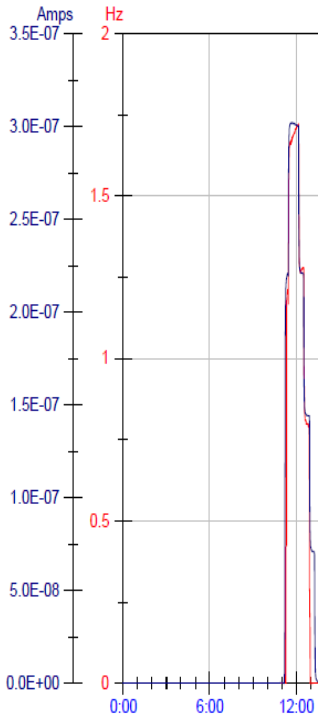
Wireless Reactor Power Distribution Measurement System Utilizing an In-Core Radiation and Temperature Tolerant Wireless Transmitter

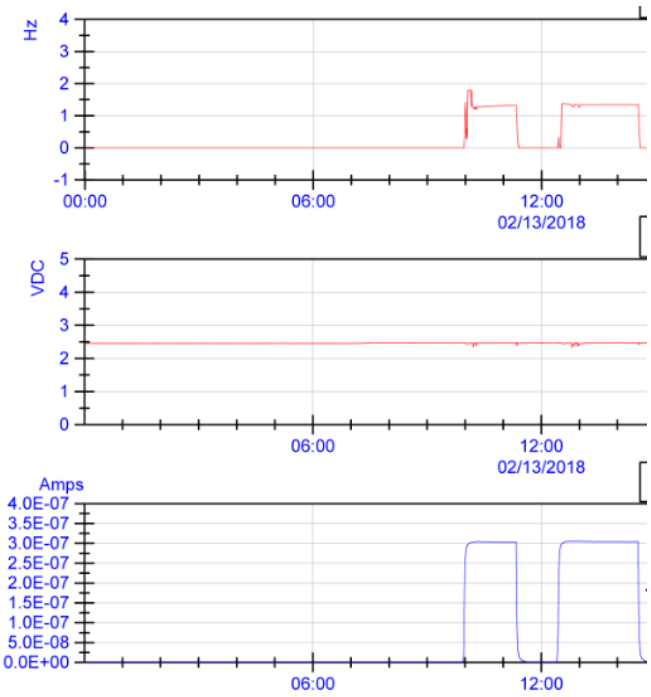
Overview

- Wireless transmitter operating inside a fuel top nozzle, capable of continuously transmitting neutron flux data during plant operation. Device itself would be powered by harvesting radiation from the core.
- Serves as an enabling technology for other applications such as in-rod sensor and other in-containment applications.

Benefits

- Increase in reactor operating margin due to measurement density increase: 100% of fuel assemblies are instrumented vs. 33%.





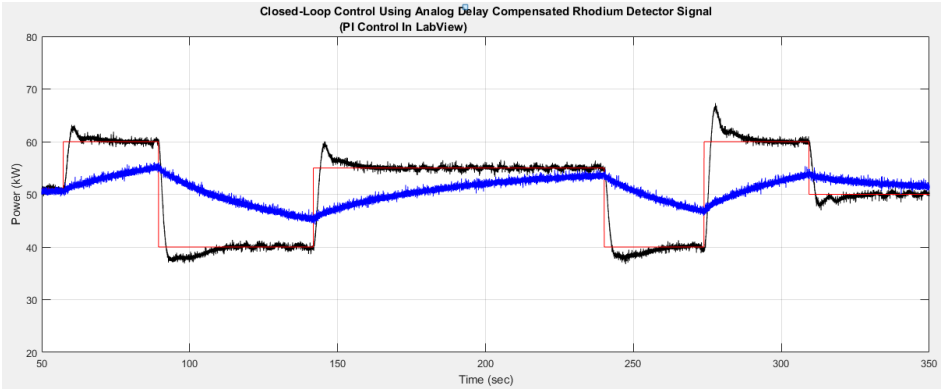
Red top trace frequency pulses:
Pulse repetition frequency varies as reactor power changes

Red middle trace is the RF carrier amplitude, which remains stable

Blue bottom trace is the Rhodium (Rh) detector current:
Reactor power monitored with Rh self-powered detector.

Test highlights (Tested at the Penn State Breazeale Reactor)

- Amplitude Modulated Wireless transmitter capable of transmitting a signal proportional to a Rhodium Self-Powered Neutron Detector.
- AM Wireless transmitter functioned as expected when exposed to a ***neutron fluence of 1x10^{19} n/cm^2***.



Rx control through SPND
Black: Analog compensation
Red: Controller Setpoint
Blue: Uncompensated detector signal

Westinghouse