

# “Simulations” Group Summary

ILC-GDE Meeting @FNAL,  
2007.10.26

Kiyoshi Kubo (KEK)

# Parallel sessions

- Joint with RTML
- Joint with MLI and Instrumentation
- Information for simulations, hardware specs
- For Work Package organization

# Joint with RTML

- Status and Plans of 2 institutes (SLAC: J.Smith and Cornell: G.Dugan)
  - Intention of major contributions and plans
  - Plans of man power
- We had some discussions
  - Technical issues about emittance preservation
  - Ultra short Bunch Compressors
    - What is the dead line for such big change?
- Report on Damp Line Design
  - Optics design, Magnet spec, Beam halos simulations, Options for collimation, were presented
  - Remaining issues:
    - Space for first bend,
    - Possibility of shorter dump lines
- Work Package organization: see later slides

# Joint with MLI and Instrumentation

## Discussions/Q and A on

- BPM (cavity BPM in cryomodule)
  - Required performance was given to Instrumentation Group
  - Could not agree on achievable accuracy of BPM calibration (scale error)
    - Without beam: a few % or much larger ?
    - Using beam can improve it?
- Beam size monitors (laser wire and ODR)

# Information for simulations, hardware specs

**Purpose: Make a common set of data base, for assumptions and input parameters of simulations.**

- This can be used as “standard” assumptions in simulations.
- This can be used as suggested specifications of hardware.
- Items: Lattice design, Alignment model, Ground motion and vibration model, RF (BC, ML) error model, Magnet error model, BPM performance model, Cold and Warm, BSM(Beam size monitor) performance model, Wakefield, Stray electromagnetic fields
- Contact person is assigned for each item (responsible for gathering information, but **not for creating information**)
- This is not a “Work Package” ??
  - Should be done soon (before official WP begin.)
  - If all works should be assigned to WP, it should be.
- Time schedule
  - First set of out put by the GDE meeting in October (we have some) → LET WS in December

# Information for simulations, hardware specs

## Presentations:

- **Lattice design of all areas** : Mark Woodley (SLAC)
- **Wakefield**: Roger Barlow (Manchester)
- **Stray electromagnetic fields**: Dmitri Sergatskov (FNAL)
- **Laser Wire performance model**: Grahame Blair (RHUL)
- **Magnet error model**: James Jones (CI, Daresbury)
- **Alignment model**: Kiyoshi Kubo (KEK)
  - Additional Report: Robert Ruland (SLAC)
- **Ground motion and vibration model**: Paul Lebrun (FNAL)

# Lattice design of all areas

## Mark Woodley (SLAC)

- a “complete” set of MAD/XSIF files exists for the primary baseline systems
  - Damping Ring injection/extraction systems are incomplete
  - some tuneup/abort lines are not included
  - diagnostic and correction components are not always called out
  - there are some remaining “zeroth-order” disconnects
- “zeroth-order” layout issues need to be addressed first, in cooperation with CF&S group
  - relative locations of beamlines in shared tunnels
  - e+ production system layout: undulator, photon transport, PSOURCE layout
  - DR injection/extraction geometry
  - escalator locations, slopes, etc.
  - connection of escalator tunnels to Main Linac tunnels
- first-order optical rematching will then be needed
  - dispersion correction
  - internal rematching to lengthened/shortened FODO arrays, etc.
  - external matching from system to system

# Wakefields

## Roger Barlow (Manchester)

### Collimator Wake

- Compendium of formulae suitable for using in simulations will be available soon, but
- “The formulae and simulations and measurements show rather poor agreement.”

### Cavity Wakefields

- Various data are available. Common database should be set up soon.

4 experts (*R. Barlow, K. Bane, G. Stupakov and R. Jones*) will have meetings.



# Stray fields

## Dmitri Sergatskov (FNAL)

- Fast changing stray field of **nT level may cause problems**
- Some measurements exist but no definite conclusion.
- **Need more data**
  - Different site; different locations on the same site
  - Consistent measurement techniques
- Defensive design ?
  - Consider (extra) shielding ?

# Laser Wire performance model

## Grahame Blair (RHUL)

- Review of beam size measurement using laser wires
  - Concept, actual experiment, near future plans. etc.

We will have

- Simple model as input to most of tracking codes.
- Complex system for full LW simulations for some special cases.
  - Formula for expected “measured” beam size as a function of a set of many Input (conditions)

We need the simple model very soon.

# Magnet error model

## James Jones (CI Daresbury)

- **Parameterized model**

- First steps are to perform literature search on other machines.
- Generate a set of “magnet families” based on current lattice
- Provide some parameterised models of field errors for each family.

(offline comment by K.K: We may simply ask experts, who are working for ILC.)

- Some **estimated tolerance spec from beam dynamics**
- Combine these two to provide a list of field error sets:
  - “ideal” = tolerances
  - “realistic” = parameterised models
- As and when magnet designs are produced, provide improved parameterised models.

