mysticom

Technology to the Core

CX4 System Performance

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Overview

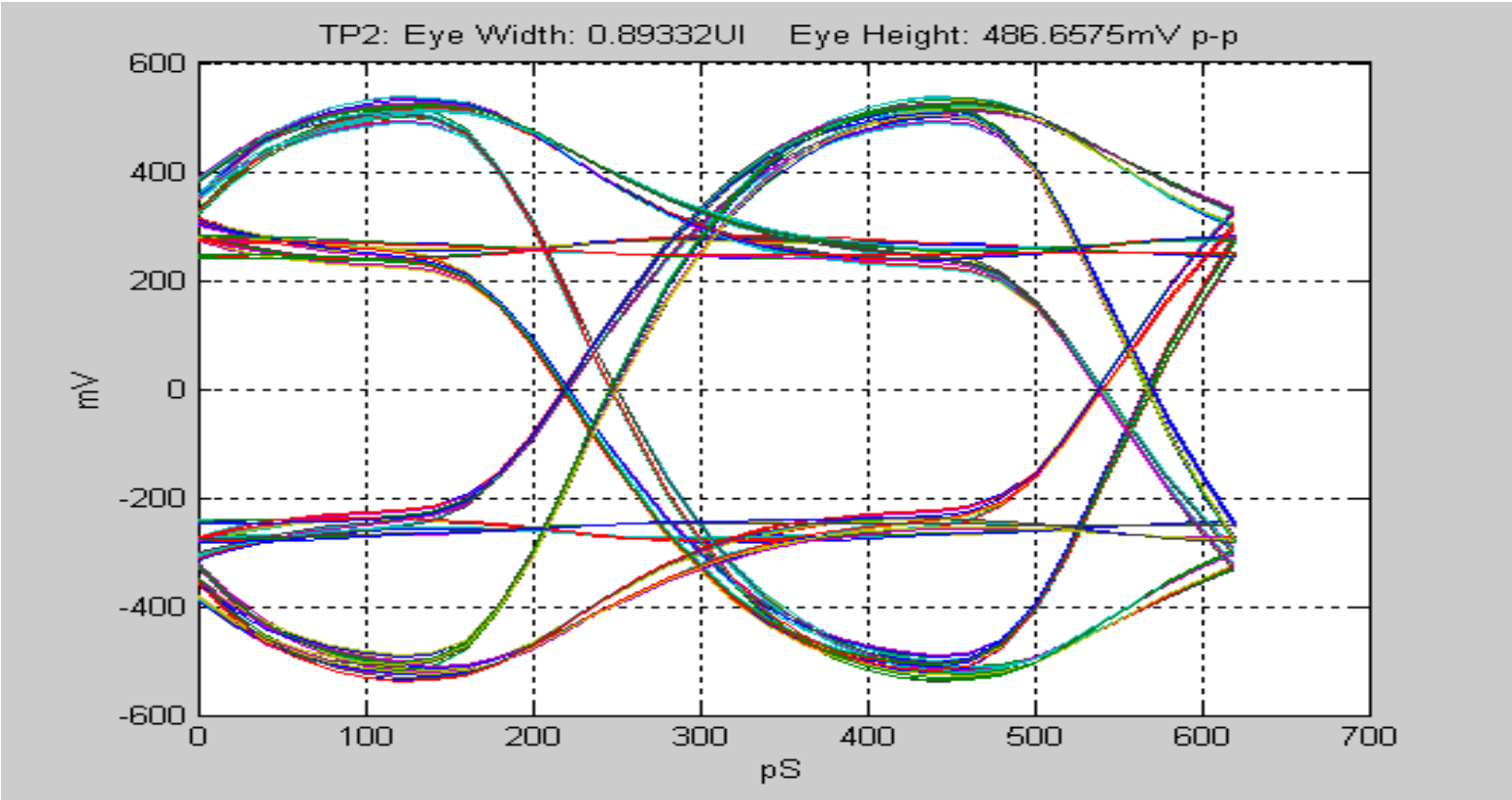
- DJ Budget
- Simulation Sanity Check
- System Results

