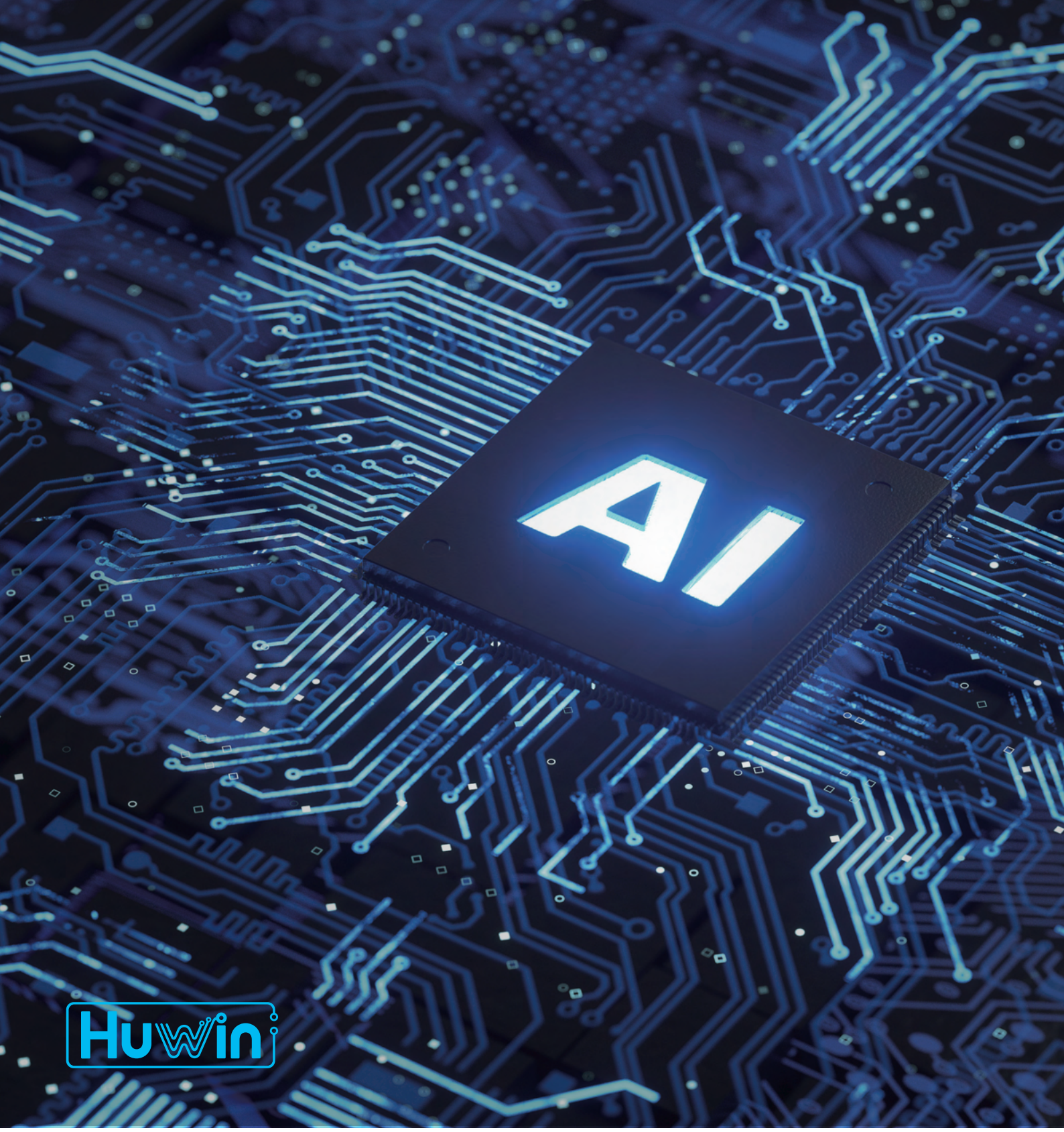


Huwin Solutions

ACVS

- The best solution for over 1000 I/O port channel systems (ex. AI Chiplet)
- S-para. analysis
- Channel analysis
- IBIS simulation for (LP)DDR
- DDR5/GDDR6/HBM single-ended AMI simulation
- SerDes AMI simulation
- C-PHY simulation

SnpView.Com

- Web-based S-parameters simulation service
- TDR, TDT, Eye-diagram, BER
- PerfectCal (Thru fixture de-embedding)
- SerDes channel simulation (2022. 2Q)

Designing the future

We continue to
pioneer new technology,
to reduce the gaps
between boundaries.

Our Mission

To lead the high-performance segment of the EDA market by leveraging engineering automation across simulation, report, and design optimization.

Huwin is based on more than 20 years of experience in EM simulation, high-speed digital signal/power/ground design, RF and EMC, and more than 10 years of R&D. We continue to develop and supply engineering solutions and collaborate with enterprises through consulting.

Huwin ACVS customers and technical partners

SAMSUNG · SK hynix · LG Electronics · HYUNDAI MOBIS · Telechips · KAIST

meritech · StepSystem · SEMI FIVE · TSE · Mokpo National University

Ansys

Huwin is ANSYS Channel Partner specialized for technical support for the ANSYS solutions.

