

# Overlapping Trigger Firmware and DHH Hardware

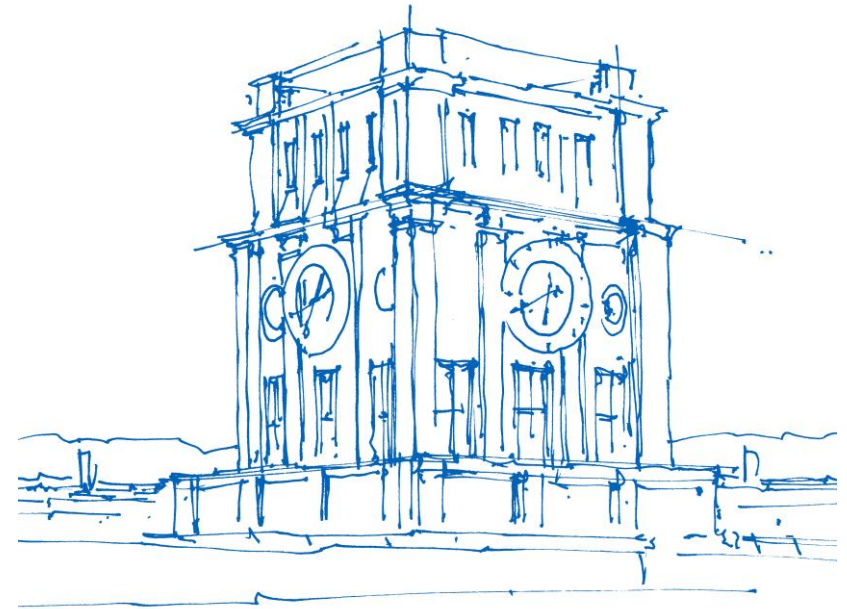
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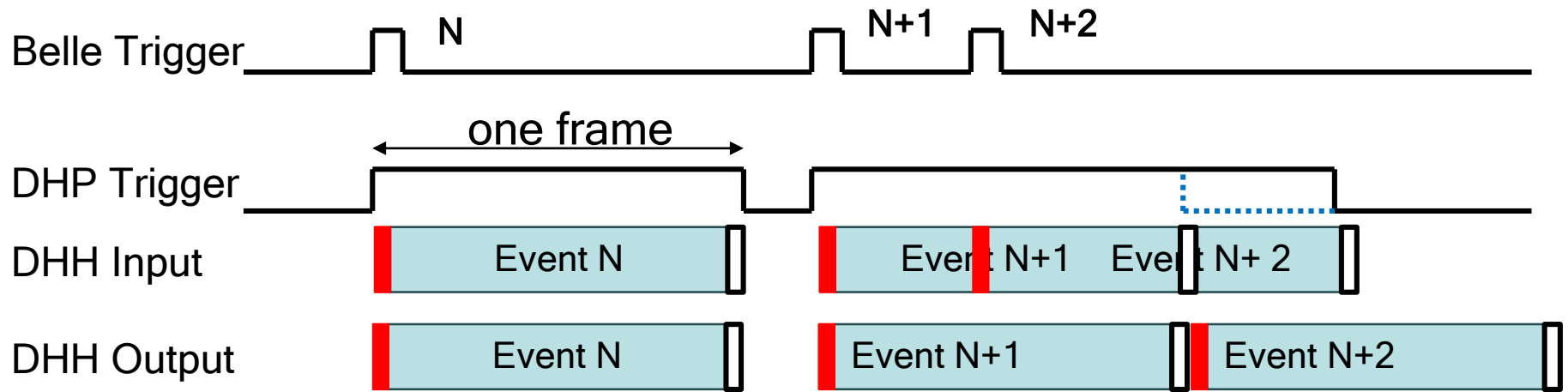
Technical University of Munich

DEPFET Workshop 09.04.2018, Ringberg



*Uhrenturm der TUM*

# Overlapping Trigger Case



# Overlapping Trigger Firmware

Data handling by Current DHE firmware :

- Each event separated in time from following one
- **Start of Event defined by TRIGGER**
- **End of Event defined by TIMEOUT**

Data handling by Overlapping Trigger DHE Firmware :

- Minimum time interval between consecutive triggers 110 ns (one row)
- DHE Frame Generator which runs synchronously with DHP shutter and provides Event Definition
- Event Definition
  - **Start Frame and Start Row Numbers**
  - **End Frame and End Row Numbers**
- Trigger Time + Programmable Offset define Start Frame and Start Row
- Trigger Time + Programmable Offset + Window Size define End Frame and End Row

Important : Requires perfect synchronization between DHE Frame Generator and DHP

# Overlapping Trigger Firmware

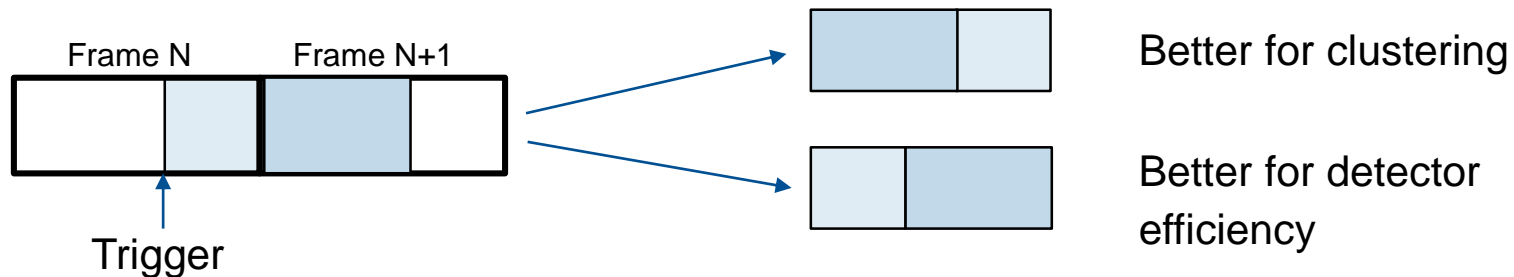
## Data Processing :

