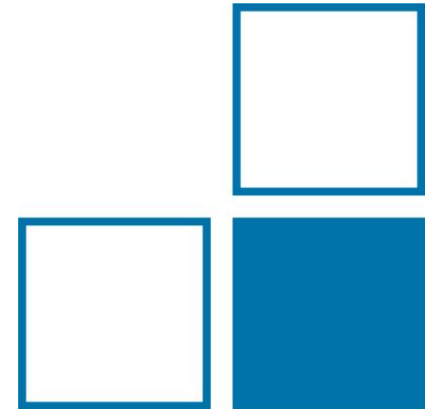


# **ADQ14: Firmware Upgrade**

R. Nolte



# PTB The Problem: Recoil Telescopes

Recoil Telescopes for TOF: 2 – 4  $\Delta E$ ,  $E$  and veto detectors

Rep. Rates of the neutron beam: 0.25 Hz (n\_TOF)

1 – 3 MHz (PIAF, TLABS, ...)

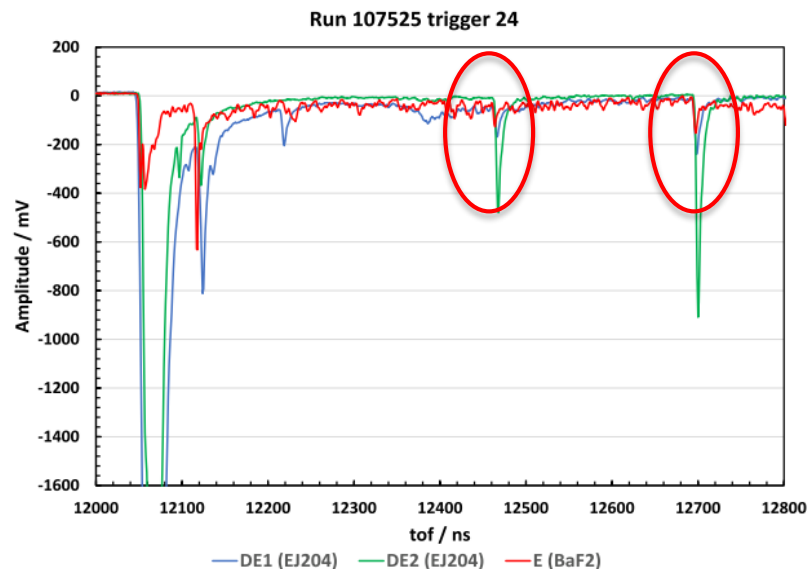
Singles rates:  $\approx 10^3 - 10^4$  cps

