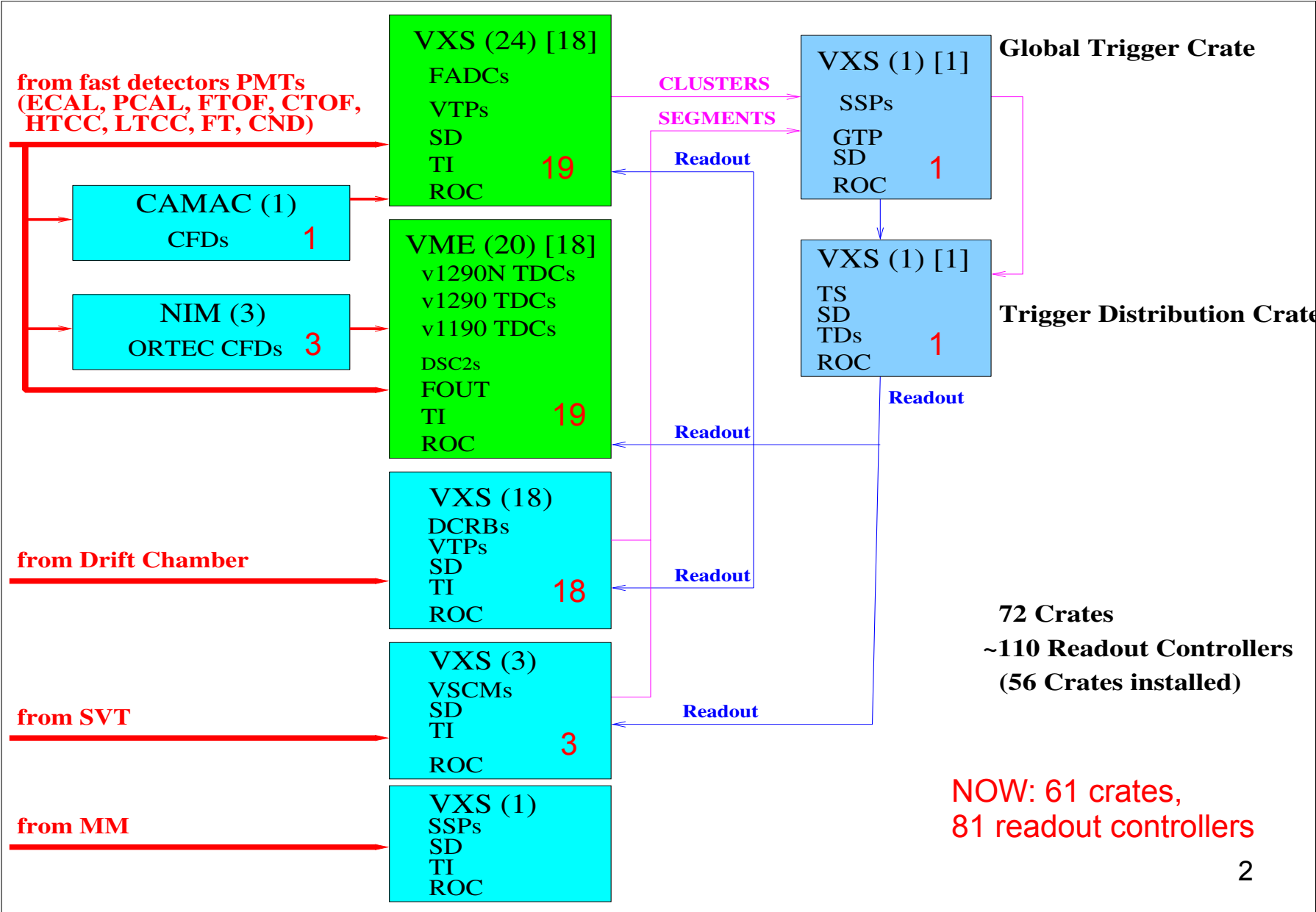


CLAS12 DAQ/Trigger/Online Status

Sergey Boyarinov

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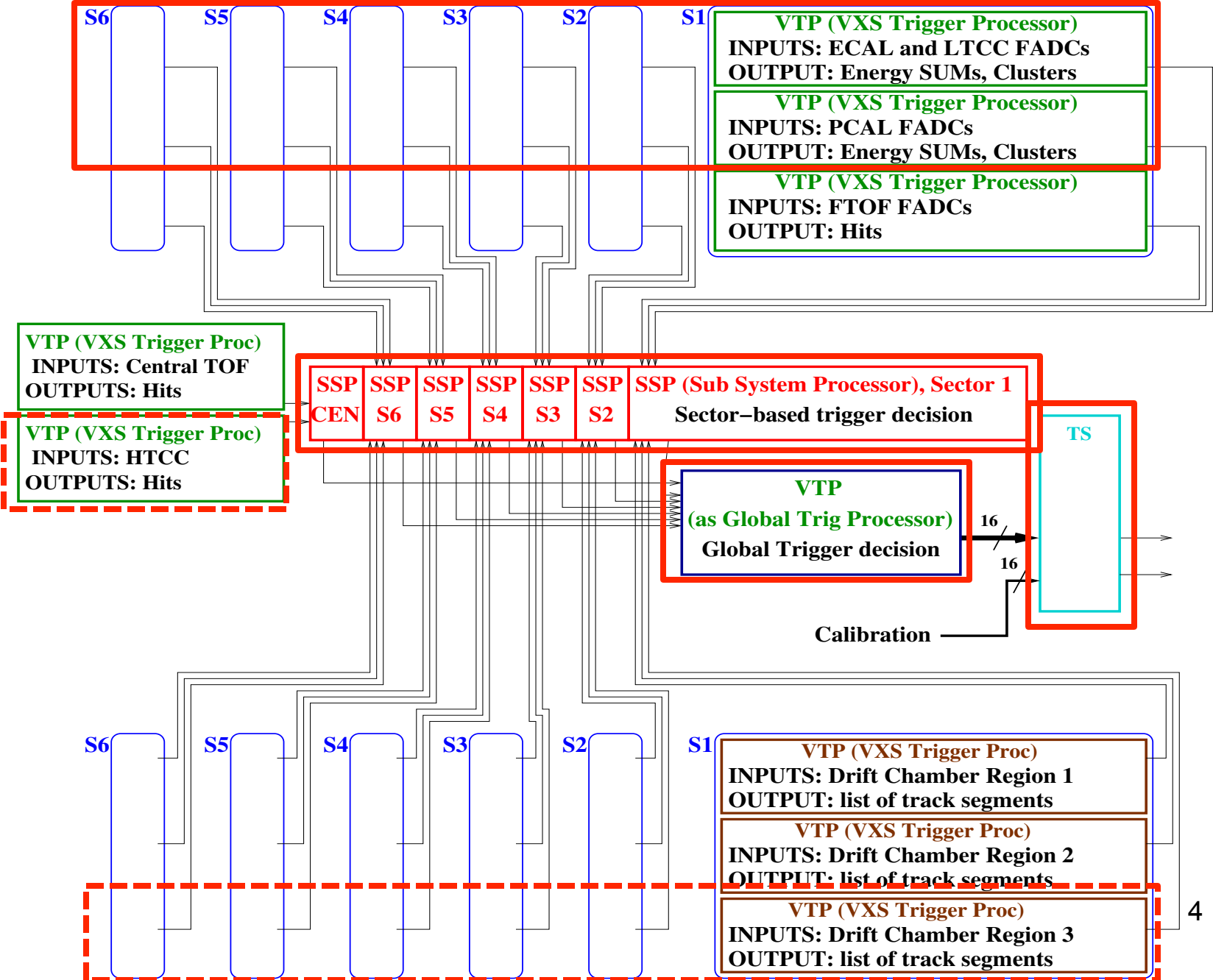
DAQ/Trigger Hardware



CLAS12 DAQ Status

- Electronics installed (and was used for KPP): ECAL, PCAL, FTOF, LTCC, DC, HTCC, CTOF, SVT
- Online computer cluster is 100% complete and operational
- Networking is 100% complete and operational
- DAQ software is operational, reliability is acceptable
- Performance observed: 5kHz, 200MByte/sec, 93% livetime (defined by hold-off timer = 15microsec)

