

Relaxation of Tx Speed Requirements

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802.3aq Task Force
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Supporters

- The following people support the need to further explore relaxed optics specs:
 - John Jaeger, Big Bear Networks
 - Martin Lobel, Intel
 - Jesper Hanberg, Intel
 - Pete Kirkpatrick, Intel
 - Bob Zona, Intel
 - John Ewen, JDSU
 - Wenbin Jiang, JDSU
 - Ed Cornejo, Opnext
 - Matt Traverso, Opnext
 - Abhijit Shanbhag, Scintera Networks

Agenda

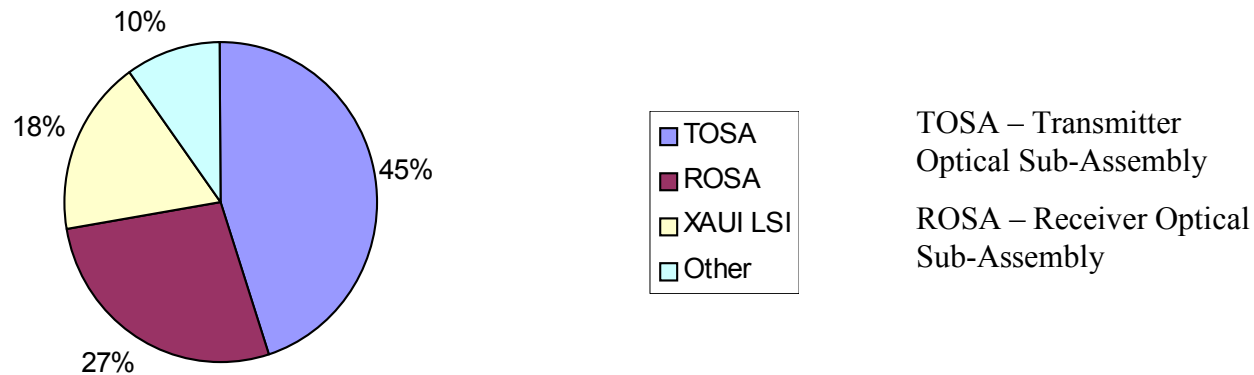
- Introduction
- Dispersion Penalty Analysis
- TP2 Tests
- Study Group
 - Invitation, schedule, tasks

Introduction

- EDC's premise is that Rx has the tools to operate in the presence of dispersion
- TOSA is highest cost component in 10G modules
 - Relaxed transmit eye will improve TOSA yield
 - Enables higher rise/fall time
 - Enables lower reference receiver bandwidth and lower relaxation oscillation frequency
 - Possibly enables more RF packaging options
- EDC has potential to reduce TOSA cost by allowing relaxed specifications

