INTEGRATED TECHNOLOGY CORPORATION

Providing Leading Edge Technology to Meet Your Future Requirements

New Approaches to Epoxy Ring & Shelf Card Maintenance

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Credits

- Matt Lauderdale, Motorola
- Todd Schnack, Spire
- John Darbyshire, Probe 2000
- Kris Dabrowiecki, Probe 2000
- Intel Corporation

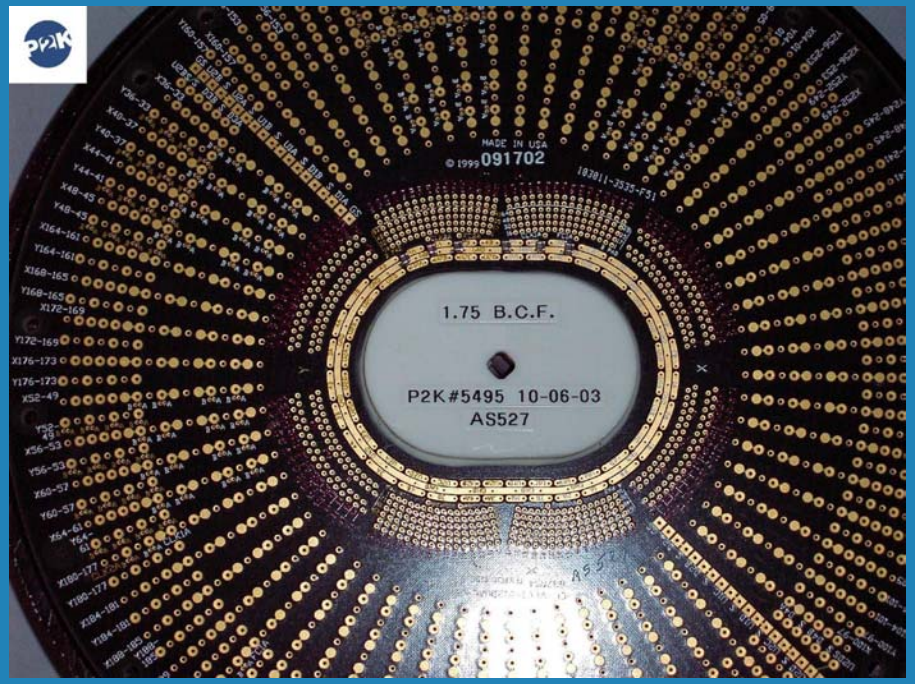
Purpose

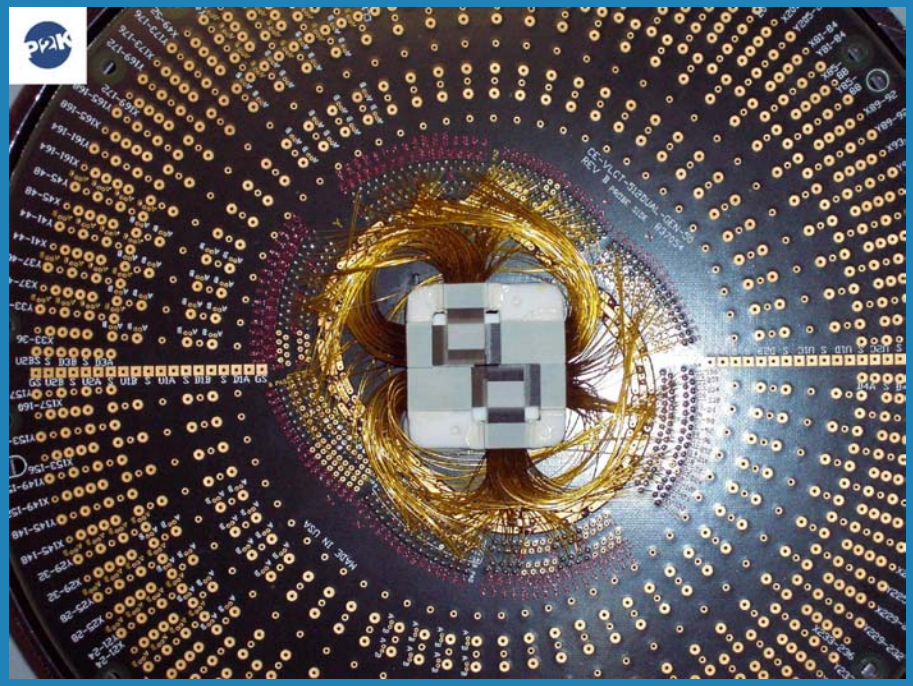
- Overview of P&A Process
- Discuss Requirements for Various Technologies
- Baseline Present Techniques
- Establish Economic Guidelines
- Present New Methods & Equipment
- Define Potential Savings

Standard Technology

- Epoxy Ring Technology
  - Still the Largest Volume
  - 85% of cards are below 300 pins
  - Requires Initial P&A in construction
  - Requires Regular P&A Adjustments in use
  - Pitch is Getting Tighter
  - Multiple Levels of Probes
  - Repair from Top Side Difficult or Impossible
    - Shelf Cards

