ALCOR V1/V2: data rates and shutter simulation

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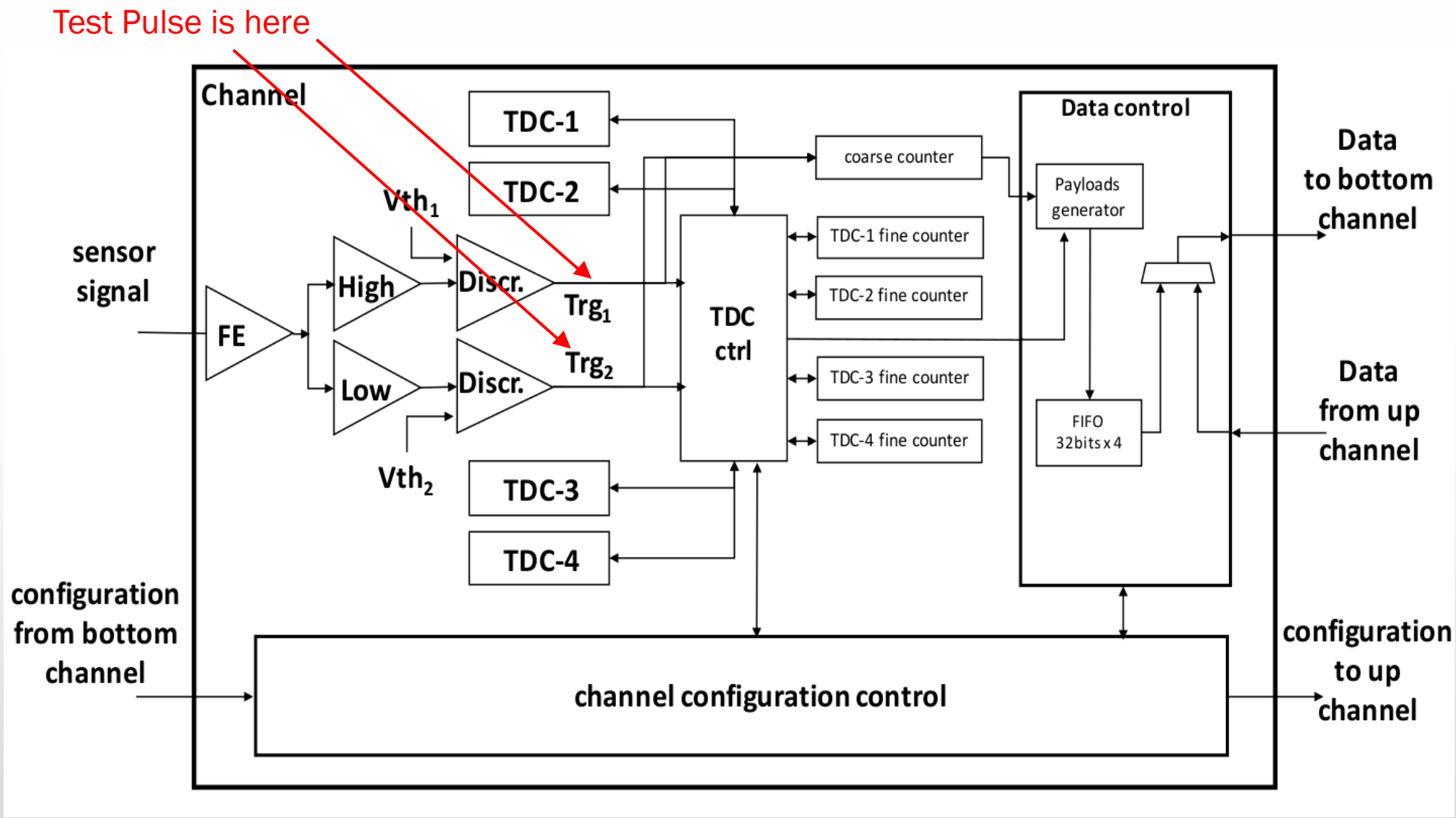
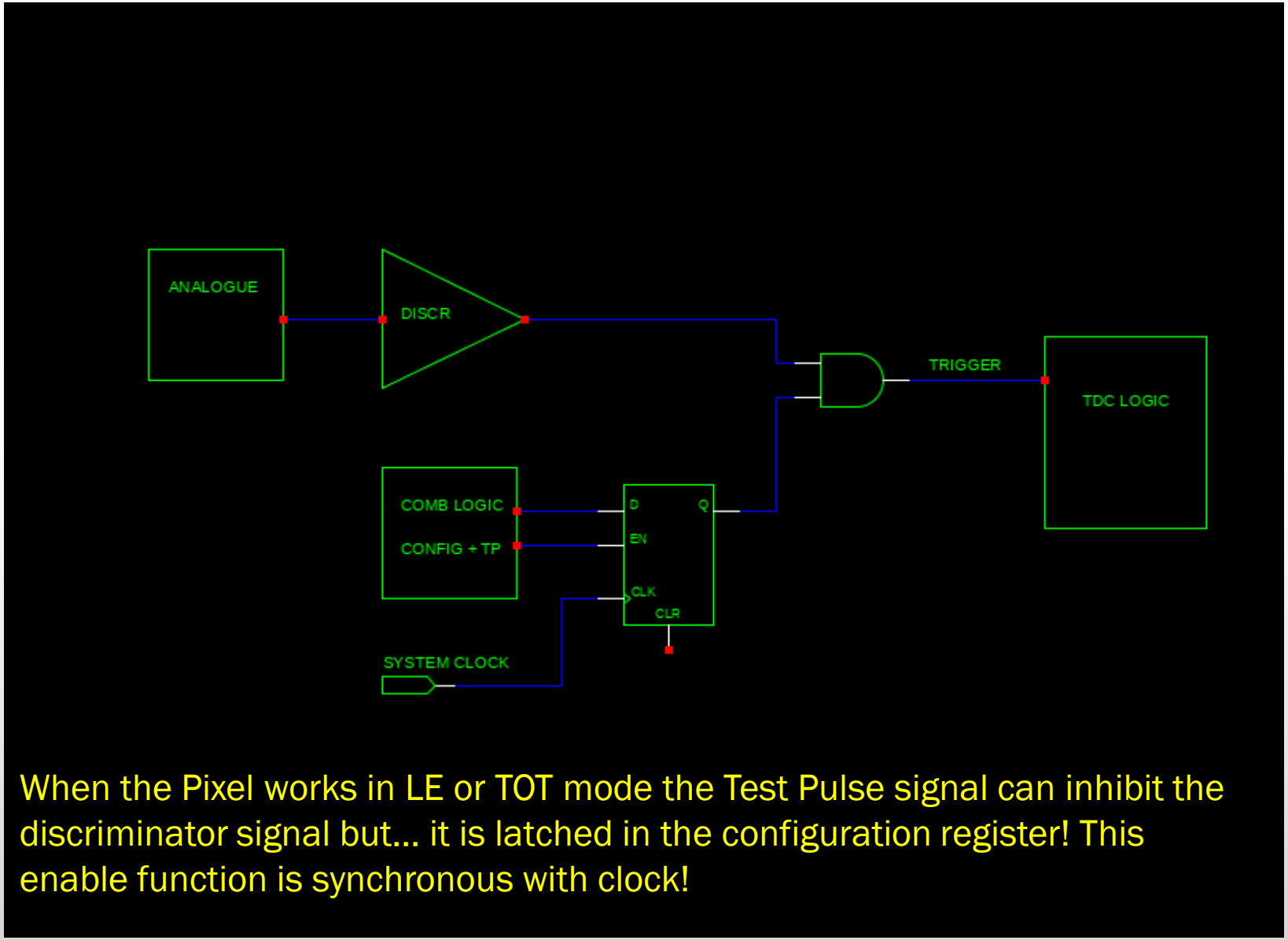
ALCOR V1/V2 maximum data rate

