

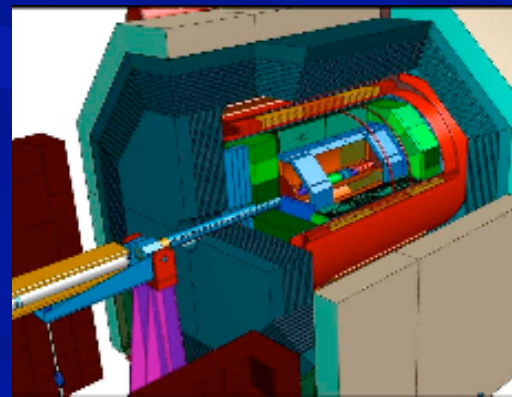
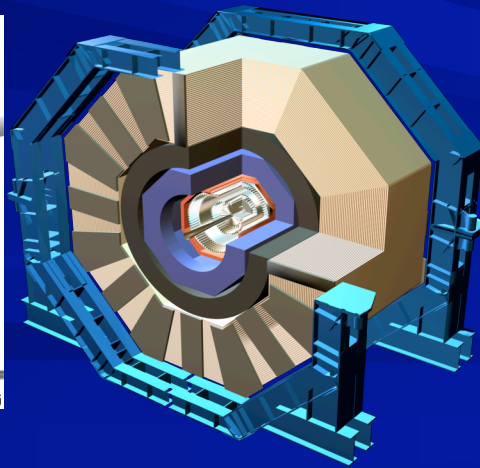
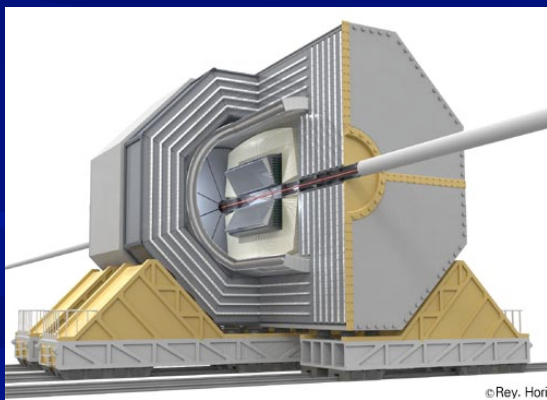
DAQ sessions Summary

From event selection to Physics

at the future International Linear Collider)

P. Le Dû

pledu@cea.fr



4th

LCWS BANGALORE - T/DAQ session 1

Saturday March 11th 9.00 -10.30
Chair U. Mallik

- 1) Introduction : U.Mallik - issues and challenges for the T/DAQ
- 2) Virtual Observatory, India project by Prof. Ajit Kembhavi
- 3) Concepts DOD T/DAQ status reports
 - GLD (P.Le Du)
 - LDC (G. Eckerlin)
 - 4th (S. Popescu)
- 4) VERY Forward Calorimeter and machine feedback (W. Wierba)
- 5) DCS for ALICE TPC (S. Popescu)
- 6) Idea for 100 MHz DC-DC Converter in 4 Tesla Field (S.Dhawan)

LCWS BANGALORE - T/DAQ session 2

Monday March 13th 9.00 -10.30

Chair H. Matsunaga

- 1) Triggering aspects seen from the Physics side (K. Moenig, Zhiqing Zhang?)
- 2) Cosmic trigger discussion (P.Le Du. G.Fisk)
- 3) Instrumentation standards (R.Larsen/S.Dhawan)
- 4) SILC Read out status and plans (A. Savoy Navarro/J.F.Genat)
- 5) CALICE calorimeter UCL january meeting report (S.Dhawan)
- 6) Summary of the EUDET kick off meeting (J.Mnich/M.Wing)

DAQ chapters DOD Reports

G.Eckerlin (LDC), P. Le Dû (GLD), S.Popescu (4th)

