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Deployment of Plasma Parameters for FDC in Metal Etch

10th European Advanced Equipment Control/
Advanced Process Control (AEC/APC) Conference
Hotel Sheraton Catania, Sicily - Italy, April 21 - 23, 2010

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Why are Plasma Parameters ideal for FDC in Etch ?

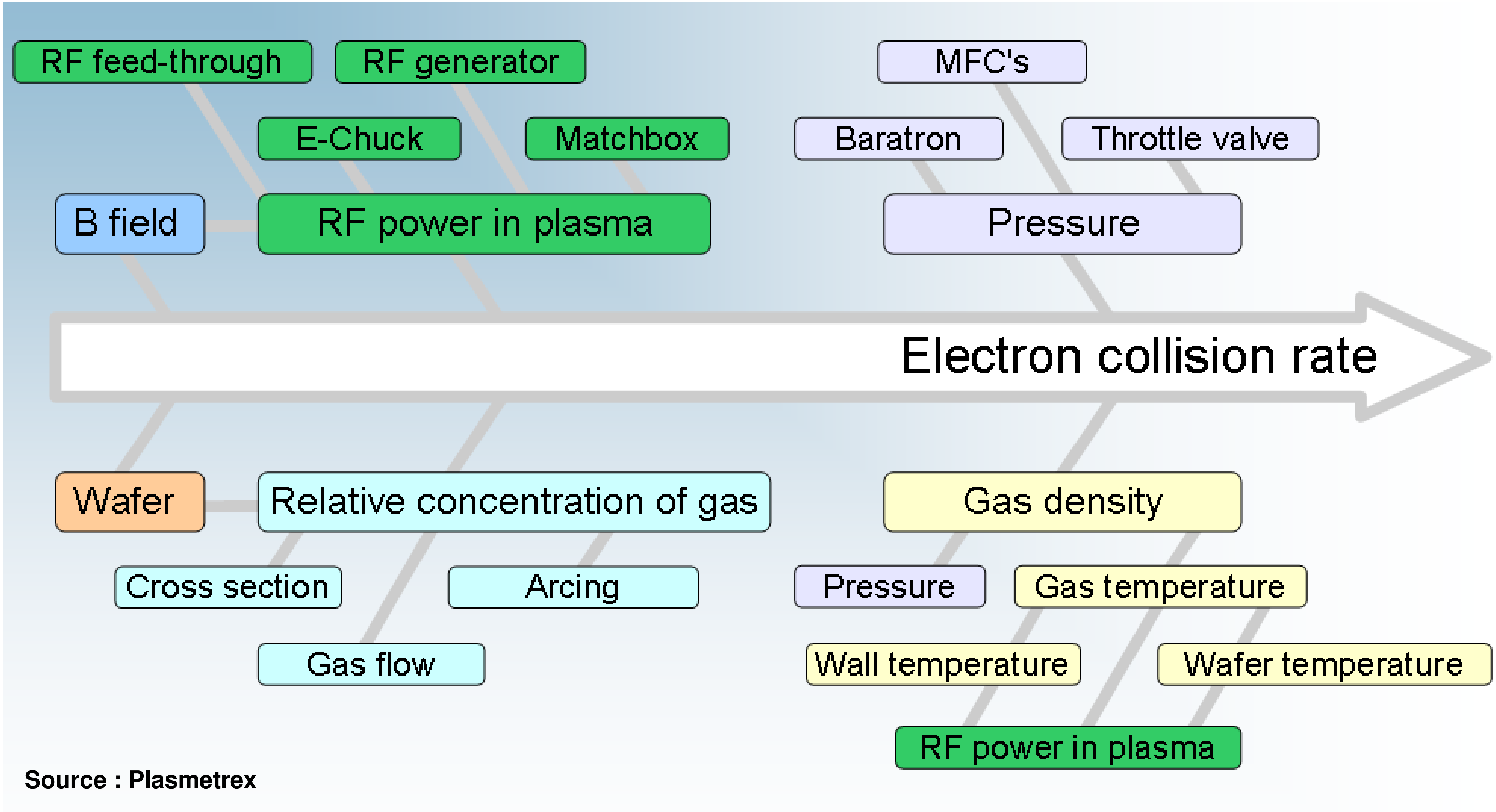
Electron Density and **Collision Rate** are sensitive to

- Process parameters (e.g. gas flow, pressure, power)
- Process / chamber drift (conditioning, clean, WAC)
- Product differences (e.g. open area)
- Tool failure (e.g. baratron, rf, MFC)

