

The DOE Nuclear Physics SBIR/STTR Program

SBIR/STTR Exchange Meeting
August 23-25, 2022
via Zoom

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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 Mission
 - Supporting this mission within the NP SBIR/STTR program
- Exchange meeting goals and agenda
- NP SBIR/STTR applications and awards metrics (FY 2022)
- The NP Mission and how it translates into SBIR/STTR Topics/Subtopics
- The DOE NP SBIR/STTR Program in FY2022-23
- Presentation Notes
- Conclusions



The SC statement on Diversity, Equity & Inclusion

The direct link is:

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

“The DOE Office of Science (SC) is fully committed to fostering safe, diverse, equitable, and inclusive work, research, and funding environments that value mutual respect and personal integrity. Effective stewardship and promotion of diverse and inclusive workplaces that value and celebrate a diversity of people, ideas, cultures, and educational backgrounds is foundational to delivering on the SC [mission](#). The scientific community engaged in SC-sponsored activities is expected to be respectful, ethical, and professional.

The DOE SC does not tolerate discrimination or harassment of any kind, including [sexual or non-sexual harassment](#), bullying, intimidation, violence, threats of violence, retaliation, or other disruptive behavior in the federal workplace, including DOE field site offices, or at national laboratories, scientific user facilities, academic institutions, other institutions that we fund, or other locations where activities that we support are carried out...”

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**
 - **Manny Oliver will address lack of reauthorization in his talk**

	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 (FY22)

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 IIA OR IIB: CONTINUE R/R&D FOR PROTOTYPES OR PROCESSES

- **PHASE IIA:** FOR CERTAIN PROTOTYPES, PRODUCTS, OR PROCESSES THAT NEED MORE DEVELOPMENT
- **PHASE IIB:** FOR R&D FUNDING REQUIRED TO TRANSITION AND/OR INNOVATION TOWARDS COMMERCIALIZATION.
- **PHASE IIC:** 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 2022)

