...Low Force Interface...

For Multi-DUT Memory and Logic

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Agenda

- Why Low Force? – impact of parallelism
- What is it? – Low Force Interface
- RF Analysis
- Test Plan
- Electrical Testing and Results
- Mechanical Design
- Life Test
- Performance Summary
- Conclusions

Lower Cost of Test

Lower Test Cost → Greater Parallelism →
High Pin Count → High Force

	Examples of Typical DUTs			
Pins tested / DUT	39 Flash	40	50	57 DRAM
Parallelism	X144	x256	x256	x512
Total contacts	5616	10240	12800	29184
Force [Kg]				
Spring probes	281	512	640	1459
LFI	56	102	128	292

SV Probe LFI

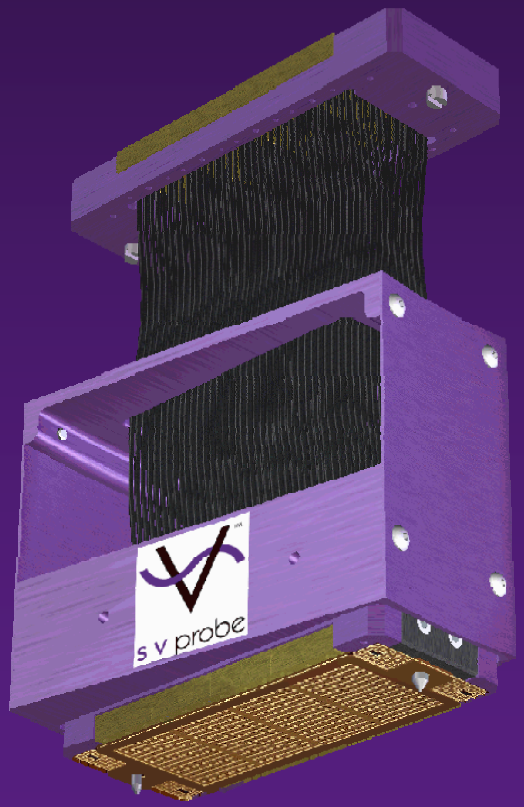
What is it?

A new high performance/ low force interface technology targeting high I/O count memory and SOC tester applications

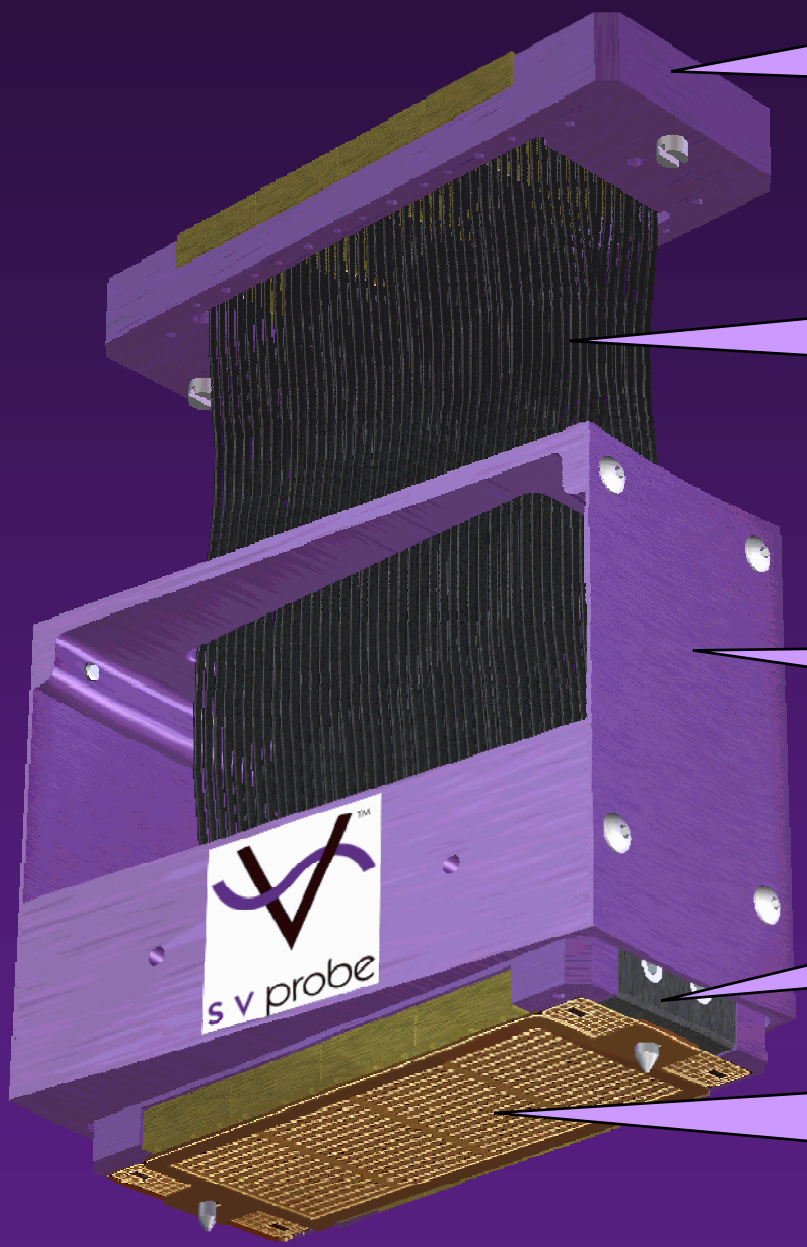
What is different?

Uses Planar Interconnect (PI) contact set to create a high performance interface

Contact force is 1/5 of spring probes without drop off in contact reliability



LFI Module



Interface to backplane connector or directly to ATE pin electronics card

Coax Cables provide high speed / low noise signal path

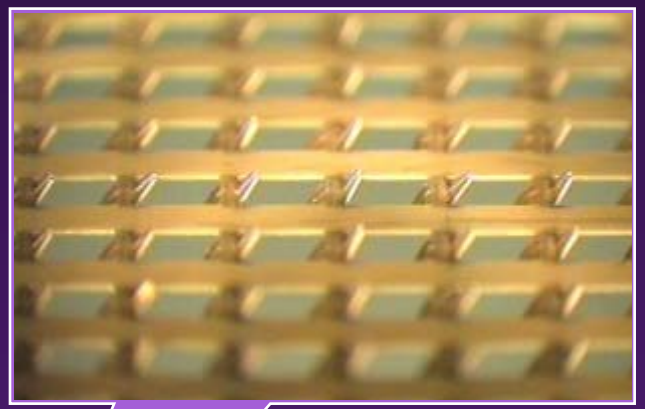
Shroud supports strain relief and base ring

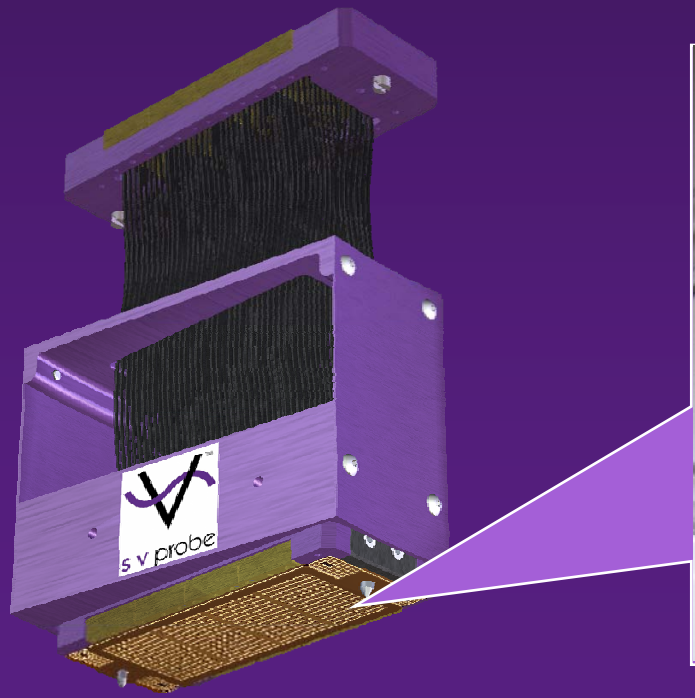
Mechanical coarse compliance (gimble) mechanism

