

# Solid target for PRad

Chao Peng

Duke University

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# Information Online

- Beryllium window
  - As thin as 8  $\mu\text{m}$
  - Max aperture  $D = 5 \text{ mm}$

## SPECIFICATIONS

Window Thickness, $\mu\text{m}$ (mil)	Max. Aperture D, mm (inch)	Mounting Method
8 (0.3)	5 (0.118)	Soldering
12.5 (0.5)	7 (0.157)	Soldering
25 (1.0)	7 (0.157)	Soldering
50 (2.0)	10* (0.315)	Soldering
100 (4.0)	10* (0.394)	Soldering

\* - larger aperture is available according to customer requests

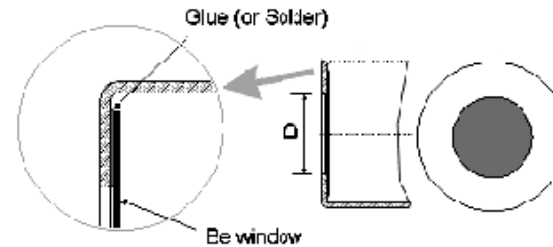
## BERYLLIUM WINDOWS



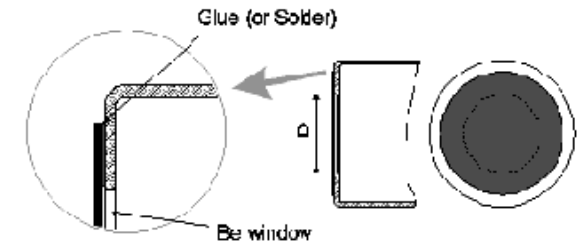
Thin vacuum tight Be windows suitable for application in X-ray detectors and tubes

- High quality Be foil
- Thin windows down to 8  $\mu\text{m}$  (0.3 mil)
- Vacuum tight quality
- Standard or custom designed covers or flanges

### INSIDE MOUNTING



### OUTSIDE MOUNTING



- Caps or flanges may be supplied by customer or provided by RMT according to customer drawings. Standard caps are made from stainless steel, aluminum, nickel.
- The windows are mounted using:
  - soldering by Pb-Sn solder  $T_{\text{melt}}=183^\circ\text{C}$
  - soldering by Lead-Free solder  $T_{\text{melt}}=217^\circ\text{C}$
- Assembly leak rate not to exceed  $5 \times 10^{-8} \text{ atm} \times \text{cm}^2/\text{sec}$  of Helium at one atmosphere differential pressure.

# Information Online

- Ultra-thin foil
  - The thickness can be tens of nm

## Request a Quote

Product Code	Product	Request Quote
BE-M-03-FN	(3N) 99.9% Ultra Thin Beryllium Nanofoil	<a href="#">Request</a>
BE-M-04-FN	(4N) 99.99% Ultra Thin Beryllium Nanofoil	<a href="#">Request</a>
BE-M-05-FN	(5N) 99.999% Ultra Thin Beryllium Nanofoil	<a href="#">Request</a>

## About

American Elements' Nanometal™ nanofoil manufacturing unit produces ultra thin foil as thin as only 50 nm thick in diameters up to 910 mm. Typically, foils are in thicknesses from [20 nm to 1000 nm, 1 micron, 2 micron, and up to a few microns thick.](#)

<https://www.americanelements.com/ultra-thin-beryllium-nanofoil-7440-41-7#section-about>

# Information Online

- Another company
  - 1 um thick
  - 25 x 25 mm<sup>2</sup>
  - Shows price



## Beryllium Ultrathin foil, 1 micron thick, 99.9% (metals basis), Alfa Aesar™

Form: On temporary copper support

**\$3925.63 - \$15219.06**

### Chemical Identifiers

Assay Percent Range 99.9% (metals basis)

CASRegistryNumber1 7440-41-7

MFCD Number MFCD00134032

Chemical Name or Material Beryllium, Temporary support removal instructions included.

