International SEMATECH Manufacturing Initiative
Wafer Probe Council

“Probe Card Tracking Operations Within SEMATECH Probe Council Member Companies”

Fred Taber
IBM Microelectronics
Probe Council General Chair

Mike Harris
Texas Instruments
Probe Council Representative

2004 Southwest Test Workshop

Outline

- SEMATECH & Probe Council Overview
- Probe Card Tracking
  - ✓ Presentation Data Sources
  - ✓ Description: Why, What & Where
  - ✓ Current Practices/Processes
  - ✓ Results
  - ✓ Down the Road(map)
  - ✓ Wrap-up

Overview: Mission

- International SEMATECH Mission
  - The members of International SEMATECH cooperatively set global industry direction and accelerate technology solutions in infrastructure, lithography, materials, and manufacturing to ensure a strong and vibrant semiconductor industry.

Overview: Mission

- International SEMATECH Manufacturing Initiative (ISMI) Mission
  - Provide productivity solutions for current and future challenges in the manufacturing plants of its members, so that members will achieve best in class productivity levels.

    This will be accomplished by providing platforms for collaboration among its members and directing development activities in key areas identified by the members.

Overview: Mission

- ISMI Background
  - Expansion of International SEMATECH's Manufacturing Methods & Productivity Division as a wholly owned subsidiary of SEMATECH
    - Offers participation to all chip manufacturers with fabs
    - Companies may participate in ISMI without becoming a full member of ISMT
      - Key focus areas: manufacturing infrastructure, productivity, cost and effectiveness
  - Began operations in January 2004
  - All current/full SEMATECH members are participants

Overview: Mission

- Probe Council Mission
  - Provide the means to improve member company technology in wafer probing technology & methods by sharing best practices, employing benchmarking techniques, observing member company operations and guiding the supplier community.

Overview: Roles

- Wafer Probe Council Project
  - ISMI: Legal, Technical & Administrative Support
    - New Facilitator: Fred Lakhani
  - Members: Technical Data & Information, Know-how & Direction…..and Dues
    - New Chair: Bill Williams of Freescale

Overview: Probe Council Members

INTERNATIONAL SEMATECH

AMD

tsmc

Launched by Motorola
freescale™
semiconductor

TEXAS INSTRUMENTS

INTERNATIONAL SEMATECH
ISMI
MANUFACTURING INITIATIVE

Infineon
technologies

PHILIPS

intel.

IBM®

Probe Card Tracking: Data Sources

- Member Company Topic Presentations
  - Presented at 1Q04 F2F Meetings
    - 7 of 8 Member Companies
  - Raw Info: Proprietary

↓ ↓

Collective SWTW Report/Summary: Non-Proprietary

PCT: Retrospective

- Manual Systems w. Some Automation
  - Data Entry and Retrieval (e.g. ID’s, Repair Tags)
  - Non-integrated
    - Stand-alone Databases
      - Inventory Crib, Repair, Test Floor, etc.
    - Not Visible Across the Organization
    - Impacted ‘Full’ Process Control
    - A ‘Different’ System at Each Site

PCT: Retrospective

- Automated Systems Now In Use At All Member Companies
  - All Internally Developed
    - Some Web-based
    - Incremental Increases in Features & Capabilities
  - Migrating to Worldwide Commonality
  - Data Input
    - Barcode, RFID, EPROM, and yes, Manual too
  - Financial Return
    - Inventory, Equipment Utilization, Card “Effectiveness”, Yield Improvement

PCT: Why, What & Where

- PROCESS CONTROL of Manufacturing Sort Floor Operations
  - Card ‘Location’ (Where is it!)
  - Improve Utilization of VERY Expensive Tools
    - Usage & Repair History
    - Card Usability Status
  - Understand & Predict Usage
  - Card Unique “Characteristics”
  - Track Operational Parameters
  - Inventory Management

