WELCOME TO THE ILL !

Institut Laue-Langevin – founded in 1967

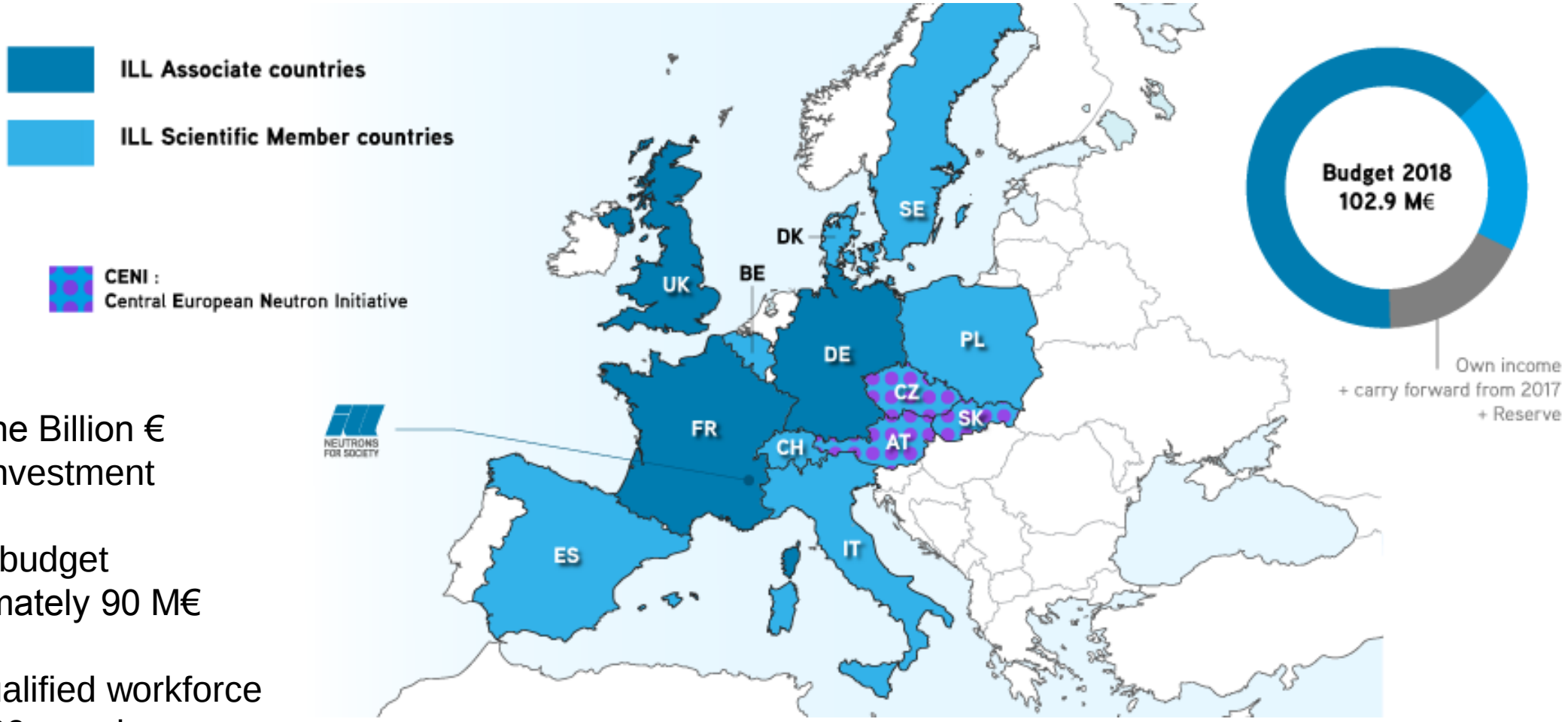
World leader in neutron science and technology

After more than 40 years, we are still number one

The ILL is the most intense neutron source in the world, at the service of international scientists, to carry out scientific research at the frontiers' of modern science.

ILL's Second Mission is to Help Building Europe

The advent of the scientific members continues the process.



- Close to one Billion € of capital investment
- An annual budget of approximately 90 M€
- A highly qualified workforce of about 500 people

