



TP2 Eyes and Penalties
- Preliminary -

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Setup - general

- Fibers
 - Cambridge 108 fibers, 300 meters, 17,20,23 micron OSL
- Rx (simulated)
 - EDC taps = 50,50 (~PIE-D), 1 UI spacing
 - Uses best linear fit to determine coefficients; determines penalty on actual waveform
 - May be a bit pessimistic

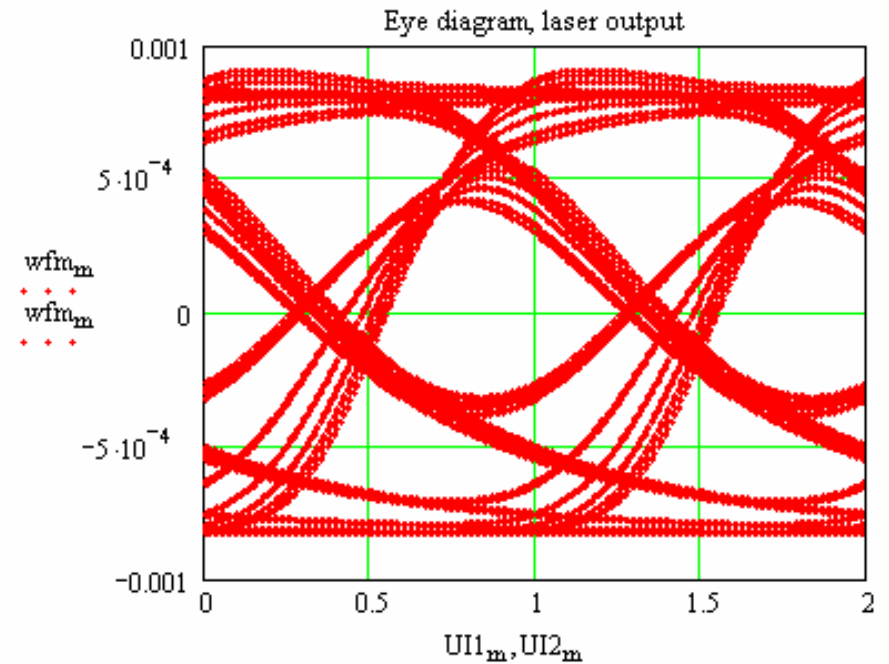
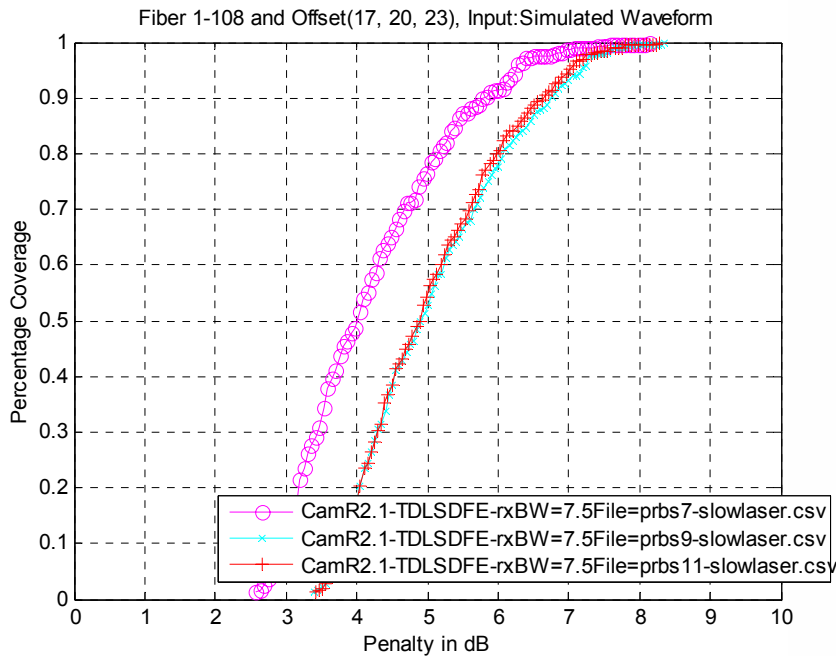


Simulated waveforms

...not rigorous...

