**TE Wave Measurements at CesrTA**

**J.P. Sikora, (CLASSE), S. De Santis (LBNL), K. Hammond (REU Harvard)**

**October 8 -12, 2010**

**TE Wave Hardware at CesrTA**

Microwaves transmitted through a waveguide will be phase shifted by the presence of a plasma. In an accelerator, the electron cloud produced by a train of bunches will phase shift microwaves transmitted through the beam pipe. This produces phase modulation sidebands of the carrier frequency, spaced at 180° phase shift at 1.7GHz.

**The TE Wave Measurement Technique**

Microwaves transmitted through a waveguide will be phase shifted by the presence of a plasma. In an accelerator, the electron cloud produced by a train of bunches will phase shift microwaves transmitted through the beam pipe. This produces phase modulation sidebands of the carrier frequency, spaced at 180° phase shift at 1.7GHz.

**Reflections in a Waveguide**

In trying to understand the impact of reflections on the TE Wave technique, REU student Kenneth Hammond (Harvard University) measured the magnitude of output microwaves from a waveguide. With repeat shots, with phase modulation shown in the figure below. Standing wave interference produce phase shifts, since there are multiple half wavelengths between the blocks. The corresponding frequencies will NOT be multiples of the lowest resonance frequency, but will resonate at a resonances denoted by a line below.

**The Effect of Reflections on the Phase Shift from a Dielectric**

Below is a demonstration of the effect of placing a dielectric in a section of waveguide. Using a section of waveguide with discontinuities a dielectric sheet is inserted across the waveguide. The phase plot is different between the two sensors with and without the dielectric. This shows the importance of understanding the standing waves in a beam pipe, both in obtaining an absolute calibration of the cloud density and the sensitivity to cloud densities that vary along the length of the beam pipe – as in the chicane cyclotron resonance measurement at left.

**Simulations**

A poster on the progress of TE Wave simulations will be presented by Kiran Sonnad at this workshop.