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State-of-the-art industrial laser technology for laser ion source applications at ISOL facilities

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The unrivaled combination of efficiency and selectivity of the resonance-ionization process has made laser ion sources a mainstay of Isotope Separator On-Line (ISOL) facilities. The growing demand for laser-ionized beams has necessitated the use of increasingly robust laser systems, which are capable of operating continuously, and possess a long mean time between failures.

Such stringent reliability requirements are commonplace in the industrial sector, where lasers used for machining applications typically operate around-the-clock. To meet our industrial-level demand, we have therefore taken advantage of the range of machining lasers that have emerged in recent years [1][2]. Whilst these systems typically satisfy the reliability requirements, only a few satisfy the particular performance characteristics needed for laser-ion-source applications. At ISOL facilities, the industry-grade lasers are extensively used for tunable-laser pumping and non-resonant ionization [3]. Laser-induced breakup of molecular species released from targets is currently under investigation. Optimal performance for each foreseeable ISOL application requires a range of specific sets of laser-pulse characteristics: pulse width, energy, repetition rate, beam quality, and linewidth. This contribution will present an overview of our current practical experience of industrial lasers used for laser-ion-source applications.

[1] B. Marsh et al., <https://doi.org/10.17181/CERN.F65D.P3NR>

[2] B. Marsh et al., <https://doi.org/10.1007/s10751-010-0168-5>

[3] S. Rothe et al., <https://doi.org/10.1088/1742-6596/312/5/052020>

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