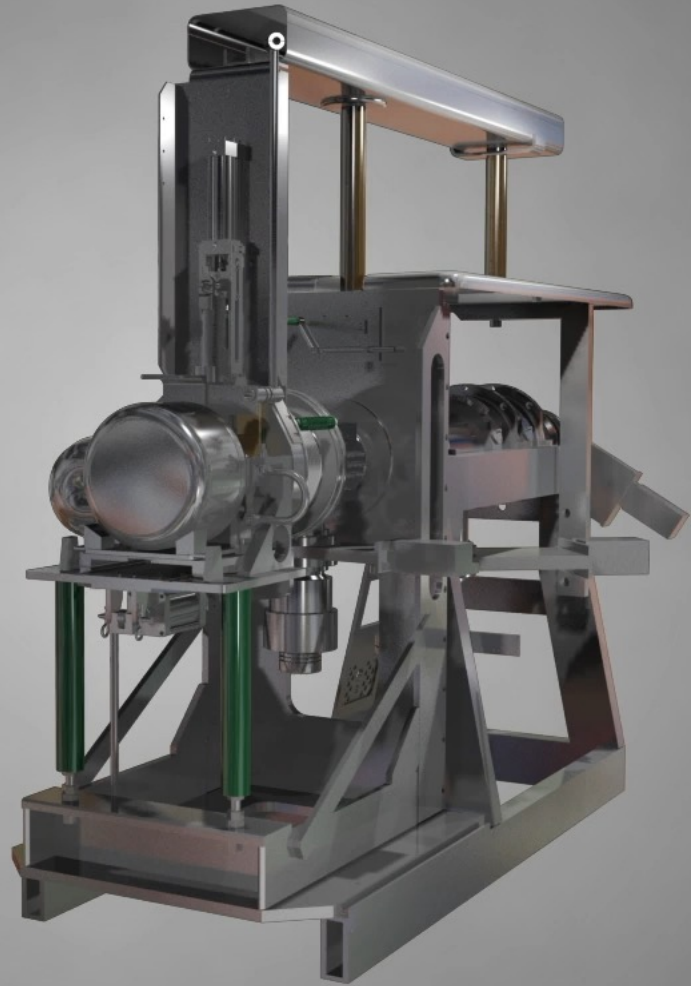




# Nuclear physics Back to the ROOTs





# The ISOL recipe

1. Mix the ingredients
2. Cook on high temperature ( $\sim 2000^{\circ}\text{C}$ )
3. Serve



# Back to start: nuclear cross sections

- It all starts with the nuclear reaction and its cross sections.



C. Duchemin et al.

Applied Radiation and Isotopes 178 (2021) 109983

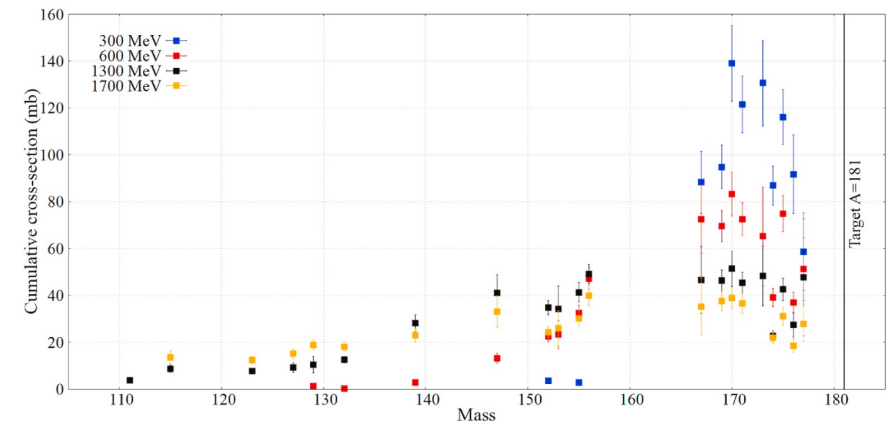
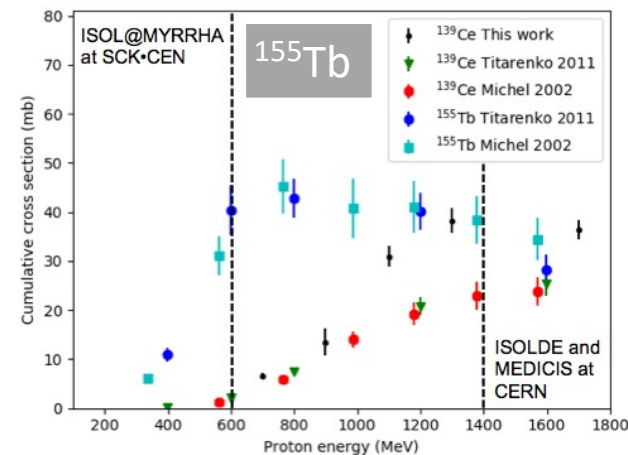
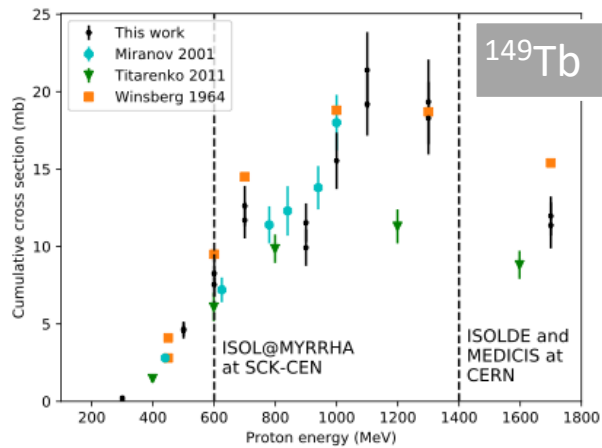


