

$(e, e'K)$ Trigger Setup

Florian Hauenstein 22.10.18

Considerations

- Main Trigger $C1 = (S0 \& S2)_L \& (S0 \& S2)_R$
- $C2 = (S0 \& S2 \& GC)_L \& (S0 \& S2)_R$ as input but prescale=0
- Coincidence trigger window 150ns and T1/T2 40ns after $(S0 \& S2)_R$
- Kaons about 3ns later than Electrons on S0 (Protons ~ 10 ns and Pions about ~ 0.2 ns)
- Single Arm Triggers $T1 = (S0 \& S2)_L$, $T3 = (S0 || S2) \& GC_L$ and $T4 = (S0 \& S2)_R$ prescaled
- Trigger time order: $C1 < (C2) < T1 < T4 < T3$ with $\Delta t = 10$ ns between each input

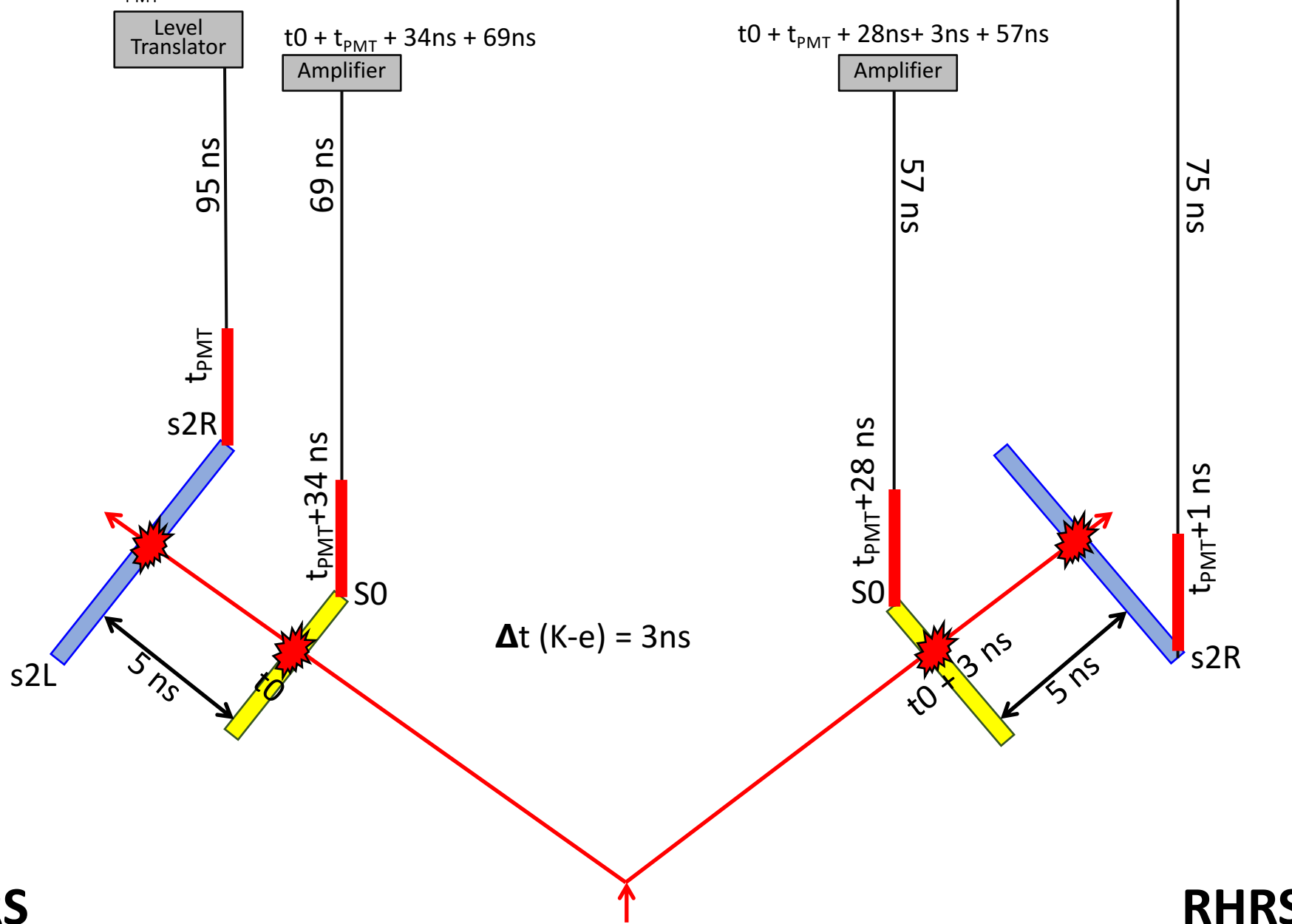
**FAKE
COINCIDENCE
SETUP**

$t_0 + t_{\text{PMT}} + 1\text{ns} + 3\text{ns} + 5\text{ns} + 75\text{ns}$

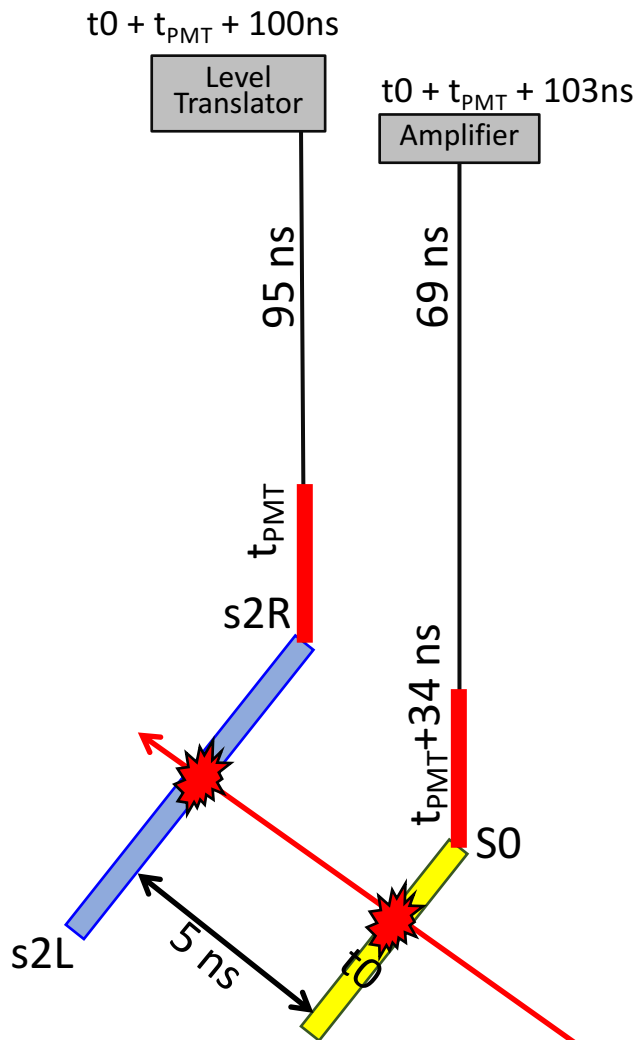
$t_0 + t_{\text{PMT}} + 5\text{ns} + 95\text{ns}$

$t_0 + t_{\text{PMT}} + 34\text{ns} + 69\text{ns}$

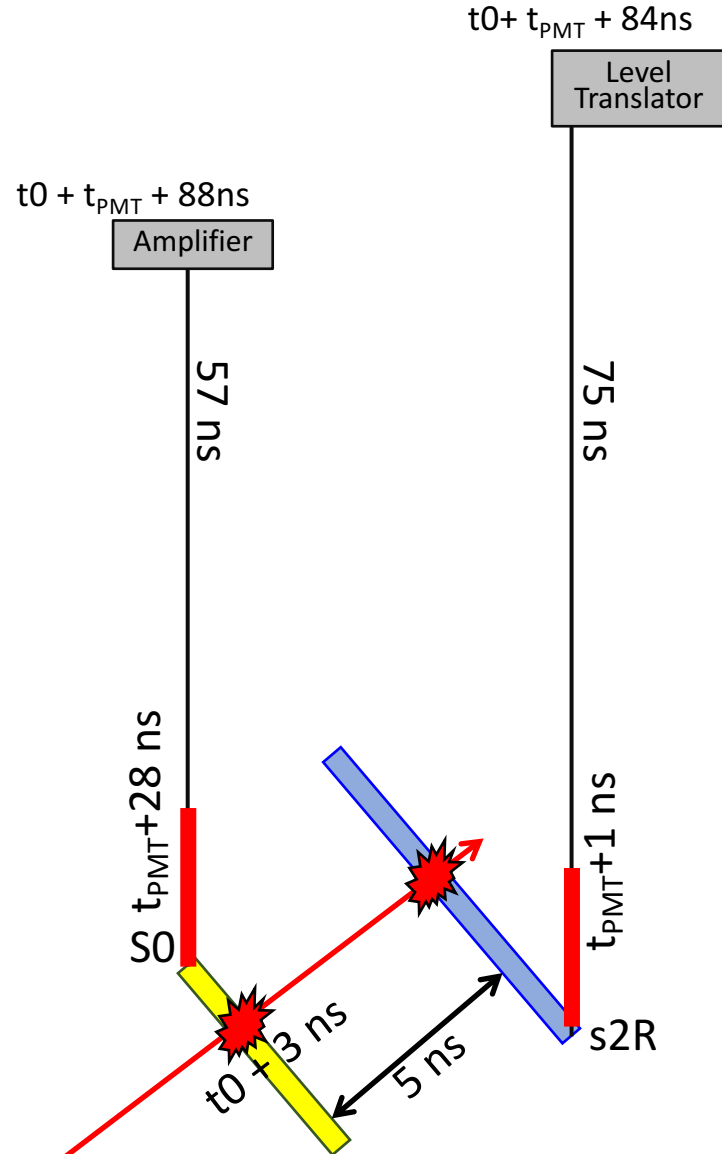
$t_0 + t_{\text{PMT}} + 28\text{ns} + 3\text{ns} + 57\text{ns}$



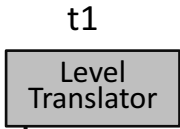
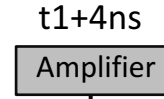
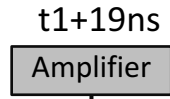
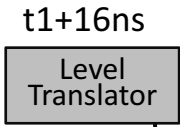
LHRS



