

Cinemascom 2011 – High Frame Rate 3D Demonstration

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Introduction

On March 31st, 2011 James Cameron hosted a demonstration for the exhibition industry at Cinemascom 2011 in Las Vegas. The purpose of the demonstration was to show the benefit of increasing the capture and display frame rates in order to minimize or eliminate the strobing artifacts present at 24 frames per second per eye in 3D presentations. The intention is to provide the audience with a higher image quality and less eye fatiguing experience.

Screening Participants:

- Christie Digital Systems
- Doremi
- Lightstorm
- RealD
- Texas Instruments – DLP Cinema

Content and Capture Participants

Content was captured specifically for the presentation using three different camera systems - the Arri Alexa, Red Epic and Phantom Flex cameras were used for acquisition, on 3D rigs from Cameron Pace Group. All content was processed and posted by Modern Videofilm.

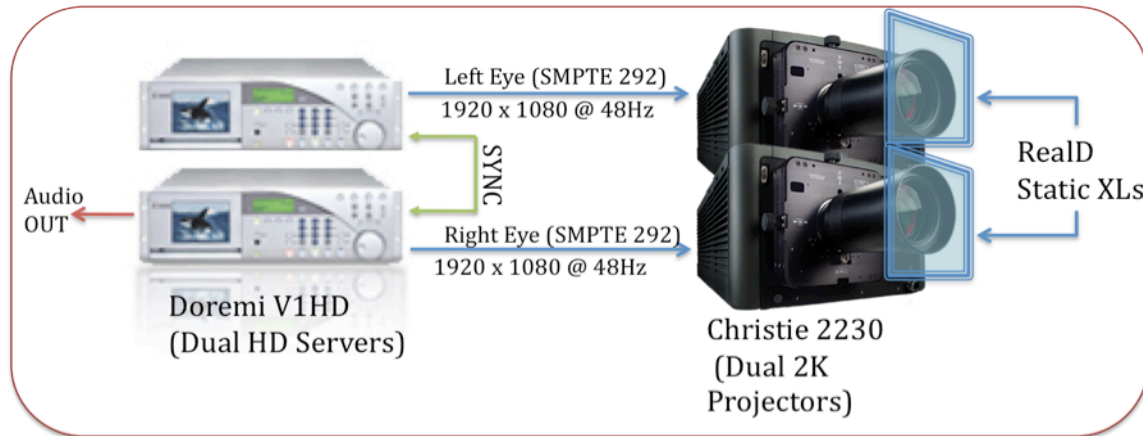
Content was captured at 23.976, 24, 47.952, 48, 60 and 120 fps per eye, at varying shutter angles.

Content was screened at 24, 48 and 60fps per eye.

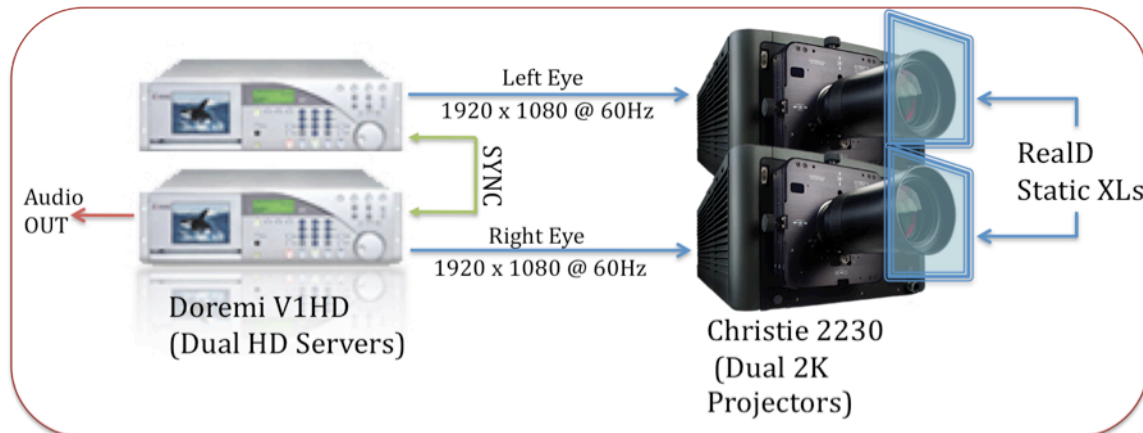
Display Configuration

- A total of 4 Christie 2230, 2K DLP Cinema projectors and 4 Doremi V1HD content players were used. The equipment was arranged in two groups each comprised of 2 projectors, two players, and two static 3D polarizers. See the diagrams below for additional detail.
- The 3D system was provided by RealD using 4 (one per projector) custom built static polarizer versions of the RealD XL system (static XLs) and RealD polarized glasses for the audience.
- The content was encoded and played back on Doremi V1HD system, using JPEG2K compression with each eye encoded at VBR 250Mbps, 4:2:2 10-bit.
- Screen size was 70 ft.
- The light level through the 3D system was 10fL.

- Audio was driven by one of the two V1HD units in each of the dual stack configurations.



Configuration for 24fps (per eye) & 48 fps (per eye) Content



Configuration for 60fps (per eye) Content

The Demonstration

The demonstration was intended for viewers to see the content back-to-back without interruption. There were multiple examples of the same take or similar takes, with the 24fps(per eye) content shown first, followed by the 48 fps (per eye) and then the 60fps (per eye). In addition to these series, frame rate extractions (processed by Reliance MediaWorks) were shown to demonstrate what was captured at 48fps (per eye) or 60 fps (per eye), then skip-printed and optimized with optical flow algorithms applied back to 24 fps (per eye) for comparison. When switching between projectors stacks, the inactive projectors were dowsed.

Considerations for Industry

A transition to higher frame rates impacts the entire workflow from production, post-production, packaging, distribution and exhibition. The industry including DCI

standards and SMPTE standards may need to be expanded to make the use of these higher frame rates for 3D.

DLP Cinema Projectors:

The current available series 2 DLP Cinema 2K platform already has the internal processing capability to support these higher 3D frame rates. Even though two projectors were used for the demonstration, software will become available later the summer (2011) from DLP Cinema that will enable single projector 3D at these frame rates.

The issue now becomes how to get the high frame rate 3D feature decoded and delivered to the projector.

Cinema Servers:

Although projector manufacturers can provide an external interface to accept a higher bandwidth signal, most external servers do not currently have the capability to output the additional bandwidth. Therefore the use of an Internal Media Block (IMB), which can drive the internal high-speed projector bus, is perhaps the better option. There currently are IMBs available and in development which can be used to output these higher frames rates. Doremi and Dolby are working toward real-world solutions for the very near future.

However, since the current SMPTE specifications limits the decoder's JPEG2K compression data rate to 250MB/s for a 48fps (3D) feature it is uncertain if this requirement needs to change to allow more bandwidth. Some of the IMBs available and in development will have the ability to support higher data rates beyond the DCI requirement. The industry will need to determine if the specifications should change.

3D Equipment:

Although custom static XLs were used for the multi-projector demonstration, the RealD XL and Zscreen systems in the field today can support these higher frame rates for use with a single DLP Cinema projector solution.

It is currently unknown what impact this would have with other 3D systems available from other manufactures.

Legacy Systems:

What if current system cannot support these higher frame rates or exhibitors choose not to upgrade my system? For this case, the content producer may provide a traditional DCP that will play at the standard 24fps per eye mode.