2019.11.27.

Sora Oh

I=64.7, Z=?

- I/Z=12+7/Z (Z<13)
- Z=4.81 ?

- $Z_{eff} = \sum a_i Z_i$
- Z_{eff} =10*1+9*6=64

- I/Z=9.76+58.8$Z^{-1.19}$ (Z>13)
- Z=0.88+0.83i

For Mixture and Compounds

- $Z_{eff} = \sum a_i Z_i$=64 (<-Z=33.1)
- $A_{eff} = \sum a_i A_i = 118$ (<-A=61.5)
- $lnI_{eff} = \sum \frac{a_i Z_i lnI_i}{Z_{eff}}$ $I_{eff} = 64.6845$
- $-\frac{dE}{dx} = 2\pi N_a r_e^2 m_e c^2 \rho \frac{Z}{A}\frac{z^2}{\beta^2}\left[\ln\left(\frac{2m_e\gamma^2 v^2 W_{max}}{I^2}\right) - 2\beta^2 - \delta - 2\frac{C}{Z}\right]$

Replace W_{max}

- $W_{max} = \frac{2m_e c^2 \eta^2}{1+2s\sqrt{1+\eta^2+s^2}}$=309.452 (<-364.234)
- $-\frac{dE}{dx}$ =2.21 (5*5*1cm)

Scintillator length

- When increase the scintillator thickness in geant4

- $-\frac{dE}{dx}$ =2.074 (5*5*10cm)
- $-\frac{dE}{dx}$ =2.083 (10*10*10cm)

Calculation value & Simulation value

- Calculation value : $-\frac{dE}{dx}$ =2.21
- Simulation value : 2.083
- percentage error: (2.21- 2.083)/2.21 * 100 = 5.7%

Replace factor

- $\delta_{eff} = \sum \frac{a_i Z_i \delta_i}{Z_{eff}}$
- $C_{eff} = \sum a_i C_i$

Detector geometry

- G4VSolid: shape, size
- G4LogicalVolume: daughter physical volumes (material, sensitivity…)
- G4VPhysicalVolume: position, rotation

Definition of materials

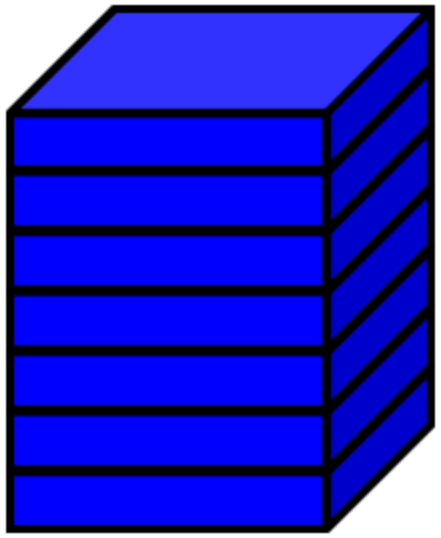
- Cs : A=55 Zeff=132.9*g/mol
- I : A=53 , Zeff=126.9*g/mol
- Density of christal of CsI is rho=4.51*g/cm^3
- G4Element* el_i = new G4Element("Iodine","I", 53,126.9*g/mole);
- G4Element* el_cs = new G4Element("Cesium","Cs",55,132.9*g/mole);
- G4Material* mat_csi = new G4Material("CsI",4.51*g/cm3,2);
- mat_csi->AddElement(el_i,1);
- mat_csi->AddElement(el_cs,1);

Pre-defined materials

- G4NistManager* nistManager = G4NistManager::Instance();
- nistManager->FindOrBuildMaterial("G4_AIR");

