Report of the Users Committee Meeting November 7-8, 2008 at Department of Physics, University of Florida, Gainesville, Florida

Voting Committee Members Attending: Vesna Mitrovic, Art Hebard, Wei Pan, Virginia Long, Madelina Furis, Keith Earle, Stephen Julian
Non-voting Committee Members elected for 2009-10 attending: Cyril Opeil, Nathaniel Fortune, Sergei Zvyagin

Introduction and Overview

The Users Committee meeting ran for two days. On the first morning the Committee heard presentations by NHMFL staff on general issues affecting the NHMFL. Then the DC/Pulsed/High-B/T subcommittee heard more specific presentations on the High B/T lab, the Pulsed Field Lab, and the DC Program. On the second morning preliminary reports were presented to NHMFL staff. The EMR Advisory Committee had met at Breckenridge, Colorado on July 22, 2007, while the ICR Advisory Committee had met 16-17 January 2008 in Tallahassee. The NMR Users' Committee met by teleconference call.

The Committee is very impressed with progress at the NHMFL in the past year, including the ongoing development of the Series Connected Hybrid which promises to bring higher fields at lower cost, the stunning new science that is emerging from the new generation of pulsed magnets in Los Alamos, progress towards a 32 T all-superconducting magnet which would transform high magnetic field research, and other developments discussed below by the individual subcommittees. Looking back over the past several years, not only have there been remarkable advances in magnet technology at the NHMFL, but there has also been a notable improvement in the User experience at NHMFL labs due the increasing availability of world-leading measurement equipment and expertise that match the magnet technology.

Whereas in 2007 we congratulated the NHMFL on the budget increase anticipated from their successful NSF renewal, the reality of 2008 is that the NHMFL has had to deal with a budget *cut* in real terms, in the form of only a three percent funding increase combined with a much more rapidly rising cost of electricity. The laboratory management has dealt with these cuts very well, and indeed a typical User who was successful in getting time would not know that the laboratory has had to make significant compromises to deal with the budget difficulties. This is a remarkable achievement. We feel compelled to point out however that in the long term there are very significant risks to the NHMFL if the budget is not restored, the most obvious being that the NHMFL will lose its edge in magnet and measurement technology to growing foreign competition. For example, one consequence of the budget cut was a further delay in constructing the split-coil magnet, which is needed to bring the NHMFL into an internationally leading position in magneto-optical measurements; another victim of the cuts has been renewal of equipment, and although this can be managed for a year without impact on the Users, over the longer

term this is unsustainable; finally, the situation with helium liquefaction and power supply controllers at Tallahassee presents a high risk to the Users program, in that a single equipment failure could result in a long shutdown of the 45 T hybrid magnet.

The NHMFL continues to bring new magnets into the User program (most notably in the past year the 60 T long-pulse magnet and the 100 T multi-shot magnet in Los Alamos) however there has not been a corresponding increase in the budget which *is required in order to keep these magnets running productively.* This represents a looming threat to the pulsed field User program. A particularly glaring need at present is for a Maintenance Budget at NHMFL Los Alamos to keep on hand spare coils in the inevitable event of failure of a coil in the new pulsed field magnets. Similarly, the high B/T facility has opened another bay and made available two new short turnaround time low temperature systems, but with no corresponding increase in staff to support these efforts. This is unsustainable even in the medium term.

Similarly, the NMR/AMRIS program continues to provide world-leading magnets and probes to the User Community, but the utility of these systems is undermined because the detection and control systems are outdated. This not only hinders the execution of novel experiments, but even prevents some routine measurements from being done. This long-running problem can be fixed without a large capital outlay (compared to new magnet development) but budget constraints have prevented this. Moreover an ongoing vacancy, unfilled because of the budget crisis, for a full-time rf-technician is becoming increasingly problematic for both the Tallahassee and Gainesville laboratories.

