

T 15: Searches/BSM I

Time: Monday 16:15–18:15

Location: KH 02.018

T 15.1 Mon 16:15 KH 02.018

Search for Di-lepton+X and Di-Photon Signatures with Forward Proton Scattering — •VIKTORIA LYSENKO and ANDRÉ SOPCZAK — CTU in Prague

The latest results are presented using combined data recorded with the central ATLAS detector and the ATLAS Forward Proton spectrometer. The focus is on two analyses, the search for a missing mass resonance in the channel $pp \rightarrow p' p' \ell \ell X$, and the search for an axion-like particle (ALP) in light-by-light scattering with the detection of a scattered forward proton.

T 15.2 Mon 16:30 KH 02.018

Search for new phenomena in dilepton final states with associated b -jets at the ATLAS experiment — •ANNA BINGHAM and FRANK ELLINGHAUS — Bergische Universität Wuppertal

An overview of a search for new phenomena in high-mass dilepton ($ee, \mu\mu$) final states with associated b -jets is presented. The main analysis considers a Z' model as a candidate explanation for potential anomalies in B hadron decays, where the Z' boson couples to b and s quarks in the production. Non-resonant contact interactions and t -channel leptoquark production are taken in account as additional interpretations. The search is carried out using the dataset collected by the ATLAS detector in Run-2 of the LHC corresponding to an integrated luminosity of 140 fb^{-1} . Backgrounds are estimated from MC and also by data-driven methods. Control, signal and validation regions are defined, and these regions are fitted in a profile-likelihood fit. Exclusion limits are obtained based on the results of the fit.

T 15.3 Mon 16:45 KH 02.018

Reconstruction of Heavy Neutral Leptons decaying into $l + \rho$ with ATLAS using mass-constraint techniques — •MAXIMILIAN RUHL — Institut für Physik, Humboldt-Universität zu Berlin

Heavy Neutral Leptons (HNLs) are well-motivated candidates for new physics in the GeV mass range and are investigated at the LHC, in particular with the ATLAS experiment, through displaced semileptonic decays. The channel $N \rightarrow \ell \rho \rightarrow \ell \pi^\pm \pi^0$ might increase the search sensitivity at low HNL masses because its branching fraction is comparatively large and the visible decay products form a clean displaced-vertex signature. If the π^0 is not explicitly reconstructed, essential kinematic information is missing. In this study, the three-momentum vector of the neutral pion is estimated using mass-constraint techniques. The photons from the π^0 decay have a direction very close to the π^0 momentum, hence $\Delta R(\gamma, \pi^0_{reco})$ is small. This characteristic pattern can help to reduce the background without requiring full reconstruction of the π^0 . The analysis investigates these photon-based observables and evaluates their potential relevance for future searches for semileptonic HNL decays with ATLAS.

T 15.4 Mon 17:00 KH 02.018

Anomaly detection for long-lived particles using CATHODE with CMS — •JOVIN DREWS, LOUIS MOUREAUX, GREGOR KASIECZKA, KARIM EL MORABIT, CHITRAKSHEE YEDE, and TORE VON SCHWARTZ — University of Hamburg, Hamburg, Germany

In high-energy physics, numerous analyses search for phenomena beyond the Standard Model (BSM). Anomaly detection methods offer a model-independent way to probe such potential BSM signatures. We discuss CATHODE, an anomaly detection method combining density estimation and weak supervision, applied to signals from long-lived particles (LLP) embedded in multijet background from the CMS experiment. The work studies LLP scenarios with varying properties and different approaches to classification.

T 15.5 Mon 17:15 KH 02.018

Search for Delayed Long-Lived Particles in Consecutive Bunch Crossings using the ATLAS Detector — •TOBIAS HEINTZ — Kirchhoff Institute for Physics, Heidelberg, Germany

This contribution presents a novel strategy to detect long-lived particles (LLPs) that decay across two consecutive bunch crossings, combining missing transverse momentum from a slowly propagating LLP in one bunch crossing with a displaced jet that appears more than 25 ns later and is azimuthally correlated. Unconventional BSM scenarios would give rise to such a signature over multiple bunch crossings, but

are not efficiently captured by conventional trigger and reconstruction approaches. The concept of a dedicated trigger and its implementation within the ATLAS detector are discussed, along with projected sensitivities for a benchmark scenario motivated by inelastic dipole dark matter.

