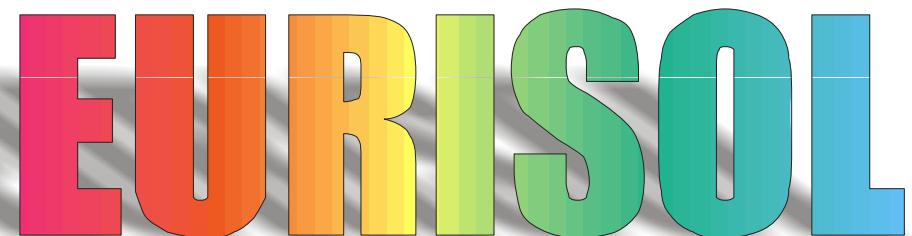


Towards EURISOL

Yorick Blumenfeld

CERN/ISOLDE (and towards IPN Orsay)



Outline

- A short history
- The EURISOL Concept
- Current EURISOL initiatives
 - EURISOL P.O.
 - ENSAR/EURISOL-NET
 - NuPNET/EMILIE
 - TIARA/THIPAC
 - PB-Bi Loop
- When and How?



A Short History

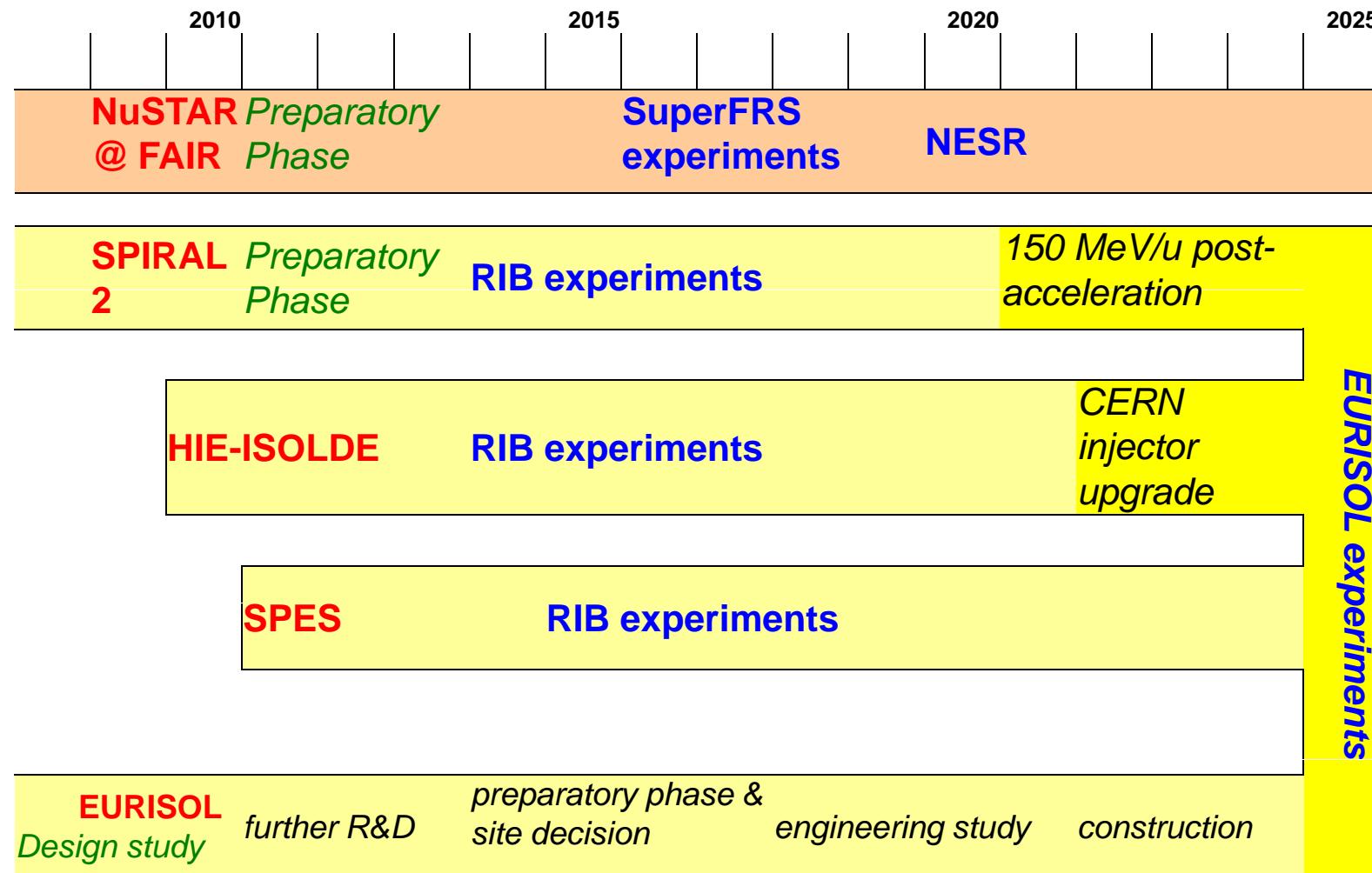
- 2000: The Idea to Build an Ultimate ISOL facility for EUROPE is born ([B. Jonson-A. Mueller- J. Vervier](#))
- 2001-2004: EURISOL RTD led by [J. Vervier](#) in 5th framework program: Conceptual Design
- 2005-2009: EURISOL Design Study led by [G. Fortuna](#) and [Y.B.](#) in 6th framework program
- 2010: Endorsed by NuPECC as highest long term priority for low energy nuclear physics in Europe.

