

# **Advanced System LSIs for Home 3D Systems**

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# Agenda

## **1. Overview of 3D Systems**

- Principles of 3D Imaging
- Frame Sequential Method

## **2. Advanced System LSIs for Home 3D**

- Integrated Platform UniPhier
- System LSIs for 3D TV and Blu-ray 3D

## **3. Supporting Technologies and Our Efforts**

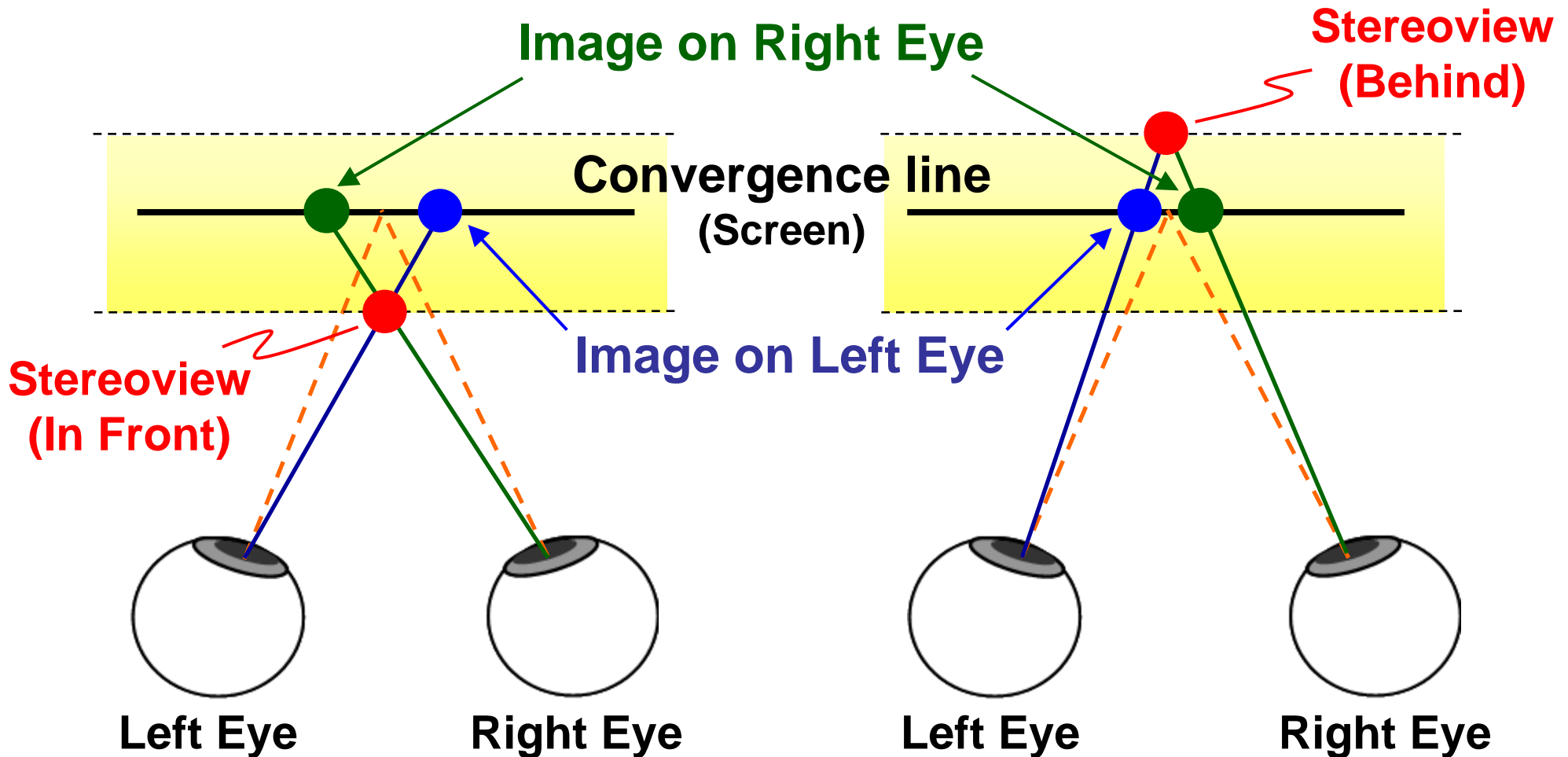
- Realization of MPEG-4 MVC Decoding
- Efficiency of System LSIs for Blu-ray Recorders
- System Emulators

## **4. Conclusion**

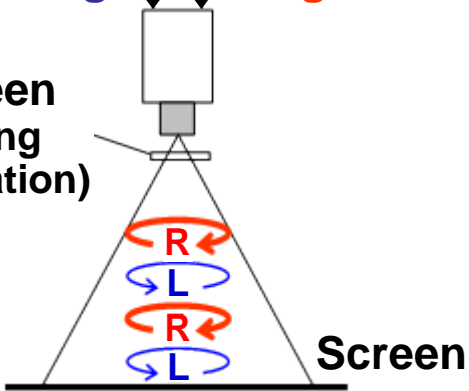
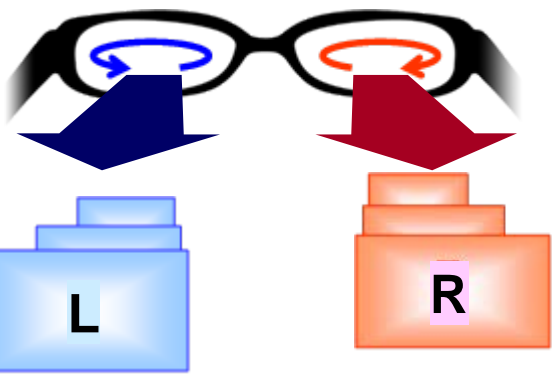
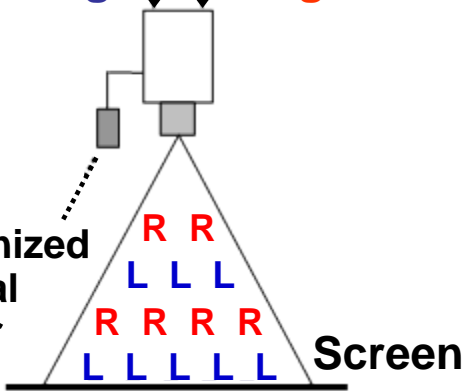
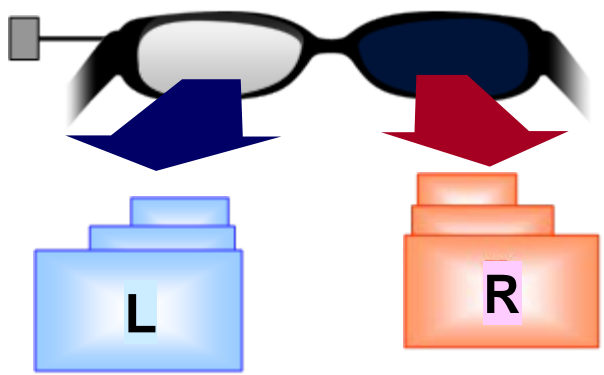
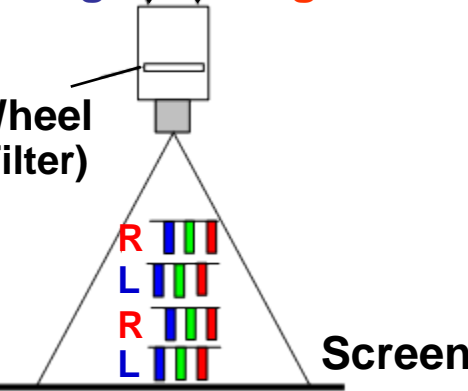
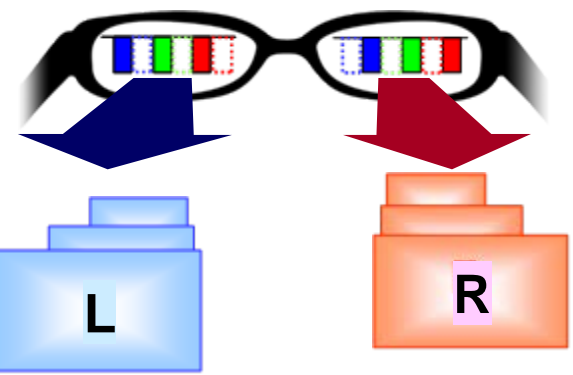
# Principles of 3D Imaging

