



DIGITAL PRODUCTION CHALLENGE

Digital Intermediate

Film shooting

Digital shooting

Digital postproduction

Digital workflow

How to choose ?

Thursday 15 to Saturday 17 November 2012, Paris (France)

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The first questions

What is the feature or program's end destination?

▪ 35 mm theater exhibition? Imax? Imax 3D?



▪ D-cinema digital projection (2K / 4K)? 3D?



▪ HD digital projection, E-cinema, large displays?



▪ Ultra HD? HDTV broadcast? 3D broadcast?



▪ Internet?


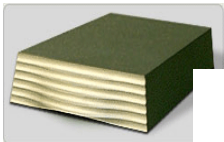



▪ Current TV broadcast?

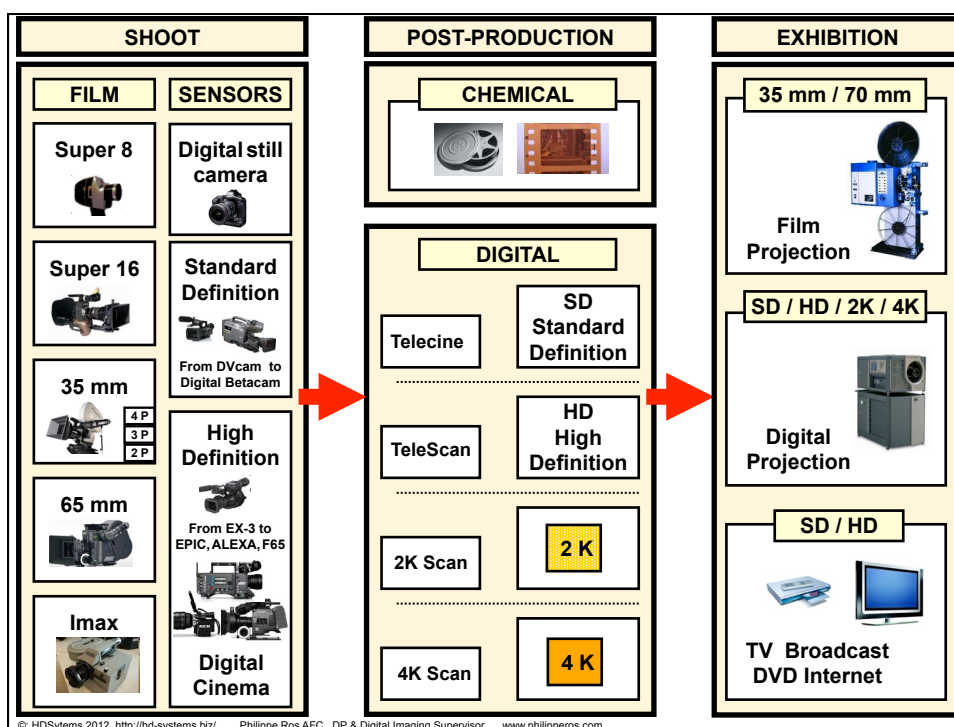


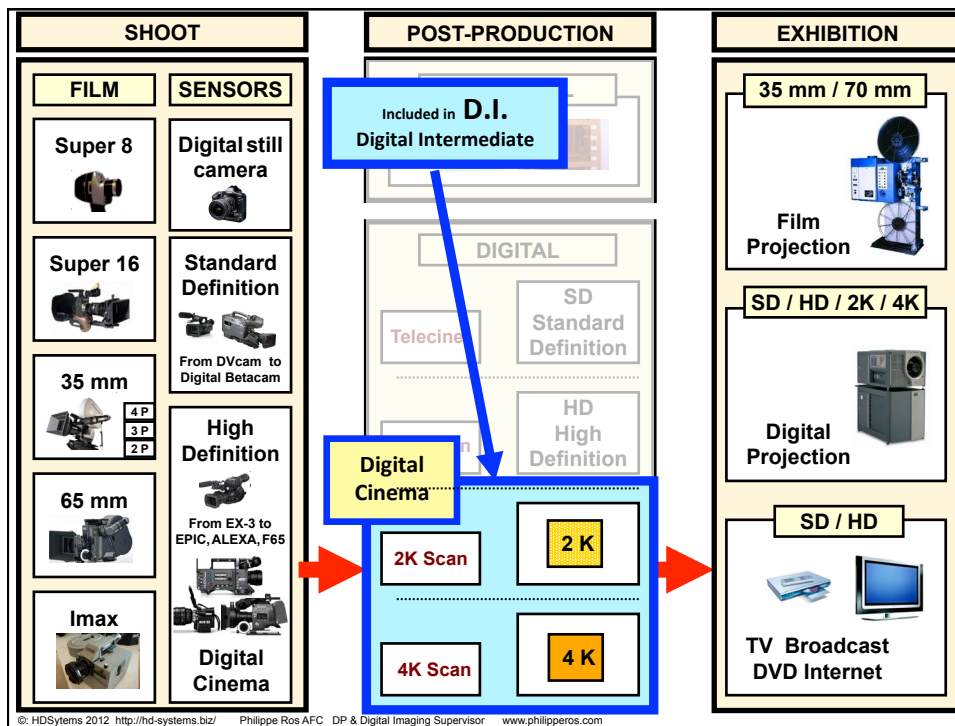
▪ DVD - HD distribution?



