

Investigation into the Effects of Antenna Tilts on Pointing for the SMA Antennas

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The Smithsonian Astrophysical Observatory Sub Millimeter Array is a sub-millimeter observatory that takes advantage of an array of eight antennas to study molecular vibrations in the 200 to 900 gigahertz frequency ranges. In order to perform its science mission at 900 gigahertz each of the antennas need to be able to accurately point within a tenth of an arc second anywhere in the sky. Currently each of the eight antennas can point within approximately 1.2 arc seconds of a target. A pointing model was built for an antenna by optically pointing to objects distributed around the sky and fitting a nineteen-term model. The most significant of these terms is involved in a two term harmonic fit of tilts the antenna experiences as a function of azimuth angle. These tilts can be measured independently thru tilt sensors mounted throughout the antenna. MathCAD was used to plot and manipulate the tilt information for finding trends, which can be used to improve the pointing model. It was discovered that the residuals of a two term harmonic fit of the tilt meters data have approximately the same magnitude of error as the over all pointing model. It is believed that if these residuals are inserted into the pointing model, the required tenth of an arc second pointing can be achieved.



Ben Berkey is a student at the University of Hawaii at Hilo, where he is pursuing a undergraduate degree in Astronomy Math and Computer Science. He was lucky enough to grow up on the island of Hawaii which not only allows him to explore his hobby of amateur astronomy, but also hike and camp in paradise. He plans to pursue a graduate degree in astronomy and hopefully one day come back home and work on Mauna Kea.