



10 Gb/s Multimode Fiber System Update

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May 28, 99

for

IEEE 802.3 HSSG

Coeur d'Alene, Idaho

Overview

- Cabling standards bodies working to provide media roadmap for next generation applications
- Concept is to extend MMF capability to simplify users cable plants
- Achievable, robust, low cost technology now in demonstration

TR42.8 Letter to US TAG

- The following represents the agreements and recommendations of TIA TR42.8 Optical Fiber Cabling Subcommittee for the Next-Generation Premises Optical Fiber Cabling System developed at the approved interim meeting in Greensboro, NC on March 24, 1999 and as modified at a teleconference on April 20, 1999 based on comments received from TIA TR42.1 members after posting of the original contribution.
- This contribution, TR42.8-99-04-06, was developed and agreed to after thorough review and discussion of contribution TR42.8-99-03-02. The meeting notes (TR42.8-99-03-04 and TR42.8-99-04-05) summarize the discussion and agreements.
- This document is being forwarded to the US TAG as TIA TR42 recommendation for the national position for Next-Generation Premises Optical Fiber Cabling Systems to be presented to ISO/IEC SC25/WG3.
- Please be advised that TIA TR42.8 elected Paul Kolesar and Steve Swanson as official liaisons to the US TAG for this issue.

Tony E. Beam

TR42.8-99-04-06

Chairman of TR 42.8 ³

USTAG Letter to TR42.8



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U.S. TAG: ISO/IEC JTC 1/SC 25/WG 3

To: Mr. Tony Beam, Chair TIA TR-42.8
From: USTAG to 'SC 25/WG 3
Subject: TR-42.8 Proposal on Next Generation Fiber Cabling
Date: April 29, 1999

The USTAG to ISO/IEC JTC-1/SC 25/WG 3 has agreed to support in principal the TR-42.8 proposal on Next Generation Fiber Cabling described in TR-42.8/99-04-06 as a US position into the next ISO/IEC JTC 1/SC 25/WG 3 meeting scheduled for June 1999.

This support is contingent on providing additional information requested by members of the USTAG that include:

- Further justification for a 300m link length specified in the proposal
- Information on bit rate capability beyond 10 gigabits/second
- Characterization of laser bandwidth capability at 1300 nm
- Clarification that this proposal is an additional fiber variant rather than a replacement for existing 50µm fiber

The USTAG has requested the TR-42.8 liaisons (Kolesar and Swanson) provide this information in the form of a revised proposal to the USTAG for presentation in Berlin that will be discussed during a teleconference scheduled for May 28, 1999.

The USTAG appreciates your efforts and thanks you for your input in this matter. We look forward to further cooperation between our respective organizations.

John Siemon, Chair
USTAG to ISO/IEC JTC 1/SC 25/WG 3

TIA TR-42.8 Recommendation for Next Generation Optical Fiber Premises Cabling System

March 24, 1999
Greensboro, NC (Interim Meeting)

and

April 20, 1999
Teleconference

Objectives

Next-Generation Fiber Cabling

- Support **lowest complexity** system solution for LAN applications from **10Mbps to a minimum of 10Gbps**
- Remain **friendly for cable manufacturer and installer**
- Provide a migration path supporting a minimum of 10 gigabits with **achievable technology**
- Meet the needs of **in-building network** applications with a **single universal medium**

Lowest Complexity @ 10 Gbps

- Transceiver
 - Serial Transmission
 - Direct Modulation
 - Uncooled and unisolated lasers
 - 850nm VCSELs
 - Multimode specific solution
- Media
 - Multimode Fiber Cable

Lowest Complexity Legacy LAN applications

- Support for existing LED-based applications
 - Ethernet
 - FDDI
 - 155 ATM
 - Token Ring 4/16
 - Fast Ethernet
- Support for existing SW laser applications
 - 622 ATM
 - Gigabit Ethernet
- 50 micron provides sufficient coupling efficiency for Legacy LED-based LANs to support in-building networks
- 50 micron completely compatible with laser-based LANs
- Core sizes smaller than 50 micron causes coupling efficiency problems for both LED and laser LANs
- New MMF specs a superset of existing specs

Cable and Installation Compatibility

- 50 micron, NA=0.20
 - is being cabled and installed today
 - is included in IS 11801 and draft TIA-568-B.3
 - can use same field test equipment and methods
 - is compatible with existing connectors and termination methods
 - is capable of supporting high data rate applications at 850 or 1300 nm operation

10 Gb/s Support with Achievable Technology

- Historically 850 nm VCSELs provide the lowest complexity and exist at 10 Gb/s today
- Modeling and experiments prove MMF can support 850 nm VCSELs at 10 Gb/s to 300 m
- Bandwidth is the most critical fiber parameter
- 50 micron fiber has the highest bandwidth potential while meeting all other objectives.

