How to produce RIB?
Two methods for RIB production

Isotope Separator On Line (ISOL) method

- Primary Accelerator
- Thick-target
- Ion source
- Separator
- RIB Accelerator
- Low energy RIB (<20 MeV/A)

Online: primary accelerator & RIB accelerator operate simultaneously

- CN/Spallation/fission/fragmentation of target nuclei
- High beam purity, quality
- But element dependent intensity, T₁/₂ limit ≥ 1sec

In-flight separation method

- Primary Accelerator
- Thinner-target
- Projectile like fragments
- Separator
- High energy RIB (>100 MeV/A)

- Fragmentation of beam nuclei
- Isotones cannot be separated;
- rejection of primary beam a challenge
- No ion-source, so all elements transported, no half-life limit
- But lower beam purity, quality
Challenges

Increase RIB intensity & find new ideas for experiments with low intensity beams

\[ I_{\text{RIB}} = I_{\text{primary}} \times N_{\text{target}} \times \text{Production cross-section} \times \text{efficiency factor} \]

- High intensity primary beam
- Development of thick, porous and refractory targets that can handle high power beams
- Efficient ionization, separation & post-acceleration of RIB (ISOL) & high acceptance, good separation (IF) for facility
- State of the art detector systems (traps, arrays, isotope/isobar separators, fragment separators, storage rings) & New ideas to improve S/N ratio

RIB development is highly R&D intensive. But new techniques are continuously evolving.
Rare Isotope Production Facilities World-Wide

Source: Introduction to ISOL Target Stations, Alexander Gottberg, Bill Paley, June 22, 2015