International Workshop on Future Linear Colliders, LCWS2024

Report of Contributions

https://agenda.linearcollider.org/e/lcws2024
Preliminary Investigation of a Higgs Factory based on Proton-Driven Plasma Wakefield Acceleration

A Higgs Factory is considered the highest priority next collider project by the high-energy physics community. Very advanced designs based on radio-frequency cavities exist, and variations on this approach are still being developed. Recently, also an option based on electron-bunch driven plasma wakefield acceleration has been proposed. In this article, we discuss a further option based on proton-driven plasma wakefield acceleration. This option has significant potential advantages due to the high energy of the plasma wakefield driver, simplifying the plasma acceleration stage, and due to the breadth of particle physics research it will make possible. Its success will depend on further developments in producing compact high-energy proton bunches at a high rate.

Apply for poster award

Primary author: FARMER, John Patrick (Max Planck Society (DE))
Co-authors: PUKHOV, Alexander; CALDWELL, Allen Christopher (Max Planck Society (DE))
Presenter: FARMER, John Patrick (Max Planck Society (DE))
Session Classification: Parallel
Track Classification: Accelerator: Advanced Accelerator Concepts
Exploring the Electromagnetically Interacting Dark Matter at the International Linear Collider

Dark Matter being electrically neutral does not participate in electromagnetic interactions at leading order. However, we discuss here fermionic dark matter (DM) with permanent magnetic and electric dipole moment that interacts electromagnetically with photons at loop-level through a dimension-5 operator. We discuss the search prospect of the dark matter at the proposed International Linear Collider (ILC) and constrain the parameter space in the plane of the DM mass and the cutoff scale $\Lambda$. At the 500 GeV ILC with $4 \text{ab}^{-1}$ of integrated luminosity we probed the mono-photon channel and utilizing the advantages of beam polarization we obtained an upper bound on the cutoff scale that reaches up to $\Lambda = 3.72 \text{ TeV}$.

Apply for poster award

Yes

Primary author:  KUMAR SHARMA, MANISH (Birla Institute of Technology and Science pilani, Goa Campus)

Presenter:  KUMAR SHARMA, MANISH (Birla Institute of Technology and Science pilani, Goa Campus)

Session Classification:  Poster

Track Classification:  Physics and Detector: BSM, Global Interpretations
The top quark EW couplings in the SMEFT

The electro-weak couplings of the top quark are directly accessible in rare "top+X" production processes at the LHC, where top quark pairs or single top quark are produced in associations with bosons. We present a new analysis of the top sector of the Standard Model EFT. The fit is based on a fully NLO parameterization and includes the most recent (differential) results from ATLAS and CMS. We show that run 2 of the LHC allows, for the first time, to overconstrain the qqtubar and two-fermion operator coefficients and yields competitive bounds. We compare the current bounds to projections for the HL-LHC and future lepton colliders, that can yield powerful constraints.

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Primary authors:  Dr CORNET, Fernando (Case Western Reserve); VOS, Marcel (IFIC (UVEG/CSIC) Valencia); MIRALLES LOPEZ, Marcos (Univ. of Valencia and CSIC (ES)); Dr MORENO LLACER, Maria (IFIC, (CSIC - Univ. of Valencia)); MIRALLES, Victor (INFN Roma1)

Presenter:  Dr CORNET, Fernando (Case Western Reserve)

Session Classification:  Parallel

Track Classification:  Physics and Detector: Top quark, QCD, Flavour, Precision Modelling
Opening remarks

Monday, 8 July 2024 09:00 (10 minutes)

Session Classification: Plenary
Physics case for Higgs and Electroweak precision

Monday, 8 July 2024 09:10 (20 minutes)

Apply for poster award

Presenter: DE BLAS MATEO, Jorge (Universidad de Granada (ES))
Session Classification: Plenary
Contribution ID: 24

Type: not specified

ILC status

Monday, 8 July 2024 09:30 (12 minutes)

Apply for poster award

Presenter: NAKADA, Tatsuya (EPFL - Ecole Polytechnique Federale Lausanne (CH))
Session Classification: Plenary
Contribution ID: 25

Type: Oral presentation (in person)

CLIC status

Monday, 8 July 2024 09:42 (12 minutes)

Presenter: STAPNES, Steinar (CERN)

Session Classification: Plenary
Status of the C3 R&D

Monday, 8 July 2024 09:54 (12 minutes)

Presenter: VERNIERI, Caterina (SLAC National Accelerator Laboratory (US))
Session Classification: Plenary
Physics case for e+e- at 500 GeV and above

Presenter: WEIGLEIN, Georg Ralf (Deutsches Elektronen-Synchrotron (DE))
Session Classification: Plenary
HALHF status

Monday, 8 July 2024 11:00 (12 minutes)

Presenter:  FOSTER, Brian (University of Oxford (GB))
Session Classification:  Plenary
Contribution ID: 29

Type: not specified

XCC status

Monday, 8 July 2024 11:12 (12 minutes)

Presenter: BARKLOW, Tim (SLAC National Accelerator Laboratory (US))

Session Classification: Plenary
CEPC status

Monday, 8 July 2024 11:36 (12 minutes)

Presenter:  GAO, Jie (IHEP)
Session Classification:  Plenary
FCCee status

**Presenter:** BENEDICT, Michael (CERN)

**Session Classification:** Plenary
Muon collider status

Monday, 8 July 2024 12:00 (12 minutes)

Presenter: SCHULTE, Daniel (CERN)
Session Classification: Plenary
Higgs Factory detector R&D

Monday, 8 July 2024 12:12 (20 minutes)

**Presenter:** RAJAGOPALAN, Srini (Brookhaven National Laboratory (US))

**Session Classification:** Plenary
Contribution ID: 34  
Type: Oral presentation (in person)

ITN: accelerator developments

Monday, 8 July 2024 14:00 (15 minutes)

Presenter:  MICHIZONO, Shinichiro (KEK)
Session Classification:  Accelerator Plenary
Contribution ID: 35  
Type: not specified

**CLIC: accelerator developments**

*Monday, 8 July 2024 14:15 (15 minutes)*

**Presenter:** BURROWS, Philip

**Session Classification:** Accelerator Plenary
C3: accelerator developments

Monday, 8 July 2024 14:30 (15 minutes)

Presenter: DHAR, Ankur (SLAC National Accelerator Lab)
Session Classification: Accelerator Plenary
CEPC: accelerator developments

Monday, 8 July 2024 14:45 (15 minutes)

Presenter: LI, yuhui

Session Classification: Accelerator Plenary
FCCee: accelerator developments

Presenter: ZIMMERMANN, Frank (CERN)
Session Classification: Accelerator Plenary
ECFA Higgs-EW-top factory study

Monday, 8 July 2024 14:00 (15 minutes)

Presenter: ROBSON, Aidan (University of Glasgow (GB))
Session Classification: Physics & Detector plenary
Physics highlight 1, experimental challenges

Monday, 8 July 2024 14:15 (15 minutes)

Session Classification: Physics & Detector plenary
Contribution ID: 41

Type: Oral presentation (in person)

Physics highlight 2, experimental challenges

Monday, 8 July 2024 14:30 (15 minutes)

Session Classification: Physics & Detector plenary
Beyond collider experiments at a Linear Collider

Monday, 8 July 2024 14:45 (15 minutes)

Presenter: SAKAKI, Yasuhiro (KEK)
Session Classification: Physics & Detector plenary
Highlights from LHC detector upgrades

Monday, 8 July 2024 15:00 (15 minutes)

Presenter: BROOIJMANS, Gustaaf (Columbia University)
Session Classification: Physics & Detector plenary
Highlights from detectors for EIC

Monday, 8 July 2024 15:15 (15 minutes)

Presenter: GUNJI, Taku (University of Tokyo (JP))
Session Classification: Physics & Detector plenary
Communication

Thursday, 11 July 2024 14:00 (15 minutes)

Presenter:  TAKAHASHI, Rika (KEK)
Session Classification:  Plenary
Strategy in Europe

Session Classification: Plenary
Strategy in the US (tbc)

Thursday, 11 July 2024 14:30 (15 minutes)

Presenter: PATWA, Abid (DOE)

Session Classification: Plenary
Strategic in Japan

Thursday, 11 July 2024 14:45 (15 minutes)

Presenter: NAKAYA, Tsuyoshi (Kyoyo U.)

Session Classification: Plenary
Global Strategy - ICFA view

Thursday, 11 July 2024 15:00 (15 minutes)

**Presenter:** CAMPANA, Pierluigi (INFN e Laboratori Nazionali di Frascati (IT))

**Session Classification:** Plenary
New Technologies for Higgs Factory Detectors

Thursday, 11 July 2024 16:00 (25 minutes)

Presenter: DEMARTEAU, Marcel (Oak Ridge National Laboratory)
Session Classification: Plenary
Physics Vision

Thursday, 11 July 2024 16:25 (25 minutes)

Presenter:  MURAYAMA, Hitoshi (University of California Berkeley (US))
Session Classification:  Plenary
Vision for a Linear Collider Facility

Thursday, 11 July 2024 16:50 (25 minutes)

Presenters:  LIST, Jenny (Deutsches Elektronen-Synchrotron (DE));  STAPNES, Steinar (CERN)

Session Classification:  Plenary
Contribution ID: 53  Type: not specified

Poster awards

Thursday, 11 July 2024 17:15 (5 minutes)

Session Classification: Plenary
Closing

Thursday, 11 July 2024 17:20 (10 minutes)

Session Classification: Plenary
Energy recovery at a Linear Collider

Monday, 8 July 2024 11:24 (12 minutes)

Presenter: LITVINENKO, Vladimir

Session Classification: Plenary
Probing GHU models at the ILC with di-quark AFB at c.m.e. above the Z mass

We discuss the experimental prospects for measuring differential observables in b-quark and c-quark pair production at the International Linear Collider (ILC) baseline energies, 250 and 500 GeV. The study is based on full simulation and reconstruction of the International Large Detector (ILD) concept. Two gauge-Higgs unification models predicting new high-mass resonances beyond the Standard Model are discussed. These models predict sizable deviations of the forward-backward observables at the ILC running above the mass and with longitudinally polarized electron and positron beams. The capability of the ILC to probe these models via high-precision measurements of the forward-backward asymmetry is discussed. Alternative scenarios at other energies and beam polarization schemes are also discussed, extrapolating the estimated uncertainties from the two baseline scenarios.

