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MILESTONE REPORT

REPORT ON THE PREPARATION OF THE CALL FOR SUBMISSION OF PROJECTS TO ACCESS EACH OF THE RIs PROVIDING RADIOACTIVE-ION BEAMS MILESTONE: MS4

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Abstract:

The present document reports on the preparation of calls for submission of proposals to Radioactive-Ion Beams access facilities and their current status.

EURO-LABS Consortium, 2023

For more information on EURO-LABS, its partners and contributors please see <https://web.infn.it/EURO-LABS/>

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	Name	Partner	Date
Authored by	Emmanuel Clement, Sean J. Freeman, Paul Greenlees, Tommaso Marchi, Alessia Di Pietro, Gheorge Iulian Stefan	GANIL, ISOLDE, JYU, LNS, LNL, IJCLab	24/02/2023
Edited by	Paul Greenlees, Gheorge Iulian Stefan	JYU, IJCLab	24/02/2023
Reviewed by	Adam Maj [WP2 Coordinator]	[IFJ-PAN]	27/02/2023
Approved by	Navin Alahari [Scientific coordinator]	GANIL	28/02/2023

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Executive summary

The present document reports on the actions taken by the laboratories in Work Package 2-2-2 offering access to Radioactive-Ion Beams in order to arrange calls for proposals. The current status of calls and statistics regarding the number of proposals received and eligible for EURO-LABS support is reported.

1. INTRODUCTION

The present document reports on the current state and actions taken by the facilities participating in WP2.2 of the EURO-LABS project, facilities offering access to Radioactive-Ion Beams.

The first part of the document briefly describes the tasks of the WP2.2. The second part of the document gives an overview of the actions taken by the facilities to organize calls for proposals for access and statistics concerning the proposals received, in the case that the call (s) have already been made and proposals processed by the relevant selection committees.

Tasks and Objectives of WP2.2 – Transnational Access to Research Infrastructures delivering Radioactive-Ion Beams

1.1. OBJECTIVES AND TASK DESCRIPTION

WP2: Access to Research Infrastructures for Nuclear Physics: The participating Research Infrastructures (RIs) provide the necessary opportunities for cutting edge research in various fields covering, but not limited to: Fundamental Nuclear Science, Nuclear Astrophysics, Neutron Physics, Physics beyond the Standard Model, Atomic Physics, Biophysics, Medical Physics and Materials Science. WP2 builds on the experience gained in previous EU programmes (ENSAR/ENSAR2), expanding the access offer through the involvement of smaller facilities and neutron beam facilities. WP2 will provide more than 30000 access units (hours) in ca. 450 projects and for the benefit of more than 2400 users. This activity includes 15 RIs and more than 15 facilities/installations, for nuclear (fundamental and applied) physics experiments and the related theoretical support. The participating RIs provide access to an extremely broad range of services, delivering a myriad of ion beams covering a huge range of elements, masses, energies and intensities. The access is provided also to the interdisciplinary users, for example, offering beams of atomic clusters. Theoretical support will be provided by the strong nuclear physics theory teams at several RIs. In addition, **access is** provided to two RIs targeted to offer theoretical support for experiments (TA + VA). The RIs participating in WP2 are grouped into four tasks. All the facilities will sustainably undertake improvement and extension of their service provision in the coming years, in many cases working together to maximise synergies between them.

Task 2.2: TA to RIs delivering Radioactive-Ion Beams: The Radioactive-Ions Beams facilities of WP2 provide a wide range of radioactive ions and associated instrumentation, from low energies up to the level of GeV per nucleon.

Provision of access: In order to facilitate access to the RIs, the facilities are required to make and advertise open calls for proposals on a regular basis. The submitted proposals are then evaluated on the basis of scientific merit and suitability to the RI in question and if viewed appropriate, access to the facility can be granted and the requested beam time scheduled. In addition, the proposals are evaluated by the User Selection Panels (USP) according to the criteria listed in the Grant Agreement to determine if the user group is eligible for TA support via EURO-LABS. A User Selection Panels has been established for each Research Infrastructure, where at least half of the members are external to the RI

In the following sections the actions taken and procedures used by the various RIs in WP2.2 to arrange calls for proposals are detailed.

