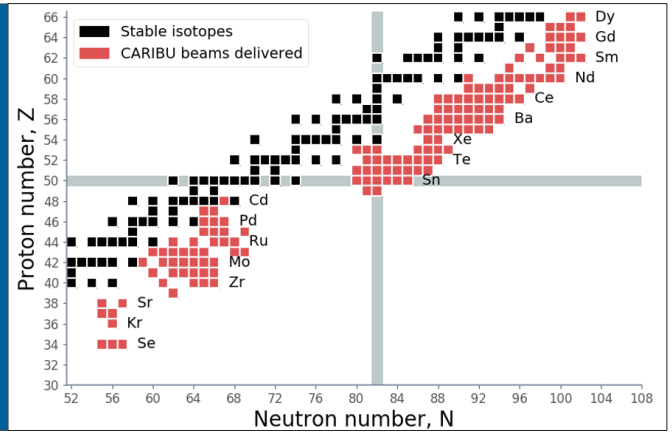
CENTER FOR ACCELERATOR TARGET SCIENCE

Argonne NATIONAL LABORATORY

SECOND GENERATION DEGRADER FOIL FOR THE CARIBU PROJECT



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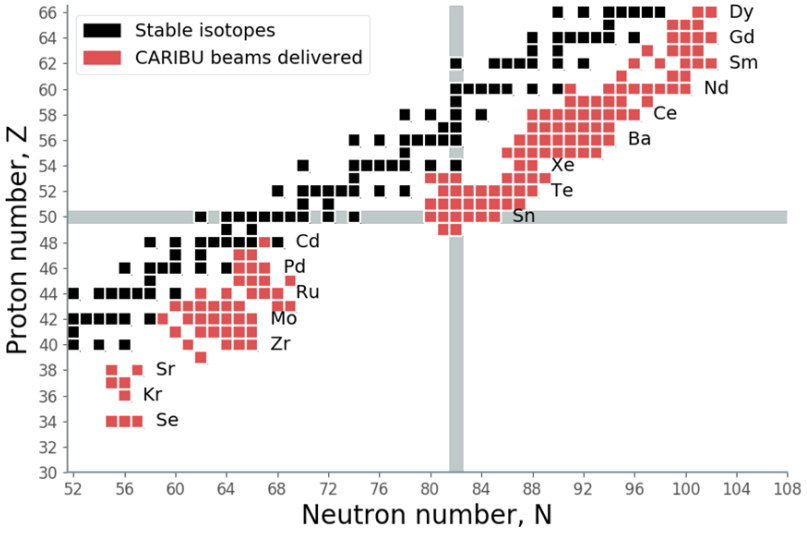
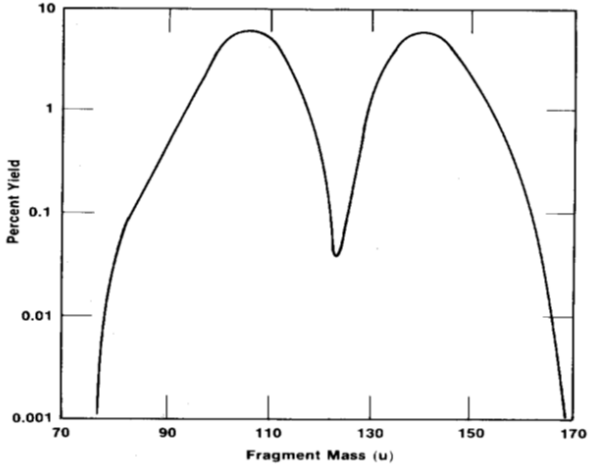
INTRODUCTION

CARIBU beams

- Neutron-rich beams based on the spontaneous fission of a ^{252}Cf source
  - 142 amu, Heavy
  - 106 amu, Light
- Pulsed beams with rates from ~ 100 ms to seconds
- High Purity (from MR-TOF)





