ANSTO accelerators and capabilities in designing tests for space radiation environments

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Since 2021, through the Space Infrastructure Funding scheme and more recently through the National Collaborative Research Infrastructure Strategy scheme, ANSTO has been a proud funding partner of the National Space Qualification Network (NSQN), offering advanced space radiation testing facilities, capabilities, and expertise to bolster Australia's space sector resilience.

With the three sovereign facilities of the Centre for Accelerator Science, the Synchrotron, and the Gamma Irradiator, ANSTO's unique infrastructure allows radiation testing of electronics and advanced materials: Displacement Damage Dose (DDD) testing using proton beams, Total and Local Ionizing Dose (TID/LID) testing using Co-60 gamma source and synchrotron X-ray beams, Single Event Effect (SEE) testing using proton, light and heavy ions beams, and SEE pre-screening using high intensity synchrotron X-rays to map radiation sensitivity within a single device [1].
To optimise the outcomes of radiation testing and advise customers on radiation-induced risks, ANSTO has developed advanced simulation and reverse engineering capabilities that enable tailored test customisation and maximising of the performance of the accelerator technologies. Additionally, characterisation of LET, energy, and SEE cross-section can be performed to align ANSTO's beamline with international standards requirements [2].
Finally, ANSTO hosts the External Beam Irradiation Facility (EBIF) on the Heavy Ion Microprobe (HIMP) [3] beamline to overcome the challenges associated with vacuum testing such as: easier sample handling, the elimination of charging effects in insulating materials, improved heat dissipation, reduced pressurisation cycle times, and the capability to irradiate living biological samples enabling radiobiology research.

The presentation will delve into the accelerator technologies for space radiation testing at ANSTO and the expertise provided to support Australian communities.

References

[1] S. Peracchi et al., "Australia's External Ion Microbeam Irradiation Facility For Space Radiation Effects Testing", 22nd European Conference on Radiation and Its Effects on Components and Systems (RADECS), pp. 140-146, Venice Italy, 2022.

[2] S Peracchi et al., "LET Calibration of Ion Microbeams and Their SEE Cross Section Characterization", IEEE Transactions on Nuclear Science, vol. 71, no. 8, pp. 1565-1570, 2024.

[3] R. Siegele et al., "The ANSTO high energy heavy ion microprobe", Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, vol. 158 no. 1-4, pp. 31-38, 1999.