Finally, the undisputed position of the ICR program as the international leader in ion cyclotron resonance is now under threat, with a number of other international centers developing higher-field magnets. This program proposes to upgrade to a 21T, 110 mm bore magnet, in order to maintain their leading position, but this will require up to $15M to construct: some creative thinking about funding is required here.

The Users' Committee was pleased to see a Policy Statement regarding confidentiality and conflicts of interest with respect to Users. We feel that it is an important step forward to have such a Policy written down, and it will be useful particularly if it is tied to APS and other Professional Organizations' Ethics Policies as they are updated from time to time. We agree that Users must keep the laboratory up-to-date with changes to their measurement plans, because only in this way can staff be aware of potential conflicts of interest between competing measurements in the same laboratory. We also feel that it is important that the NHMFL make clear to PI's within their laboratories that they are responsible for the ethical conduct of post-doctoral researchers under their supervision, and equally the post-doctoral researchers must understand that their supervisors need to be informed of any possible conflicts of interest at the earliest possible date, so that conflicts can be resolved before a problem develops. We would like an explicit statement about the PI's responsibilities in this respect to be written into the document.

As in previous reports, we request improved Statistics from the NHMFL regarding use of the facilities by Users. These Statistics are really required if the Users' Committee is going to do its job effectively. We particularly need to know how much magnet *time* is going to internal vs. external people, as well as the *numbers* of these users. We understand that some level of ambiguity cannot be avoided, but if the definitions are made clear then the Committee will be able to use the figures. For this purpose we recommend that there be three categories of users: internal (i.e. NHMFL staff), local (for example members of a local University or research laboratory), and external. In addition, it would be informative to know the number of new users (both PI's and post-doctoral) at NHMFL facilities each year, and the total number of submitted and rejected requests for time at all facilities. Also, what percent of the rejected users would have been new users and what percent of the rejected users re-submit another request? For the upcoming year we request that these numbers be made available to the Committee 30 days prior to the annual Users' Committee meeting.

The Users' Committee is pleased that Los Alamos and the NMR programs are now directly soliciting User feedback at the end of each run. This information will be useful. In addition, we suggest that the Chair of the Users' Committee be copied in on requests for such feedback, so that Users can channel any delicate feedback to the Chair, rather than to NHMFL staff. We also need to hear from people whose proposals have been rejected. Do they feel that they have been treated fairly, and was the feedback provided to them useful? For this purpose also it should be made clear to failed applicants that they can channel feedback anonymously through the Users' Committee chair.

Finally, the big unknown is still whether there is a pool of potential users who are not aware that they could be doing front-line science at the Magnet Lab facilities. Better publicity might help this, and we suggest that the NHMFL Logo be distributed to all Users, with the followup feedback email, with the request that they briefly mention the NHMFL in any talks they give about the research done there.

Users Committee Matters

The Executive Committee of the Users' Committee met briefly on Friday, 7 November. Nathaniel Fortune was elected to serve as chairman for 2009. New members of the executive committee are Madelina Furis, Cyril Opeil and Keith Earle. They join Kristina Håkansson on the 2009 Executive Committee. Two members from the NMR Sub-committee are still to be appointed, and the post of Secretary is vacant, with the departure of Andrew Webb.

Dates of the next Users Committee meeting will be fixed early in 2009. The meeting will be held in Los Alamos, NM.

At the end of this year the three year terms of Vesna Mitrovic, Wei Pan, Ayyaslaumy Ramamoorthy, Andrew Webb and Art Hebbard and will expire. Stephen Julian will leave the Committee and will take a place on the Executive Committee. The UC thanks these people for their valuable service.

Report of the DC/Pulse/High B/T Users Sub-Committee:

High B/T Laboratory: There have been several new developments that the Users' Committee welcomes. Opening a second ULT bay for external Users is good news: this will shorten the wait-times for access to the combination of ultra-low temperatures and high magnetic fields available in Gainesville. Two new fast-turnaround-time, low-field ULT systems have also been made available, and this will open up new possibilities for Users.

