ISOLDE Update

Operations 2016

Target and Ion Source Developments

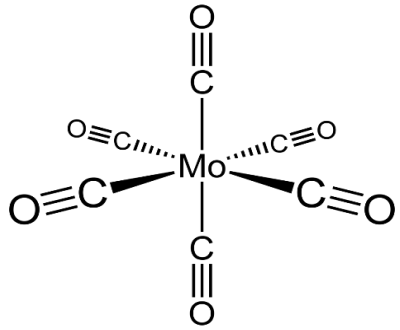
Facility Upgrades

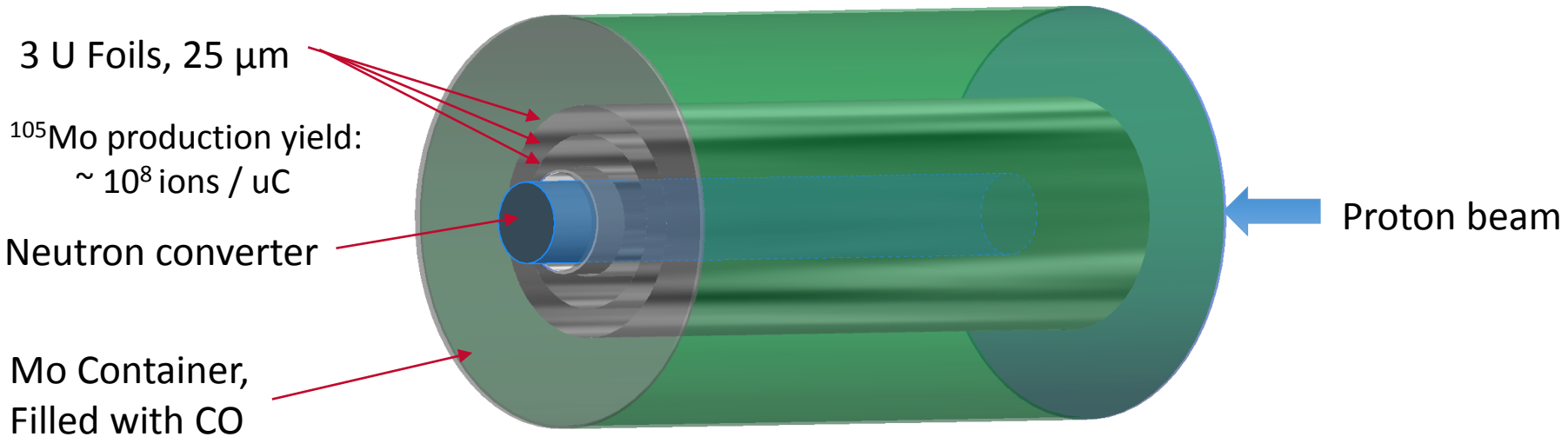
Topics of potential collaboration between TRIUMF and CERN

Operations 2016

- ISOLTRAP (mass measurement)
  - ^{59,60,61,62,63}Cr beams produced from UC2-C target + RILIS at HRS
    - Observed incidental Sc and Fe beams in MRToF device
    - Plans to enhance their production using laser ionisation (Fe already done yesterday)
- CRIS (Collinear Resonance Ionization Spectroscopy)
  - $^{63\text{-}78}$Cu beams produced from UC2-C target + RILIS at HRS
- Collections
  - ^{7}Be produced for nToF
  - Po samples produced for PSI

Target and Ion Source Development
Production of new beams

Principle: Mo $\xrightarrow{CO\ (g)}$ 



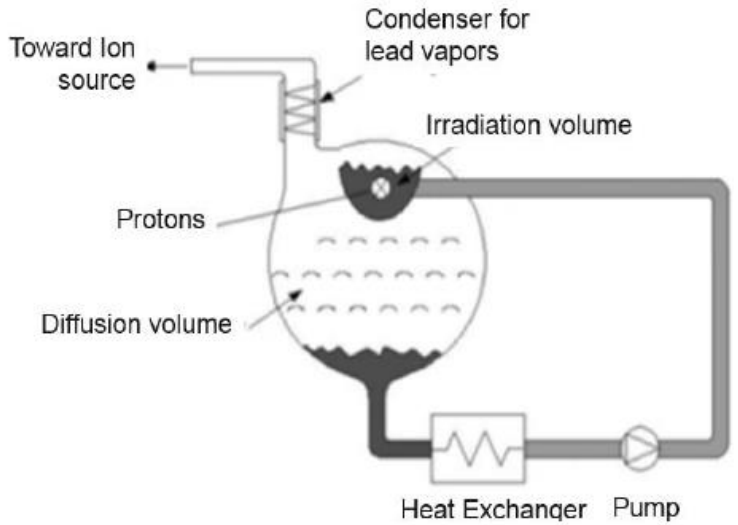
Carbonyle compounds
$V(CO)_6$
$Cr(CO)_6$
$Mo(CO)_6$
$W(CO)_6$
$Tc_2(CO)_{10}$
$Re_2(CO)_{10}$
$Ru(CO)_5$
$Os(CO)_5$
$Co_2(CO)_8$
$Rh_2(CO)_8$
$Ir_4(CO)_{10}$
$Ni(CO)_4$

