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Cost Effective Probe Card Metrology Tools

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CONTENT

- GOALS
- TEST DEFINITION
- METROLOGY TOOLS USED
- METROLOGY TOOL COMPARISON
- DATA
- CONCLUSION

GOALS OF EXPERIMENT

- Demonstrate the following
  - Selecting the right metrology tool for the application doesn't lead to a compromise in system performance
  - Lower cost tools for smaller probe arrays can still perform to the same accuracy and repeatability
  - Definition of the right metrology tool for the application will result in the best ROI.
  - A probe card manufacturer using a PB1500 can supply cards to a PB6500 user and still correlate as can an end user with a PB1500 receiving cards tested on a PB3600

TEST DEFINITION

- TEST 1
  - Use a glass photomask with “dots” on 0.1” spacing
  - Map the stage of a PB1500 metrology tool
  - Verify the accuracy and repeatability of the PB1500

TEST DEFINITION

- TEST 2
  - Test the same probe card on 3 different metrology tools for alignment, planarity, leakage, contact resistance and gram force
  - Compare the results from the 3 tools
  - Probe card used is a 45 pin test card.
  - The card is not new, the aim of the test being to show correlation is good even when the card is not perfect.

TEST DEFINITION

- Test 3
  - Run a batch of 10 repeatability tests on the PB1500
  - Probe card used is a 45 pin test card
  - The card is not new, the aim of the test being to show repeatability is good even when the card is not perfect.

METROLOGY TOOLS

- PB1500
  - Low cost metrology tool designed to handle probe arrays smaller than 75mm x 75mm
  - Holds the card “tips up” during both the test and repair operations
  - Ideal for testing all cantilever, particularly fine pitch shelf cards, and smaller fine pitch vertical arrays
  - 1280 maximum test channels

METROLOGY TOOLS

PB1500

METROLOGY TOOLS

- PB3600
  - Mid range metrology tool
  - Optional ProbeTracker simplifies tips up repair
  - Ideal for testing all probe technologies and probe cards for logic/LCD driver/mixed signal deices
  - 3072 maximum test channels

METROLOGY TOOLS

PB3600 WITH PROBETRACKER

Picture taken from joint Intel/ITC paper given at SWTest 2005:
Decreasing Repair Cost and Improving Probe Card Life
A Case Study

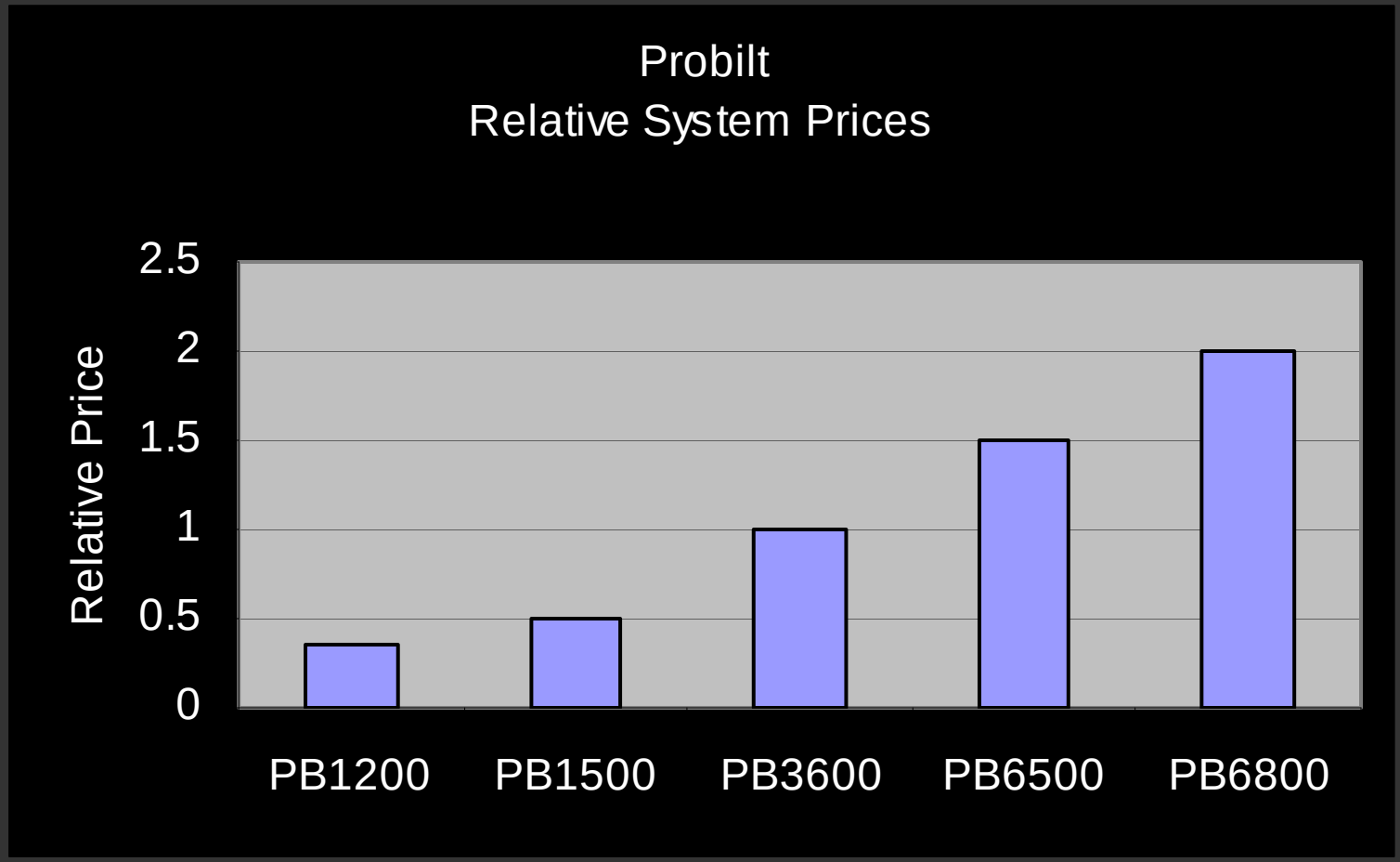
METROLOGY TOOLS

- PB65/6800
  - Tool of choice for high force vertical card applications
  - Handles cards with probe forces up to 300Kg
  - Ideal for testing microprocessor and memory probe cards (up to 200mm arrays on PB6500 or full 300mm on PB6800)
  - 12,032 maximum test channels