Shelf Card





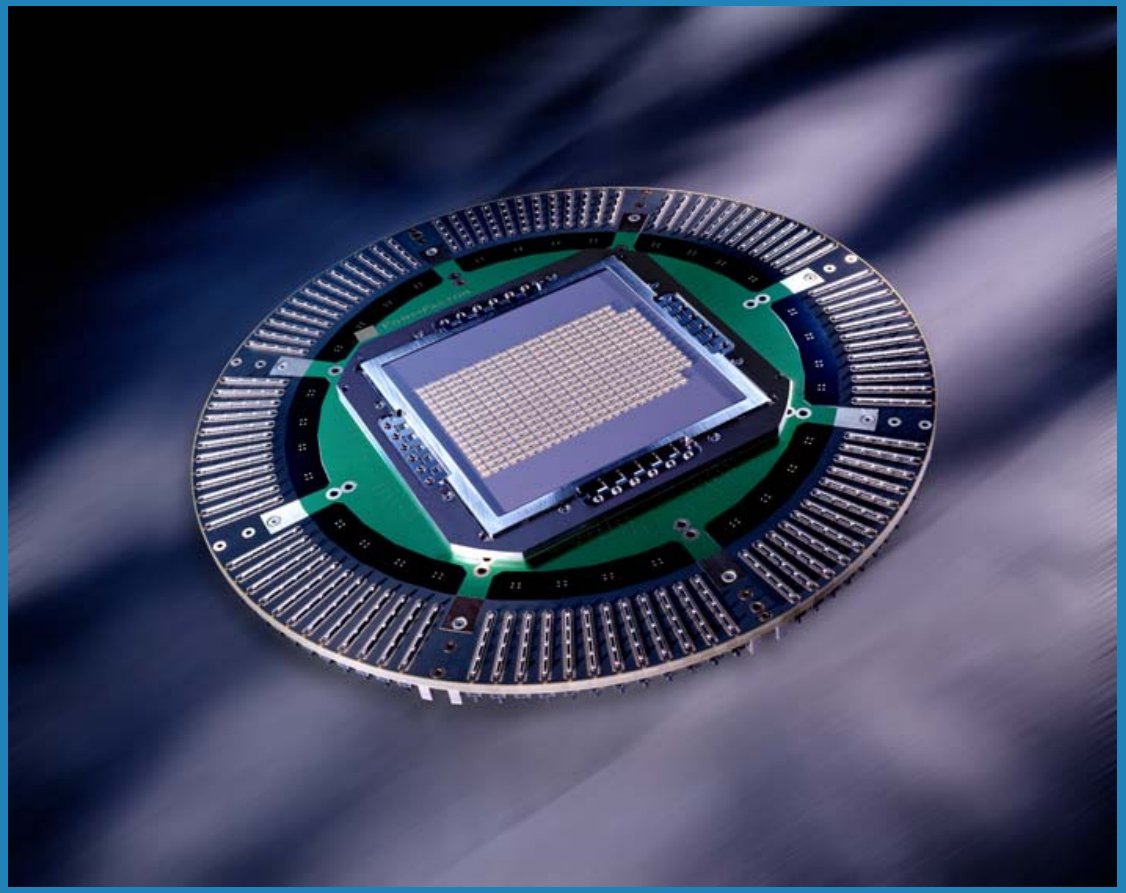
High Technology

- Cobra & Resilient Contact Cards
  - Large Number of Probes (Typical)
  - Array Formats
  - Minimal Adjustment/Repair Capability
  - Access from Bottom Only

High Technology Test/Repair

- Large Number of Probes in Array
- Very Difficult to Find a Probe
- Must be able to Remove Burned Probes
- Probe Inspection Required
- Minor Alignment Adjust/Cleaning
- Various Tip Geometries
- Must flip to Retest Results

Resilient Contact Card



Typical P&A Process

- Test P&A with Probe Card Analyzer
- Identify Failing Probes to Adjust
- Flip Card Tips Up for Inspect/Adjust
- Adjust Plan. and/or Align. (if possible)
- Flip Card Tips Down & Retest
- Repeat Process until all Probes Pass
- Perform Full Outgoing Test

Probe Card Mfg.

- Large Number of Diff. Card Types
  - MB costs are very high
  - Alignment on Analyzer is Costly
- New Cards Main Business
  - Repair is secondary
- Align. of New Card Largest Cost
  - Planarity sanded to tolerance
  - Simple Aligners + Analyzer Test/Final

Probe Card Mfg: Test/Repair

	Card Mfg A	Card Mfg B	Card Mfg C	Card Mfg D
Card Size	300 probes	300 probes	500 probes	1000 probes
% Prb's Rep.	10-30%	10-20%	10-20%	10-20%
P&A Time	3-4 hrs	4 hrs	8 hrs	12-16 hrs

Independent Dev. Mfg. (IDM)

- Fewer Types of Cards
  - MB Cost Not as Important
- Incoming Inspection Critical
- Test/Repair is Main Function
  - Both Alignment & Planarity Adjusted
- Repair Turnaround is Critical
- Historical Data is Important

IDM/Test Service: Test/Repair

	IDM A	IDM B
Card Size	200 probes	300 probes
% Prb's Rep.	30%	10%
P&A Time	60 min	72 min
Time/Probe	1.0 min/prb	2.4 min/prb

Repair Profiles

- **Probe Card Manufacturer**
  - ≥90% of Problems are Alignment
  - ≤10% of Problems are Planarity
- **IC Manufacturer/Test Service**
  - ≈65% of Problems are Alignment
  - ≈25-30% of Problems are Planarity
  - ≈5-10% Leakage, Components, GF, Etc

