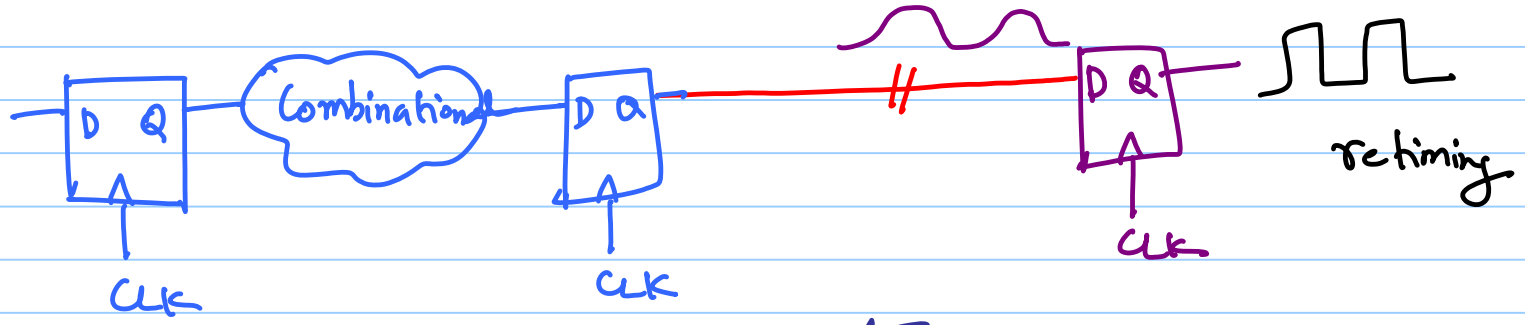
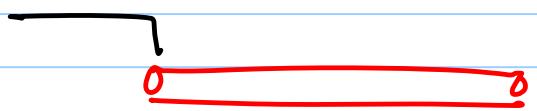
ECE 504 - Lecture 24

