

Update of holes

Jingxu Zhang

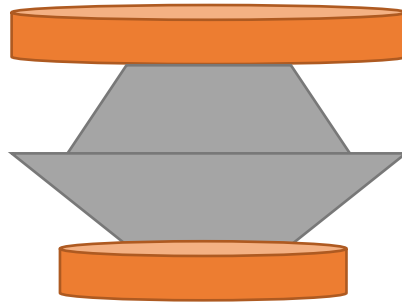
2025.05.22

Part1 Hole structure

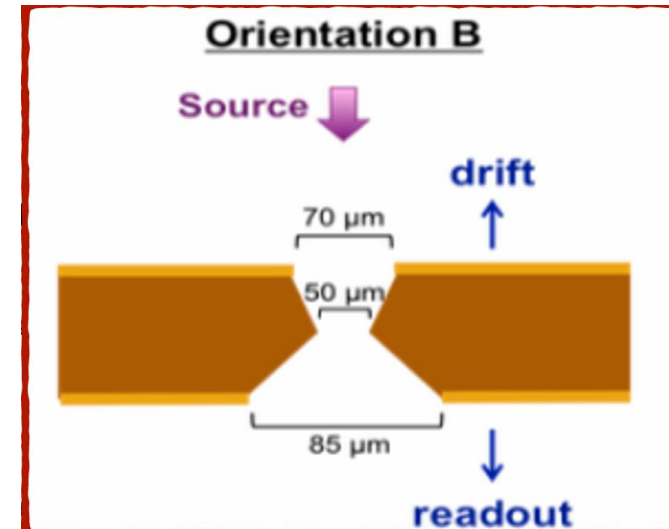
structure of holes

Question:

1. exchange of outer tubs
2. rotation of inner cones

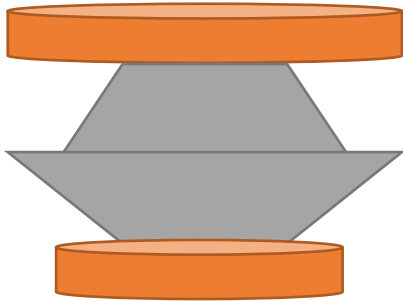


Hole structure in CGEM simulation

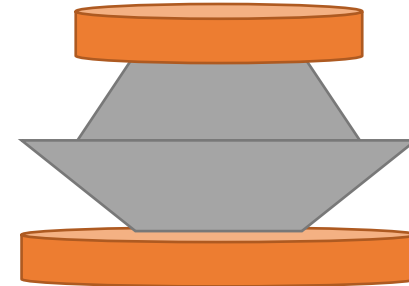


Question1: exchange of outer tubs

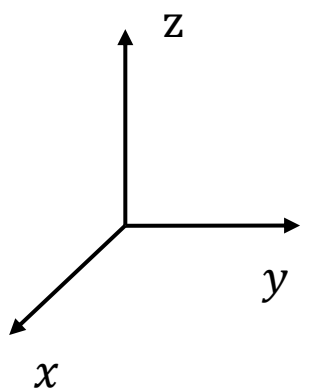
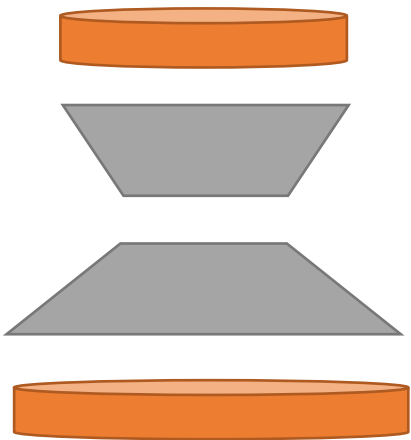
```
ssolid = "hole1"+sssolid.str(); //cout<<ssolid<<endl;  
G4Tubs *holeCu1 = new G4Tubs(ssolid,0.,lvd_R_o2_hole, lvd_L_hole1_Cu/2.,lvd_A_s,lvd_A_d);  
ssolid = "hole2"+sssolid.str(); //cout<<ssolid<<endl;  
G4Tubs *holeCu2 = new G4Tubs(ssolid,0.,lvd_R_o1_hole, lvd_L_hole2_Cu/2.,lvd_A_s,lvd_A_d);
```



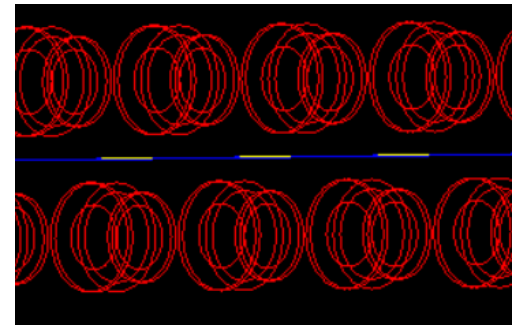
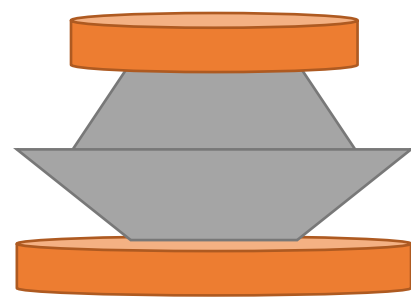
Exchange R_o1, R_o2



