TECH BRIEF

Improving Giant Screen images
Frame rate matters

We may have incredible static spatial resolution when the images on the giant screen are relatively still, but as you know, moving images are a different thing altogether. Many challenges occur with a frame rate of 24 frames per second (fps), with the fine detail in the images frequently being lost. Yet it is these fine details in the beauty shots that make high resolution Giant Screen movies spectacular.

We differentiate the effective visual resolution when images move with the term "temporal resolution" or "dynamic resolution" which is affected first and foremost by frame rate in fps.

Strobing and motion blur

Temporal resolution affects several perceptual factors, including an effect we call "strobing" or "judder" which is a jerky, jumpy, stuttery look when objects in the scene move too quickly (for example: when the camera pans too fast or we fly over a landscape quickly). This strobing artifact has always been one of the biggest challenges of Giant Screen films and filmmakers go to great lengths to try to minimize it at 24 fps.

To overcome this challenge, cinematographers have had to restrict camera and/or object movements as well as increase the amount of blur in the content to make it watchable, effectively reducing the onscreen resolution of the image. You can notice it particularly in the periphery of flying shots with bright images like white waves on dark water, or other high contrast subjects, diverging out to the edge of the screen or dome. In aerials like this, often the only sharp thing you can look at is in the center of frame that you are flying towards – the rest is blurry due to motion blur, stutters badly or is a combination of both depending on the speed of the motion.

The Christie® Mirage SST delivers up to 50,000 lumens and high frame rates of 120fps at 4K for detail-rich visuals and 3D processing.

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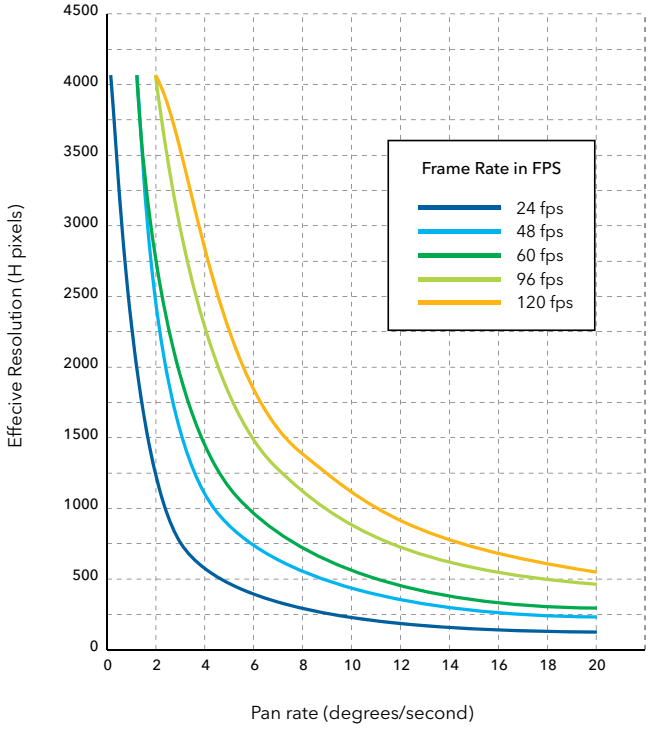
Higher frame rates improve image quality

To eliminate motion blur, and therefore improve image fidelity, you increase the frame rate.

The higher the frame rate, the sharper the image, in other words, the higher the temporal (dynamic) resolution, and that increases the effective onscreen resolution, resulting in sharper dynamic imagery.

The chart on this page illustrates that 120 fps (in orange) is clearly the sharpest frame rate, as Christie®, Doug Trumbull, Pierre Routhier and Gord Harris have demonstrated at several GSCA conferences. In fact, the 120 fps HFR (high frame rate) gathered the highest GSCA audience image quality ratings with 91% of survey respondents rating it 8 out of 10 or higher and 53% giving it a 10 out of 10 rating. In comparison, 80% of survey respondents rated the image quality of 24 fps 7 out of 10 or lower, with just 1% giving it a 10 out of 10 rating.

A perceptual study by Dr Laurie Wilcox at York University, Toronto, Ontario also found a clear preference for higher frame rates regardless of content, with the most benefit of 60 fps or higher with action shots with very rapid motion. These findings are consistent with simulation and modern gaming, which typically operates at speeds greater than 100 fps.



The huge decrease in effective resolution with even modest pan rates

The Christie D4K40-RGB and Mirage 4K40-RGB all-in-one, 40,000 lumen, 4K projectors offer high frame rate capability of 60 and 120fps respectively, with options to upgrade to higher frame rates.

HFR in the Giant Screen environment

The latest Christie® 4K RGB laser projector family supports full resolution 4K including 24, 48 and 60 all the way up to 120 fps. For specialized applications, some projectors can even support up to 480 fps. This is where large bandwidth electronics are essential. The Christie TruLife™ electronics platform has an effective bandwidth that can deliver 1.2 billion pixels per second (Gpx/s), thereby enabling compelling projection displays with enough resolution and frame rate.

For traditional cinema, 24 fps can be made to work, perhaps as our brain fills in the details. For those, we put up with the strobing, flicker and motion blur as part of that conditioned dreamy "film look". But for Giant Screen films and documentaries striving to transport people with that "you-are-there" feeling, the benefits of HFR projection at 60 fps or higher are obvious.

Published in August 2018, DIGGS 2.0 suggests 60 fps or higher as the new standard frame rate for Giant Screen theaters, which seemed like a sensible compromise between 24 and 120 fps at the time.

However, commercial cinemas have already begun moving to higher frame rates. In August 2019, Huaxia Film, a well-known film distributor in China, launched its Cinity Cinema System designed to project 4K 120 fps high frame rate movies. Plans are underway to install the first 100 of these projection systems in cinemas across mainland China, Hong Kong, Macao and Taiwan.

It is clear the Giant Screen market must improve its offering to at least keep pace with the commercial cinema market and entice audiences into their theaters. Taking advantage of higher frame rates to provide a more true-to-life, immersive experience could be one of the keys to delivering the wow factor audiences crave.

US Space and Rocket Center

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.

christiedigital.com/imagematters

For the most current specification information, please visit christiedigital.com

CD3830-Frame-rates-matter-Whitepaper-Aug-23-EN

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