

# Timing and synchronisation to ISIS RF

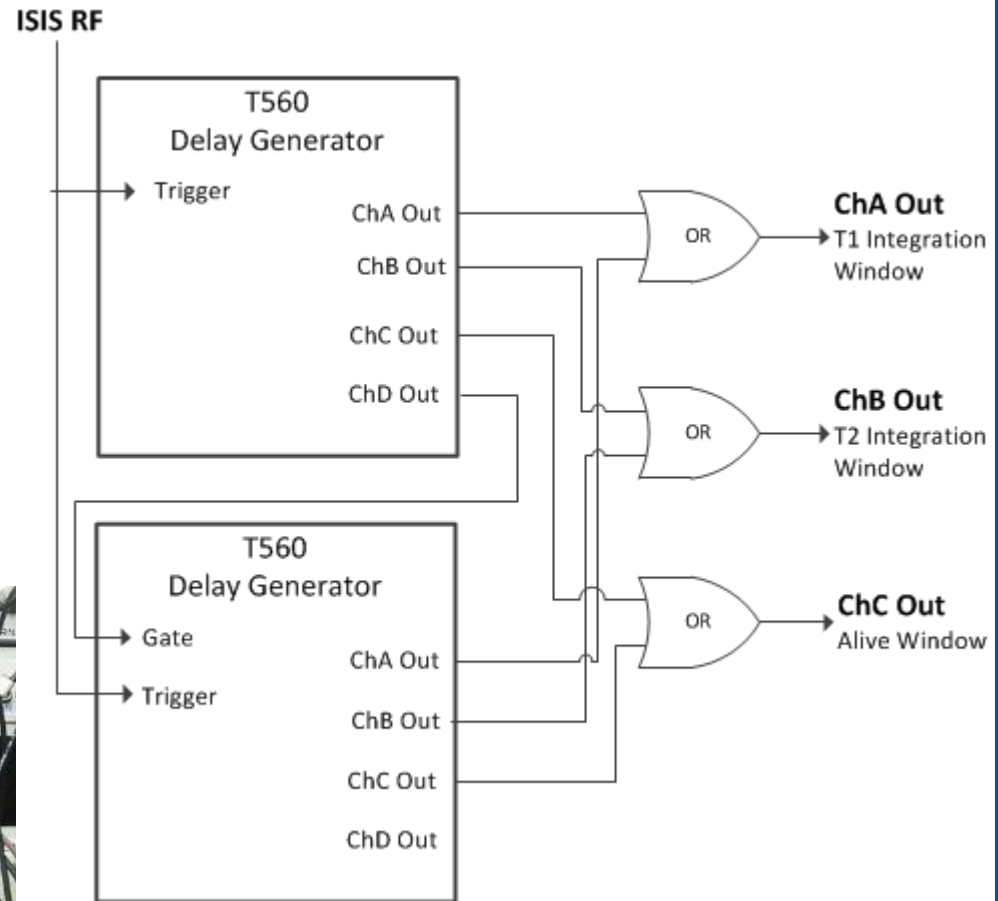
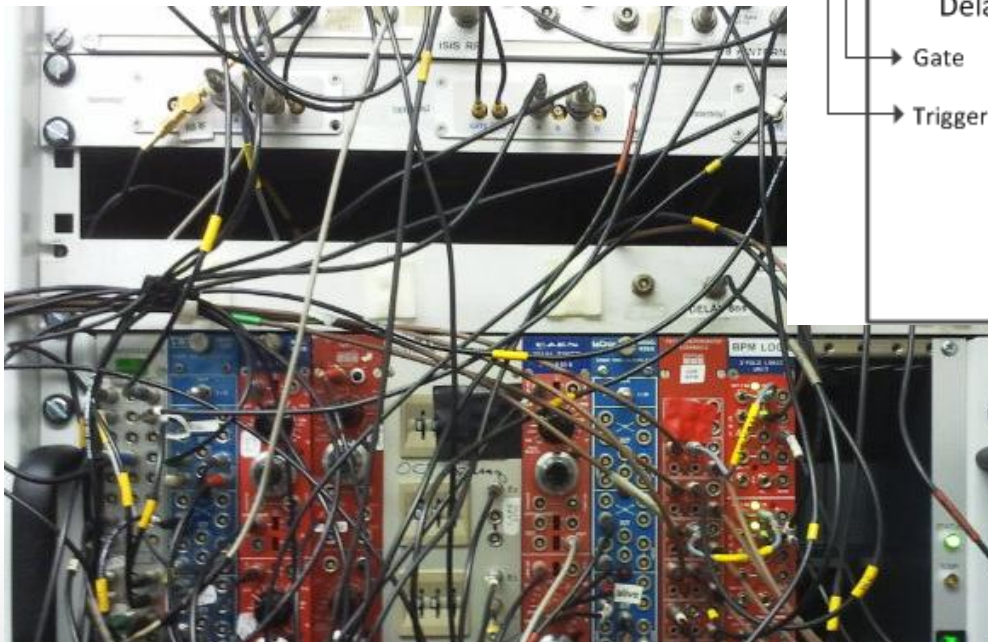
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# Contents

