Review of “Information for simulations, hardware specs” session in ILC-GDE Meeting @FNAL

2007.12 LET Workshop@SLAC

Kiyoshi Kubo

Why “information for simulations”?

In Summary of Accelerator Physics Group in DESY GDE Meeting, we have List of 10 Critical Issues. The first issue is:

Define critical specifications for components

Often, we are asked what is the tolerances, how much errors do we assume. But there is no common answer.

- We should have common set of “standard” assumptions, errors, tolerances.
- Let us make one set of documents and data files.

LIST of Contact persons

List A: Information for simulations	Contact
Lattice design	Mark Woodley (SLAC), Allex Valishev (FNAL)
Alignment model	K. Kubo (KEK)
Ground motion and vibration model	P. Lebrun (FNAL), Dirk Kruecker (DESY)
RF (BC, ML) error model	D. Schulte (CERN)
Magnet error model	James Jones (ASTeC)
BPM performance model Cold and Warm	?
BSM(Beam size monitor) performance model	G. Blair (RHUL)
Cavity wakefield	Roger Barlow (Manchester)
Collimator wakefield	
Other impedance	
Stray electromagnetic fields	N. Solyak (FNAL)

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)

- 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 Wakefileds

- 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 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 ~0.1 Hz boundary
  - Benchmark different implementations.

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

In this meeting

Presentations:

- Laser Wire : Grahame Blair
- Ground motion and vibration model: P. Lebrun, Dirk Kruecker
- Alignment model: Kiyoshi Kubo
- RF error Model: Daniel Schulte
- Magnet error Model: James Jones
- Lattice design of all areas : Mark Woodley, Peter Tenenbaum
- Wakefield: Roger Barlow + many?

Discussions for BPM, Magnet, etc.