EURISOL DS: 20 Participants

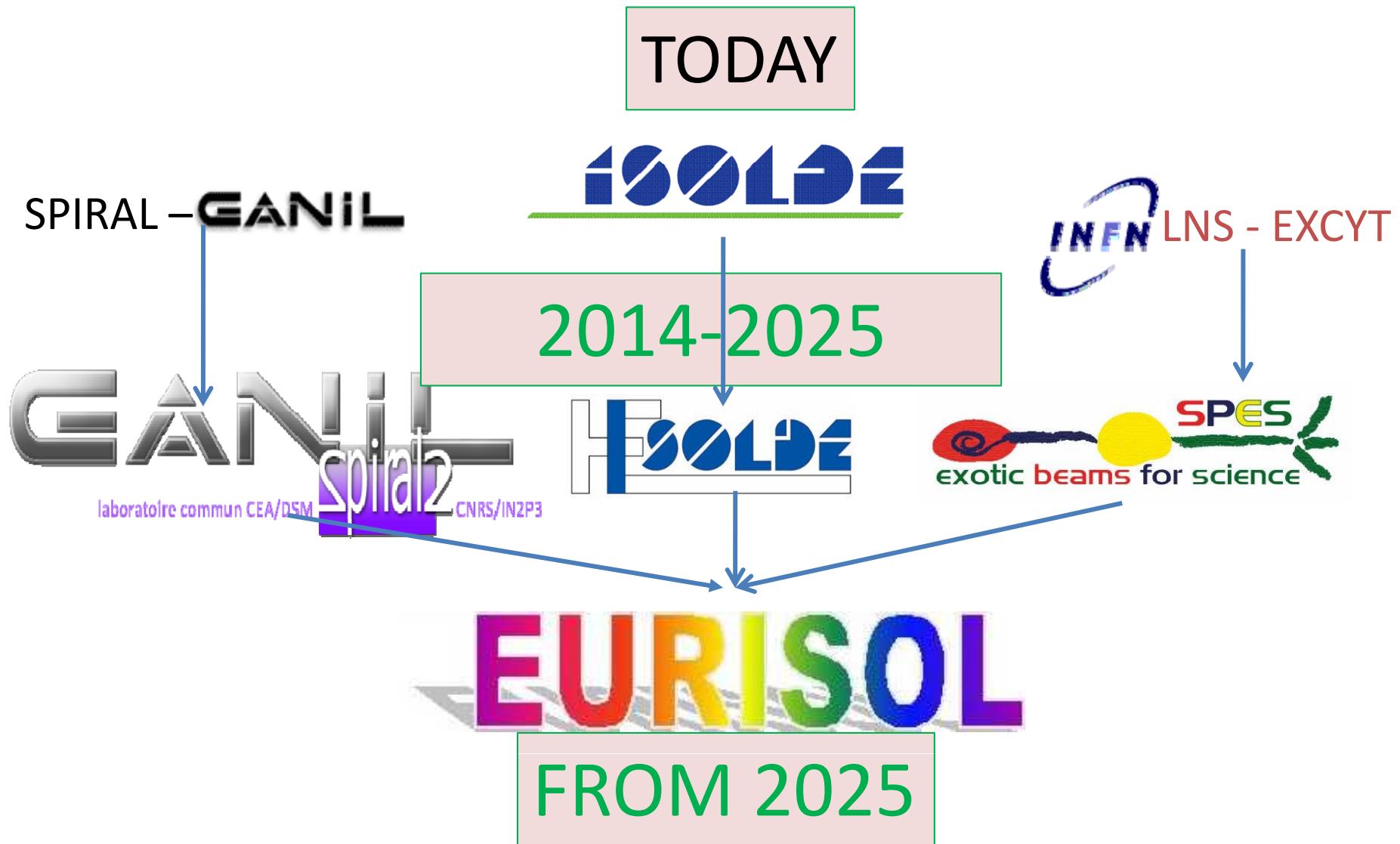
TABLE 1). Participants in EURISOL Design Study

Participant	Country	Participant	Country
GANIL (coordinator)	France	Inst. Physics Vilnius	Lithuania
CNRS/IN2P3	France	Warsaw University	Poland
INFN	Italy	Inst. Phys. Bratislava	Slovakia
CERN	Europe	U. Liverpool	United Kingdom
U. C. Louvain	Belgium	GSI Darmstadt	Germany
CEA	France	U. Santiago	Spain
NIPNE	Romania	CCLRC Daresbury	United Kingdom
U. Jyväskylä	Finland	Paul Scherrer Institute	Switzerland
L.M.U. München	Germany	Inst. Phys. Latvia	Latvia
FZ Jülich	Germany	Stockholm. U. MSL	Sweden

