Back-potting and Testing of Cables Fabricated for the Photomultiplier Tubes of the Hall C Neutral Particle Spectrometer

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High voltage cables were fabricated to provide ~1100 V to the photomultiplier tubes (PMTs) of the Hall C Neutral Particle Spectrometer (NPS). After fabrication, quality control tests were conducted at 2000 V, and again after back-potting the Radiall connectors, which was done to prevent unseating of connector pins. This note details the retesting of the cables and the results of these tests.

The high voltage to the PMTs of the NPS is routed from 30 CAEN A7030TN modules housed in two CAEN SY4527 crates via the high voltage supply cables and the flat signal and high voltage cables, Fig. 1 [1].

Forty high voltage cables were fabricated. The cables are ~145 feet long and have forty-two, 26-AWG, insulated conductors and are terminated at one end with a Radiall 52-pin connector and at the other end with three Samtec connectors (two 30-position connectors and one 16-position connector) [2]. All 40 cables were tested in the high voltage cable test station after fabrication.

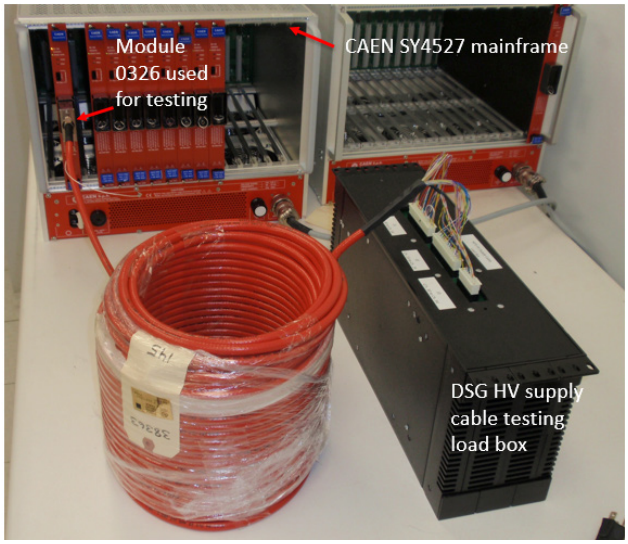

FIG. 2. High voltage cable test station.

The test station, Fig. 2, comprised a single CAEN SY4527 crate populated with nine CAEN A7030TN high voltage modules. The high voltage supply cable to be tested was attached to a high voltage module (via the Radiall 52-pin connector) and at the other end to the DSG-designed and built high voltage supply cable testing load box (via the three Samtec connectors). The cable testing load box was populated with 36 3-MΩ resistors, each of which, at 2000 V, is expected to draw a current of 667 μA. None of the fabricated cables had an issue [3].

To remedy the issue of the Radiall connector pins becoming unseated during connection and disconnection, the Radiall connectors were back-potted using thermoplastic adhesive (Power 7718 Knot Filling Hot Melt Glue), Fig. 3. After back-potting the connectors, the cables were retested at 2000 V for ~12 hours; current and voltage were monitored to verify that back-potting had not impaired cable performance.

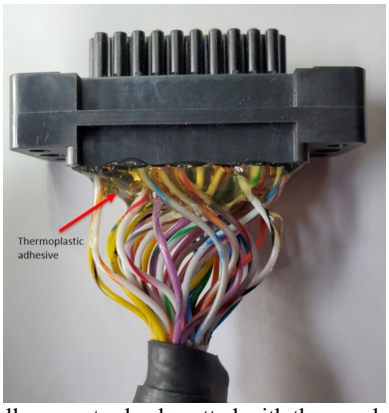

FIG. 3. Radiall connector back-potted with thermoplastic adhesive.

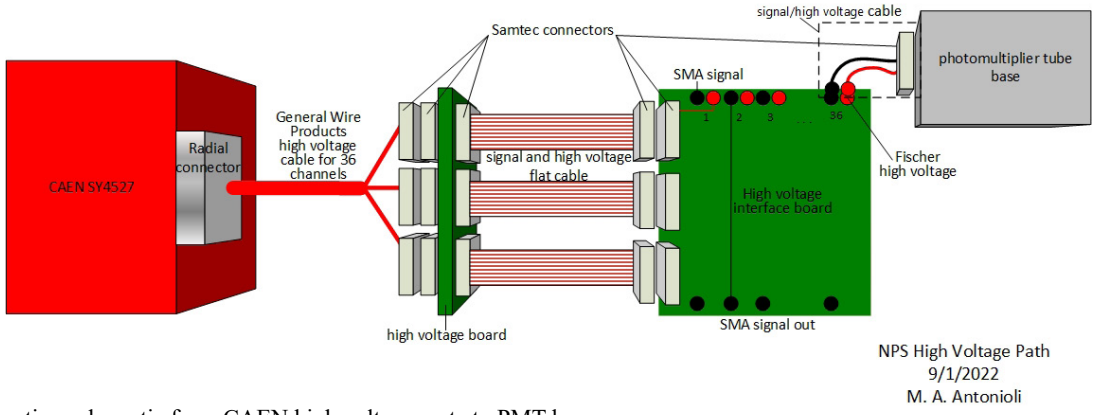

FIG. 1. Connection schematic from CAEN high voltage crate to PMT base.

