

# Isotopes and Applications

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*\* J. J. Ressler*

B. Sherrill: (FRIB/MSU) Introduction

T. Ruth (TRIUMF): Medical applications

S. Lapi (Wash. U): Medical applications

M. Nortier (LANL): Isotope production

J. Greene (ANL): Targetry

M. Flaska (U. Mich): Homeland security

A. Couture (LANL): Safeguards science

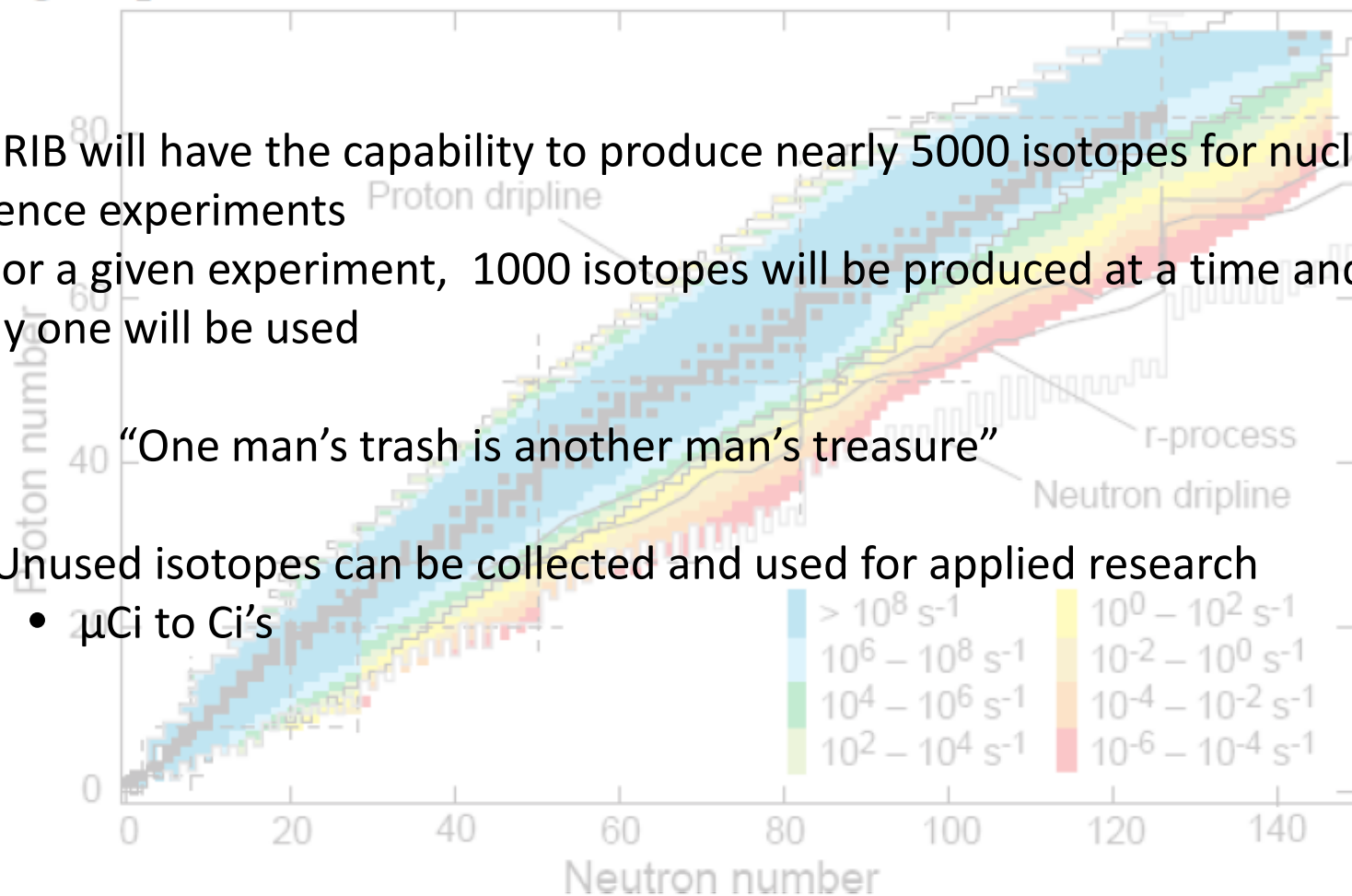
J. J. Ressler (LLNL): Nuclear energy

# FRIB isotopes

- FRIB will have the capability to produce nearly 5000 isotopes for nuclear science experiments
- For a given experiment, 1000 isotopes will be produced at a time and only one will be used