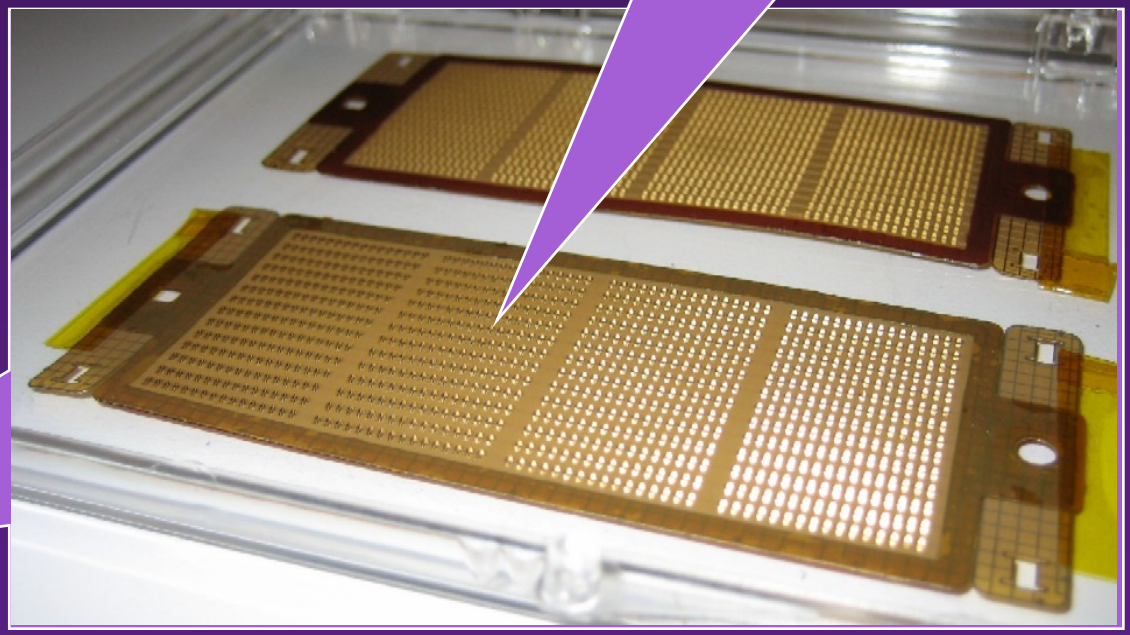
Interface to the probe card / DUT board thru Planar Interconnect (PI)

Planar Interconnect

- LGA type contact set
  - Force <10 g/contact
  - CRes <30 mΩ
  - No connectors on probe card / DUT board







Flexible Cable Assembly

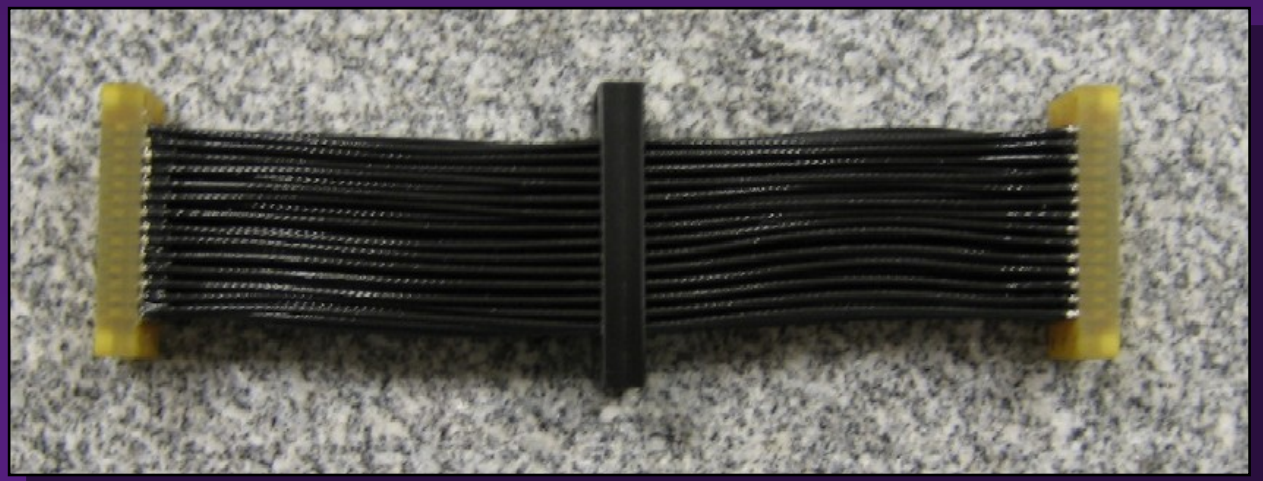
112 Signal / Gnd (Pairs)

- or -

224 Power/Gnd/Utility (Single Contacts)

- or -

Signal/Gnd/Power/Utility (Mix)



Cable Definition Flexibility

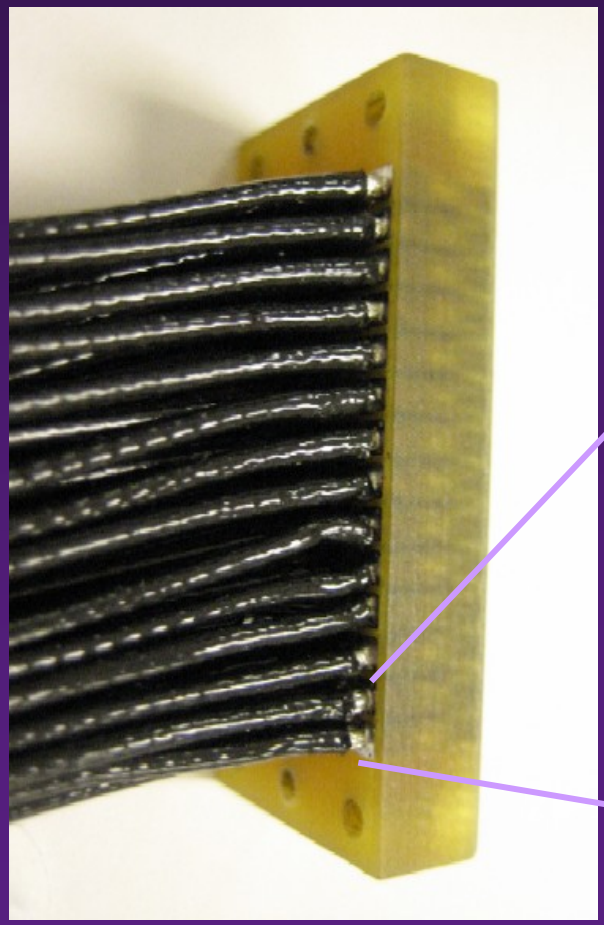
Contact Definition	Example Configurations			
Signals	96	0	0	112
Grounds	96	100	112	112
Power	0	100	112	0
Utilities	32	24	0	0
Total	224	224	224	224

