

Full Wafer Contact Repeatability and Reliability

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Agenda

- **Full Wafer Contact Challenges**
- **Contact Pin Durability**
- **Full Wafer Contact Pin Reliability/Repeatability**
- **Full Wafer Contact Resistance Measurements**
- **Conclusions**

Major Technical Challenges

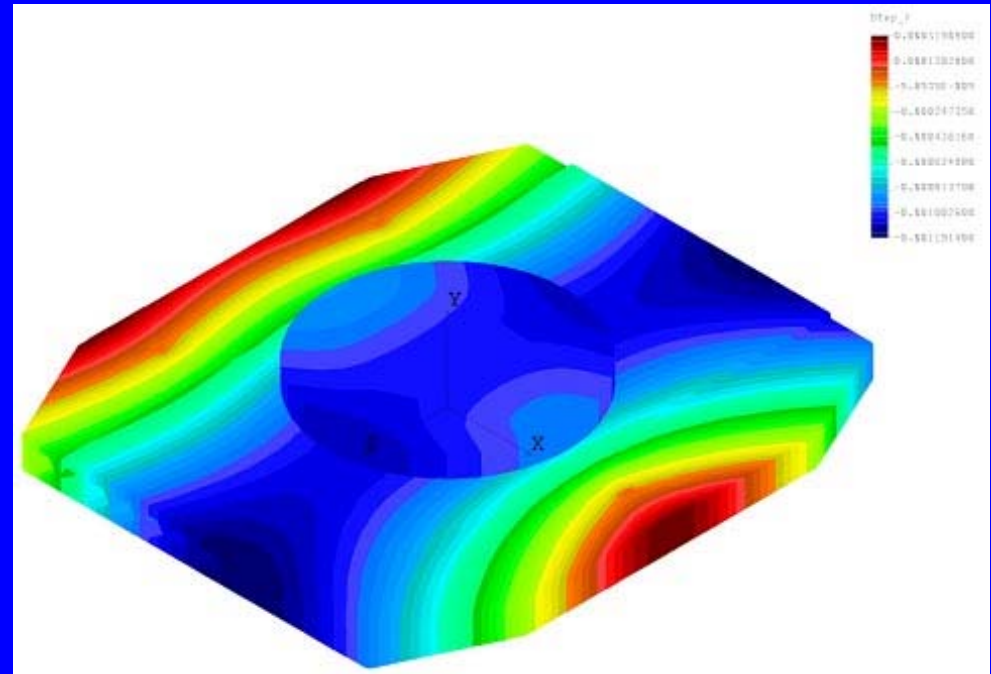
- “Only” three major challenges
 - Thermal
 - Mechanical
 - Electrical

Mechanical Challenges (cont.)

- Aligning wafer to contactor
- Cost effective design
- High contact pressures
 - 8” SDRAM wafer with 50 pads/die, 500 die requires 25,000 pin contactor
 - At 10 grams per pin about 250 kg required
 - Maintain planarity to microns at these forces

Thermal Chuck Flatness Test Results

- Thermal chuck analyzed and designed to provide a very flat surface in contact with the wafer
- Used Finite Element Analysis tools



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- How to generate and control such high forces

Contact Force Control

- Pressure based versus Vacuum based
 - Not limited to one atmosphere
 - More precise, uniform control of force
 - Any leaks drive away contamination
 - Can control location of force
- Probe to force versus to position
 - Required for most contactor technologies
 - Compensates for non-planarity

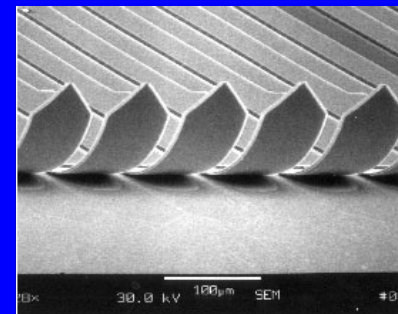
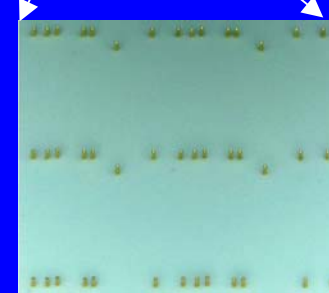
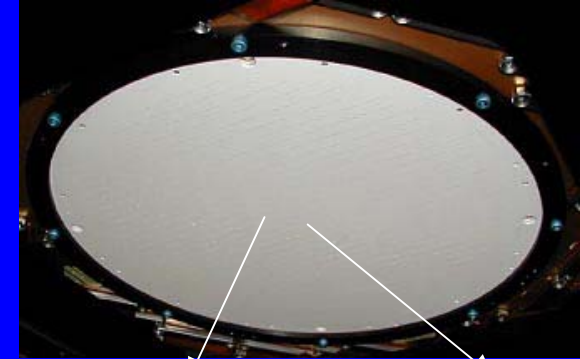
 Full wafer contact produces on-axis forces

Mechanical Challenges (cont.)

