

LCWS06 (Linear Collider Workshop 2006)

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Book of Abstracts

<p> This document and all information concerning the conference programme can be accessed online via the CHEP06 web site: <http://www.tifr.res.in/lcws06>. The information on the web will be updated in the event on any last minute changes in the programme. These will also be communicated directly at the conference. </p>

<p> This document contains all abstracts of the talks and posters to be presented at LCWS 2006. They are ordered by Abstract Number. Information on when, and in which session, the presentation is due to be made is also given here for completeness. The Conference Programme should be consulted to view the complete schedule of talks and cross reference to this document made using the Abstract Number.</p>

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Machine Detector Interface / 0**The 2mrad Crossing Angle Interaction Region and Extraction Line****Author:** Rob Appleby¹¹ *The Cockcroft Institute*

The complete optics design for the 2mrad crossing angle interaction region and extraction line was presented at Snowmass 2005. Since this time, the design task force has been working on developing and improving the layout. The work has focused on optimising the final doublet (including by using higher gradient magnet materials), on reducing the power losses resulting from the disrupted beam transport and on evaluating backgrounds. In this talk, the most recent status of the 2 mrad layout, three new final doublet layouts which use high gradient superconducting materials and the corresponding performance are presented.

Higgs and EWSB / 1**New corrections in the c/rMSSM to Higgs masses and mixings****Author:** Sven Heinemeyer¹**Co-authors:** Georg Weiglein ²; Heidi Rzehak ³; Wolfgang Hollik ⁴¹ *University of Zaragoza*² *IPPP Durham, UK*³ *PSI, Switzerland*⁴ *MPI Munich, Germany***Corresponding Author:** sven.heinemeyer@cern.ch

We present new corrections to Higgs boson masses and mixing angles in the MSSM with real and complex parameters. A numerical analysis of the impact of these new corrections is presented.

Higgs and EWSB / 2**FeynHiggs2.3: new features****Author:** Sven Heinemeyer¹**Co-authors:** Georg Weiglein ²; Thomas Hahn ³; Wolfgang Hollik ³¹ *University of Zaragoza*² *IPPP Durham, UK*³ *MPI Munich, Germany***Corresponding Author:** sven.heinemeyer@cern.ch

FeynHiggs is a program for computing MSSM Higgs-boson masses and related observables, such as mixing angles, branching ratios, couplings and production cross sections, including state-of-the-art higher-order contributions (also for the case of explicit

CP-violation). The centerpiece is a Fortran library for use with Fortran and C/C++. Alternatively, FeynHiggs has a command-line, Mathematica, and Web interface. We present the new version FeynHiggs2.3.

New Physics at TeV Scale and Precision Electroweak / 3

Precise Predictions for M_W in the MSSM with complex Parameters

Author: Sven Heinemeyer¹

Co-authors: Arne Weber²; Dominik Stockinger³; Georg Weiglein⁴; Wolfgang Hollik²

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We present the currently most complete calculation of the W boson mass in the MSSM. We include a full one-loop calculation, for the time also for complex parameters, the full available SM result as well as all available MSSM two-loop corrections. In a numerical analysis we show the effect of the complex phases and the results for M_W in various MSSM scenarios.

Higgs and EWSB / 4

Charged and neutral Higgs boson decays and $\tan(\beta)$ measurement at CLIC

Author: Arnaud Ferrari¹

Co-author: Elias Coniavitis¹

¹ *University of Uppsala*

The Minimal Supersymmetric Extension of the Standard Model (MSSM) predicts the existence of new charged and neutral Higgs bosons. The pair creation of these new particles at the multi-TeV e^+e^- Compact Linear Collider (CLIC), followed by decay cascades into Standard Model particles, were simulated along with the corresponding background. Beam-beam effects such as ISR, beamstrahlung and hadronic background were included. We have investigated the possibility of using the ratio between the number of events found in various decay channels to determine the MSSM parameter $\tan(\beta)$ and we have derived the corresponding statistical error from the uncertainties on the measured cross-sections and Higgs boson masses.

Machine Detector Interface / 5

Power losses in the ILC/CLIC 20 mrad extraction line at 1 TeV

Author: Arnaud Ferrari¹

Co-author: Yuri Nosochkov ²

¹ *University of Uppsala*

² *SLAC*

We have performed a detailed study of the power losses along the post-collision extraction line of a TeV e^+e^- collider with a crossing angle of 20° at the interaction point. Five cases were considered: four luminosity configurations for ILC and one for CLIC. For all of them, the strong beam-beam effects at the interaction point lead to an emittance growth for the outgoing beams, as well as to the production of beamstrahlung photons and e^+e^- coherent pairs. The power losses along the extraction line, which are due to energy deposition by a fraction of the disrupted beam, of the beamstrahlung photons and of the coherent pairs, were estimated in the case of ideal collisions, as well as with a vertical position or angular offset at the interaction point.

Calorimetry and Muons / 6

Muon identification and pion rejection in the 4th Concept

Author: John Hauptman¹

¹ *Iowa State University*

We describe a completely new way to reconstruct and identify muons with high efficiency and very high pion rejection in the 4th Concept detector. The air-volume dual-solenoid magnetic field allows the reconstruction and precision momentum measurement down to a few GeV (just the energy loss in the 10-interaction-length calorimeter and the coil) and the dual-readout calorimeter provides a new, unique and powerful separation of muons from pions. We use test beam data for the calorimeter and calculations for the magnetic fields.

Summary:

New methods for muon reconstruction and identification in a colliding beam experiment are described.

Higgs/Gamma-Gamma / 7

Associated Single Photons as Signals for a Doubly Charged Scalar at Linear e^+e^- Colliders

Author: SANTOSH RAI¹

Co-author: BISWARUP MUKHOPADHYAYA ¹

¹ *Harish-Chandra Research Institute*

Doubly charged scalars, predicted in many models having exotic Higgs representations, can in general have lepton-number violating (LFV) couplings. The basis of most searches for this charged scalar has been to look for its direct production and its subsequent decay to like-sign final state leptons. In this work we show that by using an associated monoenergetic final state photon seen at a future linear e^+e^- collider, we can have a clear and distinct signature for a doubly-charged resonance and also

determine its mass rather precisely. We also estimate the strength of the Delta L=2 coupling which can be probed in this way at $\sqrt{s}=1$ TeV, as a function of the recoil mass of the doubly-charged scalar.

8

Muon iron-free magnetic field of the 4th Concept

Author: John Hauptman¹

¹ *Iowa State University*

We describe the design of the co-axial dual-solenoids of the 4th concept and the rationale for a superior (better than LEP) muon system. We show the ANSYS analysis, muon resolutions, and expected physics performance. The dual-solenoids do not cover the forward angular regions, so we explore the possibility of a wall of coils to contain the magnetic field to a compact cylindrical volume and at the same time provide a radial field for the momentum measurement bending of forward muons.

Summary:

The configuration of dual co-axial solenoids coupled with a wall of circular coils at the ends of the outer solenoid provides nearly full coverage for muon momentum measurements.

Higgs and EWSB / 9

Looking for Split Supersymmetry in Higgs signals

Author: Sudhir Gupta¹

Co-authors: Biswarup Mukhopadhyaya¹; Santosh Rai¹

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We examine the possibility of detecting signals of split supersymmetry in the loop-induced decay $h \rightarrow \gamma \gamma$ of the Higgs boson at the Large Hadron Collider, where charginos, as surviving light fermions of the supersymmetric spectrum, can contribute in the loop. We perform a detailed study of uncertainties in various parameters involved in the analysis, and thus the net uncertainty in the standard model prediction of the rate. After a thorough scan of the parameter space, taking all constraints into account, we conclude that it is very unlikely that signals for Split Supersymmetry can be detected in Higgs signals at the LHC and one would require a linear collider to be able to make a distinction.

New Physics at TeV Scale and Precision Electroweak / 10

Signals of Universal Extra Dimensions at the ILC

Author: Biplob Bhattacharjee¹

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The Universal Extra Dimension models are supposed to mimic SUSY at colliders. They are also of interest as a source of cold dark matter. I discuss how ILC can discriminate between UED and SUSY from lepton pair production. I will also discuss how, in UED, single production of $n=2$ electroweak gauge bosons as s-channel resonances (much in the same vein as LEP) may lead to a precision study of these models.

Gamma-gamma, e-gamma and e-e- Physics and Technology / 11

Polarized positron source for ILC.

Author: Vitaly yakimenko¹

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We propose the scheme of a polarized positron source for the International Linear Collider (ILC). The process is based on a well-known principle of electron-positron pair creation from polarized gamma rays produced by Compton scattering of the circularly polarized laser light off a high-energy electron beam (e-beam). Our system employs multiple interactions of a 6GeV e-beam produced by a linac with CO₂ laser beams circulating inside the cavity of a regenerative laser amplifier. Ten laser/e-beam interaction points are sufficient to generate the required intensity of the polarized positrons of the order of 10¹⁴/sec. Each component in the proposed system relies on technologies that were demonstrated previously. The presentation will cover proposed laser system as well as electron beam accelerator.

Plenary / 12

GDE/ILC Overview

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The development and accomplishments of the GDE will be reviewed. In particular, the baseline configuration will be discussed, as well as efforts getting underway to develop a reference design and cost.

Plenary / 13

Physics Overview

Author: Yasuhiro Okada¹

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Physics motivations to construct ILC have been strengthened by recent world-wide efforts. I will overview physics goals of ILC and its roles in our understanding of particle physics and cosmology in the new era of high energy physics starting with LHC operation.

Plenary / 14

Experimental Overview

Author: Klaus Desch¹¹ *Physikalisches Institut***Higgs and EWSB / 15**

Higgs self coupling measurement in e+e- collisions at Linear Collider

Author: Pascal Gay¹**Co-author:** Philippe Gris ¹¹ *LPC UBP IN2P3***Corresponding Author:** pascal.gay@clermont.in2p3.fr

Feasibility of the measurement of the trilinear self-coupling of the Higgs boson is studied. Double higgs strahlung as well as WW fusion processes are under investigation.

