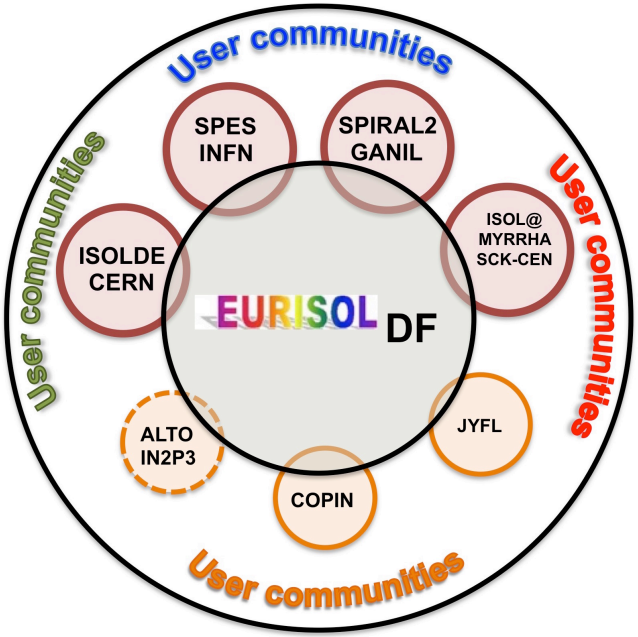
EURISOL – Distributed Facility (DF) Initiative

M. Lewitowicz
for the EURISOL Steering Committee



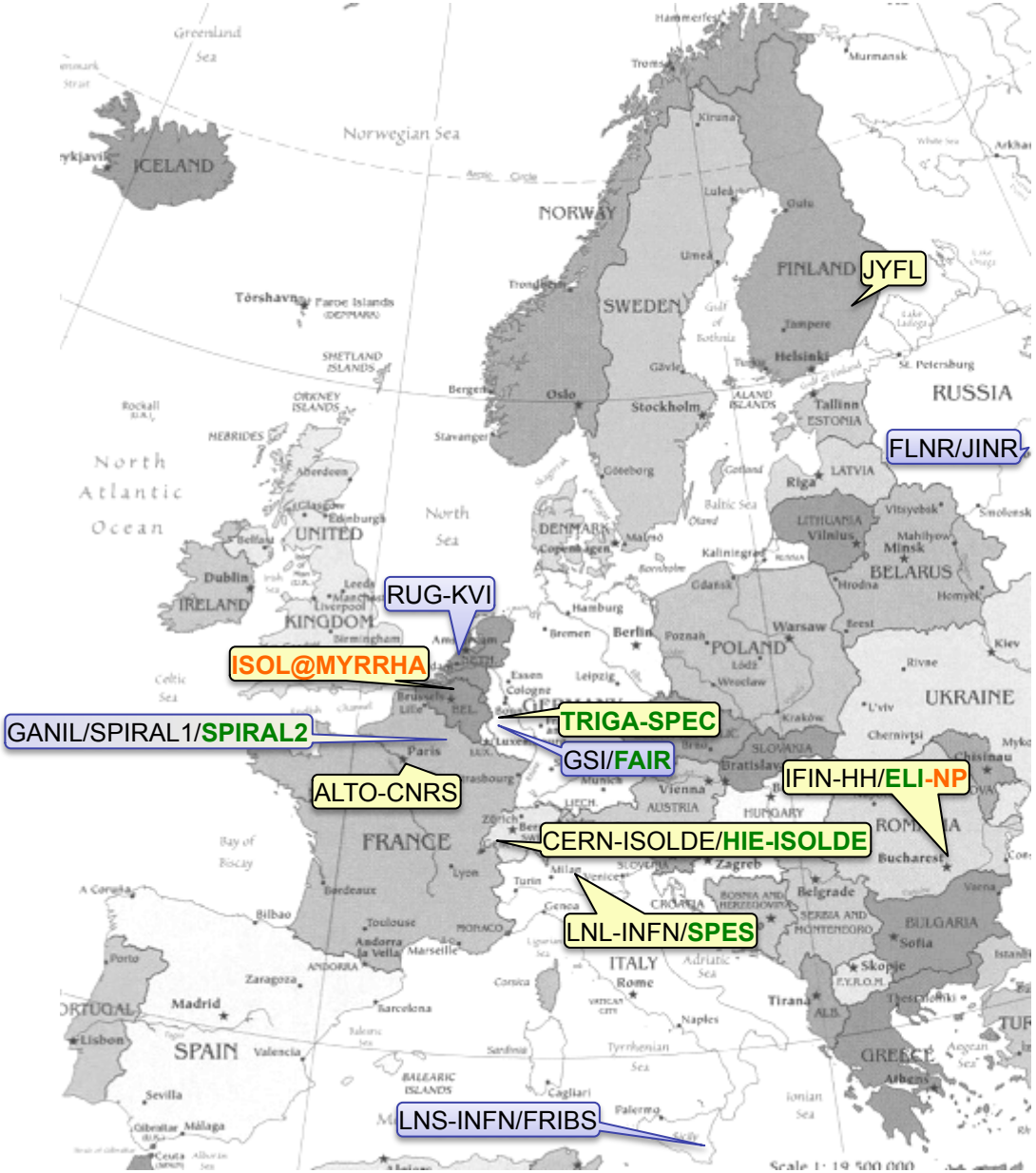
Inpc 2016

International Nuclear Physics Conference

Adelaide Convention Centre, Australia

11-16 September 2016

Radioactive Ion Beam Facilities in Europe



9 Existing RIB Facilities:

5 In-flight fragmentation

4 ISOL

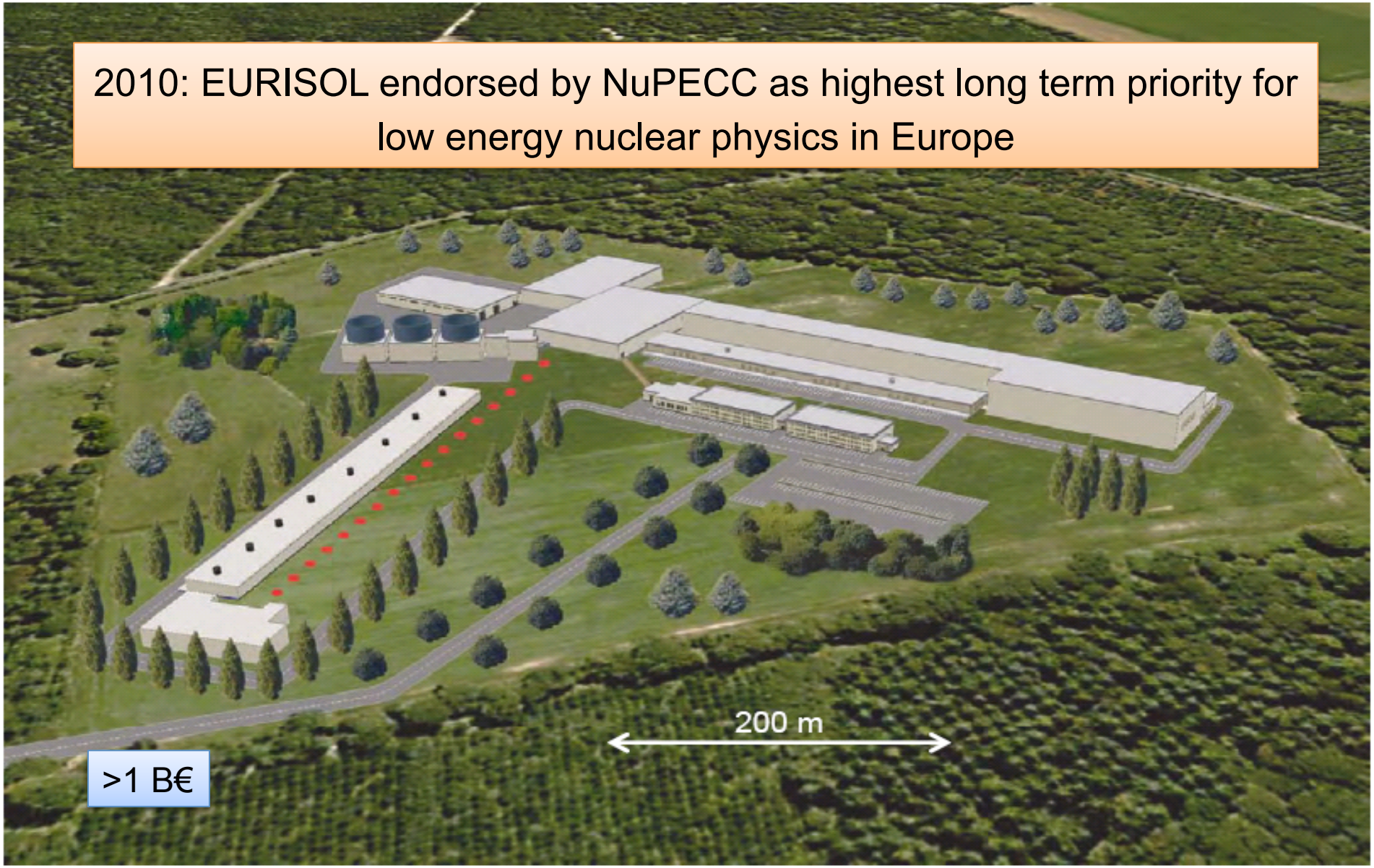
5 Facilities/upgrades under construction or commissioning

