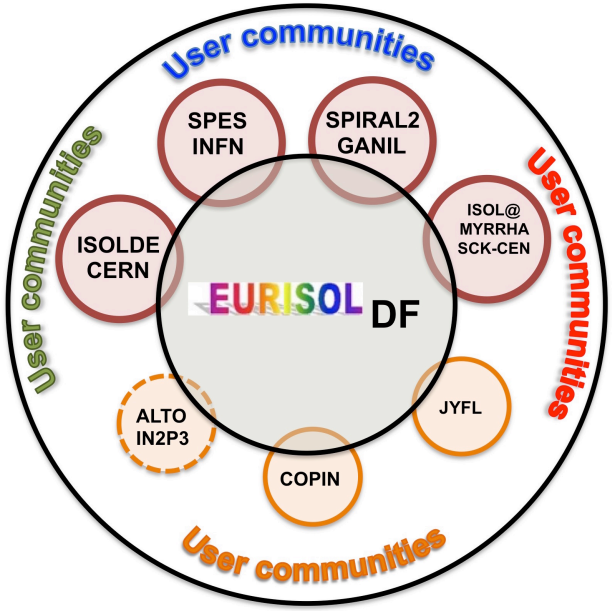
The EURISOL Distributed Facility Initiative

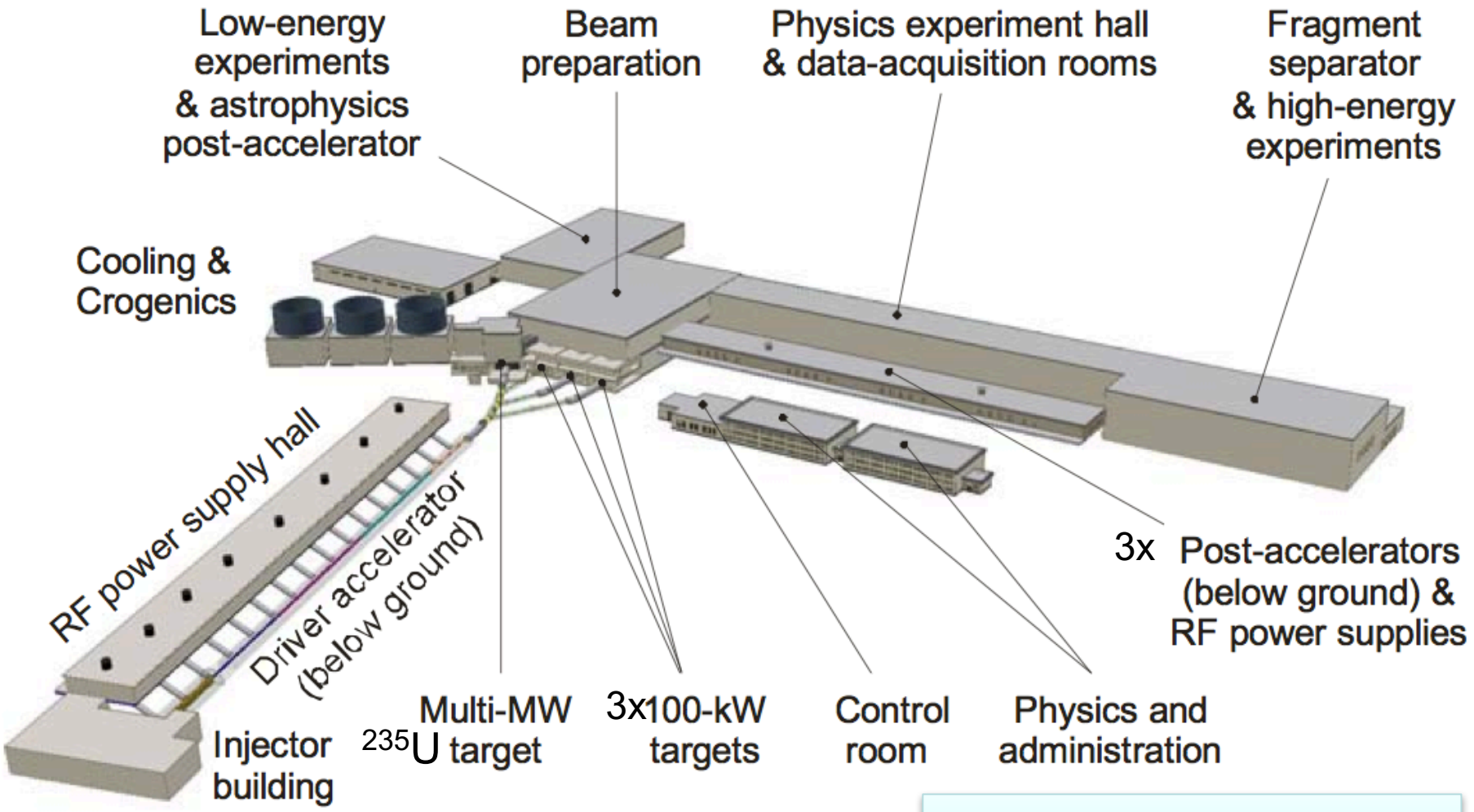
Marek Lewitowicz
On behalf of the EURISOL Steering Committee

- Motivation
- What is EURISOL Distributed Facility Initiative?
- Further steps



What is EURISOL ?

