

ISOLDE in ERINS, EURISOL-DF and ESPP March 19, 2019

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ERINS



European Reseach Infrastuctures for Nuclear Science

COORDINATOR: ANGELA BRACCO (INFN) Funding request: 10 MEuro



ERINS: Transnational Access



10 Facilities / Consortia

- Joint ALTO (F)/GANIL-SPIRAL2 CERN-ISOLDE (CH)
- GSI (D)

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- JYFL (FI)
- KVI-CART (NL)
- joint LNL-LNS (I)
 - ECT* (I)
- joint NLC (PL)
- joint IFIN-HH/ELI-NP(RO) and new a joint multi-national facility denoted as DSD (HU,ES,GR).

5 Meuro (750 kEuro for ISOLDE)



ERINS: 9 Joint Research Activities

Security and Exotic be stability of ion present and	IBIS developments of ion sources and innovative cryogenic model-based controls	
ERINS JRA developments	ASTEX o increase of the performance of gas cells for both the IFF and ISOL production methods	e
Detector Technology and Simulation, Al, Forefront theory	App4RIB will make developments for beam purification ASPHODEL to lead cutting-edge R&D for EURISOL	

DETNA: technological developments for several detector areas MANI is focused on development of methods to perform test measurements of cross sections of nuclear reactions in laser-induced plasmas CEANN: artificial neural networks and machine learning procedures in different experimental analysis

FIS-NN focuses on providing new insight into the microscopic nature of the nuclear force that underlies the structure of nuclei

LIONESS laser-based techniques and their application in medical and environmental-based science in the actinides and lanthanides. MAIA production of radioisotopes for medical applications.

ERINS: 6 Network Activities

Strengthening links in nuclear structure, reactions and astrophysics

ERINS

NA

Preparation of scientific programs for future facilities

Exploiting cutting-edge research in applications **EuPhyINN** reflects the growing need for specific nuclear structure studies connected to the field of neutrino, astro- and dark-matter physics.

RADPROBE intends to better exploit the available radioative ions for condensed matter, materials science and biophysics research

MediNeXt focuses on the implications of next-generation particle accelerators for biomedical applications and related technologies

NUSREB aims to improve integration of the researchers working in nuclear spectroscopy and reaction

ENAN focuses on integration and collaboration of European scientists working in nuclear physics for astrophysics

DEEPEN examination of the opportunities offered by electron scattering on exotic nuclei to investigate their electromagnetic properties.

Relation between ERINS WP's



34 beneficiaries, 17 countries

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ERINS: requested budget





EURISOL-DF

Several meetings (skype) of the EURISOL Steering Committee

- November 9
- December 20
- February 4

Meeting with E. Elsen to discuss ISOLDE in EURISOL-DF (January 18)

- Strongly supports a unified coherent European nuclear physics community science programme. It will give more visibility to the nuclear physics facilities, including ISOLDE@CERN, and to the community as a whole.
- > No support for a 'common PAC' that decides on (some) beam time at ISOLDE
- Suggests to start something in a less formal way (e.g. a common entry for proposals, as suggested to be prepared within ERINS).
- Summary of Minutes sent to the SC discussed in its Feb. 4 meeting
- Reply on questions by ML (on behalf of SC) sent to EE on Feb. 19



ISOLDE in ESPP: EPIC project

- Submitted December 17, 2018 (nr. 37)
- Total submitted documents = 160
- Free access: https://indico.cern.ch/event/765096/contributions/
- NEXT STEP: meeting in Granada (plenary and parallel sessions), May 13-17
 - → Marek Lewitowicz will present the NUPECC Long Range Plan
 - → G.N. present at the meeting / input ISOLDE unclear
- In parallel: meeting with E. Elsen to discuss future of ISOLDE (February 7)
 - \checkmark Set-up a brain storming meeting with technical groups of CERN
 - ✓ Try to meet before Granada Meeting (end of April?)



3 objectives

- Profit from increased driver beam energy and intensity (2 GeV, 4 μA), thanks to the LIU at CERN and improve the exploitation of the existing infrastructure
- Have multiple simultaneous beams for users
- A new storage ring for short-lived, light and heavy ions



Profit from increased driver beam energy (2 GeV) and intensity (4 μ A)

- Take advantage of CERN's LHC Injector Upgrade (LIU): higher proton intensities from LINAC4 and Booster energy increase from 1.4 GeV to 2 GeV
- GAIN FOR ISOLDE: Higher radioactive beam intensities for fragmentation and spallation products (gain between factor of 2 and more than 10 in intensity)



And improve the exploitation of the existing infrastructure

 HIE-ISOLDE post-accelerator design goal: beams up to 10 MeV/u, for light and heavy beams
NOW: max 9.4 MeV/u for light beams max 7.4 MeV/u for heavy beams



SOLUTIONS TO REACH FULL ENERGY POTENTIAL:

- ✓ Have all cavities working (will reach 8.2 MeV/u for heavy beams after LS2)!
- ✓ FINALIZE the HIE-ISOLDE energy upgrade:

post-accelerated beams in the full (low) energy range from 0.3 and 2.8 MeV/u (most important for astrophysics experiments) and up to 10 MeV/u

METHOD: upgrade of the (20 years old!) REX-part of the HIE-ISOLDE LINAC



Have multiple simultaneous and better quality beams

GOAL: serve the ever growing ISOLDE users community, who persues
very diverse research program
in nuclear physics,
fundamental interaction studies,
atomic physics
nuclear astrophysics
material sciences
biochemical/ medical research

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METHOD: . Two new additional target stations

Preliminary design: Tim Giles, presented at the EMIS 2018 Conference, CERN



Have multiple simultaneous better quality beams

METHOD:

1. Two new additional target stations

 2. A new high-resolution mass separator (state-of-the-art) to deliver purer beams (very important for HIE-ISOLDE operations)
→ currently, some RIB's beams cannot be efficiently accelerated due to contamination that is too high

A detailed design study is needed Input from other laboratory upgrades could be used (e.g. HRS for DESIR (SPIRAL2-GANIL), HRS for Triumf)

Preliminary design: Tim Giles, presented at the EMIS 2018 Conference, CERN



A new compact storage ring for light and heavy ions

- Stored radioactive beams have many advantageous:
- Can be used multiple times in an in-ring detector (luminosity increase)
- Can be cooled to deliver excellent quality beams to external experiments for high-precision studies

Research areas:

nuclear ground-state properties, reaction studies of astrophysical relevance, investigations with highly-charged ions studies with pure isomeric beams (e.g. fundamental constants) Eur. Phys. J. Special Topics 207, 1-117 (2012)

K. Blaum, Y. Blumenfeld, P.A. Butler, M. Grieser, Yu.A. Litvinov, R. Raabe, F. Wenander and Ph.J. Woods (Eds.) Storage Ring Facility at HIE-ISOLDE



A photograph of the ion storage ring TSR at the Max-Planck Institute for Nuclear Physics in Heidelberg. It is proposed to install this ring at the HEE-ISOLDE facility in CERN, thus enabling a variety of unique experiments in nuclear-, astro- and atomic physics.

science



A new compact storage ring for light and heavy ions



Preliminary design: Manfred Grieser, MPI-K Heidelberg

Preliminary integration in ISOLDE: Erwin Siesling

