

# What is the most effective laser technology to combine high projection performance with operational efficiency?

## RB laser technology - the brightest choice for the brightest outcomes

### Summary

Laser as a projection light source technology has quickly begun to replace lamps in large venue projection. The compelling benefits of heavily extended life times, consistent light output over time and high operational reliability combined with significantly lower operational costs has made laser a resounding success.

Yet laser technology is very diverse and it is important to make the right technology choice to ensure a safe and sustained projection investment. Out of the three major laser light source technologies for high bright installation projectors, RB laser combines the best of the first two technologies - laser phosphor and RGB laser – with the most advantageous results. RB laser technology delivers super-large images in bright environments while enjoying undeniable benefits in terms of cost, operational efficiency and immersive image quality.

This whitepaper is intended as a reference guide to assist you in making the most appropriate choice of laser light source in order to meet your requirements for compelling large size projection. It will help you to understand the advantages of each technology and the benefits of RB laser in more detail in order to make a more informed choice.

### Background

Large screen projection is advancing. According to market research by Futuresource Ltd. the worldwide number of large venue projectors being installed each year will increase by over 142% by 2021 - and there are some very good reasons for this substantial uptake in demand.

Whilst the performance indicators for image quality such as brightness, colour reproduction and resolution have been continuously improving, laser light technology has been the real game changer for projection devices. The significantly longer life time combined with more stable and reliable light output has led to multiple advantages that will make laser the dominant light source from 2018 onwards, according to Futuresource.

As of today, there are three main laser light source technologies in the installation projector market providing different strengths and advantages for different needs. RB laser, which is the latest one, has a low initial cost compared to RGB laser projectors yet delivers higher brightness levels and a wider colour space compared to laser phosphor. Let's take a deeper look into the different technologies and key decision criteria.



## Which key criteria influence the projector technology choice?

There are two key areas to be considered when deciding on the right laser light source technology

### Brightness requirement:

The projection brightness requirement depends on three main criteria:

- 1 The size of the projected image (measured in m<sup>2</sup>)
- 2 The ambient light, also determining the black level (measured in lux)
- 3 The required contrast ratio. The contrast ratio is the ratio of the brightest (white) and the darkest (black) brightness levels. The readability and clarity of text and image content is mainly influenced by the brightness output of the projector as well as the ambient light in the installation environment. This means that the environmental conditions have a much greater impact on the real contrast ratio and therefore the readability than the theoretical contrast value as per the datasheet which is measured in a test chamber. The higher the contrast ratio in a real life scenario, the better the readability. We will adopt a contrast ratio of 7:1 for the purposes of our calculation methods as this is the most commonly used approach when planning brightness requirements and is referenced by Infocomm as the minimum standard.<sup>1</sup>

You will achieve a precise definition of your brightness requirement by multiplying these three factors:

**Screen size (m<sup>2</sup>) x Ambient light (lux) x Recommended contrast ratio (7:1) = Recommended projector brightness.**

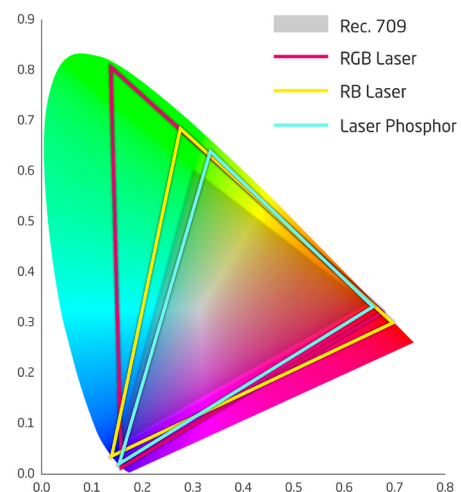
E.g.: (8m x 4.5m = 36m<sup>2</sup>) screen size x 70 lux ambient light x 7:1 contrast = 17,640 ANSI lumen brightness requirement.

In addition to these points, general aspects such as device size and weight, connectivity, texture and colour of the projection surface as well as 2D or 3D graphics playback need to be taken into the overall consideration.

### Colour space requirement:

In colour critical workflows, the process involves numerous imaging devices from cameras to displays to printers, so it is essential to be able to refer to a standard measure of colour or colour space. The colour gamut defines a specific range of colour or common standard between devices. In general, the wider the colour gamut, the more precise and natural the reproduction of the original object.

