

VI - “Innovative Instrumentation for EURISOL-DF”

Panel Discussion Topic VI

Iain Moore (Univ. Jyvaskyla)

Angelo Pagano (INFN/LNS, Catania)

Fadi Ibrahim (IPN, Orsay)

Pedro Vaz (CTN/IST, Lisbon)

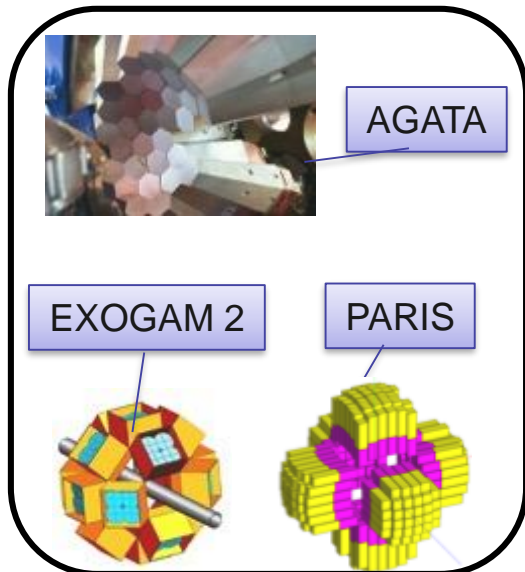
Riccardo Raabe (KU, Leuven)

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

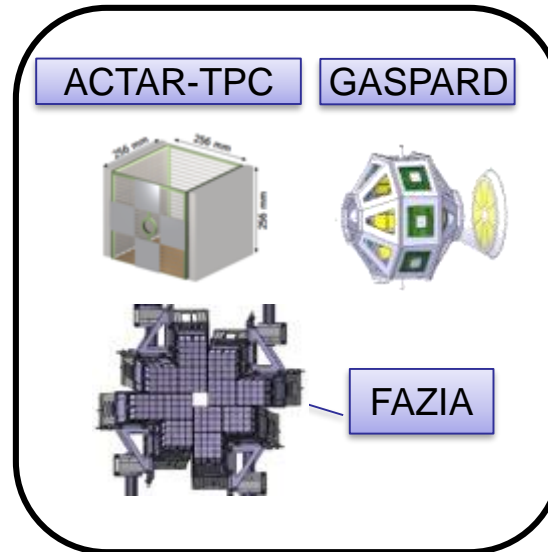
The role of the EICC is to reinforce the synergies and coordinate efforts between the facilities and the major collaborations on existing and new detectors in order to carry on **R&D** and to **reach construction milestones** and **coordinate experimental campaigns** at all RIB facilities which are members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

Traveling detectors (examples)

Gamma-ray detectors



Charged particle detectors



Neutron detectors

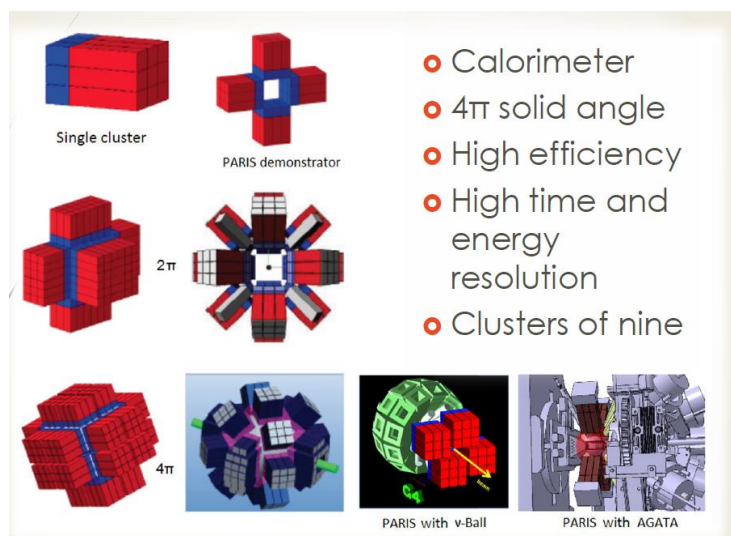


Topic VI: Innovative instrumentation for DF

M. Ciemala – “PARIS array”

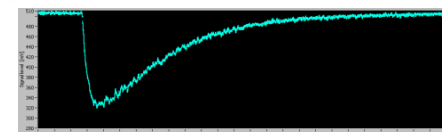
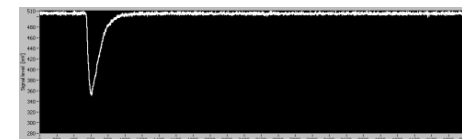


Photon Array for studies with Radioactive ion and Stable beams



- A cluster is made of 9 phoswiches, in a final phase the geometry allows 24 clusters
- Distinguish between different pulse shapes arising from different phoswiches
- The cluster concept is critical to including the “add-back” energy

