

The physics chapters in the GDE documents
Summary of discussions at LCWS 06

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Introduction

- **Physics documents to be produced by the end of 2006:**
 - GDE ILC Reference Design Report (~ 30 pages for physics)
 - Detector Concepts Report (~ 70 pages for physics chapter)
- **Editors of the physics chapters (1 exp., 1 theo. / region):**
 - **America:** Mark Oreglia, Joe Lykken
 - **Asia:** Satoru Yamashita, Yasuhiro Okada
 - **Europe:** Klaus Mönig, Abdelhak Djouadi
- **There are also detector chapters:**
 - Eds: T. Behnke, J. Jaros, A. Miyamoto; C. Damerell (R&D).
 - Work more advanced? More interaction with "physics"?
- **Plans for discussions and work**
 - Launching the discussions in Bangalore.
 - Continue in next ILC meetings (Cambridge, Vancouver, ..).
 - Most discussions and exchanges should be via E-mail?

Suggestions for Physics: Theory

- For many items one can use available material.
- For a few points, one needs some updates:
 - Determination of quark masses, ...
 - Scalar Higgs potential with effects of New Physics
 - Chiral Lagrangian approach for the no Higgs scenario
 - Update/extend benchmark points (lines?) for SUSY
- For some points, one needs new studies:
 - Model independent study of Higgs production and decay
 - DM, CPV, Baryogenesis (with light \tilde{t}) in NMSSM
 - KK Dark Matter at ILC? Other points with extra dims?...
- Joint experimental/theory new effort is needed:
 - Strongly interacting Higgs sector with $\chi\mathcal{L}$
 - Effect of P_τ in rejecting bkg for low $\Delta\tilde{m}$ SUSY
 - Scenarios for complementarity between LHC and ILC

Experimental studies: Higgs

● Higgs Branching ratios in HZ production

- This is the topic which needs a “full” simulation example!
- Needs at least the tool for b–tagging (detector help!).
- Several groups have made studies: unifying forces?
- We need to cover as many final states as possible

● Higgs self-coupling

- What kind of simulation can we make for ZZH?
- How can go beyond the TESLA-TDR analysis?
- $WW \rightarrow HH$ in conjunction with ZHH to be discussed?

● Other Higgs properties measurements

- $t\bar{t}H$ to be updated/completed (add info from LHC?).
- $WW \rightarrow H$ for $H \rightarrow \mu^+ \mu^-, \gamma\gamma$ to be adapted from CLIC
- Update the determination of CP properties (via $\tau, t, ..$).
- Try to improve also mass determination.

Experimental studies: Higgs (continued)

- **Strongly interacting Higgs sector: a priority!!!!**
 - Summarise/update the scenario with resonances
 - See for new studies with the chiral \mathcal{L} approach
 - Explicit examples in BSM (Higgsless in extra dim. ...).
- **Beyond the SM Higgs**
 - $e^+e^- \rightarrow HA, H^+H^-$ to be updated?
 - Try $e^+e^- \rightarrow b\bar{b}H/A$ for $\tan\beta$ measurement?
 - MSSM in LHC difficult scenarios: $H \rightarrow \text{inv}, \text{ICR}, \dots$
 - NMSSM for though LHC scenarios ($h \rightarrow aa \rightarrow 4b$)?
- **Other collider options:**
 - $\gamma\gamma \rightarrow H$ (cplg, CP, ..) to be updated/summarized.
 - $\gamma\gamma \rightarrow H, A$ in MSSM to be updated (reach and CP).
 - $\gamma\gamma \rightarrow h, H, A + \tau^+\tau^-$ for $\tan\beta$?
- **Many of these items need a 1 TeV collider!!!**

Experimental studies: EW and QCD

- **Top and QCD**
 - $q\bar{q}$ prod.: statistical and systematic errors on σ and A_{FB} ?
 - Top weak couplings in $e^+e^- \rightarrow t\bar{t}$ (which energy is best)?
 - QCD in continuum $t\bar{t}$ production?
- **Gauge boson physics**
 - Update W mass and width measurements?
 - Update triple gauge boson couplings determination?
 - Link with parameters for strong Higgs sector?
 - Update measurement of $\sin^2 \theta_W$ at GigaZ?
 - Simulation for $WW - ZZ$ separation?
- **Any other items???**

Experimental Studies: BSM

- **SUSY processes: focus on difficult processes at LHC**
 - Low $\Delta\tilde{m}$ scenarios for $\tilde{\tau}$ production
 - Chargino/neutralino production for heavy scalars (including CPV, mass generate gauginos, ...)
 - Light stop production for interesting scenarii (low $\Delta\tilde{m}$..)
 - Higgs \leftrightarrow chargino/neutralino decays?
 - Update also \mathcal{L} parameter determination for SPS point?
 - Any interesting item for GMSB, non minimal MSSM, ???
- **Other BSM scenarios:**
 - Selected items from extra dimensions? Which ones?
 - Z' properties measurements?
 - Production of new matter particles?
- **Any other interesting topic to be discussed?**

Suggestions for logistics

- **Set up a web page for the study (very soon!):**
 - Summarize information for studies, meetings, schedule,...
 - Link to the regional LC mailing lists?
 - Display some preliminary results, etc...?
 - Equivalent of LC notes for complete information??
- **Scientific division of the work (or Fordism):**
 - Itemize the most important (new simulation) studies.
 - Identify the groups which are interested to do some work
 - Organise working groups, etc.. ??
- **Not reeventing the weel?**
 - Use previous studies at WS (TESLA TDR, Snowmass, etc..).
 - Include very recent ones (BR(H), HHH, DM,) and update.
 - Unification of analyses (EU/US for BR(H), EU/Asia for HHH, EU/US for SUSY DM,).