

AECAPC SYMPOSIUM 2001, BANFF

Application of SEERS to real time Plasma Monitoring in Production at different FABs

Volker Tegeder

Infineon Technologies SC300

Sensor Evaluation

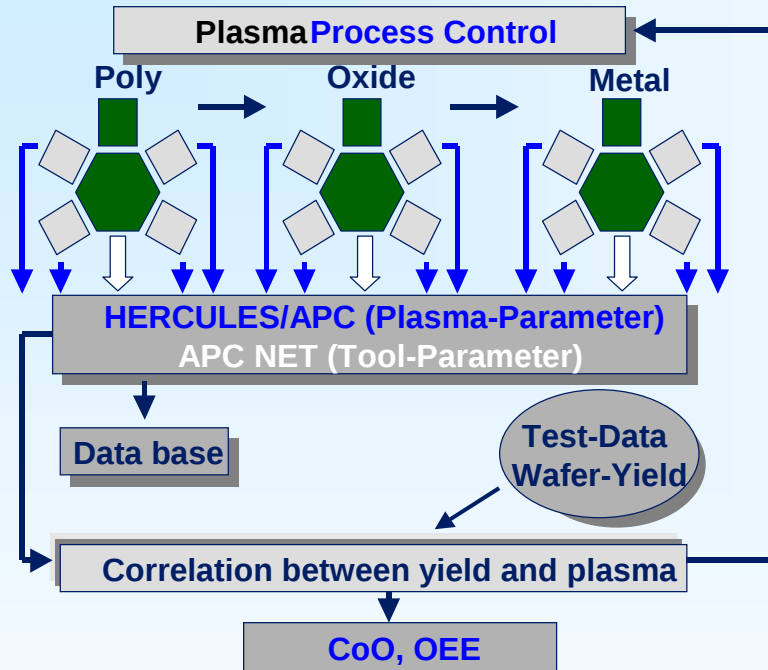
- **Calculation of expected Economical Benefit**
- **Automatic link to logistical Data**
- **Partnership**
Sensor Supplier, Tool Supplier, Manufacturer
- **Analyze Data and react on conspicuous Data**
- **Merge Sensor Data to FDC System**

Overview

Requirements for successful integration of sensors into manufacturing

Lessons Learned

European SEA IST-Project: APC300



SC300 Dresden



Dresden



Rousset



Regensburg



Berlin

Start: February 1st, 2000

End: October 31st, 2001

Calculation of expected Economical Benefit

Calculation of expected Economical Benefit

- Project Planning
- HW System Set Up
- Resources allocated to project

=> Calculation of Benefit first!

Involvement of: Process Integration, Maintenance, IT,
Product Characterization, Controlling, Process Dep.

Calculation of expected Economical Benefit

- Identify Improvement for Manufacturing
- List Preconditions and Requirements
- Correlate Improvement to Economical Benefit
- Generate Benefit Equations for Verification
- Collect Data for Calculation (pre/post)
- System Set Up to Receive the Benefit

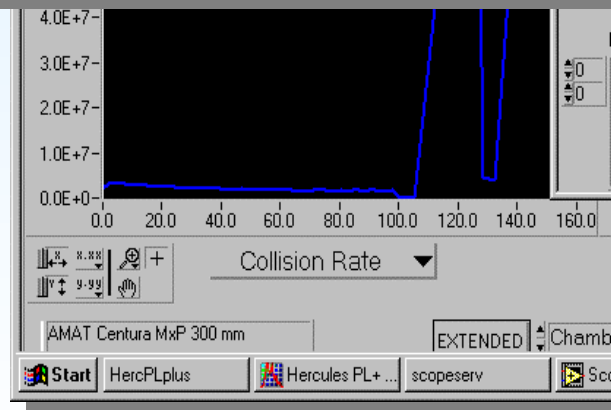
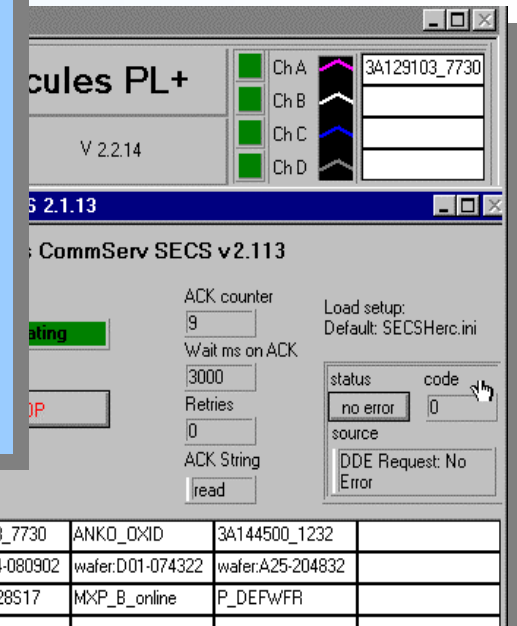
Automatic Link to logistical Data

Automatic Link to logistical Data

Analysis

correlate sensor data to

- in line data
- yield data
- tool data
- benefit calculation

Lotinfo			
3A129103_7730	ANKO_OXID	3A144500_1232	
wafer:D24-080902	wafer:D01-074322	wafer:A25-204832	
P1_C2_128S17	MXP_B_online	P_DEFWFR	

