# Report for a Monthly Meeting

Hong, Q.

Supervisor Team :

Platt, S.P.

Mein, S.J.

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University of Central Lancashire

qhong@uclan.ac.uk

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# 1 Project Background

Single event effect have an impact on electronic devices, especially applied in outer space, aircraft altitude and terrestrial environment. On the sea level, neutron as one of the factors induced single event effect has received attentions since Ziegler found soft fails in computer electronics [1]. Testing single event effect on electronic devices under natural neutron fields is not only expensive but also time consuming. Using accelerated neutron Single Event Effect (SEE) testing to explore SEE on electronic devices and system is a well established technique. As the basis of simulation, two test facilities have been considered as simulation model in the project, one is LANSCE ICE House and the other is The Svedberg Laboratory (TSL) [2, 3]. The silicon photodiodes have been applied in local beam monioring for accelerated neutron SEE testing is used to obtain a reliable estimation of neutron induced SEE cross-section [4]. It has been found that there is a possibility of gamma rays deposited energy in the photodiodes [5]. Monte Carlo simulation is good for quantitative analysis of physical and mathematical problems. The Geant4 software toolkit as a open source is developed for the passage of particles through the matter.

My project is going to use Geant4 toolkit to simulate accelerated neutron SEE testing(LANSCE and TSL), calculate neutron and gamma flux at different positions along the beam line, and compare to existing database of neutron flux.

# 2 Current Plan

Compare LANSCE measurement results with Geant4 simulation results, it shows the simulated neutron flux is a little bit higher than measurement results below about 10MeV. It is considered to attach collimator to take a look.

## 2.1 LANSCE results comparison

Comparison of neutron flux of LANSCE measurement results and Geant4 simulation results at 30 degree with collimator attached. Comparison of neutron flux of LANSCE calculation results and Geant4 simulation results at 30 degree with collimator attached.

## 2.2 ANITA results comparison

Comparison of neutron flux of analytical ANITA results and Geant4 simulation results at 0 degree with collimator attached.

## 2.3 Simulation results comparison

Comparison neutron flux of Geant4 simulation results at 0 (or 15, 30, 60 90) degree without collimator attached and with collimator attached under Bertini Model.

Comparison neutron flux of Geant4 simulation results at 0 (or 15, 30, 60 90) degree without collimator attached and with collimator attached under Binary Model.

Comparison gamma flux of Geant4 simulation results at 0 (or 15, 30, 60 90) degree without collimator attached and with collimator attached under Bertini Model.

Comparison gamma flux of Geant4 simulation results at 0 (or 15, 30, 60 90) degree without collimator attached and with collimator attached under Binary Model.

To implement these plans, it needs to construct the collimator in the geometry and place two more detectors in tandem of the collimator. Then it is possible to calculate neutron (gamma) deposition parameters in collimator, for example, neutron (gamma) fluence.

# 3 Progress against the plan

Construction of collimator does not go well. Only neutron detectors are attached in the codes. Gamma detectors will be established in Geometry.

No source management for this project, no records for the changes in each time.

# 4 Achievements since last meeting

## 4.1 Geometry of collimator

It shows positions of neutron source, detectors and collimator in accelerate SEE testing at The Svedberg Laboratory (TSL) [6]. This collimator is made up steel cuboid with a hole of 102mm in diameter. Reference to Figure 1. As it shows, some of neutrons could pass through the middle of the hole, some would go back and some have been stopped by collimator.

## 4.2 Position of detectors

In order to compare the neutron fluence results with and without adding collimator. Two more detectors will be attached along the incident direction of proton (+z) to calculate neutrons. They are located (0,0,867mm) , (0,0,collimatorLength + 867mm) and (0,0,2.5m) respectively to calculate neutrons before the neutron passing through the collimator, after the passage of neutron through the collimator. The third detector is placed in Standard User Position (it existed in the previous simulation, no collimator constructed)[6]. The output file should contain more information, like detector ID.

## 4.3 Getting Started - Git

Git is a good tool used as source manager to record changes and restore the project programming so that it is easy to recall any version at anytime anywhere. This version control system now is going to record any changes of this project. The git is used to store the snapshots for each time which is different from other competing product such as subversion. Commit, which takes the files as they are in the staging area and stores that snapshot permanently to your Git directory. Push, which takes the database from Git directory to another repository [7]. The following Figure2 shows a Git on server.

