

Towards a new implementation of CALICE ECal in LUXE GEANT4 Simulation

Oleksandr Borysov

LUXE ECal Meeting
April 28, 2022

CALICE ECAL github repository

The screenshot shows a browser window with three tabs open, all titled "SiWECAL-Sim/gene". The active tab is the third one, displaying the GitHub repository for "fabriciojm/SiWECAL-Sim". The URL in the address bar is <https://github.com/fabriciojm/SiWECAL-Sim/tree/main/generation/geometry/TB2022-03>. The repository is public and forked from "SiWECAL-TestBeam/SiWECAL-Sim".

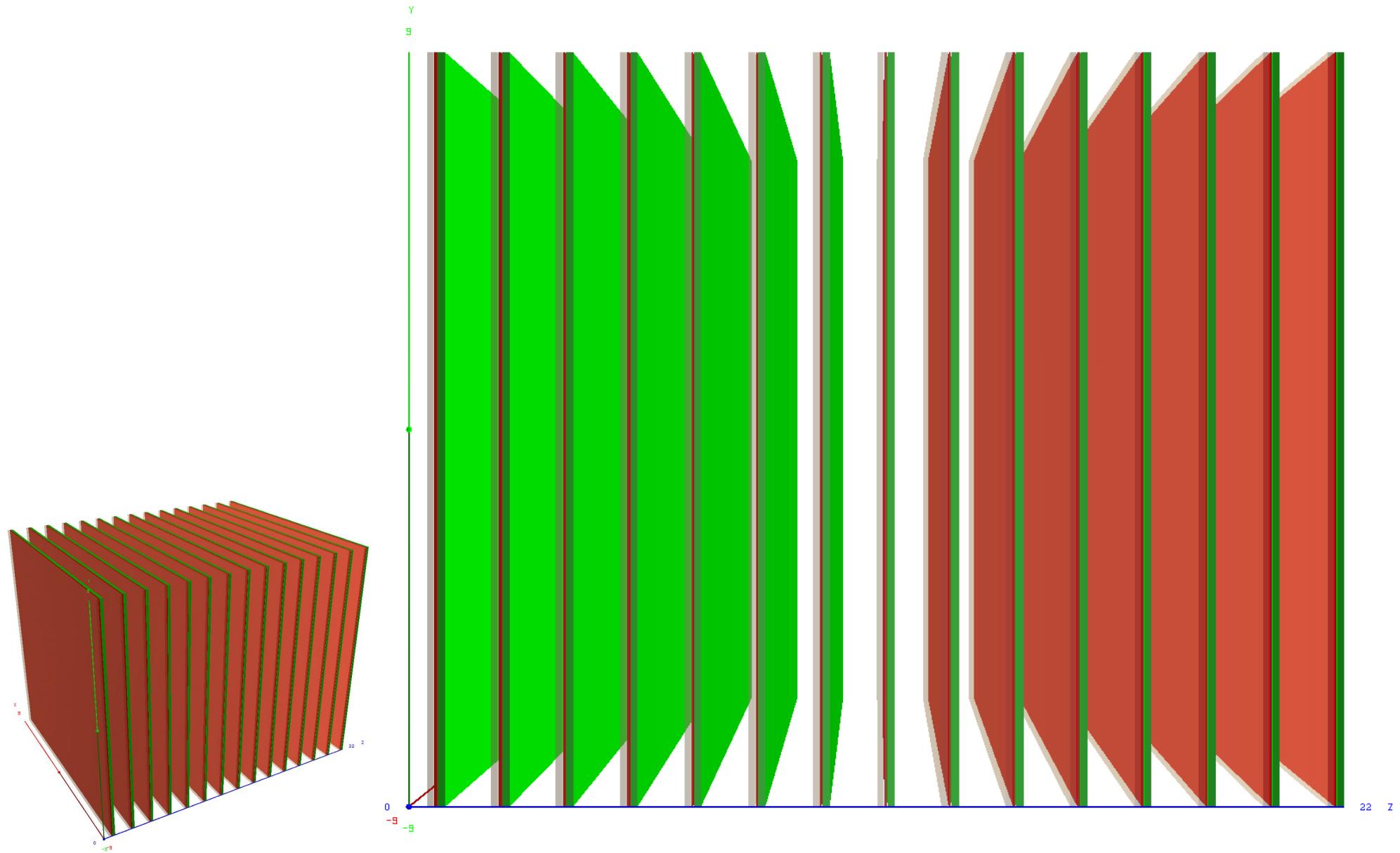
The repository page includes navigation links for "Pull requests", "Issues", "Marketplace", and "Explore". Below these are buttons for "Watch" (0), "Fork" (2), and "Star" (0). The main content area shows the "Code" tab selected, with a breadcrumb trail: "main > SiWECAL-Sim / generation / geometry / TB2022-03 /".