RHRS



$$t_1 = t_0 + t_{PMT} + 84$$



s2R

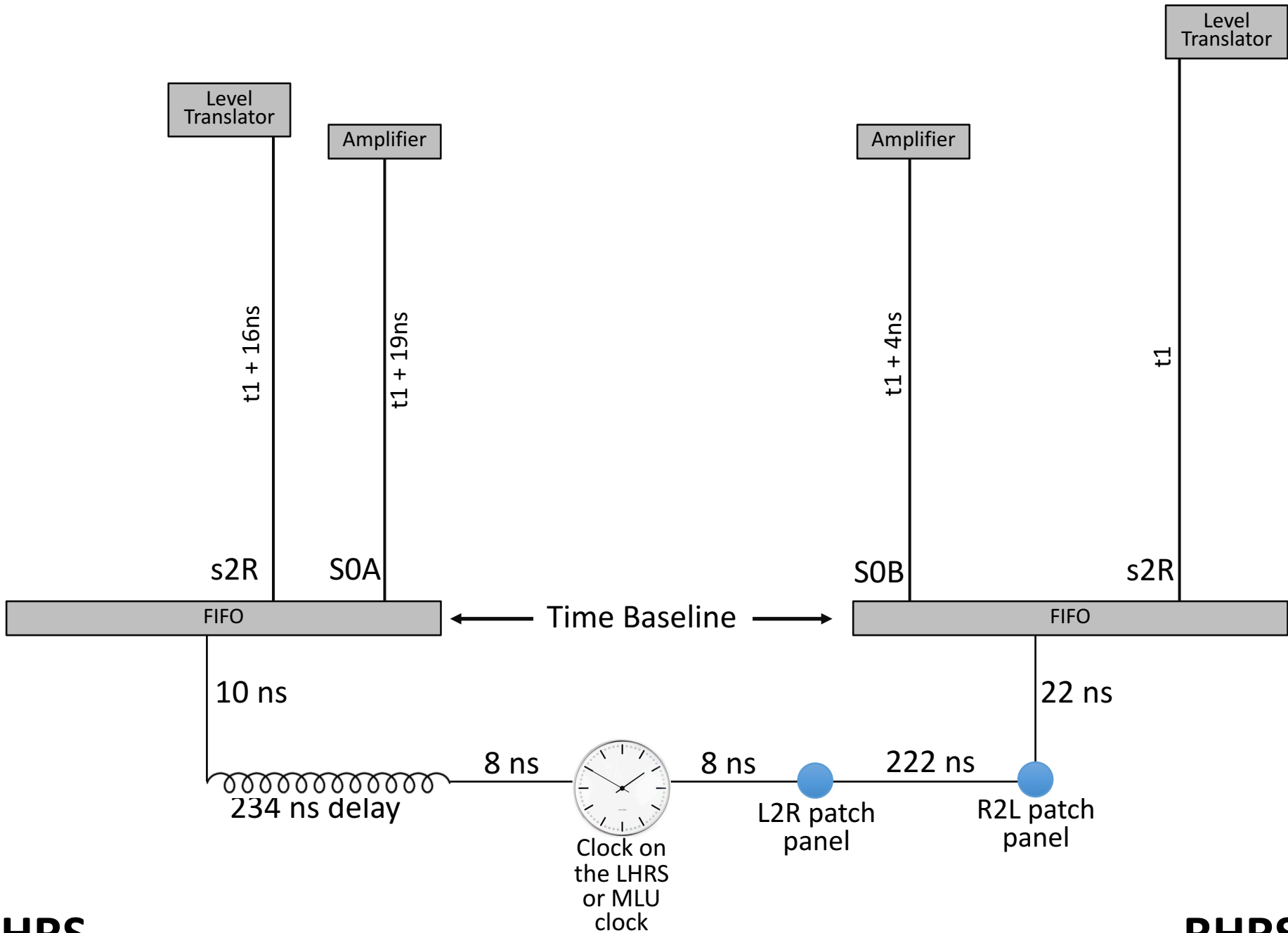
S0

S0

s2R

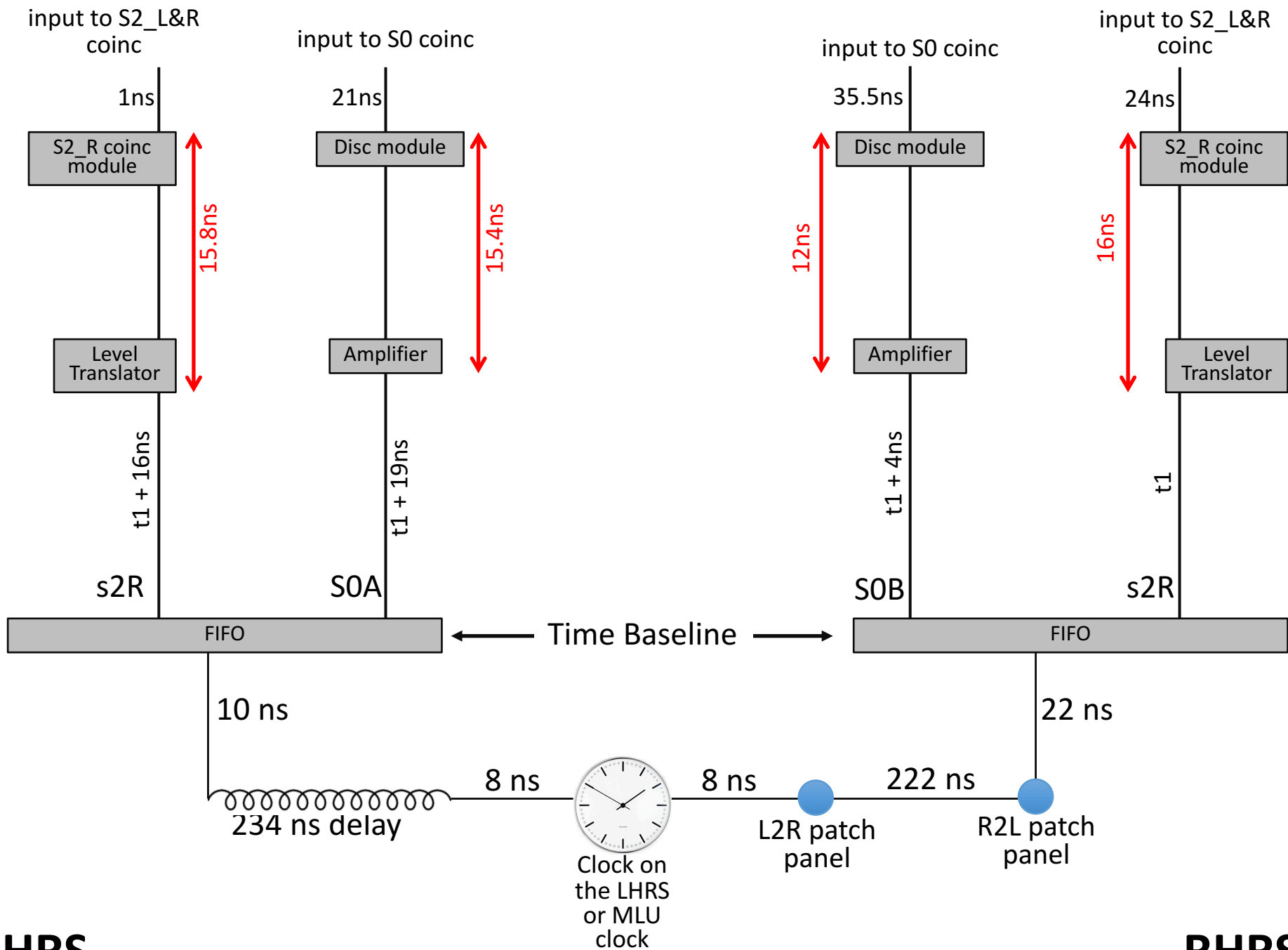
LHRS

RHRS



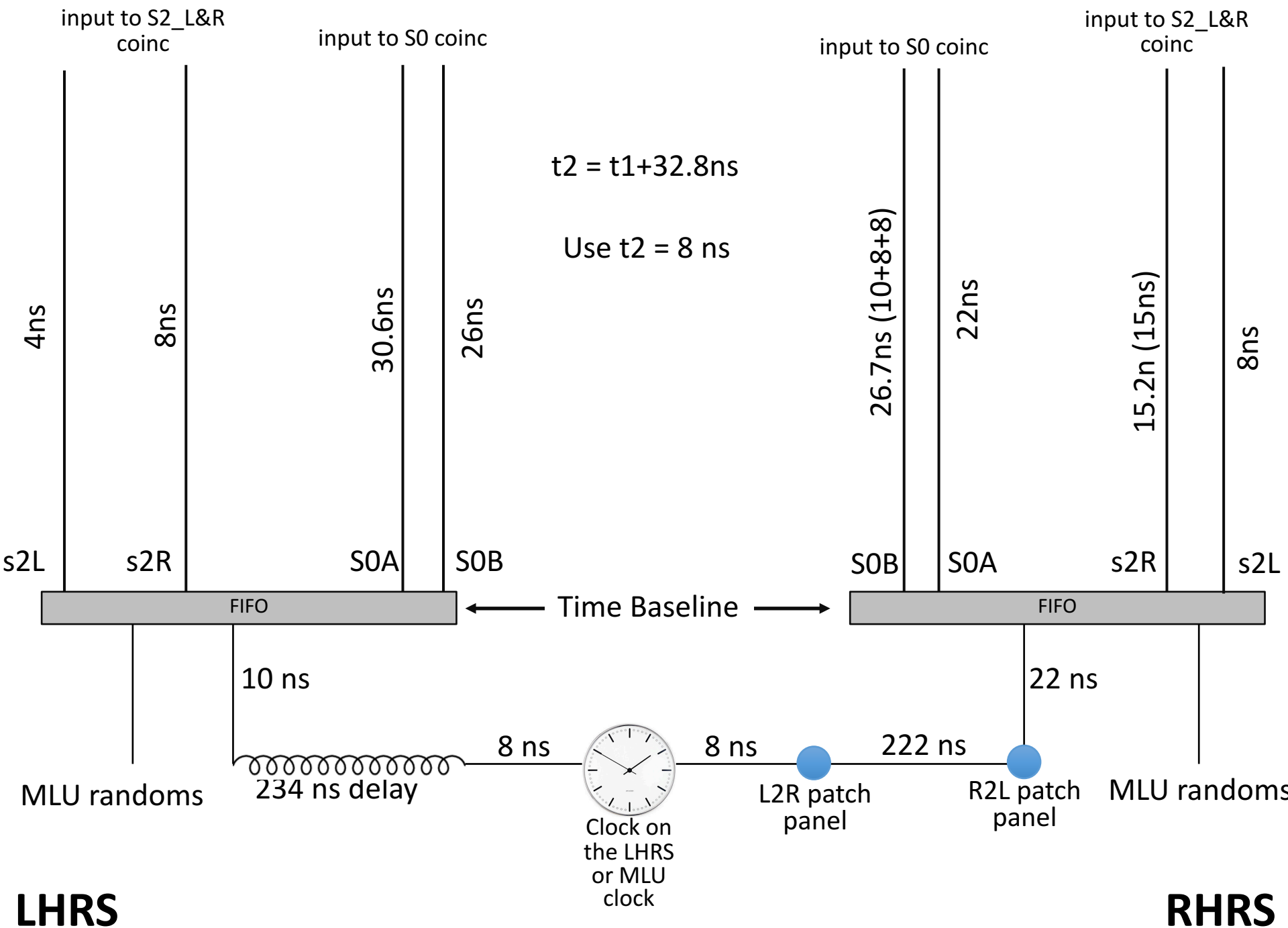
