IP-RACINE : A glimpse at the future of digital cinema

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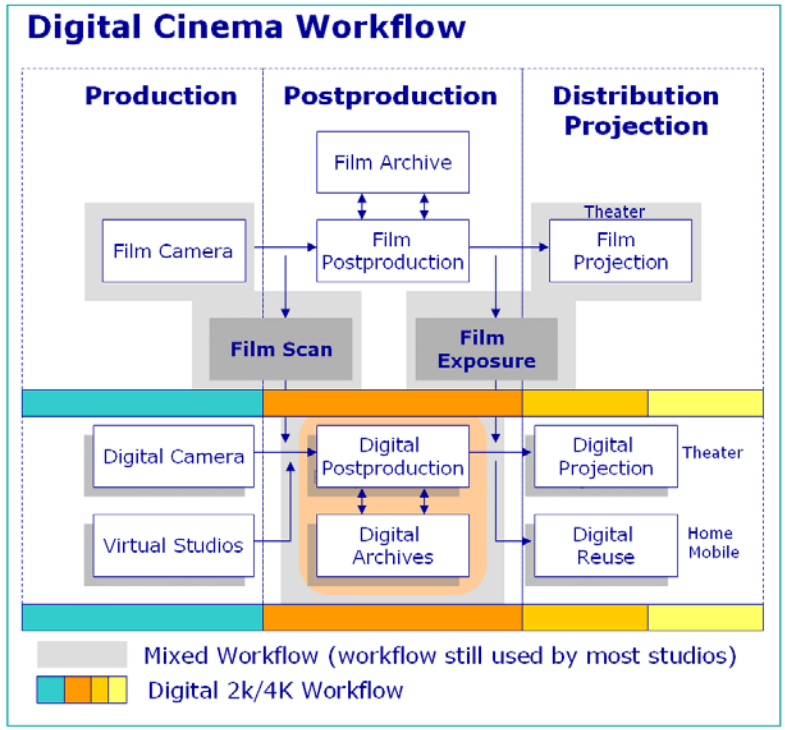
Media Salles Training Kuurne – March 30, 2007

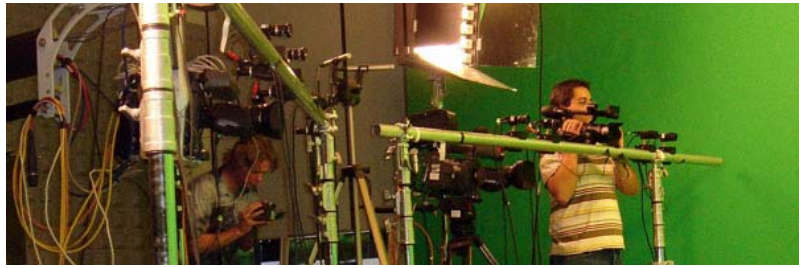
Project Objectives

Increase Interoperability along the chain



Reduce Costs

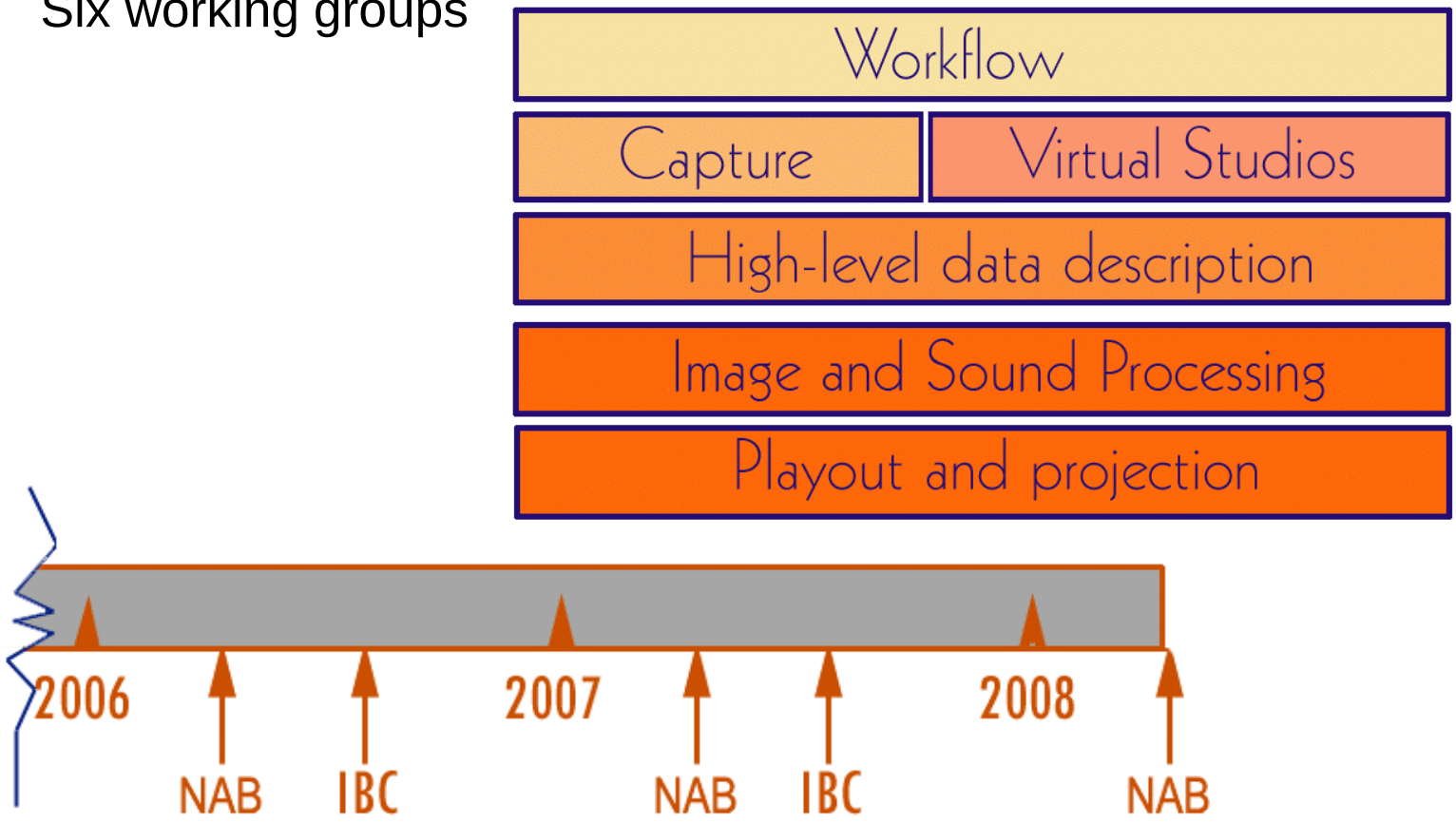
Advance the technology



Working areas

Digital Cinema improvement is needed
'*From scene to screen*'

Six working groups



Partners in the project

Acronym	Partner Name	Country
UPF	Universitat Pompeu Fabra	Spain
GV	Grass Valley Nederland BV	Netherlands
DTO	Deutsche Thomson OHG	Germany
Pandora	Pandora International Ltd	United Kingdom
FilmLight	FilmLight Ltd	United Kingdom
Barco	Barco n.v.	Belgium
HU	Hasselt University	Belgium
JRS	Joanneum Research Forschungsgesellschaft	Austria
UG	The University of Glasgow	United Kingdom
FSSG-CNR	Fondazione Scuola di San Giorgio	Italy
FBM-UPF	Fundació Barcelona Media-UPF	Spain
MEDIApro	Mediaproducción S.L.	Spain
DVS	Digital Video Systems GmbH	Germany
XDC	XDC S.A	Belgium
Brainstorm	Brainstorm Multimedia S.L.	Spain

Filmless Capture

Viper Filmstream Camera :

