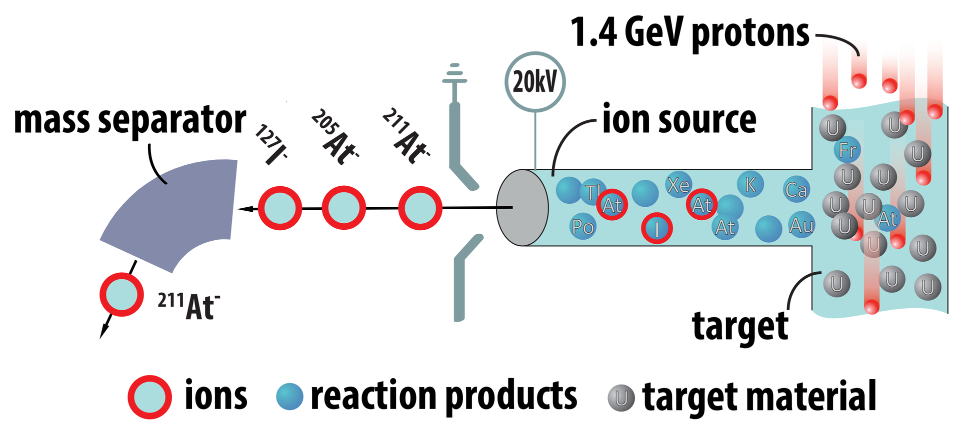
A Test Stand for the Development of Ion Sources at CERN-ISOLDE

Sebastian Rothe[1], David Leimbach[1,2,3], Jochen Ballof[1,4], Richard Catherall[1], Katerina Chrysalidis[1,5], Tim Giles[1], Dag Hanstorp[2]
Reinhard Heinke[5], Bruce Marsh[1], João Pedro Ramos[1], Thierry Stora[1]

[1] CERN, Geneva, Switzerland
[2] Department of Physics, Gothenburg University, Gothenburg, Sweden
[3] Faculty of Physics and Material Sciences Center, Philipps-Universität Marburg, Marburg, Germany
[4] Institut für Kernchemie, Johannes Gutenberg-Universität, Mainz, Germany
[5] Institut für Physik, Johannes Gutenberg-Universität, Mainz, Germany

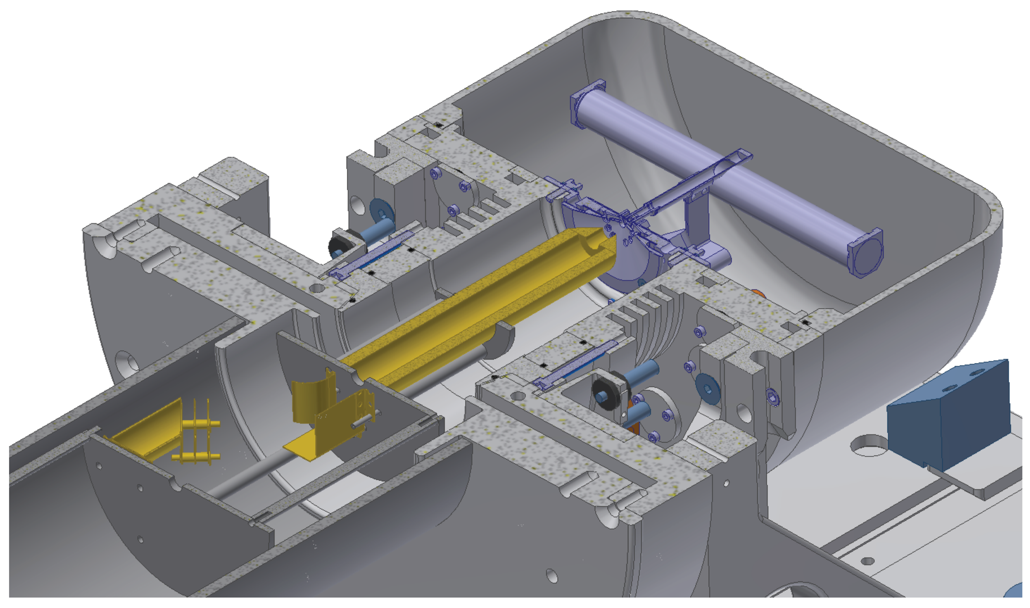
EN Engineering Department
UNIVERSITY OF GOTHENBURG

