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The world’s first 3LCD laser projector

VPL-FHZ55 - Technical Background

Welcome

As the world's first 3LCD laser projector, the Sony® VPL-FHZ55 achieves what others can't. Here are all the benefits of laser—plus all the benefits of 3LCD—in a single chassis.

The True Laser light engine means there's no lamp that needs to slowly warm up or cool down, no lamp to limit tilt angle and no lamp to burn out. The 3LCD design means you're not forced to choose between high brightness and high resolution. The projector achieves both, with light output of 4,000 lumens, colour light output of 4,000 lumens and superb WUXGA (1920 x 1200) resolution. The VPL-FHZ55 is a breakthrough; and its underlying technology rewards close examination.

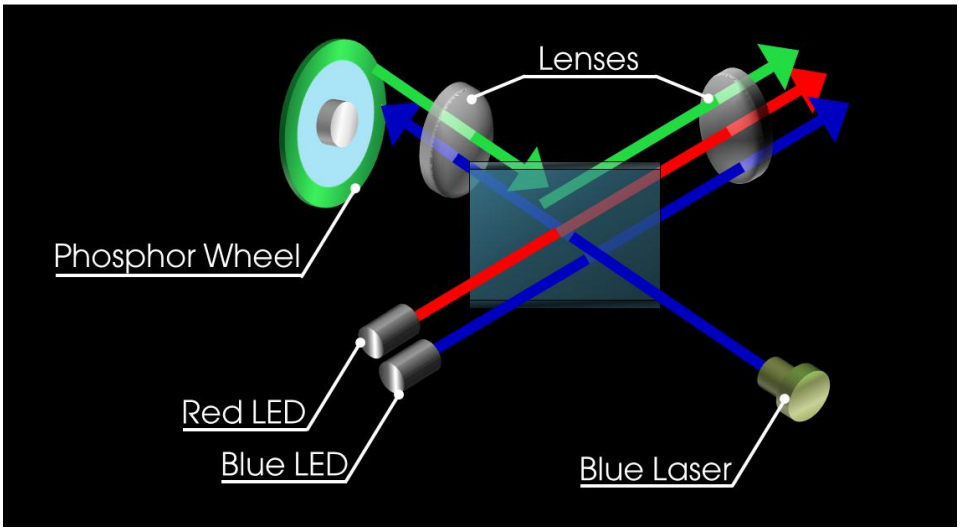
It's no surprise that this breakthrough comes from Sony. At Sony, projection is not just a product category. It's a passion. It's a quest that we've been pursuing since 1972. Our journey has led us to develop sophisticated digital video processors and has driven us to innovate at the very heart of the projector: the microdisplay. Where the vast majority of projector brands must buy their microdisplays from third-party suppliers, we make our own. Designed, fabricated and assembled by Sony, BrightEra® and SXRD® microdisplay panels help drive advances like the VPL-FHZ55.

The new laser technology

At the core of the VPL-FHZ55 is an innovative True Laser light engine. How does it work? How does it differ from previous Sony projectors? And how does it differ from other projectors that incorporate a laser? Read on.

Hybrid laser projectors

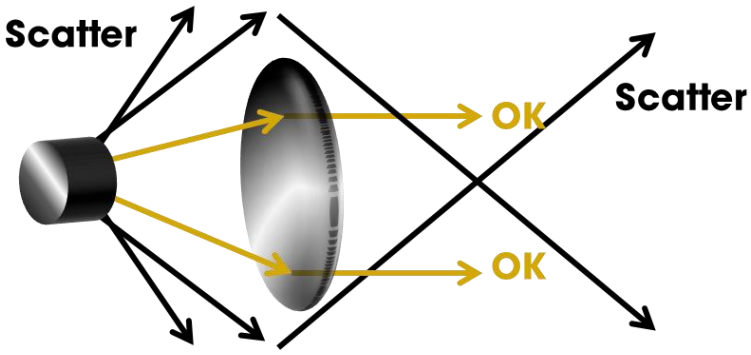
To appreciate the True Laser light engine, it helps to review commercially available "hybrid laser" designs. While individual models vary, one representative design uses three light sources. A blue laser excites a rotating phosphor wheel to provide only the green light. Red and blue are provided via LEDs. While this arrangement does incorporate a laser and does eliminate the projection lamp, reliance on LEDs becomes a major limitation.



While hybrid laser systems vary, this example is representative. Here the laser is responsible only for Green illumination. Red and Blue are handled by LEDs.

Compared to laser illumination, LEDs just aren't as bright. You might think it a simple matter to increase the brightness by increasing the LED driving power. However this incurs reliability issues that may someday be resolved by further research and development. Until then, drive power remains limited.

Alternately, you might try increasing brightness by using bigger LEDs or even multiple LEDs. Unfortunately, projection LEDs are already 1,000 times larger than projection lasers of equivalent brightness. The larger the light source, the more diffuse and difficult it is to channel toward the screen. Light tends to be wasted through scatter.

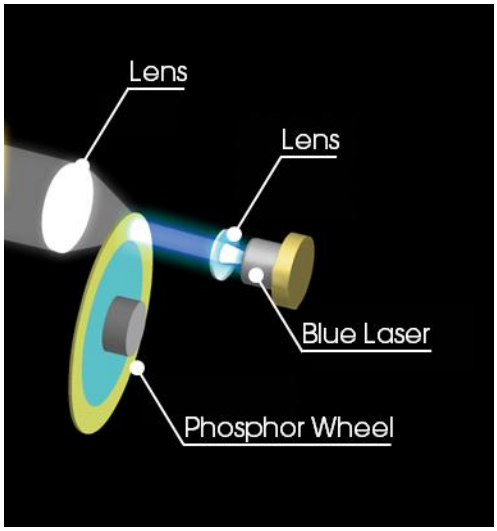


Compared to lasers, LED light sources tend to be relatively large, which incurs light-wasting scatter.

