Some Notes on Multimedia Production Process

Talk Overview

- Light (sources, requirements)
- Composition (keying, layers, image registration)
- DVD production (screen format, frame-rate, physical media construction)

Lighting in the Space

- ambient light – soft shadows or without shadows
- shadows - directions
- reflections can help but can produce problems (dynamic range, corona)
- different perception of light by our eyes and by the camera

SOFTBOX

LED plain and spot sources

Compose It All Together...!

- The Term of Composition
  - Composition of the Drawing – Golden Section
  - Composing Video

White Blank Paper Problem

- decision of how to lay out information on the plane
- golden section rule $\frac{a+b}{a}=\frac{a}{b}=\frac{1+\sqrt{5}}{2}\approx 1.61803$


WEGA
SONY


1:3
2:3

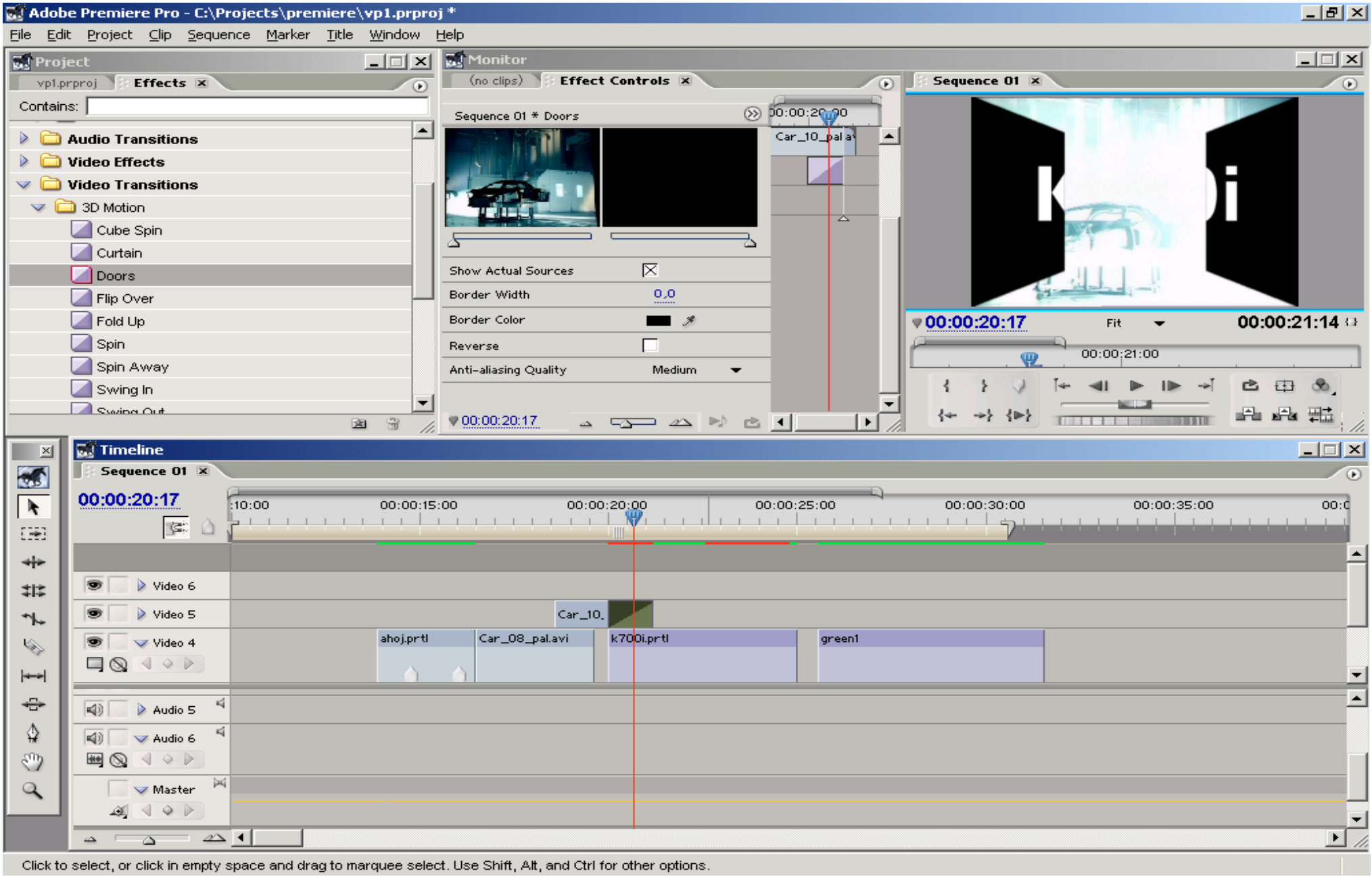
Composing Video

1993/bug. $65mil./ 1st weekend / $50mil.

1975 / bug. $8mil. / 1st weekend 7mil.

