

Case Study: Integrating a 300mm probing solution with a diagnostic Emission Microscopy tool (Meridian WaferScan)



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IEEE SW Test Workshop
Semiconductor Wafer Test Workshop

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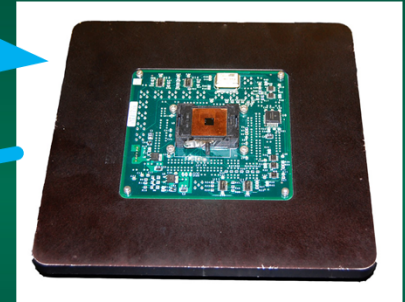
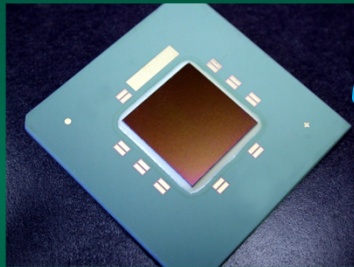
Overview

- Background – Meridian System
- WaferScan Mechanical Description
- Wafer retention
- PTPA
- Tester Interface
- Landing model
- Lessons learned from the Field
- Moving Forward

Background

- DCG Systems manufactures infrared-based microscopy tools for FA, Design/Debug & Yield Learning activities
- Central to these is the silicon property which renders it virtually transparent to the NIR spectrum.
- Traditionally, a packaged part is decapped, socketed, and turned face-down for inspection and data collection by upward-looking optics

Meridian System



Tester/ Test
Equipment

DUT Board

Optics

Traditional “air
coupled” objectives
plus SIL technology

IR Emission

LSM

LVx

Thermal

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Meridian System



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Major Development Requirements



