

Expected 1+ beam intensities from the SPIRAL upgrade

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1. Scope of the document

So far the production of SPIRAL has been limited to gaseous elements (see <http://pro.ganil-spiral2.eu/users-guide/accelerators/spiral-beams>). The SPIRAL upgrade project consists in the development of a 1+ to n+ charge breeding system, permitting the use of versatile 1+ sources for extending the range of elements available for post-acceleration to condensable elements. The SPIRAL upgrade shall provide the GANIL/SPIRAL 2 community with new beams by beginning of 2016. The new 1+ beams shall be available for DESIR. A FEBIAD ion source (from ISOLDE, the so-called VADIS) has been recently coupled to a standard SPIRAL target. Such association has been tested on-line at SIRa and most recently at SPIRAL with nominal power. The following lists are intended to prepare Lols for DESIR. They gather expected intensities from experiments done at SIRa, and projections done for a system coupling the VADIS with a Nb target. More accurate estimates shall be available once the analysis of SPIRAL experiment has been completed. Other target - ion source combinations can also be envisaged. The following lists are therefore neither exhaustive neither up-to-date, although first estimates show a good agreement between SPIRAL and SIRa experiments. They are extracted from an internal GANIL note [1]. A new version of the present document based on the results of the experiment completed at SPIRAL shall be available within the coming month.

[1]: GANIL note DIR/P/SDAPHYSP2-010A UPSP1-005A

2. Yield estimates for a graphite target coupled to VADIS

The following tables present estimated yields for the FEBIAD ion source coupled to the SPIRAL graphite target, and different impinging beams. A maximum nominal power of 1200W (or less depending of the available primary beam power) has been assumed. In-target yields are calculated using EPAX V2 fragmentation cross – sections. Release efficiencies have been deduced either from on-line measurements at SIRa or other ISOL facilities (mainly ISOLDE and IPN) when available, or calculated using diffusion and effusion coefficients found in literature. The isotopes which have been produced and for which a yield has been measured at SIRa are enlightened. For the corresponding elements, isotopes of comparable or longer half-life should be produced without much problem. When comparison is possible, predicted intensities correspond rather well to measured ones (better than an order of magnitude). In the following tables rare gases or elements such as N, O, F already produced at SPIRAL have been excluded as most of them should be equally well or better produced using the present SPIRAL target – ion source system.

¹³C on graphite (1200W, 75 AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	5.5E+09	1.4E+08
9Li	178.3 ms	9.3E+08	2.0E+07
7Be	53.22 d	1.6E+10	3.8E+08
10Be	1.51 My	7.8E+09	2.6E+08
11Be	13.81 s	1.1E+09	4.1E+07

¹⁶O on graphite (1200W, 95 AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	3.1E+09	7.8E+07
9Li	178.3 ms	4.6E+08	1.0E+07
11Li	8.75 ms	1.2E+06	4.9E+03
7Be	53.22 d	1.1E+10	2.6E+08
10Be	1.51 My	3.9E+09	1.3E+08
11Be	13.81 s	2.8E+08	1.0E+07
12Be	21.5 ms	2.8E+07	2.7E+05

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
Contact : delahaye@ganil.fr

18O on graphite (1200W, 75AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	2.9E+09	7.3E+07
9Li	178.3 ms	4.9E+08	1.1E+07
11Li	8.75 ms	3.6E+06	1.5E+04
7Be	53.22 d	8.8E+09	2.1E+08
10Be	1.51 My	3.9E+09	1.3E+08
11Be	13.81 s	4.7E+08	1.7E+07
12Be	21.5 ms	7.7E+07	7.4E+05
14Be	4.35 ms	9.8E+05	2.7E+03

20Ne on graphite (1200W, 95 AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	1.9E+09	4.8E+07
9Li	178.3 ms	2.8E+08	6.2E+06
11Li	8.75 ms	6.6E+05	2.7E+03
7Be	53.22 d	6.9E+09	1.7E+08
10Be	1.51 My	2.4E+09	8.1E+07
11Be	13.81 s	1.5E+08	5.6E+06
12Be	21.5 ms	1.6E+07	1.5E+05
14Be	4.35 ms	5.4E+04	1.5E+02
17F	64.49 s	3.7E+09	2.1E+08
18F	109.771 m	9.7E+09	5.9E+08

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^{22}Ne on graphite (1200W, 80AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	1.8E+09	4.5E+07
9Li	178.3 ms	2.8E+08	6.2E+06
11Li	8.75 ms	1.1E+06	4.5E+03
7Be	53.22 d	5.9E+09	1.4E+08
10Be	1.51 My	2.3E+09	7.8E+07
11Be	13.81 s	1.8E+08	6.7E+06
12Be	21.5 ms	2.4E+07	2.3E+05
14Be	4.35 ms	1.7E+05	4.6E+02
17F	64.49 s	1.2E+09	6.8E+07
18F	109.771 m	4.4E+09	2.7E+08
20F	11.163 s	6.9E+09	4.6E+08
21F	4.158 s	5.0E+09	3.7E+08

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24Mg on graphite (1200W, 95 AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	1.3E+09	3.3E+07
9Li	178.3 ms	1.9E+08	4.2E+06
11Li	8.75 ms	3.8E+05	1.6E+03
7Be	53.22 d	4.7E+09	1.1E+08
10Be	1.51 My	1.7E+09	5.8E+07
11Be	13.81 s	8.6E+07	3.2E+06
12Be	21.5 ms	9.0E+06	8.6E+04
14Be	4.35 ms	3.3E+04	9.0E+01
17F	64.49 s	1.8E+09	1.0E+08
18F	109.771 m	5.0E+09	3.0E+08
20F	11.163 s	1.7E+09	1.1E+08
21F	4.158 s	3.4E+08	2.5E+07
20Na	447.9 ms	3.4E+08	5.1E+06
21Na	22.49 s	2.4E+09	1.8E+08
22Na	2.6019 y	7.1E+09	6.1E+08
20Mg	90 ms	1.3E+06	2.5E+02
21Mg	122 ms	2.7E+07	7.3E+03
22Mg	3.857 s	4.6E+08	1.6E+06
23Mg	11.317 s	5.3E+09	4.3E+07

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26Mg on graphite (1200W, 80 AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	1.2E+09	3.0E+07
9Li	178.3 ms	1.8E+08	4.0E+06
11Li	8.75 ms	4.4E+05	1.8E+03
7Be	53.22 d	4.1E+09	9.8E+07
10Be	1.51 My	1.5E+09	5.1E+07
11Be	13.81 s	8.4E+07	3.1E+06
12Be	21.5 ms	9.8E+06	9.4E+04
14Be	4.35 ms	5.0E+04	1.4E+02
17F	64.49 s	1.0E+09	5.7E+07
18F	109.771 m	3.3E+09	2.0E+08
20F	11.163 s	2.4E+09	1.6E+08
21F	4.158 s	7.7E+08	5.8E+07
22F	4.23 s	1.7E+08	1.4E+07
23F	2.23 s	2.8E+07	2.6E+06
20Na	447.9 ms	9.9E+07	1.5E+06
21Na	22.49 s	7.6E+08	5.7E+07
22Na	2.6019 y	2.9E+09	2.5E+08
24Na	14.959 h	2.8E+09	3.0E+08
24Nam	20.2 ms	2.8E+09	1.7E+06
25Na	59.1 s	3.9E+09	4.5E+08
20Mg	90 ms	3.2E+05	6.1E+01
21Mg	122 ms	4.6E+06	1.2E+03
22Mg	3.857 s	6.6E+07	2.3E+05
23Mg	11.317 s	5.3E+08	4.3E+06

