

# Raw WIB Trigger Primitive Format

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# Introduction

Hit finding  
Firmware

Phase 2 FELIX  
Links

DUNE-DAQ  
Readout Software

## TP format v1.0

header block

hit 1  
hit 2  
hit ...  
hit N

*variable-  
sized  
payload*

pedestal block

## TP format v2.0

header block

pedestal block

hit 1  
hit 2  
hit ...  
hit N

*variable-  
sized  
payload*

## References

UDAQ Meeting 25 May 2021  
dtp-release #6  
dtp-firmware #99  
dune-daq 37  
dune-daq #40

## RawWIBTp

```
class RawWIBTp  
{  
    TpHeader m_head;  
    std::vector<TpData> block;  
    TpPedinfo m_pedinfo;  
}
```

```
struct RawWIBTp  
{  
    TpHeader m_head;  
    TpData m_blocks[1];  
}
```

# Old Format (TPv01) Vs New Format (TPv02)

## TP format v1.0

### header block

slot + flags

crate + fiber + wire

timestamp 32b-LSB

timestamp 32b-MSB

### TP data block

hit 1

hit 2

hit ...

hit N

*variable-sized  
payload*

### pedestal information block

accumulator + median

F00D + FEED

BEEF + DEAD

## TP format v2.0

### header block

slot + flags

crate + fiber + wire

timestamp 32b-LSB

timestamp 32b-MSB

### pedestal information block

accumulator + median

F00D + # hits

BEEF + DEAD

### TP data block

hit 1

hit 2

hit ...

hit N

*variable-sized  
payload*

# TPG Format (16b) Vs CR\_if / FELIX (32b)

## TPG format (16b word)

### header block

crate    fiber    wire

slot    flags

timestamp 16b-LLSB    0528

timestamp 16b-LSB    5BD4

timestamp 16b-MSB    54DA

timestamp 16b-MMSB    011B

### pedestal information block v1.0

median

accumulator

FEED

F00D

DEAD

BEEF

### v2.0

median

accumulator

# hits

F00D

DEAD

BEEF

## CR\_if / FELIX format (32b word)

### header block

slot + flags    crate + fiber + wire

16b-LSB    16b-LLSB    e.g.    5BD4    0528

16b-MMSB    16b-MSB    e.g.    011B    54DA

### in dtp-simulation

timestamp 32b-LSB    is    16b-LLSB 16b-LSB    e.g.    0528 5BD4

timestamp 32b-MSB    is    16b-MSB 16b-MMSB    e.g.    54DA 011B

32b-MSB    32b-LSB    =    54DA 011B 0528 5BD4

### in ProtoDUNE-I data captures

timestamp 32b-LSB    is    16b-LSB 16b-LLSB    e.g.    5BD4 0528

timestamp 32b-MSB    is    16b-MMSB 16b-MSB    e.g.    011B 54DA

32b-MSB    32b-LSB    e.g.    011B 54DA 5BD4 0528

### pedestal information block v1.0

accumulator + median

F00D + FEED

BEEF + DEAD

### v2.0

accumulator + median

F00D + # hits

BEEF + DEAD

# TPG Format (16b) Vs CR\_if / FELIX (32b)

## TPG format (16b word)

### TP data block

start time

end time

peak ADC

peak time

sum ADC

flags + hit continue (1b-LSB)

