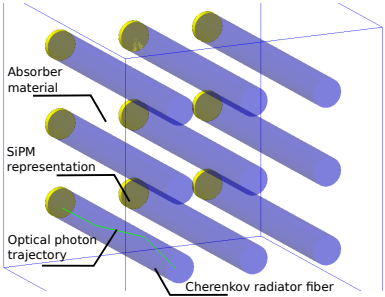
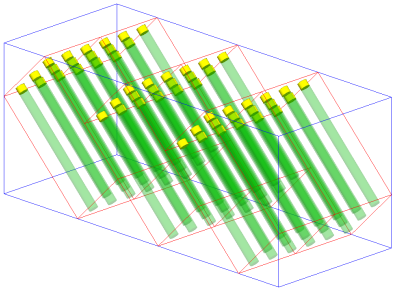
Update on direct photon calorimeter, Jaroslav Adam

- Expected yields and resolution for two versions
- Longitudinal and inclined fiber placement
- Full optics transport and sensor efficiency
- Comparison in yields and resolution will be shown in the next slides

Version 1: longitudinal fibers

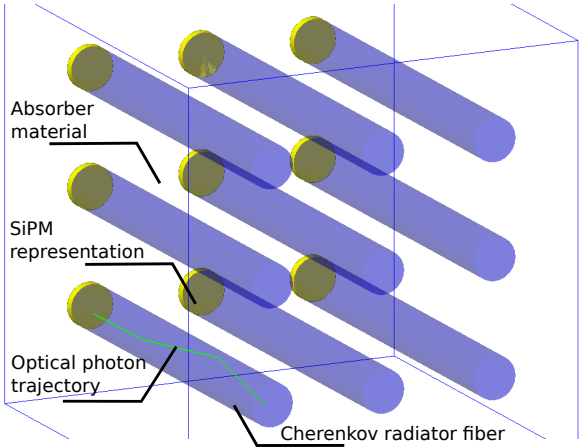


Version 2: inclined fibers



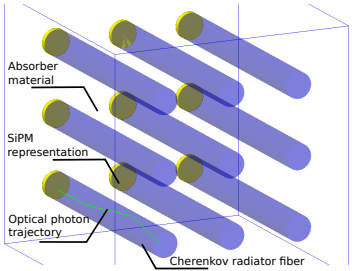
Version 1 – longitudinal fibers

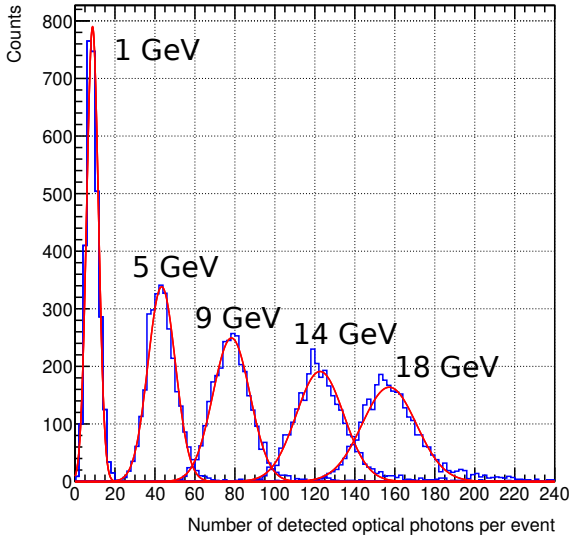
- Cherenkov quartz fibers in Cu absorber
- Parallel to shower axis, readout at the back
- Fibers of 1.5 mm diameter, 20 µm PMMA cladding, spacing of 4 mm
- Optical Cherenkov photons detected by SiPMs, groups of 3×3 act as single sensor
- Outer dimensions $\sim170\times170\times350$ mm



Optical photon yields for version 1 (longitudinal fibers)

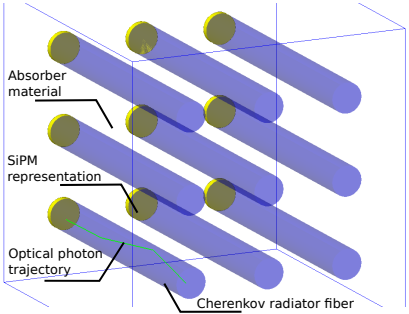
- Standalone Geant4 with optics transport
- Set of incident γ energies (labels 1 - 18 GeV)
- 3000 events simulated at each energy
- Plot shows number of optical photons detected by SiPMs in each event after applying 0.4 quantum efficiency