“One man’s trash is another man’s treasure”

- Unused isotopes can be collected and used for applied research
  - $\mu\text{Ci}$  to  $\text{Ci}$ 's



# Users

## Isotope community is broad...

### Nuclear medicine

- imaging
- radiotherapy
- kinetic studies

### Tracers

- Environmental studies
- Geochemistry
- Industrial applications

### Homeland security

- Surrogate sources

### Radioactive targets for

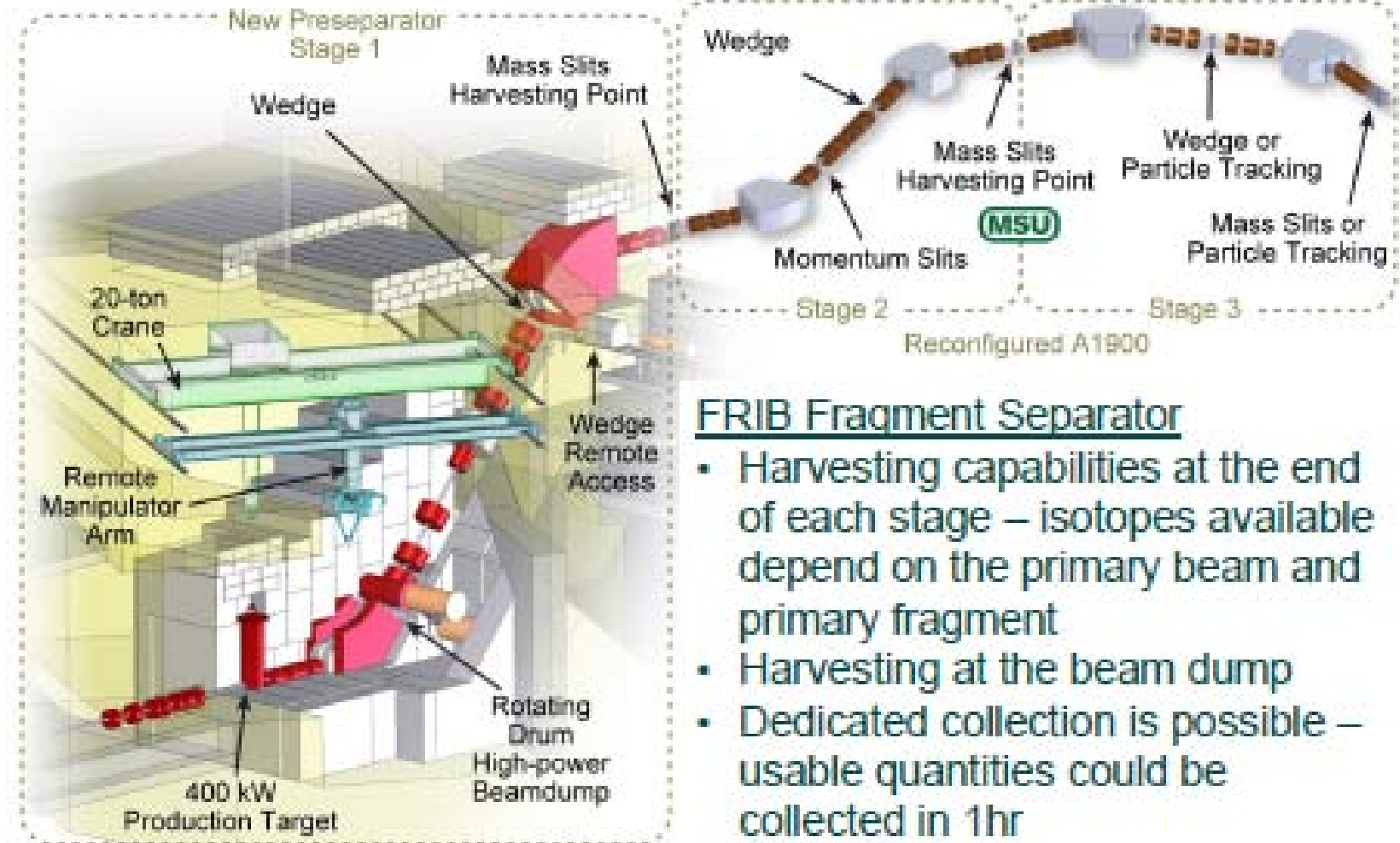
