

Gated Mode

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All information of these slides can be also found on confluence:

<https://confluence.desy.de/display/BI/DHH+gated+mode+tests>

<https://confluence.desy.de/display/BI/PXD+Gated+Mode>

Switcher Sequence / Control

- Phase 2
 - Use GatedMode with ReadOut: implement sequence as “normal” switcher sequence, i.e., not enabled/disabled by any trigger outside from DHH
- Phase 3
 - Use GatedMode with ReadOut. Only GatedMode sequence is written into DHP switcher address 512 (not combined with normal switcher sequence)

	Phase 2	Phase 3
Switcher Address 0:511	NORMAL and GatedMode sequence for some gates in between	NORMAL
Switcher Address 512:1023		GatedMode sequence only

New parameters in DHC firmware

Name	Function
Start gate	Defines in which gate relative to the revo signal the injection signal is generated
Veto distance	Defines after how many revolution cycles a new injection should be generated
Veto length	Defines how many revolution cycles the gated mode lasts (veto length should be smaller than veto distance)

Register	Function
Gated mode enable	Enables the feature
Gate offset	Offset in gates between the gate of the received veto signal and the issuing of the veto to DHP ($\text{posNew} = \text{posRec} - \text{gateOffset}$)
Gate length	For how many gates shall the veto signal be applied to the DHP NOTE: if the gated mode without readout is used the length (number of gates) must exactly match with the GM switcher sequence, otherwise we get out of sync
NO_TRIGGER offset	Offset in gates between the gate of the received veto signal and inhibiting the triggers ($\text{posNew} = \text{posRec} - \text{gateOffset}$)
NO_TRIGGER length	For how many gates shall the trigger inhibit signal be applied
Enable 2 GM per frame	For normal operation should be set to one used as there are two frames per revo cycle

Verification of DHH firmware without FTSW (1)

1. Test of basic functionality (test only the no trigger signal => data should not arrived during GM)

- Upload a test pattern (1 hit per gate) => same script as for occupancy tests (DHP testmodus enabled, load testpattern into data memory)
- Set veto distance to a high number (e.g. 1001) and veto length to the same number-1 → Gating should be enabled continuously
- On the module enable gated mode and set a reasonable no_trigger_length (e.g. 10)
- Set enable 2 GMs per frame
- Record data → you should see that for 10 gates no hits are found (where trigger is not allowed)
- Set gate length (GM length) to 0
- Result: worked

2. Align the gated mode (shift the block of 10 non-readout gates) (Start gate check)

- Use the same settings as above
- Tune the start gate on DHC in order to get the missing hits in the beginning of the frame
- Result: worked for start_gate = 4 (shifts to lower rows on if) for no-trigger length 10 and offset 0

3. no_trigger_offset and no_trigger length (NO_TRIGGER offset check & NO_TRIGGER length check)

- Repeat the measurements and check if changing these parameters do what is expected
- no_trigger length works
 - reducing the parameter mean lower rows become visible → start_gate needs to be adjusted accordingly (is this intended?)

4. Test different veto distances (VETO DISTANCE check)

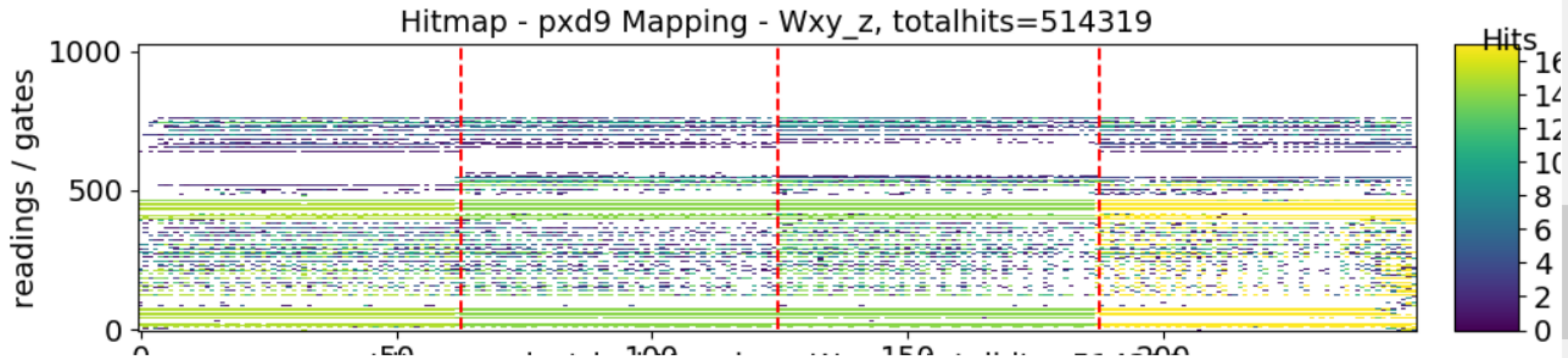
- Setting veto distance to 2x veto length should give you missing hits only in half of the events