Background projections

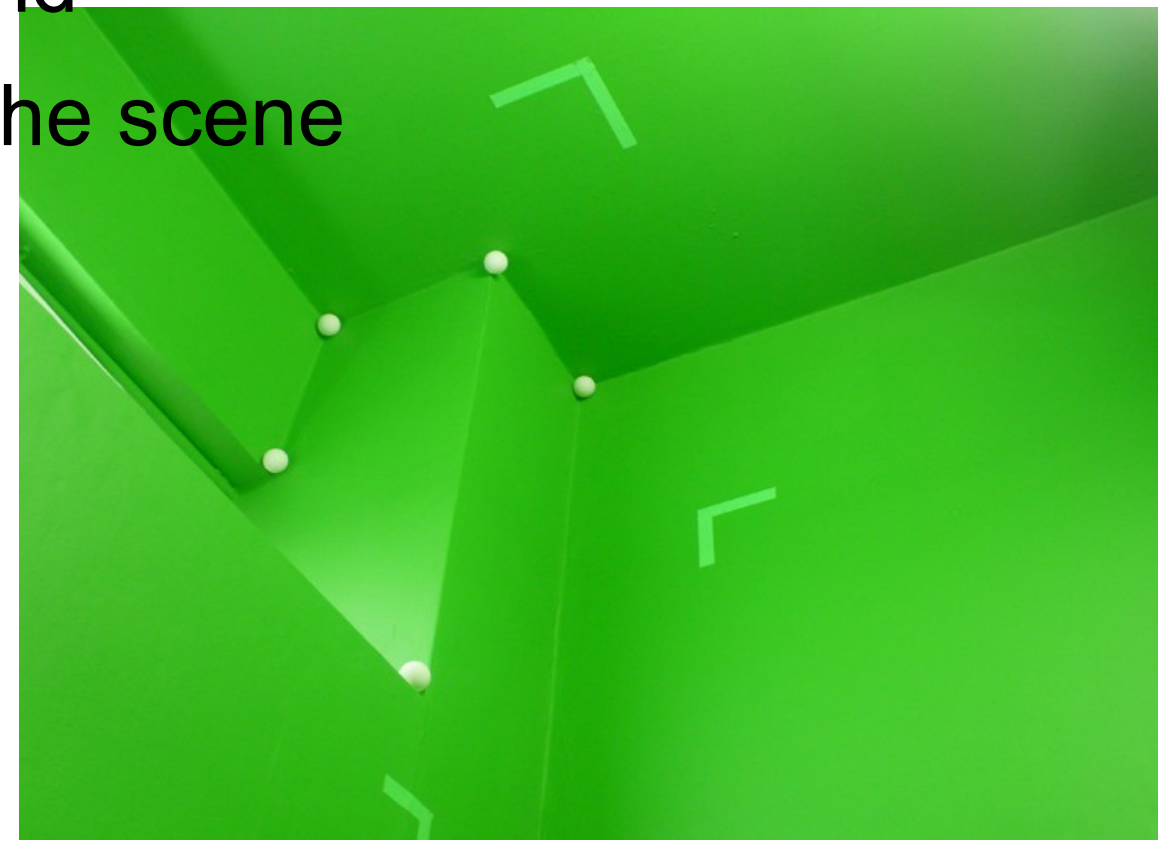
Mounting Layers



Sync of Motions

- camera motion tracking
- using markers on the tracked camera
- using reference grid
- using markers in the scene

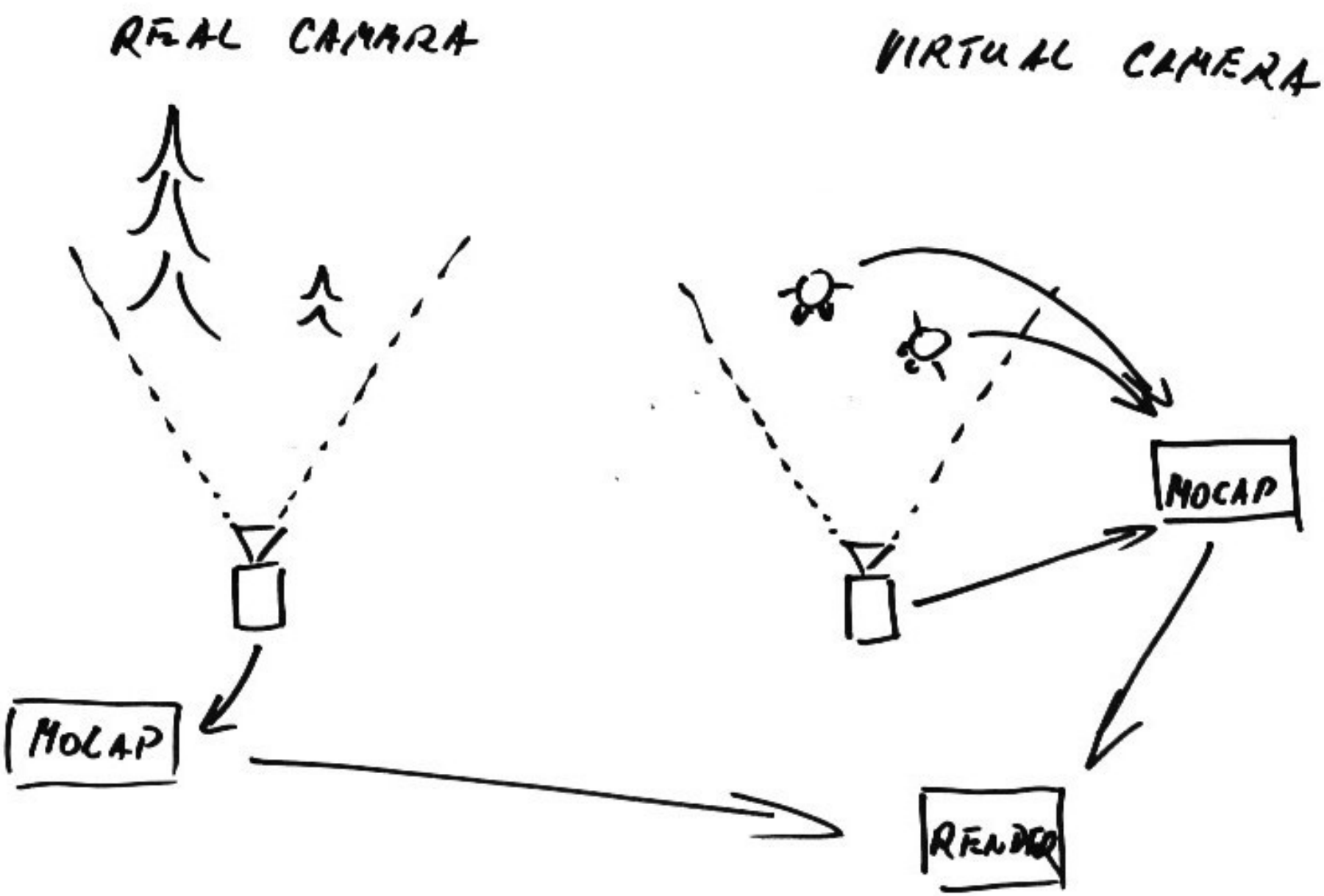
applicable in virtual studios
in composition of virtual and real shots



Virtual Camera

- representation of real camera in the virtual scene
- motions of real camera are tracked and later mapped to the virtual camera
- applicable in movie production using animated scenes or in TV virtual studios