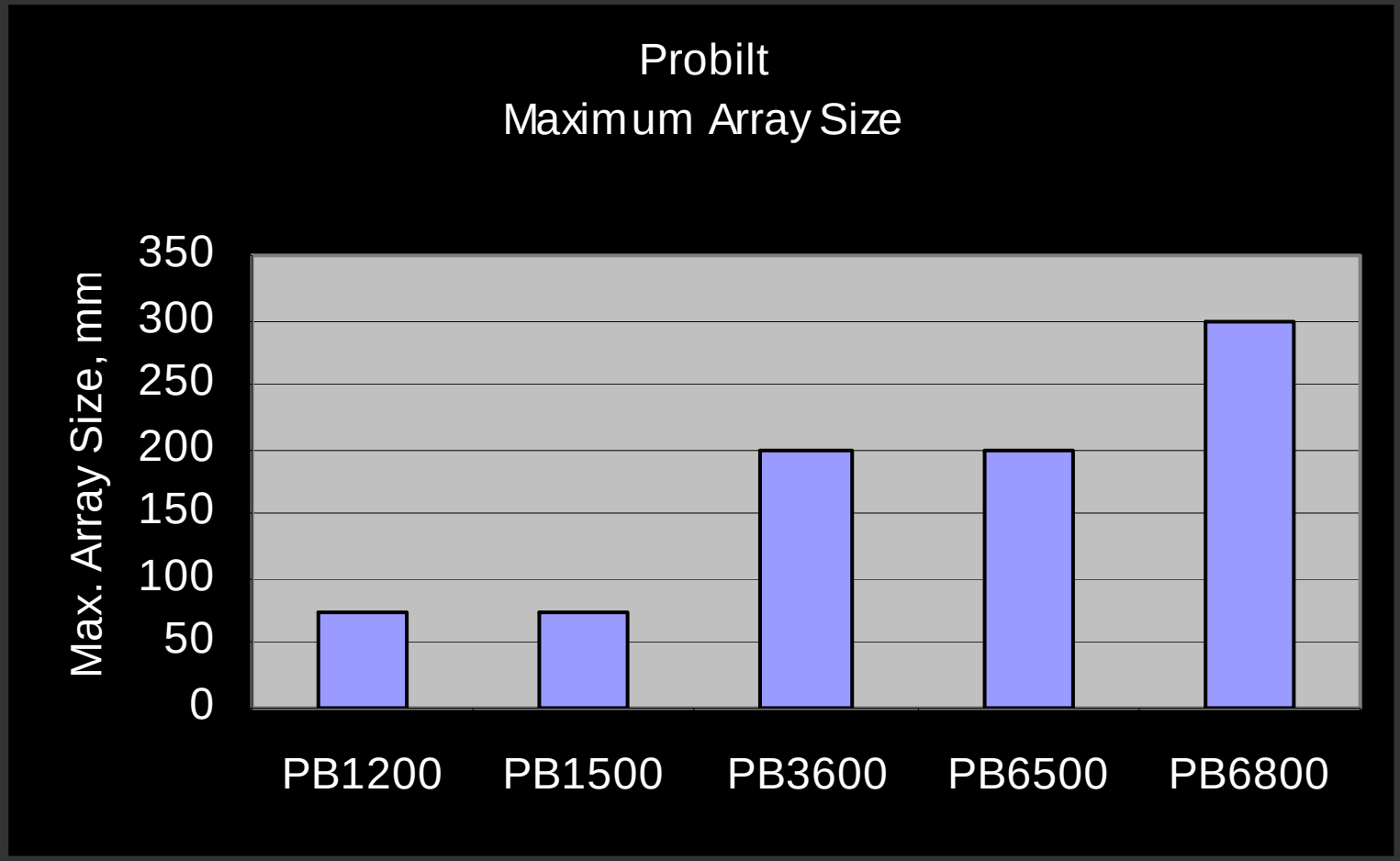
METROLOGY TOOLS

PB6500 WITH
PROBETRACKER

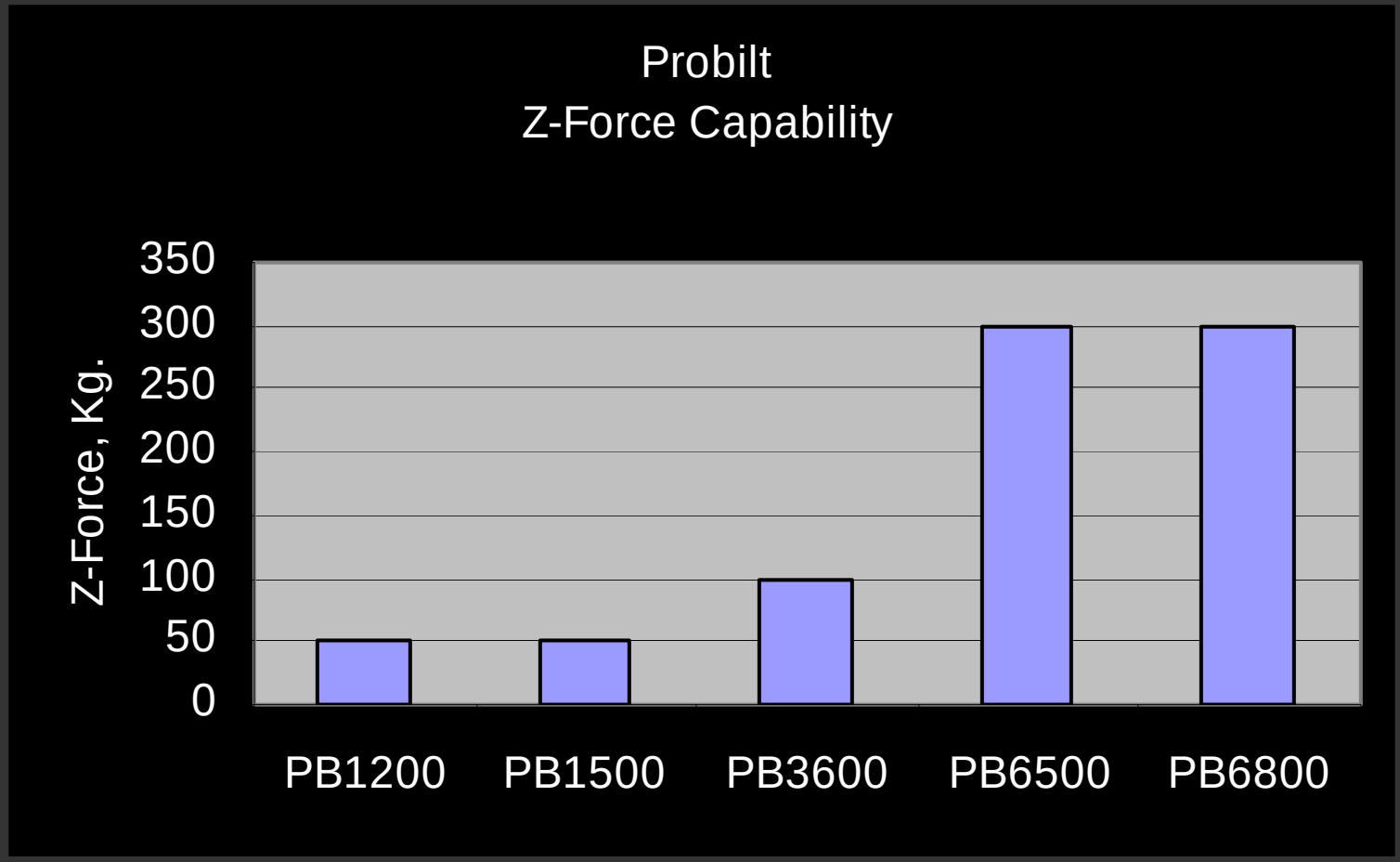
Relative Tool Pricing



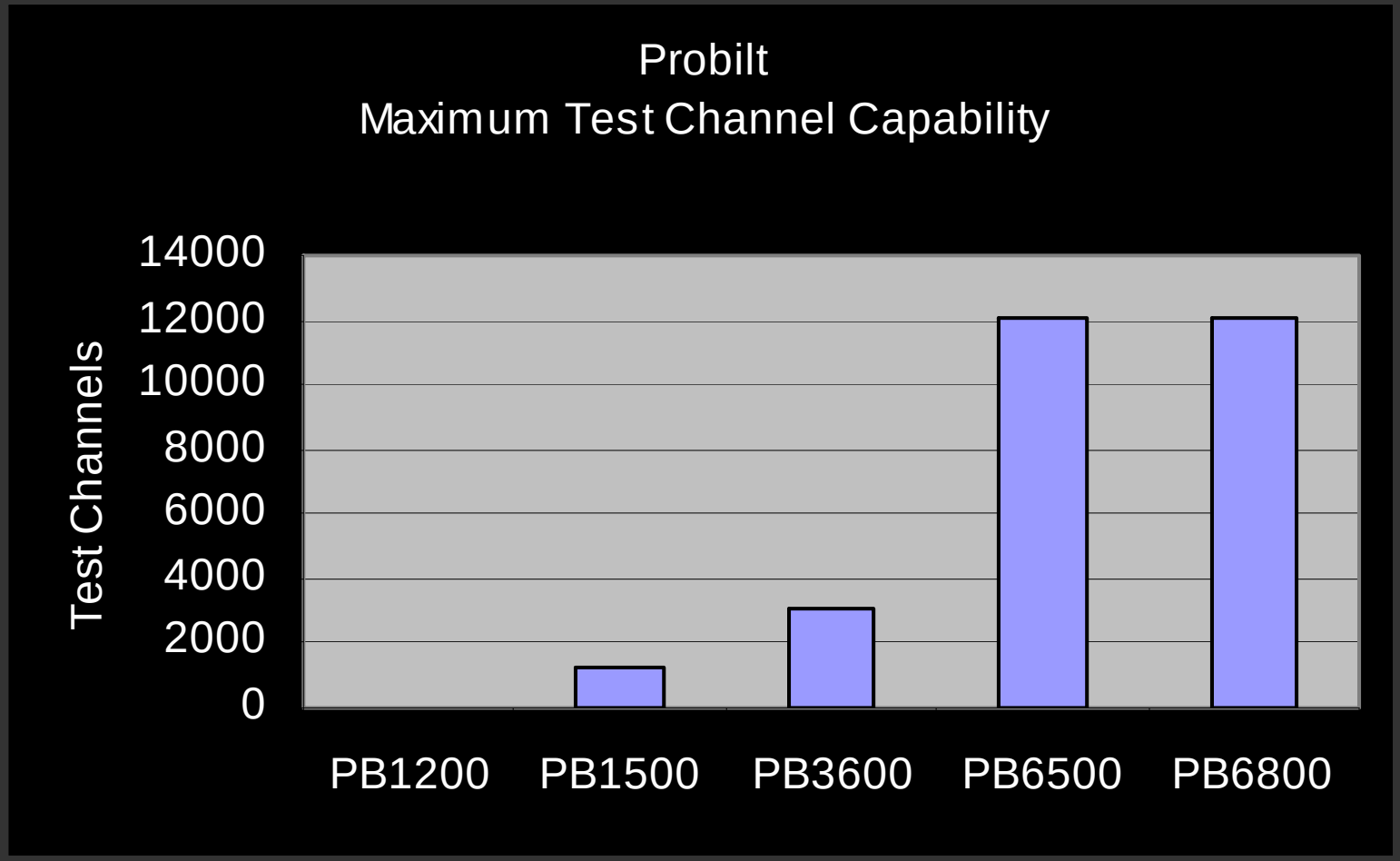
Maximum Probe Array



Maximum Probe Force



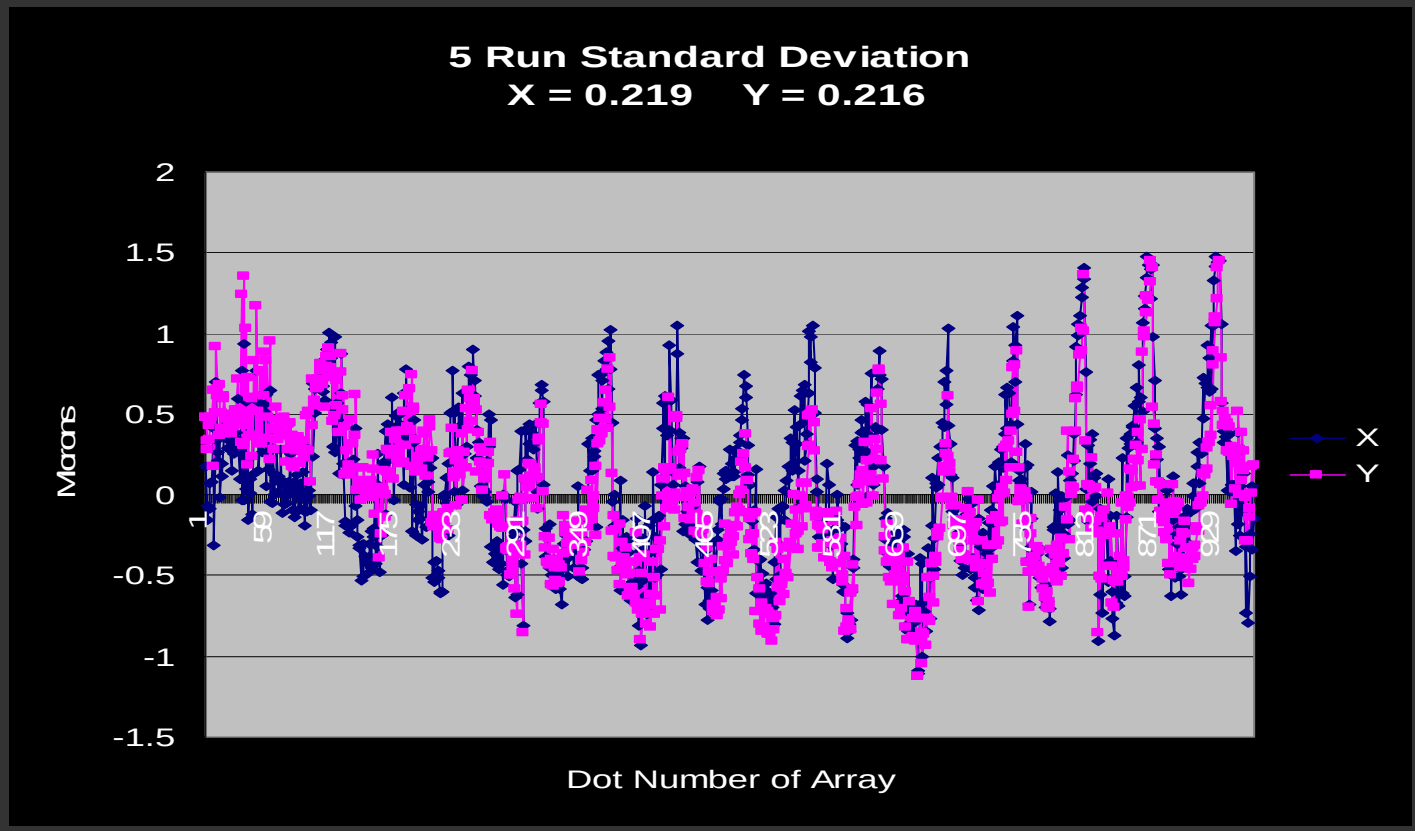
Maximum Test Channels



Data Presentation for Test 1

- The following data is the alignment accuracy & repeatability of 5 verification runs on the PB1500 using a NIST traceable glass photomask.