200mm/300mm Wafer capability

Maintain system footprint

Minimal system height impact

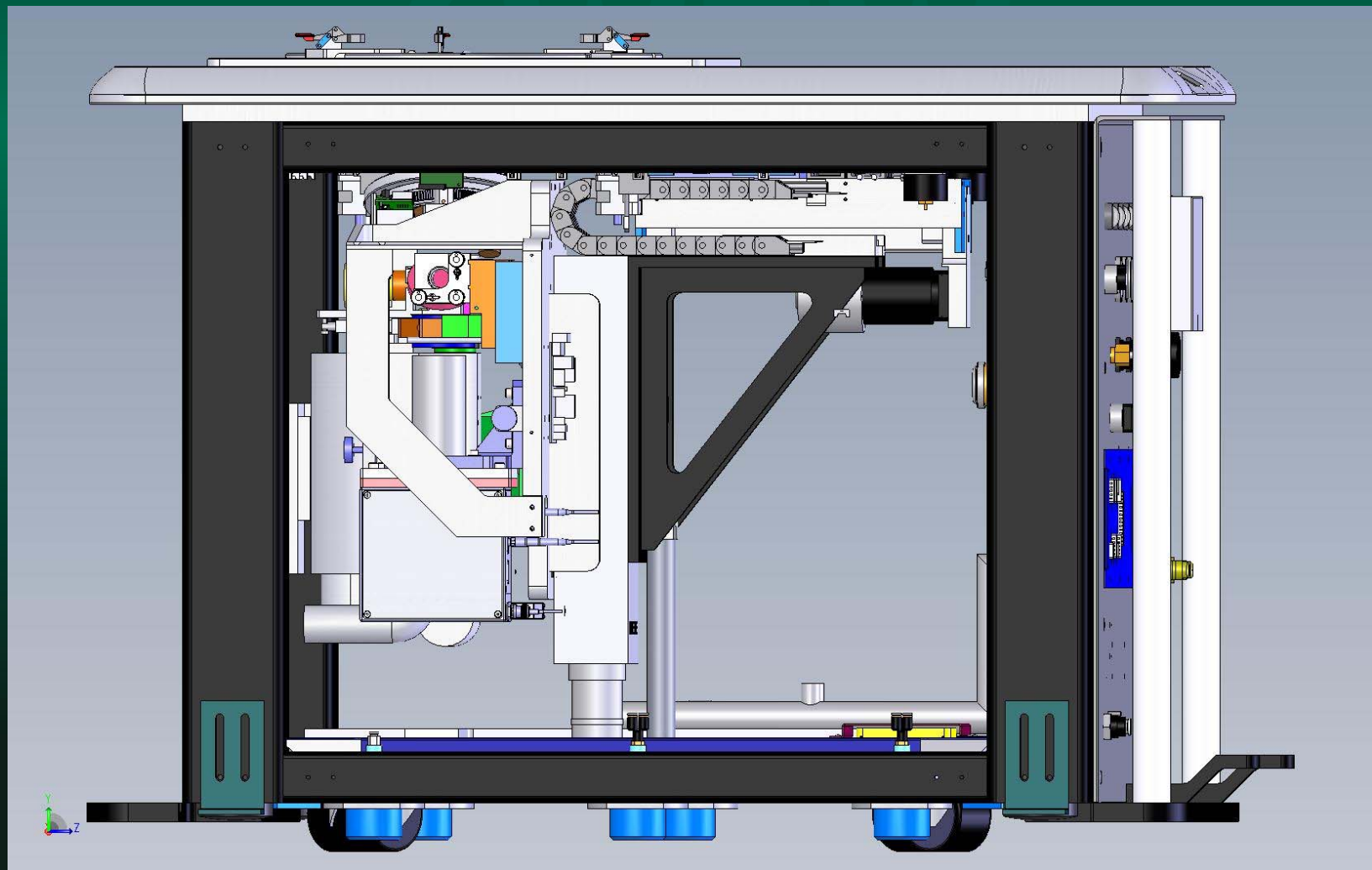
Preserve packaged part capability

Maximum Probe force 45kg

Accommodate probe cards up to 18" diameter

System Controller remotely located in E-Rack

Optics Table

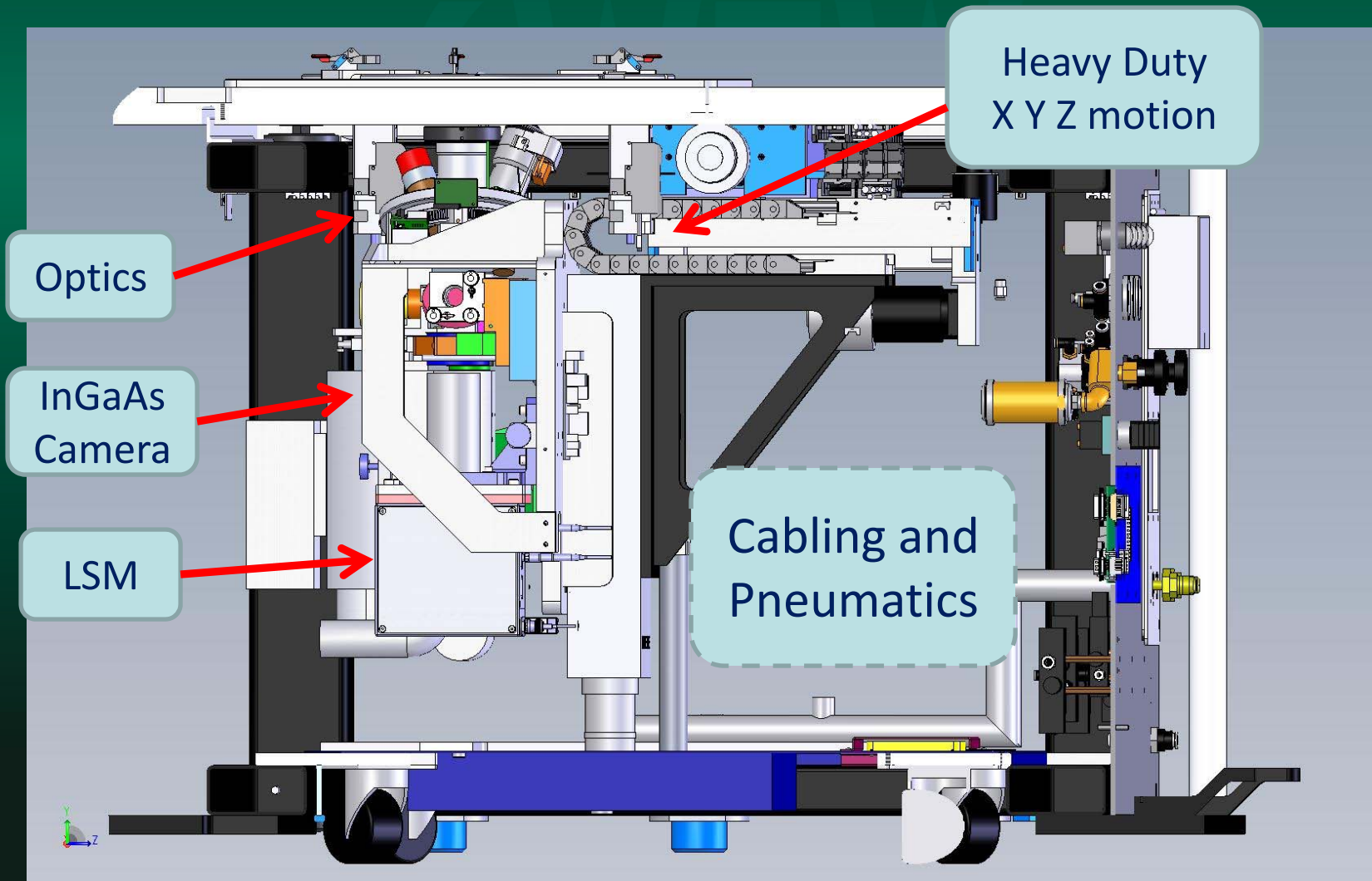


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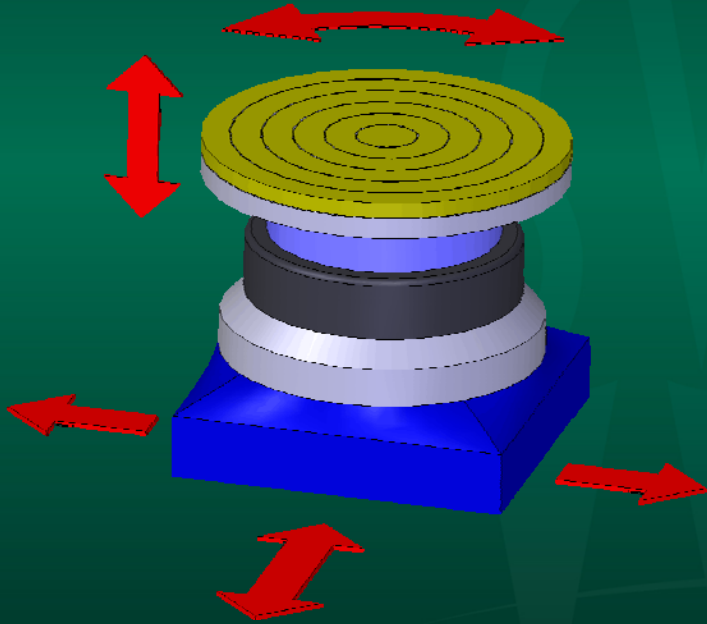