vancouver 2010

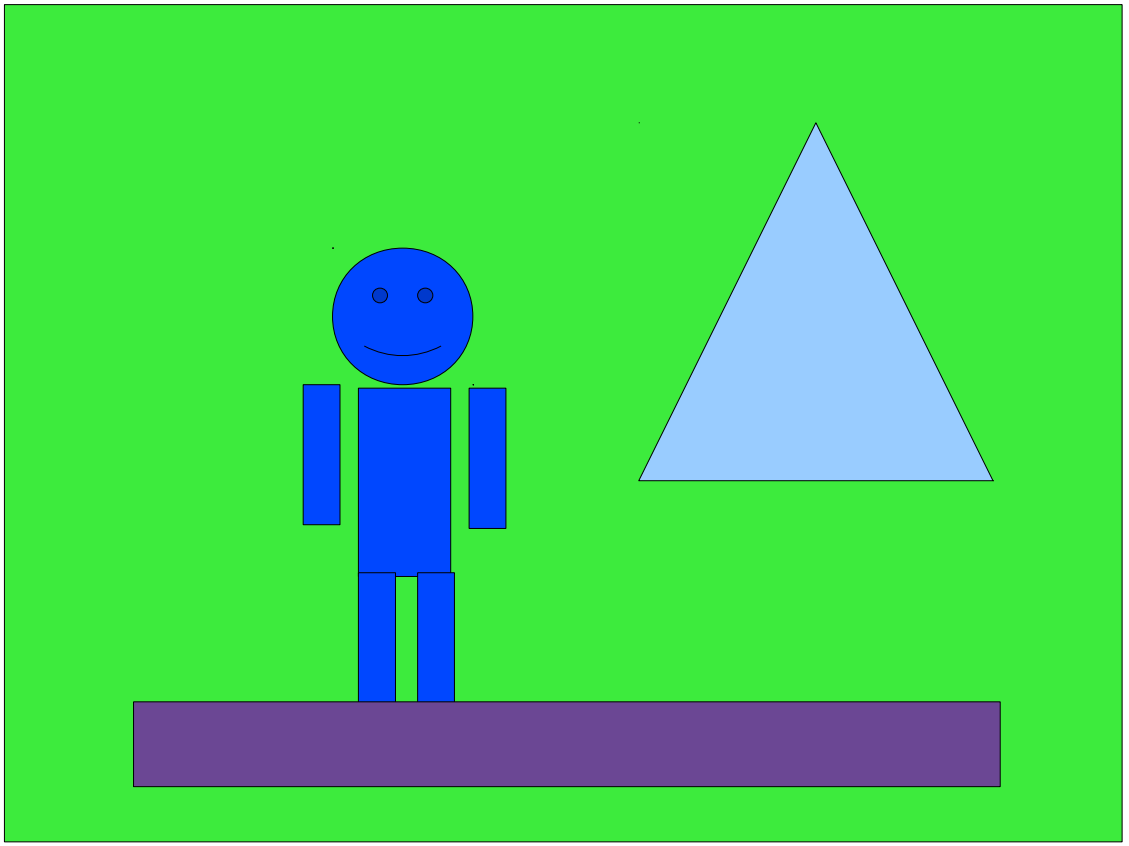

REAL CAMARA
VIRTUAL CAMERA
MOCAP
MOCAP
RENDER

Avatar, James Cameron

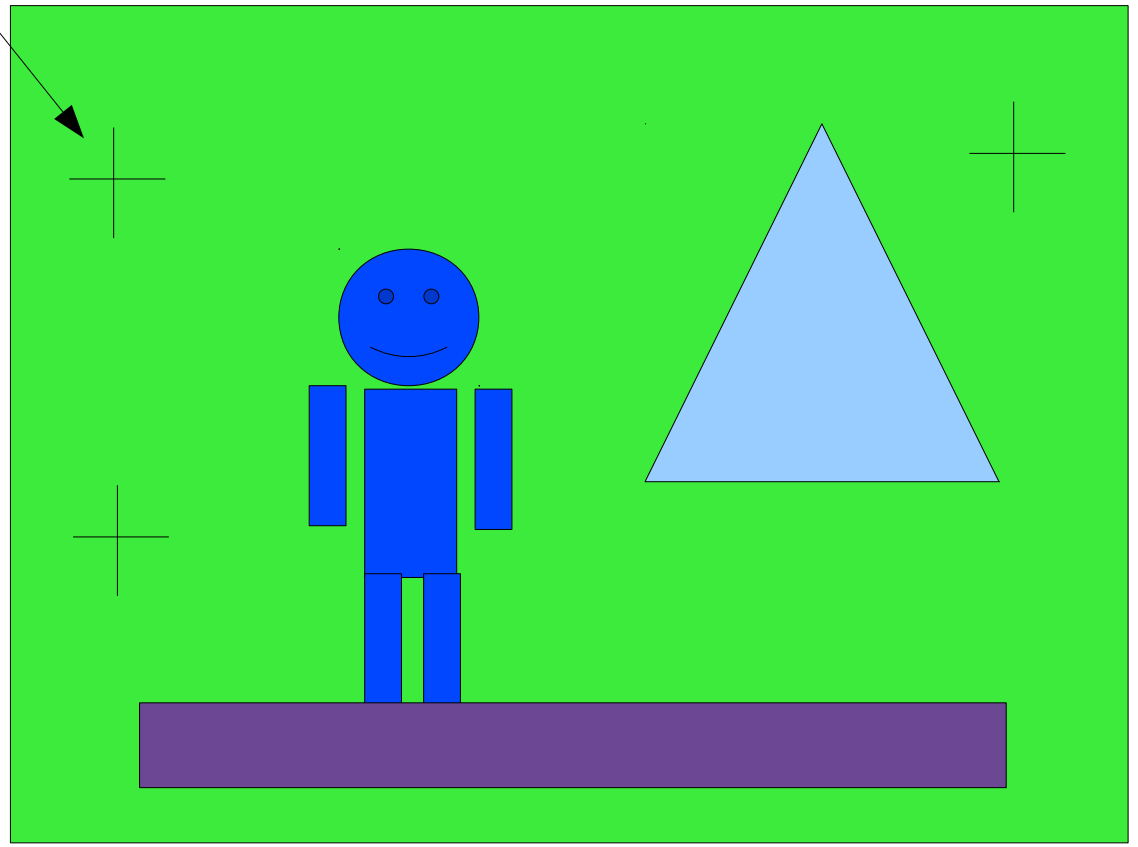
Image Registration

- a process of transformation where two or more different data sets are transformed into one coordinate system
- originates form computer vision and is applicable in many areas like medical imaging, military applications (target recognition), analyzing photographs from satellites, augmented reality

Composition Application



Registration marks



IR classification according to manner of acquisition

- different viewpoints – remote sensing, mosaicing of images, 3D shape from stereo
- different times – automatic change detection, remote monitoring, motion tracking
- different sensors – mixing different data (e.g. in medical applications)
- scene to model registration – mixing synthetic images with real ones

IR – proces overview

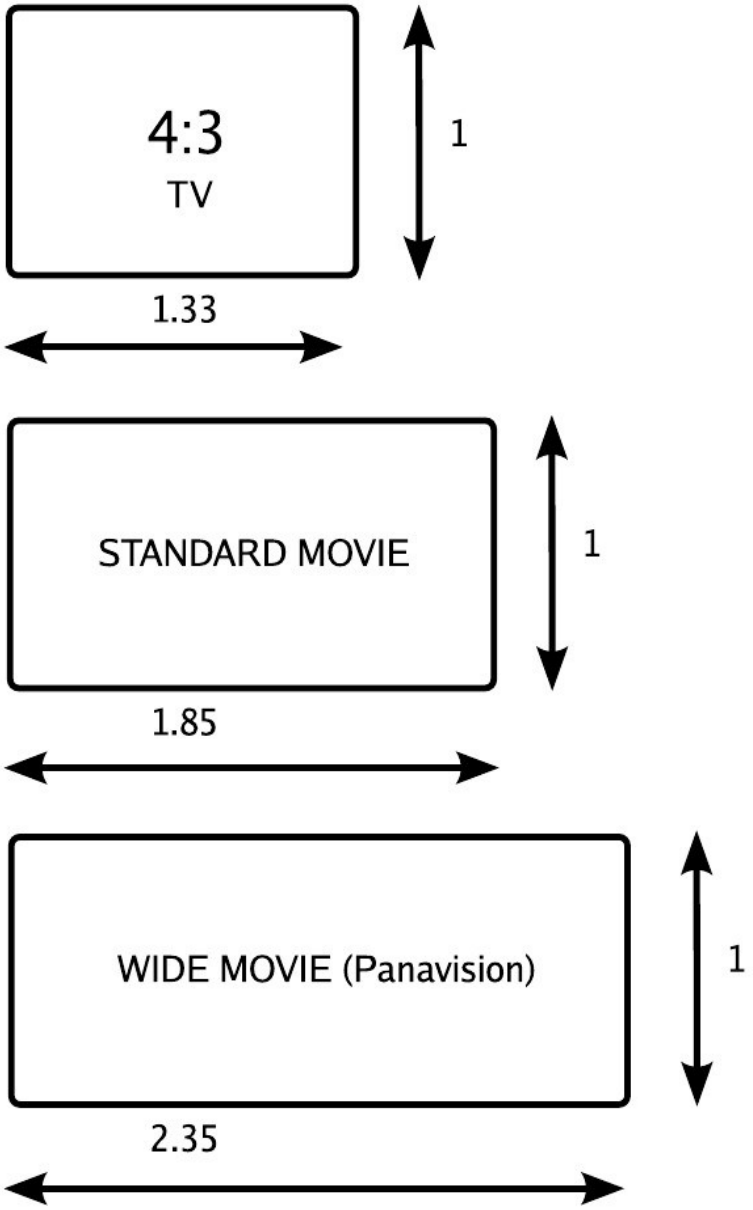
FEATURE DETECTION	detection of significant points in reference and sensed image
FEATURE MATCHING	finding corresponding points in both images
TRANSFORM MODEL ESTIMATION	computing transformations between two images
IMAGE RESAMPLING AND TRANSFORMATION	application of transformations to images to match corresponding points

