The Big Picture:
Digital Cinema Technology and Security

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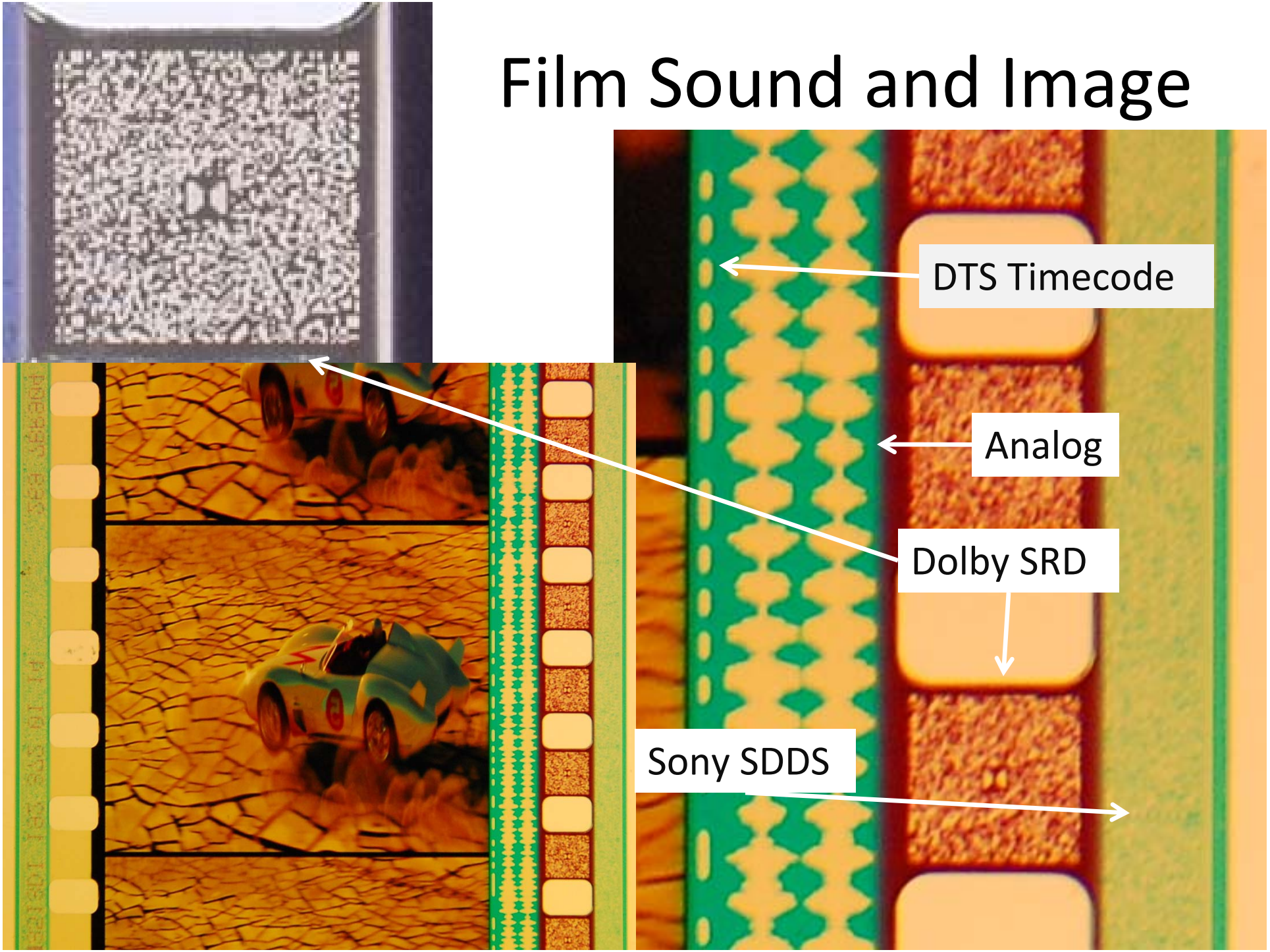
Digital Cinema Specialist

Film: How its always been done

- 35mm film is the standard, more than a mile of it for one movie.
- IMAX film is 10 times larger than 35mm.
- The image hasn’t been upgraded much in the more than a century that movies have been playing.
- The only real upgrade was from Black and White, to Color.

Film Sound and Image



Distribution/Security of Film Prints

- 70 lbs (32 kg) cans with the film inside.
- Security measures include:
- Codenames for content
- Separate shipments
- Physical locks on the cans



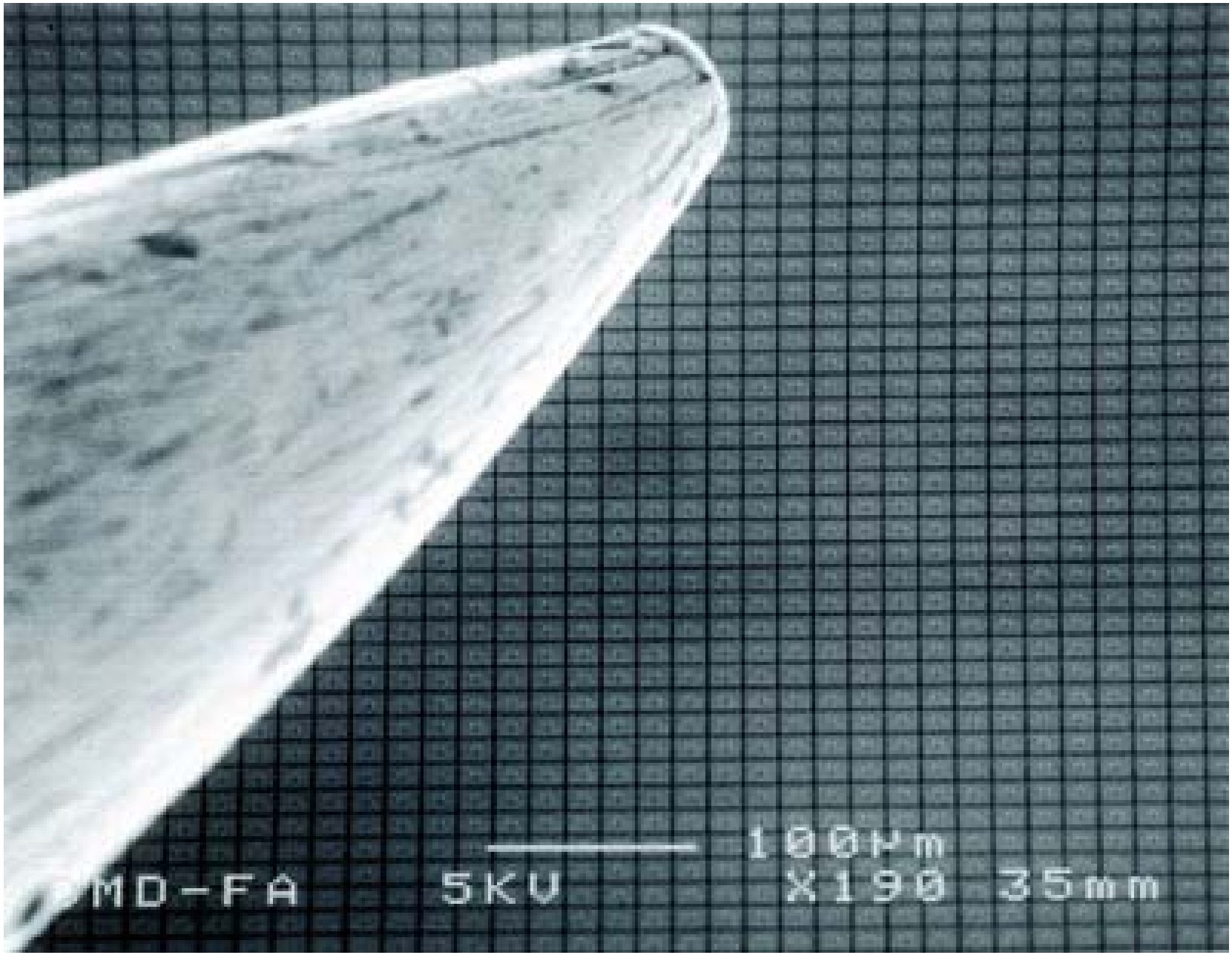
DLP technology

- First designed in 1987 By Dr. Larry Hornbeck at Texas Instruments.
- It took a long time to make a splash in the Movie market.
- The first major release in digital cinema was in 2005.

