Design and Implementation of a Polarization Sensitive Antenna Centered at 90 GHz

John C. Hood II[1,3], Stephan Meyer[1], Steve Padin[1,2], Clarence Chang[1,2], Tyler Natoli[1], Thomas Cecil[2]

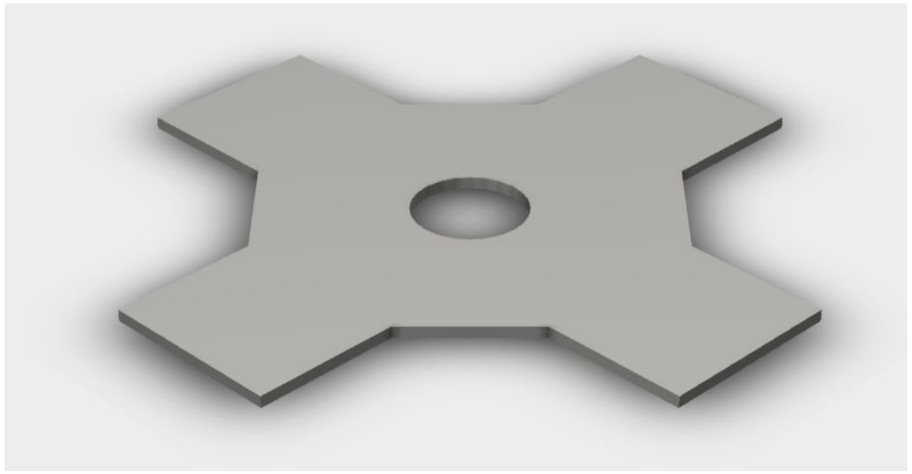
[1]Kavli Institute for Cosmological Physics, University of Chicago, 5640 Ellis Avenue, Chicago IL 60637

[2]High Energy Physics Division, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439

[3]Department of Physics and Astronomy, Vanderbilt University, 6301 Stevenson Science Center, Nashville, TN 37212

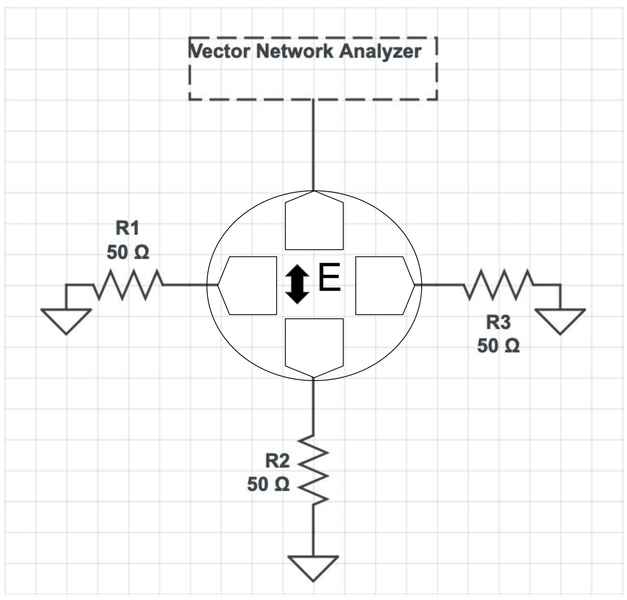
Abstract: Ortho-Mode Transducer (OMT) coupled feed horn detectors are a candidate technology for CMB-S4. At Argonne we are developing fabrication processes for these antenna. Here, we present a design for a room temperature experiment to measure the coupling properties of Argonne fabricated OMT's at 90GHz. These warm measurements are conducted by coupling test antenna to the OMT centered above a circular waveguide and choke structure. The test signal is injected down the circular waveguide where it couples to the OMT fins. The signal on the fins is then read out via a Vector Network Analyzer (VNA). We aim to use this room temperature setup to measure the polarization and coupling efficiency of candidate OMT structures.

Antenna Wafer design



Solidworks drawing of the shape the silicon wafer containing the test antenna.