Fig. 7. Cumulative cross-sections for the last radionuclide of the decay chain as a function of mass and beam energy.

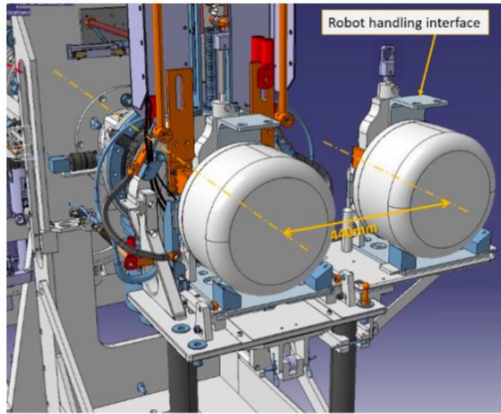
H. Verhoeven et al., NIMB 463 (2020) 327-329.

C. Duchemin et al., Frontiers in Medicine 8 (2021) 625561.

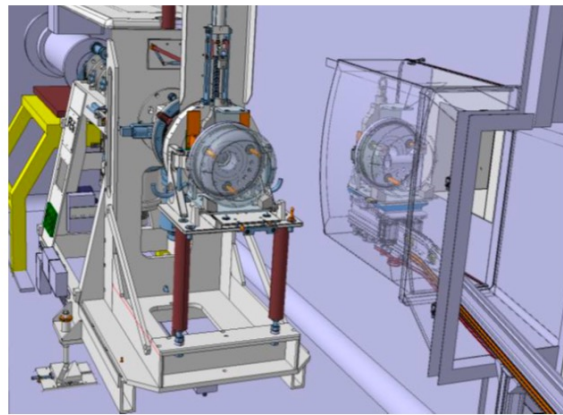
C. Duchemin et al., Applied Radiation & Isotopes 178 (2021) 109983.

# Shooting on target...

- It is all in the aim...



(a) GPS irradiation position.

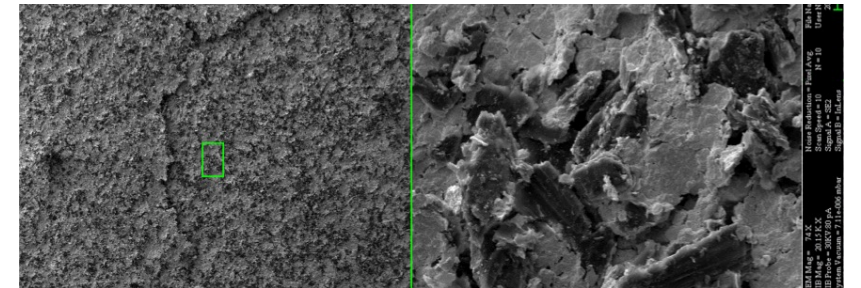
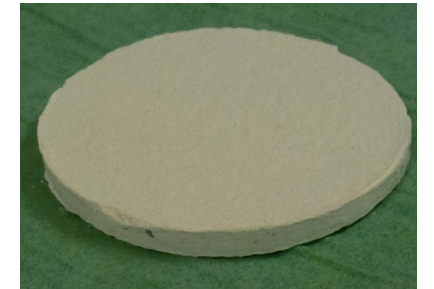
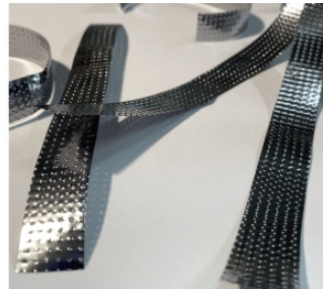
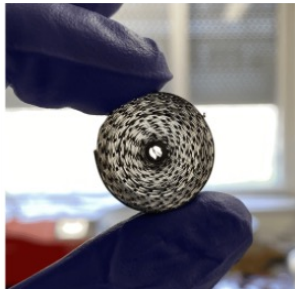


(b) HRS irradiation position (trolley low position shown)



