ILD & Test Beam DAQs session

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ILD WS 2010
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Charge of the meeting

- Many recent activities
  - ILD LoI last spring; IDAG report last summer → ILD √
  - Test Beam WS in LAL in november
  - EUDET meeting in december
  - AIDA call for FP7
- Near future
  - *Preparation of ILD DBD → Plans until 2012*
    - *Beyond the LOI*
    - *Improvement ? Extend toward CLIC ?*
  - What is needed for TB (stand alone & combined)
    - *could also be seen for ILD as a " small scale repetition"*
- Discussion
  - Mutualisation : HW, SW, protocols, experience
  - Test of technologies ?

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DAQ for ILD in the LOI

- LOI summarized in few words
  - 10^9 channels & 5 Hz * ms bunch trains
    ⇒ triggerless operation (globally) with local auto-storage & SW filters
  - Data, Computing < LHC
  - Rates estimations
    - Bgd dominated
    - Baseline SiW ECAL + AHCAL
    - Nom.:
      - HCAL 8000 Hits/BX
      - ECAL: 150 Hits/BX
      - TPC: 400 Hits/BX
      - VTX: 3 Hits/cm²

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 (DHCAL: 20)
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

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DAQ After the LoI

- Near future Preparation of ILD DBD (~ TDR)
  → Plans until 2012
  - What is missing in the LOI ?
  - Estimation of rates based on mode detailled set-up
    - ASICs occupancy
    - ASIC Pipeline length
    - Topology
    - Power-Pulsing in 4T field
  - Noise & Calibration data
  - Cost estimate
  - Commons:
    - ASIC communication ? Daisy chain vs I2C vs ...
    - FE communication ?

1. Continue **R&Ds on critical components** to demonstrate proof of principle.
2. Define a **feasible baseline design** (options may also be considered).
3. Complete basic mechanical integration of the baseline design accounting for insensitive zones.
4. Develop a realistic simulation model of the baseline design, including faults and limitations.
5. Develop a push-pull mechanism working with relevant groups.
6. Develop a realistic concept of integration with the accelerator including the IR design
7. Simulate and analyse benchmark reactions, which can be updated.
8. Simulate and analyse some reactions at 1 TeV, including realistic higher energy backgrounds demonstrating the detector performance.
9. ***Develop an improved cost estimate.***

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AIDA

- Successor of EUDET (→ end 2010) and DEVDET († 2009)
  - *Infrastructures required for the development of detectors for future particle physics experiments.*
    AIDA targets user communities preparing experiments at a number of key potential future accelerators
  - submitted in december;
    selection: April/May + 2-3m Negotiations + 3m formal agreem^{t}
    finalisation by **end 2010**
    A **4 year** project (3 years if negotiated)
  - 9 Work packages ⊃ joint research activities (RTD)
    - WP3, task 2 & 3: 3D Interconnection & Shareable IP Blocks for HEP
    - WP8 (Improvement and equipment of irradiation and beam lines)
      - task 6.1: “common DAQ infrastructure”: coord. V. Boudry & D. Haas
        → toward combined TB (Pixel + Tracking + SiTr + Calos)
        Synchronisation of systems (HW [Clk & signals], SW)
        - *Experience from EUDET Telescope + MANY*

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LCTW09: LC TB WS in LAL (3-5 nov 09)

- http://ilcagenda.linearcollider.org/conferenceDisplay.py?confId=3735
- Plans summarized for all LC R&D
- Talks on DAQ integration: VTX, TPC, Calo + summary
  D. Decotigny, M. Killenberg, D. Haas, M. WIng
  → Formalisation in a text ?
  - 1st attempt in AIDA call
    - 1st task = evaluate the situation and needs.
      Can start today
- *Summary of summary: convergence on HW & SW & data formats*
  - *TLU2, Beam InterFace, ...*
  - *EUDAQ, Calice : XDAQ + DOOCS + Tango, Slow Control (⊃ DB)*
  - *All data storage in LCIO (⊃ RAW) ?*
    - *check Frank Gaede talk this afternoon in SW session*
  - *needs a philosophy*
- *Interface to the TB facility → recording of conditions*

Open questions

- Needed developments
  for each sub-system
  (VTX, TPC, SIT, FCALs, CALO, Muons)
  - Expected data rates
  - Any change wrt to LOI ?
    - Example: is Noise included ?
    - Improved estimations ? Needed ?
  - Are we SURE the ASICs memory is sufficient near the beam pipe ?

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Open questions (2)

- Technological choices & constraints
  - Time precision needed (clock distribution)
  - Data Concentration topology & technology
    - redundancy of data/config paths ?
    - Ethernet / fibre / custom ?
    - Power distribution & local power storage
    - Power pulsing constraints in a 4T Field
    - Specifications for cables & power route on PCBs
  - Grounding & EMC (ILD & TB)
  - External trigger distribution & handling
  - Fault tolerance
  - use of FPGA or ASICs in FE (DIF)?
  - Local storage of HW configurations → PROM ?
  - Checking of loaded config ?
  - Busy handling (e.g. memory full)

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Open questions (3)

- Data format
  - Fully specified ?
  - Common BX identification ? (ILD, TB)
  - Slow Control Data
- Price of equipment
- Constraints on the mechanics (vibrations, Power pulsing @ 5Hz, push-pull)

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Open questions (4)

- Central DAQ
  - Reconstruction etc: not yet critical but not to be forgotten
  - Price of Farm & storage
  - Load balance: Switches → UDP as a data packet format ?
- Mapping : Geometry mapping vs. HW configuration Database(s)
- RAW data format storage :
  - per event / per bunch train ?
    - TPC integration time / recalibration
    - Possibility of analysis for long living particle decay
  - per sub detector ?

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Cooperation & mutualisation of sub-system equipments philosophy

- What should be common ?
- BX ID
- Data Readout network & protocols ?
- Stored Data formats ? (e.g. LCIO)
- What are the minimum criteria ?

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