

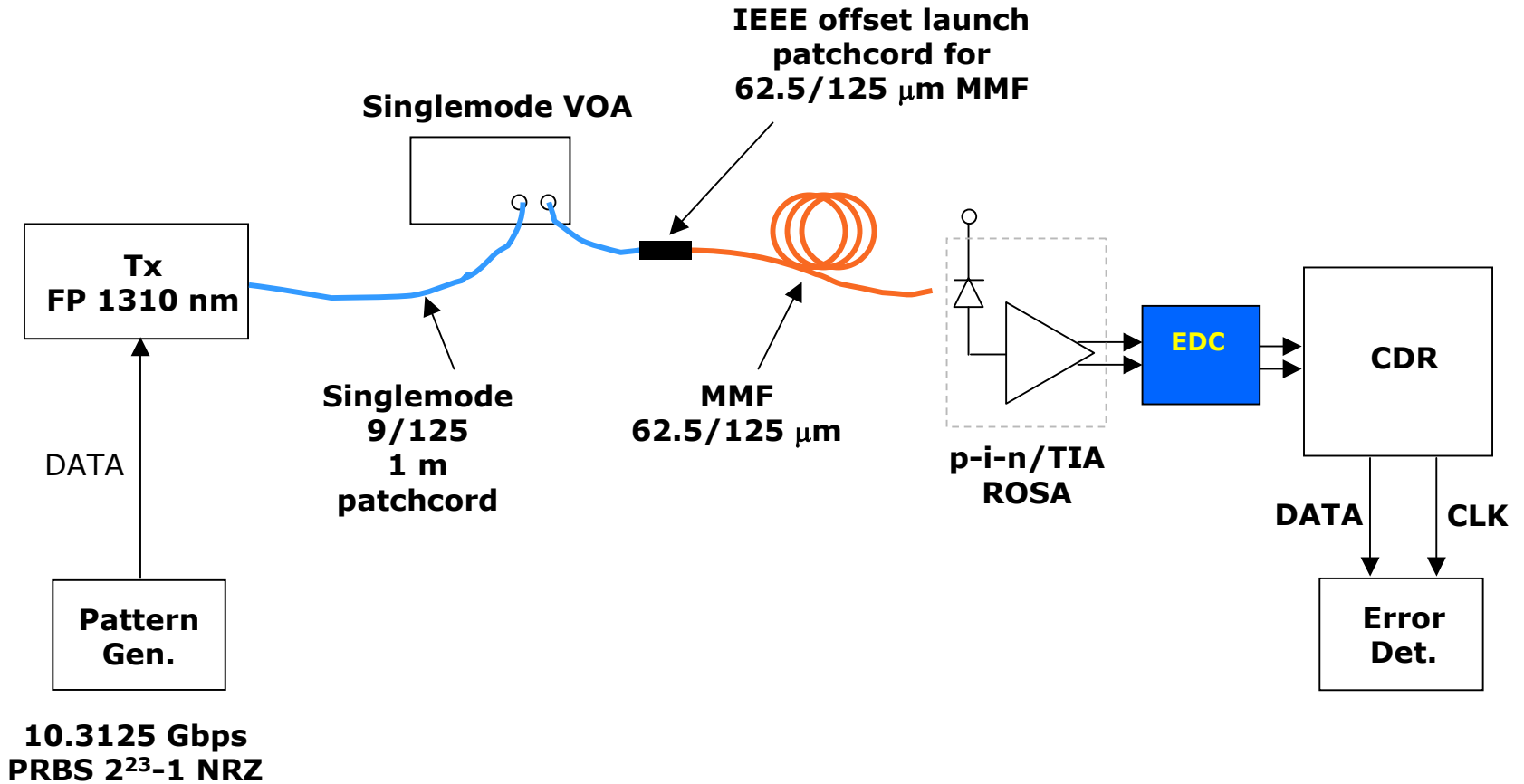
Experimental Results with TIA Round Robin MMF and OM3: Vendor Data for EDC-Based 10GBASE-LRM

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EDC: Technical Feasibility Perspectives

- **Supports a minimum of 220m over FDDI-grade MMF with a maximum power penalty of under 5-6 dB.**
- **Should be fully blind adaptive, plug and play without any need for training sequences.**
- **Should be robust w.r.t. time-varying channel effects.**
- **Should allow for enhanced yield on the receive and/or transmit optics and forthcoming low-cost optics technologies.**
 - Test results not included in current contribution.
- **Supports a minimum of 300m over selected MMF.**
 - Test results included in current contribution use corner-case OM3.
- **Feasibility in terms of low-power and form factor to enable Distinct Identity clause of 10GBASE-LRM**
 - Can fit into small form factor modules such as XFP with serial PMA

