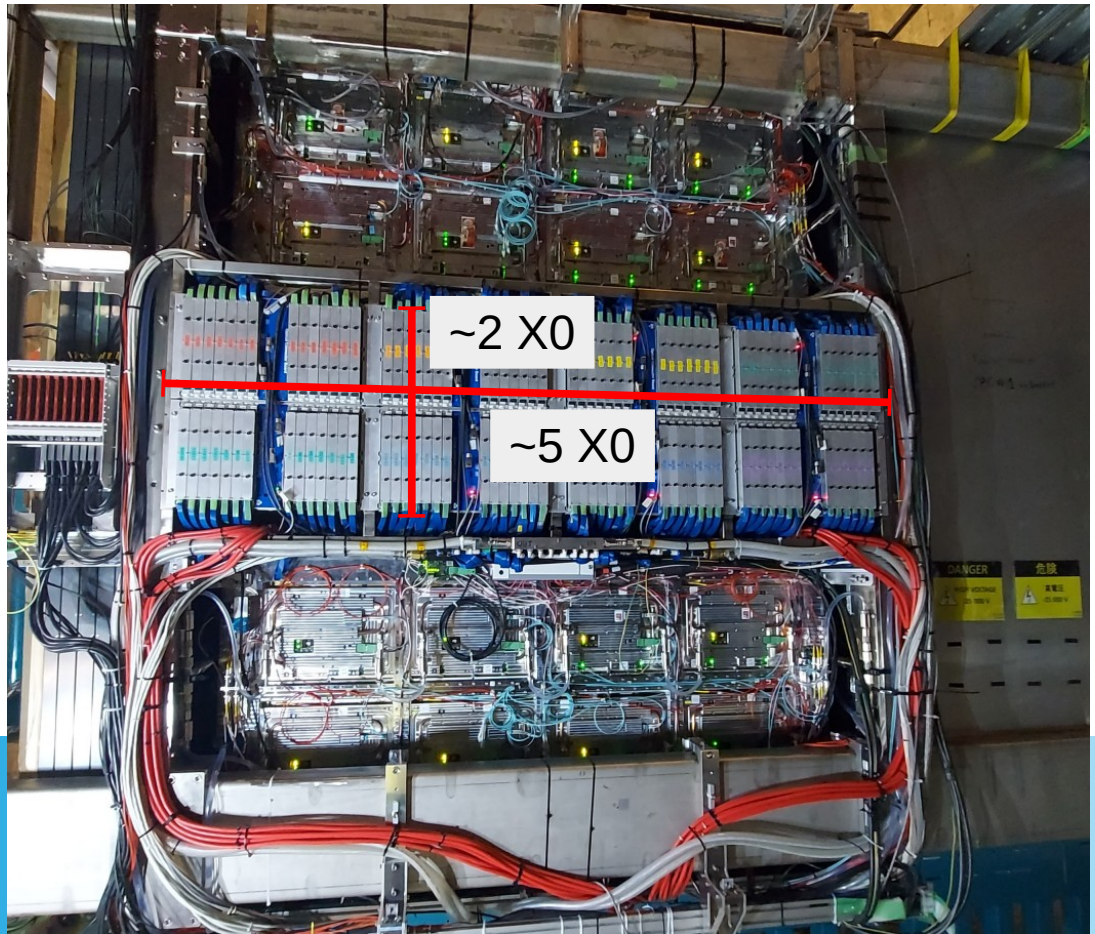