Distance support for In-building Networks

- Support 300 meters
 - 300 m supports centralized cabling and practical backbone lengths
 - 7/96 Compaq survey showed 300 m addresses ~95% of in-building backbones
 - Short wave source technology is 80 - 90% of Gigabit Ethernet market
 - Distances beyond 300 m increase the complexity of a multimode solution

TR-42.8 position on Next Generation Optical Fiber Cabling

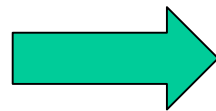
- **Additional** Multimode Cable Specifications
 - Core size and NA: 50 micron, NA=0.20
 - Bandwidth:
 - 500/500 MHz-km at 850/1300 nm over-fill launch
 - 2200/**500** MHz-km at 850/**1300** nm laser launch*
 - Attenuation: 3.5/1.5 dB/km at 850/1300 nm
 - Distance for 10 Gb/s applications: 300 m
- SM cable specifications remain unchanged
 - SM Connector return loss is under investigation

* The laser launch bandwidth measurement, which is not yet defined, must account for the mode power distributions that occur within the fiber due to the effects of source characteristics and transverse offsets in connections.

System requirements for 300 m MMF solution at 850 nm

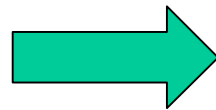
- Dispersion

- Modal



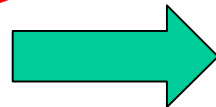
New high bandwidth fiber (ZETA)
(> 2.2 GHz-km)

- Chromatic

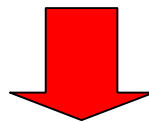


Single mode VCSELs (< 0.2 nm)

