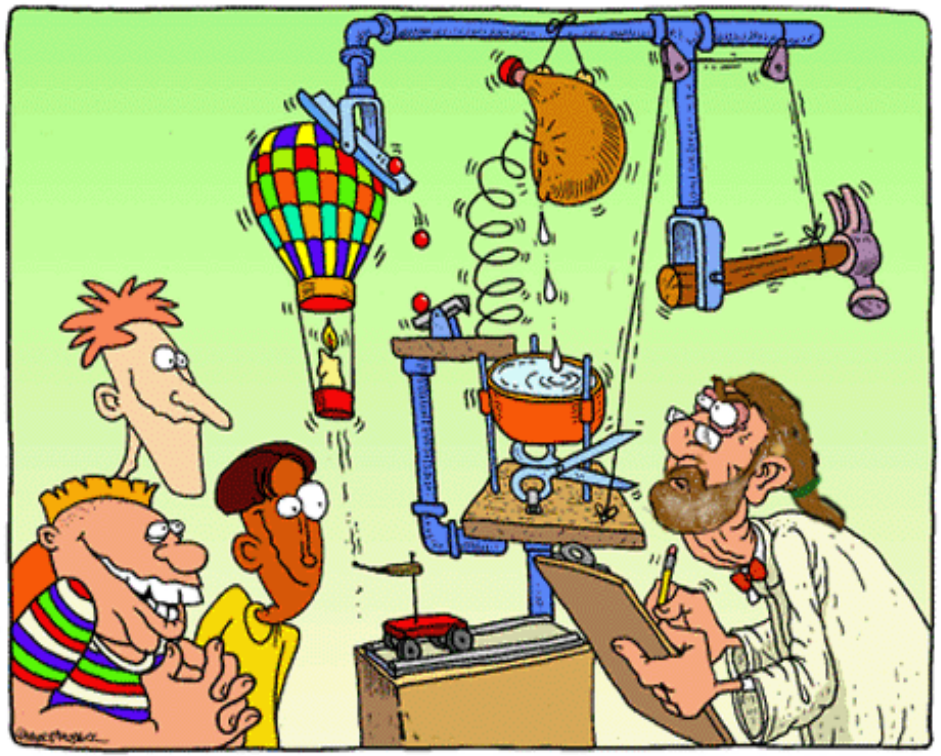
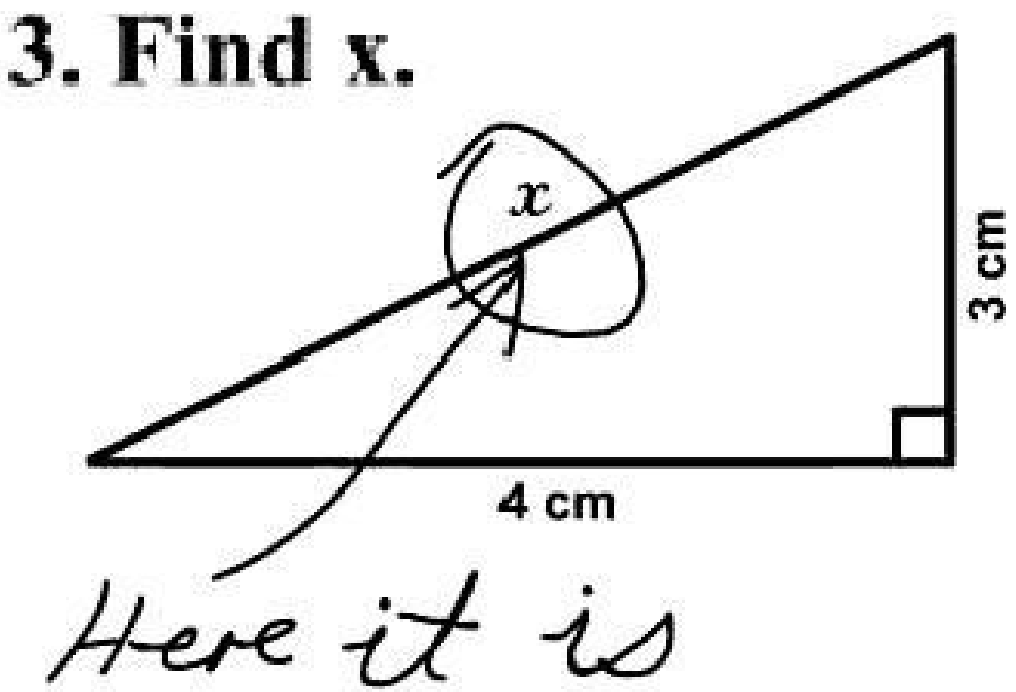


Utilizing current test strategies to drive diagnostics development, deployment and support through software tools

Agilent Technologies

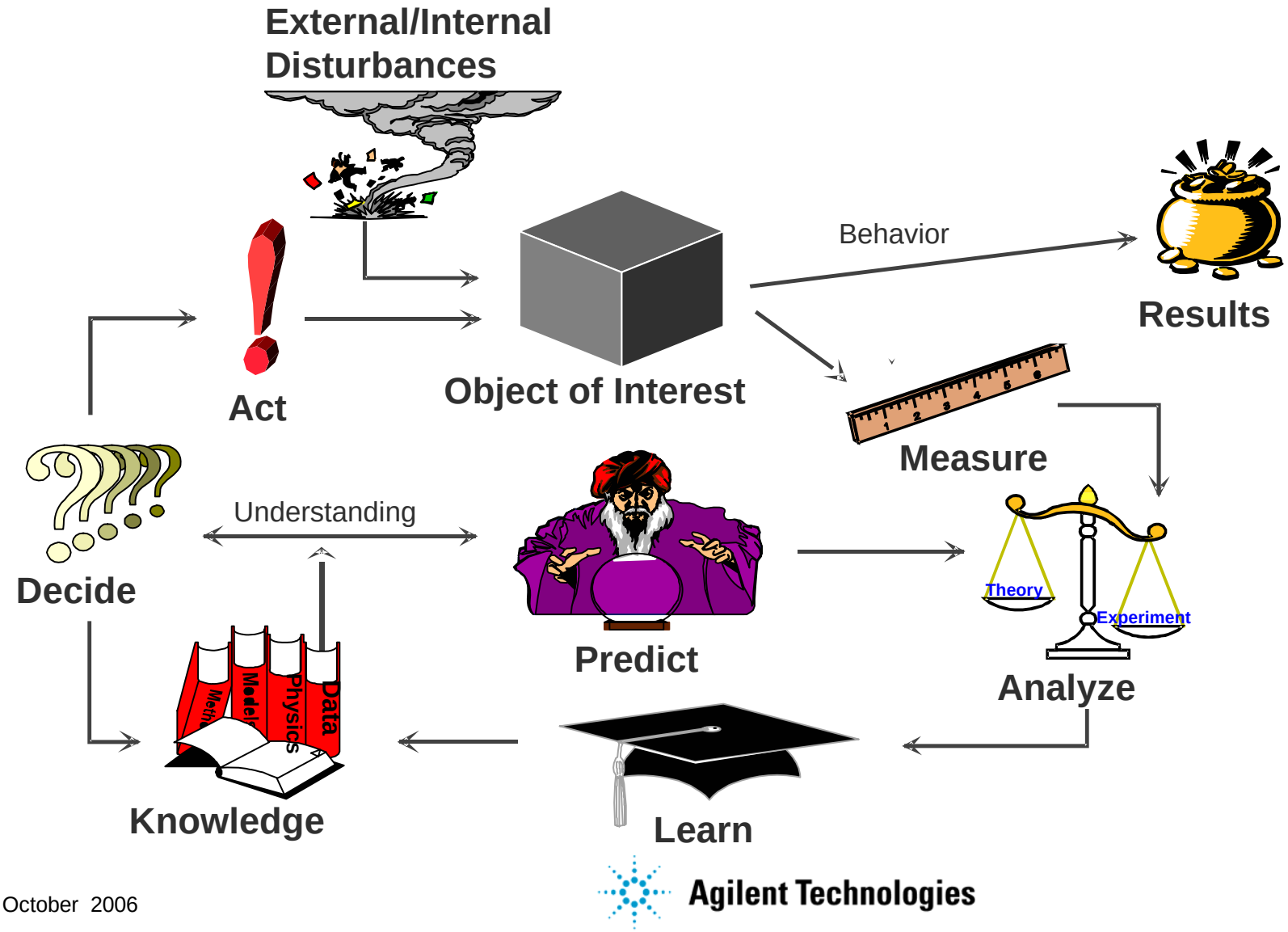
So Why Is it So Hard To Understand or Do we Just Make It Hard?

