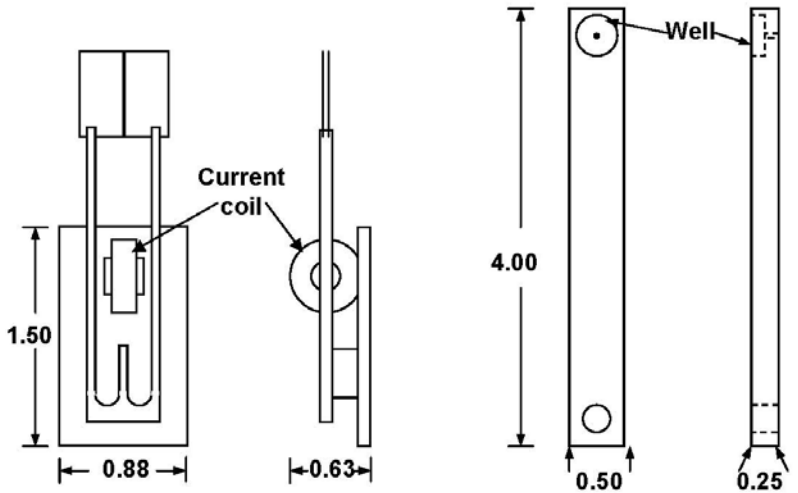
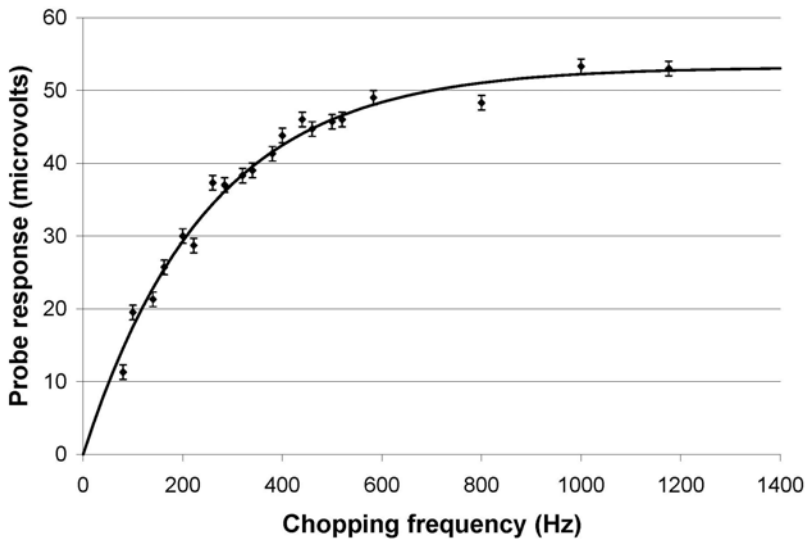
Capacitive Probe Development Progress Report



