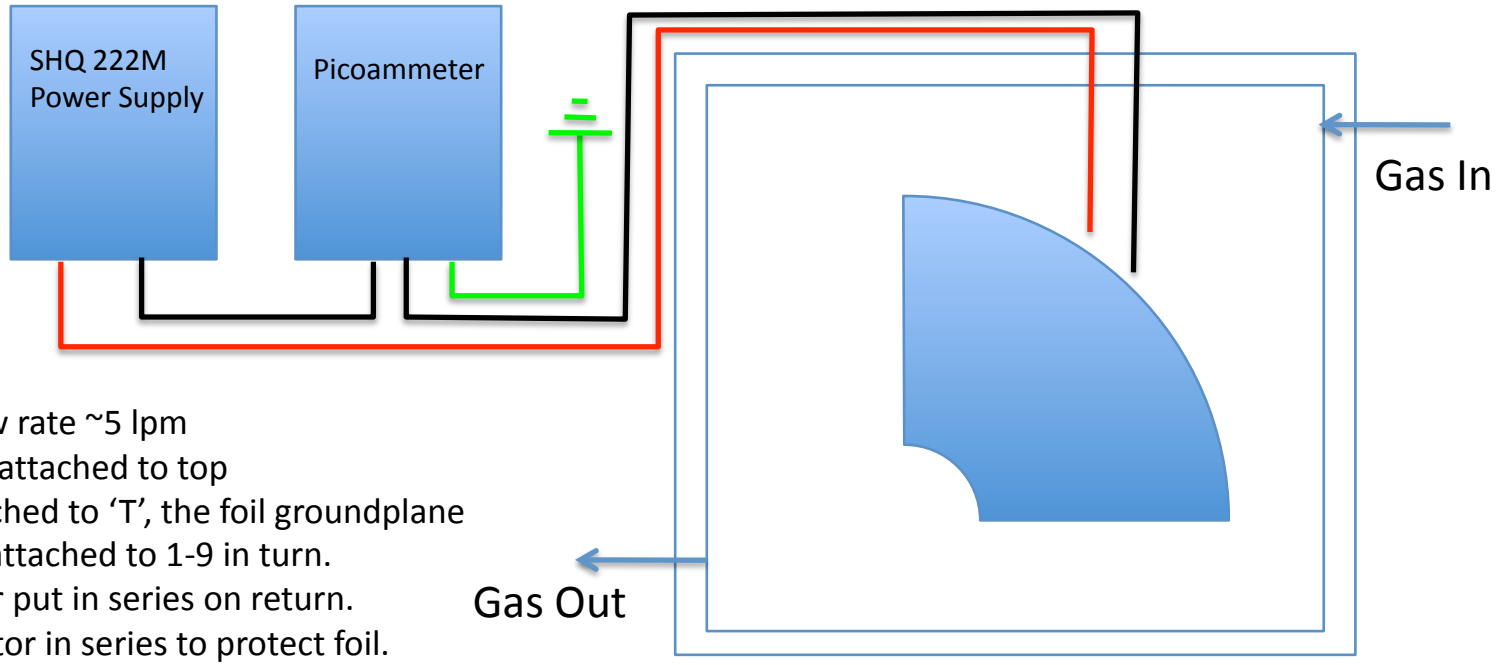
GEM Foil HV Tests

Ross Corliss

- Test Setup
- Measurements
- Summary of Results

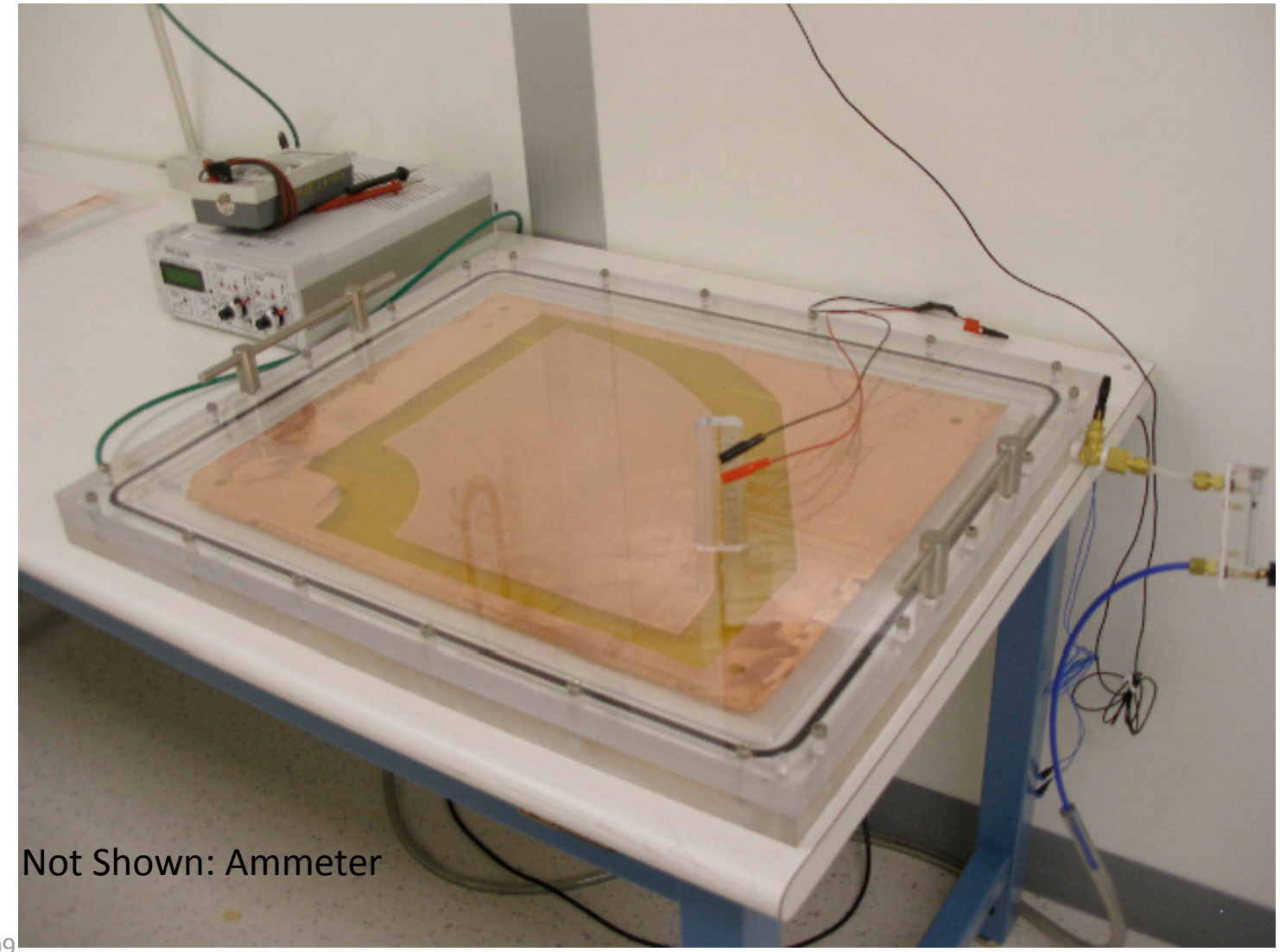
Test Setup



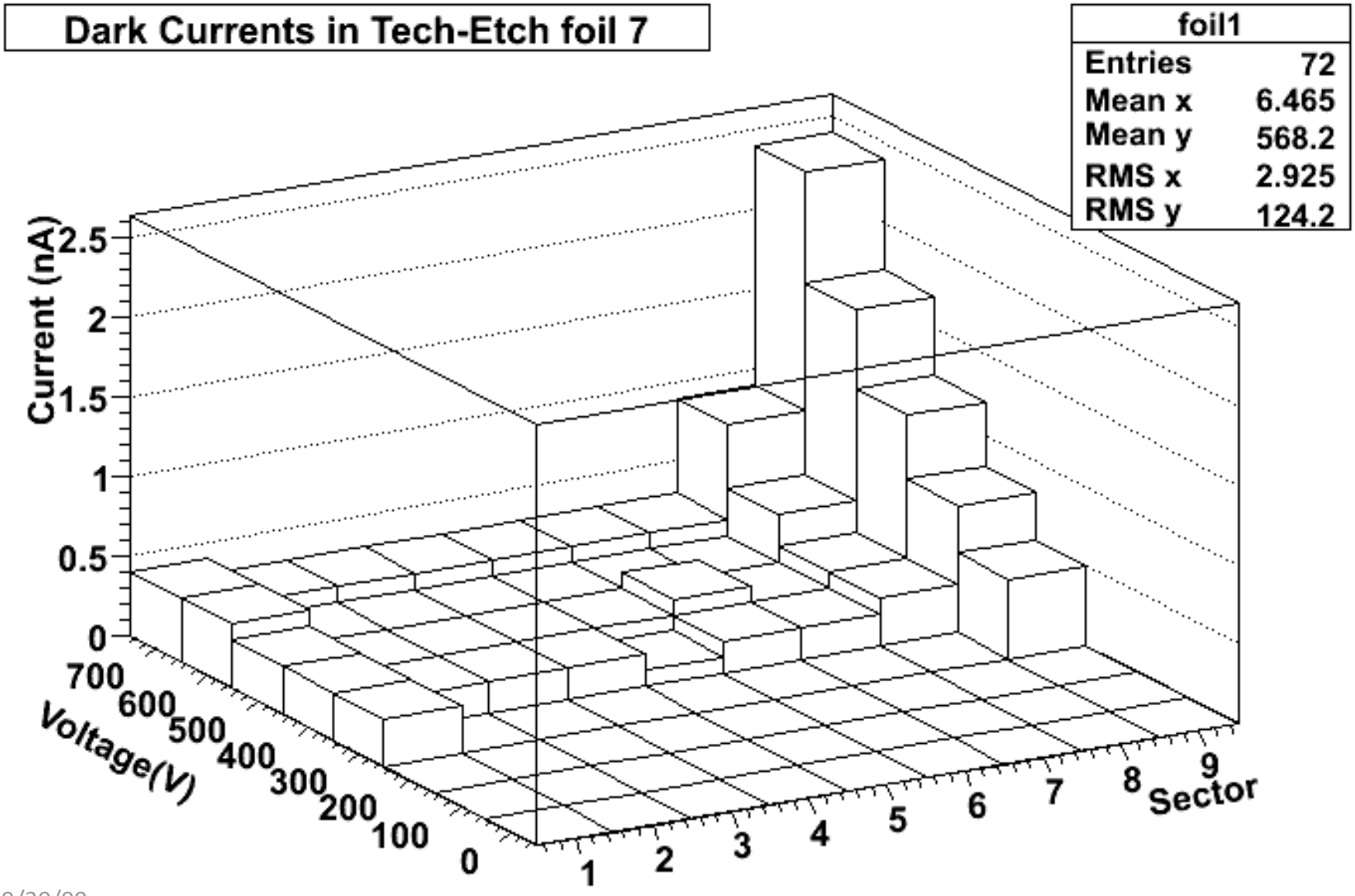
-Nitrogen flow rate ~5 lpm
-Ground lead attached to top
-HV lead attached to 'T', the foil groundplane
-Return lead attached to 1-9 in turn.
-Picoammeter put in series on return.
-100MΩ resistor in series to protect foil.
-Ammeter ground lead attached to table.

-Voltage applied to one sector at a time
-Current allowed to settle for several min.
-Voltage ramped in 100V increments
-There are usually small oscillations (~.02nA) even after settling. The recorded value is the upper bound of this.
-For some regions the current continues to have large spikes after ten minutes, or otherwise does not reach a stable value. These are labeled 'No Stable Value'.