Example --> LDC

■ Introduction

- DAQ for high precision and high luminosity experiment

■ ILC Machine operation

- 3000 Bx in 1 ms follow by 199 ms with no beam

■ DAQ concept

- No HARDWARE trigger, 1ms pipeline, software selection

■ Conceptual design

- Building block diagram & functionalities

■ Detector controls

- DCS, commissioning, calibration, monitoring, GDN

■ Requirements

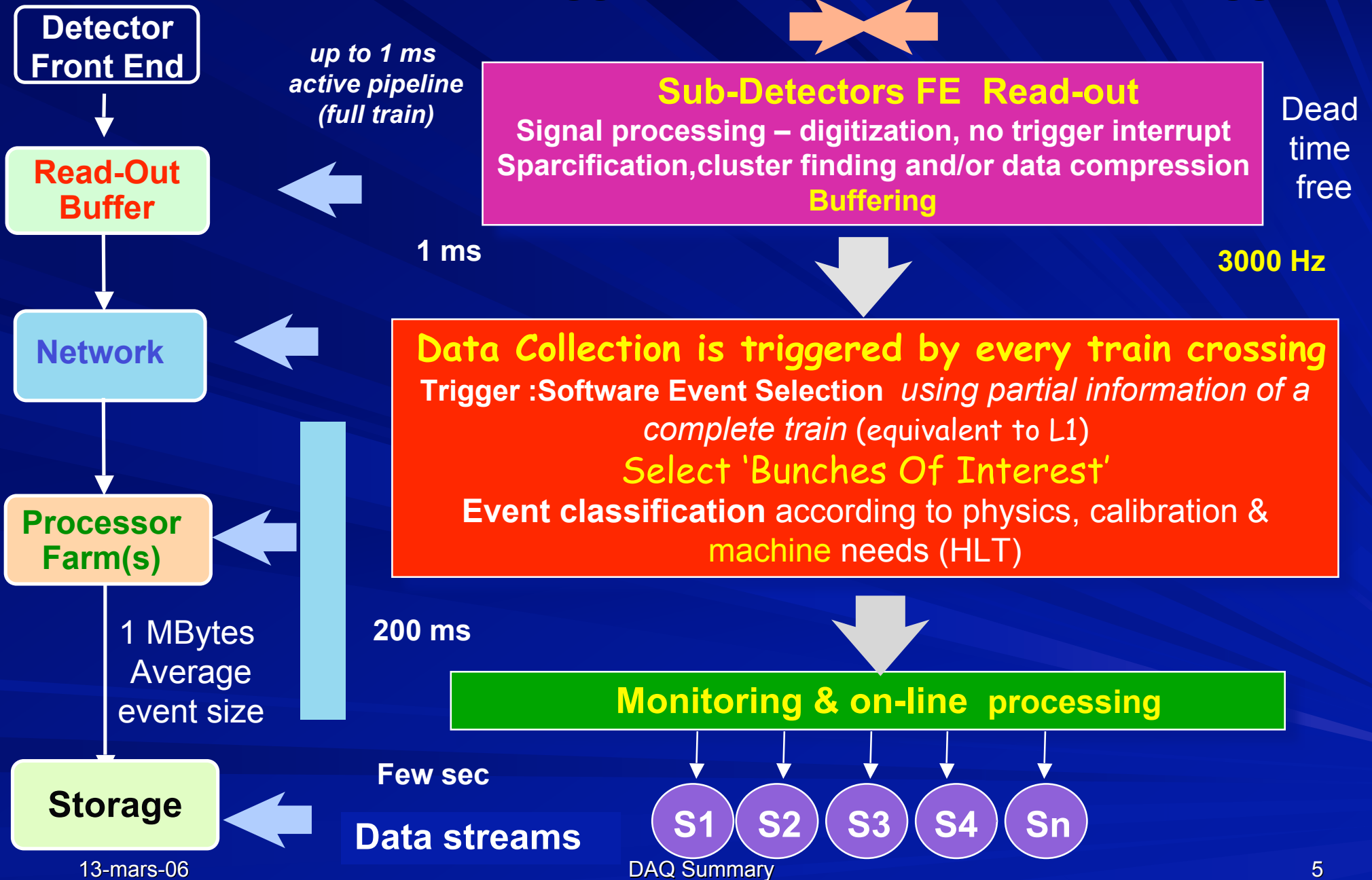
- Table of channels and data rates

