Tracker: Status, DAQ, Calibration & Trigger

MICE CM45, July 2016
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Tracker HW status

- Tracker hardware has been mostly stable since the last CM.

- Been running cryostats since Q3 2014.

  - Few glitches, but generally OK.

  - Cooling performance reduces over time due to helium loss and age.

    - Helium loss: top up the helium in the compressor.

    - Age: A service, we are using the archive monitor to keep an eye on things and estimate the best possible time for a service (hopefully after Step IV).

  - Last week Cryostat 4 warmed up sufficiently so that temperature regulation on a single VLPC was no longer possible. (Temperature rose above 9K to 9.01K over 4 days)

    - Craig and Joseph refilled the helium in the compressor, which lowered the cold head temperature by more than 0.3K.

    - Plenty of headroom for near future running.

      - Need to guestimate if this is sufficient for Step IV.

Spares

- AFE-Iit (Front end boards):

  - Spares in the tracker lab.

    - Known good readout.

    - Bias and temperature calibration required

    - Need to do one left and one right hand board

- VLSB (VME buffer board):

  - Single spare in the tracker lab. Partially working.

  - Others at FNAL, being repaired.

    - TODO: Find status.

- CAEN HW:

  - PCIE Bridge, none spare

  - CAEN Controller, none spare.

- PC:

  - Could use miceiocpcspare.

Discriminators & Timing

- First pass in setting up discriminators and timing circuitry during the last shut down

- When checking the readout:

    - there were signs of crosstalk between channels

    - interesting artefacts were added to the pedestal plots

- For the current user cycle we disabled the discriminators and timing circuitry.

    - Running with known configuration.

- Further investigation in the shut down with the LED system.

- Would like to take some data with discriminators & timing circuitry on in the next cycle.
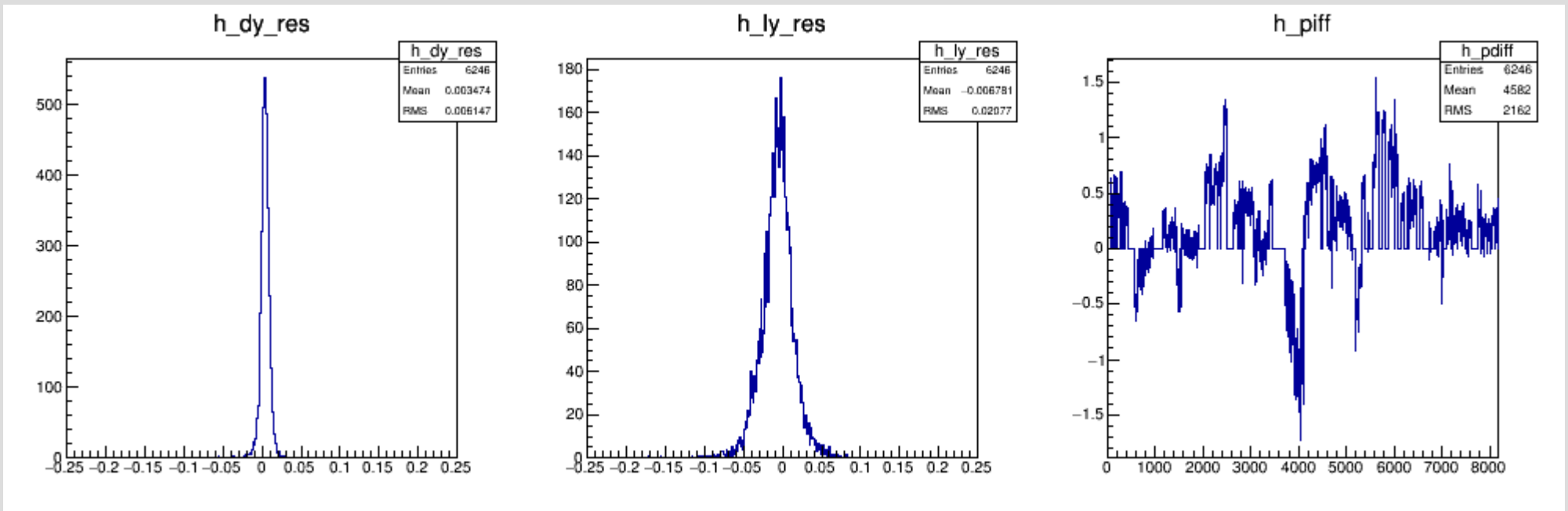
DAQ Status

