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Extraction of the weak magnetism and Fierz interference term from precision spectrum shape measurements in the miniBETA project

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Precision spectrum shape measurements in nuclear beta decay can be used for testing the Standard Model and physics beyond it with accuracy being competitive with high-energy collider experiments. Such a comparison can be carried out in the framework of effective field theory. The most prominent and poorly known effect in the Standard Model is weak magnetism, the higher-order recoil correction induced by nuclear pion exchange. Knowledge of this factor allows for study of the QCD influence on beta decay and plays an important role in determining the significance of the reactor neutrino anomaly. Searches for physics beyond the Standard Model can be realized by exploring the Fierz interference term, also modifying the beta spectrum shape.

This contribution will describe the experimental efforts in nuclear beta decay performed in the miniBETA project and will provide details on the systematic effects in the data analysis of the spectrum shape. The results from beta spectrum shape measurements on the allowed Gamow-Teller transition of 114In and 32P will be presented, including a first extraction of the weak magnetism form factor in the high nuclear mass range and a new value for the Fierz interference term. The measurements were performed with a plastic scintillator in combination with a multi-wire drift chamber, where the latter served as an effective background filter.

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