Targets for the SPES project and its applications: material selection and release simulations

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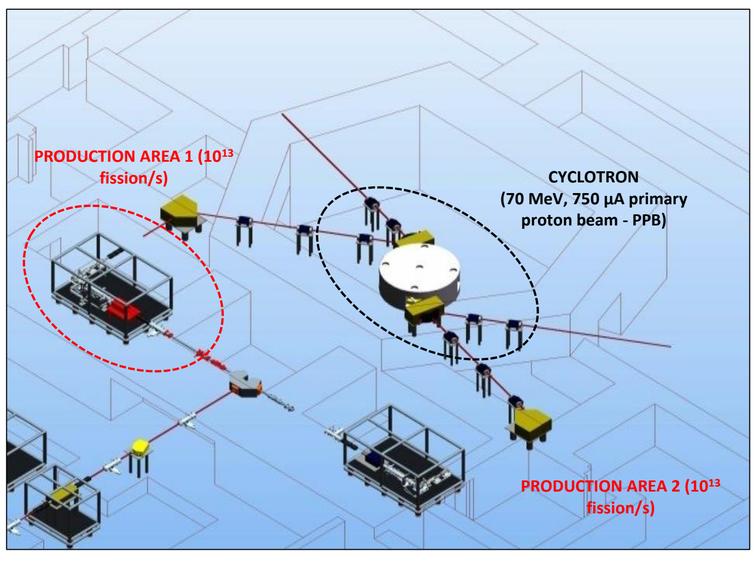
Introduction

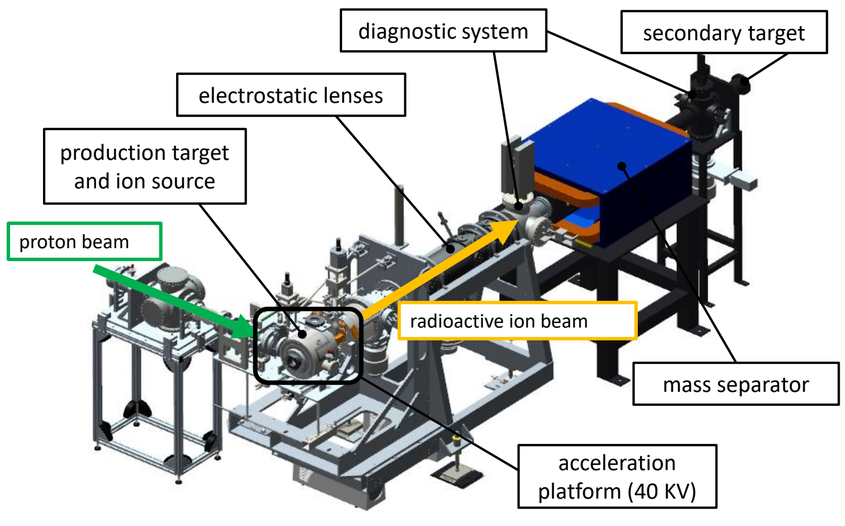
The SPES (Selective Production of Exotic Species) ISOL facility at INFN-LNL will produce Radioactive Ion Beams (RIBs) by impinging a multi-foil uranium carbide target with a proton beam, accelerated up to 70 MeV by a cyclotron. The produced nuclei will be employed in many fields of research, ranging from astrophysics to material science and nuclear medicine. Different target materials are currently under investigation with Monte Carlo simulations for the isotopes production yield. Such materials were selected taking into account both the available proton beam energy and the expected working temperature (2000°C). In addition, the release from the target of the produced isotopes is under investigation through the definition of a new custom GEANT4 Monte Carlo model.

