Digital Cinema – FAQs

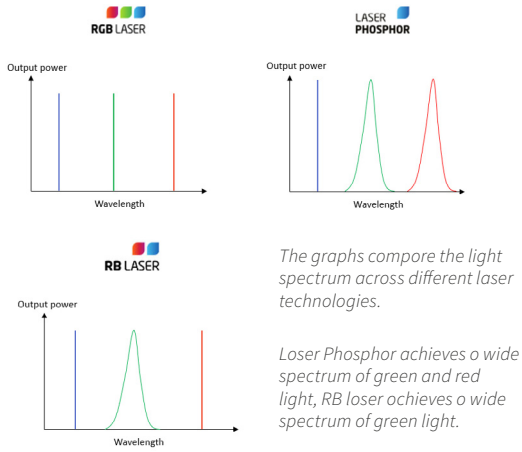
Expert advice from our cinema team

When we meet with our partners, integrators and exhibitors, we are often asked about technological developments and their comparative advantages. We are pleased to offer our expert advice to ensure our partners achieve the best possible ROI. Here we have summarised many of these frequently asked questions to offer our objective response as well as our recommendation.

Which laser technology is the right one for me?

Over the years, different laser technologies have been introduced to the cinema industry, beginning with the first **RGB laser** projector launched by NEC in 2014. NEC was also a pioneer in bringing **laser phosphor** and **RB laser** to the market in 2015 and 2017. Today, all these laser technologies have matured and are now in their third and fourth generation.

While some manufacturers strongly promote one technology (RGB), all manufacturers widen their product portfolio to embrace other technologies as well. Where all laser technologies achieve DCI specification in terms of colour, contrast and brightness levels, there remain some differences in terms of colour reproduction, maximum achievable brightness levels and compatibility with different types of screen.



The graphs compore the light spectrum across different laser technologies.

Loser Phosphor achieves o wide spectrum of green and red light, RB loser ochieves o wide spectrum of green light.

NATURAL COLOURS

In a natural environment, colour is produced in a wide bandwidth from sunlight. Xenon lamps, as traditionally used in cinema projection, produce colour which is very similar to that produced by sunlight in a wide bandwidth and is perceived as natural by the human eye.

Narrow bandwidth colours can be perceived as harsh and less natural. People sometimes perceive the same narrow bandwidth colours differently, an effect called metamerism.

RGB laser projectors produce light in narrow bandwidth, in each of the primary colours of red, green and blue. Laser phosphor uses blue laser diodes, and RB laser uses blue and red laser to produce wide bandwidth green by using a green phosphor wheel. Since green is the colour the human eye is the most sensitive to, the image produced by laser phosphor and RB laser in a wider bandwidth is perceived as more natural.

RGB laser	X
Laser phosphor	✓
RB laser	✓

COMPATIBILITY WITH ANY KIND OF SCREEN

Laser phosphor and RB laser projectors can be used in combination with any kind of screen, even with very high gain (reflectiveness), keeping the amount of speckle extremely low. Speckle can have a disturbing effect on the viewing experience and is more visible when using RGB laser projectors. Please see more information under the separate question below.

RGB laser	X
Laser phosphor	✓
RB laser	✓

COST EFFICIENCY

The use of laser in combination with phosphor is more cost effective than producing an image using laser for each of the primary colours. Especially the green laser is more cost intensive than for example blue laser, which has commonly been used in other technologies, such as Blue Ray players. The introduction of laser phosphor projectors in 2015 made laser technology affordable for many cinema operators. Today laser phosphor is also the main technology used in business and large venue projectors.

RGB laser	X
Laser phosphor	✓
RB laser	✓

Should I invest in a laser upgrade or in a new projector?

Some companies offer to upgrade Xenon projectors to laser, by exchanging the lamp house with a laser module. The goal is to extend the lifetime of the existing projector and reduce operating costs. This seems an attractive offer especially when budget is limited, however some issues need to be taken into consideration.

COST EFFICIENCY
The cost of a laser upgrade starts with the purchase of the laser module and the installation. As the projector's warranty has in most cases expired, it needs to be reactivated in order not to risk losing the investment should the projector subsequently fail. The manufacturer may require a precheck of the unit which will be an additional cost to the actual extension of the warranty. After the laser upgrade has been installed it could happen that the quality or brightness achieved is lower than expected. As the projector is probably several years old, some additional cleaning, refurbishment or even replacement of optical parts may be necessary to achieve a satisfactory result. These costs cannot be anticipated before the installation, and the total costs could be higher than originally expected.

PRODUCT LIABILITY
Any product brought to market should be certified, and the manufacturer is liable for damages which result from its agreed usage (to allow for such unlikely cases manufacturers usually take out an insurance covering several million Euros). If a product is modified without authorisation by the manufacturer, the liability becomes void, and the risk needs to be borne by the installer or the exhibitor.