■ R&D

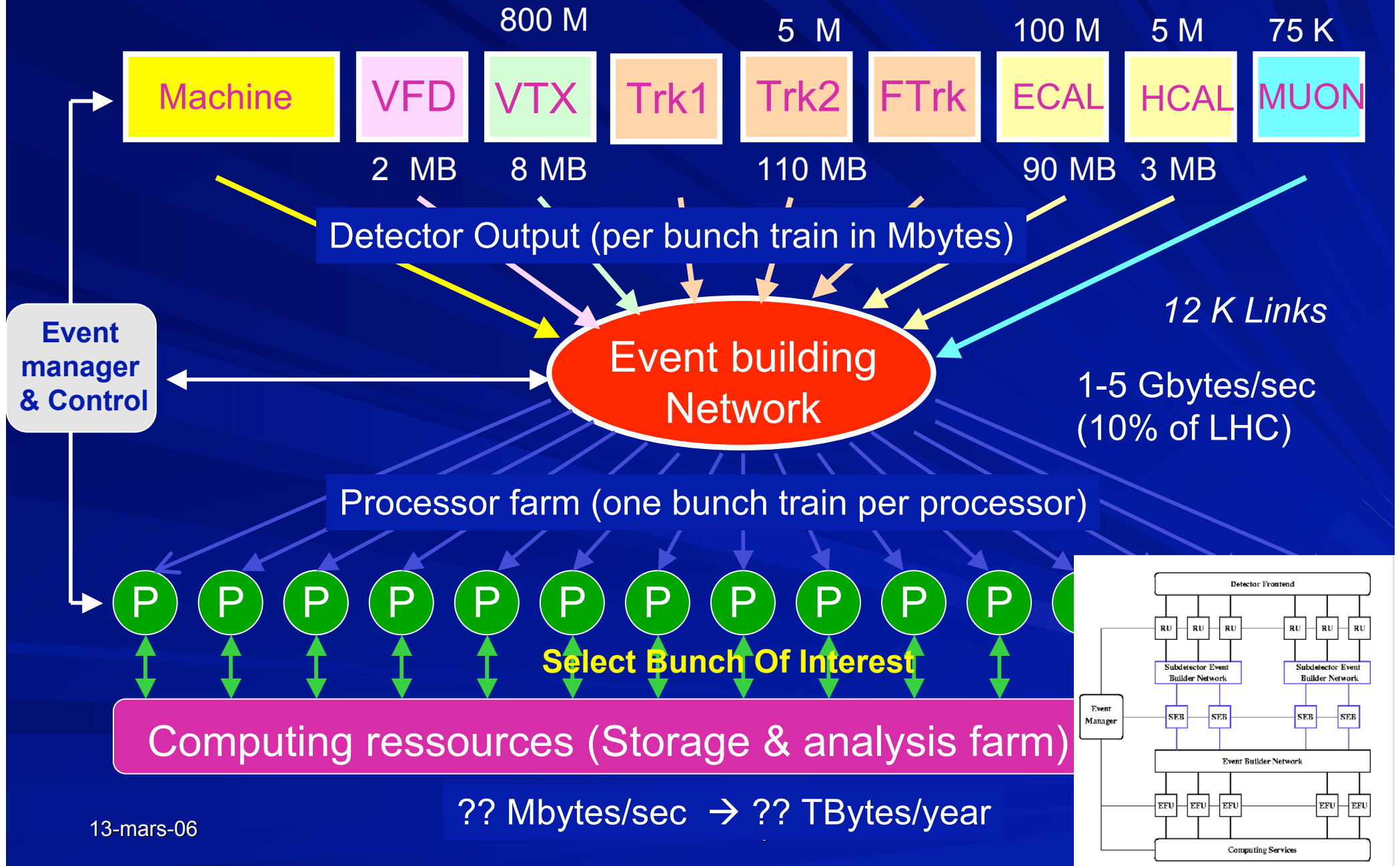
- List of should/could be done

Data Flow

Software Trigger concept → No hardware trigger !



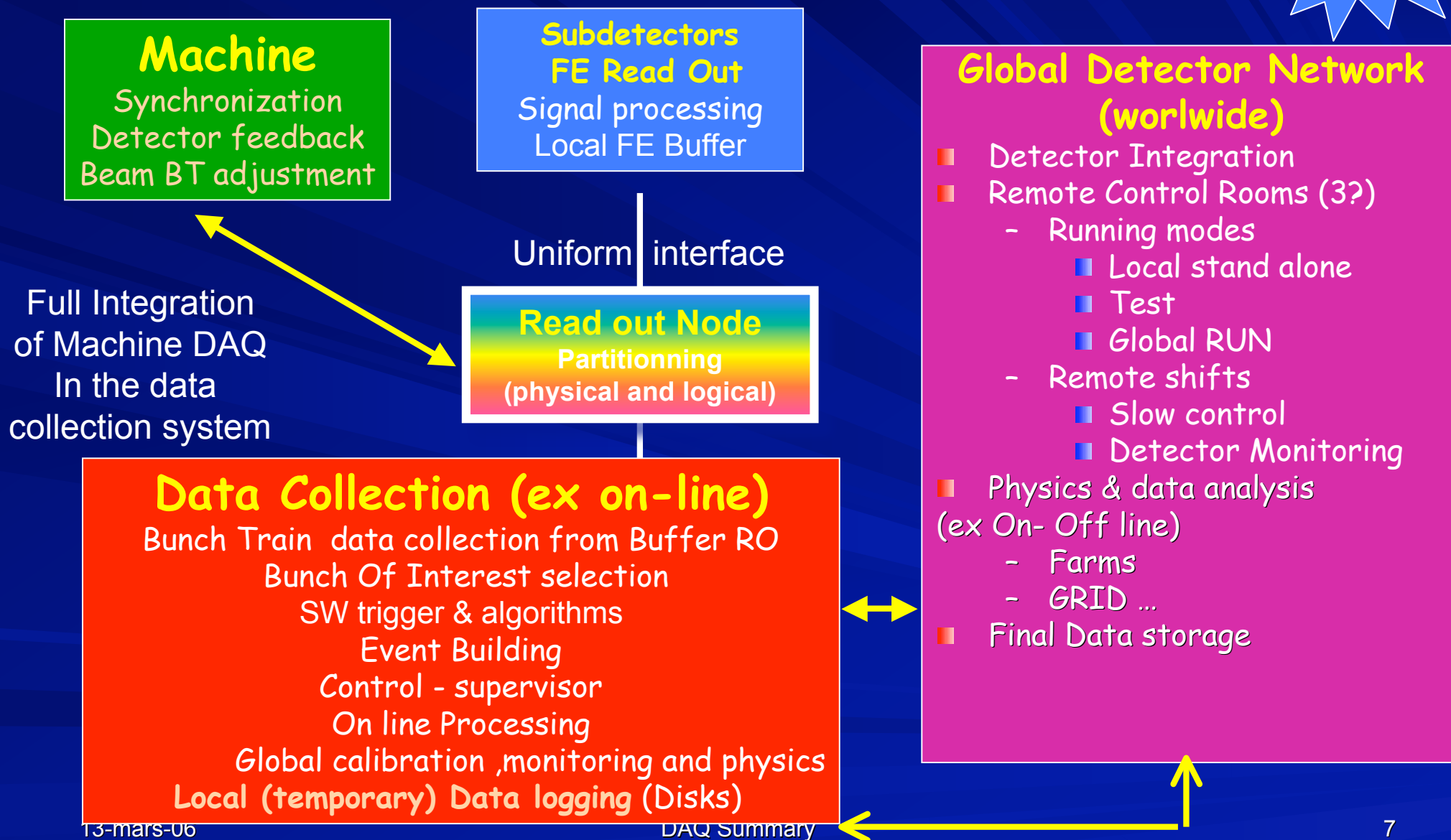
ILC DAQ conceptual (generic) Architecture (2005)