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36S on graphite (1200W, 77.5 AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	6.5E+08	1.6E+07
9Li	178.3 ms	9.7E+07	2.1E+06
11Li	8.75 ms	2.2E+05	9.1E+02
7Be	53.22 d	2.2E+09	5.3E+07
10Be	1.51 My	8.0E+08	2.7E+07
11Be	13.81 s	3.4E+07	1.3E+06
12Be	21.5 ms	4.3E+06	4.1E+04
14Be	4.35 ms	2.7E+04	7.4E+01
17F	64.49 s	3.6E+08	2.1E+07
18F	109.771 m	1.1E+09	6.6E+07
20F	11.163 s	8.3E+08	5.5E+07
21F	4.158 s	2.8E+08	2.1E+07
22F	4.23 s	6.4E+07	5.4E+06
23F	2.23 s	1.1E+07	1.0E+06
24F	400 ms	1.4E+06	1.2E+05
25F	50 ms	1.5E+05	4.9E+03
26F	10.2 ms	1.3E+04	8.0E+01
27F	4.9 ms	1.0E+03	2.5E+00
20Na	447.9 ms	3.6E+07	5.4E+05
21Na	22.49 s	2.6E+08	1.9E+07
22Na	2.6019 y	9.7E+08	8.4E+07
24Na	14.959 h	7.5E+08	7.9E+07
24Nam	20.2 ms	7.5E+08	4.6E+05
25Na	59.1 s	6.7E+08	7.7E+07
26Na	1.077 s	2.0E+08	1.2E+07
27Na	301 ms	4.6E+07	9.2E+05
28Na	30.5 ms	8.2E+06	1.1E+04

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29Na	44.9 ms	1.2E+06	2.9E+03
30Na	48.4 ms	1.5E+05	4.2E+02
31Na	17 ms	1.6E+04	1.3E+01
20Mg	90 ms	1.2E+05	2.3E+01
21Mg	122 ms	1.8E+06	4.9E+02
22Mg	3.857 s	2.6E+07	9.1E+04
23Mg	11.317 s	2.1E+08	1.7E+06
27Mg	9.458 m	1.0E+09	8.2E+07
28Mg	20.915 h	3.6E+08	5.1E+07
29Mg	1.3 s	9.6E+07	2.8E+05
30Mg	335 ms	2.0E+07	2.4E+04
31Mg	230 ms	3.6E+06	3.5E+03
32Mg	95 ms	5.2E+05	2.8E+02
23Al	470 ms	1.1E+06	2.4E+01
24Al	2.053 s	8.5E+06	1.2E+03
24Alm	131.3 ms	8.5E+06	3.4E+01
25Al	7.183 s	1.5E+08	7.3E+04
26Al	717 ky	3.6E+08	4.4E+07
26Alm	6.3452 s	3.6E+08	1.7E+05
28Al	2.2414 m	2.4E+09	8.3E+06
29Al	6.56 m	1.5E+09	9.6E+06
30Al	3.6 s	6.5E+08	2.5E+05
31Al	644 ms	2.1E+08	1.2E+04
32Al	31.7 ms	5.4E+07	4.6E+01
33Al	41.7 ms	1.0E+07	1.3E+01

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36Ar on graphite (1200W, 95 AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	5.8E+08	1.5E+07
9Li	178.3 ms	8.4E+07	1.8E+06
11Li	8.75 ms	9.7E+04	4.0E+02
7Be	53.22 d	2.1E+09	5.0E+07
10Be	1.51 My	7.2E+08	2.4E+07
11Be	13.81 s	2.2E+07	8.1E+05
12Be	21.5 ms	2.3E+06	2.2E+04
14Be	4.35 ms	8.6E+03	2.3E+01
17F	64.49 s	4.2E+08	2.4E+07
18F	109.771 m	1.2E+09	7.2E+07
20F	11.163 s	5.3E+08	3.5E+07
21F	4.158 s	1.3E+08	9.7E+06
22F	4.23 s	2.1E+07	1.8E+06
23F	2.23 s	2.4E+06	2.2E+05
24F	400 ms	2.0E+05	1.7E+04
25F	50 ms	1.2E+04	3.9E+02
26F	10.2 ms	5.5E+02	3.4E+00
27F	4.9 ms	1.9E+01	4.7E-02
20Na	447.9 ms	5.6E+07	8.4E+05
21Na	22.49 s	4.0E+08	3.0E+07
22Na	2.6019 y	1.3E+09	1.1E+08
24Na	14.959 h	4.3E+08	4.5E+07
24Nam	20.2 ms	4.3E+08	2.6E+05
25Na	59.1 s	2.5E+08	2.9E+07
26Na	1.077 s	4.5E+07	2.6E+06
27Na	301 ms	5.6E+06	1.1E+05
28Na	30.5 ms	4.8E+05	6.7E+02
29Na	44.9 ms	3.0E+04	7.2E+01

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20Mg	90 ms	2.0E+05	3.8E+01
21Mg	122 ms	3.3E+06	8.9E+02
22Mg	3.857 s	5.2E+07	1.8E+05
23Mg	11.317 s	3.9E+08	3.2E+06
27Mg	9.458 m	3.1E+08	2.5E+07
28Mg	20.915 h	5.9E+07	8.3E+06
29Mg	1.3 s	7.2E+06	2.1E+04
30Mg	335 ms	6.1E+05	7.2E+02
22Al	59 ms	1.7E+05	1.7E-01
23Al	470 ms	2.9E+06	6.3E+01
24Al	2.053 s	2.4E+07	3.4E+03
24Alm	131.3 ms	2.4E+07	9.5E+01
25Al	7.183 s	3.8E+08	1.8E+05
26Al	717 ky	7.0E+08	8.7E+07
26Alm	6.3452 s	7.0E+08	3.3E+05
28Al	2.2414 m	1.2E+09	4.2E+06
29Al	6.56 m	3.7E+08	2.4E+06
30Al	3.6 s	6.8E+07	2.6E+04
31Al	644 ms	8.1E+06	4.8E+02
31Cl	150 ms	4.1E+06	5.9E+03
32Cl	298 ms	8.1E+07	2.4E+05
33Cl	2.511 s	7.5E+08	1.8E+07
34Cl	1.5264 s	1.9E+09	3.0E+07
34Clm	32 m	1.9E+09	3.8E+08

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48Ca on graphite (700W, 60.3 AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	2.1E+08	5.3E+06
9Li	178.3 ms	3.2E+07	7.0E+05
11Li	8.75 ms	1.1E+05	4.5E+02
7Be	53.22 d	7.1E+08	1.7E+07
10Be	1.51 My	2.6E+08	8.8E+06
11Be	13.81 s	9.1E+06	3.4E+05
12Be	21.5 ms	1.5E+06	1.4E+04
14Be	4.35 ms	1.7E+04	4.6E+01
17F	64.49 s	6.7E+07	3.8E+06
18F	109.771 m	1.9E+08	1.1E+07
20F	11.163 s	1.6E+08	1.1E+07
21F	4.158 s	6.4E+07	4.8E+06
22F	4.23 s	1.8E+07	1.5E+06
23F	2.23 s	3.9E+06	3.6E+05
24F	400 ms	6.6E+05	5.5E+04
25F	50 ms	9.3E+04	3.0E+03
26F	10.2 ms	1.1E+04	6.7E+01
27F	4.9 ms	1.1E+03	2.7E+00
20Na	447.9 ms	8.0E+06	1.2E+05
21Na	22.49 s	4.8E+07	3.6E+06
22Na	2.6019 y	1.6E+08	1.4E+07
24Na	14.959 h	1.4E+08	1.5E+07
24Nam	20.2 ms	1.4E+08	8.6E+04
25Na	59.1 s	1.4E+08	1.6E+07
26Na	1.077 s	5.1E+07	3.0E+06
27Na	301 ms	1.4E+07	2.8E+05
28Na	30.5 ms	3.2E+06	4.5E+03
29Na	44.9 ms	5.8E+05	1.4E+03