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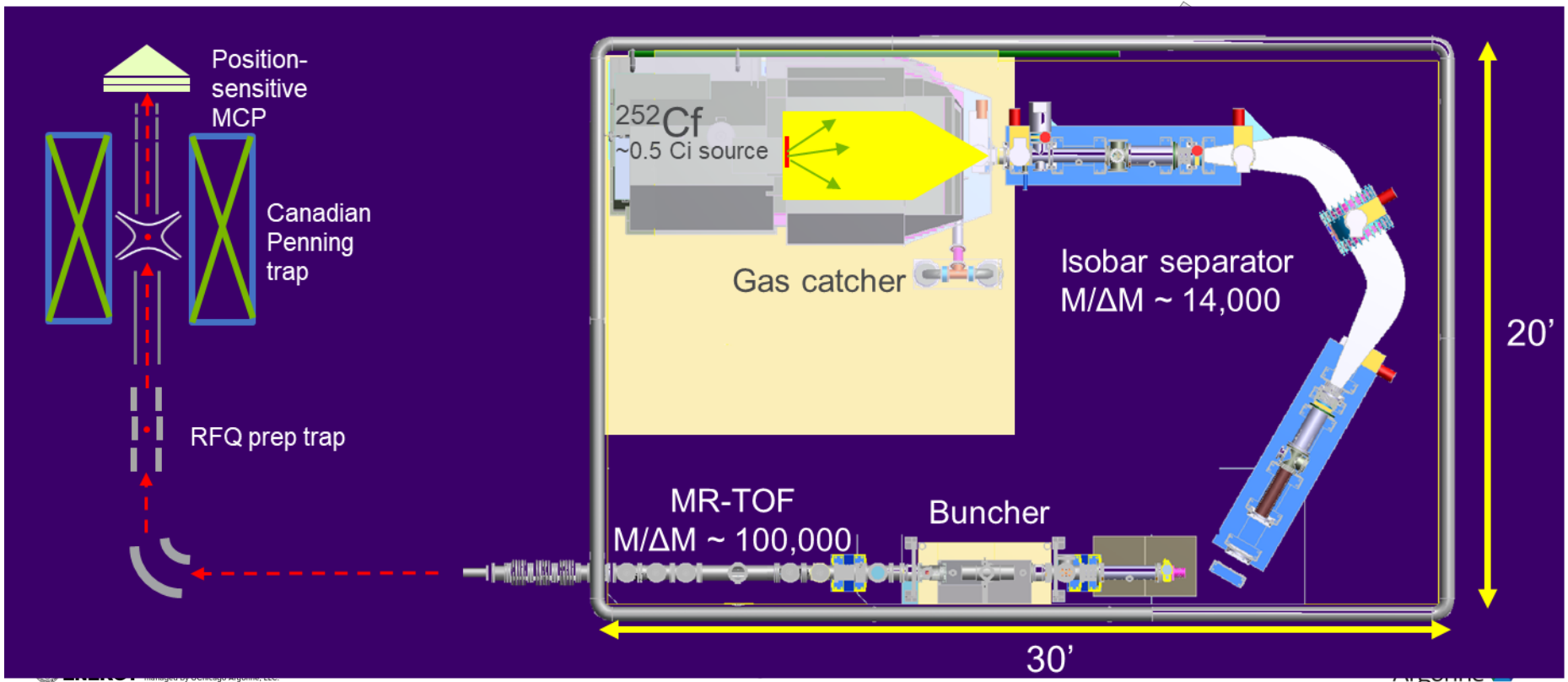
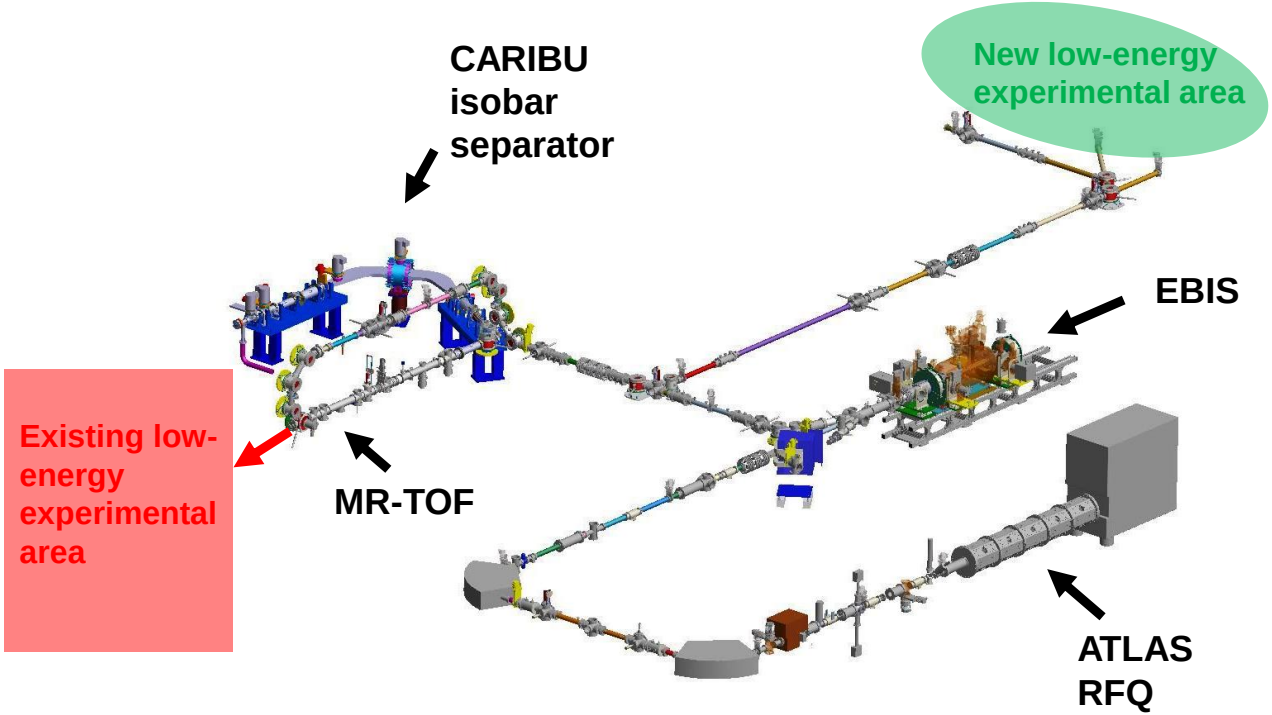
INTRODUCTION

