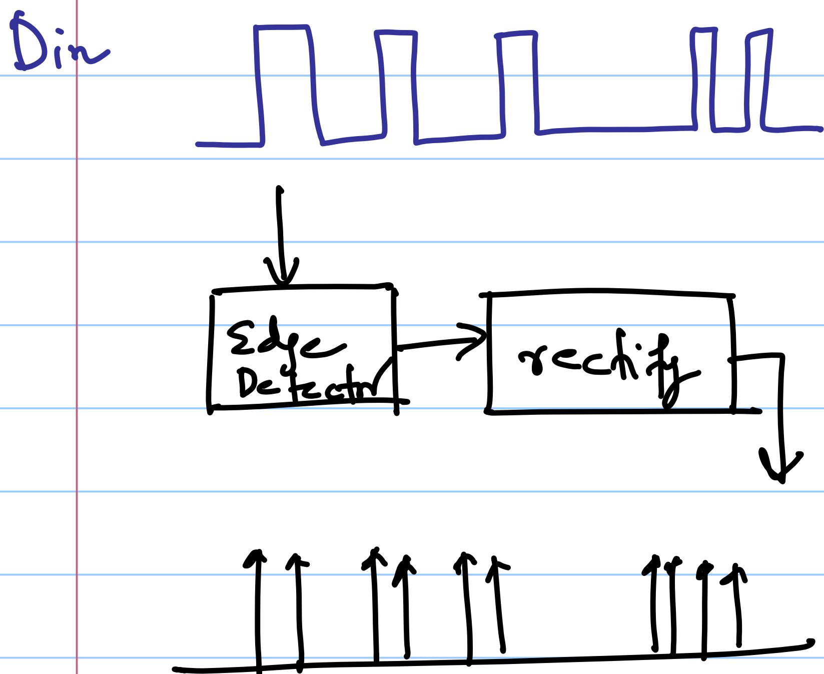
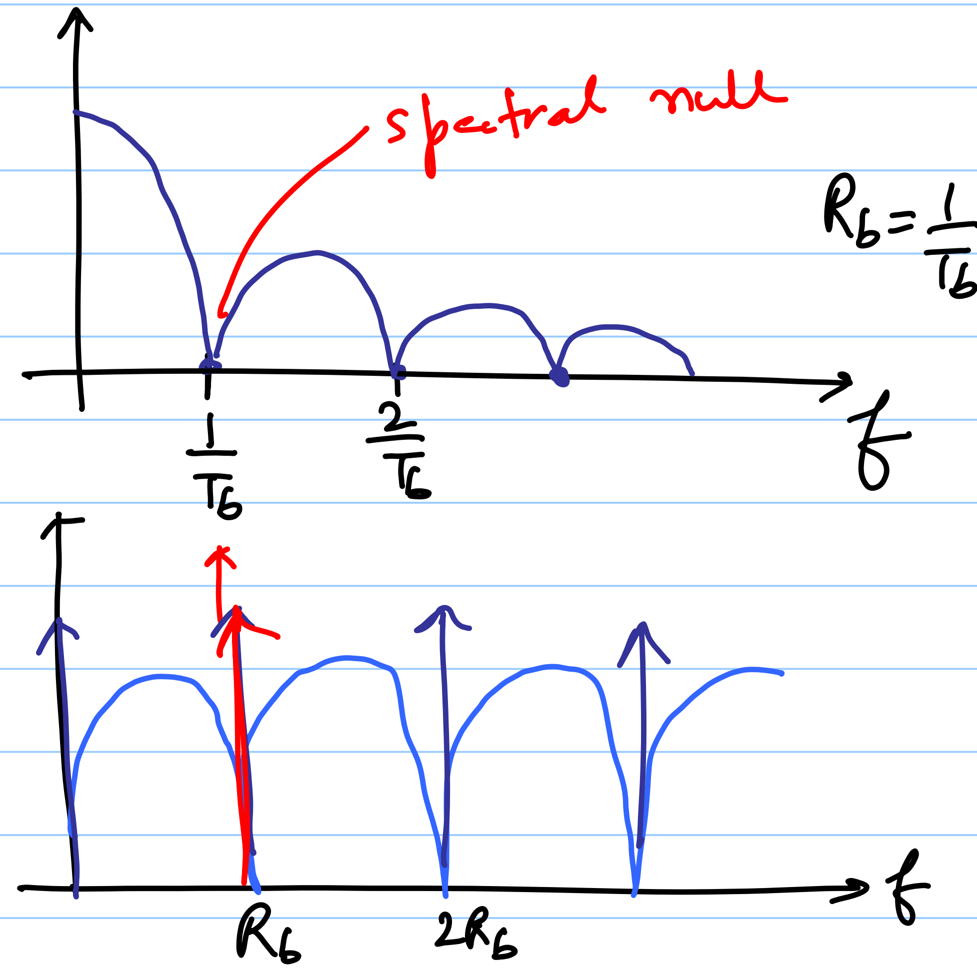