- Theoretical limitation: 4 links up to 640 Mb/s
  - 640 / 40 bits / 8 pixels => 2 MHz/pixel (1 MHz TOT mode)
- Simulation parameters
  - System clock: 3.1 ns
  - Input signal: Test Pulse to TDC
  - 256 hits per channel with constant period
  - 32 pixels readout
  - No status words
- Simulation measurements (full chip VHDL simulations)
  - No data loss up to 600 kHz / pixel
  - Data loss at higher rates due to End of Column FIFOs size (input FIFOs full flag)
  - The readout between Pixel Matrix and End of Column is capable up to 6 MHz per pixel
  - Single Pixel data loss (internal) at 7 MHz and more
- The data rate is limited by EoC FIFOs size (600 kHz/ch), then secondly by the number and speed of serializers (2 MHz/ch)
- Can we use a trigger/shutter signal to reduce the data rate?
- Can we use the same Test Pulse signal for this?

Channel diagram

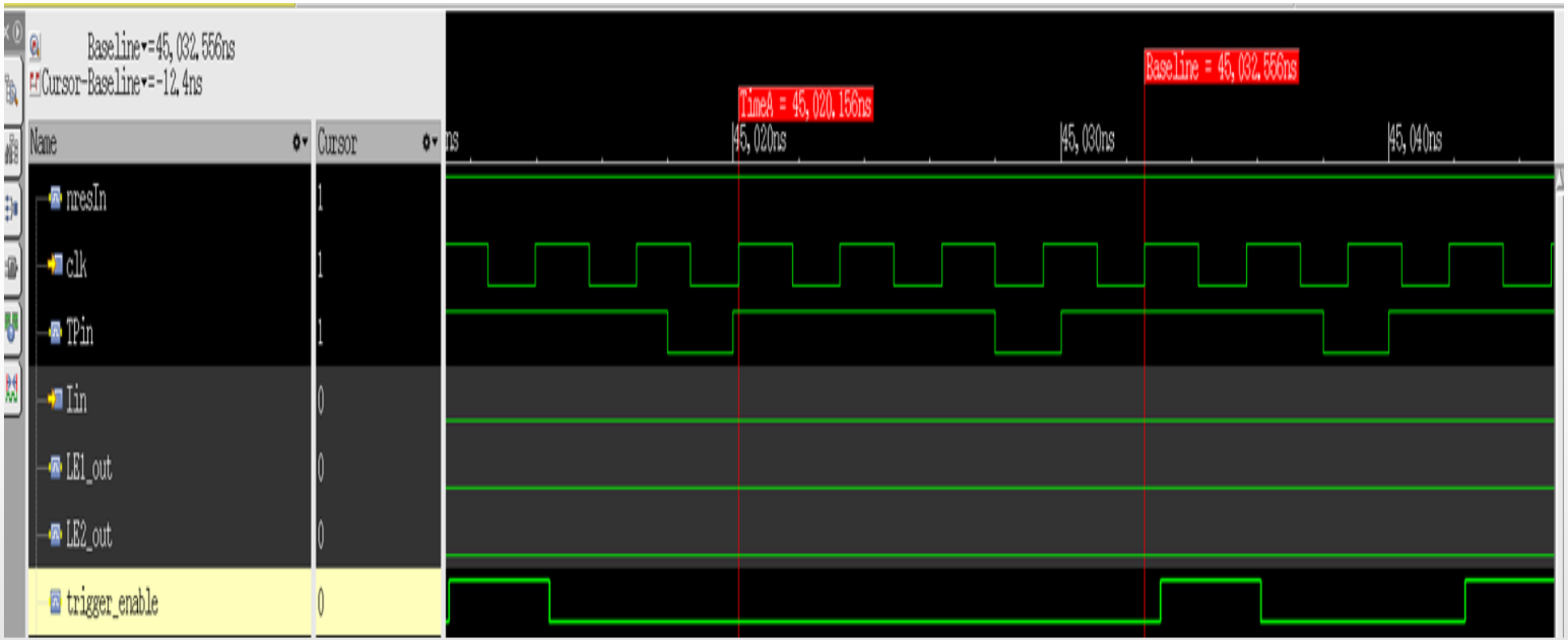


Test Pulse / Shutter (LE mode)



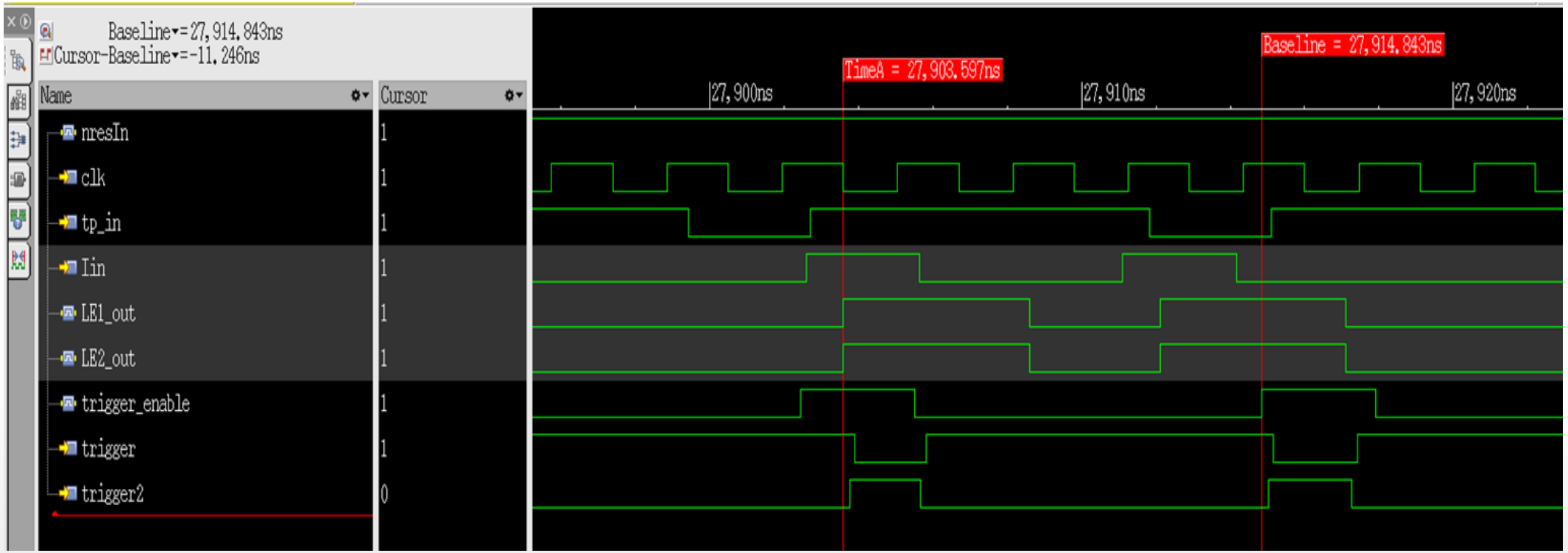
When the Pixel works in LE or TOT mode the Test Pulse signal can inhibit the discriminator signal but… it is latched in the configuration register! This enable function is synchronous with clock!