Adjustment

of settings for

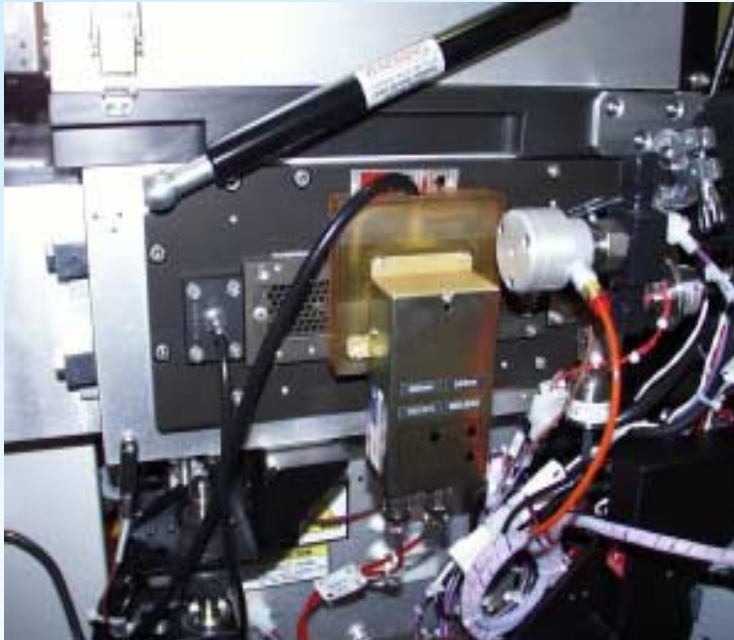
- sensor
- alarm (FDC)

Logistical Data linked to Sensor Data

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Partnership: Sensor Supplier, Tool Supplier, Manufacturer

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**Sensor Signal weak
because of Liner**

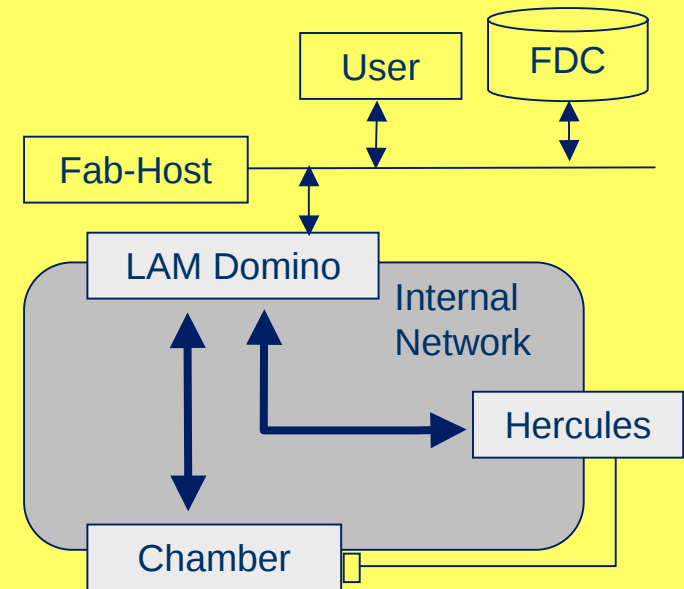
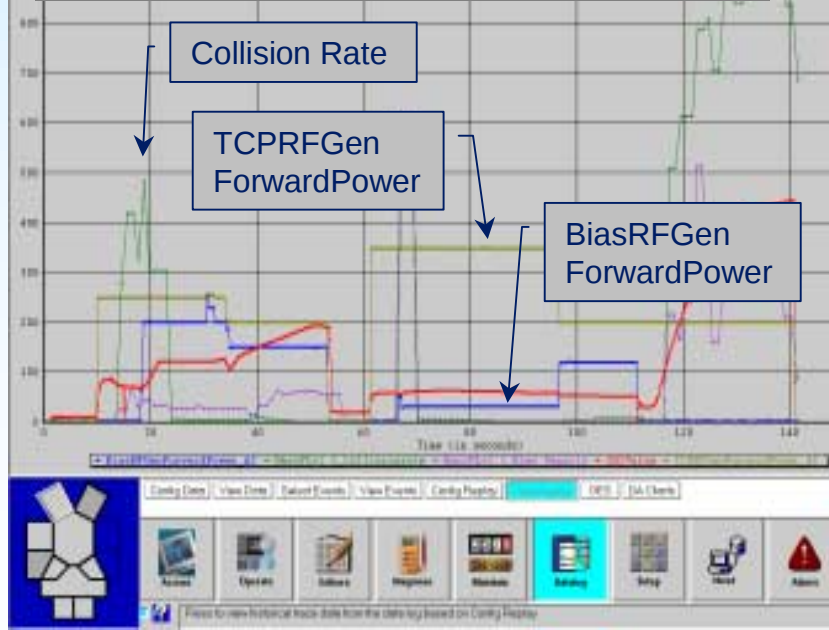
**New Platen improves
Signal to Noise Ratio**



