Effect of material in front of ECAL on energy resolution

Andrei Maltsev

23.10.2024, SPD Physics & MC

The task and the setup

- Structural material in front of ECAL (preliminary carbon fiber): $\sim$ 5 cm
- Task: consider different materials (carbon, iron, etc.) and different thicknesses to see impact on energy resolution of ECAL
- SPDROOT version 4.1.6 (using docker jemtchou/spdroot:4.1.6)
- This exercise $\rightarrow$ photons hitting perpendicularly to ECAL (to do: investigate case of larger angles)
- Three photon energies: 0.5 GeV, 1 GeV, 6 GeV
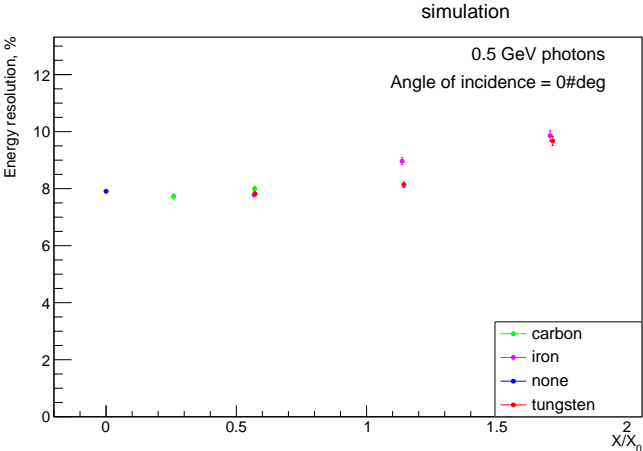
The methodology

simulation
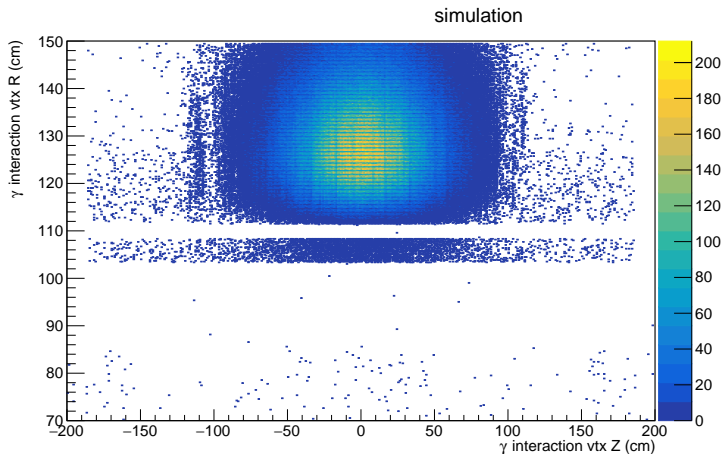
▶ material with given density placed $\approx$ 10 cm before ECAL barrel