| The DCP | The first questions |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>The DCP or Digital Cinéma Packaging is the release format for D-Cinéma (Digital Cinema), the frame being encoded in JPEG 2000.</p> | |
| <p>▪ D-cinema digital projection (2K / 4K)? 3D ? </p> | |
| <p>D-Cinema 2K frame format: 2048 pixels x 1080 lines (this is neither HD nor 2K). D-Cinema 4K frame format: 4096 pixels x 2160 lines.</p> | |
|  | <p>FORMAT: Compressed, split up in 'reels' SECURITY: Encrypted using 128-bit AES</p> <p>Reusable hard disk capacity: 2 long-feature films</p> <p>Hard disk dimensions: 17 x 12 x 4 cm (L x l x h)</p>  |

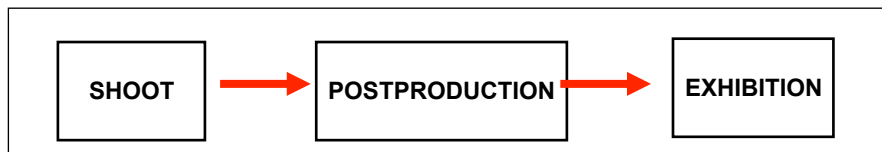
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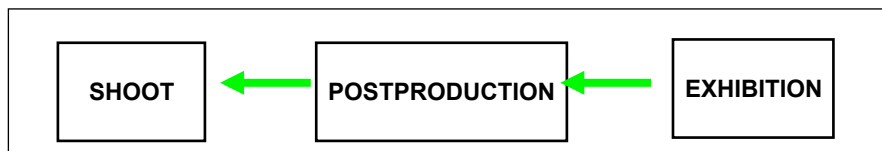


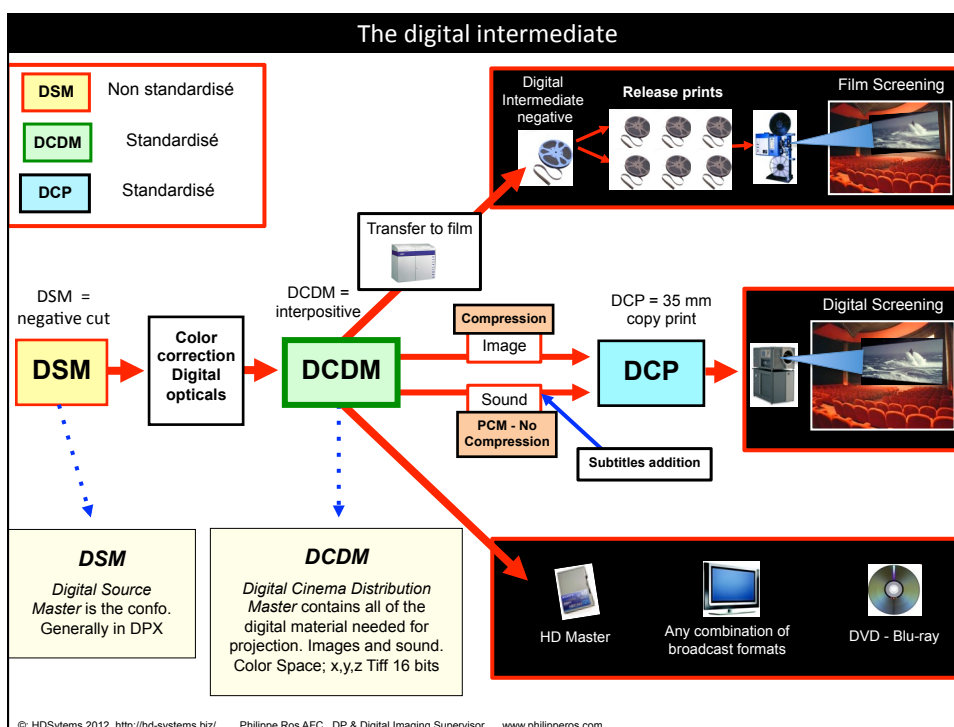
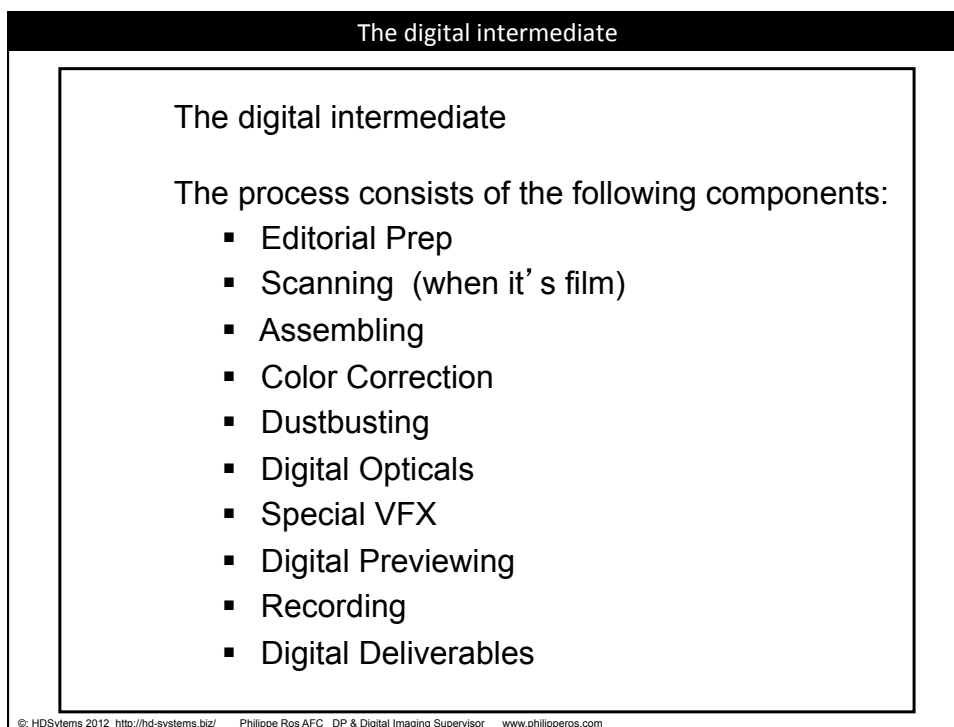
The first questions

