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Measuring high-energy neutrinos with FASERnu in the LHC Run-3

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FASERν at the LHC is designed to directly detect collider neutrinos for the first time and study their cross sections at high energies, where no such measurements currently exist. The detector will be located in the far-forward region of ATLAS. Deployment on the beam collision axis maximizes the flux of all three neutrino flavors, and allows FASERν to measure their interaction cross-sections in the currently unexplored TeV energy range. For electron and tau neutrinos, these measurements will extend existing cross section measurements to significantly higher energies. In 2018 we performed a pilot run with the aims of measuring particle fluxes at the proposed detector location and of possibly detecting neutrino interactions for the first time at the LHC. We installed a 30-kg lead/tungsten emulsion detector and collected data of 12.2 fb^{-1}. The analysis of this data has yielded several neutrino interaction candidates, excluding the no-signal hypothesis at the 2σ level. During Run-3 of the LHC starting from 2022, we will deploy an emulsion detector with a target mass of 1.1 tons, coupled with the FASER magnetic spectrometer. This would yield roughly 2,000 ν_e, 8,000 ν_μ, and 50 ν_τ interacting in the detector. We present the status and prospects of FASERν, as well as the neutrino detection in the pilot run data.

Reference to paper (DOI or arXiv)

https://doi.org/10.1140/epjc/s10052-020-7631-5, and a recent paper https://arxiv.org/abs/2105.06197

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