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Effective Methodology for Correlating Measurement to Simulation for IBIS-AMI Models

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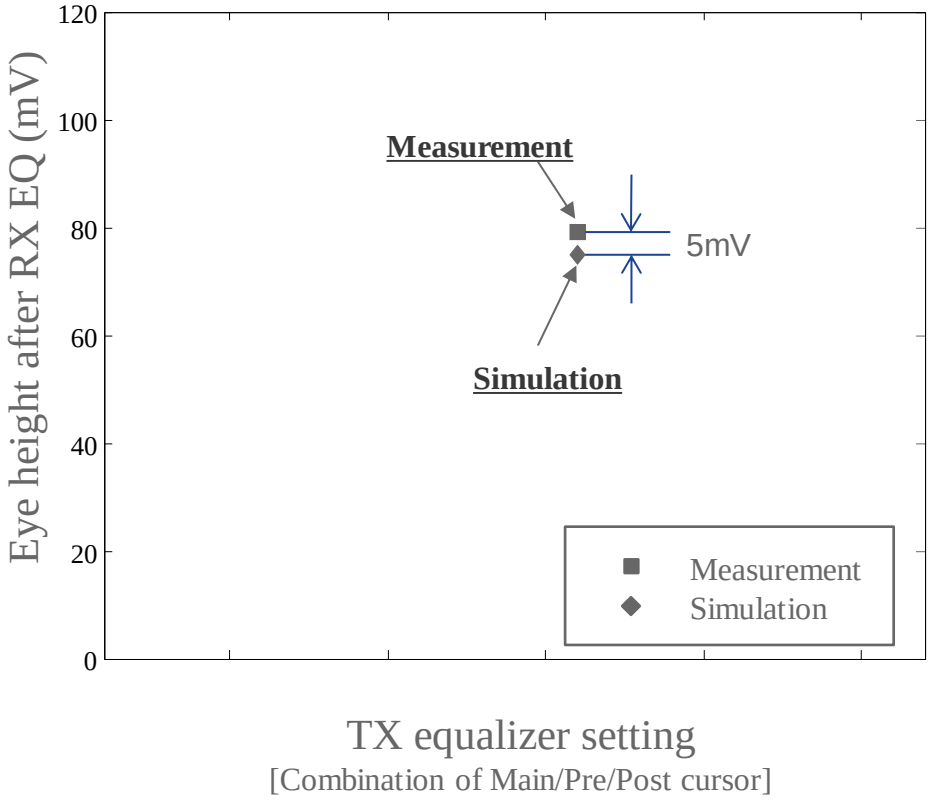
Why use IBIS-AMI model

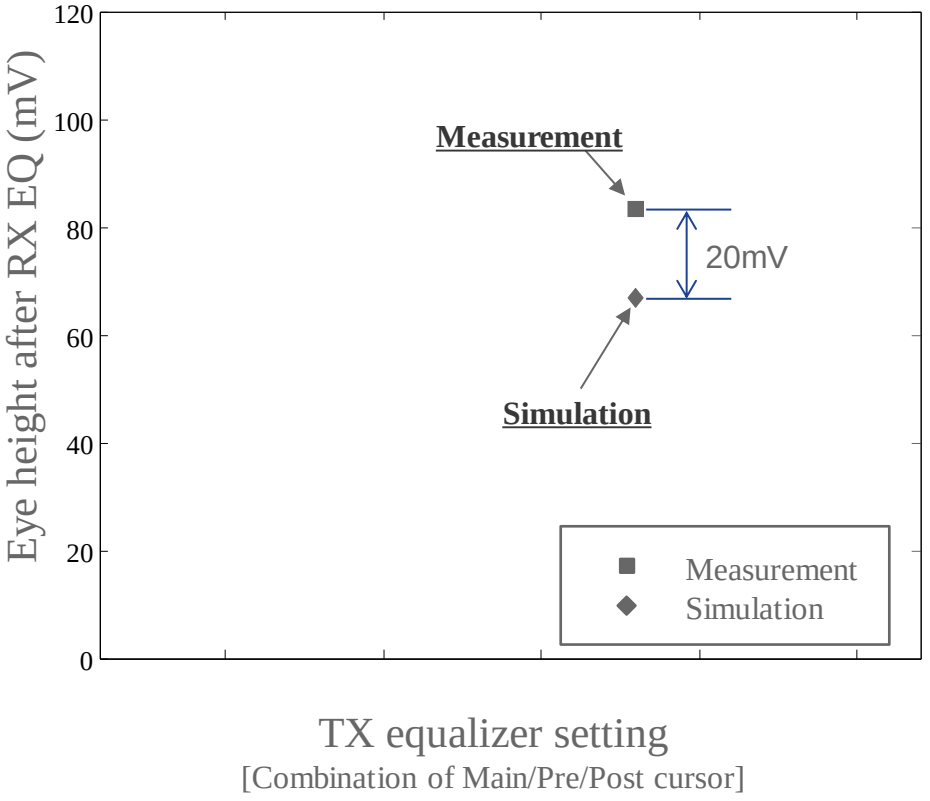
- SerDes data rate enters the GHz range
- Several types of equalizers are required to overcome significant insertion loss and ISI
- Traditional transistor-level model has limitation due to simulation speed and IP protection.
- IBIS-AMI model is actively used for solving the issues.
- Accurate model is needed to improve trust level of behavior model

