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RILIS developments 2017

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The Resonance Ionization Laser Ion Source (RILIS) at ISOLDE is the most frequently used ion source, providing 60% of the ion beams in 2017, and more than 85% in 2016. The ionization mechanism, based on stepwise resonance excitation of an outer electron of the atom, is element selective. For certain elements even isomer-selective ionization can be achieved, enabling the delivery of beams with an enhanced isomer- or ground-state abundance. This year isomeric indium beams were delivered for IDS and CRIS experiments. In the reduced laser linewidth mode, Doppler-broadening becomes the limiting factor in terms of spectral resolution but, for certain atomic transitions, the isotope shifts or hyperfine structures can be resolved. Our ongoing campaign to study these for the lead-region continued this year with bismuth –together with our first use of the ISOLDE Decay Station for this purpose.
The 2017 technical developments and new laser hardware will be presented, along with the resonance ionization scheme developments that have been performed in an attempt to reduce the dependence on dye lasers during standard operation. The generation of high-power blue laser beams by intra-cavity frequency doubling inside the Ti:Sapphire lasers is now routine operation, resulting in an improved laser beam shape and higher power for the blue and deep-UV range. RILIS ionized radiogenic Sc was measured for the first time, representing a new beam to the ISOLDE user's community. Further attempts to extract laser-ionized Se were made, although suitably efficient and selective Se beam production needs further development. The technical developments of the VADLIS: RILIS ionization inside the ISOLDE FEBIAD have been continuing at the ISOLDE offline separator, with promising progress towards optimizing the RILIS-mode of operation. The advances towards the goal of high-resolution, Doppler-free RILIS ionization making use of two-photon excitation will be presented. If successful, this approach may not only provide the means for high-resolution in-source spectroscopy of exotic nuclei, but also enable selective resonance ionization of elements with high ionization potentials that can so far only be ionized with a plasma ion source.

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