Calorimeter shower profile simulation results

21 / March / 2019

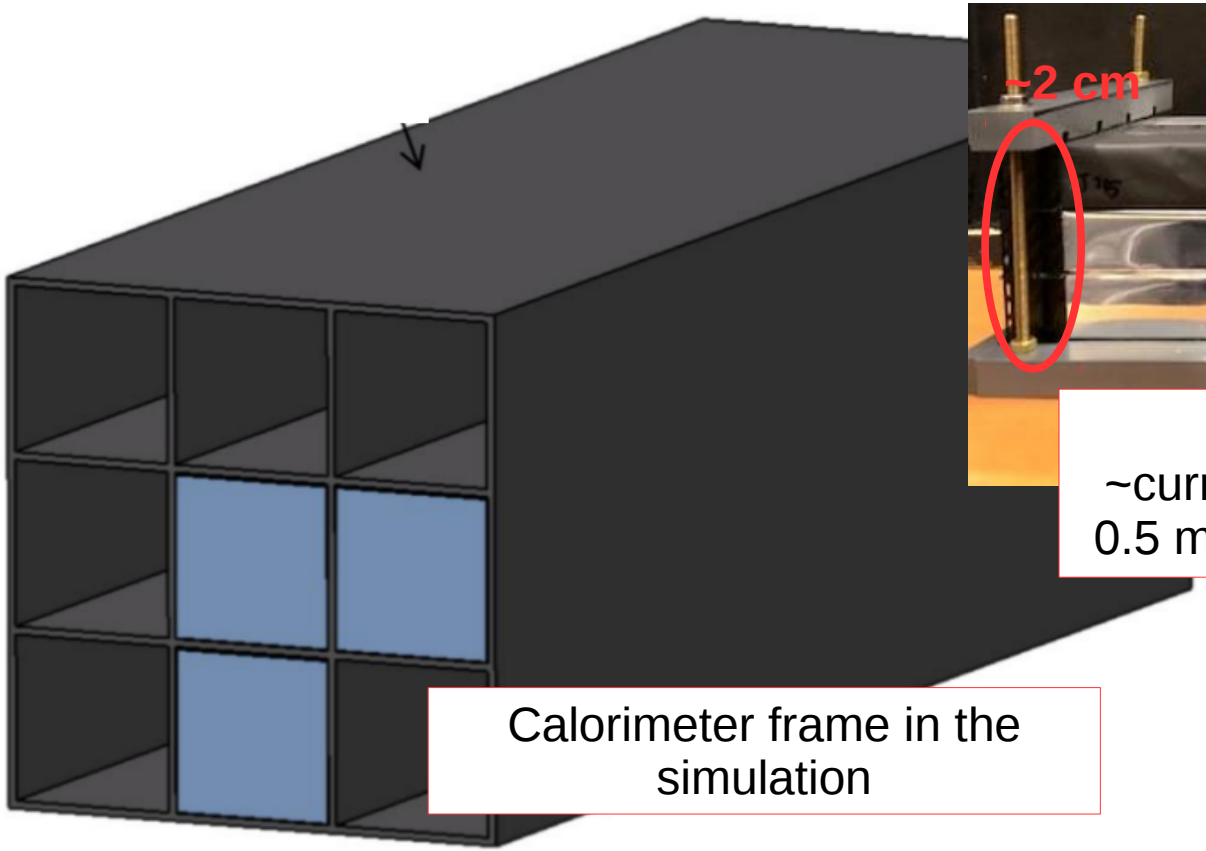
Institut de Physique Nucléaire d’Orsay

Ho San KO

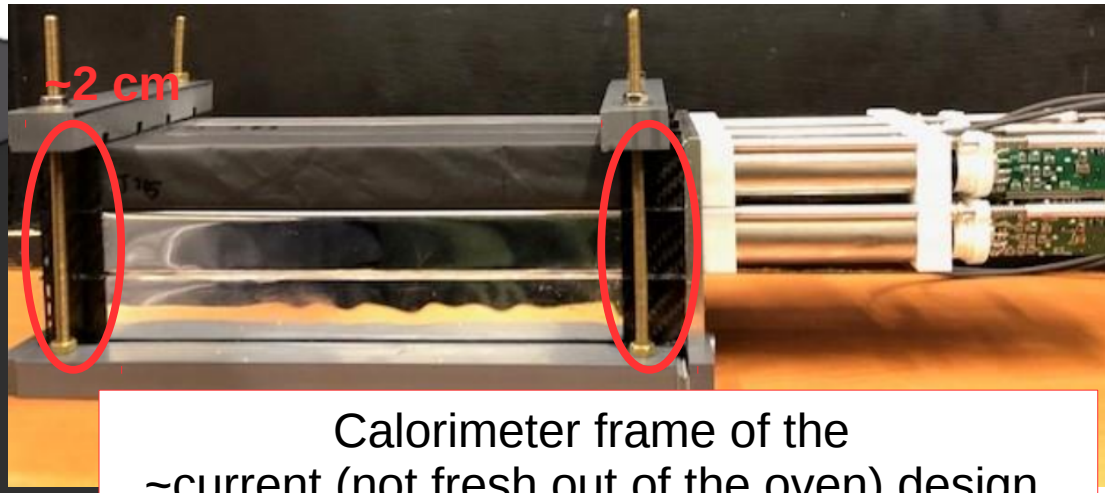
Outline

- Comparisons of
  - Energy resolution
  - Longitudinal energy deposition
  - Lateral energy deposition
- with different material of the frame
  - No gap; no frame
  - 1mm of air
  - 1mm of carbon