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30Na	48.4 ms	9.2E+04	2.6E+02
31Na	17 ms	1.3E+04	1.0E+01
21Mg	122 ms	4.6E+05	1.2E+02
22Mg	3.857 s	5.8E+06	2.0E+04
23Mg	11.317 s	3.8E+07	3.1E+05
27Mg	9.458 m	2.1E+08	1.7E+07
28Mg	20.915 h	8.6E+07	1.2E+07
29Mg	1.3 s	2.7E+07	7.9E+04
30Mg	335 ms	7.0E+06	8.3E+03
31Mg	230 ms	1.5E+06	1.4E+03
32Mg	95 ms	2.7E+05	1.5E+02
33Mg	90.5 ms	4.3E+04	2.4E+01
23Al	470 ms	2.9E+05	6.3E+00
24Al	2.053 s	2.0E+06	2.8E+02
24Alm	131.3 ms	2.0E+06	7.7E+00
25Al	7.183 s	2.8E+07	1.4E+04
26Al	717 ky	6.0E+07	7.5E+06
26Alm	6.3452 s	6.0E+07	2.9E+04
28Al	2.2414 m	4.1E+08	1.4E+06
29Al	6.56 m	2.9E+08	1.8E+06
30Al	3.6 s	1.4E+08	5.4E+04
31Al	644 ms	5.2E+07	3.1E+03
32Al	31.7 ms	1.5E+07	1.3E+01
33Al	41.7 ms	3.7E+06	5.0E+00
34Al	56.3 ms	7.9E+05	1.7E+00
35Al	38.6 ms	1.5E+05	2.0E-01
31Cl	150 ms	1.9E+04	2.7E+01
32Cl	298 ms	2.6E+05	7.8E+02
33Cl	2.511 s	3.1E+06	7.4E+04
34Cl	1.5264 s	1.1E+07	1.8E+05
34Clm	32 m	1.1E+07	2.2E+06

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36Cl	301 ky	2.8E+08	6.2E+07
38Cl	37.24 m	3.3E+08	7.8E+07
38Clm	715 ms	3.3E+08	3.0E+06
39Cl	55.6 m	4.8E+08	1.2E+08
40Cl	1.35 m	2.8E+08	6.0E+07
41Cl	38.4 s	1.4E+08	2.5E+07
42Cl	6.8 s	5.8E+07	4.3E+06
43Cl	3.07 s	2.2E+07	8.7E+05
44Cl	560 ms	7.2E+06	5.9E+04
45Cl	400 ms	1.9E+06	1.1E+04
35K	178 ms	2.5E+03	1.5E+02
36K	342 ms	3.2E+04	2.9E+03
37K	1.226 s	4.2E+05	6.8E+04
38K	7.636 m	2.1E+06	4.9E+05
38Kxm	923.9 ms	2.1E+06	3.1E+05
40K	1.251 Gy	1.0E+08	2.6E+07
42K	12.36 h	5.6E+08	1.5E+08
43K	22.3 h	8.0E+08	2.1E+08
44K	22.13 m	9.2E+08	2.5E+08
45K	17.3 m	9.2E+08	2.5E+08
46K	105 s	8.0E+08	2.2E+08
47K	17.5 s	5.3E+08	1.4E+08
39Ca	859.6 ms	1.1E+05	3.1E+01
41Ca	102 ky	8.3E+06	2.2E+06
45Ca	162.67 d	7.1E+08	1.9E+08
47Ca	4.536 d	2.8E+09	7.8E+08

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
Contact : delahaye@ganil.fr

58Ni on graphite (700W, 60.3 AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	1.3E+08	3.3E+06
9Li	178.3 ms	1.8E+07	4.0E+05
11Li	8.75 ms	8.7E+03	3.6E+01
7Be	53.22 d	4.5E+08	1.1E+07
10Be	1.51 My	1.6E+08	5.4E+06
11Be	13.81 s	2.0E+06	7.4E+04
12Be	21.5 ms	2.0E+05	1.9E+03
14Be	4.35 ms	7.5E+02	2.0E+00
17F	64.49 s	3.5E+07	2.0E+06
18F	109.771 m	9.8E+07	5.9E+06
20F	11.163 s	4.5E+07	3.0E+06
21F	4.158 s	1.1E+07	8.2E+05
22F	4.23 s	1.9E+06	1.6E+05
23F	2.23 s	2.2E+05	2.0E+04
24F	400 ms	1.9E+04	1.6E+03
25F	50 ms	1.2E+03	3.9E+01
20Na	447.9 ms	4.4E+06	6.6E+04
21Na	22.49 s	3.1E+07	2.3E+06
22Na	2.6019 y	1.0E+08	8.6E+06
24Na	14.959 h	3.7E+07	3.9E+06
24Nam	20.2 ms	3.7E+07	2.3E+04
25Na	59.1 s	2.2E+07	2.5E+06
26Na	1.077 s	4.4E+06	2.6E+05
27Na	301 ms	6.3E+05	1.3E+04
28Na	30.5 ms	6.6E+04	9.2E+01
29Na	44.9 ms	5.3E+03	1.3E+01
21Mg	122 ms	2.5E+05	6.8E+01
22Mg	3.857 s	3.8E+06	1.3E+04

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
Contact : delahaye@ganil.fr

23Mg	11.317 s	2.9E+07	2.3E+05
27Mg	9.458 m	3.1E+07	2.5E+06
28Mg	20.915 h	6.8E+06	9.6E+05
29Mg	1.3 s	1.1E+06	3.2E+03
30Mg	335 ms	1.2E+05	1.4E+02
31Mg	230 ms	1.1E+04	1.1E+01
23Al	470 ms	2.0E+05	4.3E+00
24Al	2.053 s	1.7E+06	2.4E+02
24Alm	131.3 ms	1.7E+06	6.6E+00
25Al	7.183 s	2.6E+07	1.3E+04
26Al	717 ky	4.9E+07	6.1E+06
26Alm	6.3452 s	4.9E+07	2.3E+04
28Al	2.2414 m	1.2E+08	4.2E+05
29Al	6.56 m	4.2E+07	2.7E+05
30Al	3.6 s	1.0E+07	3.9E+03
31Al	644 ms	1.7E+06	1.0E+02
32Al	31.7 ms	2.2E+05	1.9E-01
31Cl	150 ms	7.4E+04	1.1E+02
32Cl	298 ms	1.4E+06	4.2E+03
33Cl	2.511 s	1.5E+07	3.6E+05
34Cl	1.5264 s	3.9E+07	6.2E+05
34Clm	32 m	3.9E+07	7.8E+06
36Cl	301 ky	2.4E+08	5.3E+07
38Cl	37.24 m	2.2E+07	5.3E+06
38Clm	715 ms	2.2E+07	2.0E+05
39Cl	55.6 m	1.0E+07	2.5E+06
40Cl	1.35 m	1.8E+06	3.8E+05
41Cl	38.4 s	2.4E+05	4.3E+04
42Cl	6.8 s	2.6E+04	1.9E+03
43Cl	3.07 s	2.1E+03	8.3E+01
35K	178 ms	4.2E+04	2.5E+03