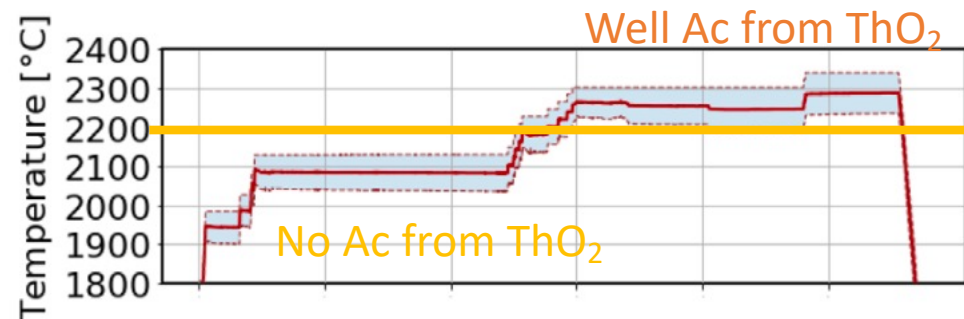
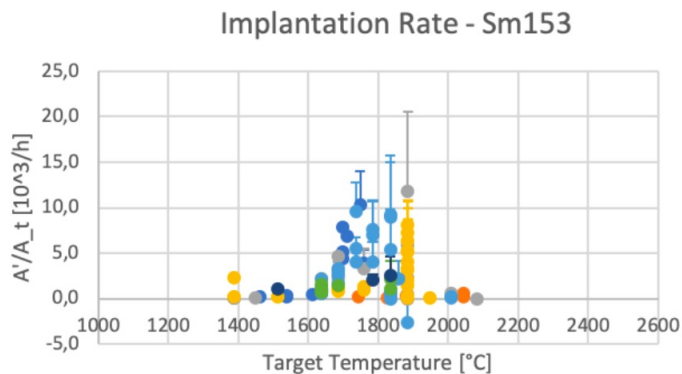
# Next ingredient: the target

- ISOLDE has a big pantry of targets where we can 'shop', but we can also make something new...