A message at the top of the code view states: "This branch is 16 commits ahead, 1 commit behind SiWECAL-TestBeam/SiWECAL-Sim:main." There are buttons for "Go to file", "Add file", and an ellipsis (...).

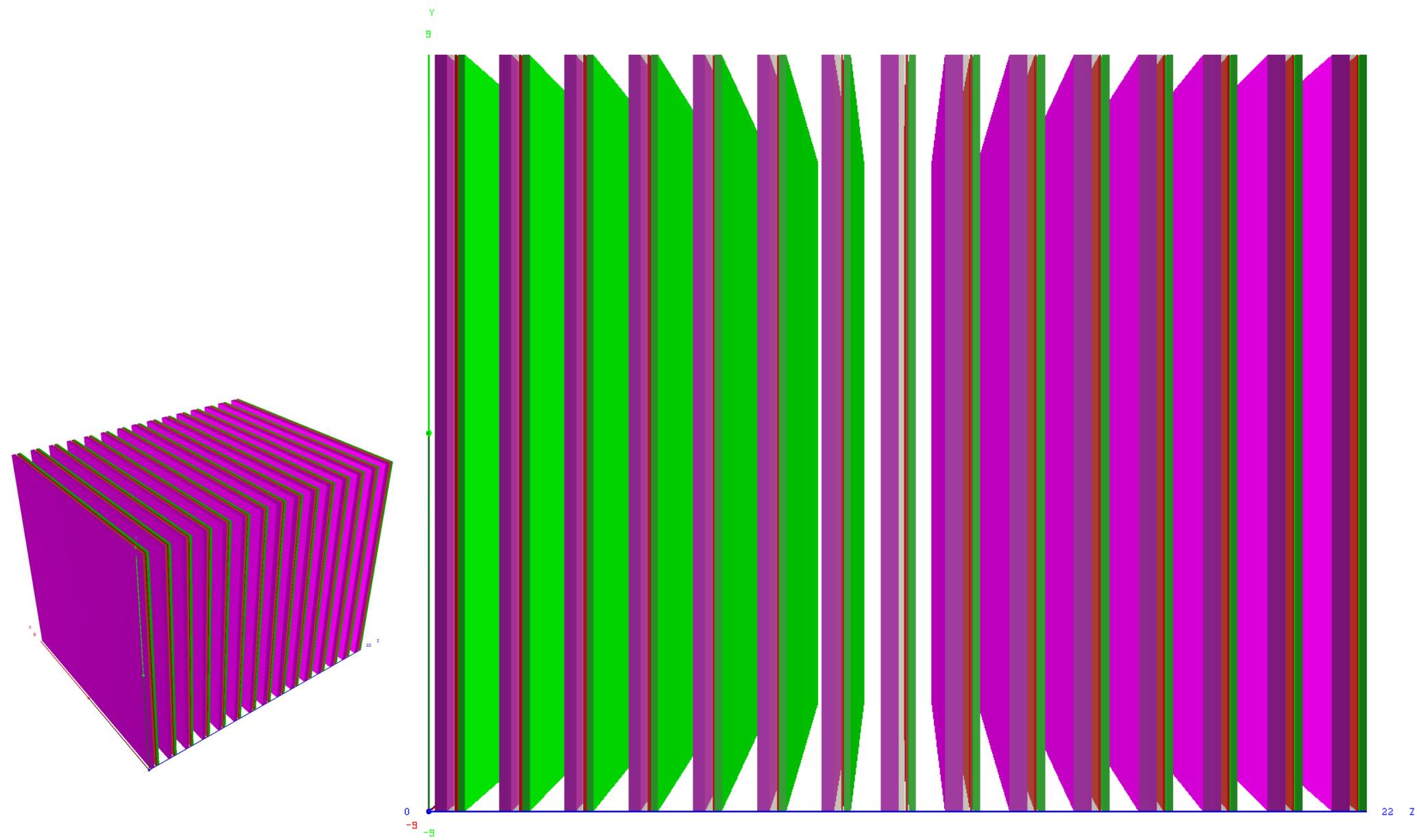
The commit history starts with a message from "fabriciojm": "Major changes: geometry TB2022 updated, angle runs, digitization proc...". This was committed 8 days ago. Below this, there are ten more commits, each corresponding to a file in the "TB2022-03" directory, all with the same message: "Major changes: geometry TB2022 updated, angle runs, digitization proc...". These commits were also made 8 days ago.

