

## ReA3 Radioactive Beam List

The following list is for ReA3 experiments. If you plan to propose a very low energy "stopped beam" experiment, for example using LEBIT or BECOLA, the rates will be higher and a wider range of elements may be available. Please contact Antonio Villari for assistance.

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
22	12	Mg	g	3.8755	sec	8.70E+02	5.5
23	12	Mg	g	11.317	sec	1.80E+04	5.3

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
29	15	P	g	4.142	sec	6.40E+02	5.4
30	15	P	g	2.498	min	3.10E+03	5.3
32	15	P	g	14.263	d	4.60E+03	5.0
33	15	P	g	25.35	d	3.10E+03	4.8
34	15	P	g	12.43	sec	1.20E+03	4.7
35	15	P	g	47.3	sec	3.90E+02	4.6

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
31	16	S	g	2.572	sec	4.30E+03	5.5
35	16	S	g	87.37	d	1.85E+04	4.9
37	16	S	g	5.05	min	3.25E+03	4.7
38	16	S	g	170.3	min	1.20E+03	4.5
39	16	S	g	11	sec	4.40E+02	4.4

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
32	17	Cl	g	298	ms	1.10E+03	5.6
33	17	Cl	g	2.511	sec	1.70E+04	5.5
34	17	Cl	g+i	1.5266	sec	8.80E+04	5.4
38	17	Cl	g+i	37.24	min	5.20E+04	4.8
39	17	Cl	g	56.2	min	2.20E+04	4.7
40	17	Cl	g	1.35	min	5.70E+03	4.6
41	17	Cl	g	38.4	sec	2.70E+03	4.5
42	17	Cl	g	6.8	sec	1.00E+03	4.4
43	17	Cl	g	3.13	sec	5.80E+02	4.3

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
34	18	Ar	g	843.8	ms	3.30E+03	5.7
35	18	Ar	g	1.7756	sec	3.40E+04	5.5
37	18	Ar	g	35.011	d	1.40E+04	5.3
39	18	Ar	g	269	y	1.00E+05	5.0
41	18	Ar	g	109.61	min	3.10E+04	4.8
42	18	Ar	g	32.9	y	3.10E+04	4.7
43	18	Ar	g	5.37	min	1.80E+04	4.6
44	18	Ar	g	11.87	min	7.80E+03	4.5
45	18	Ar	g	21.48	sec	2.70E+03	4.4
46	18	Ar	g	3.13	sec	7.00E+02	4.3

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
37	19	K	g	1.2	sec	1.20E+04	5.5
38	19	K	g+i	7.636	min	7.90E+04	5.4
42	19	K	g	12.4	hr	3.90E+04	5.0
43	19	K	g	22.3	hr	6.80E+04	4.8

44	19	K	g	22.1	min	8.60E+04	4.7
45	19	K	g	17.3	min	9.80E+04	4.7
46	19	K	g	105	sec	7.7 E+04	4.6
47	19	K	g	17.5	sec	4.70E+04	4.5

<b>A</b>	<b>Z</b>	<b>Element</b>	<b>g/i</b>	<b>Half-life</b>		<b>ReA Intensity (pps)</b>	<b>Max Energy for given Intensity [MeV/u]</b>
38	20	Ca	g	444	ms	5.4E+02	5.7
39	20	Ca	g	860	ms	3.6E+03	5.6
45	20	Ca	g	162.61	d	1.4E+03	4.9
47	20	Ca	g	4.536	d	3.6E+03	4.7
49	20	Ca	g	8.718	min	7.2E+02	4.5

<b>A</b>	<b>Z</b>	<b>Element</b>	<b>g/i</b>	<b>Half-life</b>		<b>ReA Intensity (pps)</b>	<b>Max Energy for given Intensity [MeV/u]</b>
43	21	Sc	g+i	3.89	hr	6.0E+02	5.4
44	21	Sc	g+i	3.97	hr	6.7E+02	5.3
49	21	Sc	g+i	57.18	min	3.8E+02	4.8

<b>A</b>	<b>Z</b>	<b>Element</b>	<b>g/i</b>	<b>Half-life</b>		<b>ReA Intensity (pps)</b>	<b>Max Energy for given Intensity [MeV/u]</b>
50	25	Mn	g+i	283.2	ms	4.80E+02	4.5
51	25	Mn	g	46.2	min	1.80E+03	4.4
52	25	Mn	g+i	5.59	d	3.60E+03	4.3
53	25	Mn	g	3.70E+06	y	2.80E+03	4.2
54	25	Mn	g	312.1	d	2.00E+03	4.2
56	25	Mn	g	2.58	hr	1.10E+03	4.0
57	25	Mn	g	85.4	sec	5.30E+02	4.0
58	25	Mn	g+i	3	sec	3.60E+02	3.9

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
51	26	Fe	g	0.3	sec	4.40E+02	4.6
52	26	Fe	g+i	8.3	hr	1.20E+03	4.5
53	26	Fe	g+i	8.5	min	8.00E+03	4.4
55	26	Fe	g	2.7	yr	2.10E+04	4.3
59	26	Fe	g	44	d	2.50E+03	4.1
60	26	Fe	g	1.50E+06	y	1.80E+03	4.0
61	26	Fe	g	6	min	5.80E+02	4.0