Primary authors: IRLES, Adrian (IFIC (CSIC/UV) Valencia); SAIBEL, Andrej (Univ. of Valencia and CSIC (ES)); RICHARD, Francois; Prof. YAMAMOTO, Hitoshi; MÁRQUEZ HERNÁNDEZ, Jesús P. (IFIC (CSIC/UV)); YAMATSU, Naoki; POESCHL, Roman (Université Paris-Saclay (FR))

Presenter: IRLES, Adrian (IFIC (CSIC/UV) Valencia)

Session Classification: Parallel

Track Classification: Physics and Detector: BSM, Global Interpretations
Investigating hidden sectors at future e+e- colliders through two-particle angular correlations

Exploring long-range angular correlations among emitted particles in high-energy collisions provides an opportunity to uncover physics beyond the Standard Model like Hidden Valley (HV) models. We focus on a hidden QCD-like sector, where the interplay between HV matter and QCD partonic cascades could enhance azimuthal correlations between final-state particles. Our investigation, performed at detector level, specifically targets the detectability of these phenomena at future e+e-colliders, yielding a cleaner experimental signature as compared to the Large Hadron Collider (LHC). Remarkably, the observation of ridge structures in the two-particle correlation function may suggest the existence of New physics.

Primary authors: IRLES, Adrian (IFIC (CSIC/UV) Valencia); SARKISYAN-GRINBAUM, Edward (CERN and Texas U., Arlington); MUSUMECI, Emanuela (Univ. of Valencia and CSIC (ES)); CORREDOIRA, Imanol (Universidade de Santiago de Compostela (ES)); SANCHIS-LOZANO, Miguel-Angel (IFIC-University of Valencia); Dr PÉREZ-RAMOS, Redamy (IPSA/LPTHE); MITSOU, Vasiliki (Univ. of Valencia and CSIC (ES))

Presenter: MUSUMECI, Emanuela (Univ. of Valencia and CSIC (ES))

Session Classification: Parallel

Track Classification: Physics and Detector: BSM, Global Interpretations
Stau searches at future e+e- colliders

The future e+e- colliders offer excellent facilities for SUSY searches. The stau, superpartner of the tau-lepton, is one of the most interesting particles for these searches, being likely the lightest of the sfermions, first one that could be observed, and it can be regarded as the worst and thus most general scenario for the searches.

The prospects for discovering stau-pair production at future e+e- factories and the resulting detector requirements will be discussed. The study takes the ILD detector concept and ILC parameters at 500 GeV as example. It includes all SM as well as beam induced backgrounds. It shows that with the chosen accelerator and detector conditions, SUSY will be discovered if the NLSP mass is up to just a few GeV below the kinematic limit of the collider.

Expectations for another accelerator and detectors conditions are derived. In particular the role of the hermeticity of the detector and of the ability to operate trigger-less will be discussed.

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Primary authors: LIST, Jenny (Deutsches Elektronen-Synchrotron (DE)); NUNEZ PARDO DE VERA, Maria Teresa; BERGGREN, Mikael (Deutsches Elektronen-Synchrotron (DE))

Presenter: NUNEZ PARDO DE VERA, Maria Teresa

Session Classification: Parallel

Track Classification: Physics and Detector: BSM, Global Interpretations
The first Southern Hemisphere X-band Laboratory for Accelerators and Beams (X-LAB) has been commissioned at the University of Melbourne. One of the key projects within this laboratory involves repurposing half of the CERN X-band test stand XBOX3, now known as Mel-BOX. This initiative aims to validate the performance of high-gradient travelling wave accelerating structures, crucial for the Compact Linear Collider (CLIC) beam-based acceleration baseline, operating at a frequency of 12 GHz.

To assess the structures’ performance under high peak power and short pulse width RF conditions, two klystron-based test facilities have been operationalised for this year. Similar to XBOX3, Mel-BOX adopts an innovative approach to combine high average power klystron units, facilitating power distribution to two testing slots with a repetition rate of up to 400 Hz. Additionally, the parameters such as repetition rate, peak power, pulse length, and pulse shape can be tailored to meet specific testing requirements. This novel method of generating high-power, high-repetition RF pulses holds promise for various applications necessitating multiple test slots.

Moreover, there are plans to leverage this technology as a foundation for developing compact accelerators tailored for medical or university applications, including radiotherapy and compact light sources.

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**Primary author:** VOLPI, Matteo (University of Melbourne (AU))

**Presenter:** VOLPI, Matteo (University of Melbourne (AU))

**Track Classification:** Accelerator: Normal Conducting RF
Prospects for constraining light-quark electroweak couplings at Higgs factories

Electroweak Precision Measurements are stringent tests of the Standard Model and sensitive probes to New Physics. Accurate studies of the Z-boson couplings to the first-generation quarks could reveal potential discrepancies between the fundamental theory and experimental data. Future e+e- colliders running at the Z pole and around the ZH threshold would be an excellent tool to perform such a measurement, unlike the LHC where hadronic Z decays are only available in boosted topologies. The measurement is based on comparison of radiative and non-radiative hadronic decays. Due to the difference in quark charge, the relative contribution of the events with final-state radiation (FSR) directly reflects the ratio of decays involving up- and down-type quarks. Such an analysis requires proper modeling and statistical discrimination between photons coming from different sources, including initial-state radiation (ISR), FSR, parton showers and hadronisation. In our contribution, we show how to extract the values of the Z couplings to light quarks and present the estimated uncertainties of the measurement.

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Primary authors: ZARNECKI, Aleksander Filip (University of Warsaw); JEANS, Daniel; TIAN, Junping (University of Tokyo); REUTER, Jürgen (DESY Hamburg, Germany); MEKALA, Krzysztof

Presenter: MEKALA, Krzysztof

Session Classification: Parallel

Track Classification: Physics and Detector: Top quark, QCD, Flavour, Precision Modelling
Cavity tuner development for the ITN cryomodule at KEK

In this contribution we report on the development of a cavity tuner for a cryomodule, which is being developed and will be built and tested in the scope of the International Linear Collider (ILC) Technology Network (ITN) at KEK until 2027. We have simulated Lorentz-force detuning of the according SRF 1.3 GHz 9-cell TESLA-type cavities to understand the tuner requirements better. As a base of the ITN cavity tuner design the LCLS-II double-lever tuner was selected. In a collaboration with Fermilab we have tested the LCLS-II tuner on an LCLS-II cavity at room temperature and atmospheric pressure. Based on the gained experience, design adjustments are being considered. Slow and fast tuner driving electronics were partially selected.

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Primary author: Dr OMET, Mathieu (High Energy Accelerator Research Organization (KEK))

Co-authors: YAMAMOTO, Akira; Dr KUMAR, Ashish (KEK); Mr CONTRERAS-MARTINEZ, Crispin (FNAL); UMEMORI, Kensei (KEK); DOHMAE, Takeshi; YAMAMOTO, Yasuchika (KEK); PISCHALNIKOV, Yuriy (FNAL)

Presenter: Dr OMET, Mathieu (High Energy Accelerator Research Organization (KEK))

Track Classification: Accelerator: Superconducting RF
Status of BSM searches at ATLAS including some future prospects at HL-LHC

Despite successfully predicting the outcome of hundreds of measurements at colliders and other experiments, the standard model of particle physics cannot be the final theory of nature. Searches for beyond-the-standard model (BSM) physics are now a major component of the research program at the ATLAS and CMS experiments at the Large Hadron Collider (LHC). This talk presents highlights of BSM searches at the LHC, including dark matter, long-lived particles, heavy resonances, leptoquarks, supersymmetric particles, BSM decays of SM particles, and other exotic phenomena. Experimental methodologies, sophisticated analysis tools including machine learning, experimental results, and phenomenological interpretations including Effective Field Theories are presented.

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Primary author: BELLERIVE, Alain (Carleton University (CA))
Presenter: BELLERIVE, Alain (Carleton University (CA))
Session Classification: Parallel

Track Classification: Physics and Detector: BSM, Global Interpretations
Top quark flavor changing neutral currents at future linear colliders

In this talk, I will discuss the potential discovery of top quark flavor changing neutral current (FCNC) at future linear colliders (LCs). First, I will discuss the theoretical predictions in a class of simplified dark matter models where the rates of top quark FCNC decays are generated by dark-sector particles. I will then discuss the sensitivity of the LCs on the top quark FCNC for some channels and some benchmark center-of-mass energies.

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Primary authors: JUEID, Adil (Institute for Basic Science); Prof. KANEMURA, Shinya (Osaka University)

Presenter: JUEID, Adil (Institute for Basic Science)

Session Classification: Parallel

Track Classification: Physics and Detector: Top quark, QCD, Flavour, Precision Modelling
HNL at e+e- colliders

Neutrinos can be a key to solving several cosmological problems, such as the mystery of the baryon-antibaryon asymmetry in the universe or the origin of dark matter. The existence of their heavier partners, the so-called heavy neutral leptons (HNL), is a well-motivated scenario which could also contribute to explaining the mass-generation mechanism for light neutrinos. Future lepton colliders, including e+e- linear machines, will offer the farthest discovery reach for these particles and allow for studying their features, probing the lepton-flavour universality and constraining their Dirac or Majorana nature. In this talk, we will show how to look for HNL with masses above the Z-pole at future lepton colliders and answer the fundamental questions concerning their properties.

Apply for poster award

Primary authors: ZARNECKI, Aleksander Filip (University of Warsaw); REUTER, Jürgen (DESY Hamburg, Germany); MEKALA, Krzysztof

Presenter: MEKALA, Krzysztof

Session Classification: Parallel

Track Classification: Physics and Detector: BSM, Global Interpretations
"Here be SUSY" - Prospects for SUSY searches at future colliders

Some say SUSY is dead, because LHC has not discovered it yet. But is this really true? It turns out that the story is more subtle. SUSY can be 'just around the corner', even if no signs of it has been found and a closer look is needed to quantify the impact of LHC limits and their implications for future colliders. Here, a scan of the relevant parameter space of (weak-scale) SUSY parameters, is presented.

I concentrate on properties relevant to evaluate the experimental prospects: mass differences, lifetimes and decay-modes. The observations are then confronted with estimated experimental capabilities.

I have considered what can be expected from (HL-)LHC, where it turns that large swaths of SUSY parameter space will be hard to access. For e+e- colliders, the situation is simple: at such colliders, SUSY will be either discovered or excluded almost to the kinematic limit.

Apply for poster award

**Primary author:** BERGGREN, Mikael (Deutsches Elektronen-Synchrotron (DE))

**Presenter:** BERGGREN, Mikael (Deutsches Elektronen-Synchrotron (DE))

**Session Classification:** Parallel

**Track Classification:** Physics and Detector: BSM, Global Interpretations
Update on CARIE high gradient photocathode test stand at LANL

This talk will report on the status of commissioning of the Cathodes And Radio-frequency Interactions in Extremes (CARIE) high gradient C-band RF photoinjector test stand at Los Alamos National Laboratory. We are assembling and testing the high gradient photoinjector capable of producing electric fields at the cathodes up to 250 MV/m. The photoinjector will be powered by a 50 MW, 5.712 GHz Canon klystron. The klystron was delivered to LANL in July of 2023, installed, and commissioned. The waveguide line from the klystron goes through a high-power circulator into a concrete vault that is rated to provide radiation protection for electron beams with beam power up to 20 kW. The all-copper photoinjector was fabricated, tuned, and is awaiting high gradient testing. The second version of the photoinjector will be built with replaceable high quantum-efficiency cathodes to test behavior of advanced photocathode materials at high gradients. Adding capability to operate the photoinjector at cryogenic temperatures is considered. The status of the facility and its high-power operation and plans for photocathode testing will be presented.

