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LETTER OF INTENT

STUDY OF ν_e AND $\bar{\nu}_e$ INTERACTIONS IN BEBC

Inter-University Institute for High Energies ULB-VUB; BRUSSELS
LPNHE, Ecole Polytechnique; PALAISEAU
D.Ph.P.E., CEN; SACLAY

Good experimental checks exist on muon-electron universality in electromagnetic and charged current induced weak interactions. However, no experiment has so far investigated universality in weak neutral current interactions. Also, the question of heavy leptons coupled to ν_e or $\bar{\nu}_e$ is totally open, a first example being the τ (1).

An experimental study of these problems is very difficult in a classical wideband neutrino beam because of the very small ν_e or $\bar{\nu}_e$ contents of such a beam (less than 1 %). It is our intention to investigate both problems using a ν_e beam from K^o_L decays. This beam differs from the classical wideband beam by the fact that the charged neutrino parents (π and K mesons) are defocussed by a sweeping magnet directly downstream the target.

Preliminary flux calculations have been performed at CERN (2) for such a beam produced by 400 GeV/c protons from the SPS and a 420 m decay length. The ν_e and $\bar{\nu}_e$ fluxes are found to be substantial enough to make such an experiment feasible. The unavoidable ν_μ and $\bar{\nu}_\mu$ contamination can be limited to an acceptable level.

To achieve the physics goals, a clean separation of the charged current induced interactions of the four types of neutrinos involved is required. The identification of the secondary charged lepton is thus essential and, especially for final state electrons, requires the use of the bubble chamber technique. It is therefore requested to use BEBC equipped with the two plane EMI and filled with an intermediate H_2-Ne mixture ($\chi_o \simeq 60$ cm). This filling liquide is chosen as a satisfactory compromise between electron identification and the possibility to measure their momentum.

An exposure of 250.000 pictures (2.5 10^{18} protons) to the considered ν_e beam would yield about 1.000 ν_e and $\bar{\nu}_e$ charged current induced interactions within a suitable fiducial volume in BEBC. Approximately twice as many charged current ν_μ and $\bar{\nu}_\mu$ interactions are expected.

A first measurement of the strength of the neutral current coupling for electron neutrinos can be obtained from these charged current ν_μ, $\bar{\nu}_\mu$, ν_e and $\bar{\nu}_e$ interactions and the measured NC/CC ratio for muon neutrinos. The comparison to the strength expected from universality would be achieved with a statistical accuracy of 10 to 15 %. It should be pointed out that severe differences in the NC production rates are suggested by some theoretical models (3).

A detailed comparison of the charged current interactions of neutrinos of the muon and the electron type within the same experiment and with comparable statistics would also give an answer to the possible coupling of the τ or leptons of higher mass to ν_e or $\bar{\nu}_e$.

The relatively minor changes to the present wideband neutrino beam line in the SPS west area to obtain an enriched ν_e beam could be carried out during the long $\bar{p}p$ shut down. The experiment could then be run immediately after the shut down.

Contact person :
M. NEVEU - Saclay.

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