

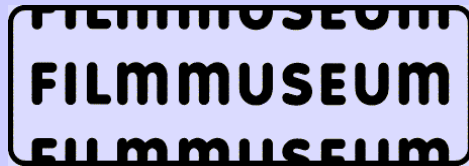
Het digitaliseren van archieffilms

Giovanna Fossati

Conservator, Filmmuseum

TAPE, 20 september 2007





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- algemene principes
- werktraject: hardware en software
- digitale restauratie
- digitale conservering

Algemene principe

- resolution
- bit depth
- dynamic range
- system performance
- operator's judgement

Resolution

What is resolution?

The capacity of a means of reproduction to describe an image in detail.

Resolution is measured (quantified) by defining the smallest possible distinguishable element (shape).

Resolution in photographic film:

Grain - chaotic system of crystals of variable dimension and shape

Resolution in digital film:

Pixels - system of identical elements arranged in an orderly way

Bit* Depth

* bit (short for *binary digit*) is the smallest unit of data in a computer. A bit has a single binary value, either 0 or 1.

What is bit depth?

The capacity of a pixel to describe grey/colour tones.

Bit depth (or number of bits) is the exponent to be given to the base number 2 to obtain a certain number of tones.

Examples:

1 bit (2^1) = 2 tones (levels)

2 bits (2^2) = 4 tones