Typical P&A Times

- **Probe Card**
  - 300 Probes, 20% bussed
  - Alignment Spec: +/- 7.5u
  - Probes to Adjust: 25% x 300 = 75
  - Time to Adjust: 1-3 min/probe
- **Total Repair Time**
  - Setup + Test: 30 minutes
  - Adjust/Repair: 75-225 minutes
  - Final Test/Tear Down: 45 minutes

Epoxy P&A Problems

- Locating the Correct Probe
  - Typically Must “Count Probes”
  - Cannot stop without Losing Place
  - Easy to Miss & Adjust the Wrong Probe
- No Reference for Adjustment
- Must Flip to Retest Results
- Consumes Valuable Analyzer Time

Improved Repair System

- Tips Up P&A and/or Inspection
- Absolute Reference
  - Move to Specific Probe
  - Show Correct Probe Location
    - P&A Adjustment Reference
- Retest/Verify Results W/O Flip
  - Test in “tips-up” position

Probilt® Tips Up Repair

- Three Practical Approaches
  - ProbeTracker™ Option
  - PB1500 Low Cost Tips Up Analyzer & Repair Station
  - PB1200 Low Cost Tips Up Repair Station

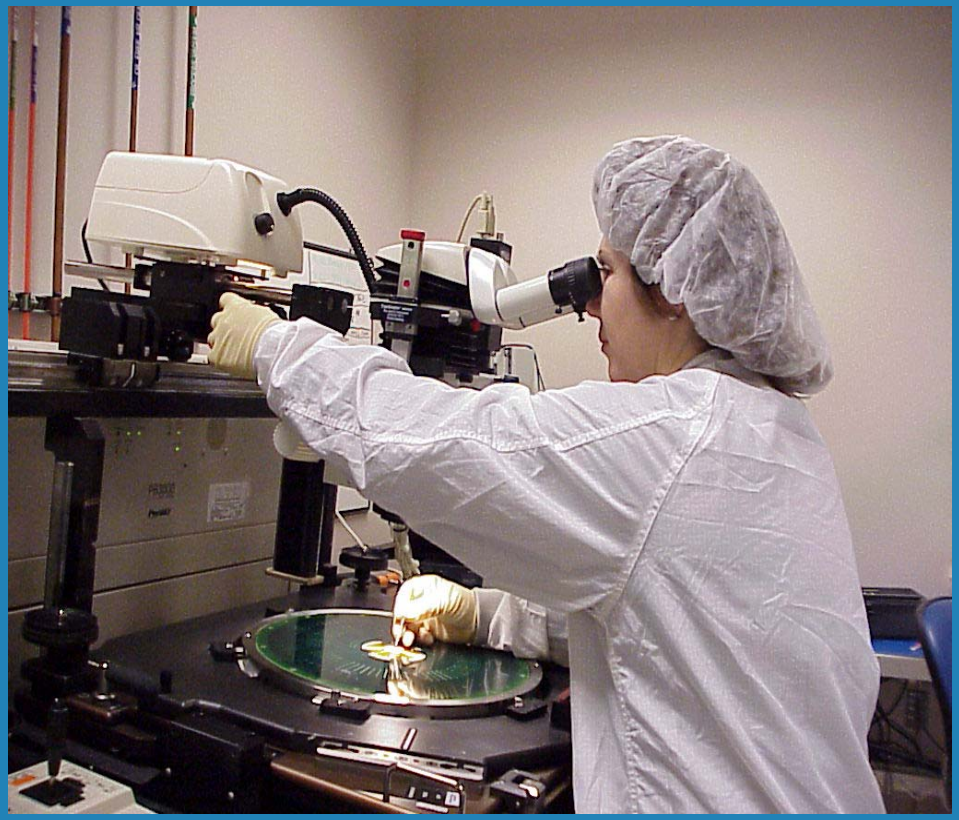
Probilt® ProbeTracker™

- Software Controlled Microscope
- Provides Tips Up Align Reference
- Provides Tips Up Retest/Verify
- Option Available on Probilt®
  - PB3500
  - PB6500

Ergonomic issues

- Std Manual scope has an extended reach allowing for an improper ergonomic reach and stance.
- This places strain on the arm and spine over an extended period of time.
- To prevent the strain the technician must take a break every 15 min. for a period of 5 min.
- On a card taking 90 min repair time this extends the repair by 30 min.

