Grant Agreement No: 101057511

EURO-LABS

EUROpean Laboratories for Accelerator Based Science

HORIZON-INFRA-2021-SERV-01-07 Project EURO-LABS

MILESTONE REPORT

REPORT ON STATUS OF THE CALLS FOR SUBMISSION OF PROJECTS TO ACCESS EACH OF THE RIS PROVIDING NEUTRON BEAMS

MILESTONE: MS 6

Document identifier:	EURO-LABS-MS 6
Due date of milestone:	End of month 6 (February 2023)
Report release date:	28/02/2023
Work package:	WP2: Access to Research Infrastructure for Nuclear Physics; Task WP2.3: TA to RIs providing neutron beams
Lead beneficiary:	CERN
Document status:	Final

Abstract:

The present document reports on the state of the art of the calls for submission of proposals to access neutron beams provided by the community of Institutions participating in the first phase of the WP2 of EURO-LABS.

For more information on EURO-LABS, its partners and contributors please see

https://web.infn.it/EURO-LABS/

The EUROpean Laboratories for Accelerator Based Science (EURO-LABS) project has received funding from the Horizon Europe programme dedicated to Research Infrastructure (RI) services advancing frontier knowledge under Grant Agreement no. 101057511. EURO-LABS began in September 2022 and will run for 4 years.

Delivery Slip

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EXECUTIVE SUMMARY

The present document reports on the status of the calls to the nuclear physics community for access to the neutron beams provided by the institutions participating in the EURO-LABS project. The first part summarizes the aims and tasks of the working group WP2, Task 2.3. The second part of the document gives an overview of each facility providing neutron beams and the actions taken by the facility coordinators to promote TA for neutron beams and related neutron induced reaction experiments.

1. INTRODUCTION

The Nuclear data are required for understanding and accurately modeling of processes taking place in astrophysical scenarios (big bang nucleosynthesis, stellar evolution, merging and explosions), for applications in advanced nuclear technology developments (nuclear fusion, emerging fields of medicine) and for fundamental aspects of nuclear structure and reactions. Producing these nuclear data, in particular those obtained by experiments inducing neutron interactions, is a complex and in many respects a challenging process which relies on neutron facilities and on highly trained nuclear physicists.

The EURO-LABS project brings together state-of-the-art European laboratories in which neutron beams are produced by a wide range of generators, such as high-energy proton synchrotrons as well as by small Van de Graaff accelerators.

The aim of the Task 2.3 in the WP2 of the EURO-LABS project is to exploit the capabilities for producing accurate nuclear data for science and technologies at the neutron time-of-flight facility at CERN (n_TOF), at the Neutrons For Science facility at GANIL (NFS), at the LICORNE neutron facility at ALTO/Orsay, at the at the BELINA neutron source of the Legnaro National Laboratory of INFN, and at the HiSPANoS facility of the Spanish National Accelerator Laboratory (CNA) in Sevilla.

The whole European nuclear physics community working with neutrons is offered the opportunity of transnational access to the facilities that are part of the EURO-LABS consortium, for measurements of high-resolution neutron induced reactions over an extremely wide range of neutron kinetic energies (from sub-meV up to GeV). Experiments on extremely low mass isotopically enriched stable and radioactive samples are envisaged. State-of-the-art detection systems for light charged particles, gamma-rays, heavy-ions from fission as well as neutrons are operating and available at the facilities involved in the project. The different methods of neutron production, experimental conditions, and complementarity in the physics programs for the facilities are part of the project and set the basis for further developments in terms of instrumentation and available beam characteristics.

2. PARTICIPATING INSTITUTIONS AND STATUS OF THE CALLS FOR TA PROJECTS

In the present Section, an overview of each of the institutions participating at the initial stage of the EURO-LABS project. For each facility, the status of the procedures for submitting proposals for support within the EURO-LABS project is provided, together with some statistics (when available) on recent proposal's evaluation history.

2.1. n_TOF AT CERN

The n_TOF facility is based on the 20 GeV/c proton beam from the CERN Proton-Synchrotron accelerator, transported to a target/moderator assembly that feeds two beam lines of length respectively of 185m (horizontal) and 18.2m (vertical) with respect to the incident proton beam direction. At the end of each beam line there are two fully equipped areas, EAR1 and EAR2, where the experimental activities are taking place. The experimental areas are radiation-protection controlled areas (Class-A labs) in which open radioactive sources can be handled. A third area, located at 2-3 meters from the spallation module has been recently constructed (the n_TOF NEAR Station) which can provide higher neutron flux for irradiation activities and activation measurements. The NEAR Station performances has been commissioned during 2021 and started operation at the beginning of 2022.

The n_TOF facility is a world-wide unique installation which offers a pulsed neutron beam with an extremely wide energy spectrum covering the thermal region (sub-meV) up to the fast region with neutrons up to GeV energies. Very high resolution in low-background conditions in both experimental areas are characteristics of the facility, which coupled to the low duty-cycle/high-intensity characteristics of the driver accelerator makes n_TOF a unique neutron source for nuclear physics experiments. During the last 20 years of operation, the n_TOF Collaboration has developed detection systems for a variety of neutron induced reaction studies. The dedicated state-of-the-art n_TOF data acquisition system, coupled to the CERN large IT infrastructure, provides the advanced environment necessary to perform challenging neutron induced reaction studies for a wide range of applications.

