WP2:Status

Maryvonne De Jésus

GDR-DUPHY General Meeting #3

October 20-21, 2022, Nantes

WP2:Status

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**

- **<u>Round table: NAA Invited talks</u>**
  - 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)

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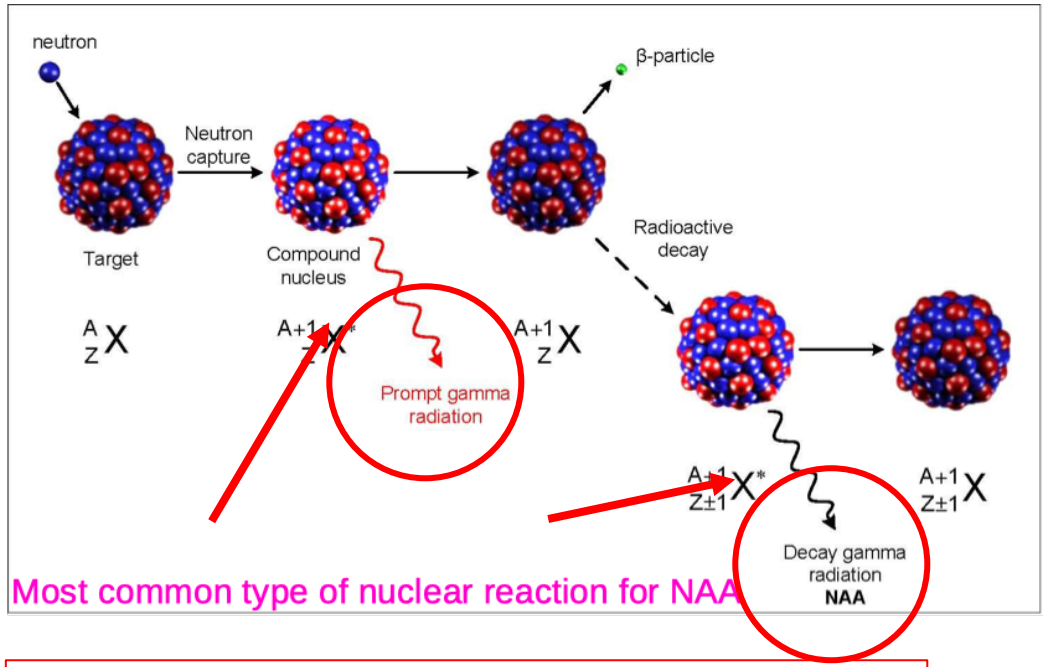
- **Kick-off Meeting may 2021 : Talk Monica Sisti**

https://indico.in2p3.fr/event/23971/contributions/95730/attachments/64516/89543/MonicaSisti_NAA.pdf

Neutron activation



Measurement of emitted γ rays

Neutron sources

Radioisotopic neutron sources:

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

Neutron generators:

- 2.4 MeV neutrons from D(d,n)^{3}He
- 14 MeV neutrons D(t,n)^{4}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/cm^2/s**

