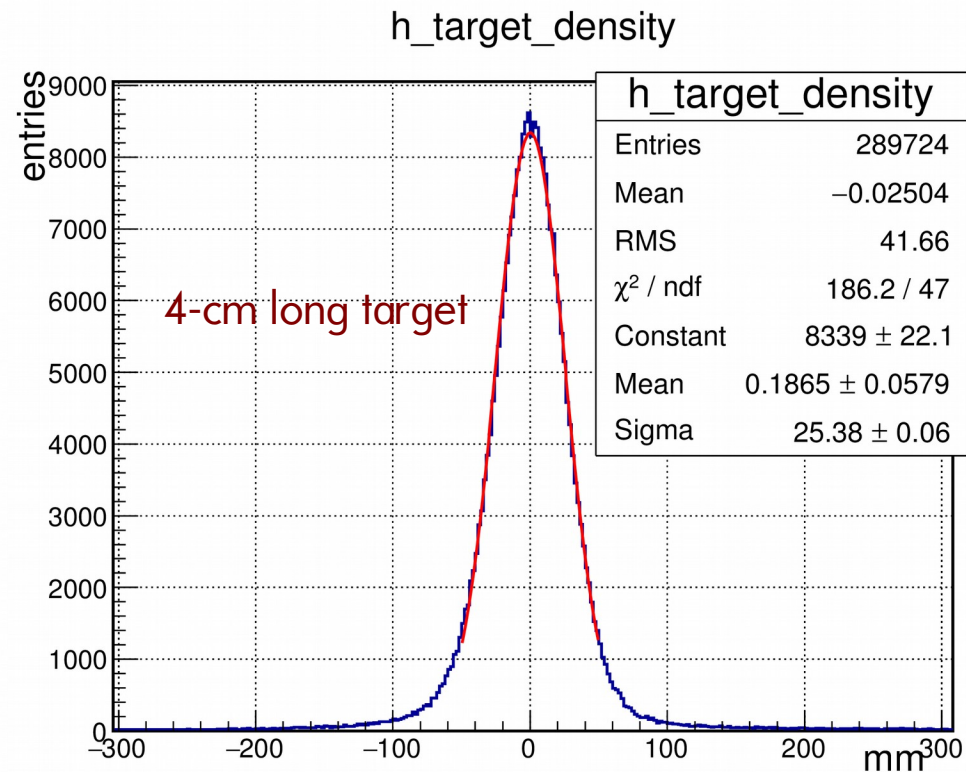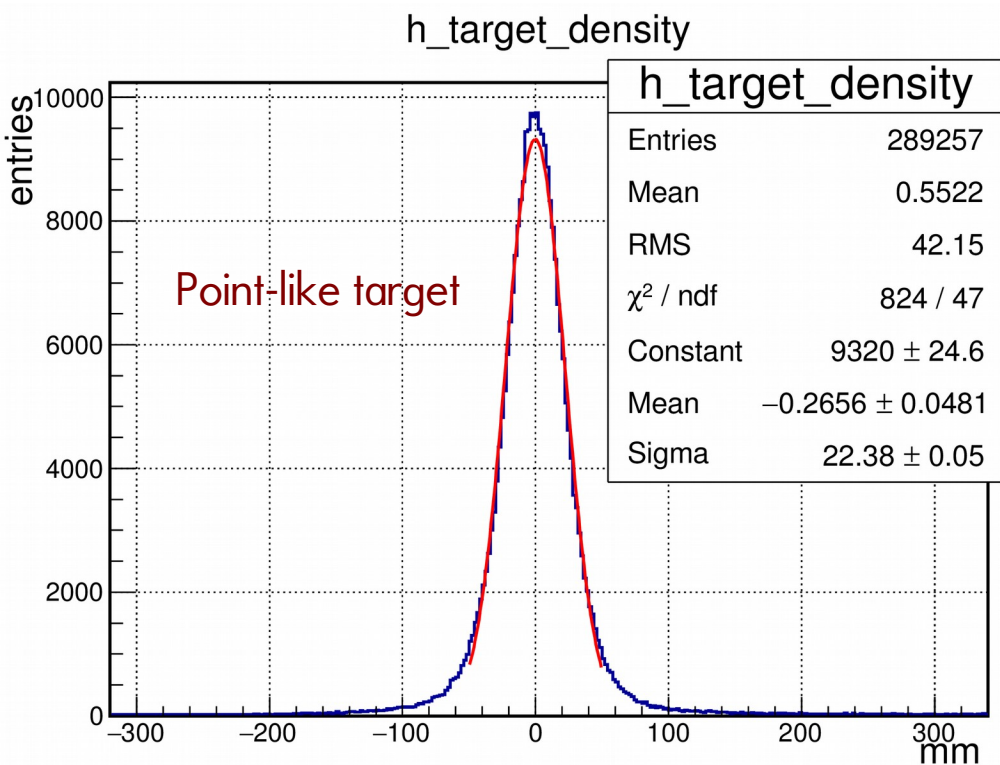# Z vertex reconstruction using double arm moller events in simulation