ACVS Advanced Channel Verification System

S-para. analysis	Single S-parameter analysis (ex. package)
Channel analysis	Auto channel configuration using multiple S-para. Freq. and time domain analysis
IBIS simulation	The fast transient simulation for (LP) DDR
DDR5/GDDR6/HBM AMI simulation	The fast single-ended AMI simulation
C-PHY simulation	Full transient C-PHY simulation with Tx/Rx EQ
SerDes AMI simulation for Gen5/6 (extremely low BER)	**PDN analysis**

SnpView.com Free web S-para. Freq. / Time view and link (share)

Advanced port termination	Easy, fast configuration of S-parameters' ports
Frequency domain analysis	
Time domain analysis	Time domain reflectometry(TDR), Time domain transmission (TDT), Eye-diagram, BER
PerfectCal ®	Thru fixture de-embedding
Web SerDes channel simulation (2023. 3Q)	Channel configuration, Tx/Rx Setting(Impedance, Trf, EQ, Jitter, Noise etc), Eye-diagram, BER.

ACVS Advanced Channel Verification System for (LP)DDR4/5,GDDR6,HBM SerDes

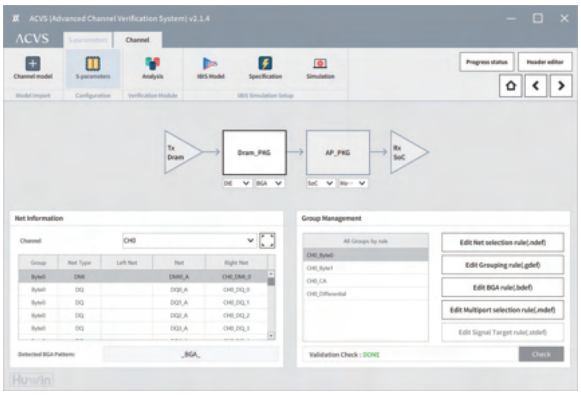
A memory bus channel or SerDes channel verification requires a lot of analysis time and effort. This is because channel systems (including driver/receiver, and S-parameter) should be configured, long-time simulation is required for various analysis cases, and simulation results should be analyzed and reported. Huwin ACVS enables full automation of all of these procedures, ensuring high efficiency of channel analysis. This solution allows engineers to quickly and easily analyze the various channels and cases. The accuracy and efficiency can be ensured by the newly developed **'SimX'** engine, and the report can be fully customizable.

Huwin ACVS (Advanced channel verification system) is a verification solution for a bus or SerDes channel such as DDR, PCIe.
Unlike conventional simulators, this solution enables full automation of system configuration, simulation, and reporting tasks required for channel analysis.
Therefore, the user can quickly and accurately analyze the channels in a few steps. The accuracy and efficiency are ensured on the newly developed 'SimX' engine. The customization of the report is also supported. (e.g., formats and analysis items)

Key Benefits

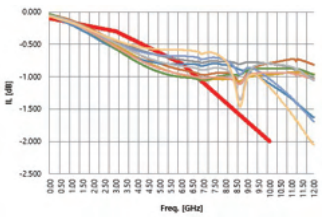
- Auto system configuration and simulation
- SimX engine: Fast and accurate freq. and time domain simulation
- Supports the fast **DDR5/GDDR6/HBM single-ended AMI** simulation
- The fully customized report

Step 1.
Auto configuration and simulation



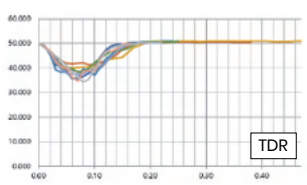
Step 2.
Auto reporting

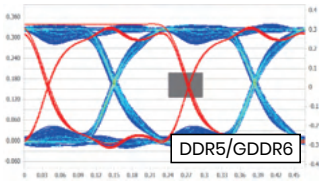
Freq. domain

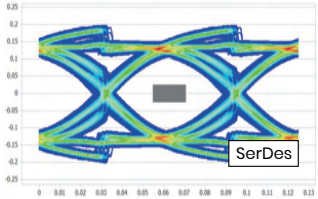


- Insertion/return loss
- NEXT, FEXT
- PDN analysis
- Z0 estimation

Time domain



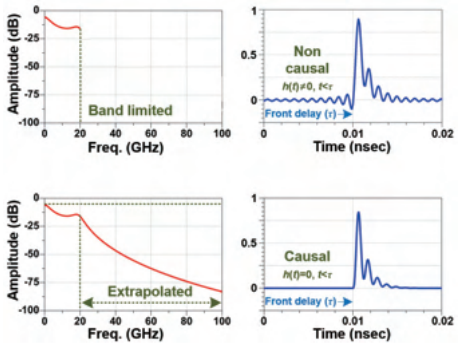




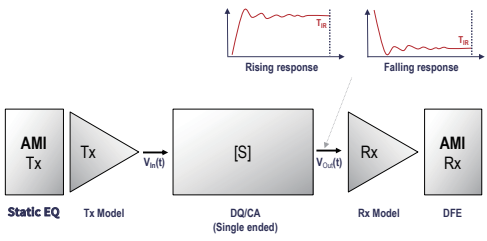
- TDR, TDT
- Eye-diagram
- BER, Bathtub
- Delay, skew, slew rate, etc.