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Optics Table



Prober Motion



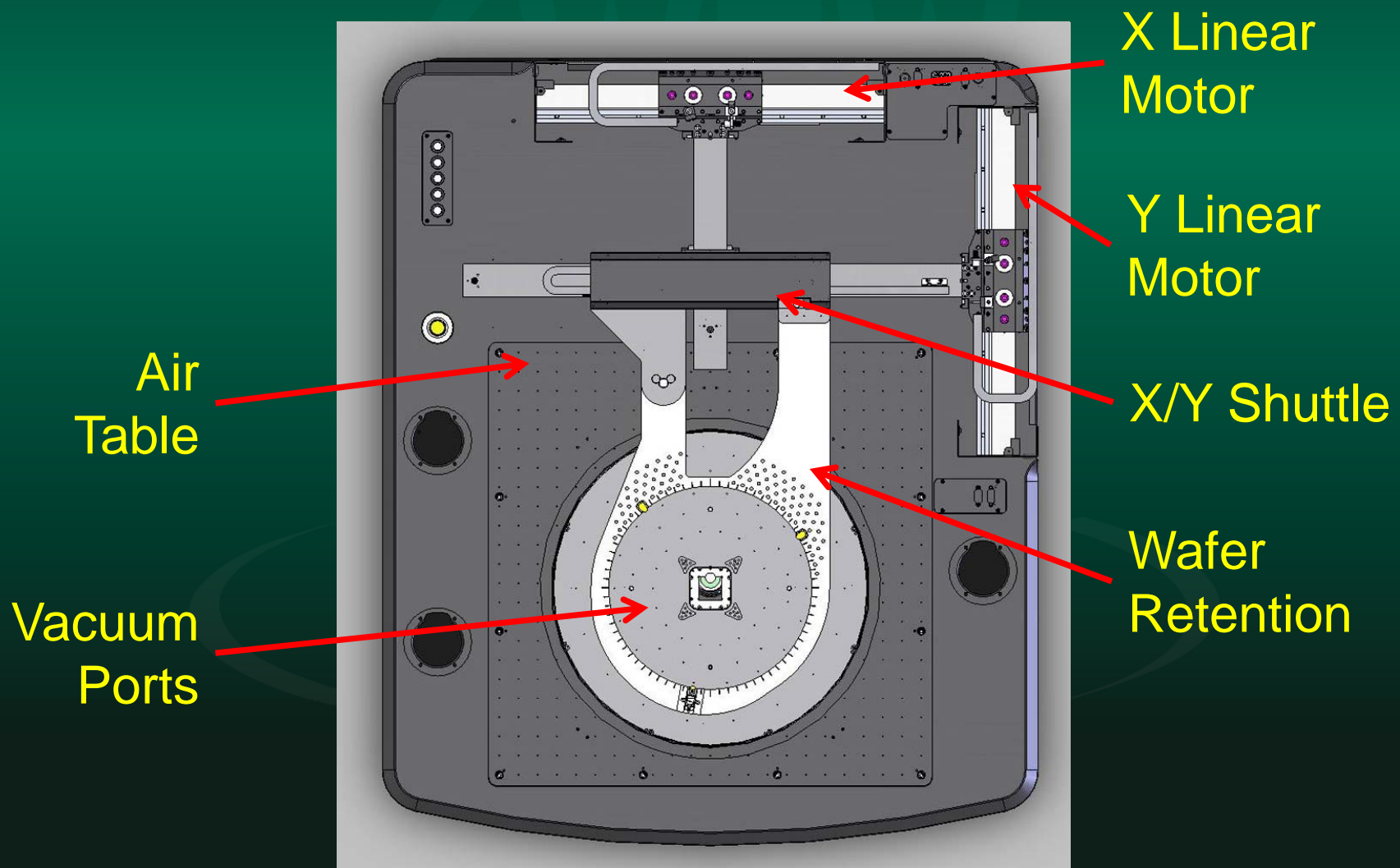
Traditional Implementation

- Stationary probe card.
- 4-Axis motion is handled in the forcer.
- All probe mechanics live below the table top.

WaferScan Implementation

- | | |
|----------------|--|
| • Z Motion | Stationary Wafer and Moving Probe Card |
| • X/Y Motion | Linear Motors mounted at table top |
| • Theta Motion | Rotating Probe Card |