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Primary author: SIMAKOV, Evgenya (LANL)
Co-authors: ALEXANDER, Anna (LANL); RAI, Deepak (LANL); XU, Haoran (LANL); ZUBORAJ, Muhammed (LANL); ANISIMOV, Petr (LANL); GRUMSTRUP, Torben (LANL); HAYNES, William B. (LANL)
Presenter: SIMAKOV, Evgenya (LANL)

Track Classification: Accelerator: Normal Conducting RF
X-band activities for the EuPRAXIA@SPARC_LAB Linac

Over recent years, significant efforts have been dedicated to validating the reliability and functionality of X-band technology at extremely high peak fields and accelerating gradients to achieve the realization of increasingly compact linacs. The Eupraxia@SPARC_LAB project entails the development of a 1 GeV Linac utilizing a X-band booster comprising 16 accelerating structures operating at a nominal gradient of 60 MV/m. At the Frascati laboratories of INFN (LNF) in the last year various X-band RF components essential for the Eupraxia Linac have been developed and have been tested at nominal peak power conditions. This was made possible thanks to the use of the TEX test facility devoted specifically for the development and testing of RF devices and accelerating structures in the X-band. Recently, the first RF prototype of X-band accelerating structure designed at LNF has been manufactured and tested at high power. This report presents the results of the latest tests conducted at TEX and the preliminary results of the conditioning of the first accelerating structure prototype for the EuPRAXIA@SPARC_LAB project.

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Primary author: CARDELLI, Fabio
Co-authors: LIEDL, Andrea; BUONOMO, Bruno; DI GIULIO, Claudio; ALESINI, David; DI PASQUALE, Enrico; DI RADDÒ, Gianluca (INFN-LNF); LATINI, Giulia; PIERSANTI, Luca (INFN-LNF); DIOMEDE, Marco; PIOLI, Stefano; LOLLO, Valerio (INFN-LNF)
Presenter: CARDELLI, Fabio
Track Classification: Accelerator: Normal Conducting RF
Application of laser-plasma accelerators to future linear colliders

Laser-driven plasma accelerators have demonstrated ultra-high accelerating gradients, offering the potential to reduce the size and cost of a future energy-frontier linear collider. In this presentation, I will discuss the design considerations for the application of laser-driven plasma-based accelerator technology to a multi-TeV linear collider. Plasma accelerators naturally accelerate short bunches using large longitudinal and transverse wakefields in plasma, and this presents unique beam dynamics challenges. I will discuss several of these challenges, including staging laser-plasma accelerators, scattering with background plasma, and beam transverse stability. Key to the realization of the collider application is the development of high average and high peak power laser systems, operating with high efficiency. Coherent combination of fiber lasers is a promising solution to achieve high average and high peak power lasers suitable for high-energy physics applications, and I will describe recent progress and outline the R&D path toward a collider based on laser-plasma accelerator technology.

Apply for poster award

Primary author: SCHROEDER, Carl (LBNL)
Co-authors: BENEDETTI, Carlo (LBNL); OSTERHOFF, Jens (LBNL); NAKAMURA, Kei (LBNL); ESAREY, Eric (LBNL)
Presenter: SCHROEDER, Carl (LBNL)
Session Classification: Parallel
Track Classification: Accelerator: Advanced Accelerator Concepts
Prospects for light exotic scalar measurements at the e+e- Higgs factory.

The physics program of the Higgs factory will focus on measurements of the 125 GeV Higgs boson, with the Higgs-strahlung process being the dominant production channel at 250 GeV. However, production of extra light scalars is still not excluded by the existing experimental data, provided their coupling to the gauge bosons is sufficiently suppressed. Fermion couplings of such a scalar could also be very different from the SM predictions leading to non-standard decay patterns. Considered in the presented study is the feasibility of direct light scalar observation at future Higgs factory experiments assuming different decay channels.

Apply for poster award

Primary author: ZARNECKI, Aleksander Filip (University of Warsaw)

Co-authors: BRUDNOWSKI, Bartlomiej (Faculty of Physics, University of Warsaw); ZEMBACZYN-SKI, Kamil (Faculty of Physics, University of Warsaw)

Presenter: ZARNECKI, Aleksander Filip (University of Warsaw)

Session Classification: Parallel

Track Classification: Physics and Detector: BSM, Global Interpretations
Development of a half-meter scale Traveling-Wave (TW) SRF cavity

While a demonstration of TW resonance excitation in the 3-cell structure in 2K liquid helium had been prepared and carried out at Fermilab in collaboration with Euclid Techlabs, the RF design process of 0.5–1 meter scale TW cavity was begun at Fermilab as the next step of TW development towards an accelerator-scale one. Considering the physical dimensions of existing SRF facilities (for fabrication, processing, and cryogenic testing), Fermilab has proposed a half-meter scale TW RF design consisting of a 7-cell structure and a power feedback waveguide (WG) loop. The WG loop design includes the new RF configurations for TW resonance control during a high-power operation. 1-year US-Japan collaboration program focused on EBW optimization for the TW shape iris joint within the narrow gap was awarded and the efforts had been made by KEK, Jlab, and Fermilab. 1-year LDRD program of Fermilab is awarded recently to fabricate a low-cost mockup of the WG loop with new RF configurations and validate them. Here we will present a preliminary 7-cell TW RF design and report the progress and challenges through the awarded programs.

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**Primary author:** Dr FURUTA, Fumio (Fermilab)  
**Co-author:** MCGEE, Kellen (Fermilab)  
**Presenter:** Dr FURUTA, Fumio (Fermilab)  
**Track Classification:** Accelerator: Superconducting RF
Streamlined jet tagging network assisted by jet prong structure

Attention-based transformer models have become increasingly prevalent in collider analysis, offering enhanced performance for tasks such as jet tagging. However, they are computationally intensive and require substantial data for training. In this paper, we introduce a new jet classification network using an MLP mixer, where two subsequent MLP operations serve to transform particle and feature tokens over the jet constituents. The transformed particles are combined with subjet information using multi-head cross-attention so that the network is invariant under the permutation of the jet constituents. The network structure is closely related to the multiscale nature of HEP events.

The proposed network demonstrates comparable classification performance to state-of-the-art models while boosting computational efficiency drastically. The network structure can be applied to the various collider processes.

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**Primary author:**  Prof. NOJIRI, Mihoko (IPNS, KEK)

**Co-author:**  Dr HAMMAD, Ahmed (KEK)

**Presenter:**  Prof. NOJIRI, Mihoko (IPNS, KEK)

**Session Classification:**  Parallel

**Track Classification:**  Physics and Detector: Software, Reconstruction, Computing
Distributed Coupling Linac for Efficient Acceleration of High Charge Electron Bunches

Future colliders will require injector linacs to accelerate large electron bunches over a wide range of energies. For example, the Electron Ion Collider requires a pre-injector linac from 4 MeV up to 400 MeV over 35 m. Currently, this linac is being designed with 3 m long traveling wave structures, which provide a gradient of 16 MV/m. We propose the use of a 1 m distributed coupling design as a potential alternative and future upgrade path to this design. Distributed coupling allows power to be fed into each cavity directly via a waveguide manifold, avoiding on-axis coupling. A distributed coupling structure at S-band was designed to optimize for shunt impedance and large aperture size. This design provides greater efficiency, thereby lowering the number of klystrons required to power the full linac. In addition, particle tracking analysis shows that this linac maintains lower emittance as bunch charge increases to 14 nC and wakefields become more prevalent. We present the design of this distributed coupling structure, as well as cold test data and plans for higher power tests to verify on the structure’s real world performance.

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Primary authors: DHAR, Ankur (SLAC National Accelerator Lab); NANNI, Emilio (SLAC National Accelerator Laboratory); WHITE, Glen (SLAC); BAI, Mei; OTHMAN, Mohamed; TANTAWI, Sami (SLAC); LI, Zenghai (SLAC)

Presenter: DHAR, Ankur (SLAC National Accelerator Lab)

Track Classification: Accelerator: Normal Conducting RF
Impact of NLO QCD on Key Physics Processes at Future Higgs Factories

The majority of Monte-Carlo (MC) simulation campaigns for future Higgs factories has so far been based on the leading-order (LO) matrix elements provided by Whizard 1.95, followed by parton shower and hadronization in Pythia6, using the tune of the OPAL experiment at LEP.

In this contribution, we test the next-to-leading-order (NLO) mode of Whizard. NLO events of $e^+e^- \rightarrow q\bar{q}$ and $e^+e^- \rightarrow \mu^+\mu^- b\bar{b}$ are generated by POWHEG matching, with parton shower and hadronization provided by Pythia8.

The NLO effect on hadron multiplicities and event shape variables of jets will be discussed and compared with MadGraph5 at hadron-level.

After passing the events through the full detector simulation of the International Large Detector concept as an example for a ParticleFlow-optimised detector, the jet energy resolution and typical kinematic quantities are compared between NLO and LO at reconstruction level.

A first assessment of which physics prospects of future $e^+e^-$ should be studied with NLO MC in the future will be given.

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Primary author: ZHAO, Zhijie (DESY)

Co-authors: LIST, Jenny (Deutsches Elektronen-Synchrotron (DE)); BERGGREN, Mikael (Deutsches Elektronen-Synchrotron (DE))

Presenter: ZHAO, Zhijie (DESY)

Session Classification: Parallel

Track Classification: Physics and Detector: Software, Reconstruction, Computing
Top mass measurement at the CEPC

The study is based on the publication of EPJC 83, 269 (2023). We present a study of top quark mass measurements at the $t\bar{t}$ threshold based on CEPC. A centre-of-mass energy scan near two times of the top mass is performed and the measurement precision of top quark mass, width and $\alpha_S$ are evaluated using the $t\bar{t}$ production rates. Realistic scan strategies at the threshold are discussed to maximise the sensitivity to the measurement of the top quark properties individually and simultaneously in the CEPC scenarios assuming a limited total luminosity of 100 fb$^{-1}$. With the optimal scan for individual property measurements, the top quark mass precision is expected to be 9 MeV, the top quark width precision is expected to be 26 MeV, and $\alpha_S$ can be measured at a precision of 0.00039. Taking into account the uncertainties from theory, background subtraction, beam energy and luminosity spectrum, the top quark mass can be measured at a precision of 14 MeV optimistically and 34 MeV conservatively at CEPC.