About systems boundariesmoving due to !

→ evolution of technologies, sociology

NEW!



Current view of a uniform RO architecture

Sensor technology

Integration
To be studied!

- VTX**
CCD
MAPS
DEPFET
.....
- TRK**
Si
TPC
- ECAL**
Si W
Scint W
- HCAL**
Digital
Analog
- Muon**
RPC
Scint ...
- VFD**

Common/uniform Interface

On detector
Very Front End

Local/Global Controls & Services Partition

Running mode (Stand alone, test, RUN)
Synchronization & machine interface
Databases : Calibration & Monitoring

Preampli
Shaper
Digitizer

Local Signal
Processing
and
buffer

FPGA

Local
Data
Management

Receiver
Digital Processing
MUX
RO Buffer

Read Out Node/Hub

G
D
N

Front End
(On / Near detector)

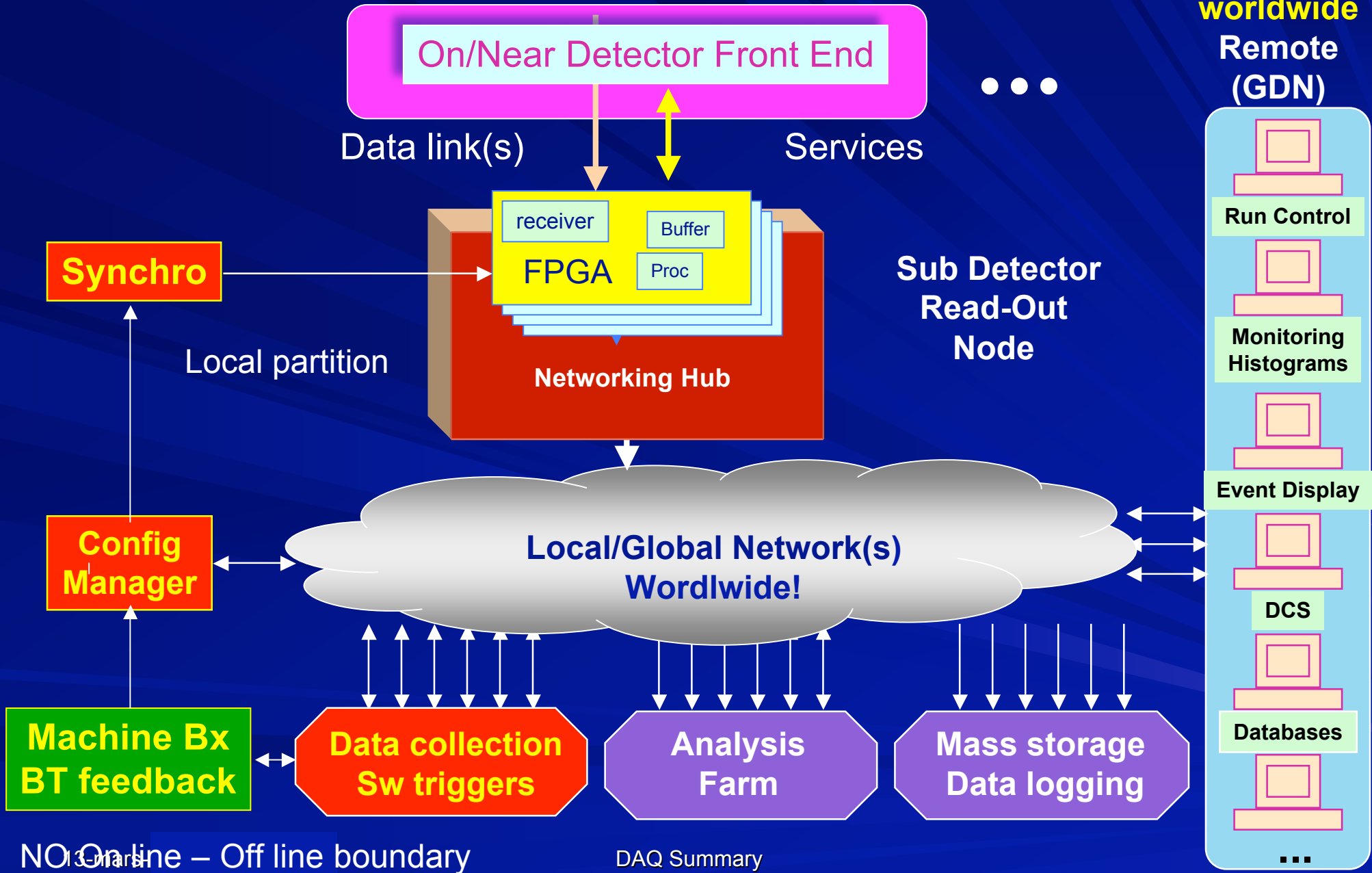
Global
Detector
Network

Dedicated ASIC and/or SOC*

Commercial standard

*System On Chip

ILC 'today' Data Collection Network model



Very Forward calorimeters & machine interface

Wojciech. Wierba (INP Cracow, Poland)

■ 2 Very Forward calorimeters (LDC)

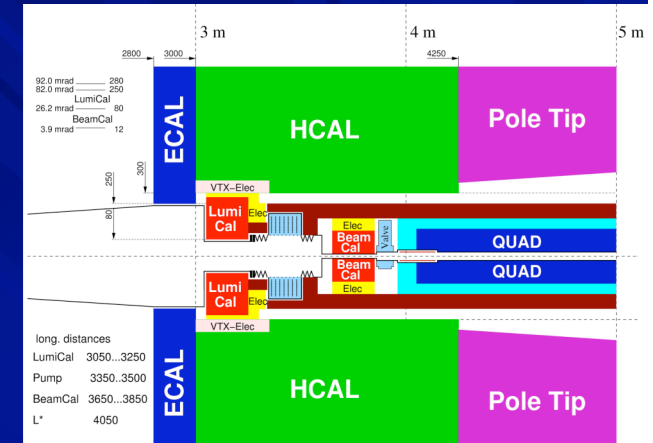
- Limited space for electronics
- Very high segmentation 300 k channels
- Readout electronics have to be placed directly on the detector surface

■ SiW LumiCal Lumi cal

- Channel occupancy 20% and dynamic range 14 bits
- Provide raw Luminosity after each BT
- 2,25 GB per BT