Verification of DHH firmware without FTSW (2)

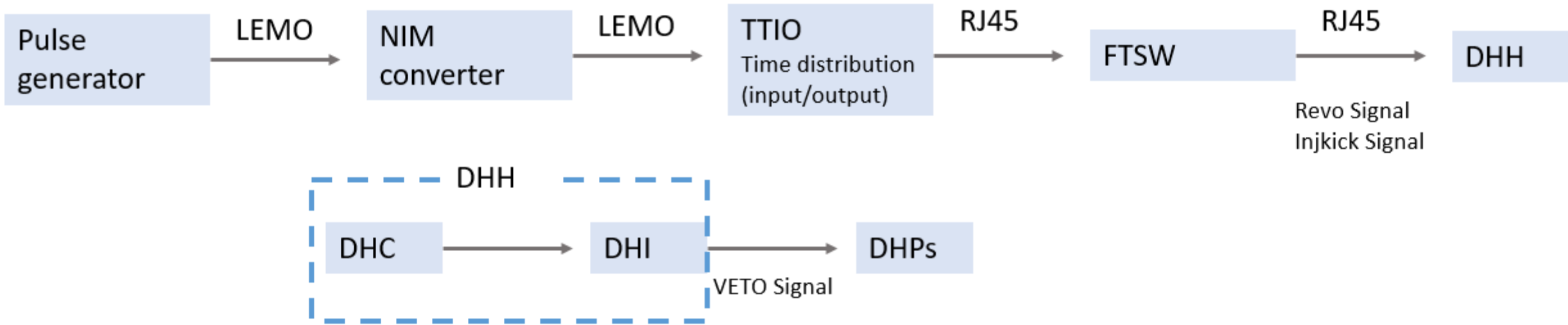
Having tuned these parameters the same parameters can be used for testing the real gating.

1. Basic test

- Set veto distance to a high number (e.g. 1001) and veto length to the same number-1 → Gating should be enabled continuously
- Set no_trigger_length to 0
- Set gate length (GM length) to 10
- Upload gated mode sequence.. and configure the system accordingly
- Go to peak
- Check if there is increased noise at the same position where the hits were lost in the previous tests
- I had problems with the readout of our system. However, currents of clear on and off change as expected when 1 and 2 GM per frames are activated. I was finally able to take a small set of zs data with GM and I could see the pedestal changes. The data was very noisy but one can see both GM sequences quite clearly.



Signal propagation @ DESY



Tests done up to now:

- No Injkick Signal from FTSW --> generated internally in DHH

Comparison to KEK:

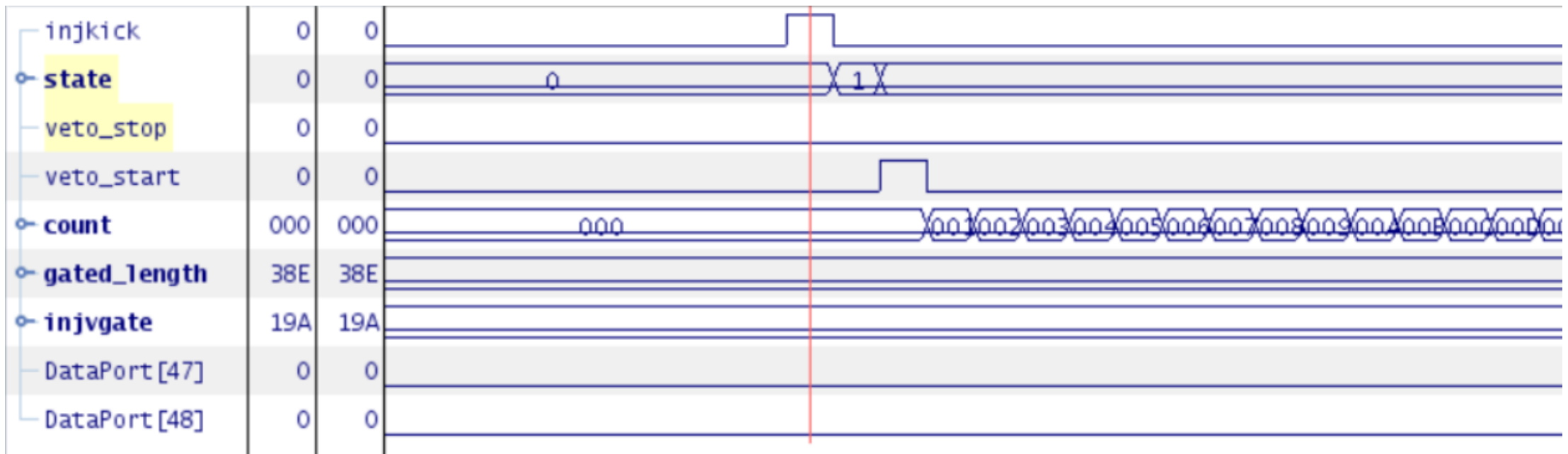
- FTSW at DESY is hardware version 2
- FTSW at KEK is hardware version 3

Problems:

- GM firmware for FTSW v3 was tested
- GM firmware for FTSW v2 was developed recently

Verification of FTSW v3 firmware at KEK

- Verification of FTSW (hardware v3) and DHH at KEK on April 25, 2019



Verification of FTSW v2 firmware at DESY

- FTSW unit 55
- Injkick Signal is „seen“ by DHH
- Missing signals required by DHH (vFull and vGate) Generating triggers by FTSW not possible („not connected“)
- Flashing of another firmware not possible anymore („not connected“)
- => need input from Mikihiro Nakao
- Felix J. back on June 10
- Varghese will continue with tests

Test of FTSW and DHH

Parameters which can be tuned at DESY:

- ☐ Gate mode enable: True
- ☐ Gate length: 6 gatesEnable 2 GM per 1 frame
- ☐ NO_TRIGGER_length (for how many gates the trigger inhibit signal should be applied): first tuning at DESY. (6 gates + pedestal oscillation)
 - ☐ Apply a special pedestal mask which allows to read out only 2 drains. The NO_TRIGGER parameter should be set to 0 (or 1 if 0 is not allowed) to get a feeling for the pedestal oscillation
 - ☐ take and upload normal pedestals and apply GM & Sweep this parameter and have a look at the ZP data (HITMAP)
 - ☐ aka reduce damping time (advanced):
 - ☐ adjust threshold
 - ☐ adjust clear-on voltage
 - ☐ adjust gate-off voltage
 - ☐ Remove all the electrons from the internal gate - how to do this?
 - ☐ Do not remove charge from internal gate during GM - how to do this?

Parameters which can be tuned only at KEK:

- ☐ ☐ Veto distance (after how many revo cycles a new injection should be generated): from machine
- ☐ Veto length (how many revo cycles the gated mode lasts): (CLAWS, background studies)
- ☐ Start Gate (which gate relative to the revo signal the injection signal is generated) - **how to do it?**
- ☐ Gate Offset (Offset in gates between the gate of the received injkick signal and the issuing of the veto to DHP) - **how to do it?**
- ☐ No Trigger offset (offset in gates between the gate of the received injkick signal and inhibiting the trigger): start with 0 - play with occupancy - **is this the correct way?**
- ☐ reduce damping time (see DESY steps)