National Superconducting Cyclotron Laboratory
Call for Proposals—PAC43

October 22, 2018

Dear NSCL User:

We invite proposals for beam time to be considered at the next meeting of the NSCL Program Advisory Committee (PAC43) scheduled for March 7-8, 2019. PAC43 will likely be the last PAC meeting for the NSCL Coupled Cyclotron Facility. All proposals for review by PAC43 need to be received at the NSCL by 5 pm EDT on Monday, January 14, 2019 to allow for scientific and technical review of the proposals prior to the PAC43 meeting.

PAC43 will consider experiments using fast, stopped and reaccelerated beams as at previous, recent PAC meetings. The major change for PAC43 is that the Gamma-Ray Energy Tracking In-beam Nuclear Array (GRETINA) will return to NSCL in spring 2019 and be coupled to the S800 spectrograph. GRETINA will be available for experiments at NSCL for an extended campaign starting in June 2019. Details of the planned operation of GRETINA at NSCL are referenced in item #7 of the “Notes for PAC43” below.

PAC43 will not accept ReA6 proposals, but Letters of Intent will be accepted for ReA6 programs. We anticipate operation of ReA6 near the end of the NSCL program and possibly during the transition period when the fragment separator is reconfigured for FRIB. Depending on the availability of time and ReA6 for these activities, a separate PAC for evaluation of proposals will be completed at a later date. For more information on Letters of Intent, please see item #12 of the “Notes for PAC43” below.

General information on the NSCL proposal process is available at: (http://nscl.msu.edu/users/guide.html). The website has recently been updated to clarify the PAC process, and includes a link to Advice on Proposal Preparation, http://www.nscl.msu.edu/users/Advice.html, where users can find two example proposals.

The timetable for PAC43 is:

Monday, January 14, 2019	Proposals must be received by 5 pm EST
Thursday-Friday, March 7-8, 2019	PAC43 Meeting
Monday, March 11, 2019	List of approved experiments posted online and spokespersons notified.

The members of PAC43 are:

Daniel Bardayan	University of Notre Dame
Michael Carpenter	Argonne National Laboratory
Catherine Deibel	Louisiana State University
Paul Fallon	Lawrence Berkeley National Laboratory
Alexandra Gade	NSCL
Eric Ormand	Lawrence Livermore National Laboratory
Berta Rubio	IFIC-Valencia
Guy Savard	Argonne National Laboratory

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

Information must be provided for your proposed use of NSCL facilities to allow the Program Advisory Committee to assess the scientific merit and level of NSCL support needed to carry out the proposed research. Therefore, each proposal submission must contain the following items:

(A) Completed PAC43 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, the Safety Information worksheet, the S800 Spectrograph/Sweeper Magnet Worksheet (if necessary), the "Status of previous NSCL experiments" page, and the "Educational Impact of the proposed experiment" page are all included in the online form. When listing the Status of previous NSCL experiments, please list outcomes, such as publications or theses of each prior experiment. The supporting 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) The PAC43 Proposal Elements Document, available at the same web site, must contain a description of the experiment, or the body of the proposal. There is a strict text limit for the description of 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:

1. Physics justification, including background and references;
2. Goals of the proposed experiment;
3. Experiment details
    - i. what is to be measured;
    - ii. technical feasibility of measurement (demonstrated by simulation and/or reference to prior work);
    - iii. counting rate estimates (including assumptions), expected statistics, and level of uncertainty;
    - iv. explanation of the basis of the time request (include time for experimental device tuning, debugging the experimental setup, calibrations, any test runs, and any stable beam runs necessary for reference, etc.);
    - v. an indication of present state of readiness of the experiment and an estimated earliest date for the run;
    - vi. a clear statement of any technical assistance (design, fabrication, installation, etc.) that may be requested from NSCL;
    - vii. apparatus (including drawing);