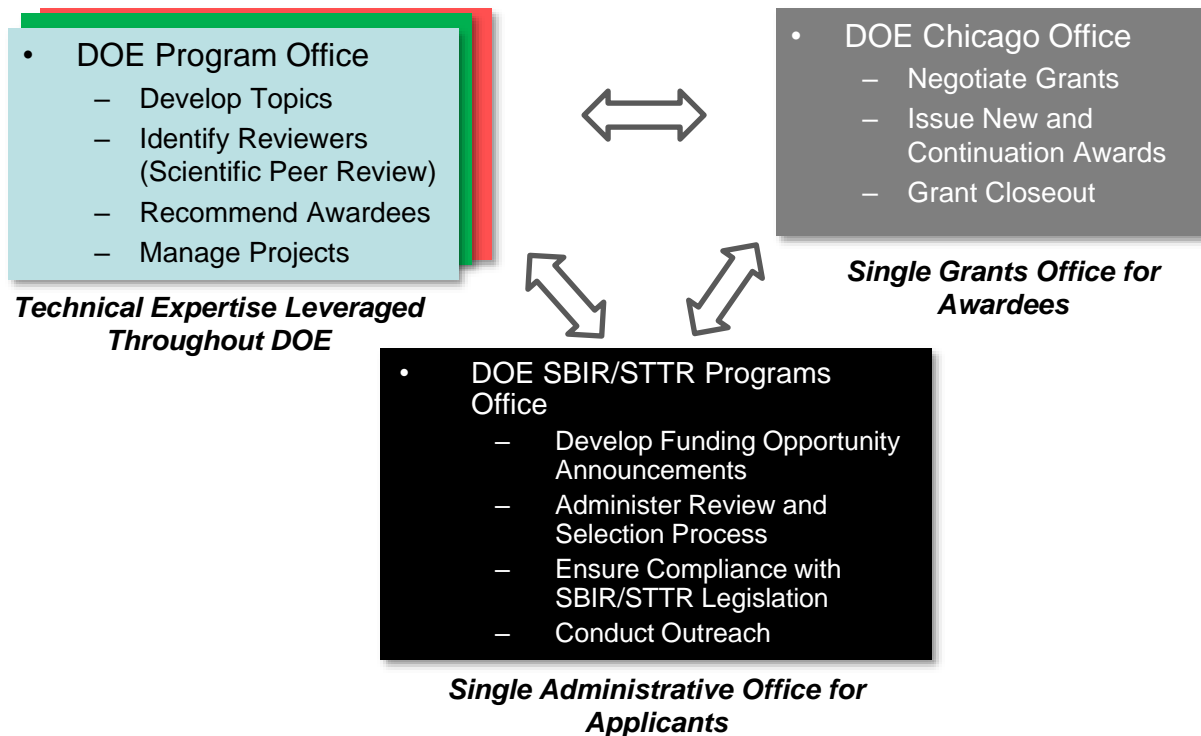
Phase I Release 1

- 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)

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.



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 →

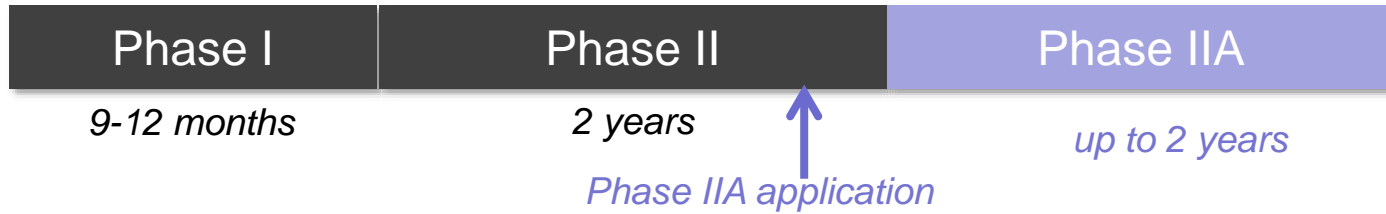
Phase IIB: For R&D funding required to transition an innovation towards commercialization. Starts immediately after completing a Phase II or up to 1 year later.

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

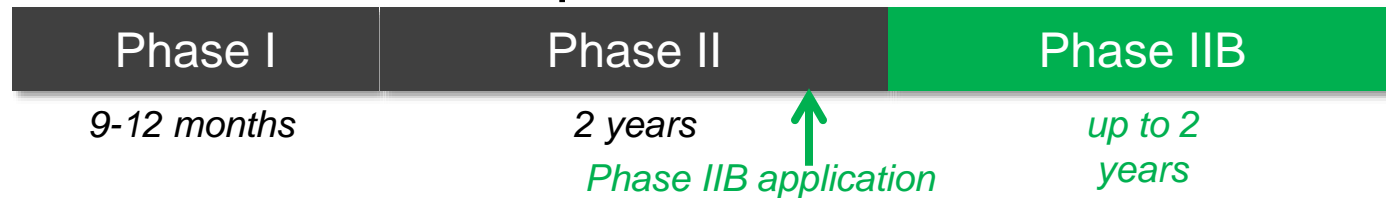
In the FY 2022 Phase II cycle: NP received 7 Ph IIAs, 3 Ph IIBs, and 0 Ph IIC applications. We funded 2 Ph IIAs & 1 Ph IIB. **As sequential IIA,B, and C compete with new Phase II applications, the success rate is usually lower. Covid-19 impacts (delays) led to more Phase IIA proposals this year.**

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 generally not request no fund extensions if they wish to apply for a Phase IIB
 - 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 21) 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 are 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 2022 Phase II awardees are invited as participants only and will be invited to present in the next two year's meetings.
- Included is a keynote talk on the DOE SBIR/STTR Program Office's Diversity, Equity, and Inclusion initiatives by Dr. Eileen Chant on the 1st day, as well as one by Dr. Manny Oliver, Director of the DOE SBIR/STTR Program Office on the 3rd day of the meeting.

