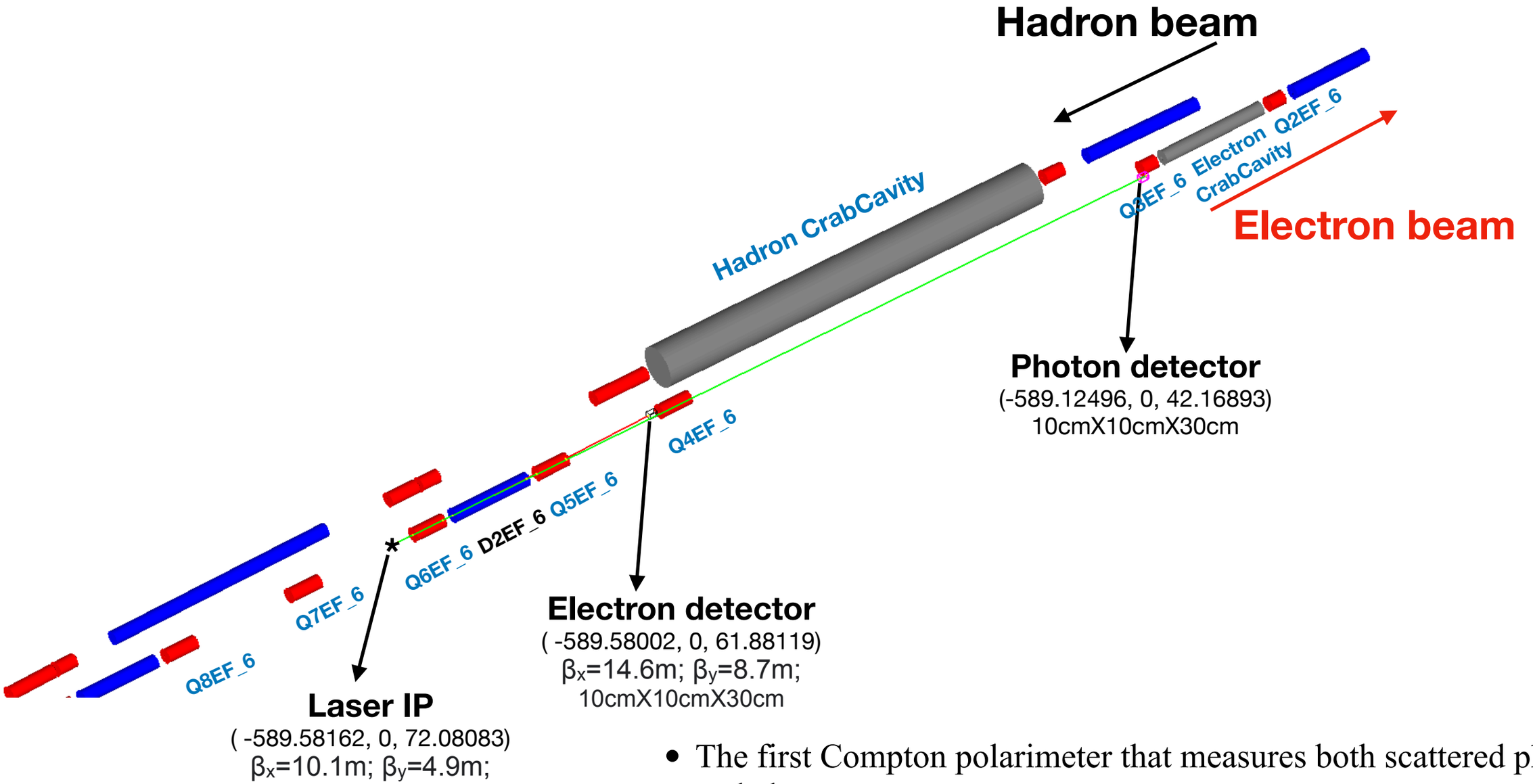
The geometry of the photon and electron detector for Compton polarimeter

