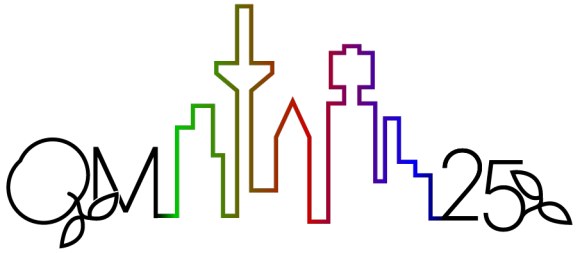

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Performance of the Silicon pad sensors for the ALICE Forward Calorimeter upgrade at the LHC

A new high-precision forward calorimeter (FoCal) will be installed in the ALICE experiment at the LHC during Long Shutdown 3 for data-taking during LHC Run 4, currently scheduled for 2030-2033. FoCal consists of a Si+W sampling electromagnetic calorimeter with longitudinal and transverse segmentations (FoCal-E) and a conventional Cu+scintillating-fiber hadronic calorimeter (FoCal-H). FoCal has a front face of approximately 90×90 cm^2 and is placed at $z = 7$ m from the nominal interaction point. It covers the pseudo-rapidity range of $3.2 < \eta < 5.8$. FoCal has unique capabilities to measure the direct photon production at the forward rapidity that probes the gluon distribution in protons and nuclei at small-x. Furthermore, FoCal will enable to carry out inclusive and correlation measurements of photons, neutral mesons, and jets in hadronic pp and p-Pb collisions as well as J/ψ production in the ultra-peripheral p-Pb and Pb-Pb collisions.

The key component for FoCal-E is the large-size Silicon pad sensor with the high radiation tolerance. The estimated radiation dose in the innermost part of FoCal-E is approximately equal to 7×10^{13} 1 MeV n_{eq} / cm^2 over the full Run 4 period. Some p- and n-substrate silicon pad sensors were manufactured by way of trial and those characteristics were studied through irradiation tests at the RIKEN RANS facility in Japan and beam tests including temperature dependence. We try to operate the sensors at room temperature across an increase of the leakage current by radiation damage. Finally, the p-substrate silicon PIN photodiode array from the 6-inch double-sided polished wafer with ⟨100⟩ orientation by Hamamatsu Photonics K. K. has been proven to be able to operate in such environment. Mass production will begin soon and a new probe station for the quality assessment (QA) of all delivered sensors is ready as well. We would like to present performance of the Silicon pad sensors and our QA plan.

Category

Experiment

Collaboration (if applicable)

The ALICE Collaboration

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