Introduction to the Meeting and Workplan

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LAST

- Last should connect the tasks of our workpackage
  - Need to understand our specific task
  - Clearly define the links to the other tasks
  - Similar function for the machine protection task - share much of the simulation tools
  - Will have similar discussion in the whole workpackage

Main Goals

- Study of beam dynamics for the ILC and for CLIC
- For the ILC need to integrate into international community $\rightarrow$ GDE, Snowmass
- Should review our progress and tasks
  - Are we satisfied? Sure, if the others are.
  - Is the ILC community satisfied?
  - Is the CLIC community satisfied?
  - Is the EU satisfied?

Synergy

- Large overlap between ILC and CLIC studies
  - Most code or algorithm developments can be re-used
  - Large benefits for benchmarks
  - Some differences
    - Intra-train feedback
    - Repetition frequency
    - Phase error due to drive beam

ILC

- Snowmass meeting was a good step forward
  - Agreed on fundamental design for LET (which sub-systems)
    - Basis for discussion/criticism/simulations
  - Need to design/evaluate sub-systems
    - Volunteers for some
    - More volunteers needed

Schedule

- Schedule for ILC is different from what we foresee in EUROTeV
- Baseline configuration document
  - End of 2005
  - Further changes require formal procedure
- Design report/costing in 2006
  - We had the first main milestone in mid 2006
- Will try to adjust but need to follow our own pace to ensure that we deliver correct results
  - I do not think pushing too much will do ILC any good

Choices

- Are the beam parameters OK?
- Initial gradient
- Energy upgrade path
- Straight tunnel
- Positron source
- Damping ring location
- Cavity shape
- Bunch compressor layout
- Turn around after damping ring
- Bypass line for low energy running
- How many diagnostics stations in main linac
- MPS design
- Tail folding octupoles
- Structure BPMs
- Collimation strategy
- Final focus strategy
- Main linac lattice
- Position of quadrupole in module
- BPM type
- Impact of ground motion

Answers

- Well, we gave input to the choices
- We need to perform a significant number of studies before we can answer some of them
  - Beam parameters
  - Tolerances, cavity choice, etc
  - Curved tunnel, see Nick
- In some cases thinking hard is sufficient

My Opinion

- Need to answer the questions and many others
- But need to continue with a systematic study, not only jump from one question to the next
- Important steps
  - Design beam lines
  - Study alignment, tuning and feedback
  - Verify results

Design of Beamlines

- Need to have a first design of
  - Damping ring to bunch compressor transport
  - Bunch compressor
  - Main Linac
  - Beam delivery system
  - Extraction line

Required Beamlines

- RTL (ring to linac geometry match)
  - Extraction geometry and beta match
    - Emit Diagnostic section?
  - Transverse collimation
    - (2 phases x 2 planes x 1 iteration)
  - Feedforward measurement
  - Turnaround
  - Spin rotator -- Jeff
  - Feedforward correction
  - Emit Diagnostic and skew correction -- FJD

Beamlines (2)

- Bunch compressor -- PT, ESK
  - BC1 RF
  - BC1 chicane(s)
    - Collimators for longitudinal DOF
  - Longitudinal diagnostics
    - Phase, sigz, correlations
  - BC2 RF
  - BC2 chicane(s)
    - Collimators for longitudinal DOF
  - Longitudinal diagnostics (same set as above)
  - Transverse emittance diagnostics
  - Transverse collimation inc. Linac protection (Frank?)

Beamlines (3)

- Linac -- Daniel
  - 1 intermediate diagnostic station
    - At optimal point defined by filamentation of initial energy spread
      - Until further notice
  - Look at dispersion bump interaction with LRWF
  - Wake bumps

BDS from WG 4

- Diagnostic and coupling correction section
  - 2d emit only (for now)
- Beam switch yard and extraction system
  - If there are 2 IPs
- Collimation
- FF with octupole doublets and all that stuff
- Detector with luminosity monitor
  - Solenoid etc
- Spent beam line inc. Lumi energy pol diagnostics

Static Tuning and Alignment

- Bunch compressor -- PT
- Main linac -- Kirti, Jeff, Kiyoshi, Daniel, Peder, Andrea, Nicolai
- BDS -- Glen, Peder, Daniel, Mark, Kuroda, James, Maxim?, Frank?
- Integrated studies -- all

Feedback

- Bunch compressor
- Main Linac, Andrea, Peder Daniel, more
- BDS, Glen, Andrea, Peder, Daniel, more
- Integrated studies, all

Flight Simulator(s)

- Full integration of dynamic and static effects across all sub-systems -- all
- Need to figure out whether to use massive computing or clever short cuts

Bench Marking -2

Simulation of:

- BC (BMAD, LIAR, Lucretia, SAD, MERLIN)
- ML (BMAD, LIAR, Lucretia, SLEPT, PLACET, MERLIN)
- BDS (BMAD, LIAR, Lucretia, SAD, PLACET, MERLIN)
- IP (CAIN, GUINEAPIG)

BMAD: JS
LIAR, Lucretia: PT
SAD, SLEPT: KK
PLACET: DS
MERLIN: ?
CAIN: KY
GUINEAPIG: DS

Integration of Simulations

- Different people work on different parts of the machine and on alignment, tuning and feedback
- Minimum standard for lattices and beams
  - First XSIF then XML
- For fully integrated simulations need
  - Code packages that can handle all
  - Simplified models of each sub-system that can be easily implemented into codes
- Is there a way to simplify our lifes?

Problem of Verification

- We need to convince ourselfs and others that our predictions are reliable
- Benchmarking code to code can ensure correct implementation of models
- Difficult to ensure correctness of the model
  - Communication may help to identify missing bits
  - Experiments may allow to validate models and their completeness

CLIC

- Main additional problems are
  - Tighter tolerances in many cases due to higher energy, smaller emittances and higher wakefields
  - Difficulty to measure luminosity
  - Drive beam phase jitter
  - No intra-pulse feedback
    - Exception may be possible for the IP

Satisfying Europe

- The EU mainly wants that we satisfy the ILC and CLIC community
- But have to respect a few boundary conditions
  - Person power of the workpackages
  - The area of our contribution

Main Contributions Forseen

- Code development
- Main linac
  - Alignment
  - Tuning
- BDS
  - Feedback design and strategy
  - Alignment strategy
- Collision optimisation
- Integration of main linac, BDS and collision

What is Missing?

- We could make more contributions to the lattice design
- We do not cover the bunch compressor
  - Will be needed for integrated simulations
  - Maybe Andrea can do something
- We do not cover the CLIC drive beam
  - Not really technology independent
- Not too bad

Goal 1. Recruitment

- 1. May 2005: Fellow recruited at CERN (Andrea Latina)
- 1. September: Fellow recruited at CERN (Maxim Korrestelev)

Goal 2: Web Page

- 1. July 2005: www site available.

Goal 3: Code Development

- Develop a code package to simulate beam transport from the exit of the Damping Ring through to the Interaction Point and the extraction line, including component misalignments, ground motion and vibration sources.
- 1. June 2005: Benchmarking of the beam core tracking in different codes, namely SAD, MAD and PLACET.

Goal 3, Cont.

- 2. December 2005: First version code release and documentation.
- 1. June 2006: Implementation of the most relevant beam-based alignment, feedback and tuning strategies. Second code release.
- 2. December 2006: Code-to-code comparisons for the most relevant strategic steps. This will be performed in an international framwork.

Goal 4: Beam-based Main Linac Alignment Strategy

- Develop a beam-based main linac alignment strategy
- 1. May 2005: Study of the performance of dispersion free steering in the CLIC main linac.
- 2. December 2005: Perform the simulations for the ILC to benchmark against studies performed in the US and Japan.

Goal 5. Develop Main Linac Tuning Strategy

- May 2005: Developed a first strategy of main linac emittance and luminosity tuning bumps and applied it to CLIC.
- June 2006: Study the performance of linac tuning in presence of dynamic imperfections.
- June 2006: Develop strategy to mitigate the effect of RF jitter phase jitter induced by the drive beam.

Goal 6: BDS Feedback

- Design of ILC BDS beam-based feedback system(s) including component specifications and locations.
- 1. August 2005: Baseline design.
- 2. June 2006: Preliminary engineered design in preparation for ILC CDR.

Goal 7: BDS Beam-Based Alignment Strategy

- Develop BDS beam-based alignment strategy.
- 1. December 2005: First version of strategy.
- July 2006: Improved strategy in preparation for ILC CDR.

Goal 8: BDS Feedback Strategy

- Develop BDS beam-based feedback and tuning strategy.
- 1. August 2005: First version of strategy.
- 2. June 2006: Improved strategy in preparation for ILC CDR.

Goal 9: Integrate BDS Feedback and Tuning

- Incorporate BDS feedback and tuning strategy into global low-emittance transport luminosity optimization strategy.
- 1. December 2006: Baseline strategy as part of ILC CDR.

Goal 10: Optimisation Strategy for the Collision

- Develop an optimisation strategy for the collision parameters.
- June 2006: Develop an IP tuning strategy to optimise the collision parameters for ILC and CLIC machine.

Conclusion

- We seem to be resonably well positioned to do the work for the ILC and CLIC
- We already now see some deviations from the plan
- We seem to be a bit weak in bunch compressor and lattice design
- We should try to see how we can improve the efficiency when moving toward the integrated simulations