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1 Overview

On September 22, 2017, a test was performed at RADEF to determine the sensitivity of DDR3 SDRAM devices to single-event effects caused by high-energy electrons.

2 Test facility

The test was performed at RADEF, Jyväskylä, Finland, using the linear electron accelerator *cLinac*.

The LET vs. energy of electrons is shown in the following figure¹. Note that the stopping power (LET) is given in MeV cm² / g; for heavy-ion tests, MeV cm² / mg is more commonly used.

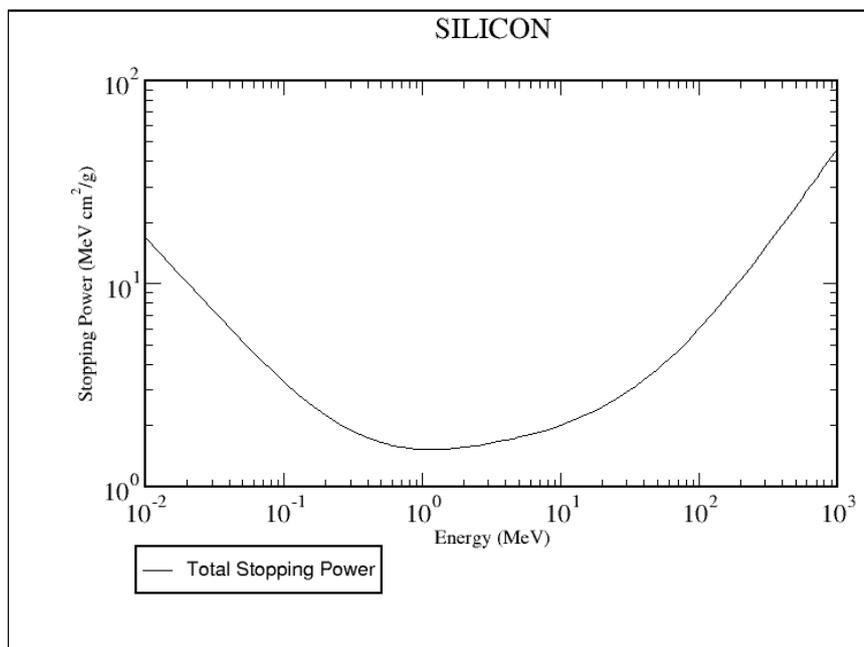


Figure 1: Electron LET

Of the relevant energy range (6 MeV to 20 MeV), the highest LET (2.5 MeV cm² / g) is achieved at 20 MeV.

3 Samples

Two device types had been selected for the test:

Part ID	Manufacturer	Part number	Capacity	Feature size	Date code
Hyn4	Hynix	H5TQ4G83MFR-H9C	4 Gbit	Unknown	1223
Sam4	Samsung	K4B4G0846B-HCH9	4 Gbit	35 nm	1216

¹ Calculated with <https://physics.nist.gov/PhysRefData/Star/Text/ESTAR.html>



Hyn4

Sam4

Figure 2: Package photos

All samples were unmodified, i. e., not opened or thinned.

All of the available Sam4 samples suffered from contact issues in the ZIF socket of the test equipment and could therefore not be tested.

4 Test procedure and test results.

Devices were tested in read mode without software conditioning. Before the irradiation, a pseudo-random pattern was written to the device. The device was then irradiated while repeatedly reading the whole device address space.

Two samples were irradiated with 20-MeV Electrons up to a dose of 100 krad at a dose rate of 1 krad/min. No errors of any kind were observed.