[View More Specs](#)

Catalog Number	Mfr. No.	Packaging	Quantity	Price	Quantity & Availability
<a href="#">AA40709FF</a>	ALFA AESAR 40709FF		25 x 25mm	● Each for \$3,925.63	<input type="text"/> <a href="#">Check Availability</a> <a href="#">Add to Cart</a>
<a href="#">AA40709FI</a>	ALFA AESAR 40709FI		50 x 50mm	● Each for \$15,219.06	<input type="text"/> <a href="#">Check Availability</a> <a href="#">Add to Cart</a>

<https://www.fishersci.com/shop/products/beryllium-ultrathin-foil-1-micron-thick-99-9-metals-basis-alfa-aesar-2/p-4864966>

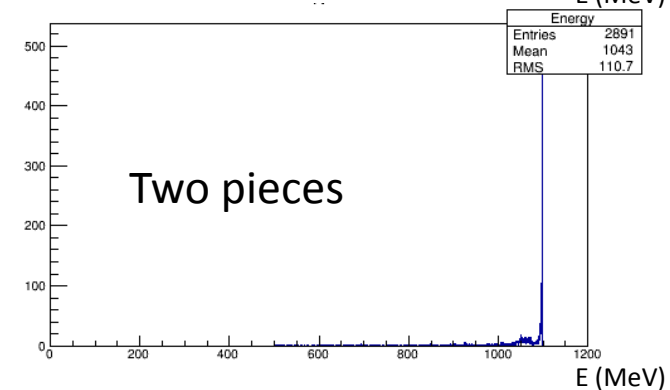
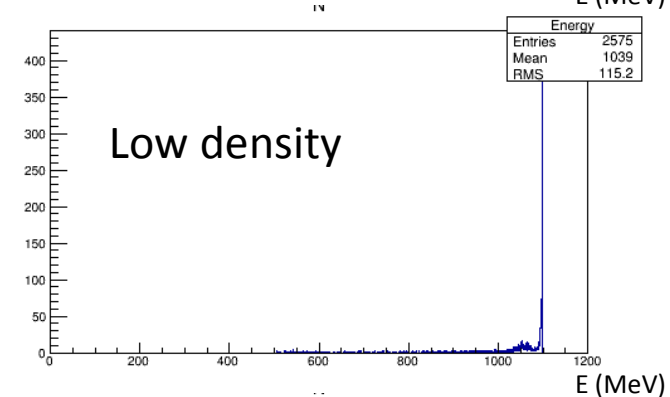
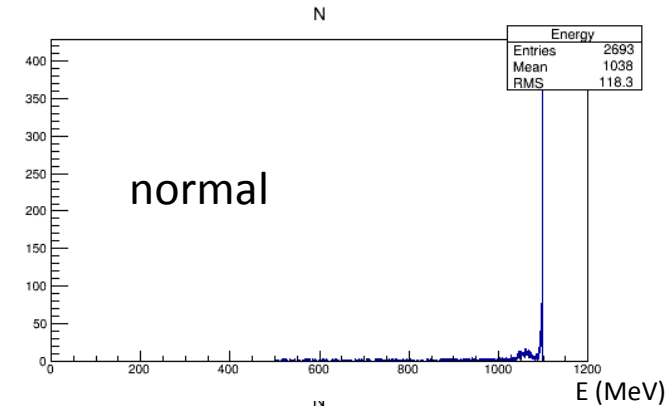
# Simulation

- The standard Geant4 models seem to be not reliable for a very thin target, so a set of simulations were performed to test the results.
- Run the simulation with different configurations and different physics models
  - Configurations: 1 mm piece, 1 cm piece but 1/10 density, two 0.5 mm pieces
  - Models:
    - Standard Geant4 electromagnetic physics list, multiple scattering (msc) model
    - Standard physics list with the step limit of msc set to minimal
    - Combined WentzelVI and Single Scattering models
- HyCal is set to be ideal detector, because different EM models affect the energy deposition
  - Threshold: total energy of single event > 500 MeV

