Data Acquisition System Status Report

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Outline

- Introduction
- Technologies
- Conceptual Design
- Performance
- Cost Estimates
- Remarks

Introduction

- Goal of the DAQ system

  high efficiency, manageable data output

- Conditions at TESLA (500GeV)

  5Hz train rate, 2820bx per train, 15kHz bx rate but in 5x 1ms

- Requirements for DAQ

  1ms deadtime free pipeline, no trigger, readout in 200ms

Technologies

- Frontend Electronics

  1Gbit serial lines, low power, high density electronics

  ADC, pipelines and hit discrimination at the detector frontend

- Network

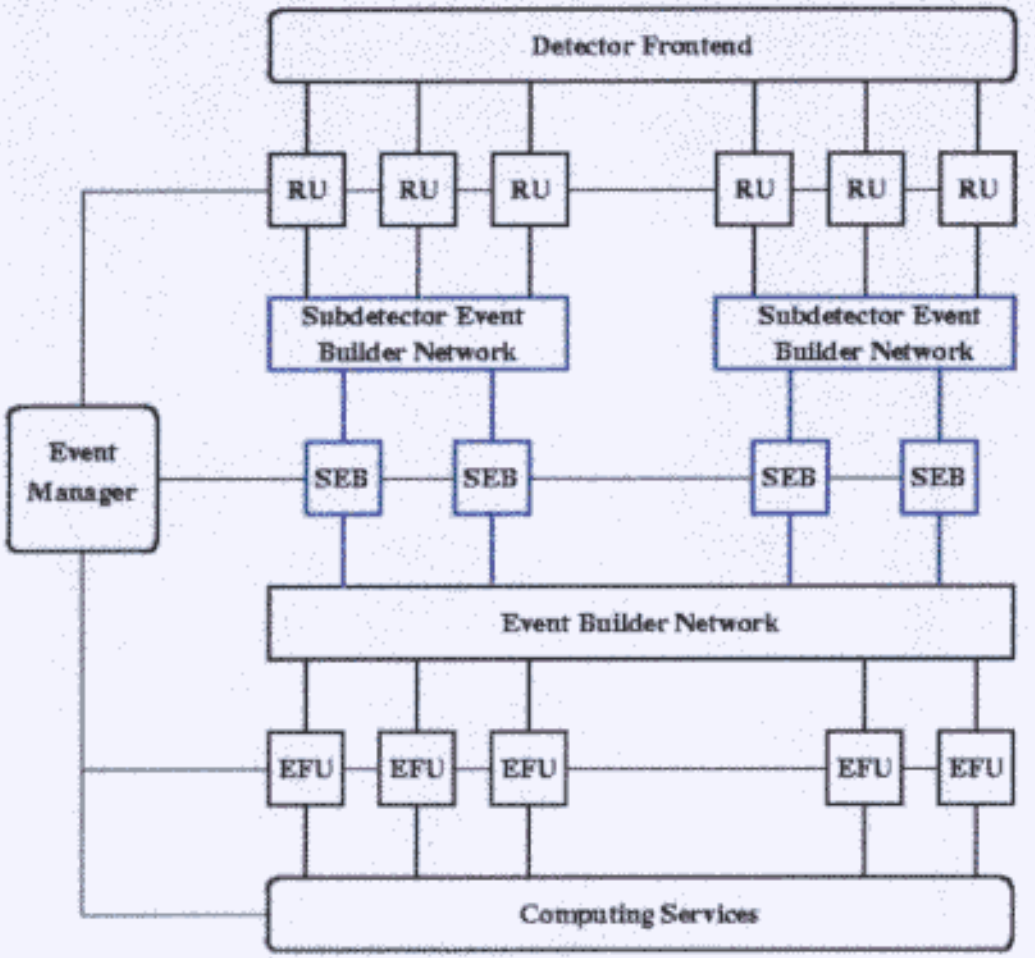
  GBit – Ethernet, switched networks, GByte/s throughput

- Computing

  cheap commodity hardware with 'main frame like specs'

  GByte RAM, 1000MHz CPUs, 500MByte/s bus speed

Conceptual Design Overview



ADC, multiplexing, hit detection

read and buffer event in Readout Unit

build subdetector data in parallel

pre-processing in Subdet. Event Builders

build full event into Event Finder Unit

full train processing event finder

permanent storage

Conceptual Design
Event Finder

Event Finder Unit :

- full data processing for the complete train
- find event candidates (= 'bunches of interest')
- send processed data for 'bunches of interest' to storage

Performance
Table of Event Rates

Physics	Process	cross section [pbarn]	Event per train	
(Lumi=3E34)	ee->ee	150	0.90	cross sections from CDR
	γγ->WW	70	0.42	
	eγ->νW	20	0.12	
	ee->WW	5	0.03	
	ee->tt	0.3	0.002	**total < 2 events of 'interessting physics'**

Background	Process	events per bx	VTX hits all layers	TPC tracks	ECAL cluster	HCAL cluser	
(N.Tesch)	pair production	50	1009	17	3500	300	**dominates**
	hadronic	0.02	–	1	–	–	
	neutrons	2000					
	moun	?					

Performance
Table of Detector Paramters

Component	Channels [10E3]	Hits per particle	Hits per Train [10E5]	Bytes per Hit	Data Volume per Train [MByte]
VXD	799000	10	57	6	34
FTD	20000	14	4	4	2
SIT	10000	4	2	4	1
TPC	1500	240	116	14	162
ECAL	32000	100	100	8	80
HCAL	200	30	8	4	3
MUON	200	12	3	4	1
LAT	10	10	28	2	6
total	~850000				~300

input received
no input received
calculated from Background and Physics Rates

–> 1.5 GByte/s

Performance
Data Volume

- Raw data from frontend (background dominated)

  300MByte/train with 5Hz –> 1.5GByte/s

- Processed event size ~ 1MByte

- Finder output

  up to 10 Hz 'physics' + 20 Hz calibration + background

  30 Hz logging with 30MByt/s –> 300TByte/year

- Z0 factory –> 300Hz from total hadronic cross section

Cost Estimate

- Assumptions on prices

  1000 euro for a PC (but increased RAM/CPU power)

  1000 euro for a >Gbit/s network connection (switches, ?)

  1000 for a readout unit (**RU**) (handling O(1000) channels)

  10000 for a crate (VME, CompactPCI, ?)

- Assumptions on units

  10^9 channels > 10^7 readout lines > 10^4 RU

  housed in 500 readout crates (20RU/crate)

  1000 nodes each for SEB and EFU

Table Cost Estimate

Component	units	price per unit [1000 euro]	total [1000 euro]
Readout Units	10000	1	10000
Readout Crates	500	10	5000
Event Building Network	4000 ports	1	4000
Subdetector Builder Unit	1000	1	1000
Event Finder Unit	1000	1	1000
Storage			1000
Infrastructure			1000
		total	**~ 25 MEuro**

Remarks

- Physics rates and Background rates to be checked !

  Cross sections taken from CDR. Acceptance cuts !

  Background taken from Norberts Table (1.2cm beampipe!)

- Detector parameters have to be checked !

  Some values are guessed only! Check Table !