SW Test Workshop
Semiconductor Wafer Test Workshop

Vertical MEMS Probe Card Applied to High Speed Loopback Test of Network Communication IC

Haiyong Song Zheng Li

Adolph Cheng Alex Wei Fred Chou

Jessie Deng Kenny Huang Zach Hsieh

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Overview

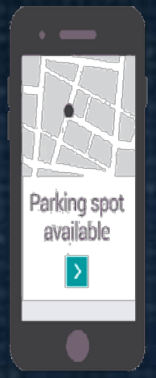
- Introduction
- MPI's Solution
- Experiment Design and Validation
- Summary

Overview

- **Introduction**
  - High Speed Market
  - MPI's Current Solution
  - High Speed Measurement Challenge
- **MPI's Solution**
- **Experiment Design and Validation**
- **Summary**

5G Coming!

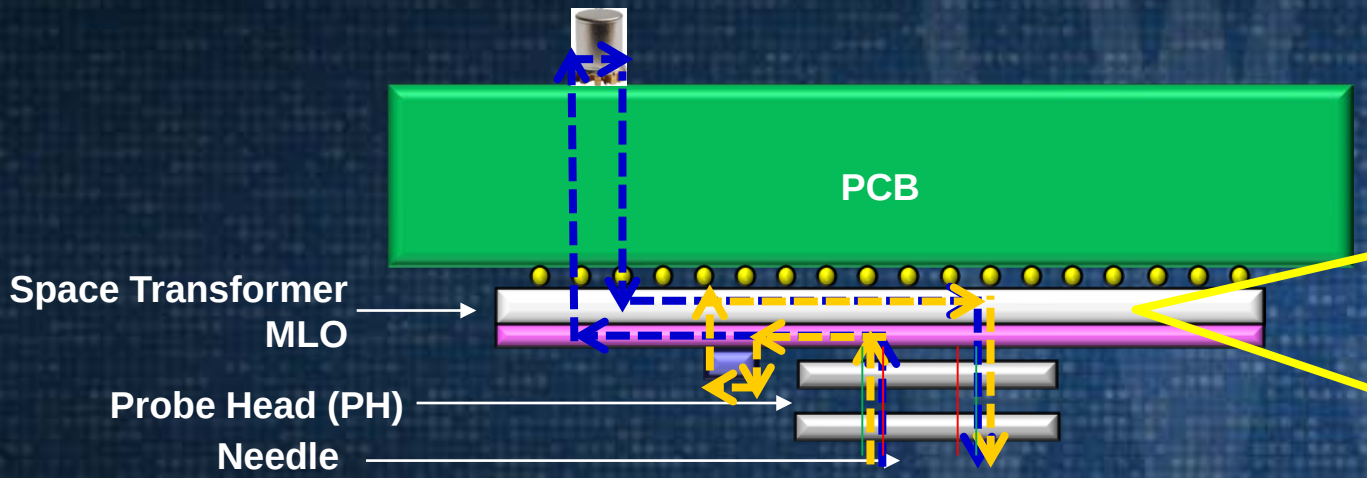
- Increased data throughput requirements are driving specification demand for high-speed digital interface such as SerDes UFS, DDR5 and so on
- Test interface has became one of today's toughest CP challenges