Partnership: Sensor Supplier, Tool Supplier and Manufacturer

Sensor Data available at the Tool

- Synchronized to Tool Data
- On-line at the Tool
- Easy to analyse



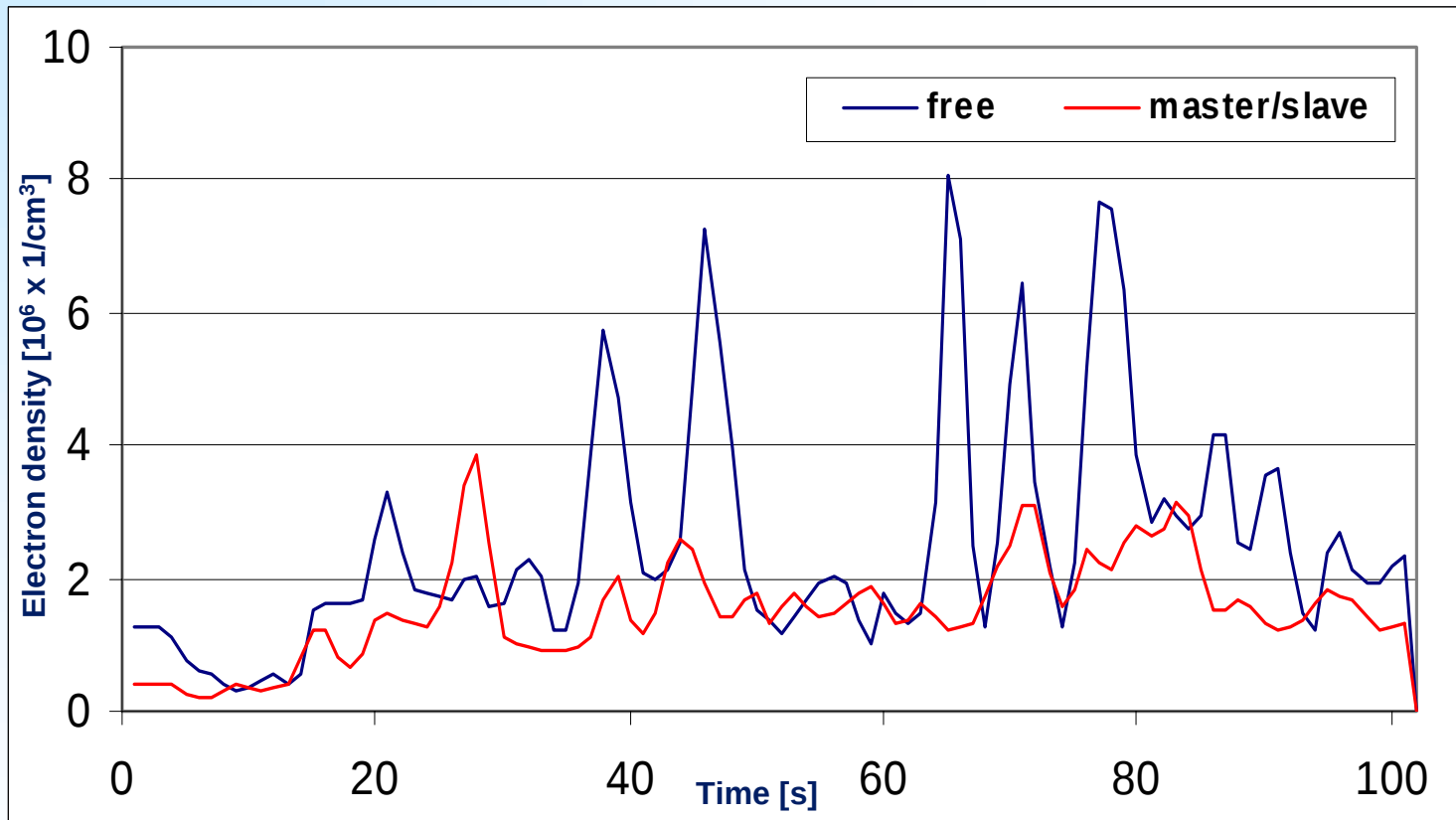
Universal Plug and Play Interface merging Tool and external Sensor Data

- Independent, Ethernet based Network (10 Mbit / 100 Mbit)
- Automatic Sensor Recognition
- Providing Sensor with logistical Data