Calorimetry and Muons / 16

Silicon Detector Technology Development in India for the Participation in International Experiments

Author: Anita Topkar¹**Co-authors:** Bharti Aggarwal ¹; M D Ghodgaonkar ¹; Praveenkumar Suggesetti ¹; S K Kataria ¹¹ *Bhabha Atomic Research Centre (BARC)*

Abstract

A specific research and development program has been carried out in India to develop the technology for 32-strip silicon detectors for application as a preshower detector for CMS experiment at LHC, CERN. The detectors have a geometry of 63mm x 63mm and these detectors incorporate 32 P+strips with width of 1.78 mm with a pitch of 1.9 mm. The fabrication technology to produce silicon detectors with very good uniformity over a large area of ~40cm², low leakage currents of the order of 10nA/cm² per strip and high breakdown voltage of > 500V has been developed in India using a 4" silicon foundry. The 32-strip silicon detectors have

been fabricated using standard silicon technology. The production of detectors is already underway to deliver 1000 detector modules and 90% production is completed. A strict quality control procedure is being used for qualification of detectors during the production. The performance of the silicon strip detectors produced for the CMS preshower is presented. The present status of the detector technology is discussed in view of exploring the feasibility for participation in building the detectors for the future linear collider.

Tracking and Vertexing / 17

Investigation in the Properties of Charge Traps Created in CCD by Neutron and Electron Irradiation

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In our earlier investigations of radiation damage effects in a CCD based detector we observed that some parameters of the radiation damage related processes were very different from the common perception. For example, trapping time of electrons by trapping centers created by irradiation was few orders of magnitude larger than it was believed it should be. Last year we did additional experiments in attempt to understand this. Results of such experiments are puzzling, though we could rule out some of hypothesis about cause of slow trapping. However, they yielded observation of another phenomenon, which though was predicted by the theory of radiation damage, but was not anticipated to show up so clearly at the level of exposure we had. We observed, that irradiation with electrons leads to slow dissolving of charge trap clusters created by neutron irradiation. While charge trap clusters created by neutron irradiation did not change in more than 4 years since they were created in 1999, (looking in 2003 measurements), they changed dramatically (number of traps reduced by almost 90%) in 2 years following high energy (60 MeV) electrons irradiation in 2003.

Higgs and EWSB / 19

Partially Composite two-Higgs doublet model

Authors: Byungchul Chung¹; Dong-Won Jung²; Kang Young Lee¹; Pyungwon Ko³

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We consider a possibility that electroweak symmetry breaking (EWSB) is triggered by both a fundamental Higgs and a composite Higgs arising in a dynamical symmetry breaking mechanism induced by a new strong dynamics. The resulting Higgs sector is a partially composite two-Higgs doublet model with specific boundary conditions on the coupling and mass parameters originating at a compositeness scale Λ . The phenomenology of this model is discussed including the collider phenomenology at LHC and ILC.

Loop Calculations/SUSY Particles / 20**Phenomenological Indications of the Scale of SUSY and Implications for the ILC****Author:** Sven Heinemeyer¹**Co-authors:** Georg Weiglein²; John Ellis³; Keith Olive⁴¹ *University of Zaragoza*² *IPPP Durham*³ *CERN*⁴ *University of Minnesota***Corresponding Author:** sven.heinemeyer@cern.ch

Electroweak precision measurements can provide indirect information about the possible scale of supersymmetry already at the present level of accuracy. We perform a χ^2 fit in various SUSY scenarios including the W boson mass, the effective leptonic weak mixing angle, the anomalous magnetic moment of the muon, the decay $b \rightarrow s \gamma$ and the lightest MSSM Higgs boson mass, taking also into account the Cold Dark Matter density. The investigated scenarios comprise the CMSSM, the VCMSSM (where A_0/m_0 is fixed), Gravitino dark matter scenarios and the NUHM (where M_A and μ are additional free parameters as compared to the CMSSM). In all the scenarios we map out the parameter regions preferred by the fit. The corresponding good prospects for the ILC are analyzed and discussed.

New Physics at TeV Scale and Precision Electroweak / 21**Event shape discrimination of supersymmetry from large extra dimensions at a linear collider****Author:** Probir Roy¹**Co-author:** Partha Konar²¹ *tata Institute of Fundamental Research*² *Universitaet Karlsruhe***Corresponding Author:** probir@theory.tifr.res.in

The production of a charged lepton ($\ell = e, \mu$) pair with a large missing energy at a linear collider is discussed as a means of distinguishing the minimal supersymmetry (MSSM) scenario from that with large extra dimensions (ADD) for parameter ranges where the total cross-sections are comparable for both. Analyses in terms of event shape variables, specifically sphericity and thrust, are shown to enable a clear discrimination in this regard.

Machine Detector Interface / 22**The stabilisation of final focus (StaFF) system****Author:** Paul Coe¹**Co-authors:** Armin Reichold¹; David Urner¹

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The StaFF (Stabilisation of Final Focus) system will use interferometers to monitor the relative positions of several key components in the beam-delivery and interaction region. The most demanding application will be the relative position monitoring of the ILCs final focus quadrupole magnets; whose mutual and beam-relative stability, will have a direct impact on detector luminosity.

Established, laser based Frequency Scanning Interferometry (FSI) and fixed-wavelength interferometry offer positional resolution at the length scales of the laser wavelength (roughly 1500 nm) and below the wavelength, respectively. As part of the ATF at KEK, the StaFF group are currently testing ideas for this system. Interferometer designs undergo trials in Oxford and tests of a network setup are being prepared for installation at the ATF at KEK to resolve the relevant performance issues.

The main issues relating to deployment of interferometers for this role at the ILC will be discussed, together with current work on interferometer design and tests to date.

Summary:

Interferometers designed to monitor the relative stability of the final focus quadrupoles are being tested at Oxford and the KEK ATF.

Gamma-gamma, e-gamma and e-e- Physics and Technology / 23

Fermion Polarization as a probe of Higgs interactions at a Photon Collider

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We discuss how the CP quantum numbers of a neutral Higgs boson may be probed using fermion polarization at a photon collider. To this aim we construct polarization asymmetries which can isolate the contribution of a Higgs boson ϕ in $\gamma\gamma \rightarrow f\bar{f}$, $f = \tau/t$, from that due to the QED continuum. This can help in getting information on the $\gamma\gamma\phi$ coupling in case ϕ is a CP eigenstate. We also construct CP-violating asymmetries which can probe CP mixing in case ϕ has indeterminate CP. Further, we take the MSSM with CP violation as an example to demonstrate the potential of these asymmetries in a numerical analysis. We find that these asymmetries are sensitive to the presence of a Higgs boson as well as its CP properties over a wide range of MSSM parameters.

Higgs and EWSB / 24

Signatures of anomalous VVH interactions at a linear collider

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We examine, in a model independent way, the sensitivity of a Linear Collider to the couplings of a light Higgs boson to gauge bosons. Including the possibility of CP violation, we construct several observables that probe the different anomalous couplings possible. For an intermediate mass Higgs, a collider operating at a center of mass energy of 500 GeV and with an integrated luminosity of 500 1/fb is shown to be able to constrain the ZZH vertex at the few per cent level, and with even higher sensitivity in certain directions. However, the lack of sufficient number of observables as well as contamination from the ZZH vertex limits the precision with which the WWH coupling can be measured.

Higgs/Top and QCD/Gamma-Gamma / 25

Lepton distribution as a probe of new physics in production and decay of t -quark and its polarization

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We investigate the possibilities of studying possible new physics in various processes of t -quark production using the kinematical distributions of the secondary lepton coming from decay of t -quarks. We show that the angular distributions of secondary lepton are insensitive to the anomalous tbW vertex and hence is a pure probe of new physics in a generic process of t -quark production. The energy distribution of these leptons is distinctly affected by anomalous tbW couplings and can be used to analyze them independent of the production process of t -quarks. The effects of t -polarization on the distributions of decay leptons are demonstrated for top-pair production process at a gamma-gamma-collider mediated by a heavy Higgs boson.

Tracking and Vertexing / 26

SiD Vertex Detector Mechanical Design

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The present mechanical design of the vertex detector for SiD will be described. The design includes a 12.5 cm long central barrel with silicon pixels. Four disks with silicon pixels and three additional disks, which could be based upon silicon pixels or micro-strips, are located beyond each barrel end. Since sensor technologies are rapidly evolving and final operating requirements are uncertain, we have assumed sensor operation at -10 Celsius or above and air-cooling. That allows the number of radiation lengths represented by the vertex detector to be limited. Carbon fiber structures integrate silicon support with support of a beryllium beam tube. Initial estimates of the number of radiation lengths represented by the vertex detector, power removed by air-cooling, and sensor temperatures will be given.

Summary:

The present mechanical design of the vertex detector for SiD is integrated with both the design of the SiD outer tracker and with beam tube support. A method to allow vertex detector servicing has been taken into account in developing the design. The design includes a 12.5 cm long central barrel with silicon pixels. Four disks with silicon pixels and three additional disks, which could be based upon silicon pixels or micro-strips, are located beyond each barrel end. Since sensor technologies are rapidly evolving and final operating requirements are uncertain, we have assumed sensor operation at -10 Celsius or above and air-cooling. That allows the number of radiation lengths represented by the vertex detector to be limited. Carbon fiber structures integrate silicon support with support of a beryllium beam tube. Initial estimates of the number of radiation lengths represented by the vertex detector, power removed by air-cooling, and sensor temperatures will be given.

Higgs/Gamma-Gamma / 27

Little Higgs model effects in gamma gamma to gamma gamma

Author: Naveen Gaur¹

Co-authors: Alan Cornell ²; Ashok Goyal ¹; S. Rai Choudhury ¹

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The predictions by Standard Model (SM) of particle physics are in excellent agreement with experiments till date. But still theoretically SM has well emphasized problems like fine-tuning and hierarchy problem. These problems are associated with the Higgs sector of SM. It is widely believed that some new physics will take over from SM at TeV scale. Many such new physics models have been extensively studied in this pursuit. Little Higgs model (LH) also provides another solution of stabilizing the Higgs mass. These models predict a set of new heavy particles. In this work we investigate the effects of LH model in gamma gamma to gamma gamma scattering.

Plenary / 28

ILC India

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Plenary / 29

ILC - Asia

Plenary / 30

FALC

Plenary / 31

Europe Strategic Plan (remote connection)

Plenary / 32

EPP 2010

Plenary / 33

LCWS Charge

Plenary / 34

DCR Physics Outline

Corresponding Author: abdelhak.djouadi@cern.ch

Plenary / 35

Calorimetry R & D Highlights

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This talk will briefly review the physics motivation for developing high resolution calorimetry for ILC detectors. Electromagnetic and hadronic calorimeter designs will be described with details of recent and projected prototype modules and beam tests.

Plenary / 36

Forward Detectors

Corresponding Author: klaus.moenig@cern.ch

The tracking in the forward region of an ILC detector is reviewed. The needs for forward tracking are discussed and possible designs and their performance are shown.

