RADIOACTIVE BEAMS AT THE NSCL

Mathias Steiner [1)]

The A1200 Fragment Separator is being used as a production facility for radioactive beams (RNB) in a wide variety of nuclear-physics experiments. The following table is intended to provide an overview of the radioactive-beam effort during 1997. Earlier beams are listed in the 1996 NSCL Annual Report.

The information provided is far from complete, but should be helpful for users planning an RNB experiment. It should be kept in mind that count-rate and beam-quality requirements vary from experiment to experiment and that the beam/target/wedge combinations and the resulting intensities may not represent the achievable maximum. If a desired RNB is not in the table, the reader may want to use the values provided for nearby nuclei to judge the reliability of codes like LISE [1] or INTENSITY [2] in predicting production rates for a given situation.

The table lists the month any experiment was run, the experiment number, its title in abbreviated form, the principal investigator, primary beam, energy, and maximum achieved intensity. The nature and thickness of target and wedge are also shown, followed by the spectrometer's momentum acceptance (full width). Finally, the secondary beam and its energy are listed, along with the observed rate, normalized to beam current in units of particles per second and particle-nanoamperes of beam, except in cases where the beam current is unknown and the achieved rate is given in particles per second (pps). A short comment is added for some beams, giving further information. Abbreviations and slang used: *Rx XSec* means reaction cross section; *CEX* is Charge Exchange; *Slits* refers to a set of horizontal slits just downstream of the A1200 focal plane, used to clean up secondary beams before transmission to experimental stations; *Purity* is the rate of desired fragments, divided by the total count rate; *Att* refers to the beam current attenuators used to adjust the cyclotron current; *Beam Angle* indicates that the primary beam impinged on the production target at an angle. The remark *BLPin* indicates that the rate was measured with the beamline PIN diode, located past the A1200 clean-up slits.

[1] D. Bazin, unpublished (further information on *www.nscl.msu.edu/~bazin*)
[2] J.A. Winger et al. NIM **B**70(1992) 380

[1)]and may others involved in the experiments summarized in the table.

Date	Expt #	Title	P.I.	Beam	Energy	Target	Wedge	P Acc	RNB	Energy	Rate
					MeV/u	mg/cm2	mg/cm2	%		MeV/u	1/pnAs
1-97	96021	Structure of 16C	Raimann			Be 1170	PE 241	3	14C	48	
									15C	46	
									16C	43	
1-97	96037	Coulomb Excitation	Glasmacher	40Ar		Be 564	none	1	22O	64	6.2
									28Ne	62	0.16
									26Ne	71	16
									24O	60	0.02
									22O	71	3.4
									28Ne	69	0.16
									26Ne	79	1.7
									18C	60	0.78
1-97	96020	8B Breakup	Davids	12C	100	Be 1900	PE 241		8B		
1-97	95012	Total Rx XSec	Crawley	55Mn	90	Be 103	none	1	50Ca	35	0.084
2-97	96048	44Ti Lifetime	Goerres	46Ti	70	Be 202	none	0.25	0	51	22k
3-97	96046	17Ne Total Rx XSec	Borcea	20Ne	80	Be 564	PE 241	1	17Ne	45	50
						Be 564	PE 241	3	17Ne	45	500pps
4-97	95046	17Ne Magn.Mom.	Anthony	20Ne	80	Nb 104		1	17Ne	75.4	1.25
						Nb 104	Al 540	1	17Ne	50	0.4
5-97	95049	11Be GDR Studies	Beene	13C	100	Be 986	PE 525	1	11Be	80	9400
5-97	96027	15C Production	Mantica	18O	80	Nb 104	none	3	15C	79	3241
									15C	76	2408
									15C	76	1883
									15C	76	1144
									15C	76	1523
6-97	96027	Mag. Mom. of 17N	Mantica	18O	80	Nb 104	Al 425	1	17N	70	lots...
7-97	96038	8B(p,p')	Suomijarvi	12C	100	Be 2134	PE 241	0.5	8B	35	352
										37	397
7-97	96035	44,46Ar(p,p')	Scheit	48Ca	70						
						Be 249	PE 241	0.5	42Ar	33	9040
7-97	96036	Shapes of sd nuclei	Glasmacher	36Ar	100	Be 564	none	0.5	42Ar	58.5	4.41
						Be 564	none	0.5	24Si	57	0.87
						Be 564	PE 241	0.5	24Si	37	0.4
							none	0.5	20Mg	59	0.82
							PE 241	0.5	20Mg	44.3	0.254
8-97		Neutron Wall Test	Galonsky	18O	80	Be 1900	PE 241	0.5	15C	35	789
				18O	80	Be 376	none	0.5	15C	72	3911
8-97	96032	14C(n,g)15C	Ieki	18O	80	Be 1170	PE 241	1	10C	39	165