DVD standard

- Video & Audio
- Frame-rate conversion problem
- Screen format conversion problem
- Physical structure

Aspect ratio problem

- the TV uses format usually known as 4:3
- movies are presented from wider formats (from 15:9 up to 24.3:9)
- HDTV is based on 16:9



So how to get from a movie to the video format?

There are three basic solutions...

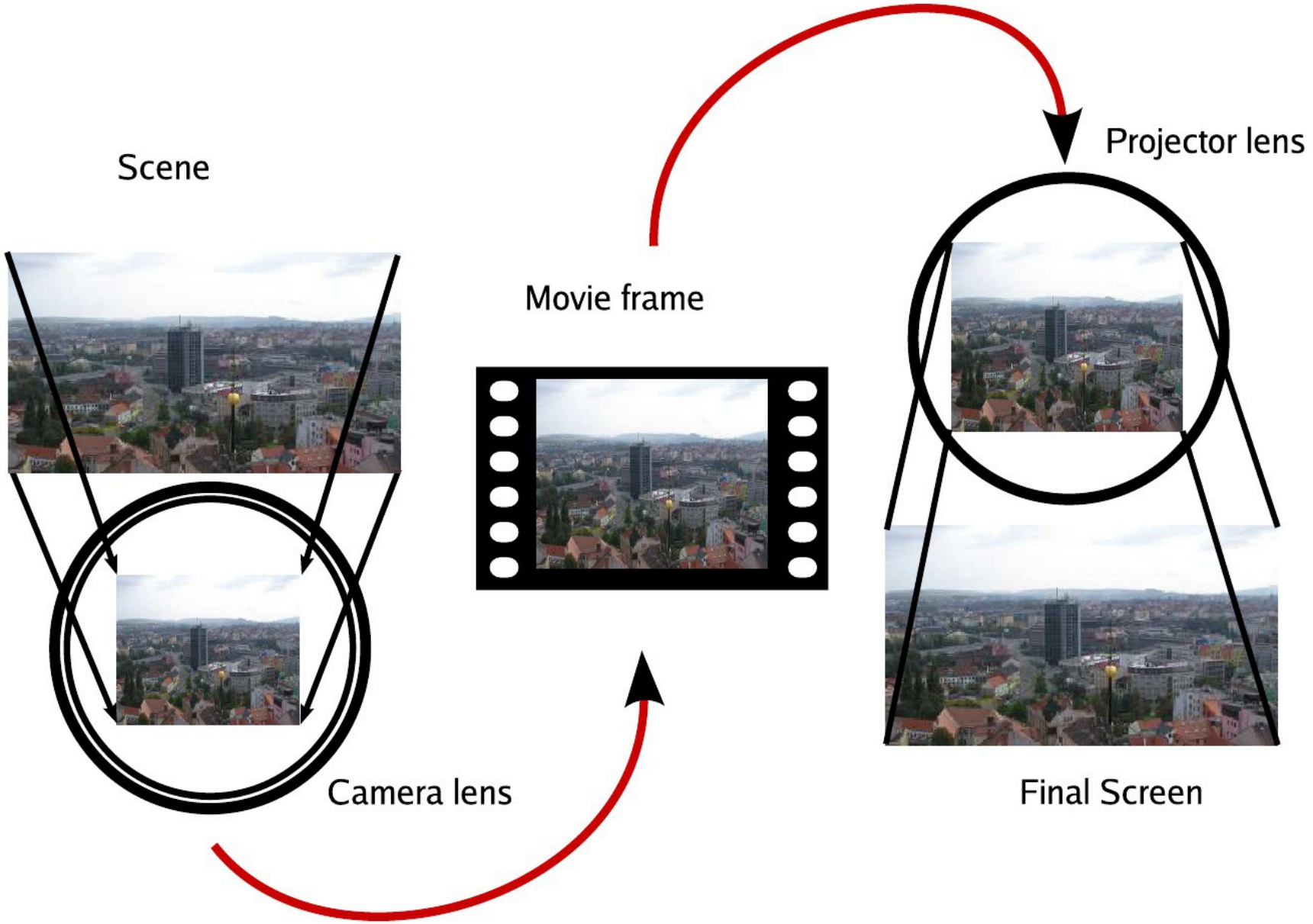
Letterboxing

pan & scan

squeeze
the picture

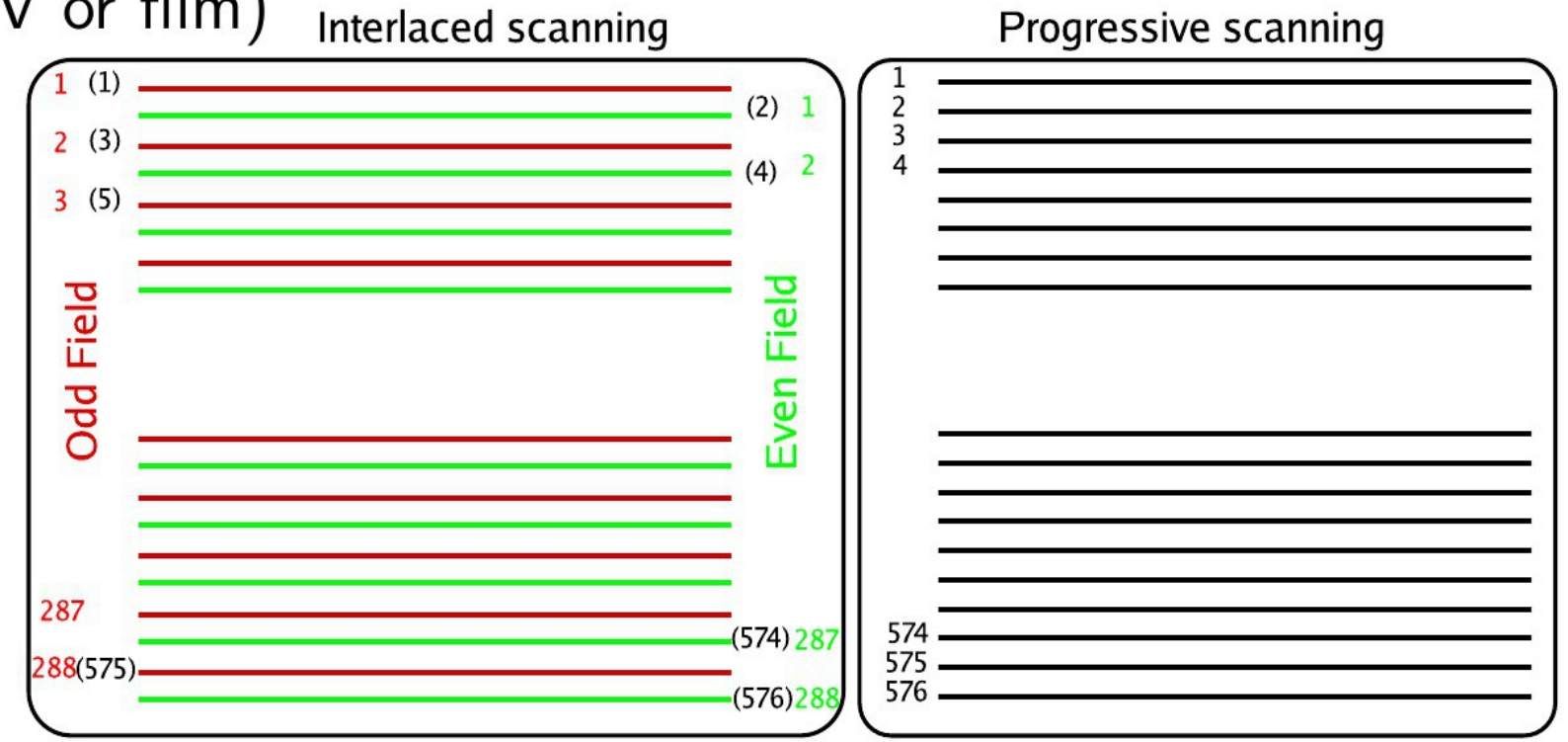
1. Shrink the original