Apply for poster award

Primary authors: SUN, Xiaohu (Peking University); FANG, Yaquan (Chinese Academy of Sciences (CN))

Presenter: FANG, Yaquan (Chinese Academy of Sciences (CN))

Session Classification: Parallel

Track Classification: Physics and Detector: Top quark, QCD, Flavour, Precision Modelling
Finding kink signatures of LLPs in TPC at ILC

Some types of LLPs can be identified by kinked tracks. The Time Projection Chamber (TPC) being designed for ILD at ILC provides almost continuous tracking. This should give excellent potential for kink finding. I will review the current kink finder algorithm, and present a new kink finding method.

Apply for poster award

Primary author:  NAKAJIMA, Jurina (SOKENDAI/KEK)
Co-author:    JEANS, Daniel
Presenter:   NAKAJIMA, Jurina (SOKENDAI/KEK)
Session Classification: Parallel
Track Classification:  Physics and Detector: Software, Reconstruction, Computing
The fabrication of the 1.3 GHz single-cell cavity utilizing the different grain size niobium materials

As the part of research into the manufacturing methods for SRF cavities used in ILC (International Linear Collider), two 1.3 GHz single-cell cavities have been fabricated by utilizing fine and medium grain size niobium materials, respectively, with the same manufacturing equipment. The fine grain size niobium material typically exhibits a grain size level equivalent to ASTM 5-6, whereas the medium grain size corresponds to ASTM 0-3 levels. The forming of the half cell shapes has been conducted using the same deep drawing die and press machine. The machining for cavity part fabrication and the welding for assembly have been carried out using identical jigs and equipment. We present the fabrication processes and the test results for cavities in detail.

Apply for poster award

Primary author: Dr HAN, Junho (Kiswire Advanced Technology Co., Ltd.)

Co-authors: Mr PARK, Heesu (Kiswire Advanced Technology Co., Ltd.); Dr KANG, Seonghoon (Korea Institute of Materials Science); Prof. KO, Byeong-Rok (Korea University); Prof. KIM, Eun-San (Korea University)

Presenter: Dr HAN, Junho (Kiswire Advanced Technology Co., Ltd.)

Track Classification: Accelerator: Superconducting RF
Cryomodule Test Buncer for ITN

ITN is an acronym for "ILC Technology Network". It is an international framework for the technological development outlined in the Work Package (WP).

KEK plans to produce one cryomodule equipped with eight superconducting 9-cell cavities for WP1 and 2 from 2023 and perform performance measurements in 2027. A test facility will be required to perform the measurements.

We are preparing the cryogenics for the facility. The refrigerator (Linde LR280) currently operating at KEK will be dedicated to that. The helium transfer line was designed. The design was based on KEKB’s transport line design, but it was slightly modified because ILC does not use liquefied nitrogen for the radiation shield. The 2K refrigerator, purification filter, and other equipment are also considered. We will report on the status of those.

Apply for poster award

Primary author: NAKANISHI, Kota (KEK)
Co-authors: NAKAI, Hirotaka (KEK); Mr HARA, Kazufumi (KEK); Dr SHIMIZU, Hirotaka (KEK); Mr HONMA, Teruya (KEK); Ms KESSOKU, Shiori (KEK)
Presenter: NAKANISHI, Kota (KEK)
Track Classification: Accelerator: Superconducting RF
Long-lived particle searches with the ILD experiment

Future $e^+e^-$ colliders, with their clean environment and triggerless operation, offer a unique opportunity to search for long-lived particles (LLPs). Considered in this contribution are prospects for LLP searches with the International Large Detector (ILD) providing almost continuous tracking in Time Projection Chamber (TPC) as the core of its tracking systems. The ILD has been developed as a detector concept for the ILC, but is also applicable to other Higgs Factory options.

The considered signature for neutral LLP production is a highly displaced decay vertex, which we search for in the TPC. Based on the full detector simulation, we study decays of both light and heavy LLPs. For the heavy, $O(100 \text{ GeV})$ LLPs, the most challenging scenarios are those with a small mass splitting between LLP and the dark matter candidate, resulting in only a very soft displaced track pair in the final state, not pointing to the interaction point. As the opposite extreme scenario we consider the production of light, $O(1 \text{ GeV})$ pseudo-scalar LLP, which decays to two highly boosted and almost colinear displaced tracks. Backgrounds both from soft beam-induced processes and hard physical events are taken into account. Different tracking system design options and their impact on the LLP reconstruction are discussed.

Assuming a single displaced vertex signature, the limits on signal production cross-section are presented for a wide range of LLP lifetimes and a set of masses or mass splittings. These limits are to a large extent model-independent, reflecting kinematic properties of the considered signature. They can be used to set limits on particular models, also for more complex signatures involving displaced vertices.

Apply for poster award

Primary author: KLAMKA, Jan (University of Warsaw)
Co-authors: ZARNECKI, Aleksander Filip (University of Warsaw); JEANS, Daniel
Presenter: KLAMKA, Jan (University of Warsaw)
Session Classification: Parallel

Track Classification: Physics and Detector: BSM, Global Interpretations
Cold Copper High Gradient Single-Cell Structure Tests

We will present results from high gradient structure testing of C-band single-cell copper (Cu) and copper silver (CuAg) accelerating structures at 77 K. C-band accelerators have been of particular interest in recent years due to their ability to provide high gradients and transport high charge beams for applications ranging from colliders to medical technologies. These technologies are made possible by new advances in high gradient technologies that can suppress the breakdown rates by using distributed coupling, cryogenic cooling, and copper alloys. Previous work has shown each of these separately to significantly improve the maximum achievable gradient. In this work, for the first time, we combine all three methods in an ultra-high gradient structure and benchmark the difference between Cu and CuAg. These structures are tested at 77K simultaneously through a hybrid manifold while breakdown statistics were collected. In addition, we will show that at gradients exceeding 200 MeV/m the presence of significant beam loading caused a suppression in the quality factor as a function of time.

Apply for poster award

Primary authors: KRASNYKH, Anatoly; DHAR, Ankur; NANNI, Emilio (SLAC National Accelerator Laboratory); SCHNEIDER, Mitchell

Presenter: NANNI, Emilio (SLAC National Accelerator Laboratory)

Track Classification: Accelerator: Normal Conducting RF
Study of Majorana Right Handed Neutrino (RHN) production at ILC

We study Majorana Right Handed Neutrinos (RHN) production at ILC. Various extensions of the SM aim to explain the origin of the tiny neutrino mass; one of them is by the introduction of RHN. When we assume that RHN is a Majorana particle, RHN pair production is allowed in $e^−e^+$ collisions. We focus on this RHN pair production based on a minimal $U(1)_{B−L}$ model. A distinctive signature is a pair of same sign leptons, which is almost free of SM backgrounds.

In our study, we used full detector simulation to analyze RHN production at ILC. We generated this process, investigated its properties, developed reconstruction and selection strategies and evaluated the sensitivity at ILC. Considering full SM backgrounds, we derived exclusion limits on minimal $U(1)_{B−L}$ parameters at ILC.

Apply for poster award

Yes

Primary author: NAKAJIMA, Jurina (SOKENDAI/KEK)
Co-authors: DAS, Arindam (UA); JEANS, Daniel; FUJII, Keisuke; OKADA, Nobuchika (University of Alabama); YONAMINE, Ryo (KEK); Dr OKADA, Satomi (The University of Alabama)
Presenter: NAKAJIMA, Jurina (SOKENDAI/KEK)
Session Classification: Poster
Track Classification: Physics and Detector: BSM, Global Interpretations
Traveling Wave Demonstration in SRF Cavity With a Feedback Waveguide

Conventional SRF cavities are used in standing wave regime and are limited by surface fields to ~50 MV/m. In order to overcome this limit, Superconducting Traveling Wave (SCTW) cavity was proposed as it allows to achieve ~1.5 times higher accelerating gradient operating at lower phase advance per cell, thus improving transit time factor. However, power recirculation through a feedback waveguide is required to maintain cavity efficiency. Funded by the U.S. Department of Energy’s SBIR program, Euclid Techalbs, in collaboration with Fermilab, demonstrated in the past the surface processing capability of a single-cell prototype with a feedback waveguide. Subsequently, a 3-cell prototype was designed and fabricated to demonstrate a traveling wave regime in SRF cavity with a feedback waveguide at cryogenic temperatures and the highest gradients. Here we present our recent results of traveling wave demonstration in the 3-cell prototype, tested in 2K liquid helium at Fermilab.

Apply for poster award

Primary author: KOSTIN, Roman (Euclid Techlabs)
Co-authors: KANAREYKIN, Alexei (Euclid Techlabs); Dr FURUTA, Fumio (Fermilab); MCGEE, Kellen (Fermilab); Mr AVRAKHOV, Pavel (Euclid Techlabs); BELOMESTNYKH, Sergey (Fermilab); KHABIBOULLINE, Timergali (Fermilab); YAKOVLEV, Vyacheslav (Fermilab)
Presenter: KOSTIN, Roman (Euclid Techlabs)
Track Classification: Accelerator: Superconducting RF
Smartcell X-Band Normal Conducting Accelerator Structure Prototype Fabrication

This presentation details the design and fabrication process of a prototype of a normal-conducting X-band accelerator structure, which we denominate Smartcell. These structures, achieved through brazing/bonding techniques, are crucial components for future linear colliders. We will cover the brazing/bonding geometry, materials selection and their implications, variations in heat cycles, and atmospheres employed during brazing/bonding. The impact of copper quality and annealing procedures implemented before, during, and after machining will be discussed specifically on how they can influence the machinability, microstructure, and ultimately the performance of the final component.

The presentation will showcase the behaviour of five mock-ups, including the results and conclusions obtained through optical examination, metrology, and SEM analysis. We will also discuss silicon carbide RF properties and characterization throughout the fabrication process.

Apply for poster award

Primary author: MORALES SANCHEZ, Pedro (CERN)
Co-author: CATALAN LASHERAS, Nuria (CERN)
Presenter: MORALES SANCHEZ, Pedro (CERN)

Track Classification: Accelerator: Normal Conducting RF
Particle-flow reconstruction with Transformer

Transformers are one of the recent big achievements of machine learning, which enables realistic communication on natural language processing such as ChatGPT, as well as being applied to many other fields such as image processing. The basic concept of a Transformer is to learn relation between two objects by an attention mechanism. This structure is especially efficient with large input samples and large number of learnable parameters.

We are studying this architecture applied to the particle flow, which reconstructs particles by clustering hits at highly-segmented calorimeters and assign charged tracks to the clusters.

We apply the structure inspired from a translation task, which uses the Transformer as both an encoder and a decoder. An original sentence is provided to the encoder input leading to a translated sentence as output of the decoder. The latter is initially provided with a start token and then recursively uses its own output as inputs to obtain the final translated sentence.

