



Production of measuring instruments:

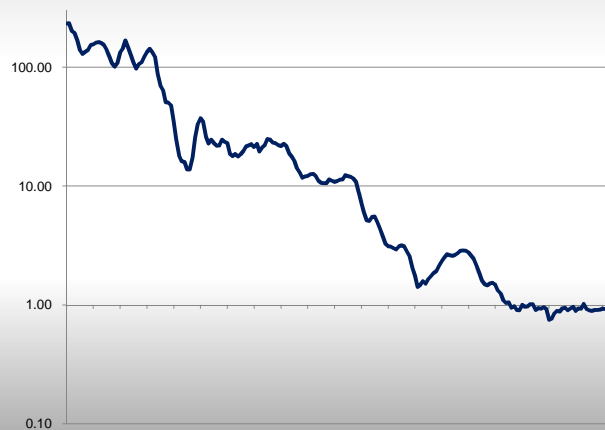
*Vacuum Sensors for efficient processes in production equipment –
intelligent systems as an example for scaling effects*

Christian Berg, INFICON AG, Balzers (FL)

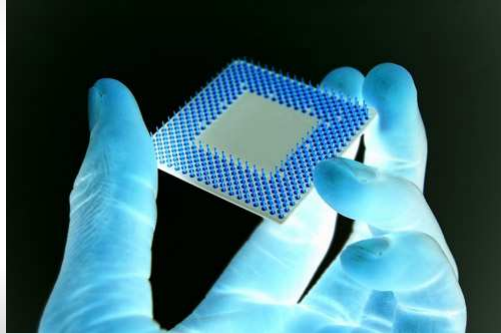


Moore's law

DRAM price in nano\$ per Bit



Semiconductor Industry



Semiconductor Industry is built on

VACUUM

INFICON is a vacuum company

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Stripe High-Speed Capacitance Diaphragm Gauge
Fast Accurate Vacuum Gauge



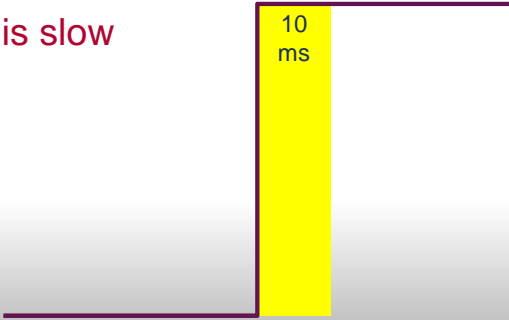
Markets We Serve






... some technical background

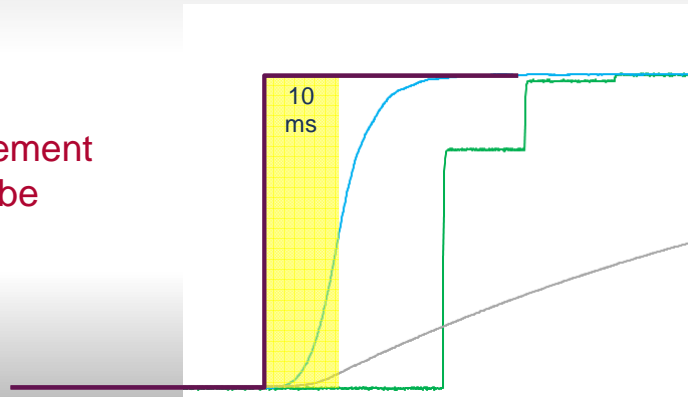
Vacuum is slow





... some technical background

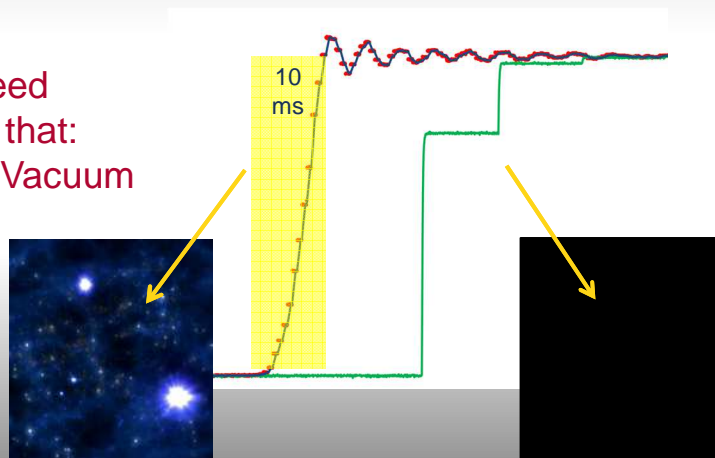
Vacuum measurement used to be slower



... some technical background



High-Speed changed that:
→ "See" Vacuum



"See" vacuum

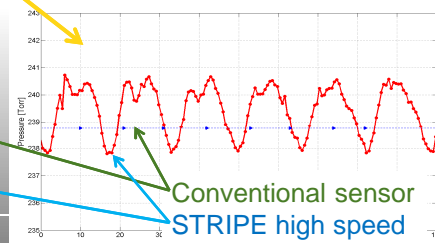
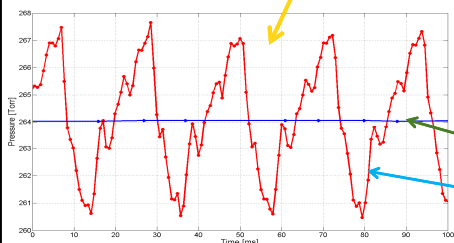


