



Effects on Avionics (Neutron Science)

Neutrons produced in the upper atmosphere are known to produce soft errors in computers at ground level, at 40,000ft atmospheric neutrons are much more abundant and are known to regularly cause soft errors in avionics. The move to smaller and smaller circuitry makes this an ever growing problem which STFC can both identify and rectify using radiation environment ASIC design knowledge.

Solar wind, a flow of fast-moving charged particles from the sun, showers cosmic ray bursts onto the earth. These neutrons from outer space collide with microchips and upset or damage microelectronic devices. These episodes, known as 'Single Event Effects' (SEEs), can affect circuitry on the ground, but the problem is 300 times greater at high altitude. This makes it of particular concern to both the civil and military **aerospace industry**.

A microchip in an aircraft can be struck by a neutron every few seconds. When a neutron hits silicon, a nuclear reaction occurs causing an electrical charge shower that can interfere with the normal operation of electronic equipment.

SEEs are now recognised as the dominant reliability issue for avionics in the coming decade. Naturally occurring neutrons in the atmosphere are the most intractable source of SEE in electronic components, because they are too penetrating to be shielded.

At ISIS we have the ability to produce intense beams of neutrons with similar energy ranges to those occurring naturally. This enables accelerated reliability testing of microelectric elements used in the aerospace industry.

With the new Target Station 2 being built, ISIS is one of few facilities in the world capable of producing enough very high energy neutrons to perform such accelerated testing. A proposed instrument at the Second Target Station would result in the creation of the best SEE screening facility in the world (<http://ts-2.isis.rl.ac.uk/>)

Results from this testing will allow manufacturers to mitigate against the problem and build triple redundancy into their electronic components. This increased confidence in the quality of electronic systems will help to make both civil and military aircraft safer.





Chip, pre and post Neutron
bombardment

For further information, please contact **Andy Bennett** or **Paul Vernon**
Tel: 01925 603193 and 01925 603141 Email: technicalsales@stfc.ac.uk