

Trigger /DAQ

LCWS 2000 Report

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- Agenda
 - What 's new since Sitges
 - Review of T/DAQ from Tesla, LCD and JLC
 - Discussion
- Session attended by only few people !
 - Sergio Zimmermann (FNAL)
 - Sean Mattingly (Brown/D0)
 - Ralf Gerhards (Desy) --> presentation on « Tesla »
 - Tony Barker (Colorado) - US Convenor
 - Patrick Le Dû - European Convenor

General comments about Trigger/DAQ



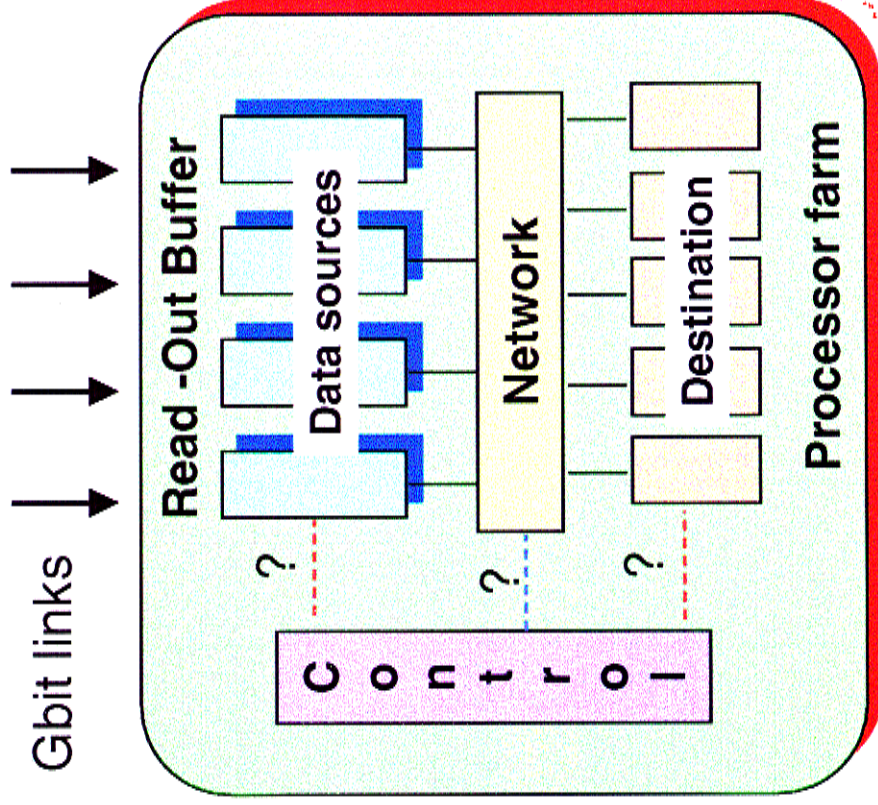
Can we achieve the ultimate T/DAQ system!

- From the Physics: NO loss
- From the Detector : Deadtimeless
- From the Machine : use 100%
- from T/DAQ people: maximum efficiency and minimum maintenance
- From new technologies use commodity products
 - Processing power and memory seems illimited (PC farms)
 - Fast networks are commercially available (ATM-GigaEthernet..)

“Modern” Architecture basic components

Basic Elements

Interface with Subdetector
Front-end Electronics Read-
out Drivers



Buffer = Data server

- Buffer manager
- Data extraction (partial or full)

Switching Network

- Data collection
- Control when “pull”

Processor :

