

The DOE Nuclear Physics SBIR/STTR Program

SBIR/STTR Exchange Meeting
August 17-19, 2021
via Zoom

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Office of Nuclear Physics



Outline

- Expectations for Professional Conduct
- DOE SBIR/STTR goals, funding, organization, and administration
 - The Sequential Phase IIA, IIB, and IIC awards
- The Nuclear Physics (NP) Program Missions
 - Supporting these missions within the NP SBIR/STTR program
- Exchange meeting goals and agenda
- NP SBIR/STTR applications and awards metrics (FY 2021)
- The NP Mission and how it translates into SBIR/STTR Topics/Subtopics
- The DOE NP SBIR/STTR Program in FY2021
- Presentation Notes
- Conclusions



The SC statement on Diversity, Equity & Inclusion

The direct link is:

<https://www.energy.gov/science/diversity-equity-inclusion>

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The DOE SBIR/STTR Program

SBIR: Small Business Innovation Research **STTR:** Small Business Technology Transfer.

- **SBIR:** Set-aside program for U.S. small businesses (SB) to engage in Federal Research and Development (R&D) with potential for commercialization. (Participations: **SB: minimum 66 % for Phase I and 50% for Phase II, Research Institution (RI): optional**)
- **STTR:** Set-aside program to facilitate cooperative R&D between SB and U.S. RI with potential for commercialization. (Participations: **SB: minimum 40%, RI: minimum 30%**)
- **“Both”:** submitted for consideration as SBIR or STTR (both). Must satisfy the minimum participation requirements listed above for both SBIR and STTR.
- Congressionally-mandated programs, funded by a small percentage of the extramural R&D budget set aside within each DOE technical program that participates.
- **2016 reauthorization bill has provided funding for the program until September 2022**

	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	----	FY2022
SBIR	0.028	0.029	0.030	0.032	0.0320	0.0320	----	0.0320
STTR	0.004	0.0045	0.0045	0.0045	0.0045	0.0045	----	0.0045
Total	3.20%	3.35%	3.45%	3.65%	3.65%	3.65%	----	3.65%



The DOE SBIR/STTR Phases (FY21)

PHASE I: FEASIBILITY, PROOF OF CONCEPT

- Award Amount: \$200,000 (guideline), \$250,000 (max.)
- Project Duration: 12 months



PHASE II: CONTINUE R/R&D FOR PROTOTYPES OR PROCESSES

- Award Amount: \$1,100,000 (guideline), \$1,600,000 (max.)
- Project Duration: 2 years



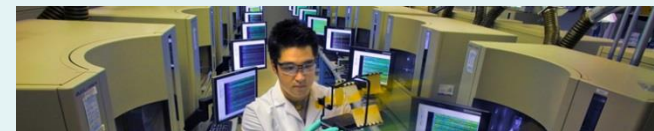
SEQUENTIAL PHASE IIIA OR IIIB: CONTINUE R/R&D FOR PROTOTYPES OR PROCESSES

- **PHASE IIIA:** FOR CERTAIN PROTOTYPES, PRODUCTS, OR PROCESSES THAT NEED MORE DEVELOPMENT
- **PHASE IIIB:** FOR R&D FUNDING REQUIRED TO TRANSITION AND/OR INNOVATION TOWARDS COMMERCIALIZATION.
- **PHASE IIIC:** COMMERCIALIZATION – REQUIRES MATCHING FUNDS
- Award Amount: \$1,100,000
- Project Duration: 2 years



PHASE III: COMMERCIALIZATION

- Federal or Private Funding (non-SBIR/STTR funds)
- No dollar or time limits





Phase I Funding Opportunity Announcements Participating DOE Programs (FY 2021)

Phase I Release 1

- Office of Advanced Scientific Computing Research (ASCR)
- Office of Basic Energy Sciences (BES)
- Office of Biological and Environmental Research (BER)
- **Office of Nuclear Physics (NP)**

Phase I Release 2

- Office of Cybersecurity, Energy Security, and Emergency Response (CESER)
- Office of Defense Nuclear Nonproliferation (NA)
- Office of Electricity (OE)
- Office of Energy Efficiency and Renewable Energy (EERE)
- Office of Environmental Management (EM)
- Office of Fossil Energy (FE)
- Office of Fusion Energy Sciences (FES)
- Office of High Energy Physics (HEP)
- Office of Nuclear Energy (NE)

FY20 NP SBIR/STTR award funding levels and requirements on Research Institution participation

