Channel Simulation Using IBIS Models with Asymmetric Rising and Falling Edges

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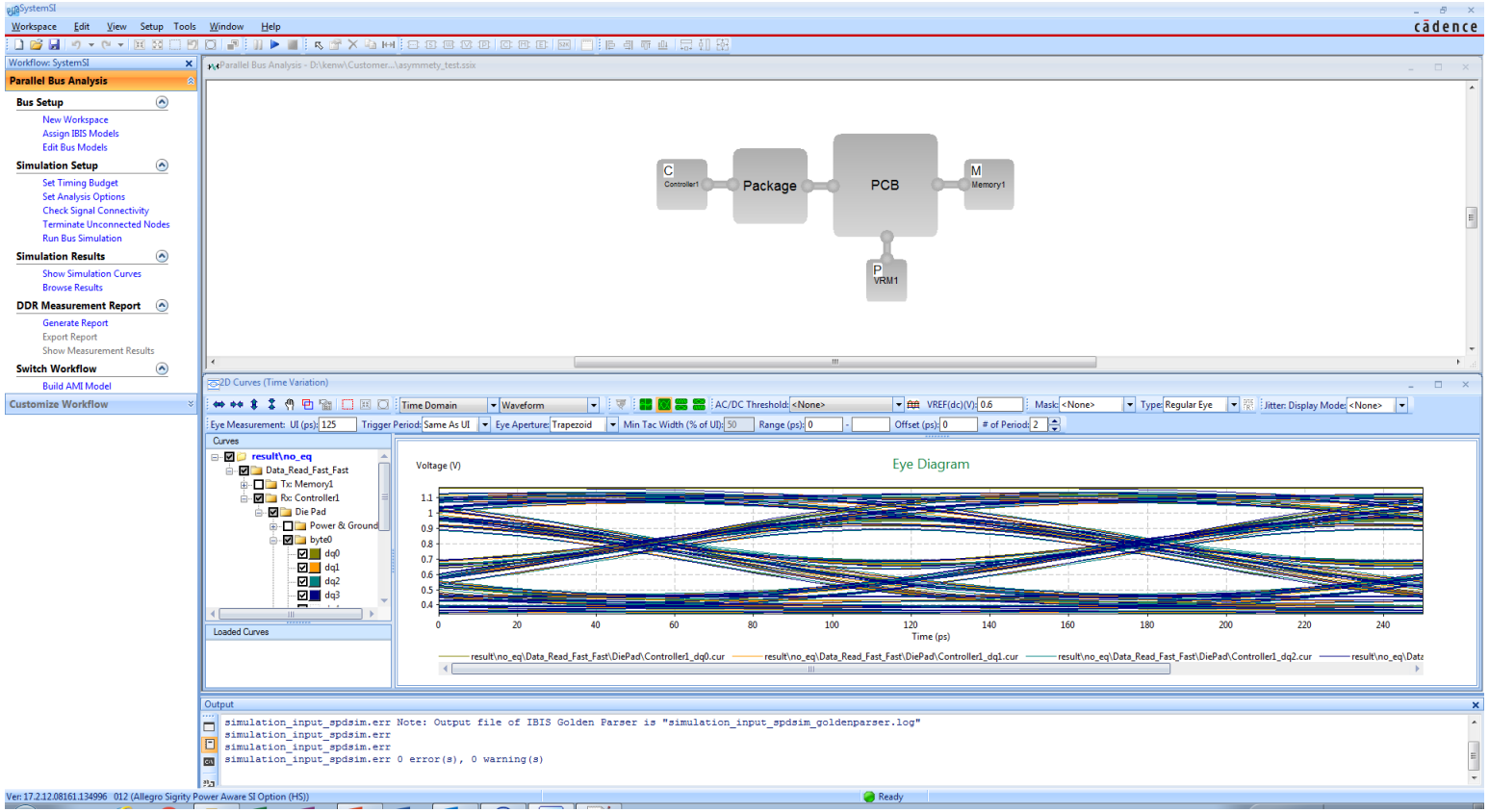
Overview

- As channel simulation and IBIS-AMI modeling methods are adapted from serial link to DDR interface analysis, we encounter IBIS IO models with asymmetric rising and falling edges
- This is different from the highly symmetric drivers we typically encounter with serial link analysis
- Traditional single step response methods for impulse response generation may not reproduce circuit simulation results accurately enough
- These slides show how an EDA tool can handle this (without changes to the IBIS specification)
- All cases use Micron's **y11a.ibs** file for 8Gbps DDR5, provided by Randy Wolff

