Recent Experiments and Modelling of Diamond Dynodes

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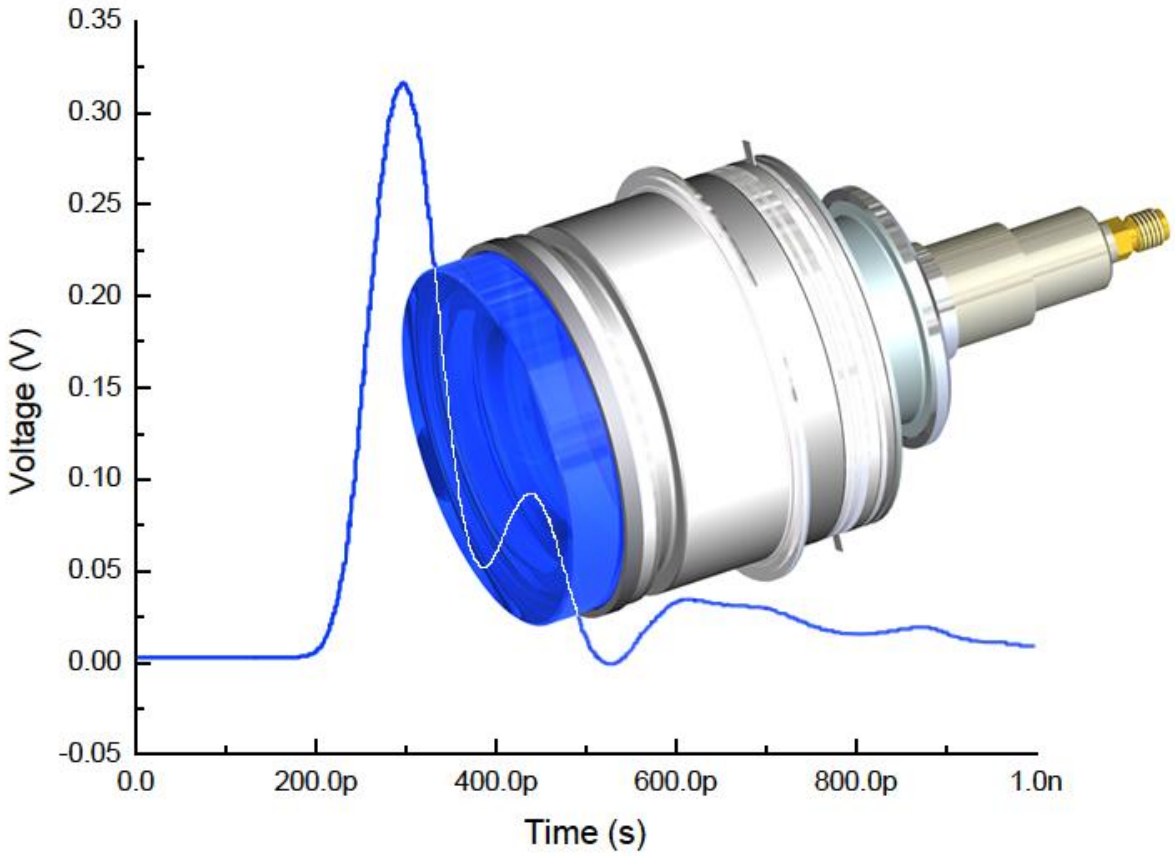
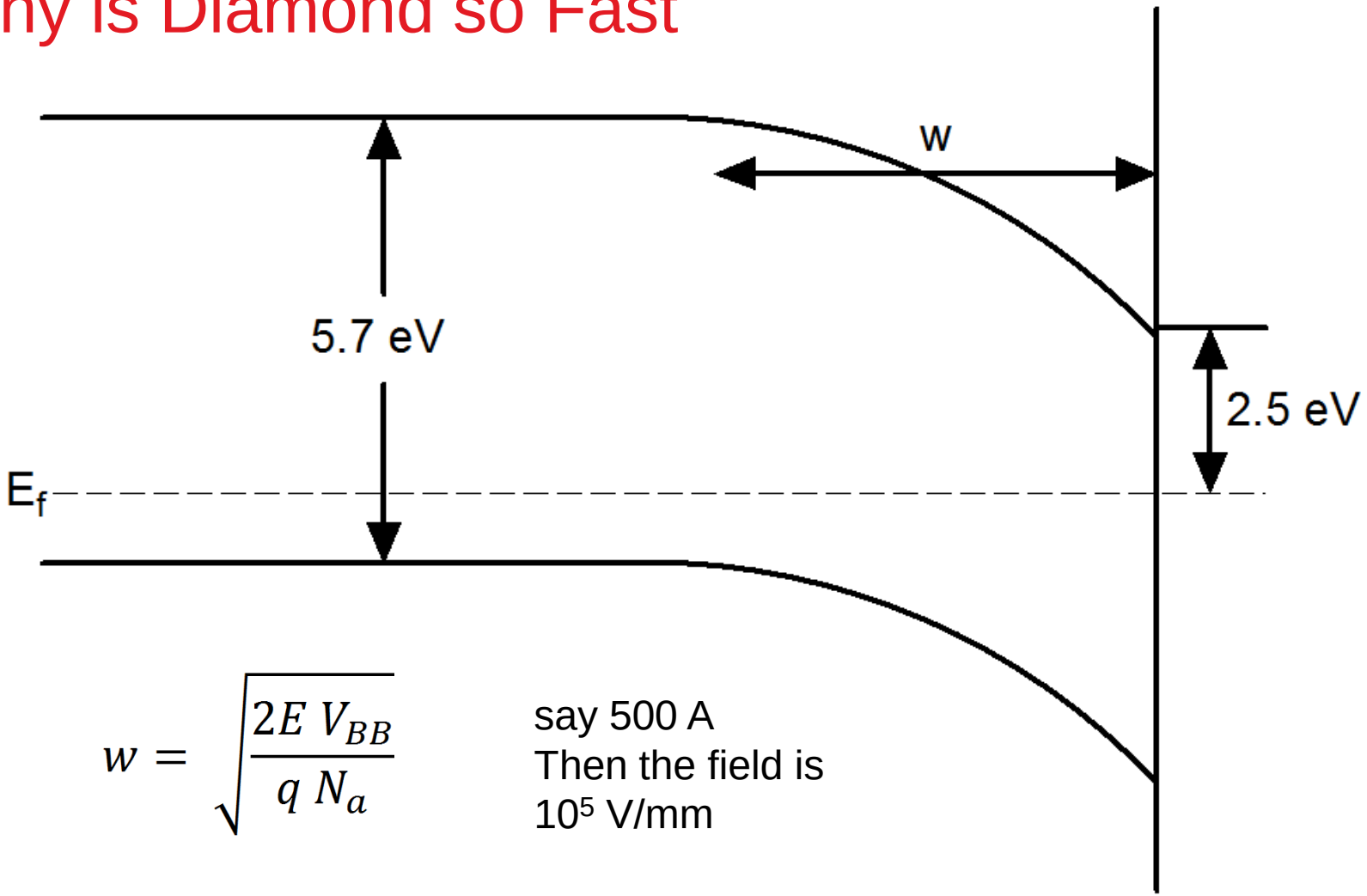
Time Resolution