- Modal Noise

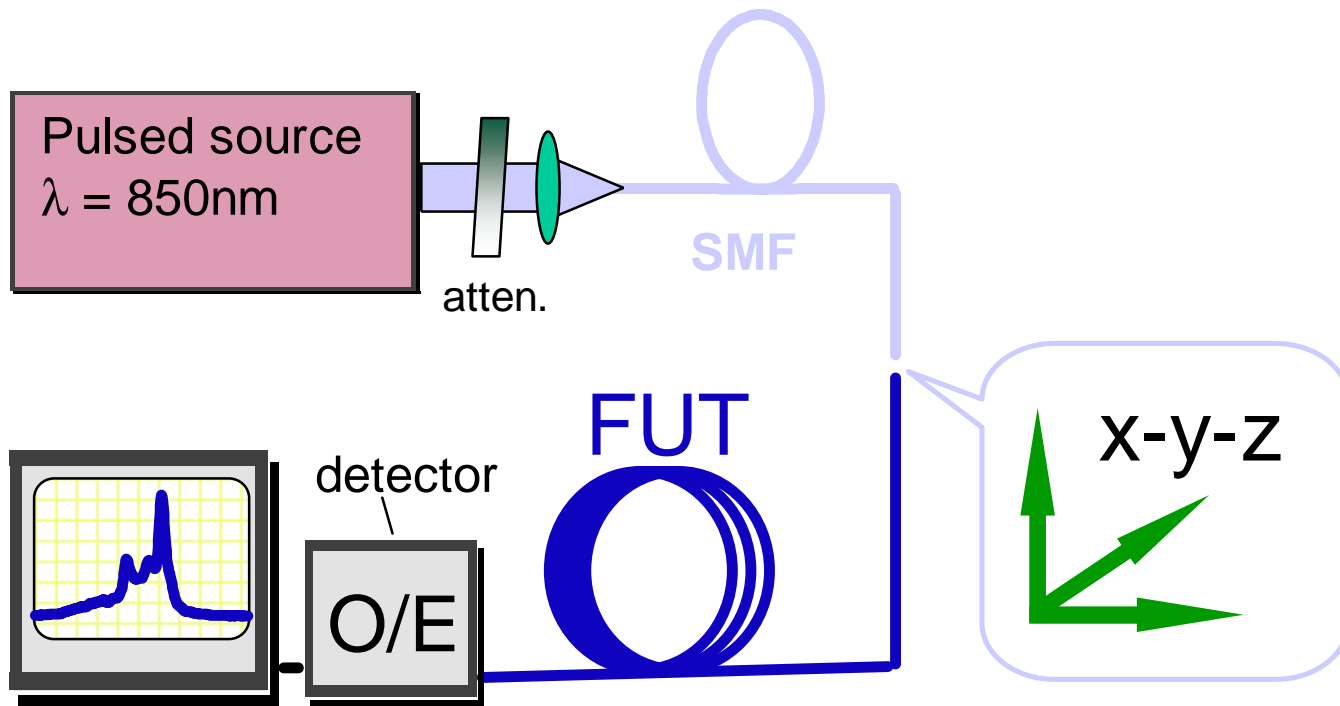


“Center” restricted launch

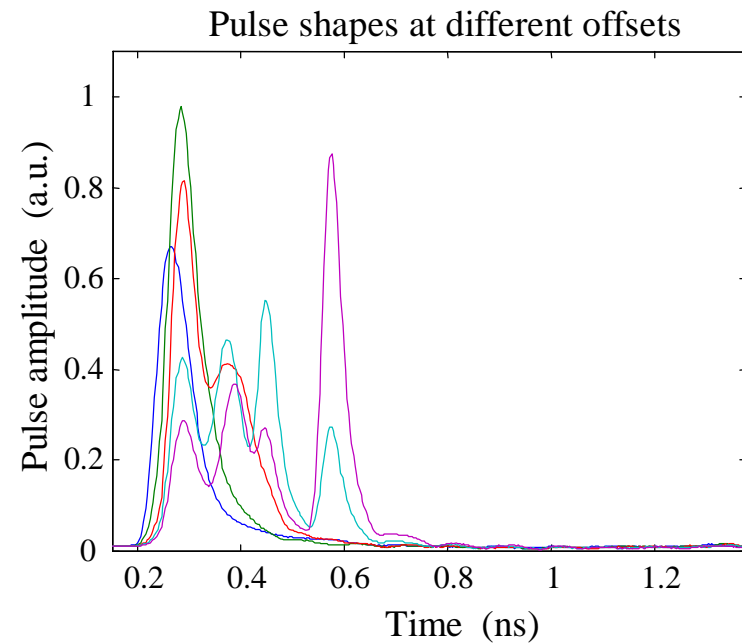
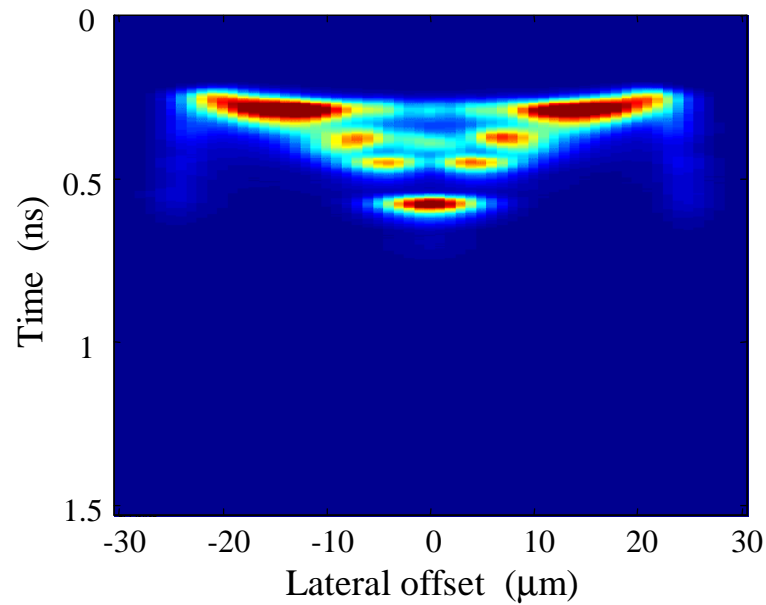