ACVS Advanced Channel Verification System for (LP)DDR4/5, GDDR6, HBM SerDes

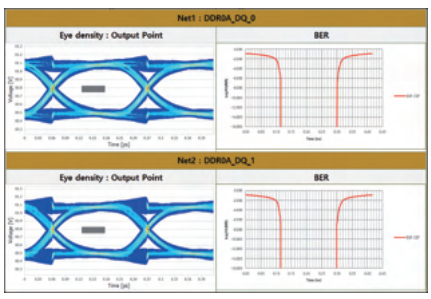
Rule based routing, termination, and IBIS/IBIS-AMI model selection.
(Rule assistant: DL based auto config)



Extrapolation of band-limited S-parameter for extrapolating accurate and casual time response



DDR5/GDDR6 channel analysis
: Supports the fast single-ended AMI simulation and forward clocking.



Report automation
: Full customization service for each customer.

Auto configuration

Complex system configuration is required to analyze bus channels such as DDR. Specifically, it requires a lot of complicated tasks such as the connection between S-parameters, a setting of each port condition, and configuration of driver/receiver. Huwin ACVS thus fully automates this process, maximizing the efficiency and accuracy of channel verification.

Auto channel configuration

The user-defined rule automatically proceeds the connection between S-parameters, port termination, and configuration of IBIS and IBIS-AMI models. Rule files can be edited directly by the user. Furthermore, we supports 'Rule assistant' that is deep learning-based auto configuration function.

Case sweep

Supports case sweeps for configuration parameters (e.g., Dara rate, IBIS models) needed for channel simulation.

SimX: High performance analysis engine

1) Frequency domain simulation

Various linear analysis methods in the frequency domain of the configured channel system are supported.

- **Insertion/return loss**
- **Crosstalk (NEXT, FEXT)**
- **Group delay, RLC extraction, Z0 estimation etc.**
- **PDN analysis (w/wo cap.)**
  : Impedance analysis (i.e. Differential Z-parameter)

2) Time domain simulation

More sophisticated techniques are required to conduct time-domain analysis using S-parameters. Huwin ACVS offers the following methods to maximize the accuracy and efficiency of time-domain analyses.

- **Band-limited S-parameter to causal time response**
  : Most of the S-parameters obtained through measurement or simulation are of limited bandwidth. Under these S-parameter conditions, the extrapolation method is applied to ensure the accuracy of transient simulation results. The extrapolation method developed by Huwin enables conversion to causal time response while maintaining the inherent characteristics of the band-limited S-parameter.
- **TDR and TDT**
  : Impedance and transmission in time-domain.
- **IBIS or IBIS-AMI simulation**
  : Huwin transient solver supports IBIS or IBIS-AMI analysis.
  : Supports
  - Legacy (LP)DDR full transient simulation
  - DDR5/GDDR6/HBM single-ended AMI simulation (The fast engine)
  - SerDes AMI simulation
- **Hawk-Eye: Pseudo worst eye-diagram**
  : Fast and accurate estimation of pseudo worst bit sequence for eye-diagram is possible due to novel Huwin's algorithms with the channel step responses.
- **C-PHY transient simulation**
  : Supports Tx/Rx EQ, jitter, noise

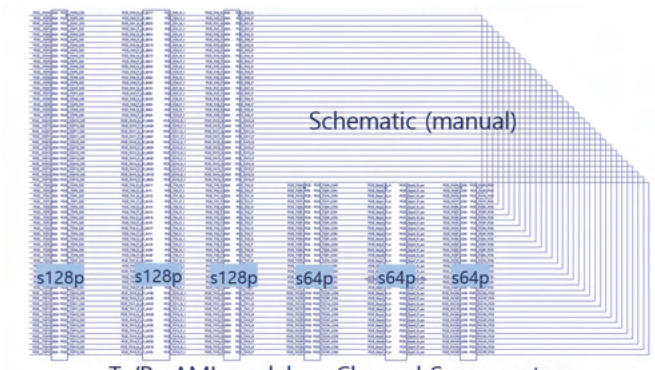
Report automation

: Supports fully customized report
: Compliance test

ACVS Demo

ACVS Advanced Channel Verification System for (LP)DDR4/5, GDDR6, HBM, SerDes

Case study 1 : PCIe Gen5 channel (loopback)

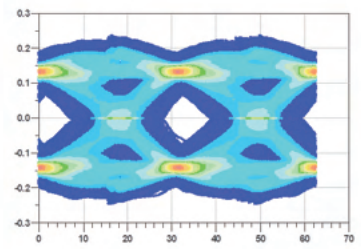


Tx/Rx AMI models + Channel S-parameters
PRBS: total 2,270,000 bits
(=ignore bits: 2,240,000+ input bits: 30,000)