X/Y Wafer Motion



Wafer Retention

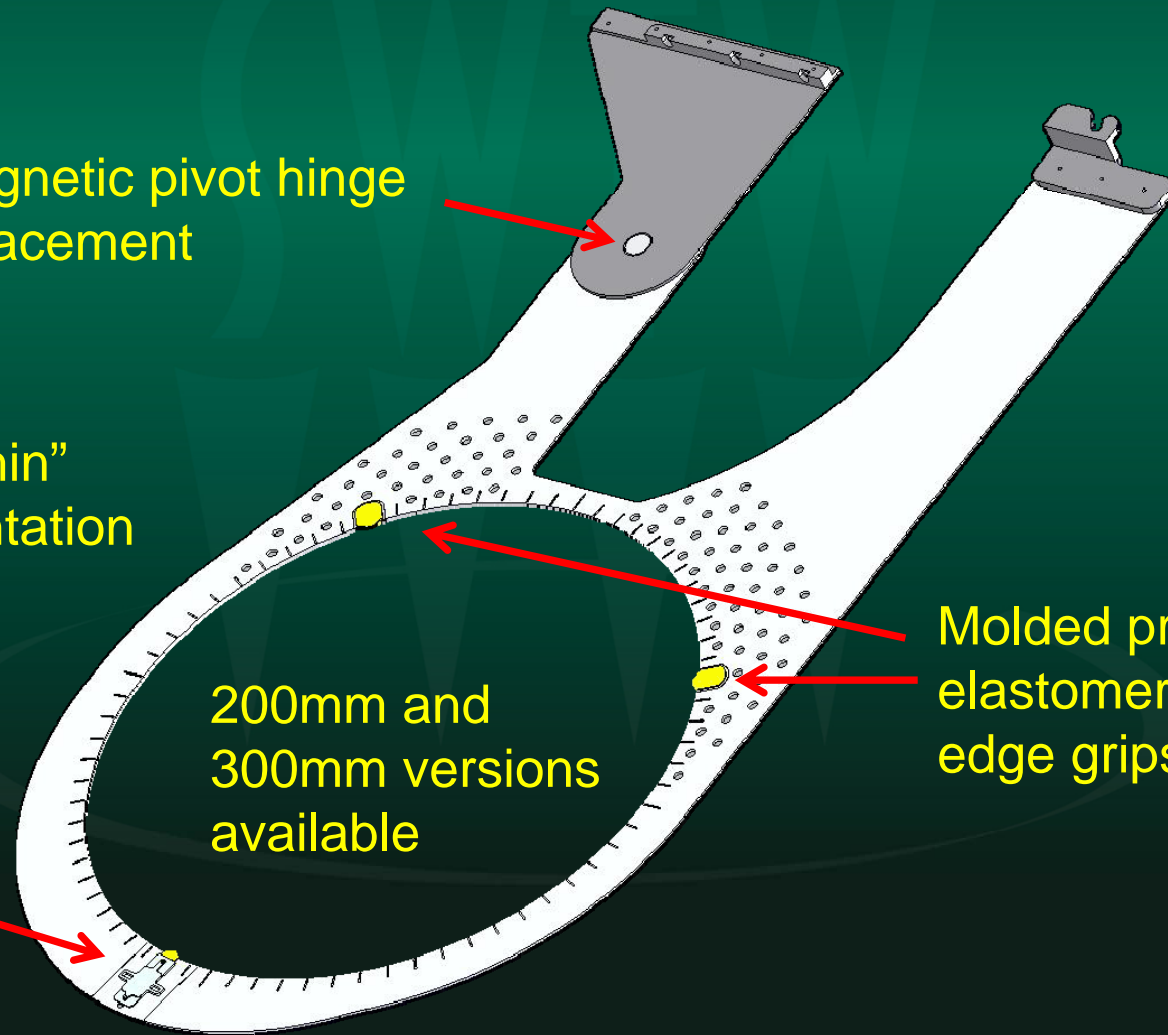
Hi Force Magnetic pivot hinge
Snap-in replacement

“Wafer-Thin”
Implementation

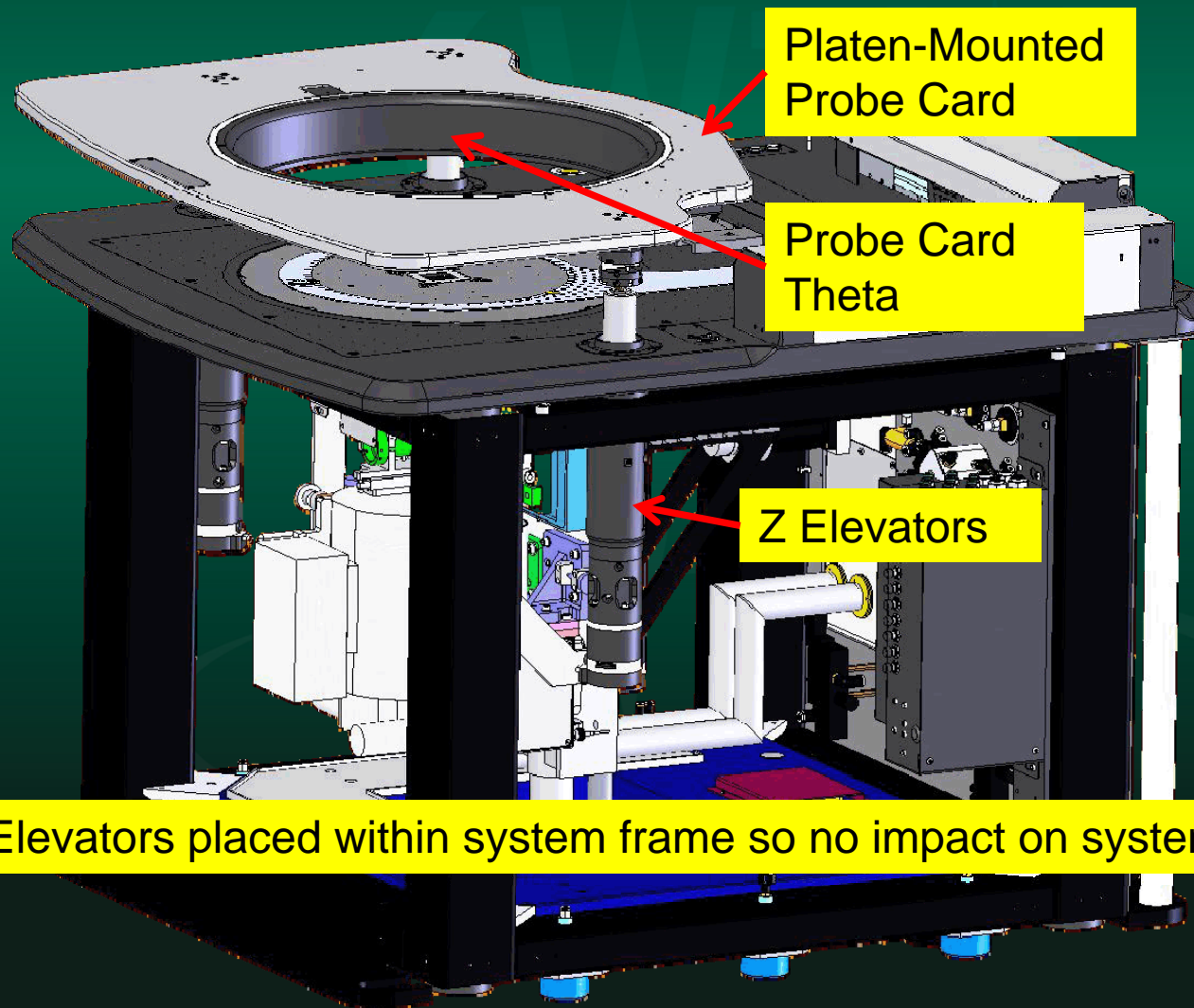
200mm and
300mm versions
available

Molded profile
elastomeric
edge grips

Spring-
loaded
latch



Probe Card Z plus Theta



Z Elevators placed within system frame so no impact on system footprint

Z Elevators



Probe to Pad Alignment

- **Issues**

- Obscured visibility in vertical probe cards
- Limited access space in gap between wafer and PC