In the before and after back-potting voltage stability plots, Fig. 4, the horizontal green line indicates the set voltage for all channels, the blue points the average voltage for each channel, and the horizontal blue line the average voltage across all channels. The red and yellow horizontal lines indicate the maximum and minimum, and typical upper and lower voltage accuracies, respectively. The average voltage over all 36 channels of the high voltage cable is 1999.91 V before back-potting and 1999.75 V after back-potting.

For the current stability plots, each colored line represents the average readback current for an individual high voltage channel. The average current over the 36 channels of the high voltage cable before and after back-potting was between ~680 μA and ~683 μA.

To conclude, back-potting the Radiall connectors of the high voltage supply cables for NPS has had no effect on the performance of the high voltage cables.

[1] M. Leffel, A. Brown et al., *Fabrication of Cables for the Photomultiplier Tubes of the Hall C Neutral Particle Spectrometer*, DSG Note 2021-28, 2021

[2] M. Leffel, A. Brown et al., *Fabrication of the High Voltage Supply Cables for the Hall C Neutral Particle Spectrometer Photomultiplier Tubes*, DSG Note 2021-25, 2021

[3] A. Brown et al., *Testing of the High Voltage Cables to be Used for the Photomultiplier Tubes of the Neutral Particle Spectrometer in Hall C*, DSG Note 2021-19, 2021

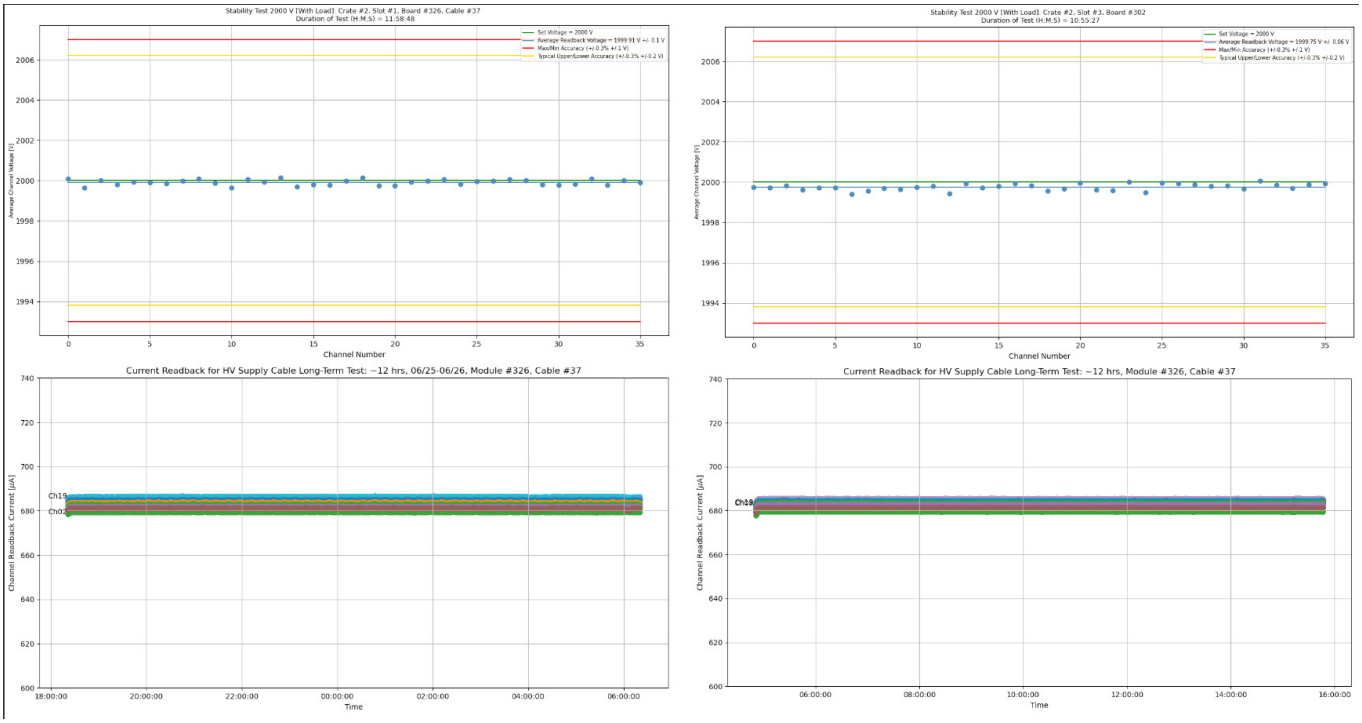

FIG. 4. Voltage (upper) and current (lower) testing results for cable #37 before back-potting (left) and after back-potting (right).