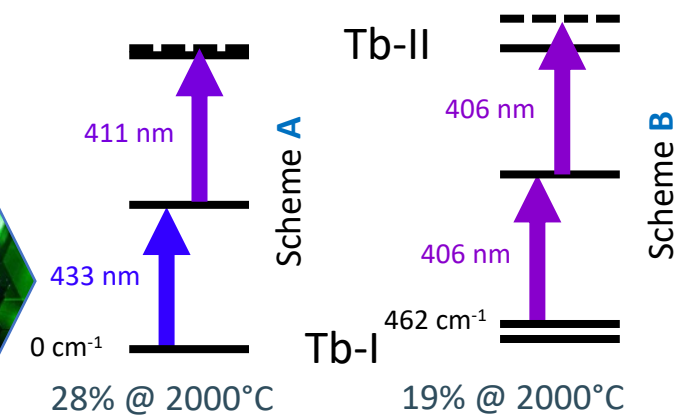
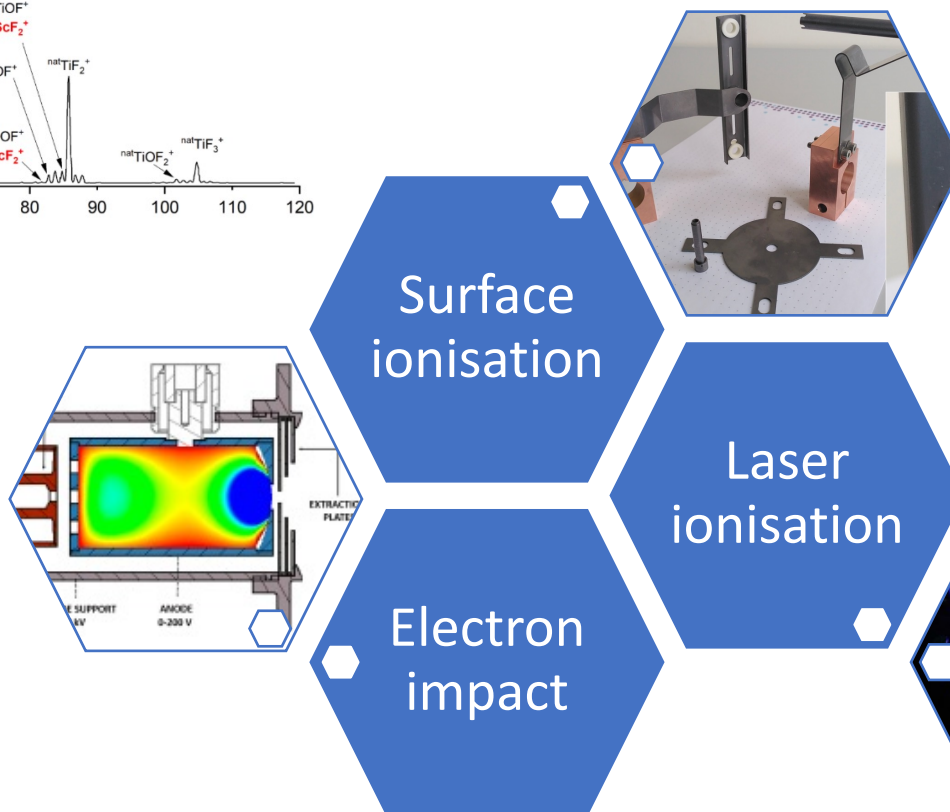
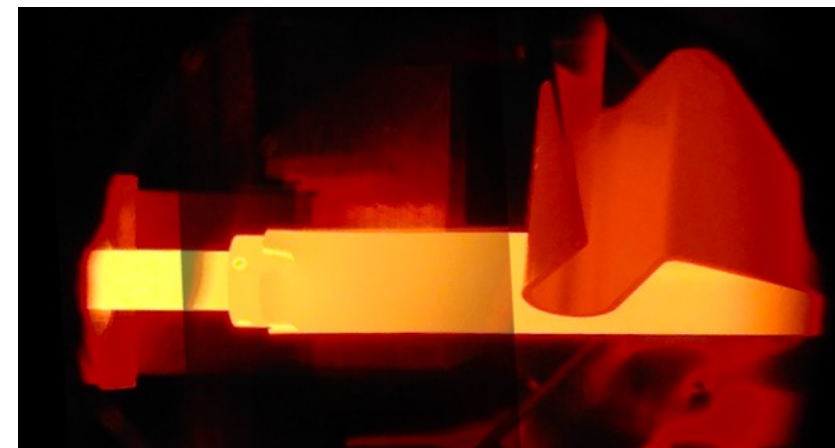
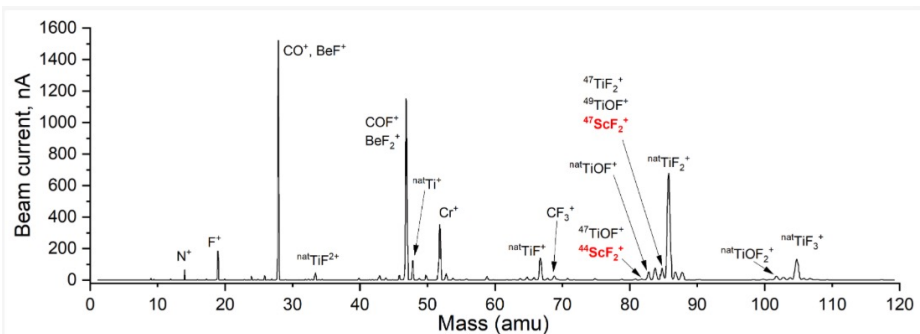


