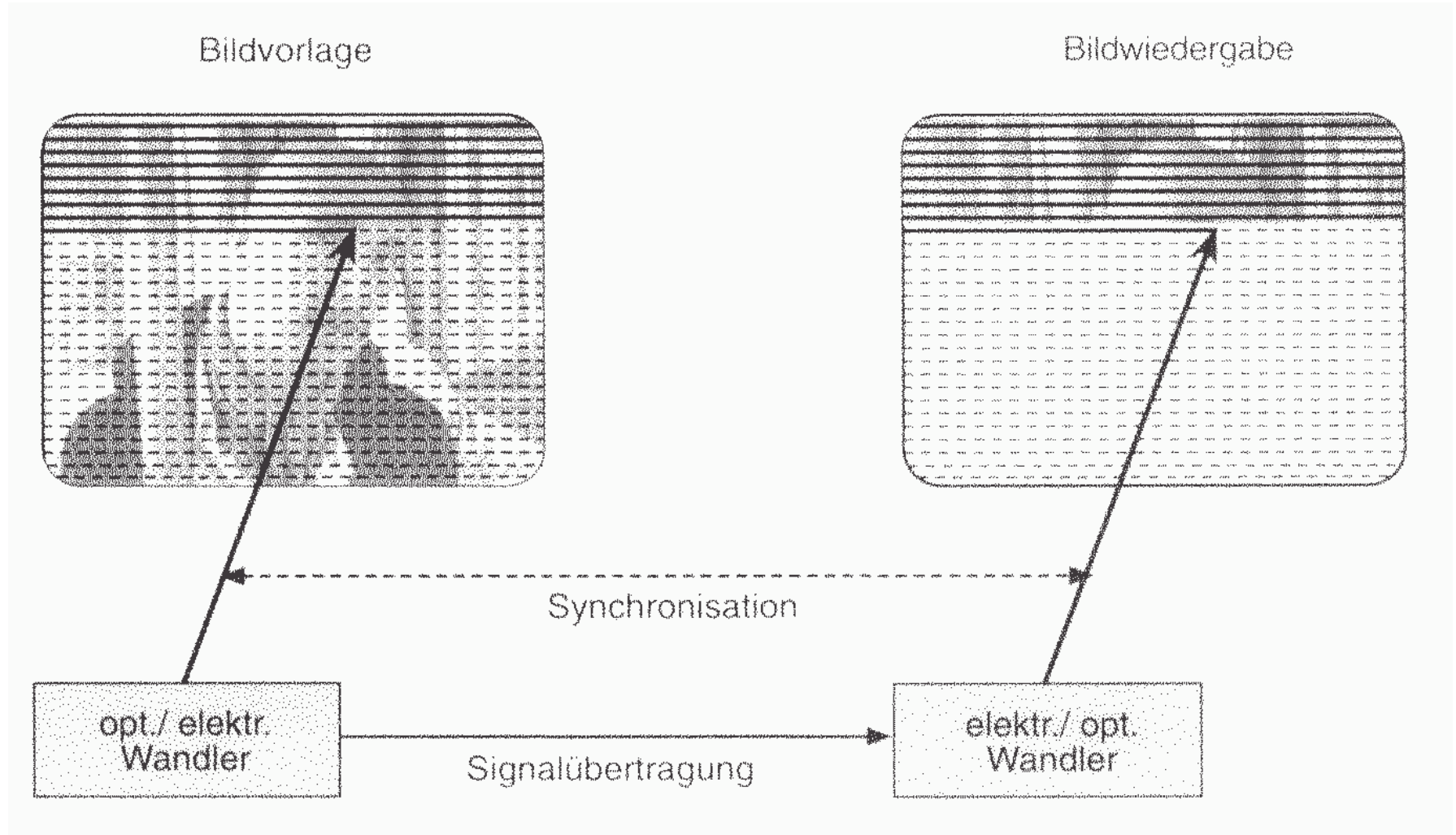


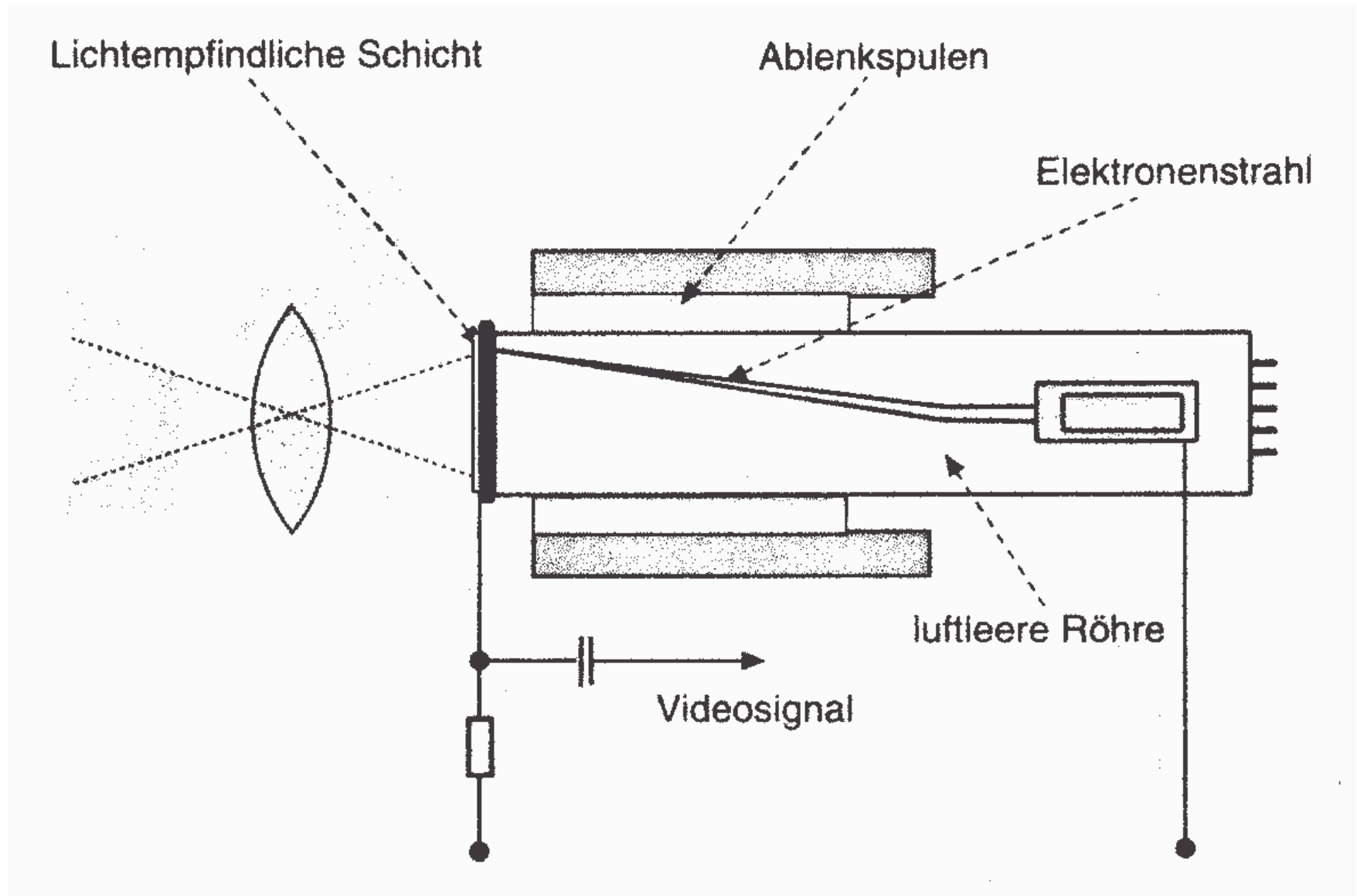
# Analoge Videotechnik

Hansjörg Mixdorff

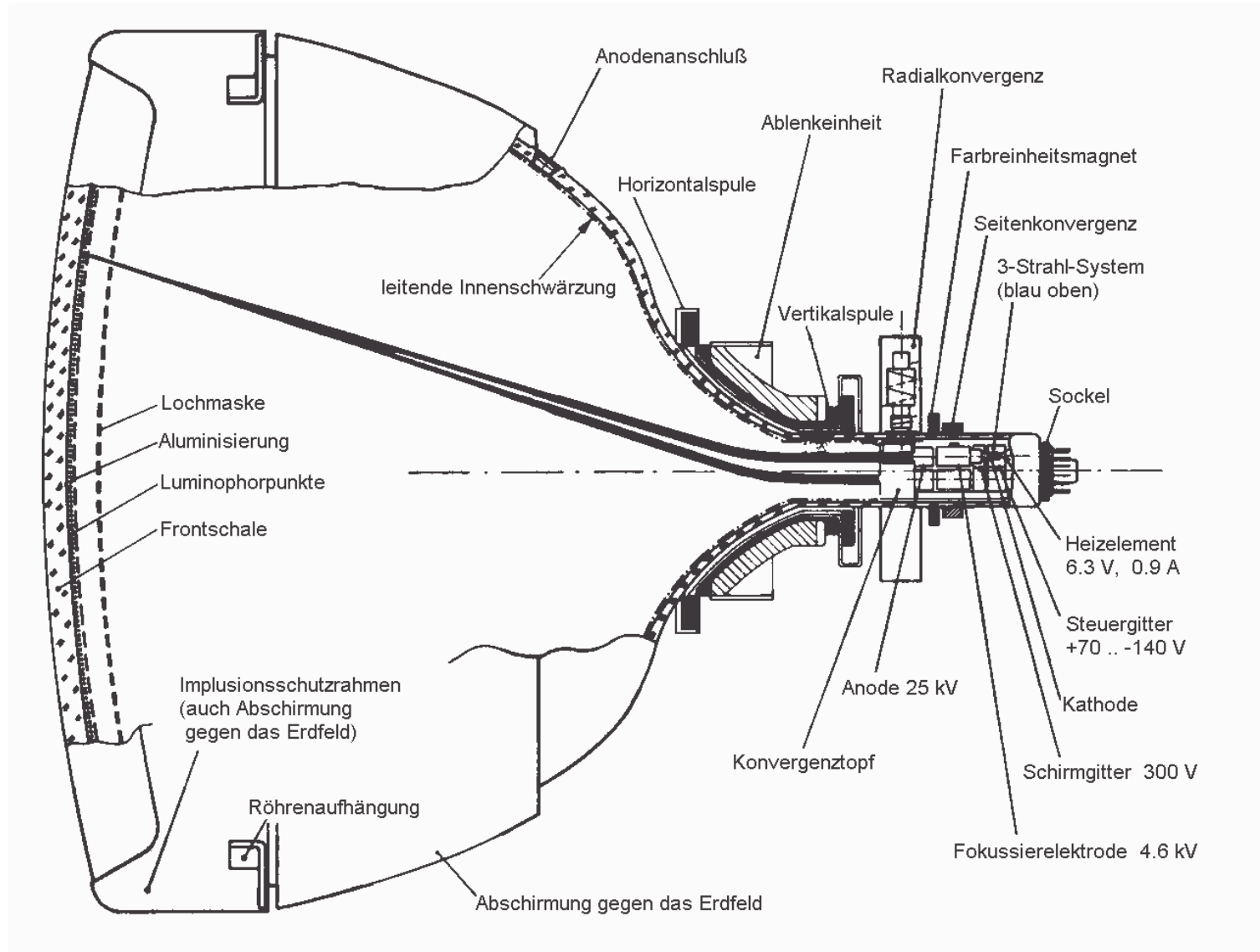
# Bildübertragung



