Unlocking the power of IBL On Set

Together with other virtual pioneers including Orbital and disguise, Quasar Science brings the worlds of technology and creativity together.

FROM VIDEO TO LIGHT

In this series exploring image-based lighting (IBL), we've examined how virtual production environments can benefit from IBL, and taken an overview of the equipment and techniques involved. Practical approaches to getting image data from its source to the production lights themselves uses the same processes which have been used for years in live event lighting, on a much larger scale.

Traditionally, the sort of lighting setups used for both live events and screen production have involved up to a few hundred individual devices. Some of the lights used in theatrical and nightclub settings might use a dozen or so control channels each, creating a situation which was already beginning to test the capability of the oldest standards. More modern setups might include dozens of LED pixel tubes, each with dozens of individually-controlled elements, each with half a dozen control parameters, representing much more data than historic control systems could practically handle.

Meanwhile, the task of taking video data and turning it into lighting control instructions is not entirely new. Using video as a source of data to create spectacular abstract effects has been common on gameshow sets for live TV and in ambitious nightclubs for some time, and IBL often leverages the same technology.

TRANSPORTING DATA

The DMX512 lighting control protocol is common, convenient and frequently used on set, but the original implementation dates from a time when intelligent lighting devices were rare and specialised, and the capability of the standard is modest. It can update 512 eight-bit values (that is, numbers from 0 to 255) about 44 times every second, for an effective data rate of about 180 effective kilobits per second. By comparison, the gigabit Ethernet that's normal even in inexpensive home networking is more than five thousand times faster, making it much more capable of transporting video data to modern, high-capability production lights.

The Architecture for Control Networks, ACN, was designed to do this, and standardized in the 2000s. The streaming version of the protocol, sACN, sends large amounts of DMX512 data over an Ethernet link using the same protocol set as general-purpose networking. Because sACN operates over Ethernet, it's easily integrated into devices such as Green Hippo's Hippotizer, or competing media servers, which can leverage the Ethernet connectivity of a workstation or laptop. Similarly, ACT's grandMA3 console supports sACN with the goal of reducing the cabling workload on conventional shows, as well as facilitating IBL control.

Art-Net has a similar goal, although is somewhat simpler than sACN. Recent revisions can address up to 32,768 DMX512 buses, allowing for nearly 17 million 8-bit values to be sent. Theoretically, both Art-Net and sACN can be sent using wireless Ethernet devices to avoid cables altogether, although technical requirements vary and some degree of network engineering expertise may be required. Art-Net, for instance, demands that involved devices support networking techniques such as arbitrary IP addresses, network address translation and port forwarding. Some domestically-targeted routers may not support these techniques, and for wireless links, both reliability and bandwidth can be concerns.

Rainbow wireless control:
CRMX, W-DMX, Bluetooth, sACN & Art-Net

CRMX, designed by Lumen Radio and often built into production lights using one of the company's modular electronic parts, is an application-specific standard for sending DMX data over a radio link, although it uses the same 2.4GHz radio spectrum as many other general-purpose radio applications, including Bluetooth and some types of wireless Ethernet. Some devices add the ability to translate between CRMX and older W-DMX protocols, so a single controller can operate a wide variety of lights.

Any of these standards might find use in IBL, although wired Ethernet-based approaches are popular due to their high capacity and reliability.

DATA CONVERSION

Converting HDMI or SDI video data to lighting control data might involve a media server – essentially a conventional computer workstation running software – or a lighting control console. The devices used to control IBL setups are often high-powered computer workstations running complex software with more features than we can discuss in depth, but they often lie at the center of an IBL workflow.

A wide variety of tools may be available to allow engineers to choose which parts of the video image control which production lights. Facilities commonly include the option to pick individual values, or ranges of values, from a video image. A color picker, for instance, might allow a single point in the image to behave as the color source for a single light. To minimize flickering caused by small variations in the image, an averaged area of pixels might also be used to control a production light. Larger arrays of lights, representing hundreds or thousands of pixels, might be controlled by pixel values derived from large areas of the image.

Because the video will often have higher resolution than the array of production lights, various scaling techniques might be involved in preparing video data for lighting devices. Physical rigging becomes important, since naturally, the size and orientation of the production lighting array must make sense in the context of the image data they receive. Also, the color and brightness of the video data might need adjustment such that production lights match the appearance of a video wall, something that's complicated by the fact that the color performance often varies between lights.

COLOR CONTROL

Until very recently, there was little attempt to achieve color consistency between different color-mixing lighting devices. At the economy-focused end of the lighting market, that might even apply between the products of a single manufacturer. Because different devices often use very different technologies, sending the same lighting control data does not guarantee a match.

