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Research and development for the SPES target ion source system

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In the facilities for the production of radioactive ion beams based on the isotope separation on line (ISOL) technique, the target ion source (TIS) system is surely the most critical object. In the specific case of the selective production of exotic species (SPES) facility, a multifoil uranium carbide target is impinged by a 40 MeV, 200 μ A proton beam produced by a cyclotron proton driver. Under these conditions, a fission rate of approximately 10^{13} fissions per second is expected in the target. The radioactive isotopes produced by the ^{238}U fissions are delivered to the $1+$ ion source by means of a tubular transfer line. Here they can be ionized and subsequently accelerated toward the facility experimental areas. In ISOL facilities the target system can be combined with different types of ion sources in order to optimize the production of specific ion beams. In this work the SPES target and the related $1+$ ion sources are accurately described, presenting their characterization and testing, together with the main research and development activities. A detailed electrical-thermal-structural study is also reported, with some considerations on long term operation at high temperature.

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