ILC Simulation RTML related WPs for RTML - Simulations joint session

2007.10.23 by K.Kubo

Description of each task is based on
http://www.slac.stanford.edu/~quarkpt/EDRPlan
quarkpt 16-May-2007

Modified 2007.08.21, 20071010
, 20071012, 20071017

DRAFT List of ILC Simulation Work Items

- RTML [emittance preservation]
  - Upstream RTML
  - Bunch Compressors
- (ML Static tuning)
- (ML Dynamic tuning)
- (BDS)
- (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

Mostly overlapped with RTML Group, except ones with ().

RTML
(Emittance tuning and preservation)

Goal: Demonstrate that the RTML's emittance preservation goals can be achieved.

- First Study (static tuning)
  - A set of standard misalignments and errors which is considered appropriate by the relevant technical experts
  - The expected beam distribution from the extraction of the DR, including any non-Gaussian features, etc..
  - Long-range wakefields
- Second study (include dynamical effects, etc.)
  - include BPM and corrector "hard failures”
  - use realistic models of misalignment, magnet errors, etc
  - incorporate dynamic features into the tuning model.

Feedback/Feedforward model and simulations

Goals of the Study

The goal is to develop a model of the orbit feedback and feedforward system and to demonstrate its performance by simulations. The model should incorporate the following components:

- Train-to-train (5 Hz) feedback loops
- Intra-train (3 MHz) feedback loops
- Bunch by bunch feed-forward (in the turnaround)
- Train-straightener feedback loops (nearly fixed, bunch by bunch orbit correction)

To the extent possible, the developed system should include specific locations for sensors and actuators, bandwidth requirements for sensors and actuators, and descriptions of the algorithms used by each loop, and communications between them, which are adequate to incorporate into a simulation package.

Deliverables

One or more technical notes which document the design and expected performance of the system.

Time schedule

- The document should be available in 2008?.
- This study is followed by “Start to End Simulation”

Control of longitudinal phase space of the beam

Goals of the Study

The is to develop a model of the control system in the longitudinal phase space of the beam, and to demonstrate its performance by simulations. This includes

- Monitoring, tuning and control scheme of:
  - Bunch length, timing, energy spread (tuning of the bunch compressors)
  - Measuring the beam energy profile and matching the quad lattice
  - Regulation of energy at the end of the linac

Deliverables

One or more technical notes which document the design and expected performance of the system.

Time schedule

- The document should be available in 2008?.
- This study is followed by “Start to End Simulation”

Emittance monitoring

Goals of the Study

The goal of the project is to simulate performance of emittance monitoring system, and/or estimate required performance of the system. This should include diagnostics in RTML, ML and BDS.

Deliverables

One or more technical notes which document the design and expected performance of the system.

Time schedule

- The document should be available in 2008?.

Comment:

This study strongly related to tuning studies. IT is not clear this should be an independent workpackage.

Start to End Simulation

Goals of the Study

This study will integrate the RTML, Main Linac, and BDS simulations into a common framework and produce direct estimates of the ILC luminosity (rather than indirect estimators such as the emittance). As such, it will incorporate the static tuning algorithms of each area, the dynamic effects and feedbacks, and the beam-beam interactions necessary to achieve a fully-realistic luminosity estimate.

In the event that the integrated simulations predict a luminosity which is lower than what is expected from the emittance-preservation studies, the efforts will be directed towards understanding the discrepancy and increasing the luminosity.

Deliverables

- The key deliverable is a "white paper" summarizing the results of the study.
- For cross checking and later use
  - The algorithms must be documented and made publicly available in some form, whether as source code or as a fully-developed technical note on the algorithms; this will allow other users to develop studies which take the tuning algorithms as a starting point.
  - Datasets representing the misalignments, other errors and corrector settings for a number of "seeds," which can be loaded into other simulation programs.

Time schedule,

The summary should be available at the time of the Engineering Design Report (ie, in early FY10).

Backgrounds

Goals of the Study

The goal is to simulate backgrounds, and performance of background mitigation system and/or estimate required performance of the system. This study includes:

- Beam Halo
- Synchrotron radiation
- Maltipacting
- Dark currents

Deliverables

One or more technical notes which document the expected background and performance of the mitigating system.

Time schedule

- The document should be available in ?2009.

Comment:

This may be a part of (or sub-workpackage of) a work package which include hardware design.

Machine protection

Goals of the Study

The goal is to simulate machine protection system, and/or estimate required performance of the system.

Deliverables

One or more technical notes which document the design and expected performance of the machine protection system.

Time schedule

- The document should be available in ? 2009.

Comment:

This may be a part of (or sub-workpackage of) a work package which include hardware design.

Spin Dynamics

Goals of the Study

The goal is demonstrate preservation of polarization of the electron and positron beams in the whole beam lines by simulations, studying spin dynamics and depolarization effects.

Deliverables

Documents summarizing the results of the study.

Time schedule

- The document should be available in 2009?.

“Known” participated institute and EOI submitted institute, in Draft sent to PM

	“Known”	EOI received
RTML	CERN, FNAL, KEK, SLACm KNU,	FNAL, KEK, KNU
ML Static tuning	CERN, DESY, FNAL, KEK, SLAC, Oxford	FNAL, KEK
ML Dynamic tuning	CERN,DESY, FNAL, KEK, SLAC, Oxford	FNAL, KEK
BDS	CERN, SLAC, RHUL, LAL, Daresbury	RHUL, KEK, LAL, Manchester
ATF2	CERN, SLAC, KEK, RHUL, LAL, Daresbury	RHUL, KEK, LAL, KNU, RRCAT
Feedback/Feedforward		FNAL, KEK
Control longitudinal phase space		
Emittance monitoring		
Start to End Simulation		KEK, RRCAT
Background		
Machine protection		
Spin Dynamics	Leverpool, Durham	Leverpool, Durham

RTML WPs related to beam dynamics simulations

- Static Tuning study
- Errors sensitivity study
- Failure mode analysis
- Specify, Study Magnetic stray fields
- Study space-charge effects
- Dynamic tuning. Specify and develop feed-back system

Overlapped.

Similar but not the same classification

NEED TO BE SORTED OUT.