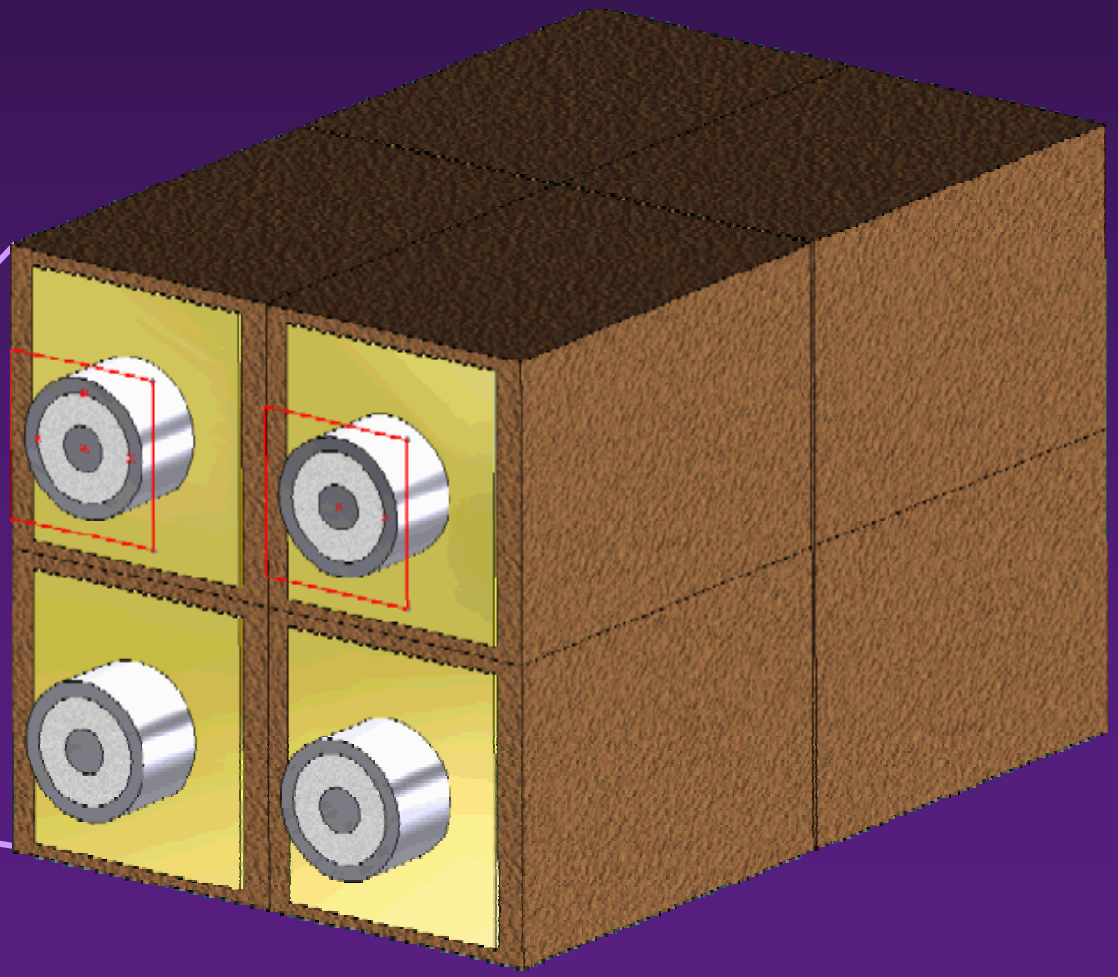
Size & Count

	Example Configurations		
Probe Card Diameter	16”	16”	19”
Cable Assy/ MDL, MDL’s	4,12	3,18	4,24
Useable Area	9.75”	11.25”	12.75”
Total Signals (S+G)	3456	3456	6912
Total Utilities	1152	1152	3072
Total Powers	2304	2304	4608
Total Grounds	0	0	0
Total Contacts	**10368**	**10368**	**21504**
Total No Conn's	384	1728	0
Total Force	108 kg	121 kg	215 kg

RF Analysis

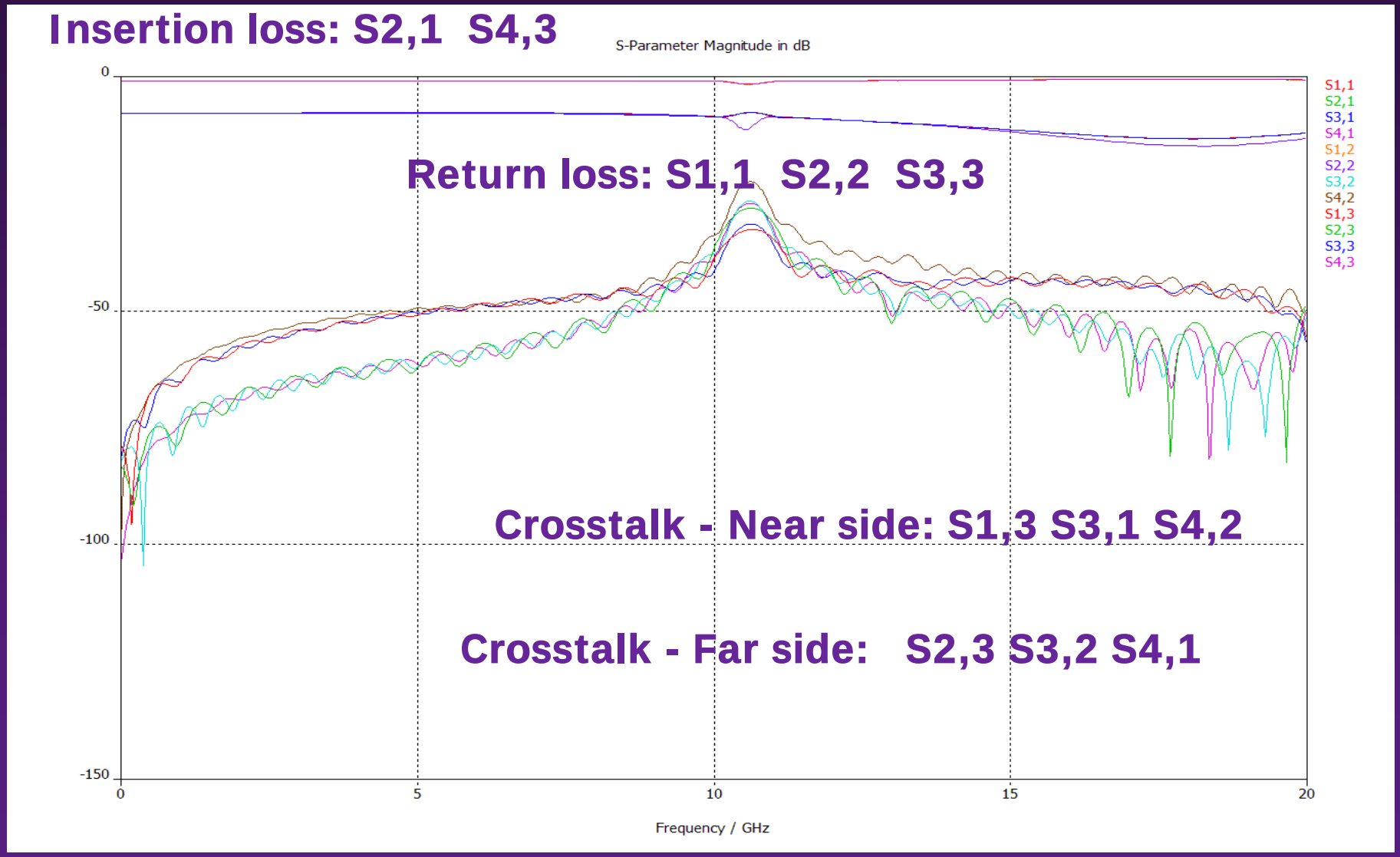
3D Electromagnetic Simulation for Mini-PCB to coax connection optimization