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
Contact : delahaye@ganil.fr

36K	342 ms	8.5E+05	7.8E+04
37K	1.226 s	1.0E+07	1.6E+06
38K	7.636 m	3.2E+07	7.7E+06
38Kxm	923.9 ms	3.2E+07	4.9E+06
40K	1.251 Gy	3.1E+08	8.1E+07
42K	12.36 h	8.0E+07	2.1E+07
43K	22.3 h	2.1E+07	5.6E+06
44K	22.13 m	4.2E+06	1.1E+06
45K	17.3 m	6.1E+05	1.7E+05
46K	105 s	6.9E+04	1.9E+04
47K	17.5 s	6.1E+03	1.6E+03
48K	6.8 s	4.4E+02	1.1E+02
38Ca	440 ms	6.5E+05	5.2E+01
39Ca	859.6 ms	8.8E+06	2.5E+03
41Ca	102 ky	2.0E+08	5.3E+07
45Ca	162.67 d	2.9E+07	7.9E+06
47Ca	4.536 d	8.6E+05	2.4E+05
48Ca	53 Ey	1.0E+05	2.8E+04
49Ca	8.718 m	9.5E+03	2.7E+03
50Ca	13.9 s	7.1E+02	3.2E+01
48Cr	21.56 h	5.3E+07	1.5E+07
49Cr	42.3 m	2.2E+08	2.6E+07
51Cr	27.7025 d	4.2E+08	1.2E+08
47Mn	100 ms	1.3E+04	1.1E+02
48Mn	158.1 ms	3.5E+05	5.8E+03
49Mn	382 ms	6.3E+06	3.4E+05
50Mn	283.9 ms	2.7E+07	1.0E+06
50Mnm	1.75 m	2.7E+07	7.7E+06
51Mn	46.2 m	2.3E+08	6.7E+07
52Mn	5.591 d	2.5E+08	7.2E+07
52Mnm	21.1 m	2.5E+08	7.2E+07

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
Contact : delahaye@ganil.fr

53Mn	3.7 My	4.9E+08	1.4E+08
54Mn	312.03 d	2.5E+08	7.5E+07
52Fe	8.275 h	2.7E+07	7.5E+06
52Fem	45.9 s	2.7E+07	1.3E+04
53Fe	8.51 m	1.3E+08	2.2E+06
53Fem	2.526 m	1.3E+08	3.8E+05
55Fe	2.737 y	8.1E+08	2.4E+08
54Com	1.48 m	2.8E+07	3.8E+04
55Co	17.53 h	3.6E+08	1.1E+08
56Co	77.23 d	1.3E+09	3.9E+08
57Co	271.74 d	1.4E+09	4.3E+08
56Ni	6.075 d	6.0E+07	1.8E+07
57Ni	35.6 h	6.3E+08	1.9E+08

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
Contact : delahaye@ganil.fr

78Kr on graphite (1200W, 70.4 AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	1.4E+08	3.5E+06
9Li	178.3 ms	2.0E+07	4.4E+05
11Li	8.75 ms	5.1E+03	2.1E+01
7Be	53.22 d	5.0E+08	1.2E+07
10Be	1.51 My	1.7E+08	5.8E+06
11Be	13.81 s	1.2E+06	4.4E+04
12Be	21.5 ms	1.2E+05	1.1E+03
14Be	4.35 ms	4.3E+02	1.2E+00
17F	64.49 s	1.9E+07	1.1E+06
18F	109.771 m	5.5E+07	3.3E+06
20F	11.163 s	2.5E+07	1.7E+06
21F	4.158 s	6.2E+06	4.6E+05
22F	4.23 s	1.0E+06	8.4E+04
23F	2.23 s	1.2E+05	1.1E+04
24F	400 ms	1.0E+04	8.4E+02
25F	50 ms	6.7E+02	2.2E+01
20Na	447.9 ms	2.4E+06	3.6E+04
21Na	22.49 s	1.7E+07	1.3E+06
22Na	2.6019 y	5.5E+07	4.7E+06
24Na	14.959 h	2.0E+07	2.1E+06
24Nam	20.2 ms	2.0E+07	1.2E+04
25Na	59.1 s	1.2E+07	1.4E+06
26Na	1.077 s	2.4E+06	1.4E+05
27Na	301 ms	3.4E+05	6.8E+03
28Na	30.5 ms	3.6E+04	5.0E+01
21Mg	122 ms	1.4E+05	3.8E+01
22Mg	3.857 s	2.1E+06	7.4E+03
23Mg	11.317 s	1.5E+07	1.2E+05

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
Contact : delahaye@ganil.fr

27Mg	9.458 m	1.6E+07	1.3E+06
28Mg	20.915 h	3.6E+06	5.1E+05
29Mg	1.3 s	5.6E+05	1.6E+03
30Mg	335 ms	6.5E+04	7.7E+01
23Al	470 ms	1.1E+05	2.4E+00
24Al	2.053 s	8.5E+05	1.2E+02
24Alm	131.3 ms	8.5E+05	3.4E+00
25Al	7.183 s	1.4E+07	6.8E+03
26Al	717 ky	2.6E+07	3.2E+06
26Alm	6.3452 s	2.6E+07	1.2E+04
28Al	2.2414 m	6.1E+07	2.1E+05
29Al	6.56 m	2.2E+07	1.4E+05
30Al	3.6 s	5.4E+06	2.1E+03
31Al	644 ms	9.3E+05	5.5E+01
31Cl	150 ms	3.5E+04	5.1E+01
32Cl	298 ms	6.6E+05	2.0E+03
33Cl	2.511 s	6.9E+06	1.6E+05
34Cl	1.5264 s	1.9E+07	3.0E+05
34Clm	32 m	1.9E+07	3.7E+06
36Cl	301 ky	1.2E+08	2.7E+07
38Cl	37.24 m	1.2E+07	2.9E+06
38Clm	715 ms	1.2E+07	1.1E+05
39Cl	55.6 m	6.0E+06	1.5E+06
40Cl	1.35 m	1.1E+06	2.3E+05
41Cl	38.4 s	1.6E+05	2.9E+04
42Cl	6.8 s	1.9E+04	1.4E+03
43Cl	3.07 s	1.8E+03	7.1E+01
35K	178 ms	1.8E+04	1.1E+03
36K	342 ms	3.5E+05	3.2E+04
37K	1.226 s	4.4E+06	7.1E+05
38K	7.636 m	1.4E+07	3.4E+06

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
Contact : delahaye@ganil.fr