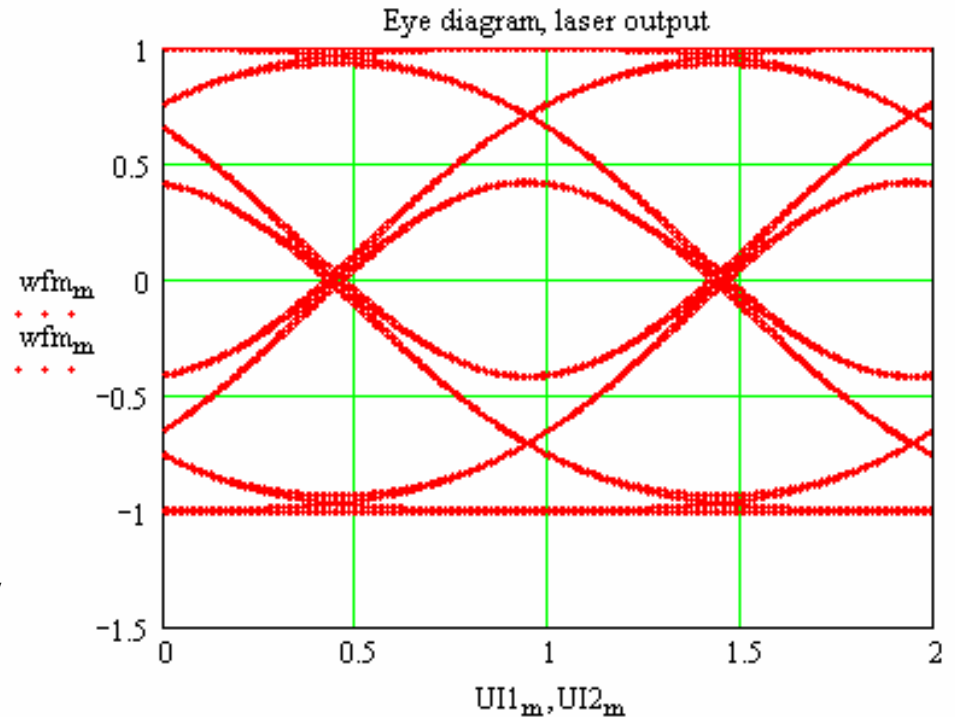
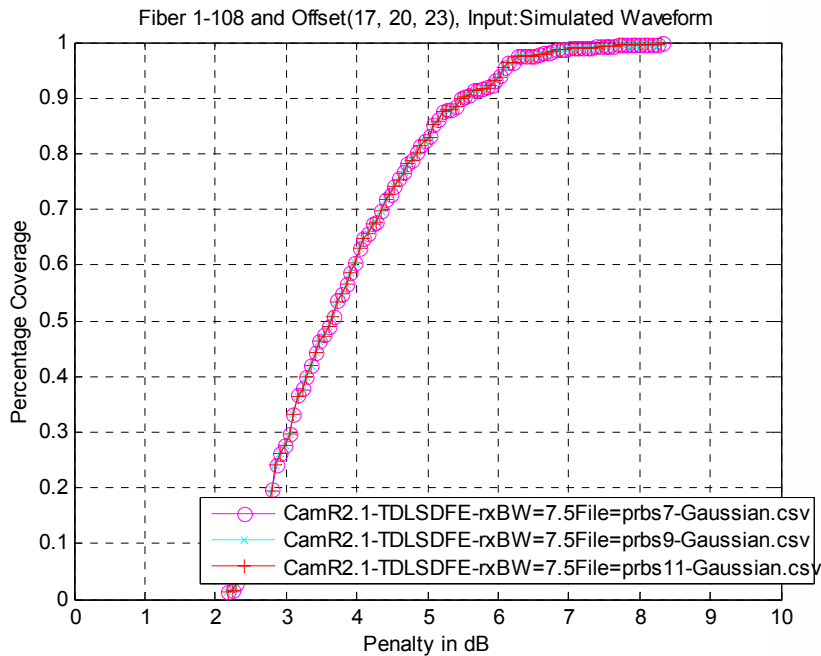
- PRBS7,9,11
- 7.5 GHz Bessel-Thomson filter
 - Simulated in Rx
- 32 samples per UI