Plenary / 37

Machine Detector Interface

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An over view of MDI issues will be presented. Forward detectors was covered by Klauss Moenig, and machine-specific issues will be covered by Andei Seryi in the GDE plenary session. This talk will focus on detector-related issues such as the DID (detector-integrated solenoid) and detector IR design.

Plenary / 38

Detector Performance, including PFA

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Plenary / 39

Round Table Follow-up from Late Morning Session

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Plenary / 40

Detector Concept (GLD)

Plenary / 41

Detector Concept 2 (LDC)

The LDC (Large Detector Concept) is one of several concepts for a proposed detector at the International Linear Collider. The LDC is characterized by a tracking system with a large volume TPC and a powerful SI tracking component, and a calorimeter optimised for particle flow. In the design particular emphasis has been put on a detector which is very robust and highly efficient. In this talk the current state of the LDC will be briefly outlined. This version has been documented in the detector outline document, which has been submitted to the community at the time of the conference

Plenary / 42

Detector Concept 3 (SiD)

The Silicon Detector Concept stresses silicon/tungsten electromagnetic calorimetry; compact, high precision, and low mass silicon tracking; pixel vertex detection with forward disks; 5 Tesla solenoidal coil; and highly segmented hadron calorimetry and muon identification. Physics requirements, the ILC environment, and costs drive the

design. The high magnetic field offers unsurpassed momentum resolution, the smallest possible radius beam pipe, and compact calorimetry. Silicon sensors record single beam crossings and stand up to errant backgrounds from beam imperfections. Costs drive the design to be relatively compact. Progress in the design and plans for needed R&D will be discussed.

Plenary / 43

Detector Concept 4

The 4th Concept detector consists of four detector systems, a small-pixel vertex detector, a high-resolution TPC, a new multiple-readout fiber calorimeter and a new dual-solenoid iron-free muon system. We will discuss the design of a comprehension facility that measures and identifies all partons of the standard model, including hadronic W and Z decays, with high precision and high efficiency with an emphasis on the calorimeter and muon systems.

Plenary / 44

WWS Detector R & D Panel

Plenary / 45

GDE R & D Board

Plenary / 46

Recent Results from Tevatron

Plenary / 47

DCR Preparation Report

Plenary / 48

LHC Machine and Detector Status

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Plenary / 49

Physics Summary (Higgs, Top, Loop Corrections, and associated gamma-gamma topics)

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Plenary / 50

DCR - Physics Summary

Plenary / 51

Tracking/Vertexing Summary

Plenary / 52

Calorimetry/Muons Summary

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Plenary / 53

DAQ Summary

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Plenary / 54

Simulation/Reconstruction Summary

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Test Beam Summary

Plenary / 56

Gamma-Gamma etc. Summary

Corresponding Author: a.finch@lancaster.ac.uk

Plenary / 57

MDI Summary

Plenary / 58

Workshop Conclusion

Gamma-gamma, e-gamma and e-e- Physics and Technology / 59

Report on Daresbury Laser Cavity Meeting

Author: Alex Finch¹

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On 10th Jan 2006 a meeting took place at the Daresbury Lab, UK to discuss the laser cavity design proposed by Klemz et. al. I will report on this meeting.

Loop Calculations/SUSY Particles / 60

Determining the SUSY-QCD Yukawa coupling in a combined LHC/ILC analysis

Author: Ayres Freitas¹

Co-author: Peter Skands²

¹ *University of Zurich*

² *Fermilab*

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In order to establish supersymmetry at future colliders, it is not sufficient to discover new particles, but the identity of gauge couplings and the corresponding Yukawa couplings between gauginos, sfermions and fermions needs to be verified. In detailed studies it was found that the SUSY-Yukawa couplings of the electroweak sector can be studied with great precision at the ILC, but a similar analysis for the Yukawa coupling of the SUSY-QCD sector proves to be far more challenging. Here a first phenomenological study for determining this coupling is presented, using a method which combines information from LHC and ILC.

Simulation and Reconstruction / 61**Fitting reconstructed track parameters using weight matrix****Author:** Nikolai Sinev¹¹ *University of Oregon***Corresponding Author:** sinev@slac.stanford.edu

The code to fit parameters of reconstructed tracks using weight matrix of measurements and solving system of equations to minimize chi square of the track residuals was ported from hep.lcd package to org.lcsim package. The performance of the fitter is reported.

Calorimetry and Muons / 62**Compact W-Si calorimeters for the PHENIX heavy ion experiment at RHIC****Authors:** Edward Kistenev¹; William Cooper²¹ *Brookhaven National Laboratory*² *Fermilab***Corresponding Author:** cooper@fnal.gov

The design and expected performance of tungsten - silicon “nose cone” calorimeters for the upgrade of the Phenix experiment at BNL will be described. The calorimeters will provide precision measurements of individual electromagnetic showers, aid in gamma / pi0 / eta / hadron identification, and aid in jet finding, jet energy, and impact position measurements. Two photon separation is expected to be provided to ~ 1/4 the Moliere radius. The calorimeters will also contribute data for a fast trigger. The design of the nose cone calorimeters provides one model for support, readout, and cooling of calorimeter elements. Design features could be applicable to the larger tungsten - silicon calorimeters under consideration for the ILC.

Higgs/Top and QCD/Gamma-Gamma / 63**Photon content of polarized and unpolarized Proton****Author:** Asmita Mukherjee¹**Co-author:** Cristian Pisano¹ *IIT Mumbai*

We investigate the QED Compton process (elastic and inelastic) in unpolarized and longitudinally polarized electron-proton scattering. The cross section can be expressed in terms of the equivalent photon distribution of the proton. We show that this process can be used to extract the photon content of both polarized and unpolarized proton at future colliders over a broad kinematical range.

Higgs and EWSB / 64**T parity conserving heavy gauge bosons at gamma-gamma Collider****Author:** Sukanta Dutta¹**Co-author:** Choudhury Debajyoti ²¹ SGTB Khalsa College, University of Delhi.² Department of Physics and Astrophysics, University of Delhi**Corresponding Author:** sukanta.dutta@cern.ch

The T parity conserving Little Higgs Model predicts the existence of heavy gauge bosons. We probe the production of heavy charged gauge bosons in the upcoming gamma-gamma collider. We further study its decay to heavy neutral gauge bosons (a promising dark matter candidate) and W bosons.

Gamma-gamma, e-gamma and e-e- Physics and Technology / 65**Ultimate parameters of the photon collider at the ILC****Author:** Valery Telnov¹¹ Budker INP, Novosibirsk, Russia**Corresponding Author:** telnov@inp.nsk.su

It is very likely that due to the cost “optimization” the ILC will have only one detector and no further energy upgrade. This scenario with a long run time at the energy $2E \leq 500$ GeV only strengthens the case of the photon collider. In any case, it is very important to develop a design which allows the best possible parameters of the photon collider. The gamma-gamma luminosity is determined only by the geometric e-e- luminosity which depends on beam emittances. Although the gamma-gamma luminosity with damping rings optimized for e+e- collisions will be sufficient for good physics but its further increase is very desirable, if it is technically possible and cost not too much. In this talk I consider ways of increasing the gamma-gamma luminosity from 2-3 times (by optimizing damping rings) to more than one order of magnitude (using a laser cooling). This will allow to measure the Higgs self interaction and to study many other processes at a new level of accuracies.

Machine Detector Interface / 66**The Stimulated Breit-Wheeler Process as a Source of Background e+e- Pairs at the International Linear Collider****Author:** Anthony Hartin¹¹ John Adams Institute, Oxford University**Corresponding Author:** t.hartin@qmul.ac.uk

The bunch fields at the interaction point of the ILC have a dominant effect on background pair production. The Breit-Wheeler, Bethe-Heitler and Landau-Lifshitz

processes have all been studied in detail. The number of background pairs per bunch crossing due to these processes is well known. However the effect of the bunch fields on the Breit-Wheeler process has not been calculated. This Stimulated Breit-Wheeler (or Stimulated Two Photon Pair Production) process, contains cross-section resonances, and significant numbers of background pairs may result from it. Presented here is a theoretical calculation and numerical investigation of the Stimulated Breit-Wheeler cross-section. This is a full QED calculation, and the external field is treated with the semi-classical approximation. The form of the bunch field considered is a plane wave, constant crossed electromagnetic field. Calculation of resonances involved inclusion of the Electron Self Energy in the external field. The end goal of the numerical investigation is the characteristics of new background pairs that can be expected at the ILC.

Summary:

Some QED work on new sources of background pairs

Tracking and Vertexing / 70

Status on the development of FE and readout electronics for Large Silicon Trackers

Author: Jean-Francois Genat¹

¹ *LPNHE UNiversite de Paris 6/IN2P3-CNRS*

Final results on the 0.18 micron UMC FE chip are summarized and preliminary results on time measurement are discussed. The status of the next version in 0.13 micron is briefly presented.

Tracking and Vertexing / 71

SiLC R&D present status and perspectives

Author: Aurore Savoy-Navarro¹

¹ *LPNHE UNiversite de Paris 6/IN2P3-CNRS*

The present status in terms of sensors R&D and on mechanical developments on ladder prototypes, large support structures, cooling alignment and integration are described. The detailed test beam schedule and roadmap including prototypes and combined tests with other sub-detectors is presented.

Tracking and Vertexing / 73

Monolithic CMOS Pixel Detectors for ILC Vertex

Author: James Brau¹

¹ *Oregon*

The Yale/Oregon effort to develop a CMOS vertex detector sensor with single bunch crossing time stamping will be reviewed. The R&D program is first developing a large pixel (50 μm x 50 μm) sensor, with a four deep memory for each pixel, and eventually will move to fine pixels (10 μm x 10 μm) by changing to a smaller feature size semiconductor process.

Higgs and EWSB / 74

Higgs Searches at D0

Author: Marcel Demarteau¹

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The latest results on searches for the Higgs boson in the standard model and minimal extensions of the standard model from the Dzero experiment will be reported.

Tracking and Vertexing / 75

Silicon Strip R&D Status in Korea

Author: Hwanbae Park¹

¹ *Kyungpook National University*

The current status of the silicon strip sensor R&D activities in Korea will be presented.

Higgs and EWSB / 76

Higgs Search at LEP

Author: Philip Bechtle¹

¹ *SLAC*

This talk presents the legacy of the four LEP experiments ALEPH, DELPHI, L3 and OPAL in the field of the search for Higgs bosons which are predicted within the framework of the Minimal Supersymmetric Standard Model (MSSM). It will focus on the search for neutral Higgs bosons. The data of the four collaborations are statistically combined and show no significant excess of events which would indicate the production of Higgs bosons. Hence, limits on model-independent quantities and on model parameters are derived. For the CP-Conserving MSSM models, stringent limits in the parameter space can be set. For CP-Violating scenarios, regions in the MSSM parameter space with light Higgs boson masses (<50 GeV) exist, for which there is only weak or no exclusion. For these scenarios, prospects for the LHC and the ILC will be shown.