Some of the local arrangements for Users continue to be problematic at the High B/T lab, and we strongly encourage the laboratory to apply for a parking space close to the laboratory for Users. This can really make a difference to Users, who typically commute from off-campus hotels and often work odd hours. In addition, there is still a problem with long-term accommodation, and we recommend that the Laboratory set up a wiki-page that each User can contribute to, regarding local arrangements, so that each new User doesn't have to discover everything for themself.

Finally, and perhaps most importantly, there is a need for more staff support in the laboratory, now that the second ULT Bay has opened up and the fast turnaround time instruments are becoming a User facility.

DC Magnet Lab (Tallahassee): The NHMFL Laboratory at FSU continues to lead the way in its superb treatment of external Users. We feel that the major challenge of reducing power consumption is being dealt with as well as possible: the proposed system of allocating a maximum mega-Watt budget empowers Users, allowing them to control how and when their power is used during a run. Similarly the proposal for flex-time should boost measurement productivity, although we feel it will have to be monitored carefully. The Committee strongly approves of the 250 liters of liquid helium provided free to each User: this again is empowering, and it could be an effective tool for attracting new Users, provided that prospective Users know about this initiative.

The prospect of an all-superconducting 32 tesla magnet is very exciting. This could reduce operating costs while allowing more measurements to be done, particularly for fixed field measurements such as NMR and specific heat, and indeed this is an exciting development for the field as a whole. We support continued growth of sample making in Tallahassee, provided that it does not distract too strongly from the high-field program. We are delighted that there are concrete plans to solve the high-field thermometry problem.

We have a number of recommendations regarding the split-coil magnet. Firstly, we note that progress on this magnet was delayed this year by the budget problems, and we sincerely hope that this will not happen again. We note that the technology for this magnet seems to be in place now, and it looks like this will be another breakthrough magnet for the NHMFL. Having said that, we perceive a possible risk in the supporting instrumentation, which at present is not up to the standard of the proposed magnet. We

therefore recommend that, next year, the pre-Users-Committee meeting be devoted to discussing how the split-coil magnet will be used, and what measurement infrastructure needs to be developed now so that the magnet will produce the best possible results. The Magnet Lab will want to partner with external Users to obtain grants for required equipment, and a strategy needs to be developed now for doing this. Leading scientists in magneto-optical spectroscopy should be polled regarding specific needs, identifying priorities for infrastructure development, and how the magnet will be used in practice. Furthermore, good coordination between the split-coil magnet development team and the existing magneto-optics staff remains essential for the success of the project. Once the equipment is in place there will be a need for an ultra-fast laser technician, who would fill an analogous role to the cryogenics experts associated with the low temperature facilities of the lab. Finally, the options for making this magnet available for general use need to be considered in designing the support infrastructure.

Regarding the **Free Electron Laser**, the DC/Pulse/High B/T subcommittee is very interested, but would like to hear more details at a future meeting, including what new science is expected to emerge, and what parallel developments are going on elsewhere.

Pulsed Field Laboratory: The new developments of the Pulsed field magnets are very exciting, and truly wonderful science is emerging from this program. However this program is at risk due to the lack of a Maintenance Budget which would allow spare magnet coils and other spare parts to be kept on hand in the event of inevitable failures that occur with pulsed magnets. We very strongly recommend that, as soon as the budget situation improves (if not sooner), a rational Maintenance Program with a proper budget, such as exists with the resistive magnets in Tallahassee for example, be put in place that will allow for the 60T Long Pulse and the 100T MS Magnet to be maintained. We hope that the NSF will take this into account if or when additional funding becomes available.

We are pleased that Los Alamos is now collecting User feedback at the end of each run. There seems to be a minor issue to do with the length of time required for issuing access passes, especially for non-US students and PI's, and we recommend that this issue be made very clear to Users when they first approach the laboratory to apply for time.

