TULIP (2019-2024)

Production of neutron deficient short-lived isotopes using an innovative ISOL configuration (fusion evaporation reactions + in-target cavity ionization)

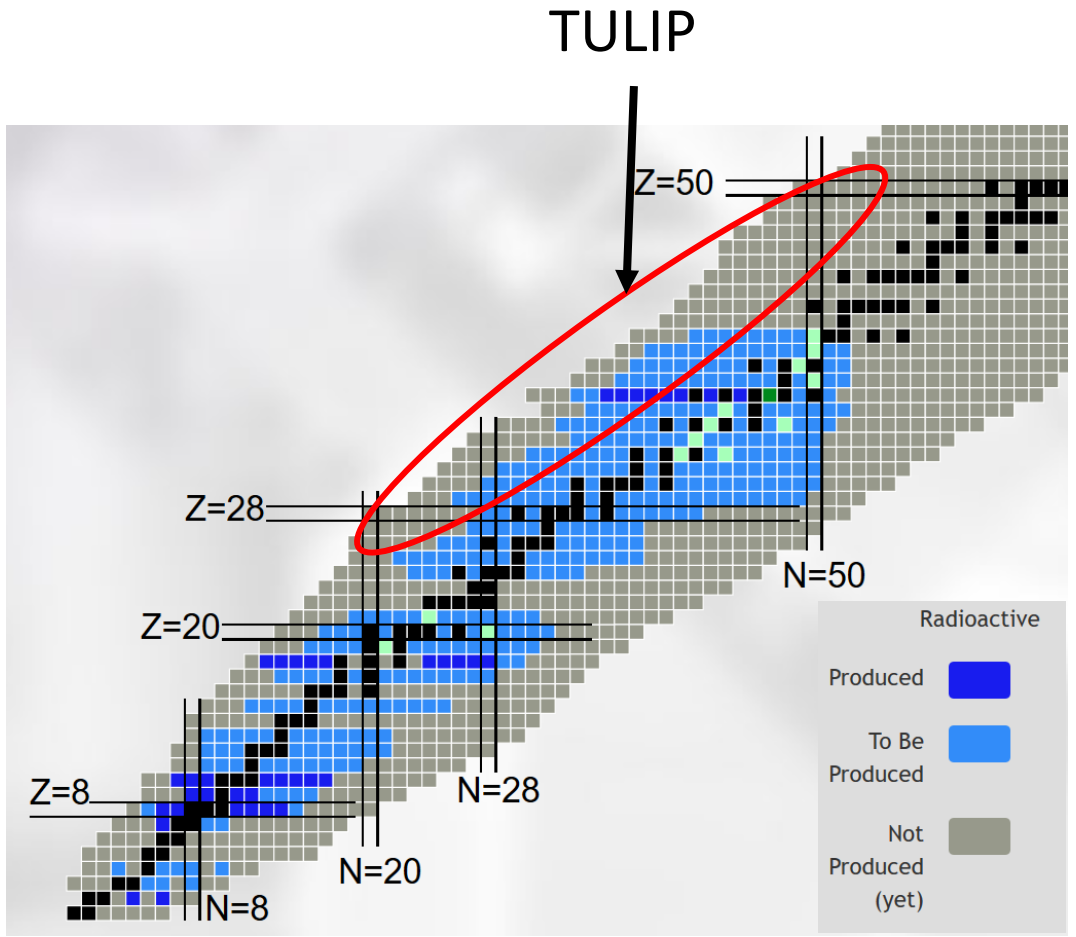
Goals of TULIP

Production of Neutron Deficient Short Lived Ion Beams for SPIRAL1

Two main on-line experiments :