Carbonyl beams of refractory elements

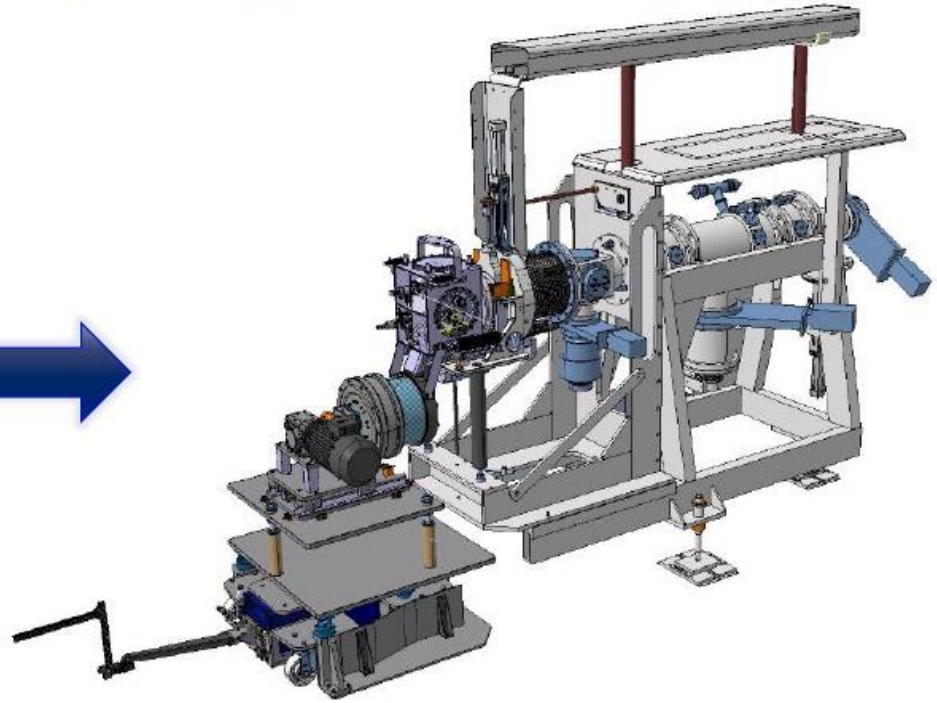
Target and Ion Source Development

LIEBE (Liquid Eutectic Lead Bismuth loop target for Eurisol)

- Development of a **high power target** that allows a higher release of **short-lived species** (targeted isotopes: ^{177}Hg (130 ms half life))

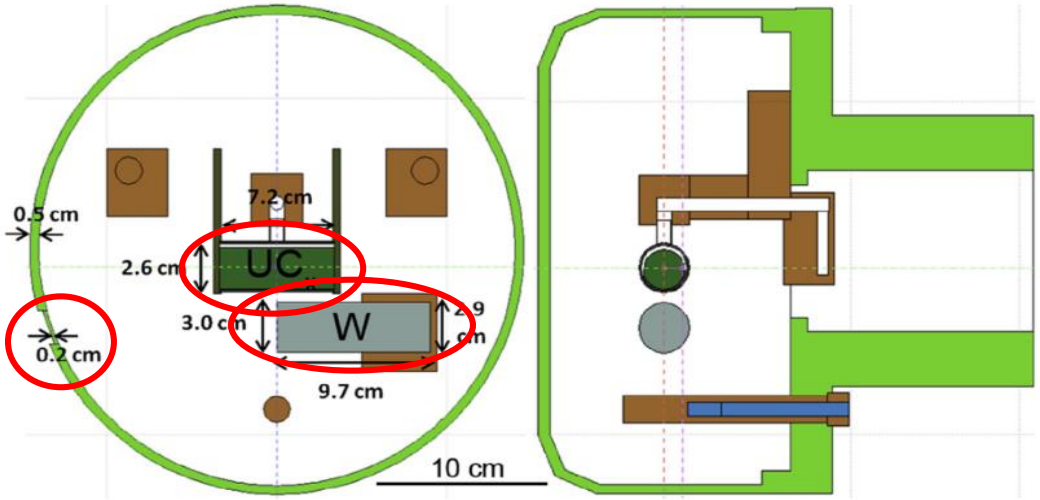


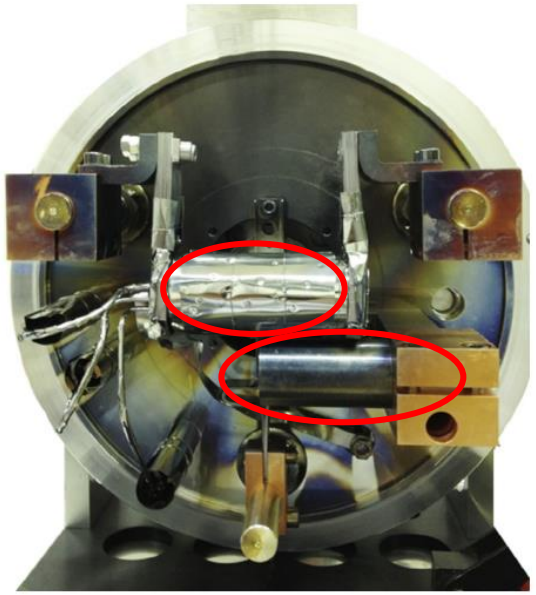
Schematic layout proposed during the EURISOL Design Study phase