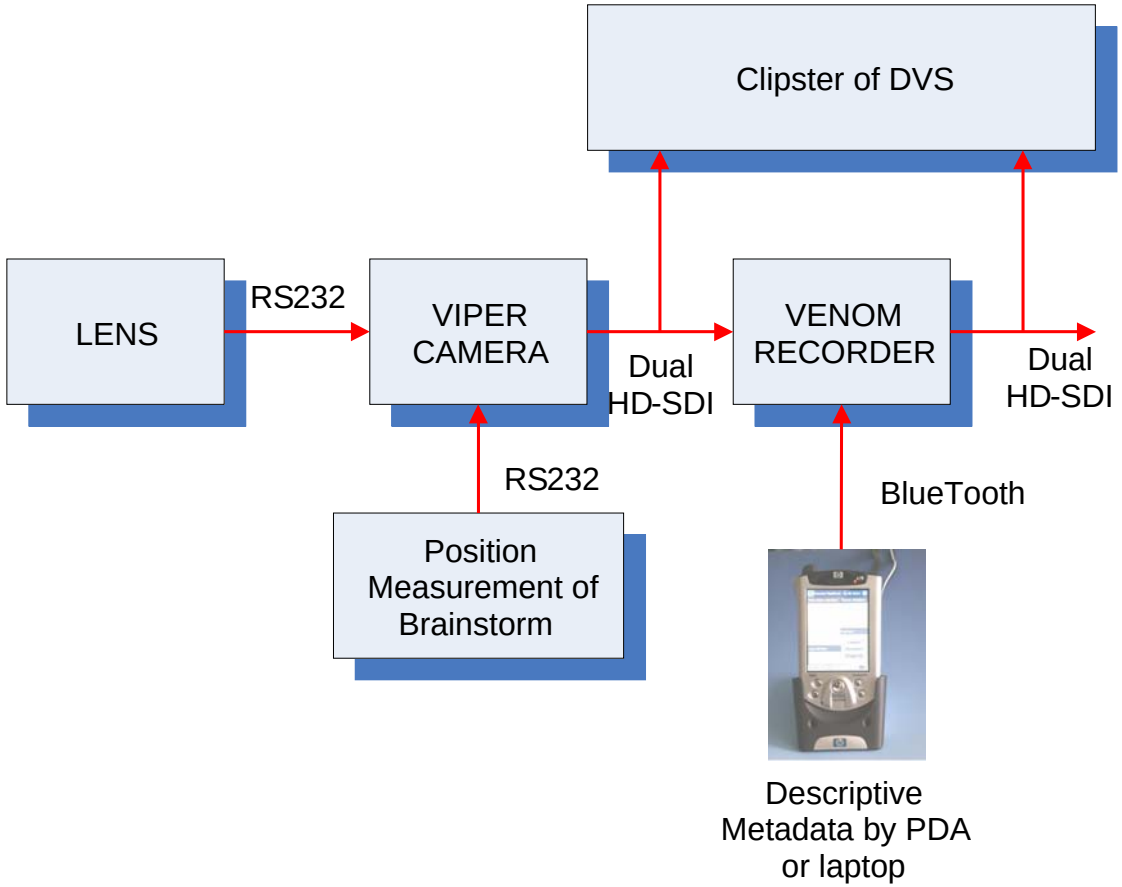
- 4:4:4 RGB Dual link output
- Metadata embedding
- Enhanced mechanics
- LUT processing

Venom flashpak recorder :

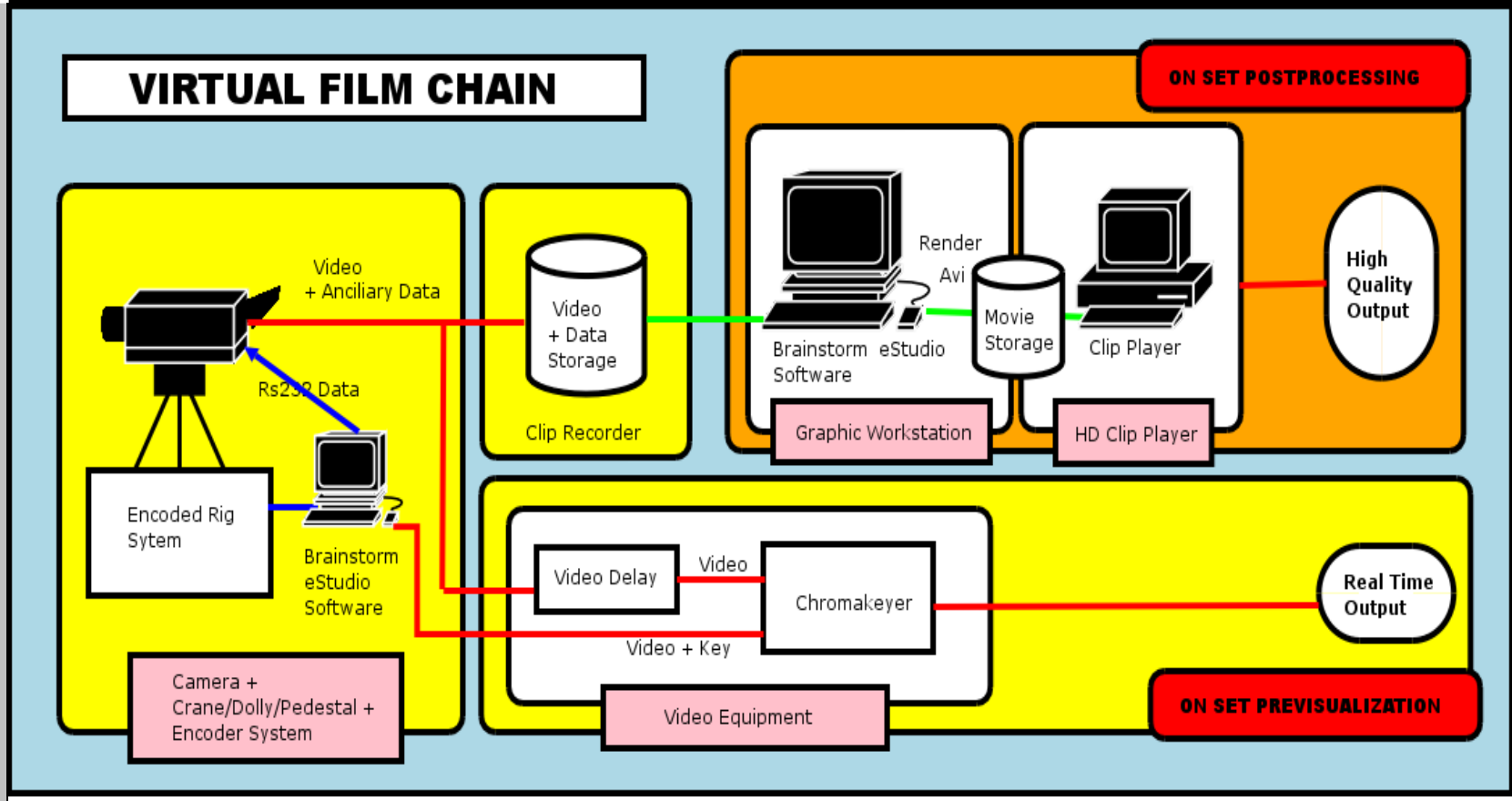
- Solid state memory
- 10 minutes recording time

Filmless Capture

- **Metadata integration :** lens information, position information



Virtual Film Studio



- On-Set pre-visualisation: Low quality real-time preview
- On-Set postprocessing: High quality, quasi real-time
- Off-line rendering : Development of high quality shaders to improve realism (illumination, texture,...), increasing speed (6 s/frame in 2K)
- Metadata : interface with camera position information

Virtual Film Studio

Pre-visualisation :

- **Real-time rendering**
  - SDI and HD rendering in real time.
  - Real-time software Chroma-Key for low quality preview.
    - Equipment and cost reduction
  - Off the shelf Graphic Boards:
    - Shader technology
    - OpenGL optimizations.
- **Virtual camera parameters sent to viper camera**
  - Embedded as metadata
- **Local data recording**

Virtual Film Studio

Post-processing :

- **QUASI-REALTIME.**
- **ON-SET High Quality Shot Preview.**
- **Automated Tool.**
- **Using Shaders:**
  - Textured Phong Lighting.
  - Textured Bump Map Lighting.
  - High quality defocus.
  - Software Chromakey

Image Manipulation

- Revolution hardware acceleration card: modular concept, high data throughput.
- Hardware Image Library (HIL) to support real-time complex processing functions like :
  - arithmetic functions
  - warping
  - median filtering….