# Releasing all the flavours at high T

- From the target material to the ion source, there are two steps: **diffusion** & **effusion**
- It is full of chemistry and weird stuff: true cooking skills are required.
- From sublimating Sm to AcO ceramics, we have faced many forms of unexpected!

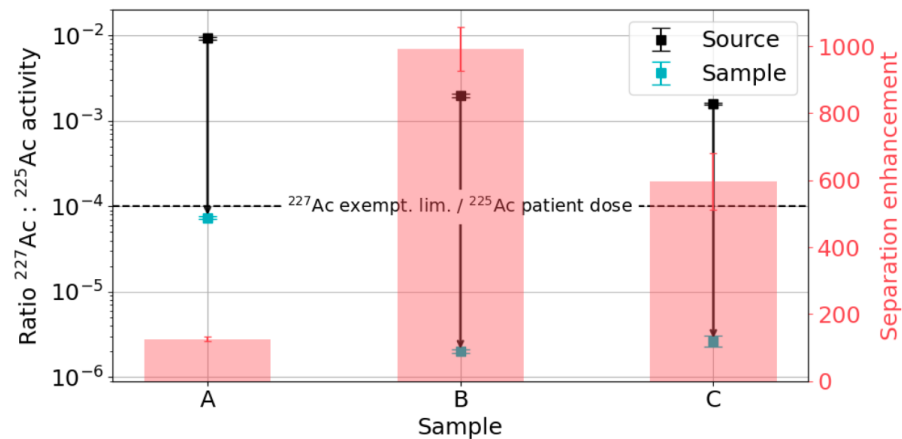
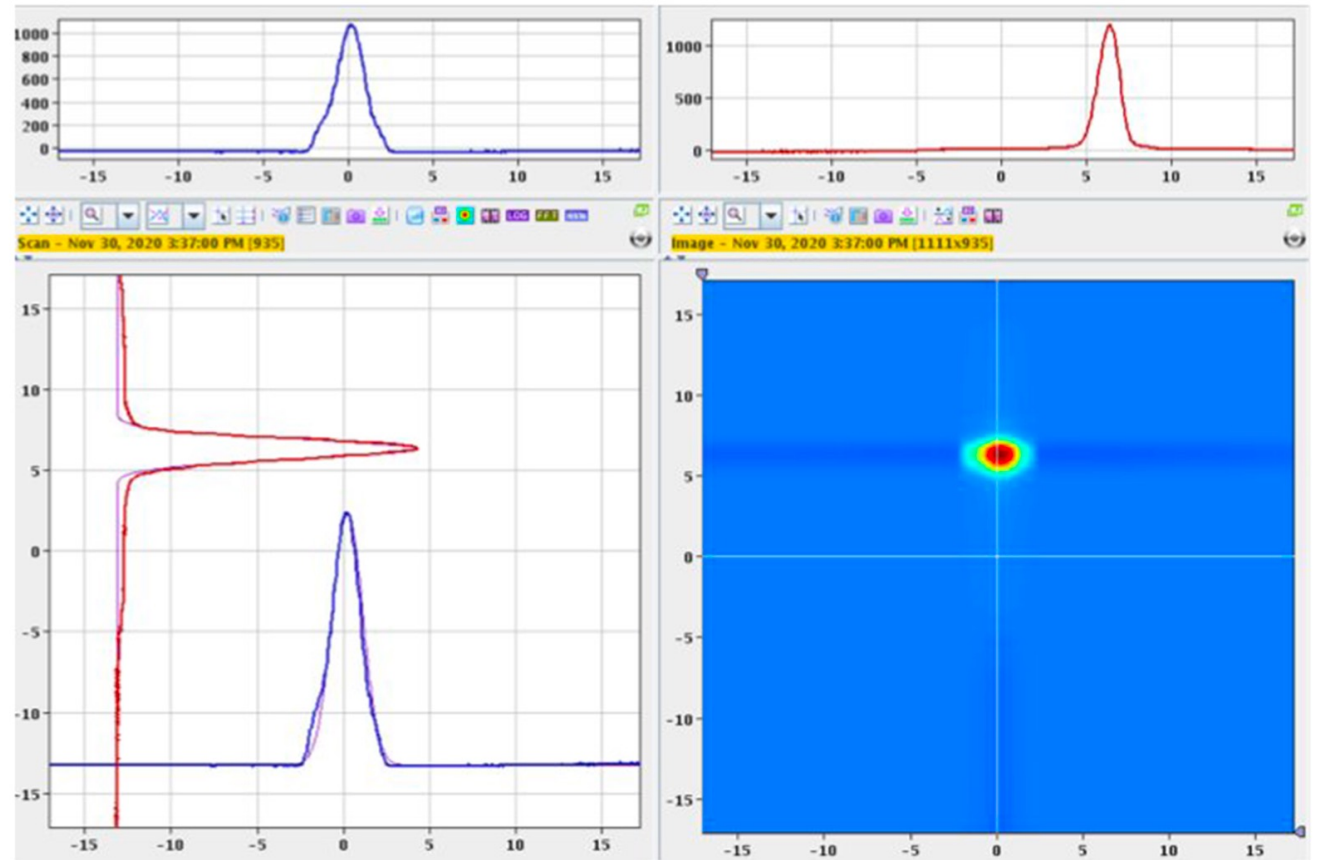
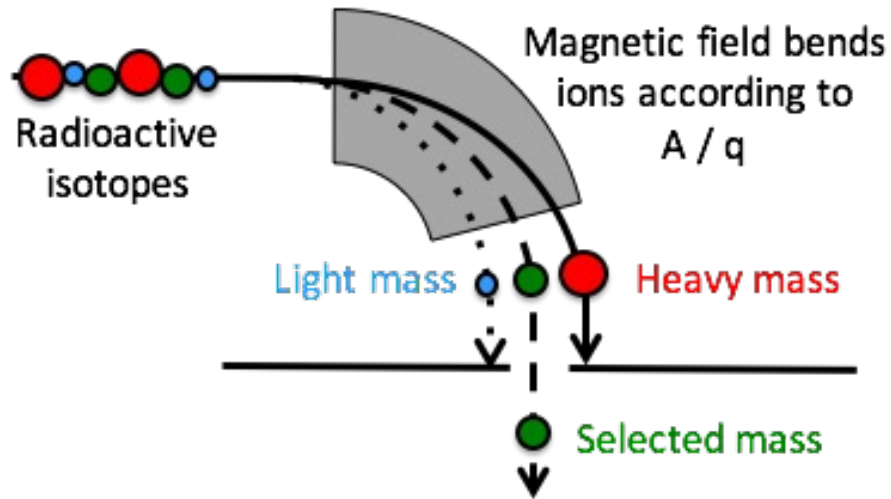


