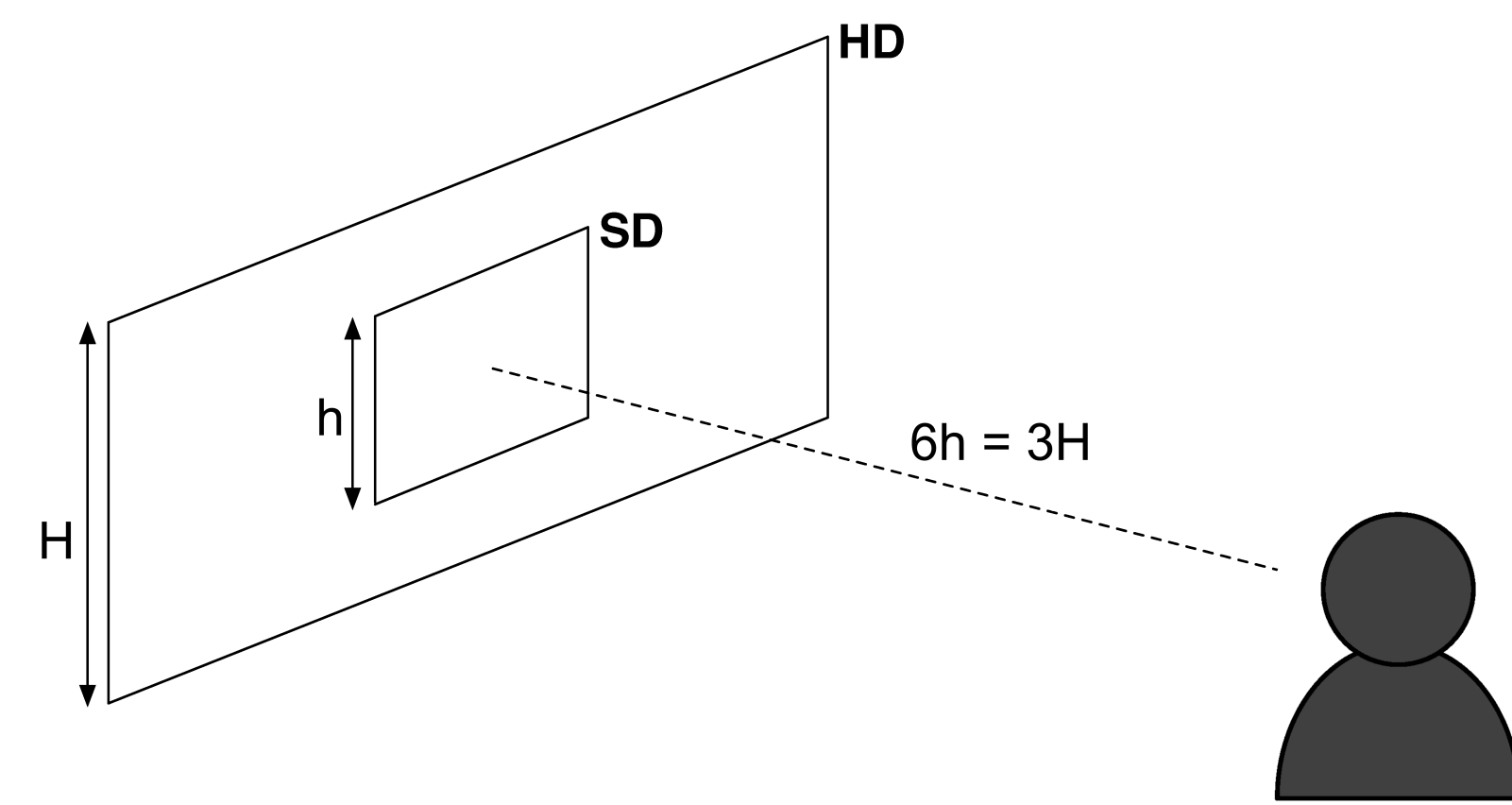


IMPACT OF THE RESOLUTION ON THE DIFFERENCE OF PERCEPTUAL VIDEO QUALITY BETWEEN CRT AND LCD

1 • HDTV and new display technologies



HDTV : A new visual experience

Increase of picture resolution
=> reduction of viewing distance (3H)
=> screen = 20% of the visual field

Need to increase the screen size to sense image immersion and impact (cinema-like experience)

New displays : LCD, plasma, etc.

