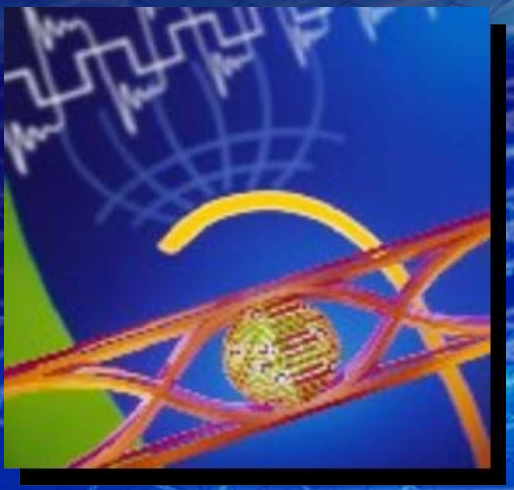
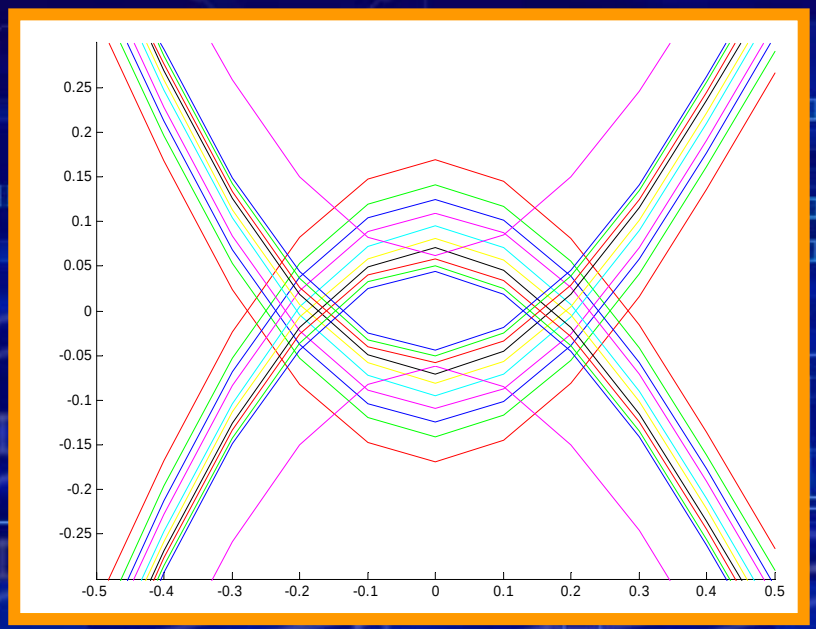
IBIS-AMI Support via VHDL-AMS

Asian IBIS Summit, Shanghai China , November 11, 2008





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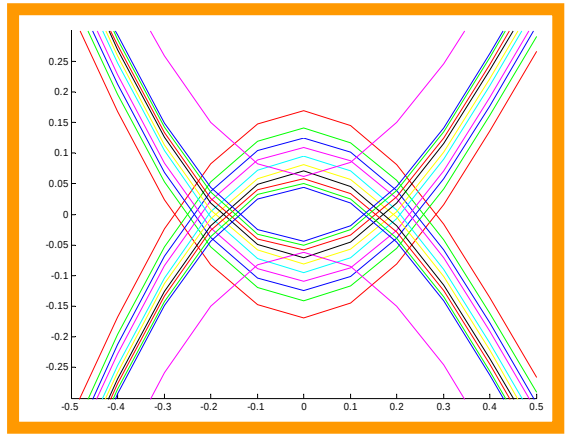

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1. **Attributes in VHDL-AMS**
2. **An IBIS-AMI example using the FOREIGN attribute**
3. **Conclusions – future work**

Attributes in VHDL-AMS

- There are two types of attributes: pre-defined and user defined
  - Pre-defined attribute examples:
    - T'left, T'right, T'low, T'high, etc...
    - A'left(n), A'right(n), A'low(n), A'high(n), etc…
    - S'delayed(t), S'stable(t), S'quiet(t), etc…
    - Q'tolerance, Q'dot, Q'integ, Q'above,
      Q'ltf(num, den), Q'ztf(num, den, t, delay), etc…
  - User defined attributes can be given to a wide variety of entity_classes, such as:
    - procedures, functions, packages,
    - architectures, natures, quantities, terminals,
    - constants, variables, signals, etc… (long list)
- One EDA vendor's VHDL-AMS implementation has a built-in user-defined attribute called "FOREIGN" acting as a C-code interface (which in turn can call practically any compiled code)
  - other EDA vendors may have different mechanisms to achieve the same results