### Stewardship science

- neutron reactions on actinides
- neutron reactions on fission products
- neutron interactions on rad chem tracers
- decay characteristics

### Nuclear energy applications

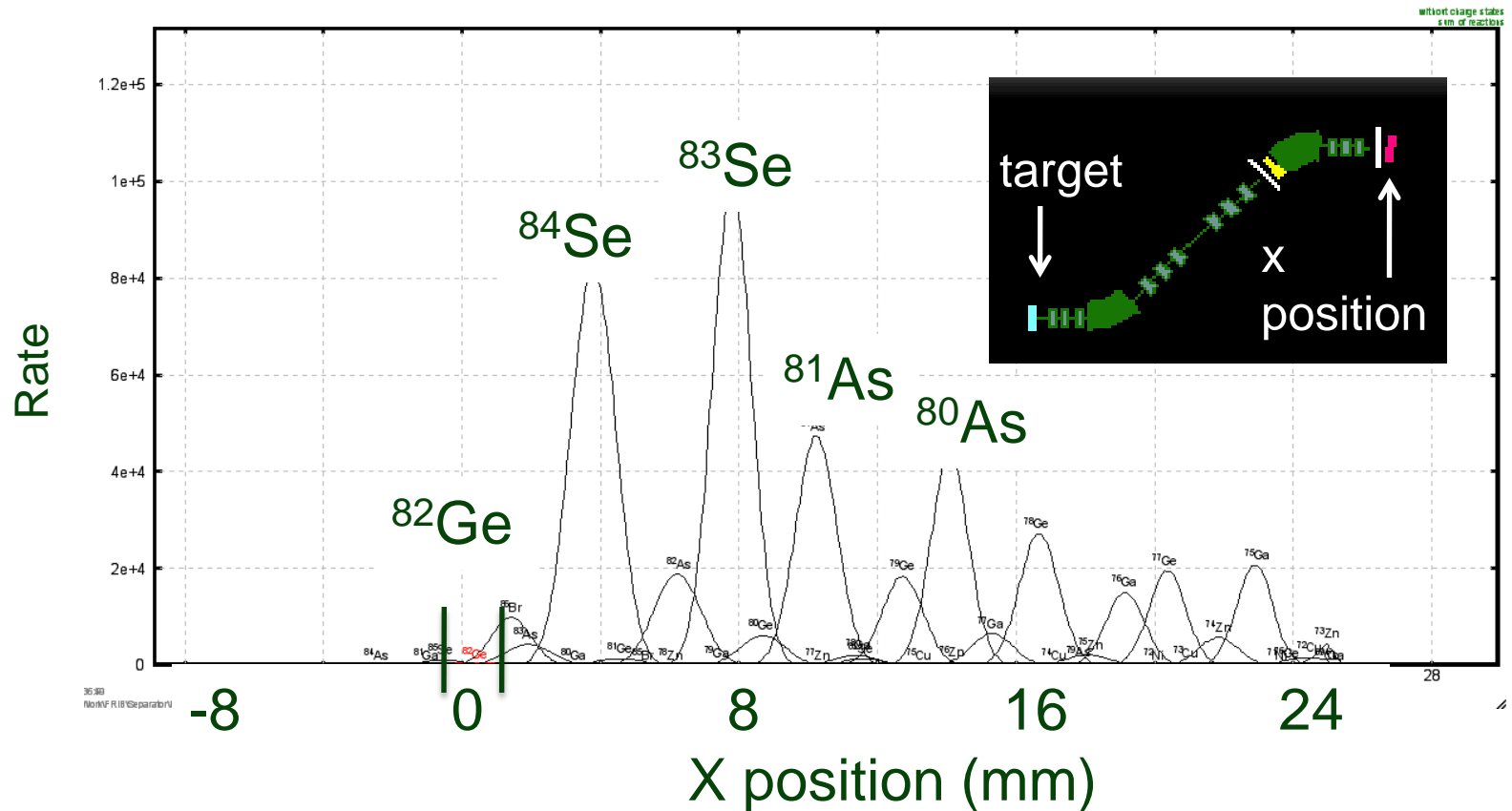
- neutron reactions on actinides
- neutron reactions on fission products
- nuclear reactions on activation products
- neutron reactions on reactor materials
- decay characteristics

