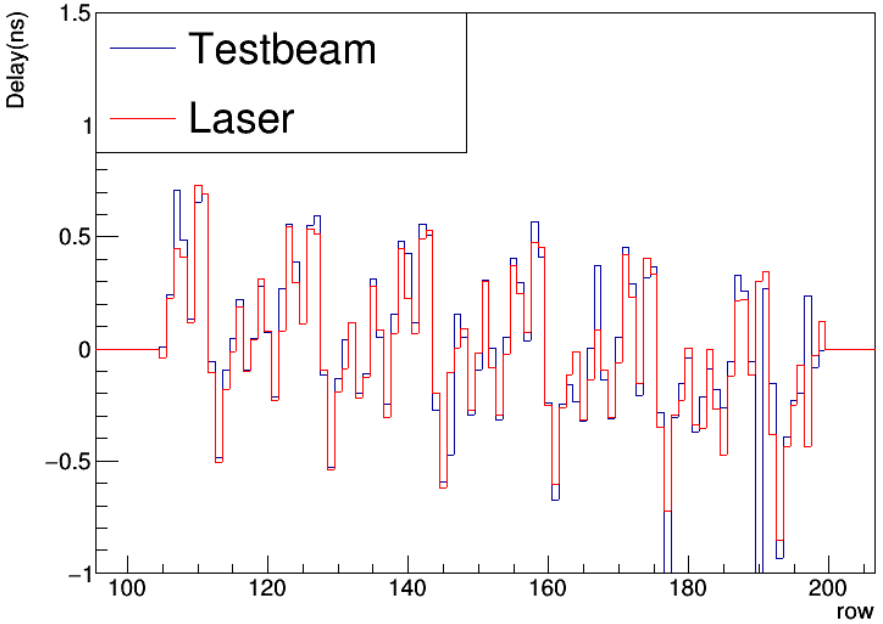
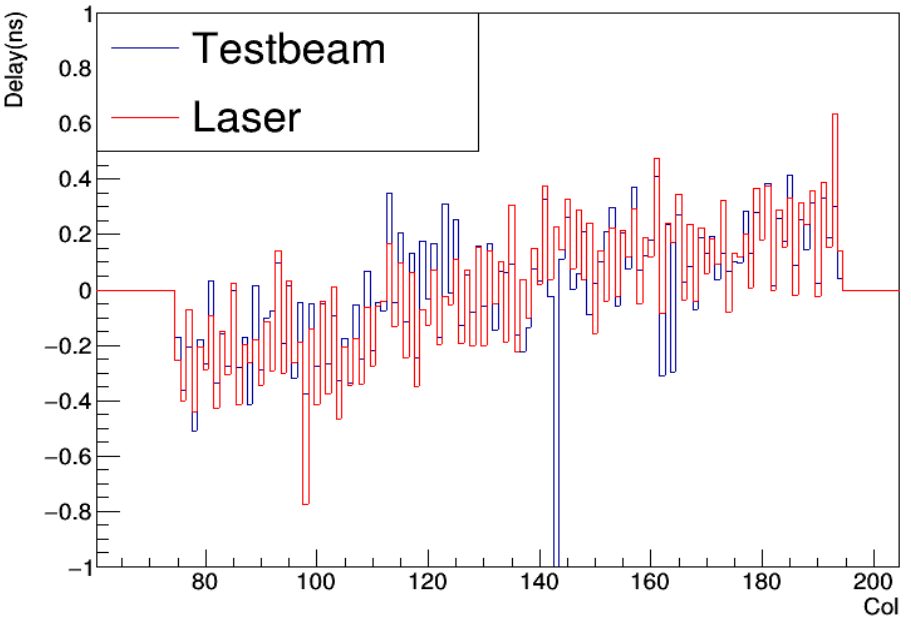
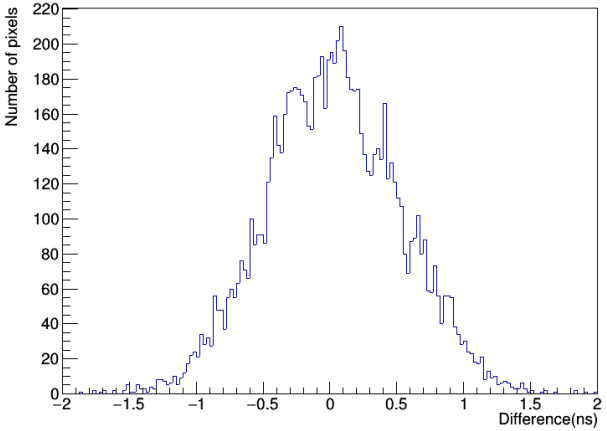
Testbeam vs laser