Slow laser



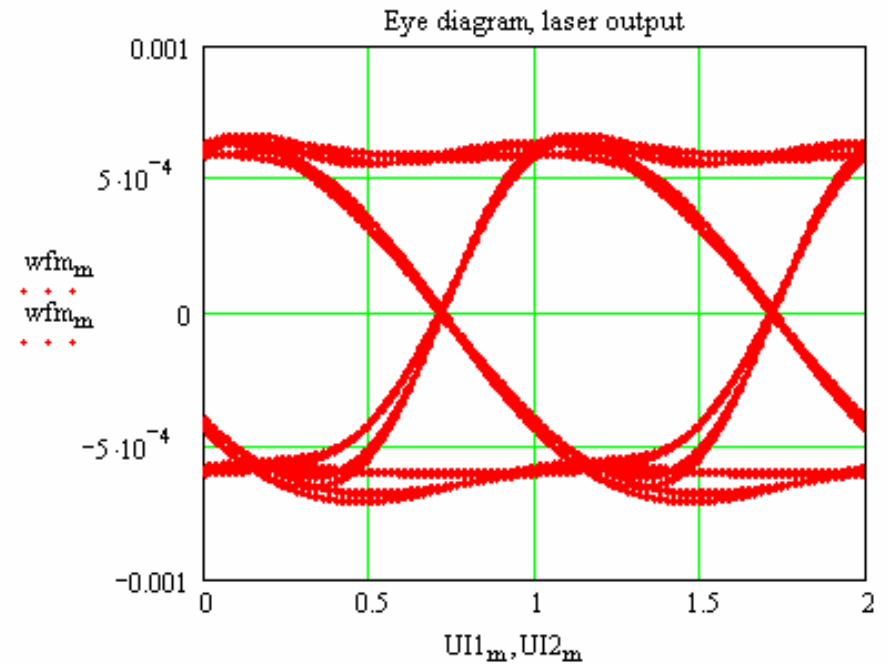
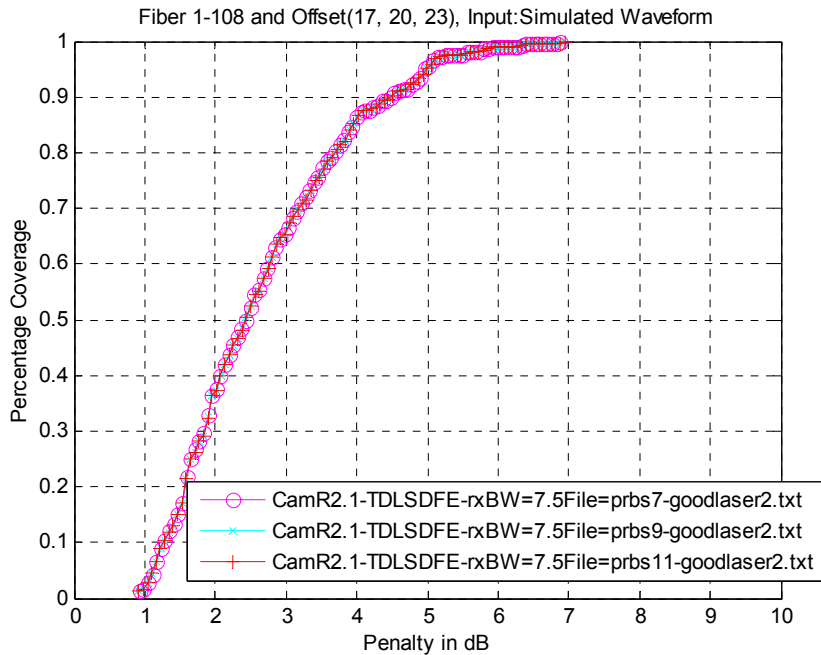
Suggests that >PRBS7 may be required

Slow Gaussian (~ 0.75 UI rise/fall times)



Candidate for TP3 source (~ 5 dB at 80%)

~good 10G laser, small electrical reflection and frequency loss



Observations

- simulations -

- Closed eyes are more sensitive to pattern length
 - PRBS7 may be insufficient
- 0.75 UI rise/fall time Gaussian represents ~5 dB penalty at 80% coverage
- More exacting simulations needed
 - Wider variety of characteristics
 - Electrical reflections and loss, etc.