Optical Test Set-up

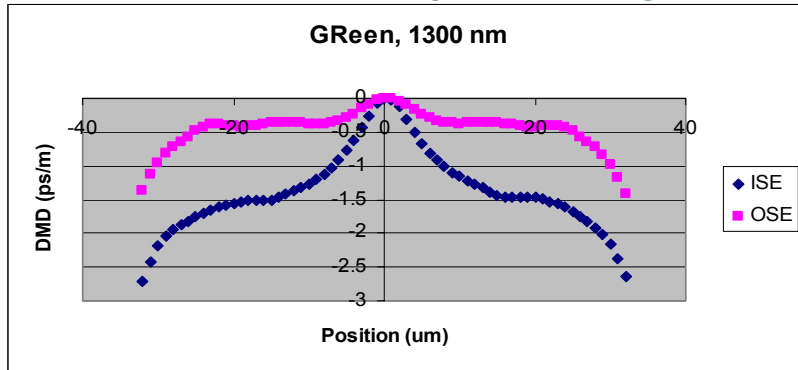


Test Set-Up Details

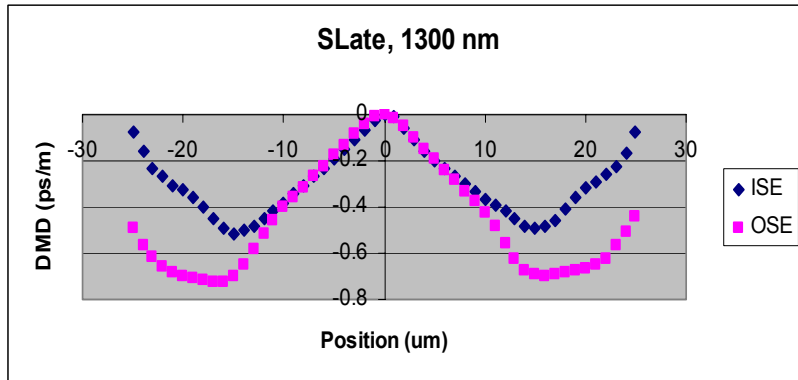
- **Transmit Optics:**
 - Fabry Perot laser at 10G
 - Tx power: -5dBm
- **MMF:**
 - 3 spools of 300m of worst-case –SX fiber (source: NIST)
 - Manufactured in May '98 for TIA Round Robin (TIA-RR).
 - 3 spools of corner case OM3 fiber (source: John George, OFS)
- **Receive Optics:**
 - Sensitivity at BER of $1e-12$ of -13 dBm

TIA-RR MMF Fiber Data

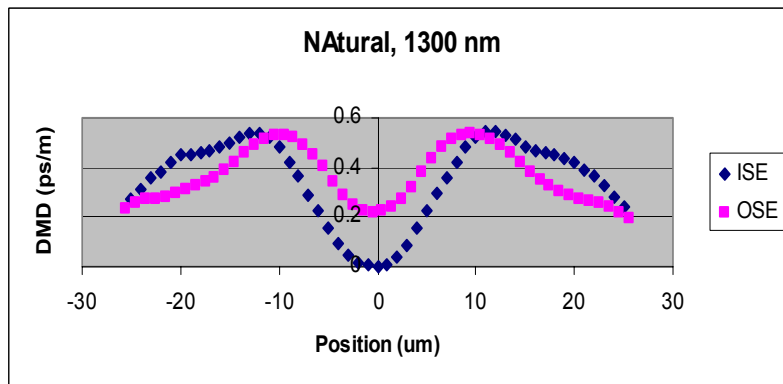
(Courtesy John Schlager -NIST)



