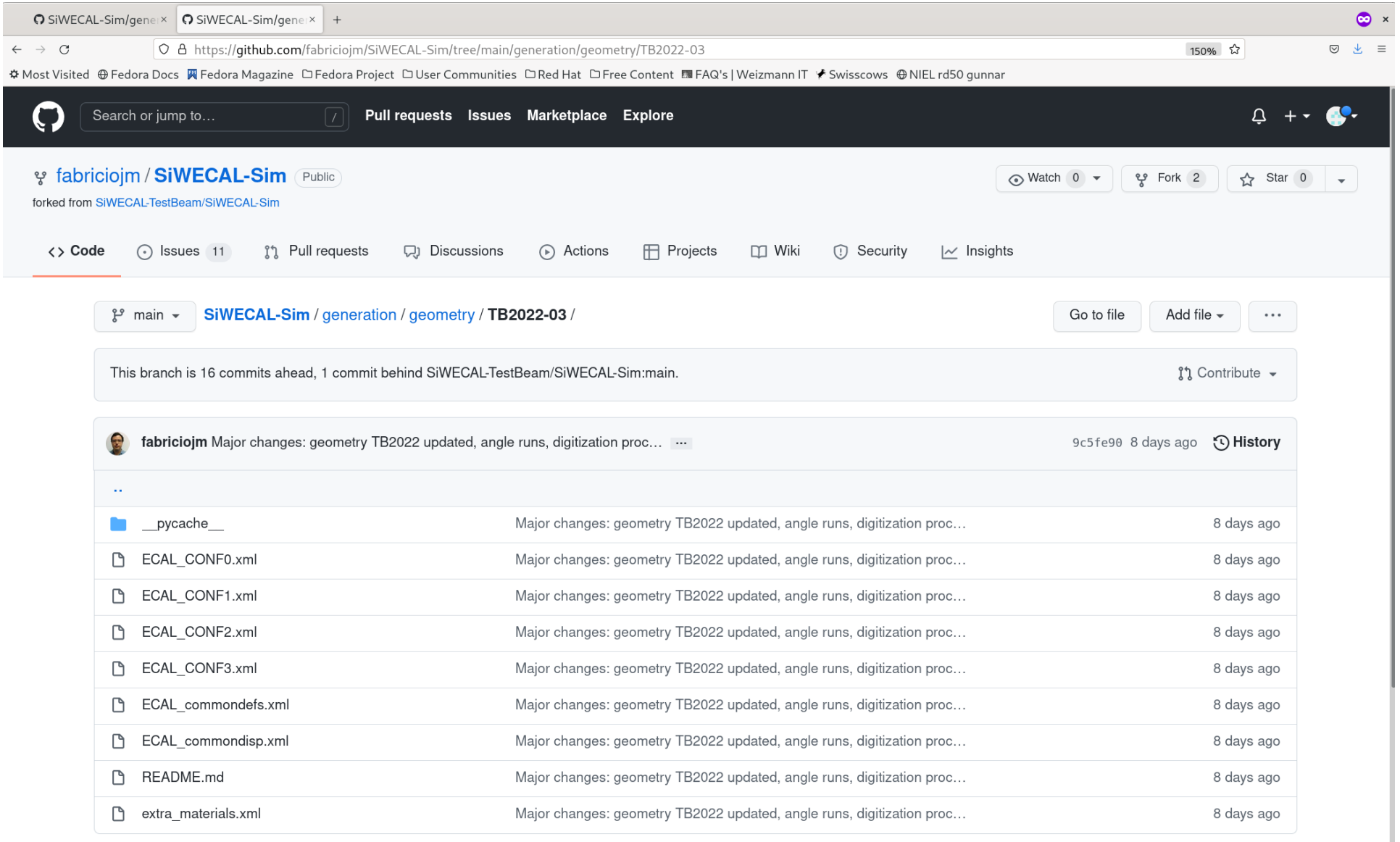
Towards a new implementation of CALICE ECal in LUXE GEANT4 Simulation

