NHMFL User Committee Report 2025

Chair: Franklin E. Leach III (University of Georgia)

General Fields Vice-Chair: Michihiro Hirata (Los Alamos National Laboratory)

Resonance Vice-Chair: Galia Debelouchina (University of California San Diego)

DC/High B/T Committee: Ryan Baumbach (University of California, Santa Cruz), Nathanael Fortune (Executive Committee Member, Smith College), Corey Frank (New Mexico State University), Paula Gallo (Universidad de Los Andes, Colombia), Long Ju (MIT), Johannes Pollanen (Michigan State University), Daniel Rhodes (University of Wisconsin – Madison), Sufei Shi (Rensselaer Polytechnic Institute), Raivo Stern (Executive Committee Member, National Institute of Chemical Physics and Biophysics, Estonia), Sergei Zvyagin (Dresden High Magnetic Field Laboratory, Germany)

PFF Committee: Charles Agosta (Clark University), Joseph Checkelsky (Massachusetts Institute of Technology), Krzysztof Gofryk (Idaho National Laboratory), Michihiro Hirata (Los Alamos National Laboratory), Rongyin Jin (University of South Carolina), Sheng Ran (Washington University in St. Louis)

NMR/MRI Committee: Vipin Agarwal (Tata Institute of Fundamental Research), Claudia Avalos (New York University), Galia Debelouchina (Executive Committee Member, University of California San Diego), Shella Keilholz (Executive Committee Member, Emory University/Georgia Tech), Isabelle Marcotte (Universite du Quebec a Montreal), Andre Obenaus (University of California, Riverside), Frédéric A. Perras (Ames National Laboratory), Lothar Schad (Medical Faculty Mannheim), Jun Xu (National Center for Magnetic Resonance in Wuhan)

EMR Committee: Alina Bienko (University of Wroclaw), Selvan Demir (Executive Committee Member, Michigan State University), Effie Kisgeropoulos (National Laboratory of the Rockies), Muralee Murugesu (University of Ottawa), Troy Stich (Wake Forest University), Joshua Telser (Roosevelt University)

ICR Committee: Jesse Canterbury (Thermo Fisher Scientific), Caroline DeHart (Frederick National Laboratory for Cancer Research), Ryan Julian (University of California Riverside), Franklin E. Leach III (Executive Committee Member, University of Georgia), Caitlin Tressler (Johns Hopkins University School of Medicine), Robert Young (New Mexico State University)

(1) Executive summary and general comments

Overall, the User Committee (UC) continues to be pleased with the National High Magnetic Field Laboratory (MagLab)'s performance and exciting future ahead under the leadership of Dr. Kathleen Amm. The MagLab retains its leading position as the provider of high magnetic fields to a broad research community that impacts a diverse swath of scientific disciplines from basic to applied science. We thank the NSF and institutional partners for their continued support and commitment to maintaining the excellence of the MagLab. Here we provide a summary of important points that affect the MagLab community as a whole. Facility-specific discussions are in the following sections.

Meeting: The UC held its annual meeting from November 5-6, 2025, in Tallahassee, FL, where we were hosted by the Florida State University site. We appreciate the hospitality of our institutional partner, personnel at the FSU MagLab campus, and overall support from the MagLab User Program staff that enabled a productive gathering. Our annual meeting was preceded by a day-long workshop that focused on the upcoming renewal. We gratefully acknowledge the efforts of the MagLab renewal team to provide an overall view of the renewal strategy and a forum for user engagement.

Start	Dur (min)	Talk/ Discussion	Day 1, Tuesday, November 4, 2025 Event Location: NHMFL, 1800 E. Paul Dirac Drive, Tallahassee, FL 32310	Presenter
6:00 PM	60		JOINT DINNER at MagLab Atrium	
7:00 PM	45	30+15	**MagLab Overview and Charge to the UC in B101**	Kathleen Amm
7:45 PM			Shuttle departs MagLab to hotel	
Start	**Dur (min)**	**Talk/ Discussion**	**Day 2, Wednesday, November 5, 2025 Event Location: NHMFL, 1800 E. Paul Dirac Drive, Tallahassee, FL 32310**	**Presenter**
8:30 AM	15		Shuttle departs from hotel	
8:45 AM	15		Registration	
9:00 AM	15		**Welcome from Institutional Representatives (B101)**	Remote: Stacey Patterson, FSU VPR; David Norton, UF VPR; Jen Martinez,
9:15 AM	15	10+5	Magnet Technology	Tom Painter
9:30 AM	15	10+5	Magnet Materials	David Larbalestier
9:45 AM	15		Open Discussion	Facilitated by Lance Cooley
10:00 AM	20	15+5	User Program - Prior year report	Tim Murphy
10:20 AM	10	5+5	DC Field User facility updates	Ali Bangura
10:30 AM	10	5+5	PFF User facility updates	Laurel Winter
10:40 AM	10	5+5	HBT User facility updates	Mark Meisel
10:50 AM	15		BREAK	
11:05 AM	10	5+5	EMR User facility updates	Hans Van Tol
11:15 AM	10	5+5	NMR User facility updates	Bill Brey
11:25 AM	10	5+5	AMRIS User facility updates	Joanna Long
11:35 AM	10	5+5	ICR User facility updates	Kicki Hakansson
11:45 AM	15		Open Discussion	Facilitated by Tim Murphy
12:00 PM	60		**BREAKOUT SESSIONS - MagLab presents *Facilities in Focus***	
			DC Field/ HBT (B101)	Ali Bangura, Julia Smith, Mark Meisel
			ICR (B210)	Kicki Hakansson
			EMR (A341)	Hans Van Tol
			NMR/ AMRIS (B333)	Joanna Long, Bill Brey
			PFF (A235)	Laurel Winter, Ross McDonald
1:00 PM	5		Group picture	Stephen Bilenky
1:05 PM	60		LUNCH in lobby & MagLab T-shirt Sale	
2:05 PM	70		**BREAKOUT SESSIONS - Users Committee asks questions of MagLab**	
			DC Field/ HBT (B101)	Ali Bangura, Julia Smith, Mark Meisel
			ICR (B210)	Kicki Hakansson
			EMR (A341)	Hans Van Tol
			NMR/ AMRIS (B333)	Joanna Long, Bill Brey
			PFF (A235)	Laurel Winter, Ross McDonald
3:15 PM		30	Condensed Matter Ensemble - DC/HBT + PFF + others interested (B101)	Ali Bangura, Julia Smith, Mark Meisel, Laurel Winter, Ross McDonald
3:15 PM		30	NMR + AMRIS + EMR + ICR (B333)	Joanna Long, Hans Van Tol, Bill Brey,
3:45 PM	15		BREAK	
4:00 PM	120		User Committee closed-door session (B101): discussion/ report writing	Franklin Leach
6:00 PM			Shuttle departs MagLab to hotel	
6:00 PM			Self-organized TOURS & self-organized DINNER to continue discussion	
Start	**Dur (min)**	**Talk/ Discussion**	**Day 3, Thursday, November 6, 2025 Event Location: NHMFL, 1800 E. Paul Dirac Drive, Tallahassee, FL 32310**	**Presenter**
8:30 AM	15		Shuttle departs from hotel	
8:45 AM	60		Informal reports from breakouts by User Committee scribes to MagLab team	Franklin Leach
9:45 AM	30		User Committee closed door session: Office Election	Franklin Leach
10:15 AM	30		BREAK	
10:45 AM	30		Outbrief with Institutional Representatives (Close Door)	Remote: Stacey Patterson, FSU VPR; David Norton, UF VPR; Jen Martinez,
11:15 AM	60		User Committee closed door session: Draft report	
12:15 PM	45		WORKING LUNCH	
1:00 PM			Adjourn	
			Shuttle departs MagLab to airport and hotel	