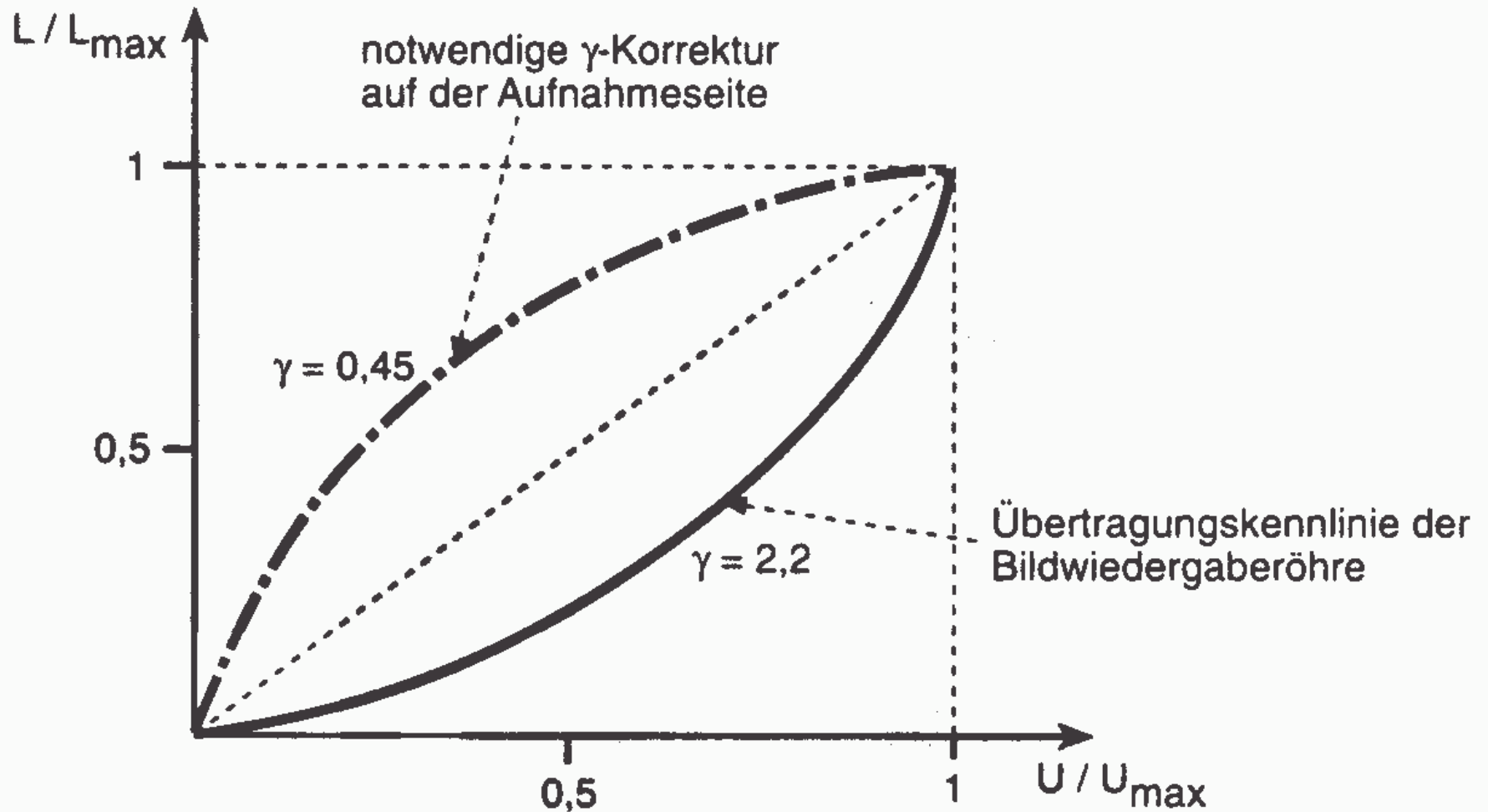
# Bildaufnahmeröhre



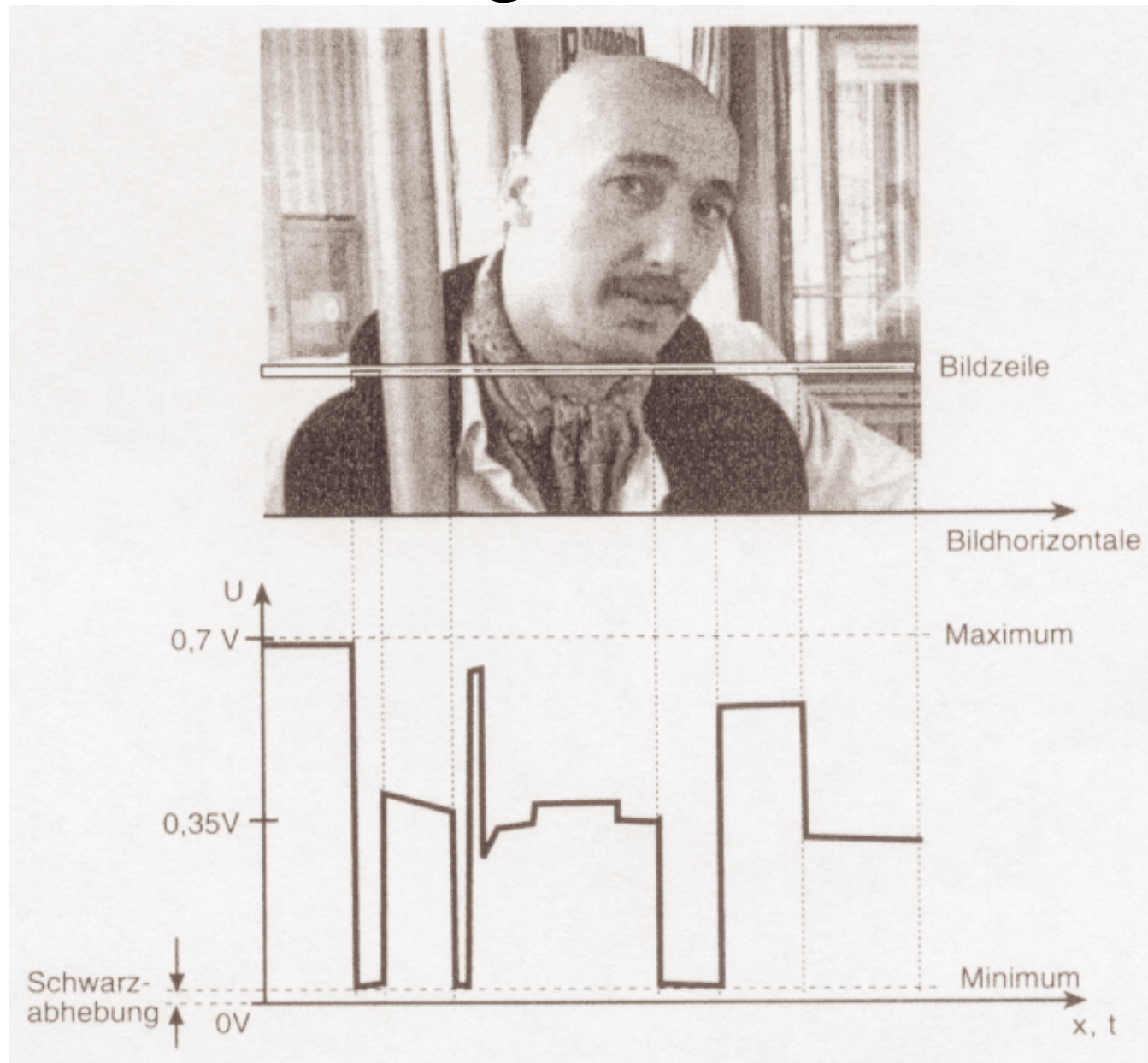
# Farbbildröhre



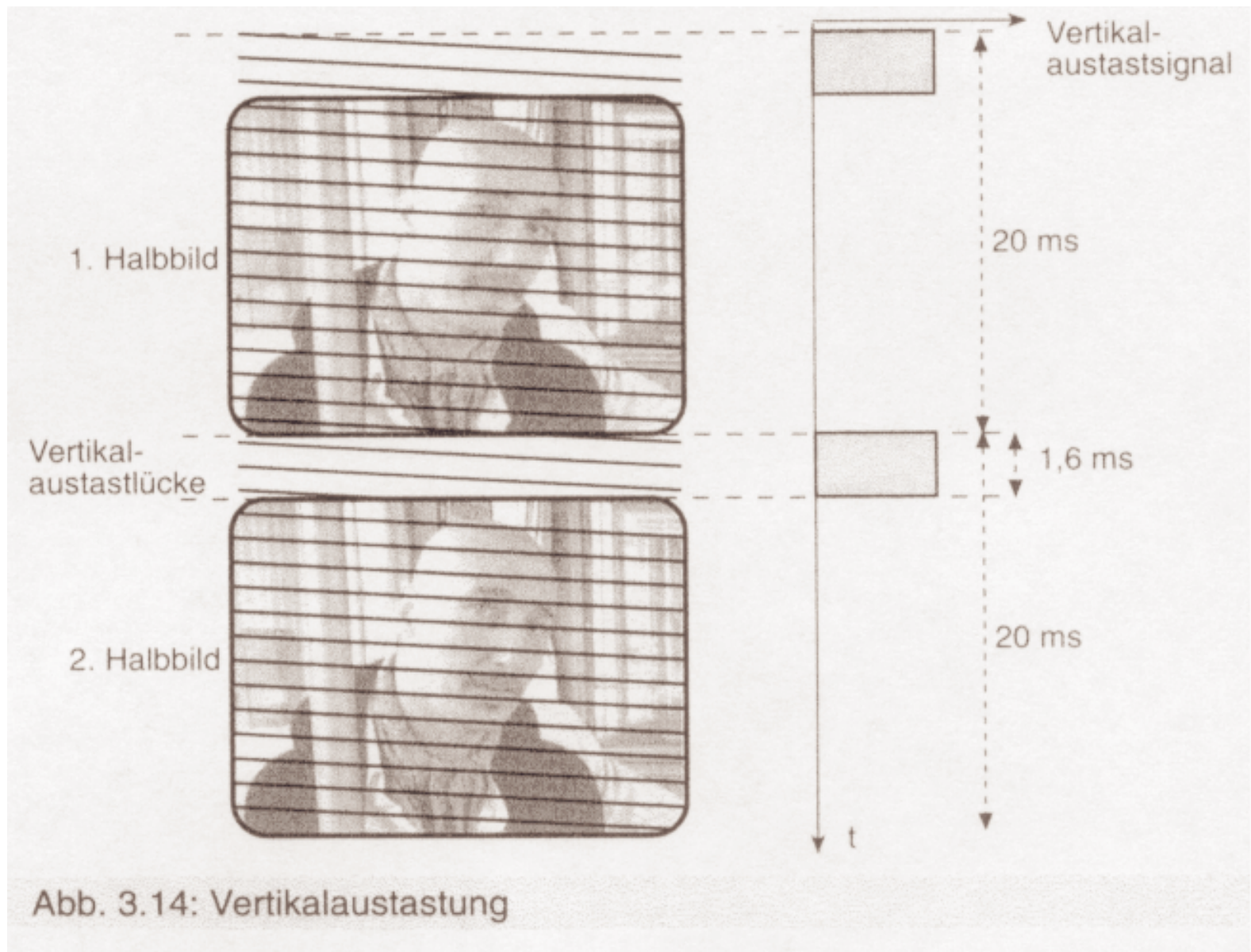
# Gradationskurve ( $\gamma$ -Korrektur)



