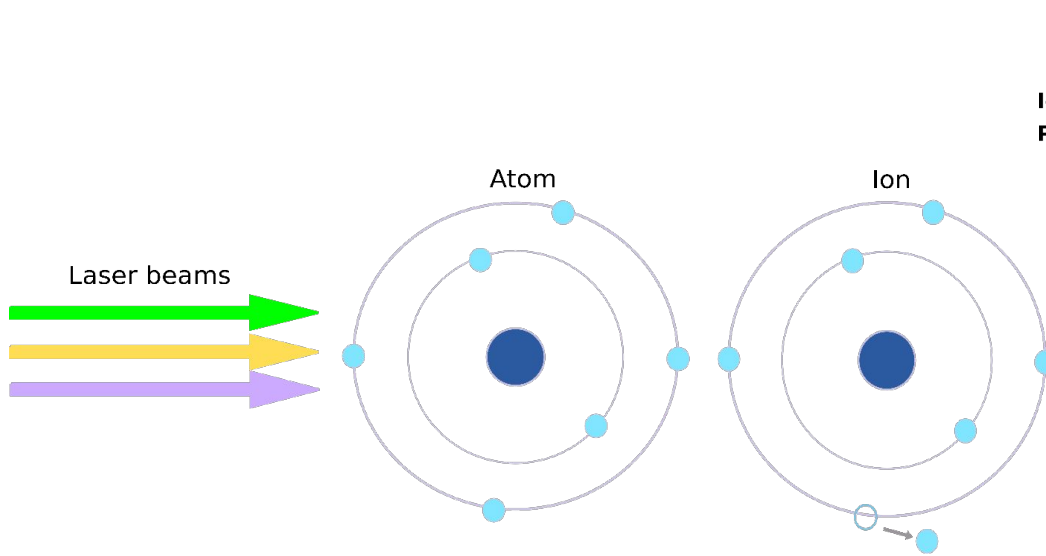


Laser ionized beams at ALTO

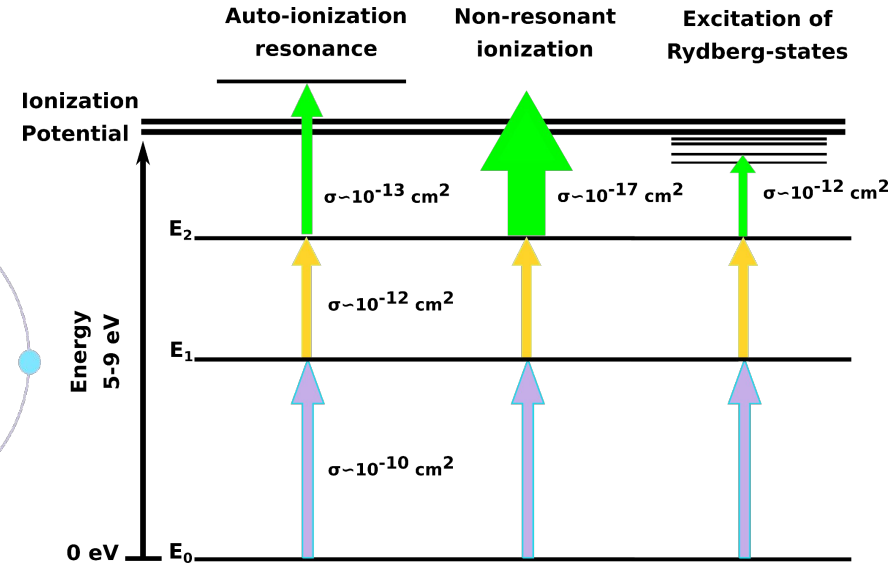
Anahi Segovia Miranda

Journées annuelles 2025 du GDR SCIPAC et du Réseau
Instrumentation Faisceau.
16/12/2025

Laser resonance ionization



Optical atomic excitation occurs when the laser radiation frequency matches the specific frequency of an atomic transition.



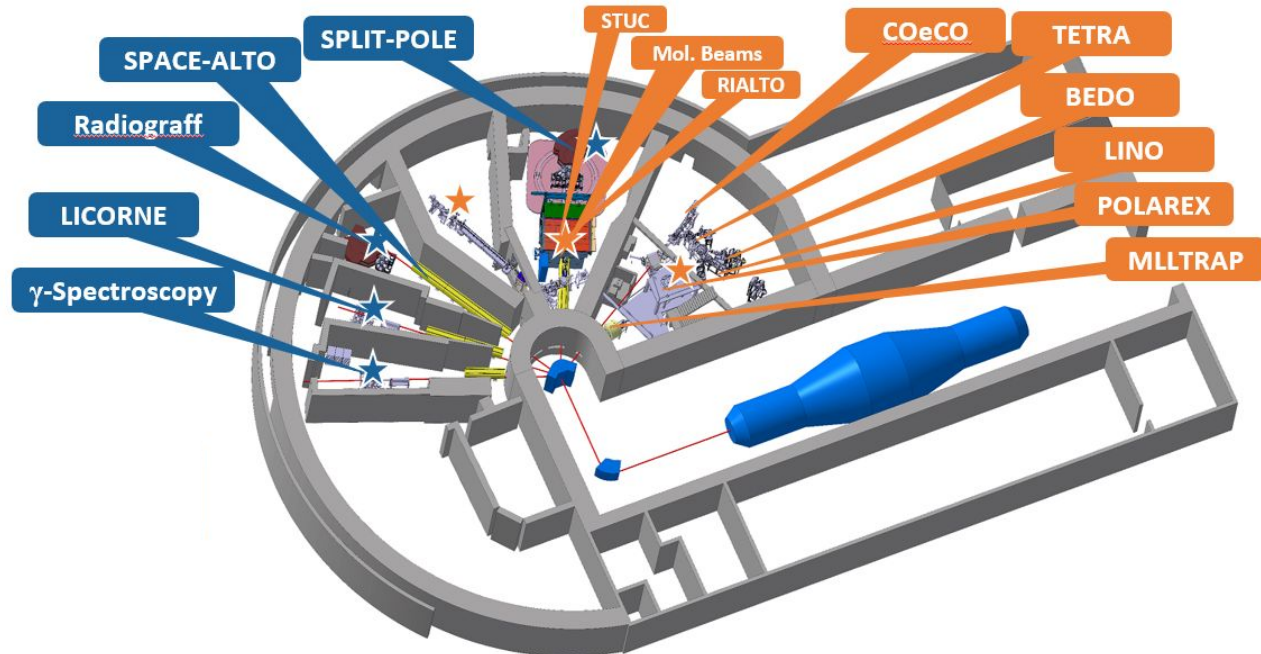
Probability of a single-step excitation process:

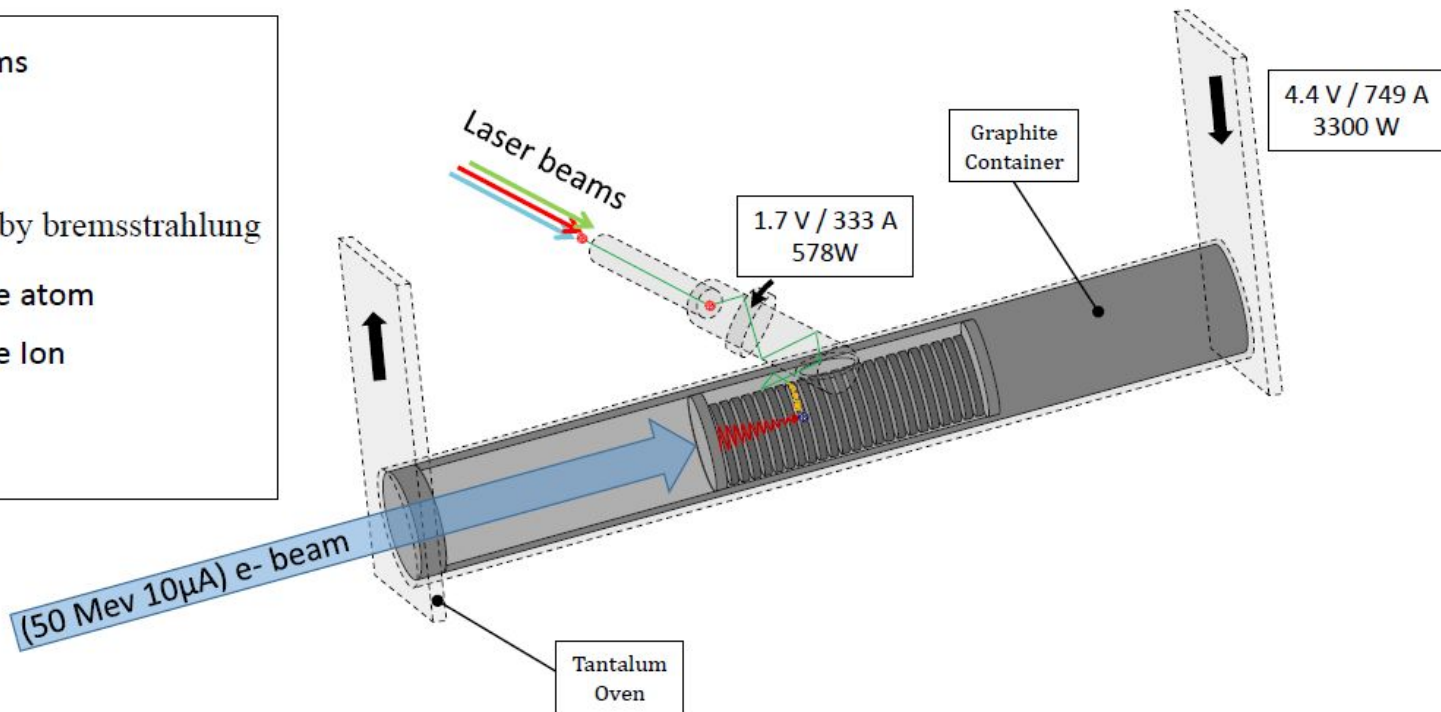
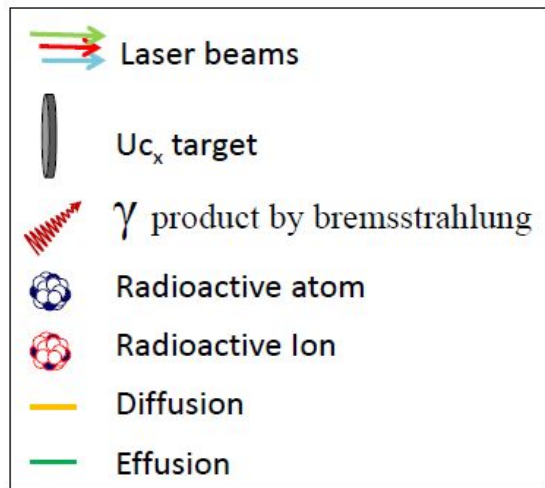
$$P = \sigma \phi_{\gamma}$$

P: ionization probability
 ϕ_{γ} : photon flux.

