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SiPM development for the TOP detector upgrade of the Belle II experiment

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The Time-Of-Propagation (TOP) is the particle identification detector in the barrel region of the Belle II experiment. The detector uses quartz bars acting as Cherenkov radiators and Micro-Channel-Plate PMTs as photodetectos. Three generations of MCP-PMT are currently installed in the TOP detector. The SuperKEKB accelerator shutdowns of 2023 and 2027 will be used to upgrade the detector with the last generation of MCP-PMT. Many improvements in SiPM production technology have been achieved in the last years. Using SiPM as a photodetector is the backup plan for the 2027 upgrade and the primary option for following upgrades with higher luminosity and higher background. The characterization of SiPMs from several producers is ongoing at the INFN/Univ. Padova laboratory at different temperatures down to -50 degrees. The selected SiPMs are the last available generation with 1x1 mm2 and 3x3 mm2 dimensions and different cell sizes. Characterized SiPMs will be irradiated in 2022 and in 2023 at INFN-LNL and tested again to measure the degradation of their characteristics. Plans of SiPM development in collaboration with FBK have been included in the AIDAinnova project, task 8.4.1 and inside a PRIN 2022 proposal recently submitted by Univ. of Ferrara, Univ. of Padova and INFN.

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