PCT: Why, What & Where

TRACKING PARAMETERS	
Card Location/Movement	Set-up Verification
Touchdowns (& Limits)	Heads & SXF’s
Maintenance History	Parametrics (Cres, Fmax, Leakage
Usage (Tester, Lot, etc.)	Binning
Metrology History	Inventory Management
Schedule Maintenance	

PCT: Why, What & Where

- Product ‘Measurements’
  - Correlate Yield, Binning, etc. to Tooling

PCT: Why, What & Where

- Supplier Interaction
  - Performance
    - Quantified/Verified Card Parameters
      - Touchdowns
      - Metrology Effectiveness
      - Repair Effectiveness
    - Highlight ‘Differences’ Between Suppliers
  - Order Placement
    - Tie Demand/Usage to Procurement

PCT: Current Practices/Processes

- Probe Environment
  - Card Inventory 100's to >10K
  - Typically <5 Setups/Tester/Day
  - Product Mix
    - uProcessors, uControllers, SRAM, Mixed Signal, RF, ASICS, eDRAM,…….
  - Sometimes Probe Heads and SXF's are Tracked Separately

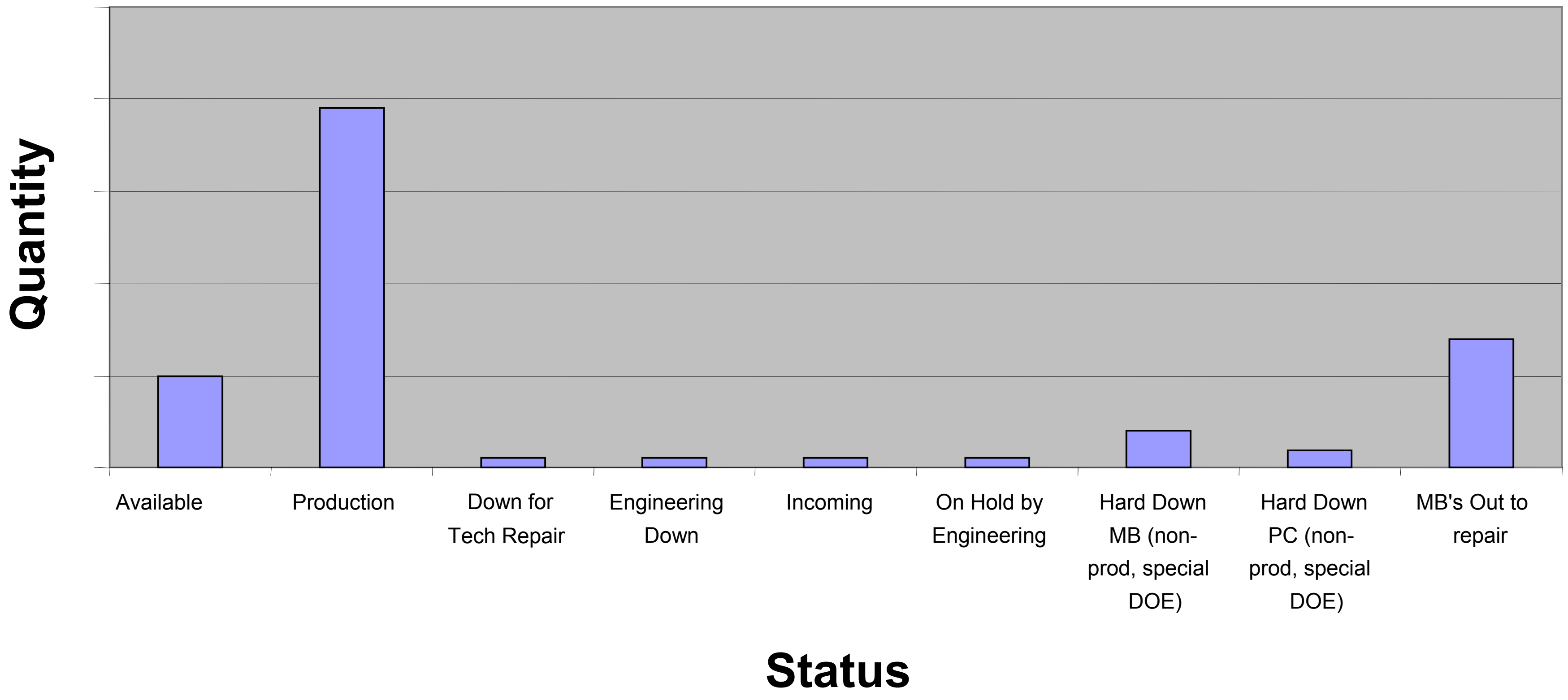
PCT: Current Practices/Processes

- Data Entry
  - No One Method Predominates
    - Manual, EPROM, Barcode, RFID
  - Typically a Transaction for Each Lot/Setup
- Stop Test
  - Wrong H/W, Setup Limits Exceeded, Touchdowns Exceeded, PM Scheduled