The Californium Rare Ion Breeder Upgrade (CARIBU) Project



NEW CARIBU LOW-ENERGY BEAMLINE

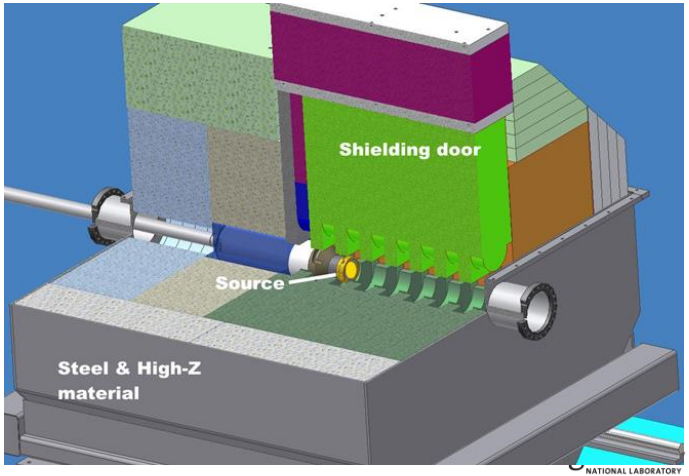


Courtesy Rick Vondrasek

INTRODUCTION

CARIBU ^{252}Cf Source

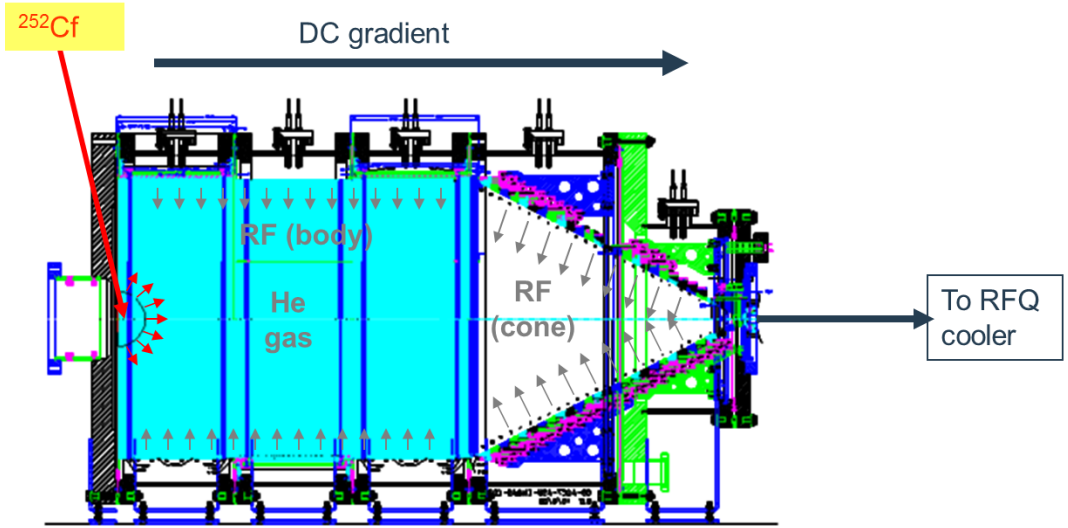
- $t_{1/2}$ = 2.65 years
- Prepared by electrodeposition at ORNL
- 500 mCi (effectively 130 mCi for radioactive recoils)
- Housed in movable shield cask and positioned in front of the large helium gas stopper cell when in use.



