Stereoscopic 3D TV

From the cameras to post production and broadcast

- **“3D TV”**
  - Mark Northeast, VP Sales, Quantel

- **“Single lens 3D technology”**
  - Payman Sultani, ISee3D &
  - Tom Mitchell P. Eng., CTO and Director, ISee3D

- **“Shooting live 3D events”**
  - What we have learned along the way
  - David J. Woods, 3reedom Digital

- **“3D in the living room”:**
  - From stereoscopic TV, DVD players and interactive games consoles.
  - Jean-François Ridel, Sensio Technologies

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Organisateur/Organiser:
Pierre Louis Landry, Incospec 450-686-0033 x108

Commanditaires/Sponsors:

- INCospec Communications Inc.
- Radio-Canada
Stereoscopic 3D (S3D)

December 2009

Mark Northeast
VP of Sales Quantel
Riding The Big Wave

- Post and Broadcast has seen many major changes:
  - Late 80’s - Analogue to Digital
  - Early 90’s - Linear to Non Linear
  - Mid 90’s - Hardware to Software
  - Late 90’s - SD to HD
  - Early 2000 – Digital Intermediate
- They all seemed big at the time
  - And they were
- But a far bigger change is coming
“This change is as significant as the invention of colour. As significant as sound.

This is the greatest opportunity for movies that has come along in 30 years”

Jeffrey Katzenberg, CEO Dreamworks

"The spectacular view of our game from a courtside seat, the closest to the field of play in any sports, is replicated in this groundbreaking 3D HD Broadcast we are unveiling for NBA”

Steve Hellmuth, Senior Vice President of Operations and Technology for NBA Entertainment
There was a ‘golden age’ in the 1950’s

- But – there were lots of ‘headaches’
  - 3D Film is difficult to shoot and Post
    - You can’t see what you are doing
  - 3D Film is difficult to project
    - Some systems used 2 projectors which easily lose synch
    - Other systems used a very complex single film process
  - Polarised or Anaglyph films were uncomfortable to watch
- In the 1950’s the business didn’t really work
There was another ‘golden age’ in the 70’s

- But we’re not talking about that today ;-)

![Image of movie posters](image)
Recent history

- In the 80’s and 90’s Stereo lived on in theme parks, occasional films and non entertainment uses like science.
- From 2000 a new generation of Stereo films appeared.
- Profits were good.
Very high. Here are some pertinent ‘lessons from history’ from the introduction of sound and colour in film:

- ‘Talking pictures will never replace the silent drama’
  Joseph Shenck, United Artists, C.1928

- ‘The reaction to talking pictures is somewhat problematical. Talking throughout the entire picture has a tendency to retard the action’
  Pat Powers, Cinephone, 1929

What is the probability that Stereo3D will happen?
And then a few years later:

- “The process of Color motion picture photography [has] never been perfected…it would tire and distract the eye, take attention from faces and acting and facial expression, blur and confuse the action…."

  Douglas Fairbanks, 1930

- ‘Whether color can make black and white pictures as obsolete as sound made silent pictures, is, as suggested, quite another question. The silent picture was slain overnight by the jawbone of Al Jolson, whose Jazz Singer threw a hitherto sceptical industry bodily into speaking likenesses. But color is not so pronounced a revolution as sound’

  Fortune Magazine, 1934
A few facts and figures

- **By IBC 2006**
  - Almost no discussion of Stereo

- **By NAB 2007**
  - First Stereo Broadcasting tests (NBA etc.)

- **By IBC 2007**
  - Quantel shows first stereo systems
  - 3ality show U23D

- **By NAB 2008**
  - ESPN, BBC, SKY, NHK, France 3 and many others making tests

- **IBC 2008**
  - Stereo is main topic at the show
  - Quantel shows Stereoscopic broadcast server and editor.
  - Most major US, Japanese, UK Broadcasters developing stereo plans

- **IBC 2009**
  - 70% of the vendors are now showing Stereoscopic 3D products

- **JAN 2010**
  - SKY UK Launch a S3D Channel
Why do people say ‘its easier than Colour’?