- Handling of the ISIS RF
- The MICE trigger configuration for the Single Station test.
- Delay measurements
- Trigger rate
- Timing to MICE

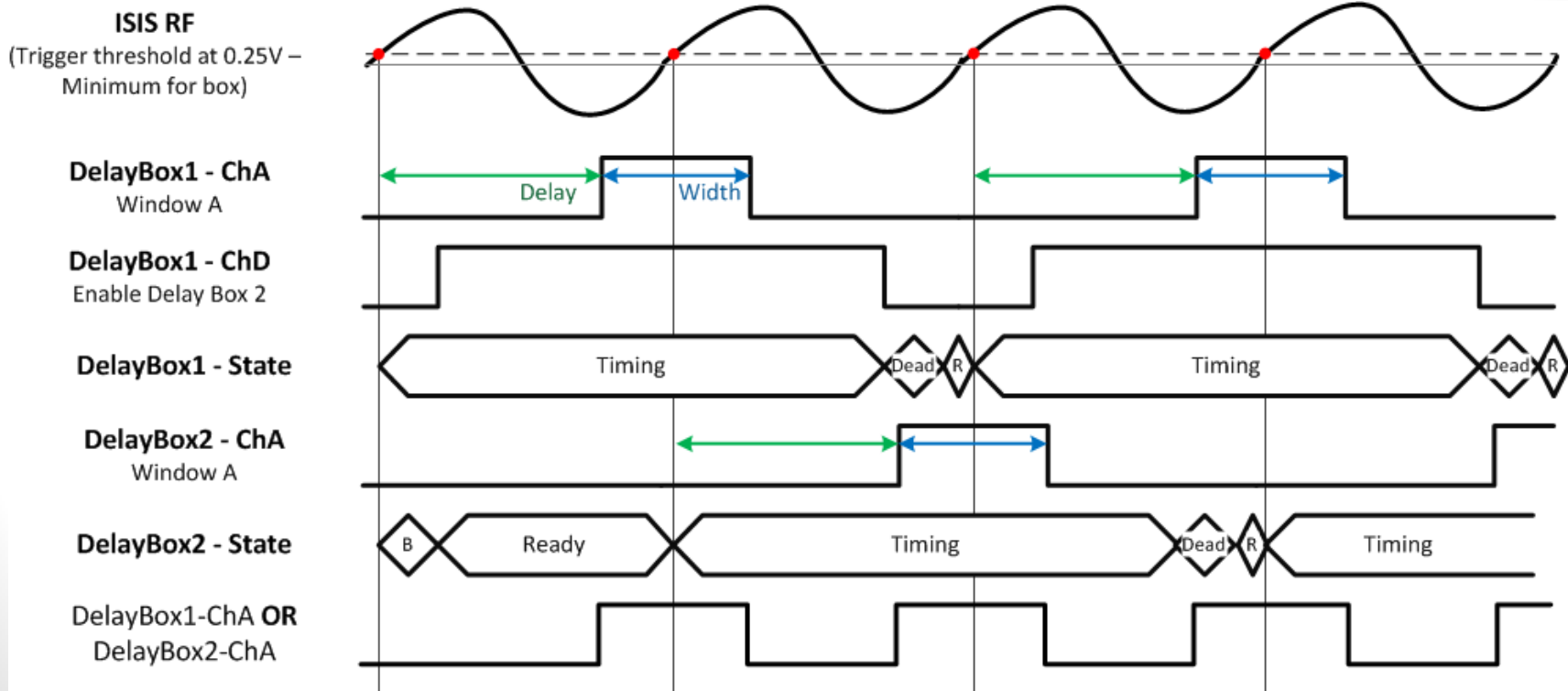
# Handling the RF

- The goal of processing the ISIS RF is to produce windows that can be moved around to meet the particles / triggers.
- The RF is handled by two delay boxes working together configurable over Ethernet.
- The second delay box triggers when the first is 'busy'.