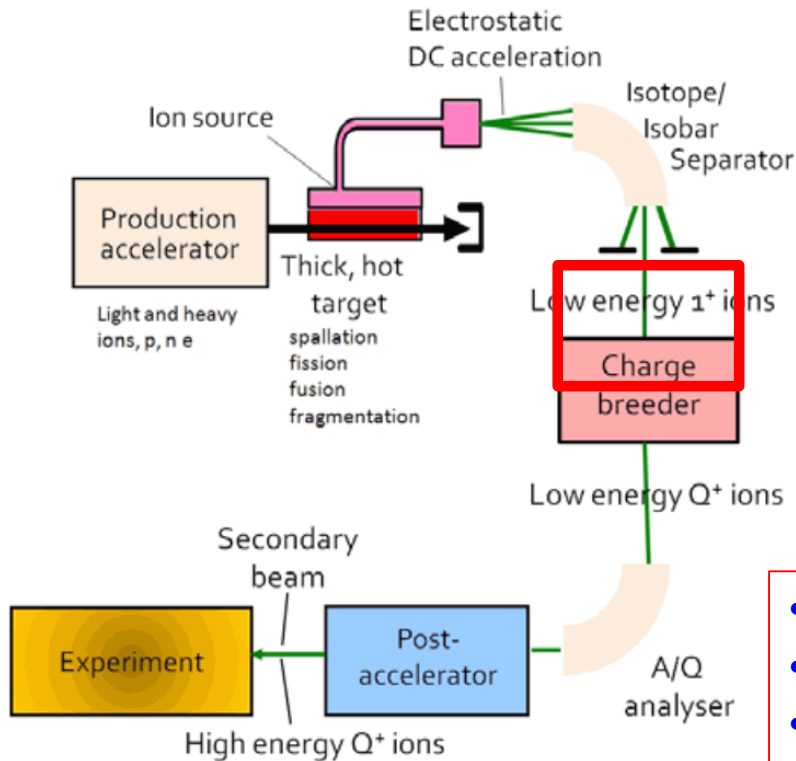
- PARIS experiments at Orsay, GANIL and Krakow
- The array is built to travel and adapt to different facilities (ideal for EURISOL-DF)



Topic VI: Innovative instrumentation for DF

T. Thullier – “*Status and future of PHOENIX ECR charge breeder*”

Charge breeding 1^+ to n^+ at ISOL facilities: two complementary concepts EBIS and ECRIS



ECRIS

- ✓ CW operation + handling of large intensities
- X High n^+ beam contamination, charge state limited

EBIS

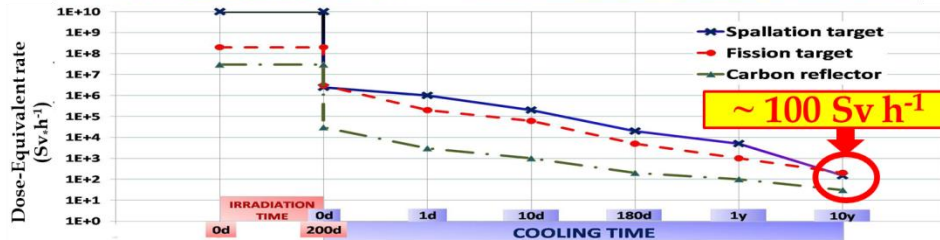
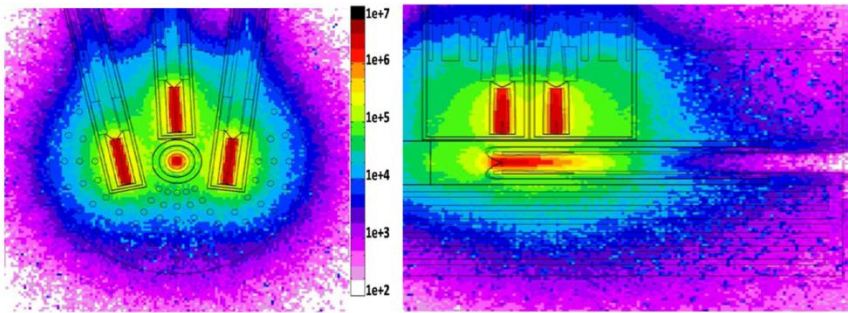
- ✓ Low n^+ contamination and high charge states
- X Pulsed operation and low intensity acceptance

- Goal to improve the ECRIS to mitigate cons
- Source of beam contaminants identified
- Plasma instabilities enhance the contaminants
- First upgrade improved charge state breeding

Topic VI: Innovative instrumentation for DF

Y. Romanets – “EURISOL – radiation protection and shielding issues”

EURISOL: Proton beam 1 GeV (1 MW power) on converter: 5×10^{15} n/cm²/s



- Exposure to extremely high neutron fluxes and doses
- Radiological and safety designs critical
- Thermal and mechanical properties
- Handling & maintenance of targets
- Review of neutron fluxes and doses of current facilities (HIE-ISOLDE 1.4 GeV p, MYRRHA facility)



- ✓ Monte-Carlo simulation codes
- ✓ Validation of cross section data sets
- ✓ Benchmarked nuclear data models