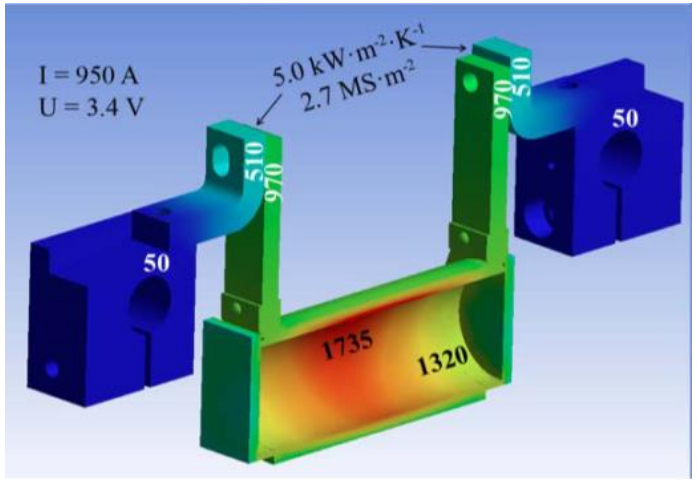
A 2-parts target: the main loop part and the pump part

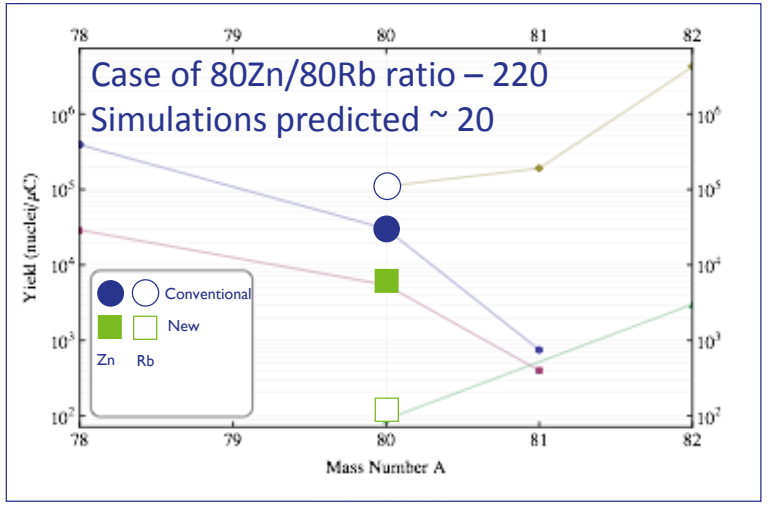
Target and Ion Source Development
Convertor prototype testing at ISOLDE





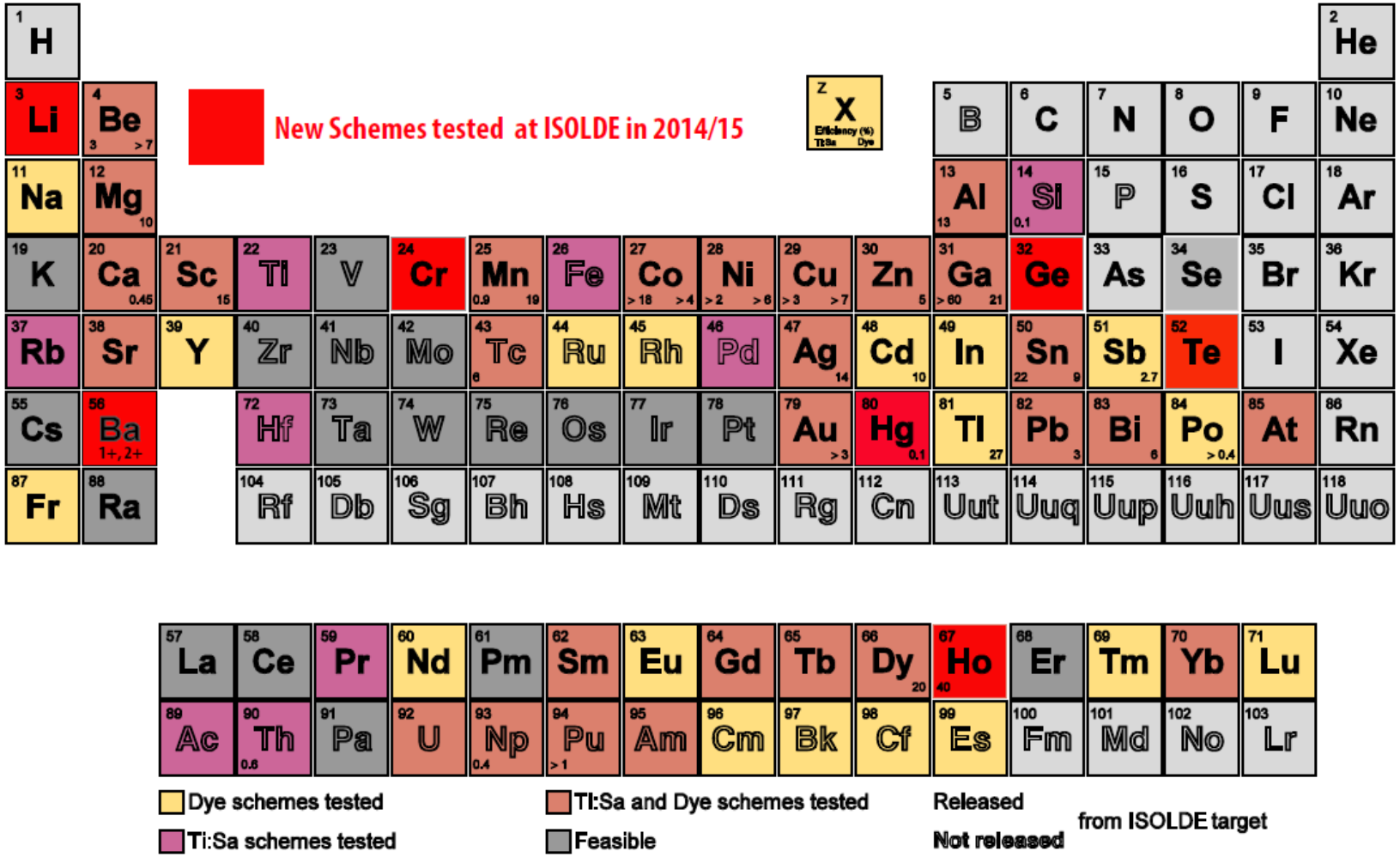
- Power supply limit 1000A
- Limited target operation temperature to 1750°C
  - Standard operation 1950-2100°C