SystemSI Testbench

- Package block uses an extracted RLCK Spice model
- PCB block uses W-elements with 0.3 meter lengths



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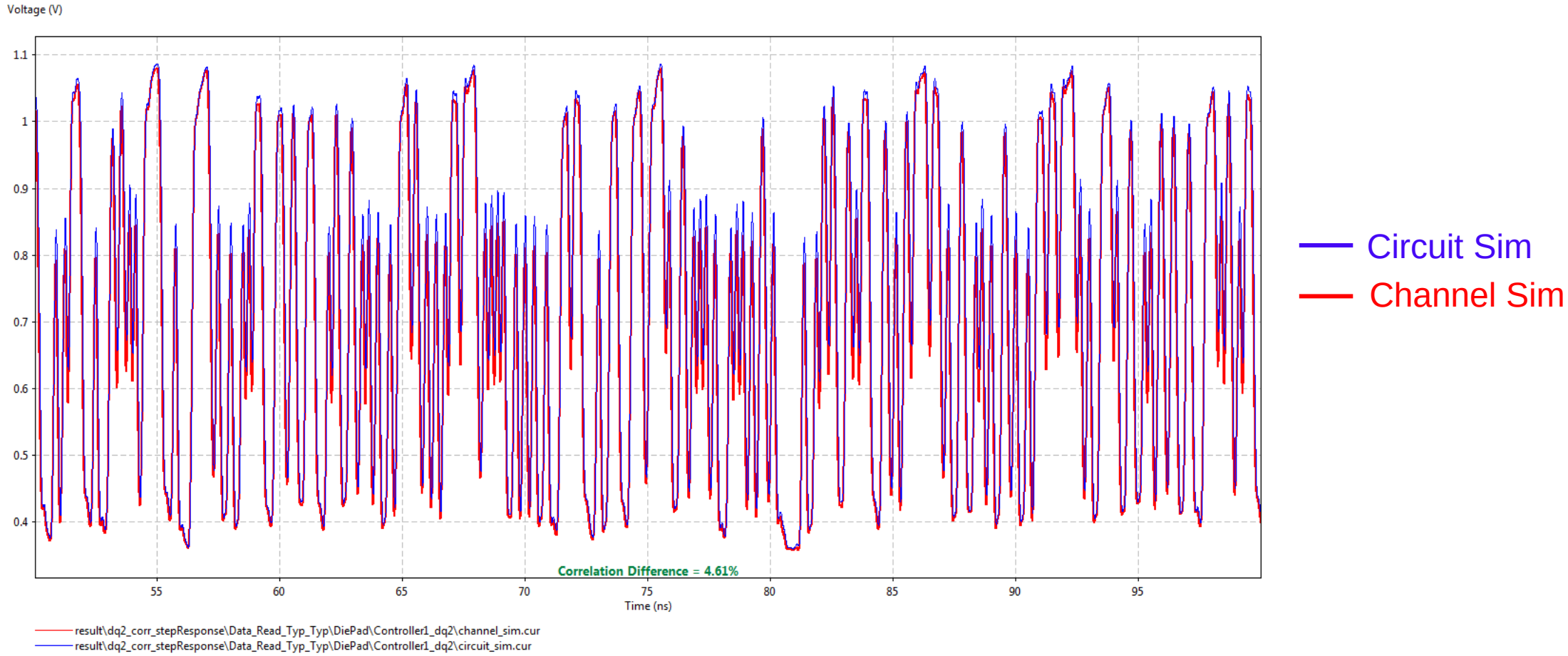
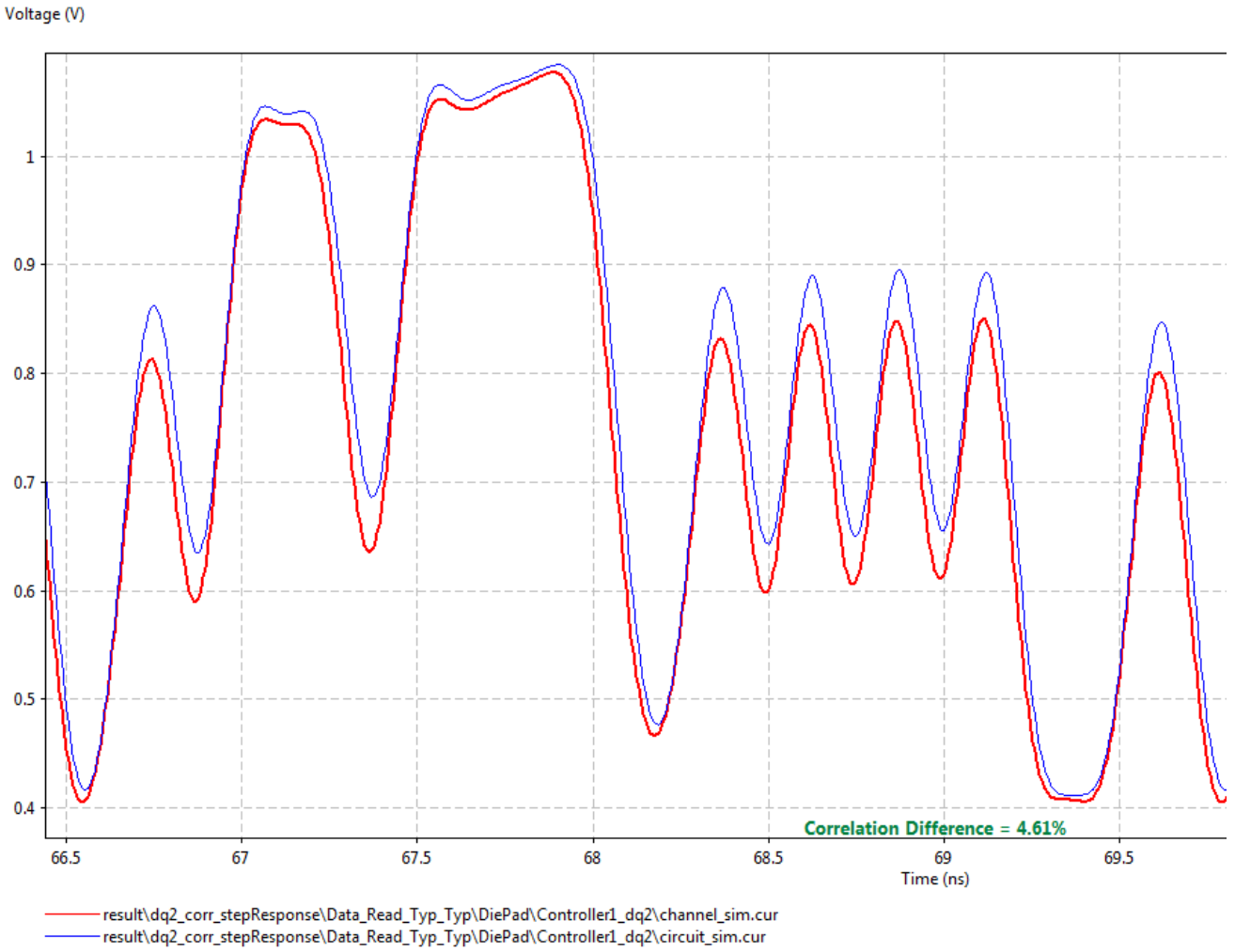
Using Standard Step Response Characterization