Answer on a student's Geometry test



Agilent Technologies

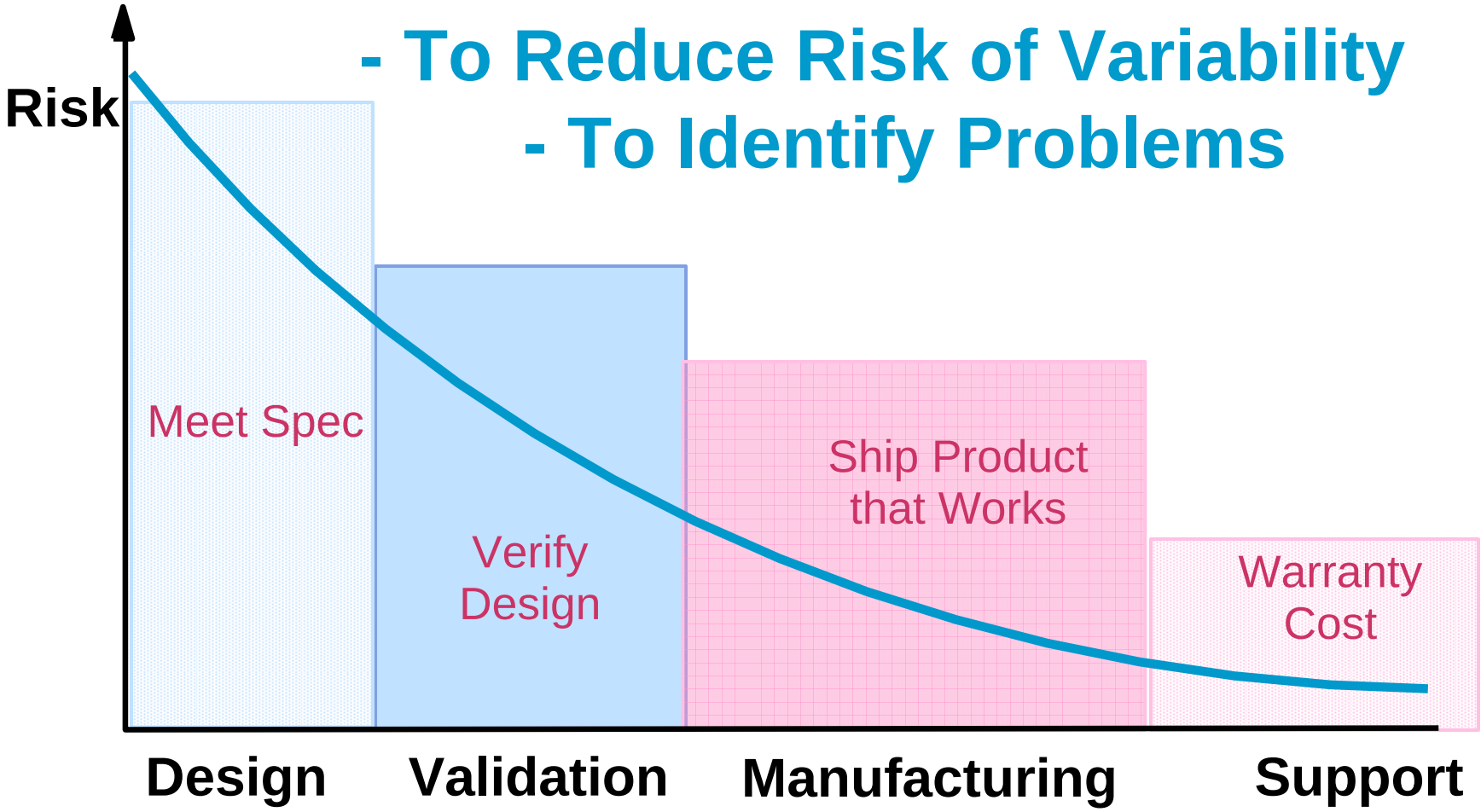
Using The Learning Organization Process to Improve



Agilent Technologies

So Why Do We Test…….

- To Measure the Health of the Process
- To Reduce Risk of Variability
- To Identify Problems

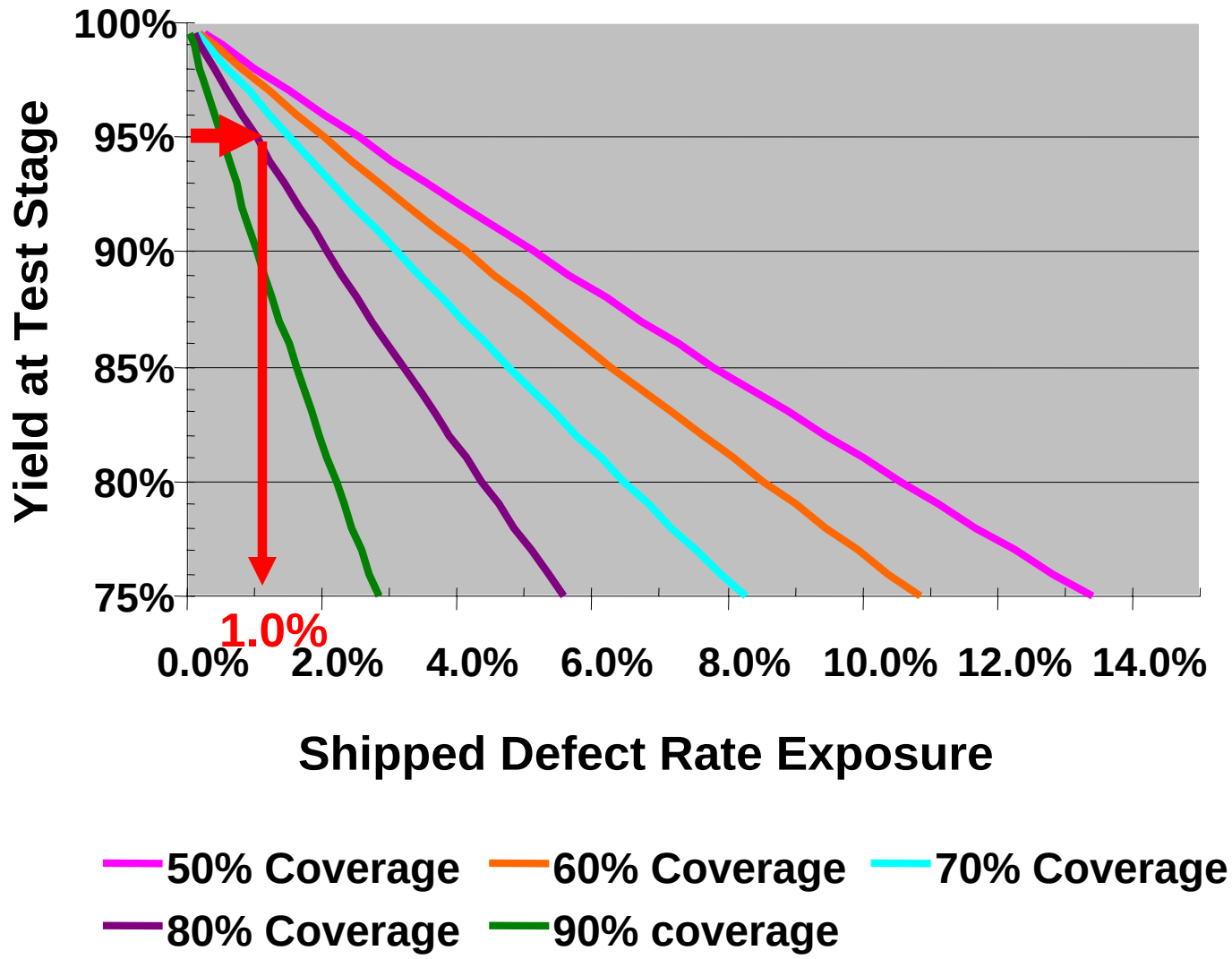


Agilent Technologies

The Problem

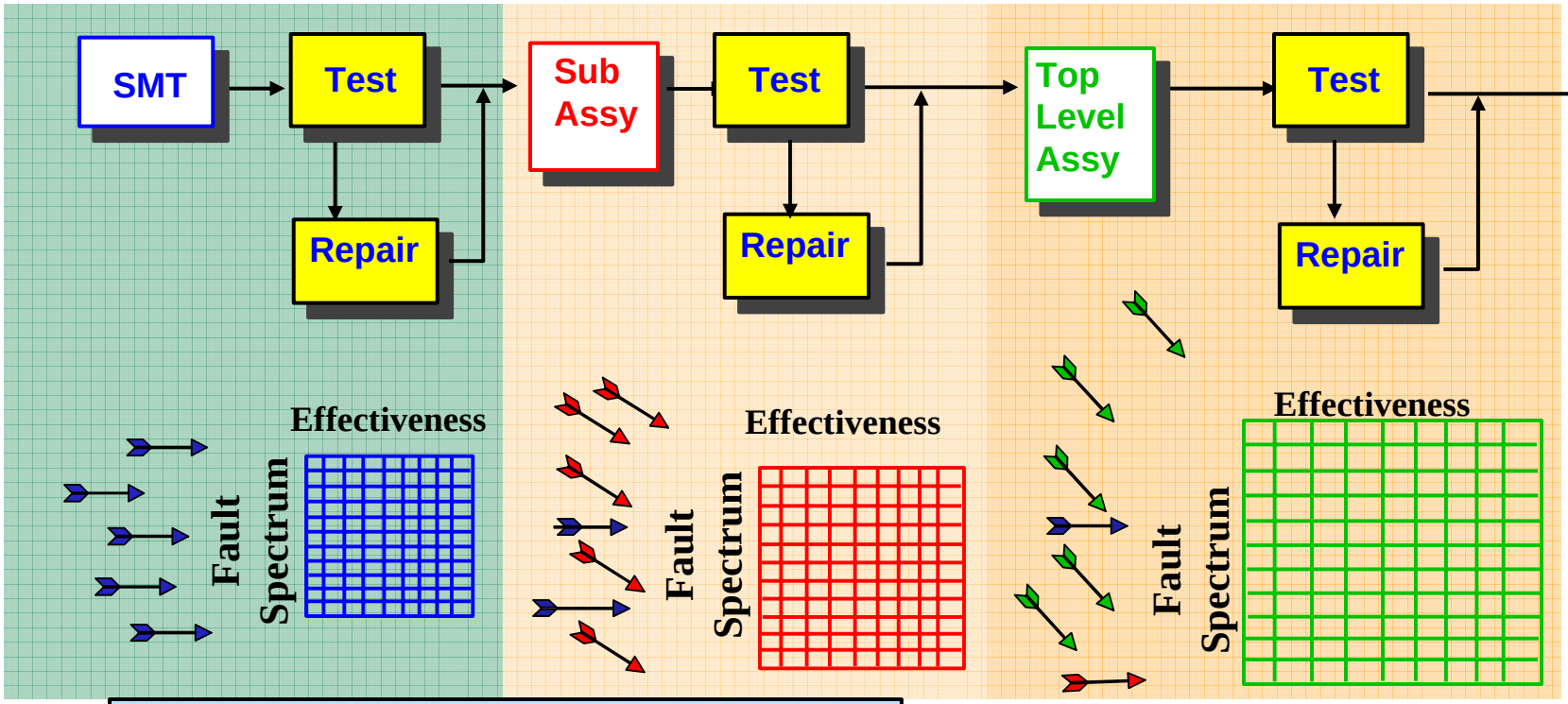
Agilent Technologies

How Much is Really at Risk ?



