# National Superconducting Cyclotron Laboratory
# Call for Proposals—PAC41

December 19, 2016

Dear NSCL User:

We invite proposals for beam time to be considered at the next meeting of the NSCL Program Advisory Committee (PAC41). Proposals for PAC41 are due by 5 pm EDT on Wednesday, March 1, 2017 in advance of the PAC41 meeting scheduled for May 3-4, 2017. PAC41 will consider experiments using fast, stopped and reaccelerated beams. Instructions for calculating beam energies and an updated list of ReA3 beams are available at (http://nscl.msu.edu/users/beams.html).

General information on the NSCL proposal process is available at (http://nscl.msu.edu/users/guide.html).

**The timetable for PAC41 is:**

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|---|---|
| Wednesday, March 1, 2017 | Proposals due at NSCL by 5 pm EST |
| Wednesday-Thursday, May 3-4, 2017 | PAC41 Meeting |
| Friday, May 5, 2017 | List of approved experiments posted online |

**The members of PAC41 are:**

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|---|---|
| Daniel Bardayan | University of Notre Dame |
| Michael Carpenter | Argonne National Laboratory |
| Joseph Natowitz | Texas A&M University |
| Eric Ormand | Lawrence Livermore National Laboratory |
| Berta Rubio | IFIC-Valencia |
| Guy Savard | Argonne National Laboratory |
| Hendrik Schatz | NSCL |
| Philip Woods | University of Edinburgh |

Brad Sherrill (NSCL Director) is the non-voting convener and Jill Berryman (Manager for User Relations) is the PAC administrator.

Detailed information is requested on your proposed use of NSCL facilities to aid the Program Advisory Committee in assessing the scientific merit and implications for NSCL of each proposal. Therefore, each proposal submission must contain the following items:

**(A)** PAC41 Proposal Form including a proposal summary of no more than 200 words. The Proposal Form is available on-line and can be accessed from the "Submit Proposal" link at the website: http://nscl.msu.edu/users/call-for-proposals.html. The Beam Request Worksheets, S800 Spectrograph/Sweeper Magnet Worksheet, and the Safety Information worksheet are all now included in the online form. The Proposal Elements Document (described in part B below) and the LISE++ files (described in part C below) should be uploaded using links within the online form.

**(B)** PAC41 Proposal Elements Document, available at the same web site, has the following three parts. All parts must be completed and pertinent questions addressed.

1. A Description of Experiment (strict text limit for the description: 4 text pages, 12 pt font, 1.5 line spacing; with no limit on figures or tables). Please organize the material under the following headings or their equivalent:

i. Physics justification, including background and references;
ii. Goals of the proposed experiment;
iii. Experiment details
   a. what is to be measured;
   b. technical feasibility of measurement (demonstrated by simulation and/or reference to prior work);
   c. counting rate estimates (including assumptions), statistics, error bars;
   d. basis of time request (include time for experimental device tuning, debugging the experimental setup, calibrations, and any test runs);
   e. discussion of present state of readiness of the experiment and an estimated earliest date for the run;
   f. discussion of any technical assistance (design, fabrication, installation, etc.) that may be requested from NSCL;
   g. apparatus (including drawing);

2. Status of previous experiments completed at the Coupled Cyclotron Facility (CCF) listed by experiment number, with status of analysis, publications, presentations, Ph.Ds. awarded, and Master's degrees awarded
3. Educational impact of the proposed experiment

**(C)** The proposal should include an estimate of the secondary beam rate to be used in the experiment based on the instructions below. We encourage the spokespersons to contact the NSCL Beam Physicist Group (beamphysicist@nscl.msu.edu) for assistance. Estimates for unusual fast-beam production (see below) must be discussed with the NSCL Beam Physicist Group prior to proposal submission. Issues with the proposed beam rates or beam properties may be identified during the standard technical review of submitted proposals. If issues are identified, the spokesperson will be contacted and the issues resolved prior to the PAC meeting.