LHRs

RHRS



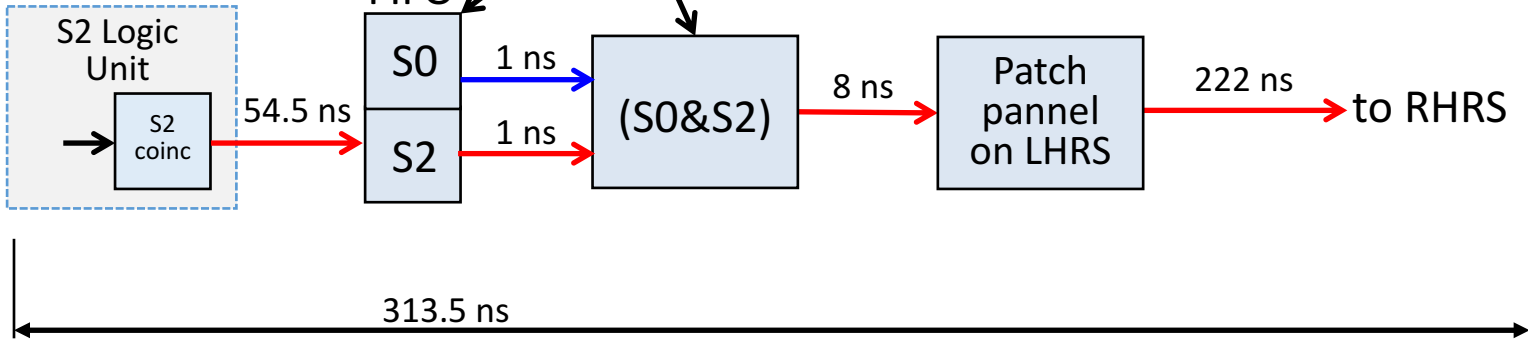
LHRs

RHRS

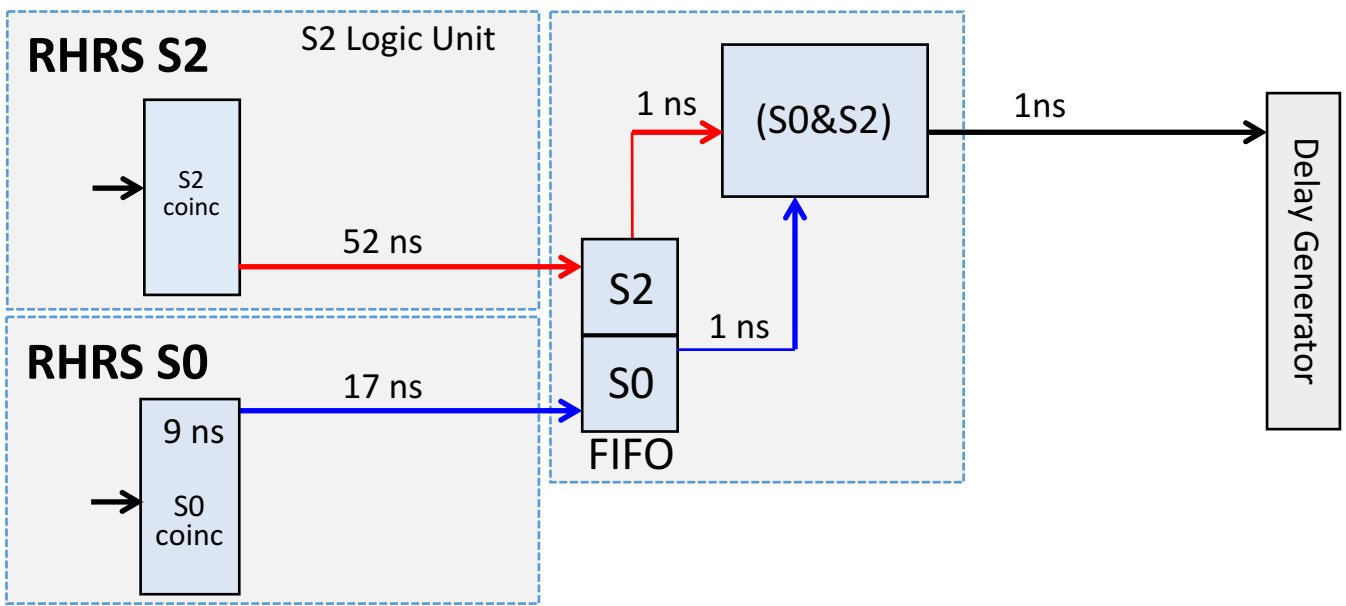


LHRS

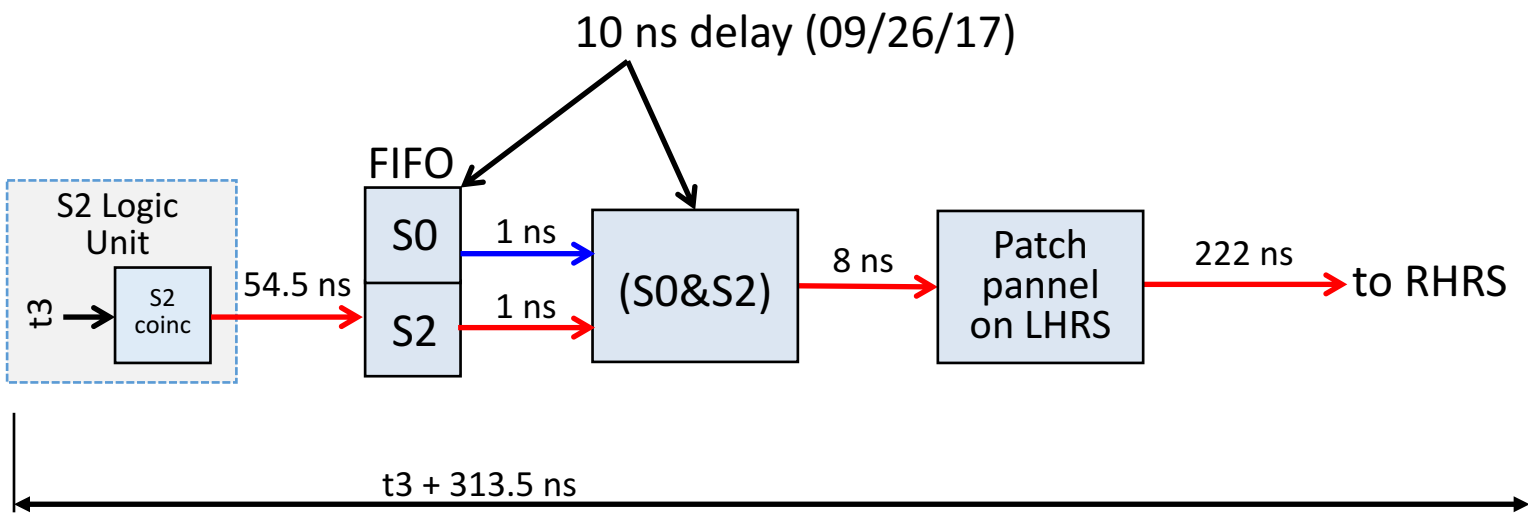
10 ns delay (09/26/17)