Simulation setup



Calorimeter frame in the simulation

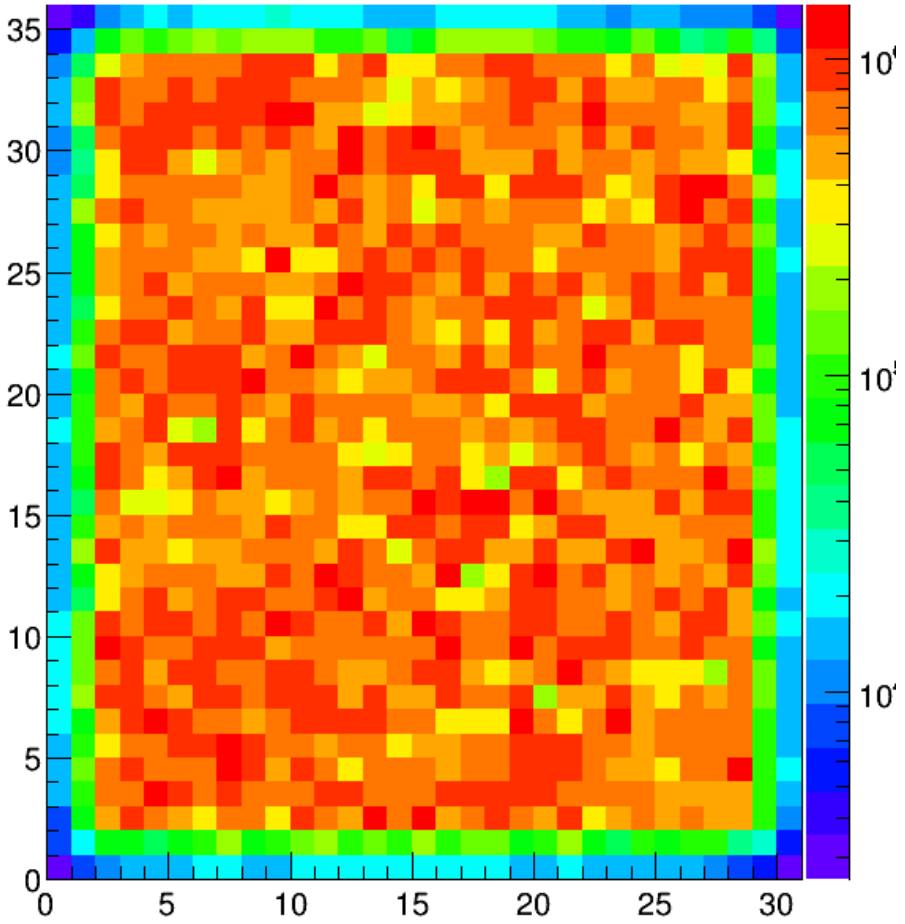


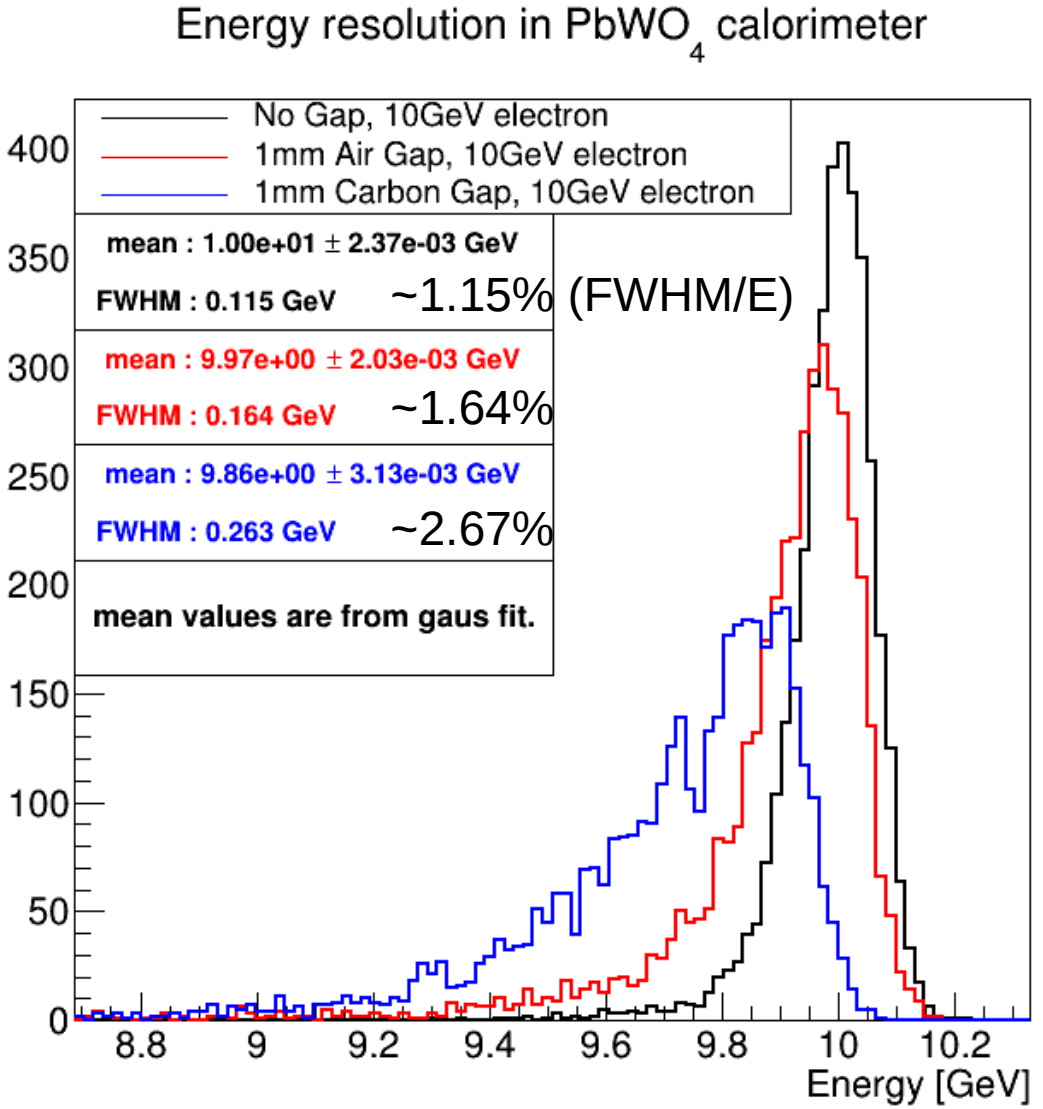
Calorimeter frame of the ~current (not fresh out of the oven) design. 0.5 mm carbon frame(red circle) + VM2000.