(C) The proposal should include an estimate of the secondary beam rate based on the instructions below. We encourage the spokespersons to contact the NSCL Beam Physics Group (beamphysicist@nscl.msu.edu) for assistance in making this estimate. Issues with the proposed beam rates or beam properties may be identified during the standard technical review of submitted proposals prior to the PAC meeting. 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 make these rare isotope intensity estimates must use the official version of LISE++ (referenced in item 3 of the "Notes for PAC43" below). The LISE input files (.lpp) 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 delivered with less than 50 MeV/u, or with more than 100 watts deposited in the production target must be discussed with the NSCL Beam Physics Group prior to proposal submission so that assumptions about the production and fragment separation can be verified and conform with NSCL operating parameters. If proposers are not sure whether the proposal requires such vetting, please contact the Beam Physics 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 must be discussed with the ReA3 Department Head (villari@frib.msu.edu) prior to 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 Monday, January 14, 2019. It will not be possible to submit proposals for PAC43 after this 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 show a physical 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 (stable or not) 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 at least read the Description of Experiment section and have agreed to participate in the experiment.
- Spokespersons must be members of the FRIB Users Organization (FRIBUO). To become a member, please register at http://fribusers.org/organization/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 the 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 will consider such added value in their recommendations. Spokespersons 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.
- The titles of approved proposals and the spokesperson 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. The Spokesperson is the primary contact person from the experimental group for the NSCL. Potential Spokespersons should review the expected roles they will play and responsibilities that must be executed in preparing, performing, and after completing an experiment at NSCL. For example, among other duties, the Spokesperson must:
  (1) Respond to requests for information about the proposal, about scheduling, and any other requests from the Manager from User Relations.
  (2) Once approved, complete the *Scheduling and Safety Questionnaire.*
  (3) Participate in person, by video, or by telephone in an Experiment Readiness Review with NSCL staff to establish the level of NSCL support and to review the final setup. The Experiment Readiness Review includes a full safety review.
  (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) Manage the execution of the experiment or indicate that this function has been delegated to a specific individual.
  (6) Complete and sign a checklist upon completion of the experiment.
  (7) 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 the spokesperson no later than two weeks after the proposal due date. The spokesperson or delegate is encouraged to contact the primary PAC member charged with the detailed review of your proposal in order 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 by the NSCL staff and the results will be communicated to spokespersons and the PAC, as described in items #14 and #15 of the "Notes for PAC43" given below.

SPECIAL CONSIDERATIONS FOR PAC43

1. Duration of PAC Approvals: The length of validity for proposals is 24 months from the start of the running period. Note that the NSCL will discontinue operation when necessary to reconfigure the A1900 separator for FRIB operation. We cannot guarantee that all of the approved experiments will be completed by the time the A1900 is taken out of service.

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 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 new beam. Development of new primary beams cannot be guaranteed prior to the reconfiguration of the A1900 for FRIB. PAC43 will not accept Letters of Intent for CCF or ReA3 new beam development.

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 Physics 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, for example from a previous experiment, they should be used. Otherwise the rates must be estimated with the program LISE++, version 10.0.6a (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 should contact the Beam Physics 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". Note that calculations using the RF fragment separator need to use the exact primary beam cyclotron RF frequency. Once rate estimates are made, and before the proposal is submitted, users are encouraged to contact the Beam Physics 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 Physics 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.

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 Physics group for consultation regarding your specific application.

For anticipated rates for ReA3 and stopped beam experiments, please see notes #10 and #11 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 require 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)	$Z_{\text{primary beam}} \leq 12$	$12 < Z_{\text{primary beam}} \leq 36$	$36 < Z_{\text{primary beam}}$
Rate ≥ 1	2	6	12
0.0001 < Rate < 1	6	14	20
Rate ≤ 0.0001	Consult Beam Physics 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 development steps 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 140 MeV/nucleon ^{40}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 ^{40}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, GRETINA, 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 Physics 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.

S800	Standard experiment: 4 hrs; High-resolution experiment: 6 hrs.
SeGA	2 hrs.
GRETINA	2 hrs.
Sweeper Magnet	4 hrs.
RFFS	4 hrs for first rare isotope; 2 hrs for each additional rare isotope.
SEE TF	4 hrs if SEE TF detectors are used
LH2 target	2 hrs.

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, SEETF facility, GRETINA, and Ursinus-NSCL Liquid Hydrogen target), 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 the effort and resources required to change configurations in your proposal. 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. GRETINA at NSCL: GRETINA, the next generation gamma-ray spectrometer, is a national resource that will return to NSCL in April 2019 and be coupled to the S800 spectrograph. We expect that the device will be available for fast-beam experiments at NSCL for an extended campaign starting in June 2019. Details can be found at: http://www.nscl.msu.edu/users/equipment.html#gretina. For questions regarding the use of this device at NSCL, please contact Dirk Weisshaar.

8. 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 researchers is required. The available devices and contact persons are as follows:

Beta Counting System (BCS), Sean Liddick;
CsI(Na) scintillator array (CAESAR), Alexandra Gade;
High Resolution Array (HiRA), William Lynch;
Low Energy Neutron Detector Array (LENDA), Remco Zegers;
MoNA-LISA detector, Sharon Stephenson, or NSCL contact Thomas Baumann;
Neutron Emission Ratio Observer (NERO), Fernando Montes
Proton Detector, Christopher Wrede
Summing NaI Detector (SuN), Artemis Spyrou;
SuperORRUBA (Oak Ridge Rutgers University Barrel Array), Steven Pain
TRIPLEX plunger device, Hiro Iwasaki;

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.

9. Sweeper magnet in the S2 vault: The Sweeper magnet, as well as the MoNA-LISA detector, moved out of the N2 vault and will be located in the S2 vault. PAC43 will consider proposals using the Sweeper magnet or MoNA-LISA, or both in the S2 vault. MoNA-LISA could be used as a stand-alone device as described in item 8. If you would like assistance in preparing your MoNA-LISA proposal, please contact Thomas Baumann.

10. 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. For experiments that utilize one of the beams on the ReA3 beam list, please allot 5 hours for the gas-stopping effort on the beam request worksheet. 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 Physics 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.