Sony's True Laser light engine

Where hybrid laser systems typically provide two out of three colours from LEDs, Sony's True Laser system starts with 100% laser light. And while a handful of other projectors can also make this claim, Sony stands alone, delivering a combination of end-user benefits that is unmatched, as of October 1, 2013.

In the True Laser light engine, light from a miniature blue laser array is concentrated even further by an aspheric lens and directed at a spinning phosphor wheel that glows bright white. It is this phosphor that provides all the illumination for the screen. Light from the phosphor wheel is concentrated by a second aspheric lens and directed toward the 3LCD panels.



Sony's True Laser light engine uses a laser and phosphor wheel to generate the full spectrum of white light. No LEDs are needed.

Both the laser and the phosphor embody Sony's deep understanding of these technologies. For example, Sony mastery of blue lasers extends to Blu-ray Disc™ players, PLAYSTATION®3 consoles and XDCAM® professional optical disc camcorders. We drew on this experience to build multiple blue lasers into an array roughly 1/1000 the size of an LED of equivalent brightness. Our laser array is highly redundant. So the failure of any single laser has negligible effect on output brightness. Because laser light is coherent, light scattering and

waste are less significant and the miniature size of the laser array reduces light scatter further still.

Sony is studying the possibility of employing this scalable laser array in future projector platforms with the addition or subtraction of lasers for either higher or lower output.

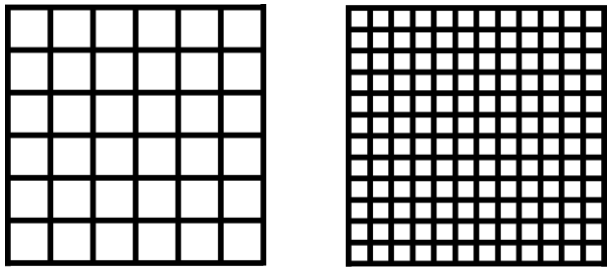
The phosphor is another unique formulation, based on decades of Sony experience with phosphor coatings in television and projection CRTs. The result is a system that can simultaneously achieve the superb resolution of WUXGA (1920 x 1200) and the high brightness of 4,000 lumens.

Light output versus resolution

Both light output and resolution are critically important. High light output enables a projector to be used in a wider range of commercial applications. High resolution enables a projector to keep pace in a world where mass market tablets and even mobile phones can display full HD. Resolution can make the difference between seeing beautiful images—or pixels. And a higher-resolution projector can display more of a computer window without the need to scroll around.

Unfortunately, there's a tradeoff between resolution and brightness. This happens because of two limitations—technology and cost.

On the technology side, the pixels in modern microdisplays measure only a few millionths of a meter across—a fraction of the thickness of human hair. The gaps between pixels are even smaller—as small as today's fabrication technology allows. As we increase resolution, the gaps between pixels occupy more and more screen area and the brightness decreases.



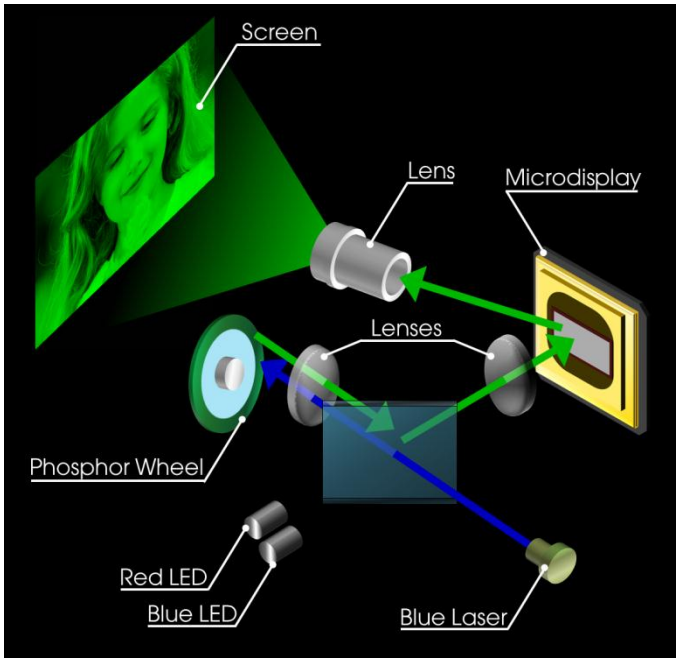
All else being equal, increasing the resolution decreases overall brightness (right) because more of the screen is occupied by the gaps between pixels.

If we can't make the gaps smaller, what about making the chips bigger? That gets very expensive. Not only do bigger microdisplays cost much more, but they also require larger, more expensive optical engines and projection lenses. Achieving both high resolution and high brightness is a challenge.

