

TECH BRIEF

Improving Giant Screen images

Resolution matters

With 4K and 8K TVs already in the home and 4K projectors in standard movie theaters, is 4K the right resolution to create the incredible experience the giant screen industry needs to get people into the seats of their theaters?

What factors impact the final perceived resolution onscreen?

Just using a statement like “4K resolution” to define performance may be overly simplistic because it omits some other factors impacting final system resolution and hence the perceived image quality for different viewers.

These include:

- › **Critical aspect** - no projector chip set exists for the industry's 1.43:1 display aspect ratio
- › **Greater vertical viewing angles in domes** - good lookup and lookdown angles are needed
- › **Lens degradation** - the optics on the projector can greatly impact the focus, clarity, sharpness and contrast
- › **Screen** - screen surface finish and perforations for sound scatter light and somewhat degrade system resolution seen by the viewer
- › **Seating position** - where the viewer is seated impacts final perceived resolution or sharpness
- › **The camera used to shoot the film and post-production processing** - both factors affect final system resolution



^ US Space and Rocket Center

How much resolution is enough?

The equivalent resolution of 15p70mm film is 18 to 36 addressable (onscreen) Megapixels.

The minimum acceptable resolution to replace film is around 22 Megapixels. This provides the audience with a minimum comparable experience to film, no matter where they are sitting in the theater. 4K resolution (4096 w x 2160 h) is simply too low to look good.

As we all know, for a dome theater, resolution is much more critical than for a flat screen.

Stretching a single 4K projector's worth of pixels on a dome has a result of very large pixels and even the best seats will see distractingly large pixels which become far worse as you sit towards the sides. This is also significantly lower resolution than 15p70mm film.

The example below illustrates why systems using multiple projectors look so much sharper than single 4K projectors:



^ COSI Planetarium

Three blended 4K projectors in portrait mode

› 5700 pixels wide x 4096 pixels high

› 22 total addressable Megapixels

One single 4K projector in landscape mode

› 4096 pixels wide x 2160 pixels high

› 8.8 total addressable Megapixels



- › The ultra-compact form factor of the Christie Mirage SST fiber-coupled RGB pure laser projection head allows it to be installed into tight, challenging environments.

The impact of anamorphic lenses on giant screen images

In the real world our visual acuity is about the same no matter which way we tilt our heads. In other words, we have equally sharp vision for vertical or horizontal lines more-or-less, or any angle for that matter (i.e. vertical resolution = horizontal resolution). If you want to reproduce what we see naturally, it is better to use square pixels than rectangular pixels, and certainly important to match the shape of the film-capture pixels to the projected pixels, or else distorted images will result.

Some film systems use anamorphic lenses (also known as fisheye lenses) to stretch images out in projection. If you do this in digital projectors with DMD's with square pixels, those pixels get elongated and are no longer square on the screen. Hence you no longer have uniform resolution – it will be less in the direction you stretch them out.

This suggests that systems using standard non-anamorphic lenses and square pixels are superior in image fidelity to those using either anamorphic or fisheye lenses in domes.

Also, if the multiple projectors in a blended system use standard lenses, each lens contributes a more uniform resolution, lower heat load, better depth of field, and higher image quality overall than any single anamorphic lens can produce in a dome.



- ^ The Christie D4K40-RGB is an all-in-one high-brightness, large-venue RGB laser projector. There are no heavy external chillers, remote laser racks, or special pedestals – everything is completely integrated into a single chassis.



- ^ Great Lakes Science Center, Cleveland Clinic DOME Theater

Connect with an expert

If you have additional questions, or if you need some help in selecting the right solution, please contact us. We can connect you with our team of experts who will be happy to help you work through the various steps of your evaluation and procurement process.

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