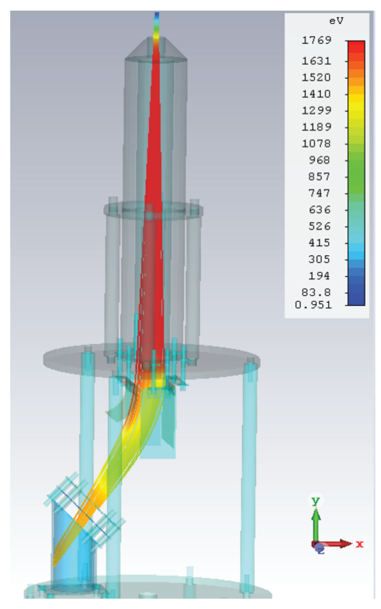
A radioactive ion beam factory



The ion sources in the CERN-ISOLDE [1] target units are the interface between the isotopes produced by nuclear reactions and the physics experiments.
Target production and development are currently sharing the same infrastructure, thus creating a bottleneck. A second off-line mass separator dedicated to development is currently being commissioned. One part of this new facility is the Ion Source Development Test Stand, presented here.

The test stand



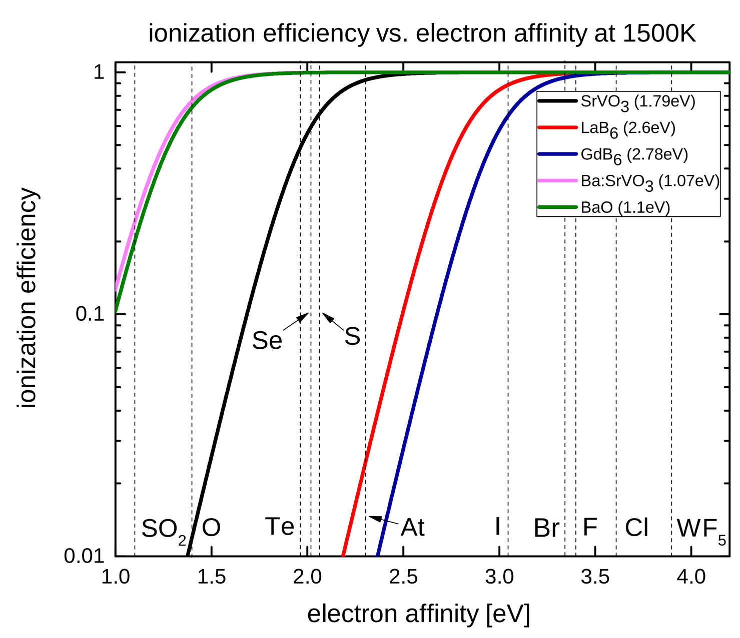


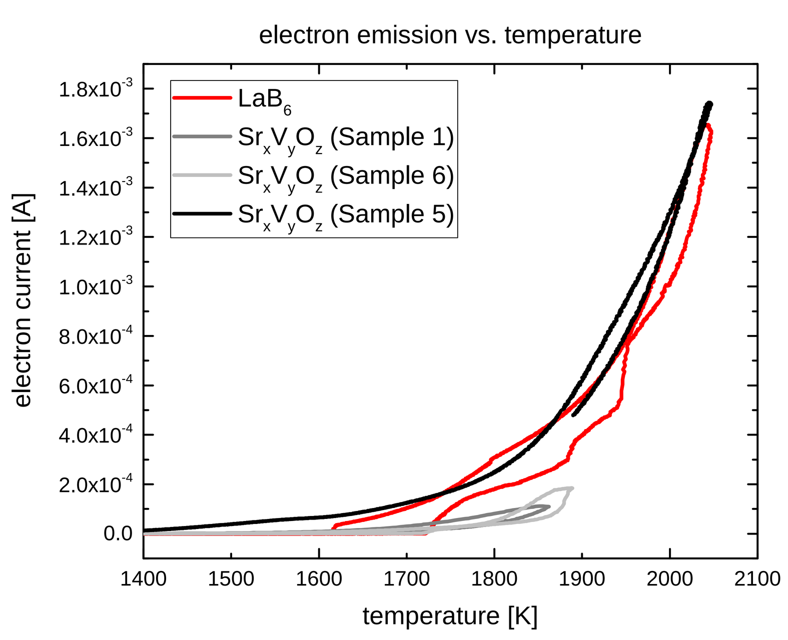
The ion source test stand is an upgrade of the calibration stand used for ISOLDE production targets with added features:

- **Ion extraction**. Optics were simulated using CST Studio.
- Ion beam detection via **Faraday cup** and pA meter.
- A **residual gas analyzer** detects degradation of materials during long-term tests.
- The NI-LabVIEW **measurement and control** system, based on [2] allows flexible and fast development of automated test routines.