Asynchronous TP: timing violations and missing signals



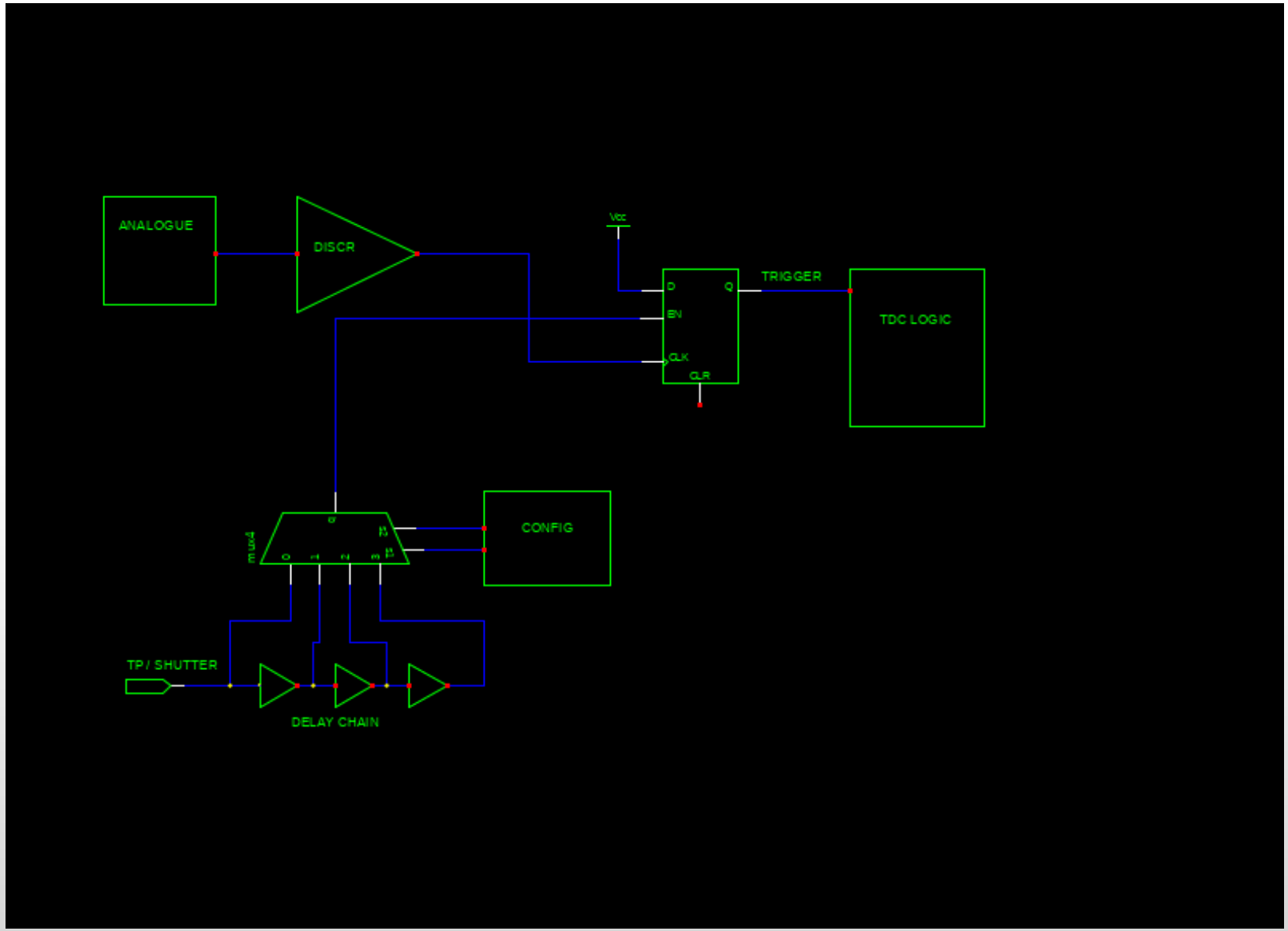
TP inverted polarity!