- Double arm moller

- Using moller events in angle range: 0.8 degree – 8.0 degree

- Elasticity: 5 sigma cut

- Coplanarity cut: +/- 10 degree

- Formula:

$$z = \sqrt{(m_e + E_{beam}) R_1 R_2 / (2 m_e)}$$

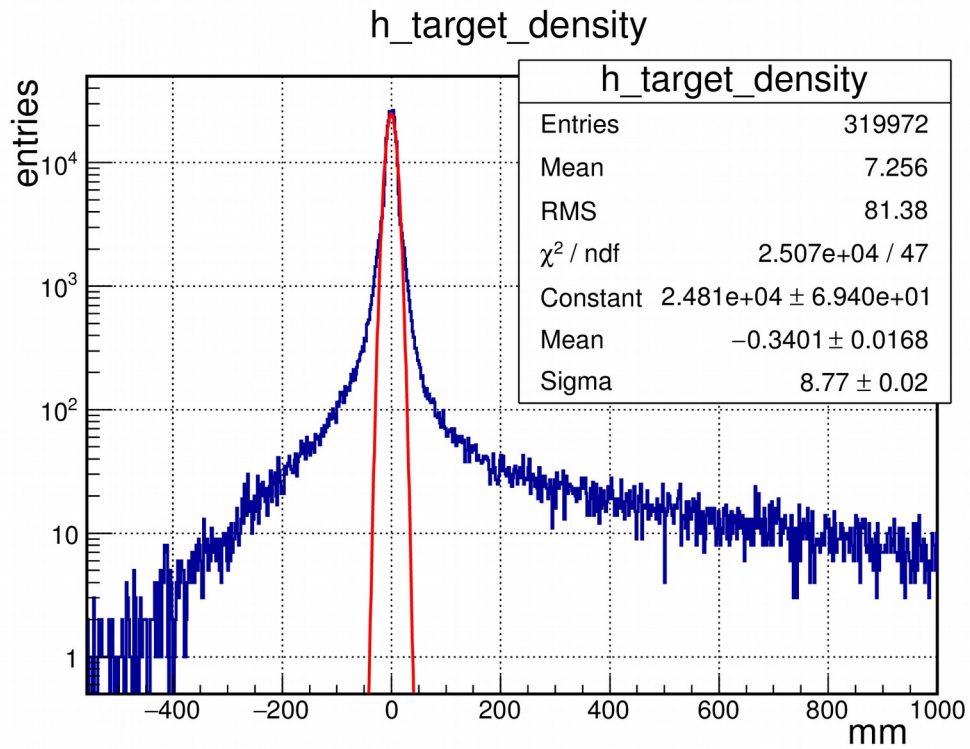# Double arm moller reconstructed Z vertex distribution
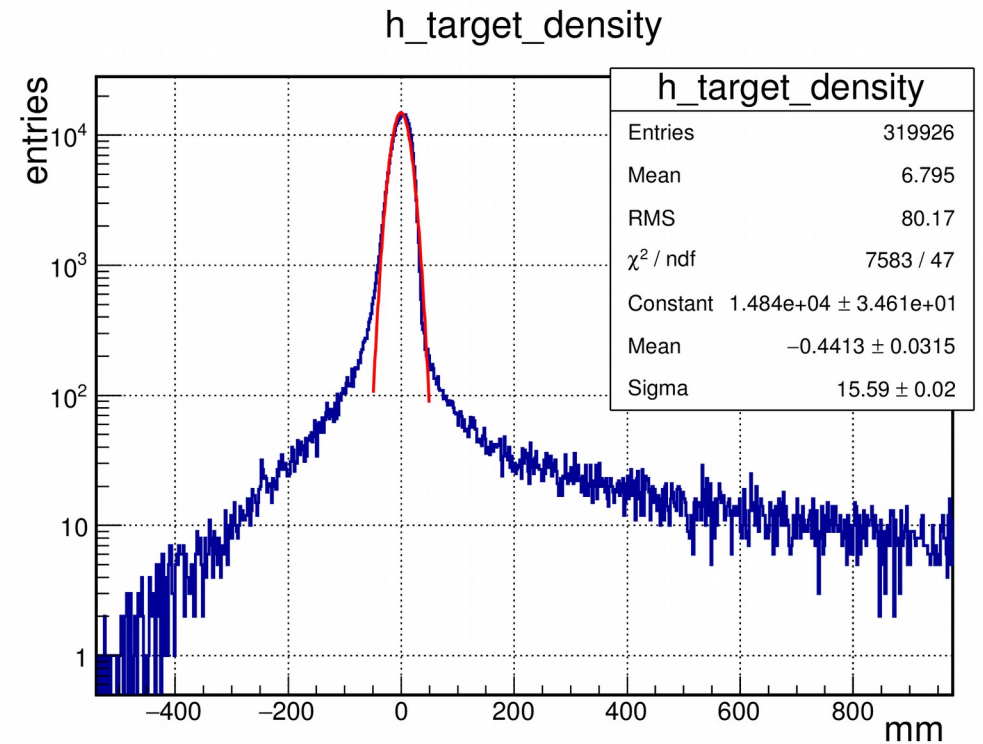
Z vertex reconstruction using double arm moller events