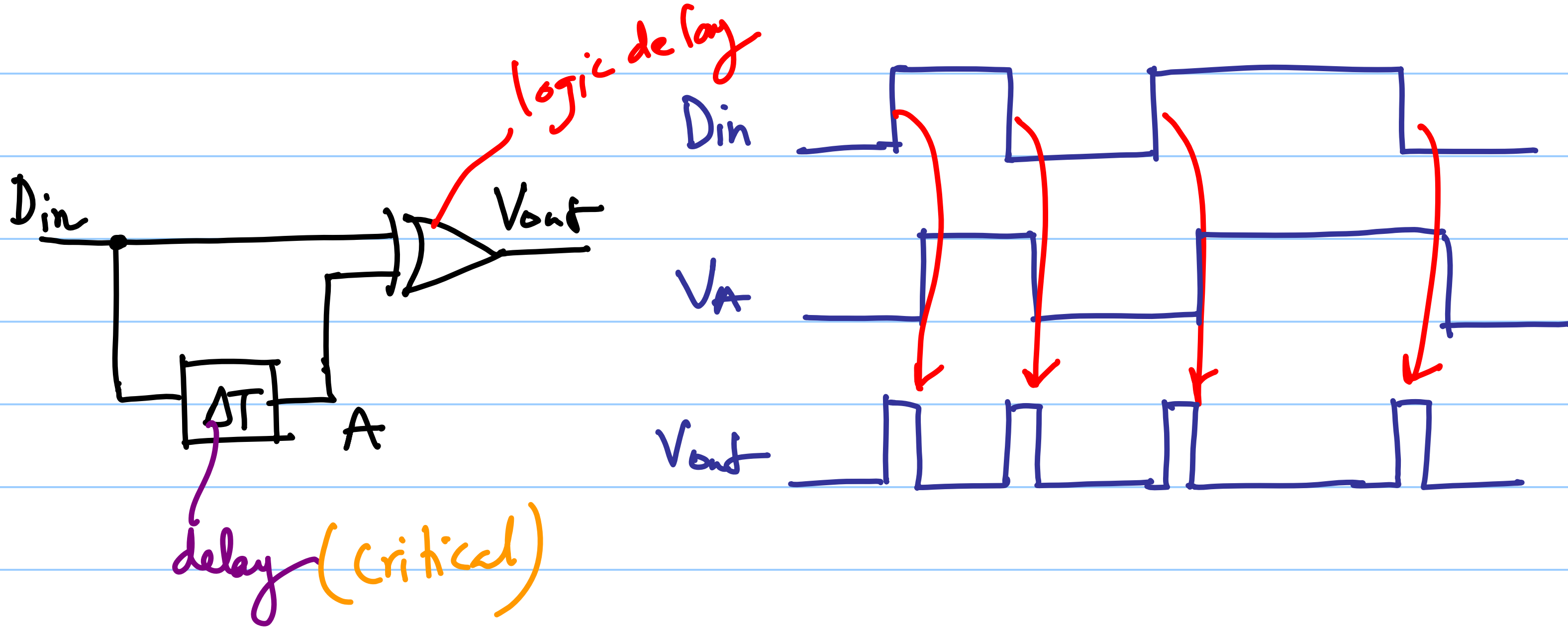
ECE 518 - Lecture 25