Cost Breakdown*

Typical cost distribution for mature module

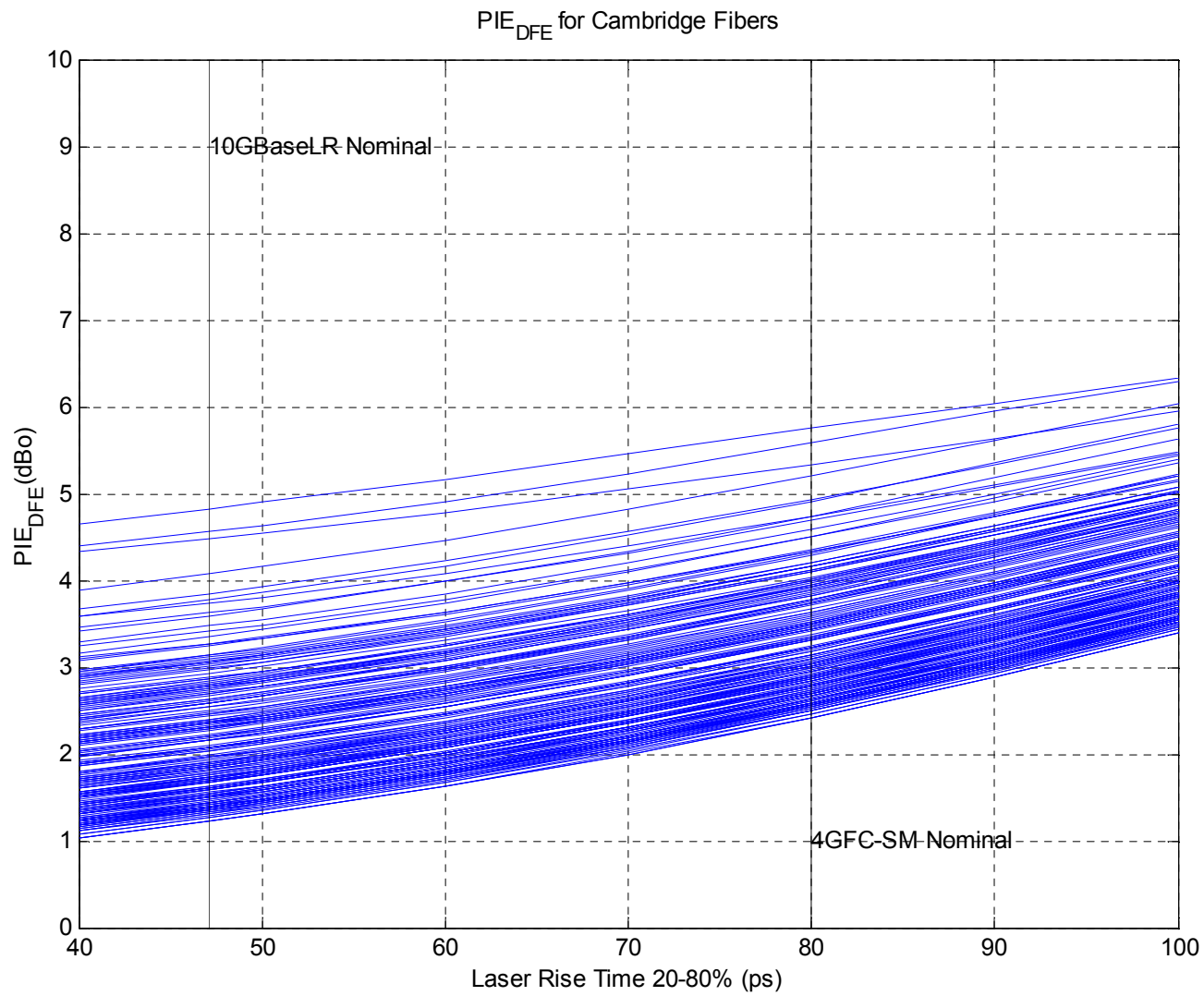


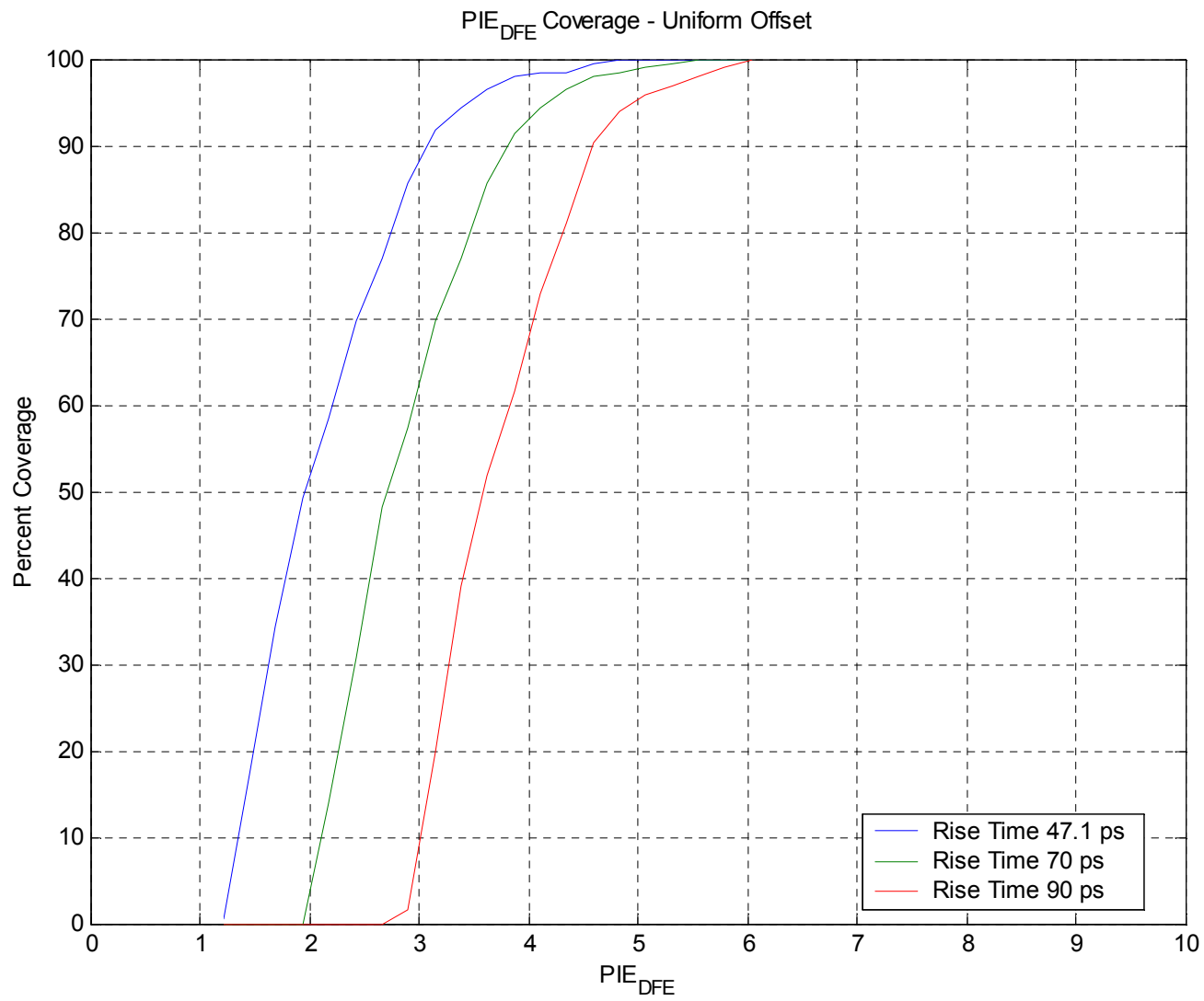
- Once a module matures, the optical front end typically accounts for most of the cost
- Aggressive approach needed to reach 3 x $\{1000\text{Base-SX}\}$ for (-LRM) applications
- Further analysis needed on cost impact of component specifications