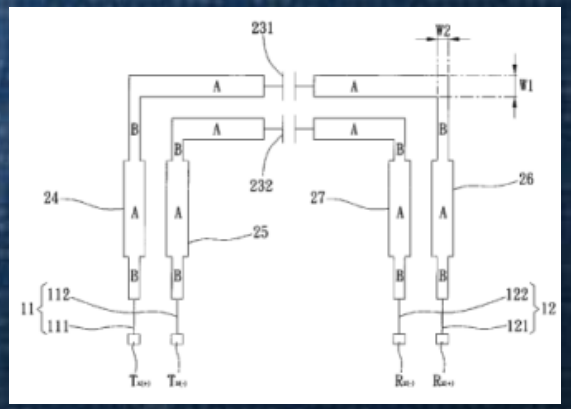
Source: www.istockphoto.com

MPI's Current Solution

- In 2015 and 2016, MPI introduced Super Eye™ for higher speed loopback test

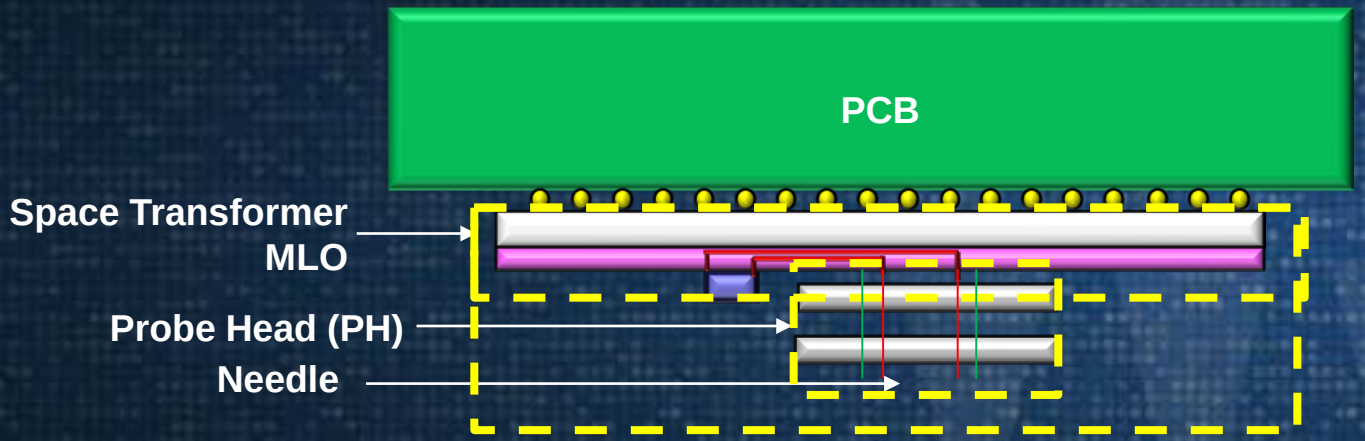


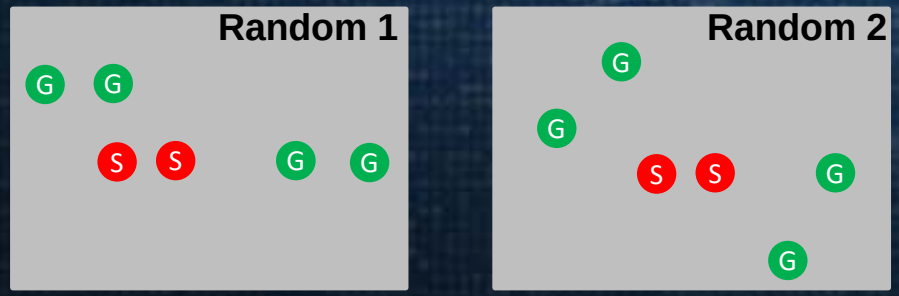
Super Eye™

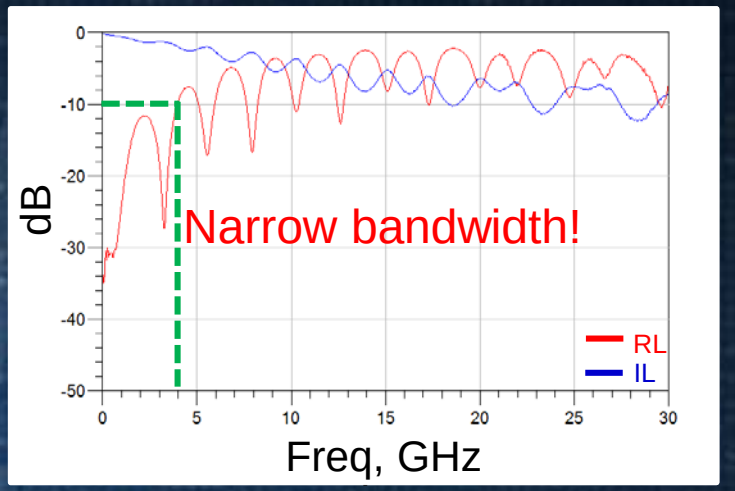


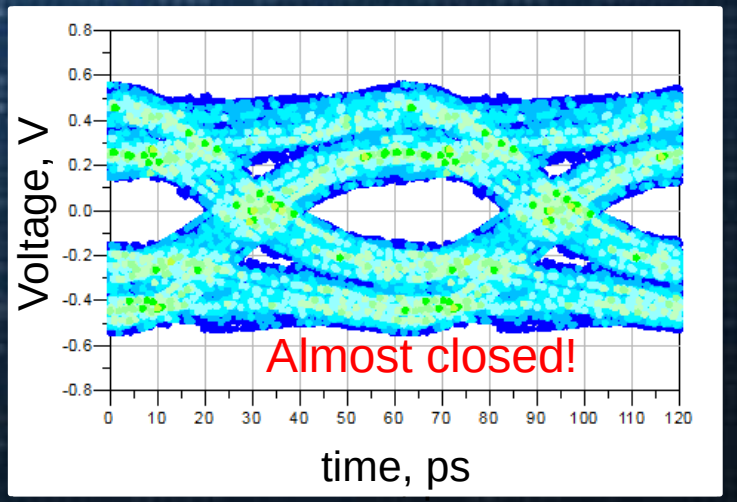
Loopback length reduction

Probe Head Development Challenge









Everybody Needs More Data and Content

- **Higher Data Date**
- **Wider Bandwidth**

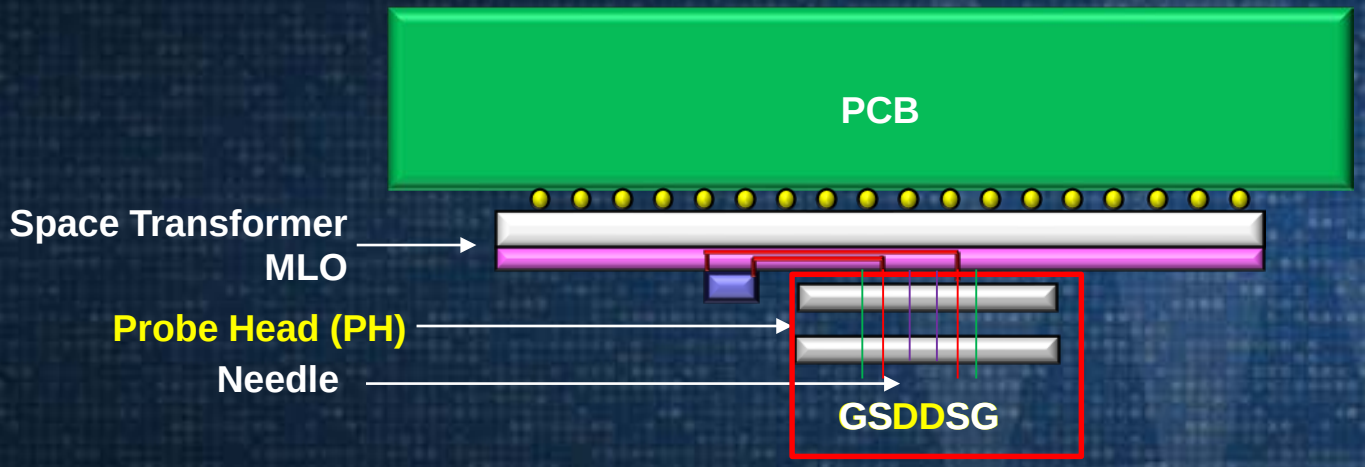
- **Challenge**
  - Probe Head development to meet higher speed requirements

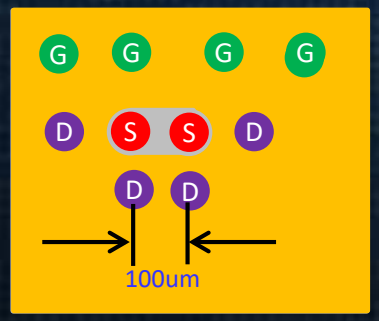
Overview

- Introduction
- MPI's Solution
  - What's the 3DS HS Probe Head solution
  - The features of 3DS HS Probe Head
- Experiment Design and Validation
- Summary

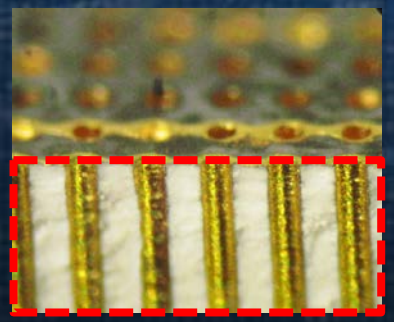
3DS HS Probe Head Solution

- **What is MPI's answer? The 3DS HS Probe Head solution**
  - Matching impedance design
  - Dragon bar and metal-plating technology

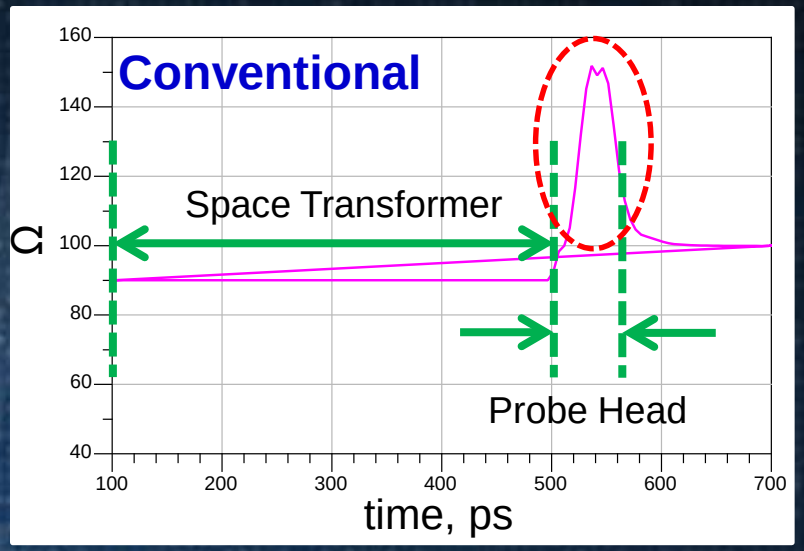


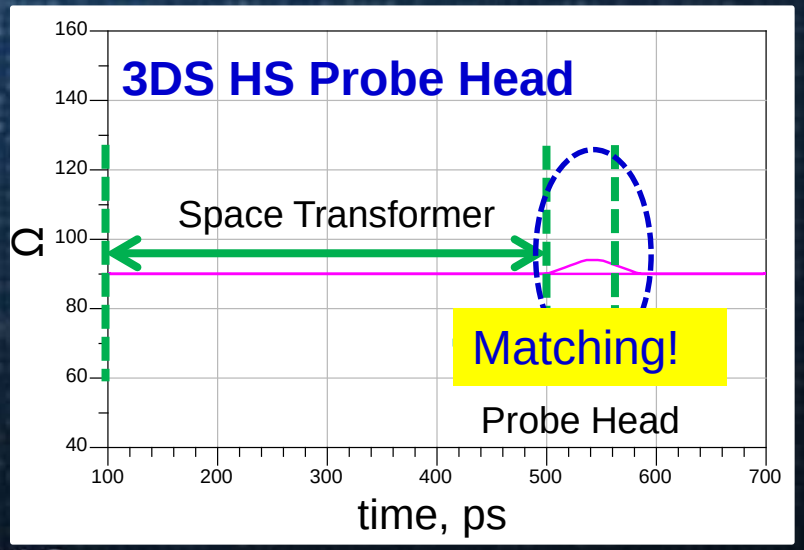


S Signal needle
G Ground needle
D Dragon bar



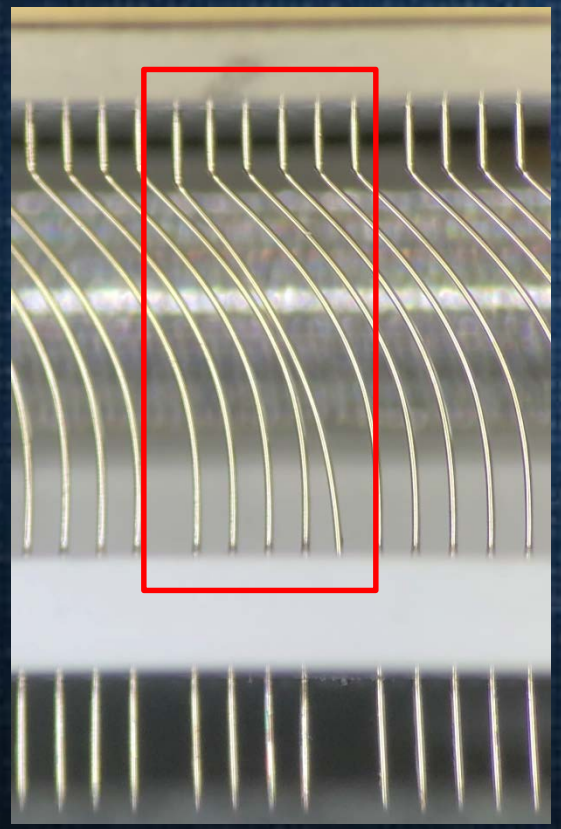
Metal-Plating Tech.