Comparison for Two Cases of Correlation

Case1 at BER1E-10



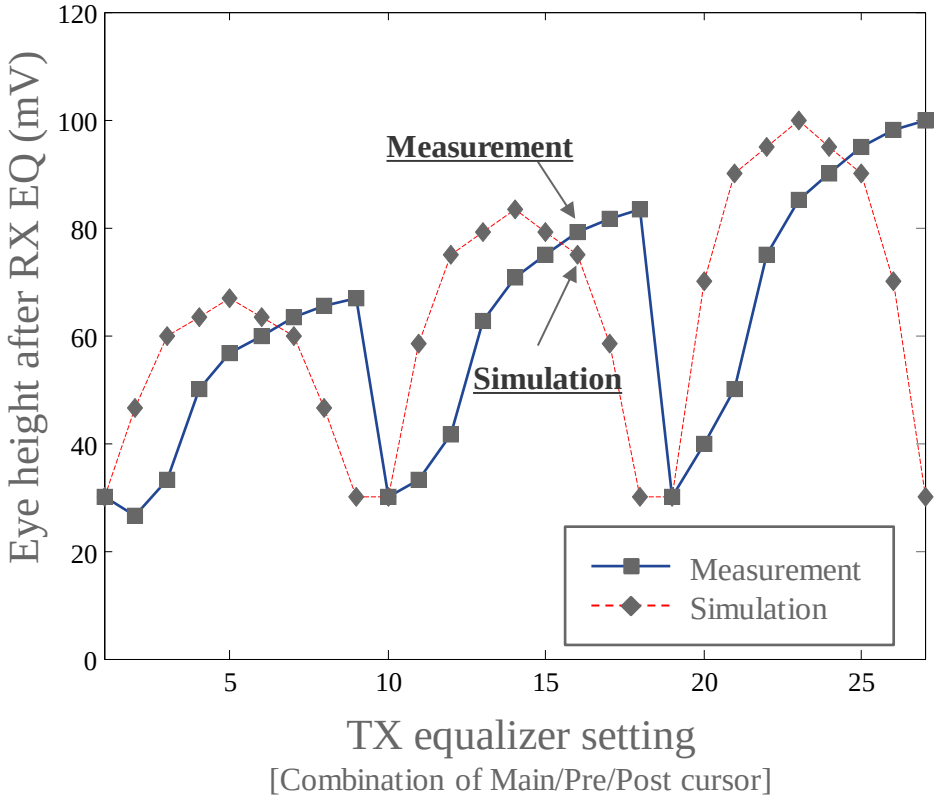
Case2 at BER1E-10



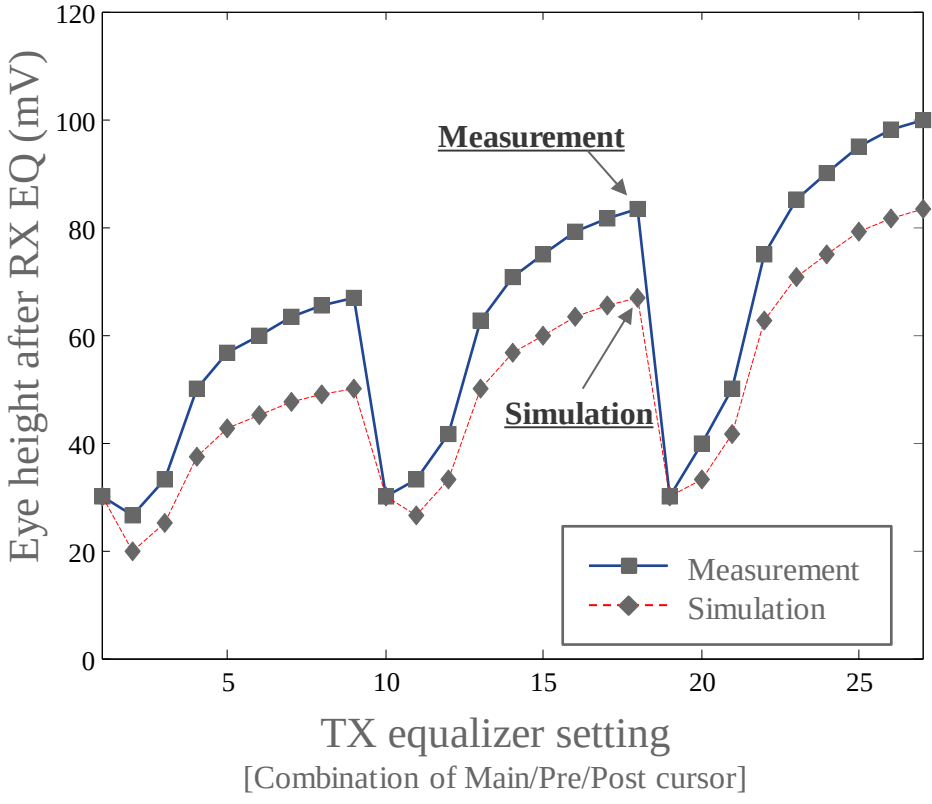
Comparison for Two Cases of Correlation

Only few cases correlation can not represent all equalizer behavior performance!!