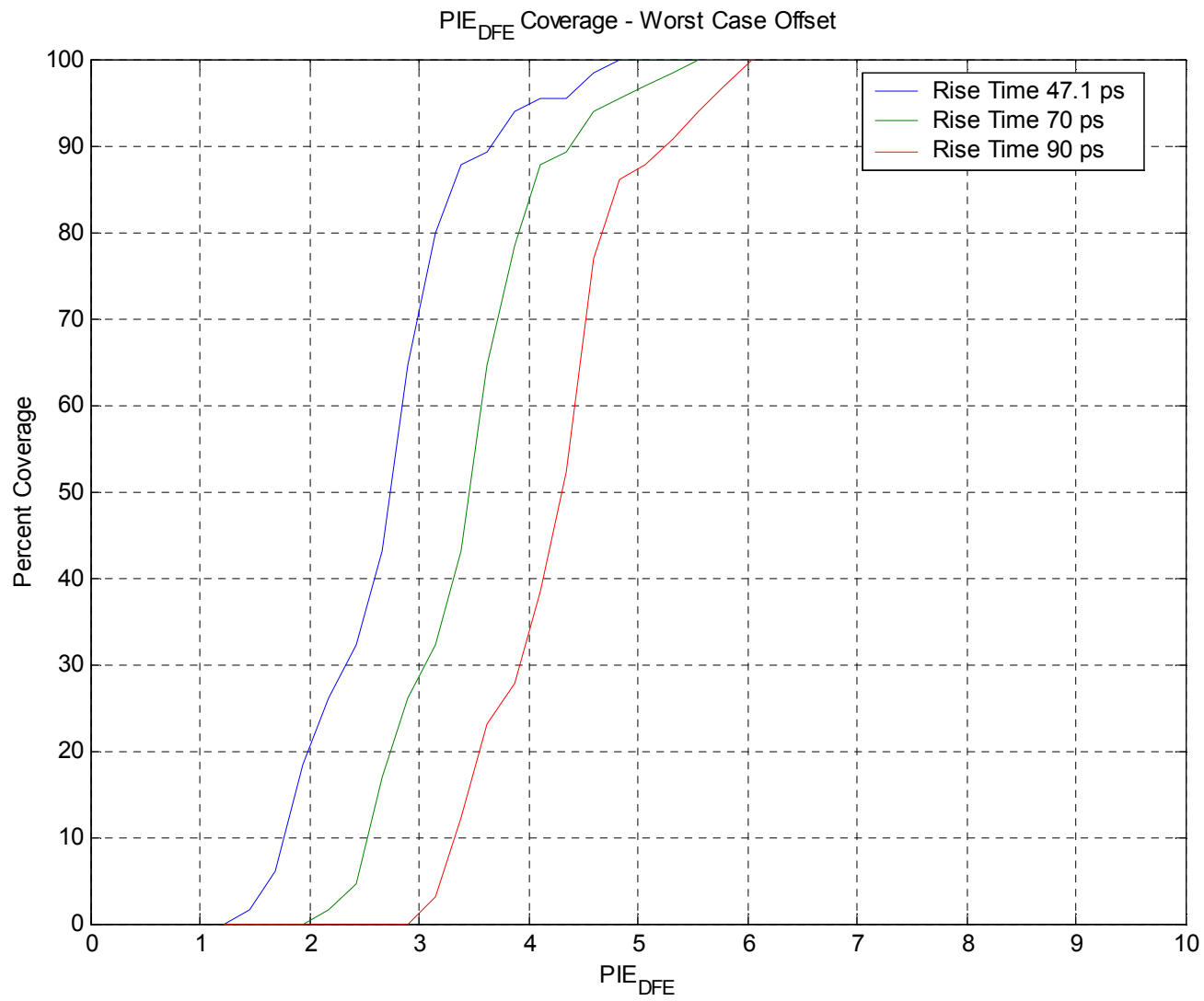
* from voois_1_0104, Vancouver