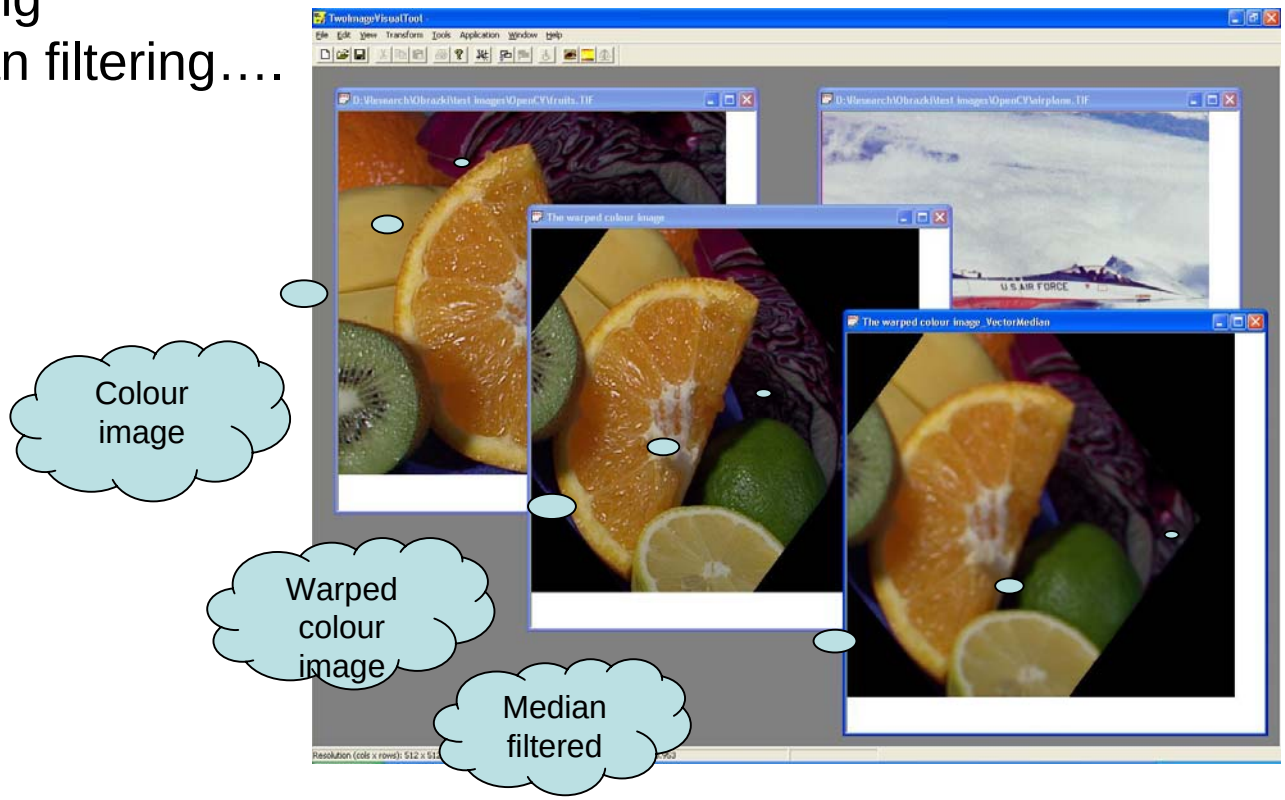
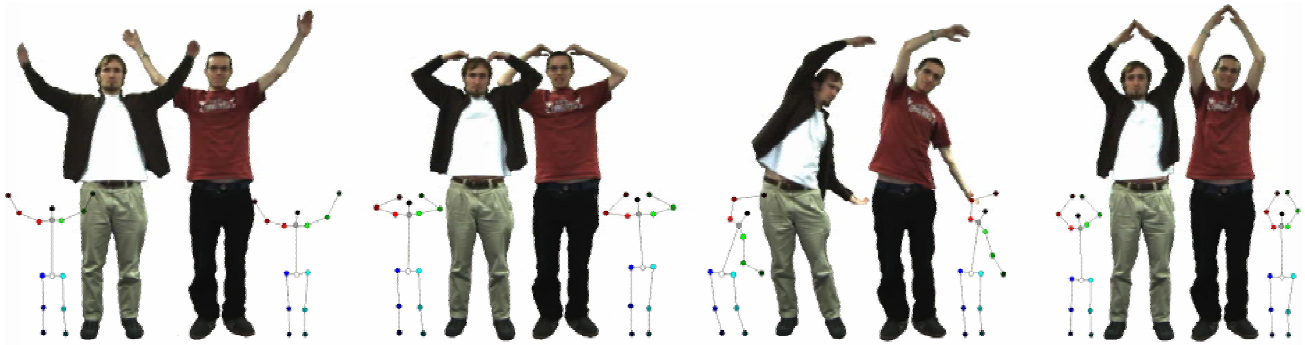


Image Manipulation

- Video Based Animation (VBA)



- Camera multi-view interpollation with low res. and high res. camera's

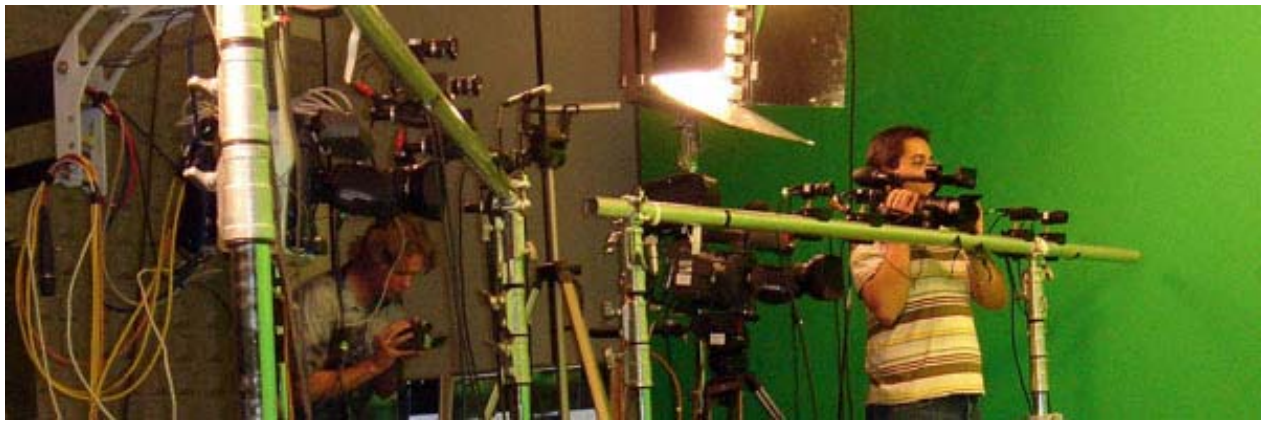


Image Manipulation

- Object re-detection
- Image coding for color correction
- Image enhancement using fractal and statistical appoaches

200% crop (top: 2x bilinear, bottom: 2x fractal)