h_target_density (Point-like target)

h_target_density	
Entries	289257
Mean	0.5522
RMS	42.15
χ^2 / ndf	824 / 47
Constant	9320 ± 24.6
Mean	-0.2656 ± 0.0481
Sigma	22.38 ± 0.05

h_target_density (4-cm long target)

h_target_density	
Entries	289724
Mean	-0.02504
RMS	41.66
χ^2 / ndf	186.2 / 47
Constant	8339 ± 22.1
Mean	0.1865 ± 0.0579
Sigma	25.38 ± 0.06

GEM resolution = 70 um

Double arm moller reconstructed Z vertex distribution

Point-like target

h_target_density

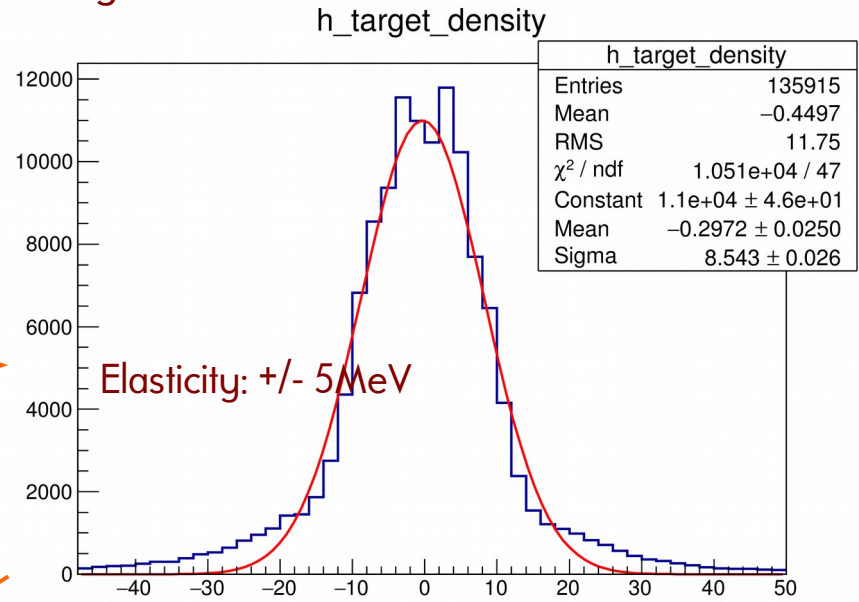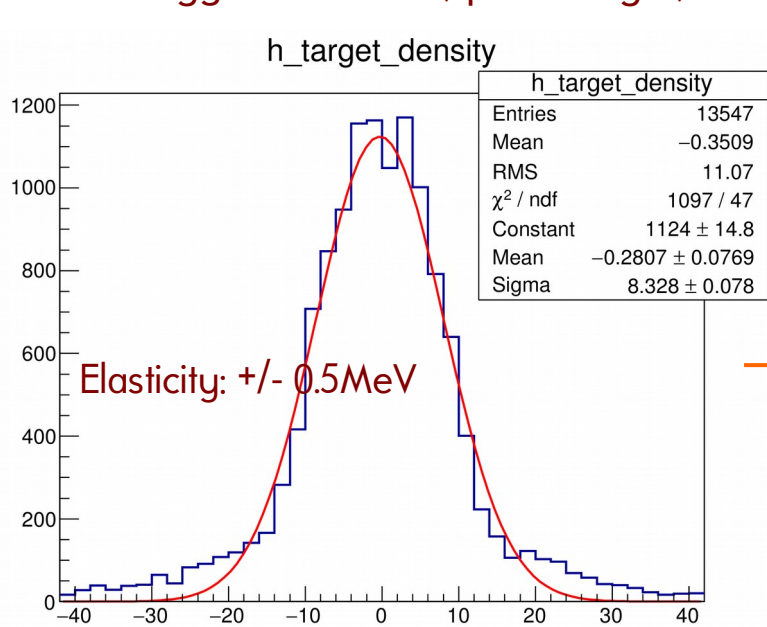| h_target_density	
Entries	319972
Mean	7.256
RMS	81.38
χ^2 / ndf	2.507e+04 / 47
Constant	2.481e+04 ± 6.940e+01
Mean	−0.3401 ± 0.0168
Sigma	8.77 ± 0.02