NuPECC Long Range Plan 2010 Timeline RIB Facilities

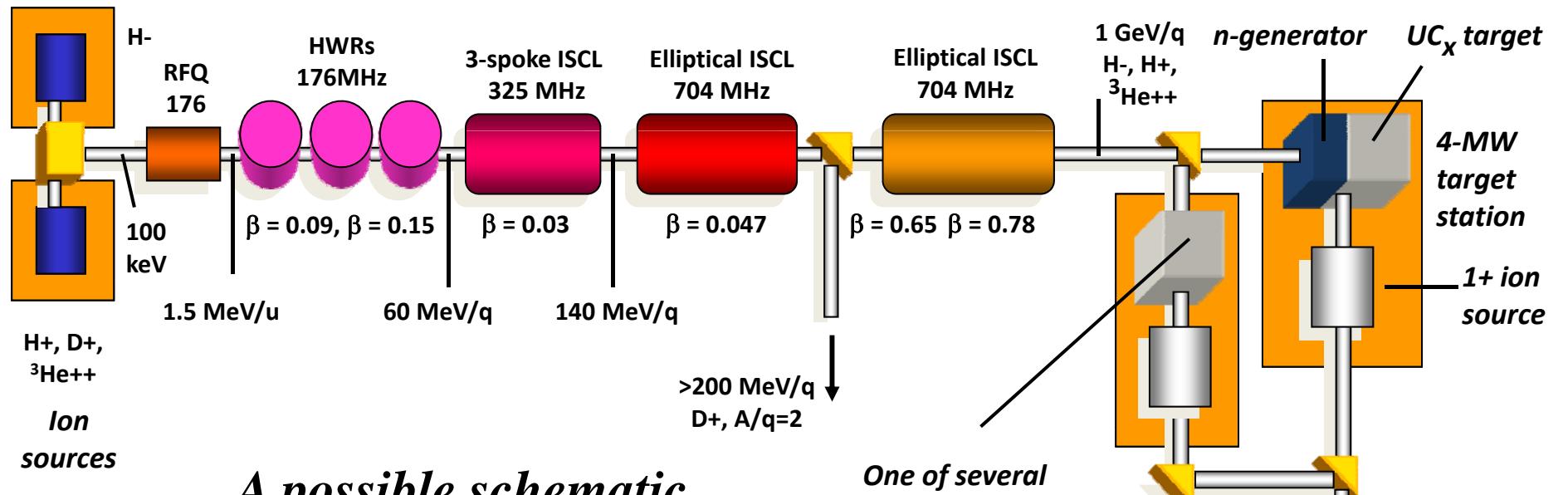


ISOL Roadmap in EUROPE



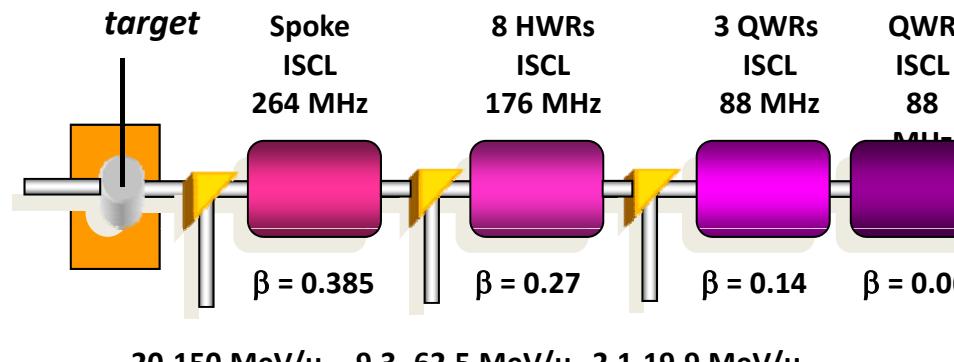
What is EURISOL?





