTUNITIES IN HIGH ENERGY PHYSICS



FY 2018 HEP Comparative Review FOA and FAQ

- **DE-FOA-0001781** issued June 28, 2017
- **Six HEP research subprograms**
 - Energy, Intensity, and Cosmic Frontiers
 - HEP Theory
 - Accelerator Science and Technology R&D
 - Detector R&D
- **Letter of Intent due August 10, 2017 by 5 PM Eastern Time**
 - Strongly encouraged
- **Final Proposal deadline September 12, 2017 by 5 PM Eastern Time**
- **In addition to the FOA, a FAQ is available and addresses topics on:**
 - Registration and eligibility requirements
 - Proposal types and proposal requirements;
 - Guidance for new faculty and those without current HEP grants
 - Guidance for PIs with existing HEP grants
 - Budget information and guidance on scope of request(s)
 - Letter of Intent
 - Information on overall scientific merit review process

Both the FOA and FAQ available at:

<http://science.energy.gov/hep/funding-opportunities/>

FINANCIAL ASSISTANCE FUNDING OPPORTUNITY ANNOUNCEMENT



U. S. Department of Energy

Office of Science
High Energy Physics

FY 2018 Research Opportunities in High Energy Physics

Funding Opportunity Number: DE-FOA-0001781
Announcement Type: Initial
CFDA Number: 81.049

Issue Date: June 28, 2017
Letter of Intent Due Date: August 10, 2017, at 5 PM Eastern Time
(A Letter of Intent is highly encouraged)
Application Due Date: September 12, 2017, at 5 PM Eastern Time

Frequently Asked Questions (FAQs) to the DOE Comparative Review in HEP

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Note: With the FY 2018 Research Opportunities in High Energy Physics (Comparative Review) Funding Opportunity Announcement (DE-FOA-0001781) and the questions and answers below are technical terms and acronyms specific to grant awards and the overall review process. Please refer to the "Glossary" contained in Section II.A of the Funding Opportunity Announcement for complete definitions of these terms.

Registrations and Eligibility

Q1: In order to submit Letters of Intent and/or Final Applications in response to the HEP comparative review Funding Opportunity Announcement (FOA), what particular systems must applicants register in?

A1: The complete list of systems that applicants are required to register with are listed in the Section IV Subsection H of the FOA (i.e., see pages 39-44 of the FOA). These include:

- Grants.gov
- DOE's Portfolio Analysis and Management System (PAMS);
- Obtaining a DUNS number: a unique nine-digit identification number for applicants;
- Obtaining a Taxpayer Identification Number (TIN);
- FedConnect;
- Federal Funding Accountability and Transparency Act Subaward Reporting System (as indicated in the FOA, registering in certain systems may take several weeks to process and complete). Therefore, the DOE Office of Science (OS) encourages applicants to register in all systems as soon as possible and well before the relevant deadlines.



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Items to Keep in Mind

- **Read the FOA carefully and follow the requirements on content, length, etc.**
 - Several requirements in the FOA are set from outside the DOE-HEP office, and there is little or no flexibility to modify. Non-compliant proposals submitted to the FOA will be declined without review
 - In recent years, 10-15% of incoming proposals were declined w/o review. Requirements that are most often missed or overlooked include: page limits, data management plans, separate budget sheets for each Frontier (if needed), and inclusion of Personally Identifiable Information (PII)



Items to Keep in Mind, cont.

- Proposed research will review best if aligned with the DOE-HEP mission, its program, and the P5 strategy
- Investigators in experimental HEP research frontiers (Energy, Intensity, Cosmic) will review best if they are closely integrated into HEP experimental collaborations and have key roles and responsibilities on those experiments
- “Generic” detector research that is not specific to a single HEP experiment but broadly applicable should be directed to the HEP Detector R&D program
 - Concern about program balance → **“Proposals for “Blue-Sky” scientific research on innovative technologies not already in contention for implementation in future DOE HEP projects are specifically encouraged”**
 - Would like to see university-lab collaborative proposals



Discussion of FOA tactics at recent CPAD meeting

- Program manager noted a small number (~2) of reviewable proposals responsive to the 2016 research FOA.
- 2016 Laboratory comparative review concluded that laboratories must improve collaboration between labs and between universities and labs.
- Several P.I.'s at CPAD noted the tension between responding to a research frontier FOA simultaneously with a detector R&D FOA. Program manager noted the discussion.
- Should/could be an opportunity for Mu2e-II.



