Mu2e-II workshop
Trigger / DAQ working group

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Northwestern University

Introduction

Welcome and thank you for participating to the trigger/DAQ session.

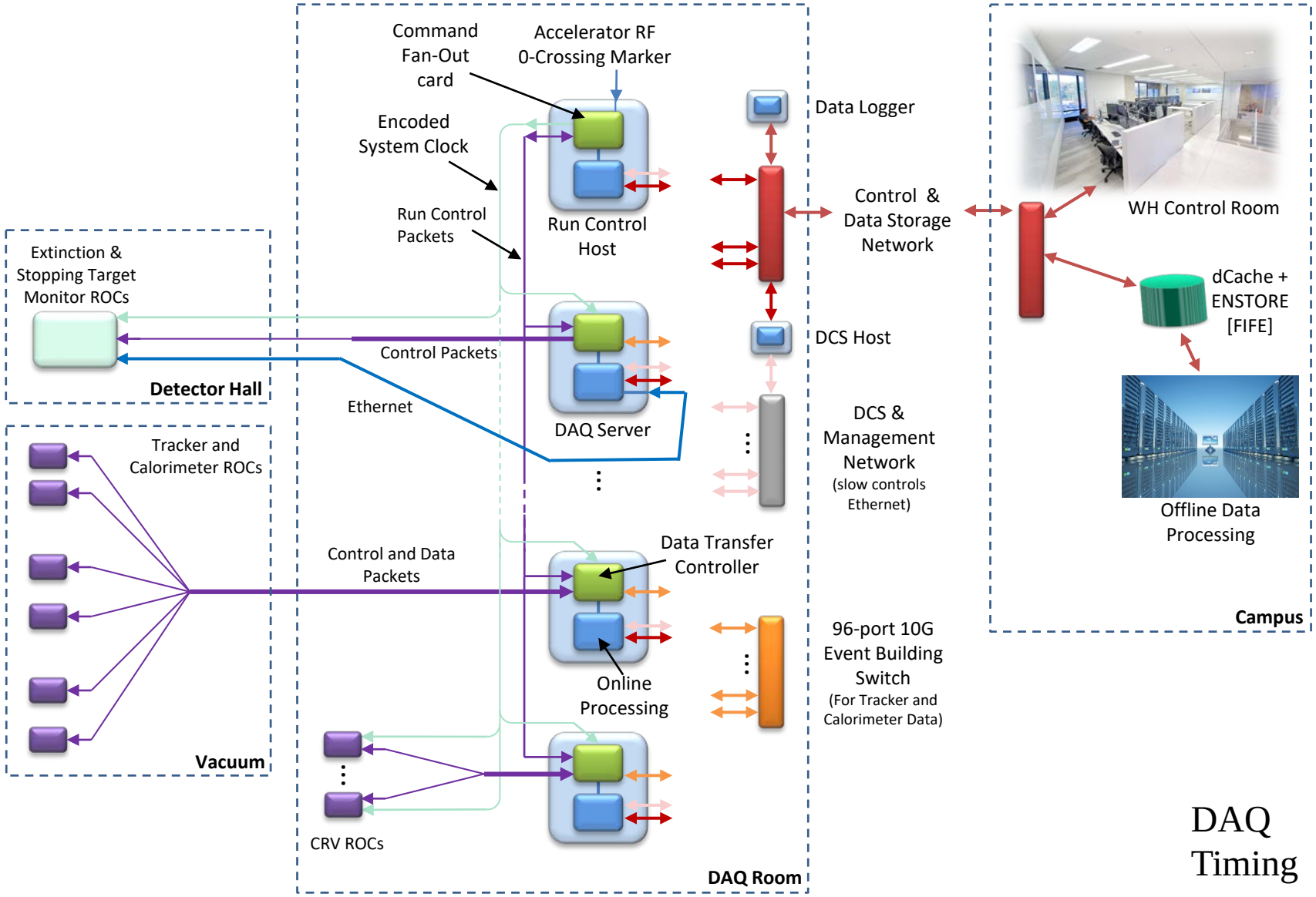
As it was mentioned earlier, the data rate in Mu2e-II will increase by a factor 10 compared to Mu2e. The experimental concept is globally the same as Mu2e, accelerator system will change (PIP-II) but the pulse beam concept will remain.

The goals of this workshop:

- Identify a DAQ architecture able to handle the increased rate
- Identify improvements in computing needed to handle the increased rate
- Define R&D tasks / questions required to provide a full design (spreadsheet)
- Write a short summary report

In other words, come up with a trigger / DAQ solution that can handle 10x higher rate.

DAQ high level schematic

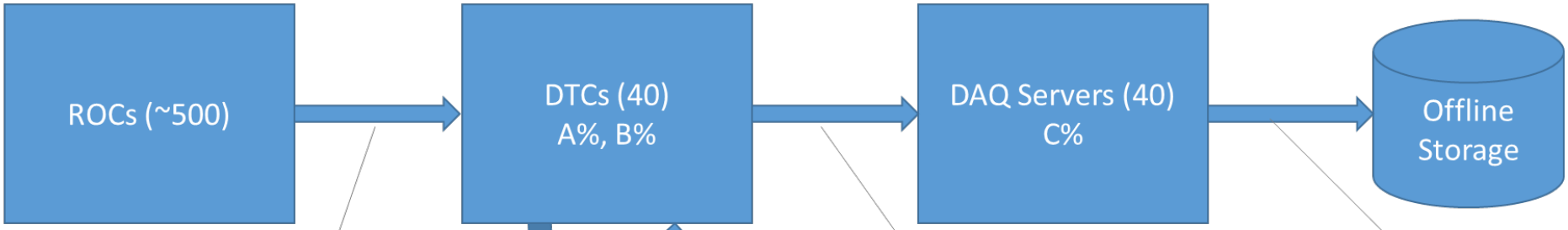


DAQ Timing

Average data rates

pre-event building (during beam OFF): A% pass
Level 0 Filter: B% pass
Level 1 Filter: C% pass