EMR advisory committee summary

Current situation

This is the beginning of an exciting new era for the EMR program.

The following new capabilities are available for the User program: 900 GHz BWO for resistive magnet, multipliers at 150 and 600 GHz for homodyne spectrometer, 336 GHz pulsed ENDOR capability, a single crystal rotation probe, a 70-1500 GHz magnetic resonance spectrometer and a Mossbauer spectrometer.

Hans van Tol, Jurek Krzystek, and LC Brunel are the supported staff members in the EMR program.

The search for a new director of the EMR program was successfully concluded. The search committee identified 2 local candidates and 5 external candidates for a joint academic appointment and solicited input from G. Smith and J. Schmidt. Steve Hill accepted an offer and started on August 8th. The new EMR director has requested external help to achieve a field-defining vision for the biology and chemistry program at NHMFL.

Recommendations:

Careful thought is needed as to how the EMR program can make a unique contribution to high field pulsed EMR. For example, the EMR program should focus on fields and frequencies not readily available elsewhere, and in particular fields and frequencies that are not available from commercial instruments. User assistance should be allocated accordingly. While the development of low-power sources at high frequencies is clearly a strength of the program, it is important to work on the development of high power pulse sources at high frequencies for pulse experiments.

It is very important to get the correct scholar scientist to assist the director in achieving a field-defining vision for biology and chemistry at NHMFL to complement the physics expertise of the new director. The scholar scientist position should be defined in such a way as to encourage successful applications for external funding. The 'wide-open' post-doc position should be focused on biochemistry or biophysics in order to assist the incoming scholar scientist.

It is noted that the magnet lab has a paucity of scientists at the graduate student/post-doctoral level in the EMR program. Moreover, the magnet lab should encourage more interactions between FSU and UF students using NHMFL equipment.

Regarding the User experience at NHMFL, we request clearer presentation of User data: frequencies and fields should be readily available.

With respect to the Free Electron Laser, the committee recommends that Extended Interaction Klystron's (EIK's) and gyroklystrons should continue to be explored as an alternative to FEL's. The Big Light project should carefully assess the desired amount of overlap with laboratories of similar capabilities, e.g. UCSB and Dresden. It might be wise for NHMFL to delay a heavy investment in proposal writing for FEL technology until the performance of instrumentation at, e.g., UCSB and Dresden can be properly assessed.

NMR Users Committee Summary

The NMR Users Committee meeting was held by teleconference this year. All relevant presentations from the User's meeting were posted on the web and accessed during the 1.5 hr meeting.

User Committee: Helene Benveniste, Andrew Lee, Steven Smith, Marek Pruski, Mark Rance. (Andrew Webb was unable to join the call).

Greg Boebinger presented the state of the NHMFL; Art Edison presented the AMRIS Facility Annual Report which included an overview of the AMRIS core missions, instrument updates, user productivity and fiscal reports. Tim Cross presented the Tallahassee NMR program site and priorities. Unfortunately there was no time to go into detail of the science accomplished in the last year. However, the committee members have access to the presentations posted on the website and the reports summarizing the science from 2008.

State of the NHMFL:

In spite of severe budget cuts (NSF $3M; State of Florida $650K), the NHMFL leadership has balanced the budget excellently so that all user programs are running as planned and meeting the needs of the users. Some changes in the workforce have been made and more changes are expected in 2009 i.e. Art Edison is taking on a new role as Director of Chemistry and Biology to develop this part of the program. The updates on the User profile including user statistics and user hosting was emphasized. Similar to the DOE User's program, the NSF is starting to look at rules to define a given 'user'. For example, the DOE Joint Genome Institute and NSLS sites have an infrastructure implemented that categorically lists user programs and user profiles. NHMFL is in the process of developing this part to accommodate future demands from the NSF.