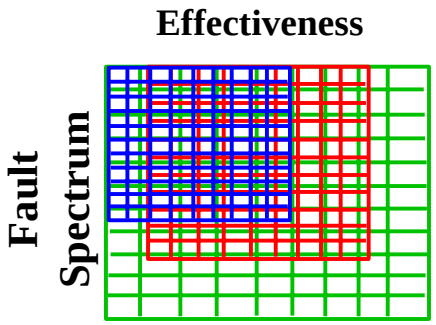
Agilent Technologies

Typical Test Strategy



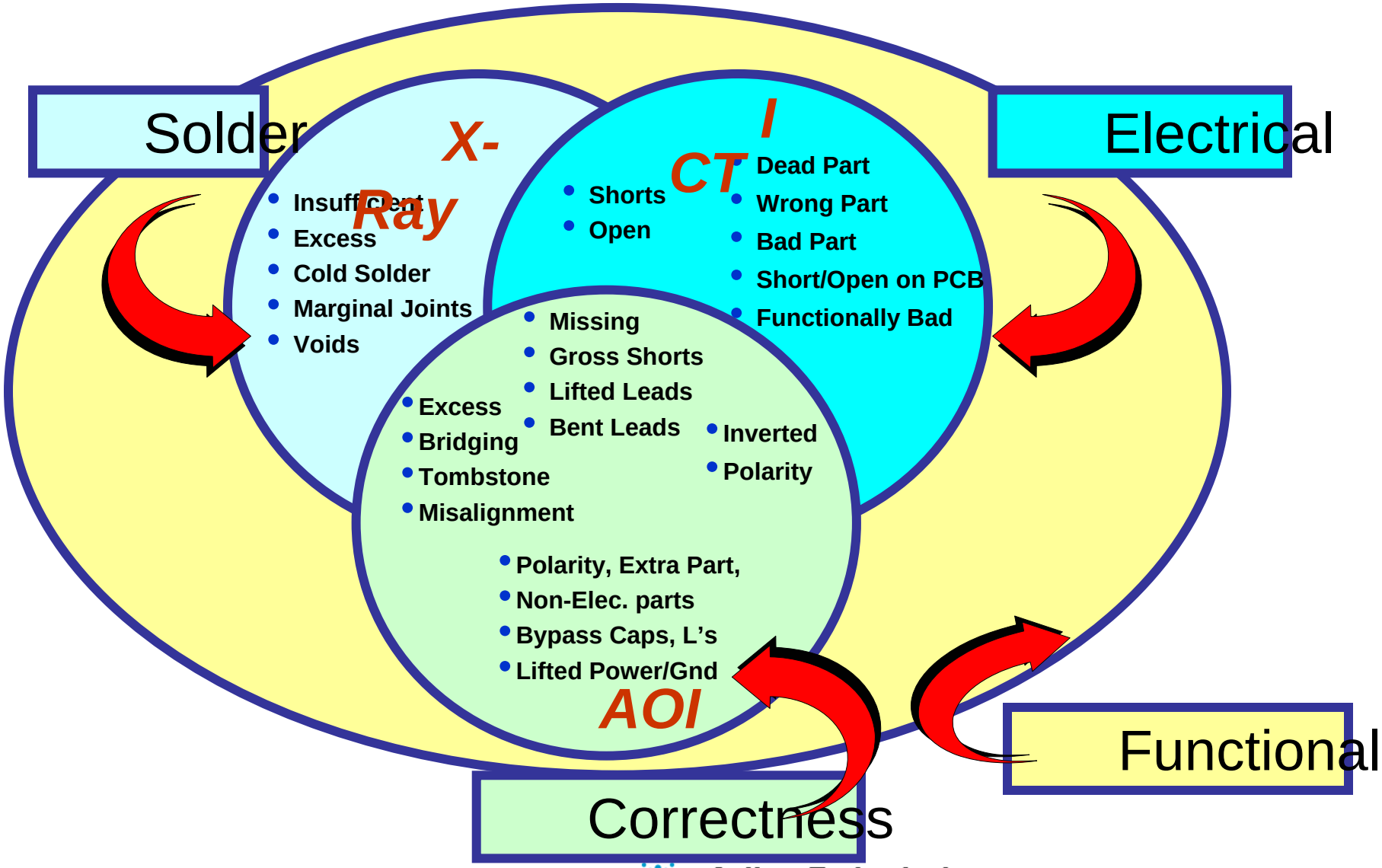
Characteristics:

- Broad coverage at each test
- High level of redundant test
- Leakage of early defects caught later by test
- Fault coverage is unpredictable