Fiber with flat and narrow DMD around the center of the fiber

Differential mode delay measurements setup

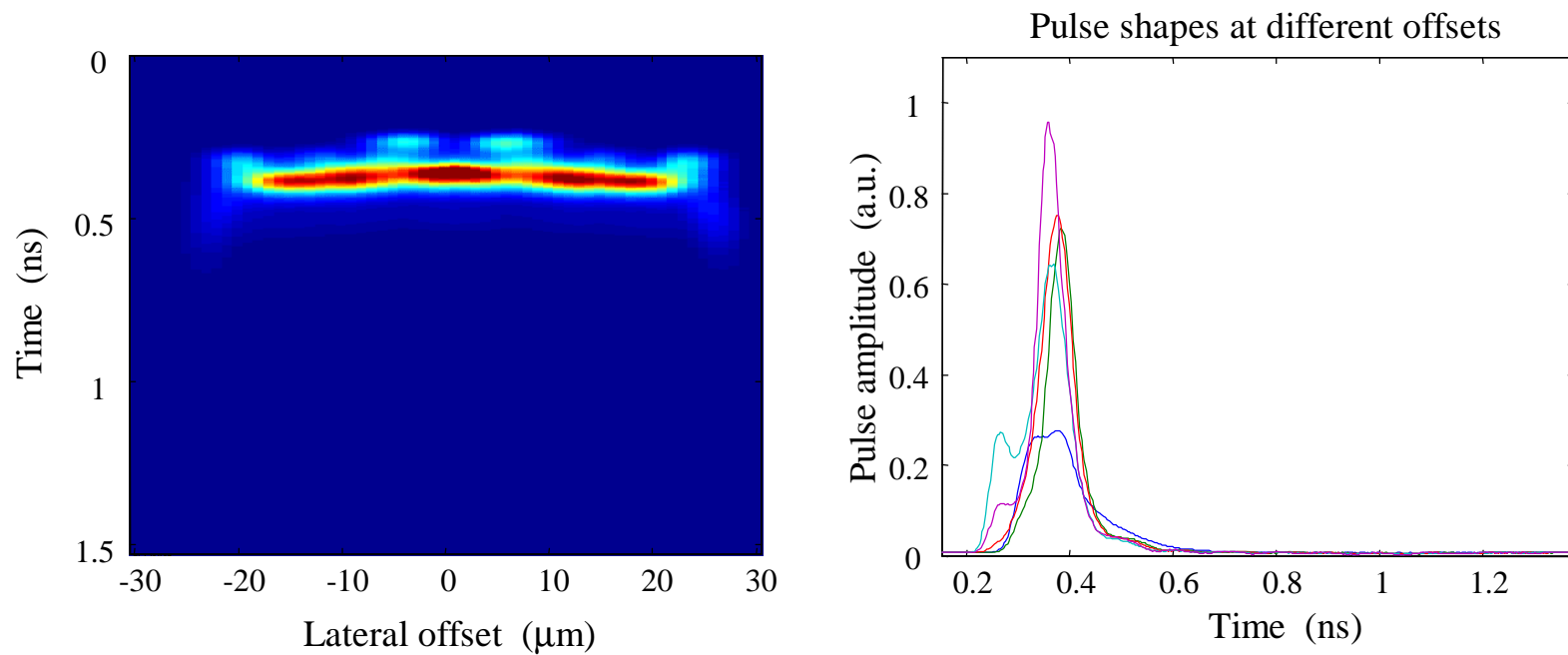


