Report of the Workshop for Industrial Researchers

December 14-17,2020

Brookhaven National Laboratory

Workshop Chairs

John Hill (NSLS-II Director), Charles Black (CFN Director), Jun Wang (Industry Liaison Officer)

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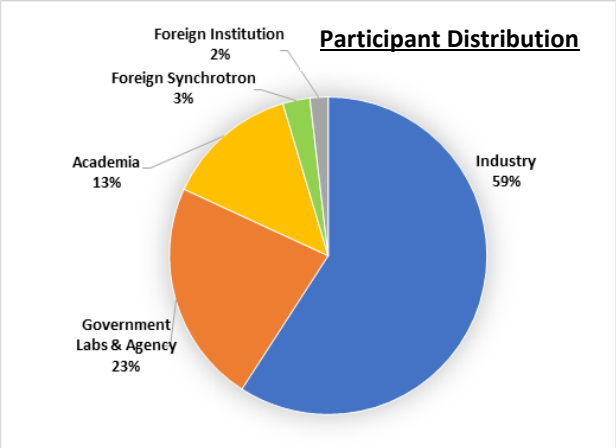
Summary of the Workshop for Industry Researchers

The BNL Workshop for Industry Researchers was held virtually at Brookhaven Lab on December 14–17, 2020. The workshop was designed to inform researchers from industry about the leading-edge capabilities and expertise at the Brookhaven user facilities National Synchrotron Light Source II (NSLS-II) and the Center for Functional Nanomaterials (CFN) and to provide details about the mechanisms for accessing them. The agenda featured presentations from industry users of Brookhaven Lab facilities, question-and-answer sessions, and opportunities to engage DOE managers of SBIR/STTR, TIR, and TCF programs designed to support industry research. Short summaries were also provided of the capabilities of the other DOE light sources and Nanoscale Science Research Centers.



The workshop featured a unique "facilities open house" format, where attendees spent time remotely in labs, observing Brookhaven capabilities in action and engaging in technical discussions with Brookhaven experts.

The workshop drew 651 registered participants for the presentations and lab open house sessions spread throughout the week.

Highlights of the workshop agenda included:

- Presentations by industry researchers from ExxonMobil, BASF, Edgehog Light Management Solutions (startup company) covering research performed using NSLS-II and CFN facilities, and engaging in technology transfer with BNL;
- Presentations on DOE programs for supporting industry research (SBIR/STTR, TIR and TCF);
- A panel of industry researchers sharing their experiences and lessons-learned from working at DOE user facilities;
- A primer on writing an effective user proposal;
- Short presentations introducing the capabilities of BES user facilities located at other DOE Labs.

Open-house live demonstrations of instruments at NSLS-II and CFN included sample preparation, data collection, and data analysis. Some demonstrations utilized real samples provided by workshop participants. The capability demonstrations included:

- Scanning Near-field Optical Microscopy (s-SNOM) and Photothermal Infrared Spectromicroscopy (PTIR)
- Small angle scattering at the Complex Materials Scattering (CMS) beamline
- X-ray Powder Diffraction (XPD) and Pair Distribution Function measurements (PDF)

- Transmission Electron Microscopy
- In-situ and Operando Soft X-ray Spectroscopy (IOS)
- Ambient Pressure X-ray Photoemission Spectroscopy (AP-XPS)
- EXAFS measurements at the Beamline for Materials Measurement (BMM, a partner beamline with NIST)
- Submicron Resolution X-ray Spectroscopy (SRX)
- Nanofabrication and Aberration-corrected Electron-beam Lithography
- Automated MX (AMX), Solution scattering at the Life science X-ray scattering (LiX) beamline, and Cryo-Electron Microscopy

Selected Q & A

Q. Will the slides of this workshop be available to us?

A. Presentations have been posted on the agenda page at the workshop website https://www.bnl.gov/industryworkshop2020/files/pdf/agenda.pdf

Q. NSLS-II is a modern synchrotron source which therefore provides many advantages in equipment and detectors, etc. However, many synchrotrons are in the process of a lattice upgrade to provide more brilliant/coherent beams. How does NSLS-II compare with these upgraded synchrotrons such as the ESRF?