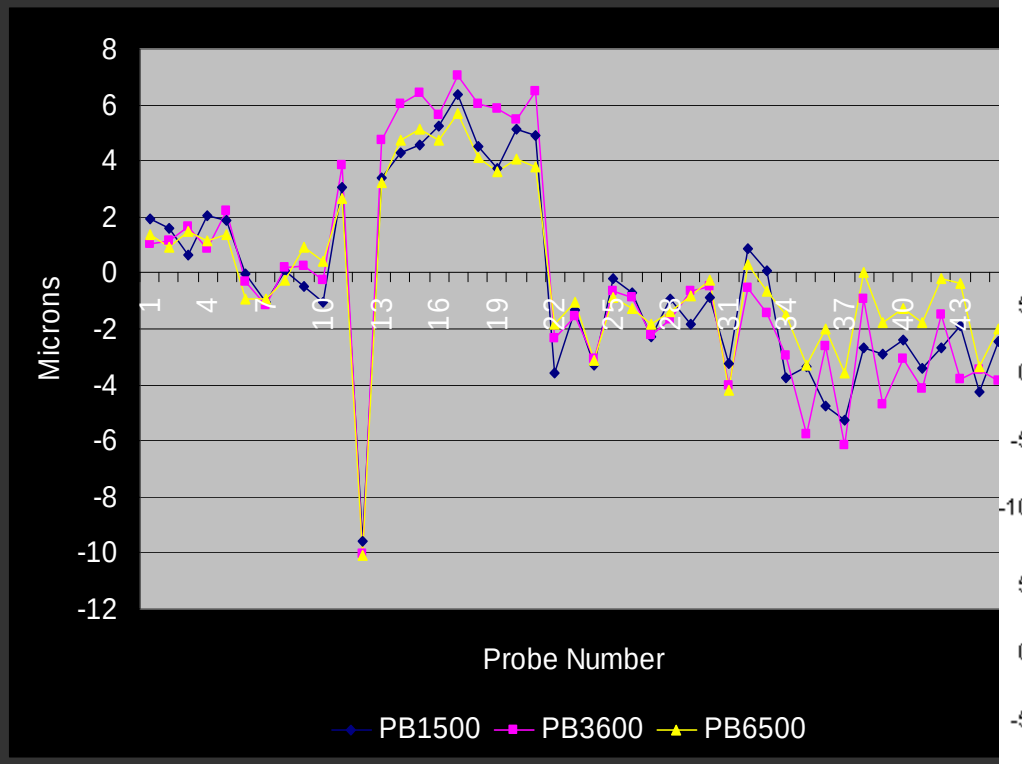
3” x 3” NIST X Y Alignment Verification

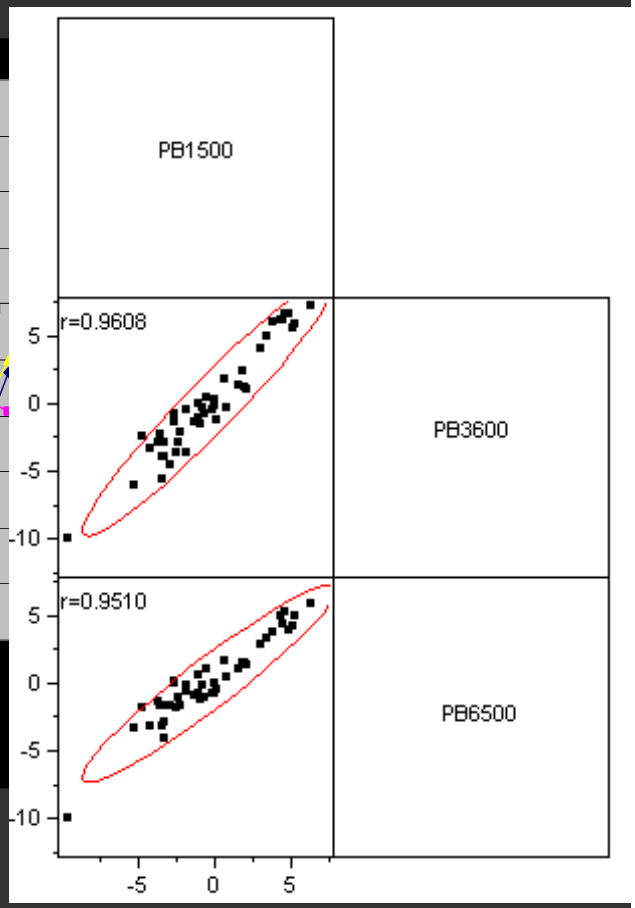


Data Presentation for Test 2

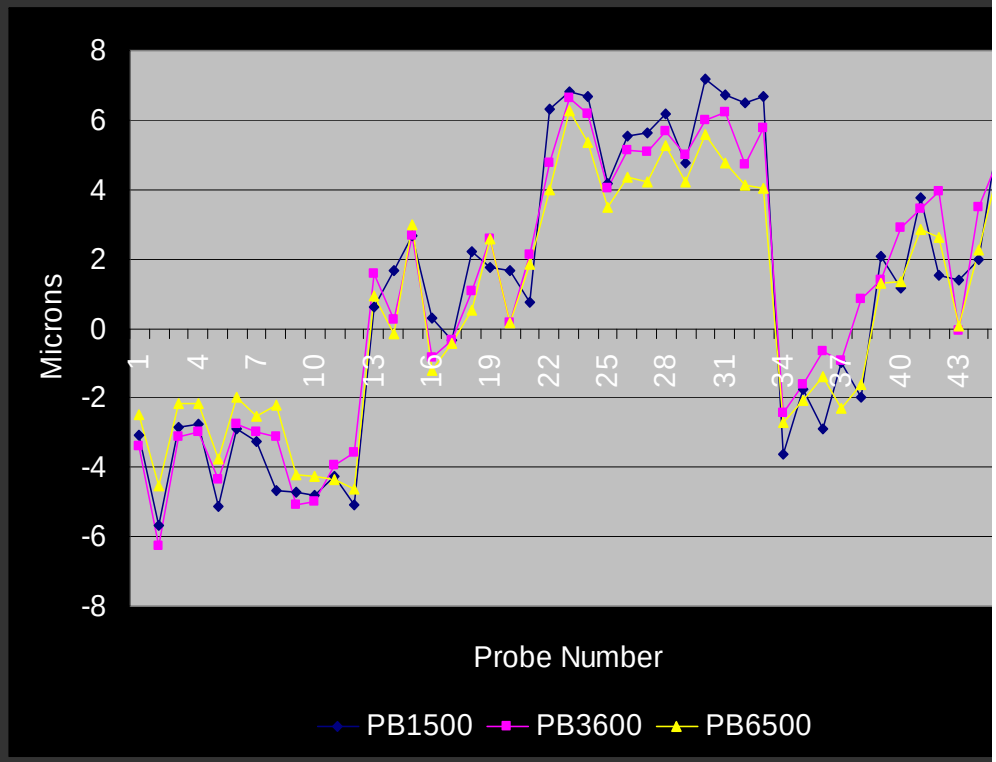
- The following slides show each test run on the PB6500, PB3600 and PB1500
- The probe card was cleaned before the tests were started but not between tests or machines
- No resistance or leakage nulling was used
- The card had two “leaky” probes

