The first radioactive ion beam of BRISOL

B. Tang , B. Cui, L. Chen, Q. Huang, R. Ma, Y. Ma, X. Ma, W. Jiang
China Institute of Atomic Energy, Beijing, China ,102413

The Beijing Radioactive ion beam facility Isotope Separator On-Line（BRISOL）is a radioactive ion beam facility based on a 100MeV cyclotron providing 100μA proton beam bombarding the thick target to producing radioactive nuclei, which is transferred into ion source to producing singly ion beam. The CaO and MgO target were tested on line. The first radioactive ion beam of $^{38}K^{+}$ was produced by bombarding CaO target by 100MeV proton beam. The first experiment with RIB ($^{20}Na^{+}$) is carrying out. The test and the current status of the BRISOL will be presented in this paper.

1 Introduction

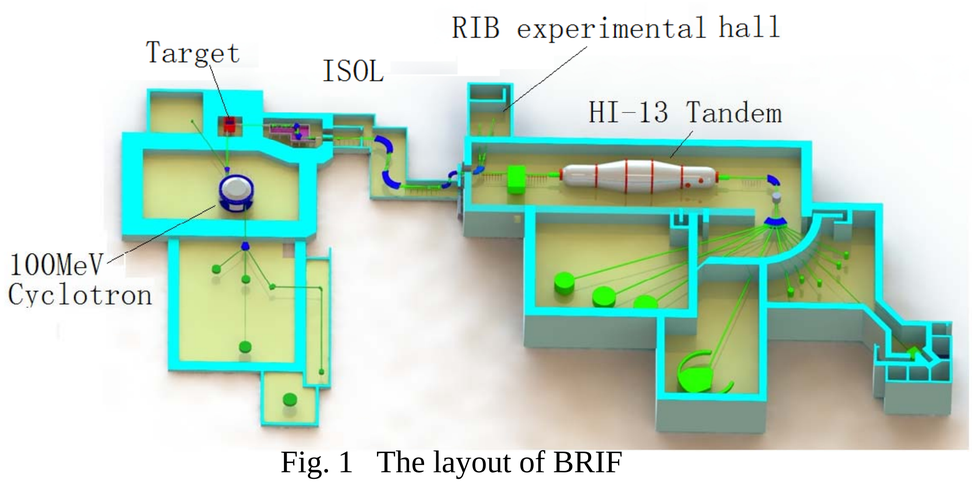
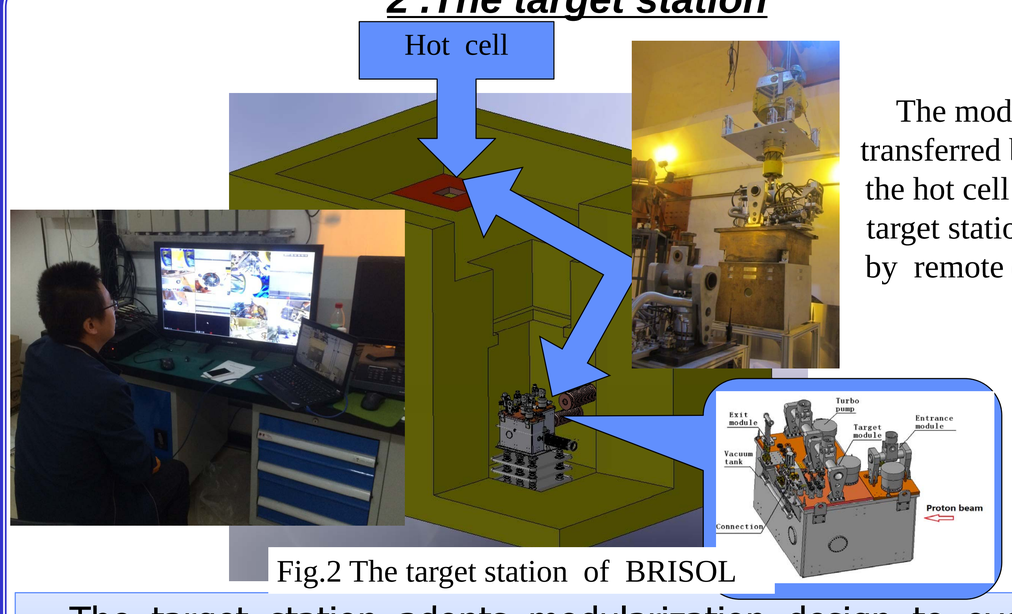


Fig. 1 The layout of BRIF

The Beijing Radioactive Ion-Beam Facility (BRIF) has being constructed at China Institute of Atomic Energy（CIAE）. This project consists of a 100 MeV high intensity cyclotron, an ISOL system （BRISOL), and a superconducting booster.