Plasma Parameters provided by HERCULES® help to

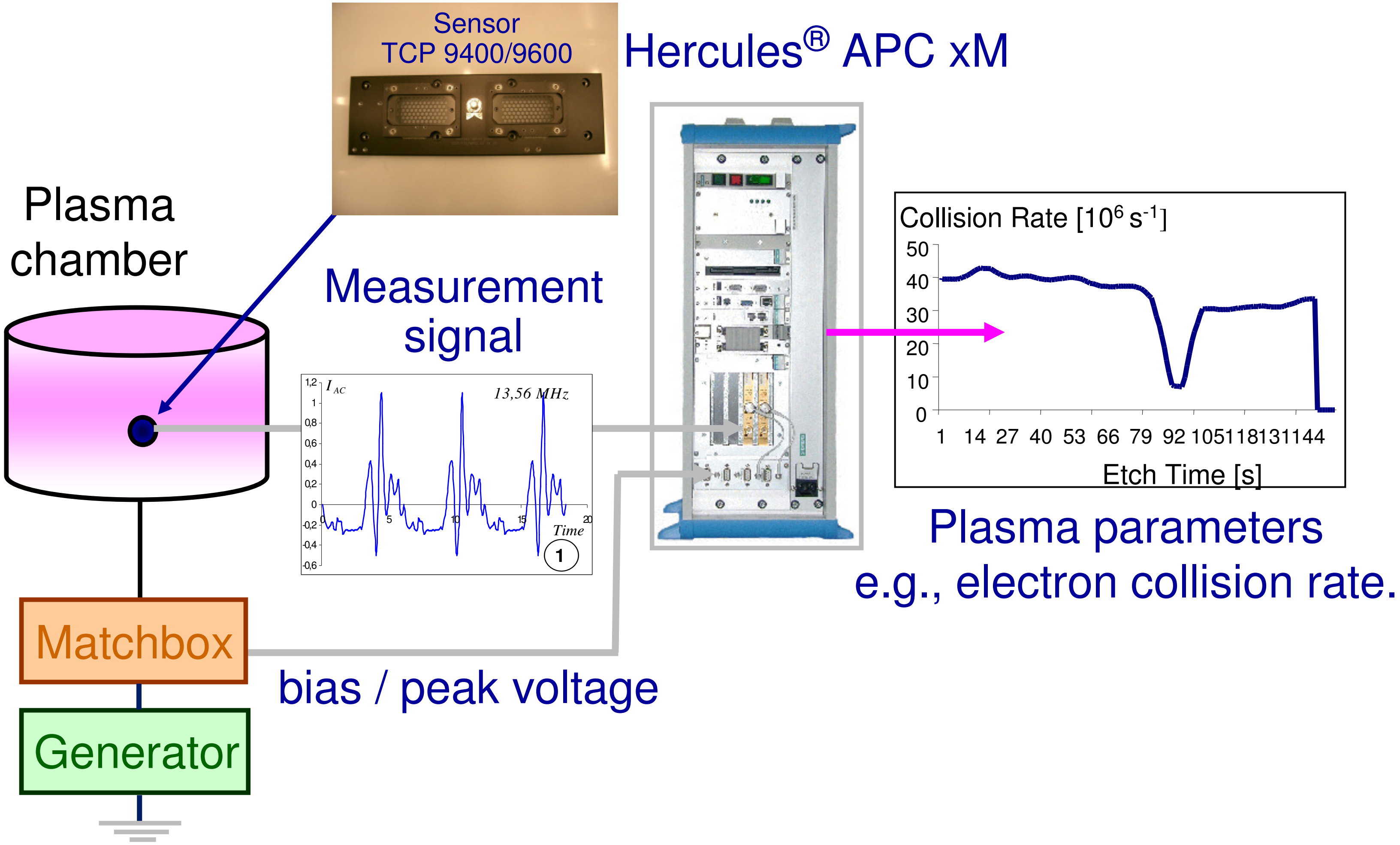
- optimize conditioning, WAC, MTBC, cleaning procedures
- understand process / tool issues

Influence of Tool / Process Parameters on Collision Rate



Source : Plasmetrex

Basic Setup of *Hercules*®



Sensor
TCP 9400/9600

Hercules® APC xM

Plasma chamber

Measurement signal

Plasma parameters
e.g., electron collision rate.