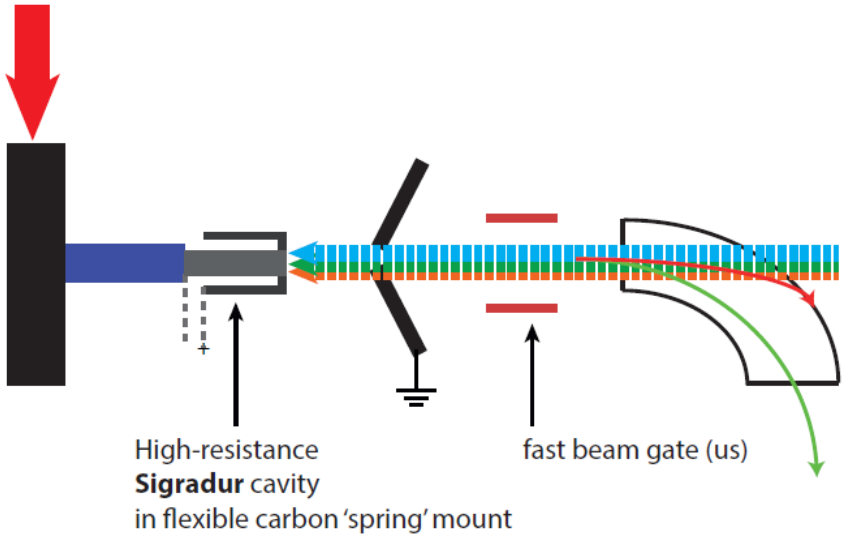


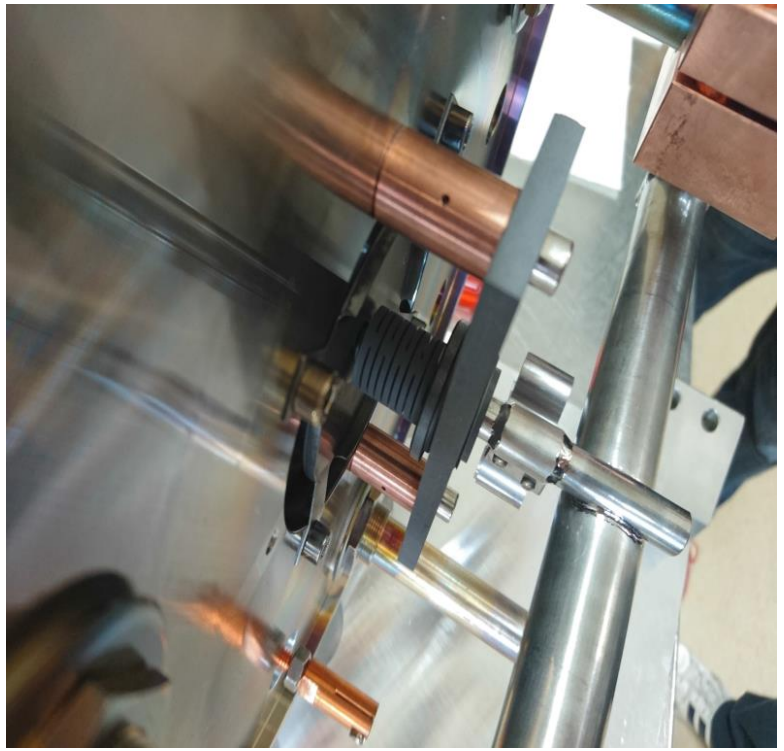
A. Gottberg, T.M. Mendonca, R. Luis, J.P. Ramos, C. Seiffert, S. Cimmino, et al.,NIMB 336 (2014) 143–148.