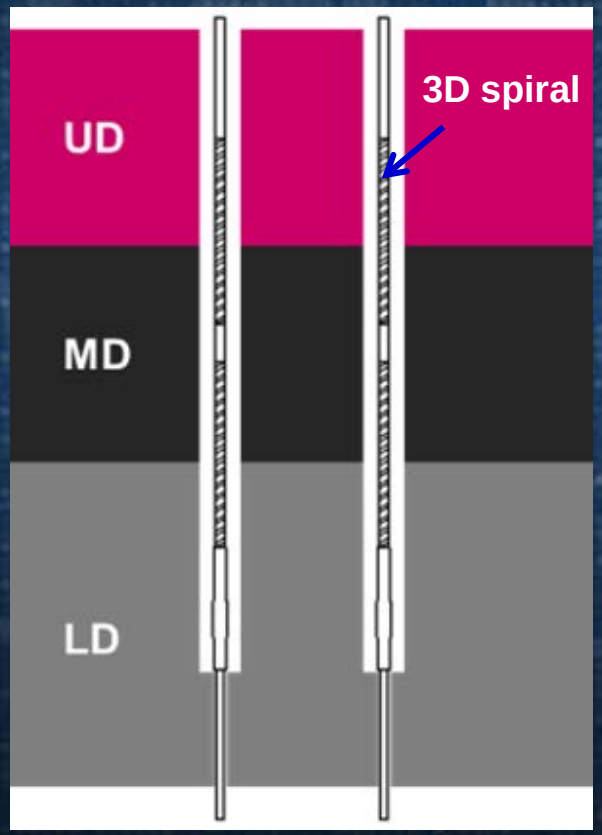




Features of 3DS HS Probe Head

- Due to MEMS 3DS HS Probe Head, we avoid mechanical interference, have good matching control, consistent needle performance and compatible with fine pitch applications



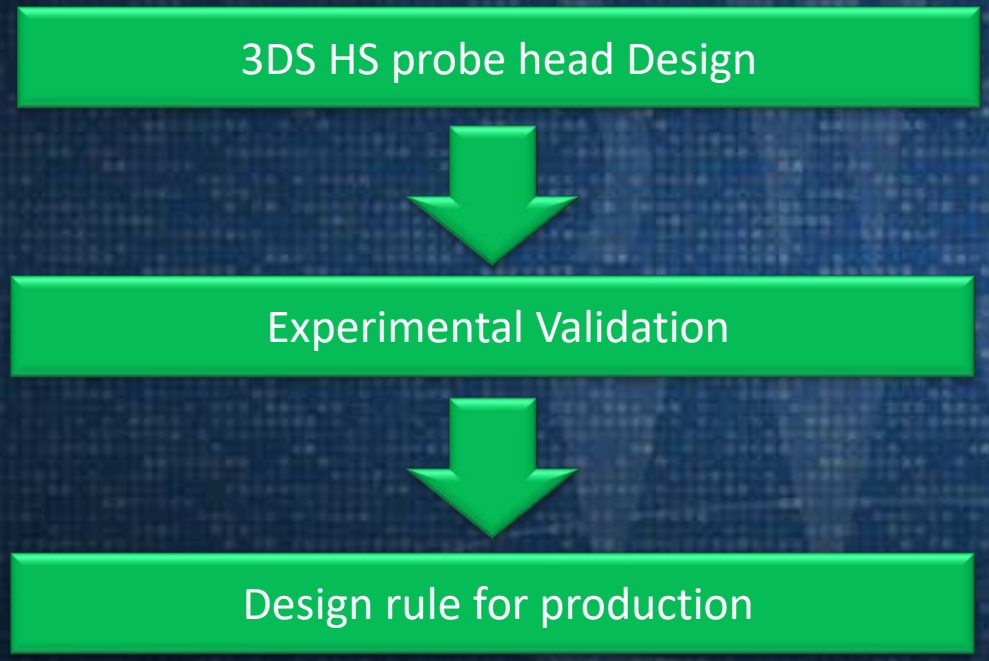


1. Eliminates mechanical interference
2. Excellent matching control
3. Consistent needle performance
4. Fine pitch application

Overview

- Introduction
- MPI's Solution
- **Experiment Design and Validation**
  - Experiment design using simulator and DOE
  - Simulation result
  - Measurement methodology for validation
  - Measurement result
- Summary

Experiment Design and Validation Process



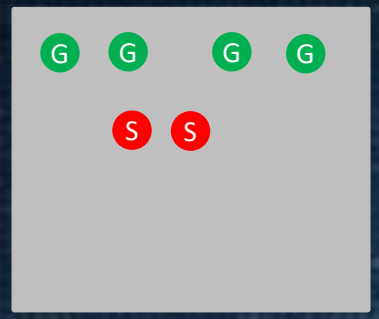
3D EM simulator and DOE
Faster time-to-market

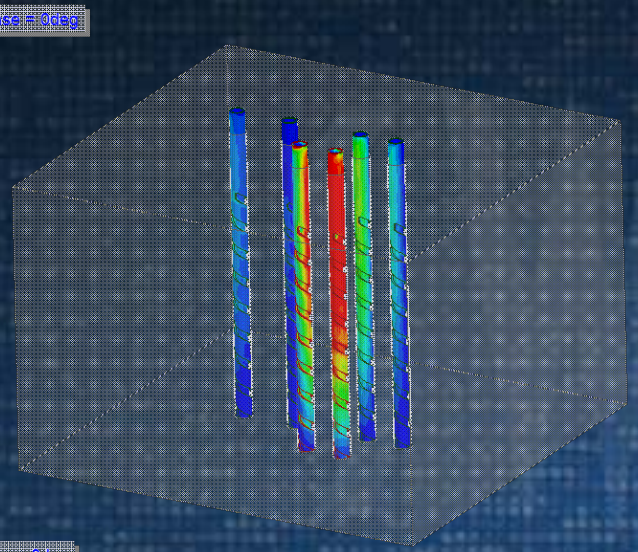
To build measurement methodology
Accuracy and Repeatability

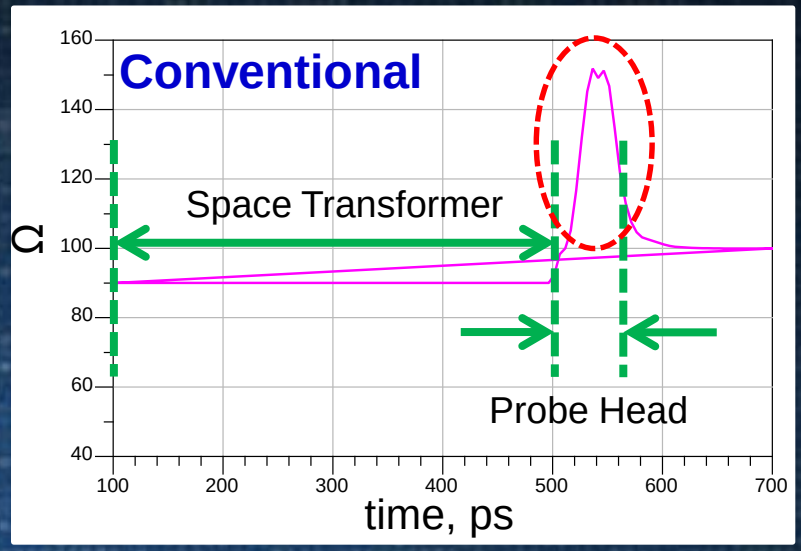
To build up data base of Dragon bar arrangement according to custom's request
Delivery Time Savings

Simulation Structure

Conventional







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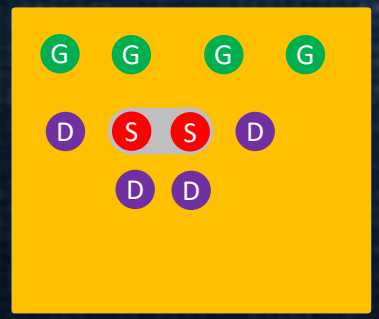
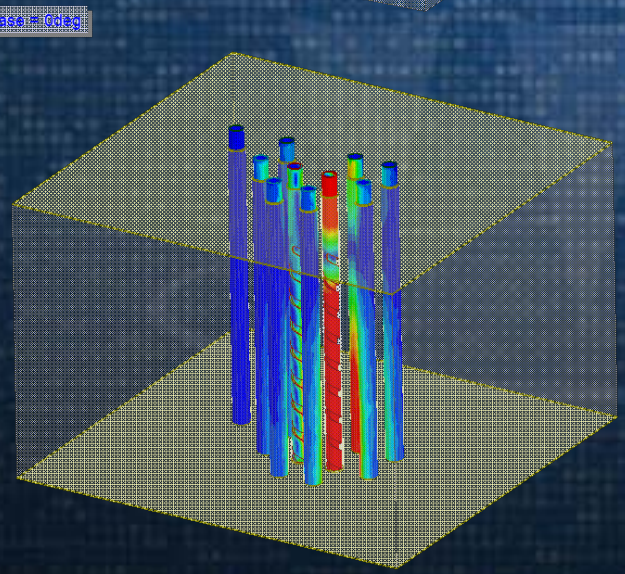
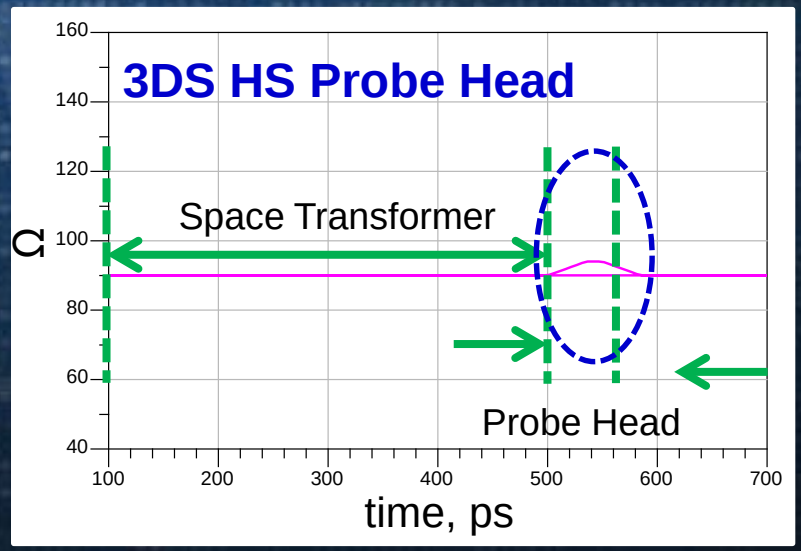