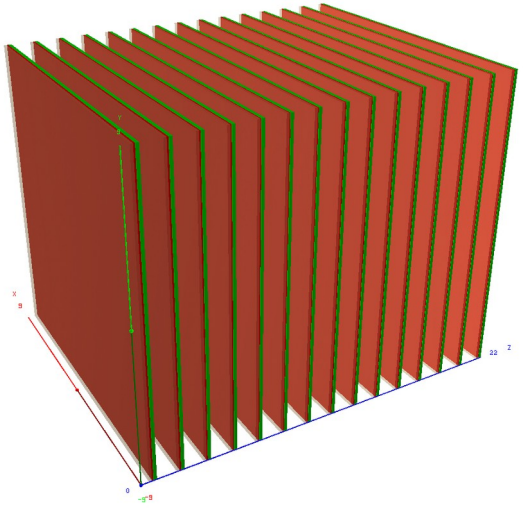
Oleksandr Borysov

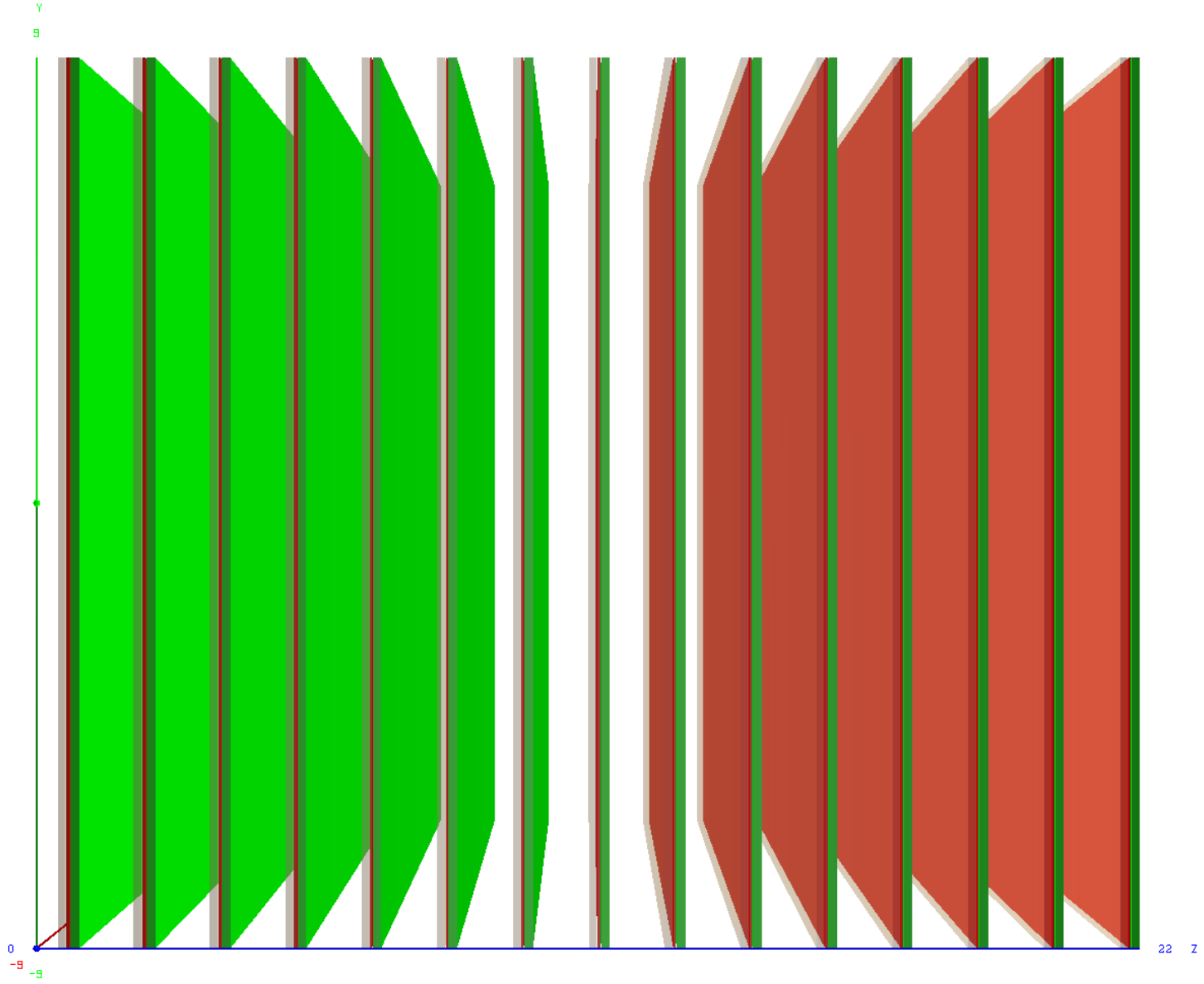
LUXE ECal Meeting
April 28, 2022

CALICE ECAL github repository

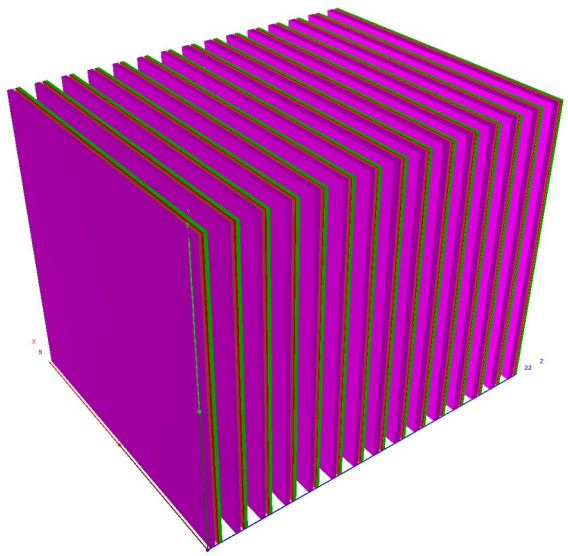


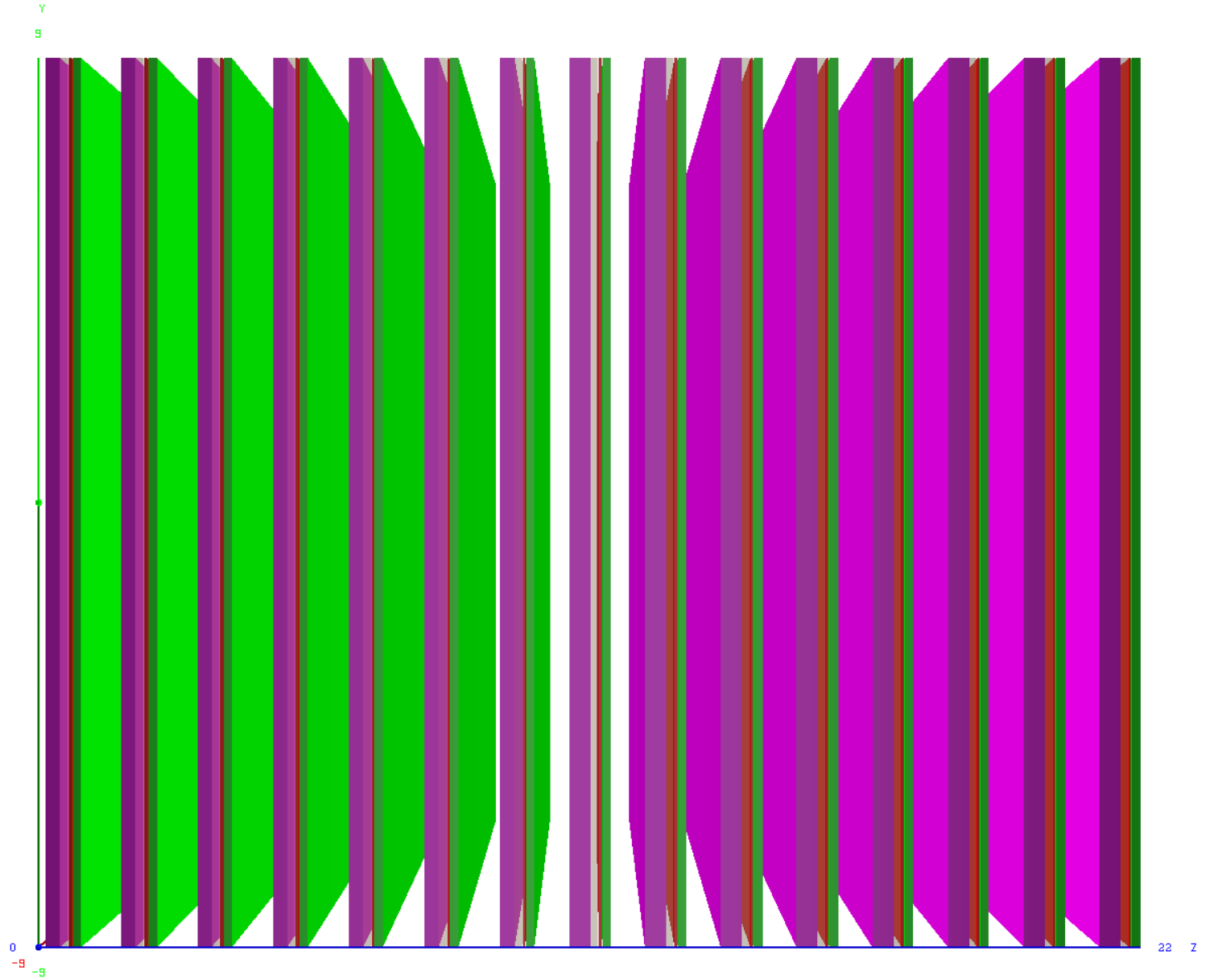