- **$^{74-80}$Rb+ production (1-2nd March, 2022) using surface ionization**

- Production of ions around ^{100}Sn (2023), using electronic impact ionization



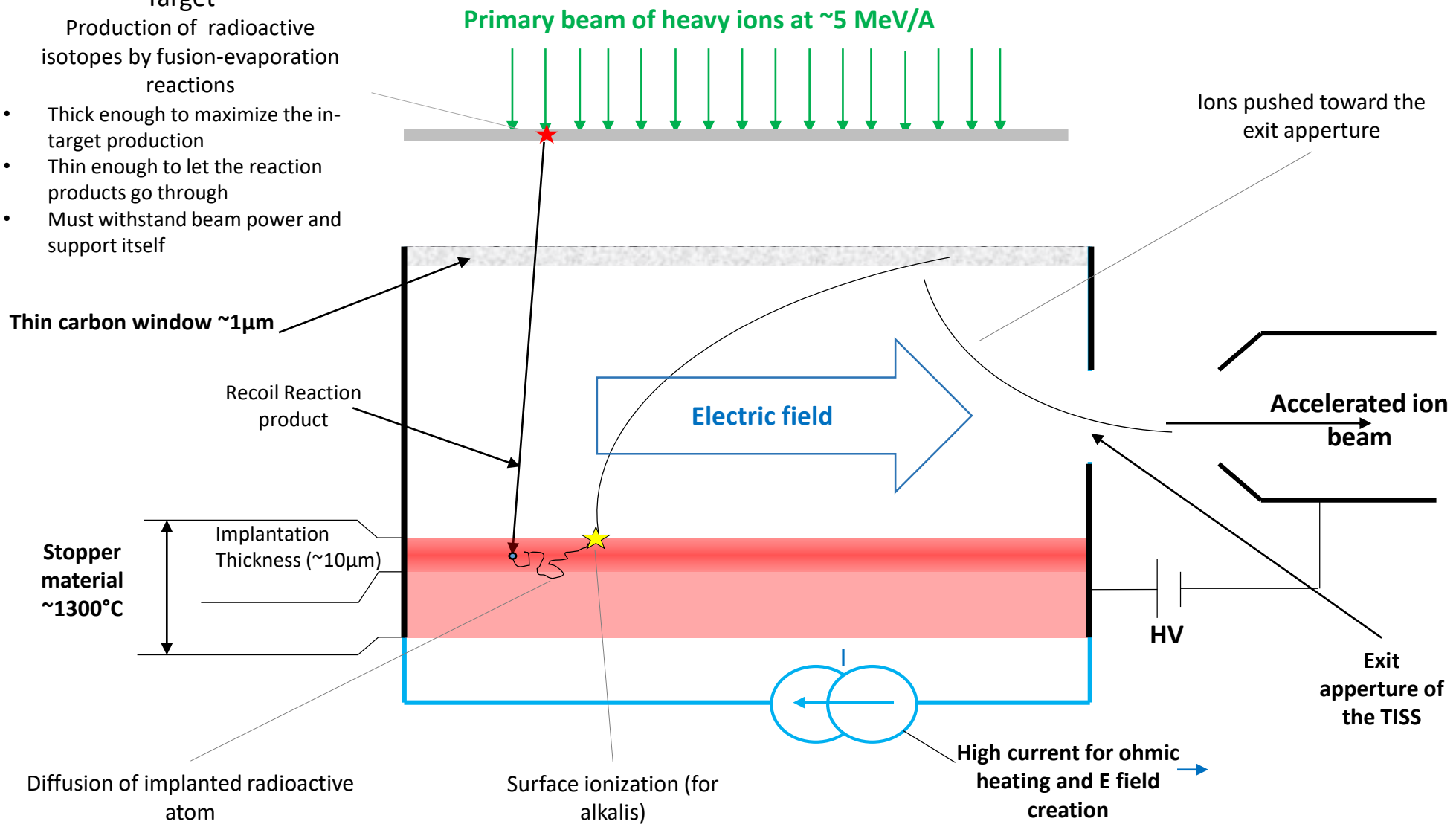
Beam available and to be produced at GANIL by the existing Target and ion source. In red the nuclei that can be created by fusion evaporation