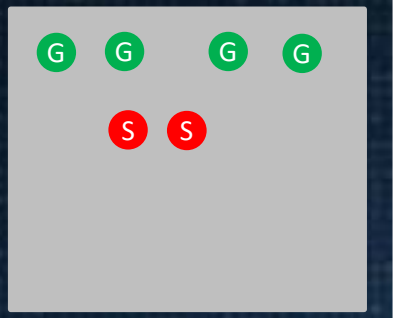


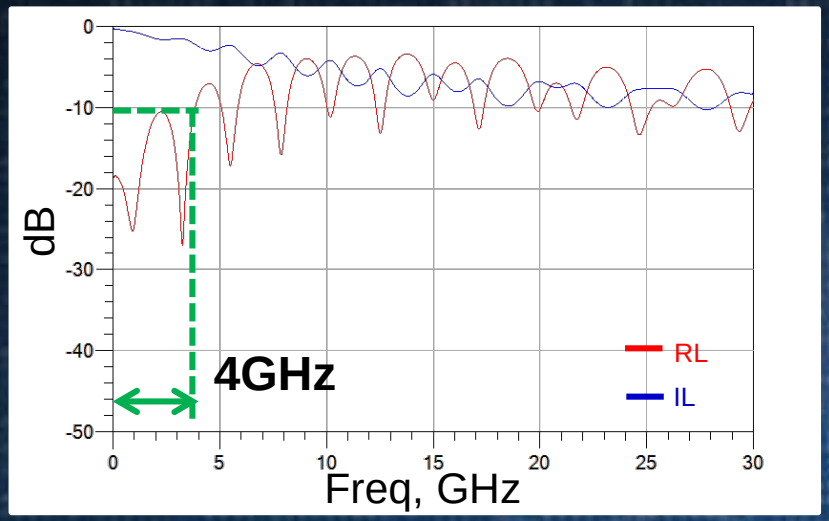


S Signal needle
G Ground needle
D Dragon bar

Simulation Results

Conventional





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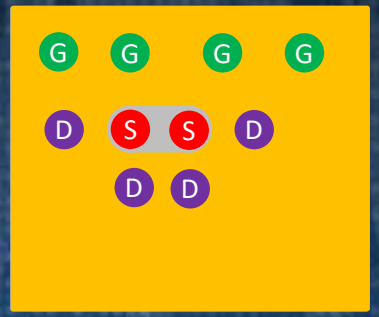
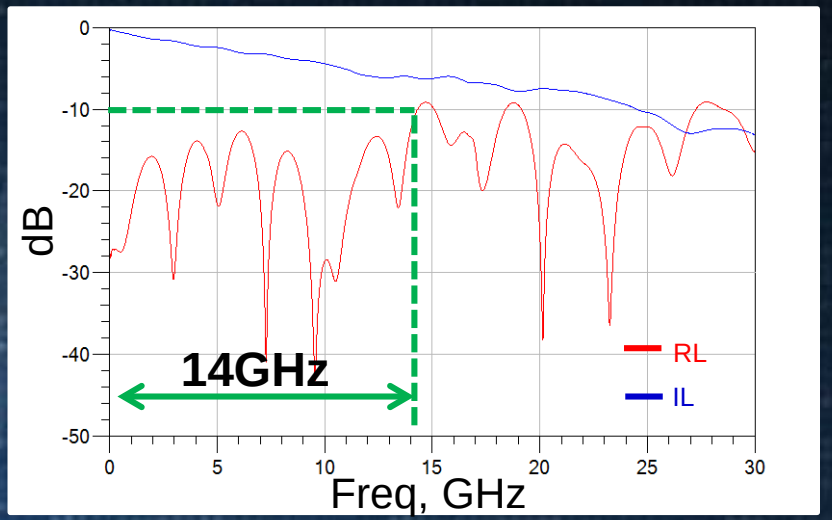
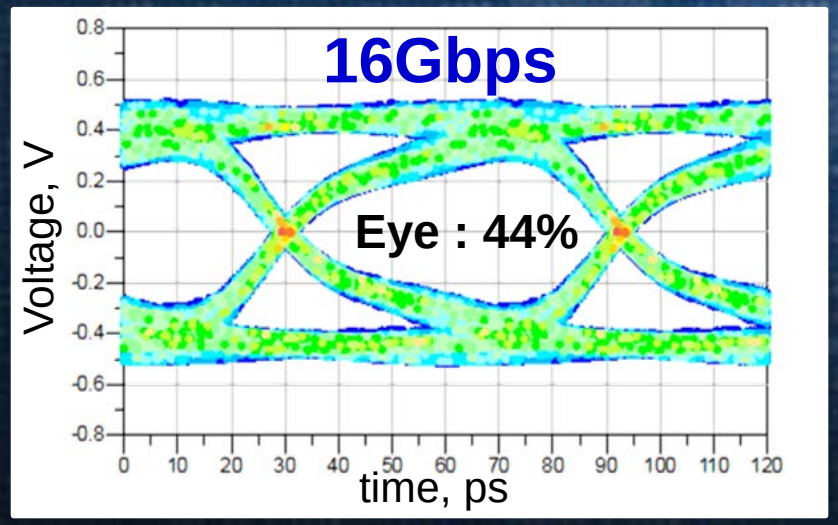
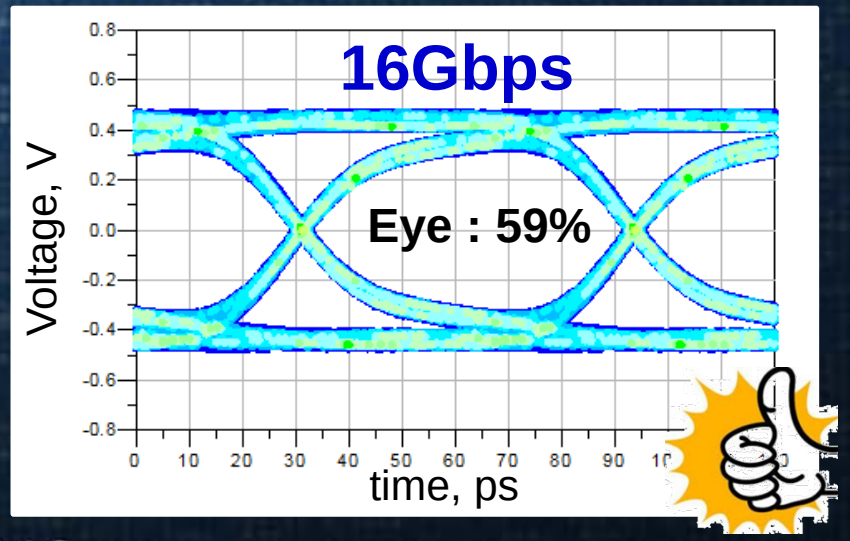
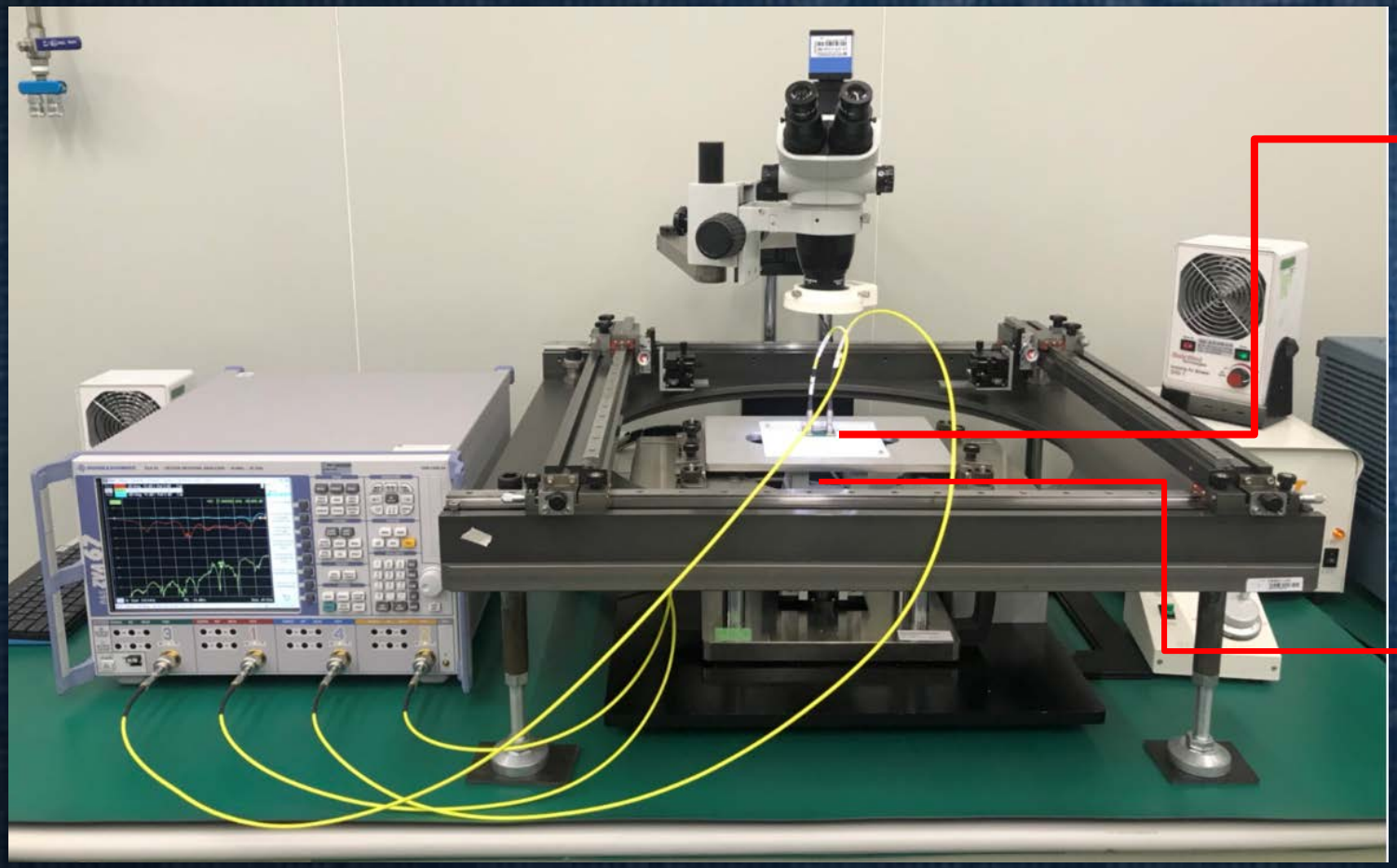