A. The brightness of the source is one component of whether or not an experiment is successful. It is true that the upgraded ESRF is a brighter source than NSLS-II, but you need to look at the details of the experiment you want to do in deciding where to carry out that work. NSLS-II offers an extensive range of photon energies along with excellent scientists who can work with you to solve your problem, which is often the most important component of success.

Q. Do you have imaging (2D and 3D) capabilities for light elements (C, N, O, Al, Si) for non-flat materials? If so, what resolution?

A. Using x-ray fluorescence imaging, NSLS-II can directly image Al and Si, but not currently C, N or O. We can get sensitivity to these later using other techniques, but not as a direct measurement. The sensitivity and resolution depend a lot on the particular experiment. For more details contact Yong Chu, Imaging and Microscopy Program Manager (ychu@bnl.gov).

There are several SEMs and TEMs with 2D x-ray mapping capabilities (EDS mapping) at CFN, but usually samples need to be flat and not large in size (3 mm in diameter for TEM, ~ 1x1 cm for SEM). Some of the microscopes at the CFN Electron Microscopy Facility can generate elemental maps for light elements (C, N, O) using both EDS and EELS. For bulk TEM samples (except nanoparticles less than about 100 nm) ion milling or mechanical polishing into a thin, flat lamella is also available at CFN. Once a thickness of 50 nm is reached, CFN staff can help users obtain 2D (or 3D with a tilt series) maps with elements like C, N, O, Al, Si to an accuracy of a few atomic layers (about 2 nm) in the CFN non-aberration corrected FEI Talos TEM/STEM. Please note that EDS rapidly loses sensitivity for all elements lighter than Carbon, but this limitation doesn't apply to EELS. In addition, CFN has recently installed a new dual-beam microscope that combines an electron and ion beam equipped with advanced capabilities for precise machining and sample characterization. For more details contact CFN Scientist Fernando Camino (fcamino@bnl.gov).

Q. What key characterization techniques were initially utilized by Edgehog at Brookhaven when developing the technology developed at CFN?

A. Edgehog has made use of both the CFN Materials Synthesis & Characterization Facility and CFN expertise in patterning by self-assembly methods (the type shown in the presentation). They also used the CFN Nanofabrication Facility and expertise in the early stage of their project.

Q. Is the "technologist in residence" (TIR) the scientist of a National Lab or a researcher from industry? Which side initiates the proposal?

A. The TIR Program involves the competitive selection of pairs comprised of a senior technical staff member from a national laboratory (Lab Technologist), and a senior technical staff member from industry, a consortium of companies, or a state or regional economic development entity (Industry Technologist). Each technologist may represent single or multiple national laboratories, single or multiple companies, or other entity. These pairs of technologists will work together for a period of 18 to 24 months to accomplish several goals (https://www.energy.gov/eere/amo/technologist-residence-program). The lab submits the application via a lab call for proposals, but the TIR program pairs a technologist from the lab with a technologist from industry. We recommend contacting the DOE TIR Program Manager.

Q. What size companies are eligible for the TIR program? Is this also the case for TCF?

A. There are no size restrictions or requirements for the TIR. With respect to the TCF, like the TIR, there are currently no specific size restrictions or preference for small, medium, or large businesses. The only requirement is that the company be willing to provide the congressionally mandated cost share and enter into a contractual (CRADA or alternative) agreement with the lab.

Q. I heard mentioned twice the "technologist in residence" program today, could you please share your experience about how to apply and the eligibility of that program?