Our brains synthesize 3D image from parallax

=> Difference between images on the left and right eyes



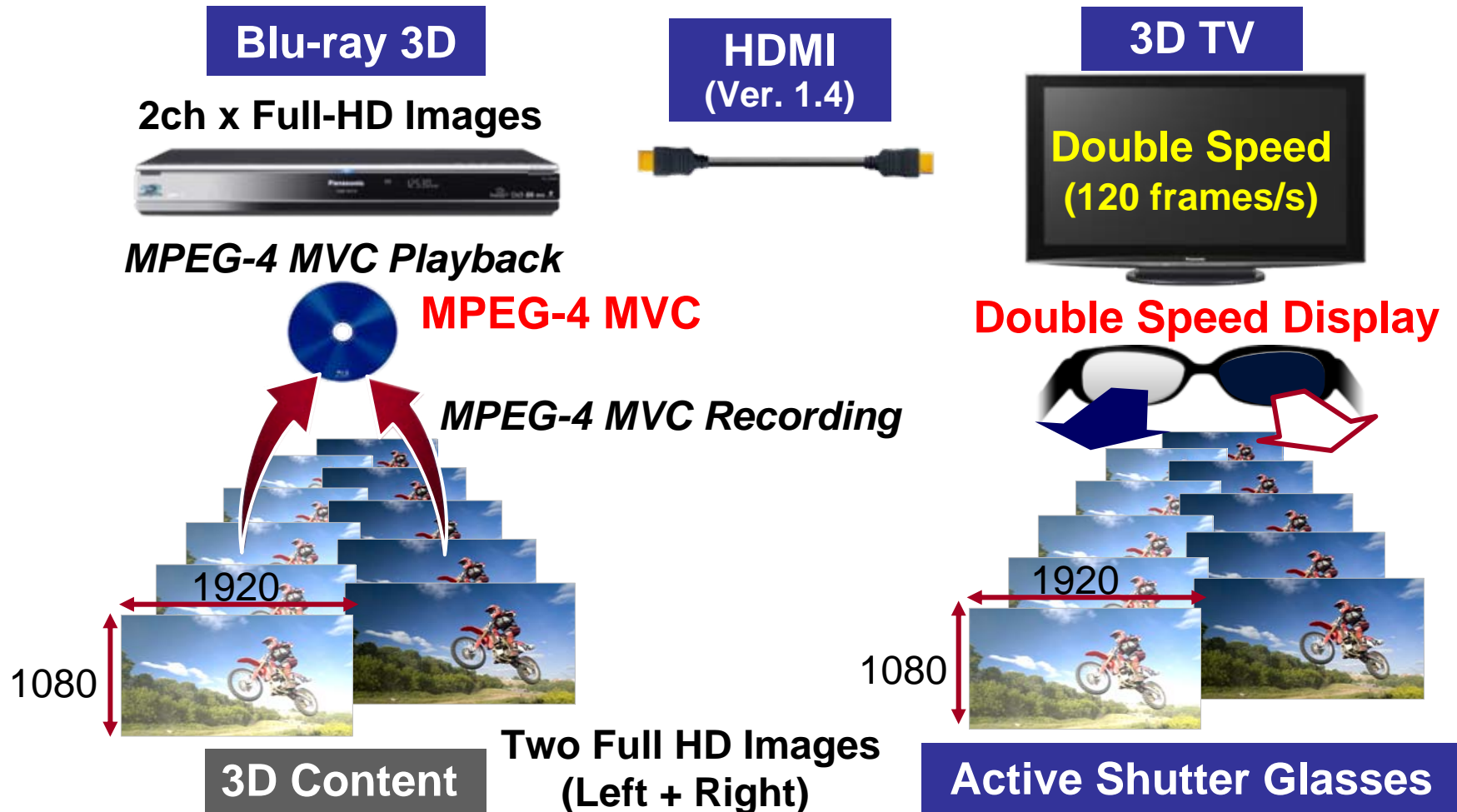
# Eyeglasses Approaches for Theater

Polarized Method	Active Shutter Method	Color Separation Method
<p data-bbox="207 349 559 442">Left Image Right Image</p>  <p data-bbox="41 506 300 635">ZScreen (Switching Polarization)</p> <p data-bbox="518 771 673 806">Screen</p> <p data-bbox="51 878 673 928">Circular Polarized Glasses</p>  <p data-bbox="165 1220 207 1270">L</p> <p data-bbox="518 1220 559 1270">R</p>	<p data-bbox="880 349 1232 442">Left Image Right Image</p>  <p data-bbox="704 664 963 749">Synchronized Signal</p> <p data-bbox="1181 771 1336 806">Screen</p> <p data-bbox="756 878 1295 928">Active Shutter Glasses</p>  <p data-bbox="839 1220 880 1270">L</p> <p data-bbox="1191 1220 1232 1270">R</p>	<p data-bbox="1543 349 1895 442">Left Image Right Image</p>  <p data-bbox="1377 535 1636 621">Color Wheel (Wave Filter)</p> <p data-bbox="1864 771 2020 806">Screen</p> <p data-bbox="1471 878 1937 928">Wave Filter Glasses</p>  <p data-bbox="1502 1220 1543 1270">L</p> <p data-bbox="1875 1220 1916 1270">R</p>