DJ Budget

- Goal: Analyze DJ budget for CX4
- Method:
  - Use random data that is 8b/10b encoded
  - Turn off/on DJ in Tx
  - Turn off/on Pre-emphasis
  - Measure eye width at TP2
- Result : Limit on Tx DJ
  - It should be less than 0.17UI

Tx DJ is off

Random Data, Tx rise time ~ 130ps, RJ=0



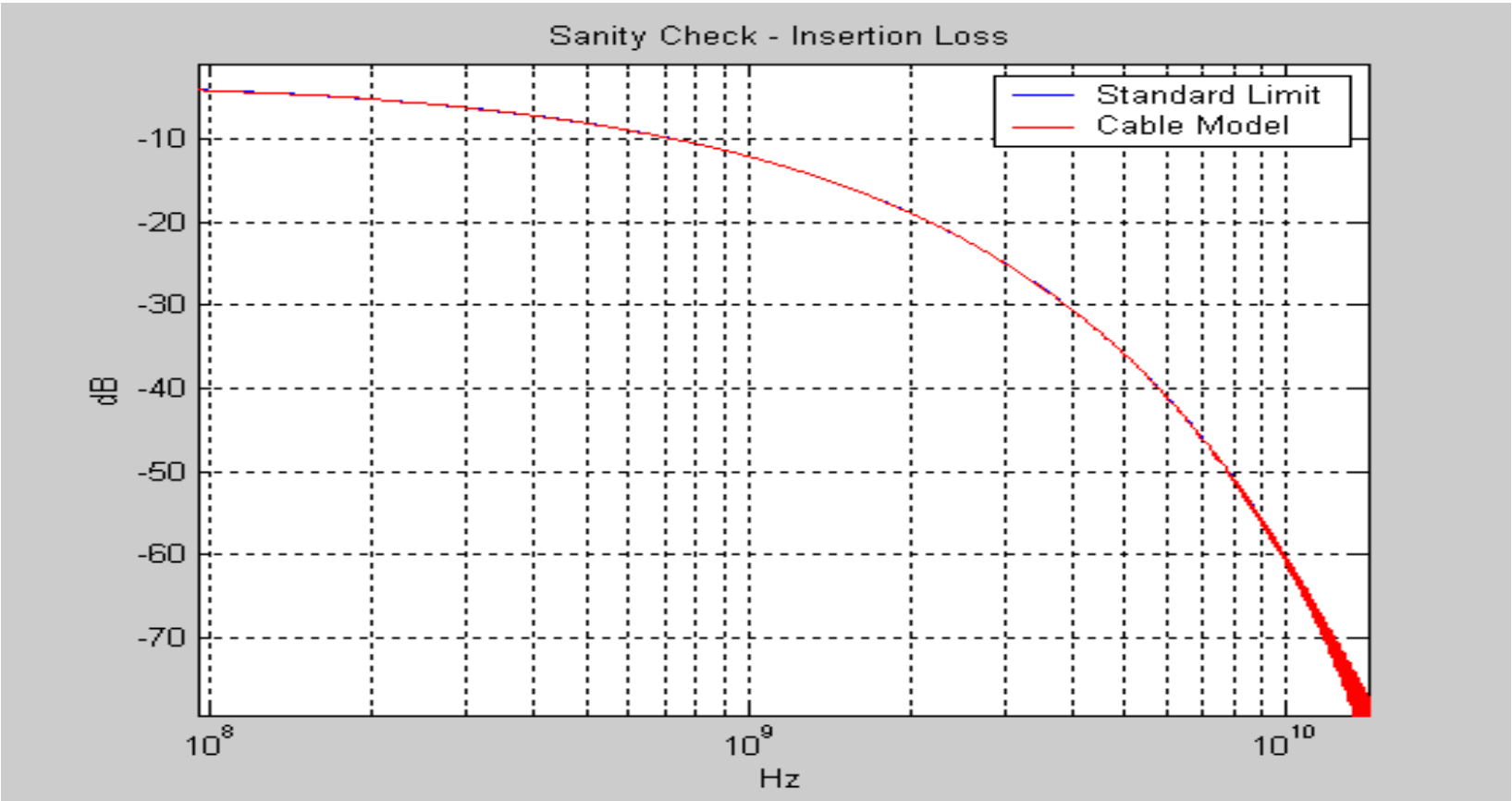
DJ @ TP2=1- 0.893=0.107UI

Measured Jitter at TP2

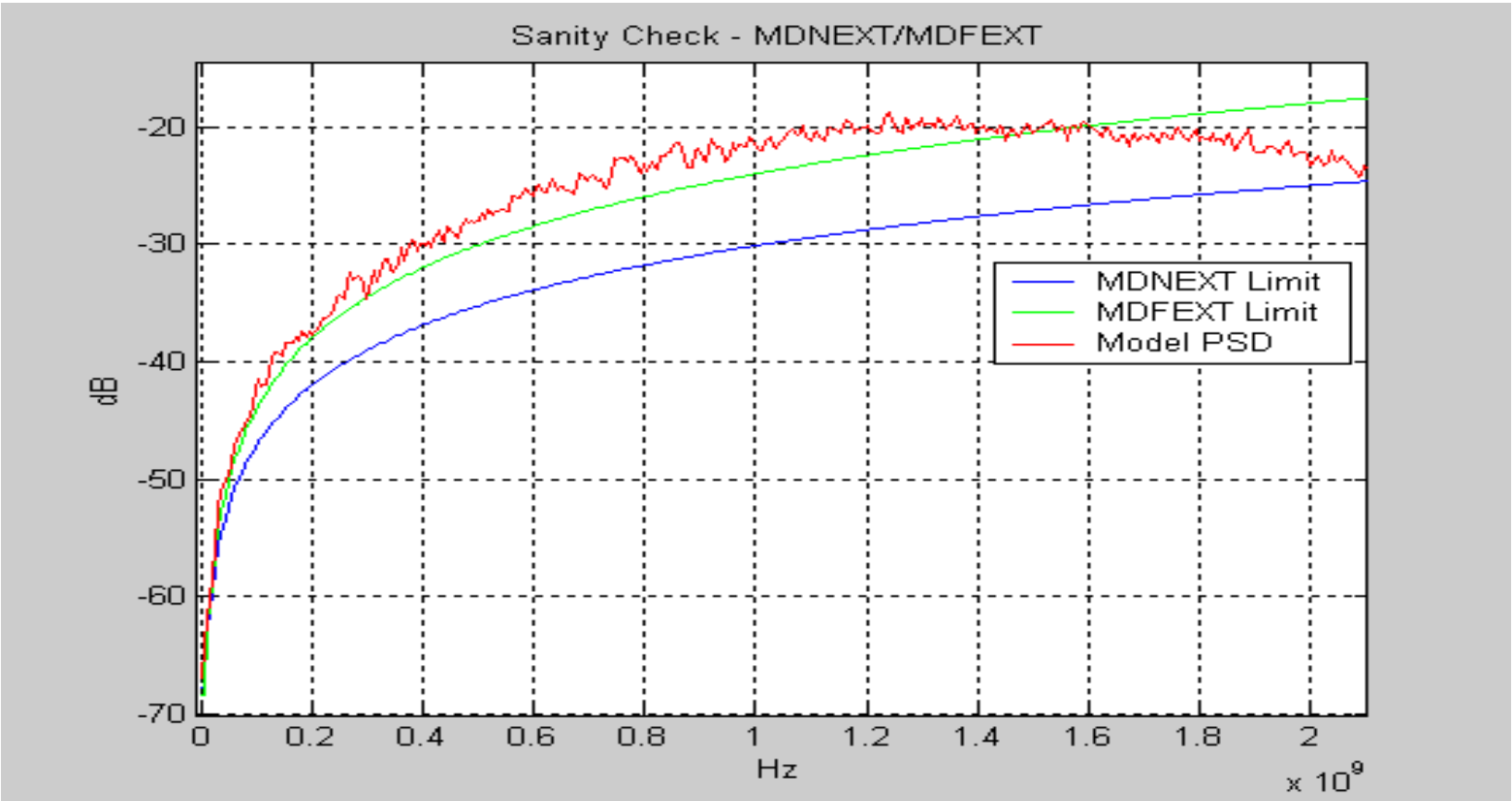
- Random data at transmitter contributes ~ 0.029 UI
- Random data + Pre-emphasis contributes ~ 0.1UI
- Adding 0.08UI to Tx DJ in addition to pre-emphasis and Tx DJ consumes allowed budget

