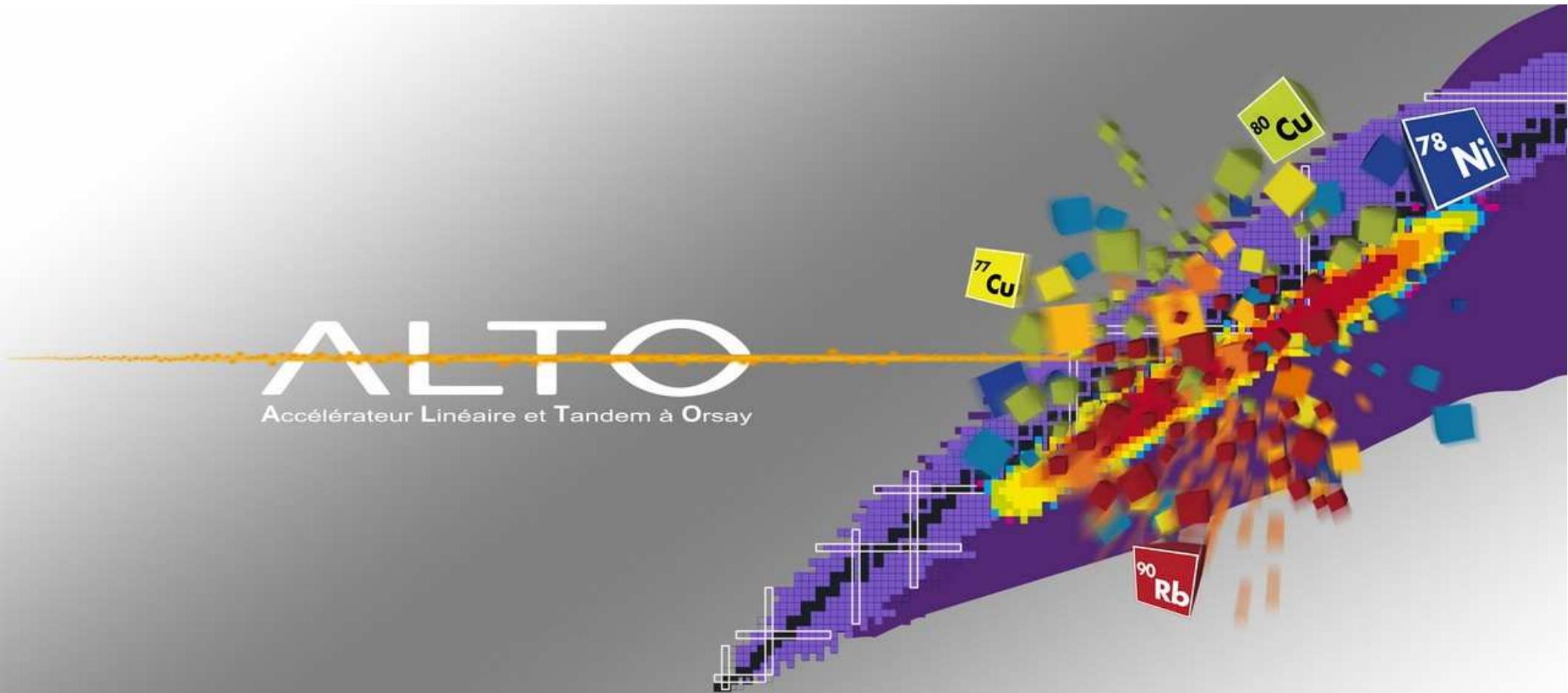


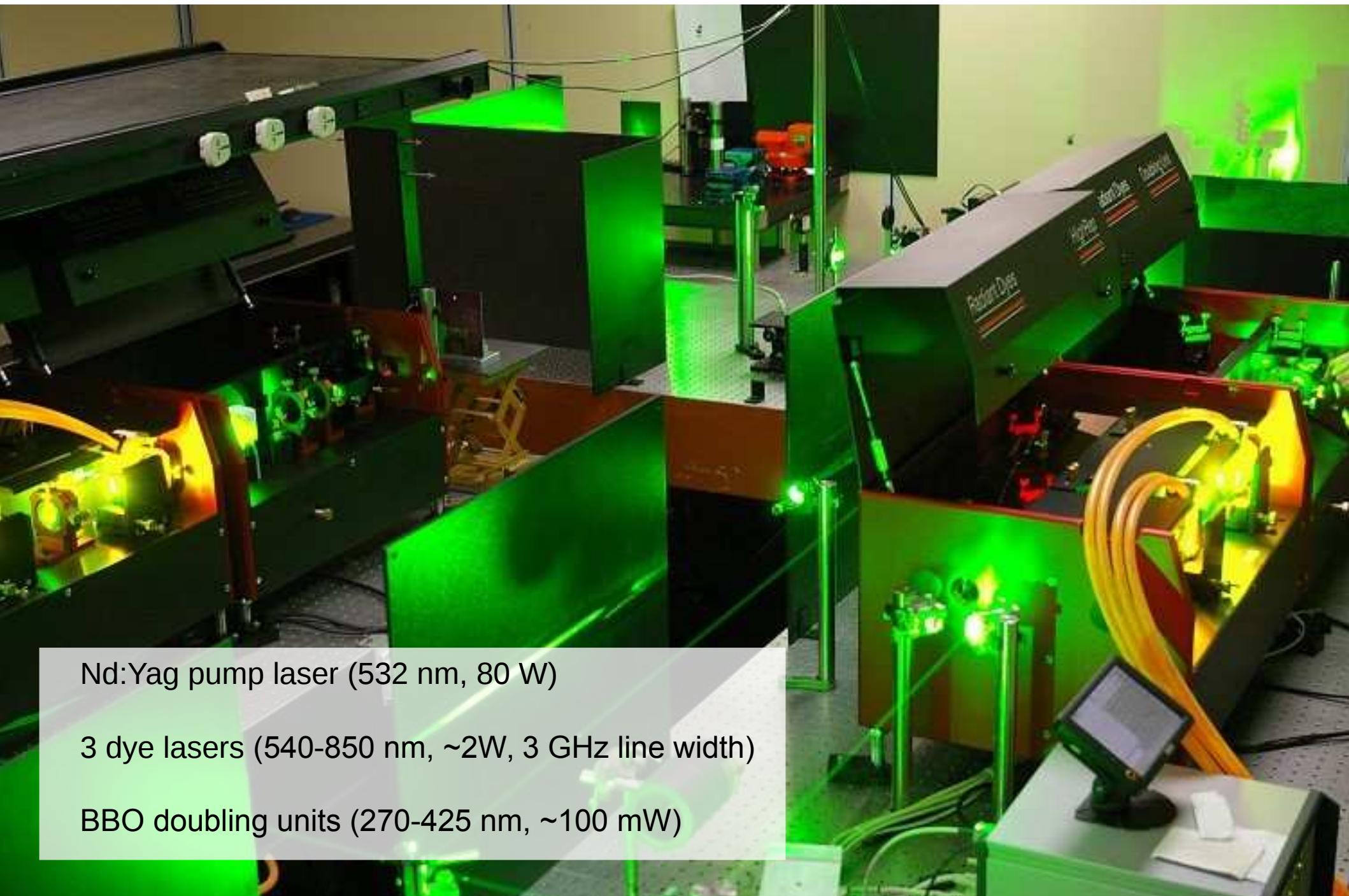
(I) Alto laser ion source

(II) Status of Reglis

Serge Franchoo
IPN Orsay



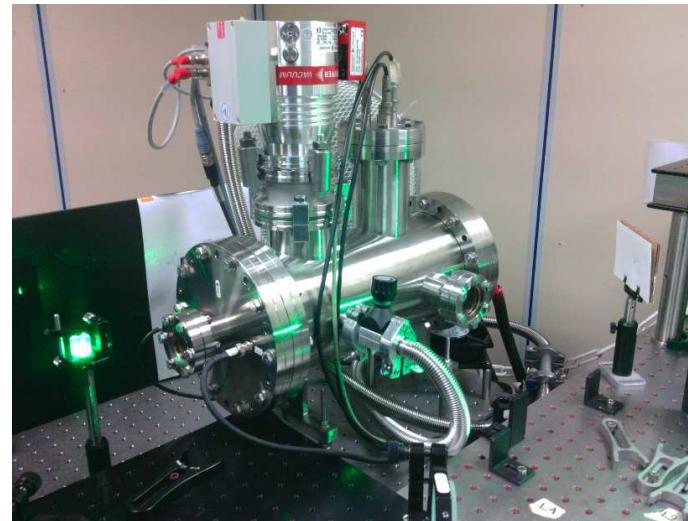
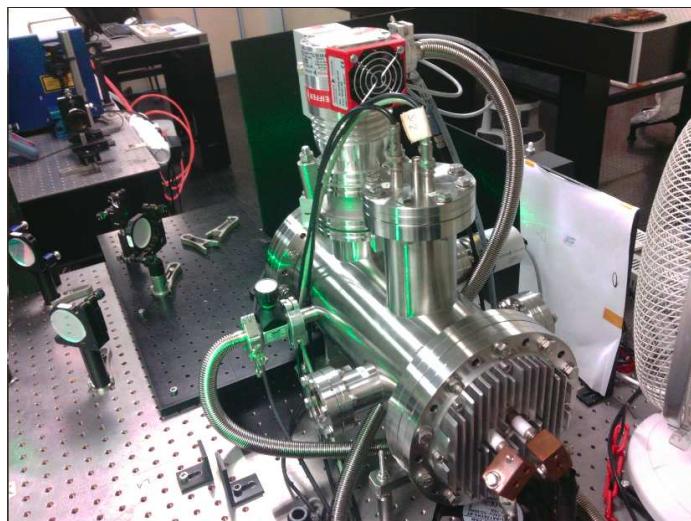
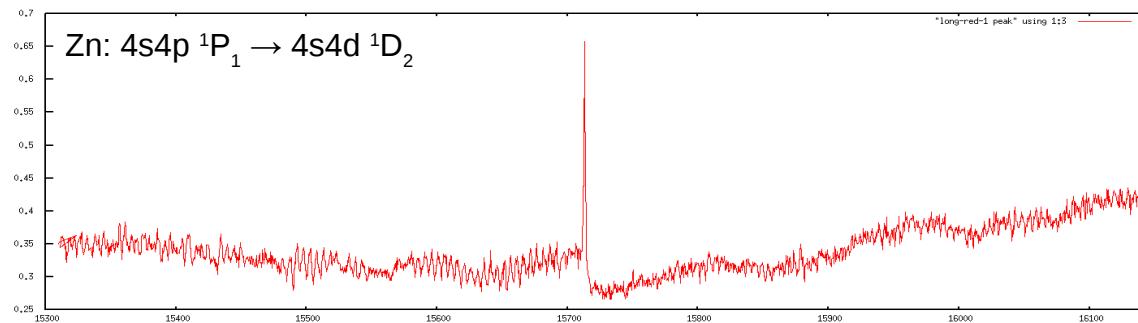
Rialto: Resonant laser ionisation at Alto (1/4)



Rialto: Resonant laser ionisation at Alto (2/4)

Status

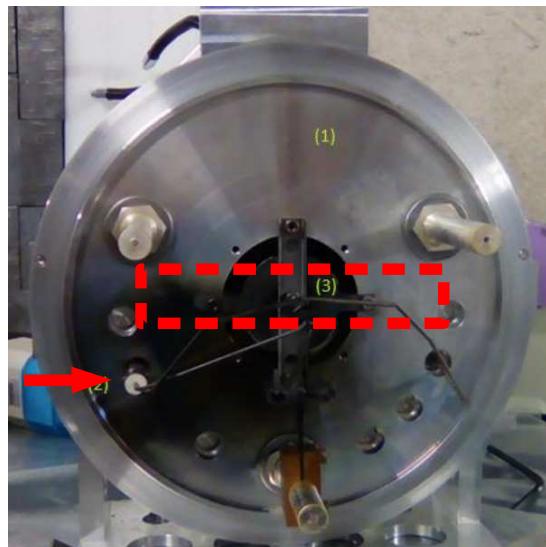
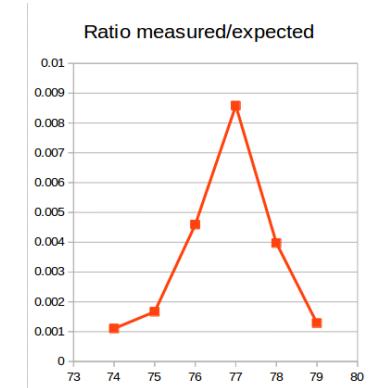
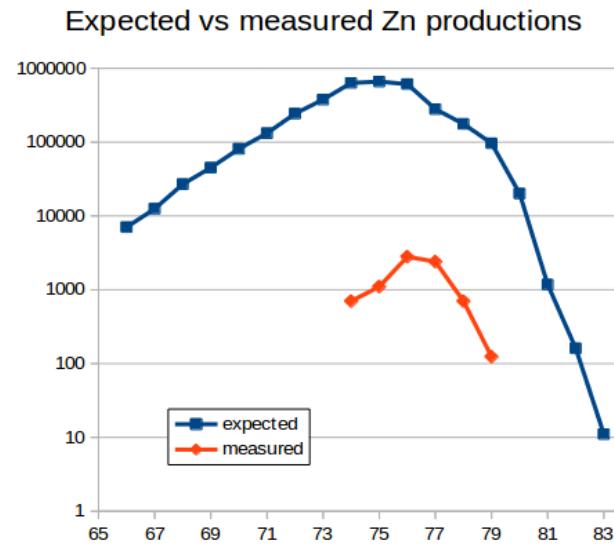