■ Diamond-W Beam cal

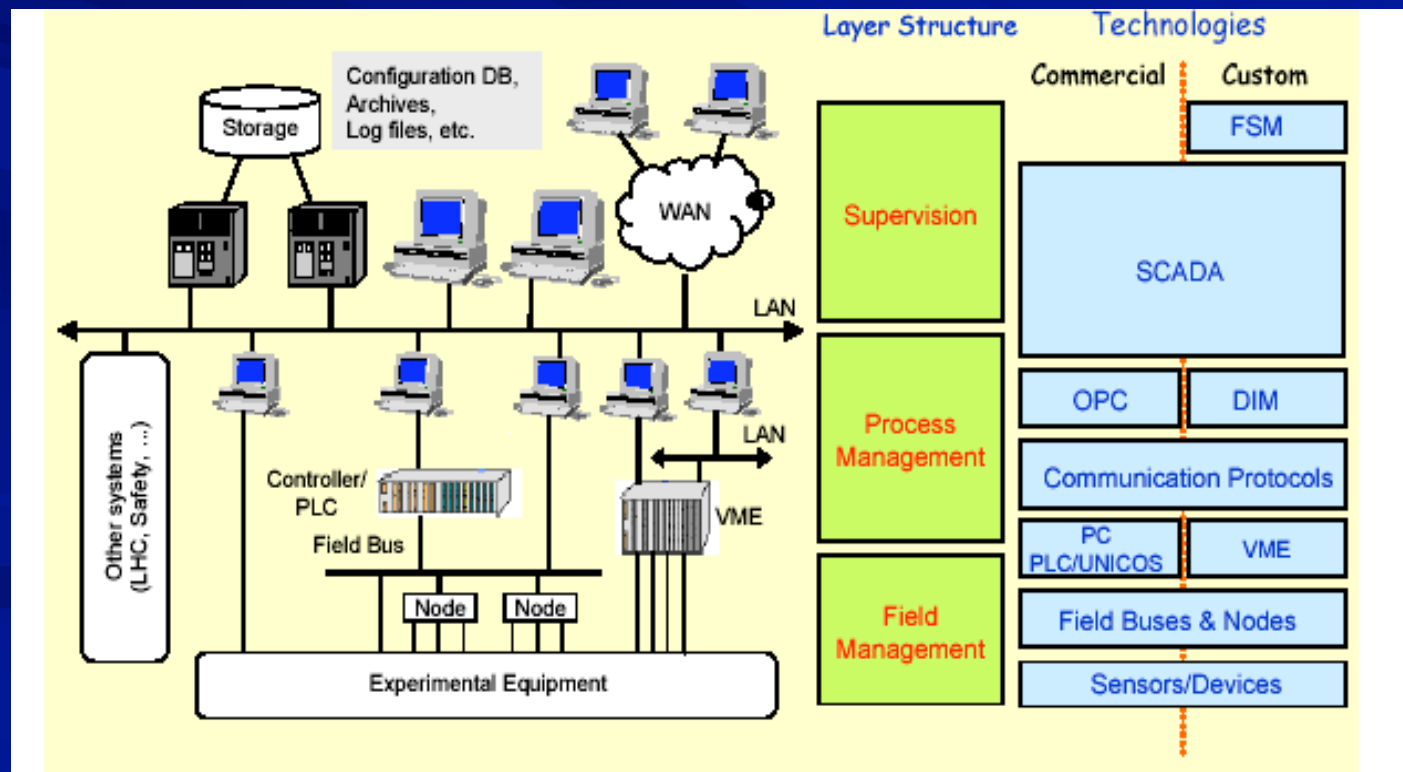
- Preamplifiers, shapers, discriminators, zero suppression = simple (?) readout electronics (no need of ADC's)
- provide Beam diagnostic ($\sigma_x, \sigma_y, \sigma_z$ and $\Delta\sigma_x, \Delta\sigma_y, \Delta\sigma_z, x_{\text{offset}}, y_{\text{offset}}$ and $\Delta x_{\text{offset}}, \Delta y_{\text{offset}}$, Bunch rotation, N particles/bunch) after a few bunches - readout should be done simultaneously with bunches every ~ 300 ns (~ 150 ns)



ALICE TPC Slow Control

Sorina Popescu - CERN

- The Joint Controls Project (IT-CO) coordinates the control for the 4 LHC experiments
- The main concept was to be able to remotely control any hardware as much as possible
- Integrate different subsystems and share the information between them
- Having the possibility to scatter and distribute the information between control systems or subsystems



Triggering aspects seen from the Physics side

■ Physics requirements (K. Moenig)

- Triggerless= all events can be analyzed off line
- Rate per train: Physics (0.1) ,Bhabha = 4, gg =215
- All events are potentially interesting? Can we write everything :
 - Tesla TDR 1GB/s -- \gg 10 TB/year --> 10 \times LHC !
- How can we reduce the data size ???
 - Data are coming from TPC (50%),ECAL (40%),VTX (5%)
- Most of data are background ---> Delete TPC,VTX and Cal for Bhabhas, time stamp for the rest --> estimate a gain of 10

■ Detector/Trigger challenge for SUSY Dark Matter Scenarios (Zhiqing Zhang)

- How to isolate smuon and staus from backgrounds?
(Challenging) DM scenarios put stringent requirement on both central and forward detectors in its
 - Particle identification capability
 - Time resolution

SILC read out

(Aurore Savoy Navarro)