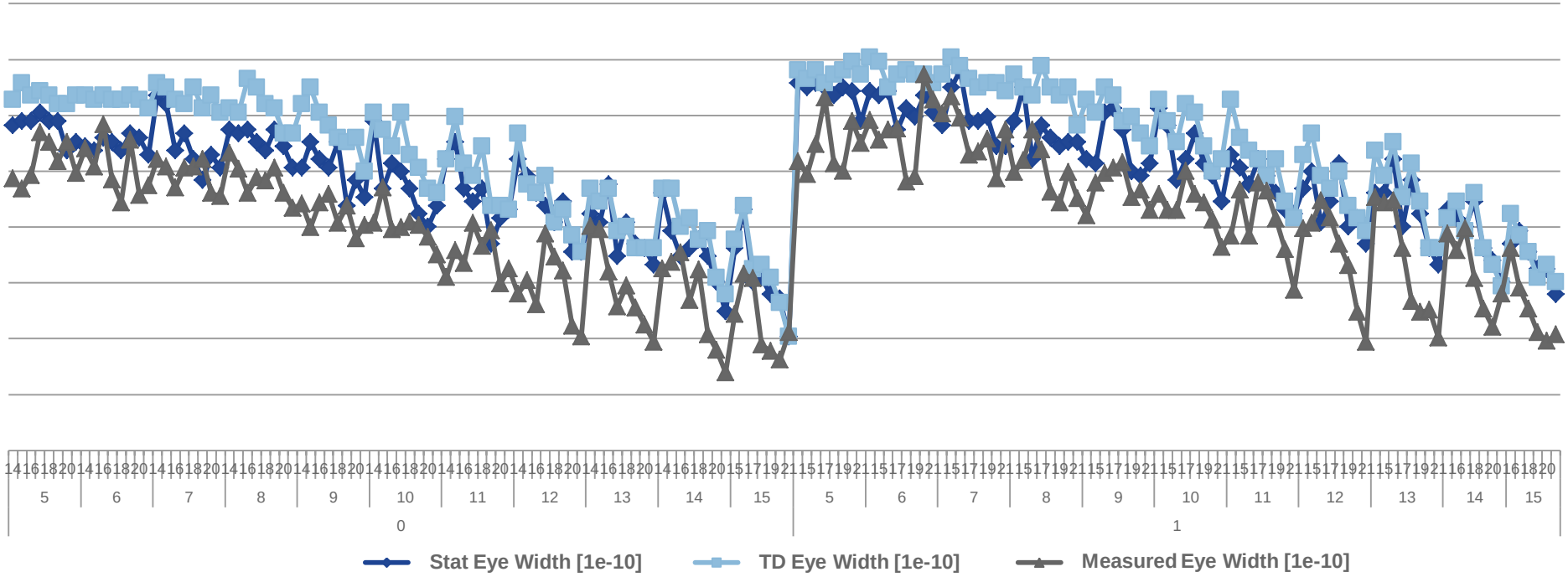
Case1 at BER1E-10



Case2 at BER1E-10

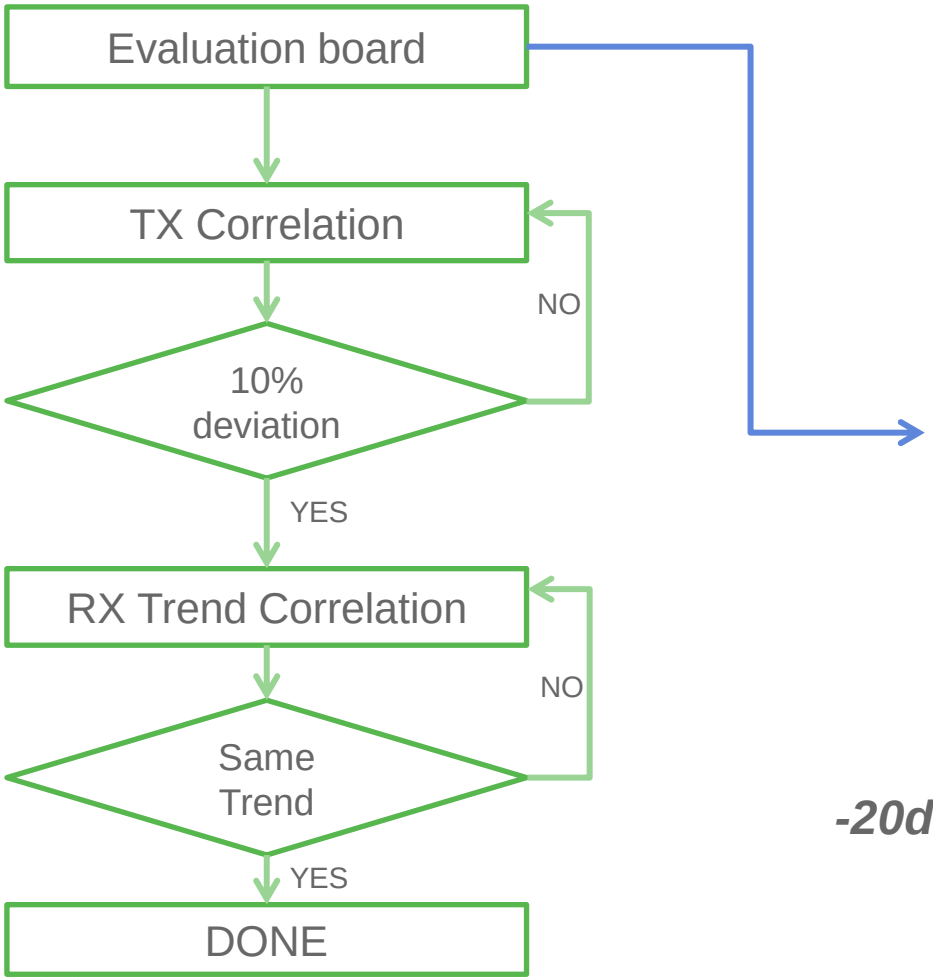


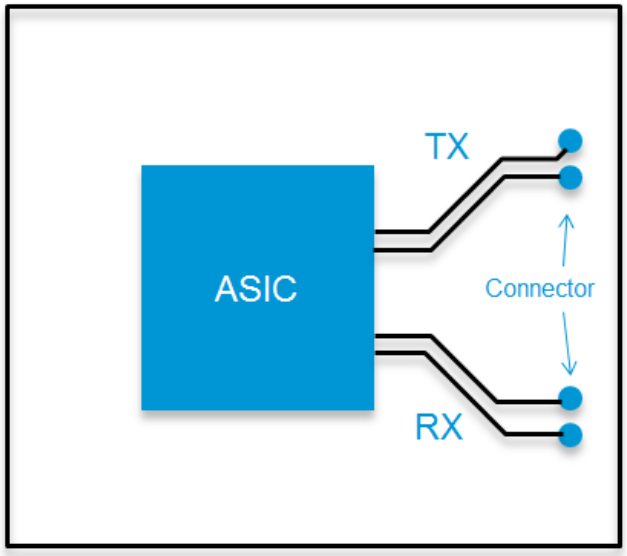
Proposed Trend Correlation



- The trend correlation is
- How to vary eye opening trend after RX equalizer by TX equalizer setting.