# Shooting it away: the ion source



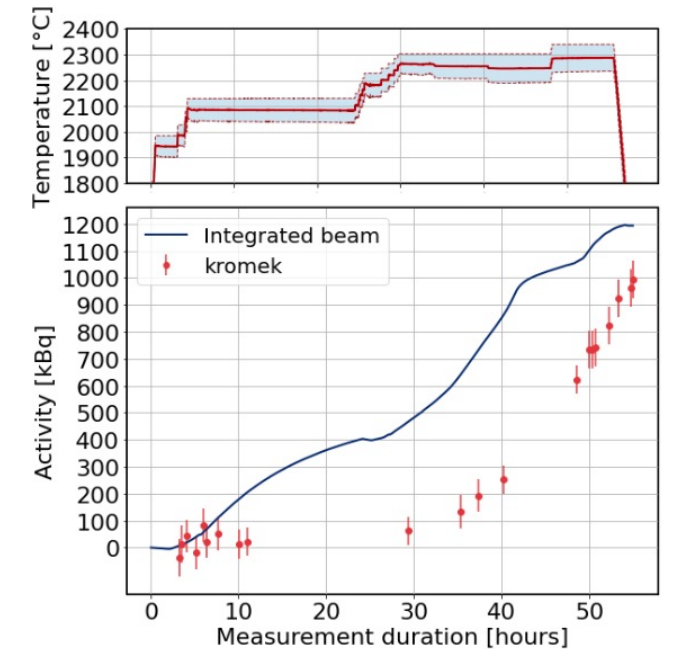
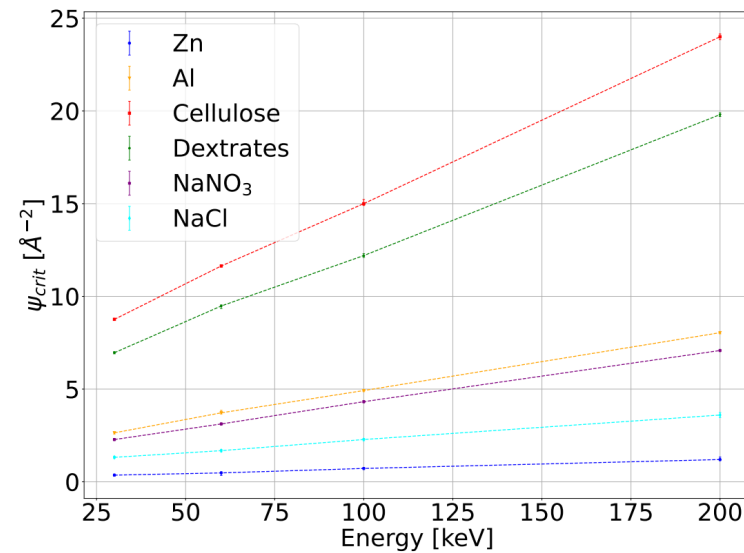
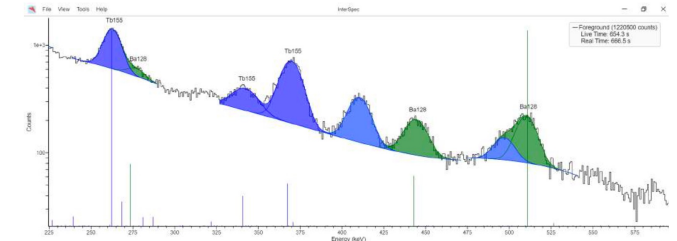
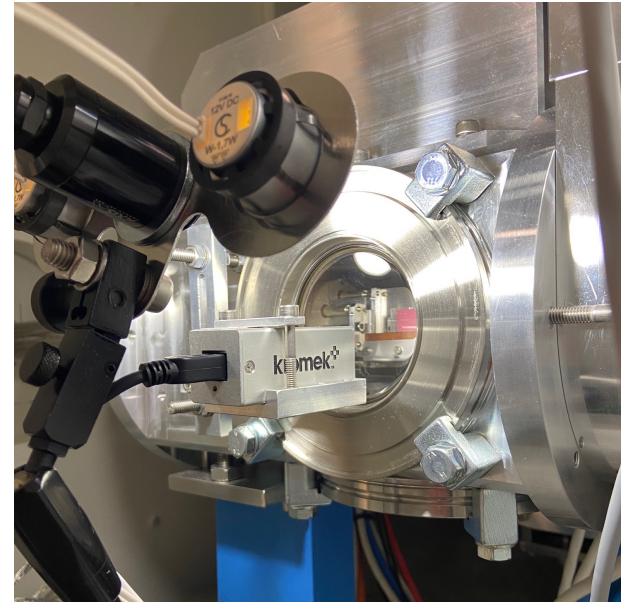
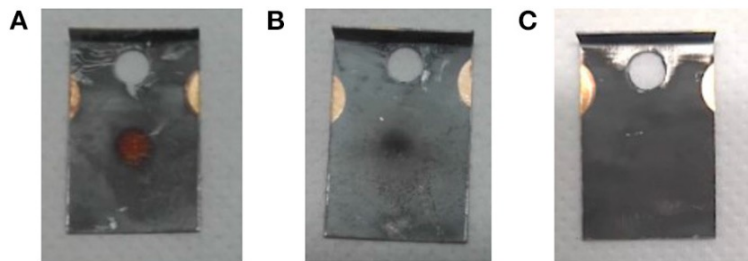
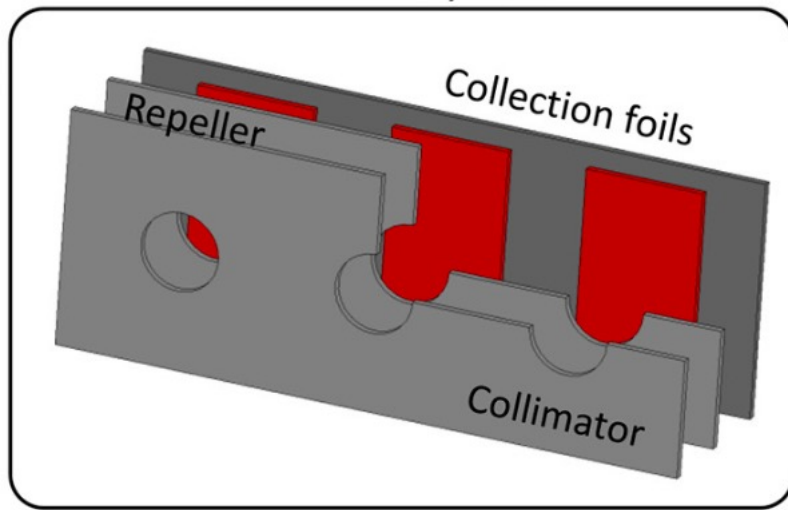