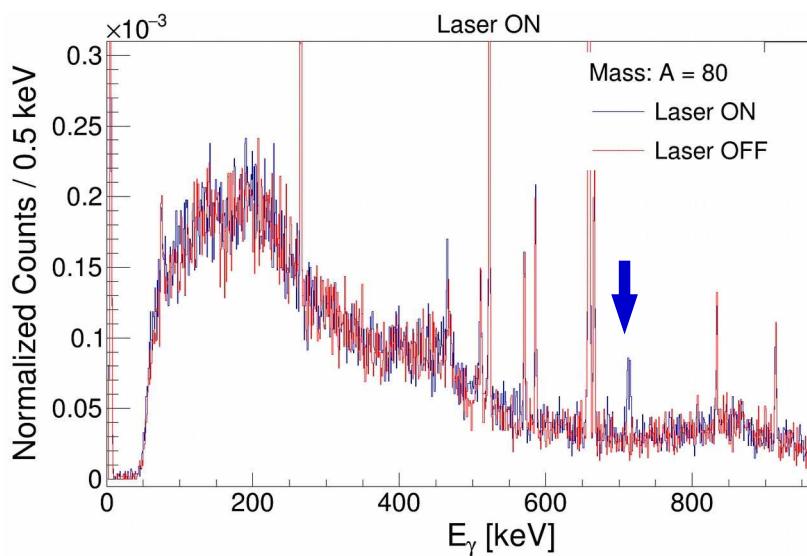
- ionised Ga, Zn (UV THG), Sn (3 resonant steps), In (mixture of 2 dyes to cover both Sn and In with same setup)
- built off-line chamber with automated wavelength scan (JGU Mainz)



Enrique Minaya, Liss Vazquez, Deyan Yordanov
Ruohong Li

Rialto: Resonant laser ionisation at Alto (3/4)

Zn productions June 2015



- **efficiency** compromised by uncontrolled release of tracers (indirect heating)
- develop oven with independent heating