Where the majority of applications are well served with the colour space of laser phosphor and the new RB laser light source, some colour critical applications, such as design processes and premium large format cinema screens, rely on the Rec. 2020 wide colour gamut which exceeds the colour gamut of the traditional Rec. 709 colour space by far.



## Which technologies are currently available?

### Laser phosphor technology



The cost-effective laser phosphor projector uses an array of blue laser diodes to create the blue colour in the final image and a yellow phosphor wheel, which emits the yellow light. This yellow light is then split by filter into yellow, green and red light components. Today, laser phosphor is the preferred choice for screen sizes up to six metres image width<sup>2</sup> under controllable light conditions.

### RGB laser technology



RGB laser uses the so-called 'pure laser' technology. Red, green and blue laser light are delivered directly to the three image chips. The light is emitted in narrow RGB bands with very distinct spectral frequencies allowing the creation of a large colour space that easily exceeds that of Rec. 709 and DCI and can even cover the demanding Rec. 2020 colour space. RGB laser provides the best colour reproduction and allows high brightness levels for huge screen surfaces. RGB laser is the preferred choice for screen sizes up to twelve metres image width<sup>3</sup> under controllable light conditions or up to 32 meters in cinema theatres and for all applications relying on the highest colour accuracy provided by the Rec. 2020 colour space or 3D/6P applications. The use of three lasers and especially the green laser component, is an incremental driver of higher initial purchasing costs.

<sup>1</sup> Source: <https://www.infocomm.org/cps/rde/xchg/SID-3EAF4386-23F13633/infocomm/hs.xsl/31899.htm>

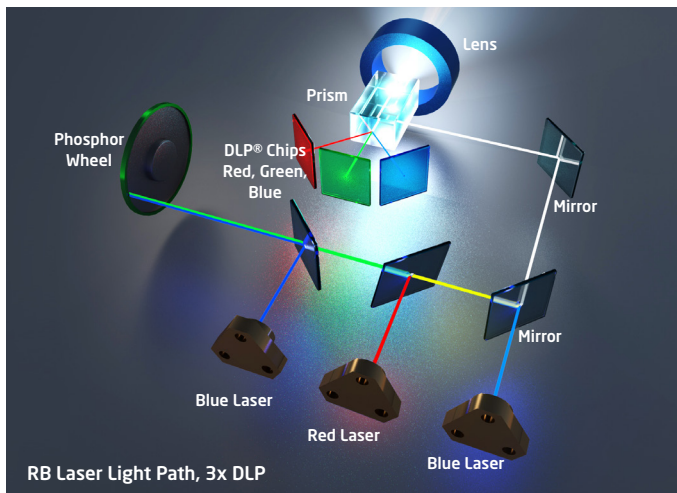
<sup>2</sup> Condition: Screen size (6 x 3.38m = 20m<sup>2</sup>) x Ambient light common (70 lux) x Contrast (7:1) = 9,800 ANSI lm

<sup>3</sup> Condition: Screen size (11.5m x 6.4m = 73.6m<sup>2</sup>) x Ambient light common (70 lux) x Contrast (7:1) = 36,000 ANSI lm

## RB laser technology



RB laser technology combines the advantages of the brilliant colour reproduction achieved by RGB laser with the cost efficiency of laser phosphor technology. In RB laser projection a blue laser is used to create the blue colour and a red laser is used to create the red colour in the final image. The green colour is generated by a green phosphor wheel emitting green light. This technique allows very efficient light reproduction by avoiding optical filters resulting in more intense and more natural colours especially in the red colour segment, plus a higher brightness output.



The outcome is impressive. Extreme brightness levels of up to 35,000 ANSI lumens allow screen sizes up to twelve metres image width<sup>4</sup> under controllable light conditions or even up to 32 meters in cinema theatres. The colour reproduction achieves reliable and vivid colours with a wide colour gamut exceeding the Rec. 709 and DCI colour space and getting close to the demanding Rec. 2020 colour space. Compared to RGB laser, RB laser allows a more cost-effective structure and use of components supporting substantially lower initial purchasing costs and provides an impressive price performance ratio for large screen presentation, events, mapping installations, digital signage applications and many more outstanding and creative illuminations. RB laser operates on a lower power consumption than Xenon and RGB and reduces operational costs effectively.