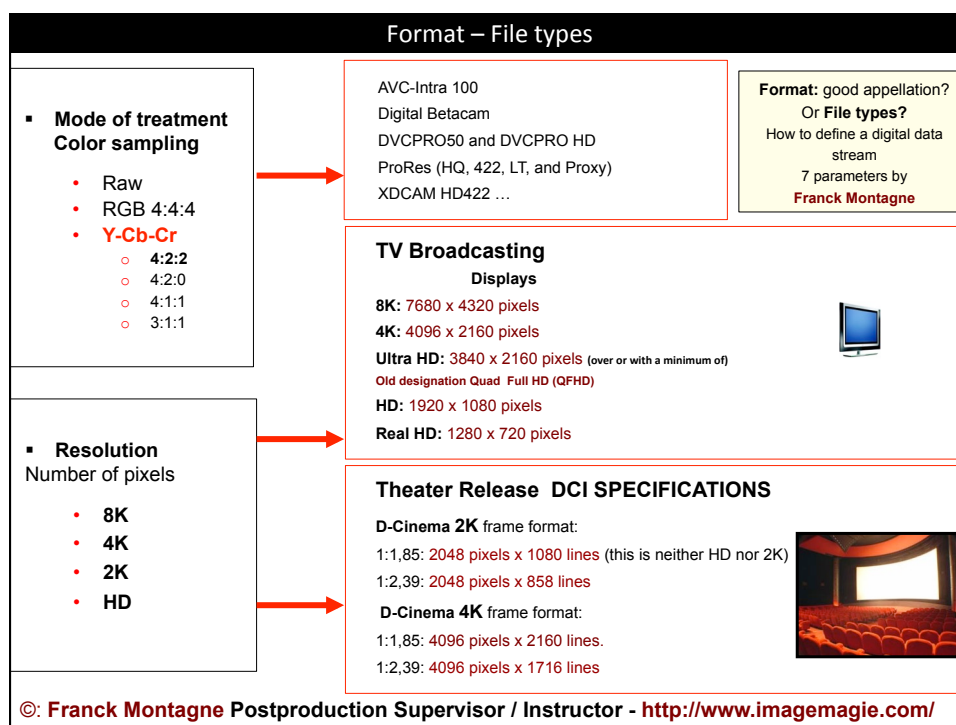
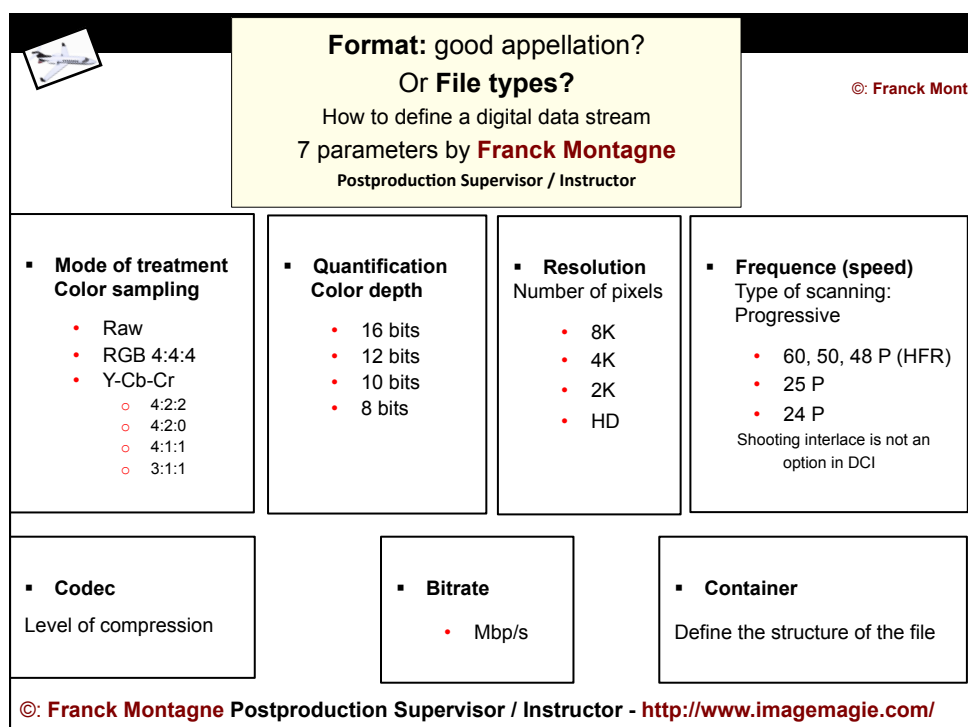
This diagram represents only a chronological flow but does not allow to choose shooting and postproduction tools