2022 Exchange Meeting Agenda (Day 1)

Meeting Agenda-Day 1

Time (EDT)	Dur. (min)		Speaker	Organization	NP SBIR/ STTR Topic	Grant Status
Tuesday, August 23, 2022						
10:00 AM	0:01	Welcome and Introductory Remarks	Hallman, Timothy	DOE, Office of Nuclear Physics		
10:01 AM	0:04	Welcome and Introductory Remarks	Farkhondeh, Manouchehr	DOE, Office of Nuclear Physics		
10:05 AM	0:35	NP SBIR/STTR Program Overview	Shinn, Michelle	DOE, Office of Nuclear Physics		
10:40 AM	0:20	Radiation Hardened Infrared Focal Plane Arrays	Chang, Yong	Epir, Inc., IL	Instrumentation	End of Year 1/IIA
11:00 AM	0:20	Boron Nitride Nanotube Vibration Damping for SRF Structures	Whitney, Roy	BNNT, LLC, Newport News, VA	Accelerator	End Year 2/new PIIA
11:20 AM	0:20	CMOS Integrated With Float Zone Pixel Sensor	Patti, Robert	NHanced Semiconductors, Inc., IL	Electronics	End Year 1
11:40 AM	0:25	Coffee Break				
12:05 PM	0:20	Fast Multi-Harmonic Kickers	Roberts, Brock	Electrodynamic, NM	Accelerator	End Year 1
12:25 PM	0:20	Large Area Multi-Anode MCP-PMT for High Rate Applications	Foley, Michael	Incom Inc., MA	Instrumentation	End Year 1
12:45 PM	0:35	Lunch Break				
1:20 PM	0:20	Digital Data Acquisition with High Resolution and Linearity	Skulski, Wojtek	SkuTek Instrumentation, NY	Electronics	End Year 1
1:40 PM	0:20	High-Quality Conductive Bellows Coatings Using Conformal Ionized PVD To Replace Unreliable Electroplating Processes	Houlahan, Thomas	Starfire Industries LLC, Champaign, IL	Accelerator	End Year 1
2:00 PM	0:20	A New Approach to Achieving High Granularity in Low-Gain Avalanche Detectors	Islam, Rafiqul	Cactus Materials, Tempe, AZ	Electronics	End Year 1
2:20 PM	0:20	Energy Recovery Linac Designs and Studies for Electron Cooling of Hadron Beams	Gulliford, Colwyn	Xelera Research LLC, Ithaca, NY	Accelerator	End Year 1
2:40 PM	0:20	Large Volume Ring-Contact HPGe Detectors (RCD) for Low-Background	Hull, Ethan	PHDS Co., Knoxville, TN	Instrumentation	End Year 1
3:00 PM	0:20	DOE SBIR/STTR Diversity, Equity, and Inclusion Activities	Chant, Eileen	DOE, SBIR/STTR Office		
3:20 PM	0:25	Coffee Break				
3:45 PM	0:20	High Performance Glass Scintillators for Nuclear Physics Experiments	Horn,Tanja	Scintilex, LLC, Alexandria, VA	Instrumentation	End Year 1
4:05 PM	0:20	High Performance FPGA-based Embedded System for Decision Making in Scientific Environments	Sun,Yu	Sunrise Technology, Inc, NY	Software	End Year 2/ASCR cofu
4:25 PM	0:20	An ASIC with a Low Power Multichannel ADC for Energy and Timing Measurements	Karnitski, Anton	Pacific Microchip Corporation, Culver City, CA	Electronics	New Ph IIB
4:45 PM	0:20	Radiation Hardened Opto-atomic Magnetometer	Hull, Chris	Hedgefog Research Inc., CA	Instrumentation	New Ph IIA
5:05 PM	0:20	Design and Fabrication of the HDSoc- High Density Digitizer System-on-Chip	Macchiarulo, Luca	Nalu Scientific, LLC, Honolulu, HI	Electronics	Year 1
5:25 PM	0	Adjourn				