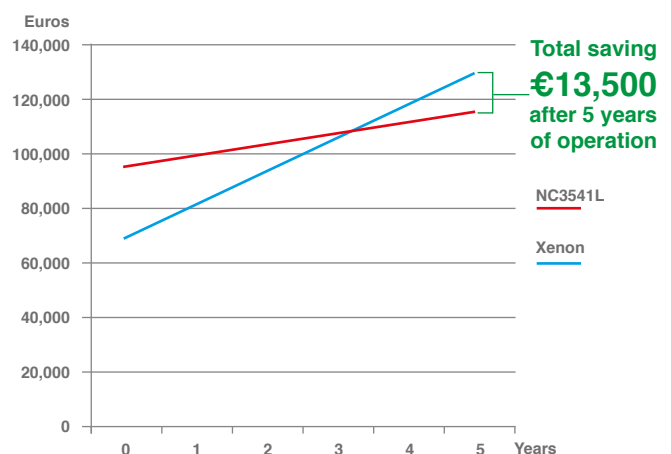


## Reduced Total Cost of Ownership

The chart below simulates initial and operational costs, comparing laser against traditional lamp technology, illustrating the direct and indirect costs of operating a high brightness projector. It is clear that due to substantial savings in operating costs (no lamp, low power consumption), RB laser projection offsets its higher initial cost to generate an impressive total saving of €13,500 over five years. This example, based on cinema projection, is equally applicable to other scenarios such as large venue presentation.

Projector type	NC3541L RB Laser	6Kw Xenon projector
Purchase price	€ 95,000	€ 75,000
Annual projector lamp costs	€ 0	€ 6,000
Annual energy costs*	€ 3,900	€ 5,600
Total annual operating costs	€ 3,900	€ 11,600
Annual saving	€ 7,700	

\* Assuming 4,000 hours p.a. and 20 ct/KWh



Additional uncalculated saving probable:

- No cost for lamp exchange and adjustment
- Very low maintenance efforts
- Reduced heat generation means less cooling required

<sup>4</sup> Condition: Screen size (11.5m x 6.4m = 73.6m<sup>2</sup>) x Ambient light common (70 lux) x Contrast (7:1) = 36,000lm



## Projection applications where RB laser represents the best choice - The bigger picture

RB laser projection is ideally used for scenarios demanding a high brightness output either for large screens sizes or for bright environments. Here, RB laser can exhibit its exceptional image quality paired with operational efficiency in creating a truly impressive outcome.

### RB laser for presentations

Presentations to very large audiences require a huge visual canvas on which to deliver an eye-pleasing and easy-to-read visual experience. In this context, projection screens in universities, multi-purpose halls, museums, enterprises as well as indoor sporting and event arenas are commonly utilising screen widths of ten metres or even more. The high installation flexibility with motorized and adjustable zoom lenses allows the image to be adapted to suit the environment and spatial requirements. The wide colour space is appropriate for PowerPoint presentations, video playback, photo/slide shows and live stream camera feeds and more. Our RB laser projectors are even certified as “Cinema Quality Picture” devices as the video processing engine meets the high quality demands of digital cinema projection.

### RB laser for mapping and façade projection

Projection onto buildings is a fascinating way to visually transform structures and express engaging stories. Thanks to high brightness levels of up to 35,000 ANSI lumen, RB laser projectors are a perfect solution for large and colourful images on buildings and other three dimensional surfaces. The broad range of wide zoom interchangeable lenses will allow a quick and easy adaption to various environmental conditions.

### RB laser for cinemas

Audiences can enjoy the most vibrant and stunning colour reproduction for incredibly lifelike scenes thanks to innovative RB laser technology. The high initial brightness levels of up to 35,000 ANSI lumen makes RB laser projectors the ideal solution for large and premium format cinema screens of up to 32m. The brightness output of these projectors can be individually adjusted from 30% to 100% to provide crisp images whether enjoying 2D or 3D movie playback. RB laser projectors provide up to 4K resolution (4096 x 2160 pixel) and ensure a unique immersive cinema experience. They are also ideal for additional non-cinematic screenings such as company presentations or gaming events helping to increase usage and maximise revenue for cinema operators.

### RB laser for rental & staging

The venues used by rental & staging companies are similar to all venues where presentations or mapping is required but the projection equipment is not permanently installed. RB laser projectors are chosen when extremely high brightness outputs are required and justify the usage of bigger projection devices.



The following table gives an overview of different use case scenarios and corresponding recommended technology. It lists typical application scenarios and related requirements in order to ensure that projection is properly displayed even under difficult lighting conditions. Please note that these values are references only and have a wide tolerance.

