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A new era of collider neutrino physics at the LHC: the SND@LHC experiment

Scattering Neutrino Detector at the Large Hadron Collider (SND@LHC) is a compact and stand-alone experiment built to perform measurements with neutrinos produced at the LHC in a hitherto unexplored pseudo-rapidity region of 7.2 < 𝜂 < 8.6, complementary to all the other experiments at the LHC. The experiment is located 480 m downstream of IP1 in the unused TI18 tunnel. The detector is composed of a hybrid system based on an 800 kg target mass of tungsten plates, interleaved with emulsion and electronic trackers, followed downstream by a calorimeter and a muon system. The configuration allows efficient distinguishing between all three neutrino flavours, opening a unique opportunity to probe the physics of heavy flavour production at the LHC in the region that is not accessible to ATLAS, CMS and LHCb. This region is of particular interest also for future circular colliders and for predictions of very high-energy atmospheric neutrinos.

In this poster, we will discuss the detector concept and the physics goals we plan to achieve. We will also report the official results from the collaboration such as the ongoing efforts for neutrino searches, muon flux background (EP pre-print: http://cds.cern.ch/record/2872668) and emulsion vertex analysis. Most importantly, we will report the recent findings of the direct observation of the muon neutrino interactions using the 2022 13.6 TeV proton-proton collisions (integrated luminosity of 36.8 fb−1) dataset from the active electronic components of the SND@LHC detector: PRL publication https://doi.org/10.1103/PhysRevLett.131.031802. Lastly, we will discuss further physics prospects of SND@LHC, as well as future plans for an upgraded version of the experiment for the high-luminosity LHC running (Advanced SND@LHC), planned for the end of this decade.

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