K500 Operations and Development

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Introduction

During the 2000-2001 reporting period, a total of 77 beams were tuned for experiments, and 192 beams were tuned for the SEE program, including two new recently developed sets of beams. The SEE program will be discussed in a separate contribution, but this represents a large increase in running time for the cyclotron. In January the transition to the new control system was completed. This will also be further discussed in a separate contribution to this report.

Ion Sources

The start-up of the upgraded ECR2 ion source will be presented in a separate contribution. Two of the new beams developed in ECR1 include chlorine and holmium. The chlorine was run, after a suggestion from LBL, with carbon tetrachloride. A small amount of liquid in a glass tube, sealed at one end and held vertically, was connected to one of the ruby-seated gas valves on the source. The holmium was sputtered into the source via the three-electrode fixture. The holmium was compressed into a disk and attached to a steel wire before being mounted in the fixture.

Cyclotron Beams

There have been several new beams of note. For the atomic physics program 3.4 AMeV $^{84}Kr^{7+}$ and 3.4 AMeV $^{129}Xe^{11+}$ were developed. Since the experimenters were interested in obtaining low charge-state beams at this energy, the field in the cyclotron had to be near its upper limit, K=490 and K=468 respectively. For a NIMROD experiment two K=478 beams were developed, $^{124}Xe^{30+}$ and $^{124}Sn^{30+}$ at 28 AMeV. At 3.5 GeV these beams represent the highest total energy from our cyclotron. For the SEE program a set of high mass 15 AMeV beams using $^{165}Ho^{30+}$, $^{181}Ta^{33+}$ and $^{197}Au^{36+}$, a set of lower mass 40 AMeV beams of $^{20}Ne^{7+}$, $^{40}Ar^{14+}$ and $^{78}Kr^{27+}$, as well as a beam of 55 AMeV $^{36}Ar^{17+}$ were developed. These beams were chosen with the goal of assuring that at least a few hundred picoamperes of beam could be delivered in a reasonably short time to the SEE chamber. For high intensity, a beam of 27 AMeV $^{10}B^{3+}$ was run for a MARS experiment at the one eμA level for over 15 days.

Operations

During the January break, the box for the hole collimator was replaced with a new one with more pumping speed, and the beam pulser plates in the injection line were widened to a 3 cm. gap from 1.3 cm. Also, the leak in the injection line was found to be in the seal at the break in the horizontal line that allows for raising the cyclotron pole cap. An adjustment in the seal improved the vacuum, although the leak has not been totally repaired. All of these measures resulted in better beam transmission. In the fall the line that supplies the temperature-controlled chilled water for the trim coils began to leak inside the west wall of the building. As a consequence, this system was bypassed until the January shutdown, at which time a new line

within this wall was connected, and temperature control was regained.

For the period April 1, 2000 through March 31, 2001, the operational time is summarized in Table I, while Table II lists how the scheduled time was divided among the experimenters. The beam-on-target time is almost a 24% increase from the last reporting period. This increase can be explained by the decrease in set-up time for NIMROD experiments and by the large increase in time devoted to the SEE program.

Table 1: 200-2001 Operational Time

Time	***Hrs.***	***%Time***
Beam on target	4641.00	58.00
Tuning cyc. & optics, Exp. Setup	876.75	10.9
Beam development	1017.50	12.7
Scheduled maint.	1010.50	12.6
Unscheducled maint.	462.25	5.8
Idle Time	0.00	0.0
Cool Down	0.00	0.0
Total	8008.00	100.0

Table 2: Scheduled Beam Time

Time	***Hrs.***	***%Time***
Nuclear Physics	1096.75	17.0
Nuclear Chemistry	1927.25	29.8
Atomic Physics	443.50	6.9
Outside Collaboration	262.00	4.1
Outside Users	1677.00	25.9
Beam Development	1054.50	16.3
Total	6461.00	100.0