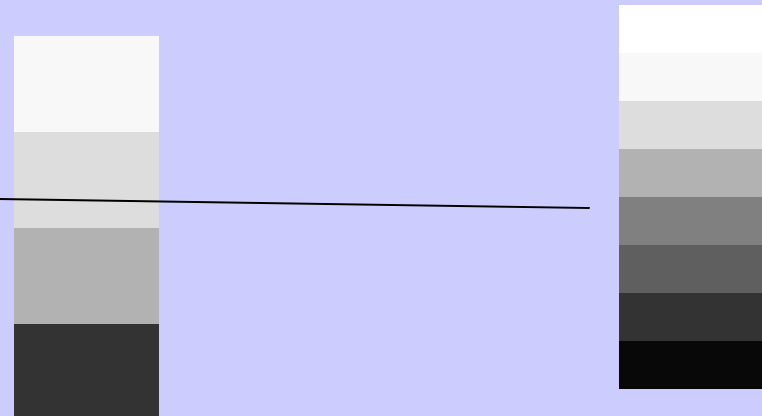
3 bits (2^3) = 8 tones

4 bits (2^4) = 16 tones

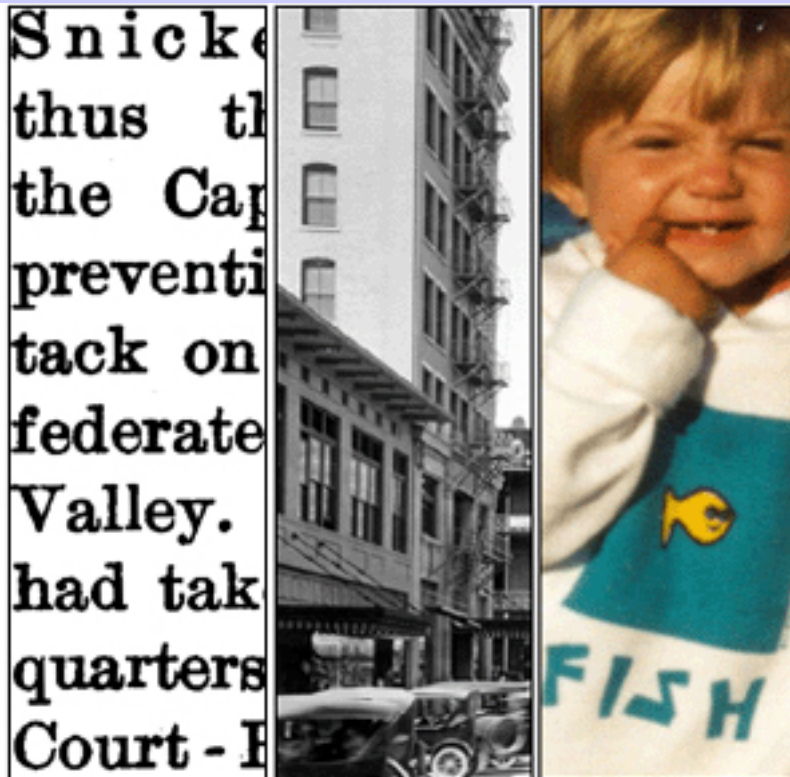
8 bits (2^8) = 256 tones

16 bits (2^{16}) = 65.536 tones

24 bits (2^{24}) = 16.777.216 tones



Bit Depth



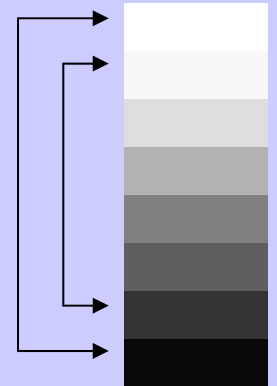
1-bit bitonal
 $2^1 = 2$ tones

8-bit grayscale
 $2^8 = 256$ tones

24-bit color images
 $(2^8)^3 = (256)^3 = 16.777.216$ tones
8 for red, 8 for green, and 8 for blue

Dynamic Range

the range of tonal difference between the lightest light and darkest dark of an image - dynamic range is governed by the bit depth used and by the system performance of the equipment used (e.g. scanner)



System Performance

Operator's Judgement





Lage definitie vs. hoge definitie

- ✓ lage definitie: ontsluiting (on-line, TV, DVD, etc.)
- ✓ hoge definitie: filmrestauratie en bioscoopvertoning



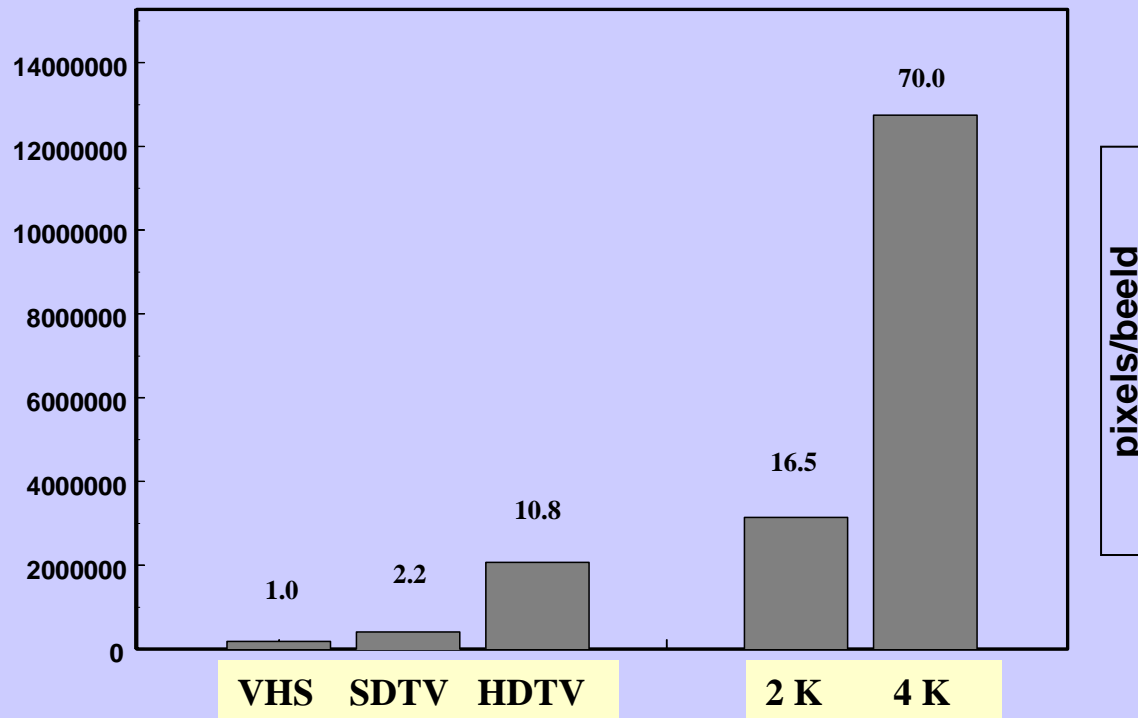
Definitie in cijfers

- ✓ *VHS (ca.): 428*328 – 187.000 pixel*
- ✓ SDTV (Pal): 720*576 – (bijv. Digital Betacam) – 415.000 pixel
- ✓ HDTV: 1920*1080 – 2.000.000 pixel

- ✓ **2K: 2048*1536 - 3.145.000 pixel**
- ✓ **4K: 4096*3112 - 12.750.000 pixel**



Het gewicht van definitie



Resolution of film originals in pixels.

