

How many pixels?
Excerpt for DigiTraining Plus 2010
from "the Pixel"
by

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Version: 19 February 2010

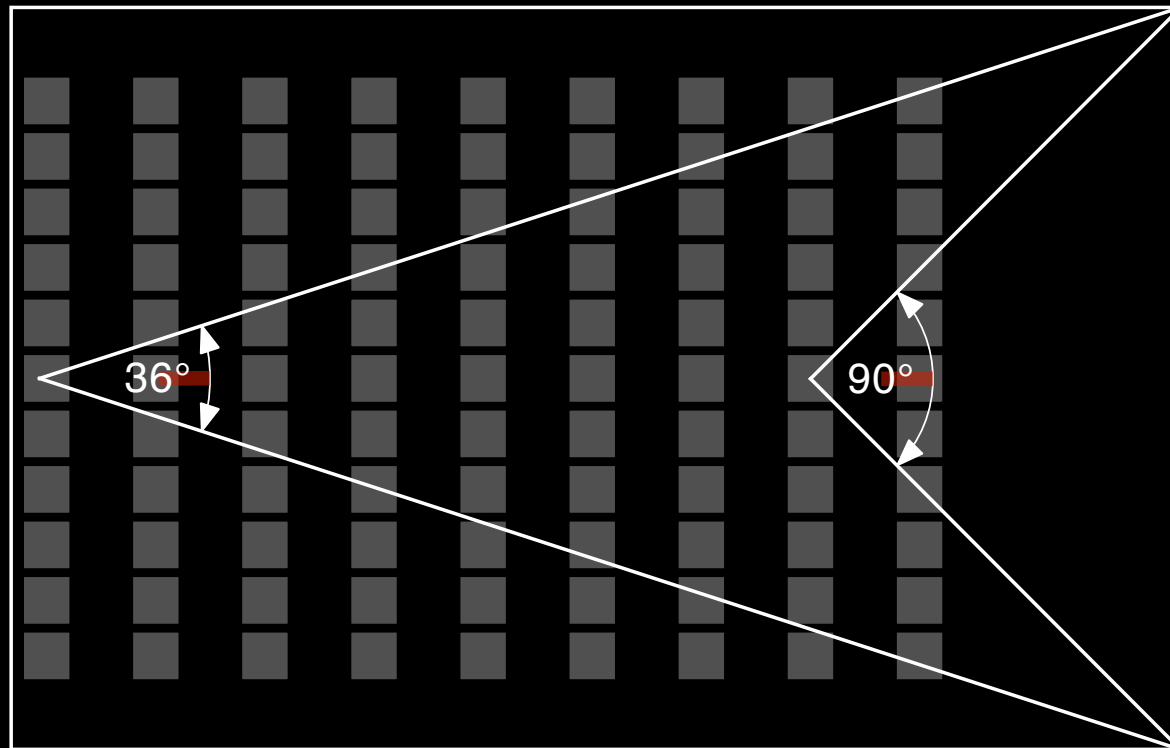
SAMPLING – How many pixels?

- “CinemaScope picture should ideally cover no less than 36° on the farthest seat” Torkell S., The Advanced Projection Manual
- KVA (Kuutti Viewing Angle) 90°
 - full unobstructed view through my eyeglasses



SAMPLING – How many pixels?

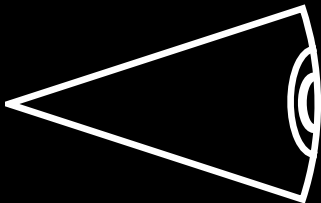
- CinemaScope 36°
- KVA 90° (= THX certified first row angle)



SAMPLING – How many pixels?

- normal human visual acuity
 - “Snellen 20/20” or “visus 1.0” vision
= smallest details $1^\circ/60$
 - visus 1.2–1.5 is common
= smallest details $1^\circ/90$ – $1^\circ/75$

smallest discernible detail
 $\approx 1^\circ/90$ – $1^\circ/60$



SAMPLING – How many pixels?

– pixel count from viewing angle

$$\left. \begin{aligned} \frac{h}{2r} &= \tan \frac{\alpha}{2} \\ \frac{w}{2r} &= \tan \frac{\beta}{2} \\ n &= \frac{h}{w} \end{aligned} \right\} \Rightarrow n = \frac{\tan \frac{\alpha}{2}}{\tan \frac{\beta}{2}}$$

