# T 91: Methods in Particle Physics V

Time: Friday 9:00–10:15 Location: KH 00.020

T 91.1 Fri 9:00 KH 00.020

**Positron Source for Future Collider Designs (HALHF, LCF, ILC, CLIC)** — •Gudrid Moortgat-Pick[1,2], Niclas Hamann[2], Manuel Formela[2], Malte Trautwein[1], Gregor Loisch[2], Tim Lengler[3], Dieter Lott[3], and Sabine Riemann[2] — [1]University of Hamburg — [2]Deutsches Elektronen Synchrotron — [3]Hereon

Higgs Physics and Beyond Standard Model Physics require high-energetic lepton colliders of at least a cms of 550 GeV. In particular the positron source is a challenge for all future lepton colliders. In the talk new R&D developments for polarized positron sources for the high-energy designs as Hybrid Asymmetric Linear Higgs Factory (HALHF), Linear Collider Facility at CERN (LCF), International Linear Collider (ILC) and Compact Linear Collider (CLIC) are discussed. The talk includes physics requirements, status of target and OMD prototypes, automatized simulation tools.

T 91.2 Fri 9:15 KH 00.020

**Jet energy resolution in future $e^+e^-$ Higgs factory experiments with ML and 5D calorimetry** — •Bohdan Dudar and Lucia Masetti — Johannes Gutenberg-Universität Mainz, Mainz, Germany

The Pandora particle-flow algorithm (PFA) remains one of the best tools for event reconstruction aiming at an excellent jet energy resolution for future $e^+e^-$ collider experiments. Moreover, the rapid development of picosecond-timing sensors and their potential implementation in the calorimeter would allow for developing a new PFA with timing information, with improved performances in shower separation and particle tracking. Yet, this needs to be integrated in a full PFA reconstruction framework.

In this study, we examine the potential impact of timing in calorimetry on jet energy resolution, using an approach entirely based on machine learning. We develop an energy regression neural network (NN) with and without time information, and compare our results to the Pandora PFA. We use beam-background-free MC samples of $Z \to q\bar{q}$ ($q = u, d, s$) reconstructed with the International Large Detector (ILD) in full simulation.

T 91.3 Fri 9:30 KH 00.020

**Calibration of calorimeter signals in theATLAS experiment using an uncertainty-awareneural network** — •Isabel Sainz Saenz-Diez — Kirchhoff Institute for Physics, Heidelberg University

The measurement of energy deposits in the calorimeters is a key aspect of particle reconstruction. In the case of the ATLAS experiment at the Large Hadron Collider (LHC), the calorimeter signals are reconstructed as clusters of topologically connected cells (topo-clusters) and need to be calibrated for energy losses that take part in hadronic showers and do not leave energy in the calorimeter cells. Machine Learning (ML) methods have been proposed in order to perform the hadronic calibration of the clusters. The talk will present the current status of the implementation and performance of a Deep Neural Network (DNN) which predicts both the energy of the clusters and its uncertainty. The impact of this new calibration in jet reconstruction and its outperformance with respect to the current calibration is discussed and both results at cluster-level and jet-level will be presented.

T 91.4 Fri 9:45 KH 00.020

**Background suppression of neutrino inelastic interactions in SHiP with a GNN using the Surrounding Background Tagger** — •Darja Lund for the SHiP-SBT-Collaboration — Humboldt Universität zu Berlin, Berlin, Germany

The SHiP (Search for Hidden Particles) fixed target experiment will be realised in a dedicated beam-dump facility in the ECN3 cavern in CERN's north area. It will take advantage of the 400 GeV SPS proton beam to search for feebly interacting long-lived particles at the MeV-GeV scale over many orders of magnitude in coupling. The search for decay signatures will be facilitated by the full reconstruction and particle identification of Standard model final states using the detector setup. Located downstream of the hadron stopper and the magnetic muon shield is the 50m long decay volume, encased by the SBT (Surrounding Background Tagger). A major focus of the experiment, and a key functionality of the SBT, is the detection and suppression of muon and neutrino inelastic scattering background inside the 50m long decay volume. For this, a GNN (Graph Neural Network) to identify background is in constant development. This talk will give an overview of the neutrino background suppression using a GNN-based veto.

T 91.5 Fri 10:00 KH 00.020

**Background suppression in the SHiP experiment with the Surround Background Tagger and different selection criteria** — •Katharina Albrecht for the SHiP-SBT-Collaboration — Institut für Physik, Humboldt-Universität zu Berlin, Berlin, Germany

SHiP (Search for Hidden Particles) is an experiment that will be installed in a dedicated beam-dump facility in the ECN3 cavern, located in the CERN north area. SHiP will search for feebly interacting particles (FIPs) produced by 400 GeV/c protons from the SPS impinging on a heavy-metal target. Over a 15-year span, the objective is to accumulate $6 \times 10^{20}$ protons on target with a detector setup that allows suppression of possible background to a negligible level. The experiment focuses on optimizing the sensitivity for models featuring long-lived FIPs below 10 GeV/c$^2$ by minimizing backgrounds induced by the huge flux of neutrinos and muons emerging from the beam-dump target. The Surround Background Tagger (SBT) is a critical component surrounding the 50 m long helium-filled decay volume. The SBT is instrumental to detect charged particles entering the decay volume from the sides as well as inelastic interactions of neutrinos and muons taking place inside the helium-filled decay volume, but also in the SBT itself. The presentation will discuss the suppression of these backgrounds from simulation studies, focusing on different selection criteria between standard and modified cuts.