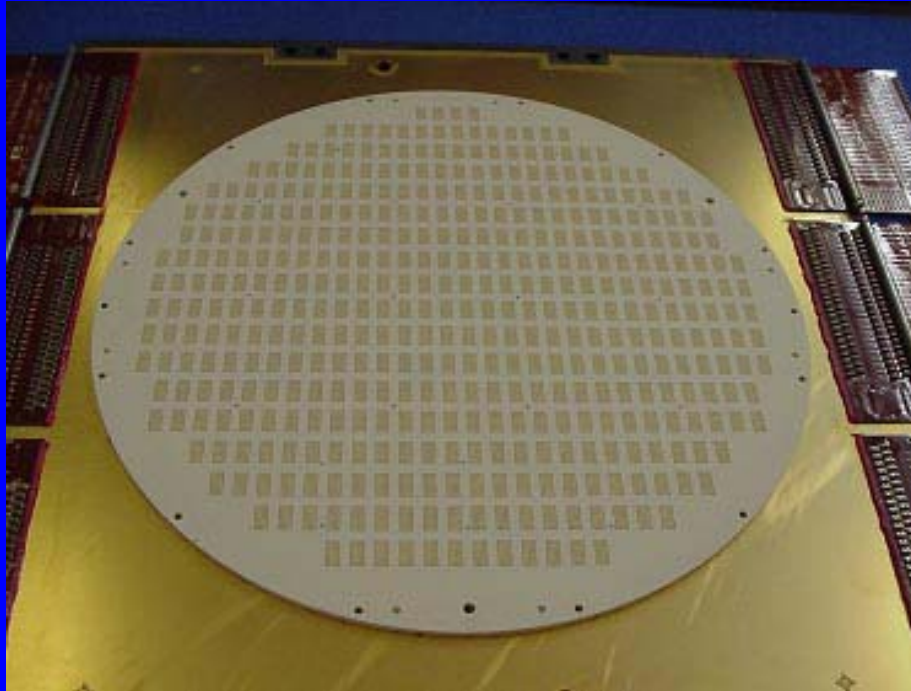
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- Cost effective design
- High contact pressures
 - 8" SDRAM wafer with 50 pads/die, 500 die requires 25,000 pin contactor
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 - Maintain planarity to microns at these forces
- How to generate and control such high forces
- Best contactor varies per application

Full-Wafer Contact Technologies

- Micro-spring contactors
 - 300 mm capable
 - > 25,000 contacts per wafer
 - Up to a million uses for test
 - Solder bumps or wirebond pads
 - Operates from 25°C to 150°C
- Nano-spring contactors
 - MEMS-based leading edge technology
 - Capable of contacting fine pad pitches (< 60 microns)

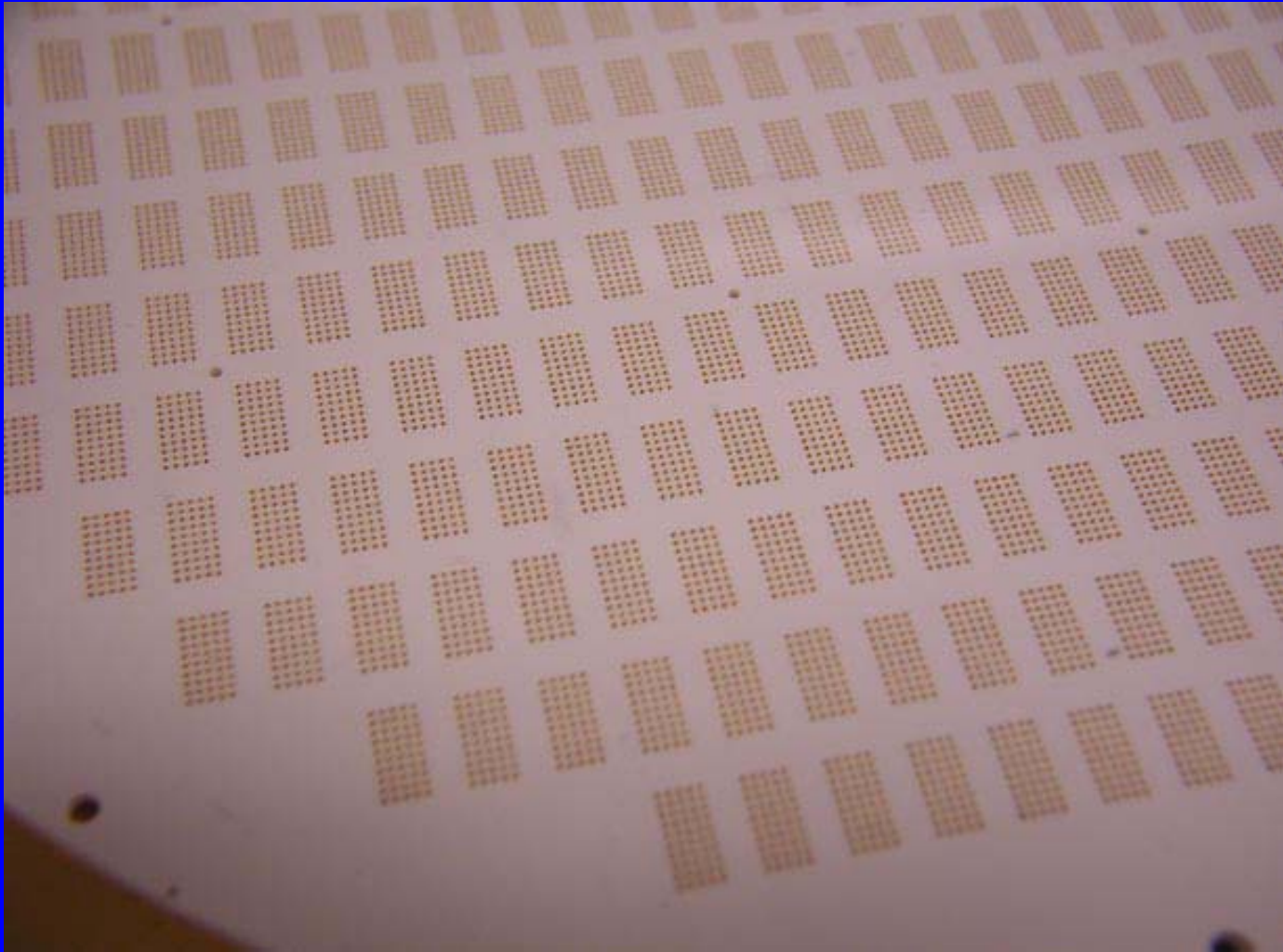


Micro Spring Contactor



- High touchdown life
- High compliance
- Works with most pad metallurgies
- Multiple pitches available

Micro Spring Close-up (750u Pitch)