- Correlation difference 4.61%



Same Result Zoomed In



Circuit Sim

Channel Sim

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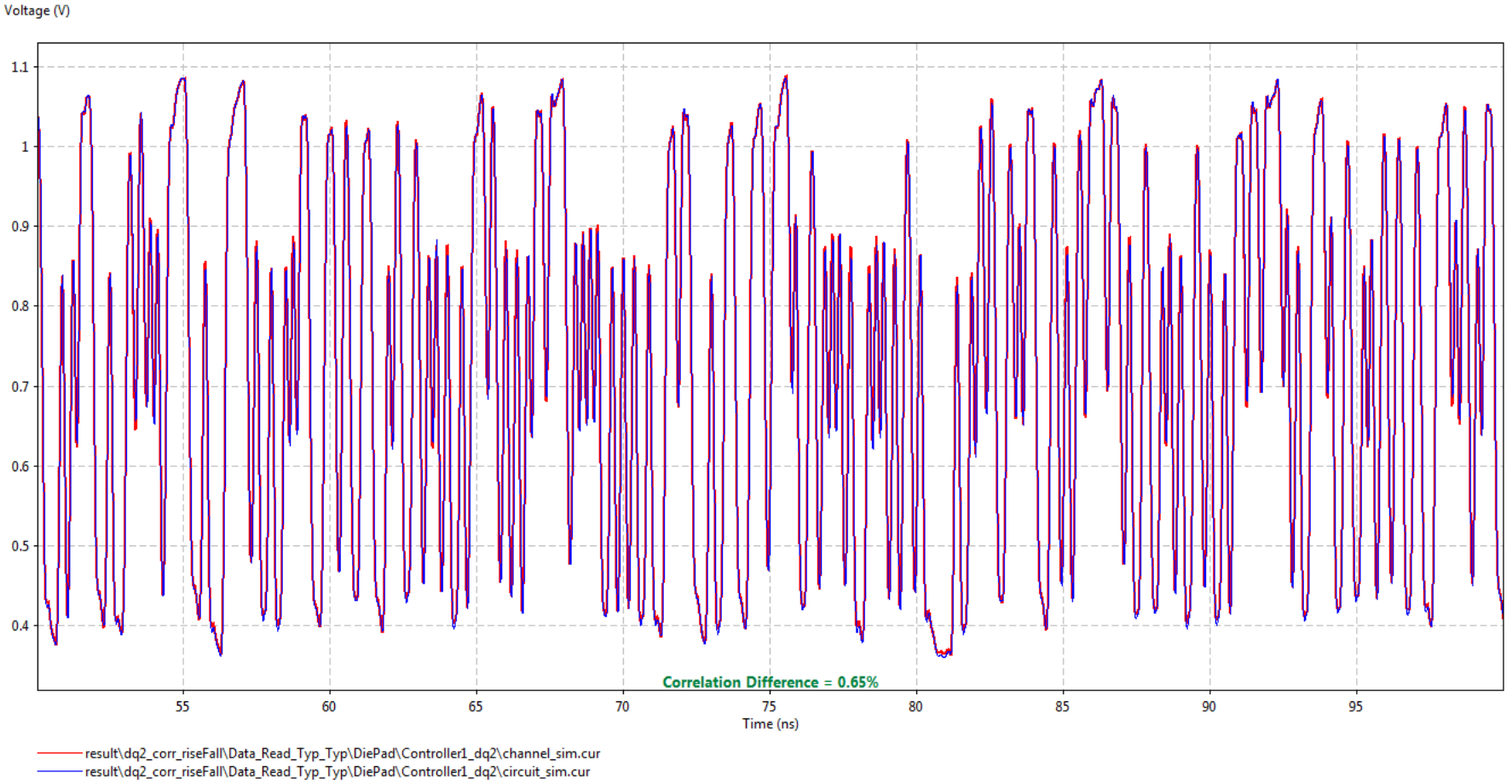
Using Rising and Falling Edge Characterization