Note Title 11/16/2016

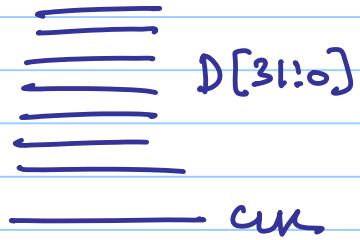


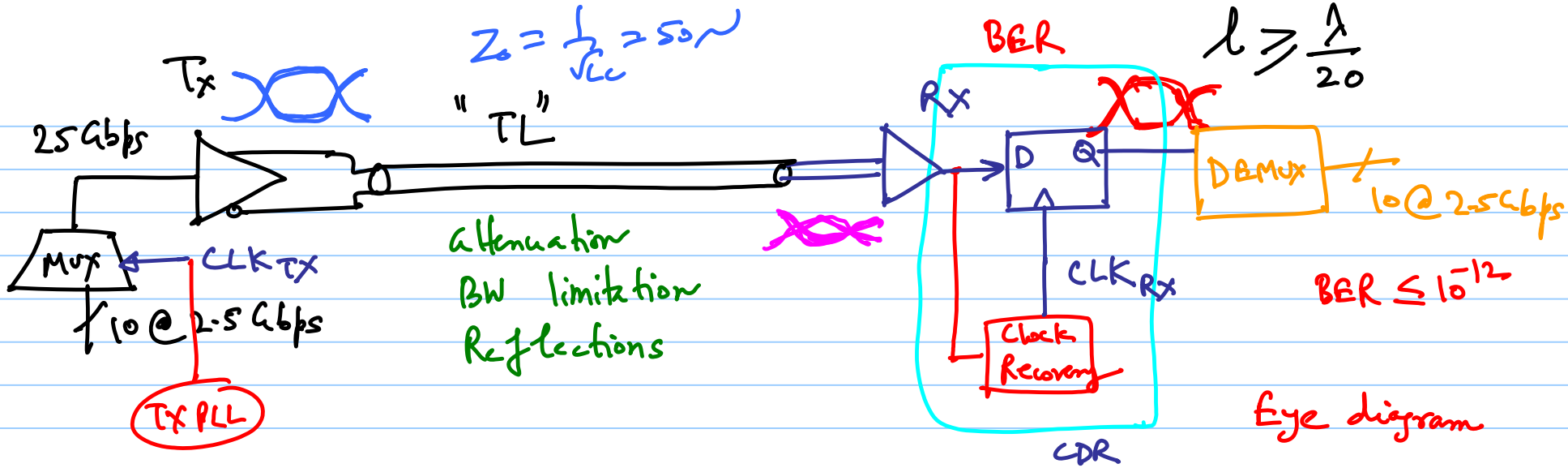
1 Tbps



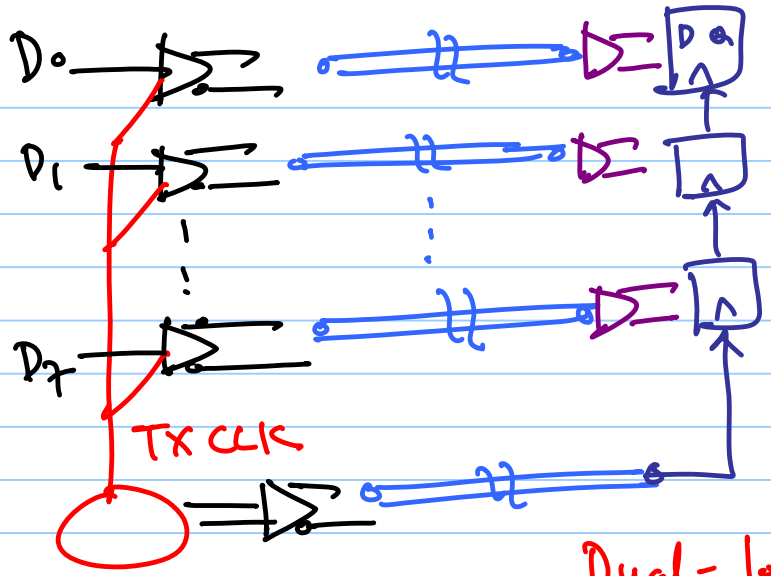
→ 28 Gbps

SERDES
SerialIo





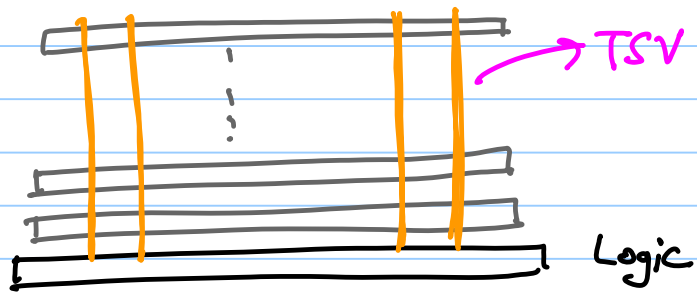
1. CDR → recover clock & sample incoming data
2. local PLL at RX at known frequency
3. clock forwarding