- the plot should be acquired by a large number of TX equalizer combination
- the same optimized setting for simulation and measurement will be obtained.

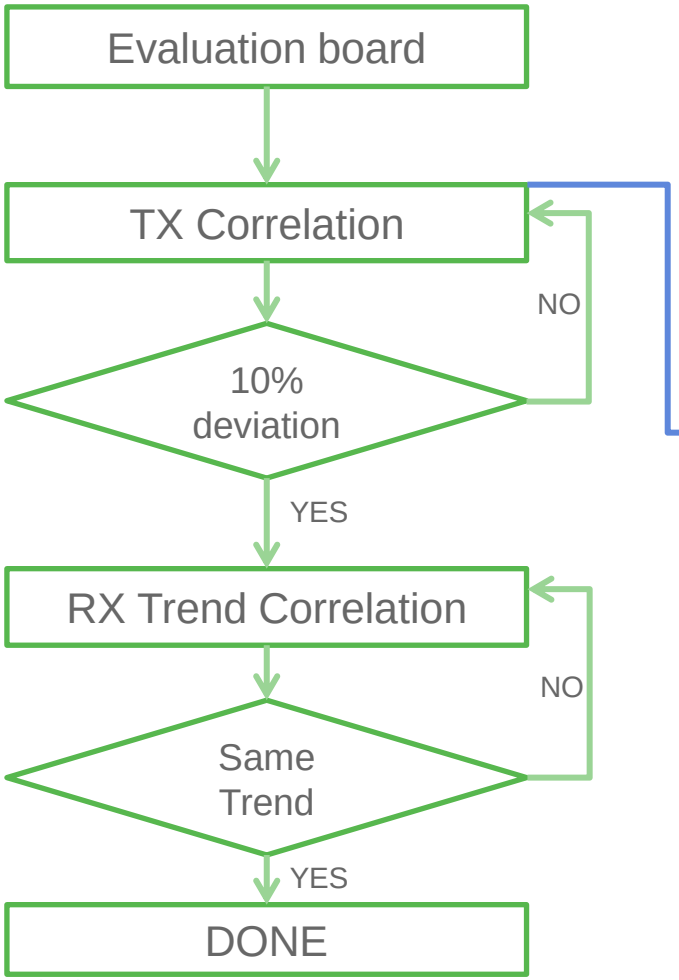
Flow Chart of Trend Correlation



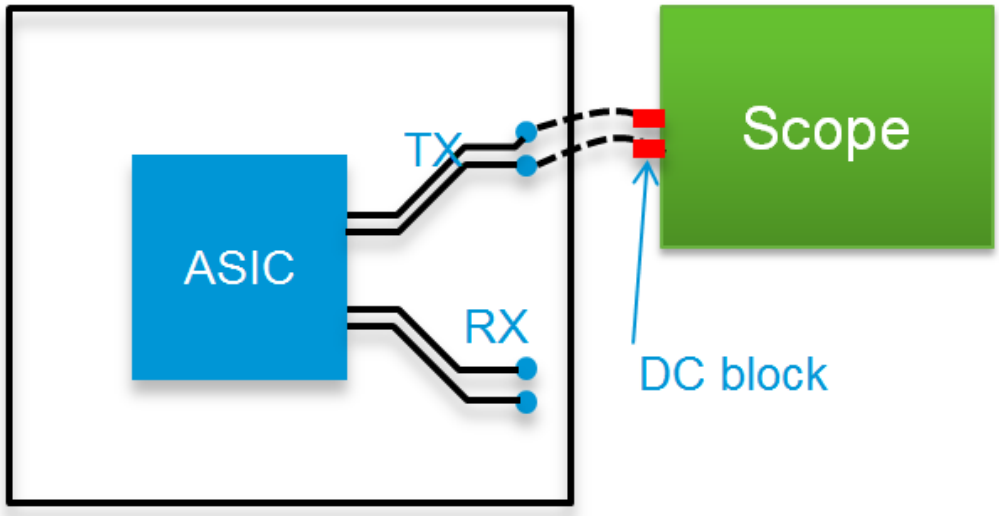


-20dB return loss at Nyquist frequency.