2022 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 24, 2022						
10:00 AM	0:20	HOM Absorber Design for eRHIC ERL Cavity	Schultheiss, Tom	TJS Technologies, NY	Accelerator	End Year 1 Phase IIA
10:20 AM	0:20	Highly Transparent Aerogel with Refractive Index < 1.01 for High Energy Particle Detection	Horn, Tanja	Scintilex, LLC, Alexandria, VA	Instrumentation	End Year 2
10:40 AM	0:20	Low-cost and Efficient Cooling of on-Detector Electronics Using Conformal Thermoelectric Modules	Joshi, Giri	Nanohmics, Inc., Austin, TX	Electronics	End Year 2/NCE
11:00 AM	0:25	Coffee Break				
11:25 AM	0:20	Low RF loss DC conductive Ceramic for High Power Input Coupler Windows for SRF Cavities	Freemire, Ben	Euclid Techlabs, LLC, OH	Accelerator	End Year 2/Ph IIA
11:45 AM	0:20	Cold Spray Technology Applications for SRF Cavity Thermal and Mechanical Stabilization.	Kostin, Roman	Euclid Techlabs, LLC, Solon, OH	Accelerator	End Year 2/NCE
12:05 PM	0:35	Lunch Break				
12:40 PM	0:20	Radiation Hard High Speed Camera System for Accelerator Beam Diagnostics	Mikkola, Esko	Alphacore Inc, Tempe, AZ	Instrumentation	End Year 2/IIC
1:00 PM	0:20	TTDAQ: A CONTINUOUS FLOW, TIMING AND TRIGGER DAQ SYSTEM	Radulescu, Radu	Telluric Labs, Red Bank, NJ	Software	End Year 2
1:20 PM	0:20	A browser based toolkit for improved particle accelerator controls	Edelen, Jonathan	RadiaSoft LLC, Boulder, CO	Accelerator	End Year 1
1:40 PM	0:20	High Performance Scintillator and Beam Monitoring System	Friedman, Peter	Integrated Sensors, LLC, OH	Instrumentation	End Year 2
2:00 PM	0:20	Design and fabrication of the "AODS": All-in-One Digitizer System-on-Chip	Mostafanezhad, Isar	Nalu Scientific, LLC, HI	Electronics	End Year 2
2:20 PM	0:25	Coffee Break				
2:45 PM	0:20	Supercritical Fluid Separation and Purification of Rare Earth Elements, particularly Lanthanides including 177-Lu, to Lower Energy	Moses, John	CF Technologies, Inc., Hyde Park, MA	Isotopes	End Year 2/NCE
3:05 PM	0:20	Long-Term Radiation Rugged Rotary Vacuum and Water Seals in Heavy-	Lalli, Jennifer	NanoSonic, Inc., Pembroke, VA	Accelerator	End Year 2
3:25 PM	0:20	Low Cost Data Acquisition Synchronization for Nuclear Physics Applications	Skulski, Wojtek	SkuTek Instrumentation, NY	Electronics	End Year 2
3:45 PM	0:20	Automated Preparation Of 211At For Targeted Alpha Therapy Applications	Marshall, Graham	Global FIA, Inc., Fox Island, WA	Isotopes	End Year 2/Ph IIA
4:05 PM	0	Adjourn				