a. The proposers of fast and thermal beam experiments should make a preliminary estimate of beam intensity and purity using the LISE++ code. An electronic copy of the LISE++ files used to obtain rare isotope intensity estimates with the official version of LISE++ (referenced in item 3 of the "Notes for PAC41" below). The LISE files should be uploaded directly using the online Proposal Form links under the tab "Documents". NOTE: proposals for unusual fast beam production such as pick-up reactions, beams produced with less than 50 MeV/u, or with more than 100 watts deposited in the production target must be discussed with the NSCL Beam Physicist Group prior to proposal submission so that the production and separation assumptions can be checked. If proposers are not sure whether the proposal requires such vetting, please contact the Beam Physicists Group.

b. The estimates for ReA3 beam intensities are available on the NSCL Website in the information for users section. A LISE++ file is not required to support ReA3 proposals. To ensure that the required beam characteristics (purity, time structure, energy spread, etc.) can be achieved, proposals should be discussed with the ReA3 Department Head (villari@frib.msu.edu) prior to proposal submission.

Please submit your completed proposal via the "Submit Proposal" link at the website http://nscl.msu.edu/users/call-for-proposals.html by 5 pm Eastern Standard time on Wednesday, March 1, 2017. It will not be possible to submit proposals for PAC41 after the deadline.

Please note the following:

- Previous PACs have emphasized that particular care should be taken to submit well-written proposals, with the proposed scientific goals clearly presented. In addition, the PAC has urged that proposers strictly follow the specified proposal format rules, including:
    - The proposal text, including the Physics Justification, Goals, and Experiment Details must be kept to a maximum of four pages.
    - References, figures, and tables should follow the text (do not imbed in text).
    - One figure should be a layout of the experiment.
    - A summary (no more than 200 words) of the experiment is required and must be included in the online Proposal Form.
    - The Safety Information Worksheet must be completed in full, including the name of the Safety Contact for the proposed experiment.
- The total beam time request for an experiment must include on-target beam time needed to test and debug equipment and to perform calibrations. Each additional beam required for testing and performing calibrations must be listed explicitly. It is especially important to identify all beams necessary for calibration or reference reactions for ReA3 experiments in the proposal. Requests for interruptions in beam time (for example a gap between a test run and the main run or an interruption in the main run to change the experimental configuration) must also be indicated.
- The spokesperson must affirm upon submission of the Proposal Form that all collaborators listed on the proposal have read the Description of Experiment part and have agreed to participate in the experiment.
- Spokespeople must be members of the FRIB Users Organization (FRIBUO). To become a member, please register at fribusers.org/6_JOIN/join.html.
- Each proposal must include, in addition to the on-target time request, a separate estimate of the beam delivery time and experimental device tuning time (using guidelines given below). This information will enable the PAC to evaluate the scientific merit of proposals in light of the total impact on NSCL operations.
- The value of a proposal is increased by noting ancillary measurements and additional scientific outcomes that may be achieved concurrent with the primary goal. The PAC considers such added value in their recommendations. Spokespeople may want to elaborate on these opportunities and encourage additional participation if appropriate to realize them.
- The PAC considers the experience and technical and scientific strength of the experimental team, in addition to the physics of the proposal and its technical feasibility. Therefore, please apprise the Manager for User Relations, Jill Berryman, of any changes in experimental personnel after submission and/or approval of the proposal.
- Approved proposals are publicly announced by title on the NSCL website. Proposers may wish to carefully consider the title of their work for competitive experiments.
- The role of Spokesperson carries significant management responsibility for the successful completion of approved experiments. Potential Spokespersons should review the expected roles they will play and responsibilities that must be executed in preparing, performing, and after an experiment at NSCL. For example, among other duties, the Spokesperson must:

    (1) Complete a *Scheduling and Safety Questionnaire.*

(2) Participate in person, by video, or by telephone in a possible conference with NSCL staff to establish the level of NSCL support and to review the final setup.
(3) Participate as required in a full safety review of the experiment.
(4) Read the document "Responsibilities of Experimenters at NSCL" prior to the experiment, and sign a form acknowledging that all members of the experimental team have also read it.
(5) Complete and sign a checklist upon completion of the experiment.
(6) Complete the Experiment Feedback Form upon completion of the experiment.