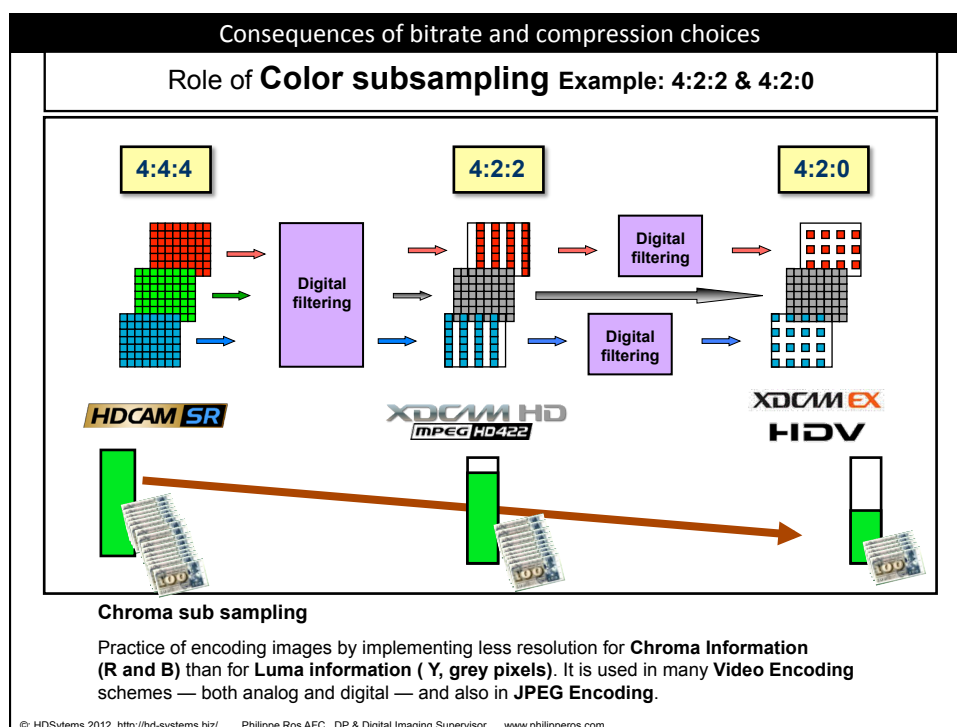
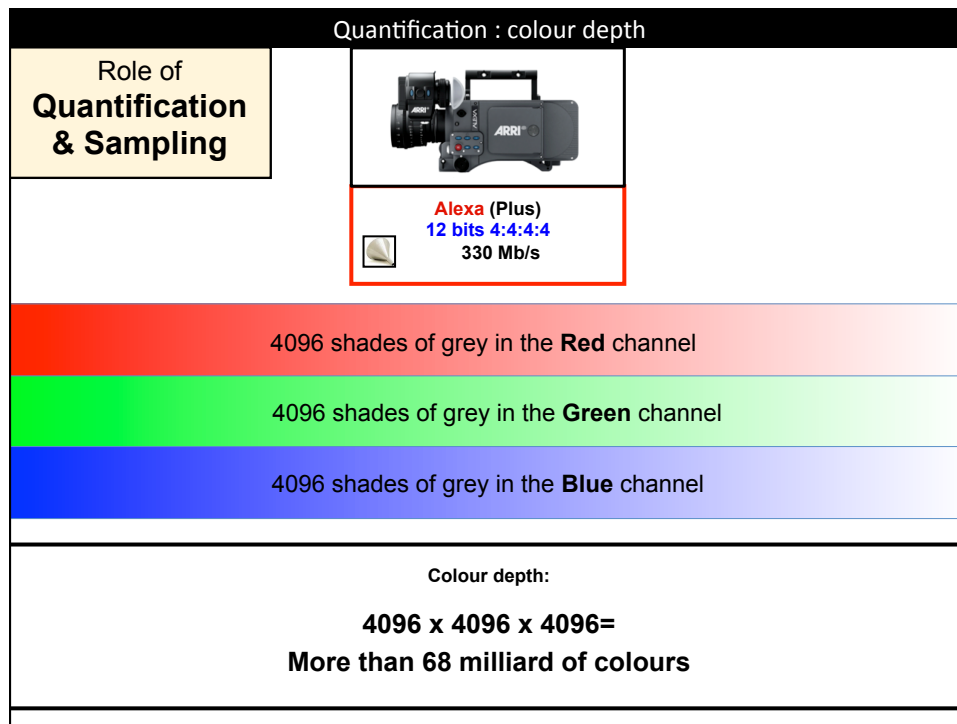


We prefer answering questions in the opposite order










Consequences of bitrate and compression choices

What is the advantage for SFX and grading of having :

- 10 bits rather than 8 bits ?
- 10 bits RGB rather than 10 bits Y-Pb-Pr ? :

- Keying made easier
- Compositing made easier
- Better rendering of flesh tones
- Color correction made easier




All these choices are not trivial.

The consequences on the finished film's quality and cost must totally be taken into account.