Future Uncertainty: The UC applauds the dedication and resolve of the entire MagLab to maintain user operations as it navigates a period of historic uncertainty for scientific funding and support. The MagLab has continued to produce cutting edge scientific results, and the committee is excited to see the vision for future innovations that will enable new scientific discoveries, novel applications, and broader societal impacts. However, the current and future achievements cannot be sustained or realized without the continued support and investment by the NSF. More clarity from NSF regarding the funding situation of the lab is imperative to sustain the operations of the lab and to prevent the loss of valuable expertise and instrumentation, which will be devastating to the large user community that relies on the lab's capabilities.

Condition Assessment: The UC previously welcomed the news that the Facilities Condition Assessment (FCA) site reviews were conducted after our 2023 meeting and that a report was delivered in early 2024 by Aerospace Corp. The initial outcome was an Asset Management Plan (AMP) to provide a tiered roadmap for equipment and infrastructure preventative maintenance and replacement of capital assets necessary to maintain the lab's position at the forefront of high magnetic field science.

Based on recent updates, the UC is disappointed that planned financial support for many of these critical upgrades is largely unavailable and that the future status of numerous Tier 1 and 2 action items is now unclear. These items continue to age and represent critical points of failure across the user program. With the absence of a funded, long-term infrastructure plan, the timeline for enhancement of these assets is not clear to the user committee and should be communicated as these plans are developed.

Three key FCA items remain at the forefront of user concern:

1. LANL Power Delivery Controllers - We are encouraged that the NSF has acknowledged responsibility for funding of the power delivery controllers (PSRs) at the LANL site. The PSRs are beyond service and repair and only partially operational, and as such present a major weak link for operation of the 100 T and 60 T long-pulse magnets at the PFF after the generator is brought back online in 2026. While the current PSRs will allow for initial commissioning of the generator the absence of a full system will impede magnet operation in 2027. This outdated system has been maintained through the creative and industrious efforts of the facility staff. Based on our awareness, failure could lead to another delay of approximately 1-2 years for the user community's access to magnetic field strengths and pulse profiles only available through use of the 60 T long-pulse and 100 T magnets. This scenario would be disastrous after the extended downtime of these magnets experienced during the rotor repair.
2. UF High B/T UPS System - We are also encouraged that UF has committed financial support to upgrade this key infrastructure. We remain concerned about the lack of clean, uninterruptible power for the UF High B/T facility, and this upgrade should be of the highest priority. The lack of this modern infrastructure presents a substantial risk for experimental failure as these measurements often require weeks (and sometimes months) to achieve and a loss of power during data acquisition negates significant effort

on the part of users and scientific staff. This aging equipment also prevents our users from achieving the lowest temperature regimes where novel, emergent phenomena are observed and lead to high impact science.

3. UF AMRIS 11 T Unshielded MRI System - Although additional Tier 1 and 2 items remain, the 11.5 T MRI warrants explicit mention. This magnet is 23 years old. It is at the end of life and is no longer supported by the manufacturer. We encourage the pursuit of a 15.2 T instrument that will provide increased scientific output, a safer working environment, and significant operating cost reduction for the AMRIS site.

Limitations of Lab Access and Foreign Countries of Concern: The MagLab UC community is a diverse group of scientists that includes US citizens, foreign visitors, and foreign nationals. The implementation of increased scrutiny for members of the user community by the State of Florida presents an elevated concern for the UC. We acknowledge that these requirements have not originated from within MagLab nor NSF, and that due to the location of the FSU and UF sites, adherence to this statute is required. This policy could potentially push many users away from NHMFL including PFF, as experiments carried out at PFF are often based on prior results obtained from FSU and/or UF site(s). Recent policy changes at LANL to restrict access now contribute to this issue. Our primary concern remains in the core fact that this regulatory process stands in direct contrast with the mission of the MagLab and spirit of science as a whole.

While we continue to disagree with this statute, we are encouraged that the user access request timeline has stabilized with a modest online process for a typical 18-day user visit and an approximate 3-week process for long-term users, a marked improvement from the 6-12 month timeframe last year. Although constrained, we appreciate the efforts to facilitate user access across all MagLab sites.

