



SerDes Modeling: Demonstrating IBIS-AMI Model Interoperability

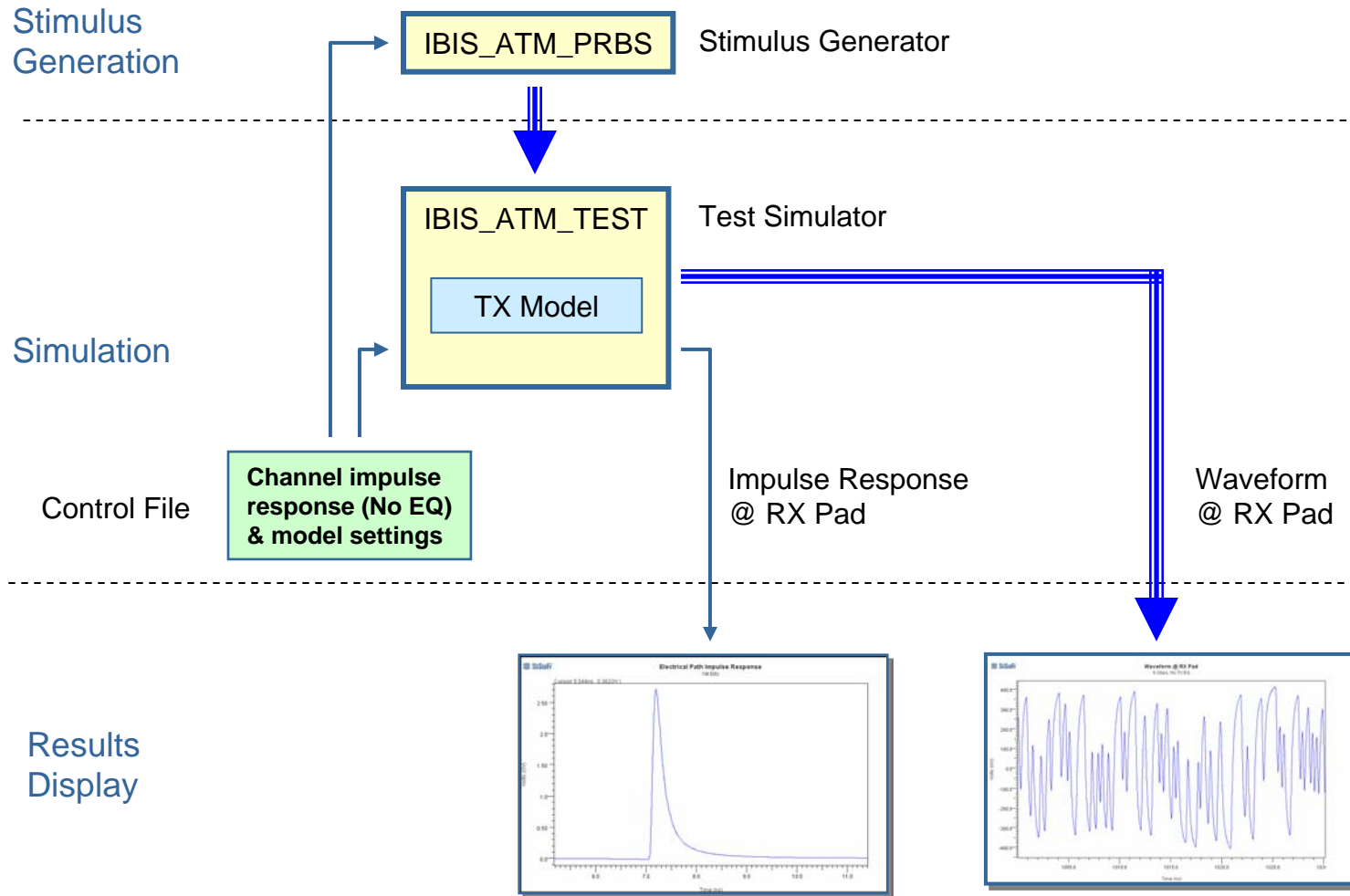
Todd Westerhoff, SiSoft
twesterh@sisoft.com