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Bitrate and codec

The bitrate



(number of information per second) depends :


- On the image width (from 960 pixels to 4096 pixels, even more)
- On the image height (from 720 pixels to 3072 pixels, even more)
- On the signal processing (Raw, RVB or Component)
- On the quantification` (8 bits, 10 bits or 12 bits)
- On the frequency (or speed) (23.98, 24, 25, 29.97, 30, 50, 59.94, 60 im/sec)
- On the Codec type used (Jpeg 2000, HDCal SR, HDCam, Mpeg2...)

Codec : Coding – Decoding


Example : JPEG 2000 (300 Mb/s) - HDCam SR (440 Mb/s) – HDCam (140 Mb/s) – AVC-Intra 100 (100 Mb/s)

Three important notions


Bitrate



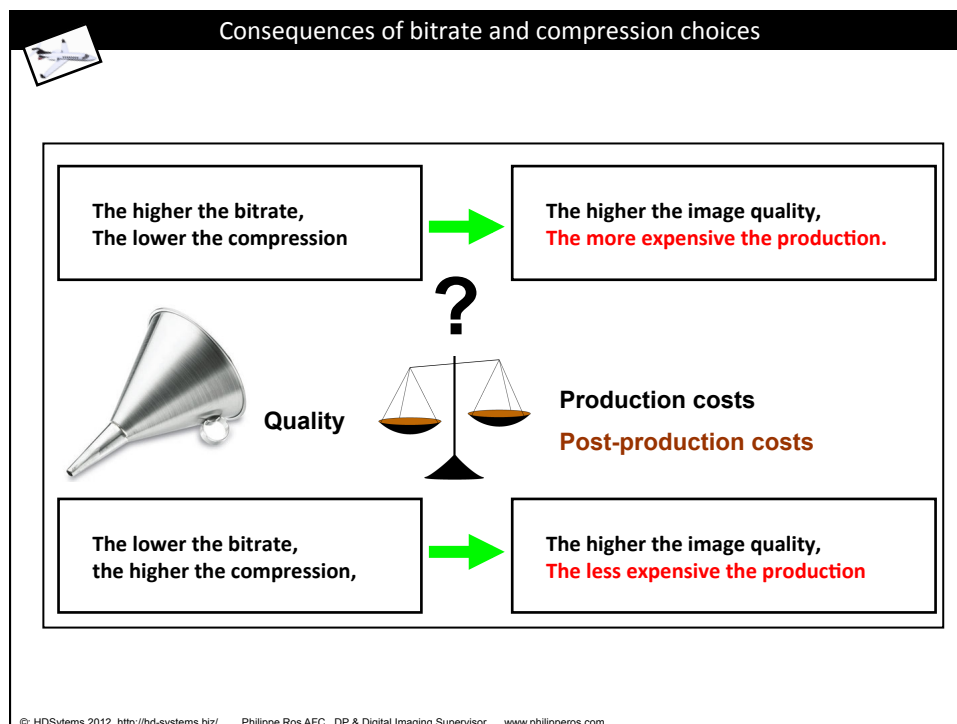
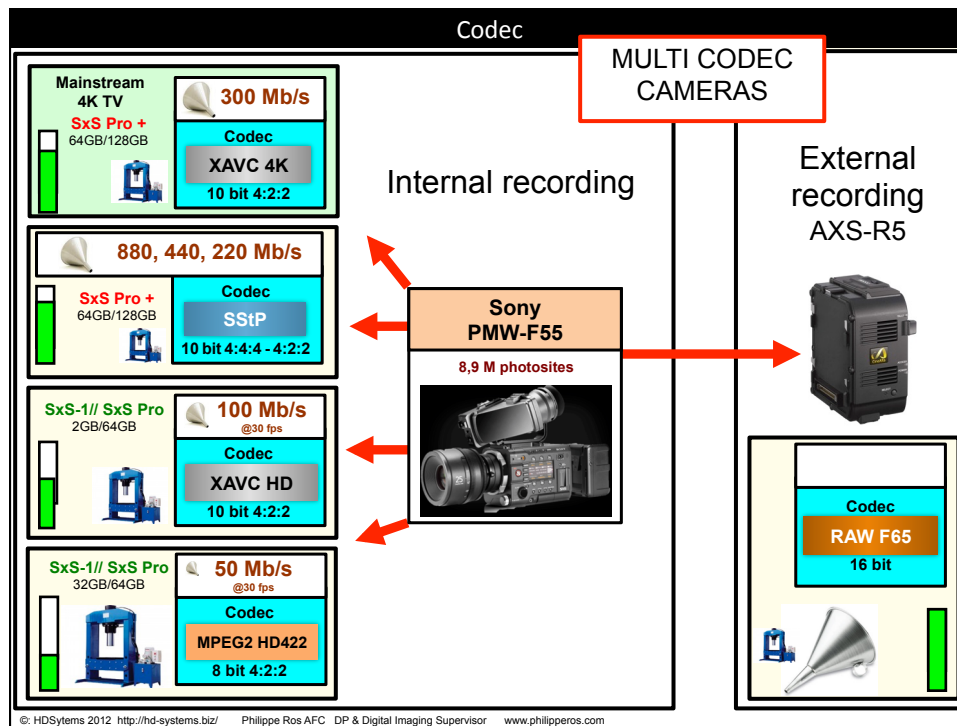
Compression

