

WP2:Status

Maryvonne De Jésus

GDR-DUPHY General Meeting #3

October 20-21, 2022, Nantes

Conveners :

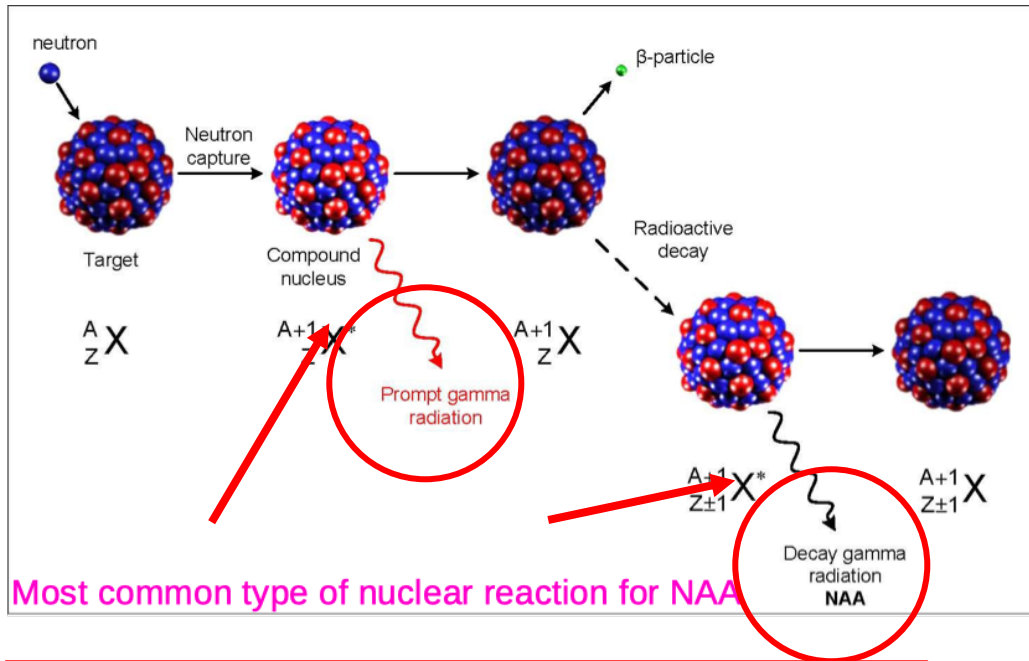
- Jose Busto (Pr, CPPM Marseille)
- MDJ (CR, IP2I Lyon)

- Reminder: <https://gdrduphy.in2p3.fr/wp/low-radioactivity-techniques/>
- Mailing list duphy-wp2@ip2i.in2p3.fr : 28 people subscribed to be informed about WP2 activities.
- To be added to the mailing list send email to *gdr-duphy-wp2@ip2i.in2p3.fr*

- **Zoom Seminar:** March 17th 2022
 - Silvia Scorza (SNOLAB, Canada): « Material screening and assay program for underground science @ SNOLAB » <https://atrium.in2p3.fr/26b5547f-36cd-4d64-8487-7b70dff8ff94>
- **Round table NAA**
- **Round table LA-ICPMS**

- **Round table: NAA Invited talks**
 - Kick-off Meeting may 2021 :
 - Monica Sisti (INFN, Milano-Bicocca)
 - #1 Wednesday November 24th 2021:
 - Olivier Meplan (LBA @ LPSC Grenoble)
 - #2 Monday January 10th 2022:
 - Ulli Koster (ILL research reactor, Grenoble)

Neutron activation



Most common type of nuclear reaction for NAA

Measurement of emitted γ rays

Neutron sources

Radioisotopic neutron sources:

- Two component neutron source based on (α, n) or (γ, n) reactions, like ${}^{241}\text{Am}(\text{Be})$, ${}^{124}\text{Sb}(\text{Be})$, ...
- Spontaneous fission sources, like ${}^{252}\text{Cf}$.
→ different energy spectra and rates depending on the involved reaction

Neutron generators:

- 2.4 MeV neutrons from $\text{D}(\text{d}, \text{n}){}^3\text{He}$
- 14 MeV neutrons $\text{D}(\text{t}, \text{n}){}^4\text{He}$

Spallation neutron sources:

Heavy elements such as W, Pb, U irradiated with high-energy protons or other particles are spalled into two or more fragments and many neutrons are released.