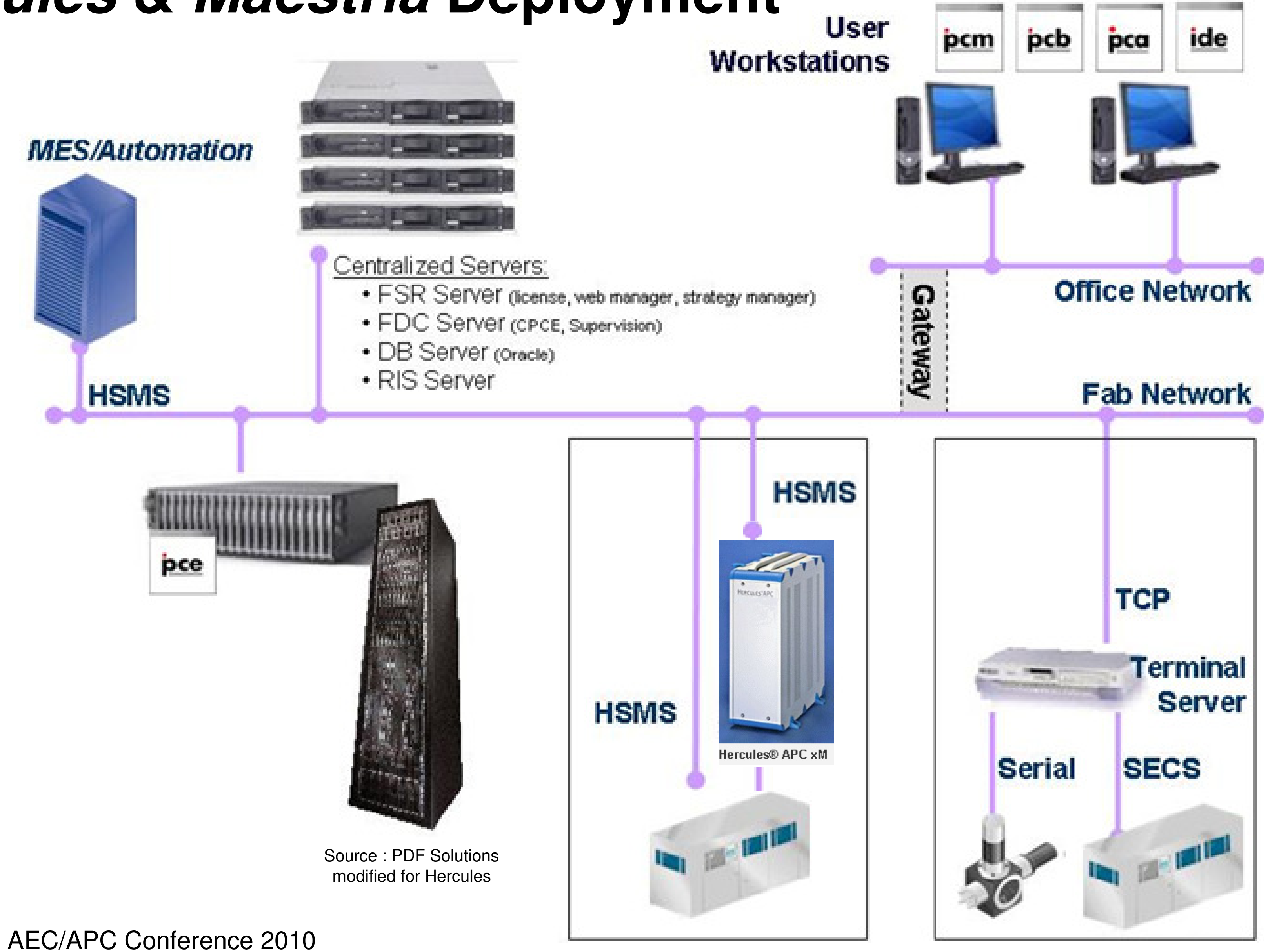
bias / peak voltage

Matchbox

Generator

Source : Plasmetrex

Hercules & *Maestria* Deployment



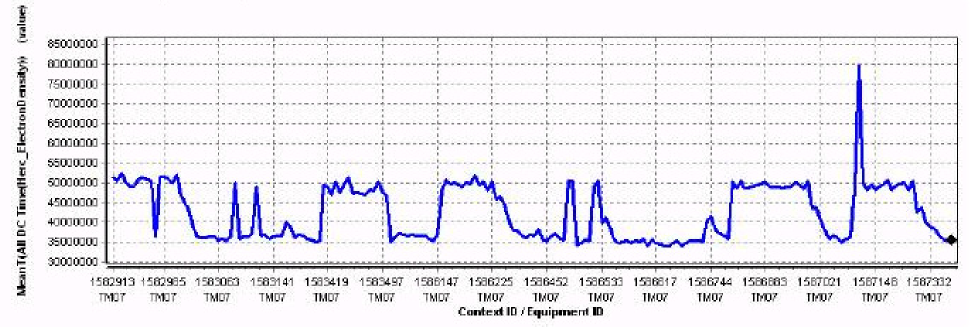
Centralized Servers:

- FSR Server (license, web manager, strategy manager)
- FDC Server (CPCE, Supervision)
- DB Server (Oracle)
- RIS Server

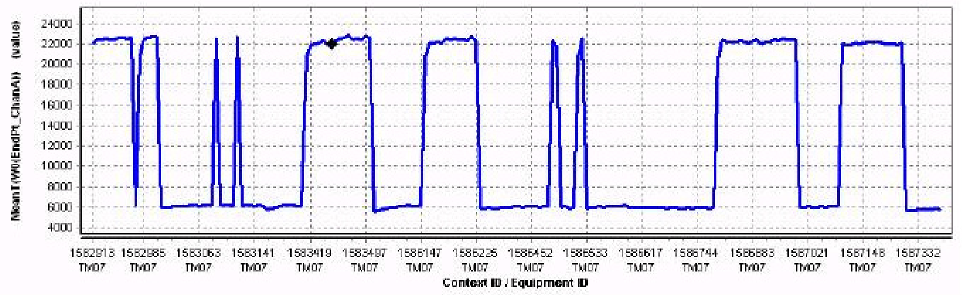
Source : PDF Solutions
modified for Hercules

FDC Example (1) : Random-Shift in Collision Rate (Leak)

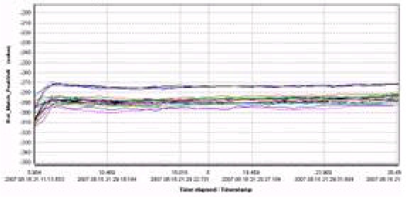
Elektronen-Dichten (Hercules)



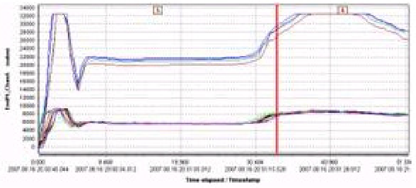
EOP-Channel A



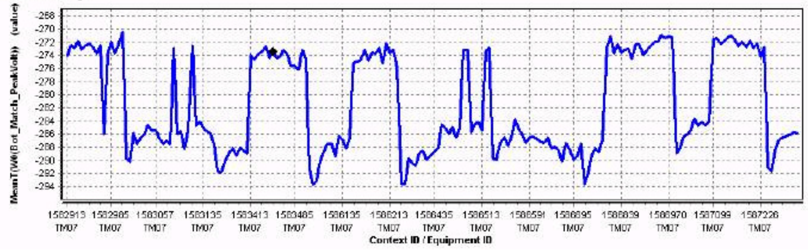
Peak-Voltage



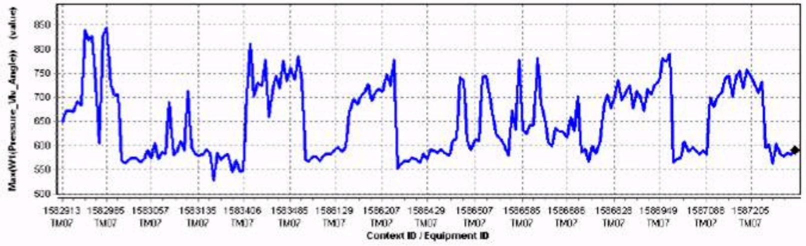
EOP-Signal



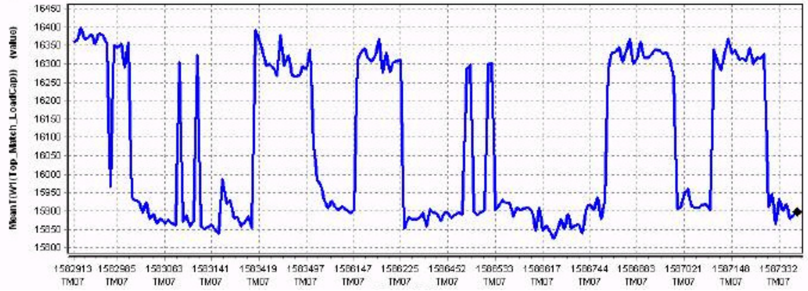
Peak-Voltage



Druck Maximale Vatvalve-Position im OE :