Note Title 4/21/2015

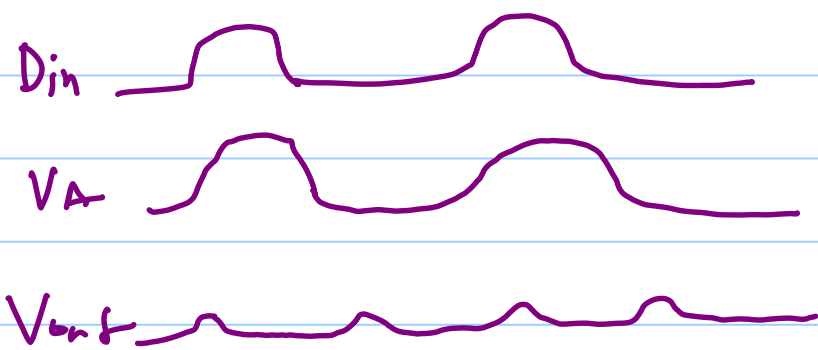




Edge Detector

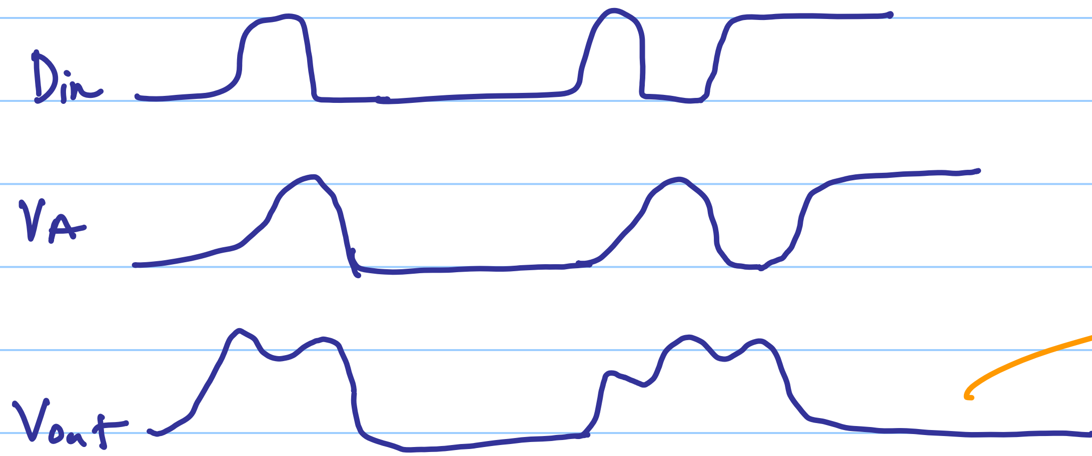


(i) If ΔT is not sufficiently large



→ very little energy at frequency R_b

(ii) If ΔT is too large $\simeq T_b$



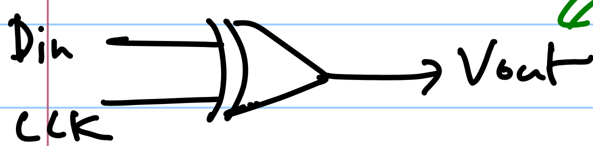
effectively no edge detection

Phase Detection :

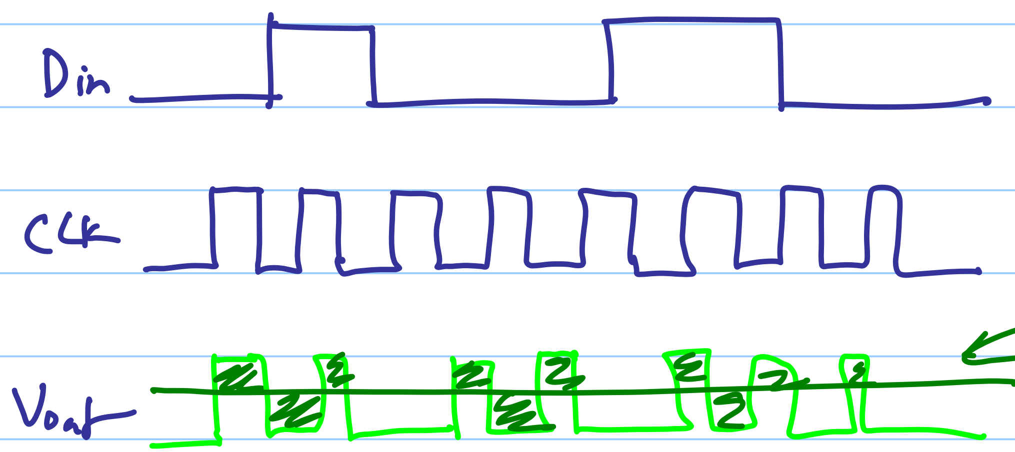
* following edge detection we need to generate clock that samples data at its peak value
  - ↳ measure the phase difference b/w the data edges & clock to drive the VCO towards the desired value.
    - ↳ PLL