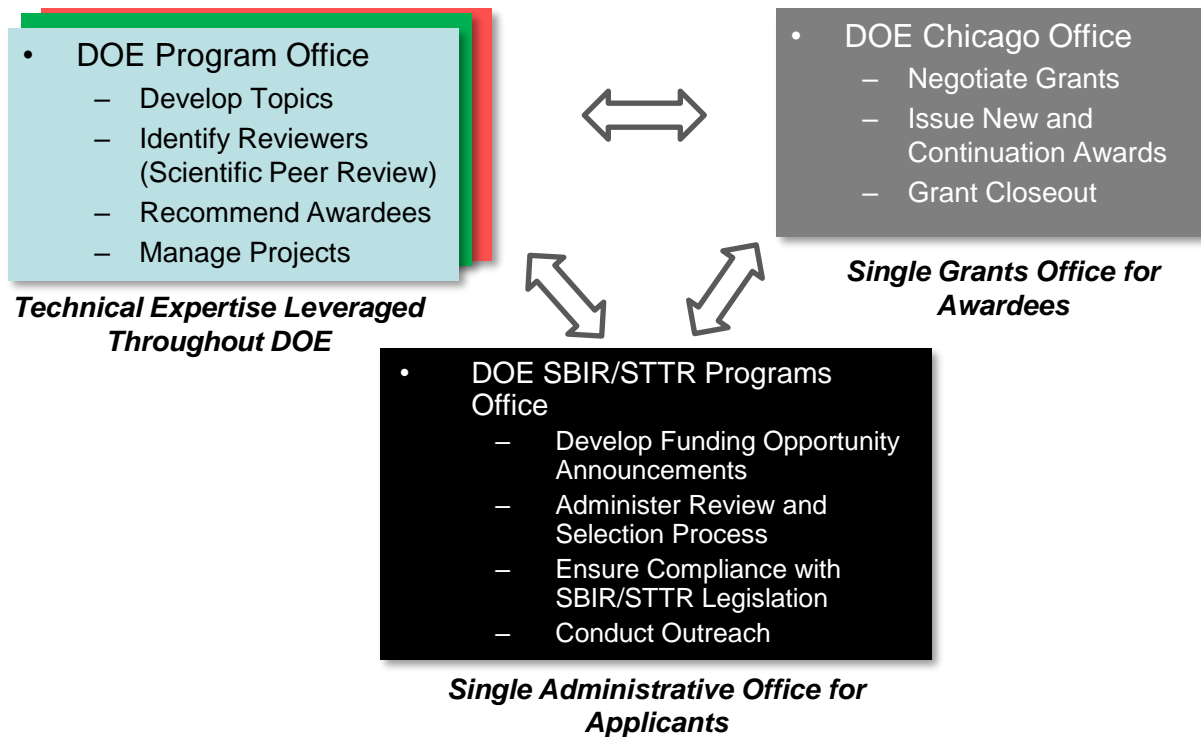
Phase I

Grant	Max award (\$k)	Small Business (Level of Effort)	Research Institution (Level of Effort)
SBIR	200	Min 66%	Optional
STTR	200	Min 40%	Min 30%

Phase II (including Sequential phases)

Grant	Max award (\$k)	Small Business (Level of Effort)	Research Institution (Level of Effort)
SBIR	1100	Min 50%	Optional
STTR	1100	Min 40%	Min 30%

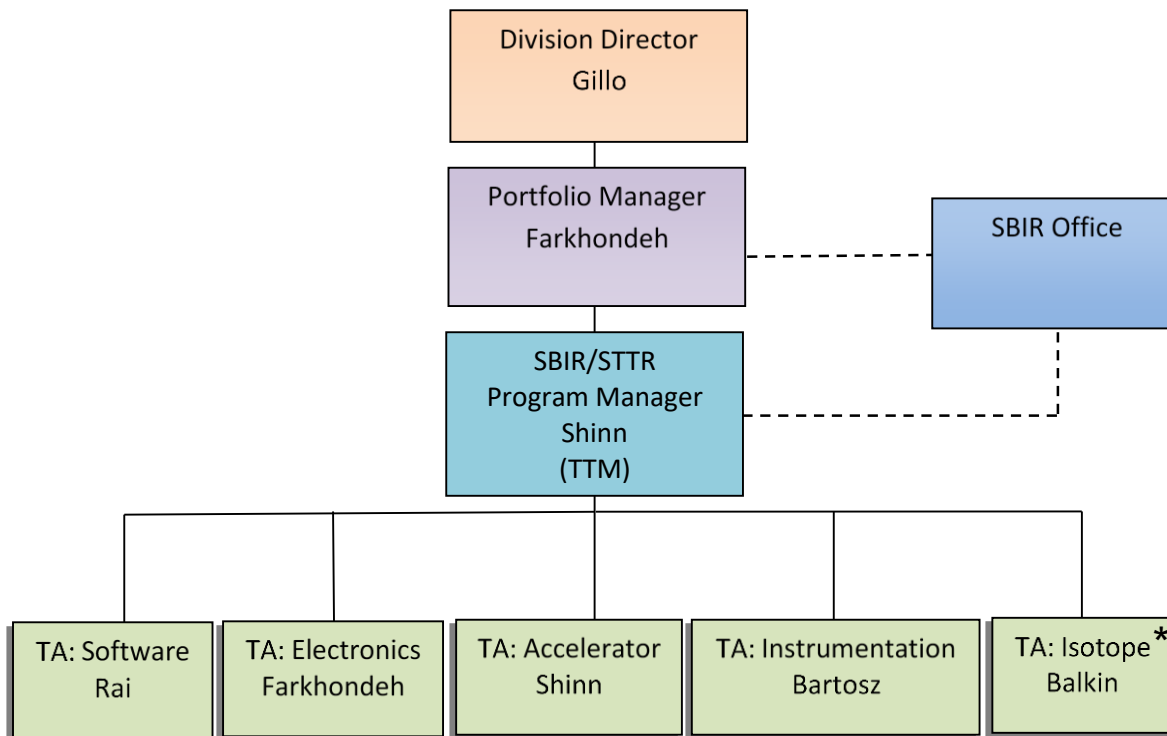
Organization of the DOE SBIR and STTR Programs



- NP recommends what R&D gets funded, but is otherwise freed of much of the administration of those funds.