ECAL_CONF0.xml



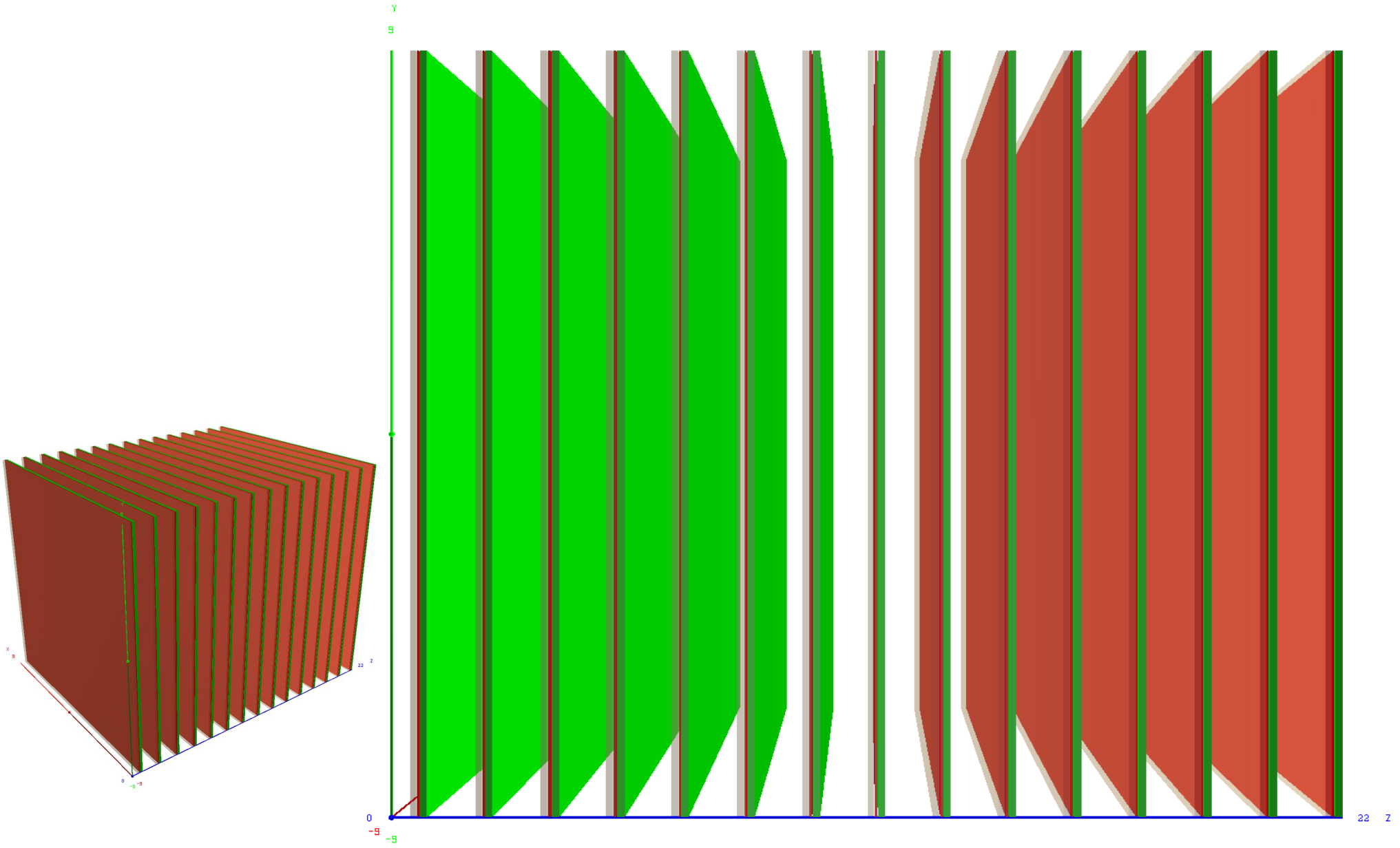


ECAL_CONF1.xml

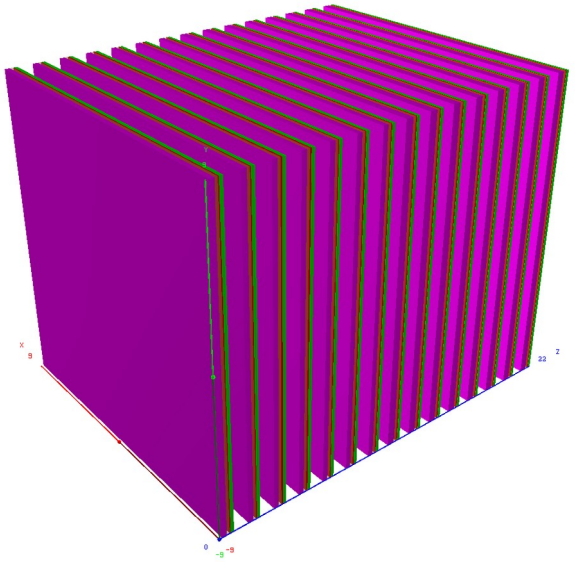


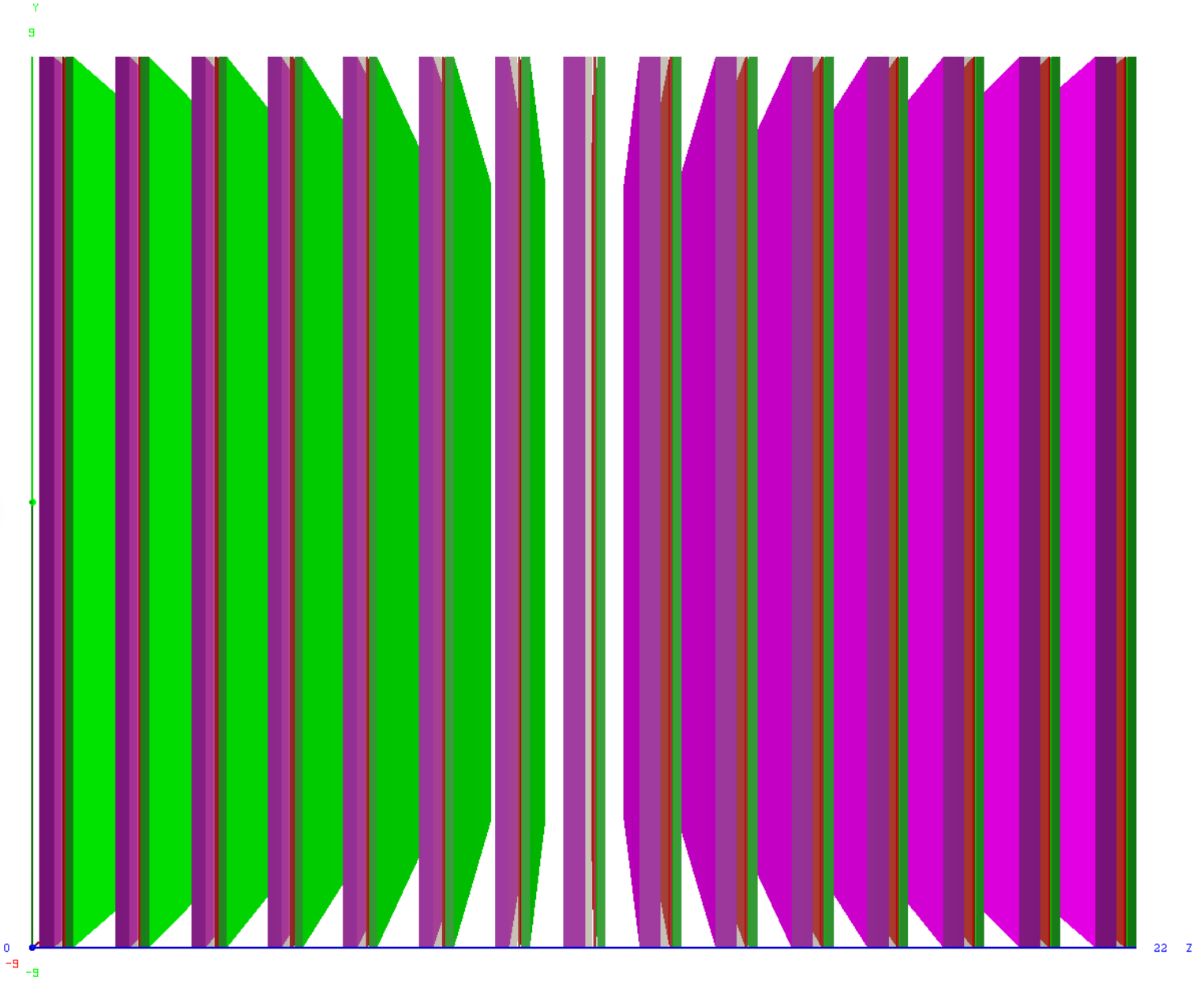


ECAL_CONF2.xml



ECAL_CONF3.xml



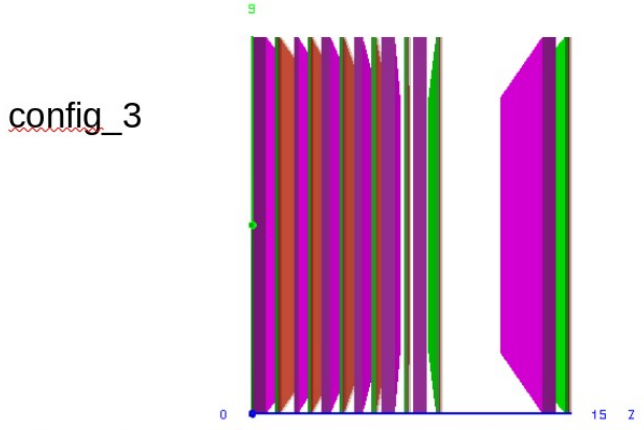