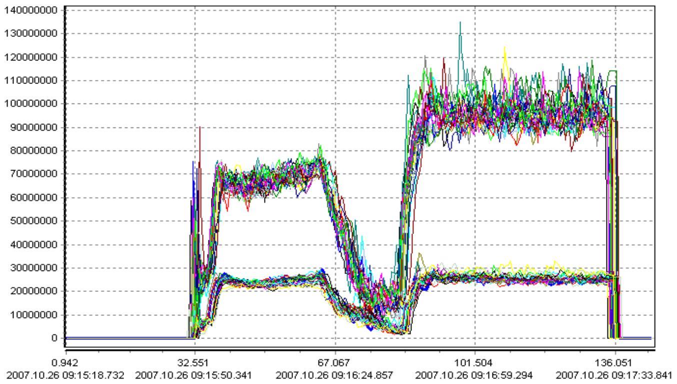


Top-Match-LoadCap

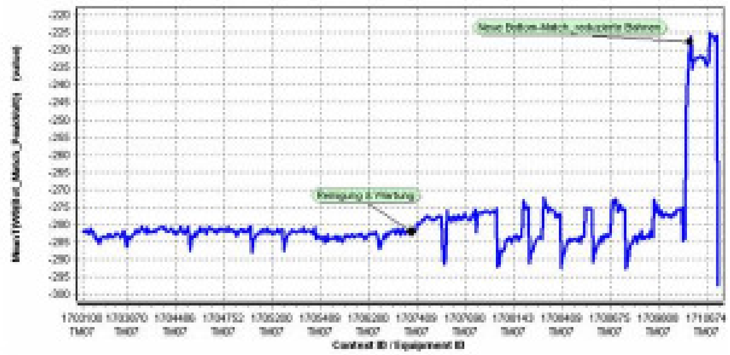


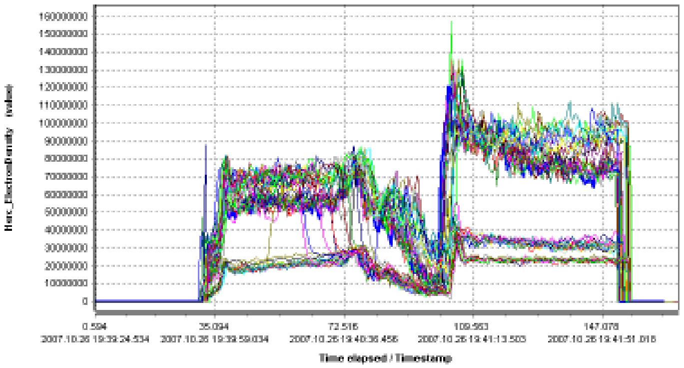
Instable plasma condition – two different states due to inner door leak

FDC Example (2) : Shift in Collision Rate (Screws not fixed)