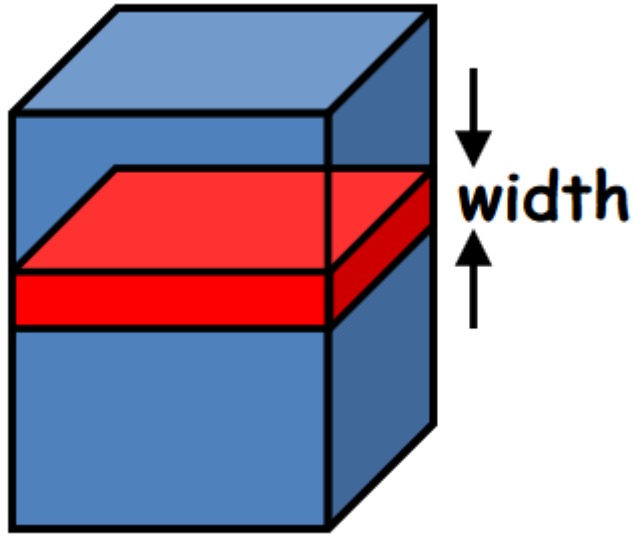
Physical volumes

- G4PVPlacement: 1 placement=1 placement volume
- G4PVParameterised: 1 parameterized = many repeated volumes
- G4PVReplica 1 replica = many repeated volumes daughters fill the mother completely without gap



