iNEMI

International Electronics Manufacturing Initiative

Agilent Technologies Functional Test Coverage Model

Ryan Kinney

Printed Circuits Expo

2/20/07

Advancing manufacturing technology

Agilent Technologies & Functional Test

My Role in Agilent

- My group focuses on designing, manufacturing, and selling extremely complicated RF instruments
- My division looks for opportunities to exploit similarities among these instruments (so individual divisions do not re-invent the wheel)
- My role is product manager for an internally used software tool named Fault Detective

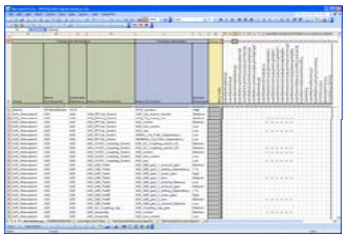
Agilent Technologies

What is Fault Detective?

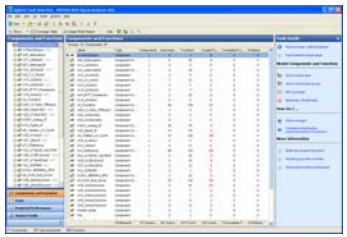
- Fault Detective is a software tool for modeling functional test
- It simulates functional test and generates metrics that measure its effectiveness
- Fault Detective enables our users to identify test gaps & redundancies

iNEMI

Assessing Test With Fault Detective



Model of Functional Test

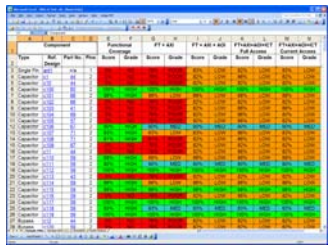


Fault Detective

Two Key Metrics

1. **Detection**
   How well do I detect failures during functional test
2. **Isolation**
   If a product fails functional test, how much effort is required to identify the faulty part

Structural Test (PCOLA-SOQ)