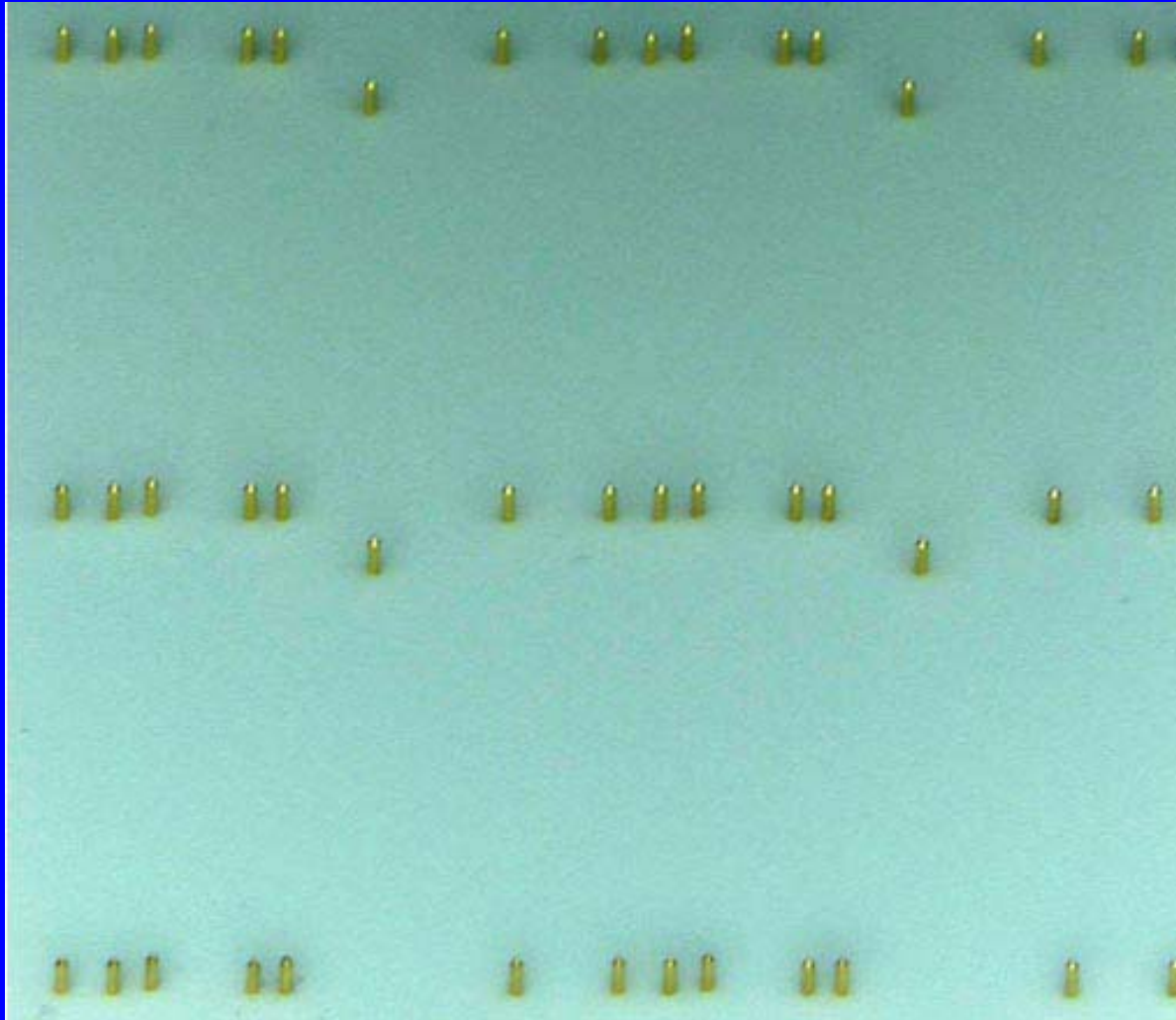




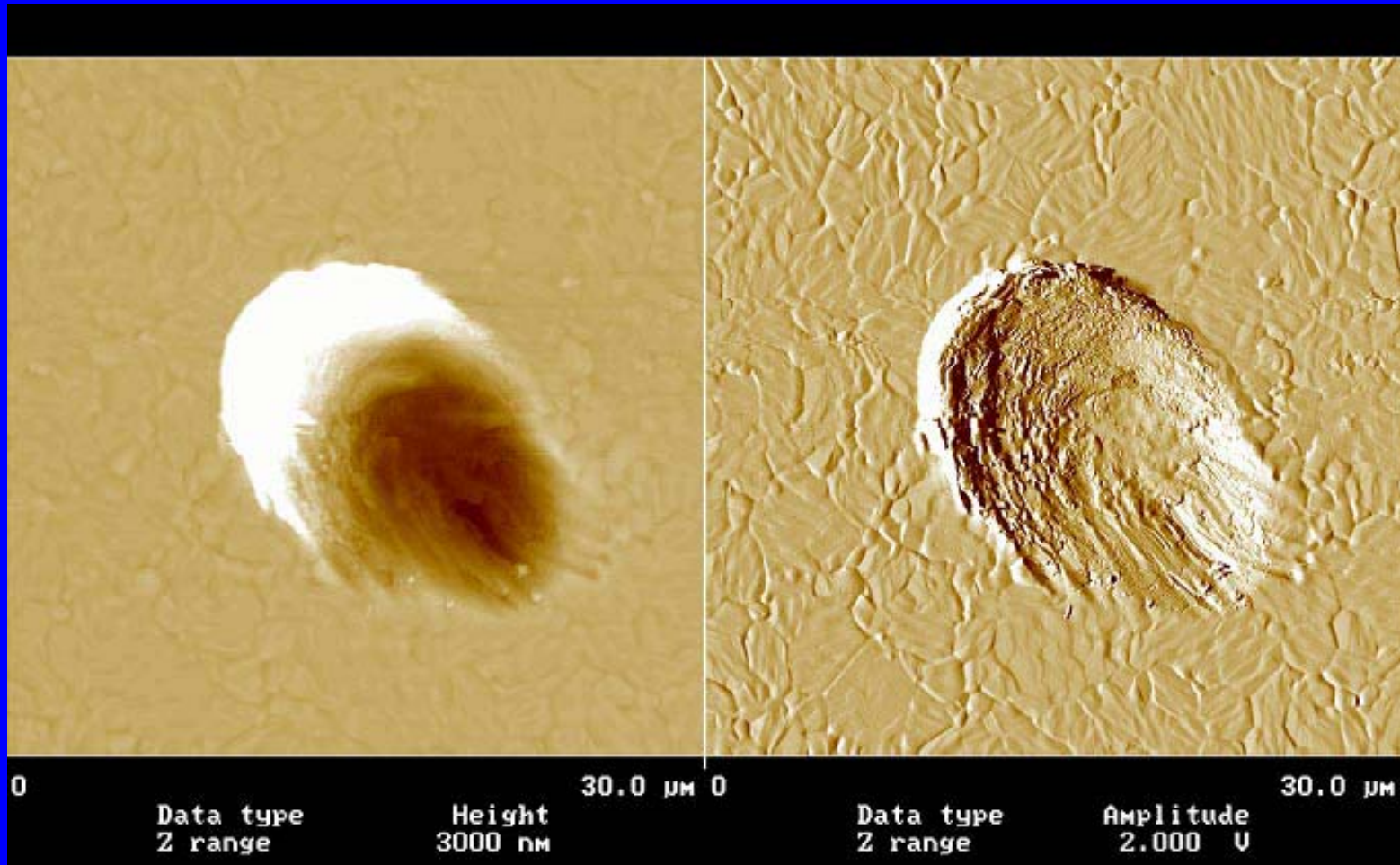