Target and Ion Source Development
RILIS – accessible elements



Target and Ion source development
RILIS – new cavity material



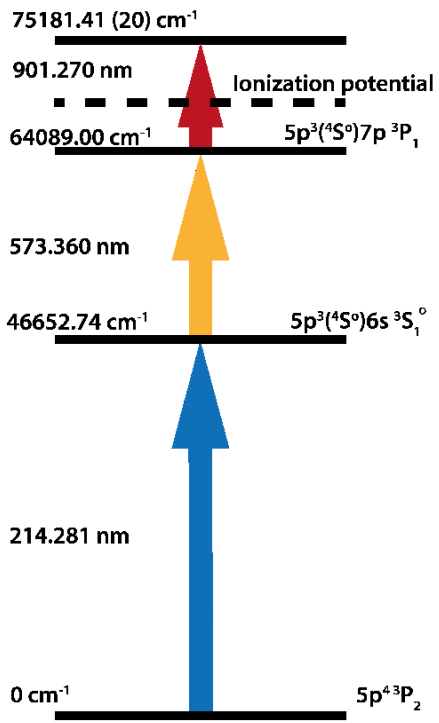


SIGRADUR: a new versatile hot cavity option
High resistance
No porosity
High work function
High temperature

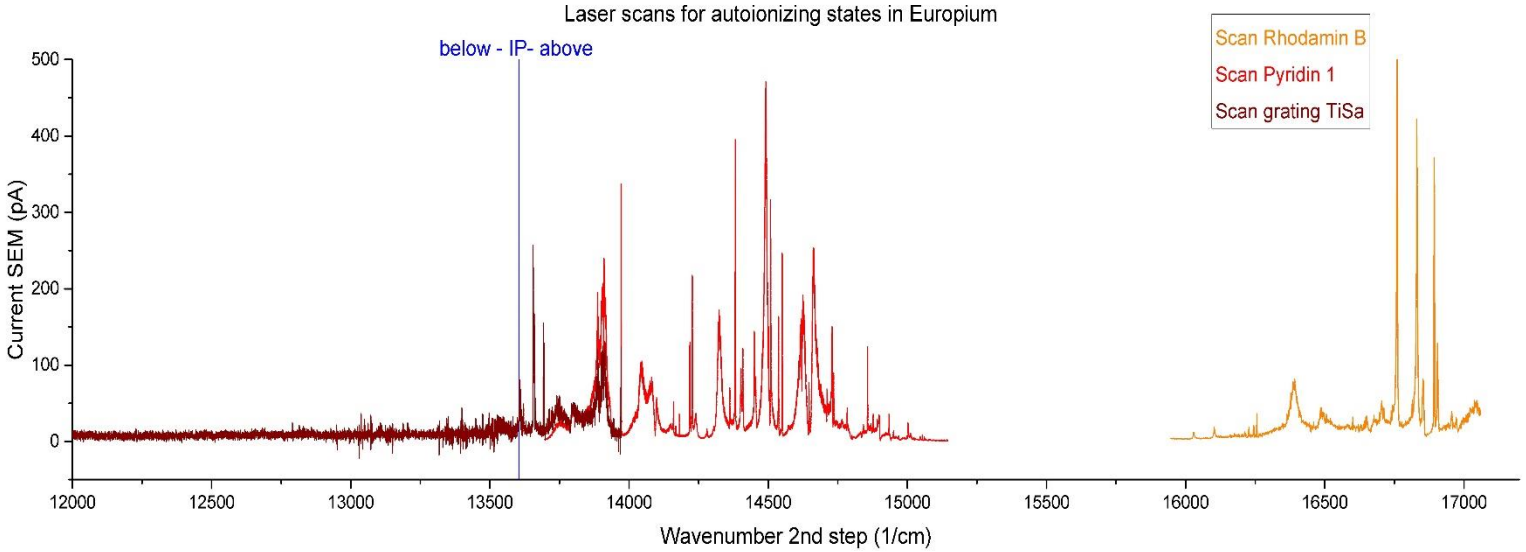
Li surface ionisation efficiency – 18% compared to 11% for a standard tungsten ioniser
To be tested for Ga efficiency with RILIS