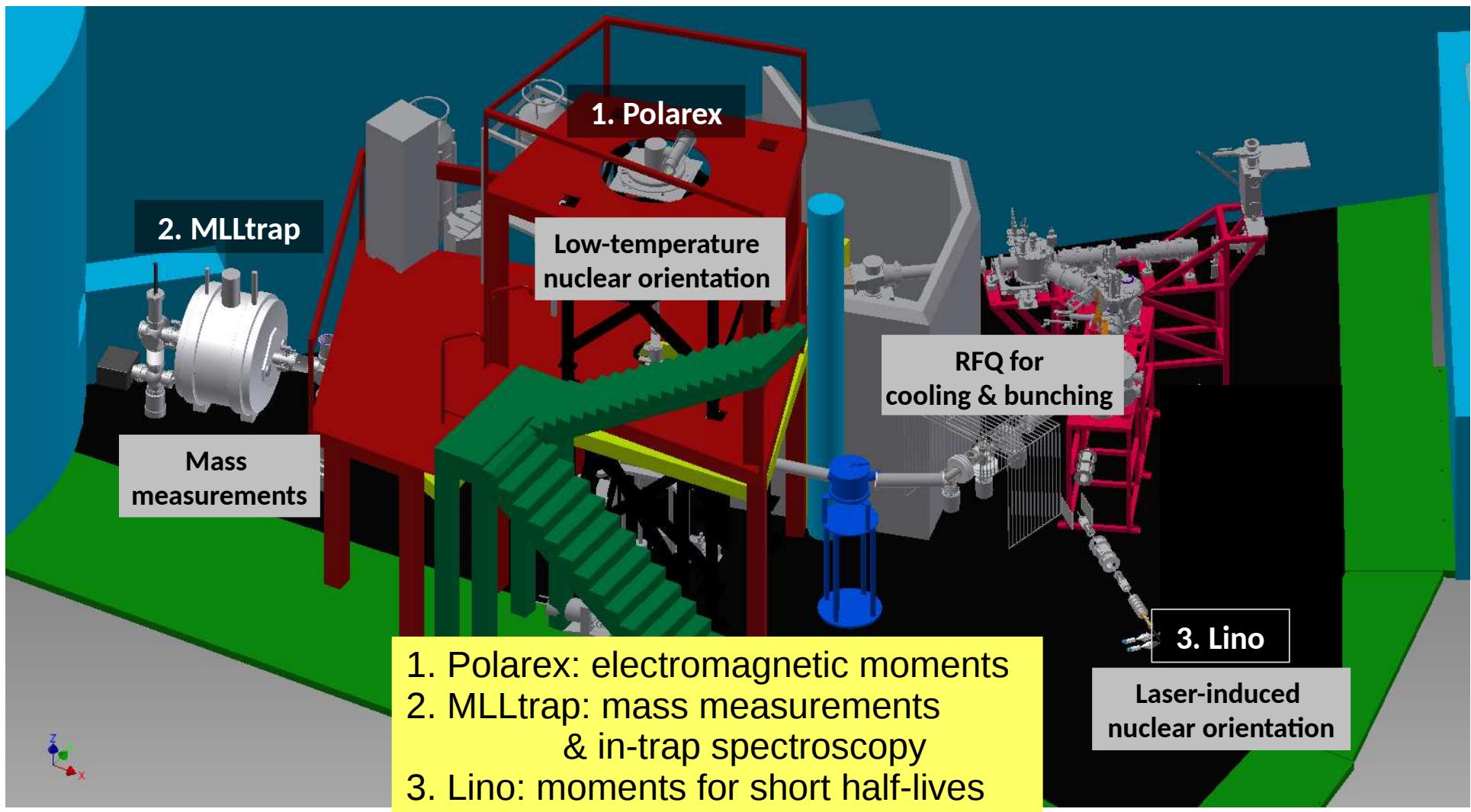
Management

- share beamline with splitpole
- limited manpower for ion sources
- time-intensive service to community

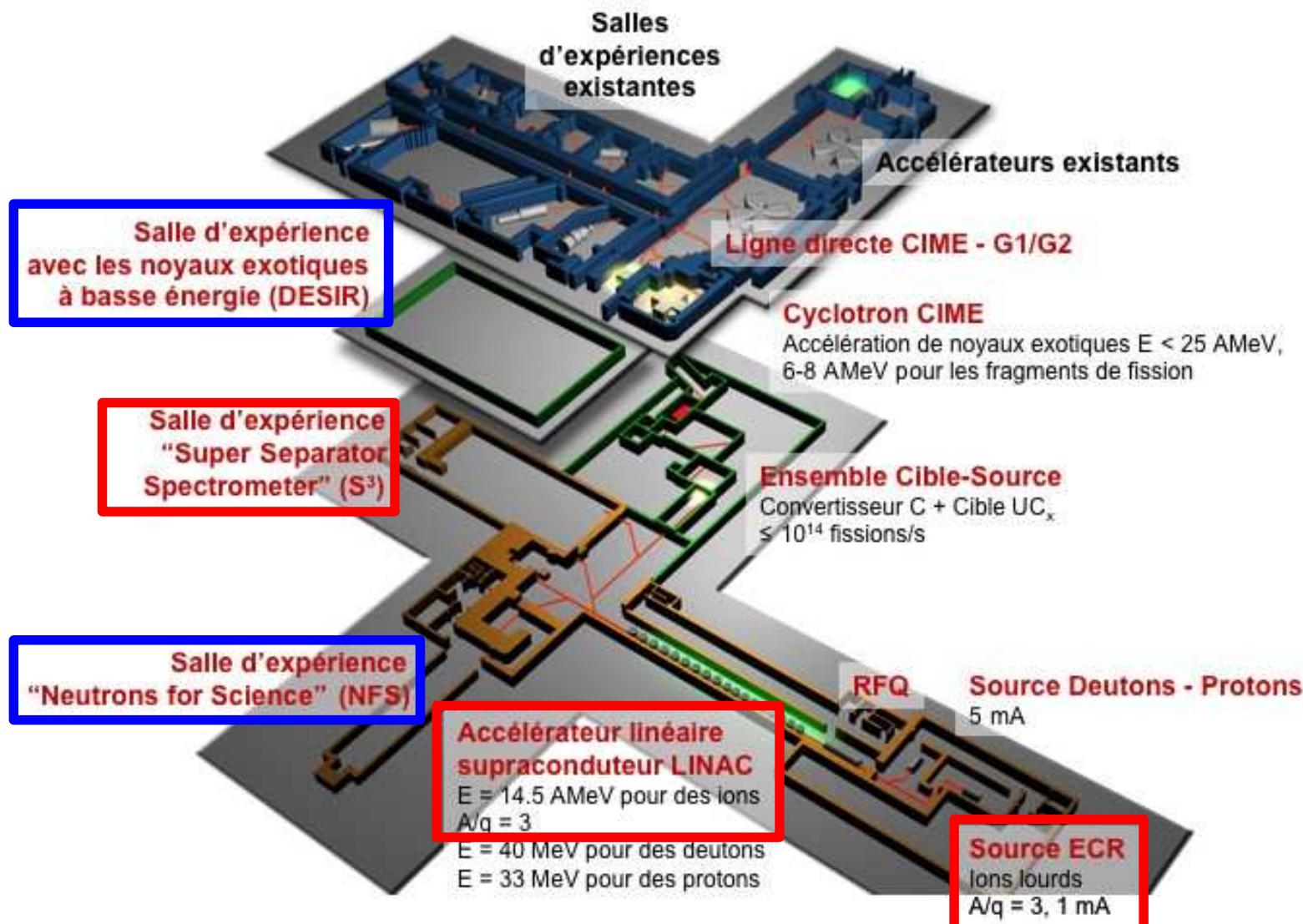
Rialto: Resonant laser ionisation at Alto (4/4)

Terra incognita

installation of new experiments at Alto: Polarex, MLLtrap, Lino
P2IO "Projets emblématiques" grant from **university Paris-Saclay**



Spiral-2: a linear particle accelerator project for the study of fundamental nuclear physics and multidisciplinary research