Machine Detector Interface / 77

Fast and Precise Luminosity Measurement at the ILC

Author: Christian Grah¹

Co-authors: Andrey Sapronov²; Cécile Rimbault³; Mila Pandurovic⁴; Ronen Ingber⁵

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In the Very Forward Region of the detectors for the International Linear Collider two subsystems will be situated: LumiCal and BeamCal. These detectors cover a polar angle range from 82 mrad down to a 4 mrad. LumiCal and BeamCal give the possibility of the detection of single high energetic particles in their coverage region. Despite this a precise measurement of the total luminosity will be done using the LumiCal. This detector is optimized to achieve a relative error on the luminosity of $10E-4$ by measuring bhabha events. Studies on the physics background in this region are presented and on systematic uncertainties introduced by displacement, beam-beam effects and the geometries for different crossing angles. The BeamCal is used to obtain a fast luminosity signal by measuring the deposited energy from pairs originating from beamstrahlung. Furthermore analysing the shape of the deposited energy grants access to the parameters of the colliding beams. These measurements can be used to tune the beams and maximize the achievable luminosity. The analysis of the energy depositions for different geometries and a realistic detector simulation are presented which show encouraging results.

New Physics at TeV Scale and Precision Electroweak / 78

Littlest Higgs Model and W pair production at ILC

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Among the viable alternatives to the Standard Higgs Mechanism is the recently proposed Little Higgs models. The advantage here is that the model has an elementary light neutral scalar particle without the hierarchy problem. The model has two heavy charged gauge bosons $W_{\pm H}$ and one heavy neutral gauge boson, Z_H , in addition to the standard W and Z. We have investigated the W pair production at ILC to study the Littlest Higgs model using different observables. Specifically, polarisation fraction of W boson is expected to be measured very accurately at ILC. We use this to put limit on the scale parameter, f in the model.

Summary:

Little Higgs model with a global SU(5) broken down to SO(5) with a gauge group SU(2) X SU(2) X U(1) broken down to SU(2) X U(1) (Std Model) is considered to study $e^+e^- \rightarrow W^+W^-$ at ILC.

Polarization fraction of W produced changes from 2% to 4% in the case of longitudinal W, for symmetry breaking scale $f=1$ TeV, and mixing parameter $\cos(\theta)=0.35$, at an ILC with $\sqrt{s}=800$ GeV.

In the semileptonic decay channel, leptonic angular and energy distributions are also found to be sensitive to the model.

Use of polarized beams will improve the sensitivity.
(computation pending)

Simulation and Reconstruction / 79

Particle Flow Algorithm for the SiD Concept

Author: Usha Mallik¹

¹ *University of Iowa*

After the Large Hadron Collider (LHC), the next step for making progress in Particle Physics is the International Linear Collider project which will make precision measurements, often complimentary to those from the LHC, and provide detailed insight into the anticipated discoveries. In order to achieve the physics goals, the detectors at the International Linear Collider must have fine precision - in particular, an excellent jet energy resolution will be critical to many of the measurements. Hence, calorimetry is central to each of the proposed detector concepts; the majority are based on the Particle Flow Algorithm (PFA) approach. The founding principle of a PFA is to isolate the charged and the neutral showers so that the charged energy can be measured with the excellent resolution provided by the tracking detector. Clearly, minimizing confusion between the fragments of showers from charged and neutral particles is very important, since it would otherwise lead to worsening of the resolution. Several implementations of the PFA are being attempted with a strong simulation effort by many groups. The proof of principle has to be established in order to finalize a detector design. An overview of the realities of a PFA algorithm and a summary of the status of a few of these studies from the US groups will be described with emphasis on the SiD concept.

Calorimetry and Muons / 80

Development of MPPC

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MPPC is the new type photon sensor of semiconductor, which is under development with Hamamatsu Photonics company. It consists of hundreds of small pixels in a sensor. Each pixel acts as a digital device to a photon. The MPPC is supposed to be used plastic scintillator calorimeter with Tungsten absorber. The development situation is reported.

development of read out electronics for MPPC

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A new scheme of read out electronics which will be used for MPPC new type of photon sensor is under development in KEK. The aim and situation is reported. Both analog to digital conversion data and timing information are relevant for this detector, thus special care are taken for them.

Tracking and Vertexing / 82

Studies on the Spatial Resolution and Drift Properties Using Micromegas Equipped TPC

Author: Rosario L. Reserva Reserva¹

Co-authors: Akira Sugiyama²; Angelina Bacala¹; Arnaud Giganon³; Atshushi Yamaguchi⁴; Dennis Arogancia¹; Hermogenes Gooc¹; Hiroshi Yamaoka⁵; Hiroyuki Fujishima⁶; Hitoshi Kuroiwa⁷; Ioannis Giomataris⁸; Keiichi Nakamura⁹; Keisuke Fujii⁵; Khalil Boudjemline¹⁰; Kirsten Sachs¹¹; Madhu Dixit¹⁰; Makoto Kobayashi⁵; Masahiro Habu⁹; Osamu Nitoh⁹; Paul Colas⁸; Philippe Rosier¹²; Ronald Dean Settles¹³; Sachio Matsushita⁶; Takashi Watanabe¹⁴; Takatoshi Higashi⁶; Takeshi Matsuda⁵; Thomas Zerguerras¹⁵; Vincent Lepeltier¹⁶; Yukihiro Kato¹⁷

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R&D studies on the performance as well as on the gas properties of the Micromegas based time projection chamber with standard readout were carried out in June 2005 using 4 GeV/c pion beam in a magnetic field from 0 to 1 Tesla at the Proton Synchrotron beam line at KEK, Japan. Analysis on the electron drift velocity, diffusion constant and point resolution of padrow measurement for Micromegas TPC filled with 95% Argon and 5% Isobutane gas are presented. The underlying physical mechanism which determines the optimal TPC performance are briefly discussed. Preliminary measurements of gas properties in close agreement with the analytical calculation and Magboltz simulation are summarized and likewise presented.

Simulation and Reconstruction / 83**PandoraPFA : A new Particle Flow Algorithm**

Author: Mark Thomson¹

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I will describe a new particle flow algorithm running in the Marlin framework. The algorithm is designed with the goal of comparing the performance of different detector parameters. First results using the Mokka simulation of variants of the LDC detector will be presented.

Gamma-gamma, e-gamma and e-e- Physics and Technology / 84**Photon Collider beam simulation with CAIN**

Author: Maria Krawczyk¹

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CAIN simulation program was used to study the outgoing beam profile for the Photon Collider at ILC. The main aim of the analysis was to verify the feasibility of Photon Collider running with 20 mrad electron beam crossing angle. The main problem is the distorted electron beam, which has to be removed from interaction region. It was shown that with new design of final dipole it should be possible to avoid large energy losses at the face of the magnet.

Higgs and EWSB / 85**Higgs Physics at LHC for Beyond Standard Model Scenarios**

Author: Kajari Mazumdar¹

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Search for the Higgs boson is the principal motivation of the LHC experiments. Potential of discovery will be presented from simulation studies by both CMS and ATLAS collaborations in the context of beyond Standard Model scenarios. We shall also discuss the relevant experimental issues.

New Physics/Top and QCD / 86**Probing Universal Extra Dimensions through KK leptons at the ILC**

Author: Gautam Bhattacharyya¹

¹ *SINP, India*

In the context of an universal extra-dimensional scenario, we consider production of the first Kaluza-Klein electron positron pair in an e^+e^- collider as a case-study for the future International Linear Collider. The Kaluza-Klein electron decays into a nearly degenerate Kaluza-Klein photon and a standard electron, the former carrying away missing energy. The Kaluza-Klein electron and photon states are heavy with their masses around the inverse radius of compactification, and their splitting is controlled by radiative corrections originating from bulk and brane-localised interactions. We look for the signal event $e^+e^- + \text{large missing energy}$ for $\sqrt{s} = 1$ TeV and observe that with a few hundred fb^{-1} luminosity the signal will be readily detectable over the standard model background. We comment on how this signal may be distinguished from similar events from other new physics.

Loop Calculations/SUSY Particles / 87

Use of tau polarization to discriminate between SUSY models and Determine SUSY parametere at ILC

Author: Monoranjan Guchait¹

Co-authors: Durga Prasad Roy ²; Rohini Godbole ³

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In many SUSY models the first SUSY signal in the proposed International Linear Collider is expected to come from the pair production of stau particles, followed by its decay into tau lepton plus lightest neutralino assumed to be the lightest supersymmetric particle. In our study a simple and robust method of measuring the polarization of this tau in its 1-prong hadronic decay channel, has been investigated. We discuss how it can be used to discriminate between SUSY models and to determine SUSY parameters.

Machine Detector Interface / 88

Study on Low-Energy Positron Polarimetry

Authors: Andreas Schaelicke¹; Sabine Riemann¹

Co-authors: Karim Laihem ¹; Ralph Dollan ²; Thomas Lohse ²

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For the design of the ILC a polarised positron source based on a helical undulator system has been proposed. In order to optimise the positron beam, i.e. to ensure

high intensity as well as high degree of polarisation, a measurement of the polarisation close to the positron creation point is envisaged.

In this contribution methods to determine the positron polarisation at low energies are discussed. For a more detailed analysis simulations with an extended version of Geant4, which allows the tracking of polarised particles taking into account the spin effects, are currently performed. A status will be presented.

SUSY Particles / 89

Phenomenology of non-universal gaugino masses and implications for the Higgs boson decays

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We study the implications of non-universal boundary conditions for the composition of the lightest neutralino as well as for the upper bound on its mass in supersymmetric grand unified theories. We derive sum rules for neutralino and chargino masses in different representations of the simplest grand unified theory based on SU(5) which lead to different non-universal boundary conditions for the gaugino masses at the unification scale. We then consider implications of the non-universal gaugino masses, that arise in such a grand unified theory, for the phenomenology of Higgs bosons. In particular we investigate the detection of heavy neutral Higgs bosons H_0, A_0 in the decay $H_0, A_0 \rightarrow \tilde{\chi}_1^0 \tilde{\chi}_2^0$ to 4l. We also study the possibility of detecting the neutral Higgs bosons in cascade decays $\tilde{\chi}_2^0 \rightarrow h_0 (H_0, A_0) \tilde{\chi}_1^0 \rightarrow b \bar{b} \tilde{\chi}_1^0$.

