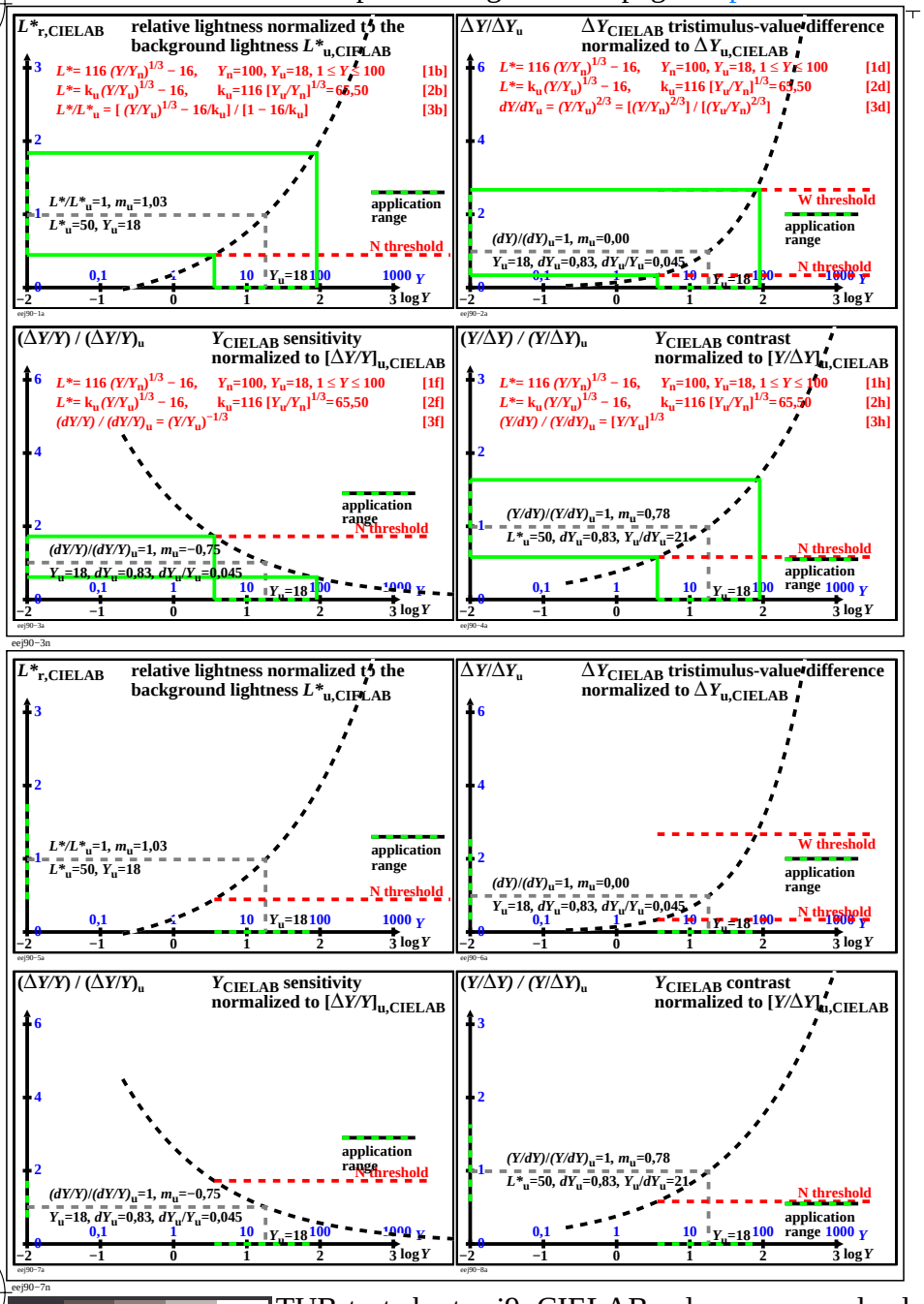

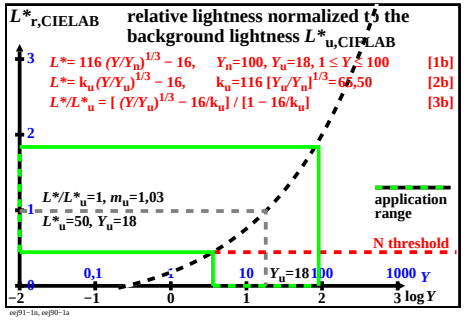

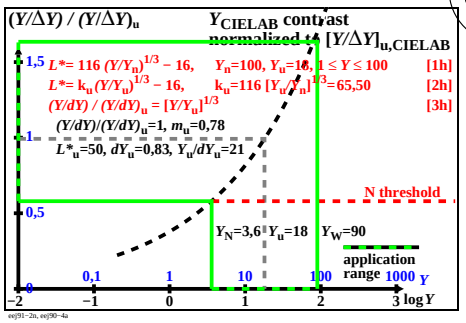

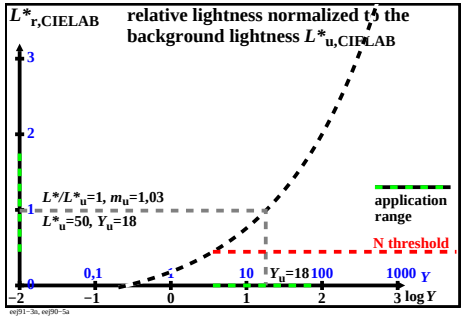

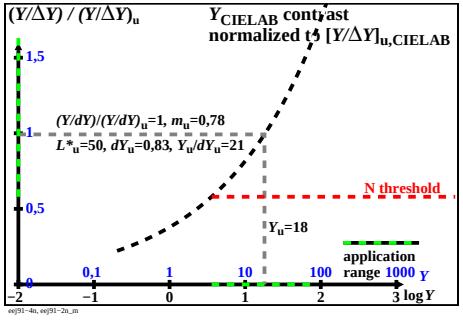

Lightness L^* and differences ΔY or dY in the colour space CIELAB

The lightness L^* is defined by the equation:

$$L^* = 116\,(Y/Y_n)^{1/3} - 16, \quad Y_n=100,\ Y_u=18,\ 1 \le Y \le 100 \qquad [1]$$

This CIELAB equation as function of relative tristimulus values is

$$L^* = k_u(Y/Y_u)^{1/3} - 16, \quad k_u=116\,[Y_u/Y_n]^{1/3}=65{,}50 \qquad [2]$$

The tristimulus values difference dY is for $dL^*=1$

$$dY = (3/116)\cdot(Y/Y_n)^{2/3} = a\cdot(Y/Y_n)^{2/3} = b\cdot(Y/Y_u)^{2/3} \qquad [3]$$

$a = 0{,}557 \quad b = 6{,}516$ [4]

Relative nomalized differences are dY/dY_u and $[Y/dY] / [(Y/dY)_u]$