<table>
<thead>
<tr>
<th></th>
<th>1960’s Monochrome to Colour</th>
<th>2000’s Monoscopic to Stereo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameras</td>
<td>New Cameras</td>
<td>Same cameras. New rigs</td>
</tr>
<tr>
<td>Recording devices</td>
<td>New VTRS</td>
<td>Same but more and Digital</td>
</tr>
<tr>
<td>Monitors</td>
<td>New monitors</td>
<td>New monitors</td>
</tr>
<tr>
<td>Live galleries</td>
<td>New Switchers</td>
<td>Same switchers.</td>
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<td></td>
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<td>New Graphics, Stereo Hardware such as SIP 2100</td>
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<tr>
<td>Post Production</td>
<td>New equipment</td>
<td>Some same (Quantel), some new</td>
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<tr>
<td>Playout</td>
<td>New VTRs</td>
<td>Same, also other digital formats</td>
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<tr>
<td>Transmitters</td>
<td>Upgrade</td>
<td>Same</td>
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<tr>
<td>TV sets</td>
<td>New</td>
<td>Mostly new</td>
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Types of TV sets available now

Active Glasses
Examples: Samsung/Mitsubishi

Passive Glasses
Example: Hyundai, JVC, Sony, LG

Lenticular and barrier
(no glasses but requires special processing)
Many systems and iPhone, iPod
Some Stereo 3D Definitions

- **Convergence**: Were two images seen from the left eye and right eye become overlaid to become one image. Where the eyes Converge.
  
  Most people Converge and Focus with their eyes at the same time.

  With stereo 3D we can converge but we are always focused on the screen plane as a viewer.

  *Note: This can be added, or adjusted in post to some degree.*

- **Interocular**: The Distance between your eyes, or the distance between your lenses or cameras. Most people have an Interocular of 6.3 cm.

  *Note: This can not be fixed in post after you have shot, you would have to invent material to do this.*

- **Screen plane**: Typically the theater screen plane where objects appear in front –Z axis or behind +Z axis or on the screen plane.
College Football Game Sept 09 (just 2 months ago):

- ESPN, Quantel, Pixar, PACE, Evertz, NEP, Sony, VizRT
- Live Event, Highlight playback, Show special.
- 11 Cameras Stations, Skycam and Goodyear Blimp.
- Replays used 6 channel EVS with 3 shot boxes 2 channel each for left and right eye.
- Stereo Switching was done with NEP truck using Sony 6 ME switcher with busses tied for LR synchronous switching.
- Transmission side by side HD feed, Muxing for monitor display (to Hyundai ST3D monitor) was done with Evertz Sensio stereo encoders to HDMI.
- Recording of the game was done using SR decks, including Stereo master, Stereo Clean, and side by side for direct writing to Blue Ray
- Quantel system did packaging, color correction and other file outputs and conversions.
Hannah Montana: The background

- Hannah Montana is a Disney Franchise
- Successful TV show aimed at pre-teen girls

- Sell out Concert tour
  - Oct 18th 2007, St Louis
  - Jan 31st 2008, Miami

- Release S3D Concert movie
  - Feb 1st 2008
What's the problem?

- Post is an iterative process
  - Everything changes all the time
  - Until the release date (or the money runs out)
- Stereo post was not an iterative process
  - Start with one eye image
  - Change a value in one eye in 1st pass and write to storage
  - Then change the same value in the other eye image as a 2nd pass and write to storage
  - Then transfer each eye from storage to a stereo playback server
  - Then playback from the server to a display
  - Then check the look
  - Then repeat the process until the right look is achieved
The problem

- That caused many issues in color correction, editing and vfx
  - Poor creative feedback to operators and clients
  - Many possibilities for technical errors
  - Slow
  - Expensive
  - Can’t see what you are doing while you are doing it – difficult to get sign off

- For Disney there wasn’t time to post the movie
- But the release date couldn’t be moved and shooting couldn’t start any earlier
Disney were looking for a solution from a post facility
Fotokem said they could meet the timescales
  - Based on their Pablo workflow with some test Quantel S3D software
Disney had to be convinced
Meeting at IBC 2007 between Disney, Fotokem and Quantel

‘Look me in the eyes and tell me this will work’ – Disney
‘It will’ – Quantel
The solution

- Work directly in stereo
  - Manipulate both eye images in context
  - Playback from the system doing the manipulation
  - No proxies - full quality images
  - Quick
  - Cost effective
  - No more trial and error
  - Interactive experience for the client

- See what you are doing while you are doing it

- Normal post workflow but in Stereo 3D
Most successful movie ever opening on Superbowl weekend

$31M on first weekend playing on only 700 screens

Original plan was for 1 week limited release
  - Run was extended because of success

Winner IBC 2008 Innovation award
  - Disney/Fotokem/Quantel

Disney did a repeat performance with the Jonas Bros this year
S3D changes what we do today for 2D productions

Editorial
- Pace may need to be different
- Fast cuts can be tiring to watch in S3D
- BSkyB: ‘Linger Longer’
- Simulcast?