RF Analysis Results

S-Parameters: Signal to Crosstalk & Return Loss



Test Outline

Electrical

- RF test
  - Transmission (S21)
  - Reflection (S11)
  - Crosstalk (S13)
- DC Test
  - Leakage
  - Max current

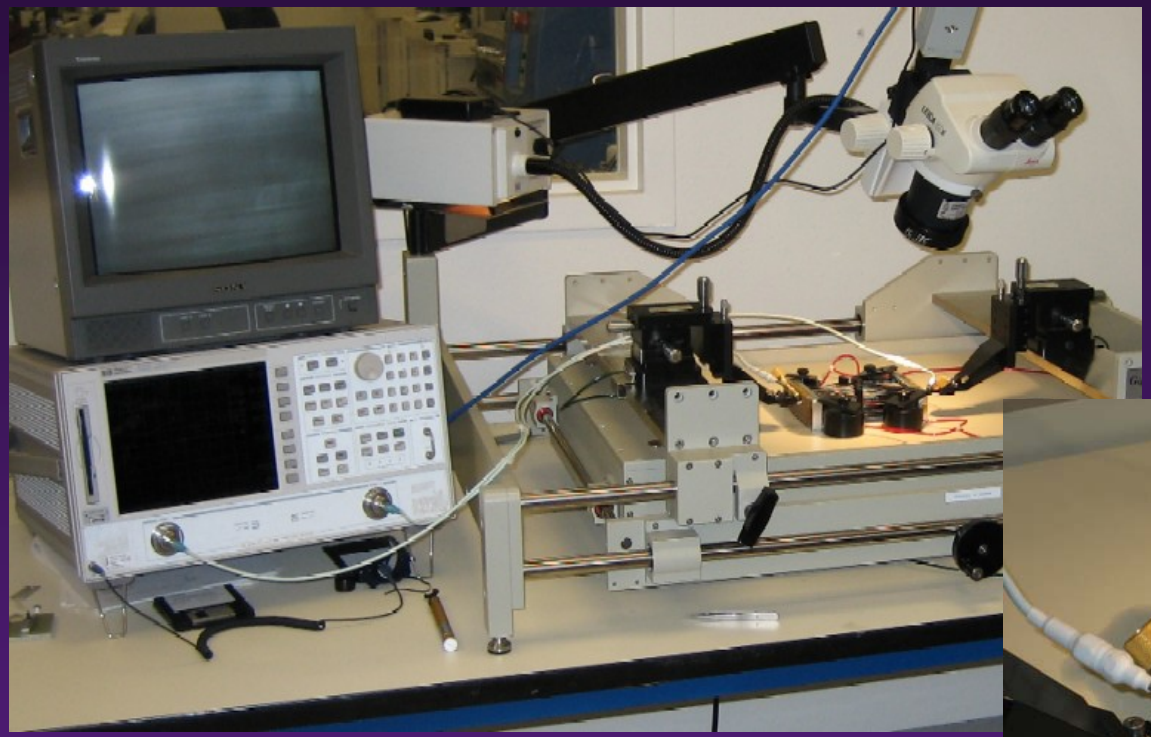
Mechanical

- Loading force
- Planar interconnect force

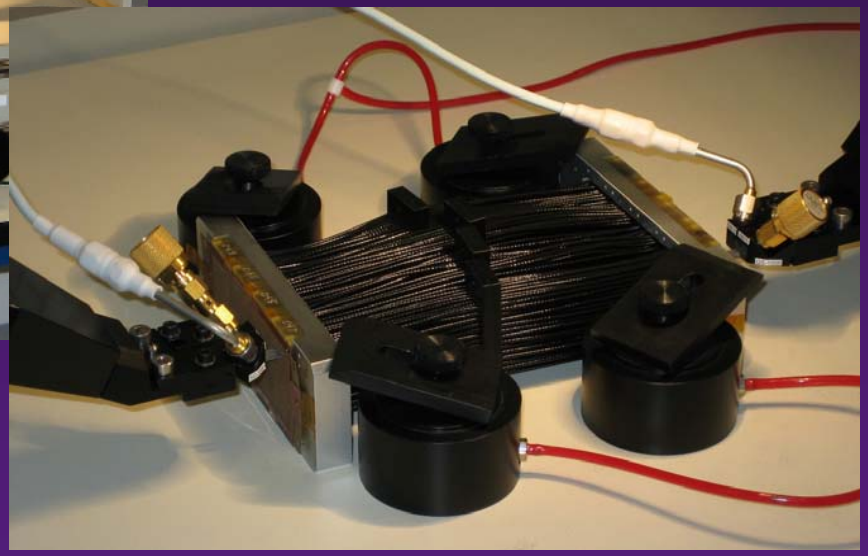
Life Test

- Path resistance

Test – RF



- HP Vector Network Analyzer
- GigaTest Probe Station
- LFI Module

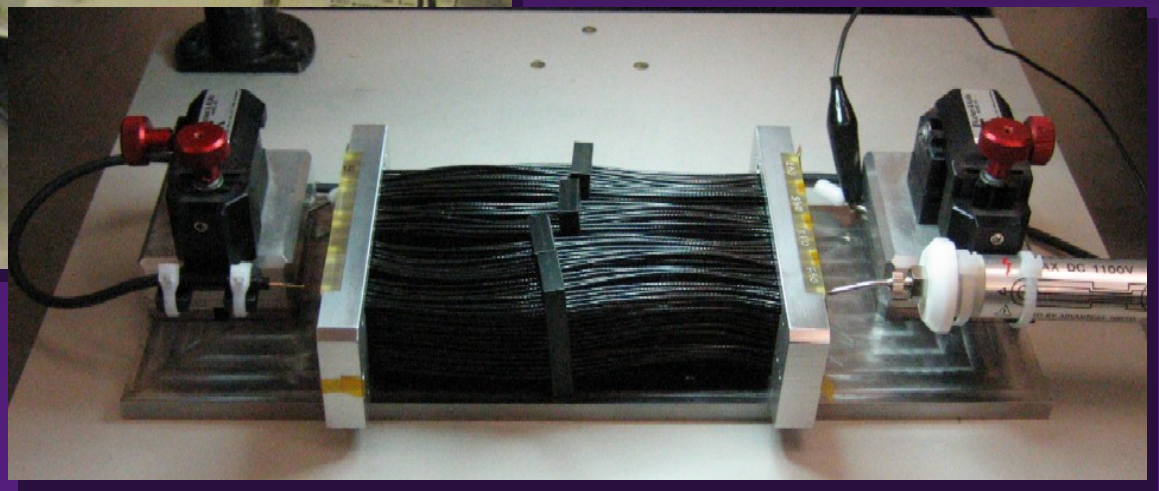


BW: 8.4GHz @-3dB

Return loss: 1.5 GHz @-25dB

Crosstalk: < -20dB @ 10GHz