Calling IBIS-AMI through VHDL-AMS

- **The VHDL-AMS model calls a C-code wrapper using the FOREIGN attribute**
  - **the C function argument types are mapped to VHDL-AMS types**
  - **obviously there are some limitations, but the wrapper function can take care of most of the type conversions if necessary**
  - **the wrapper function calls the Init, GetWave, and Close functions according to the IBIS specification**
  - **additional features and capabilities (bells and whistles) may be added to the wrapper function**
- **As a result, IBIS-AMI models can be executed directly from any VHDL-AMS simulator**
  - ***all of this is "user code", no product changes are required***

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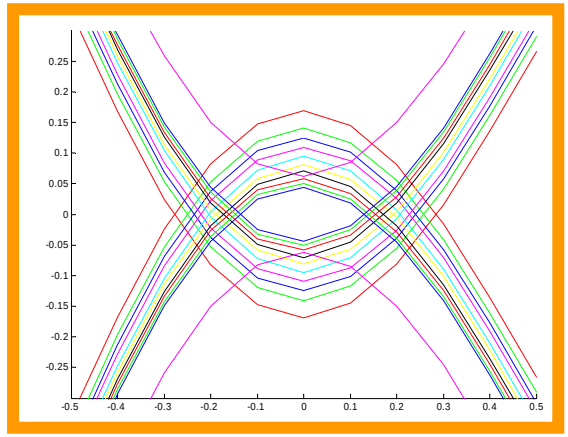

