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Optics Design for the SKA Reflector Antennas with Wide-Band Single Pixel Feeds

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As the next generation radio telescope, the Square Kilometer Array aims to have a combined sensitivity and survey speed several orders of magnitude larger than any current astronomical instrument. Operating over a extremely wide frequency band, from 100 MHz to 10 GHz, in its initial configuration, it relies on different technologies to cover the band: aperture array (both, sparse and dense) will be used in the low frequency range, from 100 MHz to 300 MHz, while for the medium to medium-high frequency range, from 300 MHz to 10 GHz in the current plan, it will use dishes with wide band single pixel feeds, with the possibility of utilizing focal phased arrays in the lower portion of this sub-band and with the same optics.

The key aspects that will make possible the expected performance of the Square Kilometer Array are a high aperture efficiency, low system noise temperature and high dynamic range. These aspects are addressed in the optical design of the reflector antenna carried out by the US SKA Technical Development Project.

We are going to present the main results of the TDP optical design effort, including an overview of the feed options, and the performance characteristics of the offset shaped optics design in terms of antenna gain, noise temperature, sidelobe levels, and Aeff/Tsys.

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