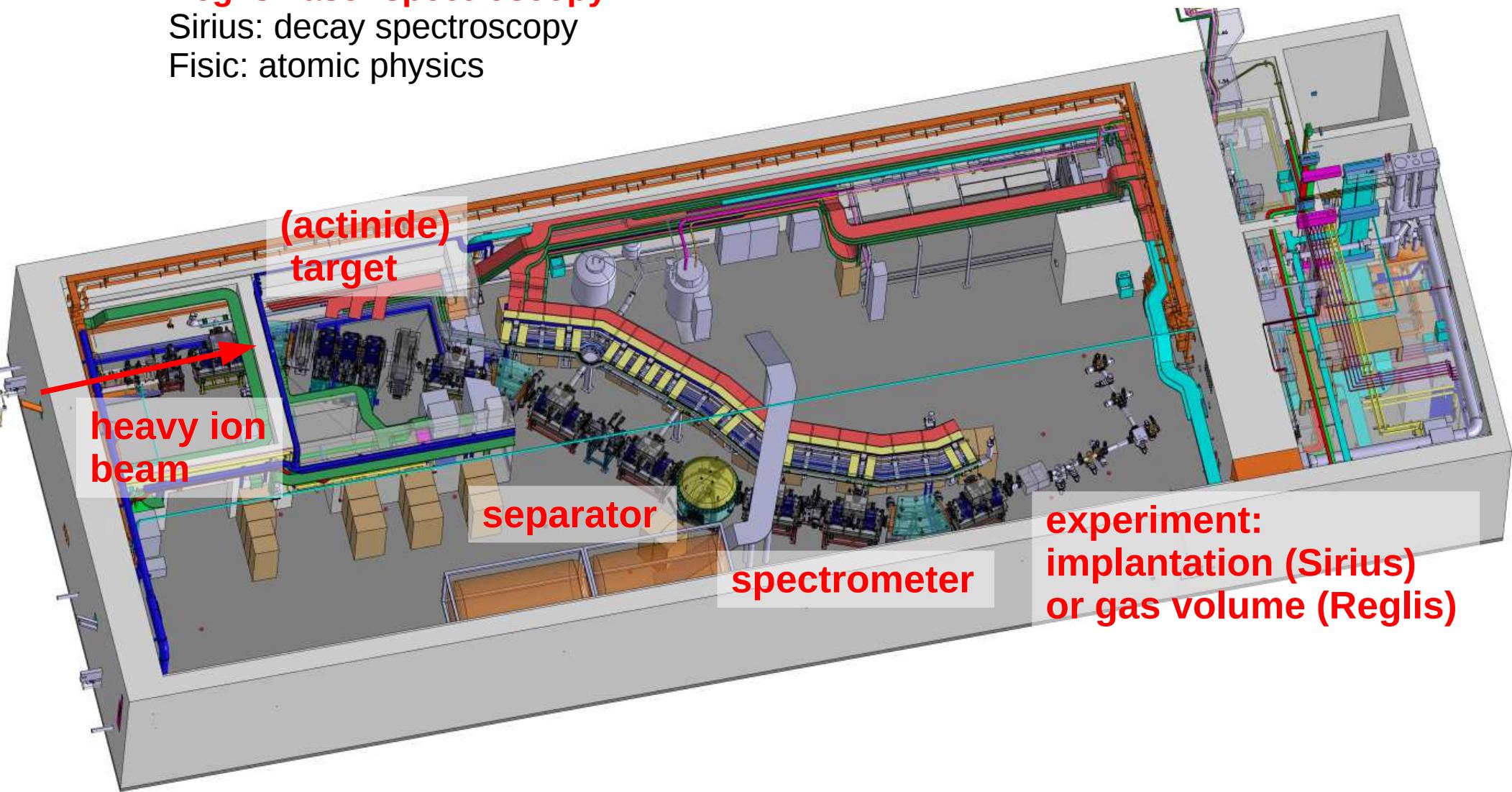
S³: Super separator spectrometer for radioactive beams at low intensity

Reaction products with weak cross sections including transfermiums ($Z>100$)

Reglis: laser spectroscopy

Sirius: decay spectroscopy

Fisic: atomic physics



Physics case (2012)