T 15.6 Mon 17:30 KH 02.018

Search for long-lived dark scalars at the LHCb experiment — •PENELOPE HOFFMANN and CHRISTOPH LANGENBRUCH — Physikalisches Institut, Universität Heidelberg, Germany

In the minimal dark scalar portal model, a potential dark scalar sector is expected to couple to the Standard Model Higgs boson, with a dark scalar particle acting as a mediator for dark matter. At LHC energies, flavour-changing neutral current decays of K and B mesons are excellent probes for dark scalar particles in the MeV/c^2 to GeV/c^2 mass region.

This talk presents a search for a dark sector scalar particle χ , produced via the decay $B^0 \rightarrow K^{*0} \chi (\rightarrow \mu\mu)$, in data recorded in late 2025 with the LHCb detector. Tracks from final state particles originating from long-lived scalar particles that decay outside the LHCb vertex detector (VELO) are reconstructed using only information from the LHCb upstream tracker (UT) and the downstream tracking system (SciFi). These tracks are referred to as downstream tracks.

Employing an improved downstream track reconstruction and a new dedicated trigger line, the preliminary expected limit presented in this talk showcases the promising potential of using downstream tracks in the search for a dark scalar particle at LHCb.

T 15.7 Mon 17:45 KH 02.018

Search for Semivisible Jets with CMS Run 2 Scouting Data — •MARCEL GAISDÖRFER¹, JONAS JANIK¹, BRENDAN REGNERY¹, MARKUS KLUTE¹, BENEDIKT MAIER², CESARE TIZIANO CAZZANIGA³, ROBERTO SEIDITA³, ANNAPAOLA DE COSA³, AIMAR AGUADO BERASALUCE³, REBECCA NATALIA HAMP³, CELESTE HOLM³, and KEVIN PEDRO⁴ — ¹Karlsruher Institut für Technologie (KIT) — ²Imperial College London — ³ETH Zürich — ⁴Fermi National Accelerator Laboratory

Cosmological observations point towards the existence of Dark Matter (DM), a type of matter not described by the Standard Model (SM) that only interacts gravitationally and at most weakly with SM particles. This search looks for a signature called semivisible jets, which are jets containing invisible DM candidates. Semivisible jets could be caused by a QCD-like dark sector, coupled to the SM via a Z' mediator. To expand previous search efforts towards lower mediator masses, this search utilizes data scouting. Data scouting records the coarser HLT reconstruction instead of the full detector information to save on bandwidth, which allows lowering trigger thresholds, giving access to events that would typically have been discarded. This talk will give an overview of the search strategy, current status and expected limits of the search for semivisible jets with CMS Run 2 HLT scouting data.

T 15.8 Mon 18:00 KH 02.018

Search for X17 particle at the BESIII — •HANG ZHOU^{1,2} and ACHIM DENIG^{1,2} — ¹Johannes Gutenberg University Mainz, Germany — ²Helmholtz Institute Mainz, Germany

The anomalous internal pair creation signals reported by the ATOMKI group suggest the emission of a new boson with an invariant mass of approximately 17 MeV, often referred to as X17. This hypothetical particle has been proposed as a mediator of a fifth force or as a portal between the Standard Model (SM) and a dark sector. Besides the ATOMKI measurements, several dedicated experiments, such as NA64, MEG II and PADME, have searched for X17-like signatures. So far, however, no independent experiment has conclusively confirmed the existence of X17. If X17 is a real boson, it should also be produced in processes beyond nuclear transitions. One suggested possibility is heavy meson decay, e.g. charmonium decay. Charmonium Dalitz decays, which are analogous to nuclear de-excitation with internal pair creation, offer an independent test of the X17 hypothesis and a unique environment to probe its couplings to second-generation quarks. Moreover, the available phase space in these decays is well suited for searches for MeV-scale dark photons that couple weakly to SM particles.

The BESIII experiment operating at the BEPCII e^+e^- accelerator,

has collected world's largest data sample in the τ -charm region. Using these data, a dedicated search for X17 in charmonium Dalitz decays is performed. This talk will present the analysis strategy and recent

results from BESIII, providing a complementary and collider-based probe of the X17 scenario.