Americas Region EDR Kick-Off Meeting
Alignment & Metrology

Richard Ford

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Mission statement

The Alignment and Metrology Group provides the following services:

- Geodetic network for the whole ILC site
- Tunnel reference networks
- Fiducialization of ILC components
- Precision alignment of ILC components
- Alignment monitoring and stabilization of components
- Ground motion and vibration measurements and analysis
- Alignment Database & Information Systems

EDR Work Packages

Conventional Facilities and Siting Group - CFS

Alignment & Metrology Subgroup

Engineering Design Report Planning

Functional Work Breakdown Structure and Work Package Descriptions

x.x.2.8.1 Work Package - 1
Alignment & Metrology Criteria

x.x.2.8.2 Work Package – 2
Alignment & Metrology Baseline Configuration

x.x.2.8.3 Work Package – 3
Value Engineering Reviews

x.x.2.8.4 Work Package – 4
Develop EDR Schedules and Project Execution Plan

Work Package 1 - Criteria

x.x.2.8.1	Work Package 1 - Alignment & Metrology Criteria		
	Subactivities		
	x.x.2..8.1.1	e- Source	
		x.x.2.8.1.1.1	Obtain Final e- Source EDR Criteria
	x.x.2..8.1.2	e+ Source	
		x.x.2.8.1.2.1	Obtain Final e+ Source EDR Criteria
	x.x.2..8.1.3	Damping Rings	
		x.x.2.8.1.3.1	Obtain Final Damping Rings EDR Criteria
	x.x.2..8.1.4	Ring to Main Linac	
		x.x.2.8.1.4.1	Obtain Final Ring to Main Linac EDR Criteria
	x.x.2..8.1.5	Main Linac	
		x.x.2.8.1.5.1	Obtain Final Main Linac EDR Criteria
	x.x.2..8.1.6	Beam Devlivery System	
		x.x.2.8.1.6.1	Obtain Final Beam Delivery System EDR Criteria
	x.x.2..8.1.7	Interaction Region	
		x.x.2.8.1.7.1	Obtain Final Interaction Region EDR Criteria
	x.x.2..8.1.8	General	
		x.x.2.8.1.8.1	DevelopFinal EDR Criteria for Surface Network
		x.x.2.8.1.8.2	DevelopFinal EDR Criteria for Tunnel Networks
		x.x.2.8.1.8.3	Obtain Final EDR Criteria for Vibration Tolerances

Work Package 2 - Baseline Configuration

x.x.2.8.2	Work Package-2, Alignment & Metrology Baseline Configuration	
	Subactivities	
	x.x.2.8.2.1	Geodesy
	x.x.2.8.2.2	Alignment Techniques & Integration
	x.x.2.8.2.3	Fiducialization, Prototyping, & Mechanical Supports
	x.x.2.8.2.4	Alignment Monitoring, Stabilization, & Ground Motion
	x.x.2.8.2.5	Alignment Database & Information Systems
	x.x.2.8.2.6	Tracking Alignment Requirements

Work Package 3 - Value Engineering

x.x.2.8.3	Work Package-3, Value Engineering Reviews	
	x.x.2.8 3.1	Review Shaft Requirements (Number and Size)
	x.x.2.8.3.2	Review trade-offs between design or criteria changes and alignment costs
	x.x.2.8.3.3	Review Industrialization Techniques for Cost Advantages
	x.x.2.8.3.4	Review Alignment Monitoring & Stabilization Strategies for various Frequency Domains
	x.x.2.8.3.5	Review Cost effectiveness of in-house vs. Commercially Available Software
	x.x.2.8.3.6	Evaluate Cost Impact of Criteria Changes

Work Package 4 - Regional Interests

x.x.2.8.4	Work Package-4, Develop EDR Schedules and Project Execution Plans	
	Subactivities	
	x.x.2.8.4.1	Develop Schedule Through Site Selection - Asian Region
	x.x.2.8.4.2	Develop Schedule Through Site Selection - European Region
	x.x.2.8.4.3	Develop Schedule Through Site Selection - Americas Region
	x.x.2.8.4.4	Provide Geodetic Support Site Selection Process for ILCSC

