Minimum Average Power

$P_1 \rightarrow$ '1' bit

$P_0 \rightarrow$ '0' bit

$I_1 = R P_1$

$I_0 = R P_0 \leftarrow 0$

$\bar{P}_{rec}$ = Av. received power

$= \dfrac{P_1 + P_0}{2} = P_1/2$

$P_1 = 2\bar{P}_{rec}$

Noise:

'0' $\qquad \sigma_0^2 = \sigma_T^2$

'1' $\qquad \sigma_1^2 = \sigma_s^2 + \sigma_T^2$

$$\sigma_s^2 = 2 q R (2 \bar{P}_{rec}) B$$

$$\sigma_T^2 = \frac{4 K T B}{R_L}$$

$$Q = \frac{I_1 - I_0}{\sigma_1 + \sigma_0} = \frac{I_1}{\sigma_1 + \sigma_0}$$

$$= \frac{2 R \bar{P}_{rec}}{(\sigma_s^2 + \sigma_T^2)^{1/2} + \sigma_T}$$

$$\bar{P}_{rec} = \frac{Q}{R}\left(q B Q + \sigma_T\right)$$

Thermal Noise Dominated

$$\bar{P}_{rec} = \frac{Q \sigma_T}{R} \propto \sqrt{B}$$

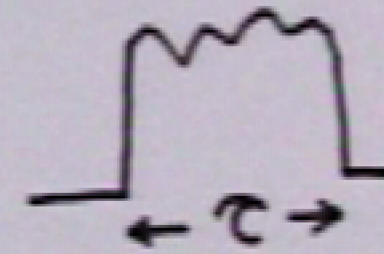
Short Noise Dominated

$$\bar{P}_{rec} = \frac{q B Q^2}{R} \propto B$$

Quantum Limit of Detection

No. of e-h pairs

$$N = \frac{\eta}{hf} \int_0^{\tau} P(t)\, dt$$

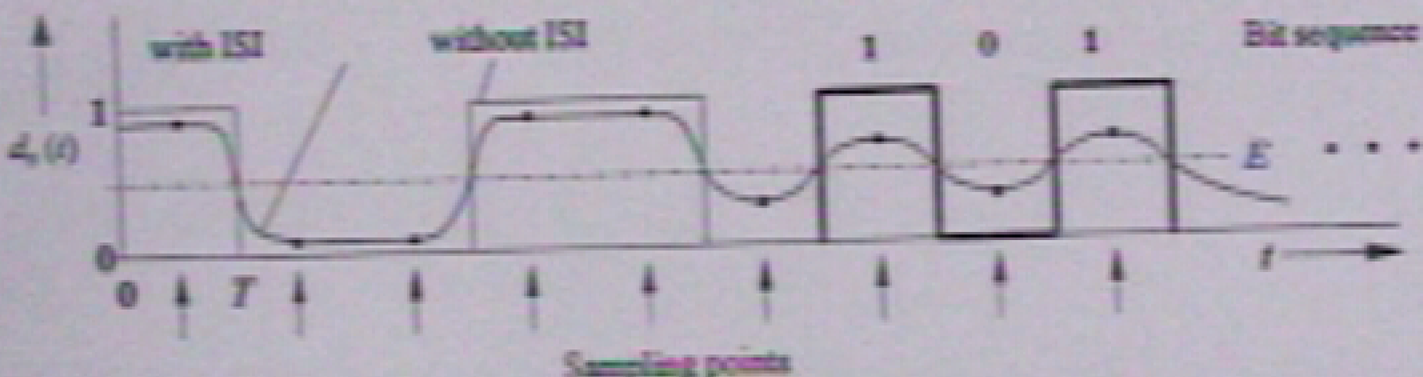


Prob of n e-h pairs

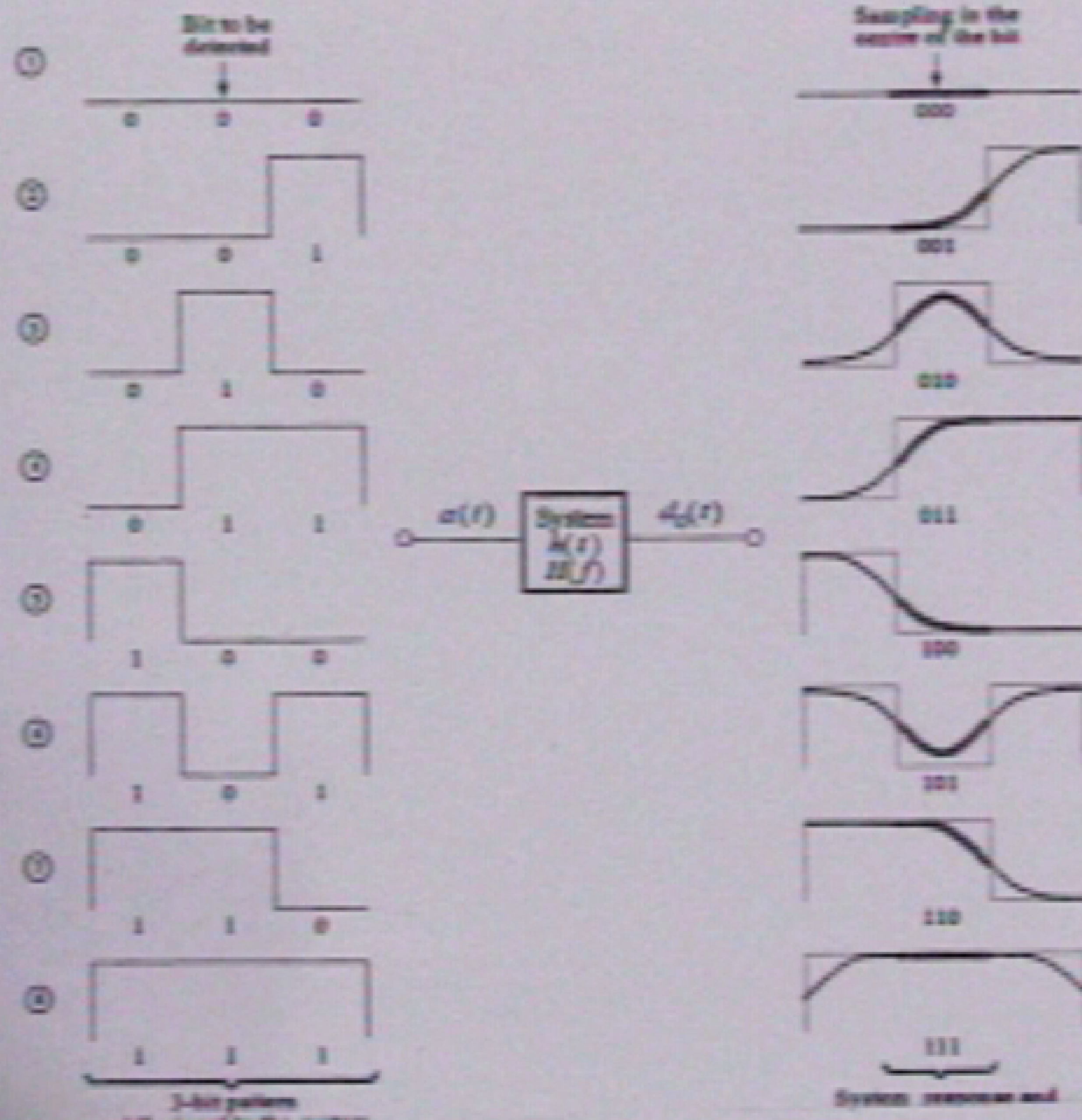
$$P(n) = N^{n} \frac{e^{-N}}{n!}$$ Poisson's Distribution

$$P(0) = N^{0} \frac{e^{-N}}{0!} = e^{-N} = 10^{-9}$$

$$N \approx 21$$



with ISI
without ISI
1 0 1
Bit sequence
1
E
0
t
0
T
Sampling points



Bit to be detected
Sampling in the centre of the bit
0 0 0
0 0 1
0 1 0
0 1 1
1 0 0
1 0 1
1 1 0
1 1 1
System
h(t)
H(f)
000
001
010
011
100
101
110
111
System response and