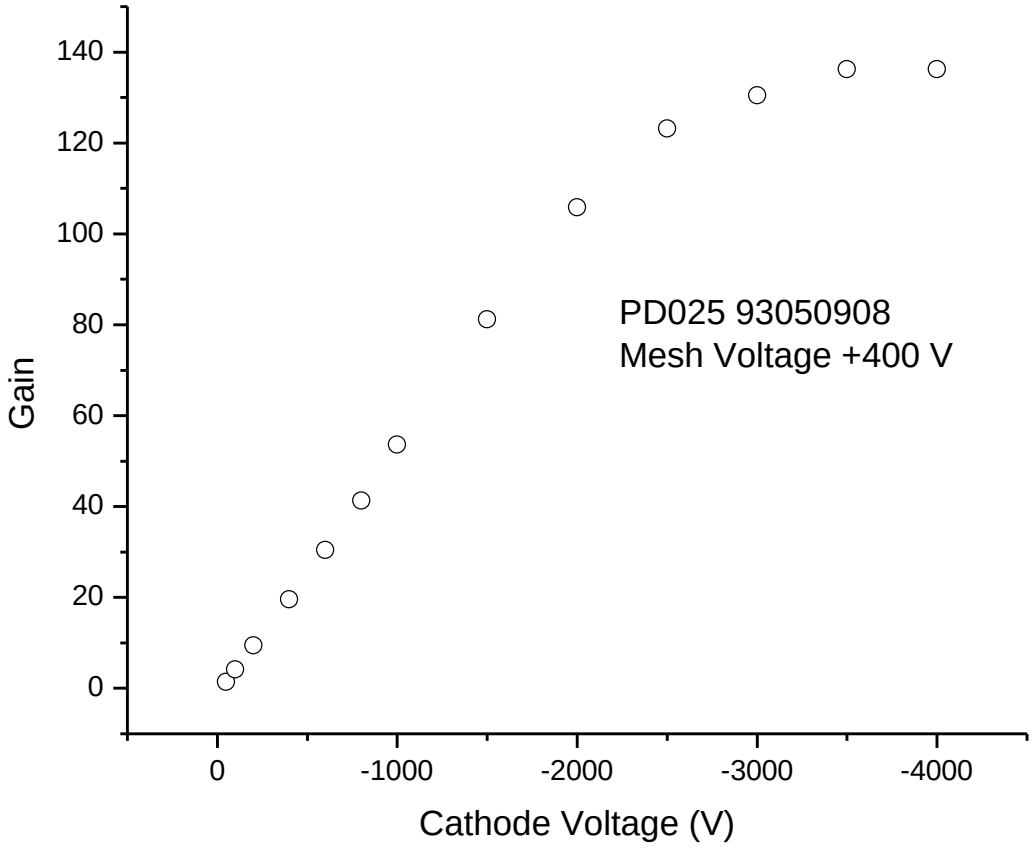
Why is Diamond so Fast



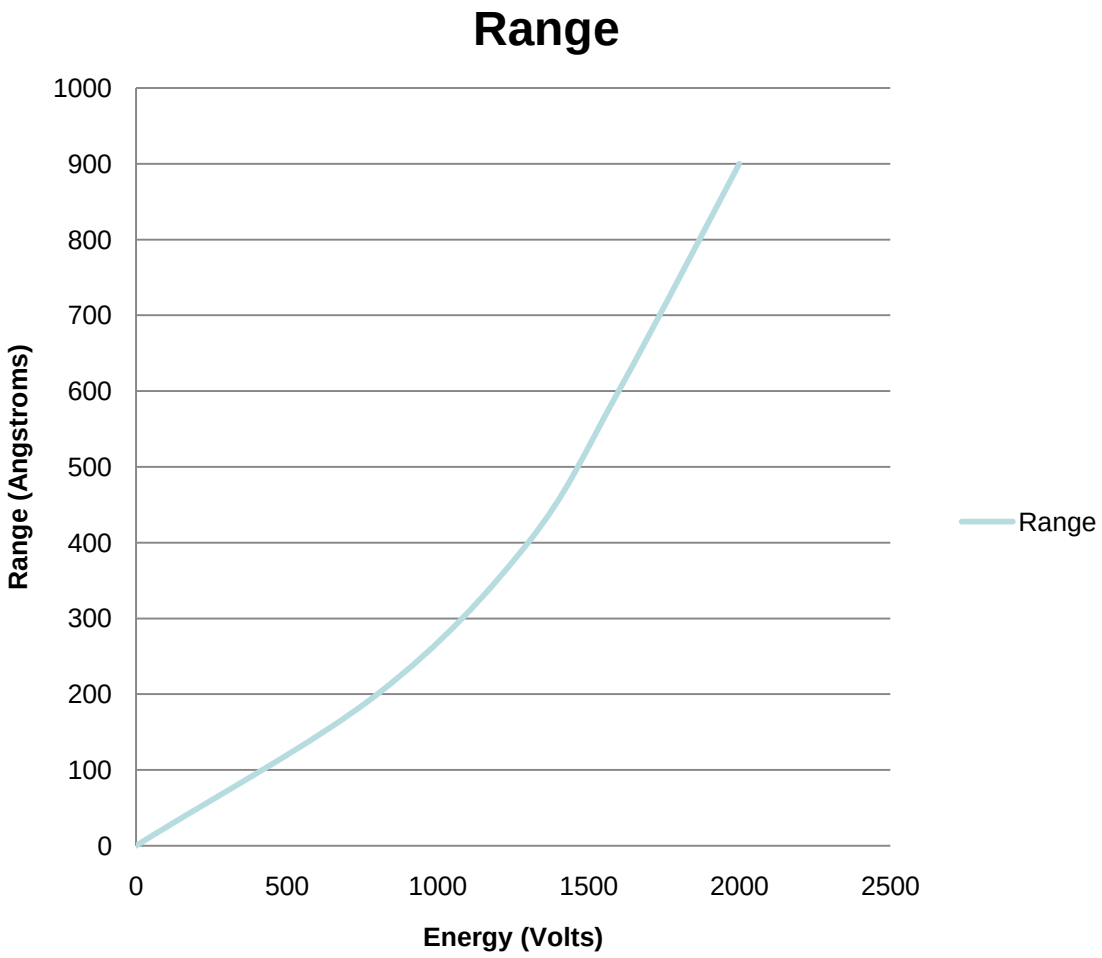
$$w = \sqrt{\frac{2E\ V_{BB}}{q\ N_a}}$$