Lab waveforms

- Lasers
 - 1310 nm FPs, various suppliers and rated speeds
 - Bias-T with pattern generator and precision current source
 - OMA & extinction ratio settings

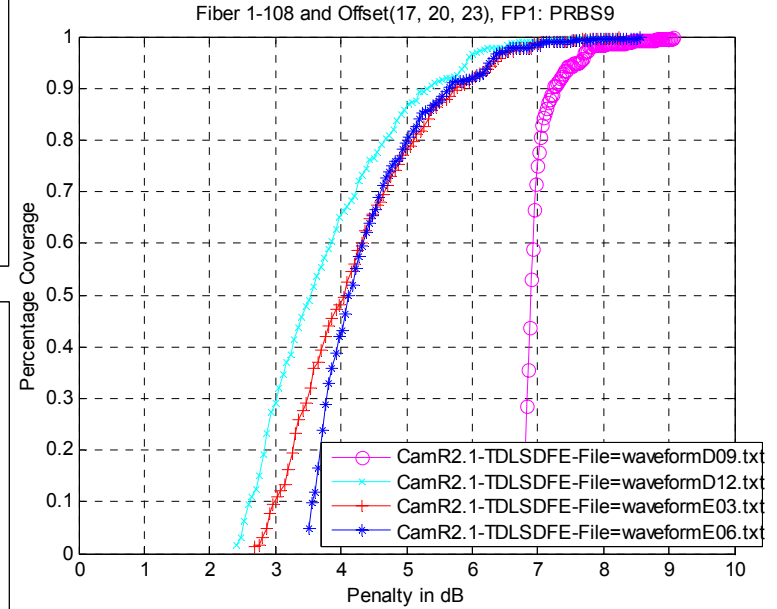
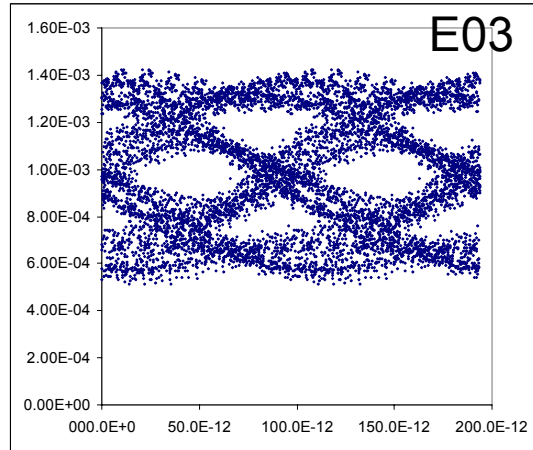
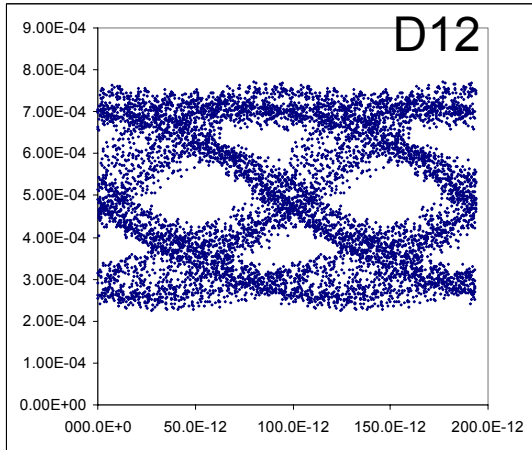
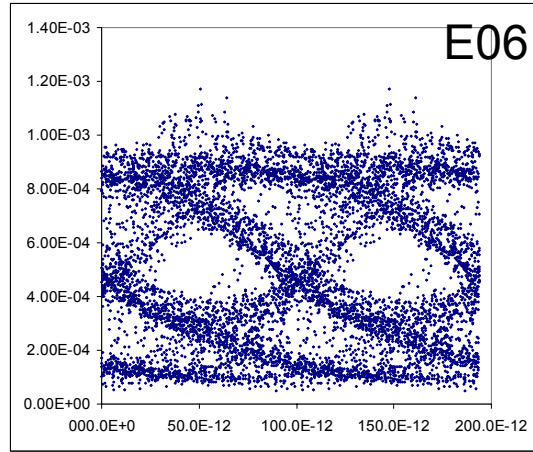
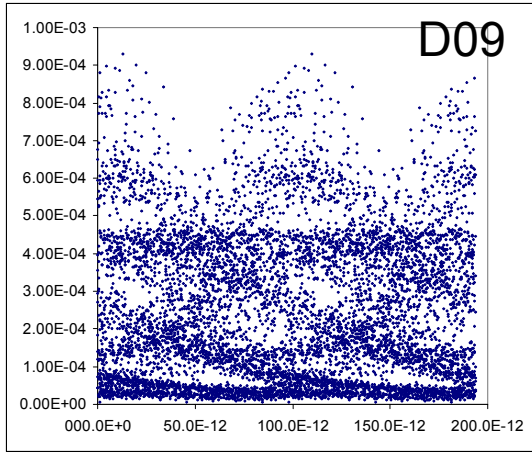
P_{avg}, uW	OMA, uW	OMA, dBm	ER, dB
250	390	-4.1	9.1
500	390	-4.1	3.6
500	780	-1.1	9.1
1000	780	-1.1	3.6