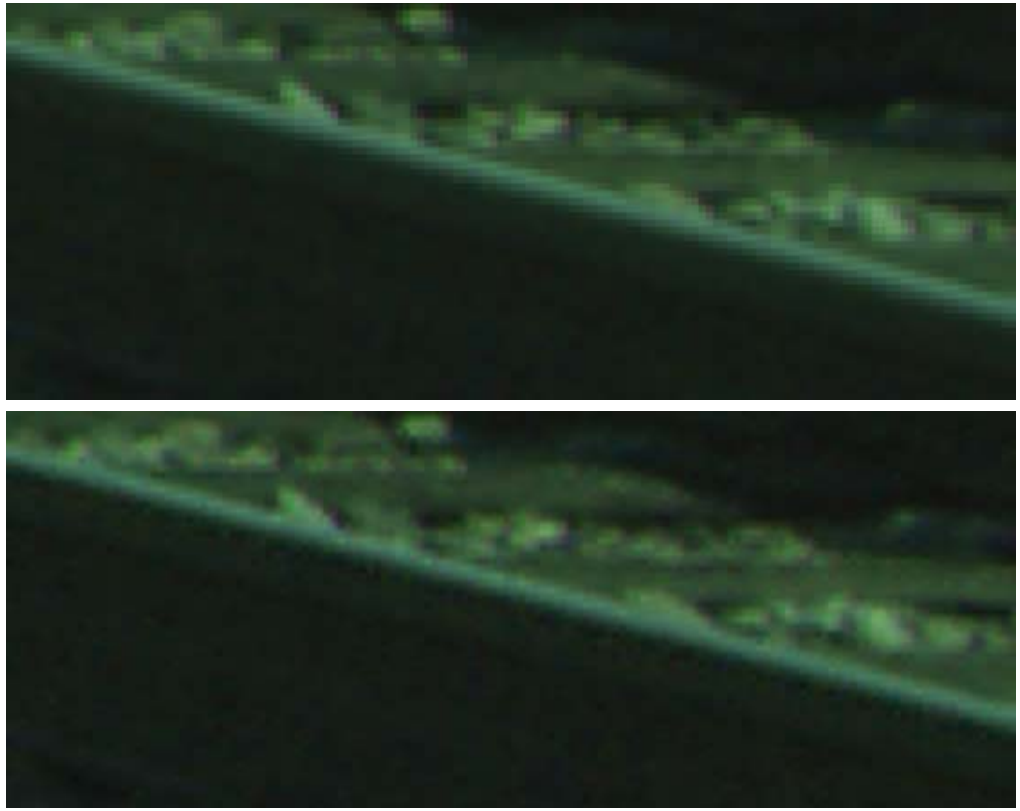


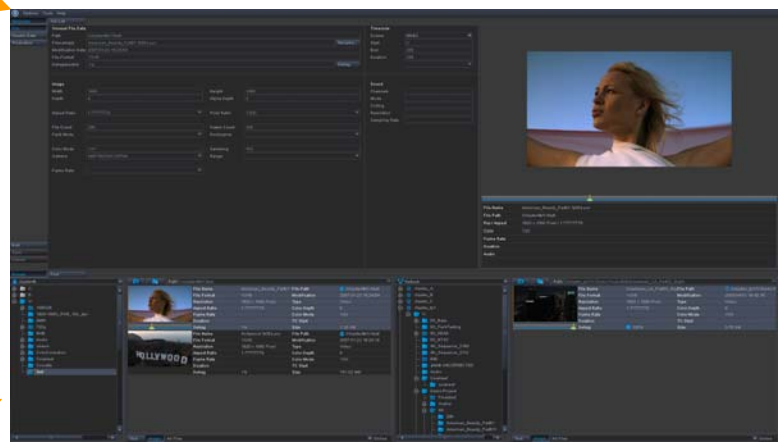
Image Manipulation

- Depth of field algoritms, running real-time on clustered hardware

Workflow and Metadata

CLIPSTER®
Editing / Finishing /
Color Grading

Any PC



Spycer®
File/Metadata Management

DVS-SAN
Storage

Pronto2K.2 / ProntoHD.2
HD-Recording

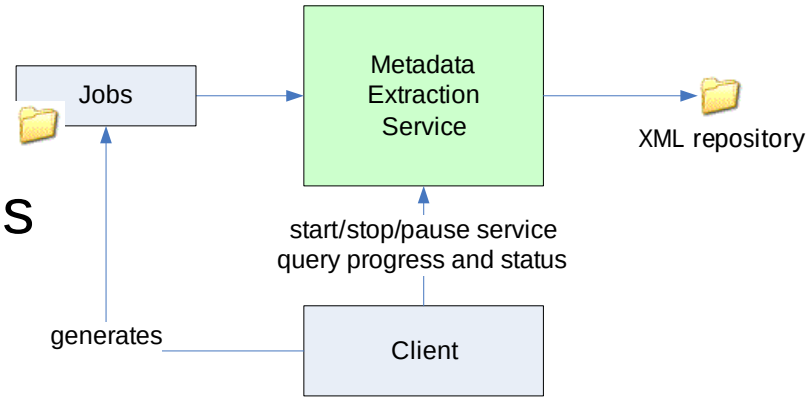
Workflow and Metadata

- **Spycer file/metadata management software**
  - **Active software on every workstation**
  - **Automatic metadata extraction → fast file search**
  - **Management of large file sequences (e.g. 4K clips)**
  - **Open and flexible system (3rd party software has access to all data)**
  - **File management "tools" (High-speed copy, Defragmenter)**
  - **No central server required → every workstation extends the distributed content management network**

Free version available at www.spycer.net

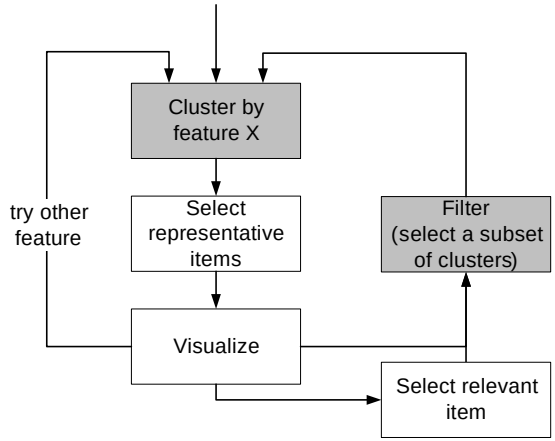
Workflow and Metadata

- Workflow metadata organizer
  - Metadata extraction
    - plugin for extracting metadata from DPX sequences (technical metadata, lens & camera metadata)
    - described in MPEG-7
  - Automatic content analysis
    - shot boundary detection
    - key frame extraction
    - stripe image extraction
    - camera motion detection
    - description of all extracted metadata in MPEG-7

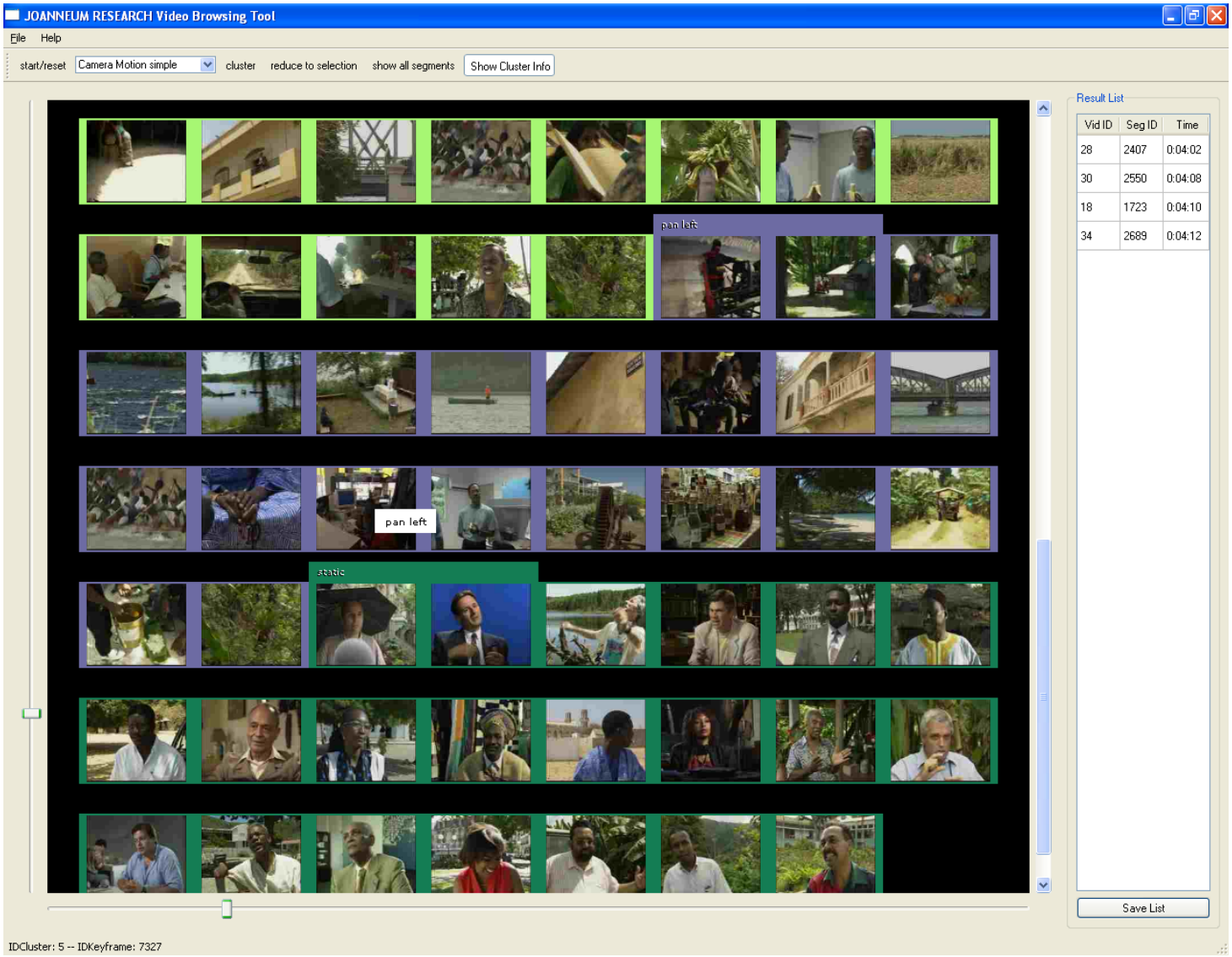


Workflow and Metadata

- Pictoral summary
  - Browsing tool for collection of un-annotated videos (e.g. rushes)
    - software framework for summarization and browsing
    - visualisation component
    - iterative clustering by different features and filtering :
      - camera motion
      - motion activity
      - audio level
      - color similarity
      - face occurence