Analyze & React

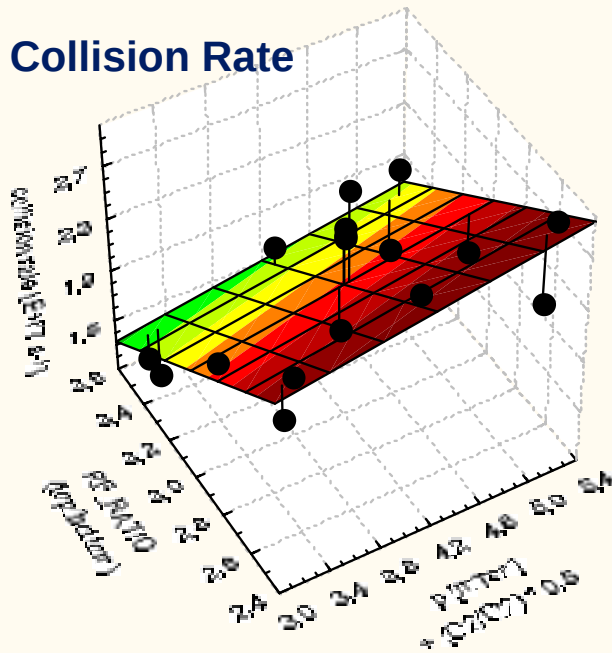
Analyze & React



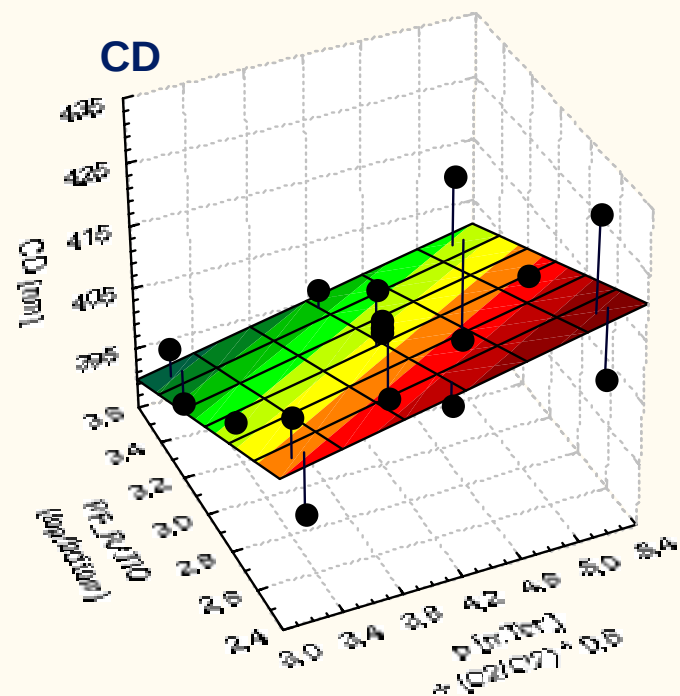
- Strong Fluctuations detected for new Tool
- Root Cause: missing Phase Coupling

Analyze & React

Collision Rate



CD



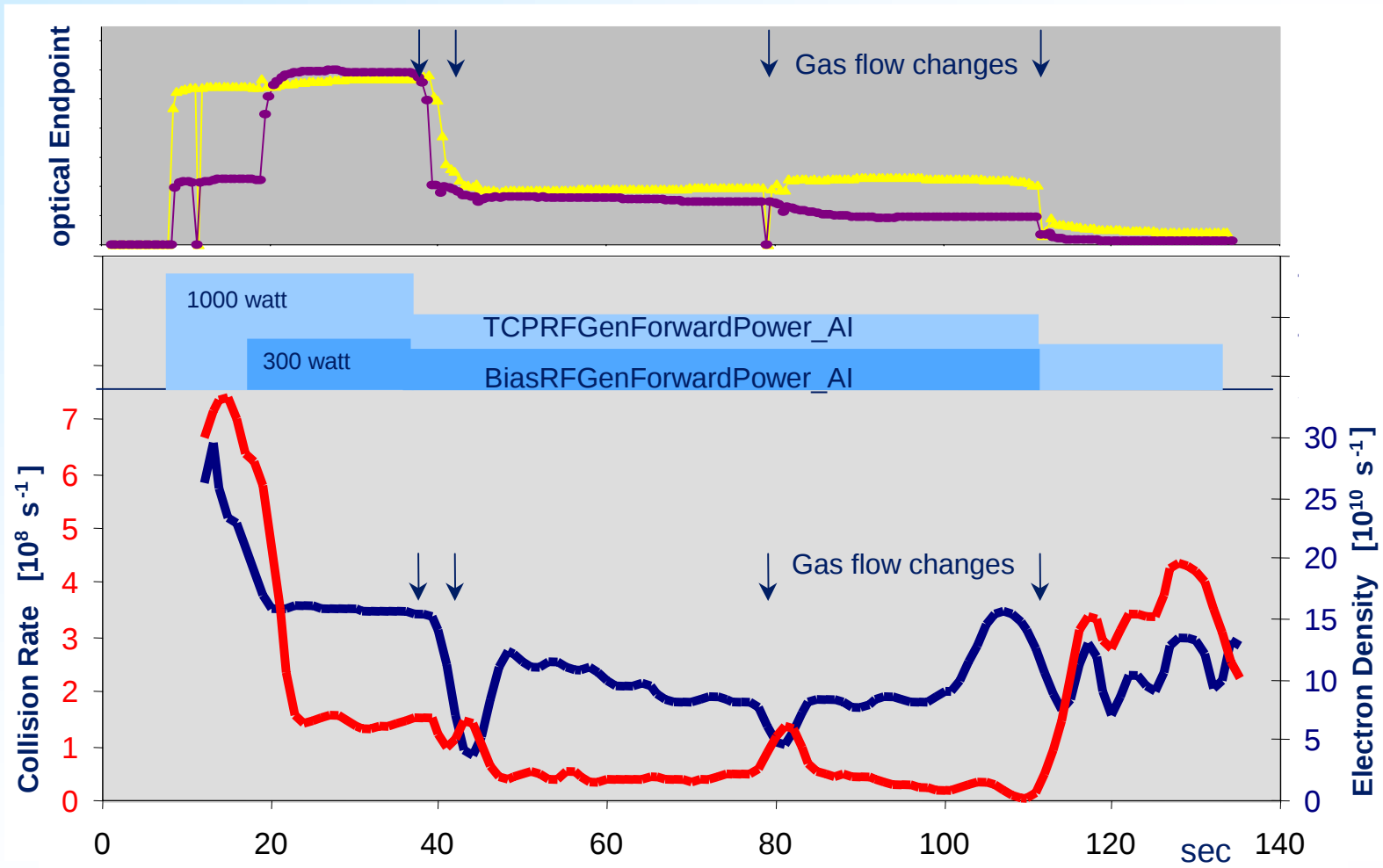
**Gate Etch DOE Results:
Pressure, RF Top/Bottom and O₂/Cl₂ Variation**