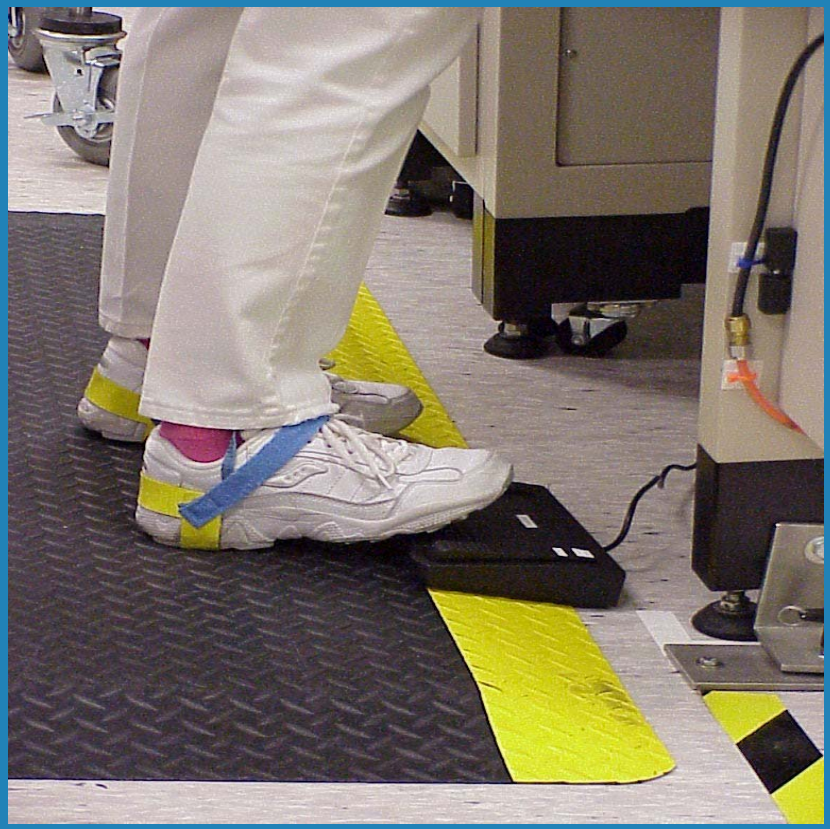
Manual Microscope



Improved ergonomics

- The foot pedal used with the Probe Tracker allows hands free probe tweaking (repair) by the technician. Correct ergonomic use and allows for a faster TPT on repairs.
- Movable pedal allows for variations of standing positions or seating.