=> high size and resolution
=> small load and nice design

but **New visual shortcomings with respect to CRT**

CRT



- mature technology
- suited for motion reproduction

LCD

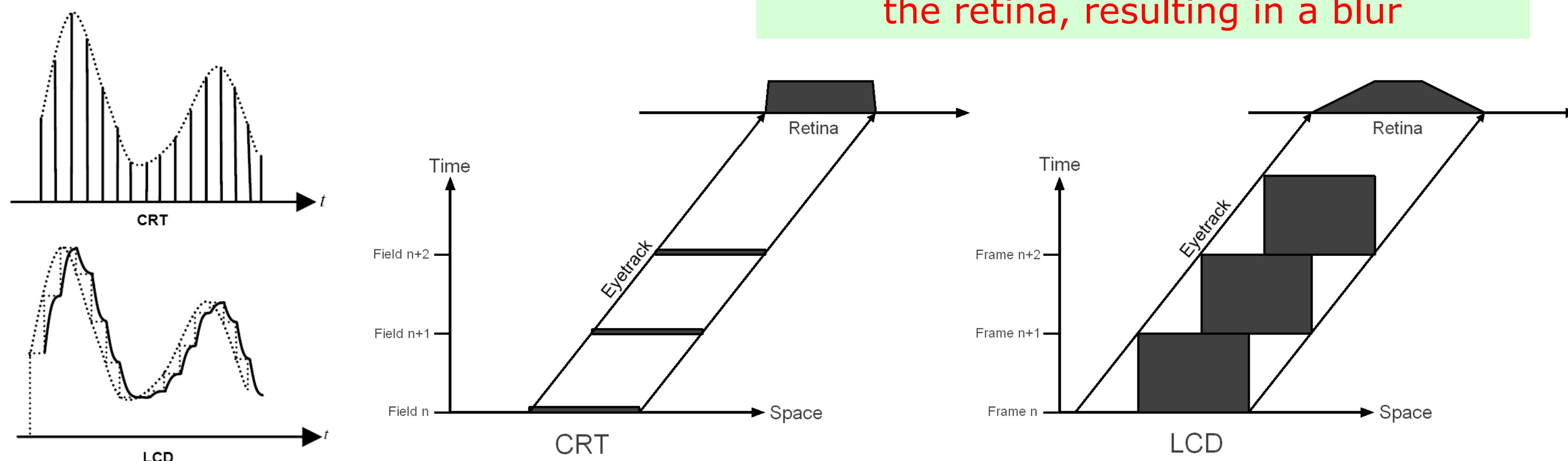


- recent technology
- suited for still pictures less for motion

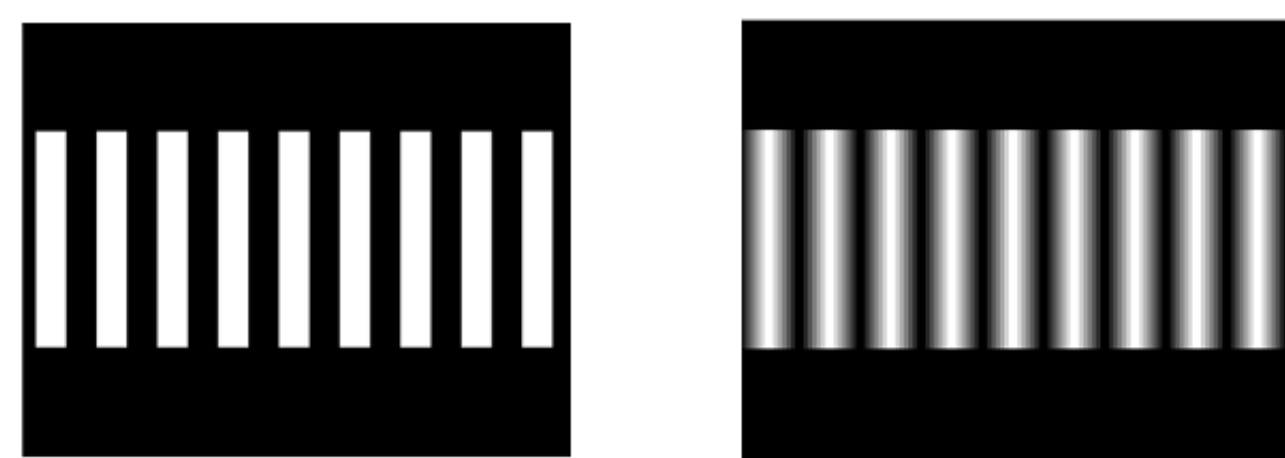
3 • LCD motion blur

CRT: light is emitted by pulses
LCD: light is sustained on the screen

When eyes are tracking a moving object, the edges of the object are displaced on the retina, resulting in a blur



Psychophysical measurements



- scrolling grating
- several directions and colors

Observers had to adjust the period of the grating until blurred areas just merged

LCD motion blur modeling

• Relation between motion speed V and width W perceived blur:

$$W = a V$$

- W in visual degrees
- V in degrees per frame

• Agree with analytic model

[Pan et al., LCD motion blur modeling and analysis, ICIP2005]

• Parameter a depends on the temporal step response of the display

• Magnitude of perceived blur increases as the viewing distance is reduced

2 • Problematic

• LCD technology brings some display-dependent distortions such as:

- LCD motion blur
- color differences
- color balance at low levels
- etc.

• Moving artifacts such as LCD motion blur are particularly annoying

• A couple of studies reported than as a whole perceived quality is lower on LCD than on CRT

[ITU, Questions ITU-R 95/6, 102/6, 2005]

• Moreover, high image immersion increases the impact of coding artefacts

[Pécharde et al., From SD to HD TV: effects of H.264 distortions versus display size on quality of experience, ICIP 2006]

• Impact of display-dependent distortions on the perceived quality on LCD ?

• Influence of the reduction of the viewing distance in a HDTV context ?