Following the performance of the experiment, the Spokesperson must take responsibility for data management and the active organization of data analysis to facilitate timely publication of results. Additional information about the Spokesperson's responsibilities is available at: http://nscl.msu.edu/users/guide.html.

Each proposal will be reviewed by the entire PAC and will be assigned to two PAC members (one primary and one backup) for detailed consideration. The names of the primary and backup PAC members will be sent to you within two weeks after the proposal due date. You are encouraged to contact the primary PAC member charged with the detailed review of your proposal to address questions she/he may have and/or provide clarifications, afterthoughts, etc. The proposals will also undergo a technical review and a safety review and the results will be communicated to spokespersons and the PAC, as described in items #12 and #13 of the "Notes for PAC41" given below.

## NOTES FOR PAC41

**1. Duration of PAC Approvals:** The length of validity for proposals is 24 months from the start of the running period, with the possibility of extension of up to a year if justified.

**2. Beams:** The list of primary beams being offered can be found at http://nscl.msu.edu/users/beams.html. The quoted intensity estimates are based on operating experience with the CCF. If an experiment requires a primary beam or maximum beam intensity other than what is included on the list of offered beams, the user is encouraged to contact the NSCL Operations Department for advice regarding the preferred course of action. Following this advice, the user may follow one of two courses: (a) submit a proposal in the usual fashion, with the recognition that it may be approved on a "reserved" basis, with release of beam time contingent on the successful development of the beam; (b) submit a Letter of Intent, to get feedback from the PAC on the PAC's assessment of the physics interest in the proposed measurement. The latter course is especially appropriate if a very difficult beam is required. (Please note that approval of experiments on a reserved basis expires on the same time frame as normal approval of experiments.)

Rare-isotope beam development is the responsibility of NSCL. Experimenters wishing to use the A1900 as an experimental device should consult and collaborate with the Beam Physicists group.

**3. Estimates of Rare-Isotope Beam Rates:** With the exception of ReA3 experiments, experimenters are required to estimate the expected intensity for each rare-isotope beam requested in the proposal. If experimentally known rates are available, they should be used. Otherwise the rates must be estimated with the program LISE++, version 10.0.6 (see groups.nscl.msu.edu/a1900/software/lise++/, with the option file "A1900_2016.lopt" and configuration file "A1900_2016.lcn"). Note that the website groups.nscl.msu.edu/a1900/ also

provides other useful information for planning experiments with rare isotopes (for example, instructions on using LISE++ for simulating rare-isotope settings in the A1900). Users who would like help with performing LISE++ simulations can contact the Beam Physicists group. For calculation of yields from $^{238}$U fission, start LISE++; from the "File" menu, select "Open"; look in the "Examples" folder; select and open the example file "AF_238U_Be_NSCL.lpp" and use this as the starting point. For simulations with the RF fragment separator, use the NSCL configuration file "A1900_RFFS_2013.lcn". For calculations using the RF fragment separator, it is necessary to input the correct primary beam cyclotron RF frequency. Once rate estimates are made, and before the proposal is submitted, users are encouraged to contact the Beam Physicists group for consultation regarding optimization and the identification of possible problems. Users must upload an electronic copy of LISE++ calculation files used for rare-isotope beam intensity estimates together with their proposals to help resolve any questions that may arise during the technical review of the proposals. As noted above: proposals for unusual fast beam production such as pick-up reactions, beams produced with less than 50 MeV/u, or with more than 100 watts deposited in the production target must be discussed with the NSCL Beam Physicist Group prior to proposal submission so that the production and separation assumptions can be checked. If proposers are not sure whether the proposal requires such vetting, please contact the Beam Physicists group for assistance.

