**Removal of daytime thermal deformations in the GBT active surface via out-of-focus holography**

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The 100-m diameter Green Bank Telescope (GBT) was built with an active surface in order to achieve and maintain an accurate paraboloidal shape. While much of the large-scale gravitational deformation of the surface can be described by a finite element model, a significant uncompensated gravitational deformation exists. In recent years, the elevation-dependence of this residual deformation has been successfully measured during benign nighttime conditions using out-of-focus (OOF) holography (Nikolic et al, 2007, A&A 465, 685). Parametrized by a set of Zernike polynomials, the OOF model correction has been applied during all high-frequency observations since Fall 2006, yielding a consistent gain curve that is flat with elevation. However, large-scale thermal deformation of the surface has remained a problem for daytime high-frequency observations. OOF holography maps taken throughout a clear winter day indicate that surface deformations become significant when the Sun is above 10 degrees elevation, but that they change slowly while tracking a single source.

In this paper, we describe a further improvement to the GBT active surface that allows an observer to measure and compensate for thermal surface deformation using the OOF technique. "AutoOOF" is a new Astrid procedure that acquires a quick set of in-focus and out-of-focus on-the-fly continuum maps on a quasar using the active receiver. Upon completion of the maps, the data analysis software is launched automatically which produces and displays the surface map along with a set of Zernike coefficients. These coefficients are then sent to the active surface manager which combines them with the existing gravitational Zernike terms and FEM in order to compute the total active surface correction. The end-to-end functionality has been tested on the sky at Q-Band and Ka-band during several mornings and afternoons. The telescope beam profiles on a bright quasar typically change from slightly asymmetric to Gaussian, the peak antenna temperature increases, and significant sidelobes (when present) are eliminated. This technique has the potential to bring the daytime aperture efficiency closer to its nighttime level. The execution time of the procedure is 20 minutes. The time interval over which the solutions remain valid will likely vary with the weather conditions and program of observations, and can be better evaluated once a larger dataset has been acquired.

We are presently researching the OOF technique using MUSTANG, the first 90 GHz instrument on the GBT. MUSTANG is 64-pixel bolometer camera, presently operating as a shared-risk science instrument. The use of multi-pixel MUSTANG maps has the potential to significantly speed the process of measuring and correcting thermal deformations to the surface. The efficiency of 90 GHz observations with the GBT is also limited by the small-scale surface roughness due to errors in the initial setting of the actuator zero points and the individual panel corners. We plan to measure these errors in detail with traditional holography in the near future.