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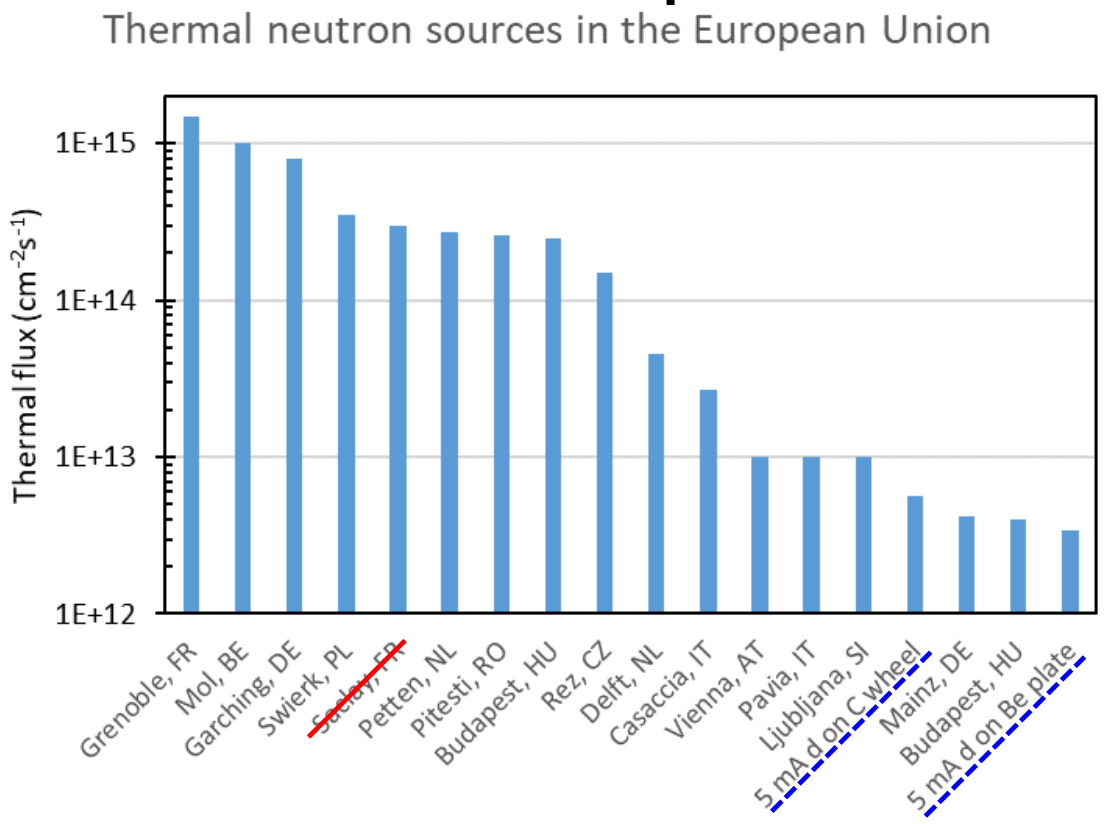
In France :

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



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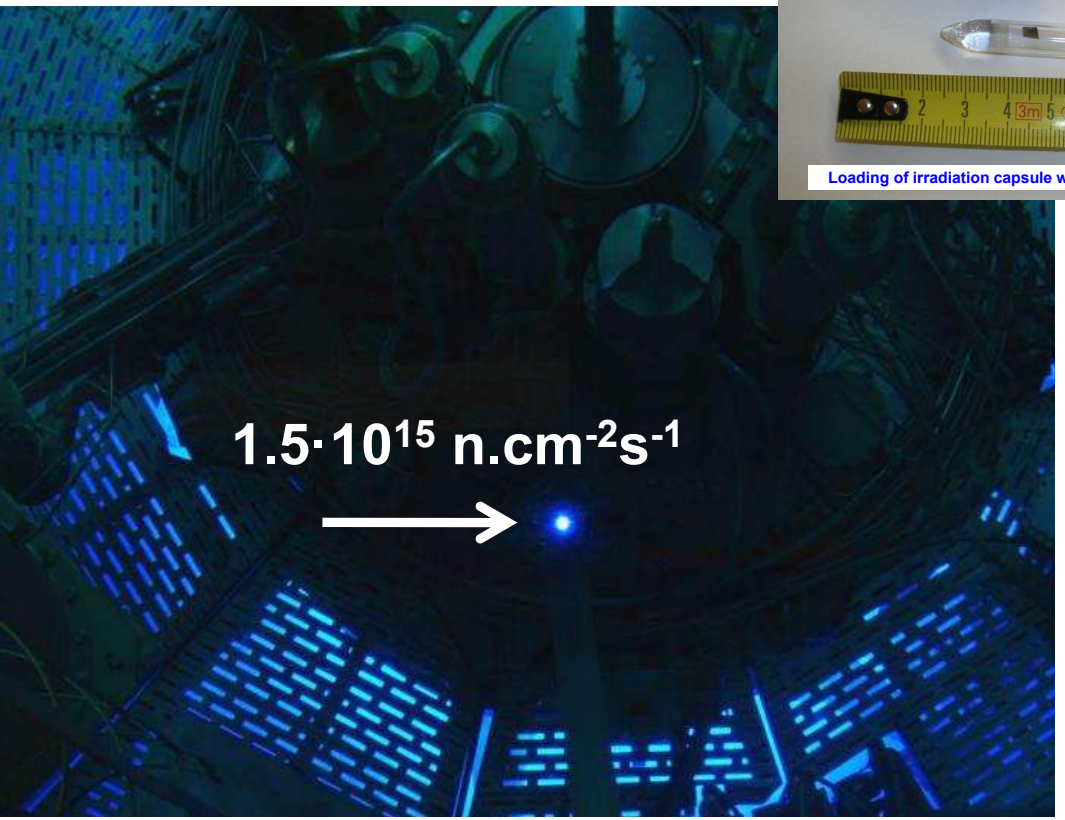
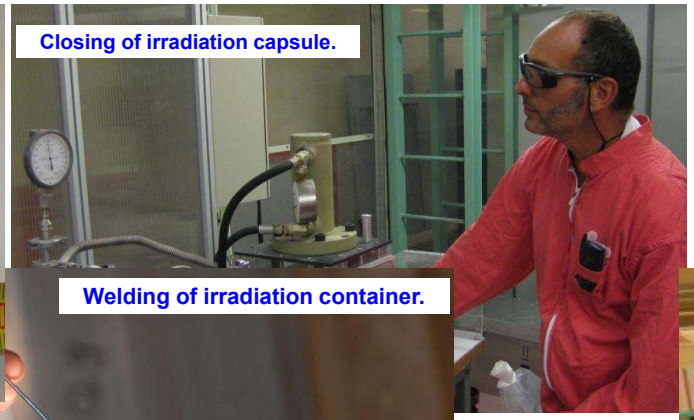
- **#2 Monday January 10th 2022: Ulli Koster (ILL Grenoble)**