Tx DJ [UI]	Rise Time	Pre Emphasis	Measured Jitter at TP2 [UI]
0	130	off	0.0287
0	130	on	0.1067
0.08	130	off	0.1067
0.08	130	on	0.1656

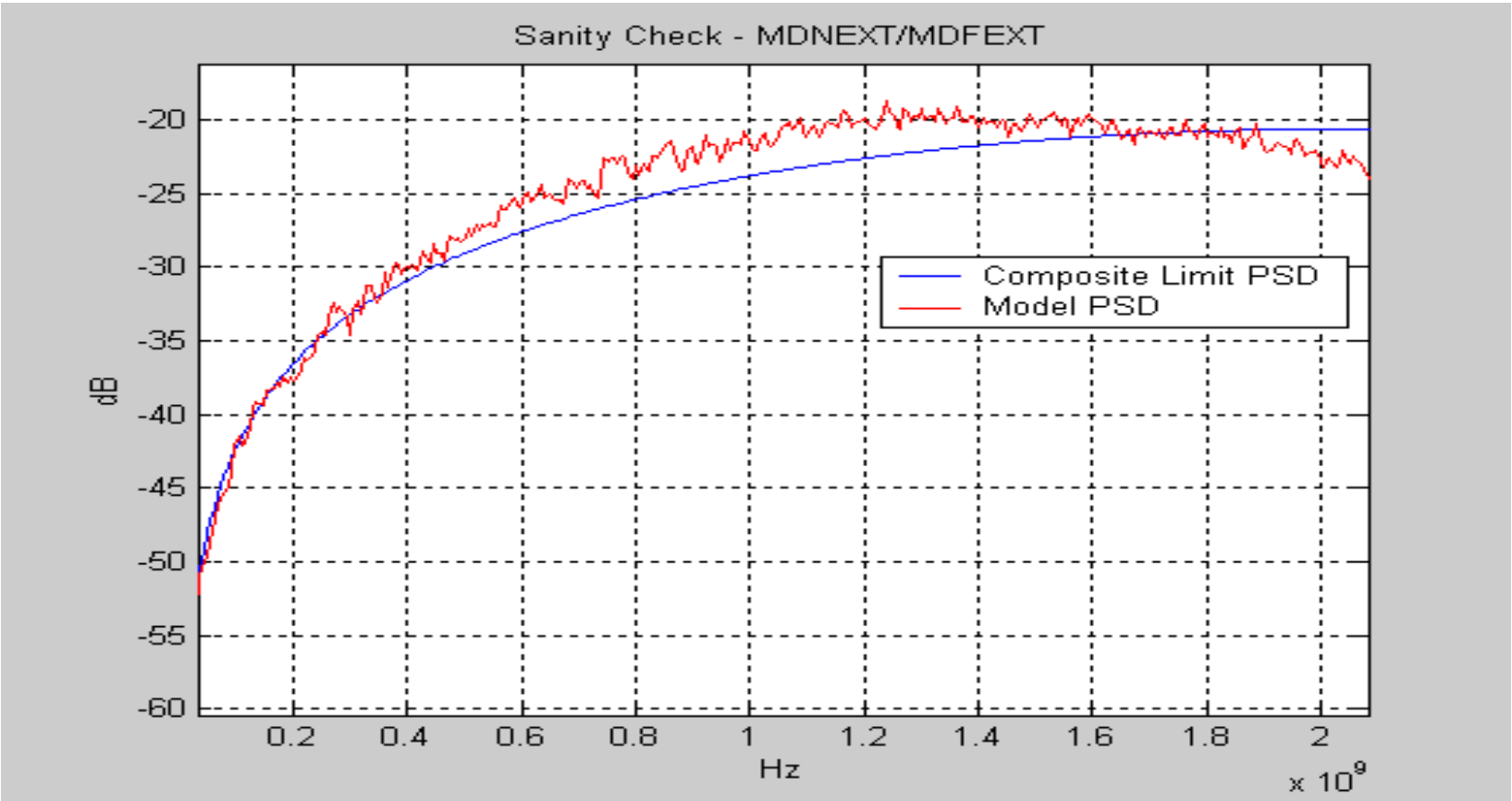
Simulation Sanity Check – Cable Assembly