Improved Ergonomics

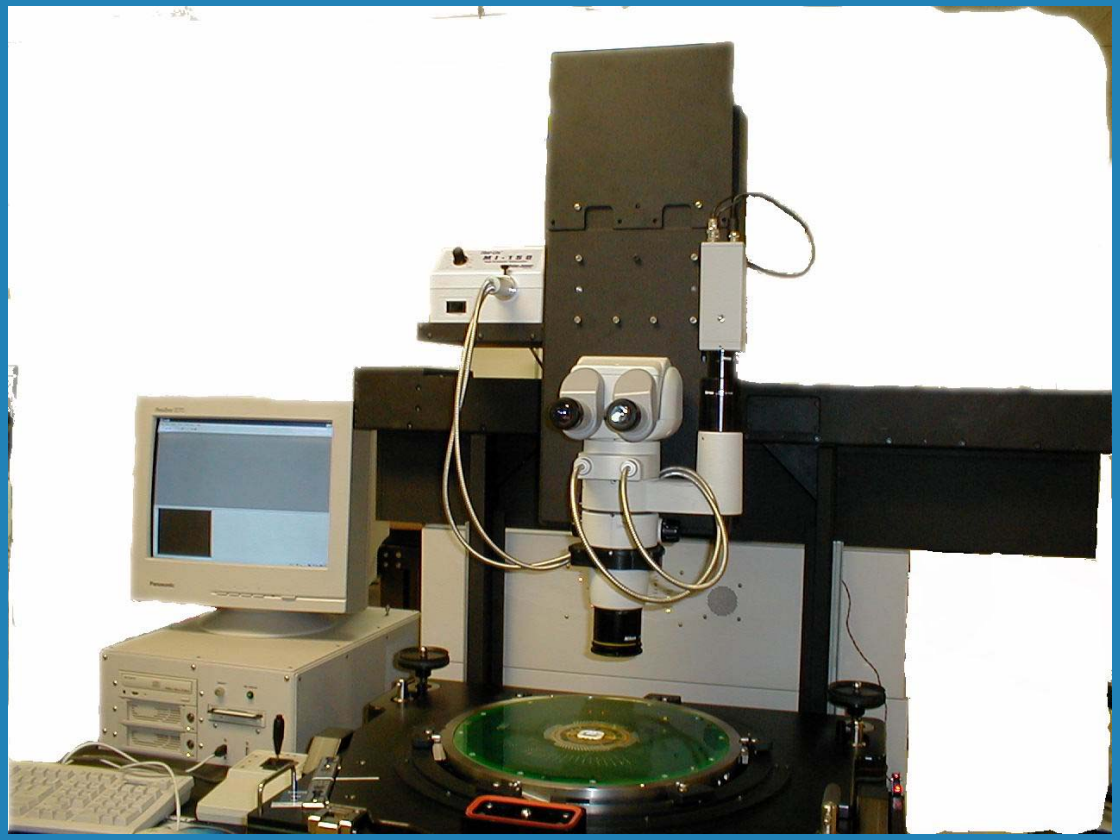


Improved Ergonomics

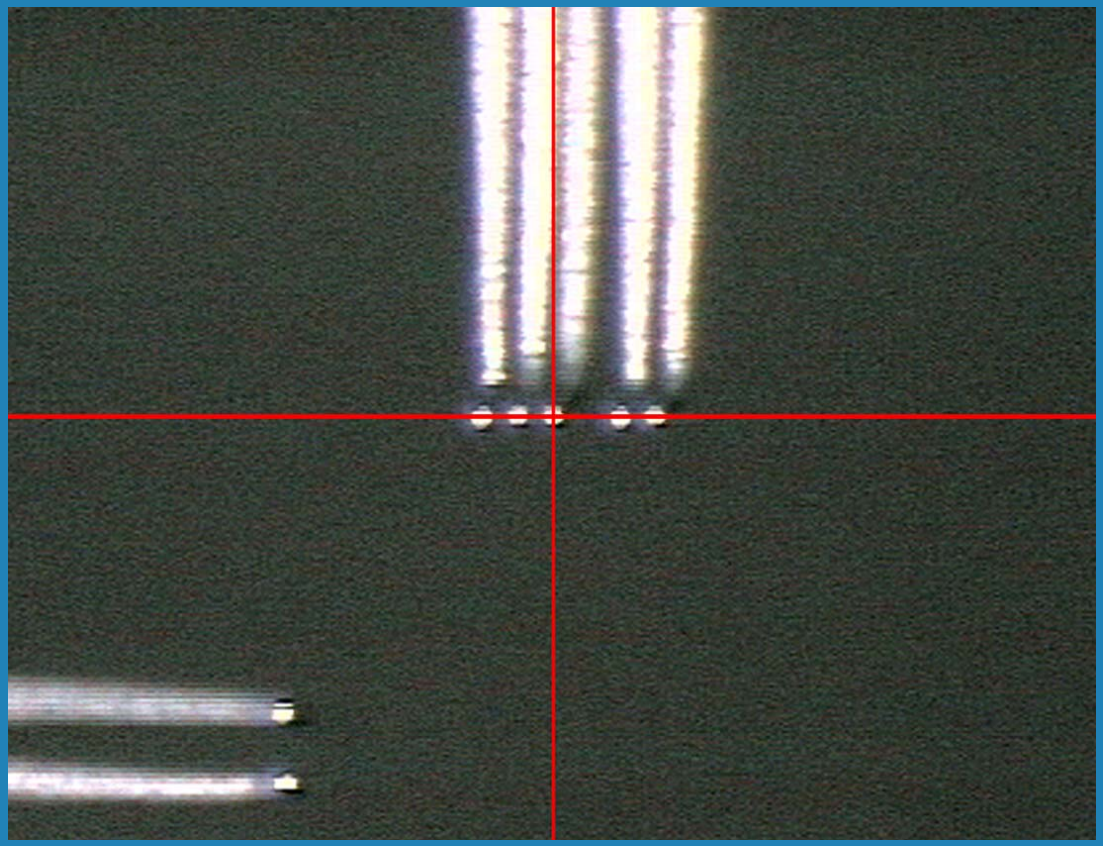
- Hand controls allows for quick access for multi functions on the Probe Tracker
- Initial set-up using the joystick takes ~5 (technician dependant) min. preventing the extended reach, not like on the Std. Manual microscope.

Improved Ergonomics

ProbeTracker™



ProbeTracker™ Repair View



Evaluation Program

- Comparison of Methods
  - Standard Analyzer Approach – PB3500
  - PB3500 with ProbeTracker™
- Repair Time for Each Method
- Retest Data After Repair
  - % Errors in Adjustments
  - Overall Accuracy of Adjustments