We supply hits and tracks to the encoder as input, and a start token to the decoder to obtain the first cluster. Truth clusters information are provided at learning stage to compare with the decoder output.

Detailed implementation of the network as well as initial results of particle flow reconstruction using this method will be shown in the presentation.

Apply for poster award

Yes

Primary authors: WAHLEN, Paul (ICEPP, The University of Tokyo); SUEHARA, Taikan (ICEPP, The University of Tokyo)

Presenter: WAHLEN, Paul (ICEPP, The University of Tokyo)

Session Classification: Poster

Track Classification: Physics and Detector: Software, Reconstruction, Computing
**X-band dielectric assist accelerating structure.**

A dielectric assist accelerating (DAA) structure, which consists special dielectric cell structures operating in the TM02n mode, is greatly superior in power efficiency compared with the conventional normal conducting copper structures. On the other hand, DAA structures stays at a low achievable accelerating gradient due to multipactor and breakdowns. To overcome these problems, we try to develop X-band standing-wave DAA structures and work to understand the physics of the breakdown phenomena occurring inside them.

A two-cell DAA structure composed by sapphire cell structures has been developed. The unloaded Q was measured to be above 60,000 at room temperature, in good agreement with the simulation results. This DAA structure is to be tested using the X-band high power test facility, Nextef2 at KEK. In the high-power test, we plan to perform a short pulse RF excitation using step pulse input in DAA structures to verify the potential of them to generate a high accelerating field. In this conference, we will present the status and progress in the development of the X-band DAA structure.

**Apply for poster award**

**Primary author:** SATOH, Daisuke (National Institute of Advanced Industrial Science and Technology (AIST))

**Co-authors:** TETSUO, Abe (KEK); AKEMOTO, Mitsuo (KEK); MATSUMOTO, Shuji (KEK); TAKATOMI, Toshikazu (KEK); HIGO, Toshiyasu (KEK); HIGASHI, Yasuo (KEK)

**Presenter:** SATOH, Daisuke (National Institute of Advanced Industrial Science and Technology (AIST))

**Track Classification:** Accelerator: Normal Conducting RF
Cavity Beam Position Monitor Development for the ILC Main Linac

For future particle colliders, cavity Beam Position Monitors (cBPMs) have emerged as the optimal solution for precisely measuring the beam position, crucial for guiding and stabilizing high-energy beams with nanometer precision, thus enhancing luminosity at the interaction point. Resonant BPMs operate under the principle of detection of specific field configurations (resonant modes) induced by an off-centered beam within a cavity.

Development is underway for a cryostat accommodating a reentrant cBPM and a superconducting (SC) quadrupole for the ILC Main Linac. Initially, the cBPM and its associated electronics readout system will undergo testing at ATF under ambient conditions and subsequently at STF for cryogenic temperature tests. Alignment of the SC quadrupole and cBPM centers within the cryostat is crucial for precise beam position determination. Moreover, the BPM prototype must be capable of measuring the beam position on a bunch-by-bunch basis with temporal and spatial resolutions of less than $6 \text{ ns}$ (for STF) and $1 \mu\text{m}$, respectively.

Currently, electromagnetic simulations are being conducted using the commercial software CST Studio Suite to evaluate BPM performance and converge towards a system that meets the aforementioned requirements.

Additionally, a numerical method called BI-RME 3D is being employed to simulate the effect of a well-defined beam on the cBPM, providing estimates of voltages and waveforms observed at the output ports.

The selection of the read-out electronic system is critical to effectively down-convert the frequency of the rapidly decaying signal (less than $6 \text{ ns}$) while preserving a spatial resolution of under $1 \mu\text{m}$. Looking ahead, initial tests are aimed to be conducted at ATF using an existing prototype developed by CEA-Saclay (France), along with the corresponding readout system, by the end of 2024.

The presentation aims to provide an overview of the cBPM working principle and the progress made towards the new model.

Apply for poster award

Yes

Primary author: PEDRAZA MOTAVITA, Laura Karina (IFIC (Universidad de Valencia - CSIC))

Co-authors: Mr GIMENO MARTÍNEZ, Benito (IFIC (Universidad de Valencia - CSIC)); Ms FUSTER MARTÍNEZ, Nuria (IFIC (Universidad de Valencia - CSIC)); Mr ESPERANTE, Daniel (IFIC (Universidad de Valencia - CSIC))

Presenter: PEDRAZA MOTAVITA, Laura Karina (IFIC (Universidad de Valencia - CSIC))

Track Classification: Accelerator: Beam dynamics
Cavity Beam Position Monitor Development for the ILC Main Linac

For future particle colliders, cavity Beam Position Monitors (cBPMs) have emerged as the optimal solution for precisely measuring the beam position, crucial for guiding and stabilizing high-energy beams with nanometer precision, thus enhancing luminosity at the interaction point. Resonant BPMs operate under the principle of detection of specific field configurations (resonant modes) induced by an off-centered beam within a cavity.

Development is underway for a cryostat accommodating a reentrant cBPM and a superconducting (SC) quadrupole for the ILC Main Linac. Initially, the cBPM and its associated electronics readout system will undergo testing at ATF under ambient conditions and subsequently at STF for cryogenic temperature tests. Alignment of the SC quadrupole and cBPM centers within the cryostat is crucial for precise beam position determination. Moreover, the BPM prototype must be capable of measuring the beam position on a bunch-by-bunch basis with temporal and spatial resolutions of less than 6 ns (for STF) and 1 μm, respectively.

Currently, electromagnetic simulations are being conducted using the commercial software CST Studio Suite to evaluate BPM performance and converge towards a system that meets the aforementioned requirements.

Additionally, a numerical method called BI-RME 3D is being employed to simulate the effect of a well-defined beam on the cBPM, providing estimates of voltages and waveforms observed at the output ports.

The selection of the read-out electronic system is critical to effectively down-convert the frequency of the rapidly decaying signal (less than 6 ns) while preserving a spatial resolution of under 1 μm.

Looking ahead, initial tests are aimed to be conducted at ATF using an existing prototype developed by CEA-Saclay (France), along with the corresponding readout system, by the end of 2024.

The poster aims to provide an overview of the cBPM working principle and the progress made towards the new model.

Apply for poster award

Yes

Primary author: PEDRAZA MOTAVITA, Laura Karina (IFIC (Universidad de Valencia - CSIC))

Presenter: PEDRAZA MOTAVITA, Laura Karina (IFIC (Universidad de Valencia - CSIC))

Track Classification: Accelerator: Beam dynamics
Feasibility study on the search for an exotic decay of the Higgs boson into two light pseudoscalars in e+e-collider

A feasibility study is conducted to search for an exotic decay of the Standard Model Higgs boson decaying into a pair of light pseudoscalar bosons in the Cool Copper Collider (C3) experiment. The Higgs boson is produced in association with a Z boson and the decay products consist of a pair of b-quarks and tau leptons. The pseudoscalar bosons are probed over a mass range spanning from 20 to 60 GeV. A simplified algorithm is devised to reconstruct the tau lepton in its hadronic decay mode. A limit on the branching ratio of the Higgs boson to a pair of light pseudoscalars is presented assuming 1 fb-1 of data.

Apply for poster award

Primary authors: MOHAMMADI, Abdollah (University of Wisconsin Madison (US)); NEE, CHENG-HSU (UW-Madison); DASU, Sridhara (UW-Madison)

Presenter: NEE, CHENG-HSU (UW-Madison)

Session Classification: Parallel

Track Classification: Physics and Detector: BSM, Global Interpretations
New developments in the Whizard event generator

We give a status report on new developments within the WHIZARD event generator. Important new features comprise NLO electroweak automation (incl. extension to BSM processes like SMEFT), loop-induced processes and new developments in the UFO interface. We highlight work in progress and further plans, such as the implementation of electroweak PDFs, photon radiation, the exclusive top threshold and features for exotic new physics searches.

Apply for poster award

Primary authors:  REUTER, Jürgen (DESY Hamburg, Germany); BREDT, Pia (DESY Hamburg); Dr HÖFER, Marius (KIT); KILIÁN, Wolfgang (University of Siegen); Mr KREHER, Nils (University of Siegen); Dr LÖSCHNER, Maximilian (DESY); MEKALA, Krzysztof; OHL, thorsten; Mr STRIEGL, Tobias (University of Siegen); ZARNECKI, Aleksander Filip (University of Warsaw)

Presenter:  REUTER, Jürgen (DESY Hamburg, Germany)

Session Classification:  Parallel

Track Classification:  Physics and Detector: Top quark, QCD, Flavour, Precision Modelling
Heavy Neutral Leptons (HNL) at e+e- colliders - theory

In this talk I will review the models motivating searches for heavy neutral leptons at future e+e- colliders by linking their properties to different frameworks for neutrino mass generation and mixing. Several different regimes of prompt decays vs. long-lived HNLs vs. displaced tracks will be discussed together with their experimental signatures.

Apply for poster award

Primary author:  REUTER, Jürgen (DESY Hamburg, Germany)
Presenter:       REUTER, Jürgen (DESY Hamburg, Germany)
Session Classification:  Parallel
Track Classification:  Physics and Detector: BSM, Global Interpretations
High Power RF Testing of REBCO Samples

SRF materials such as niobium have been extremely useful for accelerator technology but require low temperature operation "4K. The development of high temperature superconductors (HTS) is promising due to their operating temperatures being closer to that of liquid nitrogen "77K. This work hopes to determine the high-power RF performance of such materials at X-band (11.424 GHz). We have tested two kinds of REBCO coatings, film deposited, and tapes on a copper substrate. Testing was done in a hemispherical TE mode cavity due to its ability to maximize the magnetic field on the sample and minimize electric field. We will report on conductivity vs temperature measurements at low and high power, as well as preliminary tests of a TM01 cavity which could utilize REBCO tapes. We have observed quenching within these REBCO samples and explain the evidence which implies that the quenching is most likely due to reaching the critical current and due to average applied heat load for powers up to 1.6 kW.

Apply for poster award

Primary authors: DHAR, Ankur (SLAC National Accelerator Lab); Dr LE SAGE, Greg (SLAC National Accelerator Lab); SCHNEIDER, Mitchell

Co-authors: NANNI, Emilio (SLAC National Accelerator Laboratory); NOT SUPPLIED, JOFFRE GUTIERREZ ROYO; GOLM, Jessica (CERN); KRKOTIC, Patrick (CERN); CALATRONI, Sergio (CERN); WUESCH, Walter (CERN)

Presenter: DHAR, Ankur (SLAC National Accelerator Lab)

Track Classification: Accelerator: Superconducting RF
HOM Detuning and Damping of C-Band Distributed Coupling Structure

Standing wave structures typically operate at the pi-mode. Evidently the cell length of such a structure is half a wavelength. However, maximal shunt impedance per unit length was found to be at a cell length of 3/8 wavelength, which corresponds to phase advance per cell of 135 degrees. A distributed coupling structure at 5.712 GHz was developed based on the high efficient 135/degree phase advance design. For practical linear collider designs, the structure must include HOM detuning and damping to mitigate long-range wakefields effects. Due to the high cutoff frequency of the cell iris, effective detuning and damping of the dipole HOMs at frequencies up to 40 GHz is required. In this presentation we will present HOM detuning and damping schemes to meet the long-range wakefield requirements of a linear collider design.