Nuclear research reactors:

mostly used

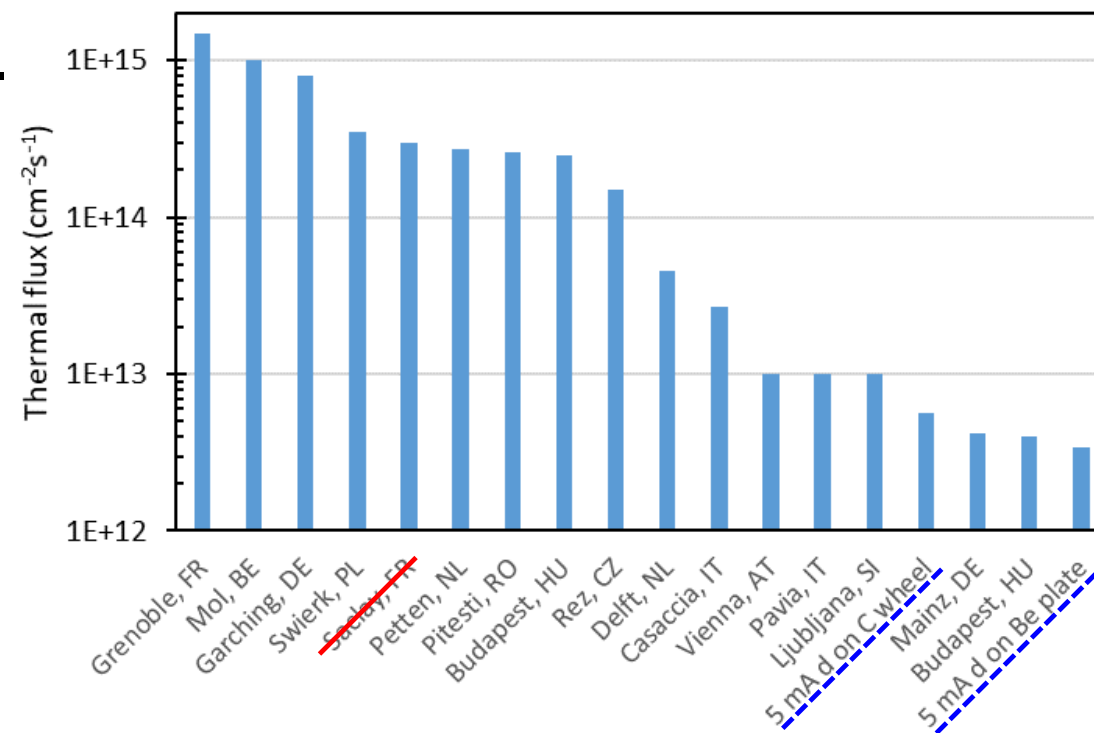
Measurement of radioisotope concentrations at ultra-low levels below 10^{-14} g/g by NAA method requires very high neutron fluxes

➤ Nuclear Research Reactors with thermal neutron fluxes of $10^{11} - 10^{14}$ n/cm²/s

In France :

- Orphee Reactor (CEA Saclay) **closed in 2019**
- ILL neutron source two strong for our application
- Futur research reactor Jules Horowitz @ Cadarache 2025 **?**

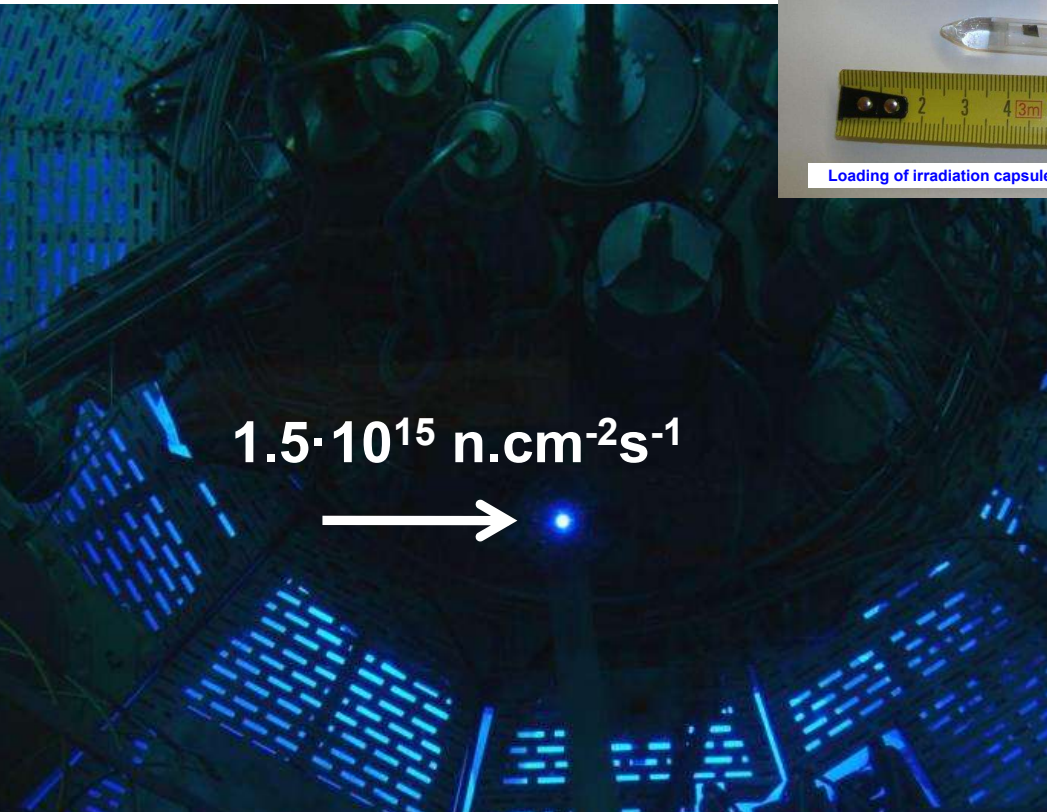
Thermal neutron sources in the European Union



• #2 Monday January 10th 2022: Ulli Koster (ILL Grenoble)

<https://atrium.in2p3.fr/0adf2db8-0f75-49e9-9df0-352173a668c7>

V4: The highest neutron flux in Western Europe



Fixation of irradiation container in irradiation position.