CLAS12 Trigger System Logic

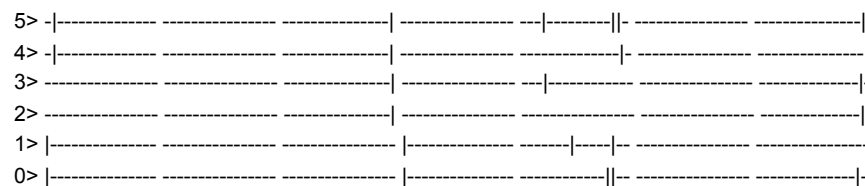


CLAS12 Trigger Status

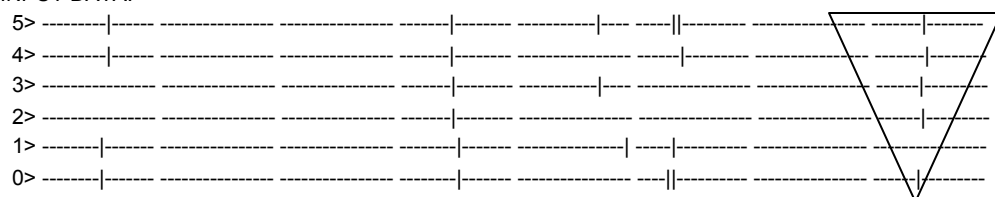
- All trigger electronics installed. It includes 20 VTP boards (stage 1 and 3 of trigger system) in ECAL, PCAL, HTCC, Region 3 Drift Chamber and main trigger crates, and 9 SSP boards in stage 2.
- Two separate triggers systems: hit-based PCAL only (CAEN V1495) and FADC-based ECAL cluster+ECAL total sum+PCAL total sum
- During KPP, FADC-based trigger was used without PCAL because of timing problem was observed in stage 2, ECAL-INNER cluster energy threshold was used to obtain different running conditions; problem solved, testing with cosmic underway
- Readout from trigger boards was not working during KPP, problem solved, testing underway
- All trigger algorithms modeling completed including HTCC and DC
- Following to be implemented into hardware: cluster finding for PCAL, improved energy correction for both ECAL and PCAL, HTCC, DC segment finder, DC road finder – all in Ben Raydo's hands

DC Trigger: Segment Finder, 4 hits minimum

ORIGINAL DATA:

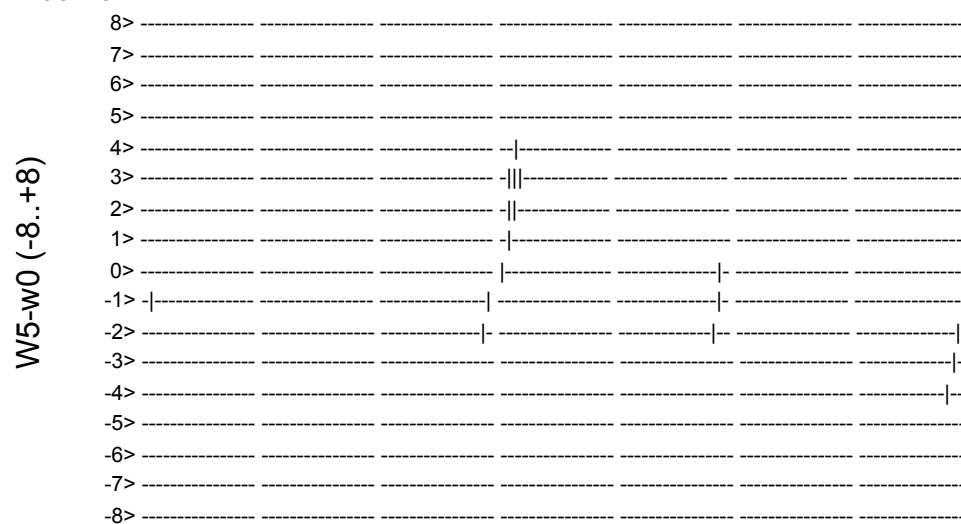


INPUT DATA:



try all possible segments for layer 0 wire 0,
repeat 112 times moving along layer 0,
fill 2-dim array below

