

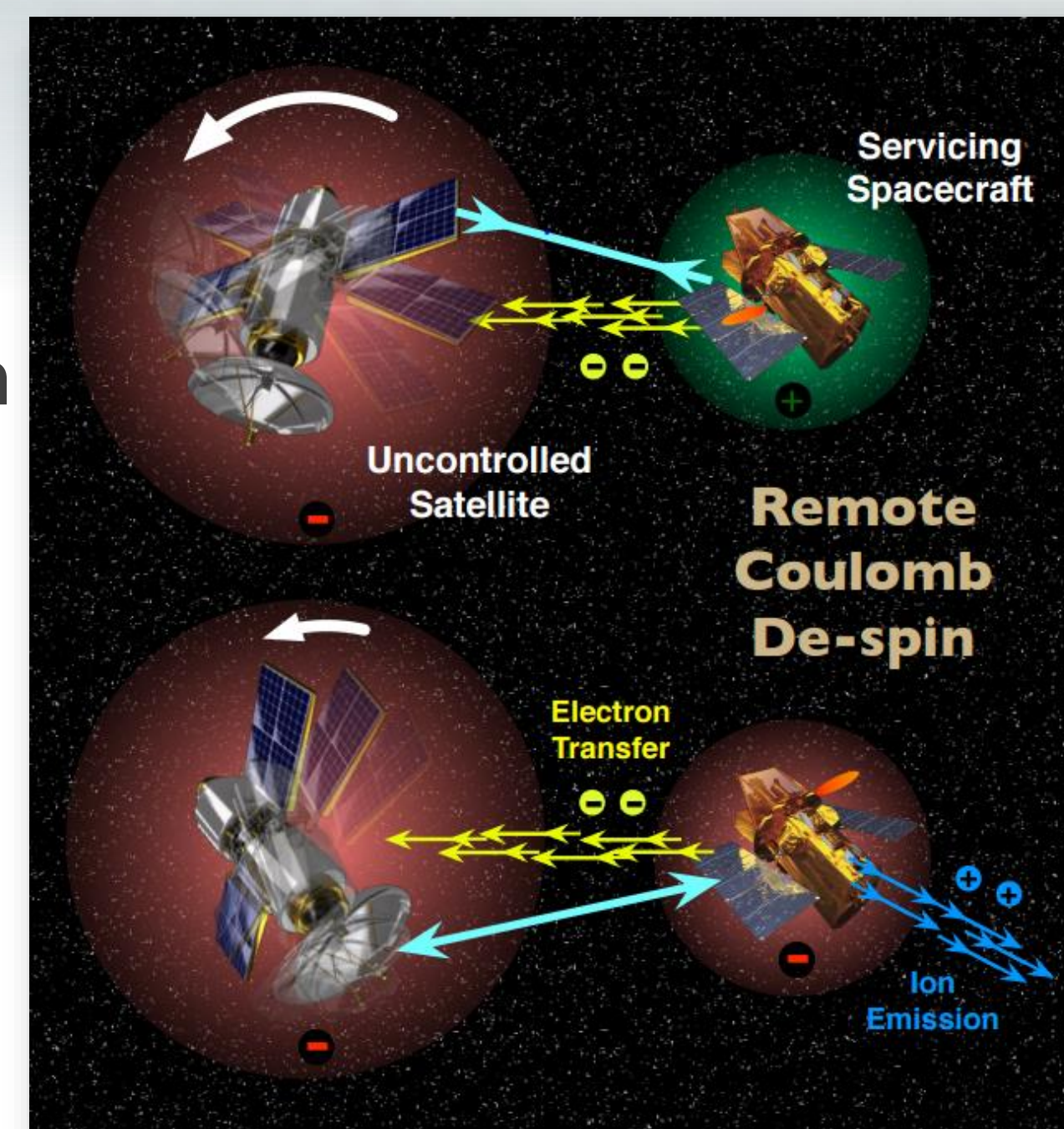


Electromagnetic Interference in Strong Electric Fields

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Background

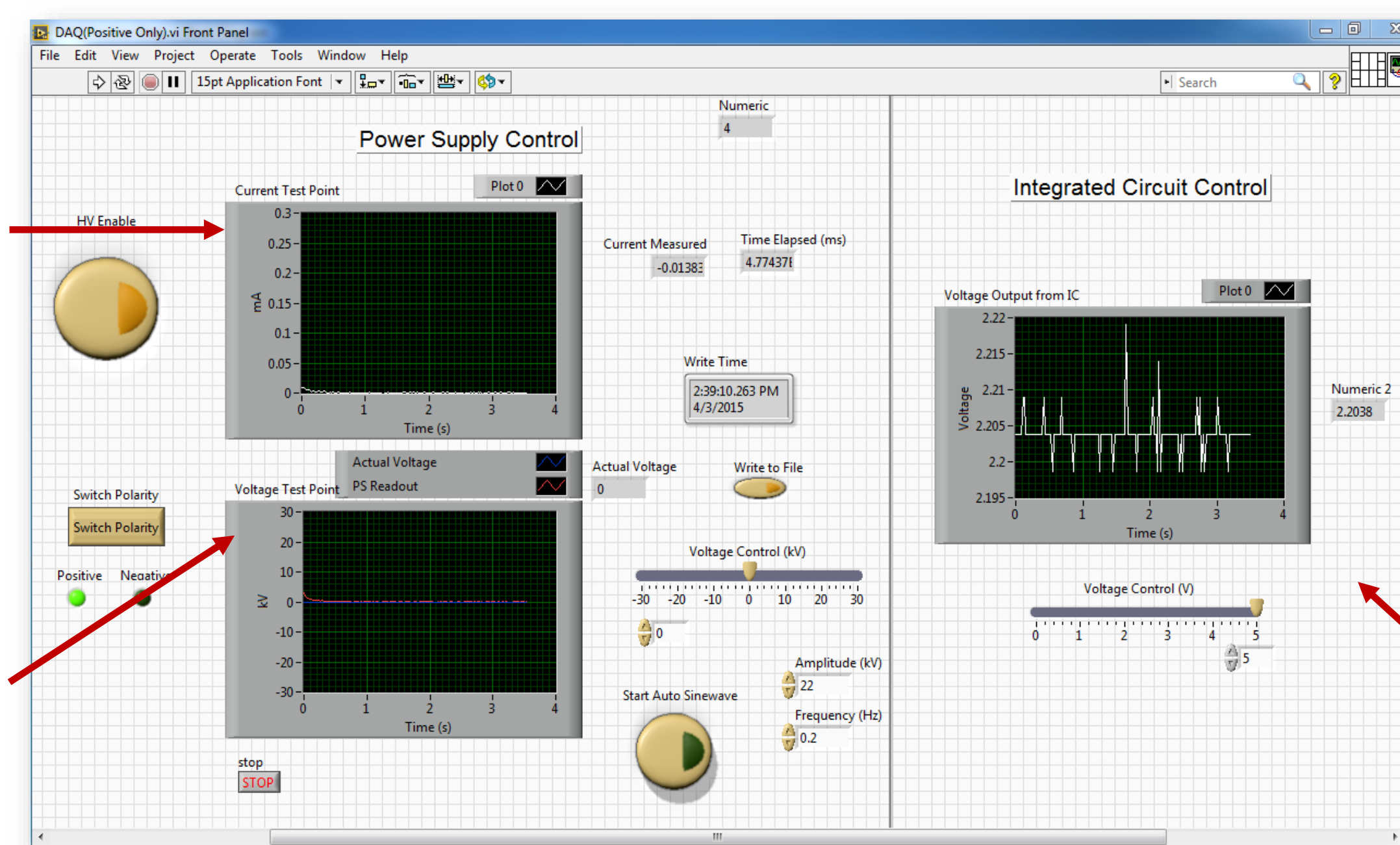
- Space debris de-spin using Coulomb forces modeled in lab with charged sphere and cylinder
- Sphere and cylinder charged between +/- 30 kV
- Magnetic encoder measuring angle of cylinder is destroyed in presence of strong electric fields
- Expensive component to replace