Synchronous TP



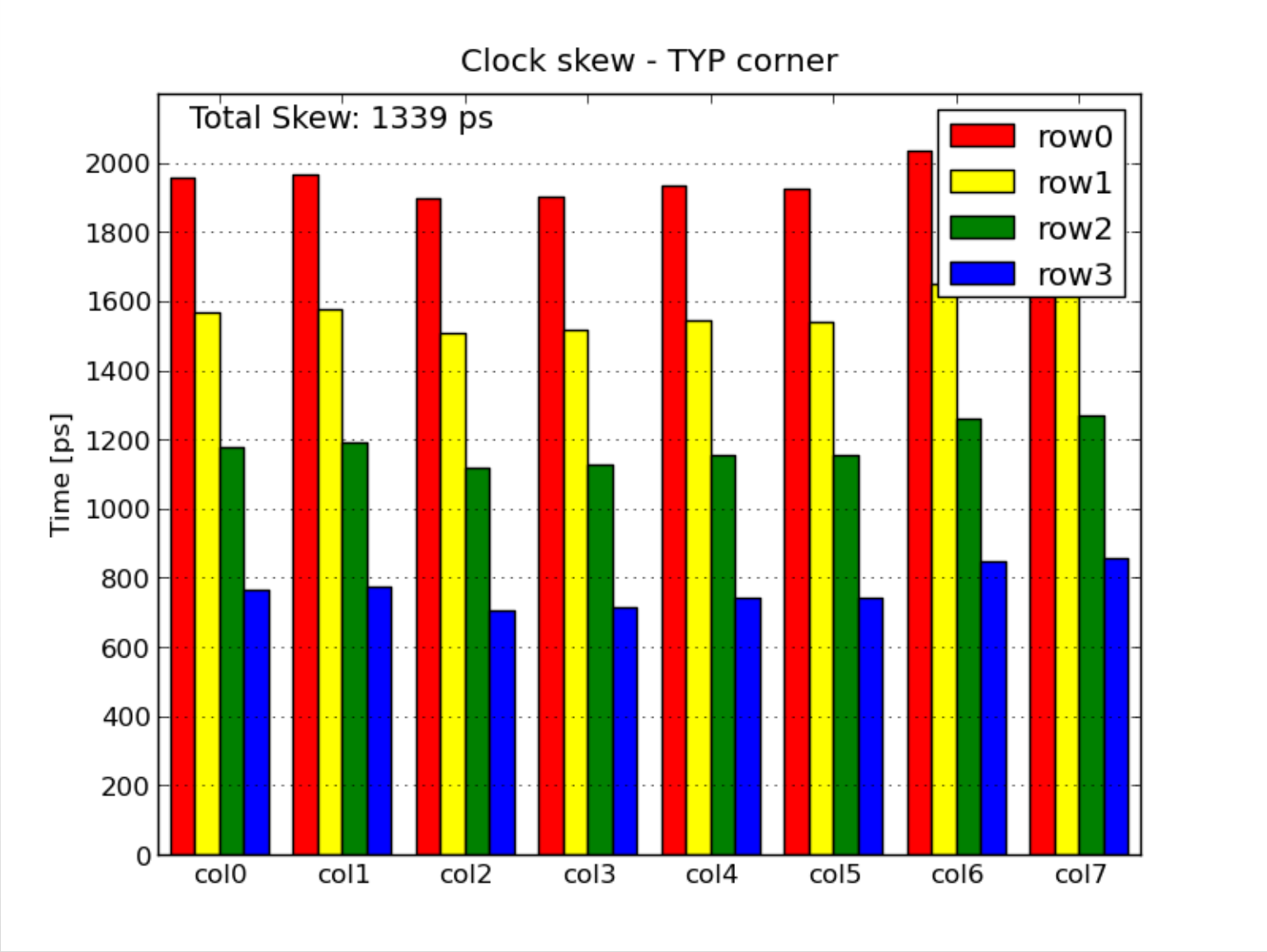
- ¼ clock frequency with duty cycle 25% (3.1 ns on and 9.3 ns off)
- No timing errors on trigger enable but…TDC trigger could be synchronous with TP!
- Never possible to use it in TOT mode

