DUKHEP01-07-01

HV plate Micro Discharge Study.

Manus Donahue, Bill Ebenstein, Seog Oh

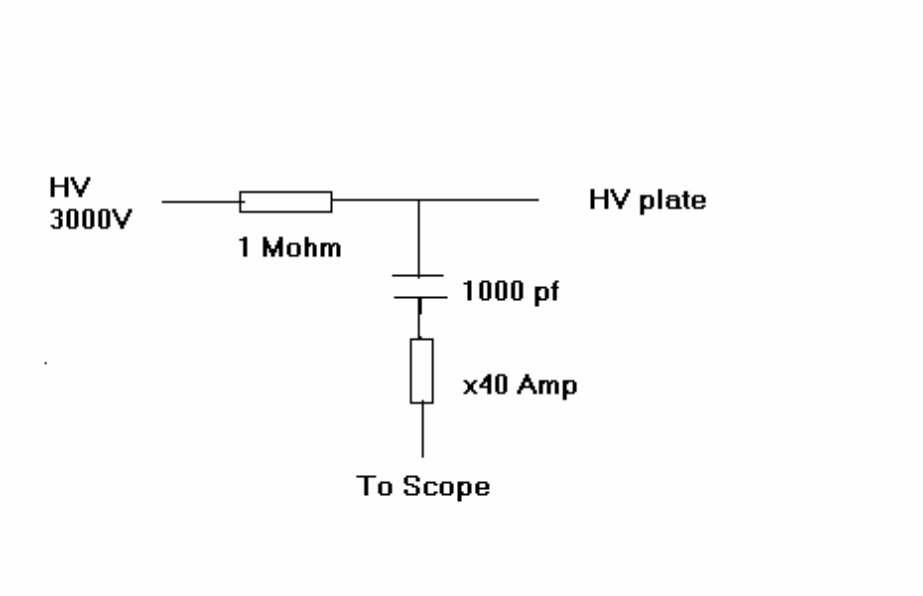
Department of Physics
Duke University.
Durham, NC. 27708

1. Introduction

In this paper, we report the result on the barrel TRT HV plate micro discharge study. One of the functions of the HV plate is to provide HV to the straws. It is made of G10 and has copper traces to route high voltage. Because the plate is inaccessible once a module is constructed, the robustness is important. One of the concerns of the plate is the long term high voltage integrity. It has been suggested that the frequency of micro discharge is correlate to the long term HV stability. As one of the QA procedures of the plate, we have performed a micro discharge study.