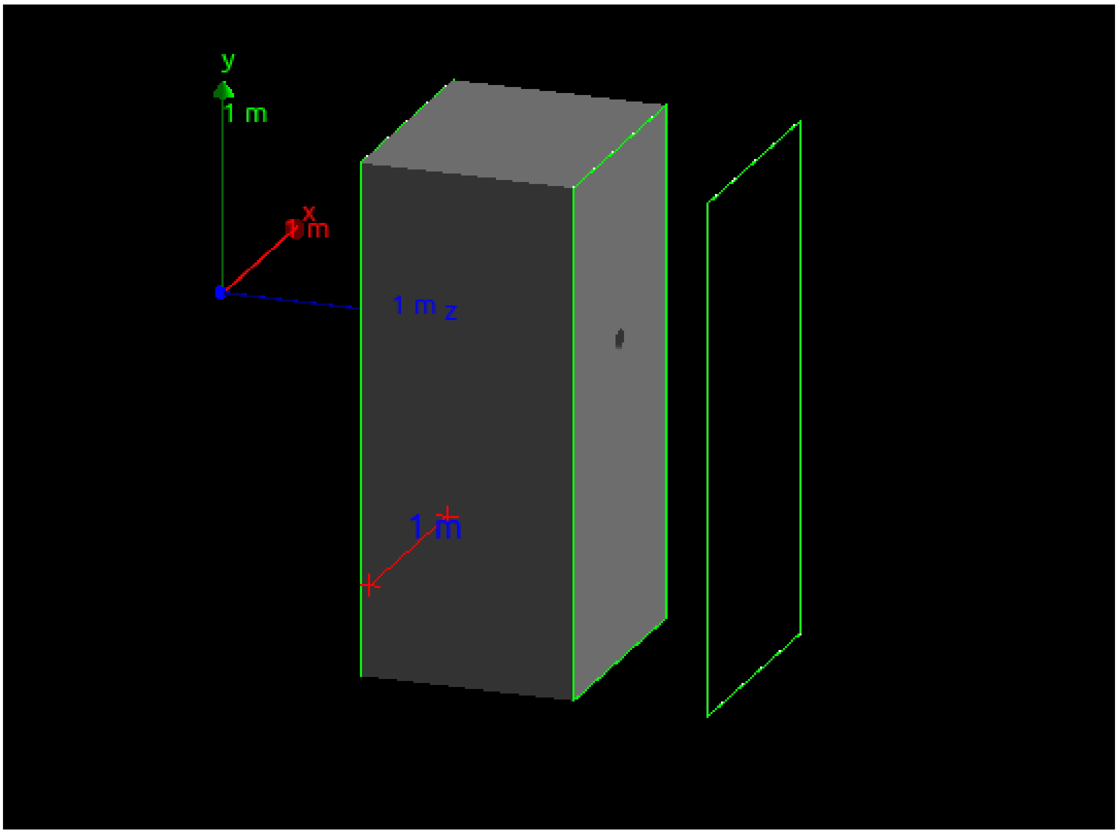


**Figure 1:** Geometry with collimator append

## 4.4 G4 Learning

The visualization can be controlled from both commands and compiled code. The commands are written in macro file withe using commands like /vis/open "visualization driver" and /vis/drawVolume. Visualization Manager G4VVisManager, which as calling methods existing in G4UserRunAction and G4UserEventAction so that when Geant4 simulation is running, visualization can be implement with no user intervention .

## 4.5 Geant4 Installation support

New finding for Geant4, Geant4 is officially supported on Scientific Linux CERN 5 with gcc 4.1.2 or 4.3.X, 32/64bit and Scientific Linux CERN 6 with gcc 4.6.X, 64bit. This operating system has been installed, the following Figure3 shows interface. It is possible to try this system rather than one system. Now Geant4 source code has been installed in SL6 but lack of Integrated development environment. XCode and Eclipse are suggested in Geant4 installation manual and it is precious to try.

## 4.6 Latex

Using text editor (TexnicCenter) to write monthly meeting report.