NP SBIR/STTR Org. Chart 10/01/2018



Technical Topic Manager (TTM)

Activities

- Communicate w/ SBIR Office
- Prepare annual solicitation
- Chair 1st step panel review
- Organize & Chair Exchange Meeting
- Rank proposals
- Recommend funding
- Visit companies
- Read progress and final reports
- 2nd year continuation

Topic Associate (TA)

Activities for Assigned Topics

- Provide input to annual solicitation
- *Assign reviewers
- *Assess proposals
- Manage assigned grants
- Read reports assigned

*Time Sensitive tasks

- *In 2020 the DOE Isotope Program became its own Office
- It will no longer participate in the SBIR/STTR program
- Active Ph I and Ph II awards will still have the opportunity to apply for future award
 - e.g., Ph I → Ph II



Sequential II A, B, and C

2012 SBIR/STTR Reauthorization permitted agencies to issue **sequential Phase II awards**

- 15 USC 638 (ff) Additional SBIR and STTR awards. (1) Express authority for awarding a sequential Phase II award. A small business concern that receives a Phase II SBIR award or a Phase II STTR award for a project remains eligible to receive 1 additional Phase II SBIR award or Phase II STTR award for continued work on that project.
- Only Phase II awardees are eligible
- At most, 2 additional sequential Phase II awards may be made per Phase II project

Invitation needed →

Phase IIA: For certain prototypes, products, or processes that need more than a single Phase II award. Starts immediately upon completion of the Phase II.

- *DOE NP Program Managers will select the topics/subtopics for which Phase IIA applications will be accepted (By subtopic invitation only)*

No Invitation needed →

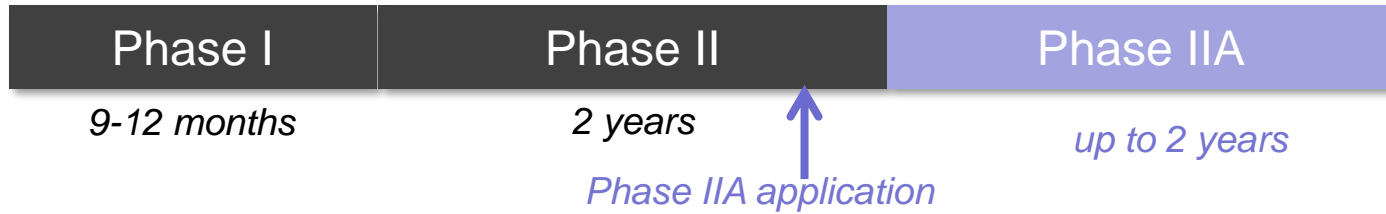
Phase IIB: For R&D funding required to transition an innovation towards commercialization. Starts immediately after completing a Phase II or up to 1 year later.

Phase IIC: An R&D to improve commercialization outcome – requires equal match in funding (up to \$1.1M) right after either a Phase IIA or Phase IIB

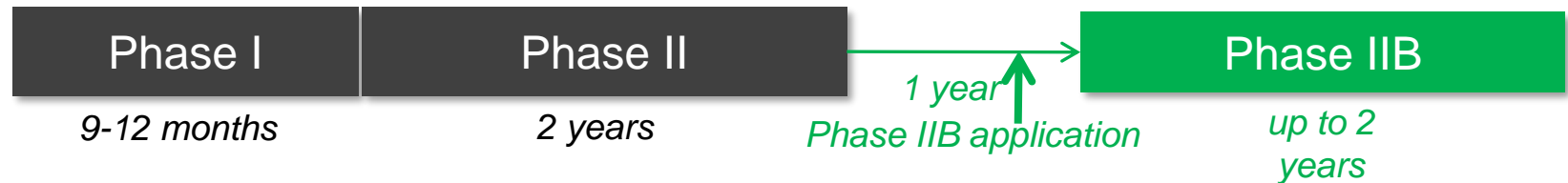
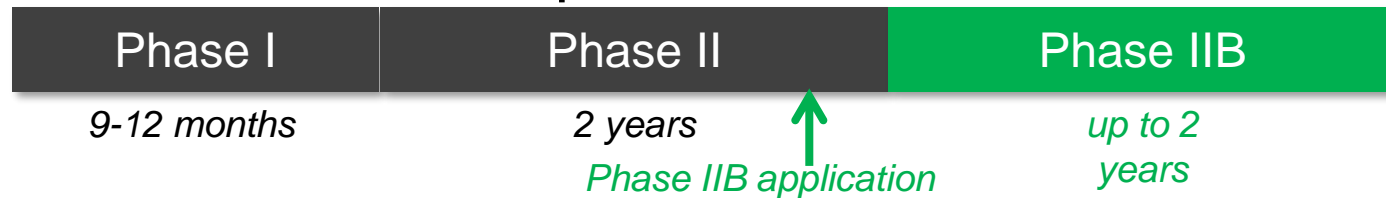
In the FY 2021 Phase II cycle: NP received 3 Ph IIAs, 2 Ph IIBs, and 0 Ph IIC applications. We funded 3 Ph IIAs. **As sequential IIA,B, and C compete with new Phase II applications, the success rate is usually lower. Covid-19 impacts (delays) led us to only fund Phase IIA proposals this year.**