KEY FIGURES ABOUT THE ILL

1400 users from an active community of 12 000 scientists

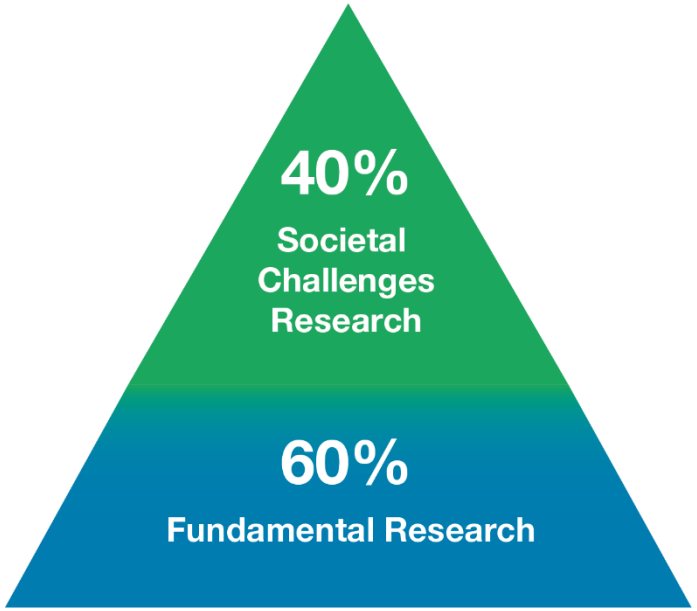
850 experiments/year

650 publications/year

65 countries

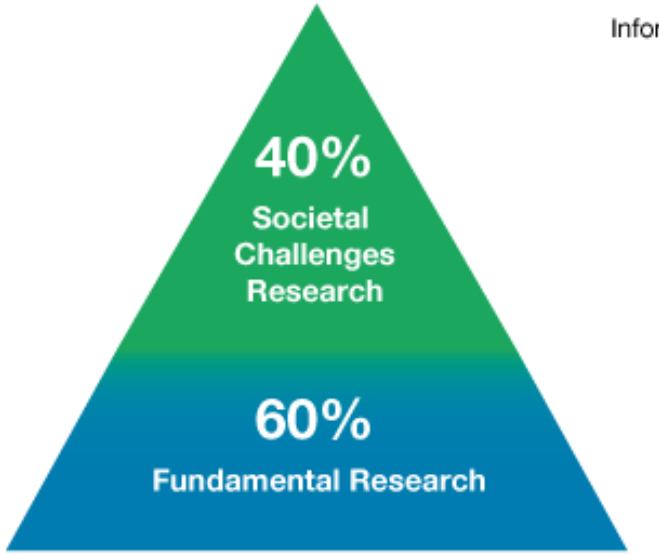
28 instruments + 10 CRG

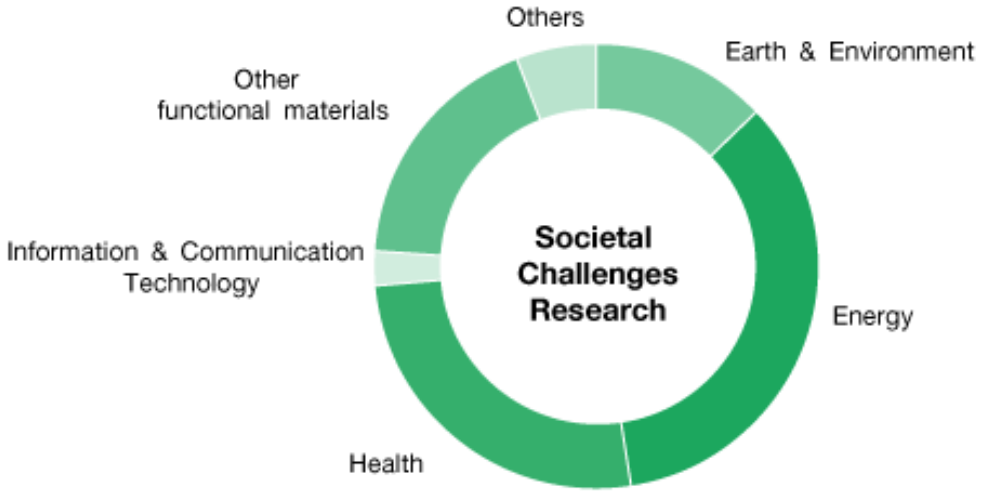
4 cycles of 50 days/year

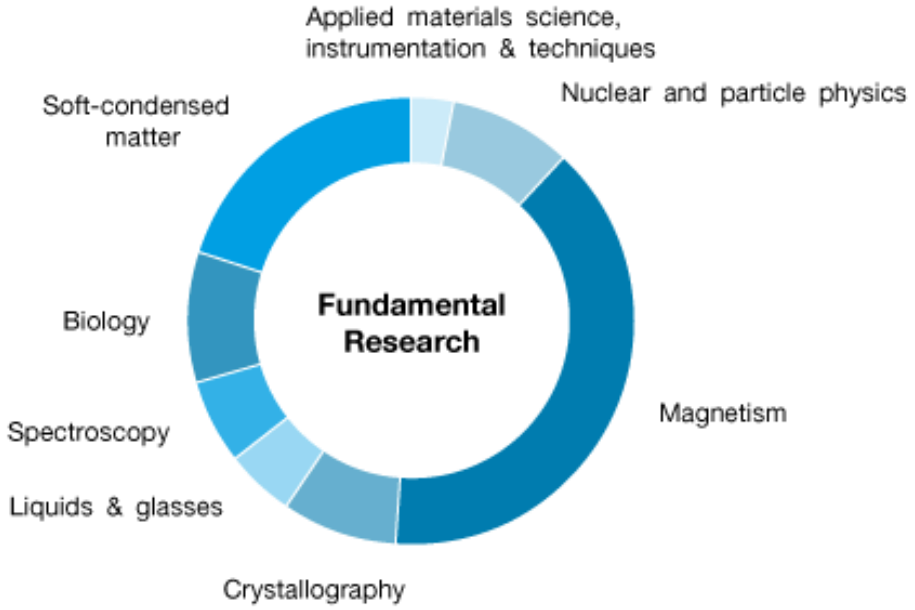


Research areas covered by the ILL

As per accepted proposals

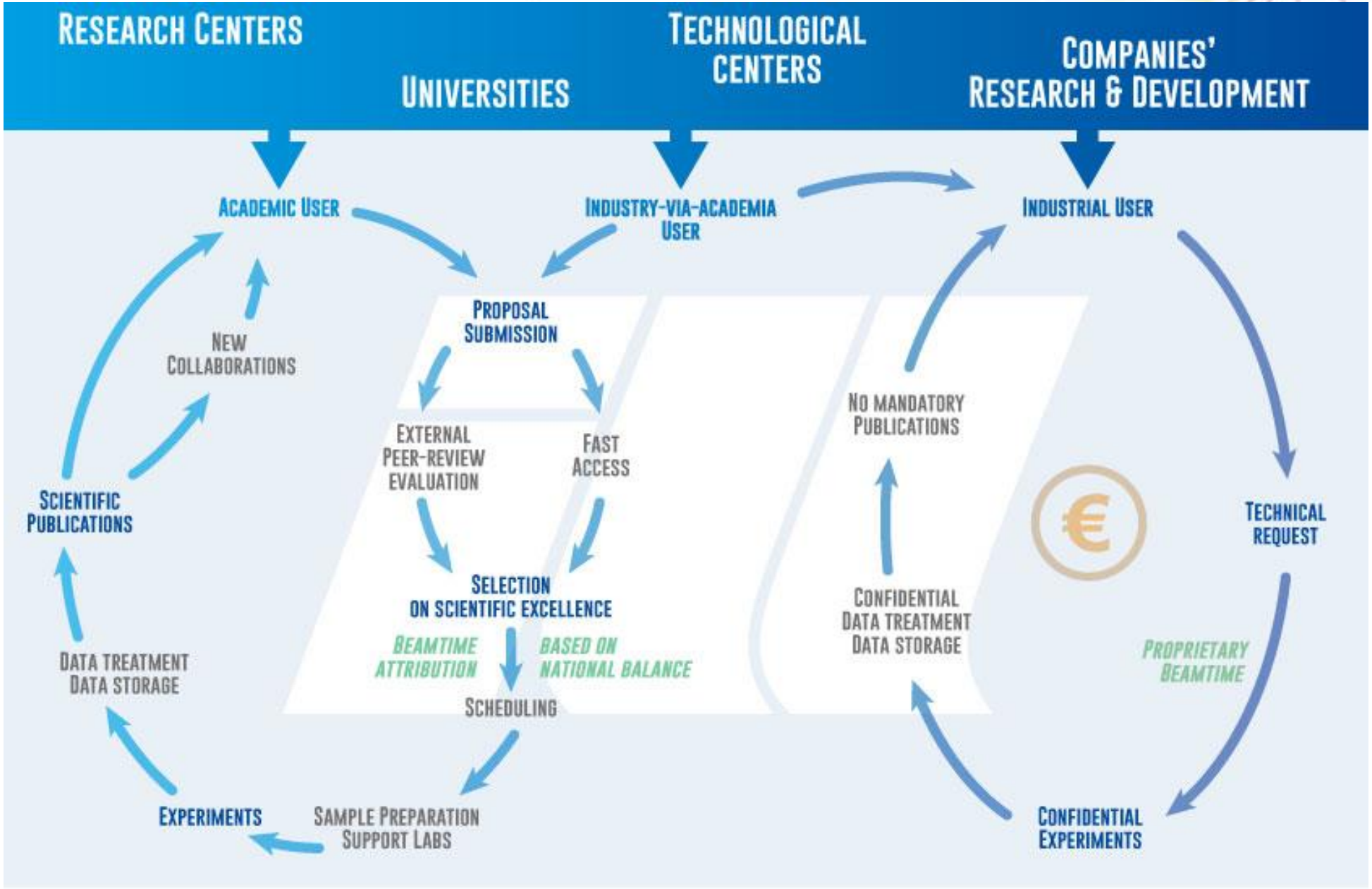




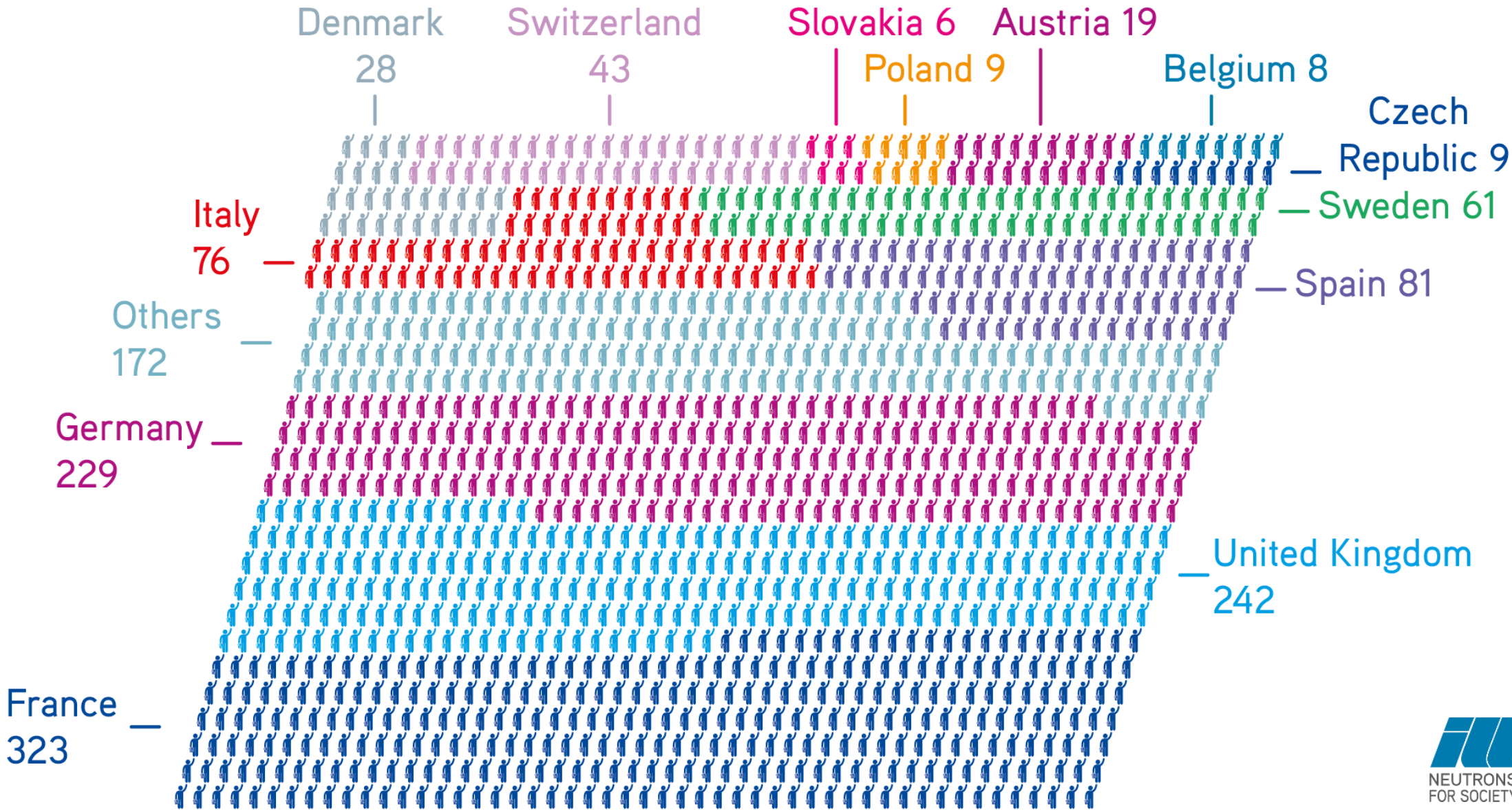


NEUTRONS FOR SOCIETY

How to request beamtime at the ILL?



National affiliation of the ILL users in 2016

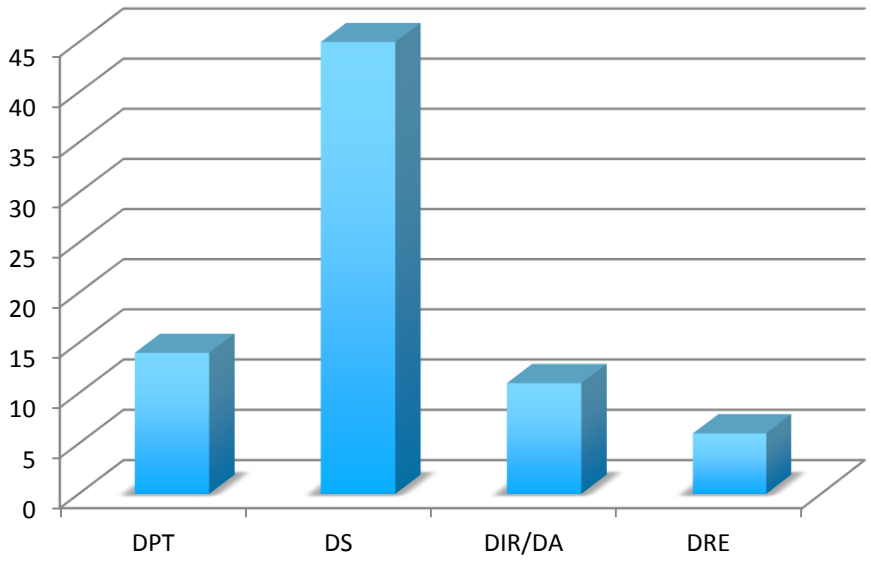


NEUTRONS FOR SOCIETY

More than 180 scientific experts for User Support

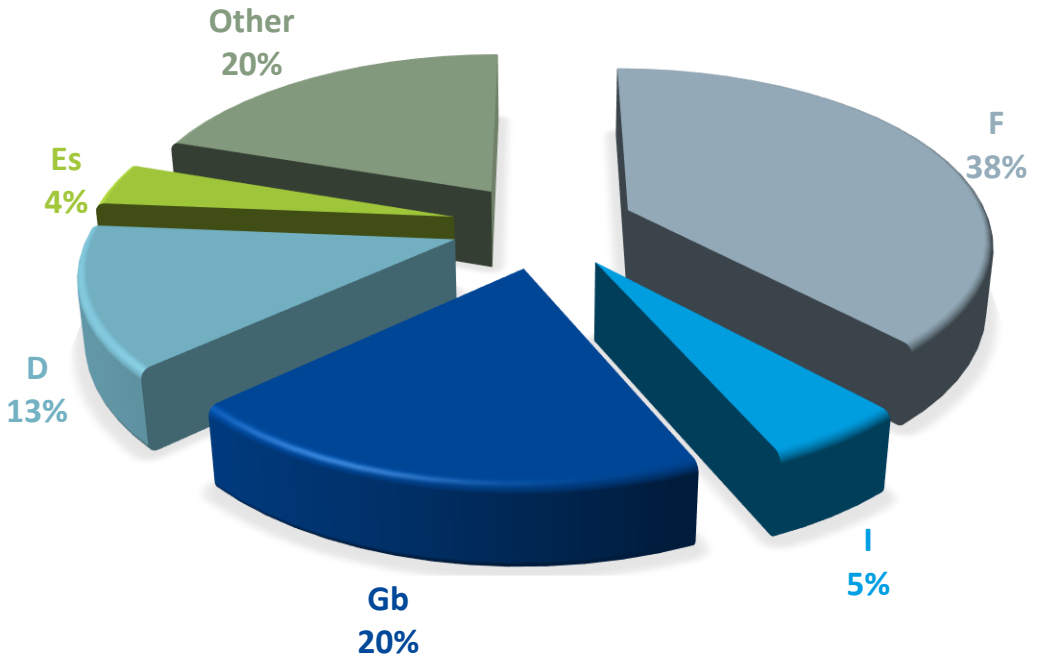
Students @ ILL

- 180 month of traineeship from ILL dedicated budget allocated each year
- Specific external founding
  - Erasmus
  - STFC
  - EU projects