A possible schematic layout

Secondary fragmentation for a EURISOL facility

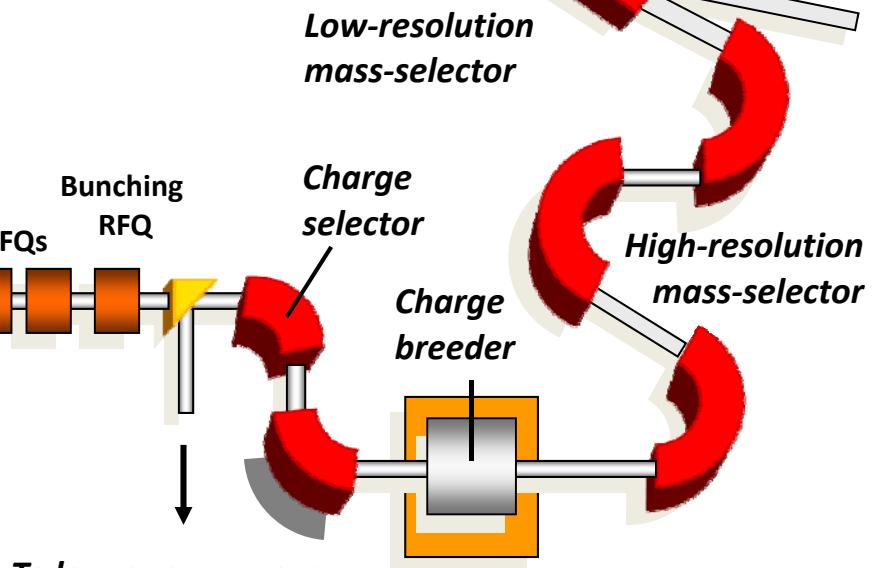


To high-energy experimental areas

To medium-energy experimental areas

One of several
100-kW direct
target stations

To low-energy areas

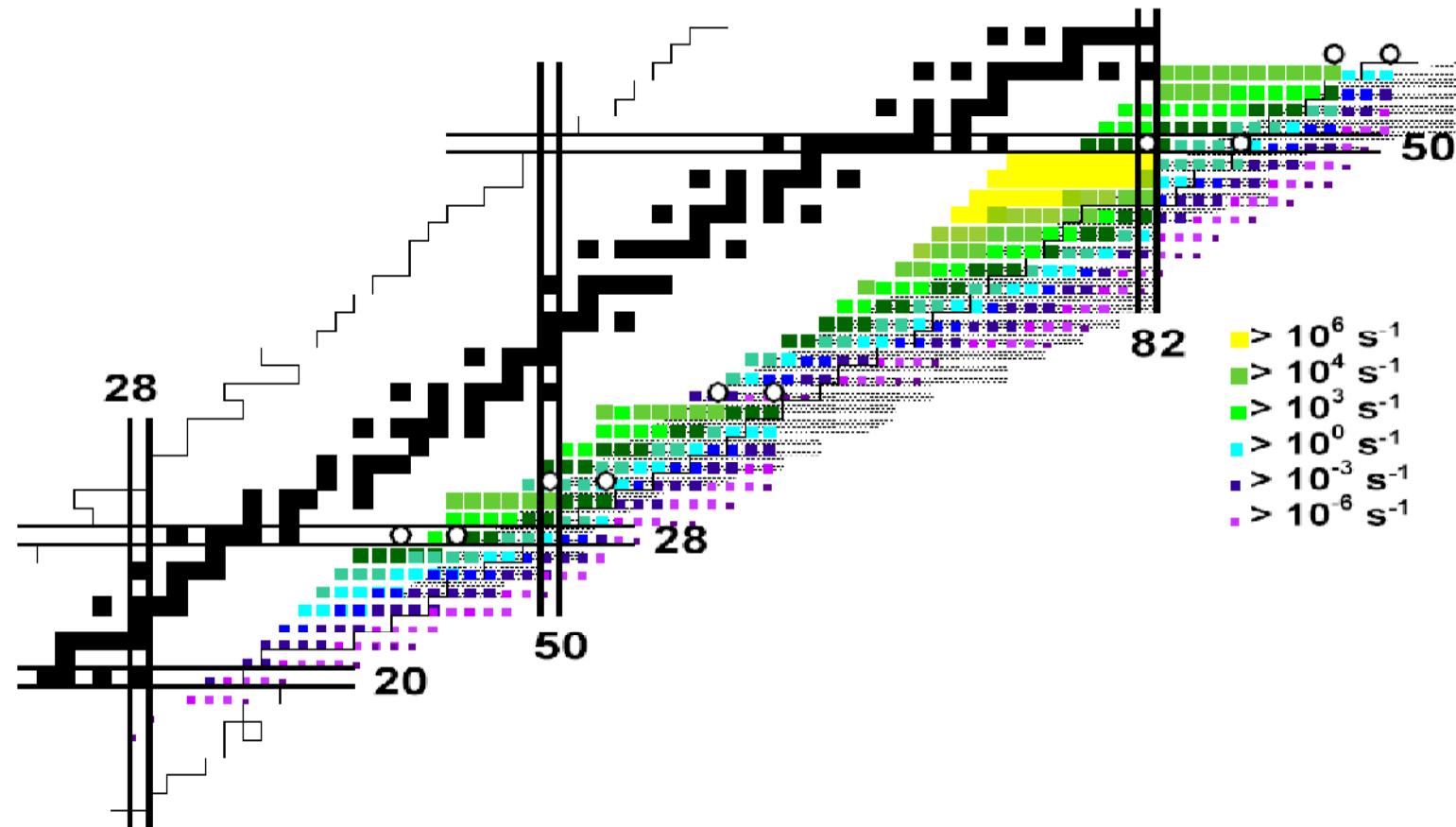


EURISOL

Accelerated ^{132}Sn yields (per second) (*fission factories only*)