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Following seven slides from [L.K. Len's June 2017 HEPAP presentation](#)

DOE HEP General Accelerator R&D

HEPAP Meeting
June 5, 2017

L.K. Len
Research and Technology Division

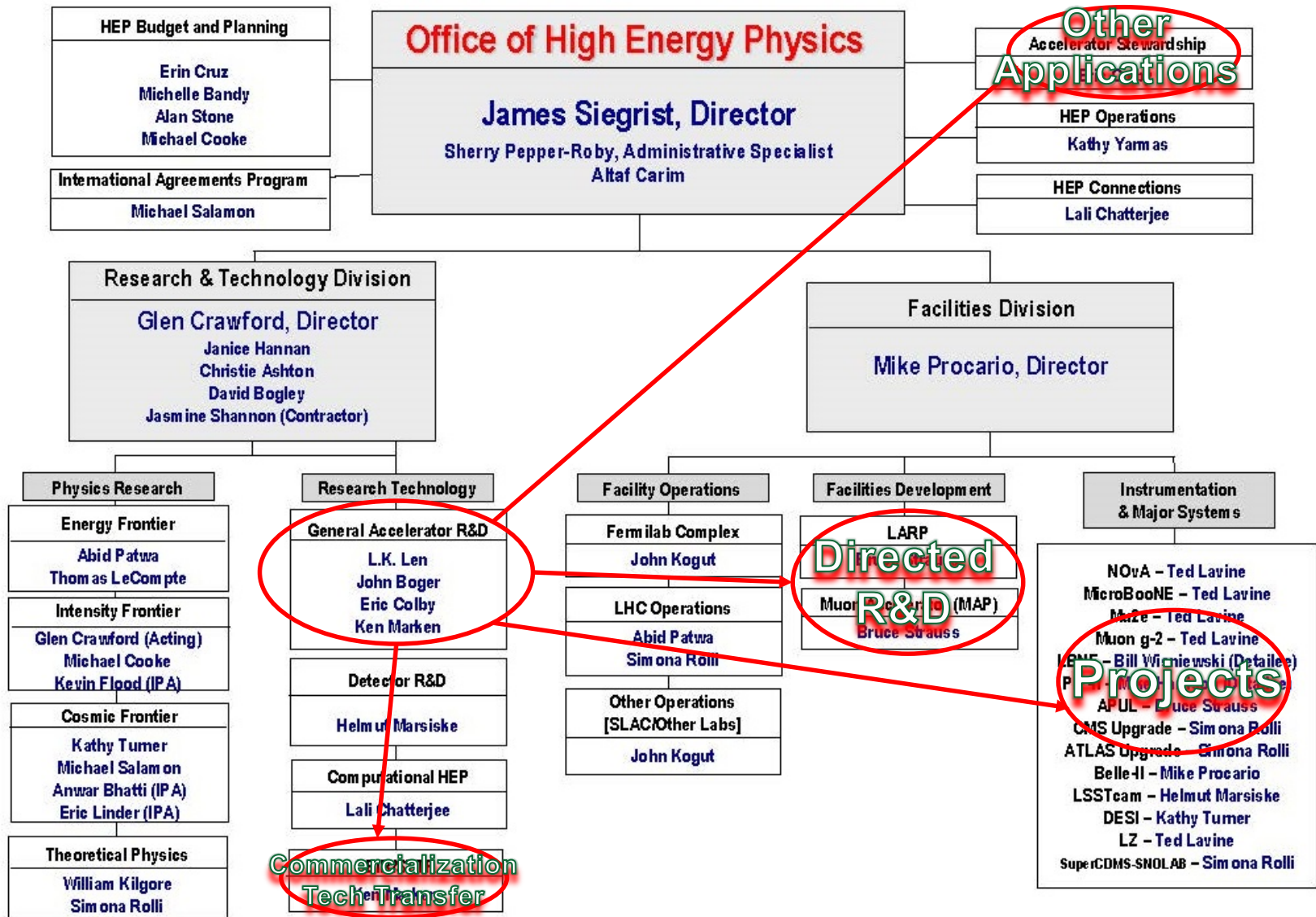
Office of High Energy Physics
Office of Science, U.S. Department of Energy

The HEP GARD Program

- GARD supports accelerator science and technology R&D aimed at enabling HEP discovery science. It does so by developing new accelerator concepts, materials, designs and by pushing the performance limits, while acquiring and broadening the knowledge base of accelerator science.
- GARD funds medium and long term accelerator R&D primarily aimed at supporting the High Energy Physics mission. However, the long-term generic R&D may also benefit other applications—one can regard it as [small case] “accelerator stewardship”.
 - Medium term accelerator R&D refers to work performed in the support of possible new facilities or of upgrades to existing ones. This applies to facilities that possess a reasonable conceptual idea for implementation.
 - Long-term accelerator R&D refers to the development of ideas and underlying technologies that could support facilities for which we do not currently have an integrated implementing concept