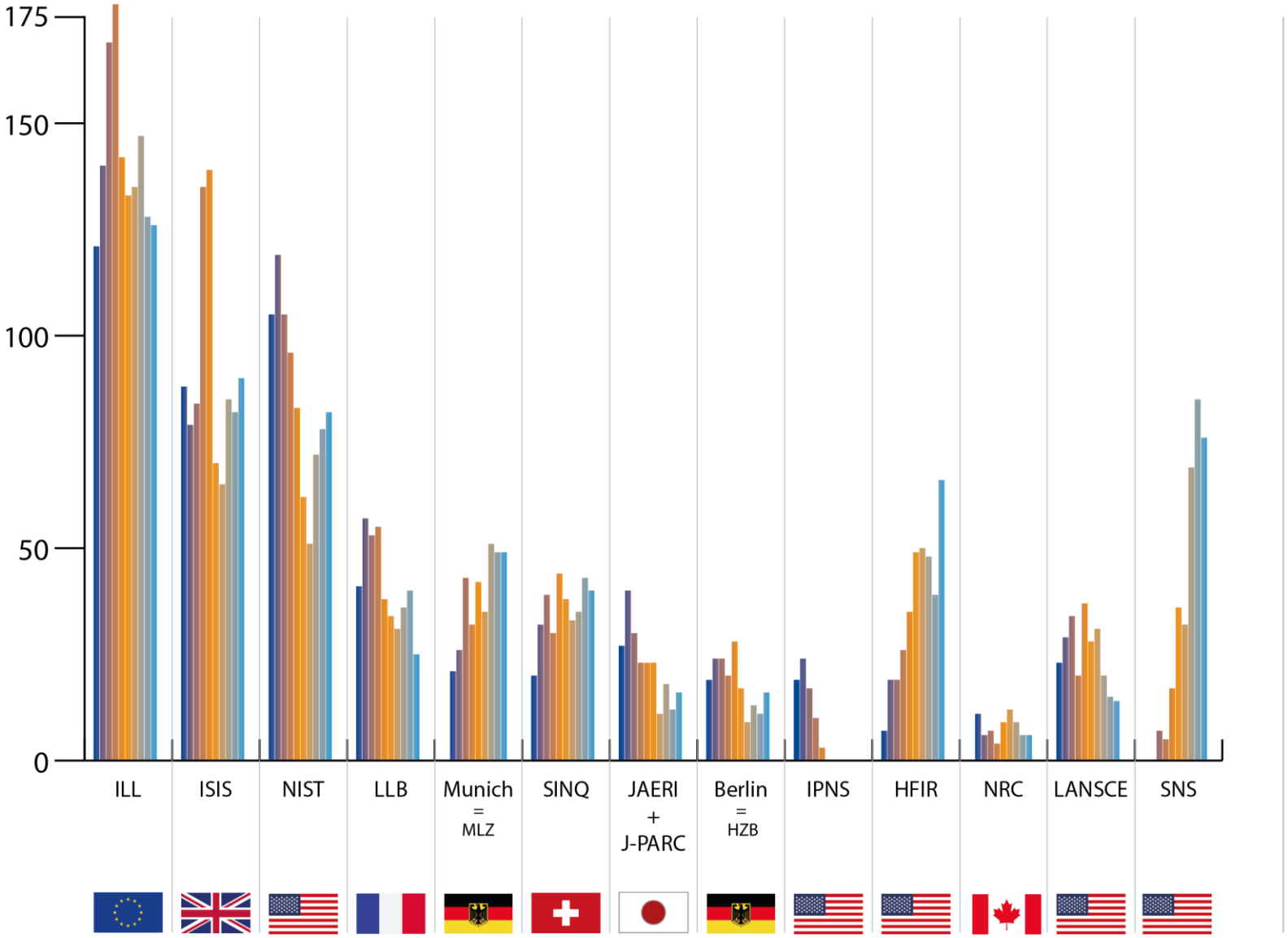
Students distribution per division

National balance



Average of about 10 new PhD students/year

PUBLICATIONS IN HIGH-IMPACT SCIENTIFIC JOURNALS AT THE ILL

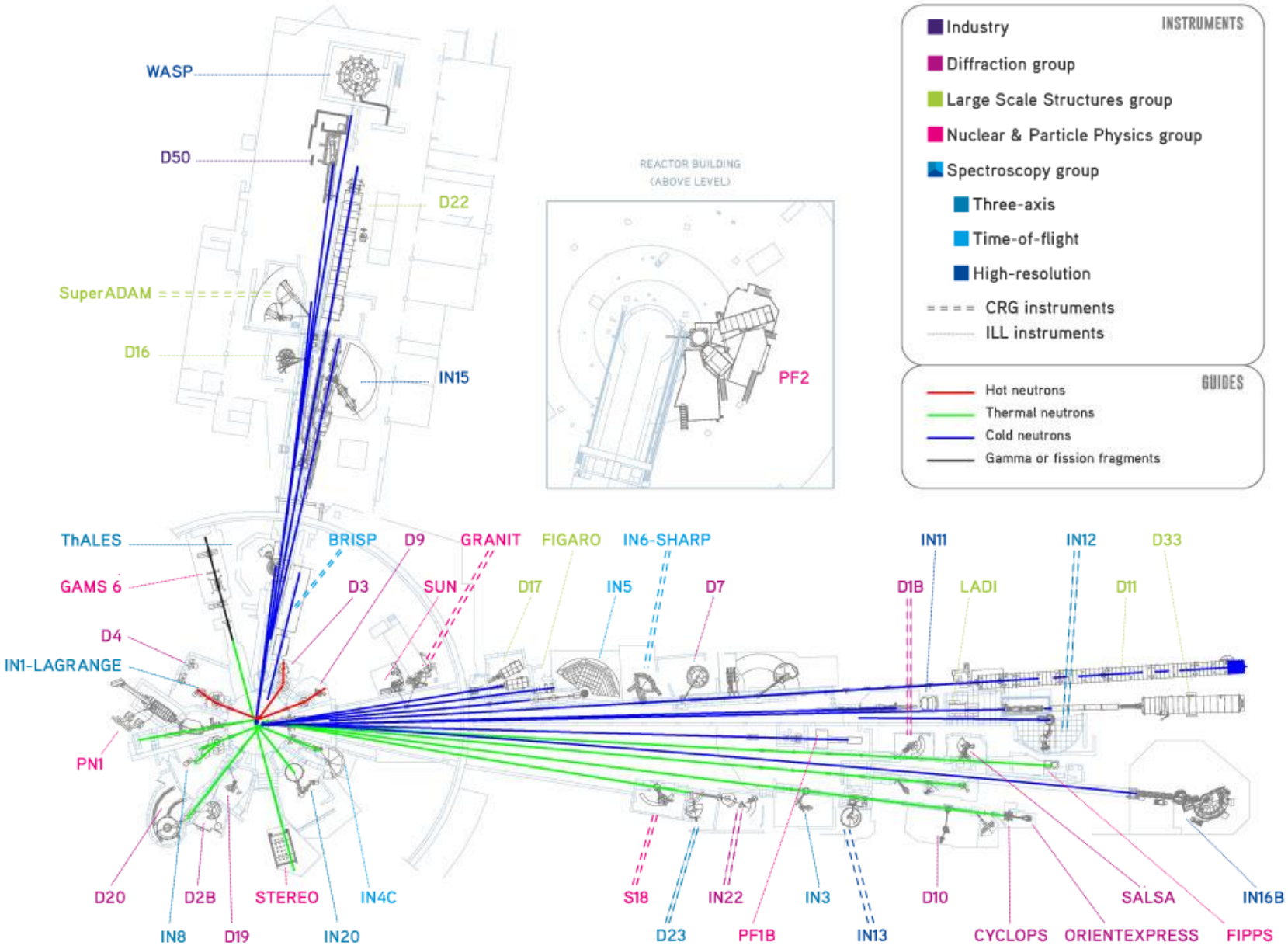


Chemistry of Materials
Europhysics Letters
J. Molecular Biology
JACS
Langmuir
Macromolecules
Nature
Nature Materials
Nature Physics
Phys. Rev. B
Phys. Rev. C
Phys. Rev. E
Phys. Rev. Lett.
Science