A. Don Dimarzio, one of the panelists, shared his experience as the TIR participant at CFN: The purpose of the DOE “Technologist in Residence” (TIR) program is to “strengthen America’s competitiveness by streamlining engagement and increasing collaborative early-stage R&D between national laboratories and industry” (https://www.energy.gov/eere/amo/technologist-residence-program). This includes working with various DOE Nanoscale Science Research Centers, light sources and accelerator facilities (e.g., radiation testing). In the TIR program, the DOE funds a team of DOE national lab staff to work with the designated company to search out collaborative opportunities that help the company with its needs. To get this TIR program started, the company needs to designate a scientist or engineer as their “TIR” at a particular DOE lab and consults with the Industrial Liaison Officer Jun Wang (junwang@bnl.gov). This works best if the company “TIR” has already been working at one of the DOE labs on a project in collaboration with one of the resident DOE lab scientists. The TIR and the DOE lab partner would then write a formal TIR proposal to the DOE to provide funding for the DOE lab partner. The company TIR does not have to be literally “in residence” at the particular DOE lab, but it helps if that TIR can make periodic trips to the lab for his or her research and for the TIR program.

Stan Petrash, one of the panelists, added his comments from his experience: Another excellent part of the TIR program is the "Council of Technologists", a regular meeting between the TIR partners at one of the DOE labs. In my case it was at NREL in Colorado. It was an excellent opportunity to exchange the experience with other TIR partners as well as visit and tour a DOE facility I would otherwise overlook.

Q. For companies applying for SBIR/STTR funding and wish to use BNL facilities as part of the proposal, how are these proposal reviews at SBIR/STTR and at BNL coordinated?

A. We can help you explore the right research group(s) for your proposal. Depending on the project, the BNL researcher can provide content and help provide feedback on the proposal. Your proposal will be reviewed by the SBIR/STTR program office and at least three independent expert reviewers.

Q. How long in advance would it typically take to get a letter or approval from the lab in support of an SBIR?

A. It will take about two weeks to obtain a letter of authorization from the DOE site office. We encourage you to contact us in the early stages of proposal development to find the right PI at BNL to work with you to develop the SBIR/STTR proposal.

Q. What is the role of user agreements in funded access to the user facilities at BNL? Should SPP be used for the funded access to the facilities?

A. There are two types of user agreement for users to access the user facilities. A non-proprietary user agreement for non-proprietary research and a proprietary user agreement for proprietary research. The user agreement is typically the mechanism for users to access the user facility.

If external use of user facilities results in BNL solving a particular scientific problem that involves a defined Statement of Work (SOW), an SPP is the appropriate mechanism.

Q. Hope your lab can simplify the proposal application and user process. The complex approval processes at national laboratories hinders the collaboration.

A. We are working closely with all related offices in the lab to efficiently process the applications. We'll continue to refine our effort to better help industrial users.

Details about the application process and user process can be found in Jun Wang's presentation https://www.bnl.gov/industryworkshop2020/files/pdf/8_JWang.pdf; and Lisa Miller's presentation https://www.bnl.gov/industryworkshop2020/files/pdf/9_Miller.pdf.

Q. Is the review based on scientific merit for industrial users' non-proprietary work? Do you have a special review committee for industrial user proposals?

A. None of the facilities have a separate panel for industry proposals, but some facilities have review criteria that capture industry research success metrics. Please consult the individual facilities for specific policies and practices.

At BNL, we do not have separate industrial panels, but the review criteria consider industrial / technological importance. NSLS-II has reviewers from industry in review panels to reflect the importance of the applied research.

Q. Are the proposals reviewed internally before they go out to the review committee?

A. Non-proprietary proposals are reviewed and ranked by the review committee. User facility staff will review the feasibility of the proposal first before the proposal goes out to the review panel. Proprietary proposals at NSLS-II are only reviewed by the facility director or the director's designee.