GARD w.r.t. HEP Org Chart



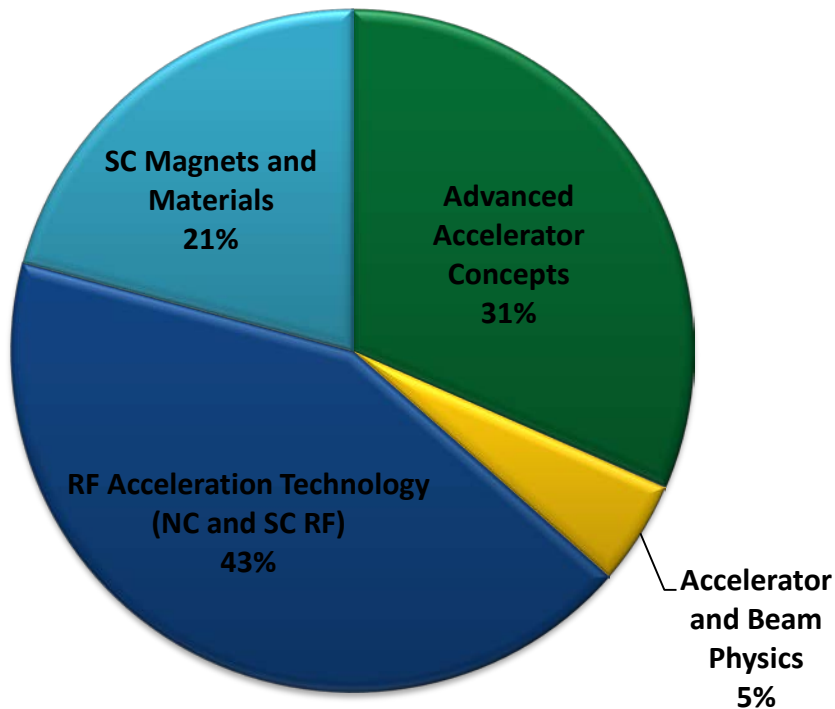
GARD Thrusts

- **Supports 5 Research Thrusts:**
 - **Advanced Accelerator Concepts**
 - **Accelerator and Beam Physics**
 - Expanded to include beam instrumentation and controls
 - **Particle Sources and Targets**
 - **RF Acceleration Technology (NC and SC RF)**
 - Includes RF sources, NCRF and SRF R&D
 - **Superconducting Magnets and Materials**
- **Support research efforts at:**
 - **7 DOE national labs**
 - **30 university grants**

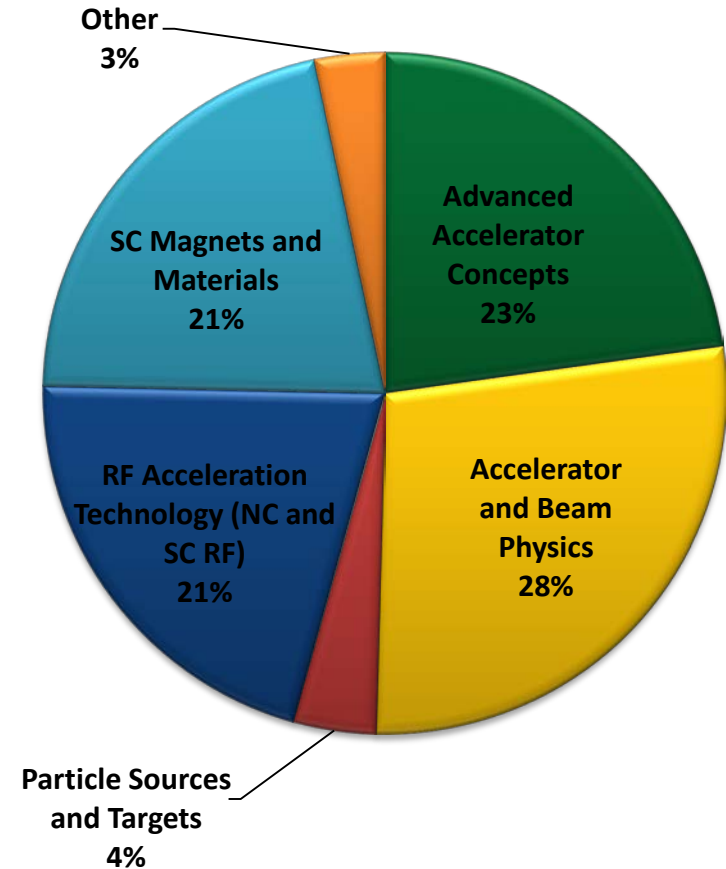


FY 2016 GARD Research – % By Thrusts

GARD Facility Ops by Thrust (\$27M)