							1	15C	35	151
								14C	29	31000
8-97	97017 Final-State IA 8He+n	Blank	18O	80	Be 1455	PE 241	1	12Be	30	120
						PE 725	1	12Be	30	161
						PE 725	1	11Be	30	270
					Be 846	none	1	11Be	56	563
			13C	80	Be 1900	PE 241	1	11Be	30	1725
								11Be	30	725
9-97	96006 Deformed 56Ni	Zgajnar	64Zn	70	Be 202	Al 70	0.5	56Cu	33	1.2
					Ni 233			56Cu	33	0.44
					Be 202	Al 70	0.5	55Ni	32	62
										15
10-97	96043 p Halos in sd shell	Bazin	36Ar	100	Be 470	none	0.5	28P	73	475
							0.5	28P	71	668
						Al 70	0.5	28P	66	534
						none	0.5	27P	76	22
						Al70	0.5	26P	68	0.82
10-97	96037 Shape Evln sd shell	Prtychenko	40Ar	90	Be 564	PE 241	0.5	20O	51	107
					Be 564	PE 241	0.5	26Ne	52	7.5
					Be 564	PE 234	0.5	30Mg	46	49
10-97	97009 CoulEx 38Ca	Cottle	40Ca	80	Be 202	Al 70	0.5	38Ca	58	7600
					Be 203	Al 70	0.5	26Si	58	237
10-97	96036 Shape of p-rich nuclei	Cottle	36Ar	100	Be 564	PE 241	1	26Si	55	744
					Be 376	PE 241	0.5	32Ar	53	4.1
11-97	96037 Shape Evol sd shell	Glasmacher	48Ca	80	Be 376	Al 70	0.5	40Si	60	0.024
								40Si	57	0.02
								28Ne	60	0.612
								32Mg	66	2.82
11-97	97043 Isospin Dep. Nuc Rx	Bjarki	40Ar	100	Be 202	none	1	40Cl	90	41430
			40Ar	125	Be 376	PE 241	1	40Cl	100	64500
			40Ca	80	Be 103	none	0.5	40Sc	71	1697
					Be 103	none	1	40Sc	71	3030
			40Ca	125	Al 150	none	0.5	40Sc	117	1640
					Be 155	none	0.5	40Sc	115	7331
					Be 155	PE 241	1	40Sc	101	5140
						PE 241	1	40Sc	101	4960
12-97	96043 17,19Ne Halo Nuclei	Bazin	22Ne	80	Be 470	PE 241	0.5	17C	64	37
					Be 470	PE 241	0.5	19C	59	0.042

11-97	97004	Decay studies 78Ni	Mantica	76Ge	70	Be 202	Al 70	0.5	69Ni	40	86
						Be 202	Al 70	0.5	68Co	37.6	54
12-97	97003	Test Run	Axelsson	12C	75	Be 1289	none	0.5	9C	10	5
						Be 1455	none	0.5	9C	10	30
12-97	97050	Test Run	Chartier	22Ne	120	Be 376	none	0.5	20O	109	33500
										113	28500
										117	7875
						Be 367	PE 241	0.5	20O	105	18500
12-97	96031	(t,3He) CEX	Fujiwara	4He	140	Be 4360	PE 2359	0.5	3He	115	
1-98	97003	9Li(d,p) inv. kin.	Kolata	13C	40	Be 376	PE 133	0.5	9Li	21	30
2-98	97032	Mag Mom 21Mg, 25Si	Mantica	18O	80	Nb 642	PE 241	0.5	12B	66	1700
				24Mg	80	Nb 642	PE 241	1	21Mg	39	16
									20Na	36	72
						Be 470	PE 133	1	20Mg	44	0.3
									20Mg	45	0.9
						Be 564	PE 241	0.5	21Mg	32	43
									20Na	29	290
									20Mg	45	2.2
3-98	96013	17Ne Mom. Dist.	Steiner	20Ne	100	Be 376	PE 133	0.5	17Ne	82	92
									15O	79	26000
3-98	97024	19N Decay	Anthony	22Ne	80	Be 564	none	1	19N	63	463
						Be 564	PE 241	1	19N	58	386
						Be 564	PE 241	1	16C	57	800
						Be 564	PE 241	1	20N	52	9
						Be 564	PE 241	1	20N	56	12
4-98	97012	18F Isomer	Ronningen	17O	45	n/a	C 43	n/a	18F	41	
4-98	97011	Strct. heavy S,Cl,Ar	Winger	48Ca	80	Be 376	Al 70	0.5	42P	56	0.17
						Be 376	PE 241	1	41P	47	3.9
5-98	97007	CoulEx of heavy Na	Thirolf	40Ar	90	Be 564	PE 241	0.5	29Na	62	2
						Be 564	PE 241	1	21O	59	30
						Be 564	PE 241	1	22O	54	4.2
7-98	97025	D,Q moment 32Cl	Rogers	36Ar	100	Nb 642	Al 425	1	32Cl	38	638