Abstract

The fact that no stable nuclides of mass 8 exist impedes the reaction flow towards higher masses in a variety of different astrophysical environments. While in hydrostatic stellar burning the gap is bridged by the reaction 3_ ! ^{12}C via the so-called Hoyle-state, other scenarios, such as Big Bang Nucleosynthesis and the formation of r-process seeds in supernovae do not have the required Helium-density for this, and must thus proceed via radioactive intermediaries. One important step for which experimental data is required in such models is the reaction ^{8}Li(_; n)^{11}B.
While several experiments have measured a cross section for this reaction, there is significant disagreement between the results, and they all suffer from severe rate limitations. To address this, a new time projection chamber (TPC) was built to measure and identify the charged reaction product ^{11}B. The design includes a blind central region to avoid rate saturation due to detected beam particles. The detector is operated with a modern digitizing data acquisition system, allowing the recording of full signals.
Several campaigns with different species of ion beam were undertaken already, but a detailed analysis requires an in-depth characterization of the detector. This thesis performs such a characterization utilizing primarily data taken with a ^{148}Gd alpha source. After some problems were addressed over the course of the experimental work, the system is found to be capable of accepting a much higher beam rate than previous experiments and the experimental resolutions are shown to be in line with expectations from Geant simulations. Some suggestions are made to further improve the capabilities of the detector.