Pragmatic estimates from discussions (1997-8)

EBU Tech 3289 - Supplement 1 - Table 6 – April 2004

RESOLUTION REQUIREMENTS IN PIXELS

Estimates from discussions

FILM SYSTEM and frame size	RESOLUTION REQUIRED? Height x Width pixels Approximations	total Pixels millions
35mm Eastman Colour Academy frame 1997	2057x3656	7.52
35mm Eastman Colour full frame 1997	2664x3656	9.74
35mm Eastman Colour Vistavision 1997	3456x6144	21.23
35mm Technicolor print Academy frame 1950	1000x1750	1.75
35mm Black & White nitrate negative Academy 1935	2057x3656	7.52
35mm Black & White nitrate print Academy 1935	2057x3656	7.52
35mm Black & White nitrate negative full frame 1920	1140x2000	2.28
35mm Black & White nitrate negative full frame 1915	1140x2000	2.28
35mm Prussian Blue toned full frame 1925	761x1354	1.03
35mm Cinecolor [2-colour] print Academy 1940	1000x1750	1.75
16mm Eastman Colour frame 1997	900x1575	1.4
16mm Ektachrome EF News film	761x1354	1.03
16mm Eastman Colour print 1960	761x1354	1.03



Werktraject

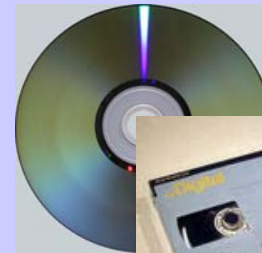
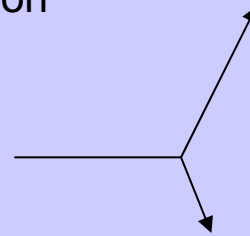