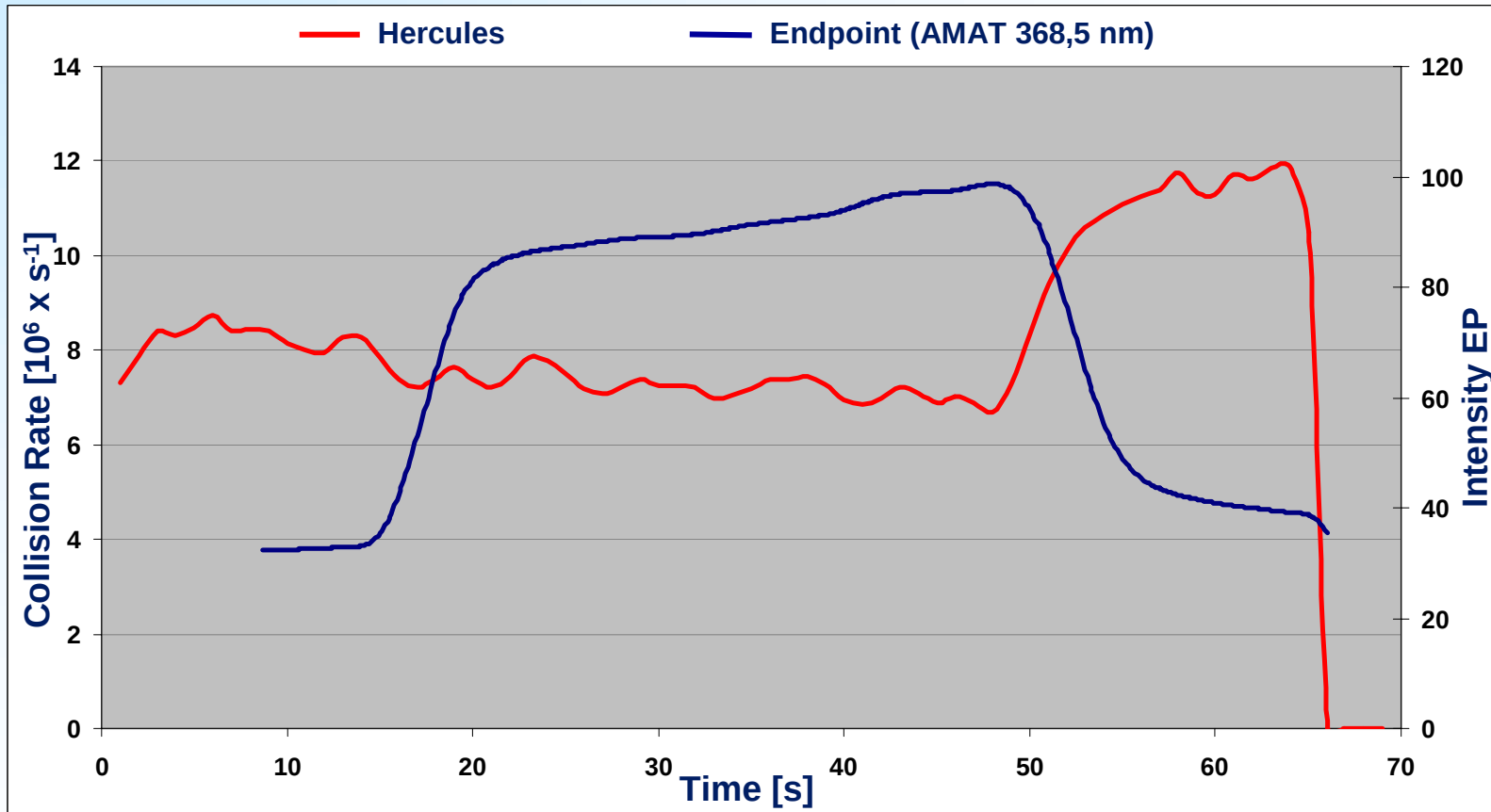
Rousset

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Analyze & React



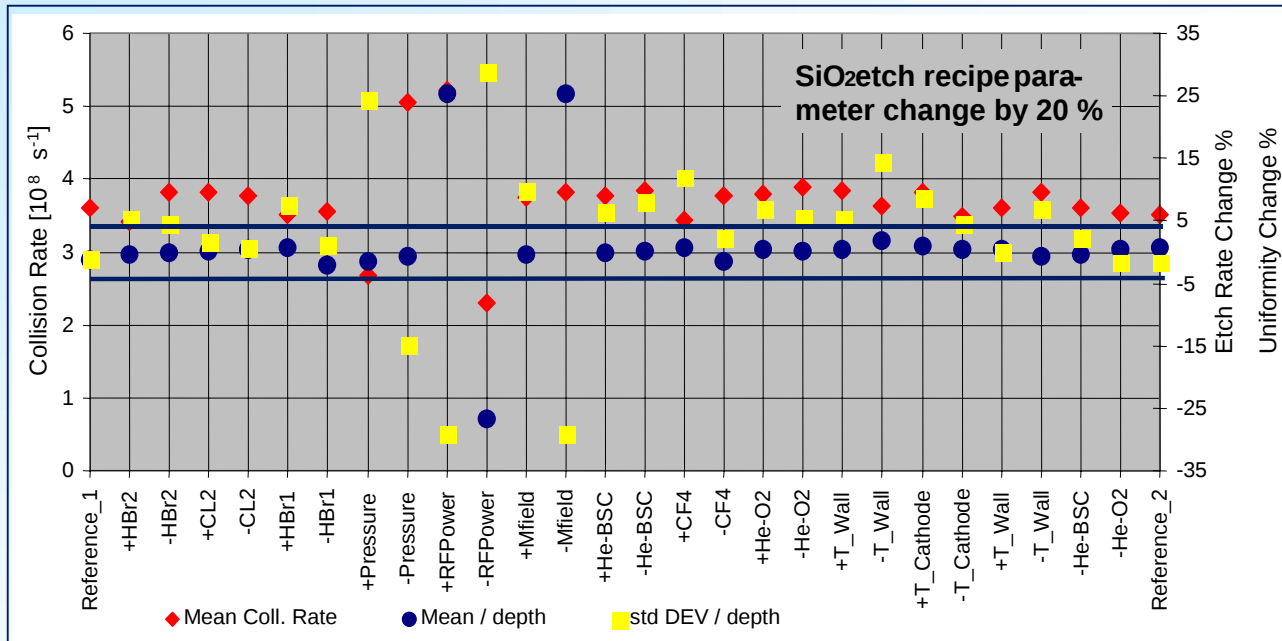
Analyze & React



Oxide Process (one Recipe step), Overetch identified by collision rate.

