



IEEE 802.3ap (or 10GBASE-KR)
Jitter Spec is Inclusive Of
Package Crosstalk and is
Sufficient for IEEE 802.3ba
Systems

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Package Crosstalk is an Important Performance Parameter

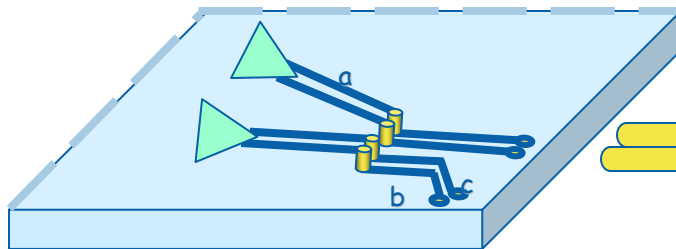
- In mellitz_01_1107 the following was suggested
 - “Adoption of IEEE 802.3ap 10GBASE-KR as a baseline for 40GbE backplane is a natural progression”
 - This presentation is to further support that position
- A proprietary mix of specific crosstalk and other component parameters may be used by designers to increase margin, improve solution space, or improve cost efficiency.
- On the surface it would appear that package crosstalk is a parameter that needs to be specified for IEEE 802.3ba

Package crosstalk is directly included in the KR standard.

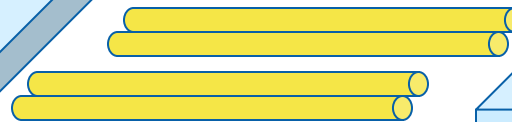
- Hypothesis:
 - Crosstalk induces proportional deterministic jitter that directly affects system BER.
 - The induced jitter is not dependant on the exact nature of package crosstalk.
- An integral of the crosstalk waveform squared is power and is a number that is independent of exact timing and nature of crosstalk.
 - The specifics of package design dictate the timing and nature of crosstalk waveforms.
 - Crosstalk power is a measure where specifics of the package design and crosstalk waveforms are averaged.

Experiment

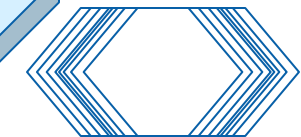
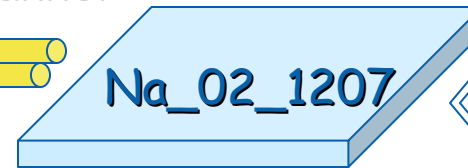
Lossy package
generated w/ HFSS