# Pick & choose: mass separation



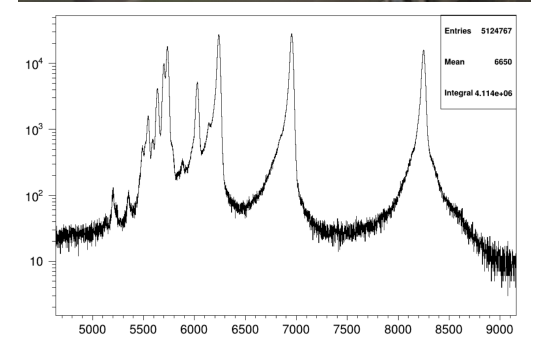
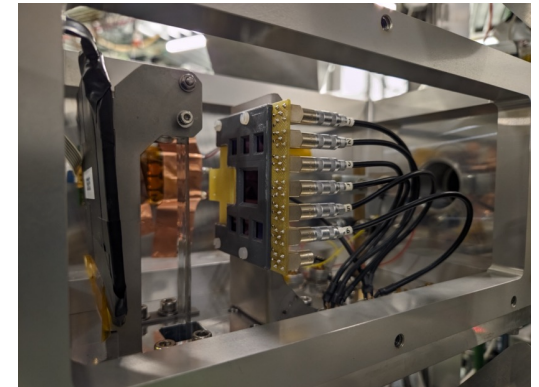
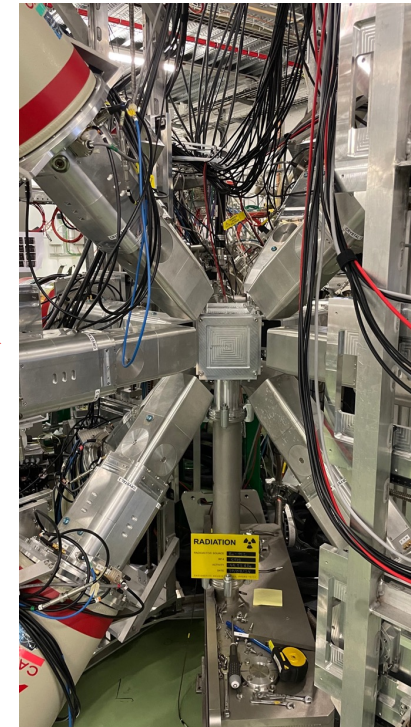
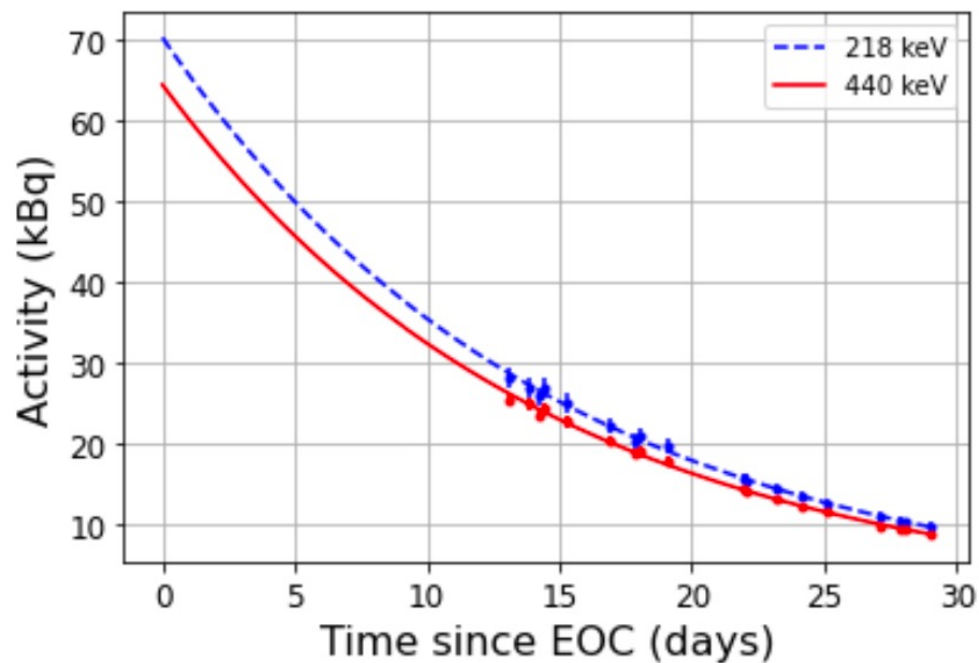
# Ready to serve?

