U.S. DEPARTMENT OF ENERGY | Office of Science

The DOE Nuclear Physics SBIR/STTR Program

SBIR/STTR Exchange Meeting
August 15-17, 2023
DoubleTree by Hilton Washington DC North/Gaithersburg and via Zoom

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DOE Office of Science
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 Mission
  - Supporting this mission within the NP SBIR/STTR program
- Exchange meeting goals and agenda
- NP SBIR/STTR applications and awards metrics (FY 2023)
  - Impacts of funding allocation change
- The NP Mission and how it translates into SBIR/STTR Topics/Subtopics
- Changes to the DOE NP SBIR/STTR Program in FY2023-24
  - Modifications to Topics in new funding arrangement
  - Promoting Inclusive and Equitable Research (PIER) Plans
- Presentation Notes
- Conclusions

The SC statement on Diversity, Equity & Inclusion

The direct link is:
https://science.osti.gov/SW-DEI/DOE-Diversity-Equity-and-Inclusion-Policies

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https://science.osti.gov/SW-DEI/DOE-Diversity-Equity-and-Inclusion-Policies/How-to-Report-a-Complaint

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.
- 2022 reauthorization bill has provided funding for the program until September 2025
- Specifies reviews for national security risks, cybersecurity and commercialization metrics

	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	-----	FY2024
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%**

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The DOE SBIR/STTR Phases (FY23-FY24)

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

Slide modified from M. Oliver, SBIR/STTR Office

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Phase I Funding Opportunity Announcements Participating DOE Programs (FY 2023)