Up to 150 AMeV for ^{132}Sn

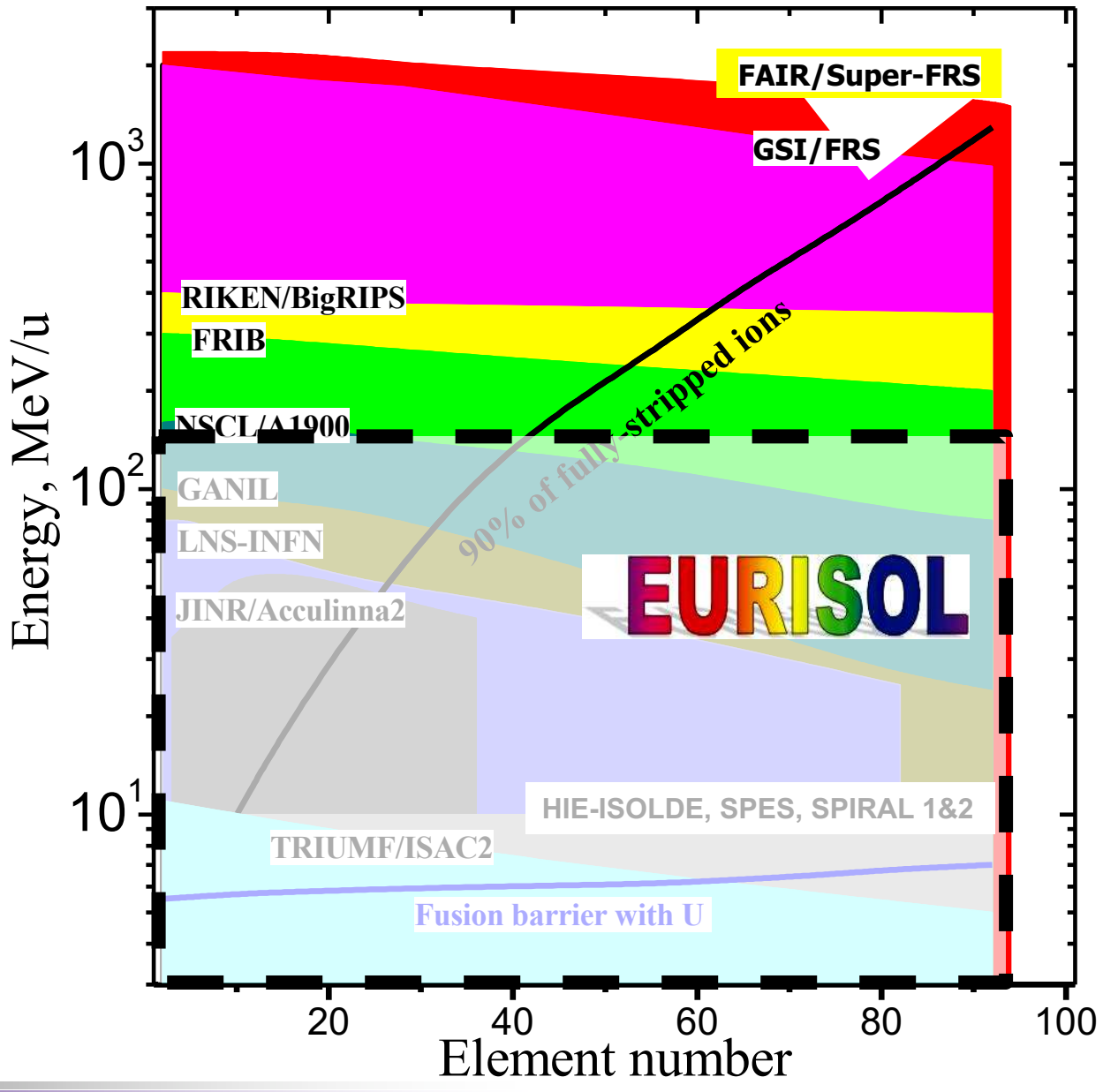


LINAC: H, D, He and A/q=2 ions up to 1 A GeV

Multi-user capabilities

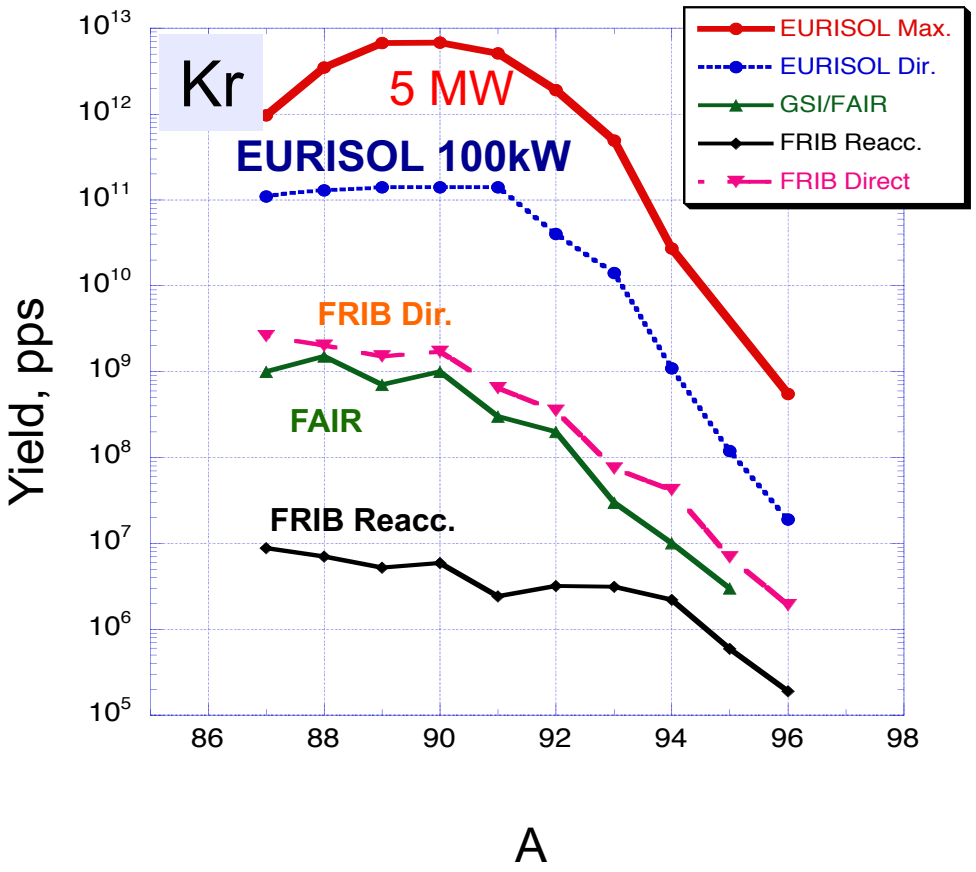
Cost: > 1.3B€

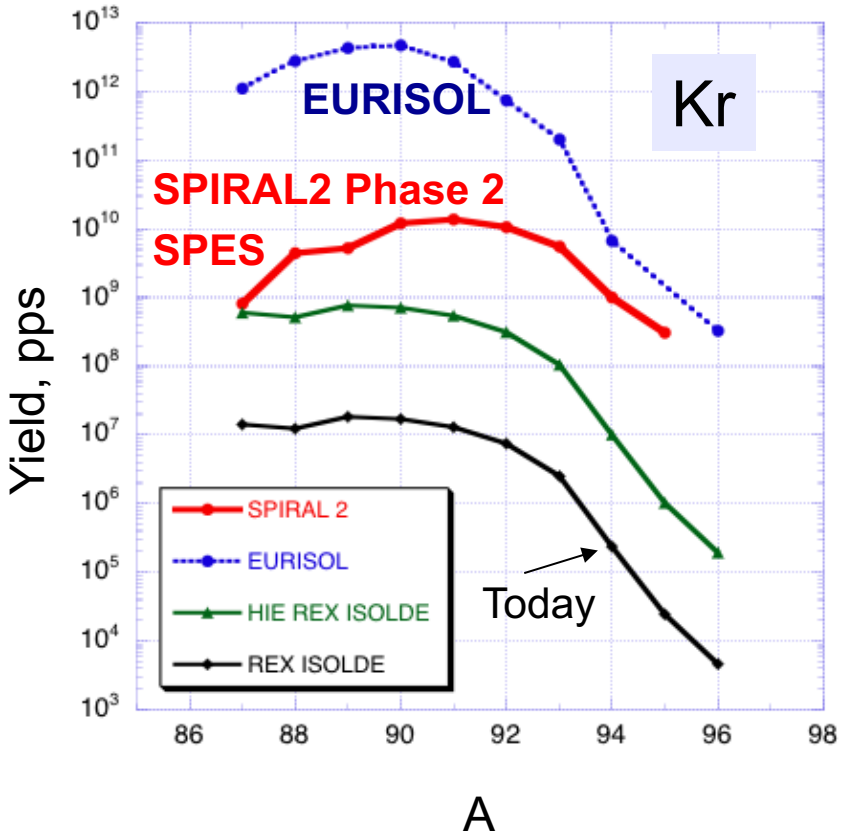
Energy domain



RIB intensities (example)

EURISOL: Precision experiments with RIB at low cross sections and very exotic nuclei at few MeV/nucleon