MDNEXT & MDFEXT



PSD of MDNEXT & MDFEXT Model vs. Limit



System Performance Scenarios

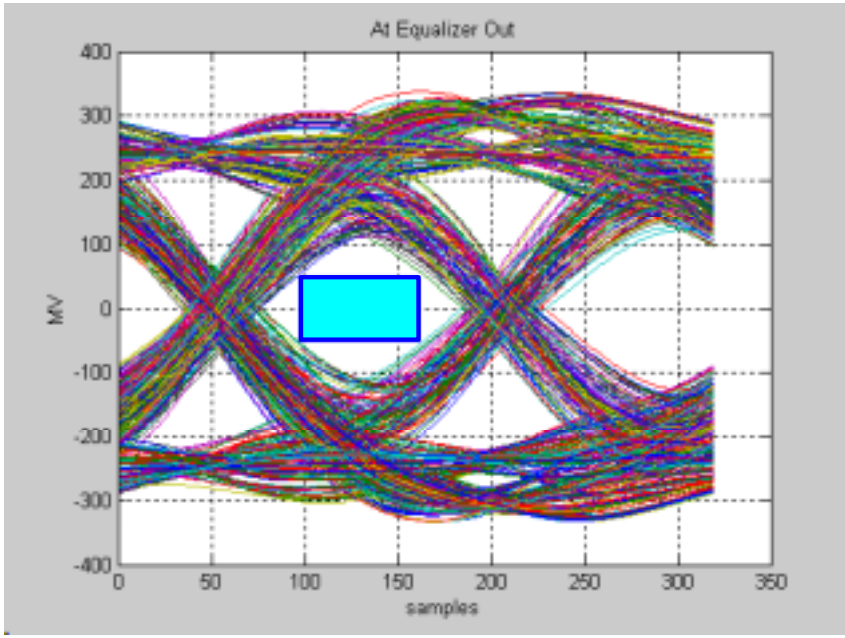
- Input Parameters
  - Tx Peak
    - 800mv, 1000mv, 1200mv
  - Rise Time
    - 65ps, 100ps, 135ps
  - Pre Emphasis
    - 45%, 50%, 55%
- Measure
  - Eye width and height
  - Measurement Points
    - TP2
    - TP4
    - Equalizer Output