Coincidence rates:  $\approx 1$  cps

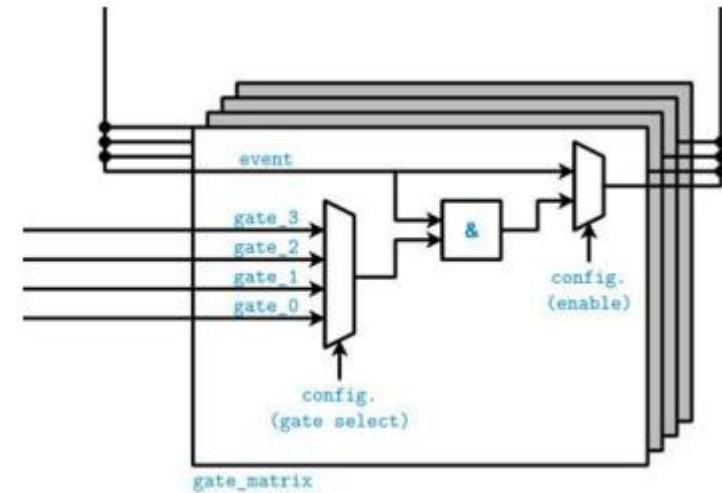
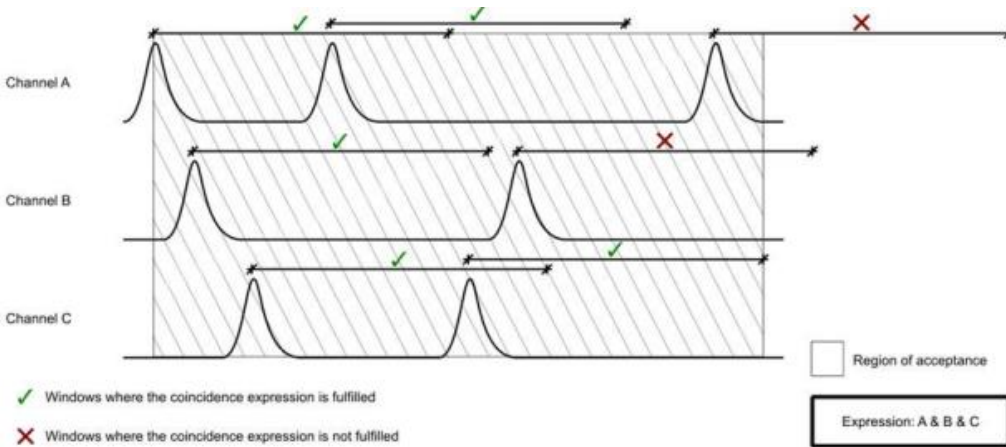
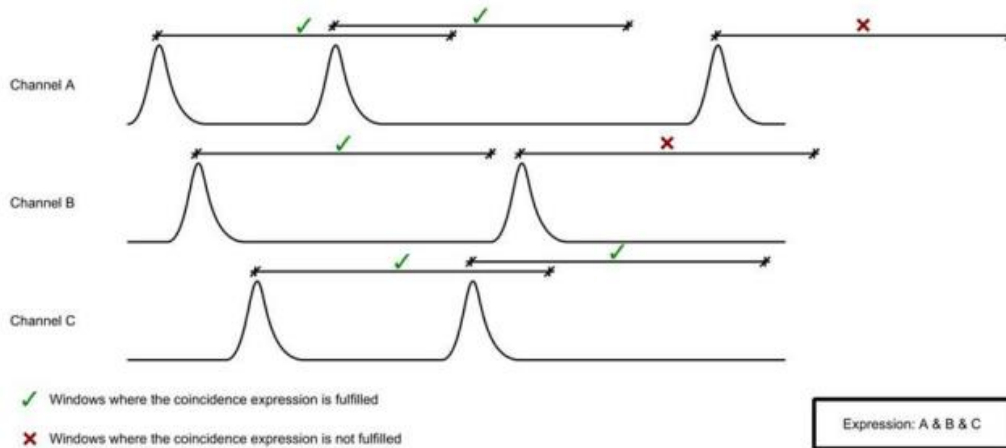
- We cannot store and analyze everything offline
- We do not want to realize complicated and error-prone hardware triggers

⇒ Detect coincidence triggers on the FPGA

⇒ Flexible coincidence and anti-coincidence patterns



# Firmware for Coincidence Detection



### **Requests for an upgraded pulse detection firmware for the ADQ14 digitizer**

The upgraded firmware shall mask coincident events in the data streams produced by the four channels of ADQ14 digitizers. Only masked data shall be routed to the output data stream, thereby enabling a reduction of the amount of data to be stored in raw data mode.

The upgraded software must fulfill the following specifications:

- Coincident events are defined by a pattern of signals on different channels within a given time window, the coincidence resolving time. The coincidence pattern is defined by logical AND and OR operations.
- The coincidence pattern can involve any number of channels between two and four.
- If the coincidence condition is satisfied, the waveform data within a time window, the output gate, are routed to the output data stream.
- The output gate width shall be larger than the coincidence resolving time.
- The maximum output gate width shall be 3  $\mu$ s (3000 samples).
- If two coincident events occur completely or partially within the coincidence resolving time, the output gate shall extend accordingly.
- Waveform data from channels not included in the coincidence pattern shall also be routed to the output stream during the output gate.
- Output gates can be produced in direct succession without losing data due to an intermediate dead time between the gates.

The upgraded firmware will be made available at no further cost for all ADQ14 systems purchased by the PTB.