4-cm long target

h_target_density

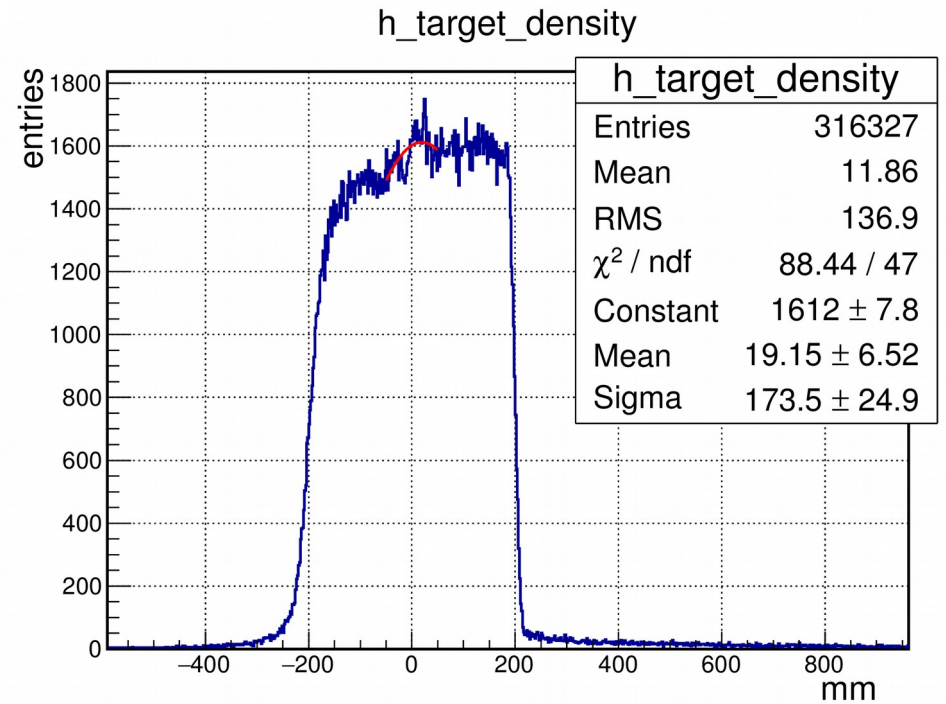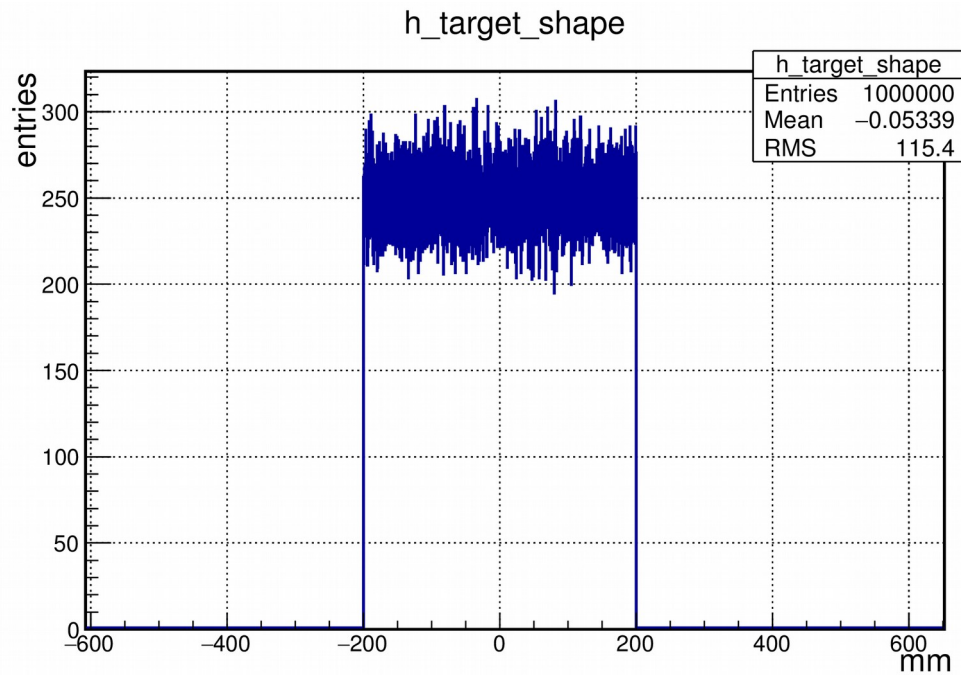| h_target_density	
Entries	319926
Mean	6.795
RMS	80.17
χ^2 / ndf	7583 / 47
Constant	1.484e+04 ± 3.461e+01
Mean	−0.4413 ± 0.0315
Sigma	15.59 ± 0.02

