Report for a Monthly Meeting

Hong, Q.

Supervisor Team :

Platt, S.P.

Mein, S.J.

November 27, 2013

University of Central Lancashire

qhong@uclan.ac.uk

Contents

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 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 used 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 fluence at different positions along the beam line, and compare to existing data 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. Now it is planned to add collimator in the simulation and then compared with simulated results without adding collimator.

Background Radiation, Information about the neutron and gamma background-spectrum fluence rate Calculate neutron fluence by placing two more detectors in tandem. It is possible to calculate neutrons deposition parameters in collimator, for example, radiation leaking from the shielding.

2.1 Position 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

2.2 Position of detectors

In order to compare the neutron fluence results with and without adding collimator. Three 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 passage of neutron through the collimator, after the passage of neutron through the collimator and Standard User Position.

Figure 1: Geometry with collimator append

3 Progress against the plan

4 Achievements since last meeting

4.1 Git

Git or ColudForge will be a good tool used as source manager to record and restore the project programming.

4.1.1

4.2

4.2.1

5 Difficulties encounted since last meeting

More detectors have been attached, no records from the output files. In order to check the programming, Debugger on Qt creator would be used, but it fails to debug. The debugger installed on Linux operating system which is new to me. It need to take some time to learn how to debug on WildCat for this project.

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

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

6 Next steps

7 Actions

8 Revised plan

References

[1] J.F. Ziegler, H. W. Curtis, H.P. Muhlfeld, C.J. Montrose, B. Chin, M. Nicewicz, C. A. Russell, W. Y. Wang, L. B. Freeman, P. Hosier, L. E. LaFave, J.L. Walsh, J. M. Orro, G. J. Unger, J. M. Ross, T.J. O'Gorman, B. Messina, T.D. Sullivan, A. J. Sykes, H. Yourke, T. A. Enger, V. Tolat, T. S. Scott, A. H. Taber, R. J. Sussman, W. A. Klein, and C. W. Wahaus. Ibm experiments in soft fails in computer electronics (1978-1994). *IBM Journal of Research and Development*, 40(1):3–18, 1996.

[2] S.P. Platt, A.V. Prokofiev, and X.X. Cai. Fidelity of energy spectra at neutron facilities for single-event effects testing. In *Reliability Physics Symposium (IRPS), 2010 IEEE International*, pages 411–416, 2010.

[3] A.V. Prokofiev, J. Blomgren, S.P. Platt, R. Nolte, S. Rottger, and A.N. Smirnov. Anita - a new neutron facility for accelerated see testing at the svedberg laboratory. In *Reliability Physics Symposium, 2009 IEEE International*, pages 929–935, 2009.

[4] L.H. Zhang and S.P. Platt. Minimally invasive neutron beam monitoring for single-event effects accelerated testing. In *Radiation and Its Effects on Components and Systems (RADECS), 2011 12th European Conference on*, pages 945–949, 2011.

[5] L.H. Zhang. *Neutron beam monitoring for single-event effects testing*. PhD thesis, School of Computing,Engineering and Physical Science; University of Central Lancashire, 2012.

[6] A.V. Prokofiev, J. Blomgren, M. Majerle, R. Nolte, S. Rottger, S.P. Platt, Cai Xiao Xiao, and A.N. Smirnov. Characterization of the anita neutron source for accelerated see testing at the svedberg laboratory. In *Radiation Effects Data Workshop, 2009 IEEE*, pages 166–173, 2009.