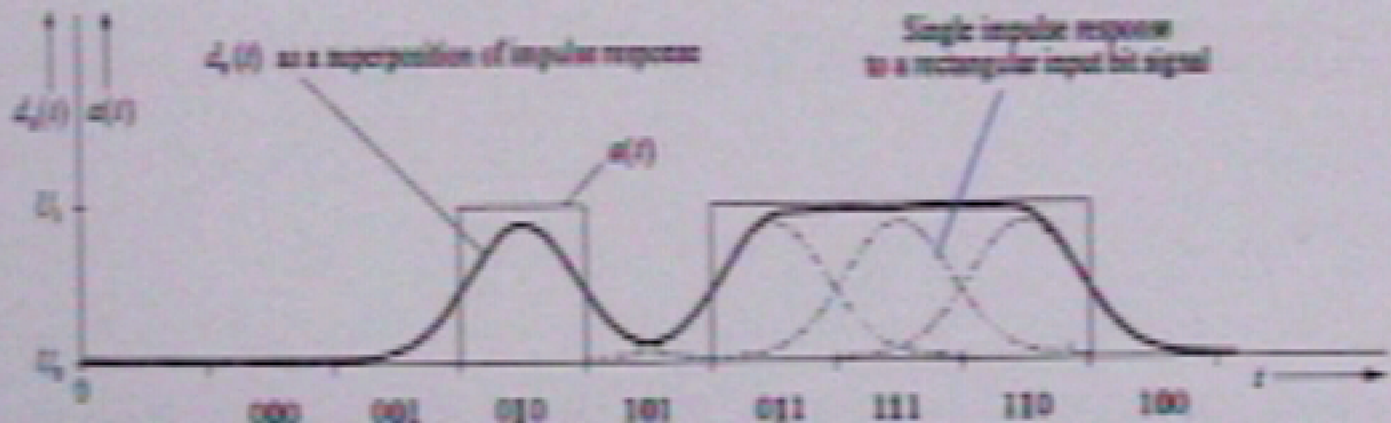
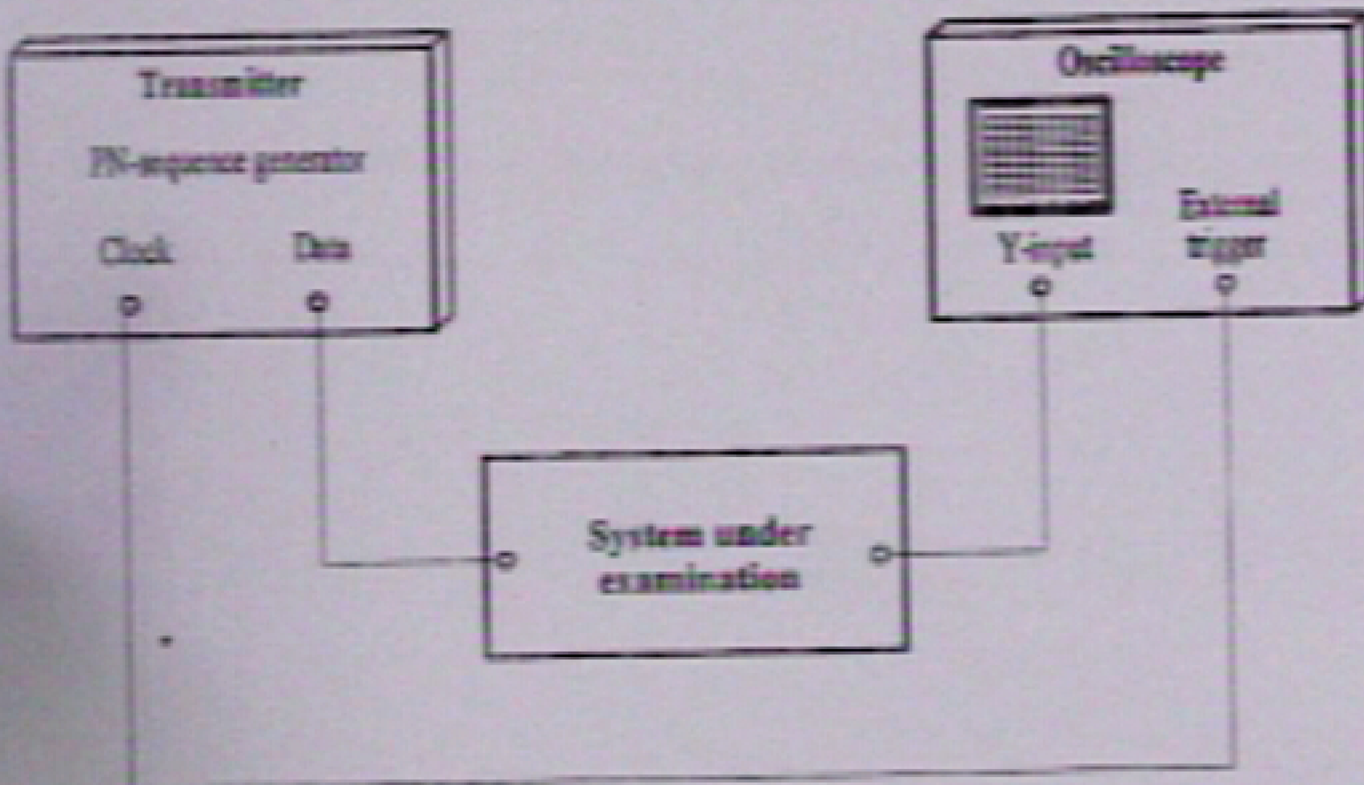
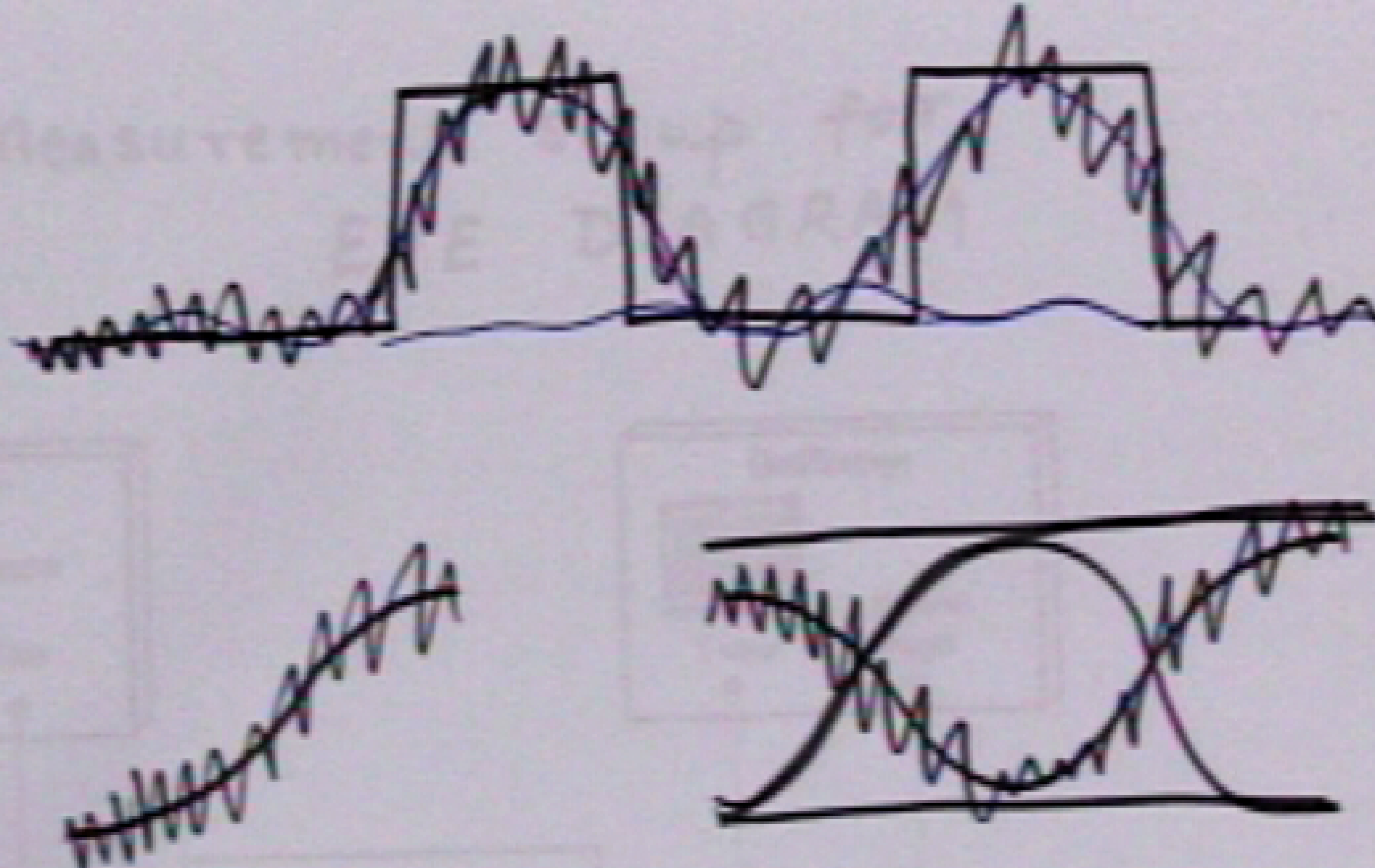


Fig. Principle of eye pattern recording (explanation 1)

Measurement setup for EYE DIAGRAM





EYE DIAGRAM