NIST 1:
OFL bw at 1300nm: 1260 MHzkm

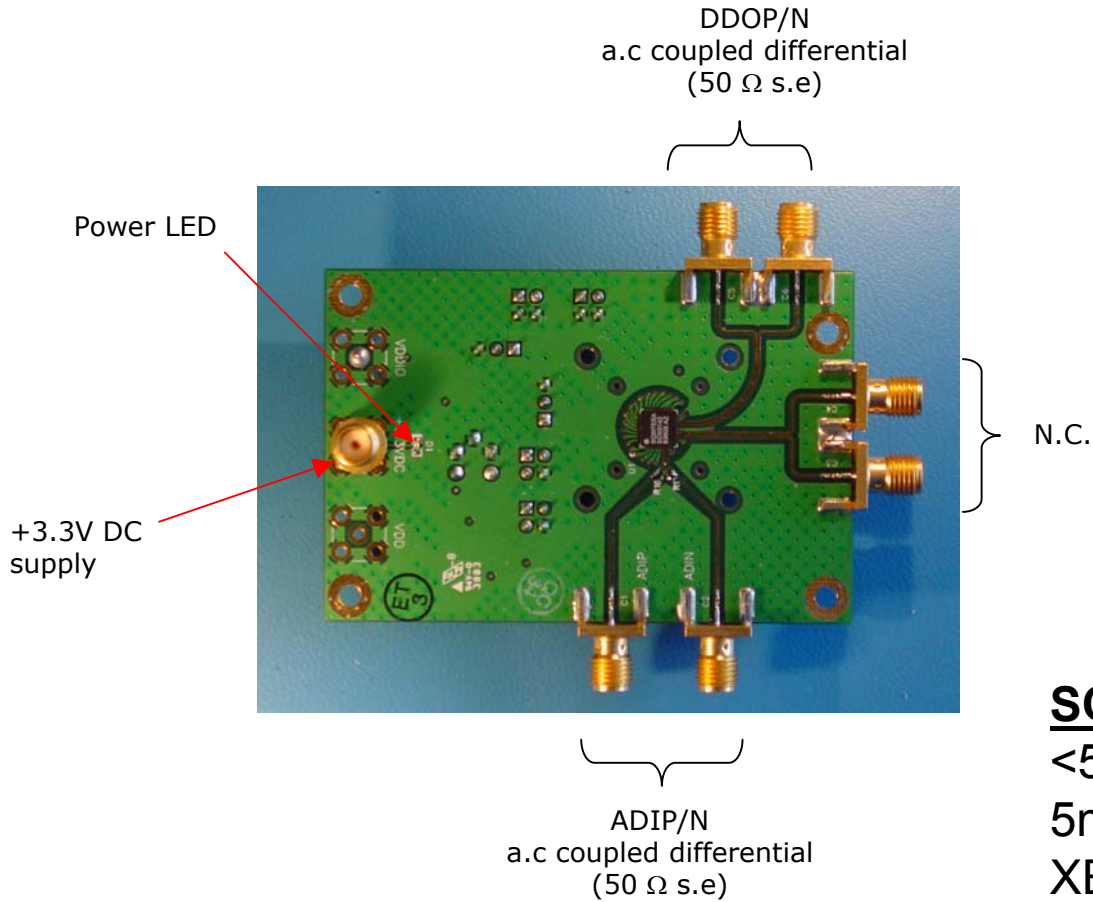


NIST 2:
OFL bw at 1300nm: 789 MHzkm



NIST 3:
OFL bw at 1300nm: 1352 MHzkm

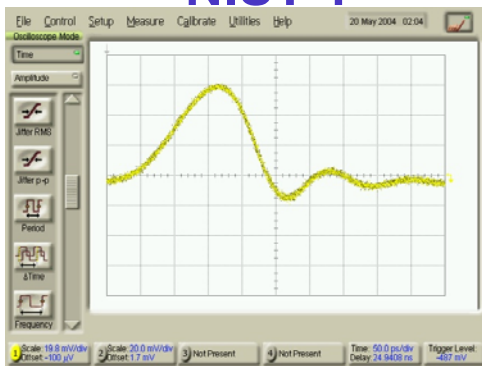
Eval Board



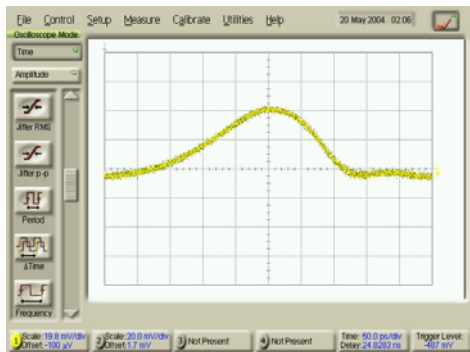
SCN3142:
<500mW
5mmX5mm QFN
XENPAK, X2, XFP