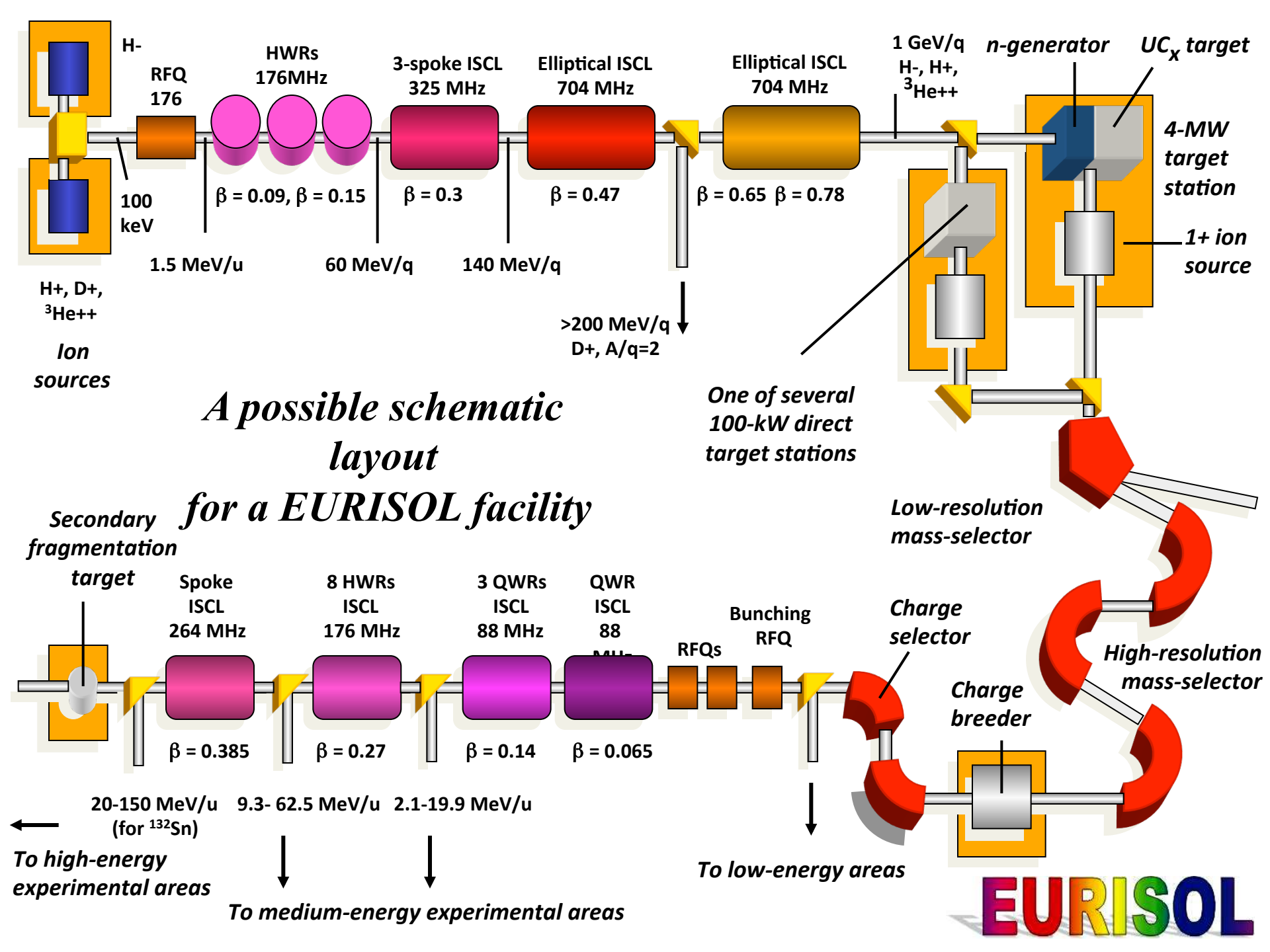
2 Projects under design

Community: 2700-3000 scientists and highly qualified engineers

What is EURISOL ?

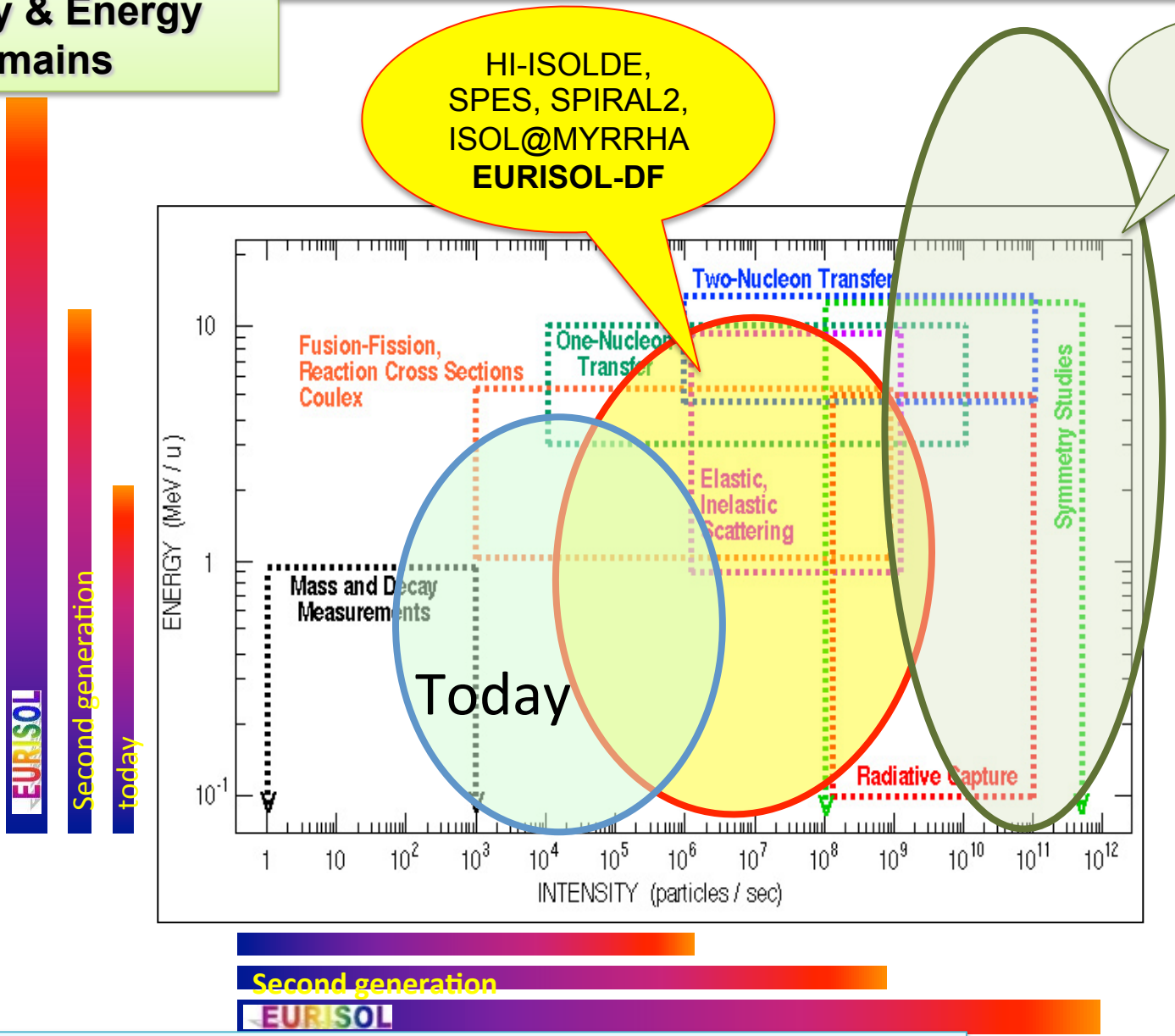
as defined in the 2005-2009 EU funded Design Study




H-
RFQ
176
HWRs
176MHz
3-spoke ISCL
325 MHz
Elliptical ISCL
704 MHz
Elliptical ISCL
704 MHz
1 GeV/q
H-, H+,
3He++
n-generator
UCx target
4-MW
target
station
1+ ion
source
100
keV
β = 0.09, β = 0.15
β = 0.3
β = 0.47
β = 0.65 β = 0.78
1.5 MeV/u
60 MeV/q
140 MeV/q
H+, D+,
3He++
Ion
sources
>200 MeV/q
D+, A/q=2
One of several
100-kW direct
target stations
A possible schematic
layout
for a EURISOL facility
Secondary
fragmentation
target
Spoke
ISCL
264 MHz
8 HWRs
ISCL
176 MHz
3 QWRs
ISCL
88 MHz
QWR
ISCL
88
RFQs
Bunching
RFQ
Charge
selector
Low-resolution
mass-selector
High-resolution
mass-selector
Charge
breeder
β = 0.385
β = 0.27
β = 0.14
β = 0.065
20-150 MeV/u
(for 132Sn)
9.3- 62.5 MeV/u
2.1-19.9 MeV/u
To high-energy
experimental areas
To medium-energy experimental areas
To low-energy areas
EURISOL

