CARIBU and ATLAS Status and Operation

Workshop on:
Decay Spectroscopy at CARIBU: Advanced Fuel Cycle Applications, Nuclear Structure and Astrophysics
April 14-16, 2011

Richard Pardo
Argonne National Laboratory
CARIBU Today

- Isobar Separator
- Gas Catcher
- Source Transport & Shield Cask
- HV platform
- Power Transformer
- Switchyard
- Beamline to ECR Breeder
- RFQ Buncher
- low-energy beamline
ECR Charge Breeder Results

In order to accelerate beams in ATLAS the charge-to-mass ratio (q/m) must be raised to >1/8 (depending on the desired energy).

For A=143 → q > 18

Rate and Efficiency for Mass 142/25+, \( ^{129}\text{Xe}^{25+} \) and \( ^{133}\text{Cs}^{26+} \) as function of Voltage difference between ECRCB & 1+ source
ECR Charge Breeder Results

Rigidity scans for mass 141 & 142 using β decay detection.

Best breeding efficiencies: 11-15% for gases, solid, & RIBs.
ECR Charge Breeder Results

Best breeding efficiencies: ~11-15% for gases, solid, & RIBs.
Accelerator Configuration for Weak Beams

- Initial tune of accelerator performed with a ‘guide’ beam of similar (q/m) ratio.

  - For $^{143}\text{Ba}^{27+} \rightarrow q/m = 0.18892$
  - Guide beam of $^{132}\text{Xe}^{25+} \rightarrow q/m = 0.18954$
  - So the scale factor to $^{143}\text{Ba}$ is 1.00329
Accelerated Mass 143 Beam at PII Exit, December 2010.

Efficiency corrected rate: 300 /s $^{143}$Ba
500 /s $^{143}$Cs
$^{143}$Ba and $^{143}$Cs accelerated to 6.1 MeV/u on March 15, 2011
CARIBU Operating Status

• $A=143$, $q=27+$ accelerated to 6.1 MeV/u
  • Not sufficient $^{143}$Ba for commissioning
  • Hope to complete at end of April
  • 25% acceleration efficiency (should be 65%)
• 141-146 Cesium masses measured in trap
Beam Contaminants for accelerated CARIBU Beams

Two sources of beam contaminants:

1. Degenerate isobars not separated by Isobar Separator.

   - Masses of A=132 isotopes
     - 131.9
     - 131.91
     - 131.92
     - 131.93
     - 131.94
     - 131.95
     - 131.96

   - CARIBU Beams

   - R = 20000

2. Stable beams with the same q/m ratio as beam of interest.

   - 53Cr^{10+}
   - 90Zr^{17+}
   - 122Sn^{23+}
   - 180Hf/Ta/Wn^{34+}
Next Steps

April 27-May 1: Next CARIBU acceleration test to achieve commissioning goals

• Need at least 400 $^{143}\text{Ba} \text{ /s} @ 6 \text{ MeV/u}$ at ATLAS Diagnostics region.
• Deliver RIB beam to target facility and reach sufficient intensity for initial test experiment.
  • Improved weak beam diagnostics to allow beam tuning and optimization