Set GEM resolution to 0, and remove HyCal Al Window (multi-scattering)

Double arm moller reconstructed Z vertex distribution

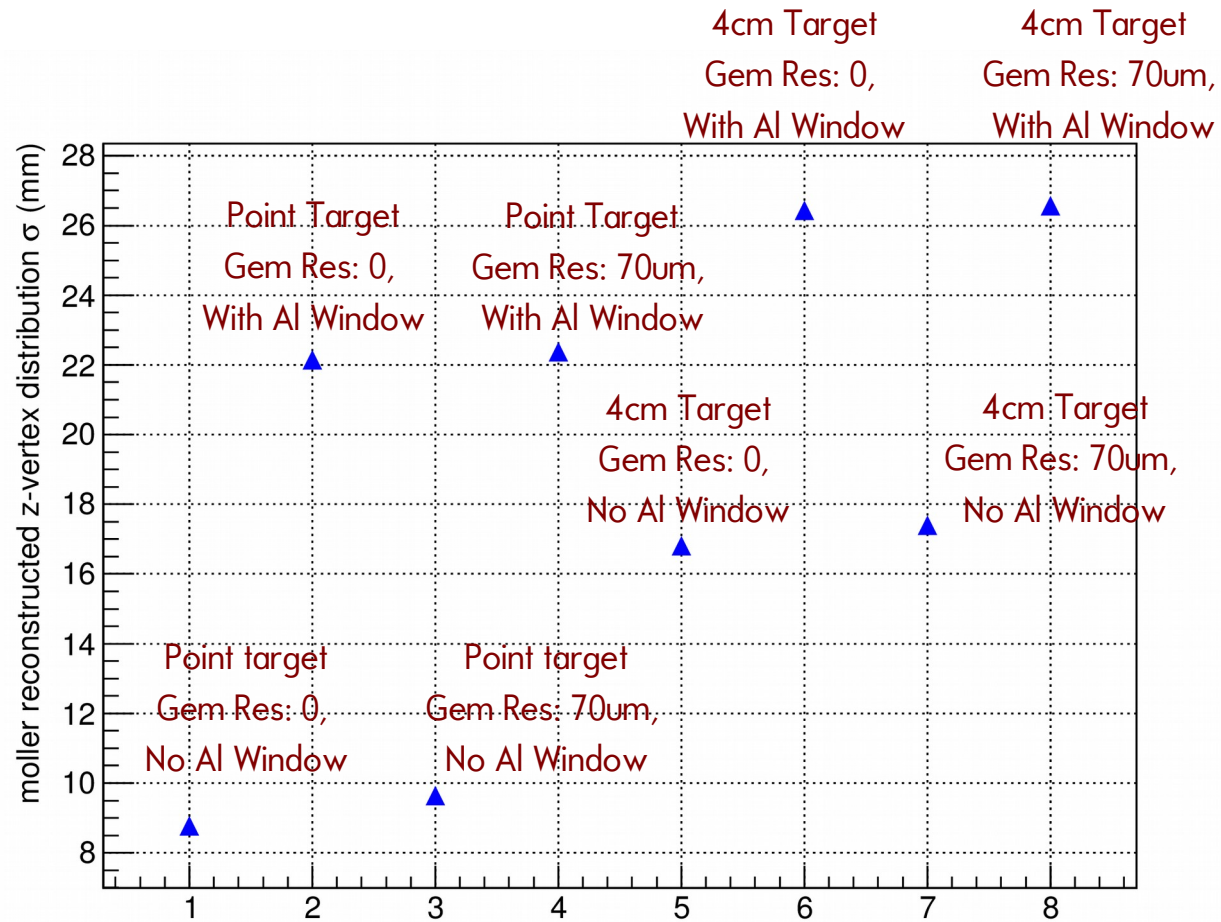**Beam energy = 1100 MeV, point target, Gem res = 0, no HyCal Al Window**