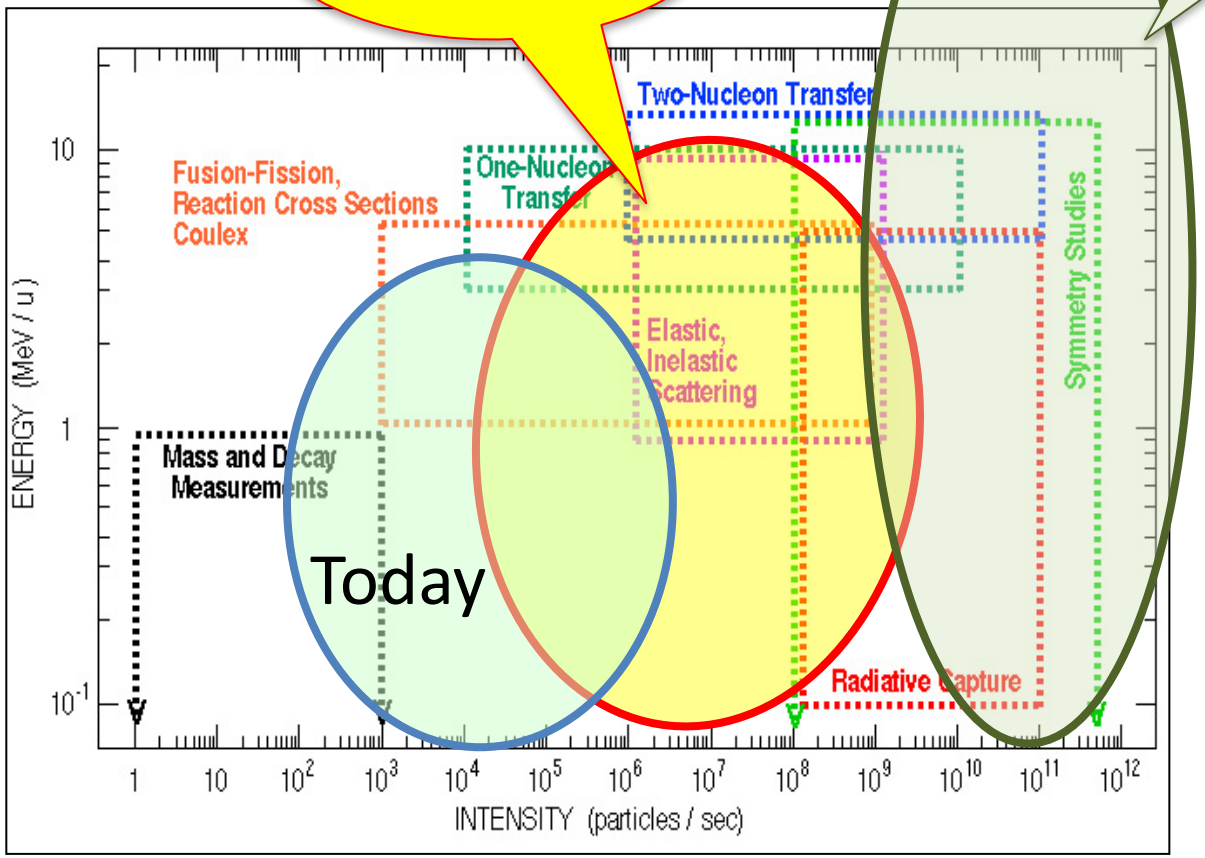


Physics with ISOL RIB Intensity & Energy domains

Precision nuclear structure physics & applications

HIE-ISOLDE,
SPES, SPIRAL2,
ISOL@MYRRHA
EURISOL-DF

EURISOL



EURISOL

Second generation

today

Second generation

EURISOL

-> EURISOL-DF (Distributed Facility) Initiative from 2014 as an intermediate step towards EURISOL

EURISOL DF

EURISOL MoU

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, JYFL

The MOU is implemented by a Steering Committee with one representative per signatory. The members are:

MJG Borge/G. Neyens (CERN), M. Lewitowicz (GANIL, chair), A. Maj (COPIN), S. Pirrone (INFN), L. Popescu (BEC), A. Jokinen (JYFL) A. Bracco (NuPECC representative) and Y. Blumenfeld (EURISOL JRA ENSAR2, invited), Berta Rubio (Chair of the EURISOL User Executive Committee, invited)

-> EURISOL-DF Initiative from 2014

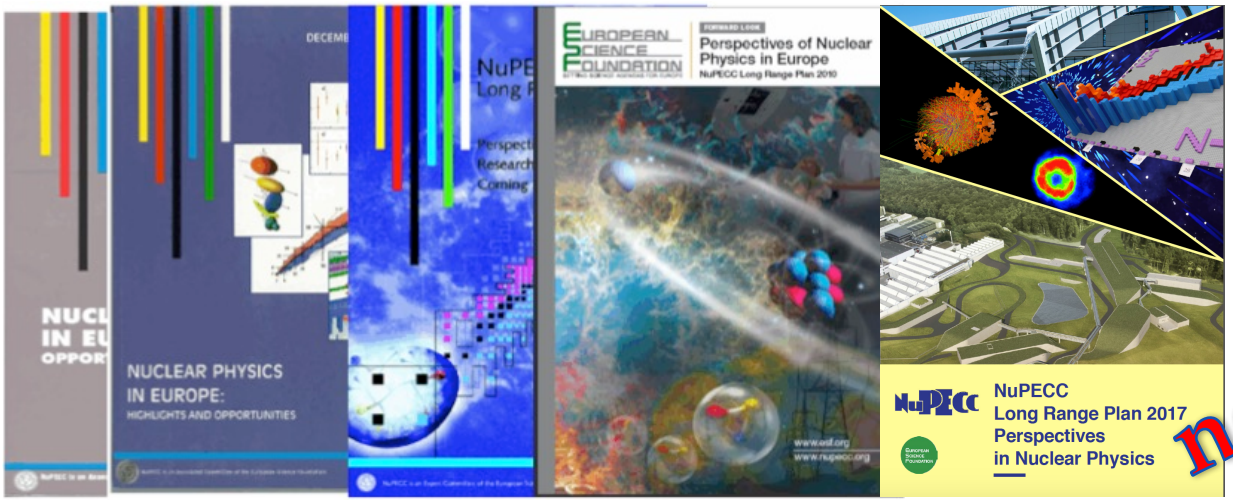
EURISOL DF

NuPECC Nuclear Physics European Collaboration Committee

Long Range Plan 2017

www.nupecc.org/lrp2016/Documents/lrp2017.pdf

1991 1997 2004 2010 2017



new!