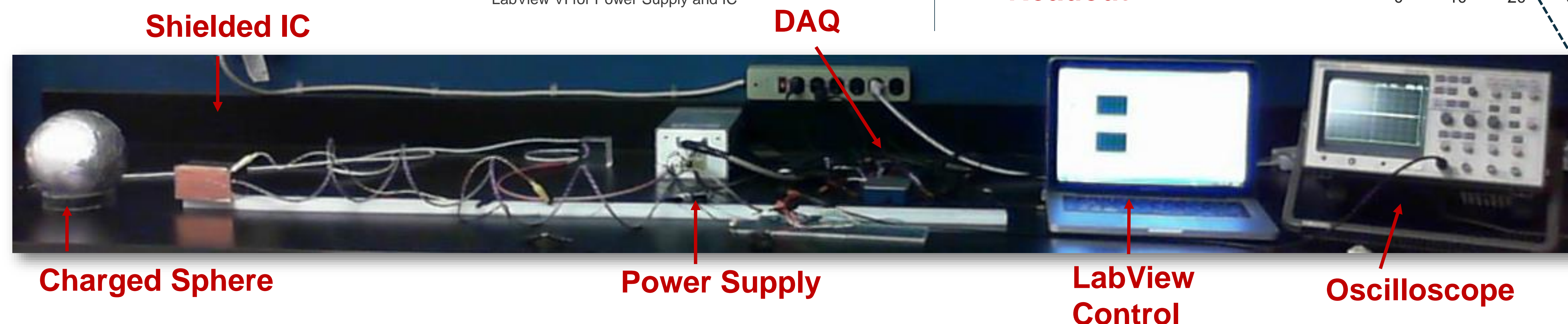
Electrostatic/dynamic shielding is necessary to protect electronic components in high voltage test beds

Experimental Setup

- Power supply controlled using LabView
- Integrated Circuit (IC) controlled using LabView
- Oscilloscope used to measure when DAQ (data acquisition) fails
- Representative of lab model **NOT** space environment