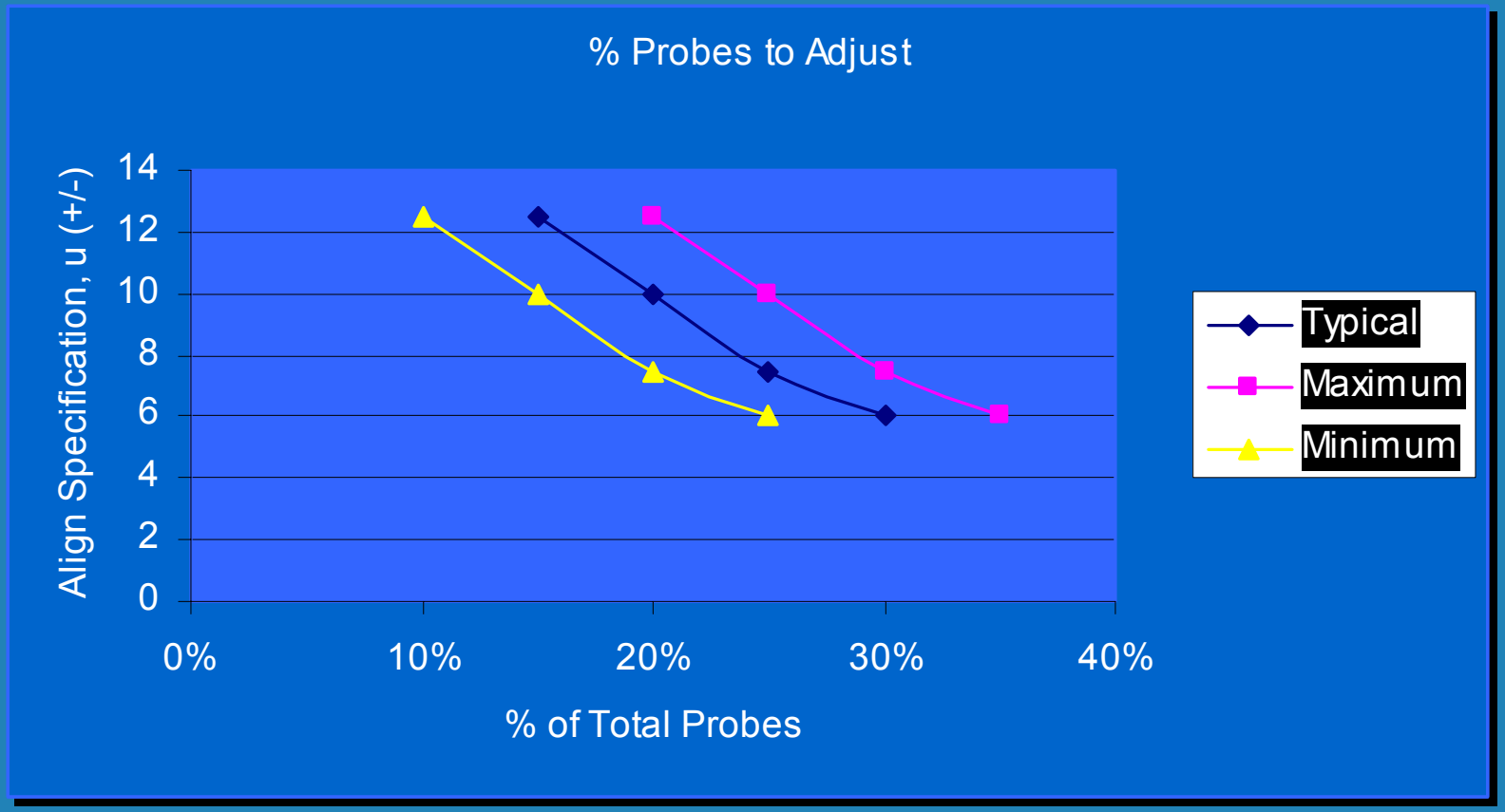
Test Procedure

- 400 Probe Test Card
  - Select Probes to Adjust
  - Move the Probes Out of P&A
- Test Technicians Repair Card
  - Using Standard PB3500 Analyzer
  - Using PB3500 with ProbeTracker™
  - Data taken with two technicians

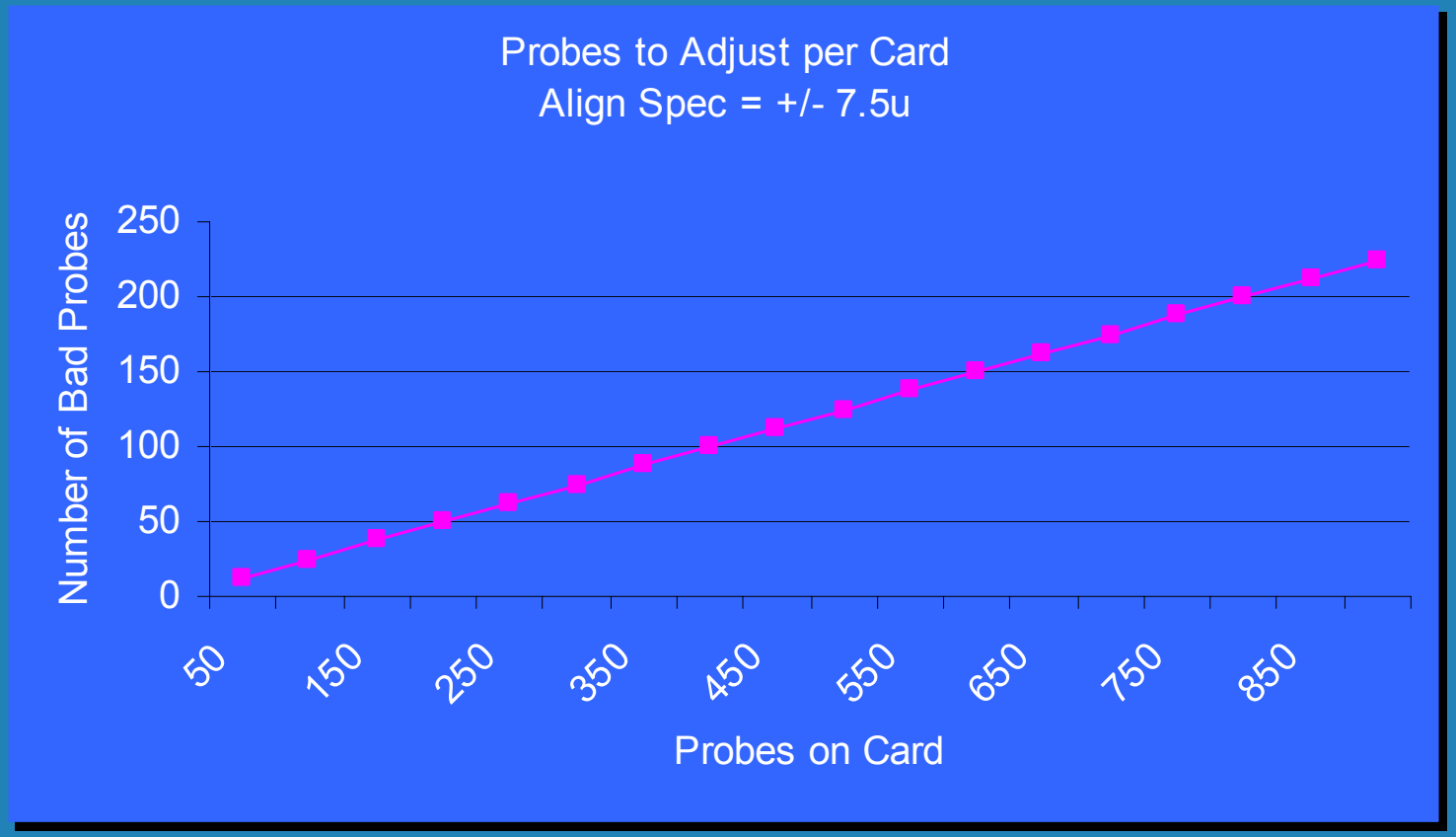
Repair time comparison

Parameter	Operator 1	Operator 2
Std. Manual Scope		
No. of probes repaired	27	20
Total Time	72 minutes	52 minutes
Time/proe	2.6 minutes/probe	2.6 minutes/probe
ProbeTracker Ultra		
No. of probes repaired	50	54
Total Time	66 minutes	89 minutes
Time/proe	1.3 minutes/probe	1.64 minutes/probe