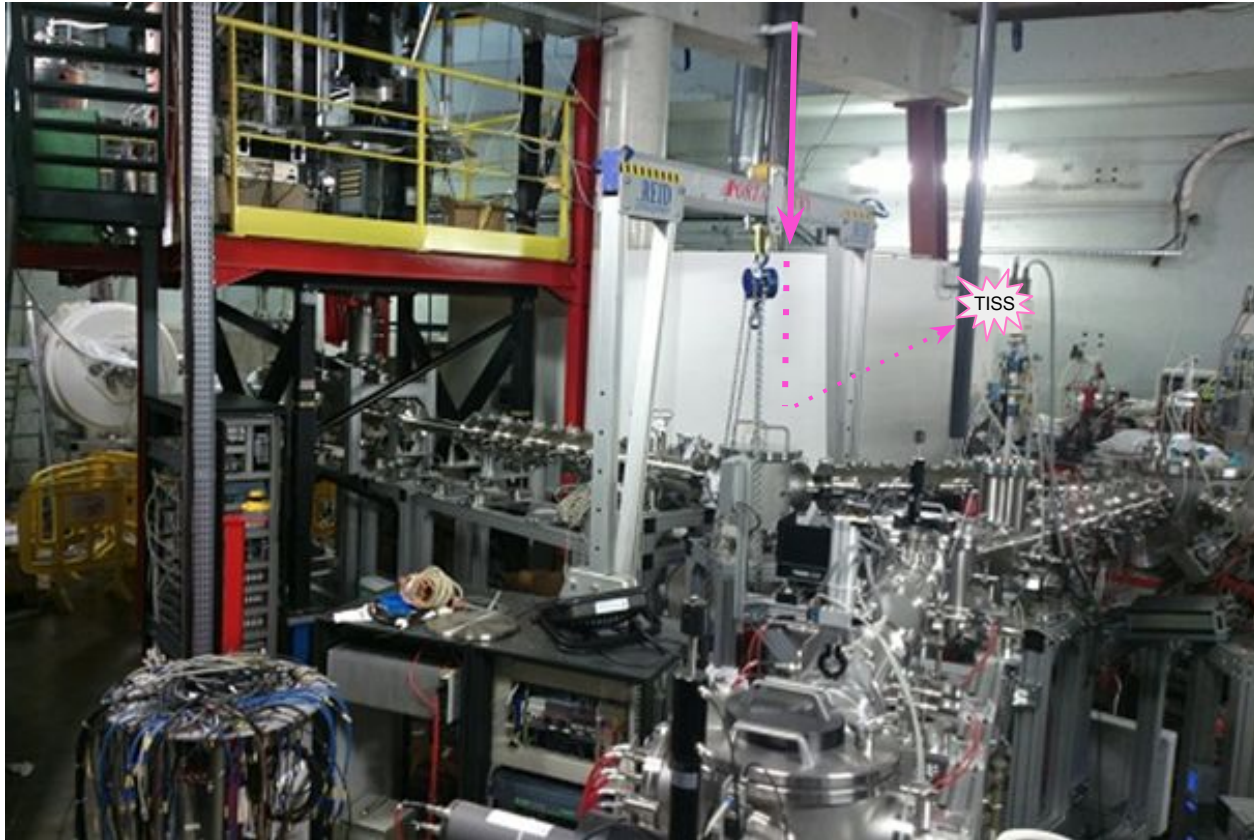
ALTO Facility (Accélérateur Linéaire et Tandem d'Orsay)

✿ 10 μ A Electron beam
accelerated at 50 MeV on a
UCx target to produce
neutron-rich radioactive
nuclei by **photofission** of
uranium.





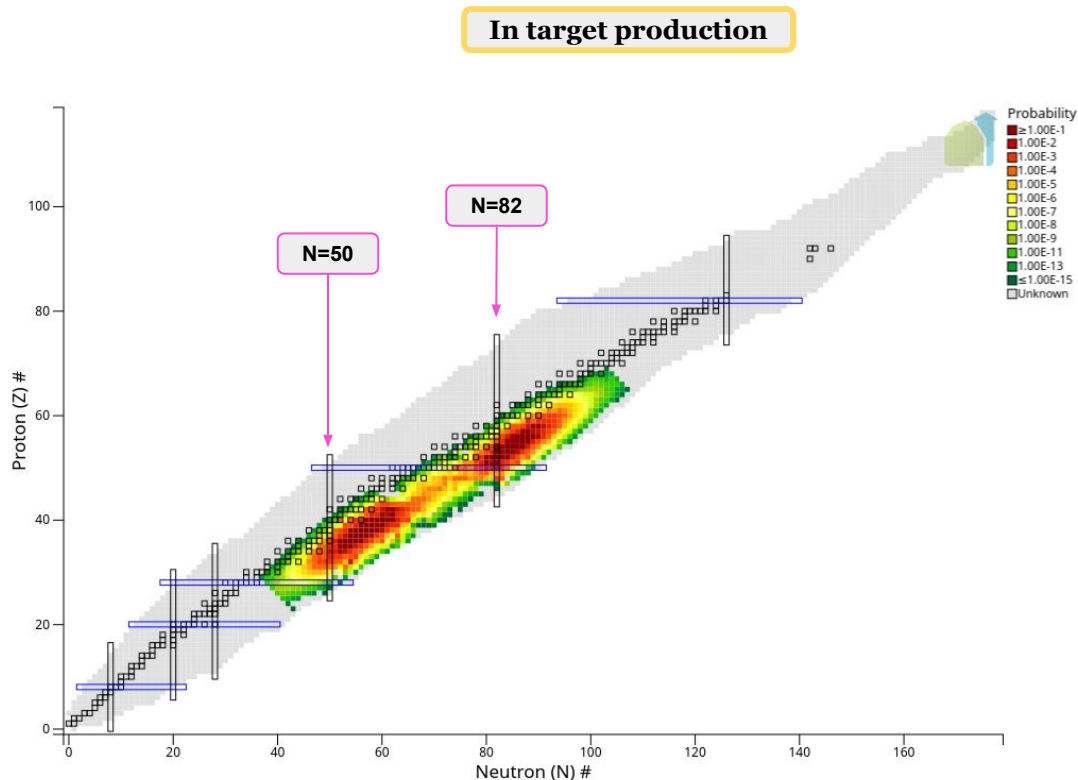
ALTO LEB



Photofission

Interesting regions for fission fragments:

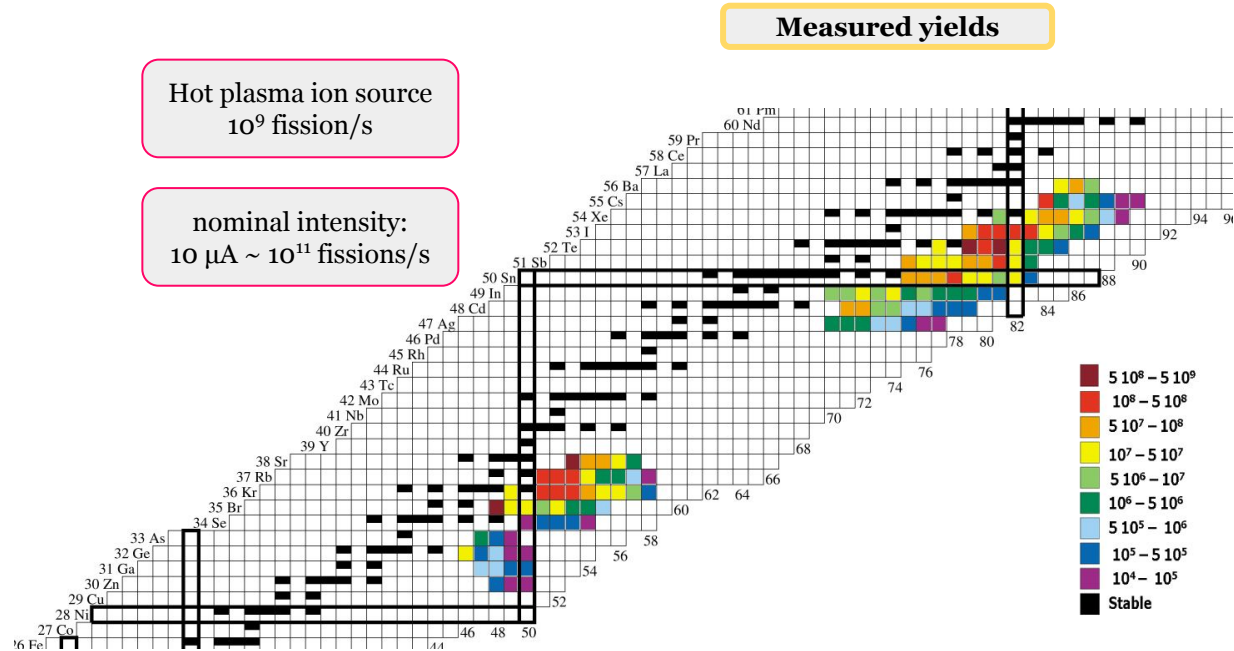
- ✿ Nuclei near neutron shell closures: $N = 50$ and $N = 82$.
- ✿ Nuclei at the boundary of the deformation region with $N > 60$.



Photofission at ALTO

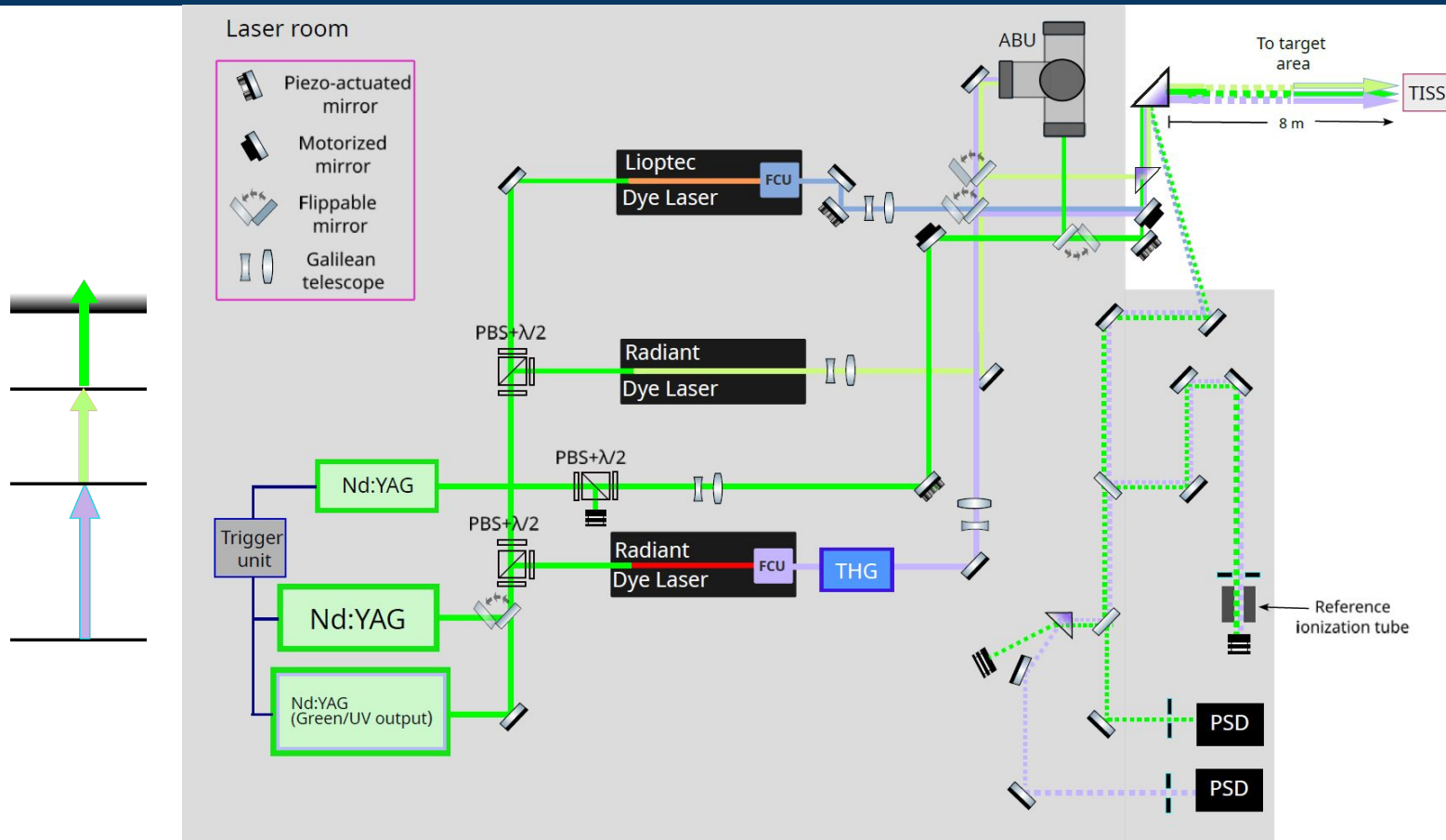
Interesting regions for fission fragments:

- ✿ Nuclei near neutron shell closures: $N = 50$ and $N = 82$.
- ✿ Nuclei at the boundary of the deformation region with $N > 60$.