# Handling the RF

- Timing diagram for single channel of the delay box.
- Can Adjust Delays and Width independently.
- Maximum Frequency =  $2 / (\text{Delay} + \text{Width} + \text{Dead time}(60\text{ns}) + \text{Safety}(10\text{ns}))$
- Delay + Width = 575ns



# Configuration of the delay boxes

- Used a simple CLI python script to configure the delay boxes for the Single Station Test.
- The script saved a record of every setting downloaded to the delay boxes with a hard coded filename (so it will be possible to read/reload them later).

```
[miceacq11] delayTest > ./setTrackerTiming.py -h
```

```

┌──────────┐           ┌─────────┐  ┌─────────┐
│          │           │         │  │         │
│   T  a  k  e      |   T  i  m  i  n  g  |   │
│   T  e  s  t      |   S  c  r  i  p  t  |   │
└──────────┘           └─────────┘  └─────────┘
=====
Configuration and Download Script |

```

```
usage: setTrackerTiming.py [options]
```

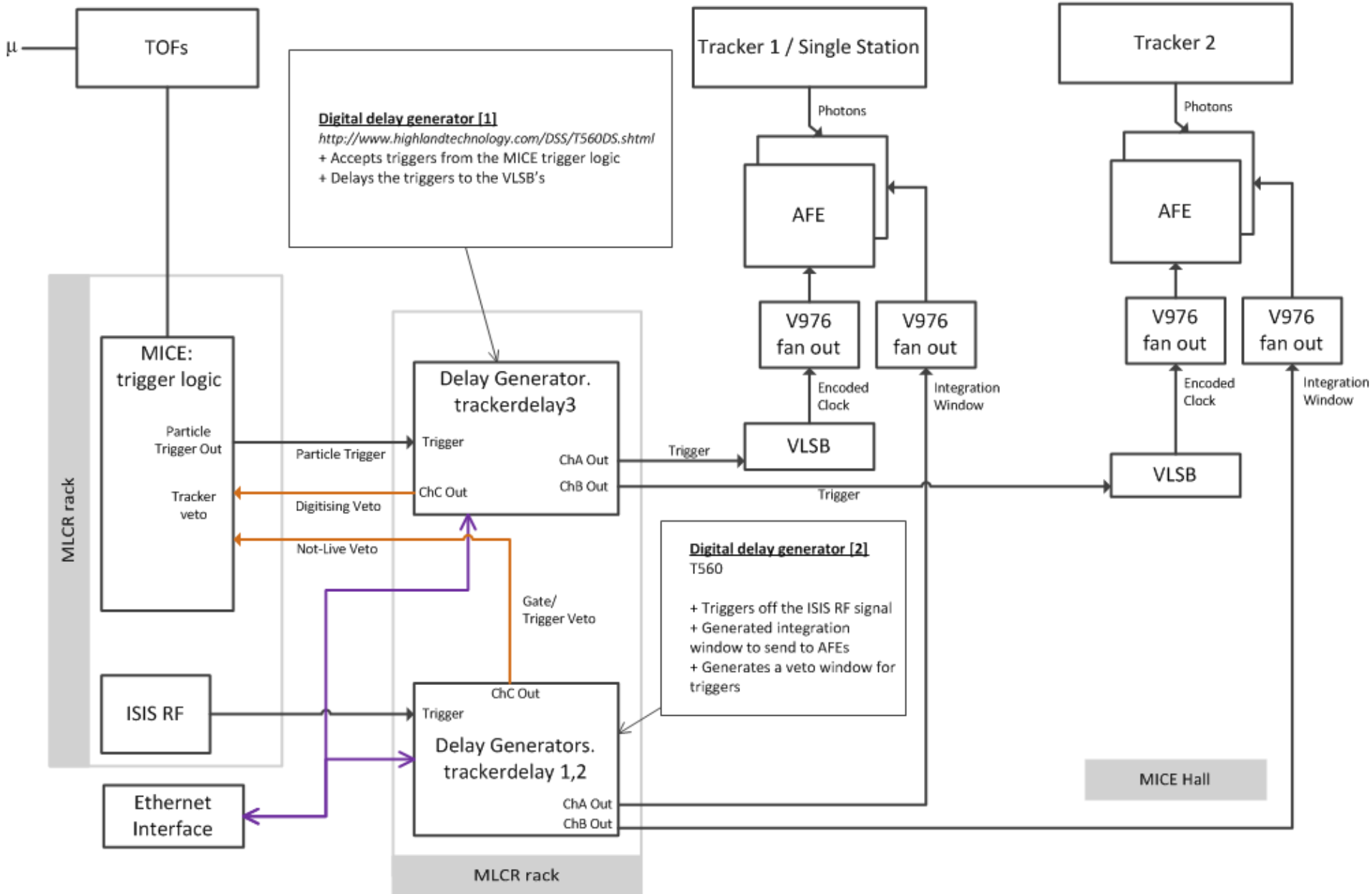
This script calculates and downloads settings to the T560 Delay boxes, in order to configure the alive window and integration windows for the tracker.