## CR\_if / FELIX format (32b word)

### TP data block

end time

start time

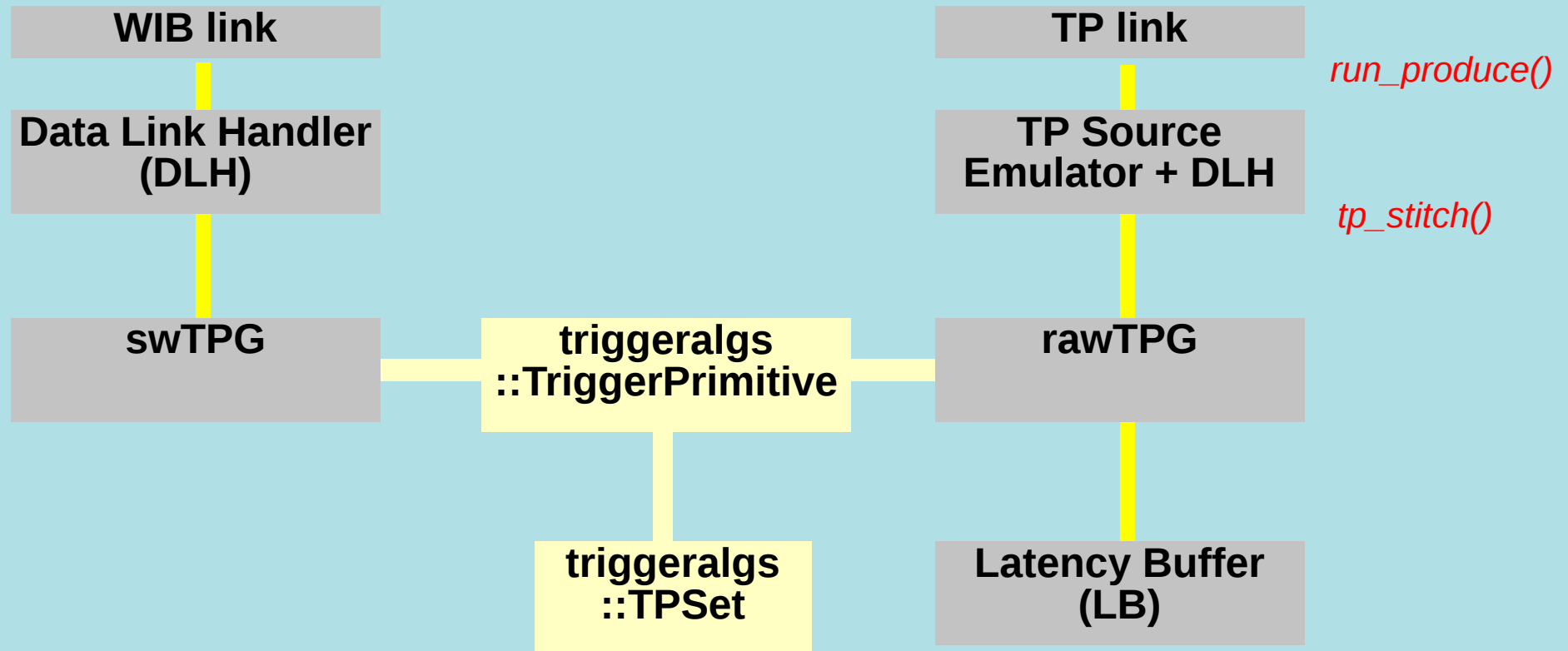
peak time

peak ADC

hit continue + flags

sum ADC

# TP Implementation in DUNE-DAQ Readout



# vtune

Activities Intel VTune Profiler 18 Oct 23:17 Intel VTune Profiler (on epdttdi104)

Project Navigator

- dunedaq\_app
- error\_handling
- mellanox\_tests
- sample (matrix)
- tp\_tests
  - r000hs
  - r001hs
  - r002hs
  - r003hs

Hotspots Hotspots by CPU Utilization

Analysis Configuration Collection Log Summary Bottom-up Caller/Callee Top-down Tree Platform

Grouping: Function / Call Stack

Function / Call Stack	CPU Time	Instructions Retired	Microarchitecture Usage	Module
▶ extract_cie_info	0.005s	0	0.0%	libgcc_s.so.1
▶ error_swapgs	0.020s	42,000,000	28.6%	vmlinux
▶ error_sti	0.030s	28,000,000	95.2%	vmlinux
▶ error_entry	0.035s	14,000,000	57.1%	vmlinux
▶ effective_load.isra.38	0s	28,000,000	0.0%	vmlinux
▶ dunedaq::readout::TPEmulatorModel::run_produce	2.661s	770,000,000	11.9%	libreadout_F...
▶ dunedaq::readout::TaskRawDataProcessorModel<dunedaq::readout::typ	0.055s	0	0.0%	libreadout_D...
▶ dunedaq::readout::TaskRawDataProcessorModel<dunedaq::readout::typ	0.040s	700,000,000	100.0%	libreadout_D...
▶ dunedaq::readout::ReadoutModel<dunedaq::readout::types::RAW_WIB	0.005s	14,000,000		libreadout_D...
▶ dunedaq::readout::ReadoutModel<dunedaq::readout::types::RAW_WIB	1.609s	13,384,000,000	56.0%	libreadout_D...
▶ dunedaq::readout::RAWWIBTriggerPrimitiveProcessor::tp_stitch	10.334s	13,874,000,000	8.3%	libreadout_D...
▶ dunedaq::readout::RateLimiter::limit	0.090s	42,000,000	66.7%	libreadout_F...

Thread

- consumer-0 (TID: 88513)
- fakeprod-tp-0 (TID: 88510)
- cleanup-0 (TID: 88517)
- daq\_application (TID: 88511)
- daq\_application (TID: 88506)
- daq\_application (TID: 88524)
- CPU Time

Thread Legend

- Running
- CPU Time
- Spin and Overhead...
- Clocktick Sample

CPU Time Legend

- CPU Time
- Spin and Overhead...

FILTER 100.0%

Any Process Any Thread Any Module Any Utiliz User functions - Functions or Show inline f

# Profiling Setup (vtune)

Run daq\_application inside vtune for 100s

run\_produce: TP hits → RawWIBTp

tp\_stitch: RawWIBTp → triggeralgs::TriggerPrimitive

	<b>CPU Time</b>	<b>μArch Usage</b>
	<b>v1.0 / v2.0</b>	<b>v1.0 / v2.0</b>
<b>slowdown 10</b>		
run_produce	0.04s / 0.02s	0.0% / 0.0%
tp_stitch	0.05s / 0.05s	0.0% / 0.0%
<b>slowdown 1</b>		
run_produce	0.1s / 0.1s	6.0% / 5.0%
tp_stitch	1.2s / 1.2s	3.0% / 2.0%
<b>slowdown 0.01</b>		
run_produce	1.5s / 3.5s	20.0% / 12.0%
tp_stitch	12.5s / 9.0s	5.2% / 10.0%



# Summary

- **Preliminary profiling test using vtune**
- **Default configuration with 3 slowdown values of 10, 1, 0.01**
- **Comparing TP format v1.0 (old) vs v2.0 (new) → relative measurement**
- **Current status**
  - Default configuration shows no significant differences
  - At extreme configuration, with some caveats, old format performance worse, however test job running conditions become unstable anyway
  - Further measurements to be done soon with the available tools