Sequential Phase II timing

Sequential Phase IIA



Sequential Phase IIB



A Phase IIC immediately follows the Phase IIA or IIB

No Fund Extensions and Sequential Phase II Eligibility

- A company can only receive a Sequential Phase II award if their Phase II project has completed.
 - Phase IIA applicants should not request no fund extensions
 - Phase IIB applicants should not request no fund extensions if they are still working on their Phase II project at the time of application.



The NP SBIR/STTR Exchange Meeting

- NP is seeking to effectively assess the performance of NP supported SBIR/STTR projects in contributing to the NP mission and goals. Started in FY2010, the Exchange Meeting is designed to serve that purpose and to achieve the following goals:
 - To **provide a platform** for small businesses to present the status of NP-supported Phase II grant work to the NP community and Federal Program Managers.
 - To offer an opportunity to **exchange information** regarding the **companies' capabilities** and the technical needs of the NP programs.
 - To **strengthen the ties** of the SBIR/STTR businesses **with the community** and enhance the possibilities for commercialization.
- For this year's meeting, all Phase II awardees at the end of Year-1, Year-2 (started in FY20 and 19) and awards still active or recently concluded under "no cost extension" are invited. A total of **40** SBIR/STTR PI presentations will be given in 3 days.
- There is also two "Breakout rooms", Lobby 1 and Lobby 2, where groups may have meetings – you can just select the breakout room and move to it, then return.
- FY 2021 Phase II awardees are invited as participants only and will be invited to present in the next two year's meetings.
- Also included are three keynote talks related to NP long term initiatives, this year they will be one microelectronics and the Electron-Ion Collider (EIC).
- A talk by Dr. Manny Oliver, Director of the DOE SBIR/STTR Program Office will be on the 3rd day of the meeting.



2021 Exchange Meeting Agenda (Day 1)

Meeting Agenda-Day 1

Time (EDT)	Dur. (min)	Speaker	Organization	NP SBIR/ STTR Topic	Grant Status
Tuesday, August 17, 2021					
10:00 AM	5	Welcome and Introductory Remarks	Farkhondeh, Manouchehr	DOE, Office of Nuclear Physics	
10:05 AM	35	NP SBIR/STTR Program Overview	Shinn, Michelle	DOE, Office of Nuclear Physics	
10:40 AM	20	Nuclear Physics Gamma-ray Imaging System for Real-Time Rare Isotope Harvesting, Monitoring and Radiochemical Separation	Hull, Ethan	PHDs Co., TN	Instrumentation End Year 2
11:00 AM	20	Low Cost, High-Density Digital Electronics for Nuclear Physics	Skulski, Wojtek	SkuTek Instrumentation, NY	Electronics End Year 2/PH IIB/
11:20 AM	20	Manufacturing and Packaging of Reliable Bialkali Photocathodes via Sputtering	Nagarkar, Vivek	Radiation Monitoring Devices, MA Accelerator	End Year 2/NCE
11:40 AM	25	Coffee Break			
12:05 PM	20	Long-Term Radiation Rugged Rotary Vacuum and Water Seals in Heavy-Ion Accelerators	Lalli, Jennifer	NanoSonic, Inc, VA	Instrumentation End Year 2/IIA
12:25 PM	35	NP Instrumentation in the High Luminosity Era	Aschenauer, Elke	Broohaven National Laboratory	
1:00 PM	35	Lunch Break			
1:35 PM	20	Development of Gen-II LAPPDTM Systems For Nuclear Physics	Foley, Michael	Incom Inc., MA	Instrumentation End Year 2/new IIA
1:55 PM	20	Distributed digital data acquisition system with network time synchronization	Henning, Wolfgang	XIA LLC, CA	Software/Data End Year 2/NCE
2:15 PM	20	Boron Nitride Nanotube Vibration Damping for SRF Structures	Whitney, Roy	BNNT, LLC, Newport News, VA	Accelerator End Year 2/new PIIA
2:35 PM	20	IP Access Gateway	Radulescu, Radu	Telluric Labs, NJ	Software/Data End Year 2/NCE
2:55 PM	20	Radiation Hardened Infrared Focal Plane Arrays	Chang, Yong	Epir, Inc., IL	Instrumentation End of Year 2
3:15 PM	25	Coffee Break			
3:40 PM	20	12-bit 32 Channel 500MSps Low Latency ADC	Karnitski, Anton	Pacific Microchip Corp., CA	Electronics End Year 2/NCE
4:00 PM	20	Radiation Hard High Speed Camera System for Accelerator Beam Diagnostics	McBane, Doug	Alphacore Inc, AZ	Instrumentation End Year 1/Ph IIC
4:20 PM	20	Resonant Polarimetry and Magnetometry.	Roberts, Brock	Electrodynamic, Albuquerque,	Accelerator End Year 2/NCE
4:40 PM	20	High power fiber laser system for polarization of 3He gas	Lu, Wei	Raytum Photonics LLC, VA	Instrumentation End Year 2/NCE BES cc
5:00 PM	20	Automated Preparation Of 211AT For Targeted Alpha Therapy Applications	Marshall, Graham	Global FIA, Inc., WA	Isotope End Year 2/NCE
5:20 PM	20	Supercritical Fluid Separation and Purification of Rare Earth Elements, particularly Lanthanides including 177-Lu, to Lower Energy Consumption, Reduce Processing Time and Reduce Wastes	Sinclair, Laura	CF Technologies, MA	Isotope End Year 1
5:40 PM	0	Adjourn			



