

### Making a <sup>64</sup>Cr Beam with the FRIB Fragment Separator

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# Step 1

- We chose, arbitrarily, to make a <sup>64</sup>Cr beam
- Our first info comes from <u>https://groups.nscl.msu.edu/frib/rates/fribrates.html</u>
  - Use an <sup>82</sup>Se beam with 236.6 MeV/u
  - Expect about 1000 pps for year-1 conditions
- Then we set up a first setting
- We assume you have seen the program LISE<sup>++</sup>
  - lise.nscl.msu.edu/lise.html



## Starting

| A   |  |  |  | (                     |                        | 000           | - |
|---|--|--|--|-----------------------|------------------------|---------------|---|
| C C Material and a second   | THE HERE THE ARE ADD   | Ale and a second   | • 0][1   | HAPUT-1               | p -                    | w w w         | - |
| G Files presented _ Q T40509-TD-000_  | S portal bib mea. S porta  | Avb.msa 💟 202004 TSAC  | Decement Like. C 202015 DOE ORA C DCC - H  | ana 🖉 potal bili.rea. | - C Recommendati. 3 FR | B Estimat., × | 5 |
| File Edit View Favorites Tools H  | elp  |  |  |                       |                        |               |   |
| A C FRIS Home C DCC - Home D  | Enterprise 🖗 eCAM 🎽 195  | - Olog He HourLog 🐔 Eq   | perimental Schedule N., 🔲 Short Term Schedule 😤 wiki   |                       |                        |               |   |
| Select the user of operation  |  |  |  |                       |                        |               |   |
| sense on year or operation  |  |  |  |                       |                        |               |   |
| O Year One  |  | 98.  | 9.6  |                       |                        |               |   |
| O Year Two  |  | 100  |  |                       |                        |               |   |
| <ul> <li>Uttimate FRB yields</li> </ul>   |  |  |  |                       |                        |               |   |
| Enter values for A and Z  |  |  |  |                       |                        |               |   |
| , A   |  |  |  |                       |                        |               |   |
| z   |  | 4  | 00   |                       |                        |               |   |
| N   |  |  |  |                       |                        |               |   |
|   |  |  |  |                       |                        |               |   |
| Typ   | sec  |  |  |                       |                        |               |   |
| Calcula   | te Yield   | - FR   | IB   |                       |                        |               |   |
|   |  |  |  |                       |                        |               |   |
| A2  |  | FRIB Estimated Ra  | tes Version 1.08   |                       |                        |               |   |
| Energy  | MeV/u  | 99922  |  |                       |                        |               |   |
| Exament   |  |  |  |                       |                        |               |   |
| Energy  | MeV/u  |  |  |                       |                        |               |   |
| B <sub>P</sub> (Q=Z)  | Tm   |  |  |                       |                        |               |   |
| Fast beam rate  | pps  |  |  |                       |                        |               |   |
|   |  |  | D  |                       |                        |               |   |
| Stopped beam rate   | 205  |  |  |                       |                        |               |   |
| Reaccelerated beam rate   | pps  |  |  |                       |                        |               |   |
|   |  |  |  |                       |                        |               |   |
| A). The LISE** code (v.9.2.68) has been   | used to estimate fragment to   | anamission.  |  |                       |                        |               |   |
| B) The rates are estimated based on th<br>C) Reaccelerated and stopped beam rates               | e EPAX 2.19 <sup>14</sup> cross section<br>des.above 1E+8 are very unc | parameterization for tragmen<br>ertain. The use of solid catch | fation and the USE++ 3EER model <sup>and</sup> for in-flight fission<br>ers may visid higher rates in some cases. This option is | not included.         |                        |               |   |
| D) Year one assumes 10kW and a limit  | ed set of primary beams. Yes   | r two is 50kW with additional                                  | primary beams added.   |                       |                        |               |   |
| E). Estimated rates may change as the   | various assumptions are tesh   | id and refined.  |  |                       |                        |               |   |
| [1] K. Sammener and E. Bark, Phys. Rev. C 41,<br>21-O.B. Parastri and D.Barn, No. 6, 206, 2008. | (2000) 204607.<br>4657-468   |  |  |                       |                        |               |   |
| 20-08 Yarason, "LISE++ development Abraso   | n-Fasian", Pault Rep. MSUCL1280  | NSCL Mumper State University 20                                | 05   |                       |                        |               |   |
| 0   |  |  |  |                       |                        |               |   |
| For further information regarding these   | calculations, please refer to th                                       | e readme lile (PDF - 420 kl)                                   | ).   |                       |                        |               |   |

### **Step 2 – Calculate Purity**





#### **Facility for Rare Isotope Beams** U.S. Department of Energy Office of Science

### **Step 3 – Improve Purity**





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### **Step 4 – Improve Purity Further**





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## **Resulting Purity**





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### **Smaller Momentum Acceptance**





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### **Result With Smaller Acceptance**





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## Summary

- Made 64Cr from 82Se primary beam (10 kW)
- Single wedge  $\rightarrow$  about 1100 pps, purity a few percent
- Two wedges  $\rightarrow$  about 900 pps, purity about 50%
- Two wedges with tweaking slits  $\rightarrow$  about 700 pps, purity about 80%
- Alternative setting with narrow momentum acceptance
  - 1% acceptance (after target)  $\rightarrow$  about 0.4% width after compression
  - Rate about 180 pps, purity about 98%
- These settings could serve different types of experiments
- There are a few other factors that could come into play. Your FRIB beam physicist will look into these on a case-by-case basis and optimize the setting to optimally support your experiment

