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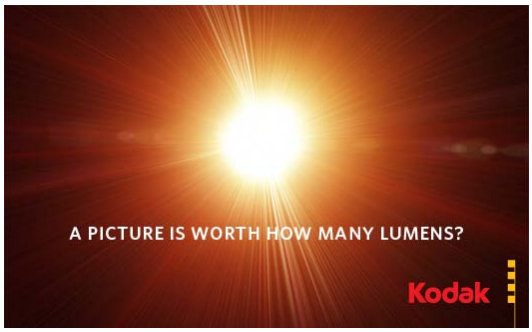
Kodak Demonstrates Laser Projector

Kodak (Rochester, NY) has developed an 11K-lumen laser projector with a 10K:1 dynamic range. Kodak will demonstrate the system to selected industry representatives on Oct. 7 and 15 in the 1,500-seat Theater on the Ridge in Eastman Business Park in Rochester, NY. The theater has a 40-foot-wide screen, according to Kodak. (The first demonstration took place on Sept. 30.)



One of the advantages of the use of laser illumination, Kodak says, is the fact that 3D images generated by a laser projector are about twice as bright as 3D images produced by a lamp-based projector with the same 2D lumen output.

Kodak will be demonstrating the projector in both 2D and 3D modes. For the 2D mode, the 40-foot screen will have a gain of 1 and the image will be shown at 14 foot-lamberts. For the 3D demo, a 40-foot silver screen will be used with a gain of 2.3. With the same laser power used in the 2D demo, the image will be 8 foot-lamberts. For comparison, the specified theatrical 3D brightness is 5.5 foot-lamberts but 3.5 – 4 foot-lamberts is a more common brightness achieved by exhibitors.


Kodak Laser Cinema Projector

Insight Media recently had a chance to talk to Barry Silverstein, projection technology manager in the Kodak Entertainment Imaging group. He emphasized that the projector Kodak will be demonstrating is not a laboratory breadboard. Rather, it is a prototype of a commercially viable projector and it has been installed in the projection booth of the theater. The current version is somewhat larger than a xenon-based, 11K-lumen digital cinema projector, but Silverstein said Kodak has already done the mechanical design work that will make the projector the same size as a xenon-based unit with the same output.

Silverstein said the projector is a 3-DLP projector that uses the normal DCI-compliant DLP imagers and electronics. While the current prototype uses 2K imagers, the optical design will allow the use of 4K DLP imagers in the future.

Kodak designed the optical block of the system from the ground up for laser projection. In particular, he said this demo is not just laser light being fed into a standard cinema projector originally designed for xenon illumination. All of the optics were specifically designed to take advantage of the laser's properties. During the design phase, Kodak took into consideration both performance and cost. Performance, of course, includes 3D performance.

Silverstein said the demo unit uses lasers from Necsel (Formerly Novalux) (Sunnyvale, CA), although the design and Kodak are laser-agnostic. He said lasers from other manufacturers could be used with the current design. When asked specifically, he said a Kodak licensee could use lasers from Laser Light Engines (LLE) (Salem, NH) in the design, if desired. The demo unit produces 11K lumens from 12 green and 12 blue frequency-doubled lasers from Necsel that run at 3W output per laser. The 12 red lasers are direct-emission bar lasers that are packaged by Necsel and run at higher power.

One of the major benefits of laser cinema is the long life of lasers compared with the life of xenon lamps. Insight Media asked Silverstein about laser life and whether his experience supports laser manufacturers' claims. He said that while Kodak has not done independent studies on laser life, his experience is that the laser-makers' lifetime claims are perhaps on the conservative side. He did add that proper cooling of the lasers is essential to get the target life.

According to Silverstein, the current design is not limited to 11K-lumen output. Kodak has designed the optical system so additional lasers can be added without change to the imaging system design, up to a maximum output of about 40K lumens.