Test – Hi-Pot Leakage

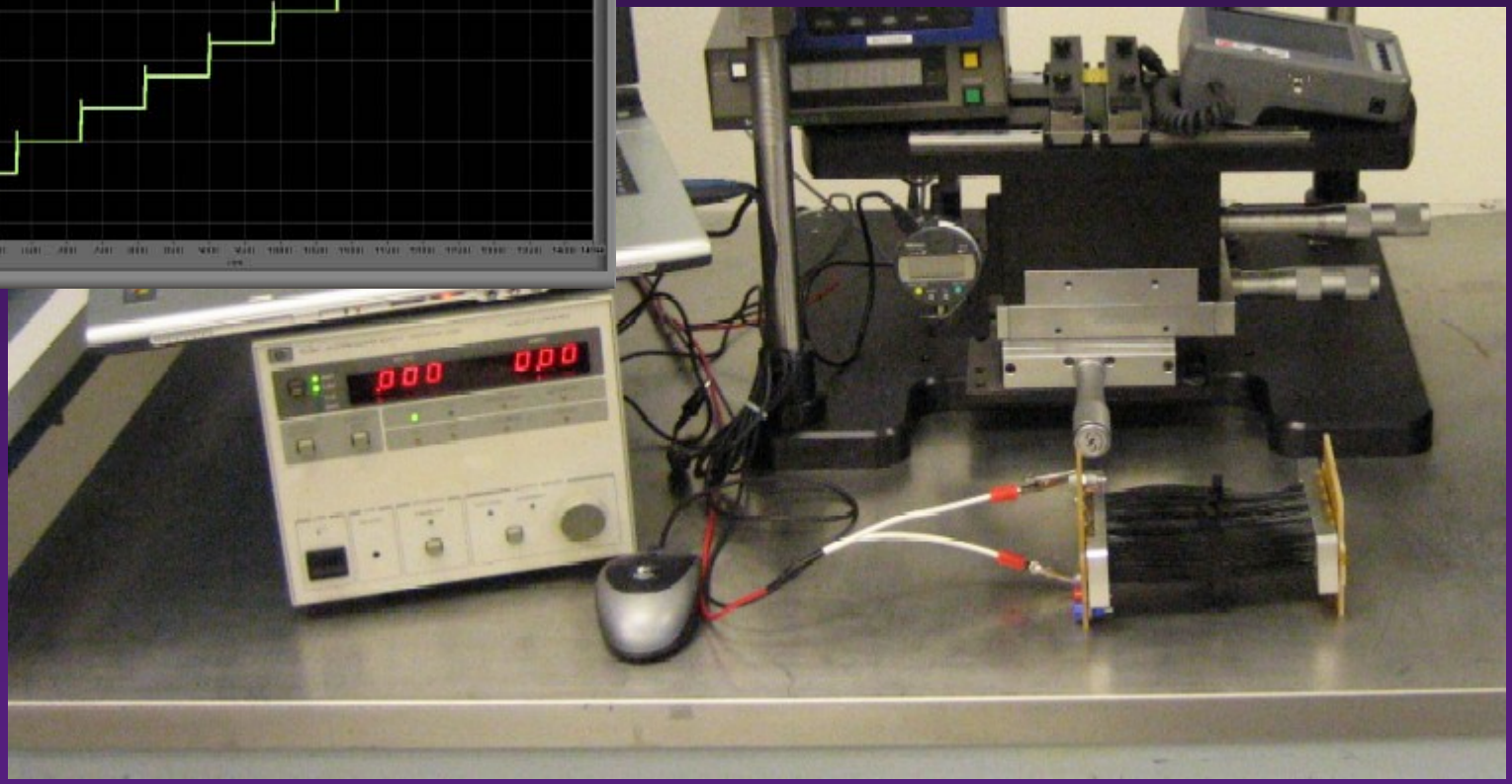


- Advantest Ultra High Resistance Meter
- LFI Module

Leakage: ≤ 3nA @ 200V

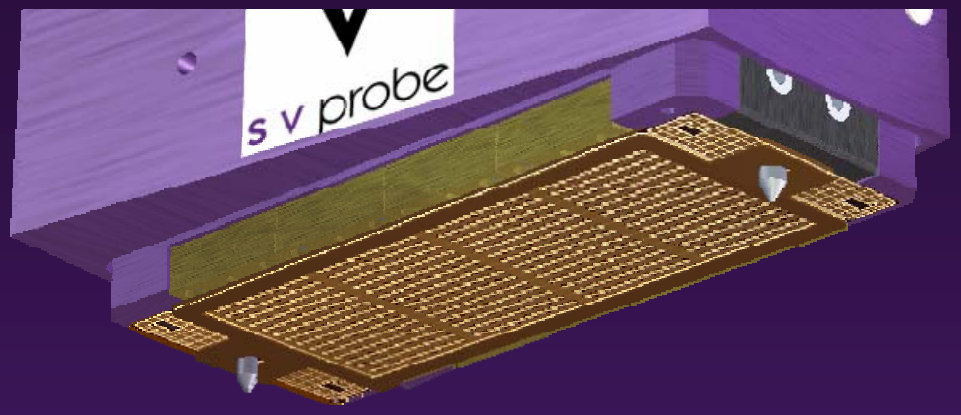
Test – Max Current

- HP Programmable Power Supply
- LFI Module



Current Carrying Capability: 2A for 3 min

Compliance Mechanism

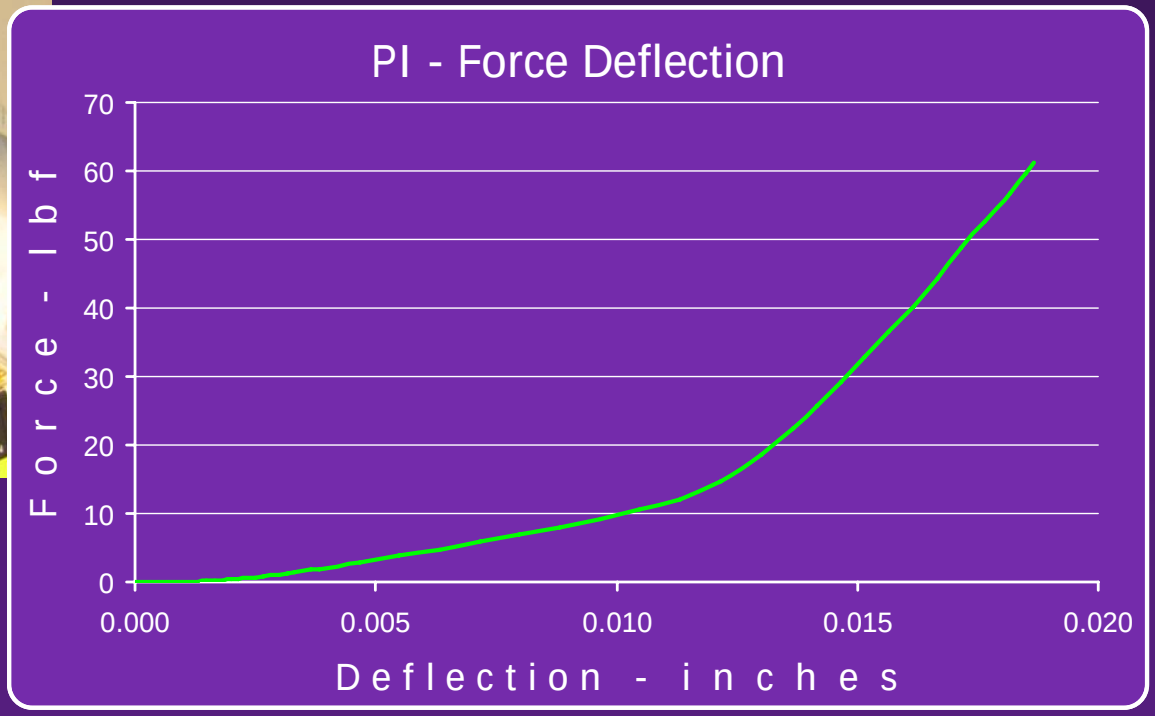


Functions:

- Coarse compliance in Z direction
- Provides fine alignment in XY directions without adding parts to probe card or DUT board
- Limits maximum force
- Independent suspension allows interface assembly to be modular