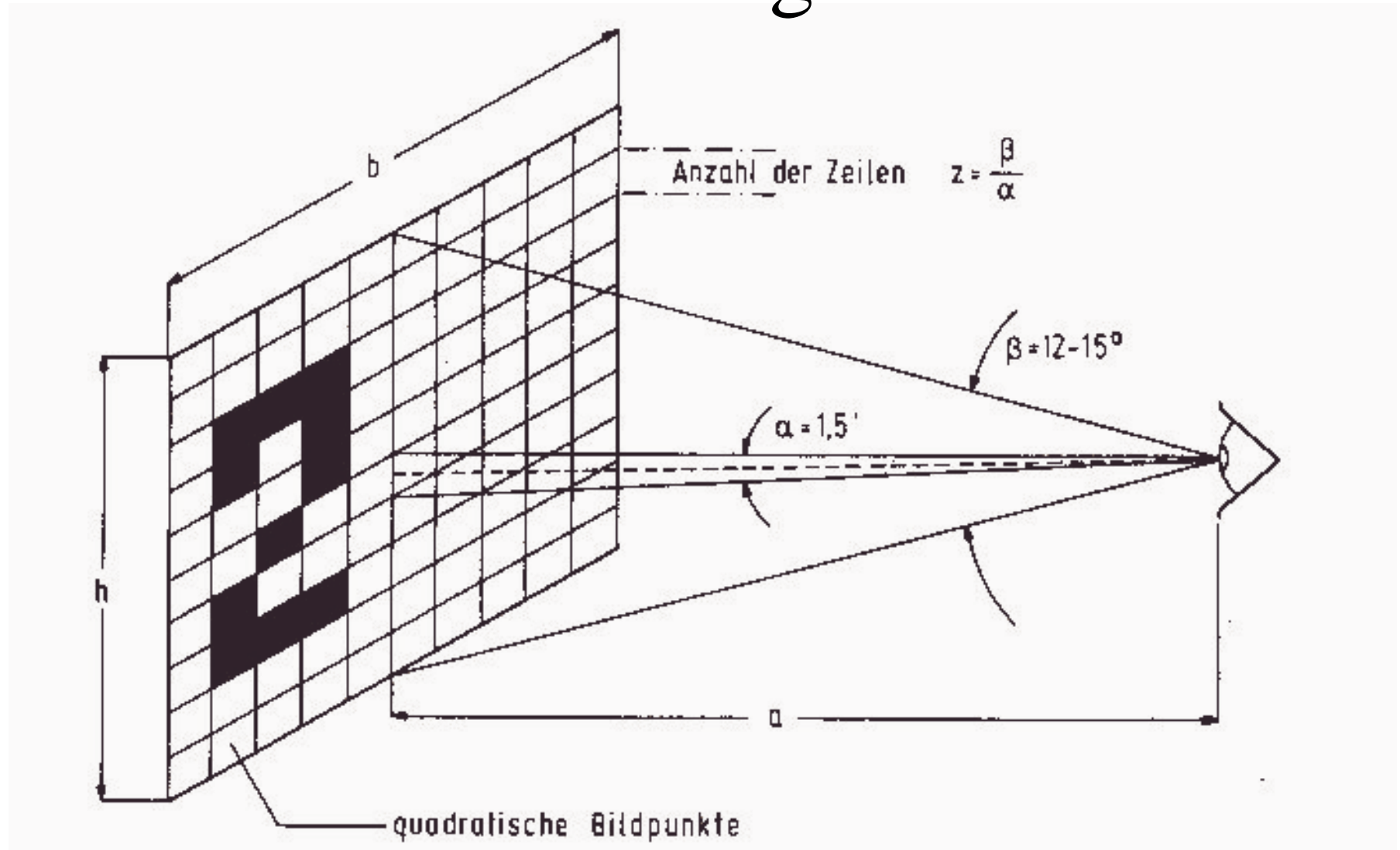
# Videosignalverlauf



# Vertikale Halbbilder

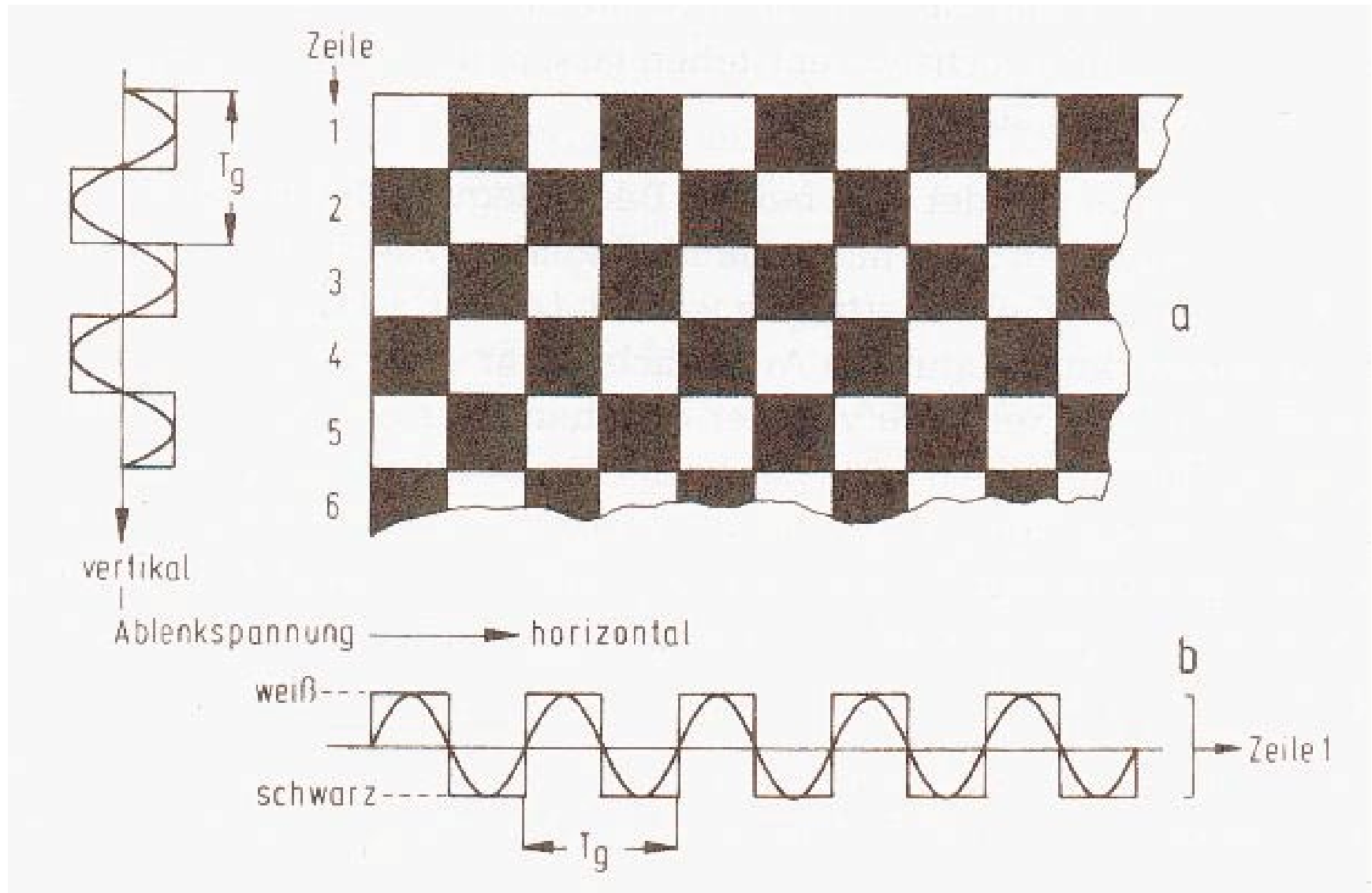


# Zeilenzahl / Auflösungsfähigkeit des Auges

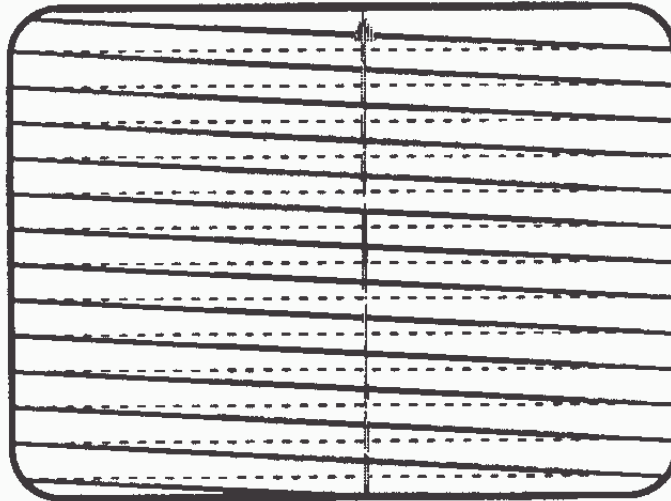




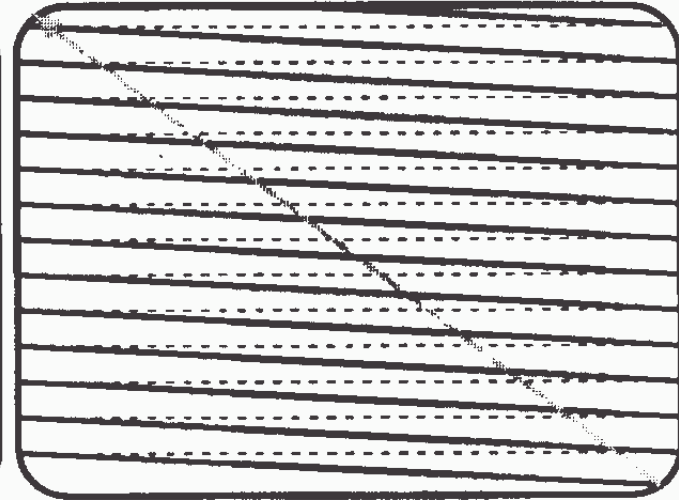
# Ermittlung der Videobandbreite



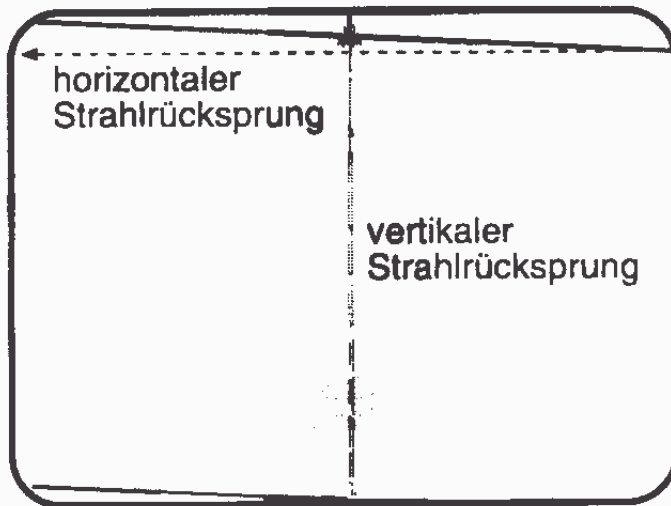
# Aufbau des Fernsehbilds



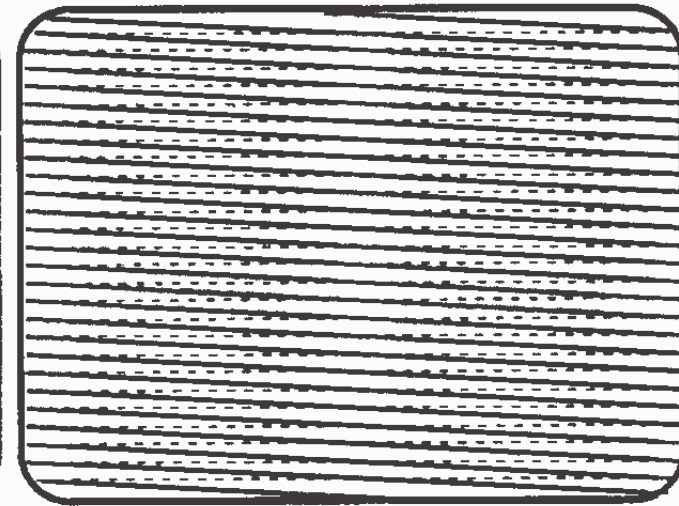
1. Halbbild



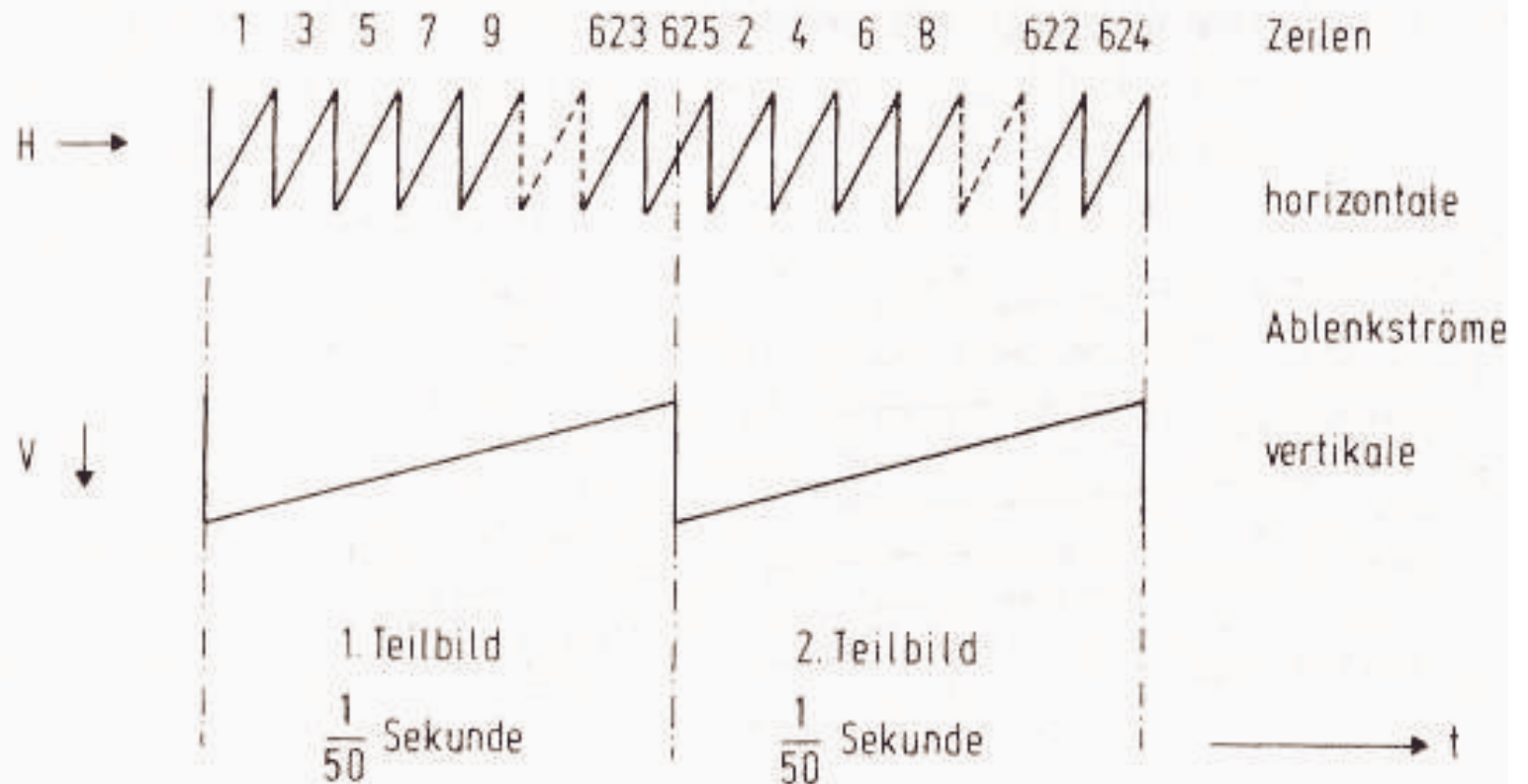
2. Halbbild



Gesamtbild



