DEVELOPMENT OF A PROTON-TO-NEUTRON CONVERTER FOR RADIOISOTOPE PRODUCTION AT ISAC-TRIUMF

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Introduction

In the ISOL method (Isotope Separation On Line) applied at TRIUMF, an incoming 500 MeV proton beam interacts with the target material within a tantalum container and induces the production of a variety of radioisotopes.

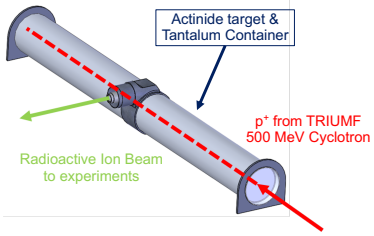
Motivation

Direct proton irradiation of **standard actinide target** materials induces the production of many radioisotopes through spallation and fission reactions. However, experiments often require much purer beams than usually provided.

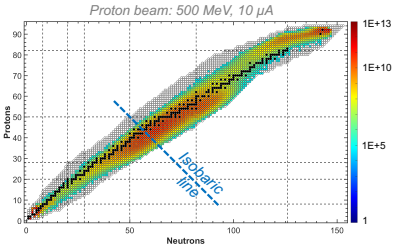
Solution

A collaboration between TRIUMF, CERN and SCK•CEN is developing a high-power proton-to-neutron converter target. It aims at reducing the contamination level of unwanted isotopes without affecting the production rate of the ones of interest

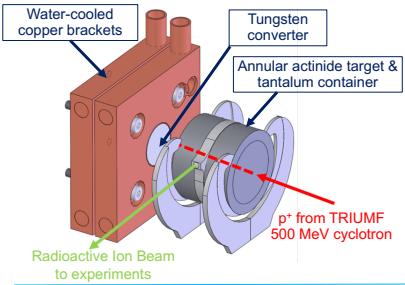
Standard Actinide target



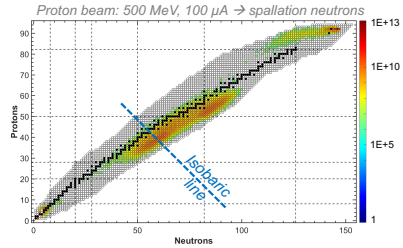
- Many nuclides are produced from the same actinide target ✓
- Experiments often suffer from **isobaric contamination** ✗ Selective production is needed.
- Direct proton beam on target creates **cold spots** detrimental for isotope extraction ✗



New proton-to-neutron converter target

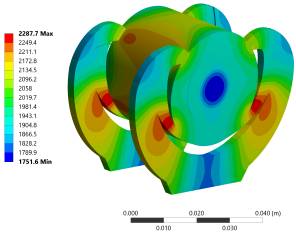


- Match or increase the standard production of neutron-rich fission fragments ✓
- Reduce by a factor 100 the contamination from neutron deficient isobaric nuclides ✓
- Avoid proton beam induced cold spots for more efficient isotope extraction ✓



Converter and Target Design

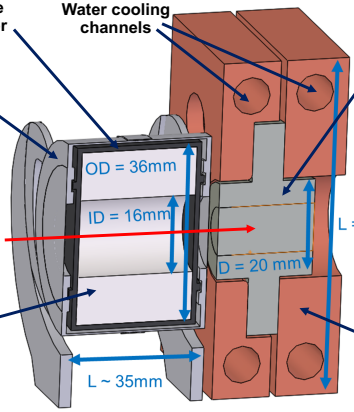
Tantalum container / heater
- Contains target material
- Heated by current of 1600 A



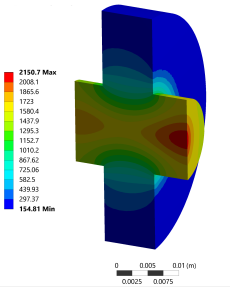
Graphite container

Water cooling channels

Cut view of figure up-top



Tungsten proton-to-neutron converter
- 7.5 kW deposited by p+ beam
- T_{max} = 2150 °C



Actinide annular target material
- Annular, no direct interaction with protons
- Neutrons induce 3E+11 fiss/s
- Minimum operational temperature = 1900 °C

Copper alloy brackets
- Clamp converter to dissipate heat
- Includes water cooling channels

Outlook

Offline target heating tests needed to validate the concept are planned for Spring 2018, while online irradiation of this target is foreseen for Winter 2018.

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