# Home 3D System Using Frame Sequential Method

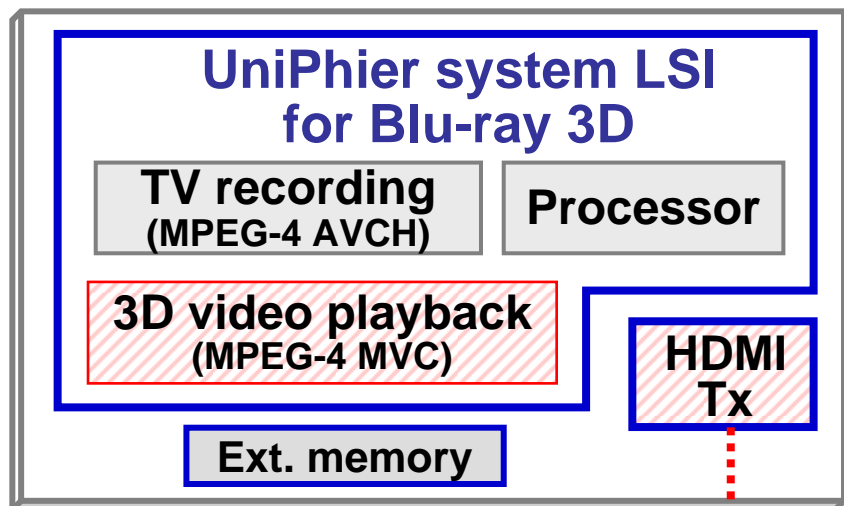
## Full HD 3D system components :

- Blu-ray 3D device (MPEG-4 MVC-compliant)
- 3D plasma TV (2x speed display)
- HDMI version 1.4
- Active shutter glasses



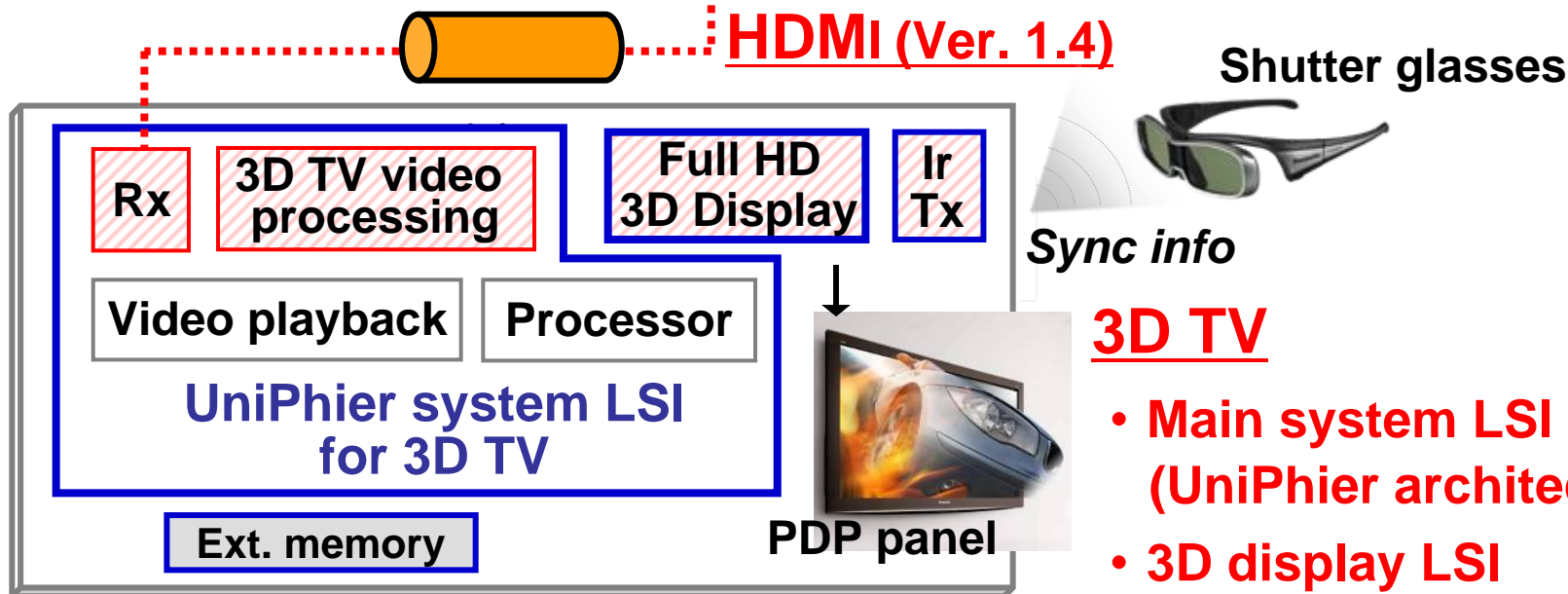
# Overview of Home 3D System Using 3D LSIs

3D technologies were implemented into a suite of system LSIs



## Blu-ray 3D device

- Main system LSI (UniPhier architecture)
- HDMI Tx LSI (Ver. 1.4)