2. Pan, scan and zoom to chop off parts of the image
3. squeeze the image to fit the desired shape

Anamorphic squeeze



Interlaced vs. Progressive scanning

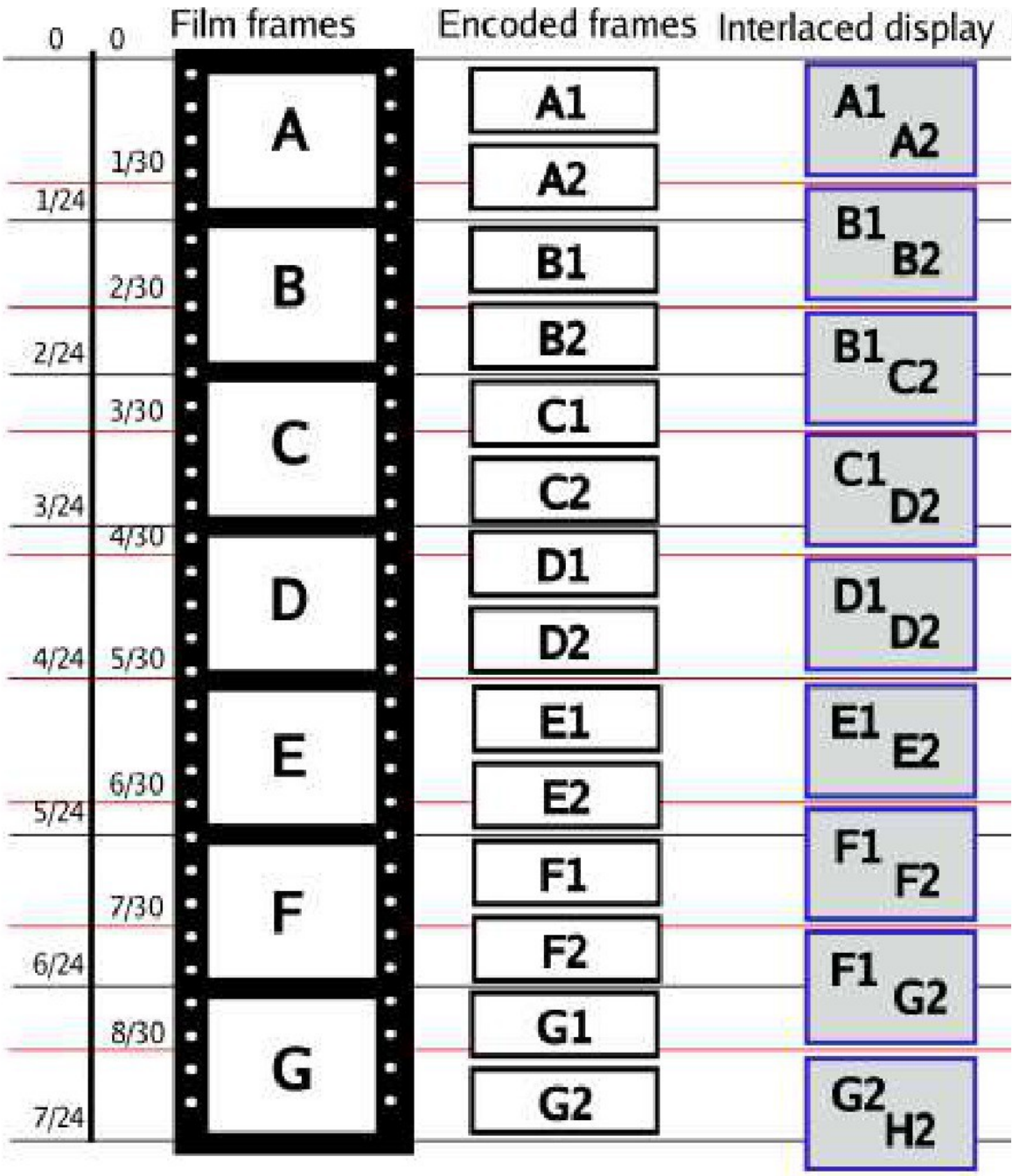
- field based video presentation (odd & even) - *interlaced scanning*
- PAL 576 active lines – 50 fields/s ⇒ 25 frames/s (288 lines/field)
- NTSC 480 active lines – 60 fields/s ⇒ 30 frames/s (240 lines/field)
- presentation of whole frame in one sweep → *progressive scanning* (e.g. HDTV or film)