Double arm moller reconstructed Z vertex distribution
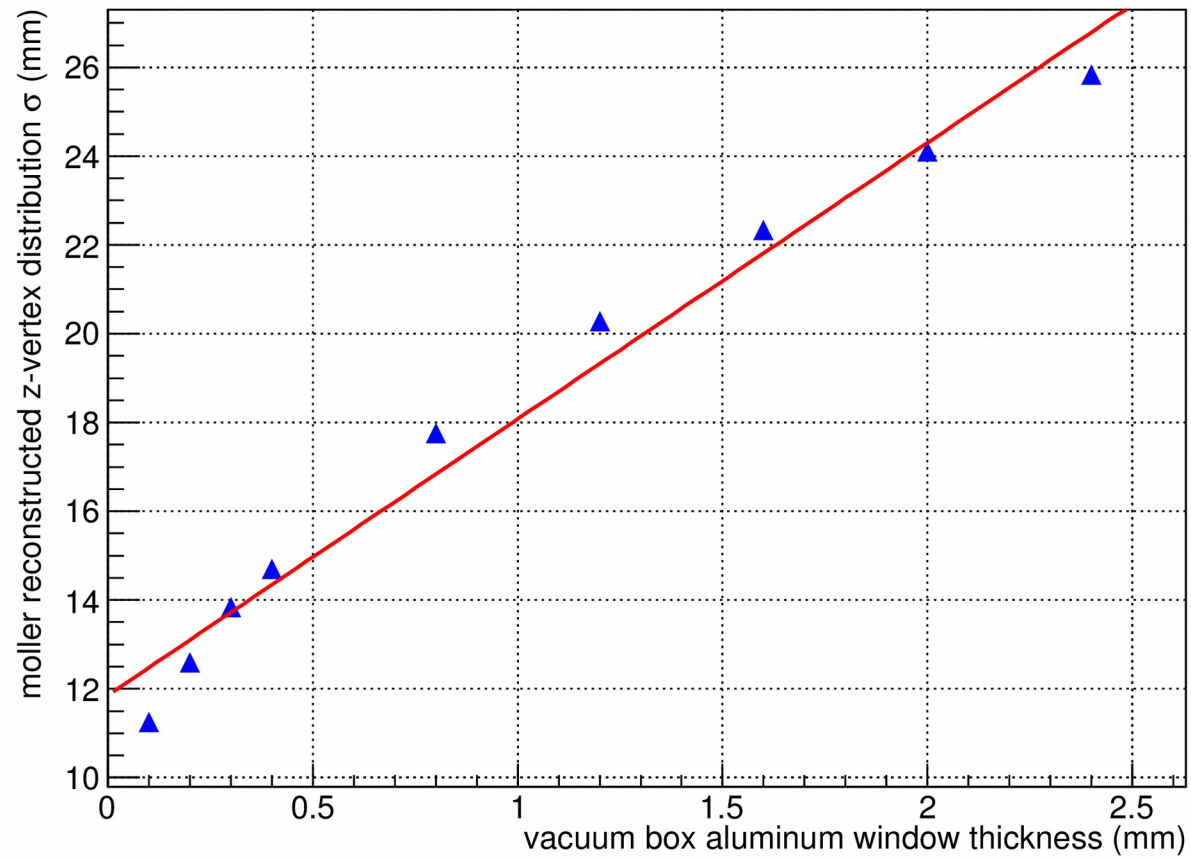