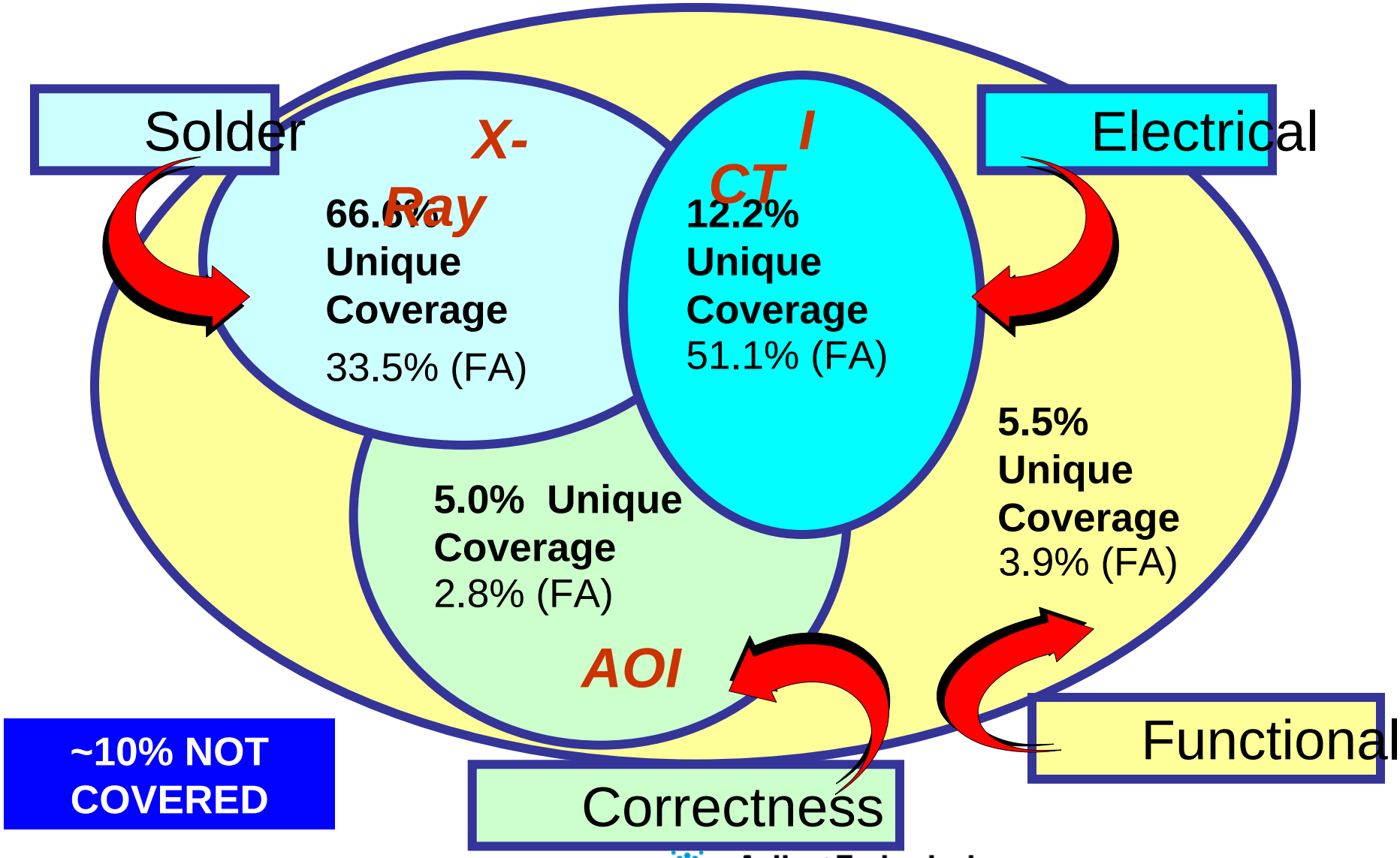
Agilent Technologies

Process Test Coverage Redundancy



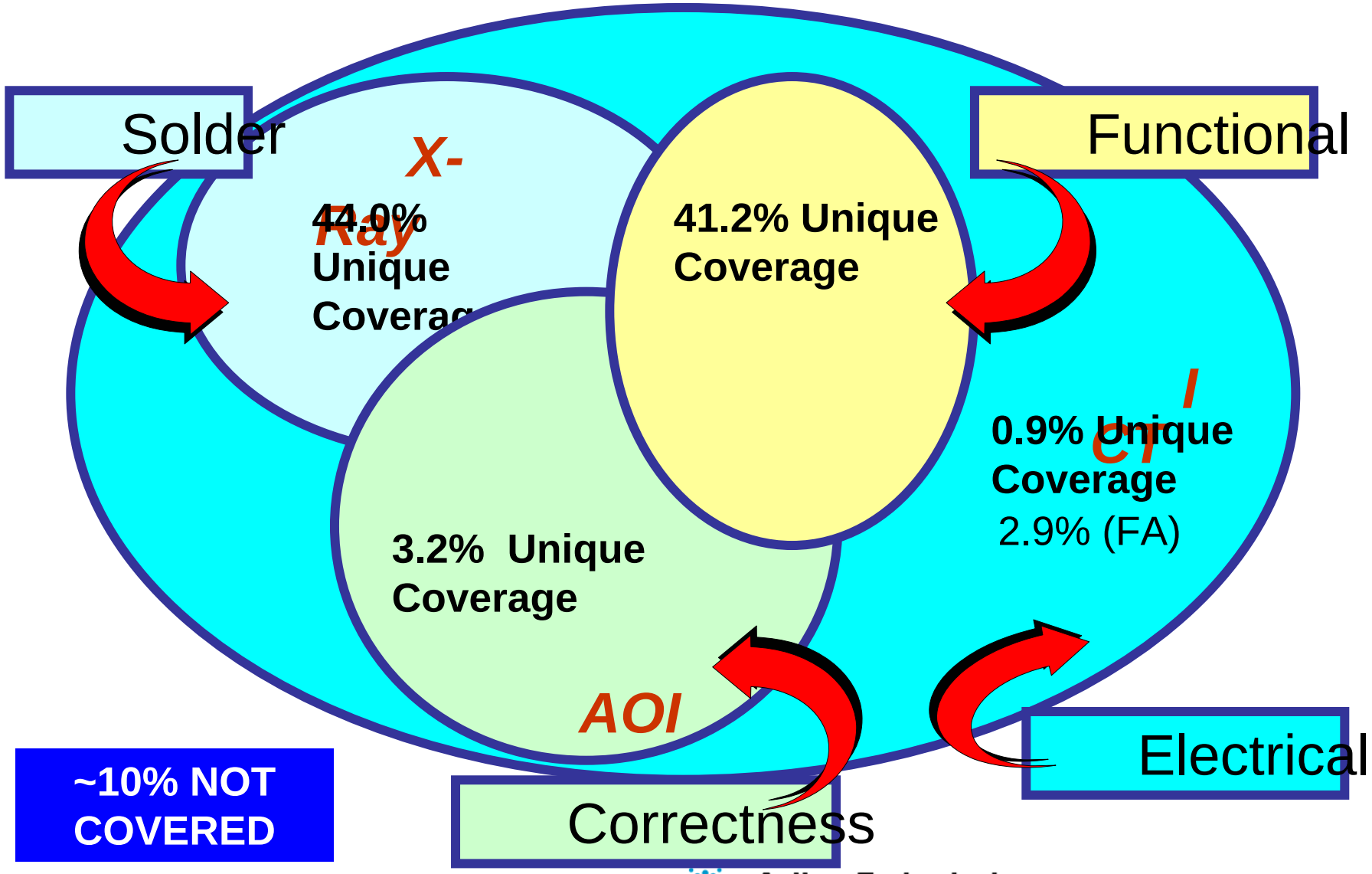
Agilent Technologies

Example Design Coverage
ICT → AXI → AOI → Functional



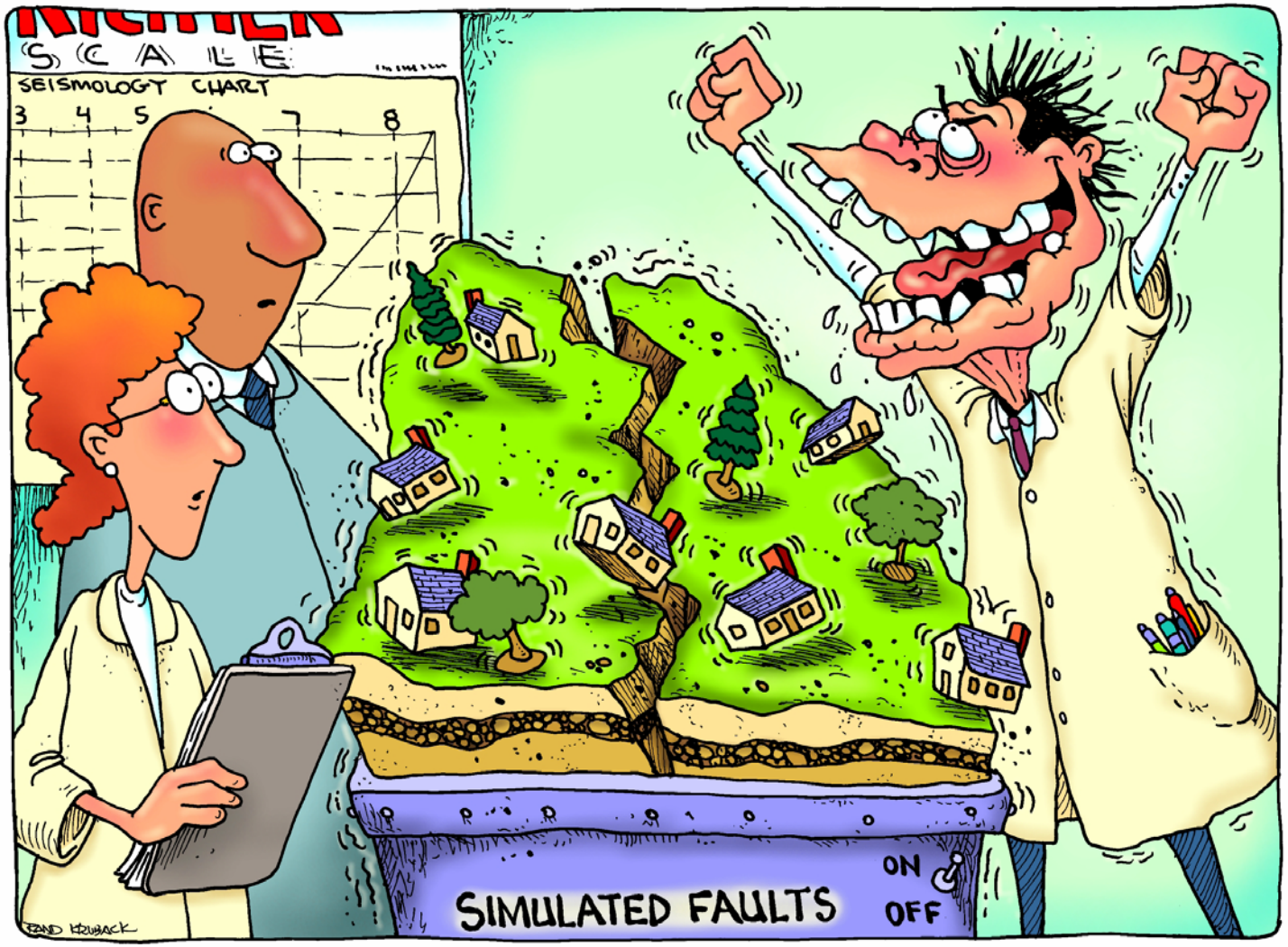
Agilent Technologies

Example of Coverage
Functional → AXI → AOI → ICT



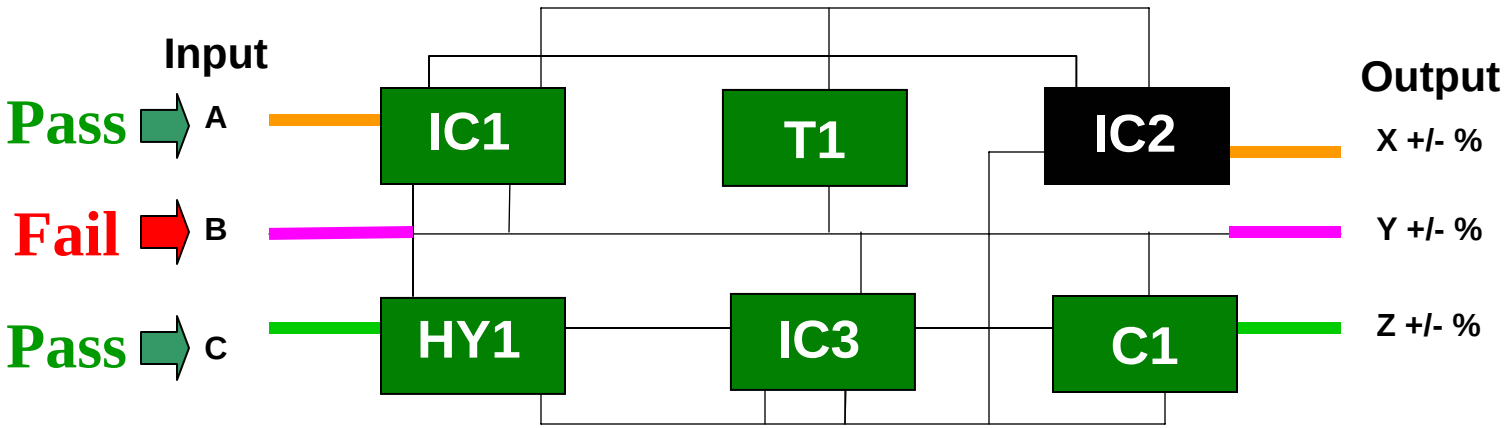
Agilent Technologies

What is Needed



Agilent Technologies

Coverage Mapping and What We Know

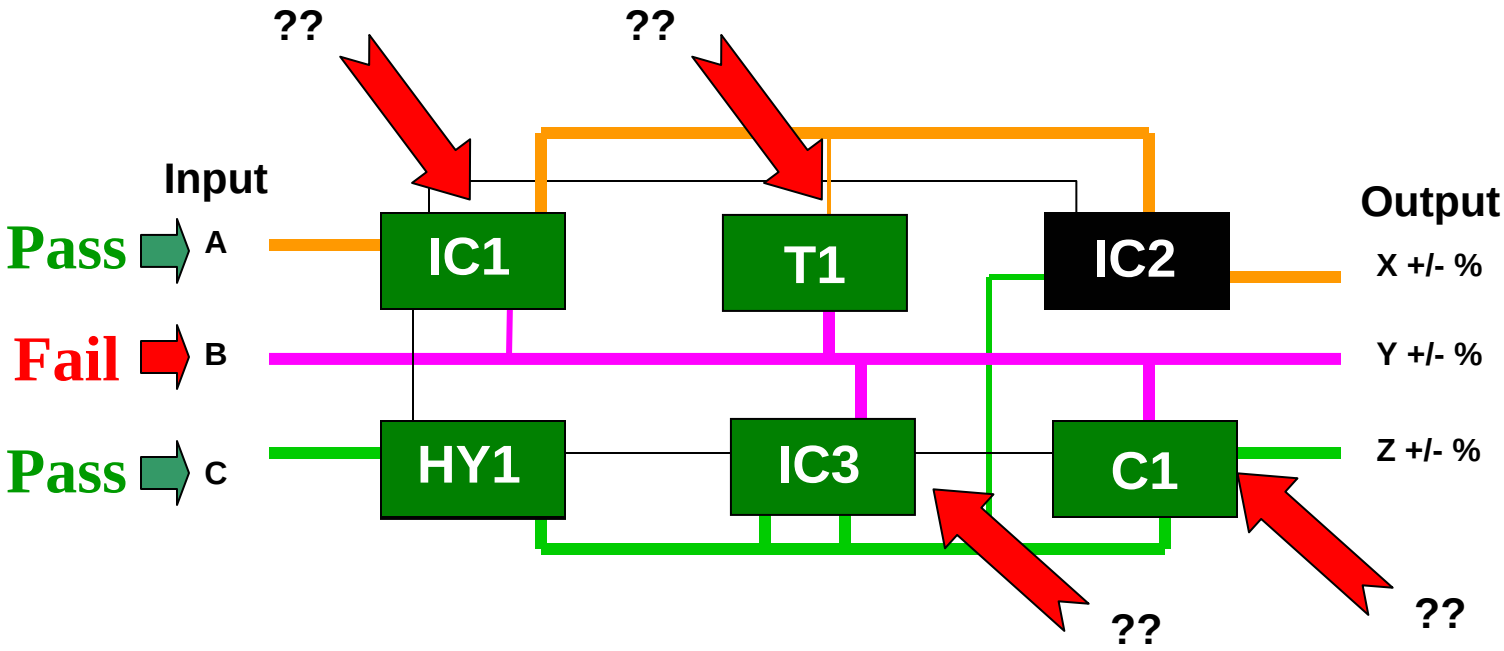


Process Test Coverage (Static) -

