[RADNEXT] Thermal neutron effects in electronic components

Report of Contributions

https://indico.cern.ch/e/ThN

Contribution ID: **1** Type: **not specified**

Introduction

Monday 19 September 2022 16:00 (5 minutes)

Presenters: CAZZANIGA, Carlo; LETICHE, Manon (ILL)

Contribution ID: **2** Type: **not specified**

Boron 10 and All That Jazz: The Impact of Thermal Neutrons on Integrated Circuit Reliability

Monday 19 September 2022 16:05 (40 minutes)

Radiation effects often dominate reliability failures in electronics. This is particularly true in high reliability terrestrial environments encountered in autonomous vehicles, supercomputer clusters, industrial (medical and nuclear) electronics, and aerospace electronics; anywhere that a failure, even a "soft"one, can lead to loss of life or mission failure. After a quick review of the primary environments where thermal neutrons are present in relatively high concentrations, we consider the primary nuclear reaction of concern - the interaction between 10B and thermal neutrons. We then examine the various ways and regions in which 10B is introduced or accumulated in the semiconductor fabrication process. We consider some methods of mitigation from the IC manufacturing and packaging point of view and highlight the need for thermal neutron test facilities and standardized methodologies for dealing with and determining the thermal neutron component of SEE.

Presenter: BAUMANN, Robert (Radiosity Solutions LLC)

Contribution ID: **3** Type: **not specified**

Thermal Neutrons Effects on Supercomputers and Autonomous Vehicles: Have we learned the lesson?

Monday 19 September 2022 16:55 (40 minutes)

The high performance, high efficiency, and low cost of Commercial Off-The-Shelf (COTS) devices make them attractive for applications with strict reliability constraints. As a result, today COTS devices are adopted in HPC and safety-critical applications such as autonomous driving. Unfortunately, the cheap natural boron widely used in COTS chip manufacturing process makes them highly susceptible to thermal (low energy) neutrons. In this talk, we demonstrate, comparing the experimentally measured error rate to high and low energy neutrons, that thermal neutrons are still a significant threat to COTS device reliability. In the talk, to have a broad overview, we consider two DDR memories, an AMD APU, three NVIDIA GPUs, an Intel accelerator, and an FPGA executing a relevant set of algorithms. We predict the error rate of COTS in different scenarios that impact the thermal neutron flux such as weather, concrete walls and floors, and HPC liquid cooling systems. Correlating beam experiments and neutron detector data, we show that thermal neutrons FIT rate could be comparable or even higher than the high energy neutron FIT rate.

Presenter: RECH, Paolo (UFRGS)

Contribution ID: **4** Type: **not specified**

Q&A section

Monday 19 September 2022 17:35 (10 minutes)

Contribution ID: **5** Type: **not specified**

Q&A section

Monday 19 September 2022 16:45 (10 minutes)