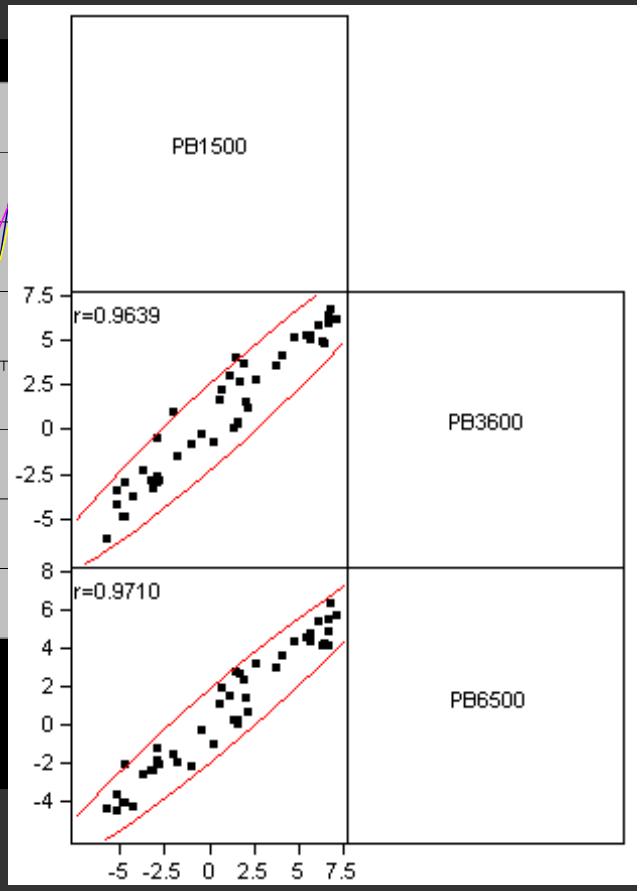
Alignment X Correlation



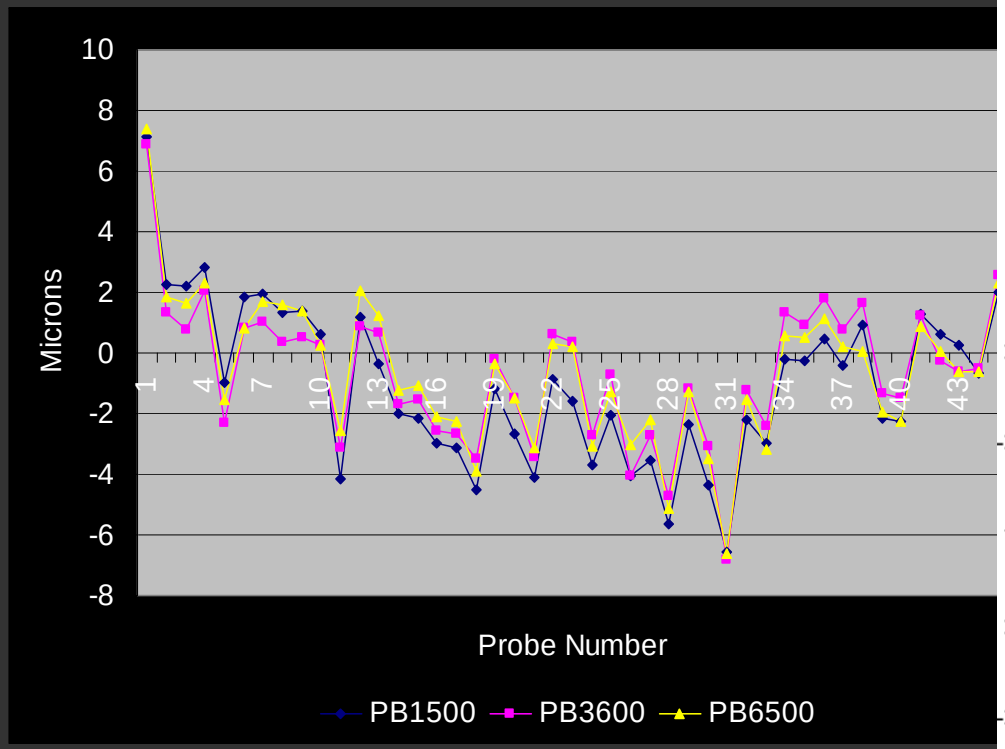


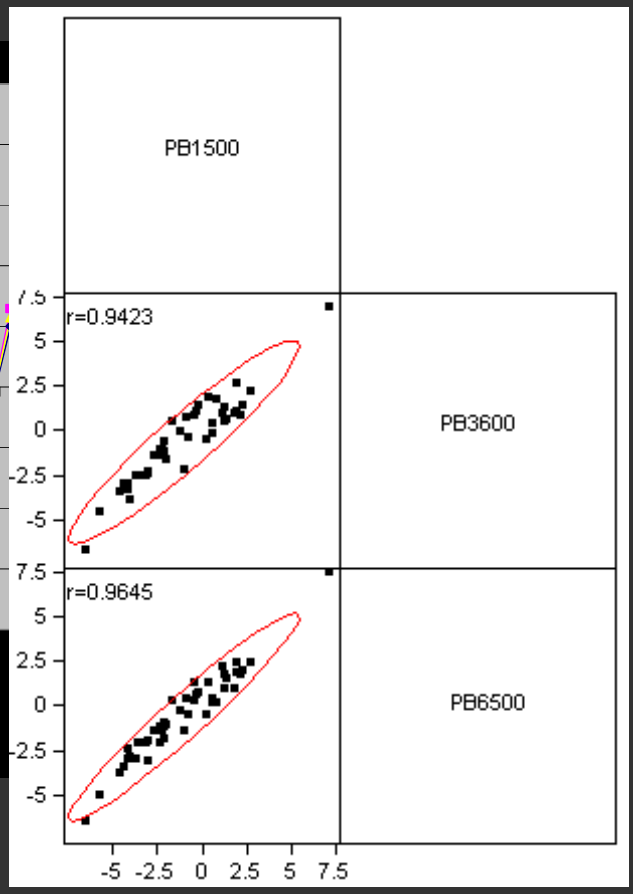
Alignment Y Correlation



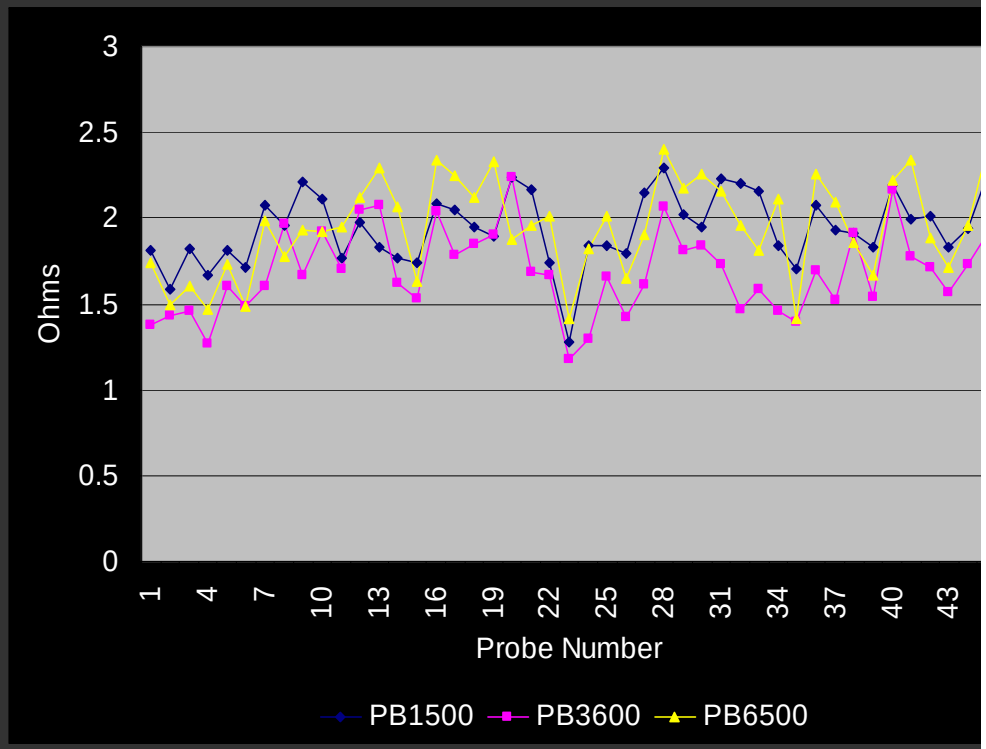


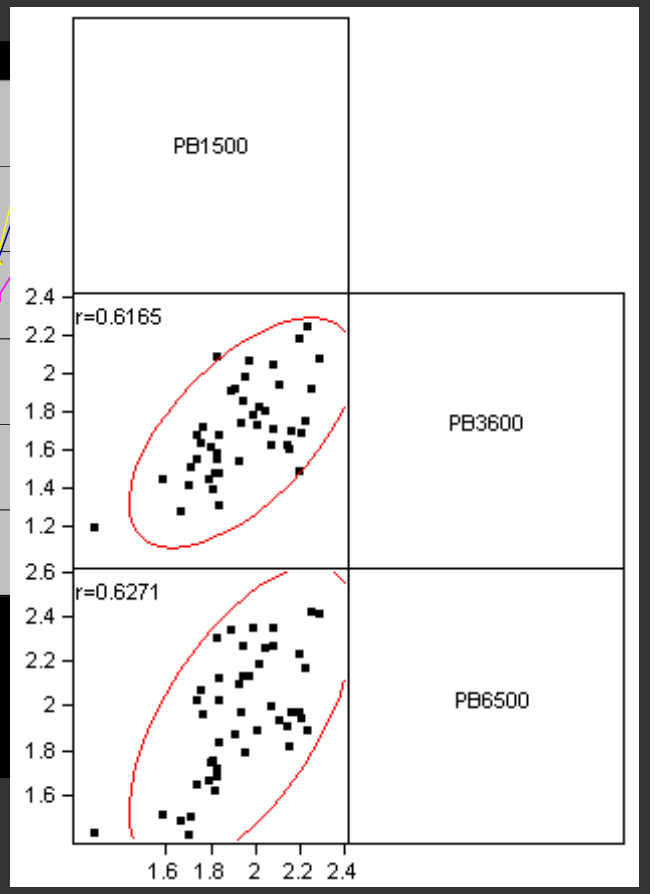
Planarity Correlation