* Since the spectrum of random data has null at the bit-rates, PD/PFD used for periodic clock completely fail.

↳ can't use XOR, tri-state PFD



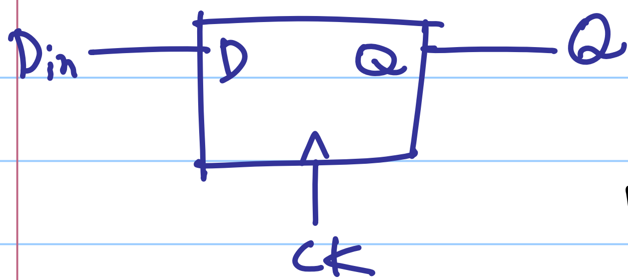
avg is always zero

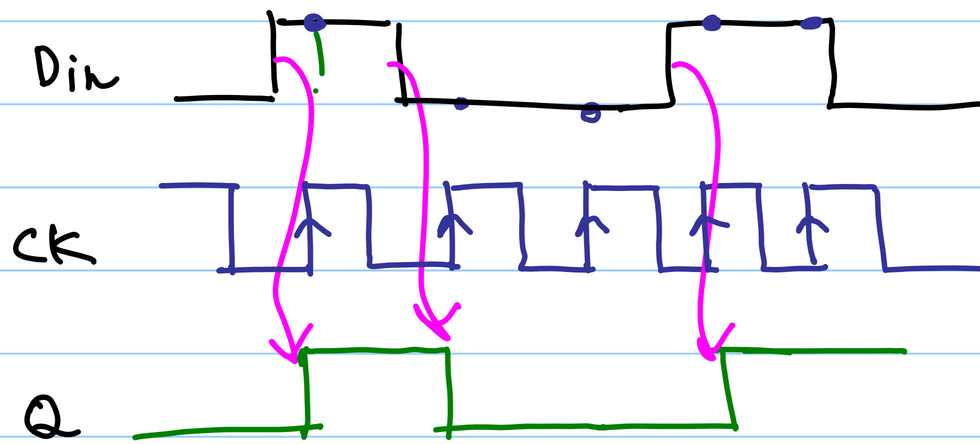


average is always zero irrespective of $\Delta\phi$

1's & 0's occur with equal probability

How about DFF for phase-detection:





Q ⇒ delayed replica of Din

↳ avg(Q) has no signal content

↳ Doesn't work!