# Ablenkströme



Bildwechselfrequenz

$$f_B = 25 \text{ Hz}$$

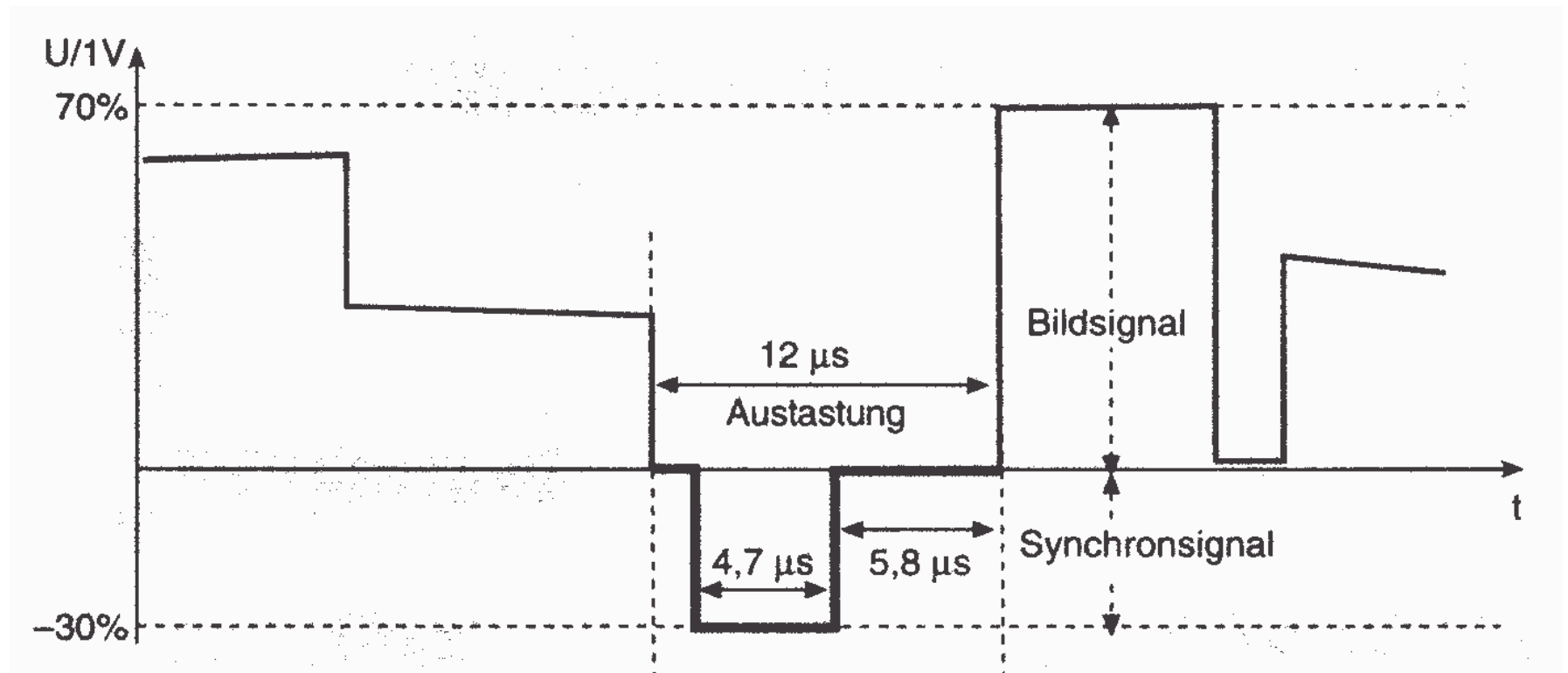
Vertikale Ablenkfrequenz

$$f_V = 50 \text{ Hz}$$

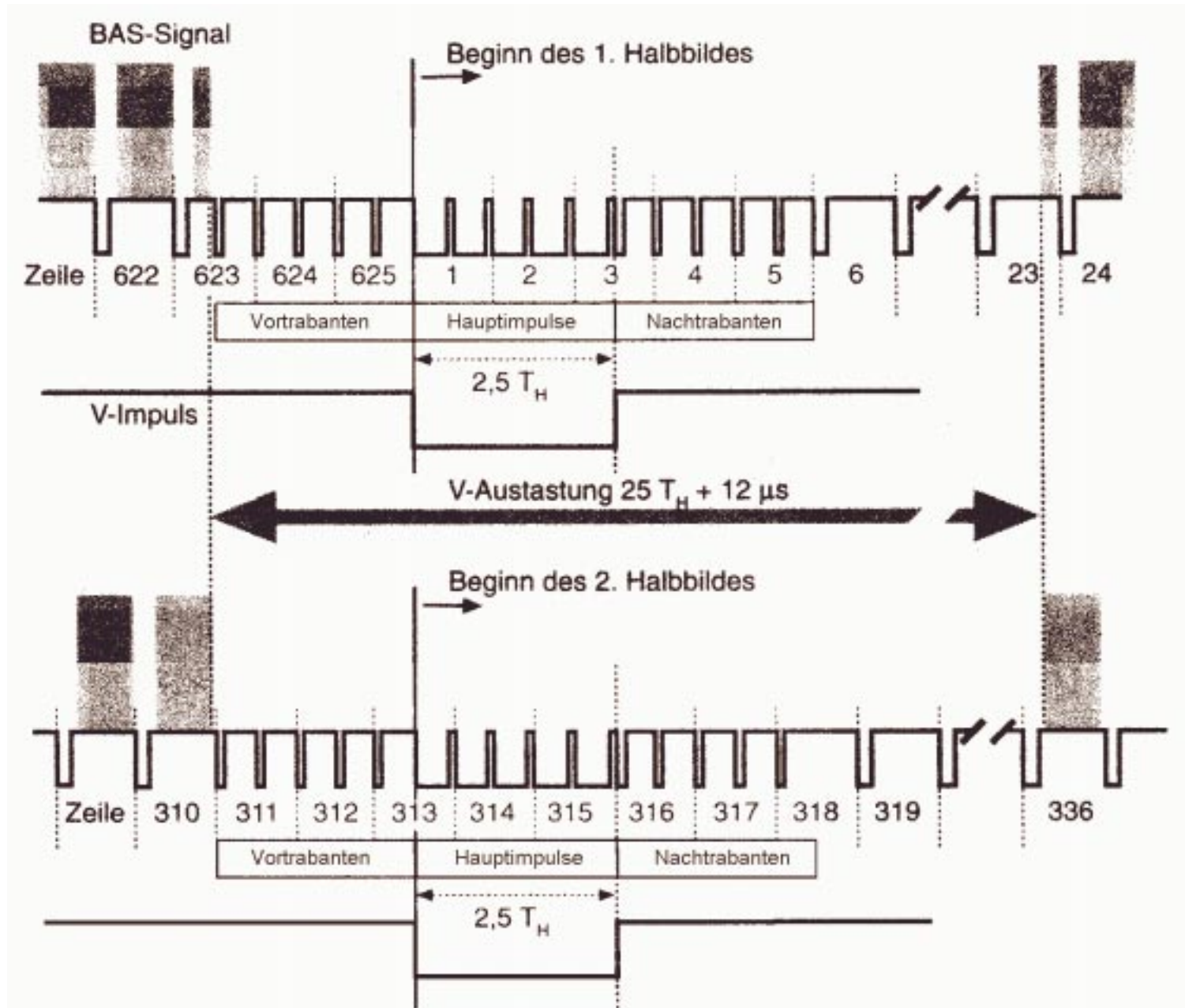
Horizontale Ablenkfrequenz

$$f_H = 15\,625 \text{ Hz}$$

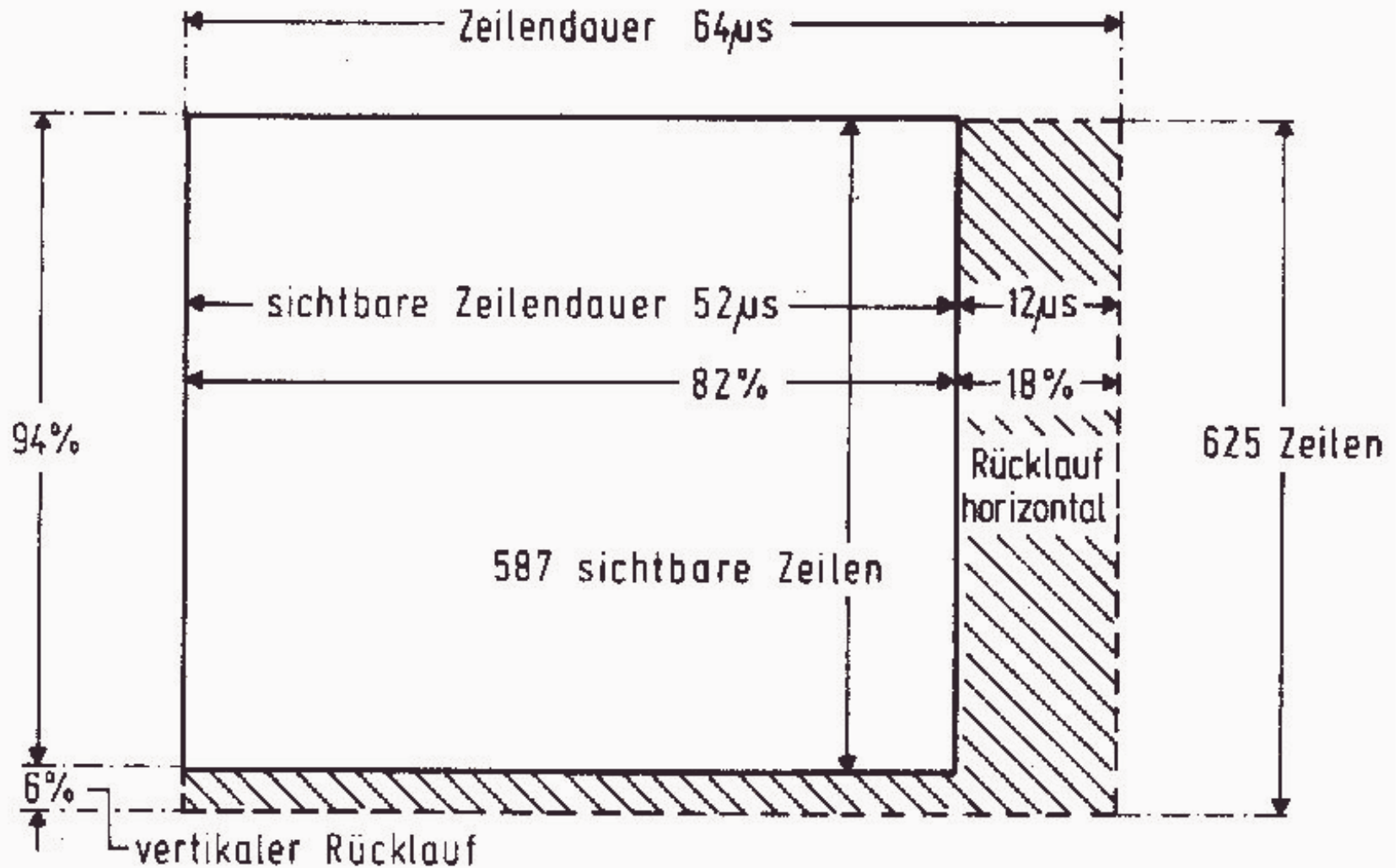
# Horizontaler Synchronimpuls



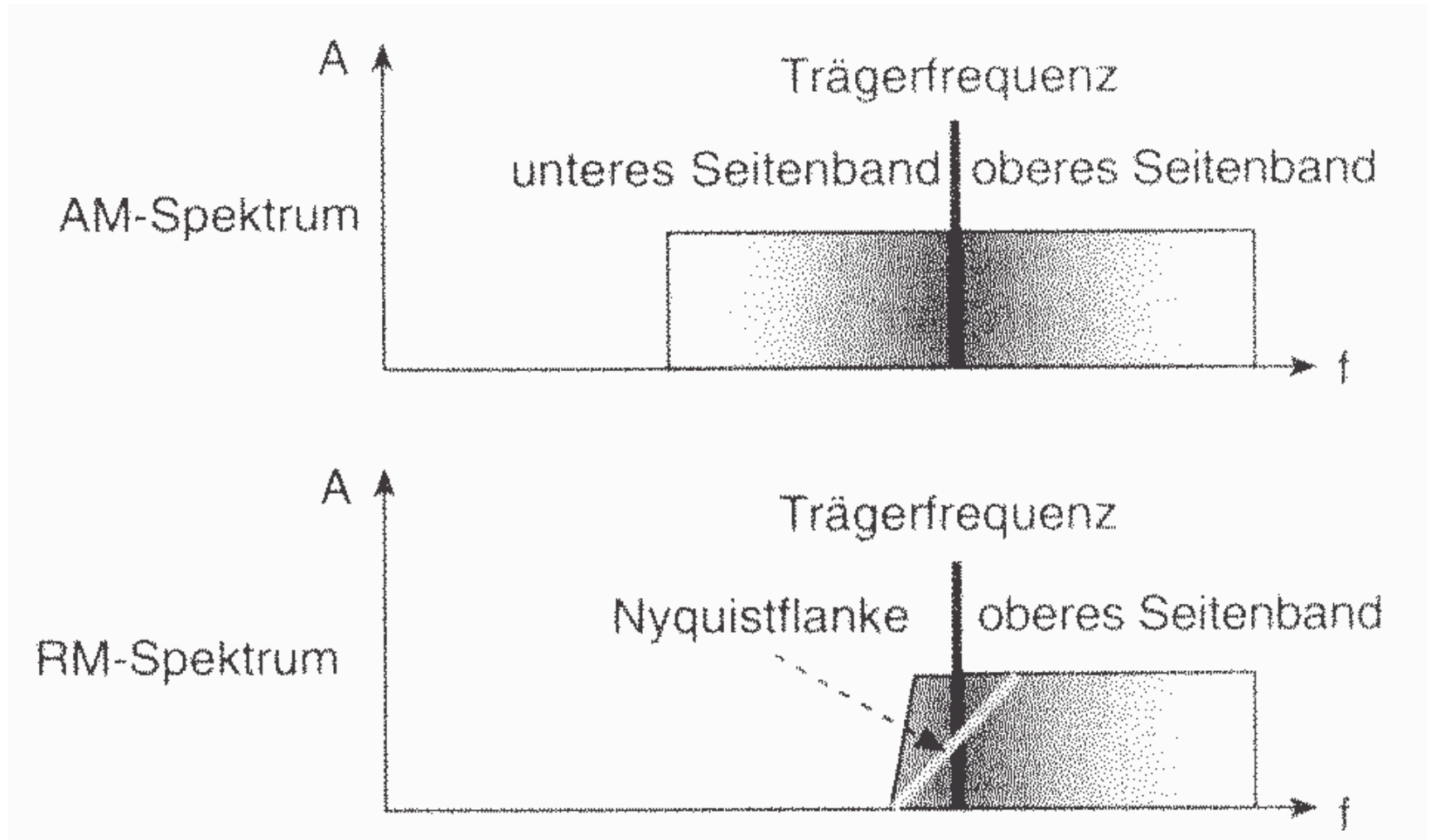
# Halbbildsynchronisation



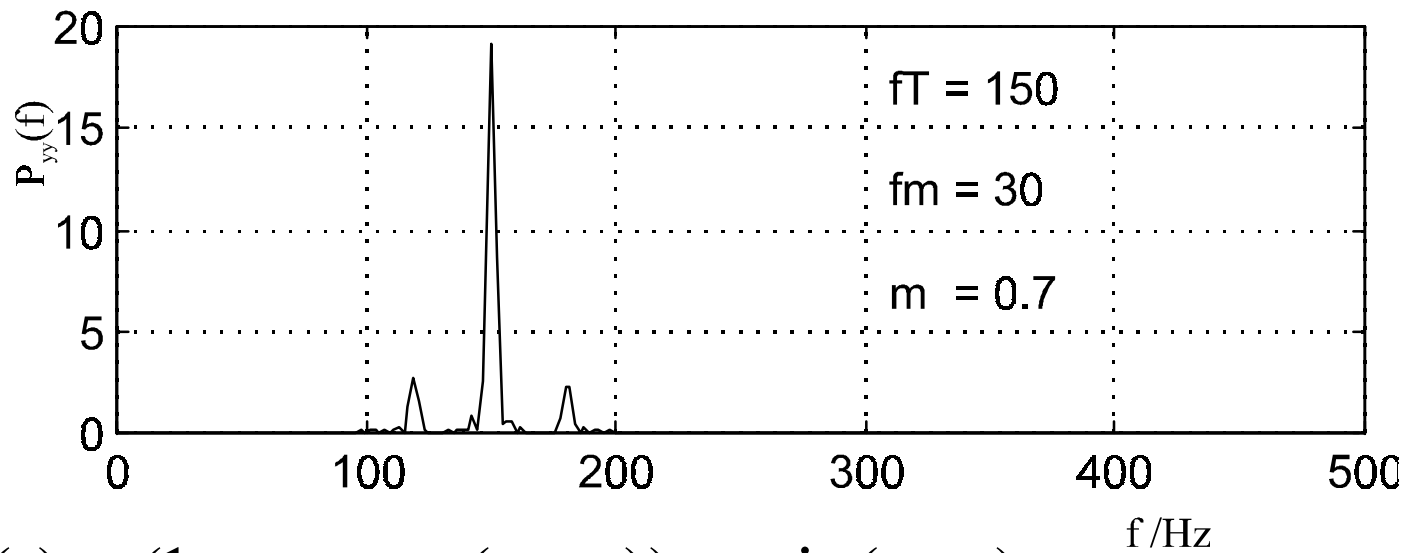
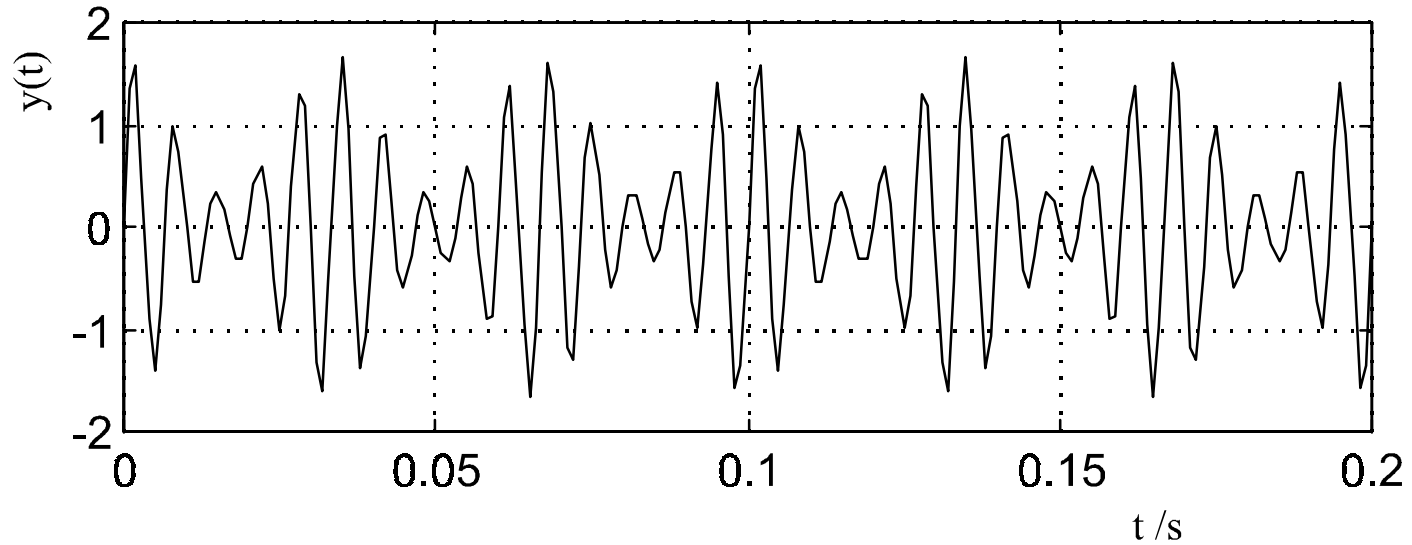
# Sichtbare Zeilen