GARD Research by Thrust (\$44M)



P5 Report Strategy for GARD

- In 2014—The P5 report recommended moving forward with a focused **Advanced Technology R&D strategy**:
 - Play a leadership role in superconducting magnet technology focused on the dual goals of increasing performance and decreasing costs
 - Pursue accelerator R&D with a focus on outcomes and capabilities that will dramatically improve cost effectiveness for mid-term and far-term accelerators



Accelerator R&D Subpanel

- In 2015—Following P5, the Accelerator R&D Subpanel (charged to identify the most promising accelerator research areas to support the advancement of HEP) rolled out its report with 25 recommendations
 - provides prioritization advice to GARD on accelerator R&D towards the Next Steps [Medium-term] and Further Future [Long-term] accelerators



	Intensity Frontier Accelerators	Hadron Colliders	e^+e^- Colliders
Current Efforts	PIP	LHC	
	PIP-II	HL-LHC	ILC
Next Steps	Multi-MW proton beam	Very high-energy pp collider	1 TeV class energy upgrade of ILC*
Further Future Goals	Neutrino factory*	Higher-energy upgrade	Multi-TeV collider*

**dependent on how physics unfolds*



ARDS Recommendations – PST

- **Particle Sources and Targets**

- Develop plan to support high-power target for Intensity Frontier

- [1] Fund generic high-power component R&D at a level necessary to carry out needed thermal shock studies and ionizing radiation damage studies on candidate materials that are not covered by project-directed research.

Recent [High Power Targetry R&D Roadmap Workshop](#) at Fermilab at Fermilab highlighted Mu2e-II targetry challenges.

• **Implemented**

• **Implementing**

• **In progress**

• **Deferring**



Discussion of FOA/FWP tactics with GARD program manager

- Healthy university program
- Lab-university partnerships are favorable in the review process. Laundering schemes to fund lab activities will however be viewed with disfavor
- Host-lab model for Field Work Proposals with sub-contracts (pass-thru) to collaborating labs viewed favorably
- Lab-based LDRD activities that enable stronger GARD proposals are viewed favorably
- Good opportunity for Mu2e-II

DOE Early Career Awards

- Competitive! 59 accepted from 700 proposals across SC in 2017.
- FY18 solicitation and submission process delayed this year, (submission nominally by now) expected to still occur with a shortened timeline to recover some of the timeline delay.
- Has played a role recently for CMB-S4, ~10 years out.

<https://science.energy.gov/early-career/>

How to Prepare for an Early Career Proposal

- **Address the following questions:**
 - What challenges/problems are you trying to solve?
 - Is someone else doing it already? If you carry out these efforts, why are they unique and require 'you'?
 - How does this research exploit/engage the unique capabilities of your institution?
 - What resources are needed to complete the project?
 - Does your proposal outline a 5-year timeline, with key deliverables and personnel profiled during this project period?
 - Have you led the activities that you are proposing? Why are you a future leader in high energy physics?
- **Reviewers look for innovative, balanced proposals**
 - Can be speculative, but not implausible
 - Needs to have the potential for impact
 - Should have a detector physics component
- **Prior to submission, applicants may want to seek guidance from senior faculty/staff, and/or topical experts, and /or previous applicants while preparing proposals (including the budget material)**



US-Japan program

- Presently an equitably funded program between the U.S. (\$2M) and Japan (\$2M)
- Proposals nominally due Dec 15th 2017, to ensure processing before the beginning of the Japanese fiscal year (April)
- Strong Japanese partners required, good recent successes with neutrino targetry and synchrotron slow extraction.
- Good opportunity for Mu2e-II.

Laboratory LDRD

- Lab specific. Some theme-based, some strong-P.I. based, some strategic.
- Piloting R&D FOA proposals viewed favorably by program managers.
- Fermilab LDRD tends to be strategic. A good opportunity for Mu2e.

Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) DOE programs.

- Has historically been an effective and important partner in muon R&D (Muons Inc).

<https://science.energy.gov/sbir/funding-opportunities/>

Timelines

- Next round of lab FWP proposals, spring of 2018
- Next round of DOE FOA proposals, fall of 2018
- Next round of ECA proposals, November 2018
- Next round of US-Japan proposals, December 2018

- Next round of LDRD...lab dependent

-This is not a lot of time-

Assuming a favorable Fermilab PAC process we should initiate campaigns to socialize Mu2e-II with the agencies, and develop partnership in Japan in preparation for the US-Japan proposal.