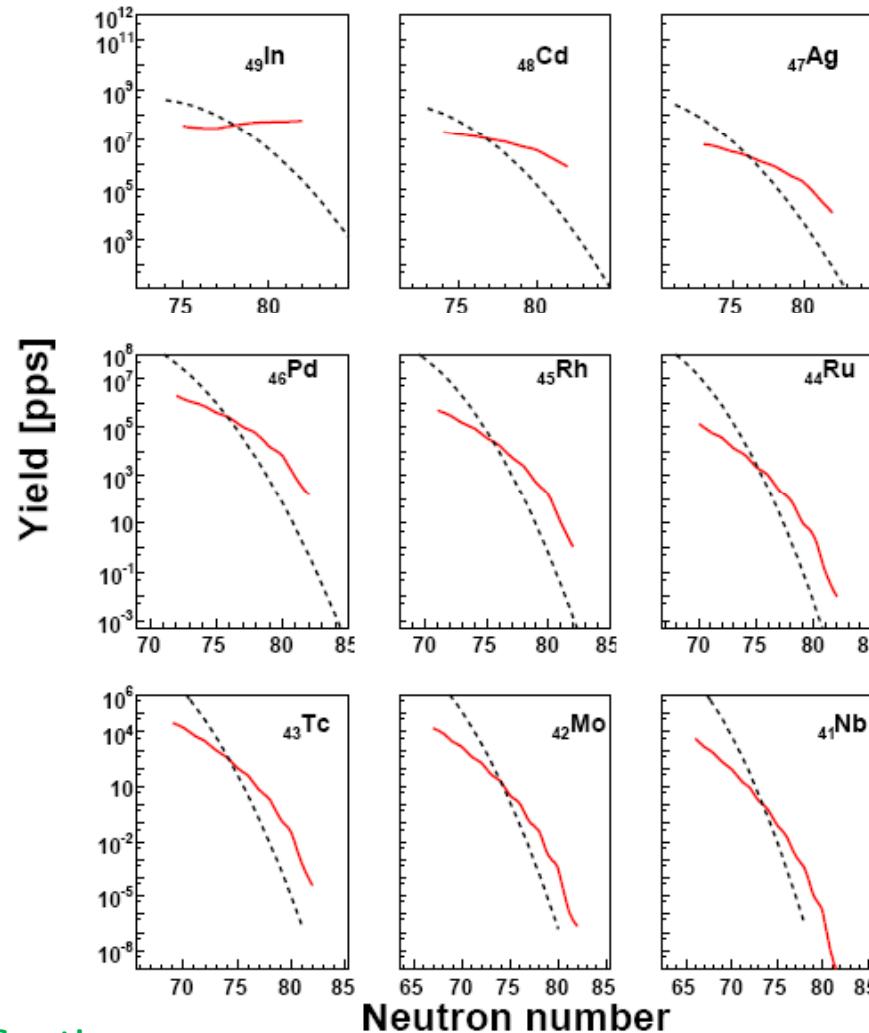
HRIBF	10^5	4.5 MeV/u	(now)
REX-ISOLDE	10^6	3 MeV/u	(now)
CARIBU	5.10^4	10 MeV/u	(2010)
TRIUMF p-driver	10^7	5 MeV/u	(2010)
CARIBU phase 2	10^6	14 MeV/u	(2013)
HRIBF HDU	2.10^8	4.5 MeV/u	(2014)
HIE-ISOLDE	10^8	10 MeV/u	(2014)
TRIUMF e-driver	5.10^8	5 MeV/u	(2015)
SPES	5.10^8	9 MeV/u	(2015)
SPIRAL-2	2.10^9	7 MeV/u	(2015)
FRIB	3.10^6	100 MeV/u	(2019)
EURISOL	10^{12}	150 MeV/u	(2025)

Secondary Fragmentation of Fission Fragments at EURISOL



D. Loureiro, PhD thesis, Santiago

EURISOL vs. FAIR



D. Loureiro, PhD thesis, Santiago

Figure 5.20: Production yields in the fragmentation of ^{132}Sn (solid line) and in-flight ^{238}U fission induced by a beryllium target (dashed line).

EURISOL: The Transition Period (2010-2013)

- **The EURISOL project office**
(Y Blumenfeld *chair*, A Facco, M Lewitowicz, P Van Duppen)
setting up the EURISOL collaboration: (MOU circulating)
- **The EURISOL User Group** (*A. Bonaccorso chair*) + elected executive committee
 - Organizes topical meetings and town meetings in collaboration with EURISOL-NET
 - Catania Dec. 2009: Structure of r-process nuclei
 - Valencia Feb. 2011: Neutron-deficient nuclei
 - Lisbon, OCT. 15-18 2012: Town meeting + topical meeting on Light nuclei.
 - Elections in fall 2012 to replace 4 members of the executive committee
- **The EURISOL-NET Network in ENSAR** (105 k€; *Y. Blumenfeld leader*)
 - Participants: CERN/ISOLDE, IN2P3/IPNO, INFN/LNS, PISA, IN2P3/IPNO, JYFL
 - Task 1 : Coordination of R&D (*Y. Kadi leader*): First workshop at CERN 27-28 June 2011
 - Task 2: Physics and Instrumentation (*A. Bonaccorso leader*)

