Multiple Coulomb Scattering in the MICE LH2 Absorber

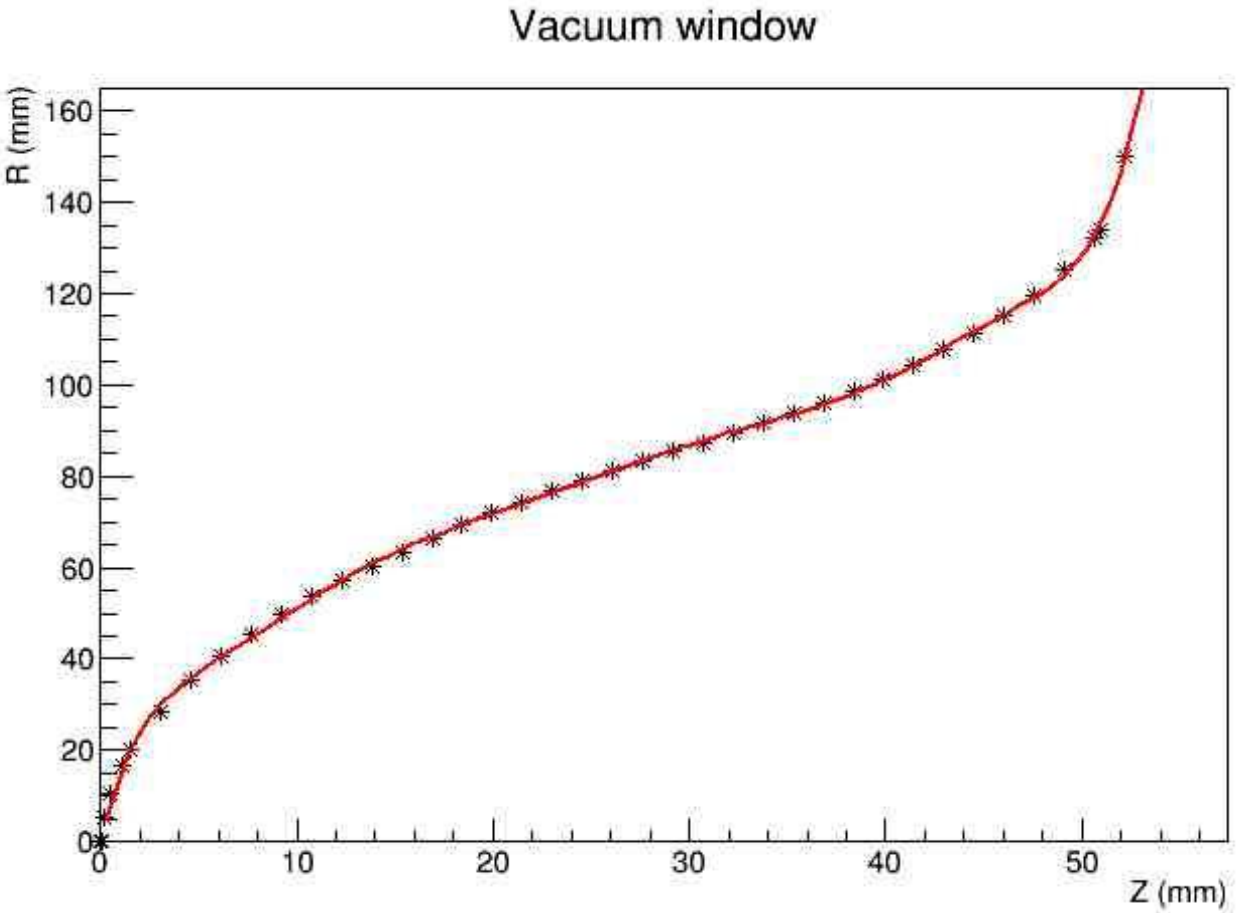
- MICE V 3.2.0 is successfully installed in CENTOS
  - Pip installs numpy but MAUS installation can't find it
  - Bash script for numpy third party install works

  (my thanks to Paolo Franchini and Durga Rajaram)