SEERS Fingerprint and optical EP

Analyze & React

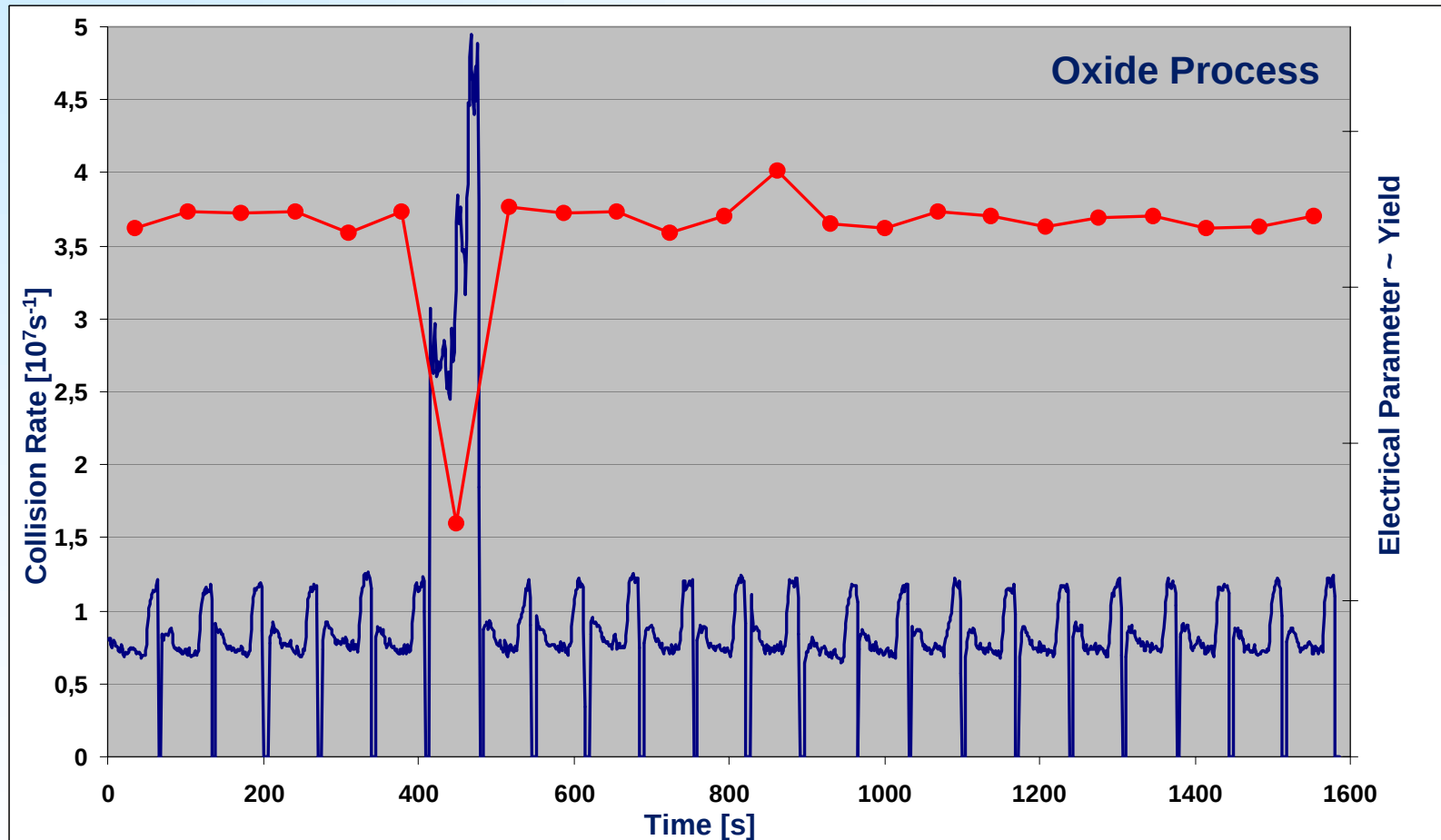


Etch Uniformity Change indicated by collision rate

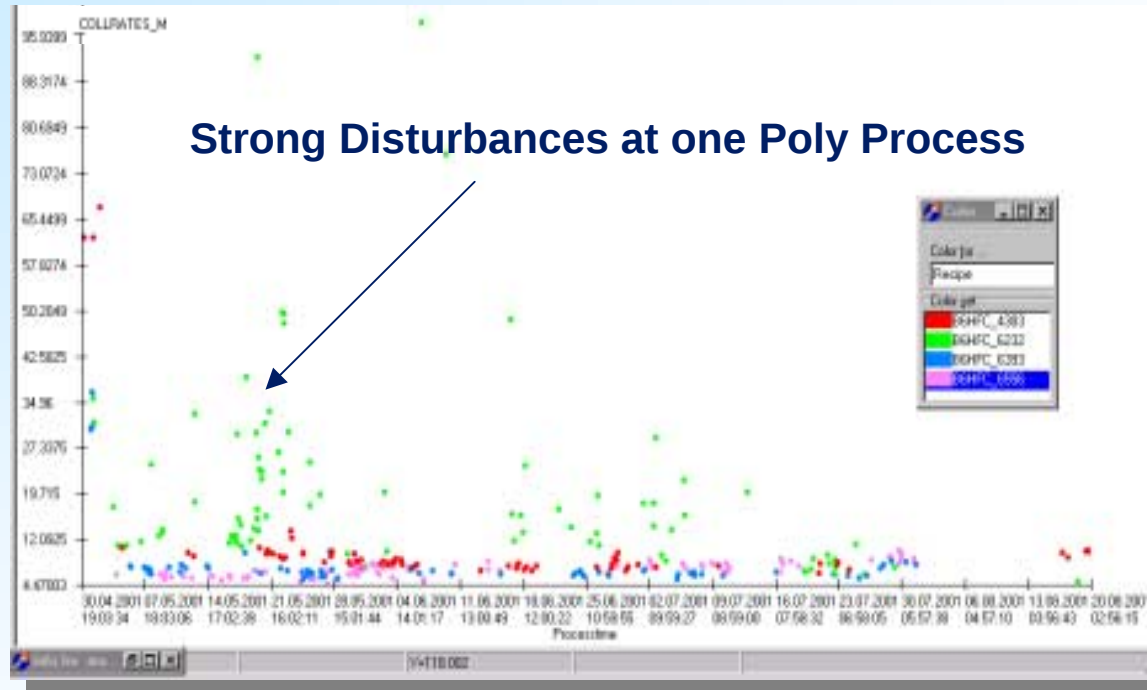
- Similar Results for Si Etch at MxP but lower Sensitivity
- For Poly Etch at DPS not sensitive enough to detect Errors

Merge Sensor Data to FDC System