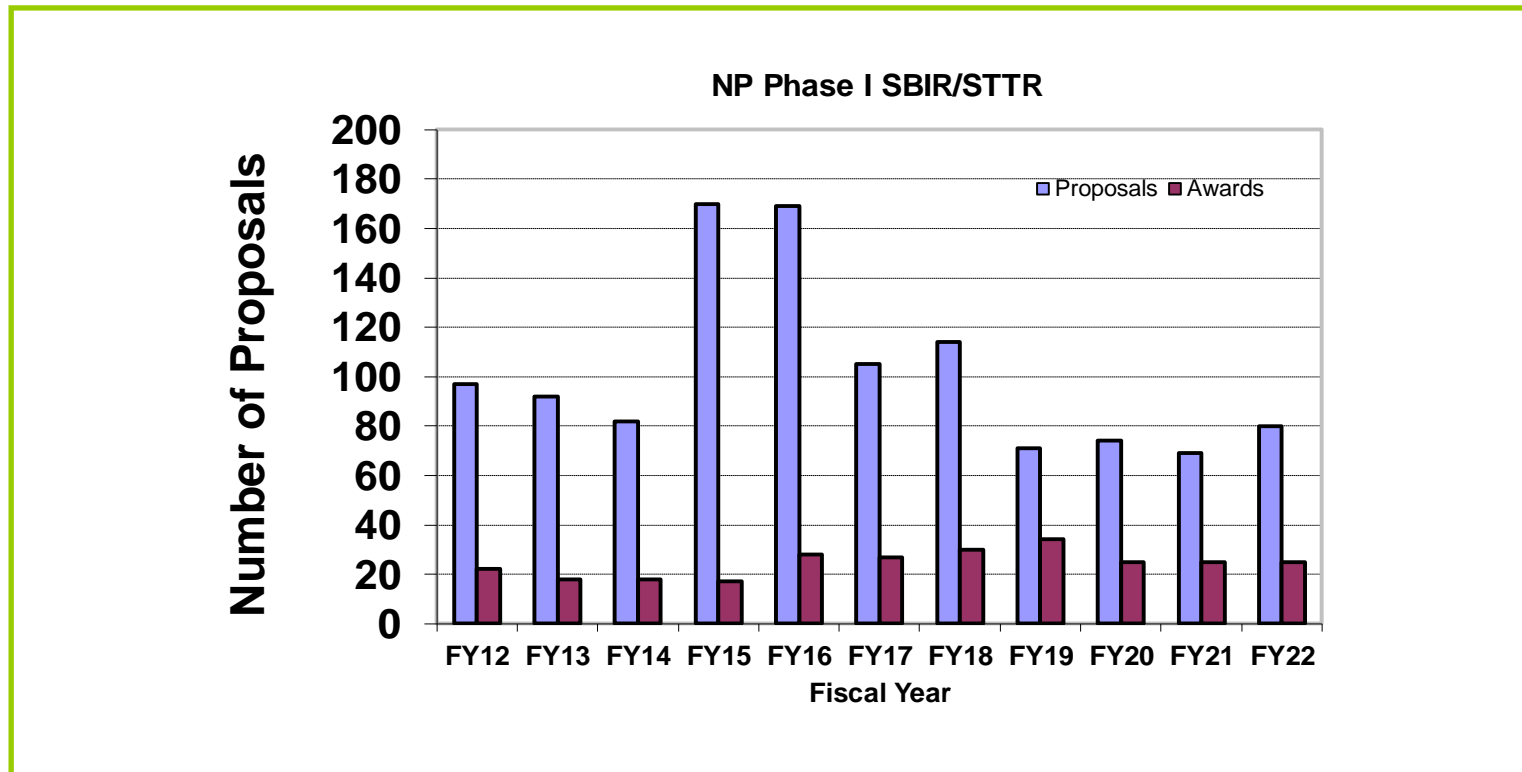
2022 Exchange Meeting Agenda (Day 3)