Zhengqiao Zhang
BNL

The latest version of layout of Compton polarimeter

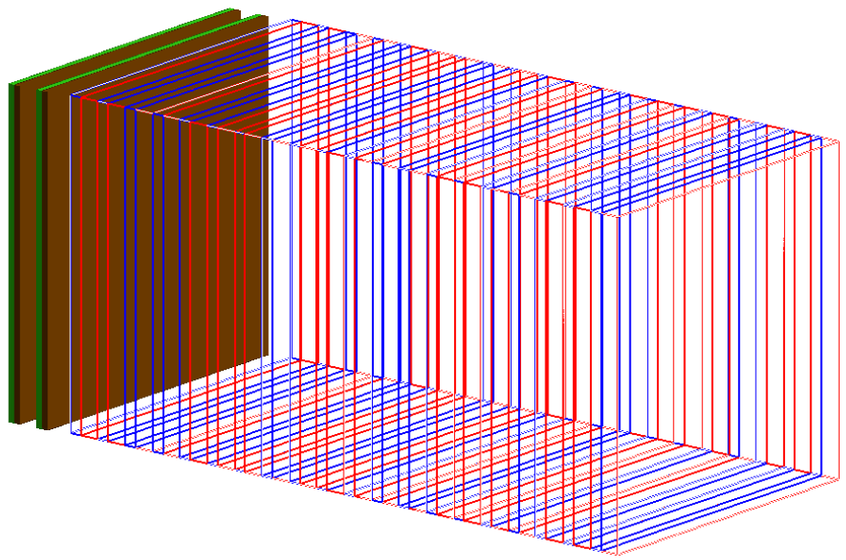
*IP6



- The first Compton polarimeter that measures both scattered photon and electron;
- The laser IP is in front of *Q6EF_6* and is about **72m** away from IP6;
- The spin components at laser IP is 0.58 in longitudinal and -0.81 in transverse;
- We put the photon detector in front of the *Q3EF_6*;
- The distance between the photon detector and the laser IP is **29m**;
- Open midplane or a hole in the return yoke is required for *Q4EF* to allow the photons go through;
- The coordinate system we used here is “RHIC Center”;