Each crystal of calorimeter is fully enclosed by a material of the frame.
They are also wrapped with VM2000.

Material in the simulation :
- No gap(no frame) between the crystals. Only VM2000 wrapper
- 1mm air gap + VM2000
- 1mm carbon gap + VM2000

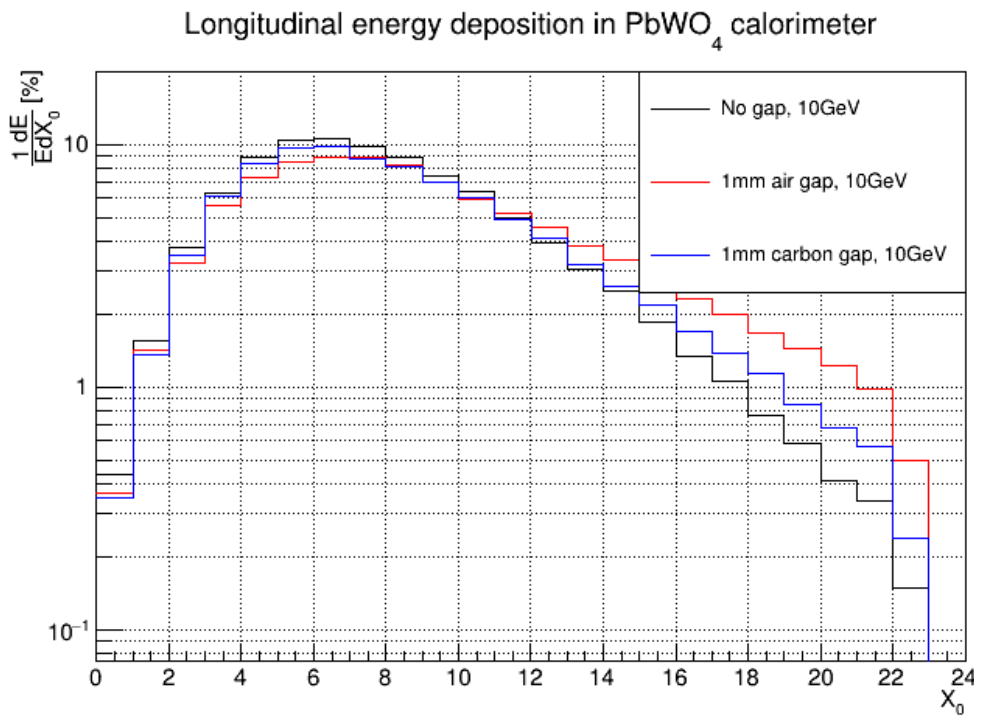
Energy resolution comparisons

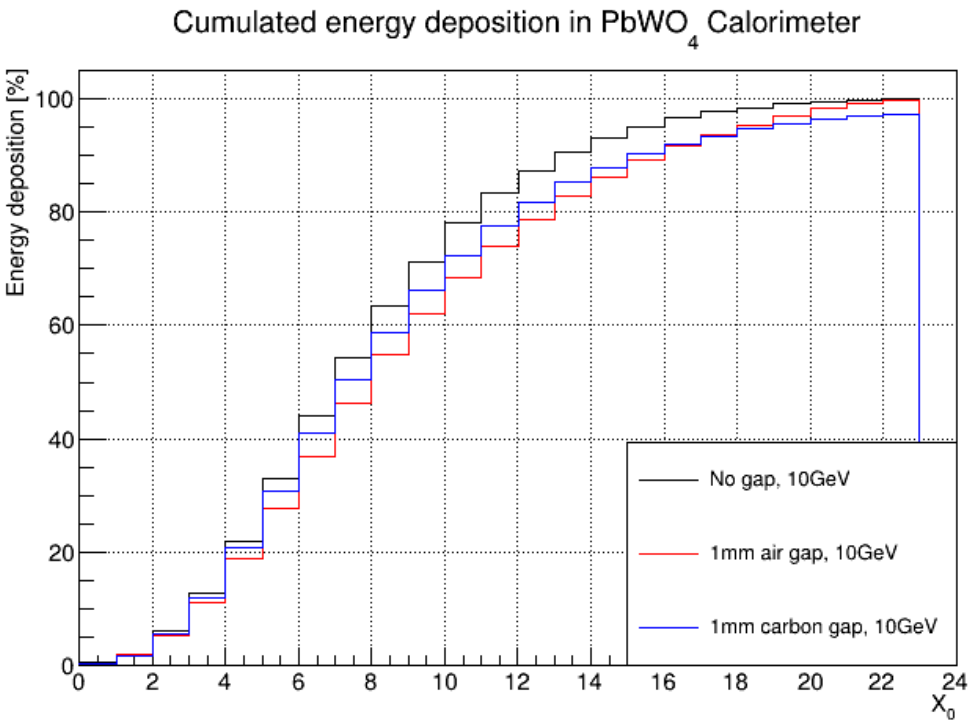




10GeV electrons spread across the calorimeter.
2 layers of crystals at the edge were ignored.