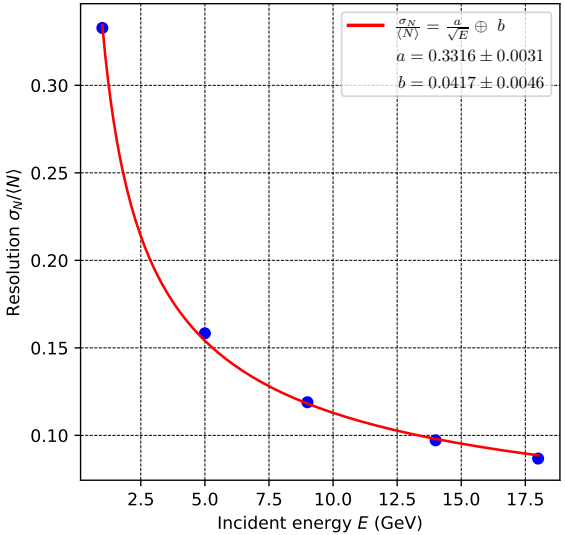




Energy resolution for version 1 (longitudinal fibers)

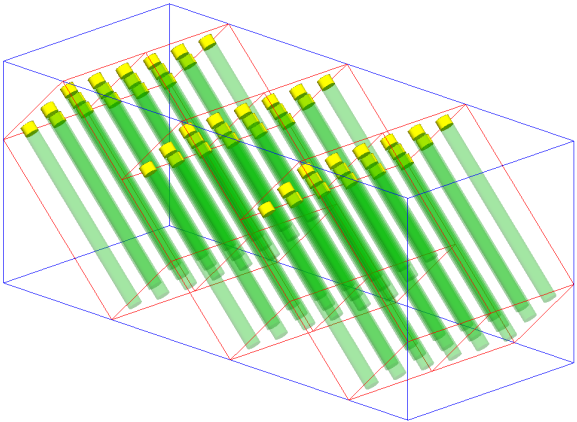
- Expected resolution as sigma/mean in detected photon counts from previous page
- 33%/$\sqrt{E}$ and 0.04 constant term

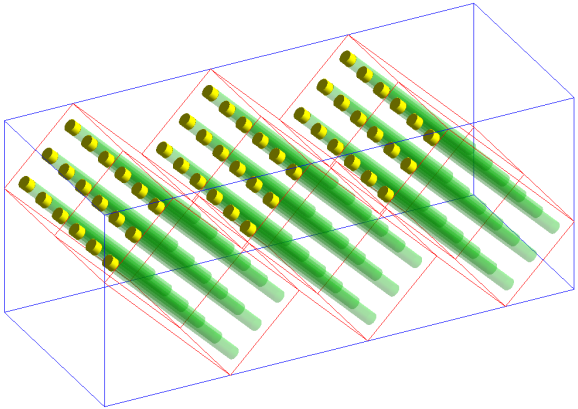




Version 2 – inclined fibers

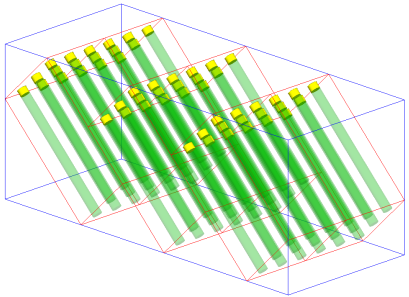
- Same fibers, sensors and absorber as in previous case of longitudinal placement
- Angle of 45° relative to incoming γ photons, expectation for better optical photon yields
- About same outer size as longitudinal version 1, length of inclided segments is 225 mm

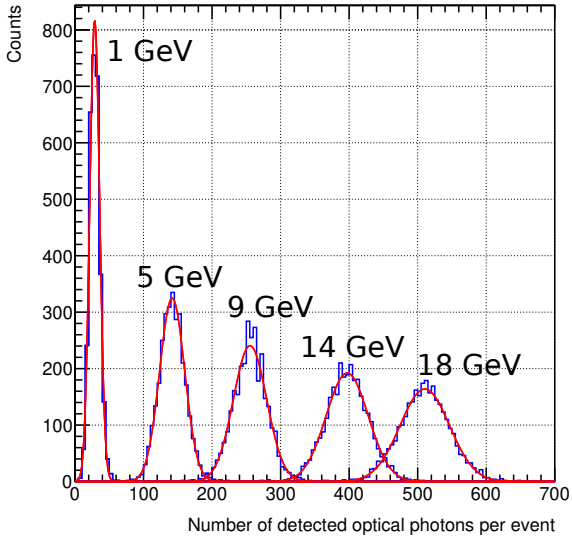




Optical photon yields for version 2 (inclided fibers)

- Same set of incident γ energies (plot labels)
- 3000 events at each energy (same as before)
- Plot shows detected optical photon counts, also after 0.4 quantum efficiency
- $3\times$ larger yields than in longitudinal version, the only cost is no vertical segmentation





Energy resolution for version 2 (inclinded fibers)

- Resolution as sigma/mean in detected photon counts (same procedure as before)
- 25%/$\sqrt{E}$ and 0.04 constant term (was 33% in longitudinal case)
- Next steps include trapezoidal light guide at the end of the fibers and realistic noise by dark counts