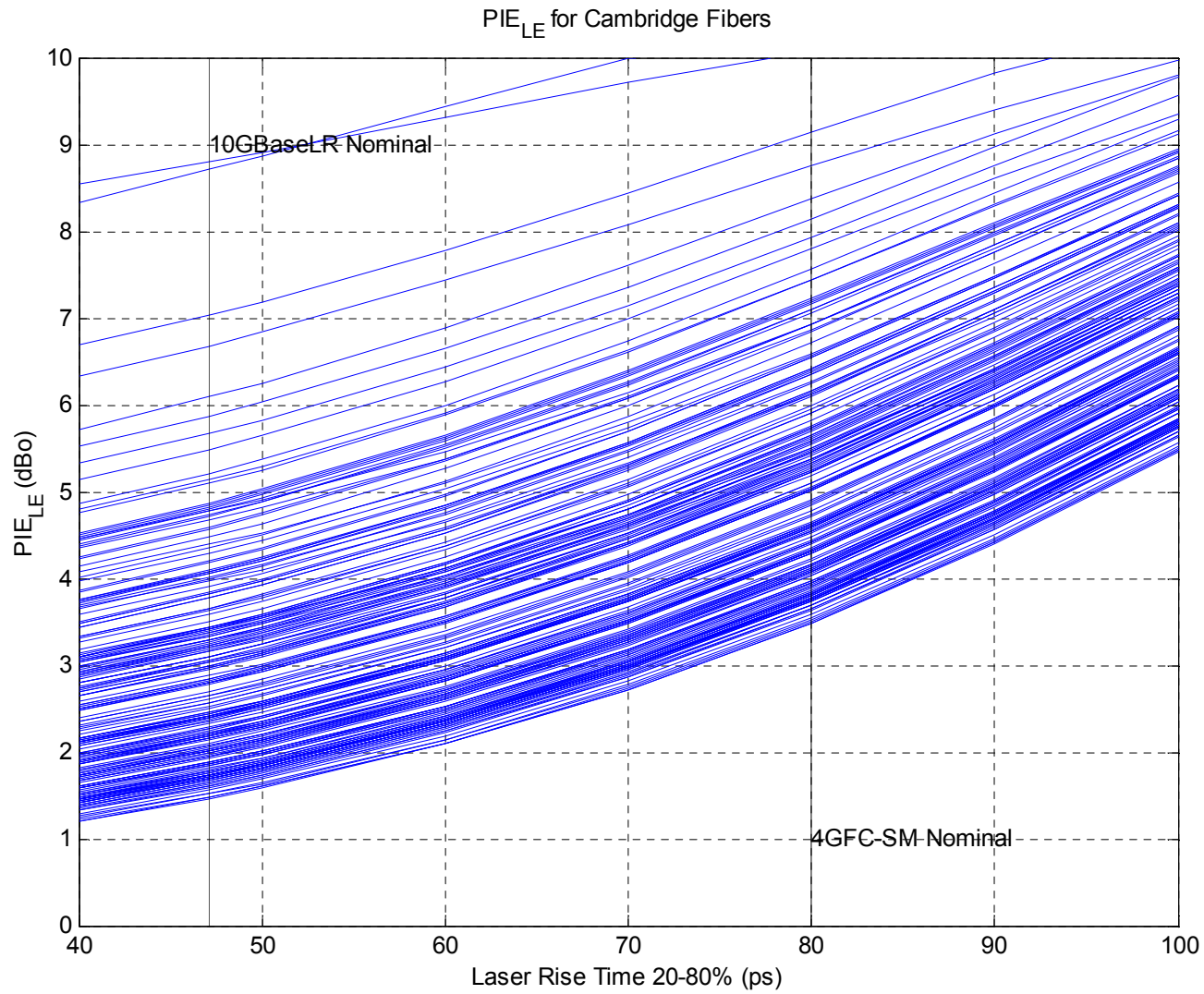
Dispersion Penalty Analysis - Simulation Parameters