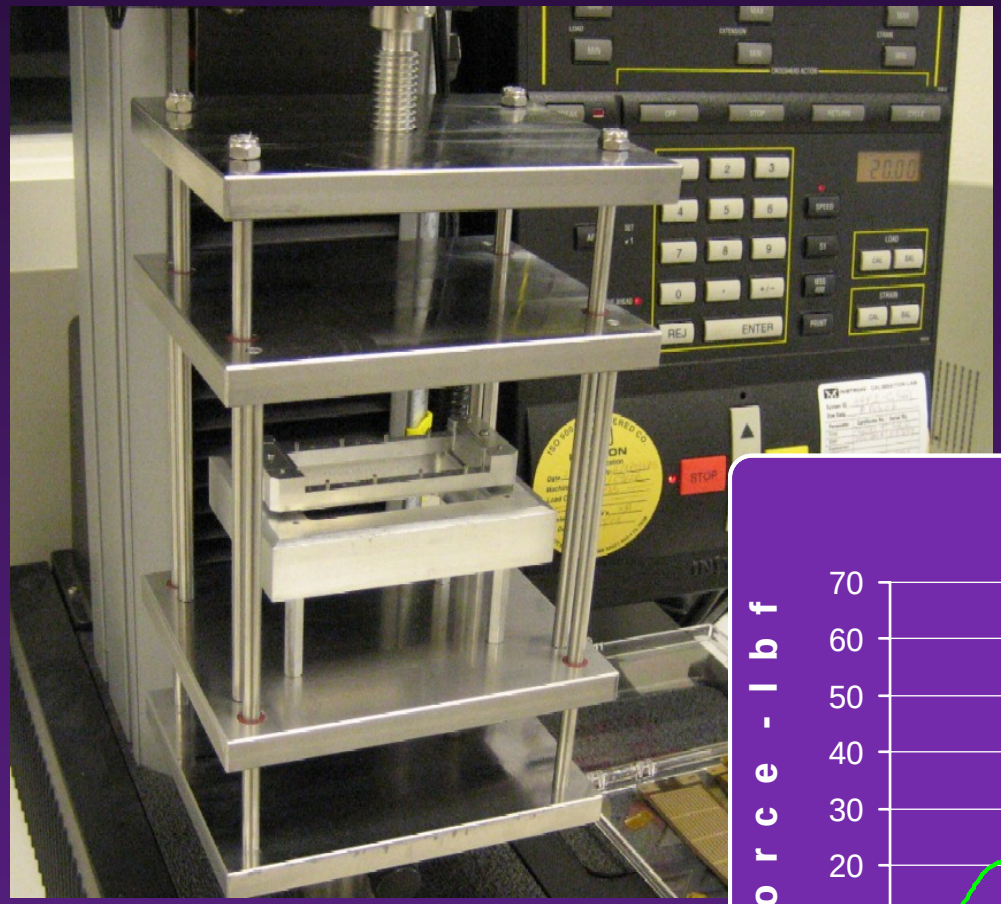
Test – Planar Interconnect

- **Instron force / deflection tester**
- **Planar interconnect contact set**

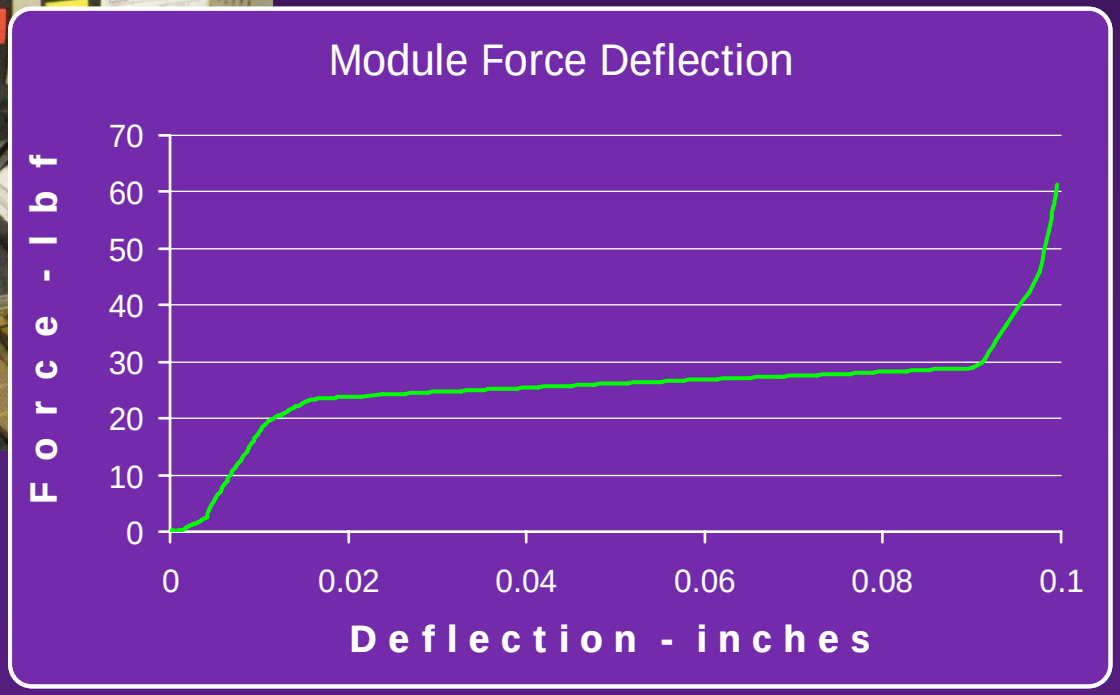


- Compliance 10.3 mils
- Force 16 lb (8.1 g/contact)