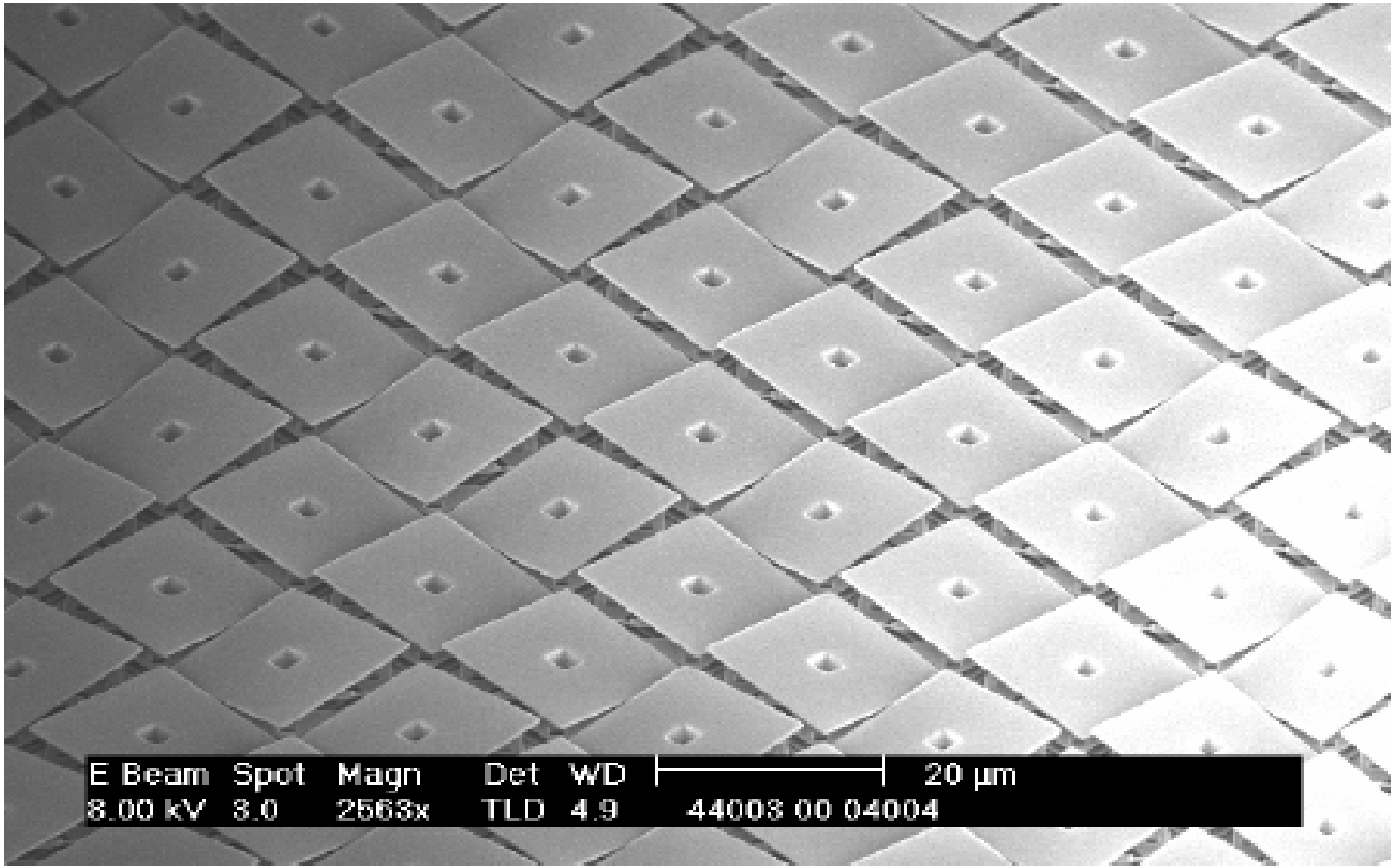
The DLP Chip



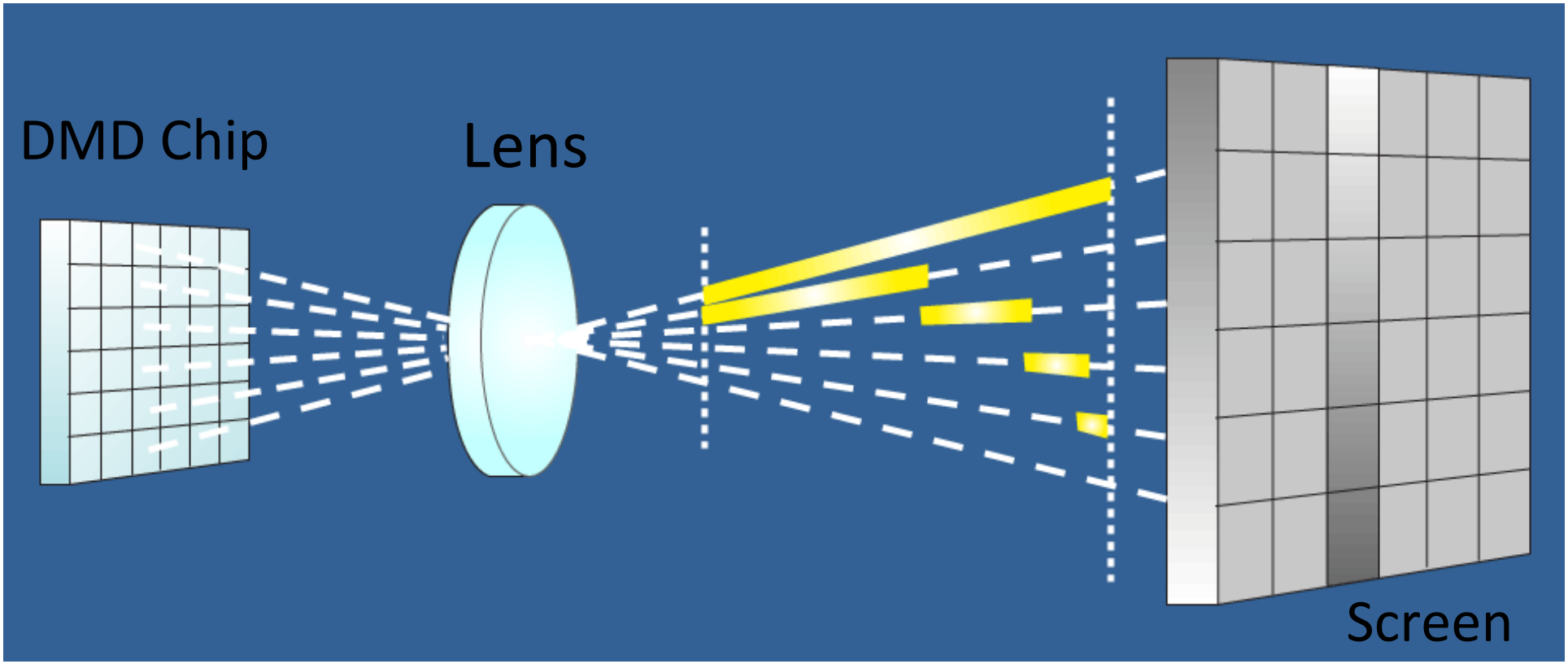
So how tiny are these mirrors?