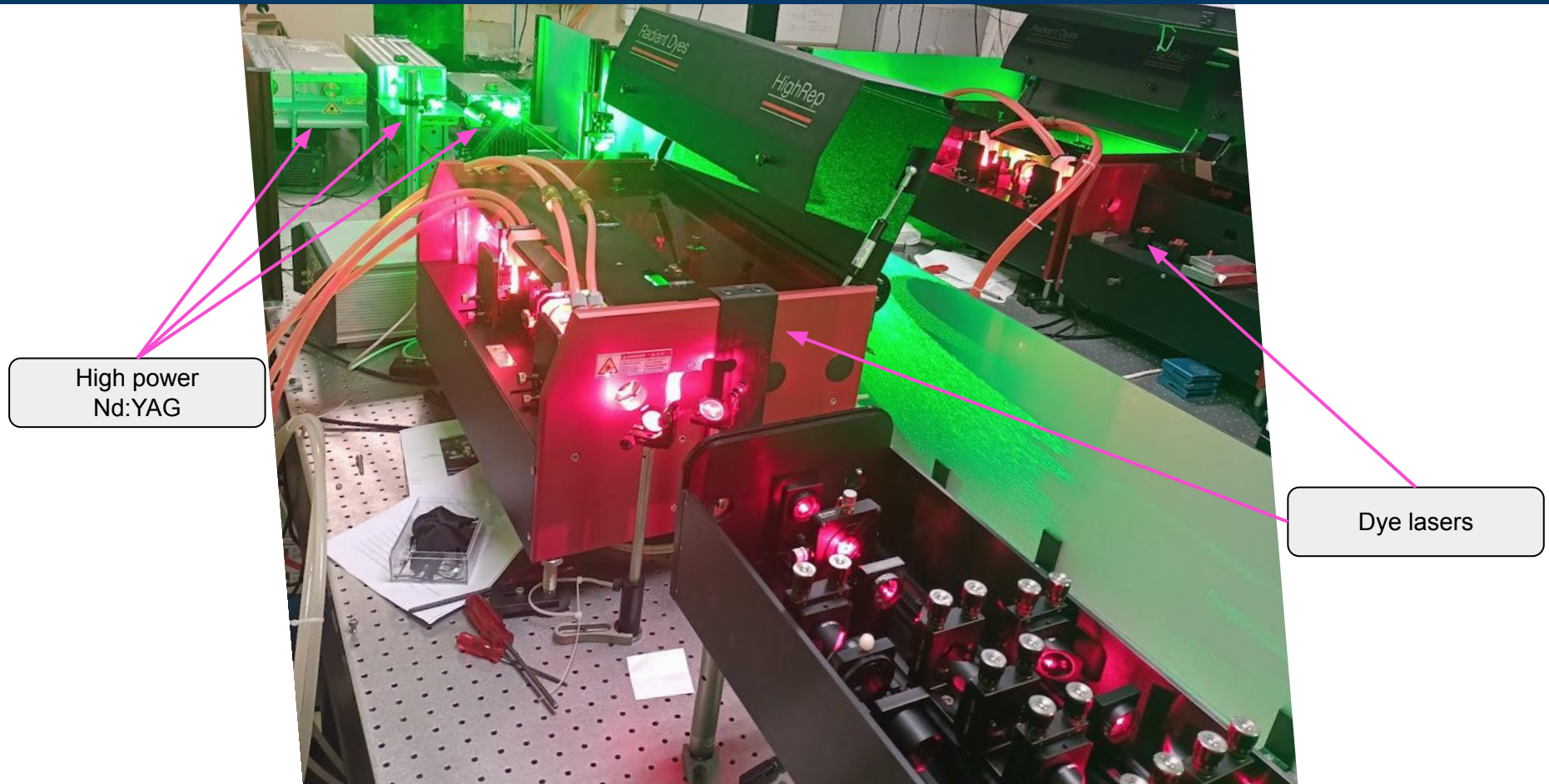


F. Ibrahim, et. al., Nuclear Physics A, 787(1):110–117, 2006.

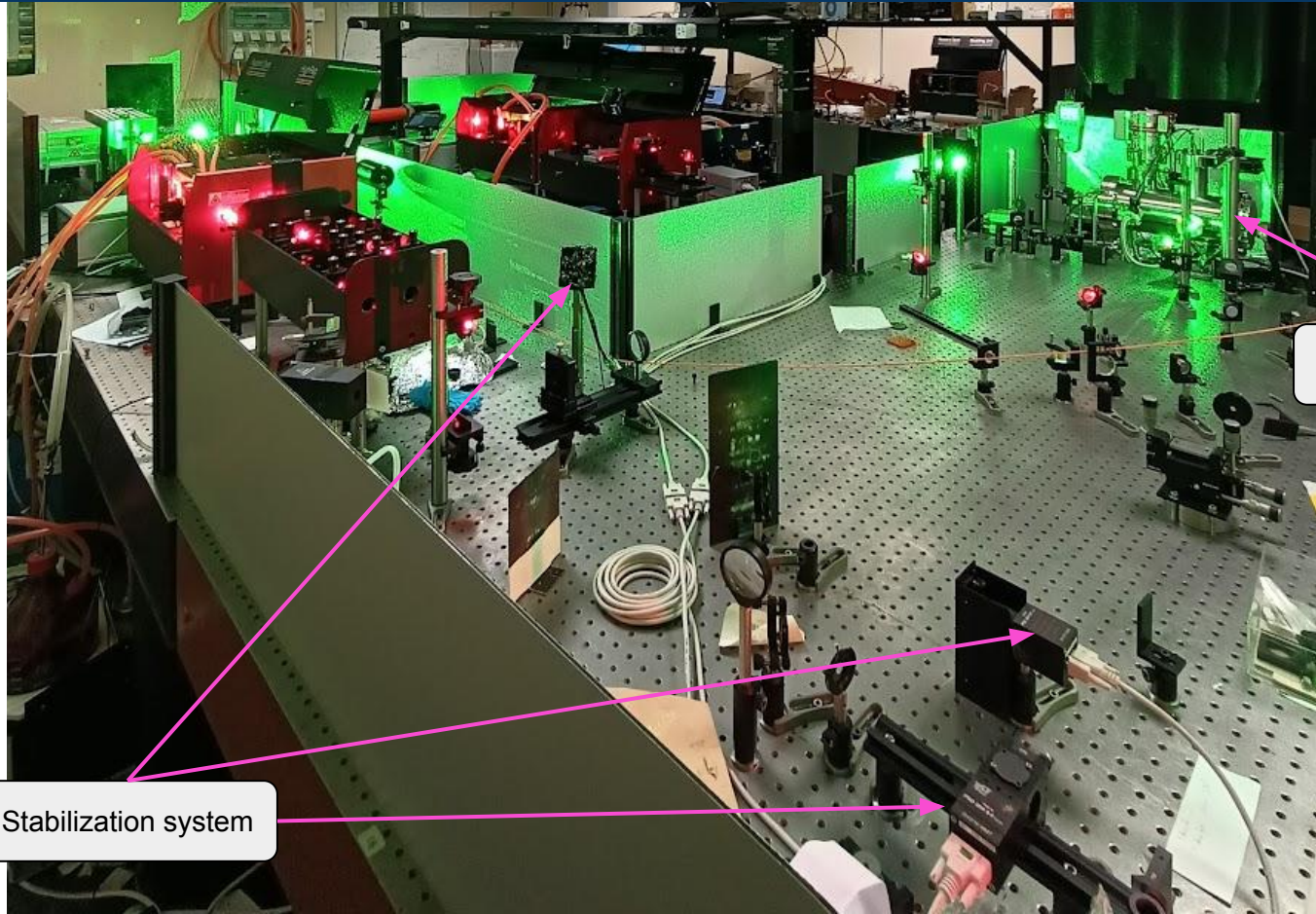
Resonance Ionization laser ion source at ALTO (RIALTO)



Resonance Ionization laser ion source at ALTO (RIALTO)



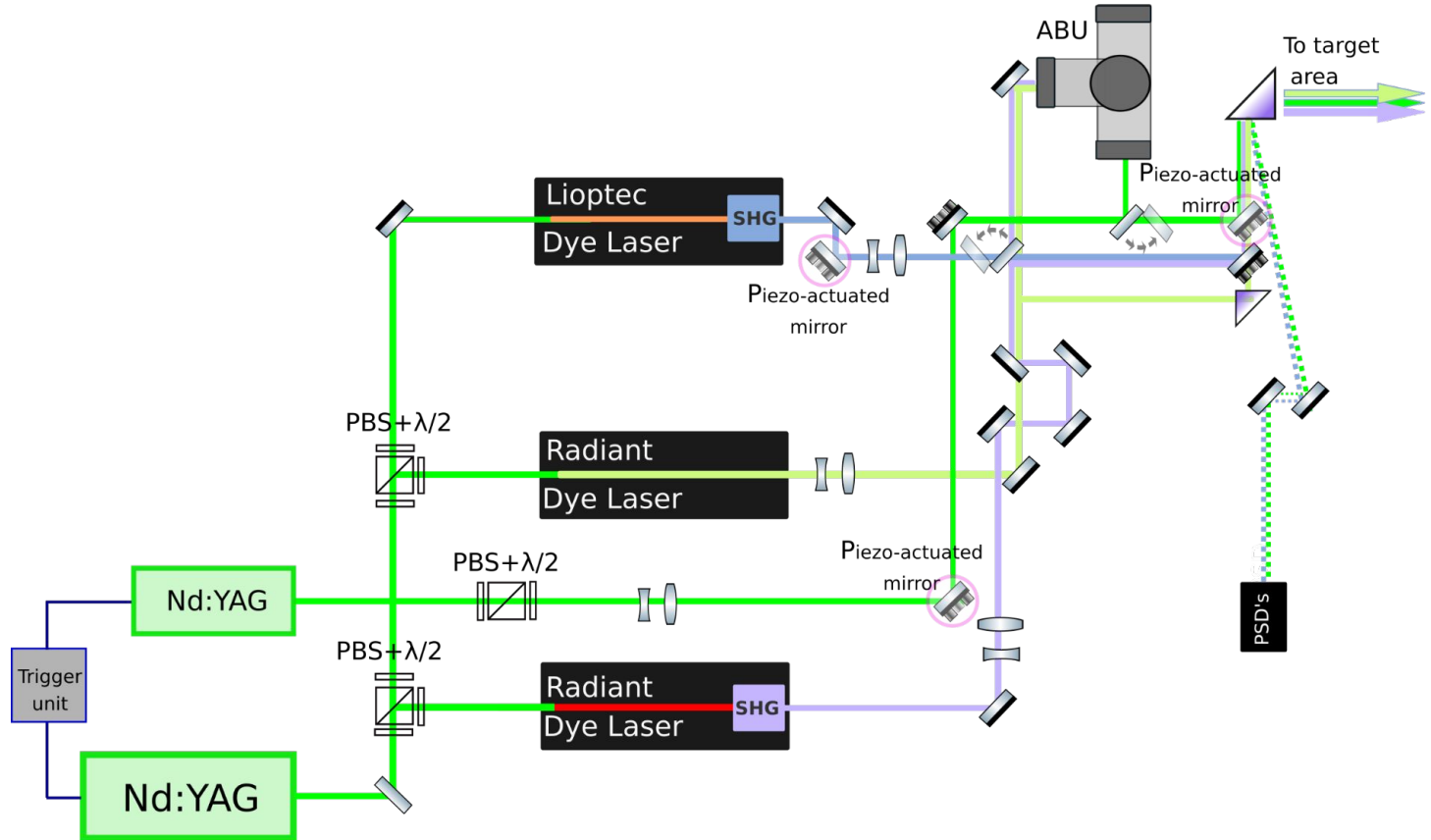
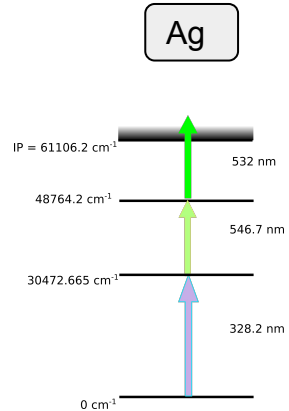
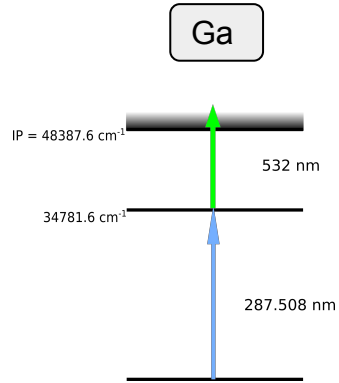
Resonance Ionization laser ion source at ALTO (RIALTO)