2021 Exchange Meeting Agenda (Day 2)

Meeting Agenda-Day 2

Time(EDT)	Dur. (min)	Grant Title	Speaker	Organization	NP SBIR/ STTR Topic	Grant Status
Wednesday, August 18, 2021						
10:00 AM	20	HOM Absorber Design for eRHIC ERL Cavity	Schultheiss, Tom	TJS Technologies, NY	Accelerator	End Year 2/New IIA
10:20 AM	20	Scintillating Bolometer Crystal Growth and Purification for Neutrinoless Double Beta Decay Experiments	Tower, Joshua	Radiation Monitoring Devices, Inc., MA	Instrumentation	End Year 2 IIA
10:40 AM	20	High Performance FPGA-based Embedded System for Decision Making in Scientific Environments	Yu, Dantong	Sunrise Technology, Inc	Software/Data	End Year/ASCR cofunc
11:00 AM	25	Coffee Break				
11:25 AM	35	NP Accelerator Needs at the Dawn of the EIC Era	Seryi, Andrei	Thomas Jefferson National Accelerator Facility		
12:00 PM	35	Lunch Break				
12:35 PM	20	A Multi-channel Radiation-tolerant, Low power, High-speed, and Resolution Analog-to-Digital Converter for Nuclear Physics Detectors	Gui, Ping	TallannQuest LLC DBA Apogee Semiconductor, TX	Electronics	End Year 2
12:55 PM	20	An RF beam Sweeper for Purifying In-Flight Produced Rare Isotope	Smirnov, Alexander	Radiabeam Technologies, LLC.,	Accelerator	End Year 1
1:15 PM	20	Ultrafast High Voltage Kicker System Hardware for Ion Clearing Gaps	Smirnov, Alexander	Radiabeam Technologies, LLC.,	Accelerator	End Year 1
1:35 PM	20	High Performance Scintillator and Beam Monitoring System	Friedman, Peter	Integrated Sensors, LLC, OH	Instrumentation	End Year 1
1:55 PM	20	Design and fabrication of the "AODS": All-in-One Digitizer System-on-Chip	Mostafanezhad, Isar	Nalu Scientific, LLC, HI	Electronics	End Year 1
2:15 PM	25	Coffee Break				
2:40 PM	20	Next-Generation Technology for the Extremely Efficient Storage, Distribution, and Processing of Nuclear Physics Data	Gonzalez, Juan	Accelogic, LLC, FL	Software/Data	End Year 2/NCE
3:00 PM	20	Radiation Hardened Opto-atomic Magnetometer	Choi, Jae	Hedgefog Research Inc., CA	Instrumentation	End Year 2
3:20 PM	20	Modeling Plasma Discharge Cleaning of SRF Cavities	Leddy, Jarrod	Tech-X Corporation, CO	Accelerator	End Year 2
3:40 PM	20	Low Cost Data Acquisition Synchronization for Nuclear Physics Applications	Skulski, Wojtek	SkuTek Instrumentation, NY	Electronics	End Year 2
4:00 PM	20	Low RF loss DC conductive Ceramic for High Power Input Coupler Windows for SRF Cavities	Kanareykin, Alex	Euclid Techlabs, LLC, OH	Accelerator	End Year 1/Ph IIA
4:20 PM	0	Adjourn				