ALCOR V3: *trigger/shutter* proposal

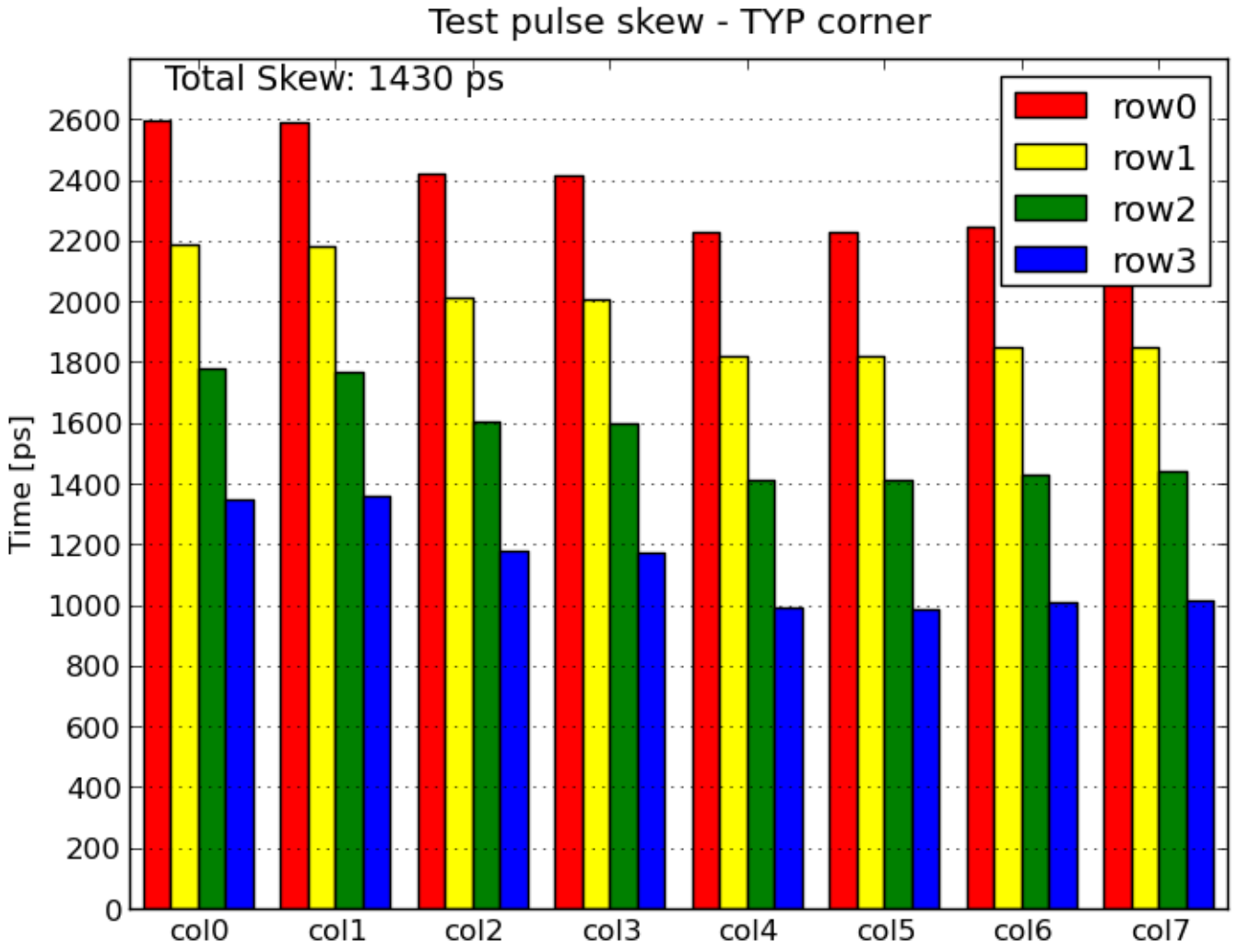


- The enable timing window can be very short
- Time tuning required to compensate internal skew?
- Extra logic for TOT mode. TOT really required?