INTRODUCTION

CARIBU Helium Gas Catcher

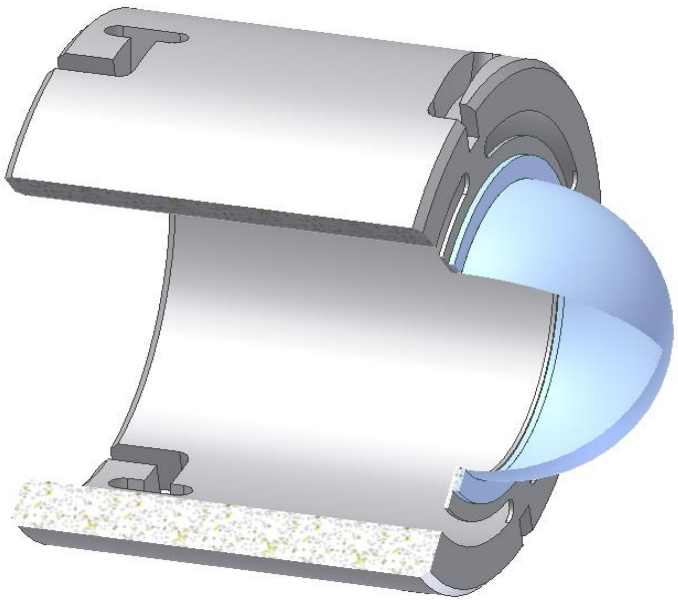
- Large DC field plus RF focusing throughout
- Incoming particles are slowed down, stopped, and stripped
- End up with one or two electrons removed
- Very fast source – providing cooled bunched beams for post acceleration
- Routine mass measurements on short-lived isotopes using the Canadian Penning Trap