This time: projections







σ(testbeam) = 0.55ns
σ(laser) = 0.58ns
σ(testbeam – laser) = 0.49ns

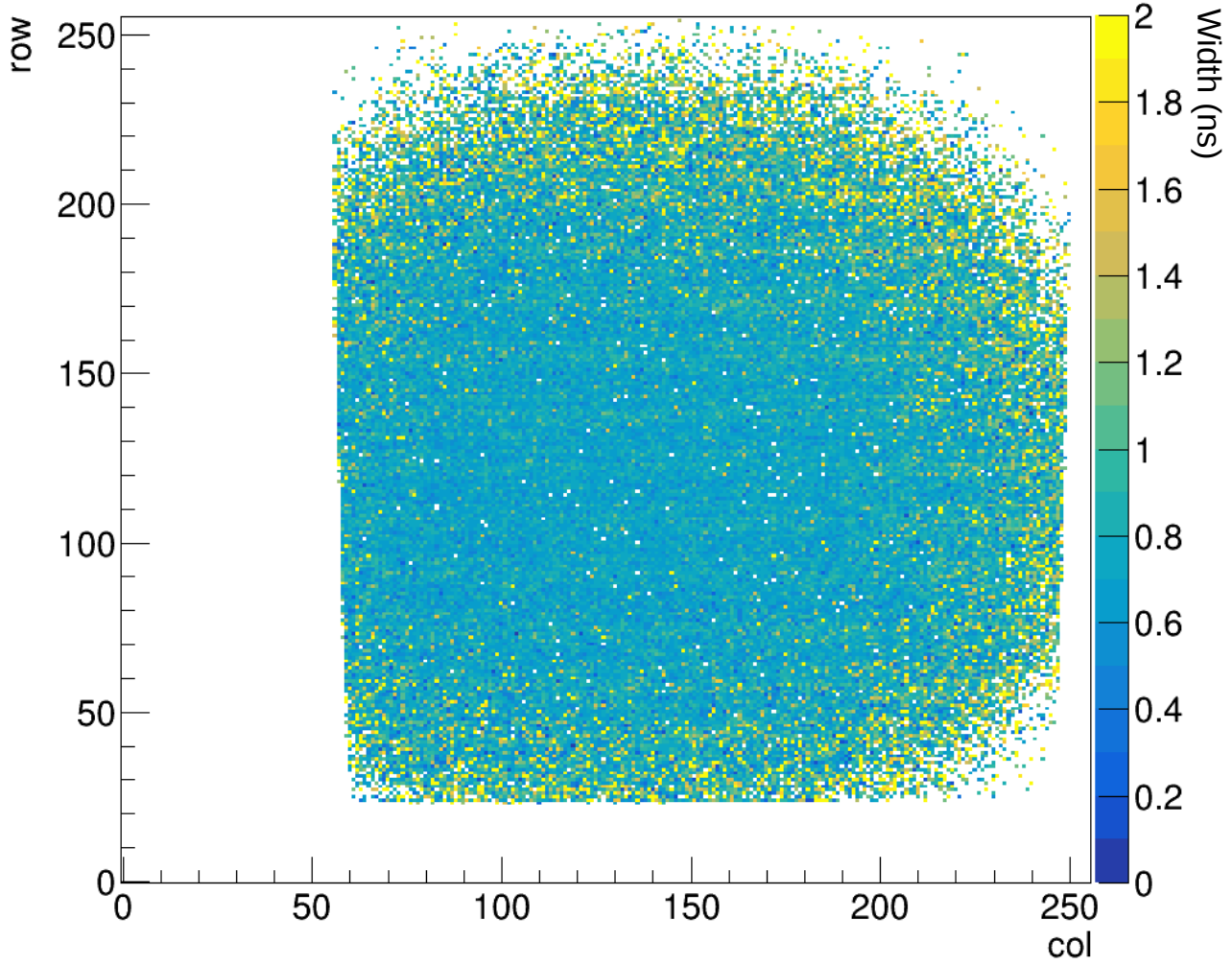
Not uncorrelated?

Testbeam vs laser

This time: distributions

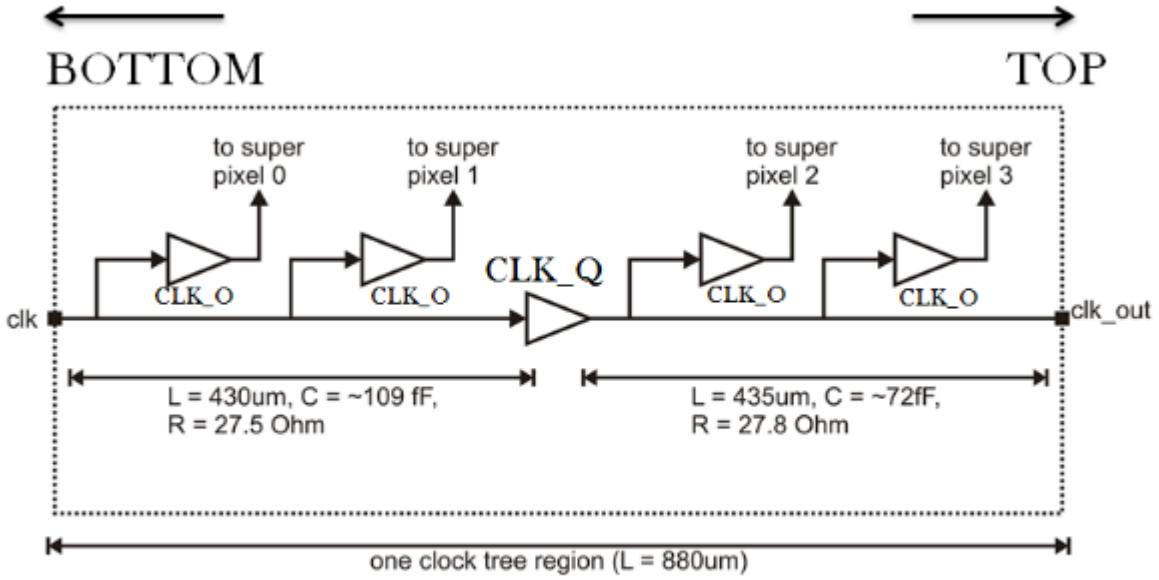
Width of the distribution of the delay for a testbeam run:

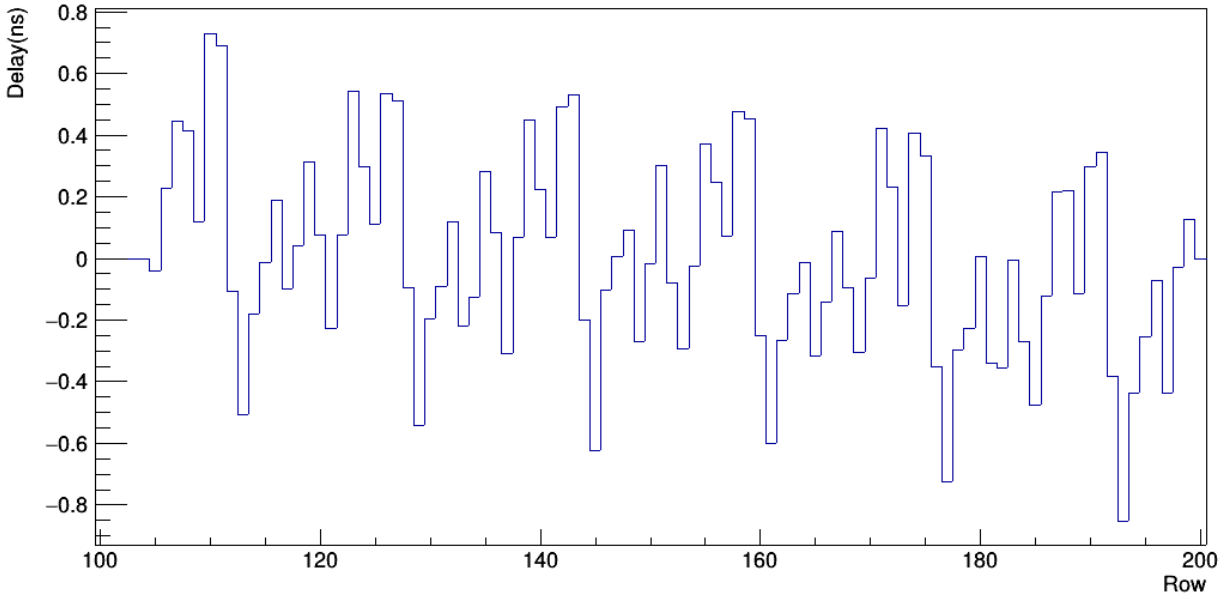
All distributions are the same width because the dominating time scale is the 1.5ns of the bin



Pixel matrix delay

From Tuomas Poikela's thesis





CLK_Q = "relatively large buffer"
CLK_O = "smaller buffer"

From his thesis:
This clock tree is divided into sections of 880µm and the trunk is buffered with a relatively large buffer (CLK_Q) at the same intervals.This buffer uses regular Vt transistors to reduce the delay.

Could this explain the 16 pixel periodicity we see?

However, it looks like the large buffer is between superpixel 2 and 3, and not between 4 and 1...