- Analogue models for in Pixel data decimation?
- Trigger algorithms at the EoC can be adopted as an alternative?

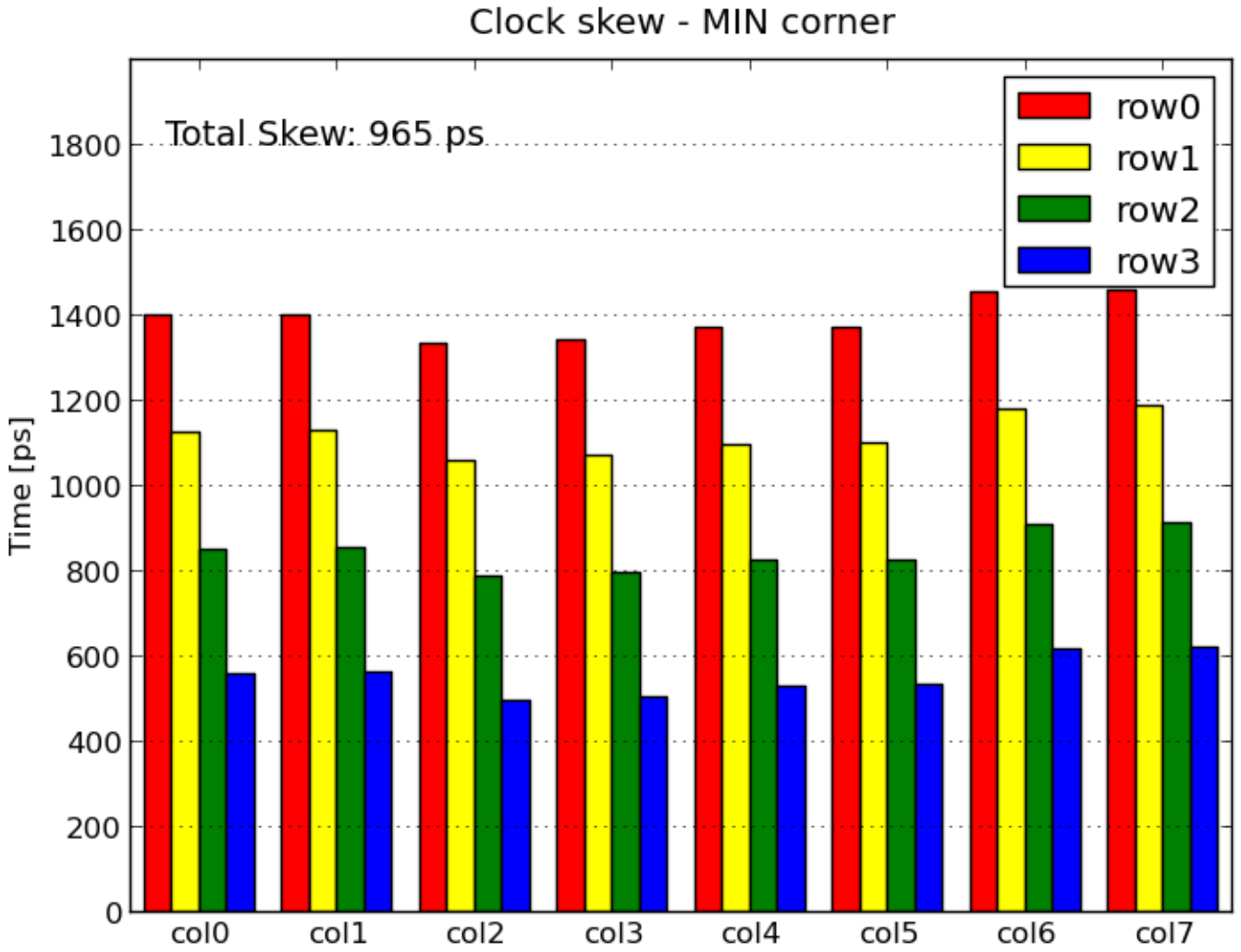
CLOCK skew (typ: tc, 1.2V 25 C)