The SPES ISOL facility

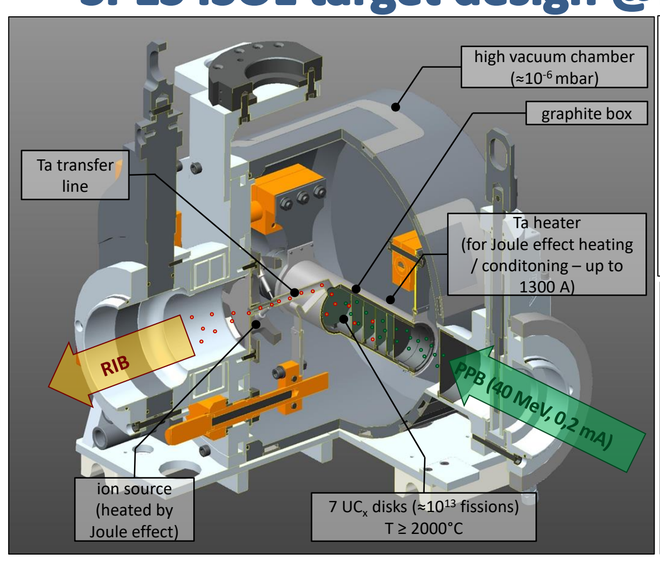
General overview

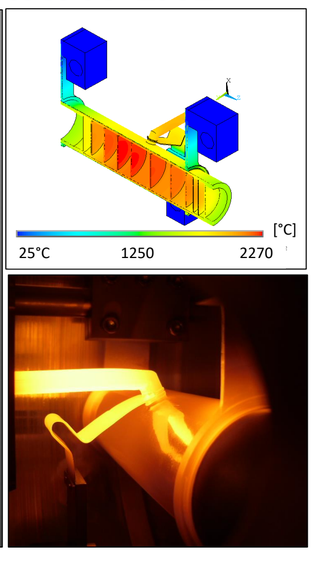


Production area



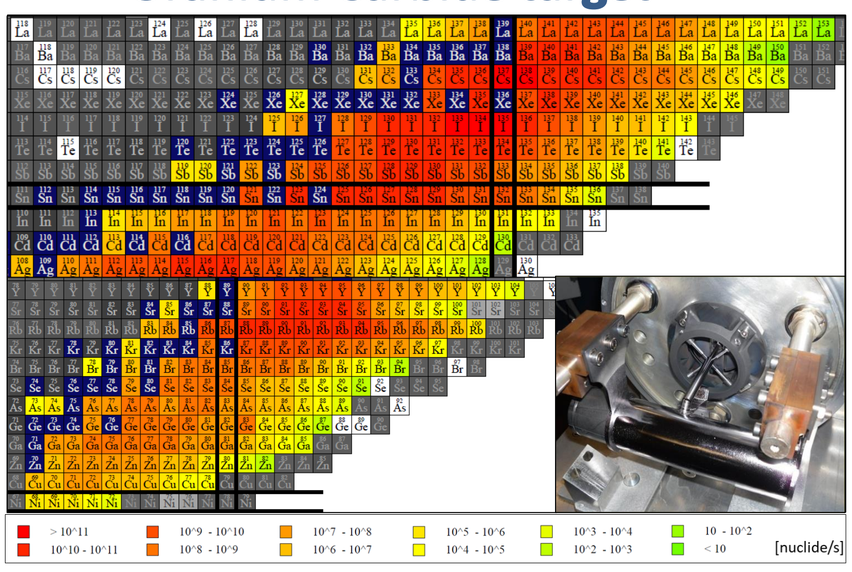
SPES ISOL target design @INFN-LNL [1]



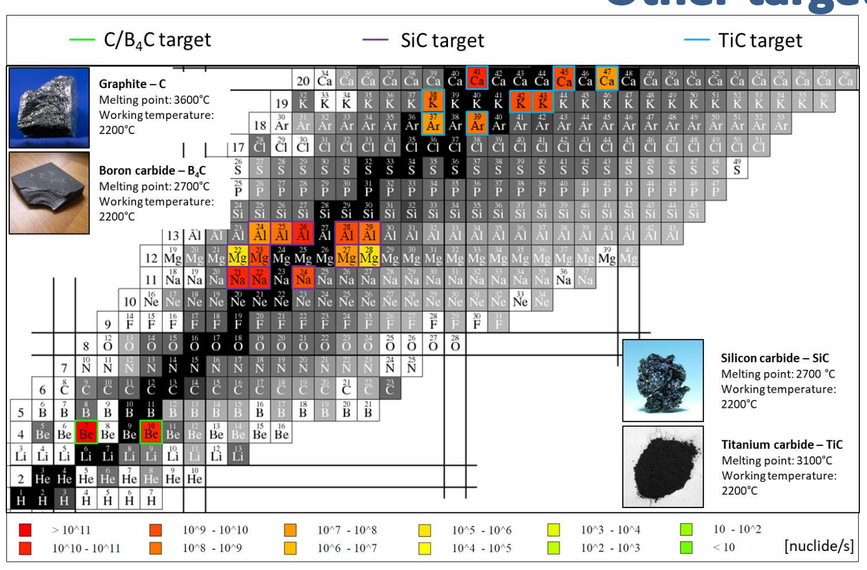


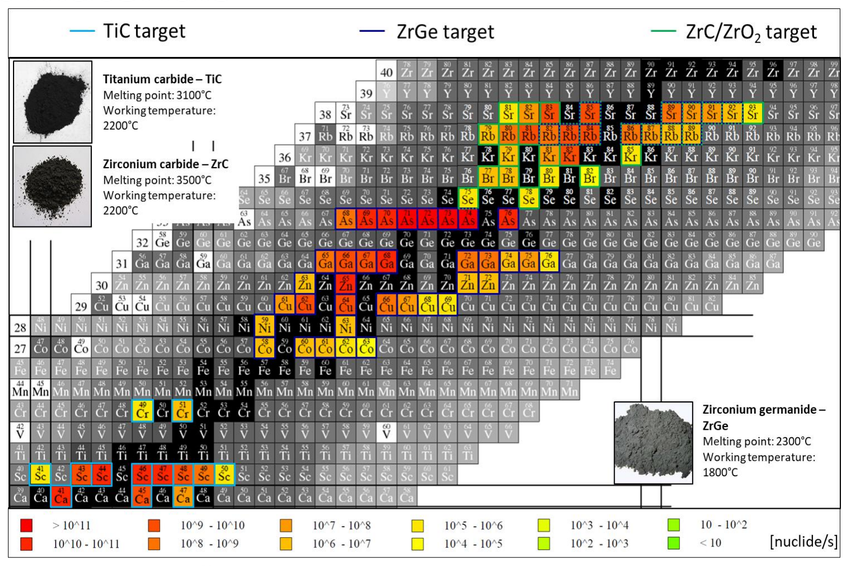
Expected beam intensities @ SPES

Uranium Carbide target [2]



Other target materials [3]





Yield calculations done with the MC code FLUKA, corrected with the experimentally evaluated ionization efficiency and the estimated release efficiency

Isotope release simulation using GEANT4 (under development)

Simulation concept

Implemented model

A case study: rubidium isotopes

Conclusions

Monte Carlo calculations (FLUKA) show promising results for the selected target concepts, UC_x, SiC, TiC and ZrGe will be further developed and tested.
The GEANT4 release model will be benchmarked with experimental data.

References

1. M. Manzolaro et al. [2014], Rev. Sci. Instrum. 85: 02B918.
2. Monetti A. et al. [2015], Eur. Phys. J. A., 51: 128.
3. Gottberg A. [2016], Nucl. Instr. Meth. B,376: 8-15

7th High Power Targetry Workshop
June 4th, 8th 2018 – East Lansing, MI - US