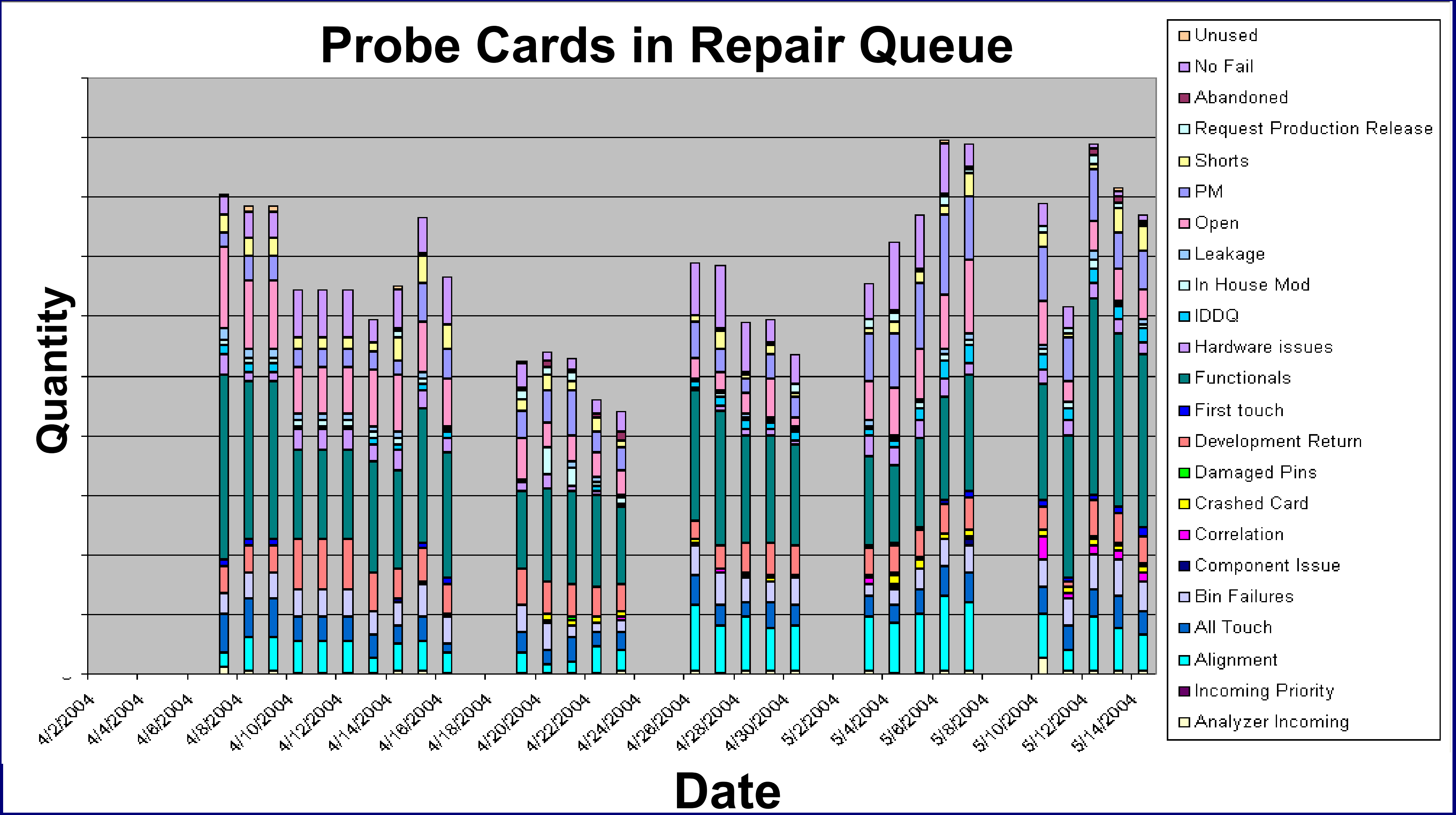
Probe Card Tracking Operations

PCT: Results

Sample Pareto of Probe Card Locations

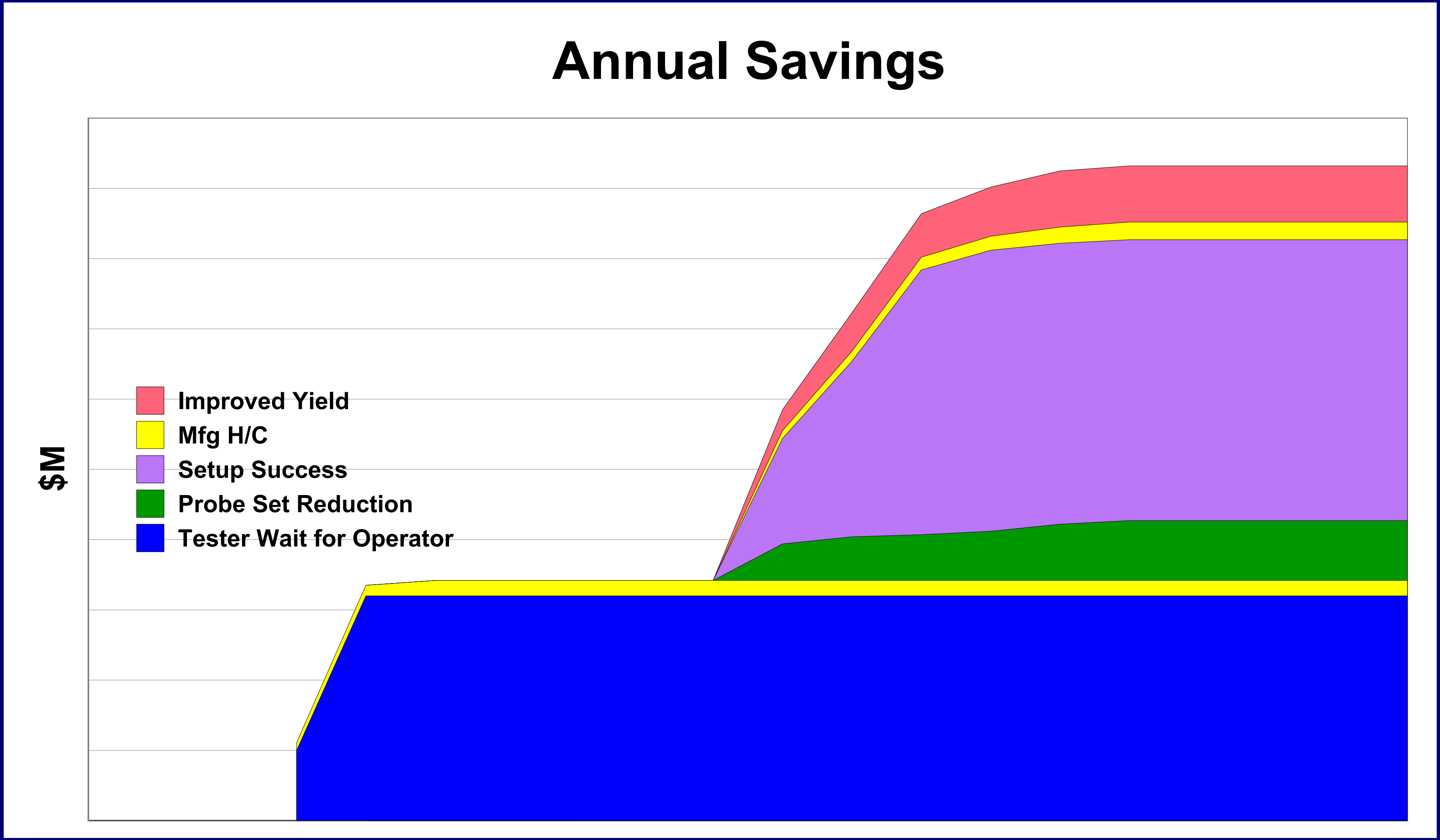


PCT: Results


Probe Cards in Repair Queue
Quantity
Date
4/2/2004
4/4/2004
4/6/2004
4/8/2004
4/10/2004
4/12/2004
4/14/2004
4/16/2004
4/18/2004
4/20/2004
4/22/2004
4/24/2004
4/26/2004
4/28/2004
4/30/2004
5/2/2004
5/4/2004
5/6/2004
5/8/2004
5/10/2004
5/12/2004
5/14/2004
Unused
No Fail
Abandoned
Request Production Release
Shorts
PM
Open
Leakage
In House Mod
IDDQ
Hardware issues
Functionals
First touch
Development Return
Damaged Pins
Crashed Card
Correlation
Component Issue
Bin Failures
All Touch
Alignment
Incoming Priority
Analyzer Incoming

Probe Card Tracking Operations

PCT: Results



PCT: Down The Road(map)

- Integration…..Integration…..Integration
  - Standard Window to all Databases & Intranet Access
  - Consolidate Databases
  - Cross Database Reports (Data Sharing!!) and Analysis