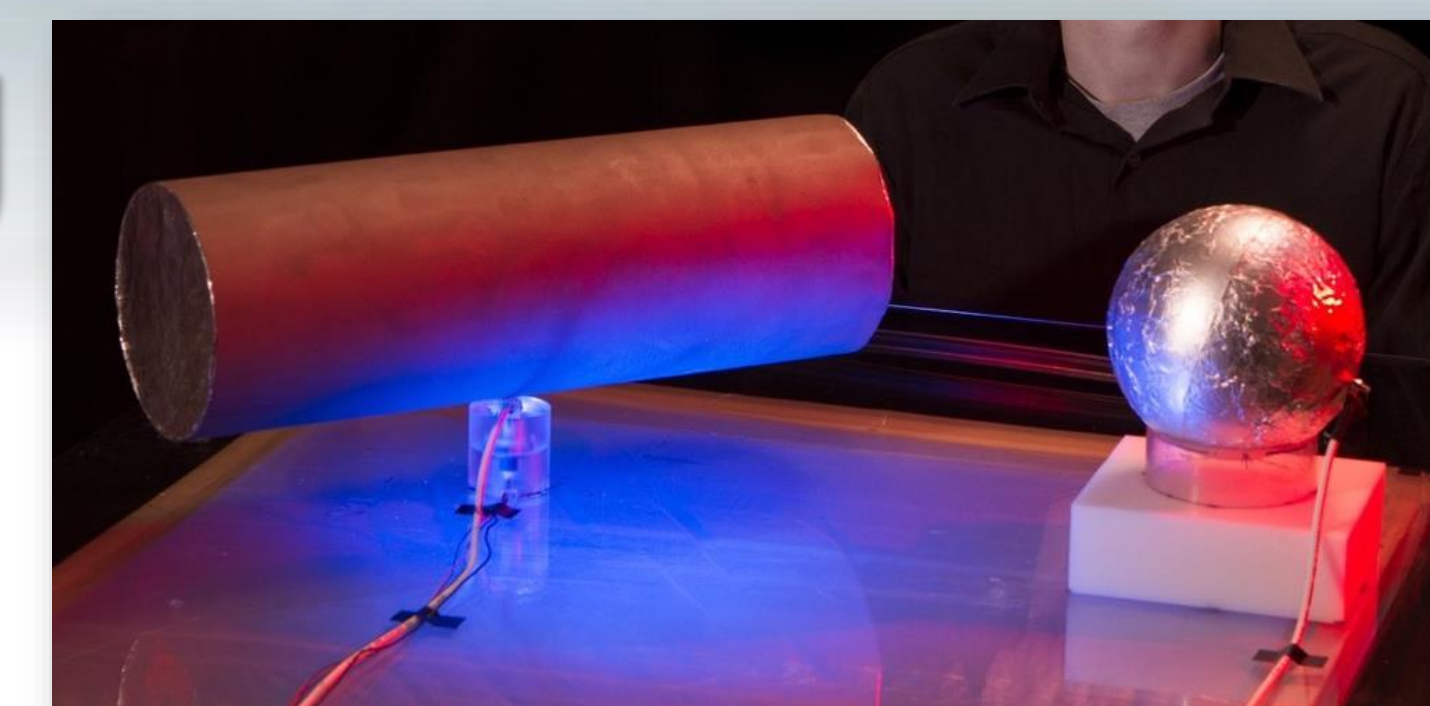


LabView VI for Power Supply and IC



Initial Testing

- IC used is a dual operational amplifier (common component)
- Used oscilloscope for initial shielding trials
- Found dynamic E-Field to cause interference



