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Study of Alignment Sensitivity of TMT Primary Mirror Segments on Image Quality

TMT is a ground-based optical/infrared telescope. The telescope utilizes a Ritchey-Chrétien optical design with 30-meter hyperboloid f/1 primary mirror. As it is difficult to make a monolithic mirror of such dimension the primary mirror is subdivided into 492 hexagonal segments each having a diameter of 1.44 meter from edge to edge. The primary mirror is having 6-fold symmetry and hence they are divided into 6 sectors. Each mirror segment is supported by segment support assembly consisting of 3 actuator and 12 capacitive edge sensor which controls the relative segment position. Any misalignment of these segments from their mean position causes a deviation from near diffraction limited performance. The algorithms for aligning and phasing these segments is similar to that of Keck primary mirror algorithms with few modifications. Keck is a 10-meter class telescopes with 36 hexagonal segments with 492 segments TMT algorithm has to process large amounts of data. An attempt was done in the present work to simulate the sample of TMT model using Python and thereby determining the PSSN (Normalized Point Source Sensitivity) for different segment perturbation, further clustering these values for creating a database for better error analysis using neural network algorithm.