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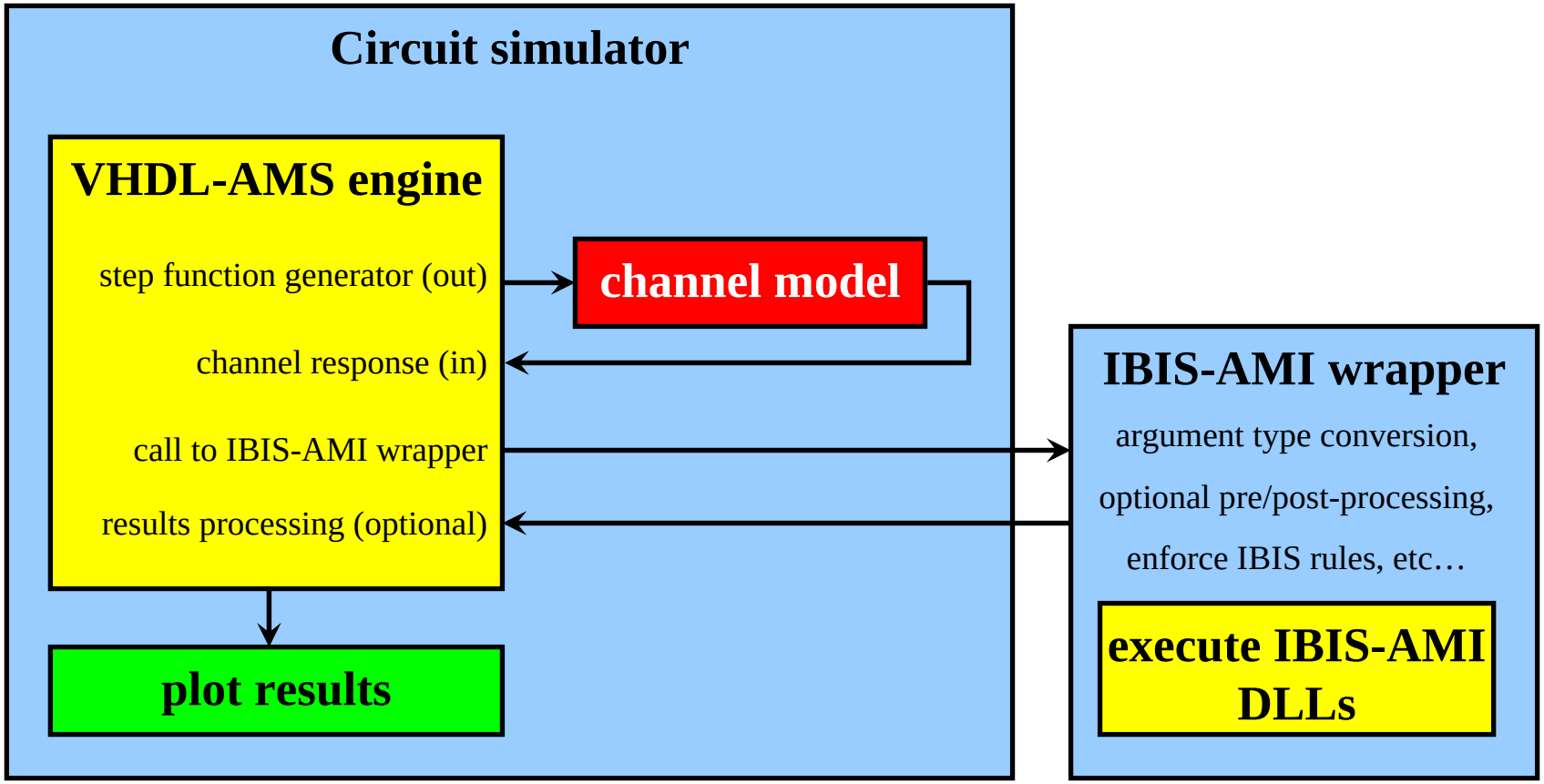
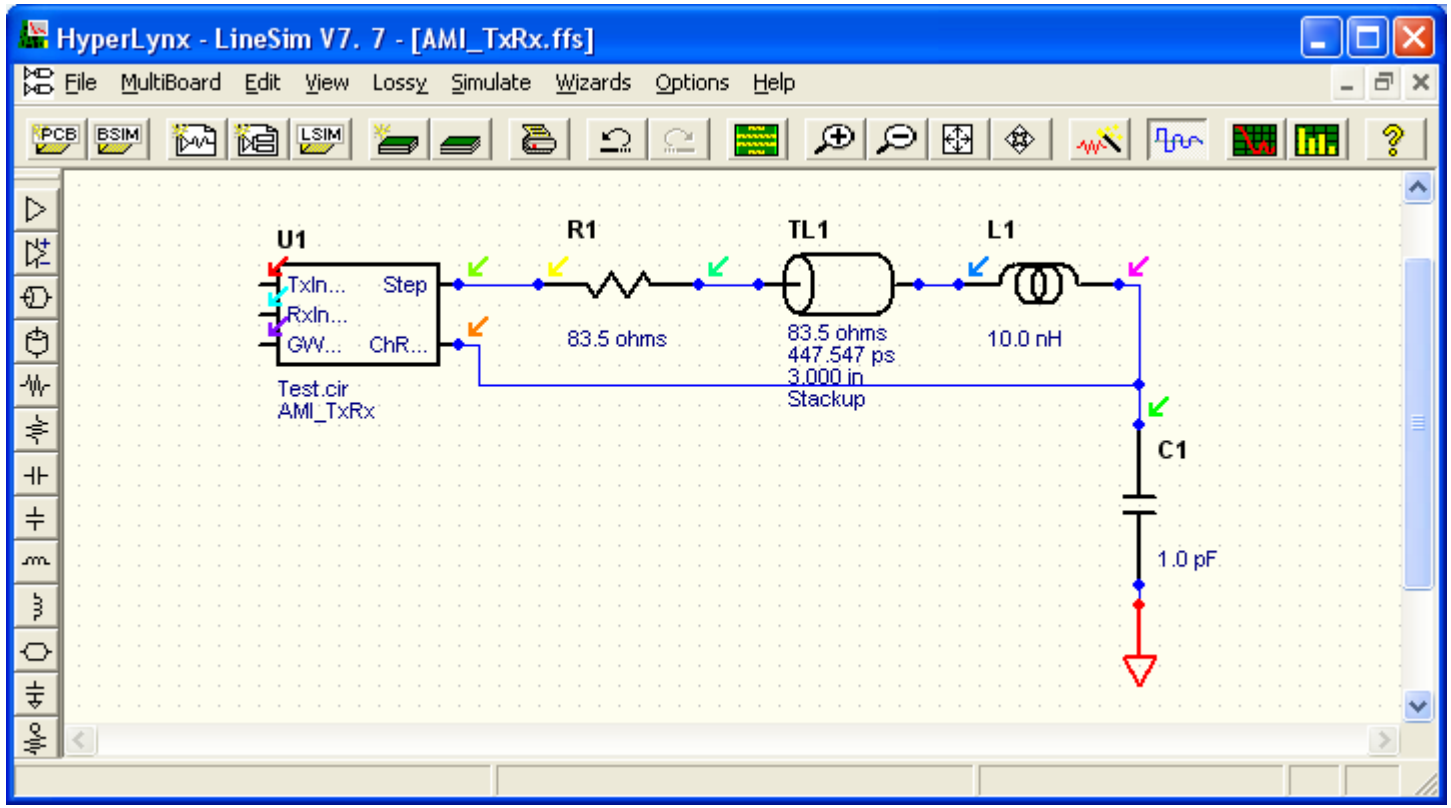
Block diagram of the following example