User Program Workforce Development: MagLab personnel are a key component of the user program, and we continue to encourage the retention and attraction of talented individuals for scientific and administrative support. A key aspect of success in this area is a well-defined vision of roles, responsibilities, and expectations for all. We support the continued implementation of a workplace values system under the direction of the new lab leadership and acknowledge that the entire user experience will benefit from the establishment of norms for expectations and clear communication. As the MagLab user program continues to evolve, this open dialogue and engagement with the users will be critical for success.

Moving forward, these activities will promote staff retention while also providing an attractive environment to recruit new talent for user support and technology development so that single points of failure within the support system can be minimized. The committee recognizes these ongoing efforts and continues to encourage the MagLab to consider additional funding avenues for training new PI and young scientist users. These opportunities are required to sustain a thriving high magnetic field science community. With a generational retirement now in process, the potential forthcoming loss of institutional knowledge in all high field science disciplines should not be underestimated.

User Program Enhancements and Feedback: The complete cycle of user science and feedback is a central component of the user program. Discussion during our meeting provided opportunities for further optimization of this experience that we will encourage implementation in a collaborative effort with our community. First, a key component of a user visit is technique training. This aspect has largely been an oral tradition passed down through facility personnel and users. This expertise should be documented to establish and maintain a knowledge base for high field science. Secondly, we would like to request that facility personnel close the loop of feedback after a visit. Users provide comments related to their experience, and it would be beneficial and appreciated to learn that concerns have been heard and that broken equipment has been repaired prior to requesting additional magnet time. Finally, we encourage the availability of a MagLab overview slide and facility-specific capability slides for the user community so that we can assist in outreach for the user program. We currently acknowledge the NSF core grant and user program support in manuscripts and presentations, and this content would further improve the MagLab's visibility.

Magnet Infrastructure and Future Development: We continue to recognize the importance of sustained funding for the development of new magnet materials and designs to support future technology development for high field science. We applaud the efforts of the MS&T group over the past year as they have managed both future design projects as well as key flagship magnet repairs. The 40 T project design phase is near completion and nearly all test objectives have been met. The UC was pleased to hear that repairs for both the 32 T and 36 T SCH magnets have been planned with tentative timelines set. In the downtime of these productive systems, care should be taken to continually evaluate the landscape for user science. For example, 30 T persistent, all-superconducting magnets are on order and future developments will continue to diminish the competitive advantage of MagLab infrastructure.

We continue to strongly encourage well planned and documented hand-offs to the operations staff so that these transitions proceed smoothly without incident and to ensure robust and safe operation over time. Although we recognize both bandwidth and funding limitations, we continue to encourage the MagLab to also advance high field technologies required for the resonance facilities. Unfortunately, these disciplines are approaching a sole-source scenario where a single vendor will dictate the design and availability for these systems with accountability to shareholders potentially taking priority over scientific advancement.

The UC was also pleased to learn of ongoing collaborative efforts to deploy a 20 T magnet system to the NSF CHESS X-ray beamline along with coordinated user proposal reviews to facilitate science between the two facilities.

Housing Needs: The limited availability and elevated expense of housing near all MagLab campuses remains an ongoing concern for the user community. Given the spirit of an NSF user facility is to enable science, we again suggest that the NSF make a concerted effort to support travel and housing for MagLab experiments to ensure access to all. There also remains an important need for non-rent based affordable long-term dorm/visitor housing at the B/T site, as 6-month hotel stays are impossible, and rent cannot be charged to grants.

We also provide a reminder that other global high-field experimental sites routinely provide travel reimbursement and may start to present a more viable option to some users who have historically been affiliated with MagLab.

Outreach and Access: The MagLab continues to maintain a broad portfolio of programs that span community outreach and education as well as advanced training opportunities. These efforts have benefited in recent years from increased social media presence. Examples of these activities include an RF coil building workshop, several winter/summer schools, education events at local libraries, and community outreach days that occur annually. We also applaud facility engagement in global efforts such as the European PANACEA project for solid-state NMR as well as the International Complex Matrices Molecular Characterization (iC2MC) joint laboratory effort.

(2) Report of the DC Field and High B/T Facility User Advisory Committee

Overview:

- We applaud the renewed effort to improve the current facilities and refine existing measurement capabilities in addition to the pursuit of additional funding to continue this process. We applaud the efforts by the FSU, UF, and LANL administrations to provide major infrastructure support throughout this process.
- We would like to highlight our enthusiasm for recruiting and training highly capable technical staff, including electricians, machine shop engineers, and other DC field support personnel. We applaud recent efforts from MagLab Leadership to improve professional development and training opportunities for MagLab staff.
- We are happy to see that the open support staff positions at the high B/T facility have also been filled and that an assistant director for the facility has also been recruited to eventually fill the director position in the coming years after the current director retires.
- We also applaud the creativity of the Magnet Lab MS&T team in completing designs for the 40 T all-superconducting magnet under the current budget limitations.
- A major concern from previous years was the repair of the 32T all-superconducting magnet. We are happy to see that DC Field has now set in place a firm timeline for the repair and outlined improvements on the previous design to enhance its ultimate lifetime. We note that this is also true of the Series-Connected-Hybrid and appreciate this as well.
- We are excited to see NHMFL reach out to other national lab facilities for integrating other experimental techniques with high magnetic fields. Specifically, we are excited about the possibility of working with high-field magnets at the NSF-funded CHESS facility and the administration's ongoing effort to ease experimental transfer between NHMFL and CHESS. We encourage the NHMFL administration to continue looking for similar collaborations with research institutions, potentially with those focusing on fusion, quantum information, or high energy science, which can enhance the potential number of alternate sources of funding.
- We are extremely happy to hear that the NHFML is considering partnering with the newly formed FSU/FAMU MSE Department to facilitate partial appointments of NHMFL research faculty within the College of Engineering. We strongly encourage the administration to

continue this path and to maintain engagement with the new MSE faculty hires. This will be an excellent opportunity to strengthen the intellectual research environment in the MagLab and boost the filling of open research faculty positions in the CMS division.