Workflow and Metadata



Workflow and Color Management

Truelight

Print emulation

- Measurement based tool to generate 3D LUTS, by characterising film-out path and displays

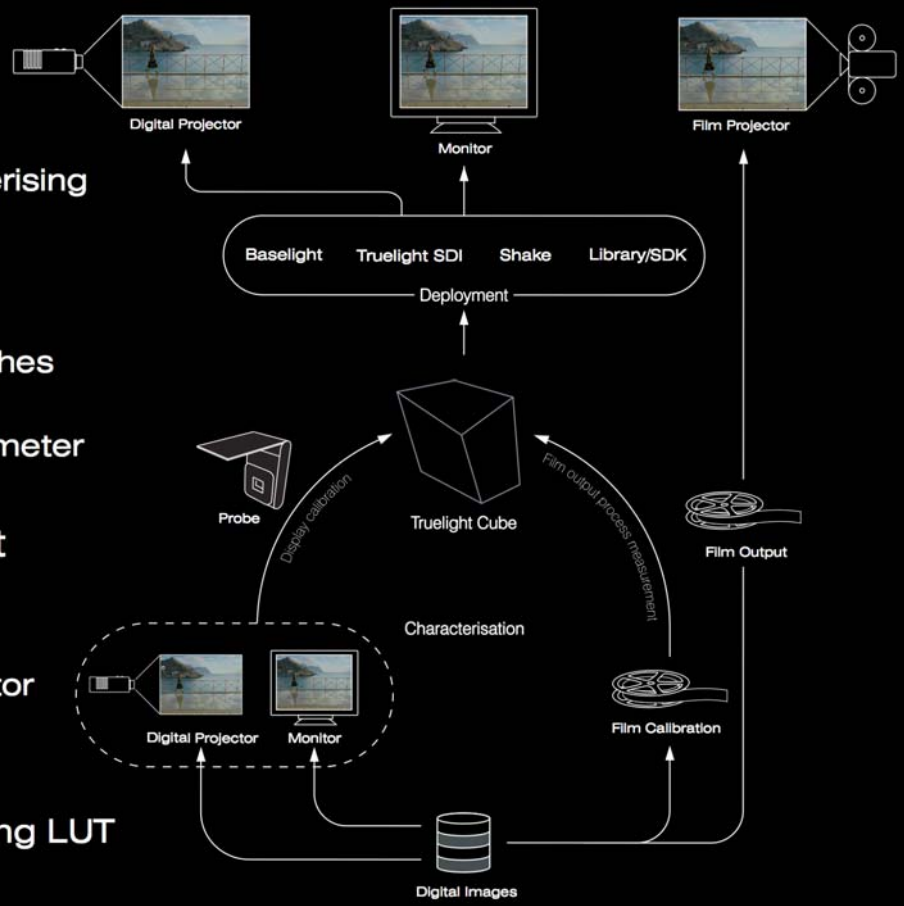
Film-out path measurement

- Client film-out of standard patches to film stock of choice
- Measure on motorized densitometer

Digital Display measurement

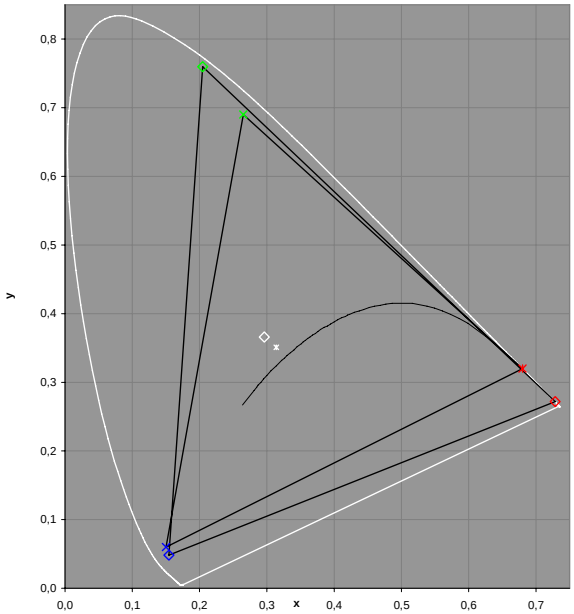
- VGA or HD Monitor, HD or DVI projector
- Measured using Truelight Monitor Probe

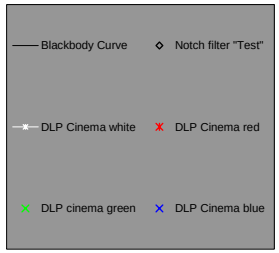
Combination generates 3D viewing LUT

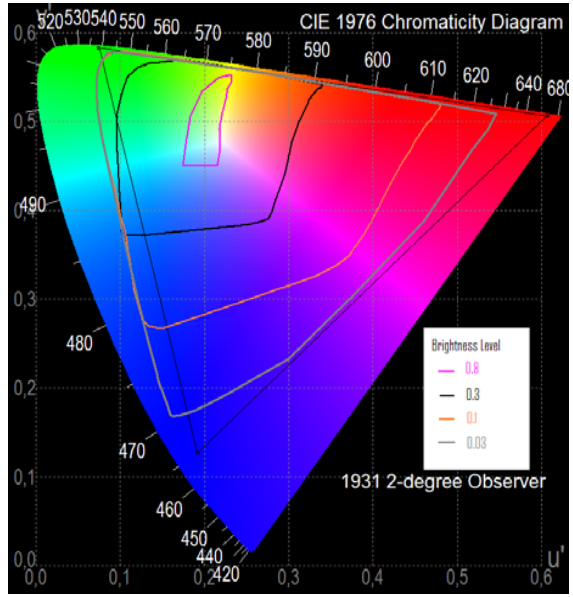


Workflow and Color Management

- Wide gamut post-production projector
  - Wider colour gamut : Extension of the cyan and magenta range over standard theatre projector. Encompasses almost all the colours of 35mm print film,.





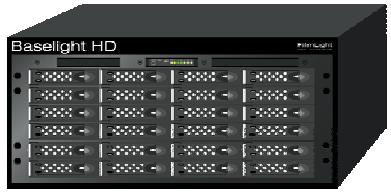


  - Enhanced illumination system : better white uniformity and 10-15 % contrast increase

Workflow and Data Stream

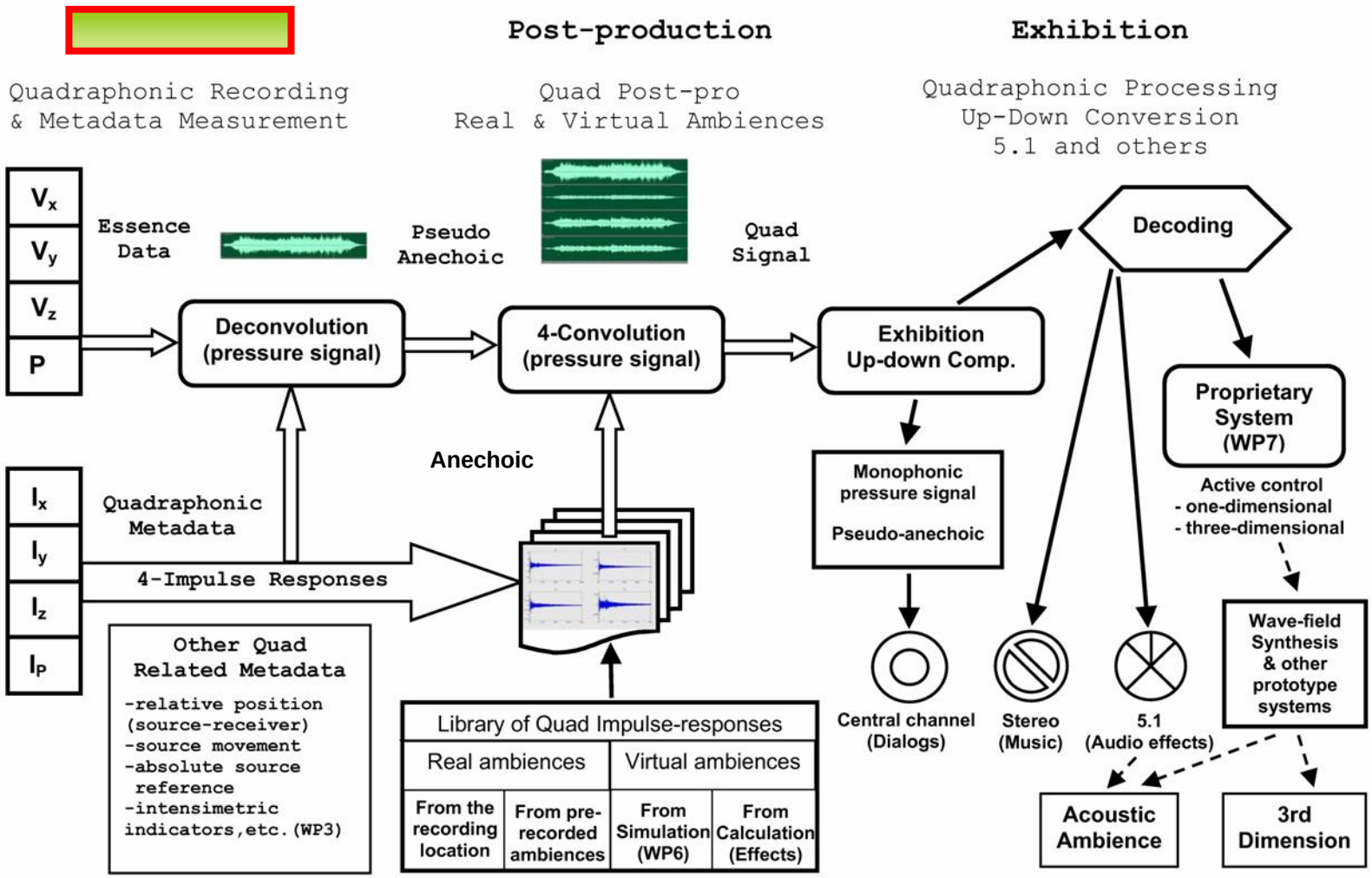
Large scale infrastructure and interoperability