38Kxm	923.9 ms	1.4E+07	2.1E+06
40K	1.251 Gy	1.5E+08	3.9E+07
42K	12.36 h	4.6E+07	1.2E+07
43K	22.3 h	1.4E+07	3.8E+06
44K	22.13 m	3.1E+06	8.4E+05
45K	17.3 m	5.3E+05	1.4E+05
46K	105 s	7.3E+04	2.0E+04
47K	17.5 s	8.3E+03	2.2E+03
48K	6.8 s	7.8E+02	2.0E+02
49K	1.26 s	6.2E+01	1.2E+01
38Ca	440 ms	2.5E+05	2.0E+01
39Ca	859.6 ms	3.4E+06	9.6E+02
41Ca	102 ky	8.3E+07	2.2E+07
45Ca	162.67 d	2.0E+07	5.5E+06
47Ca	4.536 d	9.3E+05	2.6E+05
48Ca	53 Ey	1.4E+05	3.9E+04
49Ca	8.718 m	1.7E+04	4.8E+03
50Ca	13.9 s	1.8E+03	8.1E+01
48Cr	21.56 h	9.7E+06	2.7E+06
49Cr	42.3 m	5.2E+07	6.1E+06
51Cr	27.7025 d	2.2E+08	6.4E+07
55Cr	3.497 m	6.7E+06	3.3E+04
56Cr	5.94 m	1.4E+06	1.5E+04
57Cr	21.1 s	2.3E+05	3.8E+01
47Mn	100 ms	1.6E+03	1.4E+01
48Mn	158.1 ms	3.4E+04	5.7E+02
49Mn	382 ms	6.8E+05	3.7E+04
50Mn	283.9 ms	3.8E+06	1.4E+05
50Mnm	1.75 m	3.8E+06	1.1E+06
51Mn	46.2 m	4.4E+07	1.3E+07
52Mn	5.591 d	7.0E+07	2.0E+07

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
Contact : delahaye@ganil.fr

52Mnm	21.1 m	7.0E+07	2.0E+07
53Mn	3.7 My	2.3E+08	6.8E+07
54Mn	312.03 d	2.0E+08	6.0E+07
56Mn	2.5789 h	3.7E+07	1.1E+07
57Mn	85.4 s	1.0E+07	3.1E+06
58Mn	3 s	1.1E+06	2.9E+05
58Mnm	65.2 s	1.1E+06	3.4E+05
59Mn	4.59 s	4.0E+05	1.1E+05
60Mn	51 s	2.9E+04	9.1E+03
60Mnm	1.77 s	2.9E+04	6.4E+03
61Mn	670 ms	7.1E+03	8.0E+02
62Mn	671 ms	3.7E+02	4.2E+01
52Fe	8.275 h	2.9E+06	8.1E+05
52Fem	45.9 s	2.9E+06	1.4E+03
53Fe	8.51 m	1.9E+07	3.3E+05
53Fem	2.526 m	1.9E+07	5.6E+04
55Fe	2.737 y	2.4E+08	7.2E+07
59Fe	44.495 d	1.5E+07	4.7E+06
60Fe	1.5 My	3.5E+06	1.1E+06
61Fe	5.98 m	6.5E+05	7.5E+03
62Fe	68 s	1.0E+05	9.9E+01
54Com	1.48 m	2.2E+06	3.0E+03
55Co	17.53 h	3.1E+07	9.2E+06
56Co	77.23 d	1.2E+08	3.6E+07
57Co	271.74 d	2.4E+08	7.4E+07
58Co	70.86 d	1.4E+08	4.2E+07
58Com	9.04 h	1.4E+08	4.0E+07
60Co	5.2713 y	3.4E+07	1.1E+07
60Com	10.467 m	3.4E+07	8.6E+05
61Co	1.65 h	2.1E+07	4.8E+06
62Co	1.5 m	2.6E+06	3.9E+03

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
Contact : delahaye@ganil.fr

62Com	13.91 m	2.6E+06	9.8E+04
63Co	26.9 s	1.0E+06	2.5E+02
56Ni	6.075 d	3.3E+06	1.0E+06
57Ni	35.6 h	2.5E+07	7.6E+06
59Ni	101 ky	2.4E+08	7.5E+07
63Ni	100.1 y	2.9E+07	9.4E+06
65Ni	2.5172 h	1.7E+06	4.6E+05
66Ni	54.6 h	3.1E+05	1.0E+05
55Cu	40# ms	2.6E+02	4.7E+00
56Cu	93 ms	6.4E+03	2.7E+02
57Cu	196.3 ms	1.6E+05	1.3E+04
58Cu	3.204 s	2.5E+06	6.3E+05
59Cu	81.5 s	2.1E+07	6.5E+06
60Cu	23.7 m	9.7E+07	3.0E+07
61Cu	3.333 h	2.4E+08	7.6E+07
62Cu	9.673 m	3.3E+08	1.1E+08
64Cu	12.7 h	1.1E+08	3.6E+07
66Cu	5.12 m	1.2E+07	4.0E+06
67Cu	61.83 h	2.8E+06	9.3E+05
68Cu	31.1 s	2.8E+05	9.0E+04
68Cum	3.75 m	2.8E+05	9.2E+04
69Cu	2.85 m	8.7E+04	2.9E+04
70Cu	44.5 s	3.3E+03	1.1E+03
70Cum	33 s	3.3E+03	1.1E+03
70Cun	6.6 s	3.3E+03	1.0E+03
71Cu	19.4 s	8.0E+02	2.7E+02
58Zn	84 ms	4.3E+03	5.2E+01
59Zn	182 ms	1.1E+05	2.6E+03
60Zn	2.38 m	1.9E+06	5.6E+05
61Zn	89.1 s	9.0E+06	2.6E+06
61Znn	140 ms	9.0E+06	1.8E+05

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
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62Zn	9.186 h	8.9E+07	2.8E+07
63Zn	38.47 m	2.4E+08	7.7E+07
65Zn	244.06 d	2.8E+08	9.2E+07
69Zn	56.4 m	2.3E+06	7.6E+05
69Znm	13.76 h	2.3E+06	7.6E+05
71Zn	2.45 m	6.0E+04	1.9E+04
71Znm	3.96 h	6.0E+04	2.1E+04
72Zn	46.5 h	1.0E+04	3.5E+03
60Ga	70 ms	3.0E+03	1.2E+01
61Ga	168 ms	8.1E+04	8.1E+02
62Ga	115.99 ms	1.5E+06	1.1E+04
63Ga	32.4 s	1.6E+07	3.0E+06
64Ga	2.627 m	8.2E+07	2.2E+07
65Ga	15.2 m	2.3E+08	7.3E+07
66Ga	9.49 h	3.7E+08	1.2E+08
67Ga	3.2612 d	3.4E+08	1.1E+08
68Ga	67.71 m	1.9E+08	6.3E+07
70Ga	21.14 m	2.7E+07	9.0E+06
72Ga	14.1 h	5.5E+05	1.9E+05
72Gam	39.68 ms	5.5E+05	1.2E+03
73Ga	4.86 h	1.2E+05	4.2E+04
62Ge	130 ms	2.2E+03	9.1E-02
63Ge	142 ms	6.2E+04	2.9E+00
64Ge	63.7 s	1.2E+06	8.9E+04
65Ge	30.9 s	1.3E+07	5.2E+05
66Ge	2.26 h	7.0E+07	2.3E+07
67Ge	18.9 m	2.2E+08	6.2E+07
68Ge	270.95 d	3.8E+08	1.3E+08
69Ge	39.05 h	4.0E+08	1.4E+08
71Ge	11.43 d	6.0E+07	2.1E+07
71Gem	20.4 ms	6.0E+07	1.7E+02

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
Contact : delahaye@ganil.fr