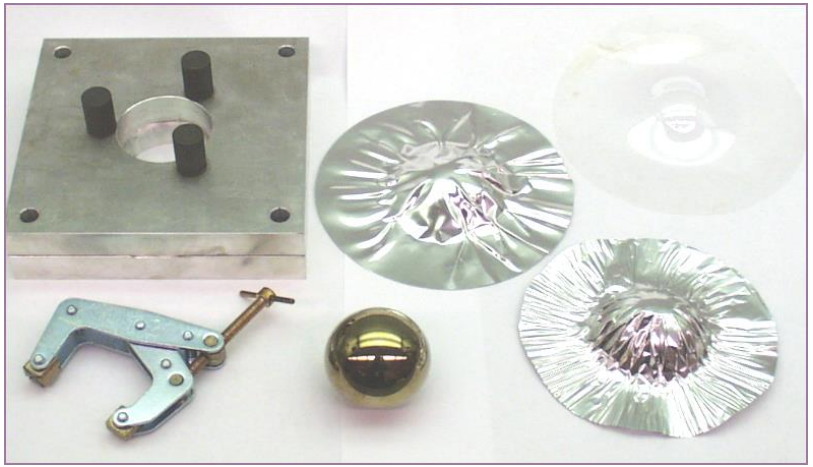
INTRODUCTION

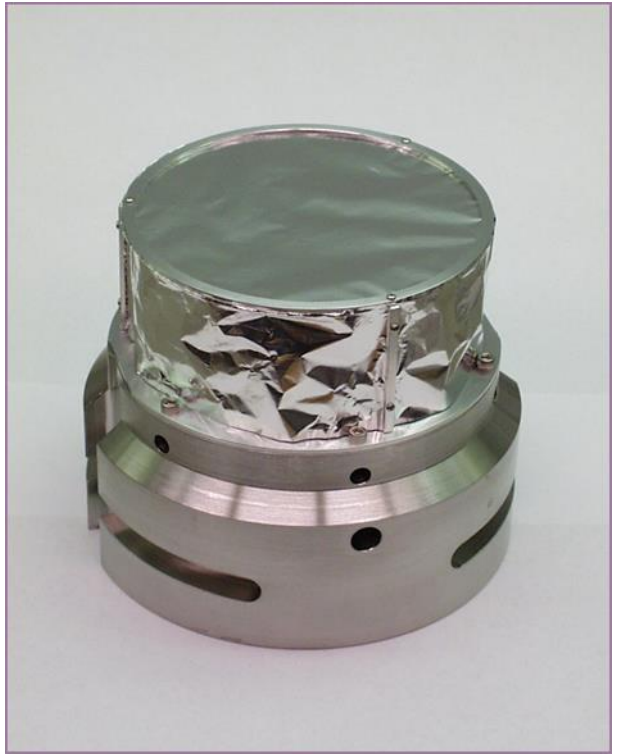
CARIBU Degrader Foil

- Plays role in energy loss of the fission fragments
- The ideal geometry is thin hemispherical degrader for uniform energy loss.
- Cannot use any cements or epoxies due to outgassing
- Mounted separately from source so it can be independently be removed



PREVIOUS ITERATIONS OF DEGRADER

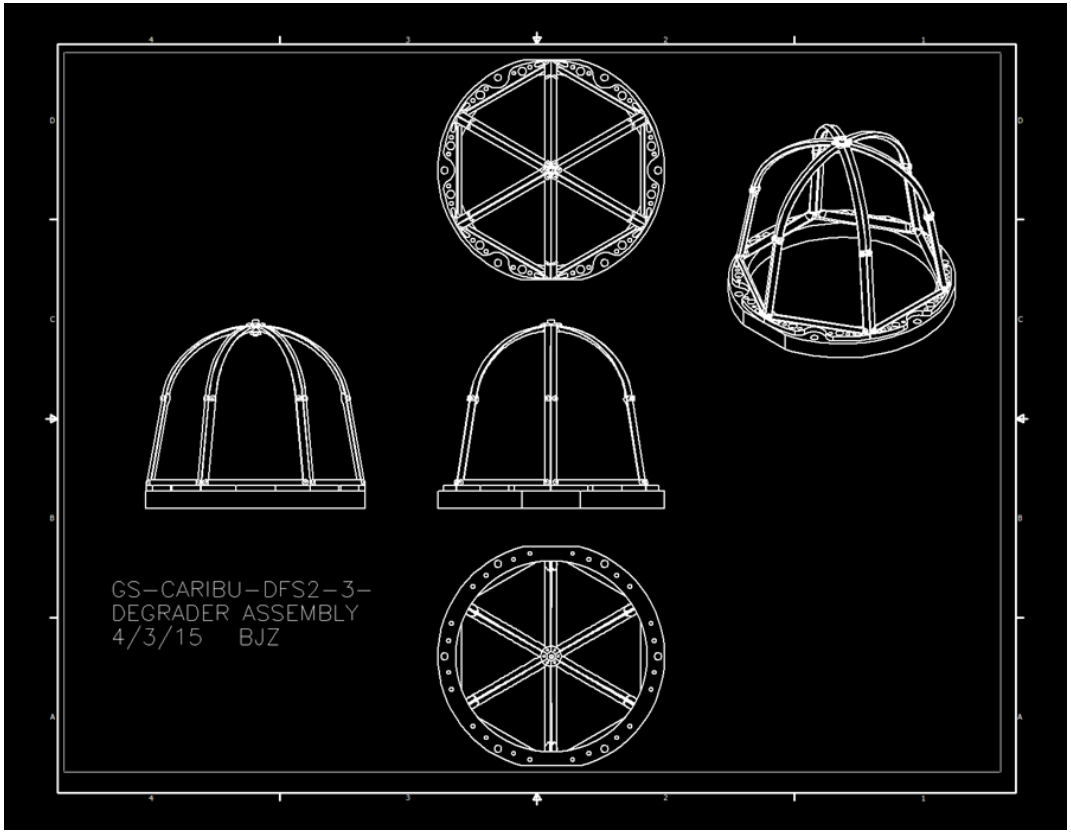




First Generation Degrader

DESIGN OF THE DEGRADER FOIL

- Engineered by Bruce Zabransky and Brad DiGiovine
- 3D printed by external company
- Holes tapped and base plate prepared by Physics Division Machine Shop