- Stable.
  - No changes have been made to the readout code since the last run.
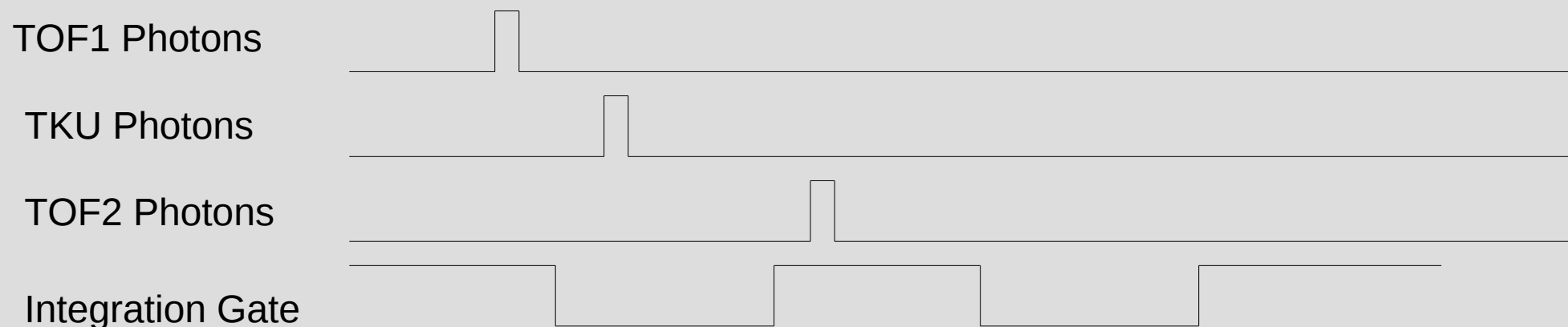- Data integrity checks running.
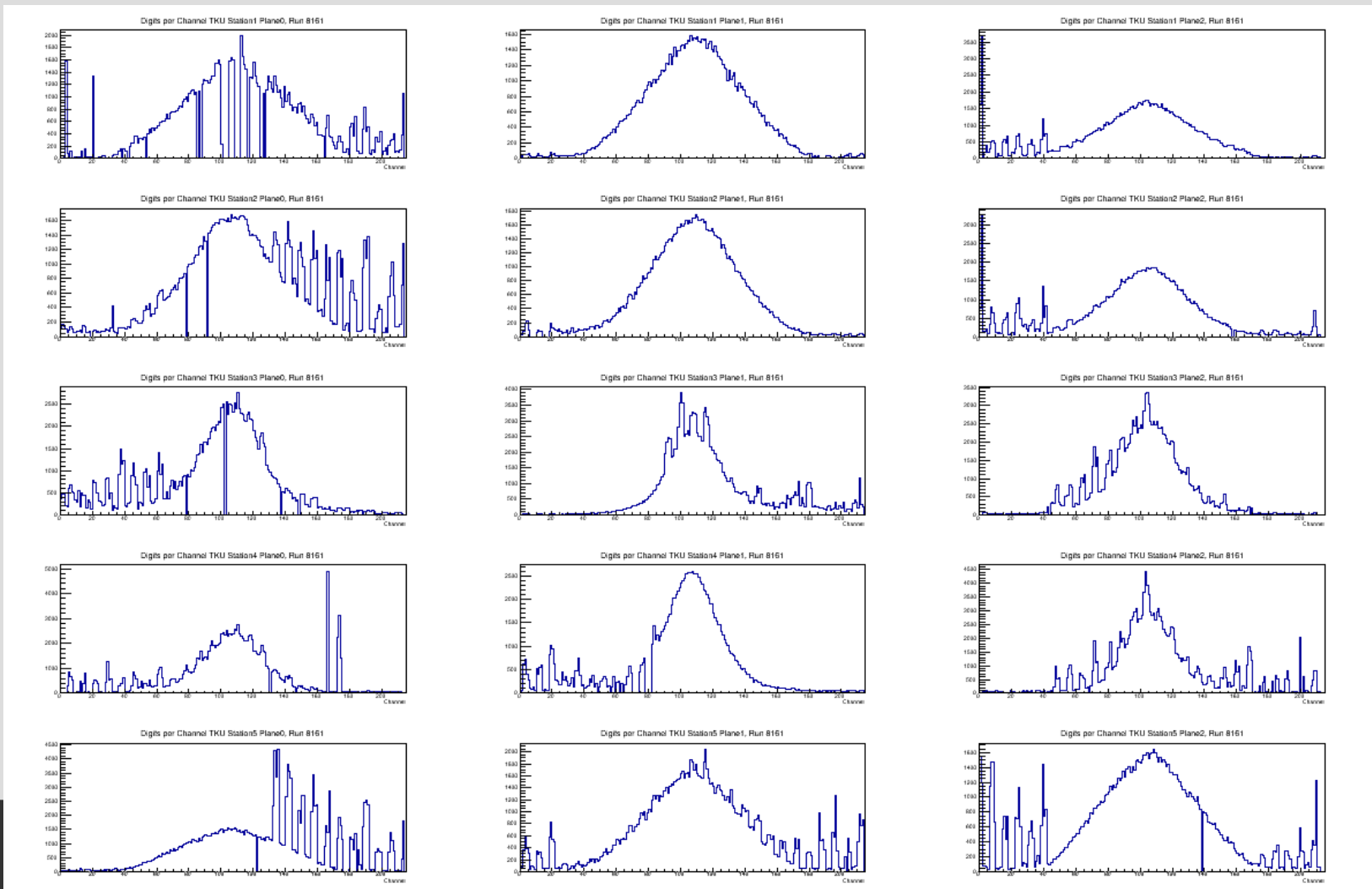
Calibration Status