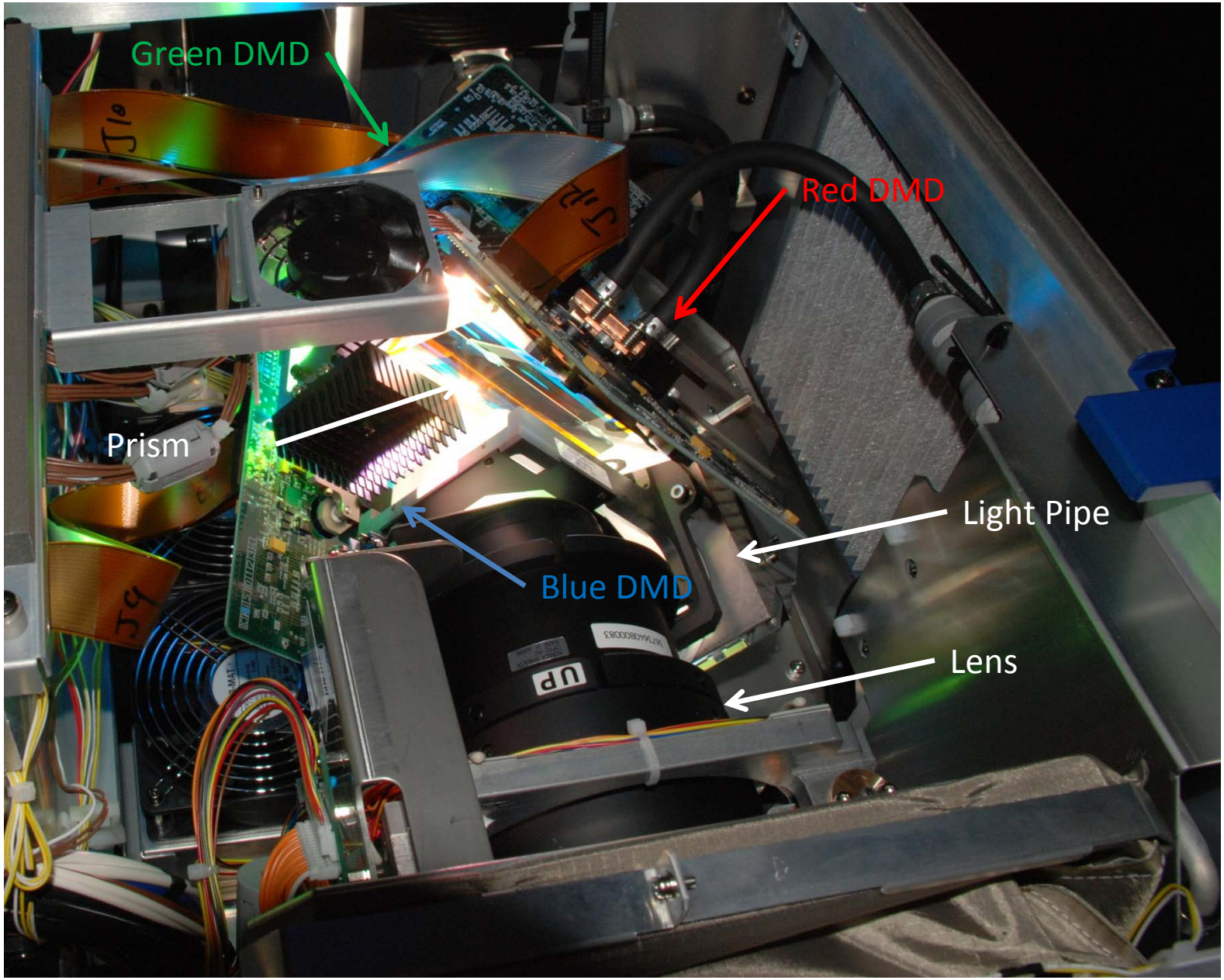
Even closer!


E Beam Spot Magn Det WD
8.00 kV 3.0 2563x TLD 4.9
20 µm
44003 00 04004

Creating an image (greyscale)