System Performance at TP4- Results

Simulation Conditions			TP2		TP4		TP EQ	
TxPeak [MV]	Rise Time [ps]	Pre Emphasis	Measured Jitter [UI]	Eye height [MV]	Measured Jitter [UI]	Eye height [MV]	Measured Jitter [UI]	Eye height [MV]
800	65	45%	0.25	386	0.51	56	0.37	71
		50%	0.25	341	0.44	67	0.40	78
		55%	0.25	299	0.41	77	0.43	80
	100	45%	0.26	394	0.50	44	0.37	62
		50%	0.27	350	0.43	55	0.40	68
		55%	0.28	310	0.38	65	0.43	73
	130	45%	0.28	411	0.53	34	0.38	52
		50%	0.29	369	0.44	45	0.41	59
		55%	0.30	329	0.38	56	0.44	63
1000	65	45%	0.25	491	0.51	71	0.37	90
		50%	0.25	433	0.44	85	0.40	99
		55%	0.25	380	0.41	98	0.43	101
	100	45%	0.26	501	0.50	55	0.37	78
		50%	0.27	445	0.43	70	0.40	86
		55%	0.28	394	0.38	83	0.43	92
	130	45%	0.28	523	0.53	43	0.38	66
		50%	0.29	468	0.44	58	0.41	76
		55%	0.30	418	0.38	71	0.44	79
1200	65	45%	0.25	590	0.51	85	0.37	108
		50%	0.25	522	0.44	102	0.40	119
		55%	0.25	458	0.41	118	0.43	122
	100	45%	0.26	603	0.50	67	0.37	94
		50%	0.27	536	0.43	84	0.40	104
		55%	0.28	474	0.38	100	0.43	111
	130	45%	0.28	629	0.53	51	0.38	80
		50%	0.29	564	0.44	69	0.41	91
		55%	0.30	503	0.38	86	0.44	96