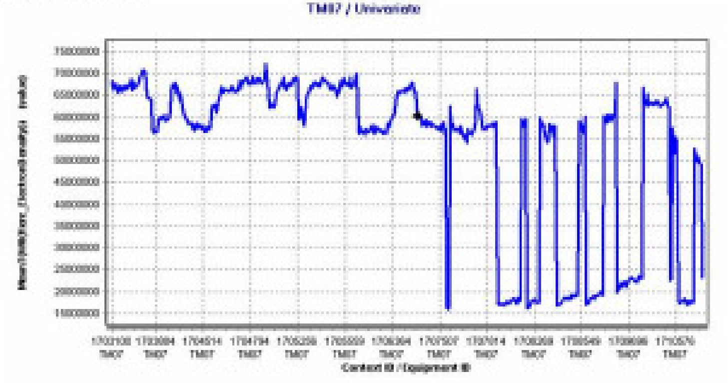


Peak-Voltage Step 5



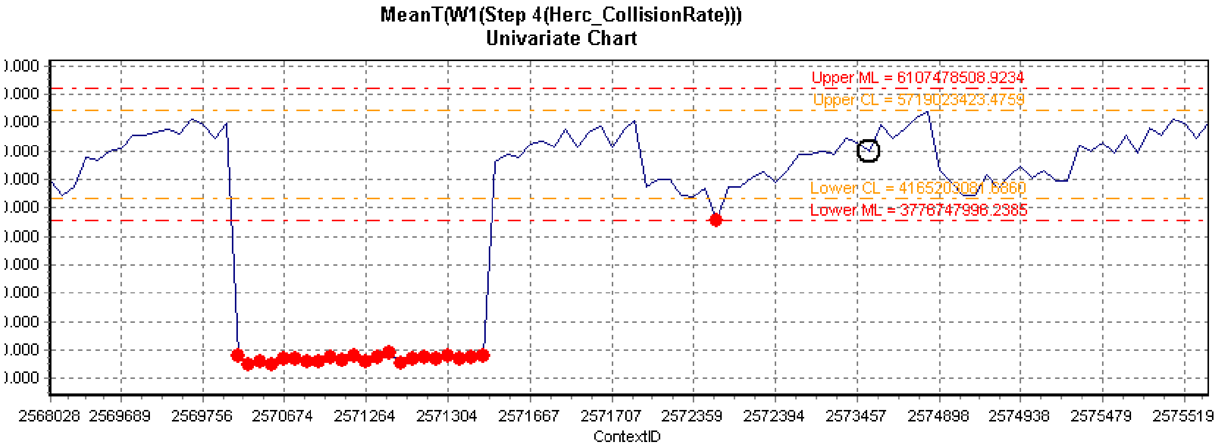


Kollisionsrate Step 5



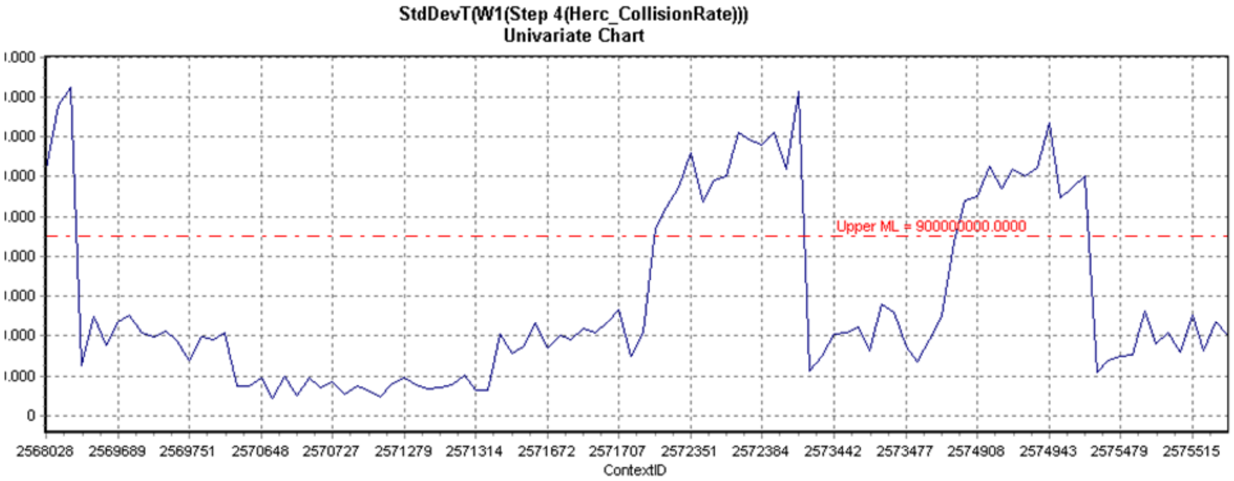
Instable plasma condition – two different states due to loose screws of grounding ring. Shift in collision rate >600%, Peak-Voltage 6%, no EOP-Shift !

