SCK•CEN

STUDIECENTRUM VOOR KERNENERGIE
CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE

The ISOL@MYRRHA Project at SCK•CEN Synergies with EURISOL

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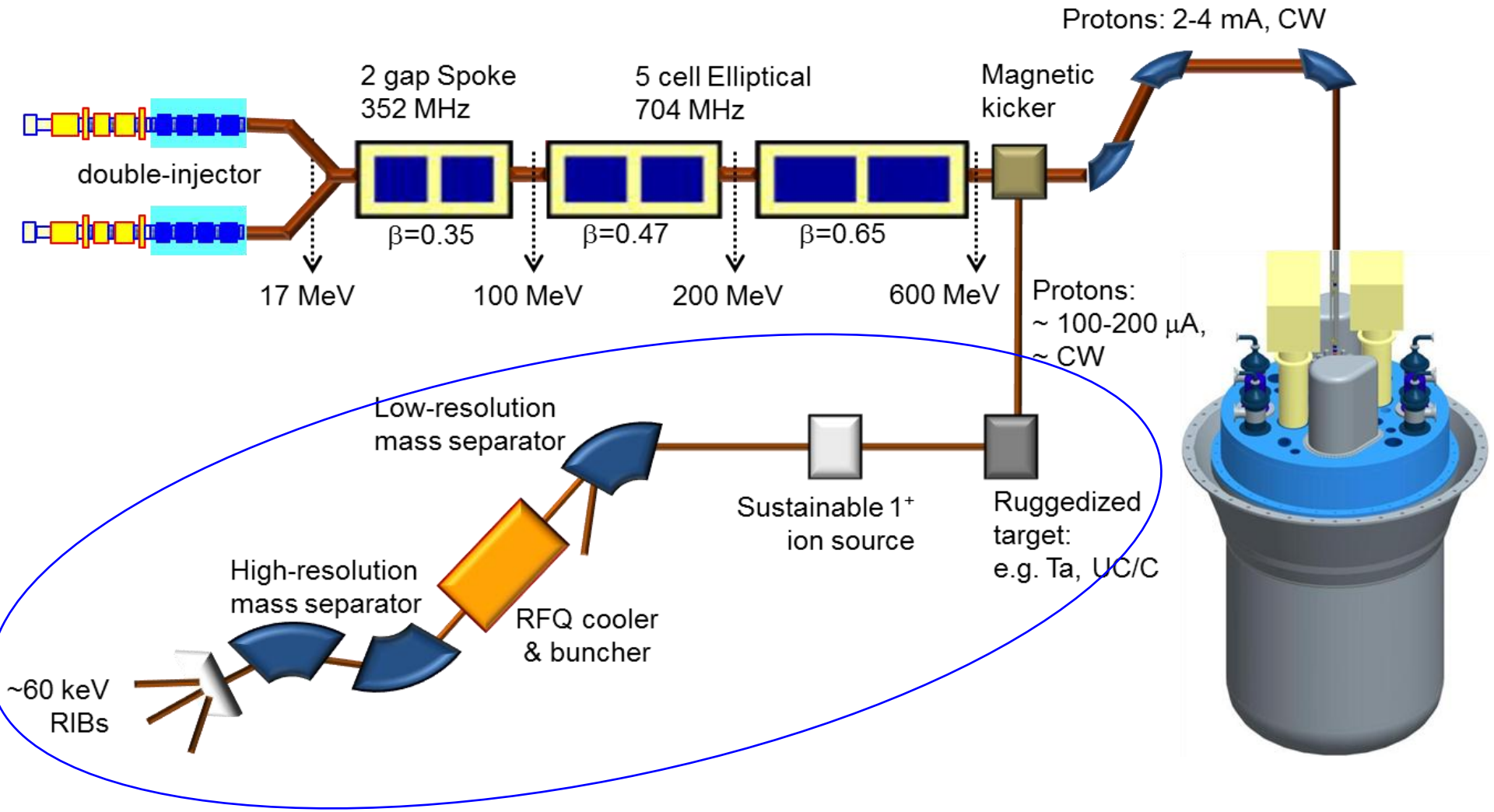
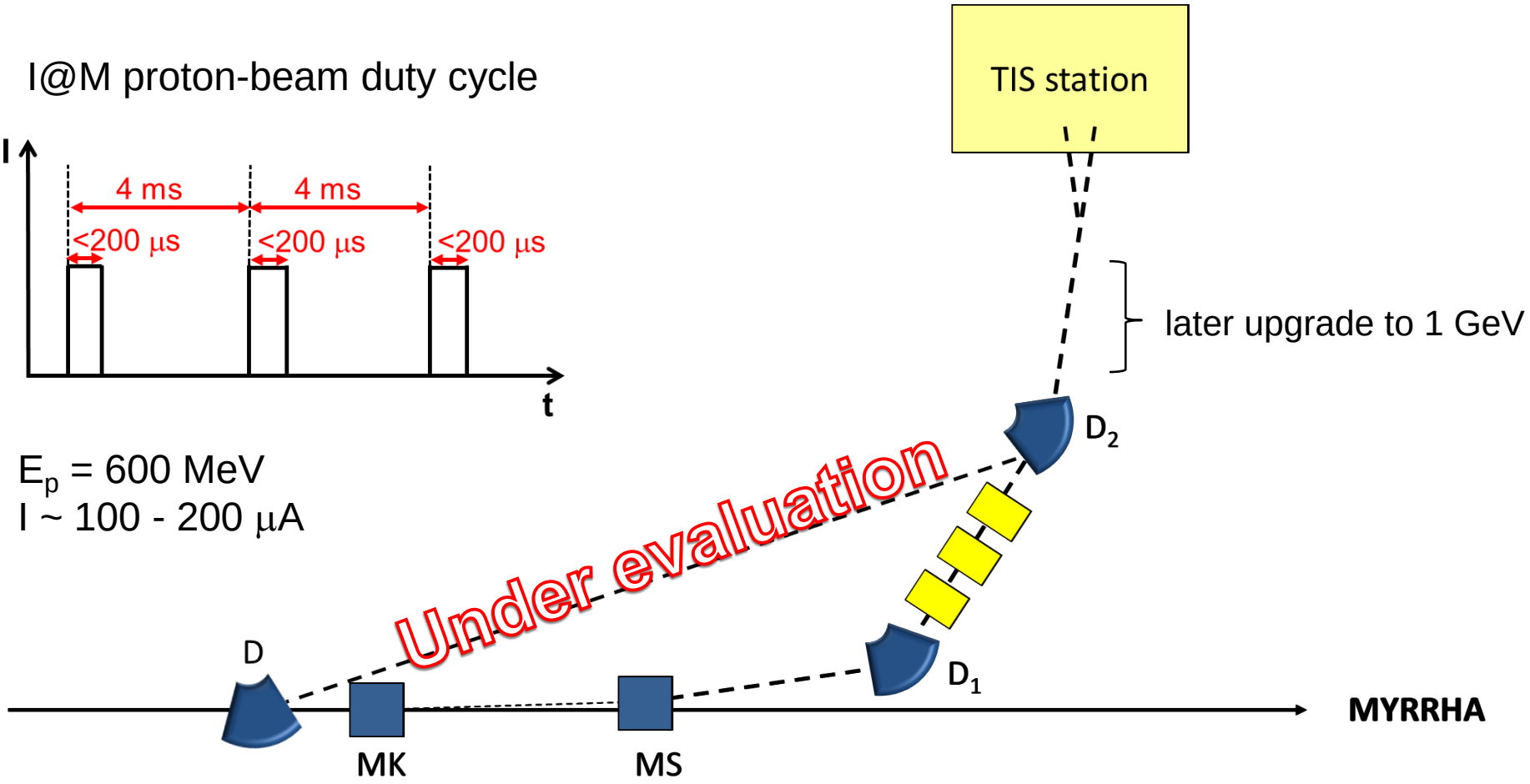
Conceptual Design