TULIP : an innovative ion source

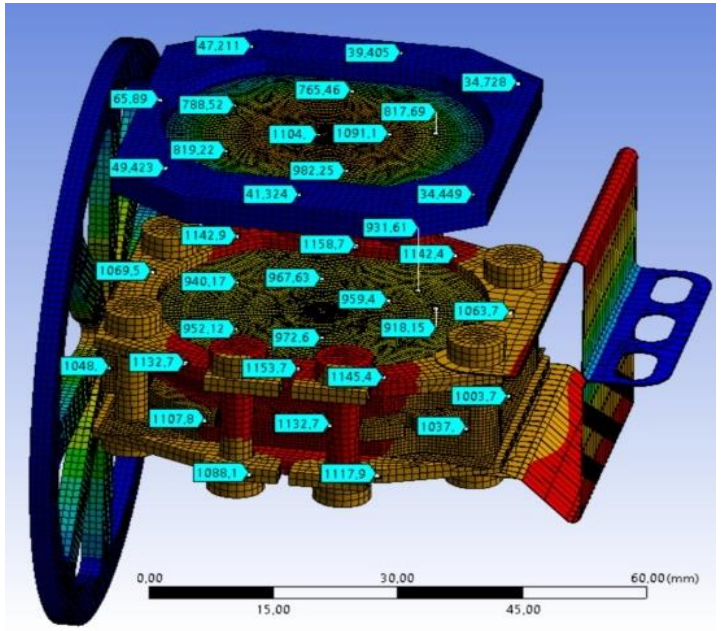
Target

Production of radioactive isotopes by fusion-evaporation reactions

- Thick enough to maximize the in-target production
- Thin enough to let the reaction products go through
- Must withstand beam power and support itself



TULIP : design and off-line test



Design

- ElectroThermal Ansys simulation

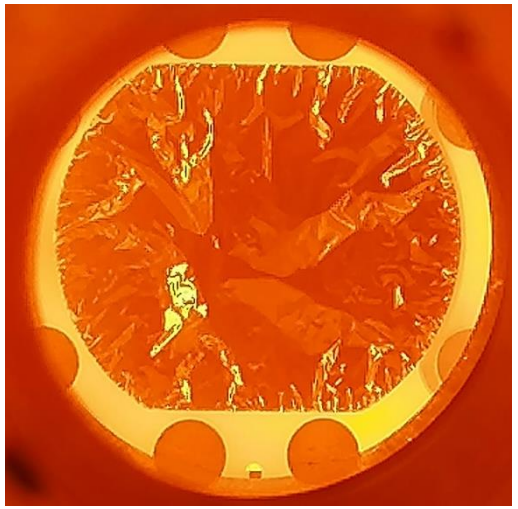
- Lise++ in-target production and transmission of nuclei

Fully tested off-line (except radiation damage)