This is only one of many possible ways of implementing IBIS-AMI support via VHDL-AMS

Example with IBIS-AMI Tx and Rx models



VHDL-AMS model to interface the IBIS-AMI DLL

Tx driver impedance

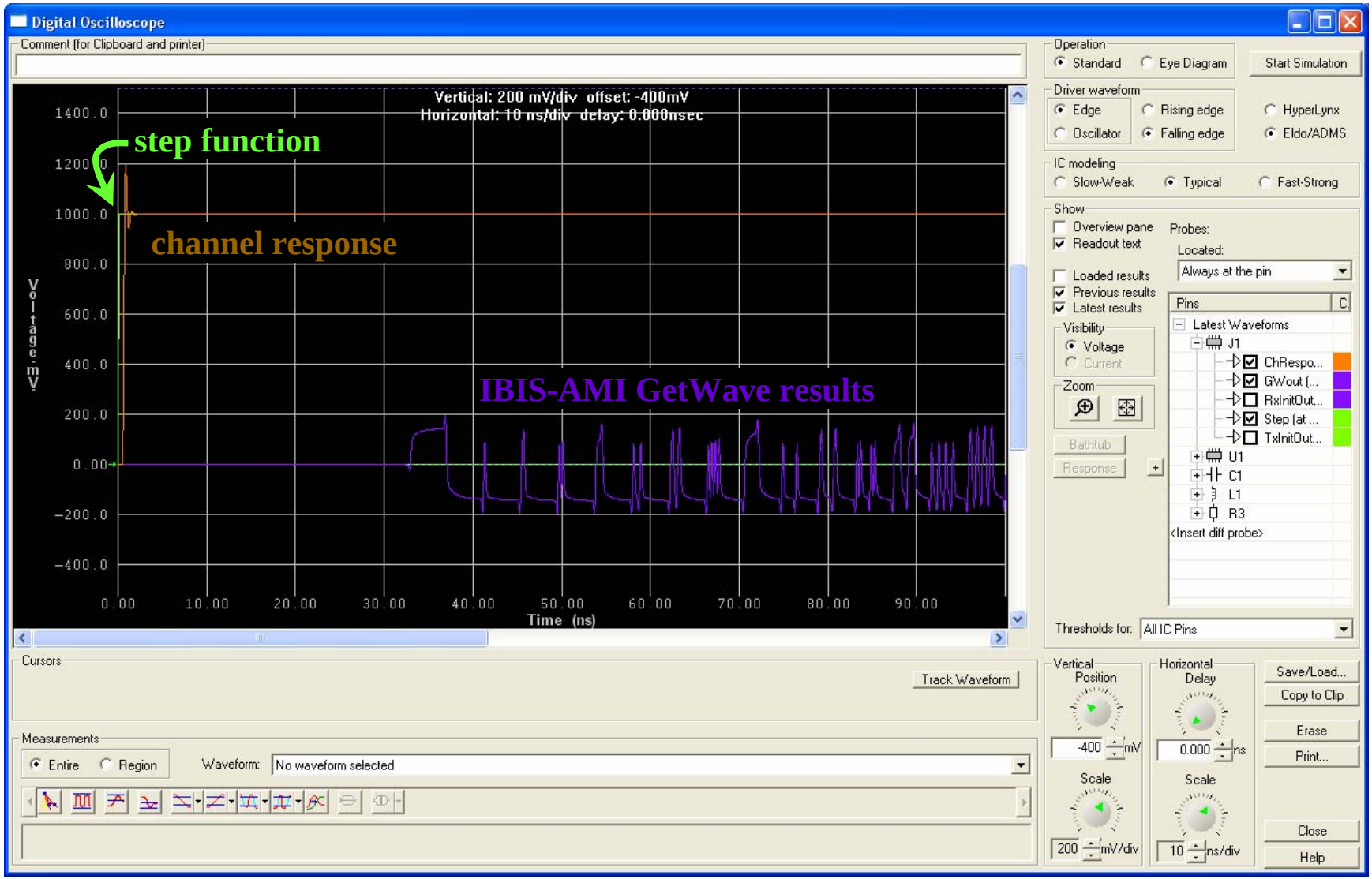
Channel model

Rx package and input capacitance

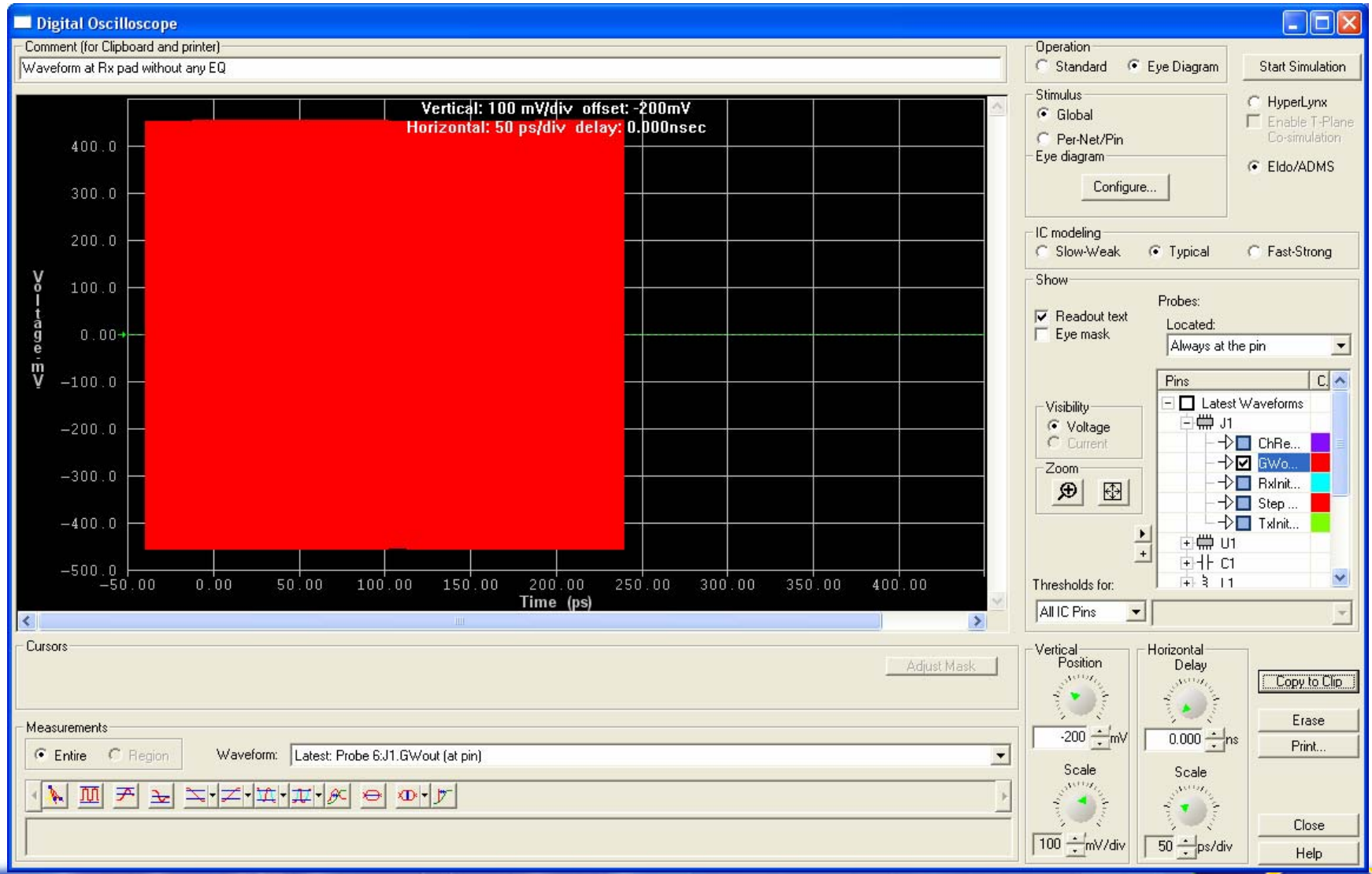
Example circuit description

- U1 contains a VHDL-AMS model
  - it includes a step function generator to excite the “channel”
- R1 represents a simple resistive driver impedance
- TL1, L1, C1 represents a T-line, package and input
  - the “channel” can be an arbitrary circuit, including S-parameter models, but it must include the Tx and Rx impedances
- The first part of the TD simulation generates a channel response
  - the duration is parameterized in the VHDL-AMS model
- When the channel response is done, the AMI Tx and Rx models are executed using that channel response
  - the VHDL-AMS model includes a PRBS pattern generator
- After that, the results are returned to the simulator through the VHDL-AMS model for plotting