Frame rate

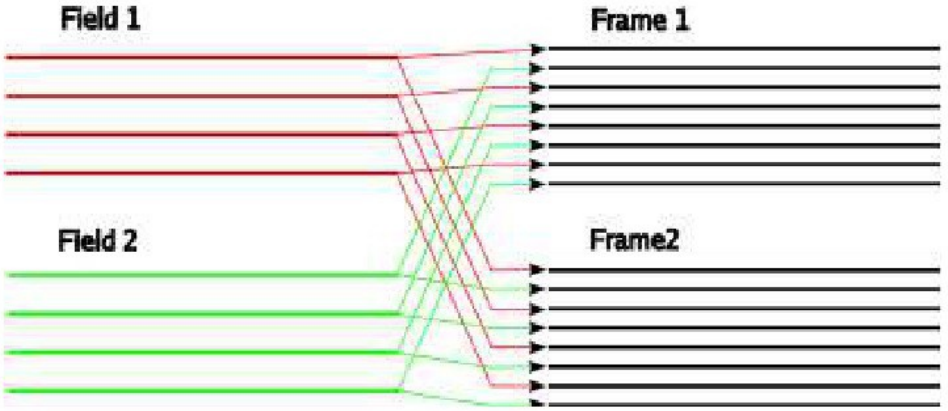
- film uses 24 pictures per second
- video PAL uses 25 pictures per second
  - conversion by process called *2-2 pull-down*
    each film frame is shown as two fields, playing 4 percent faster
- video NTSC uses 30 pictures per second
  - conversion by process called *2-3 pull-down*
    each first film frame is shown as two fields and each second frame is shown as three fields $\rightarrow$ causes artifacts

Conversion of film to NTSC frame-rate

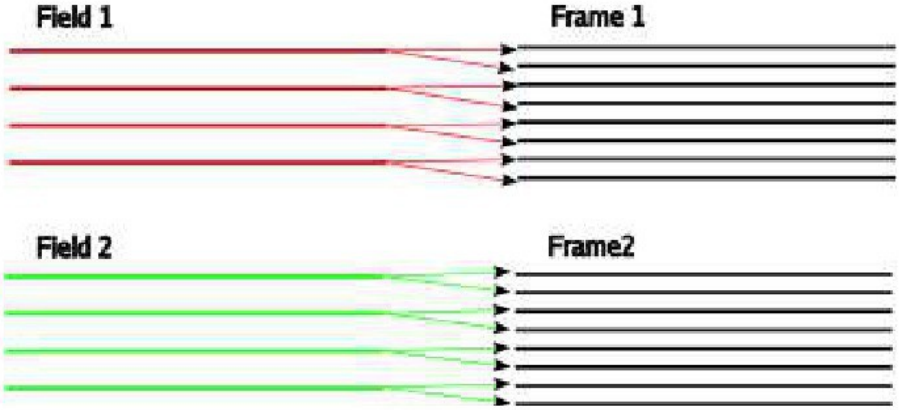


Methods of converting from interlaced video to progressive video:

1. *Re-interleave (weave)* — recombination of two fields to single frame (progressive source)



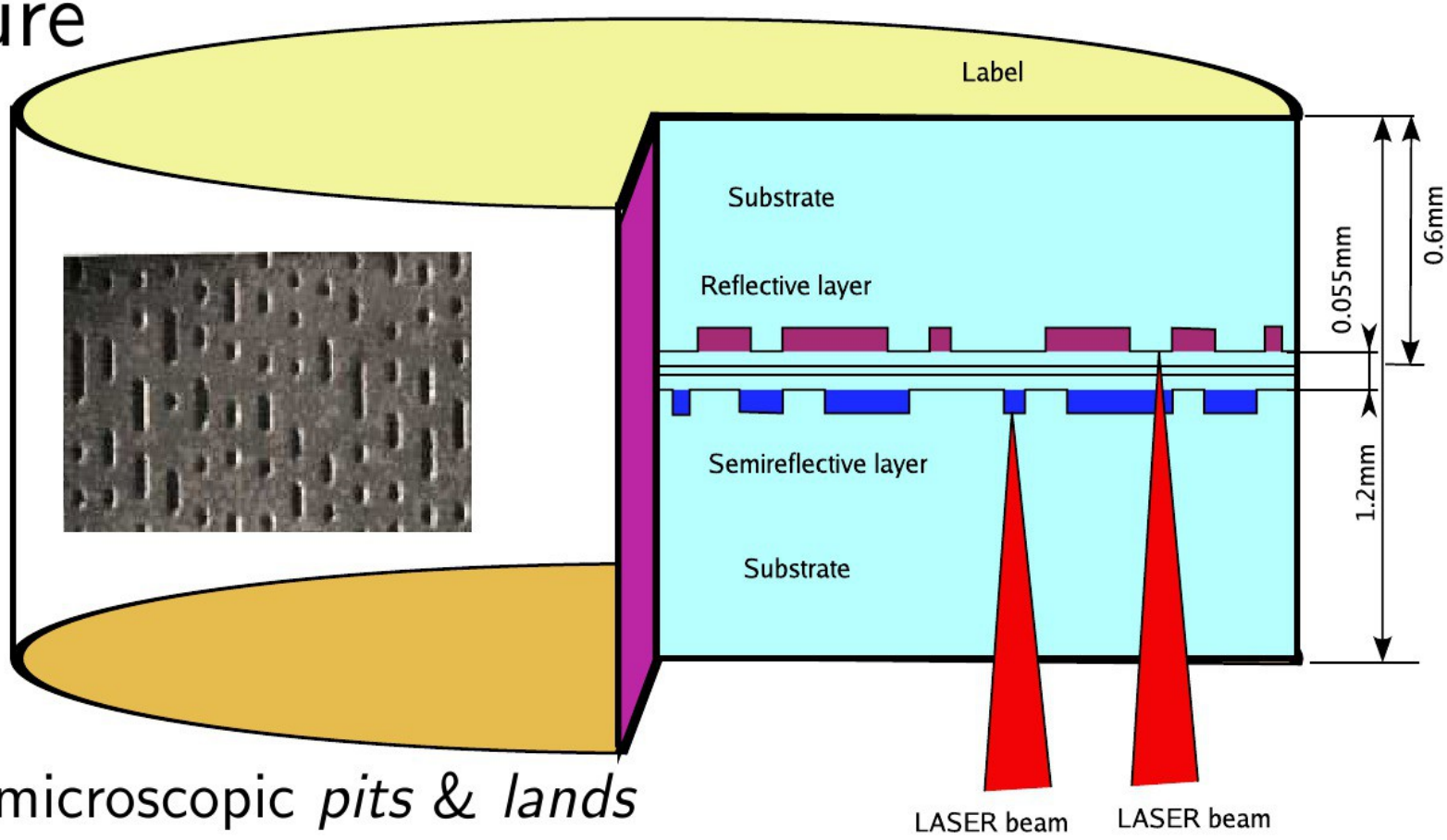
2. *Line-double, line-multiply (bob)* — each line is repeated twice to form the frame (interlaced source)



More sophisticated methods:

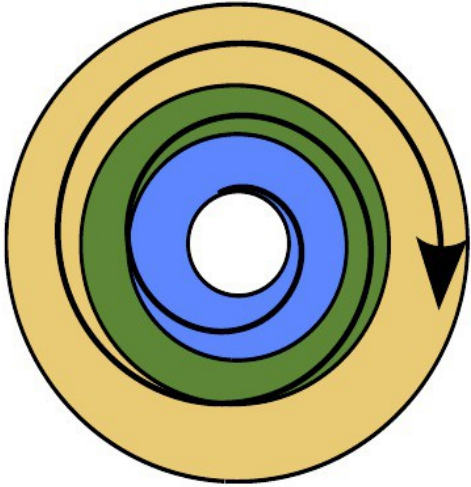
3. *field adaptive deinterlacing* — application of both previous methods according to the comparison of individual pixels in the following fields – high cost
4. *Motion predictive deinterlacing* – using segmentation to identify moving objects and to selectively apply wave or bob to regions of the picture