Physics with ISOL RIB Intensity & Energy domains

Precision nuclear structure physics & applications



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

EURISOL DF

EURISOL – Distributed Facility (DF)

Members :

- **HIE-ISOLDE/CERN**
- **SPES-INFN**
- **SPIRAL2-GANIL**

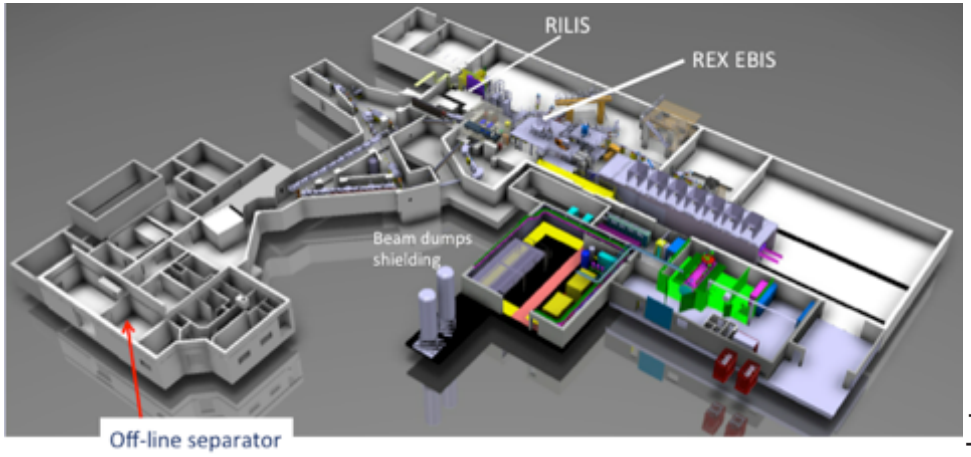
- **JYFL, Finland**
- ***ISOL@MYRRHA (BEC)***
- **COPIN Consortium, Poland**

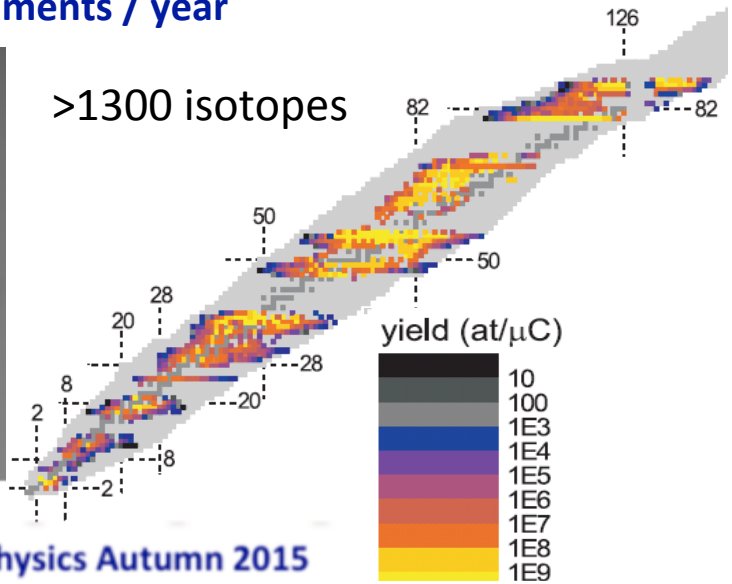
…and hopefully soon
ALTO, Orsay

EURISOL DF

HIE-ISOLDE Facility

- ISOLDE is the CERN radioactive beam facility (approved 50 y 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**





✓ HIE STAGE 1

RFQ | IHS | 7G1,2,3 | 9GP | HB-1 | HB-2

Physics Autumn 2015
@ 4.3 MeV/u
Spring 2016 5.5 MeV/A

✓ HIE STAGE 2

HB-1 | HB-2 | HB-3 | HB-4

2017
10 MeV/A

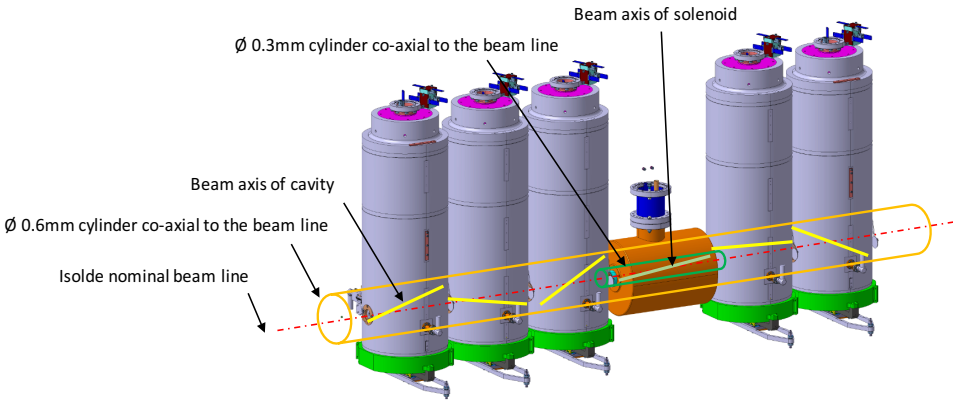
Started Jan 2010
Budget 35 M€

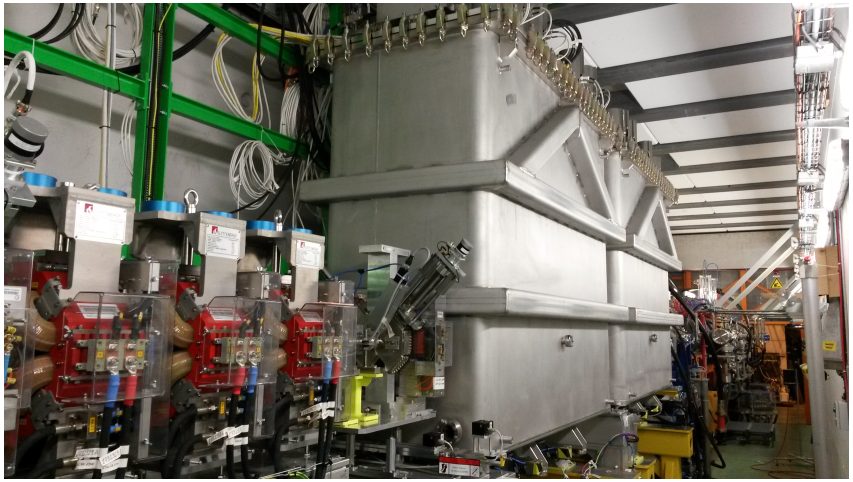
✓ HIE STAGE 3 WITH CHOPPER LINE **2018 (LS2)**

