Consensus Building Group Report
Channel Analysis Method For 802.3bj
Qualification and Specification

Minneapolis, MN
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Authors

- Rich Mellitz, Adee Ran – Intel
- Will Bliss – Broadcom
- Chris DiMinico - MC Communications/LEONI Cables & Systems
- Walter Katz – SiSoft
- Pavel Patel – Tektronix

Presentations submitted to consensus building group. Files to be zipped and posted with May 2012 interim meeting materials.

- Proposal for 100G-KR4 Channel Specification – Will Bliss – Broadcom
100GKR4channelSpecification1b.pdf

- Pulse Response Comparison - Walter Katz – SiSoft
Katz_April_4_2012.pdf

- Statistical Simulation Comparison Between Exact PDF & Quick PDF
 & Gaussian rms Generated PDF - Richard Mellitz – Intel
SimulationComparisonBetweenExactPDF&QuickPDF&GaussianPDF.pdf

- S-parameters extrapolation to DC: Performance of extrapolation – Pavel Zivny – Tektronics
Zivny_04_2012Sparams_extrapolation_behavior.pdf

Supporters

- Liav Ben-Artsi – Marvell
- Vasu Pathasarathy – Broadcom
- Rick Rabinovich - Alcatel-Lucent
- Mike Dudek - QLogic

Scope

- Channel analysis implemented in Matlab for users of 802.3bj. Copyright release and download location to be included in 802.3bj; see example >> 40.6.1.2.4 Transmitter distortion..

- Initial: Matlab code example implementation to quantify channel residual inter-symbol interference (slide 4).

- Follow-on:
  - Reference architecture(s) to specify/qualify channels
  - Fast optimization method with sufficient accuracy
  - Fast analytic method to gauge performance on the optimized reference architecture
    - reference architecture to enable
      - ✓ consideration for analytic method options
      - ✓ qualification of channels