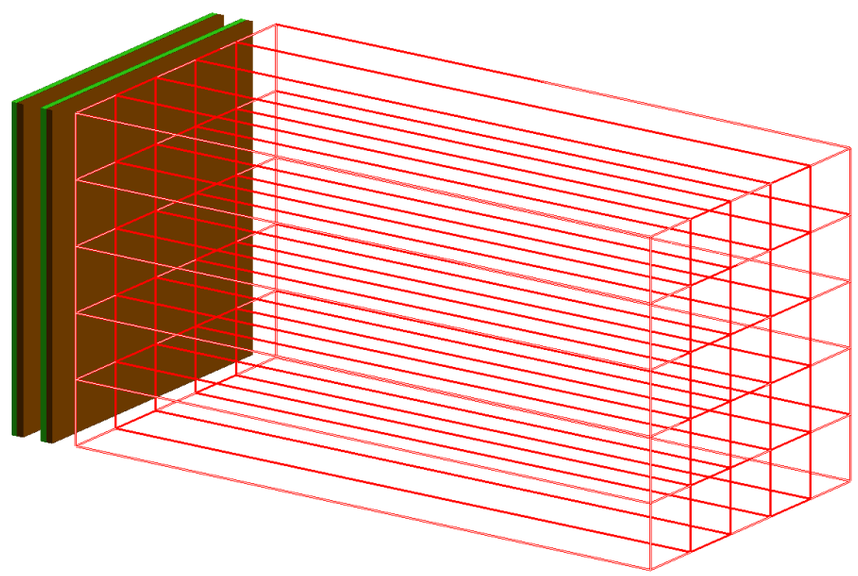
Photon Detector geometry in Geant4

Sampling Calorimeter with Preshower detector

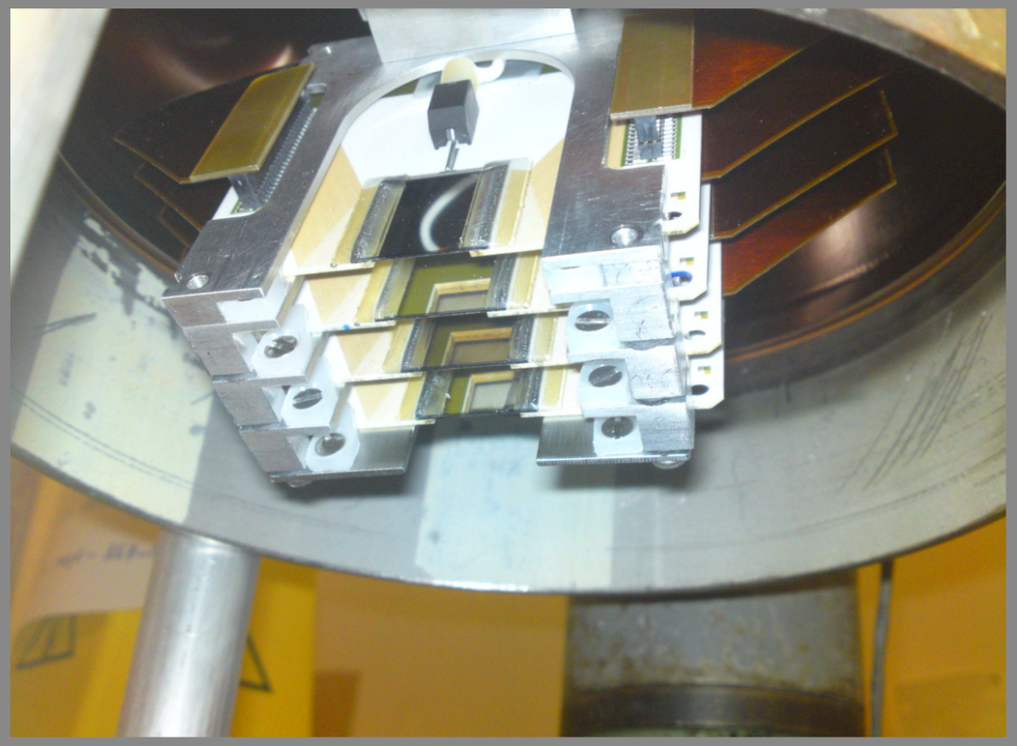


- The preshower is made of two planes of lead followed by silicon sensors;
- The ECal size is 10cmX10cmX20cm;
- 20 layers;
- Each layer is made of 6.2mm tungsten and 3.8mm PbWO4;
- Cheaper, compact but lower energy resolution;