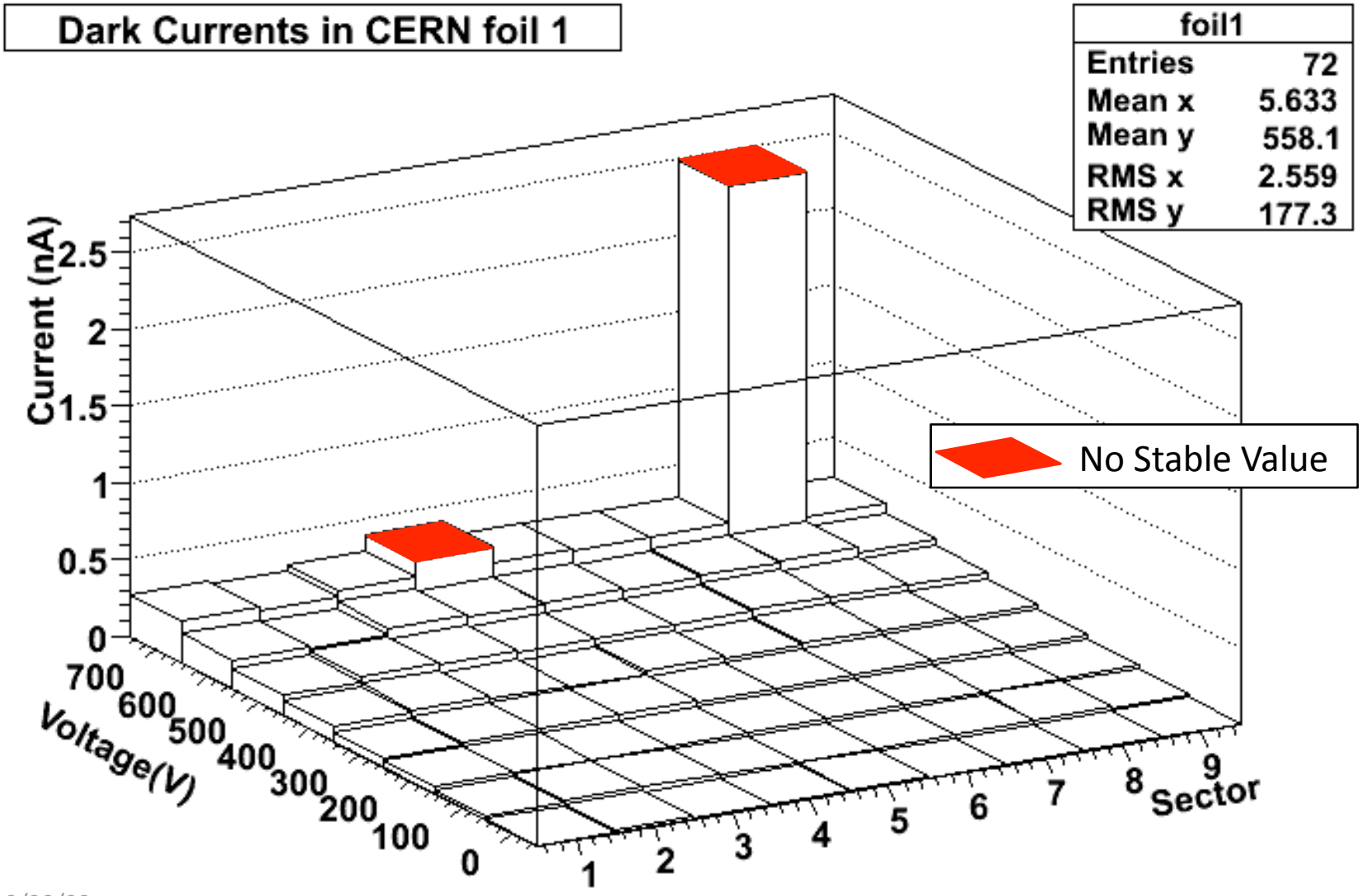
Test Setup



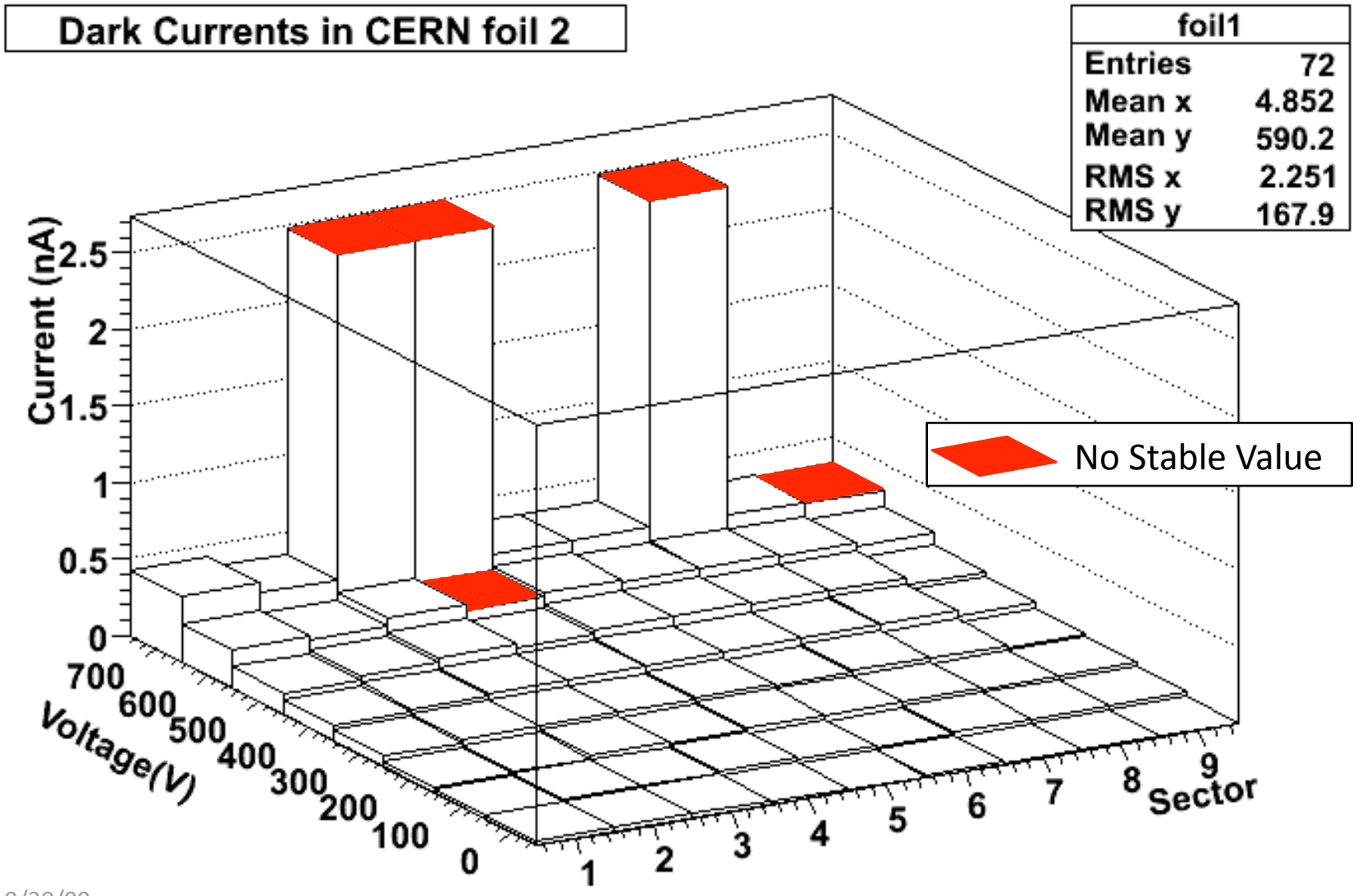
Measurement of Tech-Etch Foil



Measurement of CERN foil



Measurement of CERN foil



HV Differences

- All Tech-Etch foils were stable up to 700V on sectors 1-8. CERN foils do not seem to be.
- All Tech-Etch foils show significantly larger dark currents in sectors 8 and 9 at higher voltages. Aside from stability issues at 700, the CERN foils do not have higher currents.