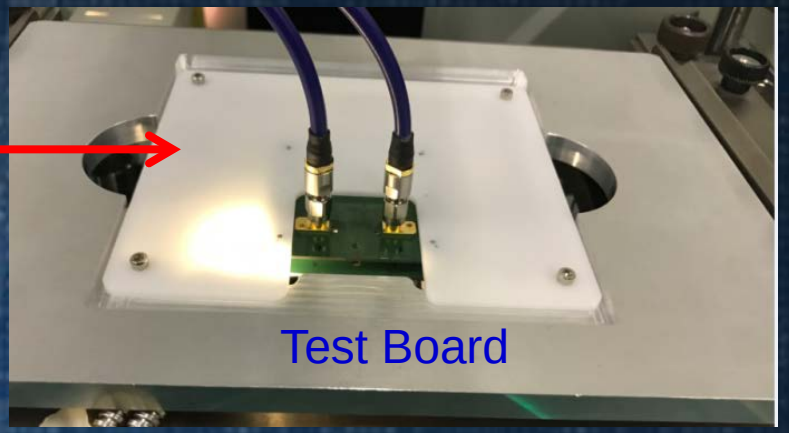






Measurement Structure

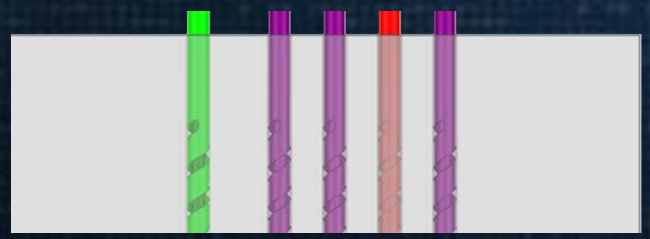




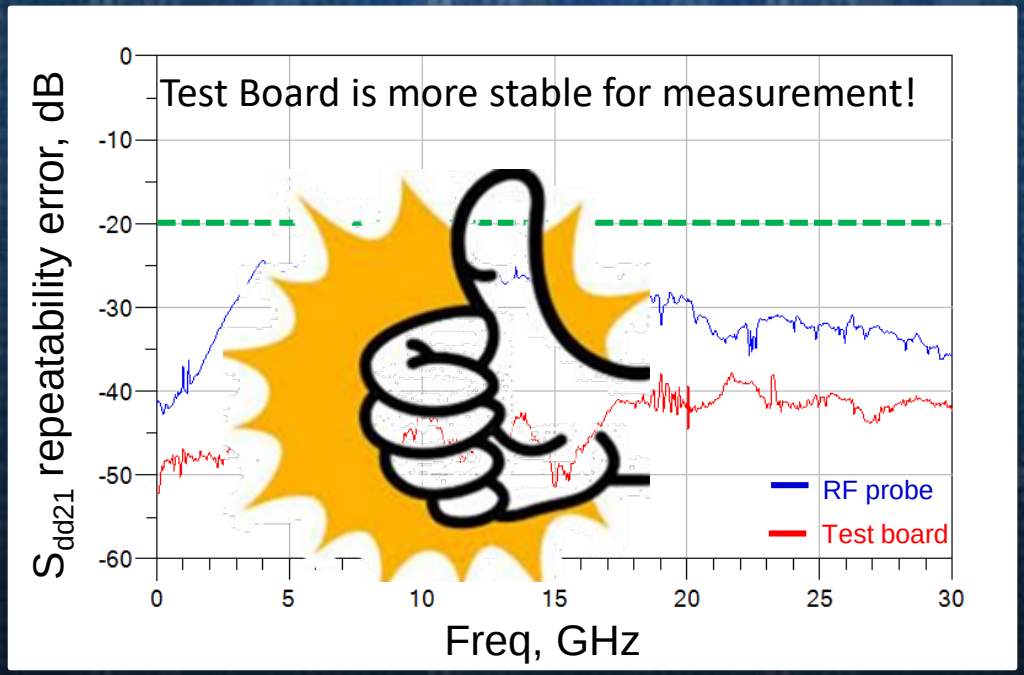
Test Board Methodology

- **The benefit of measurement structure using test board**
  - Good contact repeatability