# Isotope Harvesting Sites



# Example: Primary Experiment $^{82}\text{Ge}$ from $^{86}\text{Kr}$

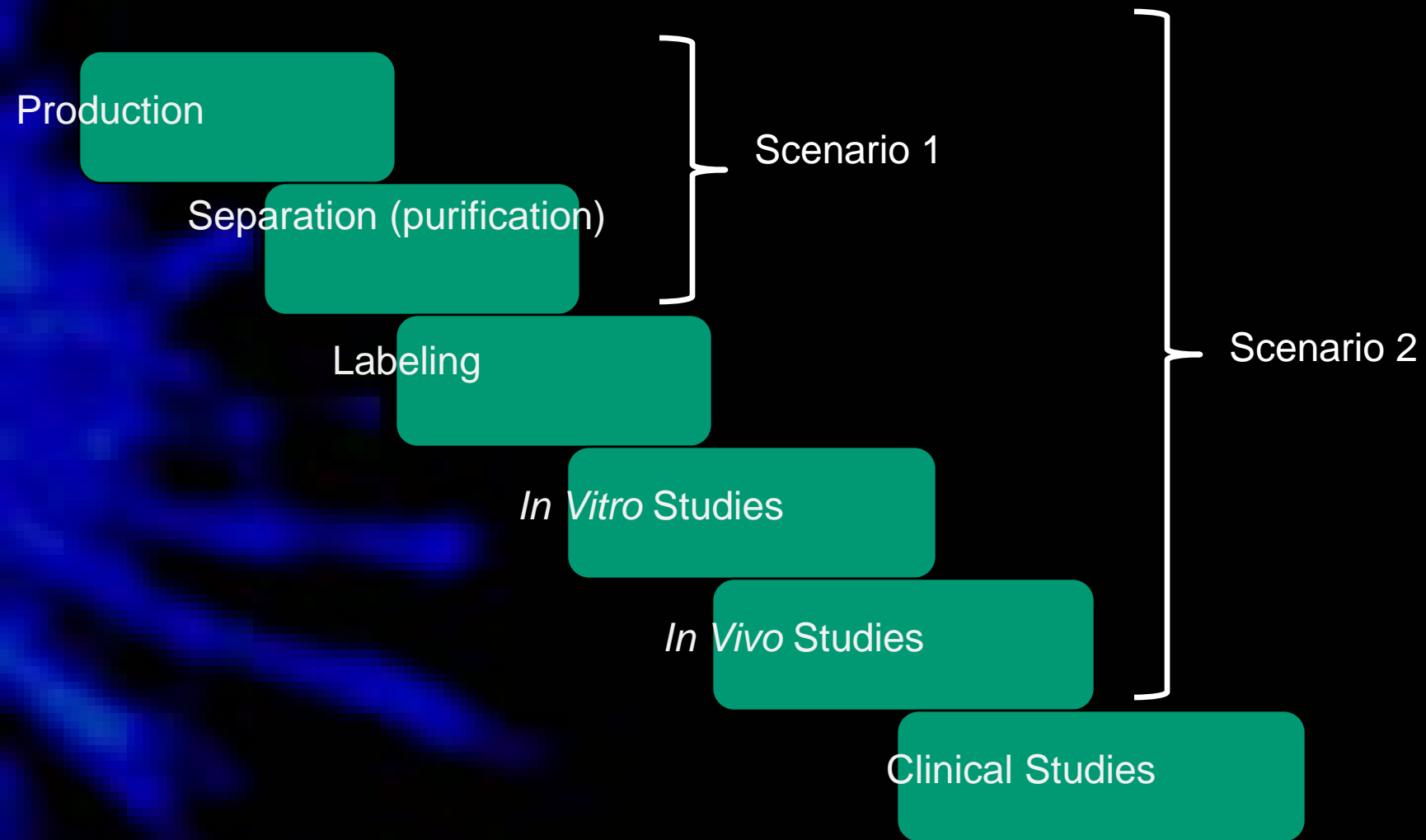
- Calculated with LISE++ (<http://groups.nsl.msui.edu/lise/lise.html>)
- Simulation code developed at GANIL and NSCL