The beam line transport efficiency for rare isotope beams between the A1900 focal plane and end stations located in the experimental vaults depends on the optical properties of the beam and can vary from 100% to less than 50%. Please contact the Beam Physicists group for consultation regarding your specific application.

For anticipated rates for ReA3 and stopped beam experiments, please see notes #8 and #9 below.

**4. Beam Delivery Time Calculation:** To enable the PAC to evaluate the scientific merit of proposals while weighing the total impact on the facility, each proposal will include an estimate of beam delivery time as part of the overall time request. The beam delivery time estimate is made as follows:

(a) Preparation time for each occurrence of a coupled cyclotron primary beam tune used in an experiment is 12 hours. (Note that a primary beam isotope delivered at two different energies by retuning the coupled cyclotrons counts as two different primary beams and will require a beam delivery time allotment of 2×12= 24 hours; a primary beam delivered with a lower quality and at a lower energy by degrading the beam from the coupled cyclotrons does not cost the extra 12 hours of beam delivery time.) If the primary beam is used at a location beyond the A1900, a time allotment of 3 hours per rigidity setting is needed to cover the time for beam delivery to the experiment. A single time allotment of 3 hours can be used to cover delivery of more than one beam beyond the A1900 if the rigidities of the delivered beams lie within a range of 10%.

(b) The time estimate for rare-isotope beam experiments based downstream of the A1900 will also include preparation time for each rare-isotope setting according to the table below:

| | **Tuning time** (hours) | | |
|---|---|---|---|
| **Rate** (pps/pnA) | $Z_{primary\ beam} \leq 12$ | $12 < Z_{primary\ beam} \leq 36$ | $36 < Z_{primary\ beam}$ |
| Rate ≥ 1 | 2 | 6 | 12 |
| 0.0001 < Rate < 1 | 6 | 14 | 20 |
| Rate ≤ 0.0001 | Consult Beam Physicists group | | |

The expected rate can be obtained from a LISE estimate or from a previous measurement of the rate at the A1900 focal plane. (A rare isotope delivered from the same primary beam but with two different rigidities or purities would require two developments and thus would count as two rare-isotope settings.)

(c) A time allotment of 3 hours per rare-isotope setting is also needed to cover the time of beam delivery to the experiment. A single time allotment of 3 hours can be used to cover delivery of more than one rare-isotope setting beyond the A1900 if the rigidities of the settings lie within a range of 10%.

For example, an S800 experiment requiring primary beams of 141 MeV/nucleon $^{41}$Ar and 170 MeV/nucleon $^{24}$Mg would need to allocate (2×12) = 24 hours for primary beam development. If the experiment also requires two secondary beam settings, one from $^{41}$Ar with an expected rate for the isotope of interest of 300 pps/pnA and the other from $^{24}$Mg with an expected rate of 5 pps/pnA, the additional time for development and tuning to the S800 target will be (6+3)+(2+3) = 14 hours. If the experiment furthermore requires the delivery of degraded primary beam at two rigidities for testing or calibration, the additional tuning time will be 3+3 = 6 hours. Thus, the total tuning time is 24+14+6 = 44 hours. (If the rigidities of both degraded primary beams and both rare-isotope settings lie within a range of 10%, the tuning time would be reduced by 9 hours to a total of 35 hours.) The tuning time request in this example is in addition to the beam on target time needed to carry out the experiment.

**5. NSCL-Supported Experimental Devices:** NSCL-supported experimental devices include: the A1900 Fragment Separator, the S800 Spectrograph, the Segmented Germanium Array, the Sweeper Magnet, the RF Fragment Separator, the Ursinus-NSCL Liquid Hydrogen target, and the SEETF facility. NSCL strives to make it possible for experiments utilizing facility-supported devices to be conducted without collaboration with MSU researchers by providing technical assistance within existing resources. Each of these devices has a Service Level Description which outlines (a) the standard configuration options available for the device, (b) the NSCL support level that users can expect for the device, and (c) the responsibilities of users working with the device. Facility support is available for these devices when they are operated in their standard configurations. The Service Level Descriptions are available on the technical information web pages linked from http://nscl.msu.edu/users/equipment.html. For further information on a device, please contact the appropriate person listed on that website. Users are encouraged to collaborate with members of the A1900 group for experiments requiring the development of a very difficult rare-isotope beam (i.e., in cases where the beam development and identification represent the bulk of the experimental effort), or if the A1900 will be used as an experimental device. Users of the RF Fragment Separator should contact the Beam Physicists group for help setting up the LISE simulation, which must include the correct cyclotron RF frequency.