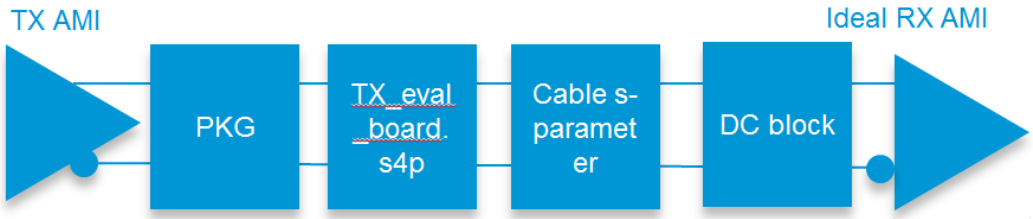
Flow Chart



Measurement

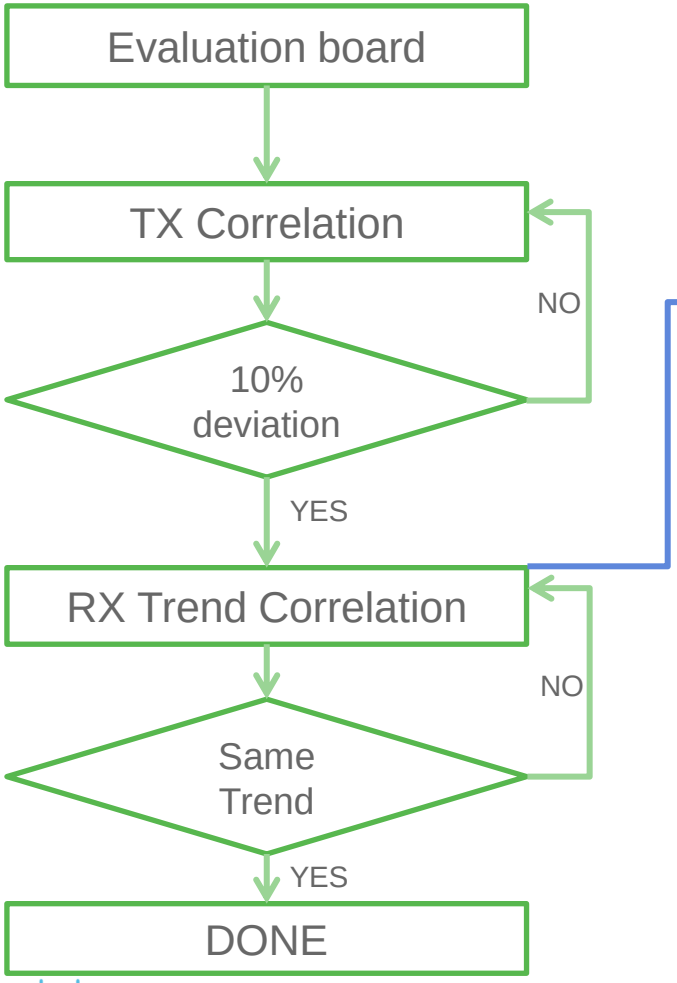


Simulation

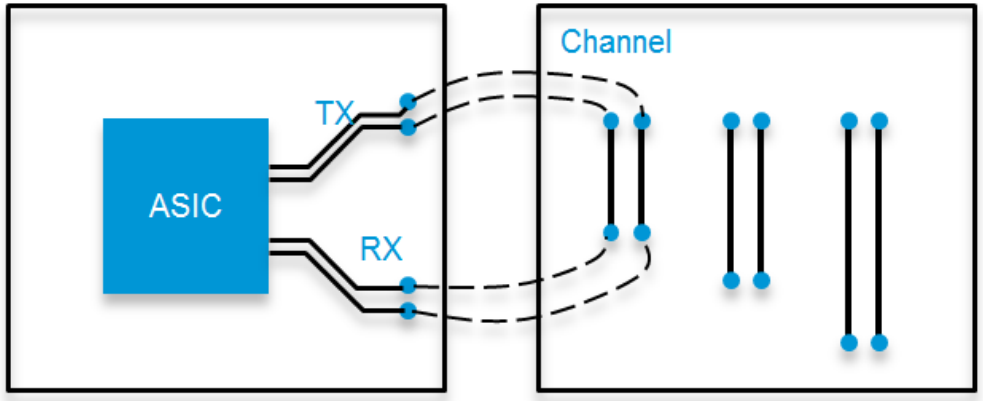


Bird 123 jitter model need to be included in TX model

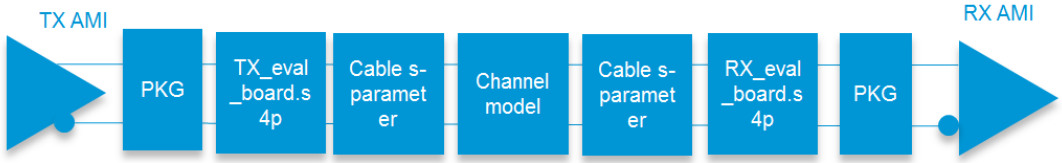
Flow Chart



Measurement



Simulation

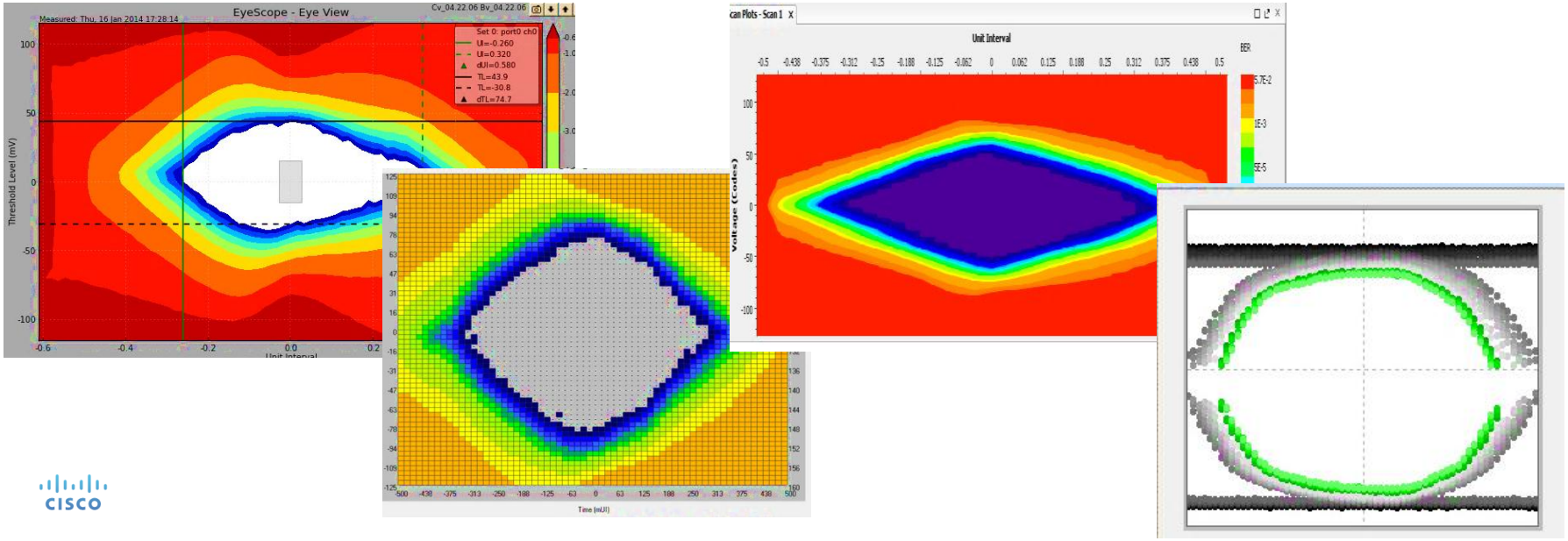


all RX adaptive equalizer value should be shown in EDA tool

Requirements to do better correlation

Internal Eye-diagram Scope

- It is difficult to measure the signal after RX equalizer.