VI - “Innovative Instrumentation for EURISOL-DF”

Panel Discussion Topic VI

Iain Moore (Univ. Jyvaskyla)

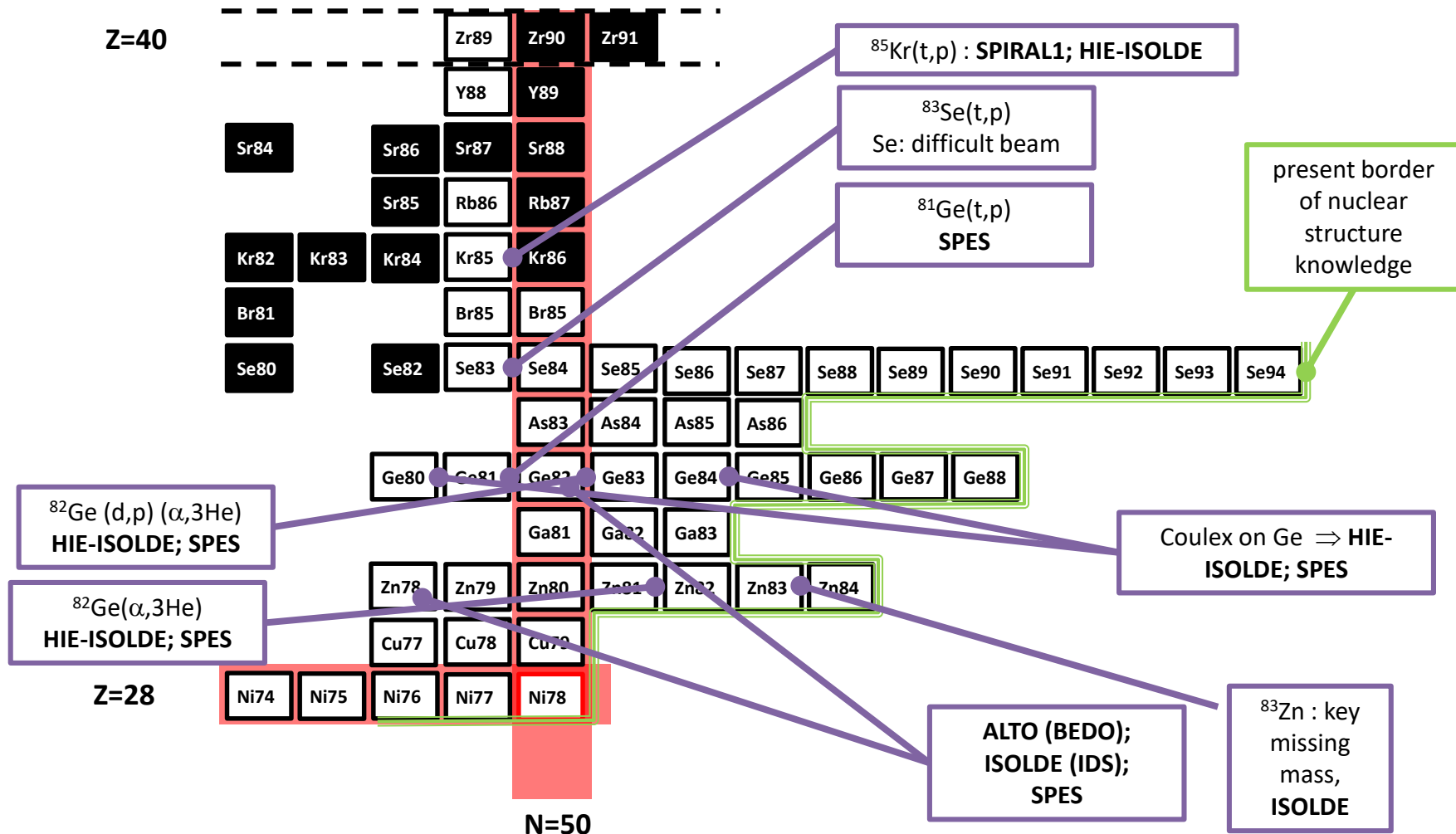
Angelo Pagano (INFN/LNS, Catania)

Fadi Ibrahim (IPN, Orsay)