- We were delighted to learn about the revival and improvement of the portable dilution refrigerator system for the DC field facility, particularly the improved electronic temperature environment. We appreciate the efforts of the MagLab staff to restore this key functionality to the user program.

Highest Priority Concern Regarding Facilities and Infrastructure: The procurement and installment of uninterruptible low noise power has been a multi-year issue at the high B/T facility. The lack of this UPS puts highly sensitive equipment at risk due to damage by power fluctuations and is a major contributing factor to productivity challenges at this facility. Specifically, achieving electronic temperatures below 10 mK, which is key to advancing scientific output at the high B/T facility, is nearly impossible due to the current unstable power supply.

Highest Priority Concerns Regarding Research Faculty positions:

1. At the time of this report, there are 4 or more unfilled positions within the Research Faculty rank and another four vacancies in operations and technical support staff. Both put an extra burden on the remaining research faculty, who must take on additional responsibilities on top of their regular duties. This situation is of concern for several reasons: (1) the potential to impair facility operation, (2) the overwork of research faculty and (3) the reduced availability of research faculty for training of new users, particularly undergraduate students, graduate students and postdoctoral researchers . This impairment in training and reduction of opportunities for collaboration disrupts one of the key educational goals of the lab: producing a new generation of magnet and cryogenic scientists. To the credit of the Magnet Lab, many NHMFL alumni now work in industries crucial to national security priorities and economic competitiveness, perhaps most notably quantum computing (e.g., Bluefors, Maybell, Quantum Design) and semiconductor devices (e.g., Intel, Applied Materials). We understand the fiscal uncertainty in which the lab finds itself may lead them to question their ability to provide secure funding to new hires at this time but caution against going into a budget renewal understaffed.

To address this, we recommend that all open positions be filled as soon as possible and that in the meantime, the lab collaboratively work with its current research faculty to review, prioritize, and where necessary defer tasks to avoid burnout.

2. We are concerned that there is now an imbalance between the twin responsibilities and expectations of the Research Faculty: to provide technical support and to engage in world-class science. These twin roles and responsibilities of the Research Faculty are clearly outlined in MagLab bylaws and union contracts. It is, however, all too easy in practice for the former to impair the latter - particularly when there is a staffing shortage - and we are concerned that the responsibility to perform world-class science needs additional support from the lab. As users, we wish to stress that we would also benefit from such a rebalancing: a research faculty with the time, ability, and resources to engage in individual scientific

pursuits strengthens the science produced by the lab, offers a source of professional development and collaboration for these staff scientists, and ultimately enhances the scientific capabilities of the lab available to users . We also believe it will be easier to attract world-class talent to the MagLab if it is clear that the Research Faculty are supported in their scientific careers as independent researchers. Longer term, as part of bylaw revisions and contract negotiations, the lab should also consider how appointments to chief scientist positions might also address this issue.

To address these concerns, we encourage the lab to consider ways to strengthen support for and identify/remove impediments to pursuing independent research above and beyond a return to full staffing and an enhancement of in-house research opportunity grants, and we recognize this may affect hours of operation, frequencies and durations of shutdowns, and allocations of magnet time.

Additional Concerns Relating to Staffing:

1. We anticipate that the current immigration rules for highly qualified foreign nationals will further exacerbate staff shortages, making it difficult to recruit talented scientific personnel. We encourage the NHMFL administration to continue working closely with the FSU Center for Global Engagement to facilitate effective solutions.

2. Multiple chief scientist positions have been created and filled in a noncompetitive process. It is unclear what the roles and responsibilities of these additional administrative positions are and how they contribute to the user program.

3. A large amount of user support falls on the shoulders of a small number of individuals, creating single points of failure. One specific example is Dr. David Graf, who often handles multiple users in a single week, including over holidays, and has been the only user staff, for many years now, that knows how to manage the pressure cell experiments. We encourage the NHMFL to continue to identify these areas and target hiring such that these single points of failure are alleviated.

General User Concerns and User Committee Recommendations:

- The cost of visiting the NHFML has skyrocketed in recent years. This includes the cost of flights, rental cars, and housing. While we recognize that there is little that can be done about rental and airfare costs, we implore NHMFL administration to find a better solution to the housing costs. Possible suggestions include partnering with FSU or FAMU for the use of housing facilities or negotiating special rates with hotels in Tallahassee. A webpage stating group rates available for MagLab users does exist but hotels are not aware of this negotiated rate. We recommend that this page be updated and hotels that are actually supported at these rates be more clearly presented to users. For example, including these reduced rates as additional emailed travel information when magnet time is awarded to users.

- Related to the travel costs of visiting the NHMFL, reimbursements for first-time users and for those severely inconvenienced by malfunctioning magnets are often onerous processes that typically require constant reminding, across many weeks, to finalize.
- We feel that the MagLab could improve user feedback response rates by adjusting how user feedback is requested. For example, the MagLab safety report portal is an easy-to-find and easy-to-access web resource that all group members who attend magnet time can access independently, immediately, and, when needed, anonymously. This has been an effective approach to improve safety engagement, and we suggest that a similar portal for user-feedback (independent of the emailed survey links) would similarly encourage users to submit user feedback to the MagLab. We would further suggest that the MagLab consider the potential benefit of periodically reviewing and revising survey forms and questions to continuously improve the quality and actionability of user submitted feedback. We feel this would help the MagLab and the User Committee understand the true scope and timeline of issues that are raised.
- We suggest the MagLab determine and communicate a simple, standardized strategy to encourage users to label malfunctioning measurement equipment, cables and connectors beyond the traditional honor system currently implemented. For example, improving the availability of "Out of Order" tags, updating SOPs, or including a relevant module in the online user training suite are all strategies that could help users communicate minor equipment failures to the MagLab more effectively and more consistently.

Finally, we sympathize with the budget uncertainties faced by the NHMFL administration and greatly appreciate their resolve in maintaining the continuity of the NHMFL mission to support users within the DC Field facility and across the entire NHMFL user ecosystem.