	Sector	0V	100V	200V	300V	400V	500V	600V	700V
Tech-Etch	8	0.0	0.0	0.0	0.0	0.3	0.3	**0.5**	**0.9**
CERN	8	0.01	0.04	0.06	0.09	0.15	0.19	**0.25**	**0.34**
Tech-Etch	9	0.0	0.0	0.0	**0.5**	**0.8**	**1.2**	**1.7**	**2.4**
CERN	9	0.01	0.04	0.06	**0.07**	**0.11**	**0.14**	**0.22**	--

Physical Differences

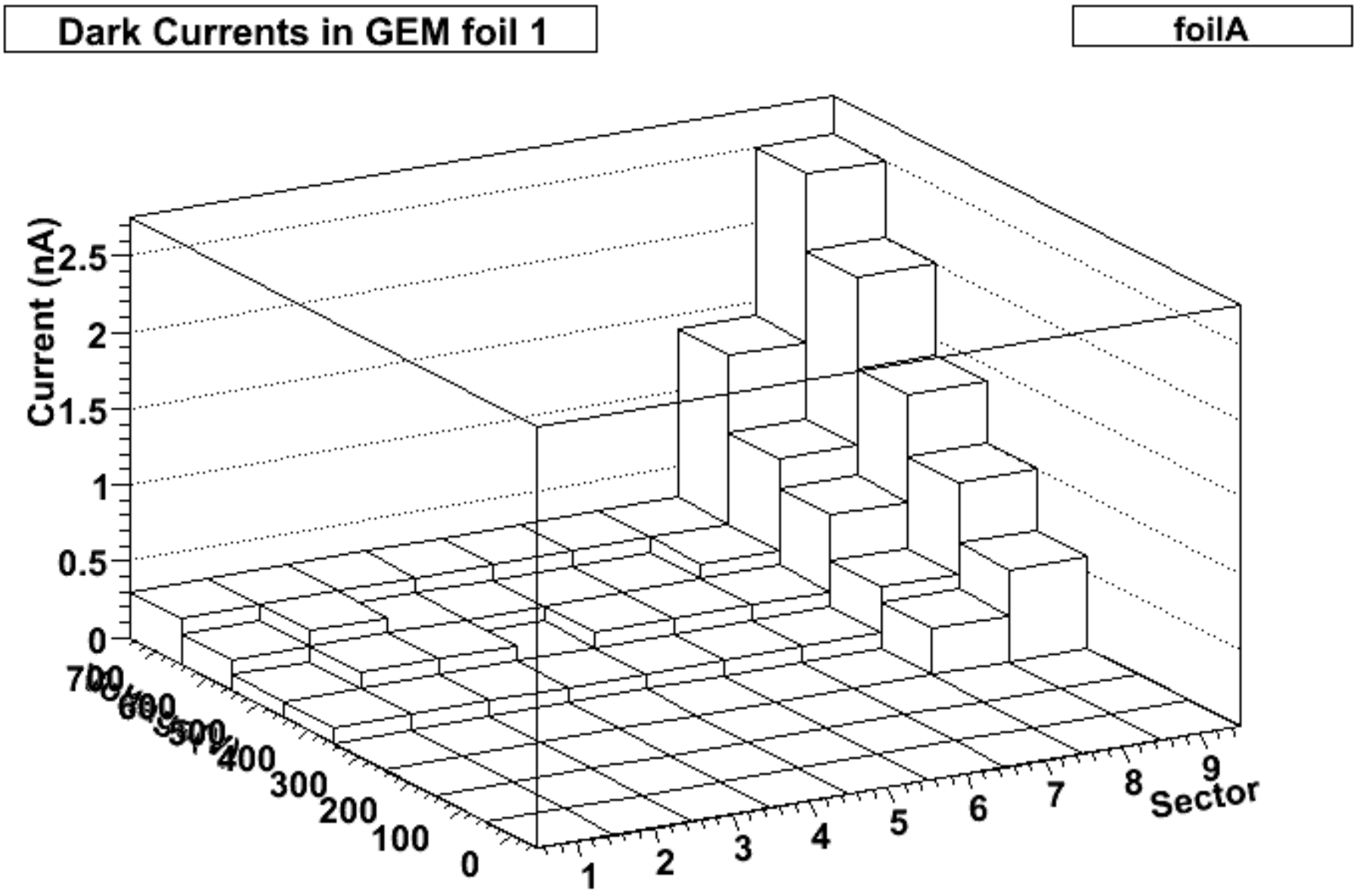
When oriented to fit into the test setup:

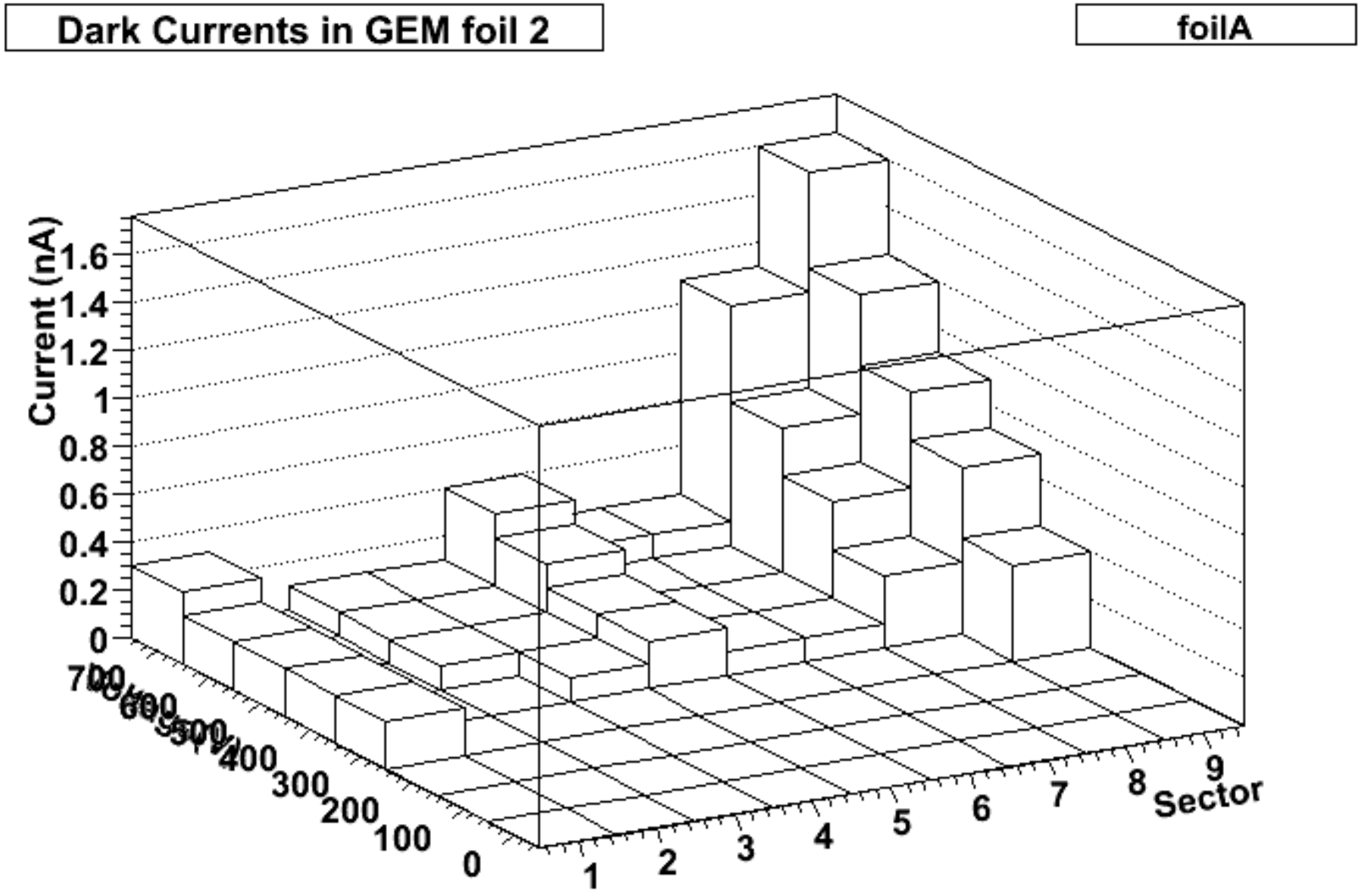
- The Tech-Etch foil has the segmented plane on bottom, and HV contacts ordered 1357T98642
- The CERN foil has the segmented plane on top, and HV contacts ordered 13579T8642.
- The CERN HV contact for the ground plane (T) is not plated through. To correct this, a small strip of copper tape was placed under the contact on the bottom and routed to the correct point on the top.