Q. Is there any possibility to use proprietary beamtime on sample basis not hourly basis for industry users?

A. The proprietary beamtime is charged by a rate approved by DOE and based on the actual beamtime used. Details about how the proprietary beamtime is charged can be found at https://www.bnl.gov/ps/industry/files/pdf/ProprietaryResearchPolicyandProcedure.pdf.

Q. For proprietary beamtime, do we have to book for a minimum 8-hour schedule?

A. The proprietary beamtime is charged based on the actual beamtime used. A minimum 8-hour block of time is not required. A minimum2-hour charge for setting up and wrapping down is added to the invoice.

Q. For proprietary research, is there a minimum spending on the facility user service?

A. Proprietary research is charged on an hourly basis for both NSLS-II and CFN. At NSLS-II, the beamtime is charged based on actual beamtime used plus 1-hour setup and 1-hour take down. More information can be found in the NSLS-II proprietary procedures and policy https://www.bnl.gov/ps/industry/files/pdf/ProprietaryResearchPolicyandProcedure.pdf. The full cost recovery charge rates at CFN can be found here https://www.bnl.gov/cfn/docs/FullCostRecoveryRatesForGeneralFacilityUse.pdf.

Q. One issue that small companies deal with is the requirement for prepayment of proprietary time. For low usage this isn't an issue, but for those using 24+ hours per week, it is difficult for startups or small companies to generate cash flow to handle that level of prepayment. While this has been a long-standing DOE policy, I am wondering if the user facilities can better adapt the payment policy for proprietary time. This may also allow better efficiency on the BNL finance team.

A. A 100 percent advance of the estimated usage per run cycle of proprietary research hours is required to be in the account before proprietary work can begin, and a balance equal to the

cost of 100 percent of the estimated proprietary usage per run cycle must be maintained. This is required as stated in the U.S. Department of Energy Accounting Handbook. Once you have the funds covering the 100 percent advance of estimated usage in your account, you will pay your actual used proprietary time after your experiment.

To help the company which has funds but is not able to have it in their account prior to the experiment due to unexpected issues, we can provide a bridge loan for temporary help if the request is approved by the facility director. The company must pay back the loan as soon as possible.

Q. If an experiment is delayed or interrupted by a problem at the beamline at NSLS-II, is the industrial user responsible for paying proprietary fees for this down time?

A. No, if there is a technical problem with the beamline or accelerator, the user will not be charged for that down time. Details can be find in the NSLS-II proprietary procedures and policy https://www.bnl.gov/ps/industry/files/pdf/ProprietaryResearchPolicyandProcedure.pdf.

Q. With the impact of the ongoing global pandemic, has the one-year shutdown associated with the APS-U been delayed from the previously anticipated June 2022 date? If so, what is the new projected date for the shutdown?

A. As of today, the one-year shutdown has not been delayed and is still scheduled for June 2022. As you might imagine, the Upgrade Project team is monitoring the impacts of COVID on the APS-U on a daily basis.

Q. Question for NSLS-II, SSRL, and ALS: We use APS weekly for proprietary research in MX. For the APS-U long shutdown, we would like to arrange weekly beam time at other DOE synchrotron beamlines. Is it possible to arrange this commitment of beam time far in advance?

A. We will coordinate and arrange the needs among the user facilities. For specific beamlines, it is better to discuss with the beamline group and check beamtime availability.

Q. What is distribution between small and large industry in the current users of the facility?

A. At NSLS-II, the small business holds about 2/3 of the total number of companies for proprietary research. At CFN, the distribution between small business and large industry is about the same (1/1).

Q. How does BNL protect the exchange of proprietary information between users and beamline scientists?

A. BNL staff is required to take a training to raises awareness around the kinds of information we work with in our research and operations such as business proprietary, confidential, commercial in confidence and copyrighted information, and what we need to do to protect them from unauthorized access.

In principle, we ask our industry users not to share their proprietary information with us. If a non-disclosure agreement (NDA) is needed, the NDA can be signed between BNL and the institution.

