

6. Screens for Digital 3D Cinema



Andrew Robinson
Managing Director
Harkness Screens



HARKNESS SCREENS

Introduction

Digital projection has made single projector 3D solutions much cheaper and of a much higher quality than traditional film projector systems. A single projector can be used. All 3D systems rely on creating separate images for the right eye and left eye. Different technologies are used to create the separate right eye and left eye image streams. Depending on the technology used, there are significant implications for the choice of cinema screen.

3D Technologies

There are 3 principal technologies used for 3D systems in cinemas:

- Polarised light systems. These rely on light being polarised in different forms to create the right eye and left eye image. This can either be done by circular polarisation or linear polarisation or a combination. This technology is well established and has been used for a long time with film projection. It is used by RealD, which is the most popular system used with digital projection in cinemas. Master Image also use a variation of this technology.
- Dolby use a system based on different wavelength triplets of visible light to create separate right eye/left eye images. This, like the polarised light system, is a passive system.
- So called "active" 3D systems use special eyewear with shutters to control the provision of separate images to the eyes. The eyewear is battery operated and controlled by an IR signal. Xpand use this technology.

One feature of all 3D systems is that they absorb a very large amount of the light that is normally available from the projector in 2D mode. The light loss is a result of having to create separate images for each eye, which immediately loses 50%, and there are further losses from the filters in the system. Because of the huge light losses, high power lamps normally need to be used in the projectors; typically 6kw Xenon lamps, although for smaller screens 4kw may be sufficient. RealD's XL system recovers some of this lost light and has a higher overall efficiency making it very suitable for larger screens.

Screen implications for 3D systems

Polarised light systems require a screen that will maintain the polarisation of the light when it is reflected. So-called silver screens are used for this purpose. In fact, these screens are coated with a special paint containing fine aluminium flakes. The usual white cinema screens are not suitable, as they diffuse the light and change the polarisation. The signal-to-noise (or extinction) ratio measures the amount of interference between the right eye and left eye images. Typically at least 120:1 extinction ratio on axis is required to maintain a good 3D image. The 3D image has a "ghost image" if the left eye

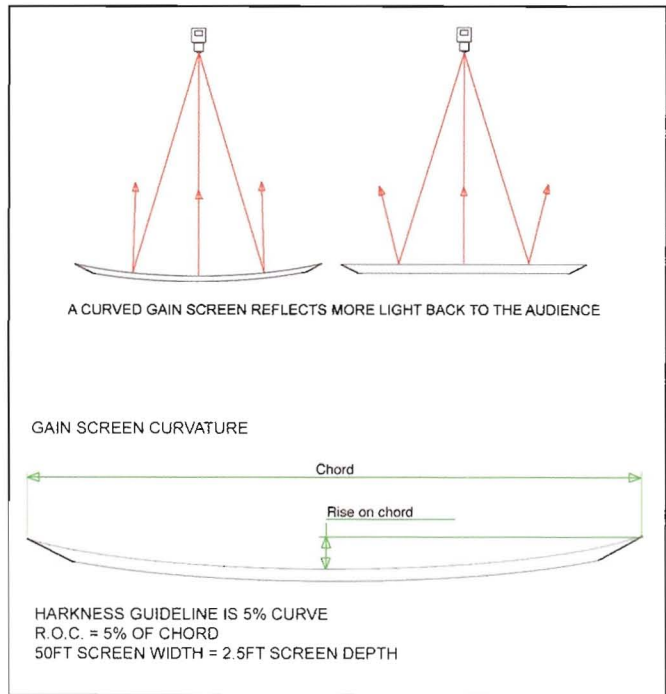


image is partially received by the right eye.

The other 3D technologies use white screens but because of the huge light loss, screens with a high degree of "gain" are required for all screens except small sizes. Silver screens inherently have a high gain level (typically 2.4) so polarised light systems benefit from the intrinsic gain of the silver screen. The implication of this is that, in most theatres, it will be necessary to change the screen when installing any 3D system using a single projector. This will always have to be done with the polarised light system, but often it will need to be done with other systems to achieve adequate brightness levels.

Harkness Screens has introduced a 2.2 gain screen specifically for 3D systems that do not use polarised light but which will benefit from a higher gain level.

Implications for 2D viewing

As theatres are not usually dedicated to run 3D movies all the time, 2D movies will be run in the same theatre and on the same screen. Regardless of the system being used, the main implication is that the screen will have a higher brightness level than is needed for 2D. This means that the projector light output has to be reduced by decreasing the current or by changing the lamp. RealD's XL system, because of its higher efficiency, does not usually require this adjustment.

| Provider | Technology | Light efficiency (1) | Screen type | Eyewear | Max screen size (2) |
|--------------|---|----------------------|--|---------|---|
| REAL D | Polarised light and Z screen | 15% XL 27% | Silver 2.4 gain | Passive | 45ft, >60ft with XL |
| DOLBY | Wave triplets and filter wheel | 12% | White 1.8/2.2 gain, except for small screens | Passive | 40ft with high gain screens; <30ft with matt white screens |
| XPAND | Synchronised projector and eyewear shutters | 18% | White ; gain on bigger screens | Active | 50ft with high gain screens |
| MASTER IMAGE | Polarised light, rotating polarising wheel | 15% | Silver 2.4 gain | Passive | 45ft |

(1) Light measured through eyewear compared with projection in 2D mode on same screen gain.

(2) To achieve a minimum of 4.5 ft. lamberts in 3D mode.

Implications for theatre selection

Because of the high gain level, the viewing angle on the screen is narrower and, as a result, the seats in the more extreme regions at the front of the theatre may see some variation in brightness. It is therefore recommended, when deciding in which theatre to install a 3D system, to choose auditoria that have a relatively long "throw" in relation to the screen width because this minimises the consequences of the viewing angle effect of high gain screens. Theatres that have relatively short focal length lenses for 2D will contain more poor seats than longer throw theatres. Seats that are outside a viewing cone of 25-30° off screen axis are likely to suffer a poorer viewing experience.

Screen size and shape

Screens for 3D viewing should be curved as this improves the

light distribution. The recommended curve is 1:20 (depth / width). The diagram illustrates how a curved screen reflects more light back to the audience.

Light levels

With a 6kw lamp in a digital projector and a screen gain of 1.8 or more, it is possible to operate 3D on screens up to 45-50 ft with acceptable light levels. Whereas for 2D viewing 14ft lamberts is recognised as the norm for digital projection, for 3D it is expected only to achieve 4.5ft-lamberts, and films are colour graded accordingly. RealD's XL version can be used for screens over 60ft.

Andrew Robinson
email: A.Robinson@harkness-screens.com

The New 2010 QUBE XP-D SERIES 2

Designed for flexibility
Engineered for the long haul



The fastest, most versatile and cost-effective 3D mastering system in the world.

QUBE
MASTER *Pro*

World's #1 3D Digital Cinema
mastering system

Quality, reliability and next gen technology that create a seamless digital cinema experience - the new Qube XP-D Series 2 server guarantees this and more!

The trusted solution to international standards-compliant digital cinema across continents. The all new Qube XP-D Series 2.

QUBE

Digital Cinema
www.qubecinema.com

Qube Cinema, Inc.

Europe

Nigel Dennis
Tel: +44 (208) 144-5661 | Mobile: +44 7878717548
email: nigel@qubecinema.com

USA

4640 Lankershim Boulevard, Suite 601, North Hollywood, CA 91602-1844, USA
Tel: +1 (818) 392-8155 | Fax: +1 (818) 301-0401
email: info@qubecinema.com