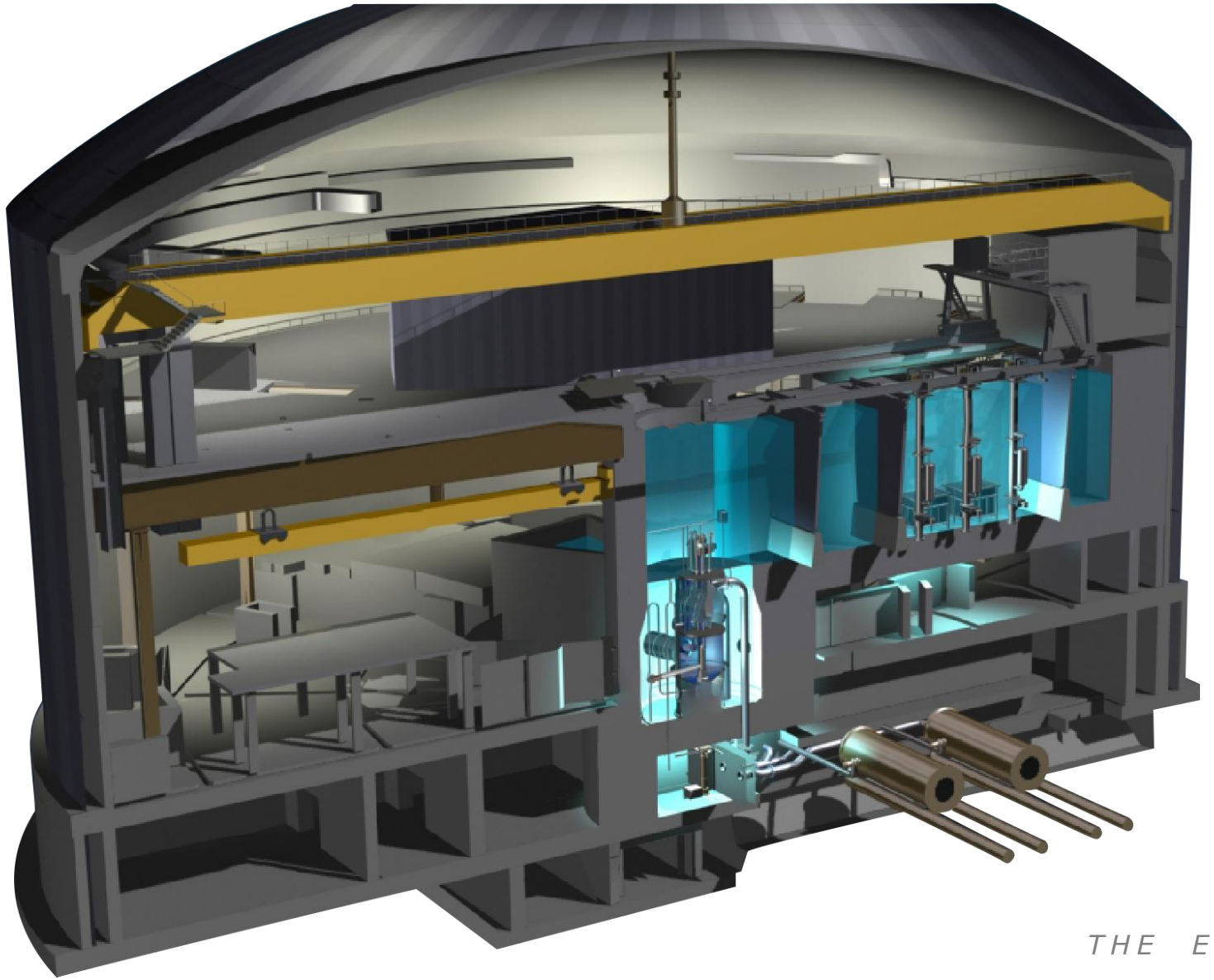
2007 — 2016

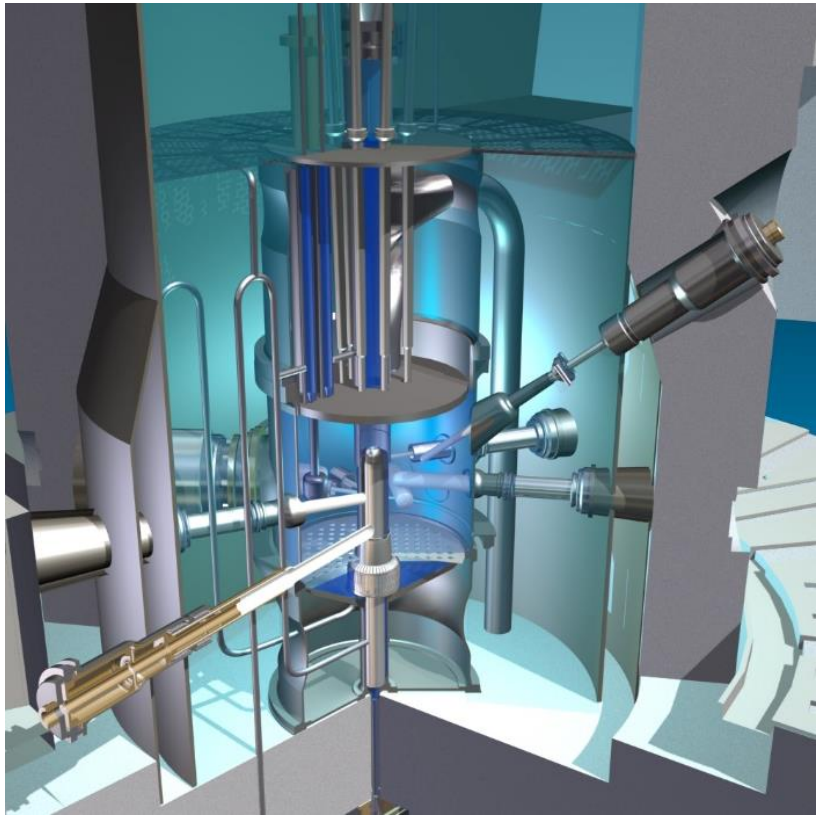
NEUTRONS FOR SOCIETY

The ILL's instrument suite



THE ILL REACTOR



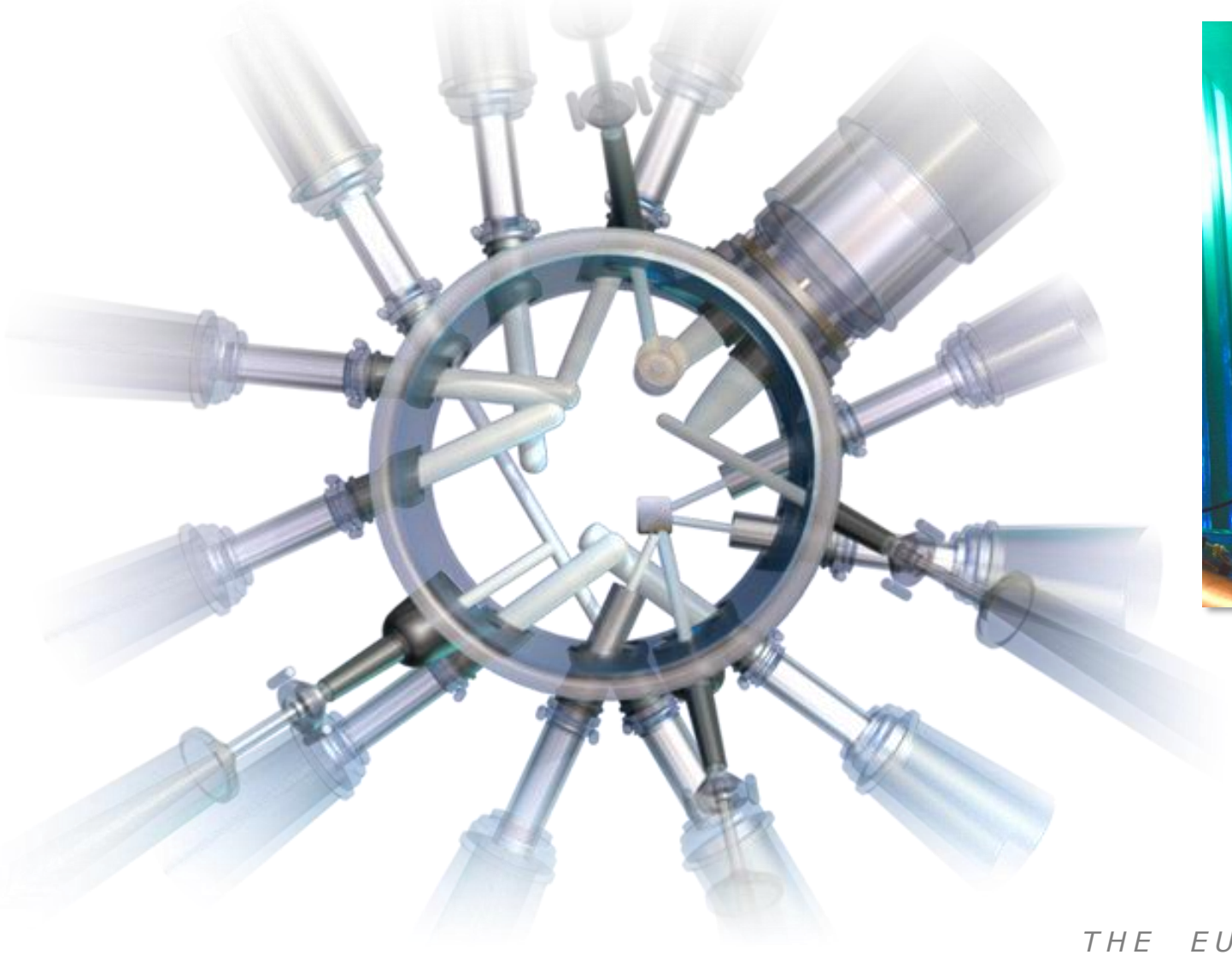


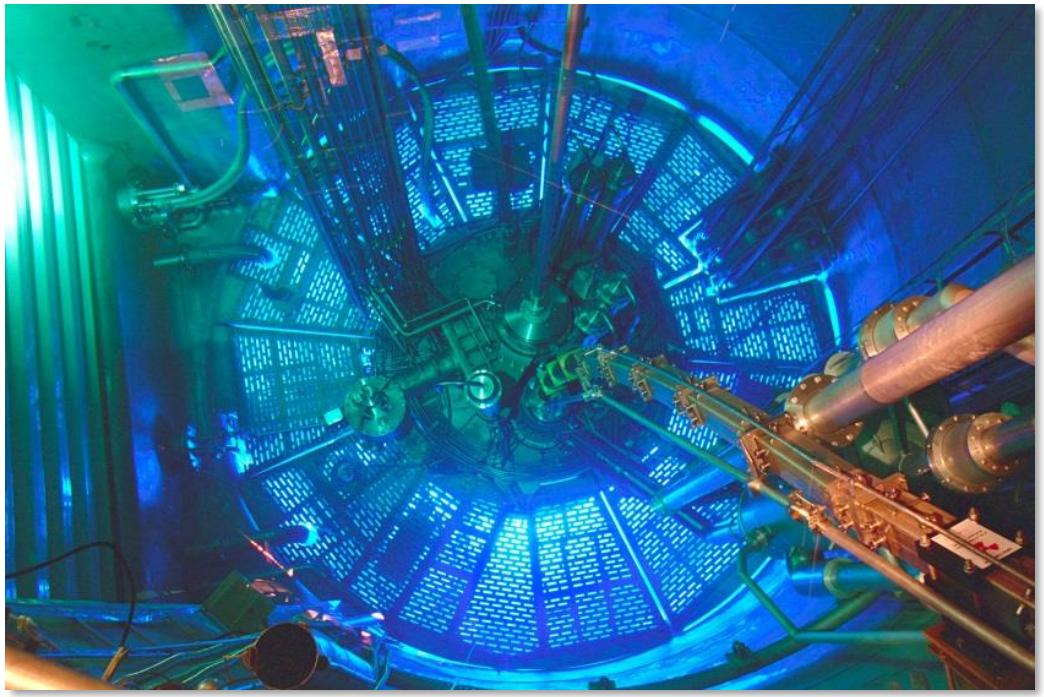
A neutron source generating

5 x 10^{18} fast neutrons/sec

at a max power of 58 MW

How neutrons are extracted and guided





NEUTRON PRODUCTION

Fission Reaction

$n^1 + U^{235} \longrightarrow$ 2 fission fragments + 2.5 n^1 + 200 MeV

Thermal

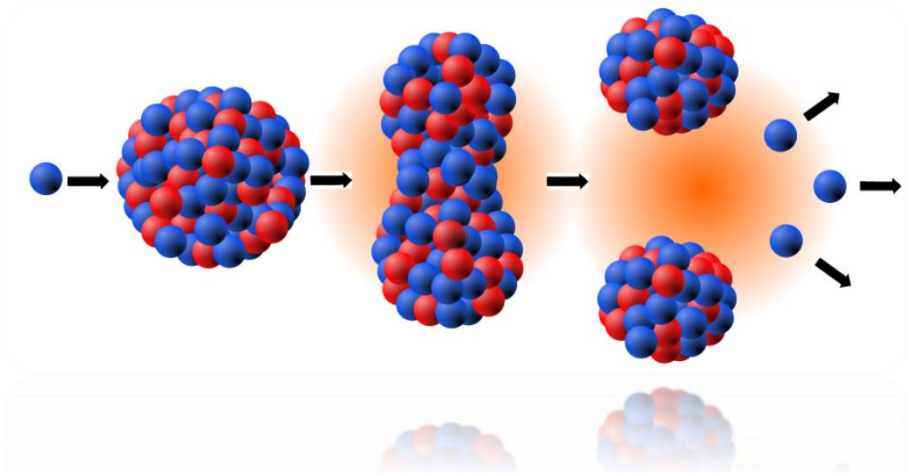
1 neutron to maintain chain reaction

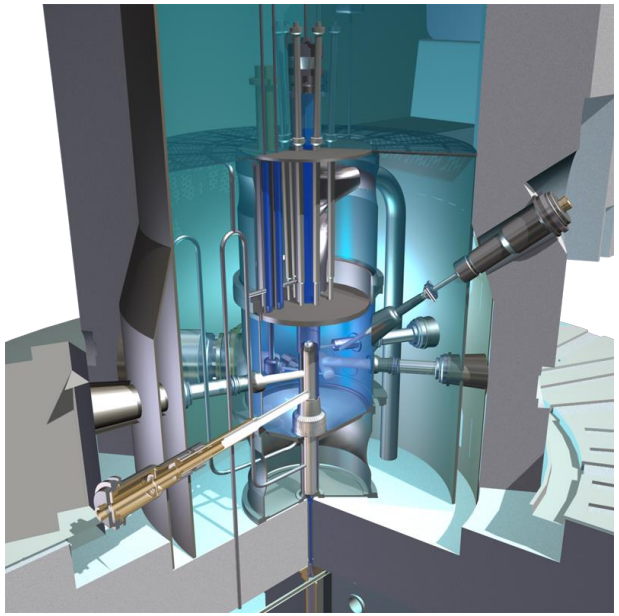
1 neutron escapes & is available for use

0.5 neutrons absorbed

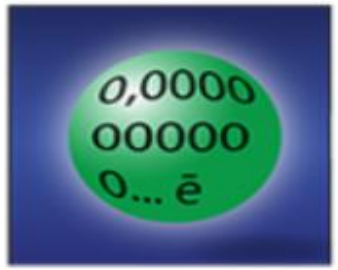
2 to 3 neutrons

No. of fissions/sec $= \frac{20 \times 10^6 \text{ watts}}{200 \text{ MeV/fission}}$



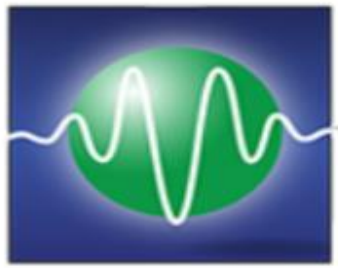


Neutrons, a Powerful Probe



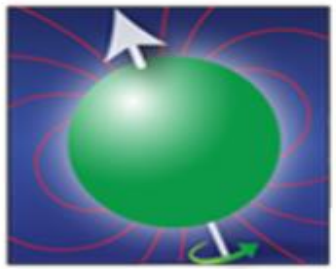