Longitudinal energy deposition comparisons

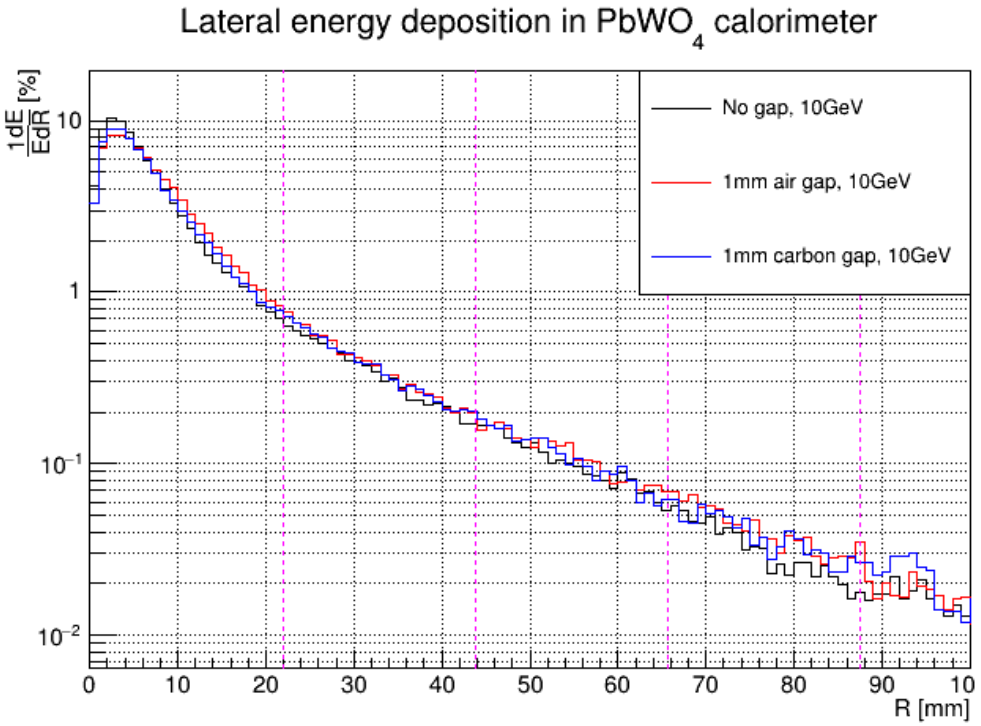


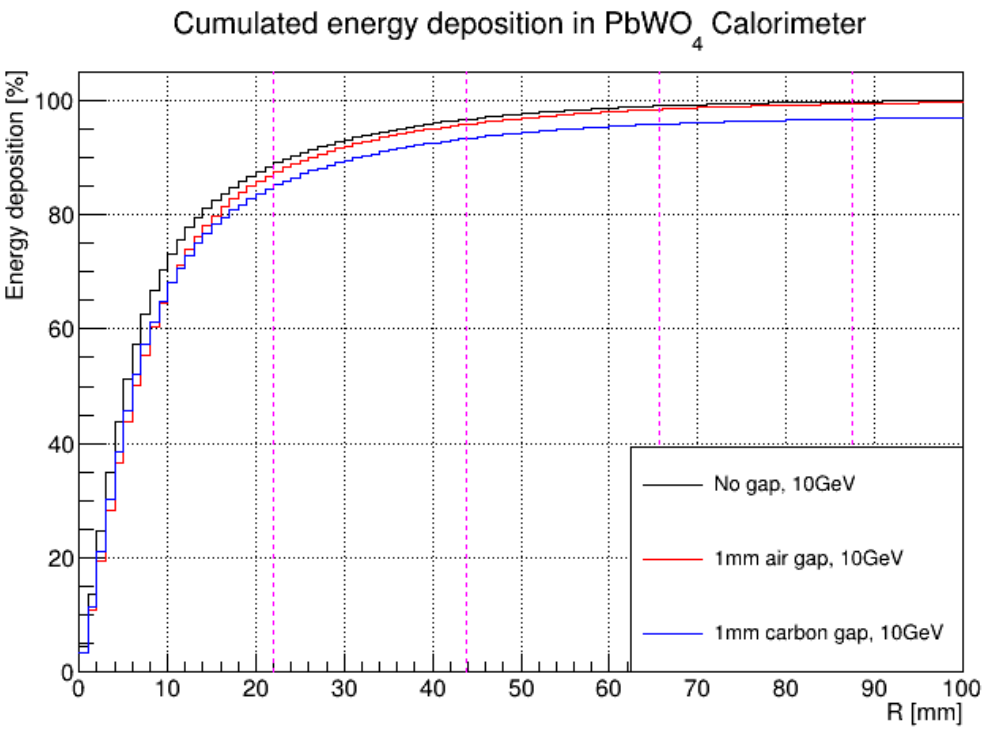


1mm air gap : ~100% energy deposition
1mm carbon gap : >95% energy deposition

Lateral energy deposition comparisons