(3) Report of the Pulsed Field Facility User Advisory Committee

Overview: The MagLab's Pulsed Field Facility at LANL holds the world record for the highest non-destructive magnetic field at 100 tesla (T). It also leads globally in user access, serving more external researchers with its 65+ tesla magnets than any other pulsed field facility in the world. The energy storage generator for the 100 T system was damaged a few years ago, and the replacement rotor for this generator, first fabricated in Japan and currently being tested in Switzerland by General Electric , is almost ready to be shipped to Los Alamos from Birr, Switzerland . We appreciate the attention and priority this project has been given at LANL (>$30 M investment), and we are looking forward to the renewed access to the unique and powerful 100 Tesla pulsed field system. The rotor delivery is anticipated in July of 2026, and the system is expected to be operational by early 2027.

Capability Development: The user committee appreciates the development effort of "actinide cell", or the Blue tank, dedicated to radioactive 5f-electron samples (mostly transuranics) and studies up to 50 T. The notable capabilities to explore high-field physics and materials properties in transuranic based samples is not seen elsewhere and therefore is highly unique to Los Alamos. We encourage the facility to consider future development of capabilities utilizing single-turn coil magnets to achieve magnetic fields in

the 100–170 T range for actinide studies within the non-destructive sample regime. While we acknowledge the current manpower shortage, advancing pulsed field capabilities, both in this field range and in the ultra-short pulse regime, alongside expanded experimental access, would represent a significant step forward. These facilities provide critical new capabilities for advanced materials science and engineering studies that are essential to national security missions across DOE and DOD. Beyond their immediate applications, these developments also support future DOE priorities, including those of NNSA, NE, and FE programs.

We believe it would benefit the pulsed field program if synergistic experimental programs could be found that align with the main scientific priorities of Los Alamos National Laboratory. These priorities are often driven by security issues or nuclear physics associated with weapons or energy generation. The new push for civilian fusion energy is a good example.

The committee also acknowledges the successful deployment of the 75 and development of the 85 T duplex magnets and the new generation of 65 T magnets with a much shorter cool-down time. These important systems represent a significant step toward the advancement of future next-generation magnets exceeding 100 T, in addition to providing simpler capacitor driven magnets that allow users to test and optimize measurements in an environment similar to the rotating generator driven 100 T magnet.

We appreciate the implementation of a DAC system that allows us to apply pressures as high as 5 GPa, with the understanding that right now the sample space is greatly limited and the types of measurements compatible with this setup is highly limited. In general, the user committee encourages the development of techniques and capabilities for pulsed field measurements under applied pressure. We also appreciate the technical difficulties associated with such measurements, and do not necessarily expect a “plug and play” capability for users. Nevertheless, emergence of systems including superhydride superconductors and UTe2, as well as the growing interest in pressure stabilized, light element superconductors, all underscore the need for capabilities for measurements in both extreme fields and under applied pressure. Given that high magnetic fields and high-pressures represent key tuning parameters for studying quantum matter, we anticipate that the PFF would benefit from investment in the staff, expertise, and equipment needed to assist future users in such measurements.

Talent acquisition and retention (short-staffed) is always an important issue for continuing the improvement of the laboratory. For example, the development of pressure capability alone will require at least one FTE’s effort. We understand that these are difficult times, but innovative ways to increase the number and effectiveness of staff is critical at any stage of a world class laboratory, particularly if one wants to remain at the forefront of international research.

User Access: The committee appreciates that access for foreign nationals remains problematic at Los Alamos (typical processing time 21 days, sensitive countries 90 days). Early processing is essential to warrant access approval, and for this, an appropriate notice to the users well in advance with a prompt and smooth communication is appreciated. We acknowledge and appreciate the PFF staff’s understanding

and support in this matter. We also support the effort to automatically export data to universally accessible sites such as Open Science Framework to allow easy access to remote users of the laboratory.

(4) Report of the NMR/MRI User Advisory Committee

Overview: The committee acknowledges the difficult and uncertain funding landscape and applauds the NMR/AMRIS leadership and staff for continuing to find creative solutions to outstanding challenges, serving their large user community, and producing cutting edge results and publications.

Over the past year there have been investments to acquire refurbished systems from other institutions and upgrades to consoles and equipment, ensuring that users have reliable access to the workhorse lower field instruments. As a result, all spectrometers and imaging systems not under repair continue to be utilized at maximum capacity, and productivity as measured by the number of high impact publications has continued to increase. The DNP system, in particular, continues to be the most productive instrument of its class in the world and recent upgrades to the instrument were much needed and welcomed by the users.

The committee and user community look forward to the rebuild of the 36 T series-connected hybrid (SCH) magnet, which has pushed the boundaries of what is possible for NMR spectroscopy of material and biological systems. However, the committee would like to acknowledge that by the time this system is back up and running (planned for second half of 2027), the high field NMR landscape in the US and the world will be very different, and the NHMFL is in real danger of losing its position as a world leader in guiding the future of NMR spectroscopy. Similarly, the NHMFL has been a longstanding world leader in developing and supporting magnets for pre-clinical MRI imaging, which have enabled exciting new applications. More investments in these areas, especially focused on high field systems, will be necessary to sustain the lab's competitive edge. In this context, the committee strongly supports initiatives to partner with industry to develop a 1.4 or 1.5 GHz persistent-mode magnet specifically for NMR applications and to be placed at the NHMFL, the submission of proposals to bring DNP and MAS cryoprobes to higher fields, and the proposed replacement of the aging 11 T MRI system at UF with a shielded and efficient 15.2 T system for pre-clinical imaging. We provide more details below.