73Ge	499 ms	4.8E+06	1.5E+03
64As	40 ms	1.6E+03	1.2E-03
65As	170 ms	4.4E+04	2.9E-01
66As	95.77 ms	8.8E+05	2.5E+00
67As	42.5 s	9.3E+06	1.6E+05
68As	151.6 s	2.8E+07	1.8E+06
68Asm	111 s	2.8E+07	1.3E+06
69As	15.2 m	1.9E+08	4.0E+07
70As	52.6 m	3.8E+08	1.1E+08
71As	65.28 h	4.9E+08	1.7E+08
72As	26 h	3.9E+08	1.3E+08
73As	80.3 d	2.1E+08	7.3E+07
74As	17.77 d	6.9E+07	2.4E+07
75Asm	17.62 ms	6.0E+06	1.4E+00
67Se	133 ms	2.6E+04	2.0E+01
68Se	35.5 s	5.2E+05	9.8E+03
69Se	27.4 s	5.7E+06	9.5E+04
70Se	41.1 m	3.6E+07	4.9E+06
71Se	4.74 m	1.4E+08	7.4E+06
72Se	8.4 d	3.9E+08	1.3E+08
73Se	7.15 h	3.5E+08	9.8E+07
73Sem	39.8 m	3.5E+08	4.8E+07
75Se	119.779 d	4.1E+08	1.5E+08

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3. Yield estimates for a Nb target coupled to VADIS

The following table present estimated yields for the FEBIAD ion source coupled to a Nb target, and a $2E13$ pps ^{12}C beam at 95 MeV, corresponding to a maximum nominal power of 3600W. In-target yields are calculated using EPAX V2 fragmentation cross – sections. Release efficiencies have been deduced either from on-line measurements, or calculated using diffusion and effusion coefficients found in literature. Isotopes whose 1+ beam intensity has been measured at SIRa using a graphite target are enlightened. Rare gases or elements such as N, O, F already produced at SPIRAL have been excluded. They should appear in the next version of this document.

^{12}C on Nb ($2^{\circ}13\text{pps}$ à 95 AMeV)

Isotope	T1/2	In - target yield (pps)	1+ beam intensity (pps)
8Li	840.3 ms	3.5E+09	8.8E+07
9Li	178.3 ms	5.0E+08	1.1E+07
11Li	8.75 ms	8.8E+04	3.6E+02
7Be	53.22 d	1.2E+10	2.9E+08
10Be	1.51 My	4.2E+09	1.4E+08
11Be	13.81 s	2.0E+07	7.4E+05
12Be	21.5 ms	2.1E+06	2.0E+04
14Be	4.35 ms	7.4E+03	2.0E+01
17F	64.49 s	3.3E+08	1.9E+07
18F	109.771 m	9.2E+08	5.6E+07
20F	11.163 s	4.1E+08	2.7E+07
21F	4.158 s	1.0E+08	7.5E+06
22F	4.23 s	1.7E+07	1.4E+06
23F	2.23 s	2.0E+06	1.8E+05
24F	400 ms	1.7E+05	1.4E+04
25F	50 ms	1.1E+04	3.6E+02
26F	10.2 ms	5.7E+02	3.5E+00
20Na	447.9 ms	4.0E+07	6.0E+05
21Na	22.49 s	2.8E+08	2.1E+07
22Na	2.6019 y	9.0E+08	7.8E+07

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24Na	14.959 h	3.3E+08	3.4E+07
24Nam	20.2 ms	3.3E+08	2.0E+05
25Na	59.1 s	2.0E+08	2.3E+07
26Na	1.077 s	3.9E+07	2.3E+06
27Na	301 ms	5.5E+06	1.1E+05
28Na	30.5 ms	5.8E+05	8.1E+02
29Na	44.9 ms	4.7E+04	1.1E+02
20Mg	90 ms	1.4E+05	2.7E+01
21Mg	122 ms	2.2E+06	5.9E+02
22Mg	3.857 s	3.4E+07	1.2E+05
23Mg	11.317 s	2.5E+08	2.0E+06
27Mg	9.458 m	2.7E+08	2.2E+07
28Mg	20.915 h	5.8E+07	8.2E+06
29Mg	1.3 s	9.1E+06	2.7E+04
30Mg	335 ms	1.1E+06	1.3E+03
31Mg	230 ms	9.4E+04	9.0E+01
23Al	470 ms	1.8E+06	3.9E+01
24Al	2.053 s	1.4E+07	2.0E+03
24Alm	131.3 ms	1.4E+07	5.6E+01
25Al	7.183 s	2.2E+08	1.1E+05
26Al	717 ky	8.3E+08	1.0E+08
26Alm	6.3452 s	7.5E+08	3.6E+05
28Al	2.2414 m	9.9E+08	3.4E+06
29Al	6.56 m	3.6E+08	2.3E+06
30Al	3.6 s	8.7E+07	3.4E+04
31Al	644 ms	1.5E+07	8.9E+02
32Al	31.7 ms	1.9E+06	1.6E+00
33Al	41.7 ms	1.9E+05	2.5E-01
31Cl	150 ms	5.5E+05	8.0E+02
32Cl	298 ms	1.0E+07	3.0E+04
33Cl	2.511 s	1.1E+08	2.6E+06

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34Cl	1.5264 s	2.9E+08	4.5E+06
34Clm	32 m	2.9E+08	5.7E+07
36Cl	301 ky	1.9E+09	4.2E+08
38Cl	37.24 m	1.9E+08	4.5E+07
38Clm	715 ms	1.9E+08	1.8E+06
39Cl	55.6 m	9.4E+07	2.3E+07
40Cl	1.35 m	1.8E+07	3.8E+06
41Cl	38.4 s	2.6E+06	4.7E+05
42Cl	6.8 s	3.0E+05	2.2E+04
43Cl	3.07 s	2.8E+04	1.1E+03
44Cl	560 ms	2.3E+03	1.9E+01
35K	178 ms	2.7E+05	1.6E+04
36K	342 ms	5.3E+06	4.9E+05
37K	1.226 s	6.6E+07	1.1E+07
38K	7.636 m	2.1E+08	5.0E+07
38Kxm	923.9 ms	2.1E+08	3.2E+07
40K	1.251 Gy	2.2E+09	5.7E+08
42K	12.36 h	7.1E+08	1.9E+08
43K	22.3 h	2.2E+08	5.9E+07
44K	22.13 m	4.8E+07	1.3E+07
45K	17.3 m	8.5E+06	2.3E+06
46K	105 s	1.2E+06	3.3E+05
47K	17.5 s	1.4E+05	3.8E+04
48K	6.8 s	1.3E+04	3.4E+03
49K	1.26 s	1.1E+03	2.2E+02
50K	472 ms	7.6E+01	1.1E+01
38Ca	440 ms	3.7E+06	3.0E+02
39Ca	859.6 ms	5.0E+07	1.4E+04
41Ca	102 ky	1.2E+09	3.2E+08
45Ca	162.67 d	3.2E+08	8.8E+07
47Ca	4.536 d	1.5E+07	4.2E+06