Isotopes with lifetimes longer than 10 minutes can be difficult to tune. Please contact Chandana Sumithrarachchi for assistance if you would like to use any of these beams.

Devices that have been run 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 8, 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 Kasey Lund. The Low-Energy beam area has recently been expanded and there are two general purpose beams lines for users.

Currently, only a limited set of elements has been extracted from the gas cell. We believe that a wider range of elements and their 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. If a desired isotope does not appear on the beam list, 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; Ryan Ringle
Beam Cooling and Laser Spectroscopy (BECOLA), Kei Minamisono;
Summing NaI Detector (SuN), Artemis Spyrou.
General Purpose Low-energy beam lines: Kasey Lund

11. ReAccelerated Beams: The ReA3 experimental program enables experiments with reaccelerated beams of 0.3-6 MeV/u depending on mass-to-charge ratio of the beam extracted from the EBIT. The ReA3 beams and intensities are available at http://nscl.msu.edu/users/beams.html. Please be aware that mixed ground and isomeric states may be possible; known cases are noted on the list of beams. Please consult with the Beam Physics group for help in working with such cases. Please, also be aware that the beam is often contaminated by the daughter of the requested isotope depending on the half-life by decay during thermalization and charge breeding. Please work with the ReA3 Department Head to estimate the contamination level. Isotopes with lifetimes longer than 10 minutes can be difficult to tune. Please contact Antonio Villari for assistance if you would like to use any of these beams.

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 delivery of beam bunches spaced at 62.1 ns instead of 12.4 ns. Please, note that the overall efficiency of the system decreases by about 30% 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 about 5% of the full beam intensity.

It will be the responsibility of the experimenters to include the required experimental effort for the beam thermalization and reacceleration 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 Chandana Sumitrarachchi. The contact person for ReA3 is Antonio Villari.

A1900 setup	5 hrs
Gas Cell setup	5 hrs
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 as a separate request in the proposal.

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 generally results from an optimization process of 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 (note that: $0.25 \leq q/A \leq 0.5$).

The typical macro time structure provided by the EBIT charge breeder is 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. As noted before, within the time-on period, the micro bunch structure from the linac is 12.5 ns. Any requirements for special macro time structures (and whether the experiment is sensitive to the time structure) should be noted on the beam request worksheet. Please contact Antonio Villari for an estimate of the tuning time required for energy changes greater than 20%. Please, note that the most efficient energy variations are carried out by decreasing the beam energy. The time involved for increasing the beam energy can be significantly higher, please, contact the ReA team in this case.

Experimental equipment for the ReA3 program resides on two dedicated beam lines and a central general purpose beam line. Collaboration is required for use of the existing equipment:
Si-barrel ANASEN, Jeff Blackmon
Active Target Time Projection Chamber (AT-TPC), Daniel Bazin
Coincident Fission Fragment Detector (CFFD), Dave Morrissey
Gas Handling System for Hydrogen Gas Target, Jorge Pereira
JENSA gas target, Kelly Chipps
Low Energy Neutron Detector Array (LENDA), Remco Zegers
Heavy ion Accelerated Beam induced (Alpha,Neutron) Emission Ratio Observer (HabaNERO), Fernando Montes
Separator for Capture Reactions (SECAR), Hendrik Schatz
Summing NaI (SuN) detector, Artemis Spyrou
SuperORRUBA (Oak Ridge Rutgers University Barrel Array), Steven Pain

For other devices, please contact the ReA3 Hall Coordinator, Dave Morrissey.

12. Letters of Intent: Letters of intent (LOIs) will be considered by the PAC for ReA6 programs. 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 amount of beam time per year that is expected to be needed and the estimated duration of the program.

LOIs can be sent as a pdf by email to Jill Berryman.

13. 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 high energy beam lines can transport beams with rigidities in the range of 1.0 to 5.0 Tm for almost all ion-optical solutions. If your experiment requires very low or high rigidities or special ion optics (e.g. low-divergence ion optics), please include a description of your needs in the proposal. Proposals requiring new ion 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 Physics group.

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

15. 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 promptly communicated to the spokespersons 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 require an Activity Hazard Document be prepared that describes the potential hazards and planned mitigation strategies. Transportation of all radioactive source materials and activated materials (targets) must comply with the FRIB Laboratory radioactive materials license and must be approved by the Laboratory radiation safety officer, Peter Grivins.

16. Liaison with NSCL: All communications and particularly requests for assistance should be directed to the Manager for User Relations, Jill Berryman. Users are responsible for staging and carrying out their approved experiments. The level of support needed should be identified in the proposal and stated in detailed in a questionnaire submitted by the spokesperson, which is required at least six months prior to when an experiment can be scheduled. Decisions on the level of assistance reside with the NSCL Director or his/her designee. The delegation of tasks to appropriate NSCL technical personnel will be coordinated by the Manager for User Relations. It is assumed that experimenters will provide any special equipment needed for their experiments.

Brad Sherrill

NSCL Director