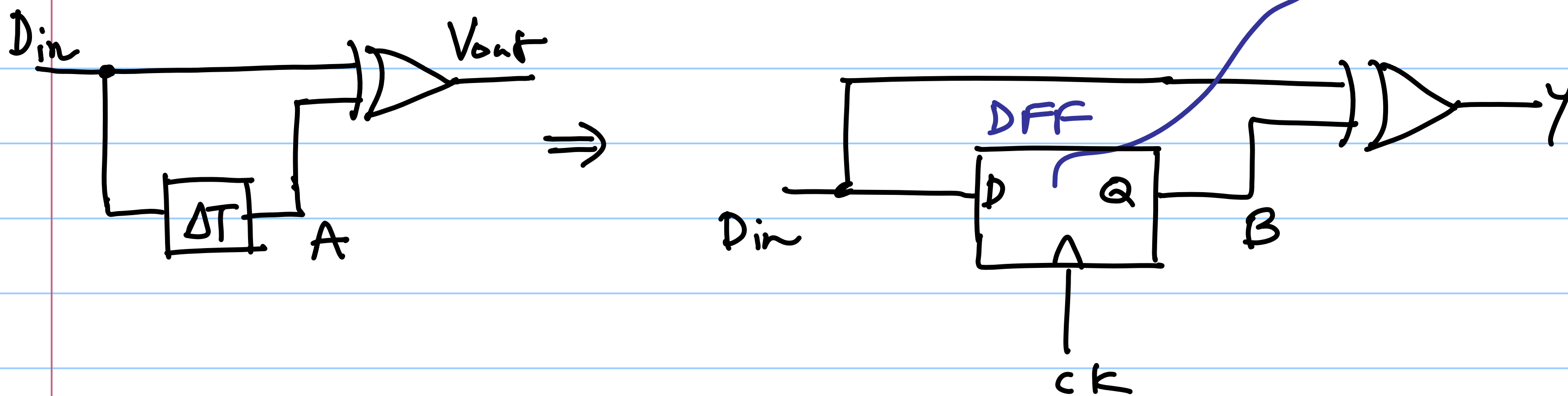
Phase Detectors for Random Data

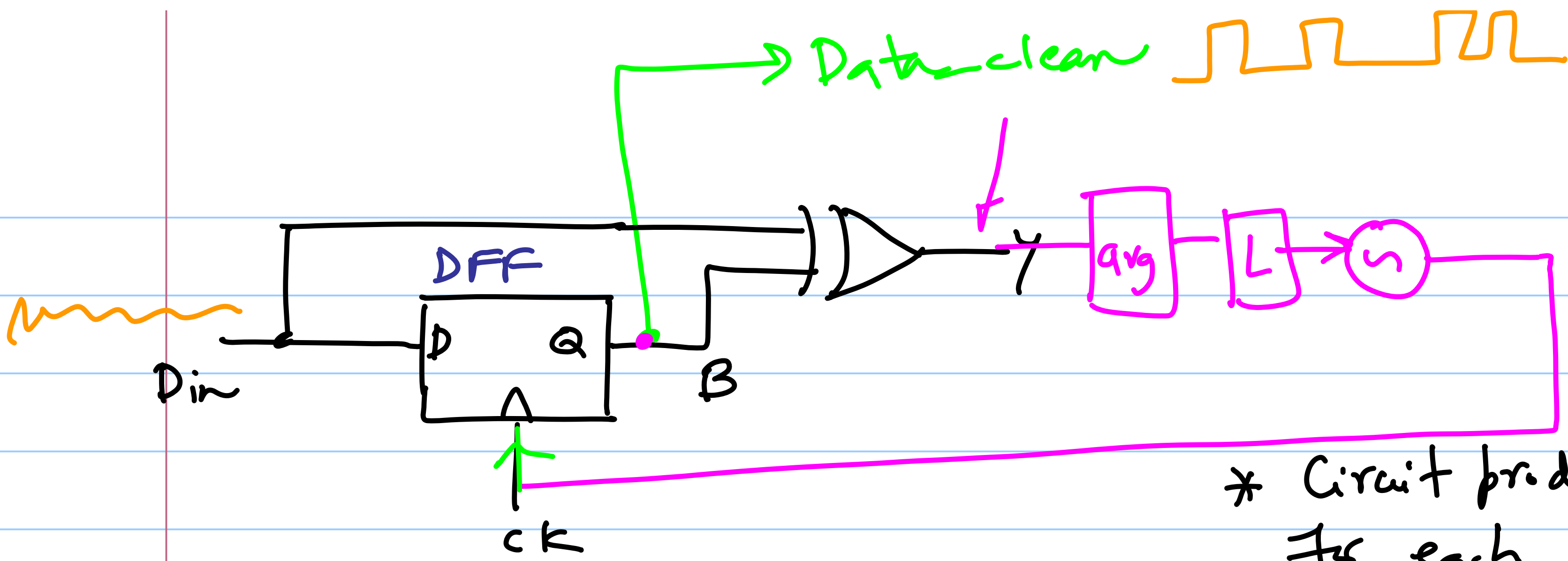
PD's for random data must perform

1. data transition (edge) detection
2. phase difference detection wrt to VCO CLK

① Hogge PD:

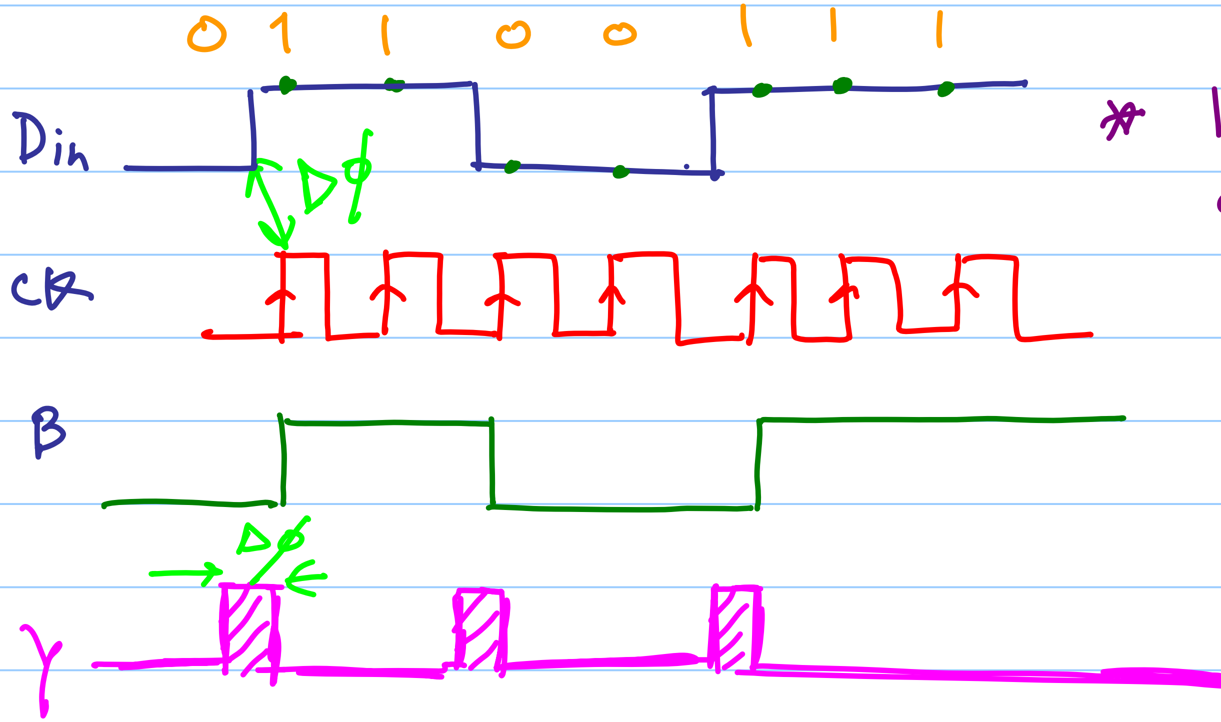
Current Mode Logic
↑
CML FF @ High-frequencies





