CDC ETF Module Status

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Contents

- Review
- Logic Test
  - difference between TSIM & VHDL
  - performance
- Plans
- Summary

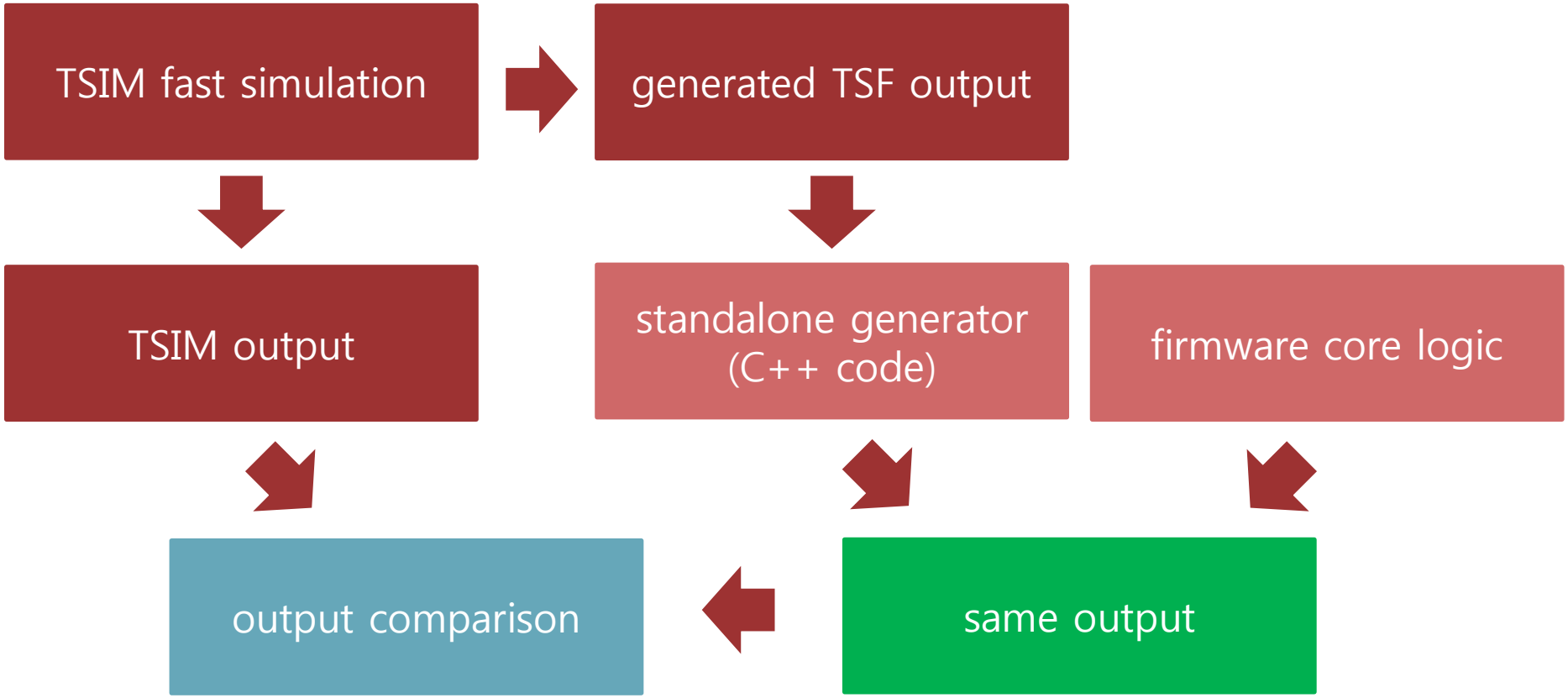
Review

- 24th B2GM
  - TSIM
    - Fast simulation code implemented more realistic.
    - Added function which generates input for VHDL firmware.
  - Firmware
    - Debugging 4 ns resolution version.
    - Core logic test with C++ generated output.