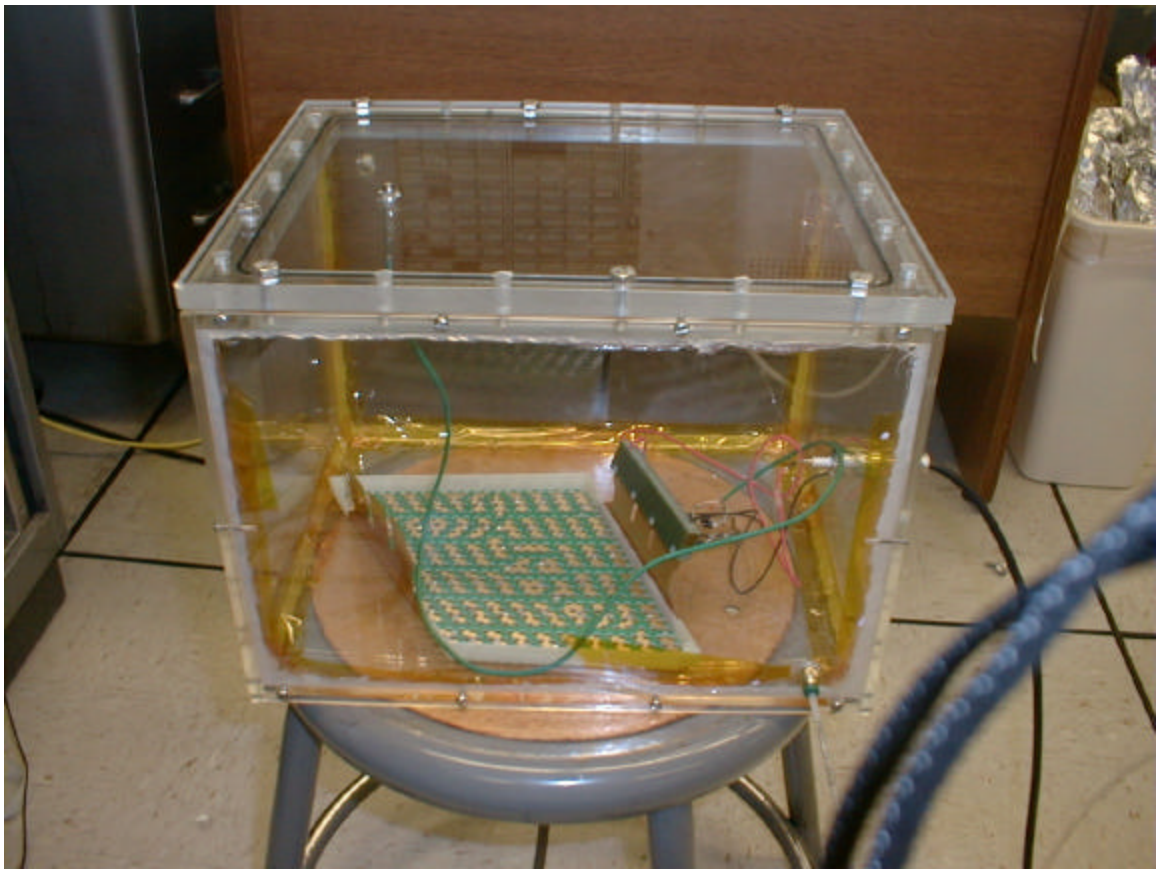
2. Setup

The circuit for the test is shown below. The high voltage is applied to half of the islands while the other half are grounded. A type II production HV plate is used for this test and there are 65 islands. Normally each island provides HV to eight straws.



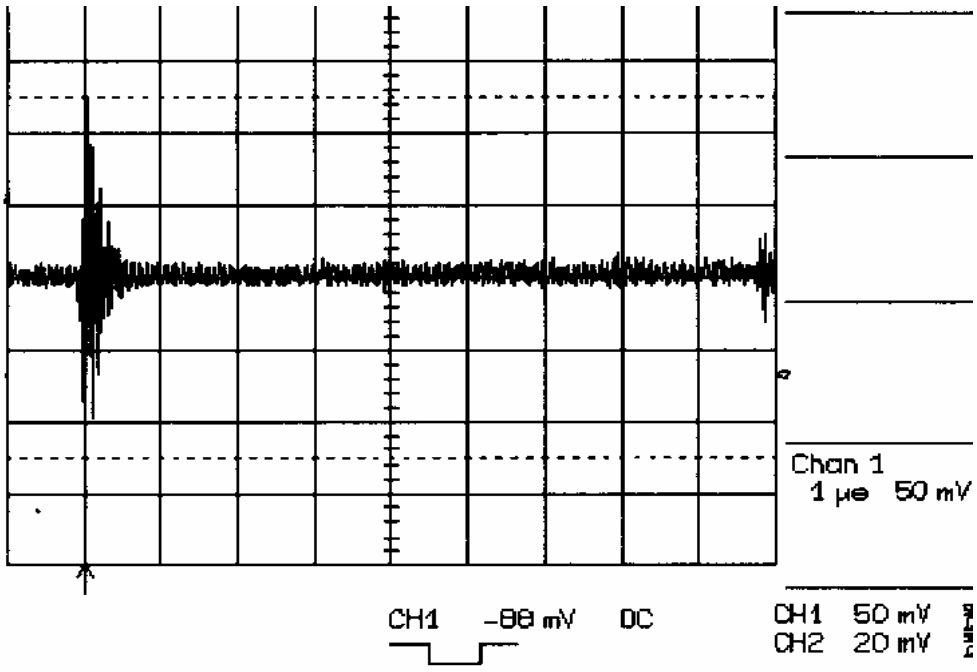
The micro-discharge signal is taken directly from the HV feed through a 1000 pF capacitor. The capacitor is rated for 7kV. The signal is amplified by 40 times and connected to a Lecroy Digital Scope to record the pulse shape. The HV applied to the plate is 3000 volts.