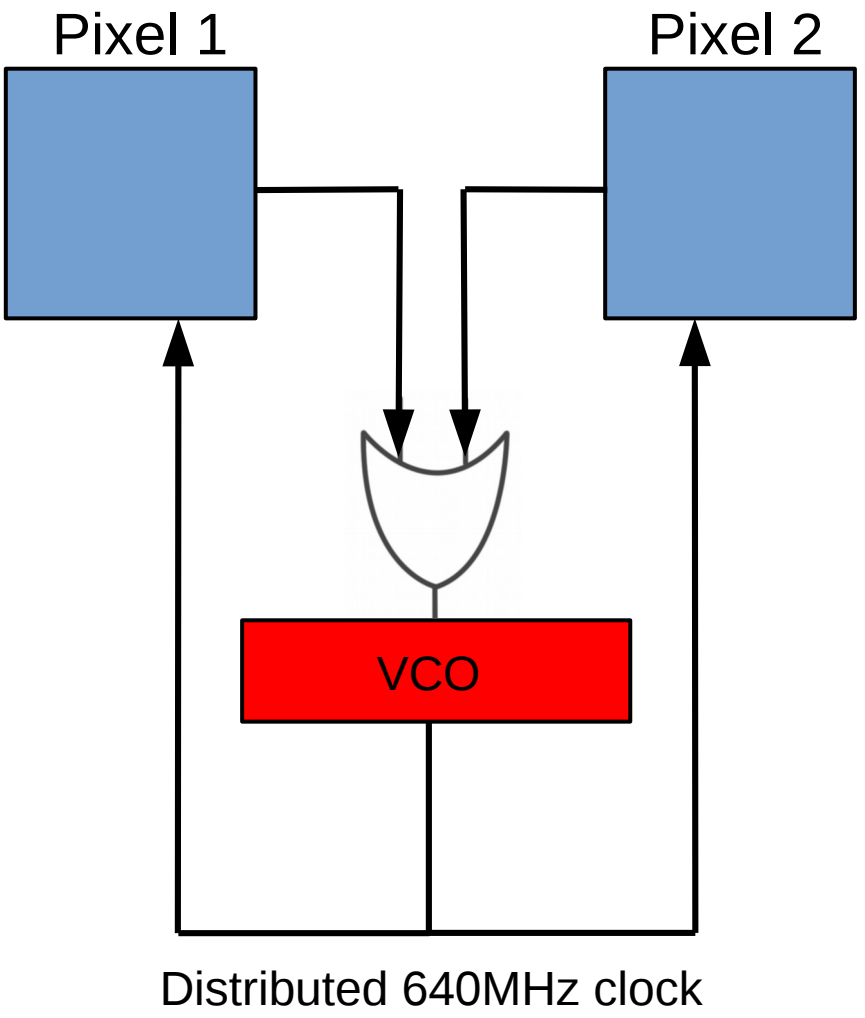
Pixel matrix delay

Further important notes from Tuomas' thesis:

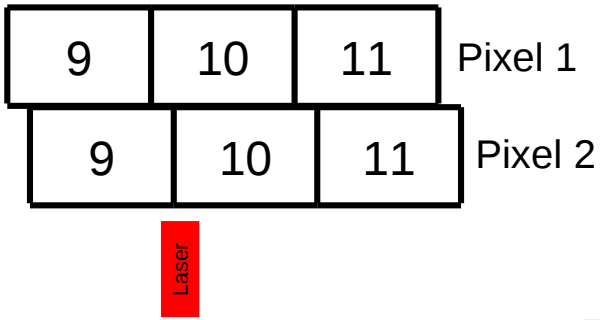
- Matrix was constructed using a block of 4 superpixels (not from 1 superpixel!)
- A drawback due to this, which was already noticed in simulations, are timing mismatches in the digital logic while measuring the fine timestamp

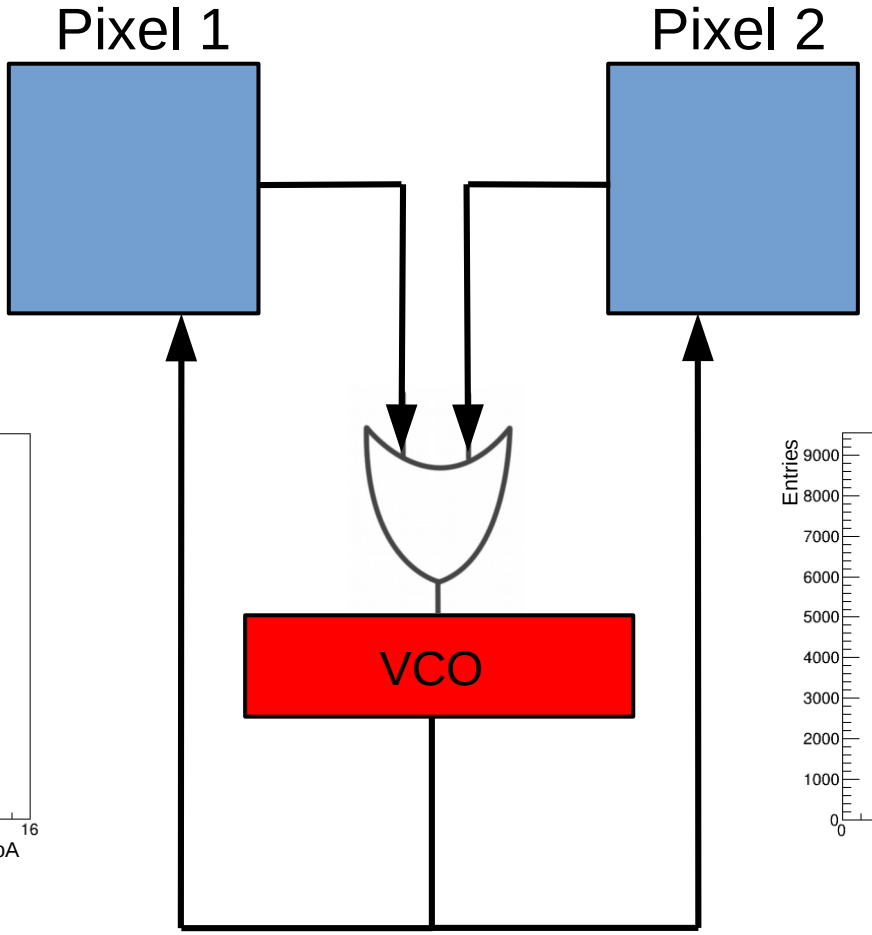
- The superpixel layout is not identical for all 4 superpixel due to automatic place and route