film



scanner film-data

digital image restoration



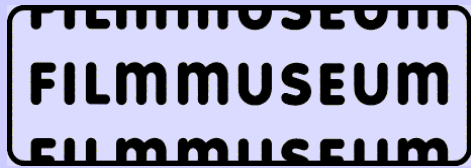
digital support
on-line



recorder data-film

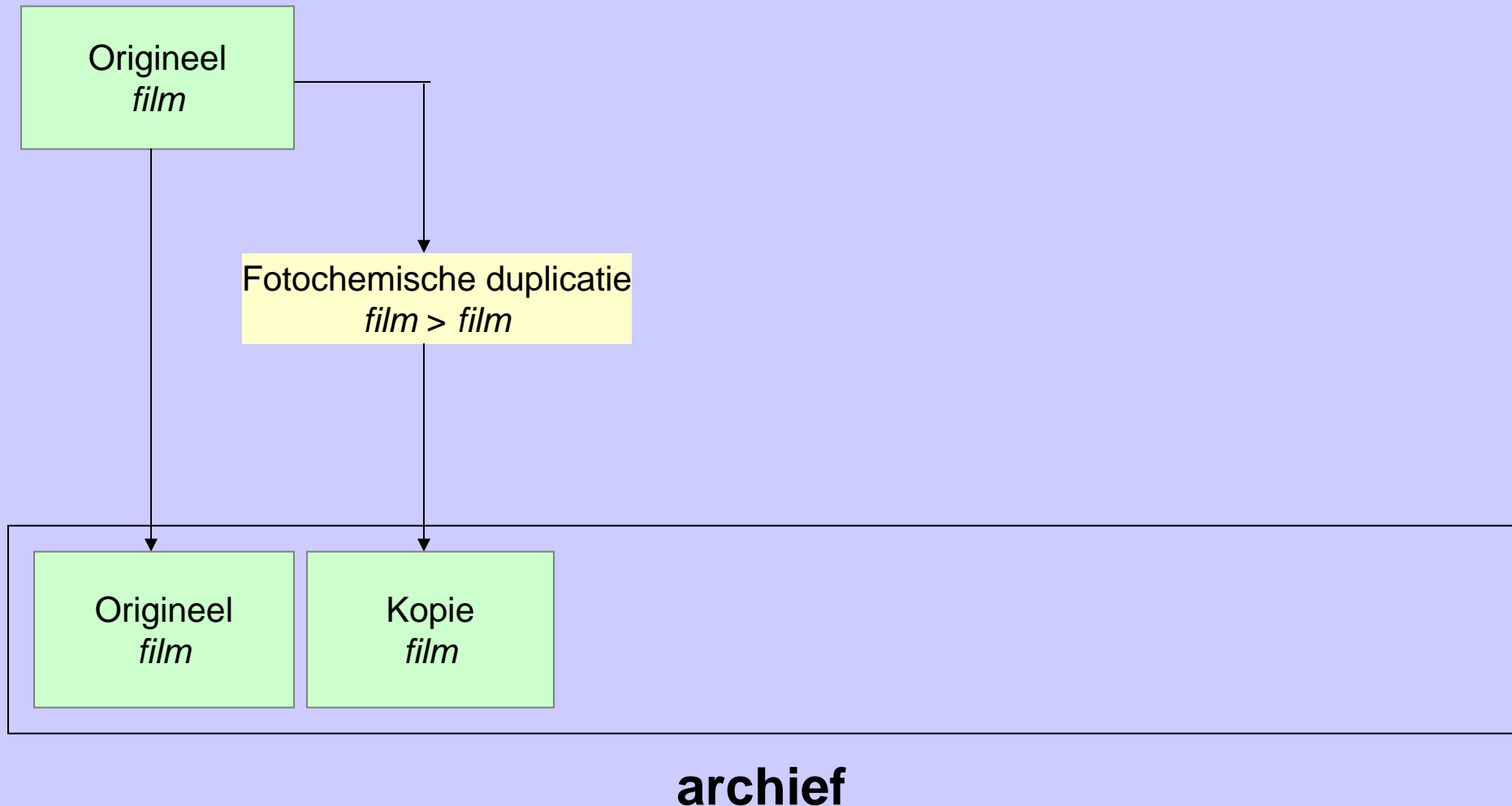


back to film



Werktraject

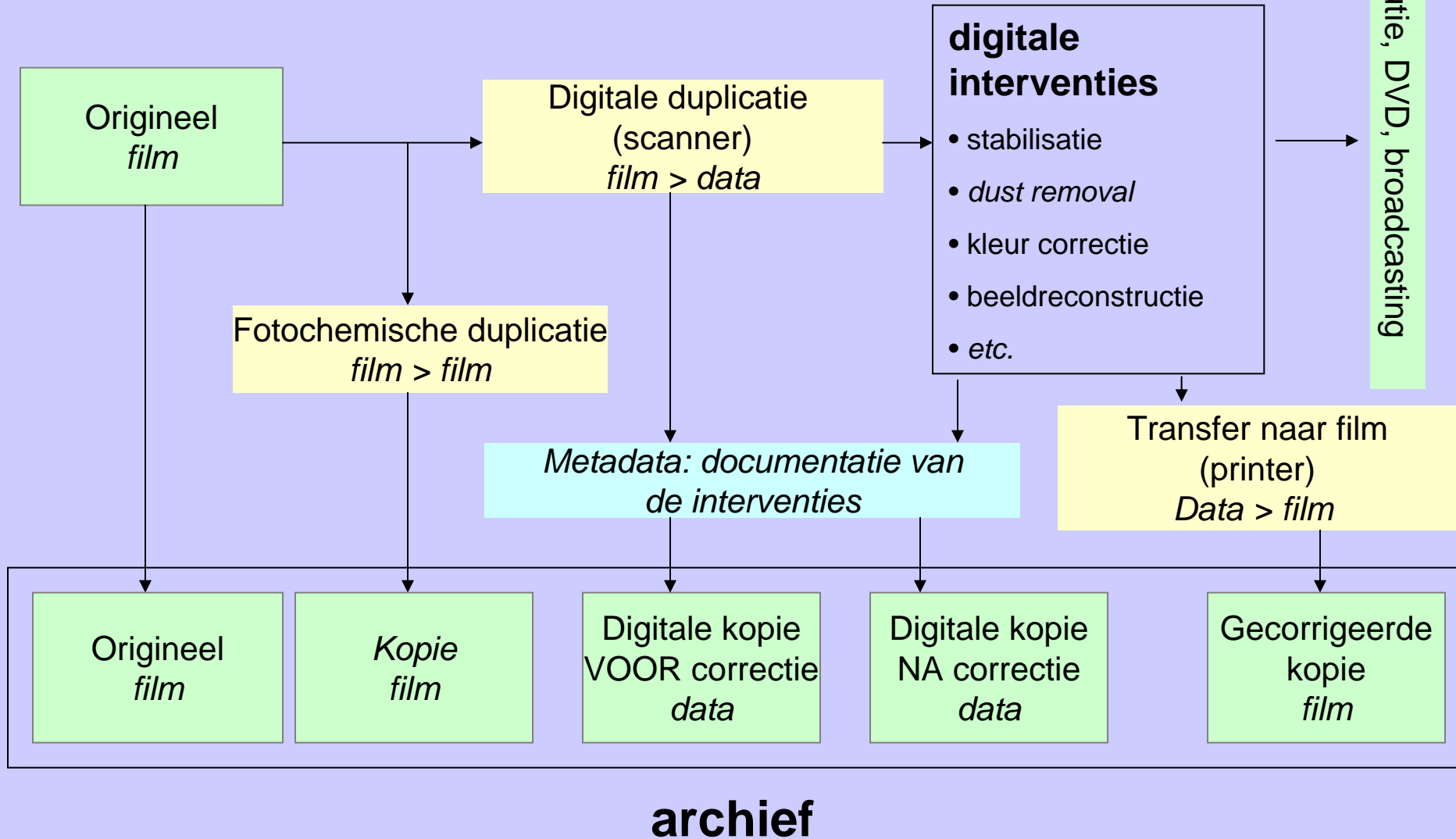
film naar film (fotochemisch/analooq)