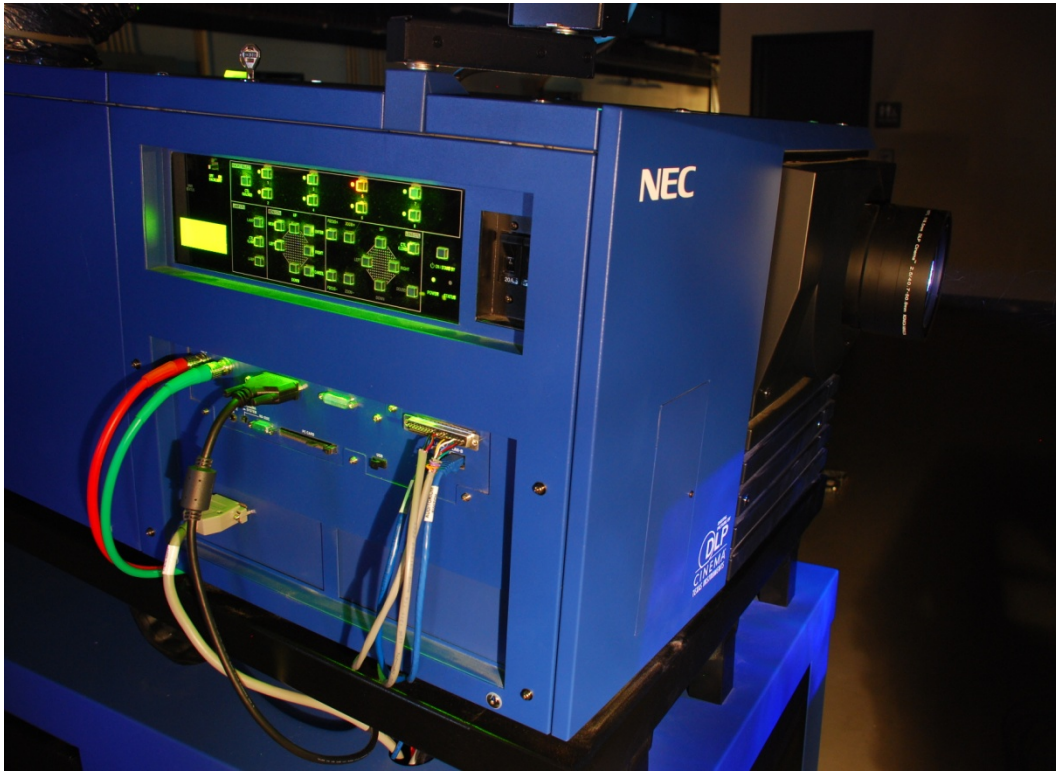


And finally, what it really looks like



A couple different DLP projectors





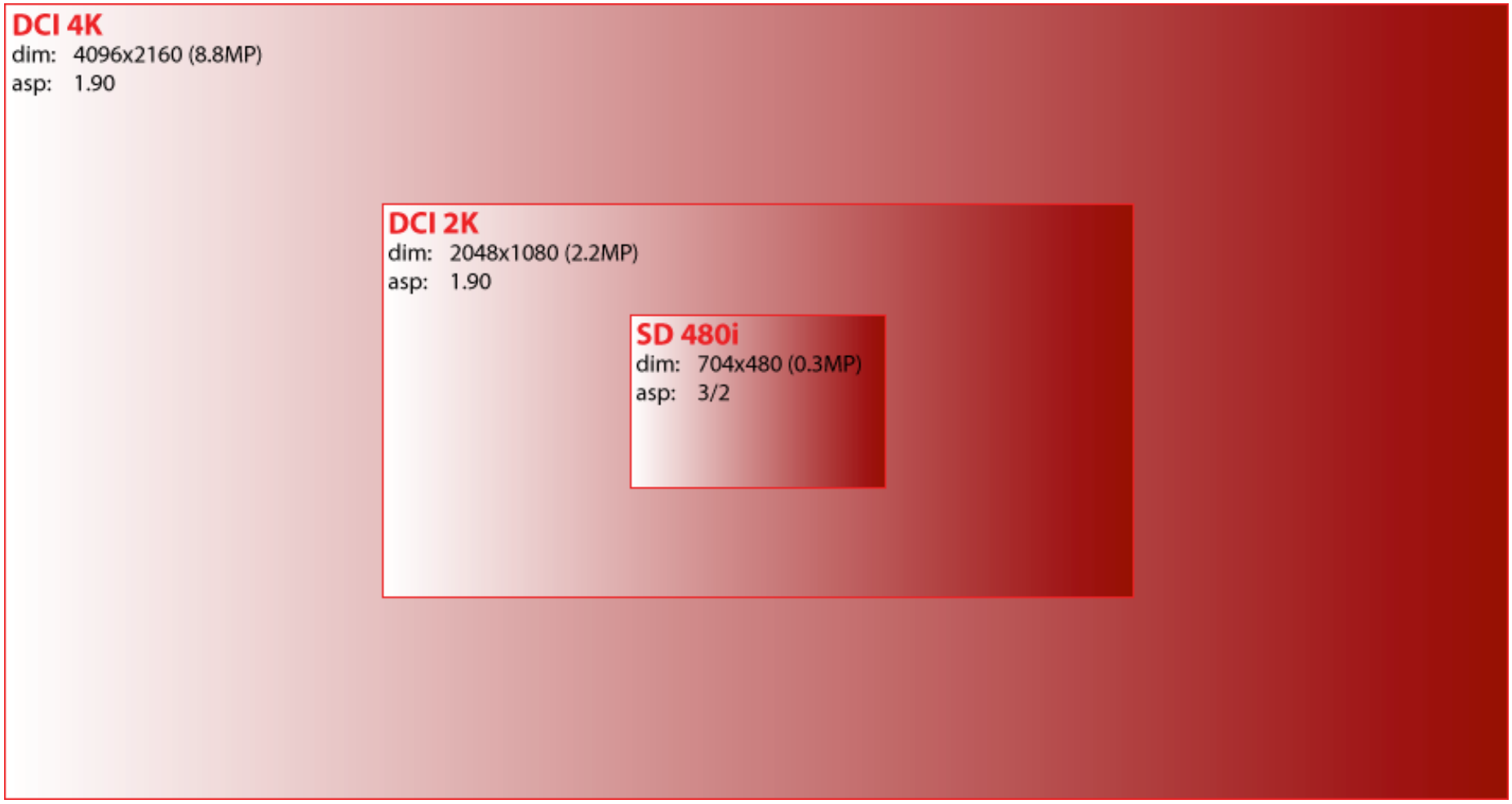
Sony SXRD

- Silicon X-tal Reflective Display





Resolution

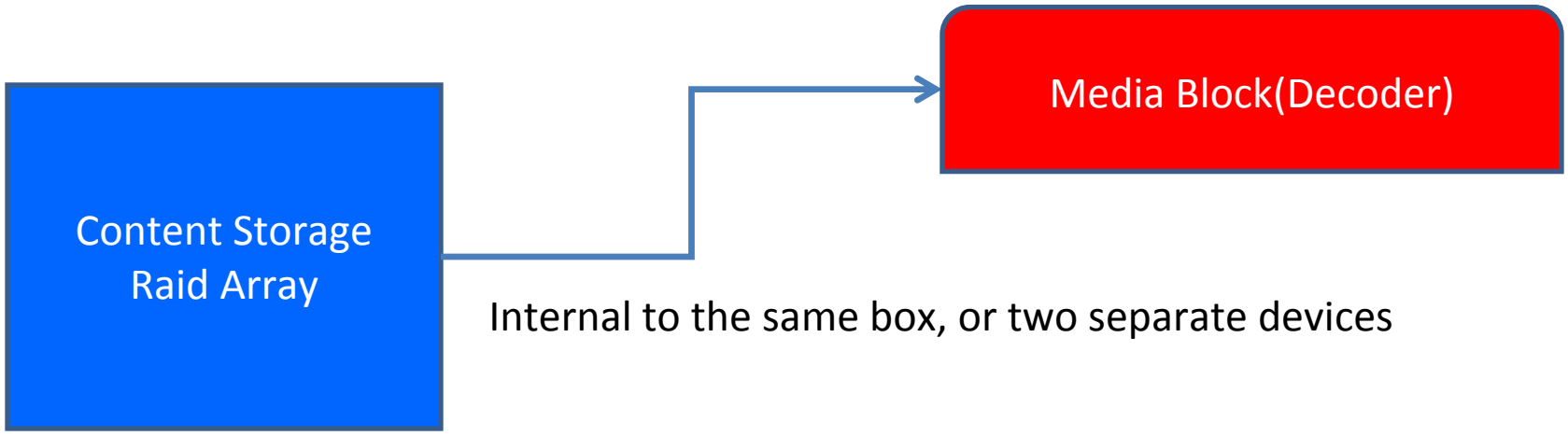

DCI 4K
dim: 4096x2160 (8.8MP)
asp: 1.90
DCI 2K
dim: 2048x1080 (2.2MP)
asp: 1.90
SD 480i
dim: 704x480 (0.3MP)
asp: 3/2

Digital Cinema Distribution

- Multiple methods of delivery
- Hard Drive
- Network Transfer
- Satellite

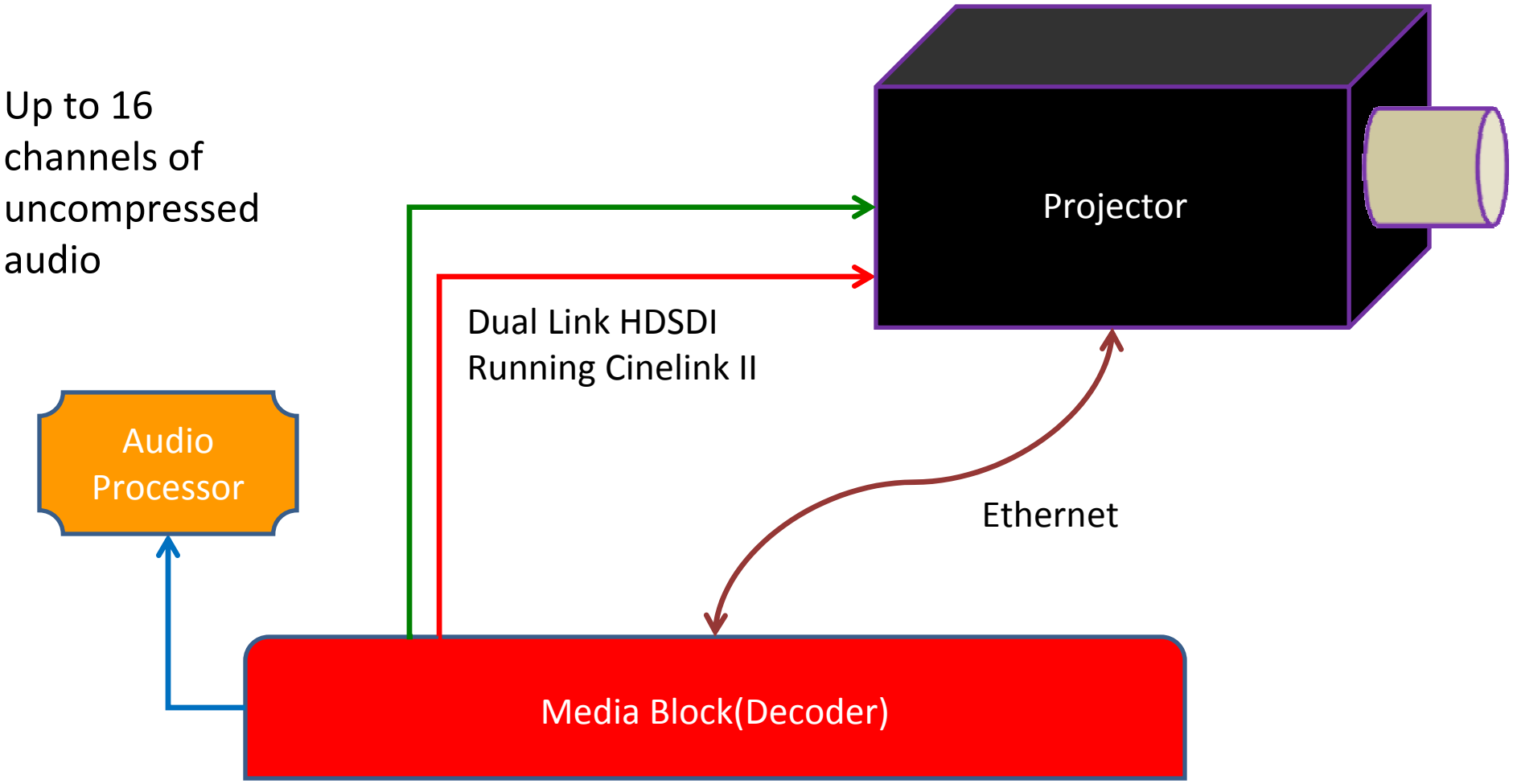
- Interesting facts about content

Security in Digital Cinema



Step 1:

1. Content is served out from a storage point, to the Media Block
2. The content is encrypted.



- The Show Player decodes the video/audio with the KDM, the audio is passed to the audio processor.
- The video is re-encrypted with Cinelink II, and sent to the projector.

Cryptography Section

Media Block(Decoder)