2. PARTICIPATING INSTITUTIONS

In the present Section, an overview of the actions taken by the relevant RIs to arrange calls for proposals to access the facilities is given. The section is organized in different subsections, one for each of the RIs offering access to Stable Ion Beams.

2.1. ALTO – ACCELERATEUR LINEAIRE ET TANDEM A ORSAY

The ALTO facility has two accelerators, a LINAC for RI production and a Tandem accelerator for stable ion and neutron beam production. Beam time requests for all three types of beams are evaluated during the same call for proposals which is typically issued once a year.

Beam time is allocated by examination of proposals received based on the criterion of scientific merit by the Program Advisory Committee (PAC). The ALTO facility held its last PAC meeting on the 12 and 13th of January 2023. Beam time was requested for low energy Radioactive beams, high energy stable beams and fast neutron beams.

Before the PAC meeting 15 proposals were received demanding a total of 2112 hours of beam time, 504 hours of which was for radioactive beams. Of the 14 proposals accepted by the committee, 7 of these are eligible for EURO-LABS transnational access (TA) support. Additionally, a further 5 proposals approved at the previous PAC in October 2021 are eligible to receive EURO-LABS TA support since they were waiting to be scheduled to run after the start of the EURO-LABS project in September 2022.

The panel which decides the trans-national access is comprised of the Program Advisory Committee chairman, Augusto Machiavelli (Oak Ridge National Laboratory, USA) and the ALTO scientific coordinator (Jon Wilson, IJC Lab, Orsay). Typically, an eligible experiment will receive around 28 days of international user support to run the experiment provided that the spokesperson of the experiment agrees to give support in priority to young researchers (postdocs and PhD students) and first-time users. Four experiments have received EURO-LABS TA support to date (between September 2022 and February 2023).

2.2. GANIL – GRAND ACCELERATEUR NATIONAL D'IONS LOURDS

The “Grand Accélérateur National d'Ions Lourds” (GANIL) located at Caen-France is delivering radioactive beams since 30 years to the nuclear physics community. GANIL uses two techniques: the in-flight separation and the ISOL method. Using the CSS2 cyclotron, high intensity and high energy stable beams are delivered to the LISE fragment separator to produce, separate and transmit radioactive ions from fragmentation of the primary beam at energies between 25 and ~70 MeV/u to perform decay or secondary reaction measurements. Using the SPIRAL1 facility, ISOL beams, at low energy or post-accelerated using the CIME cyclotron, are produced from the fragmentation of the primary beam on a thick carbon target and delivered to the users. The RI has established [procedures](#) to manage the access to the beams and to the support from the GANIL personal for the users. One call is organised per year with a dead line for submission in autumn. The call for proposals uses an electronic submission system (<https://u.ganil-spiral2.eu/pac/>). After the deadline, a technical advisory committee (TAC) is organised by the beam coordinator to check the technical aspects of the proposals in term of beams to be delivered, security/safety aspects, and experimental apparatus performances.

Following the TAC, the submitted proposals are evaluated by the Programme Advisory Committee (PAC) in December. The committee is composed of 12 [members](#). During the open meeting, the PAC hears a brief oral presentation made by the spokesperson, or their representative, for each of the experimental proposals (submitted before the PAC deadline) followed by questions. After all of the presentations, the PAC meets in a closed session to rank the experiments and recommends to the Directors those experiments that should be selected to receive beam time. Each spokesperson receives the recommendation of the PAC through e-mail within a few days of the PAC meeting. Detectors tests, beam developments or other technical studies can have access to the RI after the approval by the GANIL management.

In 2023, the beam schedule is shared as follow: 54% for high energy nuclear physics, 20% of interdisciplinary physics, 16% for industrial application and 10% for technical studies.

