KU LEUVEN

Update muX meeting 09/02

Marie Deseyn

^{108m}Ag target production overview

What is needed?

- > 5 μg of ^{108m}Ag
- Purity (N(^{108m}Ag)/N(tot)) > 95%
- In a realistic separation time at GLM

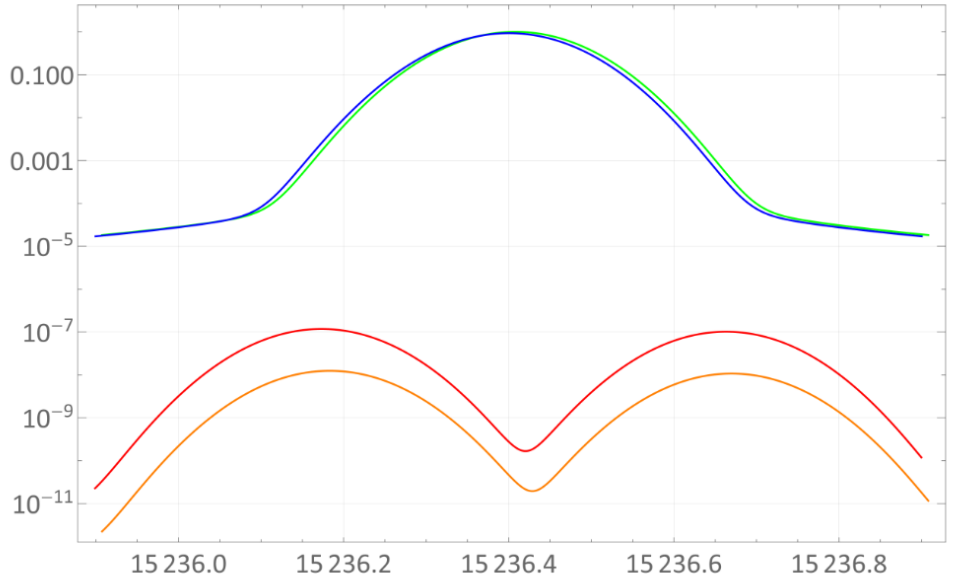
Irradiation of **100mg** enriched ^{107}Ag to a fraction of ^{108m}Ag of **1%** (corresponding to $5.63 \cdot 10^{18}$ ^{108m}Ag particles) and collection at ISOLDE-GLM in **off-resonance laser** mode.
This would yield:

- fraction of ^{108m}Ag on collection foil = 99.96%
- $6.5(2) \cdot 10^{16}$ ^{108m}Ag particles incoming on the foil
- $\approx 3.1(1) \cdot 10^{16}$ ^{108m}Ag particles retained on the foil (at most $\approx 3.6 \cdot 10^{16}$, if collection is stopped at the maximum of the self-sputtering curve)
- A collection time at ISOLDE-GLM of ≈ 1.63 days

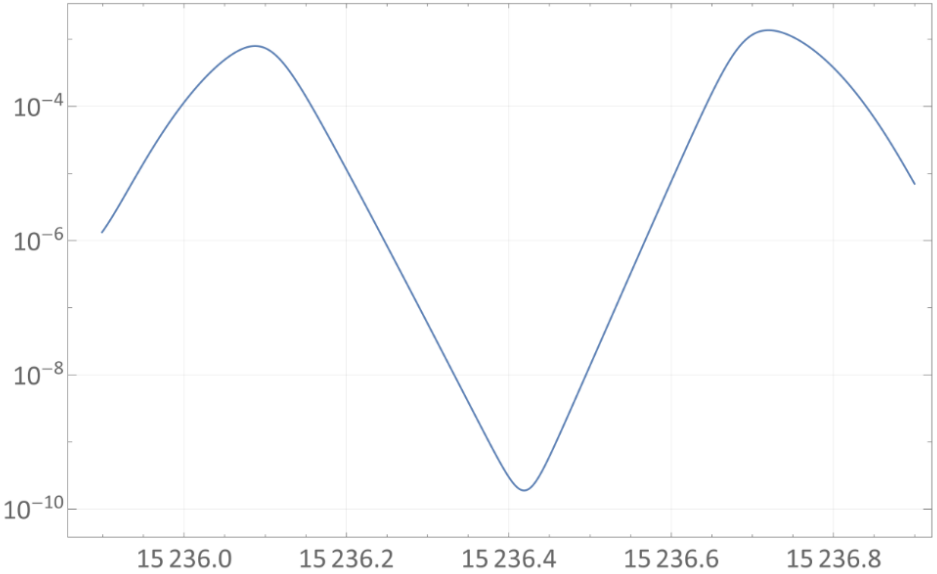
Main limitations

GLM side

- Ion load effects occur for **total** currents > 150nA



(a) Simulated beam fraction as a function of wavelength of the first step laser. The green and blue lines correspond to ^{107}Ag and ^{109}Ag respectively, while the red and orange curves correspond to ^{109m}Ag and ^{110m}Ag respectively.