Electrical Schematic

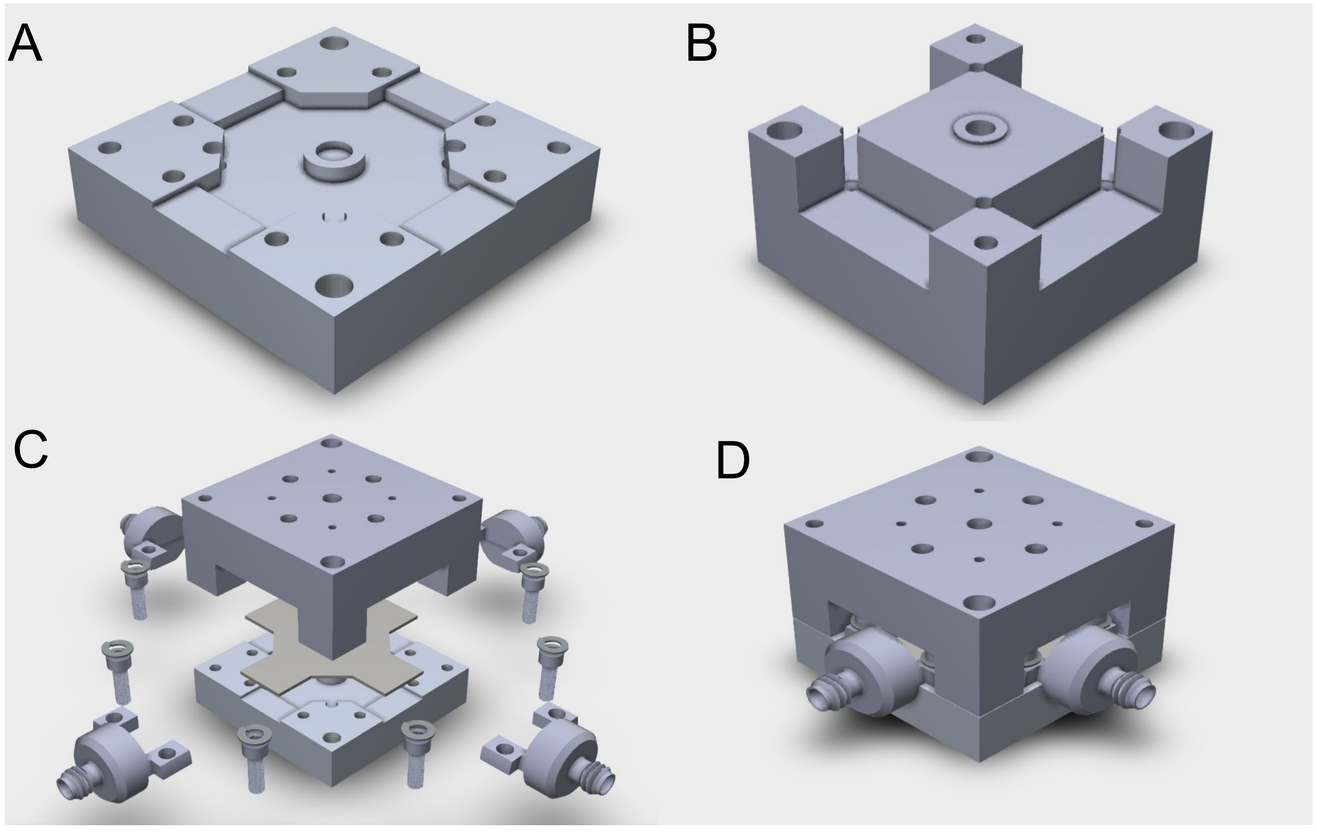


Electrical diagram showing the path of the electric field from input to output through the antenna on the test wafer. The electric field is directed down onto the antenna via waveguide onto the antenna fins.

Summary and Next Steps

We present here a test setup for OMT coupled feedhorn detectors in a room temperature experiment. This test will allow us to measure the coupling properties of Argonne fabricated OMT's at 90GHz. HFSS simulations will be conducted in the coming weeks as well as the design and development of a cryogenic test setup. The 3D models present are used to check the rest of the test structure, this includes a coax to waveguide converter, rectangular to circular waveguide converter and our assembly designed to hold a single antenna on a SiO2 wafer.