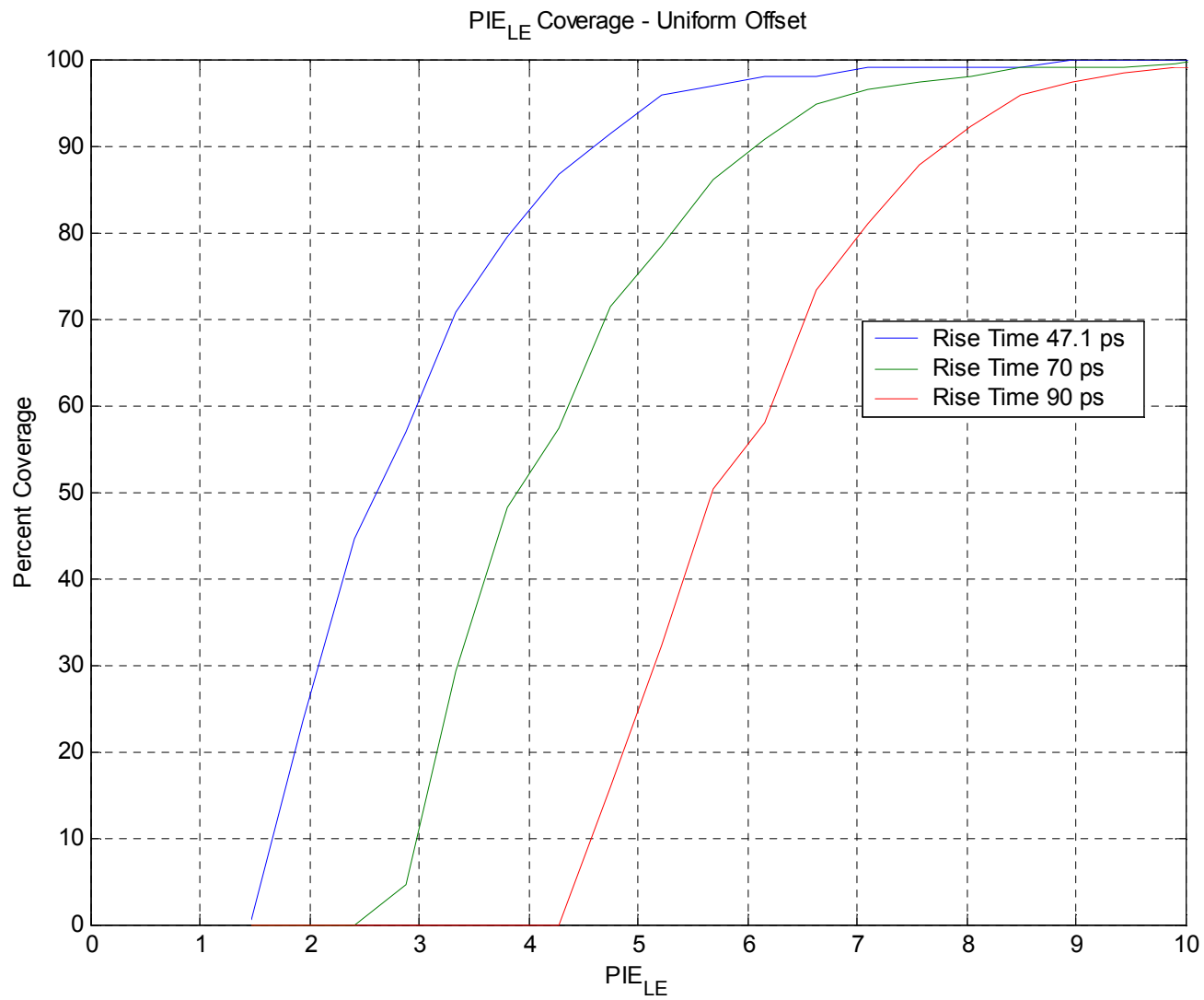
- Laser
 - Gaussian impulse response
 - Rise/fall time varied from 40 to 100 ps
- Fiber
 - Cambridge data set (65 fibers)
 - 17, 20, 23u offset (195 cases)
 - 220m
 - Version 2.0
- Receiver
 - 4th order Bessel Thompson
 - 3 dB Electrical BW = 7.5 GHz