say 500 A
Then the field is
10^5 V/mm

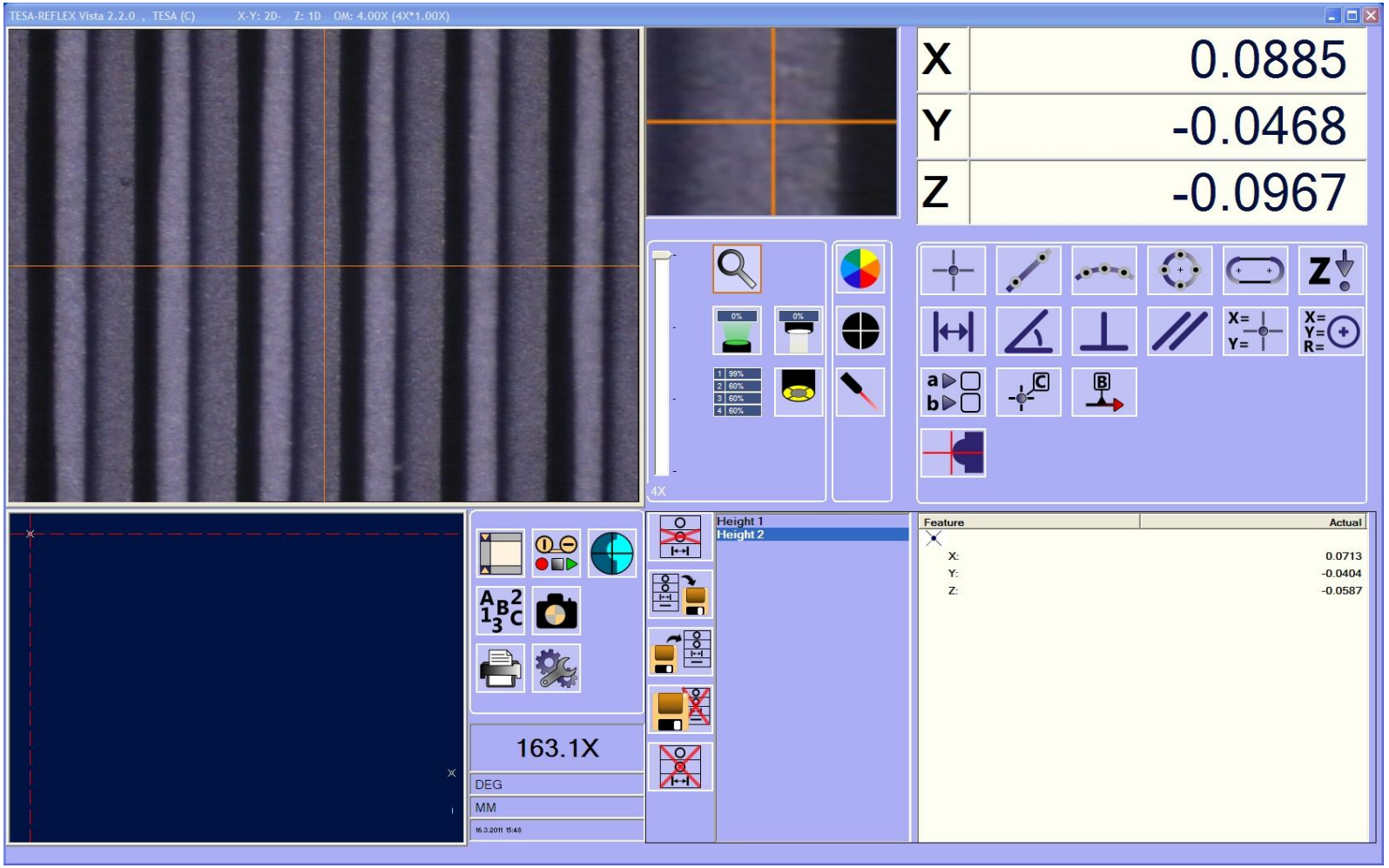
Gain


Gain
140
120
100
80
60
40
20
0
0
-1000
-2000
-3000
-4000
Cathode Voltage (V)
PD025 93050908
Mesh Voltage +400 V