Apply for poster award

Primary author: LI, Zenghai (SLAC)
Co-authors: NANNI, Emilio (SLAC); SHUMAIL, Muhammad (SLAC); TAN, Wei-Hou (SLAC)

Presenter: LI, Zenghai (SLAC)

Track Classification: Accelerator: Normal Conducting RF
Searches for Long-Lived Particles at the Future FCC-ee

The electron-positron stage of the Future Circular Collider, FCC-ee, is a frontier factory for Higgs, top, electroweak, and flavour physics. It is designed to operate in a 100 km circular tunnel built at CERN, and will serve as the first step towards ≥ 100 TeV proton-proton collisions. In addition to an essential and unique Higgs program, it offers powerful opportunities to discover direct or indirect evidence of physics beyond the Standard Model. Direct searches for long-lived particles at FCC-ee could be particularly fertile in the high-luminosity Z run and at other collision energies. Several physics cases producing long-lived signatures at FCC-ee are highlighted in this contribution: heavy neutral leptons (HNLs), axion-like particles (ALPs), and exotic decays of the Higgs boson.

Apply for poster award

Primary author:  DE FILIPPIS, Nicola (Politecnico e INFN, Bari (IT))
Presenter:  DE FILIPPIS, Nicola (Politecnico e INFN, Bari (IT))
Session Classification:  Parallel
Track Classification:  Physics and Detector: BSM, Global Interpretations
Fragmentation functions at future lepton colliders

Fragmentation functions (FFs) are essential non-perturbative inputs for precision calculations of hadron production cross sections in high energy scattering from first principle of QCD. They are usually extracted from global analysis on world data from single inclusive hadron production at lepton colliders, semi-inclusive DIS and pp collisions, e.g., as in recent NPC23 analysis. Future lepton colliders operated at several center of mass energies will provide high-quality hadron multiplicity data from Z boson to W boson pair as well as Higgs boson production, and ensure an accurate and precise determination of FFs based solely on data from lepton colliders. Projection for several scenarios of future leptons colliders are considered and compared to FFs from most recent global determination.

Apply for poster award

Primary author: Prof. GAO, Jun (Shanghai JiaoTong University)
Presenter: Prof. GAO, Jun (Shanghai JiaoTong University)
Session Classification: Parallel
Track Classification: Physics and Detector: Top quark, QCD, Flavour, Precision Modelling
Possible effects of the composite dark matter at the linear collider

The existence of dark matter is currently one of the strong motivations for beyond the standard model. We consider the model of the composite dark matter. Our model assumes that meson-like dark matter (call it dark mesons) is a bounded state of dark quark ($\psi$) and anti-dark quark ($\bar{\psi}$) pairs, where $\psi$ and $\bar{\psi}$ have a confining force at work. Confining force is based on the QCD-like $SU(N)$ hidden color gauge theory. This dark matter sector connects to the Standard model via a real singlet scalar particle. The $SU(N)$ hidden color gauge sector in the dynamical chiral symmetry breaking generates Nambu-Goldstone bosons ($\tilde{\pi}$ dark meson) and massive composite scalar bosons ($\tilde{\sigma}$ dark meson) simultaneously. A real singlet scalar particle gives the current mass for the dark quark. The current mass for dark quark breaks explicitly chiral symmetry. Nambu-Goldstone bosons are massive, meaning they are dark matter candidates. We use an effective theory for dark matter interactions in the framework of the linear sigma model. In the dark mesons of $SU(N)$ hidden color, the chiral partner of the $\tilde{\pi}$ meson is the $\tilde{\sigma}$ meson (iso scalar-scalar). $\tilde{\sigma}$ is also a candidate as dark matter. We will investigate the missing energy for the final state of our model at HL-LHC and the future linear collider.

Apply for poster award

**Primary authors:** MURAKAMI, Yuko (Hiroshima University); Dr SEKIGUCHI, Motoo (Kokushikan University); Dr WADA, Hiroaki (Kokushikan University); Dr WAKAYAMA, Masayuki (Chiba Institute of Technology)

**Presenter:** MURAKAMI, Yuko (Hiroshima University)

**Session Classification:** Poster

**Track Classification:** Physics and Detector: BSM, Global Interpretations
Classifying importance regions in Monte Carlo simulations with machine learning

In this work, we attempt to classify regions in a multidimensional parameter space according to their importance during a simulation. Considering that the parameter space could be high dimensional and the simulated process could result in arbitrary shapes, we involve a neural network in the process of guessing such shapes without running the full simulation for every point. We illustrate the process with a few examples, including scattering processes with several outgoing particles and compare with other known techniques for Monte Carlo simulations.

Apply for poster award

**Primary authors:** Dr BAN, Kayoung (Korea Institute for Advanced Study); Prof. PARK, Myeonghun (Seoultech); RAMOS, Raymundo (Korea Institute for Advanced Study)

**Presenter:** RAMOS, Raymundo (Korea Institute for Advanced Study)

**Session Classification:** Parallel

**Track Classification:** Physics and Detector: Software, Reconstruction, Computing
Third family quark mass hierarchy and FCNC in the universal seesaw model

We study the quark sector of the universal seesaw model with $SU(2)_L \times SU(2)_R \times U(1)_{Y'}$ gauge symmetry in the massless limit of the two lightest quark families. This model aims to explain the mass hierarchy of the third family quark by introducing a vector-like quark partner for each quark. In addition to the Standard Model Higgs doublet, we also introduce one right-handed Higgs doublet. In this presentation, we show the $Z, Z', h, H$ FCNC for the third family quark ($t, b$) and the heavy partner ($t', b'$).

Apply for poster award

**Primary author:** PANULUH, Albertus (Hiroshima University)

**Co-author:** MOROZUMI, Takuya (Hiroshima University)

**Presenter:** PANULUH, Albertus (Hiroshima University)

**Session Classification:** Parallel

**Track Classification:** Physics and Detector: Top quark, QCD, Flavour, Precision Modelling
WIMP search at future lepton collider

Minimal dark matter is one of the most motivated dark matter candidates, and many analyses at collider experiments for this model have been discussed. In our work, we considered the search for minimal dark matter at future high-energy lepton collider experiments. We found that the indirect search, which measures the quantum correction to the muon elastic scattering, is much more sensitive than the direct search. We also discussed the usefulness of the polarised muon beam in this search.

Apply for poster award
Yes

Primary authors:  NIKI, Atsuya (University of Tokyo); Dr FUKUDA, Hajime (University of Tokyo); Mr WEI, Shang-Fu (University of Tokyo); Prof. MOROI, Takeo (University of Tokyo)

Presenter:  NIKI, Atsuya (University of Tokyo)

Session Classification:  Poster

Track Classification:  Physics and Detector: BSM, Global Interpretations
Application of Particle Transformer to quark flavor tagging in the ILC project

International Linear Collider (ILC) is a next-generation $e^+e^-$ linear collider to explore Beyond-Standard-Models by precise measurements of Higgs bosons. Jet flavor tagging plays a vital role in the ILC project by identification of $H \rightarrow bb, cc, gg, ss$ to measure Higgs coupling constants and of $HH \rightarrow bbbb$ and $bbWW$ which are the main channels to measure the Higgs self-coupling constant. Jet Flavor Tagging relies on a large amount of jet information such as particle momenta, energies, and impact parameters, obtained from trajectories of particles within a jet. Since jet flavor tagging is a classification task based on massive amounts of information, machine learning techniques have been utilized for faster and more efficient analysis for the last several decades. In recent years, a novel machine learning architecture from natural language processing called Transformer has been developed, and it has been showing state-of-the-art performances in multiple fields. Particle Transformer (ParT) is a software that applies the Transformer architecture to jet analysis, including jet flavor tagging. In this study, we apply ParT to ILD full simulation data to improve the efficiency of jet flavor tagging.

Our research focused on evaluating the performance of ParT compared to the previously used flavor tagging software, LCFIPlus, and optimizing network architectures and input parameters. Specifically, we verified performance stability through multiple training runs, assessed the performance when independently embedding charged particles and neutral particles, and evaluated the dependence on data size and number of learnable parameters. We will also report on the status of performance study of strange tagging using ParT with ILD full simulation, which can be applied on analysis of Higgs-strange coupling.

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Primary author: TAGAMI, Risako (University of Tokyo (JP))
Co-authors: ISHINO, Masaya (University of Tokyo (JP)); SUEHARA, Taikan (ICEPP, The University of Tokyo)
Presenter: TAGAMI, Risako (University of Tokyo (JP))
Session Classification: Parallel
Track Classification: Physics and Detector: Software, Reconstruction, Computing
Development of particle flow algorithm with GNN for Higgs factories

Particle flow plays an important role in precise measurement of Higgs bosons at future lepton colliders such as ILC and FCCee. Various detector concepts are designed to maximize the effect of particle flow to be able to separate each particle inside jets and improve the resolutions. For the standard particle flow algorithm, PandoraPFA is used for long in ILC studies. It is a multi-step reconstruction algorithm consisting of clustering, track-cluster association, and various refinement processes. We have studied machine learned particle flow model using Graph Neural Network based algorithm developed in the context of CMS HGCAL clustering. This model utilizes GravNet as GNN architecture and Object Condensation loss function for training. Since the HGCAL algorithm only performs clustering at the calorimeter, we developed track-cluster matching feature inside the network to realize full PFA. Details of initial implementation of the track-cluster matching algorithm as well as performance evaluation with multiple tau events and jet vents will be shown. We also report the comparison result between computational performance of the machine learned algorithm and the PandoraPFA.

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Yes

Primary authors:  SUEHARA, Taikan (ICEPP, The University of Tokyo); MURATA, Tatsuki
Presenter:  MURATA, Tatsuki
Session Classification:  Parallel
Track Classification:  Physics and Detector: Software, Reconstruction, Computing
Accurate and fully differential predictions are crucial inputs for the precise experimental analyses at linear colliders and are typically provided by parton shower Monte Carlo programs. The event generator Sherpa with its focus on the inclusion of higher-order EW and QCD effects is available in a new version 3.0 this year and we will summarise its new features in particular where they relate to linear colliders.