TIA-RR MMF Fiber Pulse Response & Input Eye Diagram at EDC

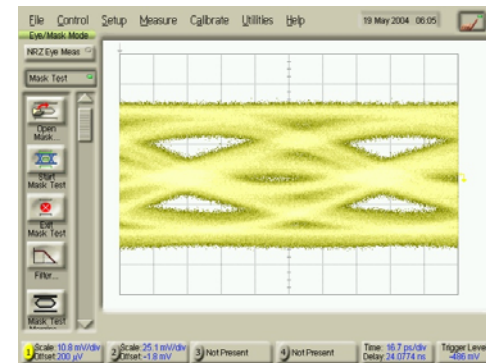
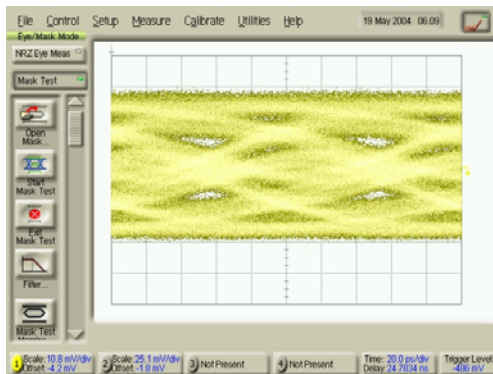
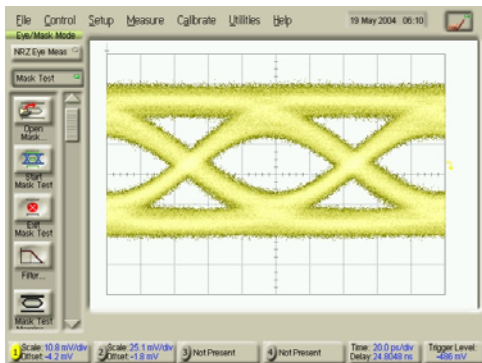
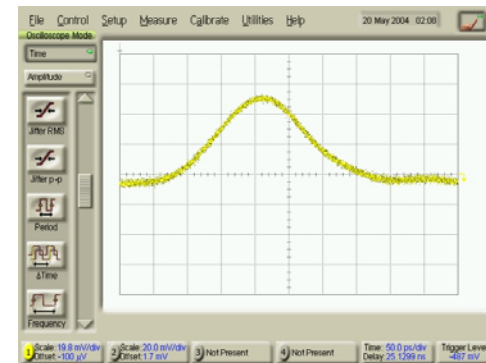
NIST 1