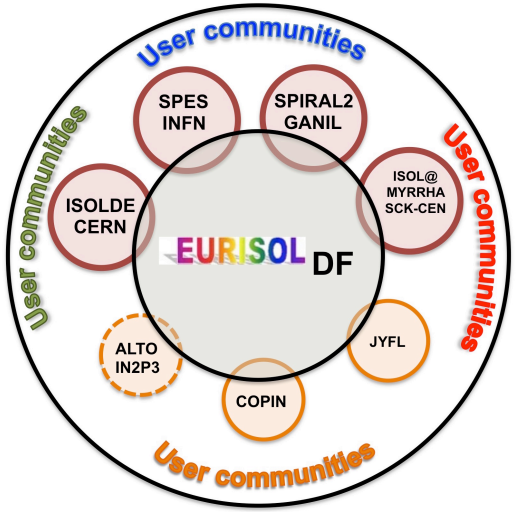
- The LPR **identifies opportunities** and priorities for the nuclear science in Europe (***including new facilities and upgrades of existing ones***)
- The LRP **provides** the European Commission and national funding agencies with a **framework for coordinated advances** in nuclear science in Europe (***including EU funded coordination projects : ENSAR2, Hadron Physics IA,…***)

Official presentation in Brussels Nov. 27, 2017

Support for construction, augmentation and exploitation of world leading ISOL facilities in Europe.

The urgent completion of the ESFRI facility SPIRAL2 along with SPES and the energy and intensity upgrade of HIE-ISOLDE (+ storage ring), including their unique instrumentation will consolidate the leading role of Europe. These ISOL facilities with low energy and reaccelerated exotic beams, offer extraordinary opportunities for scientific discoveries to probe questions that concern the atomic nucleus and nuclei in the cosmos. **The successful completion and exploitation of these facilities would be the major step toward the ultimate European ISOL facility, EURISOL. With this aim, a strong European collaborative initiative, the EURISOL-Distributed Facility, is strongly supported to maximize synergies to address and solve new scientific and technical challenges.**

EURISOL – Distributed Facility (DF) Initiative



Core members :

- **HIE-ISOLDE/CERN**
- **SPES-INFN**
- **SPIRAL2-GANIL**
- **ISOL@MYRRHA-SCK*CEN**

Associated Members

- **JYFL, Finland**
- **COPIN Consortium, Poland (ALTO, Orsay)**

EURISOL DF

EURISOL – Distributed Facility (DF) Initiative

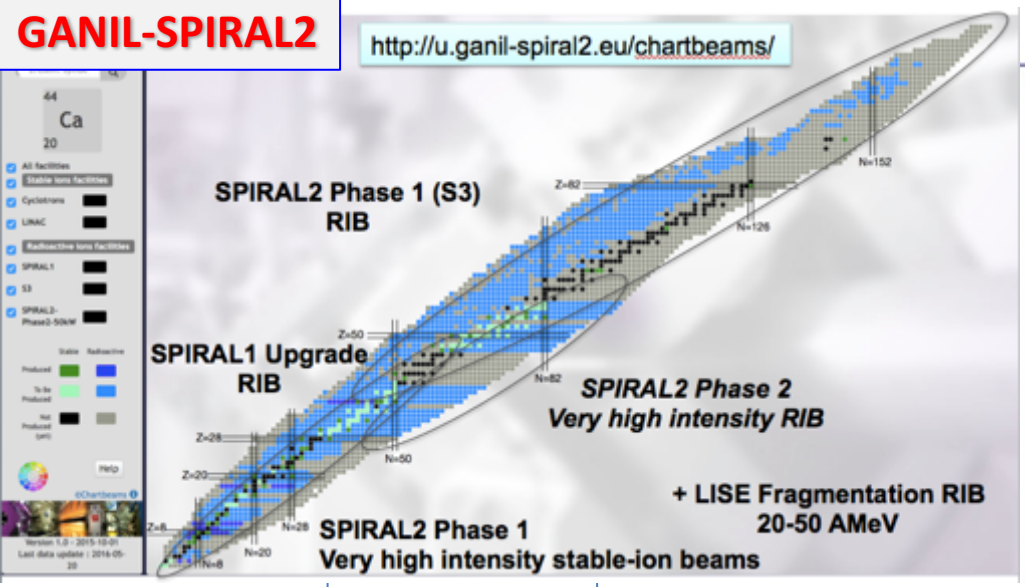
EURISOL-DF working groups for the preparation of the ESFRI-list proposal:

- **WG1**: Science & applications (together with EURISOL User Group): Coordinator R. Raabe
- **WG2**: Technical R&D – accelerators: Coordinator A. Facco
- **WG3**: Technical R&D – RIB beam handling, targets and ion sources: Coordinator M. Borge
- **WG4**: Technical R&D – spectrometers & detectors: Coordinator H. Savajols
- **WG5**: EURISOL-DF & relationships with ESFRI & EC and its future legal structure: Coordinator: A. Bracco

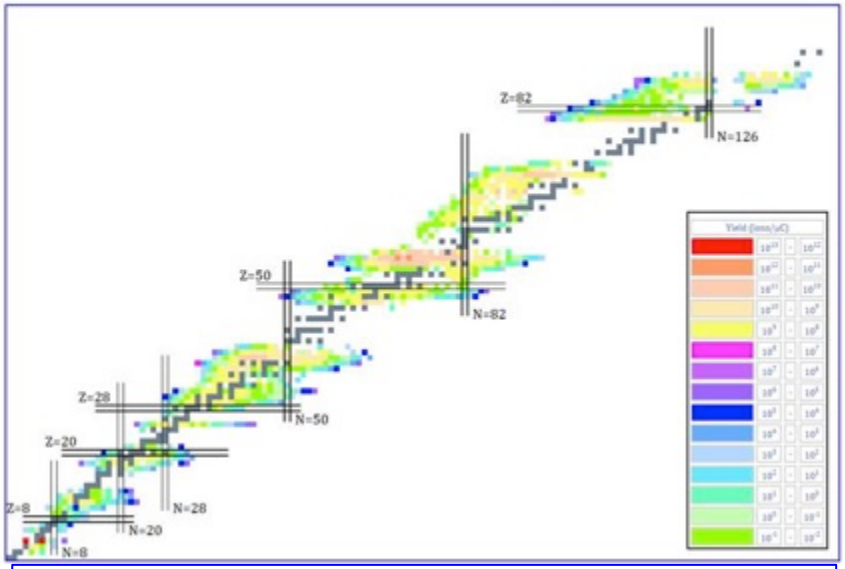
EURISOL DF

RIBs and Beam Time

GANIL-SPIRAL2

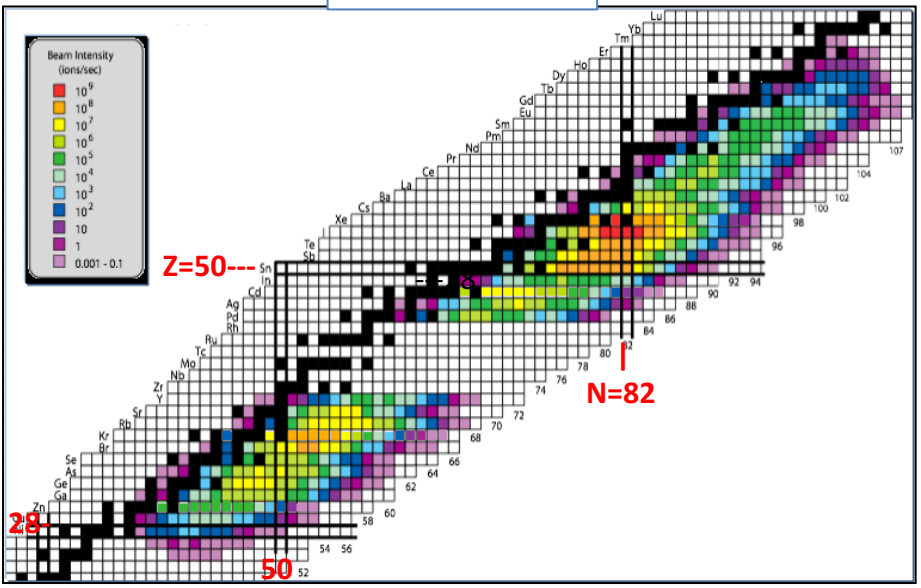


ISOLDE-CERN



http://test-isolde-yields.web.cern.ch/test-isolde-yields/query_tgt.htm

INFN - SPES



https://web.infn.it/spes/index.php/news/spes-beam-tables

EURISOL-DF:
Enhance complementarities
&
avoid duplication of efforts in the beam developments