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48Ca	53 Ey	2.3E+06	6.5E+05
49Ca	8.718 m	2.9E+05	8.2E+04
50Ca	13.9 s	3.0E+04	1.3E+03
51Ca	10 s	2.7E+03	7.2E+01
48Cr	21.56 h	1.3E+08	3.6E+07
49Cr	42.3 m	7.0E+08	8.3E+07
51Cr	27.7025 d	3.2E+09	9.3E+08
55Cr	3.497 m	1.2E+08	6.0E+05
56Cr	5.94 m	2.5E+07	2.7E+05
57Cr	21.1 s	4.5E+06	7.4E+02
58Cr	7 s	6.7E+05	2.1E+01
47Mn	100 ms	2.0E+04	1.7E+02
48Mn	158.1 ms	4.3E+05	7.2E+03
49Mn	382 ms	8.5E+06	4.6E+05
50Mn	283.9 ms	4.8E+07	1.8E+06
50Mnm	1.75 m	4.8E+07	1.4E+07
51Mn	46.2 m	5.7E+08	1.7E+08
52Mn	5.591 d	9.0E+08	2.6E+08
52Mnm	21.1 m	9.0E+08	2.6E+08
53Mn	3.7 My	3.2E+09	9.5E+08
54Mn	312.03 d	3.0E+09	8.9E+08
56Mn	2.5789 h	6.2E+08	1.9E+08
57Mn	85.4 s	1.8E+08	5.5E+07
58Mn	3 s	2.2E+07	5.6E+06
58Mnm	65.2 s	2.2E+07	6.6E+06
59Mn	4.59 s	8.4E+06	2.4E+06
60Mn	51 s	7.0E+05	2.2E+05
60Mnm	1.77 s	7.0E+05	1.5E+05
61Mn	670 ms	1.9E+05	2.1E+04
62Mn	671 ms	1.2E+04	1.3E+03
62Mnm	92 ms	1.2E+04	1.0E+02

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63Mn	275 ms	2.4E+03	9.8E+01
52Fe	8.275 h	3.4E+07	9.6E+06
52Fem	45.9 s	3.4E+07	1.7E+04
53Fe	8.51 m	2.3E+08	4.0E+06
53Fem	2.526 m	2.3E+08	6.8E+05
55Fe	2.737 y	3.2E+09	9.6E+08
59Fe	44.495 d	2.8E+08	8.7E+07
60Fe	1.5 My	7.3E+07	2.3E+07
61Fe	5.98 m	1.5E+07	1.7E+05
62Fe	68 s	2.7E+06	2.7E+03
63Fe	6.1 s	4.0E+05	1.1E+01
54Com	1.48 m	2.4E+07	3.3E+04
55Co	17.53 h	3.5E+08	1.0E+08
56Co	77.23 d	1.4E+09	4.3E+08
57Co	271.74 d	3.2E+09	9.8E+08
58Co	70.86 d	2.0E+09	6.0E+08
58Com	9.04 h	2.0E+09	5.8E+08
60Co	5.2713 y	6.0E+08	1.9E+08
60Com	10.467 m	6.0E+08	1.5E+07
61Co	1.65 h	4.3E+08	9.8E+07
62Co	1.5 m	6.0E+07	9.0E+04
62Com	13.91 m	6.0E+07	2.3E+06
63Co	26.9 s	2.7E+07	6.7E+03
56Ni	6.075 d	3.3E+07	1.0E+07
57Ni	35.6 h	2.7E+08	8.2E+07
59Ni	101 ky	3.0E+09	9.4E+08
63Ni	100.1 y	6.3E+08	2.0E+08
65Ni	2.5172 h	4.7E+07	1.3E+07
66Ni	54.6 h	9.6E+06	3.2E+06
67Ni	21 s	1.7E+06	3.0E+02
68Ni	29 s	2.6E+05	7.6E+01

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55Cu	40# ms	2.5E+03	4.5E+01
56Cu	93 ms	5.7E+04	2.4E+03
57Cu	196.3 ms	1.3E+06	1.0E+05
58Cu	3.204 s	2.2E+07	5.6E+06
59Cu	81.5 s	2.0E+08	6.2E+07
60Cu	23.7 m	9.9E+08	3.1E+08
61Cu	3.333 h	2.8E+09	8.9E+08
62Cu	9.673 m	4.4E+09	1.4E+09
64Cu	12.7 h	2.2E+09	7.2E+08
66Cu	5.12 m	2.9E+08	9.6E+07
67Cu	61.83 h	7.8E+07	2.6E+07
68Cu	31.1 s	8.5E+06	2.8E+06
68Cum	3.75 m	8.5E+06	2.8E+06
69Cu	2.85 m	3.3E+06	1.1E+06
70Cu	44.5 s	1.8E+05	6.1E+04
70Cum	33 s	1.8E+05	6.0E+04
70Cun	6.6 s	1.8E+05	5.5E+04
71Cu	19.4 s	7.7E+04	2.6E+04
72Cu	6.6 s	9.8E+03	3.1E+03
73Cu	4.2 s	1.1E+03	3.3E+02
74Cu	1.594 s	1.1E+02	2.7E+01
57Zn	38 ms	1.4E+03	7.4E+00
58Zn	84 ms	3.3E+04	4.0E+02
59Zn	182 ms	7.8E+05	1.8E+04
60Zn	2.38 m	1.4E+07	4.1E+06
61Zn	89.1 s	7.0E+07	2.0E+07
61Znn	140 ms	7.0E+07	1.4E+06
62Zn	9.186 h	8.0E+08	2.6E+08
63Zn	38.47 m	2.5E+09	8.0E+08
65Zn	244.06 d	4.6E+09	1.5E+09
69Zn	56.4 m	6.5E+07	2.2E+07

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69Zn	13.76 h	6.5E+07	2.2E+07
71Zn	2.45 m	3.1E+06	1.0E+06
71Znm	3.96 h	3.1E+06	1.1E+06
72Zn	46.5 h	1.1E+06	3.8E+05
73Zn	23.5 s	5.7E+04	1.5E+04
73Znm	13 ms	5.7E+04	9.0E+01
73Znn	5.8 s	5.7E+04	9.6E+03
74Zn	95.6 s	2.3E+04	7.4E+03
75Zn	10.2 s	2.8E+03	5.9E+02
76Zn	5.7 s	3.3E+02	5.7E+01
60Ga	70 ms	1.9E+04	7.6E+01
61Ga	168 ms	4.5E+05	4.5E+03
62Ga	115.99 ms	9.1E+06	6.4E+04
63Ga	32.4 s	1.0E+08	1.9E+07
64Ga	2.627 m	6.3E+08	1.7E+08
65Ga	15.2 m	2.2E+09	7.0E+08
66Ga	9.49 h	4.4E+09	1.5E+09
67Ga	3.2612 d	5.2E+09	1.7E+09
68Ga	67.71 m	3.6E+09	1.2E+09
70Ga	21.14 m	6.6E+08	2.2E+08
72Ga	14.1 h	2.6E+07	9.0E+06
72Gam	39.68 ms	2.6E+07	5.8E+04
73Ga	4.86 h	1.1E+07	3.8E+06
74Ga	8.12 m	1.1E+06	3.5E+05
74Gam	9.5 s	1.1E+06	1.3E+05
75Ga	126 s	3.6E+05	1.0E+05
76Ga	32.6 s	5.4E+04	1.1E+04
77Ga	13.2 s	7.7E+03	1.1E+03
78Ga	5.09 s	1.0E+03	9.9E+01
79Ga	2.847 s	1.3E+02	9.7E+00
61Ge	39 ms	4.4E+02	3.1E-03