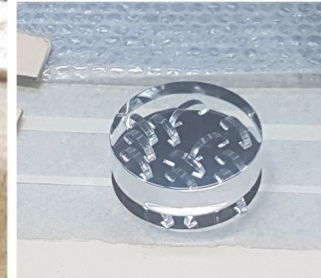


Practical NAA

Sample preparation



Preparation of standards inside quartz vials (for high neutron fluxes)



Laser cutting of acrylic samples



Clean room preparation of samples:



Clean room class 1000 with MilliQ water system



Acrylic samples



LAB samples

Conclusion on NAA round tables:

- **ILL sample procedure not adapted to ultra-trace measurements for which extreme care is needed to avoid adding unwanted contaminants**
- **The NAA round tables are suspended for the moment**

- **Round table: LA-ICPMS Invited talks**
 - Kick-off Meeting may 2021 :
 - Frédéric Perrot (Bordeaux)
 - General Meeting November 2021 Paris:
 - Christophe Pécheyran (IPREM, Université de Pau et des Pays de l'Adour)
- Convener Frédéric Perrot Next talk

- NAA and ICPMS round tables started with 8-13 people attending Zoom meetings

The screenshot shows the Atrium web interface. The top navigation bar includes links for HOME, ARBORESCENCE, RECHERCHE, ESPACE PERSONNEL, WEBUI, DASHBOARD, TICKET SUPPORT, DÉCONNEXION, and a user profile for m.de-jesus@ipnl.in2p3.fr. The left sidebar displays a tree view of the project structure under 'Atrium', including 'Zone de Diffusion', 'Laboratoires', 'Projets', 'GDR-DUPhy', 'WP1 -- Rare-event physics', 'WP2 -- Low radioactivity techniques', 'TablesRondes', 'Slides-Invited-Talks', 'Cr-TablesRondes', 'WP3 -- Detection of rare-events', 'WP4 -- Simulation and Analysis', 'WP5 -- Future experiments', and 'Common'. The main content area is titled 'TablesRondes' and features a tabbed interface with 'Contenu' selected. Below the tabs, there is a 'Nouveau document' button, a search filter, and a 'Documents/page: 30' dropdown. A table lists documents with columns for checkboxes, Type, Titre, Atrium ID, Créé le, Créé par, Modifié le, Modifié par, and Vrs. El.

<input type="checkbox"/>	Type	Titre	Atrium ID	Créé le	Créé par	Modifié le	Modifié par	Vrs. El
<input type="checkbox"/>	📁	Cr-TablesRondes		14 févr. 2022	Maryvonne DE JÉSUS	14 févr. 2022	Maryvonne DE JÉSUS	
<input type="checkbox"/>	📁	Slides-Invited-Talks		14 févr. 2022	Maryvonne DE JÉSUS	14 févr. 2022	Maryvonne DE JÉSUS	

- New WP2 convener: **Silvia Scorza** (DR LPSC from December 1st)
- The ***radiopurity.org*** database hosted@SNOLAB has *been* upgraded and is operational (a WP2 seminar will be organized).

The screenshot shows the homepage of radiopurity.org. At the top, there are logos for Pacific Northwest National Laboratory, radiopurity.org, and SNOLAB. Below the logos, there are links for 'documentation' and 'GitHub'. A navigation menu contains buttons for 'about', 'search', 'advanced search', 'insert', and 'update', with 'advanced search' currently selected. The main heading is 'Query Assistant'. In the top right corner, there is a small table of conversion factors:

1 Bq U-238/kg	= 81 ppb U	(81 x 10 ⁻⁶ gU/g)
1 Bq Th-232/kg	= 246 ppb Th	(246 x 10 ⁻³ gTh/g)
1 Bq K-40/kg	= 32300 ppb K	(32300 x 10 ⁻⁶ gK/g)
1 Bq U-235/kg	= 1.76 ppm U	(1.76 x 10 ⁻⁶ gU/g)

Below the table is a search form with the placeholder text 'Search for records containing the term...'. There is a checked checkbox for 'include synonyms' and a blue 'search' button. A link for 'advanced search' is also present.

Summary :

- Round Table NAA : Stand by
- LA-ICPMS (F. Perrot): on-going
- Open new round table
 - Underground labs ?
 - Radon ?
 - Germanium spectroscopy ?
 - Material cleaning procedures
 - Purification techniques
 - ...

Thank You



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