New low work-function materials

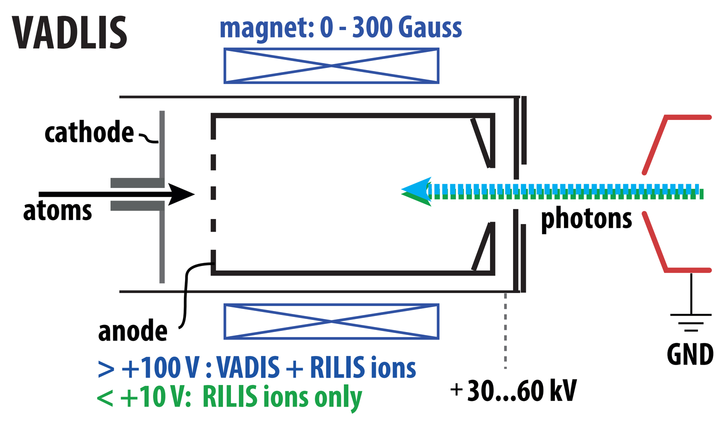
New compounds have been tested in order to improve the ionization efficiency for elements with low electron affinity (EA < 2.3 eV).

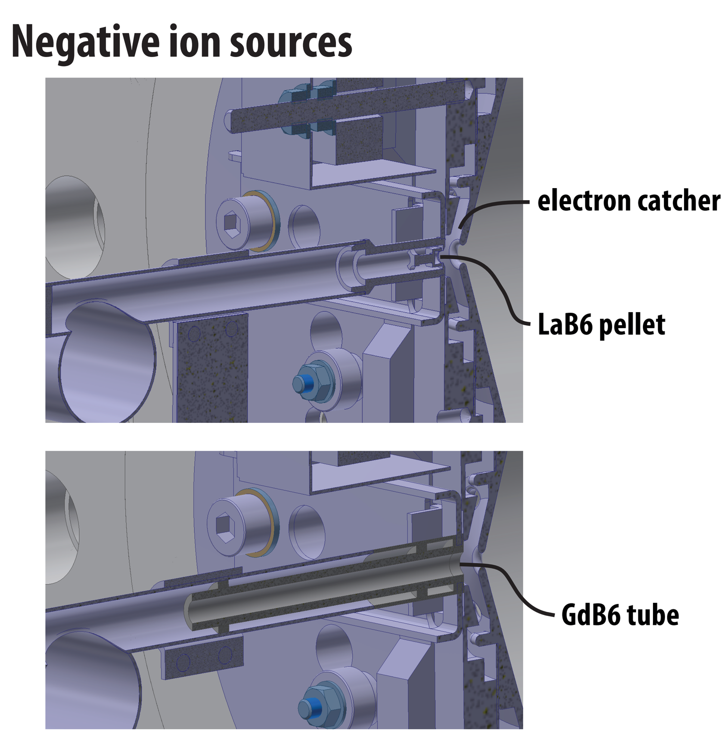




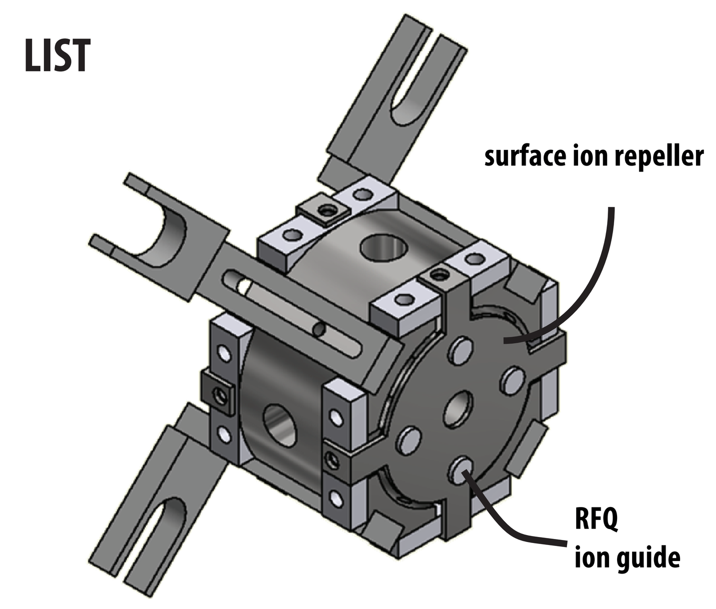
- Strontium vanadate $SrVO_3$ is a candidate with expected work function < 2 eV [7].
- Samples have been produced in-house from $SrCO_3$ and V_2O_5 under different conditions.
- Electron emission has been investigated at the new test stand and is compared to LaB_6.

