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Mirror Segment Error Budget Development for 10 meter class Telescope; NLOT/MSE

The proposed India's National Large Optical Telescope and the Mauna Kea Spectroscopic Explorer are optically designed to have nearly identical hyperbolic primary of 60 segments of size 1.44m, delivering a circumscribed 11.25 meter aperture. In order to get the best image quality, all the segments in the primary mirror need to be aligned in the telescope for a monolithic profile. Any deviation from the monolithic profile would degrade the Image Quality(IQ).

The possible error contributions from M1 which could cause the image degradation are categorized into seven major groups: (i) Segment Residual Figure Error (SRFE), (ii) Segment Thermal Distortion (STD), (iii) Segment Support Print Through (SSPT), (iv) Segment Drift Errors (SDE), (v) Segment In-plane Displacement (SIPD), (vi) Segment Out-of-plane Displacement (SOPD) and (vii) Segment Dynamic Displacement Residuals (SDDR).

The primary error components in each of the above mentioned group is represented as the lower order Zernike term (4th order) except the 1g gravity effect where the higher order Zernike terms are significant. Most of the lower order surface deformation on each of the segment will be corrected by warping harness in the segment support system but eventually introduces high frequency residuals. In order to achieve the M1 system-level top-down IQ allocation, we have developed M1 shape error budget which includes lower and higher order surface deformation. The Image quality is characterized by the 80% Encircled Energy (EE80) in error budget. Details about the technique used for the development of the mirror segment error budget and the sensitivity of each lower order term and gravity effects on M1 for telescope Zenith angle 0 and 30 degree for on-axis as well off-axis fields will be discussed here.