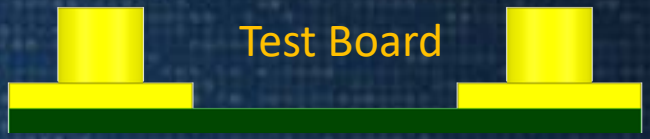
RF Probe

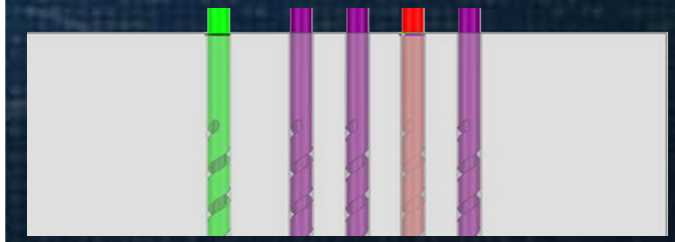


Probe Head



Test Board

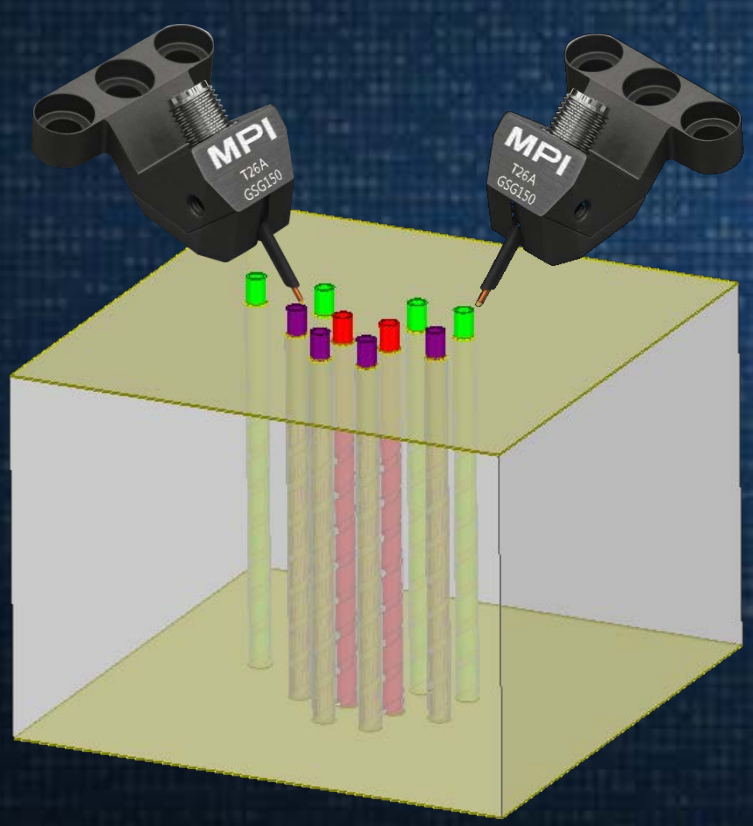


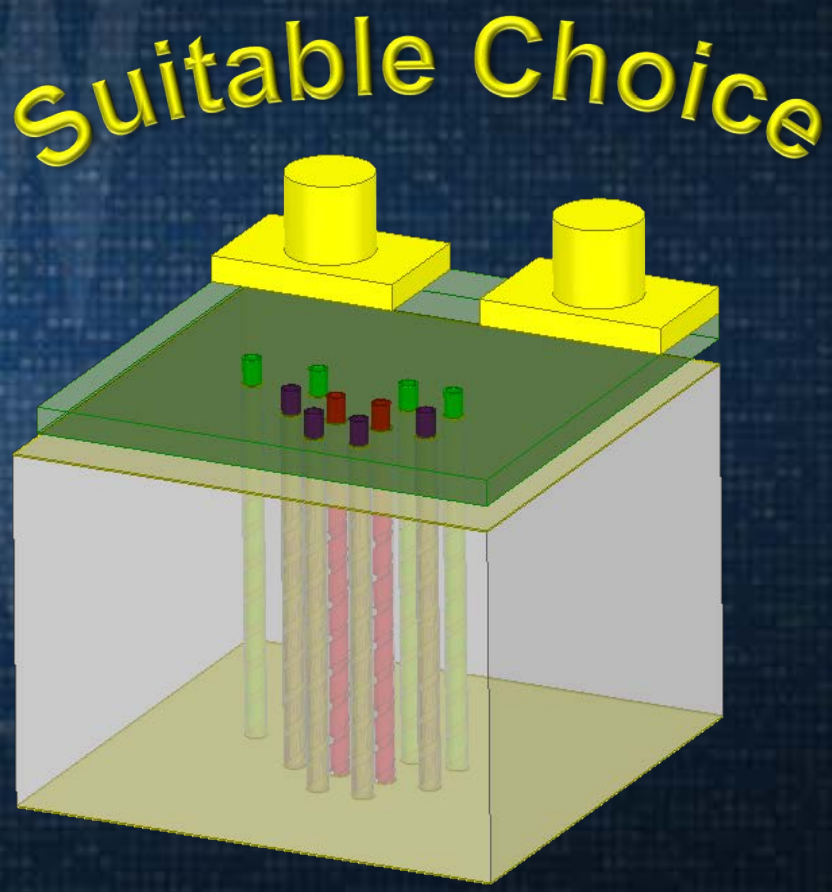


Probe Head

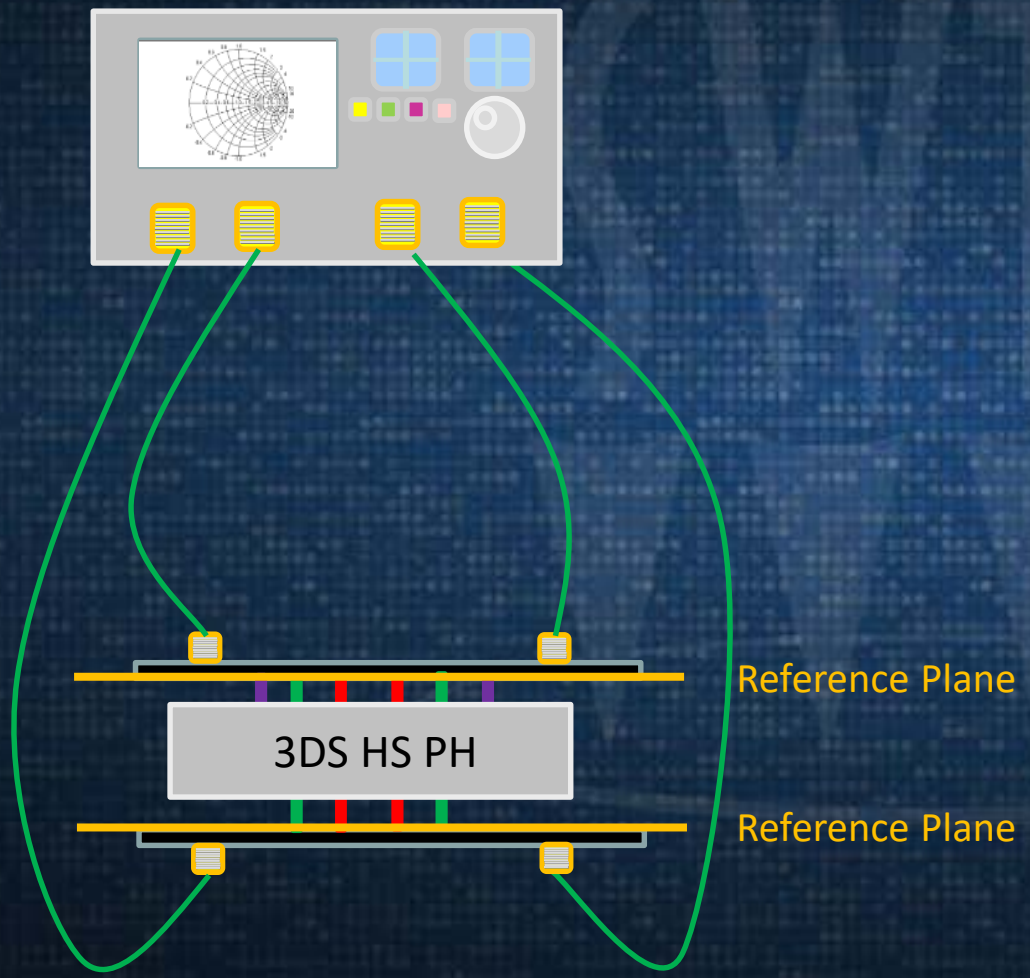
Test Board Methodology

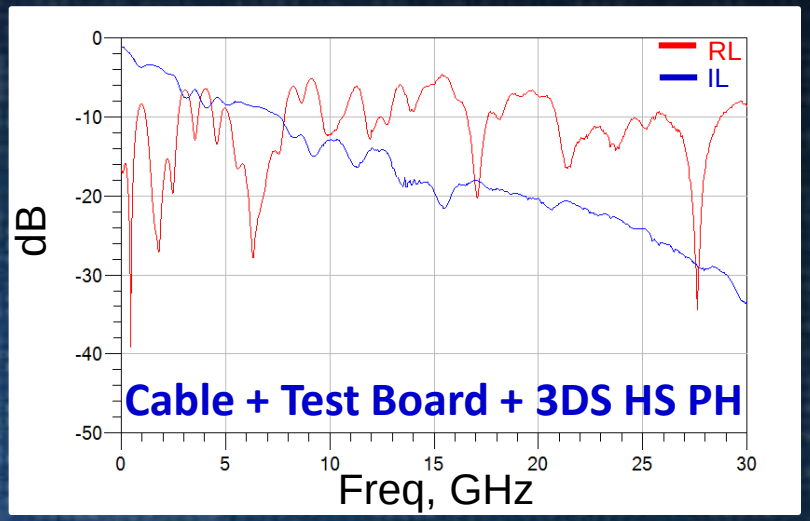
- **The benefit of measurement structure using Test Board**
  - Suitable for random needle arrangement