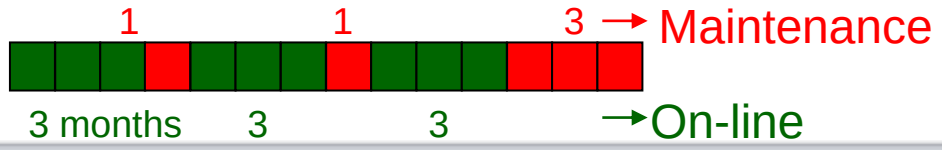
Beam-Splitting System (Concept)

I@M proton-beam duty cycle

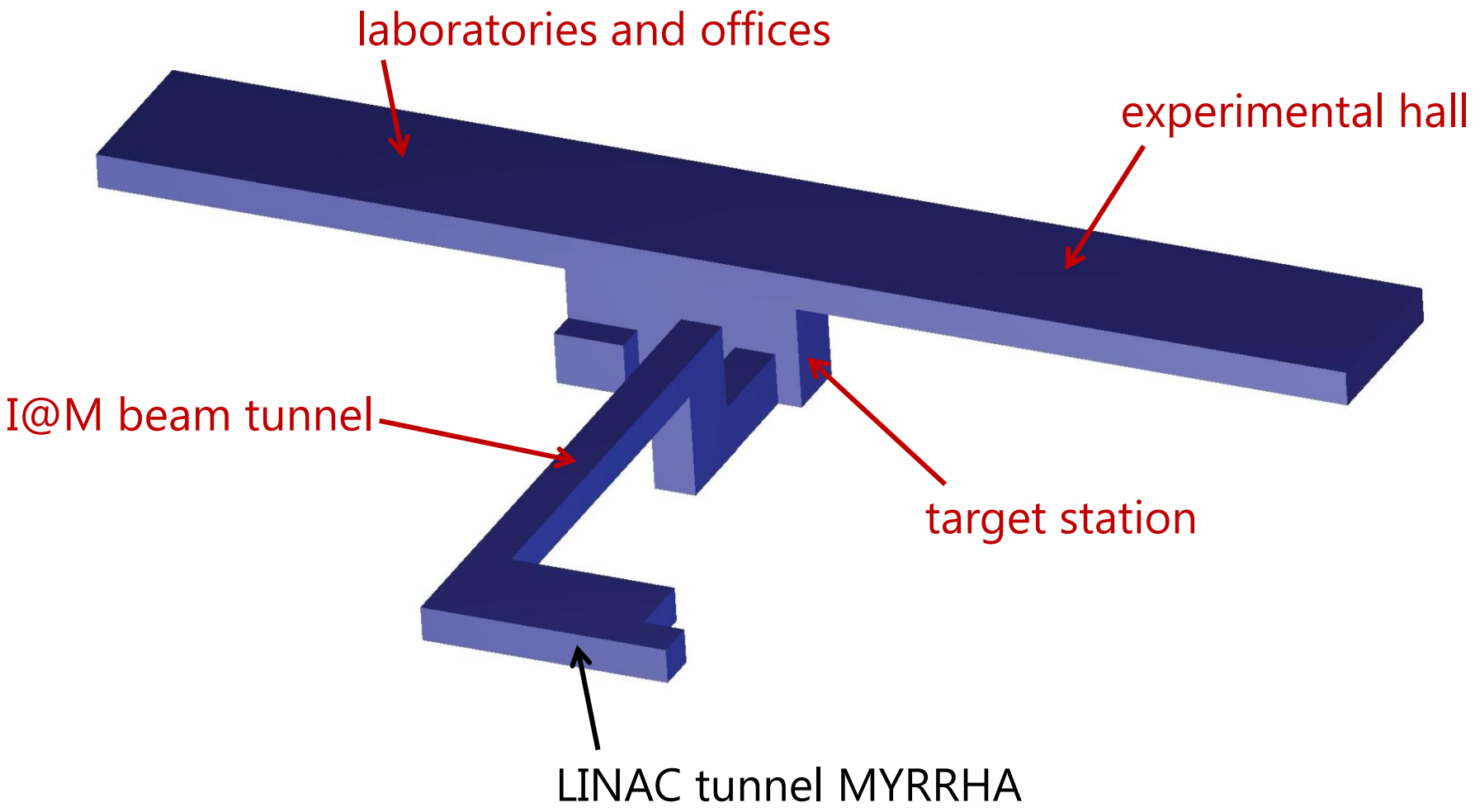
E_p = 600 MeV
I ~ 100 - 200 μA



MYRRHA operation:

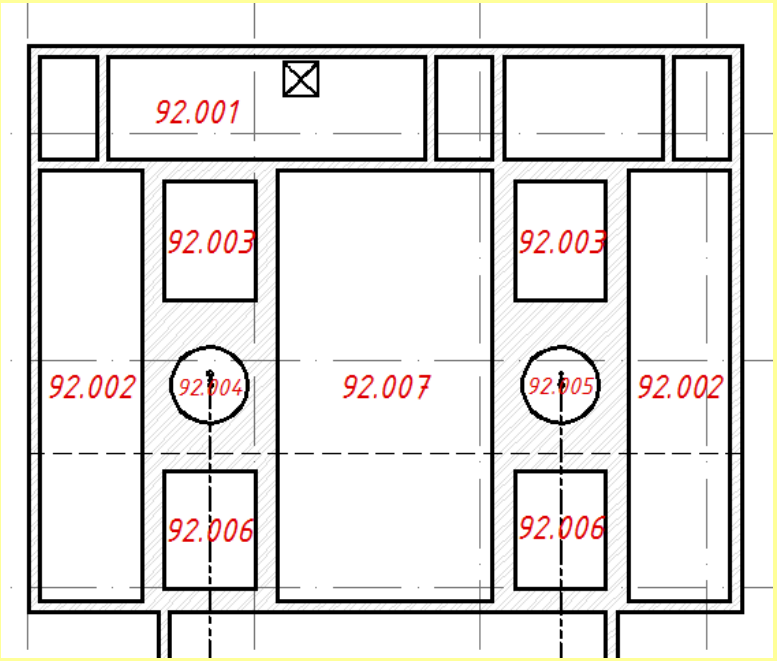