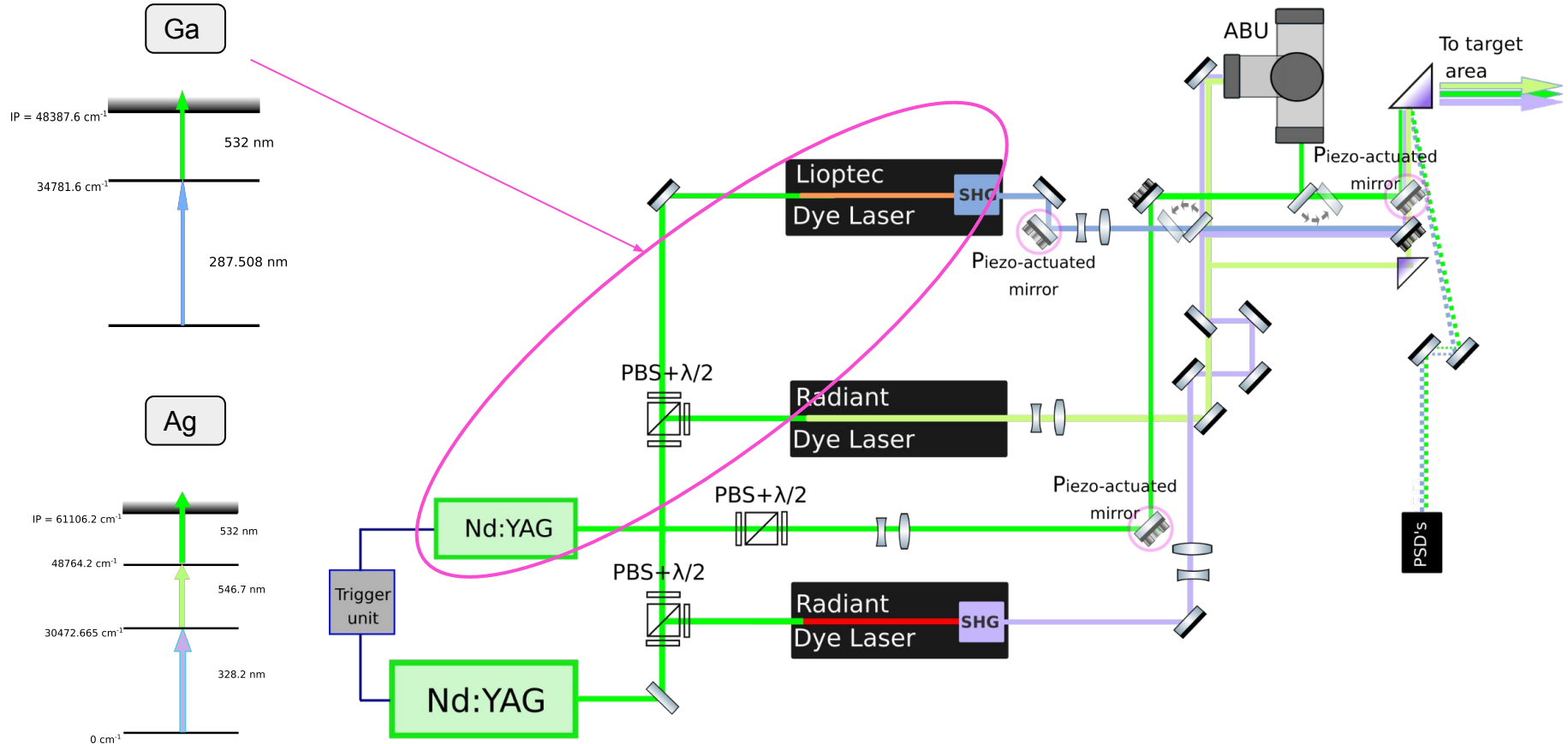
Atomic Beam Unit

Stabilization system

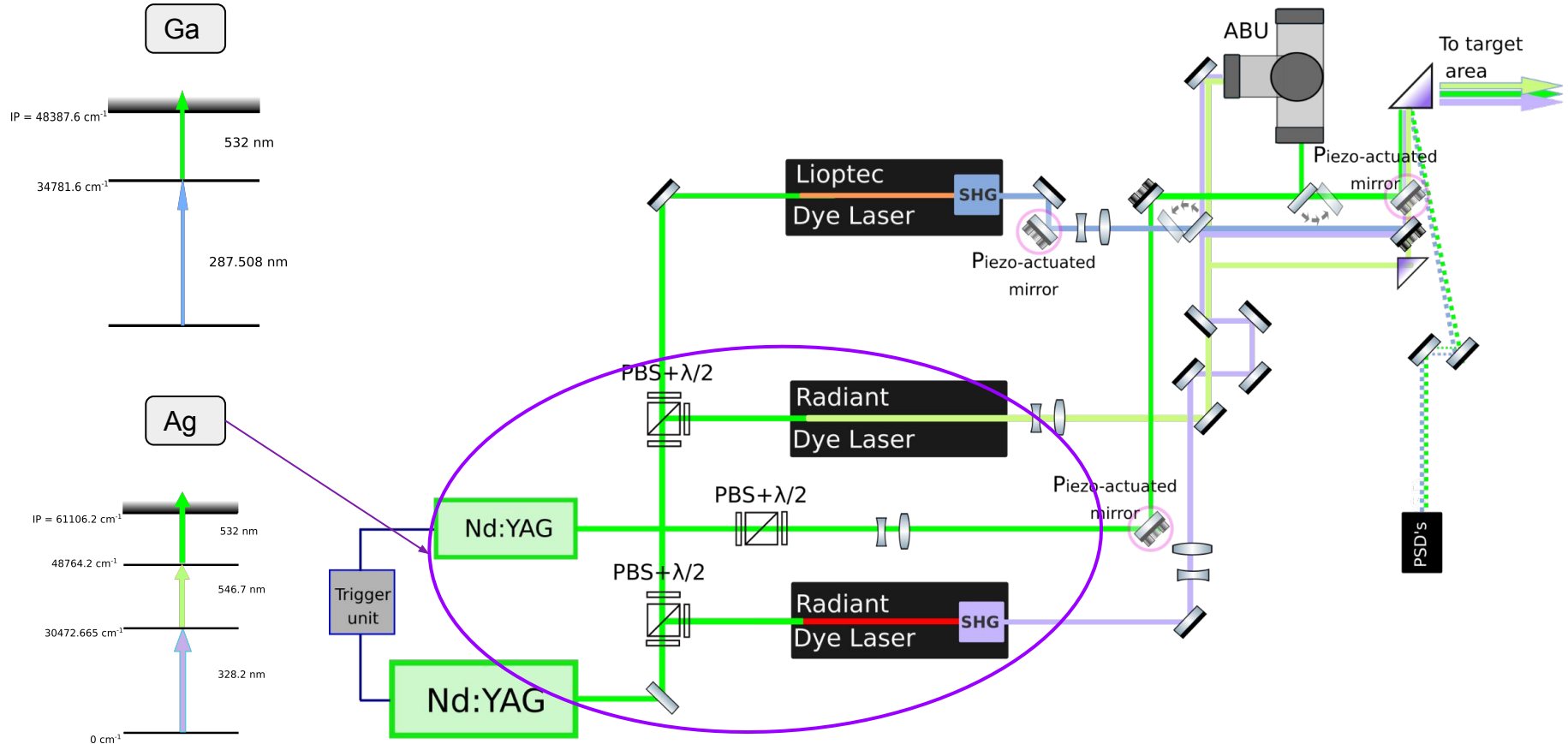
Ionization of two elements



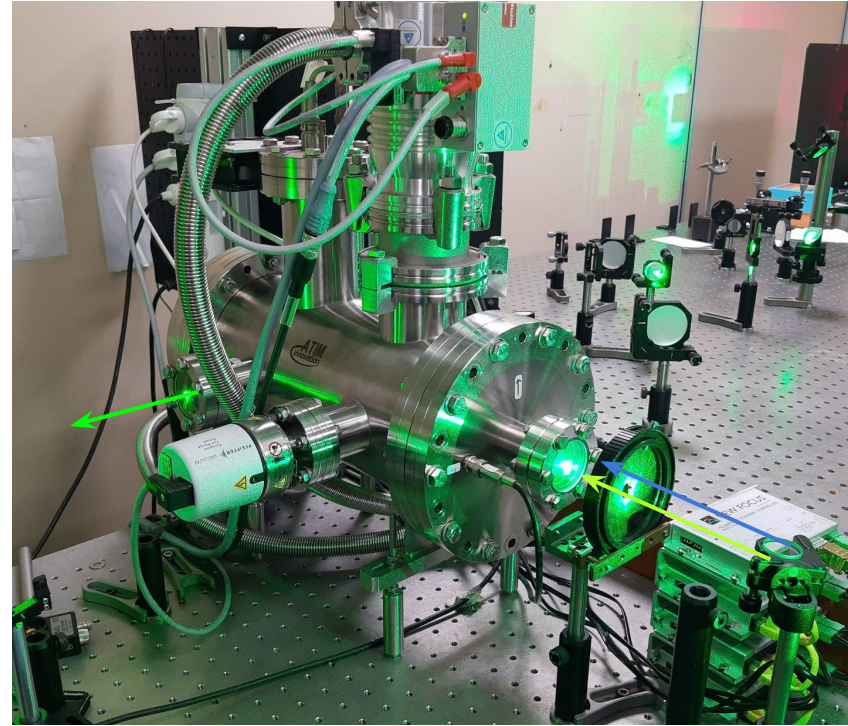
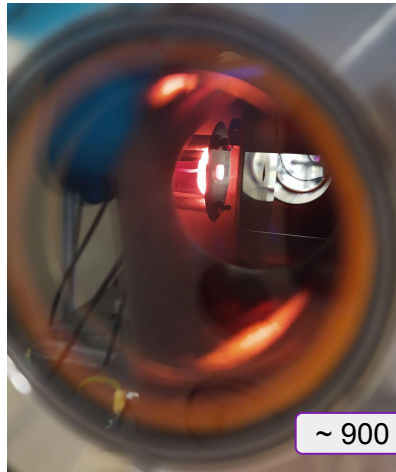
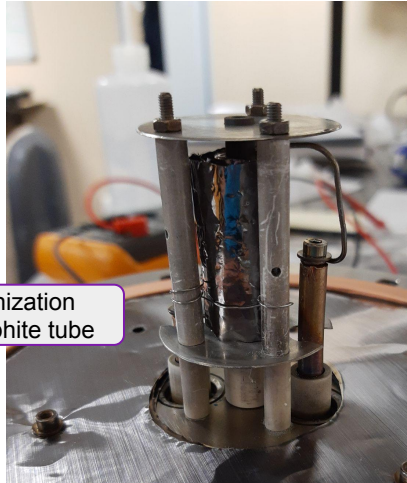
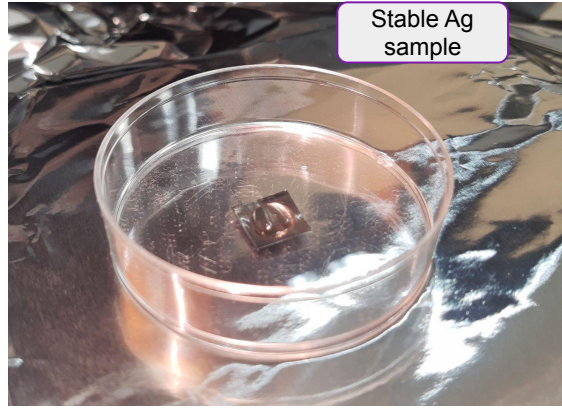
Ionization of two elements