Homogeneous Calorimeter with Preshower detector

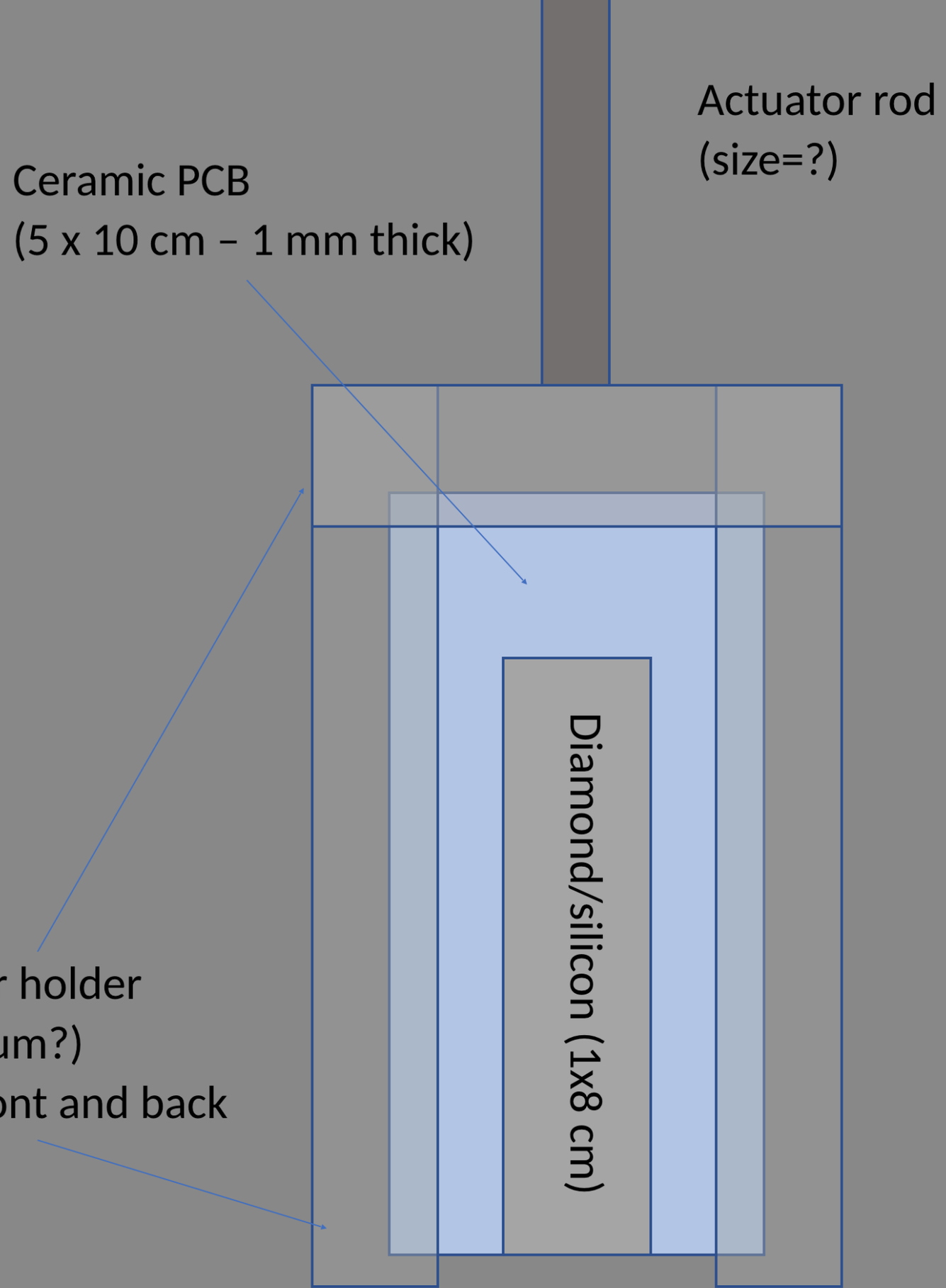


- The preshower is made of two planes of lead followed by silicon sensors;
- The ECal size is 10cmX10cmX20cm;
- 5X5 PbWO4 crystals;
- The size of the crystal is 2cmX2cmX20cm;
- Expensive and better energy resolution;