Functional Coverage (Dynamic) -

Agilent Technologies

Coverage Mapping and What We May Know

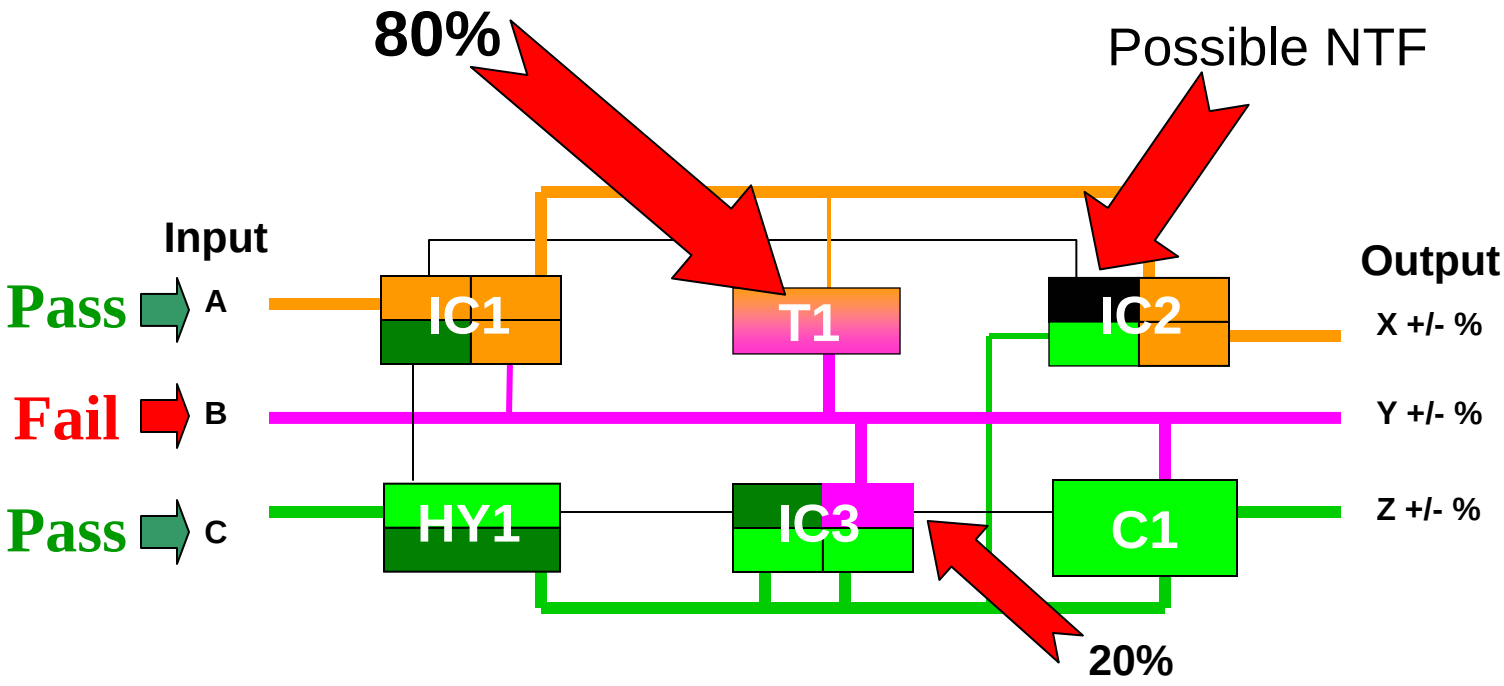


Process Test Coverage (Static) -

Functional Coverage (Dynamic) -

Agilent Technologies

Coverage Mapping and What We Want to Know

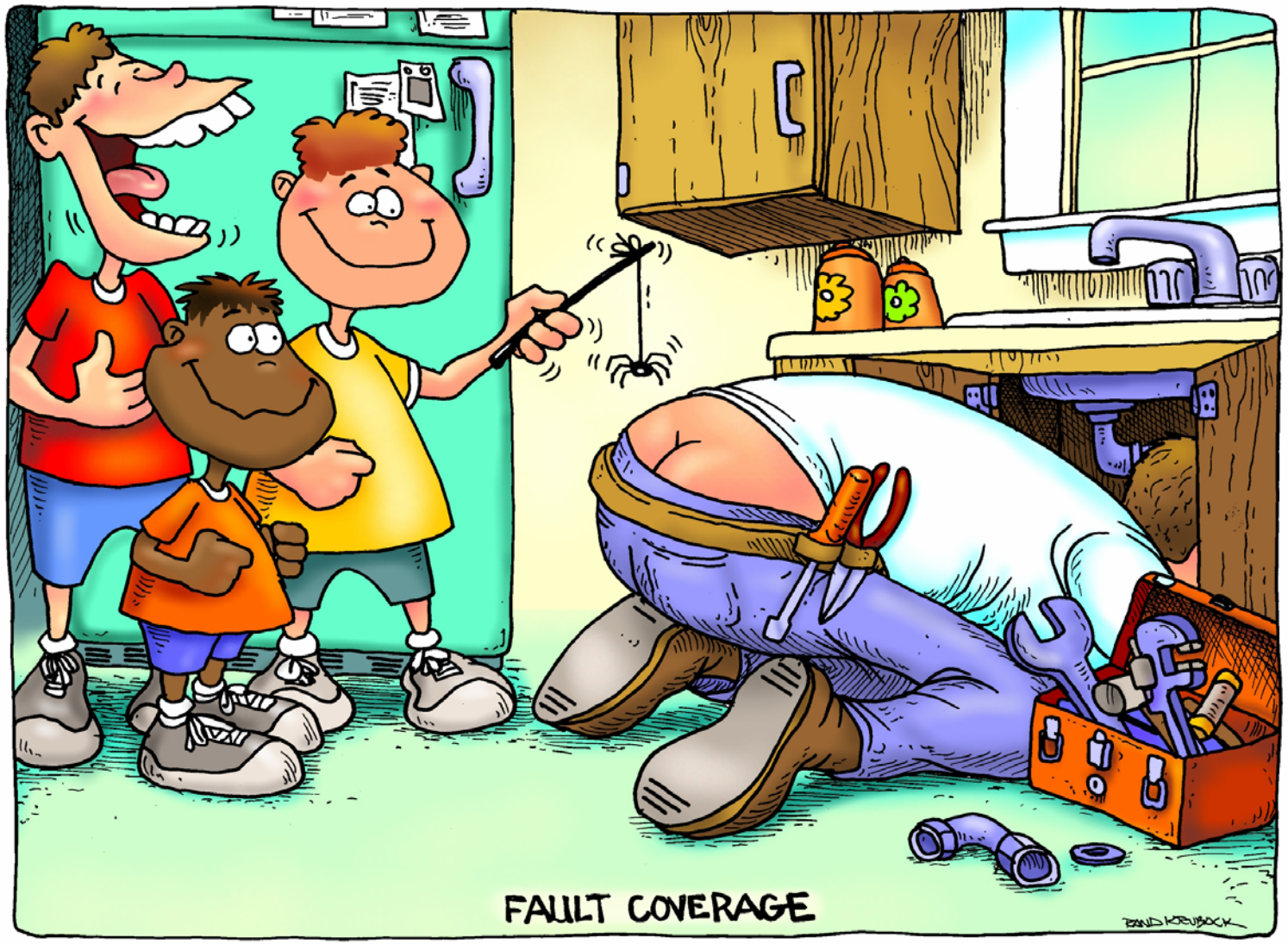


Process Test Coverage (Static) -

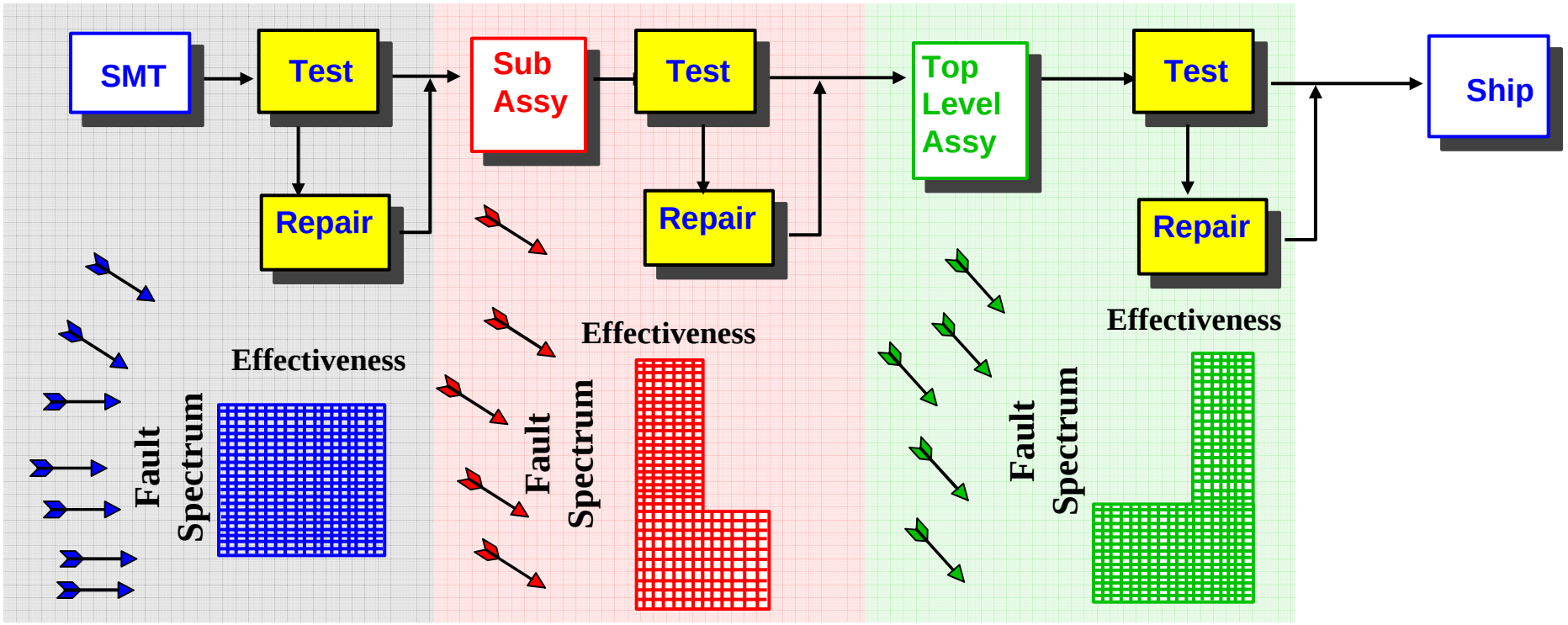
Functional Coverage (Dynamic) -

Agilent Technologies

The Answer

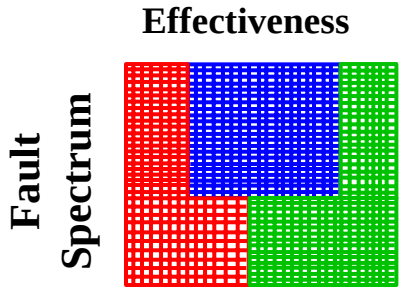


Desired Production Test Process



Characteristics:

- Test in right place
- Minimize redundant test
- Effectively catch defects at origin
- Fault coverage is predictable



Agilent Technologies

What is Needed For Effective Test Strategies

- *A common Framework for describing Test Strategies.*
- *Standardized documentation for test.*
- *Metrics to make test tradeoffs between test strategies (AXI, AOI, ICT, Functional, etc) for gaps and overlaps.*
- *Ability to simulate a Test Strategy as the product is being developed to feedback DFX input.*
- *A consistent, repeatable process throughout the product life cycle.*

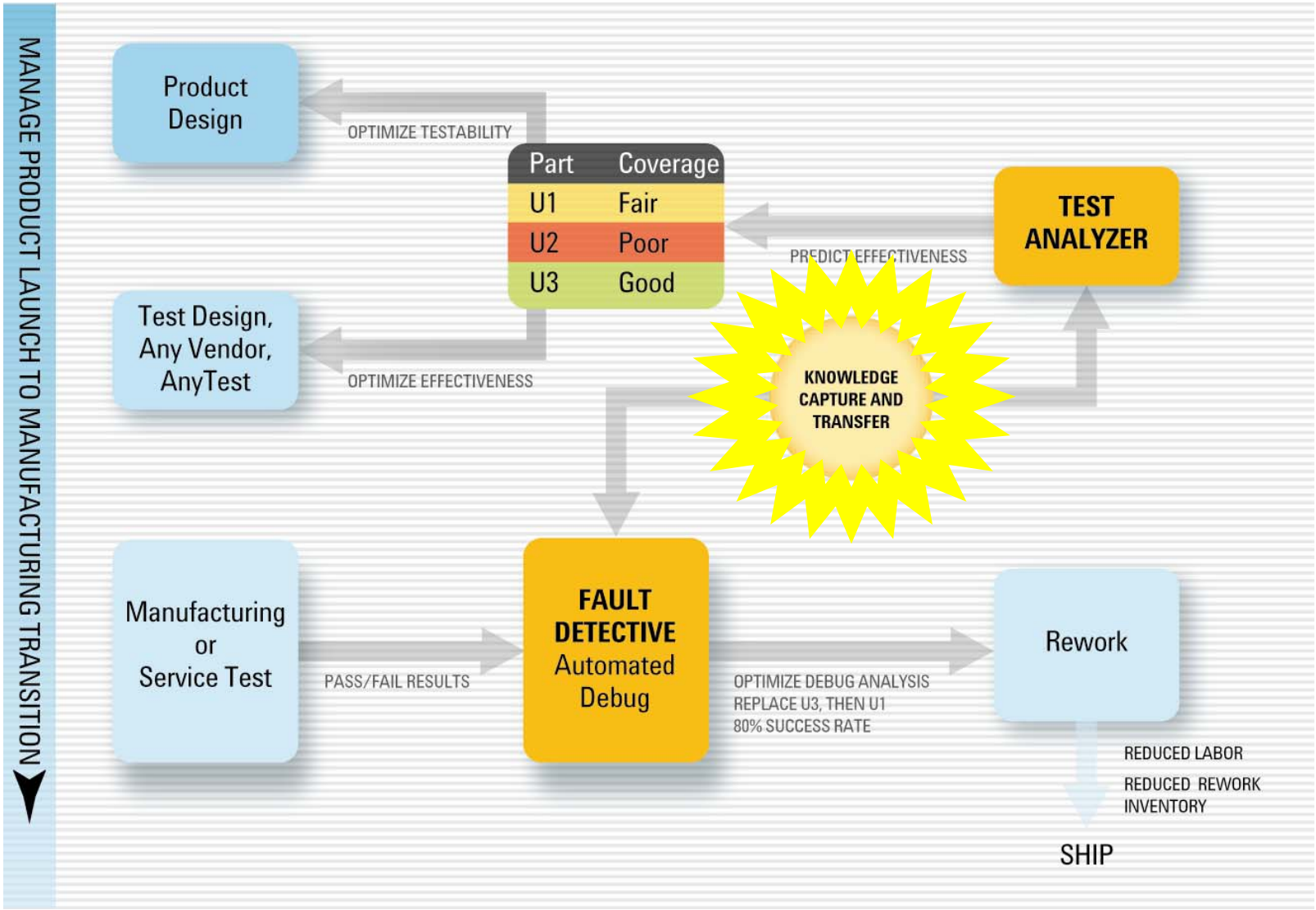
What is not needed is…….

- ***An automated way to develop test plans***
- ***A tool to eliminate the need for test developers***

Sample of Product Coverage Mapping

Component		Functional Coverage		FT + AXI		FT + AXI + AOI		FT+AXI+AOI+ICT Full Access		FT+AXI+AOI+ICT Current Access	
Type	Pins	Score	Grade	Score	Grade	Score	Grade	Score	Grade	Score	Grade
Resistor	2	0%	NO	79%	POOR	83%	LOW	94%	MED	94%	MED
Resistor	2	95%	HIGH	95%	MED	95%	MED	95%	MED	95%	MED
Resistor	2	0%	NO	79%	POOR	83%	LOW	94%	MED	83%	LOW
Resistor	2	0%	NO	79%	POOR	83%	LOW	94%	MED	83%	LOW
Resistor	2	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH
Resistor	2	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH
Analog LIB	5	95%	HIGH	95%	MED	95%	MED	95%	MED	95%	MED
Analog LIB	6	93%	HIGH	93%	MED	93%	MED	93%	MED	93%	MED
Other LIB	10	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH
Connector	2	0%	NO	76%	POOR	82%	LOW	82%	LOW	82%	LOW
Other LIB	5	0%	NO	76%	POOR	82%	LOW	82%	LOW	82%	LOW
Single Pin	1	0%	NO	79%	POOR	83%	LOW	82%	LOW	83%	LOW
Mixed LIB	28	95%	HIGH	95%	MED	95%	MED	95%	MED	95%	MED
Other LIB	6	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH
Digital LIB	48	86%	HIGH	86%	LOW	86%	LOW	100%	HIGH	100%	HIGH
Other LIB	24	95%	HIGH	95%	MED	95%	MED	95%	MED	95%	MED
Digital LIB	8	83%	HIGH	83%	LOW	83%	LOW	95%	HIGH	95%	HIGH
Digital LIB	6	0%	NO	76%	POOR	82%	LOW	95%	HIGH	82%	LOW
Digital LIB	6	0%	NO	76%	POOR	82%	LOW	95%	HIGH	95%	HIGH
Digital LIB	6	0%	NO	76%	POOR	82%	LOW	95%	HIGH	95%	HIGH
Other LIB	80	38%	LOW	76%	POOR	82%	LOW	82%	LOW	82%	LOW
Mixed LIB	6	83%	HIGH	83%	LOW	83%	LOW	83%	LOW	83%	LOW
Other LIB	4	95%	HIGH	95%	MED	95%	MED	95%	MED	95%	MED
Other LIB	28	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH
Other LIB	4	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH
Digital LIB	6	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH
Mixed LIB	6	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH
Other LIB	24	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH
Analog LIB	5	88%	HIGH	88%	LOW	88%	LOW	91%	MED	88%	LOW
Other LIB	6	81%	HIGH	81%	POOR	82%	LOW	82%	LOW	82%	LOW
Other LIB	28	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH
Other LIB	4	90%	HIGH	90%	MED	90%	MED	90%	MED	90%	MED
Analog LIB	4	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH

Test Optimization Software: Knowledge Transfer

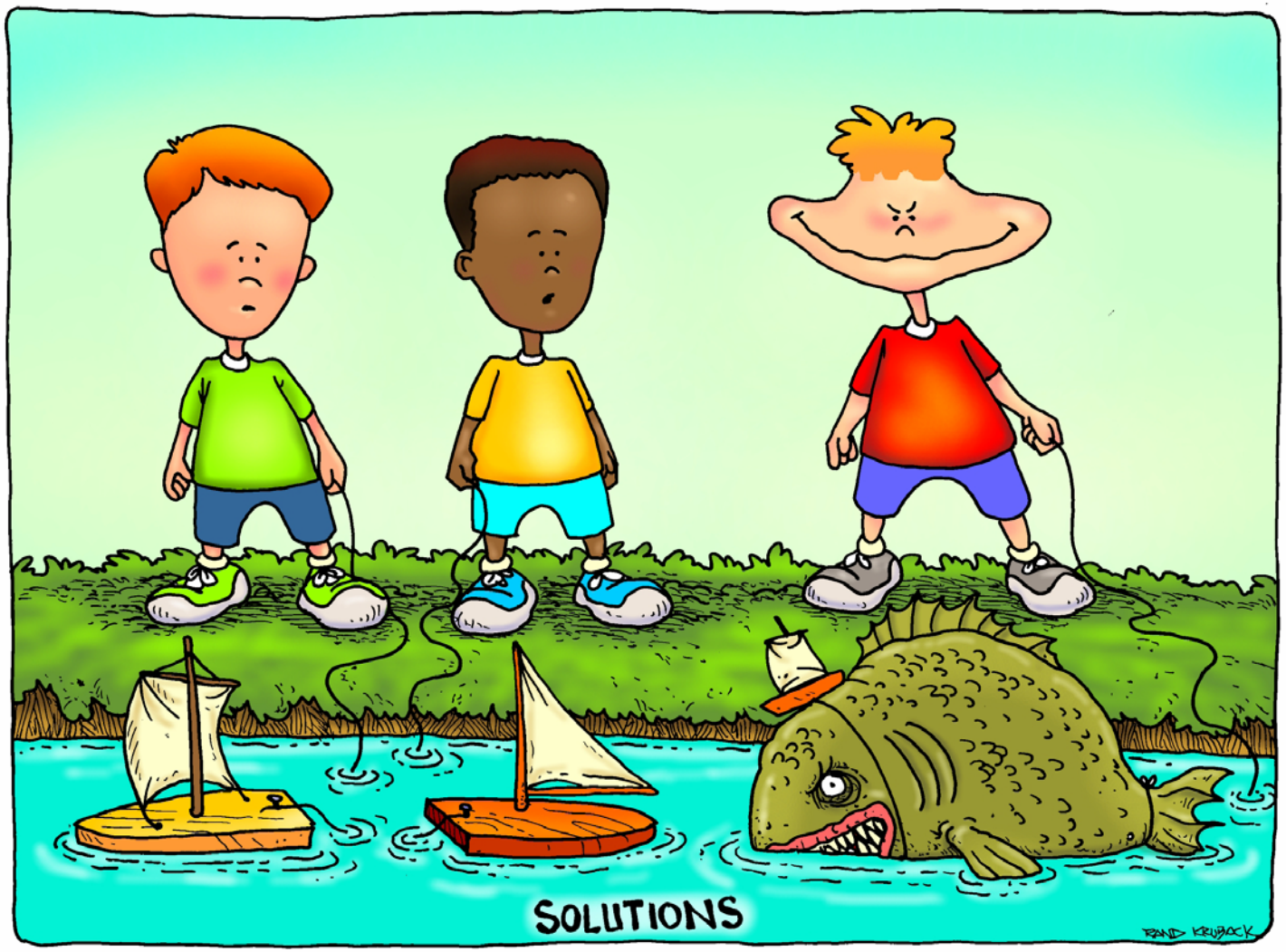


Agilent Technologies

Elements for a true Product Life Cycle Test Strategy

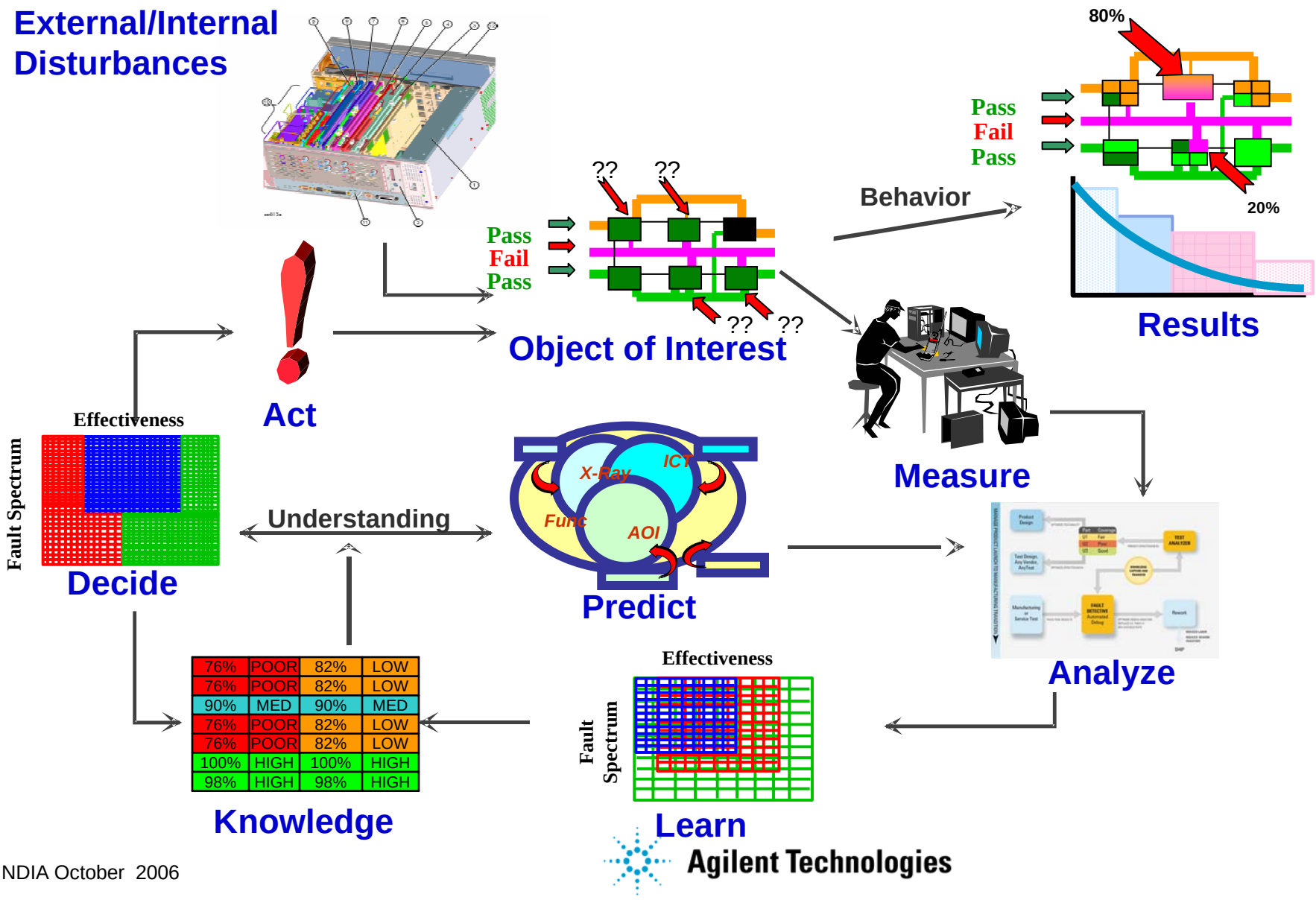
- Multiple design teams, multiple locations, using common design rules, common design tools for uniform test strategies.
- Transfer product designs, processes, test and repair knowledge in a predictable, repeatable manner to anyone anywhere.
- Model, simulate and predict test performance, quality, and cost drivers.
- Deliver manufacturing specifications without flying engineers everywhere.
- Have a common language for communicating product/process functionality.
- Consistent repair and diagnostic process with no variability, any time, any where and by anybody.

Example of Change



Agilent Technologies

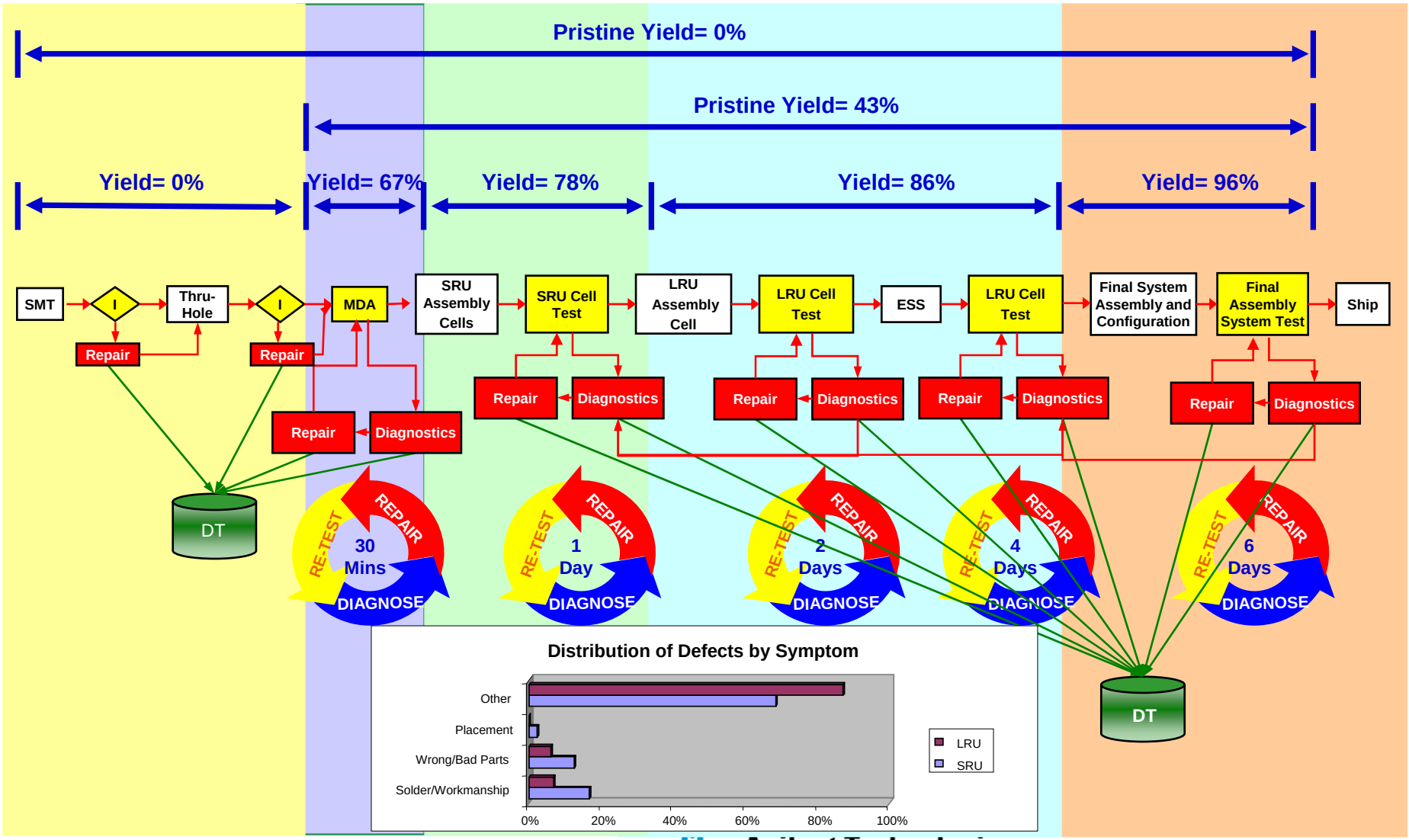
Using The Learning Organization Process to Improve