Energy deposition in the cylinder with radius R





Energy deposition in 2 Molière radii

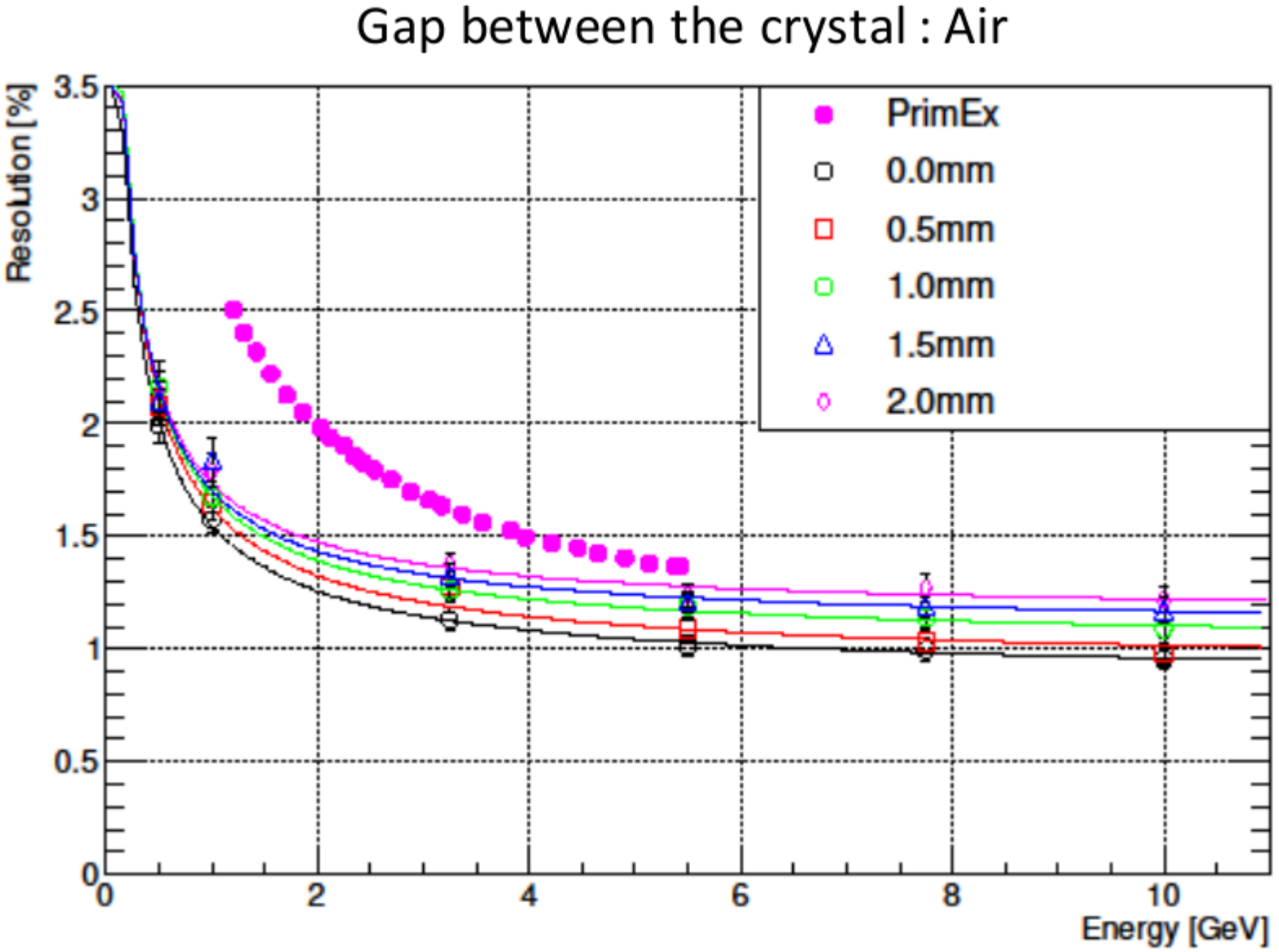
1mm air gap : >95% energy deposition

1mm carbon gap : ~93% energy deposition