- Correlation difference 0.65%



Circuit Sim

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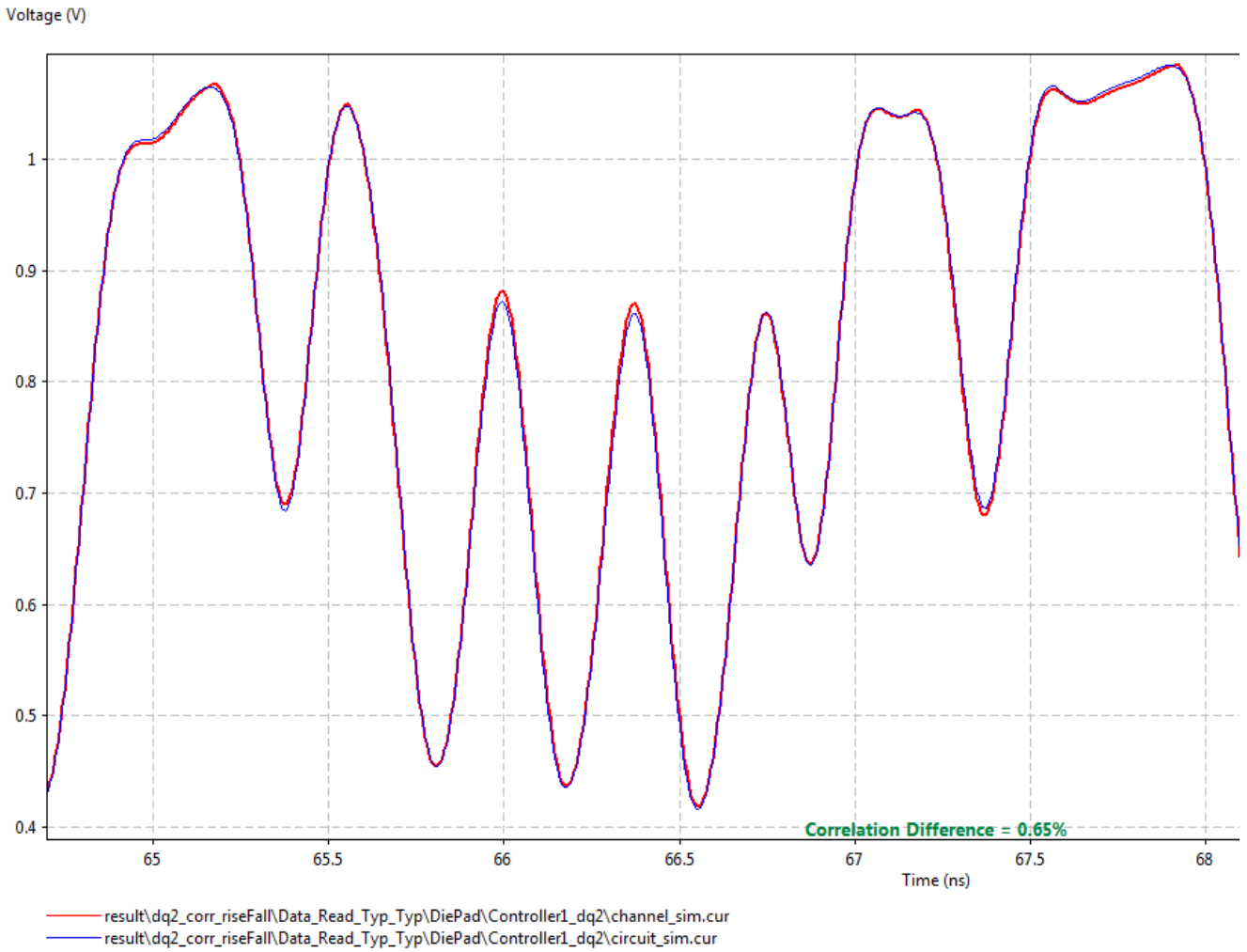
Same Result Zoomed In