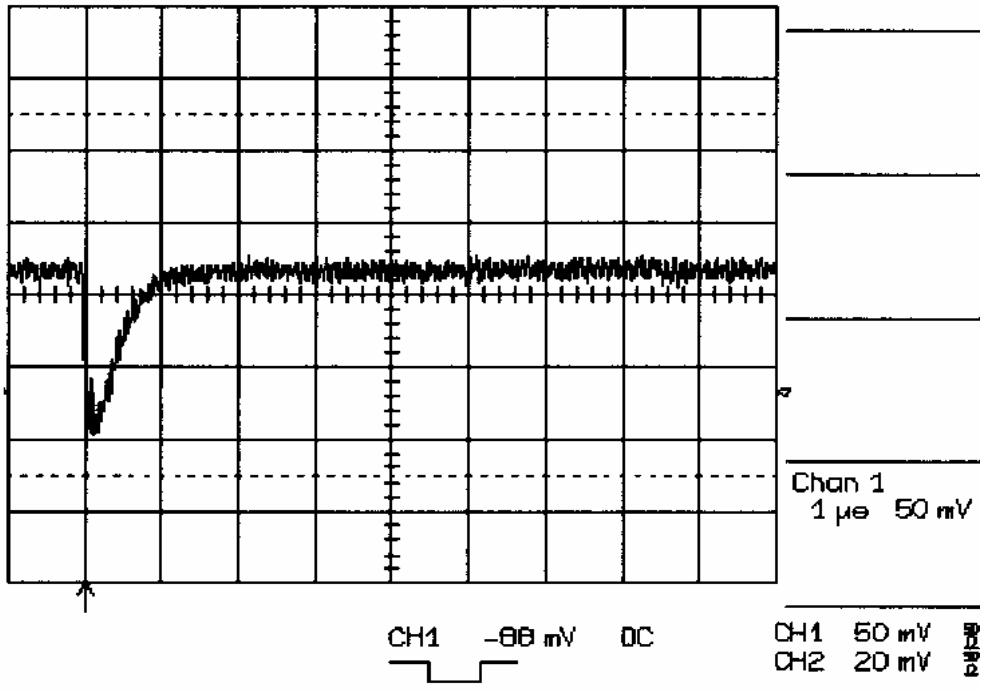
The setup was inside a gas tight plastic box as shown below. Dry nitrogen was flowed through the box. It was necessary to cover the entire box with a good shield to reduce the background.



3. Data taking

The typical noise (upper plot) and signal (lower plot) are shown below. The signal shape of the noise was obtained with HV off. In order to ensure that signals originated from the HV plate, data was also taken with HV on but with the HV plate disconnected. With the HV plate disconnected, we did not observe any signal. Because of the low rate, we were able to count the number of signals from the scope. The data was taken with the scope trigger threshold varying from 25mV to 60 mV (or 0.6 mV to 1.5 mV before amplication).


Chan 1
1 µs 50 mV
CH1 -88 mV DC
CH1 50 mV
CH2 20 mV
T/div 1 µs


Chan 1
1 µs 50 mV
CH1 -88 mV DC
CH1 50 mV
CH2 20 mV

4. Results

The typical noise rate is less than 0.1 Hz (depending on the time of the day and the number of people in the room) and the typical signal rate is about 0.02 Hz when a *positive HV supply* is used, and less than 0.01 Hz when a *negative HV supply* is used. It is not clear why the polarity results in the different rate. We also note that the rate depends little on the trigger threshold.