# Survey/Alignment for alignment model

## Robert Ruland (SLAC)

We (simulations people) learned:

- **How survey lines are produced**
  - Results will depend on methods.
- Realistic local alignment accuracy will be ~50 micron, at best.
- Component rotation will be adjusted using gravity
  - **Variation of gravity may and may not be important. It is site dependent.**
- And more

# Alignment model

## Kiyoshi Kubo (KEK)

- Report on a realistic alignment model.
  - Draft document of first trial has been available and sent to experts who signed up [metrology/alignment/acc.physics](mailto:metrology/alignment/acc.physics) mailing list set up at DESY GDE meeting
  - Start from setting reference points, every 2.5 km (every shaft)
  - Include process of survey, long range errors.
- Our Goal is to make a model suitable for tracking simulations
  - Simple as possible and
  - Realistic enough from beam dynamics point of view

# Ground motion and component vibrations

## Paul Lebrun (FNAL)

- Review of references and **data base for Ground Motion** (GM)
- **Experimental data of cryomodule vibration** at DESY
  - Quad vs top vessel and ground in the vertical direction
- GM models, ATL+waves, available (e.g. Seryi et.al.)
- Possible upgrade
  - Tides simulation
  - Review “cultural noises” and vibrations.
  - Correlations across the  $\sim 0.1$  Hz boundary
  - Benchmark different implementations.

(offline question by K.K: Do we really need upgrade? Can we have any “standard model” now?)

# Session for Work Package

- This was supposed to be review and discussions among “all area”, at least all LET. But, Unfortunately,
  - Only ML leader could attend.
  - No representative of other Groups, No PM.
  - **Out put was limited**
- There were a lot of useful comments and suggestions
  - But no conclusion/definite result
- See following 5 slides

# DRAFT List of ILC Simulation Work Items (Packages)

- RTML (emittance preservation)
    - Upstream RTML
    - Bunch Compressors
  - ML Static tuning
  - ML Dynamic tuning
  - BDS (emittance/luminosity preservations)
  - ATF2
  - Feedback/Feedforward model and simulations
  - Control of longitudinal phase space of the beam
  - Emittance monitoring
  - Start to End Simulation
  - Background
  - Machine protection
  - Spin dynamics
- Single area
- Inter-area

Should be modified, later.



**Received EOI**, Institutes and estimated FET (Not complete. Do not quote)  
 (Big difference of level of commitment between institutes)

	Institutes (FET)	total
RTML	Cornell (2.2), FNAL (0.5), KEK (?), KNU (0.5), IHEP (?), SLAC (1.3)	5.2+ 3.2+
ML Static tuning	FNAL (0.8), KEK (?), IHEP (1)	1.8+
ML Dynamic tuning		
BDS	RHUL, KEK, LAL, Manchester, SLAC (x)	x+??
ATF2	RHUL, KEK, LAL, KNU, RRCAT, IHEP, SLAC (6.5-x)	6.5-x+??
Feedback/Feedforward	FNAL (0.5), KEK (?)	0.5+
Control longitudinal phase		0
space Emittance monitoring		0
Start to End Simulation	KEK (?), RRCAT (0.5)	0.5+
Background		0
Machine protection		0
Spin Dynamics	Liverpool (0.4), Durham (0.6)	1

?: Difficult to identify how much is FTE is for beam dynamics

Total 13.5+??+

# Single Area WPs (almost single area)

Proposed by Sim.	Overlapped WPs Proposed by Area G.
RTML	RTML: Static Tuning study, Errors sensitivity study, Failure mode analysis, Specify and Study Magnetic stray fields, Study space-charge effects, Dynamic tuning, Specify and develop feed-back system
ML Static tuning	MLI: Static tuning, Initial Alignment
ML Dynamic tuning	MLI: Dynamic tuning
***	MLI: General ML BD
BDS	BDS: Most of "Acc & Det phys. design & optimiz." of BDS
ATF2	BDS: ATF2 Installation, integration, component commiss. Develop control & operation tools ATF/ATF2 commiss., operation & beam study

# Inter-Area WPs

Proposed by Sim. Group	Related Wps proposed by Area Groups					
	RTML	ML	BDS	e-	e+	DR
ML Static tuning		Static tuning (Wakefields)			Undulator system Lattice design	
ML Dynamic tuning		Dynamic tuning				
Feedback/Feedforward	Dynamic tuning. Specify and develop feed-back system	**	Design feedback and tuning procedures			*
Control longitudinal phase space	**	Energy Errors	*			*
Emittance monitoring	**	**	**			*
Start to End Simulation	**	**	**		**	*
Background	Study of beam halo in the RTML	**	Background and beam-beam study			*
Machin Protection	Design, Specify MPS	**	Design MPS system of field value failure detection			*
Spin dynamics	**	**	** (?)	Polarization specific issues	Polarization specific issues	** (?)

\* Some relation, but no specific WP proposed

\*\* Strong relation, but no specific WP proposed

# Question: Beam dynamics (of LET) WP: under which group?

- Single area work items
  - Under Area Groups, or
  - Under Simulations Group?
- Inter-area work items
  - Divided into areas, and under Area Groups, or
  - Under Simulations Group?

There was a suggestion: in any cases,

- All beam dynamics simulation workers should be in Simulations Group and closely communicate each other.

# **ILC-LET Beam Dynamics Workshop 2007**

## **December 11 (Tue.) - 13 (Th.) at SLAC**

- **Conveners**
  - Daniel Schulte (CERN)
  - Kiyoshi Kubo (KEK)
  - TBC (FNAL)
  - TBC
- **Local Organization**
  - Peter Tenenbaum (SLAC)