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Extending the capabilities of the ISOLDE RILIS by blurring the boundaries between ion sources at ISOLDE

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For the first time, the RILIS laser ion source has been combined with other ion sources at ISOLDE, offering both immediate applications and a possible direction to meet the laser ion source requirements of the future. The ISOLDE RILIS was combined with a surface ion source for the first hot cavity 2+ resonance ion-ionization and also with the VADIS (Versatile Arc Discharge Ion Source), a first step towards extending the capabilities of both the RILIS and the VADIS.

2+ resonance ion-ionization was originally developed for the case of neutron deficient barium. Resonance ion-ionization of singly surface ionized barium selectively doubles the charge to mass ratio, shifting the barium in the mass region, away from surface ionized 1+ caesium and indium isobars, to a region where surface ionization is not considered to be efficient.

Laser ionization inside the VADIS cavity was first demonstrated off-line with gallium, identifying two new modes of VADIS operation: an element selective RILIS-only mode and a combined RILIS+VADIS mode. These capabilities have since been verified on-line for the production of mercury beams as part of a feasibility study for a future in-source laser spectroscopy study of mercury isotopes. There are numerous immediate applications of these developments: it is now possible to couple a molten lead target with the laser ion source at ISOLDE; laser spectroscopy can be performed inside the VADIS cavity; and switching from VADIS mode to the element selective RILIS mode allows for signal identification. For future developments, the combination of element selective RILIS ionization with the capabilities of the VADIS source to ionize any element or perform molecular break-up, will be explored as a possible method of producing previously unavailable ion beams at ISOLDE.

Primary author: Mr DAY GOODACRE, Thomas (CERN; The University of Manchester)

Co-authors: Dr GOTTBERG, Alexander (CERN); Mr CREPIEUX, Bernard (CERN); Dr MARSH, Bruce (CERN); Ms VAN BEVEREN, Celine (KU Leuven); Dr SOTTY, Christophe (KU Leuven); Dr FEDOROV, Dmitry (PNIP); Mr RAMOS, Joao Pedro (Ecole Polytechnique Federale de Lausanne; CERN); Prof. BILLOWES, Jonathan (The University of Manchester); Dr LYNCH, Kara Marie (CERN); Dr GAFFNEY, Liam (KU Leuven); Mr VEINHARD, Matthieu (CERN); Dr MOLKANOV, Pavel (PNPI); Mr ROSSEL, Ralf E. (CERN; Hochschule RheinMain); Dr CATHERALL, Richard (CERN); Dr ROTHE, Sebastian (CERN); Mr SELS, Simon (KU Leuven); Dr MENDONÇA, Tania Manuela (CERN); Dr STORA, Thierry (CERN); Dr COCOLIOS, Thomas E. (The University of Manchester); Dr FEDOSSEEV, Valentin (CERN)

Presenter: Mr DAY GOODACRE, Thomas (CERN; The University of Manchester)

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