Traditional MMF



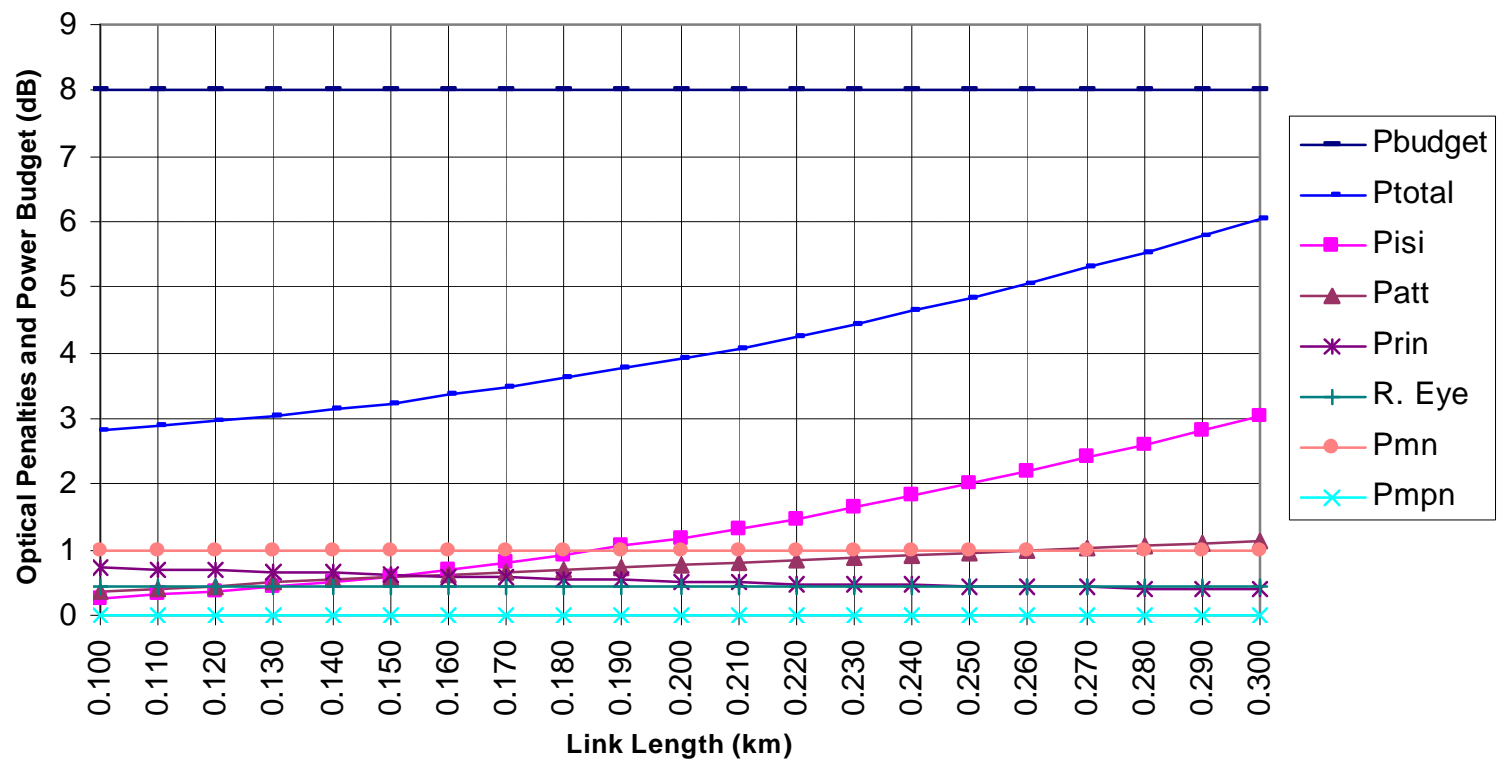
- The traditional MMF can not support robust 10Gb/s transmission