Circuit Sim

Channel Sim

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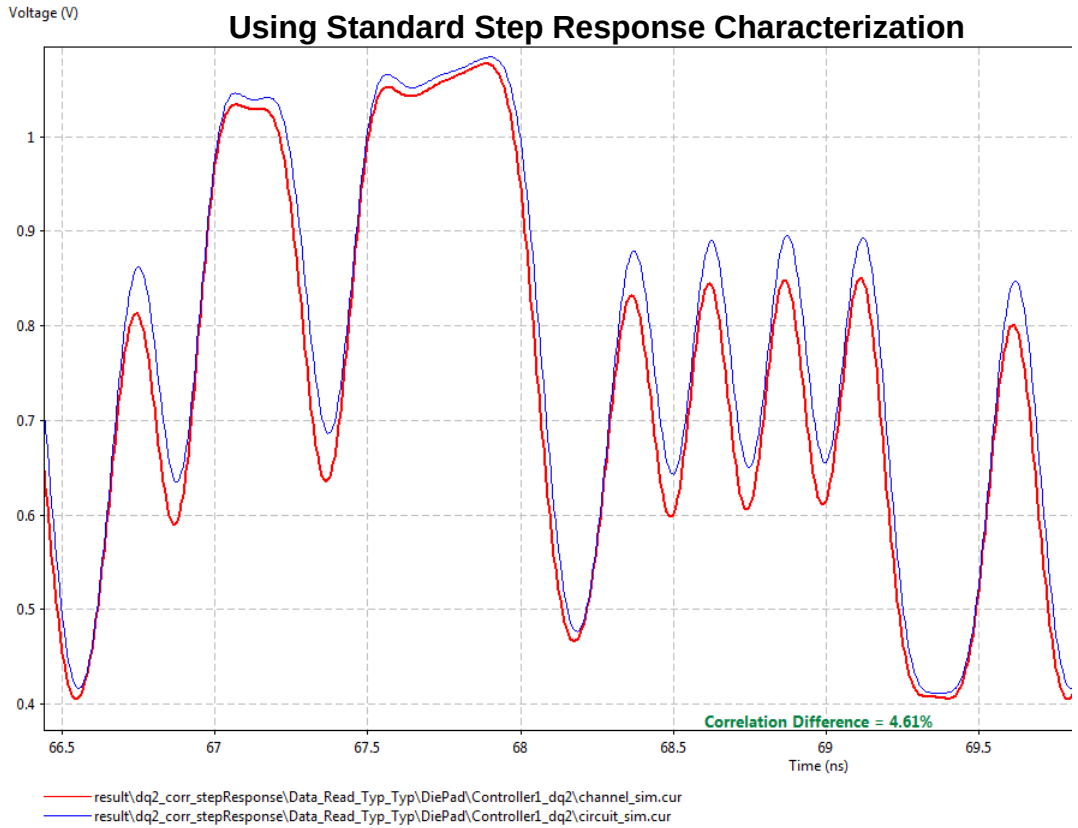
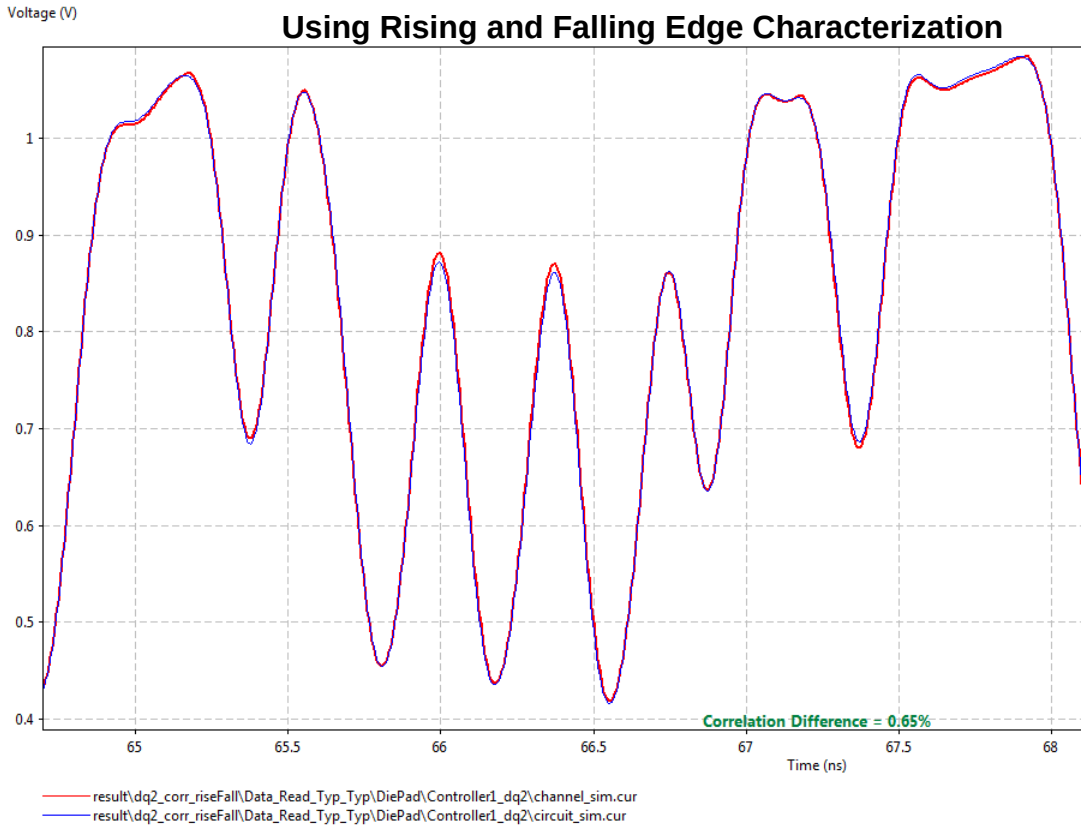
Comparison of Both Methods

- Correlation error vs. circuit simulation reduced by about 4%





Summary

- The **DQ_34_3600** IO model has some asymmetry in its rising and falling edges
- Standard SerDes step response characterization did not do a great job in capturing this behavior, as seen in the circuit / channel sim correlation
- Characterization methods using rising and falling edges captured this behavior very well for channel simulation

```
|**************************************************************************
|
[Ramp]
R_load = 50
|
|          typ                          min                          max
|
dV/dt_r 3.7990E-01/6.4024E-11    3.4860E-01/8.7846E-11    4.0938E-01/4.9359E-11
dV/dt_f 4.4605E-01/5.4840E-11    4.2048E-01/7.6564E-11    4.6793E-01/4.2557E-11
|**************************************************************************
```