- Sha1 256 key
- Correct Date Range
- Correct content
- No tampering detected

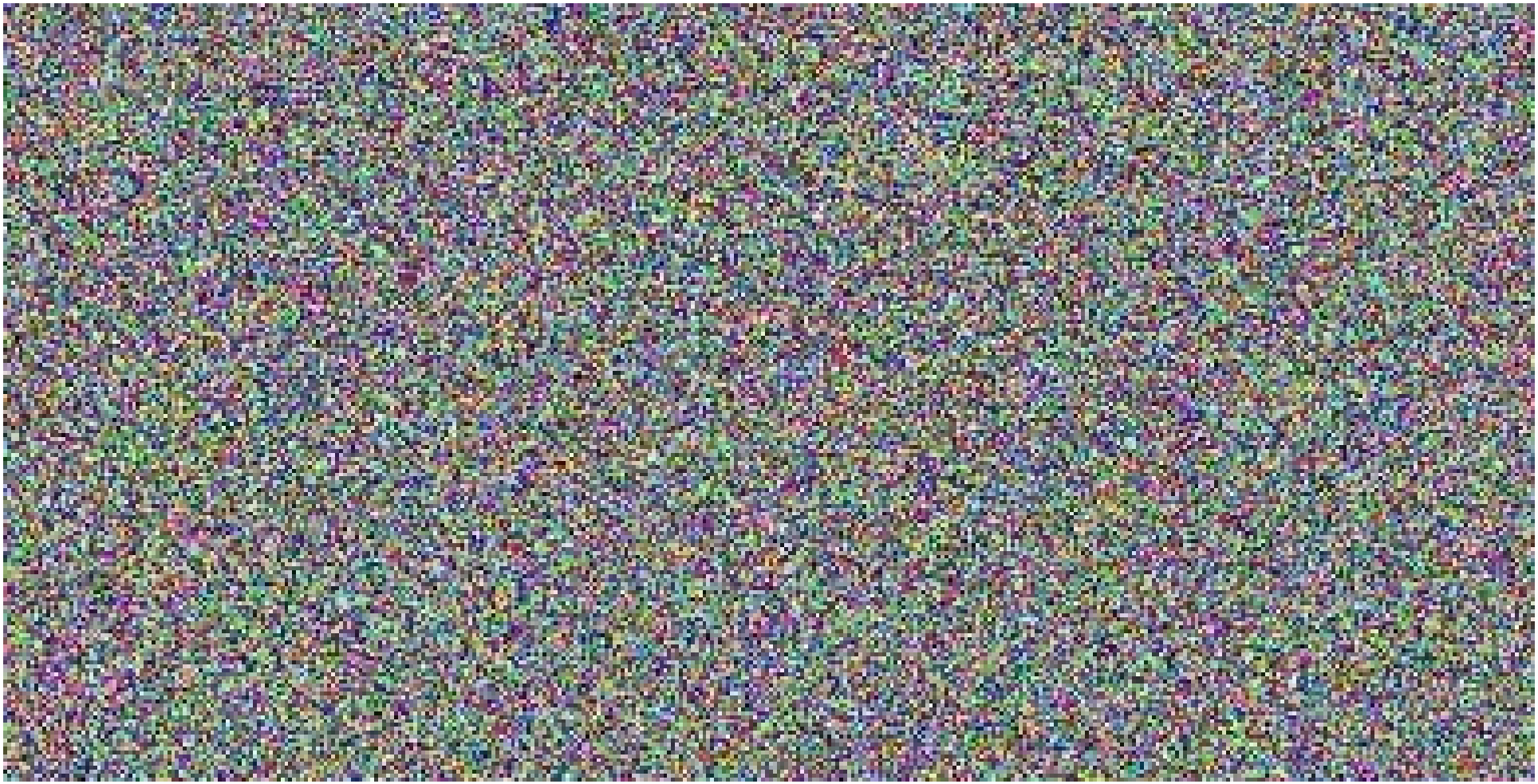
- Sha1 256 key
- Secure connection to the Media Block
- No open access panels

Any of these fail, and you cannot play the movie

KDM or Key Delivery Message

- <ds:X509IssuerName>**dnQualifier=\+62TOmh@eqB0D1966oR2gdu7SdM=, CN=Root.CA.DC.Cinea.Com,OU=CA.DC.Cinea.Com,O=DC.Cinea.Com**</ds:X509IssuerName>
- <ds:X509SerialNumber>**1799**</ds:X509SerialNumber>
- </X509IssuerSerial>
- <X509SubjectName>**dnQualifier=TRxe7YERGorsOIg1M/WegWToIvrs=,CN=SM.Dolby-DSP100-00000000,O=DC.Cinea.Com,OU=DolbyShowPlayer**</X509SubjectName>
- </Recipient>
- <CompositionPlaylistId>**urn:uuid:d12ky0XqY-f997-c039-aece-4a0af0b982d3**</CompositionPlaylistId>
- <ContentTitleText>**DEFCON_FTR_S_EN-XX_US-NC_51_2K_DI_20080808_Mike**</ContentTitleText>
- <ContentKeysNotValidBefore>**2008-08-08T06:01:00-00:00**</ContentKeysNotValidBefore>
- <ContentKeysNotValidAfter>**2008-08-10T09:59:00-00:00**</ContentKeysNotValidAfter>

When a security breach is detected

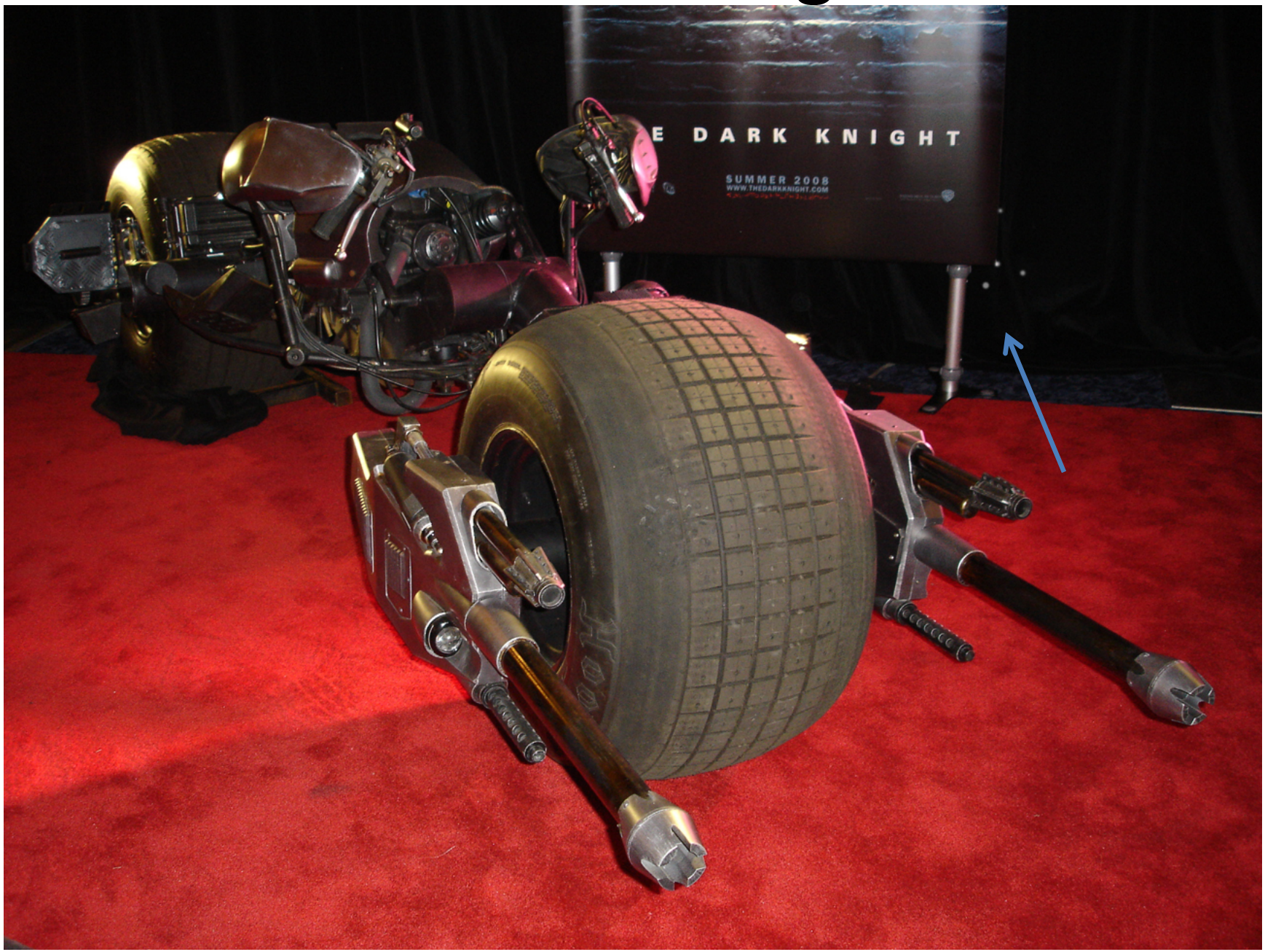


A couple other security methods in Digital Cinema

Searching for Pirates…
Forensic Marking DCDM



Forensic Marking POM



Security Wrap up

- How tough is Digital Cinema Security Overall?
- Are there any weaknesses?

3D Technology

- Have you seen a film in 3D before?
- What did you think?