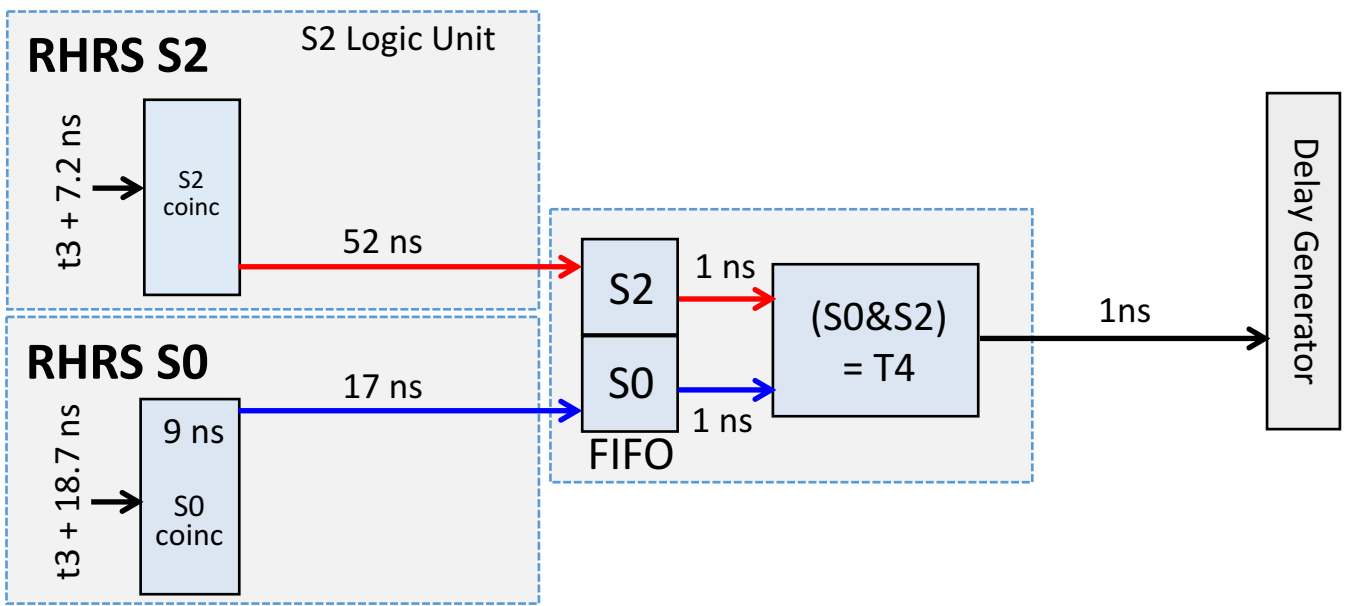
RHRS

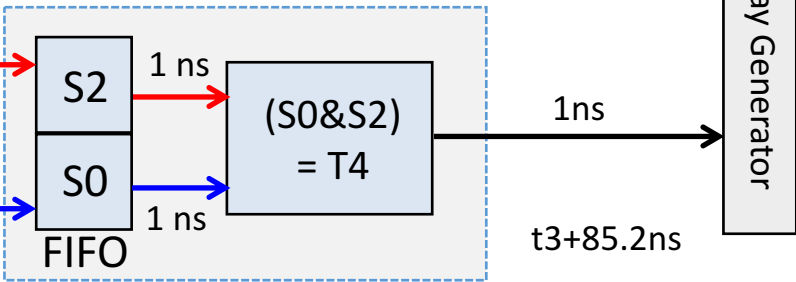
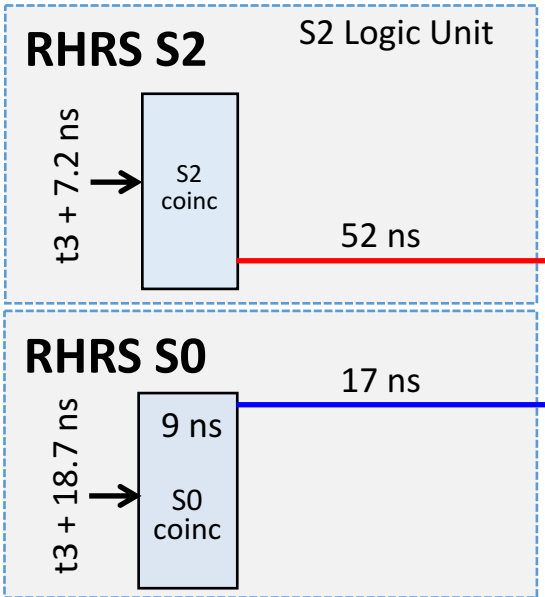
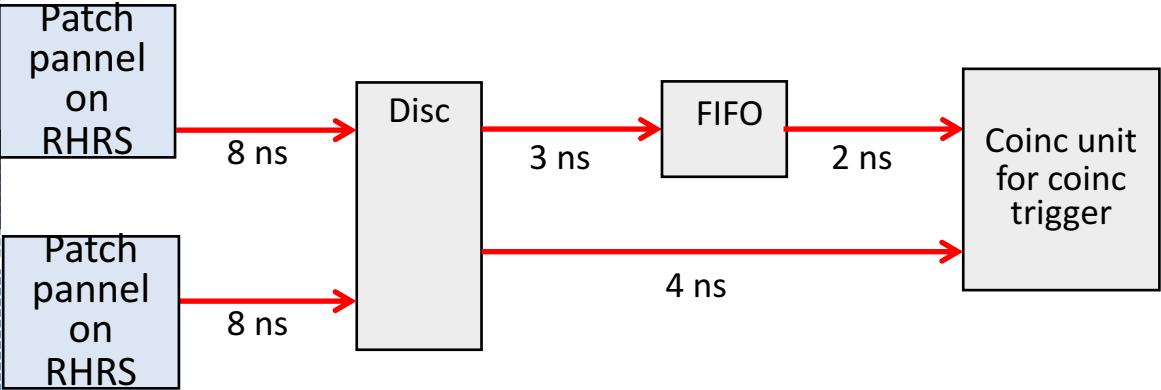
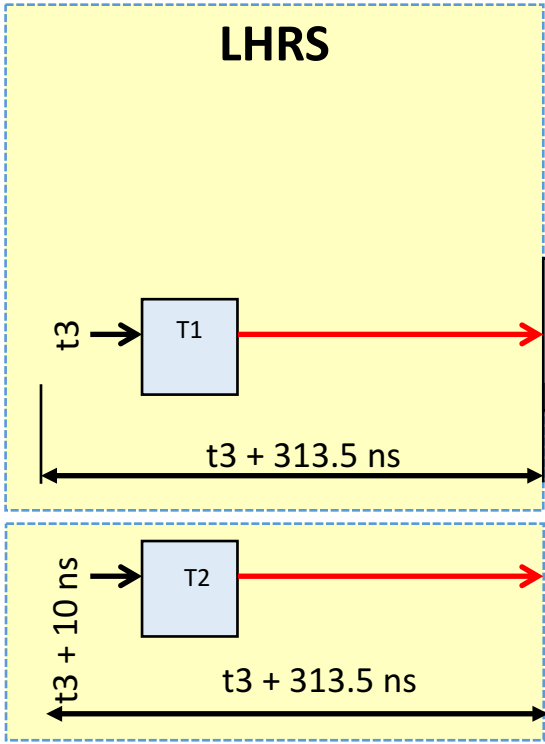


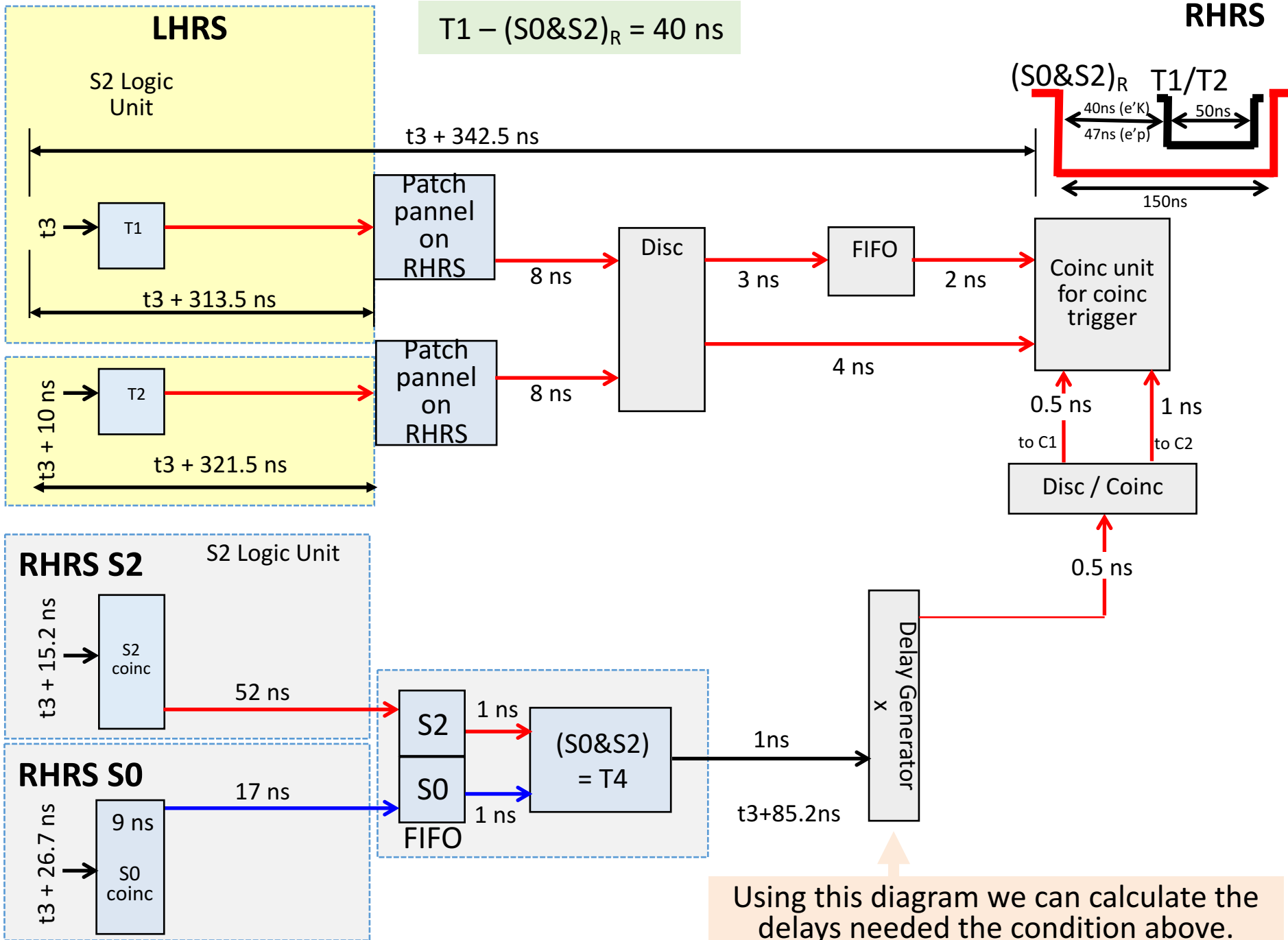
LHRS



RHRS







Prediction for the delays on RHRS for coinc trigger

C1: Need to set delay in RHRS delay generator for S0&S2 (RHRS) to:

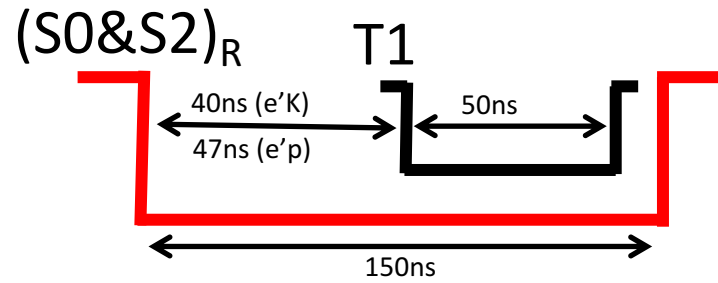
$$t_3 + 342.5 - (t_3 + 85.2 + x + 0.5 + 8 + 0.5) \text{ ns} = 40 \text{ ns}$$

C2 $x = 208.3 \text{ ns} \approx 208 \text{ ns}$

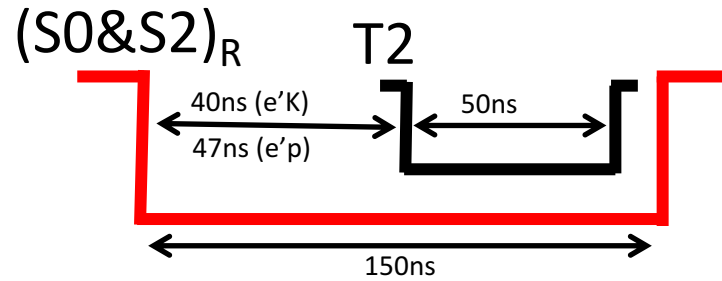
Time was 4ns off -> changed delay to 212ns.