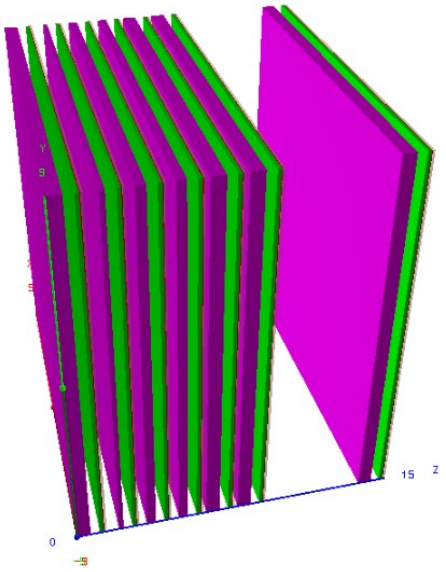
CALICE ECal dd4hep implementation used for LUXE

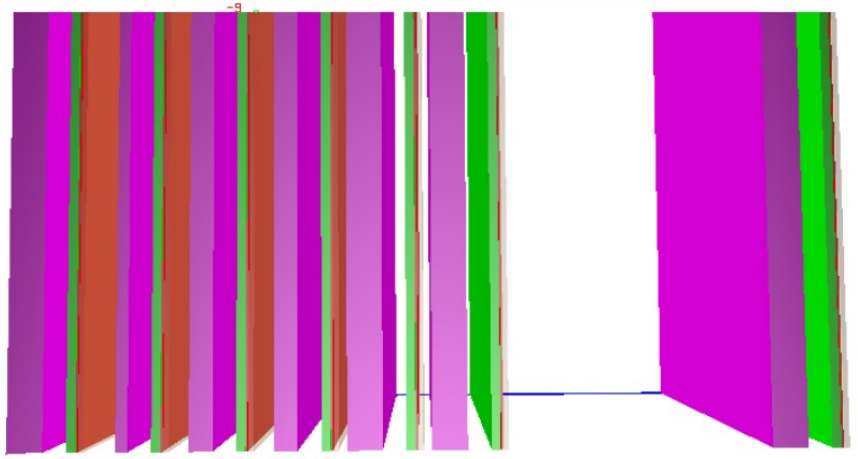
CALICE Ecal

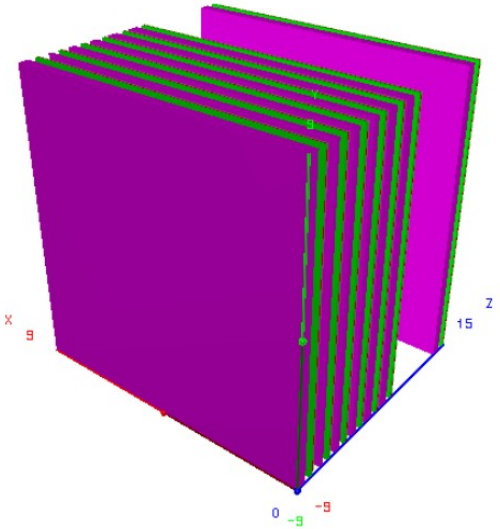
- DD4Hep implementation;
- most probably for beam tests, 3 configurations.