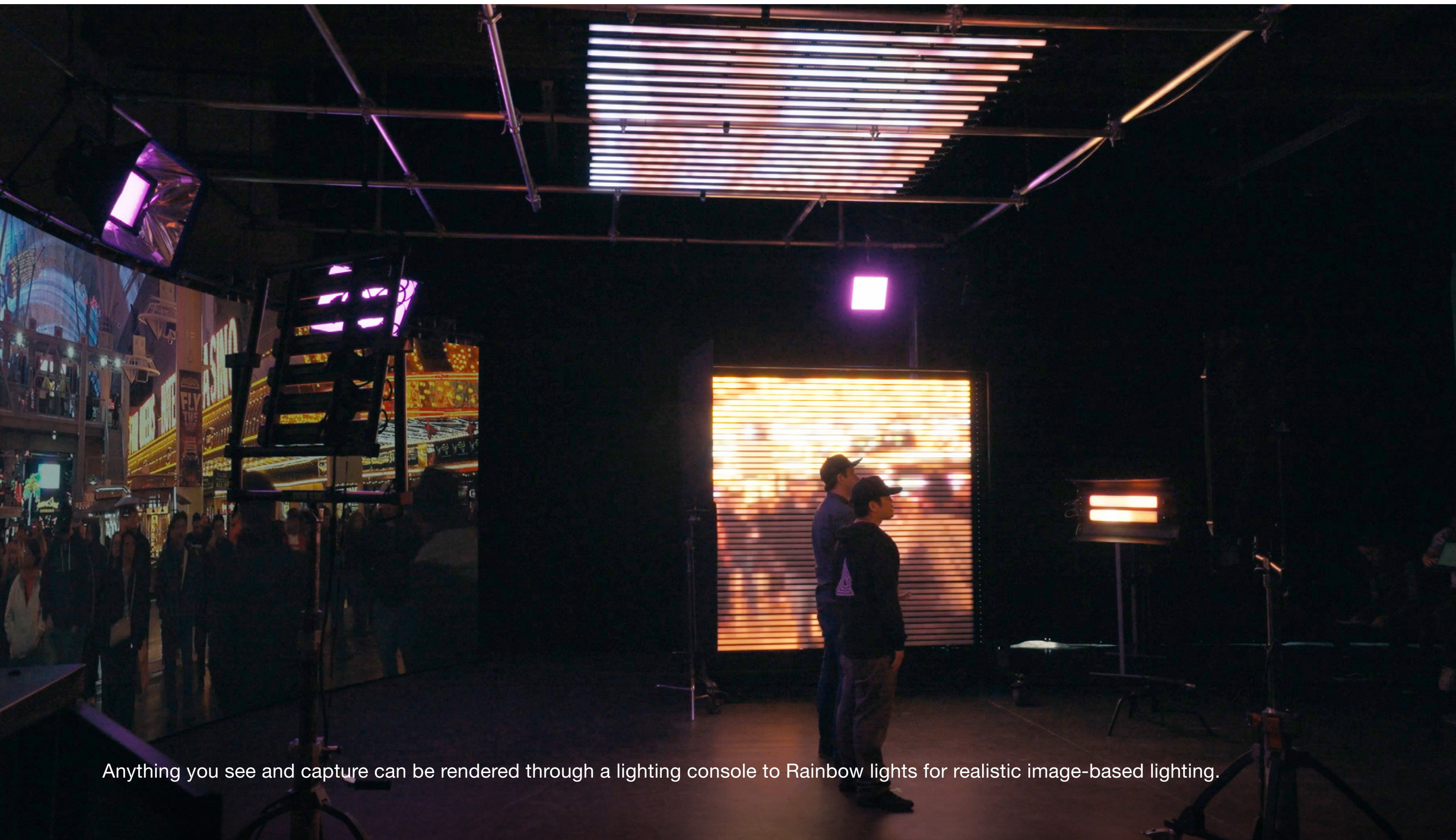
Lighting designers have been dealing with this for decades. Before the advent of high-power LEDs, color mixing lights were (and are) built using gas discharge sources and several color filters, so that many colors could be created by using those filters in various combinations. These features might be controlled by an eight-bit value, allowing for 255 steps of each color and a theoretical total of at least 16.7 million color combinations.

While that works, the precise color of the filters and light source is not usually standardized, and nor is the amount of color introduced in response to a particular control signal value. LED lighting often suffers similar concerns, since different designs might use different combinations of LED emitters and different processes in the control electronics. Common designs might use just red, green and blue emitters, or add one or two shades of white, or add other colors. Video wall panels to date use only red, green and blue, which is why their light has poor color quality, and one good reason we might prefer to use supplementary lighting in the first place.