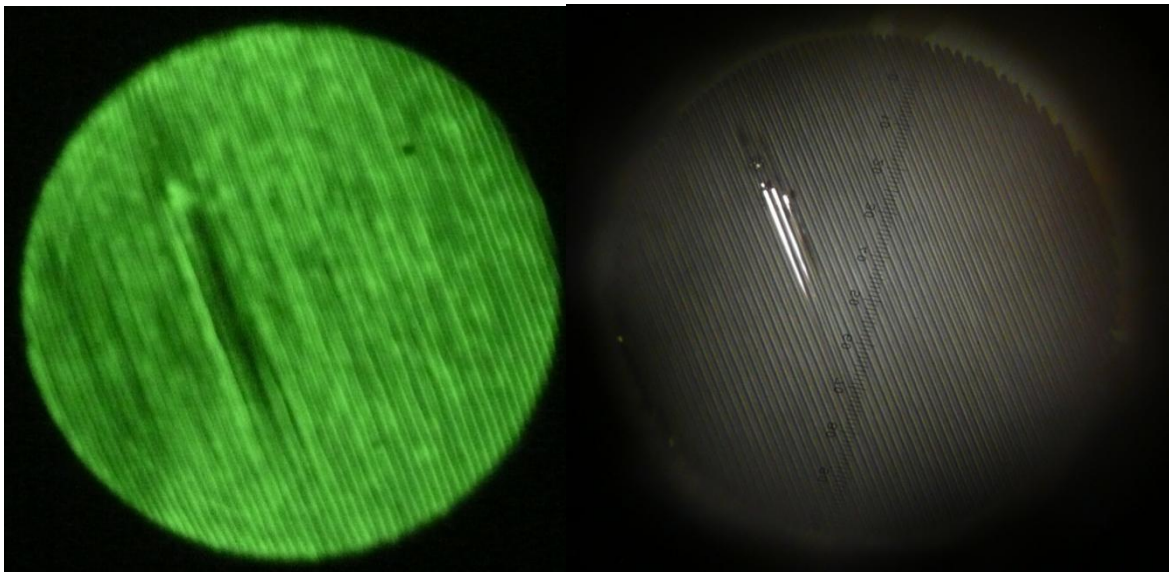
Electron Range in Diamond



Metal Venetian Blind Dynode



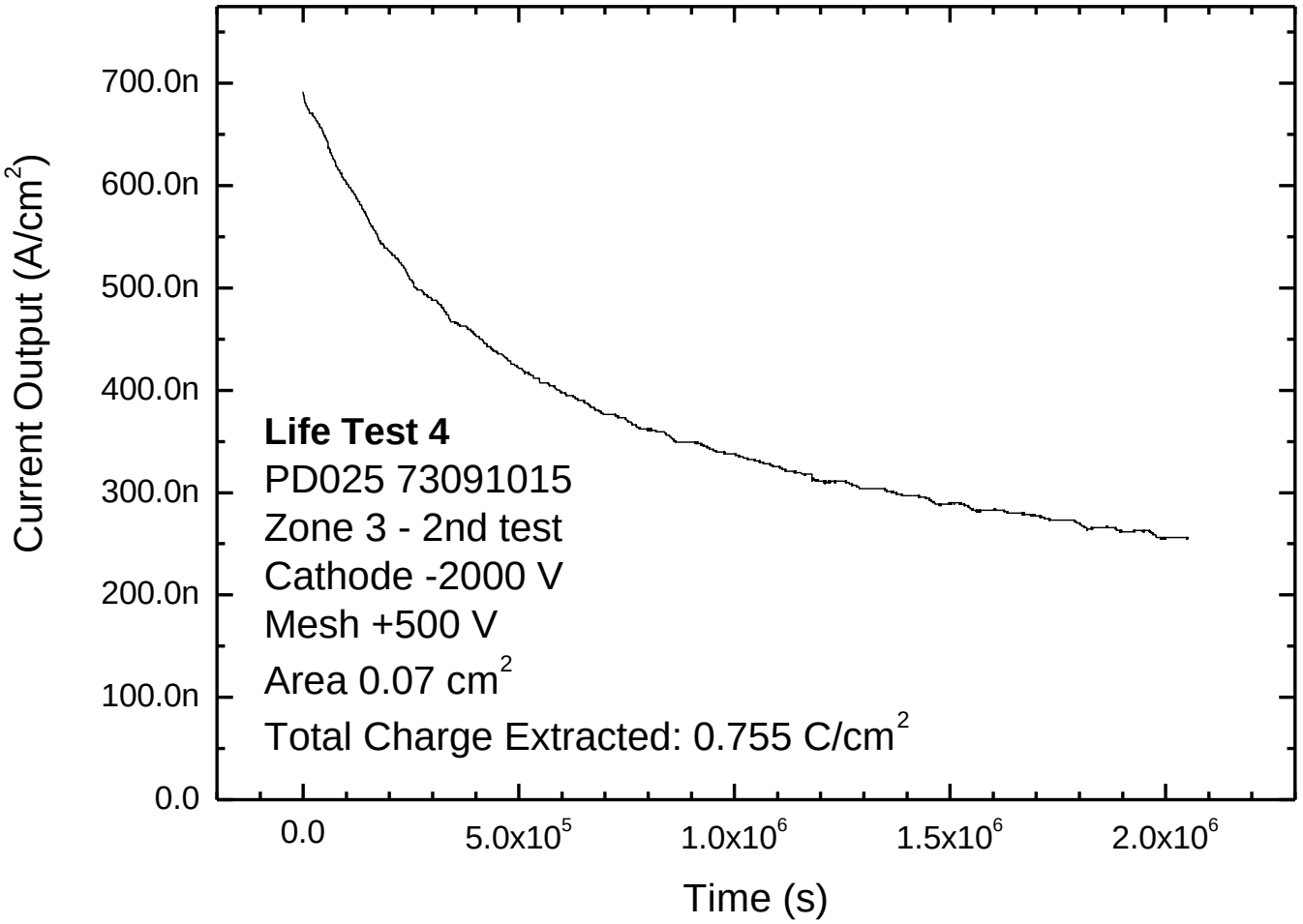
Assessment of Slit Dynode in Transmission Mode