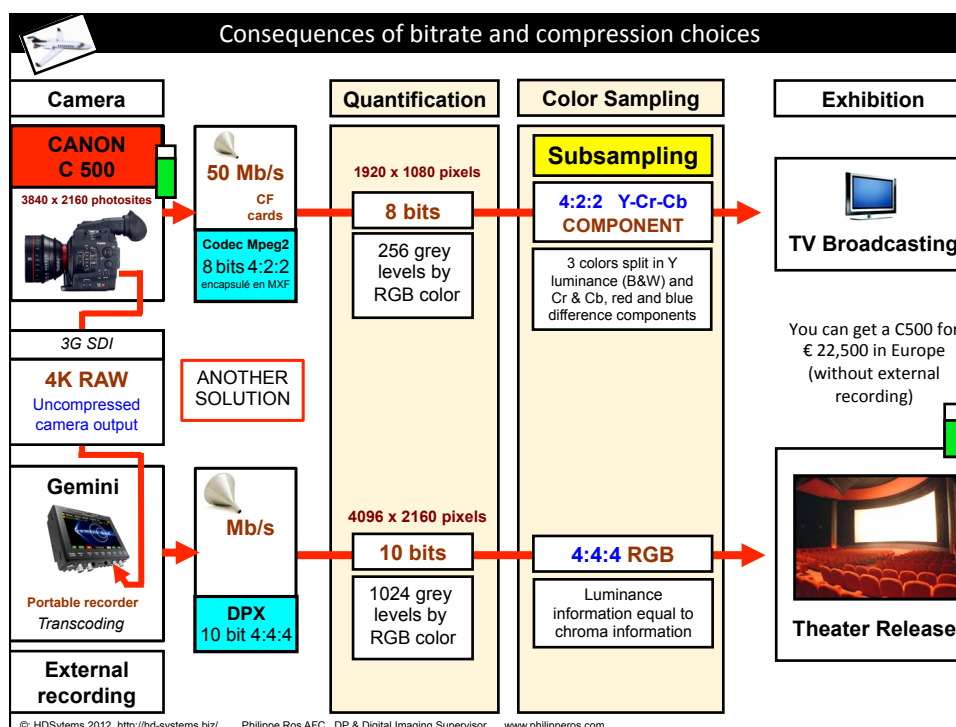
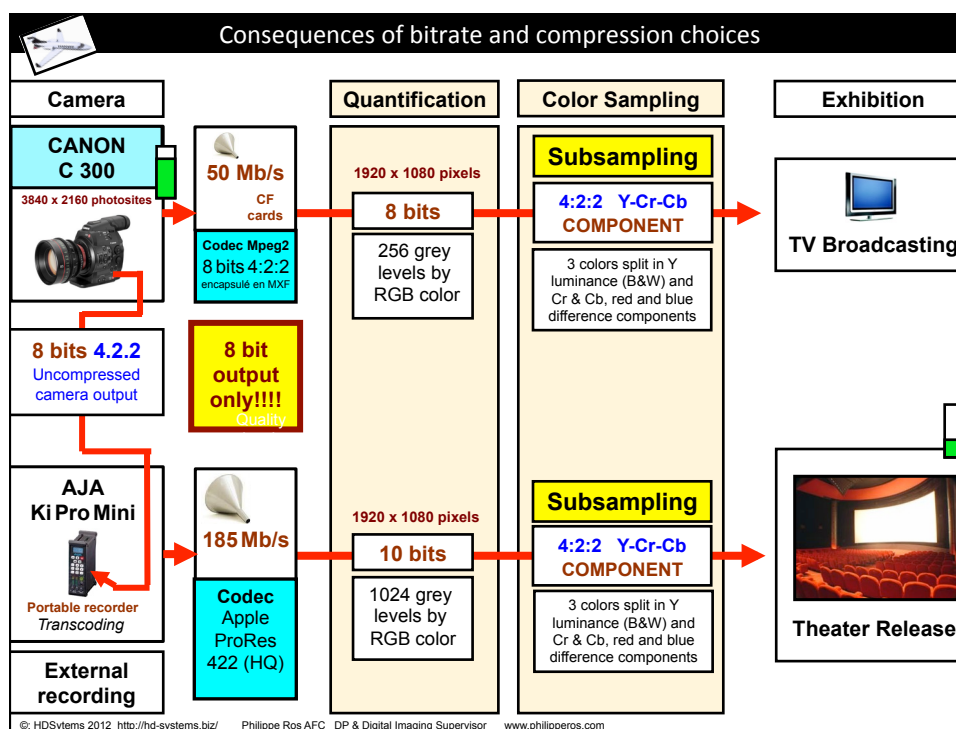


