Updates to NIMROD for low density nuclear matter studies surface mounting Samtec connectors and new feedthrough designs

N. Shaffett and K. Hagel

A reliable understanding of the nuclear Equation of State (EOS) at various densities and temperatures is a vital component to understanding various nuclear and astrophysical phenomena. In particular, studies of temperatures of several MeV and densities below normal nuclear matter density n0 ~ 0.15 fm−3 are necessary in the study of core collapse supernovae. [1] Previous research into this field has been done at Texas A&M using "The Neutron Ion Multi-detector for Reaction Oriented Dynamics" (NIMROD) and upgrades to this array will aid in future research [,2].

NIMROD is a 4π array of detectors built to study reaction mechanisms in heavy ion reactions [3]. It consists of a 228 segment charged particle array set in a neutron ball. The Array is arranged in 15 rings of Si-CsI telescopes or single CsI detectors arranged concentrically around the beam axis as shown in Fig.1. The CsI detectors are 1-10 cm thick TI doped crystals read by photomultiplier tubes, with a pulse shape discrimination method being employed to identify light particles in the CsI [4]. Previous work with NIMROD to study low density nuclear matter has employed coalescence model methods to extract the source size, and by extension the density [1-2]. However, an alternative method of determining source size is to use correlation functions and employ telescopic methodology [5-7]. Extracting correlation functions using NIMROD will require improved angular resolution, therefore preparations for the upcoming test run this summer, and the following experiment have been focused on replacing the previously used quadrant silicon detectors with a configuration of 16 vertical strip ΔE, and 16 horizontal E detectors .

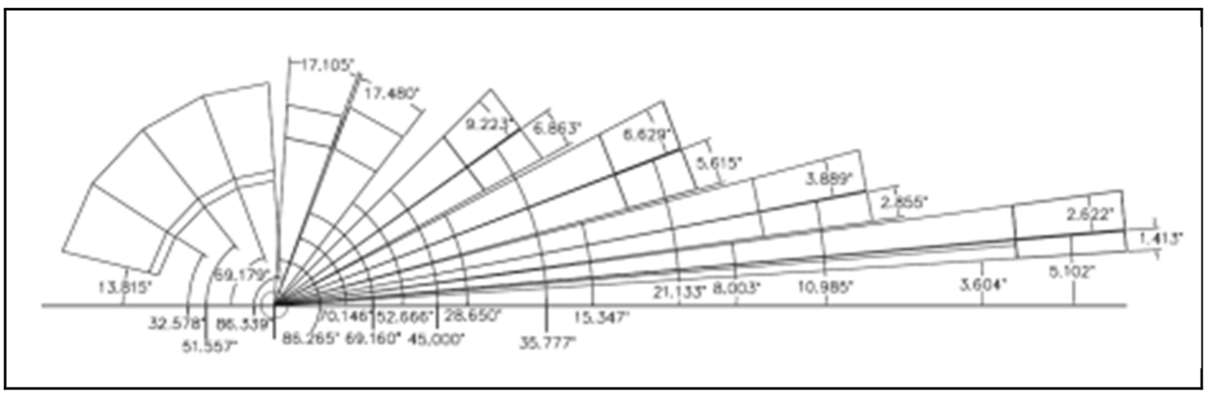

Fig. 1. Angular configuration of the NIMROD detectors.

The current focus is on the modules in ring 8-9 since this angular range, around 45° in the lab, highlights the intermediate velocity source while minimizing contributions from secondary decays of projectile like and target like sources [2]. In order to replace the quadrant detectors, which each have 5 signals (4 front and one back), with strip detectors, which each have 17 signals (16 front and one back), a new setup that utilizes pcb boards and high density Samtec cables has been developed.

Figure 2 shows an example of one of these Samtec cables connecting prototype silicon connector and feedthrough boards after surface mounting the Samtec connectors. The surface mounting process begins with placing the board on a vacuum table and covering all of the board except the individual pads with a stencil. Soldering paste can then be spread over the stencil using a spatula filling in the holes where each pad sits. The Samtec connector can then be placed on the pads using a vacuum pick up tool before being placed into an oven to melt the paste to create a solder bond. After determining connectivity additional components such as header pins can be added to the rest of the board using traditional soldering techniques.

