Development of TexCAAM: Texas CsI Array for Astrophysical Measurements

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High efficiency, compact CsI(Tl) gamma-ray array is being developed at TAMU. It will be primarily utilized for indirect nuclear astrophysics studies with stable and rare isotope beams. The main focus of these studied will be astrophysically relevant α-capture reactions. With stable beams the TexCAAM will be used in conjunction with the MDM spectrometer, and with rare isotope beams thick target and Si detector will be used to provide an event ID using coincidence with charged particles from (^{6}Li,d) or (^{7}Li,t) reactions. γ-ray spectroscopy will be used to determine excitation energies, α-ANCs, and spin-parities for the near α-threshold states relevant for astrophysics.

TexCAAM (the **T**exas **C**sI **A**rray for **A**strophysical **M**easurements) consists of 32 Scionix CsI(Tl) (5x5x4 cm^{3}) detectors readout by Si pin-diodes with the preamps directly attached to them for optimal noise conditions. The crystals are arranged as shown in Fig. 1. SIS3316 Struck wave-form digitizers are used to digitize and record the signals from the preamps directly.

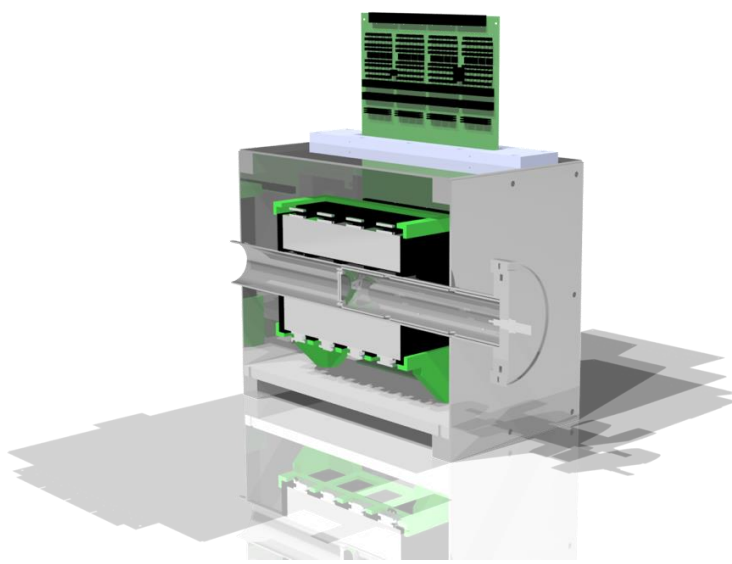

FIG. 1. Cutaway CAD drawing of TexCAAM. The target is inserted so that it is directly halfway into the CsI array. The array of CsI is designed to maximize the solid angle covered while allowing the beam-pipe to go through the array. The black and green parts are a 3D printed skeleton that holds the CsI in place around the beamline.

The commissioning experiment of TexCAAM is planned to be the ^{7}Be(^{6}Li,dγ)^{11}C* reaction to determine the contribution of the sub-threshold 3/2^{+} state to the production of ^{12}C in astrophysical environments, particularly in zero metallicity population-III stars [1,2]. Another early TexCAAM

experiment will be focusing on constraining the spin-parity assignments for astrophysically relevant states in ^{26}Mg that contribute to the ^{22}Ne(α,n) and ^{22}Ne(α,γ) reactions.

At present the array is being tested using gamma-ray sources to optimize data acquisition parameters for energy resolution, and determine efficiency of the setup. Further tests will be done to determine TexCAAM's ability to measure γ-γ angular correlations. The design of the target assembly has been completed and construction of it is set to begin shortly.

[1] M. Wiescher *et al*., Astrophys. J. **343**, 352 (1989).
[2] M. Hartos *et al.*, Astrophys. J. **862**, 62 (2018).