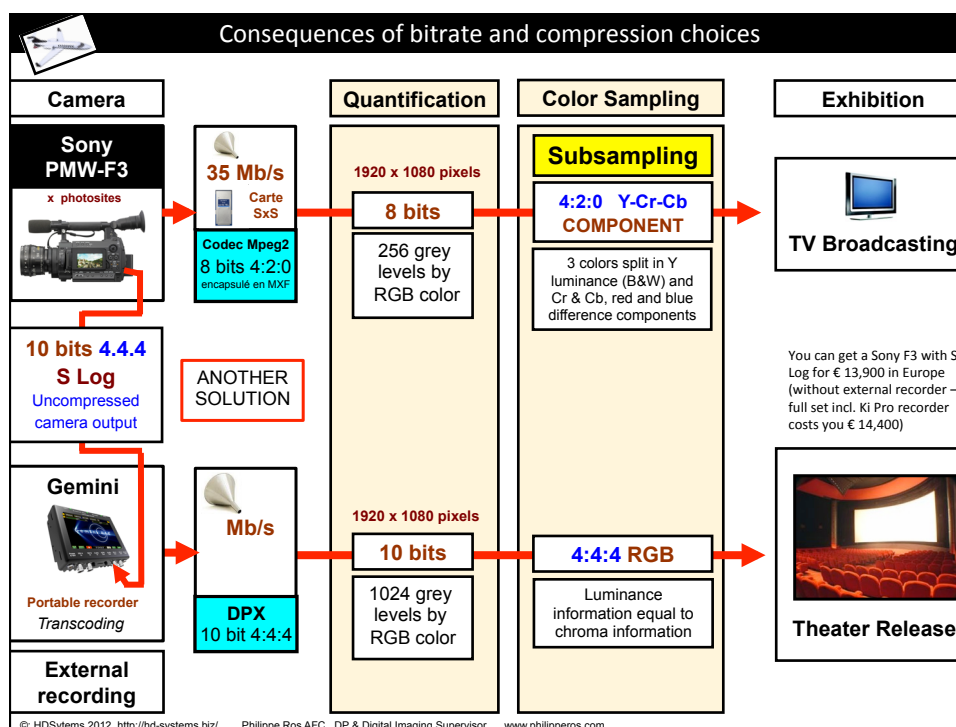
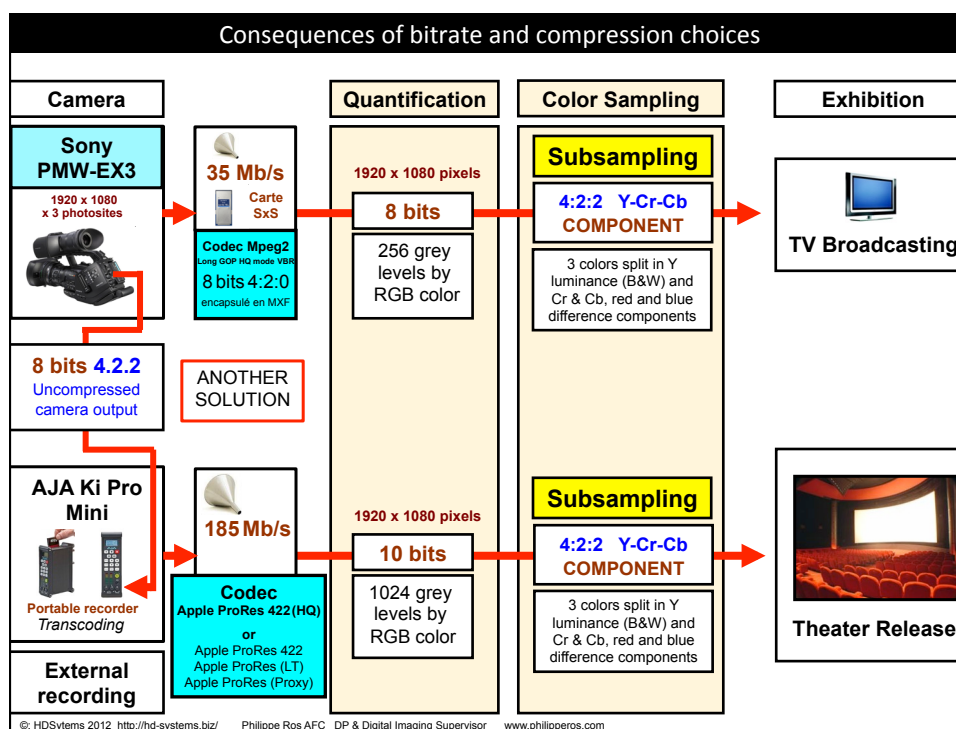
Information reduction



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Bitrate and codec

Issues related with frequencies?

Countries in 60 Hertz (USA, Canada, Japon...):
More easy when editing and mixing with 23.98, 29.97, 59.94 fps

Countries in 50 Hertz (Europe...):
More easy when editing and mixing with 24, 25, 50 fps

Before choosing frequency:
Better to know the country where postproduction will be done

In Europe, better shooting and postproducing in 25 fps,
or in 24 fps if you have to send deliveries to USA, Canada, Japon

Playtime of programmes depends on contracts and depends on frequency.
Better to anticipate safeties during editing for all foreign deliveries.

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Pixels vs Photosites

Great confusion or / and good marketing between:

- Number of photosites
- Size of the sensor
- Number of sensors
- Type of sensor
- Number of pixels recorded
- Resolution / sharpness / MTF
- Recording format
- Exhibition format

The type of sensor will
have a direct influence
on the workflow and
therefore on the budget

FINAL RESOLUTION

Marketing stories


The fact that a camera can deliver a 4 K image doesn't mean that it has the required numbers of photosites to deliver a real 4K resolution.

Whitout carefully paying attention, all these matched informations can lead to wrong decisions and to wrong process (during post: SFX, keying).