Target length = 20cm

GEM resolution = 0

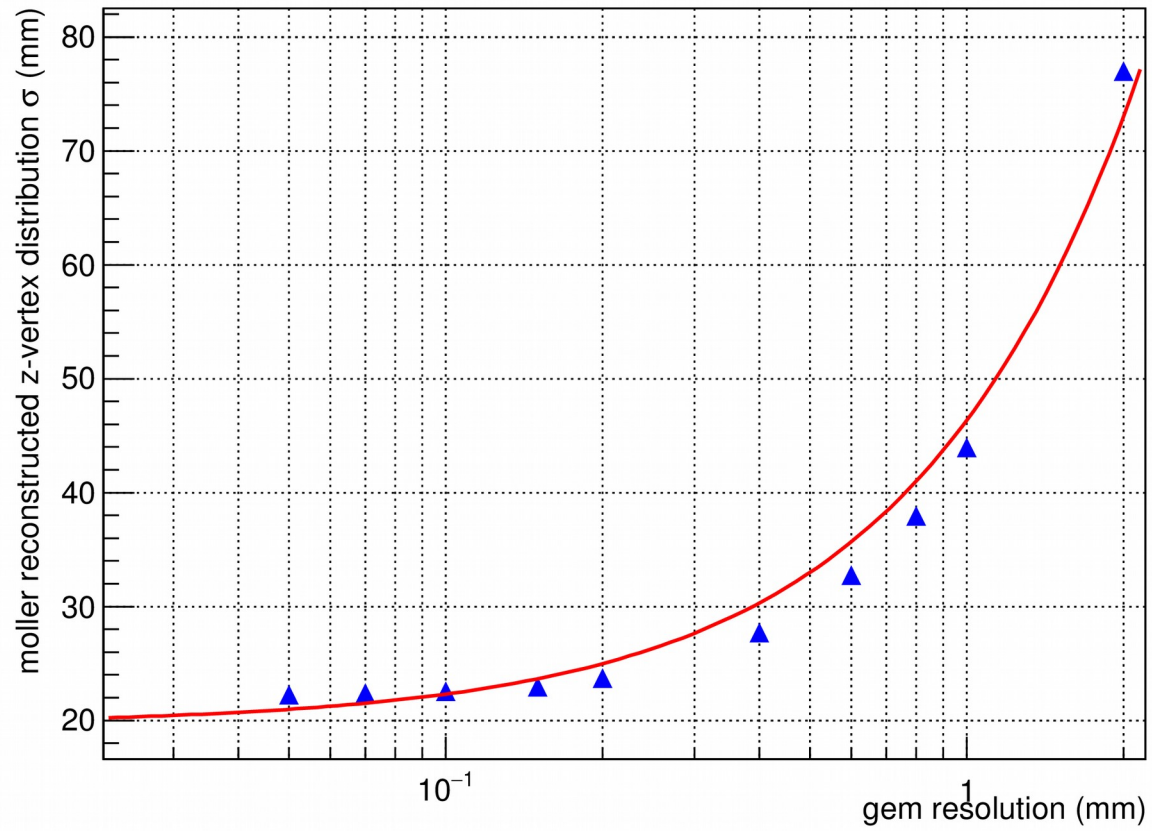# Moller reconstructed Z vertex distribution sigma

- Resolution dominated by HyCal downstream Al Window
- GEM resolution has no major effect

Moller reconstructed Z vertex distribution sigma

Scan for HyCal downstream Al Window thickness

Moller reconstructed Z vertex distribution sigma

Scan for GEM resolution, HyCal Window thickness=16mm