# AM- und RM-Spektren



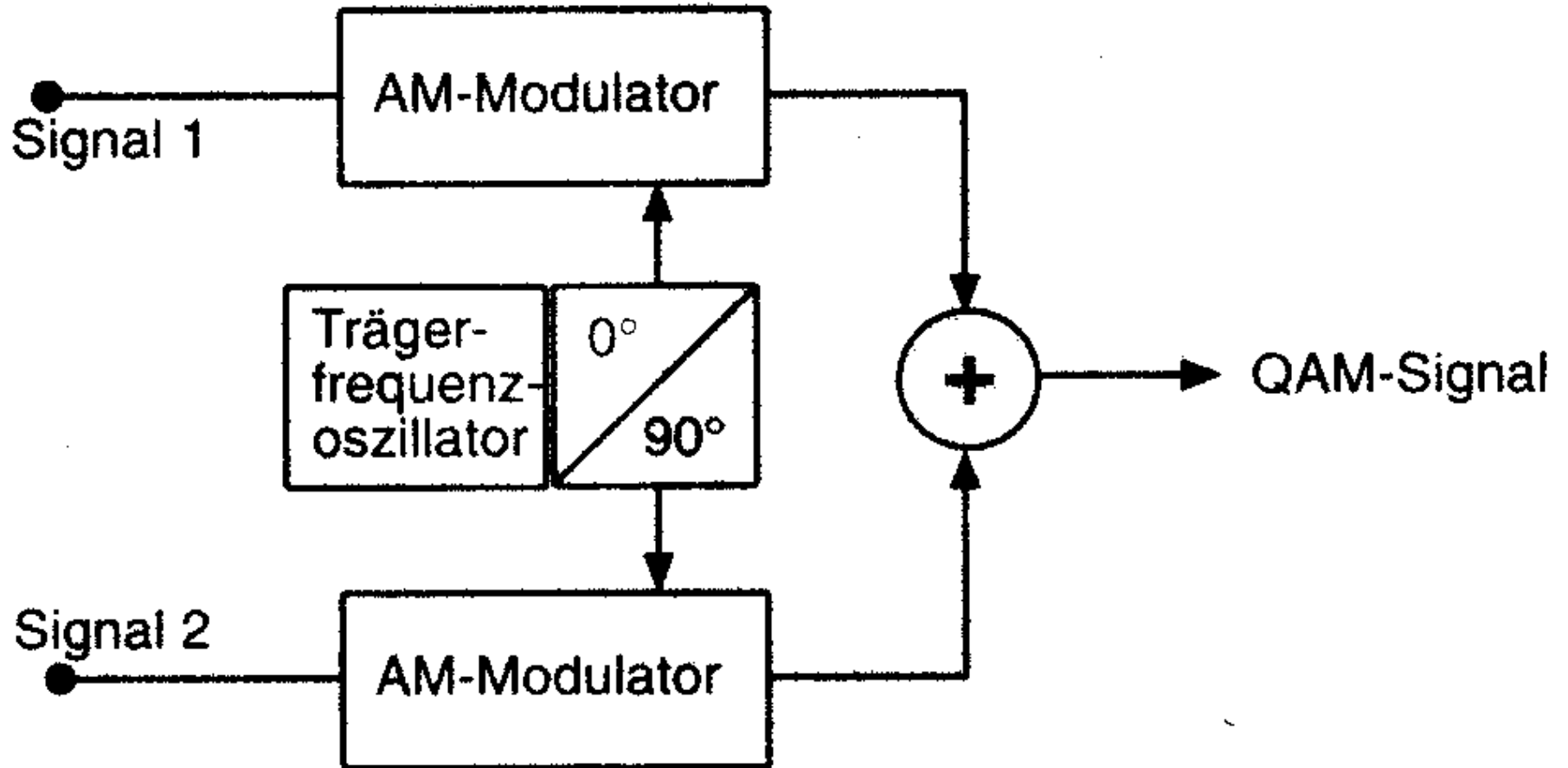
# AM-Modulation



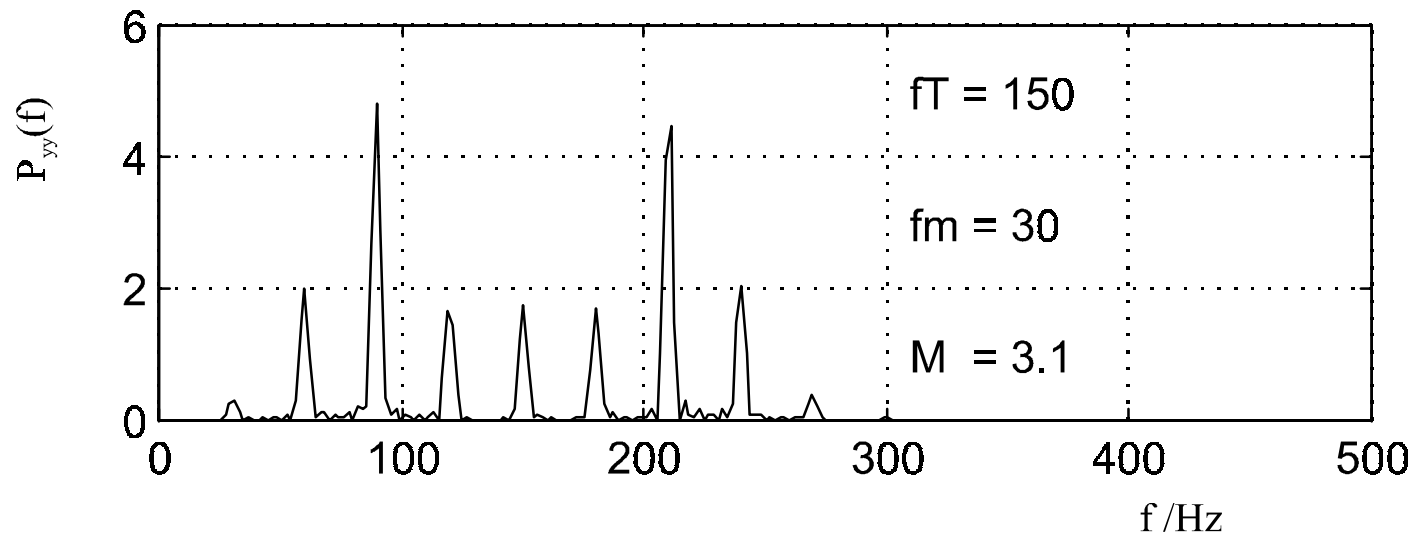
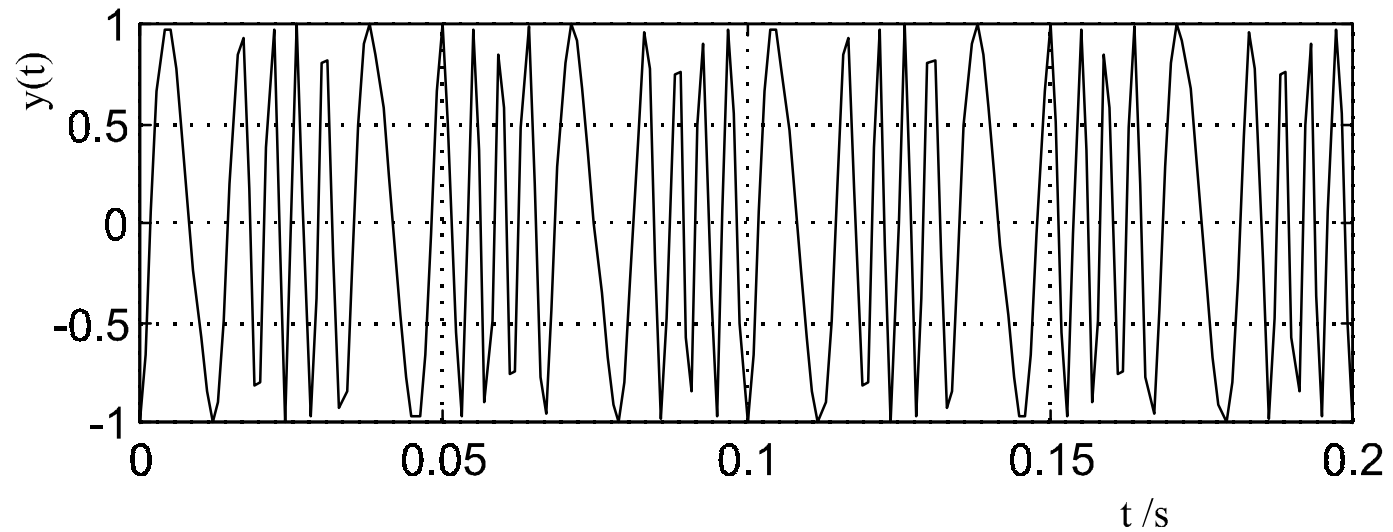
$$a_{AM}(t) = (1 + m \cdot \cos(\omega_M t)) a_T \sin(\omega_T t)$$



# QAM-Modulation



# FM-Modulation

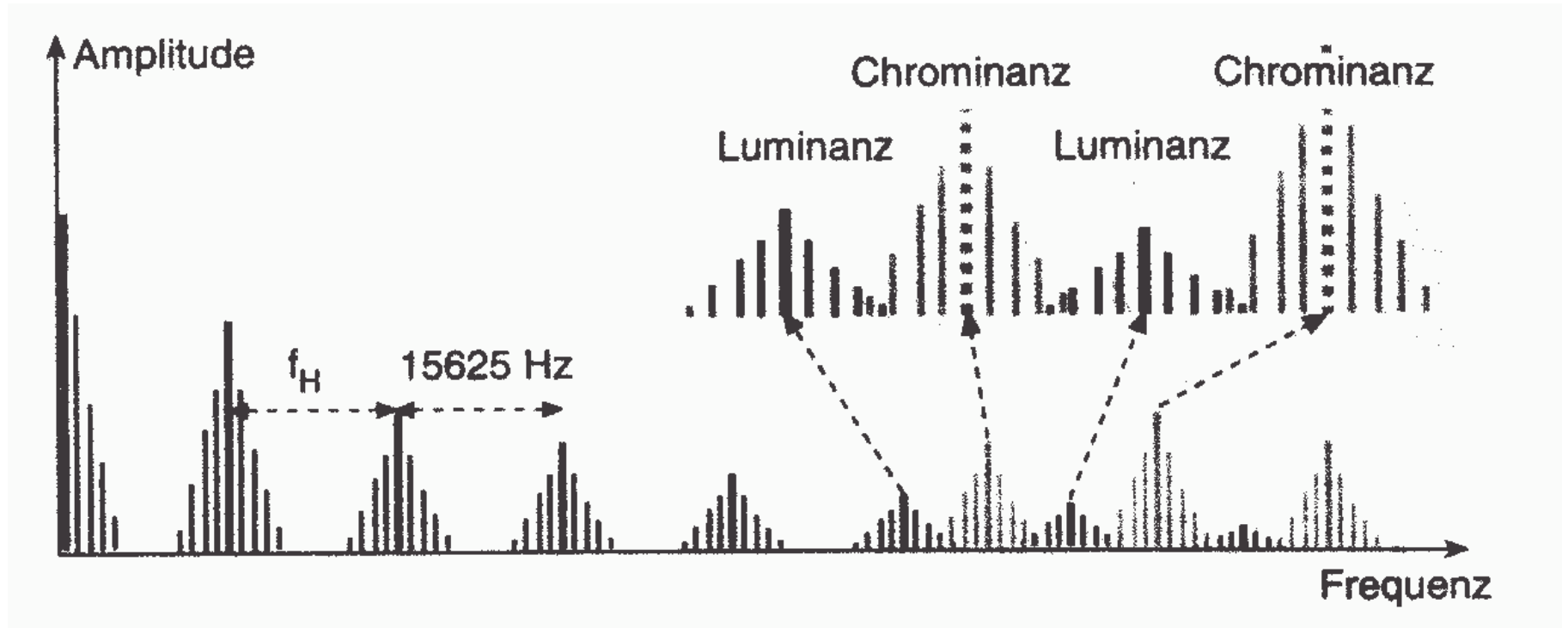


$$a_{FM}(t) = a_T \left[ \cos(\omega_T t) - \frac{\eta}{2} \cos((\omega_T - \omega_M)t) + \frac{\eta}{2} \cos((\omega_T + \omega_M)t) \right]$$

# Farbfernsehstandards

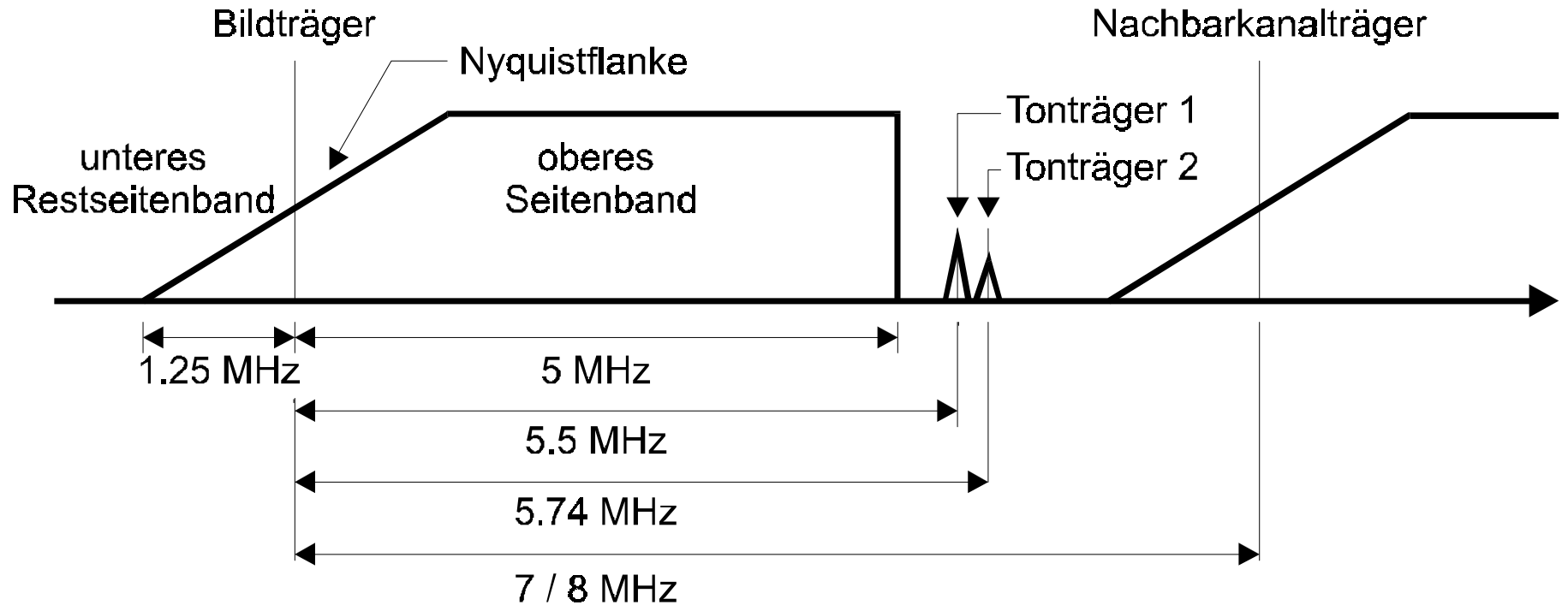
	PAL	SECAM		SECAM	NTSC
	B/G	D/K	I	L	M
Einsatzgebiet	Mittel-europa	Ost-europa	Groß-britannien	Frank-reich	USA
Zeilen/Vollbild	625	625	625	625	525
Halbbildfrequenz (Hz)	50	50	50	50	60
Zeilenaustastdauer ( $\mu$ s)	12	12	12	12	10.8
Bildaustastdauer (Zeilen)	25	25	25	25	20
Videobandbreite (MHz)	5	6	5.5	6	4.2
HF-Kanalbandbreite (MHz)	7/8	8	8	8	6
Bild/Tonträgerabstand	5.5/5.74	6.5	6	6.5	4.5
Bildmodulation (AM)	neg.	neg.	neg.	pos.	neg.
Tonmodulation	FM	FM	FM	AM	FM