- PCs (Linux or WN^o T) farms

Control & protocol

- Push vs Pull

Main issues

- Link occupancy
- Network speed & size
- Software Overheads

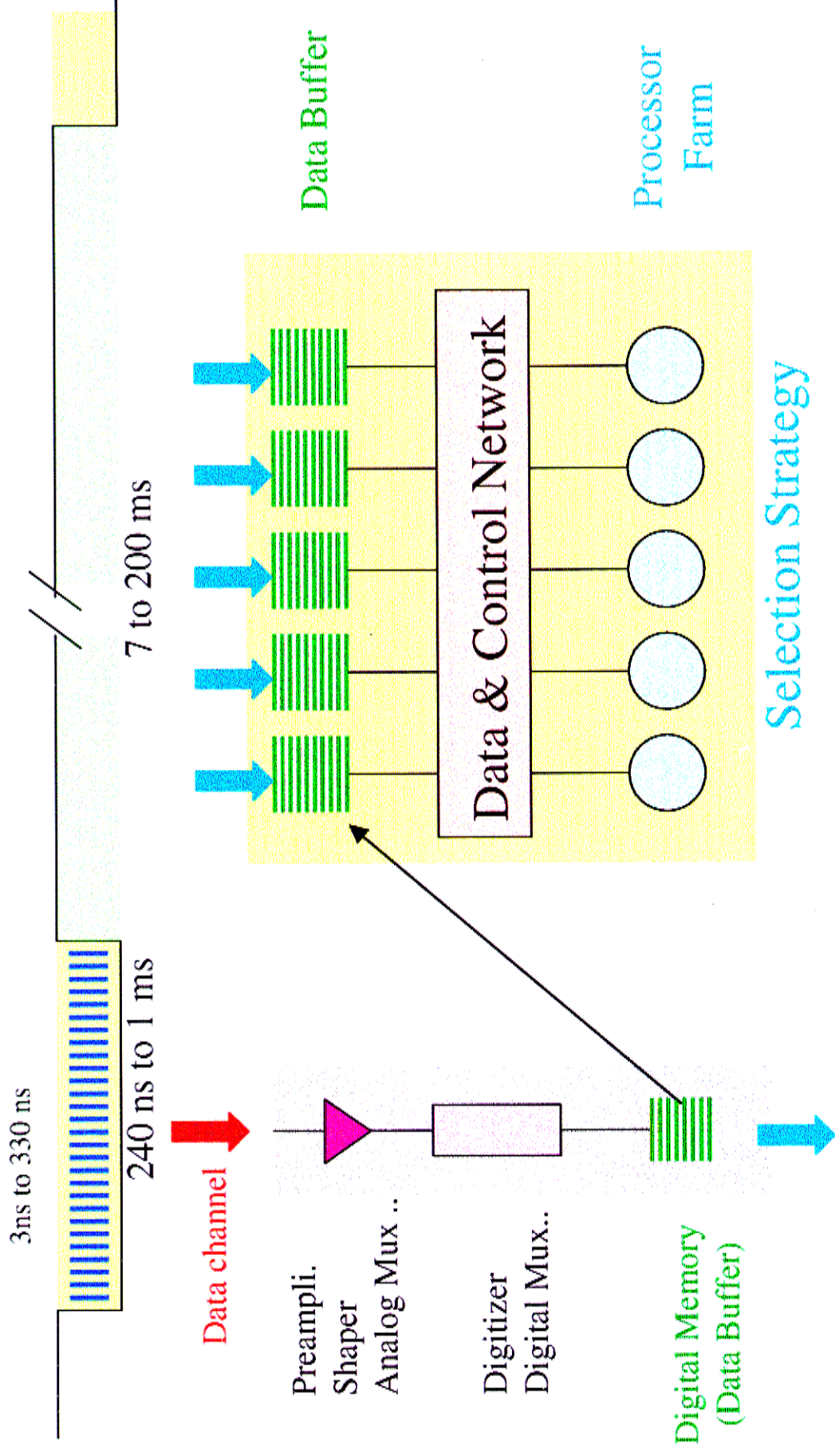


Latency **NOT** important
Throughput Important

Basic Concept: NO hardware trigger

- Read-out and store front end digitized data of a complete bunch train into buffers
 - Deadtime free -- no data loss
- **DAQ triggered by every train crossing**
 - build the event and perform zero suppression and/or data compression
 - full event data information of complete bunch train available
- **Software selection between train : software trigger**
 - using « off-line » algorithms
- **Classify events according**
 - physics, calibration and machine needs
- **Store events :**
 - partial or everything!

Linear Collider: software trigger concept



- Build & format event
- Classify & store “bunches”
- Select & analyze “Bunch Of Interest” ...

Detector Electronics

Advantages

- **Flexible**
 - fully programmable
 - unforeseen backgrounds and physics rates easily accomodated
 - Machine people can adjust the beam using background events
- **Easy maintenance and cost effective**
 - Commodity products : Off the shelf technology (memory, switches, processors)
 - Commonly OS and high level languages
 - on-line computing ressources usable for « off-line »
- **Scalable :**
 - modular system

Consequences on detector concept

- **Constraints on detector read-out technology**
 - **TESLA: Read 1ms continuously**
 - VTX: digitizing during pulse to keep VTX occupancy small
 - TPC : no active gating
 - **JLC/LCD :**
 - **7 ms pulse separation**
 - detector read out in 5 ms
 - veto trains
 - **3 ns bunch separation**
 - off line bunch tagging
- **Efficient/cheap read-out of million of front end channels**
 - silicon detectors (VTX and SiWcalorimeters)

“On-off line” boundaries are moving



Detectors and electronics are becoming more reliable

- » High efficiency & Low failure rate
- » Powerful “on-line” diagnostics & error recovery: expert systems



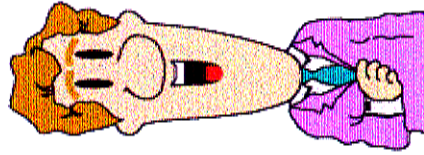
On-line computing is not doing only “data collection”

- » “Off-line” type algorithms early in the selection chain--> ex IP
- » Selection of “data streams” --> Important role of the “Filter”
- » Precise alignment needed for IP triggering
- » Detector calibration using Physics process available (Z0 for em)