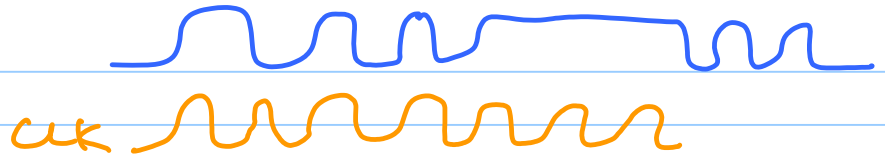


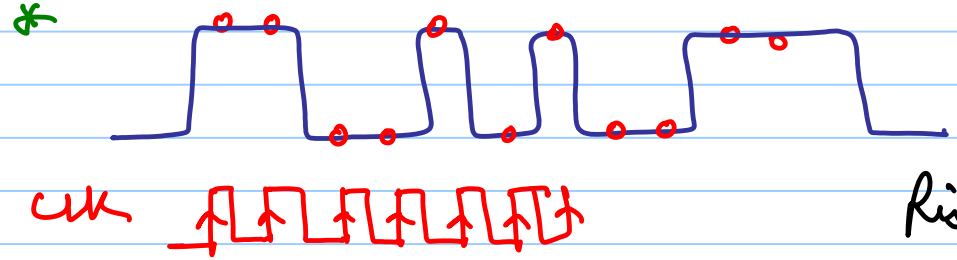
Dual-loop CDR

↳ separate clock generation + phase alignment

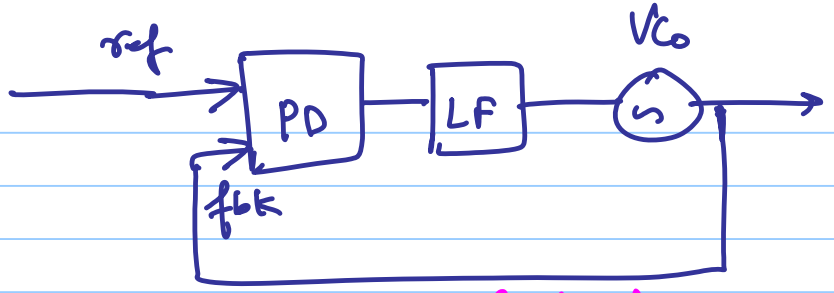
HMC / 3DIc

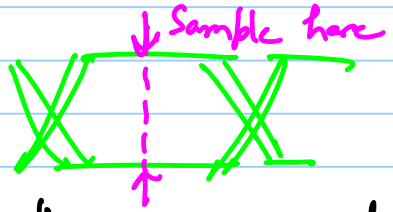






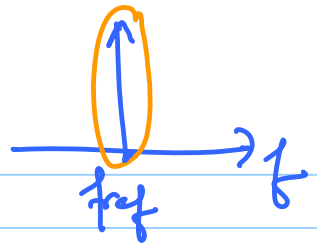
* the recovered clock should have low jitter

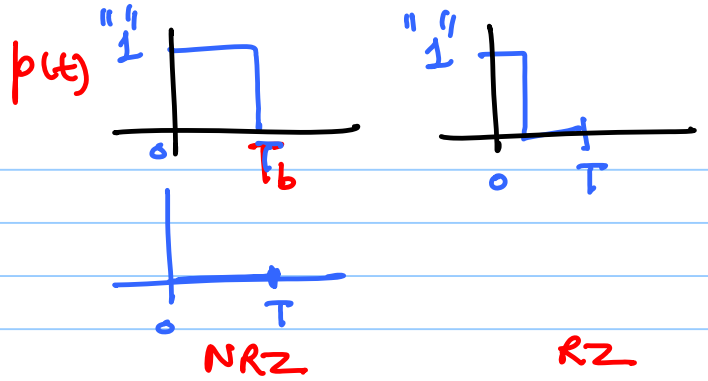




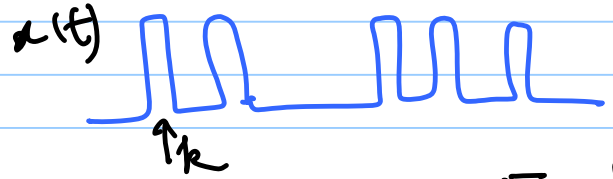
Rising edge of the recovered clock should align with the middle of the bit period (i.e. center of the data)