Coincidence triggers

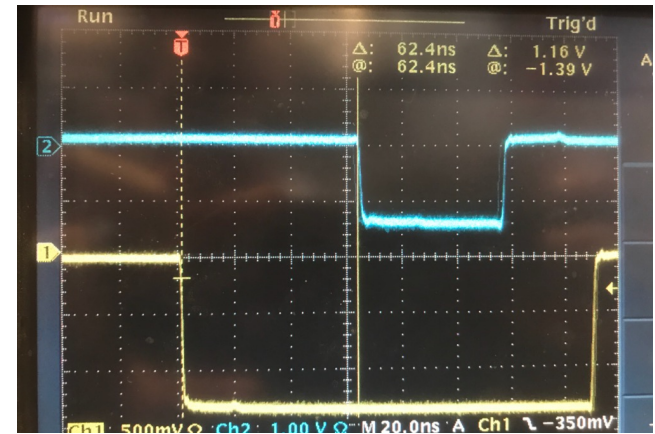
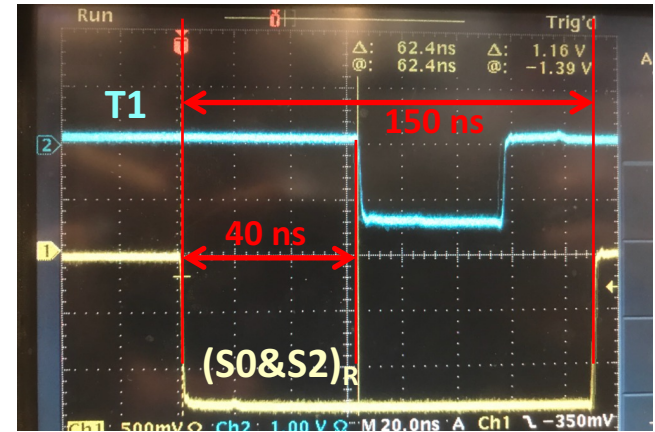
C1:

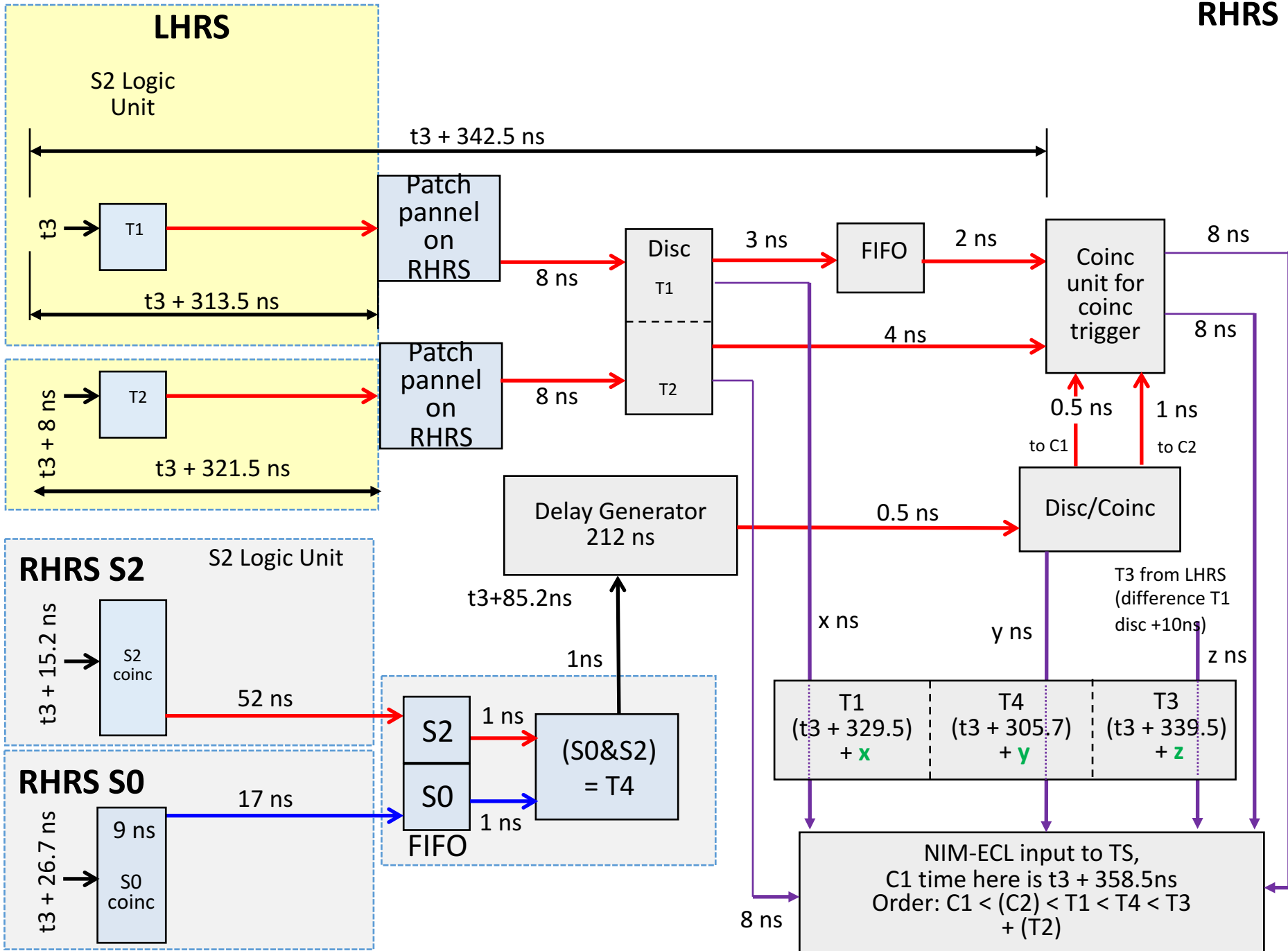


C2:



Picture from (e,e'p)





Calculated Trigger Inputs Delays

C1-T1 = -10ns:

$$t_3 + 358.5 - (t_3 + 329.5 + x) \text{ ns} = -10 \text{ ns}$$
$$x = 39 \text{ ns} \approx 40 \text{ ns}$$

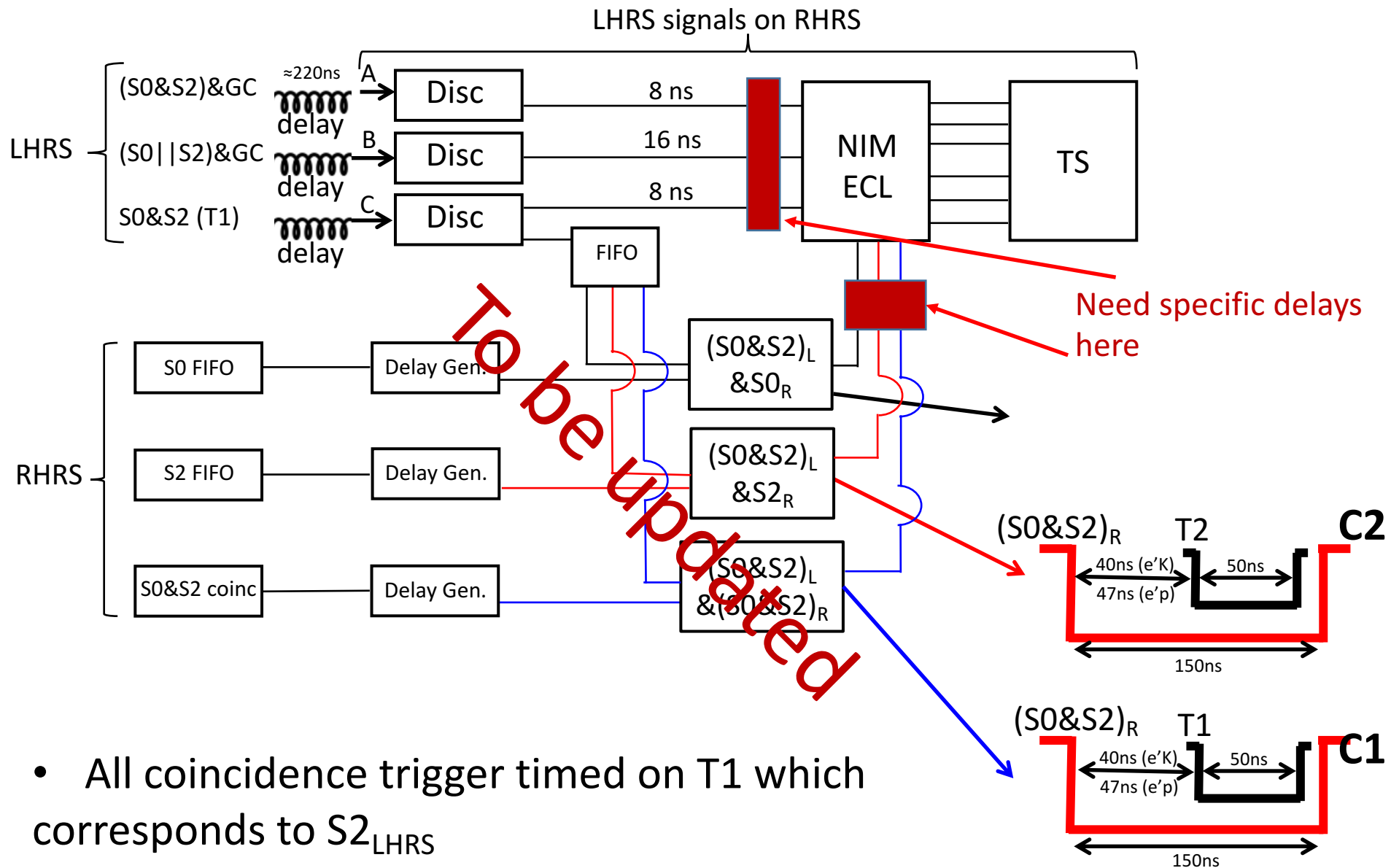
C1-T4 = -20ns:

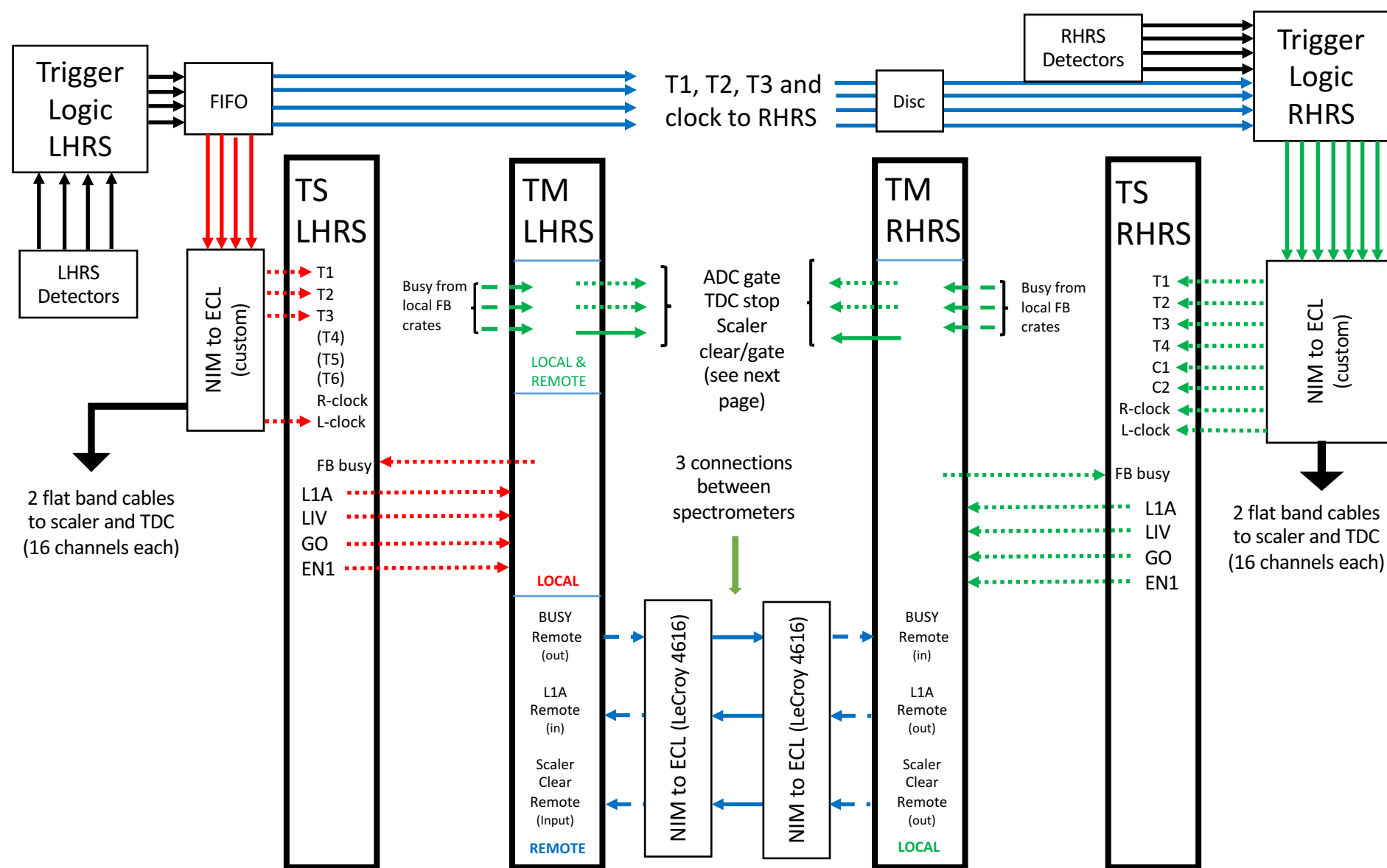
$$t_3 + 358.5 - (t_3 + 305.7 + y) \text{ ns} = -20 \text{ ns}$$
$$y = 72.8 \text{ ns} \approx 72 \text{ ns}$$

C1-T3 = -30ns:

$$t_3 + 358.5 - (t_3 + 339.5 + z) \text{ ns} = -30 \text{ ns}$$
$$z = 49 \text{ ns} \approx 50 \text{ ns}$$

Coincidence triggers





- NIM connection
- ECL connection on twisted pair
- - - - ECL on LEMO TWINAX connection
- · - · - ECL on TWINNAX to 2pin
- (Red) for 2 DAQ setup (MARATHON, x>1)
- (Blue) for 1 DAQ setup (e, e'p, coincidence)
- (Green) for both setups

Signals Exchange LHRS and RHRS

Fast cables (black, 222ns):

1. T1
2. T2
3. T3
4. L1A Remote
5. LHRS clock
6. Retiming signal , $(S0 || S2)_{RHRS}$

Slower cables (grey, 240ns):

1. RHRS clock
2. Busy Remote
3. Scaler Gate/Clear Remote

Flatband RS485 connection TS to LHRS Fastbus and VME crates

- + add second RS485 connection for slow scaler readout on LHRS
- + add interconnection line for random pulser / accidental test

Setup Changes

Hardware changes:

- LHRS: Switch RS485 cable to establish communication between RHRS Trigger Supervisor (TS) and LHRS crates.
- RHRS: Plug coincidence trigger into NIM-ECL converter that then goes to TS.
- RHRS: Adjust trigger input delays in NIM-ECL converter to TS.
- RHRS only (fall 2018): Adjust ADC Gate for Fastbus.
- Connect another RS485 cable to establish LHRS scaler readout to RHRS TS

Software changes:

- **LHRS: Change boot code of Fastbus and TS crate.**
- **Change CODA control configuration.**
- **Replay script for coincidence.**
- **CODA start/end run scripts.**
- Adjust FADC latency (ADC gate for FADCs) (has to be done after we start taking data).
- Modify scaler GUI.
- Modification of scaler readout (LHRS slow scaler started in RHRS start script).
- Change datamon (software for live dead time monitoring).

Things to do for DAQ change (counting house)

- Restart Fastbus crates and stop auto boot
- Use changeboot scripts (changeboot_coincidence or changeboot_single) to adjust bootcode

- Startcoda with “startcoda 1” on adaq2 to start the coincidence connections
- Change FADC settings to mode 10 and threshold on
- Load RHRS_Twoarm config (or what we are using for nnL)
- See if CODA will download, config and start
- Take data

- Check if scalers on both arms are working
- Check if LHRS slow scaler are started in the RHRS start script

