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Reliability of Space Instrumentation

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Space-borne instrumentation has entered a maturity age with standards, methods and workmanships that grant instrument lifetimes exceeding ten years without maintenance. This has been achieved through the adoption of a common technical reference imposed by space agencies to all segments of a space mission.

I will shortly expose this reference with associated methods and how our lab (Astrophysics Dept of CEA-IRFU) has implemented it on the instruments of the Euclid ESA mission to be launched in 2020.

I will in particular discuss the following aspects, covering all steps from the initial definition of the architecture of the instrument, to the detailed design and manufacturing of its subsystems:
- The reliability apportionment from top level to subsystems, with trade-off of architectures, and detailed reliability analysis of subsystems
- The Failure Mode Effect Analysis, with early identification of failure tolerance requirements, and detailed FMEA analysis at subsystem level
- The part-stress and worst-case methods, aimed at limiting the wear-out of components and predicting the ageing drifts of critical functions
- The control of procurement (components, manufacturing processes).

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