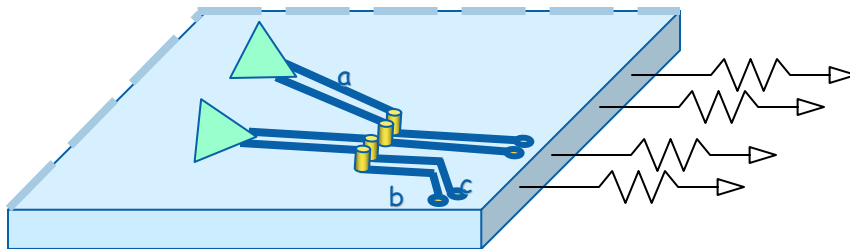
Peters B20 Channel



Na_02_1207



System BER

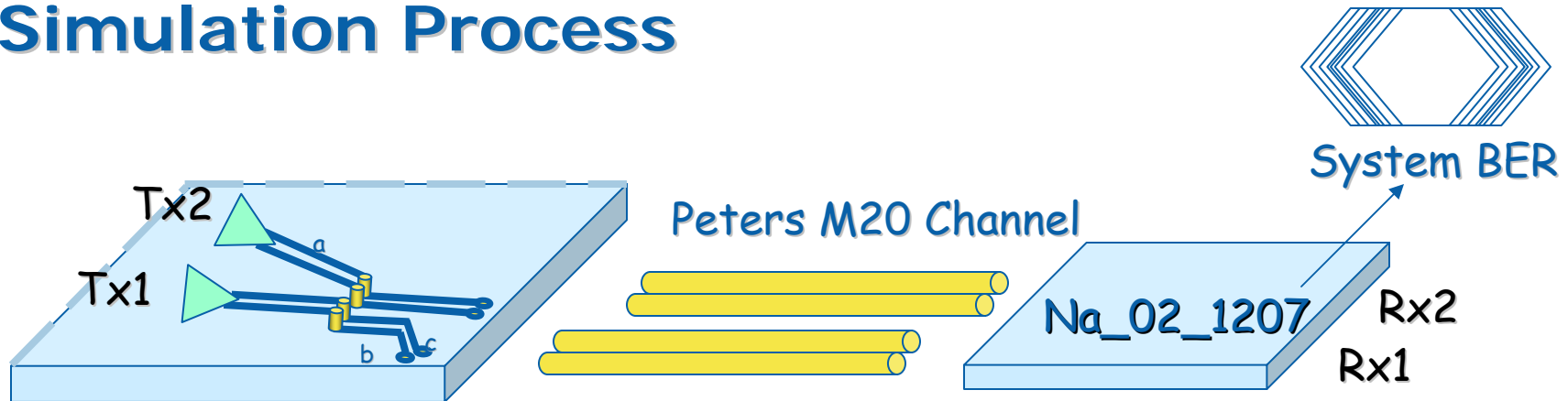


Measures:

1. Change Jitter at Package Pin
2. Crosstalk Power
3. System BER

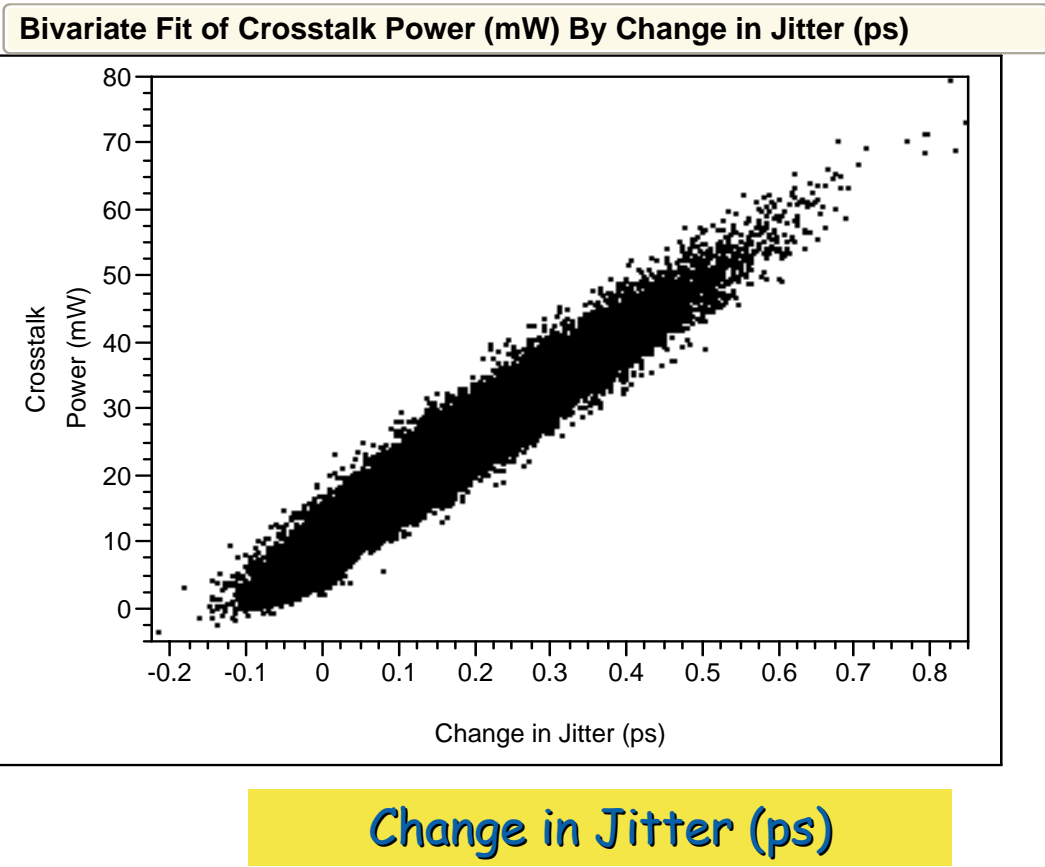
Adjust where, when, and how much crosstalk occurs

Simulation Process



- System BER Generation
 - Tx1 to Rx1 through step response
 - Tx2 to Rx1 crosstalk step response
- Crosstalk power is measured as the integral of the crosstalk step response waveform squared
- Package swept parameters
 - Length: .8" to 1.7"
 - Impedance: 75Ω to 95Ω
 - Coupling length: .1" to 1.2"
 - Coupling distance: 30μm to 70μm
 - Coupling position: .1" to .9"
 - Die pad load: .4 pf
- Configuration
 - Vswing: .8 v to 1.2v
 - Tdj=.115 UI; Trj=.130 UI p-p;
 - Tdcd=.035 UI p-p (Tx)
 - Swept Rise Time: 30ps to 45 ps
 - FFE3, DFE5
 - 10dB Rx peaking amplifier/filter at 3 GHz
 - Data rate: 10.3125 Gb/s
- Utilize Design of Experiments to determine the correlation between
 - Crosstalk Power and Jitter
 - Crosstalk Power and BER