Instrumentation: The NHMFL continues to be an impressive resource for unique and high-quality instrumentation for NMR and MRI users globally. The NMR/MRI facilities host 14 NMR spectrometers, including the highest field MRI magnet (21.1 T) in the world. The committee was excited to see the recent development of unique NMR/MRI probes that significantly outperform existing commercial instrumentation as well as the installation of a new DNP gyrotron along with improved infrastructure for liquid nitrogen delivery. In addition, the committee commends the recent acquisition of a Bluefors He recovery system at UF, which will have an overwhelmingly positive impact in reducing costs in maintaining magnet systems at AMRIS. We note that the NHMFL staff have been great stewards of aging equipment that continues to produce high quality results, including the 900 WB 21.1 T system, the only dissolution DNP system in a user facility, and the unshielded 11 T MRI system at AMRIS. The committee is eager to see the 36 T SCH back online given it has allowed for the access of new magnetic field regimes for probing the local atomic structure in critical materials. The SCH has been world-leading and any downtime is a loss to the community.

MRI transition: The committee is impressed with the pre-clinical imaging capabilities that are available and maintained at the AMRIS facility. Comments were made that after having seen the quality of the MR images produced at higher magnetic fields that they would distrust conclusions made using diffusion/tractography data obtained at the more commonly available 7 T, pre-clinical imaging instrumentation. The 11 T MRI instrument housed at AMRIS is a hallmark of the NHMFL; however, it has reached its end of life. The magnet is 23 years old and can no longer receive support: the manufacturer no longer exists, and third-party maintenance and servicing are not an option. In addition, the MRI group in Tallahassee has recently suffered a setback and is in transition. The committee is relieved to see that short-term measures have been undertaken to support the students, postdocs and the day-to-day operations of the MRI systems. However, this also is an opportunity for long-term strategic planning regarding the future of the facility. A key aspect appears to be the lack of a vibrant MRI community locally at FSU that can support and enhance the operations of the facility in the long term, a problem that necessitates discussions with institutional representatives and a potential strategic hiring initiative to boost the MRI research activities at FSU/NHMFL.

Personnel: The NMR group at the NHMFL is currently down several positions. The committee is pleased to see that efforts are underway to fill the staff scientist positions for DNP and SCH, and biosolids, respectively, and understands that these efforts may take some time due to the uncertain funding landscape. The situation with the MRI staff in Tallahassee is much more problematic and the committee is currently unclear who exactly oversees the MRI user program. The NMR staff in Tallahassee expressed some concern regarding the departure of the machinist who supported the probe building operations of the group. The committee is relieved to hear that the NHMFL leadership has been actively working with the group to ensure that their machining needs are met, so that they can continue the innovation and development of instrumentation that provides unique advantages for the NHMFL NMR user community.

In addition, the committee is extremely concerned about the loss of the machinist who has traditionally supported the NMR probe development group, which limits their ability to deliver the unique NMR probes that are the hallmark of the NMR user program. The committee urges clarity regarding the situation with the MRI user facility and staff in Tallahassee and strongly hopes that adequate machine shop support can be provided to the NMR probe team, so that they can continue the innovation and development of instrumentation that provides unique advantages for the NHMFL NMR user community.

Vision for the future: The NHMFL continues to push the boundaries of pulsed and hybrid magnet technology. The 36 T SCH magnet has been easily the single most productive high-field NMR magnet worldwide, producing roughly one high-impact scientific publication for every two days of operation, and far surpassing the collective output of all commercial GHz-class platforms around the world for the past four years. Unfortunately, the 36 T instrument has been inoperable for the past two years. Meanwhile, the persistent, all-superconducting, magnet technology from industry has continued to advance; 30 T commercial high-field NMR magnets are on order, and 28 T magnets have been delivered at various locations in the United States and globally, outcompeting the currently highest magnetic field for NMR of 21.1 T at the NHMFL. This instrumentation is further slowly reducing the competitive edge afforded by the 36 T SCH magnet at the NHMFL. The committee would like to emphasize that the continued success of biological and materials NMR efforts in the United States is reliant on strong innovation at the NHMFL. An NSFI RI-1 proposal has been submitted for a 1 GHz solid-state NMR instrument with DNP and MAS cryoprobe capabilities, which would be a unique high-sensitivity and high-field NMR instrument worldwide. The installation of such an instrument at the NHMFL, as opposed to academic groups at

universities, should be viewed as a national research priority. Similarly, high-level discussions between Bruker and NHMFL were held in regard to the installation of a commercial 1.4 or 1.5 GHz persistent magnet-based NMR system at the NHMFL, a prospect which the committee viewed with tremendous excitement. This high-field system, which would be pursued via the mechanism of an NSF RI-2 Midscale Proposal, would be dedicated to expanding NMR across the Periodic Table, opening unprecedented new avenues of research in chemistry, materials science, and biology. The remarkable successes of the SCH and DNP systems at the NHMFL demonstrates that situating these types of one-of-a-kind instruments within a national user facility, where they are openly accessible to the entire scientific community and adequately supported, maximizes their impact and ensures the highest level of scientific return.

The committee was impressed and excited by the vision to replace the 11 T MRI instrument housed at the AMRIS site with a far more compact, safer, and more powerful 15.2 T instrument. The instrument would enable for a threefold increase in output and a dramatic reduction in operating costs given that the current instrument consumes about 8000 L of liquid helium per year; a $30K annual cost expected to increase by 9% yearly for the foreseeable future. Unfortunately, the $10M cost for replacement is large, but should be given a high priority in the near future for the continued success of AMRIS and the pre-clinical imaging program at the NHMFL/FSU. The 15.2 T system is on the condition assessment list for the NHMFL and could alternatively be pursued as part of an NSF RI-2 funding mechanism.

The NHMFL further continues to be a leader in probe development, which is maintained via obtaining smaller equipment grants to keep the NHMFL probe development at the bleeding edge for both MRI and NMR groups. Notably, accessibility to high-quality probes for high magnetic fields has been a challenge at other high-field NMR facilities that rely on commercial probes lacking NHMFL innovations for producing strong radiofrequency fields. This may partly explain why many of the commercial GHz-class NMR platforms world-wide have not yet achieved comparable levels of productivity compared to the 36 T SCH system at the NHMFL. Having access to the highest field NMR and MRI instruments will position the NHMFL to continue to push innovative probe design and solidify the NHMFL as the global leader of high-field NMR and MRI.

