

## DEVELOPMENT OF TARGET ION SOURCE (TIS) MODULE MOCKUP IN RAON

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*The target ion source (TIS) module mockup for ISOL front-end system has been developed to verify ISOL target module operation and maintenance at the rare isotope beam generating condition to 10kW using UCx target. The front-end system is a device of emitting high level radiation. All parts of the device should be designed to withstand radiation and the material should be selected to reduce the radiation. The development of the Target and Ion Source(TIS) Module was focused on the replacement and the maintenance cycle of the component under the high-level radiation environment. The ISOL front-end vacuum system is separated to a primary vacuum system for a beam line evacuation and a secondary vacuum evacuation for the outside of the beam line. The pumping system is located to the top area of the module for easy maintenance. The quick connection and driving system is one of the important point of ISOL front-end system development. The cable duct and radiation shielding structure have been developed for the remote connecting and disconnecting of power lines, signal-lines, cooling lines and pneumatic lines to the front-end system. In addition, the remote control method is developed for the TIS Module to assemble and de-assemble all components. This paper presents the results from engineering design to tests of the TIS module mockup.*

### I. MODULE SYSTEM OF THE TARGET AND THE ION SOURCE

Target ion source (TIS) is a isotope generating component at isotope separator on-line (ISOL) system at RAON. The TIS is highly radiated area which is impossible to be accessed by human. The modularized structure of TIS is required to operate the components remotely. We designed and fabricated a mockup for TIS module to reduce the risk of TIS system for ISOL.

#### I.A. Target and Ion Source System

The Target and Ion Source(TIS) system is a device that accelerates and ionization of various isotopes using non-UCx and UCx target which is projected by the proton beam up to 70 MeV energy. TIS mockup has been developed to verify to functions and performance of TIS for ISOL. TIS mockup is designed to a module structure with a quick connection and disconnection system for all of signal and power lines and the evacuation pipes. The high voltage requirement for the TIS is up to 60 kV. All components of the modularized TIS mockup fabricated to operate remotely. Target chamber of TIS mockup designed an easy disassemble structure to periodic replacement by remote handling and control system.

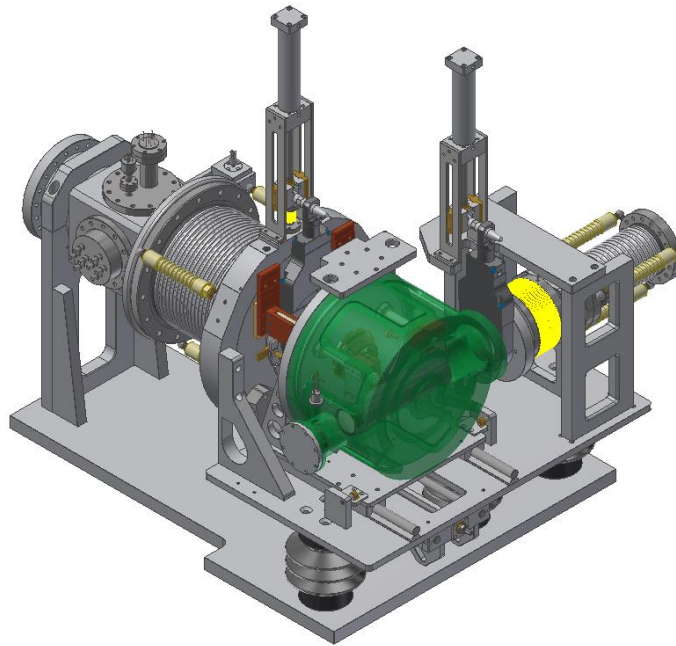
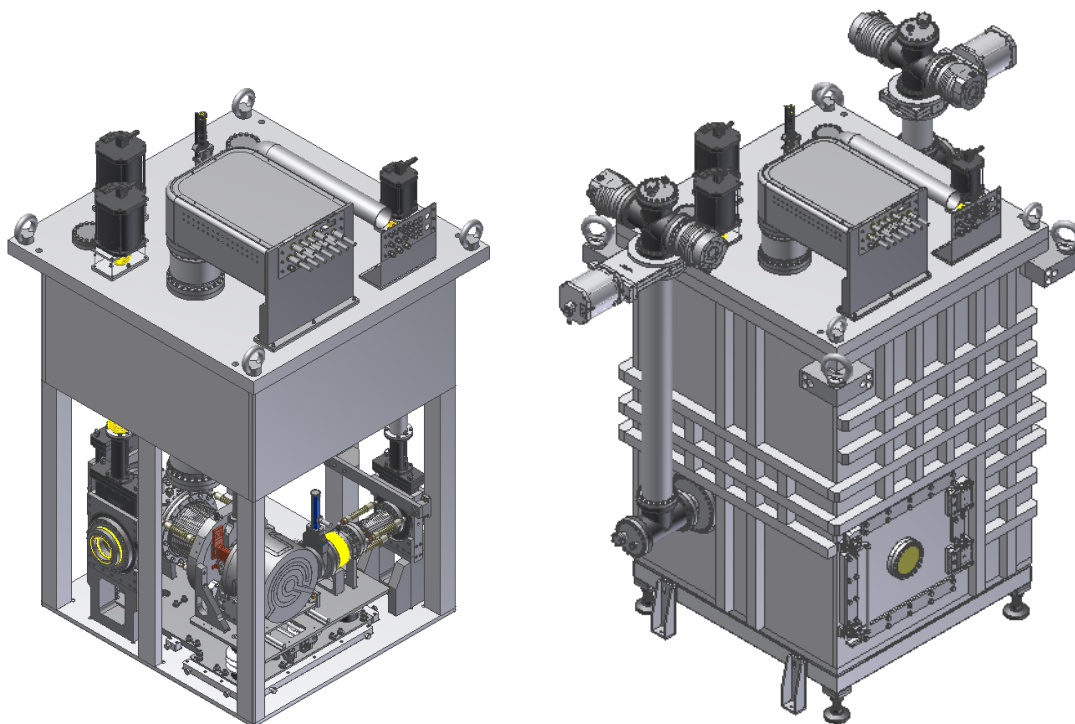


Fig.1. Target and Ion Source System.

### I.B. TIS Module System

The TIS mockup is installed at test facility. The vacuum components are positioned at the top area of the module. The evacuation system will be located on the shielding block at the ISOL target hall. Cable trays are connected to the active devices of target through the shielding block. The BN power is pulled the high voltage duct to protect the neutron flux generated from target. Three pillow seals are applied to the proton beam line, the rare isotope beam line and primary vacuum line for remote sealing. The extraction electrode and the two quick connection system is operated by air motor. A side door is adopted to maintain the inside components.



(a) (b)  
Fig.2. TIS Module system(a) and TIS Module Assemble(b).

## II. CONCLUSIONS

The TIS module mockup is manufactured and installed to be less than  $\pm 0.5$  mm tolerance. The vacuum level of the target chamber named primary vacuum system is within  $1E-7$  mbar and the module chamber vacuum level for secondary vacuum area which is outside of target chamber satisfied the requirement by  $1E-5$  mbar. The pillow seal operation was succeeded to connect and to disconnect from each connection flange. The pillow seal vacuum has no leak. TIS module mockup encapsulated well followed the guide pin. Hot cell manipulator performance satisfied to design value to mount and handle the TIS module mockup. The TIS module mockup endured to 60 kV high voltage level by design value.

TIS module mockup verified the design performance and functions of TIS module system for ISOL. After minor adjustment, the TIS module system will be fabricated and installed to ISOL target hall at RAON.

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