

K500 operations and development

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Introduction

During the 2008-2009 reporting period a total of 30 different beams, including 10 newly developed beams, were used for experiments, and there were a total of 34 beam tunings for these experiments. In addition, seven new beams were developed for the SEE program. The SEE program will be treated separately.

Ion Sources

During the January shut-down ECR1 was opened for examination and cleaning. There was no further deterioration in the damaged spot that had previously developed over a plasma flute on the aluminum wall. In January of 2008 the axial field of the source had been reversed to move the bulk of the plasma heating away from this spot.

The method for sputtering isotopic titanium foil into ECR1 was improved with the development of an aluminum holder that serves as a clamp to the foil. Aluminum was chosen because it seems to be impervious to sputtering at the voltages that are applied, and several kilovolts are required in order to sputter a significant amount of the titanium sample. A stainless-steel holder tends to be sputtered into the plasma more than the titanium. The aluminum is emissive, however, and several milliamps of current are drawn from the aluminum. This causes heating of the holder, and the subsequent out-gassing increases the conditioning time to several hours as opposed to the usual minutes which are usually required. After conditioning this method works much better than other methods using foil samples spot-welded onto stainless-steel supports.

Cyclotron Beams

New beams of ^4He at 15 and 24.8 AMeV, ^7Li at 20 AMeV, ^{14}N at 15, 24.8, 38 and 40 AMeV, ^{15}N at 15 AMeV, ^{16}O at 40 AMeV, ^{20}Ne at 25 AMeV, ^{40}Ca at 10, 25 and 35 AMeV, ^{47}Ti at 32 AMeV, ^{64}Ni at 35 AMeV, ^{64}Zn at 35 AMeV and ^{70}Zn at 35 AMeV were developed.

Operations

For the period April 1, 2008 through March 31, 2009, the operational time is summarized in Table I, while Table II lists how the scheduled time was divided. There were five major repairs that caused significant loss of time. The helium refrigerator contamination problem from the last reporting period was finally resolved after the loss of the month of April and half of the month of May in the new period. Finally, on May 15 a beam was extracted from the K500. Then again in the month of June over

five days were lost to a failure of the helium expansion engine. In September and October more than eleven days were lost first to the failure of the rf “B” amplifier and then to the vacuum failure of the rf lower “A” insulator. Finally, in March over a week was lost to the failure of one of the three E1 deflector insulators. As a consequence, the unscheduled maintenance for this year represents a much higher percentage of time than for previous years.

TABLE I. 2008-2009 Operational Time

Time	Hrs.	%Time
Beam on target	5461.75	72.0
Tuning, optics, set-up	40.00	0.5
Beam development	604.50	8.0
Scheduled maint.	11.00	0.1
Unscheduled maint.	1474.75	19.4
Idle time	0.00	0.0
Total	7592.00	100.0

TABLE II. 2007-2008 Scheduled Beam Time.

Time	Hrs.	%Time
Nuclear physics	1601.50	24.9
Nuclear chemistry	1103.50	17.2
Atomic physics	144.00	2.3
Outside collaboration	13.00	0.2
Outside users	3198.50	49.8
Beam development	361.00	5.6
Total	6421.50	100.0