EURISOL – Distributed Facility (DF) Initiative

M. Lewitowicz
for the EURISOL Steering Committee
> 16 Existing RIB facilities
> 7 RIB facilities under construction
> 8 Projects – design and R&D
Radioactive Ion Beam Facilities in Europe

9 Existing RIB Facilities:

- 5 In-flight fragmentation
- 4 ISOL

5 Facilities/upgrades under construction or commissioning

2 Projects under design

Community: 2700-3000 scientists and highly qualified engineers
What is EURISOL?
A possible schematic layout for a EURISOL facility

Secondary fragmentation target

To high-energy experimental areas

To medium-energy experimental areas

To low-energy areas

20-150 MeV/u
(for $^{132}$Sn)

9.3-62.5 MeV/u
2.1-19.9 MeV/u

$\beta = 0.09$, $\beta = 0.15$
$\beta = 0.3$
$\beta = 0.47$
$\beta = 0.65$, $\beta = 0.78$

One of several 100-kW direct target stations

Low-resolution mass-selector

Charge selector

Charge breeder

High-resolution mass-selector

A possible schematic layout for a EURISOL facility
EURISOL & EU ISOL facilities
Post-accelerated beam intensities

Ex.: At 1nb 1 nucl./day via fusion-evaporation
Physics with RIB
Intensity domain

HI-ISOLDE, SPES, SPIRAL2, ISOL@MYRRHA EURISOL
EURISOL – Distributed Facility (DF) Initiative

Background

• 2001-2005: EURISOL RTD
• 2005-2009: EURISOL Design Study (see http://www.eurisol.org)
• 2010: EURISOL endorsed by NuPECC as highest long term priority for low energy nuclear physics in Europe
• EURISOL Office
• EURISOL User Group: Update of the physics case
• EURISOL related R&D Initiatives
• Existing & planned ISOL facilities in Europe:
  • GANIL-SPIRAL2, HIE-ISOLDE, SPES, ISOL@MYRRHA, ALTO, JYFL

-> EURISOL MoU
Physics of the proton rich side of the nuclear chart

*Valencia*

The formation and structure of r-process nuclei

*Catania*

Going to the limits of mass, temperature, spin and isospin with heavy Radioactive Ion Beams

*Krakow*

Each meeting:
- 40-70 participants
- 25-30 talks
- 2.5 days

EURISOL related R&D Initiatives

- **EMILIE**: Charge Breeding
- **LIEBE**: Pb-Bi target
- **TIARA**: Test Infrastructures
- **EURISOL JRA** in ENSAR2
The EMILIE project

« Enhanced Multi-Ionization of short Lived Isotopes for EURISOL »
Charge breeding techniques for ISOL facilities

High charge states

Intense beams

Consortium of 8 European laboratories

EBIS beam debuncher

Longitudinal Paul trap for EBIS pulses debunching

Tests using the SHIRAC test bench


Tests at LPC Caen with pulsed 1+ beams during the fall of 2014

Prototype simulated by Emil Traykov (GANIL)
Design and Construction Yvan Merrer/P. Desrues (LPC Caen)
RF DC electronics and wiring J. F. Cam (LPC Caen)
The EURISOL MoU establishes a common understanding among the Parties of the collaborative effort required for the continued development of EURISOL, including more focused R&D and a more refined cost estimate.

Signatories: CERN, COPIN (Poland), BEC (Belgium), GANIL, INFN
The MOU is implemented by a Steering Committee with one representative per signatory. The members are:

MJG Borge (CERN), M. Lewitowicz (GANIL, chair), A. Maj (COPIN), S. Pirrone (INFN), L. Popescu (BEC) and A. Bracco (NuPECC representative)

-> EURISOL-DF Initiative
EURISOL – Distributed Facility (DF)

Members Initially:
HIE-ISOLDE/CERN
SPES-INFN
SPIRAL2-GANIL

Candidate - future facility: ISOL@MYRRHA

EURISOL MoU member: COPIN Consortium Poland

Smaller scale ISOL facilities: ALTO, JYFL?