File	Message	Date
__pycache__	Major changes: geometry TB2022 updated, angle runs, digitization proc...	8 days ago
ECAL_CONF0.xml	Major changes: geometry TB2022 updated, angle runs, digitization proc...	8 days ago
ECAL_CONF1.xml	Major changes: geometry TB2022 updated, angle runs, digitization proc...	8 days ago
ECAL_CONF2.xml	Major changes: geometry TB2022 updated, angle runs, digitization proc...	8 days ago
ECAL_CONF3.xml	Major changes: geometry TB2022 updated, angle runs, digitization proc...	8 days ago
ECAL_commondefs.xml	Major changes: geometry TB2022 updated, angle runs, digitization proc...	8 days ago
ECAL_commandisp.xml	Major changes: geometry TB2022 updated, angle runs, digitization proc...	8 days ago
README.md	Major changes: geometry TB2022 updated, angle runs, digitization proc...	8 days ago
extra_materials.xml	Major changes: geometry TB2022 updated, angle runs, digitization proc...	8 days ago

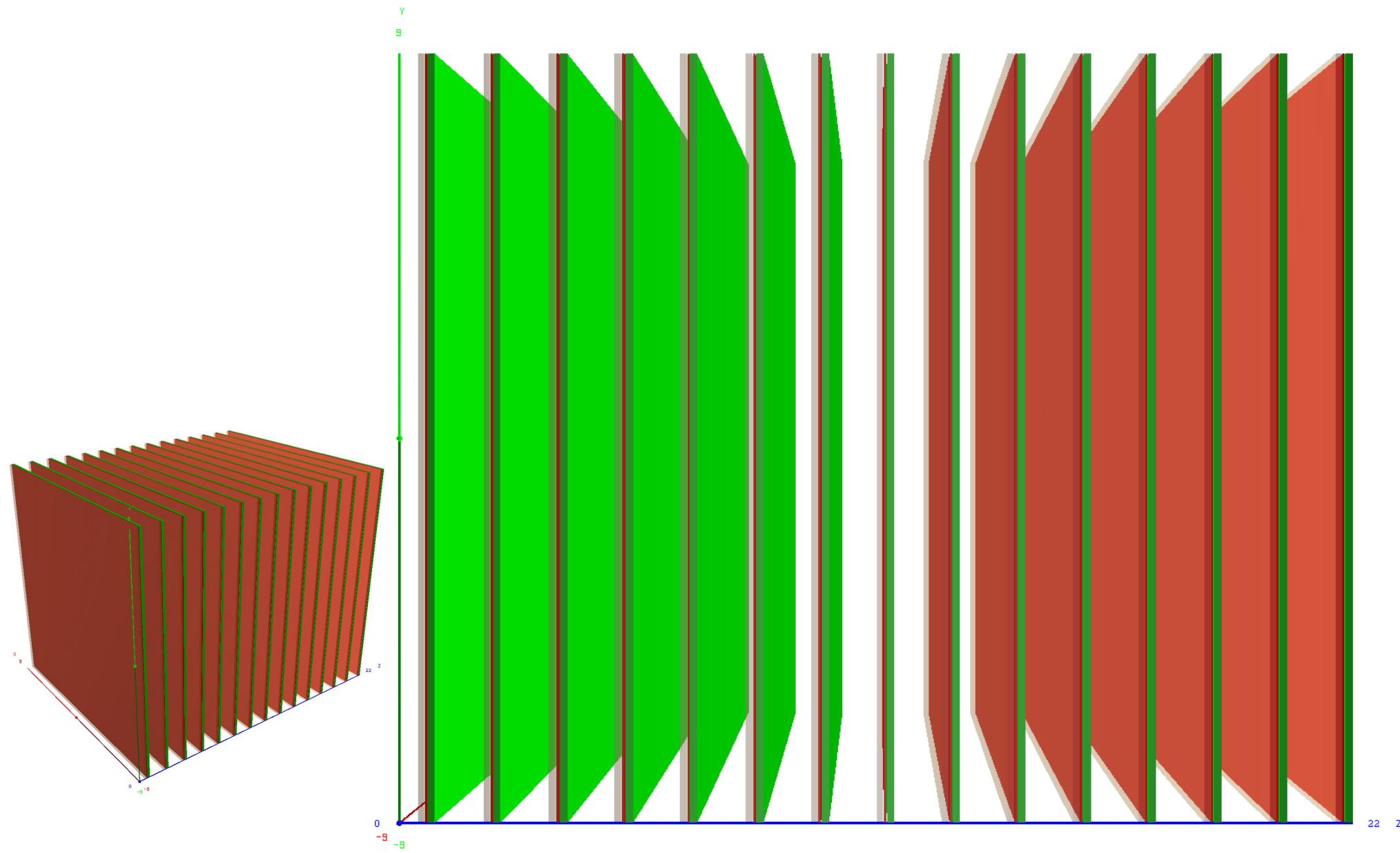
ECAL_CONF0.xml



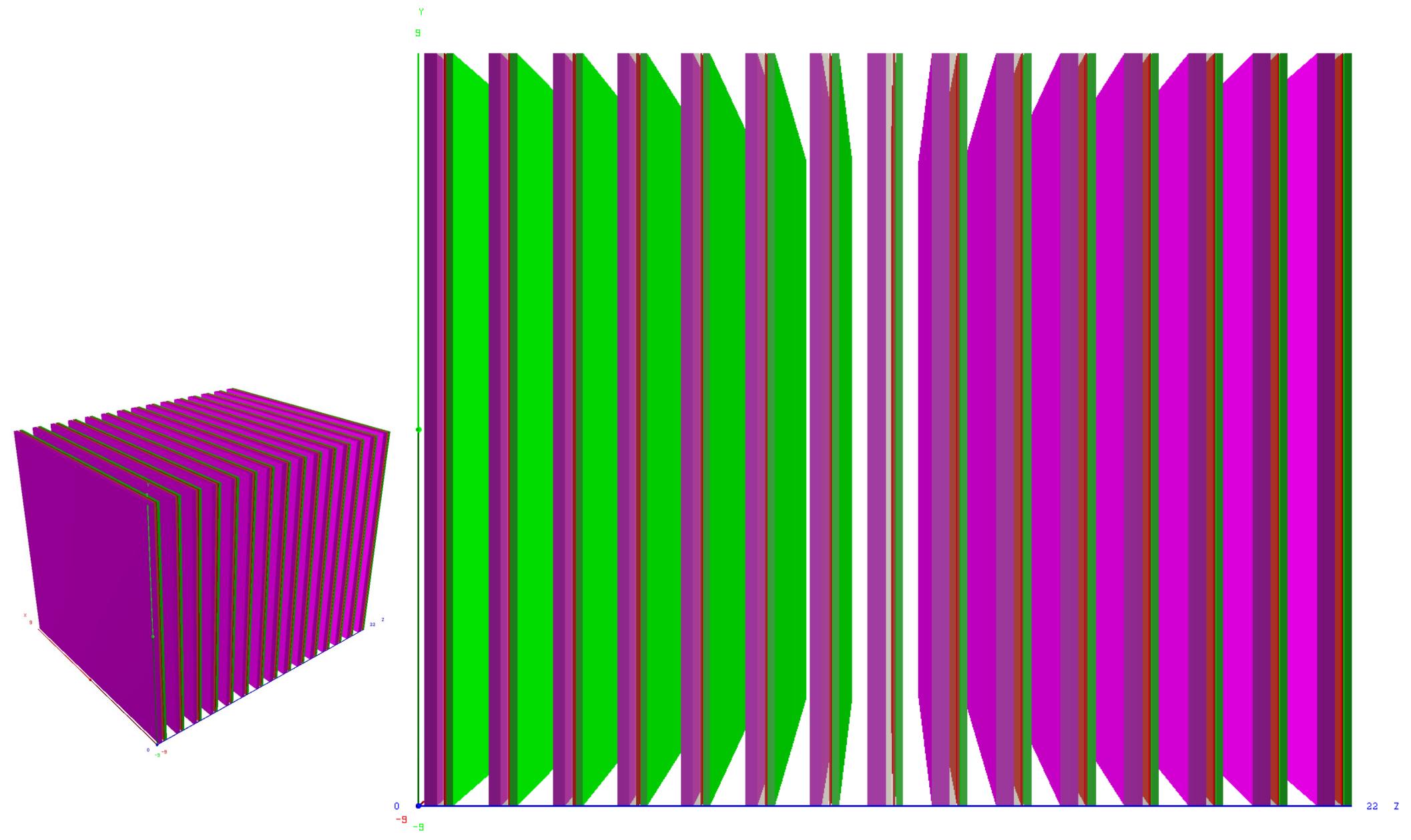
ECAL_CONF1.xml



ECAL_CONF2.xml



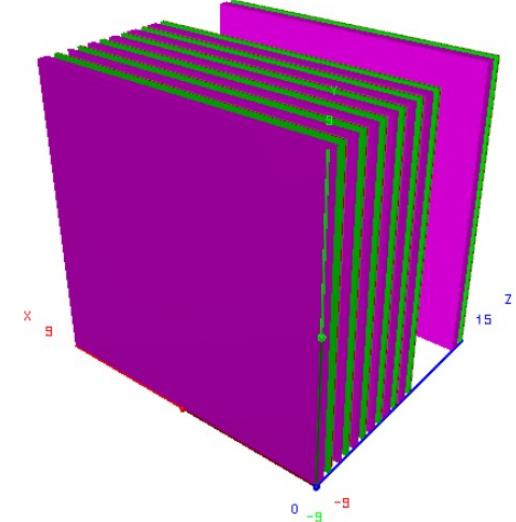
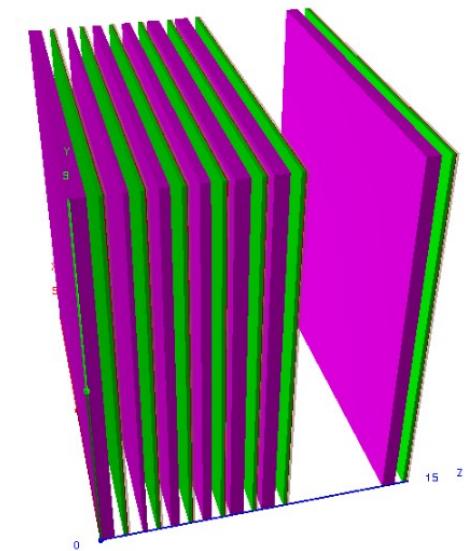
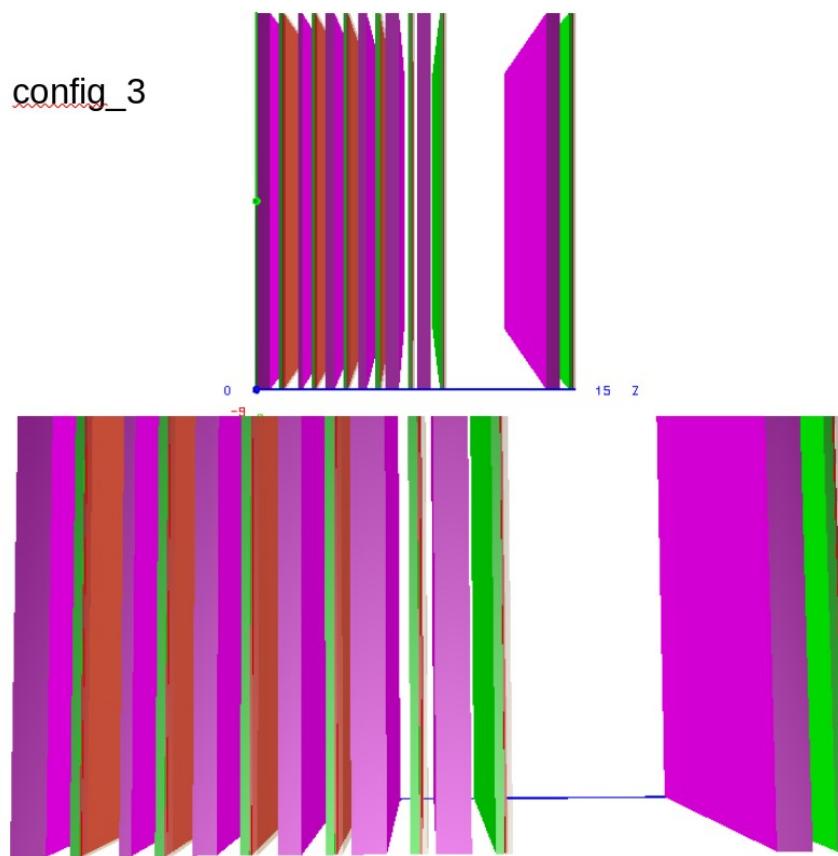
ECAL_CONF3.xml