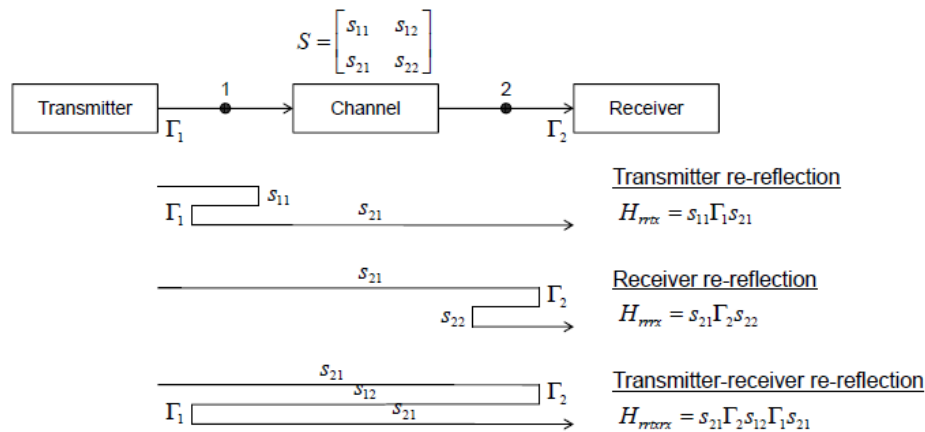# Matlab Code

- Initial: Matlab code including but not limited to;
  - post process channel VNA measurements (S4P) for conversion to time domain (pulse response)
  - Interpolation of s-parameters
  - DC extrapolation
  - Pre-filter
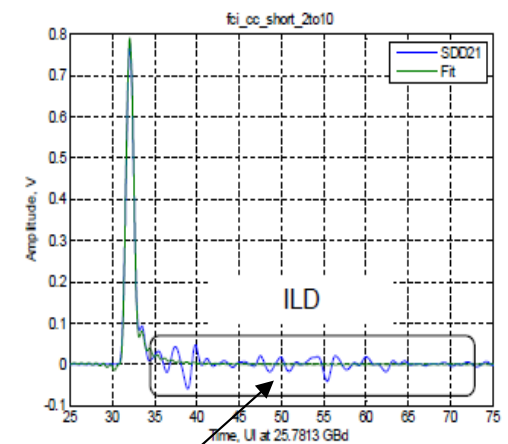 - Reference time and sample rate
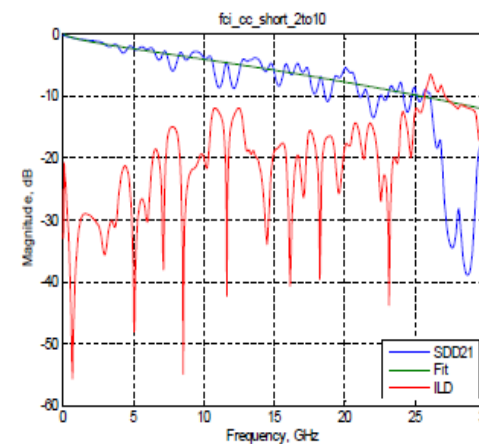 - 32 samples per UI

Residual inter-symbol interference*

Re-reflection interference (noise)

- Transmitter, receiver, and channel return loss influence the transfer function of the assembled link

$$S = \begin{bmatrix} s_{11} & s_{12} \\ s_{21} & s_{22} \end{bmatrix}$$

Transmitter — 1 — Channel — 2 — Receiver

Γ_1 Γ_2

Transmitter re-reflection
$H_{rrx} = s_{11}\Gamma_1 s_{21}$

Receiver re-reflection
$H_{rrx} = s_{21}\Gamma_2 s_{22}$

Transmitter-receiver re-reflection
$H_{rtxrx} = s_{21}\Gamma_2 s_{12}\Gamma_1 s_{21}$

ILD noise example

• **Residual inter-symbol interference**

802.3bj Cu specifications
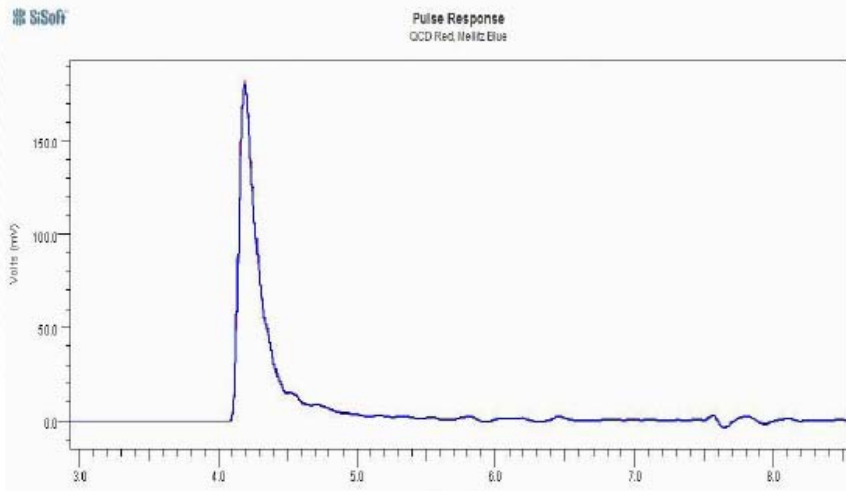
Initial Findings

Channels

- Channels
  - Thru_S06-P20-10-AB_S14-P23-04-CD_NNN.s4p
  - FEXT_S14-P23-03-AB_S06-P20-10-CD_NNN.s4p
- 38ps UI
- No Package
- 1V Peak to Peak Input Voltage
- Tx
  - 50 Ohm Single Ended Impedance, no C_Comp (Cdie)
- Rx
  - 50 Ohm Differential Impedance, no C_Comp (Cdie)
- 32 Samples per UI
- Comparing to Mellitz Pulse Response (March 29, 2012)
- Colors
  - Red QCD
  - Blue Mellitz