IBIS Summit @ DesignCon 2008
Santa Clara, CA
February 7, 2008

Agenda

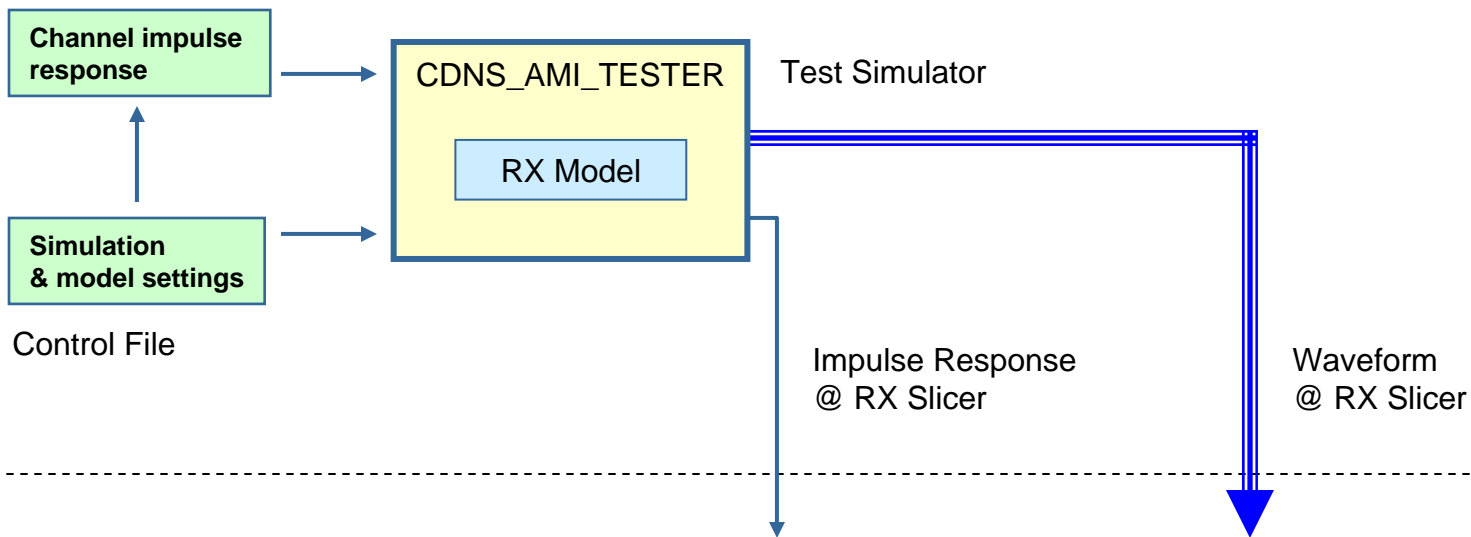
- IBIS-AMI public toolkits
 - SiSoft toolkit components and flow
 - Cadence toolkit components and flow
- IBIS-AMI model parameters
- Combined model simulation flow
 - Control file and batch job
- Combined simulation results / metrics
- Closing Thoughts

SiSoft Toolkit

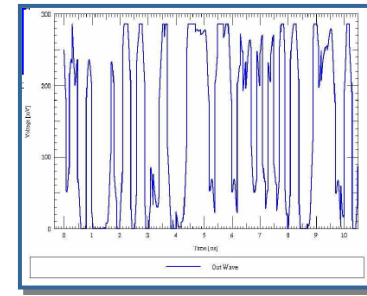
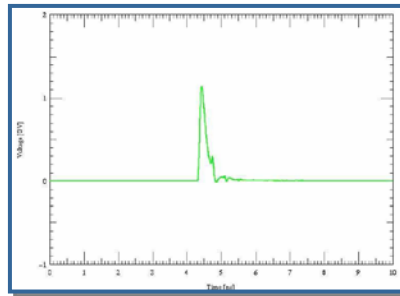