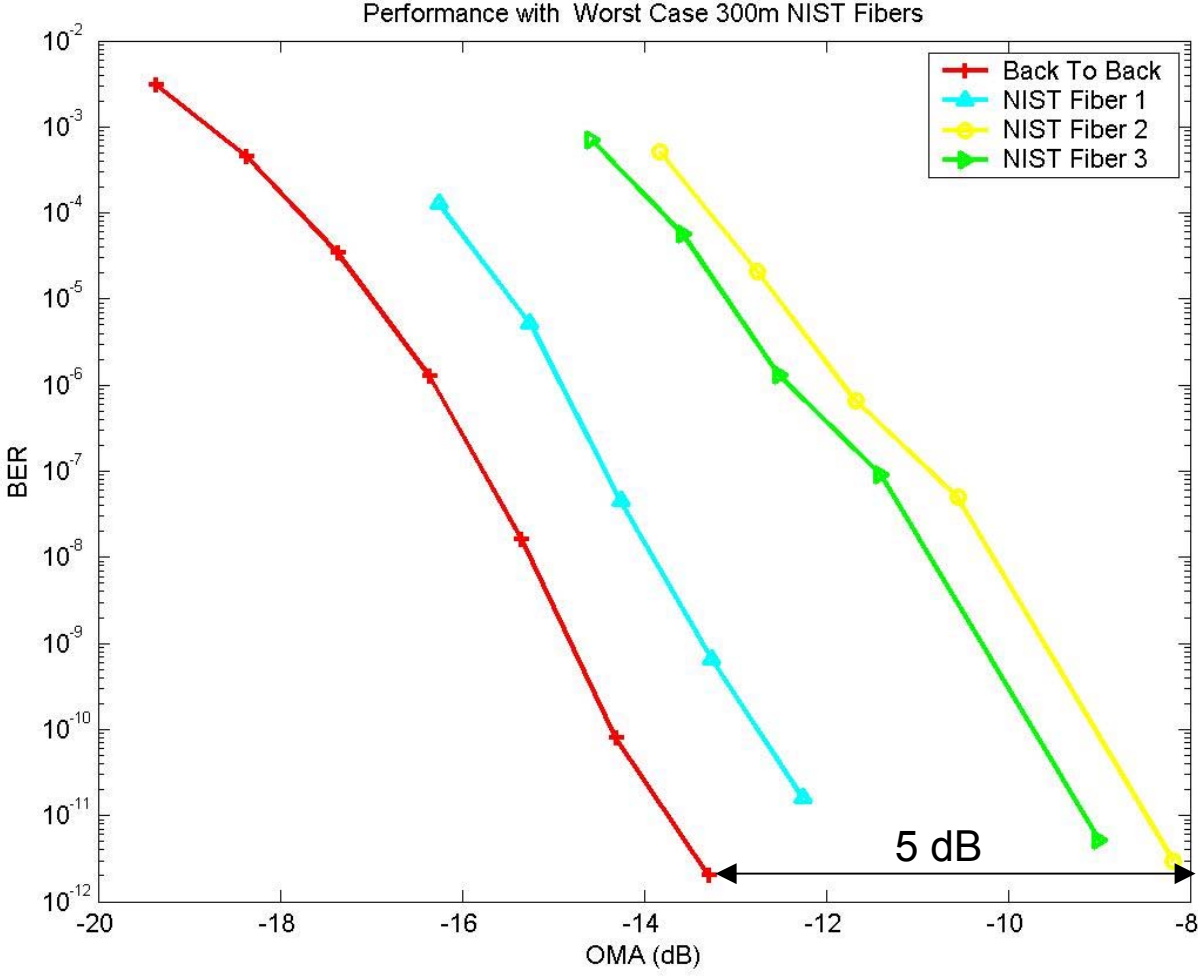
NIST 2



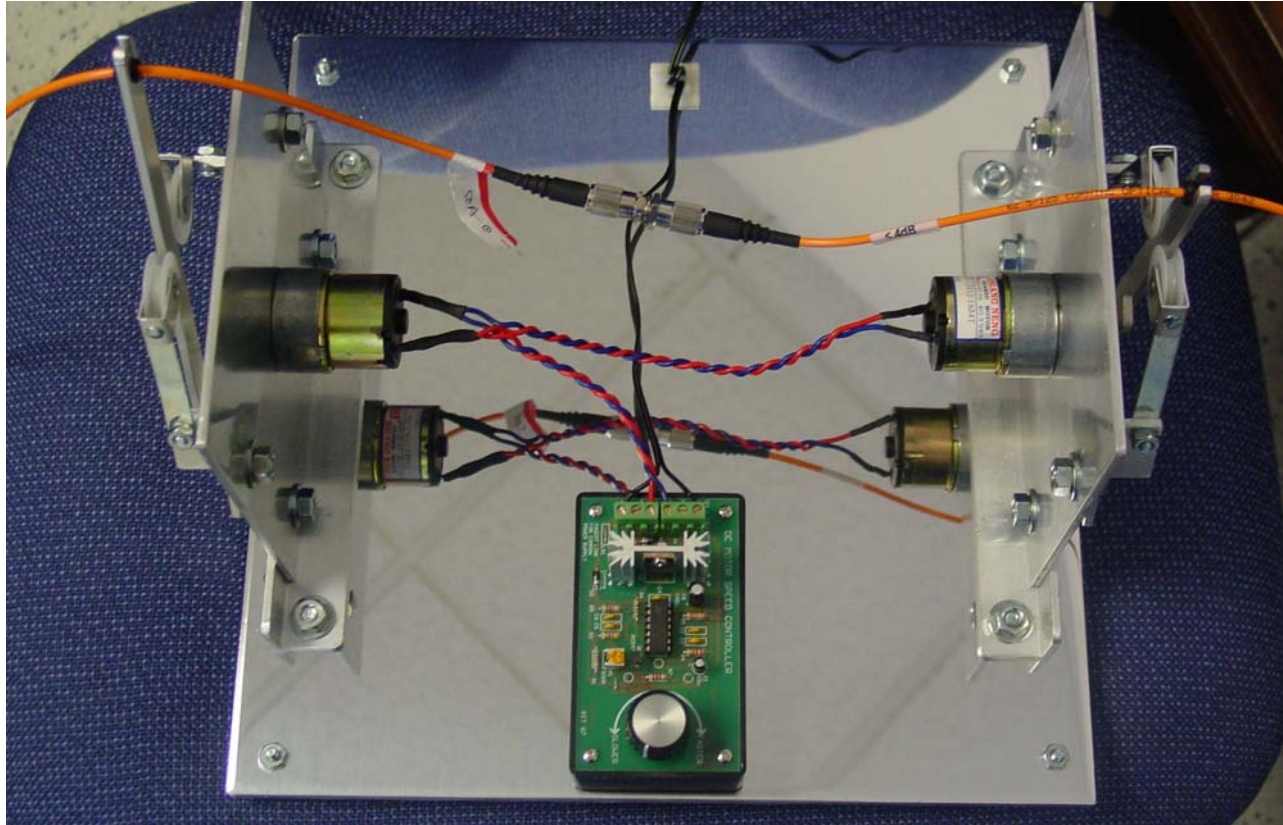
NIST 3



Link Performance with TIA Round Robin fibers (Static)



