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Redshift Calibration of Lens Samples in DESY3 from the combination of SOMPZ and clustering

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Biased redshift calibration is one of the limiting factors of wide-field imaging surveys. Cosmological constraints from weak gravitational lensing suffer particularly from this misestimation, since they rely on the redshift distributions of both the lens and source galaxies. Lens catalogues are generally constructed by selecting galaxies with optimal quality redshifts (i.e. redMaGiC), but this results in samples with low number density. Instead, the Dark Energy Survey (DES) built MagLim, an alternative lens catalogue for the Year 3 (Y3) analysis, with bright magnitude limits at each tomographic bin imposed to reduce photo-z error at maximum density. In this work we present an alternative calibration of the MagLim lens sample redshift distributions. This is based on a combination of a Self-Organising Maps scheme and clustering redshifts to estimate redshift distributions and inherent uncertainties, which is expected to be more accurate than the original DES Y3 redshift calibration of the lens sample. We describe in detail the methodology, we validate it on simulations and discuss the main effects dominating our error budget. The new calibration is found to be in fairly agreement with the fiducial DES Y3 calibration, with only mild differences in the means and widths of the distributions. We study the impact of this new calibration on cosmological constraints, analysing DES Y3 galaxy clustering and galaxy-galaxy lensing measurements, assuming a ΛCDM cosmology. The ~0.4σ shift in the main matter density and clustering amplitude plane compared to the fiducial DES Y3 results, highlights the importance of the redshift calibration of the lens sample in multi-probe cosmological analyses.

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