EURISOL DF

RIBs and Beam Time

Beam Time for users & simultaneous operation

# of Months of RIB/year*	Today	In the next few years	Nominal	Nominal # of simultaneous RIB
ISOLDE	7	7	**7**	**2**
GANIL-SPIRAL2	1	4	**8**	**2**
SPES		4	**8**	**1**
ISOL@MYRRHA			**4,5**	**2**
ALTO	0,7	1,2	**1,2**	**1**
JYFL	2	2,5	**2,5**	**1**
Total	**10,7**	**18,7**	**31,2**	**9**

RIB energy range 0(keV) - 10 MeV/nucl.

** Including beam preparation & development time*

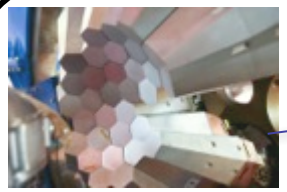
EURISOL DF

EURISOL-DF Instrumentation Coordination Committee (**EICC**)

The role of the EICC is to reinforce the synergies and coordinate efforts between the facilities and the major collaborations on existing and new detectors in order to carry on **R&D** and to **reach construction milestones** and **coordinate experimental campaigns** at all RIB facilities which are members of EURISOL-DF.

Traveling detectors (examples)

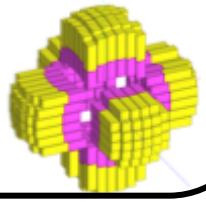
Gamma-ray detectors



AGATA

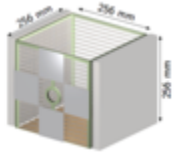
EXOGAM 2

PARIS



Charged particle detectors

ACTAR-TPC

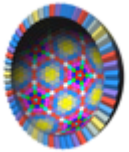


GASPARD

FAZIA

Neutron detectors

NEDA

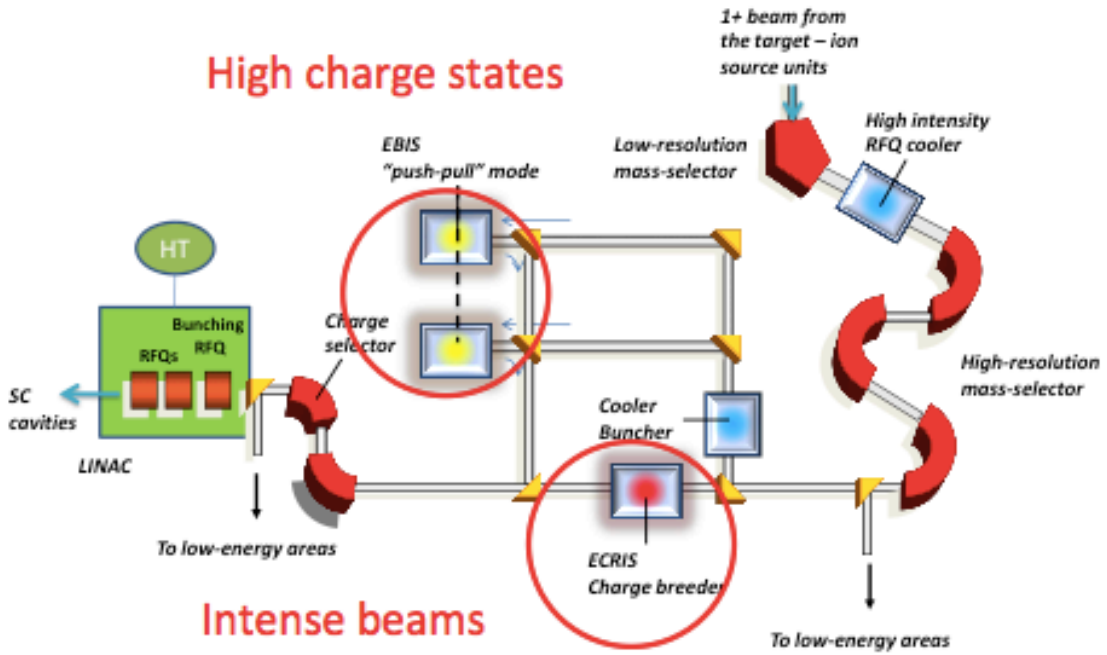


DEMON

EURISOL R&D Example: The EMILIE project

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

Charge breeding techniques for ISOL facilities



Consortium of 8 European laboratories

+ EURISOL JRA in the EU funded ENSAR2

The goals of EURISOL-DF project (1/3)

- Implement a **new scientific policy** tackling major problems in nuclear physics at ISOL-based European facilities and in particular:
  - organise **experimental campaigns** using all available observables, techniques, facilities (at least two) and theoretical approaches to answer key questions in nuclear structure (eg. modifications of magic numbers in nuclei far from stability) and astrophysics (eg. genesis of middle to heavy mass elements in the Universe) ;
  - have a single entry point for **a significant fraction (up to 50%) of the Radioactive Ion beamtime** dedicated at ISOLDE-CERN, SPIRAL2-GANIL & SPES-INFN for the EURISOL-DF experiments and distributed via the EURISOL-DF Program Advisory Committee;

EURISOL DF

The goals of EURISOL-DF project (2/3)