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)**

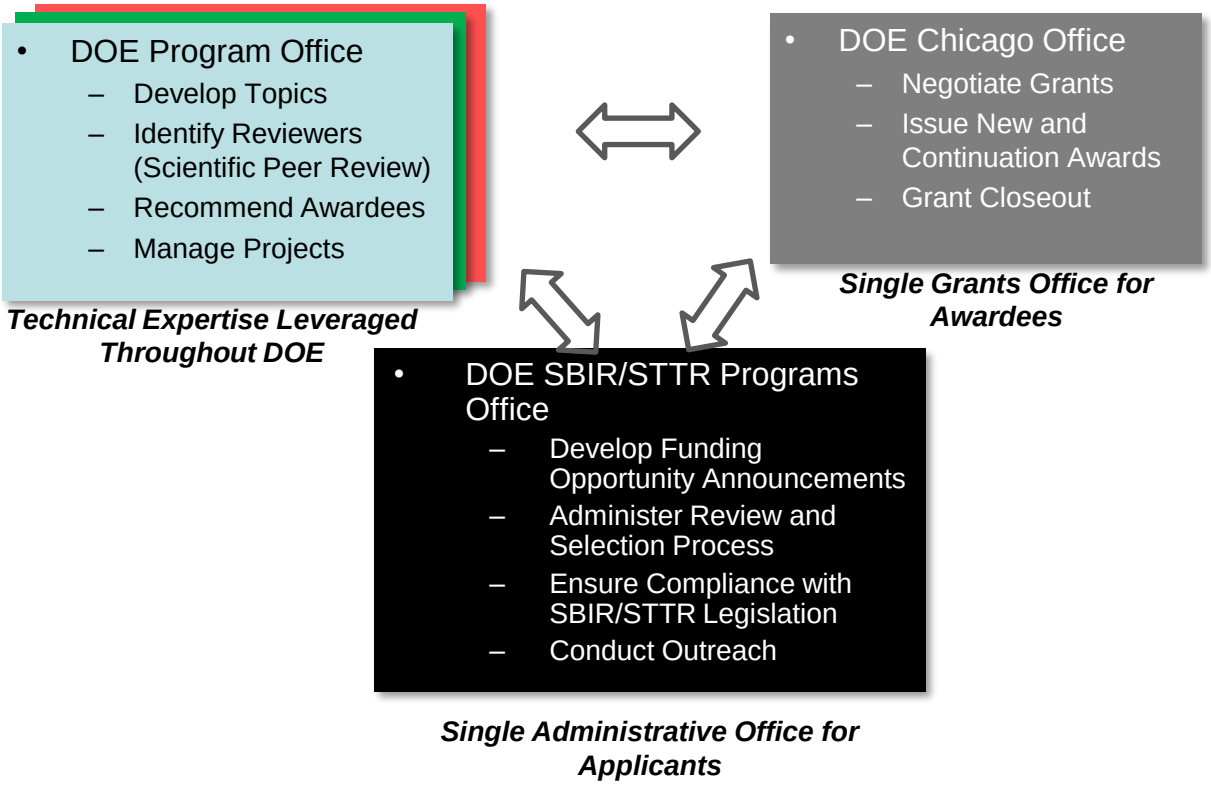
Phase I Release 2

- 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)

In FY24, FES and HEP will also be in Release I

Modified from a slide originally from M. Oliver, SBIR/STTR Office

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.
- Fees for this administration roughly doubled in past year (due diligence, diversity supplements and other initiatives)

Slide courtesy M. Oliver SBIR/STTR Office

Sequential II A, B, and C

Since the 2012 SBIR/STTR Reauthorization agencies can issue sequential Phase II awards

- 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 →

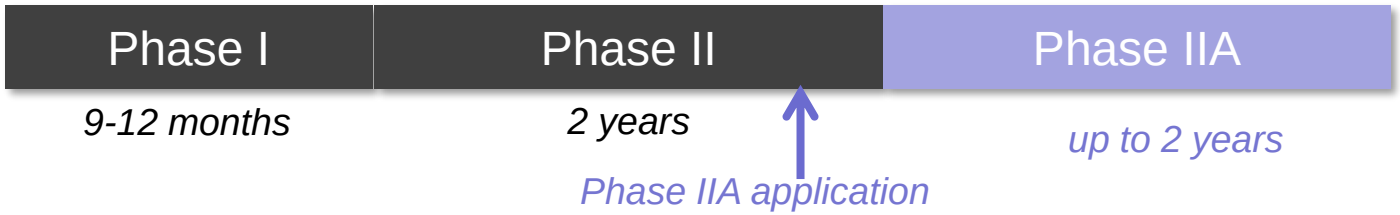
Phase IIB: For R&D funding required to transition an innovation towards commercialization. Starts immediately after completing a Phase II or up to 1 year later.

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 2023 Phase II cycle: NP received 7 Ph IIAs, 3 Ph IIBs, and 0 Ph IIC applications. We funded 1 Ph IIA & 1 Ph IIB. As sequential IIA, B, and C compete with new Phase II applications, the success rate historically is usually lower.

Sequential Phase II timing

Sequential Phase IIA



Sequential Phase IIB

A Phase IIC immediately follows the Phase IIA or IIB

Slide: Courtesy of Dr. Manny Oliver

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, meaning all funds expended.
  - Phase IIA applicants should generally not request no fund extensions past March of the FY in which 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 FY21 and 22) and awards still active or recently concluded under "no cost extension" are invited. A total of 48 SBIR/STTR PI presentations will be given in 3 days.
- There are also two Zoom "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.
- <u>FY 2023 Phase II awardees are invited as participants only and will be invited to present in the next two year's meetings.</u>
- There will be a keynote talk by Dr. Manny Oliver, Director of the DOE SBIR/STTR Program Office on the 3rd day of the meeting.
- The optional get together to share commercialization strategies and success stories has returned. We'll gather in the lobby after the first day's talks conclude.