Ionization of two elements



Ag development



Séparateur
4339.06 Gauss
128.752 A
Masse demandée : 107

Mass separator (PARRNe)

Ensemble target ion source (TIS)

COeCO

Vide insuffisant section 5

Dérouleur PARRNe

Steerer COeCO
0.00 kV General
0.00 kV X
0.00 kV Y

Dérouleur BEDO

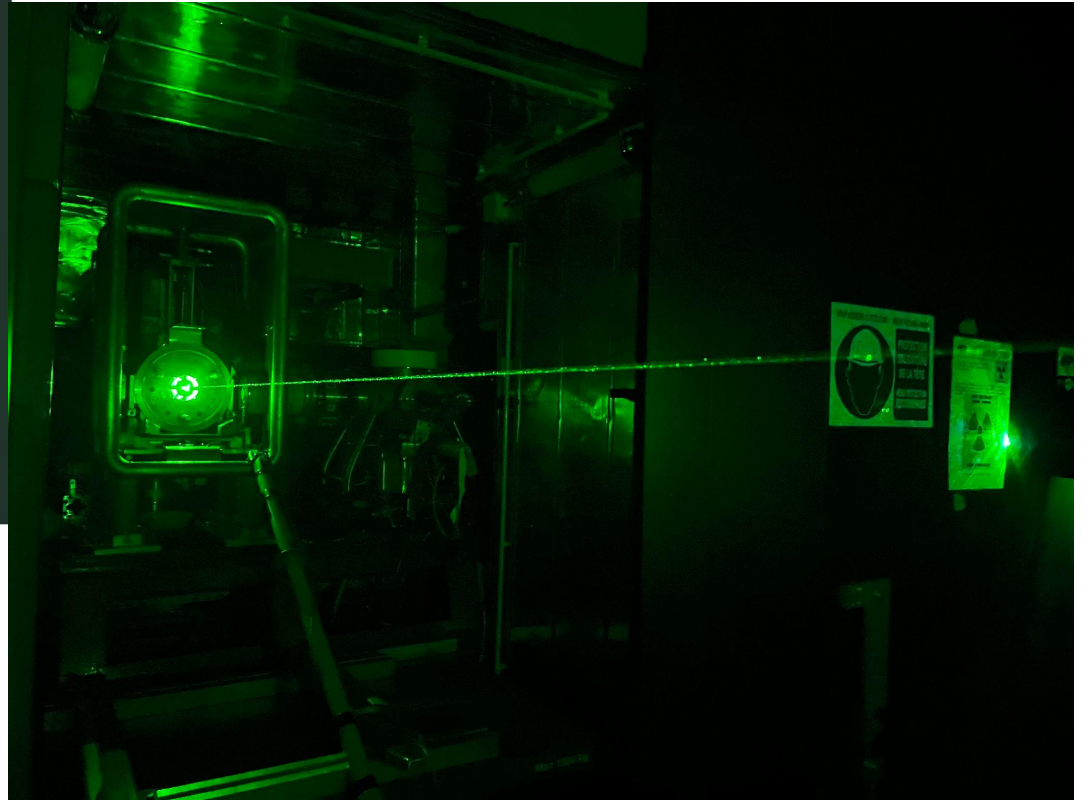
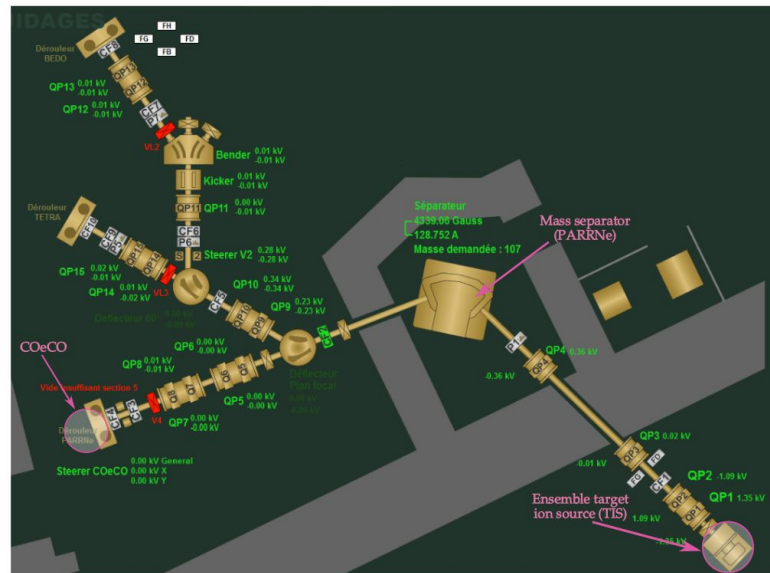
Dérouleur TETRA

QP1 1.35 kV
QP2 -1.09 kV
QP3 0.02 kV
QP4 0.36 kV
QP5 0.00 kV
QP6 0.00 kV
QP7 0.00 kV
QP8 0.01 kV
QP9 0.23 kV
QP10 0.34 kV
QP11 0.00 kV
QP12 0.01 kV
QP13 0.01 kV
QP14 0.01 kV
QP15 0.02 kV

Steerer V2 0.28 kV
Kicker 0.01 kV
Bender 0.01 kV
Deflecteur 50° 0.00 kV
Deflecteur Plan focal 0.00 kV

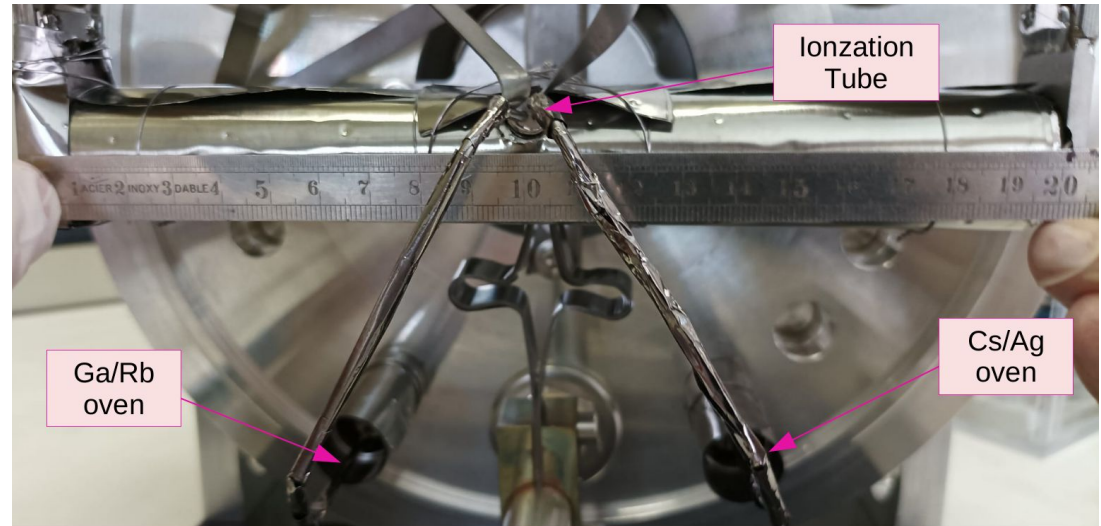
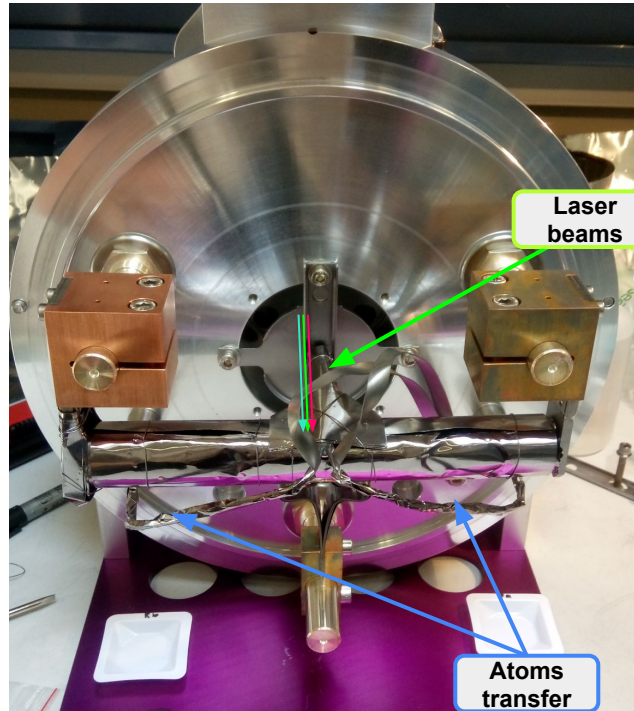
VL1 0.00 kV
VL2 0.01 kV
VL3 0.01 kV
VL4 0.01 kV
VL5 0.01 kV
VL6 0.01 kV
VL7 0.01 kV
VL8 0.01 kV
VL9 0.01 kV
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VL189 0.01 kV
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Stable ionization “online”



Stable ionization online

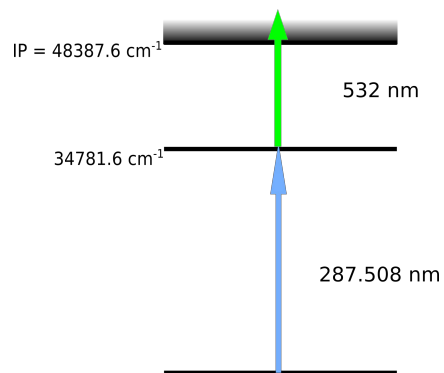
Front-end (posterior view)



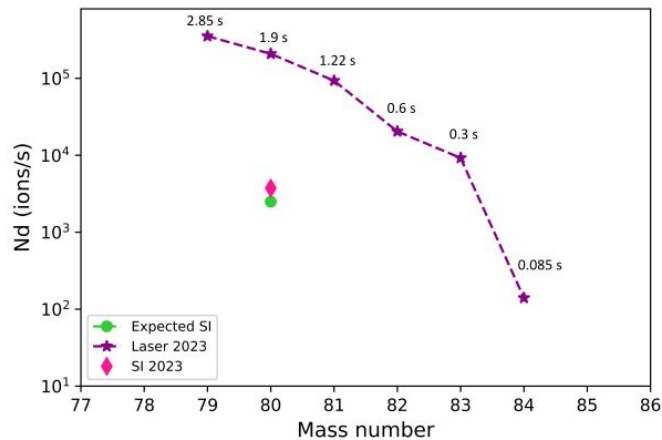
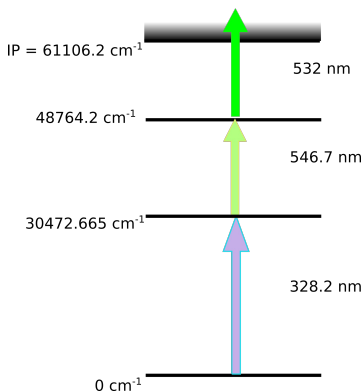
A sample is placed in a capillary oven container connected to the transfer line.