Topical meeting on Structure of r-process nuclei

Catania December 2009

- 25 talks:
<http://agenda.ct.infn.it/conferenceTimeTable.py?confid=236>
- Proceedings available:
http://www.df.unipi.it/~angela/top_all_19dic.pdf
- Generalities on the r-process
- Mass measurements and calculations
- Coulomb excitation, dipole strength, pygmy resonances
- Structure around N=82

Topical Meeting on Neutron Deficient Nuclei

Valencia Feb. 2011

- 76 participants; 31 talks: <http://ific.uv.es/~eug-valencia>
- Proceedings being finalized
- One-, two- and three-proton radioactivity
- Main Topics
 - $N \approx Z$ Nuclei
 - Special $N=Z$ nuclei subtopic: Superallowed Fermi decays, precise $T_{1/2}$, branching ratios and $Q\beta$ values
 - Nuclear Astrophysics
 - Other Reaction Experiments: Coulex and transfer
 - Atomic Physics for Nuclear Physics
 - Exotic excitations in proton rich nuclei and clusterisation

Meeting on EURISOL related R&D

CERN, June 2011

- 42 participants; 16 talks

<https://indico.cern.ch/conferenceTimeTable.py?confId=138670#20110627>)

- Main topics:
 - Neutron converter studies at CERN and ESS
 - Target material studies, in particular Uranium Carbide at CERN, GANIL and IN2P3- Orsay
 - Ion source improvements at GANIL, IN2P3-Orsay, INFN and JYFL
 - SCRF cavity developments at CERN and IN2P3-Orsay
 - Beam diagnostic developments at CERN, INFN and Kyiv Institute for Nuclear Research



« Enhanced Multi-Ionization of short Lived Isotopes for EURISOL »

Charge breeding techniques for ISOL facilities

Improving performances of charge breeders based on:

- **EBIS**
 - Testing a concept of debuncher using a Paul trap to produce CW beams
- **ECRIS**
 - Improving charge breeding efficiencies for metallic ions

Partner	Funds
IN2P3 (coord)	250 k€
INFN	80 k€
HIL	159 k€
JYFL	24 k€

Consortium of 9 europeans laboratories



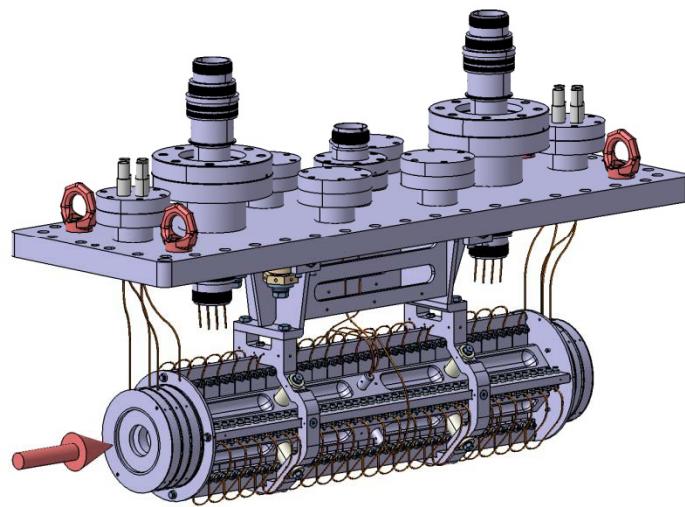
J. Angot, G. Ban, L. Celona, J. Choinski, P. Delahaye (GANIL IN2P3, coord.), A. Galata (INFN, deputy coord.), P. Gmaj, A. Jakubowski, P. Jardin, T. Kalvas, H. Koivisto, V. Kolhinien, T. Lamy, D. Lunney, L. Maunoury, A. M. Porcellato, G. F. Prete, O. Steckiewicz, P. Sortais, T. Thuillier, O. Tarvainen, E. Traykov, F. Varenne, and F. Wenander

Latest progresses

- Started 1/1/2012
- Web site: <http://www.emilie-eurisol.eu/>
- Consortium agreement being finalised
- Logo found

EBIS debuncher :

Design done! By LPC Caen Y. Merrer and coworkers



Simulations ongoing: see [Emil Traykov's poster](#)