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2023 Exchange Meeting Agenda (Day 1)

Meeting Agenda-Day 1

Time (EDT)	Dur. (min)	Grant Title	Speaker	Organization	NP SBIR/ STTR Topic	Grant Status
Tuesday, August 15, 2023						
9:00 AM	0:03	Welcome and Introductory Remarks	Hallman, Timothy	DOE, Office of Nuclear Physics		
9:03 AM	0:02	Welcome and Introductory Remarks	Farkhondeh, Manouchehr	DOE, Office of Nuclear Physics		
9:05 AM	0:35	NP SBIR/STTR Program Overview	Shinn, Michelle	DOE, Office of Nuclear Physics		
9:40 AM	0:20	Data Management for High Speed, Distributed Data Acquisition	Maggio, Jeffrey	SkuTek Instrumentation, NY	Instrumentation	End Year 1
10:00 AM	0:20	High Voltage Pulse Generator for High-Energy Beam Kickers	Prager, James	Eagle Harbor Technologies, Inc.,	Accelerator	End Year 1
10:20 AM	0:20	High Performance Scintillator for Nuclear Physics Research	Datta, Amlan	CapeSym, Inc., Natick, MA	Instrumentation	End Year 1
10:40 AM	0:25	Coffee Break				
11:05 AM	0:20	Scalable Micron-Sized Flexible Interconnects Enabled by Dielectric-Metal	Abbaspour, Reza	DUJUD LLC, Atlanta, GA	Electronics	End Year 1
11:25 AM	0:20	Inexpensive Low Noise Fast Switching DC High Voltage Power Supply	Sadwick, Larry	INNOSYS, INC., SALT LAKE CITY,	Accelerator	End Year 1
11:45 AM	0:20	High-Density Glass with Tuned Scintillation/Cherenkov Response to	Pegg, Ian	Scintilex, LLC, Alexandria, VA	Instrumentation	End Year 1
12:05 PM	1:30	Lunch Break				
1:35 PM	0:20	Organic Glass Scintillators for Nuclear Physics Experiments	Shirwadkar, Urmila	Radiation Monitoring Devices,	Instrumentation	End Year 1
1:55 PM	0:20	Compact, low-cost higher order mode absorbers formed by cold spray	Carriere, Paul	Radiabeam Technologies, LLC.,	Accelerator	End Year 1
2:15 PM	0:20	Development of Ultra Low Radioactivity Cables and Circuitry	Uka, Harshad	Q-FLEX INC, Santa Ana, CA	Instrumentation	End Year 1
2:35 PM	0:20	A New Medium Field Superconducting Magnet for the EIC	Gupta, Ramesh	Particle Beam Lasers, Inc., CA	Accelerator	End Year 1
2:55 PM	0:20	Fast, Large Area Detector for Position and Energy Determination	Konovalov, Valeriy	Applied Diamond, Inc., DE	Instrumentation	End Year 1
3:15 PM	0:20	High Output Pulsed Power Source	Smirnov, Alexander	Radiabeam Technologies, LLC.,	Accelerator	End Year 1
3:35 PM	0:25	Coffee Break				
4:00 PM	0:20	Sheet Electron Probe for Beam Tomography	Dudnikov, Vadim	Muons, Inc., Batavia, IL	Accelerator	End Year 1
4:20 PM	0:20	Novel High Voltage Cryogenic Breaks	Rey, Christopher	Energy to Power Solutions (e2P),	Accelerator	End Year 1
4:40 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	End Year 1/Ph IIB
5:00 PM	0:20	Radiation Hardened Opto-atomic Magnetometer	Choi, Jae	Hedgefog Research Inc., CA	Instrumentation	End Year 1/Ph IIA
5:20 PM	0:20	Adjourn				
5:40 PM	60	Optional Gathering to Discuss Challenges and Best Practices for Commercialization				