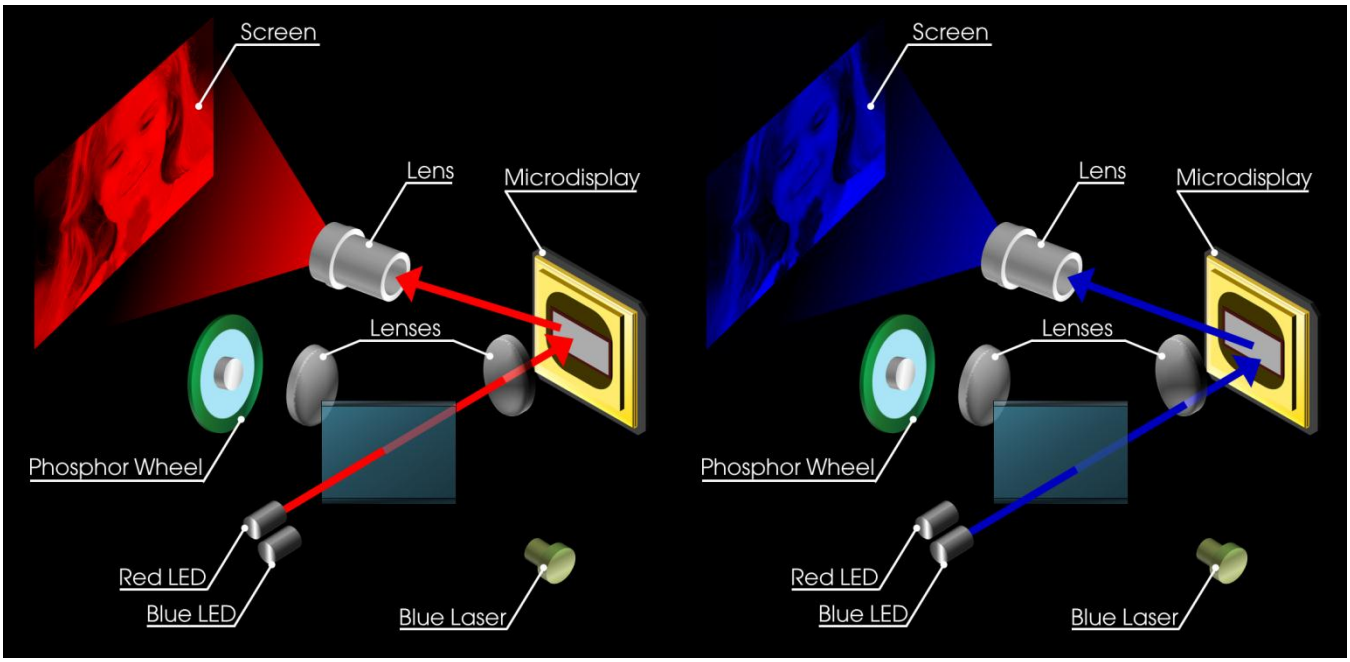
As a result, the brightness limits of the hybrid laser system have forced designers to sacrifice resolution. In a review of hybrid laser projectors as of October 1, 2013, most models had less light output than the Sony VPL-FHZ55. Only one model had equivalent brightness—at lower resolution. Similarly, most models had significantly lower resolution than the Sony projector. And the two models that approached our resolution fell short in brightness! The VPL-FHZ55 is the only laser projector to achieve the twin benchmarks of high resolution (WUXGA 1920 x 1200) and high brightness (4,000 lumens).

The single-chip limitation

Another issue in hybrid laser designs is the reliance on a single microdisplay chip. Single-chip projection means sequential colour. At any given instant, the system can show either Red, or Green, or Blue, but never all colours at once. Not only does this limit colour accuracy, it means that brightness takes a further hit when colour images are displayed. Because the single chip can only project one colour at a time, colour light output is only a fraction of the light output for an all-white screen.



Using a single microdisplay, the hybrid laser can only present one colour at a time—either Red or Green or Blue. In the example shown here, when the laser is active, the projector presents a Green picture.