Q. All the panelists represent experiences coming from academia or large industries. Could you talk about what are the issues that small businesses must consider for applying to be a BNL facility user?

A. The issues faced by businesses – large or small – in becoming a BNL facility user will largely be shaped by their own research philosophy, business environment, and the immediacy with which return on investment is needed. While not universally true, often the weaknesses of large businesses are the strengths of small ones, and vice-versa.

Some potential issues and perceived barriers could include:

- We're entirely unfamiliar with synchrotron techniques but want to see if they could be useful in answering some of our technical questions
- We don't know how to start the administrative process of gaining access and obtaining time
- The business doesn't have a scientist skilled in the technique(s) of interest
- Management is reluctant to support the investment of time and/or money for pursuing work at a user facility
- There is uncertainty whether the results will truly provide actionable information to justify the investment
- Proprietary time is expensive
- Non-proprietary time requires disclosure of results to the scientific community, which could result in disclosure of trade secrets
- It is difficult to craft a peer-reviewed proposal, required for non-proprietary time, which is competitive with submissions from high performing universities from around the world
- We don't want to divulge the technical information needed to obtain non-proprietary time
- It takes a long time to go through the process to obtain beamtime and collect data
- Our lawyers advised us to not accept the terms of the agreements
- We can't travel to the beamline due to COVID quarantine restrictions (or for other reasons)

All of the above challenges can be addressed and mitigated if discussed. Every case will be different, and as such the best place to begin is by contacting the Industrial Liaison Officer Jun Wang (junwang@bnl.gov) to begin the conversation.

It is the same process for small or large business to apply to be a user. Details about the application process can be found in Jun Wang's presentation https://www.bnl.gov/industryworkshop2020/files/pdf/8_JWang.pdf

Q. For each of the panelists, what is one thing you think BNL/DOE can do to attract more small businesses in industry?

A. The panelists think that it is critically needed that the industrial office should have a dedicated group of beamline staff to support the industrial research from conceiving ideas, running experiments to analyzing data. It can help industry, particularly small business which may not have expertise in using user facilities, to engage deeply and efficiently with DOE user facilities. Having such a dedicated group is widely adapted in other synchrotron user facilities. For example, the Swiss Light Source, which is much smaller than NSLS-II, has a group of 15 dedicated staff to support industrial research. BNL/DOE could initiate a pilot program for three years, to see if it will increase the number of industrial users. It will highlight the impact of DOE user facilities that industry and the economy have benefited from the user facilities.

The panelists also suggest that this dedicated group should be given access to run trial fabrications and/or measurements at no cost to the company. If the company finds these preliminary results valuable, then they can enter into a formal agreement with the Lab, either as a general user (non-proprietary) or as a proprietary user. A non-disclosure agreement (NDA) can be signed if it is needed.

Q. Do industrial users of European light sources have similar or different experiences than users of US-based synchrotrons?

A. Stan Petrash, one of the panelists, added his experience: In general, the industrial access overseas could be just as competitive as in the US. The main difference is that in Europe synchrotrons do not belong to such an organization as DOE, which, as everyone knows in US, has other functions other than promoting academic and industrial science.

As a result, there is more flexibility in working out modes of access, since the negotiations are conducted directly with the management of each particular synchrotron, not with a large governmental entity, such as DOE.

There are also country-specific issues for each light source, ones that do not exist in the US. For example, the Diamond Synchrotron in UK has a special department staffed with people dedicated 100% to industrial projects, so getting help with an industrial beamtime is very easy and the whole experience is very good. Other facilities are more interested in demonstrating that they can generate a stable source of income (however limited) in exchange for the beamtime, so it was possible to have an equivalent of a "partner agreement" without spending millions of dollars in equipment to achieve this status. Yet other facilities weren't interested in money at all, having plenty of government funding, so they had sufficient staff resources to

support industrial projects with more attention and “handholding” that would otherwise be required for an academic user, without asking the company to explicitly pay for such support.