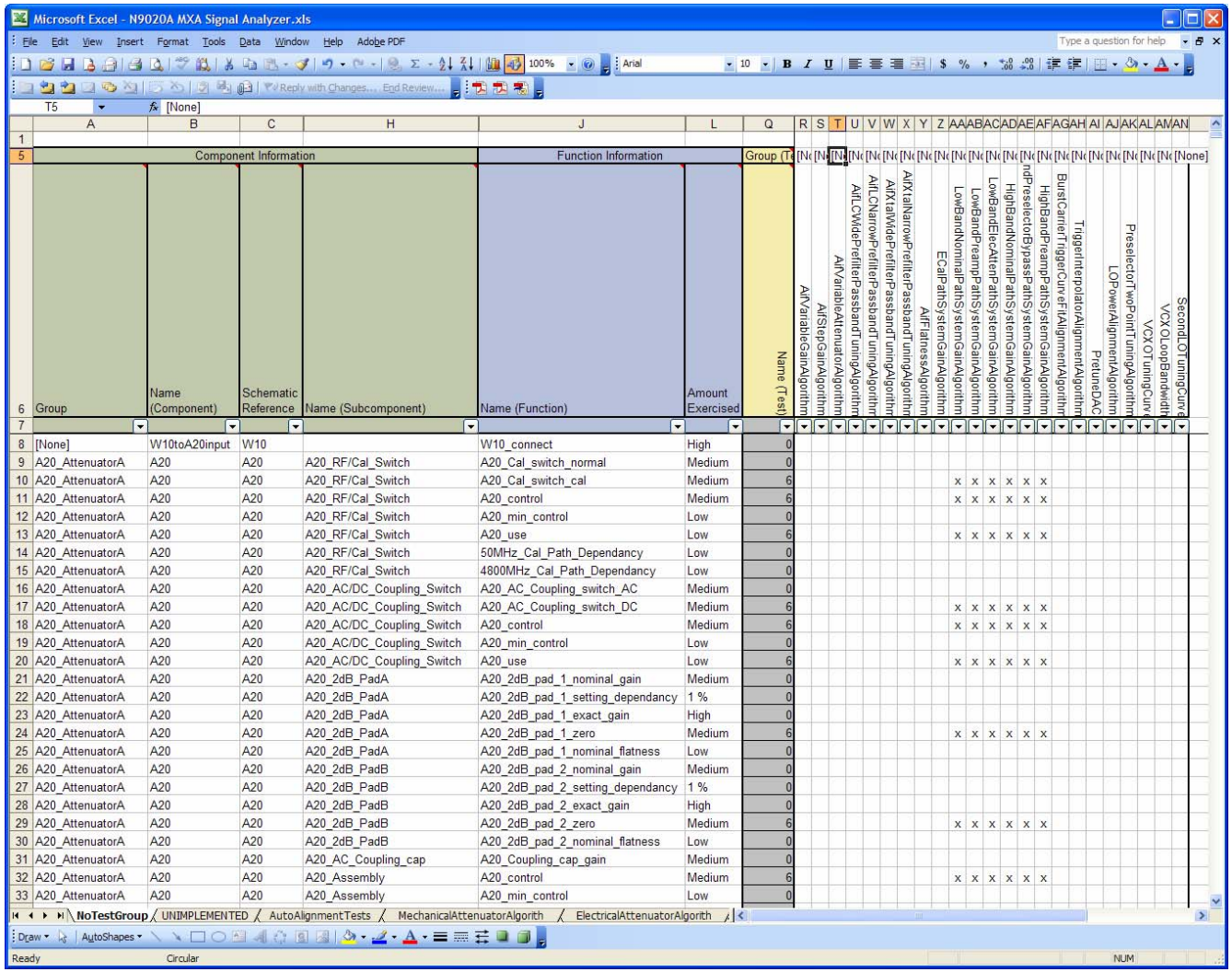


Complete Test Process Summary

Functional & Structural Test Assessment Process

1. Create a model of the functional test process
2. Analyze the model in Fault Detective