PIECING THE DEGRADER TOGETHER

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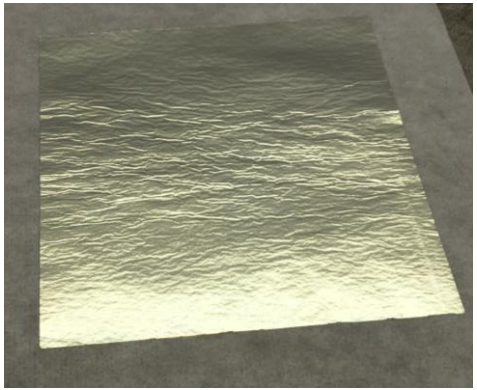
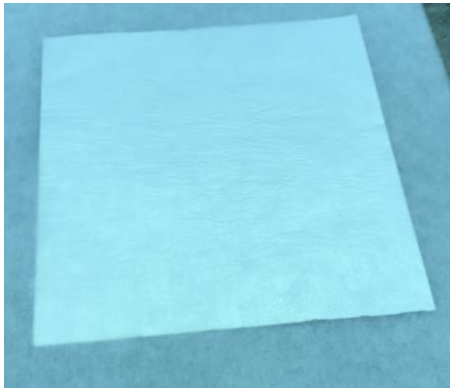
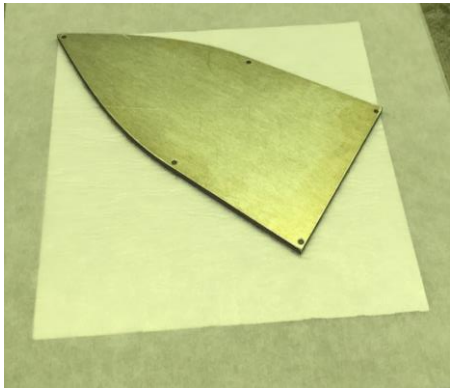
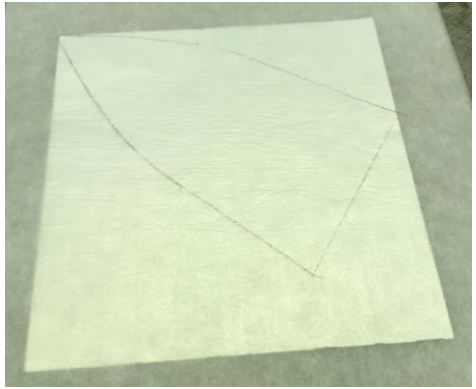
PIECING TOGETHER THE DEGRADER