where

w = size of pixel

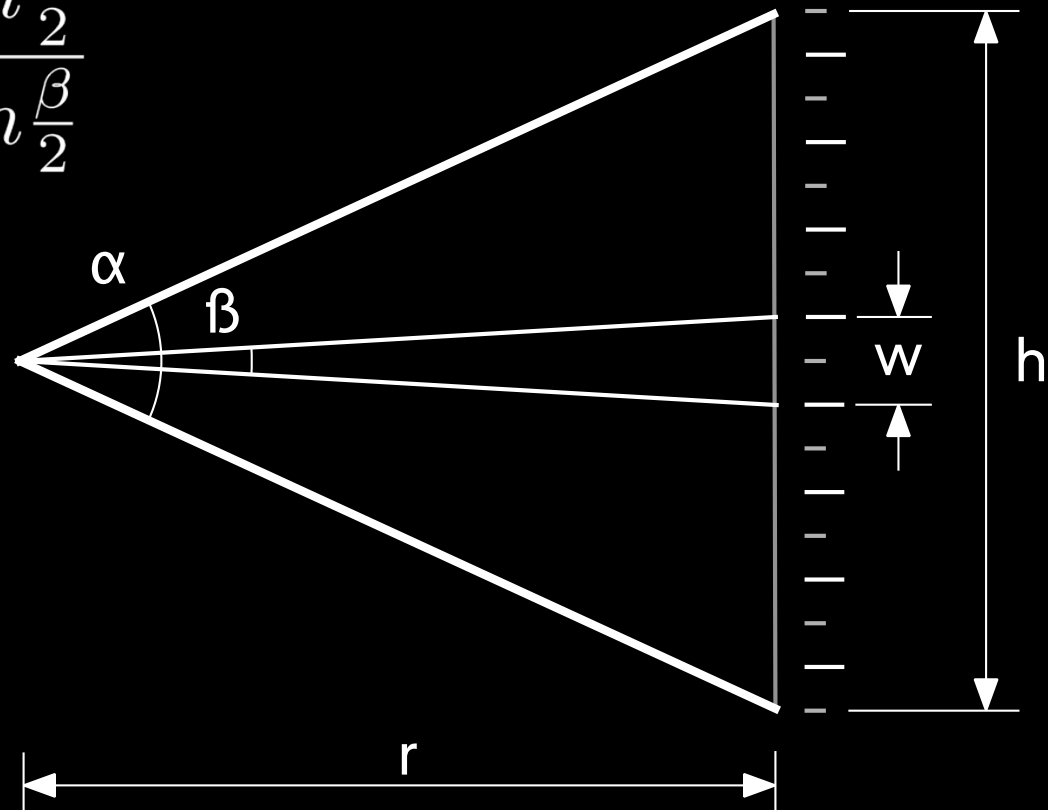
h = size of screen

r = viewing distance

α = viewing angle

β = angle of detail (e.g. 1°/60)

n = number of pixels



SAMPLING – How many pixels?

- visual limits for on-screen pixel count for constant height projection

human visual acuity 1°/60		horiz. px		vert. px
	2.39	1.85	1.37	1
36° (back)	2234	1729	1281	935
52° (middle)	3353	2596	1922	1403
90° (front)	6875	5322	3941	2877

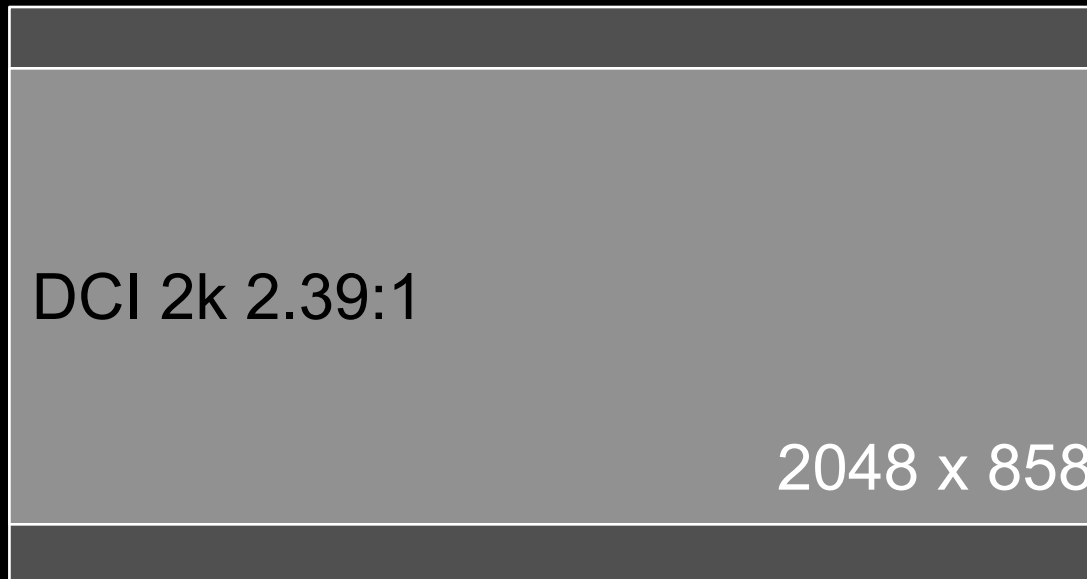
human visual acuity 1°/75		horiz. px		vert. px
	2.39	1.85	1.37	1
36° (back)	2792	2162	1601	1168
52° (middle)	4192	2421	1793	1754
90° (front)	8594	6653	4926	3596

SAMPLING - How many pixels?

