

## Simulation of the influence of real lead on neutron and photon energy spectra emitted in the process of spontaneous fission of Cf-252

Real lead material set in GEANT4 (8"x4"x2" brick):

```
//-----real lead-----
G4Isotope* iso_Pb204 = new G4Isotope("iso_Pb204", /*Z=*/82, /*A=*/204 , /*Isotope
mass=*/203.97*g/mole);
G4Isotope* iso_Pb206 = new G4Isotope("iso_Pb206", /*Z=*/82, /*A=*/206 , /*Isotope
mass=*/205.97*g/mole);
G4Isotope* iso_Pb207 = new G4Isotope("iso_Pb207", /*Z=*/82, /*A=*/207 , /*Isotope
mass=*/206.97*g/mole);
G4Isotope* iso_Pb208 = new G4Isotope("iso_Pb208", /*Z=*/82, /*A=*/208 , /*Isotope
mass=*/207.97*g/mole);

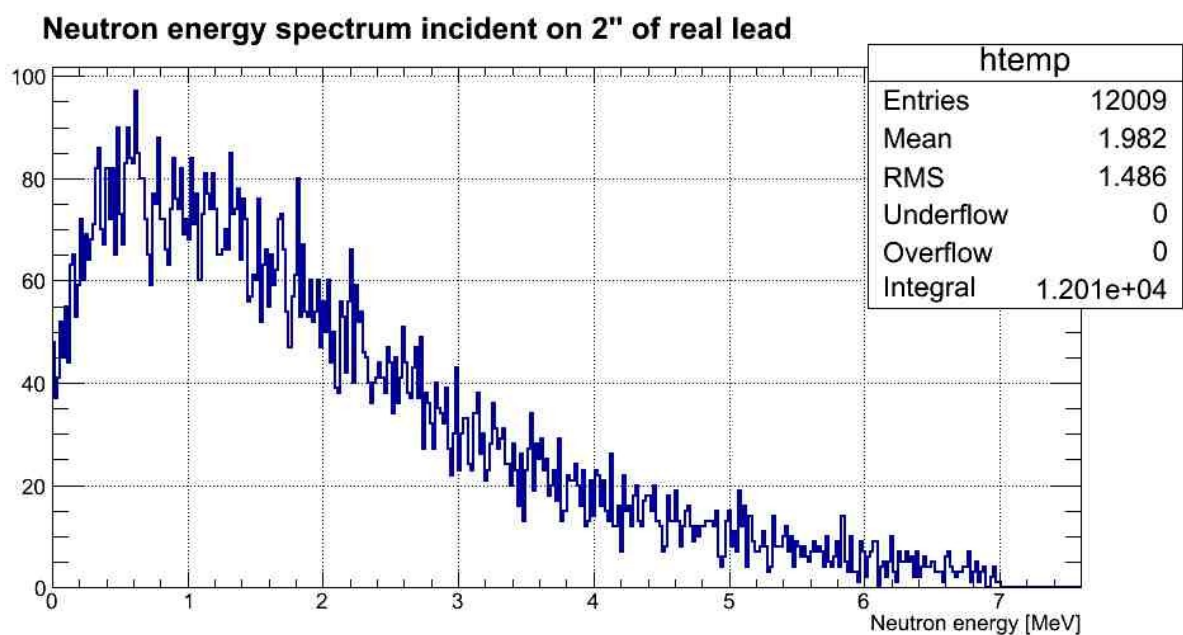
G4Element* RealLead = new G4Element("RealLead", 11.34*g/cm3, 4);
RealLead->AddIsotope(iso_Pb204, /* Abundance*/ 1.4*perCent);
RealLead->AddIsotope(iso_Pb206, /* Abundance*/ 24.1*perCent);
RealLead->AddIsotope(iso_Pb207, /* Abundance*/ 22.1*perCent);
RealLead->AddIsotope(iso_Pb208, /* Abundance*/ 52.4*perCent);

G4Material* RL = new G4Material("RL", density= 11.34*g/cm3, 1);
RL->AddElement(RealLead, 100.*perCent);
```

The incident particles were hitting the brick along 2" side and there was no particle divergence ("pencil" beam). The spectra obtained under the neutron irradiation of the brick are presented below and the emission is in 4pi.