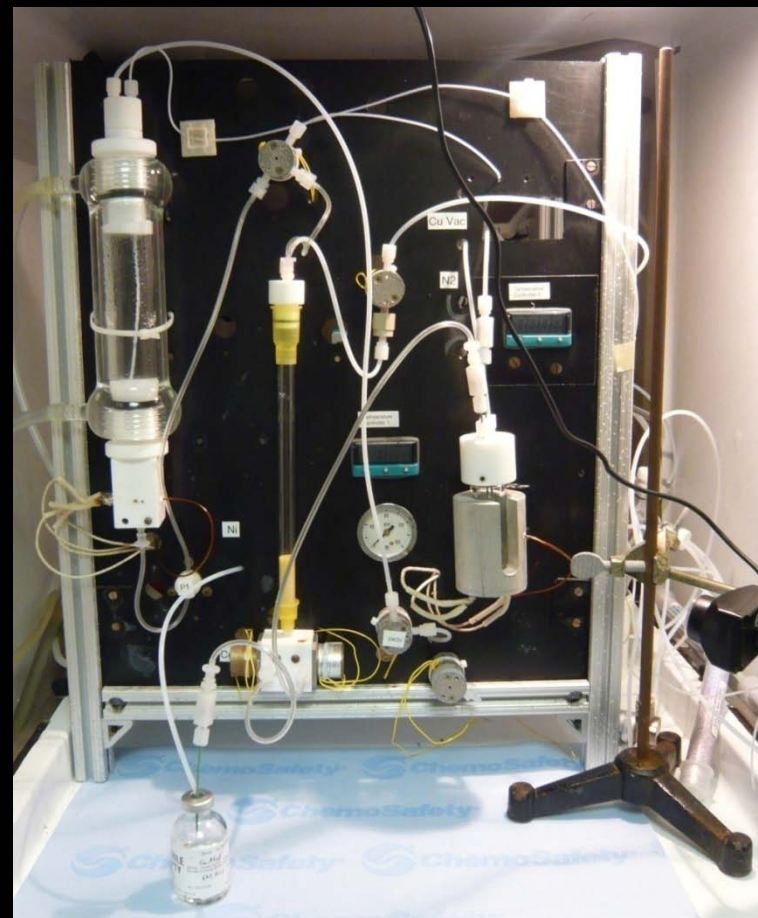
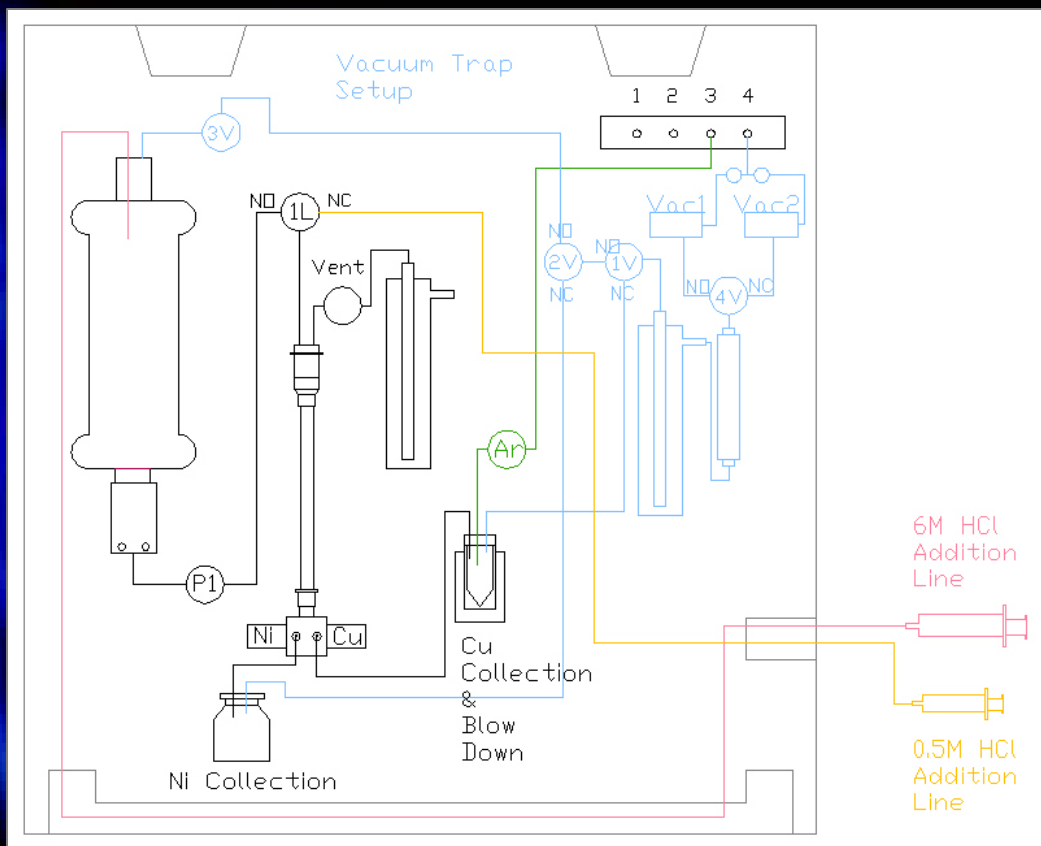
# Essential Requirements for Supplying Radionuclides for Clinical Use