No electric charge

It therefore has an excellent penetration depth for most materials.



Associated wave

Neutron beams can be reflected, refracted, diffracted, just like any other wave.

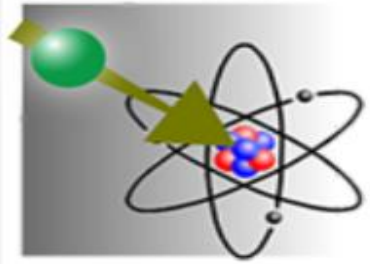


Spin + associated magnetic moment

It therefore behaves like a tiny compass needle able to probe magnetism at the atomic scale.

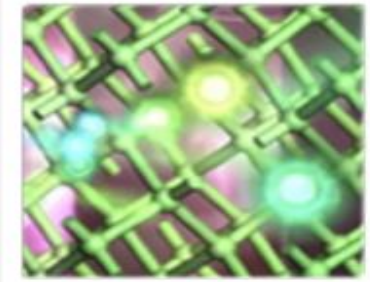
Interacts with the nucleus of atoms

Whereas X-rays and electrons interact with the electron cloud.



Energy range

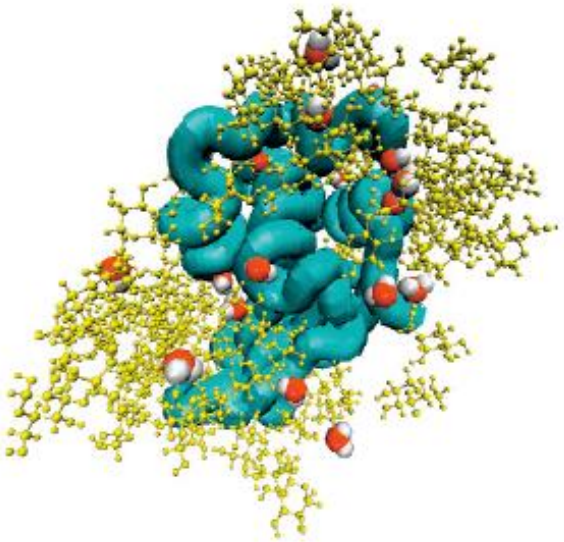
It is similar to the energy of atomic and molecular motions in matter, making the neutron very sensitive to these motions.



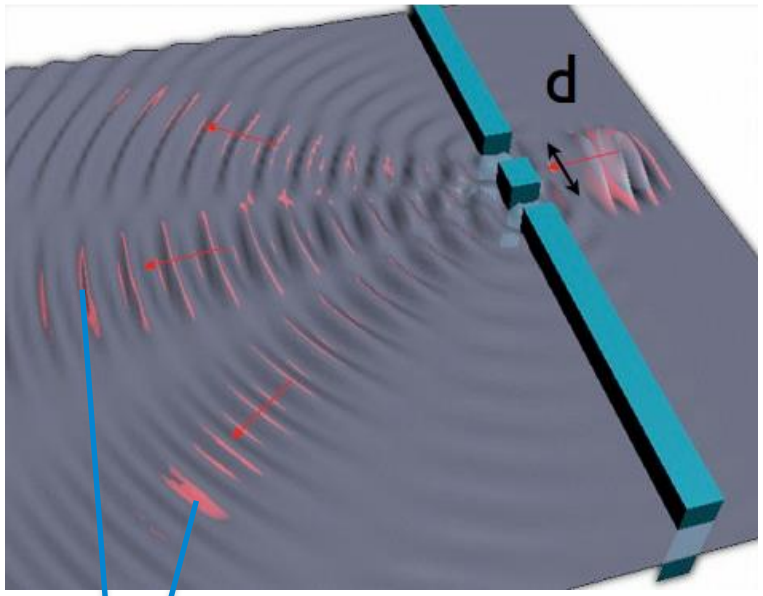
NEUTRONS WAVELENGTHS IS COMPARABLE TO ATOMIC SIZES

Adapted to the dimensions of atomic and molecular structures, neutrons can « see » atoms, even in complex configurations.