- Large-scale parallelism: 16 - 64 cpu cores
  - Process scheduling, render optimisation, multitasking
- 16-core numa platform (Baselight HD)



- 10GigE network fabric
  - Up to wirespeed data communications (920MB/s)
  - Inter-cluster, Inter-node, between host and cluster

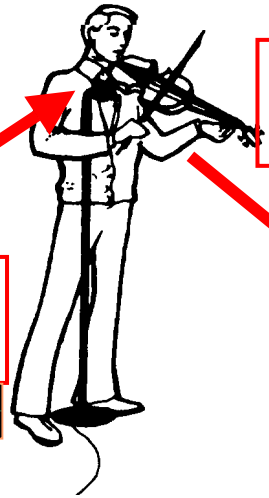
Quadraphonic Audio workflow



AQ audio workflow for digital cinema

Audio Production

Sound source



Near field pressure mike

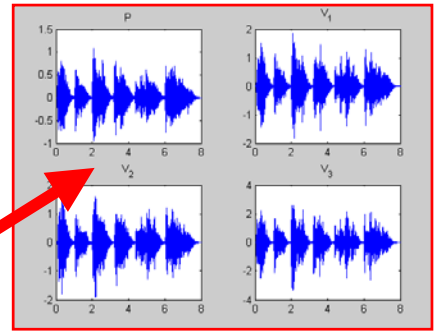
Intensimetric Probe

Portable System (Hard + Soft)

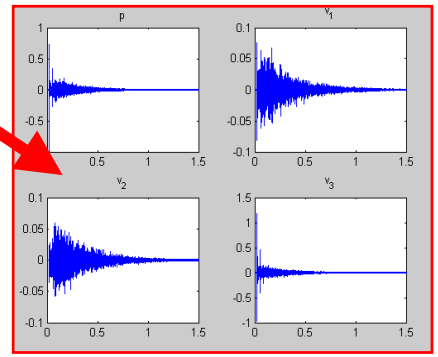
Impulse source

- Acquisition of audio data (pressure + three velocity components)
- Calculation of four impulse responses
- Calculation of standard room acoustic indices
- Calculation of intensimetric indices

