MPI Penalties for 400GBASE-FR8/LR8 Links

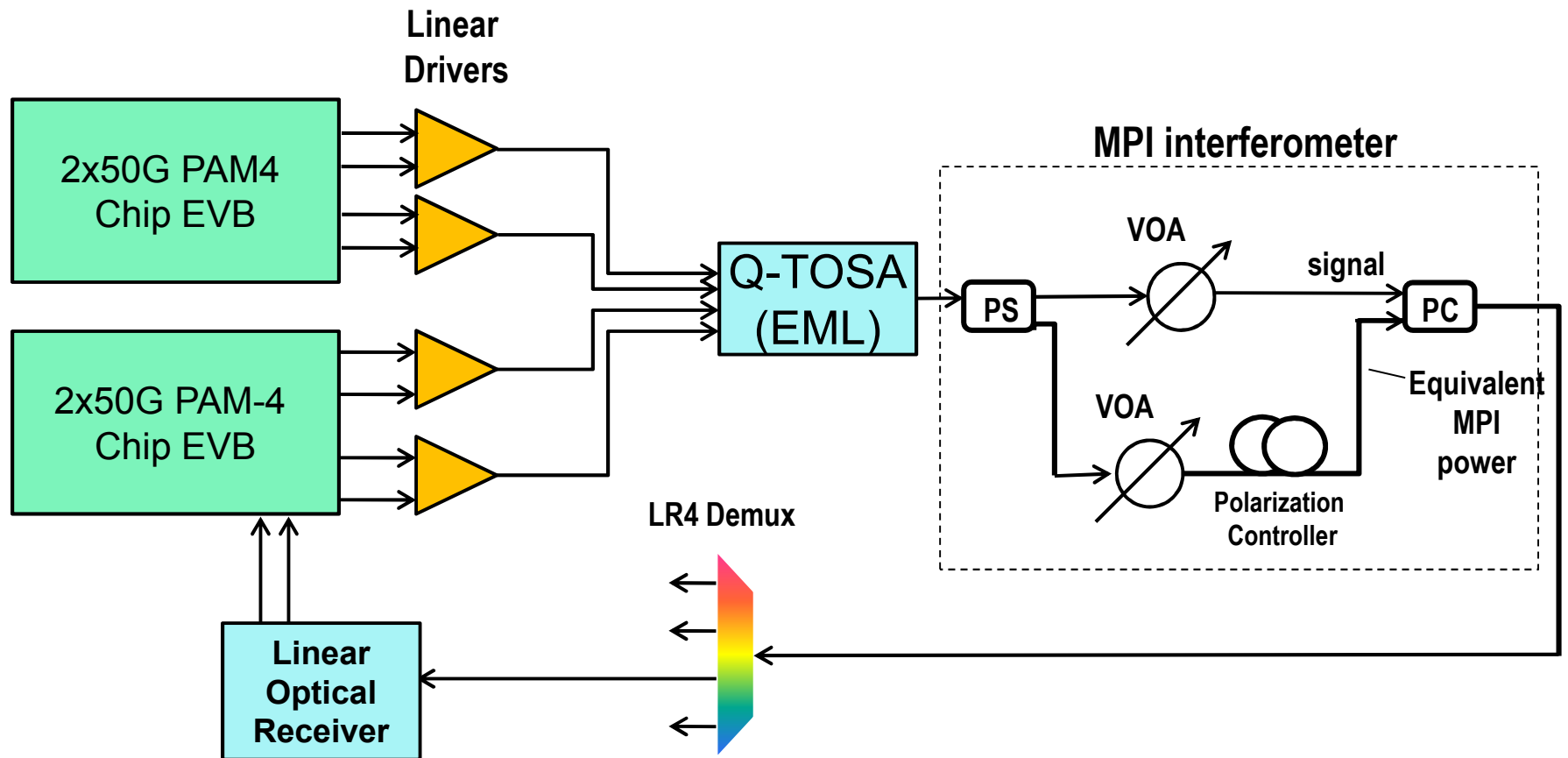**Winston Way and Trevor Chan**
NeoPhotonics, USA

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Goals

- **Based on MPI measurement results, provide inputs to the following "TBD" parameters for 400GbE-FR8 and –LR8 links in IEEE802.3bs/D0.9:**