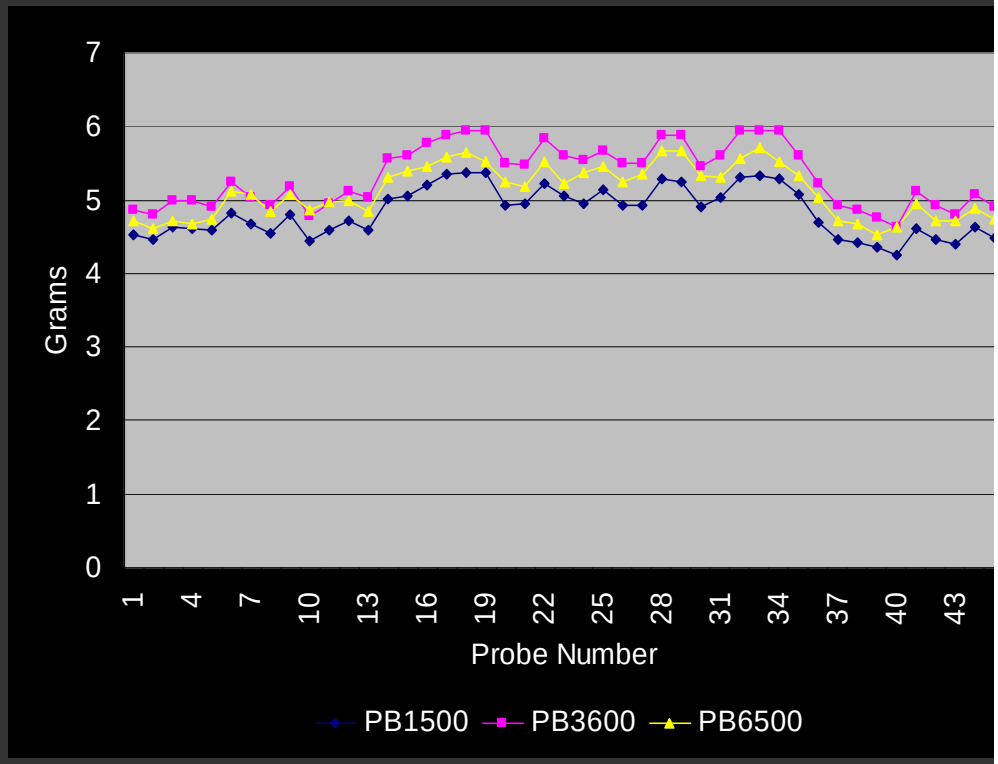


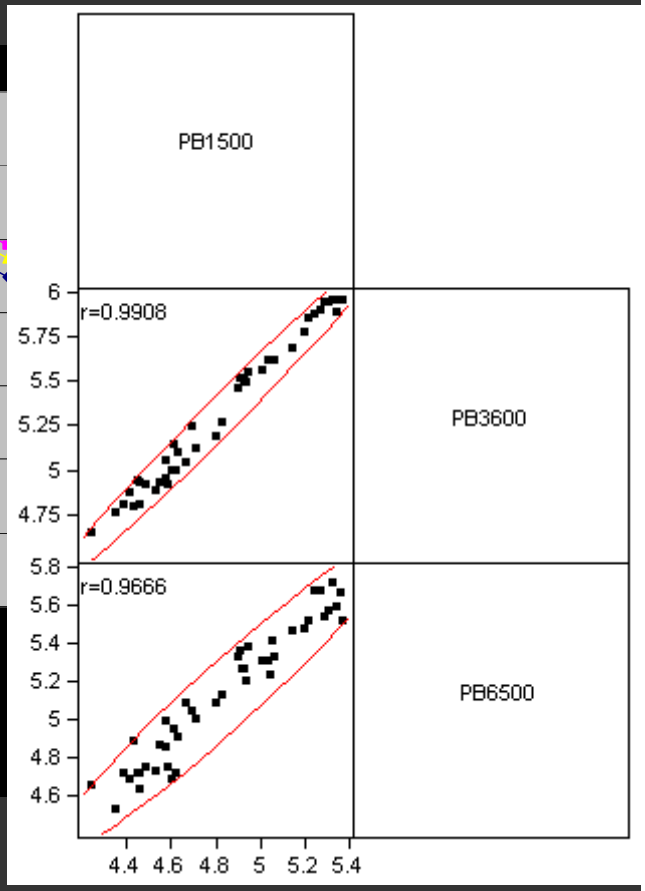
Contact Resistance Correlation



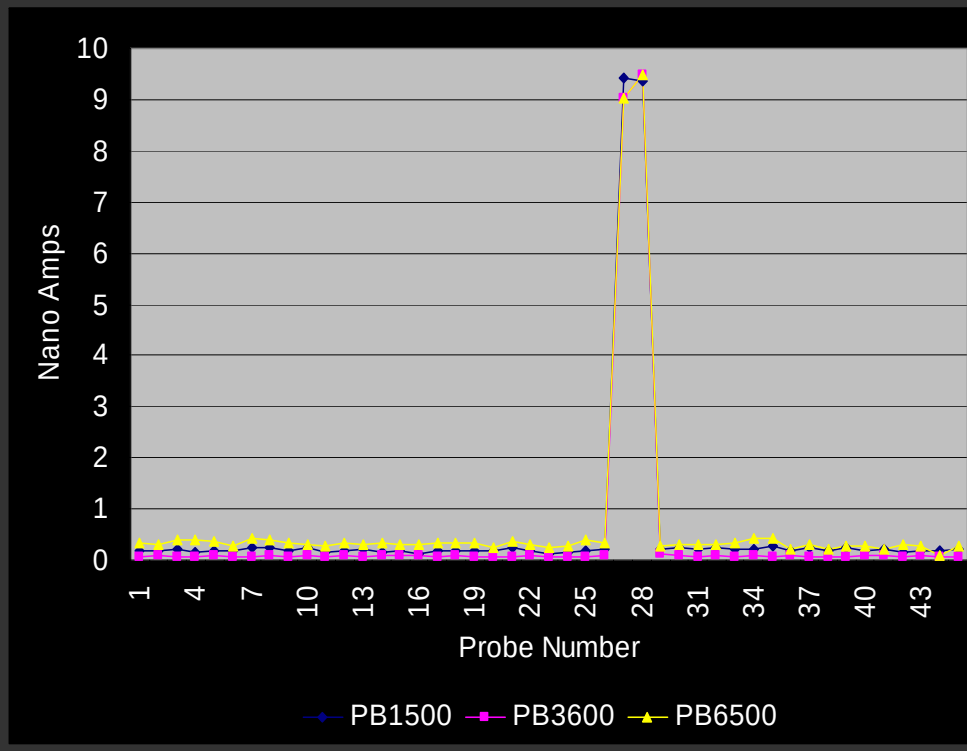


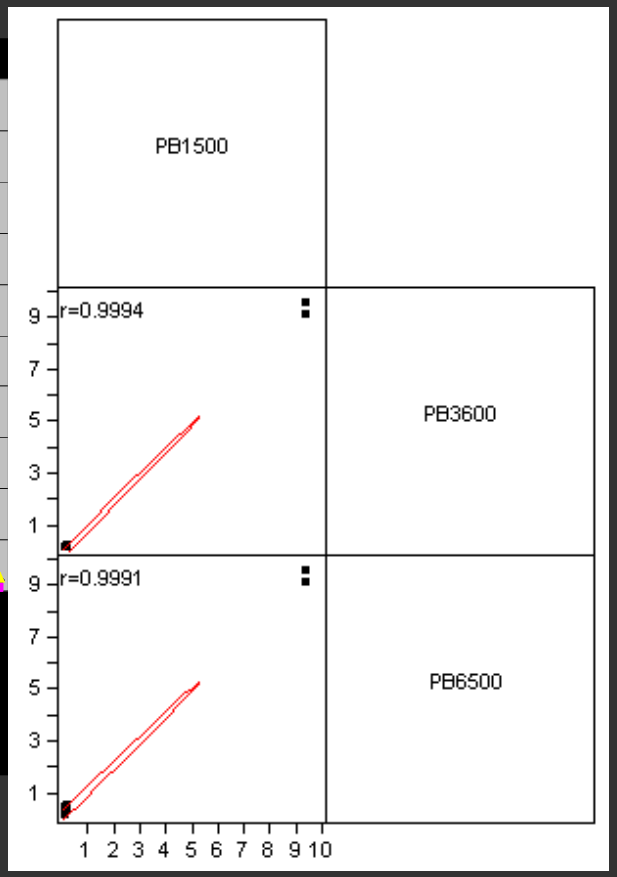
Gram Force Correlation





Leakage Correlation

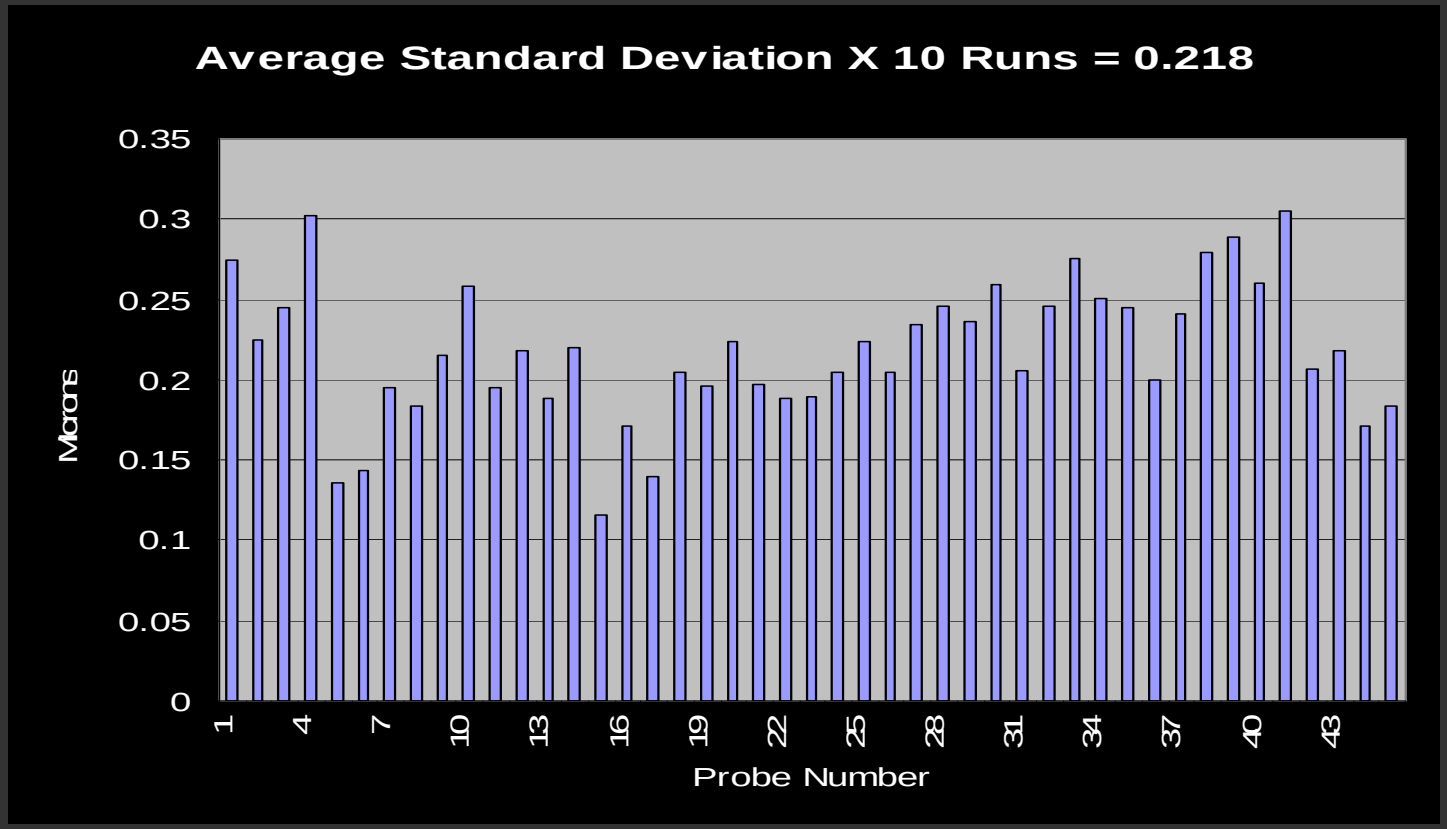