CALICE ECal dd4hep implementation used for LUXE

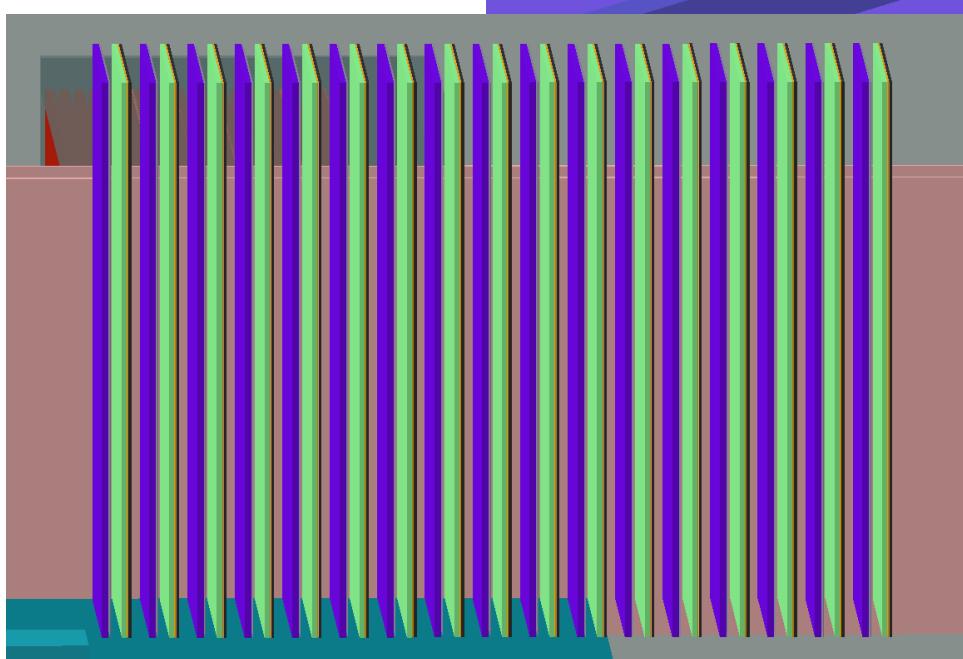
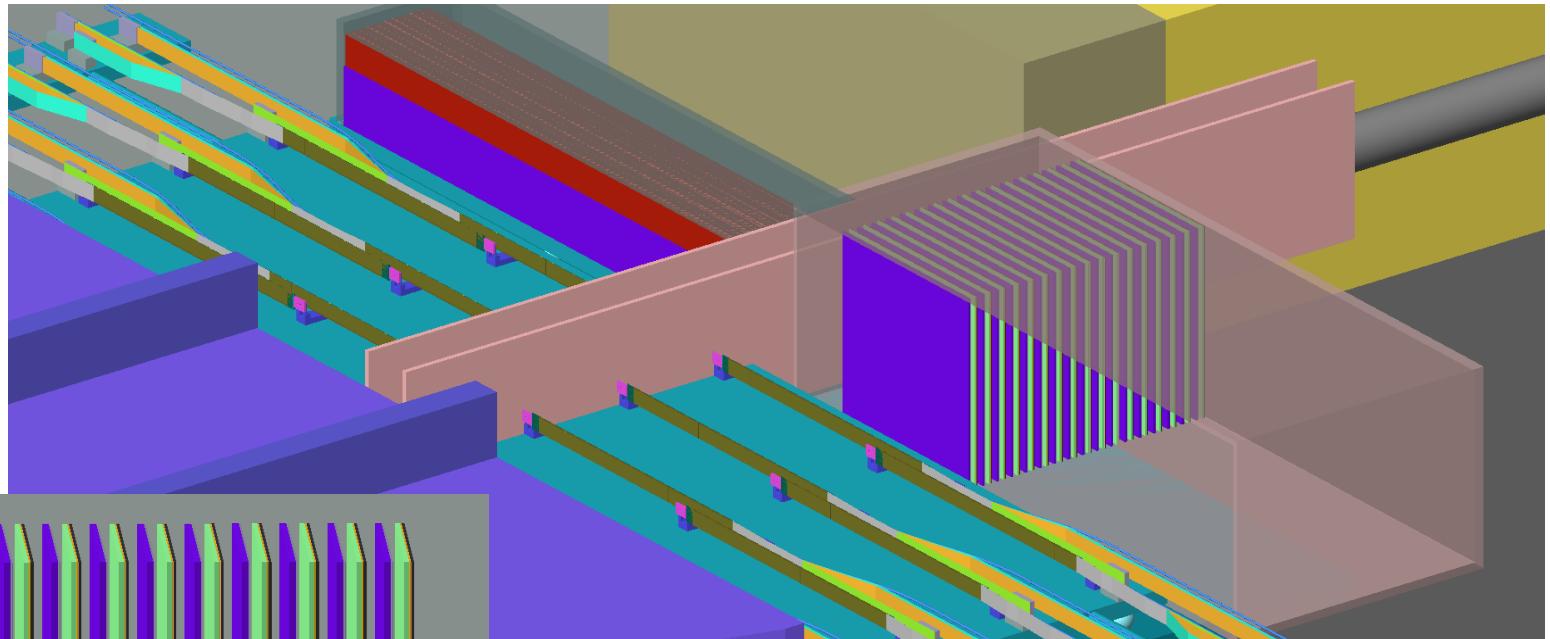
CALICE Ecal

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



LUXE S&A Meeting
October 19, 2021

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_WaferThickness - Ecal_KaptonThickness
- Ecal_CFThickness - Ecal_GlueThickness_pcb - Ecal_GlueThickness_kap;