Question2: rotation of inner cones

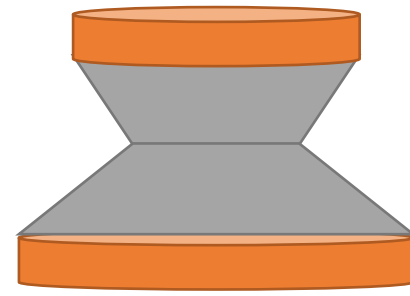


`rot->rotateY(90*deg);`

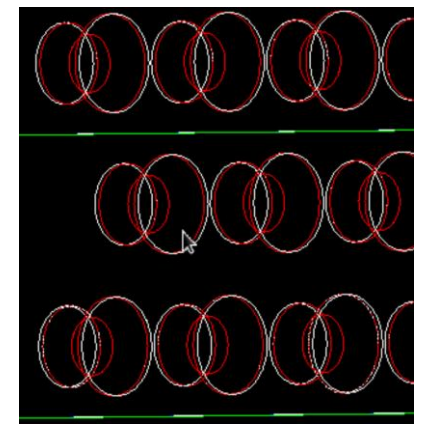


Old structure

`rot->rotateY(-90*deg);`



Updated structure



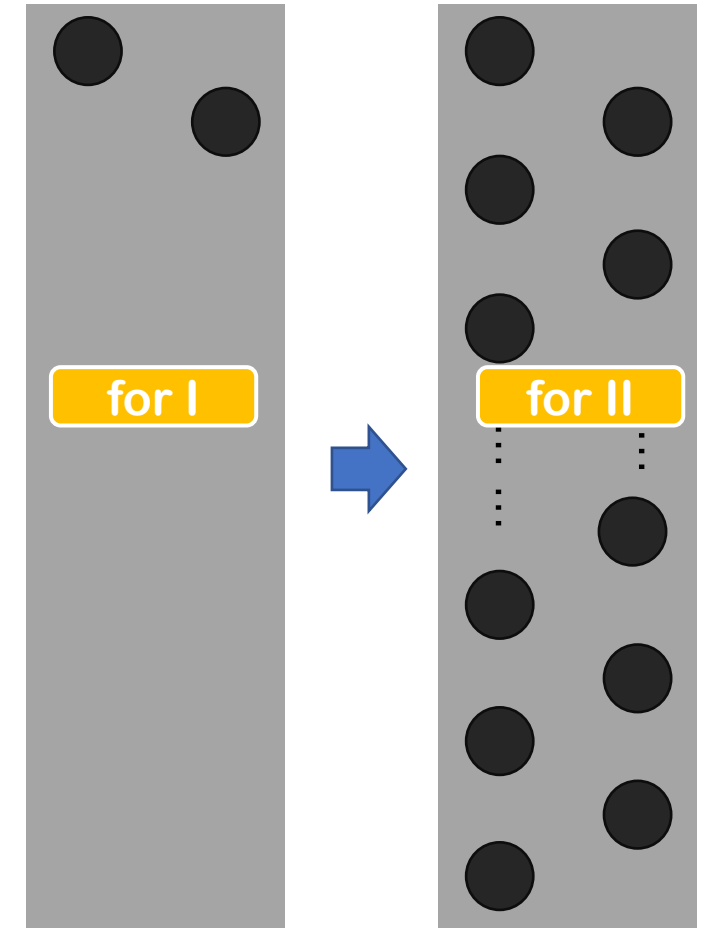
Part2 Hole placement

Update of holes placement

Original solution

```

894      //place holes.[-----> need to add holes for two Cu layers]
895      for(G4int iHole = 0;iHole<2;iHole++){
896          G4cout<<"place iHole "<<iHole<<G4endl;
897          if(iHole==1) firstHoleZ = -nholeZ*holepitchz/2+0.5*holepitchz;//line no.1 holes, nholes_z=nholeZ-1
898          if(iHole==0) firstHoleZ = -nholeZ*holepitchz/2;//line no.2 holes, nholes_z=nholeZ
899          G4double holePosPhi = 0.25*anglephi+0.5*iHole*anglephi;
900          G4RotationMatrix* rotHole = new G4RotationMatrix();
901          rotHole->rotateY(90*deg);
902          rotHole->rotateX(-holePosPhi);
903          G4cout<<"nholeZ-iHole="<<nholeZ-iHole<<G4endl;
904      for(G4int zhole=0;zhole<(nholeZ-iHole);zhole++){
905          //if(zhole%10) continue;
906          G4double holePosZ = firstHoleZ+zhole*holepitchz;
907          G4double holerho1 = lvd_R_i+0.5*holeh1;
908          G4double holerho2 = lvd_R_o-0.5*holeh1;
909          G4double holerho0 = lvd_R_i1+0.5*lvd_L_hole1_Cu;
910          G4double holerho3 = lvd_R_i2+0.5*lvd_L_hole2_Cu;
911          G4ThreeVector holePos1,holePos2,holePos0,holePos3;
912          holePos1.setRhoPhiZ(holerho1,holePosPhi,holePosZ);
913          holePos2.setRhoPhiZ(holerho2,holePosPhi,holePosZ);
914          holePos0.setRhoPhiZ(holerho0,holePosPhi,holePosZ);
915          holePos3.setRhoPhiZ(holerho3,holePosPhi,holePosZ);
916          G4VPhysicalVolume* hole1PV = new G4PVPlacement(rotHole,holePos1,hole1LV,"hole1PV",lv_GemFoil_Kapton_logic,lv_boolen,lv_copyNo,false);
917          G4VPhysicalVolume* hole2PV = new G4PVPlacement(rotHole,holePos2,hole2LV,"hole2PV",lv_GemFoil_Kapton_logic,lv_boolen,lv_copyNo,false);
918          G4VPhysicalVolume* holeCu1PV = new G4PVPlacement(rotHole,holePos0,holeCu1LV,"holeCu1PV",lv_GemFoil_Cu_logic,lv_boolen,lv_copyNo,false);