NHMFL user program survey:

A NHMFL user program survey was presented to the user's committee for approval. The survey is designed to collect essential information on the user portfolio e.g. number of users, internal vs external users, user satisfaction, data analysis needs, number of new users.

The NMR Users Committee agrees that it is essential to collect this information for the following reasons: 1) to stay at the forefront of new and ever evolving science within the NHMFL mission cores; 2) to continuously meet the demands of the old and new users; 3) to maintain the NMR/MRI instruments at the highest operating levels; 4) to assure that user access is based on scientific merit and 5) that access is a logical and transparent process.

Conclusions & Recommendations: It was agreed that the NHMFL User Program Survey addresses the key questions necessary to collect this important information. However,

one feature that is not addressed in the survey is mission relevance (which is a big deal for the DOE); one of the survey sections could address this aspect in a subcategory. This might also provide feedback to the NHMFL, for example, the distribution of time for NMR vs MRI on the individual systems.

What to do if more funding becomes available?

Greg Boebinger requested input from the user's committee for new areas of interest and/or strategies in the event that more funds suddenly become available. The following lists suggestions from the members of the user's committee:

Recommendations:

- Benveniste: Upgrade 11.1 T/40 cm console if the NIH proposal does not come through (same for 600 console upgrade)
- Benveniste: Replace 4.7 T/40 cm imaging system with 7 T/30 cm 'workhorse' for routine users
- Benveniste: Build ^{1}H NMR databases of prior knowledge signatures of essential biomarkers with focus on translational science (HIV biomarkers, cancer biomarkers i.e. fusogenic viruses).
- Pruski: 2 kW amplifier to be used with low-γ probes at 830 and 900 MHz. Make sure that the 900 MHz console upgrade includes a probe capable of ultra fast MAS.
- Lee: go back to recommendations from last year that remain unaddressed. e.g. Upgrading consoles on 500, 600 and 36T; replace 720 with 800; repair of 830.
- Lee: Hire RF engineer (see below)

AMRIS:

Art Edison presented the AMRIS user program cores and achievements including instrument usage and highlights:

The user program cores are 1) Molecular Imaging (Glenn Walter) 2) Microimaging (Steve Blackband) and 3) High Sensitivity NMR (Art Edison). The scientific output from each of the cores in the past year has been outstanding. Of note, the demonstration of small molecules regulating mating and development in C. Elegans using the maglab's 1-mm NMR probe in Nature (Srinivasan et al., Nature 2008) and Dr. Blackband's new data on direct visualization of hippocampal single neurons at 7 um MRI resolution are striking. The molecular imaging data are also groundbreaking demonstrating unique advantages of high field strength and contrast agent enhancements for visualization of live tissue conditions in mouse models of human diseases.

Instrumentation needs:

- The 11.1 T/40 cm console need is hopefully solved; the NIH SIG got a score of 136 (PI: Edison); the console upgrade is essential for further growth and for meeting user demand.
- The 600 console upgrade is part of a 1.5-mm HTS NIH proposal and is still pending.
- More vertical magnet capability – new proposal to NSF for a 700 MHz was suggested.
- 4.7T/40 cm imaging system very old – major workhorse for users - should it be replaced?

Recommendations: It is clear from the user statistics that if the console upgrades do not come through from outside funding sources, it will be essential to get them replaced with internal funds. This need was emphasized in the 2007 user's committee report and is still essential. The NMR Users Committee still finds that the substandard quality of consoles and RF electronics hinders the execution of novel and even some of the routine experiments. Given the relatively minor cost of consoles compared to state-of-the art and unique magnets, this is a misguided strategy (cf. last years report).

The 4.7/40 cm imaging system is still a workhouse and is very old. It might be advantageous to replace this system with a 7.0T/30 cm workhouse if funds were available. It is unclear however, how many external/internal users are accessing this instrument.