DCI 2k 1.85:1

1998 x 1080

SAMPLING - How many pixels?



SAMPLING – How many pixels?

4096 x 2990, 11.68 Mpx

4k film scan 1.37:1

SAMPLING – How many pixels?

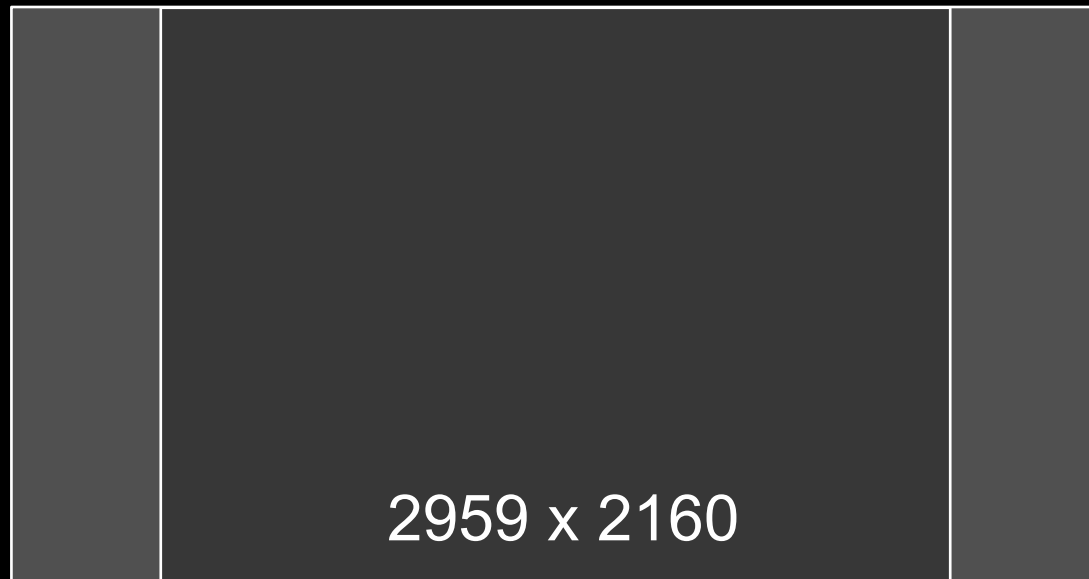
4096 x 2990, 11.68 Mpx

DCI 4k container

4096 x 2160, 8.44 Mpx

SAMPLING – How many pixels?

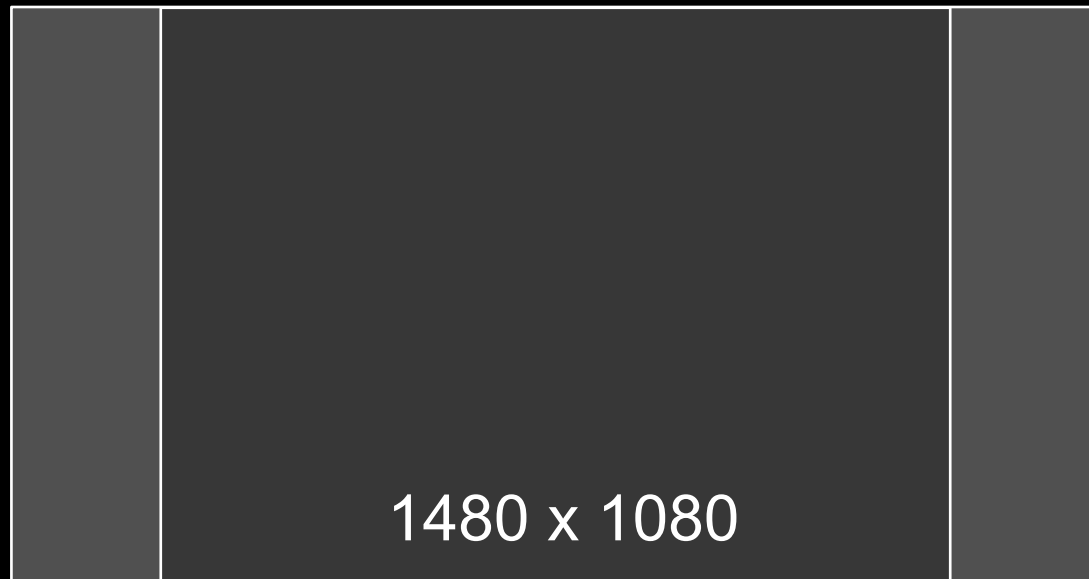
4k restoration in 4k Digital cinema



from 11.68 Mpx to 6.10 Mpx

SAMPLING – How many pixels?

4k restoration in 2k Digital cinema



from 11.68 Mpx to 1.6 Mpx