config_3





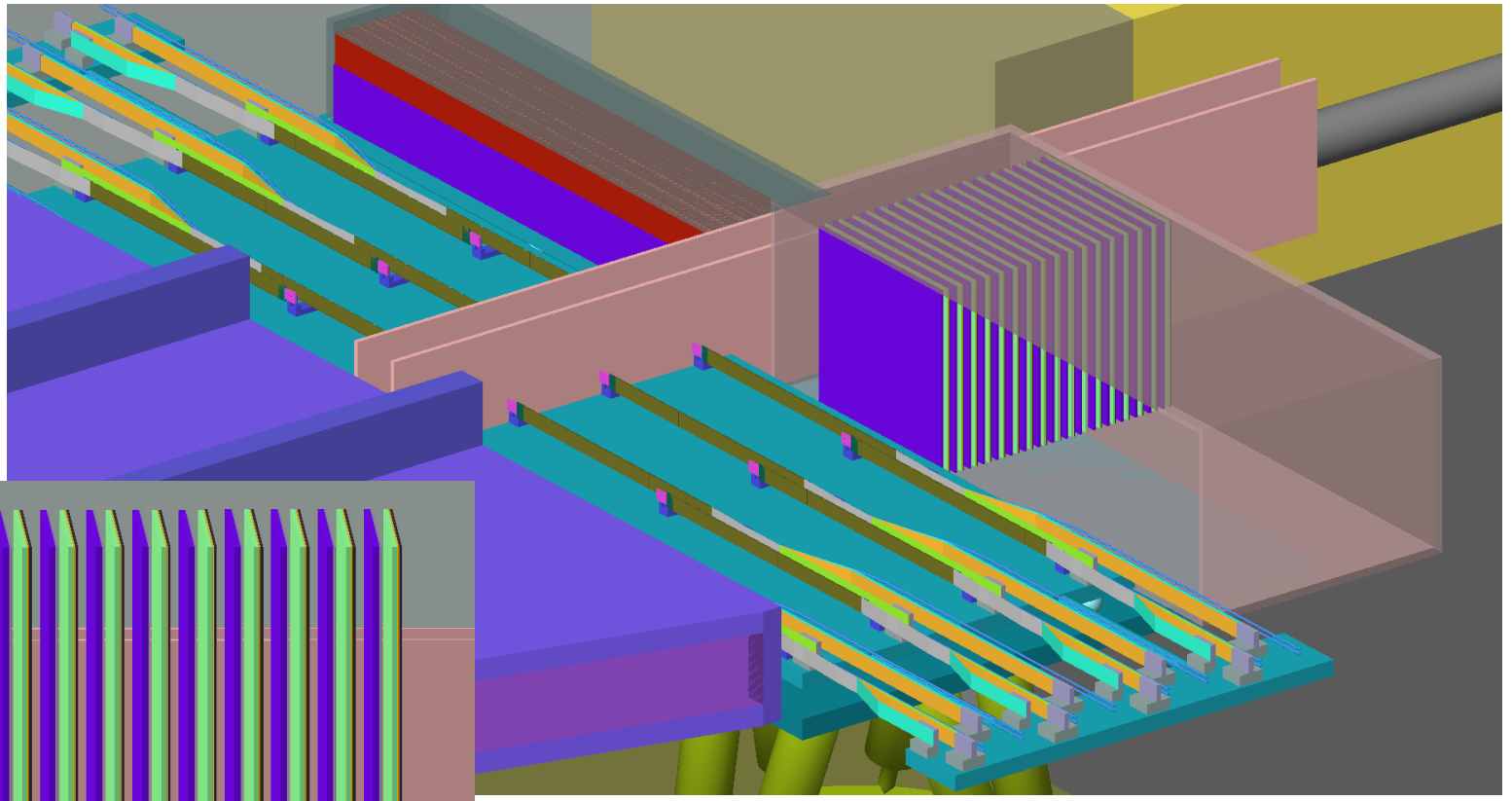


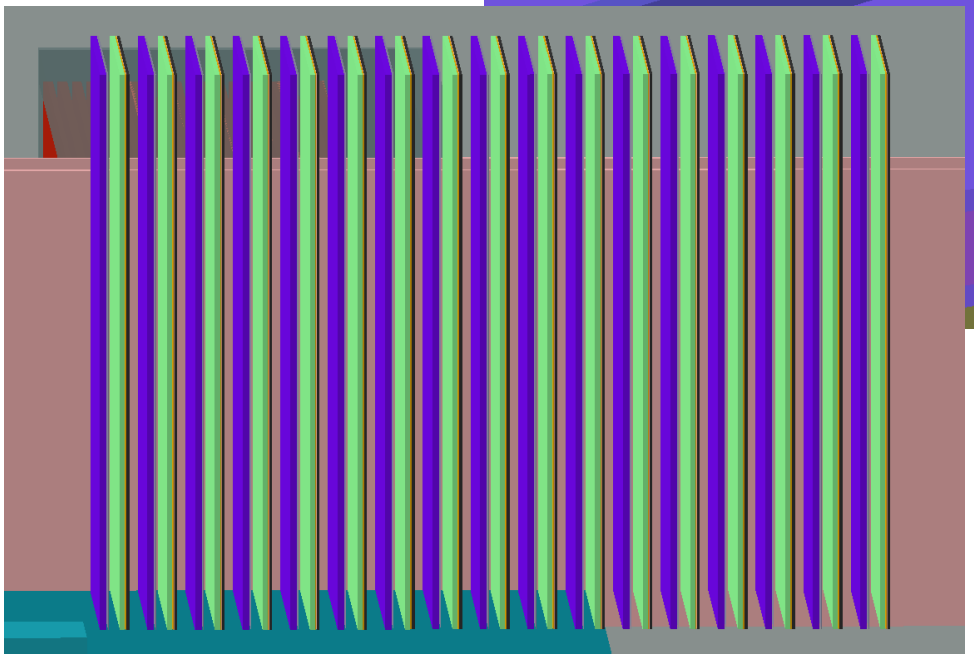


LUXE S&A Meeting
October 19, 2021

https://indico.desy.de/event/31945/contributions/111596/attachments/69311/87786/luxe_sim_update_19102021.pdf