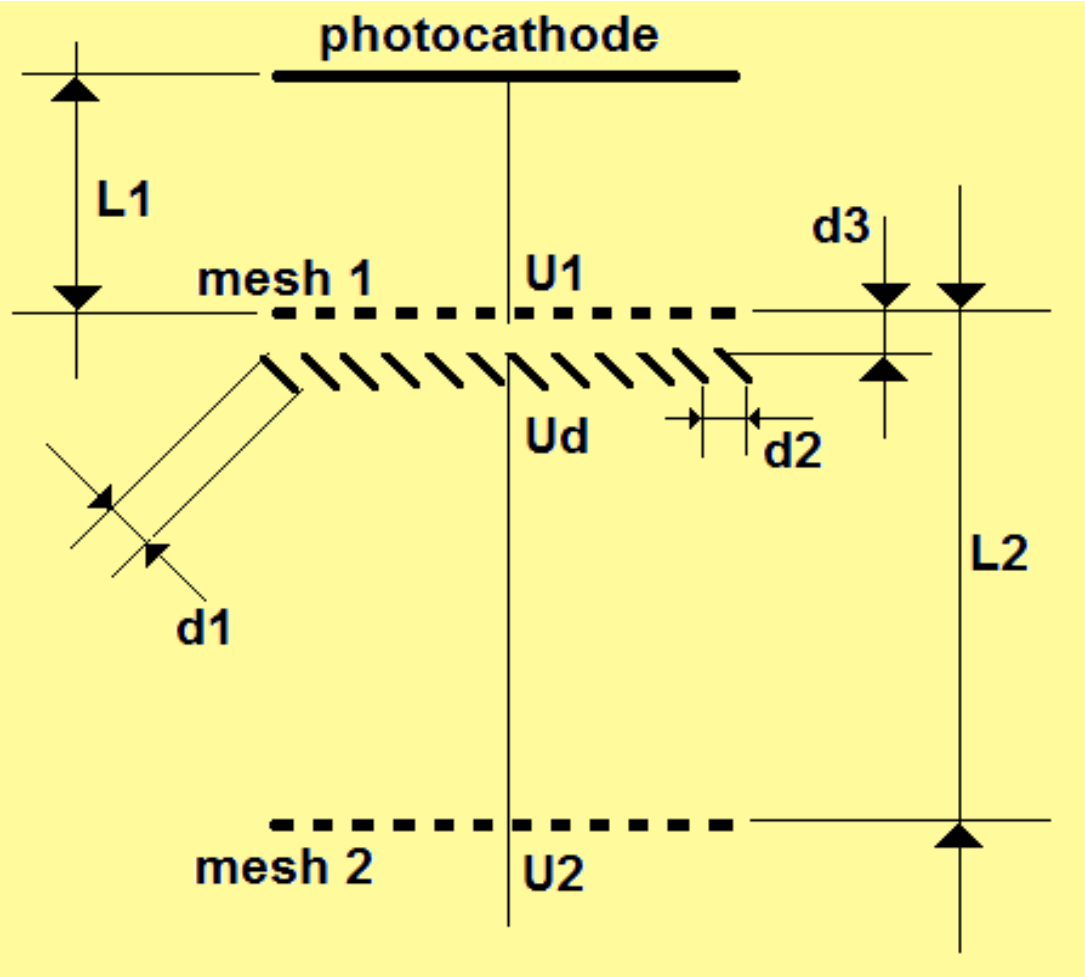
Left image:
MCP IN: 0 V
MCP OUT: 650 V
Dynode pair & mesh: 1150 V
Phosphor screen: 5650 V