- Did not integrate the full auto-updating calibration since the last CM.

  - Request to limit unnecessary pushes to the CDB.

 - Now going through an identifying significant changes to push.

Front end (in hall) timing

TOF1 Photons

TKU Photons

TOF2 Photons

Integration Gate

- Tracker is only able to accept charge arriving inside the integration gate.

- Integration gate is synchronised to MICE particles using the ISIS RF.

  – Therfore does not change dependent on trigger.

- Hit times are checked against "alive window" in rack room, to verify the front end electronics were in use

- Hits from TOF1/2 are delayed due to particle TOF.

  – Triggers from TOF2 are delayed WRT the fixed timing of the integration gate.

  – Need to factor these changes in when swapping between triggers.

Current implementation
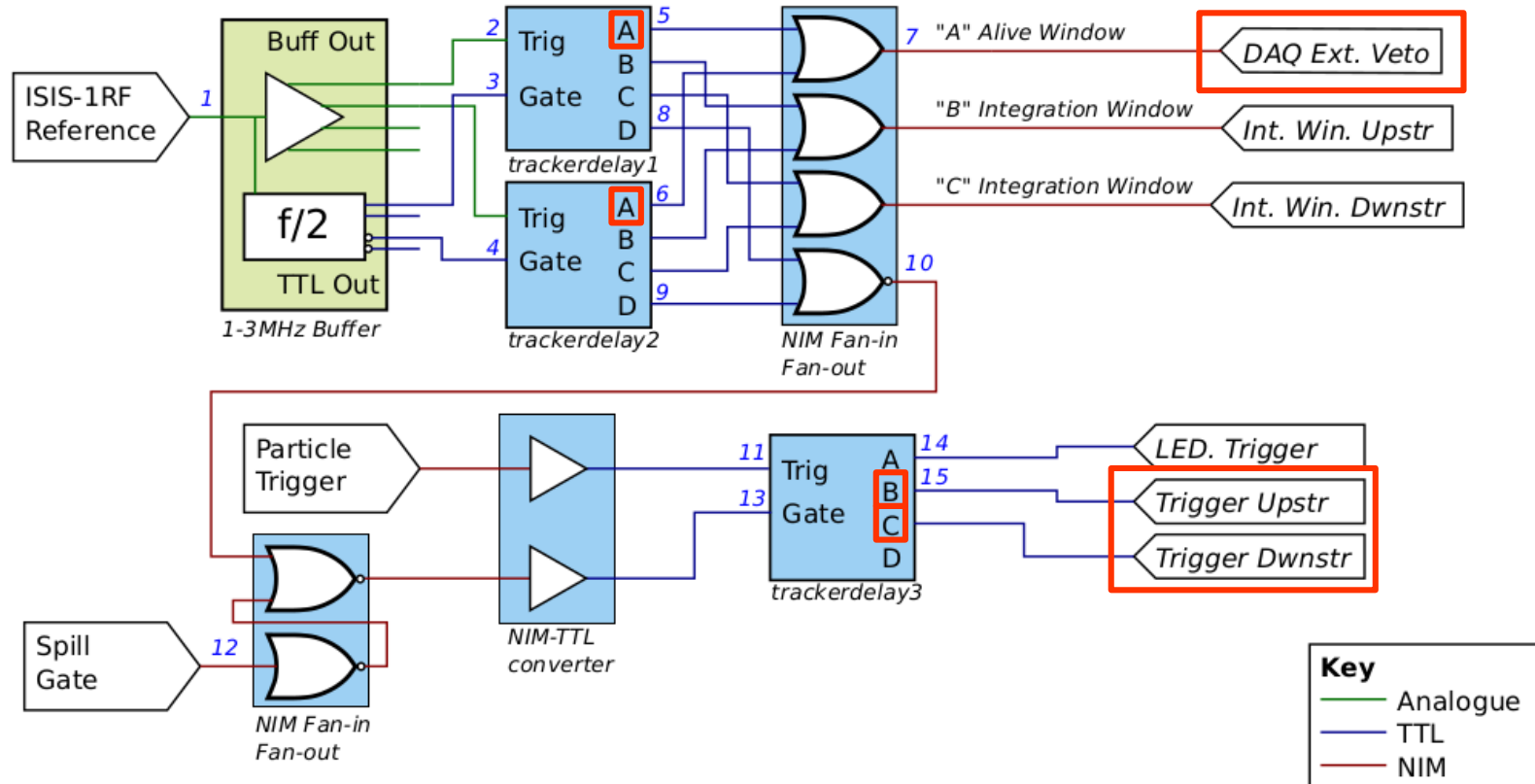
◉ Indicates a parameter which needs changing for TOF 0,1,2 trigger conditions