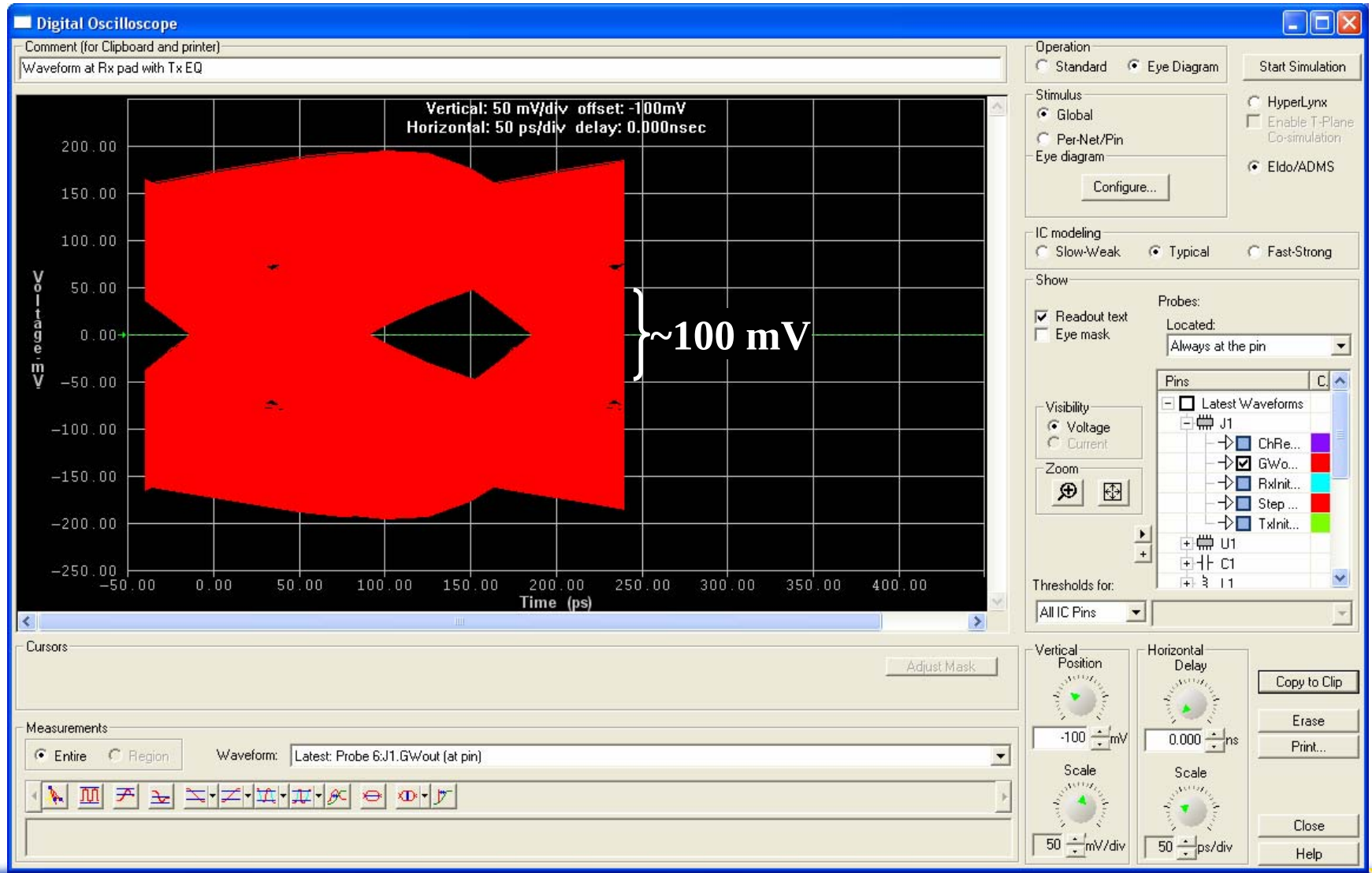
Waveform results of the example



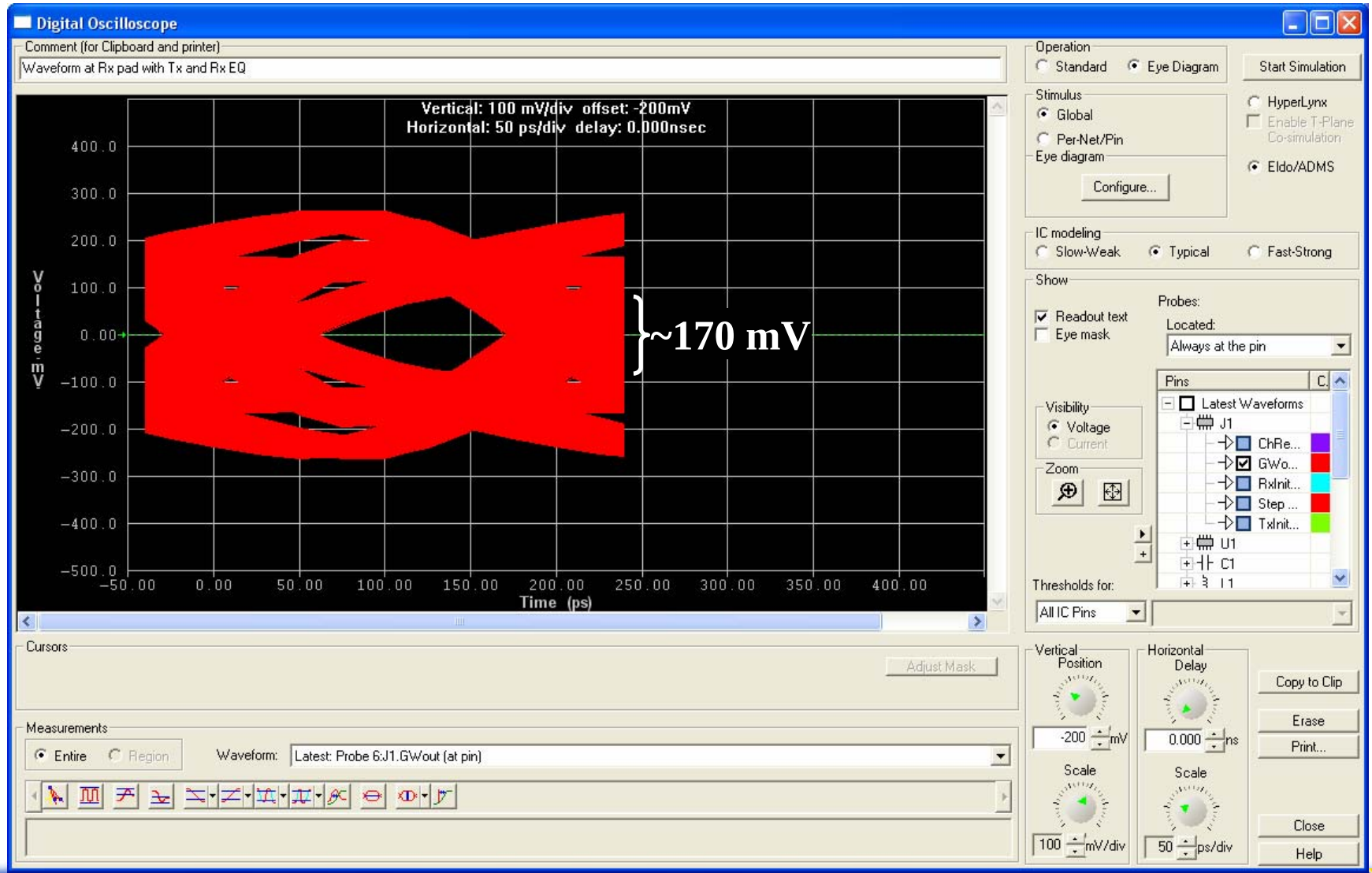
100k bits of PRBS 22 over 20 µs – no EQ



100k bits of PRBS 22 over 20 µs – Tx EQ



100k bits of PRBS 22 over 20 µs – Tx & Rx



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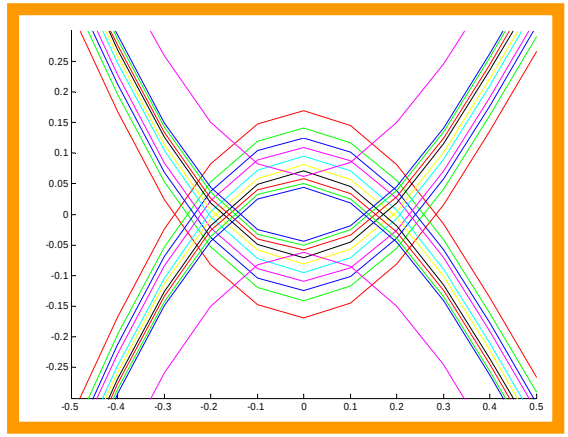
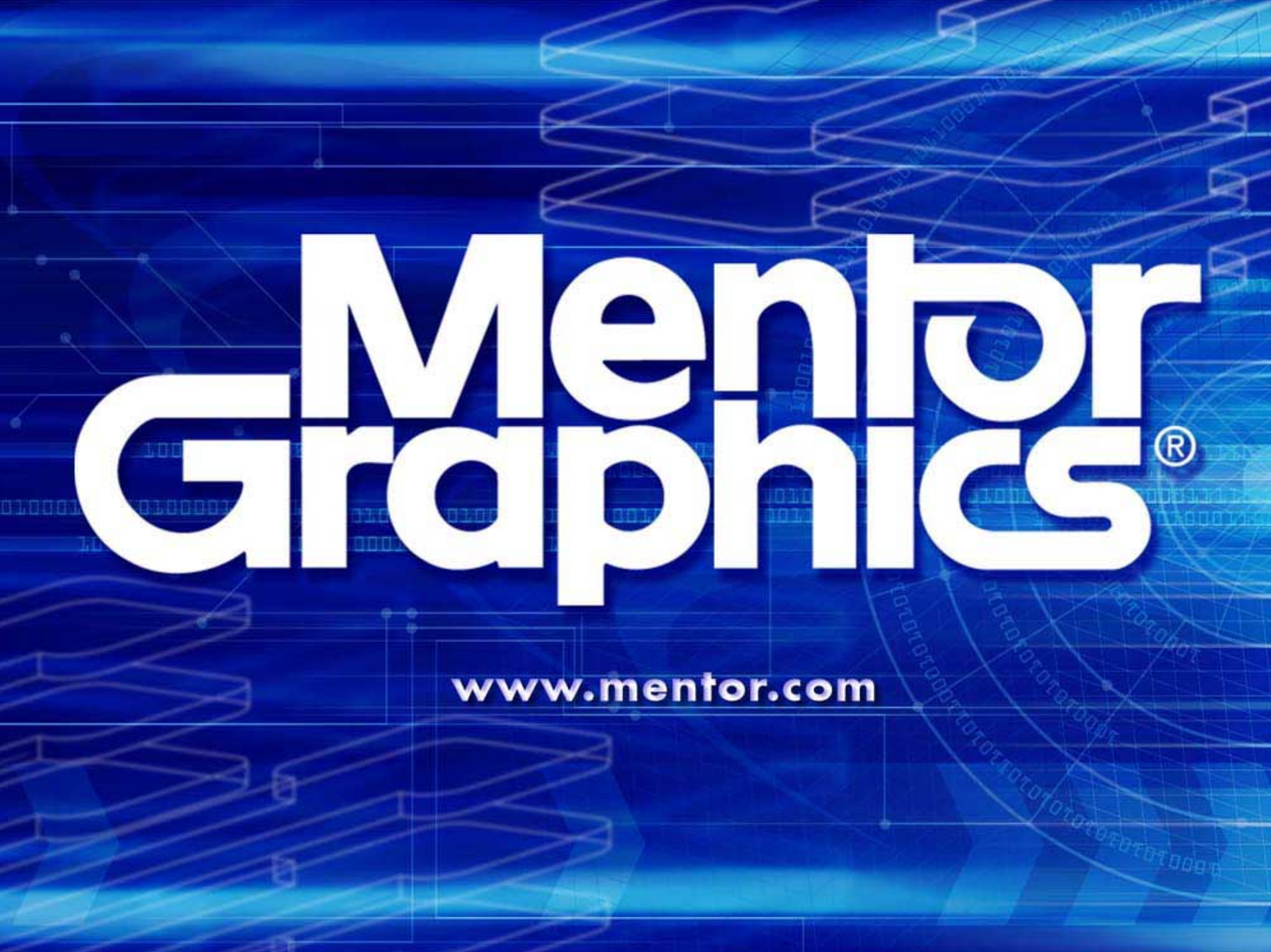


- Attributes in VHDL-AMS
- An IBIS-AMI example using the FOREIGN attribute
- Conclusions – future work

Conclusions – future work

- **IBIS-AMI models (DLLs) are fully supported from VHDL-AMS through attributes**
  - **this is direct execution of the compiled IBIS-AMI models**
- **Any programming language, capable of producing executables could also be supported the same way**
  - **Matlab, Visual Basic, Perl, you name it**
  - **execution speed of the compiled code does not suffer any degradation through VHDL-AMS since it is executed externally**
- **An IBIS (v5.0) parser will be needed to automate the IBIS parameter extraction for the IBIS-AMI models**
  - **this will happen most likely soon after the IBIS v5.0 parser has been released**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