Meeting Agenda-Day 3

Time(EDT)	Dur. (min)	Grant Title	Speaker	Organization	NP SBIR/ STTR Topic	Grant Status
Thursday, August 25, 2022						
10:00 AM	0:20	Precise and ultra-stable laser polarization control for polarized electron beam generation	Lu, Wei	Raytum Photonics, VA	Accelerator	End Year 2
10:20 AM	0:20	Modeling Plasma Discharge Cleaning of SRF Cavities	Leddy, Jarrod	Tech-X Corporation, Boulder, CO	Accelerator	End Year 3
10:40 AM	0:20	IP Access Gateway	Radulescu, Radu	Telluric Labs LLC, Red Bank, NJ	Software	End Year 4/NCE
11:00 AM	0:20	Coffee Break				
11:20 AM	0:20	Scintillating Bolometer Crystal Growth and Purification for Neutrinoless Double Beta Decay Experiments	Tower, Joshua	Radiation Monitoring Devices, Inc., MA	Instrumentation	End Year 3/IIA
11:40 AM	0:20	Low Cost, High-Density Digital Electronics for Nuclear Physics	Skulski, Wojtek	SkuTek Instrumentation, NY	Instrumentation	End Year 3/IIB
12:00 PM	0:35	Lunch Break				
12:35 PM	0:20	A novel injection-locked amplitude-modulated magnetron at 1497 MHz	Neubauer, Michael	Muons, Inc., IL	Accelerator	End Year 4/NCE
12:55 PM	0:20	Distributed digital data acquisition system with network time synchronization	Henning, Wolfgang	XIA LLC, CA	Software/Data	End Year 4/NCE
1:15 PM	0:20	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/NCE
1:35 PM	0:20	Ultrafast High Voltage Kicker System Hardware for Ion Clearing Gaps	Smirnov, Alexander	RadiaBeam Systems, CA	Accelerator	End Year 2
1:55 PM	0:20	Novel methods for in-situ high-density surface cleaning (scrubbing) of ultrahigh vacuum long (100m or longer) narrow tubes to reduce secondary electron yield and outgassing	Herschovitsch, Ady	Poole Ventura, Inc., Oxnard, CA & Brookhaven National Lab	Accelerator	Year 2
2:15 PM	0:20	An RF beam Sweeper for Purifying In-Flight Produced Rare Isotope Beams	Smirnov, Alexander	RadiaBeam Systems, Santa Monica, CA	Accelerator	End Year 2/new IIA
2:35 PM	0:35	Update on the Department of Energy SBIR/STTR Program, Q/A	Oliver, Manny	DOE, SBIR/STTR Office		
3:10 PM	0	Adjourn				

NP Phase I SBIR/STTR Applications and Awards

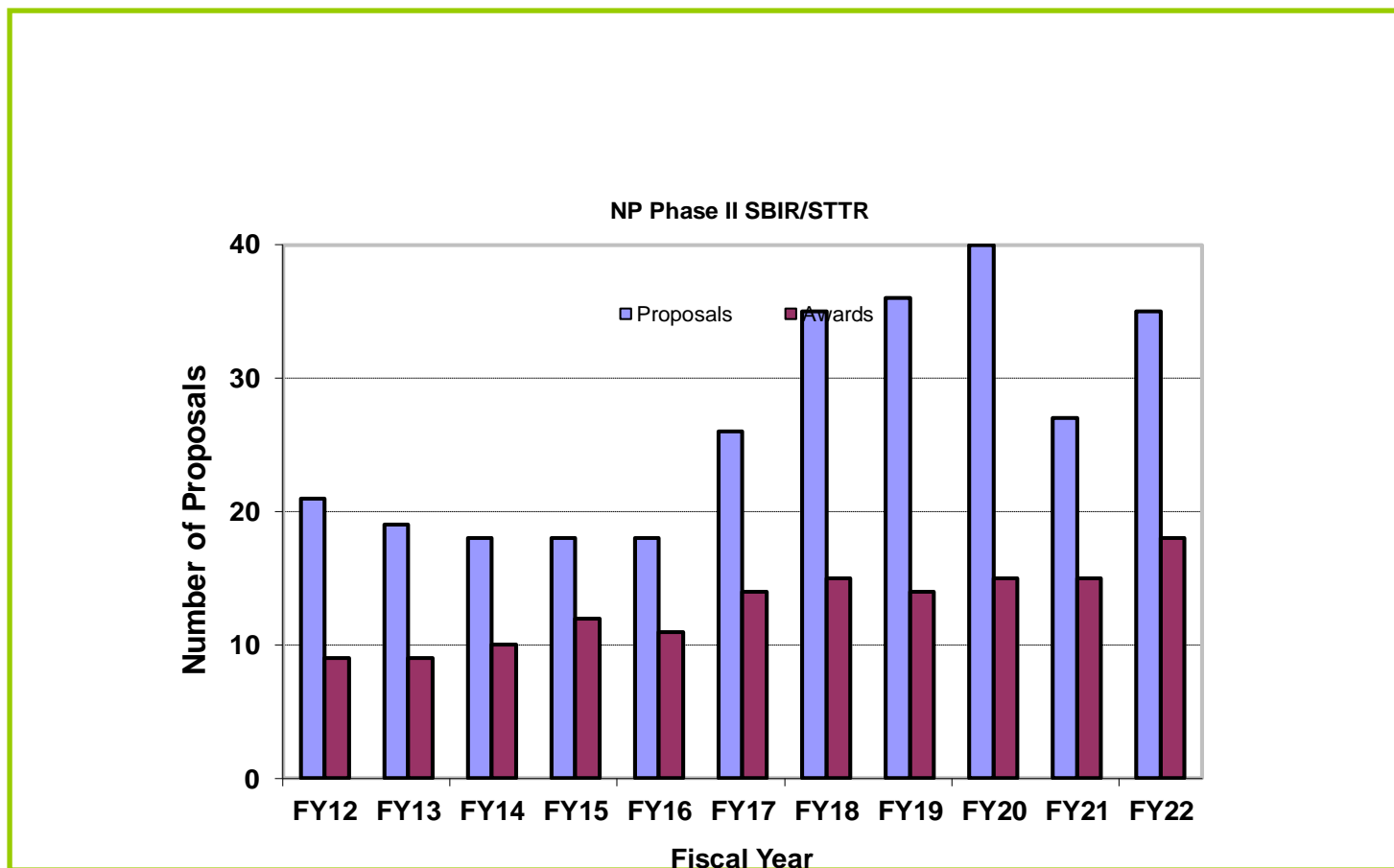
- NP received a total of **139** Letters of Intent and **80** phase I proposals in FY 2022, with over **450** review requests for a total of **216** mail reviews. Total of **25** proposals funded (cf 25 in FY21).