The last nuclear physics PAC for heavy ions at the Cyclotrons complex was organised in December 2022. 16 proposals were submitted for 422 UT (1UT = 8h of beam time) with 10 proposals involving a radioactive beam (6 LISE and 4 SPIRAL1). 8 proposals for 169 UT were approved including 6 using a radioactive beam. The distribution of these 6 experiments are 3 using LISE for 73 UT and 3 using SPIRAL1 for 71 UT. 5 accepted experiments are eligible to the EURO-LABS TNA access. The TNA eligibility is validated by four people: the chairman of the PAC, the GANIL director, the GANIL TNA coordinator (the beam coordinator) and the chair of the GANIL Users Executive Committee ([GUEC](#)). In 2023, the RI continues its R&D effort with 18 UT of beam time dedicated to SPIRAL1 beam developments.

2.3. GSI/FAIR – GSI HELMHOLTZZENTRUM FÜR SCHWERIONENFORSCHUNG, FAIR – FACILITY FOR ANTIPROTON AND ION RESEARCH

GSI-FAIR provides radioactive beams to users at various places, in particular at the Fragment Separator FRS. The FRS is in operation since 1991 and allows the production and in-flight separation of nuclei far off stability. It utilizes beams from the heavy-ion synchrotron SIS18, which can accelerate ions of all elements between hydrogen and uranium with a maximum magnetic rigidity of 18 Tm. Accordingly, protons can be accelerated up to 4.2 GeV and uranium ions up to ~1 GeV/u. The radioactive ion beams can be studied at the FRS itself or they can be injected in the storage ring ESR, which has a maximum bending power of 10 Tm. Equipped with stochastic pre-cooling and electron cooling, the storage ring ESR can store and cool exotic ion beams for internal target experiments. Exotic nuclei could be further decelerated to energies down to 100 keV/u in the storage ring CRYRING; here reactions relevant for nuclear astrophysics can be studied close to the Gamow window.

At GSI, the General Program Advisory Committee, [G-PAC](#), a panel of international experts, is responsible for the scientific evaluation of beam time proposals. The latest G-PAC meeting of GSI took place in September 2022. The call for proposals was open until June 30th 2022, and a total of 124 proposals (58 of which to G-PAC) have been handed in via a novel submission system. In total 58 proposals requesting in total shifts (8 hours / shift) have been evaluated. The G-PAC has assessed and ranked the proposals in four categories (A, A-, B and C) and has made recommendations for amounts of beam time. 10 proposals employing radioactive beams from the SIS18/FRS have been ranked A by the G-PAC and have been granted with 1600 hours of beam time in the period 2024/25. Because of the rising energy costs after the Russian invasion into Ukraine, some beam time, which was originally planned for 2023, has to be shifted to 2024.

The form to apply for Transnational Access is provided at the EURO-LABS website of GSI as well as the access to the user registration and to the statement of travel costs. Calls for applications are published on the website, in mails distributed via the GSI user mailing list, in presentations, collaboration meetings and during the experiment proposal submission process. A user selection panel has been set-up in order to evaluate applications.

In late 2023, an engineering run is planned to test and take into operation the accelerators GSI. This will ensure a fast start of experiments in early 2024. The beam time scheduling for 2024 and 2025 is in progress.

2.4. ISOLDE FACILITY AT CERN

The ISOLDE Facility at CERN has benefitted from several previous transnational funding initiatives providing access to users. Therefore, very well-established procedures from the administration of previous TNA have been adopted for EURO-LABS.

The scientific evaluations of beam time requests are undertaken by the CERN ISOLDE and n_TOF Committee (INTC), which meets three times a year in Feb/March, May/June and November with deadlines for the submission of scientific proposals around six weeks before the INTC meeting. The INTC consists of eleven independent scientific experts who review proposals and make recommendations for the award of beamtime. The spokesperson for the proposal makes a short presentation to the INTC in an open meeting. Queries are raised with the spokesperson in advance so that they can be addressed during the presentation and any remaining questions are asked at the meeting. The INTC discusses each proposal during a closed session in order to decide on their recommendation. There is a technical review by local experts from the facility before the INTC meeting so that the spokesperson can consider any operational and safety considerations in their presentation. After the meeting, the INTC Chair presents the recommendations to CERN Research Board who award the beam time.