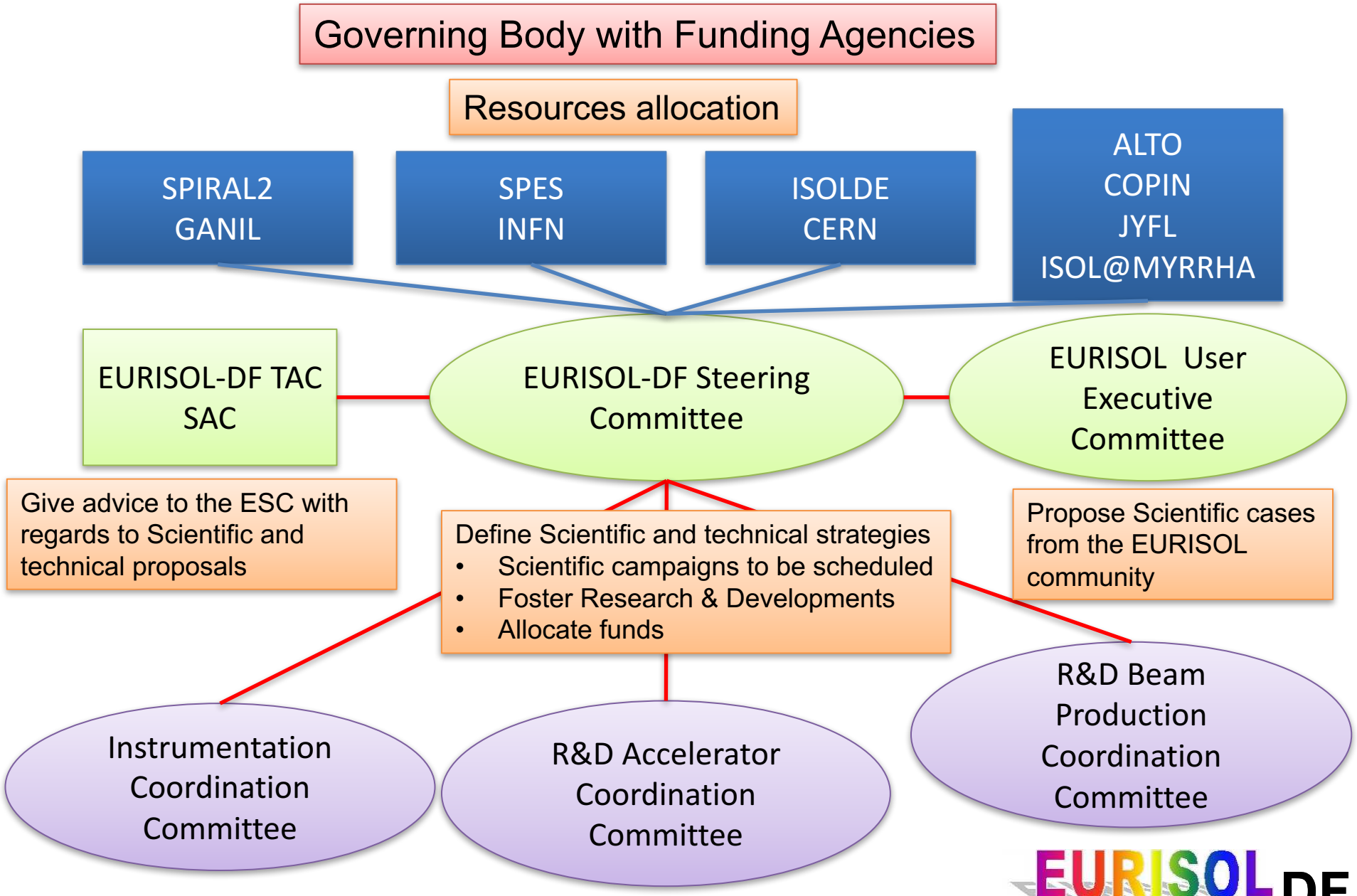
- Develop **R&D on RIB production and instrumentation** towards EURISOL and in particular:
  - organise and open to all EURISOL-DF members the R&D platforms to develop RIB (ex. ion sources, targets, separation techniques) and detector systems;
- Promote **user driven policy** with an important role played by the **EURISOL User Group** and the EURISOL Instrumentation Coordination Committee in order to organise and optimize the campaigns of travelling detectors and arrays;

The goals of EURISOL-DF project (3/3)

- Have **EURISOL-DF included on the ESFRI list by 2020** and attract additional member states and EU funds, in particular:
    - in-kind and/or cash contributions of the members for joint developments for EURISOL in the domains of accelerators, RIB production and instrumentation for experiments;
- Establish a **joint strategy in education and training in nuclear science** (eg. organising joint summer schools, hands on training, topical workshops and conferences);
- Develop **EURISOL as a single site facility as a long-term goal**.

EURISOL DF

EURISOL-DF Organisation (Preliminary)



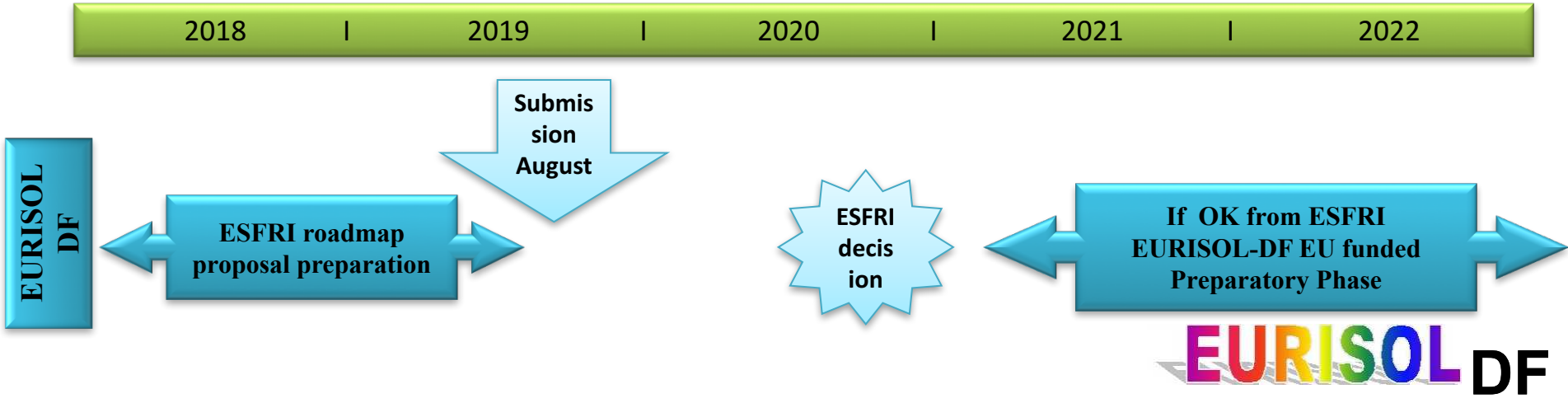
EURISOL DF

EURISOL – Distributed Facility (DF) Initiative – next steps (1/2)

- *EURISOL-DF Workshop in Lisbon in* ***November 15-16, 2017***
- 5 Working groups (Science, Accelerators, RIB, Instrumentation, Legal aspects) -> reports by the **end of 2017**
- First draft of the full EURISOL-DF proposal including the WG reports, feed-back from the Lisbon conference, NuPECC LRP recommendations by **March 2018**
  - *Writing Committee (B. Rubio, Y. Blumenfeld and M. L.) in a close collaboration with the EURISOL Steering Committee and EURISOL UEC*

EURISOL – Distributed Facility (DF) Initiative – next steps (2/2)

- Lobbying and green light from the labs and at least 3 countries by **November 2018**
- Draft of the full EURISOL-DF proposal by **January 2019**
- Consultation of the draft with the involved countries and community with an involvement of the EURISOL User Executive Committee: **March-July 2019**
- Submission of the EURISOL-DF project to ESFRI by **July-August 2019 (dead-line August 2019)**



Conclusion

EURISOL-DF Pan-European added value:

- Optimal approach to study major questions in modern nuclear structure physics, nuclear astrophysics and related applications
- European coordination of EURISOL related physics and technical R&D
- Secured resources for operation of the ISOL facilities and additional resources for R&D and detectors
- Clear strategy for upgrades of the complementary EU ISOL facilities towards EURISOL