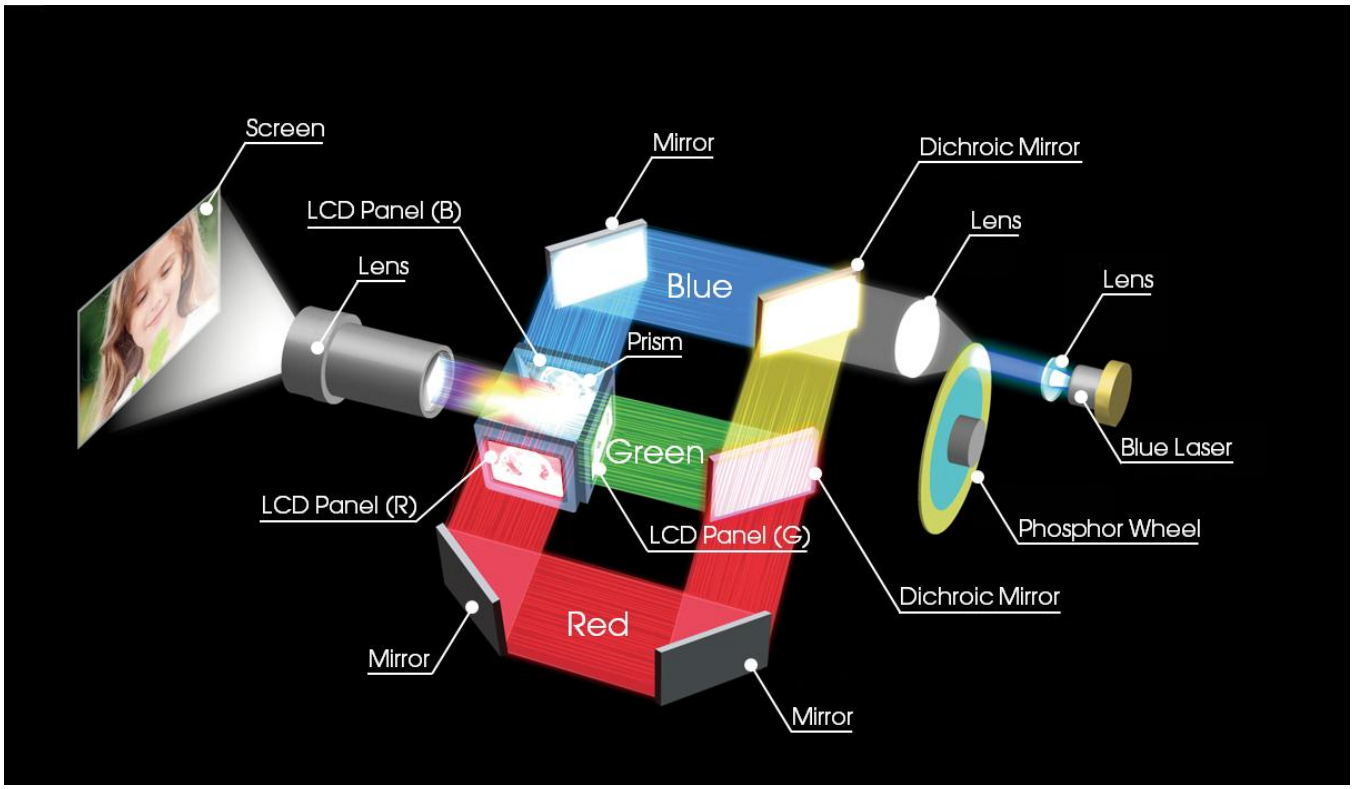


The Red and Blue pictures are illuminated, in turn, by dedicated LEDs.

The 3LCD advantage

After Sony's laser and phosphor wheel, the remaining optical engine is largely based on Sony's proven VPL-FH30 projector. This means the VPL-FHZ55 reaps all the benefits of Sony's 3LCD system. And the FHZ55 goes further with a refined version of Sony's BrightEra® LCD microdisplay.

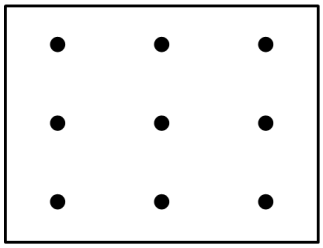
In the 3LCD system, a pair of dichroic mirrors separates white light into Red, Green and Blue beams. These pass through the LCD microdisplays, which reproduce the Red, Green and Blue components of the video picture. These Red, Green and Blue components immediately pass into an optical prism, which fuses them into a unified, full-colour image.

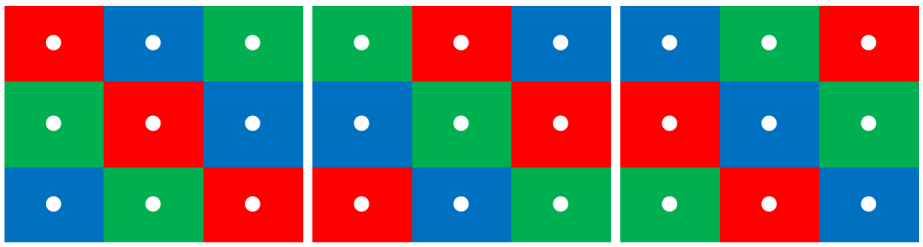


The complete light path of the True Laser optical engine. Sony uses BrightEra® LCD microdisplay panels arranged on three sides of the prism. In the 3LCD design, there's one panel each for Red, Green and Blue, enabling the projector to show all the colours all the time—a powerful advantage.

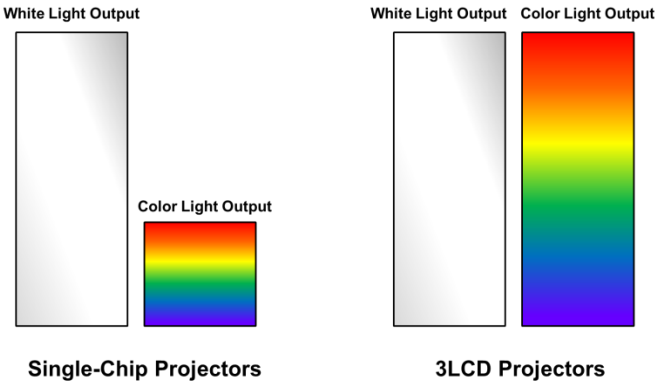
The benefits are many:

- **4,000 lumens of light output.** The 3LCD design is instrumental in delivering the benchmark performance of 4,000 lumens. Another enabling technology is Sony's BrightEra® LCD microdisplay. The VPL-FHZ55 debuts a highly refined version of the display with advanced technology that helps extend operating life at high brightness.
- **4,000 lumens of colour light output.** Projector light output is conventionally measured on an all-white screen—not exactly an accurate representation of actual viewing conditions. A more realistic (and more demanding) test is colour light output, as standardised by the Society for Information Display (SID) in 2012. The colour light output of single-chip projectors is just a fraction of the white light output claimed in typical brochures. But the VPL-FHZ55 shines, with colour light output of 4,000 lumens—exactly equal to the white light output specification.





White light output measures nine test points on an all-white screen (left). It's a holdover from the days when computer screens were mostly text on a white background. Colour light output measures 27 test points on a sequence of three colour screens (right). It's far more representative of today's projector usage.



Single-chip projection colour light output is just a fraction of the white light output claimed in brochures and ads. For the 3LCD system of the VPL-FHZ55, the two measures are identical.

- **Colour accuracy.** Projecting all the colours, all the time, 3LCD projectors are known for high colour accuracy.
- **Colour stability.** Depending on viewing conditions and individual viewer sensitivity, single-chip projectors can reveal 'colour breaking' and 'rainbow' artifacts. These tend to be especially notable on scenes with high contrast and high motion. Because 3LCD projectors display all the colours all the time, they are immune to these artifacts.