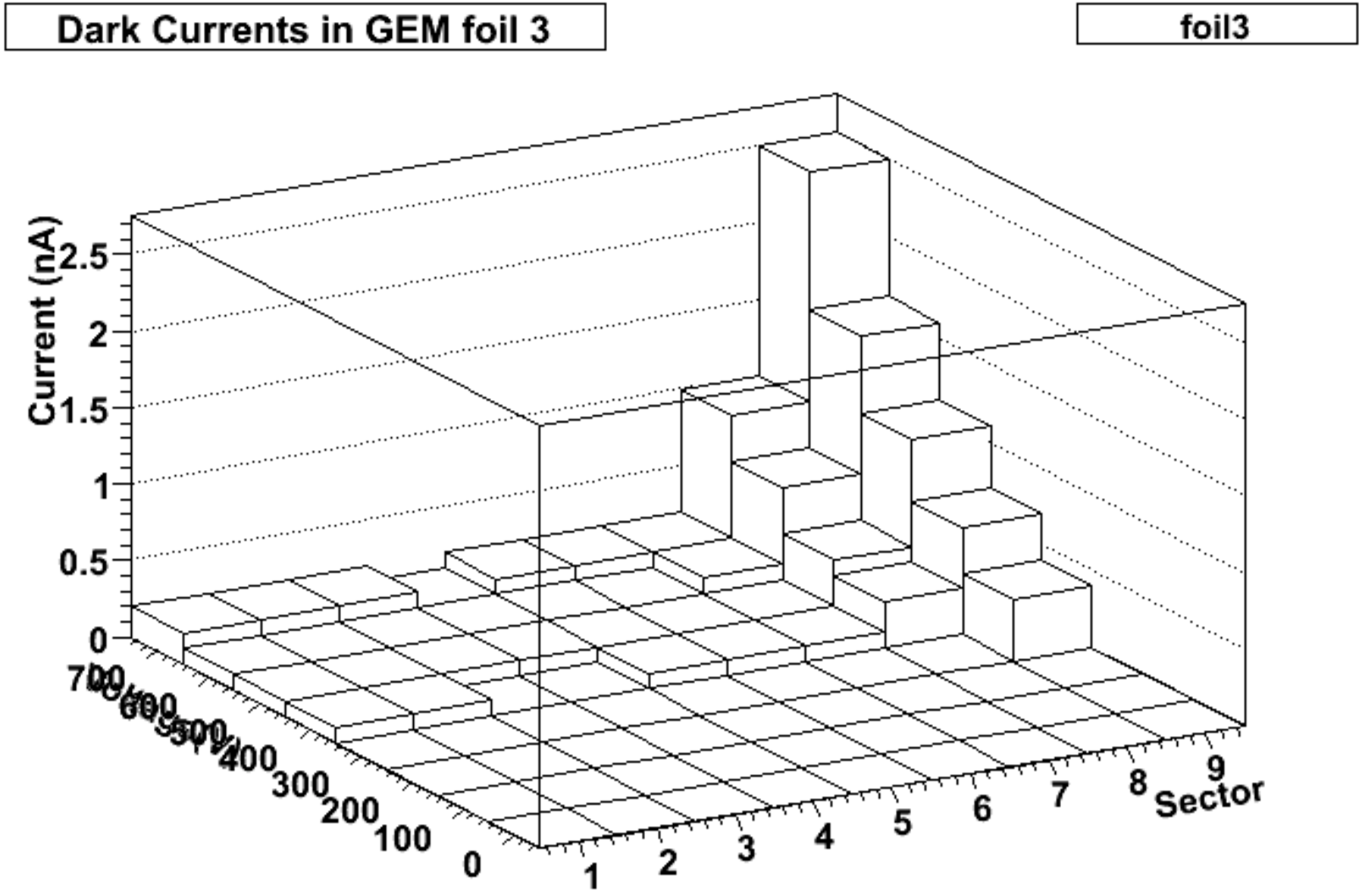
Future Plans

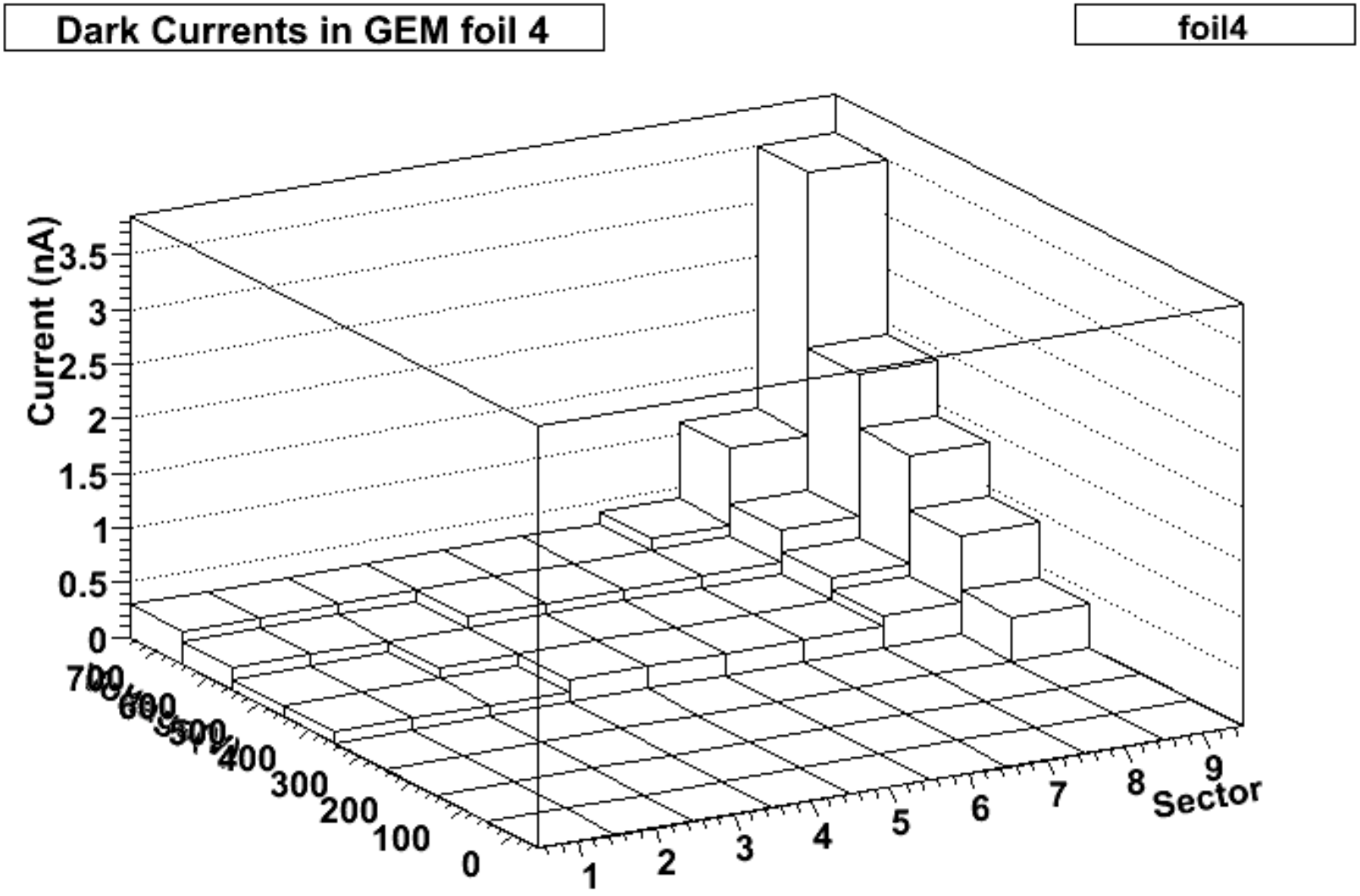
- Measure remaining CERN foils
- Measure cleaned Tech-Etch foils when returned.