Fixes
- Left and right eye signals should be the same except for parallax differences
- Any other differences impair S3D effect and may cause fatigue
  Camera misalignment, lens flare, rig issues, lens issues
A basic ‘fully live’ stereo programme narrowcast is currently being done like this:

- Fixed rigs using Two matched cameras. Dual HDSDI out
- Conventional vision mixer with tied crosspoints
- Dual signal uplink
- Dual signal downlink
- Dual signal display
Long term issues with this model for general Broadcast:

- Zooms difficult.
- Convergence is fixed.
- No tally.
- No CCU remote camera adjustment.
- Sync/colour/geometry issues can't be quickly fixed.
- If one signal lost, or occlusion, very unpleasant to watch.
- Danger of unlocked sync. Double payload if not compressed.
- Eye artefacts if heavily compressed (differential DCT blocking in eyes, loss of GOP sync). Strong stereo from high resolution cameras can overload standard codecs.
- Back compatibility with 2D.
Quantel Stereo 3D Server

4 port HD Stereo server using AVC-I or DV100
- Different configurations available 2:2, 3:1, 1:3, 1:1

Single side by side signal for Hyundai, JVC, Sony, stereo monitor and/or single wire distribution

- Previewed on the show floor at IBC
Quantel and 3ality show live 3D camera input into the sQ server and using the same Quantel broadcast applications editing in real time and playback using standard Broadcast HD production tools a typical workflow for Sports and News.
New Production tools: SIP 2100

- Beam splitter rig correction

Faster post production from better quality images
Where to put the screen plane?

S3D Post: New things to think about

- Parallel shooting puts everything in front of the screen
  - Inherently safe as cannot shoot images with positive parallax
  - Difficult to shoot close ups
  - Post needed to push things behind the screen

- Converged shooting lets you choose what’s on the screen plane
  - Creates images with negative and positive parallax elements
  - Can shoot close ups
  - Positive parallax can lead to discomfort if it requires eyes to diverge

Where do you put the captions?

- A window on the world or the world in your living room?
  - Objects coming out of the screen need careful handling if they go out of shot
  - More of an issue on TV screens than IMAX
Managing Depth across edits

1/25th Second

Impacts editorial shot choice and timing
Keyframe convergence (L/R offset) around edit points
What about off-line?

- Side-by-side format allows conventional offline systems to cut S3D
Versioning for different screen sizes

S3D Post: New things to think about

- Technical considerations
  - Is positive parallax within acceptable limits?

- Creative considerations
  - Does Stereo3D achieve desired effect?

- Adjust convergence (L/R Offset) to balance these requirements
New Post tools: SIP 2100

- Real-time Stereo 3D Depth analysis

Confirmation of Stereo 3D quality
Stereo images can now be accurately measured and corrected for example using the new 3ality Digital SIP2100.
Movies and Broadcast are not the same

- 3D Stereo post production is a realistic business today

- Live broadcast and fast turnaround broadcast is not today
  - More time pressure
  - More budget pressure
  - Only one chance to get it right

- Production and post production problem

- Need technology to solve this problem
  - SIP2100 is the first of a new breed of Stereo tools
Don’t forget the basics of S3D

- Each project requires a left eye and a right eye to be post-produced
- Twice as much storage
- Twice as much rendering
- Twice as much media to manage
- Efficient workflow needs real-time S3D capabilities
  - Ingest, playout and manipulation
Pablo and iQ Key S3D capabilities

- Live convergence
  - No rendering, no media written back to disc
    - Avoids hours of rendering time and Terabytes of data
- Live editing
  - Cut both eyes simultaneously
    - Useful for Film; vital for Broadcast
- In context colour correction and compositing
  - See left and right eye result instantly
    - Avoids wasting time on iterative changes and costly mistakes
- Real-time ingest and playout of HD S3D
Time is Money

- Increasing need to create good Stereo3D on time and in budget
- Stereo 3D post requires new tools and techniques
- Creative and commercial issues must be considered
- Get it wrong and it’s a headache (literally)
- Get it right and it’s a real opportunity
Mobile 3D on the iphone . . . . .

Mobile 3D www. Spatialview.com

- **3DeeShell**
  - **3DeeCamera** - take your own stereo pictures, using your iPhone
  - **3DeeVusion** - manipulate and create stereo images
  - **3Dee!oadr** - store and work with your 3D images on Flickr.

- All are available at the Apple iTunes store.

- Wazabee ... like being there.
Quantel IBC 2008 Camera to Screen
Camera Rigs
Quantel Summary

- 40+ Post systems sold
- Eight awards in the past year
- Almost all stereo film projects using Quantel
- Stereo Broadcasting products available now
Thank you.

Q & A