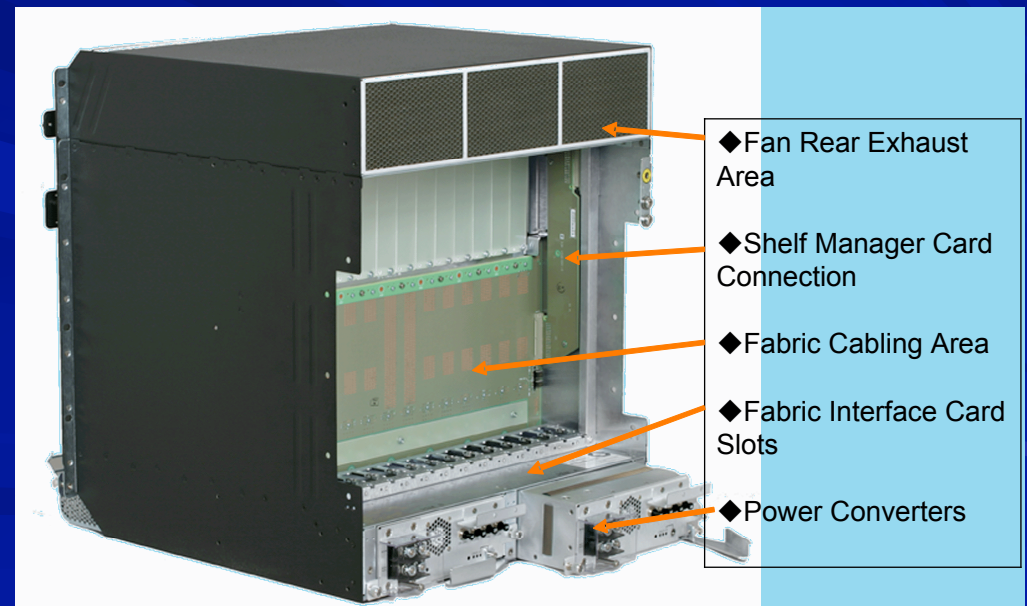
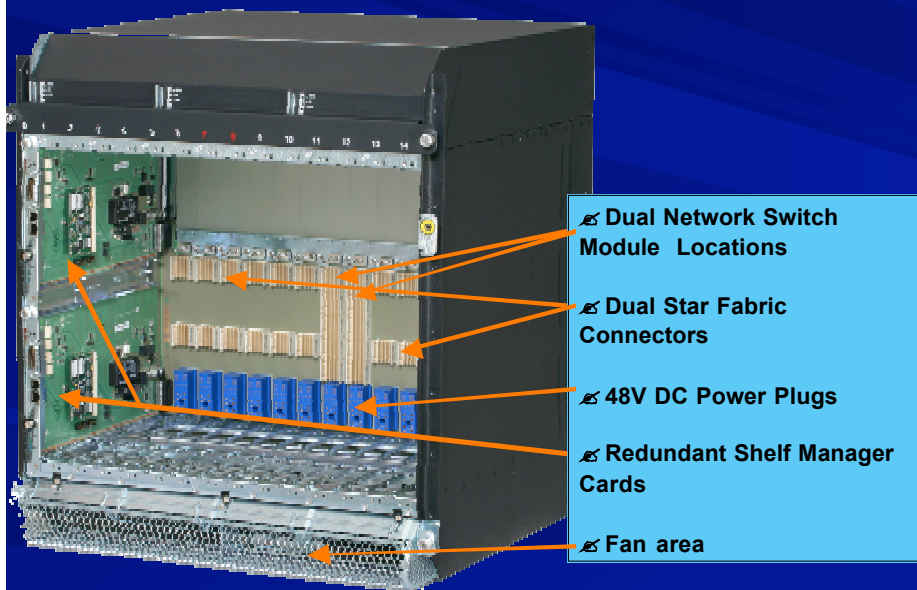
- The digitized and preprocessed information from the Si tracking will be provided at the detector stage
- Of the order of 8 to 16 fibers for the external layers per side
- Exact number of channels and cables for Inner parts to be evaluated; will depend on the technologies

Starting to have an idea of the way to go to DAQ
Followed in the SiLC collab meetings
<http://lpnhe-lc.in2p3.fr/silc2>

Futures Technologies

(Satish Dhawan/Ray Larsen)

- Instrumentation standard for HIGH AVAILABILITY electronics systems (machine and detectors)
- New telecom industrial standard
 - ATCA (Advanced Telecommunications Computing Architecture)