CALICE ECal in LUXE



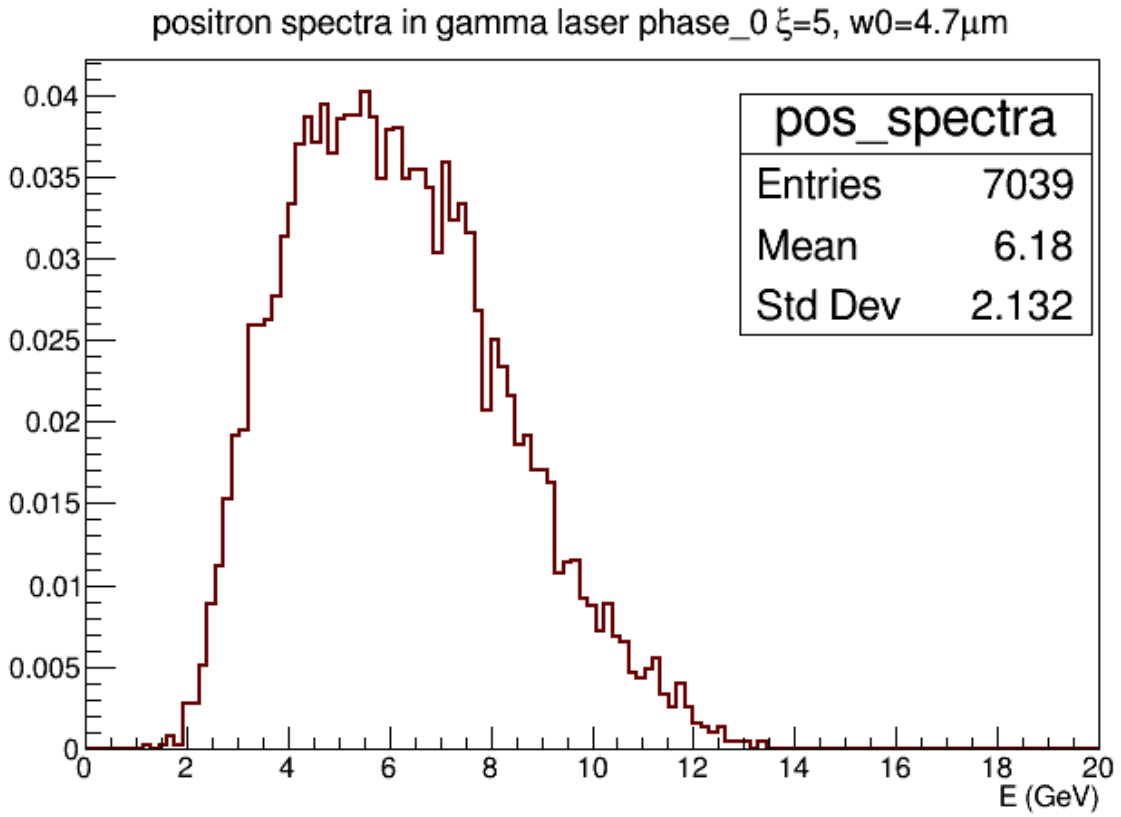


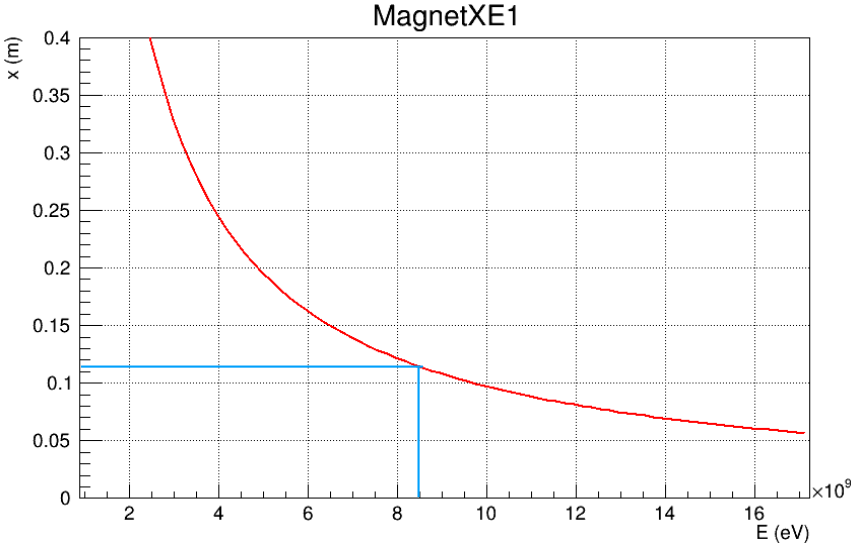
```
Ecal_LayerDistance = 15.0*mm; // <!-- this is the period -->

Ecal_slab_thickness = 6.73*mm;

Ecal_AlThickness = 0.1*mm; // <!-- there is also a 1.7mm thickness "plaque Al" but it doesn't cover whole surface, I think, just the edge-->
Ecal_PcbThickness = 1.61*mm;
Ecal_GlueThickness_pcb = 0.08*mm;
Ecal_WaferThickness = 0.325*mm;
Ecal_GlueThickness_kap = 0.08*mm;
Ecal_KaptonThickness = 0.06*mm;
Ecal_CFThickness = 0.9*mm;

//  <!-- this is the gap within a slab (electronics, etc) -->
Ecal_GapThickness = Ecal_slab_thickness - Ecal_AlThickness - Ecal_PcbThickness - Ecal_WaferThickness - Ecal_KaptonThickness
                    - Ecal_CFThickness - Ecal_GlueThickness_pcb - Ecal_GlueThickness_kap;

Ecal_WThickness = 2.1*mm;

Ecal_w_slab_gap1 = 0.5*mm;
Ecal_w_slab_gap2 = Ecal_LayerDistance-3*Ecal_WThickness-Ecal_slab_thickness-Ecal_w_slab_gap1;
```

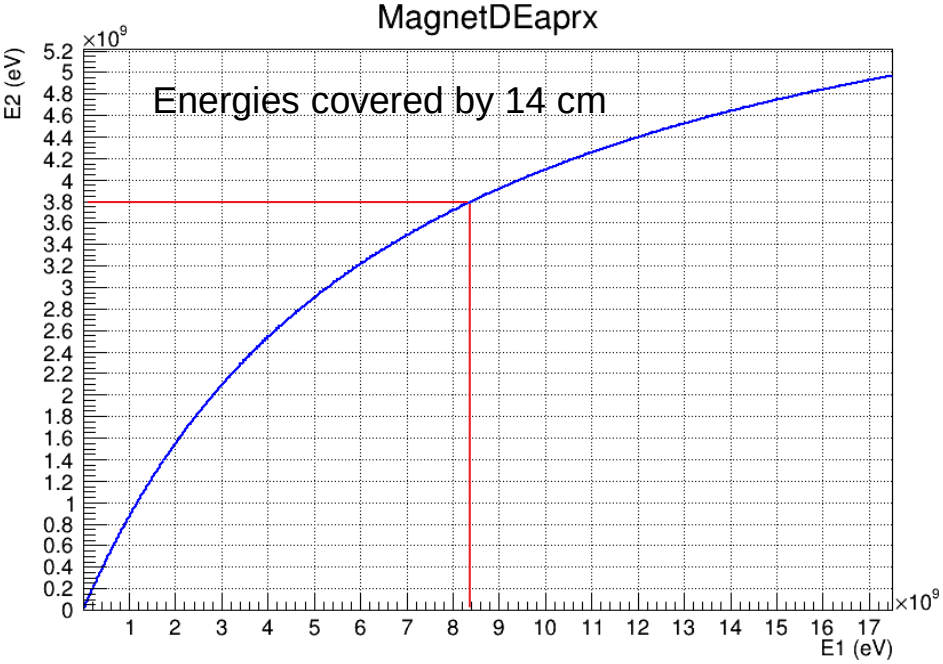
```
std::vector<G4double> lcthickness = {2.0*Ecal_WThickness, Ecal_WThickness, Ecal_w_slab_gap1, Ecal_AlThickness, Ecal_GapThickness, Ecal_PcbThickness,
                                     Ecal_GlueThickness_pcb, Ecal_WaferThickness, Ecal_GlueThickness_kap, Ecal_KaptonThickness, Ecal_CFThickness,
                                     Ecal_w_slab_gap2};
std::vector<G4String> lcmaterial = {"G4_AIR", "CaliceTungstenDens1910", "G4_AIR", "G4_Al", "G4_AIR", "CalicePCB", "G4_AIR", "G4_Si", "G4_AIR",
                                    "G4_Cu", "G4_C", "G4_AIR"};
std::vector<G4String> lcname = {"AirGap", "CaliceAbsorber", "AirGap", "CaliceAl", "AirGap", "CalicePCB", "AirGap", "CaliceSi", "AirGap",
                                "CaliceCu", "CaliceCarbonFiber", "AirGap"};
```