Higgs and EWSB / 90

Identifying new physics contributions in the Higgs sector at linear $e^+ e^-$ colliders

Author: SANTOSH RAI¹

¹ *Harish-Chandra Research Institute*

We study the dilepton-dijet signal in the dominant Higgs production channel at a linear $e^+ e^-$ collider. We show that by taking a simple ratio between cross-sections of two different final states different new physics scenarios can be identified. The case of distinguishing radions from Higgs is considered. We also highlight the effects of new particles in the loop contributing to the $H \rightarrow gg$ decay through this channel.

SUSY Particles / 91

Top squark and neutralino decays in a R-parity violating model constrained by neutrino oscillation data

Author: Sujoy Poddar¹

Co-authors: Amitava Datta¹; Siba Das¹

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In a R-parity violating (RPV) model of neutrino mass with three bilinear couplings μ_i and three trilinear couplings λ_{i33} , where i is the lepton index, we find six generic scenarios each with a distinctive pattern of the trilinear couplings consistent with the oscillation data. These patterns may be reflected in direct RPV decays of the lighter top squark or in the RPV decays of the lightest superparticle, assumed to be the lightest neutralino. Typical signal sizes at the Tevatron RUN II and the LHC have been estimated and the results turn out to be encouraging. The predictions of this model also depend on the parameters of the R-parity conserving (RPC) sector. Measurement of these parameters kinematically at the LHC and/or ILC would further sharpen the predictions. Finally the Branching Ratios (BRs) of the RPV decays turn out to be rather suppressed in some regions of parameter space. Measurement of the BRs of these rare decay modes in the clean environment of the ILC would then be a challenging programme.

New Physics at TeV Scale and Precision Electroweak / 92

Transverse polarization and new physics in gamma Z and Higgs Z production

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Transverse polarization of electron and positron beams can be useful because it permits the use of azimuthal asymmetries even when the final state consists of two particles. It is found that with the use of transverse polarization, a CP-odd and T-odd observable can be constructed when the final-state particles are self-conjugate. In the case of HZ production, this observable can be used to probe a certain effective four-point e^+e^-ZH CP-violating coupling, which is not accessible without transverse polarization. Effective CP-violating ZZH coupling does not contribute to this observable. A similar observable for the case of γZ production can be used to probe certain effective CP-violating γZV ($V = \gamma, Z$) or $e^+e^- \gamma Z$ four-point couplings.

SUSY Particles/Cosmological Connections / 93

Model Independent Approach for Dark Matter Phenomenology: Signatures in Linear Colliders and Cosmic Positron experiments

Author: Shigeki Matsumoto¹

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We have studied the phenomenology of a dark matter in ILC and cosmic positron experiments based on a model independent approach. We have found that there is a strong correlation between a dark matter signatures in ILC and an indirect detection experiment of a dark matter using positrons. Once the dark matter is discovered in a cosmic positron measurement such as PAMELA, its nature will be investigated in the details at ILC.

Gamma-gamma, e-gamma and e-e- Physics and Technology / 94

Anomalous gauge couplings of the Higgs boson at high energy photon colliders

Author: Bin Zang¹

¹ *Tsinghua University*

We study the sensitivity of testing the anomalous gauge couplings (g_{HVV}) of the Higgs boson in the formulation of linearly realized gauge symmetry via the processes $\gamma\gamma \rightarrow ZZ$ and $\gamma\gamma \rightarrow WWWW$ at polarized and unpolarized photon colliders based on e+e- linear colliders of c.m. energies 500 GeV, 1 TeV, and 3 TeV. Signals beyond the standard model (SM) and SM backgrounds are carefully studied. We propose certain kinematic cuts to suppress the standard model backgrounds. For an integrated luminosity of 1 ab⁻¹, we show that (a) $\gamma\gamma \rightarrow ZZ$ can provide a test of $g_{H\gamma\gamma}$ to the 3 sigma sensitivity of order 10⁻³ to 10⁻² TeV⁻¹ at a 500 GeV ILC, and of order 10⁻³ TeV⁻¹ at a 1 TeV ILC and a 3 TeV CLIC, and (b) $\gamma\gamma \rightarrow WWWW$ at a 3 TeV CLIC can test all the anomalous couplings g_{HVV} 's to the 3 sigma sensitivity of order (10⁻³) to 10⁻² TeV.

Calorimetry and Muons / 95

Software studies of GLD calorimeter

Author: Hiroyuki Matsunaga¹

¹ *University of Tsukuba*

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I will describe simulation studies of GLD scintillator-based calorimeter. This talk contains two parts: the first is π^0 reconstruction with scintillator-strip ECAL, and the second is a study of digital HCAL performance. Preliminary results of these studies will be presented in my talk.

Simulation and Reconstruction / 96

Simulation and Reconstruction in the IV Concept

Author: Corrado Gatto¹

¹ *INFN Lecce*

“We present the software package for the simulation and reconstruction of the IV Concept detector: IVCroot. It is based on the architecture of Aliroot, the Offline system of Alice experiment. The architecture is discussed along with some preliminary results”

Tracking and Vertexing / 97

LCFI Vertex Detector Design Studies

Authors: Andre Sopczak¹; Caroline Milstene²

¹ *Lancaster University*

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A vertex detector concept of the Linear Collider Flavor Identification (LCFI) collaboration, which studies pixel detectors for heavy quark flavour identification, has been implemented in simulations for c-quark tagging in scalar top studies. The production and decay of scalar top quarks (stops) is particularly interesting for the development of the vertex detector as only two c-quarks and missing energy (from undetected neutralinos) are produced for light stops. Previous studies investigated the vertex detector design in scenarios with large mass differences between stop and neutralino, corresponding to large visible energy in the detector. In this study we investigate the tagging performance dependence on the vertex detector design in a scenario with small visible energy for the International Linear Collider (ILC).

SUSY Particles / 98

Small Visible Energy Scalar Top Iterative Discriminant Analysis

Authors: Alex Finch¹; Andre Sopczak¹; Ayres Freitas²; Caroline Milstene³; Michael Schmitt⁴

¹ *Lancaster University*

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The precision determination of scalar top quark properties will play an important role at a future International Linear Collider (ILC). The scenario with small expected visible energies, from almost mass degenerate stops and neutralinos, is cosmologically motivated and experimentally particularly challenging. This scenario has been investigated with an Iterative Discriminant Analysis (IDA) and first results on the IDA performance are reported. The simulation is based on a fast and realistic detector simulation. A vertex detector concept of the Linear Collider Flavor Identification (LCFI) collaboration, which studies pixel detectors for heavy quark flavour identification, is implemented in the simulations for c-quark tagging.

Simulation and Reconstruction / 99**Marlin and MarlinReco, a status report on recent software developments****Author:** Oliver Wendt¹¹ *DESY*

Marlin is a Modular Analysis and Reconstruction framework for detector simulation studies at the ILC. It is based on C++ and consists of software modules, called processors, which can be accessed and parametrised easily via a simple XML-based steering file. The native transient data format used for Marlin is LCIO.

Marlin itself provides the framework only. All more specialised modules, for reconstruction in particular, are embedded in a package named MarlinReco. It includes a full set of modules, starting from processors for the digitisation of simulated data, full tracking as well as clustering, ending up with modules to create particle flow objects and perform simple analyses.

This talk introduces the basic structure of Marlin and MarlinReco and reports on the status of the software, most recent developments and results.

Simulation and Reconstruction / 100**Simulation and Reconstruction Frameworks for the ILC****Author:** Ties Behnke¹**Co-author:** Frank Gaede¹¹ *DESY*

Software plays an important role in the optimisation and design of detectors for the ILC. Over the past years, a first version of a coherent software system has been developed within the ILC community. It is based on a common data format, LCIO, and on the definition of interfaces between different parts of the simulation and reconstruction chain. Particular emphasis is put on a highly modular structure, which ensures that the system is open for future developments and can evolve with time. The current implementation of this system is based on C++, but the modular structure in principle allows the use of other languages like Fortran or Java or others. In this talk the state of the software structures and the strategy for further evolution is discussed.

Simulation and Reconstruction / 101**Calorimeter energy calibration using the energy conservation law****Author:** Vasiliy Morgunov¹¹ *DESY and ITEP*

A calorimeter energy calibration method has been developed for ILC detectors. The method uses the center mass energy of the accelerator as a constraint. It was shown

that using the energy conservation law it is possible to do an ECAL and HCAL cross calibration in a way to reach a good energy resolution for the simple calorimeter hit energy sum.

The Application of this method in LDC detector geometries optimization will be discussed.

Tracking and Vertexing / 102

LCFI Status Report: Sensors for ILC Vertex Detector

Author: Konstantin Stefanov¹

¹ *CCLRC Rutherford Appleton Laboratory*

Recent results are presented on the design and testing of silicon sensors for the ILC vertex detector and of the associated readout electronics. The sensors discussed are the Column Parallel Charge-Coupled Device (CPCCD) and the In-situ Storage Image Sensor (ISIS), both of which have the potential to satisfy the requirements for operation at the ILC. Progress with the development of the CPCCD is presented and the programme that will lead to readout at the speeds needed for operation at the ILC discussed. A radiation damage model based on full FEA and a simplified model has also been developed.

Measurements of the performance of the first ISIS are shown and progress with the design of the next generation of these devices discussed. Studies of the column parallel readout chip that will allow the fast readout and online processing of the data from the CPCCD are also presented.

Tracking and Vertexing / 103

LCFI Status Report: Physics and Mechanics for ILC Vertex Detector

Author: Steve Worm¹

¹ *CCLRC Rutherford Appleton Laboratory*

The Linear Collider Flavour Identification (LCFI) Collaboration is developing sensors, electronic systems and mechanical support structures necessary for the construction of a high performance vertex detector at the ILC and investigating the contribution such a vertex detector can make to the physics accessible at the ILC. Extremely low mass support structures will be required for the sensor modules, in conjunction with careful mechanical design of the vertex detector. In addition, flavour tagging and heavy flavour charge identification investigations will be used to both optimise the vertex detector design and to maximise the physics potential of the ILC. The status of both mechanical and physics studies will be presented.