Cadence Toolkit

Stimulus &
Simulation



Results
Display



IBIS-AMI Models

SiSoft TX Model

- Impulse processing
- Waveform processing

Parameters

tap_filter

-1, <float>

0, <float>

1, <float>

2, <float>

tx_swing

Cadence RX Model

- No impulse processing
- Waveform processing

Parameters

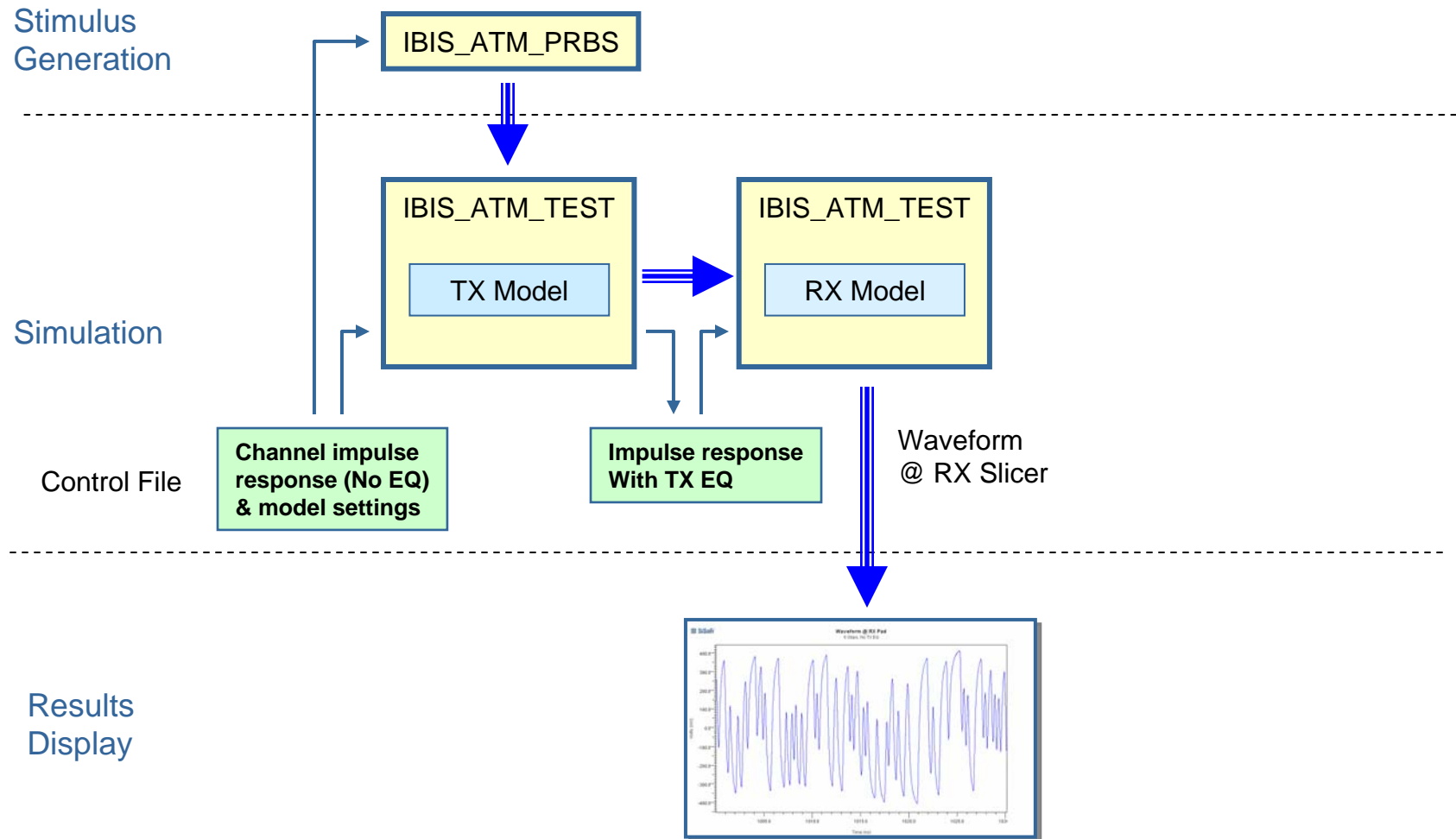
fwd

<float>, <float>, <float>, <float>

bwd

<float>, <float>, <float>, <float>

Combined Model Simulation Flow



SiSoft Control File

* 5 Gb/s 8 samples/symbol 128 symbols

* row_size 1024

* aggressors 0

* register_length 22

* sample_interval 2.50E-11

* bit_time 2.00E-10

* stop_time 4.00E-06

25 ps samples
200 ps bit time
(5 Gbps, 8 samples/bit)

* AMI_parameters_in Start

* IBIS_AMI_Tx

* tap_filter

* -1 0

* 0 1

* 1 0

* 2 0

* tx_swing 1