From 1000 nm

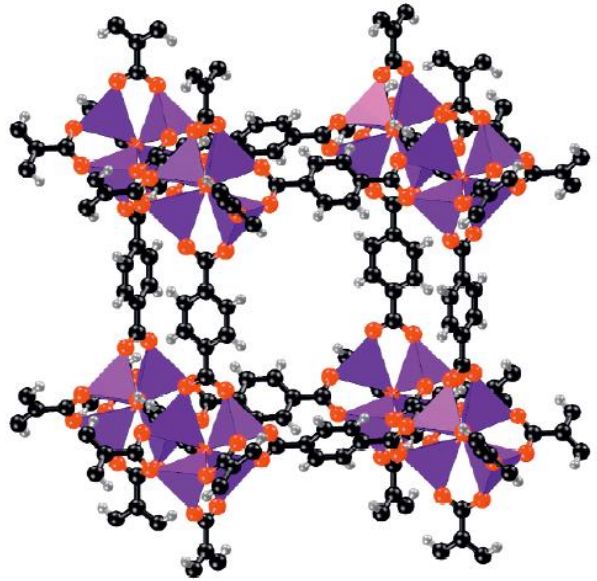


Cold neutrons



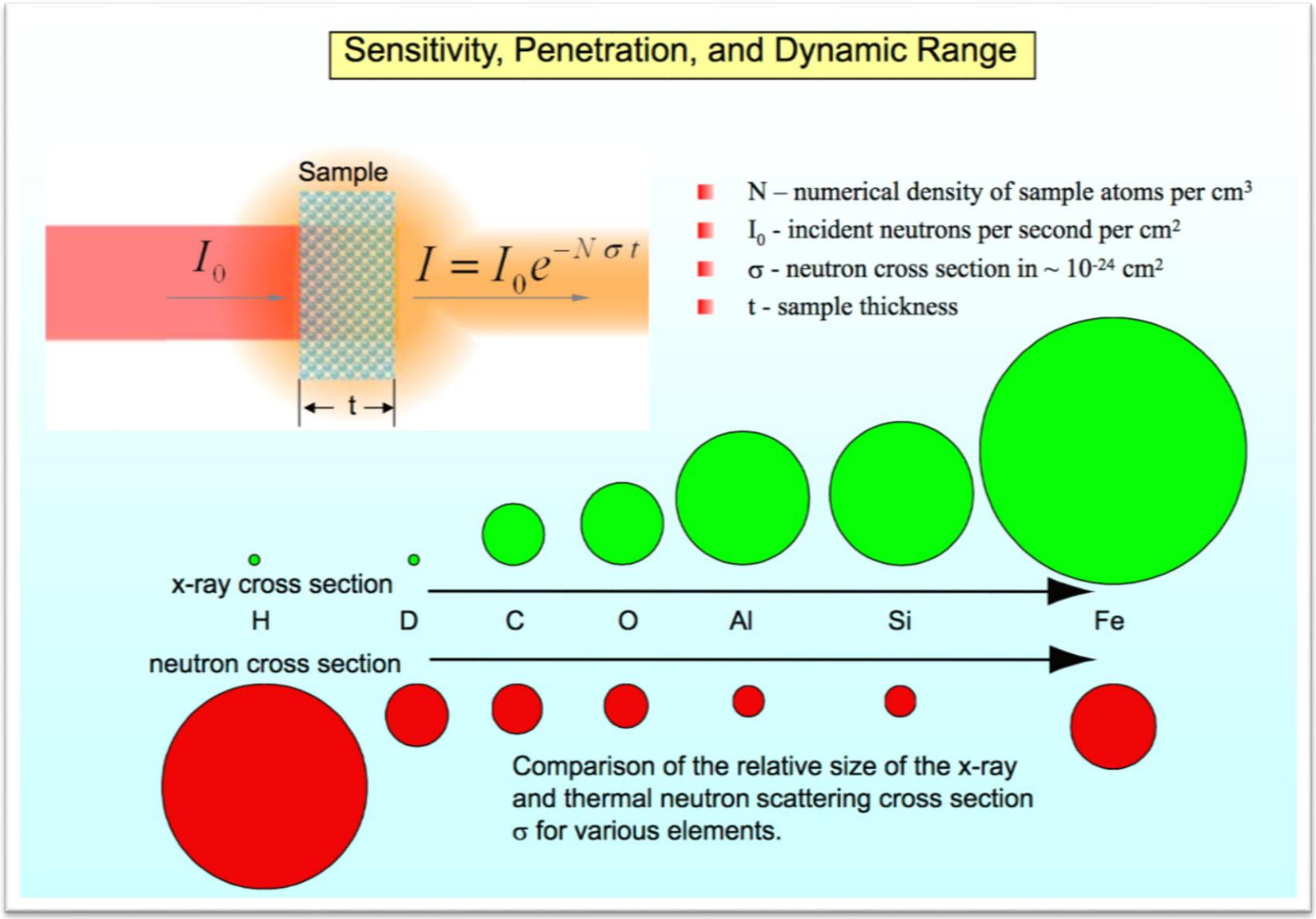
$$\Delta\phi = \frac{\Delta y}{D} = \frac{\lambda}{d}$$