CALICE Ecal position

/nfs/dust/luxe/group/MCProduction/Signal/ptarmigan-v0.8.1/brem-laser/phase0/gpc/b0gpc_5.0_0_particles.h5

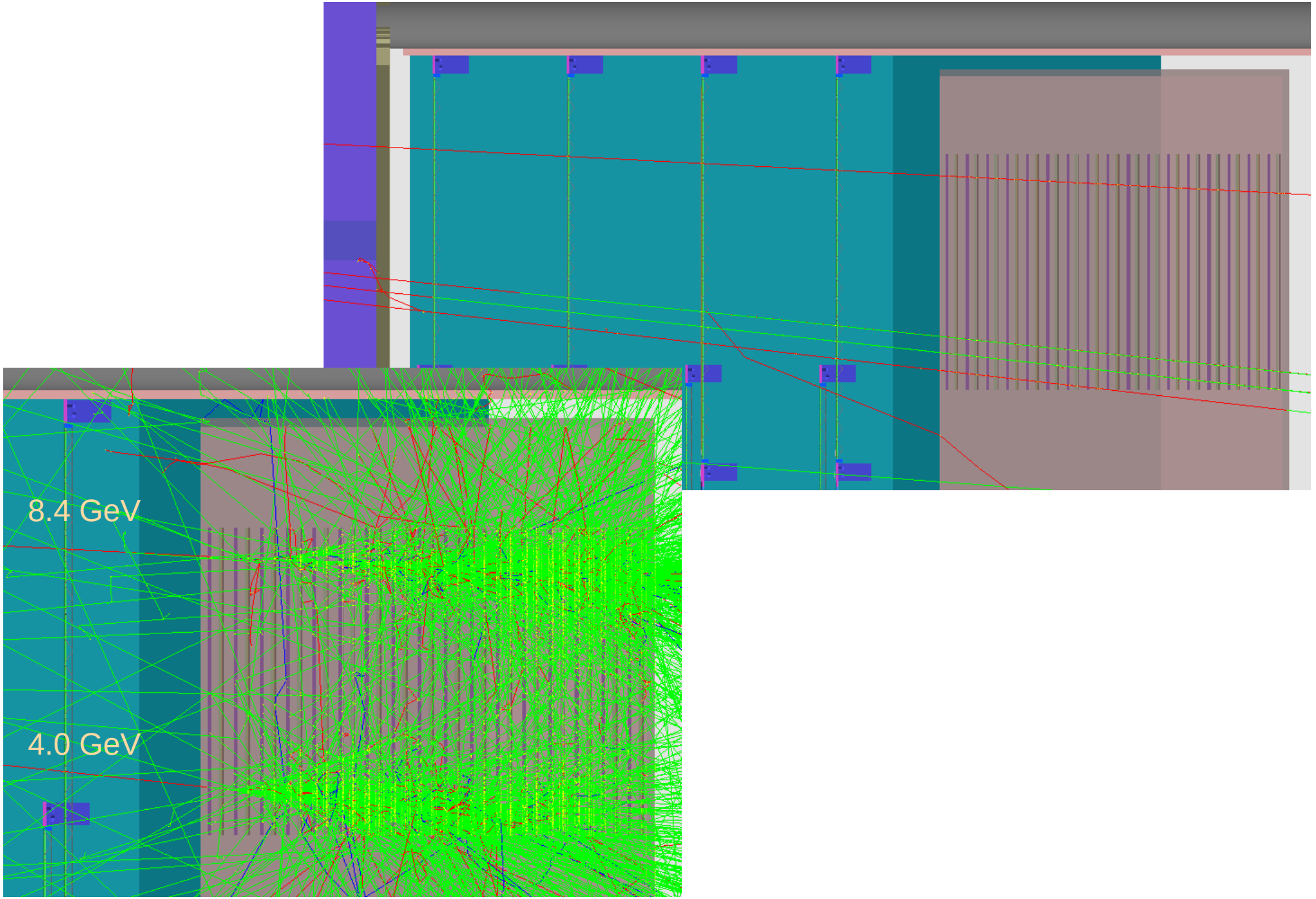






Energy range covered by CALICE ECAL corresponds to ~dX = 14cm;
(17.6 – 2*1.8)

Electrons 8.4 GeV and 4.2, 4.0, 3.8 GeV



Summary

- Importing CALICE dd4hep implementation to Geant4 is not automatic, but rather straightforward;
- Can be also parameterized using natural Geant4 interface (mac file)