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Merge Sensor Data to FDC System



Regensburg

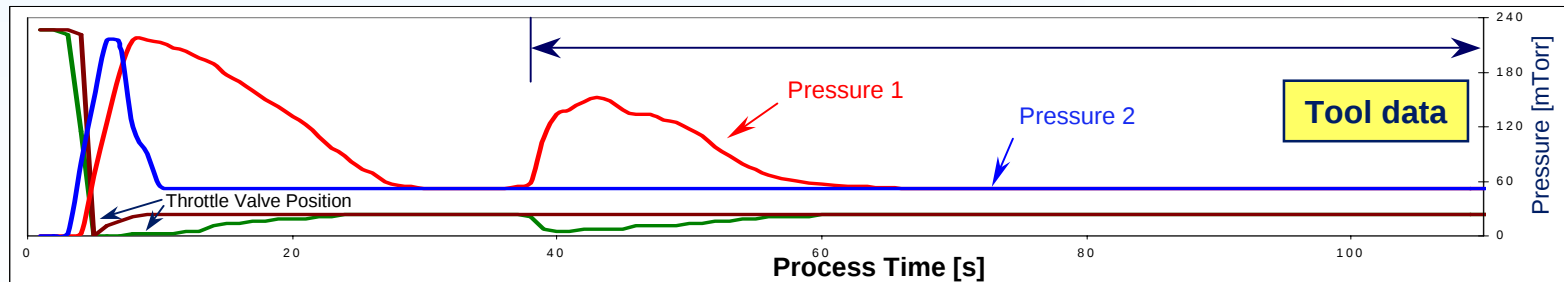
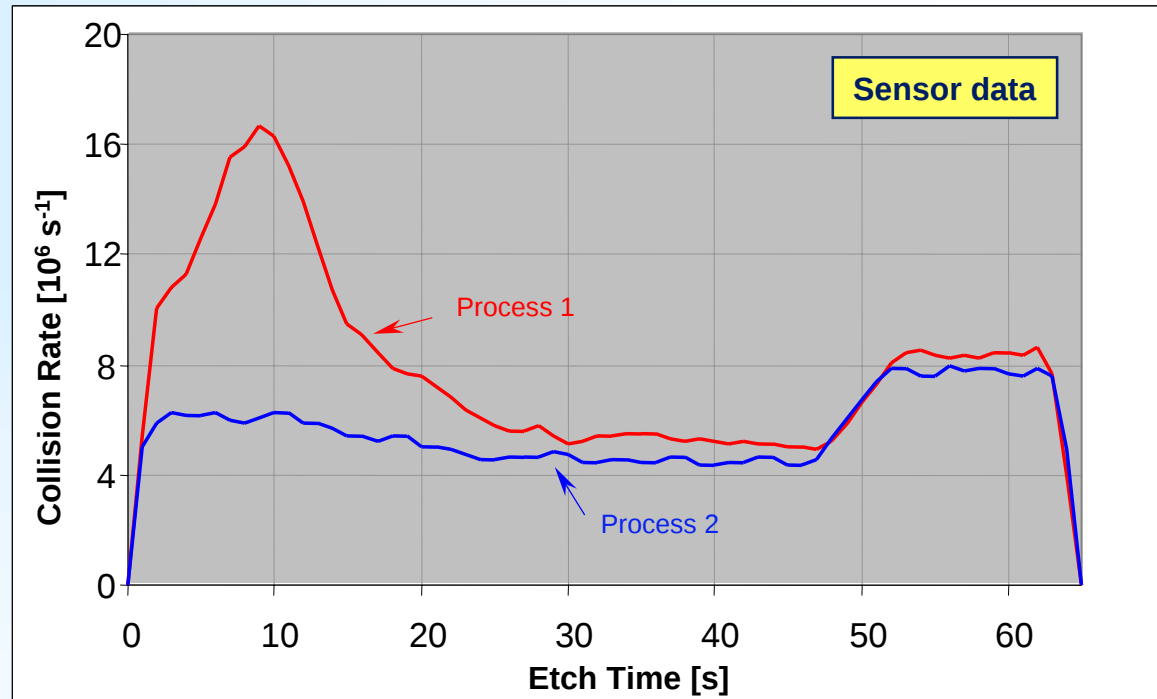
- Process for new Product with bigger open Area was unstable
- Improvement of the Process by changing the Recipe (Pressure) since 7/19 verified by Collision Rate