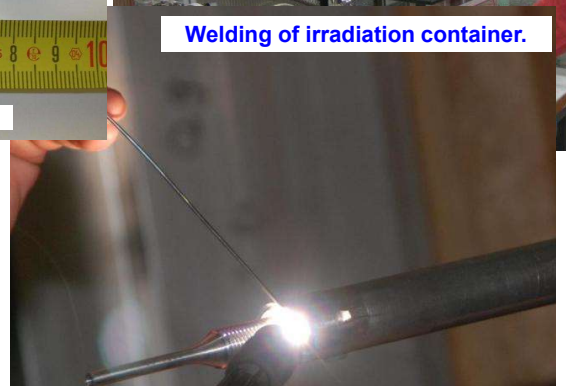
https://atrium.in2p3.fr/0adf2db8-0f75-49e9-9df0-352173a668c7

V4: The highest neutron flux in Western Europe




Loading of irradiation capsule with samples.


Closing of irradiation capsule.

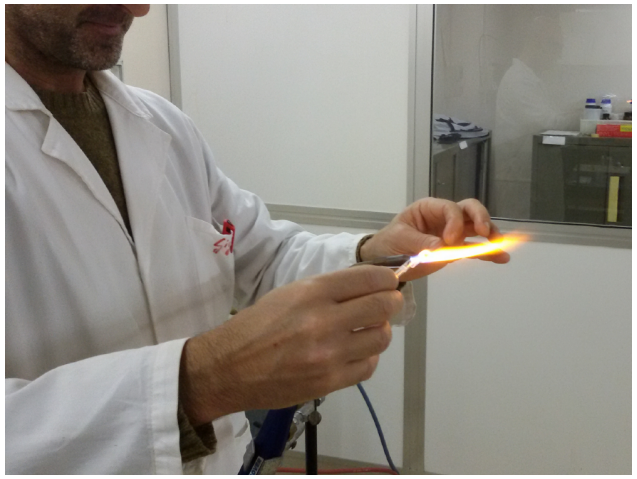

Welding of irradiation container.

Fixation of irradiation container in irradiation position.

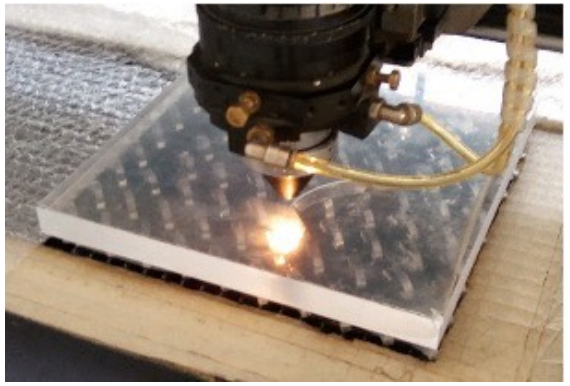

After irradiation transfer to hot cell (manual multi step procedure not shown here).

