

## 1) Data Format :

Data format read data from Data Processing Memory, put the data in proper format as described in FADC Data Format, and write to external FIFO to host. The data format falls into 5 categories: Event\_Header, Time\_Stamp, Window\_Raw\_Word1, Pulse\_Raw\_Word1, Window\_Pulse\_Raw\_Words\_2\_to\_N, Pulse\_Integral and Event\_Trailer. The words are 36 bits wide.

Event\_Header indicates the start of an event and bits are assigned as follow:

(35-34) = 0

(33-32) = 1

(31) = 1

(30-27) = 2

(26-0) = trigger number

→ x"19 trigger number"

Trigger Time (Time\_Stamp) indicates time of trigger occurrence relative to the most recent global reset. The six bytes (48 bits) of trigger time Ta Tb Tc Td Te Tf are format in two 32-bits words:

Word1:

(35-34) = 0

(33-32) = 0

(31) = 1

(30-27) = 3

(26-24) = 0

(23-16) = Ta

(15-8) = Tb

(7-0) = Tc

→ x"0980 time stamp hi

Word2:

(35-34) = 0

(33-32) = 0

(31) = 0

(30-24) = 0

(23-16) = Td

(15-8) = Te

(7-0) = Tf

→ x"0000 time stamp lo

Window Raw Word1 indicates the beginning of Window Raw Data.

(35-34) = 0

(33-32) = 0

(31) = 1

(30-27) = 4

(26-20) = Channel number (0-72)

(19-12) = 0

(11-0) = Window Width (PTW) (in number of samples).

→ x'0A ChannelNumber 00 numberOfSamples'

3322 2222 2222 1111 1111 1198 7654 3210  
1098 7654 3210 9876 5432 10

-----  
1010 0Cha n000 0000 0000 Ptw- ---- ----

Pulse Raw Word1 indicates the beginning of Pulse Raw Data.

(35-34) = 0

(33-32) = 0

(31) = 1

(30-27) = 6

(26-20) = Channel number (0-72)

(19-18) = pulse number (0-3)

(17-10) = 0

(9-0) = time from beginning of PTW that the pulse crossed threshold

→ x'0B ChannelNumber 00 TIME'

3322 2222 2222 1111 1111 1198 7654 3210  
1098 7654 3210 9876 5432 10

-----  
1011 0Cha nP#0 0000 0000 00Ti me-- ----

Remaining words for Pulse Raw Data and Window Raw Data have the same format.

(35-34) = 0

(33-32) = 0

(31) = 0

(30) = 0

(29) = 1 indicates sample x not valid

(28-16) = ADC sample x (includes overflow bit)

(15-14) = 0

(13) = 1 indicates sample x+1 not valid.

(12-0) = ADC sample x+1 (includes overflow bits).

3322 2222 2222 1111 1111 1198 7654 3210  
1098 7654 3210 9876 5432 10

-----  
00xA dcSa mple ---- 00xA dcSa mple ----

**Pulse Time** (8) – time associated with an identified pulse within the trigger window.

(31) = 1

(30 – 27) = 8

(26 – 20) = channel number (0 – 72)

(19 – 18) = pulse number (0 – 3)  
~~(19 – 18) = measurement quality factor (0 – 3)~~  
 (17 - 16) = reserved (read as 0)  
 (15 – 6) = coarse pulse time  
 (5 – 0) = fine pulse time

3322 2222 2222 1111 1111 1198 7654 3210  
 1098 7654 3210 9876 5432 10

-----  
 1100 0ChanP#0 0000 Puls eTime

**Pulse Integral (7)** – integral of an identified pulse within the trigger window. The pulse integral may be a simple sum of raw data samples over the pulse duration, or the result of a complex fit to pulse shape. Pedestal subtraction may be included.

(31) = 1  
 (30 – 27) = 7  
 (26 – 20) = channel number (0 – 72)  
~~(22 – 21) = pulse number (0 – 3)~~  
~~(20 – 19) = measurement quality factor (0 – 3)~~  
 (19) = ‘ 0’  
 (18-0) = pulse integral

3322 2222 2222 1111 1111 1198 7654 3210  
 1098 7654 3210 9876 5432 10

-----  
 1011 1ChanP#0 0PulseIntegral

**Pulse Vmin Vpeak (10)** – ADC count for minimum and peak value of a pulse. This is too be used off line to apply correction to Pulse Time in TDC mode.