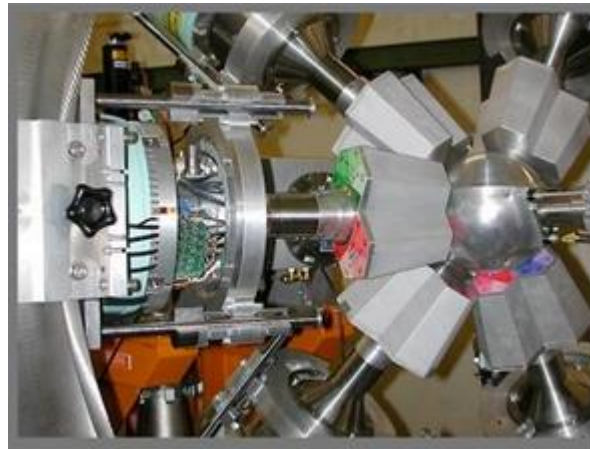
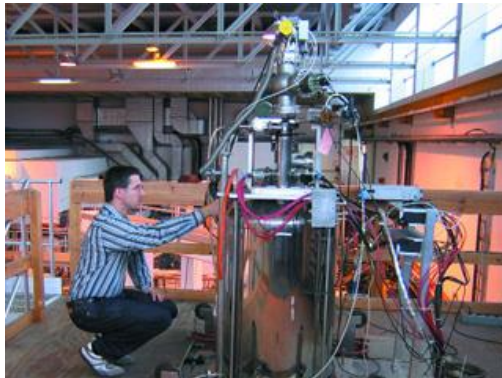
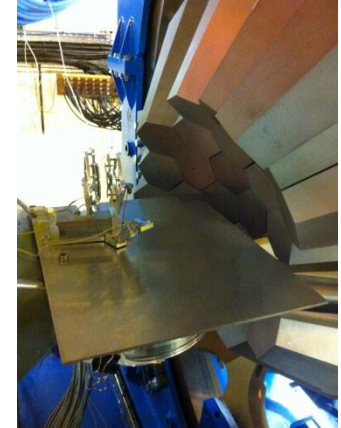
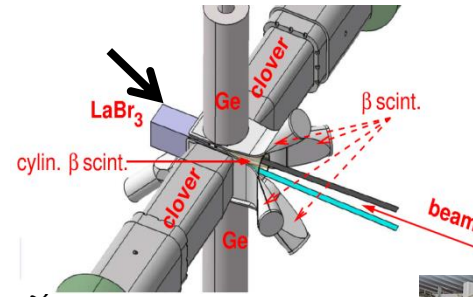
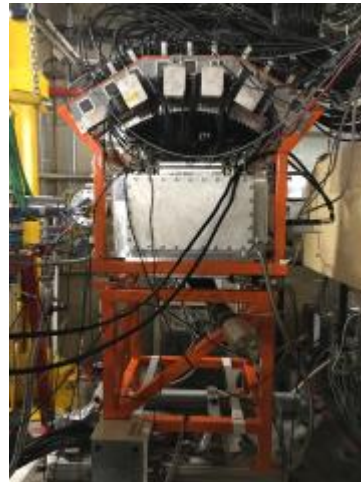
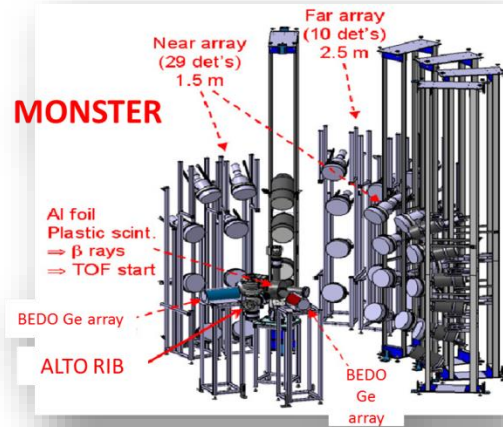
Pedro Vaz (CTN/IST, Lisbon)

Riccardo Raabe (KU, Leuven)

An example of a EURISOL-DF Program



Beta decay, beta neutron decay @ ALTO, ISOLDE, Jyväskylä
 Half life measurements of excited states, GANIL, AGATA, Plunger
 direct nucleon exchange, ISOLDE, SPES, ACTAR



What is sure : we don't have a lack of detectors in Europe
Maybe a lack of beam time

How can we organize ourselves to make the campaign that have
been presented in the physics case session ?

should we create an instrumentation working group in EURISOL-DF ?

Cost of the use of the different detectors in different facilities ?

VI - “Innovative Instrumentation for EURISOL-DF”

Panel Discussion Topic VI

Iain Moore (Univ. Jyvaskyla)

Angelo Pagano (INFN/LNS, Catania)

Fadi Ibrahim (IPN, Orsay)

Pedro Vaz (CTN/IST, Lisbon)

Riccardo Raabe (KU, Leuven)

**The Impact of
Radiological Protection and Radiation Safety Requirements
in the
Next Generation, Emerging and Innovative Nuclear
Technology Facilities**

Pedro Vaz, Raul F. Luís, Yuriy Romanets

@EURISOL DF Meeting, IST, Lisbon, 16th November 2017

Despite the impressive amount of high-quality design studies and R&D activities during the last 15 years...

Did we overlook
Radiation Protection and Safety
issues and requirements ?