TX equalization = OFF

* amictfparams

* fwd 0.8 -0.15 -0.035 -0.015

* bwd 0 0 0 0

RX fwd equalization = ON
RX bwd equalization = OFF

* AMI_parameters_in End

Time impulse(primary)

0 -275476.4714

2.50E-11 -286948.1753

5.00E-11 -285370.2043

7.50E-11 -296956.7425

1.00E-10 -295330.735

Channel impulse response

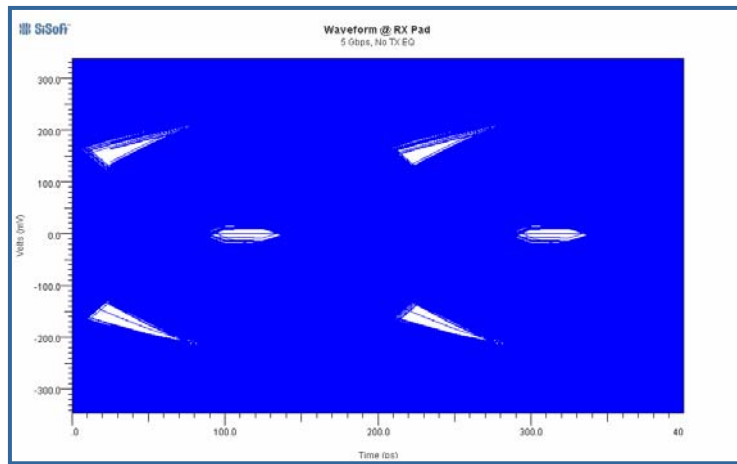
Batch Job

```
IBIS_AMI_test -f IBIS_AMI_Tx.dll -i sys_config.csv -c  
rename sys_config_out.csv impulse_rx_pad.csv  
IBIS_AMI_prbs -f sys_config.csv >waveform_stimulus.csv  
type waveform_stimulus.csv | IBIS_AMI_test -f IBIS_AMI_Tx.dll  
-i sys_config.csv -g -c >waveform_rx_pad.csv  
type waveform_rx_pad.csv | IBIS_AMI_test -f IBIS_AMI_RX.dll  
-i impulse_rx_pad.csv -g -c > waveform_rx_eq.csv  
rename impulse_rx_pad_out.csv impulse_rx_eq.csv
```