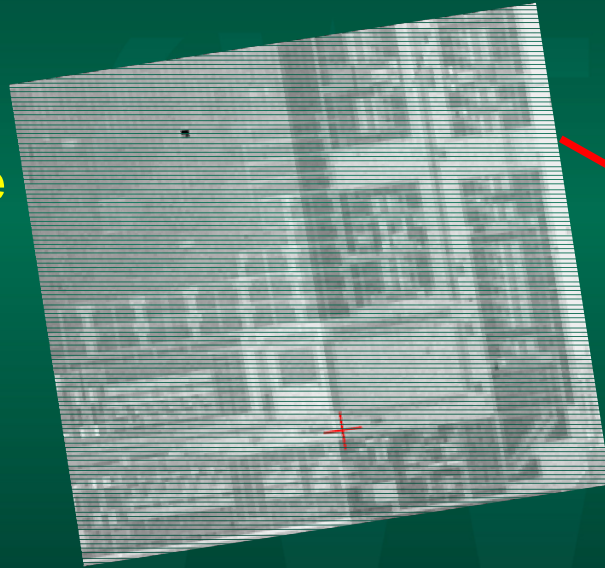
- **Solution***

- Utilize high precision Meridian camera system for “optical metrology” to measure angles and displacement of wafer and probe card

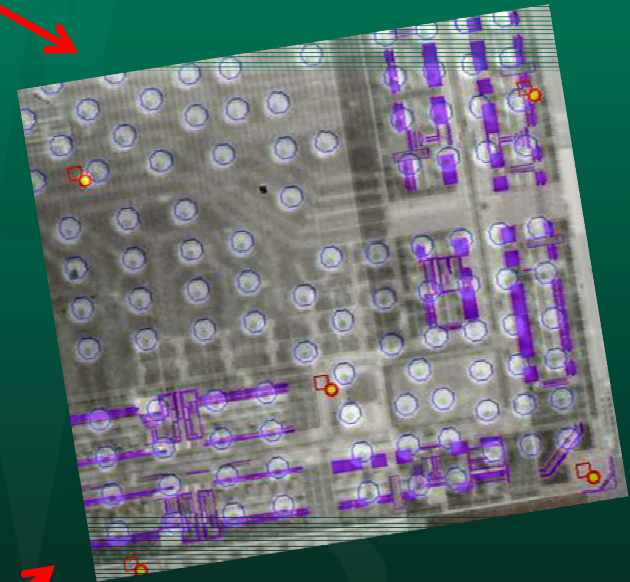
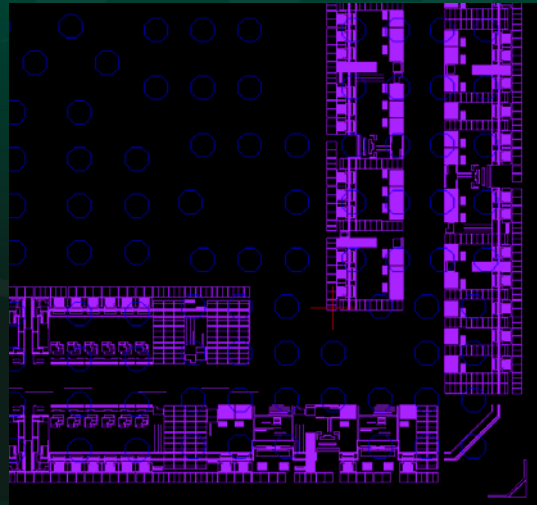
* US Patent **8159243**

PTPA Process

Capture backside
image through
device



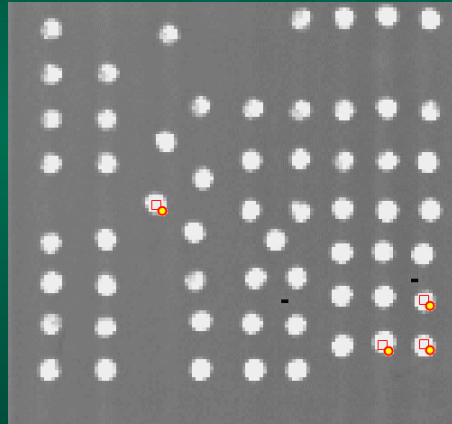
Overlay CAD
topside
information



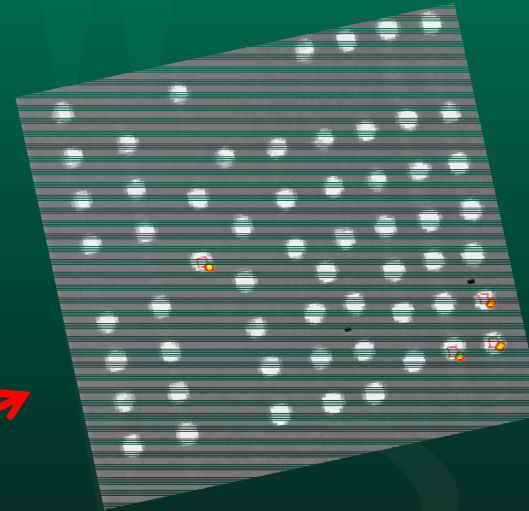
Wafer angle offset
captured by CAD
placement in
overlay