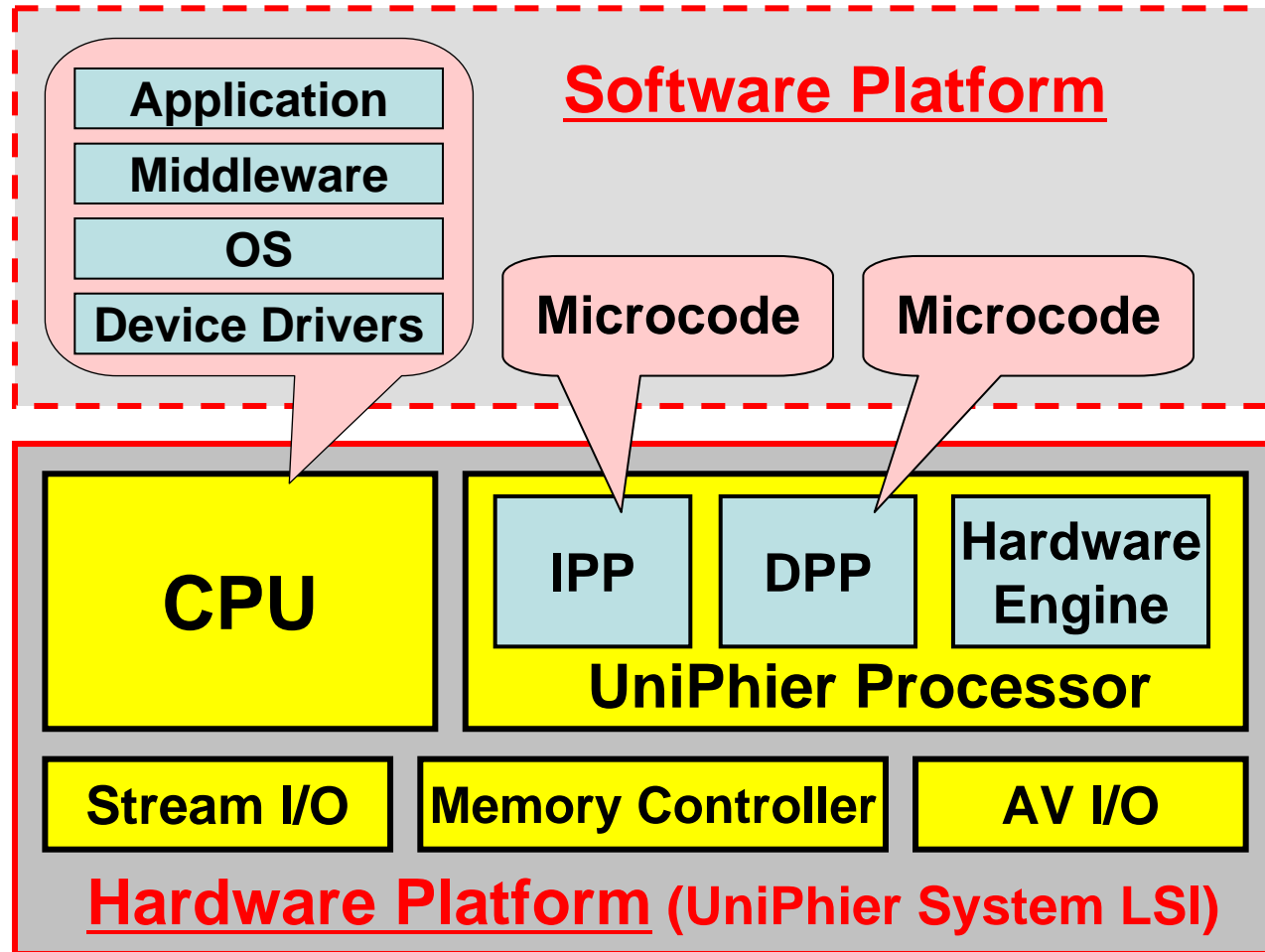


## 3D TV

- Main system LSI (UniPhier architecture)
- 3D display LSI

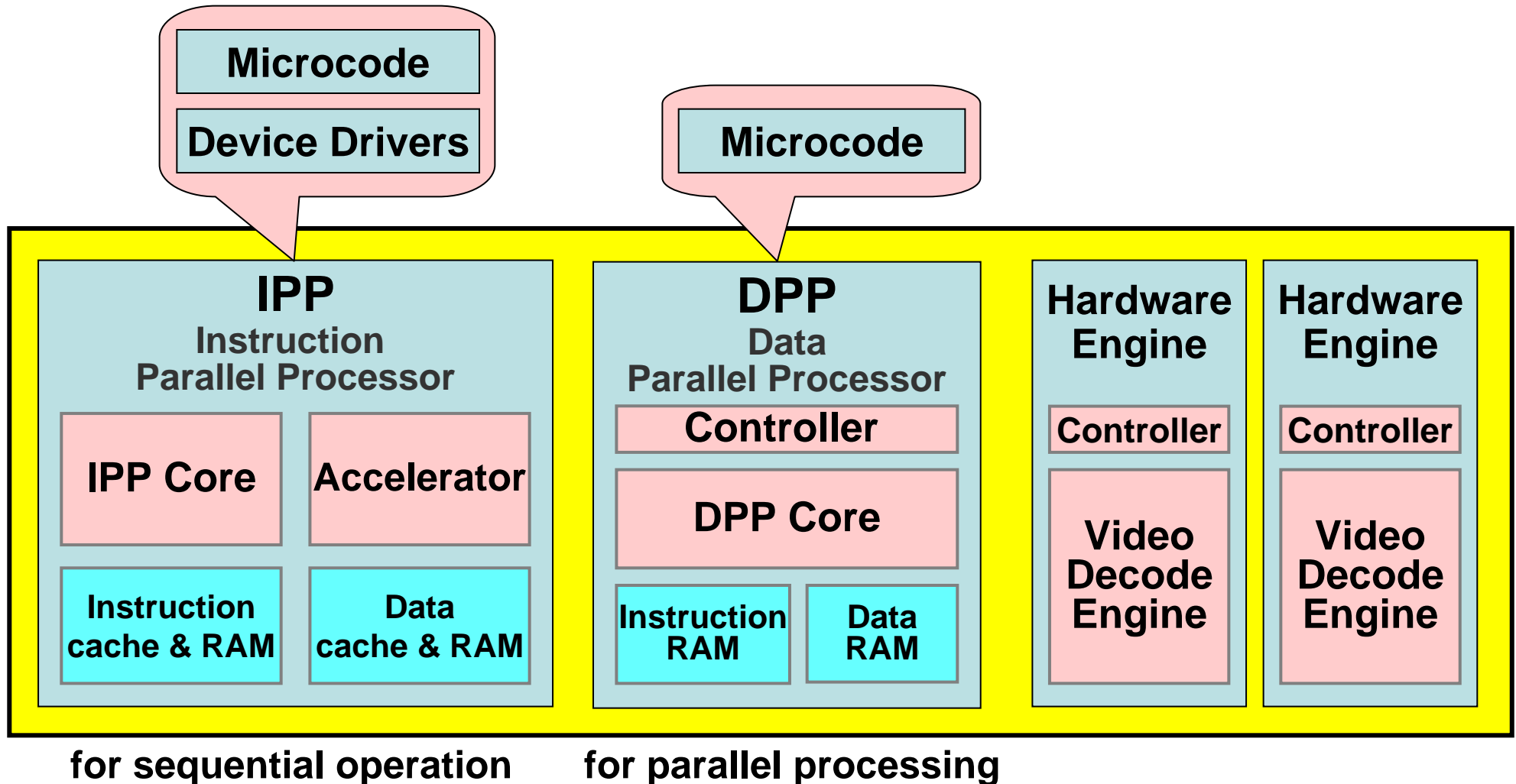
# Structure of UniPhier Platform

UniPhier is built from a software and a hardware platform  
UniPhier system LSIs are based on the same architecture