Example:
Membrane Pump

Pumping "signature"

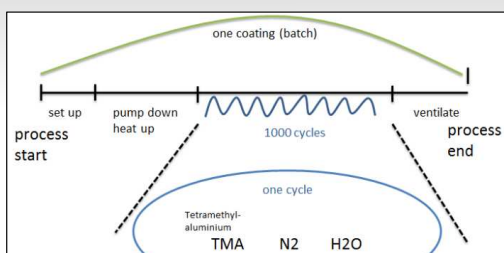
new

used

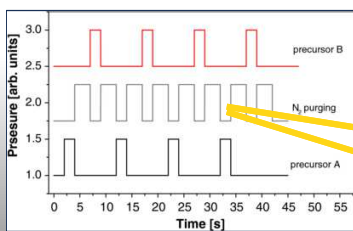


Conventional sensor
STRIPLE high speed

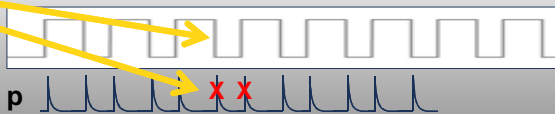
"See" vacuum



Example:
Atomic Layer
Deposition (ALD)



1 cycle = 1 Å = 0.1nm



Semiconductor Industry



1.

2.



Semiconductor Industry



- 50 B\$ annual CapEx in production tools
- One 300mm fab 1.5 - 2 B\$
- 7x24 operation
- **CapEx Burn rate 0.5 - 0.75 M\$ / day / fab**

Semiconductor Industry



- One unscheduled stop every 3rd year
- Causes 150-200 M\$ over lifetime for 65 fabs
- Mitigation 1 M\$ investment in high speed

1 : 200



There is more ...

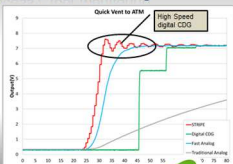


Monitoring

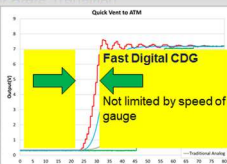
TOOL SPEED

PRECISION

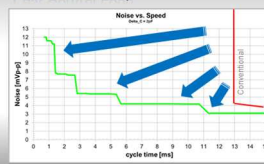
Process / Tool Monitoring



Fast State Transition



Fast Control Loop

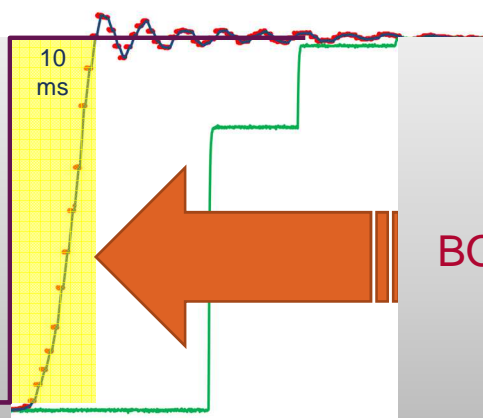


Tool Speed

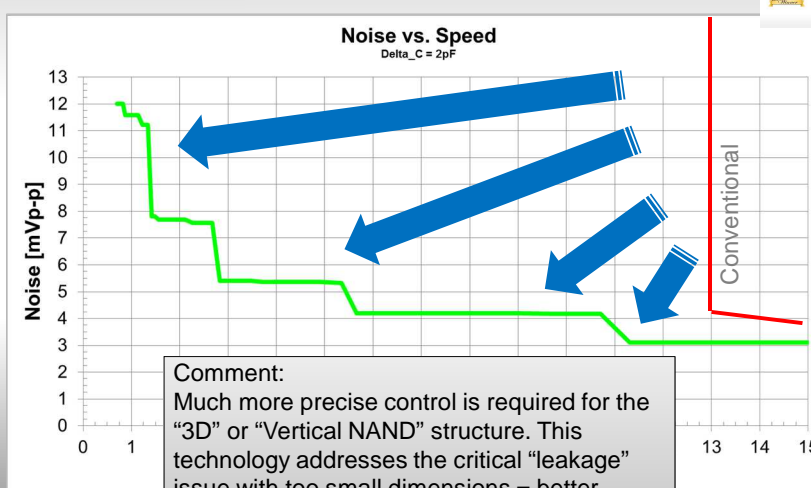


Comment:
10% more capacity
through elimination of
non productive process
(BON)

1 : 1000



Precision



Comment:
Much more precise control is required for the
"3D" or "Vertical NAND" structure. This
technology addresses the critical "leakage"
issue with too small dimensions = better
performance of battery powered devices like
smartphones.



Maybe he knew Moore