In most cases, it was a feeling that the industrial support was not an “afterthought”, since the evaluation of the performance of the synchrotron staff was conducted in much more flexible matter, without solely focusing on the yearly number of the publications in “high impact journals”, which creates a massive disadvantage for the industrial users in US-based system, since, with a few exemptions, industry cannot publish as freely as academia and their scientific problems tend to be of a more “applied” nature, as compared to more fundamental problems encountered in academia.

Summary of Lessons Learned

1. Zoom platform

Since we received more than 600 registrations which exceeded the maximum 500 people capacity of regular Zoom, we chose Zoom webinar for the plenary session for presentations and panel discussions in the morning. A regular Zoom meeting was used for the open house of NSLS-II and CFN (in parallel) in the afternoon since the regular Zoom meeting allows participants to interact better with scientists during the open-house. Therefore, we provided five different Zoom links to access the workshop. Two for the Zoom webinar in the morning, with one for speakers and panelists and one for participants, and three for regular Zoom meeting for the open house in the afternoon, with one for CFN, and two for NSLS-II two beamlines. However, this caused some confusion for some of the participants. We suggest that other labs look for a different or a customized platform to handle a workshop like this. We suggest that other labs look for a different or a customized platform to handle a workshop like this, or that a web posting of the meeting links with Excel-like format be used as the common reference point and with clear explanations provided. The Zoom platform was very stable though, providing clear audio and video, and the chat forum worked very well.

2. Invitation on calendar

Some speakers said they did not see that the event was on their calendar. It would be nice for the recipients if there is a way to have the invitation link to their calendar after they accept the invitation. This probably depends on their platform e.g., Outlook versus Google, and should be simple to resolve with ITD support.

3. Daily reminder

A daily reminder email would be helpful to remind participants of the next day's schedule and social media links. It should always refer though to the same common website with fixed links to avoid confusion and lost time from sorting and sifting.

4. Network security

Some attendees had access issues because their company IT blocked the Zoom access. Organizers should try to find a platform that industry IT can accept.

Using a staff working email address instead of an anonymous mailbox for communication could help lower the chance that the email is either blocked or goes to the receiver's junk folder.

The Zoom links were emailed by ITD staff. It would be better that the communication go through the workshop organizing chair so that there is one email sender in order to minimize the chance that email goes to the receiver's junk folder.

The assistance of the ITD staff was valuable and much appreciated. It would be worthwhile to request them to document their best practice and procedure for the zoom-aspect of this workshop so that we can share this with other National Lab facilities in this workshop series.

5. Q&A control

In order to improve control of unexpected cases, participants need to raise their hand via Zoom to be able to talk.

6. Dry run for open house

An actual dry run for each instrument/beamline would be better. It would be helpful if the corresponding program manager of the instrument/beamline could help the scientist do a dry run of the instrument/beamline. We also learned the dry run should be arranged at least one week ahead of the open house to have time to address any questions from the dry run.

7. Open house

We recognized it would be better to arrange experienced staff first to maintain audience interest. To make the showcase more interesting, it is better to have one sample from one company instead of observing the same samples from one company.

8. Marketing

651 registration was a great response. There is still room to better market the workshop and increase its visibility. For example, it would be nice to easily find the workshop on the BNL main webpage.

9. Follow-up and legacy

The live presentations by the staff were of uniformly high quality and the interactive component was very interesting and helpful. Many attendees may wish to revisit the sessions for better comprehension, while others may have missed the sessions altogether because of conflicting presentations or other reasons. Links and access to the presentations and pre-recorded video would be of considerable value. Convergence to a uniform IT “look and feel” with successive industry workshops across the labs will reduce returning attendee “overhead” and help preserve and propagate best practice.

10. Confidentiality

Regarding especially panel discussions, presentations from outside invited speakers, and industry speakers, there may be an issue regarding what can be said in an open forum, mainly because of company concerns. Organizers need to be sensitive to this issue in terms of workshop planning, pre-consultation to invited speakers, and advisories to dial-in registrants.