Primary authors: PRICE, Alan (Jagiellonian University); SIEGERT, Frank (Technische Universitaet Dresden (DE))

Presenter: SIEGERT, Frank (Technische Universitaet Dresden (DE))

Session Classification: Parallel

Track Classification: Physics and Detector: Top quark, QCD, Flavour, Precision Modelling
Longitudinally-split side-coupled high-shunt-impedance C-band structure fabricated in two halves

Side-coupled structures operated with $\pi/2$ mode have been widely used particularly for compact linacs. The structure has various advantages; however, there are some difficulties in fabrication due to many complicated parts to be bonded in the conventional fabrication method. On the other hand, longitudinally-split structures are easy to fabricate due to the small number of parts (two halves or four quadrants). In recent years, in collaboration with Mitsubishi Heavy Industries, we have been developing longitudinally-split side-coupled C-band structure fabricated in two halves with a high shunt impedance based on our successful experience on the quadrant-type X-band CLIC prototype structure development. We report the status and results of this project.

Apply for poster award

Primary author: TETSUO, Abe (KEK)
Presenter: TETSUO, Abe (KEK)
Track Classification: Accelerator: Normal Conducting RF
RF breakdown studies at nanosecond timescales using structure wakefield acceleration

High-energy particle accelerators are crucial to the next big discovery in particle physics. To reduce the size and cost of particle accelerators, increasing the accelerating gradient (energy gain per unit length for the particle beam) is of critical importance. Advanced accelerator concepts (AACs) hold the promise of revolutionary future particle colliders with dramatically higher gradients than what conventional accelerator technologies allow. One advanced concept, structure wakefield acceleration (SWFA), aims to raise the gradient and the efficiency by confining the microwave energy in a short and intense pulse. The SWFA concept has inspired a new approach to generate nanosecond RF pulses with a high peak power (on the order of a few hundred megawatts). By using the short RF pulses to study RF breakdown on the nanosecond time scale, we have demonstrated that the short pulse length could potentially mitigate the impact of RF breakdown, and the beam-driven short-pulse acceleration technique could enable a new class of compact accelerators.

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Primary author: LU, Xueying (Northern Illinois University / Argonne National Lab)
Presenter: LU, Xueying (Northern Illinois University / Argonne National Lab)

Track Classification: Accelerator: Normal Conducting RF
Advanced structures R&D for structure wakefield acceleration at the Argonne Wakefield Accelerator

Research and development on novel structures is at the core of advancing structure wakefield acceleration (SWFA), and is critical to future AAC-based linear colliders. In this talk, I will present recent progress on the R&D of advanced radiofrequency (RF) structures for Structure Wakefield Acceleration, metamaterial structures, and sub-terahertz structures. The experiments were performed at the Argonne Wakefield Accelerator (AWA) facility, where we capitalized on the capability of generating shaped-electron bunches to improve SWFA performance.

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**Primary author:** LU, Xueying (Northern Illinois University / Argonne National Lab)

**Presenter:** LU, Xueying (Northern Illinois University / Argonne National Lab)

**Session Classification:** Parallel

**Track Classification:** Accelerator: Advanced Accelerator Concepts
The Alaric parton shower algorithm

Parton showers are important tools in the event generation chain for future collider. Recently, their formally achieved accuracy has been under extended scrutiny. In this talk I will present a novel take on dipole parton showers [1], resulting in the design of a new parton shower called Alaric that is implemented in the Sherpa framework. I will discuss its resummation properties and show analytic and numerical proofs of its NLL accuracy. I will discuss the latest developments, see [2], and their implications for final state evolution.

[1] JHEP 10 (2023) 091

Apply for poster award

Primary author: REICHELT, Daniel
Presenter: REICHELT, Daniel
Session Classification: Parallel

Track Classification: Physics and Detector: Top quark, QCD, Flavour, Precision Modelling
Searching for heavy neutral leptons through exotic Higgs decays at the ILC

In this study we investigate the feasibility of detecting heavy neutral leptons ($N_d$) through exotic Higgs decays at the proposed International Linear Collider (ILC), specifically in the channel of $e^+e^- \rightarrow qq\,H$ with $H \rightarrow \nu N_d \rightarrow \nu lW \rightarrow \nu l qq$. Analyses based on full detector simulations of the ILD are performed at the center-of-mass energy of 250 GeV for two different beam polarization schemes with a total integrated luminosity of $2\,ab^{-1}$. A range of heavy neutral lepton masses between the $Z$ boson and Higgs boson masses are studied. The $2\sigma$ significance reach for the joint branching ratio of $BR(H \rightarrow \nu N_d) \cdot BR(N_d \rightarrow lW)$ is about 0.1%, nearly independent of the heavy neutral lepton masses, while the $5\sigma$ discovery is possible at a branching ratio of 0.3%. Interpreting these results in terms of constraints on the mixing parameters $|\epsilon_{id}|^2$ between SM neutrinos and the heavy neutral lepton, it is expected to have a factor of 10 improvement from current constraints.

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Primary authors: TIAN, Junping (University of Tokyo); ISHINO, Masaya (University of Tokyo (JP)); THOR, Simon

Presenter: THOR, Simon

Session Classification: Parallel

Track Classification: Physics and Detector: BSM, Global Interpretations
Physics Considerations for 10-30 TeV e+e-, γγ, and μ+μ- Colliders

After the program of Higgs boson physics at a linear collider is completed, we expect that the long, straight tunnel can be used with advanced acceleration methods, such as plasma wakefield, to create a higher-energy collider in the 10’s of TeV CM region. This might be an e+e- or a γγ collider. (Circular) muon colliders are also discussed for this energy regime. I will discuss the physics goals of these machines, the luminosity requirements, and the trade-offs among the μ+μ-, e+e-, and γγ options.

Apply for poster award

Primary author:  PESKIN, Michael
Presenter:  PESKIN, Michael
Session Classification:  Parallel
Track Classification:  Accelerator: Advanced Accelerator Concepts
A CP violating top-Higgs coupling with SMEFT in the Feynman-Diagram gauge

We calculate the cross section for the process $\mu^- \mu^+ \rightarrow \nu_\mu \nu_\mu t\bar{H}$ with complex top Yukawa coupling, which can be obtained by adding a gauge invariant dimension-6 operator to the Standard Model (SM) Lagrangian. The Feynman-Diagram (FD) gauge and the unitary (U) gauge amplitudes give exactly the same cross section, and subtle gauge theory cancellation among diagrams in the U gauge at high energies is absent in the FD gauge, as has been observed for various SM processes. In addition, we find that the total cross sections at high energies are dominated by a single, or a set of non-vanishing Feynman amplitudes with the higher dimensional vertices in the FD gauge.

Apply for poster award

Primary authors: HAGIWARA, Kaoru; KANZAKI, Junichi; MATTELAER, Olivier; MAWATARI, Kentarou; ZHENG, Ya-Juan

Presenter: ZHENG, Ya-Juan

Session Classification: Poster

Track Classification: Physics and Detector: BSM, Global Interpretations
A Wakefield Resilient, High Shunt Impedance Accelerating Structure for the Cold Copper Collider

The initial proposed design of the Cold Copper Collider (C3) is based on a distributed coupling accelerating (DCA) rf structure where the phase advance between the accelerating standing wave cavities is $\pi$. In these cavities the aperture radius is 2.624 mm and the corresponding shunt impedance is 300 M$\Omega$/m with 77K copper walls. We propose a novel DCA rf structure with $3\pi/4$ phase advance between the individually fed cavities aperture radius of 3.55 mm for the same shunt impedance and the peak field constraints. Because of this 35% larger aperture, this rf structure is much more resilient to both short-range and long-range wakefield effects. The researchers at SLAC have already proposed and designed a $3\pi/4$ DCA with four feeding waveguide manifolds. The implementation of four waveguide manifolds is, however, mechanically challenging. Here, we present a novel $3\pi/4$ DCA for C3 which is based on only two waveguide manifolds. This rf structure comprises of 56 cavities where cavities are fed in pairs through a standard $\pi$ phase advance rf manifold. This is achieved by pairing the cavities as, first and third, second and forth, and so on. With such pairing, the phase advance between the two cavities in a pair is $\pi/2$ and the phase advance between successive pairs is $\pi$. The copper cavities are designed to give a coupling coefficient of 1.82 at 77K temperature, as required for critical coupling to accelerate 190 mA with 70 MV/m gradient.

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Primary authors: NANNI, Emilio (SLAC National Accelerator Laboratory); SHUMAIL, Muhammad (SLAC); LI, Zenghai (SLAC)

Presenter: SHUMAIL, Muhammad (SLAC)

Track Classification: Accelerator: Normal Conducting RF
Status and Plans for the C3 Quarter Cryomodule

To achieve target performance of the C3 accelerator, many elements will need to be manufactured, assembled, and aligned in use to very tight tolerances. Testing of accelerating structure manufacturing, alignment, mounting, and liquid nitrogen cooling will be performed at SLAC using an accelerator length of approximately 2 meters. This talk will review progress and plans toward commissioning a Quarter Cryo-Module “QCM” test system including the design of a 1 meter length of accelerating structure and the support and alignment system required for test. This system review will include details of the vacuum insulated cryostat sized to allow testing 2 sections of 1m long accelerating structure with quad and BPM supported on a frame representative of a system that could be used in the C3 target cryo-module containing 8 meters of accelerating structure. It is intended that the QCM system will be used to evaluate a series of accelerating structures, supports, and measurements techniques. Some of the initial plans will be reviewed in this talk.

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Primary authors:  VERNIERI, Caterina (SLAC National Accelerator Laboratory (US)); NANNI, Emilio (SLAC National Accelerator Laboratory); Mr ANDY, Haase (SLAC National Accelerator Laboratory / Stanford University); BREIDENBACH, Martin (SLAC); SHUMAIL, Muhammad (SLAC); LI, Zenghai (SLAC)

Presenter:  Mr ANDY, Haase (SLAC National Accelerator Laboratory / Stanford University)

Track Classification:  Accelerator: Normal Conducting RF
High Gradient Testing of a Meter-Scale Distributed-Coupling C3 Accelerating Structures

In this paper we report on the design, fabrication, tuning and high-power RF testing of the fundamental accelerating structure for the Cool Copper Collider (CCC). The results presented here cover the temperature range from room temperature to liquid nitrogen boil off: 20°C - 77 K.

At room temperature, RT, with a N2 gas purge of 1 atmosphere, the CCC structure was tuned to a resonance frequency of $< f_o > = 5.693\,420\, \text{GHz}$, at 77K the structure tuned frequency is reported as $< f_o > = 5.712\,057\,667\, \text{GHz}$. The repeatability of the CCC structure to undergo both vacuum pump down and thermal cycles from RT to LN2 will be presented.

For the high-power RF testing the CCC structure was immersed in liquid nitrogen at the Radiobeam C-Band test facility. High Power RF breakdown data will be present along with our future experimental plans.