options:

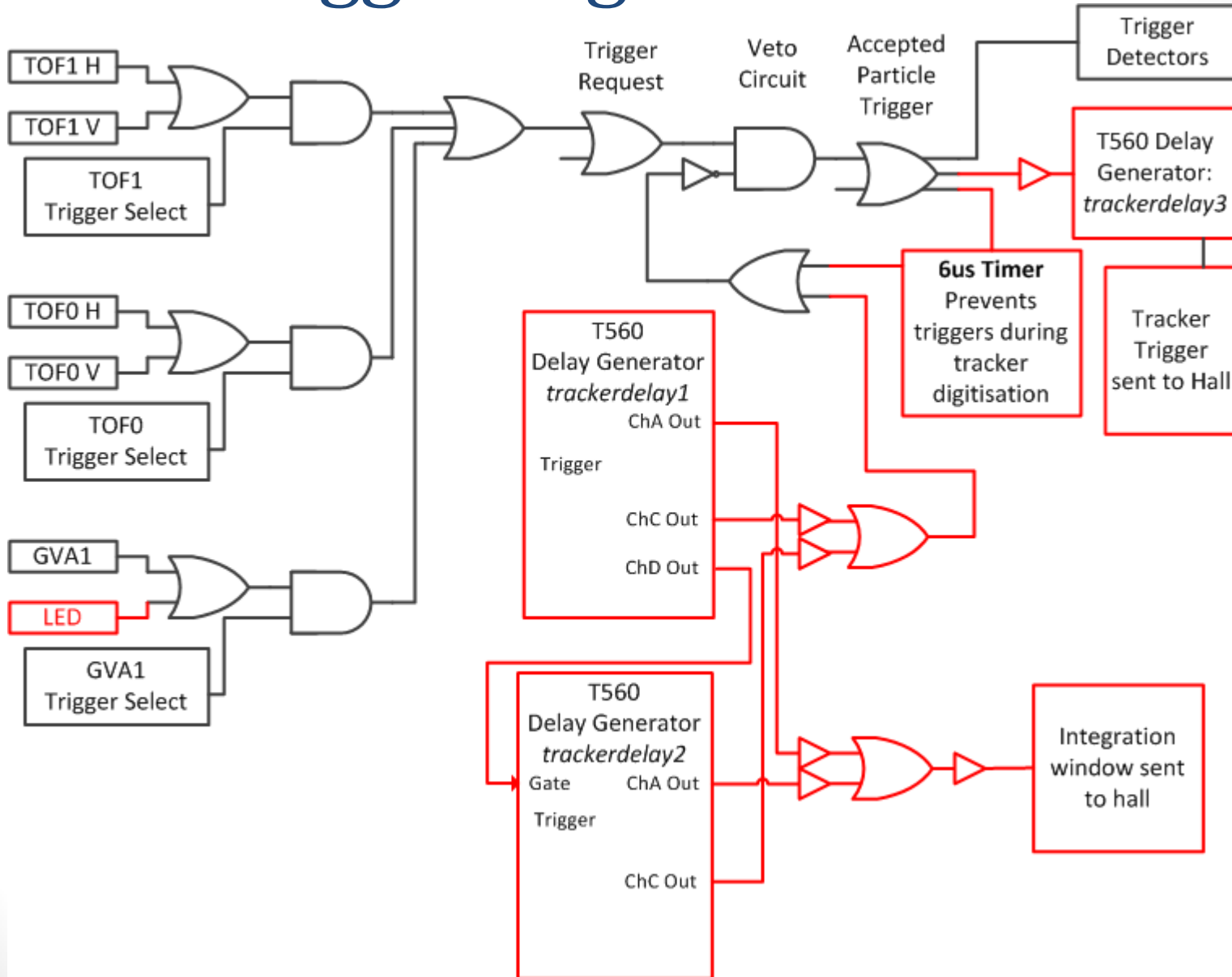
```
-h, --help            show this help message and exit
-c CFGFILE, --config=CFGFILE
                        read delay configuration from CFGFILE

-v, --verbose         Print out everything
--logs=LOGDIR         destination to place configuration logfiles
--skipconfigure       skip the configuration step
--skipdownload        skip the download step
```