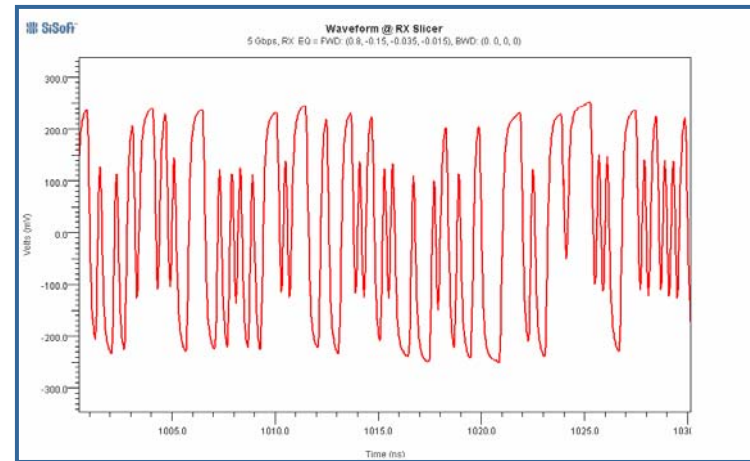
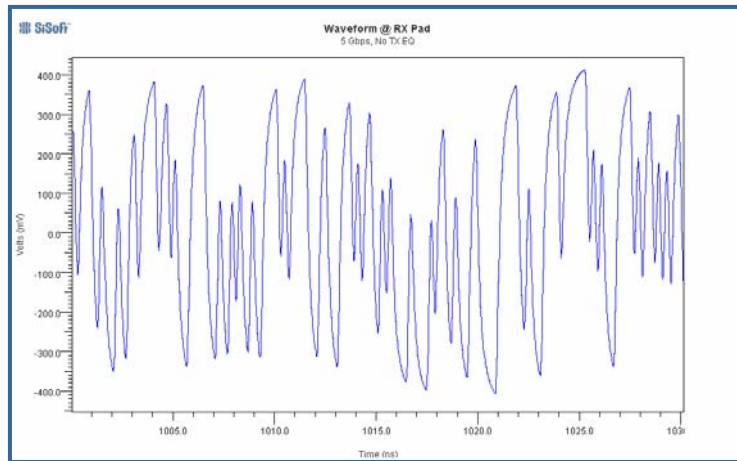
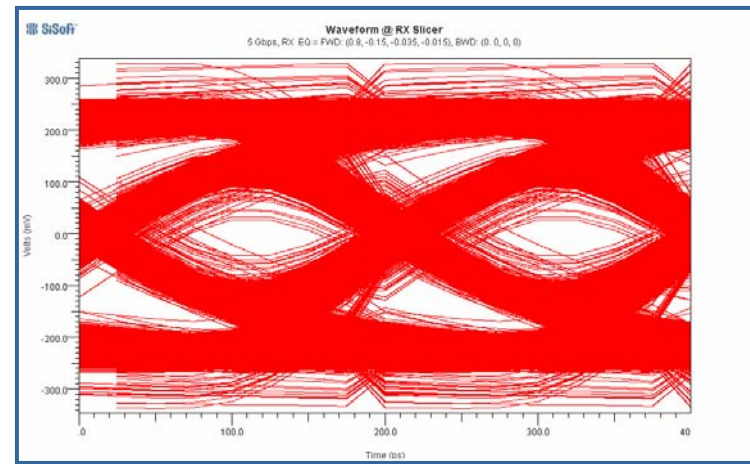
1. Impulse response @ RX pad
2. Generate input stimulus
3. TX analysis, waveform @ RX pad
4. RX analysis, waveforms @ RX slicer

Combined Simulation Results

Signal @ RX pad



Signal @ RX Slicer



Simulation Metrics

	Run time	Output file size
Impulse @ RX pad	<1 sec	24 KB
Stimulus generation	15 sec	83 MB
Waveform @ RX pad	27 sec	117 MB
Waveform @ RX slicer	28 sec	112 MB