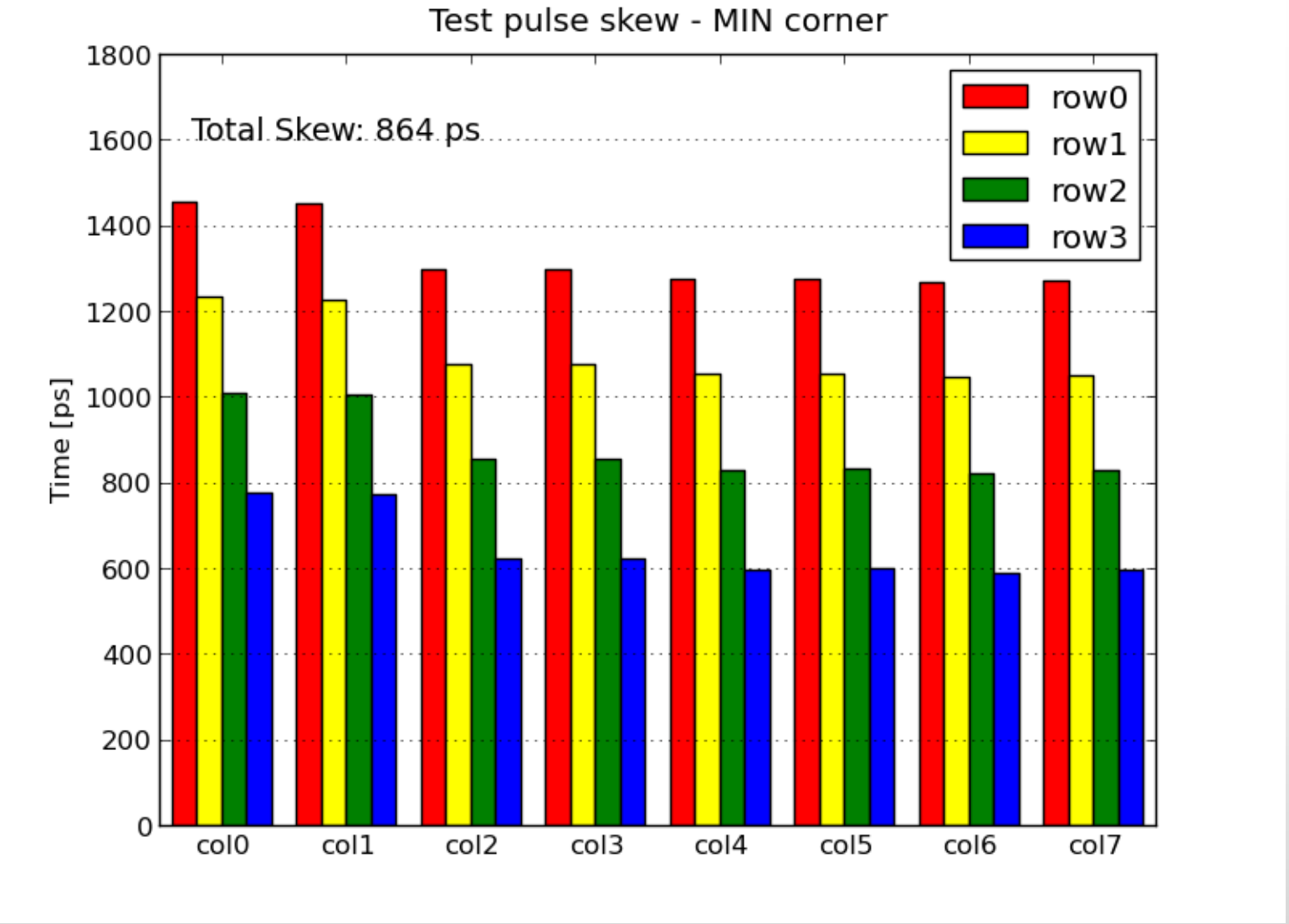
TP skew (typ: tc, 1.2V 25 C)