- The latest scope has the ability of equalizer, but it is for generic function and not exactly same with ASIC's equalizer
- The internal eye diagram should be required



Script for TX Parameter Sweep

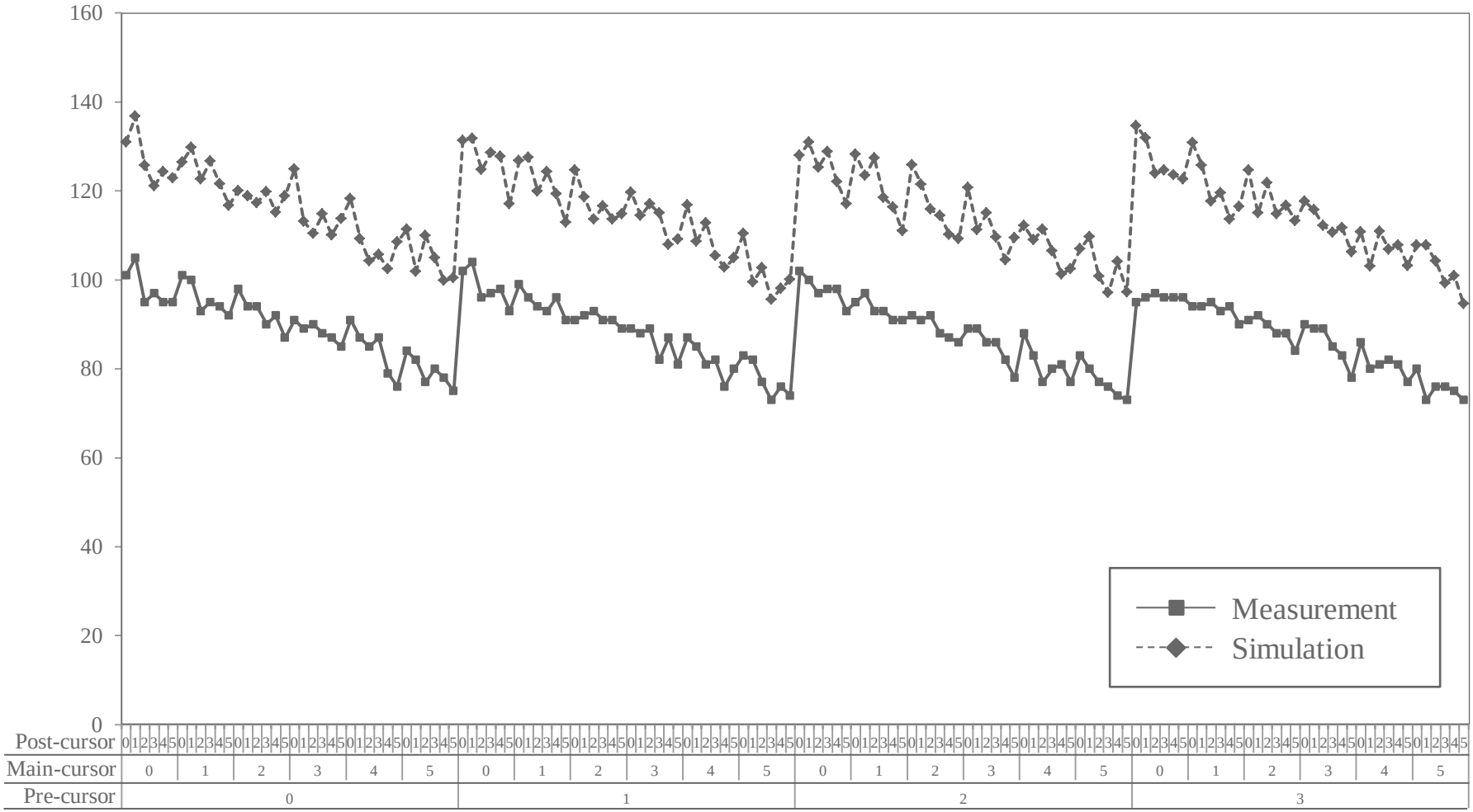
- The internal eye diagrams should be measured with many combination of TX equalizer setting.
- It is very time consuming work if there is no TX parameter sweep script which measures
- Eye height and width for each TX equalizer setting need to be measured automatically.