# Verschachtelung von Y und C



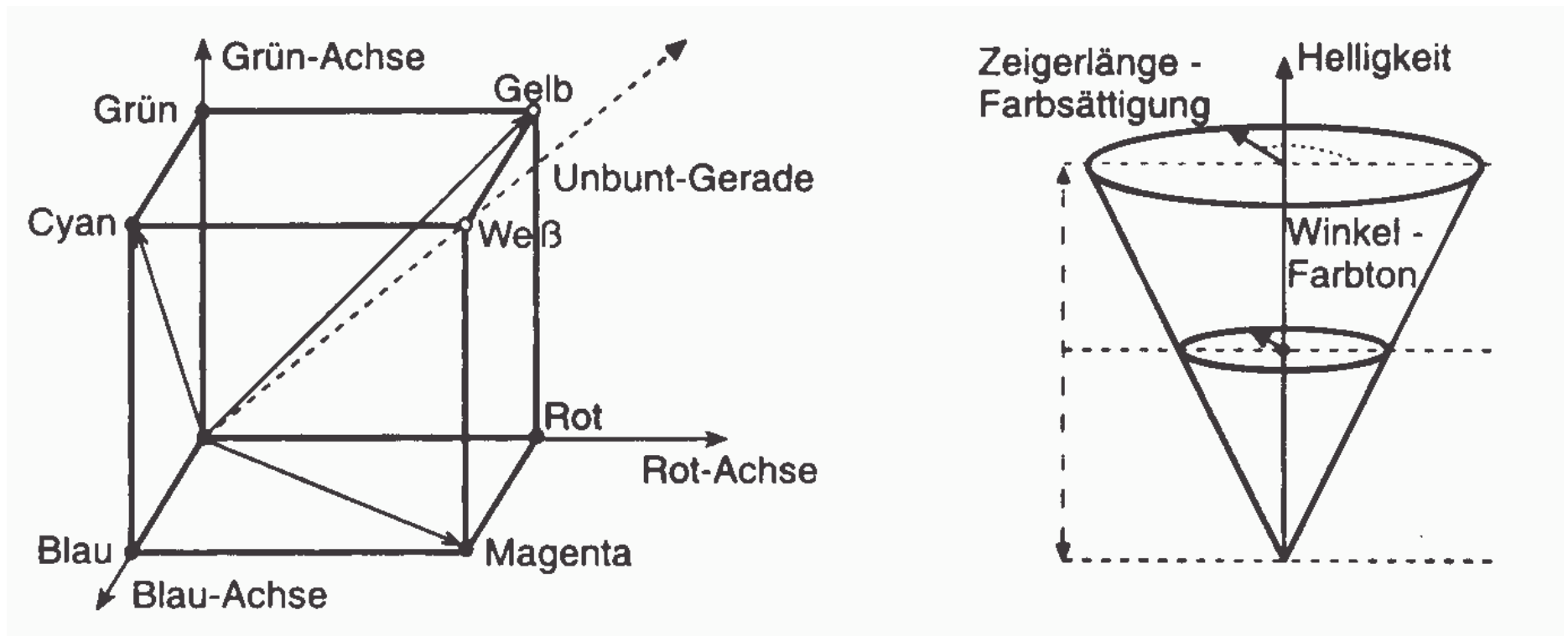
Norm	Farbhilfsträger	
NTSC	$f_{sc} = (n + 0.5) f_H$	$f_{sc} = 3.58 \text{ MHz}$ bei $n = 227$ $f_{sc} = 4.43 \text{ MHz}$ bei $n = 283$
SECAM	$f_{scRot} = 272 f_H$ $f_{scBlau} = 282 f_H$	$f_{scRot} = 4.25 \text{ MHz}$ $f_{scBlau} = 4.4 \text{ MHz}$
PAL	$f_{sc} = 283.75 f_H + 25 \text{ Hz}$	$f_{sc} = 4.43 \text{ MHz}$