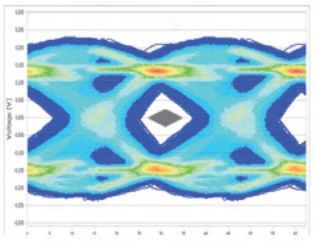
```
(Ignore_Bits (Usage Info) (Type Integer) (Default 2240000)
```

Solution type	Conditions	Analysis time
Solution A	-manual setting (over ~1h) -without reporting	AMI: ~9h 30m
ACVS	-auto setting -auto reporting	Basic-SI: ~38m AMI: ~3h 40m

Analysis results

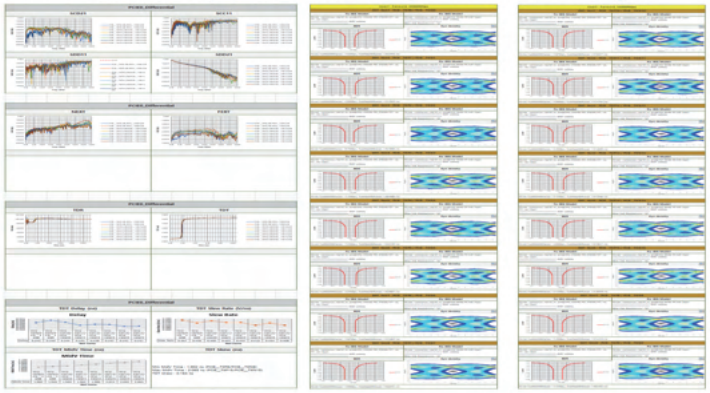


Solution A



ACVS

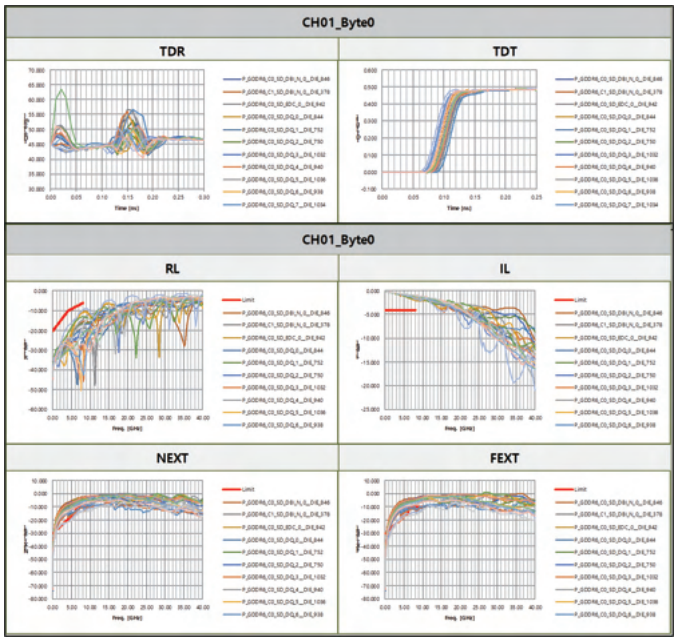
Solution: ANSYS Ch. modeling + ACVS SI/PI analysis



Basic-SI: 38m AMI: 3h 40m

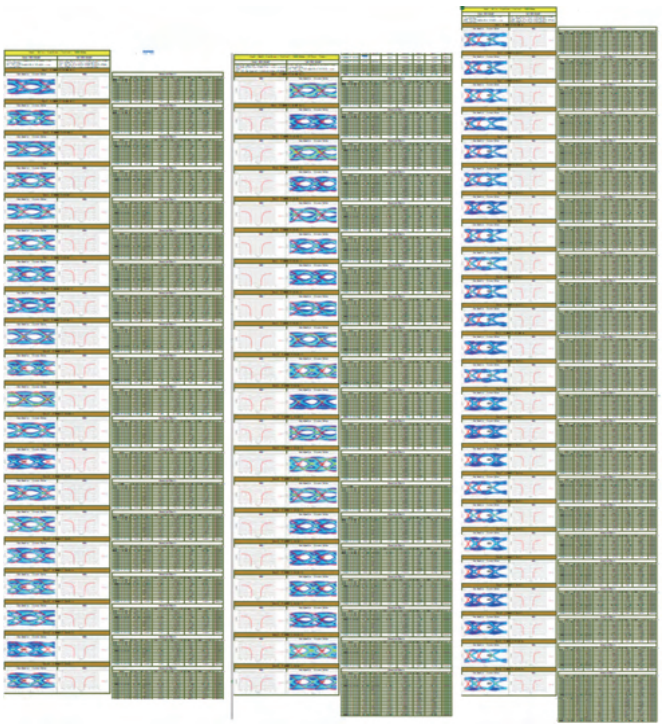
Case study 2 : AI chip channel

ACVS Ch. Verification solution
(GDDR6 total : ~10hours)



Basic-SI : 2h. 40m (GDDR6 Byte0~7)

AMI analysis : 6h. 30m (GDDR6 byte~7)