### WRITE PROCESS

- Aurora Frame Headers removed
- Hit information or Amplitudes(full frame readout) written to Dual Ported Memory without changes
- Pointers of Start-of-Event and End-of-Event transmitted to READ PROCESS

### READ PROCESS

- Reads data from Dual Ported Memory and reassembles "DHP frame"
- Data structure :
  - one frame per event, row order not changed
- Data arrangement allows to program trigger length longer than one frame
- Cluster reconstruction vs Detector Efficiency



# Firmware Tests

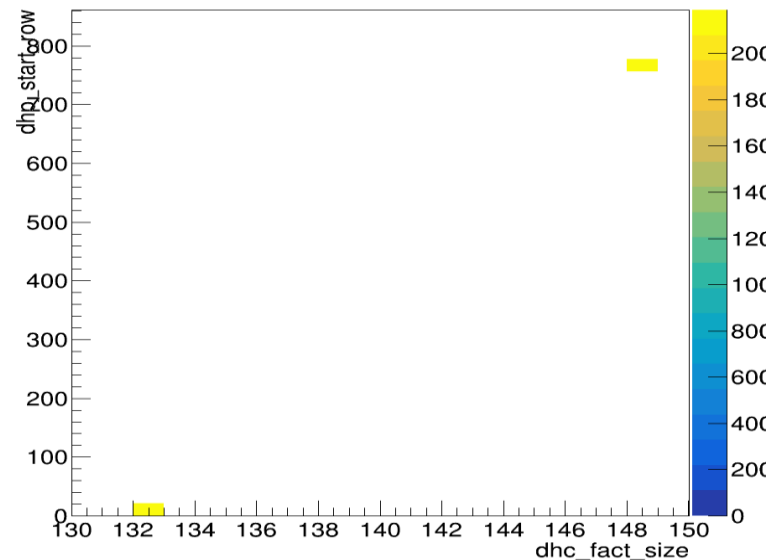
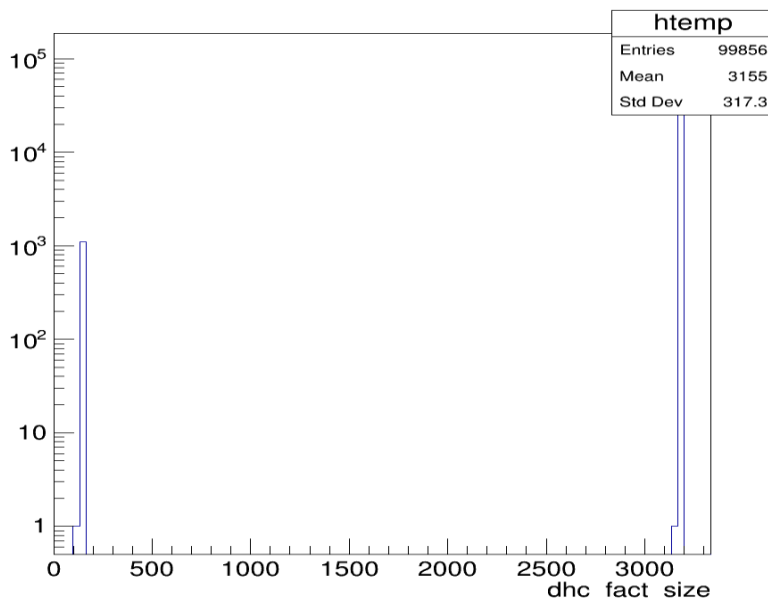
DHP programmed with pattern one hit per gate/one hit per row

Trigger rate from 100Hz to 30 kHz

Data transmitted to PC via UDP

Observed problems :

- Stable read out but with event size problem
- Data transmission stopped after few events



# Problems

## Event size problem

- Occur only when trigger starts at last and first GATE
- Problem not understood yet

## Stopped data transmission

- DHP does not understand Trigger commands and does not provide data
- Small shift of GCK clock phase resolves problem
- Problem fixed and was caused by wrong reset sequence

# Plans

- Identify a problem of small events
- Test full frame read out
- Test of overlapping trigger cases

# DHH Hardware Status

- 20 additional DHE/C cards received and to be tested
- DHI is about to complete, test of 10 cards to be performed next week  
last hardware project !!
- DHH for half shell to be installed at DESY in April



# Summary and Outlook

- Overlapping trigger firmware working stably at 30 kHz
- Problem of small event sizes to be identified and test up to 5MHz to be performed within next week
- 20 spare DHH modules produced
- Presence at KEK
  - May 1-15 (Igor) - shifts and test of gated mode
  - 2 weeks in June (Igor) - phase 3
  - July (Stefan) - phase 3

THANK YOU

