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Irradiation study of ATLAS ITk strip sensors, ATLAS18, with 80MeV protons

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The ATLAS18 silicon strip sensors for the ATLAS Inner Tracker Phase-2 upgrade are to operate near the interaction point to the integrated luminosity of 4000 fb⁻¹, which results in the maximum fluence of 1.6×10¹⁵ neq/cm². To confirm the key properties of the sensors, dedicated test structures are regularly irradiated and tested as part of the quality assurance (QA) program in 4 irradiation and 7 QA test sites. To enhance the QA program, the strip sensor community is considering to include China Spallation Neutron Source (CSNS) as a proton irradiation and Institute of High Energy Physics (IHEP) as a QA test site. We have improved the irradiation setup at CSNS to increase the throughput. The new irradiation setup is featured with better cooling control. The QA testing is improved to enhance the measurement precision. A collimator is designed for the CCE measurement setup at IHEP to limit beta particle scattering. The gain of the amplifier chip has been improved as a function of temperature. We have executed three irradiations with fluences of 6.0×10¹⁴, 1.6×10¹⁵, 2.6×10¹⁵ neq/cm². A total of 18 sensors irradiated at CSNS and an unirradiated sensor are measured at IHEP, including IV, CV, CCE characteristics. Two sensors irradiated with neutrons in Ljubljana and two sensors irradiated with protons in Birmingham are included in CCE measurements for cross-checking. This contribution also describes problems and their solutions that have occurred during the measurements.

Primary experiment

Authors: Mr ULLAN, Miguel (CNM-Barcelona (ES)); LIU, Peilian (Chinese Academy of Sciences (CN)); FADEYEV, Vitaliy (University of California, Santa Cruz (US)); SHI, Xin (Chinese Academy of Sciences (CN)); Mr LIU, Yang; HUANG, Yingjun (Sun Yat-Sen University (CN)); UNNO, Yoshinobu (KEK High Energy Accelerator Research Organization (JP))

Presenter: HUANG, Yingjun (Sun Yat-Sen University (CN))

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