Obtaining energy resolutions
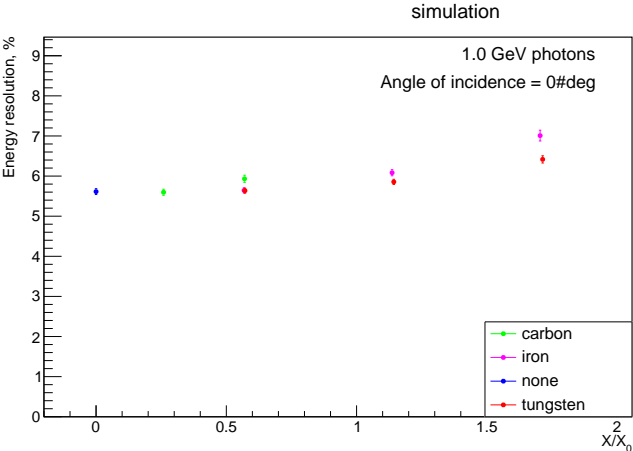
- ▶ Gaps in azimuthal angle → non-gaussian tail towards lower energies → fitting the gaussian part to get energy resolution
- ▶ Energy resolution = (width of peak) / (position of peak), no postprocess calibrations applied
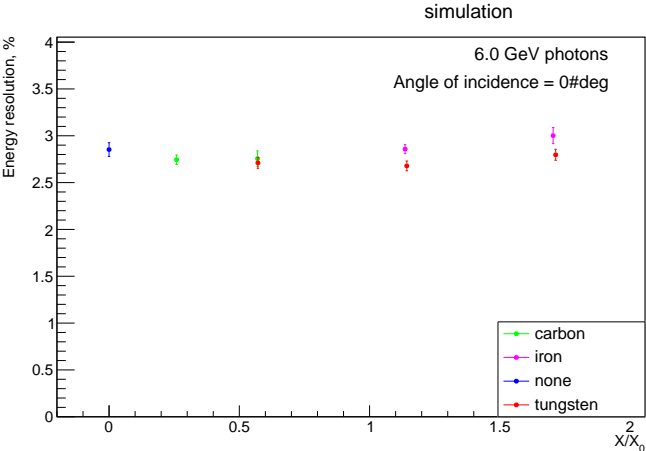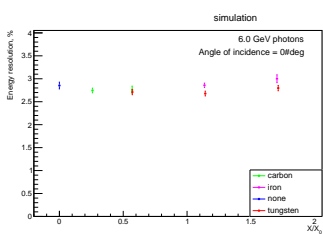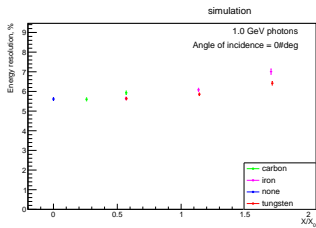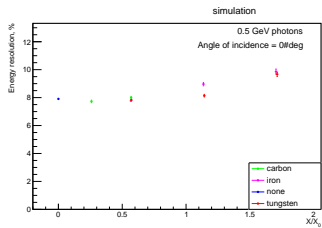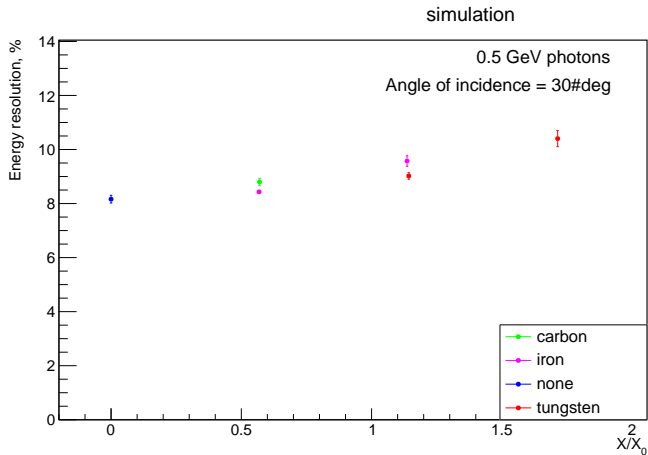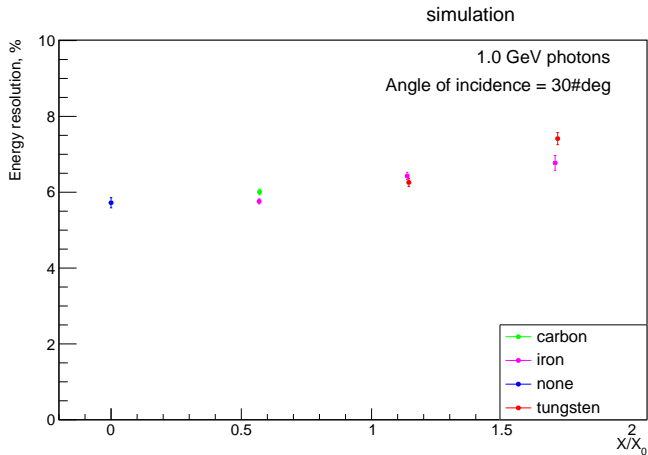- ▶ 5 cm carbon, 1 GeV
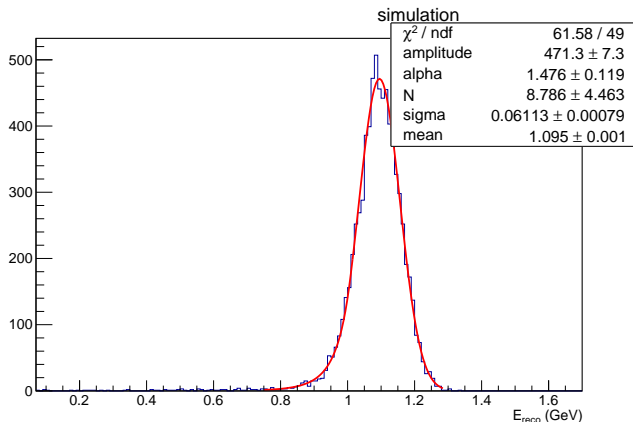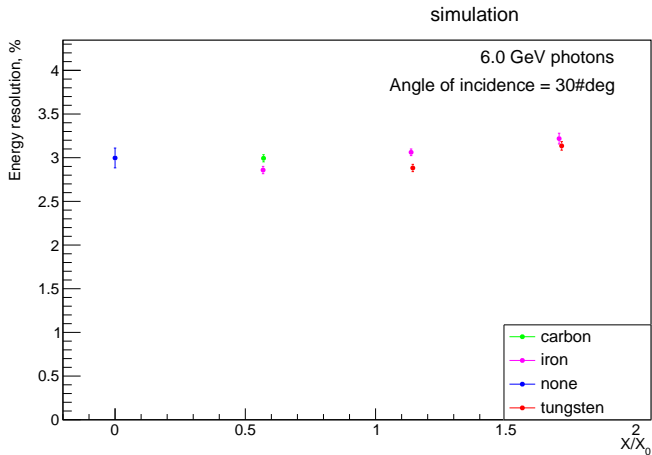
Results

Results

Results

Results
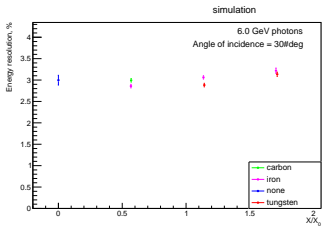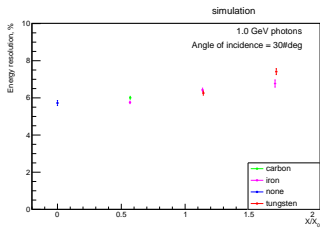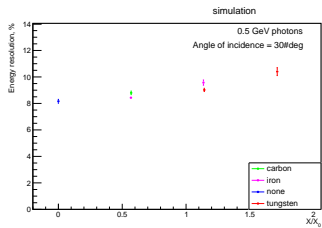
Results (30 degrees)

Results (30 degrees)

Results (30 degrees)

Results (30 degrees)

Conclusions/next steps

Conclusions:

- ▶ Material below 0.25 X_0: no significant impact on energy resolution
- ▶ 0.5 X_0 of extra material: energy resolution at low energies worse by $0.2 - 0.3\%$
- ▶ With more material, heavier material seems to be preferrable

Next steps:

- ▶ Impact of slices in Z/sectors in ϕ: efficiency, energy/position resolution