# Bild-und Tonträger

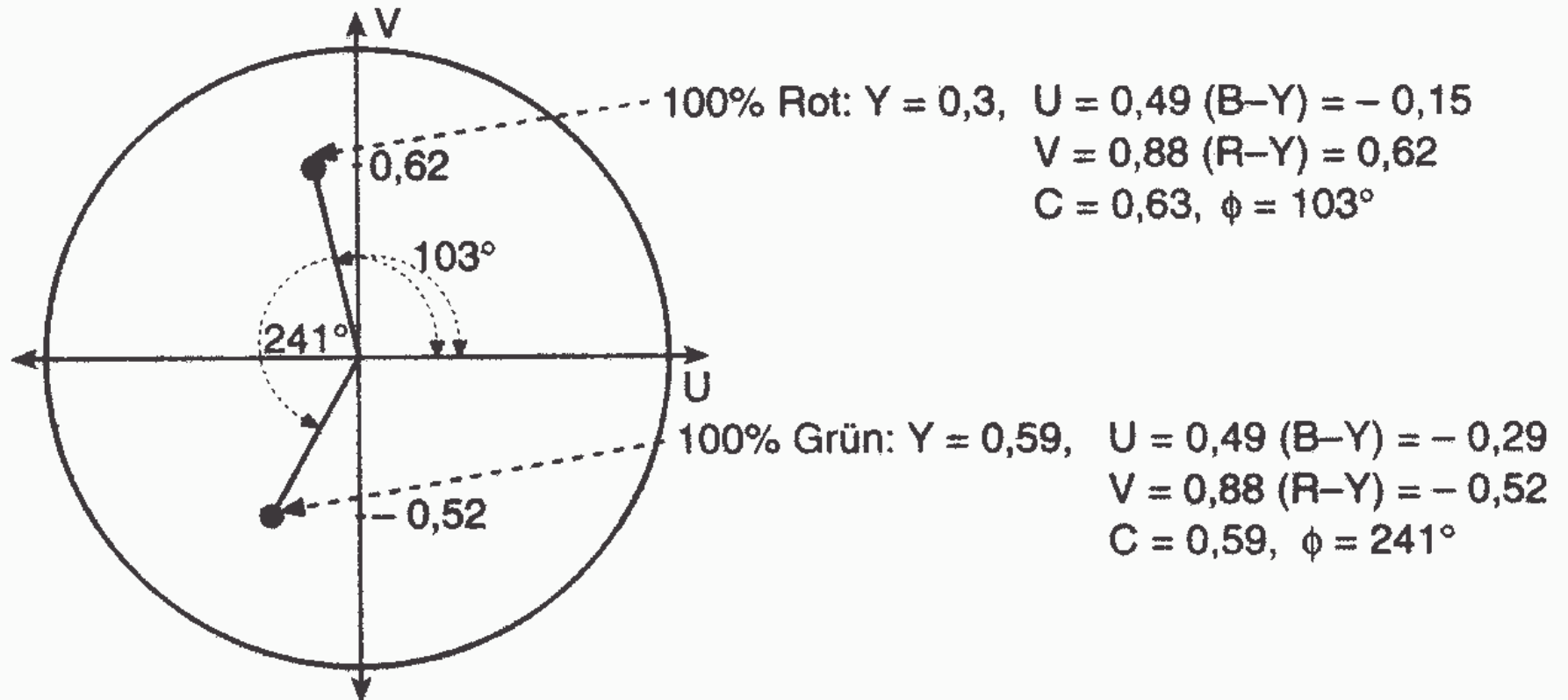


# Dreidimensionale Farbdarstellung

$$\text{Luminanz } Y = 0.3 R + 0.59 G + 0.11 B$$



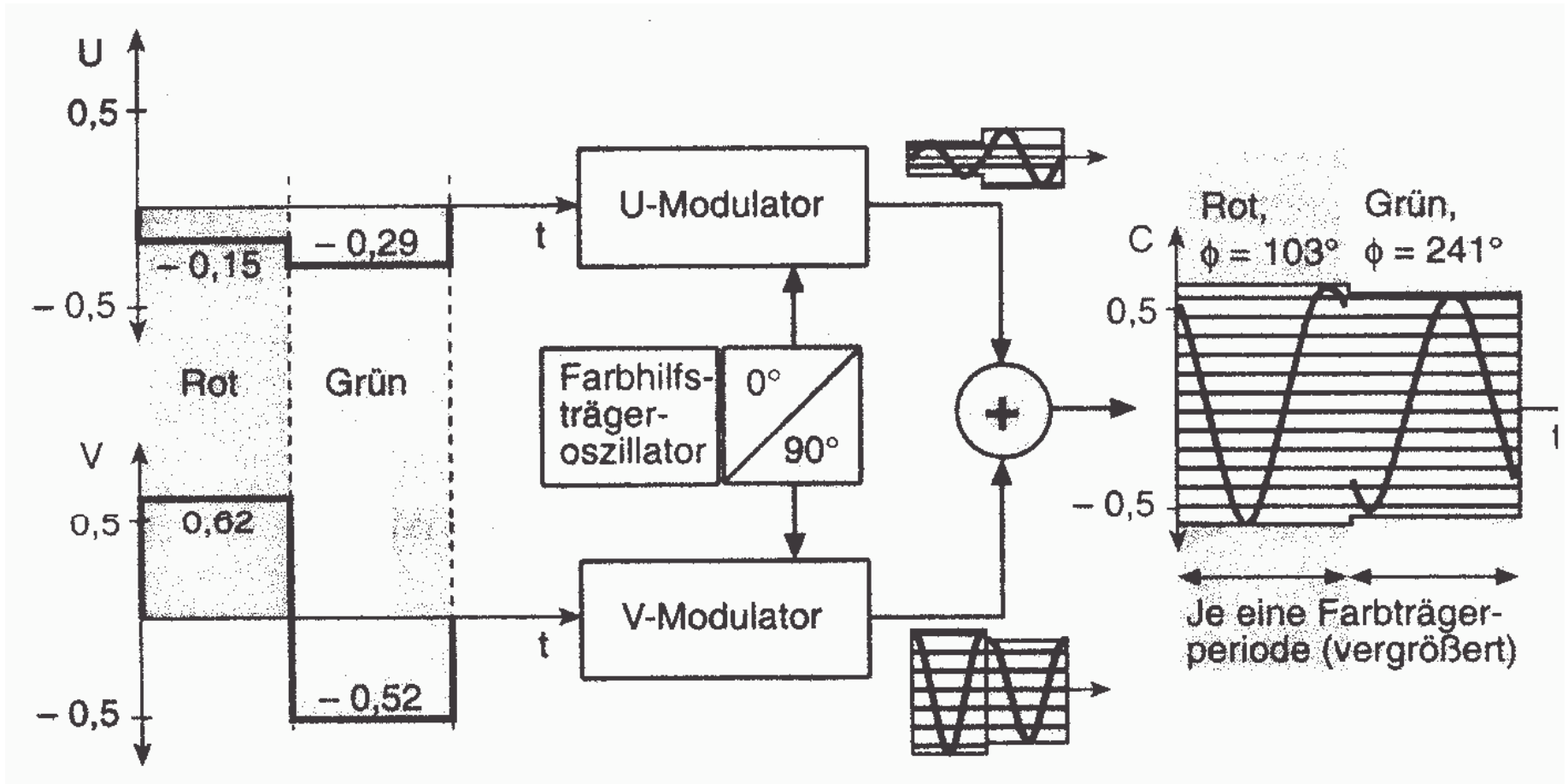
# Crominanzkoordinaten U und V



$$U=0.493 (B-Y)$$

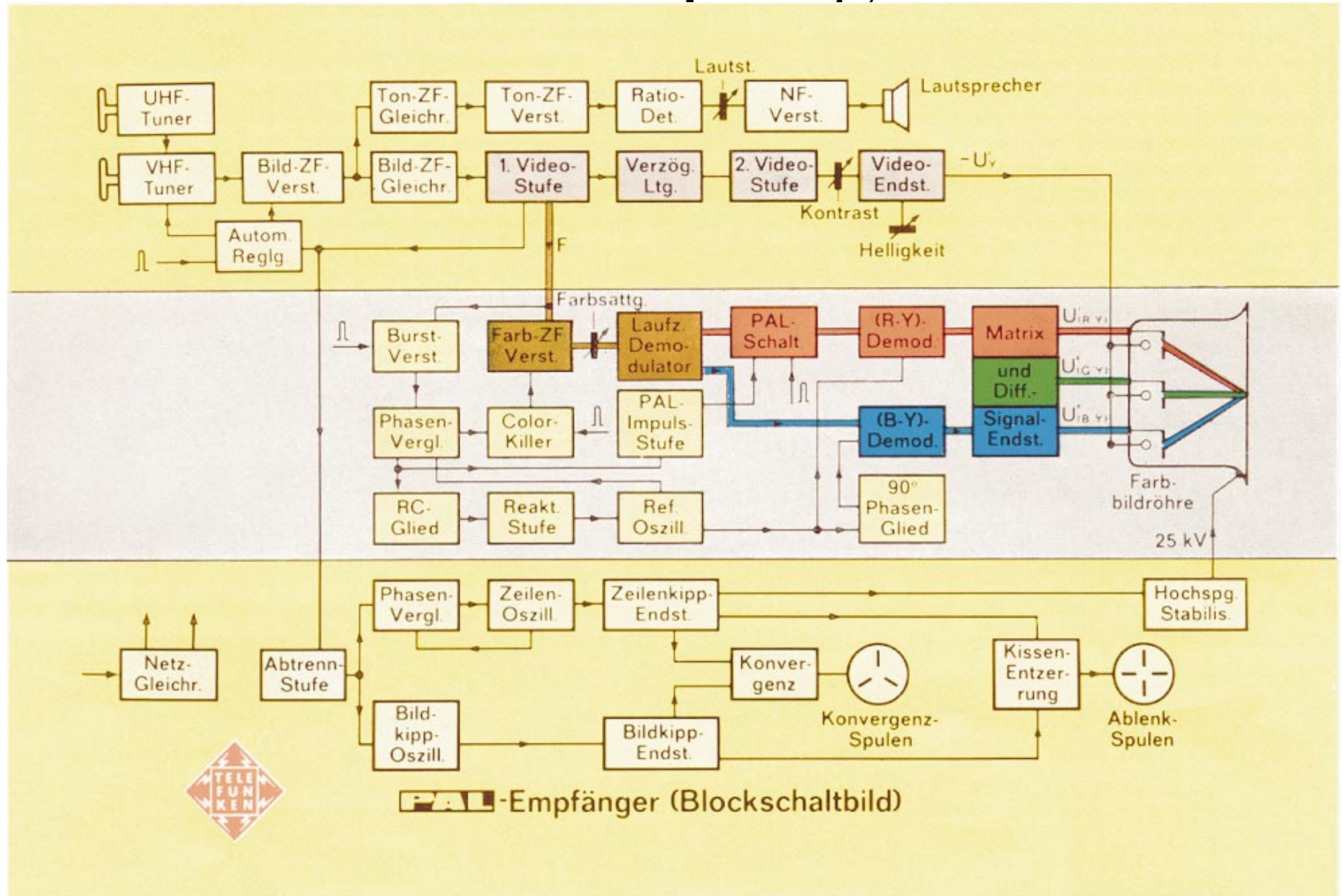
$$V=0.877 (R-Y)$$

# QAM-Modulation

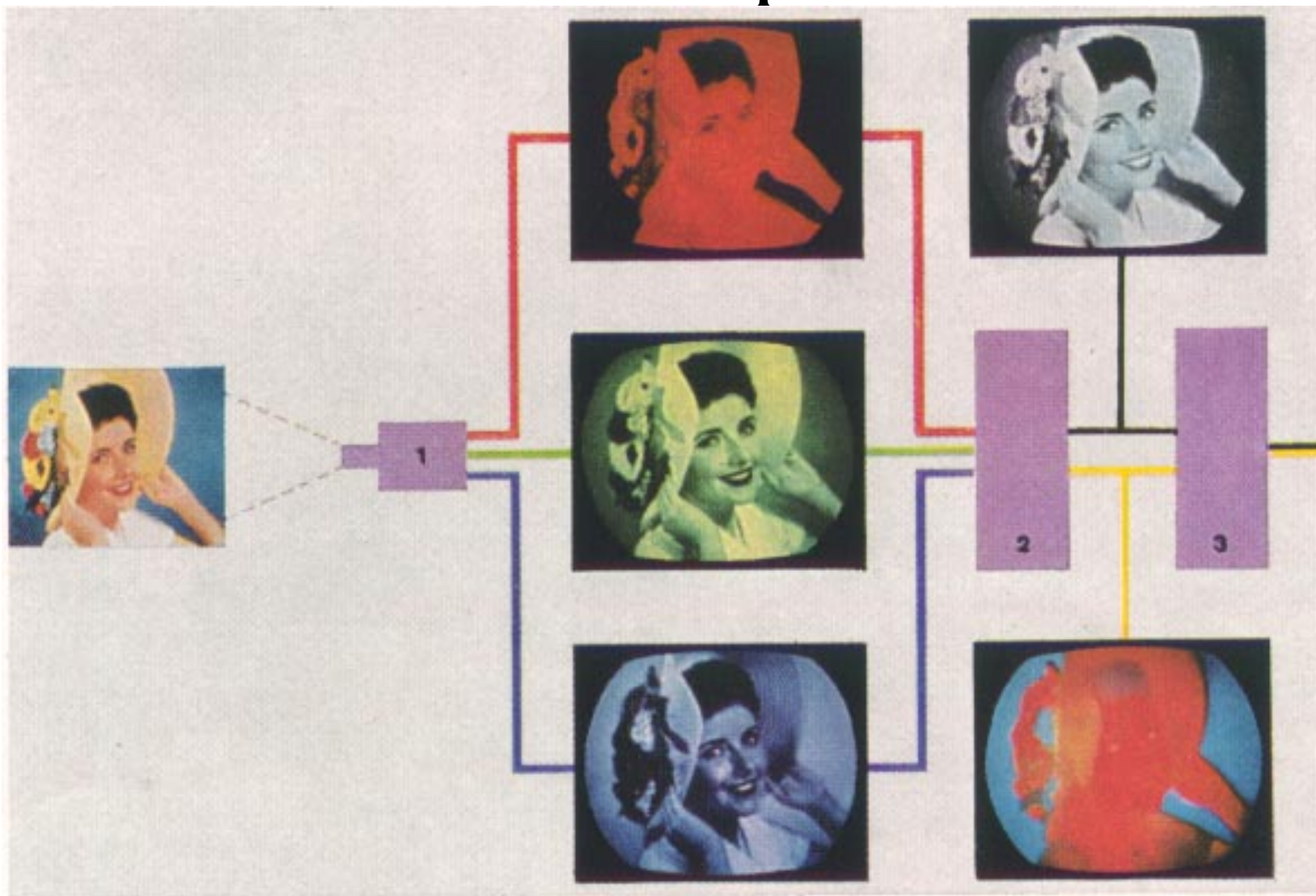




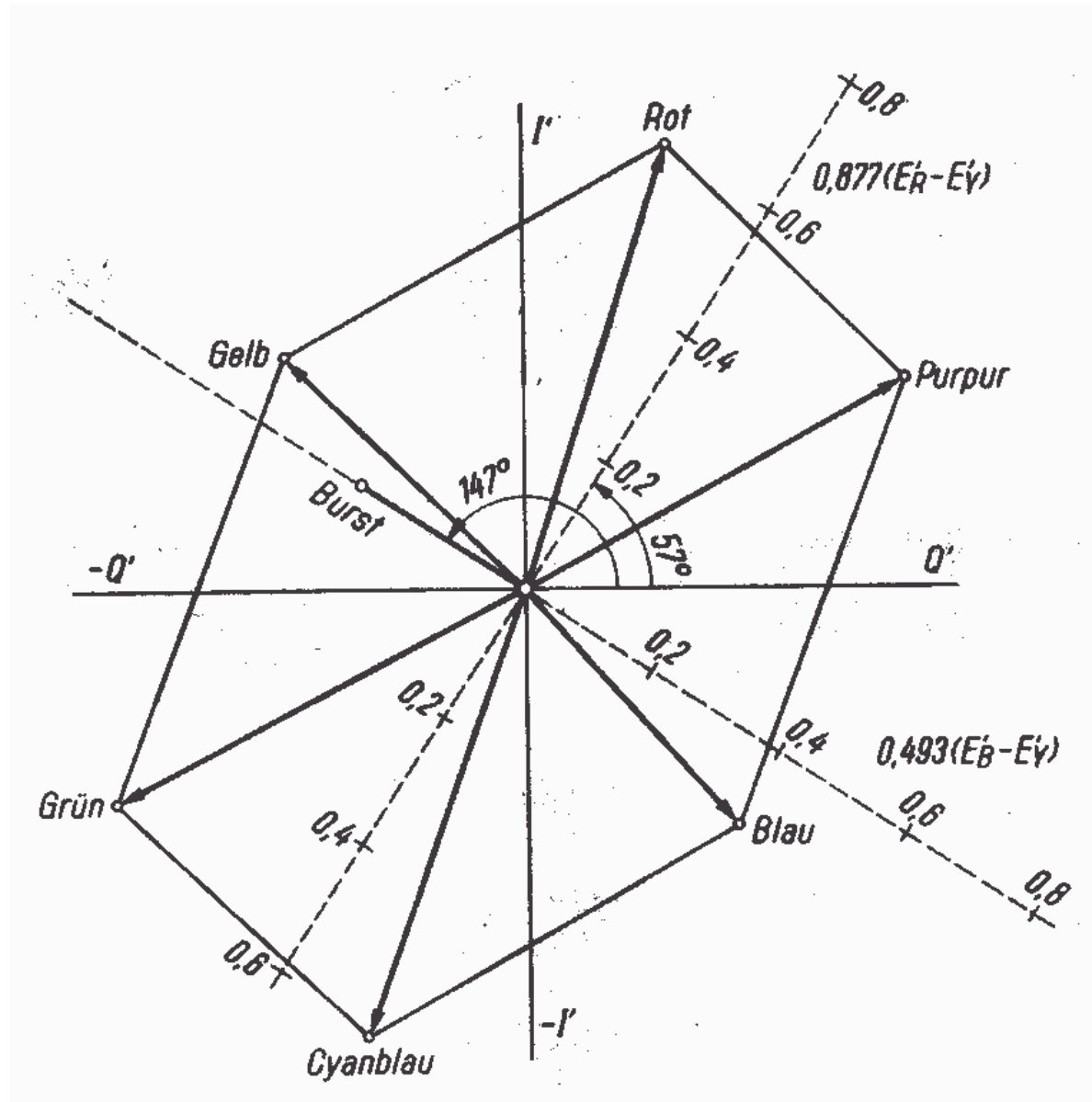
# PAL-Empfänger



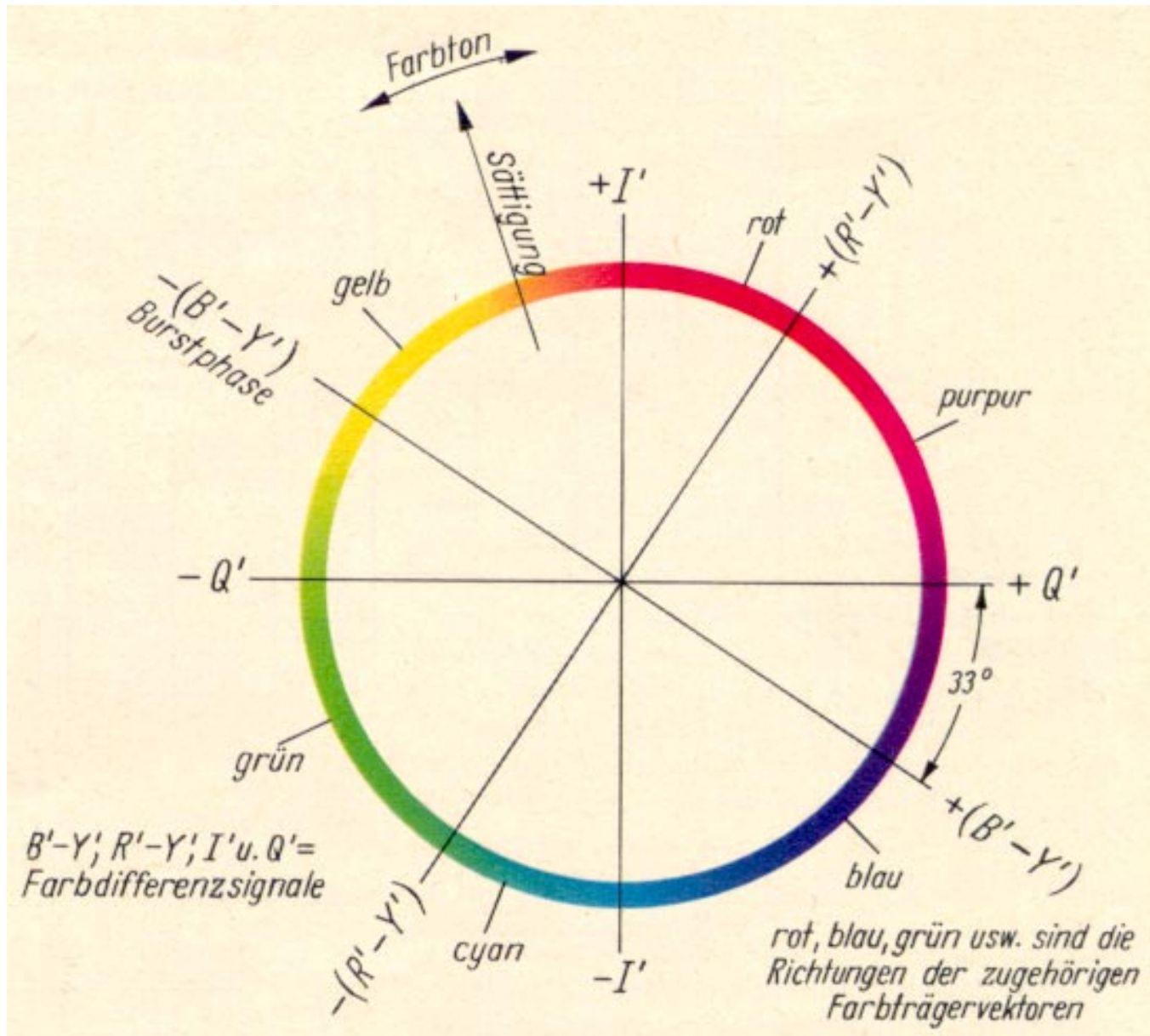
# Zerlegung in die RGB- und YUV-Komponenten