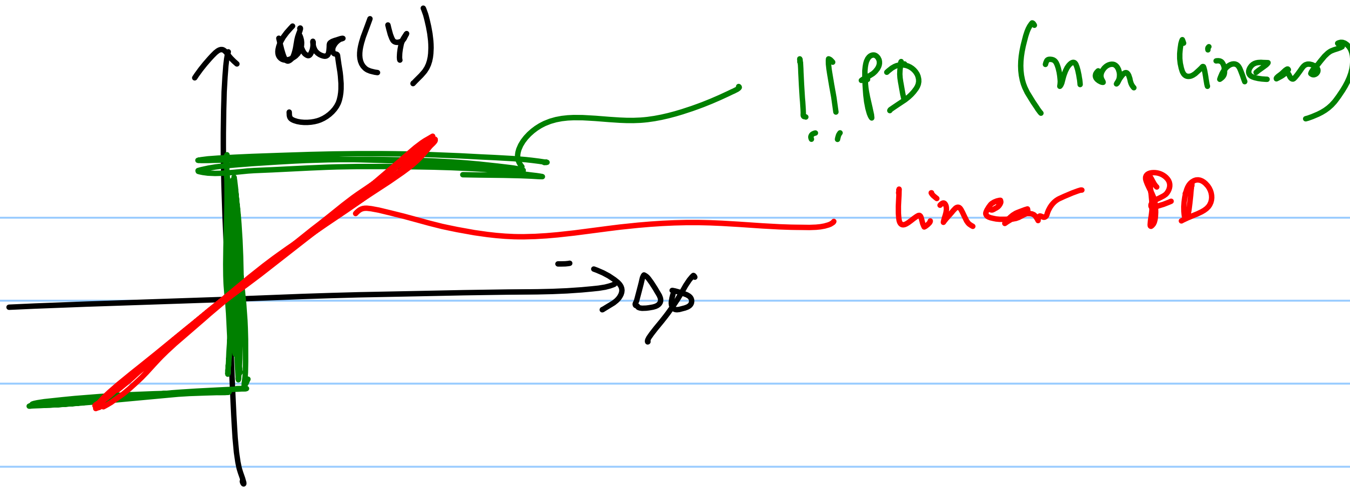
BER < 10^{-12}

* Circuit produces a pulse for each data transition



* The width of the o/p pulses vary linearly with the Δφ between Din & Ck.

"Linear PD"