Full Wafer Contactor



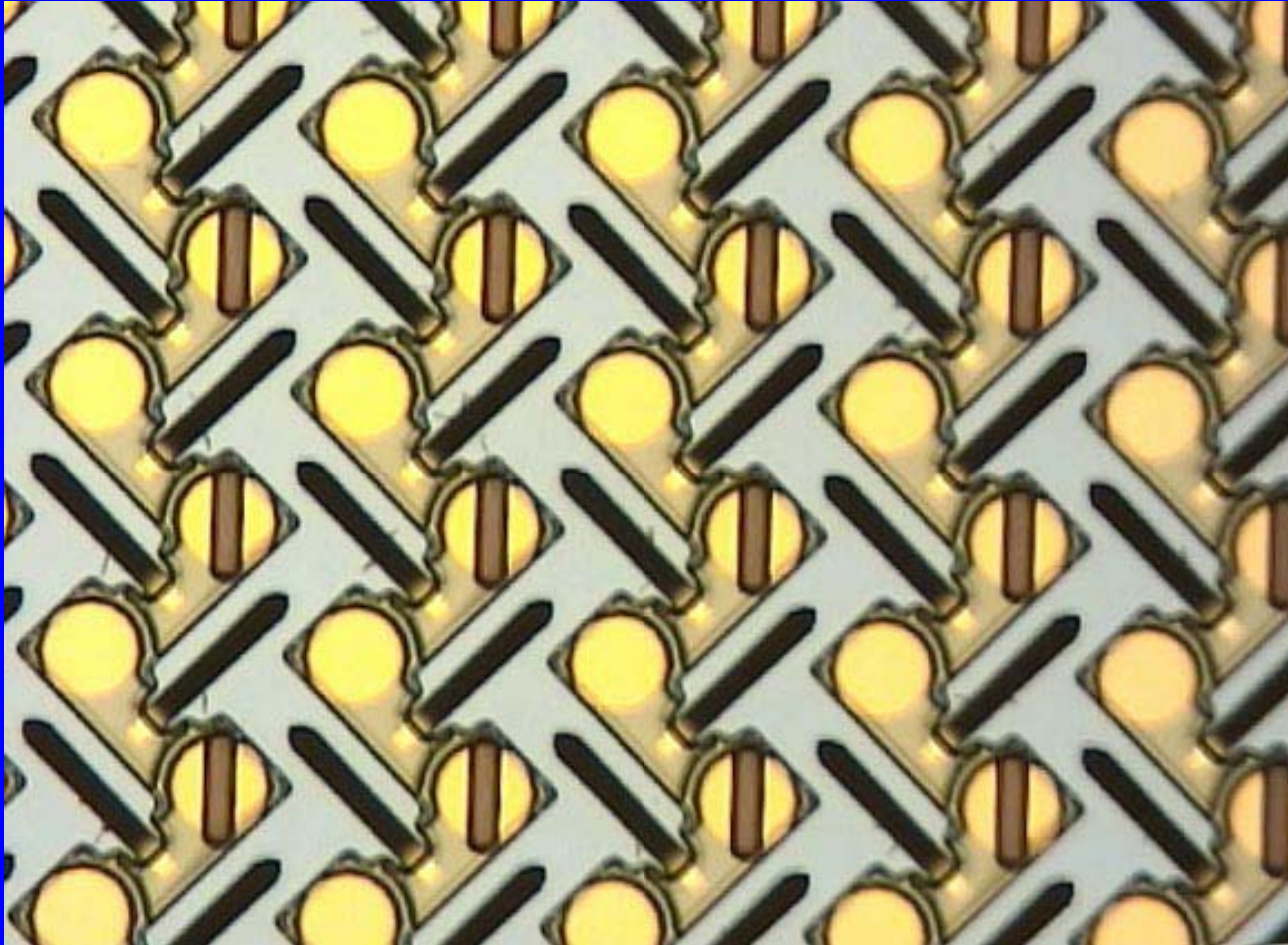
Micro Spring Close-up (200u Pitch)