Slides shred by Adrian

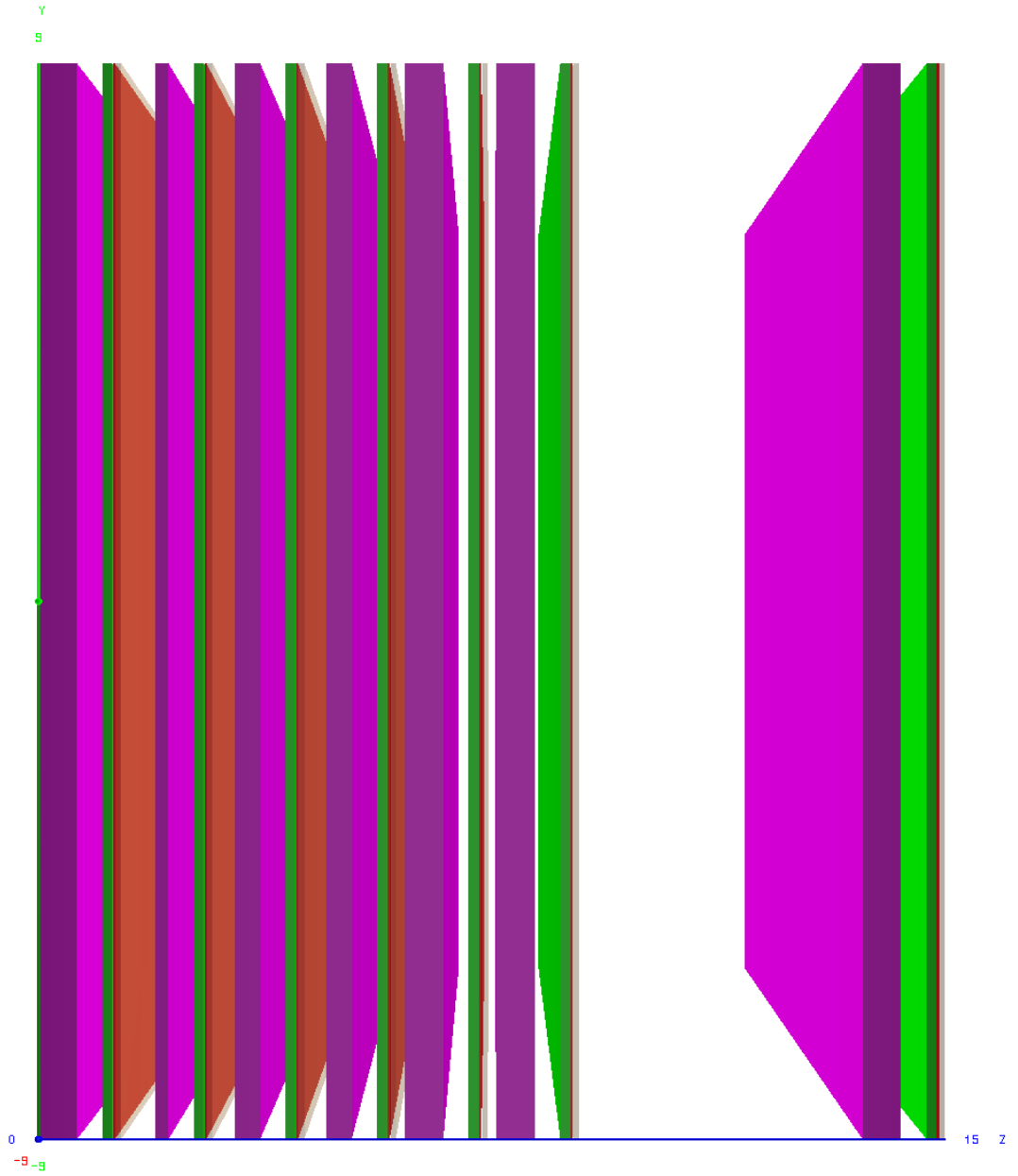
Expected development of CALICE geometry

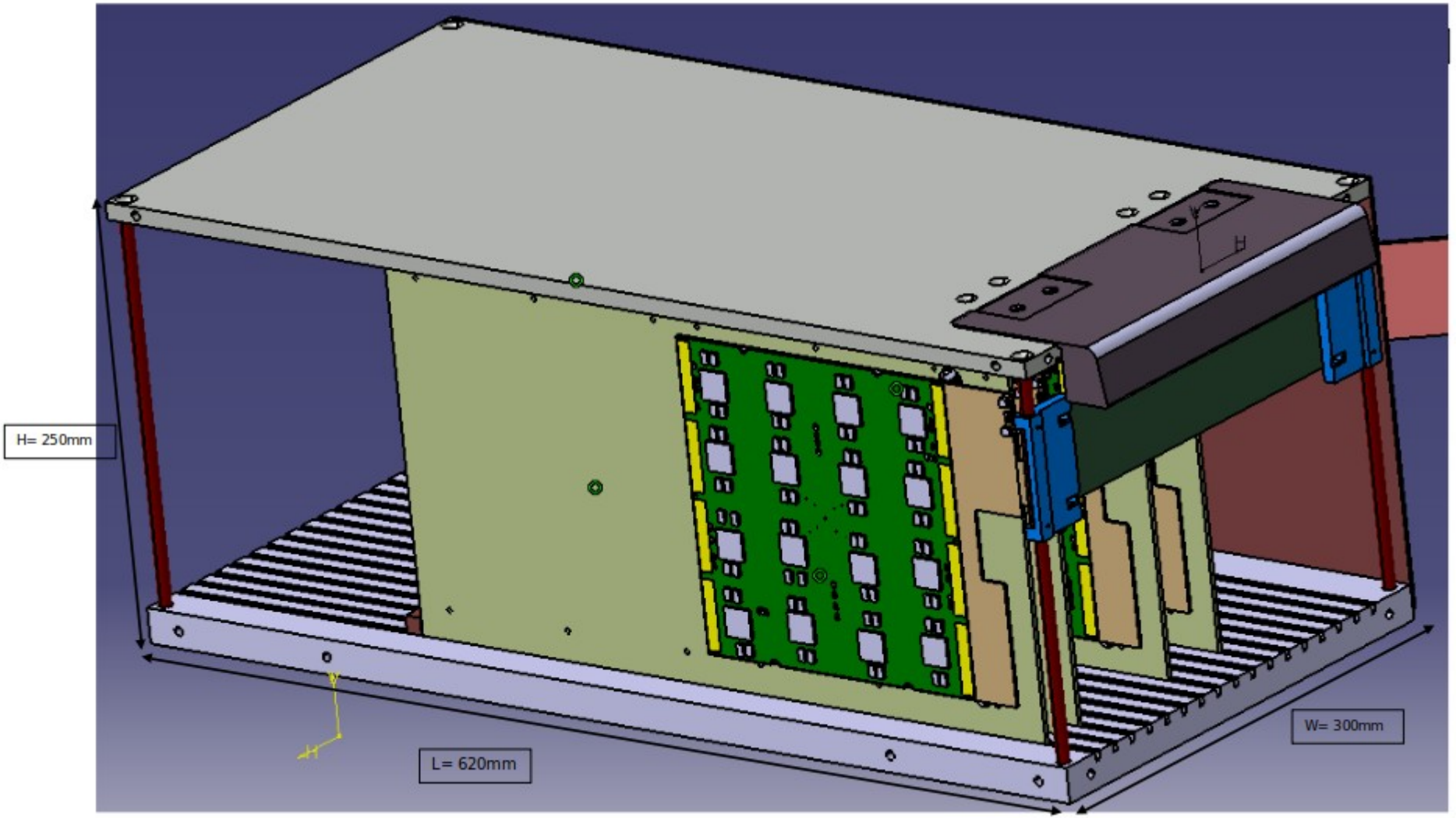
Code

- Based on DD4HEP
  - Most updated geometry can be found in https://github.com/fabriciojm/SiWECAL-Sim/tree/main/generation/geometry_TB2022
  - Validated geometry will be added to the main repository soon
    - https://github.com/SiWECAL-TestBeam/SiWECAL-Sim
  - Digitization software is also included in the repository → in the validation process

Backup

Version of CALICE ECAL_CONF3.xml used for LUXE




H= 250mm
L= 620mm
W= 300mm