Simulation and Reconstruction / 104

DigiSim: a package to simulate signal collection, propagation, and conversion

Author: Guilherme Lima¹

Co-author: Vishnu Zutshi¹

¹ *Northern Illinois University*

We present the status of DigiSim, a package designed for parametric simulation of the conversion of (GEANT4) energy deposits into digitally stored “hits”, specifically for the ILC detector(s). DigiSim is well integrated to two of the most widely used reconstruction frameworks for the ILC, namely `org.lcsim/java` and `Marlin/C++`. Simple implementations exist for the most common processes, such as crosstalk, noise, discrimination, timing cuts, inefficiencies and smeared linear transformations. New features or effects can be easily added to the modular and extensible structure. In the process of simulation-based evaluation of different technology and geometry options We expect DigiSim to serve as an essential step between simulation of energy deposits in the detector volume and realistic reconstruction/analysis based on a “raw” data format similar to what we eventually expect to see from real physics runs. Detector and algorithm developers experts are encouraged to try it out and make suggestions to improve its usefulness.

Simulation and Reconstruction / 105

The Directed-Tree clustering algorithm for Particle Flow Reconstruction

Author: Vishnu Zutshi¹

¹ *Northern Illinois*

We present the status of particle-flow algorithm development at Northern Illinois University. A key element in our approach is the calorimeter-based “Directed Tree” clustering algorithm. We have attempted to identify and tackle the essential challenges and analyze the effect of several different approaches to the reconstruction of jet energies and the Z-boson mass. A number of possibilities have been studied, such as analog vs. digital energy measurement, hit density-based clustering and the use of single or multiple energy thresholds (the so-called “semi-digital” approach). We plan to use this PFA-based reconstruction to compare some of the proposed detector technologies and geometries.

Simulation and Reconstruction / 106

Performance of GLD detector

Author: Tamaki Yoshioka¹

¹ *ICEPP, Univ. of Tokyo*

The study uses a quick simulation of the GLD named QuickSim. For a better performance of physics event study, we have checked several parameters for that purpose. The physics event, say, $e^+ e^- \rightarrow Z h$, has been studied.

Gamma-gamma, e-gamma and e-e Physics and Technology / 107

Heavy, neutral MSSM Higgses at PLC - a comparison of two analyses

Author: Maria Krawczyk¹

Co-authors: Michael Spira²; Piotr Nlezurawski³

¹ *Institute of Theoretical Physics, Warsaw University*

² *PSI*

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Measurement of the heavy neutral MSSM Higgs bosons H and A at the Photon Collider is considered for the parameter range corresponding to the so-called “LHC wedge”. The main background for the measured process, $\gamma + \gamma \rightarrow A, H \rightarrow b + \bar{b}$, is due to the direct heavy-quark production, $\gamma + \gamma \rightarrow Q + \bar{Q}$. Here assumptions and results of two analyses which take into account NLO QCD corrections to the heavy-quark production are compared [Phys.Lett. B508 (2001) 311, and hep-ph/0507006]. It is shown that different approaches to NLO corrections (full resummation of Sudakov and non-Sudakov logarithms versus resummation of non-Sudakov logarithms up to 4-loop order) and jet definitions (Sterman-Weinberg vs. JADE) lead to comparable results for direct heavy-quark production cross sections. The most significant difference is due to condition for minimal polar angle of quarks in 3-jet events.

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Layout of the photon collider

Author: Valery Telnov¹

¹ *Budker INP, Novosibirsk, Russia*

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Configuration of beamlines, the crossing angle, removal of disrupted beams, beamdump, path of laser beams and required modifications of the interaction region and detector are briefly considered.

New Physics at TeV Scale and Precision Electroweak / 109

Distinguishing New Physics Scenarios at ILC with Polarized Beams

Author: Alexander Pankov¹

¹ *Techn. Univ. of Gomel*

Numerous non-standard dynamics are described by contact-like effective interactions that can manifest themselves only through deviations of the cross sections from the Standard Model predictions. If one such deviation were observed, it should be important to definitely identify, to a given confidence level, the actual source among the possible non-standard interactions that in principle can explain it. We here estimate the identification reach on different New Physics effective interactions obtainable from angular distributions of fermion $e^+e^- \rightarrow \bar{f}f$ at the ILC with polarized beams. The models for which we discuss the range in the

relevant high mass scales where they can be identified as sources of corrections to the Standard Model predictions, are the interactions based on gravity in large and in TeV^{-1} extra dimensions and the conventional four-fermion contact interactions. We emphasize the role of beams polarization on enhancing the identification sensitivity.

New Physics at TeV Scale and Precision Electroweak / 110

Neutrino masses and the decay of triplet Higgs in the Littlest Higgs scenario

Author: Raghavendra Srikanth¹

¹ *Harish-Chandra Research Institute*

We investigate the sources of neutrino mass generation in Little Higgs theories, by confining ourselves to the Littlest Higgs scenario. Our conclusion is that the most satisfactory way of incorporating neutrino masses is to include a lepton-number violating interaction between the scalar triplet and lepton doublets. The tree-level neutrino masses are generated by the vacuum expectation value of the triplet. We also calculate the various decay branching ratios of the charged and neutral scalar triplet states, in regions of the parameter space consistent with the observed neutrino masses, hoping to search for signals of lepton-number violating interactions in collider experiments.

Calorimetry and Muons / 111

Understanding the Performance of the CMS Hadron Calorimeter

Author: Seema Sharma¹

¹ *Tata Institute of Fundamental Research (TIFR)*

We have studied the performance of the CMS hadron calorimeter using the testbeam facilities at CERN. Two wedges of brass-scintillator calorimeter are exposed to negative and positive beams with momenta between 3 and 300 GeV/c. Light produced in the scintillators were collected using wavelength shifting fibres and read out using Hybrid photodiodes. Each of the wedges had 17 layers of scintillators. In one of these wedges signal from all 17 layers were grouped together while in the other each layer was read out separately. The response, energy resolution, longitudinal and lateral shower profiles are measured and compared with GEANT4 simulation results.

SUSY Particles / 112

Detecting metastable staus and gravitinos at the ILC

Author: Felix Sefkow¹

Co-author: Hans-Ulrich Martyn¹

¹ *DESY*

We present a study of various SUSY scenarios in which the lightest supersymmetric particle (LSP) is the gravitino and the next-to-lightest supersymmetric particle (NLSP) is a metastable stau with lifetimes ranging from seconds up to several years. At the ILC such heavy stau's are copiously produced either directly or through cascade decays. A proper choice of the cms energy allows one to stop large samples in the calorimeters of the ILC detector and subsequently study the decays of stau \rightarrow photon + gravitino. A detailed simulation shows that the properties of the stau and the gravitino, such as lifetimes and masses, can be accurately determined at a future linear collider. Heavy gravitinos are interesting dark matter candidates which cannot be directly detected in astrophysical experiments.

Plenary / 113

Physics Summary (SUSY, New Physics, Cosmological Connections, and associated gamma-gamma)

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Tracking and Vertexing / 114

CMOS Monolithic Pixel R&D at LBNL

Author: Devis Contarato¹

¹ *LBNL*

The talk will present recent progress in the design and characterisation of CMOS pixel sensors at LBNL. The talk will report results of lab tests, beam tests and radiation hardness tests carried out at LBNL on a test structure with pixel of various sizes.

We will also report the first preliminary results of a detailed characterisation of backthinned CMOS pixel sensors and discuss future activities.

Simulation and Reconstruction / 117

Testing the performance of the PFA algorithms

Author: Adam Para¹

¹ *Fermilab*

Particle Flow Calorimetry promises an excellent jet energy resolution by combining the momentum measurement, electromagnetic calorimeter and using the hadron calorimeter for neutral hadron only. This technique depends on the ability of separation of energy deposits of separate particles and thus on the spatial density of particles in the calorimeter. We investigate the variation of the particle densities for different physics processes and center-of-mass energies to evaluate validity proofs-of-concept of the PFA algorithms. Demonstration of the performance of the PFA calorimetry relies primarily on the detector simulation tools. We investigate current uncertainties of the simulation tools and try to outline possible experimental tests for simulations tools and for the PFA calorimeter.

Calorimetry and Muons / 118**Muon Identification: Efficiency and Purity vs. Interaction Lengths****Author:** Caroline Milstene¹**Co-authors:** Adam Para¹; Eugene Fisk²¹ *Fermilab*² *Fermilab*

We report the findings of a study on the efficiency and purity of muon identification for the proposed SiD detector geometry. The study is based on simulated b-pair events that include a muon in the decay chain. The aim of the study was to assess the use of the highly segmented proposed hadron calorimeter in the b identification process. The study shows that the efficiency and purity of the muons from b-decay improves until the muon penetration depth exceeds about eight interaction lengths of material

Calorimetry and Muons / 119**Active Absorber Calorimeter****Author:** Zhao Zhao¹¹ *University of Washington*

This talk describes a calorimeter concept that will use cherenkov radiator plates to partially replace the metal plates in a conventional ILC hadron calorimeter design. The cherenkov radiator will have fine segmentations and will be readout by SiPMs. Energy and spatial information of the electromagnetic components in hadron showers can be measured. Combined with information from thin plastic scintillator or other detector materials, this active absorber calorimeter can potentially achieve good energy compensation for Hadron jets and an excellent jet energy resolution.

Calorimetry and Muons / 120**Tests of ILC Prototype Muon Scintillation Detectors at Fermilab.****Author:** Bib Abrams¹¹ *Notre Dame University*

A set of 4 ILC Muon prototype modules, each 1.25m x 2.5m with 64 diagonal scintillator strips has been assembled and set up in the Fermilab test beam. Two of the modules have readouts and one end of the scintillators and two of the modules have readouts at both ends of the strips. Studies of the pulse shapes and preliminary results of the beam tests will be presented.

Tracking and Vertexing / 124**Development of CMOS sensors adapted to the vertex detector requirements****Author:** Marc Winter¹¹ *IPHC-Strasbourg***Corresponding Author:** marc.winter@ires.in2p3.fr

Recent achievements with CMOS sensors of the MIMOSA series will be reported, including test results of prototypes featuring radiation tolerant pixels operated at room temperature, fast read-out architectures with integrated signal discrimination, etc. Work in progress and plans for 2006 will be outlined.