CHOPPER | LB-1 | LB-2 | HB-2 | HB-3 | HB-4 | HB-1

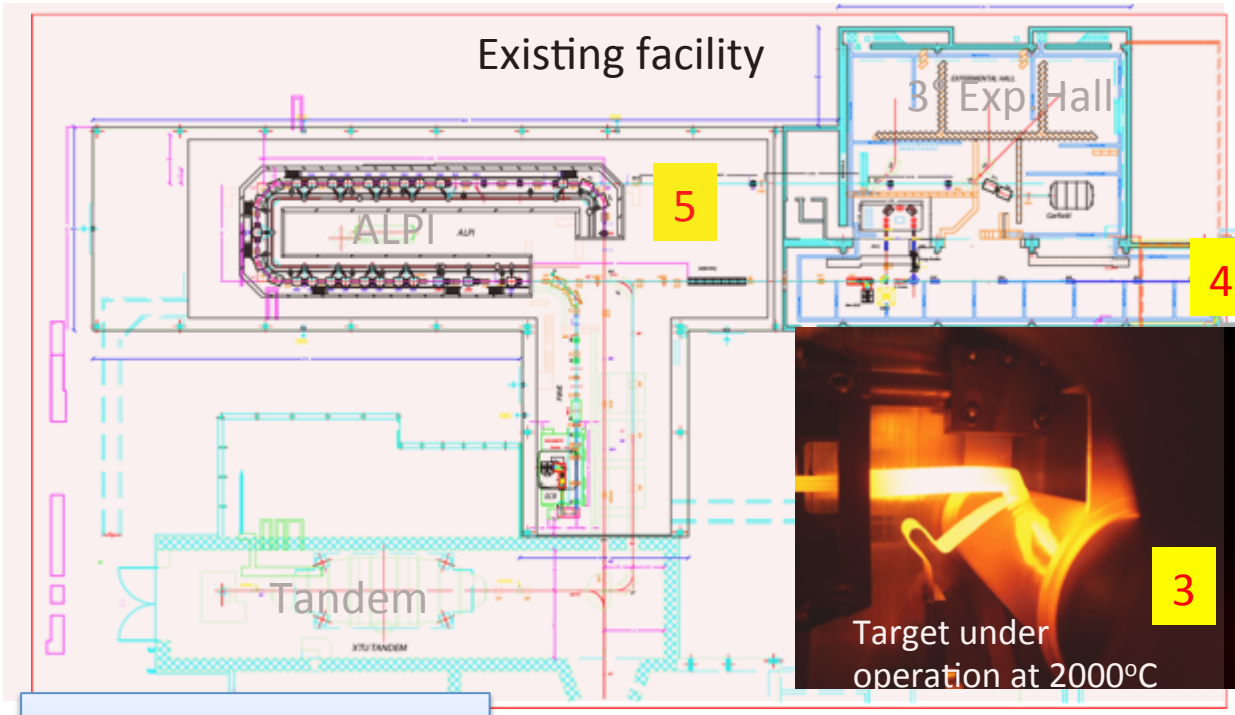
Status as of September 2016

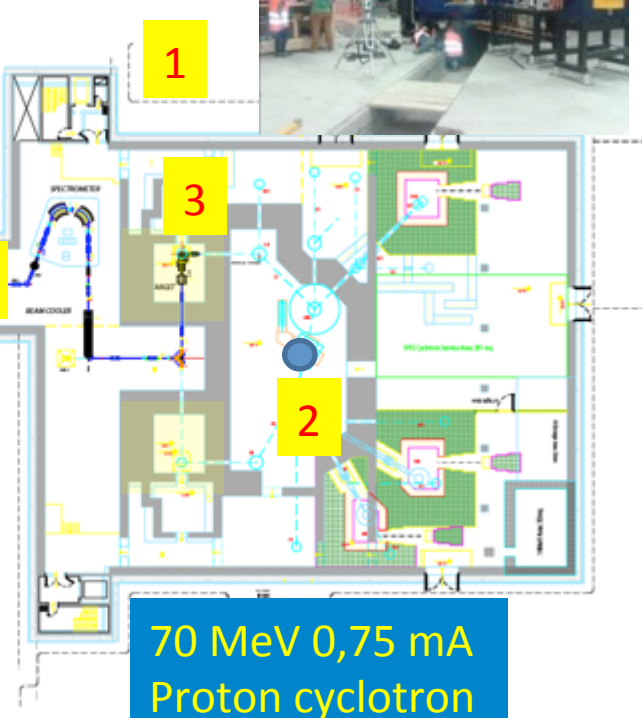
- **Rex-ISOLDE fully operational**
- HIE-ISOLDE cryo modules 1 & 2 installed and fully aligned
  - LN2 temperature achieved early June
  - 4K nominal temperature to achieved recently
- Machine commissioning completed at the end of August
- **Physics campaign @ 5.5 MeV/u already started with ^{110}Sn beam at 10^{7}pps**





SPES Facility at LNL Legnaro





70 MeV 0,75 mA
Proton cyclotron

≥ 50 M€,
first beams by 2019

	SPES sub-systems
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

SPES layout: ISOL facility installation phases

- **Phase 1. 2016** - Building + First operation with the cyclotron NOW!
- **Phase 2. 2017-18** - From C.B. to RFQ + SPES target, LRMS, 1+ Beam Lines
- **Phase 3. 2019** – HRMS-BeamCooler + RFQ to ALPI

GANIL-SPIRAL2

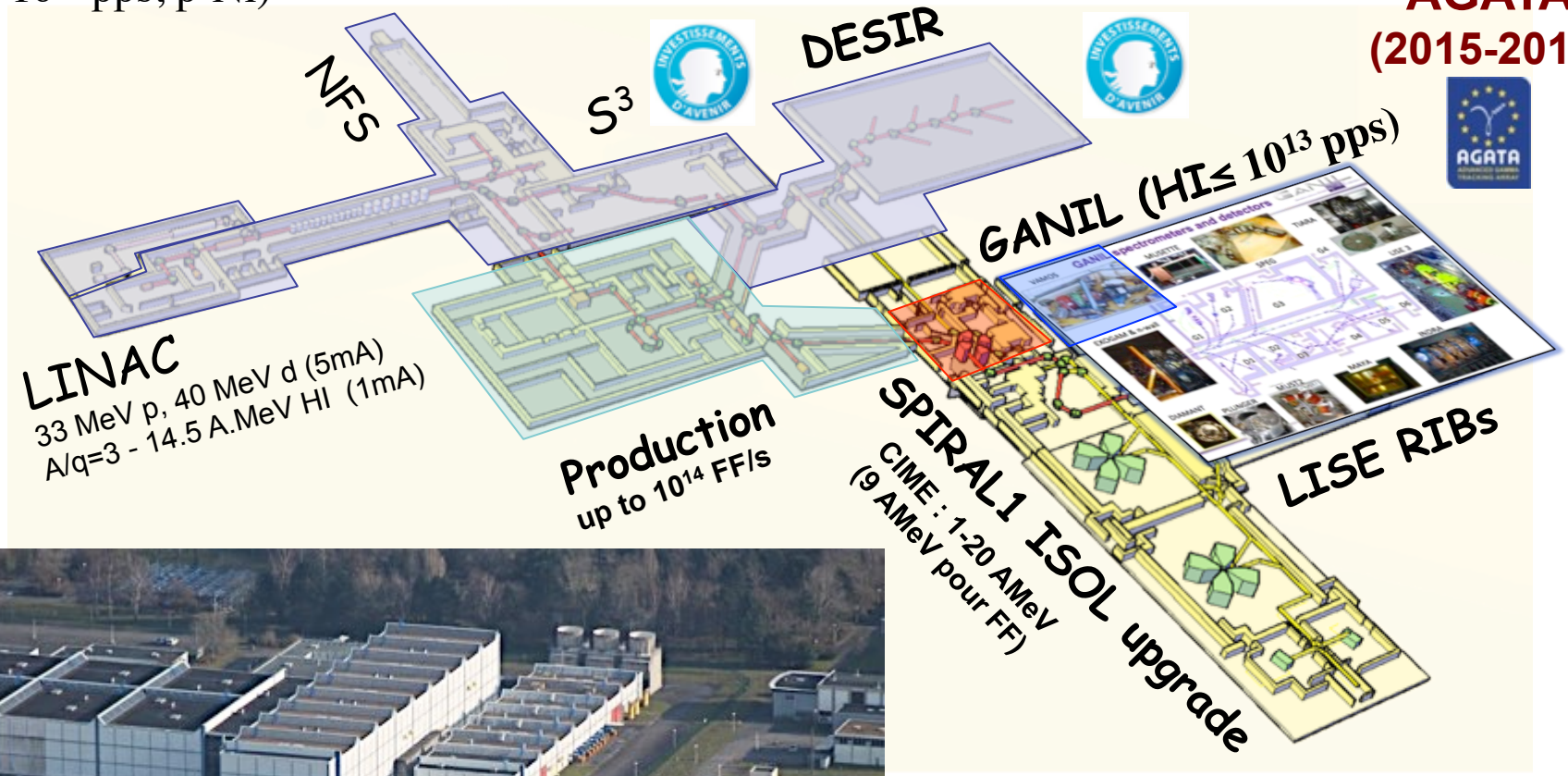
Phase1 (2017)

Increase the intensity of stable beams
High intense neutron source
(HI≤ 10^{15} pps, p-Ni)

DESIR Phase1+ (by 2022)

Low energy facility

AGATA (2015-2019)

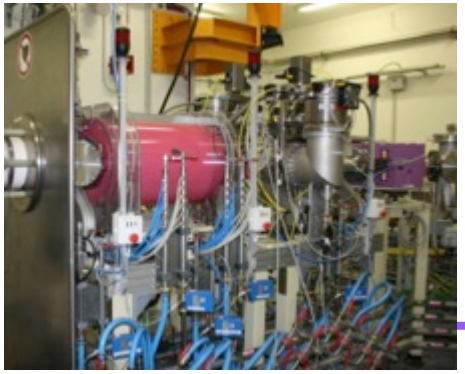


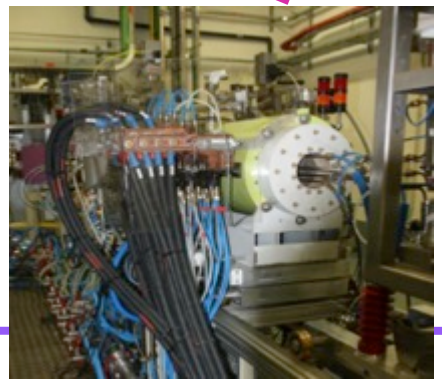
SPIRAL1 Upgrade (2017)