Cutting the foil to fit each segment



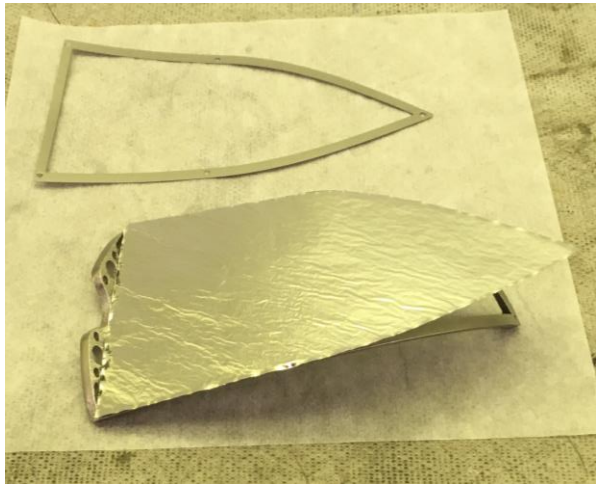


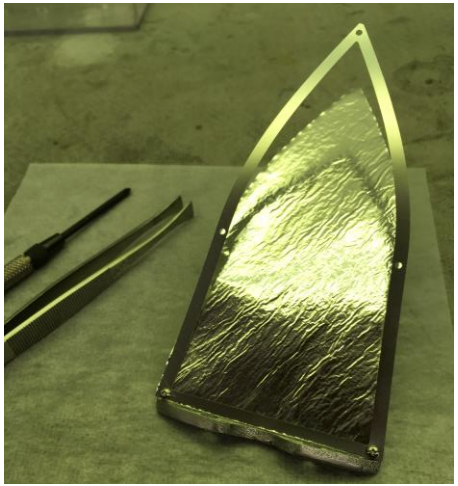




PIECING TOGETHER THE DEGRADER

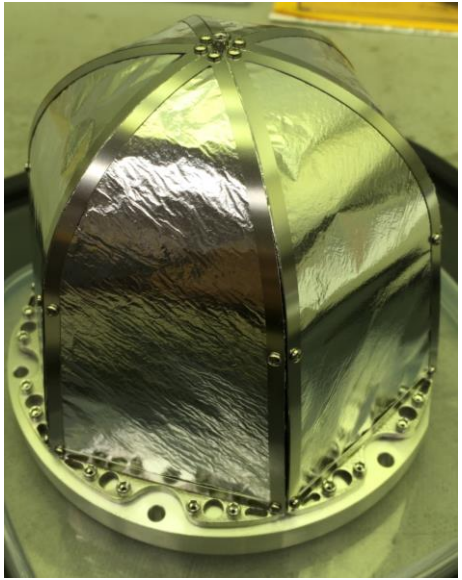
Installing the foil into each segment



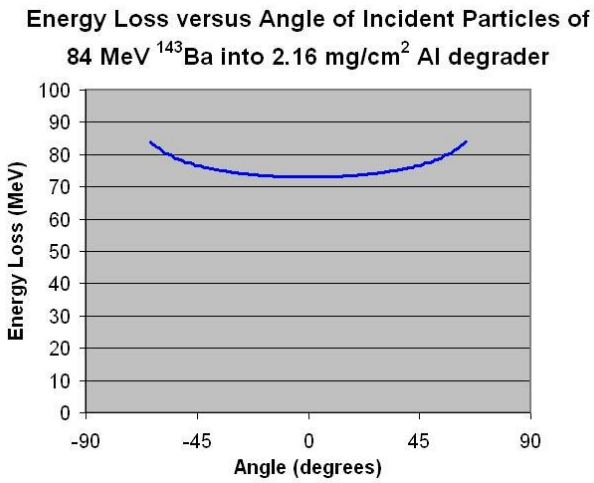


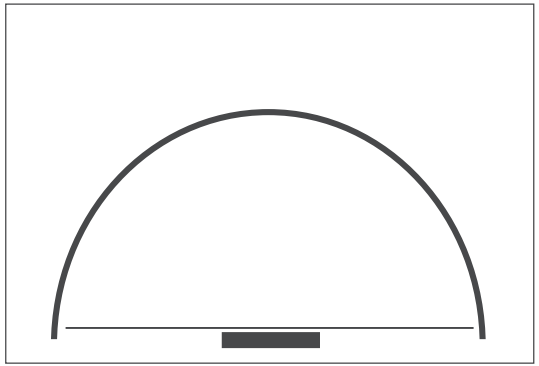
PIECING TOGETHER THE DEGRADER

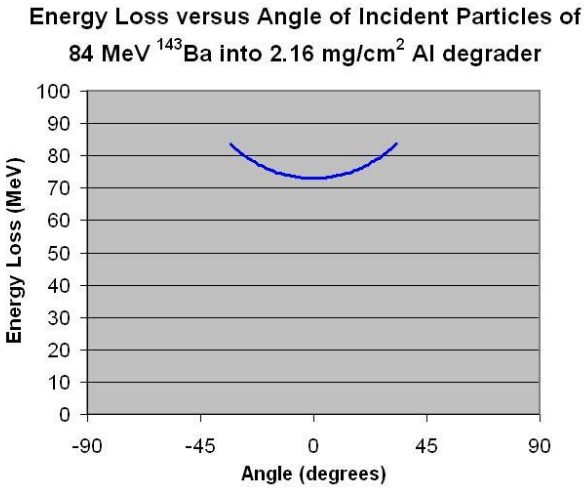
Final assembly and completed degrader



COMPARISON TO THE OLDER DEGRADER







SUMMARY

- CARIBU provides neutron-rich beams for nuclear physics experiments
- Hemispherical degrader provides a more uniform energy loss
- New 3D printed degrader provides improvement over previous design
- Great care must be made to keep the degrader clean during assembly

ACKNOWLEDGMENTS

- Jason Clark of Argonne Physics Division
- Physics Division Machine Shop
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THANK YOU FOR YOUR ATTENTION