K1200 OPERATING EXPERIENCE

D. Poe, P. Miller and M. Garbek

Table I shows operating time statistics for the K1200 cyclotron for the year of 1998, and Table II shows the various beams which were run along with the number of hours for each. It also gives the percentage of total beam time for each beam. There were 105 different beams of 68 different types occurring in 5488.75 hours of operation and 4651.25 hours of research. This implies that there was one beam change for every 52.3 hours of operation and every 44.3 hours of research.

TABLE I: K1200 Time Distribution 1998

	Hours	Percentage
Operation		
Research	4651.25	72.67
Developmeent	84.50	1.32
Overhead	753.00	11.77
(R + D + O)	5488.75	85.76
Maintenance	108.25	1.69
Breakdown	803.25	12.55
TOTAL	6400.25	100.00
OFF		2359.75

EFFICIENCY = E = (R + D + O) / (TOTAL - MAINTENANCE)

E = 5488.75 / (6400.25 - 108.25) = 0.872 = 87.2 %

There were 4651.25 hours of research in 1998 versus 4517.25 hours in 1997. The category of operation, or (research + development + overhead) was 5488.75 hours. This represents the amount of time that the cyclotron was running. The efficiency is defined in Table I as the time that the cyclotron ran divided by the amount of time that we tried to run it, and is 87.2% in 1998.

Since 1998 was not a leap year it had 8,760 hours in it. Therefore, research was carried on 53.1 % of the total time, and operation for 62.7 %.

Beams run for the first time in 1998 included 58 Fe at 20, 45 and 90 MeV/u and the analog 58 Ni at 45; 17 Oxygen at 45, 80 and 100 MeV/u; 40 Ar at 50 MeV/u; 136 Xe at 40 and 65 MeV/u; and 22 Ne at 50 MeV/u along with its analog 114 Cd 26+.

Last year a new style E1 deflector was installed, and it has worked well. The E1 deflector is made up of three segments so that the shape may be adjusted to match the beam orbit. All three segments are now made with copper, water-cooled housings (which form the anodes), and all three have a set of clamping strips for the septa. A newer style septum was developed in 1998 and was routinely used by the end of the year. It is made of tungsten, 25 mils thick, but with a ten mil thick section in the center, and with a leading edge notch. The machining is done on an EDM machine. This provides more cooling and greater rigidity. All three segments now have this type of septum.

The high power beam probe is now in routine operation and is a considerable help in tuning at high power levels, as is the non-intercepting beam probe just outside of the machine.

TABLE II:

K1200 CYCLOTRON BEAMS in 1998

Ion	E/A (MeV/u)	Hours	Time (%)
4He1+	40	177.50	3.8%
4He1+	60	30.25	0.7%
4He2+	160	12.75	0.3%
(H-He)+	30	15.00	0.3%
7Li2+	50	51.75	1.1%
7Li2+	85	2.00	0.0%
9Be3+	70	42.50	0.9%
12C3+	40	2.00	0.0%
12C3+	50	13.00	0.3%
12C4+	75	114.00	2.5%
12C4+	100	13.00	0.3%
12C6+	160	20.50	0.4%
13C3+	40	175.50	3.8%
14N4+	85	2.00	0.0%
15N5+	100	33.75	0.7%
16O4+	60	15.00	0.3%
16O6+	100	65.75	1.4%
17O4+	45	76.25	1.6%
17O6+	80	165.00	3.5%
17O7+	150	55.25	1.2%
18O6+	80	292.75	6.3%
18O6+	100	55.00	1.2%
20Ne5+	60	1.00	0.0%
20Ne6+	80	131.25	2.8%
20Ne6+	90	20.75	0.4%
20Ne6+	100	135.50	2.9%
22Ne6+	50	2.00	0.0%
22Ne6+	80	172.75	3.7%
22Ne8+	120	159.75	3.4%
24Mg8+	80	120.25	2.6%
36Ar12+	75	7.50	0.2%
36Ar12+	80	61.00	1.3%
36Ar12+	100	175.75	3.8%
36Ar15+	150	346.25	7.4%
36Ar9+	60	17.00	0.4%
40Ar10+	40	14.00	0.3%
40Ar10+	60	8.25	0.2%
40Ar12+	90	143.50	3.1%
40Ar12+	100	12.50	0.3%
40Ar9+	40	171.00	3.7%
40Ar9+	50	2.00	0.0%
48Ca13+	80	212.50	4.6%
58Fe14+	45	42.75	0.9%
58Fe15+	75	16.00	0.3%
58Fe17+	90	6.50	0.1%
58Fe18+	105	11.00	0.2%
58Fe9+	20	39.00	0.8%
58Ni14+	45	17.25	0.4%
58Ni18+	105	6.00	0.1%
58Ni9+	20	39.50	0.8%
68Zn16+	60	65.00	1.4%
81Kr17+	45	40.00	0.9%
84Kr21+	60	40.00	0.9%
86Kr18+	45	78.00	1.7%
86Kr23+	80	37.00	0.8%
106Cd24+	50	100.25	2.2%
112Sn26+	50	95.25	2.0%
114Cd26+	50	63.00	1.4%
124Sn25+	40	21.00	0.5%
124Sn26+	50	56.25	1.2%
129Xe26+	40	19.00	0.4%
129Xe28+	50	124.75	2.7%
129Xe32+	60	4.00	0.1%
136Xe29+	40	138.00	3.0%
136Xe32+	65	58.00	1.2%
197Au29+	20	84.50	1.8%
197Au35+	30	75.75	1.6%
208Pb35+	29	27.75	0.6%
		4650.50	100.0%

References

1. R. Harkewicz and Dallas Cole, NSCL Annual Report, (1996) 225
2. P. Miller and Jim Moskalik, NSCL Annual Report, (1996) 230