

Series: New Super Hi-Vision (SHV) Devices—For SHV Public Viewings of the London 2012 Olympics

This series of three articles introduces our latest devices constructed in time for use in the scheduled public viewings of Super Hi-Vision (SHV) programming from the London Olympics.

Transmission System -SHV high-efficiency video coding system



Nao Nakajima, Advanced Television Systems Research Division

NHK held public viewings of the London 2012 Olympics using the Super Hi-Vision (SHV) system. SHV is an advanced, next-generation television system that is being developed by the Science & Technology Research Laboratories. It boasts ultrahigh-definition video with 33 million pixels (7,680 horizontal × 4,320 vertical pixels) and a highly realistic 22.2 multichannel audio system, which together allowed viewers to experience a sensation of presence as if they were at the site of the Olympics.

We deployed SHV systems at public viewing (PV) locations in the U. K., U. S., and Japan. The SHV contents presented at each PV location was transmitted over an IP network from Games

sites in London (Figure). The extremely large amount of data contained in an SHV video signal were compressed using STRL's high-efficiency video coding system (Picture) for IP transmissions. This system encoded at a very high compression rate and maintained the high quality picture unique to SHV video. Table 1 shows an overview of the system.

The coding system consisted of a coding device located in London and decoding devices installed at the various PV locations. To attain real-time data compression, SHV video signals were divided into eight parts, after which parallel coding was performed on each of the one-eighth video signals. These divided, compressed video

signals were multiplexed into an MPEG-2 TS for transmission to each of the PV locations via IP networks. An individual PV location performed the decoding, a reversal of the process performed in the coding device, using its decoder for the SHV video signal output. The eight coding units were synchronized for operation. The eight decoding units in each decoding device also worked synchronously. This synchronous operation enabled output of natural-appearing SHV video at the PV locations, and the viewers were not able to detect any incongruity from the segmented processing.



Figure: IP transmission route



Picture: SHV high-efficiency video coding system exterior

Table: SHV high-efficiency coding system overview

Coding method	AVC/H.264 High Profile
Video ES bit rate	48-256 (Mbps)

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Super Hi-Vision Display Systems

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NHK, together with the Olympic Broadcasting Services (OBS) and the British Broadcasting Corporation (BBC), provided public viewings (PV) of Super Hi-Vision (SHV) broadcasts from the London Olympics, starting in July 2012. The broadcasts were shown at multiple locations in the U. K., the U. S., and Japan. Viewers of SHV experienced the excitement of the London Olympics with the same sensation of presence that they would have were at the site, thanks to SHV's ultrahigh-definition video with 33 million pixels (7,680 horizontal × 4,320 vertical pixels) and realistic 22.2 multichannel audio system. This article introduces the SHV display systems to be used for this public viewing.

While the display systems varied by location, they basically

consisted of two types of display, a large screen with a projector and a direct-view LCD to represent a home SHV viewing style. Picture 1 and Table 1 show an example of the projector that was used at a PV site. Although this projector uses an 8-million-pixel device, which is equivalent to half of a full-specification SHV image (horizontally/vertically), the incorporation of an “e-shift device” to realize a pixel shift function will make it capable of displaying an image quality that is equivalent to the full-pixel SHV video. Its smaller size and lighter weight in comparison with that of the previous SHV projectors will make its installation and adjustment relatively simple. The PV sites invited visitors to experience the Olympic competitions through the powerful SHV video projected on a large screen.

Picture 2 and Table 2 provide the specifications for the direct-view LCD to be used at the PV locations. This 85-inch LCD is capable of presenting the full pixels of SHV video. The high-definition images of the Olympic Games presented on this display gave PV visitors a taste of what future home viewing in SHV would be like.

* e-shift device: a double refraction device capable of switching between light that travels in a straight line and light that is refracted by 0.5 pixels horizontally and vertically in a time-sharing manner. This device makes it possible to effectively double the vertical and horizontal resolution.



Picture 1: Compact SHV projector

Table 1: Compact SHV projector specifications

Display device	1.3-inch Liquid Crystal on Silicon (LCOS) device number of pixel: 3,840×2,160
Resolution	7,680×4,320 pixels equivalent
Light output	3000 ANSI lumen
Gray-scale	RGB 12 bits each
Size	660(W)×783(D)×342(H) mm



Picture 2: SHV 85-inch LCD

Table 2: SHV LCD specifications

Display size	85 inch (1.8 m×1.05 m)
Number of pixel	7,680×4,320
Luminance	300 cd/m ²
Gray-scale	RGB 12 bits each

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22.2 Multichannel Sound System for London Olympics SHV Production and Public Viewing

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The SHV program production for the London Olympics involved live production for program screening using three-dimensional sound based on the 22.2 multichannel audio system (hereafter 22.2ch audio). The live production employed STRL's small, 45-cm-diameter, 22.2ch audio, sphere-shaped, one-point microphone (Picture 1) placed near the audience seating area in a sports event site. The microphone picked up three-dimensional sound of cheering spectators. An outside audio production van was equipped with a new mixing desk for the live mixing (a device to produce program sound from multiple microphone signals) using STRL's new 3D sound image panning technology (a technology to allow the sound to be perceived from an arbitrary point in three-dimensional space), as well as a 3D reverberation generation device (device to produce reverberation sound). These audio devices created dynamic sound that was highly-immersive, giving listeners the feeling of being at the Olympic site.

BBC Television Centre's temporary SHV editing studio produced the public viewing programs from 22.2ch audio materials taken at the Olympic

sites. The audio editing was done with a 22.2ch audio production system developed by STRL (Picture 2).

The SHV public viewings were held at locations in Glasgow, Bradford, and London in the U.K., as well as in Tokyo and Fukushima in Japan. They presented videos from the London Olympics on large screens using an SHV projector and 22.2ch sound reproduction system for theater applications. On the other hand, the International Broadcast Centre (IBC) at the Olympics site itself screened SHV coverage of the games using a 145-inch SHV PDP and 22.2ch sound reproduction system for the PDP (Picture 3). Table 1 shows the specifications for these sound reproduction systems. Because the sound reproduction systems used at the UK locations were operated by BBC staff members who did not have much experience with this new equipment, a simplified procedure was designed for them to confirm sound reproduction before and during the screenings.



Picture 1: Compact sphere-shaped 22.2 audio one-point microphone



Picture 2: 3D audio production system



Picture 3: 22.2ch sound reproduction system for 145-inch PDP

Table 1: 22.2ch sound reproduction system

	Theatre sound system	PDP sound system
Sound reproduction scheme	22.2 multichannel sound	22.2 multichannel audio
Loudspeakers	Compression driver tweeter + woofer Max sound pressure: 125 dB SPL	Dome tweeter + woofer coaxial configuration Max sound pressure: 108 dB SPL
Reference sound pressure / -18 dBfs	85 dB (C)	80 dB (C)
Frequency characteristic	65 Hz ~ 20 kHz	50 Hz ~ 20 kHz
Channel mapping	SMPTE2036-2 compliant	SMPTE2036-2 compliant