    - Metrology Tools Interact with PCT Database(s)
    - e.g. Metrology Tool / Mfg. Floor; Yield vs. TD's; Yield vs. ??

PCT: Down The Road(map)

- Integration…..Integration…..Integration (cont.)
  - Automated Reporting
    - Predictions, Trends, Event Notification
    - Probe Card Performance Parameters
  - Link to Probe Card Ordering System
    - Automatic Ordering

PCT: Down The Road(map)

- “Smart” Probe Cards
  - Accelerated Move To RFid
    - Minimal Use Today
    - Automates ‘Read from’ Probe Card and Enables ‘Write to’ Probe Card
    - Customized Probe Card Handling
      - Handle Individual Probe Card Uniqueness
      - Automated Setups That Are Dynamically Adaptable
    - Integrate into Current IT Infrastructure
    - Integrate With Supplier Community

PCT: Down The Road(map)

- “Smart” Probe Cards (continued)
  - Technology ‘Intersection’ Where There’s An Opportunity to Establish Industry Commonality

PCT: Wrap-Up

- Integral Part of **ALL** ISMI Member Companies’ Manufacturing Operations
  - Today: Operational and Cost Benefits
  - Future: Integrated System
    - Link to Test Results/Yield; Automatic Probe Card Ordering; Integrate With Supplier Base
- Move to RFid: A Potential Role For the Probe Council
    - An Opportunity to Establish Industry Commonality

PCT: Q&A Forum

- With The Probe Council Members
  - Bill Williams (Freescale)
  - Jens Kober (AMD)
  - Ger Koch (Philips)
  - Mike Harris (TI)
  - Jack Courtney (IBM)
  - Pooya Tadayon (Intel)
  - Oliver Nagler (Infineon)
  - YF Jeng (TSMC)

Acknowledgements

- Thanks to Jim Ammenheuser of International SEMATECH Manufacturing Initiative (ISMI) for his outstanding guidance and support of the Wafer Probe Council's activities and projects
- Thanks to the Member company principals. Their spirit of openness and sharing has enabled the success of the Wafer Probe Council and has benefited each of the member companies' operations.