  - Table 123-7: Transmitter reflectance (max) in dB
  - Table 123-8: Receiver reflectance (max) in dB
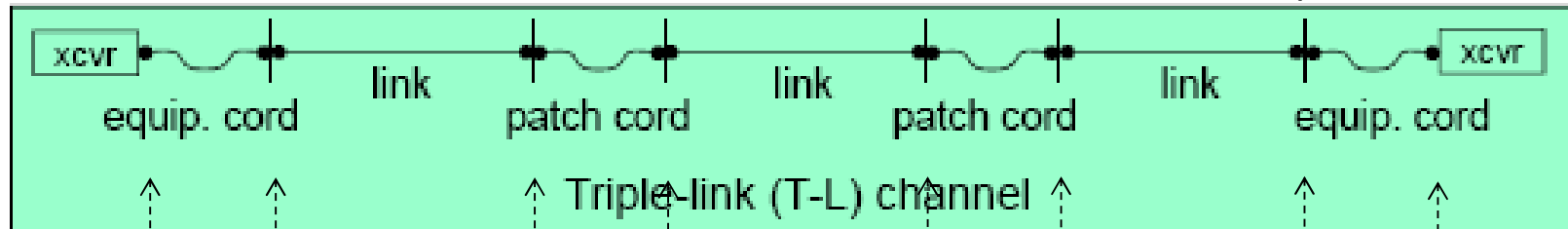 - Table 123-9: Maximum discrete reflectance in dB

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Experimental Setup I

Thanks to InPhi for providing the 2x50G PAM4 EVB

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4 cases of discrete reflectance in a triple-link

(Kolesar_3bs_01_0514)

Return loss assumption

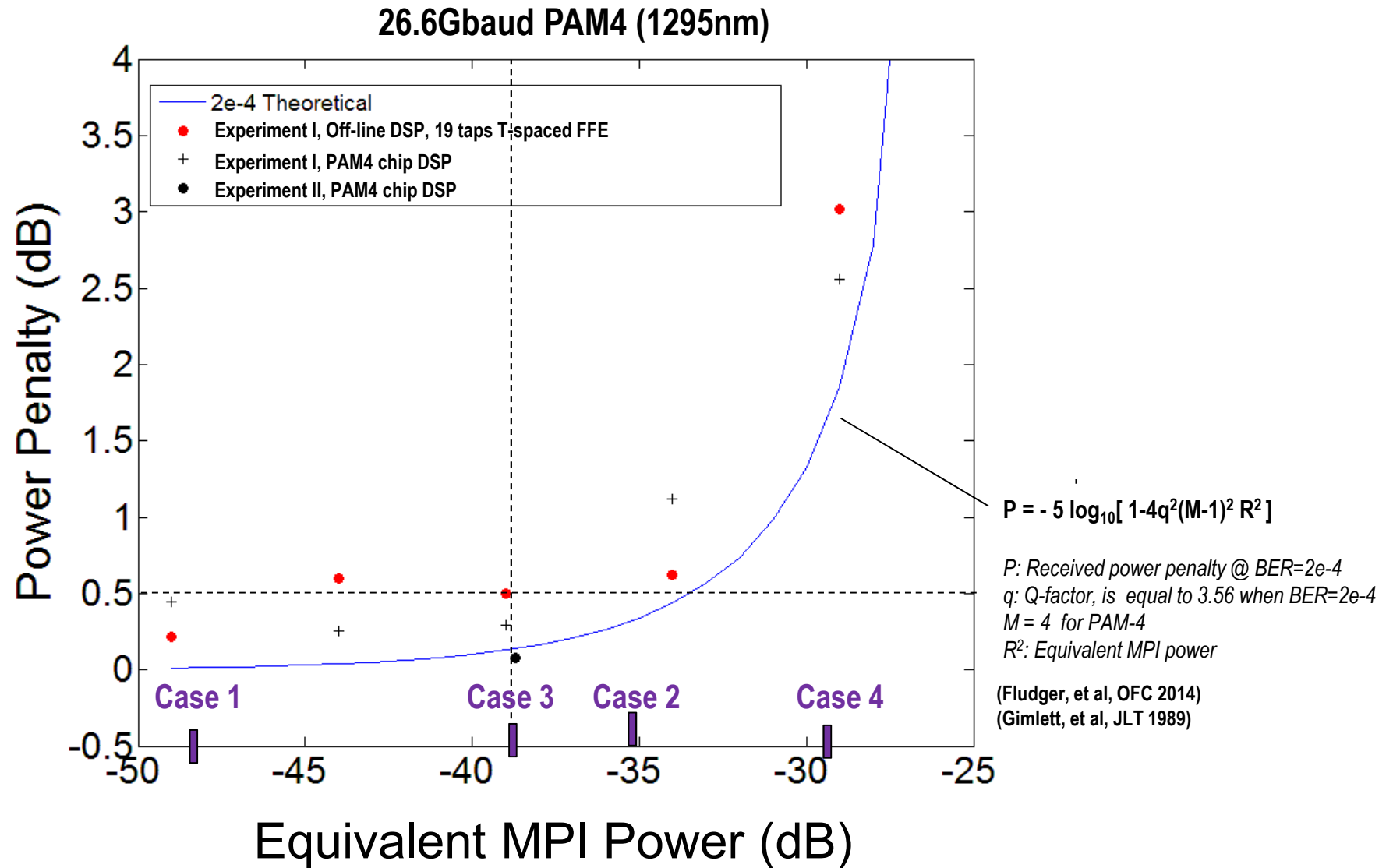|									Equivalent MPI Power
Case 1:	-26dB	-35dB	-35dB	-35dB	-35dB	-35dB	-35dB	-26dB	-48dB
Case 2:	-12dB	-35dB	-35dB	-35dB	-35dB	-35dB	-35dB	-26dB	-35dB
Case 3:	-26dB	-26dB	-26dB	-26dB	-26dB	-26dB	-26dB	-26dB	-38dB
Case 4:	-12dB	-26dB	-26dB	-26dB	-26dB	-26dB	-26dB	-26dB	-29dB