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Primary authors: DHAR, Ankur (SLAC National Accelerator Lab); PALMER, Dennis (SLAC National Accelerator Laboratory / Stanford University); NANNI, Emilio (SLAC National Accelerator Laboratory); BROZENETS, Valery (SLAC National Accelerator Laboratory / Stanford University)

Presenter: PALMER, Dennis (SLAC National Accelerator Laboratory / Stanford University)

Track Classification: Accelerator: Normal Conducting RF
Jet origin identification for electron positron Higgs factory

To enhance the scientific discovery power of high-energy collider experiments, we propose and realize the concept of jet origin identification that categorizes jets into 5 quark species (b, c, s, u, d), 5 anti-quarks (¯b, ¯c, ¯s, ¯u, ¯d), and the gluon. Using state-of-the-art algorithms and simulated ννH,H → jj events at 240 GeV center-of-mass energy at the electron-positron Higgs factory, the jet origin identification simultaneously reaches jet flavor tagging efficiencies ranging from 67% to 92% for bottom, charm, and strange quarks, and jet charge flip rates of 7% to 24% for all quark species. We apply the jet origin identification to Higgs rare and exotic decay measurements at the nominal luminosity of the Circular Electron Positron Collider (CEPC), and conclude that the upper limits on the branching ratios of H → s¯s, u¯u, d¯d, and H → sb, db, uc, ds can be determined to 2×10⁻⁴ to 1×10⁻³ at 95% confidence level.

We also discussed its application on EW and Flavor Physics measurements at future electron-positron Higgs factory.

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Primary author: RUAN, Manqi (IHEP-LLR/CERN)
Presenter: RUAN, Manqi (IHEP-LLR/CERN)
Session Classification: Parallel
Track Classification: Physics and Detector: Software, Reconstruction, Computing
Towards production readiness with the Key4hep software stack for future colliders

Physics studies for future colliders require a reliable software environment. For many years this has been delivered by iLCSoft for the linear collider communities. In the last five years a common effort of several communities, including ILC, CLIC, FCC and CEPC, have collaborated on the Key4hep software stack to deliver a common software stack for all future collider communities. This software stack has been used for physics studies already and is reaching production readiness.

This presentation an overview of the current status of Key4hep, giving special emphasis on the developments that are particularly relevant for the linear collider communities. We will show the seamless integration of existing reconstruction and analysis software that have been developed in the last 15 years by the linear collider communities. Additionally, we will lay out the path forward from a software perspective and report on experiences from migrating the standard ILD reconstruction chain towards Key4hep. Additionally, we show some new developments for ILD that are currently ongoing within Key4hep. Finally, we report on currently ongoing developments and future plans.

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**Primary authors:** SAILER, Andre (CERN); HEGNER, Benedikt (CERN); FRANCOIS, Brieuc (CERN); GAEDE, Frank; GANIS, Gerardo (CERN); STEWART, Graeme A (CERN); XINGTAO, Huang (Shandong University); ZOU, Jiaheng (Chinese Academy of Sciences); CARCELLER, Juan Miguel (CERN); SMIESKO, Juraj (CERN); REICHENBACH, Leonhard (CERN / University of Bonn (DE)); FILA, Mateusz Jakub (CERN); KO, Sang Hyun (Seoul National University); SASIKUMAR, Swathi (CERN); LIN, Tao (IHEP); LI, Teng (Shandong University); MADLENER, Thomas (Deutsches Elektronen-Synchrotron (DE)); LI, Weidong (IHEP); FANG, Wenxing (IHEP); ZHANG, Xiaomei (IHEP)

**Presenter:** MADLENER, Thomas (Deutsches Elektronen-Synchrotron (DE))

**Session Classification:** Parallel

**Track Classification:** Physics and Detector: Software, Reconstruction, Computing
Fast Timing for Particle ID

The identification of certain charged hadron species, e.g. Kaons and protons, plays an important role in many physics analyses. Time-of-flight measurements can contribute to identifying these particles if both the length of the flight path as well as the time of arrival can be determined with sufficient precision. This contribution will discuss the recent progress on both aspects, and in particular compare classic as well as machine-learning based algorithms in order to estimate the time-of-arrival at the calorimeter front from the time measurements of individual hits in a shower or MIP trace.

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Primary authors: DUDAR, Bohdan (DESY); GAEDE, Frank; LIST, Jenny (Deutsches Elektronen-Synchrotron (DE)); HELMS, Konrad

Presenter: LIST, Jenny (Deutsches Elektronen-Synchrotron (DE))

Session Classification: Parallel

Track Classification: Physics and Detector: Software, Reconstruction, Computing
Capture Cavities for the CW Polarized Positron Source Ce+BAF

The initial design of the capture cavities for the continuous wave (CW) polarized positron beams at Jefferson Lab (Ce+BAF) is presented. A chain of standing wave multi-cell copper cavities inside a solenoid tunnel are selected to bunch/capture positrons. The cavity design strategy is presented to accommodate constraints from the large phase distribution of the incident beams, RF power, radiation and RF heating, beam loading, etc. to improve the capture efficiency. A matrix of design parameters’ range are given for future system optimization when the the capture cavities are considered together with other sub-systems and beam dynamics. The contents will also be useful for other CW cavity design for beams with large phase space distribution.

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Primary author:  WANG, Shaoheng (Jefferson Lab)  
Co-authors:  USHAKOV, Andriy (Jefferson Lab); WANG, Haipeng; GRAMES, Joseph (JLab); Dr RAUT, Nabin (Jefferson Lab); RIMMER, Robert (JLab); ROBLIN, Yves  
Presenter:  WANG, Shaoheng (Jefferson Lab)  
Track Classification:  Accelerator: Normal Conducting RF
Challenges and breakthroughs in recent RF Solid State PA design by Radial Combiner design with Initiatives for SDGs

R&K, an independent company, has achieved production of 2.3 million 1.9GHz microwave power amplifiers for mobile-comm’s-base-stations and then also supplies wideband power amplifiers for automobile EMC testing for domestic automobile industries. Then 16 years ago, we started new design and producing some hundreds kW RF SSA for accelerator applications instead of Klystron/tube alternatives.

The measure characteristics of this amplifier is possible to design a band in a very wide frequency range available from few MHz to 14 GHz, and there is also max-power-changing capability in few kW to few MW design available even after system completed. Recently, SSA has gained significant advantages over vacuum tubes in terms of size, low power consumption, high efficiency, low cost, and adaptive power design. In addition to these, we have found that SSA has very low phase noise and low envelope noise that cannot be achieved with vacuum tubes.

All these points suggest a strong trend toward solid-state amplifiers and a move away from vacuum tube systems, even for power amplifiers used in particle accelerators. There is no doubt that all these improved performances will eventually lead to a strong trend towards his SDGs.

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Primary author: Mr KOBANA, Riichiro (R&K Company Limited)
Presenter: Mr KOBANA, Riichiro (R&K Company Limited)
Track Classification: Accelerator: Superconducting RF
Global EFT fits for future colliders

We present SMEFiT3.0, an updated global SMEFT analysis of Higgs, top quark, and diboson production data from the LHC complemented by electroweak precision observables (EWPOs) from LEP and SLD. We consider recent inclusive and differential measurements from the LHC Run II and estimate the impact of HL-LHC measurements on the SMEFT parameter space when added on top of SMEFiT3.0, through dedicated projections extrapolating from Run II data. We quantify the significant constraints that measurements from two proposed high-energy circular colliders, the FCC-ee and the CEPC, would impose on both the SMEFT parameter space and on representative UV-complete models. The framework presented in this work may be extended to other future colliders and running scenarios, providing timely input to ongoing studies towards future high-energy particle physics facilities.

Apply for poster award

Primary author: VRYONIDOU, Eleni (University of Manchester (GB))

Presenter: VRYONIDOU, Eleni (University of Manchester (GB))

Session Classification: Parallel

Track Classification: Physics and Detector: BSM, Global Interpretations
ttbar-threshold: Focus topics for the ECFA study on Higgs / Top / EW factories

I present the status of the ECFA Higgs/EW/Top Factory workshop activities for the ttbar-threshold focus topic (see https://arxiv.org/pdf/2401.07564).
An expert team has been setup aiming to provide a firm basis for the projected precision of the top quark mass and width measurements from a scan of the center-of-mass energy through the top quark pair production threshold. The prospects for measurements of top quark electro-weak couplings are included in the study, too. The goal is to provide a realistic estimate of statistical uncertainties, and systematic uncertainties from theory and experiment.

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**Primary author:** VOS, Marcel (IFIC (UVEG/CSIC) Valencia)

**Presenter:** VOS, Marcel (IFIC (UVEG/CSIC) Valencia)

**Session Classification:** Parallel

**Track Classification:** Physics and Detector: Top quark, QCD, Flavour, Precision Modelling
Progress of research on corrugated wakefield structures in PAL working group.

Our research group, composed of Pohang Accelerator Laboratory, Korea University, Northern Illinois University, and Argonne Wakefield Accelerator Facility, is researching on wakefields generated in corrugated structures. Main goal of our research is to make several applications such as a THz source in the GW scale, wakefield accelerators and IR-FELs.

As a first step, we designed and fabricated structures in the 200 GHz frequency range, and their performance were validated by the experimental results in AWA. In the first experiment, even with a fabrication tolerance of around 10 micrometers, the simulation results matched well with the experimental results. We are developing more precise fabrication methods by lithography for higher output power and frequency. As the second step, we are preparing to fabricate corrugated structures around 425 GHz and demonstrate GW-level THz output.

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Primary author:  KONG, Hyung-sup (Pohang Accelerator Laboratory)

Co-authors:  Dr CHEN, Gongxiaohui (Argonne National Laboratory); HA, Gwanghui (Northern Illinois University); Dr KWAK, Ho Jae (Pohang Accelerator Laboratory); Ms KIM, Jina (Pohang Accelerator Laboratory); Dr KO, Jinjoo (Korea University Sejong Campus); Dr POWER, John (Argonne National Laboratory); Dr KIM, JongHyun (Pohang Accelerator Laboratory); Mr SEO, Min Kyu (Korea University Sejong Campus); Prof. PARK, S.H. (Korea University Sejong Campus); Dr DORAN, Scott (Argonne National Laboratory); Mr KIM, Seung-hwan (Pohang Accelerator Laboratory); Dr SHIN, Seunghwan (Korea Photon Source); Dr LIU, Wanming (Argonne National Laboratory)

Presenter:  KONG, Hyung-sup (Pohang Accelerator Laboratory)

Session Classification:  Parallel

Track Classification:  Accelerator: Advanced Accelerator Concepts
Recent updates of BSM searches at CMS and future prospects at HL-LHC

This talk covers recent highlights of BSM searches from the CMS experiment and future prospects at HL-LHC.

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Primary author: LEE, Jeongeun (Seoul National University (KR))
Presenter: LEE, Jeongeun (Seoul National University (KR))
Session Classification: Parallel
Track Classification: Physics and Detector: BSM, Global Interpretations