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Study of tau neutrino production with nuclear emulsion at CERN-SPS

Content

The data on tau neutrino is very scarce, only a few experiments have detected its interactions. At FNAL beam dump experiment DONUT, tau neutrino interaction cross-section was directly measured with a large systematical (˜50%) and statistical (˜30%) errors. The main source of systematical error is due to a poor knowledge of the tau neutrino flux. The effective way for tau neutrino production is the decay of Ds mesons, produced in proton-nucleus interactions. The DsTau experiment at CERN-SPS has been proposed to measure an inclusive differential cross-section of a Ds production with a consecutive decay to tau lepton in p-A interactions. The goal of experiment is to reduce the systematic uncertainty to 10% level. A precise measurement of the tau neutrino cross section would enable a search for new physics effects such as testing the Lepton Universality (LU) of Standard Model in neutrino interactions. The detector is based on nuclear emulsion providing a sub-micron spatial resolution for the detection of short length and small “kink” decays. Therefore, it is very suitable to search for peculiar decay topologies (“double kink”) of Ds→τ →X. After successful pilot runs and data analysis, CERN had approved the DsTau project as a new experiment NA65 in 2019. During the physics runs, 2.3×108 proton interactions will be collected in the tungsten target, and about 103 Ds→τ decays will be detected. In this talk, the results from the pilot run will be presented and the prospect for physics runs in 2021-2022 will be given.

Summary

In addition to the primary aim of measuring Ds differential production cross section,in 2.3×10ˆ8 proton interactions, a high yield of O(10ˆ5)charmed particle pairs is expected.The analysis of those events can provide valuable by-products, such as a measurement of the intrinsic charm content in proton by measuring the emission angle (pseudorapidity)of the charmed particle pairs, the interaction length of charmed hadrons, the Λc production rate and search of super-nuclei, that have never measured.

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