Draft Beam Physics Worklist

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Drive Beam

- Many system need to taken care of

- Make your choice
- Fast amplifier for phase feedback
  - some resemblance with IP intra-pulse feedback amplifier

Deliverables of Beam Physics

- Performance specifications of machine components
- Studies evidencing that these specifications achieve the target performance
- This requires
  - machine design
  - dvelopement of beam-based tuning and alignment methods
  - conceptual beam-based feedback design
  - code development
  - ...
- Types of specifications
  - some can be easility specified, e.g. BPM resolution
  - but still they can depend on complex studies
  - some are not easily specified, e.g. long-distance pre-alignment
- Will first introduce activities on low emittance preservation

Ring To Main Linac (RTML)

- Static imperfections are more severe in ILC than anticipated
  - need to check for CLIC
- Dynamic imperfections can be important
  - e.g. time-varying stray fields
  - measurement campain needed
- Is important for integrated dynamic studies
  - e.g. bunch compressor timing jitter
- Many important systems, would like help on
  - design of spin rotator
  - design of vertical transfer
  - evaluation of collimation system
  - design of diagnostics systems (e.g. bunch length measurement, emittance measurement,...)
  - review of turn around loop
  - design of intermediate dump lines and spectrometer
  - performance evaluation and beam.beased alignment and tuning

Main Linac (ML)

- Lattice design exists
- Alignment tolerances
  - different methods exist
  - specifications exist
  - completion of calculations, in particular long-distance misalignments
  - verification of results by independent study
  - agreed to send around specific machines
- Vacuum level
  - difficult to achieve better than 10ntorr in ML
  - potentially severe problem with fast beam-ion instability
  - work on confirming that 10ntorr is OK
  - developed a simulation code
  - is a confirmation possible

Beam Delivery System (BDS)

- Solenoid field configuration
  - critical because of strong interaction with experiments
  - prove that beam qualitiy is preserved
  - requires choice of compensation scheme
  - collaboration appears possible
- Adjustment for energy scan
  - several percent required experiments
  - need solution for permanent magnet
  - need to check proposed solution
  - will be addressed at CERN
  - result expected soon
- Performance of collimation system needs evaluation
  - efficiency and required efficiency
  - will be addressed mainly by Javier (anybody else?)

Beam Delivery System (cont.)

- Beam-based alignment and tuning of BDS is difficult
  - important for static tolerances
  - also important impact on some dynamic tolerances
  - have some method but not yet satisfying performance

    80% of the cases yield 80% of the luminosity, while we want 90% to yield 90%

    method is slow ($O(10^4)$ iterations), potentially some minute per iteration
  - try to improve method
  - will test method in ATF2 (maybe end 2010)
- Feedback layout is required
  - controller difficult, e.g. target dispersion
  - conceptual feedback layout this year

Beam Delivery System (cont.)

- General review
- System optimisation
- Crab cavity phase stability
  - work in the UK
- Collimator design
  - material and mechanics
  - wakefields
  - impact on beam
- Luminosity tuning
- Laser wires
- IP intra-train feedback

Post Collision Line

- Conceptual layout exists
  - improvements are useful
  - polarisation measurement
  - measurement of beamstrahlung, coherent pairs, spent beam
- Loss studies for machine protection
- Background studies for the detector
- Instrumentation for luminosity tuning

Dynamic Imperfections and Feedback Studies

- Most critical remaining area
- Integrated view essential
  - e.g. RF phase stability
- Many imperfections
  - ground motion, vibrations, RF phase and amplitude jitter in drive beam, beam charge jitter in damping ring, stray fields
  - need realistic model
- RF phase and amplitude stability
  - very tight tolerance on both
  - dominated by phase and amplitude stability of drive beam
  - need good imperfection models, e.g. klystron stability
  - develop reference drive beam phase and amplitude feedback concept
  - study performance and determine tolerances
  - resources are tight

Dynamic Imperfections and Feedback Studies (cont.)

- Orbit feedback
  - relatively tight tolerances, requiring mechanical stabilisation
  - modelling of vibrations, amplification by supports/beam line elements, of mechanical feedback
  - stray fields
  - estimation of slower variations
  - integrated imperfections model, soon after data is received
  - design of conceptual feedback
  - study of feedback performance
  - feedback optimisation

- Feedback work needs to be performed in a very close loop of hardware and beam physics

Codes

- Benchmarking of codes
- Common theoretical understanding
- Fast collimator wakefields