Probe Marks



Nano Spring Contactor



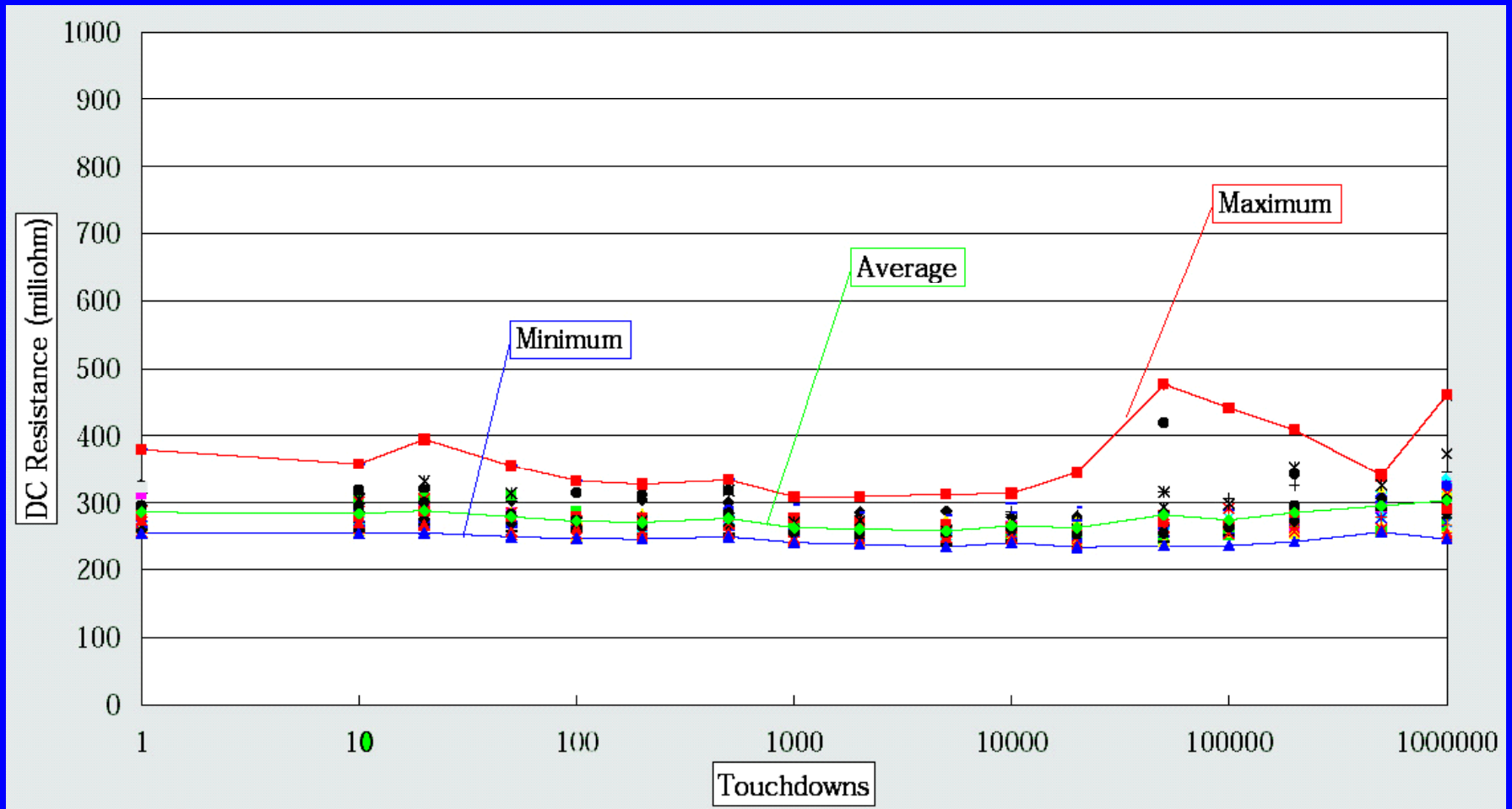
Contactor
Array
80 micron
pads

Micro Spring Durability

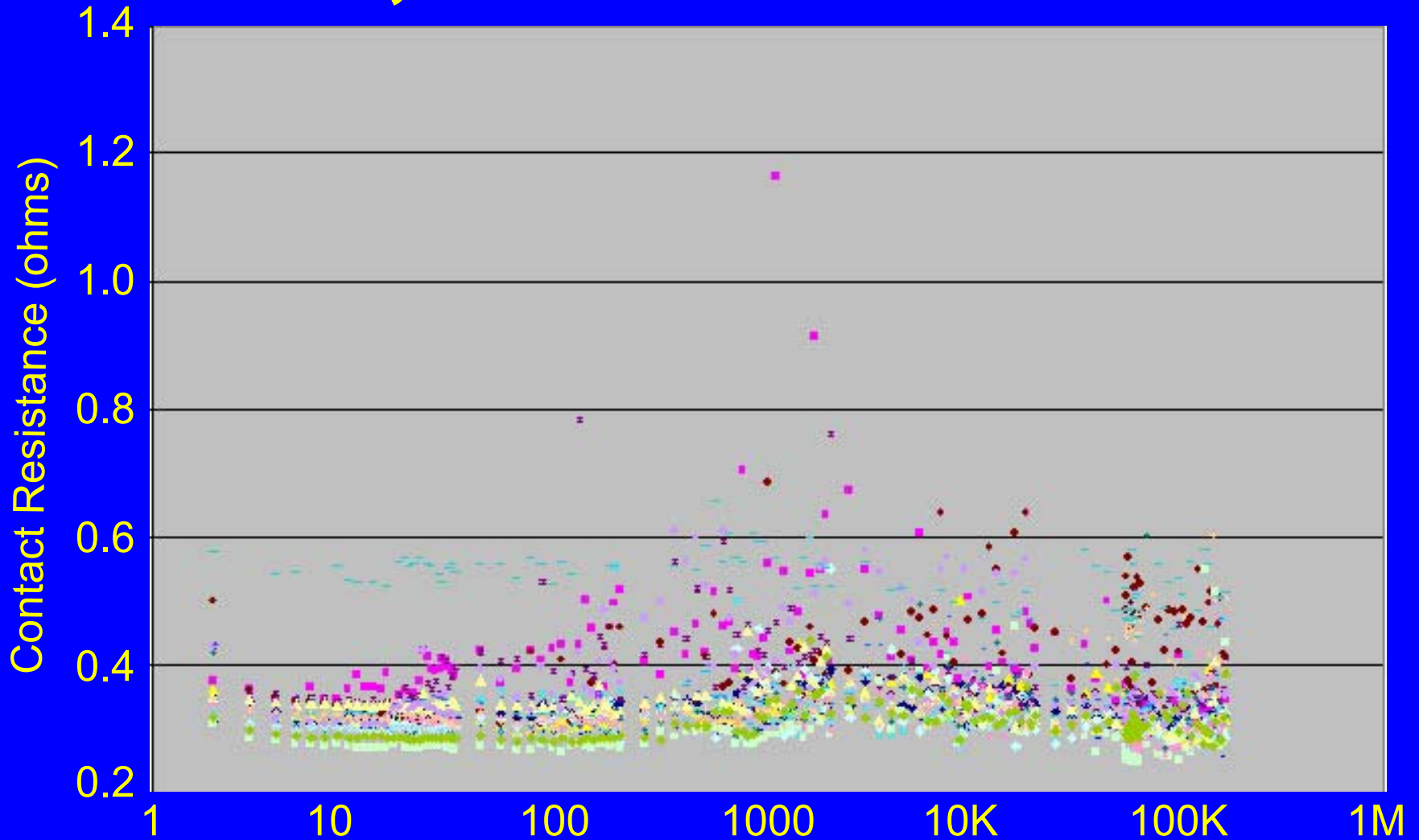
Durability n. The state or quality of being durable; the power of uninterrupted or long continuance in any condition; the power of resisting agents or influences which tend to cause changes, decay, or dissolution; lastingness.