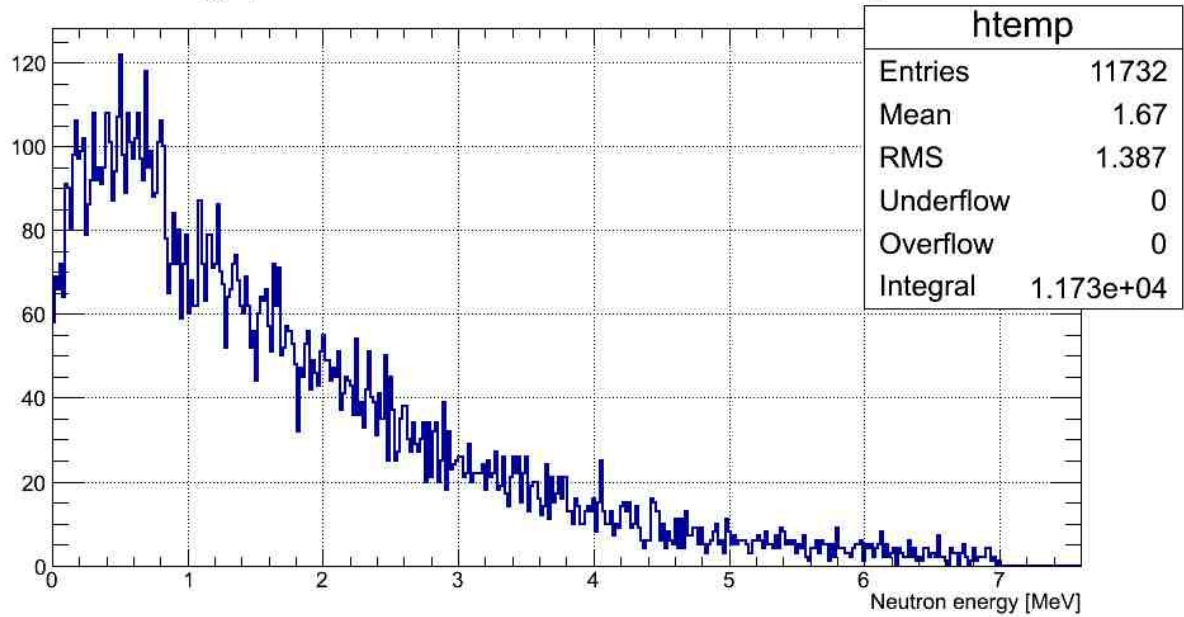
Number of the incident particles (neutrons/photons) = 12000.

### Irradiation of the lead by neutrons



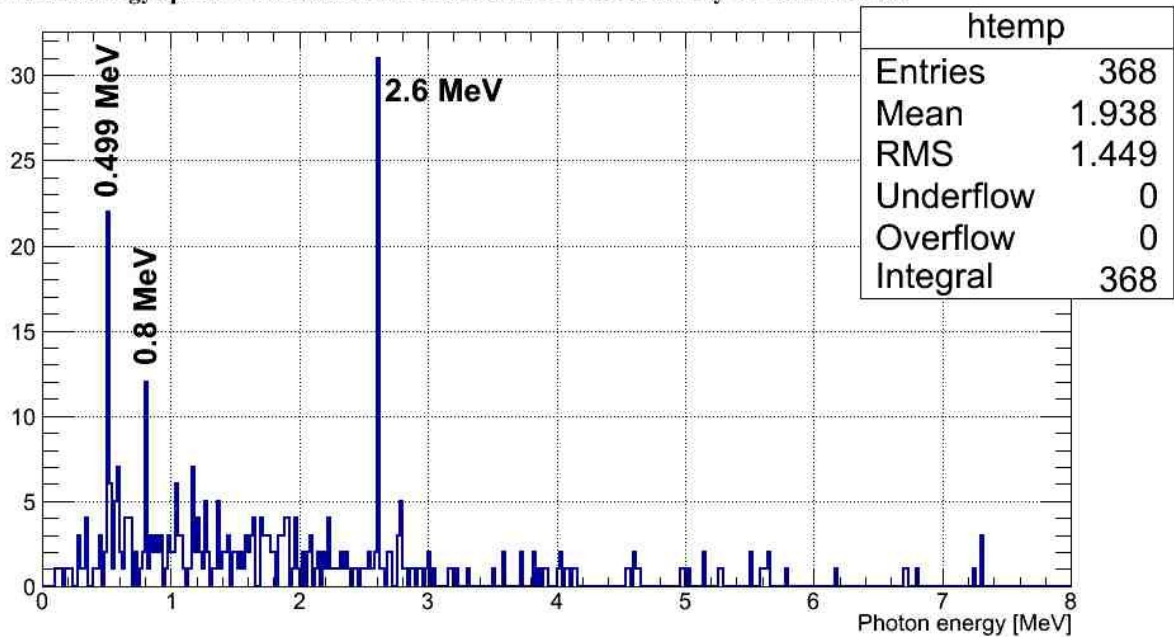
Cf-252 neutron emission spectrum.

**Neutron energy spectrum outside of the real lead brick irradiated by Cf-252 neutrons**



Neutron energy spectrum outside of the lead irradiated by Cf-252 neutrons.

**Photon energy spectrum outside of the real lead brick irradiated by Cf-252 neutrons**



Photon energy spectrum outside of the lead brick irradiated by Cf-252 neutrons.