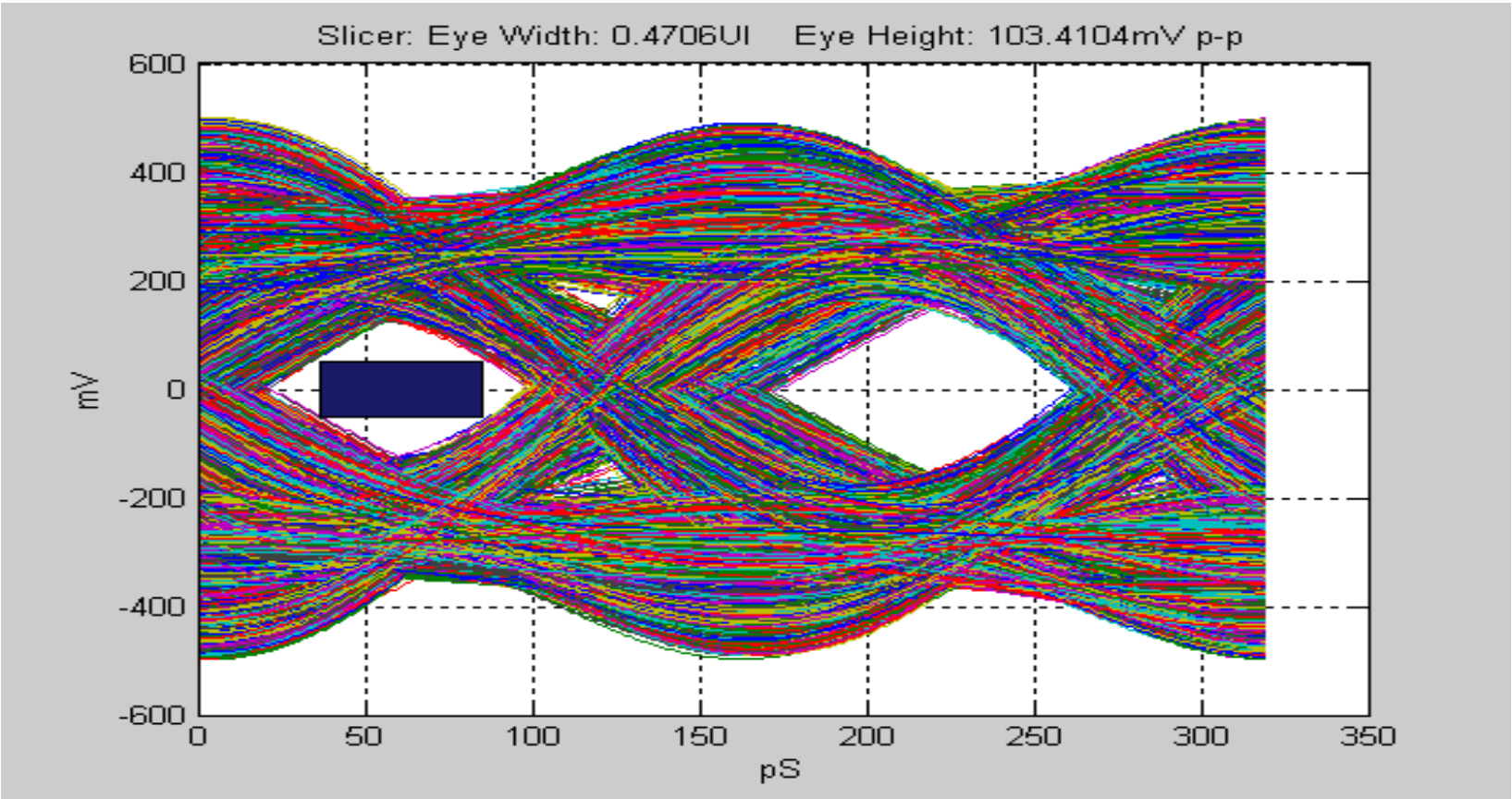
System Performance at TP6

- Include receiver PCB + package and receiver AFE till the slicer input
- Pass/Fail criteria
  - Can we fit in eye a template of +/- 50mv having width of 0.25UI



At Slicer Input- #1

Tx = 800mv, Rise Time =65ps, Pre emphasis = 45%



System Performance at TP6 – Cont'd

- All cases actually pass the 50mv width criteria
- Low Pre-emphasis values yield a marginal eye opening at slicer input

Tx Peak [MV p2p]	Rise Time [ps]	Pre Emphasis	Measured Jitter [UI]	Eye height [MV]	50 mv Width [UI]
800	65	45%	0.53	103	0.30
	65	50%	0.48	113	0.35
	65	55%	0.47	122	0.36
	100	45%	0.53	95	0.29
	100	50%	0.48	105	0.33
	100	55%	0.47	115	0.36
	130	45%	0.54	83	0.26
	130	50%	0.49	97	0.32
	130	55%	0.47	107	0.34
1000	65	45%	0.53	131	0.30
	65	50%	0.48	144	0.35
	65	55%	0.47	155	0.36
	100	45%	0.53	121	0.29
	100	50%	0.48	134	0.33
	100	55%	0.47	146	0.36
	130	45%	0.54	105	0.26
	130	50%	0.49	123	0.32
	130	55%	0.47	136	0.34
1200	65	45%	0.53	158	0.30
	65	50%	0.48	173	0.35
	65	55%	0.47	186	0.36
	100	45%	0.53	145	0.29
	100	50%	0.48	161	0.33
	100	55%	0.47	176	0.36
	130	45%	0.54	127	0.26
	130	50%	0.49	148	0.32
	130	55%	0.47	163	0.34

Summary & Conclusions

- Simulation sanity-check was shown
- System performance at receiver input seems reasonable for most conditions
  - A few “parameter corners”
    - low pre-emphasis & slow rise time
    - low voltage
- System performance of DUT (@TP6)
  - Pass 50mv width criteria
  - 45% pre emphasis yields marginal performance
    - Regardless of launch voltage
  - → check nominal pre-emphasis = 55% (+/- 10%)

Summary & Conclusions

- MDNEXT/MDFEXT limit performance
  - Exemplified in lane 3 which is the most sensitive to NEXT impairment (common knowledge for practitioners)
  - Perhaps connector vendors can improve the IB immunity to cross-talk