FINAL CONVERSION OF THE SPALLATION NEUTRON SOURCE EXTRACTION KICKER PULSE FORMING NETWORK TO A HIGH VOLTAGE SOLID-STATE SWITCH*

Beam

Summary

The Spallation Neutron Source (SNS) extraction kicker 60 Hz pulsed system uses 14 blumlein PFN modulators that require timing synchronization with stable rise times. A thyratron replacement has been investigated and the kickers have been converted to use a solid-state switch design, eliminating the lifetime and stability issues associated with thyratrons. The thyristor replacement project began on May 30, 2017, with one kicker and finished on March 25, 2019, with the 13 remaining kickers converted without a single thyristor failure in that time period. The thyristors are expected to save \$150k/year on thyratron replacements.



Kicker 6 & 12 thyristor and kicker 5 thyratron jitter over 100 days. Thyristors +/-2ns, thyratron at +/-50ns by end of life.



S56-12 switch assembly in PFN tank.



^ξ email: morrisb@ornl.gov

B. Morris^ξ, R. Saethre ORNL, Oak Ridge, TN 37831 USA

Turn-on Time











Time

Results

Temperature Testing



Thyratron vs. thyristor rise time compared to beam gap



Temperature testing of thyristor, stages 1, 6, & 12 shown. Stage 1 & 6 are below 120°F while stage 12 is above 135°F.

Differences in temperature are attributed to flow differences between each stage.



Thyristor baffling and manifold to direct flow. Manifold is indicated by arrow at location 1 and baffling by arrow at location 2.

All 14 kickers jitter/drift after conversion over 2 days.

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