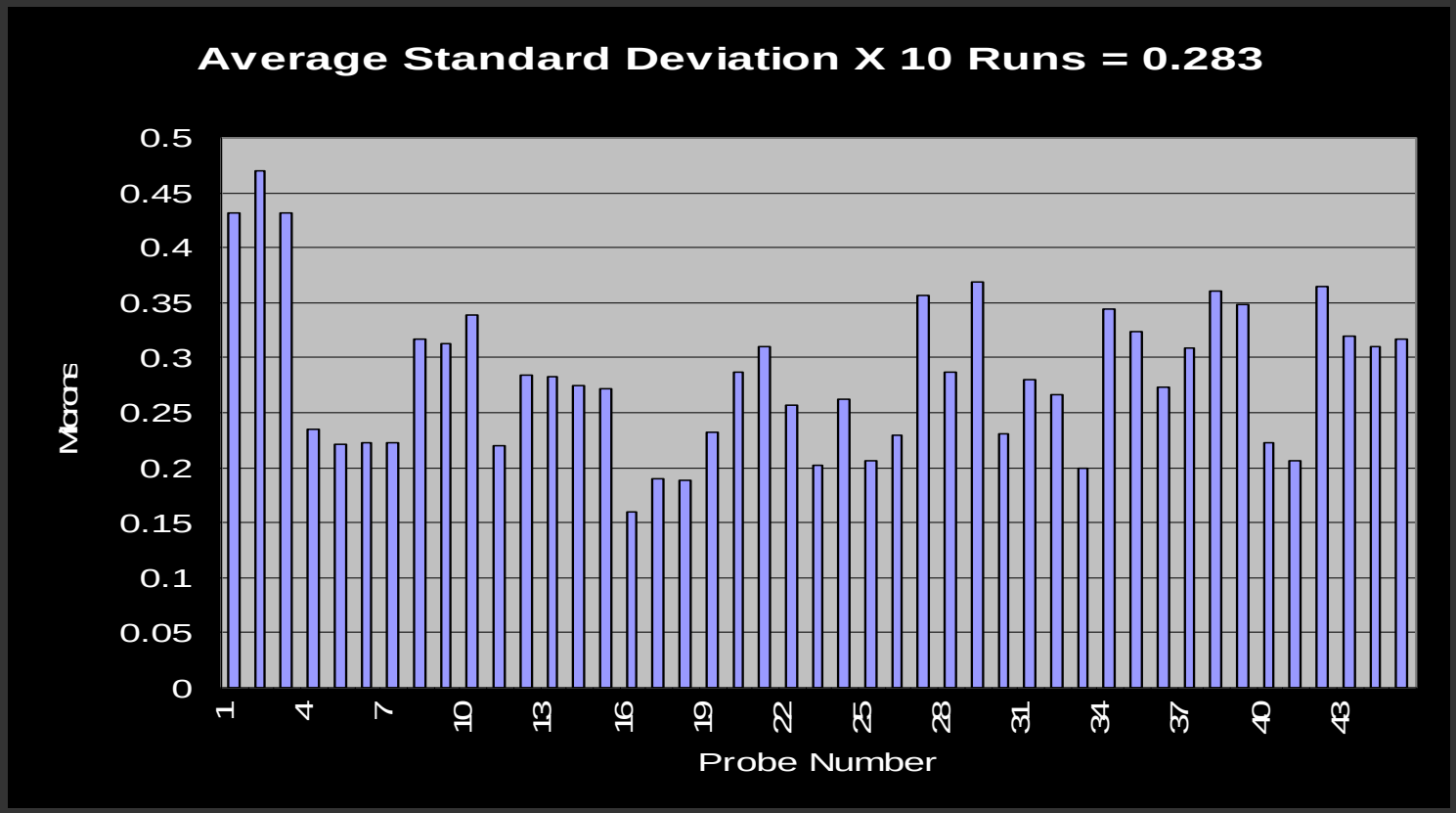
Data Presentation for Test 3

- The following data sets are the repeatability of each test performed ten times on the PB1500
- The card was not cleaned between tests
- No resistance or leakage nulling was used
- The card had two “leaky” probes

