

$\log(L^*_{80}/L^*_{80,u})$  HAULAB lightness  $L^*_{80}$  normalized to the background lightness  $L^*_{80,u}$

$$\frac{L^*/L^*_{80,u}}{L^*_{80}/L^*_{80,u}} = s(Y/Y_u)^n - d \quad (Y_u=100, Y_u=22, s=134.6, n=0.31, d=34.6) \quad [1a]$$

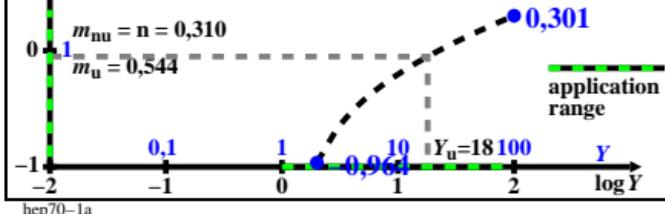
$$L^* = r(Y/Y_u)^n - d \quad (r=s(Y/Y_u)^n=79.10, L^*_u=r-d=44.5) \quad [1b]$$

$$L^*/L^*_u = g(Y/Y_u)^n - h \quad (g=r/(r-d)=1.77, h=d/(r-d)=0.77) \quad [1c]$$

$$\log([L^*/L^*_u + h] / g) = n \log(Y/Y_u) = 0.31 \log(Y/22) \quad [1d]$$

$$\ln([(L^*/L^*_u + h) / g]) = n \ln(10) \log(Y/Y_u) = 0.71 \log(Y/22) \quad [1e]$$

$$(L^*/L^*_u + h) / g = e^{n \ln(10) \log(Y/Y_u)} = e^{0.71 \log(Y/22)} \quad [1f]$$



hep70-1a

$\log(\Delta Y / \Delta Y_u)$  HAULAB tristimulus value difference normalized to  $\Delta Y_u$

$$\frac{\Delta Y / \Delta Y_u}{\Delta Y / \Delta Y_u} = s(Y/Y_u)^n - d \quad (Y_u=100, Y_u=22, s=134.6, n=0.31, d=34.6) \quad [1a]$$

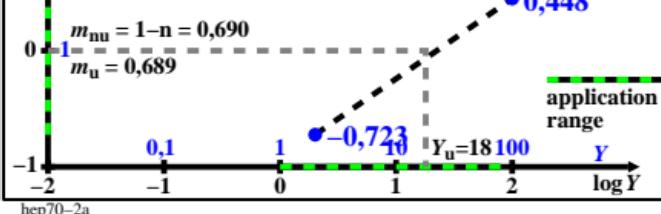
$$\Delta Y = r(Y/Y_u)^n - d \quad (r=s(Y/Y_u)^n=79.10, L^*_u=r-d=44.5) \quad [1b]$$

$$dY = [Y_u / (n s)] (Y/Y_u)^{1-n} \quad [2c]$$

$$dY_u = [Y_u / (n s)] (Y_u/Y_u)^{1-n} = 1.4084 \quad [2d]$$

$$dY/dY_u = (Y/Y_u)^{1-n} \quad [2e]$$

$$\log(dY/dY_u) = (1-n) \log(Y/Y_u) \quad [2f]$$



hep70-2a

$\log[(\Delta Y / Y) / (\Delta Y / Y_u)]$  HAULAB-Y sensitivity normalized to  $(\Delta Y / Y_u)$

$$\frac{S_r/S_{ru}}{(\Delta Y / Y) / (\Delta Y / Y_u)} = (\Delta Y / Y) / (\Delta Y / Y_u) \quad [1a]$$

$$100L^* = s(Y/Y_u)^n - d \quad (Y_u=100, Y_u=22, s=134.6, n=0.31, d=34.6) \quad [1a]$$

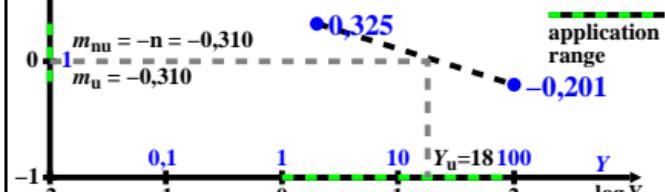
$$L^* = r(Y/Y_u)^n - d \quad (r=s(Y/Y_u)^n=79.10, L^*_u=r-d=44.5) \quad [1b]$$

$$dY/Y = [(Y_u / (n s)) (Y/Y_u)^{1-n}] / Y \quad [3c]$$

$$(dY/Y)_u = [(Y_u / (n s)) (Y_u/Y_u)^{1-n}] / Y_u \quad [3d]$$

$$(dY/Y) / (dY/Y)_u = (Y/Y_u)^{-n} \quad [3e]$$

$$\log[(dY/Y) / (dY/Y)_u] = (-n) \log(Y/Y_u) \quad [3f]$$



hep70-3a

hep70-3n

$\log[(Y/\Delta Y) / (Y/\Delta Y_u)]$  HAULAB-Y contrast normalized to  $(Y/\Delta Y_u)$

$$\frac{C_r/C_{ru}}{(Y/\Delta Y) / (Y/\Delta Y_u)} = (Y/\Delta Y) / (Y/\Delta Y_u) \quad [1a]$$

$$100L^* = s(Y/Y_u)^n - d \quad (Y_u=100, Y_u=22, s=134.6, n=0.31, d=34.6) \quad [1a]$$

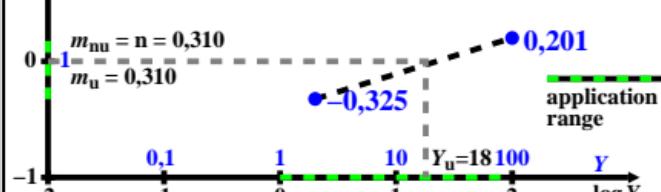
$$L^* = r(Y/Y_u)^n - d \quad (r=s(Y/Y_u)^n=79.10, L^*_u=r-d=44.5) \quad [1b]$$

$$Y/dY = Y / \{ [(Y_u / (n s)) (Y/Y_u)^{1-n}] \} \quad [4c]$$

$$(Y/Y_u) = Y_u / \{ [(Y_u / (n s)) (Y_u/Y_u)^{1-n}] \} \quad [4d]$$

$$(Y/dY) / (Y/dY)_u = (Y/Y_u)^n \quad [4e]$$

$$\log[(Y/dY) / (Y/dY)_u] = (n) \log(Y/Y_u) \quad [4f]$$



hep70-4a