2021 Exchange Meeting Agenda (Day 3)

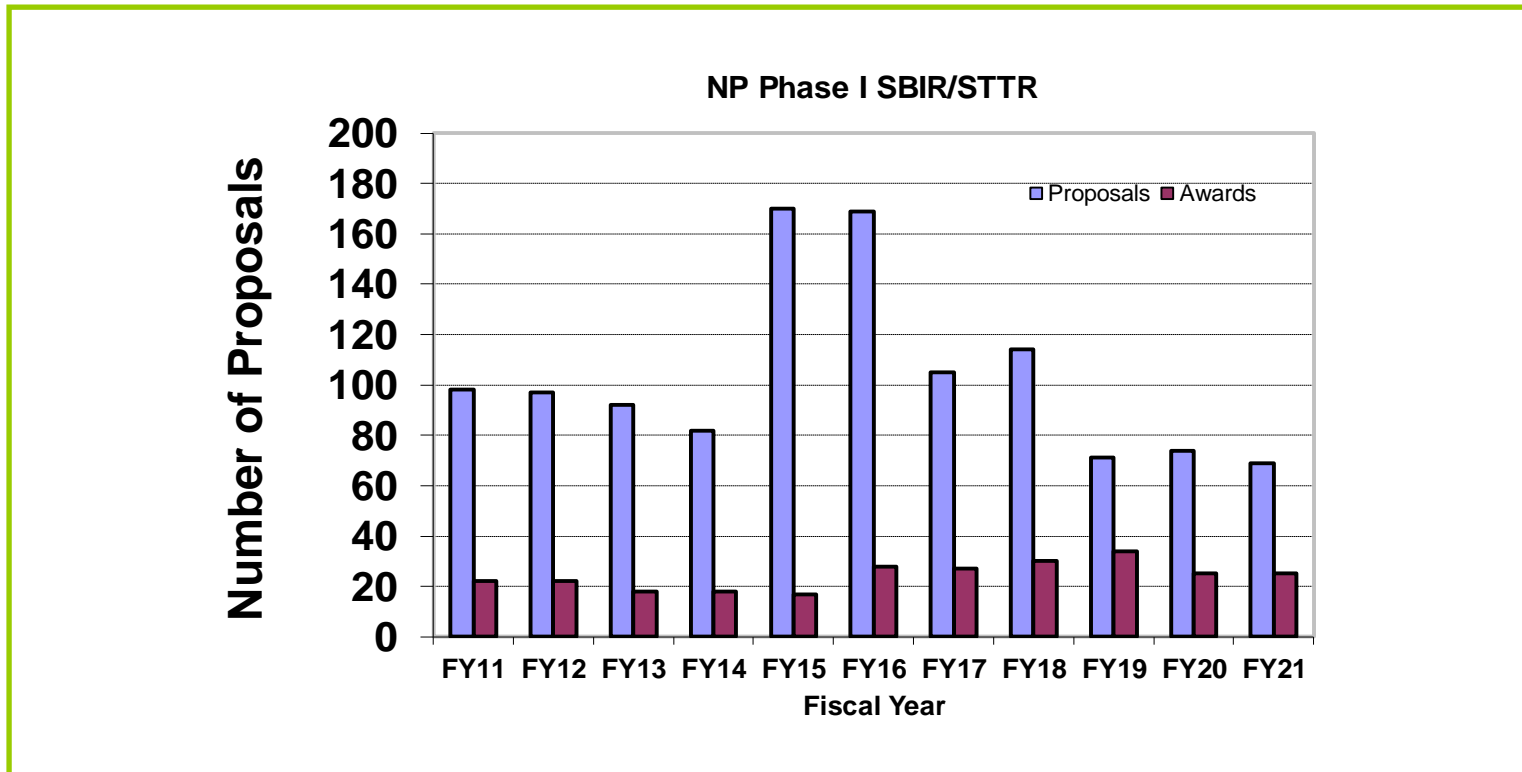
Meeting Agenda-Day 3

Time(EDT)	Dur. (min)	Grant Title	Speaker	Organization	NP SBIR/ STTR Topic	Grant Status
Thursday, August 19, 2021						
10:00 AM	20	TTDAQ: A CONTINUOUS FLOW, TIMING AND TRIGGER DAQ SYSTEM	Radulescu, Radu	Telluric Labs LLC, NJ	Electronics	End Year 1
10:20 AM	20	Additively Manufactured Z-Channel Detectors for Heavy Ion Accelerator Diagnostics	Moore, Jerome	Robot Nose Corporation, IL	Accelerator	End Year 1
10:40 AM	20	Cold Spray Technology Applications for SRF Cavity Thermal and Mechanical Stabilization.	Kanareykin, Alex	Euclid Techlabs, LLC, OH	Accelerator	End Year 1
11:00 AM	20	Dynamic friction in magnetized electron coolers for relativistic beams	Bruhweiler, David	RadiaSoft LLC	Accelerator	End Year 1
11:20 AM	25	Coffee Break				
11:45 AM	20	Highly Transparent Aerogel with Refractive Index < 1.01 for High Energy Particle Detection	Horn, Tanja	Scintilex, LLC, VA	Instrumentation	End Year 1
12:05 PM	35	Microelectronics for Nuclear Physics Instrumentation	Carini, Gabriella	Brookhaven National Laboratory		
12:40 PM	20	A novel injection-locked amplitude-modulated magnetron at 1497 MHz	Neubauer, Michael	Muons, Inc., IL	Accelerator	End Year 2/NCE
1:00 PM	35	Lunch Break				
1:35 PM	20	An ASIC with a Low Power Multichannel ADC for Energy and Timing Measurements	Karnitski, Anton	Pacific Microchip Corporation, CA	Electronics	End Year 2
1:55 PM	20	Precise and ultra-stable laser polarization control for polarized electron beam generation	Hu, Yimin	Raytum Photonics, VA	Accelerator	End Year 2
2:15 PM	20	Low-cost and Efficient Cooling of on-Detector Electronics Using Conformal Thermoelectric Modules	Joshi, Giri	Nanohmics, Inc., TX	Electronics	End Year 1
2:35 PM	20	A browser based toolkit for improved particle accelerator controls	Edelen, Jonathan	RadiaSoft LLC, CO	Accelerator	End Year 1
2:55 PM	35	Update on the Department of Energy SBIR/STTR Program, Q/A	Oliver, Manny	DOE, SBIR/STTR Office		
3:30 PM	0	Adjourn				



