Near-Field beam measurements of corrugated horns for ALMA band 10

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For the receivers of the Atacama Large Millimeter and Submillimeter Array (ALMA), one of the requirements to achieve high sensitivity is to use good optics. Corrugated horns are widely used in the optics for highly sensitive receivers because of their good performance of high efficiency, low cross polarization, and so on. As well as those receivers, we consider to use a corrugated horn for the ALMA band 10 (787-950 GHz) receiver. To characterize the performance of fabricated horns experimentally, we developed a phase and amplitude antenna test system. The signal source consists of a W-band Gunn oscillator followed by a nonupler with an open waveguide probe on an X-Y-Z-θ translation stage. A corrugated horn is attached to a subharmonic Schottky diode mixer pumped by another W-band Gunn oscillator. Both Gunn oscillators are phase-locked to a single microwave reference at around 16 GHz, but on different sideband. The IF of 90 MHz is passed to a lock-in amplifier that measures phase and amplitude. Figure 1 shows preliminary results of the near field beam pattern (at 826 GHz) of a corrugated horn made by conventional electro-forming. The far-field beam pattern calculated from the phase and amplitude data showed good agreement with the theoretical one. The measurements at 860 and 896 GHz also showed symmetrical beam pattern as predicted. By using this system, we will test another corrugated horn made by direct machining suited for series production for the ALMA receivers.

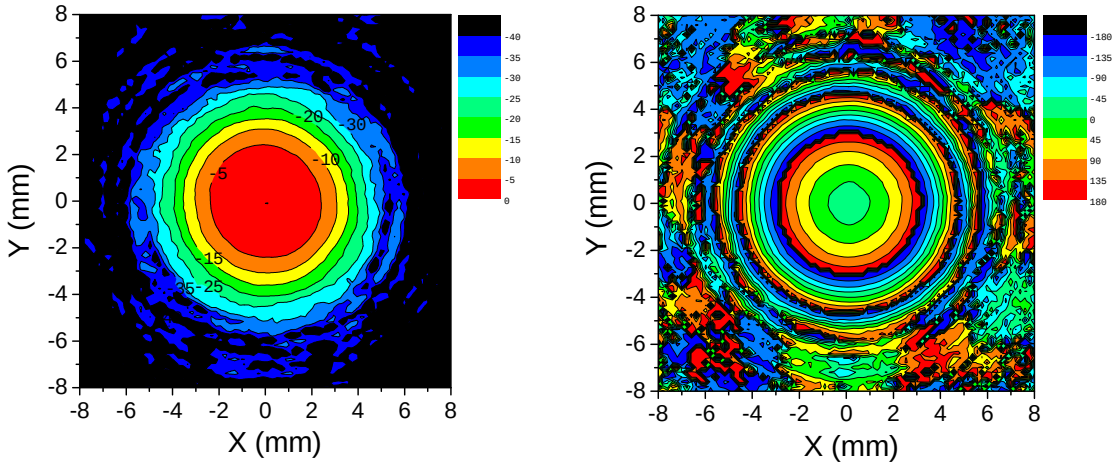

Fig. 1. Two dimensional amplitude (left) and phase (right) beam map of a corrugated horn. The amplitude contours are expressed in dB and the phase contours are shown in every 45 degree.