

Design and Analysis of a Spline-Profile Diagonal Horn Antenna at 104GHz for Microwave Holography

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Abstract— This paper presents the mechanical design and electric simulations, the measurement procedures, beam characterization and Analysis. (*Abstract*)

Keywords—Antenna Design, Diagonal Antenna, Microwave Holography, Near Field (*key words*)

I. INTRODUCTION (*HEADING 1*)

Located in the Argentine Andes, at 4800 m of altitude, the Large Latin American Millimeter Array–LLAMA is an astronomical observatory for studying the Universe at sub-millimeter and millimeter wavelengths. Currently under construction and development, LLAMA observatory is composed of a single dish telescope, which has a diameter of 12 m. Once the construction and installation is completed, the telescope must be characterized and validated. The microwave holography technique is a method of evaluating the dish surface profile, which quantifies manufacturing errors, panel alignment and gravity deformation effects among others parameters. The method utilizes the Fourier transform relation between the complex far field radiation pattern of an antenna and the complex aperture distribution [1], which requires a narrow bandwidth and a strong phase uniformity to ensure the accuracy of the usual specifications of sub-mm telescopes surface.

The telescope, as delivered, may have a total error up to 100 μm due to panel misalignment and a total residual sum of squares (RSS) error up to 20 μm , due various contributions. For the second stage of the campaign, the RSS error shall be reduced up to 15 μm by panel alignment, as described by [2]. Those requirements were defined for ALMA observatory microwave holography system and they will be applied at LLAMA observatory. The transmitter of ALMA system has a corrugated horn antenna with a correction lens. However corrugated horn antennas are expensive and impractical for manufacturing when the frequency is increased, due to the high precision requirements applied to small dimensions. The purpose of this study is to validate the design of a spline-profile diagonal Horn antenna, which is suitable for LLAMA telescope microwave holography. The spline-profile was calculated

[3] and optimized for 104 GHz. It was machined in a split-block to reduce the manufacturing costs

II. RESULTS

This paper presents the mechanical design and electric simulations, the measurement procedures and the results of the characterization. Furthermore, the results are compared with the specifications of the horn transmitter.

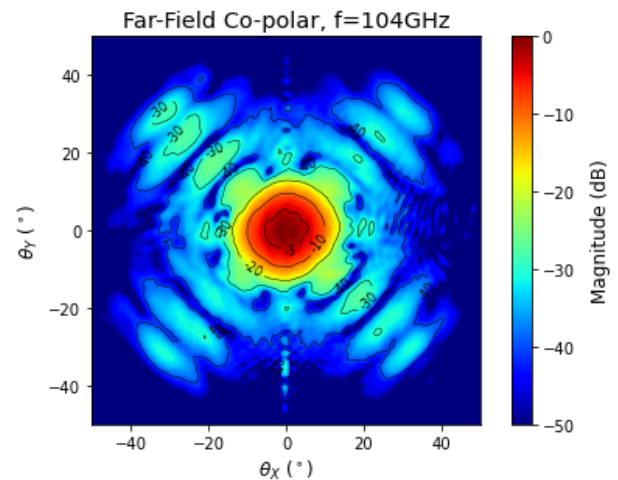


Fig. 1. Far field radiation pattern measured by Near field technique.

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