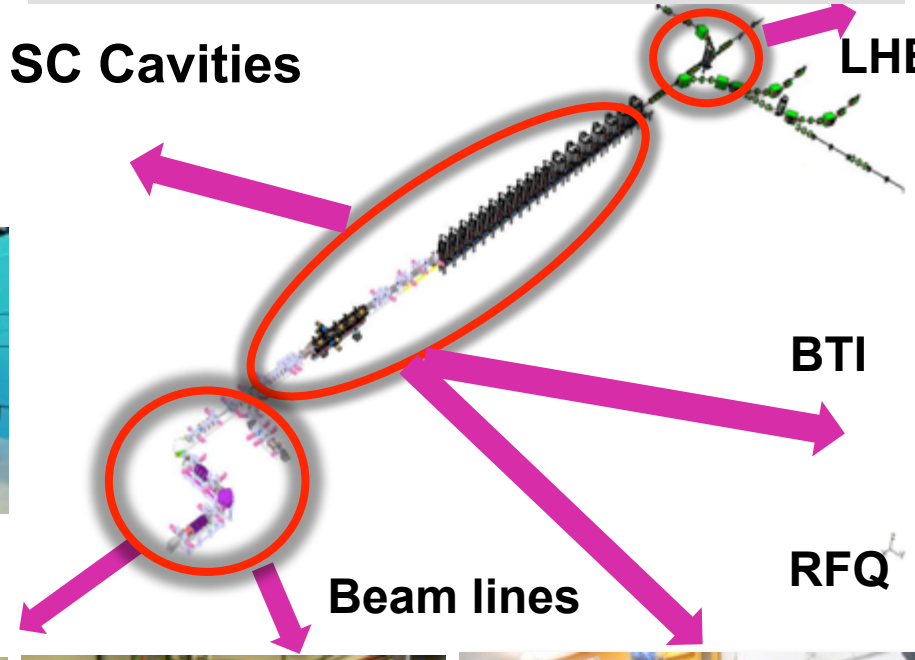
New light RIBs from
beam/target fragmentation

Installation & Commissioning of LINAC

Low energy beam : Dec 2014
RFQ beam : Dec. 2015: protons 5mA
4mA 4He beam in March 2016
First LINAC beam : 2017

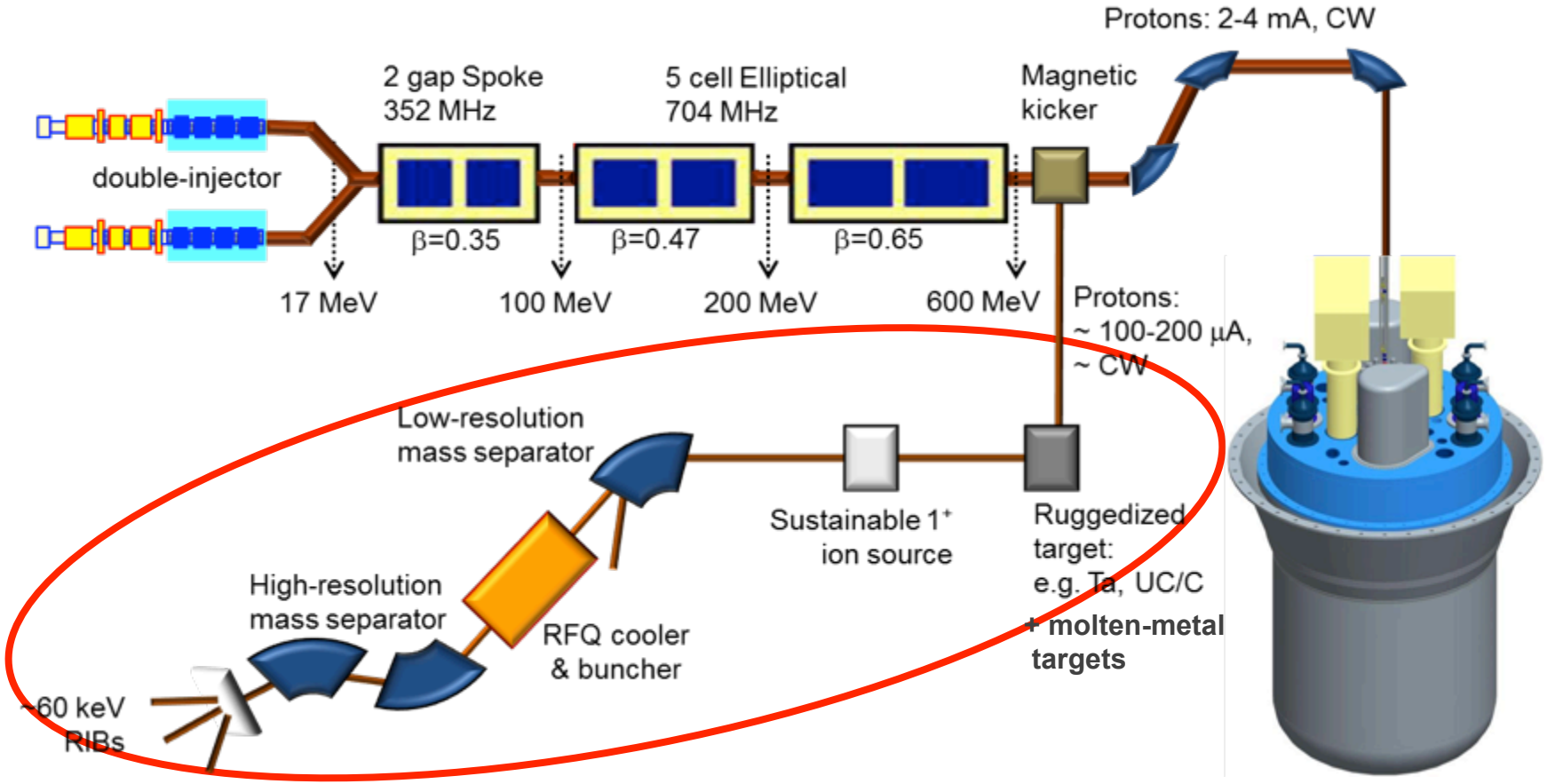






Beam lines & support

MYRRHA ADS Facility & ISOL@MYRRHA - Concept



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

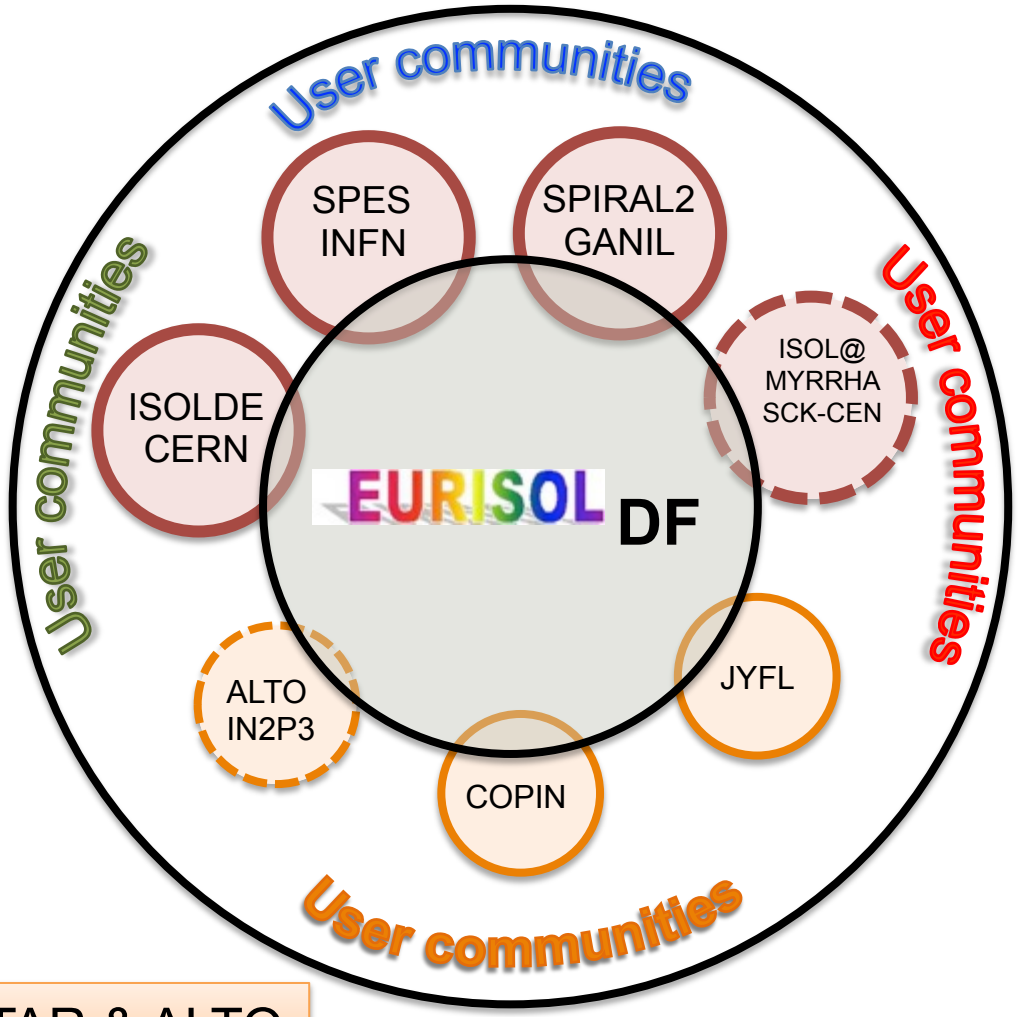
MYRRHA and ISOL@MYRRHA Project status

- **2015** - Decision on a phased approach for the implementation of MYRRHA
  - Phase 1 (2016-2024): construction of MYRRHA accelerator up to 100 MeV, 2-4mA proton beam and the Proton Target Facility
- Proton Target Facility fully embedded in Phase 1 of the MYRRHA project
  - Multipurpose target station
  - ISOL@MYRRHA phase 1
- **2016** – Belgian government provides new funding to cover the project over 2016-2017
- **End-2017** – MYRRHA-project evaluation and decision on complete funding for phase 1
- With a positive decision, construction begins in 2019

