ALGORITHM FOR PROCESSING AMPLITUDE DISTRIBUTIONS OF NEUTRAL PARTICLE ANALYZERS SIGNALS FOR ITER [*)]

[2]Navolotsky A.S., [2]Afanasyev V.I., [2]Andreev I.A., [2]Chernyshev F.V., [2]Melnik A.D., [2]Mironov M.I., [2]Nesenevich V.G., [2]Petrov M.P., [2]Petrov S.Ya., [2]Shmitov R.Yu., [1]Mokeev A.N.

[1]*Institution «Project Center ITER», Moscow, Russia, support@iterrf.ru*
[2]*Ioffe Institute, Saint-Petersburg, Russia, post@mail.ioffe.ru*

Neutral particle analyzers are used to measure fluxes of deuterium and tritium atoms emitted by ITER plasma. The analysis of the energy spectra of these atoms provides the information on isotopic ratio of deuterium-tritium fuel, which is of paramount importance for ensuring optimal thermonuclear burn conditions.

The data acquisition and processing system of the atomic analyzers consists of eight PXIe-5752B ADC modules and eight PXIe-7971R FPGA modules from National Instruments company. The signal from each detector channel is digitized by the ADC and transmitted to the FPGA to produce pulse-height distribution. There is neutron and gamma-ray induced background among the signals received from the detectors. If the amplitude of background pulses is small, the background can be separated using amplitude discrimination. However, in some detector channels, a significant portion of the background may have amplitudes close to particle signals. In this case, amplitude discrimination becomes difficult, and an alternative method of background suppression becomes necessary.

In this report the development of a real-time algorithm for separating the particle signal from the background is discussed. It describes the modeling of pulse-height distributions required to assess the algorithm's accuracy across various scenarios. Additionally, the dependency of the algorithm's accuracy on particle count rates is provided and evaluation of the algorithm's execution time on the FPGA is given.

[*)] abstracts of this report in Russian