# Structure of UniPhier Processor

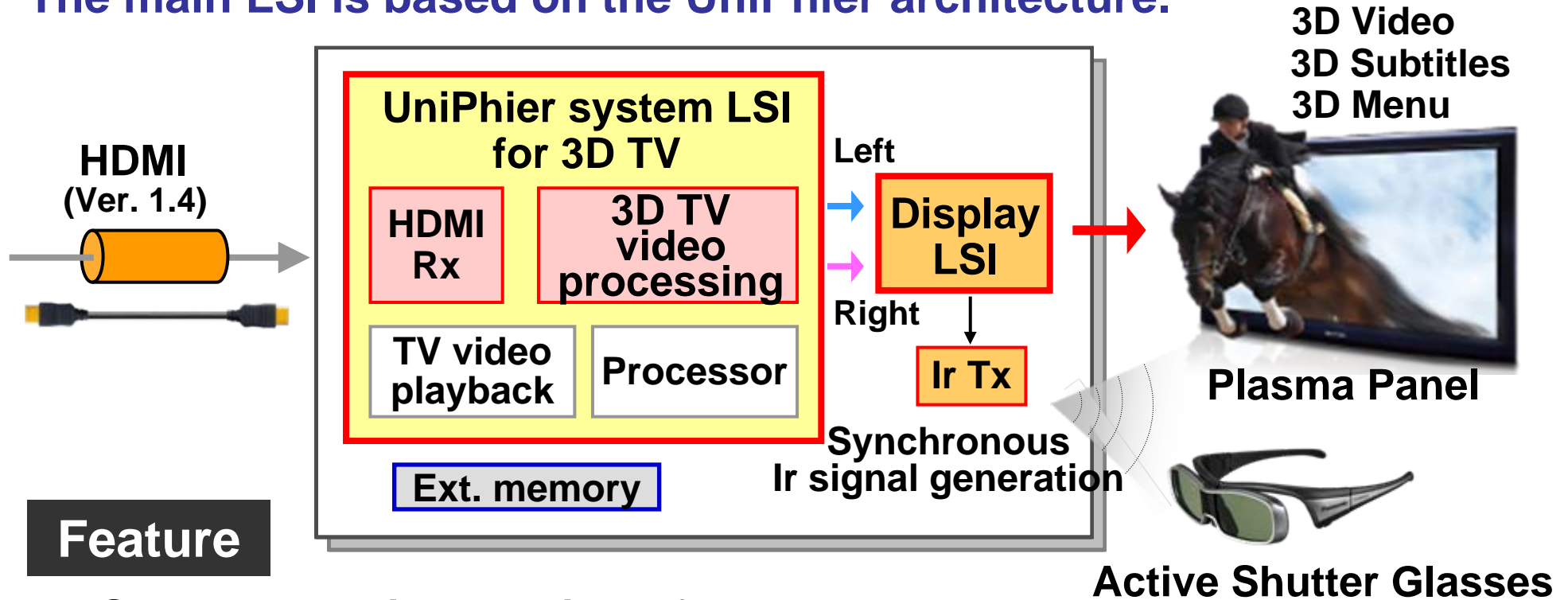
The UniPhier processor is the key module for media processing  
3D MPEG4-MVC function was achieved by using these mechanism





# Structure of System LSI for 3D TV

The main LSI is based on the UniPhier architecture.

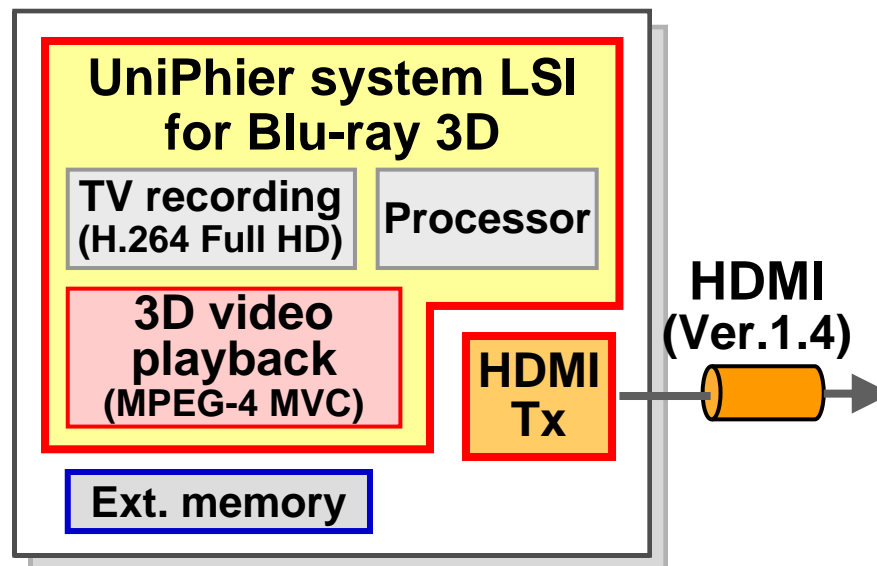
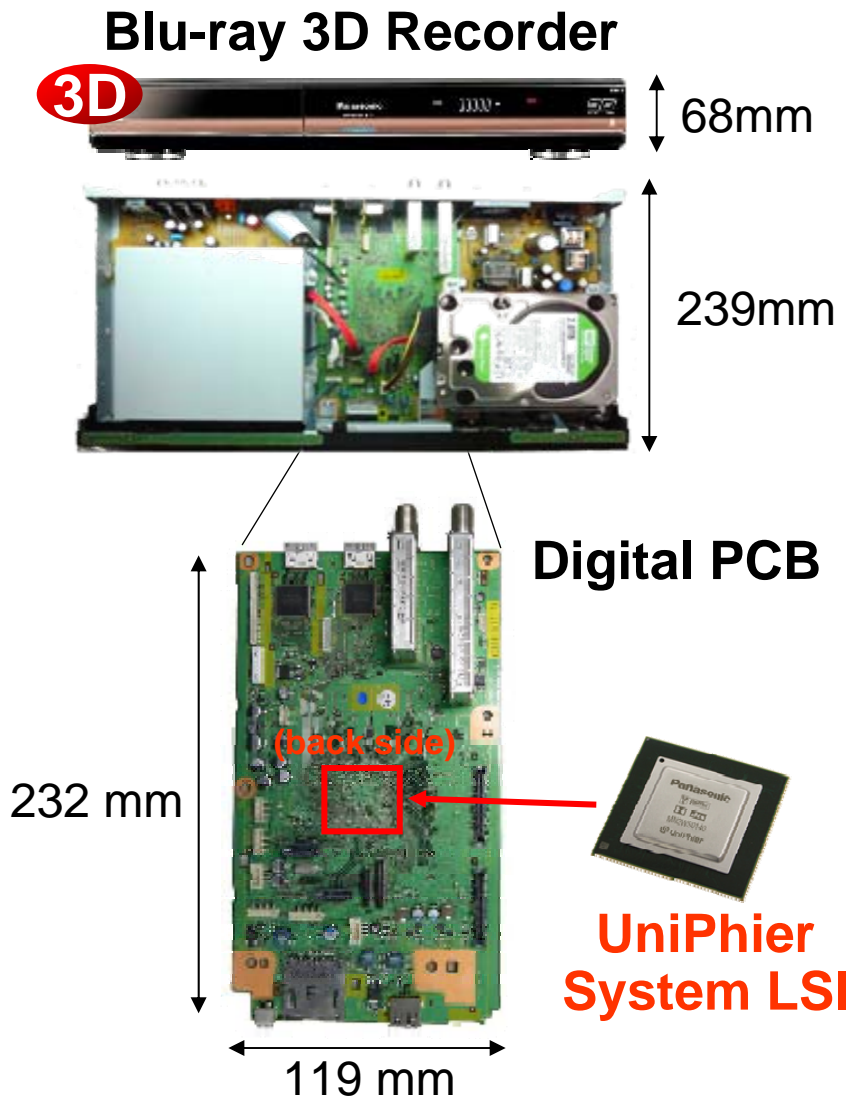