To 0.001 nm

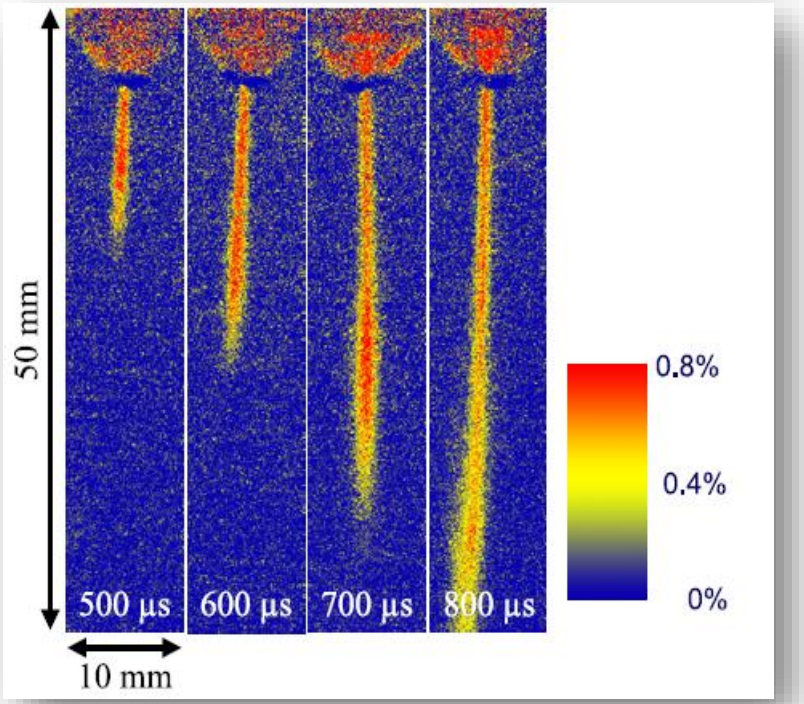


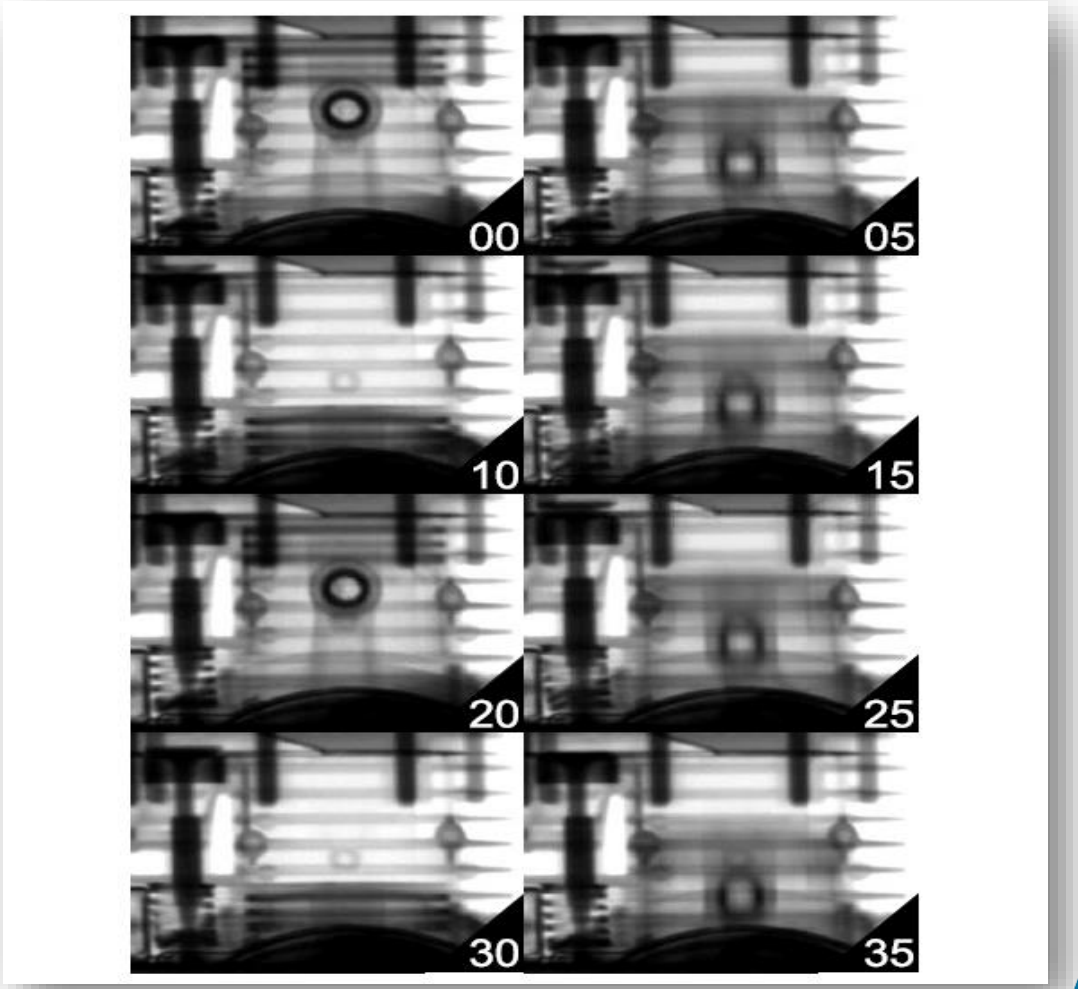
Hot neutrons

Neutrons, A Powerful Probe



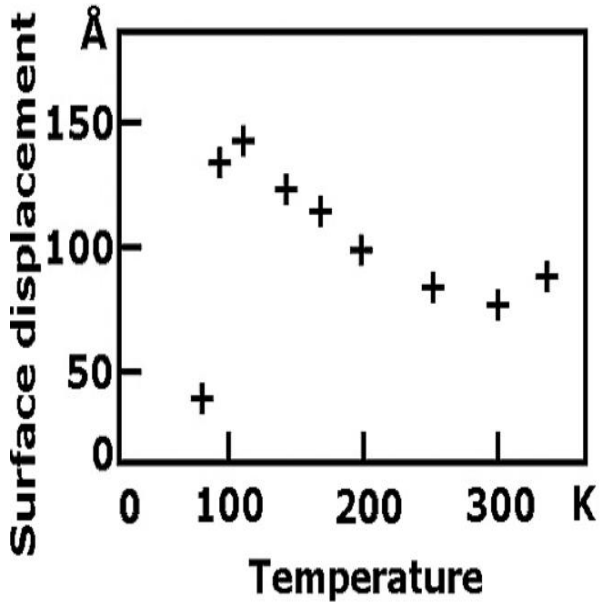
Neutron Tomography and Radiography

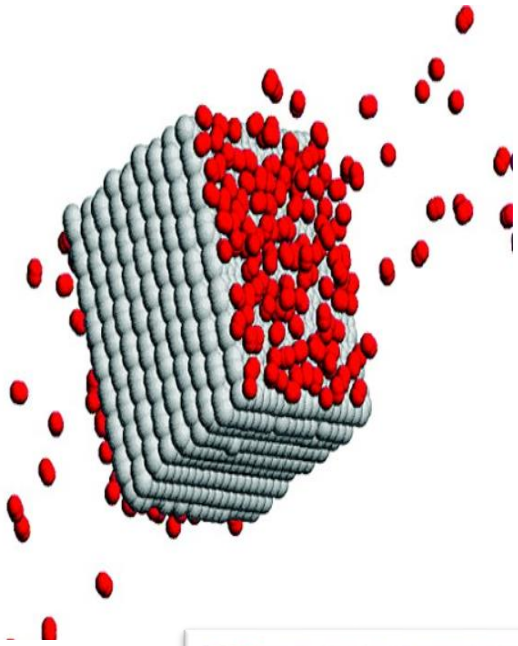




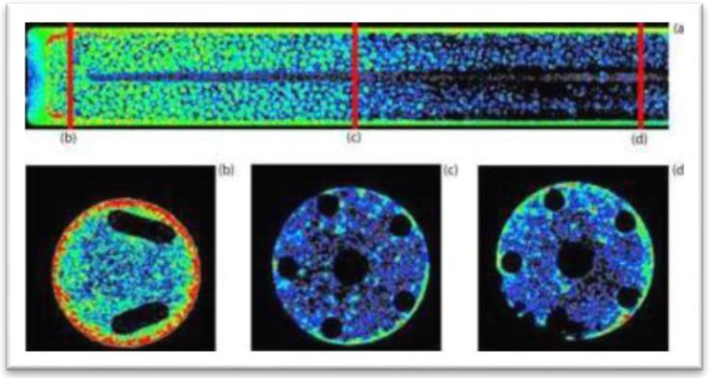
Neutron go through the engine metal parts allowing the visualization of the fuel injection and the flow of lubricant

H_2 Storage In Fuel Cells

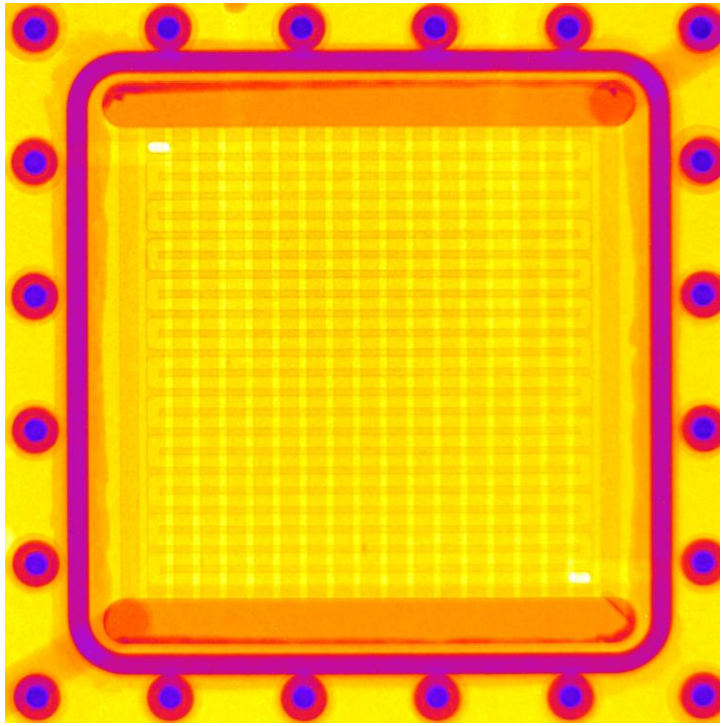




H_2 flow through a membrane



Visualization of H_2 in a fuel cell



Water formation in a H_2 fuel cell

Biology

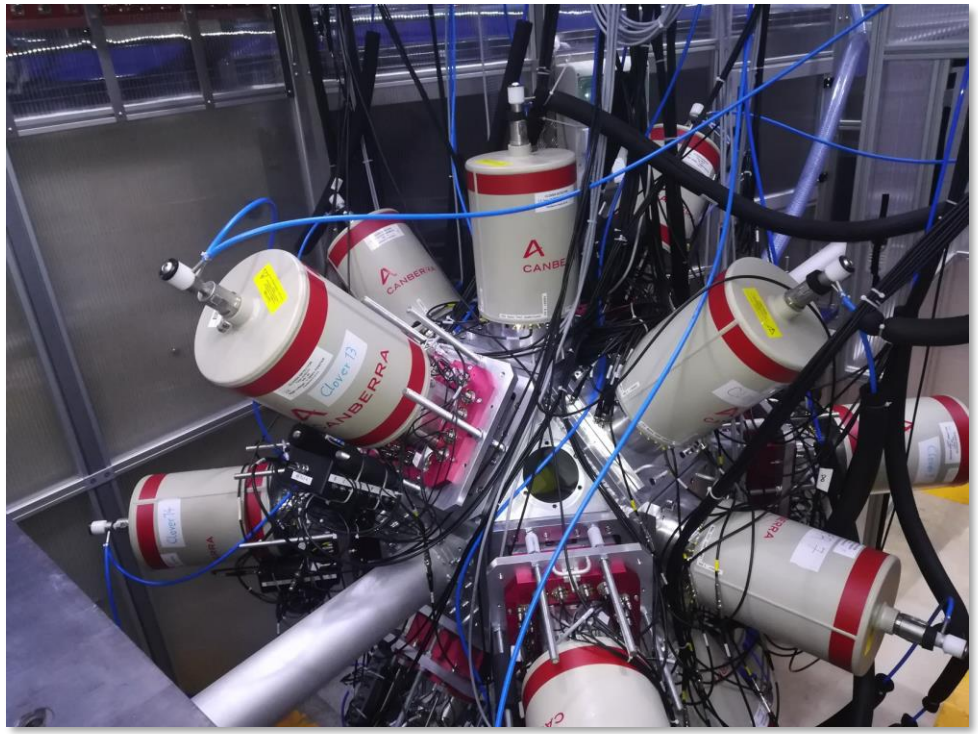
Halomonas is a microorganisms destroying the wreck of the Titanic

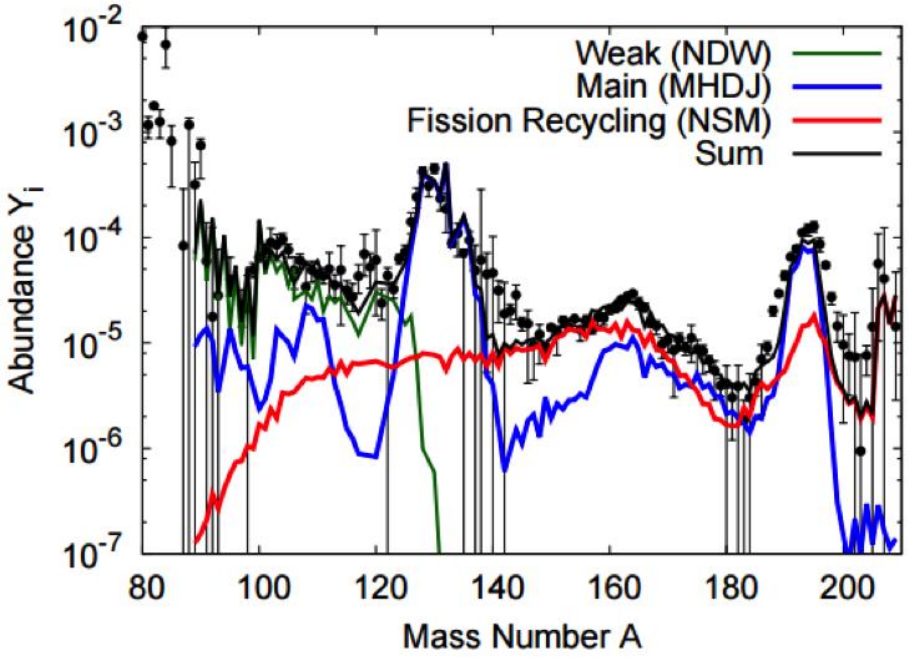
It survives at a depth of ~3800 m

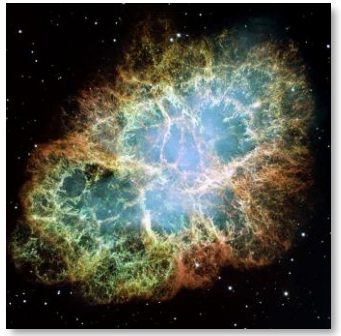
Neutron scattering experiments were designed in order to understand how ectoine permits Halomonas to survive in their extreme environment.

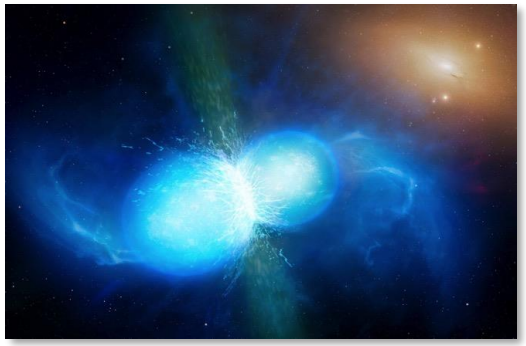
Understanding microbe adaptation to extreme environments remains a challenge of high biotechnological potential in bioremediation and waste management.