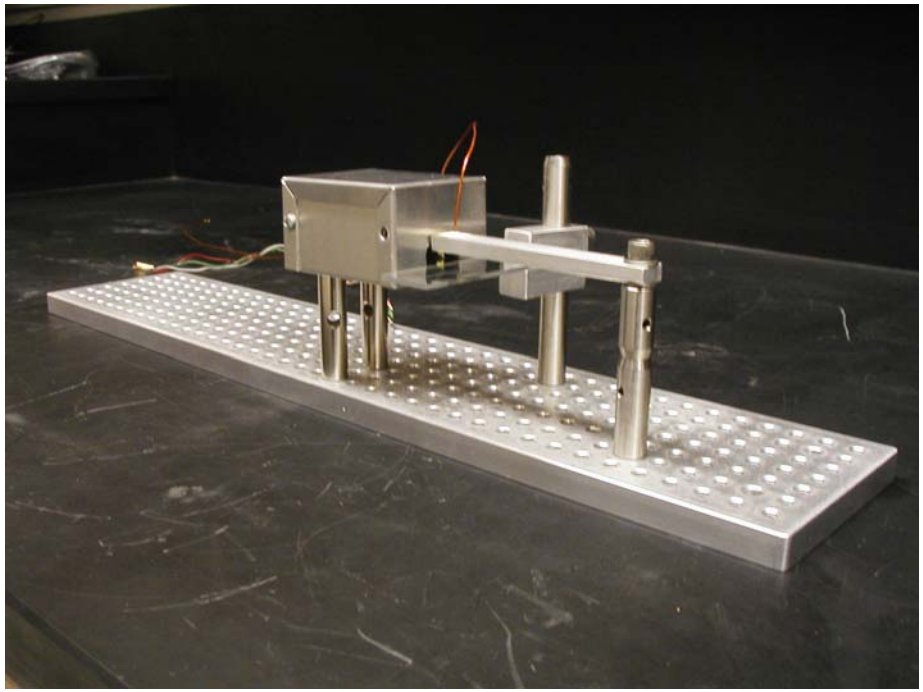


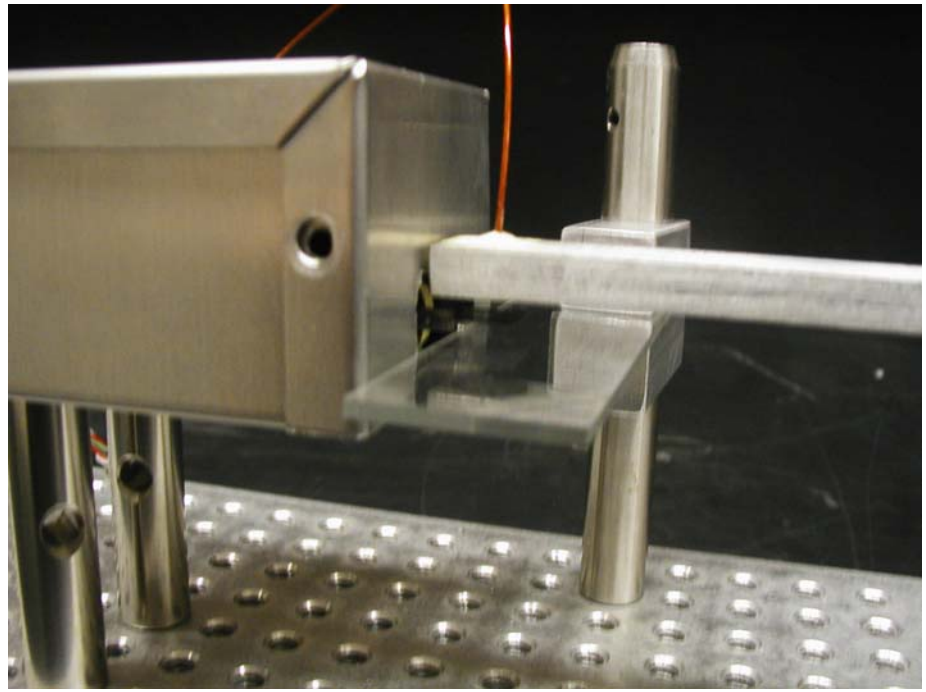
See P060053-Z, "Developing a Capacitive Probe for Measuring Surface Charge on In-Vacuum Optics".

Highlights:

- Have developed a vacuum-compatible probe with tuning-fork chopper
- Signal readout at twice chopping freq.
- Calibrated with acrylic sample, surface DC voltmeter
- Resolution = (5.0 +/- 0.7) × 10^5 e^-/cm^2
- Inverse-square with distance
- Frequency dependence consistent with RC time constant of ~1 ms (1 MΩ input imped., capacitance from BNC)

Moving Into Vacuum





A reference cavity chamber is used for the vacuum chamber, with a turbomolecular drag pump to achieve a pressure of 10^{-5} torr. This table can be slid in and out of the chamber by removing the end viewport.

In-Vacuum Measurement

First measurement with charged microscope slide sample – large signal, fluctuating between 0.33-0.37 mV for several days.

Unfortunately, signal persisted without sample.

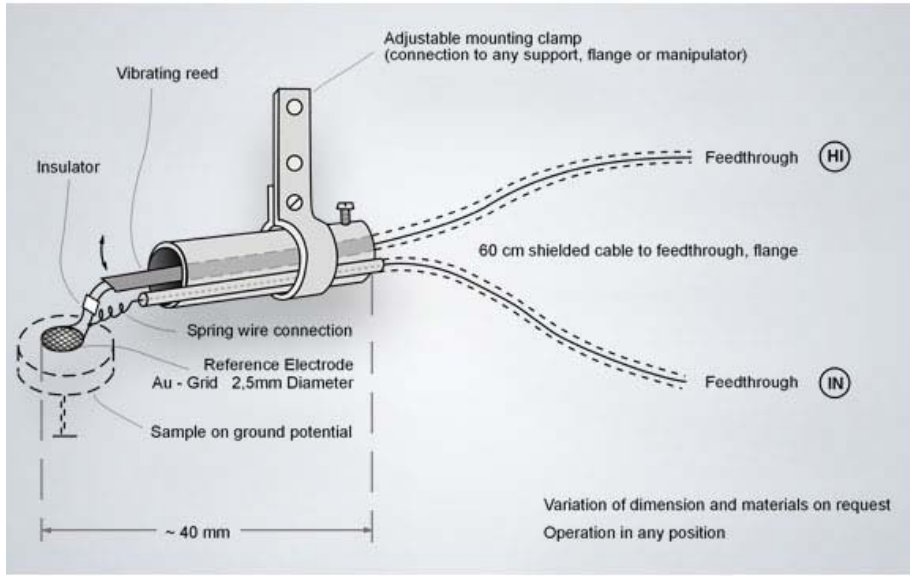
Noise appears to be due to pickup from chopper driver leads at feedthrough (signal measured at feedthrough pin even if probe disconnected).

Will likely have to run probe lead to separate feedthrough on other side of vacuum chamber – we have enough ports for this.

Next Steps

New grant means lots of purchasing:

- Besocke Kelvin probe
- Pressure gauges
- Residual gas analyzer
- Dust monitor, cleanroom gear
- Second feedthrough



We have a LIGO optical substrate and pieces of viton, and will begin attempts to measure relaxation time constants in next couple of weeks.