## Feature

- Supports multiple 3D signal formats
  - For broadcasting
  - For storage devices
- 3D graphics / 3D OSD overlay
- 3D high-quality pictures
- High-performance processor @600 MHz

# Structure of 3D Blu-ray Recorder/Player

1-chip solution for Blu-ray recorder with 3D support,  
achieving compact chassis and low power



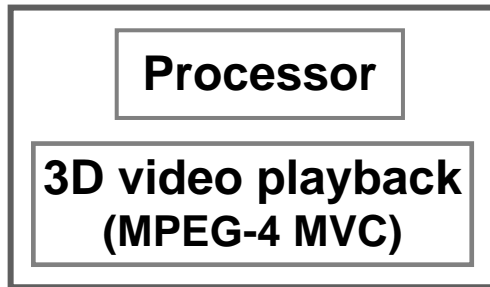
## Feature

- Double Full HD decoding (MPEG-4 MVC)
- 3D graphics / 3D OSD overlay
- 3D high-quality pictures
- Double H.264 encoding
- SMP CPU @ 500 MHz

# Overview of HDMI LSI

## HDMI LSI transmits 3D data with copyright protection

### UniPhier system LSI for Blu-ray 3D



3D Structure

Video Data  
Left/Right

Audio Data

### HDMI Transmitter LSI



HDMI cable

### Feature

- HDMI 1.4a compliant
  - Support for Blu-ray 3D formats
  - Max transfer rate: 2.25 GHz x 3ch
- Encryption : HDCP Ver1.4
- Multiple 3D formats available
  - Frame sequential, side-by-side, line-by-line, etc.

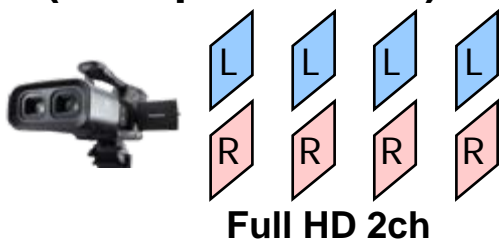


# Overview of MPEG-4 MVC Processing

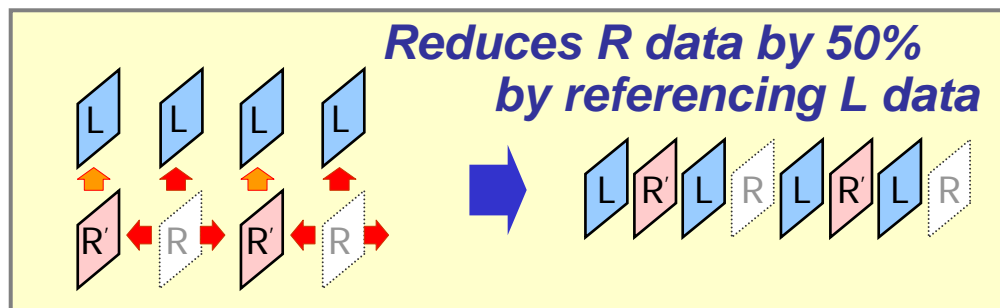
Expansion of MPEG-4 AVC spec; reduced data size of 3D content.  
Maintains compatibility with legacy players; 2D playback on left video.

## 3D Imaging

(Disc production)