FDC Example (3) : Supervision of Conditioning Wafers

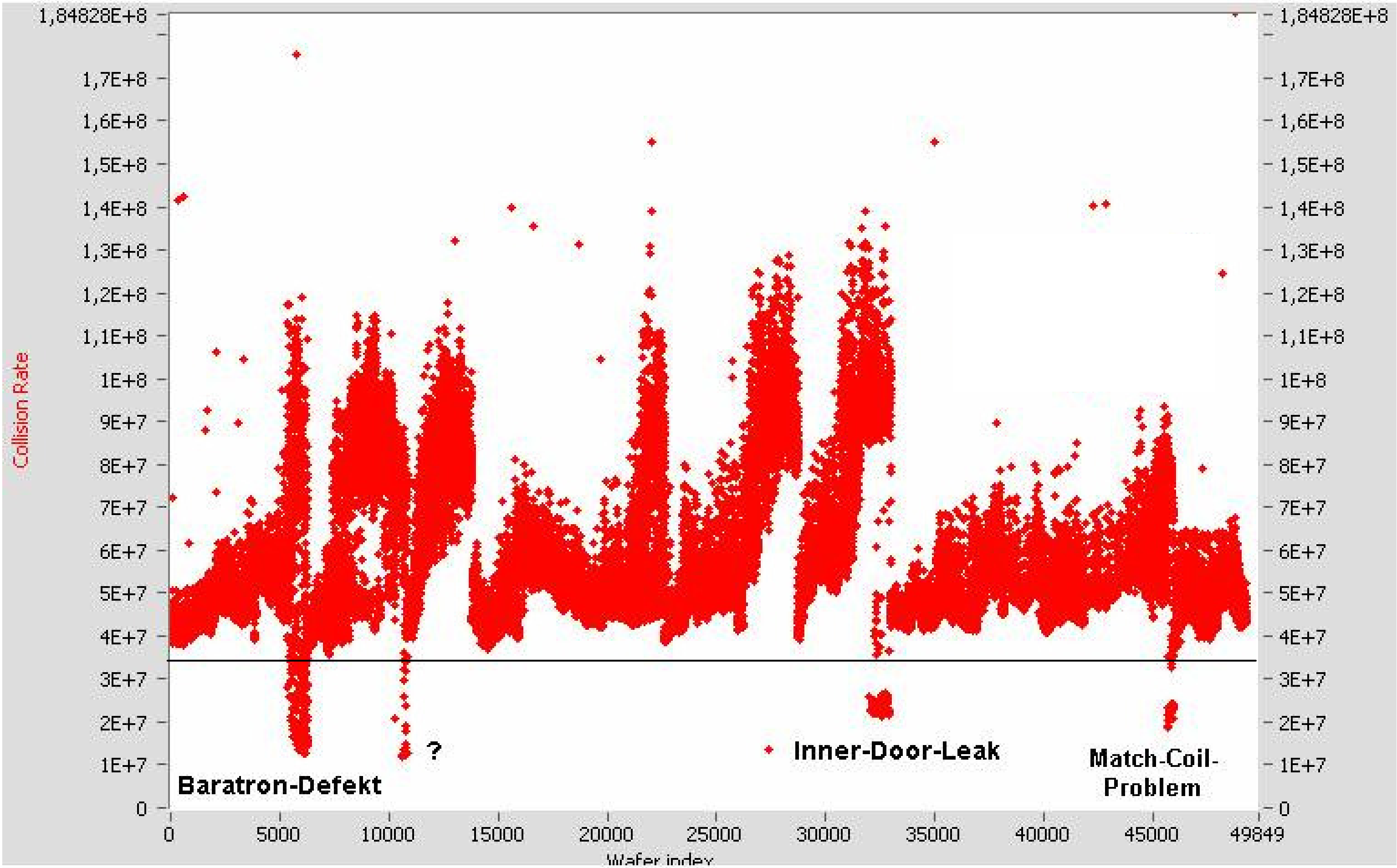


MeanT of collision rate and electron density help to identify already used wafer ready for rework

StdDevT of collision rate and electron density help to identify degradation of wafers during conditioning due to endpoint-like behaviour.