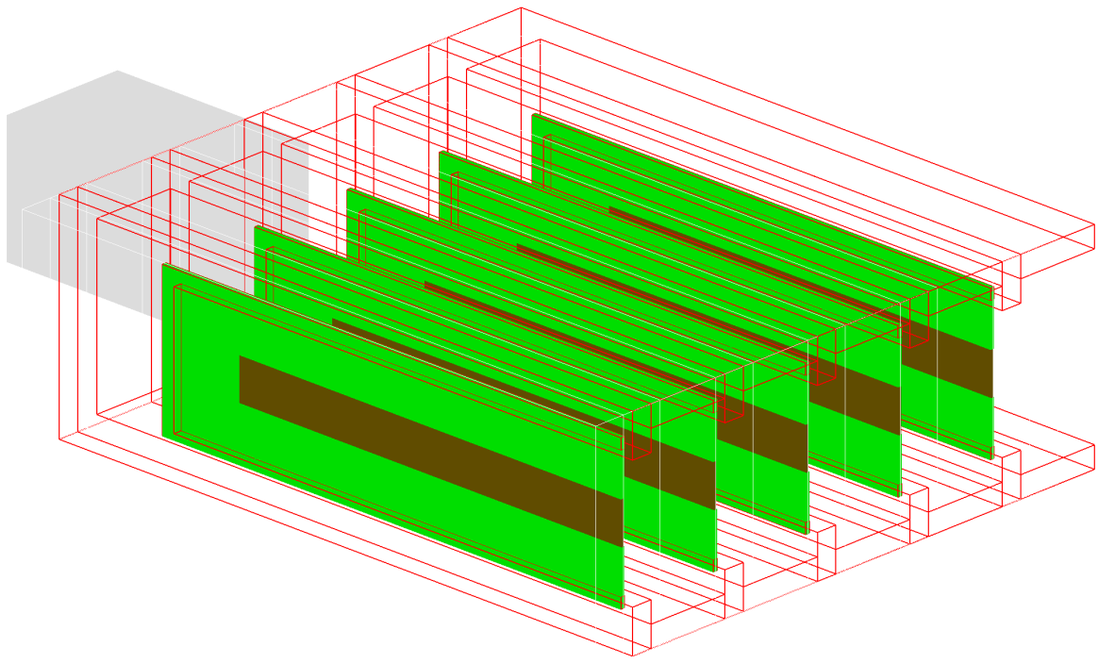


Hall C detector

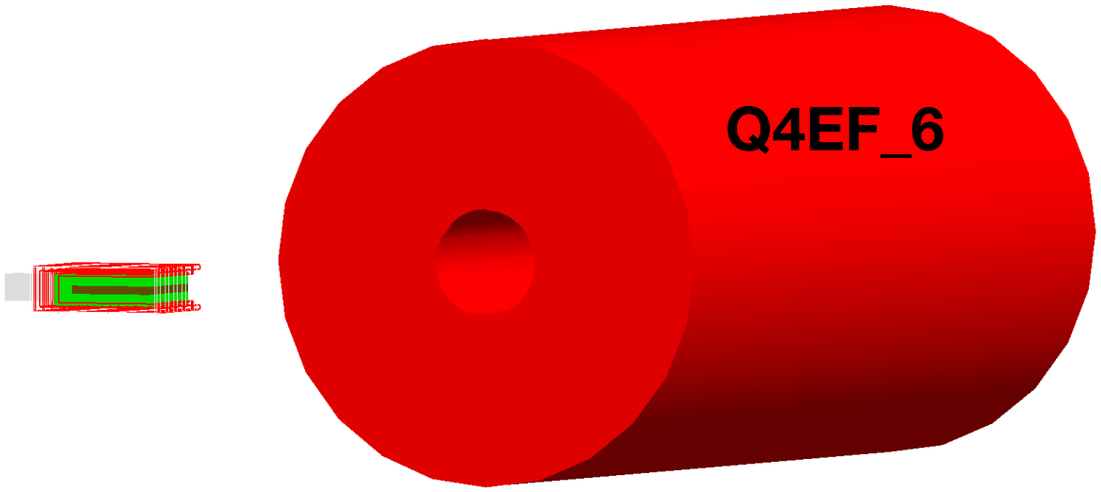
Offered by Dave



Electron detector geometry in Geant4



- The aluminum frame size is 15cmX5cmX12.5cm;
- The PCB size is 12cmX3.5cmX0.1cm;
- The silicon size is 10cmX1.0cmX0.05cm;
- 5 layers;
- The beam size in X at the diamond detector is 0.06cm;
- The distance between the edge of the Silicon sensor and the beam is 1.5cm;



Front view

The procedure to generate the STEP file

1. Generate GDML file from Geant4:

```
G4GDMLParser parser;
parser.Write("output.gdml", top_l);
```

2. convert GDML to ROOT

```
root -e 'TGeoManager::Import("PolDet.gdml")->Export("PolDet.root")'
```

3. Use xvfb to convert root to gltf (For Mac, use "Xvfb :1337 & export DISPLAY=:1337 &" instead of "xvfb-run"

```
Xvfb :1337 & export DISPLAY=:1337 & root2cad PolDet.root Default -o PolDet.gltf
```

4. Use assimp to convert gltf to stp (Assimp supports many formats for export: collada, x, stp, obj, objnomtl, stl, stlb, ply, plyb, 3ds, gltf2, glb2, gltf, glb, assbin, assxml, x3d fbx, fbxa, 3mf, assjson)

```
assimp export PolDet.gltf PolDet.stp
```

To do

- Set the physics processes;
- Do a full simulation of the detectors;