EURISOL – Distributed Facility (DF) Initiative

Goals of EURISOL-DF

- **EURISOL Science Case & Experiments**
  - Prepare strong scientific case for RIB science and applications
  - Dedicated beamtime for EURISOL-DF experiments
  - User driven policy – EURISOL User group & EICC
- **R&D for EURISOL**
  - Interaction with EURISOL JRA in ENSAR 2
- **New Legal entity**



EURISOL single site facility as a long term goal

Close Collaboration with FAIR/NUSTAR & ALTO

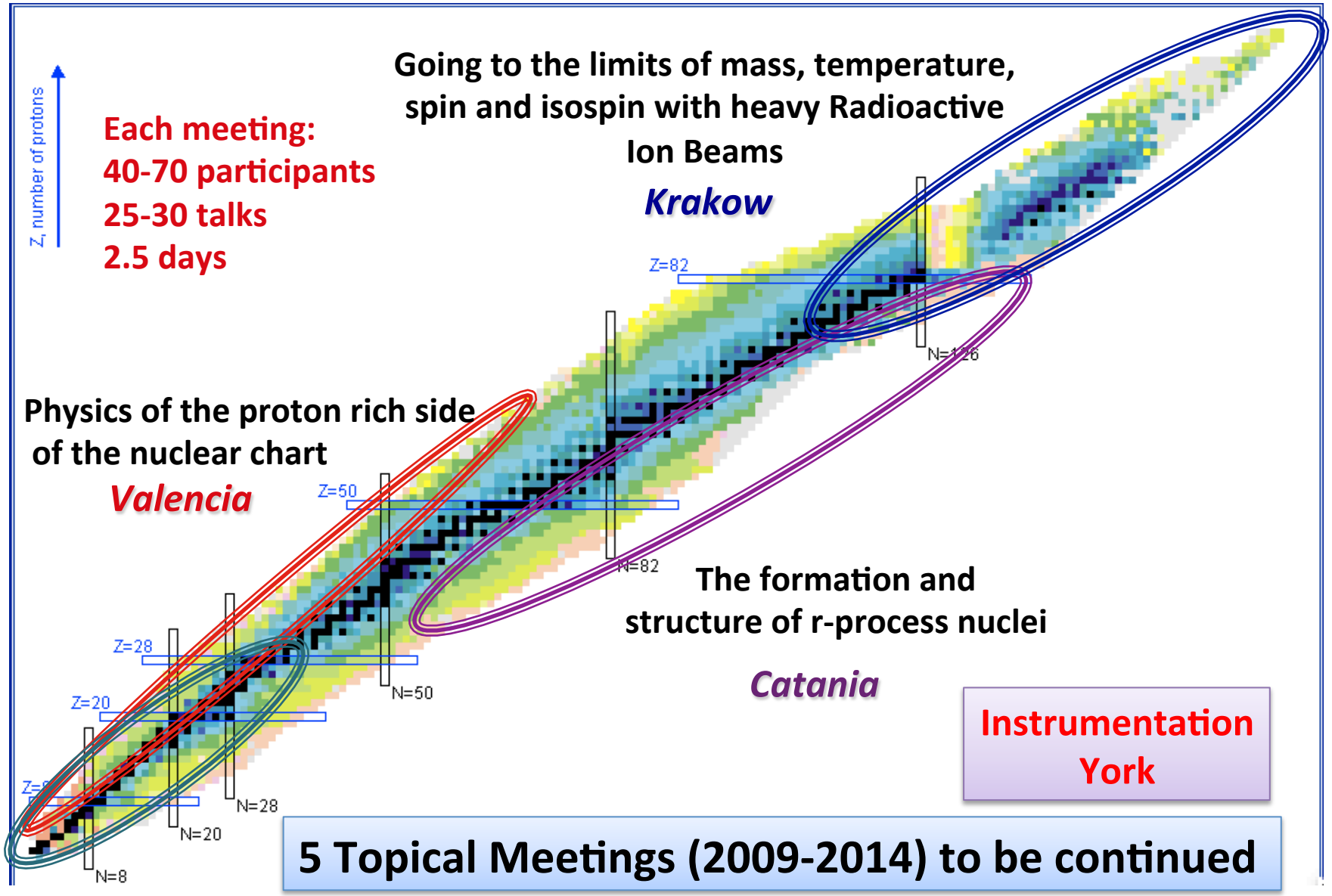
Get EURISOL-DF on the ESFRI list as a candidate project by 2018

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

EURISOL DF

Prepare strong scientific case for RIB science and applications

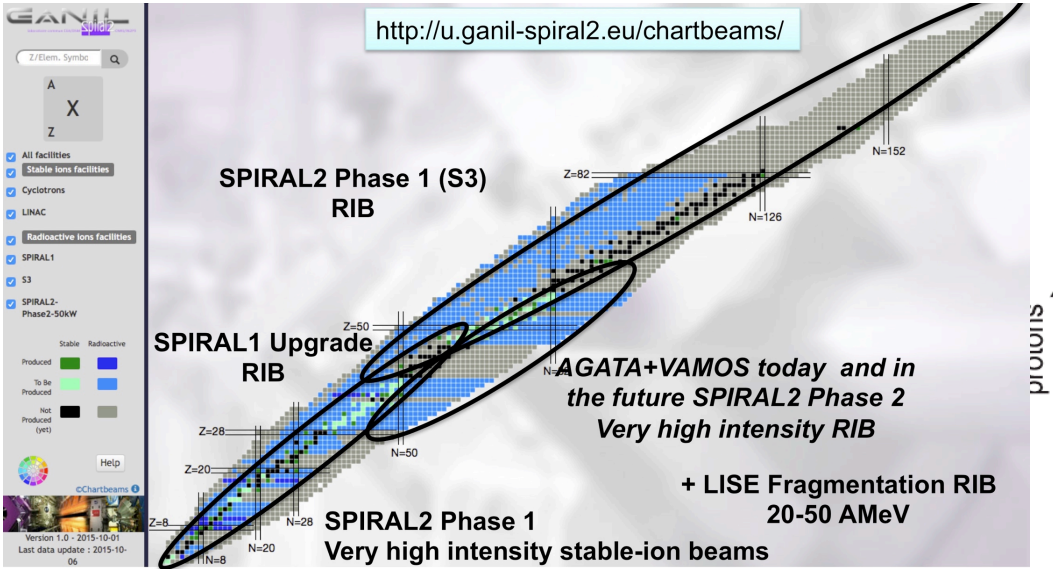
EURISOL User Group



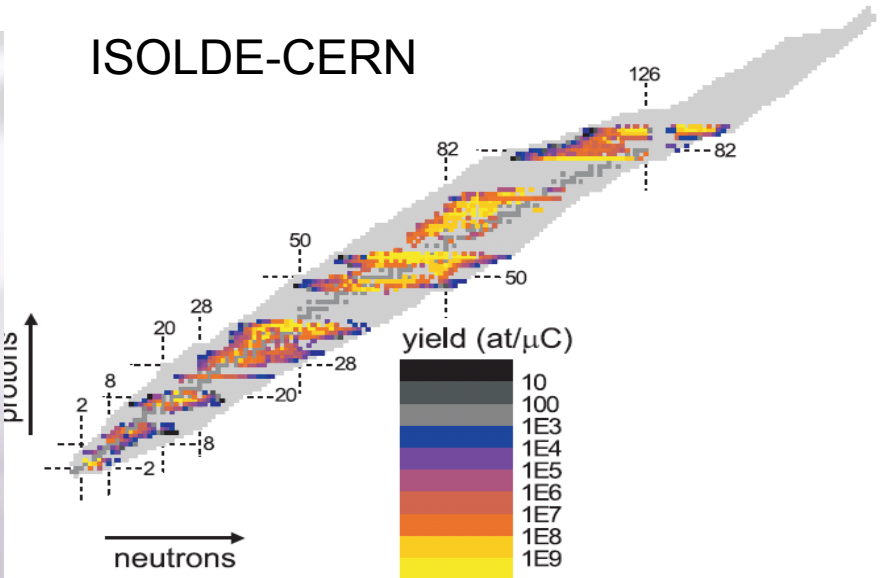
http://www.ensarfp7.eu/projects/eurisol-net/documents

RIBs and Beam Time

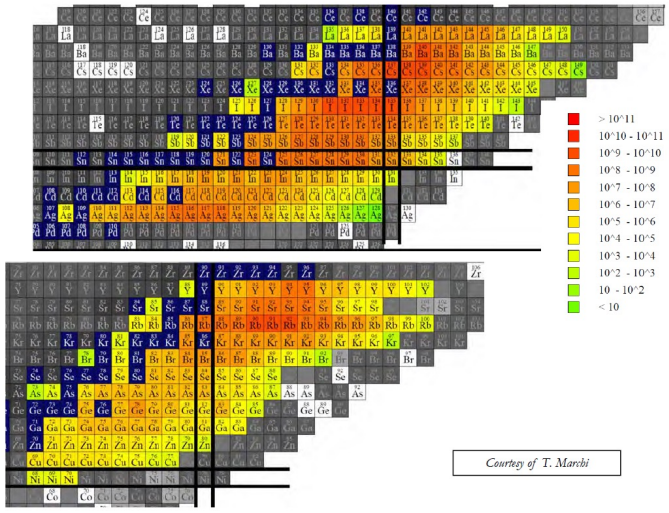
GANIL-SPIRAL2



ISOLDE-CERN



SPES beam intensities after re-acceleration



ISOLDE today offers the largest range of available isotopes of any ISOL facility worldwide.