Contents

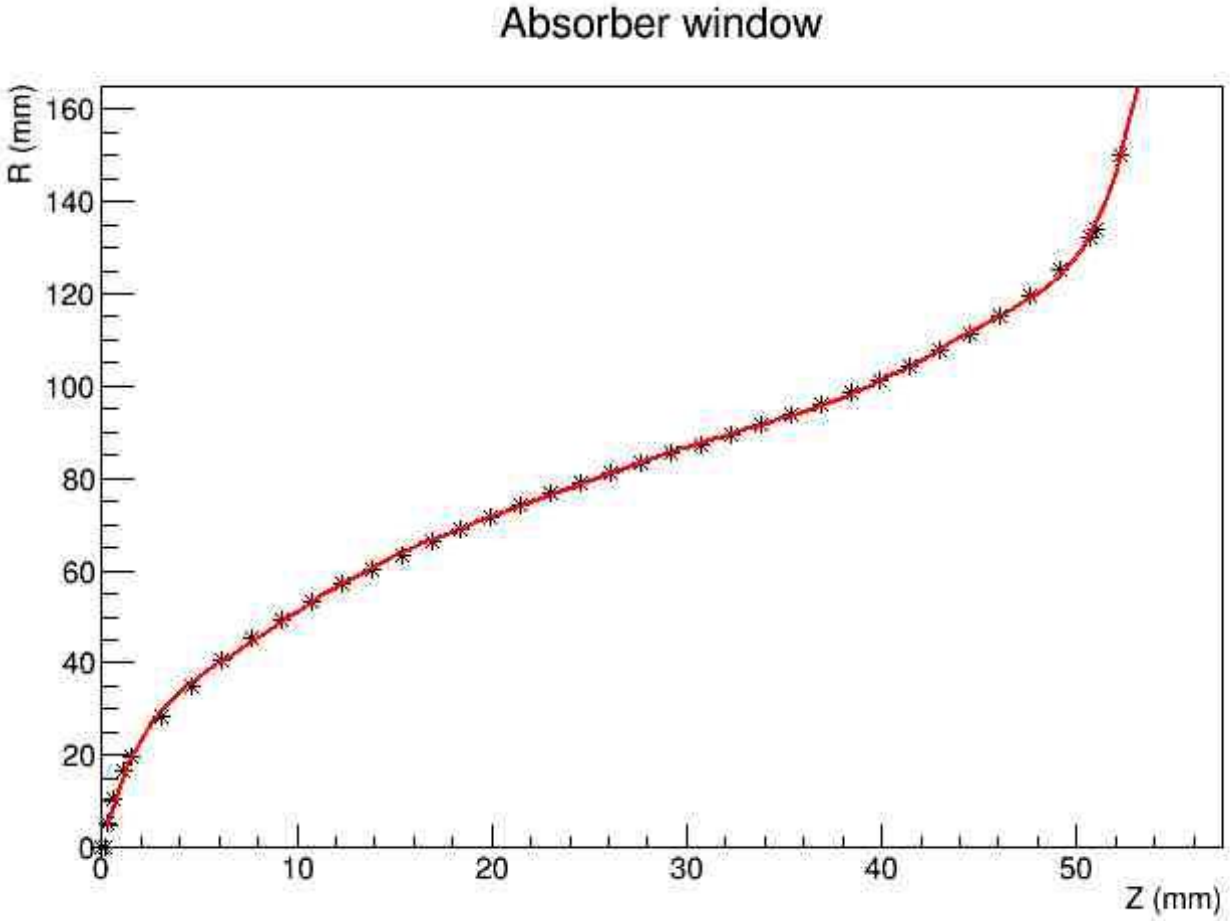
- Vacuum & Absorber Window spacepoints
- Aluminum & LH2 Path length Calculation for:
  - Energy Loss calculation
  - MCS model required parameter

