Abstract

At a c.m. energy of 6 TeV/nucleon, foreseen for the ALICE heavy-ion program at LHC, multiplicities around 10^5 per central Pb-Pb collision are expected from the current models. This large flux of particles interacting with the various detectors and materials must be taken into account to estimate the radiation dose. This is of special concern for the Inner Tracker System (ITS) of the ALICE detector, due to the small distance from the interaction region. Simulations carried out in the framework of a commonly accepted scenario for the first 10 years of data taking provide an overall dose of around 150 krad for the innermost pixel layers and a neutron flux of 3x10^11 n/cm^2.

The readout electronics for the pixel detectors in the ITS is especially subjected to possible damage from the outcoming particles. Such electronics includes a large number (about 1200) of front-end readout chips with 8192 individual cells (for a total number of 9.8 million channels) and a certain number of pilot chips (120) which will control the data flow from the pixel ladders to the DAQ. While the currently in use Omega3 family front-end electronics is not radiation tolerant, sensible progresses have been made in the technology by the use of the gate-all-around deep submicron CMOS design. Systematic irradiation tests of the Omega3 family and of the more recent ALICE prototypes have been carried out both at CERN and at several laboratories in Italy. Gammas, low-energy protons, electrons and neutrons have been used to characterise the behaviour of such electronics under irradiation. The results obtained so far point out that the recent prototypes will retain their functionality up to doses and neutron fluxes well above the expected rates in ALICE.