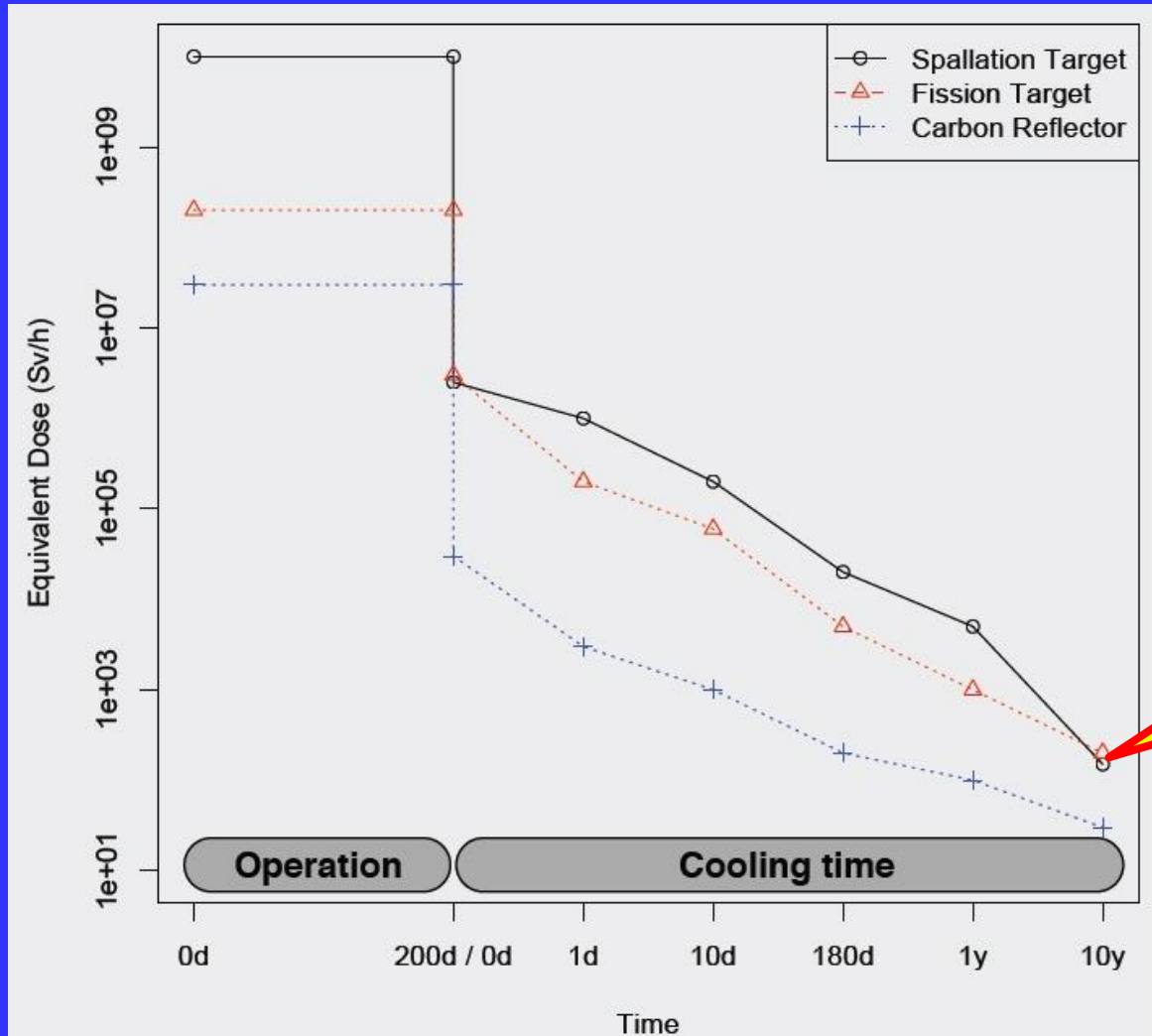
Could Radiation Protection and Safety
requirements be *show stoppers* in the operation of
such facilities ?

The intention is NOT to dispute the results and findings of past projects and design studies

But instead

To have a "hard look" at the "(hard) data", from the radiological protection and radiation safety perspective

EURISOL Design Study (Residual) equivalent dose rate



From R. Luís & Y. Romanets - FLUKA MC simulations

Inspection & Repair issues

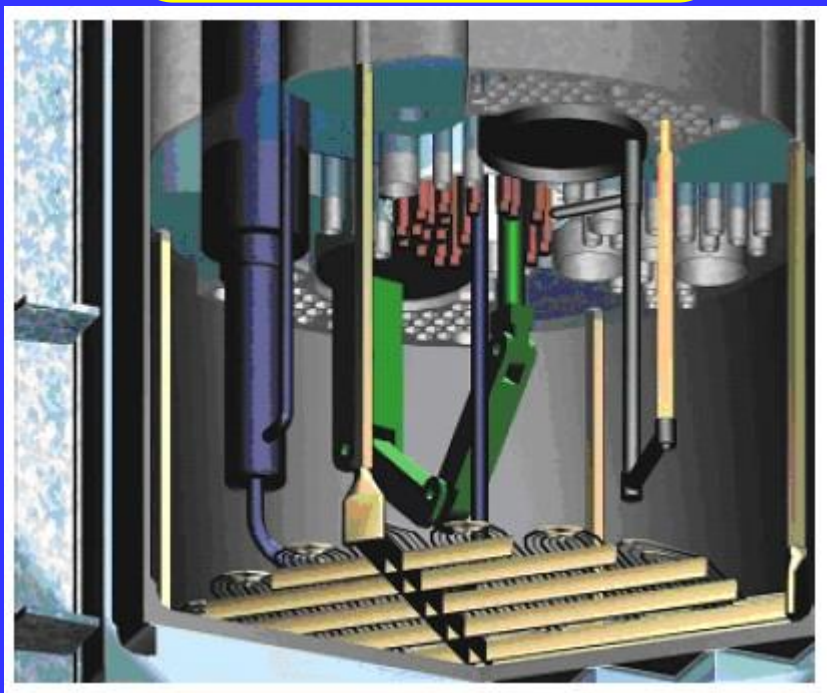
"Case study" - ADS (MYRRHA)

