ILC Controls Update

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EPICS Collaboration Meeting – DESY, April 2007
ILC Design Changes since June 2006

- Was

- Now
ILC Reference Design Report

Completed March 2007 (more or less)
- Available at www.linearcollider.org
- Includes initial value estimate
  - 1.78 Billion (ILC Units) for site-dependent costs, such as the costs for tunneling in a specific region
  - 4.87 Billion (ILC Units) for shared value of the high technology and conventional components
  - 13,000 person-years effort (== 22 million person-hours)
    - 1 ILC Unit = 1 US$ 2007 (== 0.83 Euro, == 117 Yen)

Next major task is the Engineering Design Report
- And the R&D program necessary to support an engineering design
- Due roughly end of 2009
Section 3.12 of the RDR contains:

- Overview
- Requirements and Technical Challenges
- Impact of Requirements on the Control System
- Control System Model
- Remote Access / Remote Control
- Timing and RF Phase Reference
- Beam-based Feedback
- Information Technology (IT) Computing Infrastructure
- Cost Estimation, Bases of Estimates
- Table of Components
Requirements and Technical Challenges

- Scalability
  - Quantity of technical systems
  - Physical distances between systems
- High availability
  - Simulations indicate control system must provide 99% to 99.9% availability
  - This in turn implies individual “IOC” must be 99.999% available
- Extensive automation and beam-based feedback
- Synchronous control system operation
- Precision RF phase reference distribution
- Standards and standardization, quality assurance
- Requirements on technical equipment
- Diagnostic interlock layer
Control System Functional Model
Control System Physical Model

- Above Ground - plus initial underground backbone
Control System Physical Model

- Below Ground

Diagram showing the physical model of the control system with various components and connections, including:
- Main Controls Network
- Distributed Computing
- Controls Front-end
- Technical Equipment

Not shown:
- Redundancy in network connections, switches, shelves
- Timing System distribution
- Out-of-Band Monitoring network distribution
- Interlocks, MPS
- General Purpose Controls network
- Video network
Timing and RF Phase Reference

Use phase reference from adjacent sector to aid in detecting phase wander.

Phase Reference from adjacent sector

Detects fast phase changes and noisy channels. Contains narrowband PLL to clean up phase noise.

IntraSector Distribution

To LLRF and Timing
Controls R&D Program – Americas Region

I am speaking from perspective of Americas region. Similar efforts in European and Asian regions. Goal is to collaborate and coordinate as much as possible.

- Assortment of R&D work going on right now in FY 2007 (Fiscal Year)
- Now planning FY 2008/2009 R&D program
- ILC Controls is part of ILC Global Systems WBS x.2
  - Other Global Systems are Installation, Commissioning and Operations, LLRF, Instrumentation and Feedback, Survey and Alignment
Program Areas for FY 08/09

- Accelerator Design
  - EDR (Engineering Design Report) authoring
  - Requirements development
  - Standards and methodology development

- R&D
  - In support of the EDR
  - LLRF algorithms, beam instrumentation, high availability, front-end electronics platform, diagnostic controller
  - Other R&D work in plan, but less likely to be funded, or none requested:
    - Control system architecture, installation, survey and alignment
  - Collaborate, collaborate, collaborate
Program Areas for FY 08/09

- Facilities
  - Several facilities under construction at Fermilab, called ILCTA (ILC Test Accelerator) as a whole
  - Most Global Systems work here involves developing controls, instrumentation, and LLRF for running ILCTA. Timescale and goals are somewhat different than ILC controls research.
  - However, the NML facility of ILCTA will serve as a real system in which to test and evaluate prototypes coming from R&D program.

- Program Management
  - Managing all of the above
High Availability and Electronics Platform Areas

- High Availability
  - NOT just redundancy
  - Conflict avoidance
  - Model-based resource monitoring (IPMI and SNMP)
  - Model-based configuration management
  - Automated diagnosis
  - Adaptive control
  - Controller redundancy and failover

- Electronics Platform
  - ATCA (Advanced Telecommunications Computing Architecture)
    - *BPM digitizer under development at Fermilab*
  - uTCA
    - *AMC cards for analog I/O (how to route I/O to back of chassis?)*
  - Shelf Management (IPMI over RMCP, IPMB, IPMC, BMC, etc…)
  - Analog electronics environment characterization
**ILC Global Systems**

- This is an open process.
- People are contributing at all different levels of effort and degrees of formality.
- Please contact people with your ideas
  - Top down via your region’s ILC Global Systems Manager
    - John Carwardine – Argonne National Laboratory
    - Stefan Simrock – DESY
    - Shinichiro Michizono – KEK
  - Bottom up via many participants