2 .The target station



The module is transferred between the hot cell and the target station room by remote control.

Fig.2 The target station of BRISOL

The target station adopts modularization design to overcome the maintenance of the high activation target. The modules can be taken out of the vacuum chamber and delivered to hot cell for maintenance by a overhead crane and vice versa. The vacuum, gas and electronic can be disconnected automatically when the module is pulled out from vacuum chamber remotely.

3 The separator of BRISOL

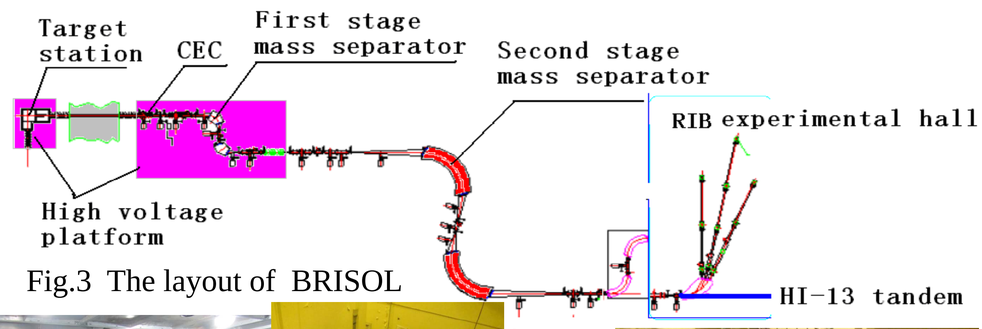


Fig.3 The layout of BRISOL

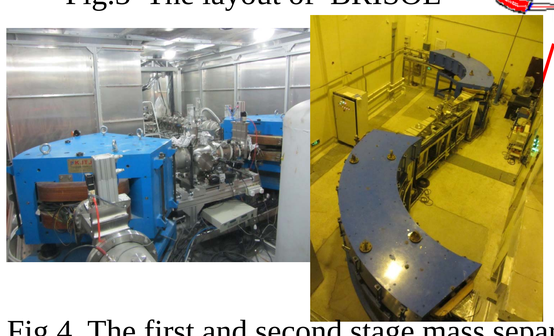


Fig.4 The first and second stage mass separator

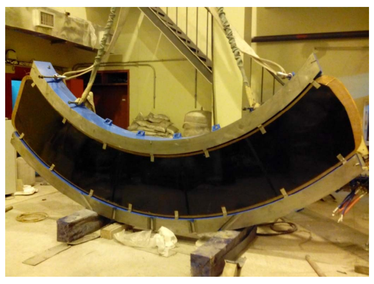


Fig.5 The surface coil of separator

BRISOL separator consists two stages of separator. The first stage of separator consists two 90° dipole magnets on 300kV high voltage platform, and the second stage separator consists two large dipole magnets(ρ=2.5m ,θ=100) on ground potential. Surface coils(β, γ) were set on the magnets. The measured mass resolution is 24,460.