ISOL@MYRRHA – 3D View



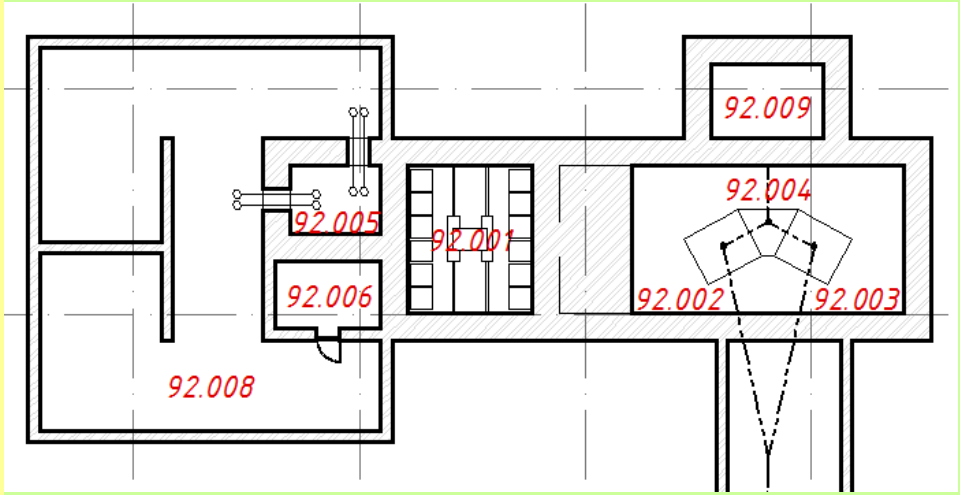
Target-Station Design

- Two options currently investigated



EURISOL-based design

- two separate target stations
- sharing part of ancillaries
- vertical RIB extraction