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2023 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 16, 2023						
9:00 AM	0:20	HOM Absorber Design for eRHIC ERL Cavity	Schultheiss, Tom	TJS Technologies, NY	Accelerator	End Year 2 Phase IIA
9:20 AM	0:20	Radiation Hardened Infrared Focal Plane Arrays	Chang, Yong	Epir, Inc., IL	Instrumentation	End of Year 2/IIA
9:40 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
10:00 AM	0:20	Fast Multi-Harmonic Kickers	Roberts, Brock	Electrodynamic, NM	Accelerator	End Year 2/NCE
10:20 AM	0:20	Large Volume Ring-Contact HPGe Detectors (RCD) for Low-Background	Hull, Ethan	PHDS Co., Knoxville, TN	Instrumentation	End Year 2
10:40 AM	0:25	Coffee Break				
11:05 AM	0:20	High Performance Glass Scintillators for Nuclear Physics Experiments	Pegg, Ian	Scintilex, LLC, Alexandria, VA	Instrumentation	End Year 2
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 3/Ph IIA
11:45 AM	0:20	CMOS Integrated With Float Zone Pixel Sensor	Patti, Robert	NHanced Semiconductors, Inc., IL	Electronics	End Year 2
12:05 PM	0:20	High-Quality Conductive Bellows Coatings Using Conformal Ionized PVD To Replace Unreliable Electroplating Processes	Houlahan, Thomas	Starfire Industries LLC, IL	Accelerator	End Year 2
12:25 PM	1:30	Lunch Break				
1:55 PM	0:20	Boron Nitride Nanotube Vibration Damping for SRF Structures	Whitney, Roy	BNNT, LLC, Newport News, VA	Accelerator	End Year 2/PIIA
2:15 PM	0:20	Large Area Multi-Anode MCP-PMT for High Rate Applications	Foley, Michael	Incom Inc., MA	Instrumentation	End Year 2
2:35 PM	0:20	A browser based toolkit for improved particle accelerator controls	Edelen, Jonathan	RadiaSoft LLC, Boulder, CO	Accelerator	End Year 2
2:55 PM	0:20	High Performance Scintillator and Beam Monitoring System	Friedman, Peter	Integrated Sensors, LLC, OH	Instrumentation	End Year 2
3:15 PM	0:25	Coffee Break				
3:40 PM	0:20	Additively Manufactured Z-Channel Detectors for Heavy Ion Accelerator Diagnostics	Moore, Jerome	Robot Nose Corporation, IL	Accelerator	End Year 3
4:00 PM	0:20	Design and Fabrication of the HDSoC- High Density Digitizer System-on-Chip	Macchiarulo, Luca	Nalu Scientific LLC, HI	Electronics	Year 2
4:20 PM	0:20	Energy Recovery Linac Designs and Studies for Electron Cooling of	Smolenski, Karl	Xelera Research LLC, Ithaca, NY	Accelerator	End Year 2
4:40 PM	0:20	Supercritical Fluid Separation and Purification of Rare Earth Elements, particularly Lanthanides including 177-Lu, to Lower Energy	Sinclair, Laura	CF Technologies, Inc., MA	Isotopes	End Year 3/NCE
5:00 PM	0:20	Digital Data Acquisition with High Resolution and Linearity	Skulski, Wojtek	SkuTek Instrumentation, NY	Electronics	End Year 2/NCE
5:20 PM	0	Adjourn				