An example



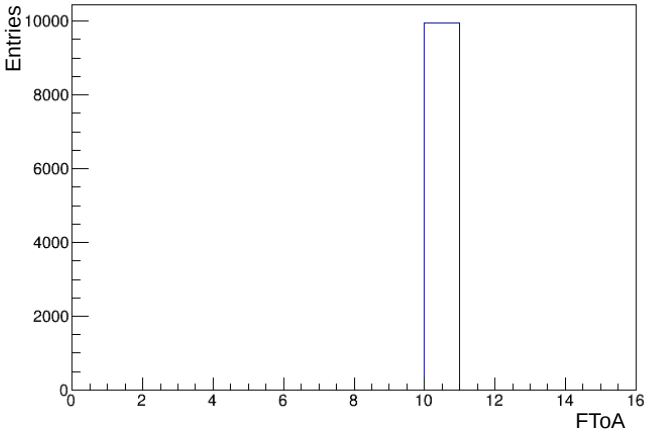
An example



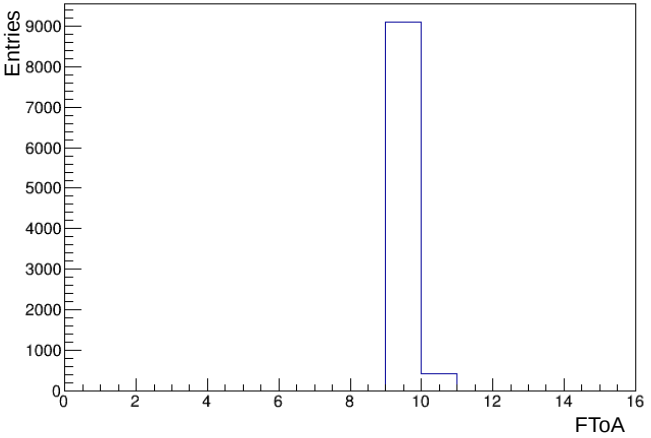


Distributed 640MHz clock

Single hit on pixel 1

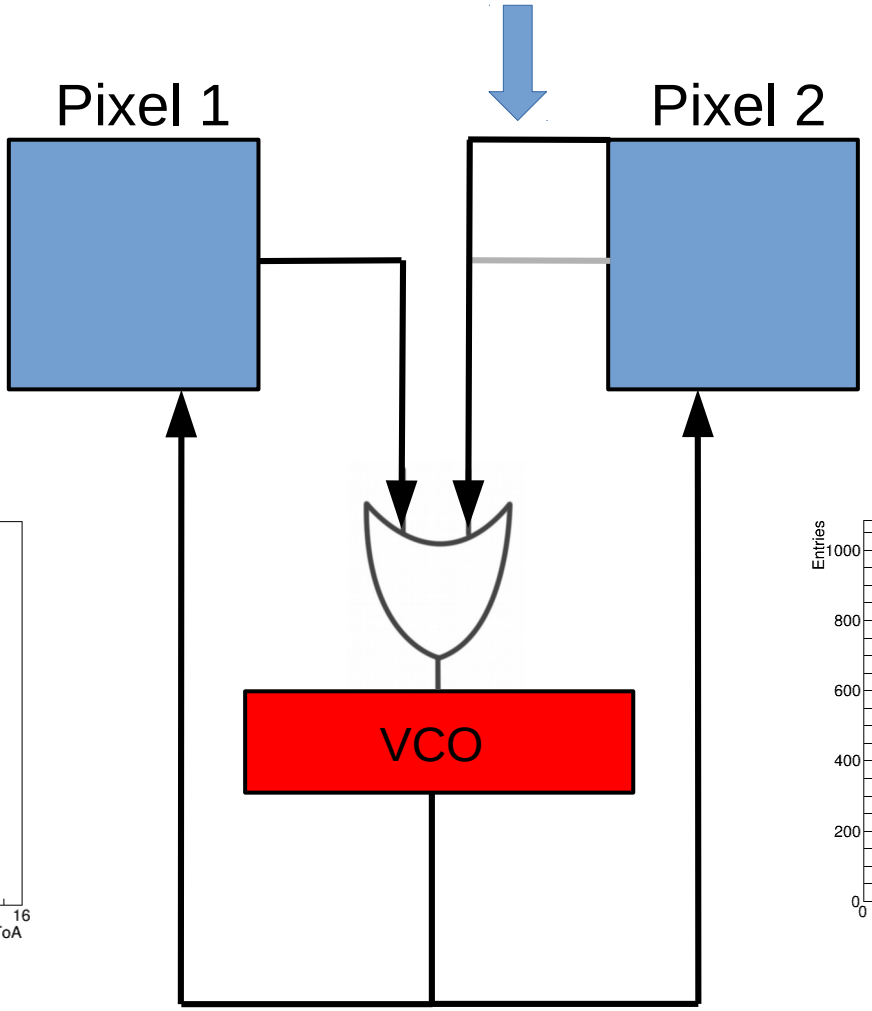


Single hit on pixel 2

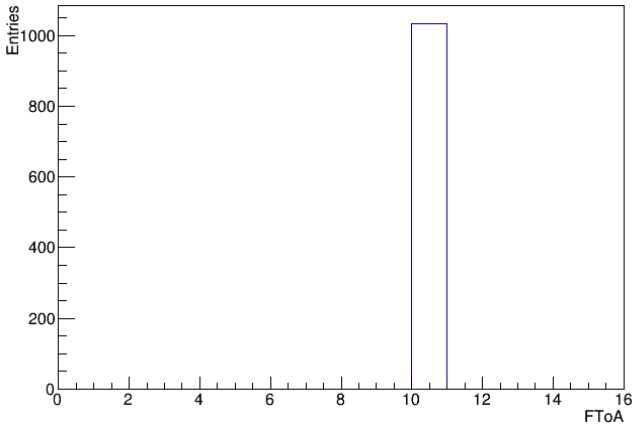


An example