Vacuum window geometry



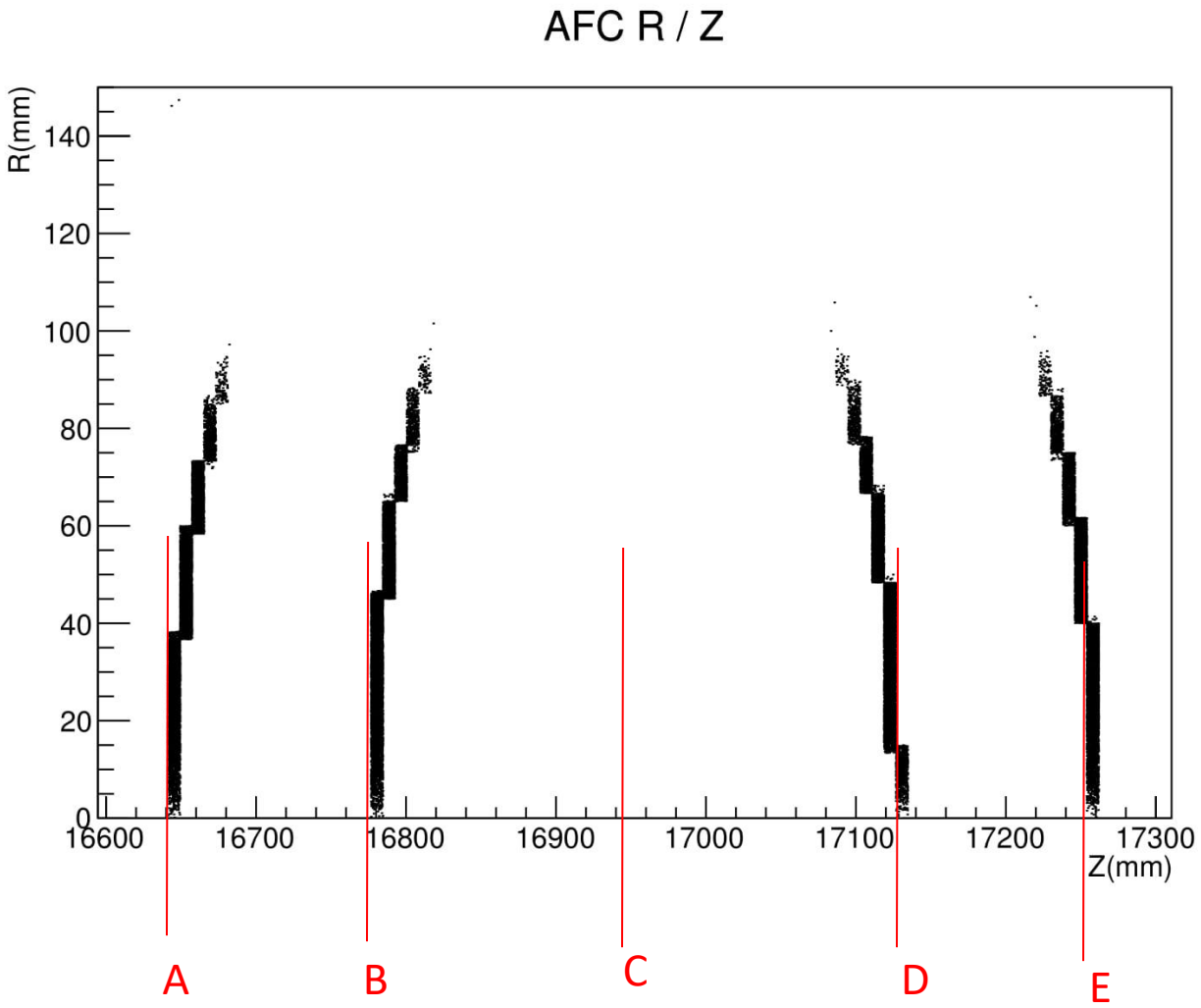
Chi2	=	21.8871	
NDf	=	30	
p0	=	0	(fixed)
p1	=	18.1059 +/- 0.642462	
p2	=	-4.08945 +/- 0.311102	
p3	=	0.578207 +/- 0.058323	
p4	=	-0.0474917 +/- 0.00557795	
p5	=	0.0023568 +/- 0.000303652	
p6	=	-7.1729e-05 +/- 9.7982e-06	
p7	=	1.30834e-06 +/- 1.85414e-07	
p8	=	-1.31156e-08 +/- 1.90027e-09	
p9	=	5.55247e-11 +/- 8.1395e-12	