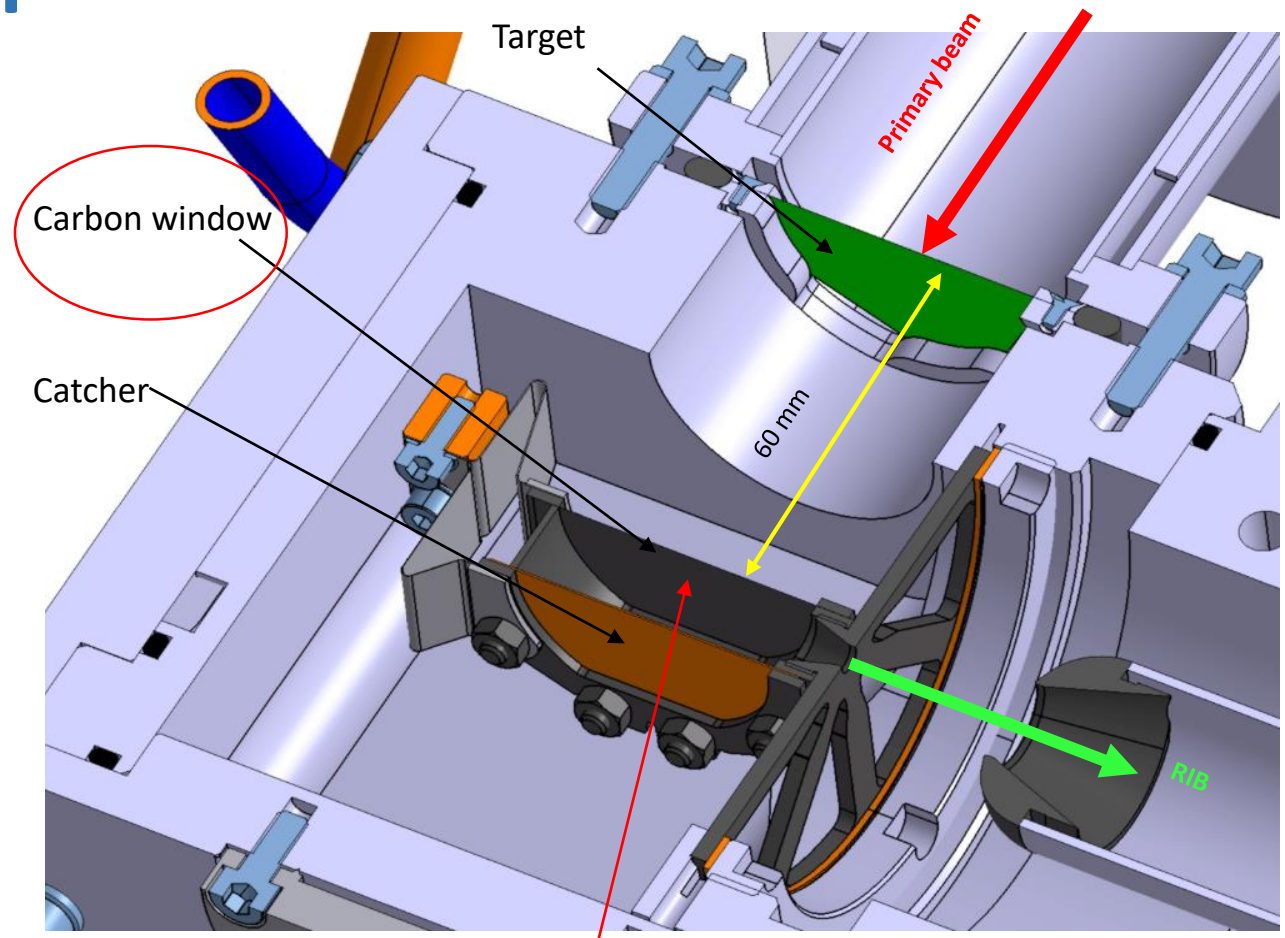
-100 h thermal endurance test at nominal temperature (1300°C) of every components : Target, source cavity, entrance window

- Atom-to-ion transformation time : 18ms (for $^{85}Rb^{+}$)

- Rb Diffusion in different catcher material was measured (ALTO/IJCLab)



