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E246/E470

The E246 experiment which is searching for T-violating muon polarization (P_T) in $K^+ \rightarrow \pi^0 \mu^+ \nu$ decay ($K_{\mu 3}$) continued data analysis after the completion of data taking in 2000. The systematic errors of the 1998 results were further studied carefully. The data from the 1999 and 2000 runs were also analyzed and a preliminary result of P_T was obtained. One of the byproduct physics from this stopped K^+ experiment is the branching ratio measurement of the direct emission in $K^+ \rightarrow \pi^+ \pi^0 \gamma$ decay. For an optimized trigger condition run, a new experiment was approved as E470 and it ran in the fall of 2001 for 120 shifts. This direct emission is interesting because it is relatively enhanced in the strong bremsstrahlung spectrum and dominated by a magnetic transition of chiral anomaly. Its branching ratio can be interpreted in terms of low energy effective theory of QCD such as chiral perturbation theory. The data taking was successful and the branching ratio of the order of magnitude of 10^{-5} is expected to be determined with an accuracy of about 10%. As another byproduct channel of E246, $K^+ \rightarrow \pi^0 e^+ \nu$ decay (K_{e3}) was studied further to constrain the exotic scalar and tensor couplings [1]. The values of $f_s/f_+(0) = 0.0040 \pm 0.0160(\text{stat}) \pm 0.0067(\text{syst})$ and $f_T/f_+(0) = 0.019 \pm 0.080(\text{stat}) \pm 0.038(\text{syst})$ were obtained. The decay width ratio of the two channels, $\Gamma(K_{e3})/\Gamma(K_{\mu 3})$, was also analyzed and determined the q^2-dependent coefficient of f_0 form factor of the K_{l3} decay to be $\lambda_0 = 0.019 \pm 0.005(\text{stat}) \pm 0.004 \ (\text{syst})$ [2].

[1] A.S. Levchenko *et al.*, hep-ex/0111048 (2001).
[2] K. Horie *et al.*, Physics Letters B513 (2001) 311.