Radioactive beam is supplied to users during the CERN proton running period, approximately April to November. Since there is often a delay between Research Board approval and scheduling of the awarded beam time, calls for requests for EURO-LABS support are made every two to three months during the running period to the spokespersons of scheduled experiments. These are considered by the User Selection Committee composed of the ISOLDE Collaboration Spokesperson (S.J. Freeman, CERN), G. Neyens (KU Leuven, Belgium), D. Sharp (Manchester, UK) and K. Riisager (Aarhus, Denmark) who decide allocations of TNA funding.

For the period from 1st September to 4th December 2022, 57 participants of 17 experiments received TNA support. In total, 185 8-hour shifts were delivered to these experiments. Some of the scientific highlights include the first β NMR resonances were observed from K ions implanted into DNA solutions. A series of Coulomb excitation measurements were made with the recently refurbished MINIBALL array, with the first measurement of conversion electrons without the use of transporting magnets in a radioactive-beam experiment. Condensed-matter physics projects looked at colour centres in diamond, properties of perovskites, and studies of multi-ferroic materials. A programme of transfer reactions was measured using the ISOLDE Solenoidal Spectrometer. Isotopic yields were compared between proton energies of 1.4 and 1.7 GeV on uranium carbide targets, which will inform a proposed improvement to the facility. Laser spectroscopy of AcF molecules was undertaken using resonant ionisation in a successful campaign after the CERN proton running period using pre-irradiated targets.

2.5. JYFL – ACCELERATOR LABORATORY OF THE UNIVERSITY OF JYVÄSKYLÄ (JYU)

The Accelerator Laboratory of the University of Jyväskylä, Finland (JYFL) has a long history of providing transnational access to users (since FP4). As a result, the RI has well-established procedures to deal with both the calls for proposals and the subsequent evaluation. The RI has two calls for

proposals per year, which always have the same deadlines for submission in the Spring (deadline 15th March) and Autumn (deadline 15th September). Proposals must be submitted through an electronic submission system through a link provided by the RI. Details of the facility and the application procedure can be found here: [JYFL Access](#)

The submitted (written) proposals are evaluated by the Programme Advisory Committee (PAC), consisting of six independent international experts who also act as the EURO-LABS User Selection Committee. At present, the evaluation procedure does not involve presentations or Q&A sessions with the spokespersons of the proposal, though the PAC have active dialogue with the spokespersons in advance of the PAC meeting. The PAC meeting is also attended by the Scientific Secretary (also acts as the Beam Time Co-ordinator), the Head of Laboratory and Professors leading the main research groups as observers.

The most recent call for proposals was the one with a deadline of 15th September 2022. At that call a total of 18 proposals were received, requesting 129 days of beam time. Of these, 16 proposals (125 days) fell within the remit of topics of EURO-LABS. The remaining two proposals were to use the RADEF radiation effects facility, for which access is offered via the RADNEXT program.

Following the evaluation by the PAC, a total of 11 from 16 proposals were approved and granted a total of 80 beam time days. Of these, 9 have user groups which are eligible for EURO-LABS support. As the RI has regularly arranged calls for proposals in a systematic way, many of the approved proposals submitted to previous calls which have not yet been scheduled for beam time are also eligible for support from EURO-LABS.

2.6. INFN – LABORATORI NAZIONALI DI LEGNARO (INFN – LNL) AND LABORATORI NAZIONALI DEL SUD (INFN – LNS)

Both LNL and LNS laboratories included in the EURO-LABS LNL-LNS facility expect to operate RIB machines in the future. At the moment both installations (SPES at LNL and FRAISE at LNS) are under construction, therefore no call for proposal was published.

The call for proposals will be included in the standard procedure already established for the stable ion beam facilities as soon as the facilities will enter into operation.