



Contribution ID: 384

Type: **Poster**

## Holographic Beam Maps with Transition Edge Sensors

*Tuesday, July 23, 2019 6:45 PM (15 minutes)*

In this proceeding we will describe the effort made in our group to address the problem of the beam characterization of a small aperture telescope with wide field of view in the microwave band between 90 and 300GHz. We will describe the case of Transition Edge Sensors (TES), baseline choice for upcoming ground Cosmic Microwave Background (CMB) experiments such as the Small Aperture Telescope (SMA) for CMB-S4 or balloon borne experiments like the SPIDER polarimeter.

For those telescopes design the far field characterization of the beam is often impractical: the far field could be located kilometers away from the telescope's aperture, and it is not unusual that such observatories are in remote and inaccessible sites like the Atacama Desert in Chile or the South Pole. The measure of the far field of a balloon borne experiment could be impossible because of mechanical reason, since they have limited pointing capabilities.

For this reason, the development of a robust and reliable technique to reconstruct the far field beam from holographic measures of the near field beam is necessary.

What makes the effort described in this work unique is twofold: because of the frequency range under study the precision of the positioning of the scanning probe needs to be a fraction of the corresponding wavelength of the radiation, requiring a large micrometric scanning stage; secondly the TES detectors have a typical time constant of about few milliseconds, this means that the radiation is able to travel several wavelength in one time constant making a direct phase measure very challenging.

To overcome those difficulties, we designed a custom automated frame to hold and move the probes with the required accuracy. The probe signal is generated by mixing two slightly offset monochromatic sources so that their intermediate frequency (IF), falls in the detector's band. The detector's response is then modulated at the same IF.

### Less than 5 years of experience since completion of Ph.D

Y

### Student (Ph.D., M.Sc. or B.Sc.)

N

**Primary authors:** Dr GUALTIERI, Riccardo (University of Illinois at Urbana Champaign); Mrs LENNOX, Amber (University of Illinois at Urbana Champaign); Prof. FILIPPINI, Jeffrey (University of Illinois at Urbana Champaign)

**Co-authors:** Mrs SHAW, Elle (University of Illinois at Urbana Champaign); Mr OSHERSON, Benjamin (University of Illinois at Urbana Champaign); Mr NIE, Rong (University of Illinois at Urbana Champaign)

**Presenter:** Dr GUALTIERI, Riccardo (University of Illinois at Urbana Champaign)

**Session Classification:** Poster session

**Track Classification:** Detector readout, signal processing, and related technologies