Target and Ion source Developments RILIS

Te

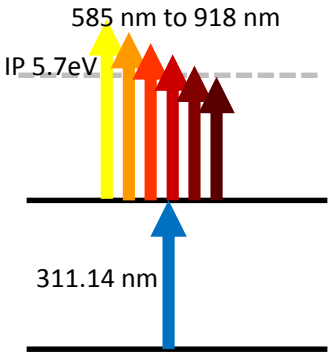


The new RILIS ionisation scheme for tellurium ionisation efficiency >18%

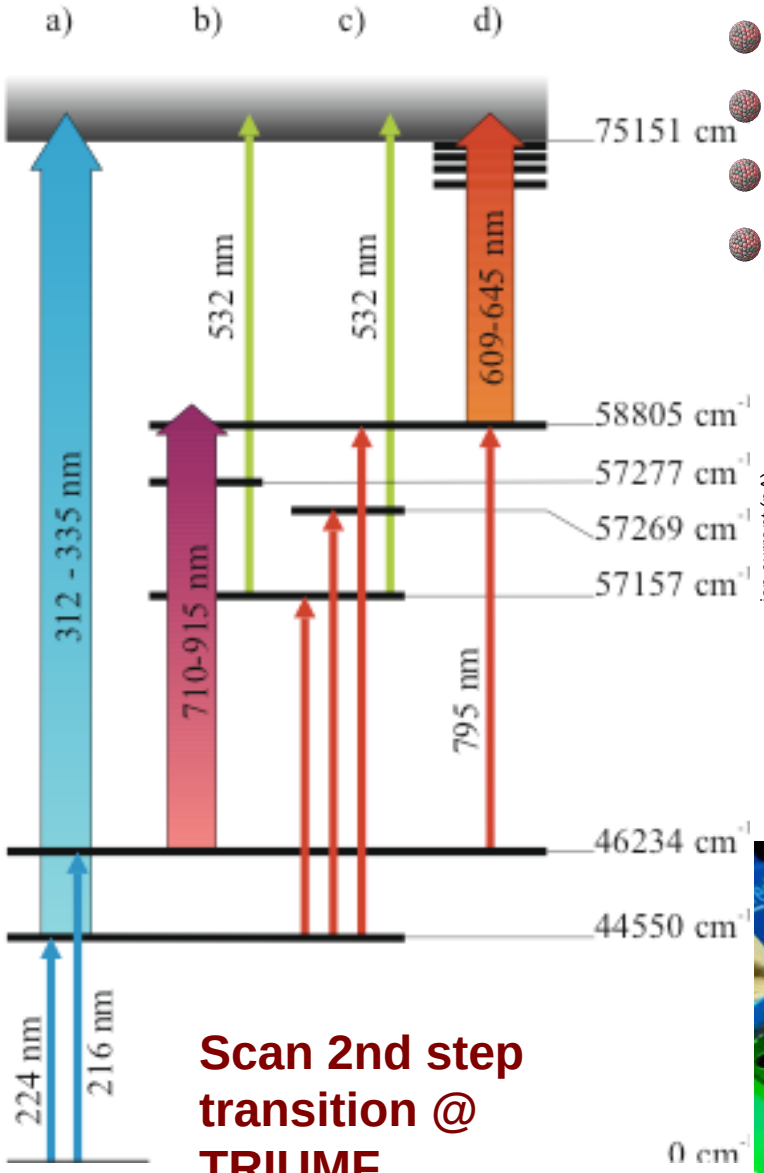


- Integrated **P**hoto**I**onization **S**pectroscopy **A**pparatus (PISA)
- To be used as reference for in-source laser spectroscopy and ionization scheme development
- Make use of RILIS set up during shut down
- Enables exploratory scheme development at RILIS, prior to test with dedicated ISOLDE target
- First candidate: Europium (Eu)
- Scan of 2 different dye lasers and new grating TiSa
- Many new autoionizing states discovered
- Two promising schemes with dye or TiSa identified

Eu

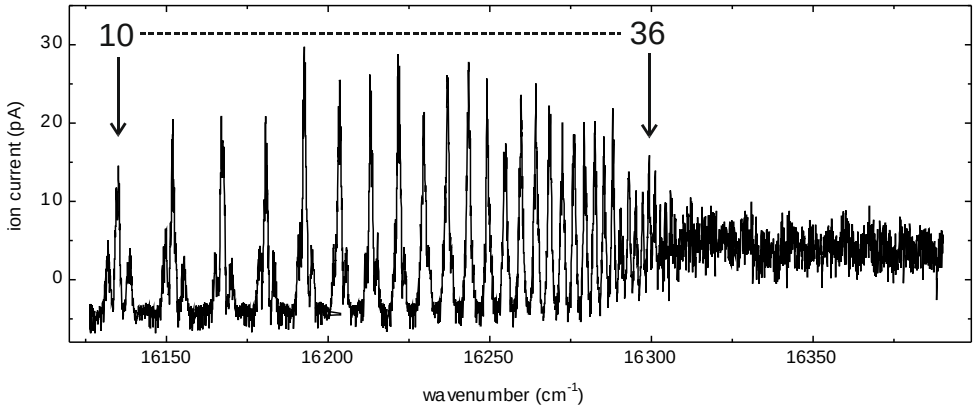


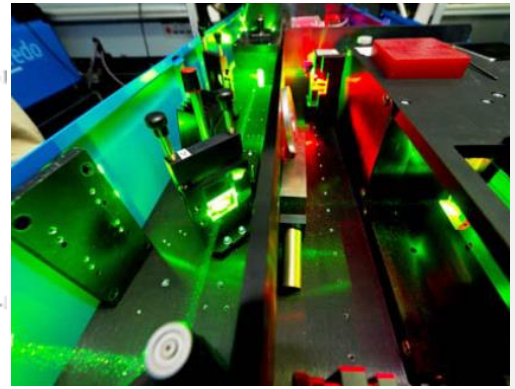
RILIS & TRILIS: Determination of Atomic properties of Astatine