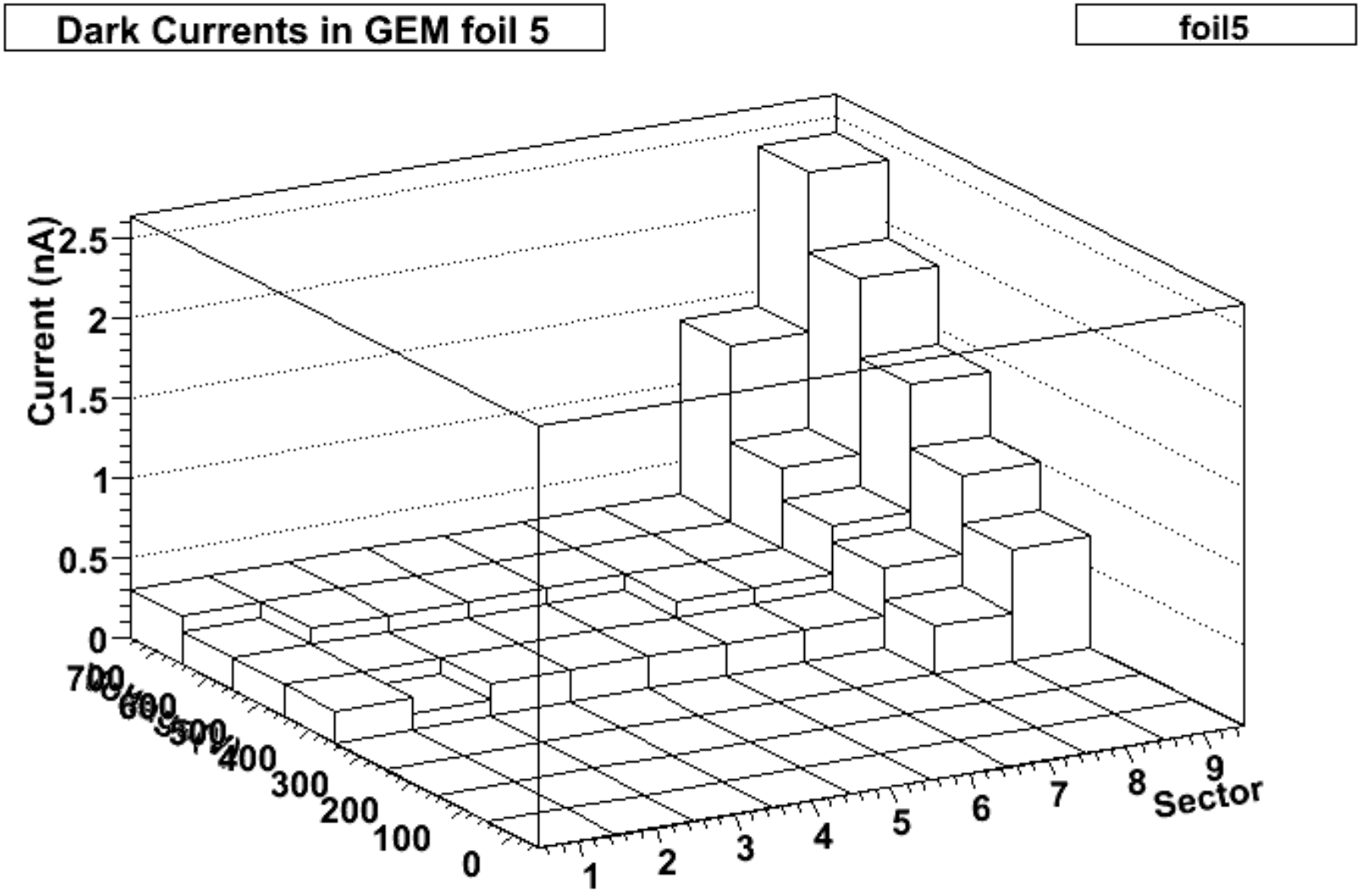
- For future CERN foils, we will not measure beyond 600V (?)


Dark Currents in GEM foil 1
foilA
Current (nA)
2.5
2
1.5
1
0.5
0
700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
Sector


Dark Currents in GEM foil 2
foilA
Current (nA)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
Sector

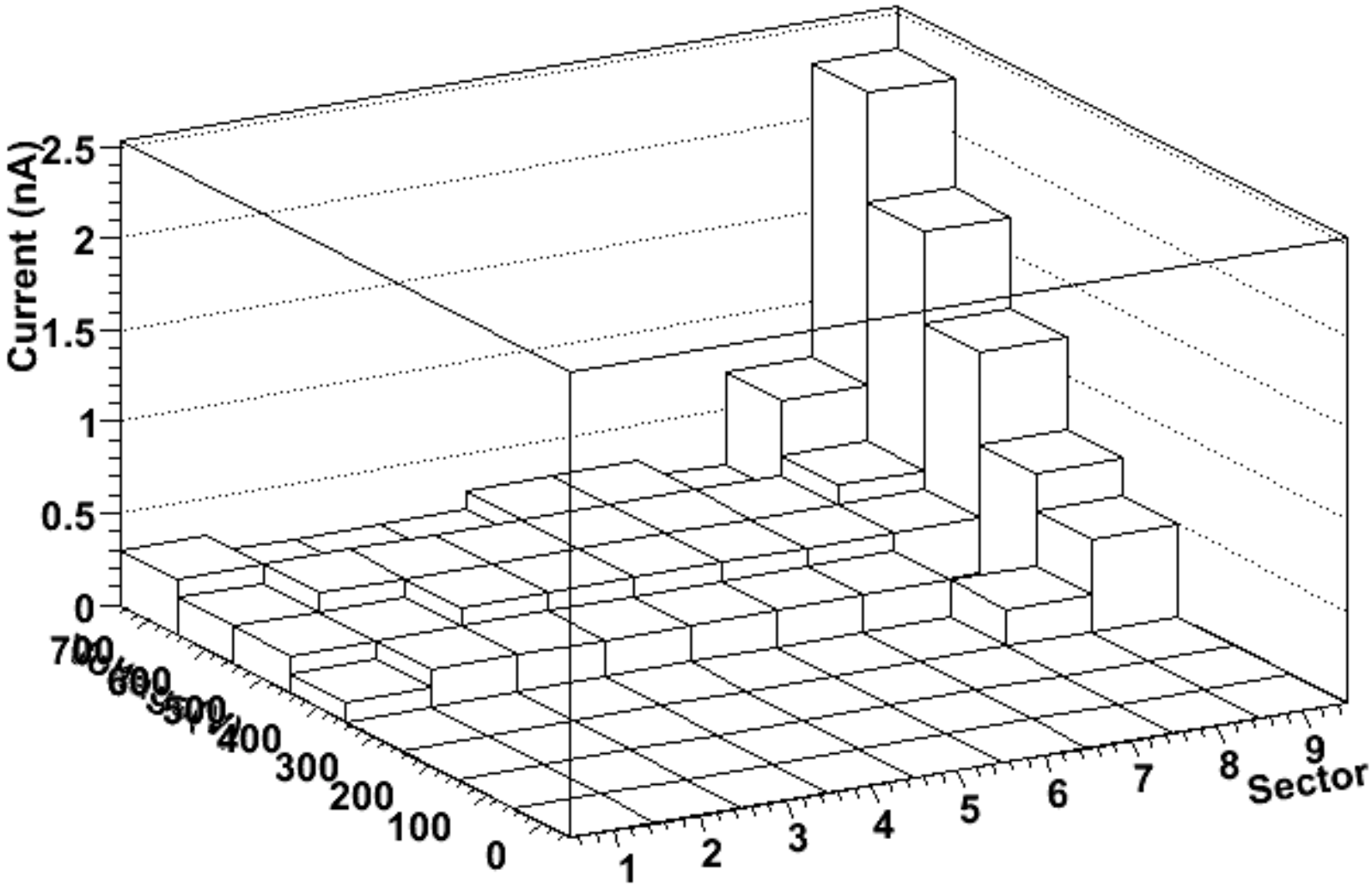

Dark Currents in GEM foil 3
foil3
Current (nA)
2.5
2
1.5
1
0.5
0
700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
Sector