ISAC-based design

- two target stations in one hall
- sharing all ancillaries
- horizontal RIB extraction

Target-Station Design

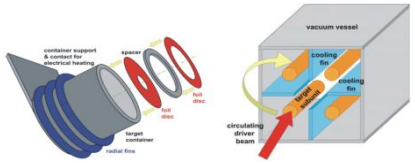
- Two options currently investigated
  - Version A: two separate target stations
  - Version B: two target stations in one hall

- Engineering study:
  - building design
  - optimum integration within MYRRHA
- Target conditioning station
- Hot-cells
- Temporary waste storage room
- Remote handling system
- …

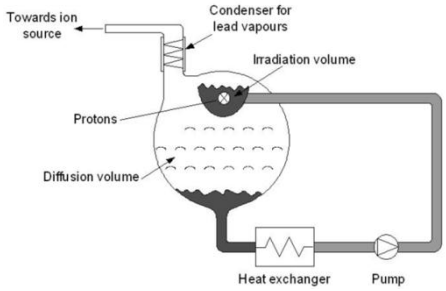
Target Design

- Ruggedized targets:
  - Solid targets based on ISAC design
    - refractory metal foils (e.g., tantalum, niobium, titanium)
    - carbide powders on a graphite sheet (e.g., ZrC/C, SiC/C)
    - UCx/C should become the workhorse target at ISOL@MYRRHA

  - EURISOL high-power solid-target design

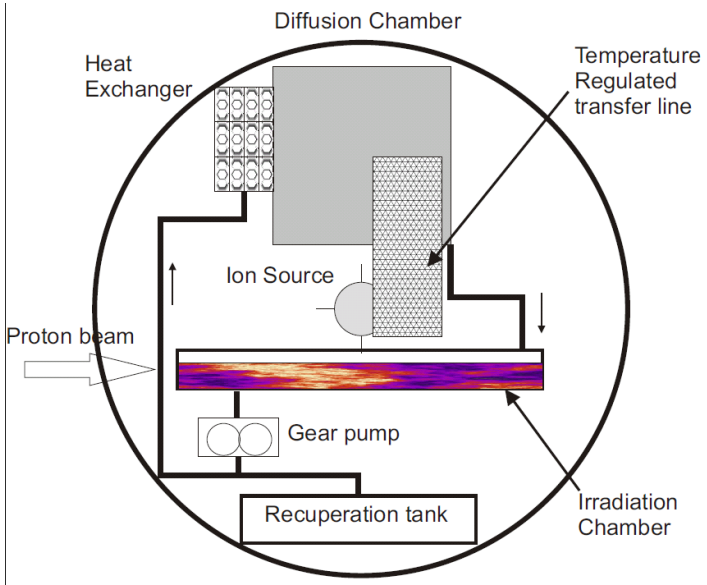


  - Liquid targets



Target Design

- Joining the project "Test of a molten Pb/Bi target loop at CERN-ISOLDE" within EURISOL (see talk T. Stora)
  - WP2 : Conceptual design & simulation (SCK•CEN)
  - WP3 : Construction (CERN)
  - WP4 : Instrumentation (PSI or ESS)
  - WP5 : Safety and Licensing (CEA)
  - WP6 : Target characterization and analysis (PSI)
  - WP7 : Radiochemistry (SINP)
  - WP8 : Offline commissioning (IPUL)
  - WP9 : Online operation (CERN)