(31) = 1  
 (30 – 27) = 10  
 (26 – 23) = channel number (0 – 15) - Not 72 channels here, only 6 per fe fpga  
 (22 – 21) = pulse number (0 – 3)  
 (20 – 12) = Vmin  
 (11 – 0) = Vpeak

3322 2222 2222 1111 1111 1198 7654 3210  
 1098 7654 3210 9876 5432 10

-----  
 1101 0ChanP#v minn nnn vpeak kkkk kkkk  
 D

**Event Trailer:** Indicate the end of an event.

EVENT\_TRAILER = "0010" & X"E8000000";

Example:

Raw Data (fa125SetProcMode 1) :

x"19 \_\_\_\_\_" Event Header  
x"98 \_\_\_\_\_" Time Stamp upper 24 bits.  
x" \_\_\_\_\_" Time Stamp lower 24 bits.  
x"A \_\_\_\_\_" Channel Number, Window Width (PTW)  
x" \_\_\_\_\_" Raw Data  
x"2E8000000" End of Event

Pulse Data (fa125SetProcMode 2):

x"19 \_\_\_\_\_" Event Header  
x"98 \_\_\_\_\_" Time Stamp upper 24 bits.  
x" \_\_\_\_\_" Time Stamp lower 24 bits.  
x"B \_\_\_\_\_" ChanNum(26-20), PulseNumb(19-18),Time from beginning of PTW  
that the pulse crossed threshold(9-0).  
x" \_\_\_\_\_" 2 pulses (12-0) (28-16) per 36 bits words.  
x"2E8000000" End of Event

Pulse Sum (fa125SetProcMode 3):

x"19 \_\_\_\_\_" Event Header  
x"98 \_\_\_\_\_" Time Stamp upper 24 bits.  
x" \_\_\_\_\_" Time Stamp lower 24 bits.  
x"C \_\_\_\_\_" ChanNum(26-20), PulseNumb(19-18),Time(15-0)  
x"B8 \_\_\_\_\_" Channel Numbe(26-20), Pulse Integral (18-0)  
x"2E8000000" End of Event

TDC (fa125SetProcMode 4):

x"19 \_\_\_\_\_" Event Header  
x"98 \_\_\_\_\_" Time Stamp upper 24 bits.  
x" \_\_\_\_\_" Time Stamp lower 24 bits.  
x"C \_\_\_\_\_" ChanNum(26-20), PulseNumb(19-18),Time(15-0)  
x"D \_\_\_\_\_" ChanNum(26-23), PulseNumb(22-21),Vm(20-12),Vp(11-0)  
x"2E8000000" End of Event

Pulse Sum and TDC (fa125SetProcMode 7):

x"19 \_\_\_\_\_" Event Header  
x"98 \_\_\_\_\_" Time Stamp upper 24 bits.  
x" \_\_\_\_\_" Time Stamp lower 24 bits.  
x"B8 \_\_\_\_\_" Channel Numbe(26-20), Pulse Integral (18-0)  
x"C \_\_\_\_\_" ChanNum(26-20), PulseNumb(19-18),Time(15-0)  
x"D \_\_\_\_\_" ChanNum(26-23), PulseNumb(22-21),Vm(20-12),Vp(11-0)  
x"2E8000000" End of Event

Raw Data and TDC (fa125SetProcMode 8)

x"19\_\_\_\_\_" Event Header  
x"98\_\_\_\_\_" Time Stamp upper 24 bits.  
x"\_\_\_\_\_" Time Stamp lower 24 bits.  
x"A\_\_\_\_\_" Channel Number, Window Width (PTW)  
x"\_\_\_\_\_" Raw Data  
x"C\_\_\_\_\_" ChanNum(26-20), PulseNumb(19-18),Time(15-0)  
x"D\_\_\_\_\_" ChanNum(26-23), PulseNumb(22-21),VminVpeak  
x"2E800000" End of Event