• Focus on LCD motion blur

4 • Subjective video quality assessment

Material

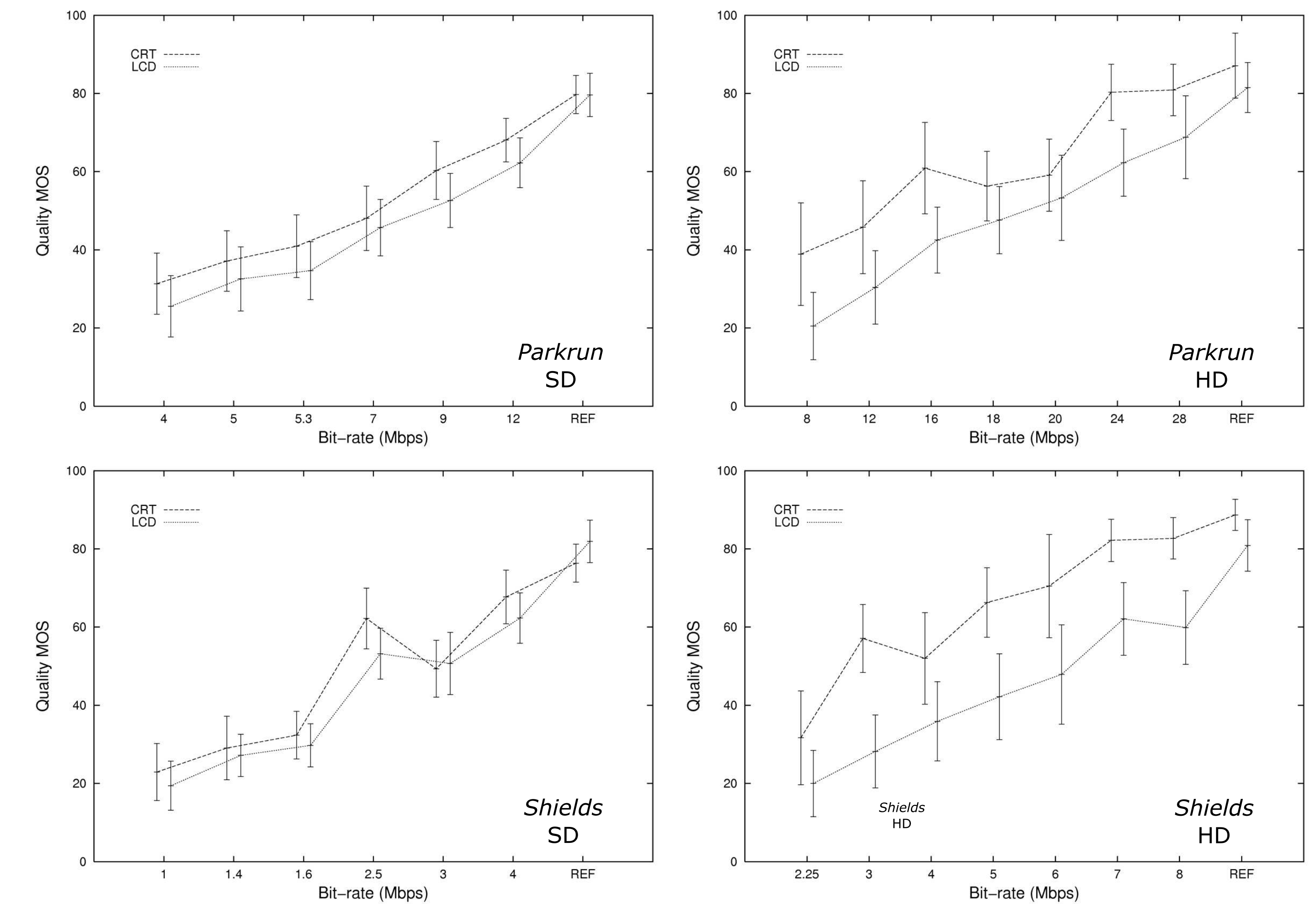
- 4 HDTV sequences (1080i) from SVT
- 4 SDTV sequences spun off from the HD ones after a half-band filtering and a downsampling by a factor 2 => 540i
- Reference and H.264-coded versions are assessed both on CRT and LCD

- Tests performed in specific showroom
- Viewing distance: $6H$ for SD, $3H$ for HD