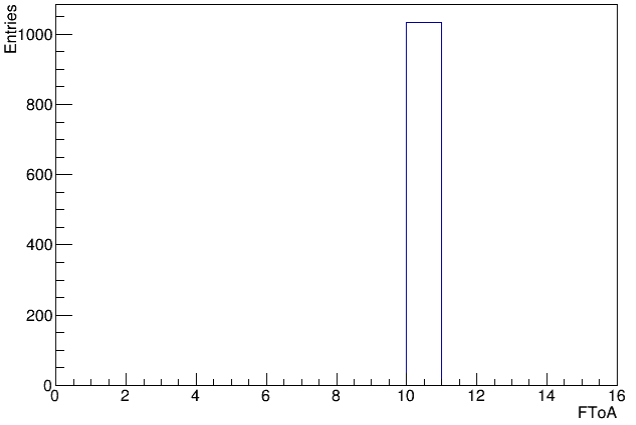
The connection of pixel 2 to the OR-gate is slower?



FtoA (pixel 1) of a double hit on 1 and 2

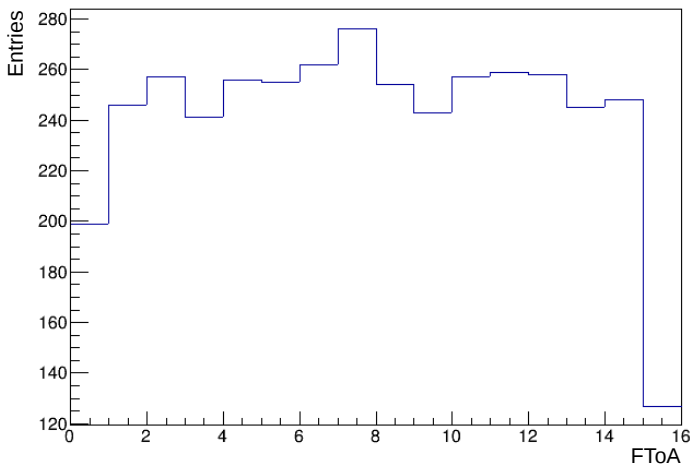


FtoA (pixel 2) of a double hit on 1 and 2

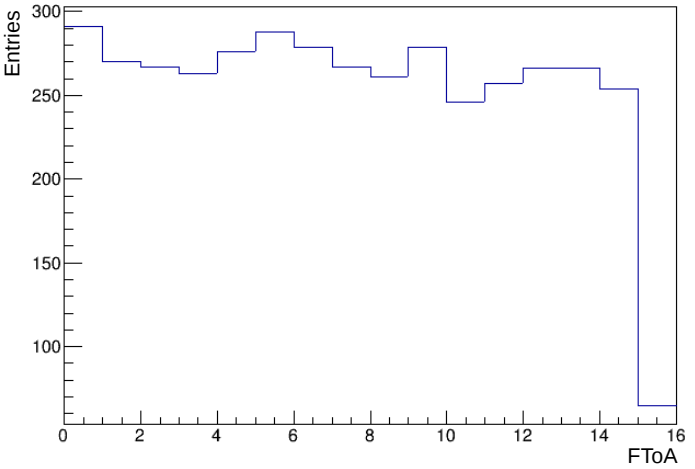


But what if we do this for all bins?