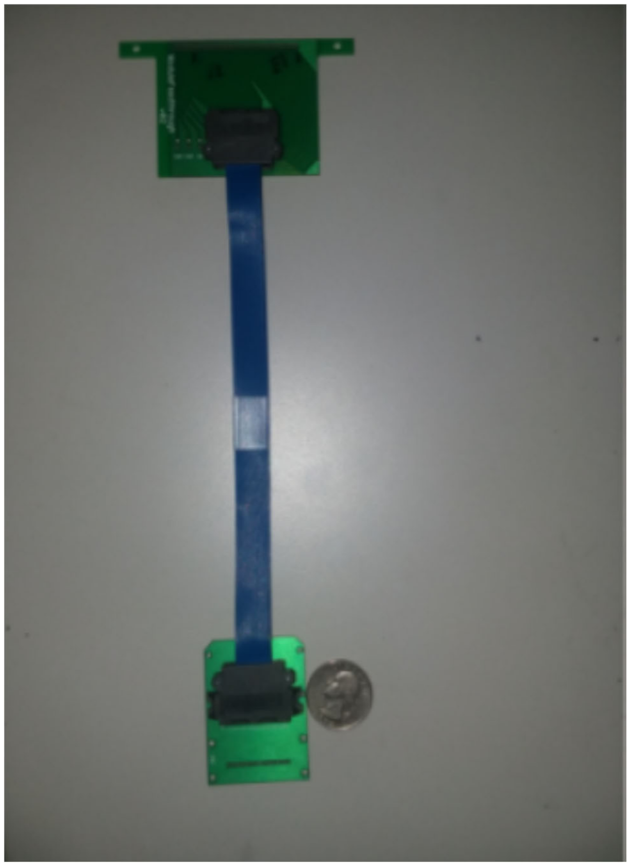

Fig. 2. Prototype boards connected by high density Samtec cables.

A finished prototype of one of the new feedthrough boards is shown in figure 3. In order to connect the CsId PMT's to these new boards SMA connectors will be utilized, and are currently being installed. A Wiener Mpod and oscilloscope has been set up and is being used to check that signals are being transported from the PMT's to outside NIMROD as expected.

Most of the new boards have been completed and are awaiting installation and all of the CsId have the new cables with SMA connectors installed to this new signal handling scheme. A test run is scheduled for the end of July to determine whether any modifications need to be made before the final setup of the experiment.

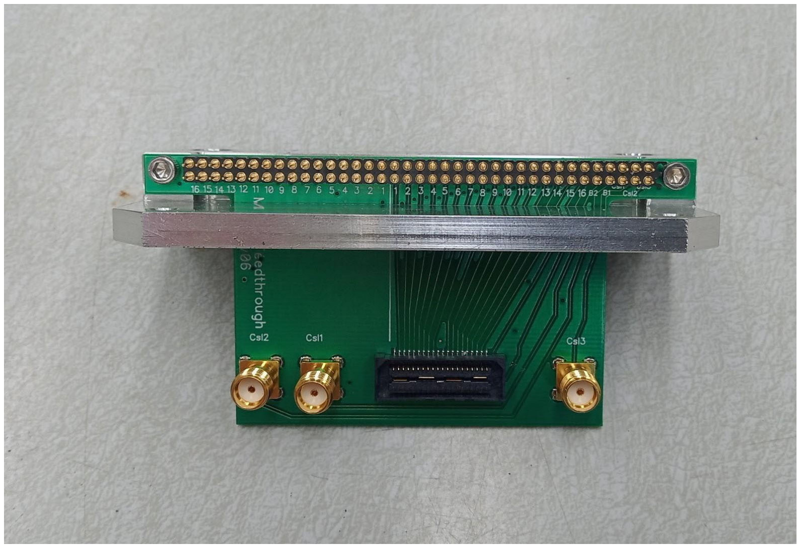

Fig. 3. Finished Prototype Feedthrough board with Samtec and SMA connectors.

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