Logic Test

- Used maximum 10 TS / SL every 32 ns
  - output event timing in 4 ns order(8 bits)
- Conditions
  - 10k cosmic ray, particle gun($\mu^+\mu^-$)
  - no background
  - CDC time window -512 ns ~ 511 ns
- Compared TSIM and VHDL firmware outputs
  - failed to put P&R inside ETF VHDL firmware
  - made C++ standalone output generator that mimics VHDL firmware

Standalone Output gen.



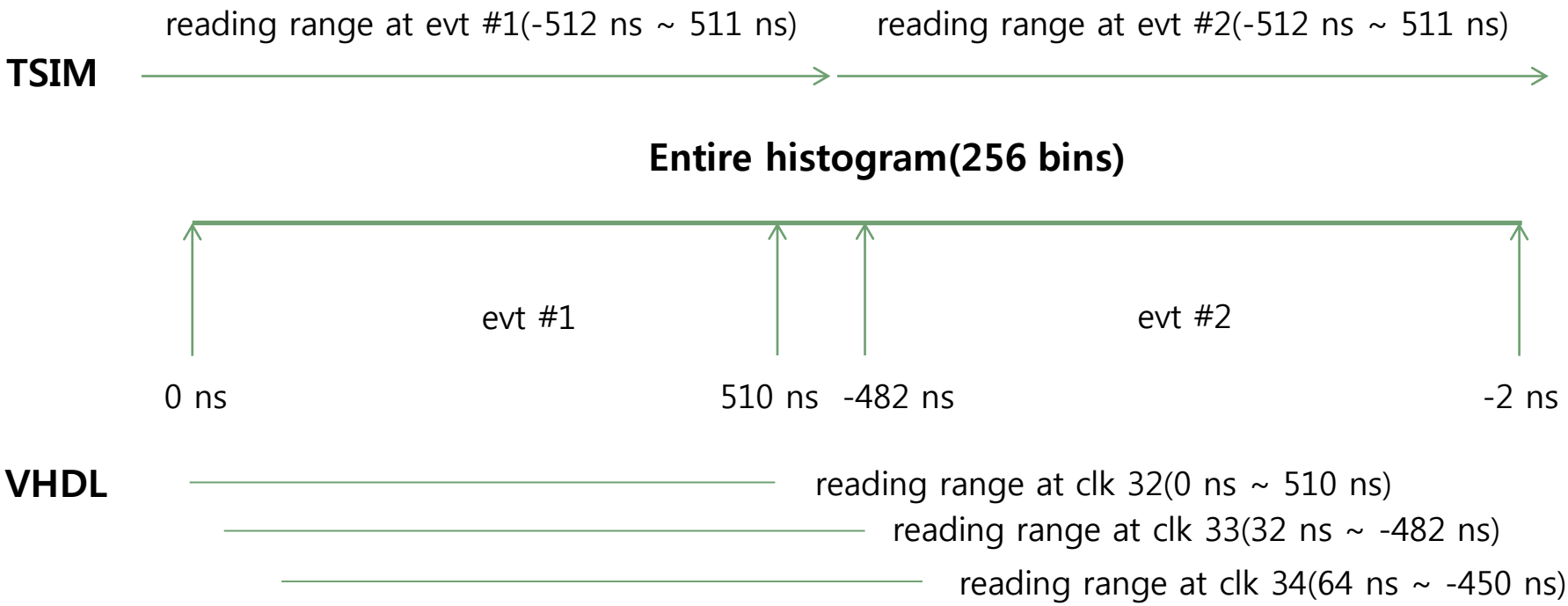
Differences

- TSIM generated Input dataset
  - time window : -512 ns ~ 511 ns (~ 1us, 32 data clks)
  - TSIM : time integrated
  - VHDL : continuous, new input every 32ns(32 input set)

- Output process
  - TSIM : fill and read hist at once, read entire time window
    one(or none) ET for single event
    no histogram overlaps between events
  - VHDL : fill and read hist every 32 ns, read last half of hist(512 ns long)
    one ET every 32 ns
    overlaps at the end of old event and start of new event
    hold output for 31 clks when ET found(update when faster)