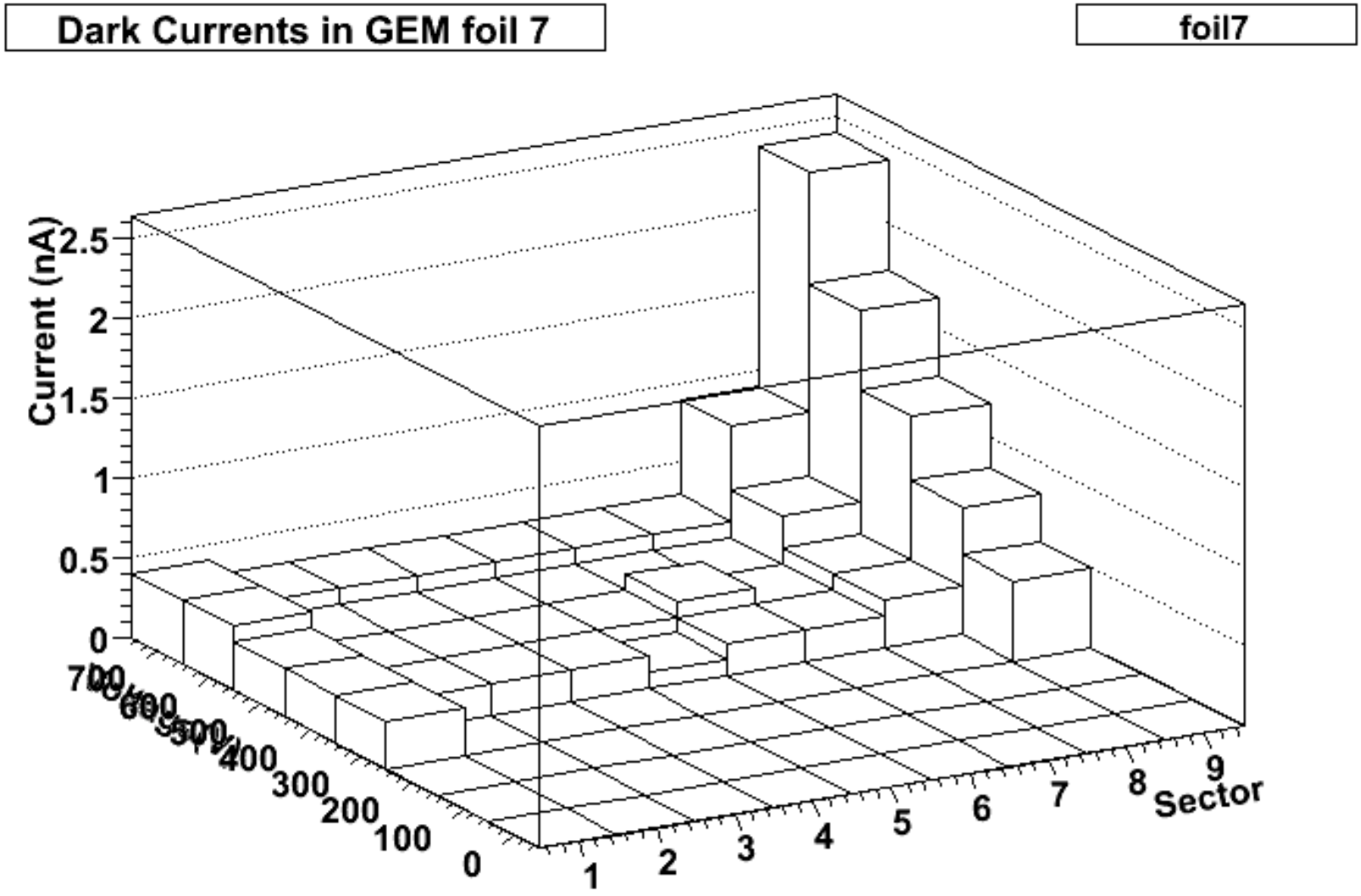

Dark Currents in GEM foil 4
foil4
Current (nA)
3.5
3
2.5
2
1.5
1
0.5
0
700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
Sector


Dark Currents in GEM foil 5
foil5
Current (nA)
2.5
2
1.5
1
0.5
0
700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
Sector

Dark Currents in GEM foil 6

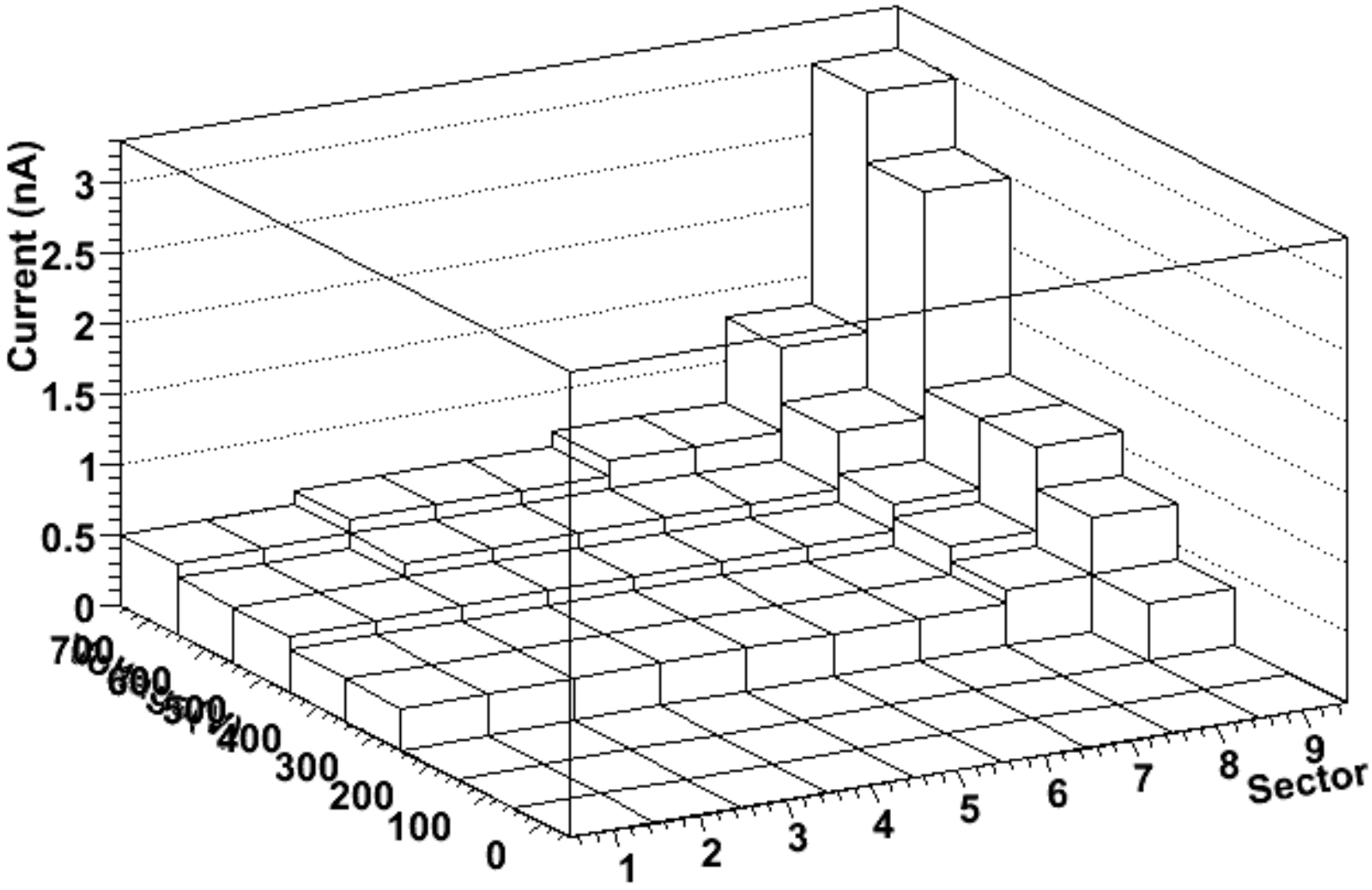
foil6




Dark Currents in GEM foil 7
foil7
Current (nA)
2.5
2
1.5
1
0.5
0
700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
Sector