- LoI_Day1_5 : **VHE ($Z \sim 89 - 102$)**

Validate nuclear and atomic theory

- LoI_Day1_4 : $^{107-101}\text{Sn}$

Test validity of shell-model predictions

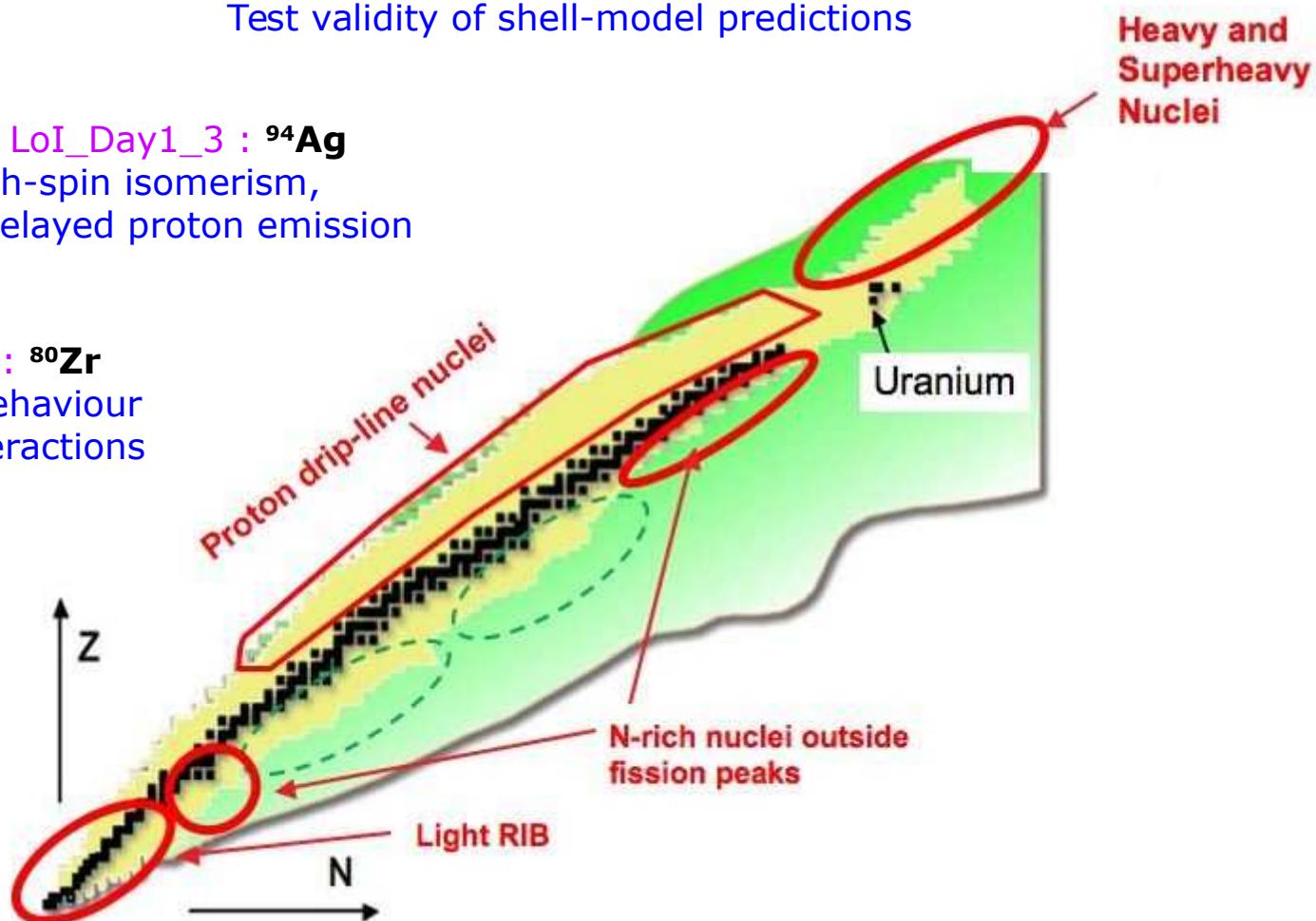
- LoI_Day1_3 : ^{94}Ag

High-spin isomerism,
 β -delayed proton emission

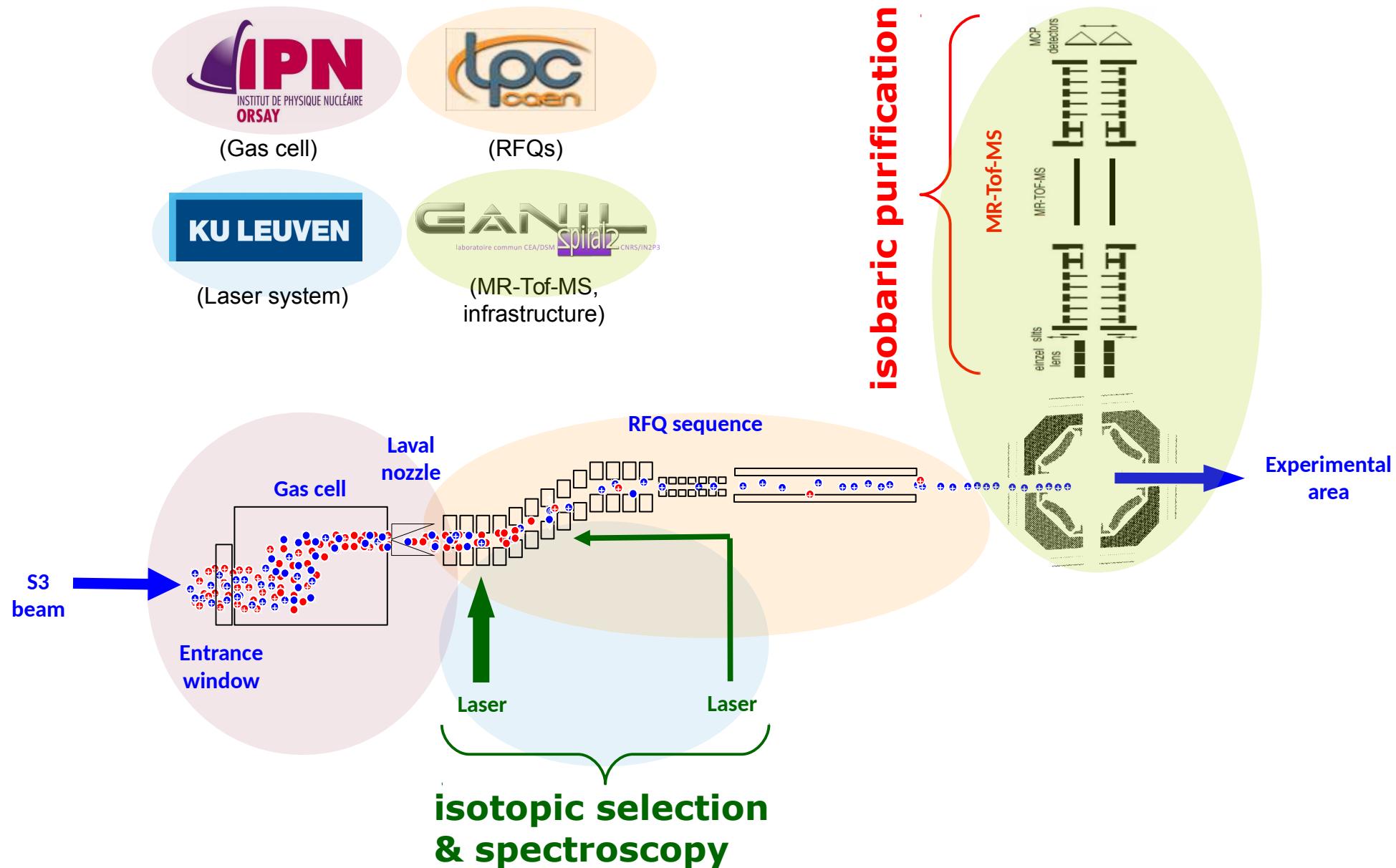
- LoI_Day1_18 : ^{80}Zr

Single-particle behaviour
and effective interactions

(...)



Reglis: Radioactive element intragass laser ion source and spectroscopy (4/10)



Reglis: Radioactive element intragass laser ion source and spectroscopy (5/10)

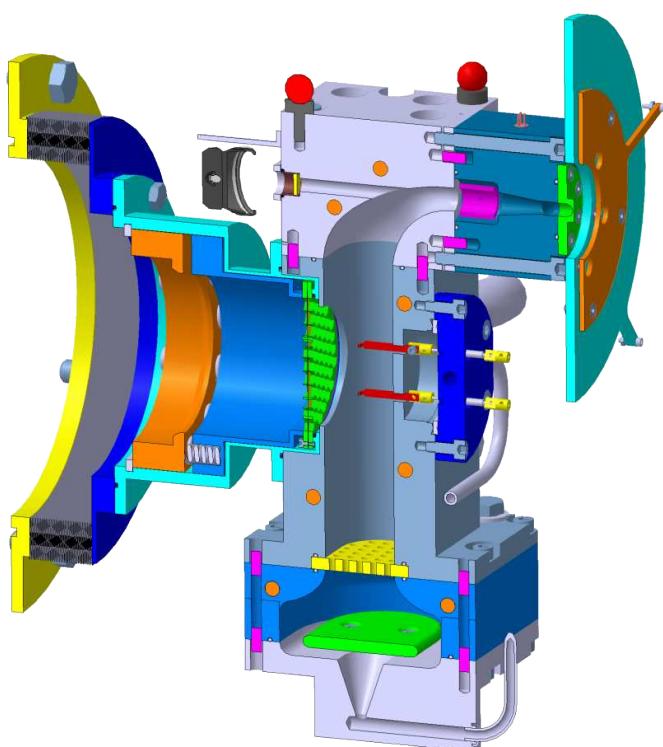
ANR funding 1.2014-12.2017

detector development & construction: IPN (gas cell), LPC (RFQ)

infrastructure & operation: Ganil

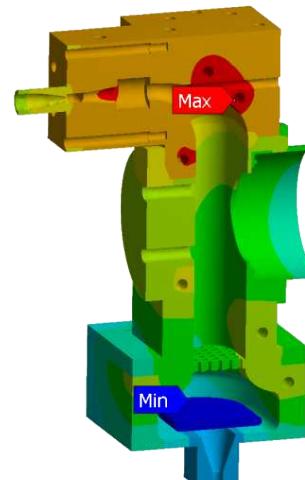
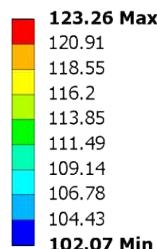
know-how: Leuven

1. Gas-cell design



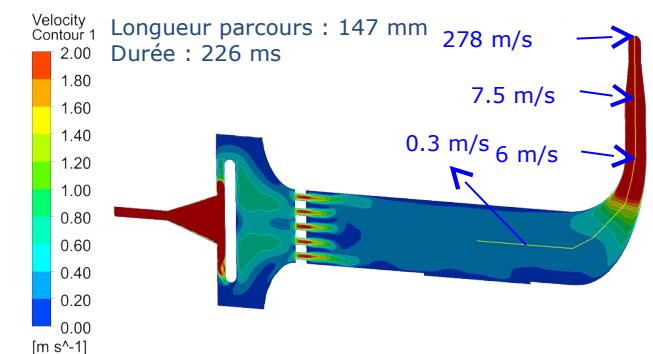
heating at 100°C

F: Transient Thermal
Temperature
Type: Temperature
Unit: °C
Time: 12000
10/12/2015 11:56