$$dY/dY_u = (Y/Y_u)^{2/3} = [(Y/Y_n)^{2/3}] / [(Y_u/Y_n)^{2/3}] \qquad [5]$$

$$(Y/dY) / (Y/dY)_u = [Y/Y_u]^{1/3} \qquad [6]$$

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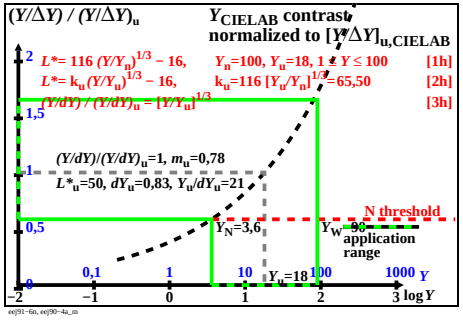

Line-element examples for grey samples ($0{,}2 \le x = Y/Y_u \le 5$)

$F(x)$ is called the line-element function of $f(x)$.
The following relations are valid for $x=Y/Y_u=Y/18$:

$$\frac{d[F(x)]}{dx} = f(x) \qquad [1]$$

$$F(x) = \int \frac{f'(x)}{f(x)}\,dx \qquad [2]$$

Example for all normalized tristimulus values $x=Y/Y_u$, for example for $Y_N=3{,}6$, $Y_u=18$, $Y_W=90$.

$$\frac{d\,[\,k_u(x)^{1/3} - 16\,]}{dx} = [\,k_u(x)^{-2/3}\,] / 3 \qquad [3]$$

$$k_u(x)^{1/3} + \text{const} = \int \frac{k_u(x)^{-2/3}}{3} \qquad [4]$$

eej91−7N