Bold values appear in legends, with waveform #

- Scope capture
 - 7.5 GHz Bessel-Thomson filter
 - PRBS9 (512 bit) ~7 samples per UI
 - Averages=16
 - Pattern trigger from PG

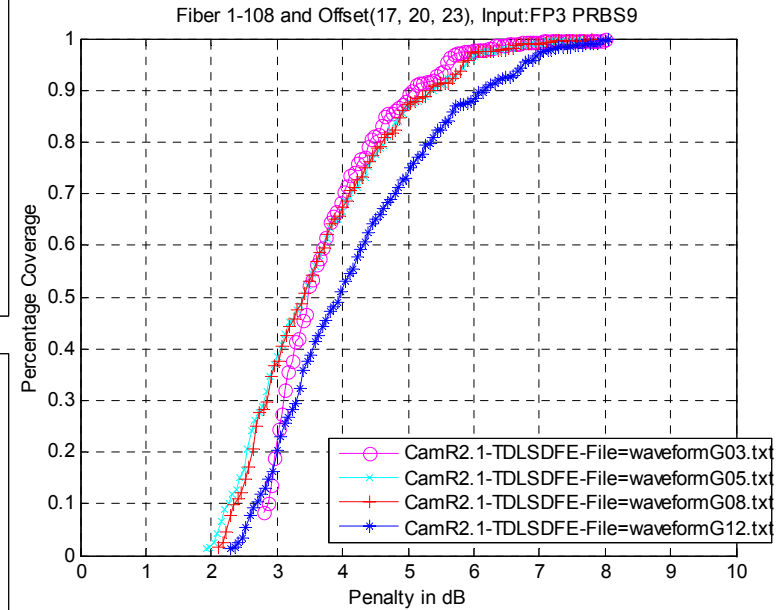
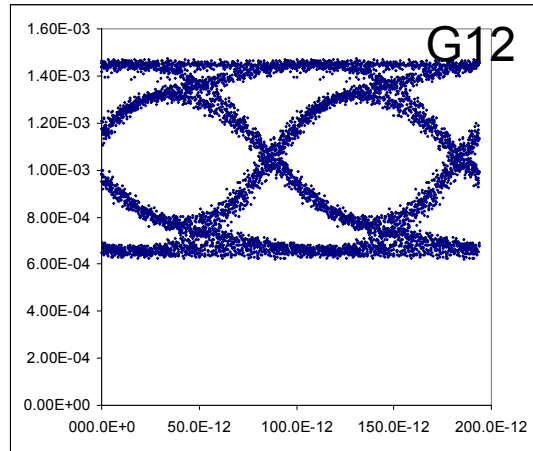
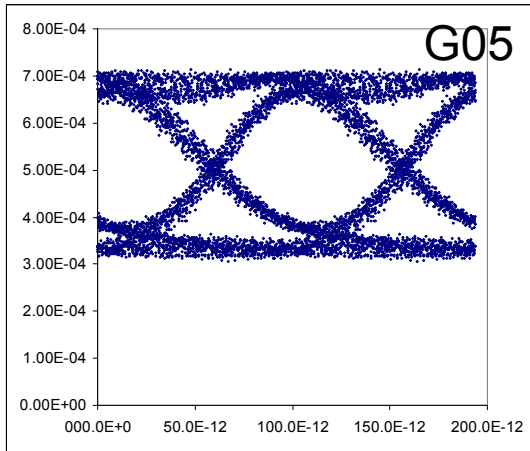
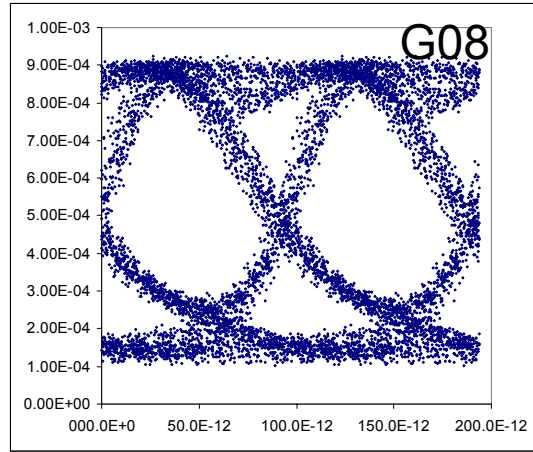
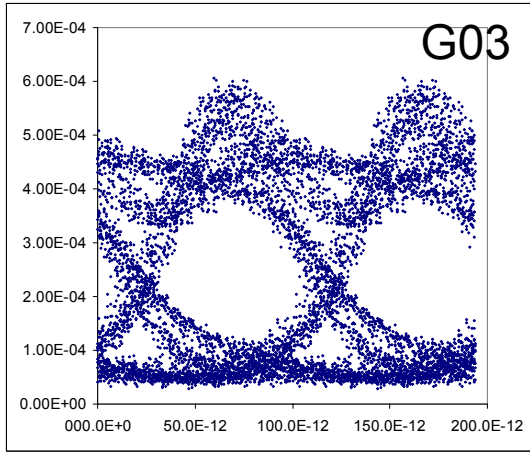
FP1