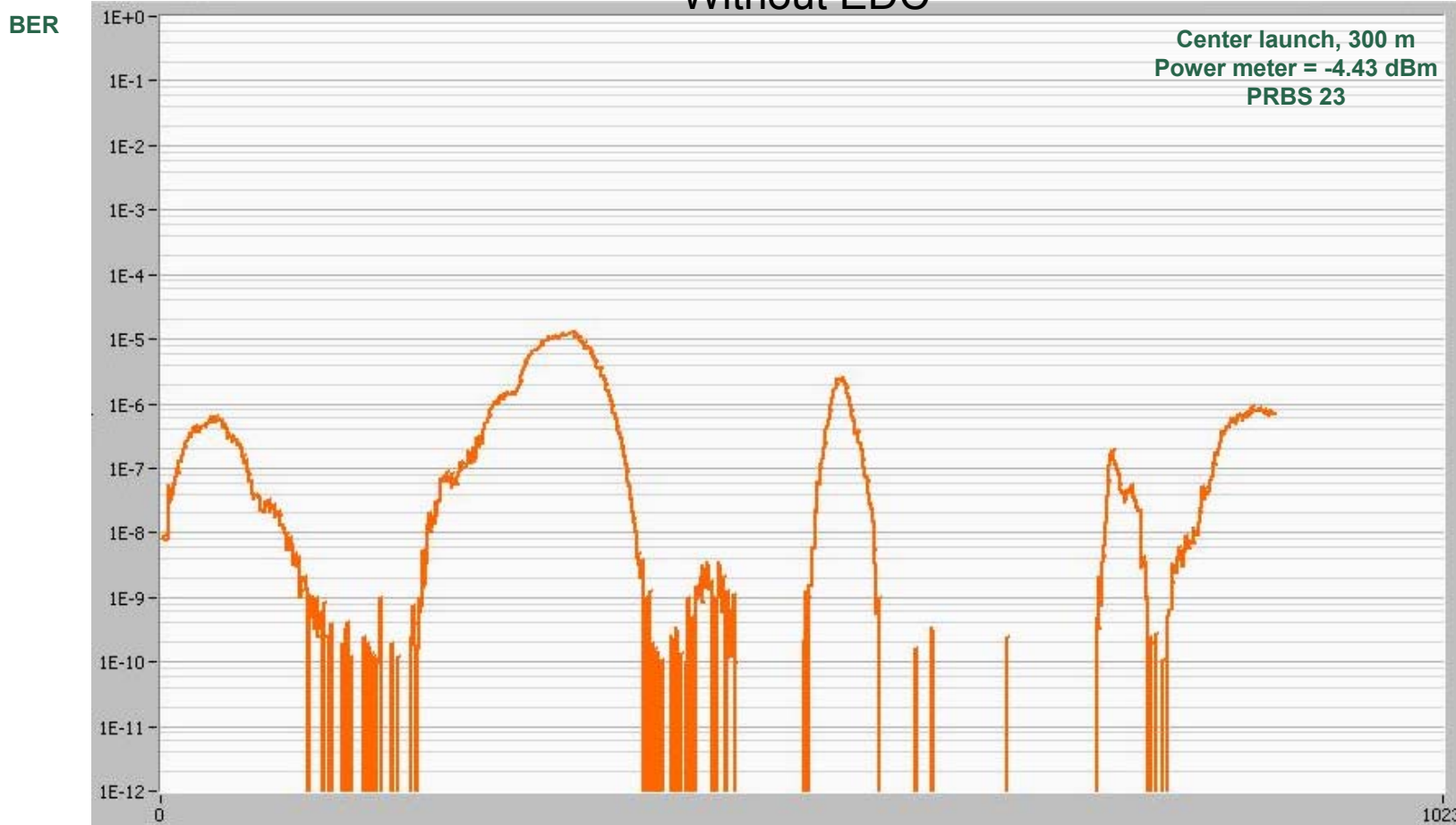
Fiber Shaker: To Create Time-Varying Channel



Induces fiber displacement of over an inch within 10's of ms.

