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Simulation and Measurement of the Shockley–Ramo Current from a Pixelated Silicon Detector

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TCAD and SPICE are used to simulate the response from a detector with a large detector-thickness-to-pixel-pitch ratio. The model indicates that the initial rising edge of the Shockley–Ramo current signal on the readout electrode has a very sharp rise time (~16ps), with an amplitude that is directly proportional to the weighting field. A silicon detector with this time resolution would have direct applications to high-energy particle physics. The modeled signal response will be validated on a sensor from a previous 8" wafer development with a pixel pitch of 30 x 100 μm and a thickness of 200 μm. The simulated induced current signal is of relatively small amplitude so a low-capacitance low-noise readout chain will be required. The simulated detector response and weighting field and proposed readout chain will be presented.

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