Contribution ID: **27** Type: **Oral presentation**

#05-27 Multi-parameter discrimination of partial-discharge-induced pulses in fission chambers designed for sodium-cooled fast reactors

Thursday, June 24, 2021 11:20 AM (20 minutes)

Fission chamber technology has been identified as the most suitable method for neutron detection to be used in the vessel of a sodium fast reactor and may possibly also be used for neutron diagnostics in fusion power (ITER, DEMO). This type of detector, namely High Temperature Fission Chamber (HTFC), must be able to operate under high irradiation of up to 10^10 n/cm².s, must have high sensitivity (~1) to detect fast neutrons, and must operate at high temperatures, up to 650°C in sodium fast reactors and probably at even higher temperatures in fusion power reactors. It has been observed that an effect of the high temperature environment is an additional signal, ascribed to partial electrical discharges, which is of similar amplitude and duration as the useful signal caused by neutron interaction with the fissile layer inside the fission chamber. Partial discharges (PD) in gases are often referred to as "Corona discharges", and are associated with the phenomenon of an electronic avalanche in the presence of strong electric field. Previous work by Hamrita et al. demonstrated how mono-parameter discrimination based on signal full width at half maximum values can discriminate neutron pulses from PD pluses, but only for small diameter fission chambers.
In the presented work, neutron and PD pulses are collected using two large diameter HTFCs, designed to be used in the vessel of a sodium fast reactor, tested at high temperature and under neutron beam irradiation and off beam. Firstly, starting from preliminary results of Hamrita et al., the collected pulses (neutron and PD) are separated using a mono-parameter discrimination method based on full width at half maximum. Then the same data are separated using the proposed multi-parameter discrimination method by means of KNN and SVM algorithms.
Finally, the results obtained from the tested discrimination methods were compared and a PD-neutron discrimination process for HTFC was proposed.

Primary authors: LYNDE, Clément (CEA); GALLI, Giacomo (ISAE SUPAERO); Dr HAMRITA, Hassen (CEA); Dr JAMMES, Christian (CEA); Dr KIRKPATRICK, Michael J. (Centralesupelec); Prof. ODIC, Emmanuel (Centralesupelec); Mr SZILAGYI, Robert (Centralesupelec)

Presenter: LYNDE, Clément (CEA)

Session Classification: 05 Nuclear Power Reactors Monitoring and Control

Track Classification: 05 Nuclear Power Reactors Monitoring and Control