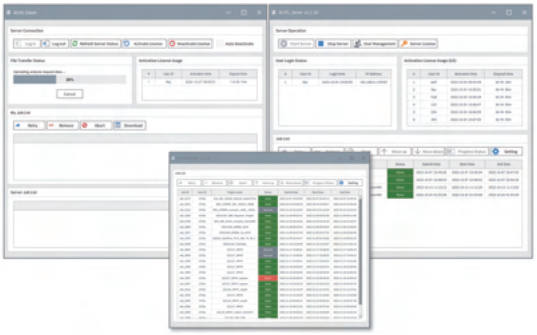


Byte0 Write Byte0 Read Byte01 CA

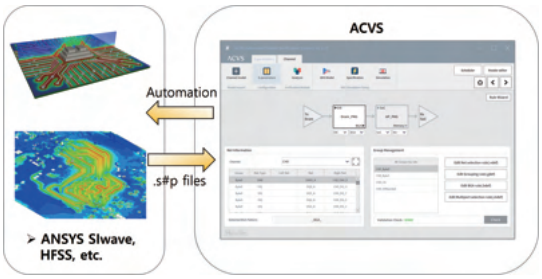
- AI Chip Complexity : PCIe Gen5(32Gbps x 32ch.), GDDR6(16Gbps, > 300 I/O nets), HBM3(6.4Gbps, 1024 I/O nets)
- Full Ch. X-talk sum, TDR, BER/Eye Verification needed.
- ACVS ensures higher efficiency and stability for the channel verification. (without time and human error issues)

ACVS Advanced Channel Verification System for (LP)DDR4/5, GDDR6, HBM, SerDes

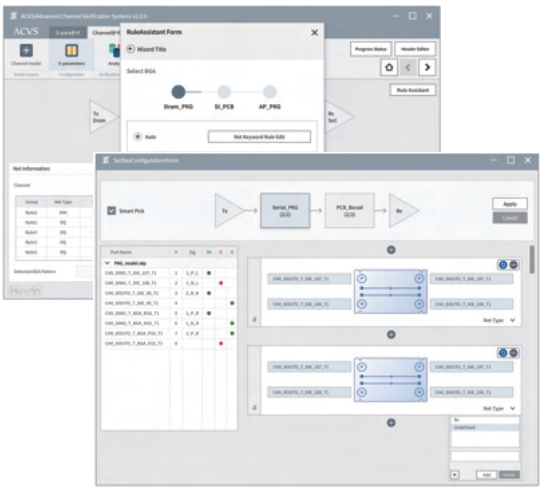
ACVS 2023 new features



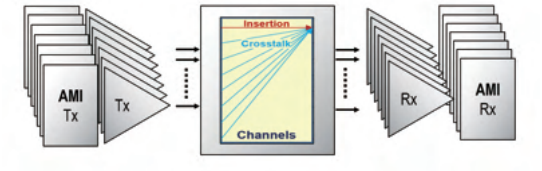
ACVS Server-Client: Multiple ACVS clients can utilize a single ACVS server.



EM automation : Seamless automation for ANSYS SIwave, HFSS in the channel verification.

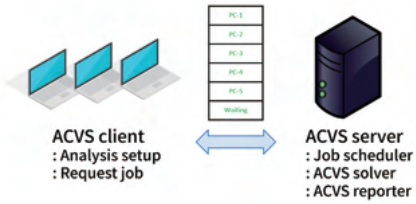


Rule assistant : Deep learning-based channel configuration. New SerDes UI: Support 'Smart Pick'



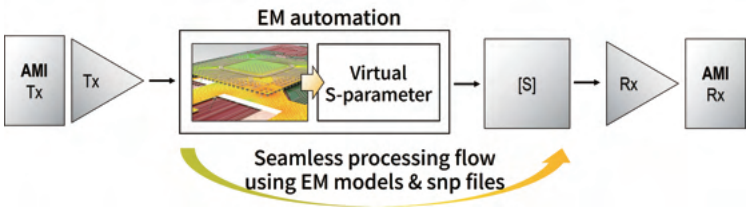
The world 1st full X-talk automation in the SerDes AMI simulation. (2023.3Q)

ACVS Server-Client (option)



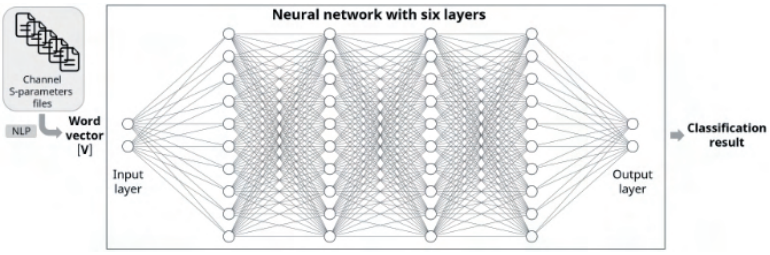
- Analysis setup using the ACVS client in each user's PC.
- Analyzing and reporting by the ACVS server.