↳ provides maximum margin for jitter & other error





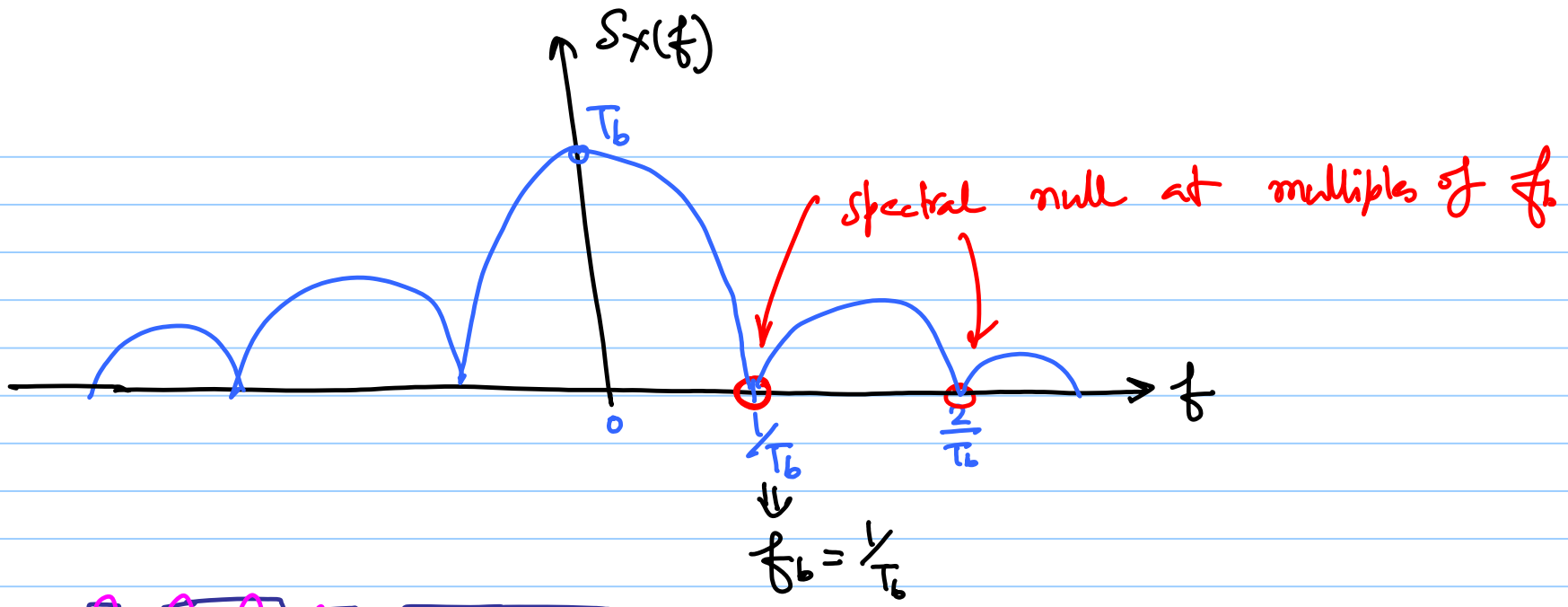
$\Rightarrow$ Random NRZ data



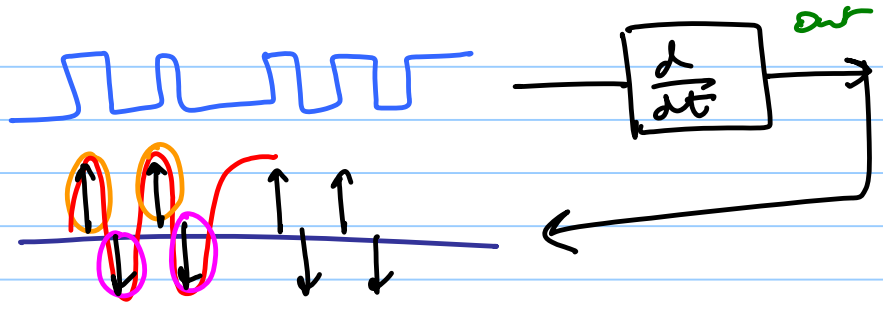
$$x(t) = \sum_k \underbrace{b_k}_{\text{random bit stream}} \cdot \underbrace{p(t - kT_b)}_{\text{NRZ}}$$