Current A & M Activities

- Gathering & Tracking Alignment Requirements
  - No Formal Process in Place; TRD?
  - Documented and Approved Alignment Requirements – none
  - Preliminary Consensus of Alignment Requirements – DR
  - Alignment Requirements Actively Being Developed – ML, RTML, BDS/IR
  - Requirements Based on Rumor, Gossip, & Innuendo – e+e- source, detectors
- Fiducialization, Prototyping, & Mechanical Supports
  - Started Effort on Cryomodule Fiducialization - FNAL, DESY
  - Alignment Support for NML Cryomodule Test Facility - FNAL

Current A & M Activities

- Geodesy
  - Developed Site Independent Global Coordinate System Proposal
- Alignment Techniques & Integration
  - RTRS testing to begin soon at DESY
  - Looking at Results of LHC Stretched Wire Methodology
- Alignment Monitoring, Stabilization, & Ground Motion
  - HLS & Seismometer Measurements in all 3 Regions
  - HLS Sensor Development at SLAC
  - Regular Joint Ground Motion, Beam Dynamics Modeling, Engineering Meetings at FNAL

Current A & M Activities

- ***Almost All Alignment & Metrology Efforts are performed pro bono***

- **Due to current other programs at all the Labs, this effort will be difficult to sustain or increase.**

ILC Global Coordinate System

Proposal for the definition of a site wide ILC coordinate system

ILC Alignment & Metrology Working Group

DRAFT 7/16/07

It is envisioned that this system will be used not only for metrology and alignment purposes but also for conventional facility planning and GIS needs. Any lattice information provided by the physics groups would need transformation into this system

ILC Coordinates System (CS) definition:

1. The origin of the right handed orthogonal Cartesian coordinate system shall be defined at the ILC interaction point (IP).
2. The y-axis of the coordinate system at that point is congruent with the local gravity vector at the IP pointing upward and away from the earth center normal to the x,z plane.
3. The z-axis is defined as bisector of the intersection angle of the projections of the e^+e^- linacs onto the x,z plane with positive values increasing from the IP towards the positron linac. The intersection angle α is defined as the angle enclosed by the e^+ linac with the extension of the e^- linac.
4. The x-axis is the bisector to the intersection angle complement (^{1} -α) and is perpendicular to the y and z axes creating the right handed Cartesian coordinate system as shown in figure1.

In order to avoid negative coordinate values sufficiently large bias values are added to the origin so that even future upgrades of the ILC to multi TeV energies can be accommodated. The offsets at the origin of the IP are as follows:

Z_0 = 100000 [m]
X_0 = 50000 [m]
Y_0 = 1000 [m]

Metric units following the SI standard shall be used for this coordinate system. Distances will be expressed in units of meter while angles are given in radians.

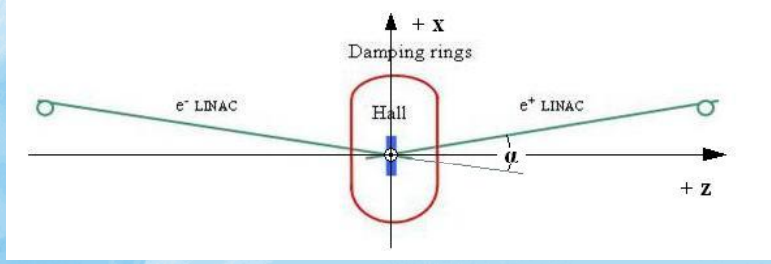

Fig. 1 Schematic of the ILC coordinate system

Summary

- A & M has an EDR structure with Work Packages
- We are attempting to Support This Project BUT:
  - We are short on People and Resources
  - It will be Difficult to Maintain even the Status Quo
  - We need a formal process for obtaining criteria and a project management plan which allows us to work efficiently