Outreach: The committee wishes to emphasize that the NHMFL has been and continues to be a leader in community enhancement and education. Educational programs at the Laboratory leverage a strong social media presence to reach tens of millions of people across the nation and worldwide to educate them about the importance of high magnetic field research. On the local level, the NHMFL annual open house reaches tens of thousands of individuals from the local community for hands-on experiences. Specific additional activities of note include the MRI coil building workshop at AMRIS and the founding of a solid-state NMR school (MagLab Summer School on Solid-State NMR Spectroscopy, to run every May) at the FSU site to teach students and scientists about solid-state NMR methods, technology, and capabilities. On the global level, the NHMFL has been involved in the European PANACEA project as one of two institutions outside of Europe, reinforcing its position as a world-leader in high-field NMR spectroscopy and DNP-enhanced NMR spectroscopy, further increasing its global reputation.

(5) Report of the EMR Facility User Advisory Committee

Overview: The user committee commends the EMR group for their continued productivity–serving 175 users producing 24 publications during 2025–despite their small size (5 staff, 1 post-doc) and modest level

of support derived from the core grant (~3% of total core funding). These accomplishments are additionally notable given that two of the main workhorse instruments were inoperable for several weeks owing to failed or failing magnets. Fortunately, the MagLab was able to use end-of-cycle funds to purchase replacement magnets, illustrating a continued investment in EMR capabilities by the MagLab. The EMR group installed and tested these magnets earlier this year and both systems are now fully operational. The UC also gratefully acknowledges Prof. Steve Hill and his team for the successful acquisition (via NSF MRI funding) of a new Bruker multifrequency (9 and 35 GHz) pulse EPR instrument installed earlier this year. Among its many capabilities, this spectrometer will serve to screen user samples before submitting them for further characterization using the over-subscribed HiPER instrument. Additionally, the operation of this commercial instrument is user-friendly compared to the lab-built spectrometers and thus, provides a more accessible means to train external users on EPR experiment design and execution. We expect this acquisition and ease-of-use will help grow the user base.

Personnel: The UC is happy with the evolution of Dr. Tomas Orlando's role in the EMR group. In addition to the initial hiring objective of stabilizing the DNP program of efforts started within EMR, in his short time in the lab he has become the lead person for users who want to perform experiments on the new Bruker *X*/*Q* system while also working to maintain and upgrade existing instrumentation. For several years the UC has brought up the need for additional, long-term staff within EMR to ensure transfer of knowledge, continued operation, and success of the user experience during upcoming generational turnover, and Dr. Orlando represents a step in this direction.

The UC was very disappointed to learn of the conversion of Prof. Steve Hill's title from "group director" to "chief science officer (CSO) for quantum information science (QIS)", but we respect the autonomy of the MagLab administrators to dictate their organizational vision. Unfortunately, the aftermath of this decision has been rife with confusion for the user community and raises some serious questions about the stability of the EMR group as a whole. The UC is eager to learn the distinction between the roles of "CSO" vs. "director" and how that might affect the EMR user experience. Most immediately, the UC is looking for clarity on who will officially serve as the interim intellectual manager of the group, as the current uncertainty imperils the definition of the science drivers for the renewal. As we understand it, the charge of the UC is to describe forward-looking objectives that improve user experience and encourage development of new experimental capabilities that serve our research goals. Historically, the EMR group director has been intimately involved in defining and executing those objectives and the uncertainty surrounding this position has made it unclear to us what happens next. Moving forward, the UC would like to see enhanced transparency and an improvement in communication of vision between relevant parties including the UC, the EMR group itself, and the MagLab.

The MagLab has begun to implement a new human resources plan in which four administrative personnel (three already existing and one newly hired) are tasked with support to NMR, EMR, and ICR. The ultimate plan is for all administration (except user scheduling) to be performed by a centralized coordinating office. The UC applauds this effort as we recognize that the scientific staff of the EMR group has previously been tasked with these administrative jobs and certainly that reduces the amount of time they have for supporting the user base and experience.

Personnel Recommendations:

- The UC is extremely encouraged by verbal assurances from Director Amm that the MagLab will be supporting two more hires into the EMR group. As emphasized in previous years, the UC continues to be concerned about ensuring vital, instrument-specific, technical knowledge is retained in the group and not subject to upcoming generational turnover. In this context, the UC would like to reiterate that most users are not EMR specialists, while the EMR instrumentation at the MagLab is more complex than what is commercially available. Thus, a user's success heavily depends on the intellectual and hands-on contribution by the EMR group. As described above, Dr. Orlando has helped in this regard, but his recruitment is not sufficient to address this problem.
- Director Amm has indicated the change in EMR leadership was strategic to free up the time of Prof. Hill to focus on science and less on administrative responsibilities. However, as alluded to above, the rollout of this change, in logistics and organization, has been unclear and lacking in communication. Given the urgency of the situation and in an effort to stabilize the EMR group, the UC asks Director Amm to develop an action plan for the replacement of the director of the EMR group. The UC is also asking for clarification on what jobs and responsibilities Deputy Lab Director Tim Murphy, as the interim director of the EMR group, is performing in this capacity.
- In this vein, the EMR UC is requesting a definition for the "director" of a group and, in particular, what roles are held by this person. The UC would also like to know the role of chief scientist and thus Prof. Hill, who is particularly important to the EMR group. Establishing the scope and responsibilities of these positions in the context of group administration, vision, etc. is vital to ensuring a successful future for the EMR group and any upcoming EMR director search.
- The UC welcomes Dr. Hans von Tol as a temporary "de facto" lead of the EMR group. However, since he is not the director, it is not clear to the UC what additional/different job(s) he is performing in this capacity (besides giving the EMR science update at the UC meeting). The UC also notes that Dr. von Tol voiced that he would be willing to lead the EMR group if being asked to do so but it is not his aspiration.
- The UC is concerned over preparations for imminent generational turnover in the EMR group. The upcoming retirement of Dr. Jurek Krzystek and Dr. Andrew Ozarowski necessitates hiring of replacement staff to allow for smooth transition of knowledge. For future hires, the committee recommends that the EMR team be encouraged to advertise widely, including within the user base.