Run on Dell Latitude D820 Laptop

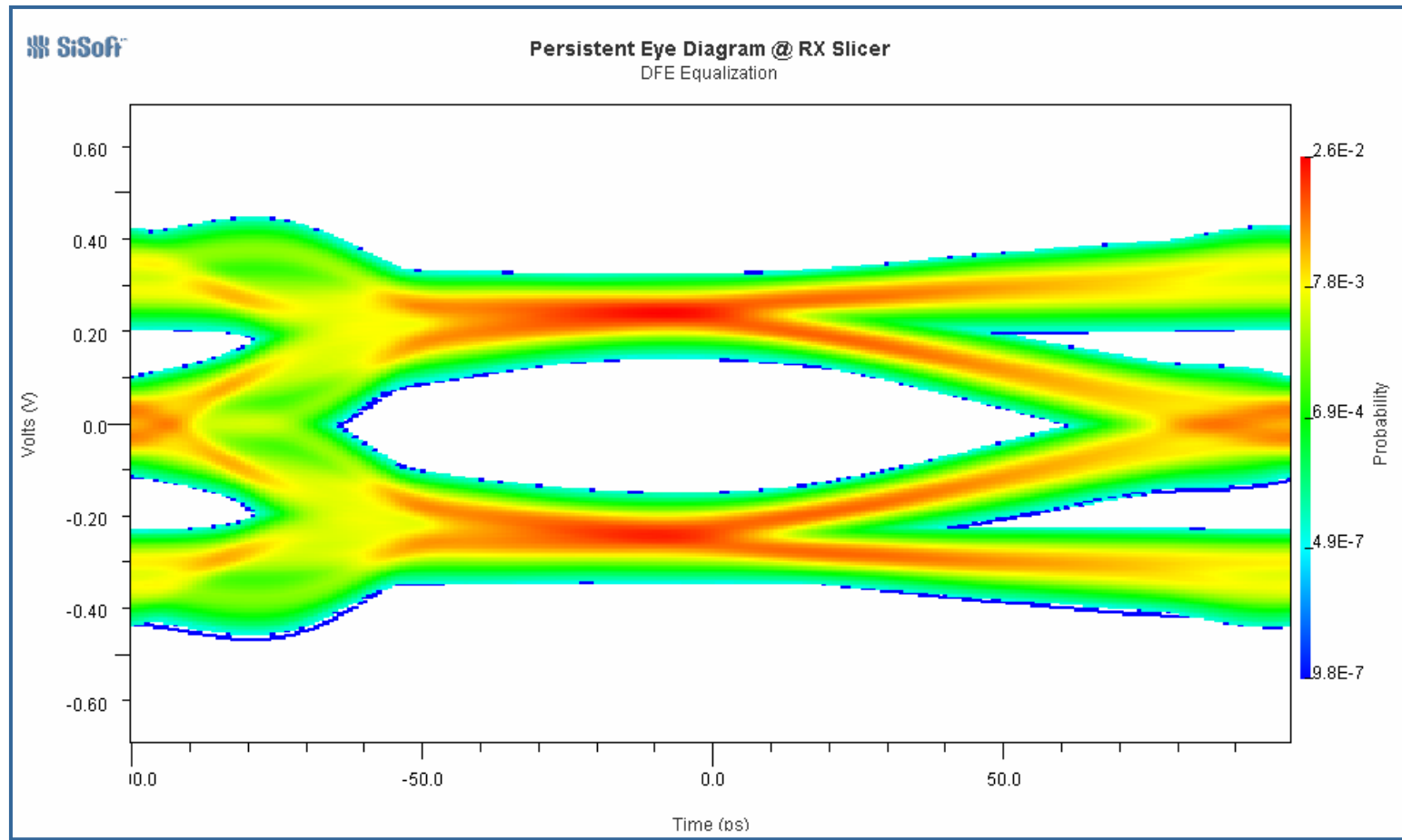
Closing Thoughts

- Performance as presented was limited by output formats & file I/O
- Output files grow quickly; practical simulations may only save sections of waveform data
- AMS vs. AMI
 - AMS specifies the model language but not the simulator/model interface
 - AMI specifies the simulation/model interface but not the model language
 - There's no reason the two can't co-exist!

