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Sensors and Front-end Electronics for the LSST Camera

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Over the next 5 years, the Large Synoptic Survey Telescope collaboration will construct a new 8m-class ground-based telescope and 3 Gpixel camera to perform an all-sky survey in the optical and near IR. Science themes of LSST include fundamental cosmology (testing the lambda-CDM paradigm and search for new physics), galactic astronomy (assembly history of the Milky Way), Solar System astronomy (asteroids and Kuiper belt objects), and optical transients. To accomplish these goals, focal plane components (sensors and front-end electronics) must satisfy stringent optical, mechanical, and electronic requirements.

LSST's science focal plane incorporates 189 high resistivity, fully-depleted CCDs in a modular arrangement of 21 "raft towers". Each tower is an autonomous, fully-functional camera with complete control, signal processing, diagnostic, and housekeeping functions for 9 CCDs (144 video channels). The sensors, electronics, mechanical, and thermal management elements of the tower are housed in a rectangular enclosure roughly 13 x 13 x 23cm inside the vacuum cryostat. Thanks to the high degree of parallelism, frame readout time is 2s at a pixel rate of 550kpix/s. Video data has a noise floor of about 9 e-, a dynamic range of 86dB and channel-to-channel crosstalk below -62dB. Locating the FE electronics in vacuum necessitates a low power budget; during readout the tower electronics dissipates less than 50W (350mW/channel). We will review performance results from pre-production towers and describe the ongoing characterization and scale-up studies.

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