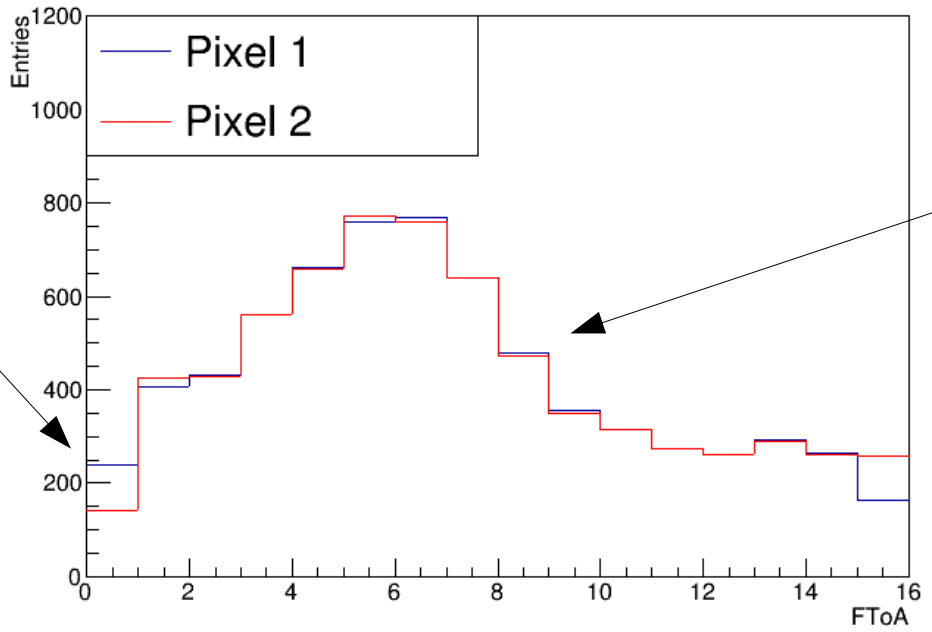
Pixel 1



Pixel 2



Due to the slower pixel 2, it can happen that the signal to the OR-gate from pixel 2 gets there after the 40MHz clock

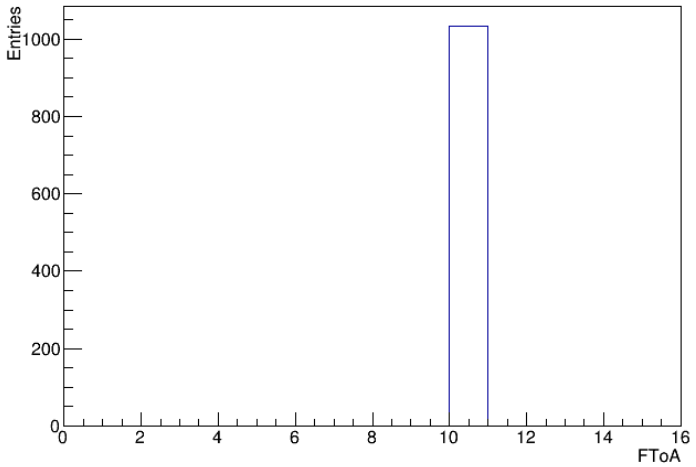


Why is the distribution not flat anymore?

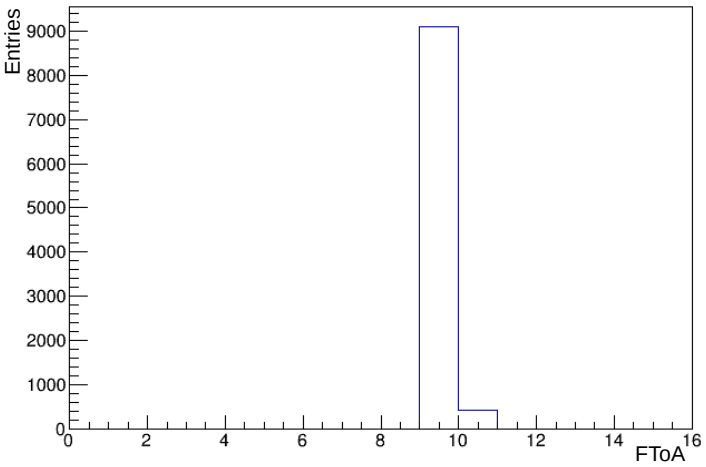
Why are there bins the same and bins different?

And what about 4 pixels?