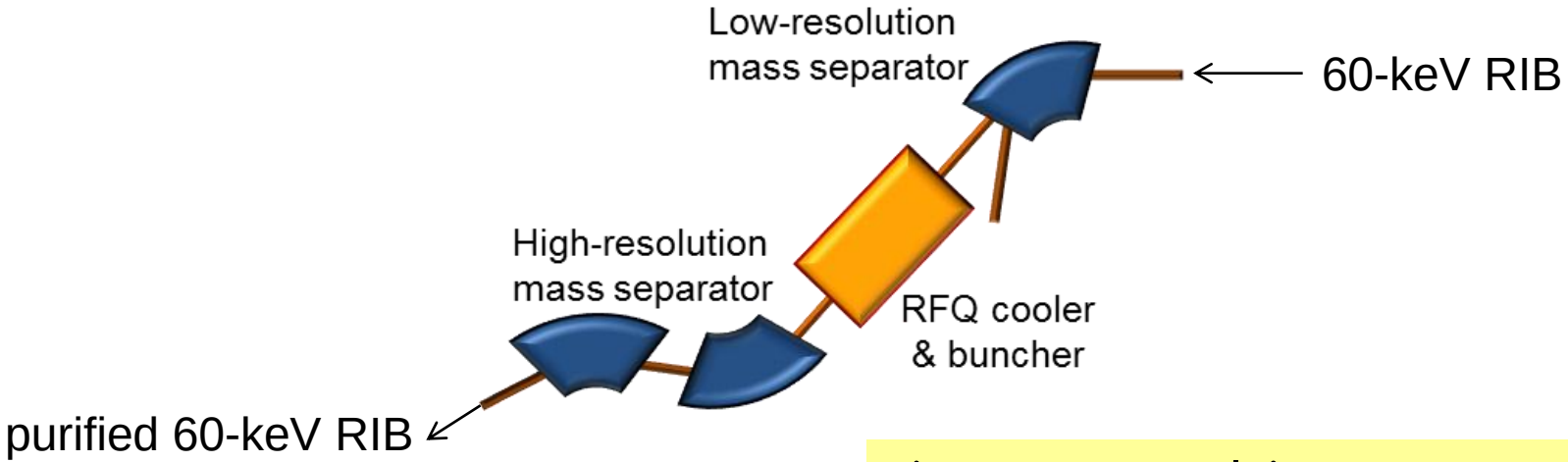
- 2 online tests at CERN-ISOLDE planned in Apr 2015 and Apr 2016
- Dedicated PhD at SCK•CEN on CFD calculations and technical design

Ion Sources

In view of the long beam times, the ion sources should have a reliable operation over at least three months without efficiency degradation

- 3 types considered:
  - ECR 1+: for gaseous elements (noble gases, C, N, O,…)
  - Surface ion source (hot cavity): for beams of alkaline and earth alkaline elements
  - RILIS : for elements with intermediate ionization potentials
- No dedicated R&D programme at SCK•CEN at present
- Activities related RILIS developments at IKS, KUL

Beam-Purification System



aim: mass-resolving power ~ 10 000

- Design study of
  - Low-resolution mass separator
  - RFQ cooler and buncher
  - High-resolution mass separator

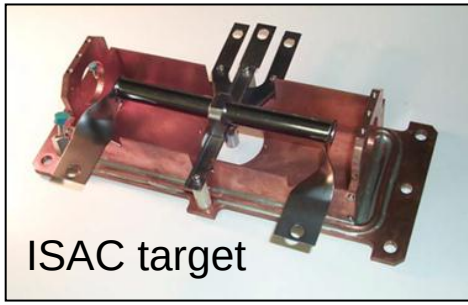
High interest, but no available man-power and/or funds at present