NP Phase I SBIR/STTR Applications and Awards

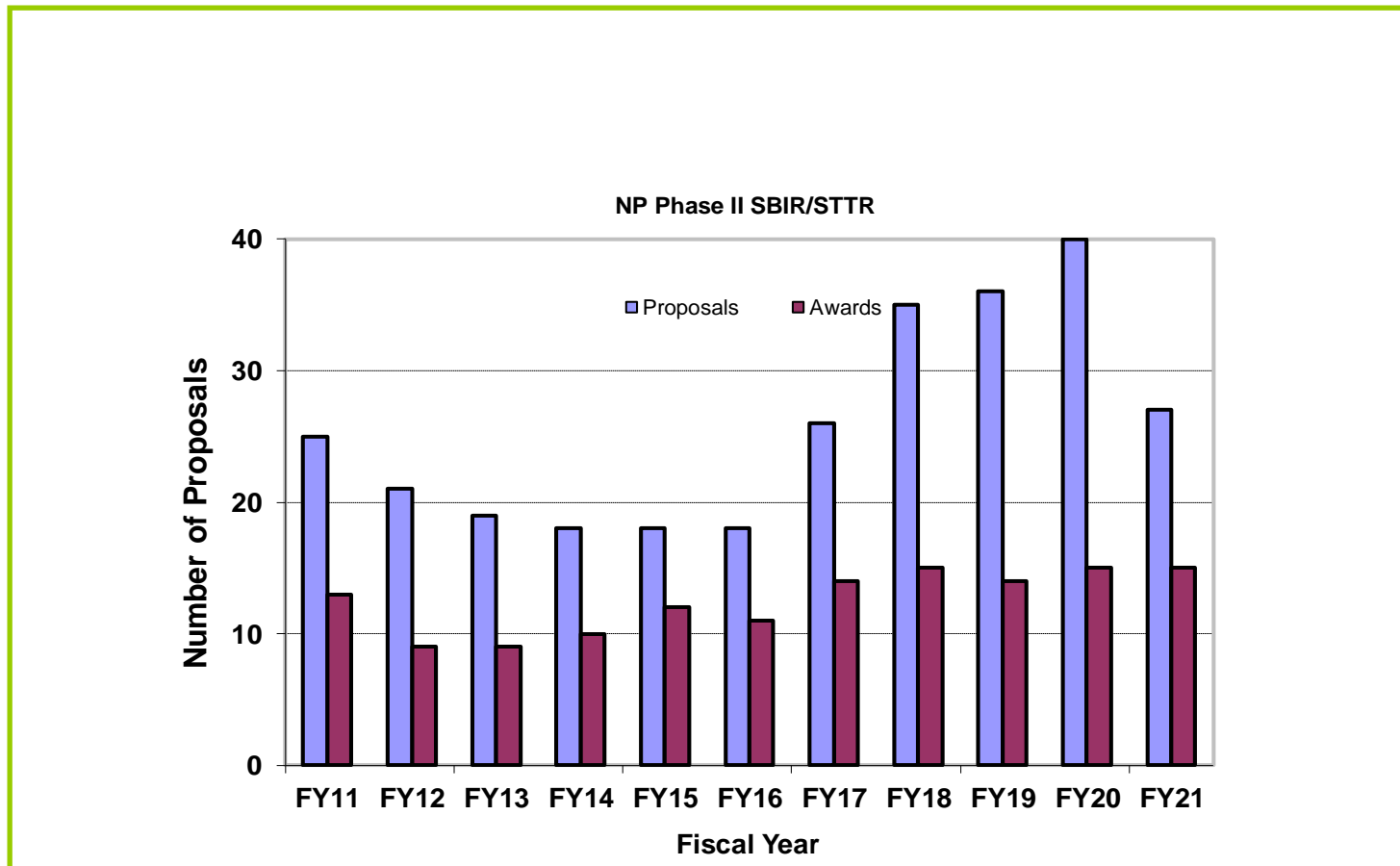
- NP received a total of **139** Letters of Intent and **69** phase I proposals in FY 2021, with **398** review requests for a total of **171** mail reviews. Total of **25** proposals funded (cf 25 in FY20).





NP Phase II SBIR/STTR Applications and Awards

- The increased number of Phase I awards in FY19 is reflected in the increased number of FY20 Phase II proposals. We were able to rebalance this in FY21. This year we only had 1 STTR proposal and so cofounded a second with ASCR.