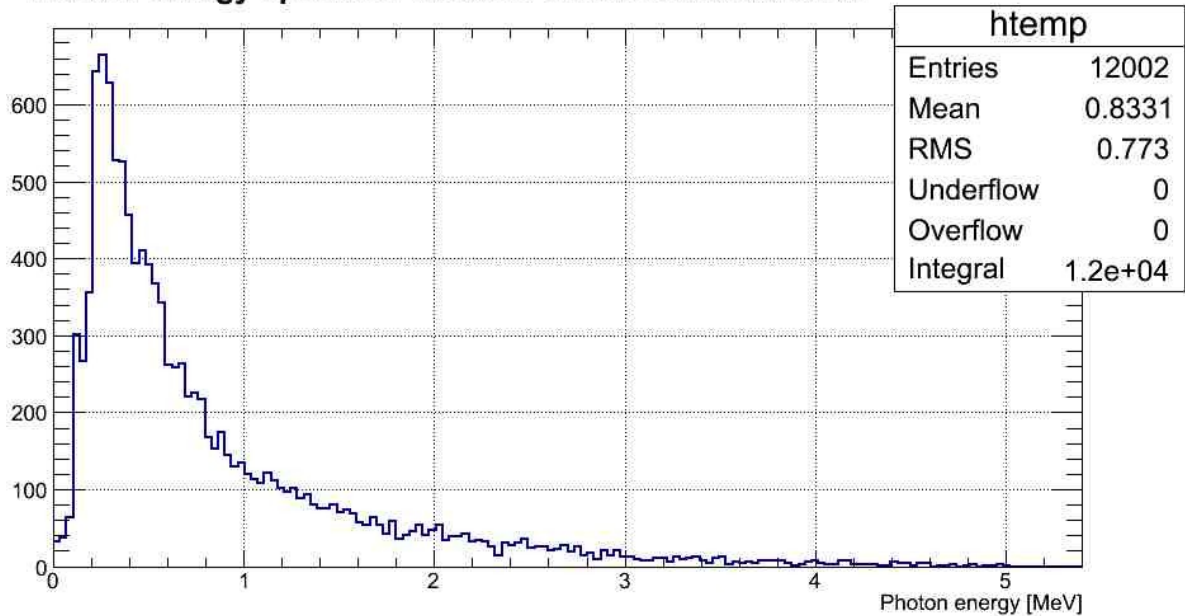
No protons were detected outside of the lead brick under irradiation by Cf-252 neutrons.

It can be seen that lead is no a good neutron absorber (only  $11732/12000 \Rightarrow 2.23\%$  of the neutrons was absorbed).

Some number of photons from neutron capture was emitted.

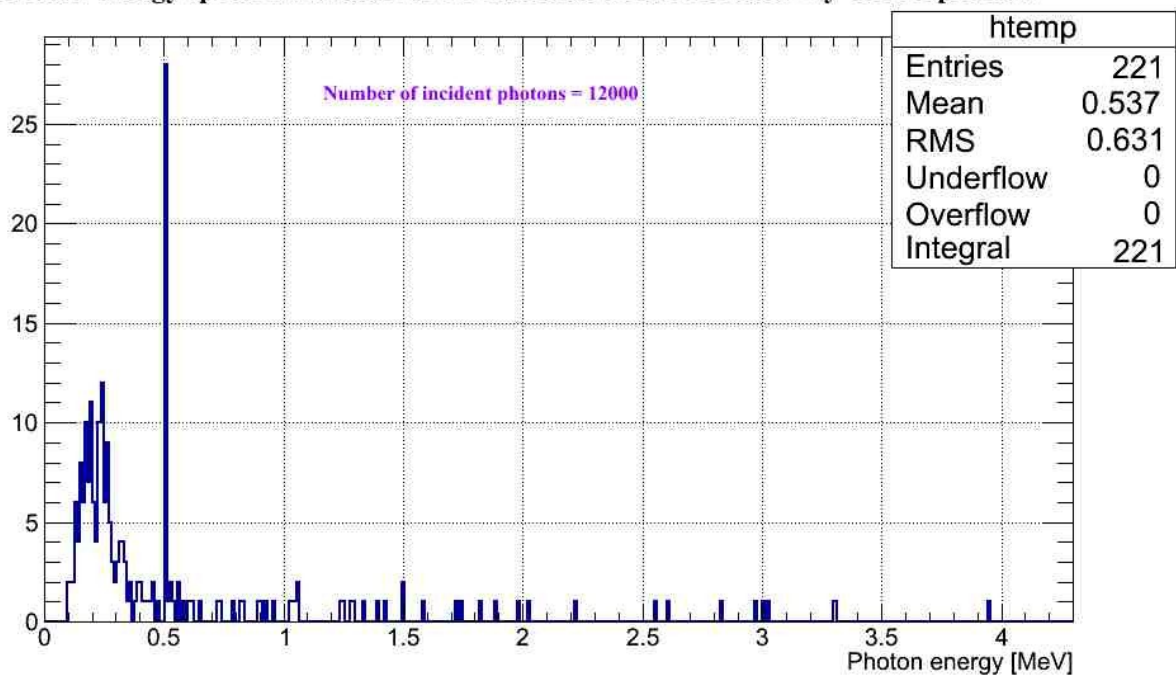
## Irradiation of the lead by photons

### Photon energy spectrum incident on the real lead brick



Cf-252 photon emission spectrum.

### Photon energy spectrum outside of the real lead brick irradiated by Cf-252 photons



Photon energy spectrum outside of the lead brick irradiated by Cf-252 photons.

No neutrons were detected outside of the lead brick.

It can be seen that lead is a good photon absorber (only  $221/12000 \Rightarrow 1.84\%$  of the photons was transmitted in  $4\pi$ ).