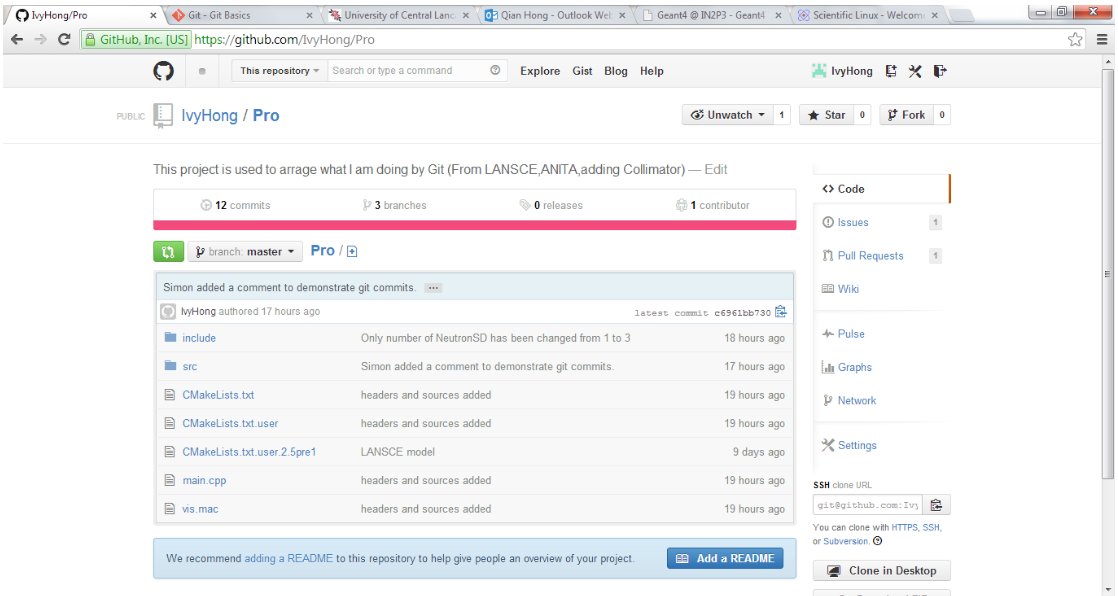


**Figure 2:** Git Repository

# 5 Difficulties encounted since last meeting

## 5.1 Problem.1

Two detectors have been attached, no records from the output files. In order to check the programming, Debugger of Qt creator would be used, but it fails to debug. The commands existing in macro file which are not compatible with the Qt creator debugger.

## 5.2 Problem.2

Except for these, any source manager has not used in this PhD project. That will be a problem. No records for each modification. The program is unable to get back according to time.

## 5.3 Problem.3

The geometry of collimator seems not correct from visualization interface window. The hole does not penetrate the collimator.

# 6 Next steps

## 6.1 Step.1

Collimator geometry needs to be checked through minimal working example method. It is capable of creating a small project which used to check geometry.

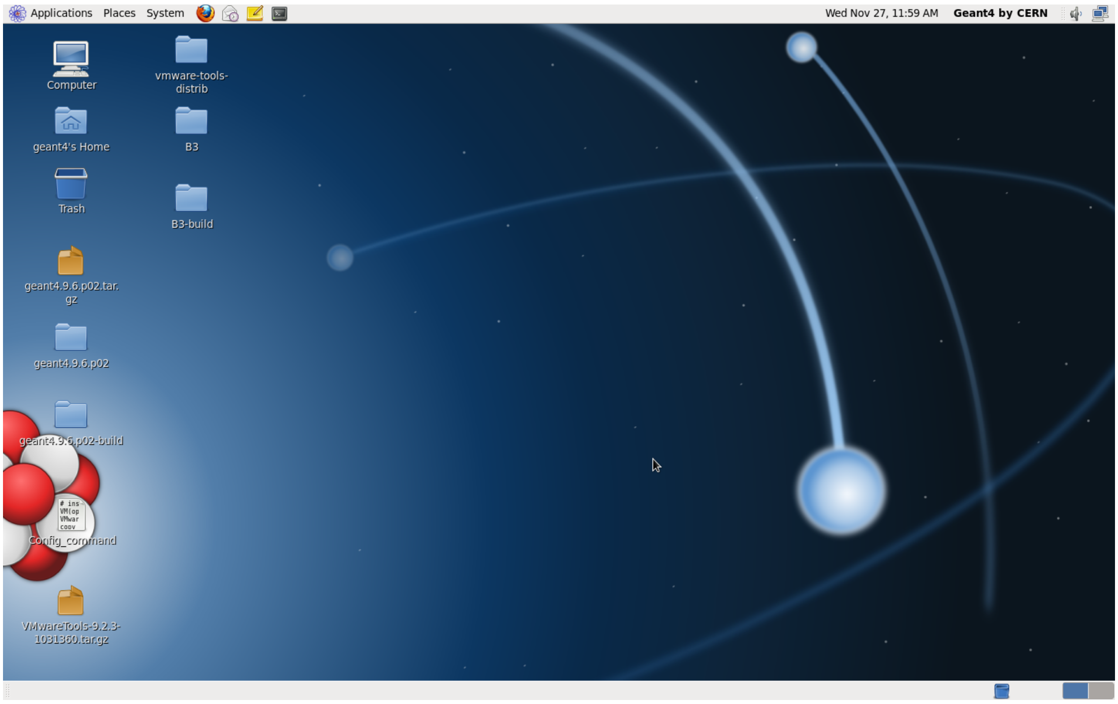


**Figure 3:** Scientific Linux Operating system user interface

After examination, if the problem can be sorted it out, the progress will follow the plan step by step. If the examination result is not ideal, it should be read Geant4 user manual and ask Supervisor for help [8].

## 6.2 Step.2

Doing research to find out Xcode and Eclipse in Linux and install on scientific Linux 6. If it works well, I would be familiar with using Geant4 in different system.

# 7 Actions

Further aim is to submit a paper.

# 8 Revised plan

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