3. Compare functional test analysis against structural analysis (PCOLA-SOQ)
4. Use metrics to improve product design & optimize test

Model of Functional Test



Step 1
List tests

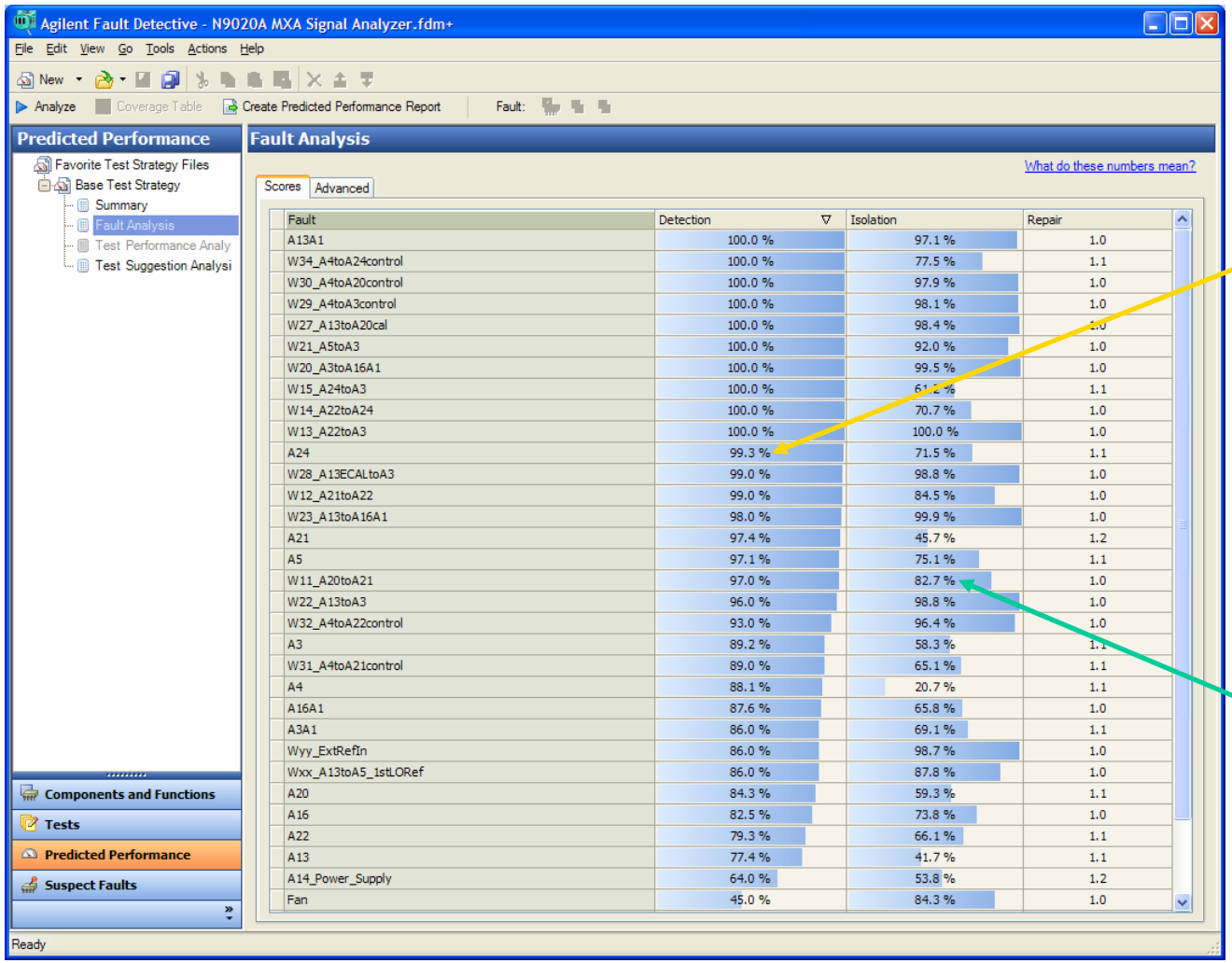
Step 2
List hardware components (nouns)