Inspection and Repair (MYRRHA)

Inspection



Repair



Inspection (general overview, detailed analysis of critical components)
Repair (recover of debris, deployment of specialized tools, etc.)
in/through opaque medium
Use of ultrasound technologies
Remote handling

Summary and Outlook (not Conclusions !)

- Next generation emerging and innovative nuclear energy facilities
 - ✓ Unprecedented radiation environment levels very high:
 - ✓ Radiation damage of structures
 - ✓ Dose rates
 - ✓ Activation of materials
 - ✓ Radiotoxicity
- Requirements for the design and construction of these facilities:
 - ✓ Robustness and safety margins
 - ✓ Redundancy and diversity
 - ✓ Reliability and maintainability
 - ✓ Licensee (operator) solutions
 - ✓ Decommissioning, Dismantling and Disposal



Some open question and unresolved issues must be carefully addressed and solutions are still to be found

VI - “Innovative Instrumentation for EURISOL-DF”

Panel Discussion Topic VI

Iain Moore (Univ. Jyvaskyla)

Angelo Pagano (INFN/LNS, Catania)

Fadi Ibrahim (IPN, Orsay)

Pedro Vaz (CTN/IST, Lisbon)

Riccardo Raabe (KU, Leuven)

Topic VI

Innovative Instrumentation for EURISOL-DF



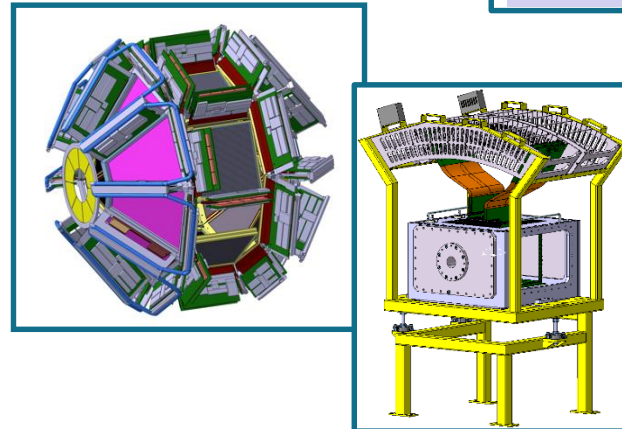
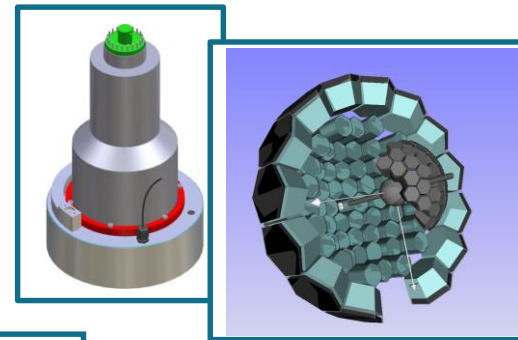
Physics Cases and Instrumentation for the EURISOL-DF

**Next step towards EURISOL
Lisbon, 15-16 November 2017**

Overview this workshop

State of the art in detector performances

- Scintillators
(Franco Camera)
→ PARIS poster (Michał Ciemała)
- Neutron detectors
(Daniel Cano-Ott)
- Charged-particle detectors
(Didier Beaumel)
→ FAZIA poster (Giovanni Casini)



Previous meetings

2014 York (focus on EURISOL)

- Upgrades and new facilities
- Instrumentation for radiation detection
- Instrumentation for beam handling
Rings, Spectrometers, MR-TOF, Traps, Lasers...
- Spectroscopic techniques
e-scattering, fast timing, RDT, Lasers...