919          G4VPhysicalVolume* holeCu2PV = new G4PVPlacement(rotHole,holePos3,holeCu2LV,"holeCu2PV",lv_GemFoil_Cu2_logic,lv_boolen,lv_copyNo,false);
920      }
921  }
    
```



Update of holes placement

New solution (parameterize)

```
// 计算孔洞位置参数
G4double holerho1 = lvd_R_i + 0.5*holeh1;
G4double holerho2 = lvd_R_o - 0.5*holeh1;
G4double holerho0 = lvd_R_i1 + 0.5*lvd_L_hole1_Cu;
G4double holerho3 = lvd_R_i2 + 0.5*lvd_L_hole2_Cu;

// 创建参数化孔洞（总数为 2*nholeZ-1）
G4VPhysicalVolume* holesPV1 = new G4PVParameterised(
    "Holes1",           // 名称
    hole1LV,           // 孔洞逻辑体积（气体材料）
    lv_GemFoil_Kapton_logic1, // 母体逻辑体积（Kapton）
    kUndefined,        // 放置方向（由参数化类控制）
    2*nholeZ-1, // 总孔洞数
    new HoleParameterisation(
        nholeZ, holepitchz, anglephi,
        holerho1
    ),
    false              // 不启用拷贝号检查
);
```

```
G4VPhysicalVolume* holesPV2 = new G4PVParameterised(
    "Holes2",           // 名称
    hole2LV,           // 孔洞逻辑体积（气体材料）
    lv_GemFoil_Kapton_logic2, // 母体逻辑体积（Kapton）
    kUndefined,        // 放置方向（由参数化类控制）
    2*nholeZ-1, // 总孔洞数
    new HoleParameterisation(
        nholeZ, holepitchz, anglephi,
        holerho2
    ),
    false              // 不启用拷贝号检查
);

G4VPhysicalVolume* holesPV0 = new G4PVParameterised(
    "HolesCu1",         // 名称
    holeCu1LV,          // 孔洞逻辑体积（气体材料）
    lv_GemFoil_Cu_logic, // 母体逻辑体积（铜）
    kUndefined,          // 放置方向（由参数化类控制）
    2*nholeZ-1, // 总孔洞数
    new HoleParameterisation(
        nholeZ, holepitchz, anglephi,
        holerho0
    ),
    false              // 不启用拷贝号检查
);

G4VPhysicalVolume *holesPV3 =
    new G4PVParameterised(
        "HolesCu2", // 名称
        holeCu2LV, // 孔洞逻辑体积（气体材料）
        lv_GemFoil_Cu2_logic, // 母体逻辑体积（铜）
        kUndefined, // 放置方向（由参数化类控制）
        2 * nholeZ - 1, // 总孔洞数
        new HoleParameterisation(
            nholeZ, holepitchz, anglephi,
            holerho3),
        false // 不启用拷贝号检查
    );
```

Time of G4Run initialization

	Original solution	New solution	No holes
Time	600-900s	30-50s	~10s
Mem (GB)	1.1	1.2	0.9

Summary

- Correct the structure of holes
- Reduce the G4RunInitialization time in simulation