The scientific committee overseeing the experimental activities performed at CERN/ISOLDE and CERN/n_TOF is the INTC Committee (ISOLDE and Neutron Time-of-Flight Experiments Committee). The INTC - established in August 1999 - takes over the duties of evaluating proposals for experiments on the ISOLDE facility that was formerly in the hands of the ISC. In addition it reviews the experiments proposed for the n_TOF facility. The INTC works on a basis of three meetings per year. The committee's conclusions and recommendations are transmitted by the Chairperson to the Research Board, which takes final decisions on approval of experiments.

During the 2020-2022 period and 1QT of 2023, a total of **21 Proposals** and **9 Letters of Intent** for experiments at n_TOF have endorsed by the INTC committee and approved by the CERN Research Board.

All proposals submitted for support through EURO-LABS funding must refer to experiments approved by the INTC Committee.

All information for submitting proposals for TA at n_TOF have been posted on the CERN EURO-LABS project website >>.

An n_TOF User Selection Panel within the EURO-LABS project has been established. It will meet (typically three times per year) to evaluated and decide on TA financial support to be granted to submitted projects. As a rule, all approved experiments that fulfil the TA eligibility criteria receive some degree of funding. The level of funding per experiment is chosen to be proportional to the number of protons required to perform the measurements. Priority is given to new n_TOF users, to young researchers and to researchers with limited funding for pursuing their research program at CERN n_TOF.

As of the end of February of 2023, **three projects** have been submitted for evaluation to the n_TOF USP. The proposals will be evaluated by the USP in March 2023, for experiments to be performed during the 2023 run (3 April – 15 October).

2.2. NFS AT GANIL

The principal characteristics of the NFS facility at GANIL are as follows:

Production methods and beam characteristics: Using the high intensity proton and deuteron beam using Be/Li target/convertor. Discrete and continuous beams up to 40 MeV. Has the highest flux in the world in the energy domain between 1 and 40 MeV.

Website: here >>

Scientific Fields: Nuclear Dynamic, Nuclear Data
Scientific program: Fundamental research in fission process, applications in fields related to nuclear power generation, nuclear medicine and radiation damage studies.
Allocated beam Time: ~200 UT per year

The Call for Proposal at NFS follows the standard Call for proposal procedure at the GANIL facility. See the related website >> for details. The call is open to the user community of GANIL. Additionally, beam time is available for tests for detectors, detectors qualifications and industrial applications. This dedicated beam time is acknowledged by the GANIL management.

The full record of NFS proposals since 2020 is the following:

Year	Number of Proposal	UT requested	Accepted	Rate %
2020	9	246	7	78%
2021	4	34	3	75%
2021-b	1	22	1	100%
2022	3	95	3	100%

The rate of eligibility for TNA Access to NFS is of 30%.

2.3. BELINA AT INFN-LNL

The EURO-LABS LNL-LNS facility is based on two main sites operating several different accelerators.

The neutron beam infrastructure for the EURO-LABS LNL-LNS facility is BELINA at the CN accelerator of the LNL site. Low energy protons and Li/Be-containing targets are used to provide (pulsed) neutron beams with few MeV kinetic energy.

The access to this facility follows the same rules as for the Stable Beam facilities of LNL described for WP2.2. No proposals were submitted for the current call (December 2022), one experiment previously approved that will be performed in the near future asked for possible EURO-LABS support. The eligibility criteria will be evaluated in the next USP meeting.

2.4. CLEAR CONSORTIUM

The distributed facility CLEAR is a consortium of three installations: ATOMKI in Debrecen, CNA in Seville, and IST in Lisbon, offering access to stable-ion and neutron beams, in the framework of the EURO-LABS project. From the three installations, CNA has the capability to provide neutron beams via its HISPANOS facility. In the context of the EURO-LABS project, the three facilities have developed a common protocol for access.

A common access point has been established, through the portal https://institucional.us.es/clear/.

There, the information of the capabilities of the different facilities is presented. Also, the information on the different calls is available, with the procedure for applying for beam time and the funds for transnational access. The proposals are submitted electronically.

The consortium has constituted a common Scientific Panel, which revises the proposals that have been made for the during the different calls. The panel is constituted by three scientific experts, proposed by each one of the facilities, plus a chairperson from the EURO-LABS management. The three coordinators of the facilities are present in the meeting of the Scientific Panel. The Scientific Panel acts also as the User Selection Panel.

CLEAR opens three calls a year. The first call went from the 1st to the 30th of September 2022. The second call went from the 1st of January to the 15 of February 2023. In the first call one proposal was submitted and approved by the scientific panel. The experiment has been already carried out at CNA. In the second call three proposals have been submitted, one for each of the three facilities of CLEAR. The proposals are presently being evaluated.

Although the experiment carried out so far at CNA and funded through EURO-LABS does not use neutron beams, other experiments (a total of 3) have been recently carried out or approved for Transnational Access via the H2020-ARIEL project which ends in February 2024. The details are:

- “Correlation of Neutron Effects in electronics to Laser-based SEU/SEL.", proposed by Aalto University.

- "Development of a 90 keV Maxwellian neutron spectrum and measurement of the 30 and 90 keV 50Cr MACS for criticality safety", proposed by CERN.
- “Characterization of the neutron response function of a C7LYC scintillator crystal for fusion plasma applications”, proposed by MIB-INFN.

2.5. ALTO AT CNRS/IJC LAB

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).

ANNEX: GLOSSARY

Acronym	Definition
USP	User Selection Panel
PAC	Program Advisory Committee
WP2	Work Package 2