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Towards a high-throughput laser ion source for MEDICIS

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Resonance laser ionization is an efficient and highly selective method for producing radioisotopes. In the laser ion source of the ISOLDE –RILIS (Resonance Ionization Laser Ion Source), the laser interaction region is inside a metal tube, the so-called "hot cavity"which is heated to temperatures >2000 degrees Celsius. In addition to providing a longitudinally confining electrostatic potential due to electron emission from the cavity material, this heating also induces surface ionization of elements with low (< 6 eV) ionization potential. If the overall ion load of laser and surface ionized species reaches a certain threshold the confining potential breaks down and the efficient extraction of laser ionized particles is compromised. In concrete terms this means that the extraction efficiency of laser ions which have a distinct and short time structure induced by the pulsed lasers reduces drastically whereas the surface ions, which have a constant mode of creation, remain unaffected (if the half-life is long enough). This effect is especially prevalent in facilities like MEDICIS which demand a high ion throughput and fast extraction for quick and efficient delivery of radioisotopes (or their precursors) for medical applications (half-lives of ˜ 5 days). This work aims to highlight the different ion source requirements for MEDICIS compared to ISOLDE and show the development work performed over the last year towards an improved ion source design for MEDICIS. Measurements with ion sources from three different facilities were performed at ISOLDE's OFFLINE2 facility and their results will be discussed.

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