TRINAT's polarized program with ^{37}K

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As discusssed in last year's report [1], TRINAT recently published the world's most precise measurement of the beta asymmetry parameter in a nucleus: $A_\beta = -0.5707(13)_{\mathrm{syst}}(13)_{\mathrm{stat}}(5)_{\mathrm{pol}}$. This 0.3% measurement was the PhD thesis of TAMU student Ben Fenker. Another student at the University of Manitoba is currently analyzing the same data set, but looking at the beta-energy dependence of the observables. When completed, we will have a measurement (or limit) on beyond the standard model physics parameters b_{Fierz} and second-class currents. These parameters are zero in the standard model, but are predicted to be finite in extensions which include tensor and/or scalar components to the predominantly $V - A$ form of the weak interaction. Our measurement will help search for these small terms or improve limits on their magnitude.

There is a steep learning curve both in the data analysis and in developing the GEANT4 Monte Carlo simulation necessary for this analysis. We have made a preliminary analysis of the observed super-ratio asymmetry as a function of energy, allowing a non-zero b_{Fierz} to be a free parameter of the fit. We include a rough response function for the β telescopes and ave included recoil-order effects. The result, shown in Fig. 1, indicates our statistical uncertainty will be ± 0.04. We hope to complete the analysis by the end of this year.

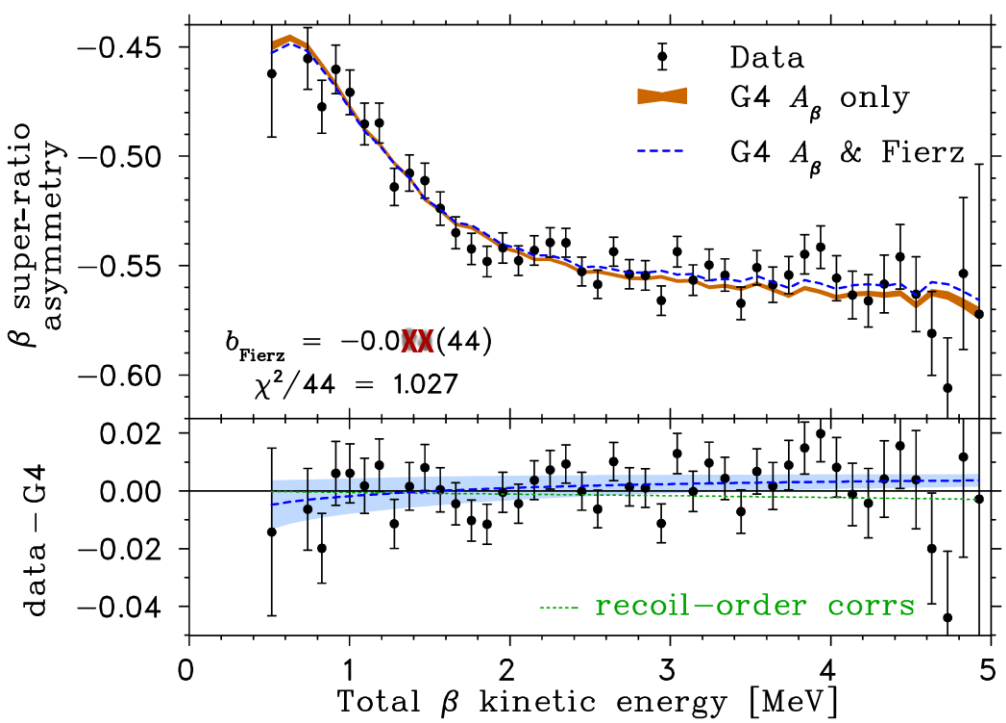

FIG. 1. Asymmetry as a function of energy. This is the same data for the $\boldsymbol{A_\beta}$ measurement shown in Fig. 3 of Ref. [2], but this time is also fit including a non-zero Fierz parameter. The value has been hidden as this is a very preliminary fit. Nevertheless, the statistical uncertainty of $\pm\mathbf{0.044}$ is a very good estimate as most of the data selection has already been made for the $\boldsymbol{A_\beta}$ measurement. A detailed analysis and the estimate of systematic uncertainties is

[1] B. Fenker *et al.*, *Progress in Research*, Cyclotron Institute, Texas A&M University (2017-2018), p.I-10.

[2] B. Fenker *et al.*, Phys. Rev. Lett. **120**, 062502 (2018).