At Sharp/NEC we do not offer laser upgrades, nor certify, nor recommend installation of any third-party equipment in existing projectors. Our strategy is to offer laser projectors that sit within limited budget parameters and work in partnership with exhibitors to develop plans which meet their requirements and budgets in the long term.

Can I keep using an existing screen with a laser projector?

The answer depends on which type of screen is used: a matt white screen, or a reflective screen. A reflective screen with a higher gain factor (the measurement of a screen's reflective property) allows use of lower brightness projectors and ability to show passive 3D.

Typical reflective screens have a gain factor of 1.4, 1.8, 2.4, or even higher.

With the introduction of laser-based systems, a phenomenon has occurred called "speckle". Speckle is an image error, visible as small reflections on the screen which can be distracting from the movie experience. Speckle occurs when narrow bandwidth light – being the nature of laser – hits a reflective surface. This causes interferences which are visible as micro-reflections. The higher the gain, the more clearly visible it is.

HOW CAN SPECKLE BE REDUCED?

One possibility is of course to lower the screen gain to 1.4, or matt white. At this gain level most viewers will find the level of visible speckle acceptable. However, on a lower gain screen more brightness is needed to achieve DCI brightness levels, demanding a brighter projector which would be at a higher cost.

Another possibility is the use of so-called screen shakers, small motors or speakers which make the screen vibrate. This reduces the amount of visible speckle to an acceptable level. However, screen shakers have some disadvantages:

- The image appears softer, an unwanted effect especially when projecting a 4K image.
- In case of a defect, or if the shakers are not adjusted correctly, artefacts can appear also causing a visual distraction.
- Additional costs are incurred not only for the purchase and installation of the shakers, but also, in the long run, due to required maintenance and energy costs.
- The screen ages faster. Vibrations cause electromagnetic charges on the screen, which attract dust. As silver screens cannot be cleaned, the screen needs to be replaced much earlier, creating additional costs.

As laser phosphor or RB laser projectors produce green in a wider bandwidth, speckle is hardly visible. Sharp/NEC promote their laser phosphor and RB laser models for any type of screen, including high gain types.

RGB laser	X
Laser phosphor	✓
RB laser	✓

What is the expected laser lifetime?

Laser diodes offered by the main three established manufacturers today have very long lifetimes. Whilst these lifetimes will vary between manufacturers and across different laser technologies, it is the usage conditions which have the greatest influence over expected lifetimes.

These conditions include:

- Operating temperature. All electronic components, including laser diodes, age faster at higher temperatures. At Sharp/NEC we recommend an operating temperature of between 20 and 25°C.
- The power at which the diodes are run. The brightness of laser diodes decreases over time. The lower the power at which the diodes operate slows the decrease in brightness thus lengthening its lifetime.

To ensure a long lifetime it is recommended to choose a projector which offers sufficient allowance in these parameters. At Sharp/NEC we recommend choosing a projector that can achieve DCI brightness levels at 70-80% brightness in the format that requires the most brightness, e.g. scope 3D. As other formats require less brightness, e.g. flat, on average the laser unit will run initially at 65-70%. For its latest models Sharp/NEC specifies laser lifetimes of more than 50,000 hours and a constant brightness expectation of 50,000h under normal usage condition.

Should I wait for new technologies, e.g. LED?

Today, most theatres are still operating with projectors installed during the first phase of digitalisation. Less than 20% of screens have so far upgraded to laser. Some exhibitors are asking whether now is the right time to invest in the latest laser technology, or whether to wait for new technological innovations.

Generally, today's laser technologies are mature; most laser projectors are already available in third and fourth generation. They will not become obsolete any time soon, and it can be expected that they will be available for many years to come.

Bringing new technologies to market is a long-term process.

For new technology to be successful it not only needs to offer added value for the cinema visitor, but it also needs to be commercially sustainable, and it needs to be supported by studios with content. Studios however prefer to reduce the number of different DCPs and formats since provision of additional DCPs creates extra costs in production and distribution.

A few years ago, LED technology entered the cinema market, and today nearly 200 screens have been installed worldwide. LED offers several advantages to projection such as very high brightness and almost perfect black levels. This enables further applications such as conferences, events, concerts etc. It also offers the possibility to design a cinema without the need for a projection booth, making it possible to add additional seat rows in the auditorium.

On the other hand, there are still several challenges to the wider expansion of LED to cinema, including high costs, fixed screen sizes, excessive weight, and last but not least, the lack of specially graded content.

Will LED eventually offer an alternative to projection on a large scale? At Sharp/NEC we believe projection will be the technology of choice for at least the next 7 years. What will be in 10+ years is hard to predict in a digital world.

Find out more about Sharp/NEC ▸

Find out more about Cinema Solutions ▸

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