Beitrag ID: **240** Typ: **Oral**

In-situ single event effect tests of electronic components for space applications

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The space environment is inhospitable to humans and the spacecrafts utilised by us to access space, its systems, subsystems and EEE component. An important element of the space environment is the abundance of high energy particles, constituting the natural space radiation environment. The space radiation environment detrimentally affects EEE components flown on space missions. The impact on electronic components vary from slow degradation of electrical parameters, due to cumulative effects, or sudden unwanted events due to transient effects.

In this presentation, we will show several cases of single event effects (SEE) and the associated radiation hardness assurance (RHA) issues. The presentation will be divided in three parts:

- In a first part, we will illustrate a major difficulty usually encountered in space projects, which is the traceability of the design and fabrication process when procuring parts from semiconductor manufacturers, and consequently the representativeness of the SEE tests performed before flight. Any modification in the design or process will induce a different SEE response, potentially catastrophic. Examples of this type of SEE issue encountered in the frame of space projects will be presented: (a) latch-up in a SRAM memory, (b) burn-out in a quad CMOS driver, used as a clock driver for CCDs.
- In a second part, SEE in two component types, Flash-based FPGAs, and Floating-gate memories, will be detailed. Both show re-programming failures after irradiation. The impact on their flight mission is though significantly different: it will directly affects the memory primary function, while FPGA are usually not reprogrammed in flight, except in few exceptional situations. The failure mechanisms, as well as other effects, such as single event upsets and transients (SEU and SET) will be shown from both broad beam and microprobe experiments.
- Finally, the example of new types of power devices, based on silicon carbide, will be highlighted and compared to silicon ones. The failure mechanism in silicon carbide is resolutely different from silicon based devices, and will necessitate to adapt SEE test methods and RHA rules.

Based on these examples, we will conclude with general considerations on failure sources in EEE components used in space and methods to prevent these failures.

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Sitzung Einordnung: Session 2

Track Klassifizierung: 00 - Invited talks