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
54	27	Co	g+i	0.2	sec	1.60E+03	4.6
55	27	Co	g	17.5	hr	1.60E+04	4.5
56	27	Co	g	77	d	6.50E+04	4.4
57	27	Co	g	272	d	6.70E+04	4.4
58	27	Co	g+i	71	d	2.00E+03	4.3
60	27	Co	g+i	5.2	y	1.10E+04	4.2
61	27	Co	g	1.6	hr	8.80E+03	4.1
62	27	Co	g+i	1.5	min	1.00E+04	4.1
63	27	Co	g	27	sec	5.90E+03	4.0
64	27	Co	g	300	ms	4.50E+02	4.0

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
56	28	Ni	g	6.075	d	1.9E +03	4.6
57	28	Ni	g	35.6	hr	1.30E+04	4.5
59	28	Ni	g	101,000	y	1.20E+03	4.4
63	28	Ni	g+i	101.7	y	1.10E+04	4.2
65	28	Ni	g+i	2.52	hr	1.30E+03	4.1
66	28	Ni	g	54.6	hr	3.40E+02	4.0

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
60	29	Cu	g	23.7	min	6.6E+02	4.0
61	29	Cu	g	3.33	hr	1.6E+03	4.0
62	29	Cu	g	9.67	min	1.8E+03	3.9
66	29	Cu	g	5.12	min	2.6E+03	3.8
67	29	Cu	g	61.83	hr	2.4E+03	3.7
68	29	Cu	g+i	30.9	sec	1.6E+03	3.7
69	29	Cu	g	2.85	min	1.1E+03	3.7

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
64	31	Ga	g	2.6	min	1.30E+03	4.1
65	31	Ga	g	15	min	4.30E+03	4.1
66	31	Ga	g	9.5	hr	5.00E+03	4.0
67	31	Ga	g	3.2	d	5.30E+03	4.0
68	31	Ga	g	68	min	2.60E+03	3.9
70	31	Ga	g	21	min	1.30E+04	3.9
72	31	Ga	g	14	hr	2.60E+04	3.8
73	31	Ga	g	4.9	hr	3.20E+04	3.8
74	31	Ga	g+i	8	min	2.20E+04	3.7
75	31	Ga	g	126	sec	1.60E+04	3.7
76	31	Ga	g	32	sec	6.20E+02	3.7

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
71	34	Se	g	4.74	min	6.3E+02	4.2
72	34	Se	g	8.4	d	1.6E+03	4.2
73	34	Se	g+i	7.15	hr	1.9E+03	4.1
75	34	Se	g	119.8	d	1.3E+03	4.0

79	34	Se	g+i	335,000	y	1.9E+03	3.9
81	34	Se	g+i	18.45	min	4.7E+02	3.8
83	34	Se	g+i	22.3	min	3.9E+02	3.8

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
72	35	Br	g+i	78.6	sec	1.75E+03	4.3
73	35	Br	g	3.4	min	1.25E+04	4.3
74	35	Br	g+i	25.4	min	4.75E+04	4.2
75	35	Br	g	96.7	min	5.00E+04	4.2
76	35	Br	g+i	16.2	hr	5.00E+04	4.1
77	35	Br	g+i	57.04	hr	3.00E+04	4.1
82	35	Br	g+i	35.282	hr	3.55E+04	3.9
83	35	Br	g	2.4	hr	3.50E+04	3.9
84	35	Br	g+i	2.4	hr	2.35E+04	3.8
85	35	Br	g	2.9	min	1.10E+04	3.8

A	Z	Element	g/i	Half-life		ReA Intensity (pps)	Max Energy for given Intensity [MeV/u]
74	36	Kr	g	11.5	min	7.00E+02	4.4
75	36	Kr	g	4.29	min	6.20E+03	4.3
76	36	Kr	g	14.8	hr	4.30E+04	4.3
77	36	Kr	g	74.4	min	1.00E+05	4.2
79	36	Kr	g+i	35.04	hr	1.20E+03	4.1
85	36	Kr	g+i	10.776	y	1.00E+05	3.9
87	36	Kr	g	76.3	min	4.00E+03	3.8

#### Notes:

- Expected ReA3 beam intensities and the corresponding maximum energy is listed in the table assuming acceleration of ions in the He-like charge state. The minimum energy is 300 keV/u; higher energies can in principle be reached up to the limit of about 6 MeV/u in selected cases. at reduced intensity. Please contact

principles be reached up to the limit of about 6 MeV, and in selected cases, at reduced intensity. Please contact Antonio Villari for assistance if you would like to propose use of a higher energy.

- The ReA3 beam has a microstructure of 80.5 MHz and a macrostructure varying from about 1 Hz to 10 Hz. Typical duty cycle varies from 10% to a maximum of 40%. The choice of the duty cycle and frequency is a compromise between the charge state to be accelerated and the experimental apparatus.

- All beams may be contaminated by their daughters and grand-daughters. Experiments should expect a level of contamination of the order of 20% or higher. Some beams can also have stable contamination, depending on the charge state used in the acceleration.

- g/i refers to presence of ground state and isomeric state

- Isotopes with lifetimes longer than 10 minutes can be difficult to tune. Please contact Antonio Villari for assistance if you need a long-lived isotope and would like to use any of these beams for your proposal.

- Additional beams not on the list may be possible. Requests for new stable beams can be sent to the Manager for User Relations, Jill Berryman, in the form of a letter to the NSCL Director. New radioactive beam requests can be made via a Letter of Intent during a period when the PAC is accepting proposals.