Close collaboration and synergy with FAIR/NuSTAR

EURORIB 2018

Giens, France

May 27th – June 1st

EURISOL

FAIR

GANIL spiral2

GSI

ISOLDE

SPES exotic beams for science

IDEAL

IDEAL is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement No 730989

Topics

- *Future RIB facilities*
- *Nuclear astrophysics*
- *Transuranium nuclei*
- *Fundamental interactions*
- *Applications to other fields*
- *Direct Reactions with radioactive beams*
- *Nuclear structure far from stability and hypernuclei*
- *Dynamics and Thermodynamics of exotic nuclear systems*
- *At and beyond the dripline and new modes of radioactivity*
- *Instrumentation, electronics and data acquisition systems*
- *Production and manipulation of RIB*

International Advisory Committee

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Faïçal Azaiez (IThemba SA)
José Benlliure (Univ. Santiago de Compostela)
Klaus Blaum (MPI-K Heidelberg)
Yorick Blumenfeld (IPN Orsay)
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Scientific Organizing Committee

Giovanni La Rana (INFN - Napoli/SPES)
Marek Lewitowicz (GANIL)
Gerda Neyens (CERN/ISOLDE)
Christoph Scheidenberger (GSI)
Riccardo Raabe (KU LEUVEN/BEC)

Local Organizing Committee

Marie-Laure Abavent (GANIL)
Marek Lewitowicz (GANIL)
Sophie Rastello (GANIL)

Acknowledgements

Warm thanks to the EURISOL SC members

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A. Maj (COPIN),
S. Pirrone (INFN),
L. Popescu (BEC),
A. Jokinen (JYFL),
A. Bracco (NuPECC Chair),
Y. Blumenfeld (EURISOL JRA ENSAR2)

EURISOL-DF WG coordinators:

R. Raabe,
A. Facco,
H. Savajols

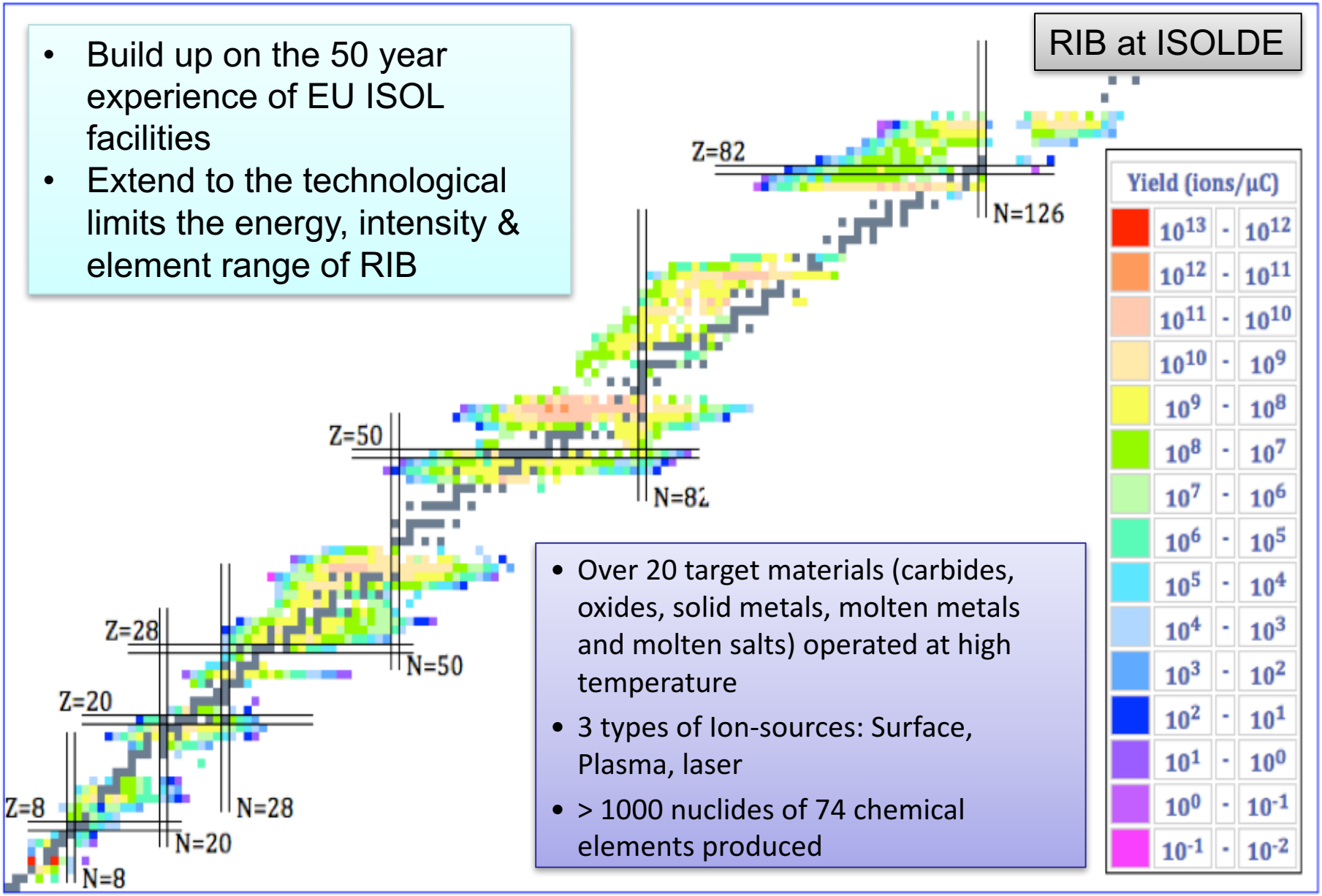
A. Bonaccorso & B. Rubio (EURISOL User Group)
and R. Julin