Safety-Related Studies

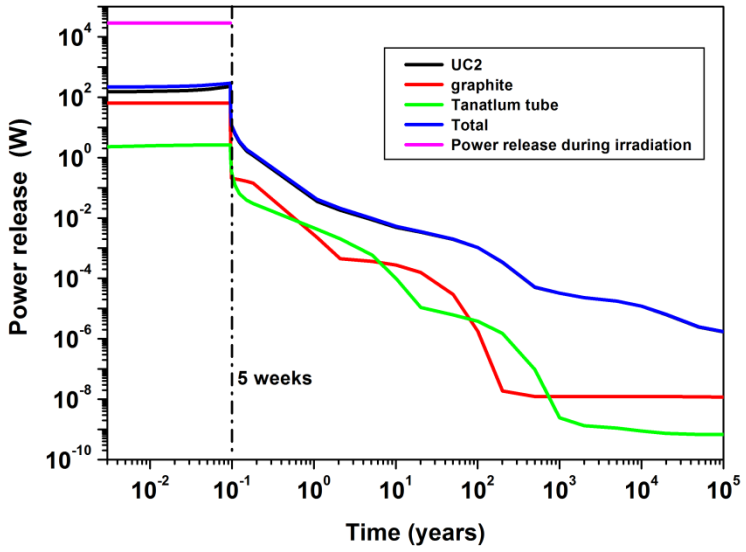
- Shielding calculations
- Waste handling procedures
- Environmental impact studies
- …

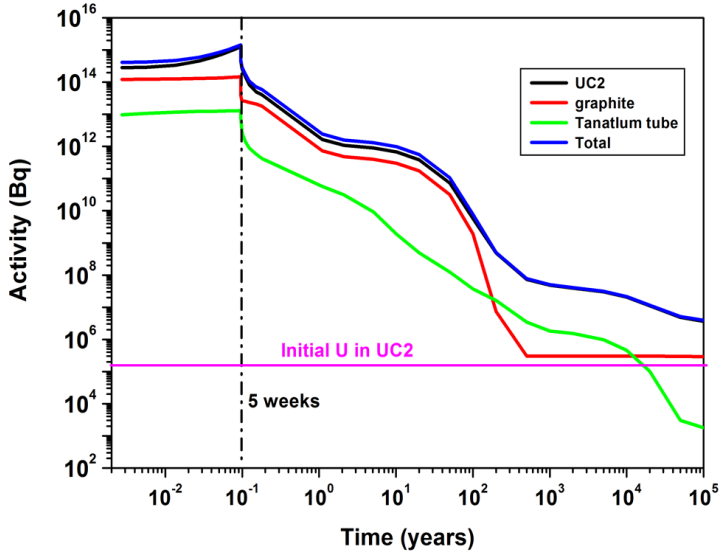
Safety-Related Studies

- e.g. Decay-heat calculations for a UC2 target at ISOL@MYRRHA



- Stacked coated carbon discs, each 0.13-mm thick, coated with 0.2-mm UC2 (50% of solid density)
- Discs stacked in Ta tube, 1.83-cm InnerDiam, 17.78-cm length (530 discs). Total target mass of 264 g.
- Irradiation time: 5 weeks
- Proton-beam parameters: Ep=600 MeV; I~200 μA (~120 kW)





Calculations by Alexey Stankovsky (SCK•CEN)

Project Schedule

2012-2014	Conceptual Design
2015-2017	Front End Engineering Design
2018	Awarding construction contracts
2019-2021	Manufacturing of components & construction
2022	Assembly & Installation
2023-2024	Commissioning
2025 -	Exploitation

Synergies with EURISOL - Summary

- Design of the 100-KW direct targets & target stations
- RIB purification system
- Proton-linac development
- Spallation target development for the high-power target
- Licensing-related aspects

ISOL@MYRRHA Topical Workshops

- Fundamental interactions (10/2011)
- Detailed decay spectroscopy (04/2012)
- RIB production
- Medical applications

(spring 2013)

- Laser spectroscopy and atomic physics
- Solid state and biology

- Aim:
  - Investigate scientific cases in more detail
  - Identify unique opportunities
  - Collect information on instrumentation
  - Gather input for design study
  - Set up a Users Group

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