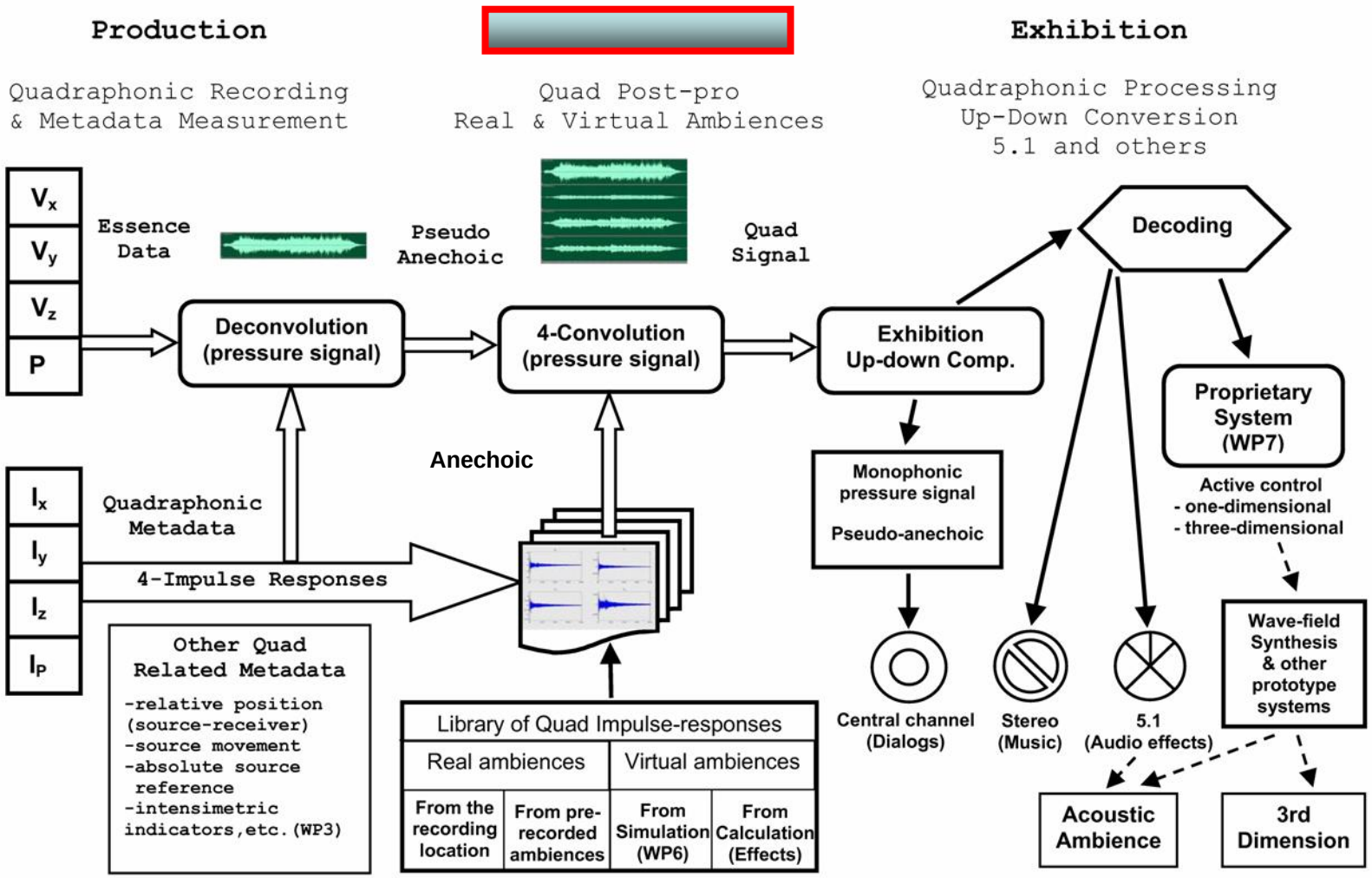
Quad-signal



Quad Impulse Response



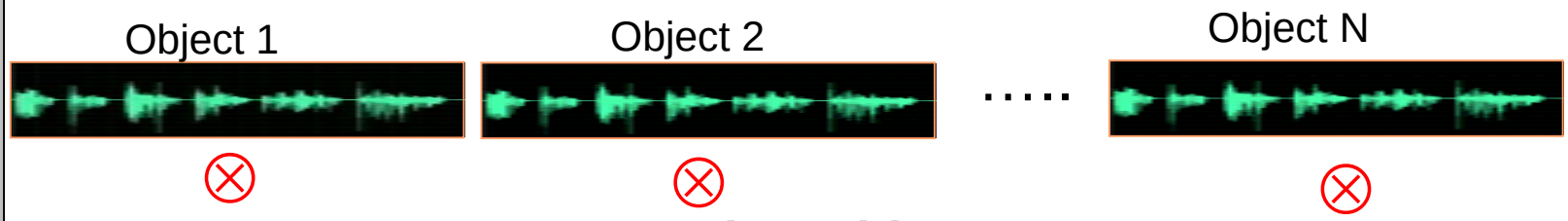
Audio post-production



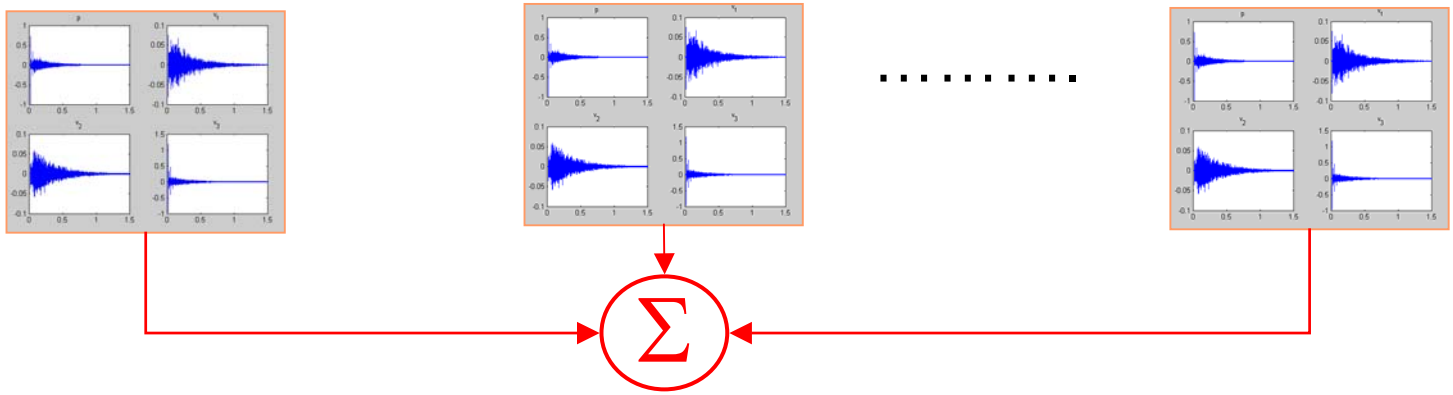
AQ audio workflow for digital cinema

Audio post-production

Anechoic or pseudo-anechoic sounds

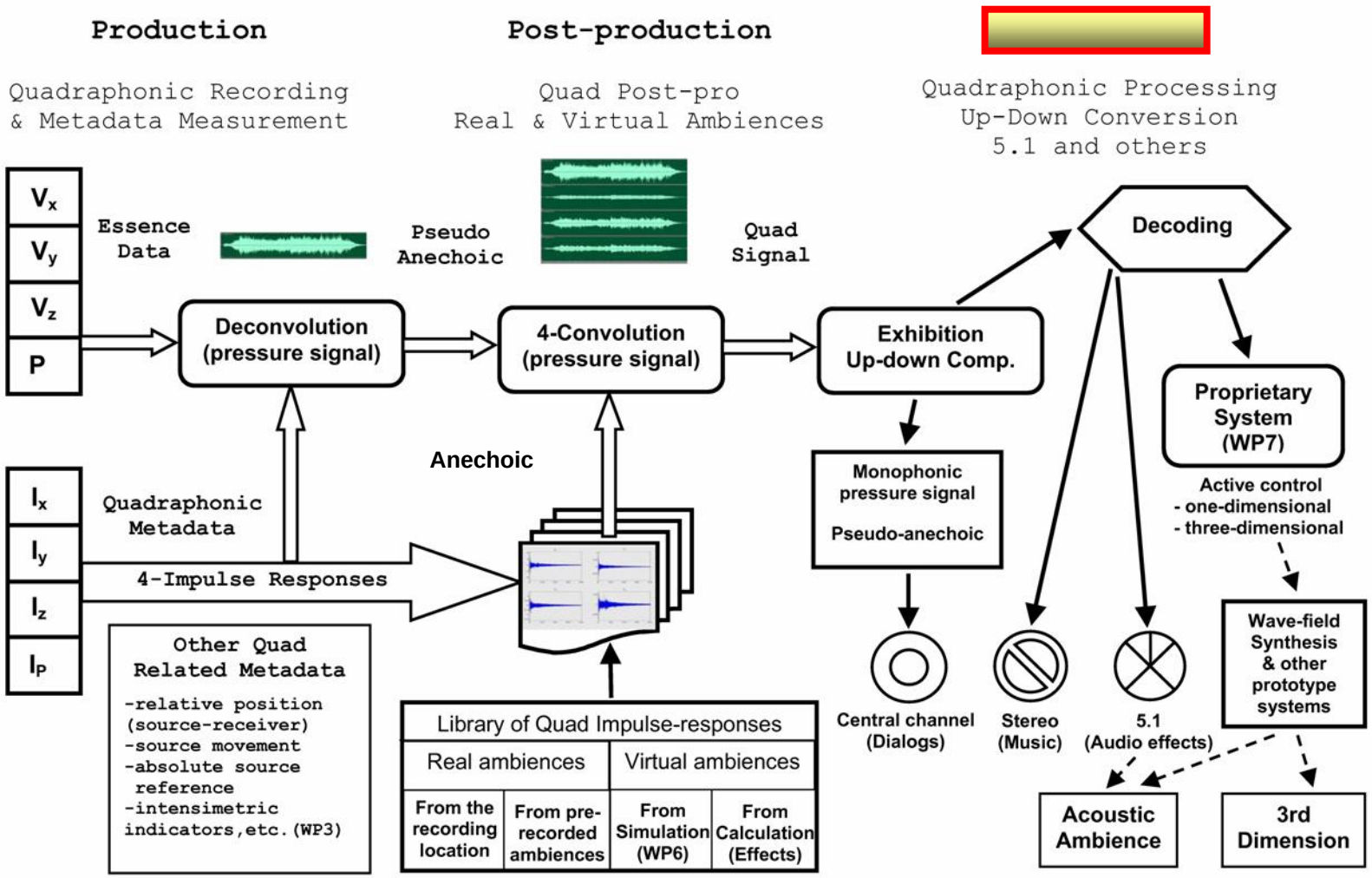


4-D convolution with a 4-IR



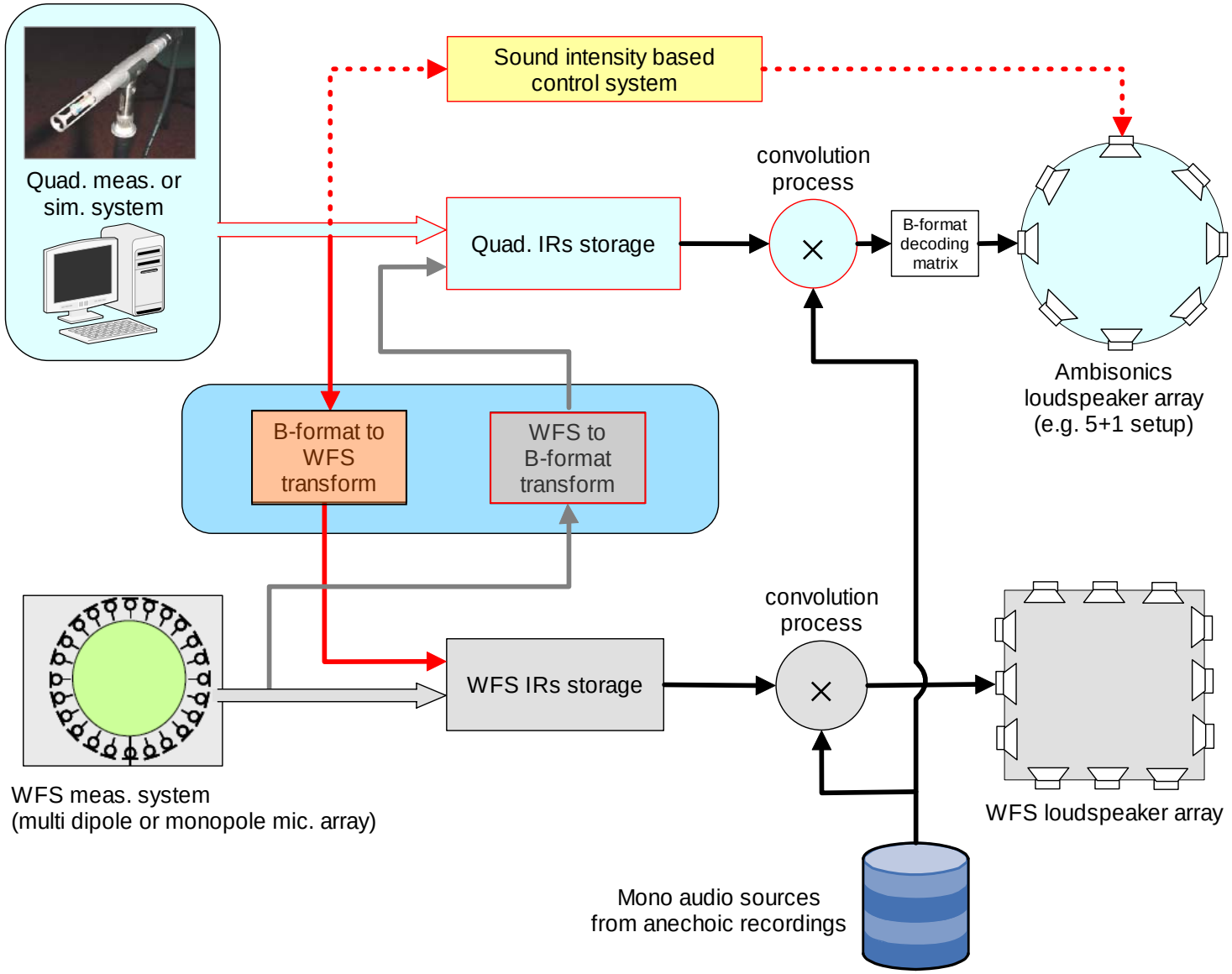
4-IR from a gallery of real and simulated environments