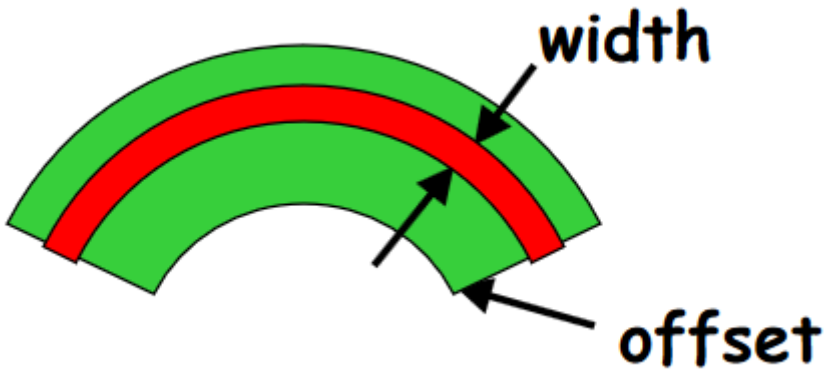
Replica-axis

- Cartensian axis
- Center of n-daughter:
  width*(nReplicas- 1)*
  0.5+n*width



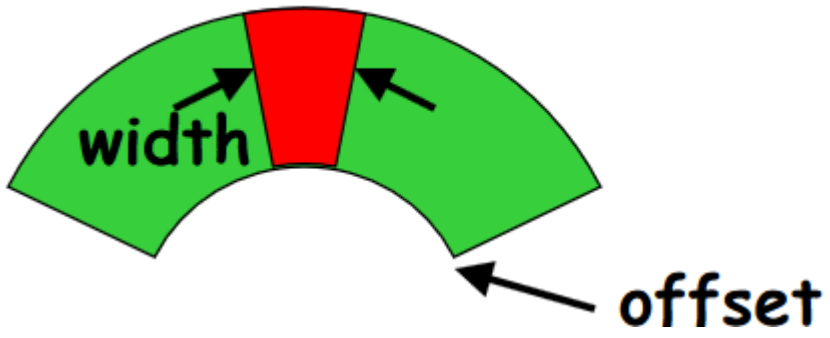
Replica-axis

- Radial axis
- Center of n-daughter:
  width*(n+0.5)+offset



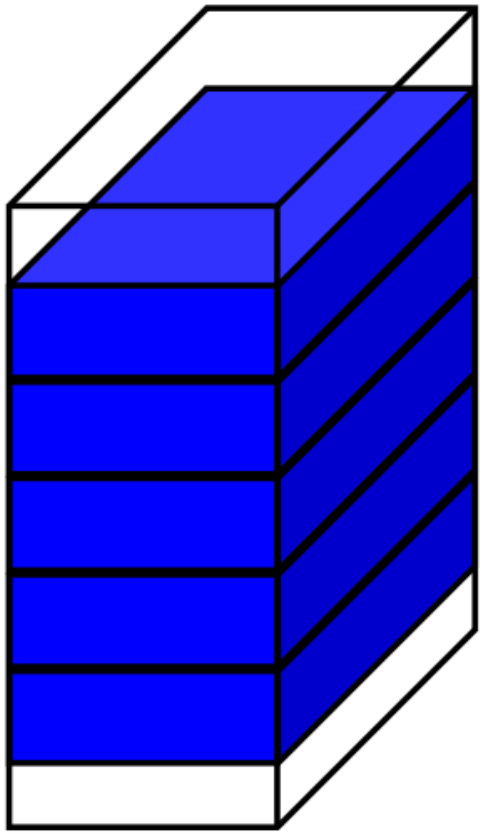
Replica-axis

- Phi axis
- Center of n-daughter:
  width*(n+0.5)+offset



Physical volumes

- G4PVDivision: 1 Division=many repeated volumes