Stabilization of Process verified

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Merge Sensor Data to FDC System

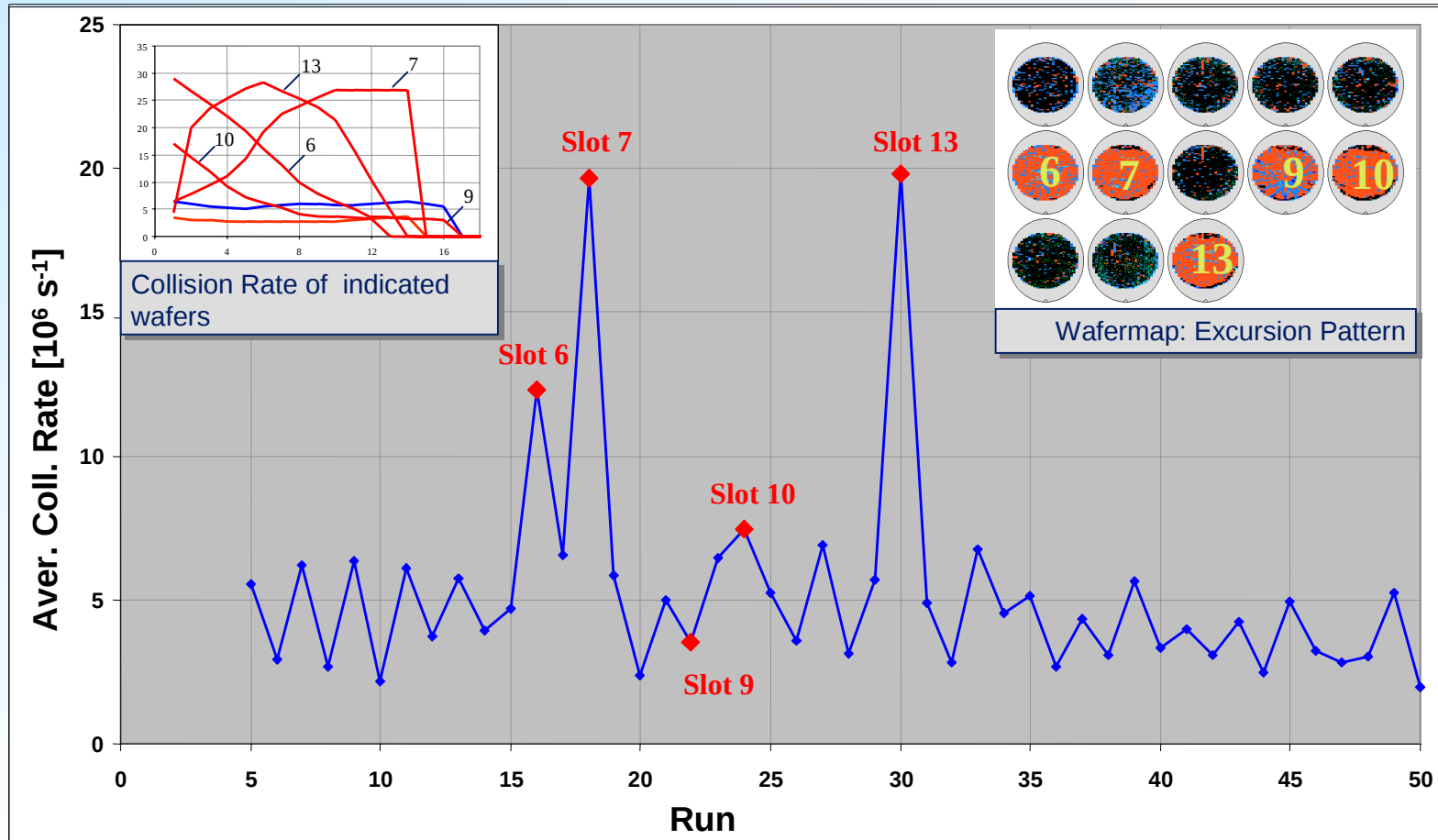
Change in Chamber Pressure impacts the Collision Rate



Tool Error identified by Collision Rate

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Merge Sensor Data to FDC System



Root Cause: Mass Flow Controller Malfunction

Test Pattern identified at Process Level

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Robert Ronchi	ST Microelectronics
Baudouin Lecohier	ST Microelectronics
Julien Pasquet	ST Microelectronics

Further Reading:

Characterization and Control..., Volker Tegeder et. al. European AECAPC Workshop 2000

Supervision of Plasma Etch Processes..., Volker Tegeder et. al. AECAPC Symposium XII 2000

The tremendous impact of APC for plasma etch, Volker Tegeder, Robert Ronchi, Sven Mueller, Solid State Technology 2001 in press

Acknowledgement:

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