4 The first radioactive ion beam of BRISOL

Fig.6 The photo and SEM of CaO target （18mm in diameter and 2.5mm in thickness)

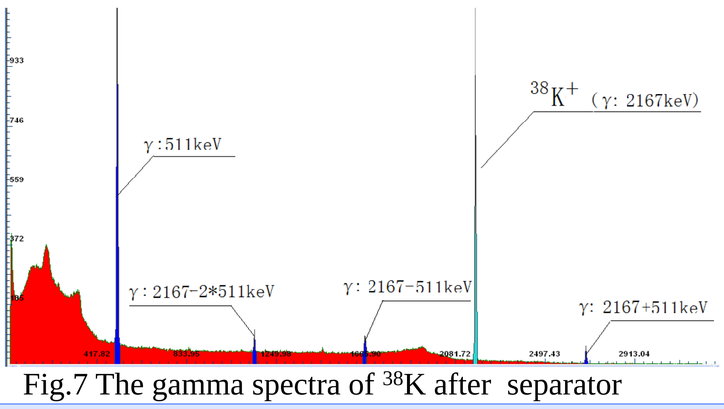


Fig.7 The gamma spectra of ^{38}K after separator

The first radioactive beams (^{38}K,^{42}K, etc.) were produced by bombarding CaO target with 100MeV proton beam from cyclotron. The production of $^{38}K^{+}$ is 1E+6 pps with surface ion source.

5 The first experiment with radioactive ion beam of BRISOL

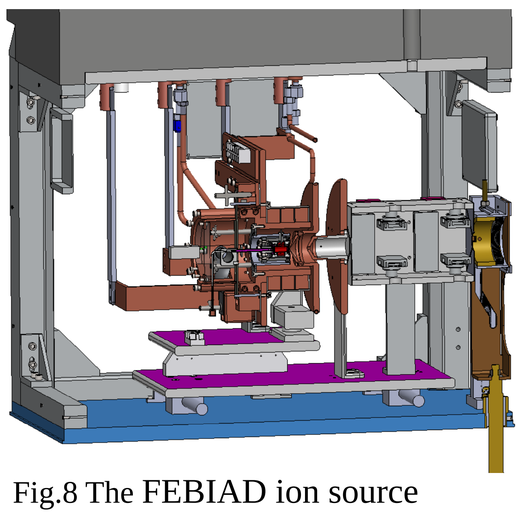


Fig.8 The FEBIAD ion source

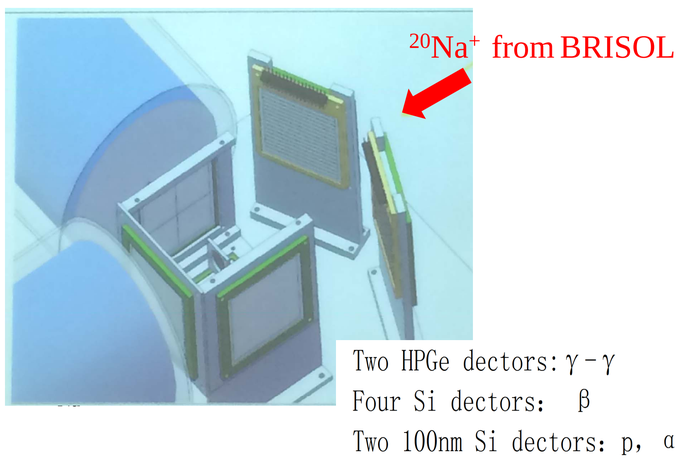


Fig.9 The setup of the physical experiment

The first physical experiment with RIB ($^{20}Na^{+}$,125keV) is carrying out at the RIB experimental hall. A new forced electron beam induced discharge (FEBIAD) type ion source was developed to produce more radioactive beam other than alkaline ions, and the beam of $^{20}Na^{+}$、$^{21}Na^{+}$, $^{23}Ne^{+}$ etc.) were generated by bombarding MgO target with 100MeV proton beam. The production of $^{20}Na^{+}$ beam is 1700pps (not optimizated), and the production of $^{21}Na^{+}$ beam is 2.5E+4pps when the primary beam(H^{+}) is 3μA.

6 Future developments

Due to the first radioactive beams ($^{38}K^{+}$, $^{20}Na^{+}$, $^{21}Na^{+}$, $^{23}Ne^{+}$ etc.) were produced, the commissioning of BRISOL is successful. Future tests will be carried out to optimize the charge exchange efficiency and R&D programme on the ion source will be under way to enhance the production yields. The production of 1E+8pps for $^{38}K^{+}$ beam is promising by the increasing of primary beam up to 50μA. And also other target, such as SiC, UCx, will be under development to produce more radioactive beam.