ZETA multi-mode fiber



- ZETA Multimode fiber has a flat and narrow DMD

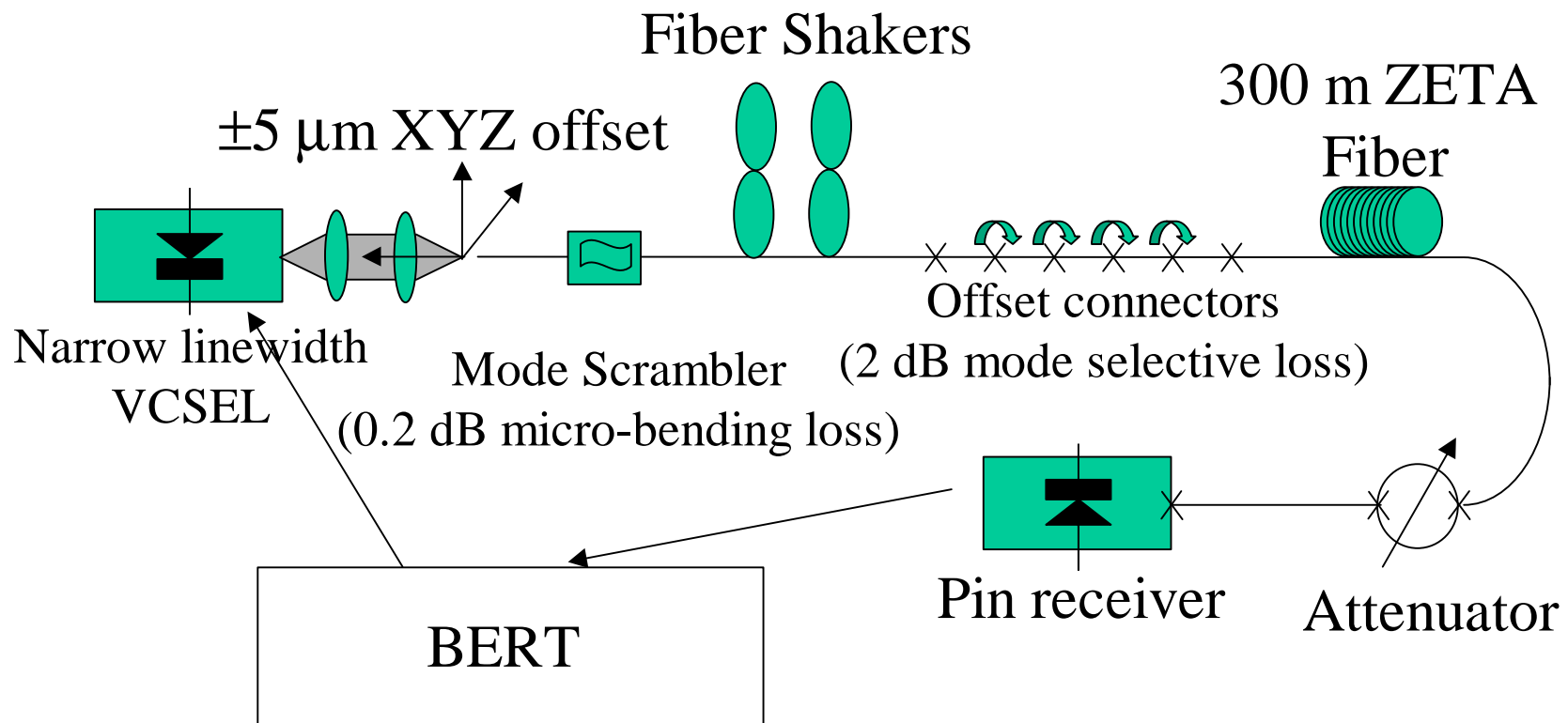
10Gb/s Ethernet power budget



- Minor modifications to the power budget compared to 1 Gb/s Ethernet

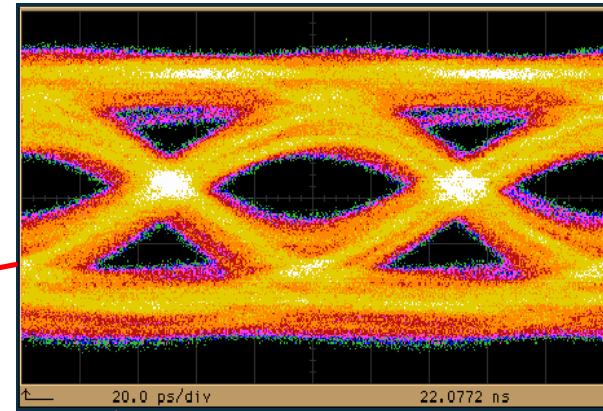
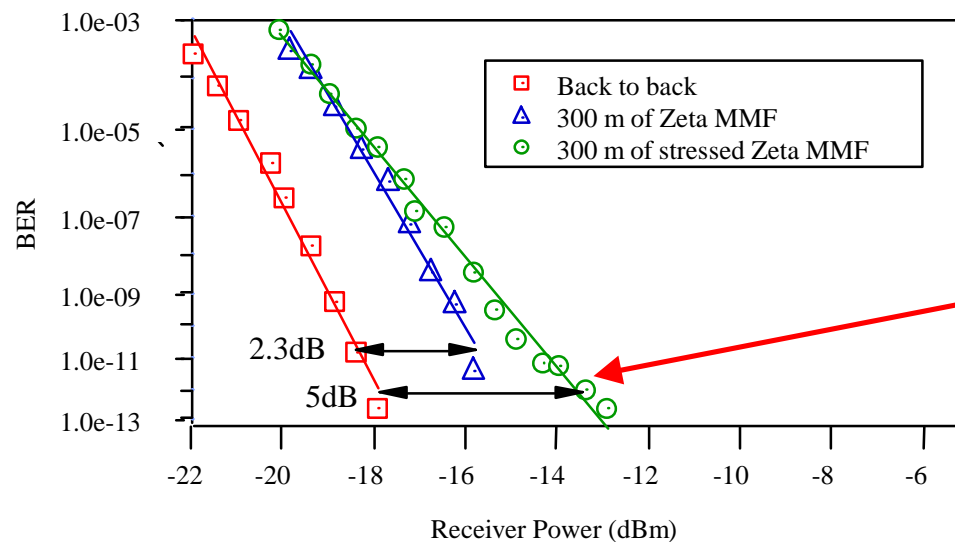
ZETA

stressed system configuration



ZETA

stressed system demonstration



- ZETA fiber can support robust 10 Gb/s transmission even under stressed conditions

Summary

- Cabling standards actively defining next generation MMF
- Motivation is to provide lowest complexity/cost solution within buildings
- Technology assessment points to 850 nm VCSELs and serial transmission
- Demonstration shows this concept is robust and achievable