Data acquisition upgrades at the Cyclotron Institute

K. Hagel, A. Jedele, A.B. McIntosh, R. Burch, and J. Gauthier

We have implemented a number of new capabilities into our data acquisition system in the last several years in order to leverage more modern technology. This has recently included waveform digitizers and the MASE system [1].

We began to employ waveform digitizers several years ago in order to leverage present improvements in technology that provide opportunities to acquire more information from our experiments. The implementation of these digitizers has allowed us to gain information that would be otherwise inaccessible [2] as well as to consolidate a complete wall of electronics and delay lines into a single VME crate [3] that provides triggering, time information as well as several integration windows of signals for pulse shape analysis.

The early versions the software to operate the digitizers relied on calls to the access functions inside the data acquisition code. This proved usable and was, in fact, indispensable in learning how to use the digitizers, but had the effect that any change to the digitizer configuration had to be performed by an expert and the data acquisition had to be exited, recompiled and started again each time the configuration was changed.

In order to mitigate this problem we developed a control GUI for the digitizers that is integrated seamlessly into the front-end data acquisition system. This allows a fast change of the configuration by simply stopping the acquisition during a run, clicking on the control GUI, clicking on what needs to be changed and continuing the next run with the new configuration. The GUI also saves the previous configuration to allow reverting to that configuration if that becomes necessary.

We are also in the process of upgrading NIMROD [3] to replace aged radiation damaged silicon detectors as well as to increase the number of super telescopes. The previous system for the silicon detector readout does not have sufficient capacity in order to allow readout of all of the new silicon detectors.

To be able to read out the larger number of detectors, we have borrowed the MASE [1] system from the group in Indiana. In the same spirit as the waveform digitizers, we have developed GUI based on the one developed by the Indiana group. This GUI is also incorporated seamlessly into the data acquisition system and works in a similar spirit to the digitizer GUI.

[1] C. Metelko, A. Alexander, S. Hudan, J. Poehlman, R.T. de Souza, Nucl. Instrum. Methods Phys. Res. **A569**, 815 (2006).

[2] S. Wuenschel, K. Hagel, M. Barbui, J. Gauthier, X.G. Cao, R. Wada, E.J. Kim, Z. Majka, R. Płaneta, Z. Sosin, A. Wieloch, K. Zelga, S. Kowalski, K. Schmidt, C. Ma, G. Zhang, and J.B. Natowitz, Phys. Rev. C **97**, 064602 (2018).

[3] S. Wuenschel, K. Hagel, R. Wada, J.B. Natowitz, S.J. Yennello, Z. Kohley, C. Bottosso, L.W. May, W.B. Smith, D.V. Shetty, B.C. Stein, S.N. Soisson, Nucl. Instrum. Methods Phys. Res. **A604**, 578 (2009).