

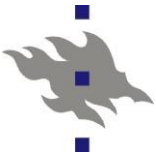


HELSINGIN YLIOPISTO  
HELSINGFORS UNIVERSITET  
UNIVERSITY OF HELSINKI

# Study of capacitance – gap distance relationship variation over cathode surface

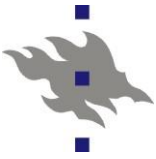
Anders Korsbäck  
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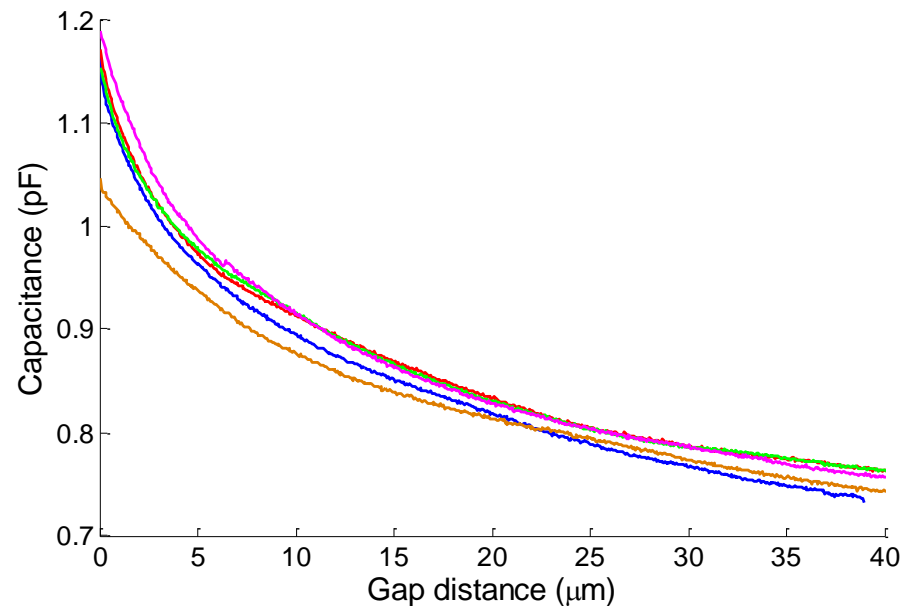
## Background

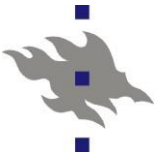
- We want to be able to control the gap size in DC Spark System II without going into contact at the actual spot where we are causing a breakdown
- Contact method: Calibrate by going into contact while measuring capacitance on the way, record the capacitance value corresponding to a gap of the wanted size (20  $\mu\text{m}$  used for now), then do the BD measurements at other spots, use recorded C value to set gap
- Problem: Capacitance as a function of distance may vary between different cathode spots
- Topic of study: How much does it differ between spots? What uncertainty do we get in the gap because of difference?



## Measurement

- Capacitance-distance curves were measured at a 5x5 square grid of cathode spots, reaching from the left edge of the cathode to the right, spots 2 mm apart
- Examples of  $C(d)$  curves at different spots:





## Results

- If a single spot is used for calibration, the achieved uncertainty in gap size becomes:
  - 2.84  $\mu\text{m}$  if using entire cathode
  - 1.66  $\mu\text{m}$  if using one vertical column of spots
- If the real average capacitance is found by using multiple spots for calibration, the achieved uncertainty becomes:
  - 2.05  $\mu\text{m}$  if using entire cathode
  - 1.20  $\mu\text{m}$  if using one vertical column of spots
- Thus, accuracy can be improved by using more spots for calibration, but tradeoff in less spots available for BD measurement