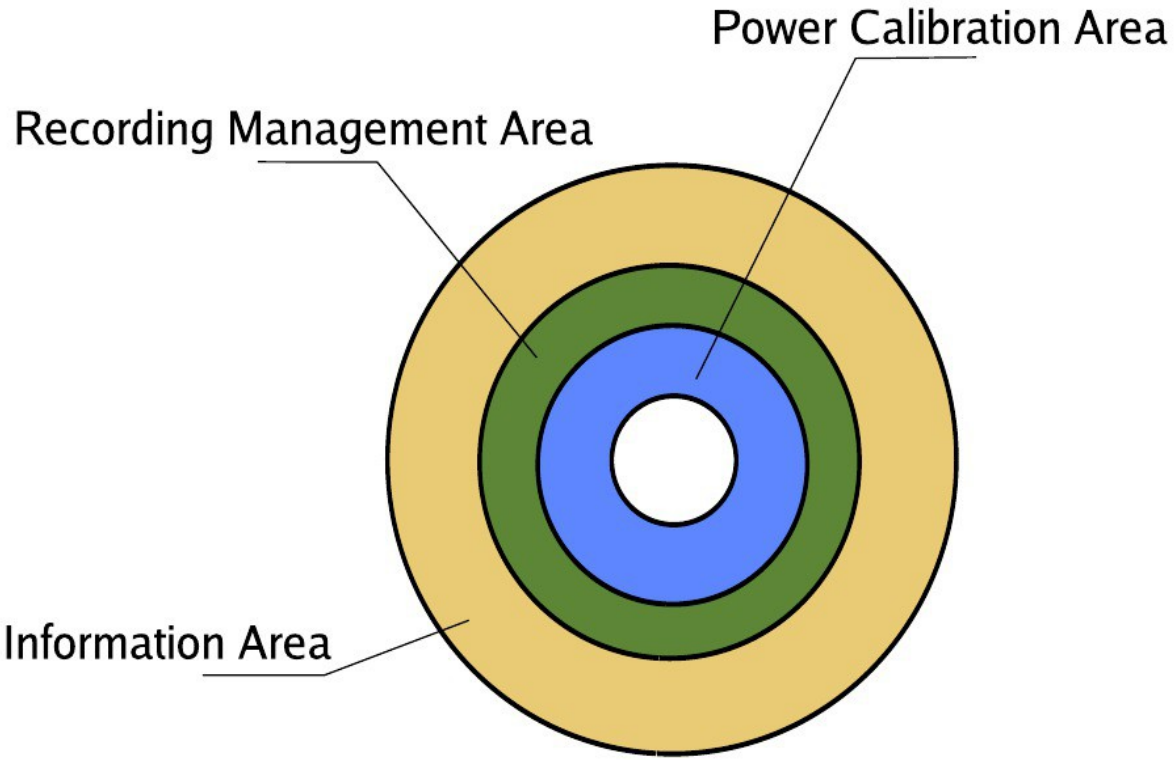
Disc Structure



- data stored in microscopic *pits* & *lands*
- on writable discs *marks* & *spaces*
- the laser beam is reflected differently from pits
- both pits and lands represent zeros
- any change between pit and land is detected as a one

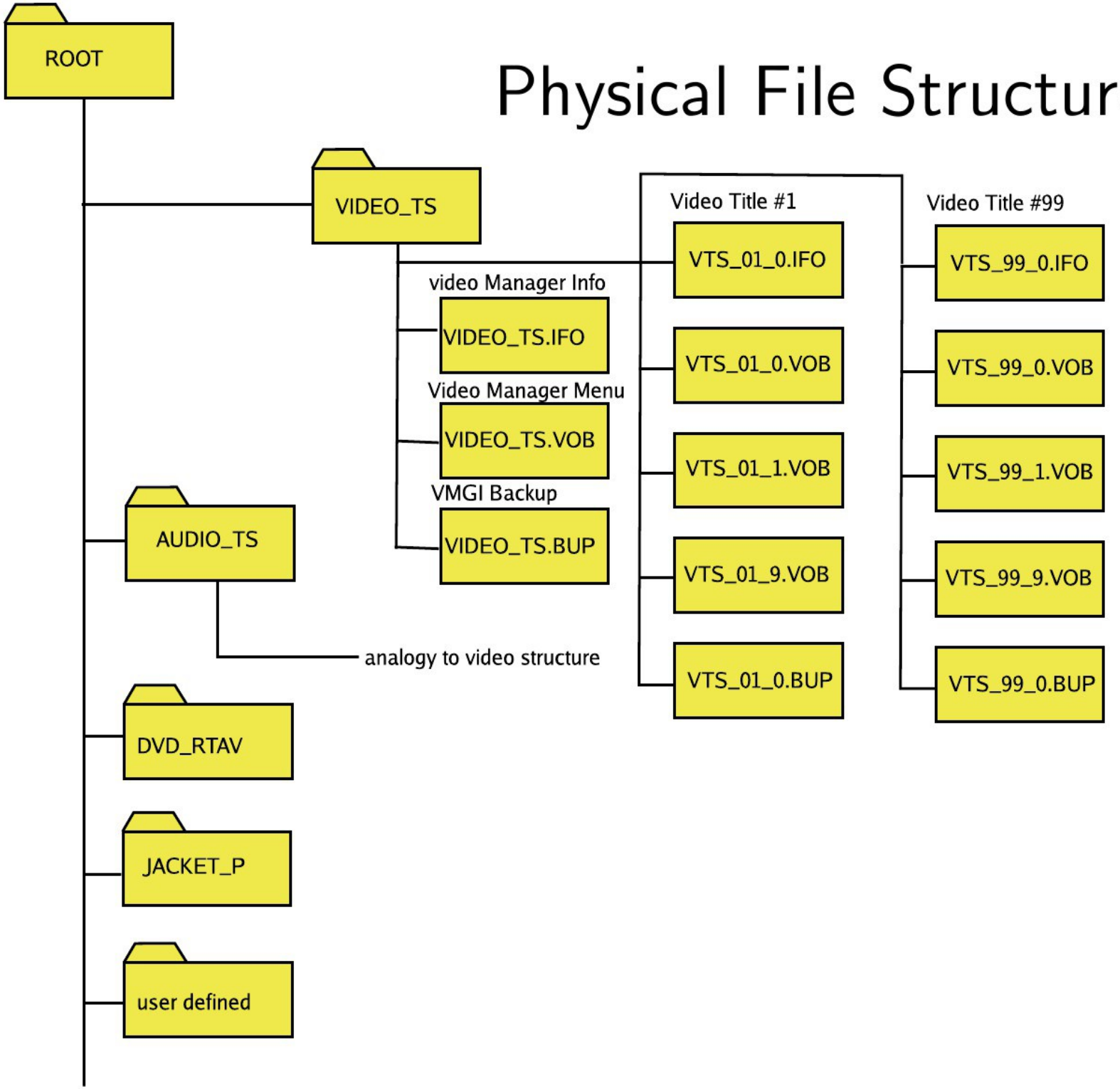
Disc Zones





- the data can be stored in sectors using CLV or CAV formats
- CLV (Constant Linear Velocity) is designed for fast sequential access (DVD-RW, DVD-Video)
- CAV (Constant Angular Velocity) – random access - used for data (DVD+RW, DVD-RAM)