2016 Leuven (EURISOL DF)

- Spectrometers and detectors (WG4)
- Beam handling, targets and ion sources (WG3)
- Accelerators (WG2)

The needs for EURISOL DF

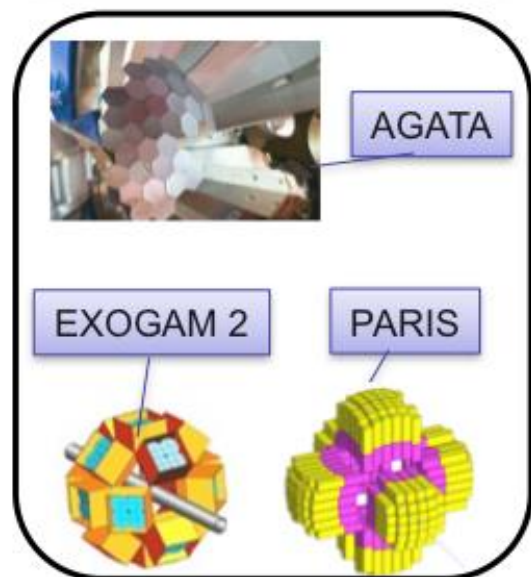
- Diversity in detection methods and instruments should be coupled to **complementarity** of the opportunities at the different locations
- coordination in the exploitation of present devices
- coordination in the realisation of new instrumentation
 - Detectors and data acquisition
 - Portability of instruments when possible
- Strategy towards the developments of new materials?

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

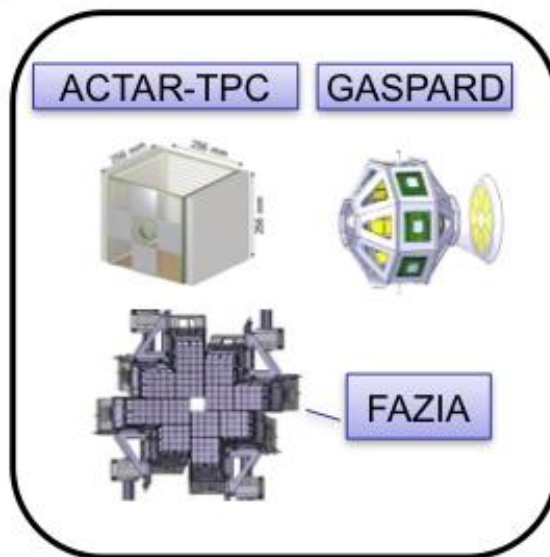
The role of the EICC is to reinforce the synergies and coordinate efforts between the facilities and the major collaborations on existing and new detectors in order to carry on **R&D** and to **reach construction milestones** and **coordinate experimental campaigns** at all RIB facilities which are members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

Traveling detectors (examples)

Gamma-ray detectors



Charged particle detectors

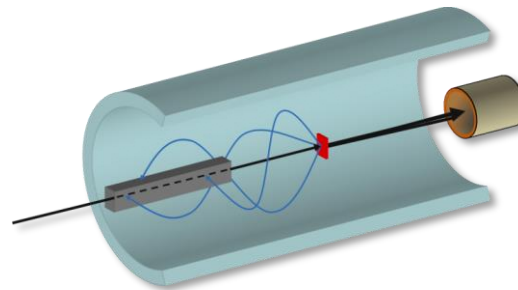
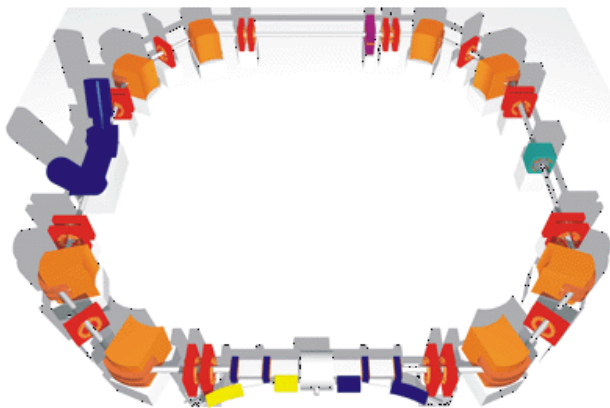
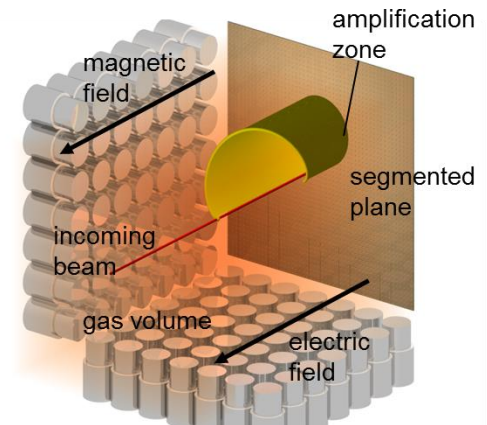
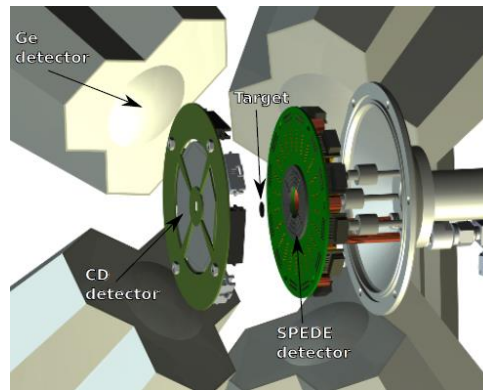
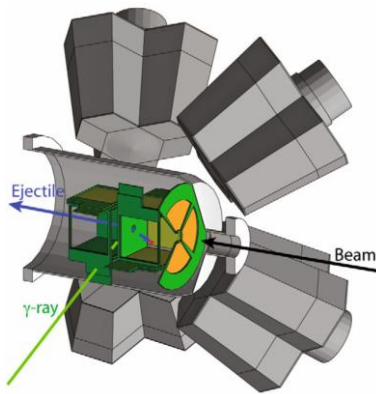
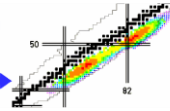