Silverstein said the optics were designed to preserve the laser polarization through the complete optical path. There is an internal polarization switch in the system to switch between two orthogonal polarizations. In 3D mode, this switch controls the display of left and right eye images and allows the system to use passive glasses. In 2D mode, the switch continues to run and aids in laser speckle reduction. In the upcoming demos, Kodak will use linear polarization for 3D, but Silverstein said there would be no problem using circular polarization.

Insight Media was told that one feature of the optical design of the projector is it eliminates the TIR prism. Silverstein said that in designing the projector, component manufacturability was taken into account. He said there are only two vendors in the world that can make TIR prisms for digital cinema projectors. To the extent possible, the Kodak design uses flats and spherical surfaces. According to Silverstein, the reduced cost and smaller size of these components will partially offset the cost of the lasers. The higher f/# and reduced back focal length of the Kodak design allows the use of much smaller projection lenses than conventional DLP cinema projectors, as shown in the photo. This will represent a significant cost savings to the projector maker and to the exhibitor. Silverstein added that no exotic materials are used in the Kodak projector: It contains materials (e.g. glass types) that have been used in the past by the digital cinema projector industry.

The demo will have a side-by-side 2D comparison with a commercial digital cinema projector with the same brightness. Silverstein said studio people and cinematographers who have seen the system in private demos have noted two features of this side-by-side demo. First, the black level of the Kodak projector is noticeably lower than the black level of the xenon-based DLP projector. Silverstein attributed this, at least in part, to the higher f/# used by the laser projector compared with that of the xenon projector.

Second, the color gamut of the Kodak projector is larger than the color gamut of a similar DLP projector with a xenon lamp. A DCI data file provides target X, Y and Z color coordinates for every pixel in every frame and the Kodak/DLP color management hardware and software displays these colors correctly even with the expanded color gamut. If the DCI file contains X, Y and Z values outside the normal xenon gamut but inside the Kodak gamut, a situation allowed by the DCI file specification, the Kodak projectors will display these colors correctly but a xenon projector will not.

When showing DCI content color-graded for a xenon projector, the laser projector produces virtually the same image as the xenon projector in the side-by-side demo. Silverstein said one visitor commented that he had never seen two projectors with such similar colorimetry. Clearly, Kodak put considerable effort into color management.

Silverstein said "eliminating" speckle is not possible and an expert can see speckle in a conventional digital cinema projector with a xenon lamp. He said the studio people and cinematographers who have seen the Kodak projector have pronounced the speckle acceptable.

Kodak has significant IP in the laser projector space, both in terms of issued patents and patent applications, he said. The focus of these patents is, of course, large-venue laser projection. He commented that some of the IP would apply to other types of laser projectors, from large-venue non-cinema designs all the way down to pico projectors.

When asked about safety and the Laser Illuminated Projector Association (LIPA) he said Kodak has not yet decided whether it will join LIPA. (See related article in this issue.) Kodak certainly supports the LIPA's goals and has provided information to further its work. He added that Kodak has already made an application to the FDA for a waiver on the projector design, which he expects will be granted soon. While a projector manufacturer would need to obtain a waiver on its commercial design, Silverstein believes that such a request would go quickly through the FDA process since the design would be similar to Kodak's and the FDA would already have experience with high-powered laser projectors from working on the Kodak application.

Kodak currently is looking for licensing partners to produce the system. Silverstein said Kodak is in discussions with several companies, but NDAs prevented him from naming them. While the main discussions have been with potential system manufacturers that would be Kodak licensees, Kodak has also talked to exhibitors and to cinematographers and studios. Kodak and exhibitors have mainly talked about total cost of ownership (TOC) and performance, while Kodak has talked to cinematographers and studios about color gamut and 3D.

Silverstein said that once a formal commercialization project has begun with a licensee, Kodak believes it would be 12 to 18 months before the laser projectors show up in local cinemas.
- Matthew Brennesholtz

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