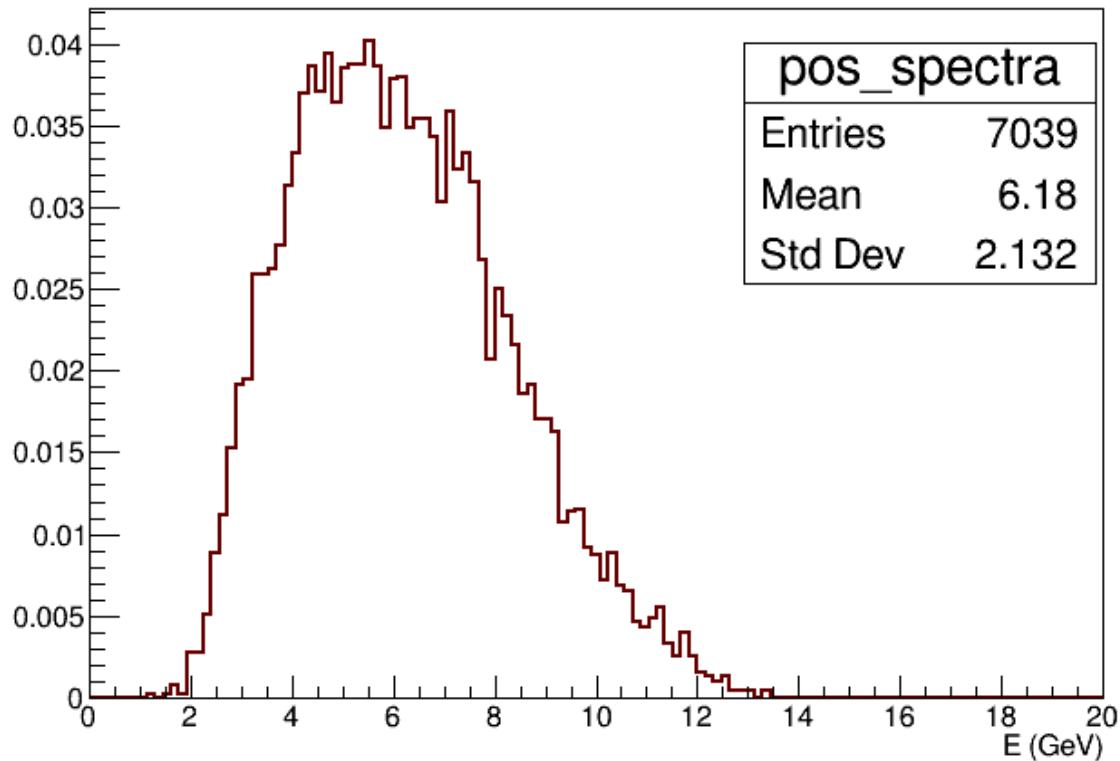
Ecal_WThickness = 2.1*mm;
Ecal_w_slab_gap1 = 0.5*mm;
Ecal_w_slab_gap2 = Ecal_LayerDistance-3*Ecal_WThickness-Ecal_slab_thickness-Ecal_w_slab_gap1;
```