# Signal Wiring – Without DAQ readout cables



# MICE Trigger Logic for the SST



# Delay Measurements

- Have started combining the measurements taken during the single station test.
- Adding the signal delay through each piece of equipment into an spread sheet →
- Have found some missing measurements (guestimate for the moment, will check when at RAL).
- So far a summary:

## Integration window delays

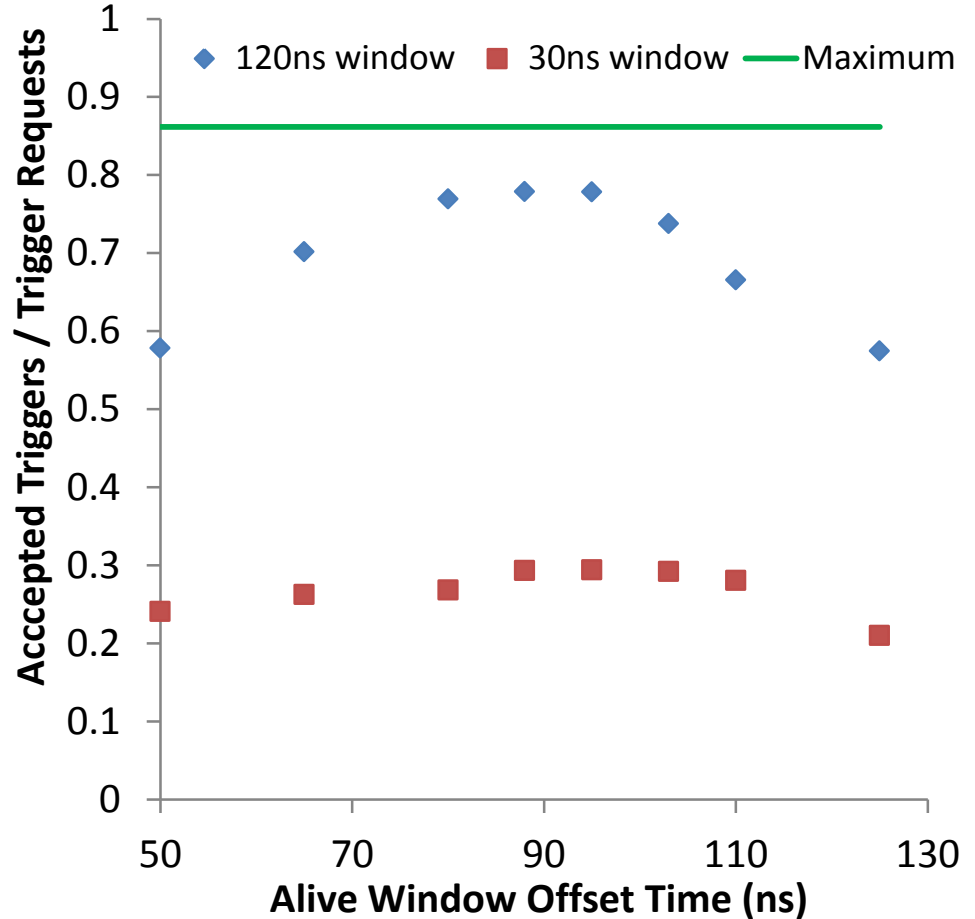
Description	Delay(ns)	Total Delay (ns)
Patch Cable	2	2
TTL->NIM Conversion?	7	9
Patch Cable	2	11
Logic Fan In/out	7	18
Patch Cable	2	20
NIM->TTL Conversion?	7	27
Patch Cable	4	31
Cable to Hall?	250	281
Patch Cable	2	283
V976 Fan out	9	292
Cable to AFE	32	324

	Delay (ns)
Integration window (RF->AFE)	324
Alive window (RF->Veto)	34
TOF Signal (PMT signal->Logic pulse in MICE trigger)	306
LED Trigger (Voltage pulse in SS -> Logic pulse in MICE trigger)	332
Logic pulse in MICE trigger -> VLSB Trigger	619



# Trigger Rate

- We measured the effect of the alive window on the trigger rate, while moving the alive window.
- **There was no digitisation dead time included for this study for the tracker (normally 6us).**
- We recorded the number of triggers on the scalars for 10+ spills.
- On average there were 150 Triggers / spill.
- **Later I took a specific run where I varied the particle triggers from 120/spill to 9/spill using the target. I excluded the digitisation window so that one could be applied later and we can see how it effects the rate..**
  - **Would this be useful?**



# Timing to other Detectors

- The tracker calculates time relative to the end of an integration window.
- The TOFs record the relative time of the particle trigger..
- A possible plan to link the two
- Not sure how far back to go...
- Hopefully should visit Yordan while he is MOM so we can have a go at this...