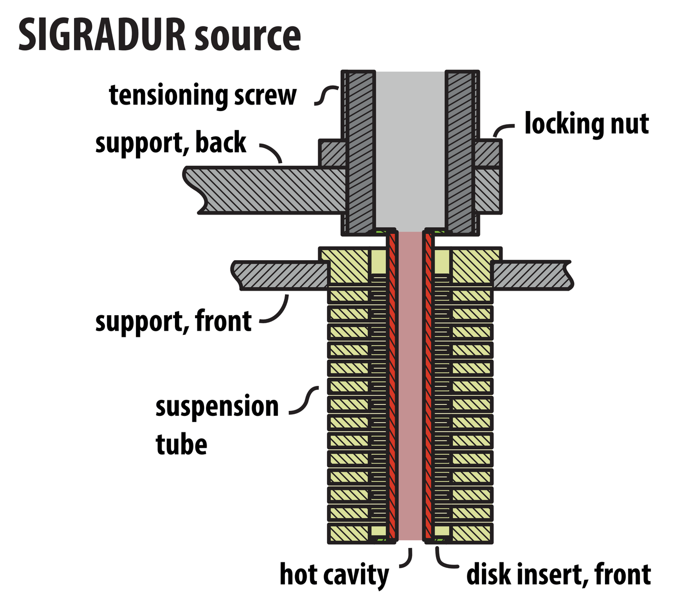
Ion source developments





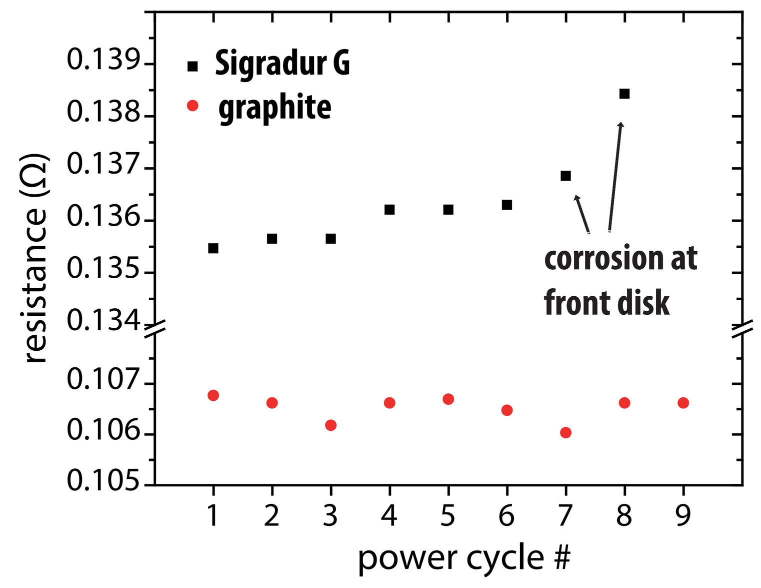
The **VADLIS** ion source aims at efficient resonance laser ionization withing a FEBIAD type ion source [3]
The **LIST** (laser ion source and trap) [4] suppresses surface ionized contaminants and transports laser ionized species using an RFQ.
Exotic materials like glassy carbon (SIGRADUR®) can be used to suppress contamination by shortening the extracted laser ion bunch in conjunction with fast beam gating techniques. [5]
Negative surface ion source development has been relaunched to satisfy the demand for negative ion beams. The electron affinity of ^{128}I has been measured [6] using laser photodetachment.





Next steps

- Integrate the ion source test stand to Offline-2.
- Add mass selectivity and single ion detection.
- Investigate long-term operation of the standard ion sources under extreme conditions.



- Determine integrated efficiency and failure modes.
- Perform material compatibility tests for the SIGRADUR source.
- Development of polarity switching (Hz to kHz) of the line heating.

References

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