K500 operations and development

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Introduction

During the April 2023 to March 2024 reporting period a total of 6 different beams, including 4 newly developed beams were used for experiments. The SEE program and the radioactive beams are treated separately in the progress report.

Ion Sources

Both the ECR1 and ECR4 ion sources were available for the K500 operation. The ECR3 ion source was also available; in addition to its main role as the Charge Breeding ECR (CBECR) ion source for radioactive beams, it was used for the production of 47 AMeV zinc beam in March 2024. ECR4 was the main ion source for K500. However, having a second ion source in ECR1, it allowed us to prepare the source for some metal beams which would take longer than a few hours to get ready. Beams of ^{54}Fe and ^{58}Fe were produced from ECR1 using the High Temp Oven. However the iron beam intensities were not strong from ECR1, so the same ^{54}Fe and ^{58}Fe beams were produced by the sputtering method from ECR4. From Nov. 2023, the SEE beams has been prioritized for ECR1.

Cyclotron Beams

Four new beams that were developed for experiments are: 7.5 AMeV $^{54}Fe^{8+}$, 11.5 AMeV $^{56}Fe^{10+}$, and 11.5 AMeV $^{58}Fe^{11+}$, and 47 AMeV $^{64}Zn^{25+}$. 47 AMeV $^{64}Zn^{23+}$ beam was developed and used from 1996 to 2002, however in order to reduce the RF and the deflector conditioning time, the 25+ charge state was selected. The $^{64}Zn^{25+}$ beam was obtained with ECR3, a rod of natural zinc was placed near entrance of ECR3 and was sputtered to produce the beam. Initially, ECR1 was tried with an enriched ^{64}Zn sample loaded into the High Temp Oven, however the beam current from ECR1 was just too weak.

Operations

For the period April 1, 2023 through March 31, 2024, the operational time is summarized in Table I.

Table I. 2023-2024 Operational Time

Time	Hrs	%Time
Science	1224	14
SEE Line	4511	52
Beam Development	532	6
Unscheduled Maintenance	237	3
Scheduled Maintenance	2232	25
Total	8736	100