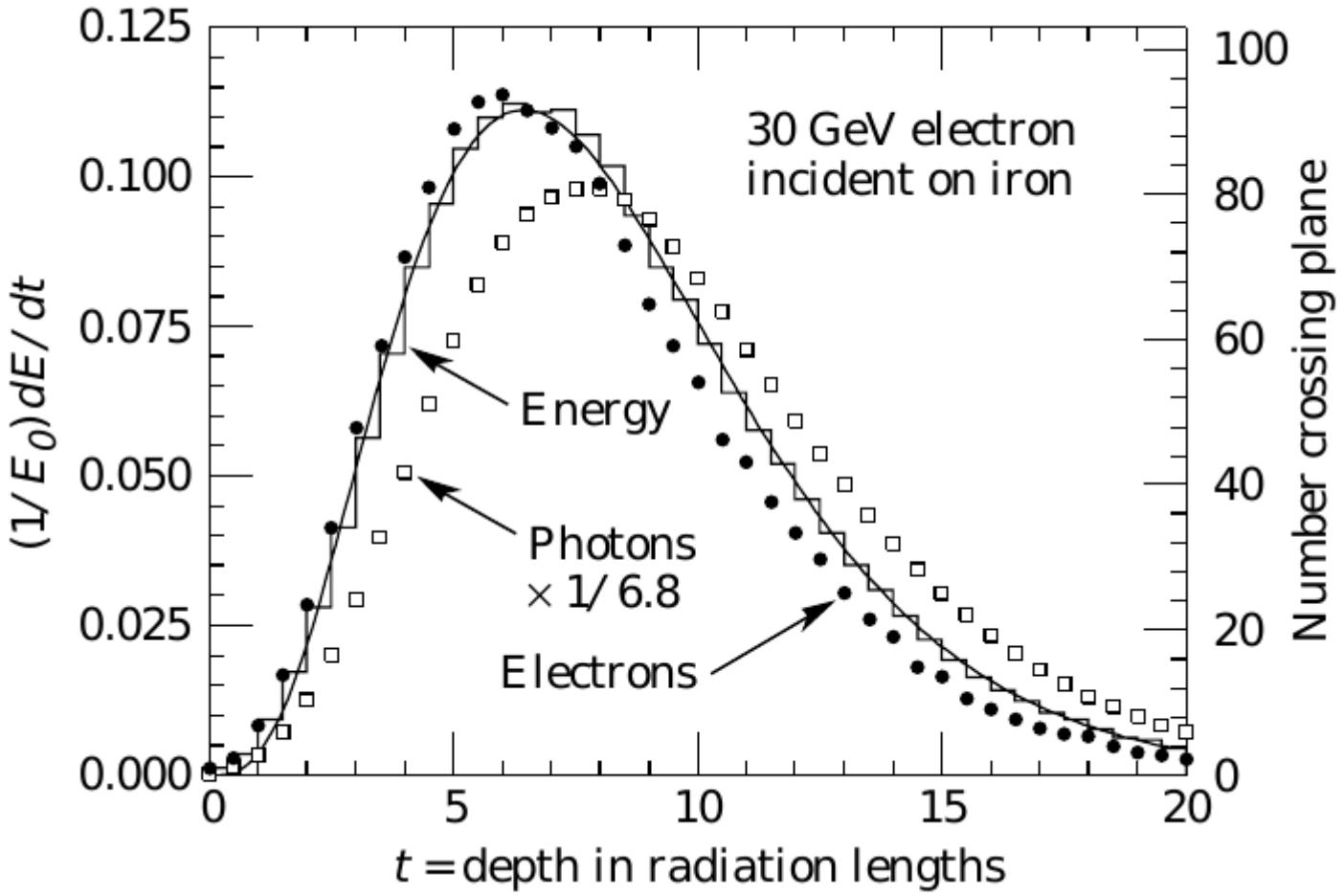
Short reminder of calorimetry