A note about direct laser systems

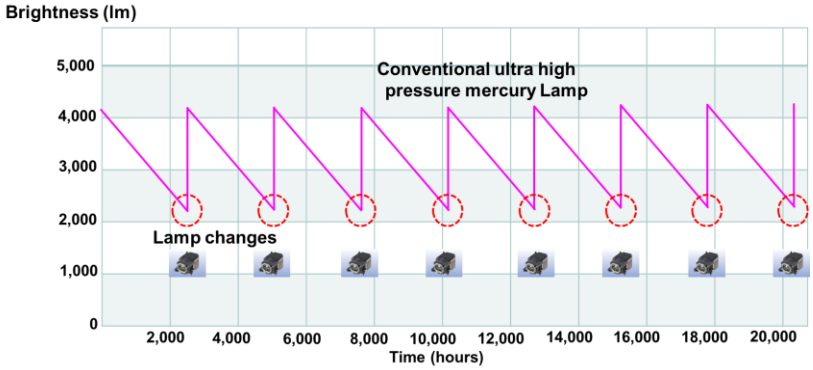
Both the hybrid laser and True Laser systems can be classified as indirect. This means the laser itself does not illuminate the screen, but rather excites a phosphor that illuminates the screen. It's worth noting the development of direct laser systems, where Red, Green and Blue lasers illuminate the screen without the need for intermediary phosphors. Direct laser systems for digital cinema have been shown in prototype, but are not commercially available as of October 1, 2013.

Operational advantages

We've seen that the True Laser light engine enables Sony's VPL-FHZ55 to achieve impressive brightness and resolution. But that's only part of the story. By replacing the typical ultra-high-pressure mercury lamp, the laser revolutionises the ownership experience. You'll notice the advantages as soon as you power up the projector. And you'll continue to experience advantages for years to come.

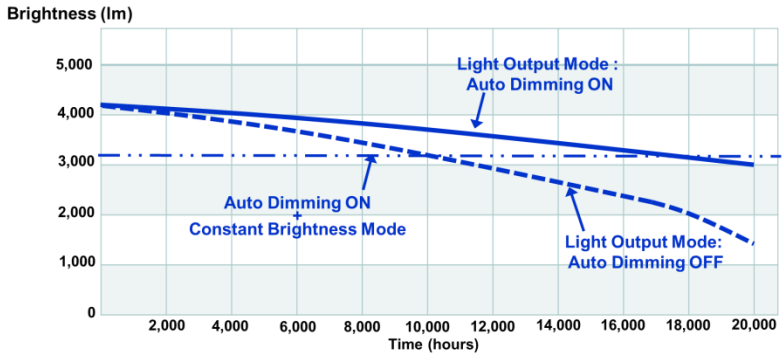
20,000 hours maintenance free (conditions apply)

The ultra-high-pressure (UHP) mercury lamp inside conventional projectors is essentially a high-tech light bulb. And like more familiar light bulbs, it burns out, typically needing replacement every 1,500 to 3,000 hours. In dramatic contrast, Sony's True Laser light engine is rated at 20,000 hours of life. That's equal to 10 hours a day, 5 days a week, 50 weeks a year for *eight years*.



Conventional projectors incur the expense (and inconvenience) of fluctuating light levels and regular lamp replacement.

Of course, some conditions apply. The 20,000 hour figure assumes an Auto Dimming duty cycle of 5% of projection time at 100% brightness, 85% of time at 85% brightness and 10% of time at 5% brightness. Actual hours may vary depending on usage environment. Maintenance-free operation is a major advance for simplicity, convenience and peace of mind.



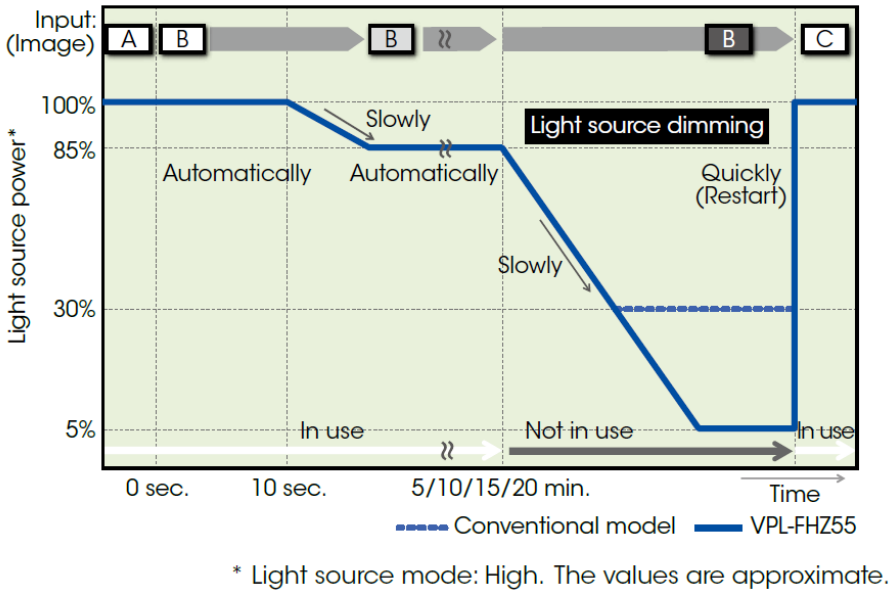
Sony's VPL-FHZ55 can go 20,000 hours maintenance free (conditions apply).

For digital signage, museums and other applications where a consistent visual experience is crucial, Sony has incorporated Constant Brightness Mode. This maintains uniform brightness throughout the life of the projector by reducing the light output.