tx cmain	tx cpost	tx cpre1
14	9	0
14	9	1
14	9	2
14	9	3
14	10	0
14	10	1
14	10	2
14	10	3
14	11	0
14	11	1
14	11	2
14	11	3

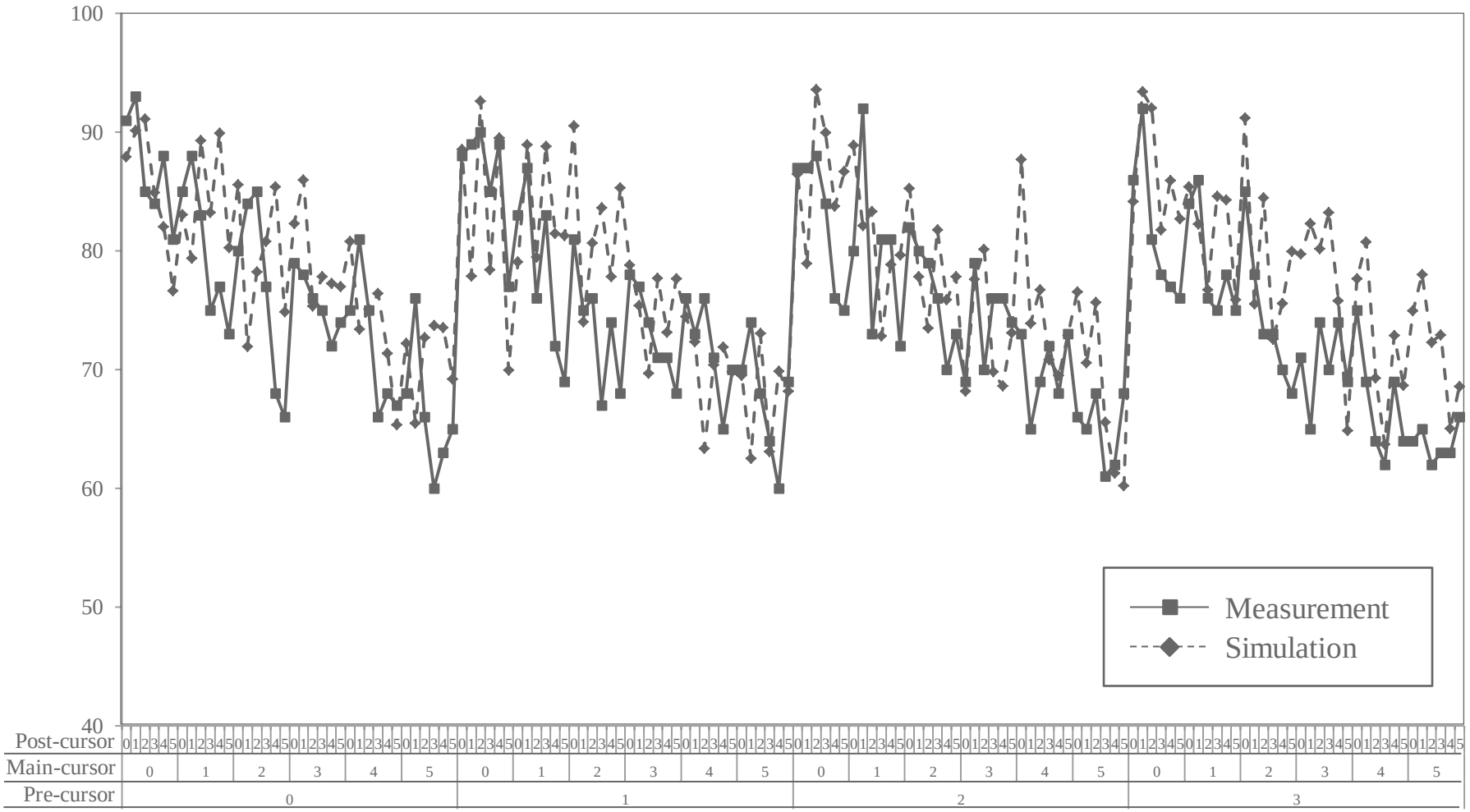
Progress	v margin	h margin	h offset
Done	72.283	0.547	-0.0385
Done	83.202	0.66	0.013
Done	100.306	0.689	0.048
Done	102.784	0.696	0.0515
Done	68.368	0.523	-0.0445
Done	78.972	0.598	-0.049
Done	99.256	0.689	0.0125
Done	112.458	0.692	0.019
Done	85.122	0.612	0.02
Done	107.87	0.626	0.044
Done	97.978	0.633	-0.0375
Done	105.221	0.635	-0.0375