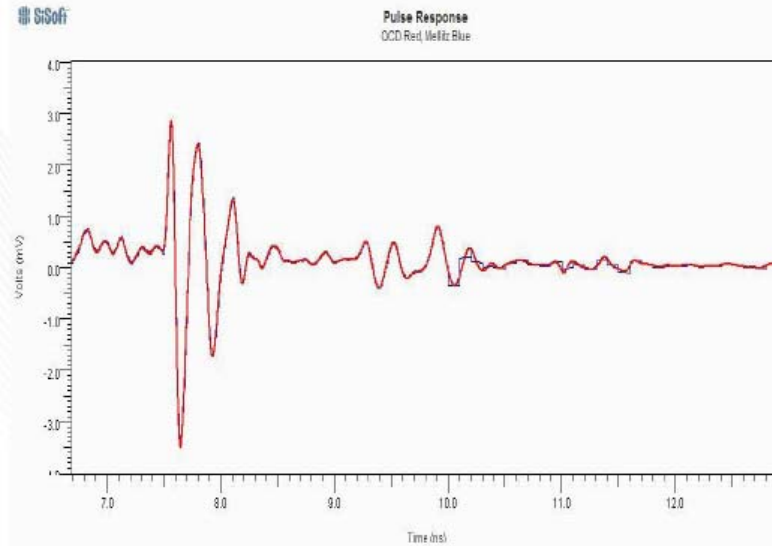**Pulse Response Comparison - Walter Katz – SiSoft Katz_April_4_2012.pdf**

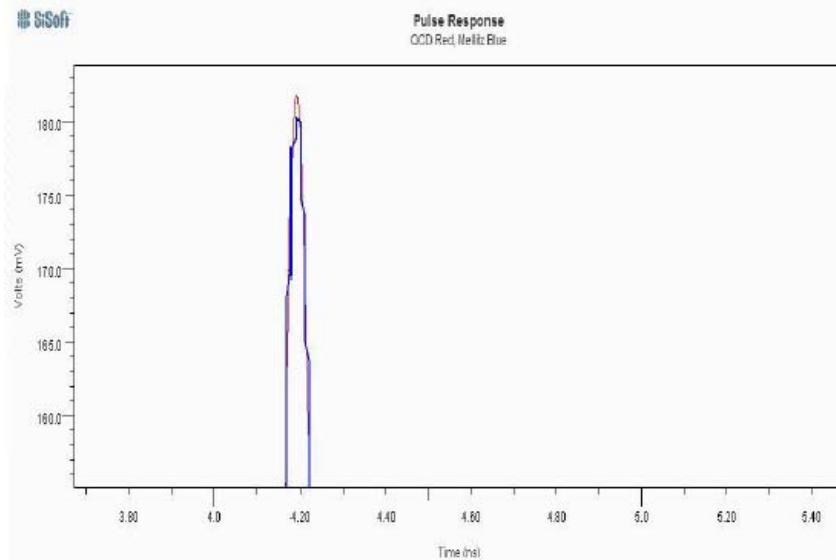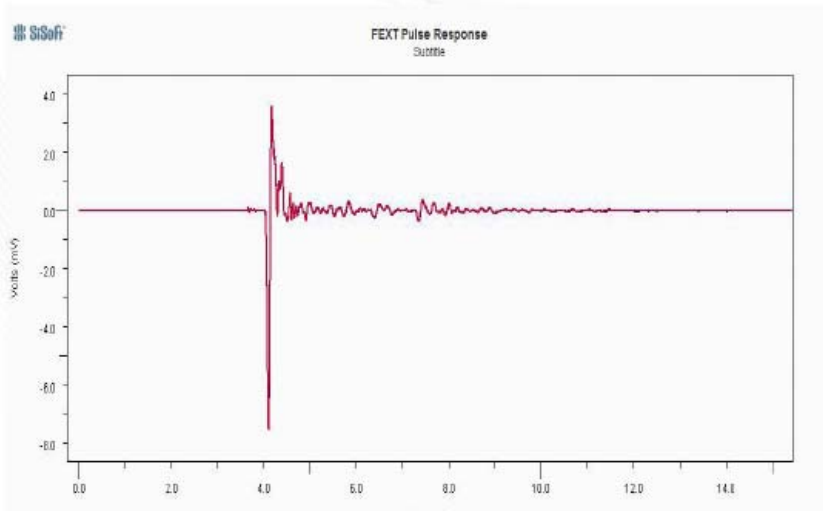**802.3bj Cu specifications**