PTPA Process

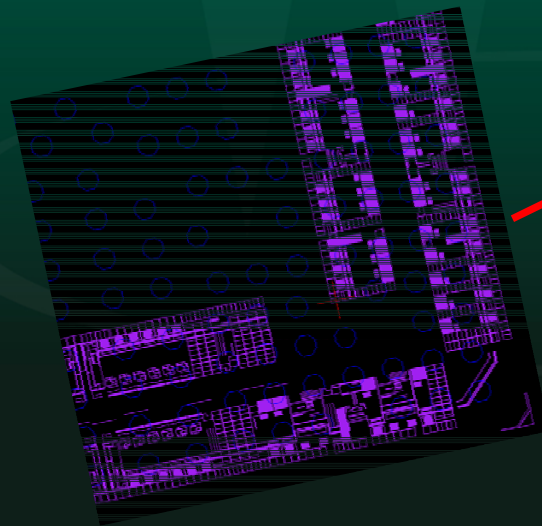
Capture
Probe Card
image



Correct PC
theta angle to
match die

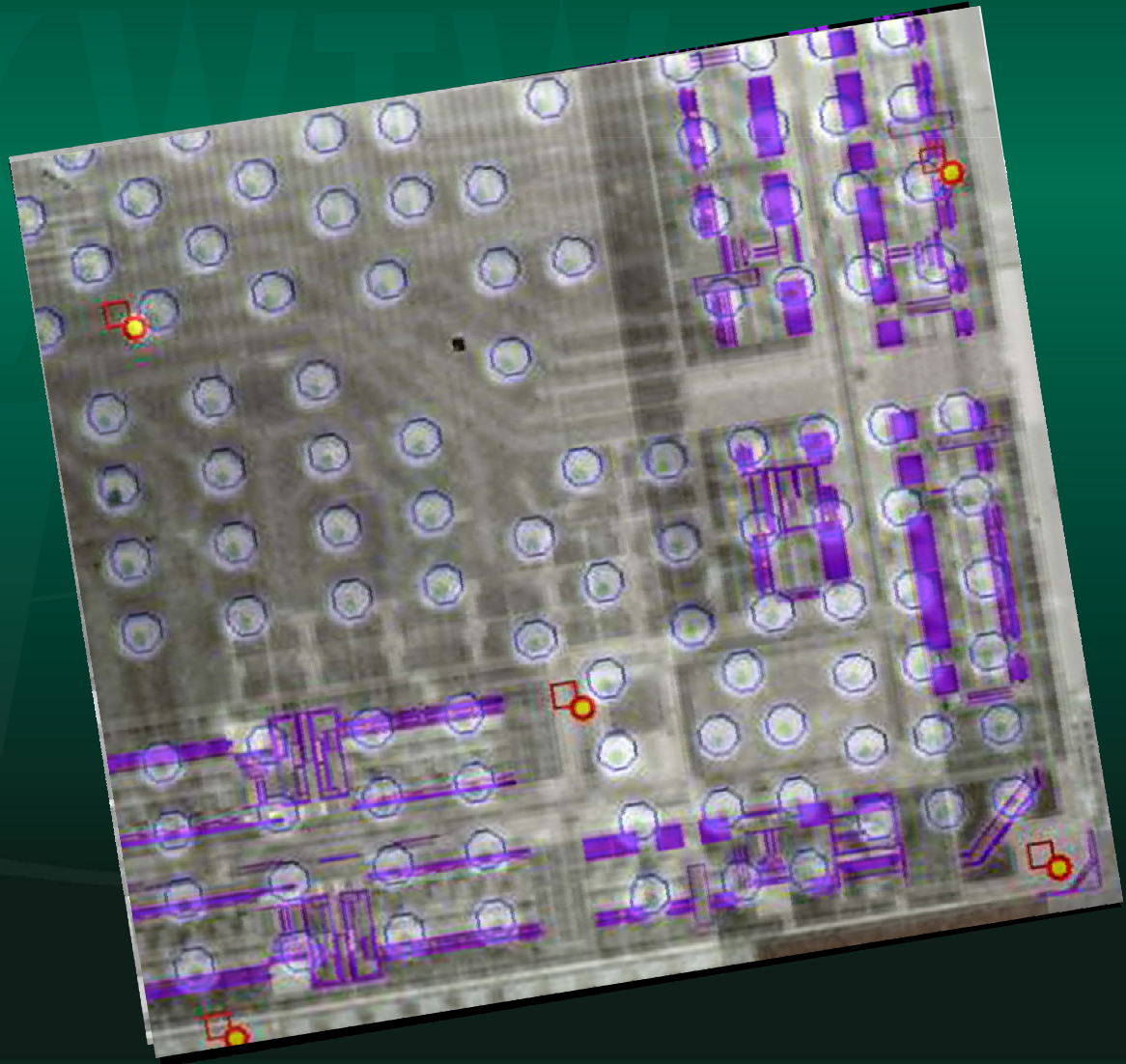


Match PC pins
to die landing
targets

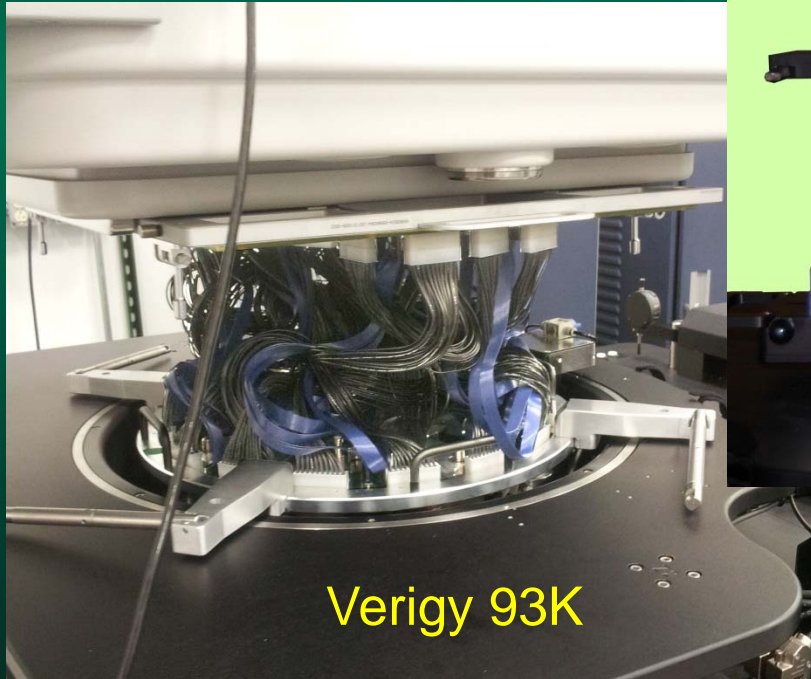


PTPA Process

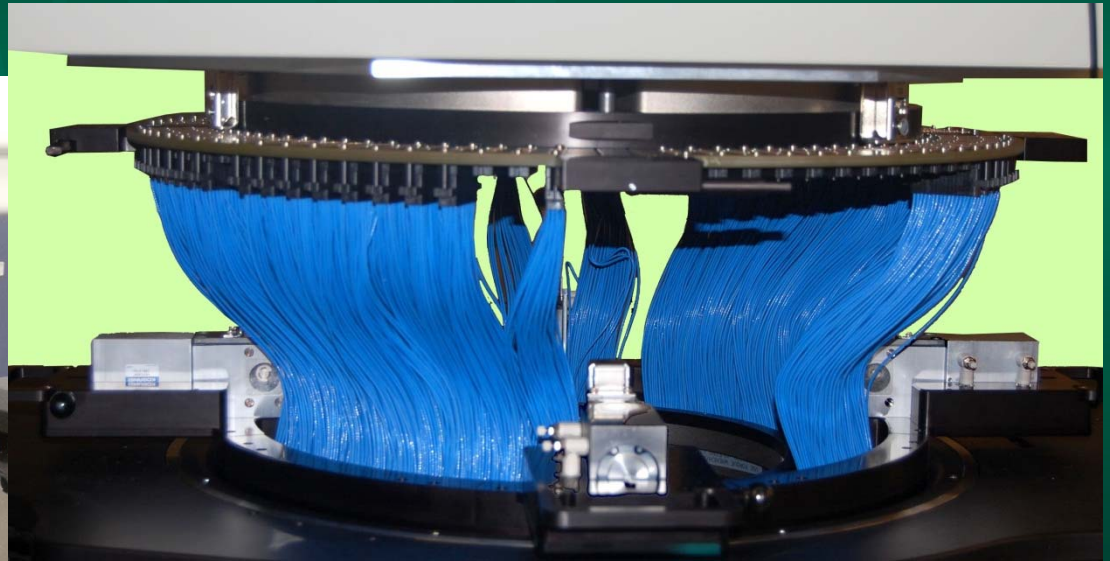
Final Wafer X/Y