Beam-related device tuning for NSCL-supported devices will be carried out by NSCL staff. The table below gives guidelines for estimating the device-tuning component of the overall beam time request. In general, device tuning is needed only once per experiment but there are exceptions, e.g. a change

of optics for the S800 will require a retune. When in doubt, please consult the appropriate device contact person.

| | |
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| S800 | Standard experiment: 4 hrs;<br>High-resolution experiment: 6 hrs. |
| SeGA | 2 hrs. |
| Sweeper Magnet | 4 hrs. |
| RFFS | 4 hrs for first rare isotope;<br>2 hrs for each additional rare isotope. |
| SEE TF | 4 hrs if SEE TF detectors are used |

Experiments using the A1900 itself should request 4 hours of experimental device tuning time. (Experiments based downstream of the A1900 do not need this time.)

**6. Non-Standard Configurations for Experimental Devices:** Descriptions of the standard experimental equipment configurations, for devices that are supported by NSCL staff (A1900, S800, SeGA, Sweeper Magnet, RF Fragment Separator), are given in the Service Level Descriptions available on technical information web pages linked from http://nscl.msu.edu/users/equipment.html. If your experiment requires a non-standard configuration, please discuss in your proposal the effort and resources required to change configurations. Proposals for experiments that require changes to the standard A1900 hardware/detector configuration must also include a request for the time necessary to modify and restore the A1900 setup since NSCL will be unable to deliver beam to other experiments while the changes are taking place; contact the Beam Physicists group for help with an estimate of the time required for the A1900 changes you wish to make.

**7. Other Experimental Devices:** Other experimental devices listed on the http://nscl.msu.edu/users/equipment.html website are available for use in NSCL experiments. These devices require substantial experience to operate them safely and properly, therefore, collaboration with qualified MSU researchers is necessary for users unfamiliar with running these devices. The available devices and contact persons are as follows:

MoNA-LISA detector, Joe Finck or NSCL contact Thomas Baumann;
Beta Counting System (BCS), Sean Liddick;
High Resolution Array (HiRA), William Lynch;
CsI(Na) scintillator array (CAESAR), Alexandra Gade;
TRIPLEX plunger device, Hiro Iwasaki;
Low Energy Neutron Detector Array (LENDA), Remco Zegers;
Summing NaI Detector (SuN), Artemis Spyrou;
Digital Data Acquisition System (DDAS), Sean Liddick.

Details about experimental devices are available at http://nscl.msu.edu/users/equipment.html. The contact persons listed there will be able to provide further information on the devices.

Estimating the device tuning time for non-NSCL-supported devices is the responsibility of the experimenters; NSCL contact persons for these devices may be consulted for input. Proposals should explicitly list the amount of beam time needed for tuning these devices.

We also welcome equipment provided by experimental groups. If you would like assistance in preparing a proposal to use your device at NSCL please contact Jill Berryman.

**8. Low-Energy Beams:** A number of low intensity rare isotope beams of very low (tens of keV) energy are available for an experimental program in the Low-Energy beam area. The gas cell is considered a NSCL-supported device for experiments which utilize one of the beams on the ReA3 beam list: http://nscl.msu.edu/users/beams.html. Experiments with low-energy beams that are not on the beam list will need to include the gas stopping effort as experiment time in the proposal and such experiments will need to run in collaboration with the beam thermalization group at NSCL. Spokespersons should work closely with the Beam Physicist group on such proposals prior to submission. It will be the responsibility of the experimenters to estimate the required experimental effort for the gas stopping, and include it in their requested beam-on-target time.