Differences

- Histogram reading

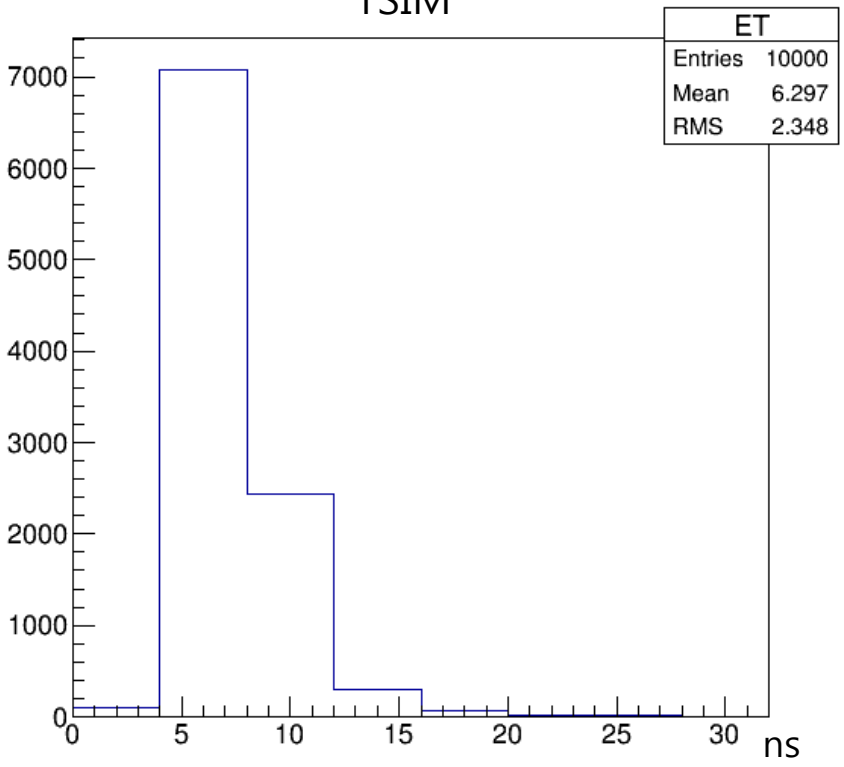


Logic Performance

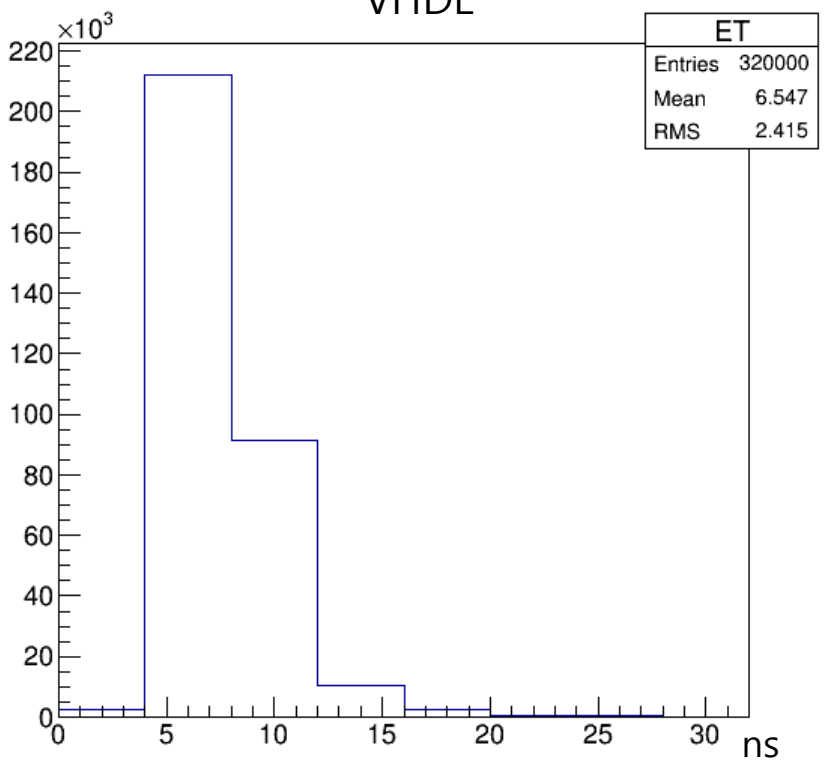
10k cosmic ray

average 27 TS hits / evt

TSIM



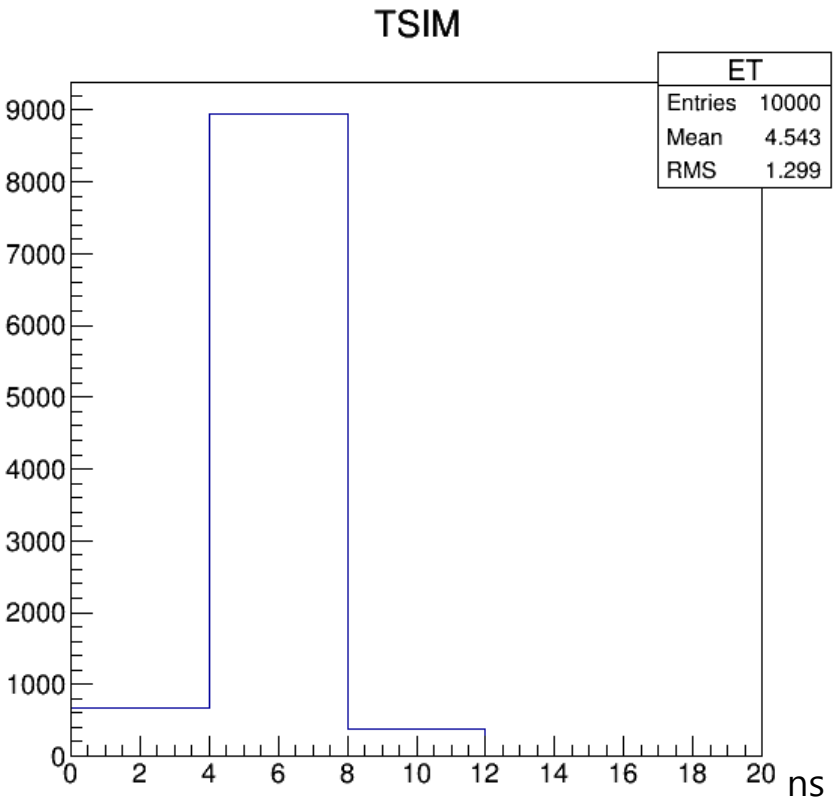
VHDL

