Short Summary of ILPS Progress in 2006

D. Schulte

- Only most important achievements are given

$\Rightarrow$ Will have to skip lots of important details

COLSIM

- Collimation system performance studies

RHUL

- Improvements of BDSIM
  - beta testing completed

  $\Rightarrow$ first release in February

  $\Rightarrow$ user guide published
- Benchmarking of BDSIM electromagnetic and hadronic processes against MARS15 and STRUCT
- BDSIM is widely used

  $\Rightarrow$ e.g. application to LHC
- 2 and 20 mradian crossing angle interaction regions implemented in BDSIM

  $\Rightarrow$ beam loss from pairs and radiative Bhabhas studied

Manchester

- Implementation of wakefields in MERLIN and related studies continued
- Energy deposition in collimator simulated with BDSIM and compared to EGS and FLUKA

CERN/IFIC

- CLIC non-linear collimation system performance has been studied
  - $\Rightarrow$ new optimised system has much better performance than previous version
  - $\Rightarrow$ close to linear system
  - $\Rightarrow$ trade-off efficiency and damage potential
  - $\Rightarrow$ comparison of wakefield effects in both systems
  - $\Rightarrow$ option for LHC

DESY

- Work shifted to 2007 due to RDR

FMSIM

- Indentification, study and possibly mitigation of key failure modes

DESY

- Simulations performed of losses due to
  - coherent RF phase errors along the linac
  - quadrupole failures

$\Rightarrow$ Single quadrupole failure acceptable

$\Rightarrow$ large RF phase error (50°) needed to have losses

$\Rightarrow$ loss density acceptable in cavities

CERN

- Simulation of losses due to RF phase error in ILC

  $\Rightarrow$ good agreement with DESY results

BCDES

PSI

- Design of a bunch compressor and a path length tuning chicane suitable for multi-TeV
  - severe problem is coherent synchrotron radiation
- Bunch compressor systematically optimised
  - CSRTrack simulation cross checked with ELEGANT

  $\Rightarrow$ achieves goal
- Tolerance study yielded first, good results
- After the turn around, the CLIC drive beam needs to be compressed in length and adjusted in phase (by feed forward)
- System consists of compressor chicane, turn-around, compressor chicane
  - the first is also used to measure phase errors the second to correct it
- Decided to include the turn-around loop since it is integral part of the whole system
- New turn-around loop has been designed

  $\Rightarrow$ emittance growth close to specification

  $\Rightarrow$ further improvement studied
- The compression chicanes have been designed

PCDL

LAL

- Studies of the ILC post collision line
- Contribution to the development and validation of BDSIM
- Severe computational resources requirements

  $\Rightarrow$ installation on the grid

  $\Rightarrow$ many "small" technical problems needed to be solved
- Photon backscattering due to local losses in post collision line has been investigated

  $\Rightarrow$ background rates in detector seem OK

  $\Rightarrow$ comparison to other SLAC simulations showed good agreement

PCDL (Cont.)

Uppsala

- Development of a post collision line suitable for multi-TeV collisions
  - very tough because of coherent pairs and large energy loss
- Last year has been focused on benchmarking the tools
- Test if 20mradian ILC extraction line is suitable for CLIC

  $\Rightarrow$ no
- Test if line can be adopted

  $\Rightarrow$ not really, loose all benefits
- A new design has been developed

  $\Rightarrow$ vertical bends to separate beam particles, coherent pairs, beam strahlung

  $\Rightarrow$ should allow to include instrumentation
- Further study of losses and instrumentation options is ongoing

HTGEN

CERN

- Goal is to provide estimates of halo and tails
- And a library that allows to include realistic distributions in other codes
- Implemented beam-gas scattering with Mott and Bremsstrahlung process

  $\Rightarrow$ integrated into PLACET and available for MERLIN
- Fast and precise synchrotron radiation generator

  $\Rightarrow$ implemented in GEANT4
- Secondary tracking in PLACET
  - tracking of secondary photons
  - loss detection
  - simple multiple scattering in collimator jaws
- Studied impact of multipoles and dark current in ILC
- close collaboration with COLSIM

BBSIM

LAL+some support from CERN

- Benchmarking and improving of GUINEA-PIG
- 2005 comparison of CAIN and GUINEA-PIG published in PRST-AB in 2006
- Translated (most of) GUINEA-PIG to C++

  $\Rightarrow$ should ease modifications

  $\Rightarrow$ plan to study potential of parallelisation
- Bhabha scattering implemented in new GUINEA-PIG and studied

  - vital for luminosity spectrum reconstruction and fast luminosty measurement

  - combined external generator and GUINEA-PIG

  - impact of deflection by beams studied

  - impact on the fast luminosity measurement studied

$\Rightarrow$ Need good knowledge of beam parameters to correctly measure luminosity

$\Rightarrow$ Need non-symmetric cuts

LAST

- Integrated simulations of luminosity performance

DESY

- Successful benchmarking with other tracking codes
- Package for dispersion free steering developed for MERLIN
  - allows different options to generate different energy beams
- Developed package to simulate dynamic effects in MERLIN
  - integration GUINEA-PIG and MERLIN
  - almost ready

  $\Rightarrow$ results in early 2007

- Improvement of PLACET
  - longitudinal motion, collimator wakefields, user interface (e.g. embedded OCTAVE), code structure, parallel code (to be continued in 2007)
- Package to study impact of dynamic imperfections during the application of dispersion free steering developed for PLACET

  $\Rightarrow$ first results are positive
- Provided program implementing A. Seryi's ground motion model
- Detailed and systematic studies of dispersion free steering in the ILC and CLIC main linac, also for a curved tunnel performed
- Benchmarking with other codes performend successfully
- Proposed and studied use bunch compressor RF phase to generate beams for DFS
- Design, optimisation study of realistic knobs for ILC and CLIC
- Together with CERN RF experts developed new basic CLIC parameter set
- Started integrated simulations of dynamic imperfection in ILC and CLIC
  - e.g. micado, localised feedback systems and one-to-one correction in main linac, quadrupole jitter and ground motion including ML, BDS and beam-beam

QMUL $\rightarrow$ Oxford

- Development of the alignment and tuning procedure for the ILC BDS

  $\Rightarrow$ world leading study

  $\Rightarrow$ came very close to achieving target (average at target for 90% level)

  - lost the RA to SLAC, where he achieved goal

- Development and study of BDS feedback

  $\Rightarrow$ angle feedback integrated into new lattice

  $\Rightarrow$ use of train straightener as end of linac intra-pulse feedback

  $\Rightarrow$ simulations of luminosity performance with static and dynamic effects and feedback

- Study of the background in the feedback BPM

Conclusion

- In spite of some problems progress has been very good
- While effort on development and benchmarking of tools had been maintained tools have been applied more
- Design of beam lines has progressed very well