Devices that will be available in the low-energy beam area include BECOLA, LEBIT, and SuN. These devices require substantial experience and training to operate safely and properly, therefore, collaboration with qualified MSU researchers is necessary. Other experimental devices, such as those listed in section 7, may also be used in the low-energy beam area. Experimenters who wish to bring their own equipment into this area, or have general questions should contact Stefan Schwarz. Additional space is provided for users to mount equipment in the Low-Energy beam area.

Not all possible isotopes will be available early in the program. We believe that a wide range of isotopes will become available over time, but the feasibility and intensity of each proposed beam will have to be evaluated on a case-by-case basis. Collaboration with the device contact people is necessary in the selection of possible experiments.

The contact persons are:
Low Energy Beam and Ion Trap (LEBIT), Georg Bollen;
Beam Cooling and Laser Spectroscopy (BECOLA), Kei Minamisono;
Summing NaI Detector (SuN), Artemis Spyrou.

**9. ReAccelerated Beams:** The ReA3 experimental program enables experiments with reaccelerated beams of 3-6 MeV/u depending on mass-to-charge ratio. The ReA3 beams and intensities are available at http://nscl.msu.edu/users/beams.html. Please be aware that mixed ground and isomeric states are possible; known cases are noted on the list of beams. Please consult with the Beam Physicists group for help in working with such cases. Please, be also aware that the beam is very often contaminated by the daughter of the requested isotope. Please work with the ReA3 Department head to evaluate the contamination level. For the first time, ReA3 can offer an alternative microstructure of the beam at 16.1 MHz, instead of the original 80.5 MHz, using a new multi-harmonic buncher. This would allow to have beam bunches spaced in time with 62.1 ns instead of 12.4 ns. Please, note that the overall efficiency of the system is decreased by about 10% when using the new buncher. Note also that, for the moment, this capability is offered without a chopper, which means that satellite bunches are still present at 80.5 MHz frequency with intensity equivalent to 5% of the full beam intensity.

It will be the responsibility of the experimenters to include the required experimental effort for the gas stopping and reacceleration, and include it in their requested beam-on-target time (given in the table below). If you have any questions on the stopping system, the contact person for the gas cell is David Morrissey. The contact person for ReA3 is Antonio Villari.

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| A1900 setup | 5 hrs |
| Gas Cell setup | 5 hrs |

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| Linac and beam line tuning | 6 hrs |
| Energy changes < 20% | 1 hr |

A limited set of stable-isotope calibration beams are available if required and need to be requested separately from the RIB beam time request.

Desired beam characteristics should be entered on the ReA3 beam request worksheet. Nominal ReA3 beam energies are 300 keV/u to a maximum of 6 MeV/u, depending on the q/A. Please, use http://nscl.msu.edu/users/beams.html as a guideline. The (final) maximum possible energy will depend on the final charge state selected for the experiment and will be an optimization between minimizing beam impurities and maximizing EBIT charge breeding efficiencies. Please, use Emax (MeV/u) = 12 q/M – where q is the charge state of the beam and M its mass – as a guideline ($0.25 \leq q/A \leq 0.5$).

The typical time structure provided by the EBIT charge breeder has a repetition rate from 2 Hz to 25 Hz with a variable time-on period (pulse width). The pulse width can be as wide as 100's of ms, depending on the frequency and duty cycle. Within the time-on period, the micro bunch structure from the linac is 12.5 ns. Special needs for the time structure (and whether the experiment is sensitive to the time structure) should be noted on the beam request worksheet. Please contact Antonio Villari for the tuning time required for energy changes greater than 20%. Please, note that energy variations should be always in the decreasing direction. For increasing direction the time involved in energy changes can be significantly higher, please, contact the ReA team in this case.