flow for 2 mm exit hole

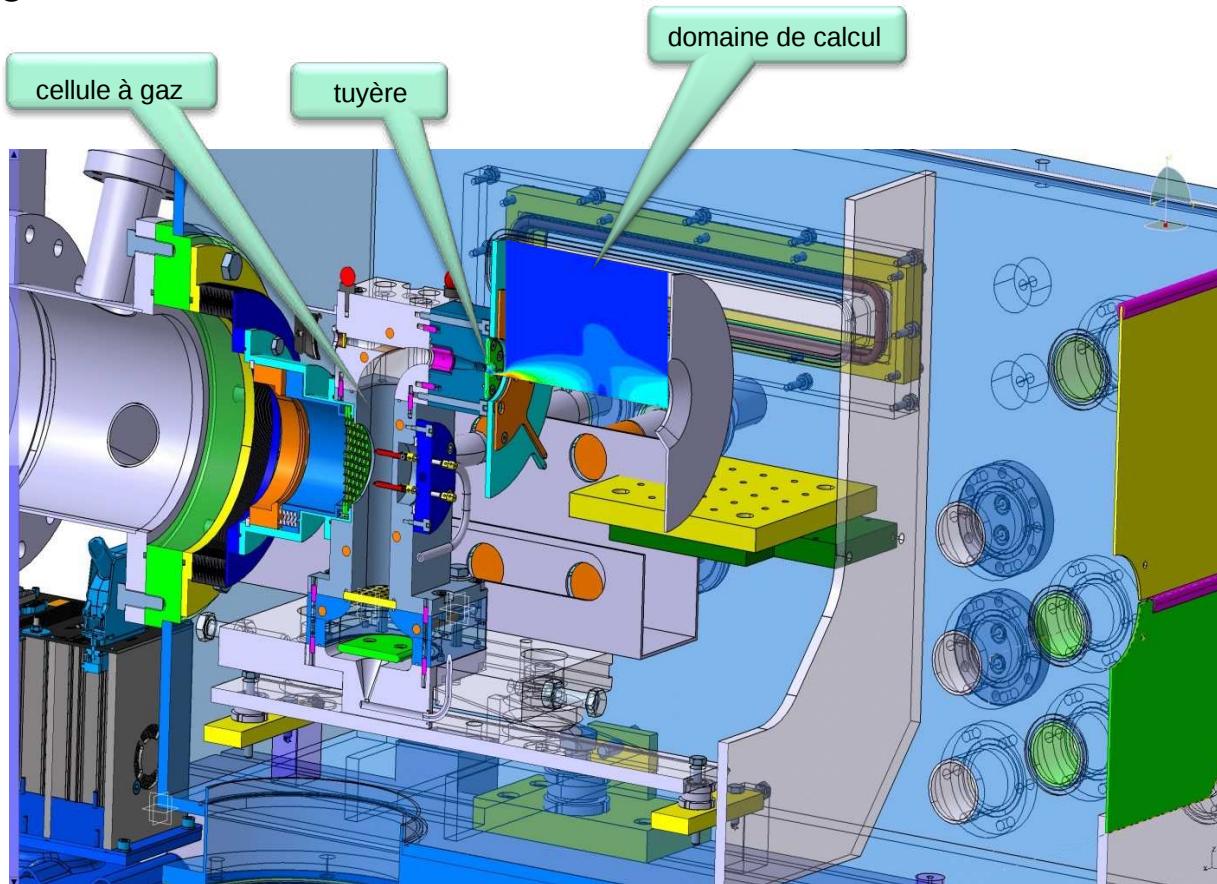
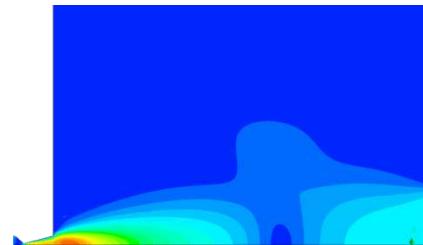
Durée de parcours des particules depuis le centre de la fenêtre à vide :



Philippe Dambre
Patricia Duchesne
Olivier Pochon

2. Gas-flow simulations

- CFD Fluent
- axial symmetry
- compressible
- transient (unsteady)
- Laval nozzle



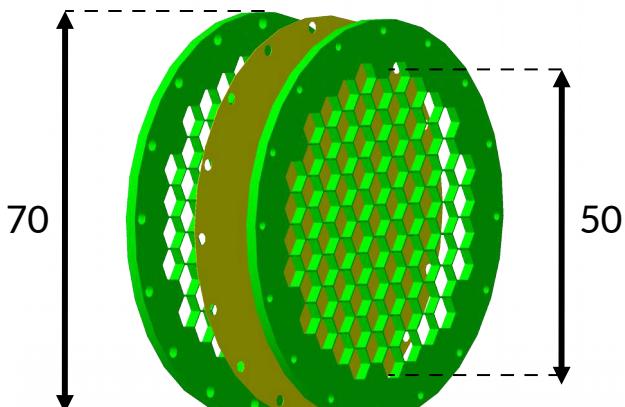
François Launay

Reglis: Radioactive element intragass laser ion source and spectroscopy (7/10)

3. Entrance window

$^{116}\text{Sn}(\text{Ar}, 4n)^{152}\text{Er}$: 0.25 MeV/u, **3-4 μm Ti**
 $^{58}\text{Ni}(\text{Cr}, x)^{100}\text{Sn}$: 0.83 MeV/u, **5-6 μm Ti**
 $^{208}\text{Pb}(\text{Ca}, 2n)^{254}\text{No}$: 0.14 MeV/u, **2-3 μm Ti**

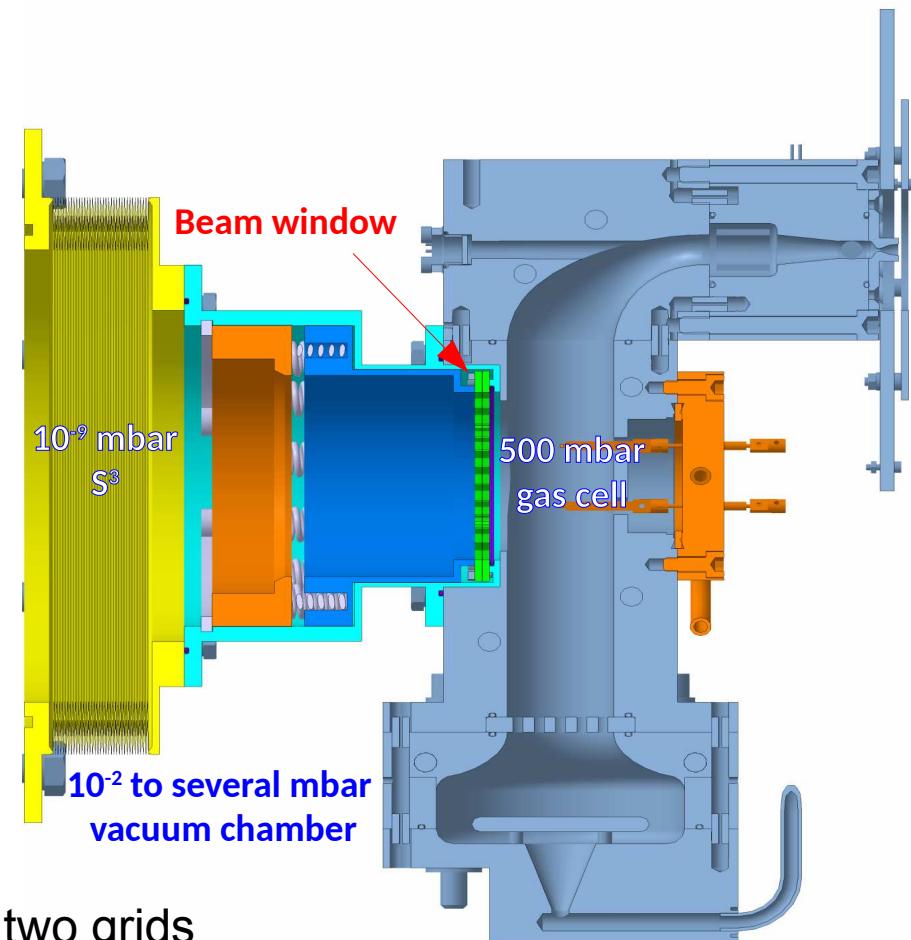
} metallic films (Ti, havar) may show pinholes
plastic films (mylar, kapton) are permeable



- independent window assembly
- grid to support $\Delta P = 1 \text{ bar}$
- mesh with at least 85% transmission
- sealing by compression of thin film between two grids

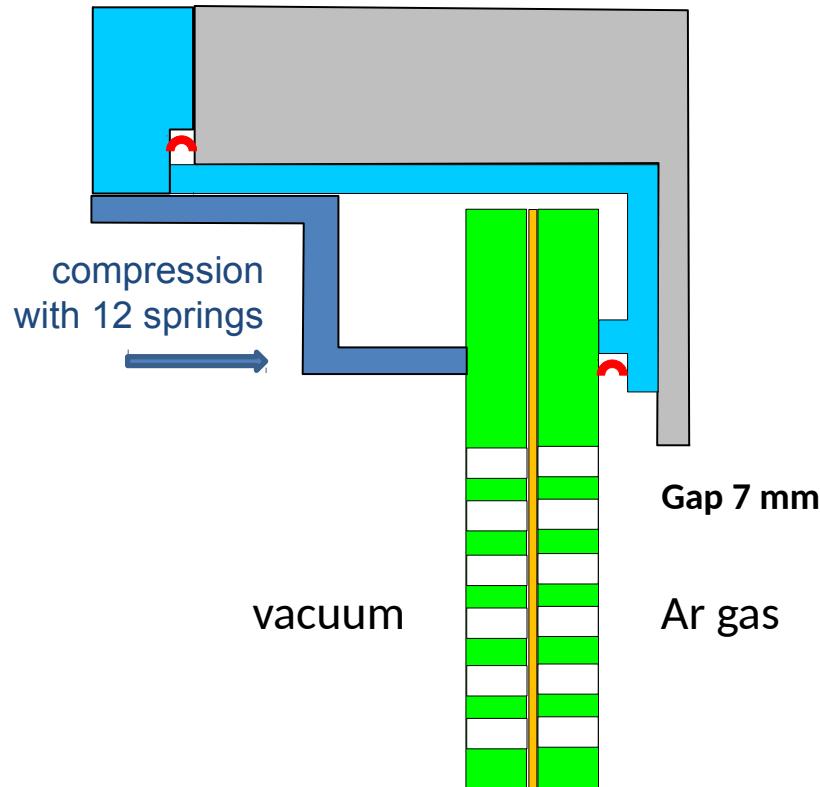
• leak test with 3.5 μm mylar:
thin film pressed against grid without bursting