OUTPUT ARRAY:



wire number (111-0)

performance: 32ns per event
(defined by backplane bandwidth)

Trigger Configuration in data file

```
VTP_CRATE adcecal1vtp # trigger stage 1
VTP_ECINNER_HIT_EMIN    100 # strip energy threshold for 1-dim peak search
VTP_ECINNER_HIT_DT      8 # +-8clk = +-32ns: strip coincidence window to form 1-dim peaks,
                          # and peak-coincidence window to form 2-dim clusters
VTP_ECINNER_HIT_DALITZ  568  584 # x8: 71<dalitz<73
.....

SSP_CRATE trig2 # trigger stage 2
SSP_SLOT all
SSP_GT_STRG_ECALIN_CLUSTER_EMIN_EN  0 1 # enable ECAL_INNER clusters in trigger
SSP_GT_STRG_ECALIN_CLUSTER_EMIN     0 2000 # ECAL_INNER cluster threshold
SSP_GT_STRG_ECALIN_CLUSTER_WIDTH    0 100 # coincidence window to coincide with PCAL etc
.....

VTP_CRATE trig2vtp # trigger stage 3
#   slot:          10 13 09 14 08 15 07 16 06 17 05 18 04 19 03 20
#   payload:       01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16
VTP_PAYLOAD_EN  0  0  0  0  1  0  1  0  1  0  1  0  1  0  1  0
# 6780 corresponds to 7900 FADC latency
VTP_GT_LATENCY 6780
# sector bits: trig number, ssp trig mask, ssp sector mask, multiplicity,
# coincidence=number_of_extended_clock_cycles
VTP_GT_TRGBIT 8 1 1 1 1
.....
```

Boards Configuration in data file

FADC250_SLOT 3
FADC250_MODE 1
FADC250_W_OFFSET 7900
FADC250_W_WIDTH 400
FADC250_NSA 44
FADC250_NSB 12
FADC250_NPEAK 1
FADC250_TRG_MASK 232
FADC250_TRG_WIDTH 232
FADC250_TRG_MINTOT 232
FADC250_TRG_MINMULT 0
FADC250_ADC_MASK 1
FADC250_TET_IGNORE_MASK 0
FADC250_ALLCH_DAC 3300 3300 3300 3300 3300 3300 3300 3300 3300 3300 3300 3300 3300 3300 3300 3300 3300 3300
FADC250_ALLCH_PED 206.286 196.143 194.571 179.571 216.357 188.214 230.357 222.786 190.929 207.643 156.786 230.000
199.214 219.714 233.000 212.429
FADC250_ALLCH_TET 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
FADC250_ALLCH_GAIN 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50

.....

DSC2_SLOT 2
DSC2_WIDTH 20 40
DSC2_TDCMASK 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
DSC2_TDCORMASK 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
DSC2_TRGMASK 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
DSC2_TRGORMASK 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
DSC2_CH_THRESHOLD 0 10 10
DSC2_CH_THRESHOLD 1 10 10
DSC2_CH_THRESHOLD 2 10 10

.....

DSC2_CH_THRESHOLD 15 10 10
DSC2_SCALER_REFPRESCALE 1
DSC2_SCALER_FLAGS 0

.....

Online Status

- Computing hardware is available for most online tasks (runtime databases, messaging system, communication with EPICS etc)
- There is no designated 'online farm' for data processing in real time, two hot-swap DAQ servers can be used as temporary solution
- Available software (some work still needed): process monitoring and control, CLAS event display, data collection from different sources (DAQ, EPICS, scalers etc) and data recording into data stream
- Work needed: runtime database (transformation to RCDB), data monitoring (some components available)

Conclusion

- CLAS12 DAQ, computing and network was tested during KPP run and worked as expected, reliability meets CLAS12 requirements, performance looks good but final tests have to be done with full CLAS12 configuration (solenoid and trigger)
- Trigger system worked as expected during KPP; some parts of stage 1 were not ready, but all completed components performed well; modeling for all algorithms completed; firmware development is in progress
- Online software development in progress, available tools allows to run but more work needed to complete the system