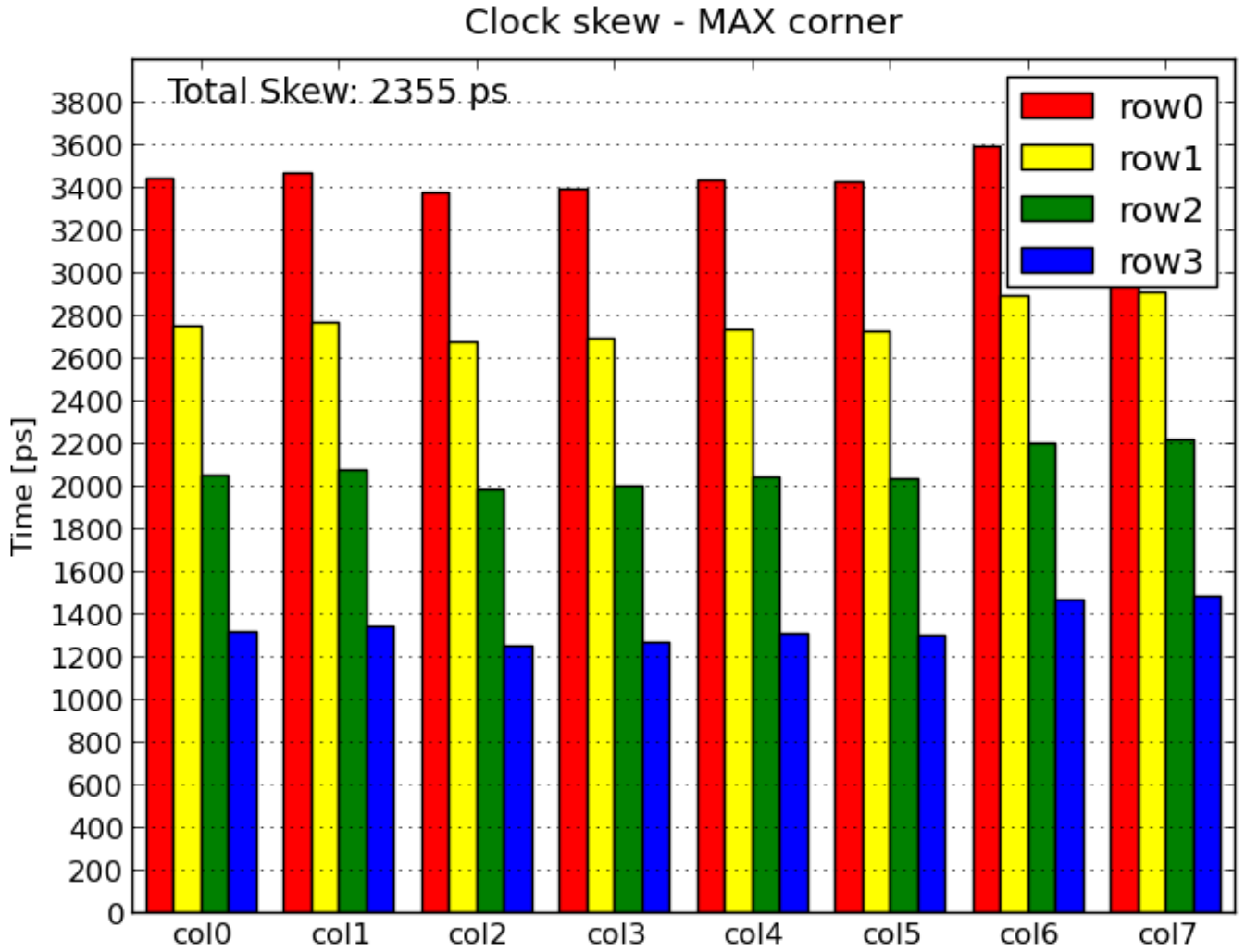
CLOCK skew (min: bc, 1.32V -40 C)



TP skew (min: bc, 1.32V -40 C)



CLOCK skew (max: wc, 1.08V 125 C)



TP skew (max: wc, 1.08V 125 C)