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Radiation Hardness of Electronics in the FCC

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FCC will need a significant amount of electronic components and systems in the accelerator tunnel, the Particle Detectors and the side galleries in order to control and monitor the various infrastructures and systems such as power converters, vacuum, cryogenics, RF systems, etc. The radiation assurance procedure will be driven by the high availability requirements of the systems and the highly challenging radiation levels.

Therefore, two complementary approaches will be implemented in the context of the FCC activities in R2E (Radiation to Electronics) in order to provide the targeted availability: the reduction of the radiation levels received by the electronic systems through shielding and optimized location and the development of electronics and equipment which is radiation resistant for FCC levels. The second point is tightly linked to the Radiation Hardness Assurance (RHA) procedure, which consists of all activities undertaken to ensure that electronics and materials developed for FCC perform to their design specifications after exposure to the FCC radiation environment, therefore involving (i) the radiation environment definition (ii) the electronic component selection (iii) the part testing and (iv) radiation tolerant design.

Concerning the radiation environment definition, the baseline approach will be that of implementing models of the FCC geometry in a Monte Carlo transport code context (i.e. FLUKA) and perform simulations in order to retrieve the relevant radiation levels. In addition, it will be important to identify the existing and foreseen radiation test facilities suitable for the characterization of FCC components and systems. Finally and in combination with the simulations, it will be essential to monitor the radiation levels in the relevant FCC locations as the latter will have a very strong impact on the radiation hardness assurance methodology.

Authors: INFANTINO, Angelo (EN/EA); FACCIO, Federico (CERN); RAVOTTI, Federico (CERN); CERUTTI, Francesco (CERN); GORINE, Georgi (Ecole Polytechnique Federale de Lausanne (CH)); CAPEANS GARRIDO, Mar (CERN); BESANA, Maria Ilaria (CERN); BRUGGER, Markus (CERN); MOLL, Michael (CERN); GARCIA ALIA, Ruben (CERN)

Presenter: GARCIA ALIA, Ruben (CERN)

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