Project to be submitted for the 2018 update of the ESFRI roadmap
ISOLDE is the CERN radioactive beam facility (approved 50 years ago!)
Provides low energy or post-accelerated beams
Run by an international collaboration since 1965. Presently 13 members (B, CERN, Dk, E, F, Ge, Gr, I, India, N, R, S, UK)
> 500 Users from 100 Institutions, 50 experiments / year

>1300 isotopes

Started Jan 2010
Budget 35 M€
SPES Facility at LNL Legnaro

Existing facility

1. Building and infrastructures with 2 ISOL bunkers for radioactive beam and application area for radioisotopes and neutrons
2. Cyclotron 70 MeV protons with 2 independent exits
3. ISOL UCx target designed for $10^{13}$ f/s - direct production with p
4. Beam transport with High Resolution Mass Separation
5. Reacceleration with ALPI superconductive linac (10A MeV A=130)
6. Radioprotection, safety & controls

≥ 50 M€, first beams by 2019

Target under operation at 2000°C

70 MeV 0.75 mA Proton cyclotron

Control system

EPICS

Cool=2 weeks

1 mSv/h

≥ 50 M€, first beams by 2019

Phase 1 (2016-)
Increase the intensity of stable beams
High intense neutron source
\((HI \leq 10^{15} \text{ pps, p-Ni})\)

DESIR Phase 1+ (2020-)
Low energy facility

AGATA (2015-2018)

GANIL (HI\( \leq 10^{13} \) pps)

LINAC
33 MeV p, 40 MeV d (5mA)
A/q=3 - 14.5 A/MeV HI (1mA)

SPIRAL1 Upgrade (2017-)
New light RIBs from beam/target fragmentation

GANIL-SPIRAL2
- Driver-beam power on ISOL@MYRRHA target: 60-120 kW
- Low-energy RIBs
- Experimental programme complementary to other ISOL facilities – long-run experiments

L. Popescu
Goals of the EURISOL-DF project:

- Prepare strong scientific case for RIB science and applications
- Support, upgrade, optimize and coordinate ISOL-based European facilities and projects as a necessary step towards EURISOL
- Foster R&D on RIB production and Instrumentation towards EURISOL
- Get EURISOL-DF on the ESFRI list as a candidate project by 2018
- EURISOL as a single site facility as a long term goal
Proposed EURISOL-DF scheme:

- EURISOL Science Case & Experiments
  - Dedicated beamtime for EURISOL-DF experiments
  - Dedicated EURISOL-DF Scientific Council & PAC
- R&D for EURISOL
  - Dedicated Technical Advisory Committee
- Legal entity (ERIC,…)

Discussions with GSI/NUSTAR and JYFL

Close Coordination with EURISOL JRA in ENSAR 2 and EURISOL User group
EURISOL JRA in ENSAR2 Horizon 2020
Participants: CERN, GANIL, HIL Warsaw, IFJ Krakow, INFN, IN2P3/CNRS
Total EU Contribution: 640 k€

- **Tasks:**
  - **EBIB (CERN, GANIL, HIL Warsaw):** Design of High Intensity and high duty cycle EBIS charge breeder
  - **BeamLab (CERN, GANIL, IFJ PAN Krakow, INFN-LNL, IPNO-IN2P3):** Extraction of “difficult” ISOL beams through the production of molecules
  - **CRIBE (GANIL, IFJ PAN Krakow):** Chart of ISOL RIB intensities in Europe
  - **STUC (all) STrUcturing the Community:** Management, networking and meetings
ENSAR 2
EU Horizon 2020

10 TNA Facilities
(7 in ENSAR)

30 beneficiaries
15 countries

Community: 2700-3000 scientists and highly qualified engineers

Coordinator: M. Harakeh
Coordinating institution: GANIL
10M€ EU funds
Duration 4 years
Beginning by the end of 2015
EURISOL – Distributed Facility (DF) Initiative

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http://www.eurisol.org/eurisol_df/