

The TWIST Experiment: Testing the Standard Model with Muon Decay

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The TRIUMF Weak Interaction Symmetry Test (TWIST) is a search for deviations from the predictions of the Standard Model of particle physics in the decay of polarized positive muons via a high precision measurement of the distribution of angle and energy of the resulting positrons. The purely leptonic decay is virtually free of strong interaction effects, and the Standard Model predicts the distributions with very small theoretical uncertainties. The high statistical samples obtained with TWIST ensure that the space-time structure of the low-energy weak interaction can be tested to the limit of the experimental systematic uncertainties. Our goal is to observe any deviations which may exist at the level of only a few parts in ten thousand, an improvement of an order of magnitude in the experimental precision for the muon decay parameters ρ , δ , and $\mathcal{P}_\mu\xi$.

First results for these parameters at the level of a few parts in a thousand have already been reported[2]. Newer data are being analyzed with the expectation of substantially reduced statistical and systematic uncertainties. Further improvements in the experiment and its analysis are still in progress with the final data sets to be completed this year. The experiment will be described, results of the most recent analyses will be presented, and the expectations for the final results will be discussed.

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- [2] B. Jamieson *et al.*, Phys. Rev. D **74**, 072007 (2006); A. Gaponenko *et al.*, Phys. Rev. D **71**, 071101(R) (2005); J.R. Musser *et al.*, Phys. Rev. Lett. **94**, 101805 (2005).