D09 – 250,390
E06 – 500,720
D12 – 500,390
E03 – 1000,700



FP3

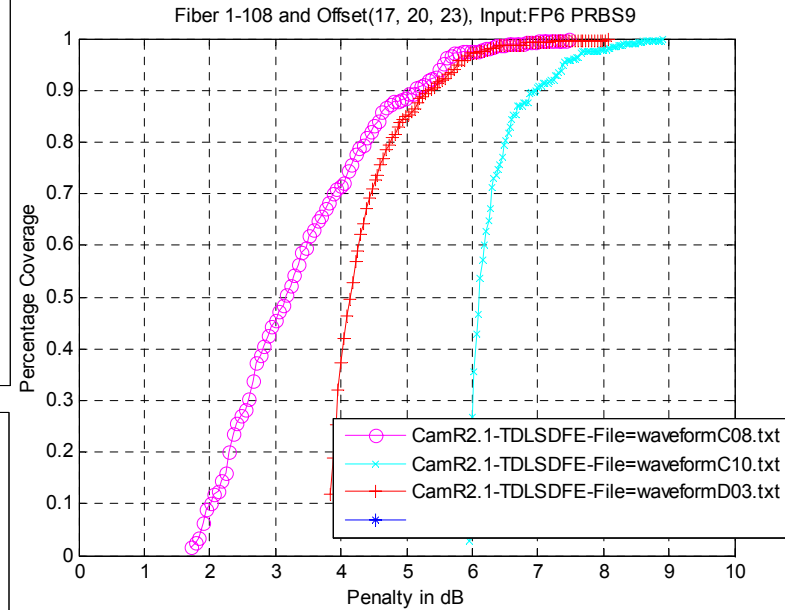
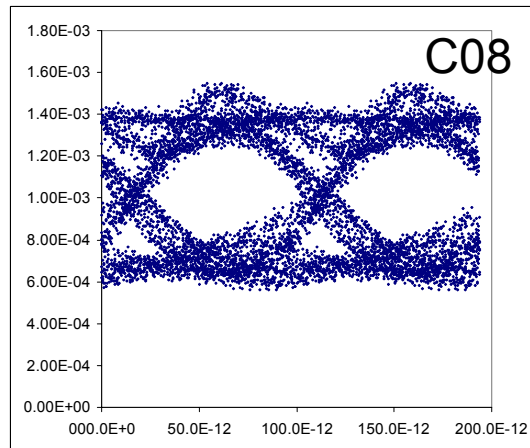
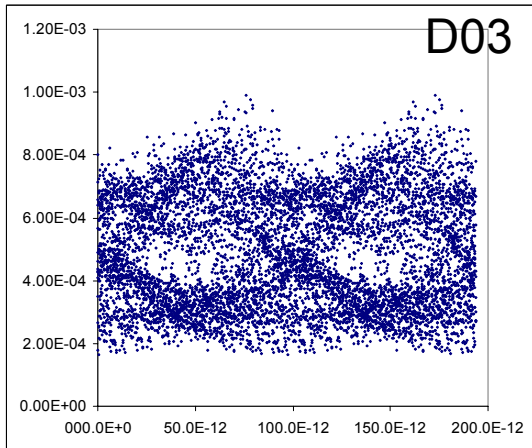
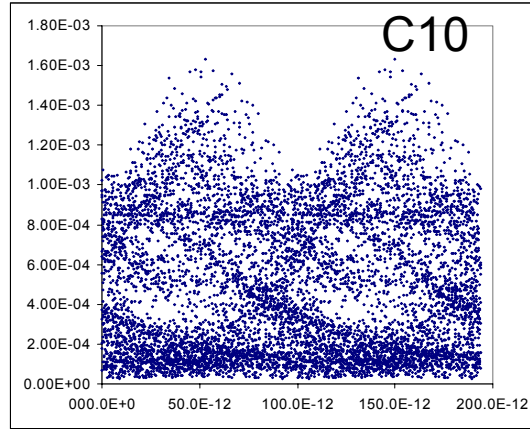
G03 – 250,390
G08 – 500,780
G05 – 500,390
G12 – 1000,780