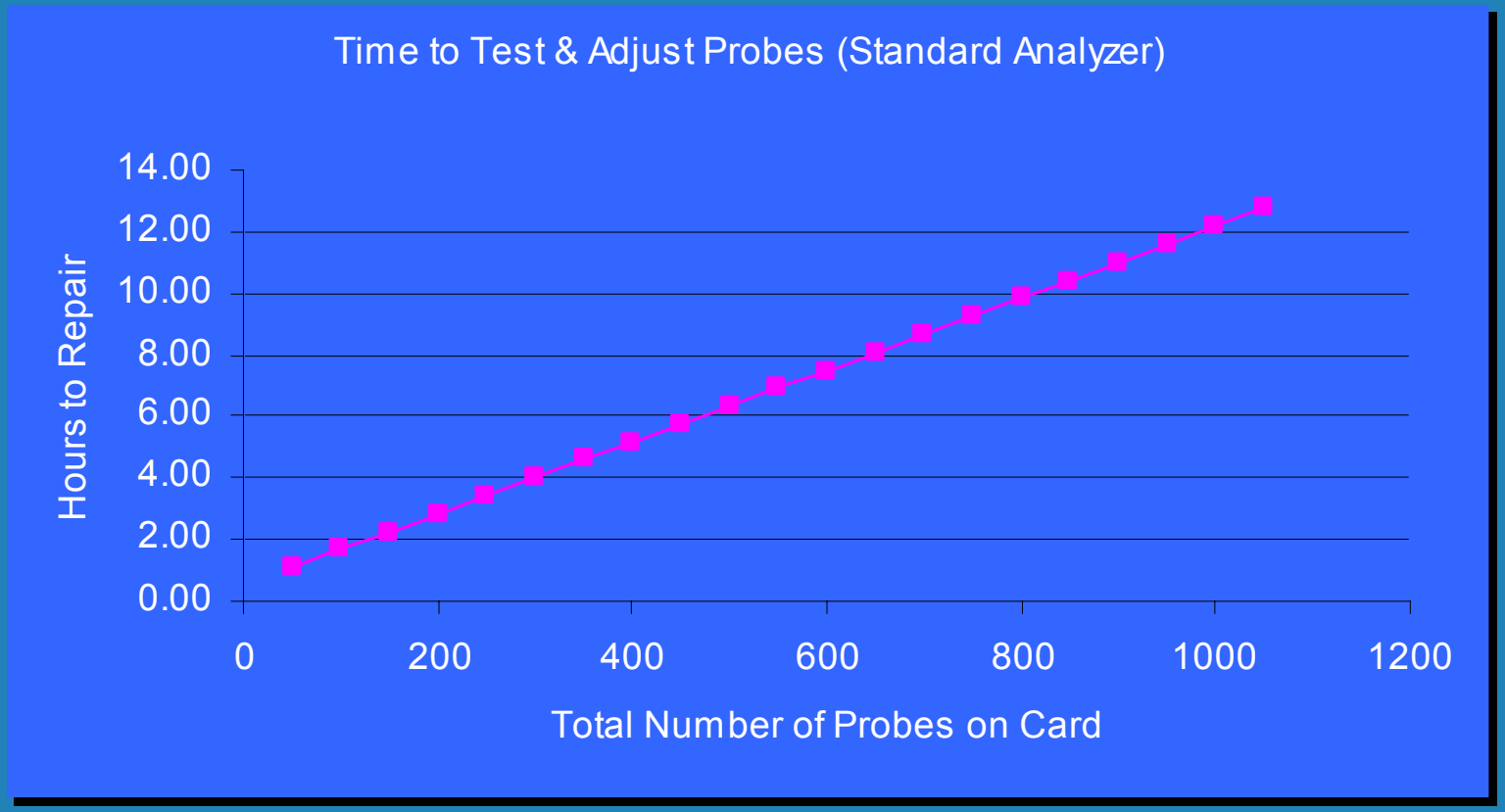
% of Probes to Adjust



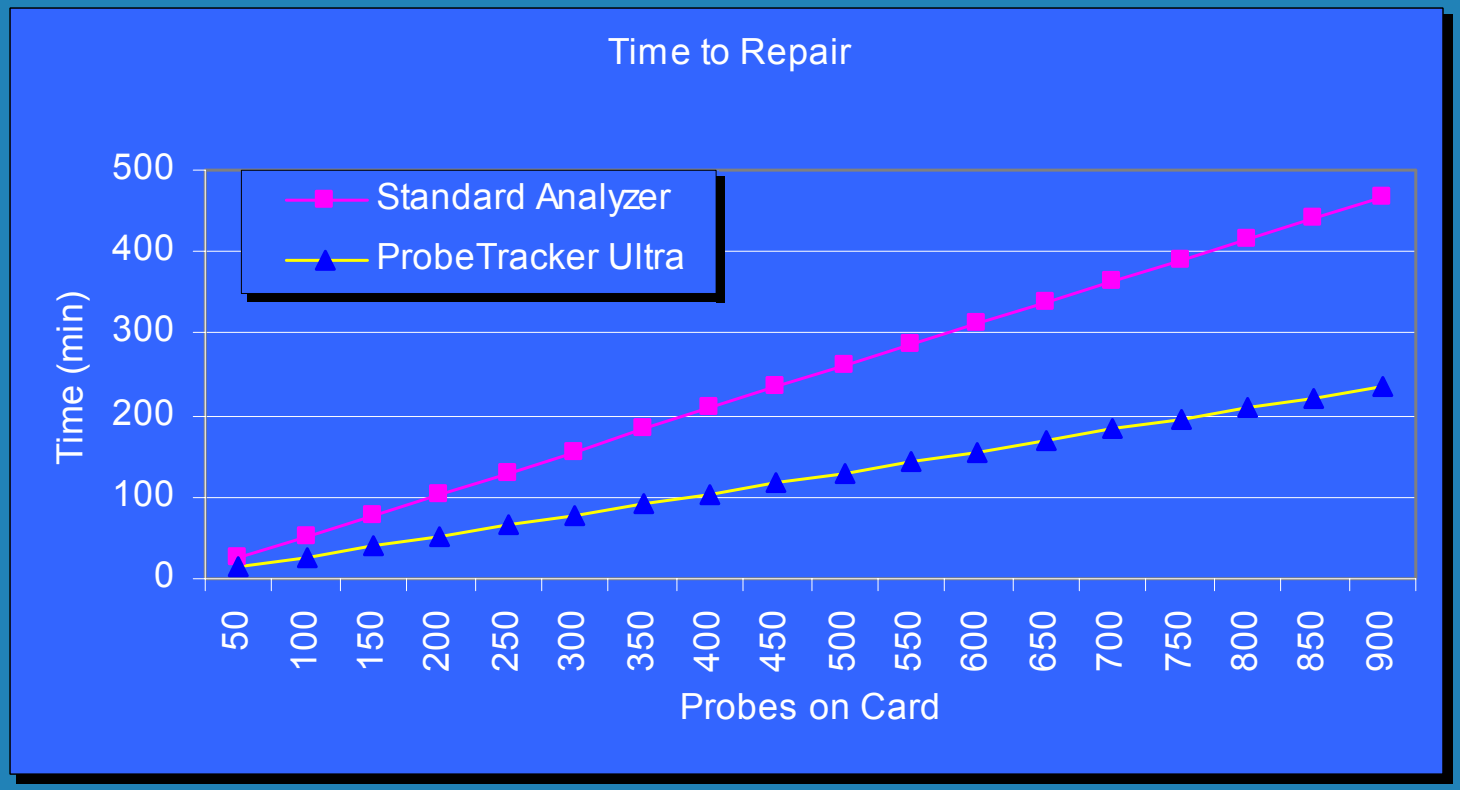
Total Probes to Adjust



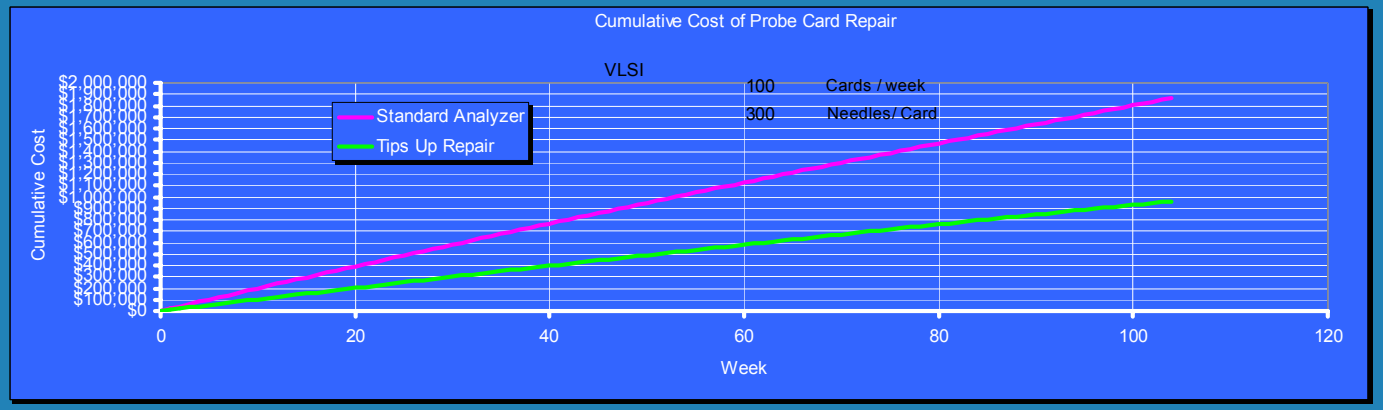
Time To Test & Repair Probes



Time to Repair Card



Cumulative Cost of PCR



	Units	Standard Analyzer	Tips Up Repair		
Setup time / card	(sec)	60	120	Probe Cards/Week	100
run time / needle	(sec)	1	1	Needles/Card	300
repair time / needle	(sec)	156	78	% Repair/Card	30%
				Cost ($/Hr)	$50

- **Graph shows the cumulative cost (in today $) of PCR over the next 2 years for 100 cards/week**
  - **Cost is discounted at a rate of 11% APR (15% devaluation - 4% increase in repair cost)**
  - **Assumed repair cost is $50 / hour**

Cost of Repair Disclaimers

- **Model is for demonstration only**
  - Volume, expense and pin counts are typical estimates from industry
  - Tips-up repair time is ProbeTracker case study
  - Analyzer repair times are based on same study
- **Assumptions**
  - 100 probe cards repaired per week
  - 300 probes per card measured
  - 90 probes per card repaired
  - $50 / hour PCR cost
  - 15% APR devaluation of currency
  - 4% APR inflation of PCR cost