1-2nd March 2022 : Radioactive Rb production



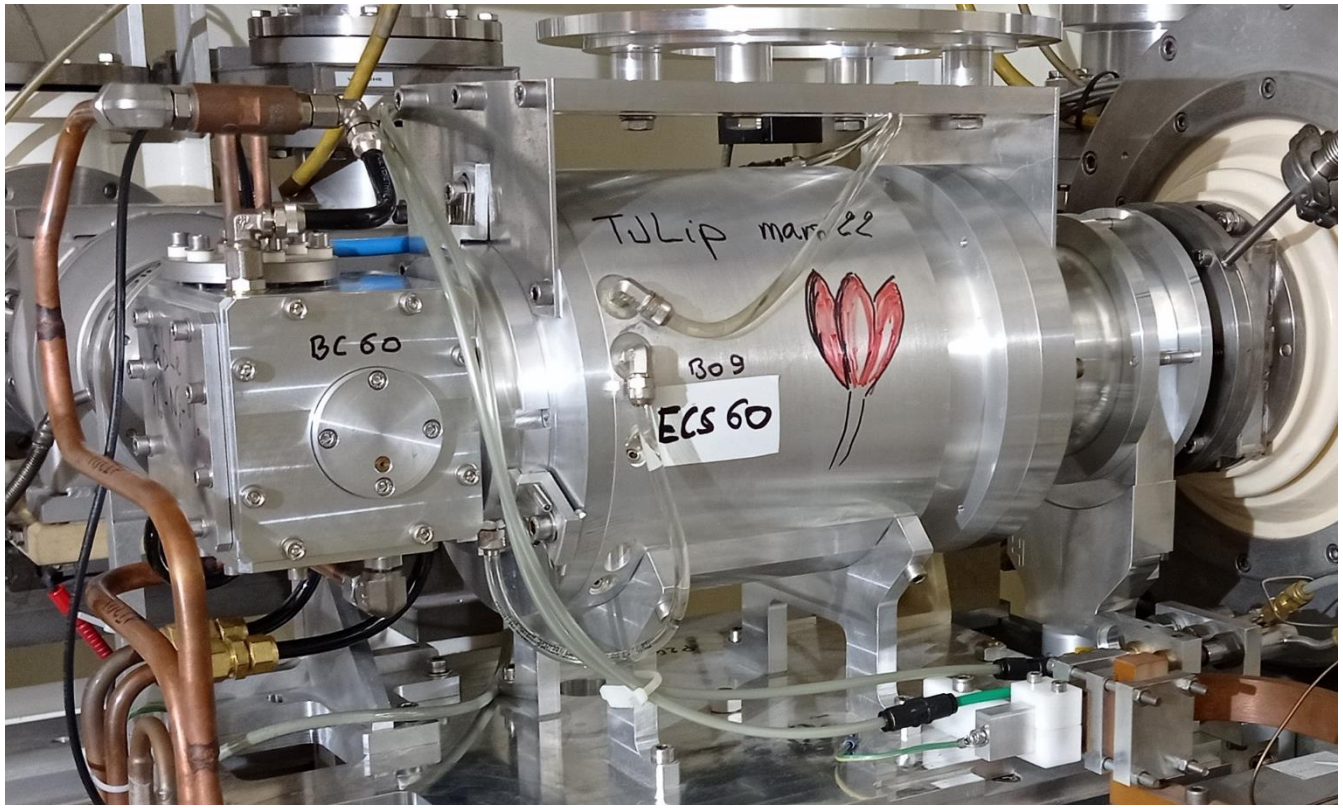
Suspected to be broken. Diagnosis will be done by april 22.