## 3D Encoding



Blu-ray 3D disc

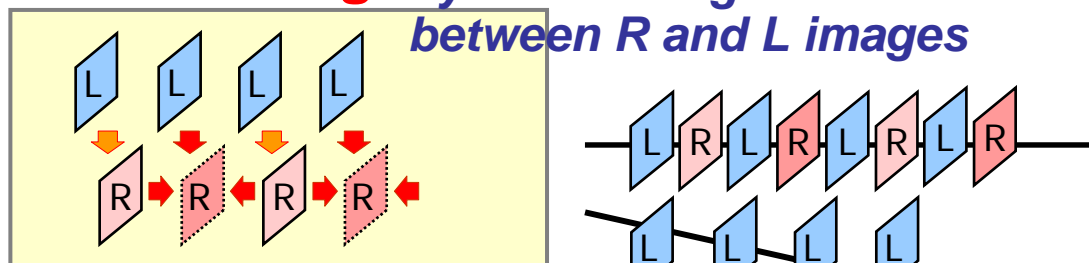


## Playback

Blu-ray 3D Player



## 3D Decoding



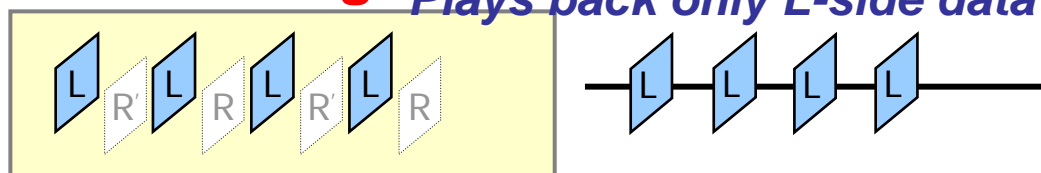
3D TV



Blu-ray Player



## 2D Decoding

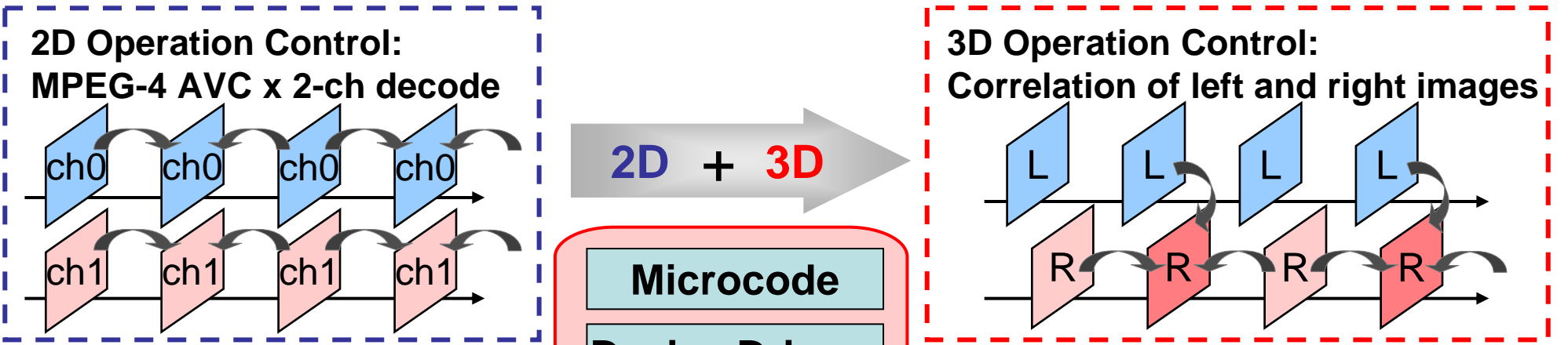


2D TV

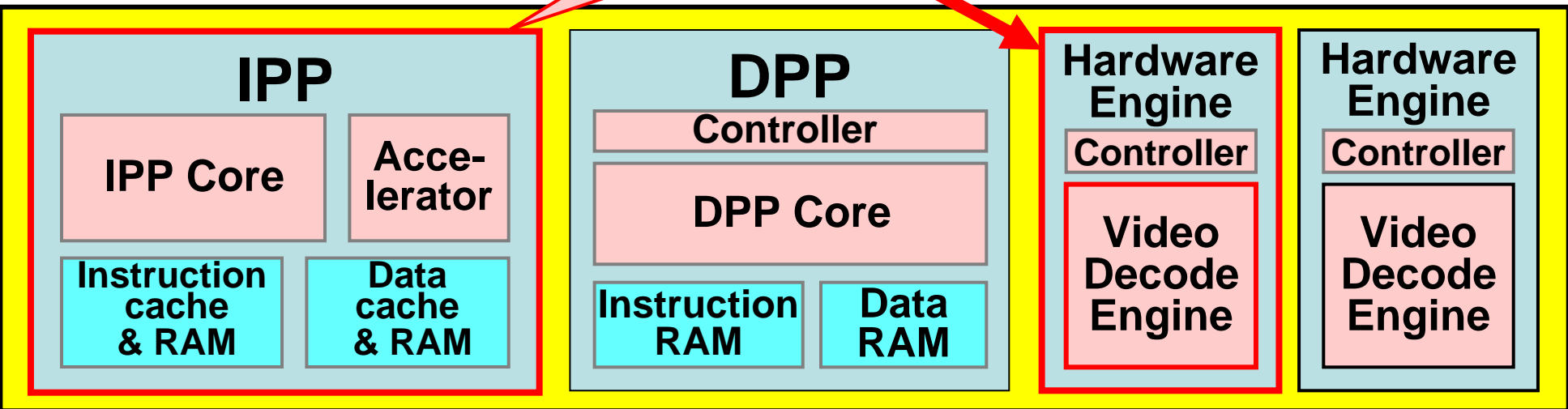


# MPEG-4 MVC with Hardware Engine and Software Processing

MPEG-4 MVC decoding was achieved through a combination of hardware and software processing



- 1) Decode processing start
- 2) Control of data input and output



# Improvement of Blu-ray Recorder through LSI Integration

Enhanced UniPhier delivers compact chassis and low power

2006 Year 2D Model



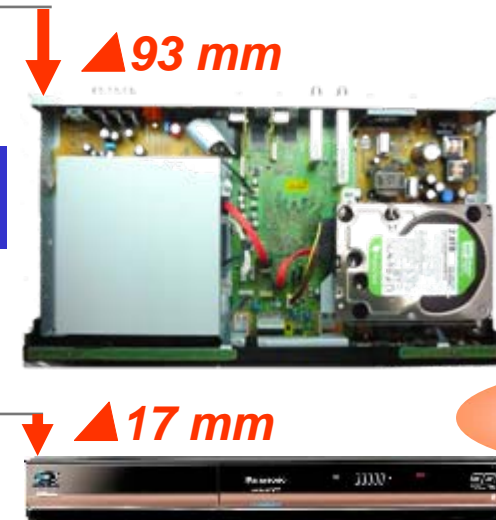
W 430 x D 332 mm

Power: **56 W**

H 85 mm

3D

3D Model



W 430 x D 239 mm

Power: **33 W**

10x long time  
W recording

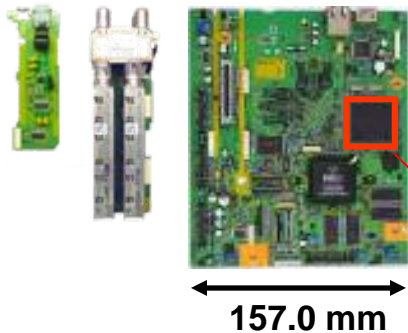
H 68 mm

▲ 23 W

Power  
▲ 41%  
Volume  
▲ 42%

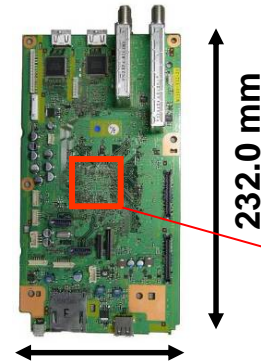
Modem / Tuner / Digital PCB

Digital PCB



4 main LSIs  
3 PCBs

UniPhier System LSI  
for MPEG-2



1-chip super Integration  
1 PCB

UniPhier System LSI  
for MPEG-4 MVC



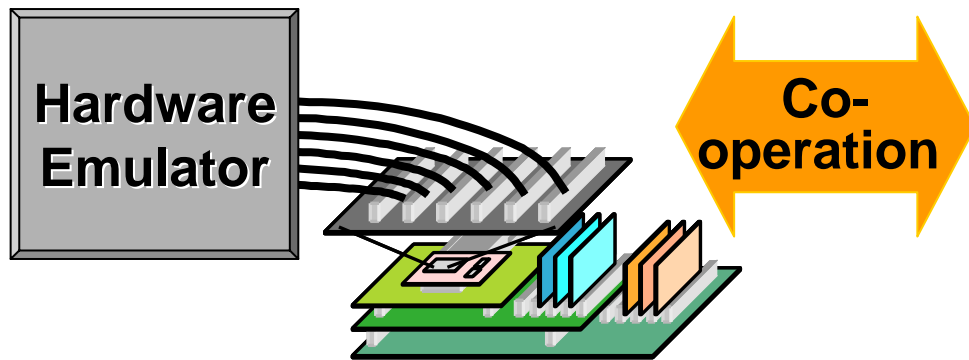
# System Emulator for Microcode Development