FP6

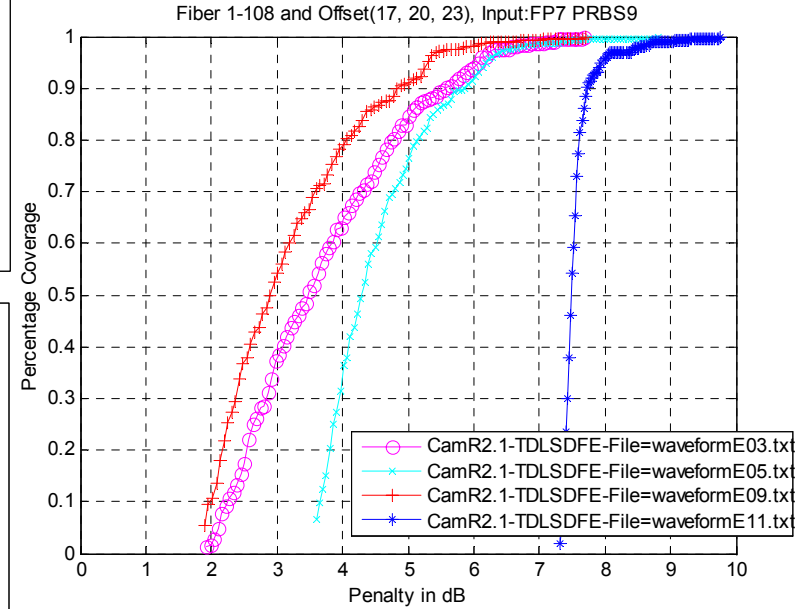
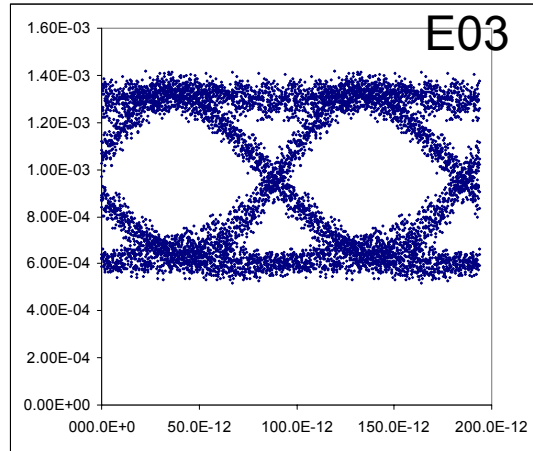
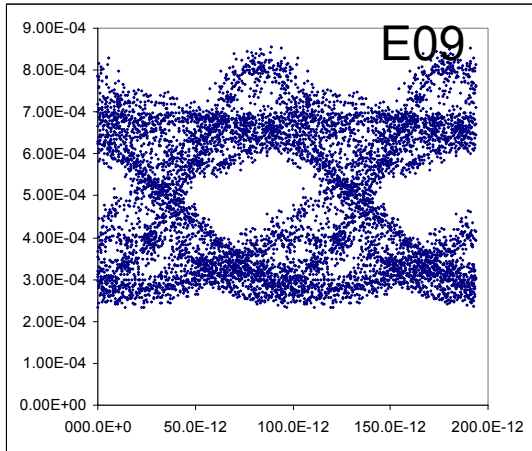
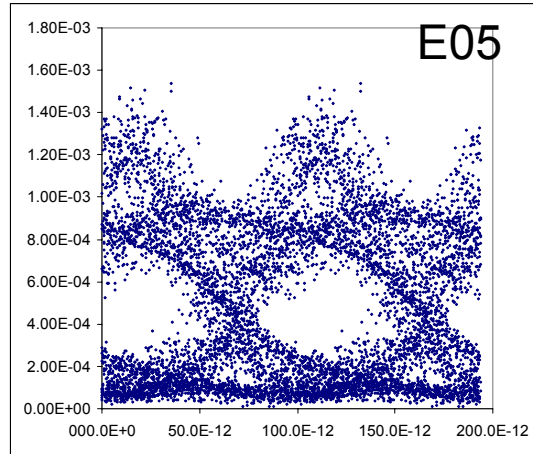
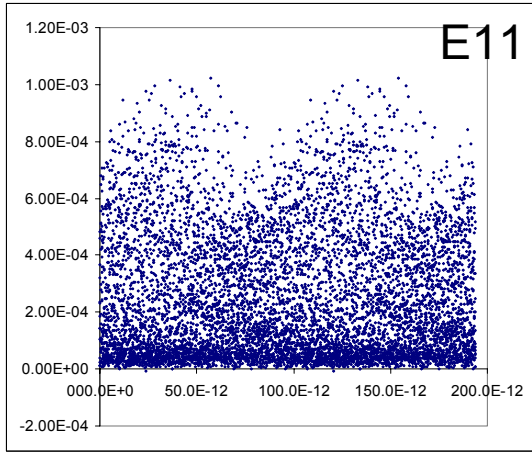
D05 – 250,390
C10 – 500,780
D03 – 500,390
C08 – 1000,780