leak around the film, sealing required between film and grid

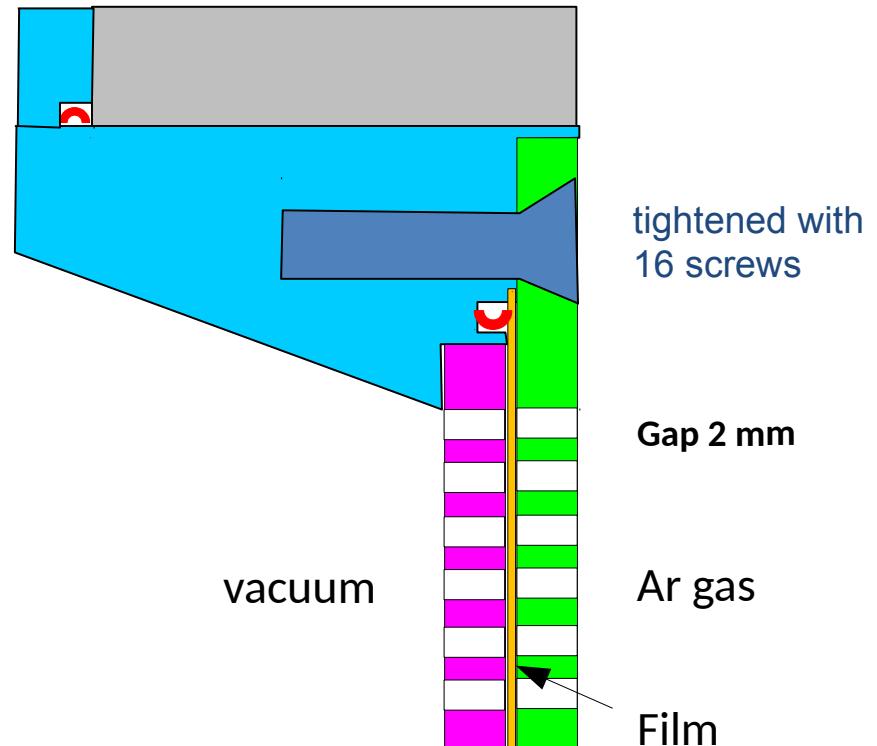


Lucia Caceres
Patricia Duchesne
Enrique Minaya

Initial design



New design



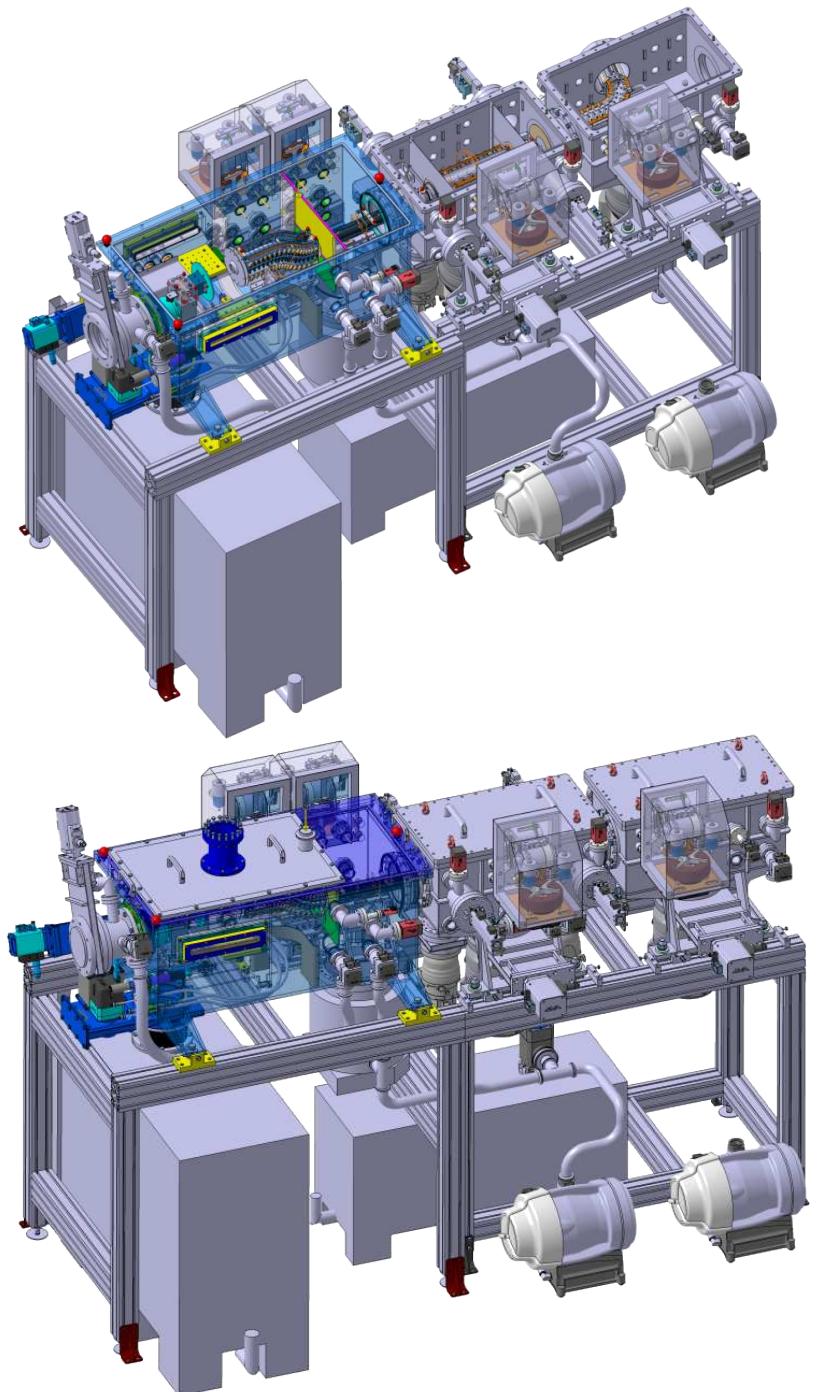
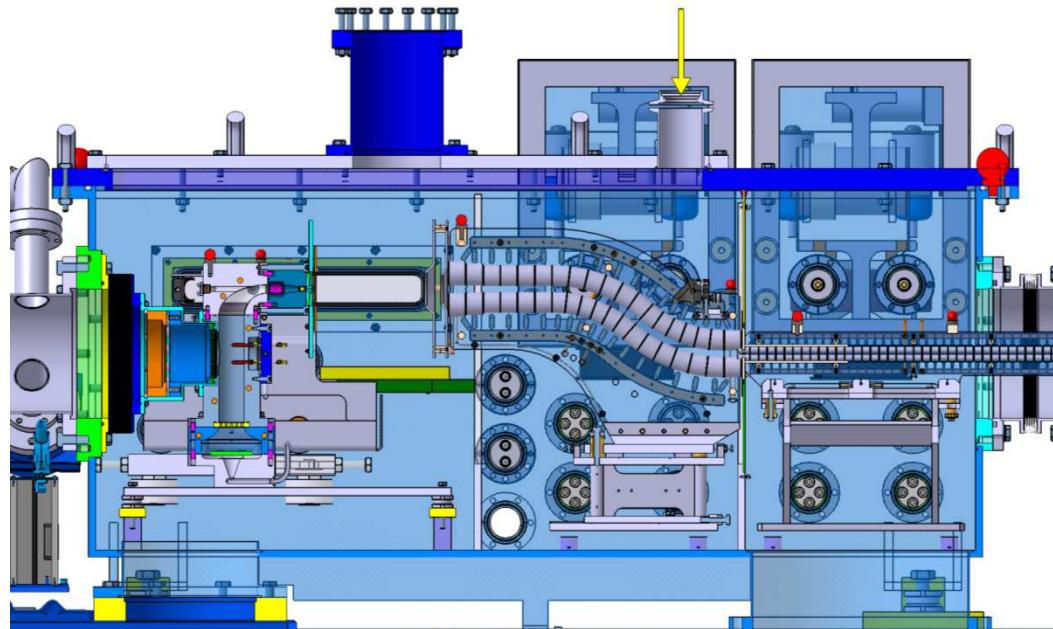
- 1st grid (pink - Ø 55 mm) in shoulder of flange (blue)
- **metallic o-ring in a groove of the flange and in contact with the thin film**
- compression of the o-ring by screwing the 2nd grid (green - Ø 70 mm)
- gap towards inner volume reduced to 2 mm
- 2nd grid could be replaced by a simple ring?
- thinner 1st grid with ring to compensate for the shoulder?

