

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 ($\sim 50\%$) and statistical ($\sim 30\%$) 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 $Ds \rightarrow \tau \rightarrow X$. After successful pilot runs and data analysis, CERN had approved the DsTau project as a new experiment NA65 in 2019. During the physics runs, 2.3×10^8 proton interactions will be collected in the tungsten target, and about 103 $Ds \rightarrow \tau$ 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 2.3×10^8 proton interactions, a high yield of $O(10^5)$ 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 Λ_c production rate and search of super-nuclei, that have never measured.

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