Personnel needs:

The need for a full-time RF engineer was requested last year and again this year; in addition a software applications scientist/engineer to develop web applications and software for the users (especially users with need for data processing help) is needed. Budget cuts have prevented filling the RF engineer position (most essential) as faculty salaries had to be covered. Art Edison also emphasized that ½ RF engineer is used to help out on the 3T whole body human scanner which is not directly part of the AMRIS/NHMFL mission and future technology development.

Recommendations: All the NMR Users Committee members deem it necessary to hire a full-time RF engineer to meet the demands of users both at AMRIS and the Tallahassee site (see below). The hallmark of the NHMFL is its unique magnets and state-of-the art RF probes and investment in preservation of this is a 'no-brainer'. Funding restraints and cuts might prohibit new hires but this particular posting (RF engineer) cannot be overlooked. The 3T whole-body technology investment and future relation should also be scrutinized given new fiscal conditions; i.e. RF engineering resources cannot continue to be spent on this system without compensation; it would be advantageous to develop a plan that would focus on building more capital (more funding or fees from clinical users) instead of abandoning/reducing the 3T support effort. In the long run translational research efforts are important for AMRIS and therefore NHLFL.

Tallahassee site:

Tim Cross presented the considerable Tallahassee Facility highlights from 2008 including expansion of the animal facility (Sam Grant received a $200K University grant for this upgrade), a new Avance III console for the 900 and much improved *in vivo* imaging results from the 900 MHz instrument.

The 900 MHz NMR Usage report shows that 56% is dedicated to imaging and 32% to SSNMR. In 2007-2008 there are eight new publications and two submitted publications from the 900 MHz which demonstrates its success. The success is critically dependent on the efforts of Kitchen, Gor'kov and Brey's excellent probe development program for the NHMFL. The Low-E Probes have uniquely been designed by this team and in collaboration with other labs and will be commercially available. Three different L-E Probes for the 900 are now available to users. Of note a new probe platform for in vivo MRI of rats have been developed which optimizes space available for the animal. Images (ex vivo and in vivo) of the rat brain are impressive.

The SSNMR experiments with low-γ nuclei thrive at 830 MHz. These projects involve ^{43}Ca, ^{95}Mo and ^{25}Mg nuclei and several users from the United States and Europe. For example, the 3QMAS spectrum of LDH material, taken by Z. Gan in collaboration with C. Grey, has been recently published in Science (*321*, 113-117, 2008). Again, on-site probe development at NHMFL plays a key role in these measurements. The studies of low-γ nuclei present an exciting opportunity for growth of the NHMFL user program.

Equipment upgrades:

Tim Cross emphasized the need for upgrades in solution NMR instrumentation including replacement of the 720 and replacement of the 600 console.

Personnel:

A full-time RF engineer (see also AMRIS request) and a software applications engineer. In addition an animal resource technician for the in vivo user of the 900 is essential.

Recommendations:

As described above (AMRIS) the NMR Users Committee strongly recommends allocation of funds for the requested personnel. The investment in the new animal facility at the Tallahassee site would be a futile effort without technical support for *in vivo* experiments. In addition to the excellent RF probe designs the key to improving image quality and MRS is physiological stability of animal preparations, including anesthesia and positioning devices. This will be partly accomplished by a dedicated animal technician who can support a diverse user base (e.g. inexperienced or experienced user).

It is also important to have a technician available so that out-side users can plan and expand the portfolio of *in vivo* imaging experiments.