- The development of an electromagnetic shower is governed by the radiation length X0
- $X0 =\sim 1/Z^2$ 5 mm lead, 40 cm for plastic scintillator



PDG


0.125
0.100
0.075
0.050
0.025
0.000
0
5
10
15
20
100
80
60
40
20
0
$(1/E_0)dE/dt$
Number crossing plane
t = depth in radiation lengths
30 GeV electron
incident on iron
Energy
Photons
× 1/6.8
Electrons

Using the PDG formula

Energy released

1 GeV electron in plastic scint.

The mean longitudinal profile of the energy deposition in an electromagnetic cascade is reasonably well described by a gamma distribution [55]:

$$\frac{dE}{dt} = E_0\, b\, \frac{(bt)^{a-1} e^{-bt}}{\Gamma(a)} \tag{27.29}$$

The maximum $t_{\max}$ occurs at $(a-1)/b$. We have made fits to shower profiles in elements ranging from carbon to uranium, at energies from 1 GeV to 100 GeV. The energy deposition profiles are well described by Eq. (27.29) with

$$t_{\max} = (a-1)/b = 1.0 \times (\ln y + C_j)\ , \qquad j = e, \gamma\ , \tag{27.30}$$

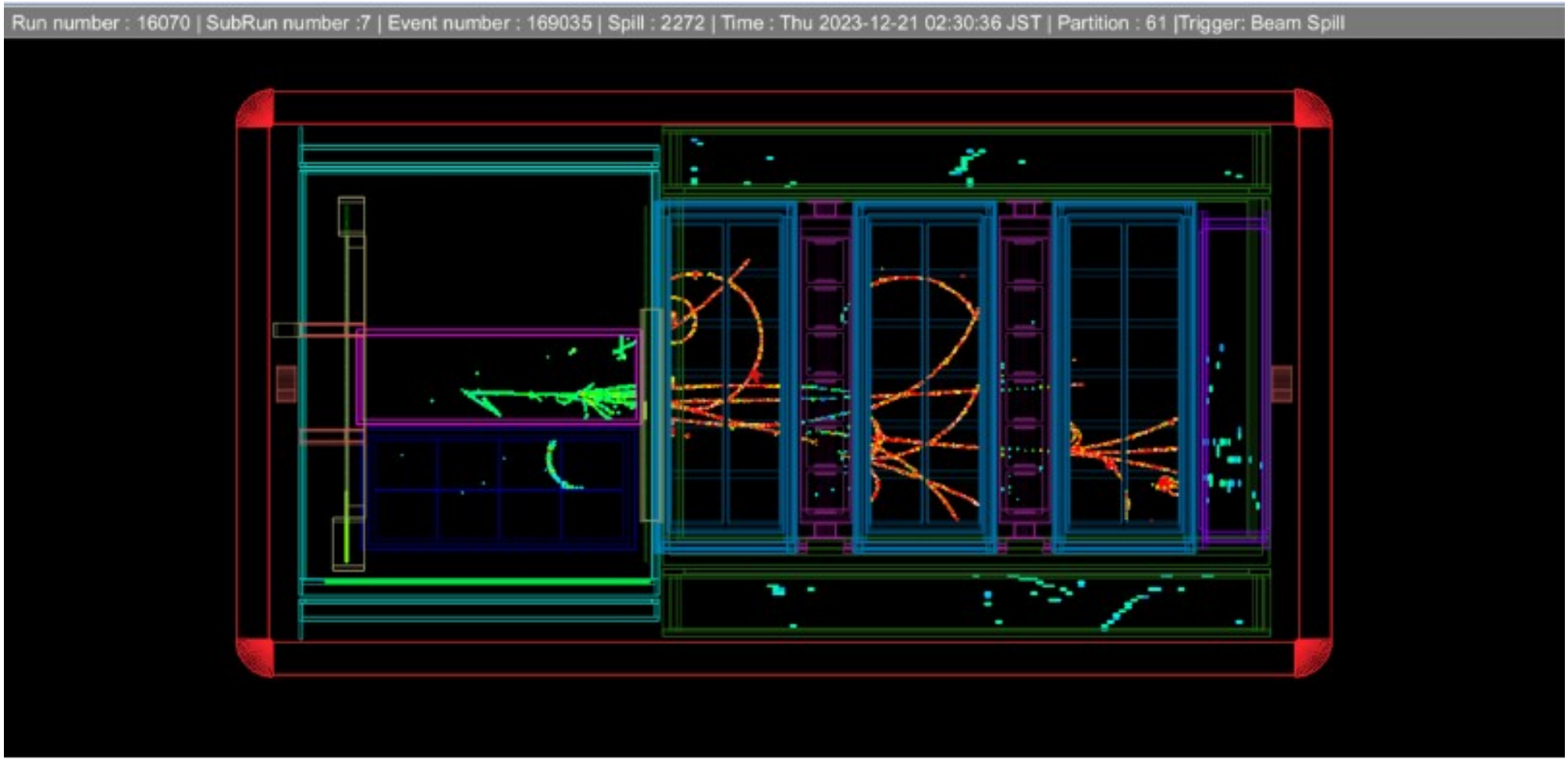
where $C_e = -0.5$ for electron-induced cascades and $C_\gamma = +0.5$ for photon-induced cascades. To use Eq. (27.29), one finds $(a-1)/b$ from Eq. (27.30) and Eq. (27.28), then finds a either by assuming $b \approx 0.5$ or by finding a more accurate value from Fig. 27.18.

Depth in X0

Fraction of Energy deposited within 2 (5) X0 = 30% (81%)
Probably large fluctuations

Electron energy reconstruction

- For nu_e interactions within SFGD
- Only partial (or very partial) containment within SFGD
- It will be difficult to catch the tail of the shower, especially the photons
- If decent energy reconstruction is required, I think the sample SFGD (single electron) + VTPC (or HATPC) can provide a


Run number : 16070 | SubRun number :7 | Event number : 169035 | Spill : 2272 | Time : Thu 2023-12-21 02:30:36 JST | Partition : 61 |Trigger: Beam Spill