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Sensor types


▪ The 3 Sensors cameras (examples)




F23 (Sony)
3-chip 2/3-inch
1920 x 1080 x 3
photosites



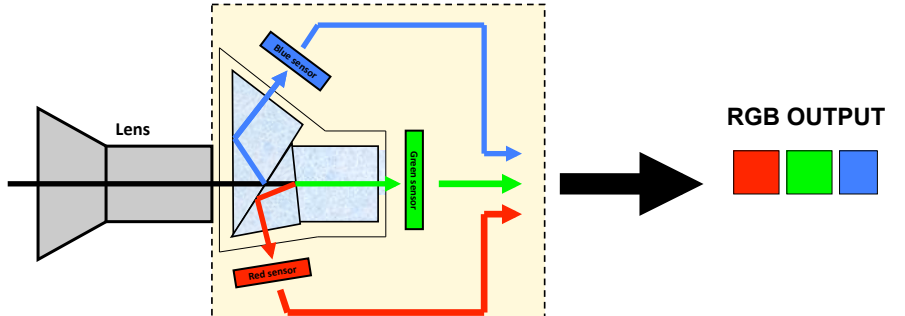
HDW-F900 (Sony)
2/3" 3-CCD sensor
1920 x 1080 x 3
photosites



AJ-HPX 3700 Panasonic
2/3" 3-CCD sensor
1920 x 1080 x 3
photosites



EX-3 (Sony)
3 x 1/2 -CMOS sensor
1920 x 1080 x 3
photosites



Camera block **CCD or CMOS block** **RGB OUTPUT**

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Sensor types

▪ The 1 Sensor cameras - The Striped pattern (examples)


UNIT CELL

| | | |
|---|---|---|
| R | G | B |
| R | G | B |
| R | G | B |

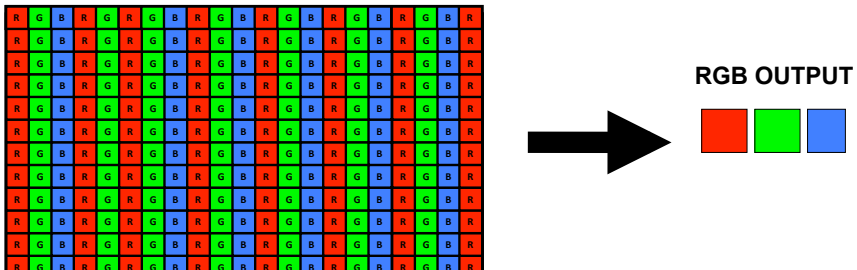
MACRO CELL



Genesis
(Panavision)
Mono CCD sensor Striped pattern
5760 x 2160 photosites



F35 (Sony)
Mono CCD sensor
1920 x 1080 x 3
photosites



RGB OUTPUT


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| Sensor types | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| ▪ The 1 Sensor cameras - The Bayer pattern | |
| <p>In the Bayer pattern, green samples are arranged in a checkerboard pattern, and the red and blue samples are arranged in rectangular grid pattern.</p> <p>The density the green samples are twice that of the red and blue ones.</p> | |
| | <p>2 x for 1 x & 1 x </p> |
| <p>The reason for why there are more green samples than red or blue samples is that the human visual system is more sensitive to luminance rather than chrominance.</p> <p>Luminance contains important spatial information, and we would like to preserve as much spatial detail as possible during the process.</p> | |
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| Sensor types | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ▪ The 1 Sensor cameras - The Bayer pattern | |
| <p>A Bayer filter could be defined as a digital negative which is used during post-production to restore an RGB flow</p> | <p>We are in front of a lab, a software which develops images and which:</p> <ul style="list-style-type: none"> • Is not always built-in • Is not always done real time. • Can be done in various ways (Irridas, Glue Tools, Phantom, Red, Arri, etc |
| | <p>Debayering</p> <p>RGB OUTPUT</p> |
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Sensor types


■ The 1 Sensor cameras - The Bayer pattern (examples)




Alexa
(Arri)
Mono CMOS sensor
3392 x 2200 photosites



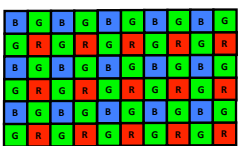
Epic
(Red Digital Cinema)
Mono CMOS sensor
5120 x 2700 photosites




PMW-F3
(Sony)
1920 x 1080 HD
recording



C500
(Canon)
Mono CMOS sensor
3840 x 2160 photosites




Debayering



Math process

Debayering is not only a mathematic process but also an artistic process.

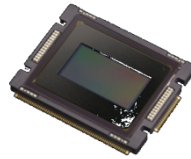
RGB OUTPUT



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Pixels vs Photosites

■ The 1 Sensor cameras - The F65 pattern



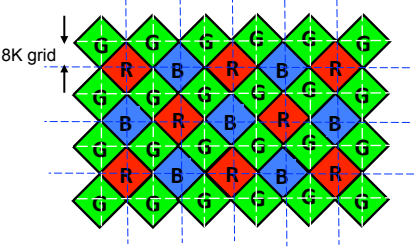
24.7mm
28mm
13.1mm

- Super 35mm 3-perf.
- Total Pixel Count: 20.0M
- 8K CMOS Image Sensor



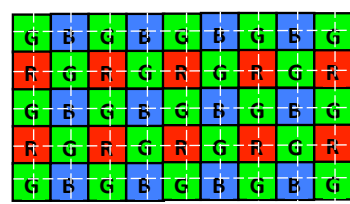
F65
(Sony)
20K photosites
4K recording

F65 Sensor



8K grid

Conventional 4K Bayer Sensor



4K grid

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