Tracking and Vertexing / 131**Large-Area Micromegas TPC R&D****Author:** Michael T. Ronan¹¹ *LBL*

We present final analysis results of cosmic ray data taken with a Large-Area Micromegas TPC by the Berkeley-Orsay-Saclay (BOS) collaboration. The TPC gas chamber for these R&D studies was 50 cm diameter and 50 cm long and was operated with three gas mixtures, Ar:CF₄ 3%, ArCH₄ (P10) and Ar:Isobutane 5% in magnetic fields up to 2 tesla. A large-area, 38 cm diameter, copper Micromegas electro-mesh with 60 micron pitch, and 50 micron mesh to anode pad plane gap provided gains up to 3000. Over 1000 channels of TPC readout electronics, with 1X10 and 2X10 mm² anode pads, have been used to cover the detector area. The detector ran very smoothly with excellent gain uniformity. Precision measurements of drift velocity, diffusion and electron attachment have been made and compared to MagBoltz simulations. We have obtained a Micromegas TPC extrapolated zero-drift, point resolution of 50 microns. We compare the measured resolution dependence on drift distance, up to 50 cm, to parameterized simulations of the drift and avalanche of individual ionization electrons for the gases studied.

Tracking and Vertexing / 133**Micromegas- and GEM-TPC resolution studies with charge dispersion in a magnetic field in a test beam.****Author:** Madhu Dixit¹¹ *Carleton University and TRIUMF*

The MPGD readout TPC for the ILC will have to measure ~200 track points with a resolution close to 100 microns for all drift distances. It may be difficult to meet the resolution target with conventional MPGD readout techniques if ~2 mm wide pads were used as is presently envisioned. Reducing the pad width to improve resolution could add significantly to the detector cost and complexity. The new MPGD readout concept of charge dispersion has been recently shown to achieve excellent resolution without resorting to narrower pads in cosmic ray TPC tests in absence of a magnetic

field. We have recently studied the performance of two small prototype MPGD-TPCs with charge dispersion readout in a 1 T superconducting magnet in a 4 GeV/c test beam at KEK for several different gas mixtures. One of the TPCs was outfitted with a Micromegas endplate and the other with interchangeable Micromegas and triple-GEM endplates. Beam data were recorded both in and outside the magnet for the two TPCs. Preliminary results are quite encouraging. Transverse resolution close to 50 microns was achieved with 2 mm wide pads at 1 T for short drift distances for one of the TPCs. The dependence of resolution on drift distance was consistent with diffusion and electron statistics. With larger suppression of transverse diffusion at higher magnetic fields, the resolution goal of 100 microns appears within reach for the ILC TPC. The present status of charge dispersion MPGD-TPC beam test resolution studies will be presented.

Tracking and Vertexing / 134

ILC TPC R&D studies at DESY/U. Hamburg

Author: Katsumasa Ikematsu¹

¹ *DESY*

I will have a review of our DESY/U.Hamburg team's recent ILC TPC R&D activities. In particular, I will report the results of 2 track separability test using UV laser. I will also summarize our future plan including EUDET related issue concerning the large prototype field cage construction and preparation for test beam.

Tracking and Vertexing / 135

Developments for a digital TPC : the SiTPC project

Author: Paul Colas¹

¹ *Saclay*

Results and simulations of a TPC with an endplate with a Micromegas or a GEM amplification followed by a readout by a VLSI CMOS chip Medipix2 will be presented. The steps in progress towards the realisation of a sizeable prototype, within the EUDET program, will be presented: improvement of the protection against breakdown, integration of the Micromegas grid onto the wafer (InGrid), and design of the Timepix chip provided with a timing and/or time-over-threshold capability.

Tracking and Vertexing / 136

Comparison between data and simulation for MT3

Author: Akira Sugiyama¹

¹ *University of Saga*

The performances of the MT3-TPC prototype (Multi-Technology Test TPC) had been studied using different gas amplification devices. The resolution is reconsidered under various conditions and compared to parametrized simulation.

Tracking and Vertexing / 137

A beam test of prototype TPCs using micro-pattern gas detectors at KEK**Author:** Makoto Kobayashi¹¹ *KEK*

We conducted a series of beam tests of prototype TPCs at the KEK PS using GEMs or microMEGAS as a detection device. The prototypes were operated successfully under a magnetic field of up to 1 tesla. Experimental results, such as pad response and spatial resolution as functions of drift distance, are presented with a special emphasis upon comparison to the expectations from an analytical calculation. The spatial resolution in the whole drift region was found to be understood in terms of pad pitch, diffusion, pad response function, and the effective number of electrons.

Tracking and Vertexing / 138

TPC R&D Plans for the Large Prototype**Author:** Ron Settles¹¹ *Max-Planck-Gesellschaft*

The LC TPC R&D work has been underway for four years, whereby the various TPC groups have been learning to use the MPGD techniques by building and measuring with an impressive number of small TPC prototypes (around 30cm diameter) using cosmics and test beams, and using a variety of different gas mixtures. The next stage of this work will focus the groups and work on building a Large Prototype (ca. 80) and using it as a testbed for the techniques to be chosen for the LC TPC. These plans will be described in this presentation.

SUSY Particles / 139

Low scale gravity mediation in warped extra dimensions and collider phenomenology on hidden sector**Author:** Nobuchika Okada¹¹ *KEK*

We propose a model of low scale gravity mediated supersymmetry breaking in Randall-Sundrum type warped extra dimensions. In our setup, both of the visible sector and the hidden sector (supersymmetry breaking sector) co-exist on infrared (IR) brane. Supersymmetry breaking is transmitted through non-renormalizable contact interactions among visible and hidden sector fields as the same as in the conventional minimal supergravity scenario in four dimensions. However, due to the warped metric, the effective cutoff scale on the IR brane is “warped down”, and, as a result, the contact interactions among the visible and hidden sector fields are enhanced. We investigate collider phenomenology in the case with the IR cutoff scale around 10 TeV. We find a possibility that hidden sector fields, if they are light enough, can be produced at future colliders, LHC and ILC. Interestingly, main production processes are similar to those for Higgs boson with comparable production

cross sections, while their decay processes are quite different and provide us with clean signatures.

SUSY Particles/Cosmological Connections / 140

Determination of dark matter properties at high-energy colliders

Author: JoAnne Hewett¹

¹ *SLAC*

If the cosmic dark matter consists of weakly interacting massive particles, these particles should be produced in reactions at the next generation of high energy accelerators. Measurements at these accelerators can then be used to determine the microscopic properties of the dark matter. From this, we can predict the cosmic density, the annihilation cross sections, and the cross sections relevant to direct detection. In this paper, we present studies in supersymmetry models with neutralino dark matter that give quantitative estimates of the accuracy that can be expected. We show that these are well matched to the requirements of anticipated astrophysical observations of dark matter. The capabilities of the proposed International Linear Collider (ILC) are expected to play a particularly important role in this study.

Loop Calculations/SUSY Particles / 141

New results from GRACE/SUSY

Author: Yoshiaki Yasui¹

¹ *Tokyo Management College*

We report the recent development on the GRACE/SUSY system. GRACE/SUSY is the computer code which can generate Feynman diagrams in the MSSM automatically and compute 1-loop Feynman amplitudes in the numerical way. We present a short review of the GRACE/SUSY system. We also show new results of various 2-body decay widths and Chargino pair production at ILC in the 1-loop level.

Higgs/Gamma-Gamma / 142

Higgs searches at the LHC: SM Scenarios

Author: Satyaki Bhattacharya¹

¹ *University of Delhi*

Search for the Higgs boson is the principal motivation of the LHC experiments. Potential of discovery will be presented from simulation studies by both CMS and ATLAS collaborations in the Standard Model scenario.

New Physics at TeV Scale and Precision Electroweak / 143**Probing space-time structure at new physics with polarized beams at ILC****Author:** B. Ananthanarayan¹¹ *IISc, Bangalore***Corresponding Author:** anant@cts.iisc.ernet.in

We approach the issue of the discovery of new physics at high energies associated with the proposed International Linear Collider in the presence of longitudinal as well as transverse electron and positron beam polarization. We determine the beam polarization dependence and the angular distribution of a particle of arbitrary spin in a one-particle inclusive final state produced in e^+e^- collisions through the interference of photon or Z amplitude with the amplitude from new interactions having arbitrary space-time structure. We thus extend the results of Dass and Ross proposed at the time of the discovery of neutral currents, to beyond the standard model currents. We also extend the case of e^+e^- annihilation in the s-channel to the production of bosons due to t- and u-channel processes. Our work provides an approach to model-independent determination of the space-time structure of beyond the standard model interactions. We briefly discuss applications of the framework to popular extensions of the standard model, and demonstrate that our framework is general enough to account for certain results in the minimal supersymmetric standard model. We briefly remark on work in progress when more than one final state momentum and when final state spin are also detected.

Higgs/Gamma-Gamma / 144**Anomalous Higgs Couplings at e gamma Collider****Author:** Mamta Dahiya¹¹ *S.G.T.B. Khalsa College, Delhi*

We examine the resolving power of an e-gamma collider in the context of HWW vertices. This has the advantage over an e^+e^- collider in being able to dissociate them from any deviations in the ZHH vertex. We construct several dynamical variables which may be used to constrain various possible form factors in the HWW vertex.

Higgs and EWSB / 145**Slot for DCR discussion**

The DCR people (Klaus Moenig, Abdel Djouadi, Jo Lykken, ...)

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Direct Readout of the Scintillator Tile by Silicon Photomultiplier

Author: Valeri Saveliev¹

¹ *Obninsk State University/DEAY*

The method and results of the direct readout of the Hadron Calorimeter Scintillation Tiles by Silicon Photomultiplier will be presented. First results of mathematical simulation of the scintillator tile with silicon photomultiplier on base Geant4.

The preliminary results of the cosmic signal with scintillator tile 3x3 cm and 5 mm thickness and Silicon photomultiplier with area 1x1 mm was measured. The results shown the good perspective of direct readout by silicon photomultiplier for the analog hadron calorimeter and semidigital scintillator/Fe calorimeter.

Higgs/Top and QCD/Gamma-Gamma / 149

Gamma Gamma Total Cross-sections

Author: Rohini Godbole¹

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We explore the predictions for the total hadronic gamma gamma cross-sections in a mini-jet model, which includes the effect of soft-gluon resummation. The non-perturbative parameters in the model are determined from the values obtained in a good fit to the pp and proton-antiproton data and the Vector Meson Dominance Model. Recently we studied dependence of the parameters for the pp/proton-antiproton case, on the parton densities used for the (anti)proton. In this study, we now investigate the effect of this on the predictions of the total, hadronic, gamma gamma cross-sections at the ILC energies.

Tracking and Vertexing / 150

Simulation Studies of VXD Performance

Corresponding Authors: rasp@mail.desy.de, alexei.raspereza@cern.ch

A procedure of digitization of hits produced in the silicon tracking subdetectors of the LC detector has been developed. The procedure has been employed to evaluate point resolution of the vertex detector. In addition stand-alone pattern recognition algorithm has been developed to search for tracks in the vertex detector. Performance of the algorithm has been evaluated in the presence of beam induced backgrounds.