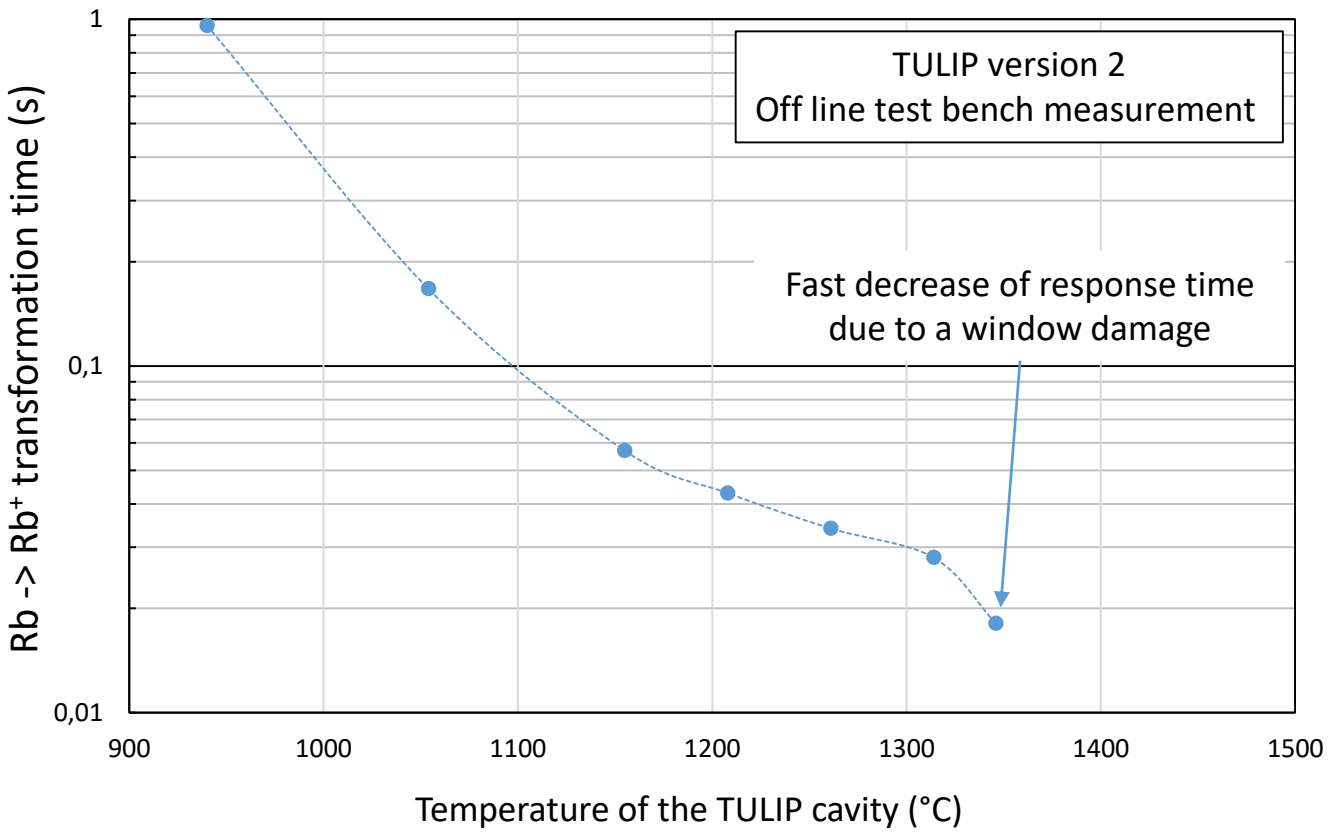
Beam-Target combination :
$^{22}Ne^{+4}$ @4,5MeV/A on 4µm ^{nat}Ni
Up to 4,7 µA of beam current