This is a short summary from what we learned. We hope it would be useful for other DOE user facilities when they organize this annual series workshop at their facilities.

Appendix Workshop agenda

Workshop for Industry Researchers

Brookhaven National Laboratory

December 14-17, 2020

All times are Eastern Time (ET)

Monday, December 14		
	Presentations from NSLS-II and CFN and industry researchers *Chairs: Chuck Black, John Hill, Jun Wang (BNL)*	
10:30 am	Welcome/Charge of the workshop	Chuck Black (BNL)
10:40 am	Synchrotron light sources and basic research at ExxonMobil	Pedro Serna (ExxonMobil)
11:10 am	Innovative chemistry through advanced microscopy techniques	Ke-Bin Low (BASF)
11:30 am	Bio-inspired invisible glass: from nature to commercialization	Calvin Cheng (Edgehog)
11:45 am	Overview of capabilities of NSLS-II and CFN	John Hill (BNL)
12:15 pm	BREAK	
	Open House (concurrent sessions at CFN & NSLS-II)	
1:00 – 5:00 pm	**CFN: Nano-IR, sSNOM** Overview of the PTIR, s-SNOM and nanoTA methods and capabilities with some examples (1:00 – 1:30 pm) Q&A session (1:30 – 1:40 pm) Video of a PTIR experiment (1:40 – 2:10 pm) Q&A session (2:10 – 2:20 pm) Live demonstrations with samples (2:20 – 4:00 pm) User samples: • Polykala Technologies - polyimide film • s-SNOM on monolayer and bilayer graphene on silicon wafer	Sam Tenney (BNL) Moderator: Priscilla Antunez (BNL)
1:00 – 3:00 pm	**NSLS-II: X-ray scattering (CMS beamline)** Beamline introduction (1:00 – 1:30 pm) User samples (1:30 – 3:00 pm): • Latex particle dispersions in water • Molecular Sieve membranes	Masa Fukuto (BNL) Moderator: Lisa Miller (BNL)
3:00 – 5:00 pm	**NSLS-II: X-ray diffraction & PDF (XPD beamline)**	Sanjit Ghose (BNL)

	Introduction to XPD presentation- PPT presentation (3:00 – 3:30 pm) Powder Diffraction from sample loading to Data Analysis- Video presentation (3:30 – 4:00 pm) Q&A Session (4:00 – 4:15 pm)	Moderator: Cara Laasch (BNL)
	Discussion on Industrial User's Data: Presentation & Q&A (4:15 – 5:00 pm)	Sanjit Ghose / Eric Dooryhee / Jianming Bai (BNL)

Tuesday, December 15

	DOE programs relevant to industry researchers Q&A *Chair: Martin Schoonen (BNL)*	
10:30 am	DOE SBIR/STTR Program	Manny Oliver (SBIR/STTR Program Office, DOE)
10:45 am	DOE TIR Program	Eli Levine (Advanced Manufacturing Office, DOE)
10:55 am	DOE TCF Program	Zack Baize (Office of Technology Transitions, DOE)
11:05 am	BNL Strategic Partnership Program	Ivar Strand (BNL)
11:20 am	Q&A	
12:15 pm	BREAK	
	Open House (concurrent sessions at CFN & NSLS-II)	
1:00 – 5:00 pm	**CFN: Electron Microscopy** Introduction (1:00 – 1:30 pm) Demo sample (thin film sample) (1:30 – 2:30 pm) User samples (2:30 – 4:00 pm): • battery cathode materials	Sooyeon Hwang (BNL) Moderator: Pam Ciufo
1:00 – 5:00 pm	**NSLS-II: Soft X-ray Spectroscopy (IOS beamline)** Beamline introduction (1:00 – 1:45 pm) User samples (1:45 – 5:00 pm): • battery cathode materials (XAS) • molecular sieve membranes (AP-XPS) • materials for semiconductor process control (XAS, AP-XPS)	Ira Waluyo (BNL) Moderator: Gretchen Cisco / Mercy Baez (BNL)