Step 3
List functionality (verbs) of each hardware component

Step 4
For each function, assign “amount of component exercised” (High, Medium or Low)

Step 5
For each test, put an ‘X’ for the functions it exercises

Functional Test Analysis



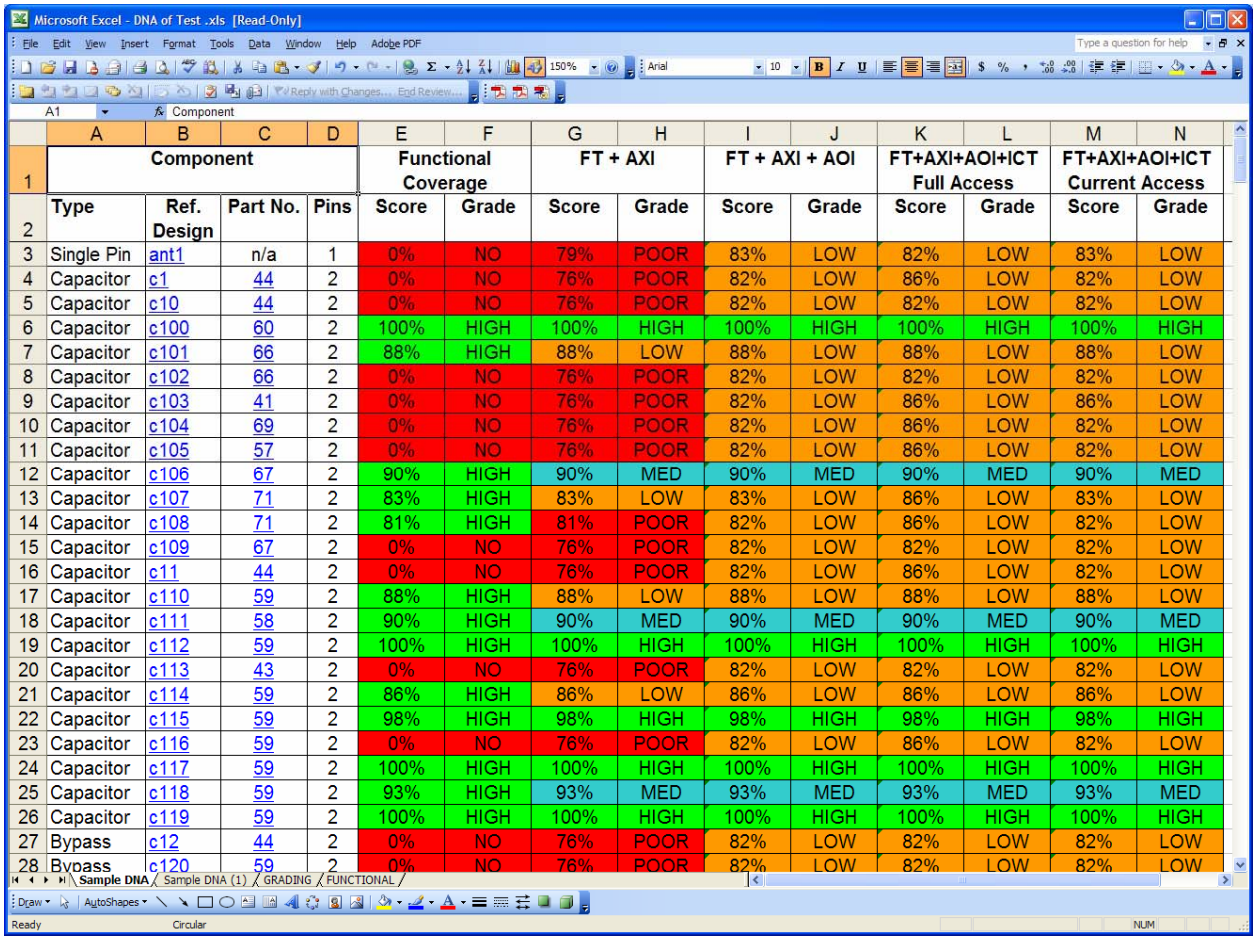
Detection

What is my ability to detect a failure in a component during functional test?

Isolation

If this component is broken, will my functional test results provide enough information to diagnose the failure?

Experiment: Comparing Structural & Functional Test



Microsoft Excel - DNA of Test .xls [Read-Only]

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Component				Functional Coverage		FT + AXI		FT + AXI + AOI		FT+AXI+AOI+ICT Full Access		FT+AXI+AOI+ICT Current Access	
2	Type	Ref. Design	Part No.	Pins	Score	Grade	Score	Grade	Score	Grade	Score	Grade	Score	Grade
3	Single Pin	ant1	n/a	1	0%	NO	79%	POOR	83%	LOW	82%	LOW	83%	LOW
4	Capacitor	c1	44	2	0%	NO	76%	POOR	82%	LOW	86%	LOW	82%	LOW
5	Capacitor	c10	44	2	0%	NO	76%	POOR	82%	LOW	82%	LOW	82%	LOW
6	Capacitor	c100	60	2	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH
7	Capacitor	c101	66	2	88%	HIGH	88%	LOW	88%	LOW	88%	LOW	88%	LOW
8	Capacitor	c102	66	2	0%	NO	76%	POOR	82%	LOW	82%	LOW	82%	LOW
9	Capacitor	c103	41	2	0%	NO	76%	POOR	82%	LOW	86%	LOW	86%	LOW
10	Capacitor	c104	69	2	0%	NO	76%	POOR	82%	LOW	86%	LOW	82%	LOW
11	Capacitor	c105	57	2	0%	NO	76%	POOR	82%	LOW	86%	LOW	82%	LOW
12	Capacitor	c106	67	2	90%	HIGH	90%	MED	90%	MED	90%	MED	90%	MED
13	Capacitor	c107	71	2	83%	HIGH	83%	LOW	83%	LOW	86%	LOW	83%	LOW
14	Capacitor	c108	71	2	81%	HIGH	81%	POOR	82%	LOW	86%	LOW	82%	LOW
15	Capacitor	c109	67	2	0%	NO	76%	POOR	82%	LOW	82%	LOW	82%	LOW
16	Capacitor	c11	44	2	0%	NO	76%	POOR	82%	LOW	86%	LOW	82%	LOW
17	Capacitor	c110	59	2	88%	HIGH	88%	LOW	88%	LOW	88%	LOW	88%	LOW
18	Capacitor	c111	58	2	90%	HIGH	90%	MED	90%	MED	90%	MED	90%	MED
19	Capacitor	c112	59	2	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH
20	Capacitor	c113	43	2	0%	NO	76%	POOR	82%	LOW	82%	LOW	82%	LOW
21	Capacitor	c114	59	2	86%	HIGH	86%	LOW	86%	LOW	86%	LOW	86%	LOW
22	Capacitor	c115	59	2	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH	98%	HIGH
23	Capacitor	c116	59	2	0%	NO	76%	POOR	82%	LOW	86%	LOW	82%	LOW
24	Capacitor	c117	59	2	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH
25	Capacitor	c118	59	2	93%	HIGH	93%	MED	93%	MED	93%	MED	93%	MED
26	Capacitor	c119	59	2	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH	100%	HIGH
27	Bypass	c12	44	2	0%	NO	76%	POOR	82%	LOW	82%	LOW	82%	LOW
28	Bypass	c120	59	2	0%	NO	76%	POOR	82%	LOW	82%	LOW	82%	LOW

Step 1

Obtained PCOLA/SOQ scores from AXI, AOI & ICT.

Step2

Obtained functional test score from Fault Detective.

Step 3

Applied a formula to combine the structural & function test results into one coverage score.