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Characterization and modelling of three building block circuitry of the Q-Pix charge read out scheme implemented using the open-source Skywater 130nm MOSFETS for application in liquid Argon detectors.

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We report room-temperature and 77 K characterization and modeling of SkyWater 130 nm (Sky130) NMOS and PMOS transistors. Using a custom closed cycle cryostat we measured the I-V characteristics from multiple Sky130 MOSFETs. These MOSFETs were fabricated on a chip manufactured as a part of the Efabless Open Multi-Project Wafer program using the Sky130 CMOS technology node specifically to evaluate their performance under cryogenic conditions. Using the data taken at 77 K, we developed an NGSpice compatible model for Sky130 MOSFETS which was used to simulate three building blocks of the QPix charge read out scheme - the integrator, the comparator and the ring oscillator. We aim to compare these simulations with the measured performance of the three circuits at 77 K. Our results will provide the overall performance of the fabricated circuits using the open source Sky130 technology node and will enable us to make improvements to the design for its optimal functionality in liquid argon detectors.

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