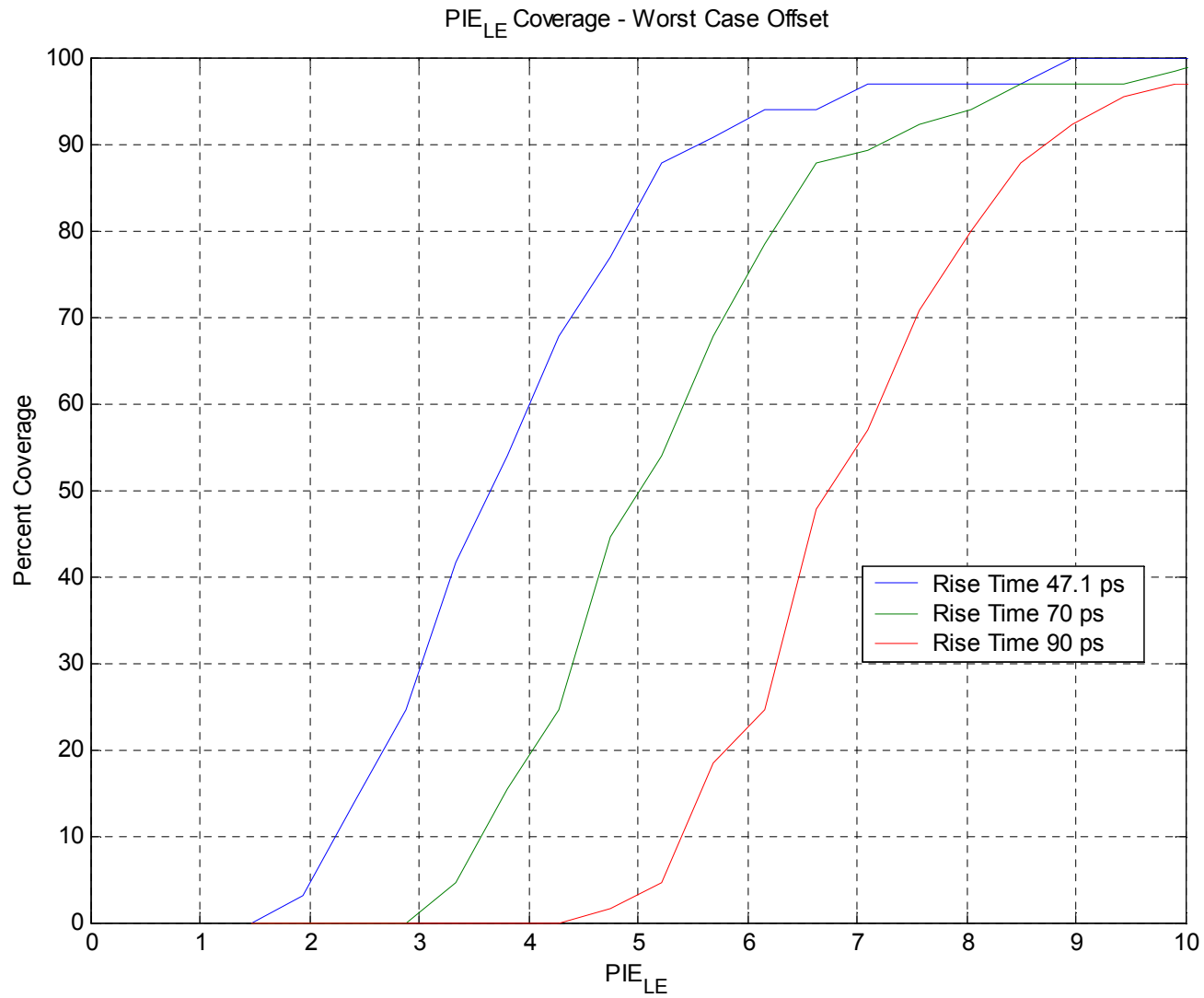












Impact to Link Budget & Test

- Link budget impact of increasing rise time spec from 10GBase-LR value (47.1 ps) to:

	70 ps	90 ps
PIE-L	1.5 dBo	3.3 dBo
PIE-D	0.7 dBo	1.6 dBo

- Measured at 80% coverage on Cambridge fiber set
- Additional penalty may come from uncorrectable distortions (lower ROF, etc.)
 - Not modeled in this analysis
- Test(s) required to limit both
 - Test(s) be independent of speed, but spec limits will be different