Physical File Structure

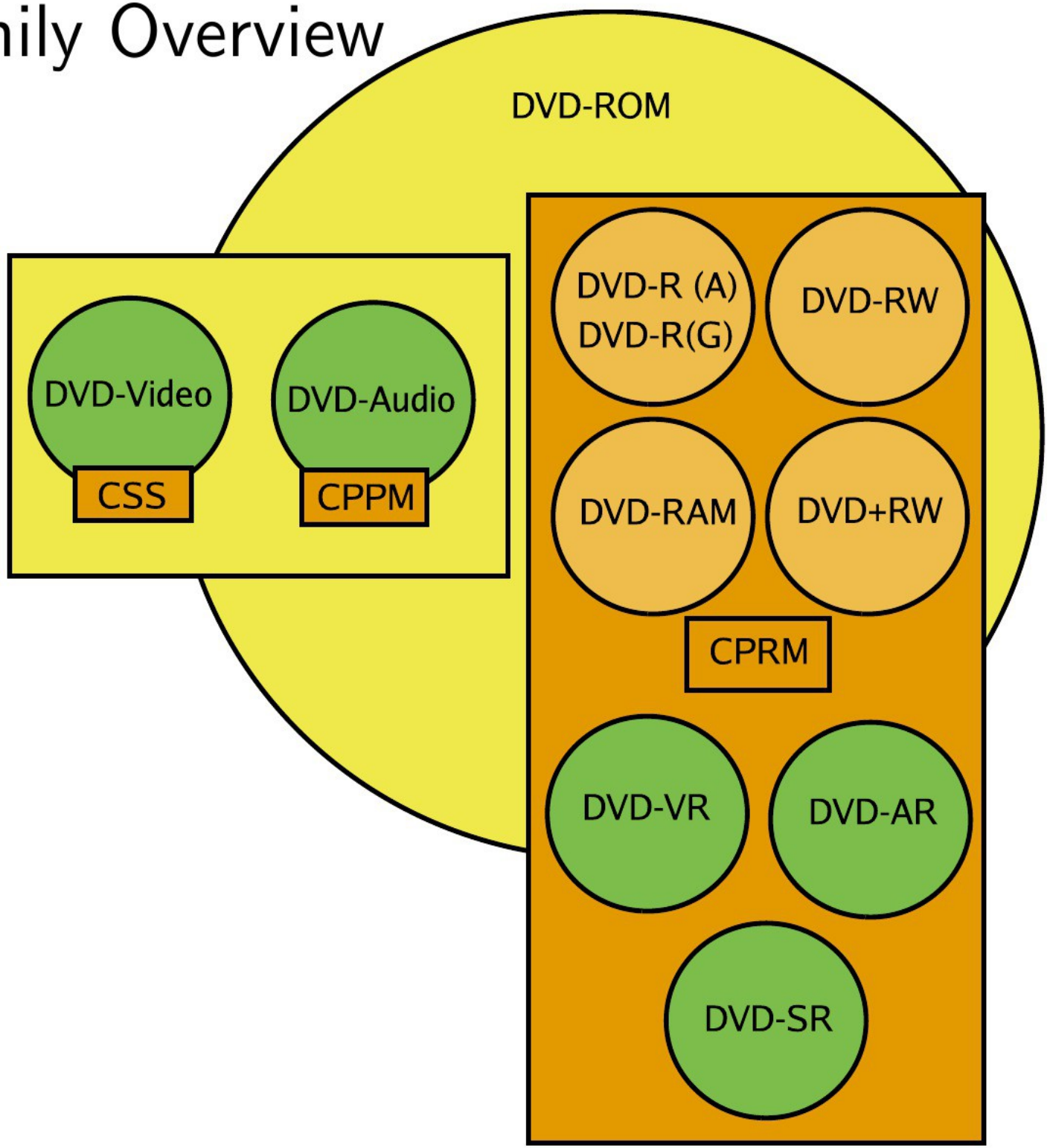


Media Configurations

Type	Configuration	Capacity	Approx. playing time[1]
DVD-5	SS/SL	4.37GB	2.25h
DVD-9	SS/DL	7.95GB	4h
DVD-10	DS/SL	8.75GB	4.5h
DVD-14	DS/(1 & 2 Layers)	12.33GB	6.25h
DVD-18	DS/DL	15.91GB	8h

[1] Assuming bitrate 4.7 Mbps

DVD Family Overview



1. **Content Scrambling System (CSS)** – data in each sector encrypted by *title key* and *dics key*
2. **Content Protection for Prerecorded Media** – encryption by *media key* and *album identifier* DVD-Audio
3. **Content Protection for Recordable Media** – uses *media ID* and *media key* for encryption
4.
5. **Copy Generation Management System (CGMS)** – enables to control copying from a DVD original
6. **Watermarking** – added noise into signal which carry CMI/CCI
7. **Digital Transmission Content Protection (DTCP)** – protection implemented to transmission protocols
8. **High-Definition Output Protection (HDCP for DVI)** – protection standard for Digital Visual Interface protocol

Content Protection Mechanisms

1. **Content Scrambling System (CSS)** – data in each sector encrypted by *title key* and *dics key*
2. **Content Protection for Prerecorded Media** – encryption by *media key* and *album identifier* DVD-Audio
3. **Content Protection for Recordable Media** – uses *media ID* and *media key* for encryption
4. **Analog Protection System (Macrovision)** – addition of pulses into V-sync signal
5. **Copy Generation Management System (CGMS)** – enables to control copying from a DVD original
6. **Watermarking** – added noise into signal which carry CMI/CCI
7. **Digital Transmission Content Protection (DTCP)** – protection implemented to transmission protocols
8. **High-Definition Output Protection (HDCP for DVI)** – protection standard for Digital Visual Interface protocol

property	DVD	Blue-ray Disc	HD-DVD
capacity SS/SL	4.3GB	25GB	15GB
capacity SS/DL	7.95GB	50GB	30GB
bitrate	5-6Mbps, max. 10Mbps	36Mbps (72Mbps)	36.5Mbps
video compression	MPEG-2	MPEG-2, MPEG-4 AVC, VC-1	MPEG-2, MPEG-4 AVC, VC-1
laser wavelength	635-650nm	405nm	405nm
resolution	720x480 (768x576)	1280x720p (1920x1080i)	1280x720p (1920x1080i)

References

- Zitová, B. Flusser, J.: *Image registration methods: a survey,* Image and Vision Computing, Vol 21, Oct 2003
- Taylor, J.: DVD Demystified, Mc Graw-Hill Companies, New York 2001, 2nd edition, ISBN: 0-07-135026-8