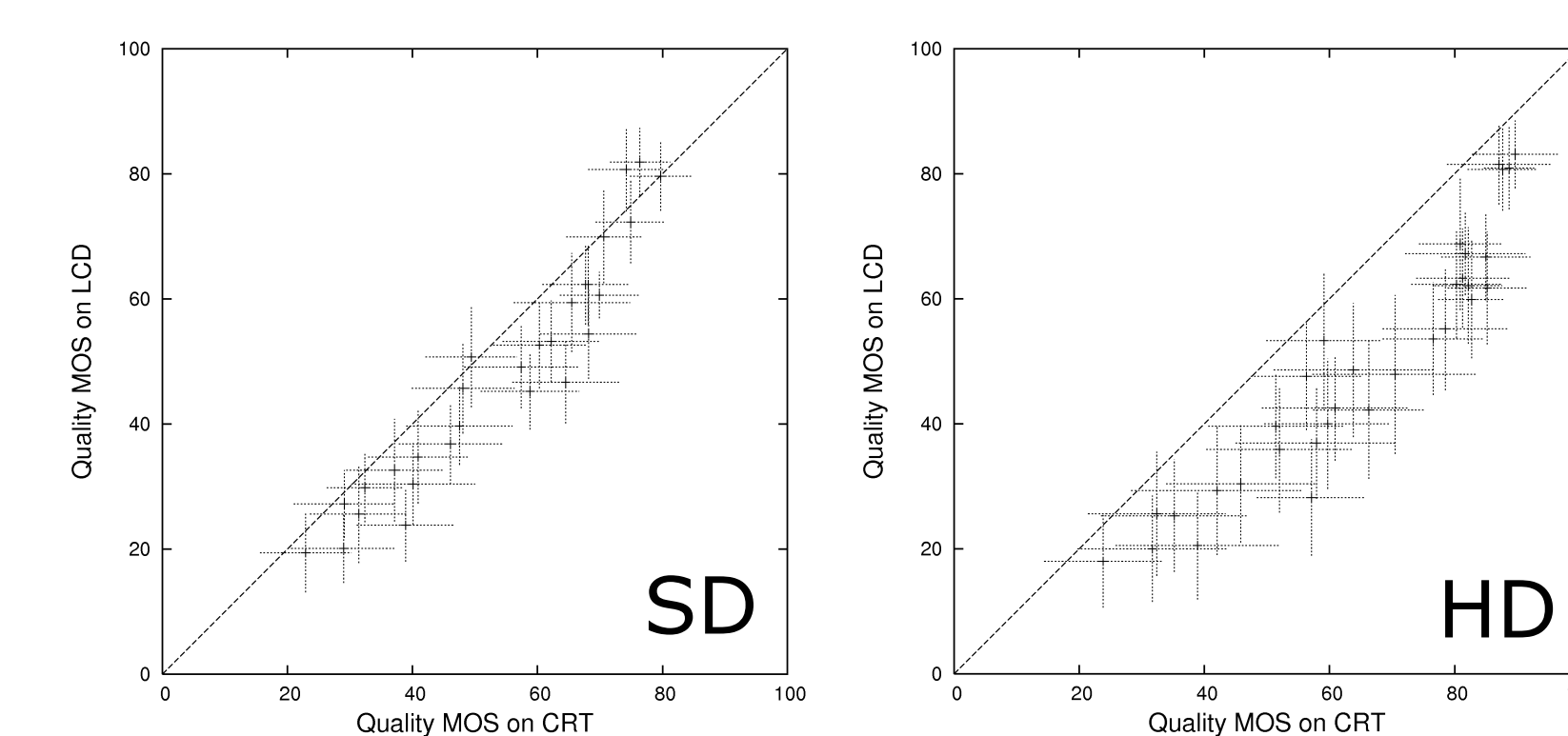


Protocol

- SAMVIQ (MSCQS, EBU and ITU std) => precise and reliable measure of the subjective video quality
- At least 15 observers have to be retained after applying a suitable "rejection process"



5 • Results and discussion



Perceived quality is higher on CRT than on LCD, particularly with HD format

• Quality loss on LCD:
 $\Delta Q = Q(CRT) - Q(LCD)$

- Mean of ΔQ :
- SD: $\Delta Q_m = 5.9$
- HD: $\Delta Q_m = 15.4$

• Quality loss is about three times higher in HDTV than in SDTV

• ΔQ can be predicted from the perceived blur in a sequence

[Tourancheau et al., Display awareness in subjective and objective video quality evaluation, EUSIPCO 2007]

• Important loss of perceived quality on LCD related to moving artefacts => display-dependent distortions has to be considered in quality evaluation

• Motion depends on video resolution => few impact on reduced video applications (cell phones, PDA) but a real issue for HDTV

• Image immersion facilitates the perception of display distortions