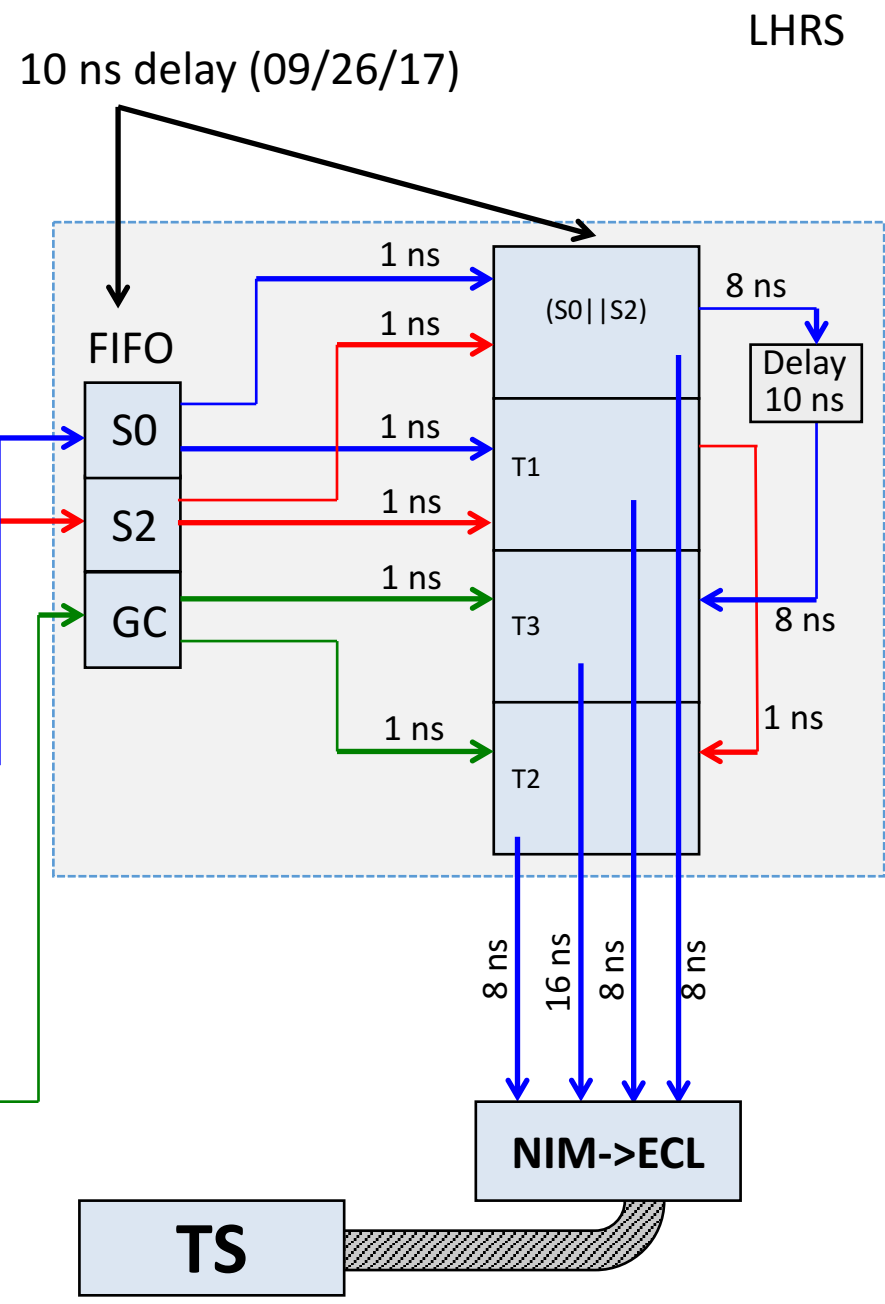
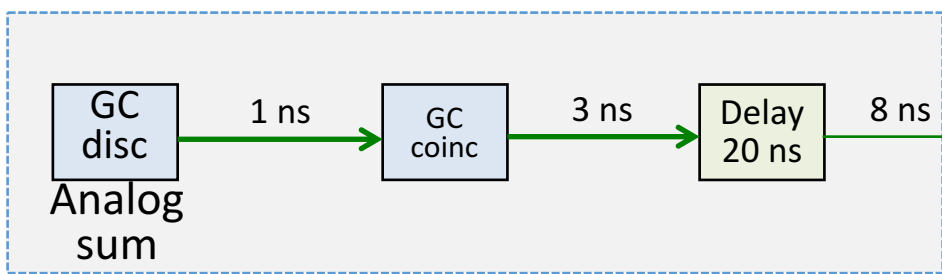
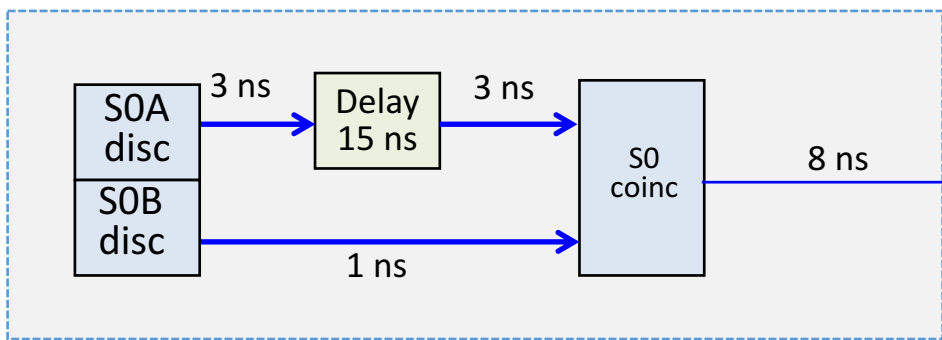
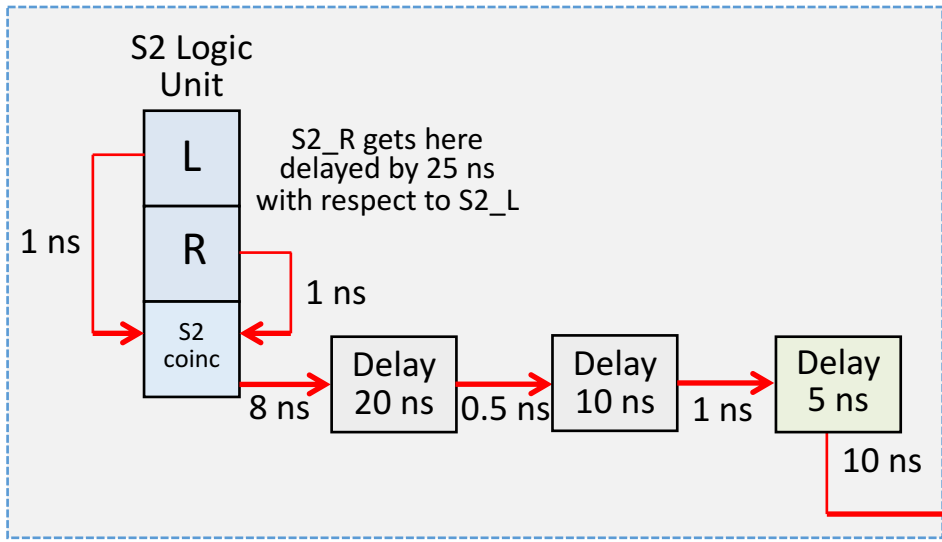
- Check FADC delays

Things to do for DAQ change (in the Hall)

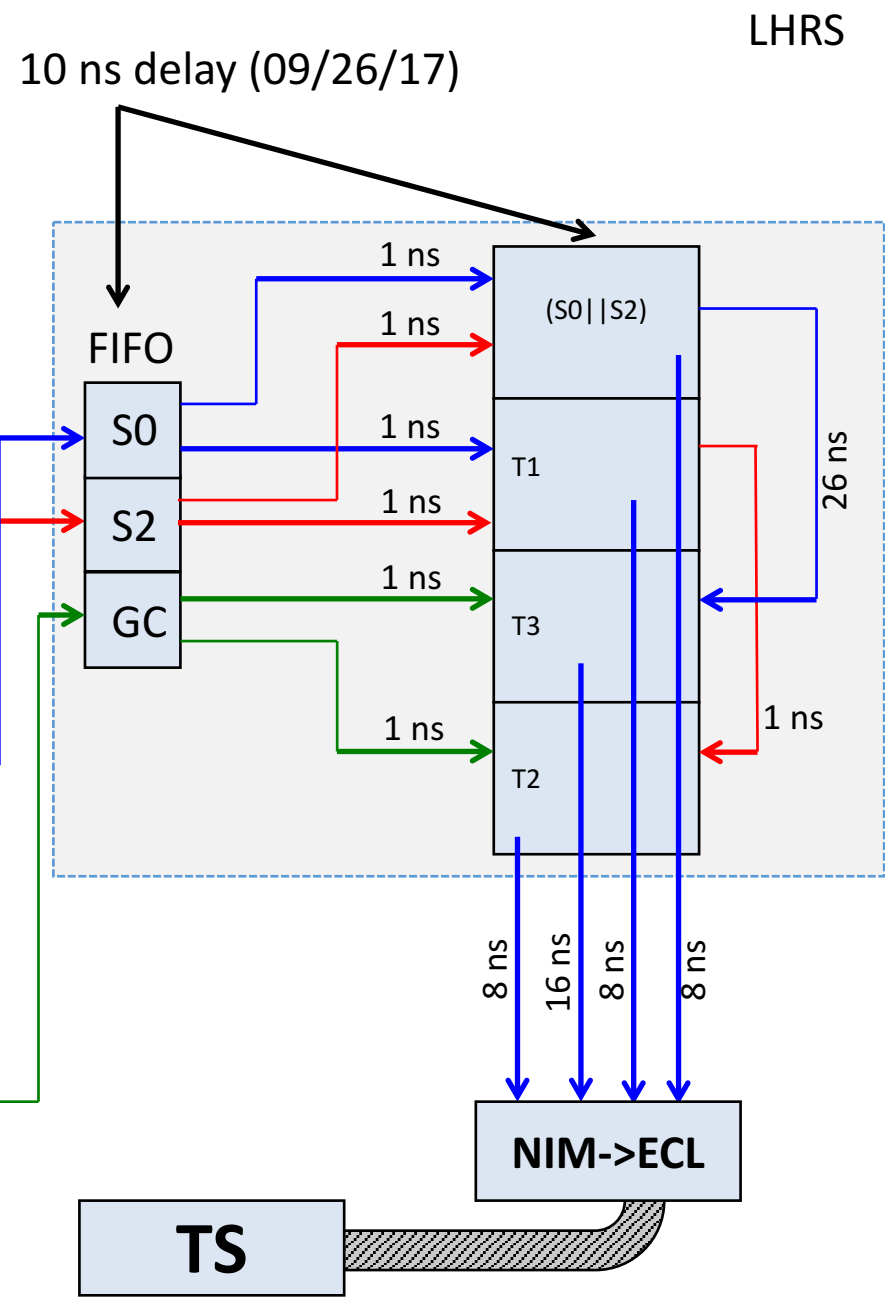
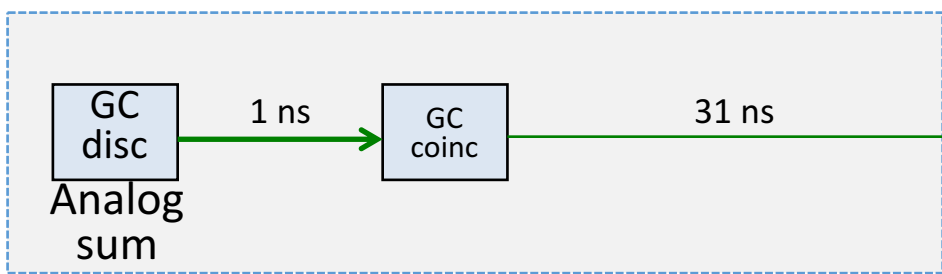
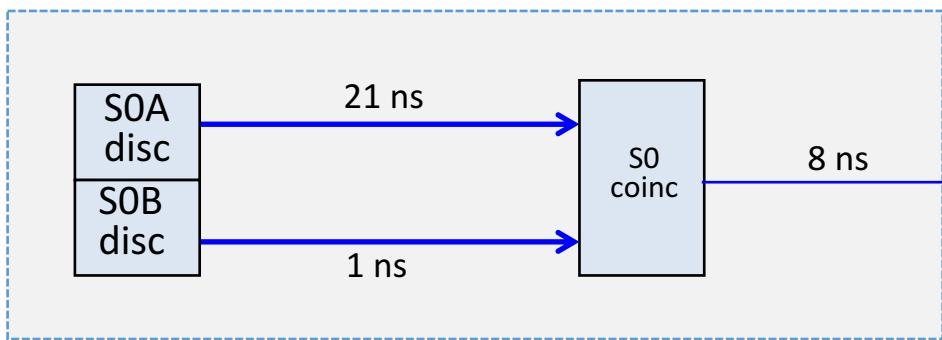
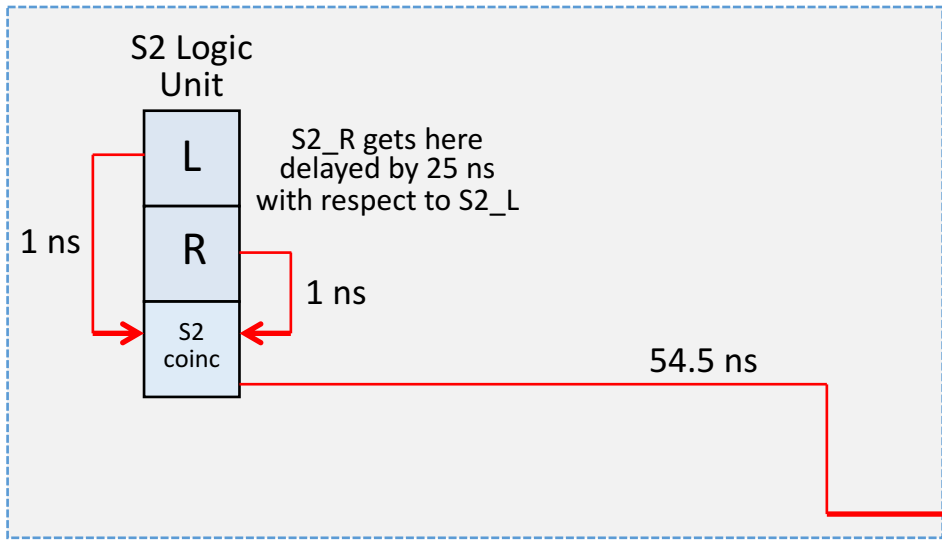
- LHRS: Move communication cable for branch
- LHRS: for F1TDC need L1A_remote input instead of L1A (best case same cable length)
- LHRS: Change L1A reference to L1A_remote FADC
- LHRS: Set up mixing of fake clock and accidentals, for C2 setup put T2 logic temporarily in OR mode)
- LHRS: Check F1TDC Trigger signal and polarity
- RHRS: Setup coincidence trigger delays with fake clock RHRS: Setup trigger delay inputs, inputs will be (T1-T3,T4,C1,C2,R and L clock)
- RHRS: S0&S2RHRS delayed output for C1 coincidence delay by 77ns more (from disc for width) and feed into TS channel 4 (currently T4). This allows for correct ADC gate adjustment for singles and delay with respect to C1 and T1
- C1, C2, T1, and T4 on Textronix 4channel scope, bring maybe 2-chan scope from LHRS to RHRS
- RHRS: Check F1TDC Trigger signal delay
- Fix problems (T6 check, more NIM modules)
- If CODA is running:
 - RHRS ADC gate adjustment with T4 and S0/GC for PS/SH
- Take Fake coincidence data
 - Only random clock trigger
 - Add accidentals with different rates on both arms
- Take cosmics data LHRS only and RHRS only with coincidence DAQ. Check F1 signals