Wednesday, December 16

Lessons learned by industry users of BNL facilities -- panel discussion

Chairs: Yan Gao (GE), Karren More (ORNL)

10:30 am	Panel discussion	Carter Abney (ExxonMobil) Donald Dimarzio (Northrup Grumman) Eugene Lavely (BAE) Stan Petrash (Henkel)
11:30 am	BREAK	
	Open House (concurrent sessions at CFN & NSLS-II)	
1:00 – 5:00 pm	**CFN: Ambient Pressure X-ray Photoemission Spectroscopy** Instrument Introduction (1:00 – 1:30 pm) User samples (1:30 – 5:00 pm): • PPE materials • Gas trapping silicates	Ashley Head (BNL) Anibal Boscoboinik (BNL) Moderator: Priscilla Antunez (BNL)
1:00 – 3:00 pm	**NSLS-II: X-ray spectroscopy (BMM beamline)** Beamline introduction (1:00 – 1:45 pm) User samples (1:45 – 5:00 pm): • Iron nanoparticles in solution (XAFS) • Aluminosilicate beads doped with nickel (XAFS)	Bruce Ravel (NIST) Moderator: Lisa Miller (BNL)
3:00 – 5:00 pm	**NSLS-II: Submicron resolution x-ray spectroscopy (SRX beamline)** Beamline introduction Sample preparation User samples: • Battery electrode particles (XRF) Data analysis and post-processing	Andrew Kiss (BNL) Yang Yang (BNL) Moderator: Mercy Baez / Gretchen Cisco (BNL)

Thursday, December 17

Help desk and other DOE user facilities Q&A

Chairs: Priscilla Antunez, Lisa Miller (BNL)

10:30 am	Industry research program, procedures and policy	Jun Wang (BNL)
10:45 am	How to write a good nonproprietary industrial proposal	Priscilla Antunez (CFN) Lisa Miller (NSLS-II)
11:00 am	Overview of other **DOE** BES user facilities followed by Q&A See ANL supplemental video See APS supplemental video See LBNL supplemental video	Denny Mills, Ilke Arslan (ANL) Andreas Scholl, Branden Brough (LBNL) Paul McIntyre (SLAC) Karren More (ORNL)

12:10 pm	Closing Remarks	Jim Misewich (BNL)
12:15 pm	BREAK	
	Open House (concurrent sessions at CFN & NSLS-II)	
1:00 – 5:00 pm	**CFN: Nanofabrication** Introduction to nanofabrication at the CFN Single-digit patterning using aberration-corrected STEM Process demonstration: biomimetic structures using self-assembly techniques Scanning electron microscopy demonstration This will be a discussion-based workshop with video examples, demos, and plenty of time to ask questions, discuss processes and potential applications, and ask questions of the CFN staff.	Aaron Stein (BNL) Moderator: Priscilla Antunez (BNL)
	CFN: Aberration-corrected e-beam lithography	Fernando Camino (CFN) Moderator: Priscilla Antunez (BNL)
1:00 – 5:00 pm	**NSLS-II: Macromolecular Crystallography (AMX beamline)**	Jean Jakoncic (BNL)
	Overview of the MX micro-focus beamlines at the NSLS-II: AMX and FMX (1:00 – 1:30 pm)	
	Overview of the LIX beamline (1:30 – 1:45 pm)	Lin Yang (BNL)
	Overview of the CryoEM Center (1:45 – 2:00 pm)	Liguo Wang (BNL)
	Live demonstration at the AMX beamline (2:00 – 4:00 pm)	Jean Jakoncic (BNL)/ Alexei Soares (BNL)
	User samples: • High throughput/high resolution GSAM: GGCSID • Beta propellers	