Right image:
Back-lit photo of dynode pair

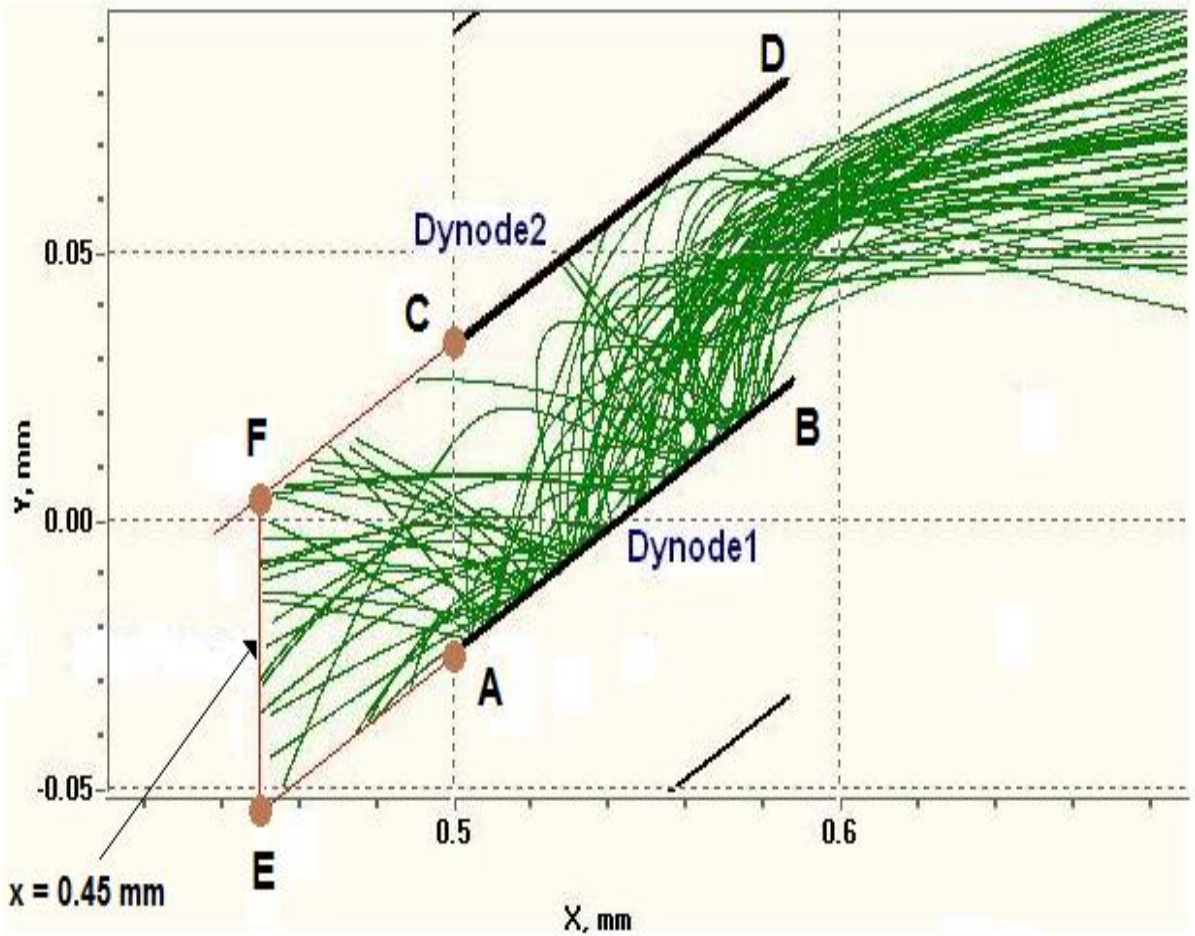
Life Test


Current Output (A/cm^2)
700.0n
600.0n
500.0n
400.0n
300.0n
200.0n
100.0n
0.0
0.0
5.0x10^5
1.0x10^6
1.5x10^6
2.0x10^6
Time (s)
Life Test 4
PD025 73091015
Zone 3 - 2nd test
Cathode -2000 V
Mesh +500 V
Area 0.07 cm^2
Total Charge Extracted: 0.755 C/cm^2