Audio exhibition



AQ audio workflow for digital cinema

Audio exhibition compatibility

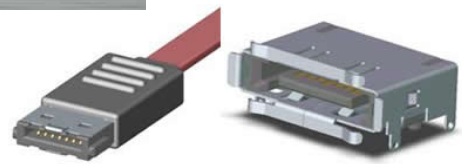


Exhibition Systems

- Compact lower cost projector platform
  - 0.98” 2k DLP chip with increased contrast
  - Highly efficient Xenon lamps : 18.000 lm with 4 kW (up to 20m screens)
  - Highly efficient optics, high contrast ratio, innovative cooling
  - Optional touch screen and fixed button panel
  - 3D capable

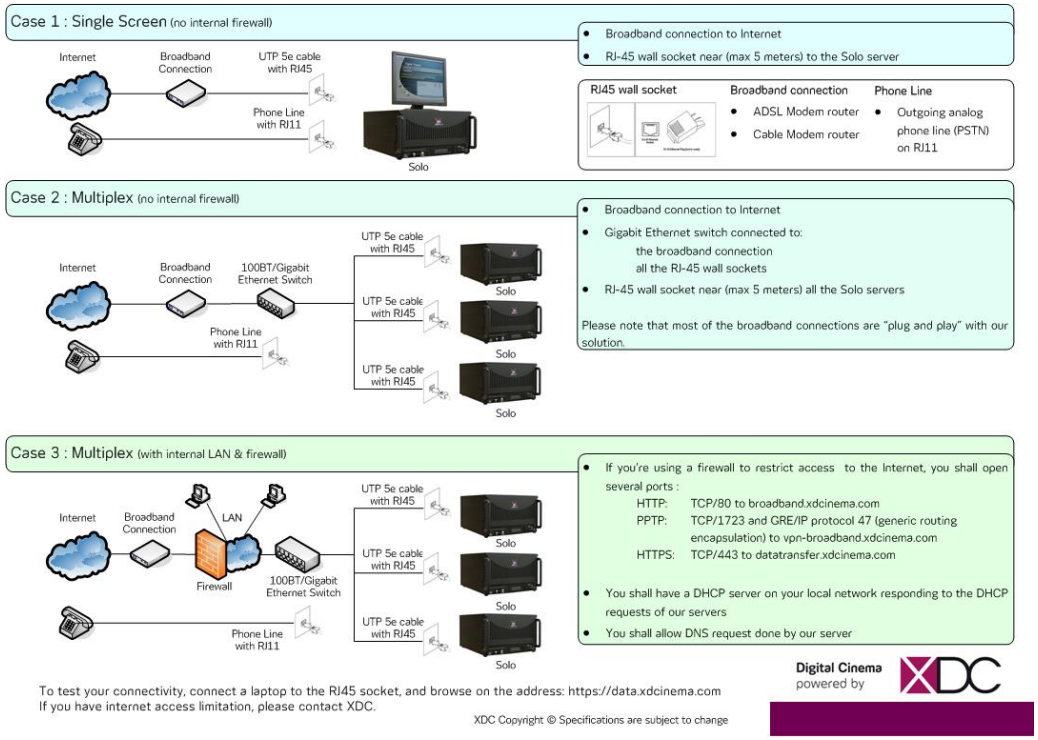
Exhibition Systems

- Cinestore Solo G3 server
  - JPEG2000 decoding, watermarking
  - MXF interop. compatible
  - Integrated audio interfacing
  - Integrated ADSL router
  - Transport via e-SATA remove-al
  - SATA raid disks
  - Touch-screen interface



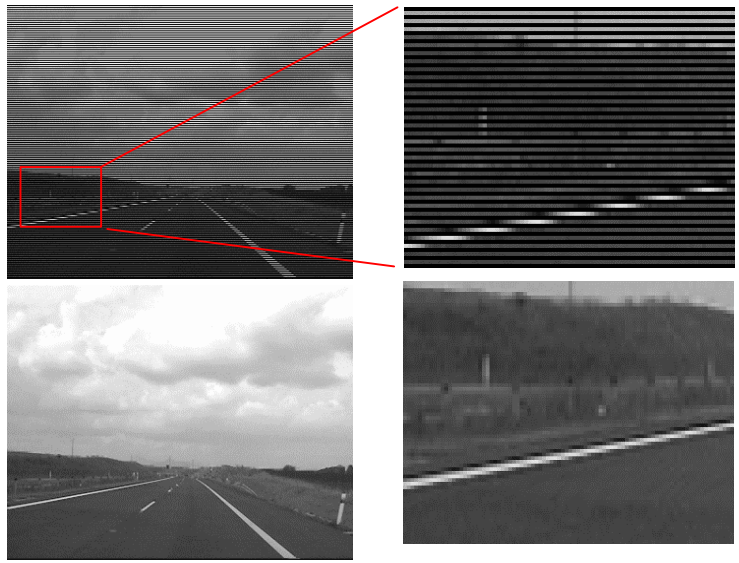
Exhibition Systems

- Remote theatre control
  - Connecting all theatres to the NOC with ADSL
  - SNMP agent for projector monitoring
  - Remote control over servers and projectors



Exhibition Systems

- De-interlacing processing for alternative content.
  - Novel Geometry-based spatial and temporal interpolation algorithm
  - Basic idea: missing lines are “gaps” to be filled taking into account “geometrical information” of the image
  - The “geometrical information” are the level-lines of the image



The future of digital cinema

- Almost all movies are digitally originated. Moving images will be captured and stored on portable, integrated camcorders, operating at resolutions better than today's film.
- Metadata will be captured automatically and will be pervasively available. This metadata will include all relevant data, including time, date, place, weather, temperature, and possibly capture the whole scene, in a full 360 degrees, in varying resolutions.
- It will be routinely possible to capture 3-D objects and scenes in real time, in great detail and some movies will be realized fully in 3-D, from data capture to display.
- Virtual Studios will be capable of creating and combining 2-D or 3-D optical and computer-generated imagery seamlessly, in real time.
- Postproduction will operate on data on higher semantic levels of information than pixels or frames. Moviemakers will be able to manipulate 'data objects,' which may be characters in a story, or the plot of the story itself.
- Cross media or cross platform transformations will be as simple as dragging and dropping an illustration between word processor documents is today.
- 3-D digital audio will be generated to compliment the scene so that an aircraft hangar will automatically sound metallic and echo, or a virtual living room with soft furnishings will sound acoustically dead.
- New forms of 'cinematic' entertainment will integrate live and recorded action, with real-time rendering and playout. Moviemakers will find new ways of manipulating experiences of in space and time.
- Digital projectors will offer better quality and brightness at costs comparable to or lower than film projectors, and 3-D digital projection will be readily available.

Thank You

- We invite you to participate in a short questionnaire about your impression of the project results.
- More information on the project website : www.ipracine.org
- Thank you for your attention!!