

Longitudinal muon spin relaxation in aluminium and silver *

J. Bueno¹ on behalf of TRIUMF Experiment 1111

¹*University of British Columbia, Vancouver, BC, V6T 1Z1, Canada*

A precise measurement of the time dependence of the longitudinal spin relaxation in high purity aluminium and silver has been made. A μ^+ SR experiment was carried out on the M20 beam line at TRIUMF, with the metal samples at room temperature. Since the depolarisation rate is of order $10^{-3} \mu\text{s}^{-1}$, a range of running conditions were necessary to allow careful consideration of the systematic uncertainties in a longitudinal μ^+ SR arrangement.

The μ^+ SR experiment is a subsidiary of the TRIUMF Weak Interaction Symmetry Test (TWIST), which is close to completing the most precise test of the standard model prediction for muon decay. In the TWIST experiment, polarised muons are stopped in either high purity aluminium or silver while in a strong longitudinal magnetic field, and the form of the time dependent depolarisation must be determined. The μ^+ SR experiment was undertaken to measure depolarisation on a timescale shorter than $1 \mu\text{s}$, and provide a complementary measurement of the depolarisation's form.

The results from the TWIST detector and the μ^+ SR experiment will be presented. The selection of muons that stop in the metal samples is the most significant challenge in both experiments, and the techniques to make this selection will be presented. The analysis technique using data from the TWIST detector will also be presented, where drift chambers are used to reconstruct the decay positron trajectory, allowing the positron counts to be weighted according to their momentum. Compared with an unweighted forward-backward asymmetry, the weighting technique reduces the statistical uncertainties in the relaxation rate by more than a factor of two.

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