D05 ran, but close to 10 dB



FP7

E11 – 250,390
E05 – 500,780
E09 – 500,390
E03 – 1000,780



Observations

- lab waveforms -

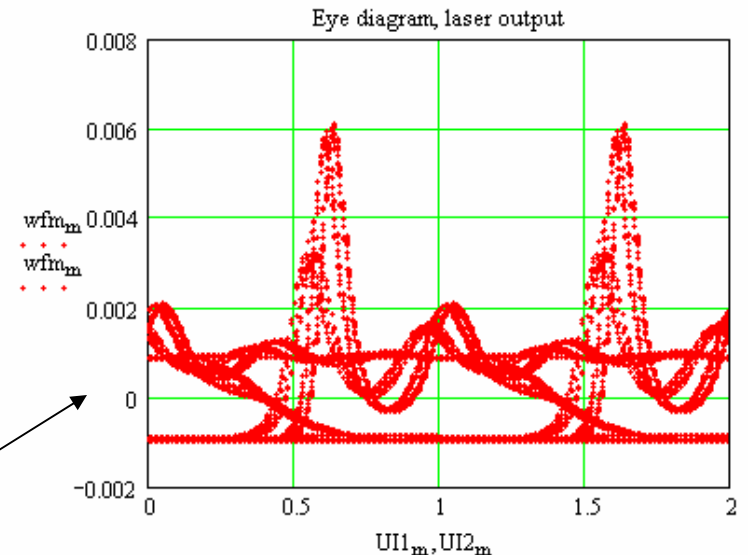
- Noticeable eye closure results in only moderate penalties in some cases
 - Eyes are not a good predictor
 - Opportunities to improve yield and cost
- Lower power lasers often have lower penalties
 - But less link power margin
- Distortion from high ER often leads to higher penalties
- Fiber and TP2 penalties do not add linearly
 - Dominance by high penalty TP2 over low penalty fiber, or high penalty fiber over low penalty TP2
 - Phasing of pre/post cursors can add/cancel
 - TP2-only penalty measurement not a good predictor
- **Preliminary:** ~5 dB total dispersion penalty may be challenging, may need to increase somewhat

TP2 penalty vs. sampling rate

- simulated -

Samples/UI	fastLaser	slowGauss	slowLaser
• No anti-aliasing filter			
32	2.8893	1.8878	2.9298
16	2.9289	1.8878	2.9307
8	3.8442	1.8878	2.9327
4	2.1734?	1.8878	2.9405
2	2.2097?	1.8881	2.8511?
• With 7.5 GHz Bessel-Thomson filter			
32	0.8660	2.1360	3.1197
16	0.8652	2.1359	3.1183
8	1.0933	2.1361	3.1235
4	2.3674	2.1356	3.1188
2	2.2305?	2.1358	3.2834

- Without filter, very little aliasing less than 16 samples per UI
- With filter, very little aliasing less than 8 samples per UI
- FastLaser is beyond realistic
16 samples per UI is adequate without filter
7-8 samples per UI is adequate with filter



Eye shown w/o any filter

Work in progress

- More waveforms from more companies
 - What is good, what is cost effective?
- Is PRBS9 the right pattern length?
- Quantify observations and conclusions
- Need corroboration



Backup/extra

Simulated – *very fast laser* (used for sampling rate study)