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Experimental Setup II
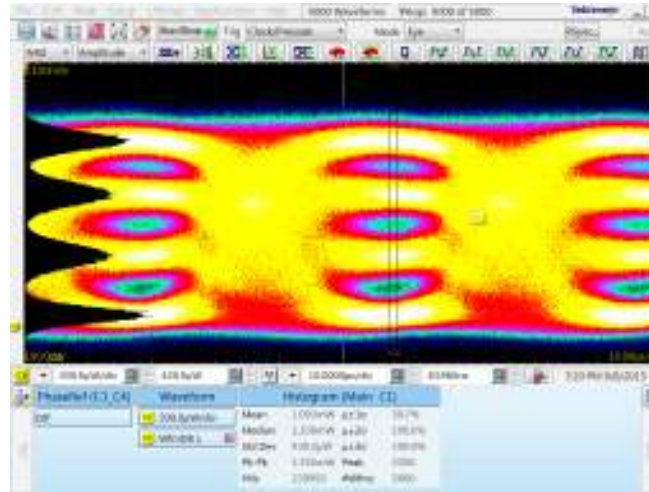

Monitor BER over 12 hours with perturbed fibers

Thanks to Ezconn for providing the special jumpers with specified reflectance

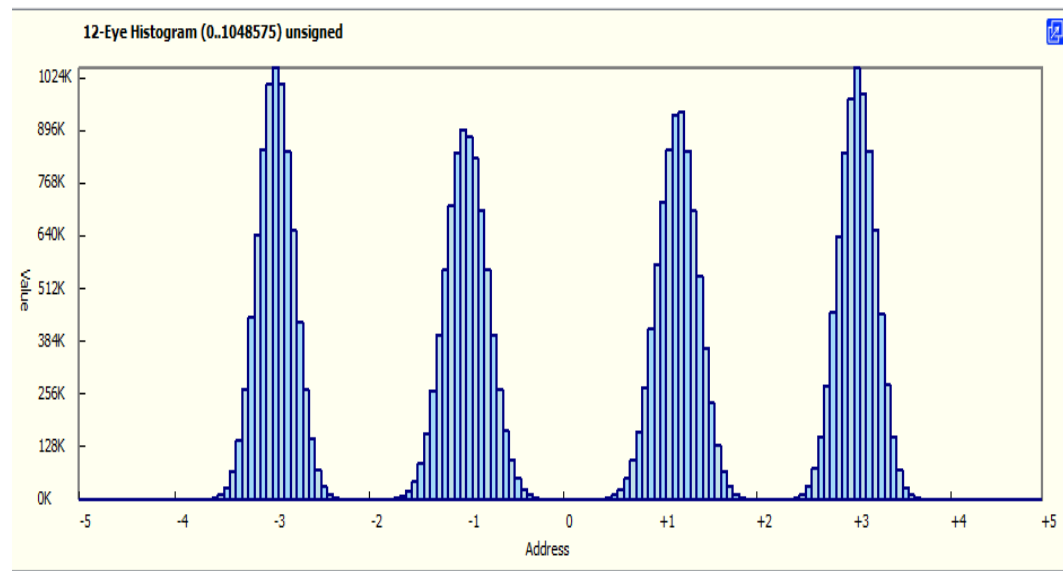NeoPhotonics

Received Power Penalty vs Total MPI Power

26.6Gbaud PAM4 (1295nm)

Legend:
- 2e-4 Theoretical
- Experiment I, Off-line DSP, 19 taps T-spaced FFE
- Experiment I, PAM4 chip DSP
- Experiment II, PAM4 chip DSP

Y-axis: Power Penalty (dB)
X-axis: Equivalent MPI Power (dB)

Case 1, Case 3, Case 2, Case 4

$$P = -5 \log_{10}[1-4q^2(M-1)^2 R^2]$$

P: Received power penalty @ BER=2e-4
q: Q-factor, is equal to 3.56 when BER=2e-4
M = 4 for PAM-4
R^2: Equivalent MPI power

(Fludger, et al, OFC 2014)
(Gimlett, et al, JLT 1989)

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Validity of Gaussian Distributed MPI

Total MPI Power = -38dB

Before RX FFE

After RX FFE

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Summary

- **To keep MPI-induced received optical power penalty under 0.5dB, we suggest**

    – Table 123-7: Transmitter reflectance (max): -26 dB

    – Table 123-8: Receiver reflectance (max): -26 dB

    – Table 123-9: Maximum discrete reflectance: -26 dB

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Thank You!

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