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Design of Cryogenic 2-14 GHz Eleven Feed for Reflector Antennas for Future Radio Telescopes

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The design of the cryogenic 2-14 GHz Eleven feed for reflector antennas in future wideband radio telescope involves electrical design of the Eleven antenna, design of center puck, different alternative solutions for integrating with low noise amplifiers (LNAs), mechanical and cryogenic design and tests, system noise temperature estimation and so on. All these design aspects will be described in the paper. A large quantity of simulated and measured data has been obtained in order to verify the electrical, mechanical and cryogenic performance, and the system noise temperature. The objective of this work is to provide a good feed candidate for reflector antennas in VILB 2010 and US SKA projects.

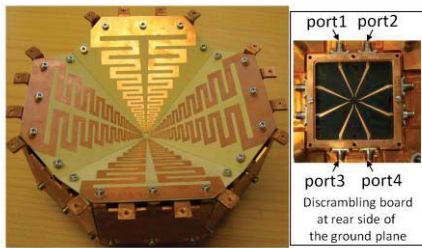


Figure 2 Photo of the Eleven feed

The system configuration of the Eleven feed can be represented by the block diagram shown in Fig. 1, which consists of three parts: the Eleven antenna, center puck and the LNA-integration circuit board. Fig. 2 shows a photo of the Eleven feed. The reflection coefficient measured at Caltech (California Institute of Technology) is shown in Fig. 3, and the aperture efficiency and other sub-

efficiencies measured at DTU (Denmark University of Technology) are shown in Fig. 4. Fig. 5 shows Steady state analysis of the thermal distribution along the feed with head load of 20W/m².

More simulated and measured data will be shown in the paper. In conclusion, the Eleven feed has good performance in the frequency range of 2 – 14 GHz, and has gone through several cryogenic tests.

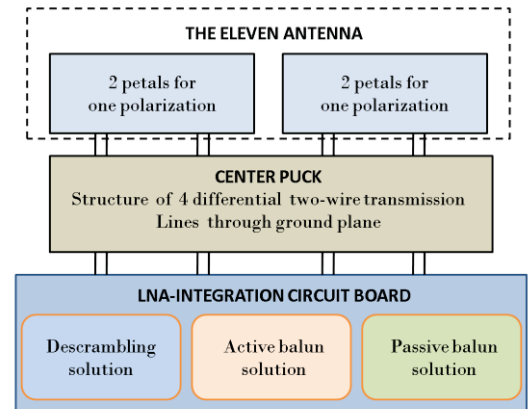


Figure 1 System configuration of the Eleven feed

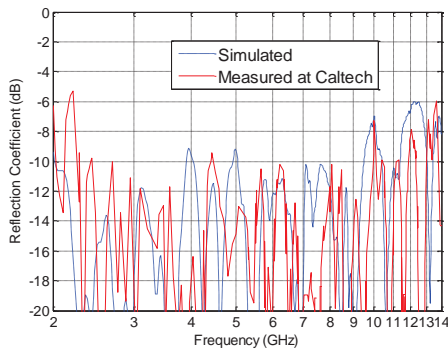


Figure 5 Simulated and measured reflection coefficient of the Eleven feed

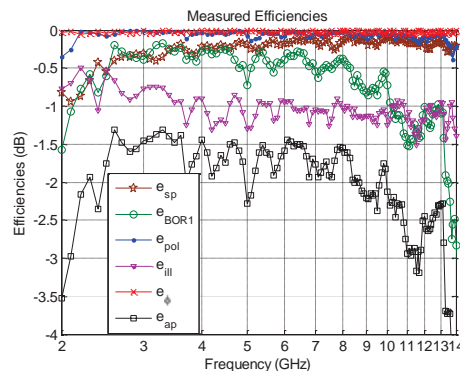


Figure 4 Measured efficiencies

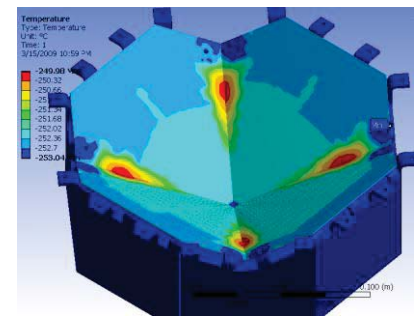


Figure 3 Steady state analysis of the thermal distribution. The temperature gradient is about 5K.

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