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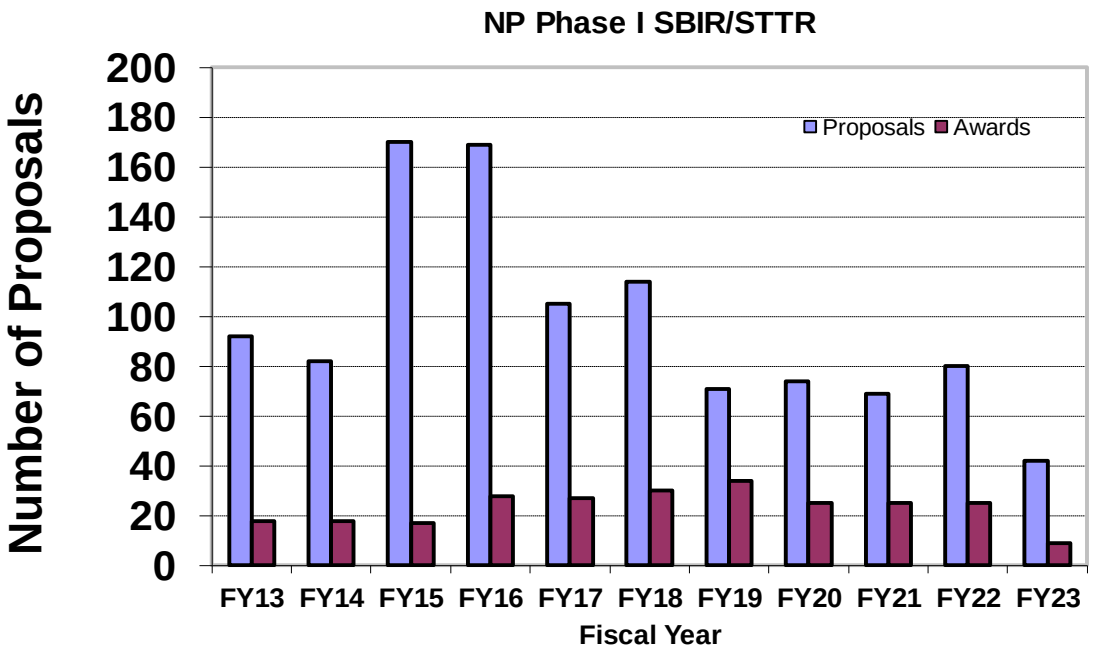
2023 Exchange Meeting Agenda (Day 3)

Meeting Agenda-Day 3

Time(EDT)	Dur. (min)	Grant Title	Speaker	Organization	NP SBIR/ STTR Topic	Grant Status
Thursday, August 17, 2023						
9:00 AM	0:20	Diaphanous diamond x-ray beam imaging system	Christian, James	Radiation Monitoring Systems	Instrumentation	Year 3/BES cofund
9:20 AM	0:20	High Performance FPGA-based Embedded System for Decision Making in Scientific Environments	Sun, Yu	Sunrise Technology, Inc, NY	Software	End Year 3/ASCR cofu
9:40 AM	0:20	Automated Preparation Of 211At For Targeted Alpha Therapy	Marshall, Graham	Global FIA, Inc., Fox Island, WA	Isotopes	End Year 4/NCE
10:00 AM	0:20	IP Access Gateway	Radulescu, Radu	Telluric Labs LLC, Red Bank, NJ	Software	End Year 5/NCE
10:20 AM	0:20	Coffee Break				
10:40 AM	0:20	Cold Spray Technology Applications for SRF Cavity Thermal and Mechanical Stabilization.	Kostin, Roman	Euclid Techlabs, LLC, Solon, OH	Accelerator	End Year3/NCE
11:00 AM	0:20	Low Cost, High-Density Digital Electronics for Nuclear Physics	Skulski, Wojtek	SkuTek Instrumentation, NY	Instrumentation	End Year 4/IIB
11:20 AM	0:20	Long-Term Radiation Rugged Rotary Vacuum and Water Seals in Heavy-	Lalli, Jennifer	NanoSonic, Inc., Pembroke, VA	Accelerator	End Year 3
11:40 AM	1:30	Lunch Break				
1:10 PM	0:20	Low Cost Data Acquisition Synchronization for Nuclear Physics Applications	Skulski, Wojtek	SkuTek Instrumentation, NY	Software	End Year 2
1:30 PM	0:20	TTDAQ: A CONTINUOUS FLOW, TIMING AND TRIGGER DAQ SYSTEM	Radulescu, Radu	Telluric Labs, Red Bank, NJ	Software	End Year 3/NCE
1:50 PM	0:20	Ultrafast High Voltage Kicker System Hardware for Ion Clearing Gaps	Smirnov, Alexander	RadiaBeam Systems, CA	Accelerator	End Year 3/NCE
2:10 PM	0:20	Design and fabrication of the "AODS": All-in-One Digitizer System-on-	Mostafanezhad, Isar	Nalu Scientific, LLC, HI	Electronics	End Year 3/NCE
2:30 PM	0:25	Coffee Break				
2:55 PM	0:20	An RF beam Sweeper for Purifying In-Flight Produced Rare Isotope	Kutsaev, Sergey	RadiaBeam Systems, Santa	Accelerator	End Year 2/IIA
3:15 PM	0:20	A New Approach to Achieving High Granularity in Low-Gain Avalanche Detectors	Islam, Rafiqul	Cactus Materials, Tempe, AZ	Electronics	End Year 2
3:35 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	Poole, Joe/Herschovitsch, Ady	Poole Ventura, Inc., Oxnard, CA & Brookhaven National Lab	Accelerator	Year 3
3:55 PM	0:35	Update on the Department of Energy SBIR/STTR Program, Q/A	Oliver, Manny	DOE, SBIR/STTR Office		
4:30 PM	0	Adjourn				

