

The physics chapters in the GDE documents

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Presentation at LCWS 2006 Bangalore

Introduction

Documents to be produced by the end of 2006:

- GDE ILC Reference Design Report (incl. a short physics chapter)
- Detector Concepts Report (including a longer 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

Editors of the detector chapters:

Ties Behnke, John Jaros, Akiya Miyamoto, Chris Damerell

Timescale:

- **Bangalore:** Presentation and discussion of the outline
- **Vancouver (July):** Detailed discussion with the community
- **Further discussions in the other regions**
 - **Europe:** Some discussion may take place at the ILC software and physics meeting in Cambridge (April)
 - **America, Asia:** nothing planned yet?

Plan for Bangalore:

- Presentation of outline in plenary
- Discussion in the working groups
- Feedback from the WGs in a parallel session
- Short presentation of the results in the summary session

Proposed outline

● Introduction

- Physics landscape in 2015 (incl. pos. outcome from LHC)
- Important open questions in particle physics
- Possible running scenario for ILC (E , \mathcal{L} , P_{e^\pm} , options)
- Physics signals at the ILC

● The physics of electroweak symmetry breaking

- The Higgs sector
- Couplings of gauge bosons (GigaZ, TGCs)
- Top quark physics and QCD
- Physics beyond the Standard Model: Supersymmetry
- Some alternatives to SUSY

● Connections to cosmology

- Dark matter: neutralinos, KK states?
- Baryogenesis and CP violation, ??

A few remarks

- **The outline is strictly physics driven**
 - “Signals” like Z’ appear in different places (mainly in “Physics signals” of introduction and referred to later) .
 - Standard Model physics including Higgs physics will be described in detail. **Full or hybrid simulations?**
 - New Physics will be described in terms of a few examples (a few SUSY scenarios, etc..). **Which ones should we choose?**
- **The chapter has to justify 500 GeV Linear Collider**
- **The need for a 1 TeV upgrade has to be discussed.**
- **Connections to LHC, cosmology etc. have to be stressed**
- **What about simultaneous running with the LHC?**

Work to do

- **We need to prove that we can do the physics we claim**
- **For some difficult key channels this means full simulation:**
 - $\text{BR}(H \rightarrow c\bar{c})$
 - $\tilde{\tau}$ in low $\Delta\tilde{m}$ SUSY
 - $WW - ZZ$ separation
- **For other channels we can live with a hybrid solution?**
 - Trilinear Higgs couplings in ZHH production
 - (Double) Higgs production in WW fusion
 - Strongly interacting Higgs sector?
 - Top quark Yukawa coupling?
- **Some other items to be discussed:**
 - $q\bar{q}$ prod.: statistical and systematic errors on σ and A_{FB}
 - Top weak couplings (which energy is needed?),

Work to do (continued)

- **Requirements from theory (examples)**
 - **Higgs couplings:**
 - What is expected in a “model independent” analysis?
 - Which ones are possible if no NP is seen at LHC?
 - Which precision on the quark masses is possible in 2015?
 - special emphasis on self-couplings (model independent).
 - **Strongly interacting Higgs sector:** summarise all available information and update and/or improve it....
 - **New Physics:**
 - which SUSY scenarios to study (SPS1a, low $\Delta\tilde{m}$, scenarios with heavy scalars,)
 - which alternatives to discuss (Little Higgs, Technicolour, compositeness, extra dimensions, ...??)
 - focus on determination of Dark Matter relic abundance?
 - . . .

Plan

- **Please discuss these points in your // sessions**
- **Come with your feedback to the DCR // session on Sunday**
- **Attend the “concluding” session on Monday**
- **Keep working and discussing with us until the end of the year!**

Thank you for your input in advance!