- Reliable delivery
- Throughout the year!
- Adequate quantities for clinical trials
- For radionuclides with half-lives  $< 1$  day production facility should be co-located with adequate shipping resources.

# From Bench to Bedside



# Separation



# TA-48 Hot Cells



# FRIB needs

## Users need from FRIB:

- Radiochemistry lab, hotcells ( $\geq 1$ )
  - ~ \$1M fully equipped
  - build infrastructure for multiple cells, add equipment as money becomes available
- Dedicated radiochemist(s)
  - Hot chemistry is complex, requires research and development

## FRIB needs from users:

- Prioritized isotope list
- Proposed collection methods

# Communication is key

Isotope users and providers are from different communities –  
researchers may need an isotope that FRIB provides,  
need to work with researchers who know how to extract it

-- White paper on how these isotopes may be harvested

Isotope community is very broad

-- White paper on opportunities using harvested isotopes

# Future Plans

240<sup>th</sup> ACS meeting, Boston, MA August 22-26, 2010

“Radiochemistry at the Facility for Rare Isotope Beams” symposium organized by P. Mantica and M. Stoyer

*The purpose of this symposium is to discuss current and future work in a number of scientific areas at the next generation rare isotope beam facility (FRIB). Topics include isotope production and harvesting, medical uses of FRIB, environmental research, nuclear astrophysics, radioactive target production/handling, and other applications.*

Isotope applications at FRIB workshop, Sante Fe, NM September 1 – 3, 2010

Organized by A. Couture ([acouture@lanl.gov](mailto:acouture@lanl.gov)) and M. Nortier ([meiring@lanl.gov](mailto:meiring@lanl.gov))

2010 ANS Winter Meeting and Nuclear Technology Expo, Las Vegas, NV November 7 – 11, 2010

“Isotopes for Medicine and Industry” embedded meeting; tentative plans for satellite FRIB isotopes workshop