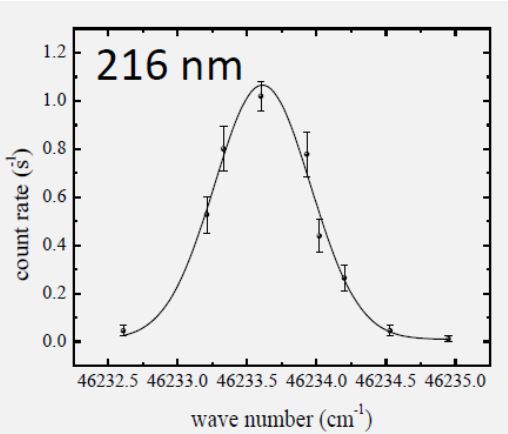


Scan 2nd step transition @ TRIUMF

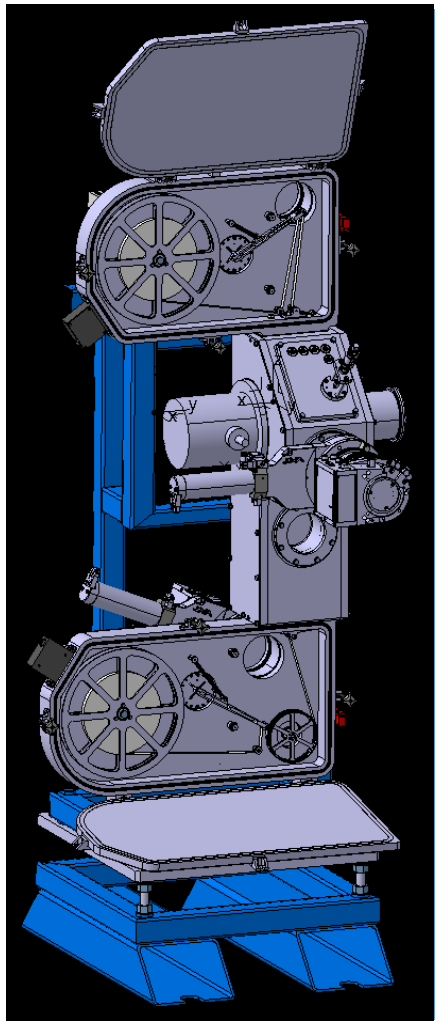
- Determination of ionising potential
- Identification of new atomic transitions
- Comparison with atomic theory
- Scan of ionizing laser: converging Rydberg levels allow precise determination of the IP



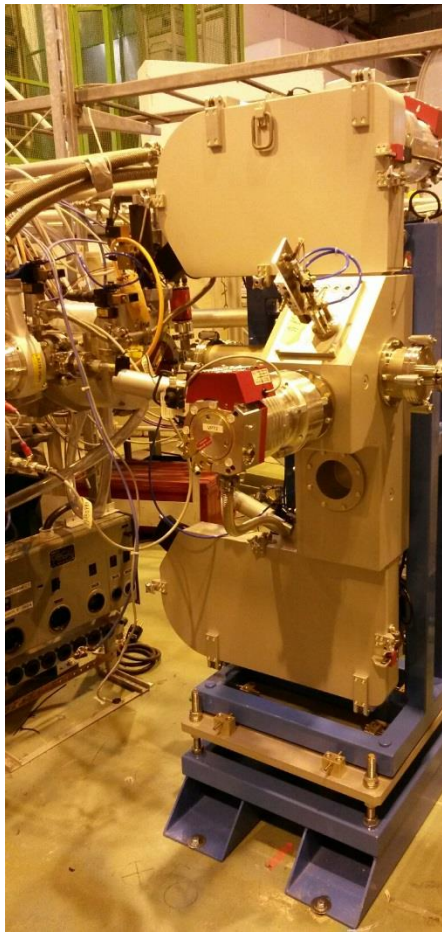




Facility Upgrades
Fast Tape Station

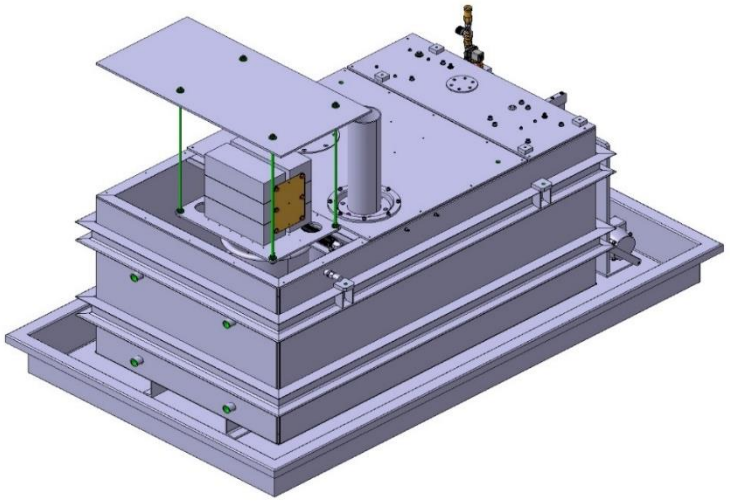


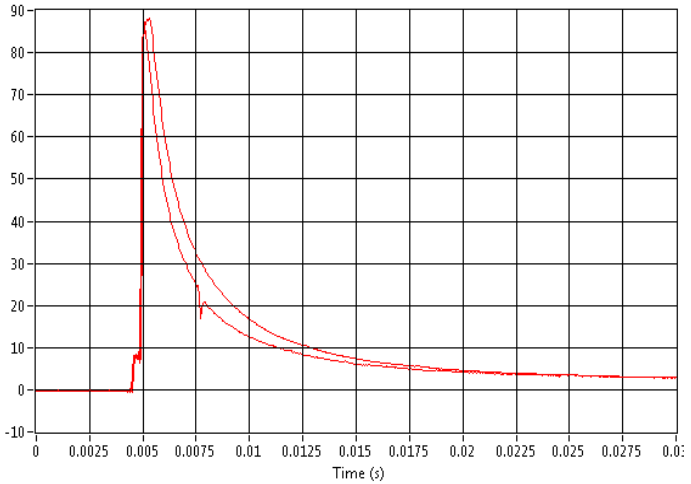
- Essential for the testing of target units and characterizing target performance prior to physic's experiment.
- Includes "in-beam" detection, deported and shielded beta detectors, possibility to install gamma detectors
- Tape transport time after sampling ~60ms (compared to 900ms at present).
- Moved into its temporary position at the LA2 beam line in the experimental hall
  - To be installed in its final position during the EYETS period
- Tests with sealed sources followed by tests with radioactive ion beam to be done throughout 2016.
  - Calibration against existing tape station