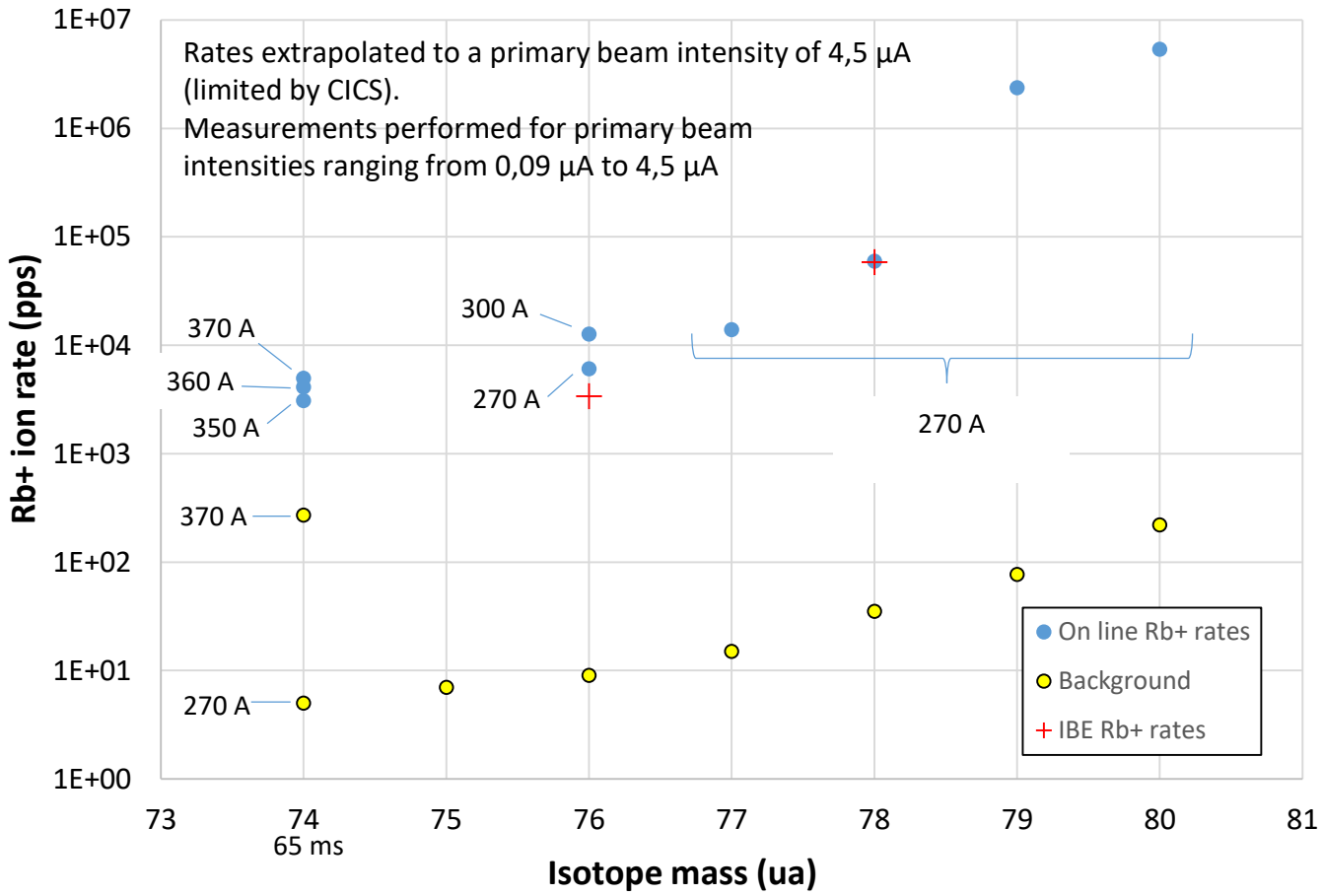
Results :
$^{78}Rb^{+}$: 5*10^{4} pps
$^{76}Rb^{+}$: 4*10^{3} pps
$^{74}Rb^{+}$: probably, not clearly observed

Next steps:
- **improve reliability**
- **test of metallic ion production with an upgraded TULIP (already built)**

Thank you!




TULIP version 2
Off line test bench measurement
Fast decrease of response time
due to a window damage
Rb -> Rb+ transformation time (s)
1
0,1
0,01
900
1000
1100
1200
1300
1400
1500
Temperature of the TULIP cavity (°C)


Rates extrapolated to a primary beam intensity of 4,5 µA (limited by CICS).
Measurements performed for primary beam intensities ranging from 0,09 µA to 4,5 µA
Rb+ ion rate (pps)
1E+07
1E+06
1E+05
1E+04
1E+03
1E+02
1E+01
1E+00
370 A
360 A
350 A
300 A
270 A
370 A
270 A
270 A
On line Rb+ rates
Background
IBE Rb+ rates
73
74
65 ms
75
76
77
78
79
80
81
Isotope mass (ua)