K500 operations and development

D.P. May, G.J. Kim, B.T. Roeder, H.L. Clark, and F.P. Abegglen

Introduction

During the 2019-2020 reporting period a total of 20 different beams, including 7 newly developed beams, were used for experiments, and there were a total of 23 beam tunings for these experiments. The SEE program and the radioactive-beam effort are treated separately in this progress report.

Ion Sources

During the shutdown the ion source that is used by the K500, ECR1, was opened for cleaning and examination. It was found that there had been further deterioration in the damaged spot, first noticed in 2008, that had developed over a plasma flute on the aluminum wall. The field measured at the wall over this spot was 3.7 kilogauss. This position measured 4.4 kilogauss over a small area corresponding to the joint between two NdFeB blocks after the initial assembly of the hexapole in 1995. It was the second weakest point in the wall field after that time. The bar with the weakest field point was damaged in that area by electron bombardment and was replaced in January of 2004. Since electron bombardment at this spot causes excessive heating, degrading performance, and could eventually permanently damage the wall of the plasma chamber, a new hexapole with more uniform magnets and more water-cooling is now being seriously considered.

Cyclotron Beams

New beams of ^{10}B at 25 AMeV, ^{13}C at 30 AMeV, ^{14}N at 14 AMeV, ^{15}N at 30 AMeV, ^{28}Si at 32 AMeV, ^{54}Fe at 36 AMeV, and ^{100}Mo at 12 AMeV were developed for experiments. The majority of experiments used the 2A line devoted to the recoil spectrometer MARS.

Operations

For the period April 1, 2019 through March 31, 2020, the operational time is summarized in Table I, while Table II lists how the scheduled time was divided. Unscheduled maintenance remained quite low. Scheduled time for outsider users, exclusively SEE customers remained about the same as in the last reporting period.

Table I. 2019-2020 operational time.

Time	Hrs.	%Time
Beam on target	6416	73.4
Beam development	560	6.4
Scheduled maintenance	1616	18.5
Unscheduled maintenance	144	1.7
Total	**8736**	**100**

Table II. 2019-2020 Scheduled Beam Time.

Time	Hrs.	%Time
Nuclear physics	1456	20.9
Nuclear chemistry	904	13.0
Outside collaboration	0	0.0
Outside users	4056	58.1
Beam development	560	8.0
Total	**6976**	**100.0**