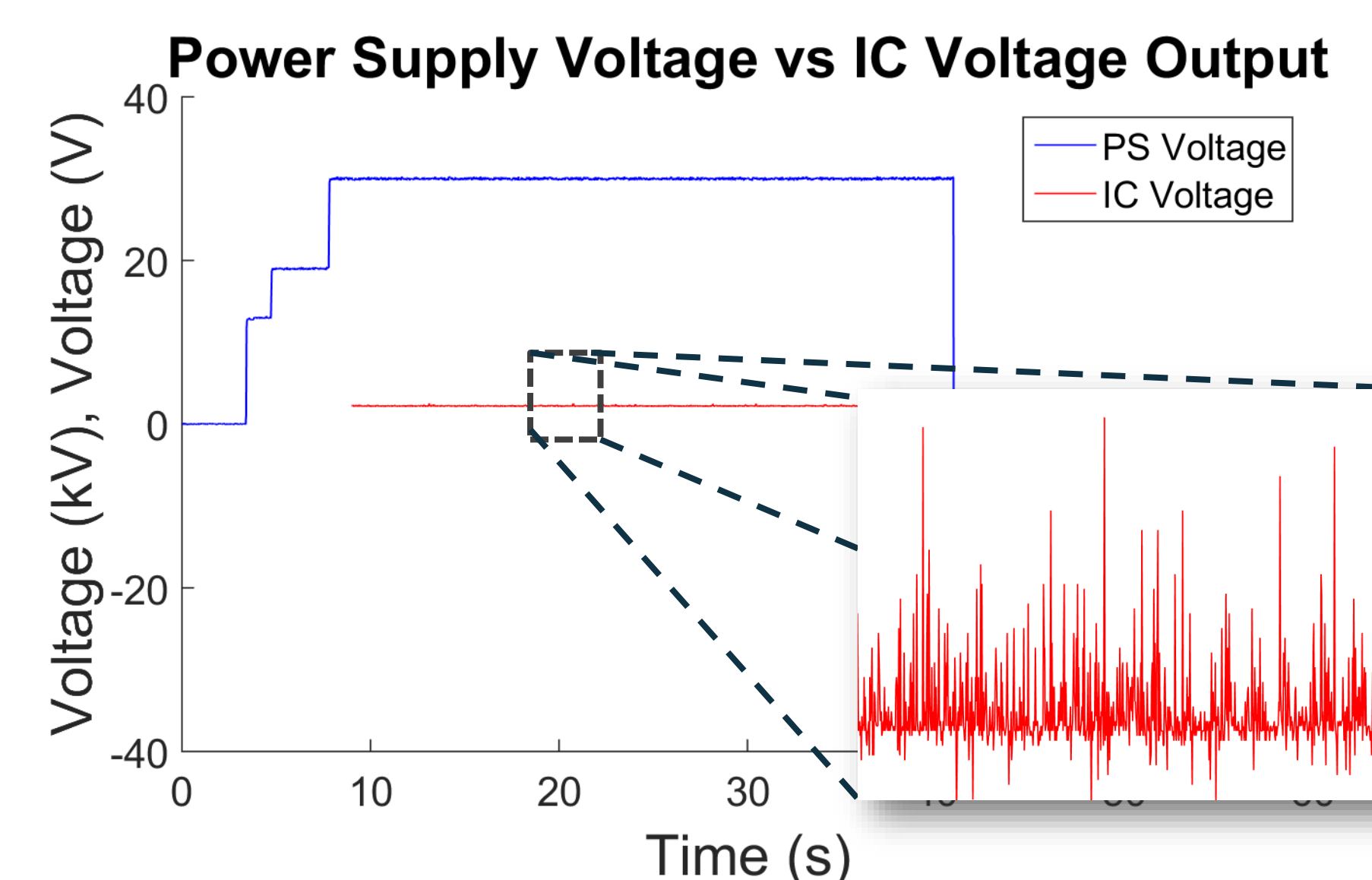
Modified Testing

- Protected IC DAQ device from current overload
- Real time data acquisition
- Created metrics to quantify further testing