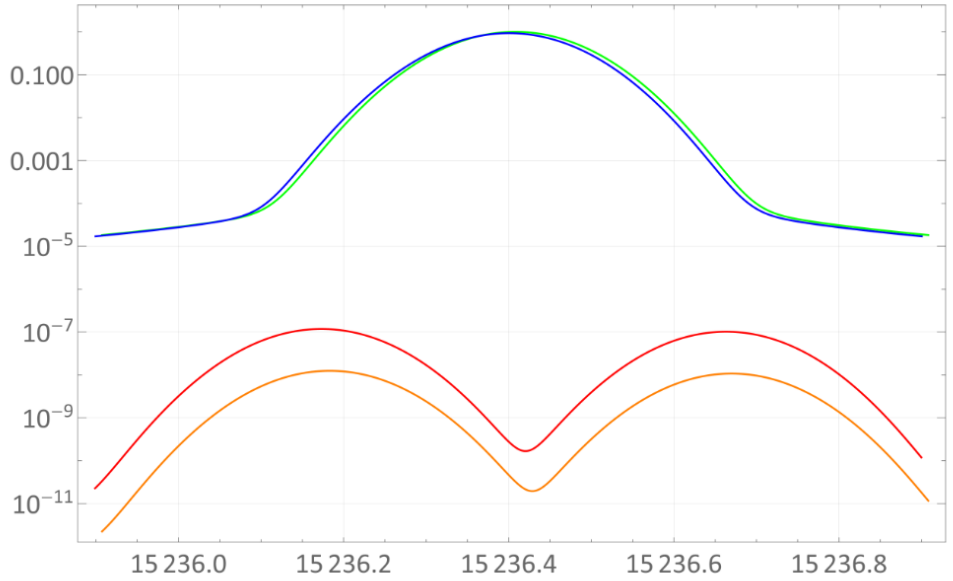
(b) Simulated beam fraction of ^{110m}Ag divided by the beam fraction of ^{109}Ag.

Main limitations

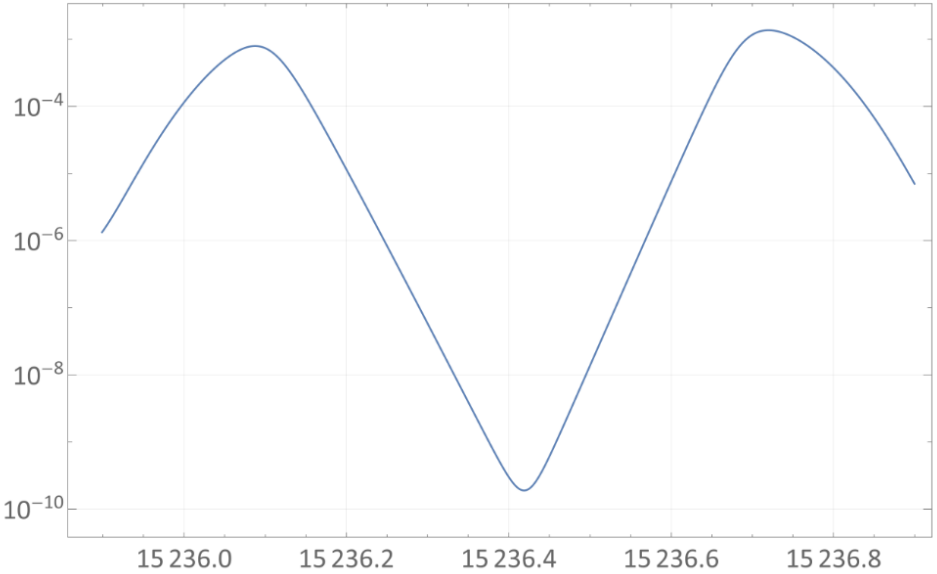
GLM side

- Ion load effects occur for **total** currents > 150nA

→ For ON resonance collection would take > 50 days (because of larger total current due to more ^{107}Ag ionization)



(a) Simulated beam fraction as a function of wavelength of the first step laser. The green and blue lines correspond to ^{107}Ag and ^{109}Ag respectively, while the red and orange curves correspond to ^{109m}Ag and ^{110m}Ag respectively.



(b) Simulated beam fraction of ^{110m}Ag divided by the beam fraction of ^{109}Ag.

Main limitations

GLM side

- Ion load effects occur for **total** currents > 150nA

→ For ON resonance collection would take > 50 days (because of larger total current due to more ^{107}Ag ionization)

- Limited ionization efficiency
  - OFF resonance: 1.16%
  - ON resonance: 3.25%
- Coating/spraying with neutral Ag

BR2/Maria side

- "transmuting 1% of ^{107}Ag into ^{108m}Ag is impossible" ~ Ulli Koster
  - Cross-section for ^{108m}Ag is too small compared to total burn-up cross-section
- 0.1% could be more realistic (if the burn-up cross-section of ^{108m}Ag is negligible (unknown))
- Other things will be co-produced which increases the overall activity of the sample to be loaded at GLM

Possible hopes

- Talked to Kati and ion load limits are being investigated and could potentially be improved by a factor 1000 (elaborate studies are planned when Offline2 reopens)
  ➔ Quick calculation assuming a 100x increase of the onset of ion load effects gives that collection ON the resonance, starting from 100mg ^{107}Ag with 0.1% purity would give ~3.3μg ^{108m}Ag and would be finished in ~11h (but neutral coating…)
- BR2 did not say no
- GEANT4 simulations to potentially increase the efficiency of the array

Great abstract! Two things only, I think you should put your name first, followed by Michael and Stella who took shifts on the implantation and led the muX campaign too, followed by the others. DEFINITELY do not keep my name first xD

Thomas 8:52 AM

muX has chosen to follow particle physics tradition and always use only the alphabetical order. The only difference is for conference abstracts and proceedings, where the speaker may be put first. Might be worth discussing this at the meeting today and make sure this is all consistent. But you can answer Michail that all muX and ReferenceRadii paper will feature him as first author, unless A Adamczac is on the paper!

KU LEUVEN