Crosstalk Results – Population Plots for All 1e6 Manufacturing Swept Parameters



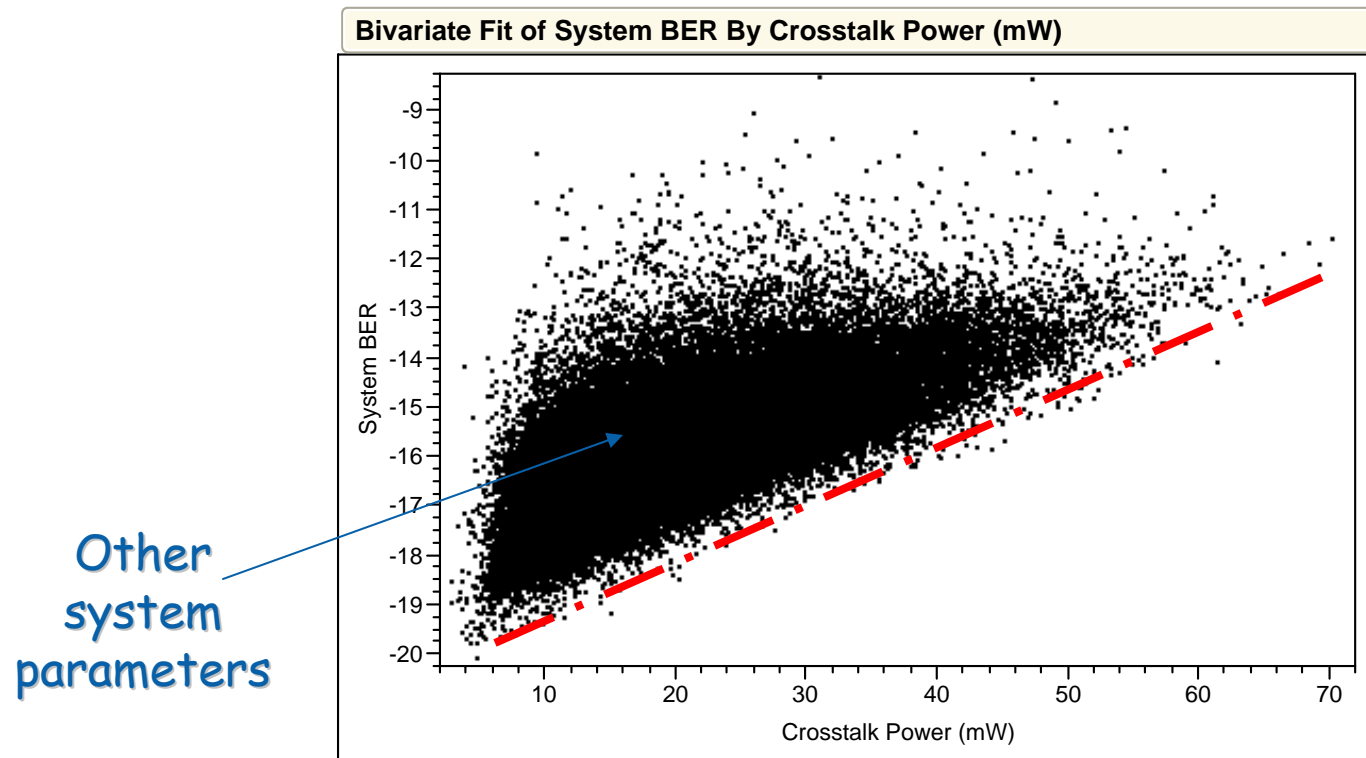
Crosstalk Power

Includes how and where since, it's an integral.

Crosstalk Power and Device Jitter are Highly Correlated (99%)



System BER results – Population Plots for All 1e6 Manufacturing swept parameters



Crosstalk directly raises the BER floor

Summary

The package contribution of crosstalk is directly and sufficiently included in a device jitter specification

- This strengthens the suggestion in mellitz_01_1107 for the adoption of IEEE 802.3ap 10GBASE-KR as a baseline for IEEE 802.3ba is a natural progression

However, designers performing 802.3ba electrical analysis should include package crosstalk

- This will enable chip designers to trade off device jitter for package crosstalk
- This will broaden the industry scope