for their contributions and help in the preparation of this talk

BACKUP SLIDES

RIB at EURISOL

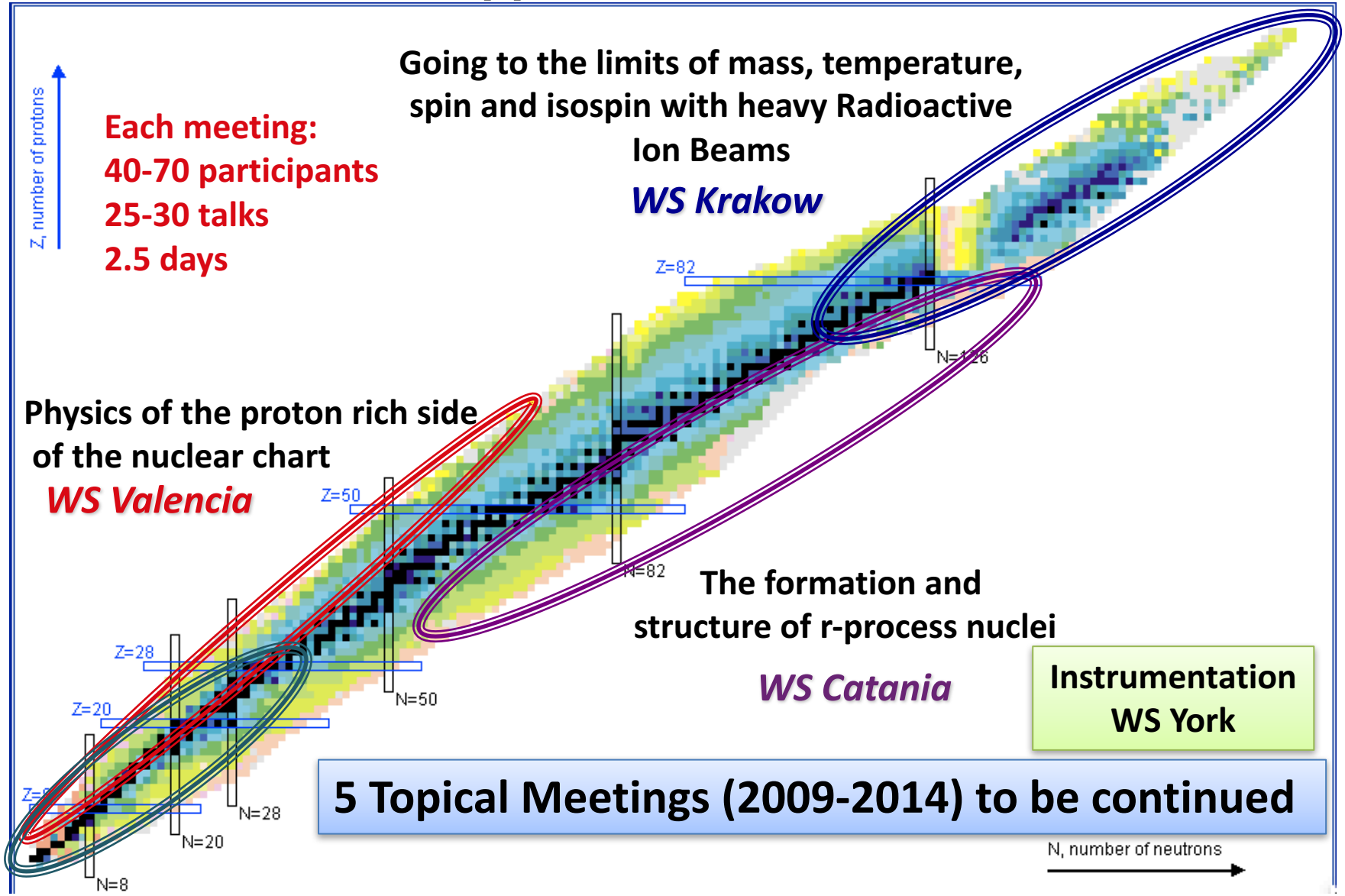
- Build up on the 50 year experience of EU ISOL facilities
- Extend to the technological limits the energy, intensity & element range of RIB



- Over 20 target materials (carbides, oxides, solid metals, molten metals and molten salts) operated at high temperature
- 3 types of Ion-sources: Surface, Plasma, laser
- > 1000 nuclides of 74 chemical elements produced

Strong scientific case for RIB science and applications

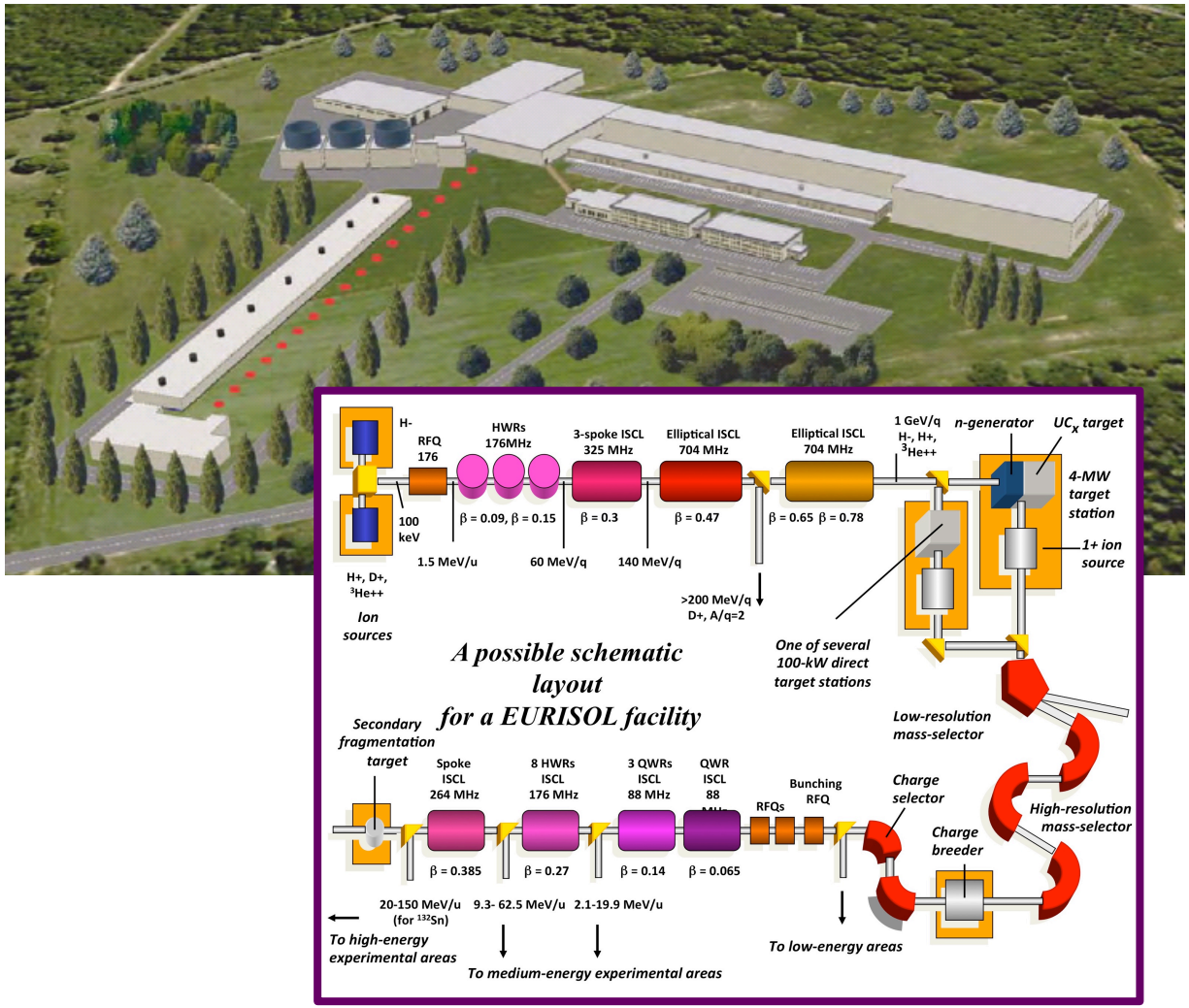
EURISOL User Group



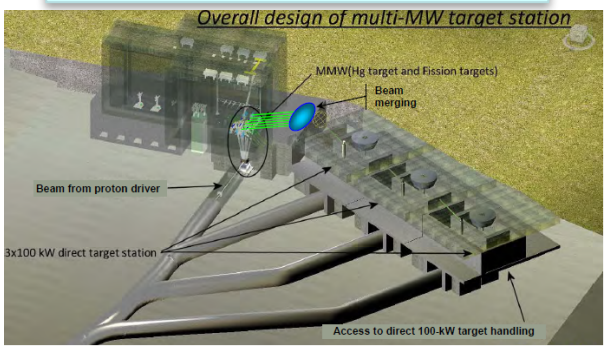
http://www.ensarfp7.eu/projects/eurisol-net/documents

What is EURISOL ?

Facility as defined in the 2005-2009 EU funded Design Study



4 target stations: Multi-user capabilities



5MW target