Initial Findings

**Pulse Response Comparison - Walter Katz – SiSoft
katz_April_4_2012.pdf**

Initial Findings
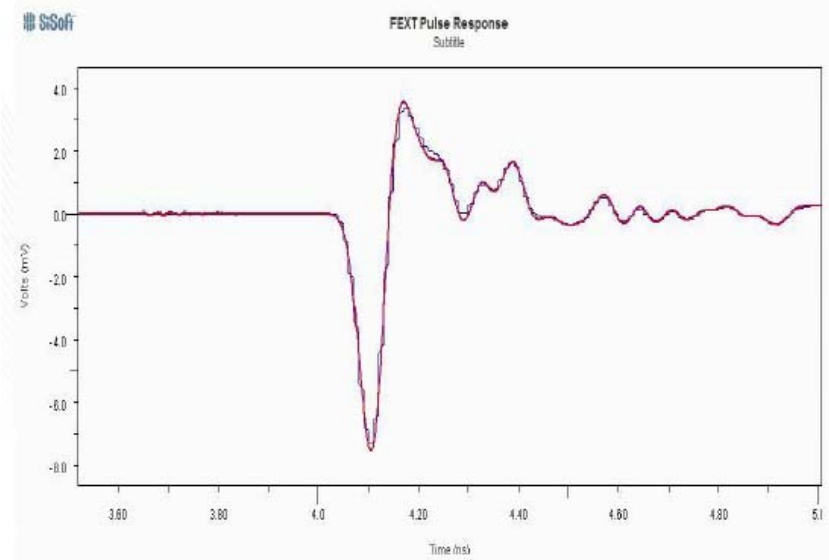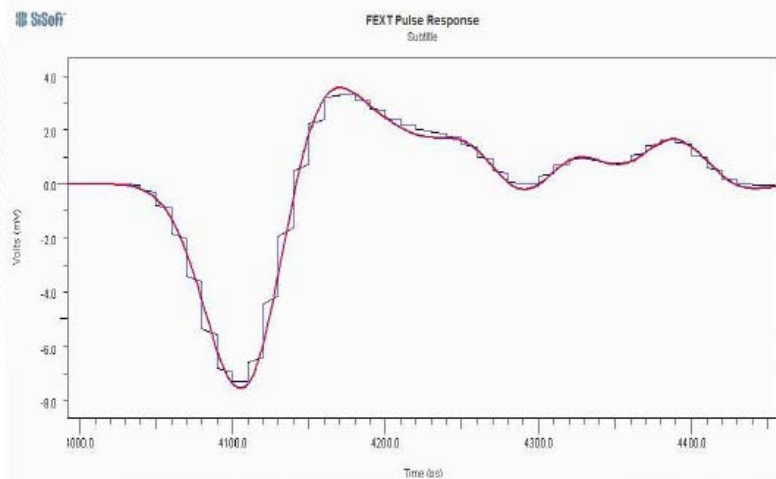

**Pulse Response Comparison - Walter Katz – SiSoft
katz_April_4_2012.pdf**

802.3bj Cu specifications

Follow-on:

Consensus building group to continue with follow-on;

1. Reference architecture(s) (e.g., receiver) to specify/qualify channels
   ++consideration for method options
   ++qualification of channels

2. Fast method of optimization reference arch parameters with sufficient accuracy; ~one minute.

3. Sufficiently accurate metric for channel evaluations.

4. Meet weekly to complete…

5. Initial: Matlab code example implementation and specification linkage to quantify channel residual inter-symbol interference (consideration in July).

Conclusions

- Pulse Response Comparison
  - General agreement <~ 0.1 mV
  - ~1.0 mV difference at main cursor

- Consensus building to continue with follow-on;
  - Reference architecture(s) to specify/qualify channels
  - Fast optimization method with sufficient accuracy
  - Fast analytic method to gauge performance on the optimized reference architecture
    - reference architecture to enable
      - ✓ consideration for analytic method options
      - ✓ qualification of channels