Spectroscopic Analysis of the β-Decay of ^{33}Mg

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The nucleus ^{33}Mg lies near N=20 in the chart of nuclides, residing in a region known as the "Island of Inversion". In this region, the internal structure of nuclei differs from what is predicted from the standard nuclear shell model due to the presence of intruder states. In this research project, data from the β-decay of ^{33}Mg into its daughter nucleus ^{33}Al is analyzed to construct a decay scheme and help provide insight into the deformed nuclear structure of ^{33}Mg. The decay scheme is particularly of interest because of the disagreement between previously reported ^{33}Al level schemes. The experiment was conducted at TRIUMF in the ISAC I facility where ^{33}Mg beam was created using the TRILIS ion source. The collected decay data consists of β-tagged γ-ray spectra obtained using the GRIFFIN spectrometer. Analysis was done using the GRSISort package and involved several procedures, including creating fits for photopeak identification, differentiating contributions from other nuclei within the ^{33}Mg decay chain, the creation of γ-γ coincidence projections to establish cascade relationships between transitions, intensity calculations, and further techniques to verify events like sum peaks, escape peaks, and doublets. The resulting decay scheme provides a clearer picture of the beta decay of ^{33}Mg, helps resolve discrepancies in previously reported schemes, and contributes to the understanding of nuclear structure in the Island of Inversion.