Voltage Readout of IC

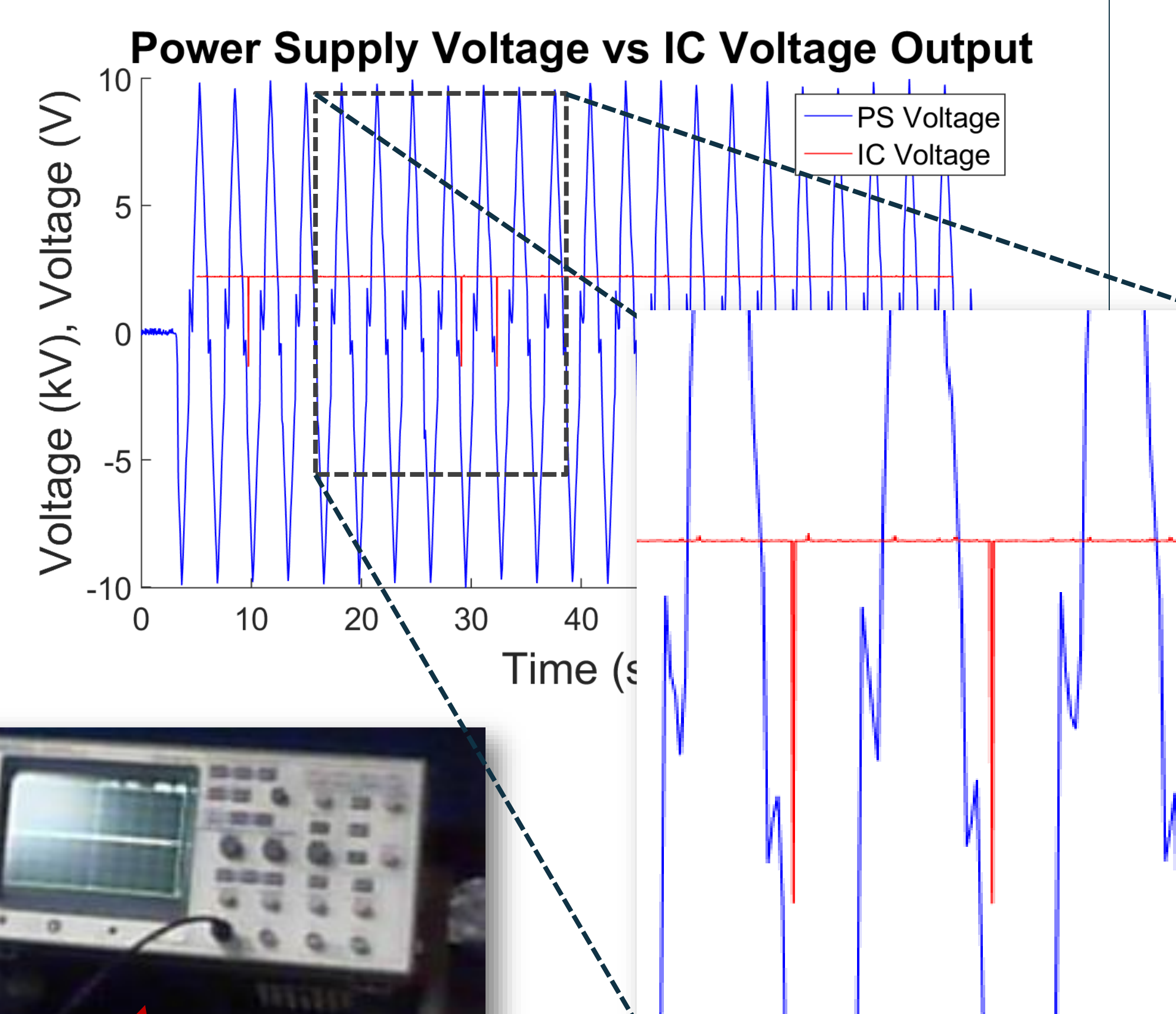
Static 30kV E-Field

- Unchanging 30kV E-Field
- No substantial effect on function of IC
- Acceptable amount of noise (+/- 0.1V)