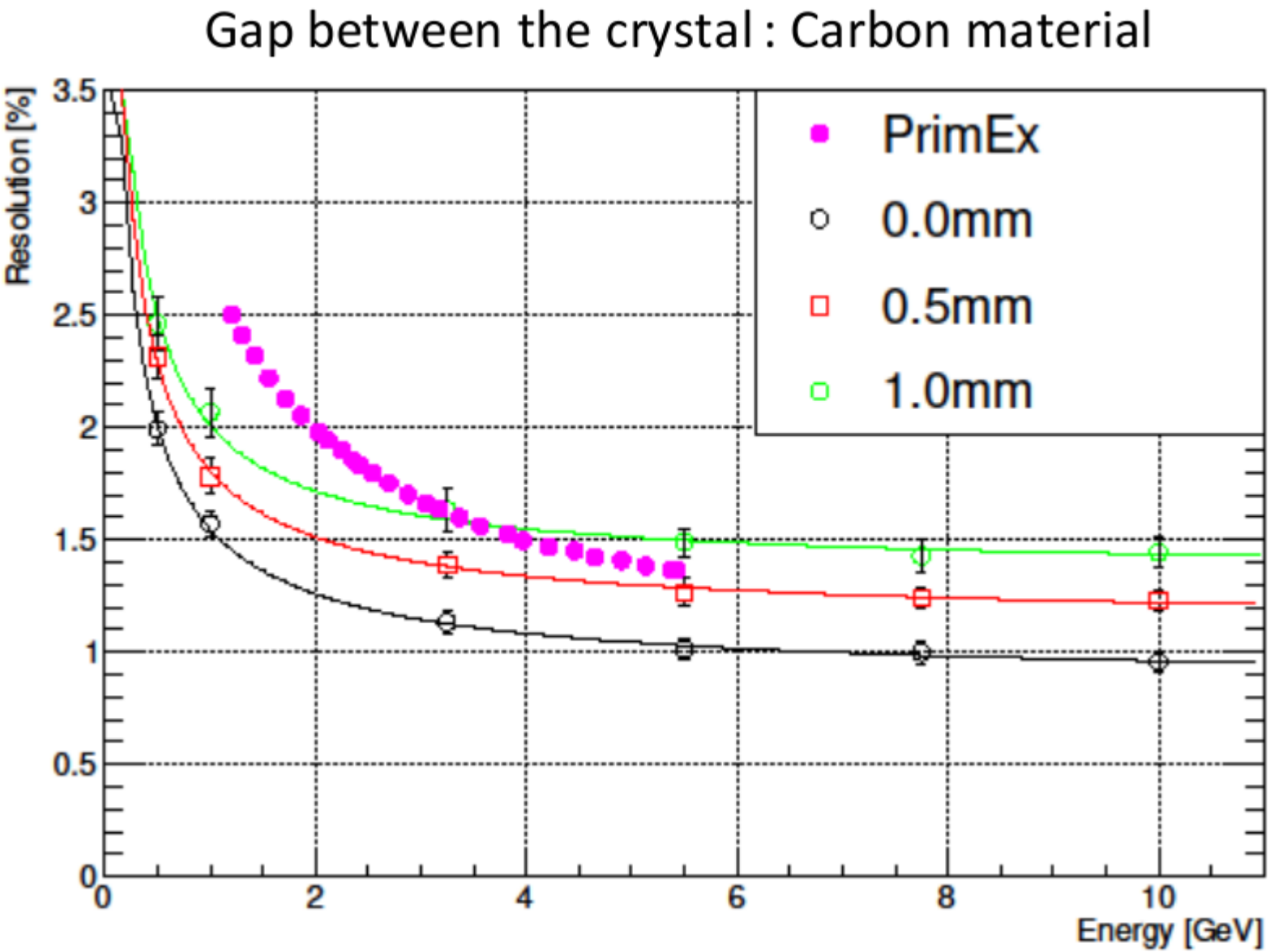
Summary

- Current design of the calorimeter frame should be closer to the 1mm air gap than to the 1mm carbon gap.
- Energy resolution(FWHM/Energy) changes ~1.2% to ~1.6% by changing from no gap to 1mm air gap.
- Total energy deposition is >95% in 2 Molière radii. with 1mm air gap and ~93% with 1mm carbon gap.

Backup



1% miscalibration
Resolution : sigma/mean of gaussian



1% miscalibration
Resolution : sigma/mean of gaussian