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62Ge	130 ms	1.1E+04	4.5E-01
63Ge	142 ms	2.6E+05	1.2E+01
64Ge	63.7 s	5.7E+06	4.2E+05
65Ge	30.9 s	7.0E+07	2.8E+06
66Ge	2.26 h	4.8E+08	1.5E+08
67Ge	18.9 m	1.9E+09	5.3E+08
68Ge	270.95 d	4.3E+09	1.4E+09
69Ge	39.05 h	5.7E+09	1.9E+09
71Ge	11.43 d	1.2E+09	4.0E+08
71Gem	20.4 ms	1.2E+09	3.3E+03
73Ge	499 ms	1.6E+08	4.8E+04
75Ge	82.78 m	1.0E+07	3.4E+06
75Gem	47.7 s	1.0E+07	6.4E+05
76Ge	1.58 Zy	4.2E+06	1.5E+06
77Ge	11.3 h	4.1E+05	1.5E+05
77Gem	52.9 s	4.1E+05	2.9E+04
78Ge	88 m	1.4E+05	4.9E+04
79Ge	18.98 s	1.2E+04	3.2E+02
79Gem	39 s	1.2E+04	6.3E+02
80Ge	29.5 s	3.5E+03	1.5E+02
81Ge	8 s	2.4E+02	2.8E+00
81Gem	8 s	2.4E+02	2.8E+00
82Ge	4.55 s	5.6E+01	3.4E-01
64As	40 ms	5.9E+03	4.4E-03
65As	170 ms	1.4E+05	9.2E-01
66As	95.77 ms	3.5E+06	9.9E+00
67As	42.5 s	4.7E+07	7.9E+05
68As	151.6 s	1.9E+08	1.2E+07
68Asm	111 s	1.9E+08	9.0E+06
69As	15.2 m	1.6E+09	3.4E+08
70As	52.6 m	4.0E+09	1.2E+09

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71As	65.28 h	6.0E+09	2.1E+09
72As	26 h	5.2E+09	1.8E+09
73As	80.3 d	3.0E+09	1.0E+09
74As	17.77 d	1.3E+09	4.6E+08
75Asm	17.62 ms	2.4E+08	5.8E+01
76As	1.0778 d	1.4E+08	5.0E+07
77As	38.83 h	3.8E+07	1.4E+07
78As	90.7 m	9.1E+06	3.0E+06
79As	9.01 m	2.0E+06	3.6E+05
80As	15.2 s	3.9E+05	1.9E+03
81As	33.3 s	7.0E+04	9.8E+02
82As	19.1 s	5.5E+03	3.8E+01
82Asm	13.6 s	5.5E+03	2.4E+01
83As	13.4 s	1.4E+03	6.0E+00
67Se	133 ms	8.1E+04	6.2E+01
68Se	35.5 s	2.1E+06	4.0E+04
69Se	27.4 s	3.2E+07	5.4E+05
70Se	41.1 m	2.7E+08	3.7E+07
71Se	4.74 m	1.3E+09	6.9E+07
72Se	8.4 d	3.7E+09	1.3E+09
73Se	7.15 h	3.1E+09	8.7E+08
73Sem	39.8 m	3.1E+09	4.2E+08
75Se	119.779 d	3.9E+09	1.4E+09
77Sem	17.36 s	3.7E+08	5.3E+06
79Se	295 ky	3.8E+07	1.4E+07
79Sem	3.92 m	3.8E+07	1.9E+06
81Se	18.45 m	2.5E+06	2.6E+05
81Sem	57.28 m	2.5E+06	4.2E+05
82Se	97 Ey	1.0E+06	3.7E+05
83Se	22.3 m	9.0E+04	1.1E+04
83Sem	70.1 s	9.0E+04	2.7E+03

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84Se	3.1 m	2.5E+04	1.2E+03
85Se	31.7 s	2.5E+03	5.1E+01
74Rb	64.76 ms	4.1E+05	1.9E+04
75Rb	19 s	8.3E+06	1.9E+06
76Rb	36.5 s	9.4E+07	2.4E+07
77Rb	3.77 m	5.9E+08	1.8E+08
78Rb	17.66 m	1.1E+09	3.7E+08
78Rbm	5.74 m	1.1E+09	3.5E+08
79Rb	22.9 m	5.2E+09	1.8E+09
80Rb	33.4 s	7.8E+09	2.0E+09
81Rb	4.576 h	4.0E+09	1.5E+09
81Rbm	30.5 m	4.0E+09	1.4E+09
82Rb	1.273 m	2.9E+09	8.5E+08
82Rbm	6.472 h	2.9E+09	1.1E+09
83Rb	86.2 d	1.7E+09	6.2E+08
83Rbm	7.8 ms	1.7E+09	3.3E+07
84Rb	32.77 d	8.0E+08	3.0E+08
84Rbm	20.26 m	8.0E+08	2.8E+08
86Rb	18.642 d	1.1E+08	4.2E+07
86Rbm	1.017 m	1.1E+08	3.2E+07
87Rb	49.23 Gy	5.5E+07	2.1E+07
88Rb	17.78 m	9.2E+06	3.3E+06
89Rb	15.15 m	9.1E+05	3.2E+05
76Sr	8.9 s	2.1E+05	4.6E+03
77Sr	9 s	4.5E+06	1.0E+05
78Sr	159 s	5.3E+07	1.6E+07
79Sr	2.25 m	3.6E+08	1.1E+08
80Sr	106.3 m	1.5E+09	5.5E+08
81Sr	22.3 m	4.0E+09	1.5E+09
82Sr	25.36 d	3.6E+09	1.3E+09
83Sr	32.41 h	3.6E+09	1.4E+09

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Contact : delahaye@ganil.fr

83Srm	4.95 s	9.2E+09	9.0E+07
85Sr	64.853 d	4.2E+09	1.6E+09
85Srm	67.63 m	5.8E+09	2.2E+09
87Srm	2.815 h	1.6E+09	6.2E+08
89Sr	50.53 d	1.3E+08	5.1E+07
90Sr	28.79 y	1.9E+07	7.4E+06
78Y	54 ms	4.4E+04	2.0E-02
78Yxm	5.8 s	4.4E+04	1.8E+01
79Y	14.8 s	1.9E+06	2.6E+03
80Y	30.1 s	1.2E+07	3.8E+04
80Yxm	4.8 s	1.2E+07	3.6E+03
81Y	70.4 s	1.7E+08	1.5E+06
82Y	8.3 s	8.2E+08	5.5E+05
83Y	7.08 m	1.3E+09	6.7E+07
83Yxm	2.85 m	1.3E+09	2.9E+07
84Y	4.6 s	2.9E+09	8.7E+05
84Yxm	39.5 m	2.9E+09	5.1E+08
85Y	2.68 h	4.7E+09	1.4E+09
85Yxm	4.86 h	4.7E+09	1.6E+09
86Y	14.74 h	6.0E+09	2.2E+09
86Yxm	48 m	6.0E+09	1.2E+09
87Y	79.8 h	6.0E+09	2.3E+09
87Yxm	13.37 h	6.0E+09	2.2E+09
88Y	106.65 d	4.3E+09	1.6E+09
88Yxm	13.9 ms	4.3E+09	2.7E+02
89Yxm	15.663 s	2.3E+09	3.7E+06
90Y	64 h	8.5E+08	3.3E+08
90Yxm	3.19 h	8.5E+08	2.7E+08
91Y	58.51 d	2.1E+08	8.1E+07
91Yxm	49.71 m	2.1E+08	4.3E+07

Beam intensities extracted from the internal GANIL note : DIR/P/SDAPHYSP2-010A UPSP1-005A
 Similar data can be found on-line: <http://pro.ganil-spiral2.eu/users-guide/accelerators/chart-beams>
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