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Rare Isotope Science Project: establishing a superconducting accelerator complex for producing radioactive ion beams

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A new accelerator complex is being built in Daejeon, Korea, which has a full super-conducting linear accelerator, two isotope production facilities and seven experimental stations[1].

This new scientific infrastructure is called RAON, Rare isotope Accelerator complex for ON-line experiments. Rare isotope production is considered as an essential tool for scientists in nuclear physics, nuclear astrophysics and various applied scientific areas such as material science and biomedical physics.

Main goal of RAON is to provide users more exotic isotope beams with high beam energy and power. First beam will be provided to users hopefully next year with lower beam energy and power.

Civil construction is almost completed and plant utilities will be ready within this year, including 154 kV of electricity line and 18 kW-class of He liquefier. Figure 1 shows an artistic rendering of the facility and Figure 2 shows the current drone-taking photo of the site.

Currently, heavy activities of assembly and installation of injector and cryo-modules are being taken place and soon we are expecting a first beam commissioning from the ECR ion source to the RFQ at the injector section.

Four different superconducting cavities are designed and being fabricated for accelerating uranium ion up to 200 MeV/u, in which the speed is above half of the speed of light[2]. Total number of cavities being used are more than 300 and each one should be tested at the cryogenic temperature, 4.5 K and 2 K before assembly and installation. Figure 3 shows the upstream part of the low energy section of the accelerator in which all the warm section components such as magnets and beam diagnostic chambers and cryo-modules and valve boxes are installed and connected each other.

Two isotope production facilities, which are a 70 kW ISOL (isotope separator on-line) driven by a 70 MeV, 1 mA proton cyclotron and a 400 kW IF (in-flight fragmentation), are also being built in parallel[3]. One of the key features of RAON is that a combined operation of ISOL and IF will be realized to provide more exotic and rare isotope beams to the users.

Highlights and technical challenges of the project will be reported.

Figure 1. Artistic rendering of the RAON facility

Figure 2. Current photo of the construction site showing that most of the civil construction is being completed.

Figure 3. The first few cryo-modules in which a super-conducting cavity is assembled, are connected with warm section components during installation

References

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