OMT Test Bracket Assembly



Solidworks models for A) base of bracket and chip holder. B) lid of bracket. C) Exploded view of entire assembly. D) complete assembly.

Warm Test Setup

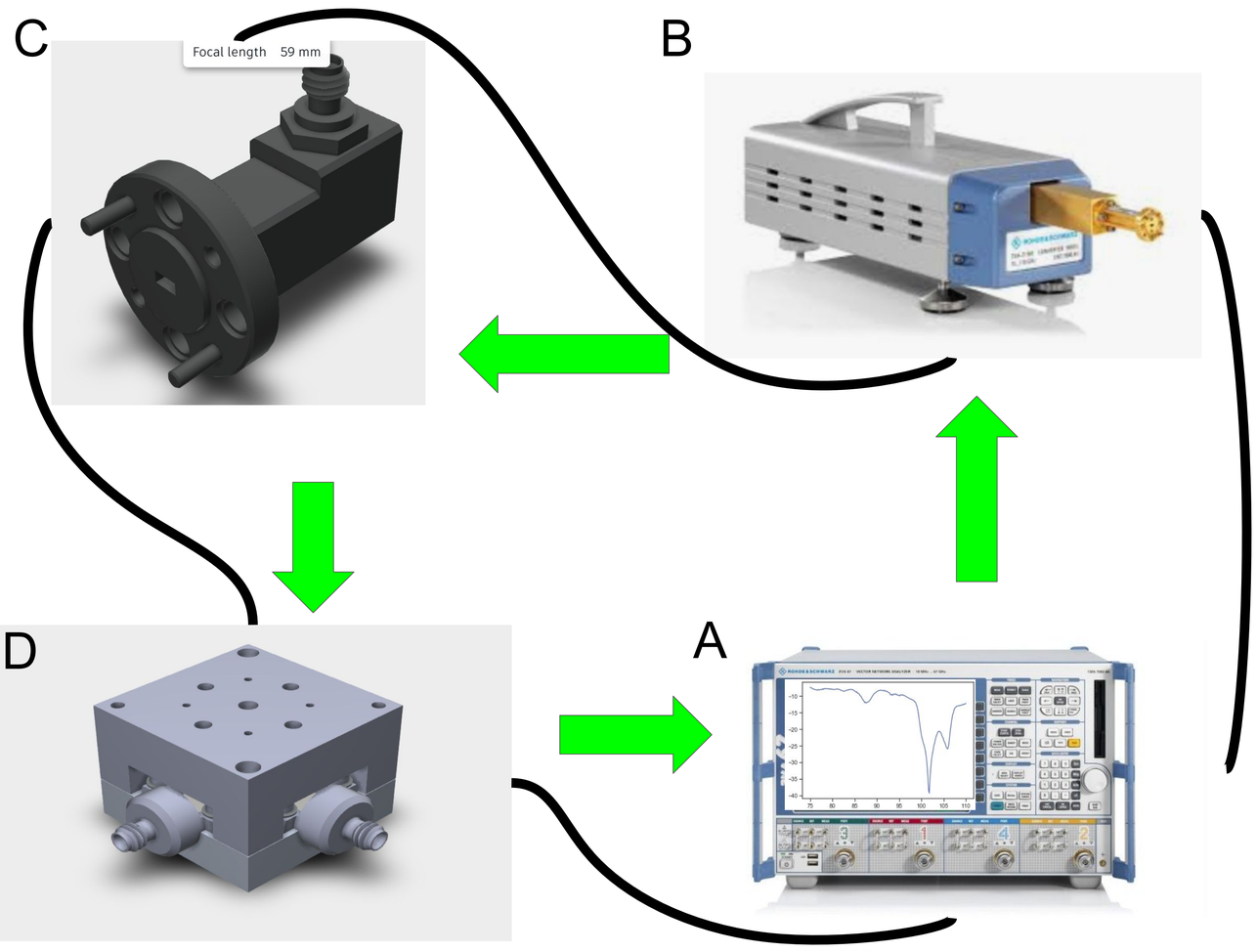


Chart showing the signal output direction through the setup. A) VNA, B) frequency converter, C) coax to waveguide converter, D) OMT test assembly

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Kavli Institute for Cosmological Physics at The University of Chicago