Neutron detectors



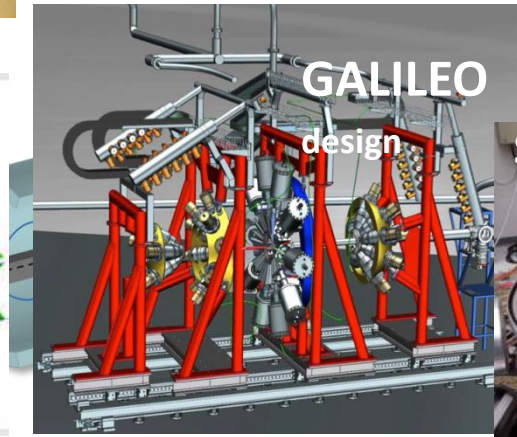
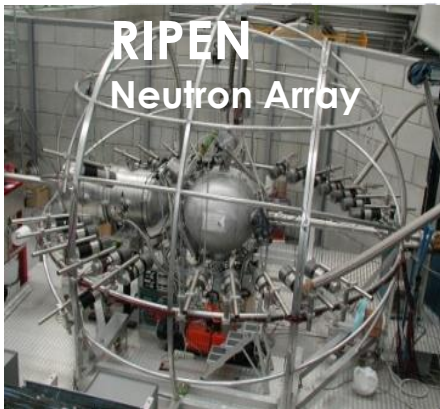
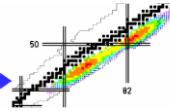
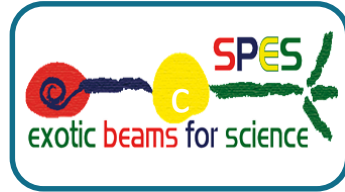
Facilities

- Presentations on HIE-ISOLDE, ALTO, SPES, ISOL@MYRRHA, SPIRAL2, NUSTAR



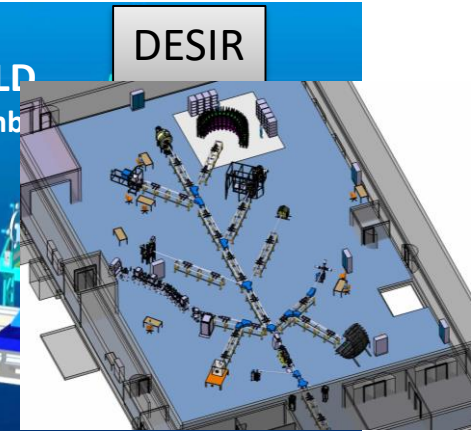
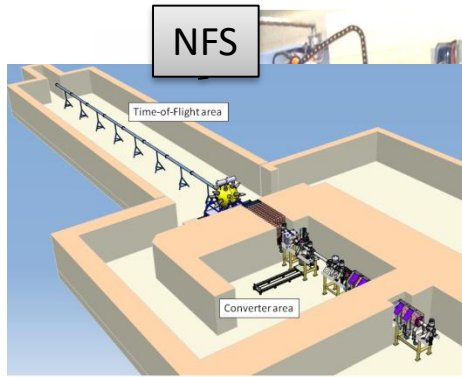
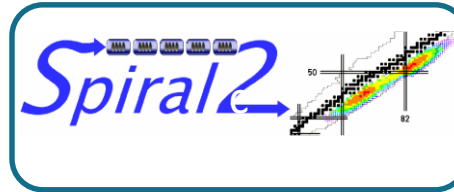
Facilities

- Presentations on HIE-ISOLDE, ALTO, SPES, ISOL@MYRRHA, SPIRAL2, NUSTAR



Facilities

- Presentations on HIE-ISOLDE, ALTO, SPES, ISOL@MYRRHA, SPIRAL2, NUSTAR



EXOAM 2 Coll. Agreement

PARIS MoU

gamma

GASPARD

Charged particle

ACTAR-TPC Coll. Agreement

FAZIA MoU

NEDA MoU

neutron



The needs for EURISOL DF

- Diversity in detection methods and instruments should be coupled to **complementarity** of the opportunities at the different locations
- coordination in the exploitation of present devices
- coordination in the realisation of new instrumentation
 - Detectors and data acquisition
 - Portability of instruments when possible
- Strategy towards the developments of new materials?

The needs for EURISOL DF

- Diversity in detection methods and instruments should be coupled to **complementarity** of the opportunities at the different locations
 - coordination in the exploitation of present devices
 - coordination in the realisation of new instrumentation
 - Detectors and data acquisition
 - Portability of instruments when possible
- Strategy towards the developments of new materials?

How to actually realise these objectives?