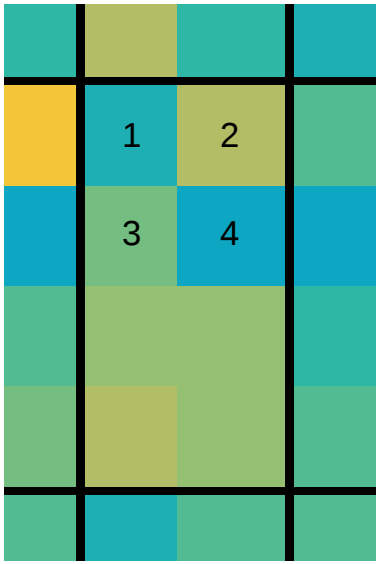
Pixel 1



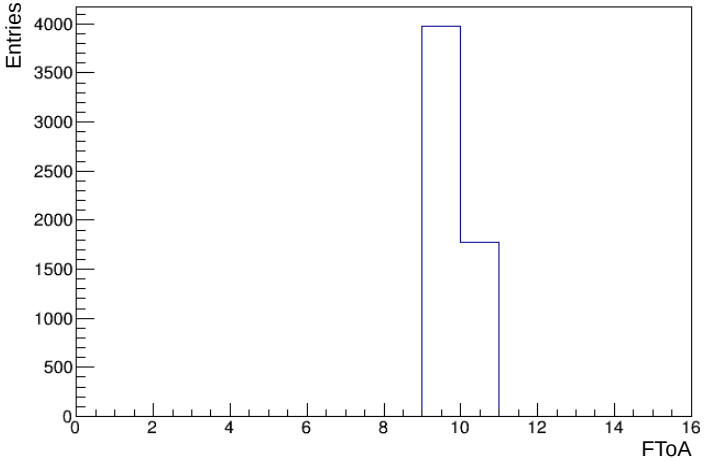
Pixel 2



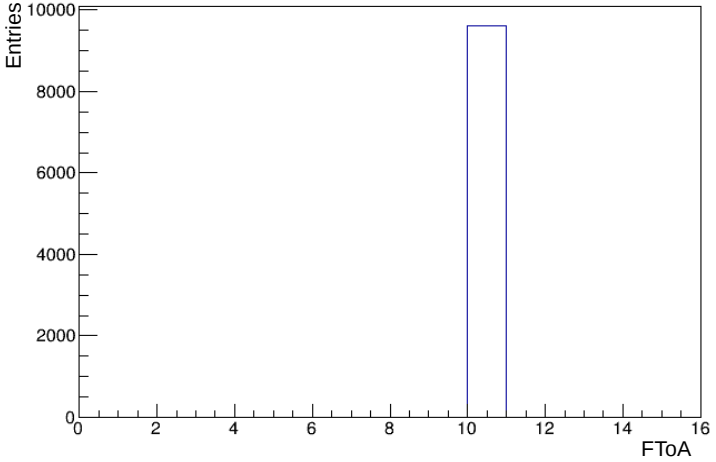
From matrix scan last week



Pixel 3

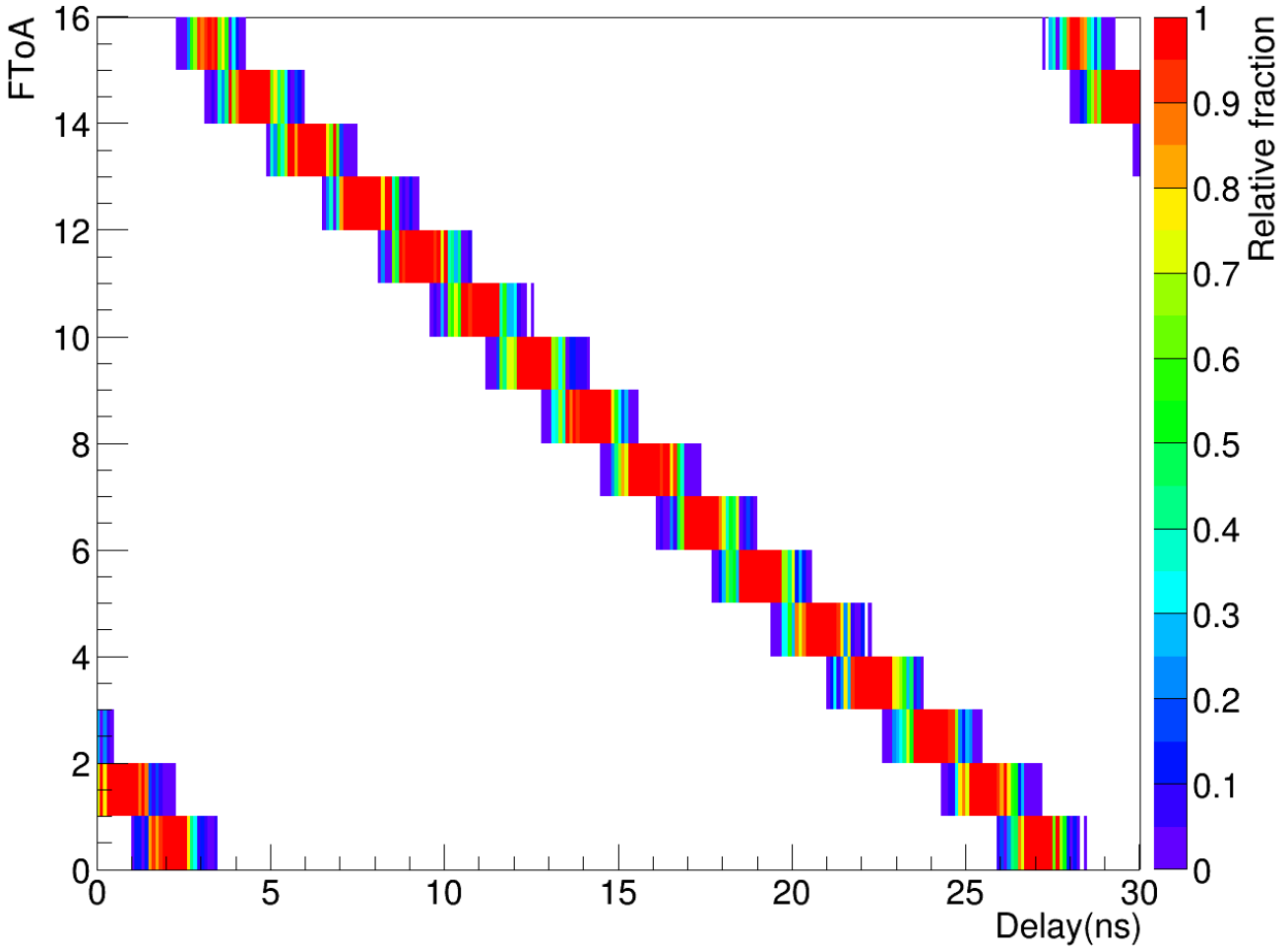


Pixel 4



To get ToT 180 in all 4 pixels the laser needed to much power → the delay began to vary due to this

FtoA bin size (pixel 1)



Measurement:

Vary the delay of the laser-pulse and measure the FtoA bin in which the hit is measured

W0020_J07
Bias = -150V
Ikrum = 10
Thl = 700e