NP Phase II SBIR/STTR Applications and Awards

- FY22 saw an increase in submissions over FY21. While total numbers were initially the same as FY21, the appropriation resulted in an increase to 18, plus a co-fund with ASCR.



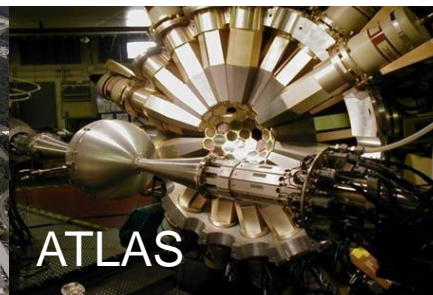


Nuclear Physics Mission

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 FY22

- 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 FY22 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 published DOE Initiatives: Advanced and Sustainable Energy, AI/ML, Genomics, High Performance Computing, Large-Scale Scientific Instrumentation, and QIS



Subtopic requests must be right-sized & timed

- We match 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.



- We continue to co-fund awards with other SC Offices. In FY22, we contributed to a Ph II SBIR award made by ASCR
 - There is a talk by a PI we co-funded with ASCR in 2020
- FY23 FOA has explicit language explaining criteria used to make final decisions on proposals that are recommended for funding
- DOE-SC has changed the activities which are considered “extramural R&D” and subject to the set-aside to bring it into alignment with the rest of DOE
 - Facility operations and support now excluded
- This greatly impacts the NP SBIR/STTR Program, funding will decrease substantially in FY23 and outyears, awaiting guidance from SC Budget Office to know how much
 - Possible impacts – no Sequential awards, drop Software Topic entirely and possibly rotate remaining Topics in outyears
- For this year’s meeting –
 - This year we will not feature talks about future needs. Refer to last year’s presentations as they are still current.

<https://science.osti.gov/np/Benefits-of-NP/SBIR-STTR/sbir-sttr-exchange-mtg-2021>



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)	warning (minutes)
35	29	6	24
20	17	3	12

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