During my internship at Fermilab, I worked under Andrew Sonnenschein and Stefan Knirck on the Broadband Reflector Experiment for Axion Detection (BREAD) collaboration. The project was part of an axion search. Axions are a promising candidate for dark matter. My project involved exploring dielectric haloscopes as a way to detect axions. The dielectric haloscope is a detector that consists of a stack of dielectrics, a mirror, a focusing lens, and a receiver. Building a dielectric haloscope is a medium term goal of the BREAD collaboration. I spent the first two weeks researching the theory behind this new design and potential advantages of the new design. I presented my findings to the BREAD collaboration. To build a good dielectric haloscope, it is necessary to have a way to measure the complex relative permittivity and loss tangent of dielectric materials. This is what my summer project was about. Knowing these two parameters is important as they are crucial design factors in the dielectric haloscope. I then researched the major relative permittivity measurement methods and presented again to the collaboration. After this, we decided on a design for the device. Much of my time was spent writing Python code to extract the relative permittivity from measured data. I simulated our measurement setup in Ansys HFSS and tested my code on the simulated measurements. Towards the end, I built the device and took real measurements. Once I got my code working we obtained some reasonable permittivity measurements. This project was an important first step towards designing a dielectric haloscope. During my internship, I improved my problem solving skills, learned a lot about microwave engineering and theoretical physics. I also got better at coding. Most importantly, I got to see up close what the life at a major national lab is like for a physicist.