# Multiple scattering model

- Incident electrons:  $10^7$ 
  - Assuming 1 nA beam
  - Assuming the rate limit is 1 kHz
  - Thickness is then scaled

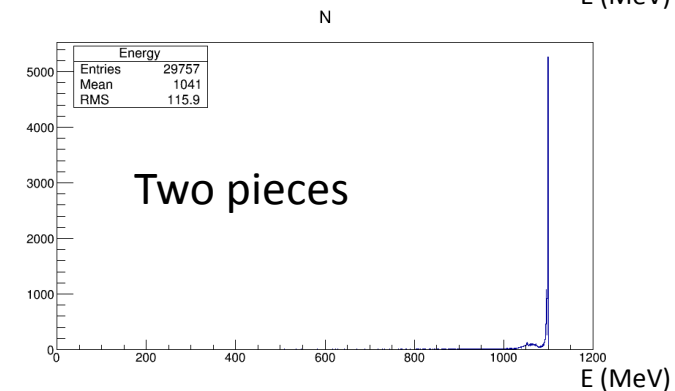
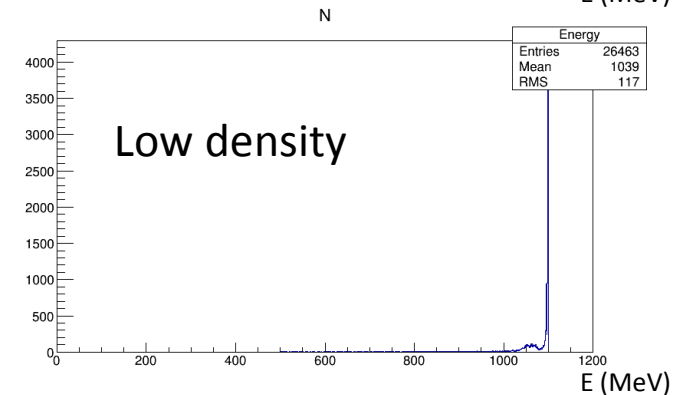
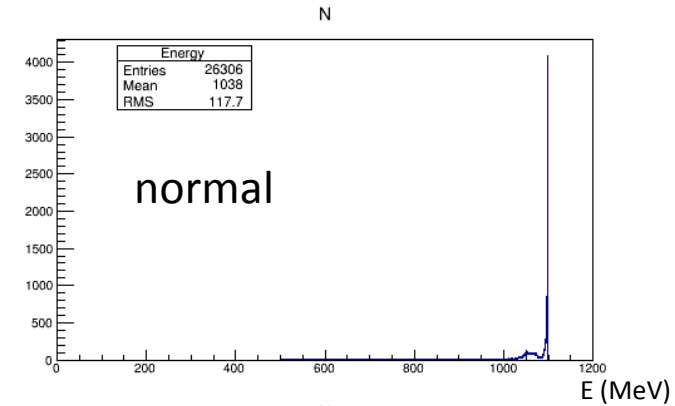
Configuration	Triggers	Tolerable thickness
Normal	2693	0.59 $\mu\text{m}$
Low density	2575	0.62 $\mu\text{m}$
Two pieces	2891	0.55 $\mu\text{m}$



# Multiple scattering model (minimal step)

- Incident electrons:  $10^8$ 
  - Assuming 1 nA beam
  - Assuming the rate limit is 1 kHz
  - Thickness is then scaled

Configuration	Triggers	Tolerable thickness
Normal	26306	0.61 $\mu\text{m}$
Low density	26463	0.61 $\mu\text{m}$
Two pieces	29757	0.54 $\mu\text{m}$



# Multiple scattering model (minimal step)

- Incident electrons:  $10^8$ 
  - Assuming 1 nA beam
  - Assuming the rate limit is 1 kHz
  - Thickness is then scaled

Configuration	Triggers	Tolerable thickness
Normal	2676	0.60 $\mu\text{m}$
Low density	2699	0.59 $\mu\text{m}$
Two pieces	2676	0.60 $\mu\text{m}$