4. Chambers and pumping

pumps: purchase made, awaiting delivery

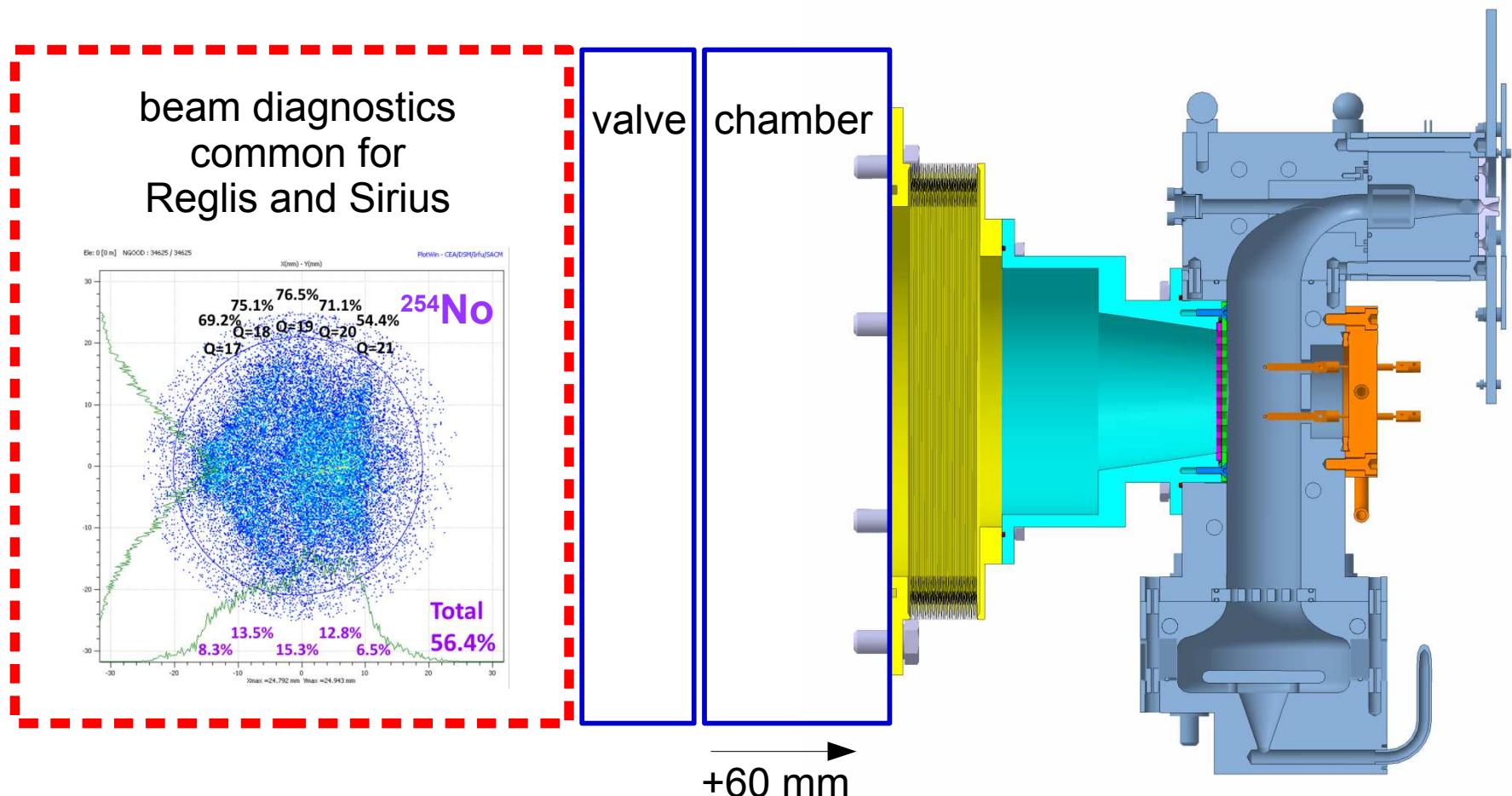
chamber: tender soon

test bench at LPC in 2017



5. Interface with S³

optics, transmission, beam diagnostics...



Lucia Caceres
Patricia Duchesne
Emil Traykov

6. RFQs: E Traykov

7. Command and control: (LPC)

8. Laser system: C Granados & N Lecesne

9. Multireflection time-of-flight mass spectrometry: (Ganil)

Budget & management

- no prolongation of ANR to make possible new requests?
- transition of ANR Reglis to MOU S3LEB
- **manpower needed for test bench at LPC during 2017**
- **installation of laser system at Ganil**
- **entrance window to be solved at IPN**
- **next: gas inlet & exhaust, command & control**
- **Reglis advancing on schedule**



Reglis: Radioactive elements intragas laser ion source and spectroscopy at S³

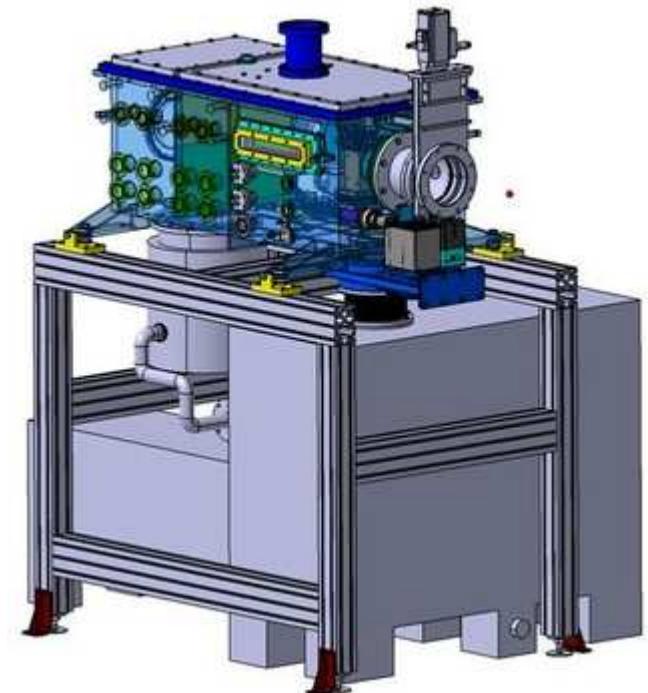
Budget & management

- gas cell: 15 kE
- chamber: 10 kE
- window & foils: 10 kE
- gas input & purifier: 30 kE
- pumping: 155 kE
- contribution to C&C: 10 kE

no prolongation of ANR to make possible new requests?

transition of ANR Reglis to MOU S3LEB

- modus operandi
- duration





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Carl Gustaf Patrik de Laval, (born May 9, 1845, Blasenborg, Swed.—died Feb. 2, 1913, [Stockholm](#)) Swedish scientist, engineer, and inventor who pioneered in the development of high-speed [turbines](#).

After 1872 he was an engineer with the Klosters-Bruck Steel Works. In 1878 he invented the centrifugal [cream separator](#), and later he applied the principle of rotation to the manufacture of glass bottles.

Laval built his first impulse [steam turbine](#) in 1882. Further advances followed, and in 1893 he built and operated a reversible [turbine](#) for marine use. A Laval reaction turbine (patented in 1883) attained a speed of 42,000 revolutions per minute. He continued ... (100 of 178 words)