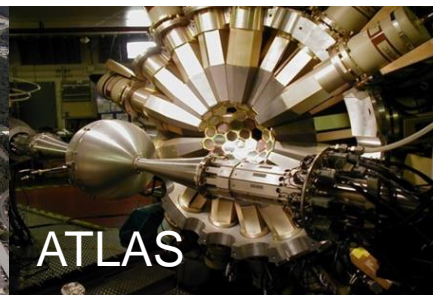


Nuclear Physics Mission

Discovering, exploring, and understanding all forms of nuclear matter

The Scientific Challenges

- The existence and properties of nuclear matter under extreme conditions, including that which existed at the beginning of the universe
- The exotic and excited bound states of quarks and gluons, including new tests of the Standard Model
- The ultimate limits of existence of bound systems of protons and neutrons
- Nuclear processes that power stars and supernovae, and synthesize the elements
- The nature and fundamental properties of neutrons and the neutrino and their role in the evolution of the early universe





How the NP Mission translated into programs for FY21

- NP's major program areas are:
 - Heavy Ion Nuclear Physics
 - Medium Energy Physics
 - Nuclear Structure-Nuclear Astrophysics
 - Fundamental Symmetries
 - Nuclear Theory
- } Low Energy Nuclear Physics
- Accelerator Science and Technology is a major component that facilitates all of the NP subprograms.
 - Within the program areas are two other subprograms, Nuclear Physics Computing and Nuclear Data, with communities we seek to serve.

NP SBIR/STTR Topics for FY21 supported these programs

- Software and Data Management
 - Electronics Design and Fabrication
 - Accelerator Technology
 - Instrumentation, Detection Systems and Techniques
-
- Every year there is subtopic revision, based on community input.



Our Topic narratives reflect areas of NP strategic importance – our “brand”

- Within each Topic, our subtopics reflect the following strategy,
- Use SBIR/STTR funding of small businesses to maintain leadership in technology areas where NP has unique needs.
 - Superconducting RF (SRF) accelerators and related technologies (e.g. cryogenics)
 - Polarized sources
 - CW RF sources
 - High current ion sources
 - Detectors with emphasis on particle identification
 - Microelectronics for extreme environments e.g., high rad from a range of heavy ions, cryogenic (≤ 2 K)
- We are interested where applicable in R&D that advances the recently published DOE Initiatives: Advanced and Sustainable Energy, AI/ML, Genomics, High Performance Computing, Large-Scale Scientific Instrumentation, and QIS
- <https://www.energy.gov/science/initiatives>



Subtopic requests must be right-sized & timed

- We match the facility's Accelerator Improvement Projects and Capital Equipment activities and mid-term upgrade plans to 3 year SBIR/STTR funding cycle.
 - Same for universities or other collaborations working on detectors.
- We coordinate with other Offices to not duplicate efforts unless a particular technology is synergistic.
 - An example might be lower cost SRF cavity fabrication that would benefit from additional investment.
- Proposed R&D must be of sufficient value to the NP community to justify the investment.

NP mission and strategic priorities tied to our community and its facilities → NP SBIR/STTR subsequent commercialization

- The 2016 National Academy of Sciences review of the DOE SBIR/STTR Phase II program had several recommendations. Two of significance are:
 - DOE should seek to develop programs linking Laboratories' procurement actions with relevant SBIR/STTR projects.
 - DOE should examine from a strategic perspective how the relationship of SBIR/STTR with the National Laboratories works today.
- We believe that the adoption by a Lab of the product from a finished grant more likely is to ask that a prototype or method be ready for testing in a NP application by the grant's conclusion
 - This increases the likelihood there will be hardware that can be rapidly purchased and deployed to fulfill the NP community's needs, as well as adjacent (national security, academic, etc.) areas.
 - Which appears to lead to higher rates of commercialization!



NP SBIR/STTR Program Updates – FY21/22

- We are co-funding awards with other SC Offices. In FY20, we contributed to awards made by ASCR, BES, and HEP
- DOE press releases on SBIR/STTR awards featured on our landing page News section
- Research Div. Program Managers asking their PIs to look at SBIR/STTR awards for possible collaboration or source of hardware/software
- We instituted changes to this meeting –
 - We've decided to stay at 20min oral talks for PIs, but having a 3rd day rather than the parallel sessions of FY20 or the poster sessions of FY19.
 - Talks by 2 PIs we cofounded will be speaking.
 - Rather than feature talks from Facilities staff, we are having talks by experts from the community about future needs.



Presentation Notes

- We have a tight agenda and must stay on time for each oral presentation.
- Sessions will start promptly at the time stated on the agenda.
- Make sure your presentation file is ready to display before the start of your talk. If you encounter problems, use Chat to let the hosts know so one of us can share your presentation.
- For Q&A sessions, please make your comments/questions short and use the coffee and lunch breaks for follow up by asking to go to breakout rooms Lobby 1 or Lobby 2
- The meeting hosts will stop sharing your screen at the end of your allotted time. A timer will be visible on screen as an aid.

Total presentation (min)	Presentation (min)	Q&A (min)	5 minute warning (min)
35	29	6	24 & 27
20	17	3	12 & 15

Conclusions

- NP uses the Congressionally-mandated SBIR/STTR Program –
 - To fund R&D that benefits the NP community
 - To build and sustain a US-based commercial infrastructure that serves society in areas other than nuclear science
- Five years of funding is equivalent to that of a large research effort
 - For example, FY14-18 funding amounted to \$81M
 - With input from NP Program Managers and the community, the NP SBIR/STTR program uses those funds for R&D that advances our core technologies as well as new initiatives, such as AI/ML
- NP uniquely fosters connections between its community and the small businesses that serve it through this annual meeting
 - This is becoming evident in the collaborations springing up between the PIs that attended past meetings as well as this one