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The irradiation tests of Silicon pad sensors for the new ALICE FoCal detector at LHC

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The ALICE Collaboration is planning to install a new forward calorimeter (FoCal) as a detector upgrade to the ALICE experiment at LHC during the next long shutdown from 2027 to 2029. The FoCal consists of a Si+W electromagnetic component with longitudinal segmentation (FoCal-E) and a conventional scintillating fiber hadronic component (FoCal-H). It will cover the pseudorapidity interval of $3.4 < \eta < 5.8$ at a place of 7 meters in the forward region seen from the interaction point. 22 FoCal-E modules will be placed around the LHC beam pipe to realize the FoCal-E component and each module is composed of 20 low-granularity layers with silicon pad sensors and 2 high-granularity layers with silicon pixel sensors. The silicon pad sensor which can take one from a 6-inch p-substrate wafer is a key component to bring a performance of FoCal into full play, and it has 72 main cells of 1cm x 1cm and 2 calibration cells of 3mm x 3mm each. In order to estimate a change of characteristics of silicon pad sensors in long-term operation in the ALICE cavern, we carried out the irradiation tests using the neutron beam at Riken RANS in 2022 and 2023, and some silicon pad sensors were irradiated within range from 1 x 10^12 to 3 x 10^14 neutron equivalent / cm^2 according to a beam intensity and a distance from the target. After that, we could have opportunities of beam tests of the irradiated silicon pad sensors at the CERN PS complex and Tohoku Univ. ELPH in 2023 and 2024, respectively, and we could get the information on a leakage current including an annealing effect, the temperature dependence and the MIPs data measurement. In this meeting, detailed results of the irradiation tests and beam tests will be presented.

Collaboration

The ALICE Collaboration

Role of Submitter

I am the presenter

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