NIMROD Upgrade

S. Wuenschel, K. Hagel, R. Wada, L. May, F.P. Abbegglen, B. Olsen, G.J. Derrig, S.N. Soisson, B.C. Stein, J.B. Natowitz, and S.J. Yennello

From its beginning, NIMROD has been a nearly 4pi detector. In its initial configuration, it consisted of 8 forward rings, covering from ~3 to 45 degrees, coupled to the back portion of the former Texas A&M CsI ball [1]. Each forward ring was composed of 12 modules containing an ionization chamber (IC) and a CsI crystal. Two modules per ring included a 300μm thick silicon detector between the IC and the CsI. Another two modules per ring included 150μm and 500μm silicon detectors between the IC and CsI. The backward direction was composed of 46 CsI, ion chambers, and some silicon detectors.

For several years, it has been a priority to mate the forward rings of NIMROD with the forward hemisphere of the ISiS array [2, 3]. The ISiS array, will replace the CsI ball in the backward direction. This will greatly increase the backward angle granularity and detection by providing 72 IC-Si-CsI modules.

Since the last project update, a number of improvements have been made. To increase the NIMROD forward angle detection, 300μm silicon detectors have been acquired for the remaining IC– CsI modules. NIMROD-ISiS signals will be treated modularly with motherboards mounted directly on the outer chamber wall. These motherboards will fit around the CsI bias supply boards.

The NIMROD motherboard has undergone several iterations over the last year due to cross talk issues between the CsI and ion chamber within a module. The latest configuration eliminated this cross talk and provided clean IC signals. This configuration placed the IC preamplifier inside the reaction chamber a minimal distance from the detector.

Chambers for the ISiS modules as well as the NIMROD ring 10-11 have been designed and are being constructed. The ISiS chamber will have 18 Indiana motherboards plugged vertically into it.

Both the NIMROD and Indiana motherboards have been built to accommodate IUCF preamplifiers. These preamplifiers have been tested and shown to produce isotopic resolution through, conservatively, Z=8 when used with a NIMROD IC-Si-Si-CsI module (Figure 1). Increased statistics may result in isotopic resolution for higher Z elements.

Ribbon coaxial cables were obtained from AMP/TYCO for relaying signals modularly from the NIMROD and ISiS motherboards. These cables connect to a splitting panel. The panel allows the output signals to be distributed to the various next stage electronics. Ideally, this set up will reduce confusion when correlating signals between the computer and detector.

Further electronics have been obtained for analyzing the signals from the NIMROD/ISiS system. Three new constant fraction discriminators (CFD) will provide trigger signals from the ISiS detectors. Fast signals from the ISiS Si shapers will be multiplexed into small groups for each CFD channel. A trigger module will now be used to regulate the electronic triggering and downscaling mechanisms.

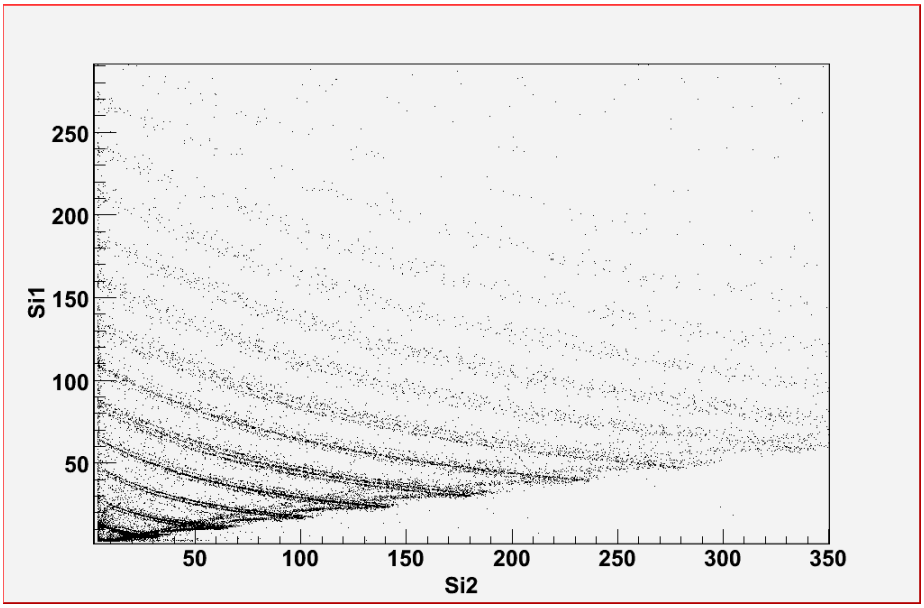

Figure 1. 150 μm Si vs 500 μm Si taken during a test run.

[1] B. Xiao *et al.*, *Progress in Research*, Cyclotron Institute, Texas A&M University (1991-1992), p. 126, *Progress in Research*, Cyclotron Institute, Texas A&M University (1992-1993), p. V-144

[2] J. Wang *et al.*, *Progress in Research*, Cyclotron Institute, Texas A&M University (2001-2002), p. V17-18

[3] K. Kwiatkowski *et al.*, Nucl. Instrum. Methods Phys. Res. **A360** , 571 (1995).