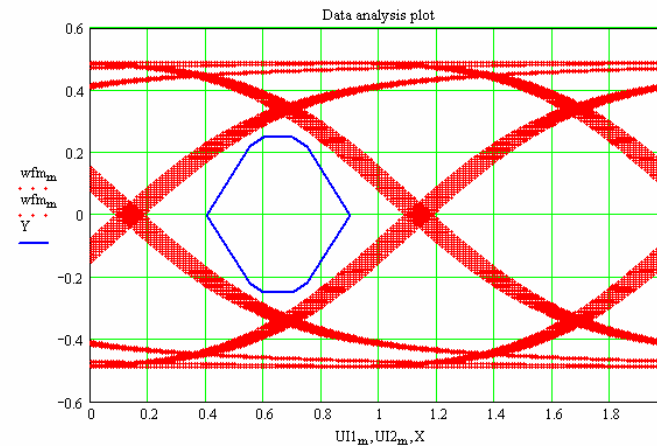
Initial TP2 Test Ideas

- Relaxed mask test
 - Relaxing mask also allows more impairments that might not be correctable
- Use -L mask test
 - But, test with square wave pattern
 - Limits uncorrectable impairments, allows more ISI
 - Increase dispersion penalty in budget
- TDP
 - *Do we need this or some equivalent spec/test in any case?*
 - Benefits
 - Holistic - captures all “sins”, assures budget
 - Parametric test – 802.3ae puts penalty burden on Tx
 - Locates “cure” with “disease”
 - Setup
 - Capture averaged waveform on digital scope and calculate penalty via simulation of channel and “golden” EDC receiver*
 - Tests for dispersion penalty
 - PRBS10 or longer pattern, or preferably PRBS7 and tighter limit
 - Handle uncorrectable impairments with mask and square wave pattern?
- Other ideas?

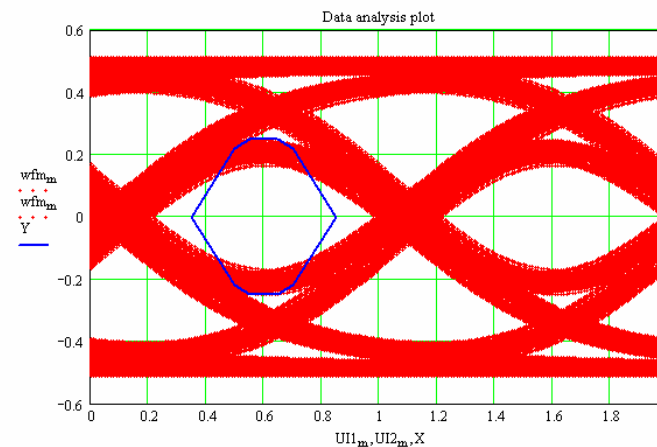
*Hardware golden EDC receiver probably not practical; simulation also eliminates need for HW ref channel

Square Wave Test Concept

- Same ISI mechanism, but square wave vs. PRBS patterns
- Present mask with square pattern should control uncorrected impairments
- Penalty required to account for ISI increase
- Can tighten X1 for add'l uncorrelated jitter control



Square wave, runs of 5



PRBS7

Study Group

- A study group of interested experts is needed to complete this task
 - Request for volunteers – please contact Tom Lindsay*
- Schedule
 - Proposal by September meeting
- Tasks
 - Next slide

*tlindsay@ieee.org, (425) 775-7013

At Portland meeting, please see Paul Voois or Norm Swenson

Study Group Tasks

- Volunteers Requested -

- Develop TP2 test metrics
 - This work may be required in any case
 - Build off list in this presentation and/or develop other proposals
- Simulation work
 - Power penalty vs. combinations of
 - **Laser rate equations & packaging effects**
 - **Optical channels**
 - **EDC receiver**
 - Uncorrelated jitter & RIN?*
 - TP2 test metric(s) vs. same combinations - correlation to penalty?
- Experimental work
 - Power penalty with EDC Rx's vs. various transmitters & channels
 - TP2 test metric(s) vs. same combinations - correlation to penalty?
- Write complete proposal for committee
- Develop supporting information on cost impact

*Jitter is probably independent of this study; RIN may be included in rate equation analysis, but must be considered if it is a function of relaxing speed requirements.

Summary

- EDC has potential to reduce cost through relaxed specs
- Present efforts aims to develop useful Tx/TP2 information to help Task Force optimize link budget tradeoffs
- Will not delay schedule
 - Fit within broader EDC proposal
 - Proceed in parallel with other work