PSD: $S_x(f) = T_b \cdot \text{Sinc}^2(fT_b)$

$$\text{Sinc}(x) = \frac{\text{Sinc}(\pi x)}{\pi x}$$

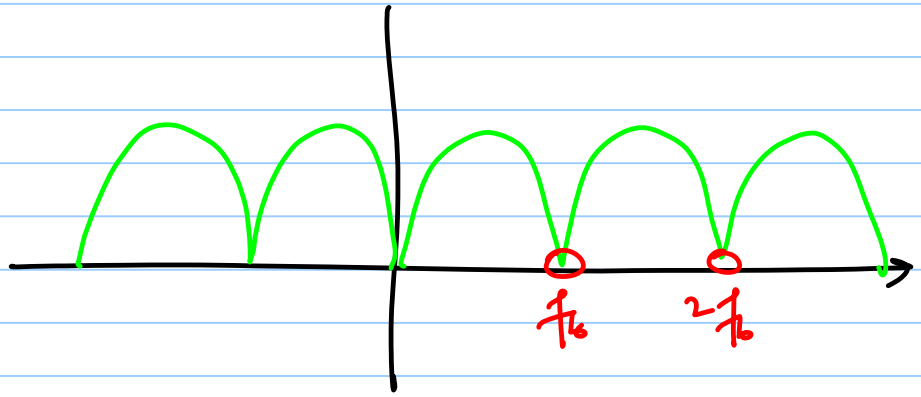

$S_X(f)$
T_b
spectral null at multiples of f_b
0
$\frac{1}{T_b}$
$\frac{2}{T_b}$
f
$f_b = \frac{1}{T_b}$

$$\frac{d}{dt}x(t) \xleftrightarrow{\mathcal{F}} (2\pi f)X(f)$$

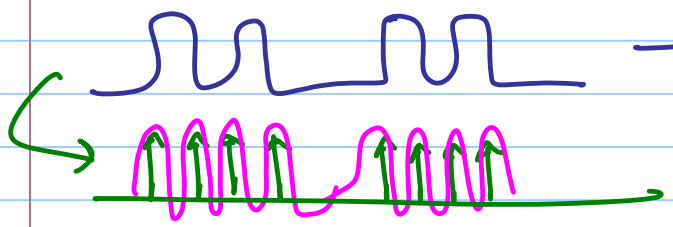


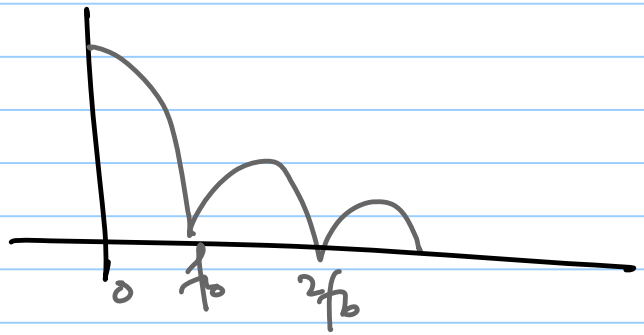
$$S_{out}(f) = (2\pi f)^2 \left(\frac{\sin(\pi f T_b)}{\pi f T_b}\right)^2$$