Laser ionized beams at ALTO

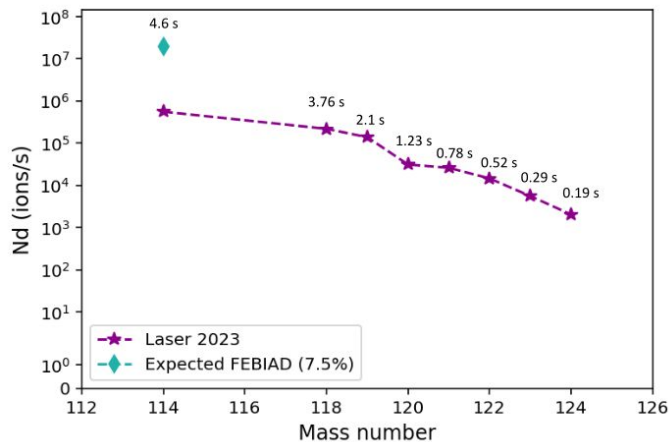
Ga



Ag

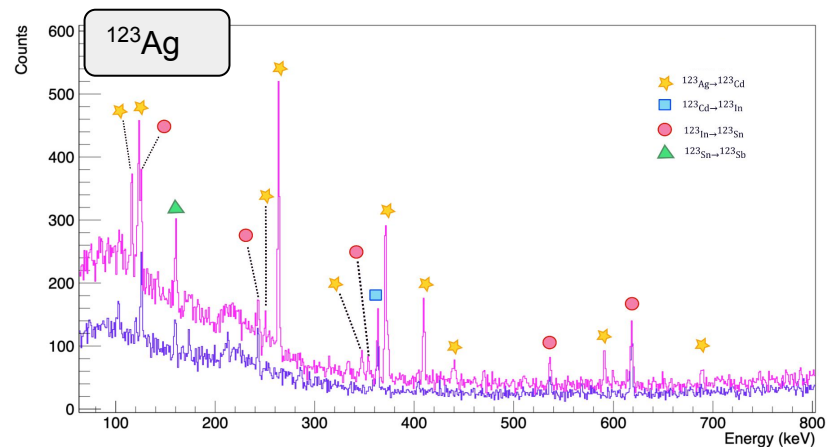
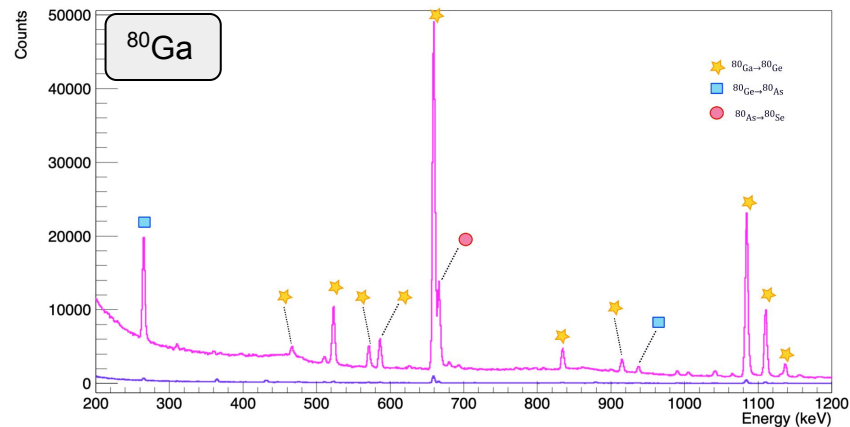
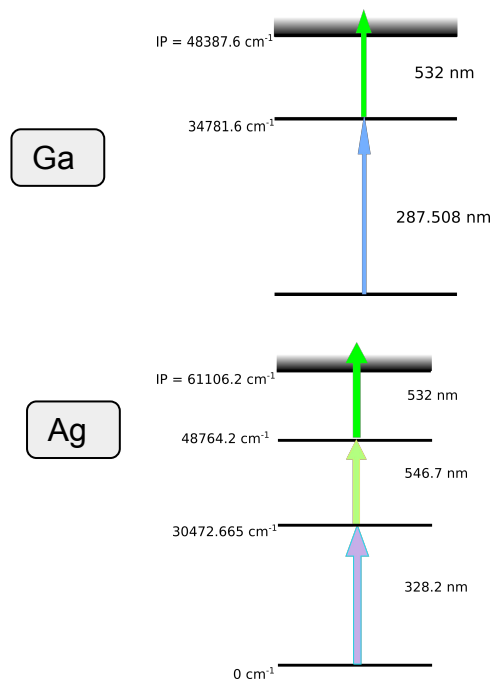


Ionization efficiency
0.5%



Ionization efficiency
0.21%

Laser ionized beams at ALTO

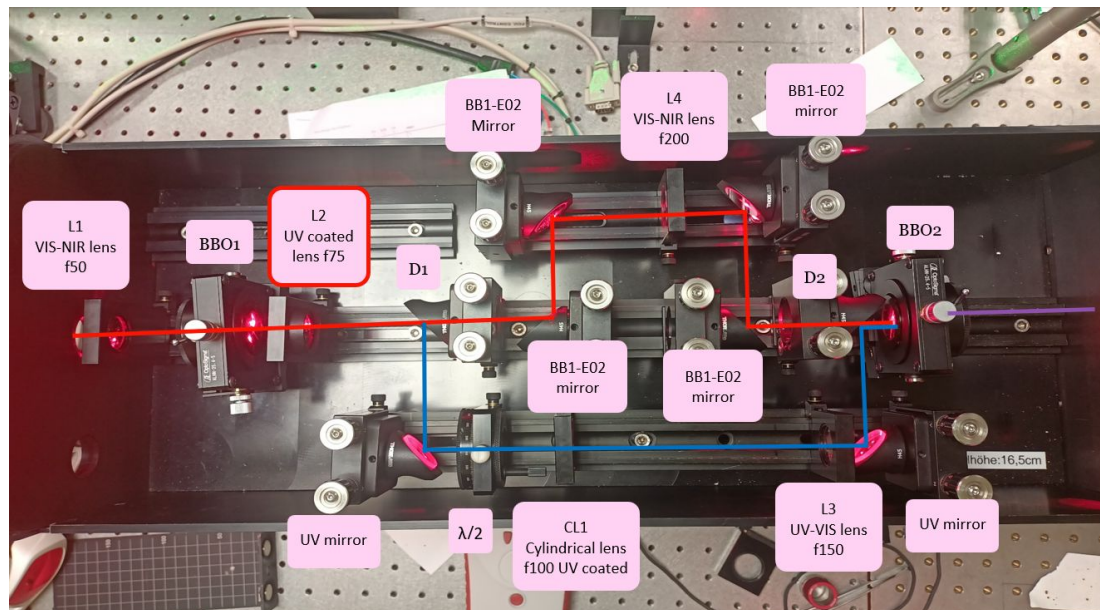
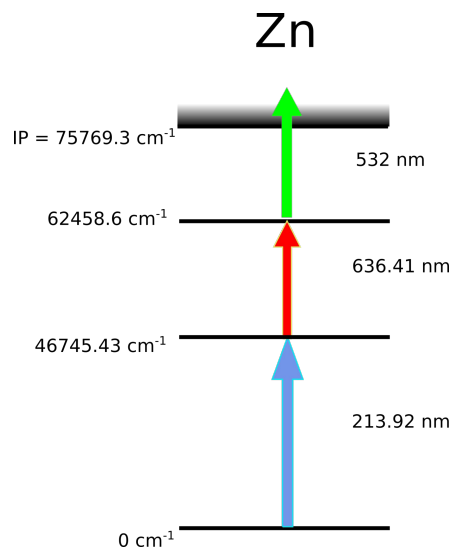


A. Segovia-Miranda et al., "Upgrades of the RIALTO facility and recent laser-ionized beams of radioactive gallium and silver isotopes", Nuclear Instruments and Methods in Physics Research A 1080 (2025) 170785

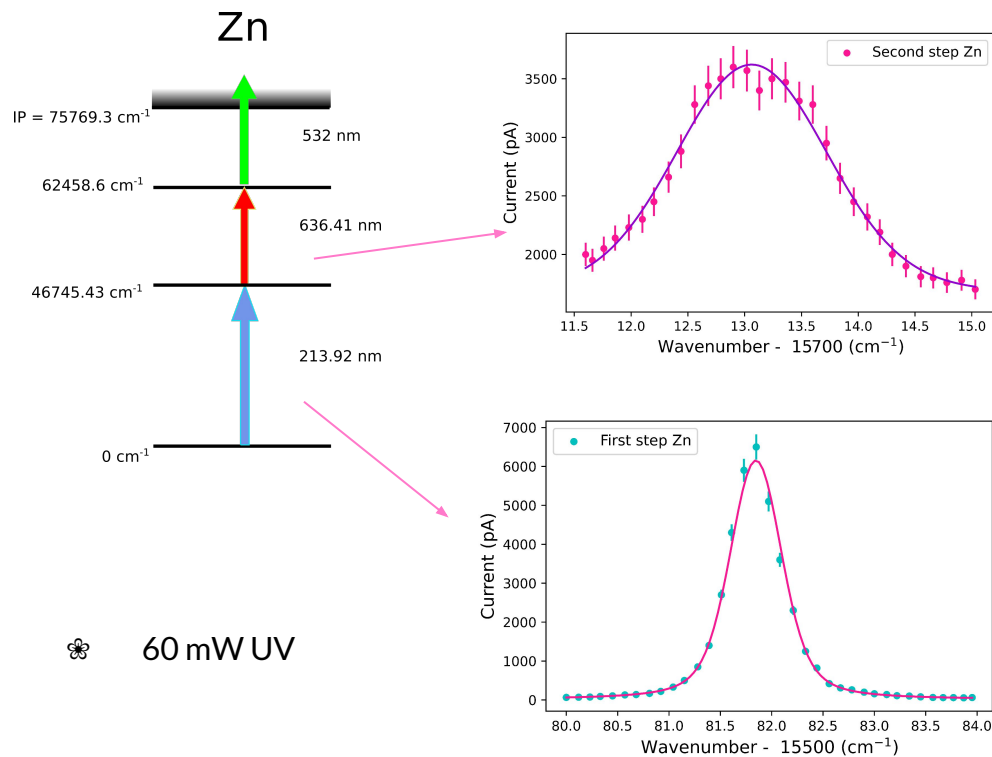
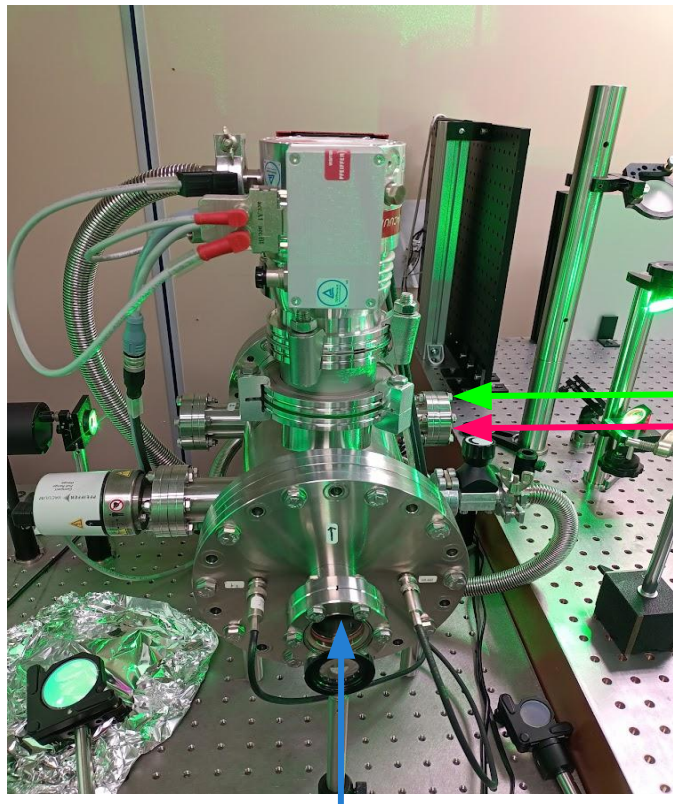
Zn development