adjustment to
bring die into
aligned position



Tester Interface



Verigy 93K



Advantest T2K

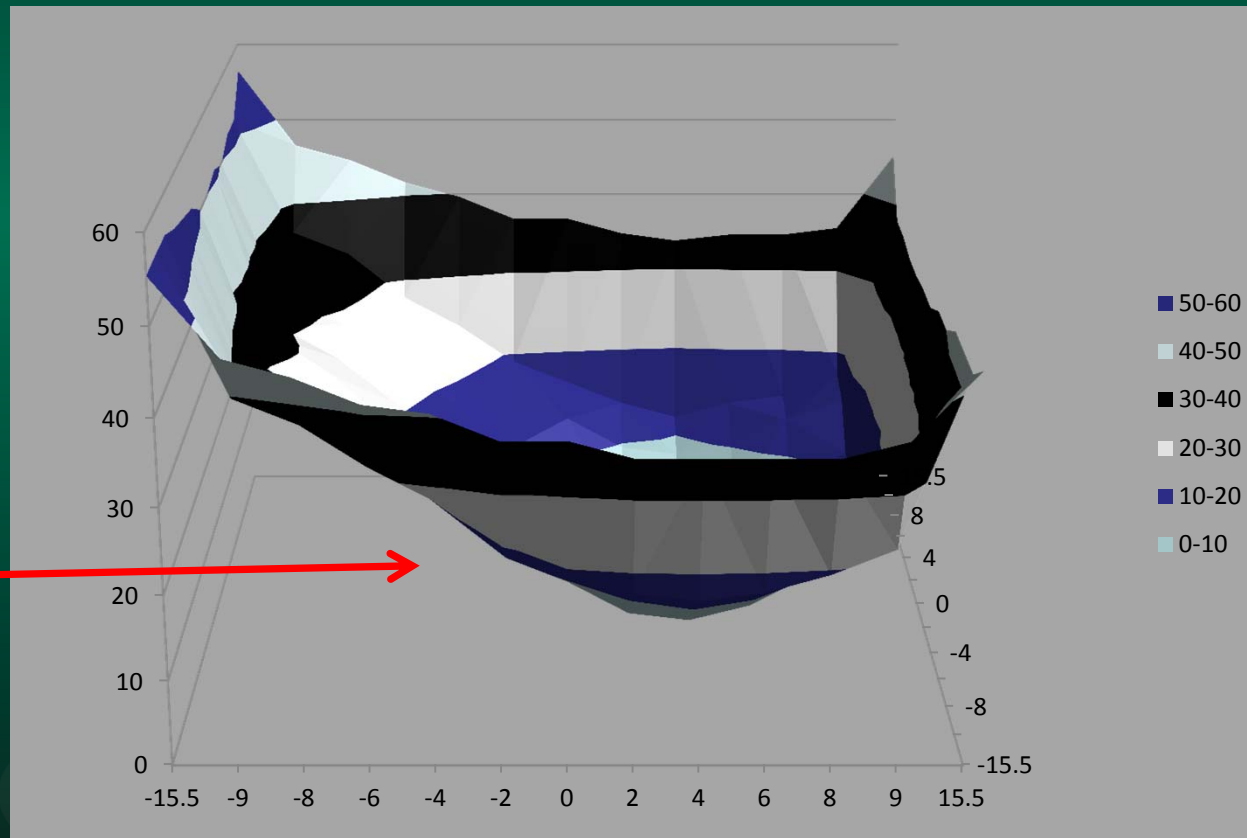
- Probe Card mounts in moving platen
- Flexible Interface between stationary test head and moving probe card
- Test Head vibration is decoupled from probe card