Industry	Application	Brightness requirement	Colour gamut requirement	Recommended technology	NEC recommended laser projectors
<b>Cinema</b>	Small and mid-sized cinema projection	Up to 20,000 lm	DCI	Laser Phosphor	NC1201L, NC1701L, NC2041L
	Large-sized cinema projection	Up to 35,000 lm	DCI	RB Laser	NC3541L
	Special format screen projection	Up to 35,000 lm	DCI	RGB Laser	NC3540LS
<b>Corporate Office</b>	Corporate meeting room presentation	Up to 8,000 lm	Rec. 709	Laser Phosphor	PA803UL, PX803UL, PA653UL
	Small and mid-sized conferencing room projection	Up to 10,000 lm	Rec. 709	Laser Phosphor	PX1005QL, PX1004UL
	Large-sized conferencing room projection	Up to 35,000 lm	Rec. 709	RB Laser	PH2601QL, PH3501QL
<b>Energy and Utility</b>	Small and mid-sized control room projection	Up to 10,000 lm	Rec. 709	Laser Phosphor	PX1005QL, PX1004UL, PX803UL
	Large-sized control room projection	Up to 35,000 lm	Rec. 709	RB Laser	PH2601QL, PH3501QL
<b>Entertainment, Leisure &amp; Hospitality</b>	Standard indoor projection	Up to 10,000 lm	Rec. 709	Laser Phosphor	PA803UL, PA653UL, PX803UL, PX1005QL, PX1004UL
	Event halls, ball rooms and arena large screen projection	Up to 35,000 lm	Rec. 709	RB Laser	PH2601QL, PH3501QL
	Mapping and façade projection	Up to 35,000 lm	Rec. 709	RB Laser	PH2601QL, PH3501QL
<b>Education</b>	Lecture hall presentation	Up to 10,000 lm	Rec. 709	Laser Phosphor	PA803UL, PA653UL, PX803UL, PX1005QL, PX1004UL
	Large-sized auditoriums	Up to 35,000 lm	Rec. 709	RB Laser	PH2601QL, PH3501QL
<b>Manufacturing and Engineering</b>	Design and development	Up to 35,000 lm	Rec. 709 and Rec. 2020	RB Laser, RGB Laser	PH2601QL, PH3501QL, NC3540LS
<b>Rental and Staging</b>	Small and mid-sized projection	Up to 10,000 lm	Rec. 709	Laser Phosphor	PA803UL, PA653UL, PX803UL, PX1005QL, PX1004UL
	Large-sized projection	Up to 35,000 lm	Rec. 709	RB Laser	PH2601QL, PH3501QL
<b>Retail</b>	Standard in-store projection	Up to 10,000 lm	Rec. 709	Laser Phosphor	PA803UL, PA653UL, PX803UL, PX1005QL, PX1004UL
	Large-sized projection surfaces	Up to 35,000 lm	Rec. 709 and Rec. 2020	RB Laser, RGB Laser	PH2601QL, PH3501QL

## Conclusion

RB laser is a superb development of laser light source technology and provides an unbeatable solution when it comes to delivering an impeccable visual experience. RB laser takes advantage of both laser phosphor and RGB laser technologies resulting in a powerful solution which delivers compelling benefits in terms of cost, operational efficiency and immersive image quality. With higher brightness, greater detail, more accurate colours and better installation flexibility, these high performance installation projectors with RB laser technology will create an unmatched visual experience that will set new standards. The use of a red and blue laser light source goes beyond the colour and brightness output of traditional laser phosphor projection systems generating a brilliant image with high uniformity. The efficient light processing system has a low initial cost compared to RGB laser projectors, provides higher brightness levels than laser phosphor projectors and delivers huge savings in operational costs compared to Xenon based projection systems by avoiding lamp and filter replacements.

## One Brand - Bright Choices

NEC offers a wide range of projectors designed to meet the needs of professional installations, especially when it comes to finding the right projection device for large screen applications.

NEC's portfolio of Installation and Cinema projectors has been carefully developed to fulfil the requirements of screen size, visual quality and image resolution in order to guarantee state-of-the-art image performance with investment and future-proof security.

In addition to the wide choice of projection devices, NEC is perfectly positioned in the market to be able to supply LCD Desktop and Large Format Displays as well as direct view LED modules. This unique position enables NEC to take a customer-focused consultative approach, remaining technology-agnostic in its recommendation for the best technology to suit the application. In order to find a display solution that perfectly fits your application, contact your local NEC sales team or NEC partner.



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