$$= \left[\frac{2\sin(\pi f T_b)}{T_b}\right]^2$$

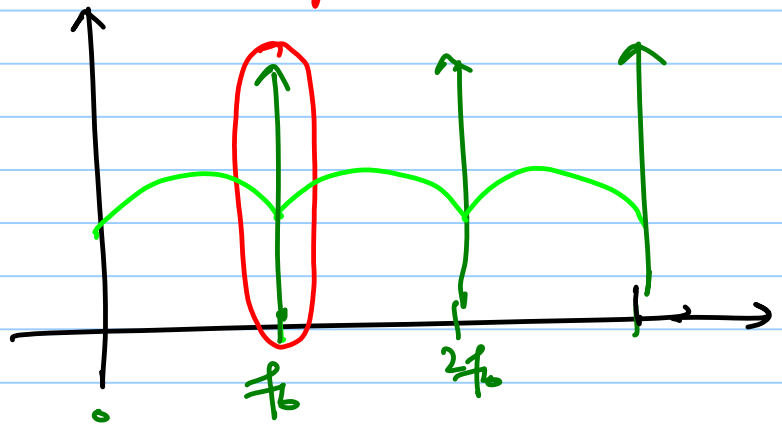


Edge detection + FW rectification

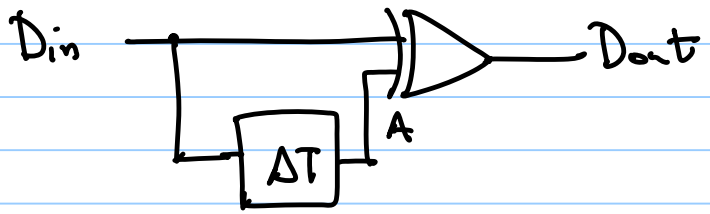


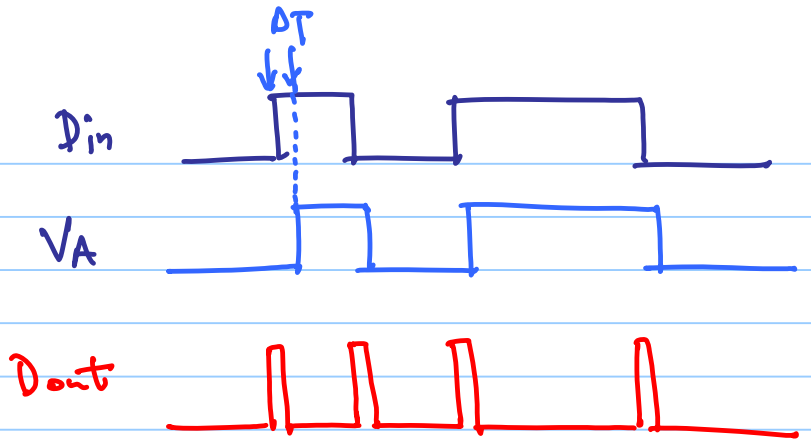


Spectral content at $\frac{n}{T_b}$!

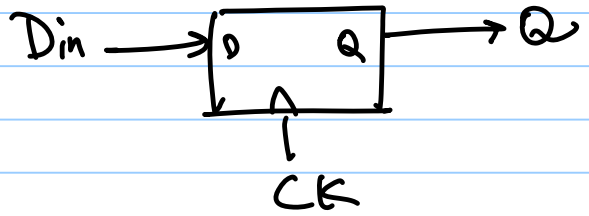


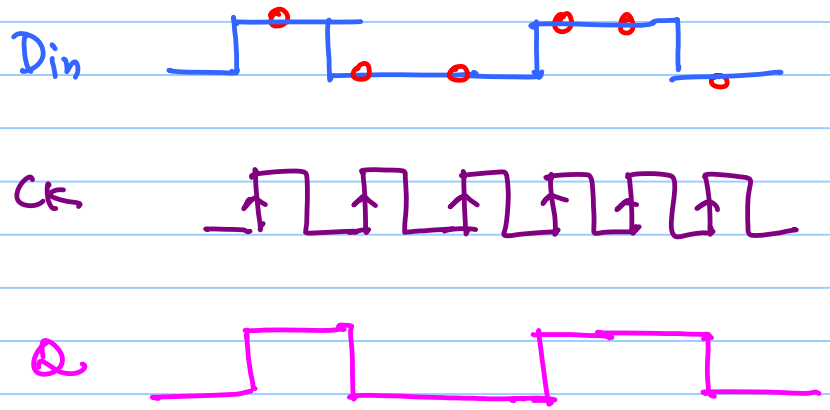
Edge Detector:





* How about DFF for phase detection?





① Hogge PD !