Absorber window geometry



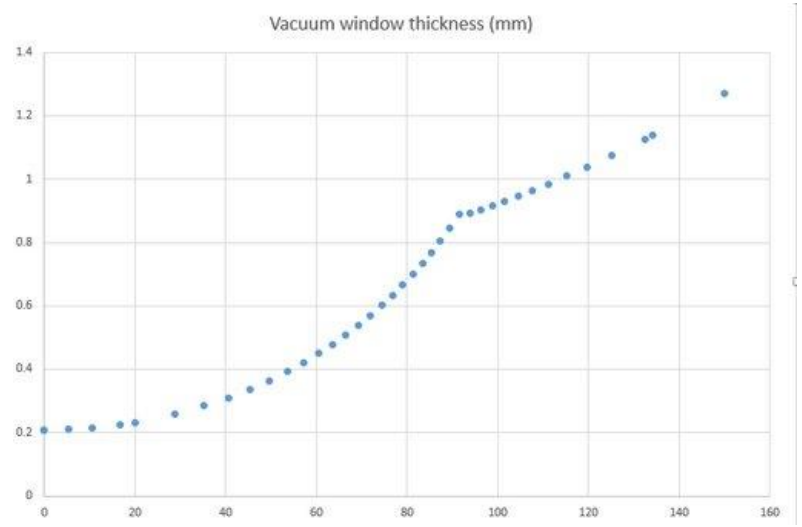
Chi2	=	20.2259	
NDf	=	30	
p0	=	0	(fixed)
p1	=	17.5384 +/- 0.607658	
p2	=	-3.85864 +/- 0.294874	
p3	=	0.540321 +/- 0.0553739	
p4	=	-0.0442244 +/- 0.005301	
p5	=	0.00219304 +/- 0.000288708	
p6	=	-6.6789e-05 +/- 9.31719e-06	
p7	=	1.21991e-06 +/- 1.76295e-07	
p8	=	-1.22502e-08 +/- 1.80637e-09	
p9	=	5.19576e-11 +/- 7.73454e-12	

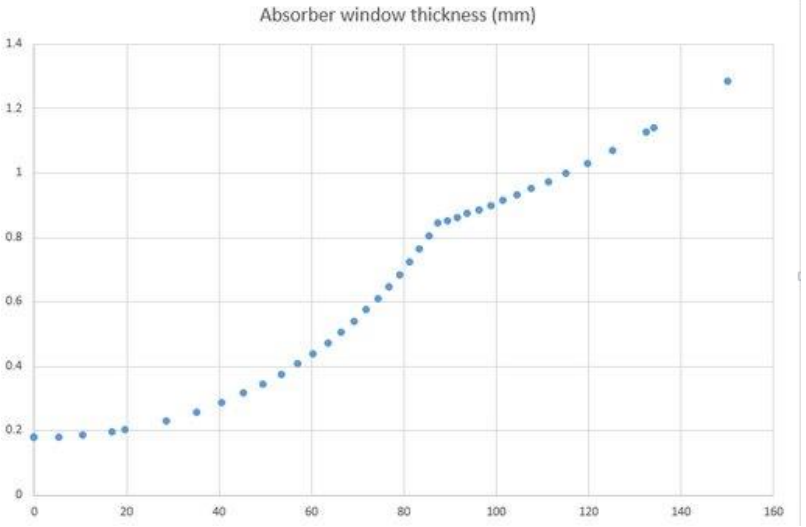
Projection of tracks to windows



From Geometry files:
[A] : US vac. win. 16644.5 mm
[B] : US abs. win. 16777.35 mm
[C] : AFC origin 16952.5 mm
[D] : DS vac. win. 17127.65
[E] : DS abs. win. 17260.5 mm

Aluminum Thickness





$$h(r) = \begin{cases} \sqrt{151.95^2 - r^2} - 2.41 - \sqrt{149.33^2 - r^2} & r \leq 92.3 \\ \sqrt{107.52^2 - (r - 158.93)^2} - \sqrt{108.88^2 - (r - 160)^2} & r > 92.3 \end{cases}$$ [1]

$$h(r) = \begin{cases} \sqrt{142.45^2 - r^2} - 2.27 - \sqrt{140^2 - r^2} & r \leq 87.2 \\ \sqrt{102.08^2 - (r - 150)^2} - \sqrt{100.8^2 - (r - 149)^2} & r > 87.2 \end{cases}$$ [1]

[1] [R.Connors et. al. 2014 LBNL *"The Thickness Measurement of MICE Absorber Aluminum Window at LBNL, Report 1"]*

Future work on vessel

- Decrease step length of projection to 0.1mm
- Include LH2 & Al path length in energy loss
- Calculate uncertainty in path length due to vacuum window scattering
- Include a small known offset of the AFC
- Assess the influence of known deformities

Of the windows on scattering & implement