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# Prototyping of Hexagonal Light Concentrators for the Large-Sized Telescopes of the Cherenkov Telescope Array

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Reflective light concentrators with hexagonal entrance and exit apertures are frequently used at the focal planes of gamma-ray telescopes in order to reduce their dead area caused by the geometries of the photodetectors, as well as to reduce stray light entering at large incident angles. The focal planes of the Large-Sized Telescopes (LSTs) of the Cherenkov Telescope Array (CTA) will also be covered by hexagonal light concentrators with an entrance diameter of 50 mm (flat-to-flat) so that we can maximize the active area and the photon collection efficiency to realize a very low energy threshold of 20 GeV. Compound parabolic cones (CPCs, also known as Winston cones) have been widely used in ground-based gamma-ray telescopes for this purpose, however, their shape is not optimized for hexagonal cone arrays in the 3-dimensional space but for 2D only. We proposed a cubic Bézier curve for the LST light concentrators instead of an inclined parabolic curve used in CPCs to achieve higher collection efficiency and a sharp cutoff simultaneously. We have confirmed that the use of a cubic Bézier curve in CTA outperforms normal CPCs by means of non-sequential ray-tracing simulations with the ROBAST software, in which the incident angle and position dependence of photocathode sensitivity were also simulated. In addition to the cone shape, the reflectance of the internal walls plays an important role to increase the collection efficiency. We have developed prototypes of LST light concentrators made of UV enhanced reflective mirror foils (R > 95%) and plastic injection cones. We report ray-tracing simulation results and measured performance of our light concentrators.

## Collaboration

CTA

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