System emulator was used for

- 1) Microcode development in parallel with the LSI development
- 2) Verification of system LSI
- 3) Confirmation of system validity and necessary performance

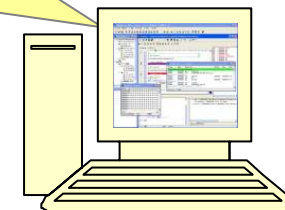
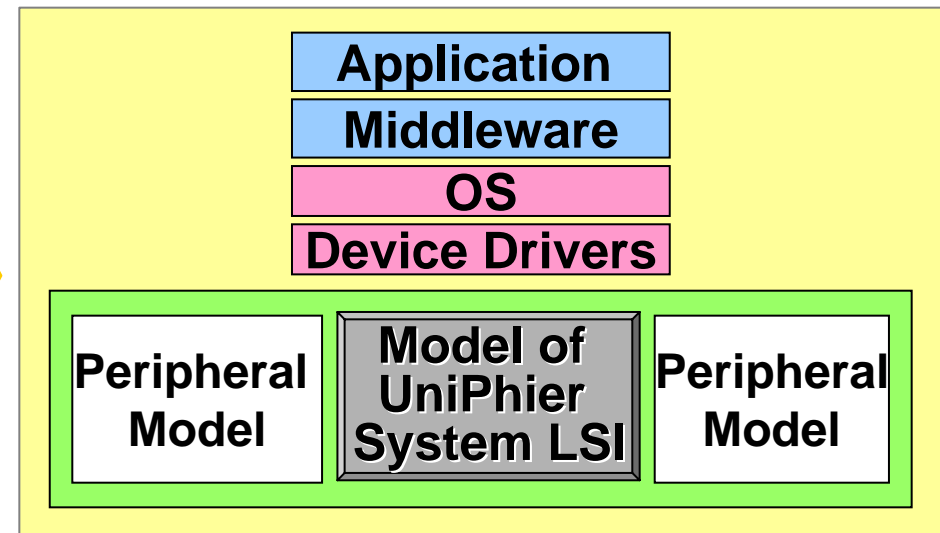
## Hardware Emulator

Mapping of LSI Circuit



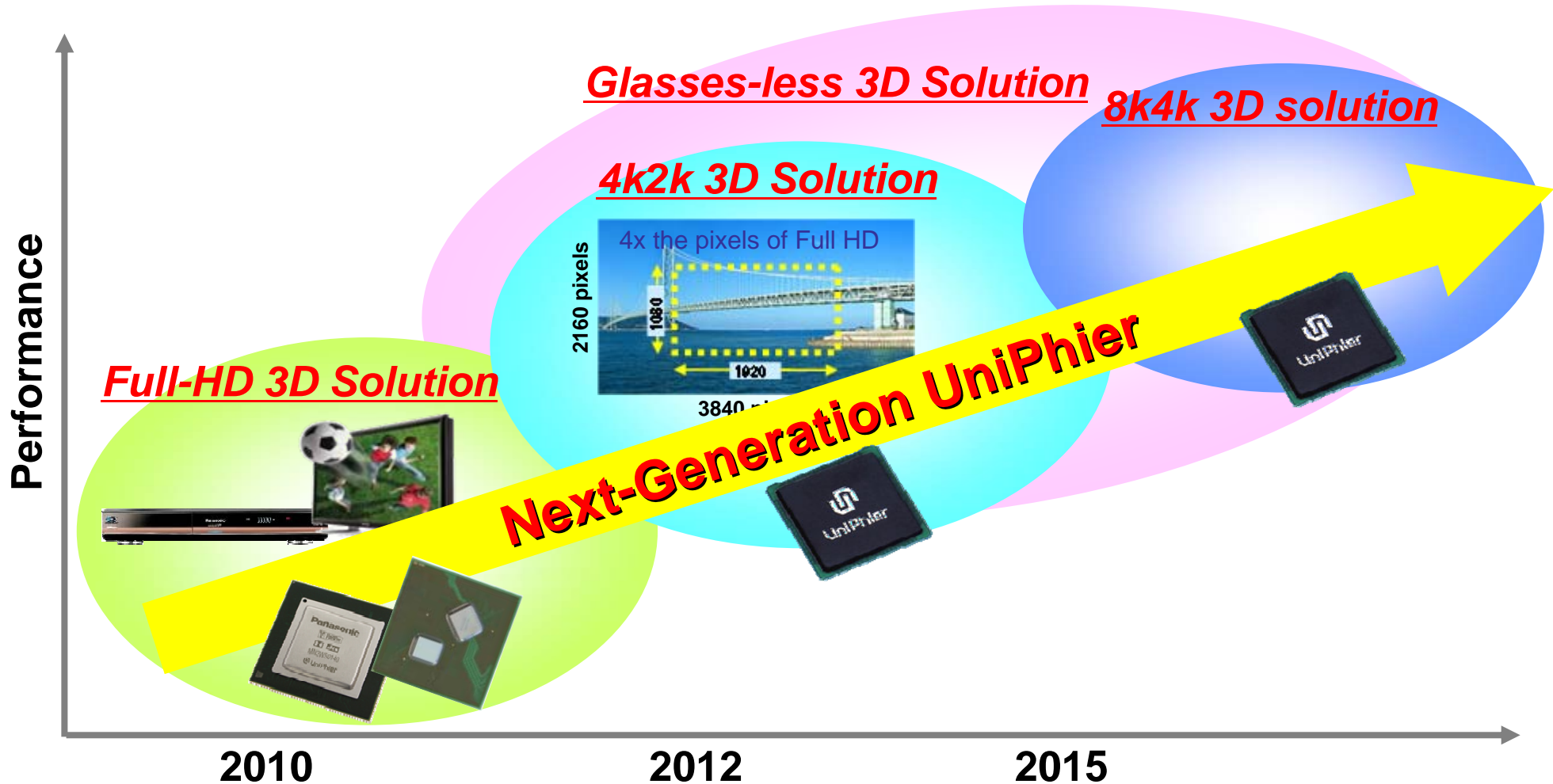
System emulation before ES  
by connection to the evaluation board

## Software Simulator



# Conclusion

We continue to evolve the UniPhier for future applications, 4k2k, glasses-less 3D, network and more future 8k4k





# Thank you for your attention.