EM Automation (option)



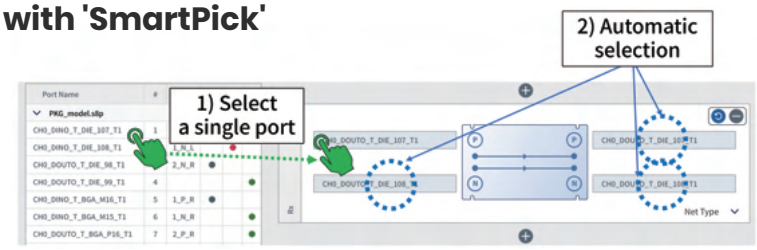
- ANSYS SIwave, HFSS automation in the ACVS.
- For the channel configuration, the virtual S-parameters can be generated using 3D EM models.
- For analyzing the channel, the actual S-parameters can be extracted using EM automation.

Rule assistant



- Automatic channel configuration using deep learning.
- Port setting is not required for analyzing the memory channel using the ACVS.

New SerDes channel configuration UI with 'SmartPick'



- SerDes channel configuration using drag & drop the ports.
- SmartPick : Select a single port and automatic selection the rest of the ports in the differential channel.

New SerDes channel configuration UI with 'SmartPick'

- No additional tasks are not required, such as complex setups in a schematic editor for analyzing each X-talk case.
- Like the DDR5/GDDR6 cases, SimX enables fast and accurate analysis in the full X-talk SerDes AMI simulation.

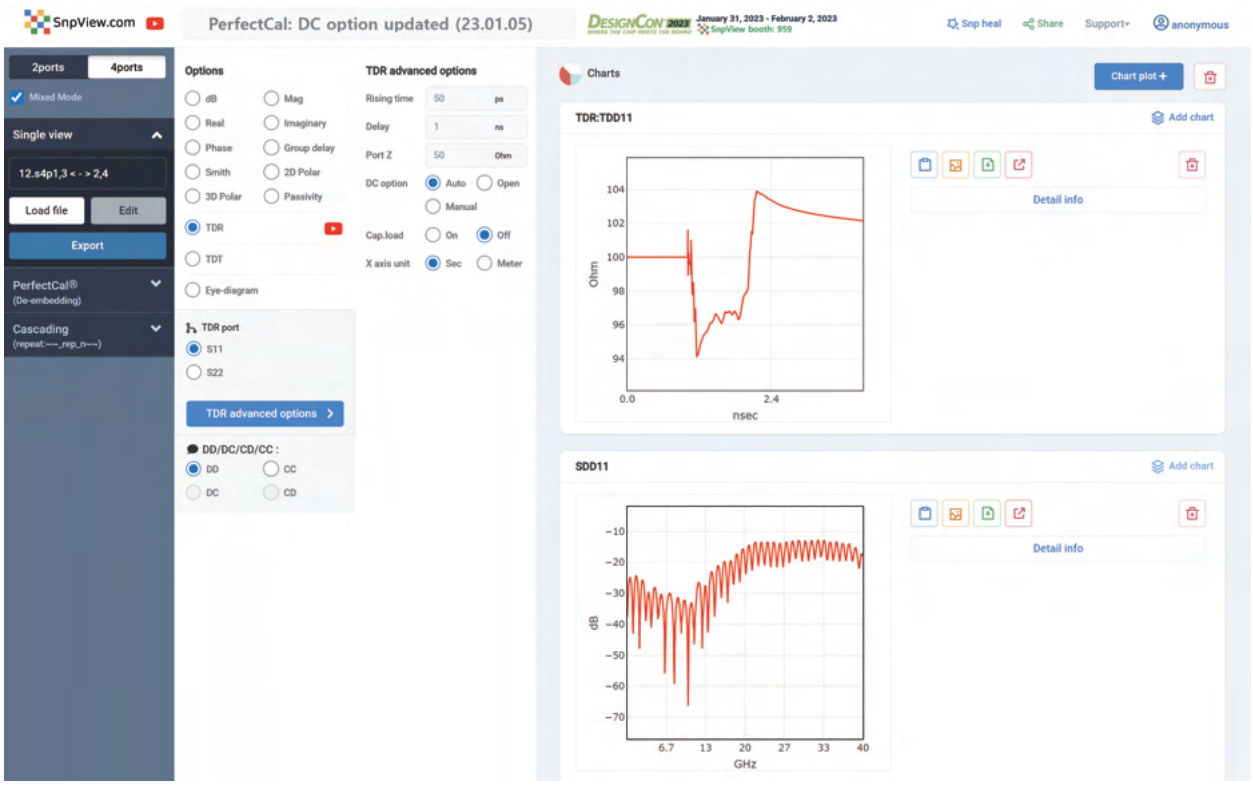
SnpView.com Easy, Fast and Accurate Channel Analysis Service

Channel analysis using S-parameters is costly and time-consuming. First, a high-performance computing server and channel simulator are required. In addition, the complex setup of the simulation and long computation time increase the verification time of the channel. To overcome this limitation, Snpview.com provides a web-based channel analysis service. Various analyses of the channel can be provided using only the local PC and web browser. In addition, newly developed time-domain analysis methods ensure fast and accurate channel analysis. It supports most of the analysis methods required for channel analysis, such as TDR, TDT, and eye-diagram.

