Discussion on DAQ

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Introduction : Outline of DAQ

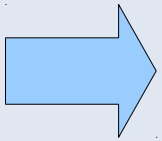
- Constraints
  - Pulsed collider
  - Huge number of channel

  - Many VFE chips
  - auto-trigger
  - local zero suppr
  - local storage + delayed readout (exception ≡ BeamCal)

- Expectations
  - Machine noise
  - Physics rates
  - Internal noise
  - Calibration data

  - TO BE REDONE
  - TO BE REDONE
  - TO BE UPDATED BY DET GROUPS (wasn't in the the LoI)

From LoI to be updated... Even^{ly} expended



Occupancy per cell
  - per det. ⇒ Buffers sizes
  - Failure (overflow) expectation...

- «Small data rate» (⇔ LHC)
  - per det. rates
    - incl. options

Subdetector	Channels [10^6]	Occupancy [%]	Data volume [MB]
VTX	800	1.0	50
TPC	2	< 0.1	12
FTD	1	9	2
SIT	1	30	6
SET	5	1	1
ETD	4	10	7
ECAL	100	< 0.1	3
HCAL	8	1	130
MUON	0.1	< 0.1	≤ 1
LCAL	0.2	70	4
BEAMCAL	0.04	100	126
TOTAL	≈920		≈340

TABLE 5.1-1
Data Volume in MB per bunch train for the major ILD detector components

Si
A

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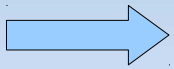
Elements

- Embedded electronics
  - Intro
  - Pulsed to limit heating
    - stability
  - Local memory
    - Noise taming
  - Configuration & Readout buses / lines
    - large surface / long lines
    - Common interfaces



has been tested (SDHCAL)

- in 3T field
- on large 400kch system

- Trigger-less system
  - trigger ≡ (end of) burst spill
  - possibility to have a standard trigger ?
    - Calibration ✔ but for physics (exotics) ?
  - Flexibility ?

- Might be needed for noisy systems.
- Backup solution ?

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Elements (2)

- Fast signal distribution
  - Clock
    - Precision needed ⇒ **from det groups**
  - Calibration
    - Amount of data & frequency ? ⇒ **from det groups**
  - Trigger / Synchronisation Event / Validation...
    - 1 fast signal for all
    - Modes.
- Data path (⇔)
  - Configuration
    - remote & local storage.
  - Data readout
- Redundancy
  - Clock distribution ?
  - Each final card has 2 readout possibility

Elements (3): Global questions

- Configuration management
  - Slow control
  - Gain corrections
    - Calibration system & immediate correction
- Handling of noisy channels
  - for analysis
  - One last global trigger to tag end of burst ?
- Online
  - Hot channels detection & masking
  - Frequency
- Global network type
- Readout protocol
  - Eth + TCP | UDP ?
  - µCTA
- Machine parameter readout
- Data format ✔
- DB with TB of calibration data ?
  - Use of GPU for LUT ?
- Event building
  - 1 processor per Bunch Train
  - Noise detection & suppression
  - Handling of time dependant config ?
  - Prompt reconstruction
- Offline computing
  - Software

Interface with SW (to be decided)

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Implementation

- Intro
- Vertex
- Si Trackers
  - input from SiLC
- TPC
  - Input from LCTPC
- Calorimeters
  - Input from CALICE
  - Input from FCAL
- Muons

Summary

- Testing of DAQ concept did much progress since 2 years
  - testing of power pulsing
  - readout of large systems ⇒ importance of noise taming
- Still much to do
  - integration of ≠ systems
  - redundancy of clock / data paths in case of failure
  - data protocol resilience
  - larger systems (esp calo & muons)
- Detectors management
  - Noise is our enemy ⇒ proper handling is critical.
  - How to handle this ?
    - Frequency of masking, correction
    - Bookkeeping and use for analysis ?

どうもありがとうございました

(dōmo arigatō gozaimashita)

&

Bon appétit !

Note