

Design and System Integration of 2-14 GHz Eleven Feed for VLBI2010

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The Eleven feed system is a compact, low-profile, decade-bandwidth feed system for reflector antennas. It has many advantages: the constant phase center location, the constant beam width, high BOR1 efficiency, low-cross polar level and a good reflection coefficient, all over a decade bandwidth and design allowing cryogenic integration to achieve low-noise performance [1]. Figure 1 shows picture of the existing 2-13GHz Eleven feed. So far six prototypes were fabricated and tested. It should be emphasized here that the property of the constant phase center location of the Eleven feed over a decade bandwidth is a unique one among all the existing ultra-wideband (UWB) feed technologies, which is very critical and important in VLBI2010 project in order to have the distance measurement error less than 1 mm over thousands of kilometers [2].

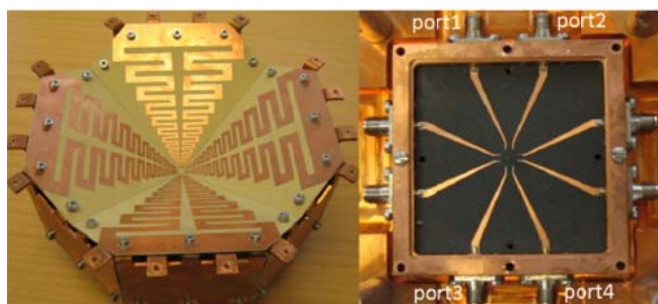


Figure 1: The existing 2-13 GHz Eleven feed

This paper summarizes the recent developments on the Eleven feed technology for VLBI2010 (Very Long Baseline Interferometry 2010) in three areas: development of antenna parts, system analysis and tests and receiver integration.

The developments of the antenna part includes: 1) the new balun feeding network; 2) the new circular Eleven feed which improves the BOR1 efficiency over a decade bandwidth from 1.3 to 14 GHz, see Figure 2.

The system analysis includes the development of noise model to characterize the expected receiver and system noise performance and analysis of the effect of the infrared filters and vacuum window when the feed is integrated in cryostat.

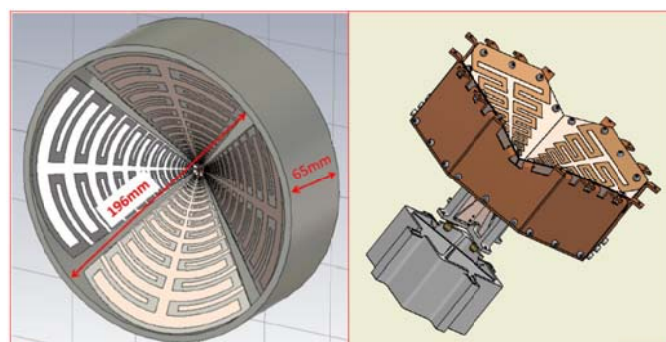


Figure 2: 1.2-14 GHz new circular Eleven feed (left) and new balun solution (right)

The receiver integration includes the design and fabrication and tests of cryogenic receiver including Eleven Feed, Low Noise Amplifiers (LNA), temperature stabilization and feeding network to realize circular polarization. The validation and selection of different LNA alternatives will be discussed from performance, operation and reliability point of view. The measured receiver temperature with wide-band 50ohm LNAs is about 20K over 70% of the 2-14GHz band.

By the time of the conference we will present the measurement data for both feed prototypes, the simulations and measurements of how the feed efficiency is affected by the dielectric material and also optimization of the vacuum window diameter to achieve optimal performance, and the receiver noise test data for the Eleven feed integrated with cryogenic differential LNAs.

REFERENCES

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