✿ Neutron-rich Zn program

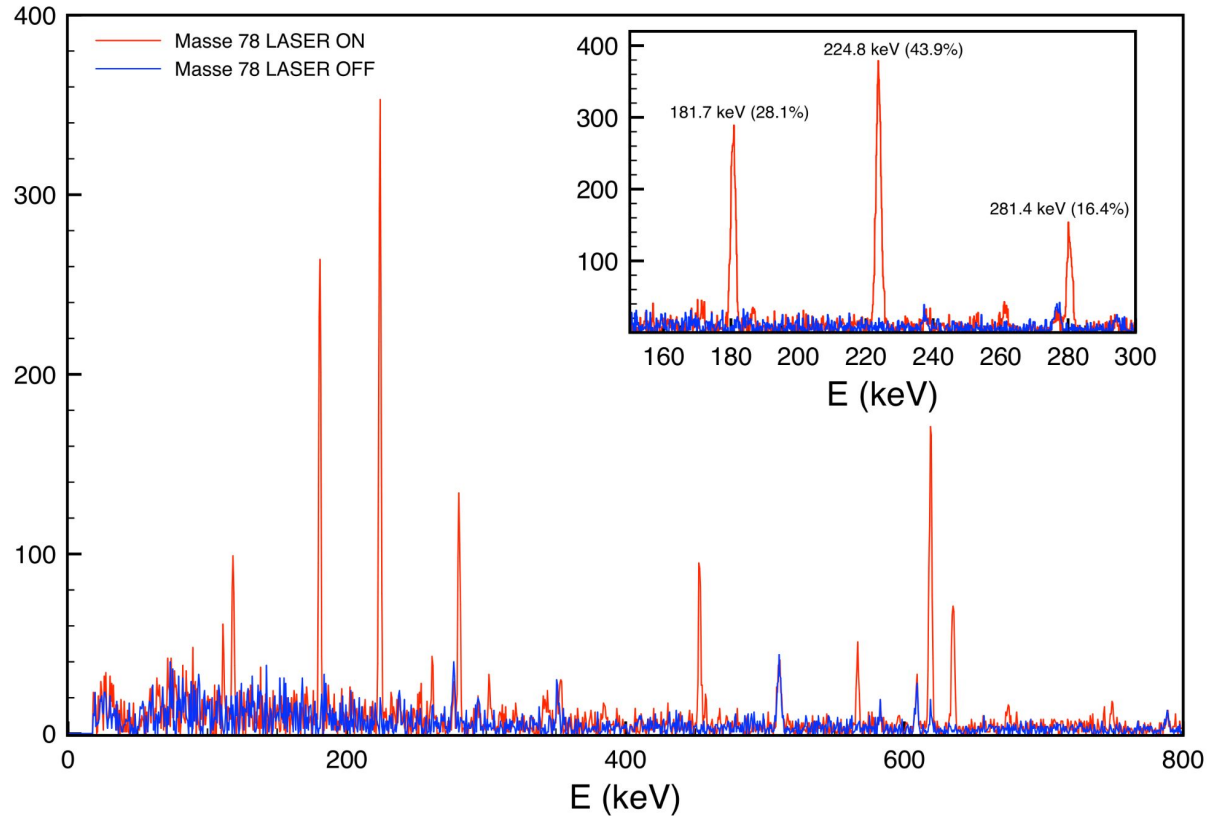
★ Monster (February 2025)



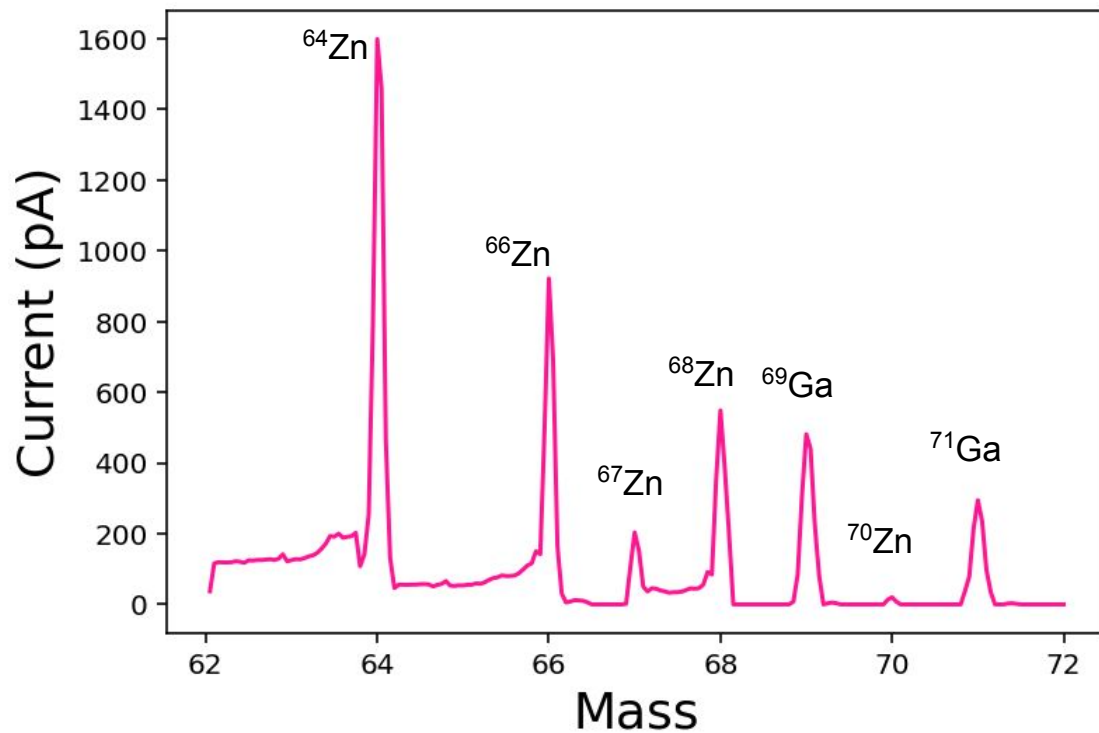
Zn offline test



Radioactive Zn production 2025

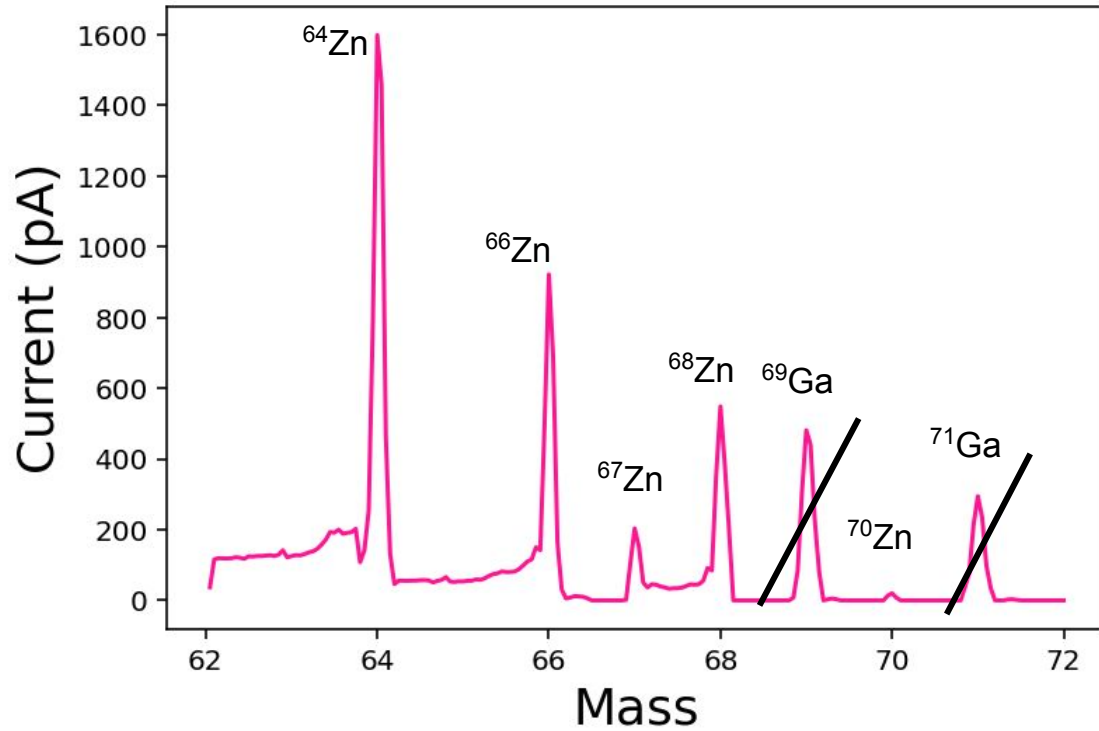


Perspectives



✿ Ta ionization tube

Perspectives



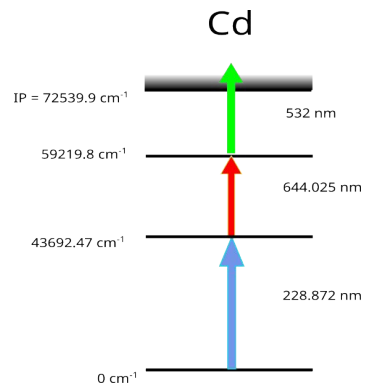
✿ Quartz ionization tube

Perspectives



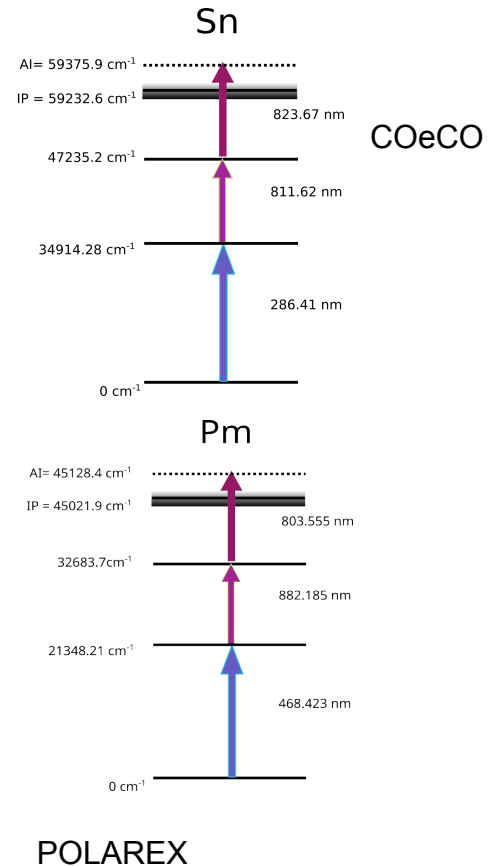
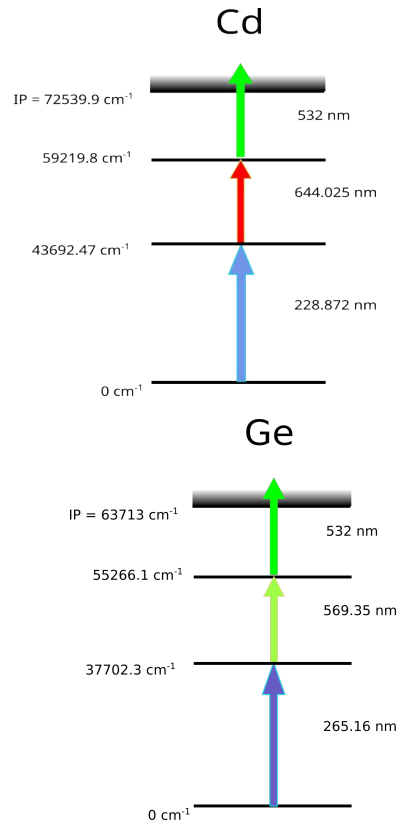
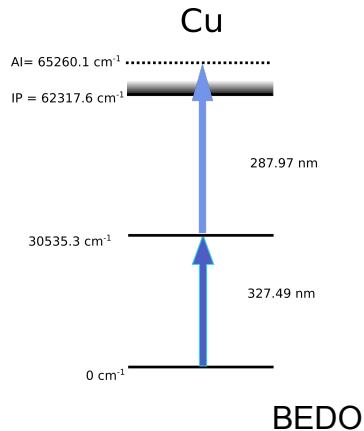
Future beams