Snpview.com is a web-based channel analysis solution. Channel analysis can be performed anytime and anywhere with a web browser without the need for expensive computing servers. Newly developed time-domain analysis methods provide fast and accurate channel analysis results. Currently, it offers most of the analytical methods required for channel verification and will support Web SerDes simulation (2023. 3Q).

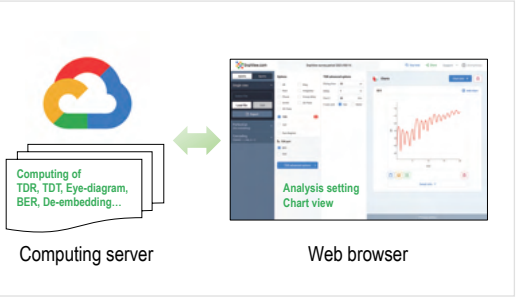
Key Benefits

- Easy view of S-parameters
- Fast and accurate time domain analysis methods
  : TDR, TDT, eye-diagram, BER
- PerfectCal®
  : Thru fixture de-embedding
- Enforcing causality and passivity of S-parameters
  : Heal function
- Share analysis results
- Web SerDes channel simulation (2023. 3Q)

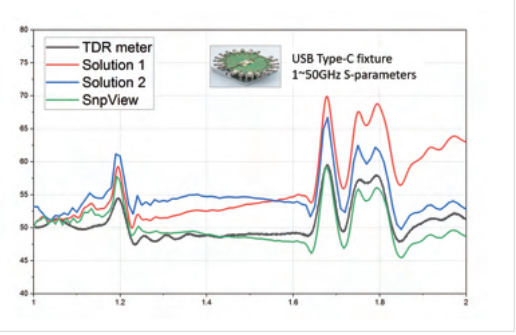


SnpView.com : Web based channel simulation
(Support chrome browser)

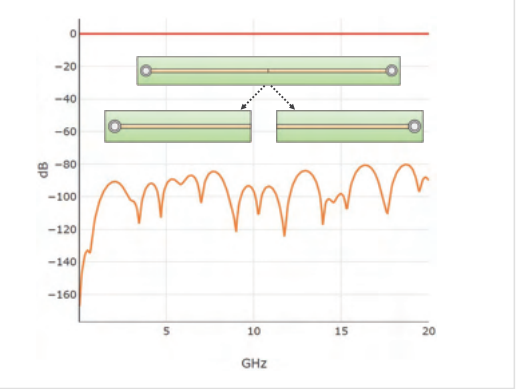
SnpView.com Easy, Fast and Accurate Channel Analysis on Web



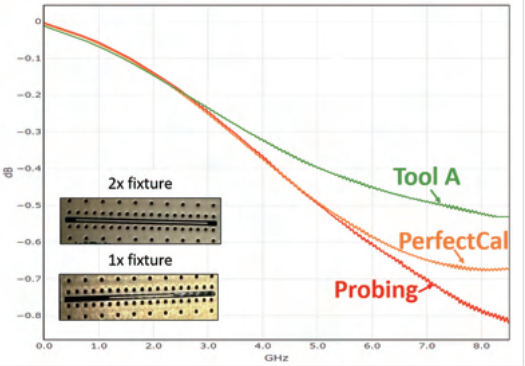
Architecture of the Snpview.com



Comparison of TDR accuracy
: Hardware TDR meter vs each solution's result



PerfectCal®
: Half gating from 2x thru fixture to 1x fixture.
: Support de-embedding function.



Comparison of characterization accuracy

- Probing result vs each solution's result
- 2x thru fixture: CPWG 10mm with FR4
- 1x fixture: CPWG 5mm with FR4
- Probe: GGB 250um GSG microprobe
- Instrument: Keysight 8GHz VNA

Efficient way for channel analysis

Usually, channel analysis is expensive and time-consuming. First of all, channel simulator and high-performance computing servers are needed for analysis. In addition, complicated analysis settings and long simulation times for channel analysis increase the development time of the system. Snpview.com is a web-based channel analysis solution that provides analysis results anytime and anywhere without the limitations of the computing environment.

- **Computing on the Snpview server**
- **Unnecessary for high performance PC**
- **Required only 'Chrome' or 'Edge' web browser**
- **Easy setup for channel analysis**

Fast and accurate time domain methods

More sophisticated techniques are required to conduct time-domain analysis using S-parameters. Snpview.com offers the following methods to maximize the efficiency and accuracy of time-domain analyses.

- **Band-limited S-parameter to causal time response**
  : Most of the S-parameters obtained through measurement or simulation are of limited bandwidth. Under these S-parameter conditions, the extrapolation method is applied to ensure the accuracy of transient simulation results. The extrapolation method developed by Huwin enables conversion to causal time response while maintaining the inherent characteristics of the band-limited S-parameter.
- **TDR and TDT**
  : Impedance and transmission in time-domain.
- **Fast eye-diagram estimation**
  : Fast and accurate estimation of worst-case eye-diagrams is possible using the channel system's step response and optimization algorithms.
- **Fast BER estimation**
  : Fast and accurate BER estimation are possible using the channel system's step response and statistical approach.
- **PerfectCal® : Thru fixture de-embedding**
  : Supporting an accurate half gating function for the thru-fixture structure. Therefore, the de-embedding of the fixture-DUT-fixture structure is possible.
- **Web SerDes channel simulation (2023. 3Q)**
  : The time domain simulation of SerDes channel with the accurate impulse responses, Tx/Rx EQ, jitter and noise.