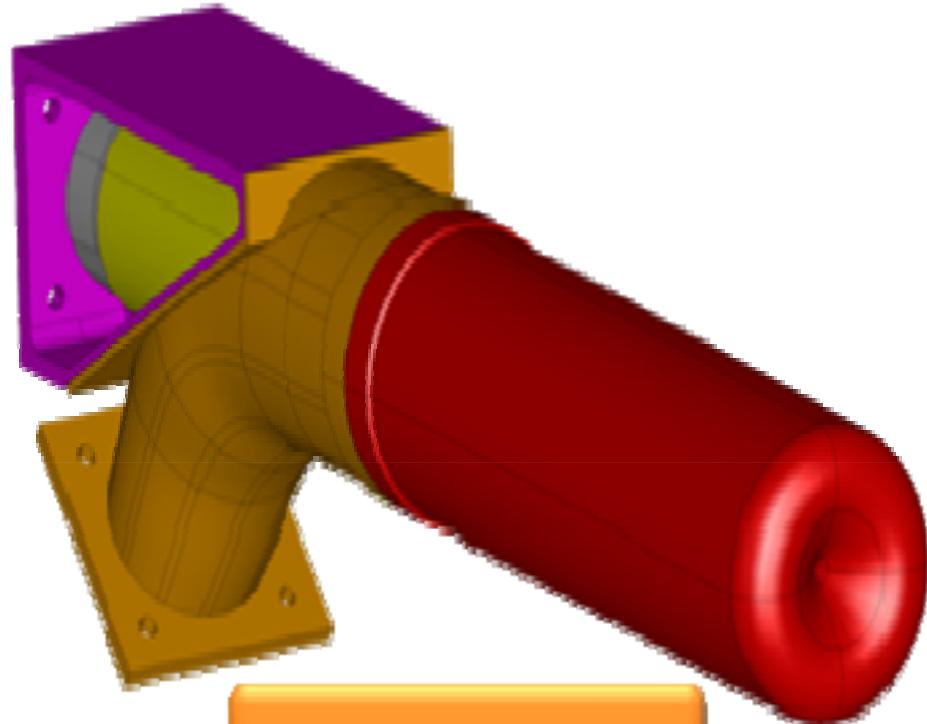
ECR Charge breeders

R&D work under progress or getting started

- Extensive simulation program (INFN LNL and LNS)
- Optimization of the Phoenix charge breeder for SPES and SPIRAL 2 and hot 1+ ECR sources (LPSC)
- Optimization of the Phoenix charge breeder performances for light ions injection at SPIRAL (GANIL)
- Test of metallic ion beam production in JYFL (8/2012 – 10/2012) and HIL

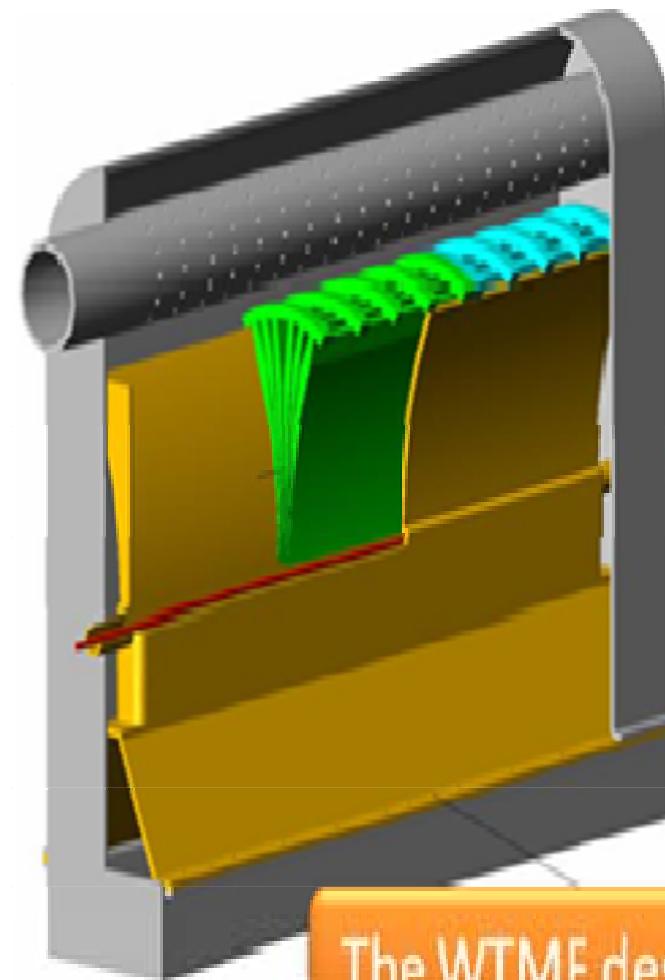
See [Pierre Delahaye's presentation](#) on Wednesday morning