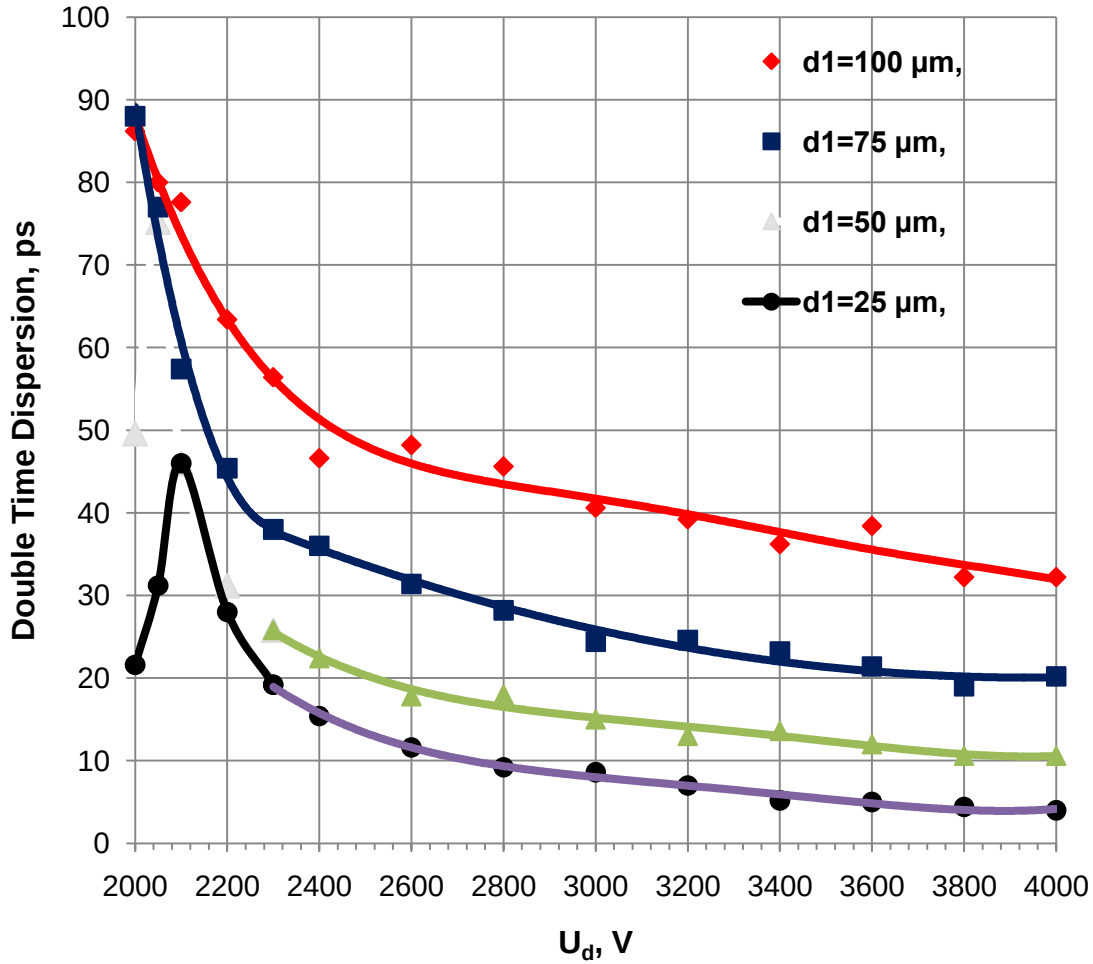
Model of Venetian Blind Dynode



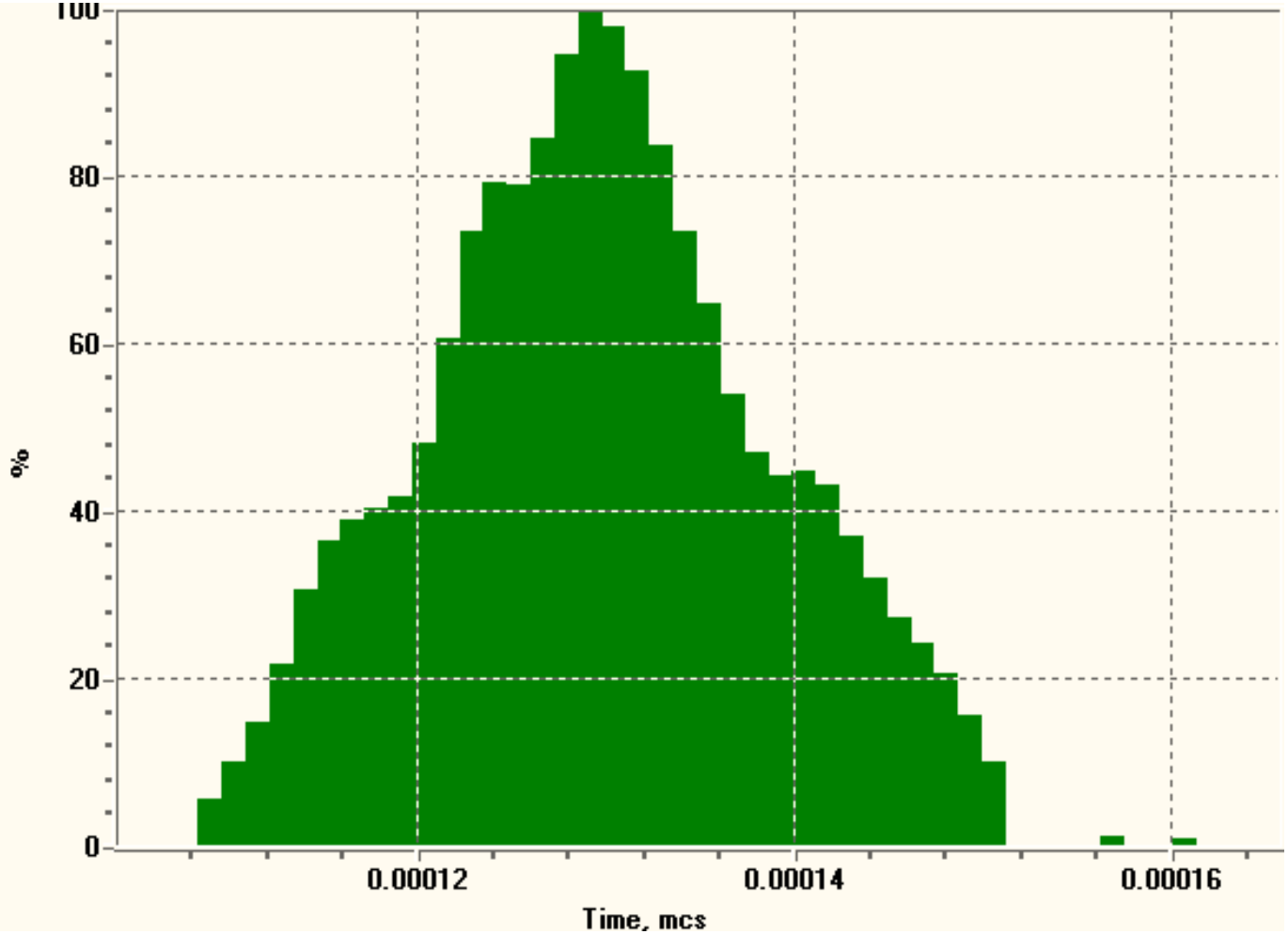
Electron Trajectories



Transit Time Spread as a Function of Mesh-Dynode Volts



TTS for a Single Stage at 800 V/mm



Summary

- No photocathode degradation
- Response time of diamond is fast because of band structure
- Venetian blind can achieve 20ps/stage at 50 micron scale
- Count rate of venetian blind is linear to very high rates

Thank you for listening

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