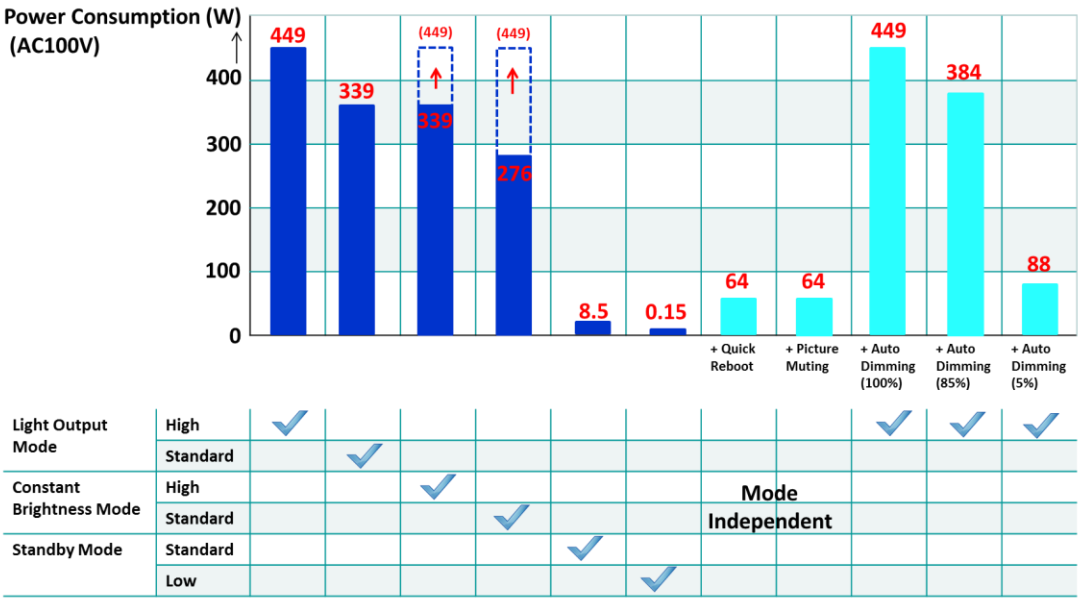
Lower cost of ownership

The True Laser light engine makes for major savings, compared to conventional lamp projectors. Consider the cost of lamp replacement. You can save €1,361 over the life of the projector (compared to Sony LMP-F272 replacement lamp at suggested retail price and recommended replacement intervals). You also save money on the labor cost of sending someone up the ladder to perform the lamp replacement.

In addition, the VPL-FHZ55 is more efficient than a competing laser projector, achieving 8.9 lumens per Watt compared to 7.6 lumens per Watt. And compared to a lamp projector, the True Laser design reduces power consumption in Auto Dimming and Picture Muting modes. In fact, the VPL-FHZ55 offers a full range of power-saving operating modes.



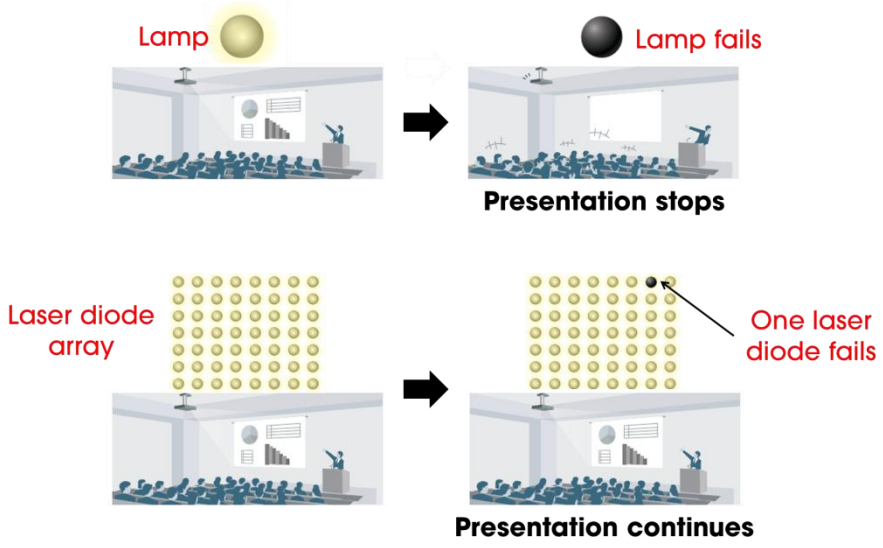
The ability of the laser to restart faster enables Sony to save more power in Auto Dimming mode.



A wide range of operating modes gives you tremendous opportunities to save power.

Worry free

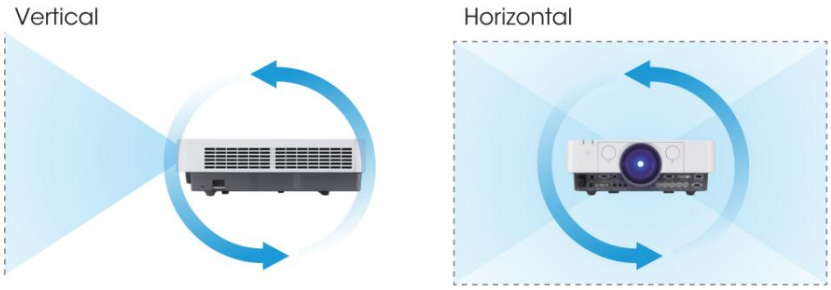
Conventional projector lamps can fail, undermining your productivity and embarrassing you at high-profile events. Sony's True Laser light engine sustains high productivity and drastically minimises downtime. Sony's blue laser light source is actually an array of multiple redundant lasers. This means that the failure of any individual laser is not a show-stopper.



You can present with greater confidence because Sony uses an array of minuscule lasers.