Werktraject

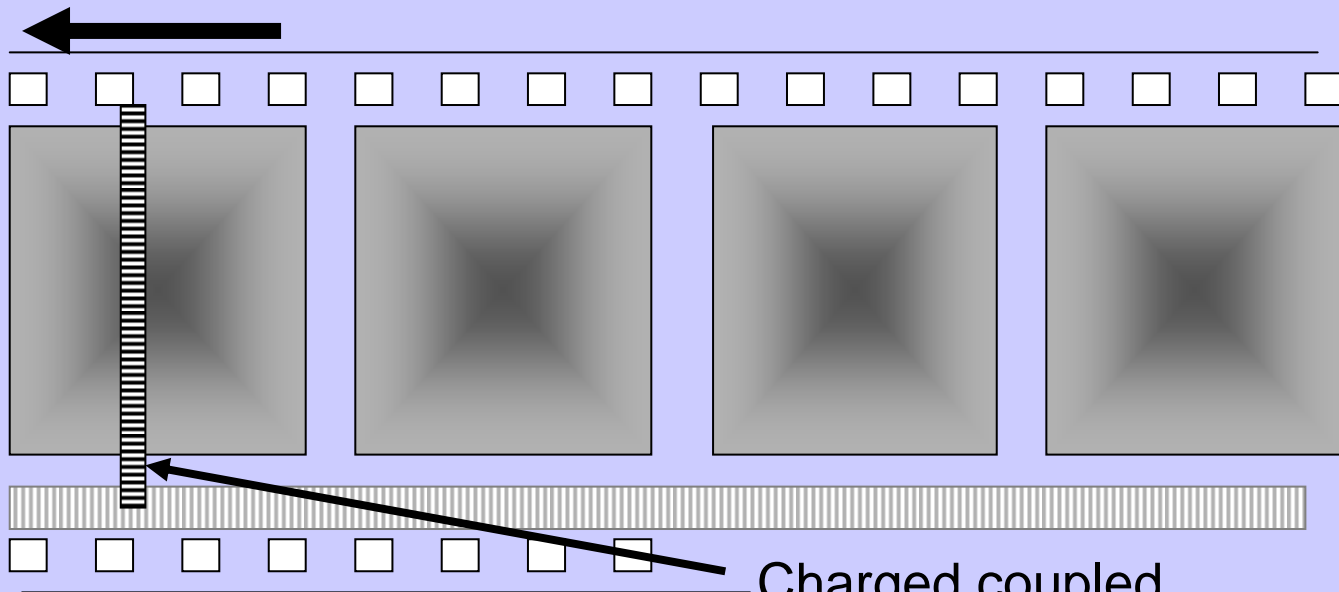
film naar data naar film (digitaal)

