Beam Tests

Trials with ^{24}Mg at the ANU

Author: P.H. Regan & D.C. Weisser

Date: 14 May 1993

^{24}Mg Beam Test for CHARISSA

P.H. Regan and D. Weisser

The experiments proposed by the CHARISSA collaboration require the 14UD to produce relatively large current yields ($\sim$5pnA on target) of ^{24}Mg at a beam energy of 170 MeV. ^{24}Mg beams are accelerated through the tandem as a hydride with with the hydrogen being introduced as NH_4 gas in the ion source. This results is beam species of ^{24}MH, $^{24}MH_2$ and $^{24}MH_3$ being created. In order to test which were the most favourable setting for the various parameters (eg. single stripping or double stripping, which hydride to use etc.) four days of beams test (including machine conditioning) were performed over the period 19-22 April 1993 using both standard and reflected geometry magnesium cones.

The three charge/terminal voltage combinations resulting in 170 MeV beams that were investigated are given in the table.

Stripping	Q_1,Q_2	V_T (MV)
Double	8^+, 11^+	15.48
Double	9^+, 11^+	15.01
Single	10^+	15.44

The initial tests used a reverse geometry ^{24}Mg cone which yielded very small currents (~5 enA) at the low energy cup. As much as 40 enA was observed after 24 hours operation but no further increase was obtained. The full tests (beam through the machine) were performed using the standard geometry cone. The table below shows the currents in enA, of the three species (A=25, 26 and 27) at the low energy cup with time. The number in brackets is the field setting of the anaylsing magnet (in gauss) for that particular species.

Time	^{24}Mg+H (3470)	^{24}Mg+H_2 (3537)	^{24}Mg+H_3 (3607)
12.35	50	60	14
13.45	50	20	35
15.15	78	30	38
15.35	105	40	80
17.05	200	37	240

The following table shows the parameters for the A=25 and 27 beams for $8^+/11^+$ at 15.48 MV. All currents are given in eNa.

Time	A	LE	Tank	HE	Stop
11.05	27	150	110	540	40
11.25	25	125	90	500	40
14.20	25	135	100	600	50
16.05	25	165	120	600	60

The $9^+/11^+$ charge states at 15.17 MV and the singly stripped 10^+ at 15.44 MV were both found to produce only approximately one third of the $8^+/11^+$ 170 MeV yield at the stop. These ratios were found to be in line with the predictions of the code STRIP. The initial cone hole diameter was measured to be approximately 1mm rising to 1.4mm by the end of the test.

In conclusion, the favored configuration of double stripping ($8^+/11^+$) at 15.48 MV resulted in acceptible currents of ^{24}Mg ($\geq$5pNa) at the stop. Either the tri-hydride or mon-hydride molecules can be used from the ion source to give the required current yields assuming a standard geometry cone used.