Late-breaking IBIS-AMI Data

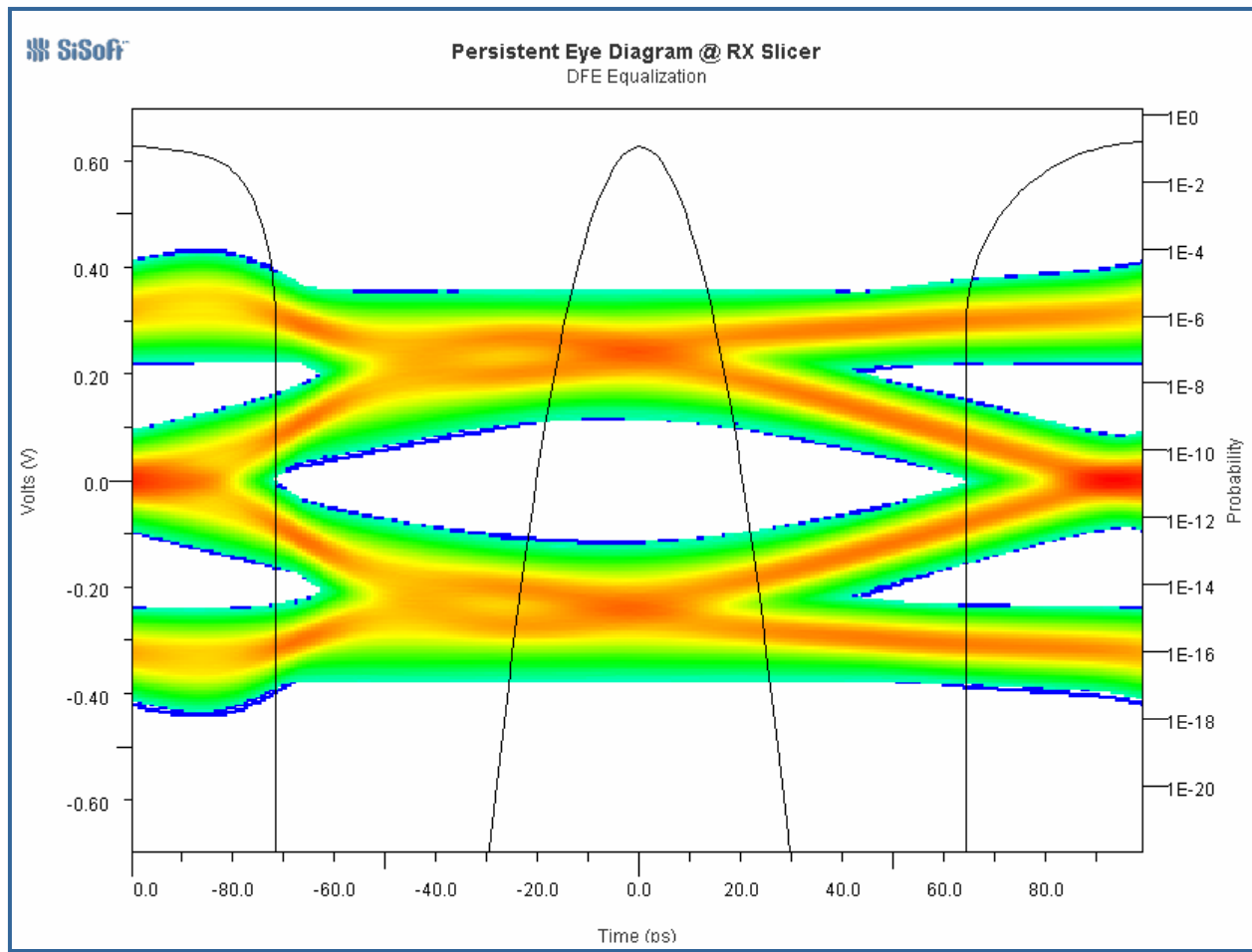
- IBIS-AMI separates channel characterization from channel analysis
 - Channel characteristics are assumed to be LTI
 - TX/RX behaviors can be non-linear and time-varying
- Examples of IBIS-AMI non-LTI behavior supported by IBIS-AMI models
 - RX DFE Equalization
 - Self-optimizing RX behavior
- The following examples are based on RX models not included in the public toolkits
 - Presented to show what is possible with IBIS-AMI models