- Implantation is not trivial!



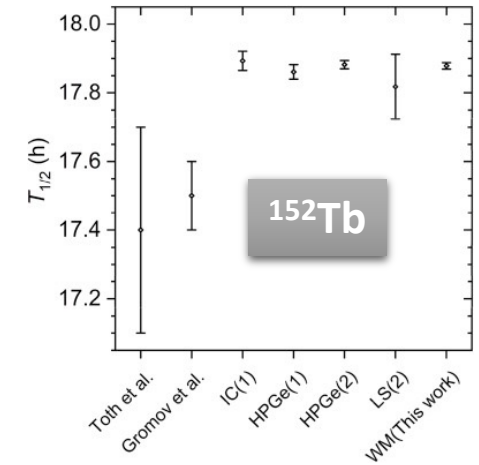
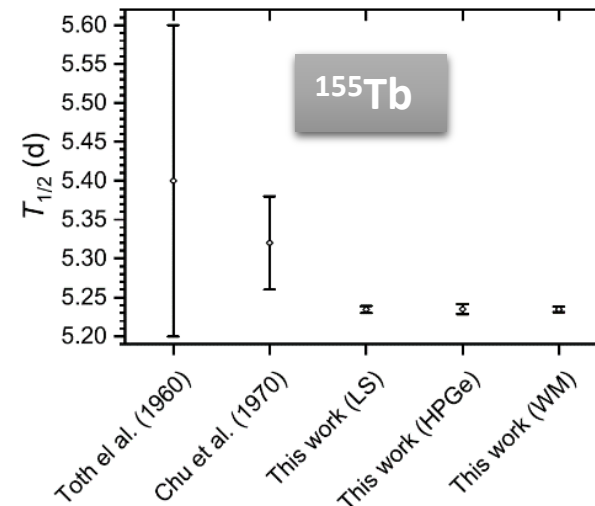
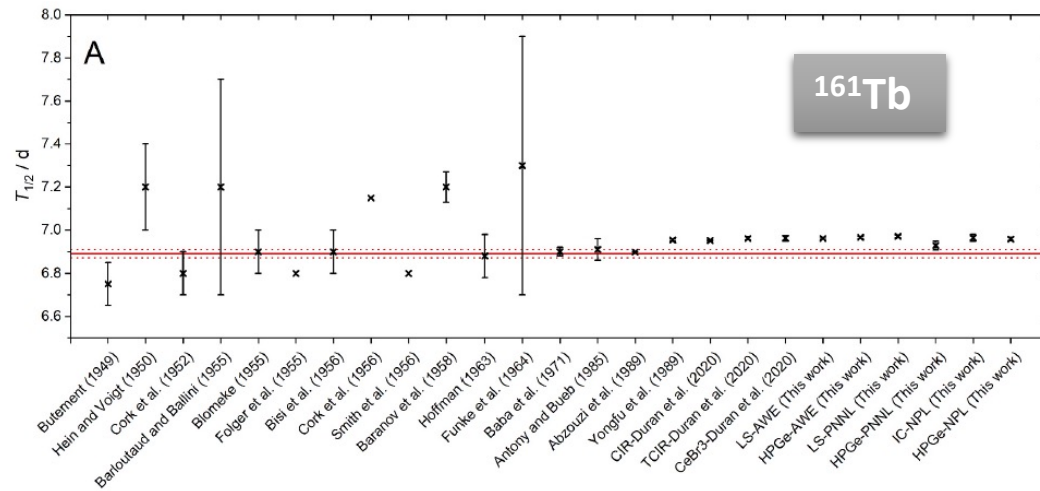
# And what do we have here?

- The nuclear data on many of these medical radionuclides are actually insufficiently known for use in clinical settings!



# And what do we have here?

- The nuclear data on many of these medical radionuclides are actually insufficiently known for use in clinical settings!



S. Collins et al., *Applied Radiation and Isotopes* **182** (2022) 110140.

S. Collins et al., *Applied Radiation and Isotopes* **190** (2022) 110480.

S. Collins et al., *Applied Radiation and Isotopes* **202** (2023) 111044.