Total Required Rejection Ratio: ~125:1



35 GBps expected
(w/30% ovrhd.)
75 GBps available

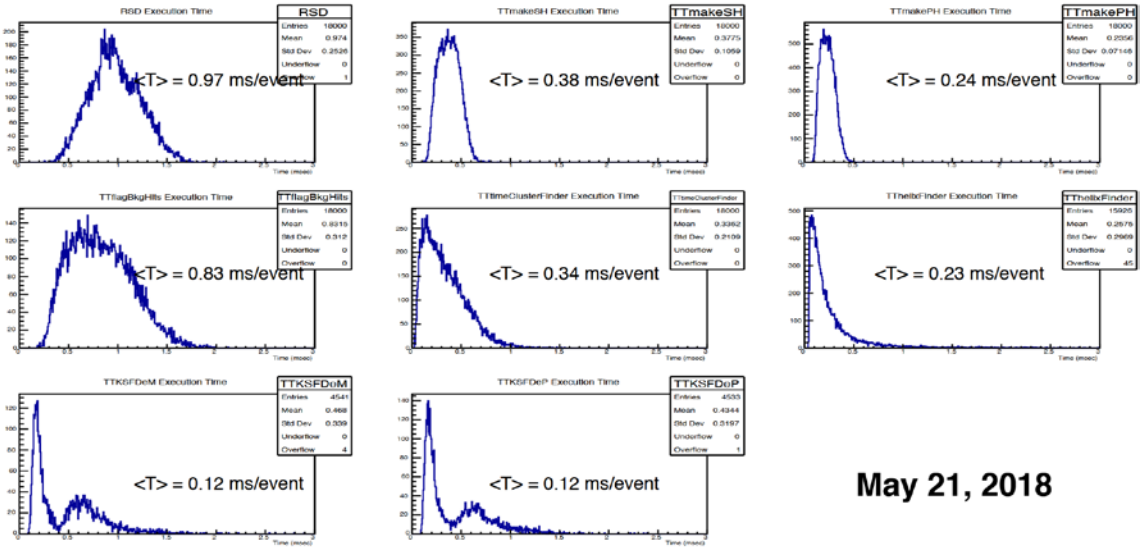
On Spill = 83 GBps = 56 Trk + 25 Cal + 2 CRV
Off Spill = 9 GBps = 2 Trk + 1 Cal + 5 CRV
Total = 83*25%+ 8*75% = 27 GBps

35 GBps x A x B
40 GB/s available

35 GBps x A
40 GB/s available

35 GBps x A x B x C
280 MB/s
(7 PB/yr assuming
80% uptime)
7 PB/yr available

Track Trigger Timing Status (triggerDev) *D. Brown*



May 21, 2018

- Total time = 3.2 (2.2) msec/event
- Reductions in makeSH, FlagBkgHits, Seed Fits

+ combined track-calo cluster
+ additional triggers

Can still improve, but likely by a factor of a few.

S. diFalco

ECAL Trigger performances: processing time

1000 events on mu2ebuild01

TimeTracker printout (ms)	Min	Avg	Max
CaloClusterFast:CaloClusterFast	0.2	0.4	0.8
FilterEcalMVATrigger	0.008	0.047	2.6

100000 events on grid machines

TimeTracker printout (ms)	Avg
CaloClusterFast:CaloClusterFast	0.5
FilterEcalMVATrigger	0.06

The cpu time/event of ECAL itself is 60 μs!
Previous estimate (1 ms) was dominated by an update of event time offset used for debugging purposes

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NORMALIZATION	Efficiency on Conversion electrons (CE) (t>700 ns)			
	CE hits* on ECAL virtual detectors (no requests on track)	Good quality tracks + CE virtual hit	Good quality tracks matching cluster with E>50 MeV + CE virtual hit	BKG rejection (t>500 ns)
Max eff	73% (±0.3)	86% (±0.4)	93% (±0.2)	120 (±4)
Max rej	70% (±0.3)	83% (±0.3)	90% (±0.3)	300 (±15)

*hit associated to an electron with p>90 MeV/c

The format of this workshop is very informal, mostly a discussion along with short talks.

34 - Introduction	*Bertrand ECHENARD et al*
36 - Mu2e-II DAQ system proposal	*Mr. Ryan RIVERA*
M164, Northwestern University	14:20 - 14:50
38 - Timing considerations	*Greg RAKNESS*
37 - Track/calo/CRV ROC	*Gianantonio PEZZULLO*
39 - artdaq developments	*Dr. Kyle KNOEPFEL*
59 - Artdaq developments	*Mr. Ryan RIVERA*

The idea is easy:

find a solution, identify R&D, fill spreadsheet / report, drink wine at restaurant

Giani and I will write a short summary and circulate it once it’s done.

Questions?