DFE – Persistent Eye @ RX Slicer



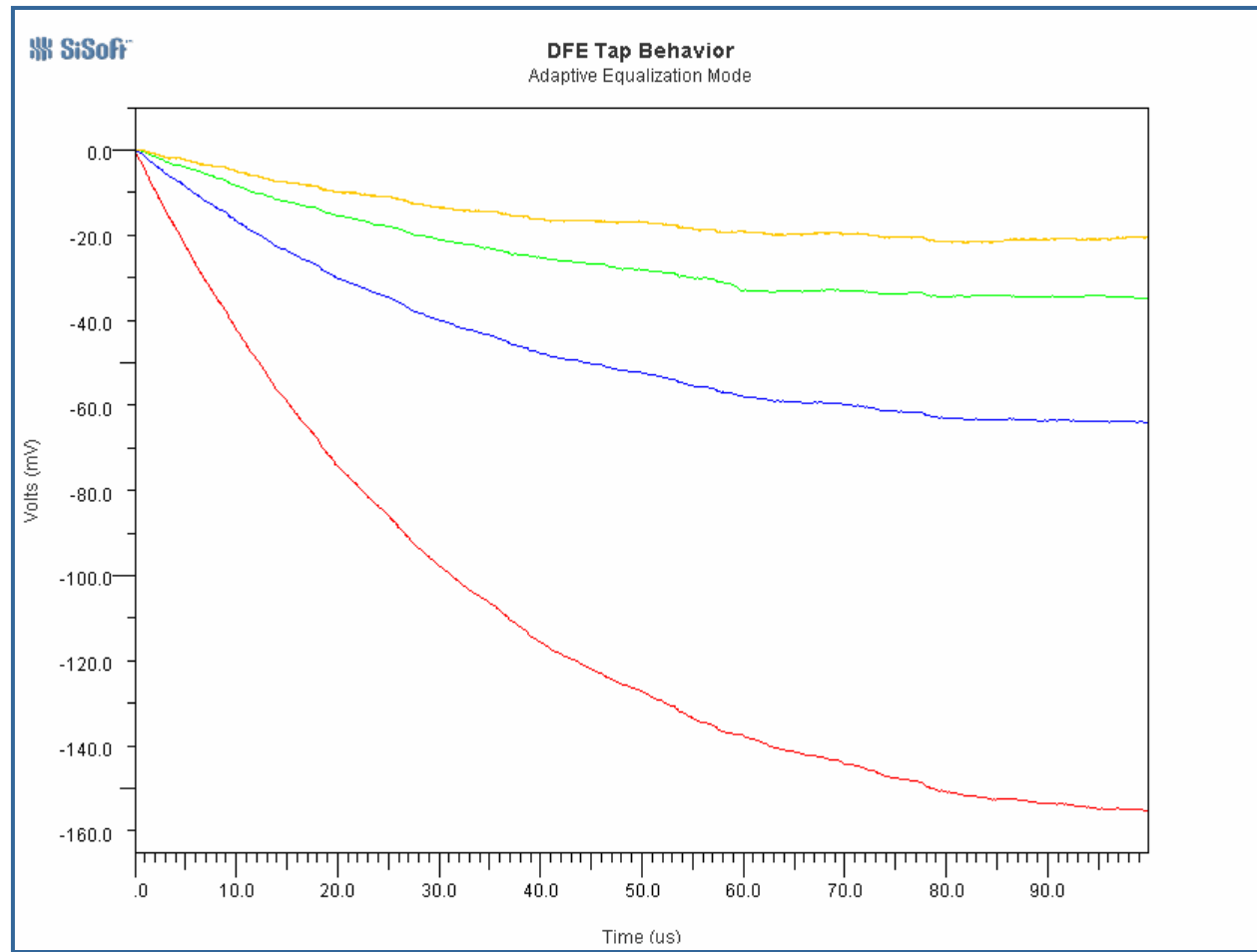
500,000 bit simulation, run time = 60 sec

DFE – Persistent Eye Analysis



500,000 bit simulation, run time = 60 sec

Time-Varying Behavior



Thanks!