```
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"};
```

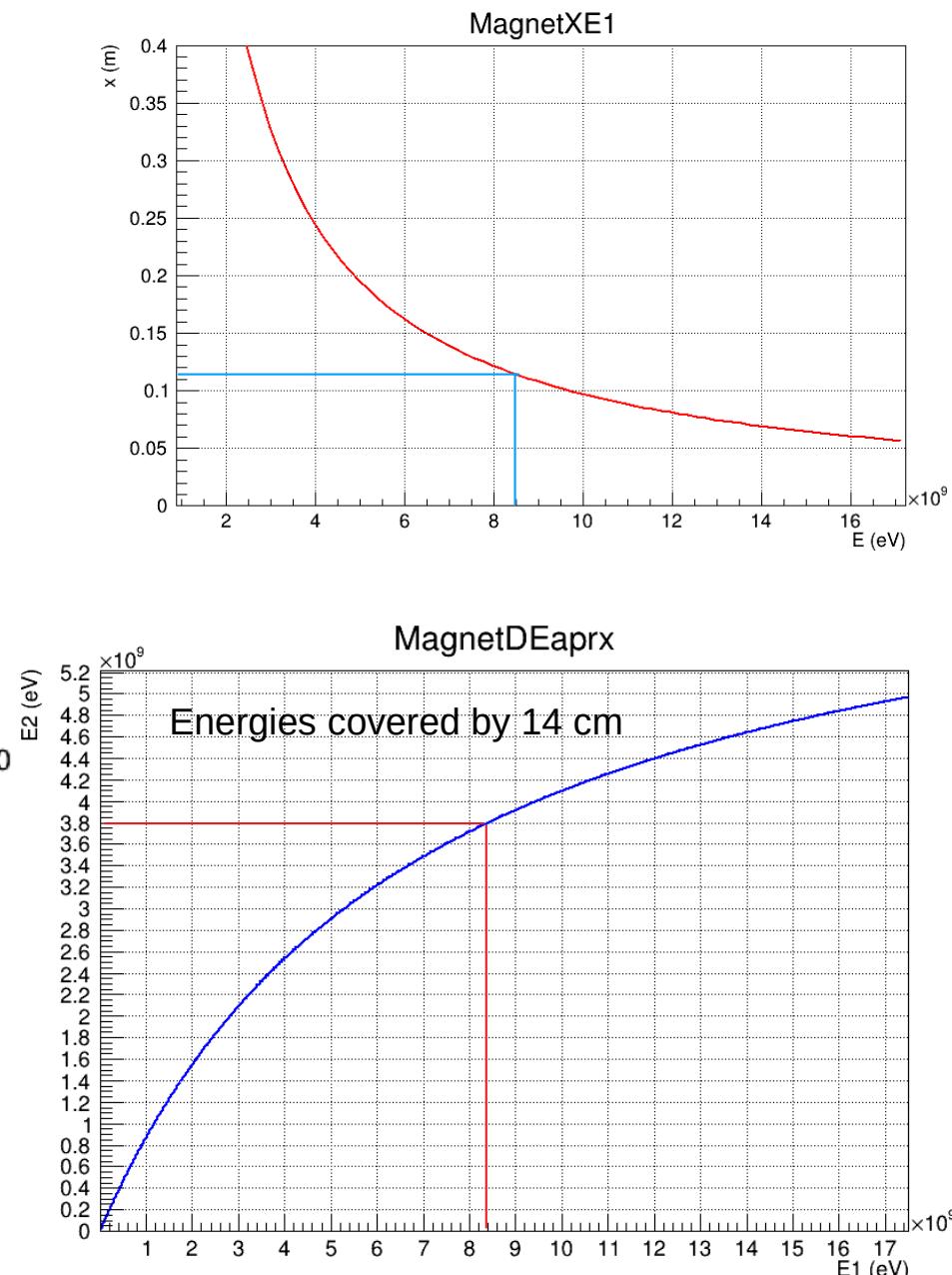
CALICE Ecal position

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

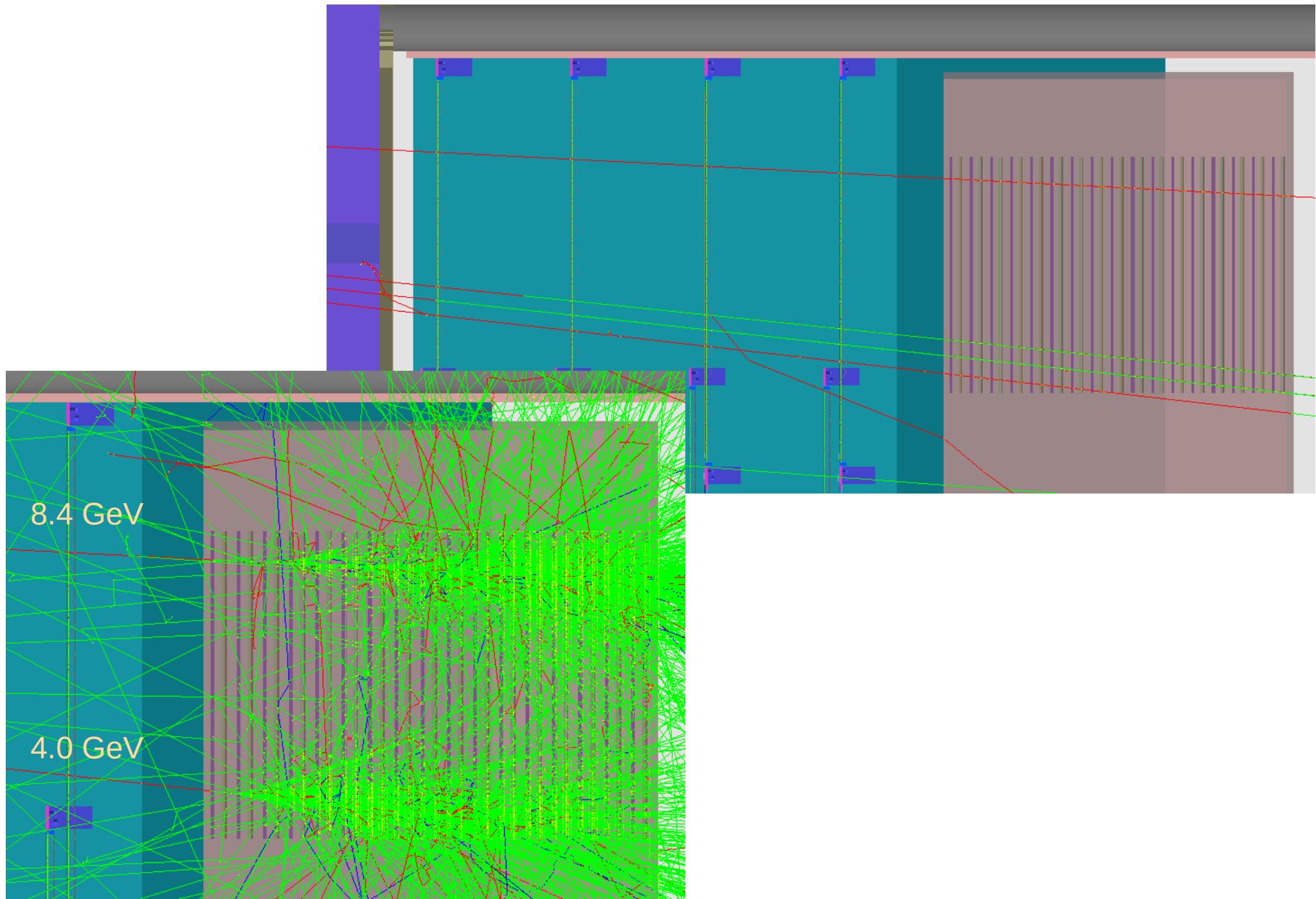
positron spectra in gamma laser phase_0 $\xi=5$, $w_0=4.7\mu\text{m}$



Energy range covered by CALICE ECAL
corresponds to $\sim dX = 14\text{cm}$;
 $(17.6 - 2 \times 1.8)$



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