-- Websters

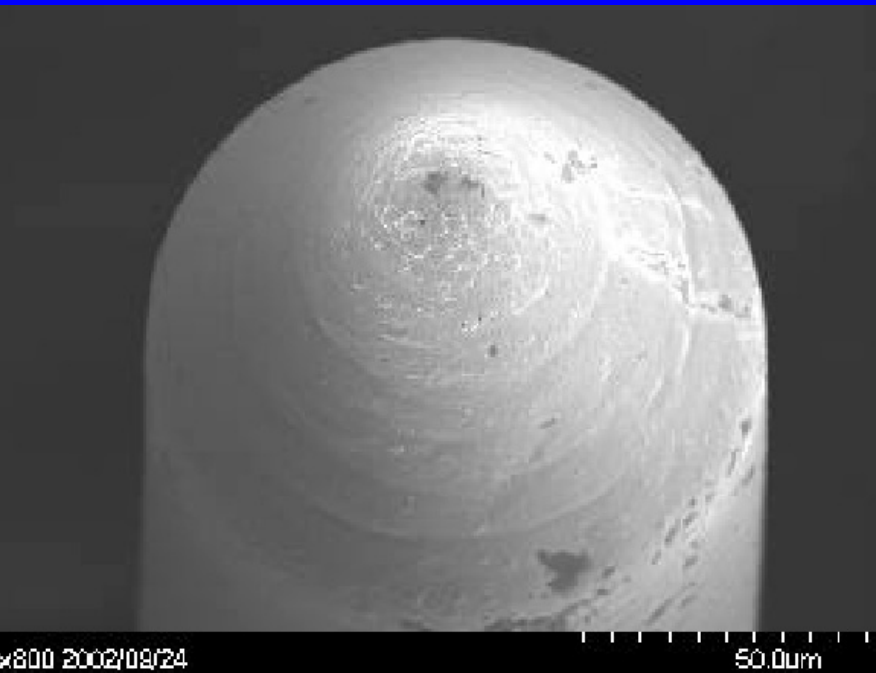
One Million Touchdowns



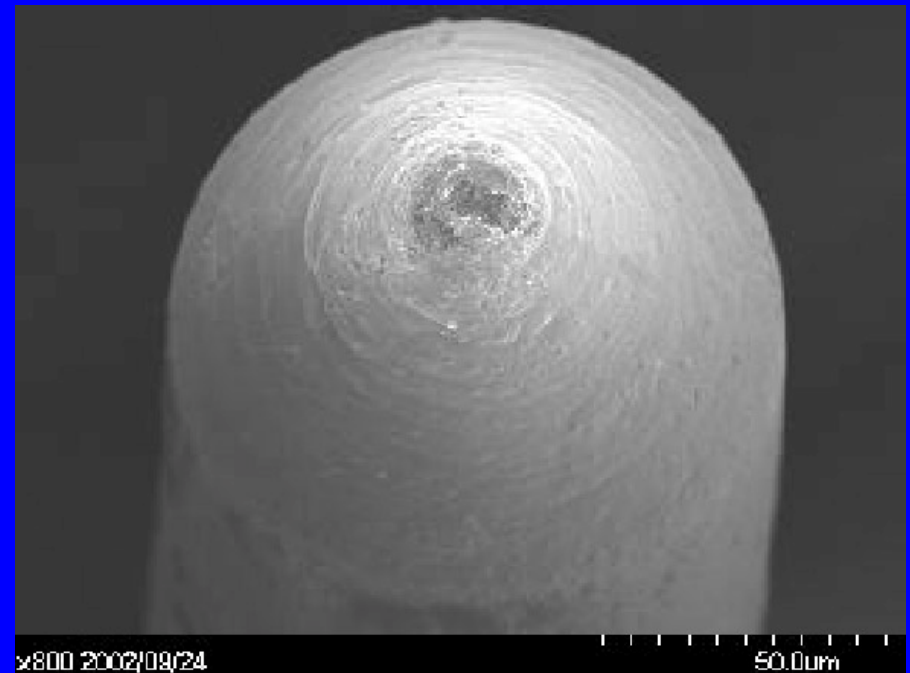
300,000 Touchdowns



Micro Spring Before and After



Pin Tip before and



after 1 million touchdowns

Reliability and Repeatability

Reliability n. The state or quality of being reliable.

Reliable a. Suitable or fit to be relied on; worthy of dependence or reliance; trustworthy.