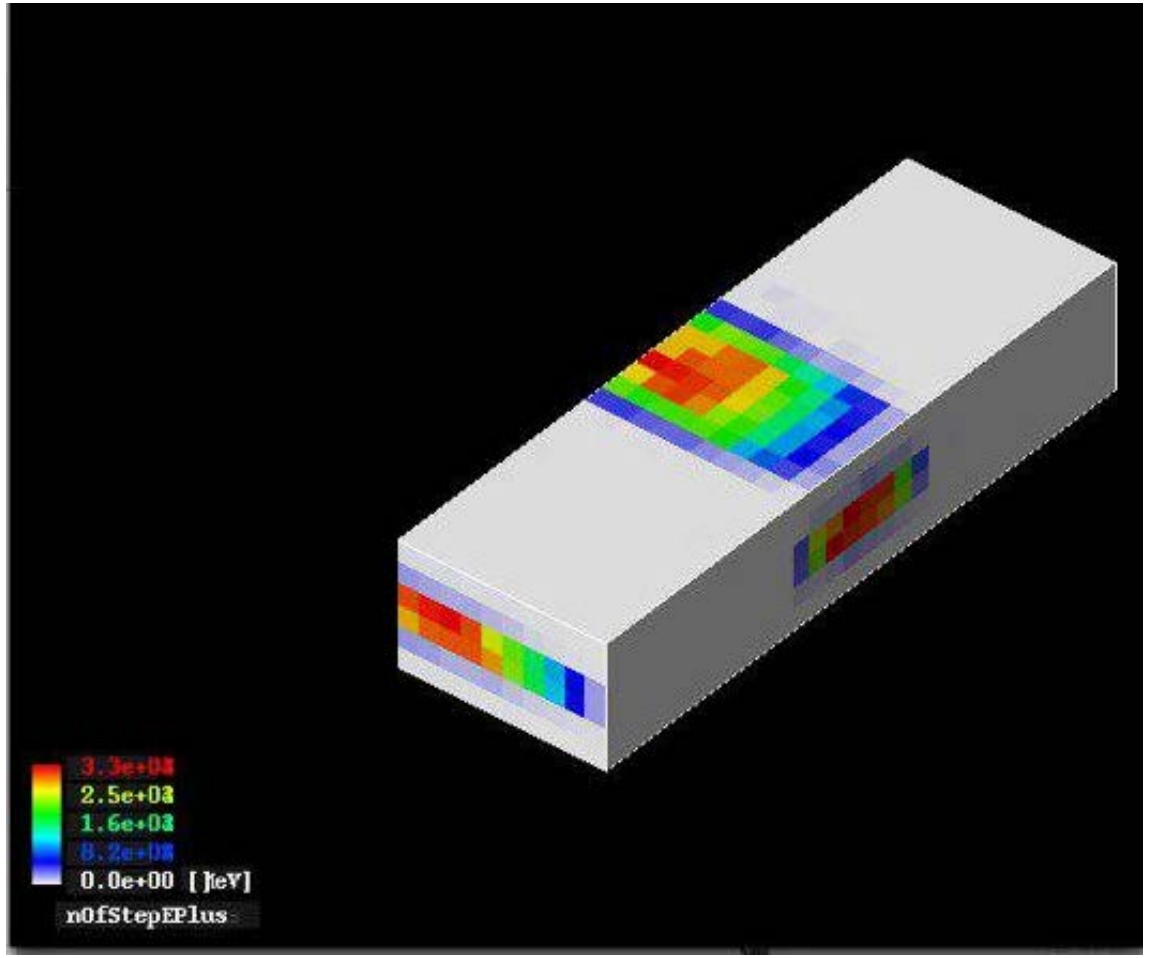


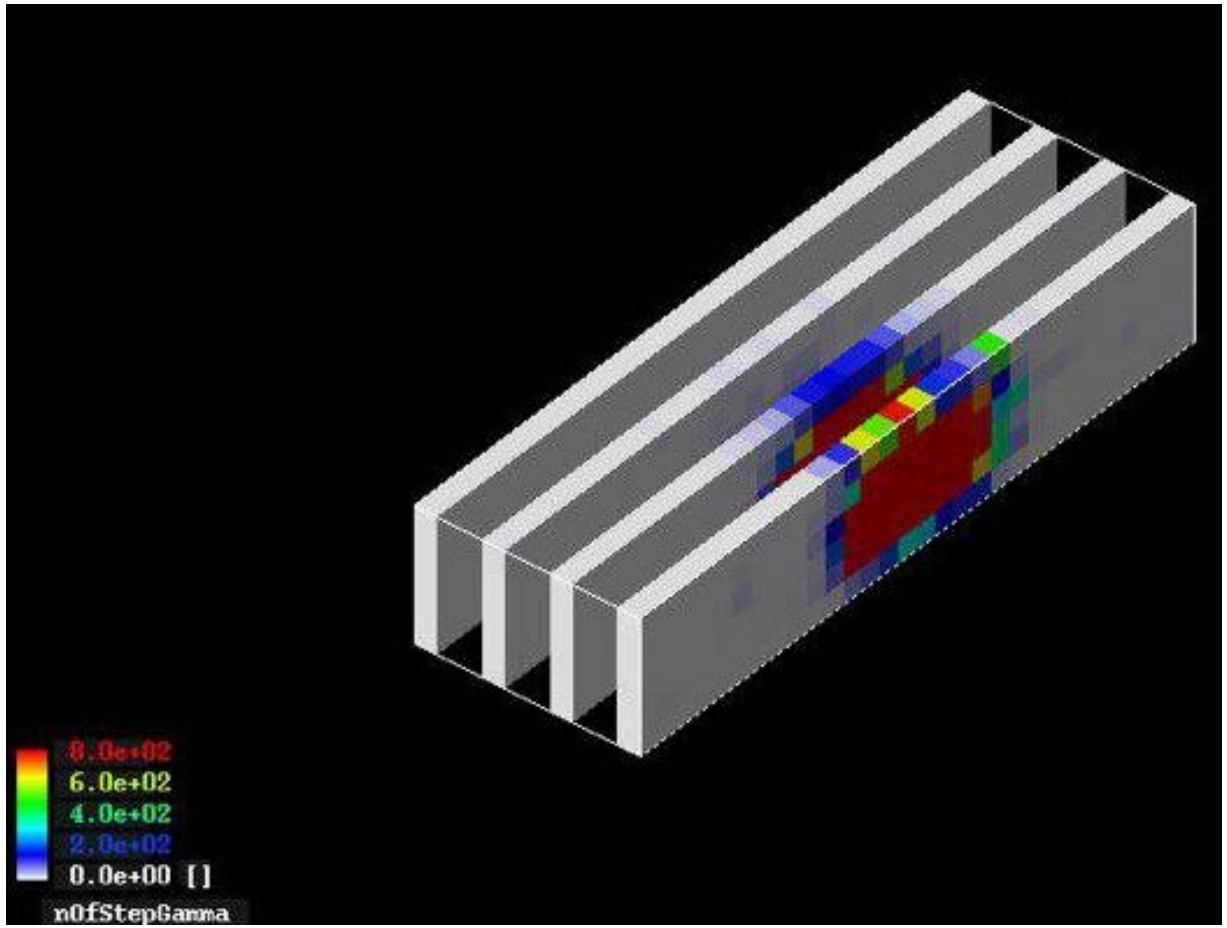
gaps between mother wall and outside daughters

Physical volumes

- G4ReflectionFactory: 1 placement=a pair of placement volumes

Hands on


3.3e+03
2.5e+03
1.6e+03
8.2e+02
0.0e+00 [keV]
nOfStepEPlus


8.0e+02
6.0e+02
4.0e+02
2.0e+02
0.0e+00 []
nOfStepGamma

Things to do

- New set up for single photon
- Look up geant4 tutorial hands on(accumulate quantities in root file)