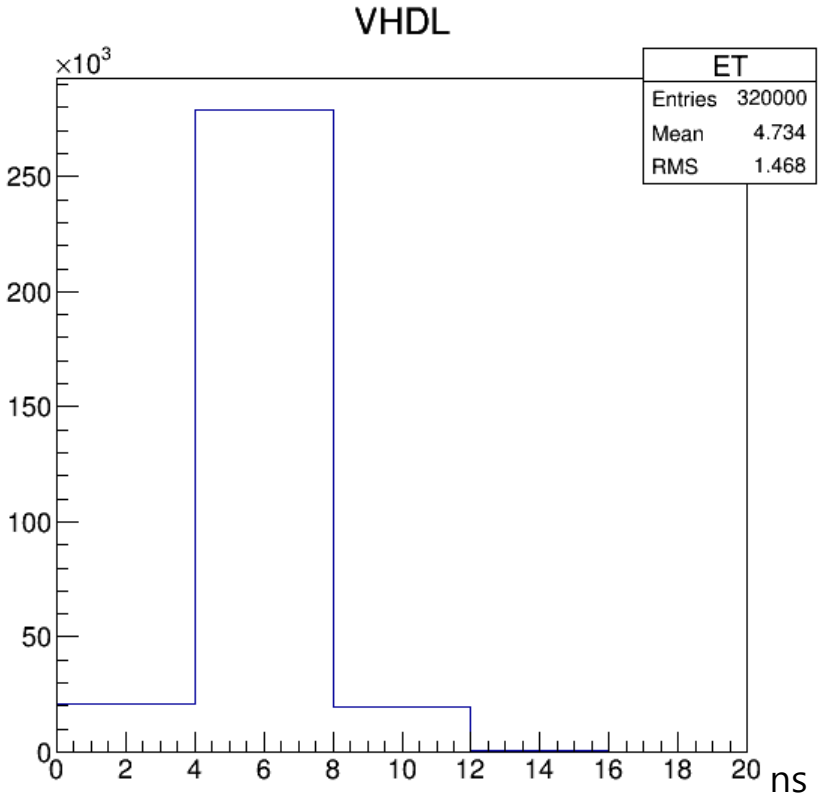


Logic Performance

10k 2 muons(0.9 GeV, θ = 90)

average 28 TS hits / evt





Plans

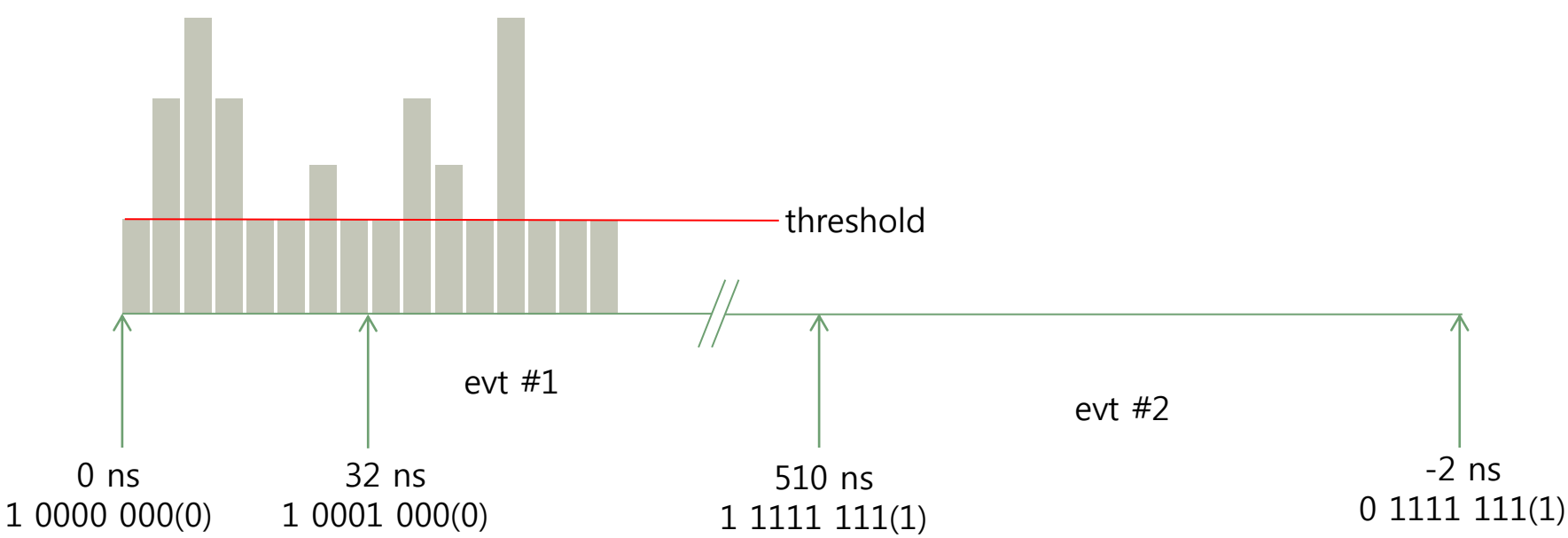
- test I/O attached version with B2L
- put C++ standalone output generator into basf2
- performance test on events with background

Summary

- Developed ETF input generator function to test VHDL firmware
- Tested VHDL firmware indirectly with C++ standalone output generator
- TSIM and VHDL logic tested with generated cosmic ray events

