K500 operations and development

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Introduction

During the 2010-2011 reporting period a total of 34 different beams, including 10 newly developed beams, were used for experiments, and there were a total of 49 beam tunings for these experiments. The SEE program is treated separately in this progress report.

Ion Sources

Before the January shut-down ECR1 began to be plagued with leaks, probably caused by x-ray damage, developing in the Poly-Flo tubing that supplies cooling water to the plasma chamber. Also, degradation of the voltage-holding ability of ECR1 was beginning to be a problem. During the shutdown ECR1 was opened for examination, and it was found that there had been no further deterioration in the damaged spot that had developed over a plasma flute on the aluminum wall. The plasma chamber was then pulled from within the axial coils so that all the poly-Flo tubing could be replaced. After it was withdrawn, examination of the G-10 flange used for support and insulation of the plasma chamber on its extraction end revealed a spark track which was subsequently repaired. This whole operation was complicated by the contamination of the chamber by ^{14}C which had been extensively used for beams. After reassembly ECR1 has exhibited much improved voltage-holding and has continued to perform well.

Cyclotron Beams

New beams of ^{3}He at 33 AMeV, ^{11}B at 26 AMeV, ^{27}Al at 25 AMeV, ^{28}Si at 45 AMeV, ^{30}Si at 18 AMeV, ^{38}Ar at 25 and 29 AMeV, ^{40}Ar at 5.5 AMeV, ^{40}Ca at 35 AMeV, and ^{64}Zn at 40 AMeV were developed for experiments.

Operations

For the period April 1, 2010 through March 31, 2011, the operational time is summarized in Table I, while Table II lists how the scheduled time was divided. In April it was necessary to use one week of unscheduled maintenance for repairs to the Sullair helium compressor in the helium refrigeration system. In September maintenance was devoted to implementing the new interlock system and merging the K500 and K150 control systems. At the same time the K500 control room was dismantled to make way for construction on the ion-guide cave described elsewhere in this progress report. Since that time tuning of the K500 has been divided among three widely separated stations. In November, breakdown of the K500 inflector high voltage was addressed by repairing a vacuum leak through a seal on the inflector

shaft. As a consequence the vacuum in the K500 improved substantially, from the low 10^{-7} torr range to the mid 10^{-8} torr range.

TABLE I. 2010-2011 Operational Time

Time	Hrs.	%Time
Beam on target	6537.00	**87.9**
Tuning, optics, set-up	49.00	**0.7**
Beam development	224.75	**3.0**
Scheduled maint.	211.50	**2.8**
Unscheduled maint.	417.75	**5.6**
Idle time	0.00	**0.0**
Total	**7440.00**	**100.0**

TABLE II. 2010-2011 Scheduled Beam Time.

Time	Hrs.	%Time
Nuclear physics	1859.75	**26.3**
Nuclear chemistry	1540.00	**21.8**
Atomic physics	95.50	**1.4**
Outside collaboration	0.00	**0.0**
Outside users	3340.50	**47.3**
Beam development	224.75	**3.2**
Total	**7228.50**	**100.0**