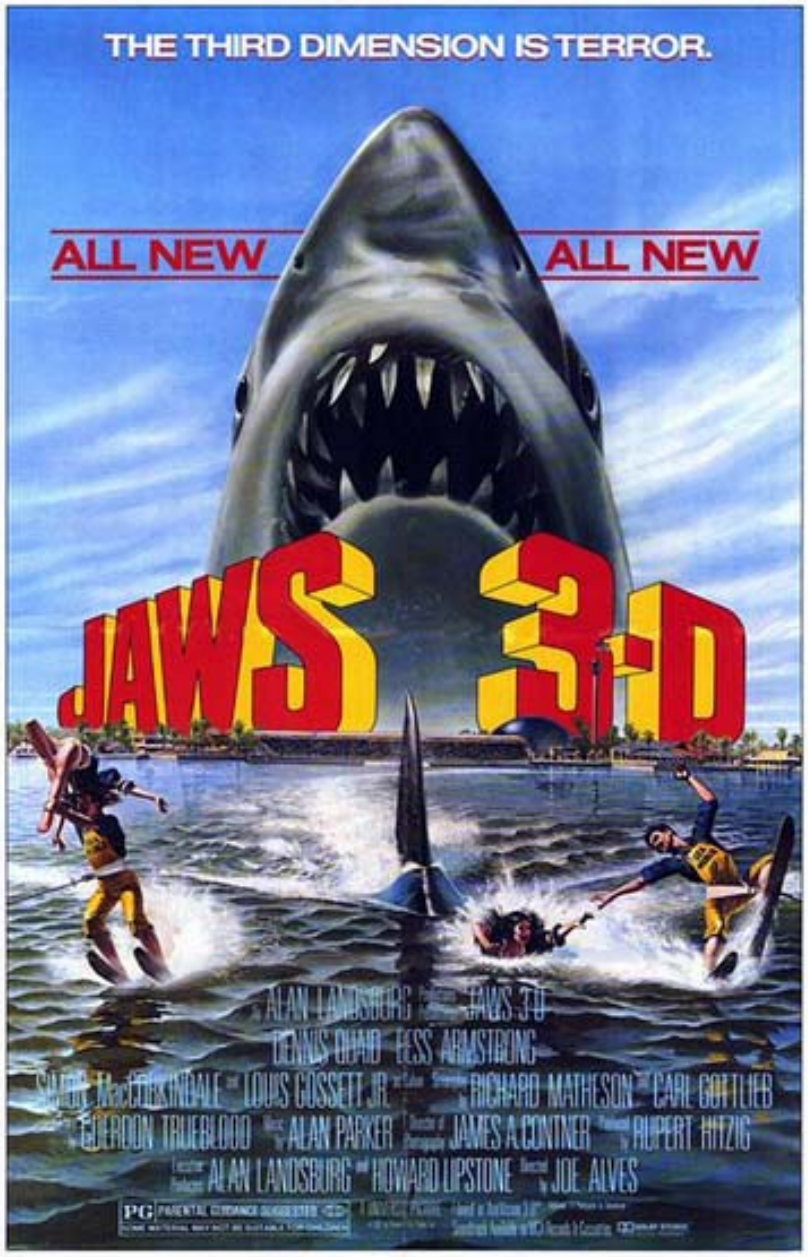


Anaglyph Technology

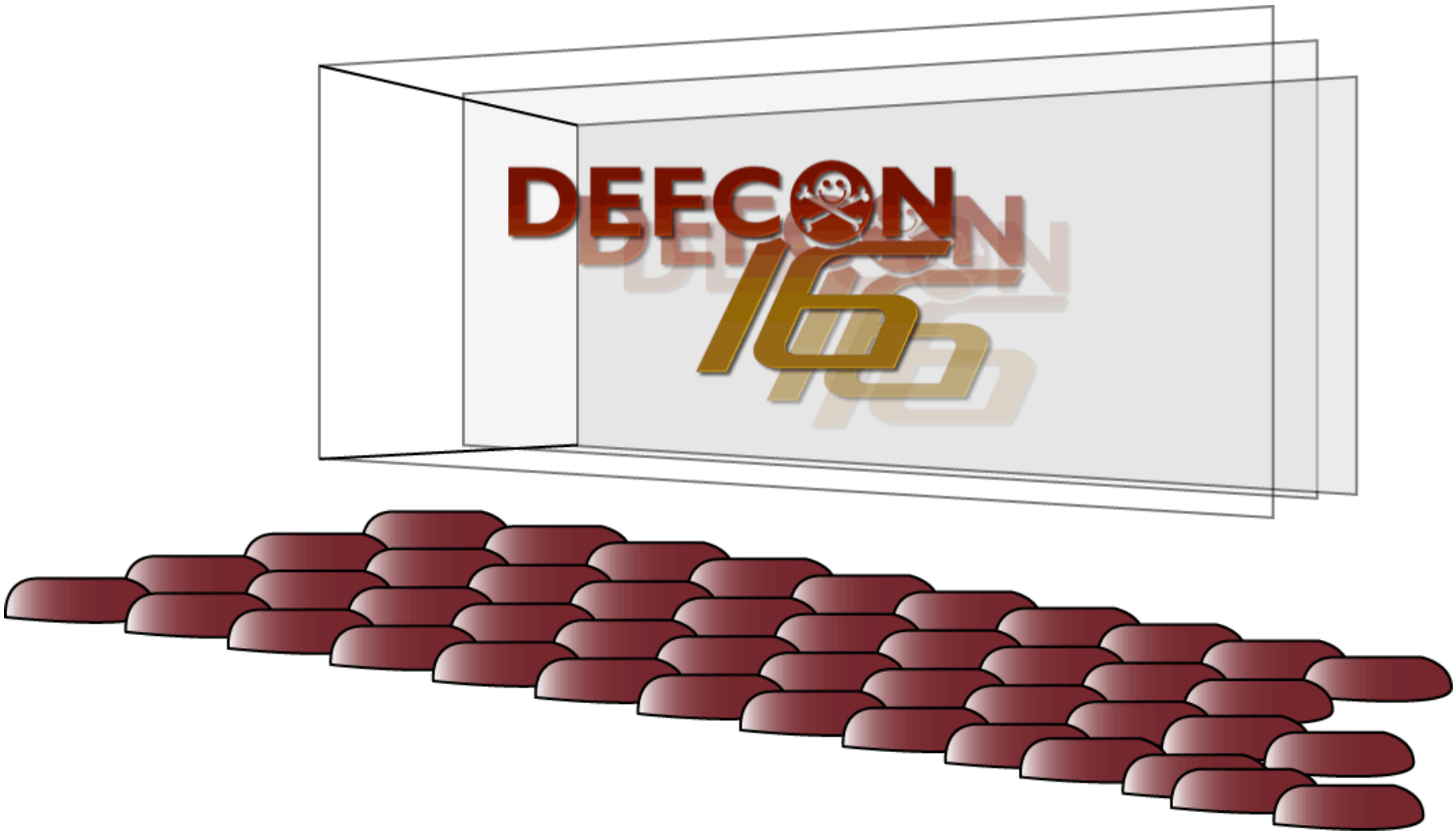


Two problems with 3D films





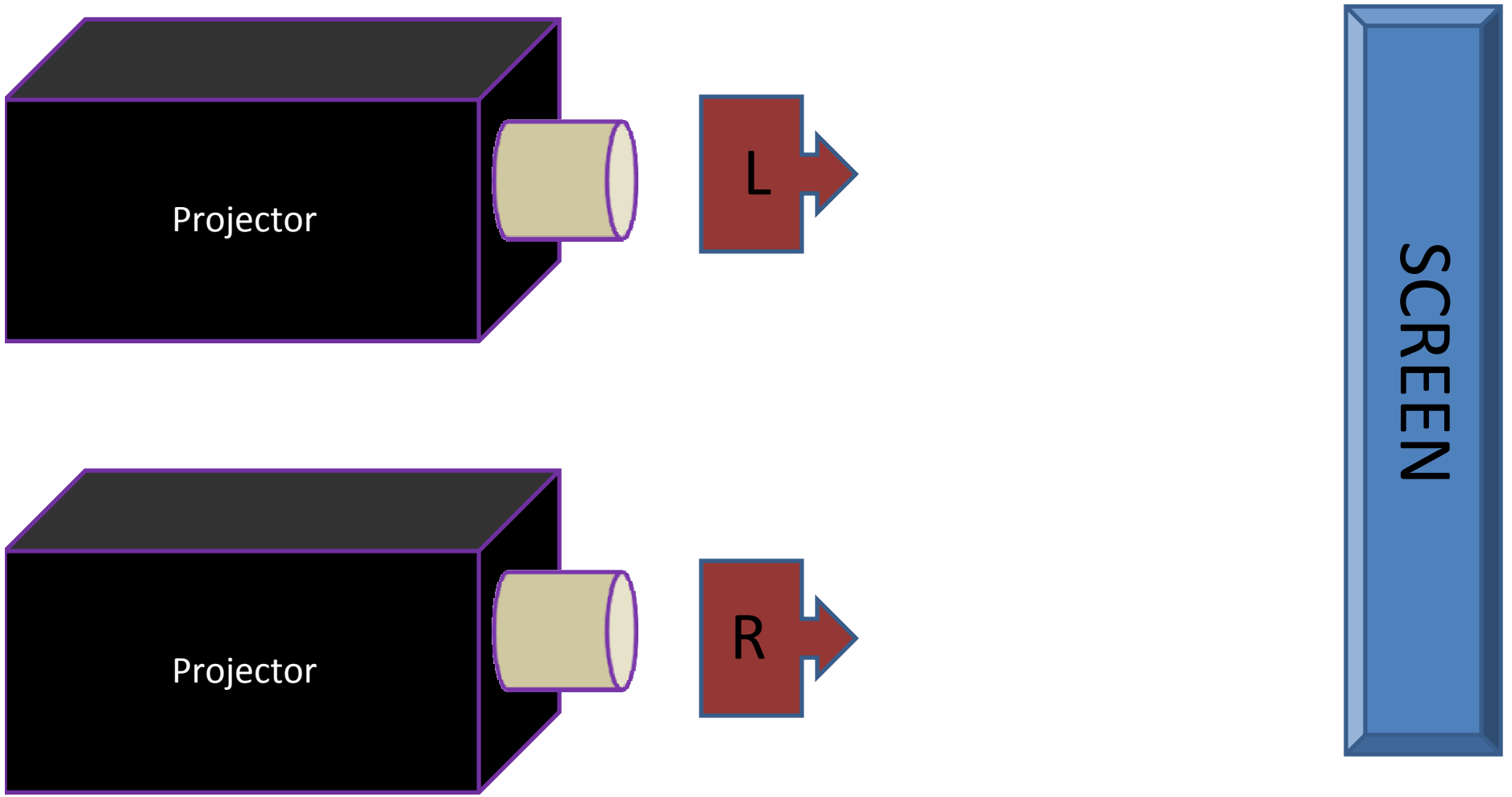
How digital cinema fixes the problem



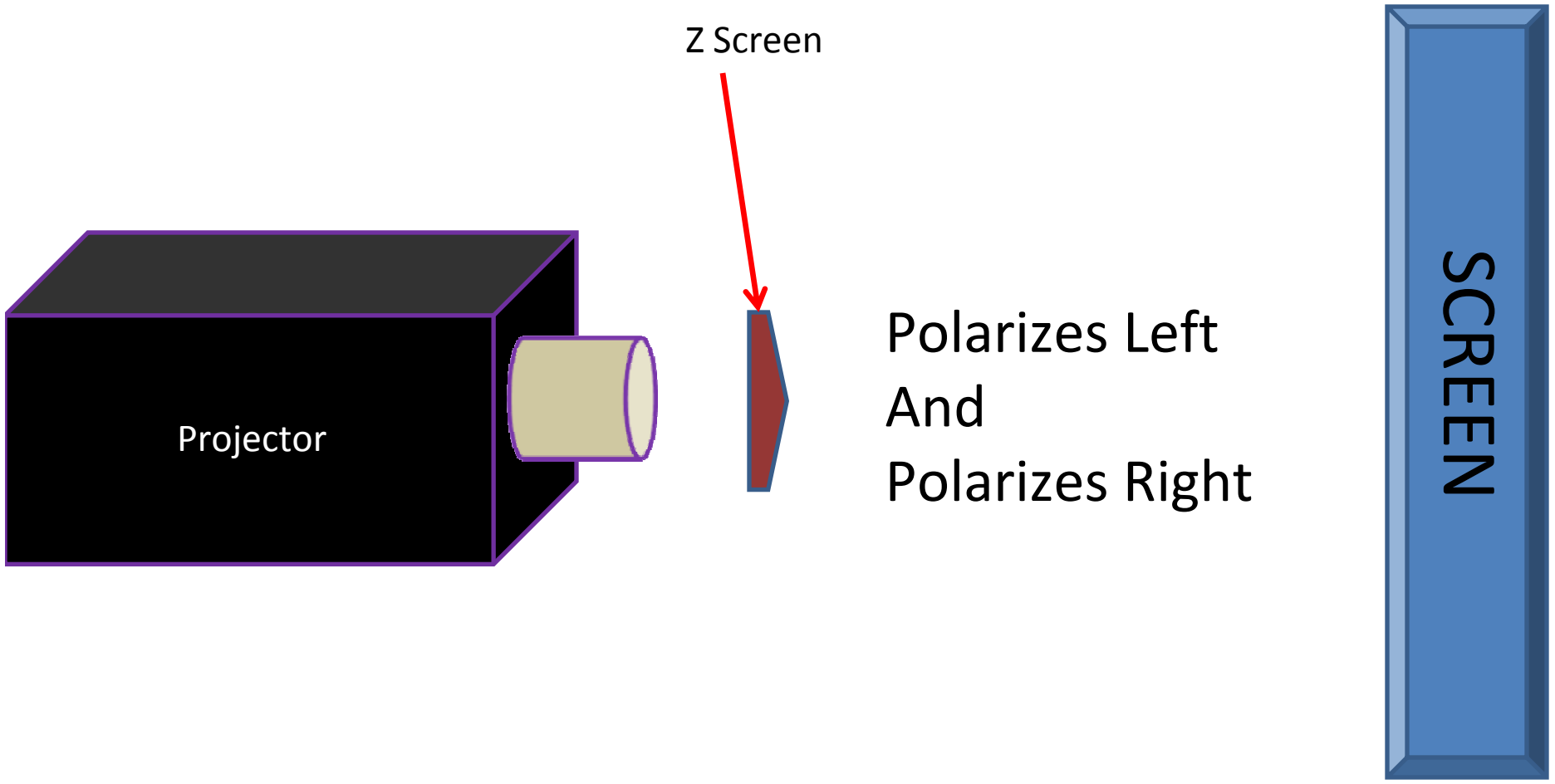
Digital Cinema 3D technologies

- There are a couple of major companies that produce 3D equipment.
- They use different methods to make the 3D effect. The main methods are:
- 1. Circular Polarization
- 2. Wavelength Multiplex

Method 1: Basic Circular Polarization



Method 1: Circular Polarization



Method 1: Circular Polarization



Circular Polarization continued…

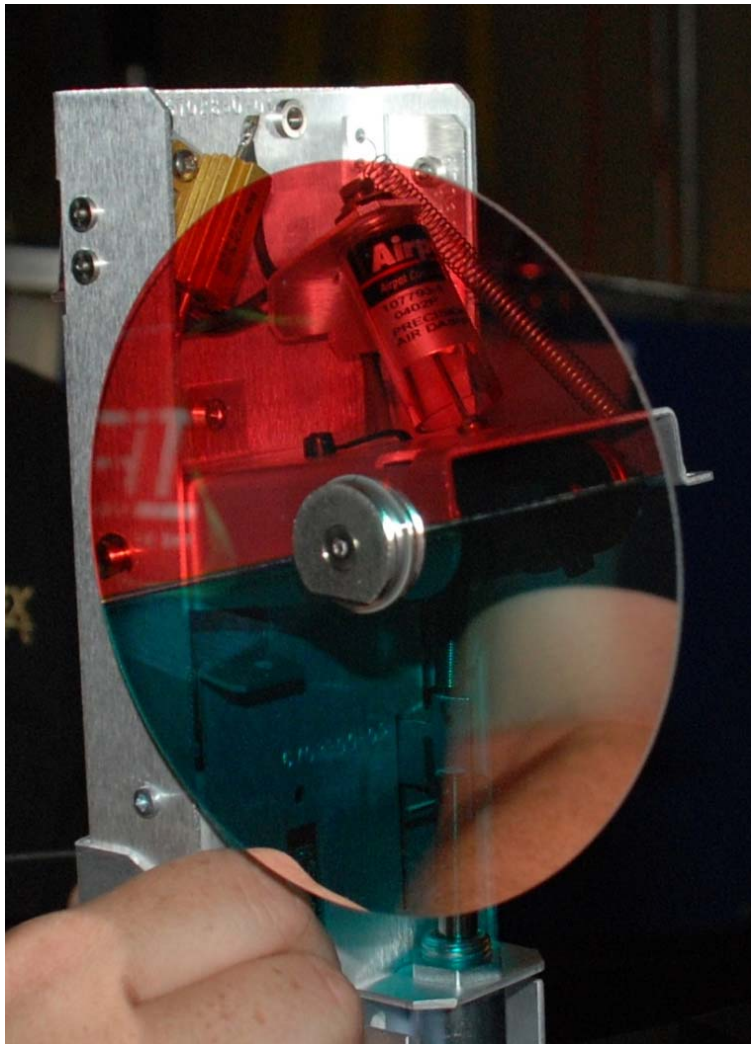
- Real D was the first major 3D format in digital cinema.
- These glasses are disposable, due to the low cost in making plastic circular polarized lenses.



