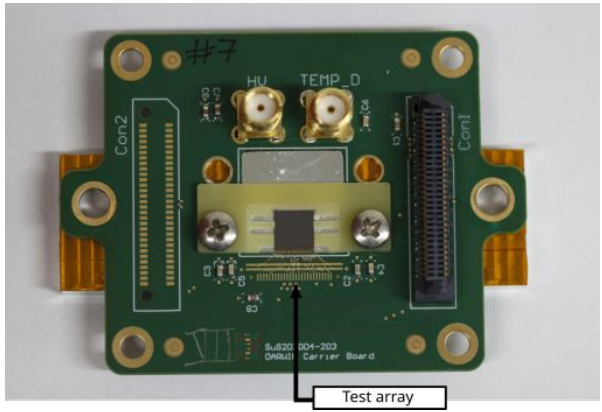
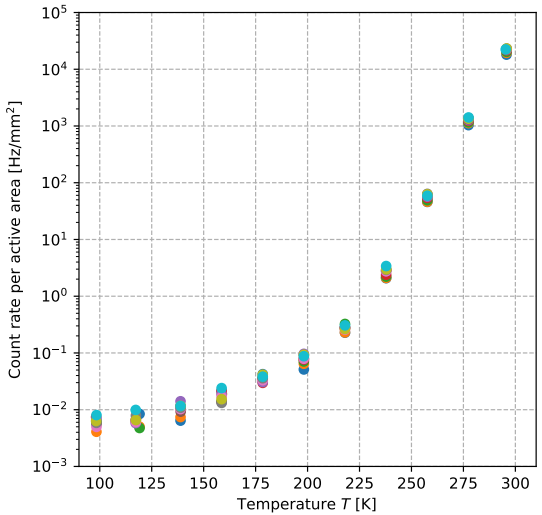
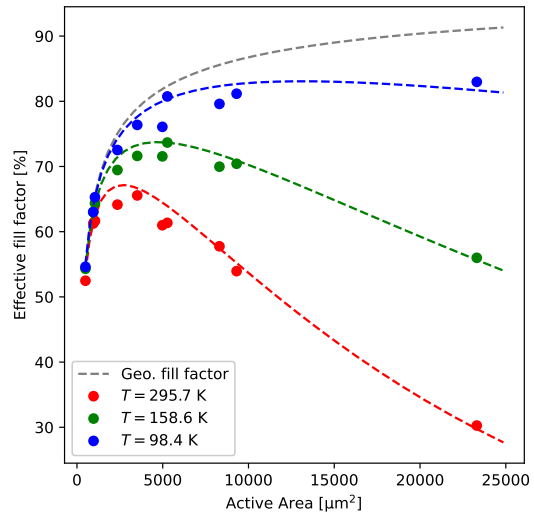
SPAD Array Chips with Integrated Readout with High Fill Factor and Low Dark Count Rate at Low Temperatures

- We tested the suitability of Digital SiPMs as light detector for rare event search experiments using Liquid noble gases. Here, low dark count rate and a good photon sensitivity are required.
- A test array was developed with focus on a high fill factor and a low dark count rate. The latter was optimized by modifying the SPAD electric field.
- At liquid Xenon Temperatures (T = 165K) a dark count rate of 0.02 Hz/mm² (active area) was observed.
- The defect density on the wafer was determined, and with that a SPAD size found for which the fill factor is highest after switching off the defect affected/noisy SPADs.
- Based on these results a high fill factor array with a realistic, low power readout architecture for rare event searches was implemented.







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