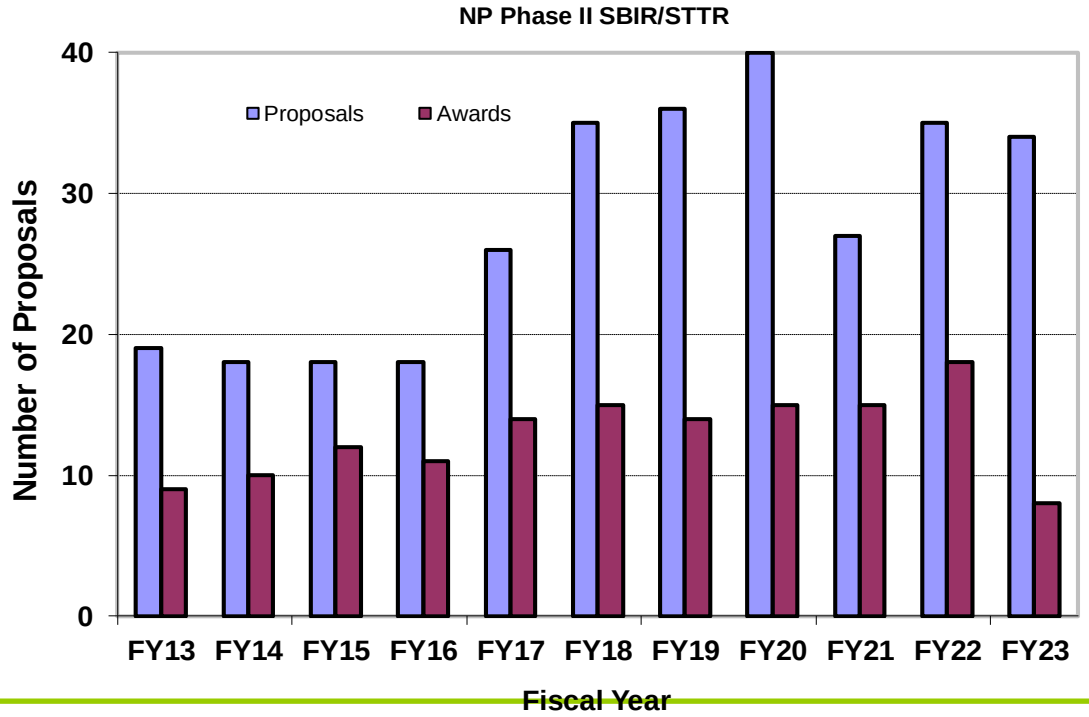
NP Phase I SBIR/STTR Applications and Awards

- NP received a total of **103** Letters of Intent and **42** phase I proposals in FY 2023, with **425** review requests/interactions for a total of **216** mail reviews. Total of **9** proposals funded (*cf* 25 in FY21&FY22).