- 2026 BEDO/COeCO



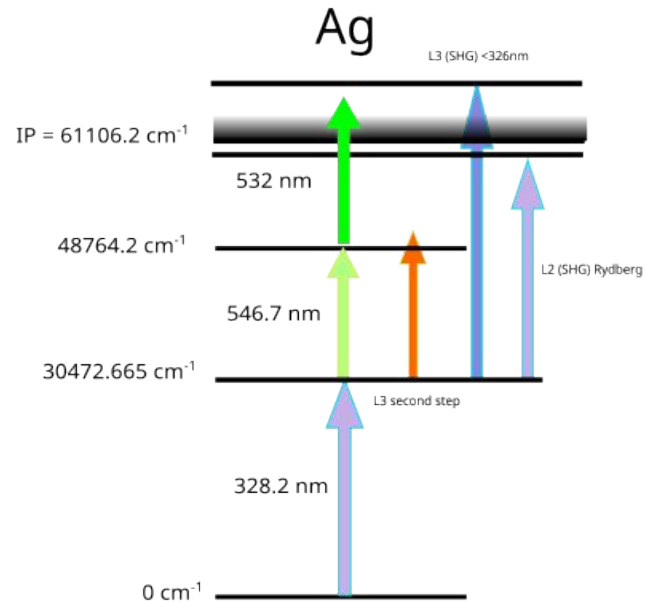
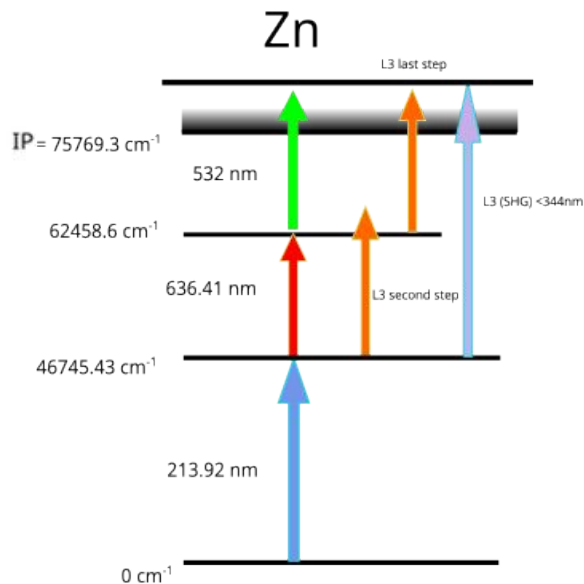
Perspectives

✿ Future beams



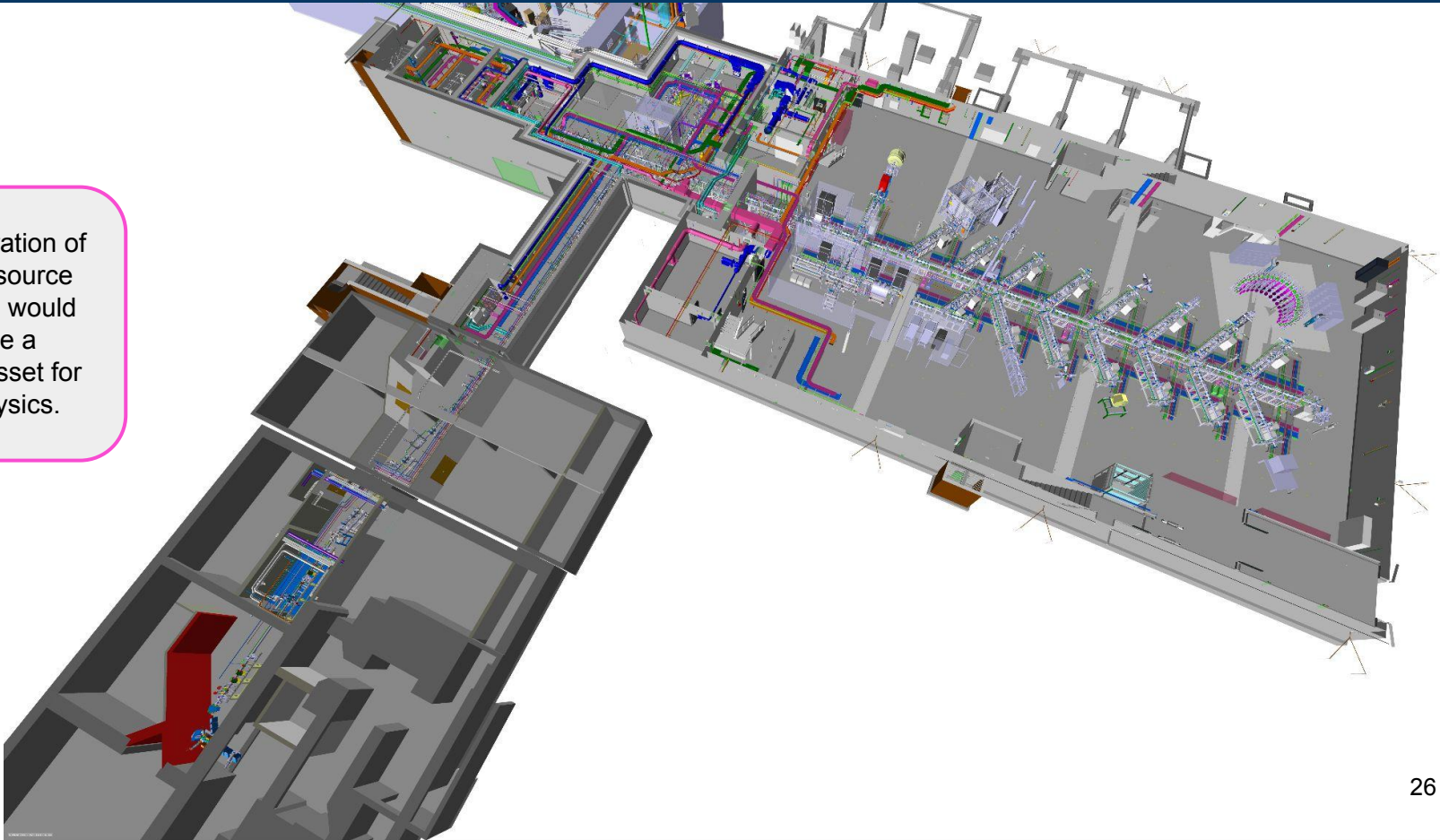
Scheme development with RIALTO (phase 2)

❁ Autoionizing States



SPIRAL 1 / DESIR

The incorporation of a laser ion source into Spiral 1 would constitute a significant asset for DESIR physics.

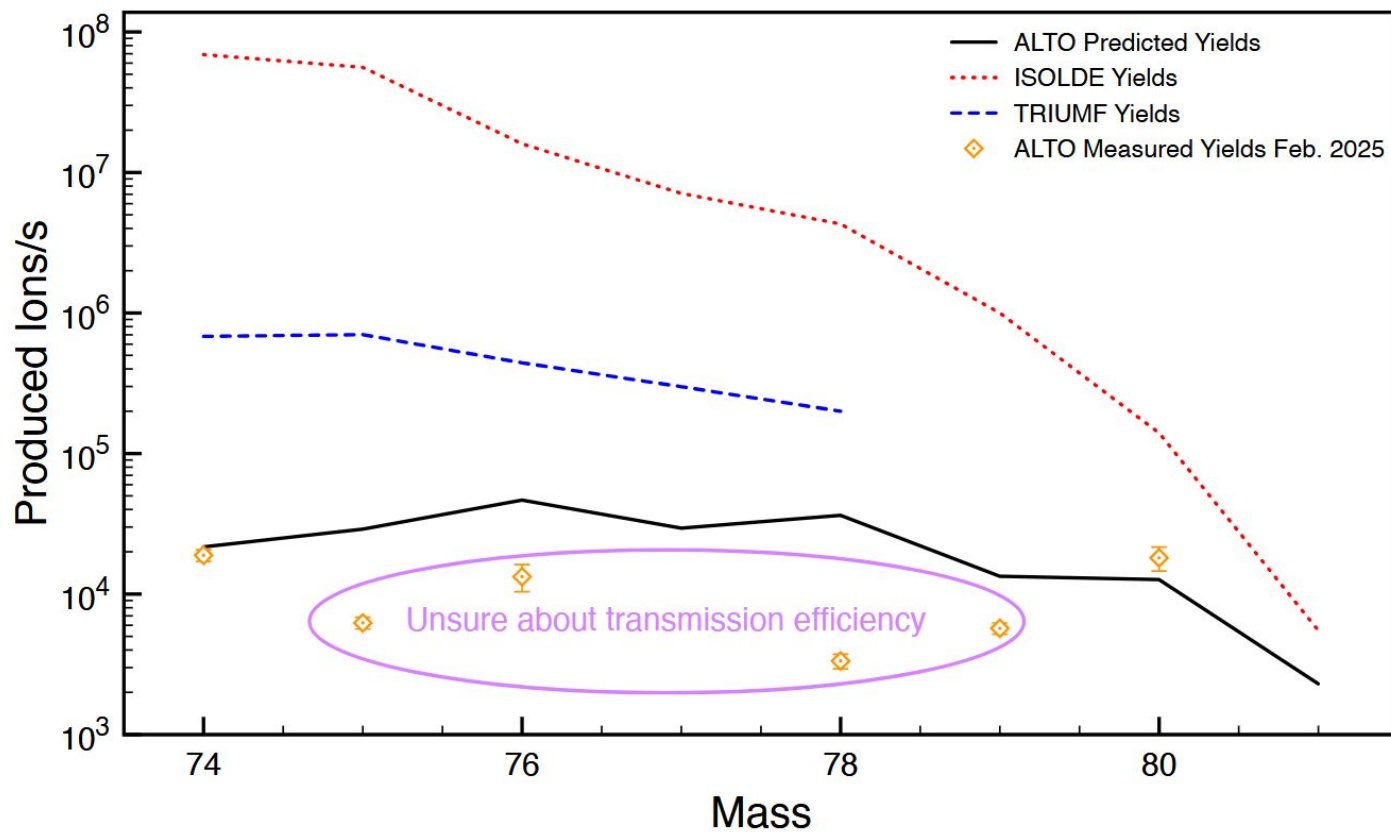


Acknowledgments

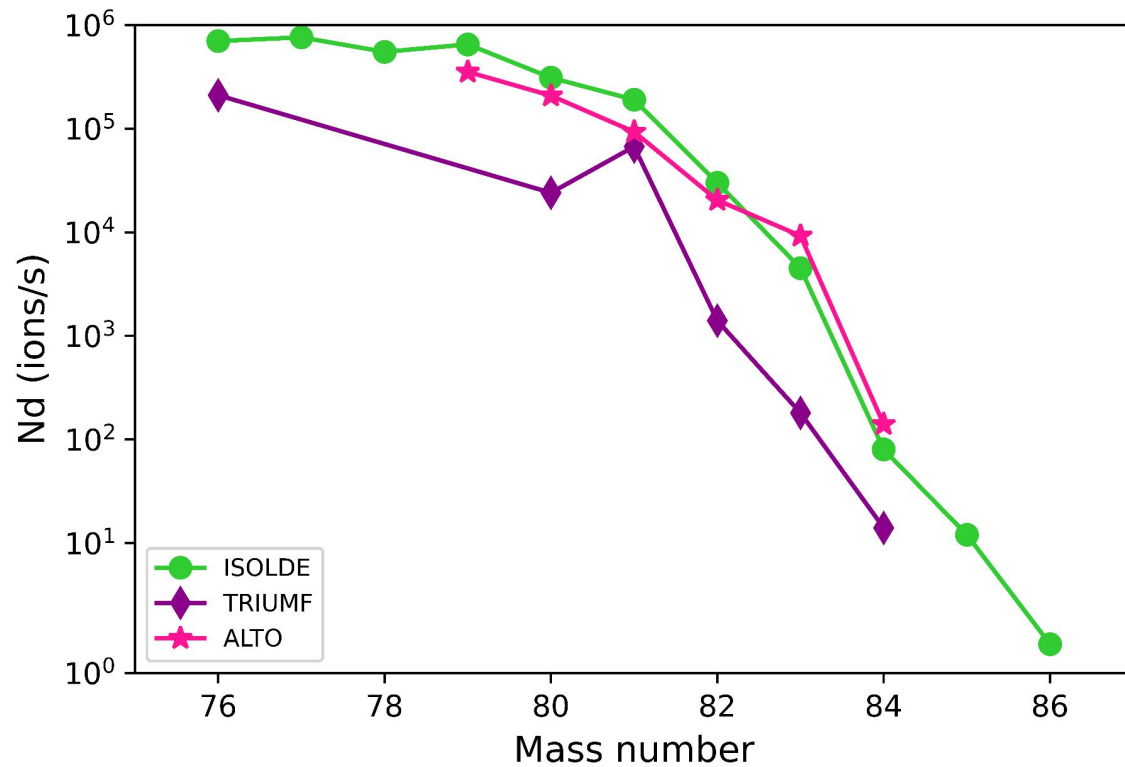


Thank you for your attention

Zn yields



Ga yields



Ag yields