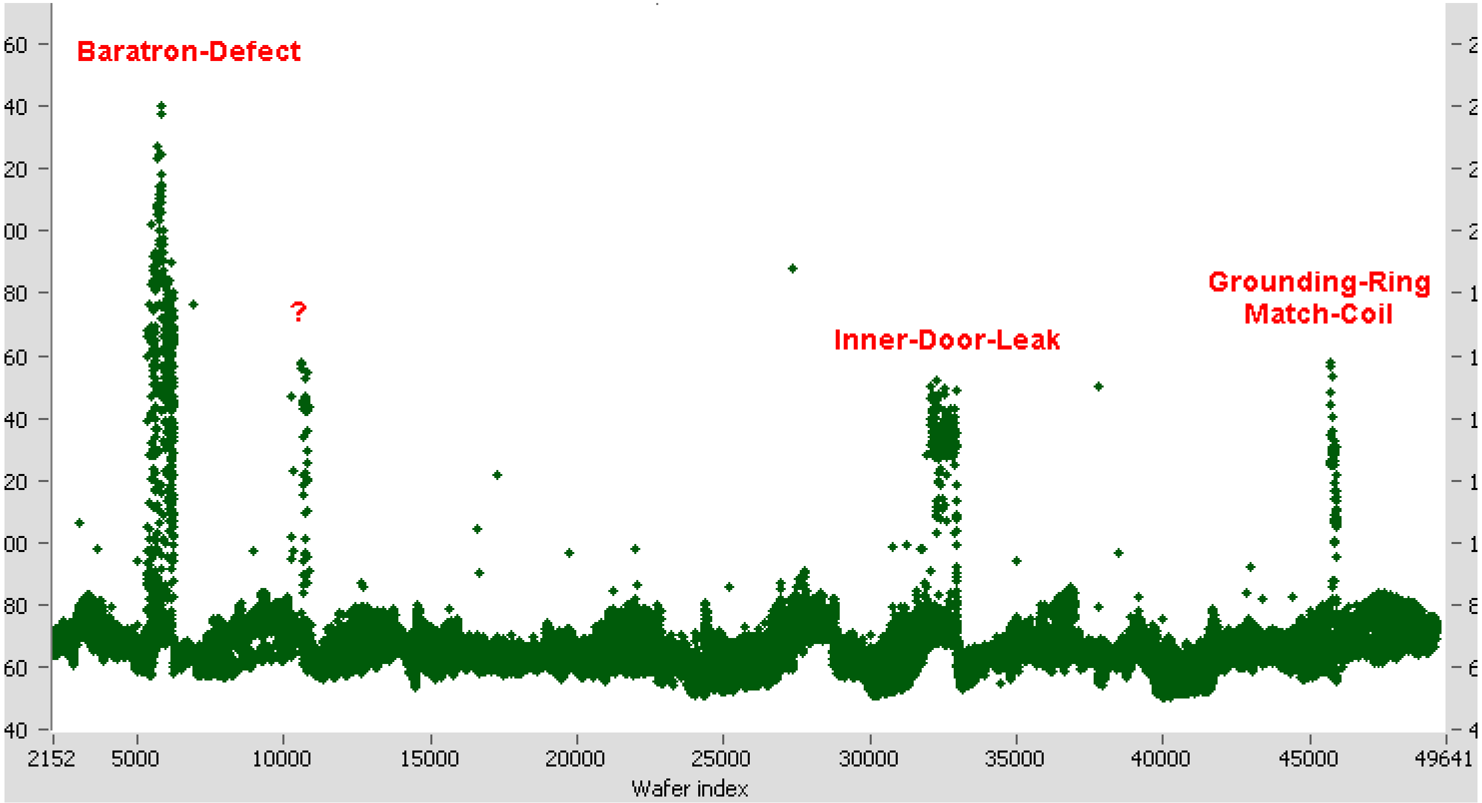


FDC Example (4) : Overview of 12 month periode (1)



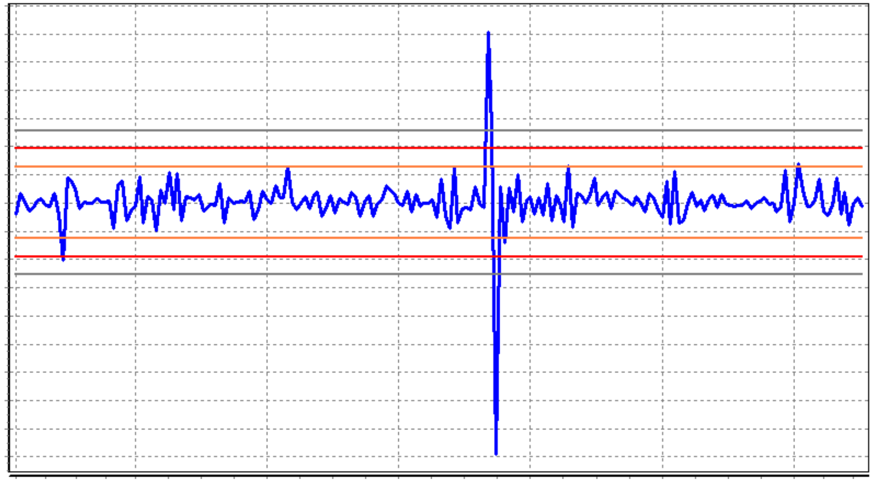
4 excursions are detected by collision rate...

FDC Example (4) : Overview of 12 month periode (2)

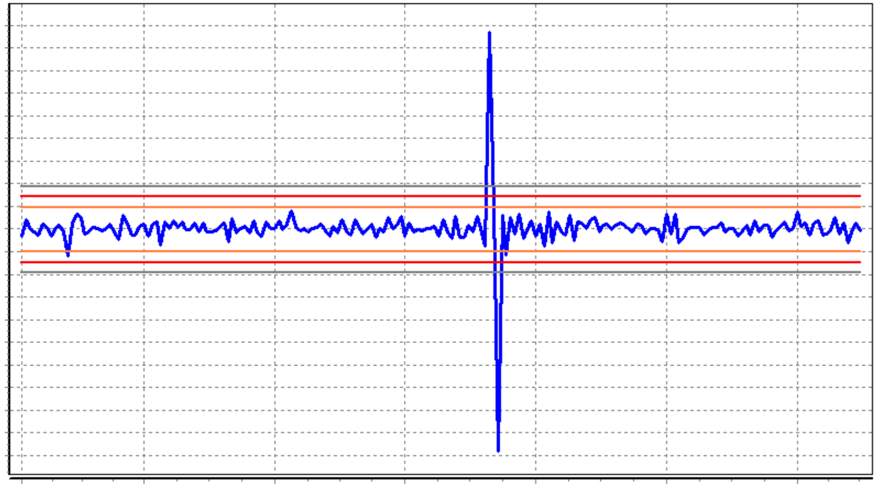


...what is even better shown by calculated dc bias

Excursion Detection by Wafer-to-Wafer-Division



Collision Rate



Electron Density

Normalization by wafer-to-wafer-division of plasma parameters is an easy recipe independent way to identify excursions, tool & process problems !

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