WHITEPAPER

Digital Cinema

Why Sharp/NEC uses RB laser light sources

Summary

The purpose of this white paper is to outline the advantages of laser as a light source, allowing cinema operators to significantly reduce costs whilst delivering a superb movie-going experience. Explaining the incidence of speckle and how to avoid it, the white paper summarises the reasons why Sharp/NEC is using RB laser light sources in its range of Digital Cinema Projectors.

The move from Xenon to laser-based projection systems.

Sharp/NEC is a pioneer of new technologies for cinema, evident since the early beginnings of the industry's digitalisation. The first ever DCI certified RGB laser projector, the NEC NC1040L, introduced in 2014, marked the start of a new era of projection technology, moving from Xenon to laser-based projection systems.

Laser technology brought many advantages to the industry, foremost: improved image quality with brilliant colours, higher brightness levels, and uniformity. The move to laser also brought improved energy efficiency resulting in reduced power usage and eliminating the need for external air ducts. With no lamp replacement needed, the laser light source also brings significant operational advantages, negating costs associated with spare parts and maintenance.

However, as with any new technology, laser driven systems will have certain limitations and special requirements. In the beginning, high initial cost was a limiting factor hindering wider deployment, but costs have reduced and can in part be offset against savings in lamp and electricity costs, whereby a more convincing total cost of ownership can be achieved.

What is speckle and how can it be avoided?

Another limiting factor is the type of screen that can be used with laser. Laser can produce disturbing artefacts on reflective screens, commonly known as speckle. This is caused by micro-reflections of the coherent laser light on reflective surfaces. Speckle can have a disturbing impact on the viewing experience and is more visible the higher the gain (a measurement of the screen's reflective property).

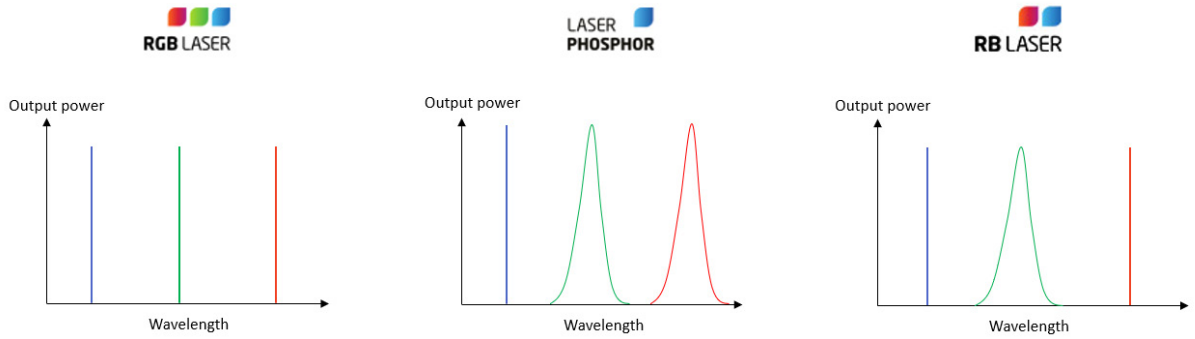
There are several possible ways to avoid speckle caused by laser projectors.

Firstly, the use of low gain (less reflective) screens reduces speckle but, in turn, this requires a projector with a higher level of lumens to achieve DCI brightness, resulting in higher costs for the projector itself as well as for the increased power consumption.

Secondly, the installation of so-called “screen shakers”; small motors or speakers attached to the screen which make it vibrate and reduce the visibility of speckle. This technology, however, brings its own disadvantages such as creating a ‘soft’ image, which negates the advantage of a pin sharp 4K resolution.

Furthermore, image artefacts can appear due to incorrect adjustment or technical errors, and dust is attracted by electrostatic charge which speeds the aging process of the screen. Ultimately, this equipment is costly and results in increased costs associated with installation, maintenance, and power use.