> 700 isotopes of 70 elements

Enhance complementarities
&
avoid duplication of efforts

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

User driven policy: Example EICC

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

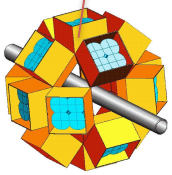
The role of the EICC is to reinforce the synergies and coordinate efforts between the facilities and the major collaborations on existing and new detectors in order to carry on **R&D** and to **reach construction milestones** and **coordinate experimental campaigns** at all RIB facilities which are members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

Traveling detectors (examples)

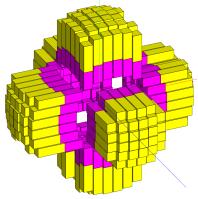
Gamma-ray detectors

AGATA

EXOGAM 2

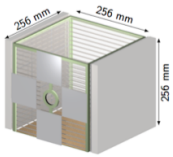


PARIS

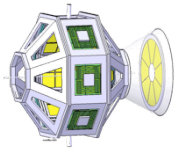


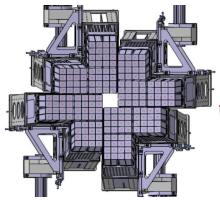
Charged particle detectors

ACTAR-TPC



GASPARD

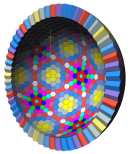




FAZIA

Neutron detectors

NEDA



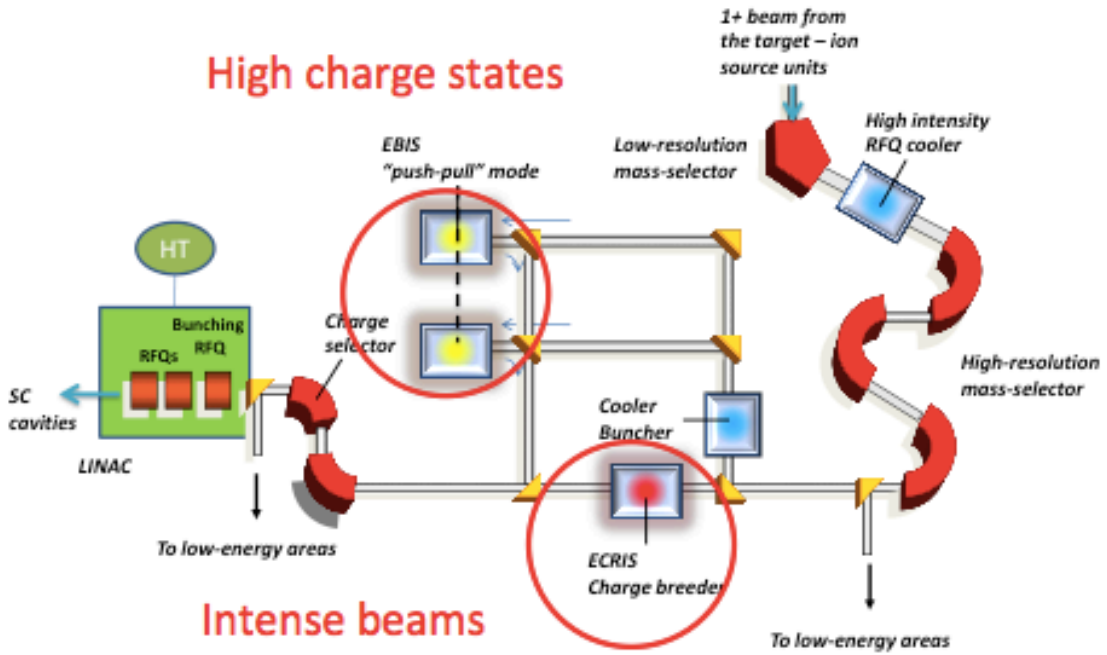
DEMON

EURISOL DF

EURISOL R&D Example: The EMILIE project

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

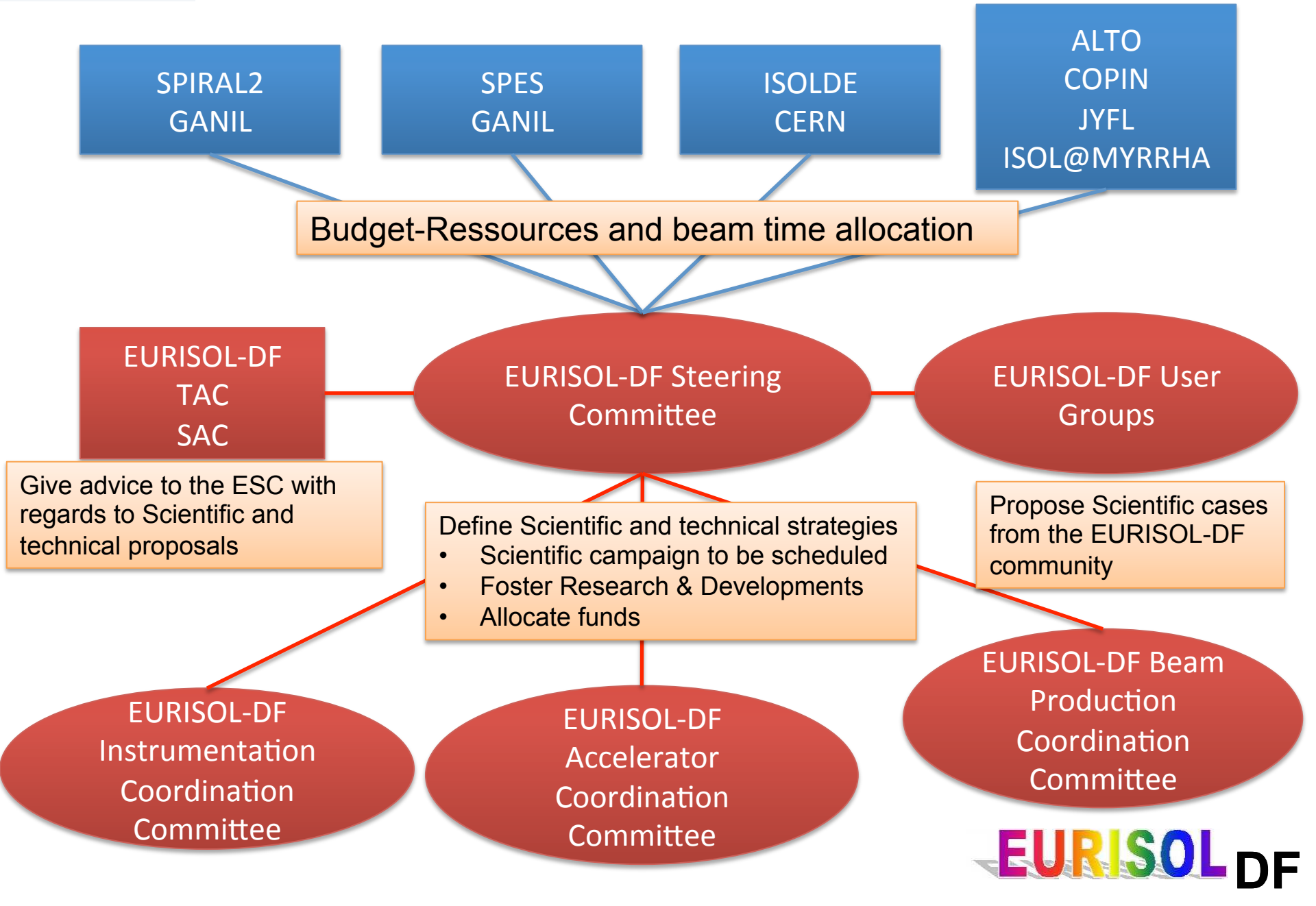
Charge breeding techniques for ISOL facilities