digital distributie, DVD, broadcasting



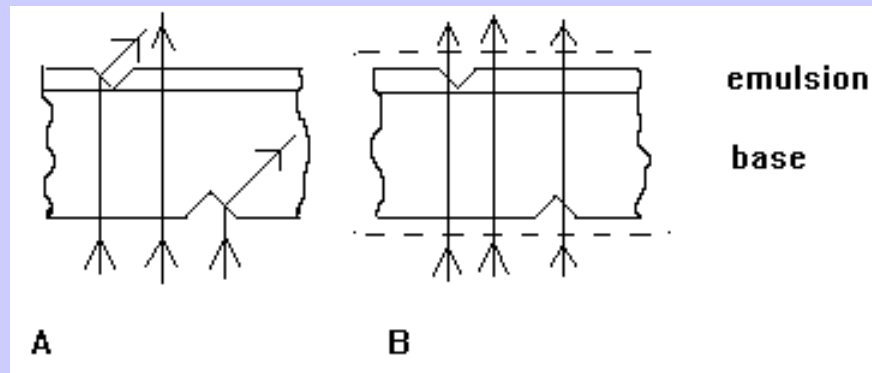


Scanning

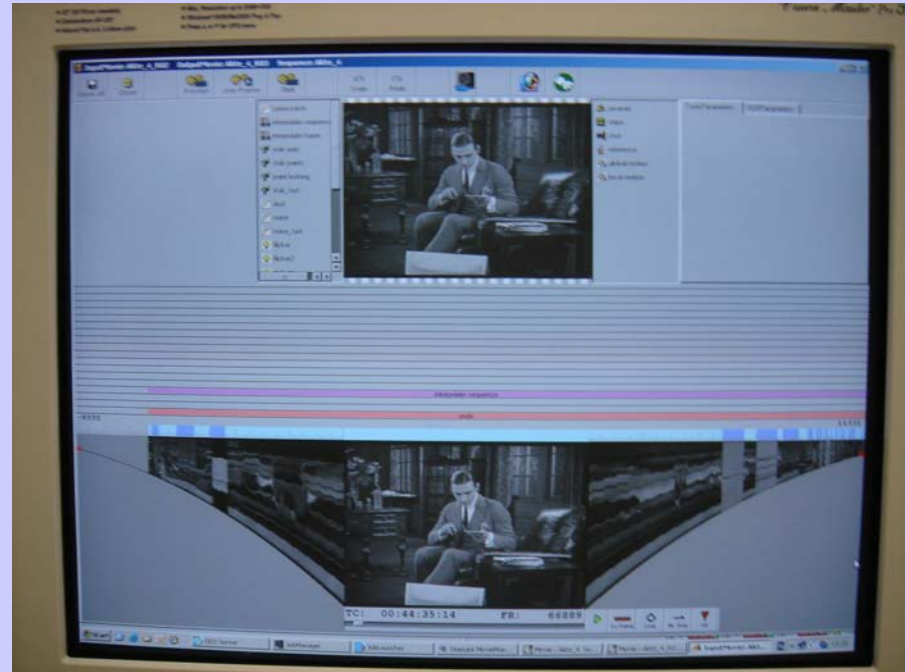


Charged coupled device (CCD) line array.

Wet gate principe ook voor digitaliseren



Software



- eerst ontwikkeld voor post-productie
- uitzonderingen: Diamant, DaVinci-Revival, MTI-DRS, Pixel Farm, The Foundry, etc..

Digitaal voor conservering: voordelen

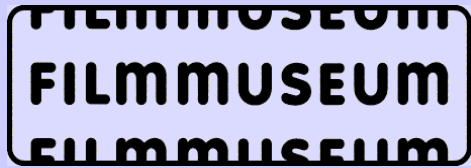
- productie van film materiaal zou (in de korte termijn) kunnen stoppen
- photo-chemical duplicaties neemt beeldverlies mee
- digitale restauratie kan meer dan fotochemische restauratie
- digitale bronmateriaal kan sneller beschikbaar gesteld worden voor *access*

Digitaal voor conservering: problemen

- technologie verandert heel snel:
 - *obsolescence* van hardware, software, formaten, etc.
 - er zijn nog geen betrouwbare *standards*
 - beperkte ervaring en *know-how* binnen archieven
- kosten zijn hoog, in feite (bijna) alle digitale kosten komen bovenop:
 - digitale conservering is structureel (migratie)
 - *maintenance*, zoals Richard Wright-BBC zegt
- opslag voor bestanden 2K resolutie is nog steeds groot/duur
e.g. 90 min. film = ca. 1,5 Terabytes

Situatie Vandaag

- digitaal voor *access* wordt in meeste archieven beleid
- digitaal wordt steeds vaker ingezet voor filmrestauratie
- digitalisering wordt conservering voor TV archieven (e.g. NIBG, BBC, RAI)
- filmarchieven zoeken naar mogelijkheden voor digitale conservering



Verwijzingen:

<http://www.prestospace.org>

<http://www.edcine.org>

<http://diamant.joanneum.at>

EG IST project FIRST