LHRS

$T1 = (S0 \& S2)$, $T2 = (S0 \& S2) \& GC$, $T3 = (S0 \mid \mid S2) \& GC$



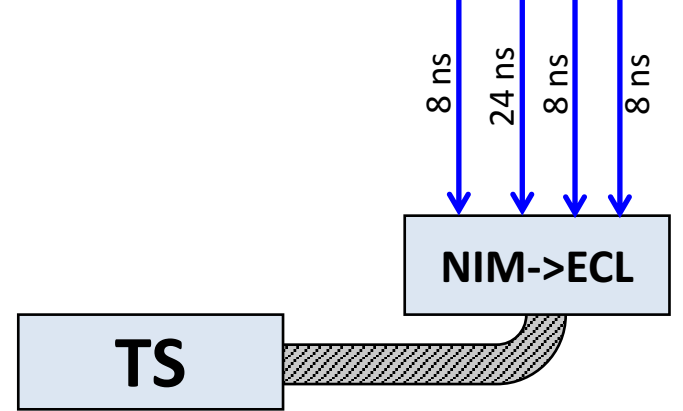
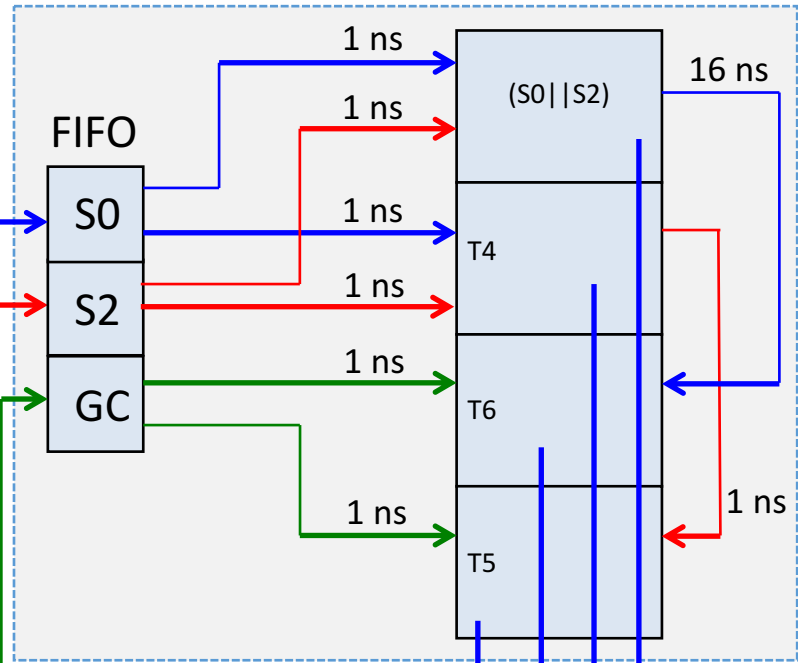
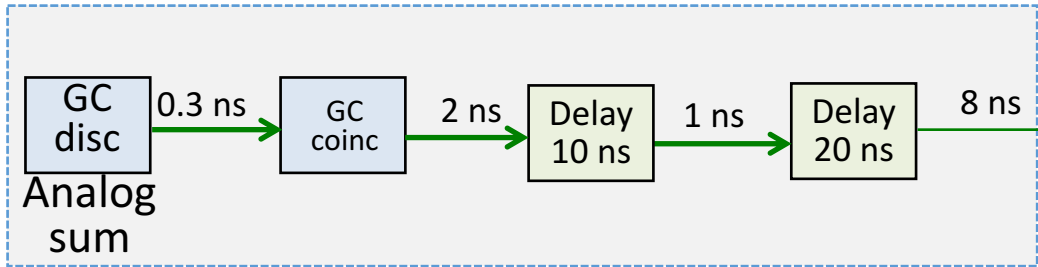
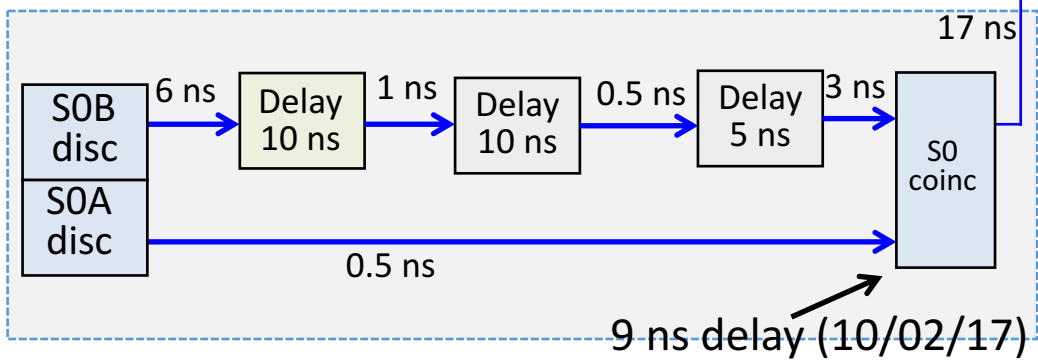
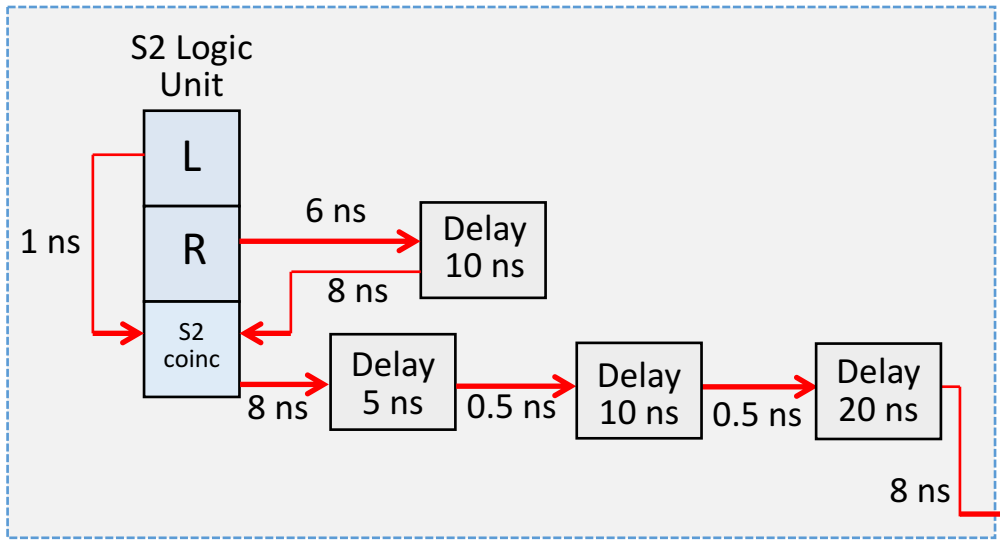
$T1 = (S0 \& S2)$, $T2 = (S0 \& S2) \& GC$, $T3 = (S0 | S2) \& GC$



RHRS

$T4 = (S0 \& S2)$, $T5 = (S0 \& S2) \& GC$, $T6 = (S0 \mid \mid S2) \& GC$

RHRS



$$T4 = (S0 \& S2), T5 = (S0 \& S2) \& GC, T6 = (S0 \mid S2) \& GC$$

RHRS