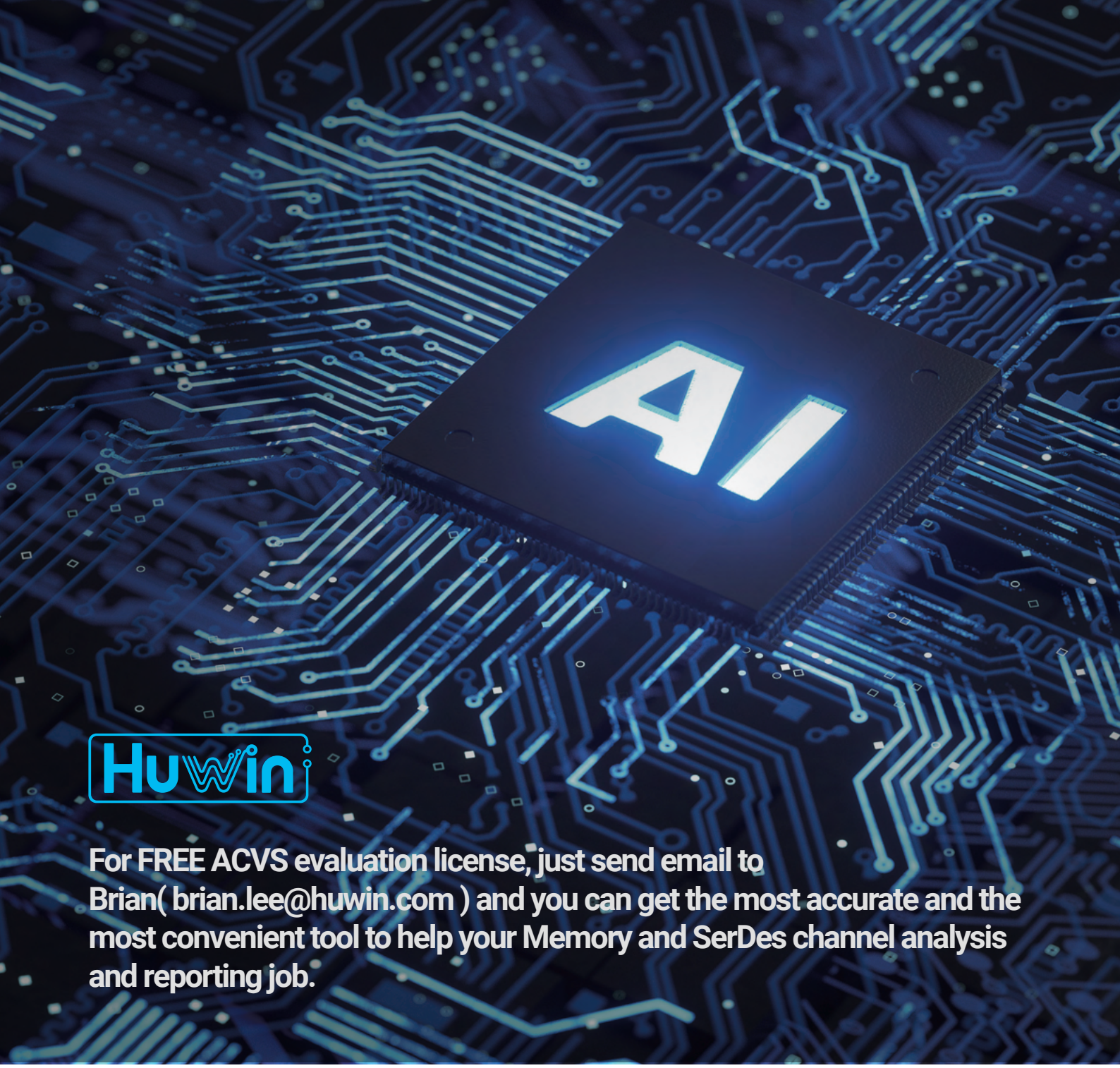
Additional functions for user convenience

- **Heal function**
  : Supporting the function to enforce causality and passivity of S-parameter.
- **Sharing analysis results**
  : Sharing S-parameters and analysis results. An open link can be created and sent to other users.

TDR accuracy

PerfectCal

SnpView demo



Huwin

For FREE ACVS evaluation license, just send email to Brian(brian.lee@huwin.com) and you can get the most accurate and the most convenient tool to help your Memory and SerDes channel analysis and reporting job.

Huwin

510 Kinstower
Bundang, Sungnamsi
South Korea

Contact

brian.lee@huwin.com

'HUWIN KOREA'

'Huwin'

www.Huwin.com

Huwin Solutions

ACVS

· Full automation of channel verification

ACVS-GSI

· SerDes channel analysis
· ANSYS SIwave automation
· Report automation

Snpview.com

· Web-based channel simulator and Thru-fixture gating for de-embedding