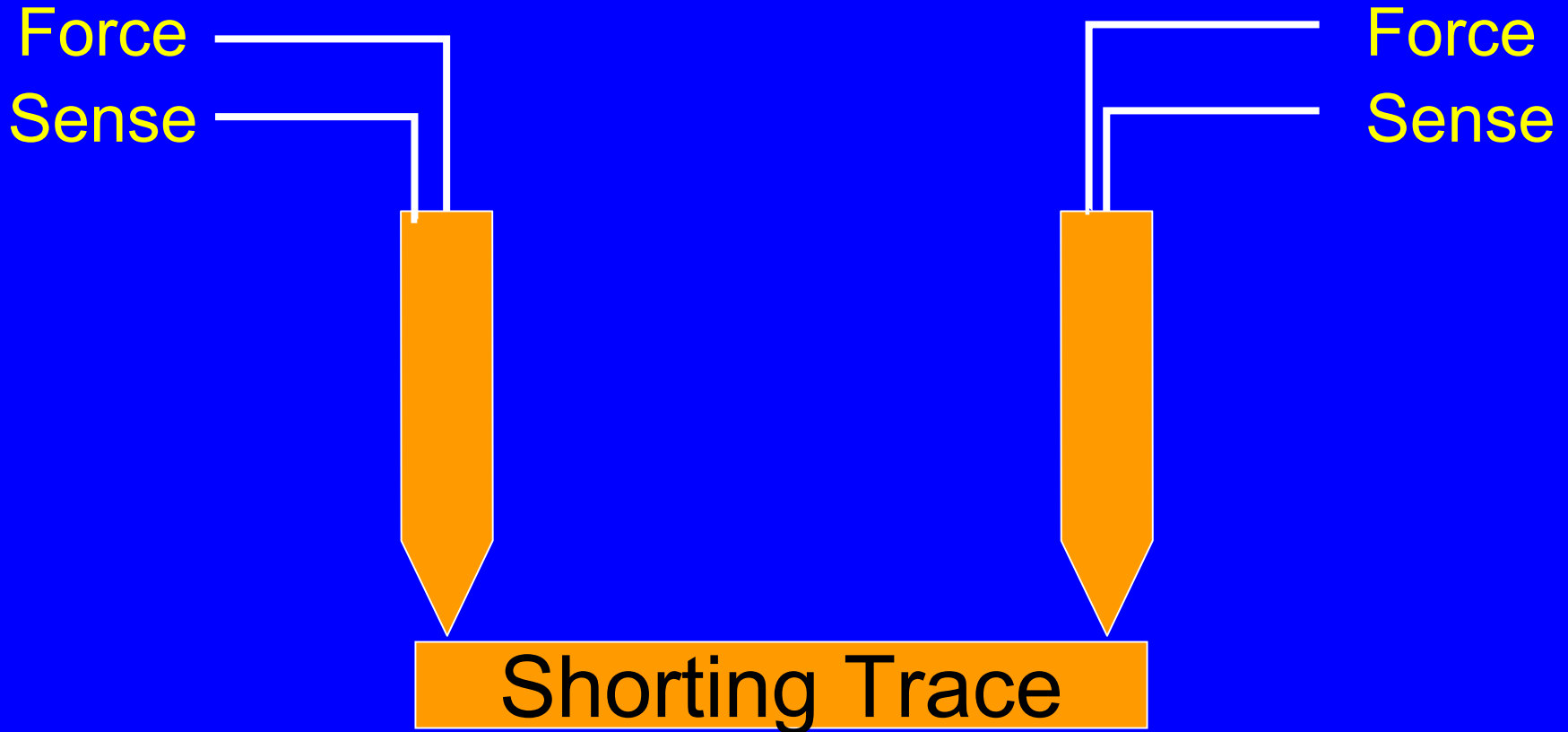
Repeating a. Doing the same thing over again; accomplishing a given result many times in succession...