Agilent Technologies

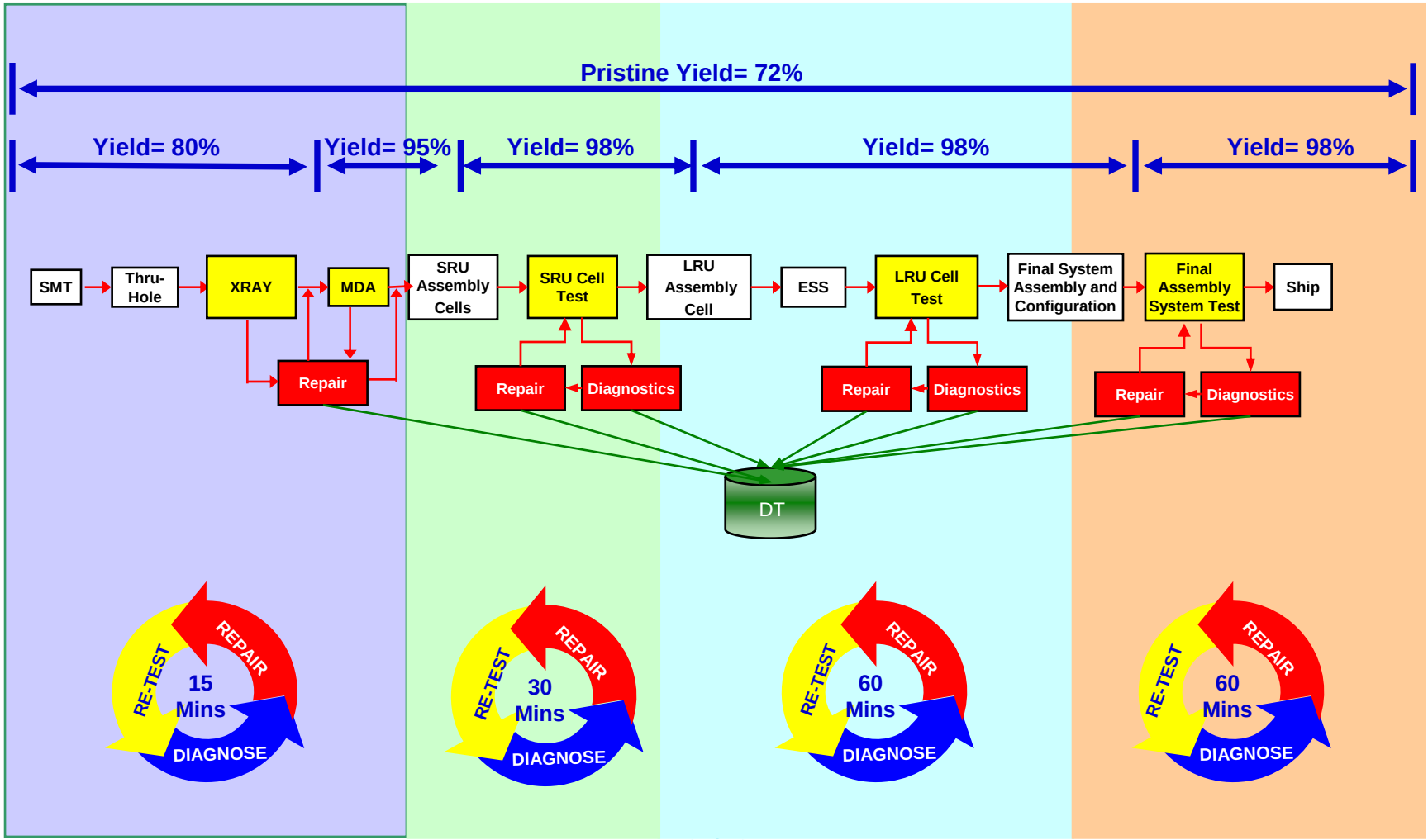
Original Manufacturing Flow

Complexity and Variability at Every Step



Agilent Technologies

Redesigned Manufacturing Flow



Agilent Technologies

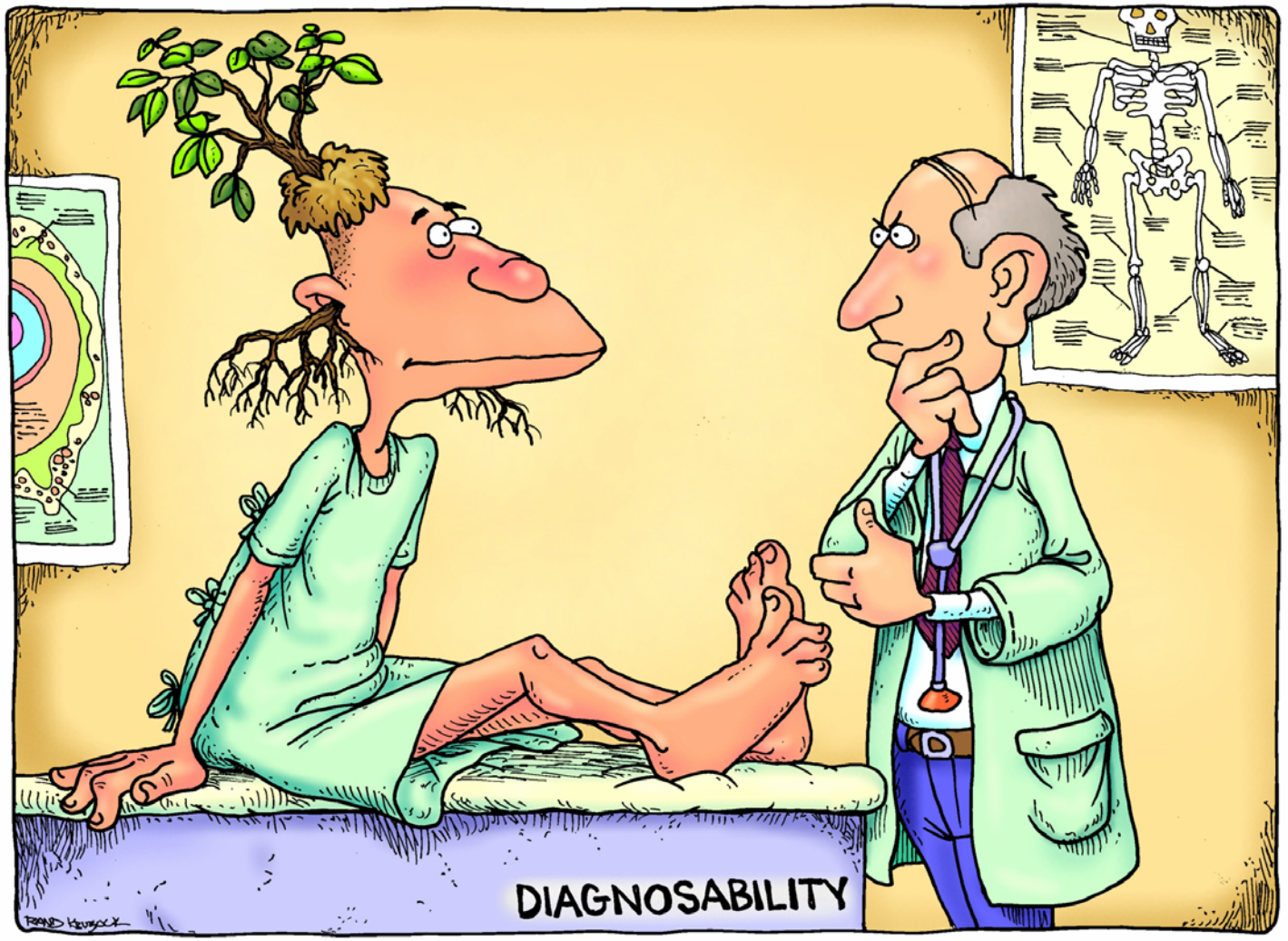
Financial Impact of Redesign Flow

What is the impact of Efficient Test and Effective Diagnostics?

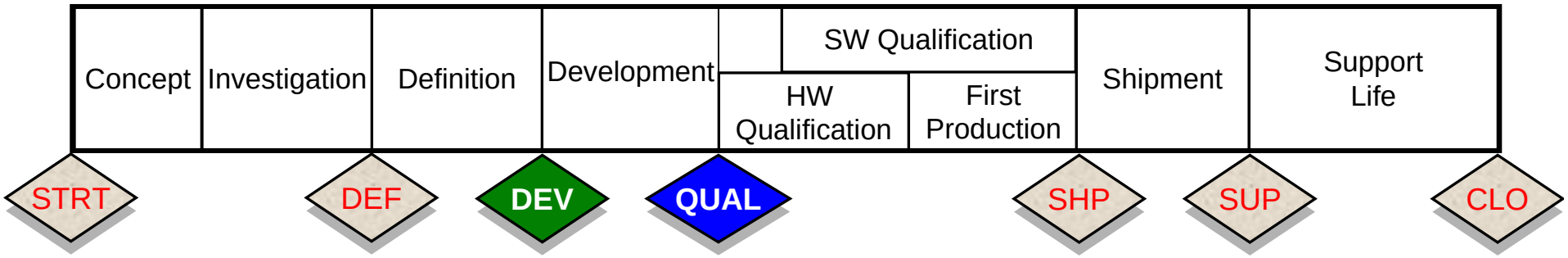
Increase in quality and reduction in diagnostic and repair of products	$.67 Million
Increase productivity of production lines due to increased test capacity (20% * 200 units/yr * $20K/unit)	$.8 Million
Savings in elimination of new tests and testers at SRU (at $500K) and LRU (at $1,000K) test cells* (($500K * 4 + $1,000 * 4) *	$1.50 Million
Reduction in total cycle time due to increased quality and re-alignment of processes (5days * $240day * 960 units/year)	$1.15 Million

Agilent Technologies

Conclusion



Leverage Points in the Product Life Cycle



80-90% of manufacturing cost determined before QUAL

90% of achievable first pass yield determined by QUAL

80% of potential profitability fixed at DEV

80% of MTBR determined before DEV

<u>Current tools will allow you to leverage these advantages by:</u>

- **Eliminating Complexity and Variability**
- **Ensuring Efficient and Effective Test Strategies before release**
- **Developing Automated Diagnostics with little additional resources during development**
- **Using Test and Diagnostics as part of a learning organization throughout the total product life cycle to leverage Results!!**

Questions???