more data pulses

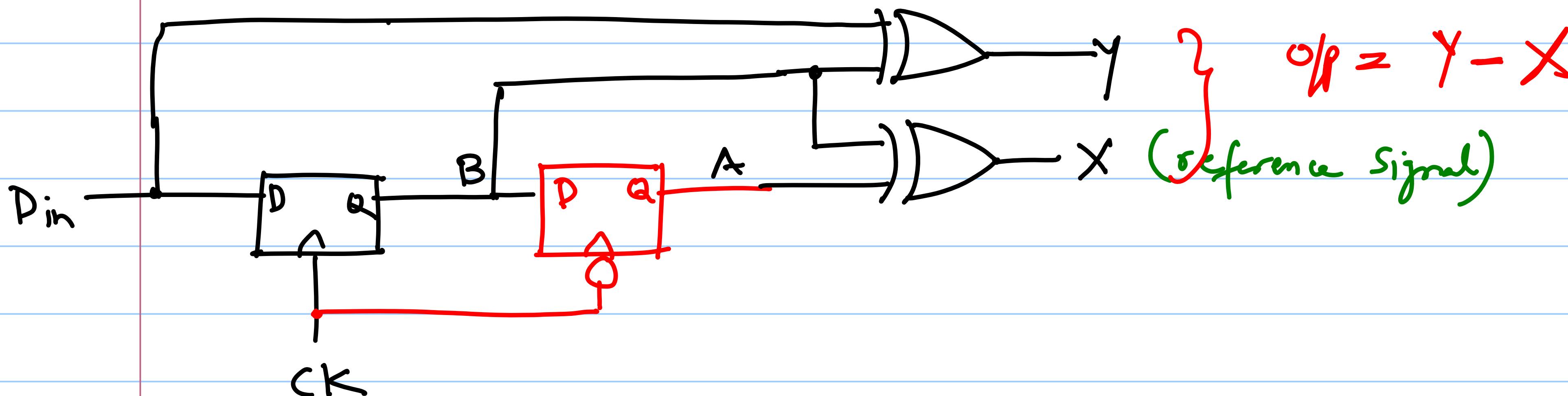
↳ more pulses in Y

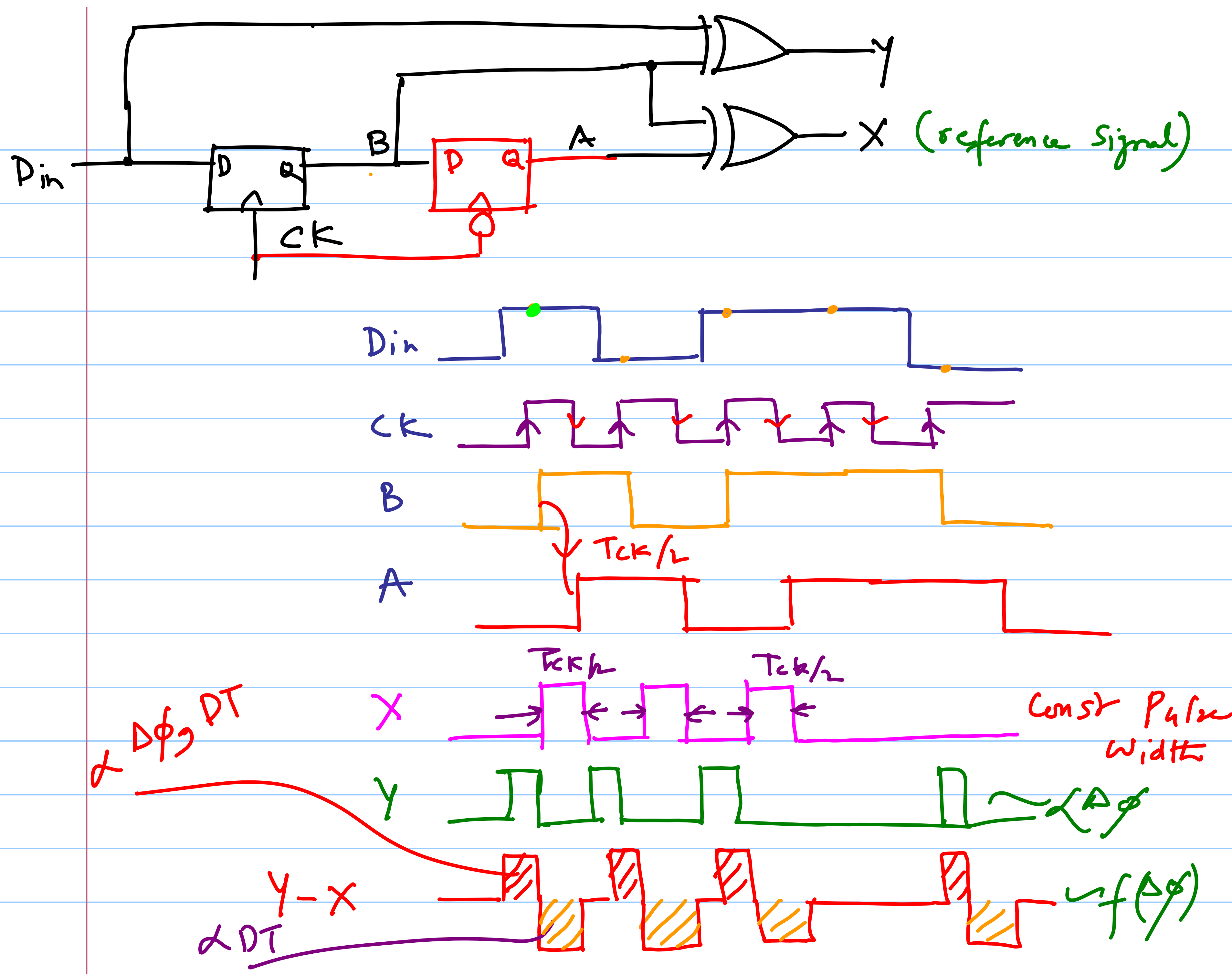
⇒ higher average value over time!

$$avg(Y) = f(\Delta\phi, \text{data transitions})$$

Need a reference pulse to compare with and generate
$o/p \propto \Delta\phi$

↳ reference pulse depends upon data density





Din
D
Q
B
D
Q
A
CK
Y
X
(reference Signal)
Din
CK
B
A
Tck/2
X
Tck/2
Tck/2
Const Pulse width
Y
~ ∠Δϕ
∝ Δϕ_g DT
Y-X
∝ DT
~ f(Δϕ)

$\arg(Y-X)$ uniquely represents $\Delta\phi$ irrespective of number of data transition

* Difference b/w Areas of X & Y at the PD output eliminates ambiguity due to transition density

* In locked condition X & Y produce equal widths

$\Rightarrow \arg(X-Y) = 0$

pulse width of X & Y $= \frac{T_{clk}}{2}$