• Note that the programmable delay units cannot be changed within a spill timesale and for a prescaled trigger would be essensially fixed.

Prescaled trigger

- **<u>Would need to implement all variable timing elements within trigger logic.</u>**

  Possible plan:

- Use existing "Alive Window" signal to generate a alive start pulse, synchronised to ISIS-1RF.

- From alive start pulse implement 3 gates internal to trigger, one for each TOF detector. Each gate has independent timing configuration.

- From the engine, need to apply condition sensetive delay to fix "tracker trigger" timing.


Tracker CM44
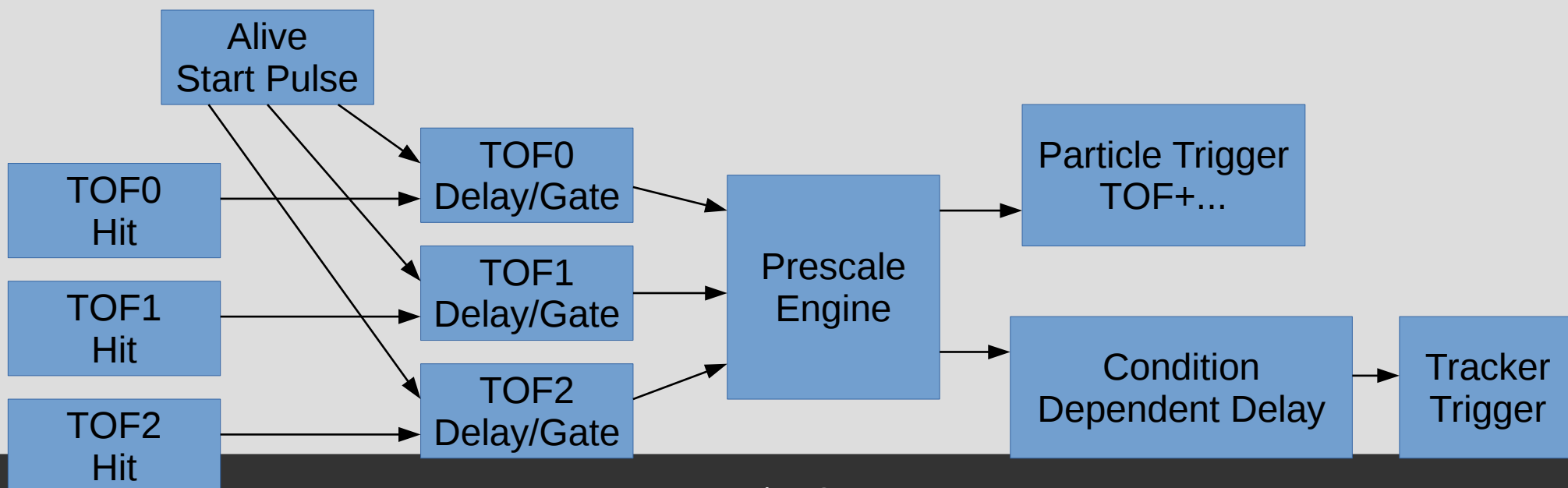
Prescaled Trigger

- Yordan has begun written a first pass of the pre-scaled trigger firmware.

- Additions need to be made for the tracker timing checks.

    - Individual gates need to be generated internally for each TOF station. Done/Tested.

    - Additions to the pre-scaler are required to accept the gates. Done/Tested.

    - Logging of hit timing is also required. Written/Untested.