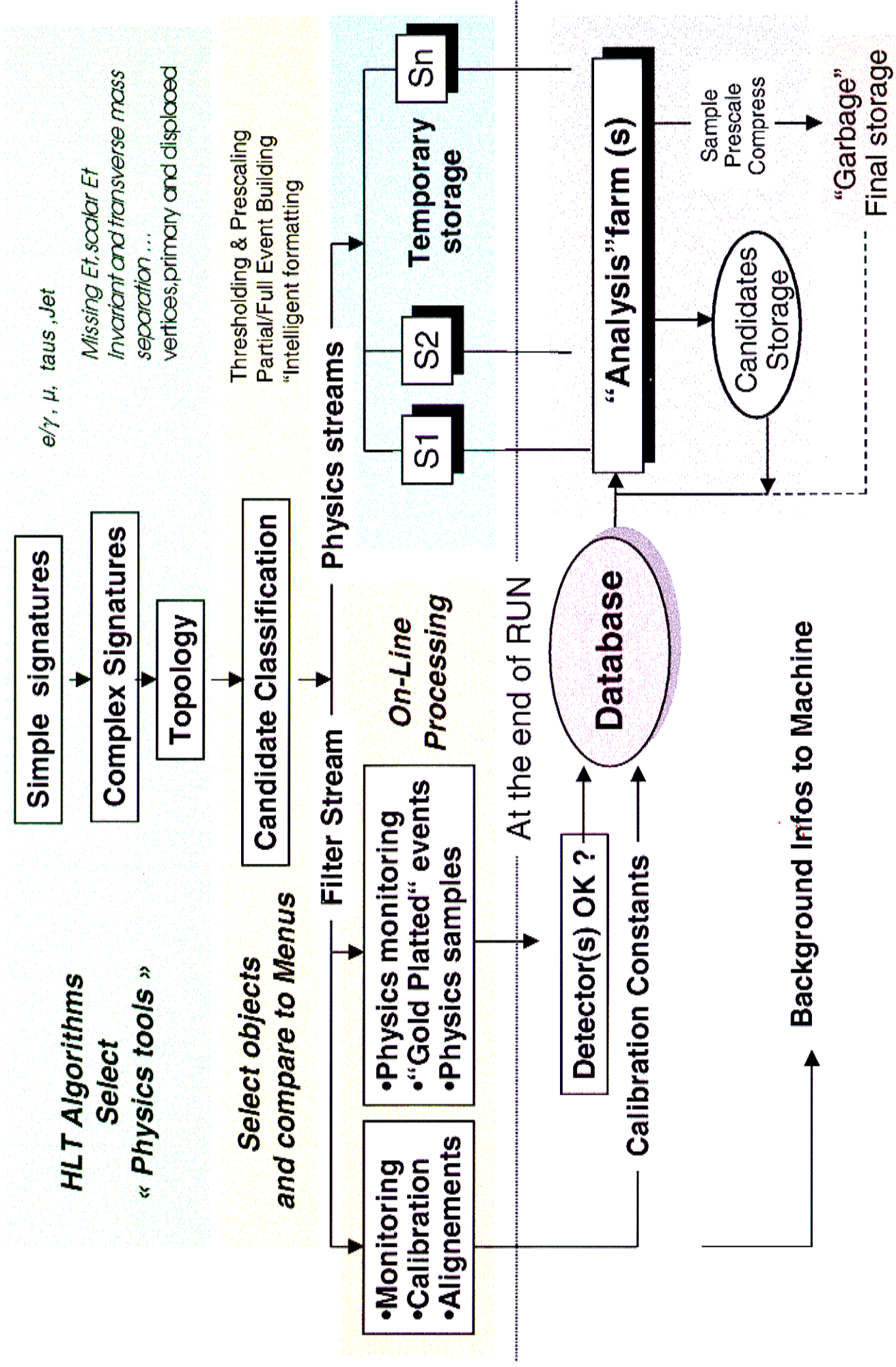
Common aspects

Algorithms : developed from “Physics Performance Experiments sociologically organized by “Physics Groups”
Processing farms : same architecture, components & tools
Database and data management : identical



“Off-line” is becoming the “Level 4”

HLT Strategy & Event Analysis model



Conclusions

- **Software trigger concept remains the ‘baseline’**
 - T/DAQ for the LC is NOT an issue !
- **Looks like the ‘ultimate trigger’**
 - satisfy everybody : no loss and fully programmable
- **Feasible - (almost) today and affordable**
 - Less demanding than LHC
- **Consequence on the detector design**
 - constraint on detectors read-out electronics (trackers)
- **Consequence on the software environment:**
 - on and off-line are merging : need to develop a complete integrated computing model with common resources from calibration, selection (algorithms and filter) and analysis /processing paths....