Evaluation by Measurement

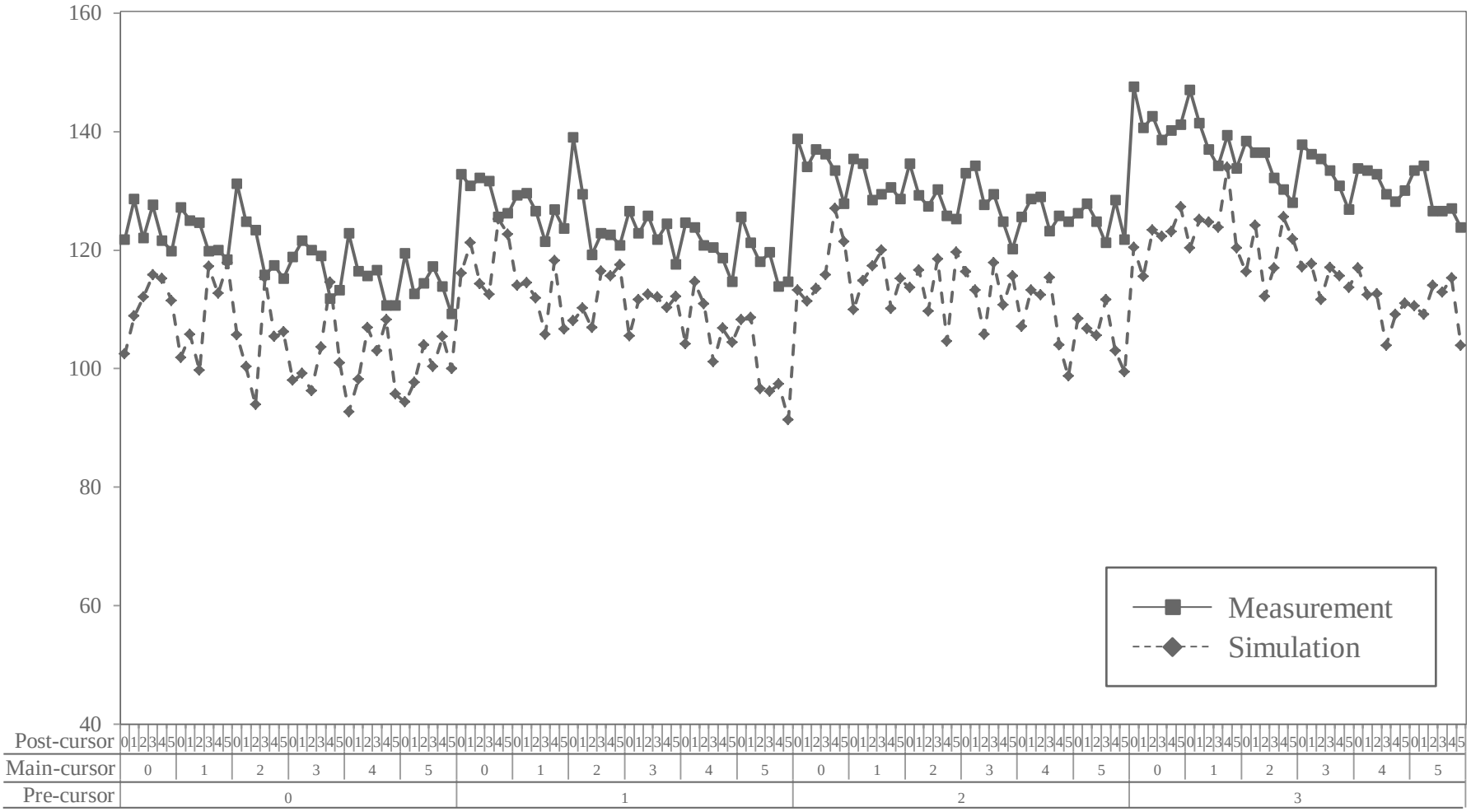
10G Correlation Result



15G Correlation Result



28G Correlation Result



Summary

- Proposed the trend correlation methodology for IBIS-AMI model correlation instead of the absolute value correlation.
- The proposed methodology should be basic correlation step to find an optimum TX and RX equalizer setting by simulation correctly.
- Proposed methodology can be used for debugging tool of model quality.

TOMORROW starts here.