- These changes then need to be integrated with the rest of trigger code, and tested!

- May also require a trigger dependent delay:

    - Possible that there is enough timing margin to ignore this, however this will make the timing configuration more sensitive.

    - Will look into implementation.

- Much to easier to select a trigger station in advance (instead of an OR or AND).

Prescaled Trigger

- Three gate generators working (in simulation):
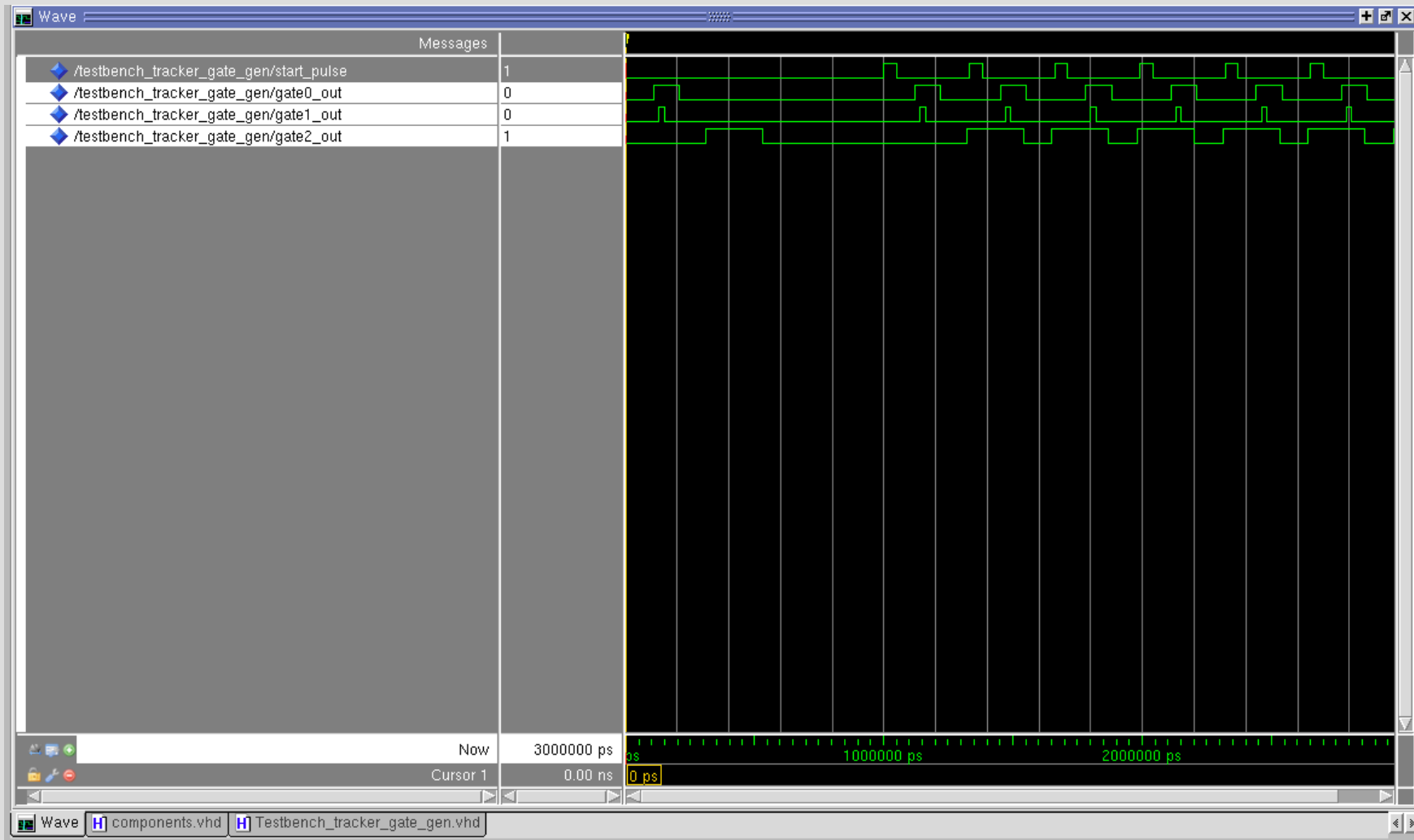
Conclusion

- Tracker systems are stable:

  - H/W has slow change in cryostat temperature. Managed by keeping an eye on temperatures and topping up with helium in the near future.

  - DAQ systems are stable.

  - Using old 'tried & true' calibration for running.

    - Option for discriminators/timing in the near future.

  - Additions for the tracker in the pre-scaler are in progress.

    - Next steps are to integrate and simulate

    - System test next user run.