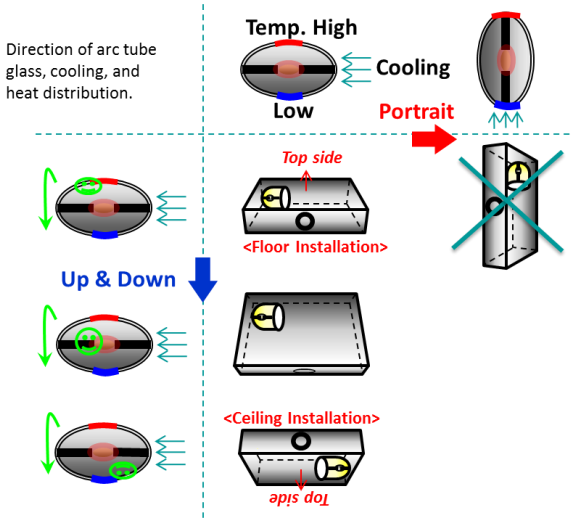
Tilt angle freedom

The VPL-FHZ55 liberates you from the mounting angle limitations of conventional mercury lamp projectors. The Sony projector offers complete freedom of installation angle: whether landscape mode or portrait mode. You get 360° of tilt about the vertical axis or horizontal axis.



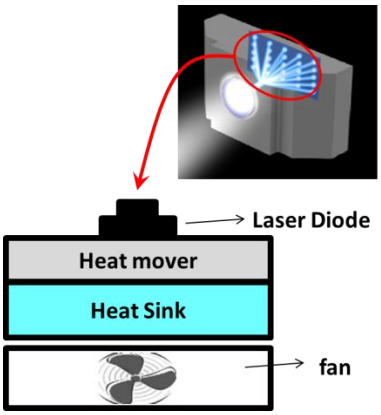
The VPL-FHZ55 achieves 360° tilt angle freedom about the vertical or horizontal axis.

The mounting angle limitations of conventional projectors are caused by cooling issues. Ultra-high pressure mercury lamps generate significant heat and require carefully designed ventilation and cooling systems. But because heat rises, the cooling system performs better at some installation angles than others. Typical lamp-equipped projectors are designed to function right-side up (when sitting on a table) or upside down (when hanging from a ceiling). These projectors tend to continue operating properly when tilted up or down at intermediate angles. But when they're rotated from landscape to portrait mode, there's trouble. Suddenly the hottest part of the lamp becomes inaccessible to cooling air. Premature lamp failure ensues.



Many lamp-equipped projectors can be either tilted vertically (i.e. for floor projection) or rotated (i.e. for portrait projection), but cannot do both due to limitations in the way lamps can be oriented. Lamps are subject to overheating and failing prematurely when the projector is not installed properly.

Thanks to an innovative laser cooling system, the VPL-FHZ55 frees you from installation angle limitations.

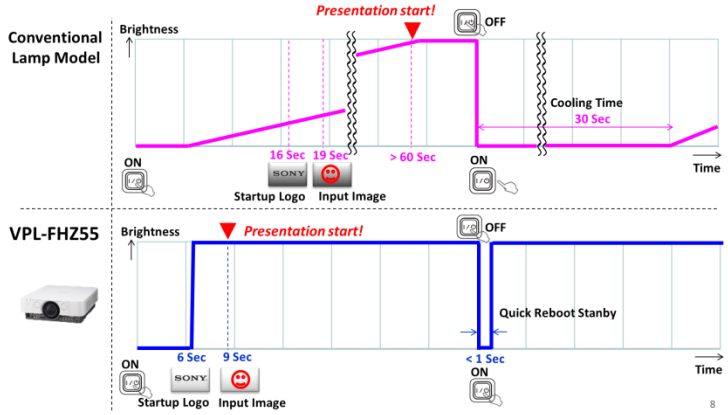


The cooling system of the VPL-FHZ55 accommodates all installation angles.

Rapid on/off

Conventional projection lamps are at odds with today's impatient culture. When you power up, it typically takes more than 60 seconds to achieve full brightness. When you power down, it typically requires 30 seconds of cooling time. When you want to reboot from standby, the 30 second cool-down becomes a minimum waiting interval. For a society accustomed to instant everything, 30 seconds can feel like an eternity.

Sony's True Laser light engine changes the rules. It takes just 9 seconds to full brightness and presentation start. It reboots from standby in less than 1 second. When you turn it off, there's no need to wait until the unit cools. And there's no limitation in reboot cycles or durations.



Compared to lamp projectors, the difference in operating convenience is night and day.

Mercury free

The VPL-FHZ55 even has better chemistry. As the name implies, the ultra-high-pressure mercury lamp contains mercury, a poison. The Sony laser system is mercury free, a far better choice for the environment.

A final word

Rarely does a single model so completely rewrite the rules of installing, operating, maintaining, funding and ultimately enjoying video projection. But that's exactly what the world's first 3LCD laser projector accomplishes. To understand what all the excitement is about, we invite you to visit an authorised reseller. Start your experience at sony.com/laser.