ICR Advisory Committee Summary

ICR Program Operation

The NHMFL Ion Cyclotron Resonance Program continues to serve its external users, as documented by any of several measures (>100 external users/year; #1 or #2 in total abstracts at the Amer. Soc. for Mass Spectrometry Annual Conference (6500 attendees in 2008); industrial users and support ($150K in unrestricted grants in 2008--the overhead for which goes to FSU, not the ICR Program); external invitations and recognitions; etc.) However, in many ways, the ICR Program continues to operate differently than other NHMFL User Programs.

a) The user base turns over from year to year. As new users come to recognize the value of the technique, they acquire their own commercial systems, and future new users take their place. Thus, there is not the continuing user community membership that characterizes most of NHMFL's Materials Research efforts.

b) In addition to NHMFL permanent staff, ICR graduate students and postdoctoral fellows are expected to collaborate with external users, thereby broadening the available local support at essentially no additional cost. Those collaborations have led to some of the most significant publications and presentations (e.g., a PNAS paper in Nov 2008 with Pfizer) and additional external support (e.g., $50 K annual grants for grad student support from Shell, Baker Petrolite, and (pending) Nalco).

c) The ICR Program has provided 24 modular data systems that control data acquisition and data reduction for FT-ICR instruments at other institutions.

d) This year, the ICR Program licensed its software for analysis of petroleum ultrahigh-resolution mass spectra to Sierra Analytics, in return for ten initial (and annually updated) "seats" (copies) of that software. The product has already been acquired by Shell (2), UOP, Schlumberger, and other oil companies, and will facilitate dissemination of NHMFL's expertise to a wide user base.

Future Needs for ICR

Throughout its existence, the ICR Program has operated within its NSF and State budget constraints. In 15 years, only 3 internally funded research grants have gone to ICR projects, and no visitor grants, no sabbaticals, no set-up budgets for new ICR Scholar-Scientists, and no NHMFL core-funded equipment grants outside the NSF Chemistry Division annual operating budgets

have been granted. However, to reach the next level of FT-ICR MS performance, it will be necessary to acquire a **21 T superconducting magnet**. To that end, and at NSF's recommendation, a Workshop was held at NHMFL in January, 2008, with ~20 invited speakers and several other participants, staged jointly with DOE's Pacific Northwest National Laboratory. A report from that Workshop is attached, and will form the basis for upcoming applications for funding of a 21 T FT-ICR MS system.

The FT-ICR MS Advisory Panel considers the 21 T magnet as the highest priority for the continued preeminence of NHMFL's ICR Program. NHMFL's 14.5 T magnet was the highest field in the world when acquired in 2004. However, a 15 T ICR magnet is already in place in Korea (we helped to build the spectrometer for that system), and 15 T magnets have already been funded for Max Planck (Germany) and for Leiden U. (The Netherlands). U. Warwick (England) is likely to acquire 15 T in 2009, and Canada is currently evaluating a proposal for an 18 T system ($9.4 M) at U. Victoria in 2009. How then could a 21 T ICR magnet for NHMFL be funded?

a) It is unlikely that such a magnet will ever be a top priority for NHMFL, because the magnet is within existing technology (and will thus be achieved much more rapidly by the commercial sector), and needs to be at least 110 mm bore diameter (because ICR performance scales with bore radius as well as magnetic field strength). Because NHMFL will always target for smaller-bore at the highest available field, the large-bore system will never be a primary priority.

b) Although NSF's Division of Materials Research has underwritten major expenditures for NMR and EMR magnets, it shows no interest in supporting an ICR magnet. Conversely, the NSF Chemistry Division, which has generously supported ICR operating expenses, does not have a mechanism to support equipment acquisitions costing more than ~$5M (and a 21 T 110 mm bore ICR magnet will likely cost ~$15M). Three years ago, the ICR Program allocated $300 K from its NSF Chemistry Division budget (and attracted another $100K each from PNNL and Korea) to support a 21 T magnet "conceptual design" by NHMFL's Magnet Science and Technology Program. Thus, that phase of the project is complete.

c) Perhaps the most proprietary application of FT-ICR MS is for "petroleomics". Therefore, the ICR Program proposes to seek major (>$1M) operating and capital support from a consortium of oil companies, leveraged by additional support from FSU and the State of Florida, for a Petroleomics Center (targeted at "Advanced Fuels", including biofuels) as part of a case for matching federal support for a 21 T magnet. Biological applications for such a system could trigger an NIH support component.