# Summary of First ILC-LET Workshop

PT for K. Kubo, D. Schulte, PT

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# A few general comments

- This was perhaps an optimal workshop size
  - About 30 participants
  - 17 prepared talks
  - 1 teleconference session
- Lots of time for discussion
- Lots of time for informal, “one on one” work
- Able to assign “homework” and collect it within the time frame of the workshop

# Lattice Design

- No prepared talks, just discussion
- Status:
  - BDS:
    - in pretty good shape though not final
    - Handled “in-house” by BDS Area System
  - Main Linac:
    - No lattice which represents qualitative features of baseline
      - 15 GeV initial energy
      - 4 CM / quad
      - Curved to follow gravitational equipotential
    - No lattice for e+ production undulator in e- linac
  - RTML:
    - Lattice which represents qualitative features of BC
    - New lattice of turnaround and spin rotator
      - May become baseline after some review
    - No lattice of collimation, DR Stretch, skew correction, linac launch

# Lattice Design (2)

- Action items agreed upon:
  - Generate a qualitatively-correct linac lattice
    - So that simulation studies can begin, codes can be tweaked to handle curvature, etc.
    - Done, lattice will be web-posted next week
  - Release BC lattices in their present state
    - Get started on BC tuning and combined BC + linac studies
    - Done √
      - http://www-project.slac.stanford.edu/ilc/acceldev/LET/BC/G3BCDecks
  - Release baseline lattices as they become available
    - Presumably these will hang off of the ILC BCD website
    - BCD website will become *de facto* lattice repository for LET
    - Plan is for all baseline lattices to be complete by mid-April

# Lattice Design (3)

- Who will do the lattice designs for the baseline?
  - BDS and DR groups will do designs “in house”
  - RTML work will probably be done at SLAC and LBL
    - Essentially “in house” for RTML group
  - As for main linac, sources, and undulator:
    - ILC Accelerator Physics group will help out if asked by area leaders…
      - Very large overlap between ILC AP TS and LET group!
    - …but nobody will be offended if area leaders decide to take care of this on their own without involvement of AP TS
      - PT to discuss with linac, e+, e- leaders at FNAL next week

# Main Linac Emittance Preservation

- An area of intense interest for many years, but still not an exhausted field
- Several methods of steering for emittance preservation studied
  - DFS (quite a lot of work on this)
  - KM
  - BA
  - QS121 (quad shunting + 1:1 steering)
- Sometimes surprising variation in results when 2 or more people study the “same” method

# Main Linac (2)

- Several studies of impact of the curved tunnel presented
  - So far nobody foresees serious problems
  - Still a lot of work to do here
- Still not as much inclusion of dynamic effects in the static tuning as we would like
- Updated presentation on the impact of LRWFs with frequency-splitting and mode rotation
  - Couples x jitter into y deflections
  - Can be addressed by splitting the tune of the lattice
    - Baseline is 75/60 lattice for this reason
- Reviewed ML AS list of questions
  - Answered as many as we could

# Main Linac (3) – Action Items

- Top priorities:
  - migration to more up-to-date lattice
  - convergence of the various different implementations of tuning methods
    - Important to have as many methods as possible qualified by multiple people
    - First emphasis on DFS because of large number of people who have tried it
  - Begin to incorporate BC
    - Non-Gaussian distribution in z may have an impact
    - May permit innovations in ML tuning
      - Use BC RF to vary energy at ML launch
      - Use BC dispersion knobs to tune ML dispersion!
    - Work on this started (still in an early stage)

# Beam Delivery System

- Very detailed simulation of static tuning
  - Magnet alignment and knob tuning at IP
  - Achieving 80% of expected geometric luminosity seems “straightforward”
  - Reclaiming the last 20% seems somewhat arduous
    - Need a better technique or diagnostics?
    - Required tuning steps subtle?
      - Example – correcting the x’y’ coupling at the IP (“unrolling” spot on divergence wire scanner) seems to make it possible to raise luminosity
- Quite a variety of signals available for final tuning
  - Beam-beam deflections, pairs, beamstrahlung…
  - All have their benefits and drawbacks

# Beam Delivery System (2) – Action Items

- More seeds!
  - Minor problem with batch cluster to resolve
- Need other LET'ers to verify the results
- Continue development of simulation
  - Dynamic effects and feedback
  - Include other beam and actual beam-beam based tuning signals
  - More optimal method of setting up the initial orbit

# Ring to Main Linac

- Rather complicated system with a lot of subsections that do wildly different things
  - Bunch compression, collimation, spin rotation, coupling correction…
- Top priority is completing baseline design
  - Should be done by early April
    - To be reviewed at the DESY meeting
- Next priority:  static tuning studies of subsystems and/or complete system
  - First example shown this week – correction of cavity pitch aberration
    - Frightening, but it turns out there were a couple of bugs, it's really not as bad as I said it was on Thursday!

# Polarization

- Spin rotator design for RTML complete
  - Allows polarization to be set to any desired orientation at IP
  - Emittance growth small for DR level energy spreads (1.5e-3), grows as square of energy spread
    - Ie, do not attempt to spin-rotate compressed bunch with large energy spread!
- Quite a few tools for spin tracking now
  - Two tuning codes (BMAD, Merlin) now have spin tracking
    - Study spin behavior in tuned systems and over time as beamline changes and corrections change

# Instrumentation

- Extensive presentation on standard ILC instrumentation
  - BPMs, laser profile monitors, bunch length monitors
  - Including cost drivers (where known), which will help lattice designers make optimized choices
  - Other system constraints (ie, how to get the photons or electrons from laser wire)
- Top priority:  inventory instruments used in tuning simulations and document the performance assumptions that went into them

# Preparation for RDR

- Extensive discussion on what we want to achieve
- Top priority:  sufficiently complete static tuning studies to credibly support luminosity promises
  - Or refute them!
  - Understand costs – “We can make 2e34, but the tolerances on the alignment must be tightened by X%”
- Mapped out the tasks and (in general) who will do them
  - In some cases we only know the institution, in other cases an actual name
    - Dangerous!  Harder to hold a lab’s feet over the fire than a person’s!
  - Caution – we’ve had ample time in the past to do everything we now want to do in the future
    - LET work generally requires serious time commitment
    - Easy to get chewed up by hundreds of small, short-term crises

# How to Keep Work Going

- D. Schulte and K. Kubo will provide overall guidance of the effort
  - Appropriate – they are AP TS leaders, and have a long history in this area
- Set up to use the Snowmass ilc-accel-wg1 mailing list for ongoing LET communications
  - PT will take care of this next week, after Fermilab meeting
- Set up a website repository for results of algorithm cross-checking
  - Jeff Smith will take care of this
  - Evolve into overall LET repository website?
- Regular phone meetings on algorithm cross-checking under discussion
  - Set up some sort of regular discussion on more general LET work
    - Maybe occasional 3-region phone or video meetings and more regular single-region meetings