Conversely, video devices, such as monitors and cameras, are well-standardized in terms of red, green and blue primaries, as well as the relationship between control signal and light output. It may be possible to solve color and brightness problems with video processing equipment working on the HDMI or SDI feeds, or by using color modification tools on the server generating the image. A better, emerging solution is for rendering servers, media servers and lights to all work with the sane color and brightness standards used by video devices, an approach that’s increasingly common on lights built with virtual production in mind. Increasingly, those same standards can also be applied to real-time rendered imagery. The OpenColorIO system became part of the popular Unreal Engine after version 4.22. The system allows various color and brightness handling standards to be applied to the virtual camera of a rendered 3D scene. It can then be treated exactly as live action material would be.

Using these approaches means video data intended to be displayed on common monitors, or video walls, can be sent directly to the light unmodified, and the colors should match. At the time of writing, the potential combinations of 3D rendering devices, lighting control systems and software, lighting devices, video wall panels and their processors are changing quickly. Specifics will always depend on the requirements of each project. However any of this is done, though, the task of selecting areas of the image to drive IBL, matching colors, and sending that data to production lighting remains much the same.

The specific color capability of any particular production light, and its ability to implement various standards, depends on the exact configuration of emitters it has and the electronics which control them. That’s crucial to both color matching and the ability of the light to fulfil the cinematographer’s intent.



Anything you see and capture can be rendered through a lighting console to Rainbow lights for realistic image-based lighting.

QUASAR SCIENCE SOLUTIONS

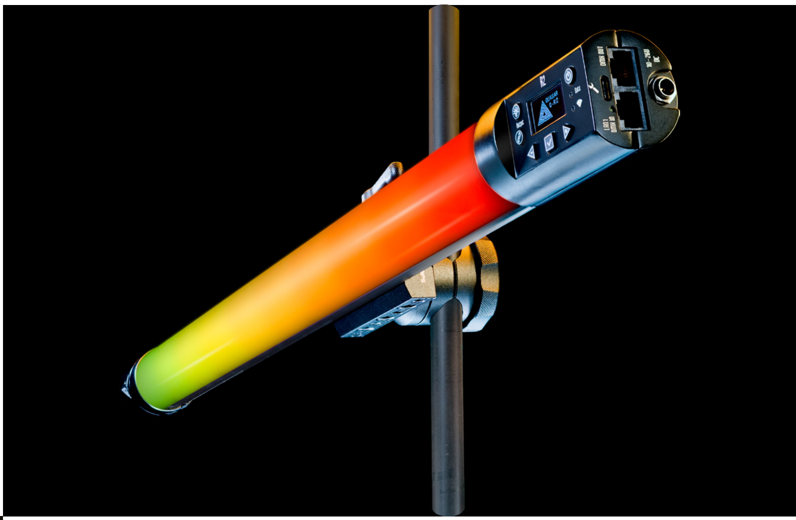
Image-based Lighting (IBL) is transforming the way DPs, console programmers, and technicians approach set lighting. Using the same assets projected onto the volume wall, IBL creates pixel mapped lighting that adds heightened realism to the virtual set. Subtle nuances in light texture, movement, and spectral characteristics create dramatic effect, elevating the storytelling potential of virtual production.

IBL is paving the way for a new level of creativity and excitement in visual storytelling, but not without some challenges that we solve with Quasar Science solutions.

RAINBOW 2

The premier linear LED for motion picture and content creation. High quality tunable white light and the highest RGB color saturation with multiple pixels to maintain super smooth, flicker free dimming, the R2 will be your workhorse. This linear LED light offers incredible data connectivity whether wired or wireless and can be powered anywhere via AC and DC power inputs. Integrated Ossium Mounting System (OMS) allows for rigging in ways previously unobtainable.

Available in: 2’ 4’ 8’



DOUBLE RAINBOW

The Double Rainbow (RR) Linear LED, with its two rows of high fidelity RGBX pixels, creates realistic lighting with vibrant saturated colors and intense white light. A unique shape provides a powerful light source using little space. Wireless and wired data connections mean no data boxes, receivers or transmitters. Built in network switch for simple native connectivity. Integrated Ossium Mounting System (OMS)rigging adapts to everything. AC/DC inputs for continuous power whenever and wherever.

Available in: 2’ 4’

OSSIUM FRAMES

Combine Rainbow tubes into stacked arrays to create a wall of light. Both Rainbow 2 and Double Rainbow bolt on using the integrated Ossium Rail, supported by the solid Ossium Frame. Power up with the included multibank adaptor, and add data for dynamic control of your lighting array. Direct Connect of every industry standard wired and wireless control option from DMX and Bluetooth through to sACN. Simple to set up, with the power to be complex in all the right ways.

Available in: 2’ 4’

Arrays for up to six Double Rainbows or twelve Rainbow 2’s. Please enquire for bespoke 8’ installations.

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