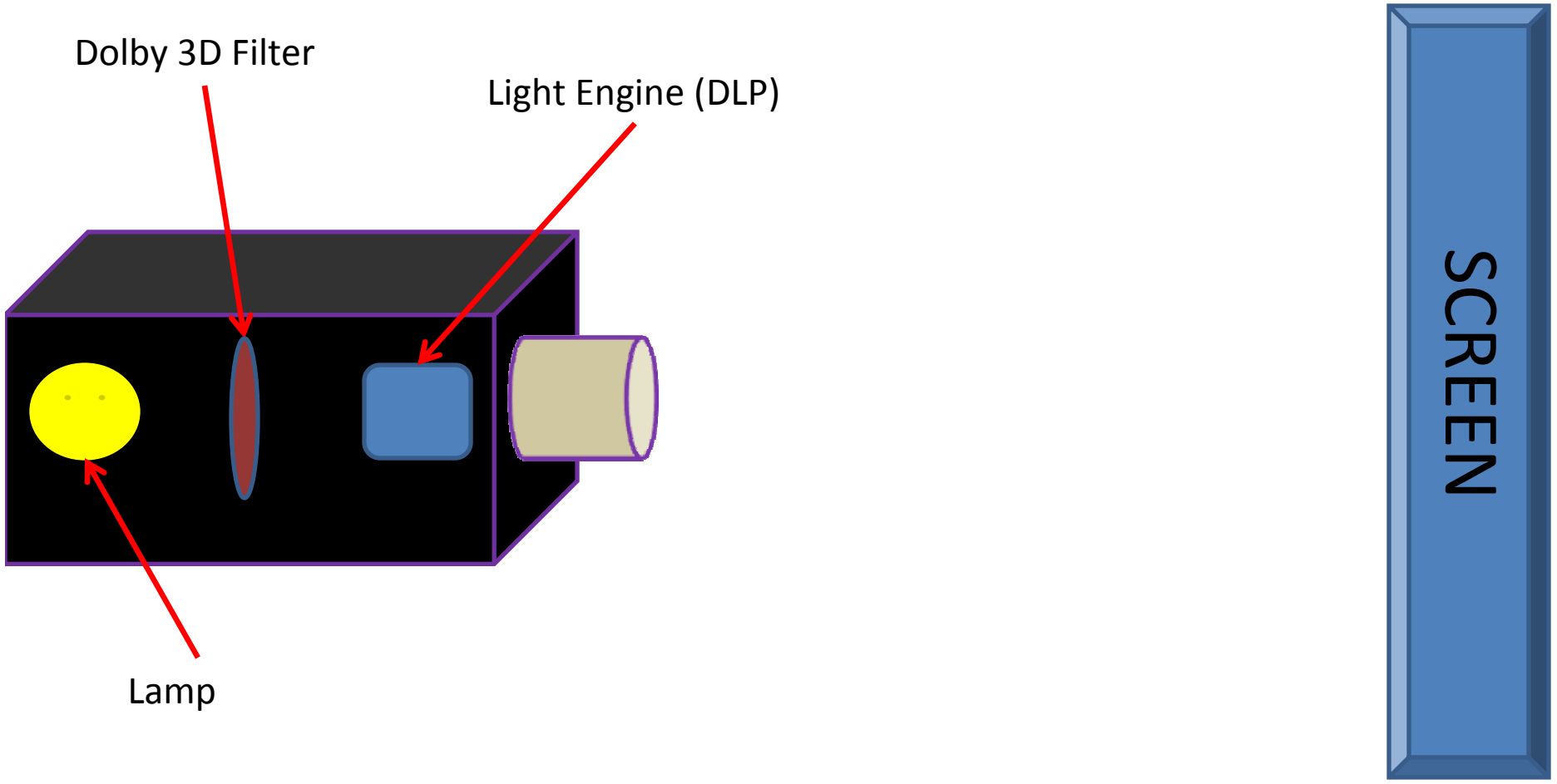
Method 2: Wavelength Multiplex

- Dolby 3D is new on the block
- Uses Wavelength Multiplex Technology. Licensed from INFITEC.
- These glasses are reusable.



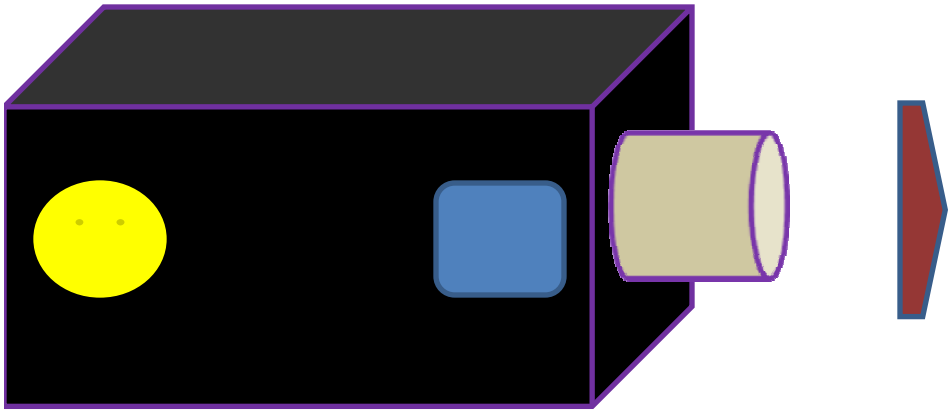


Method 2: Wavelength Multiplex

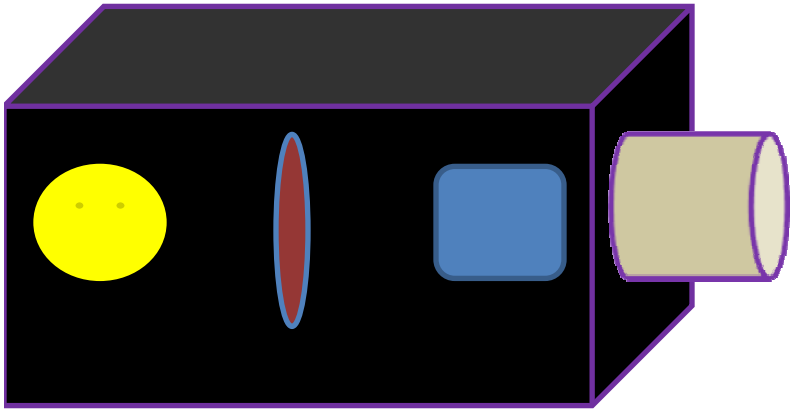


Which is better?

- This is my opinion on it:



Real D



Dolby 3D

So, what's coming in 3D

- Tim Burton's ALICE IN WONDERLAND
- SHREK GOES FOURTH
- James Cameron's AVATAR
- Michael Bay's TRANSFORMERS 2
- And of course, STAR WARS

3D Wrap-up

- Where are the best 3D presentations found?
- Do your research. This can be a bit difficult, as many theatres don’t have a clue which 3D system they use, but can save you a headache, and enhance your viewing experience.

Alternative Content

- Metropolitan Opera…yup, you know you love opera.
- Sports Events-Dallas Mavericks games have been aired at local movie theatres in 3D.
- Concerts: U23D and others
- Oh, and if you are in any way interested, Some places let you:

Play HALO 3 on the big screen!



Q & A

Thanks for Coming!
Q & A continues across
the hall in room 104 (Q&A 3)

Email: defcon@mikerenlund.com

Resources:



- Some images and design elements by:
- Craig T. Morris (f1lt3r3d0ut@gmail.com)
- Taylor & Brett for FTP and PDF resources

- Slides 7 and 8: TI/dlp.com
- Slide 12: Sony SXRD
- Slide 26: Library of Congress; Jaws 3D Poster (Universal Pictures)

Resources Continued:

- Texas Instruments: www.dlp.com
- NEC Projectors: www.necam.com/dc
- Barco Projectors: http://www.barco.com/corporate/en/products/category.asp?catid=11
- Sony Projectors: http://pro.sony.com/bbsccms/ext/SXRD/index.shtml
- Infitec: http://www.infitec.net/infi_e.html
- Dolby Labs: www.dolby.com
- Real D: www.reald.com
- Special thanks to Dr. Pepper (for keeping me awake): www.drpepper.com