Tracking and Vertexing / 151

Development of DEPFETs for the Vertex Detector

Tracking and Vertexing / 152**Discussion on the Large Prototype****New Physics/Top and QCD / 154****Extra dimension searches at hadron collider to NLO-QCD**

Author: Prakash Mathews¹

¹ *Saha Inst. of Nuclear Physics*

The quantitative impact of NLO-QCD corrections for searches of large and warped extra dimensions at hadron colliders is investigated for the Drell-Yan process. The K-factor for various distributions at hadron colliders are presented. Factorisation/renormalisation scale dependence and uncertainties due to various parton distribution functions of these distributions are studied.

Higgs and EWSB / 156**Photon Pair Production at the LHC Higgs Signal and QCD Backgrounds**

Author: Edmond Berger¹

¹ *High Energy Physics Division, Argonne National Laboratory, USA*

I present a QCD calculation of the transverse momentum distributions of Higgs bosons, and of photon pairs produced by 'background' QCD subprocesses, including all-orders soft-gluon resummation valid at next-to-next-to-leading logarithmic accuracy. Resummation is needed to obtain predictions valid in the ranges of transverse momentum where the cross sections are largest. I compare the results with data from the Fermilab Tevatron and make predictions for the Large Hadron Collider. The QCD 'background' is shown to have a softer spectrum than the signal.

Gamma-gamma, e-gamma and e-e- Physics and Technology / 160**Measuring Higgs CP properties through top quark production at a photon collider**

Author: Eri Asakawa¹

¹ *Theory Group, KEK, Japan*

We study effects of heavy Higgs bosons on the top-pair production process at a photon linear collider. The interference patterns between the resonant Higgs-production amplitudes and the continuum QED amplitudes are examined. The patterns tell us the CP

nature of the Higgs bosons. We show that the above interference patterns of the production amplitudes can be studied by observing top decay angular distributions.

Machine Detector Interface / 161

The E166 experiment: Development of a polarized positron source for the ILC.

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The full exploitation of the physics potential of an International Linear Collider (ILC), will require the development of polarized positron beams. Having both positron and electron beams polarized will be a decisive improvement for many physics studies in the linear collider, providing new insight into structures of couplings and thus access to the physics beyond the standard model. The concepts discussed for a polarized positron source are based on circularly polarized photon sources. Those photons are then converted in a relatively thin target to generate longitudinally polarized positrons and electrons. Two different approaches have been developed to test for the first time a polarized positron source. While in an experiment at KEK a Compton back scattering is used, the E166 experiment uses a one meter long helical undulator in a 46.6 GeV electron beam to produce MeV photons with a high degree of circular polarization at 8.3 MeV. Beside the development of the helical undulator, the most challenging part in E166 is to measure the positron polarization using Compton transmission polarimetry. The expected asymmetries for both photons and positrons are about 3.4% and 1% respectively. The E166 experiment had two successful run periods in June and September 2005. The data analysis shows an asymmetry in the expected range for both photons and positrons. With this experimental confirmation, the helical undulator method became a preferred candidate for an ILC polarized positron source.

Higgs and EWSB / 162

Higgs self coupling measurements in the fusion channel

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We investigate the double Higgs production process at the ILC, focusing on the measurement of the trilinear self coupling of the Higgs boson in the fusion channel. The sensitivity of this measurement is discussed in the Higgs mass range 140-200 GeV at a center of mass energy between 1 TeV to 1.5 TeV.

New Physics at TeV Scale and Precision Electroweak / 163**Higher Curvature Effects in the ADD and RS models****Author:** Tom Rizzo¹¹ *SLAC*

Abstract not available

New Physics/Top and QCD / 164**Probes of Gravitational Interactions****Author:** JoAnne Hewett¹¹ *SLAC*

No abstract available

DCR - Physics / 165**DCR Electroweak and BSM****Author:** Yasuhiro Okada¹¹ *KEK***Corresponding Author:** klaus.moenig@cern.ch

Discussion on the DCR Electroweak and BSM

DCR - Physics / 166**DCR on SUSY****Corresponding Author:** abdelhak.djouadi@cern.ch

DCR SUSY section will be discussed

DCR - Physics / 167**DCR Higgs physics****Author:** Klaus Moenig¹¹ *DESY Zeuthen*

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Discussion on DCR on Higgs Physics

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Discussion on DCR SUSY/Cosmological Connection part

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Discussion on DCR SUSY part

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Virtual Observatory: India

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The concept of virtual observatories has recently emerged to enable astronomers to deal with the management, analysis, visualization and mining of vast quantities of astronomical data. The task is difficult because of the diversity of data obtained at different wavelengths and the very different techniques used in the analysis. There is the need to develop data formats, interoperability standards, registries, data bases, and tools for exploring and using the multiwavelength and multiscale data. This is being done through large and small virtual observatory programmes based in several countries, and federated under the International Virtual Observatory Alliance.

I will describe in my talk the virtual observatory concept, and the developments which have taken place over the last few years under that banner. I will particularly consider the applications developed by the Virtual Observatory - India project, through an innovative and highly productive collaboration between astronomers and professionals from the information technology industry, and plans for future work.

The tools and techniques developed by virtual observatory programmes can be useful in any field where large amounts of data are used, like high energy physics, remote sensing, population studies and bioinformatics. I will describe some possible applications outside astronomy, and the great scope which exists for interactions between people working in completely different disciplines.

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Discussion of the DCR physics chapter

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Issues and challenges for the T/DAQ

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Concepts DOD T/DAQ report

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Reports for all 4 concepts: GLD, SiD, LDC, 4th

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Very Forward Calorimeter readout and machine interface

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VERY Forward Calor and machine feedback

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Machine and Controls aspects

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DCS for ALICE TPC

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Machine and Controls aspects

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Idea for 100 MHz DC-DC Converter in 4 Tesla Field

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Systematic limitations to luminosity determination in the LumiCal acceptance from beam-beam effects

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A way to determine luminosity at ILC is to measure Bhabha scattering in the LumiCal. For physics requirements, one needs to reach a precision of 10^{-4} for the luminosity determination and thus the Bhabha cross section. Whereas studies on theoretical uncertainties on the cross section and on mis-identified Bhabhas in the LumiCal are fully performed, bias on Bhabha measurement due to beam-beam effect has never been investigated before. Using GUINEA-PIG, we start to study how electromagnetic deflections due to beam-beam effect play a non negligible role on the Bhabha angular distribution.

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Event selection strategies

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Event selection strategies. How to separate the difficult physics channels from background.

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Cosmic trigger discussion

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Do we need it? What are the implications? How to implement it?

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Instrumentation standards

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SILC subsystem

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Higgs/Top and QCD/Gamma-Gamma / 187

Use of highly polarized electrons

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The access to the purest initial state is possible by use of two highly polarized electrons. We give an up-to-date review of where we stand in this effort - including its accessibility in the context of its basic compatibility with the beamline and detector used for e^+e^- - initiated interactions.

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GDE Design and Cost Board Meeting

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GLD Meeting

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Welcome

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CALICE ECAL Status and Prospects

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CALICE 1 sq. cm Granularity ECAL Prototype Testbeam and Results

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Dedicated Front-end Electronics and PCBs for ILC W-Si Electromagnetic Calorimeter Technologic Prototype

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CALICE Scintillator HCAL Project Overview

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CALICE Scintillator HCAL Prototype Commissioning and Calibration

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The Production of Scintillator

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Systematic study of Small Scintillators for New Sampling Calorimeter

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Calorimetry and Muons / 200**Gas Calorimetry**

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Calorimetry and Muons / 201**Preliminary Results from INO Detector R & D Programme**

India-based Neutrino Observatory (INO) collaboration is proposing a large magnetized iron tracking calorimeter of total weight 50 kton, using atmospheric neutrinos as source. The proposed detector will have a modular structure of lateral size 48 m¹⁶ m and will consist of a stack of 140 layers of 6cm thick iron plates interleaved with Resistive Plate Chamber (RPC) detector layers. A total of about 27, 000 RPCs of dimension 2mX2m will be needed for his experiment. A dedicated effort for development of RPC detectors, leading to their large scale production is in progress.

A large number of single gap glass RPCs of area 3030 cm² as well as a few of area 12090 cm² were developed, using glass procured from local market. The V-I characteristics of these detectors were studied. The noise rate was found to be a reliable way of monitoring the stability of the RPC. Plateau efficiencies of over 90% for various gas mixtures have been obtained for minimum ionizing particles. Measurements of the charge linearity and time response of the RPC as a function of applied high voltage have been made. The typical time resolution of the RPCs when operated in the operating voltage plateau is about 1.2 nSec. We have also built a couple of chambers using glass imported from Japan. These chambers are now in undergoing a long term stability tests and are in continuous operation for about six months.

We have setup a second RPC test station during the past few months. This is equipped with a sophisticated gas mixing, telescope and data acquisition systems. The gas unit is capable of mixing four input gases in the desired proportion and flow through 16 channels. We are currently operating a stack of 10 RPCs of one square foot in area in the streamer mode in this station. Triggered by a scintillation paddle based telescope, we are able to track cosmic ray muons and record their timing, using this stack.

We will a give summary of earlier results and discuss current status and future directions of this detector R & D programme.

Calorimetry and Muons / 202**Evolution of the Dual-Readout Calorimeter**

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Test Beams / 203**FNAL Testbeam Facility**

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Testbeam Status and Plans for Calorimetry and Muons

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EUDET Testbeam Infrastructure for Tracking R & D

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Testbeam Plans for Forward Instrumentation

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MDI Overview

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IR Design for GLD

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IR Design for LDC

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IR Design for SiD

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Discussion on IR Designs

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Discussion on gamma-gamma Option

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Discussion on 1 IR versus 2 IR

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Machine Detector Interface / 215

Discussion on Detector Background Tolerances

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ILC Beam Tests in End Station A

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BeamCal Performance for Different ILC Detector Concepts

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Machine Detector Interface / 219

Physics Data for Detector Calibration at $E_{cm}=91$ and 500 GeV

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The ATF Laser Wire System

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Laser Requirements

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ILC Simulation using BDSIM

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First Estimate of Backgrounds

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ACFA - ALCSC Meeting

History of LC / 225

History of LC

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An ECAL for the SiD Detector

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UCL calorimeter january meeting report

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GLD calorimeter

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Summary of the EUDET kick off meeting

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Global Design Effort / 230

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Layout of the Photon Collider at the ILC

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A Study of Delta[g(HHH)] vs. Jet Energy Resolution

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