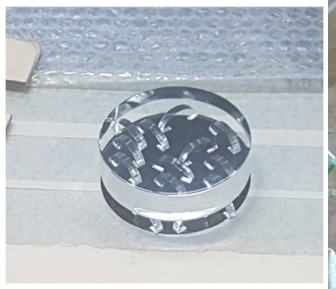
Practical NAA

Sample preparation



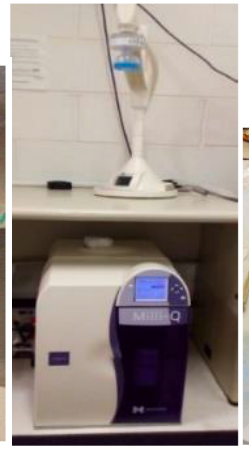
Preparation of standards inside quartz vials (for high neutron fluxes)





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**

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- **<u>Round table: LA-ICPMS Invited talks</u>**
  - Kick-off Meeting may 2021 :
    - Fréderic Perrot (Bordeaux)
  - General Meeting November 2021 Paris:
    - Christophe Pécheyran (IPREM, Université de Pau et des Pays de l'Adour)

- Convener Fréderic Perrot Next talk

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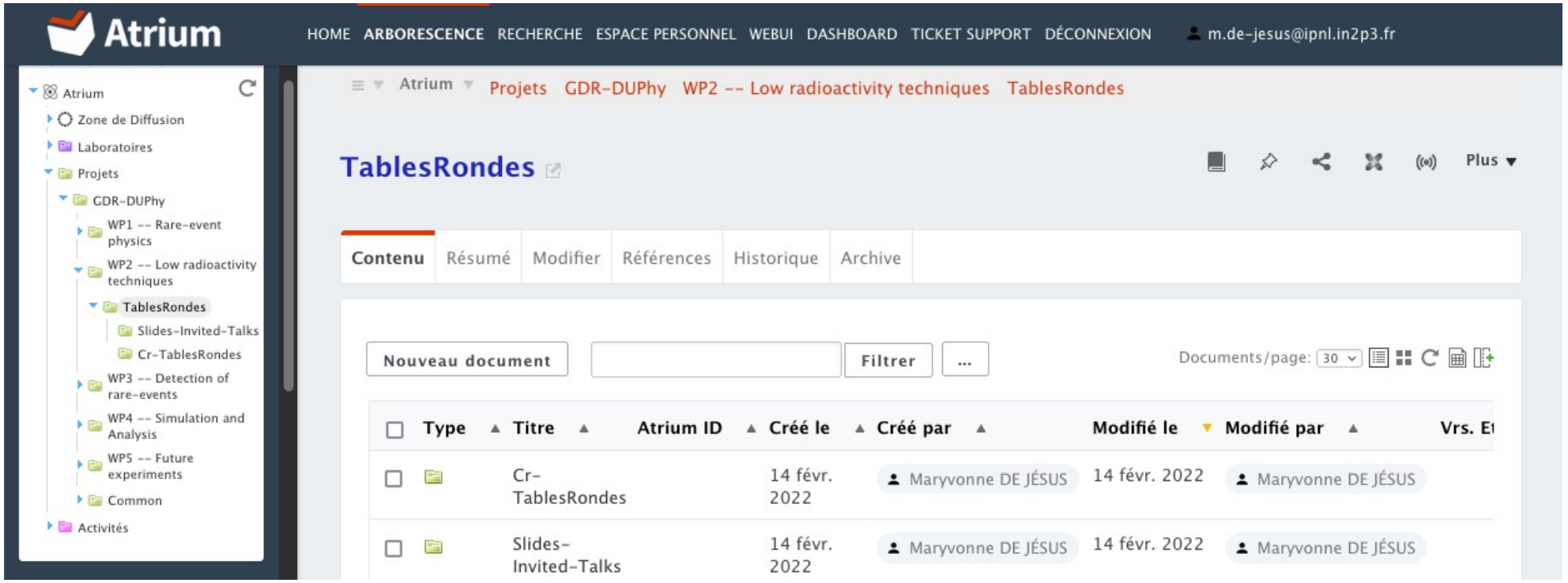
- NAA and ICPMS round tables started with 8-13 people attending Zoom meetings