A more effective way to reduce speckle is to enlarge the spectral range of the laser source. As the human eye is very sensitive to green colours, speckle is mainly visible on the green part of the image. Speckle is not perceived at all in blue and hardly at all in red colours. Therefore, enlarging the green light range has the highest impact on reducing speckle. This can be achieved by using phosphor: a blue laser diode illuminates a phosphor wheel, producing green light at wide range.



The graphs compare the light spectrum across different laser technologies.
Laser Phosphor achieves a wide spectrum of green and red light, RB laser achieves a wide spectrum of green light.

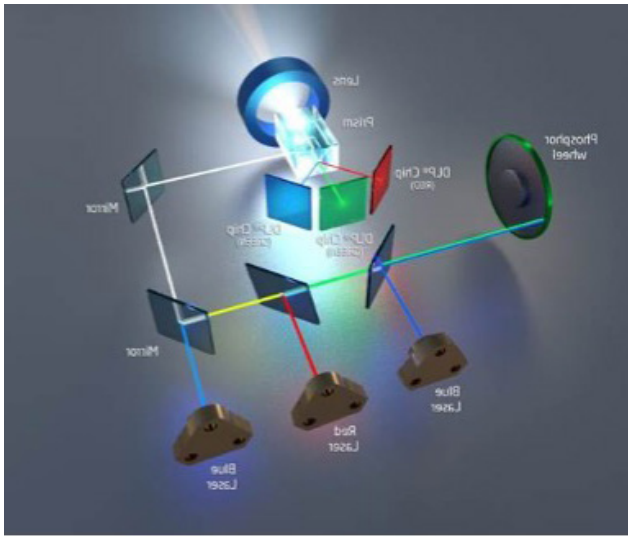
The advantages of laser phosphor

Using green in a wide range has an additional important advantage. The human eye is used to seeing colours in a wide frequency range, as it is from sunlight, or as produced by Xenon projectors. Colours in narrow bandwidth can be perceived as unnatural. It can even be perceived differently by different people, a phenomenon called “metamerism”, an effect also sometimes seen by colour measurement devices when installing the projector.

With the use of green phosphor, cinema movies can be shown in very natural colours, the way it was intended by the movie maker.

Laser phosphor projectors are already well established in the AV industry. In 2014 NEC brought this technology to cinema with the first DCI certified laser phosphor projector, the NC1100L. In addition to the advantages explained above, laser phosphor also came at much lower cost compared to RGB laser projectors at that time, allowing it to be deployed to more budget conscious exhibitors. In 2017, NEC launched the first DCI RB laser projector to the cinema market, the NC1700L, using red and blue laser diodes, still producing green with the help of blue laser with yellow phosphor.

Adding red laser diodes allowed the development of brighter models, which now range up to 35,000 lumens.



RB laser technology based on 3-chip DLP technology.

Brighter Long-life sustainability

An important point to consider when choosing a laser projector is that sufficient brightness levels can be maintained over a long period of time. This can be achieved by keeping sufficient initial brightness headroom, and by controlling the environmental temperature (20-25° operating temperature recommended). Generally, laser lifetimes have increased over the past years, also due to the improvement of laser diodes available from selected manufacturers. Sharp/NEC specifies laser lifetimes of up to 50,000 hours.

Today, Sharp/NEC offers the widest range of laser phosphor and RB laser projectors for small arthouse cinemas up to large premium screen sizes, providing brilliant and natural colours, full flexibility of screen type, high efficiency, affordable cost, and long lifetimes.

Sharp/NEC continues to develop laser systems as well as other technologies, striving to bring to market best-in-class solutions when they are commercially viable. Sharp/NEC offers its cinema customers a partnership for the long term, helping exhibitors to achieve the best possible ROI with sustainable, long-life visual solutions.

The compact, lightweight 14,000 Lumen NEC NC1503L digital cinema projector using RB laser technology, launched in 2023.

Learn more about laser projection technology ▸

Learn more about Sharp/NEC visual solutions for cinema ▸

Sharp NEC Display Solutions Europe GmbH
Landshuter Allee 12-14,
80637 Munich, Germany

infomail.sndse@sharp.eu
Phone: +49 (0) 89 99 699-0

www.sharpnecdisplays.eu

SHARP / NEC