Experimental equipment for the ReA3 program is in the development stage, hence collaboration is required for use of any existing equipment.
Si-barrel ANASEN, Jeff Blackmon
Active Target Time Projection Chamber (AT-TPC), Daniel Bazin
JENSA gas target, Kelly Chipps
Summing NaI (SuN) detector, Artemis Spyrou
Coincident Fission Fragment Detector (CFFD), Dave Morrissey
Neutron Emission Ratio Observer (NERO), Fernando Montes

For other devices, please contact the ReA3 Hall Coordinator, Jim Wagner.

**10. Letters of Intent:** Letters of intent (LOIs) will also be considered by the PAC. The general format of LOIs must include:

- a description of the proposed program and the scientific motivation;
- a description of the necessary research equipment;
- some examples of beams and reactions (if applicable) that might be used for the study;
- the approximate beam time per year that is expected to be needed and the estimated duration of the program.

PAC41 will consider special letters of intent for ReA3 experiments that require new beams not listed at http://nscl.msu.edu/users/beams.html. We anticipate that beams of other elements will be developed over the course of the ReA3 program. Experimenters wishing to use elements that have not been developed are encouraged to write a letter of intent with experimental details and a motivation. The required ReA3 beam intensity on target and the estimated experiment time should be

provided. Please contact Dave Morrissey for help in estimating likely beam intensities. Priority for beam developments will be determined in part by LOIs submitted for programs.

**11. Beam Lines and Optics:** The typical minimum beam spot diameter at the experiment location is a few millimeters for primary beams, about 1 cm for secondary fast beams, and few mm for ReA3 beams. The size can be reduced further with slits, at the expense of rate. In general, NSCL beam lines can transport beams with rigidities in the range of 1.0 to 5.0 Tm for almost all optical solutions. Higher rigidities up to 6.0 Tm are possible for some end stations, but require a review of the optics. If your experiment requires high rigidities or special optics (e.g. low-divergence optics), please include a description of your needs in the proposal. Proposals requiring new optics to be developed either within or downstream from the A1900 must include a request for the beam time necessary for testing and debugging the new optics. For more instructions or for an estimate of the time required for the optics development, please consult the Beam Physicists group. For more instructions or for an estimate of the time required for the optics development, please consult the ReA operations group.

**12. Technical Review:** Prior to the PAC meeting, technical experts on NSCL staff will review each proposal to assess its technical feasibility from the points of view of device usage and beam delivery. During this review, the beam preparation time estimate will be verified and revised, if necessary. Any issues identified in the technical review will be communicated to the spokesperson of the proposal, and the issue(s) along with response(s) from the spokesperson will be distributed to the PAC.

**13. Safety Review:** NSCL users must perform their experiments safely. To allow us to assess any hazards associated with the specific experimental set-up, the Safety Information Worksheet must be completed in full as part of the proposal package. MSU and NSCL safety experts will review all proposals upon receipt for safety issues. The committee's findings will be communicated to the spokespersons of the proposals and to the PAC. If the experiment is approved, NSCL requires the experimental group to appoint a safety representative who will participate in a more detailed safety review prior to scheduling the experiment. The duties of the safety representative are available at http://nscl.msu.edu/users/safety.html. Any specialized or non-commercial equipment brought to NSCL will be subject to an Activity Hazard Document that describes the potential hazards and planned mitigation strategies. Transportation of all radioactive source materials and activated materials (targets) must comply with MSU regulations and must go through the University's Environmental Health and Safety (EHS) office.

**14. Liaison with NSCL:** All requests for assistance required by the experimenters should be directed to the Manager for User Relations, Jill Berryman. The level of support provided for an experiment by NSCL will be based on available resources to address the requests in the proposal and on a detailed questionnaire submitted by the spokesperson at least six months prior to the experiment being scheduled. Decisions regarding assistance reside with the NSCL Director or his/her designee, and the delegation of tasks to appropriate NSCL technical personnel will be completed by the Manager for User Relations. It is assumed that experimenters will provide any special equipment needed for their experiments.

Brad Sherrill
NSCL Director