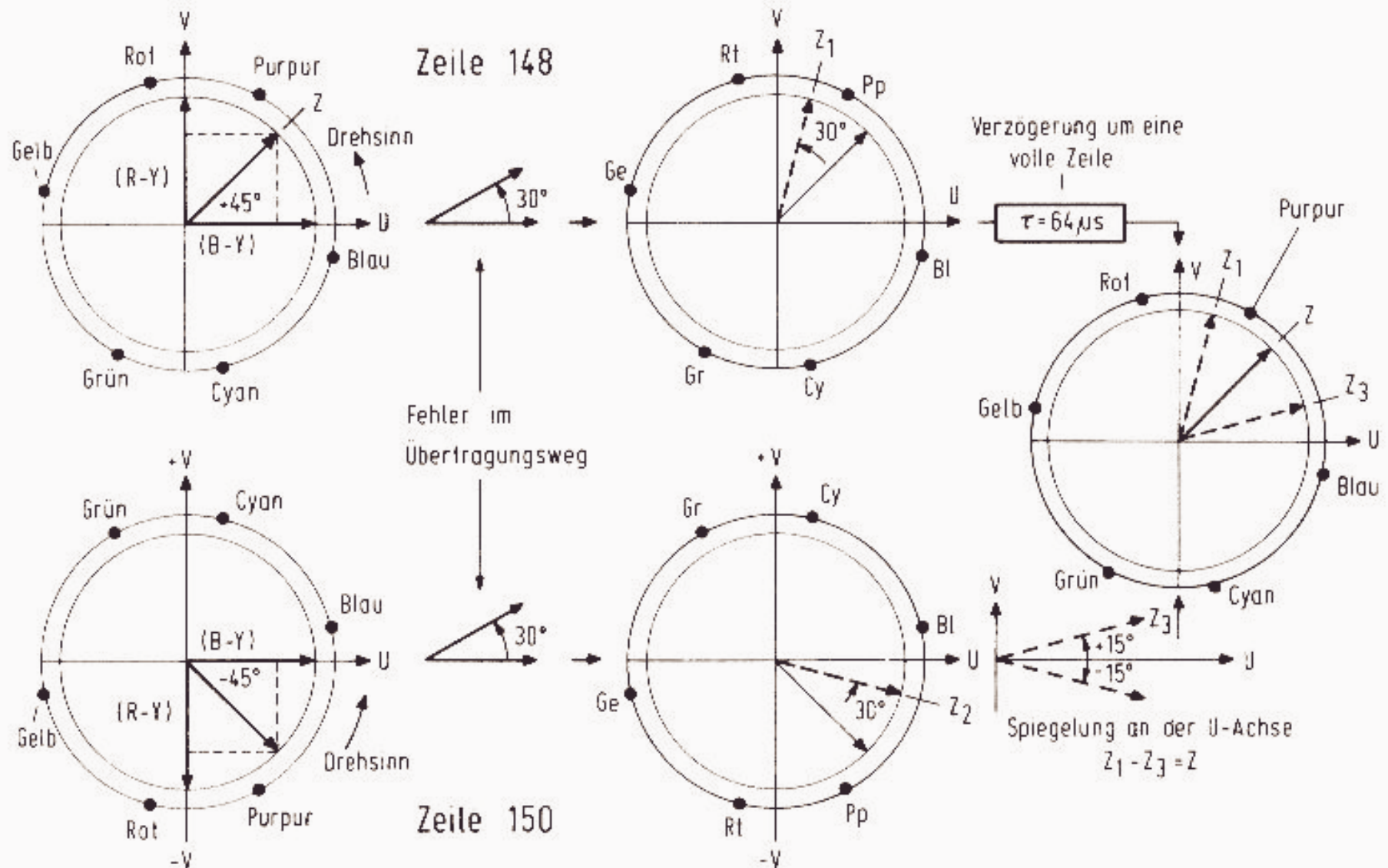
# NTSC-Farbvektoren



# NTSC-Farbkreis

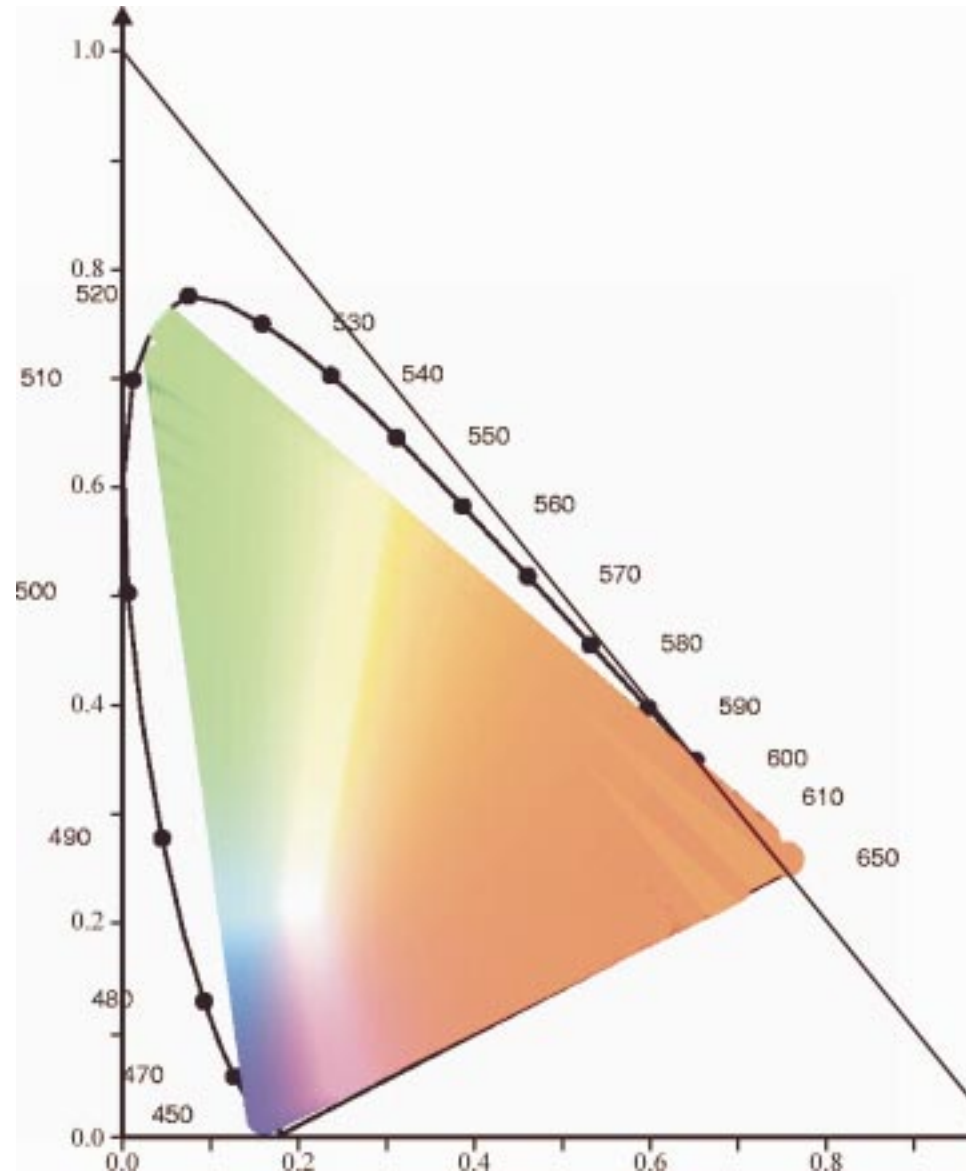


# PAL-Verfahren



Leuchtdichtesignal (Luminanz)  $Y = 0.3 R + 0.59 G + 0.11 B$   
 5 Mz Bandbreite  
 Farbdifferenzsignale (Crominanz)  $U = 0.493 (B - Y)$  1.3 -  
 2.5 MHz Bandbreite  $V = 0.877 (R - Y)$

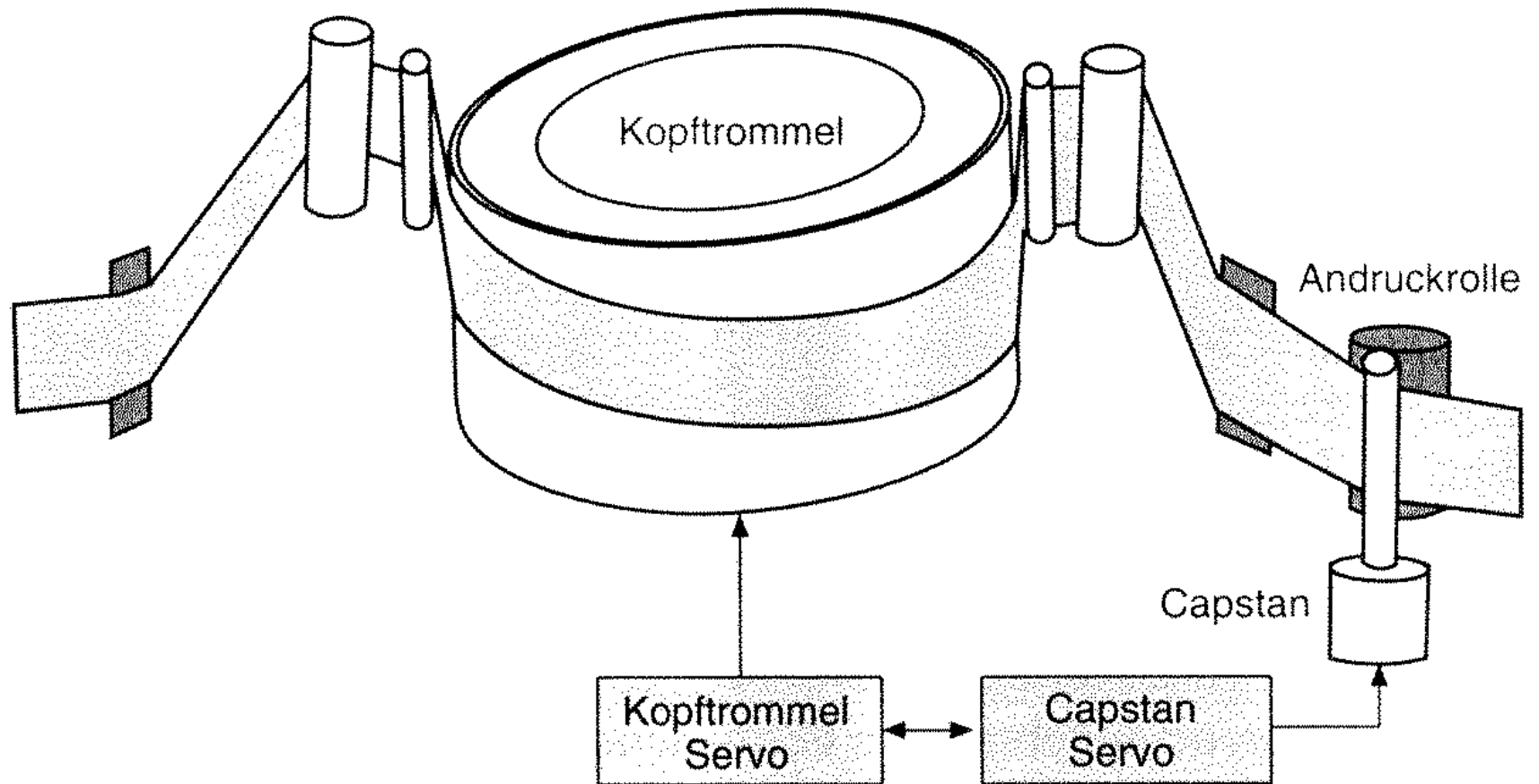
Komponentensignale:  
 $B = U/c_u + Y, \quad c_u = 0.493$   
 $R = V/c_v + Y, \quad c_v = 0.877$   
 $G = Y - 0.3/0.59 V/c_v - 0.11/0.59 U/c_u$



# Videobandformate

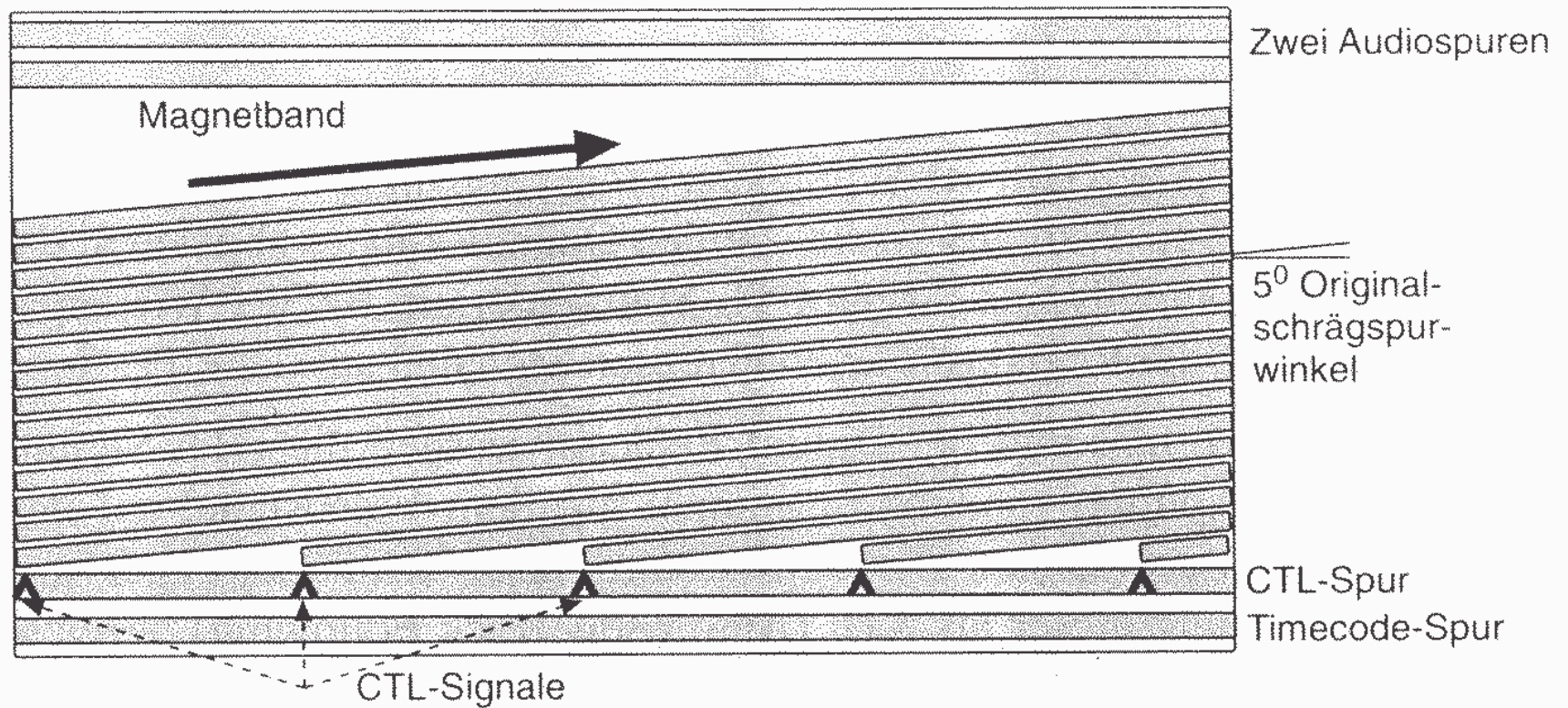
	1950	1960	1970	1980	1990
FM-Direkt		Quadruplex		1" B, 1" C	
Colour Under			U-Matic VCR	Betamax VHS	Video8 Hi8 S-VHS
Komponenten				Betacam (SP) MI MII	
Digital Composite					D2 D3
Digitale Komponenten					D1 DCT D5 D-Beta DVC

# Bandführung beim Schrägspurverfahren





# Verteilung der Spuren auf dem Magnetband



# FM-Spektren von Videosignalen