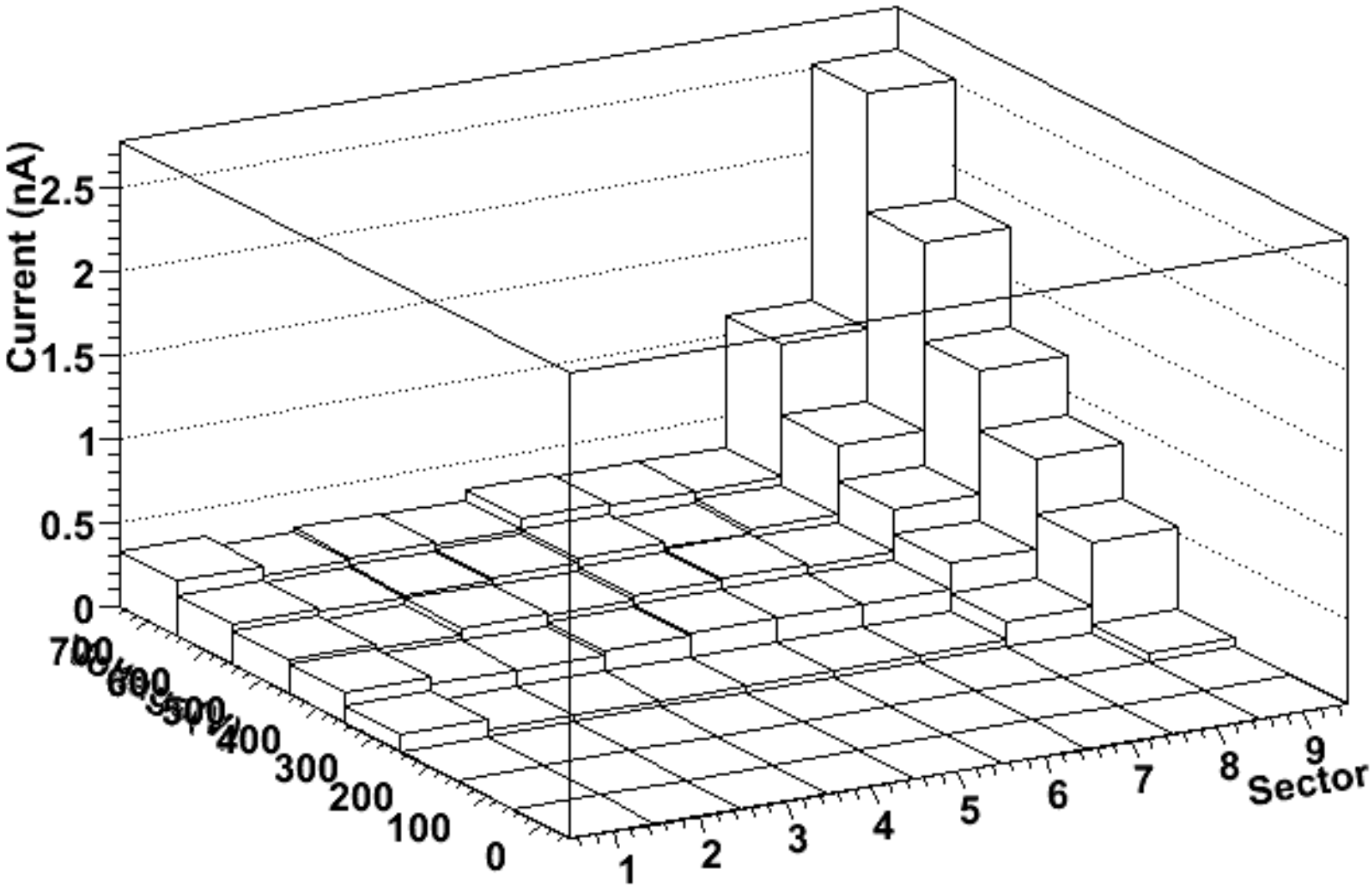
Dark Currents in GEM foil 8

foil8

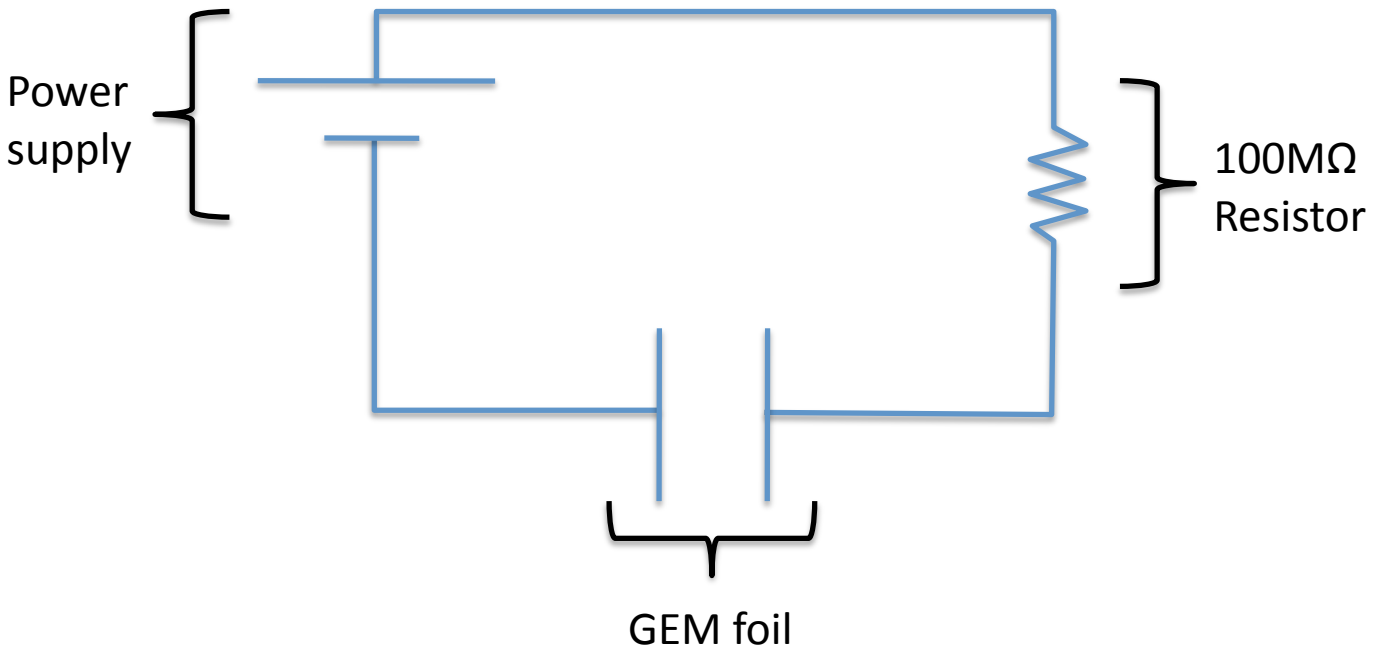


Dark Currents in average GEM foil

foilA



Equivalent Circuit



Equivalent Circuit