VPL-FHZ55 Features

- **World's first 3LCD laser light engine projector** delivers all the benefits of lasers with all the advantages of 3LCD design
- **True Laser light engine** uses no LED illumination; represents a sea-change in operating convenience, operating life, low total cost ownership
- **3LCD projection with Sony BrightEra® panels** achieves both high output and high resolution
- **High-resolution WUXGA image (1920 x 1200)** accommodates Full HD, renders images beautifully, enables you to see more of a PC window without scrolling
- **High light output: 4,000 lumens** with no sacrifice in resolution
- **High colour light output: 4,000 lumens,** thanks to the 3LCD system; does not incur the drastic drop-off in colour brightness exhibited by single-chip projectors
- **Wide lens shift:** up to 60% vertical and +/-32% horizontal
- **Keystone correction:** +/-30° horizontal; +/-30° vertical
- **Advanced geometric correction** lets you grab and fit all four corners; perfect when the projector must be offset from the screen
- **Tilt angle freedom:** full 360° rotation on the vertical and horizontal axes; supports portrait and landscape modes
- **Edge blending** supports seamless multi-projector widescreen presentation
- **20,000 hours maintenance free** for low total cost of ownership. (20,000 hours using Auto Light Dimming. Actual hours may vary depending on usage environment.)
- **Constant brightness mode** maintains a consistent visual experience across the life of the projector
- **Worry free** with multiple redundant lasers; unlike lamp failures, the failure of a single laser will not stop the show
- **Low total cost of ownership:** saves €1,361 over the life of the projector (compared to Sony LMP-F272 replacement lamp at suggested retail price and recommended replacement intervals)
- **Rapid on/off** for smooth presentation; no waiting 60 seconds for full brightness; no waiting 30 seconds for cool-down and reboot
- **Auto Dimming mode** saves energy when the projector is not in use; laser light source enables greater energy saving
- **Auto Light Source Control** for energy saving
- **Blank (Picture Muting)** mode at the touch of a button; instant return to full power

- **Automatic picture muting with no input** saves electricity; instant return to full power
- **Mercury free illumination:** better for the environment than conventional projection lamps
- **Picture-by-picture** shows two images at once
- **DICOM GDSF simulation** for medical imaging (for training and reference only; cannot be used for medical diagnosis)
- **Closed captioning**
- **Network control** via multiple third-party systems

VPL-FHZ55 Specifications

Display system	3LCD system
Display device	Size of effective display area 0.76” (19.3 mm) x 3, Sony® BrightEra® microdisplays, Aspect ratio: 16:10 Number of pixels 6,912,000 (1920 x 1200 x 3) pixels
Contrast ratio	8,000:1 (Full white/full black) (average value)
Projection lens	Zoom: Manual (Approx. 1.6 x) Focus: Manual
Light source	Laser diode
Screen size	40” to 600” (1.02 m to 15.24 m)
Light output	4000 lm
Colour light output	4000 lm
Displayable scanning frequency	Horizontal 14 kHz to 93 kHz Vertical 47 Hz to 93 Hz
Display resolution	Computer signal input: Maximum display resolution: 1920 x 1200 dots; Panel display resolution: 1920 x 1200 dots Video signal input: NTSC, PAL, SECAM, 480/60i, 576/50i, 480/60p, 576/50p, 720/60p, 720/50p, 1080/60i, 1080/50i, 1080/60p, 1080/50p, 1080/24p
Colour system	NTSC3.58, PAL, SECAM, NTSC4.43, PAL-M, PAL-N, PAL60
Computer and video signal inputs and outputs	
INPUT A	RGB / Y P_B P_R input connector: 5BNC (female) Audio input connector: Stereo mini jack
INPUT B	RGB input connector: Mini D-sub 15-pin (female) Audio input connector: Stereo mini jack (shared with INPUT C)
INPUT C	DVI-D input connector: DVI-D 24-pin (Single link), DVI 1.0-compliant, HDCP support Audio input connector: Stereo mini jack (shared with INPUT B)
INPUT D	HDMI input connector: Digital RGB/ Y P_B P_R Digital audio: PCM (32 kHz, 44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz)
S VIDEO IN	S video input connector: Mini DIN 4-pin Audio input connector: Pin jack (x2) (shared with VIDEO IN)
VIDEO IN	Video input connector: Phono jack Audio input connector: Pin jack (x2) (shared with S VIDEO IN)
OUTPUT	Monitor output connector: Mini D-sub 15-pin (female) Audio output connector: Stereo mini jack
Control signal input/output	RS-232C connector: D-sub 9-pin (female) LAN connector: RJ-45, 10BASE-T/100BASE-TX Control S input connector (DC power supply): Stereo mini jack, Plug in power DC 5 V
Operating temperature	32°F to 104°F / 0°C to 40°C (20% to 80% humidity; no condensation)
Storage temperature	14°F to +140°F / -10°C to +60°C (20% to 80% humidity)
Power requirements	AC 100 V to 240 V, 4.6 A to 1.9 A, 50/60 Hz
Power consumption	AC 100 V to 120 V: 449 W AC 220 V to 240 V: 426 W
Standby power requirements	AC 100 V to 120 V: 8.5 W (Standby mode: Standard) 0.15 W (Standby mode: Low) AC 220 V to 240 V: 9.5 W (Standby mode: Standard) 0.3 W (Standby mode: Low)
Heat dissipation	AC 100 V to 120 V: 1528 BTU AC 220 V to 240 V: 1450 BTU

Dimensions (WxHxD)	15-11/32 x 5-13/16 x 19-11/16 in (390 x 148 x 500 mm) 15-11/32 x 5-9/32 x 19-3/16 in (390 x 134 x 487 mm) (without protrusions)
Weight	25 lbs. / 11 kg
Supplied accessories	RM-PJ19 Remote Commander Size AA (R6) batteries (2) AC Power Cord Cable ties (2) Quick Reference Manual Security Label Operating Instructions (CD-ROM)
Optional accessories[1,2]	Projector Suspension Support PAM-600

1. Not all optional accessories are available in all countries and plural areas. Please check with your local Sony Authorised Dealer.

2. Information on accessories is current as of August 2013.

This data projector is classified as a CLASS 2 LASER PRODUCT. (Laser radiation IEC60825-1:2007)

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