Abstract

The SPIRAL1 facility at GANIL produces radioactive ions beams (RIB) since 2001. Target Ion Source Systems (TISS) are exposed to severe neutron and gamma dose rates, requiring both simple and radiation hard technologies. Moreover, the production is performed in a Nuclear Installation Plant, where all the processes must cope with constraining safety rules. Once the TISS is irradiated by primary beams of heavy ions, the dose rate, the activation level and the potential contamination in the surrounding of the TISS make the access and the maintenance prohibited. All parts of the production system must thus be highly reliable. An important process for the preparation, operation and recycling of the TISS has been developed to minimize the failure probability and optimize the availability of the beam for the users.

Up to now, 45 target ion source systems have produced 76 Radioactive Ion Beams for physics experiments. Only 4 TISSs have failed. The organization and methods to achieve these results will be presented.

SPIRAL 1 at GANIL: Radioactive Ion Beam (RIB) facility

Since 2001, exotic elements are produced by fragmentation of stable beams in thick targets. Once stopped in the target material, radioactive isotopes diffuse out of the target and effuse up to an ion source where they are ionized. All the TISSs are located on a High Voltage platform for reaching energy up to 34MeV/A. Up to now, only TISS based on ECR ion source were used. In the frame of the UPGRADE SPIRAL1 project, new TISSs will be designed to offer new radioactive isotopes.

Target Ion Source System Development

Many simulations and tests are performed to increase the life time and efficiency of the target ion sources. Moreover, a cost optimization is performed.

Target Ion Source System Operation

Each step is link to specific procedures which defines objectives to guarantee the yields and production time for the physicist. More than 20 procedures have to be used and 5 check list have to be completed.

Reliability, why?

To guaranty the yields of radioactive isotopes and production time to physics experiments
The high radiation level which can stop the beam delivery for few days before repairing.
To limit the cost of the operation (a TISS costs between 50k€ to 80k€ for 3 weeks)

Objectives

- Lifetime > 3weeks
- Efficiency which guarantee an intensity >10^6pps
- Stability of the beam
- Cost optimization

Statistics

SPIRAL 1: Yields measured Vs Yields requested

SPIRAL 1: Time performed Vs Time scheduled

Target Ion Source, 2 mbar; 2.000 MeV/A; 10^6pps

Environment

- High power primary beam: (4kW)
- High radiations dose (Neutron, β, γ)
- Residual gas pressure (10^-1 mbar)
- High Voltage (34kV)
- High Temperature (Up to 2000°C)

Maintenance

Preventive maintenance is performed on all technical system needed for the running of TISS (Nuclear ventilation, gas storage, vacuum, cooling system, High voltage devices,...) or for safety checking.