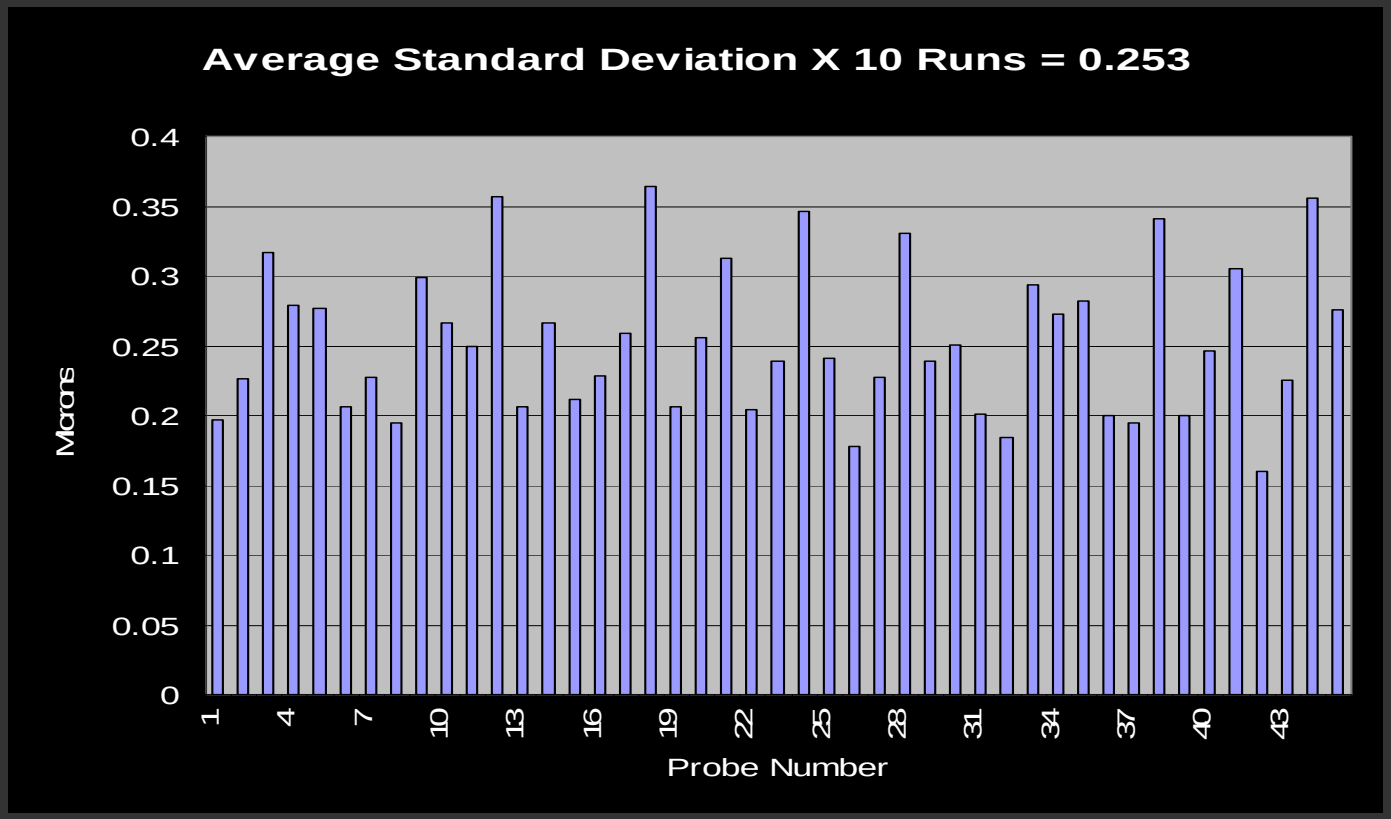
PB1500 Alignment X Repeatability



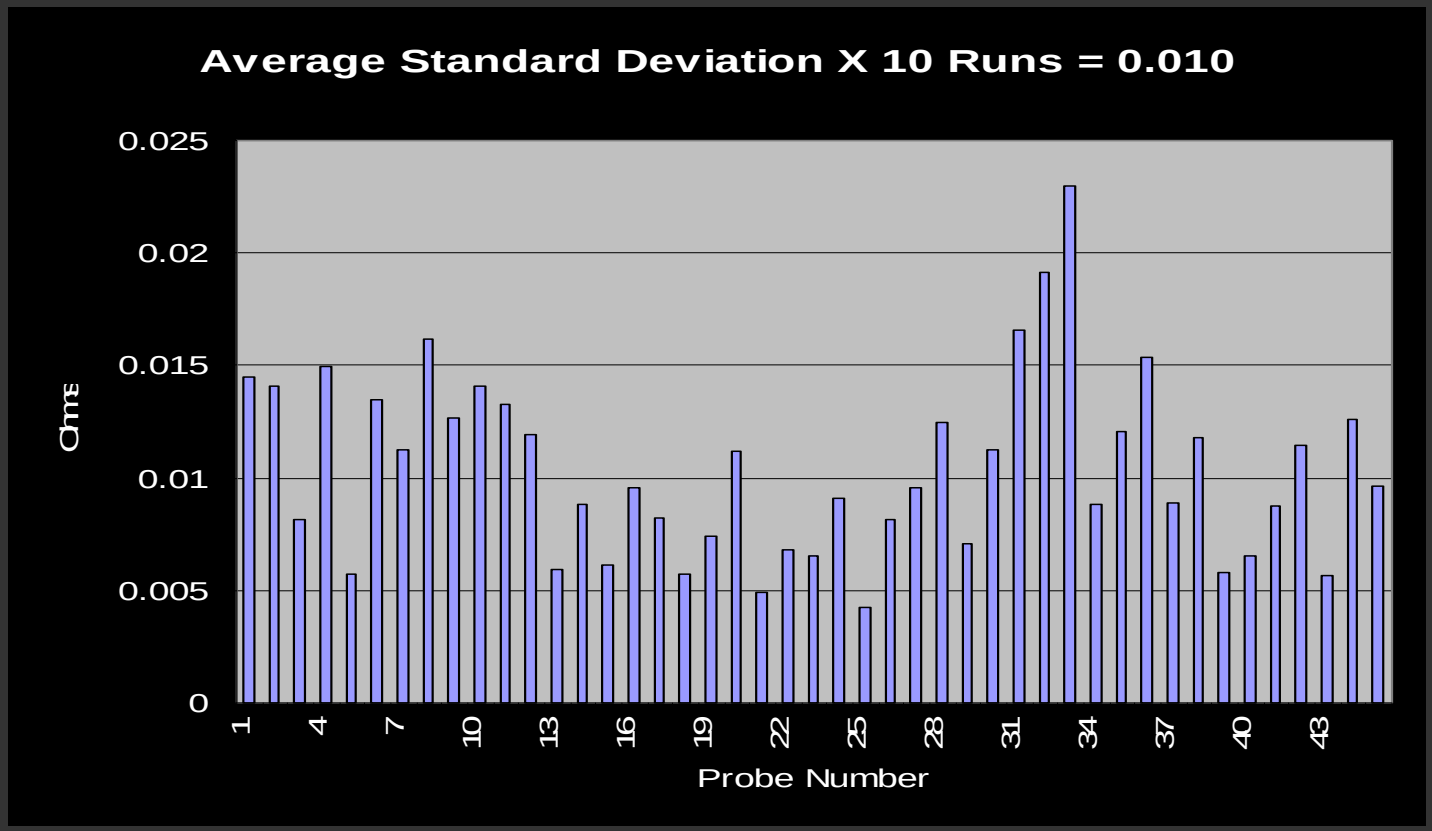
PB1500 Alignment Y Repeatability



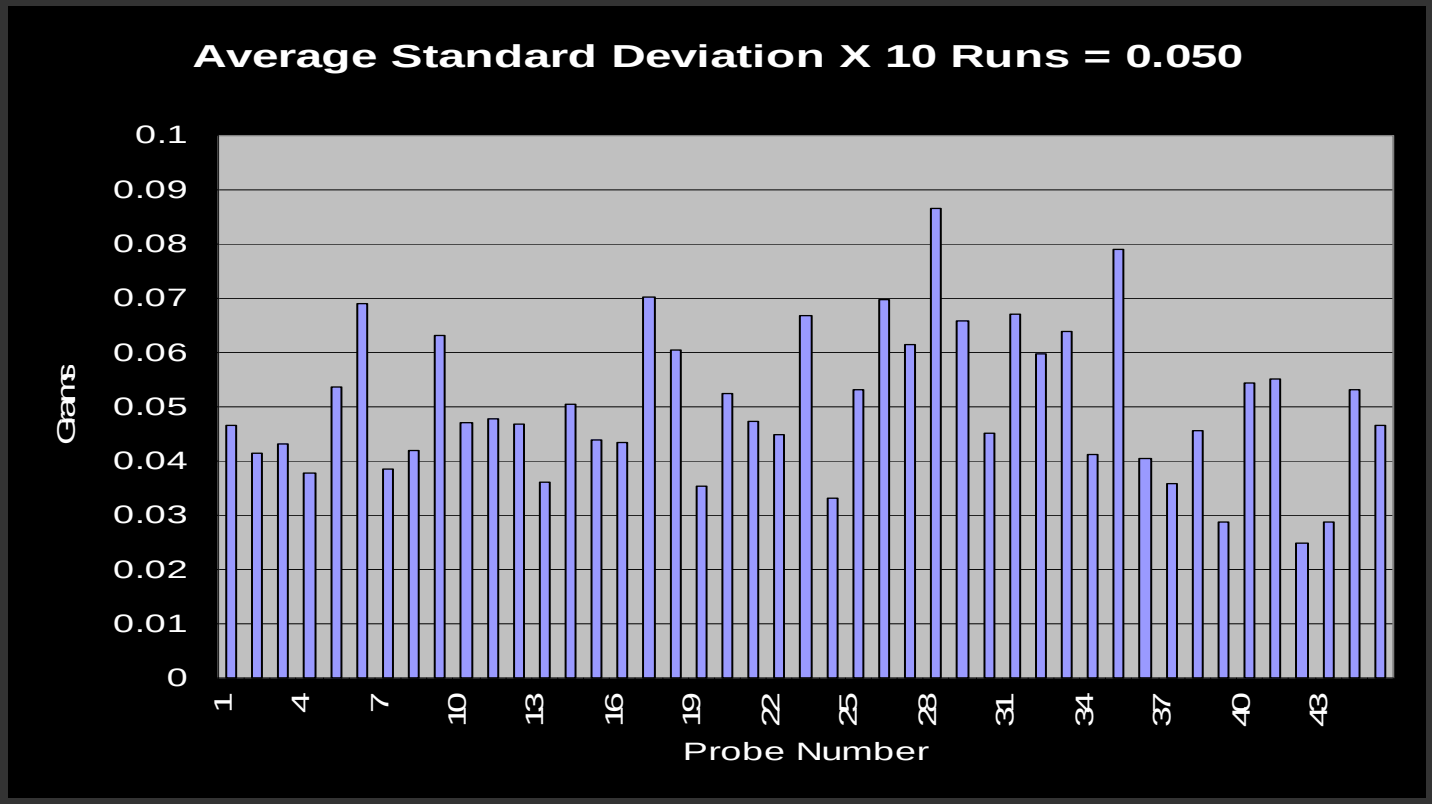
PB1500 Planarity Repeatability



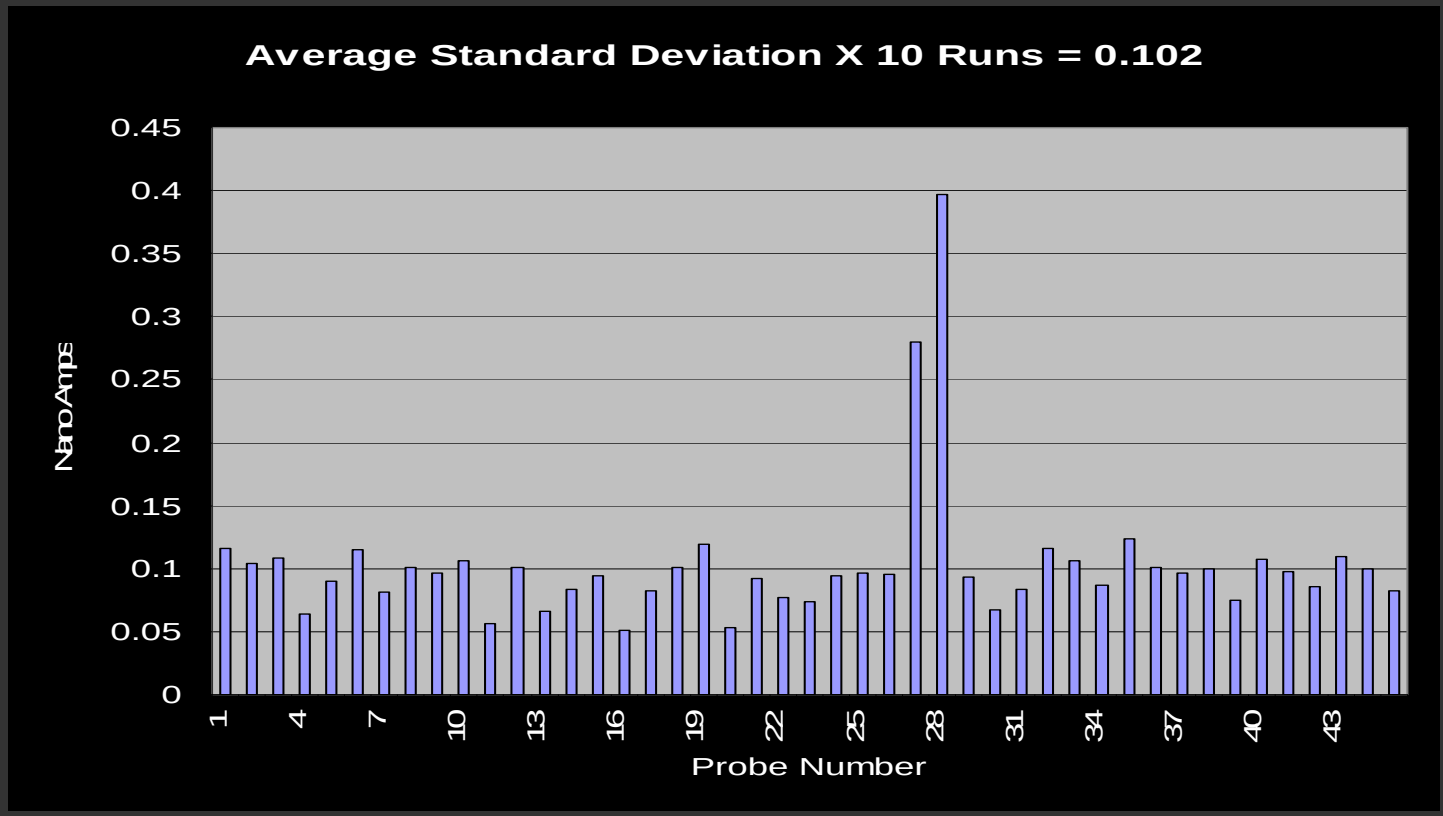
PB1500 Contact Resistance Repeatability



PB1500 Gram Force Repeatability



PB1500 Leakage Repeatability



CONCLUSIONS

- PB1500 repeatability demonstrates the same performance as the PB6500 and PB3600
- Correlation between the three tools is excellent
  - Cleaning the card between tests and running a resistance nulling to take out the path variance would improve the contact resistance correlation.
- Choosing the best tool for the application will give the best ROI
- A probe card test area could contain multiple different tools without impacting accuracy or correlation.

Acknowledgements

- Lee Sipler – ITC applications engineer – Testing
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