-- Websters

Contact Resistance Test Setup

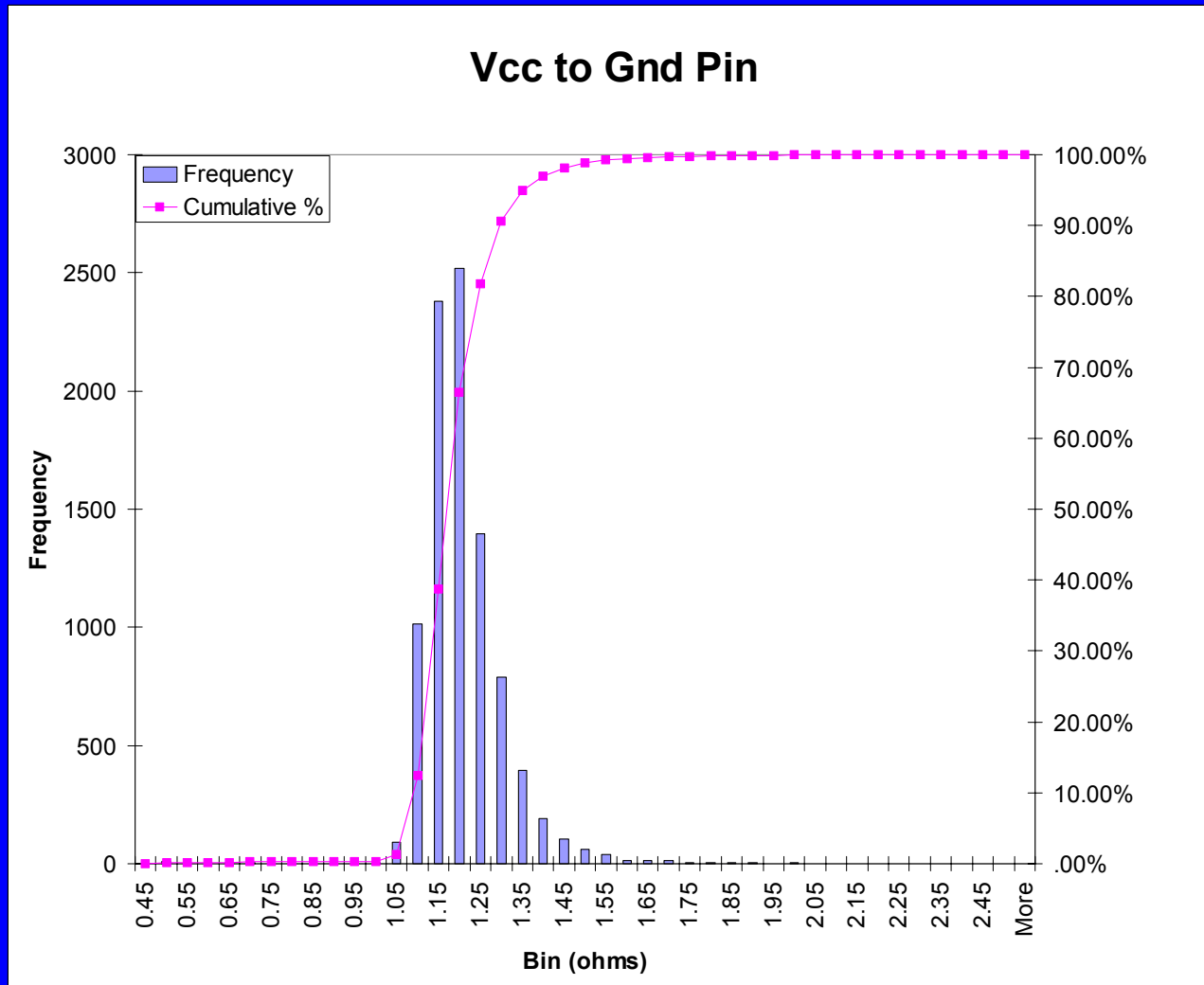


Loop Resistance Diagram

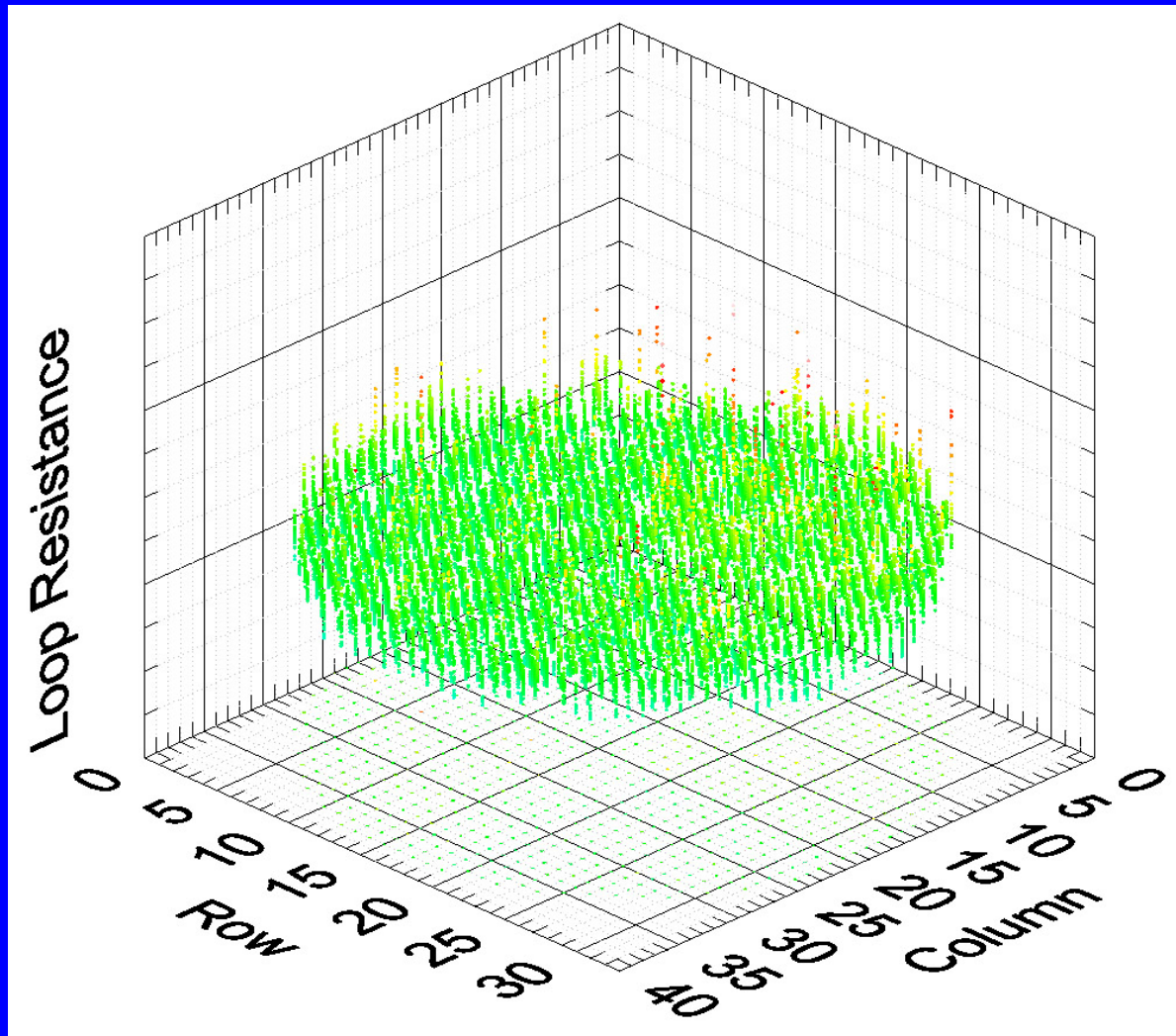


Loop Resistance =
Two contacts plus trace resistance

Loop Resistance Histogram



Full Wafer Contact Uniformity



Conclusion

- **Full wafer contact is practical today**
- **Full wafer contact mechanisms exist which are very durable -- exceeding 1,000,000 touchdowns**
- **Full wafer contact can be vary reliable and repeatable**