Time-Varying Channel (incl. Modal noise effects) with NIST MMF 1

Without EDC



BER can change 3-5x within 100ms

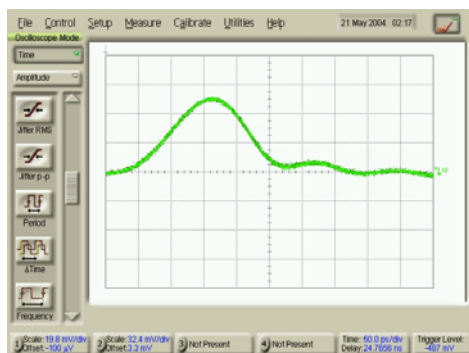
Time (1023 units = 20 min)

With EDC: No Errors recorded

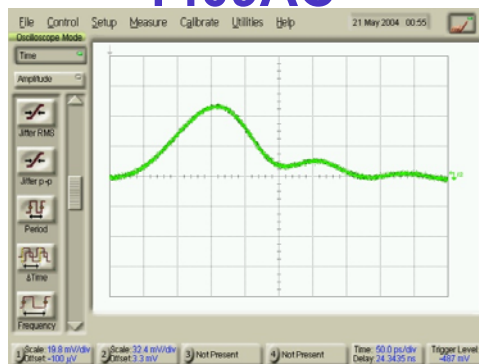
Corner Case OM-3 Fiber Pulse Response & Input Eye Diagram at EDC

Courtesy: John George, Yi Sun (OFS)

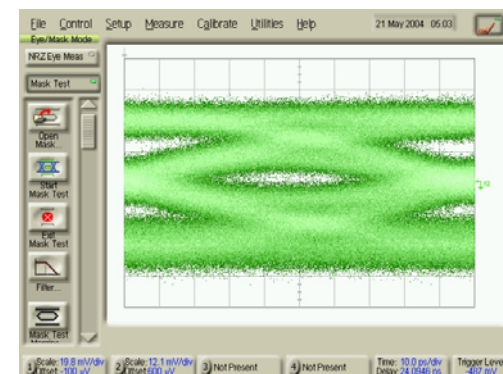
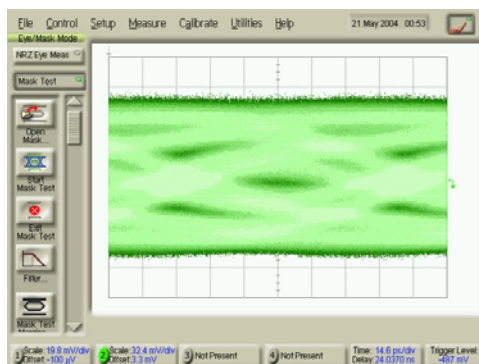
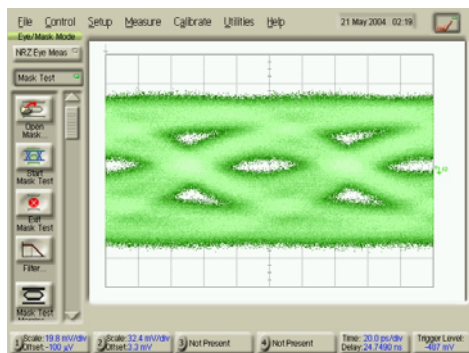
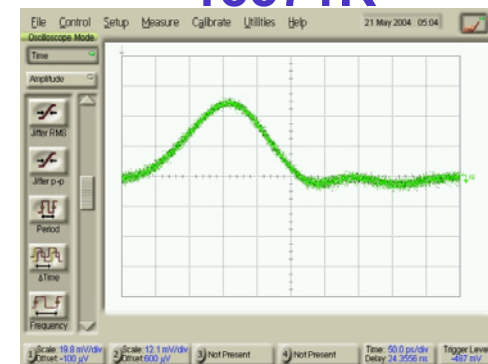
1409DC



