Beam Dynamics WG

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Presentations

- N. Solyak Coupler kick simulations update
- N. Solyak CLIC BPM
- A. Latina: Update on the Single-Stage Bunch Compressor Option for the ILC
- D. Wang: Update simulation results (BC + ML)
- D .Schulte: Transverse dynamic effects in CLIC
- A. Latina: Considerations on ILC Main Linac Alignment
- D .Schulte: Running the 3TeV CLIC at lower energies
- A. Latina: Design of the CLIC Spin Rotator
- D .Schulte: Drive beam phase and amplitude stabilization in CLIC
- N.Solyak, RTML status, L-band BPM and split quad
- K. Kubo ML simulation review (tolerances)

Status Review

- Static tuning studies
  - RTML
    - work is ongoing (Andrea, N. S., D. Wang)
    - emittance growth over budget (about factor 2)
    - no significant difference between single and double stage compressor
      - but only do 220um bunches with one stage
    - need to review emittance budget
  - Main linac
    - confirmation of previous results
    - emittance growth is within budget
      - may be we can tighten budget if we use more tuning bumps
      - but need to confirm hardware parameter specifications
    - No realistic model for long-range alignment
      - CLIC model is based on different hardware
    - Should review results on use of BC for main linac beam-based alignment
  - Undulator
    - has been studied separately, simplified studies look OK
  - BDS
    - full two-beam studies are not yet conclusive
    - current efforts focus on ATF2
    - Emittance budget seems OK
    - SB2009 simulations including traveling focus required.
    - Desirable to make effort to improve convergence speed of tuning

Status Review (cont.)

- Dynamic effects studies
  - integrated simulations are important since dynamic imperfections and mitigation techniques are coupled through the beam in the machine
    - e.g. bunch-to-bunch jitter amplified in IP feedback
  - Full simulations involving dynamic effects still to be completed, but some work done on various pieces of the lattice in isolation
  - Complete 3 region lattice required for integrated simulations
  - SB2009 needs to be studied

Status Review (cont)

- SB2009 performance implications
  - RTML has been shown to remain unchanged
  - Main linac should remain unchanged
  - Undulator at new position needs to be studied
  - BDS likely to be harder to tune, in particular with travelling focus
    - larger chromaticity leads to worse performance (ATF2 and CLIC simulation results)
    - need to understand travelling focus implications on tuning
  - Dynamic imperfections will have larger impact in SB2009
    - needs study

Short Term Work Plan

- Severe limitation in resources
- difficult to keep knowledge base with people leaving the study without replacement
- Need to provide coherent description of status of the work with specifications for hardware parameters
  - ***Make a table of present assumptions on hardware performance and related simulation results: in April***
  - ***Provide a report summarising present status of simulation studies: by ILC-CLIC WS, Oct.***
- Design SB2009 lattice of central area (from DR to return line)
  - requires input from damping ring group, sources group and CFS
- Need to assemble an SB2009 lattice
  - not clear who will do this
- SB2009 BDS tuning needs to be studied
  - if lattice is available by June can start for first results Oct. 2010
- ATF2 tuning studies are very important
  - ongoing as ATF2 progresses
- BDS tuning needs many iterations and might have potential for further improvement
  - will start small task force ATF2-CLIC-ILC
- SB2009 main linac alignment including full bunch compressor
  - for Oct. 2010

Slim Starting List of Further Tasks

- RTML
  - **Stray field measurements**
  - Check tolerance of RF stability in RDR
- ML
  - Long range alignment model
  - Repeat simulations for SB2009 (initial energy 5 GeV)
  - Study for lower energy operation
- BDS
  - Check assumptions in simulations.
    - Magnet strength fixed accuracy tolerance is tight.
  - Verify the results using other codes.
  - Continue two beam simulations
- Inter-area
  - ***Study of orbit feed-forward and feedback***
  - Study crab cavity for correcting z-y correlation in a bunch
  - Simulations with hardware failures

Example: “Standard” RF dynamic errors

from RDR

	Amplitude	Phase
BC Correlated	0.5%	0.24 deg.
Uncorrelated	1.6%	0.48 deg.
ML Correlated	0.07%	0.35 deg
Uncorrelated	1.05%*	5.6 deg
Crab e+e- Relative		0.015 deg

Correlated :same for all klystrons

Uncorrelated : klystron to klystron independent, random

What determines the tolerance?

BC: Timing at IP

ML: Energy jitter at the end.

Vertical orbit change: If fixed cavity tilt is 300 urad,

Crab: Horizontal offset at IP

Effect with 300 urad cavity tilt

BC: ?

ML: *1.2% amplitude variation in each cavity will cause 1-sigma orbit change.

Conclusion

- Do not ask what the beam dynamics working group can do for you, ask what you can do for the beam dynamics working group.