Database of radioactive isotope beams produced at the BigRIPS separator†

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Many studies on exotic nuclei far from stability have been conducted at the RIKEN RIBF[1] since 2007, taking advantage of the high intensity and large isotope variety of RI beams produced by the superconducting in-flight separator BigRIPS.[2] Neutron-rich RI beams in a very wide range of the nuclear chart have been produced utilizing the in-flight fission of a ^{238}U beam and the projectile fragmentation of ^{18}O, ^{48}Ca, and ^{70}Zn beams. Furthermore, a wide range of proton-rich RI beams have also been produced utilizing the projectile fragmentation of ^{78}Kr and ^{124}Xe beams. The systematically measured production cross sections and other related data are important to provide accurate production-yield information for planning rare-isotope experiments and to improve models and formulae to predict the cross section. Therefore, we have organized the data concerning the RI beam production and constructed a database to compile them.

The measured production cross sections and yields have been registered in the RI-beam database,[3] along with other data sets such as the setting of the BigRIPS separator and particle-identification information. We constructed such a relational database based on Microsoft Access 2010. Table 1 summaraizes the structure of the database, which consisits of five tables named "settings," "yields," "isomers," "experiments," and "papers."

The graphical user interface of the RI-beam database was developed as a web application using PHP. As illustrated in Fig. 1, the web interface of the RI-beam database graphically represents a nuclear chart based on the KTUY05 formula.[4] In the nuclear chart, RI beams produced with the BigRIPS separator are indicated by red letters. The production cross section and production yield for a nucleus of interest can be accessed through the hyperlinked site.

Fig. 1. Web interface. Cyan and yellow indicate nuclei and new isotopes produced at the BigRIPS separator, respectively. Pink indicates the nuclei predicted by KTUY05.[4] The production cross section and production yield for a nucleus of interest can be accessed through the hyperlinked site.

The RI-beam database and its web interface allow efficient RI-beam production at the BigRIPS separator. The database stores the RI-beam and related information obtained for more than 1,600 RI beams produced using BigRIPS. This system is a powerful tool for planning RI-beam production procedures, optimizing BigRIPS settings, and implementing particle identification and isotope separation. However, the present database system was developed with a focus on the use of the production yields and cross sections measured under various experimental conditions; currently, other information such as RI beam purity is not included. In the future, we plan to improve the system so that such information can be stored as well. This would further aid researchers in designing a more accurate experimental plan.

Table 1. Structure of RI-beam database system as of December 2018.

table	contents
settings	settings_id, experimental conditions (beam, target, degraders, slit openings, $B\rho$s, detectors)
yields	RI, yield, cross section, settings_id
isomers	RI, γ-ray energy, half-life, intensity, level energy, spectrum of γ-ray energy
experiments	proposal number, spokesperson, date, beam, course, delivered RIs
papers	title, doi, first author, delivered RIs

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