Facility Upgrades
HT Modulation

- Due to localised air ionisation produced by the 1.4GeV proton beam impinging on ISOLDE targets, a modulation of the accelerating voltage is required.
  - Current recovery time after modulation – 6-10ms
- Initial tests with new Belkhe switch design - 1.5-2.5ms
  - Provides more statistics on isotopes with very short half-lives

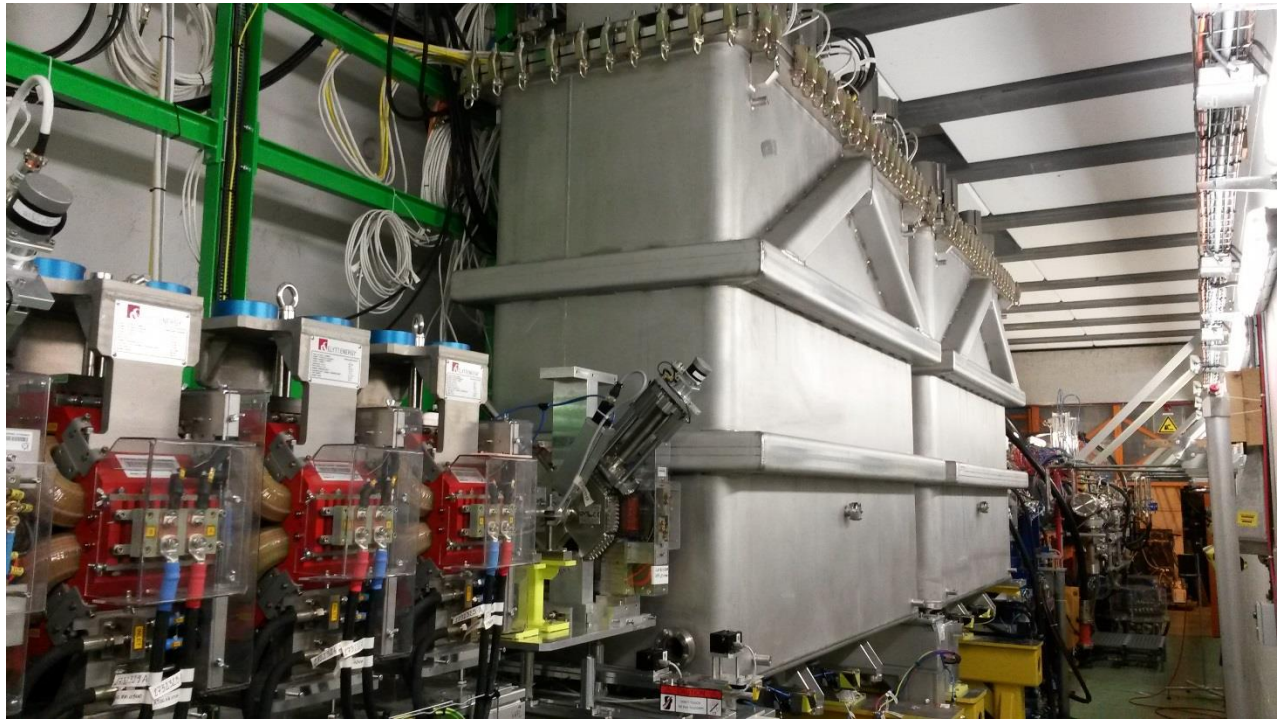




Recovery time as a function of protons per pulse
1.5E13 and 3.0E13 ppp

Facility Upgrades
HIE-ISOLDE cryomodules

- Second Cryomodule now in place
- Will enable post-acceleration of secondary beams up to 5.5MeV/u
  - Completion of phase 1 of project
- Experiments at HIE-ISOLDE to re-start at the end of summer 2016
- Low energy part of REX under commissioning
  - RF for various cavities available as from 6th June 2016



Topics of Potential Collaboration between TRIUMF and CERN

- Target and ion source development
  - Towards a 100kW facility: testing of neutron convertor at TRIUMF with 50kW beam
  - Actinide target material production –nanomaterials or UC synthesis
  - Electron Beam Ion Source, RFQ Cooler and Nier spectrometer development as used at ISOLDE
  - Sharing of laser ionisation schemes; the ionisation scheme for At being a good example
- High Resolution Mass Separation
  - Towards more pure beams: design and testing of magnet designs to reach a mass resolution of 20000
- Super conducting RF cavities
  - Use TRIUMF experience for the design of low-beta cavities for HIE-ISOLDE and review of operational issues
- Nuclear Engineering
  - Target station design and target handling for more compact target units
- Scientific exchange
  - Harmonised presentation and publication of isotope production rates