Backups

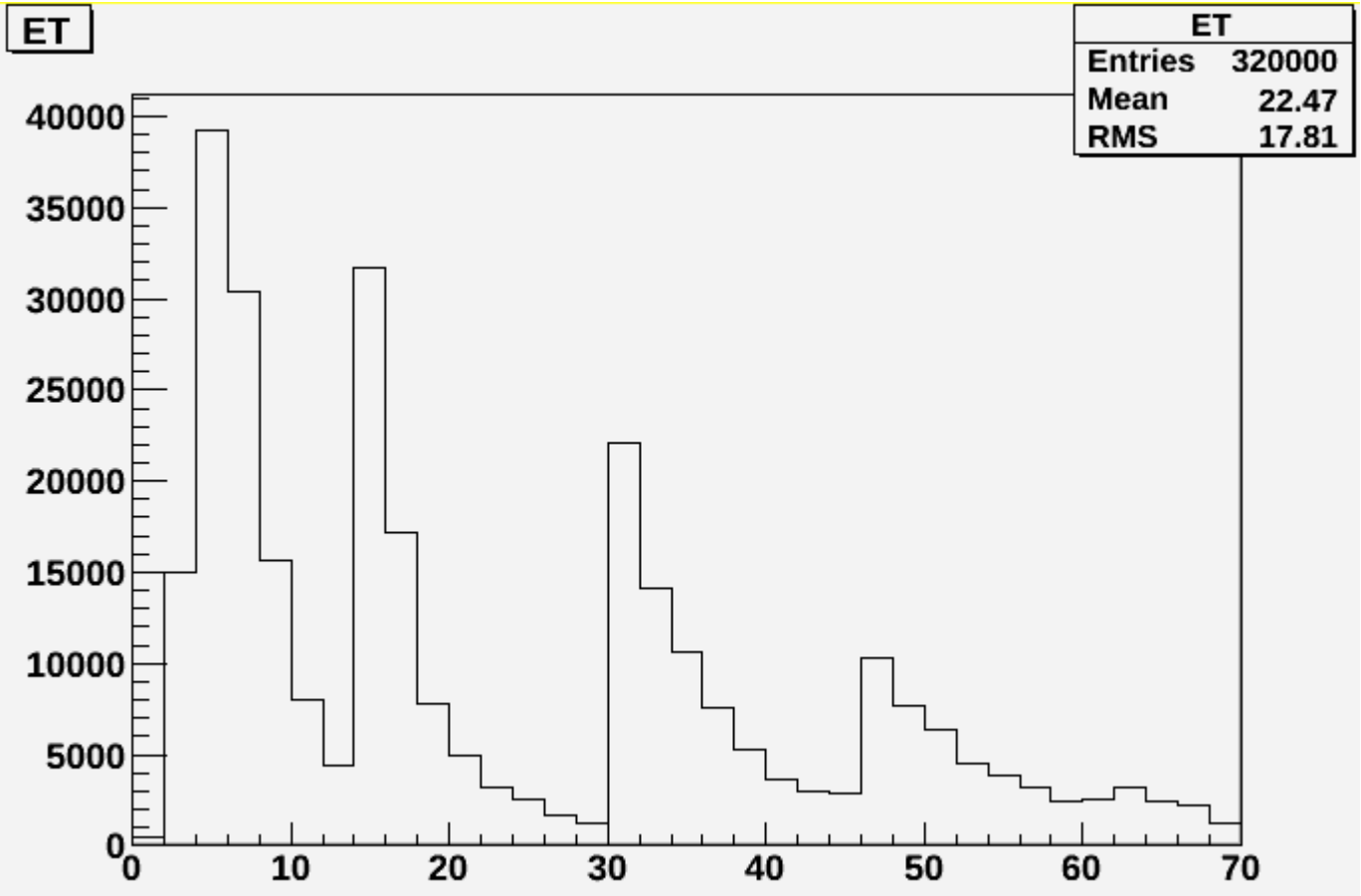
multiple peaks



reading range at clk 32(0 ns ~ 510 ns)
evt time output : 1 0000 010(0) = 8ns

reading range at clk 33(32 ns ~ -482 ns)
evt time output : 1 0001 000(0) = 36 ns

multiple peaks



intervals between peaks are around 32 ns