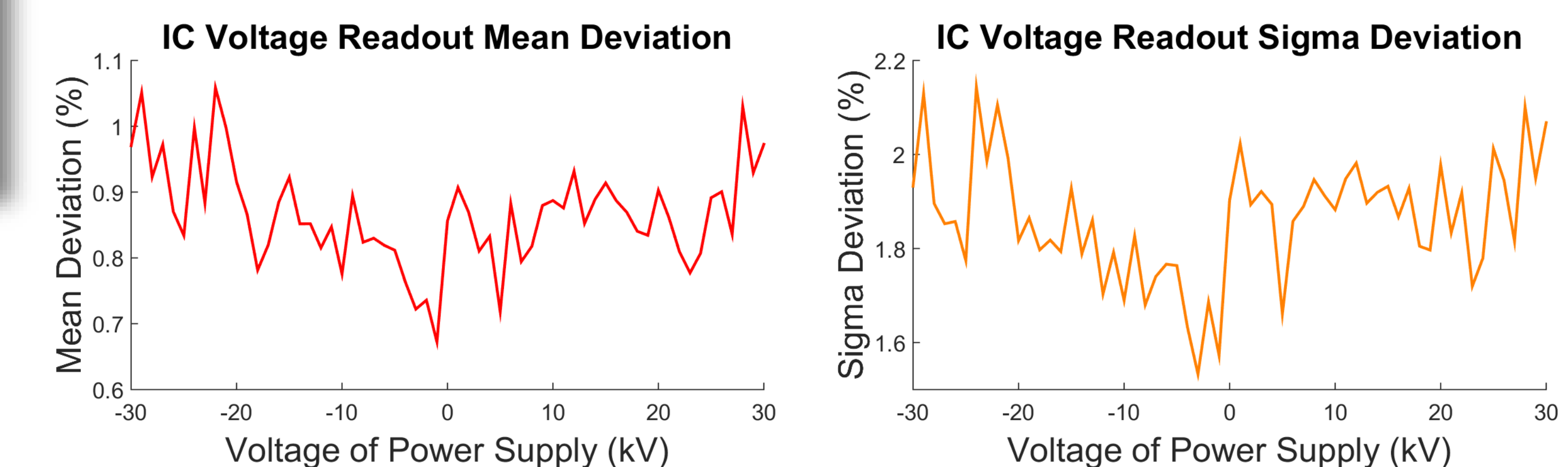
Dynamic E-Field

- Triangle wave -10kV to 10kV E-Field
- Voltage drops occur with current spikes

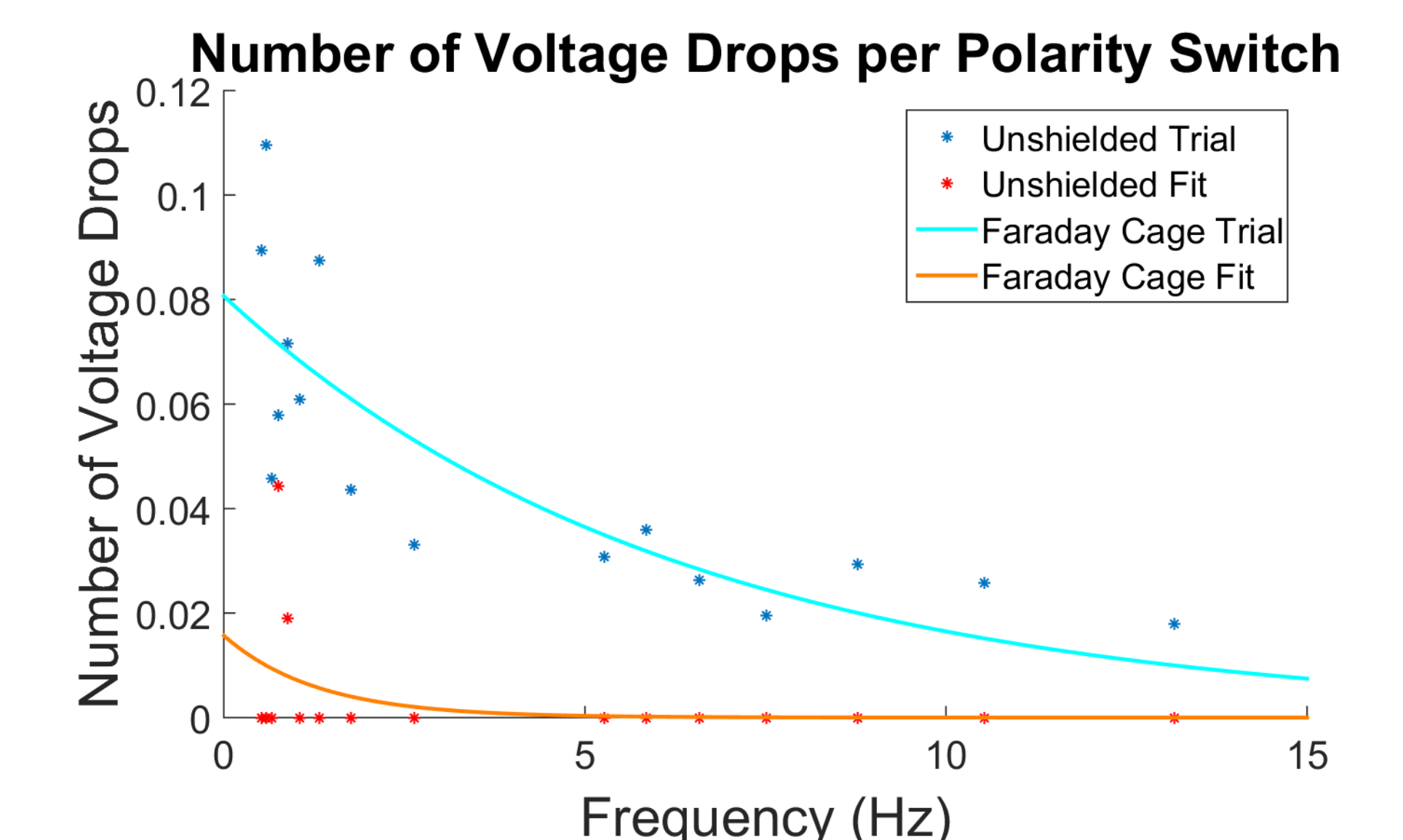


IC Voltage Readout

Static E-Field → Negligible Effects ~ 1-2%



Dynamic E-Field → Frequent Voltage Drops



Results

- Electromagnetic interference (EMI) effects negligible in electrostatic fields
- Substantial voltage effects in electrodynamic fields
- Grounded faraday cage has 3-4 times fewer voltage effects

Current/Future Testing

- EMI effects in electrodynamic fields
- Effects of high voltage changes in:
 - Frequency
 - Amplitude
- Shielding techniques:
 - Faraday cage
 - Grounded shielded wiring
 - Circuit modifications