NOT ONLY NEUTRONS: FIPPS



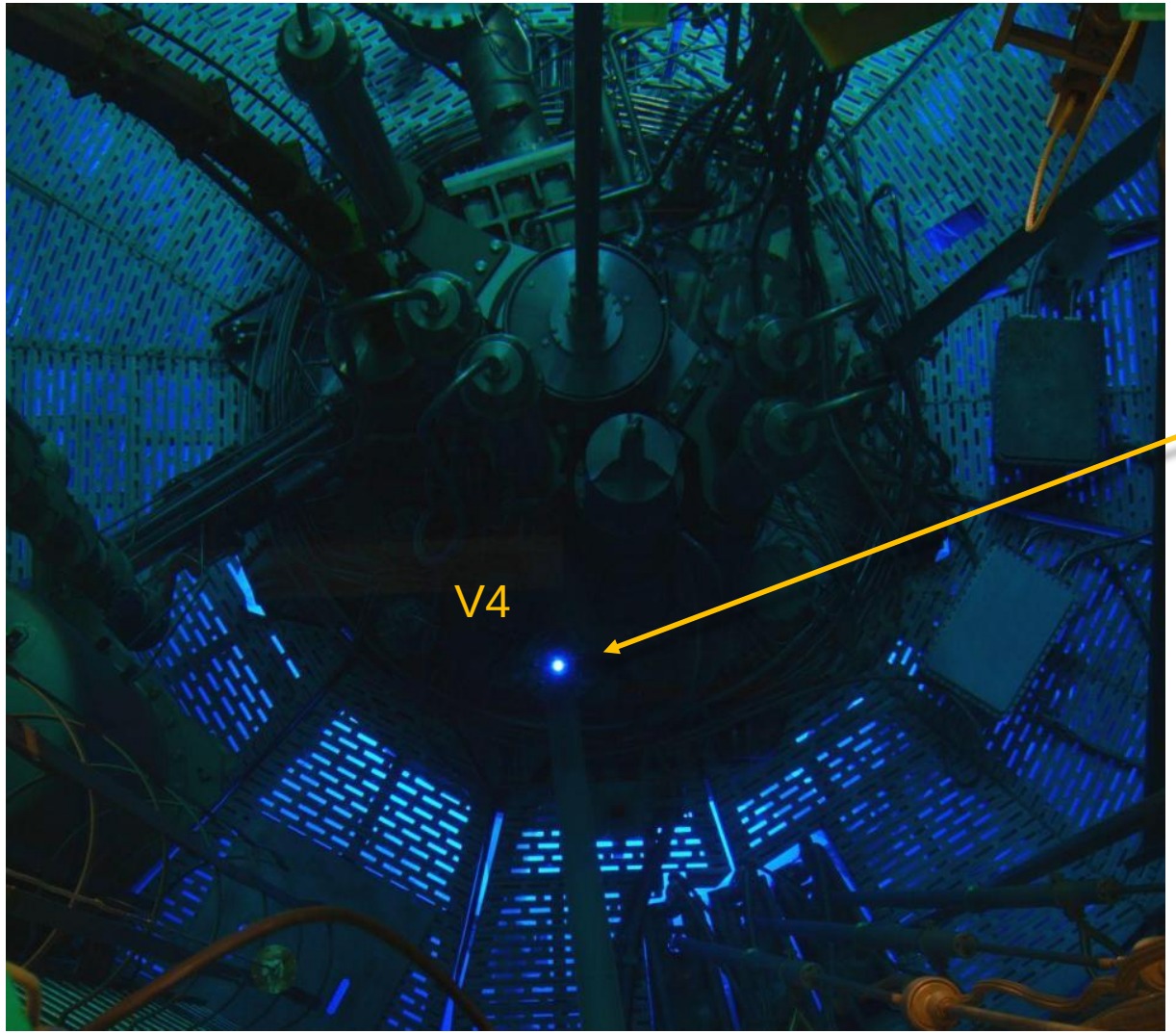






Extract nuclear information useful for the identification of the site of the heavy-elements nucleosyntesis

Radio Isotopes « Made in Grenoble »



The highest neutron flux in Western Europe

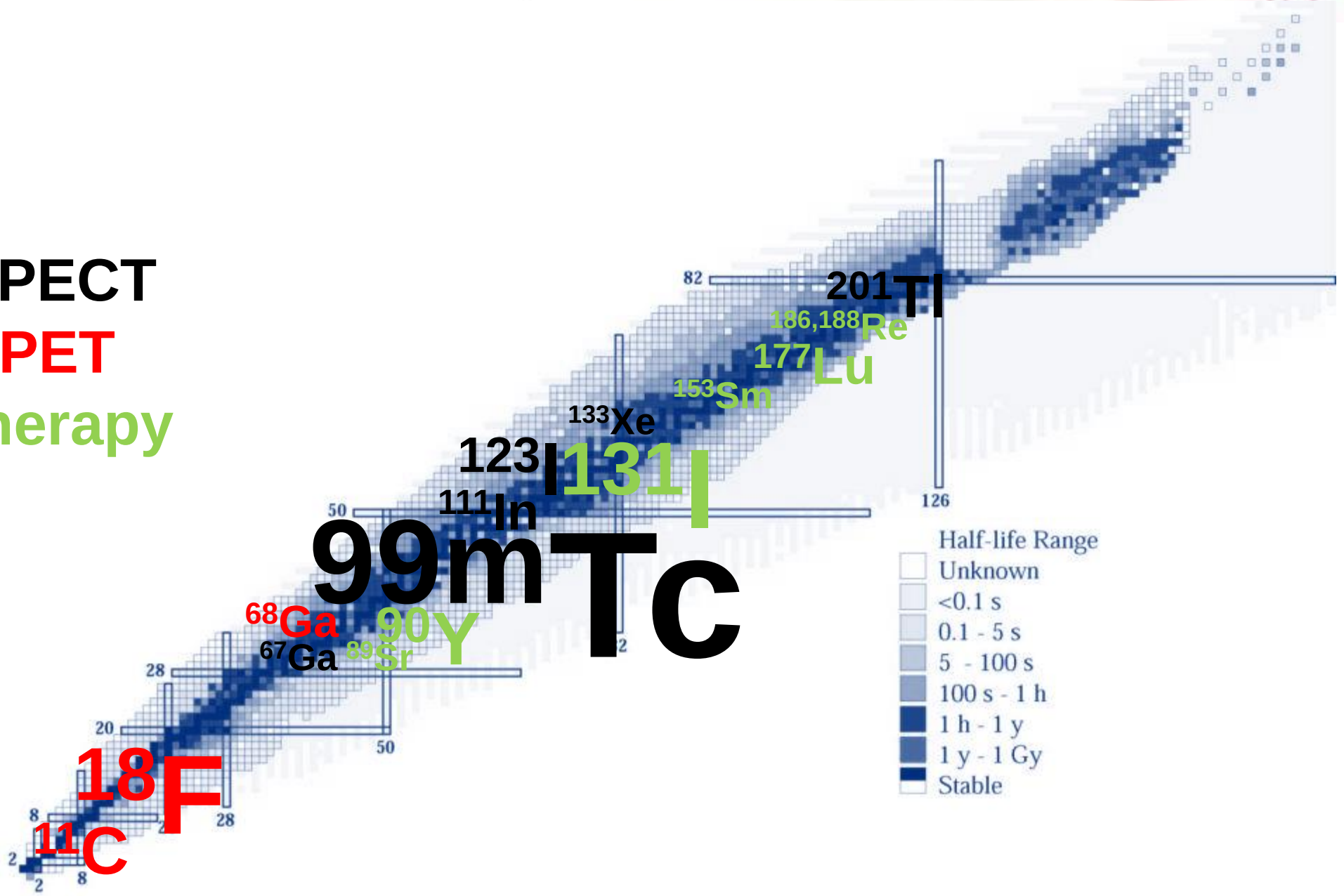
$1.5\ 10^{15}$ n cm^{-2} s^{-1}

Chart Of Nuclides – Nuclear Medicine Perspective

SPECT

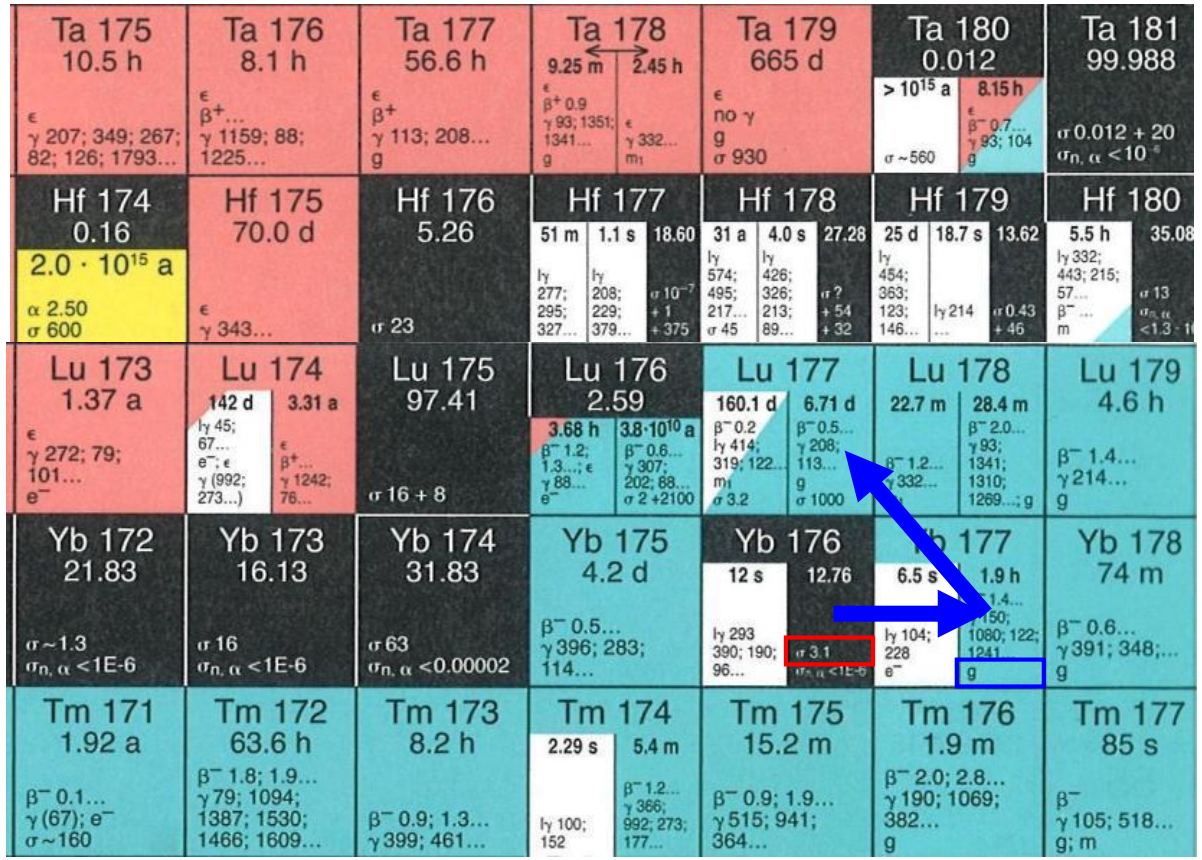
PET

Therapy



NEUTRONS FOR SOCIETY

^{177}Lu the "clean" way



- n-capture on ^{176}Yb followed by β-decay
- Free from long-lived isomers

Requires high flux reactor and advanced radiochemistry

We are looking forward to welcoming you