User Program: There is a concerning impression among leadership that there has been a lack of transparency in the scheduling process for EMR, which upon questioning appears to stem from procedures that have not been policy for many (10+) years. Specifically, there was concern about lack of structure around internal use of unsubscribed magnets. We were told by Dr. Krzystek (user program POC) this has not been the case for a while and a proposal on file is always required even for internal users. There are no negative external user comments which would indicate a problem with scheduling or with the EMR group in general. Generally, we understand the current proposal evaluation process involves Dr. Krzystek receiving proposals and subsequent distribution for evaluation by two external reviewers.

Because over-subscription on magnet time has not historically been a major problem, there has not existed a strong reason to generate more structure surrounding this system.

User Program Recommendations: Continued growth of the user base depends on the larger scientific community being made aware of the capabilities and advancements pioneered by the EMR group. To that end, the UC recommends a variety of strategies to improve the visibility and dissemination of research:

- EMR team leverages social media platforms as a strategic outreach tool.
- Emails sent to all past users announcing important updates to EMR capabilities e.g., that the new *X*/*Q* pulse EPR spectrometer is now available for use.
- Generate slide(s) that users can incorporate into their scientific presentations to advertise the techniques/facilities of the MagLab.
- We believe these approaches will enable broader engagement with diverse audiences, including academic peers, industry professionals, and the general public, thereby amplifying the impact.

Capabilities: The UC is excited and relieved that the aging and failing magnet systems for the 16 T homodyne and HiPER spectrometers have been replaced. We greatly appreciate Director Amm for using end-of-cycle funds to provide for these replacements as these are critical workhorse instruments.

The new Bruker E-580 *X*/*Q* system funded by Prof. Steve Hill and team's MRI award was installed in January of 2025. Despite numerous operational issues upon install we commend the team for their continuous follow-up on resolving these bugs, and data is actively being collected on this instrument at both X- and Q-band. We are hopeful that the remaining issues (cryostat with Oxford for repair, noisy digitizer channel) will be soon resolved. A concern was noted in Bruker's ability to provide quick turn-around on repair requests. Our worry is the long-term likelihood of repair options.

Capability Recommendations: The bolometer/detector for the homodyne spectrometer is aging (40 years old). Should it fail, it would cause an approximately 50% loss of productivity. It was noted that there is a substantial lead time for delivery of such a specialized component. It would be terrible to lose the functionality for a system whose magnet was just replaced. On the plus side, modern bolometers have much better sensitivity than that currently in use which will allow for smaller sized samples and/or greater throughput. Bolometer helium consumption is an issue in terms of having sufficient hold time to allow a full set of experiments to be performed.

(6) Report of the ICR User Advisory Committee

Overview: The User Committee commends the outstanding progress made by the ICR Program over the past year to advance the facility's scientific capabilities and infrastructure. The response to the previous year's report was highly effective, in particular the charge to focus on a select set of examples that would highlight new instrumental, software, and analytical capabilities for the upcoming renewal proposal.

Significant headway has been made to upgrade the 21 T, 14.5 T, and 9.4 T instrument platforms, bring new liquid chromatography platforms and workflows online, and purchase equipment for MALDI imaging sample preparation. Additional progress has been made to dramatically improve both sample and data

analysis throughput for both the top-down mass spectrometry and complex organic matter workflows. The committee also recognizes the revitalized strength of the ICR team under the leadership of Prof. Hakansson, which has expanded over the past year to include several new postdoctoral researchers and staff members as well as graduate student trainees. The committee notes a clear and actionable plan to complete each major project, including those that have experienced delays. The completion of recent upgrades has resulted in the availability of exceptional spectrometer platforms that will enable a broader experimental portfolio and higher project throughput. This progress greatly enhances the ICR user community's research potential while simultaneously improving confidence in data quality and research outcomes.

Future Needs and Recommendations: Moving forward, further refinement and standardization of newly developed software platforms will be critical to make them accessible to a wider user audience and the broader research community. If this process is not already underway, the committee encourages prioritization of this effort in the coming year. Moreover, we recommend increased outreach efforts, both internal and external, to highlight potential synergies between NHMFL user facilities (e.g., NMR, AMRIS) and increased awareness of NHMFL resources within the external user community. This could include the addition of standard slides highlighting the breadth of NHMFL capabilities to the end of public presentations and organizing internal meetings or seminars for NHMFL scientists to explore potential internal collaborations.

Finally, the committee is pleased to acknowledge the appointment of Dr. Lydia Babcock-Adams as Visiting Research Faculty to ensure continuity in environmental complex mixture research and the hiring of an administrative staff member for program support after the departure of Dr. Amy McKenna. We also note that efforts to hire a postdoctoral researcher qualified to perform MALDI MS imaging have not yet been successful. This researcher (and their accompanying skillset) will be critical to the successful development and expansion of the FT-ICR imaging capability. We suggest a redoubling of efforts to recruit and hire this individual (e.g., advertising on social media and posting the position on the ASMS Careers page).

Funding Outlook: We recognize that 2025 has been a year of unprecedented uncertainty for scientific research funding and that the funding landscape will likely remain uncertain for some time. To facilitate continued instrument upgrades and software development beyond support from the MagLab core grant, the UC encourages the ICR program to explore external funding opportunities, including cooperative research and development agreements with industry, to complement Prof. Hakansson's current independent funding and ensure continued support for internal and external user projects. It should be noted, however, that industrial support may primarily take the form of in-kind contributions such as equipment or materials, rather than direct financial assistance, consistent with typical practices in the private sector.

Conclusion: The committee applauds the ICR team for its focused and forward-looking progress over the past year. The combination of technical upgrades, software innovations, and strategic personnel recruitment has positioned the facility on a path for continued excellence. With sustained attention to software dissemination, inter-facility collaboration, and diversified funding strategies in the coming year, the ICR program will remain at the forefront of high-resolution analytical science and continue to provide exceptional value to the ICR user community.