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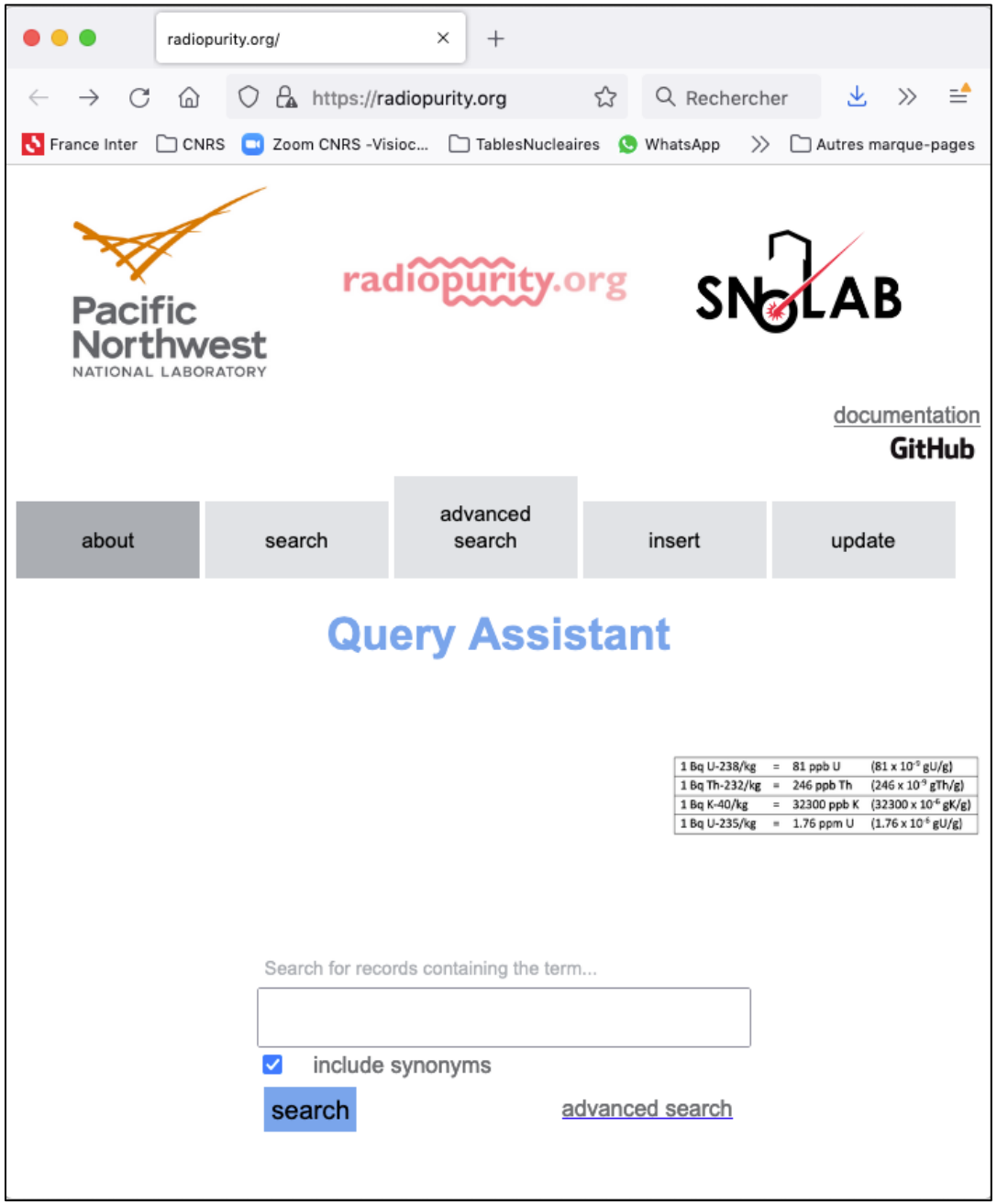
- **New WP2 convener: *Silvia Scorza* (DR LPSC from December 1st)**
- **The *radiopurity.org* database hosted@SNOLAB has *been* upgraded and is operational (a WP2 seminar will be organized).**



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