Probe landing model

- Landing Site is unsupported
- Probe force causes wafer bowing
- Traditional landing model requires revision for WaferScan applications
- “Effective Overdrive” will always be less than mechanical overdrive value

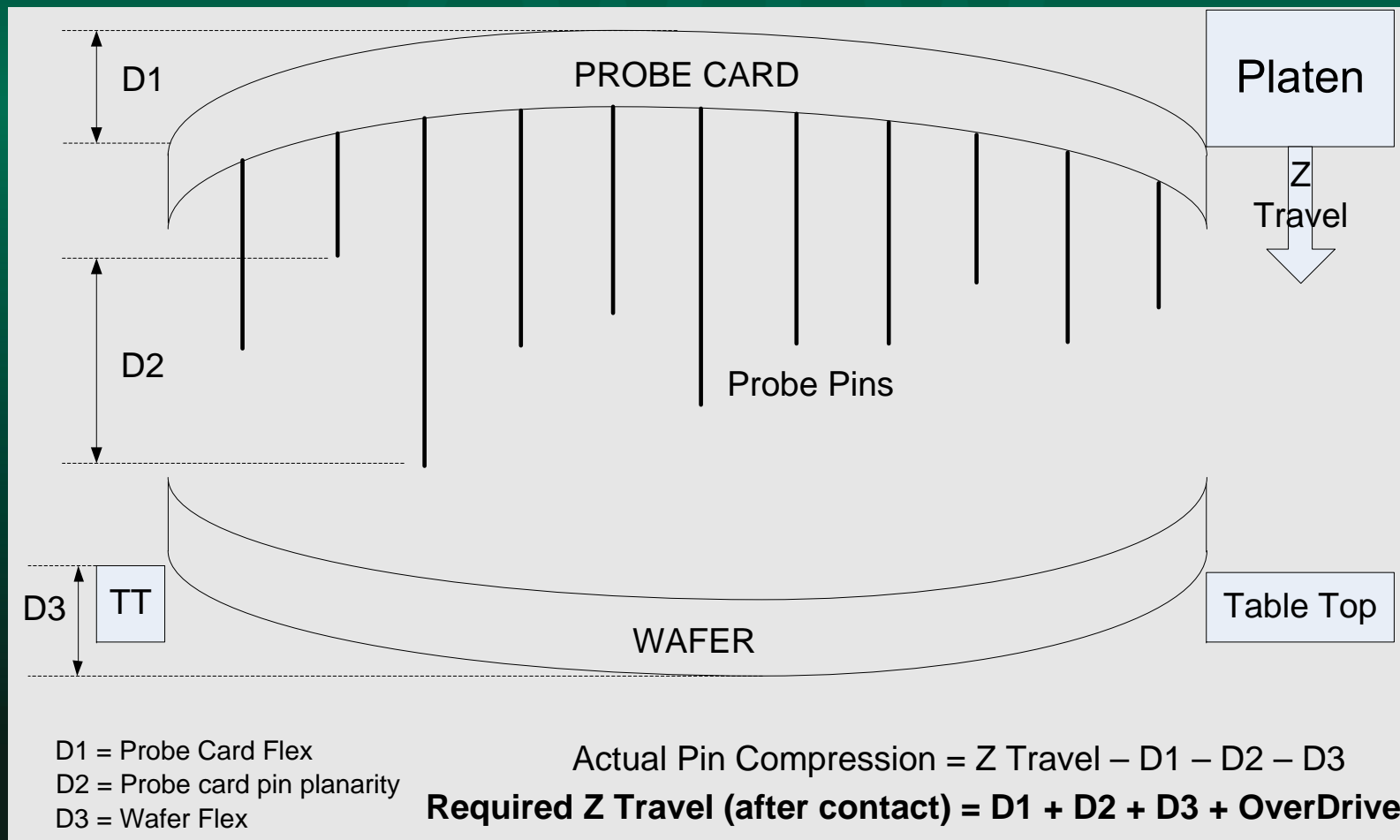
Probe Landing

Measured
Wafer
Deflection



Full thickness 300mm wafer, 27 x 27mm window
6000 pin vertical probe card with 150um overdrive
Edge deflection 30um
Deflection variation at center as much as 60um

Probe Landing Model



Lessons learned from the field

- Cantilever probe cards provide the biggest challenge to PTPA
- CAD information not always available
- Higher levels of automation required
- Higher probe force
- Direct Probe gaining in popularity
- Multi-site probing

Moving Forward

- Next generation of WaferScan to move closer to in-line applications
- Much higher probe force
- Higher levels of automation with integrated pattern recognition for alignment and die-to-die stepping
- Automated data collection across the wafer

“It’s always Something”



Thank You!