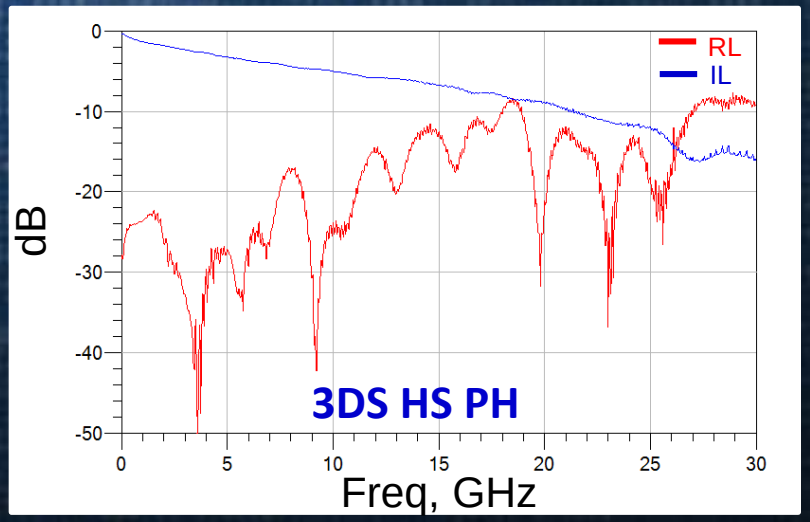




Measurement Processes

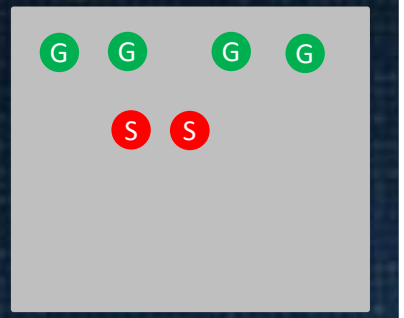


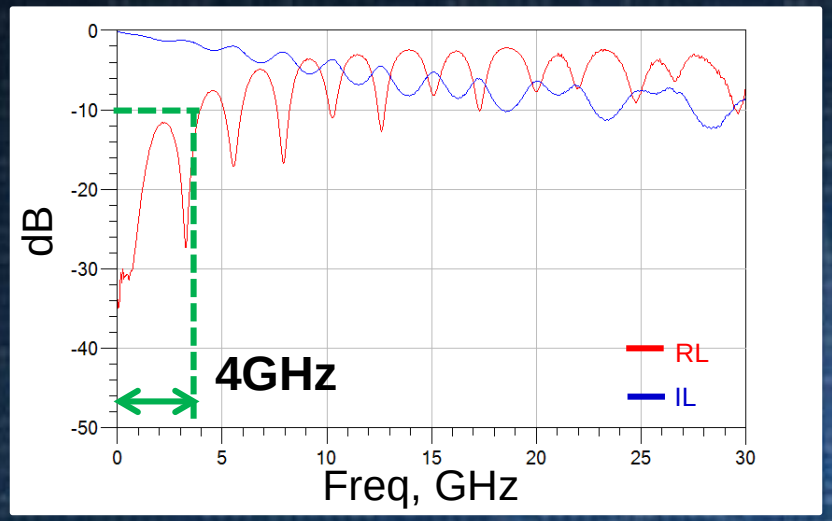




Measurement Results

Conventional





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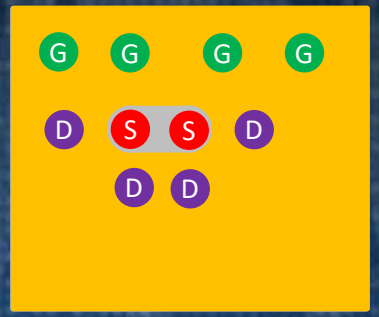