Ideas on DC-DC Converters in Magnetic Field

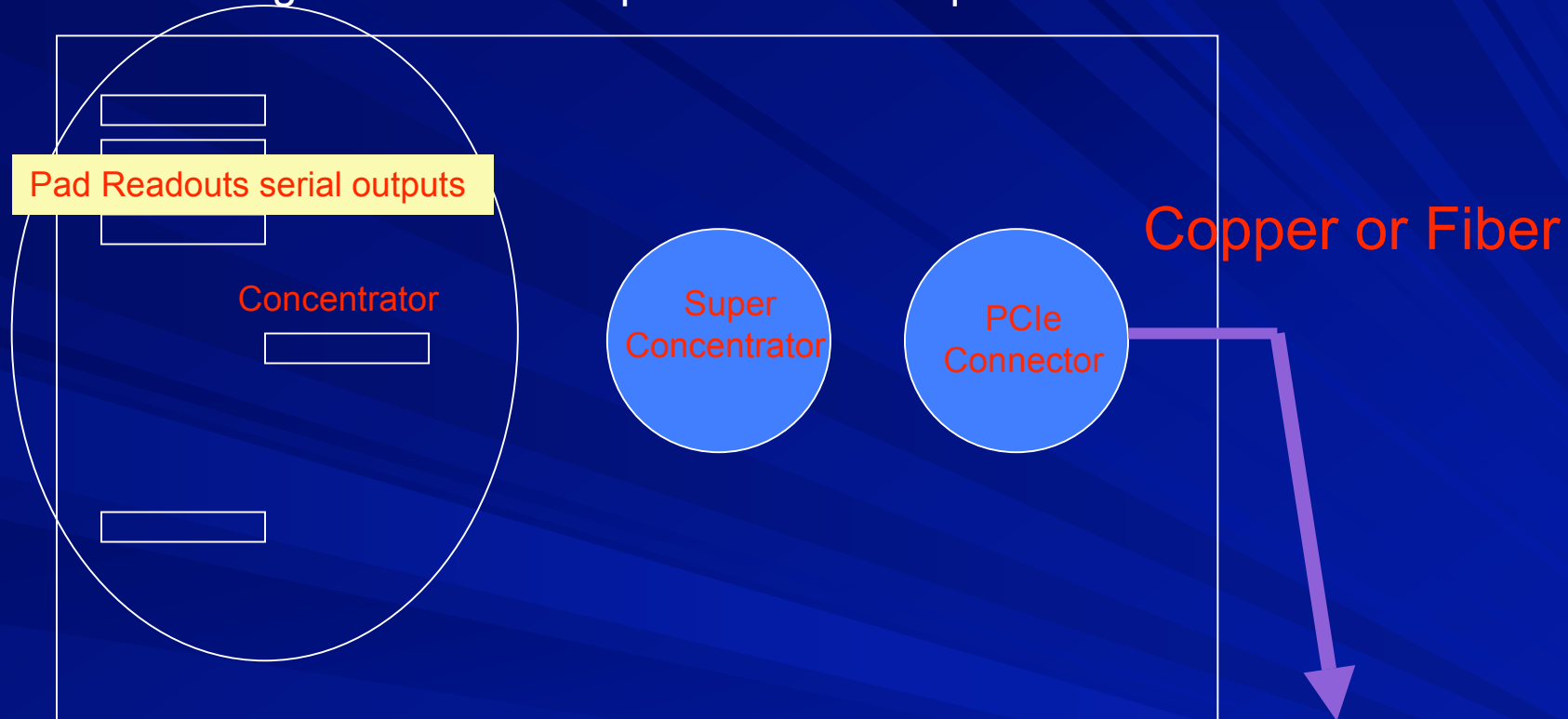
S.Dhawan - Yale

1. $V_{input} = 48$ Volts
2. Power Output 2 volts @ 60 amps
3. Efficiency $> 85\%$
4. Operate 5T & Radiation Environment
5. Design Copper leads for voltage drop
6. $V_{drop} \sim I_{peak} \times R$
7. Power = $(I_{peak})^2 \times R \times$ Duty Cycle
8. Easier Power Cabling
9. Lower Copper volume inside the Detector

Should this approach be pursued?

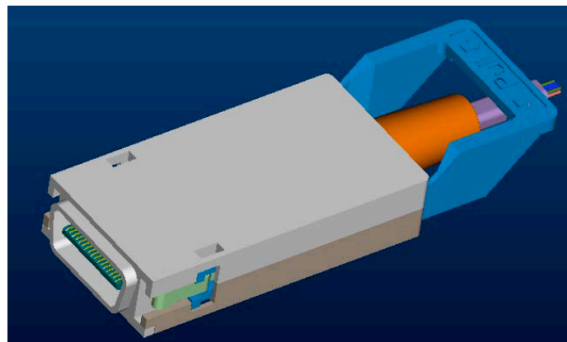
A Standard Detector Readout Output (UCL january CALICE meeting)

ILC Digital HCAL 400k pads / 1meter Square



Cu - Fiber - Cu Adapter
0.5 - 5.0 Giga bits /sec
4 Fibers
Total Rate = 20 Giga bits /sec
Standard SAS/ PCIe connector
Power = 1 watt
Cost = \$150

CX4 Plug With Optical Transceiver Inside - Preliminary



Standard Protocol
Use commercial Boards

Satish Dhawan, Yale University
LCWS06 March 13, 2006, Bangalore

EUDET

(J. Mnich/M. Wing)

- Different DAQ systems being developed for EUDET sub-systems
- Within each sub-system, DAQ trying to be generalised
- Are now thinking of common DAQ for combined beam tests
- Different philosophies and technologies will have to be integrated
- Will aid future common DAQ for final detector
- EUDET project just started
- More definite results be next workshop

A step toward an ILC PILOT PROJECT !

Conclusions

■ TRIGGER

- Conventional hardware trigger NOT needed
- How to integrate the cosmic trigger ?

■ Data volume and DAQ

- Not a technical challenge !!!
 - Tevatron, B factories and now LHC are good prototypes
- Thoughts are needed to reduce the data volume and isolate rare events.

■ Needs full synergy between accelerator, machine-detector interface and detectors

- DAQ is the right forum for instrumentation discussion across detectors (power supplies, standards like ATCA, PCI express...)
- Already good connection with SILC, CALICE, VTX, TPC, VFDgroups
- Need to integrate machine controls and detectors

■ EUDET is a good model for testing and experiencing **new standards** ---> toward a ILC World Wide PILOT PROJECT