Liquid Hg converters



The CGS design

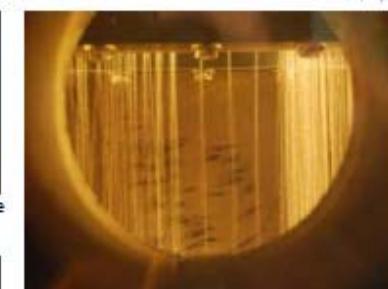
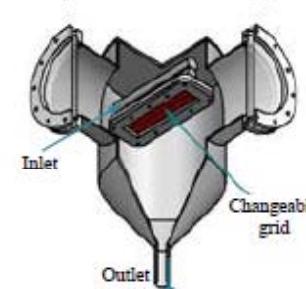
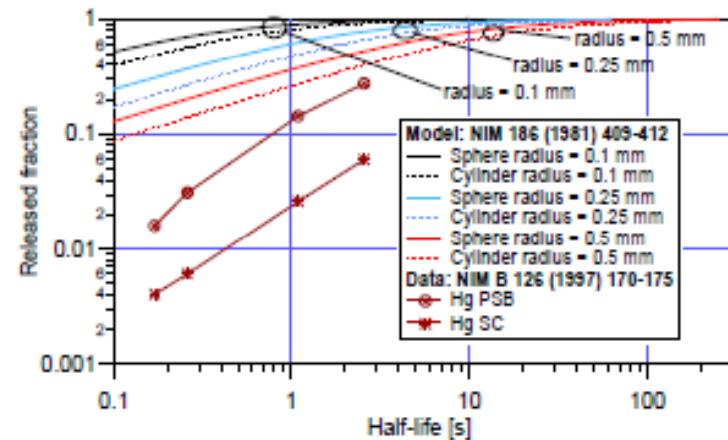
Coaxial Guided Stream



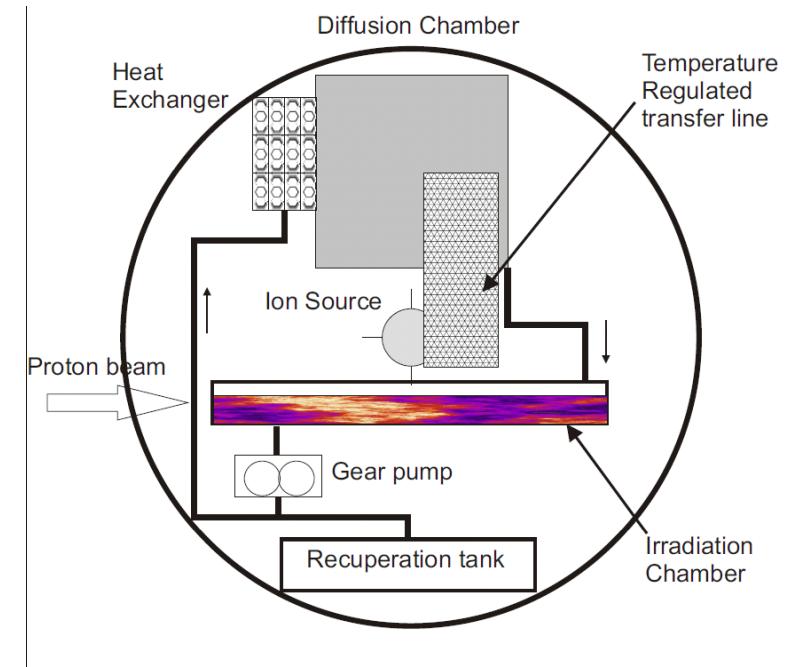
The WTMF design

Windowless Transverse Mercury Film

Pb/Bi high power target test @ ISOLDE



Target material	Pb 44.5% / Bi 55.5%
Melting point / boiling point [C]	125 / 1670
Operating temperature [C]	150-600
Target material density [kg/m ³]	10.5 @ 200C; 10.2 @ 400C; 9.9@600C
Thermal conductivity [W/K.m]	11.3 @ 400C
Irradiation cell volume [cm ³]	60
Flow rate [cm ³ /s]	60-200
Pump pressure [Bar]	0.1-2



Pb-Bi loop Work packages

(WP holder in brackets)

WP 1: Coordination	(CERN)
WP2 : Conceptual design & simulation	(SCK-CEN)
WP3 : Construction	(CERN)
WP4 : Instrumentation	(PSI or ESS)
WP5 : Safety and Licensing	(CEA)
WP6 : Target characterization and analysis	(PSI)
WP7 : Radiochemistry	(SINP)
WP8 : Offline commissioning	(IPUL)
WP9 : Online operation	(CERN)

Kick-off meeting at CERN on 10th May 2012

Review of Milestones and work-package description ongoing

2 online tests at CERN-ISOLDE planned in Apr 2015 and Apr 2016

CERN material contribution: 300 KCHF



Test Infrastructure and Accelerator Research Area

The main objective of TIARA is the integration of national and international accelerator R&D infrastructures into a **single distributed European accelerator R&D facility**.

Workpackage 9:



Addressing two major technical issues before launching the construction of EURISOL:

- i) the development of high power target and ii) low beta superconducting accelerating structures. The objective of this Work Package is to coordinate the design of the corresponding test infrastructures

Participants: IN2P3/IPNO and CERN

Upcoming Topical and Town meetings

- In Lisbon, Portugal Oct. 15-18, 2012
- 3rd Topical Meeting: Physics of light nuclei Oct 15-17
- Town Meeting: Oct. 17-18
- <http://cfif.ist.utl.pt/~eurisol/>
- Please attend to show your support for our future!

NuPECC Long Range Plan 2010 Timeline RIB Facilities