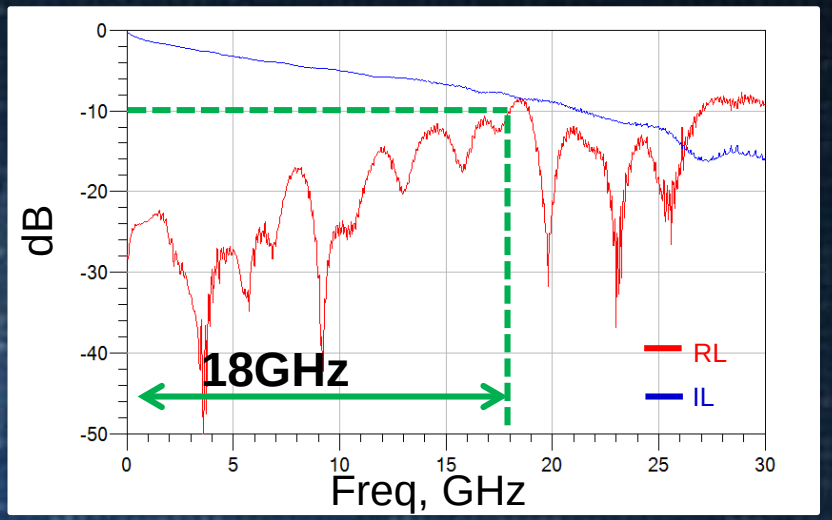

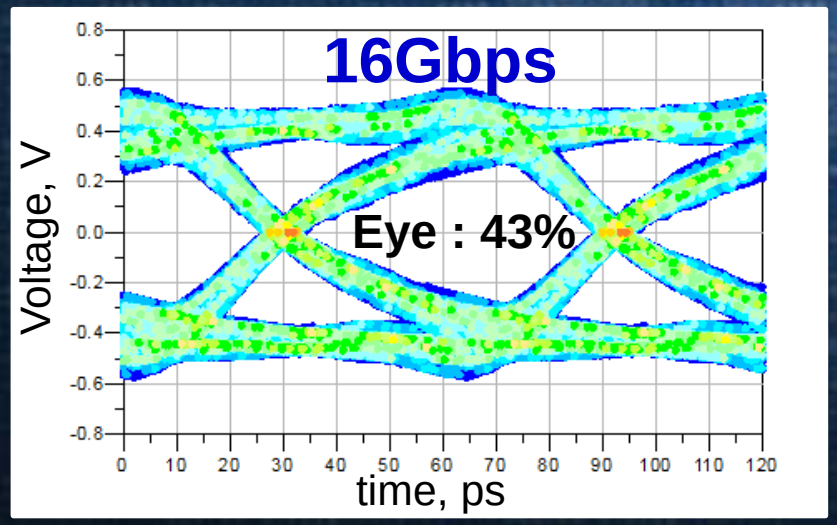

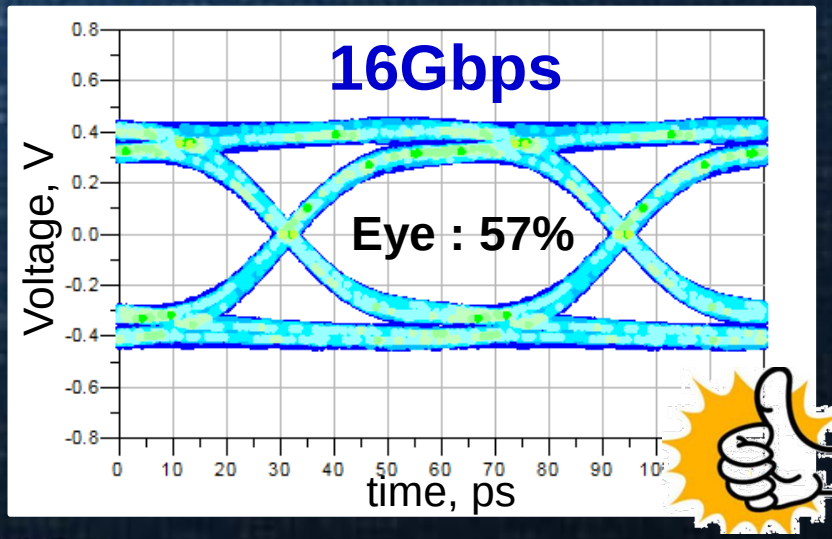

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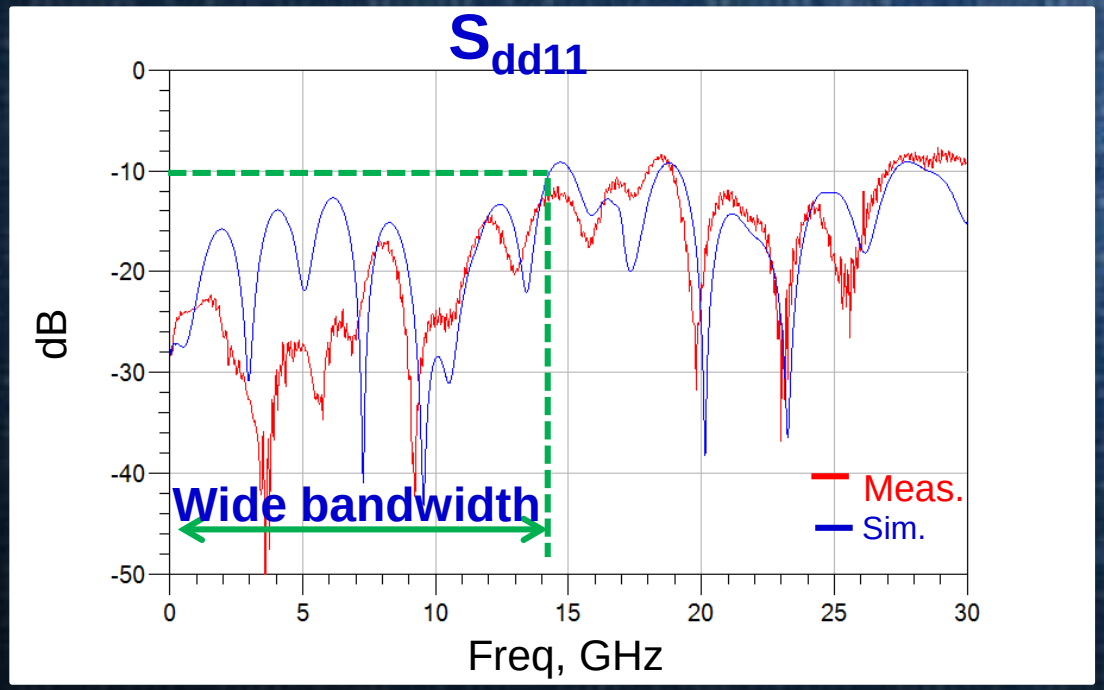
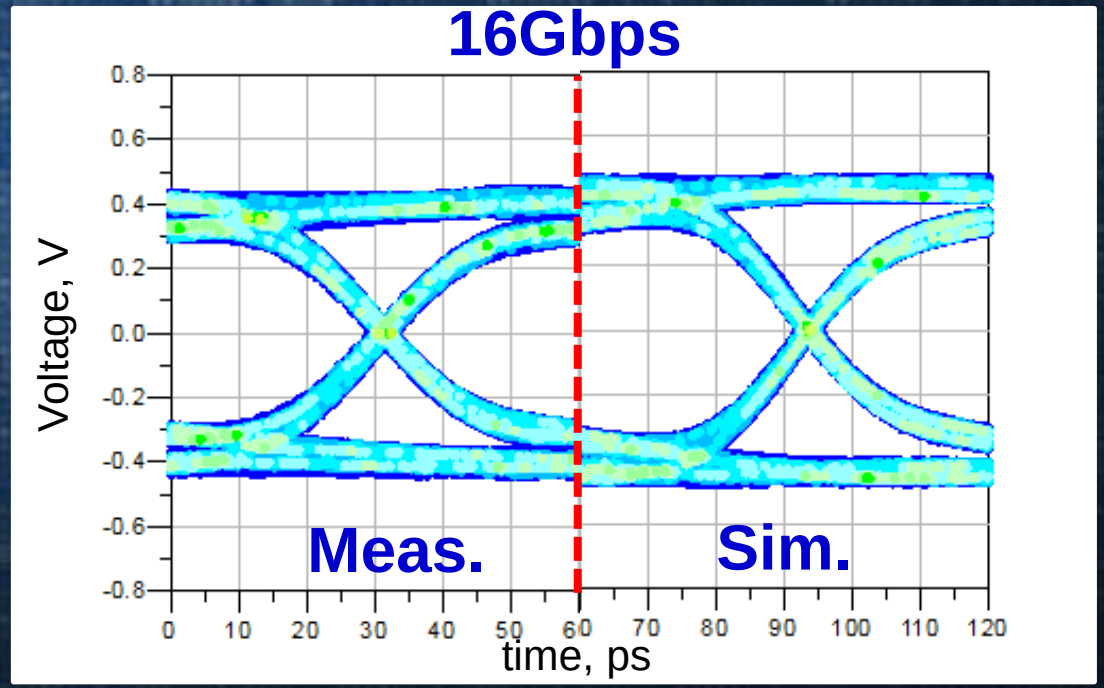
Summary

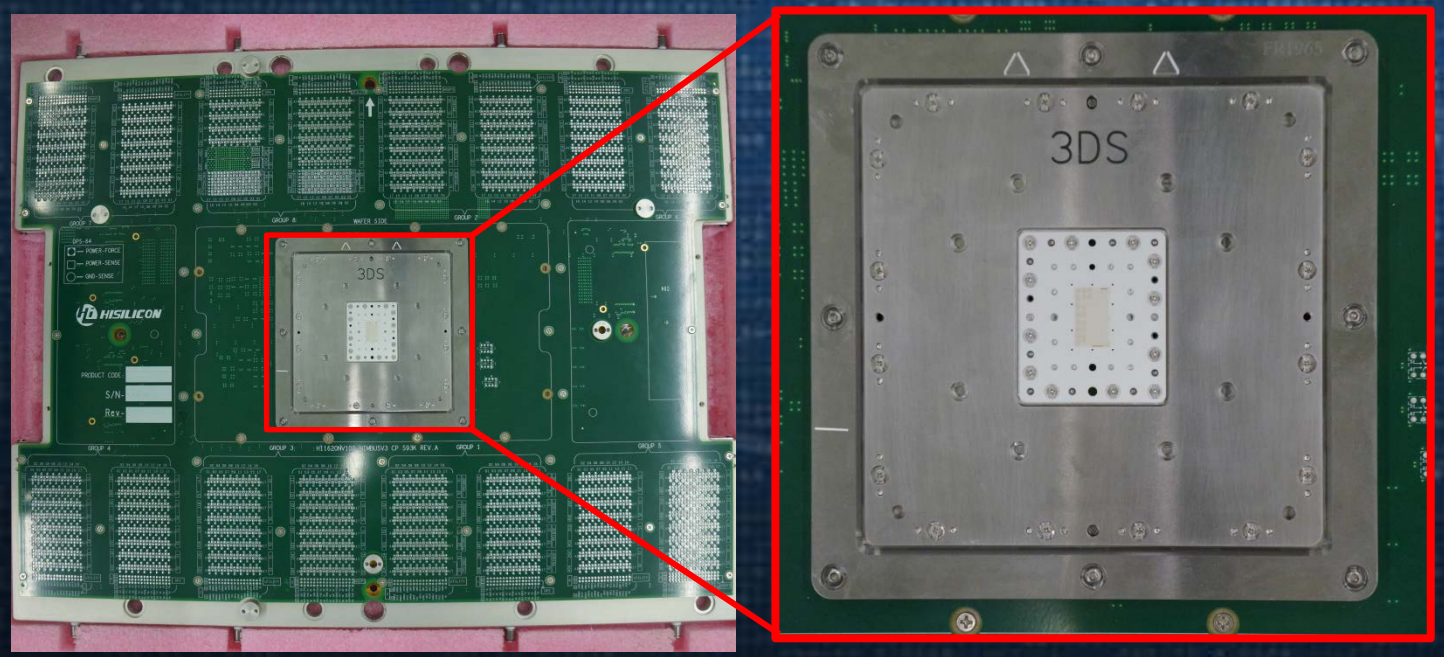
- We validated 3DS HS Probe Head technology through simulation and measurement
- Good simulation model with data correlation to actual measurement results

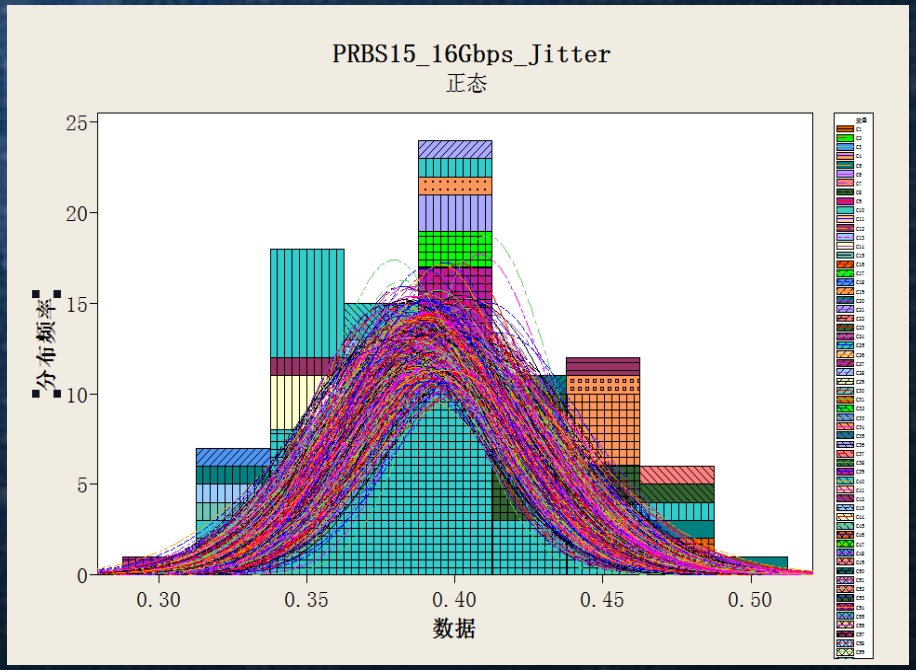




Summary

- **We've already pass customer's verification at 16Gbps with real Probe Card. Customer verified the capability of 3DS HS Probe Card is up to 26Gbps**
- **Future work:**
  - Advanced high-speed demand: 16Gbps→32Gbps
  - Ultra fine pitch: 100um→ below 80um





Acknowledgements

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Mark Sun, Omar Chang, Rob Carter,
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Thank You Very Much!