1409AC



15571R



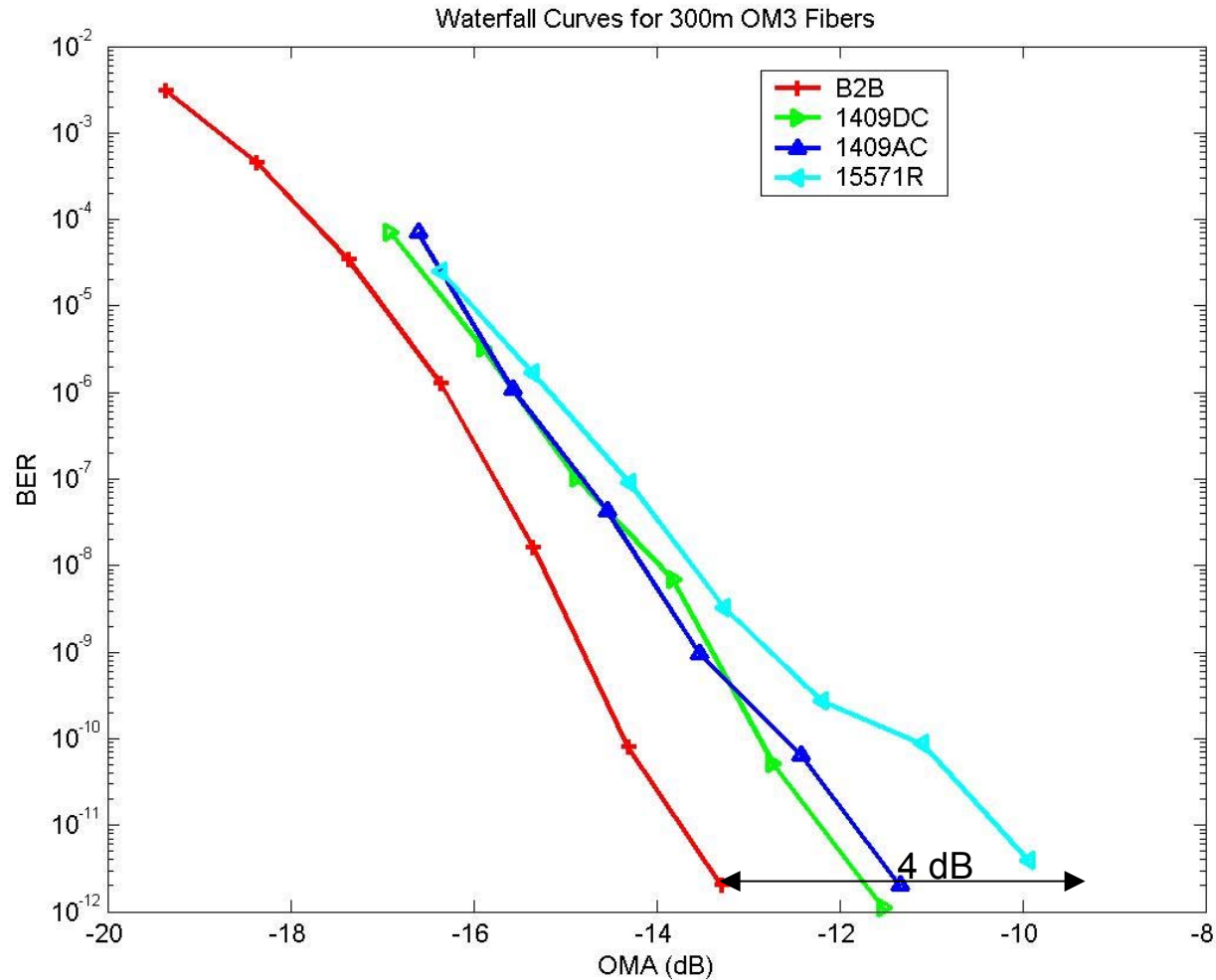
OFL BW: 610 MHz,
308m

OFL BW: 610 MHz,
308m

OFL BW: 650 MHz,
302m

Link Performance with OM-3 fibers:

Courtesy: John George, Yi Sun (OFS)



Conclusions

- **Experimental data demonstrating robust performance at up to 300m for TIA round robin fibers (3 spools with worst-case –SX performance): power penalty < 5dB.**
 - Blind adaptive
 - Robust w.r.t. time-varying effects.
 - *Suggests significant margin at 220m.*
 - Significant further performance enhancement possible by enhancing equalization capability.
- **Experimental data demonstrating robust performance at up to 300m for corner case OM-3 fiber): power penalty < 4dB.**
- **Suitable for implementation in small modules.**
 - Modules already demonstrated by multiple vendors in different form factors.
- **Large parallel body of simulation-based work supporting technical feasibility.**
- **Further experimental results for corner cases of FDDI-grade and selected MMF will be presented in future meetings.**

Many thanks to EDC SIG for very useful feedback.