Test – Mechanical Compliance



- Instron force / deflection tester
- LFI compliant module

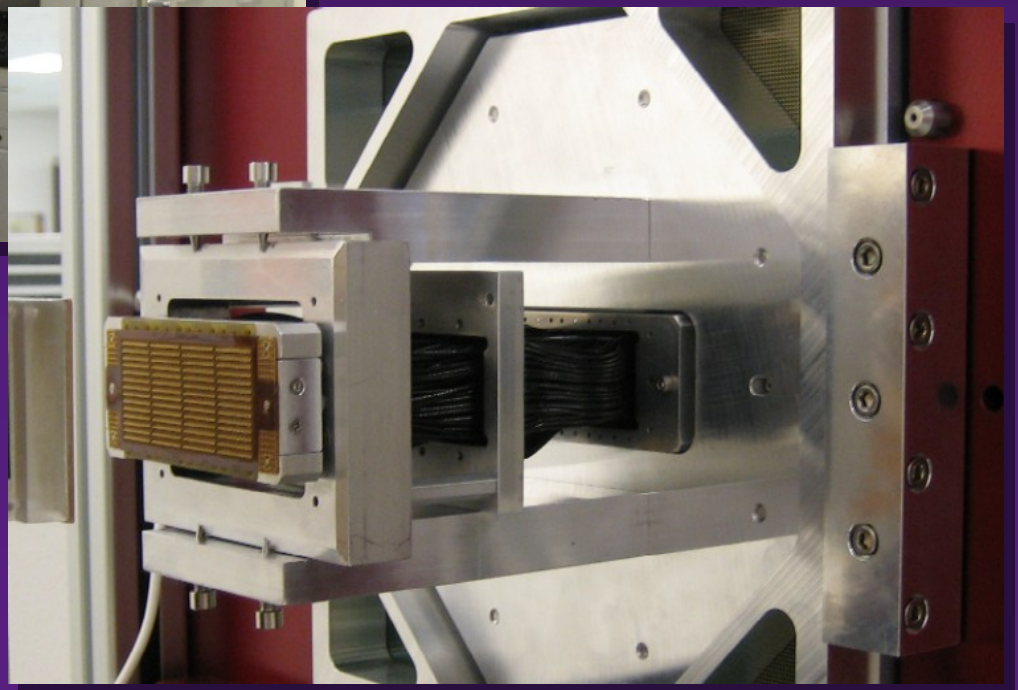


- Compliance 89 mils
- Force 29 lb Maximum

Life Test

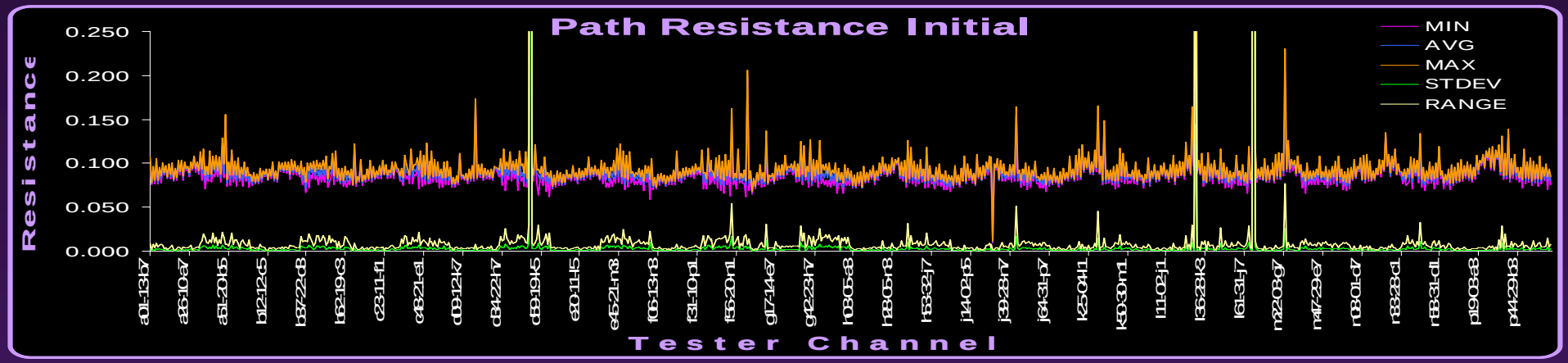
- BOSS tester

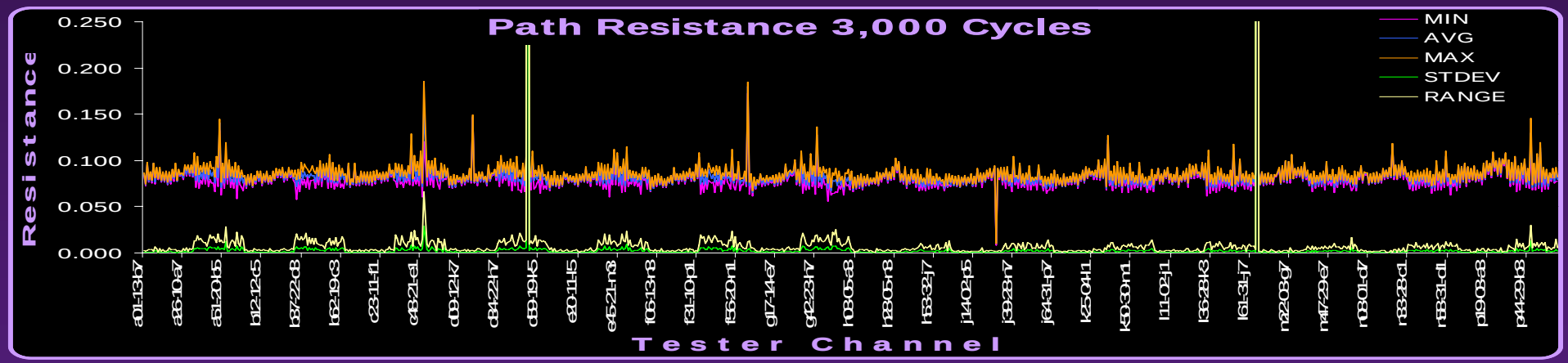
- Evertech Handler

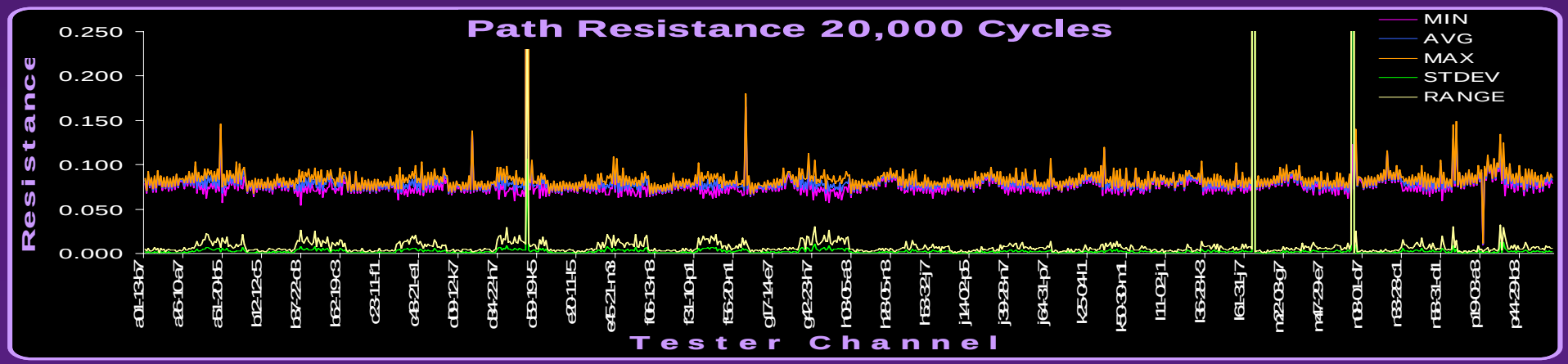


- LFI Module

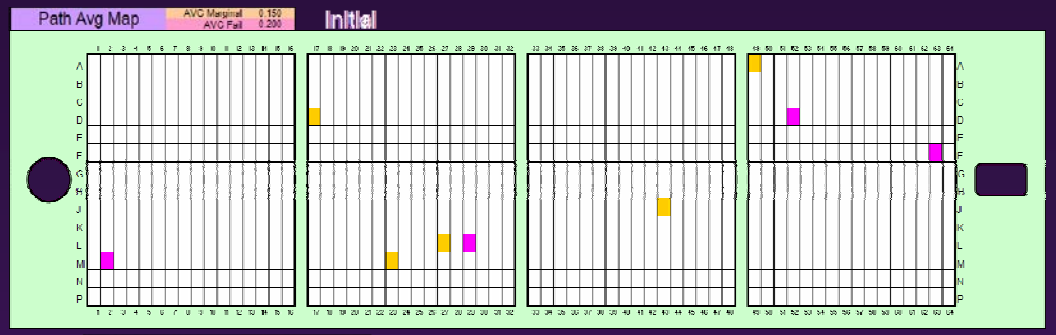
Typical Path Resistance Data



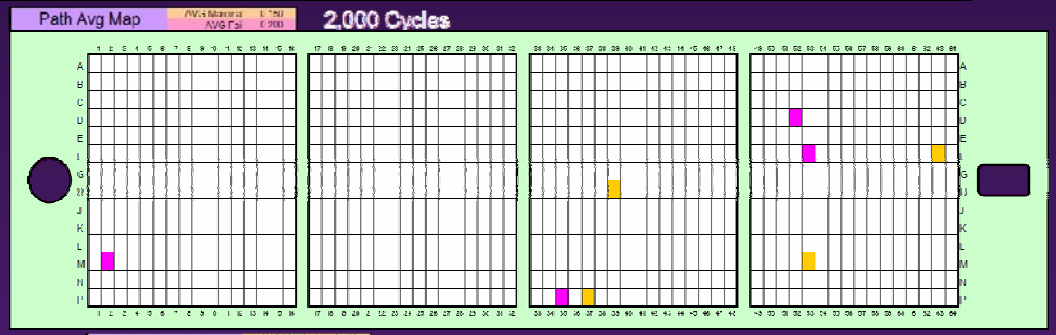




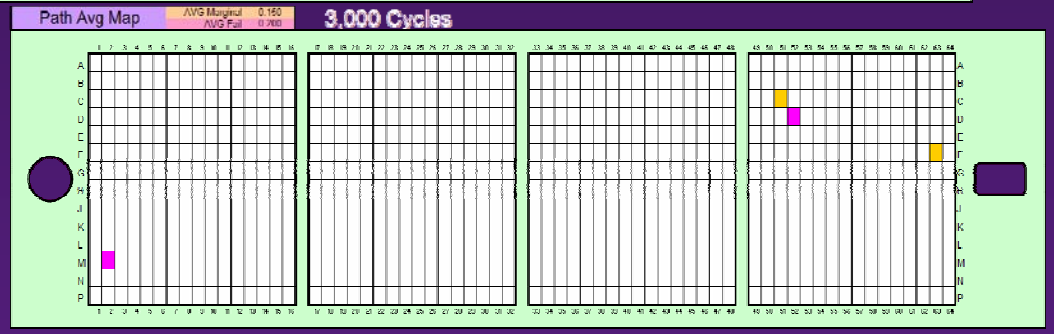
Path Resistance Data Map



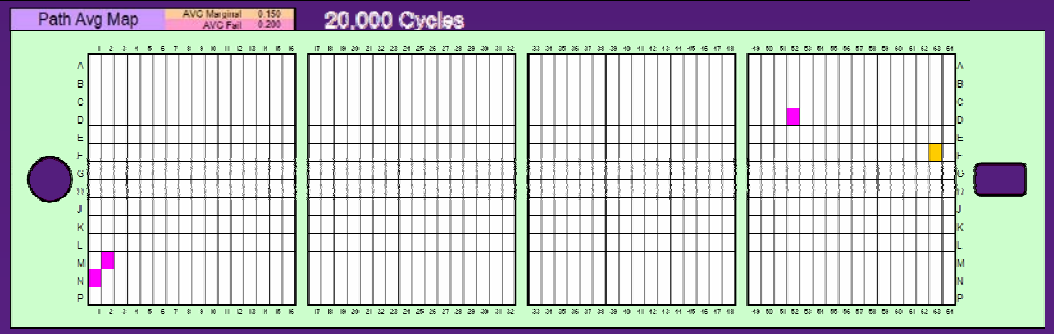
Initial



2,000 Cycles

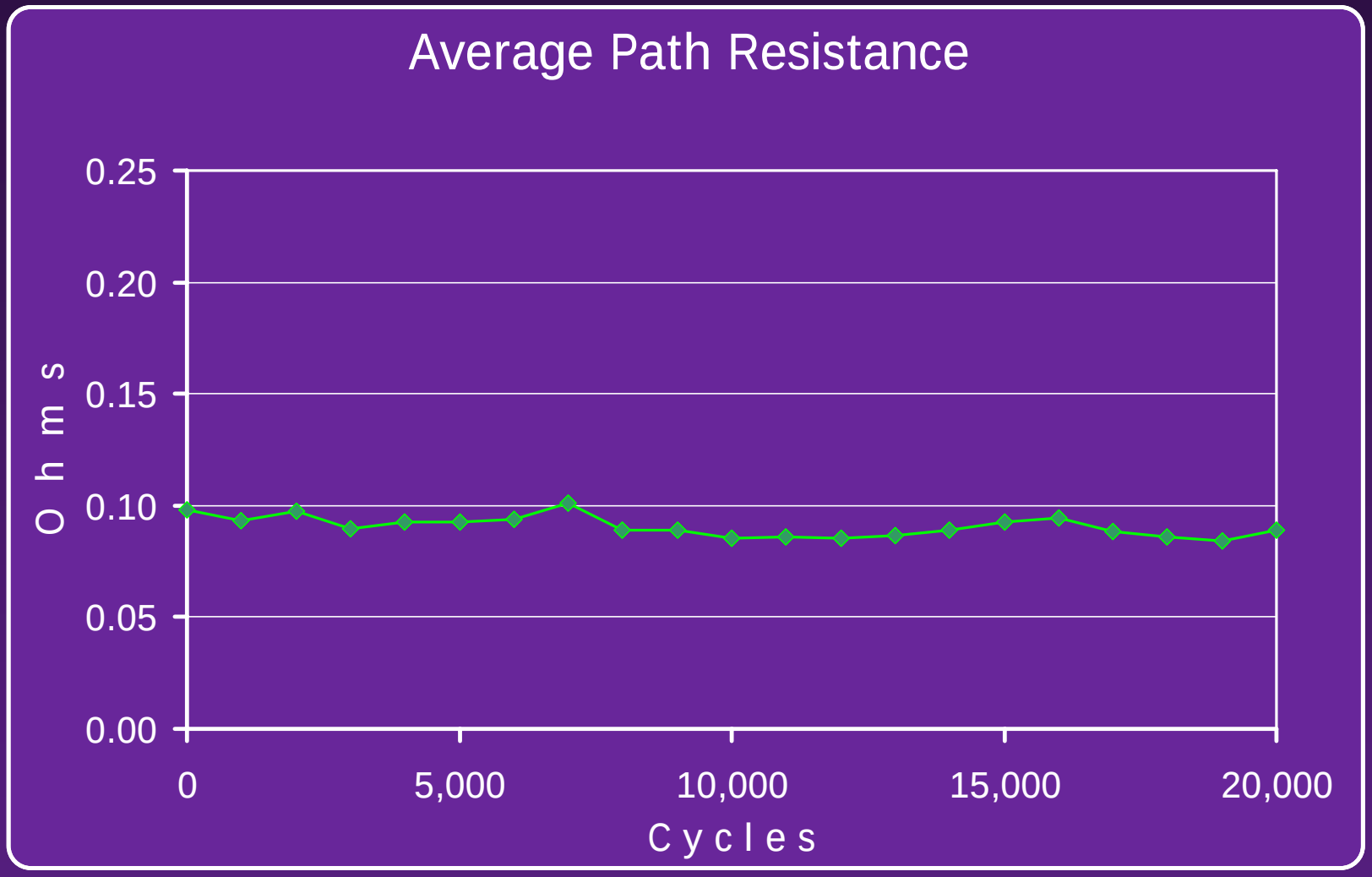


Path resistance stabilizes after 3,000 cycles



20,000 Cycles

Life Test Data



Average path resistance remains stable over life

Performance Summary

Parameter	Measured
Impedance	50 Ω +/- 5%
Insertion Loss (S21)	>8 GHz @-3dB, 6” cable
Return Loss (S11)	1.5 GHz @-25dB, 6” cable
Cross Talk (S13)	-20dB @ 10GHz
Leakage	< 3 nA @ 200V
Current Capability	2 A continuous
Ave Path Resistance	< 100 mΩ
Resistance Std Deviation	6 mΩ
Compression Force	≤ 10 g/contact
Compliance	> 80 mils
Life Cycles	20,000 Passed

Conclusions

Module testing demonstrates:

- ✓Low Force Interconnect
- ✓Mechanically robust and stable
- ✓Electrically high performance

➢LFI is a viable low force interface for high parallelism applications

QUESTIONS?