Consortium of 8 European laboratories

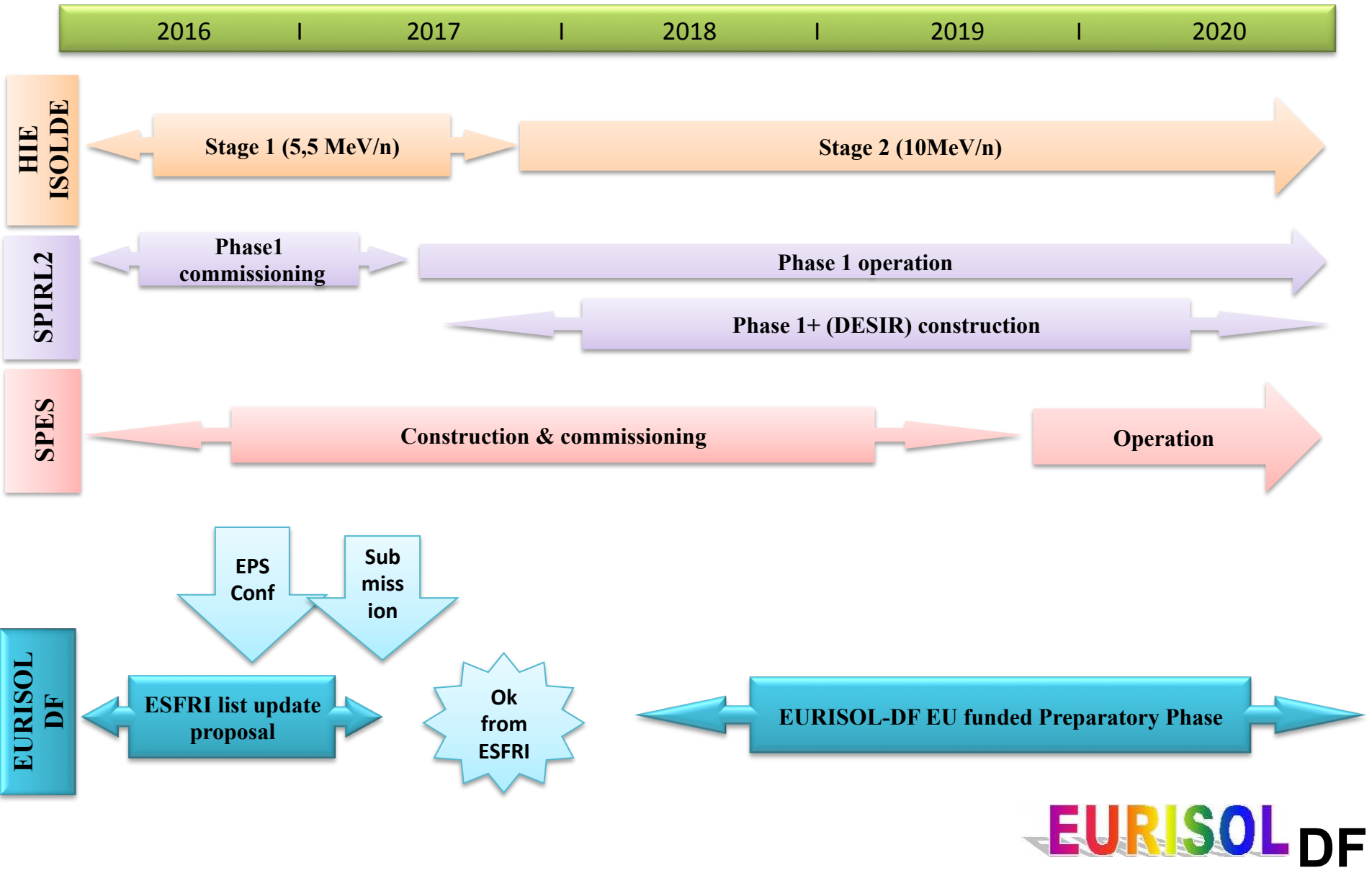
+ EURISOL JRA in the EU funded ENSAR2

EURISOL-DF Organisation (Preliminary)



EURISOL DF

Timeline EURISOL-DF



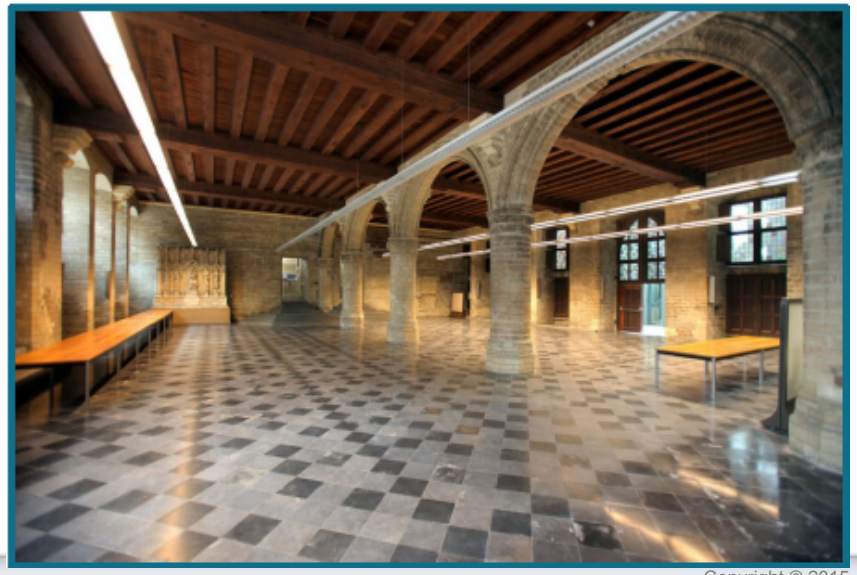
EPS Conference: Towards EURISOL Distributed Facility

http://eurisoldf2016.be

- October 18-21, 2016
- Leuven, Belgium

Promotiezaal KU Leuven
(385 places)

Jubileumzaal: coffee breaks, reception,
lunch and poster session(s)



Acknowledgements

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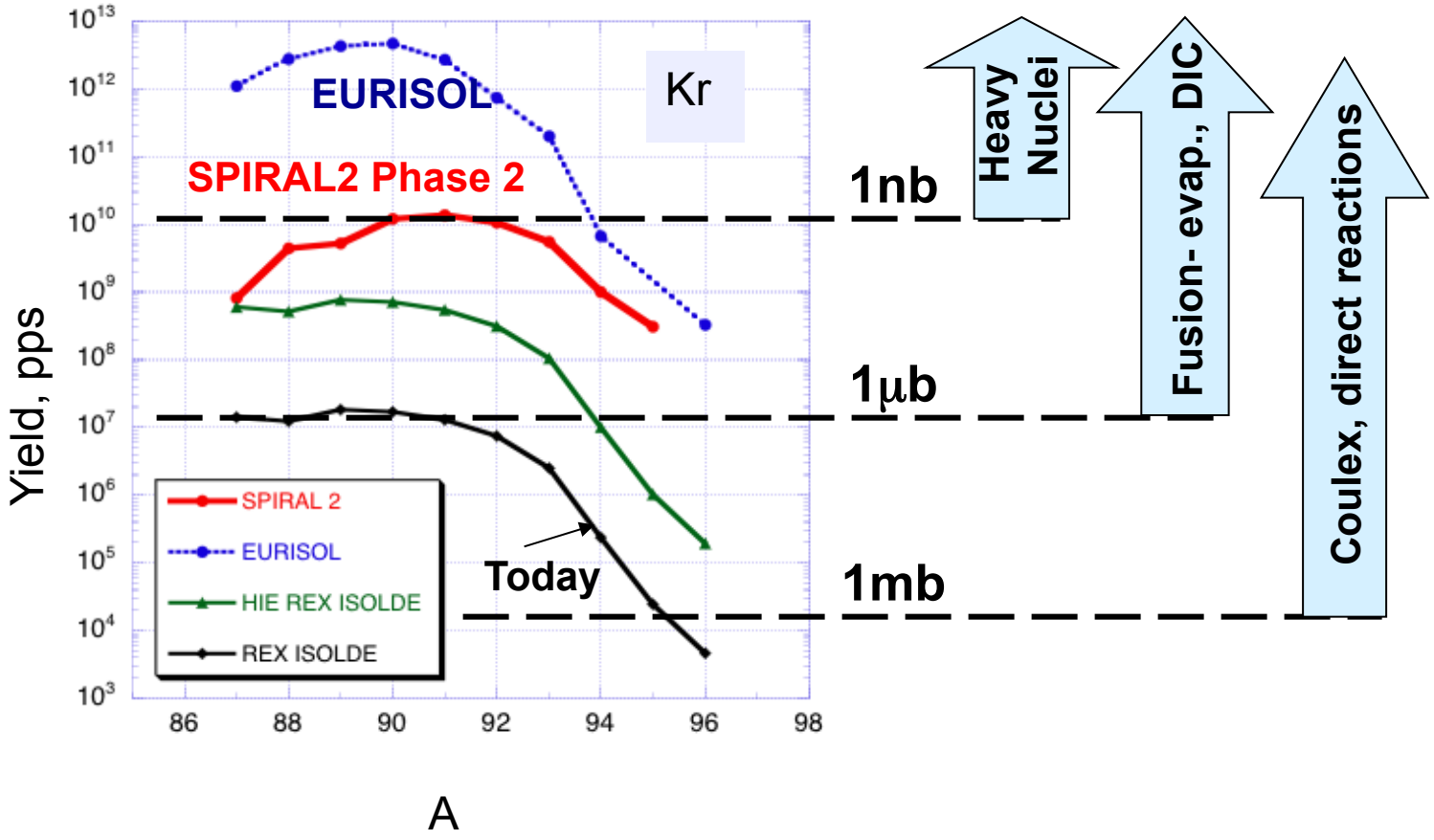
EURISOL DF

EURISOL & EU ISOL facilities
Post-accelerated beam intensities



EURISOL DF