NP Phase II SBIR/STTR Applications and Awards

- FY23 saw a slight decrease in submissions over FY22. Under the new set-aside rules, awards decreased to 8. Was 18 in FY22. Eight was possible because 2 PIs budgeted less than the ceiling amount plus BES agreed to co-fund an award along with NP-AD contributing from his reserves.



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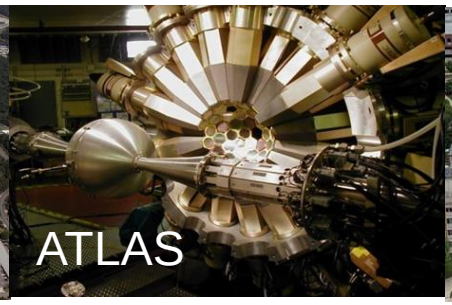
Nuclear Physics Mission

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 FY23

- 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.
- There is funding for QIS and AI/ML as Office of Science Crosscutting Initiatives

NP SBIR/STTR awards support these programs

Topics	Topic Associate
• Software and Data Management	G. Rai
• Electronics Design and Fabrication	M. Farkhondeh
• Accelerator Technology	M. Shinn
• Instrumentation, Detection Systems and Techniques	E. Bartosz

- Every year there is subtopic revision, based on community input.
- NP Program Managers are also given the opportunity to inputor edit subtopics
- Providing hardware and methods to advance initiatives recommended in the Long Range Plan for Nuclear Science is also important

NP SBIR/STTR Program Updates – FY23/24

- In FY23 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 funding of the NP SBIR/STTR Program, decreased substantially in FY23 and outyears
  - Plan going forward is to reduce number of subtopics but otherwise keep the existing 4 Topics. Balance ~5-6 awards equally across programs, and in support of Long Range Plan (LRP) recommendations
    - New LRP in preparation
- FY24 FOA has explicit language explaining criteria used to make final decisions on proposals that are recommended for funding
  - Promoting Inclusive and Equitable Research (PIER) Plans required and part of review and scoring awards
- For this year's meeting –
  - Due to the many talks we will again not feature talks about future needs. Refer to 2021 keynote presentations as they are still current. https://science.osti.gov/np/Benefits-of-NP/SBIR-STTR/sbir-sttr-exchange-mtg-2021

Promoting Inclusive and Equitable Research (PIER) Plan

SBIR/STTR Office page best resource

- https://science.osti.gov/sbir/Applicant-Resources/PIER-Plan
- All other SC grant opportunities required PIER plans in FY23
- The complexity and detail of a PIER Plan is expected to increase with the size of the small business, research team and the number of personnel to be supported
- See Notes sections for Phase I & Phase II submissions
  - Award sizes unaffected by PIER plans companies execute
- Will be evaluated and scored by merit reviewers
  - Original 3 evaluation criteria are still equally weighted. PIER plan score 10% weighting of the original 3

Presentation Notes

- We have a tight agenda and must stay on time for each presentation.
- Sessions will start promptly at the time stated on the agenda.
- For on site talks, we will have your presentation file ready to display before the start of your talk.
- At Q&A time, please make your comments/questions short and use the coffee and lunch breaks for follow up. If attending virtually, we can assist providing virtual breakout rooms Lobby 1 & Lobby 2
- We will stop sharing your screen at the end of your allotted time. A timer will be visible on screen as an aid for virtual presenters. A prompt will be on the podium for on site presenters.

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 later becomes products that benefits the NP community
  - To build and sustain a US-based commercial infrastructure that serves society in areas other than nuclear science

- 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 emerging needs

- NP uniquely fosters connections between its community and the small businesses that serve it through the structure of it's Topics and this annual meeting
  - This is becoming evident in the collaborations springing up between the PIs that attended past meetings
  - Increased number of Success Stories on SBIR/STTR Office website: 2 of the most recent 10 are from NP
  - Anecdotally, total sales to Federally-funded facilities and worldwide increasing, based on my annual poll