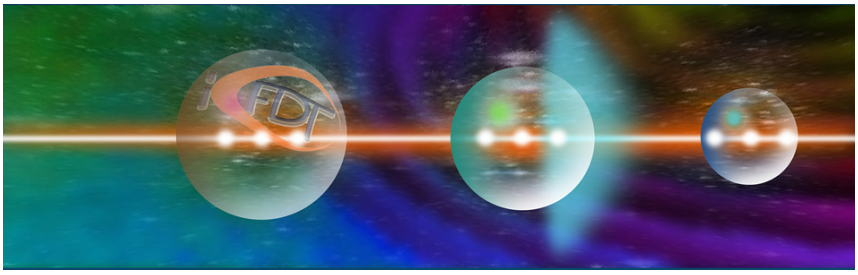

Contribution ID: **25** Type: **Poster**

Latency and throughput of online processing in Soft X-Ray GEM based measurement system

Thursday, 4 October 2018 14:30 (1h 30m)

Plasma magnetic confinement with tokamak device usage is a complex phenomenon. To understand it clearly, various diagnostics must be used. One of them is plasma impurities monitoring, which can be done with measurement of their soft X-ray radiation. Our system implements such functionality [1].

Done from scratch with Gas Electron Multiplier (GEM) based detector, analog and digital (with use of FPGA) electronics and connection to server-grade PC (based on Xilinx DMA driver) it holds complete execution environment for low latency and high-performance calculations. The systems consist of analog modules, analog-to-digital converters, FPGA-based modules capable of fast acquisition and pre-processing of the data and PC with dual socket CPU motherboard.

It is the upgrade of the former system presented earlier in [2] for offline (prior to pending plasma shot) calculations done in MATLAB environment. Current version, with improved latency of computations, was implemented with performance in mind and can provide online output. It consist of upgraded PCIe communication, software environment preparation for low latency processing, data dispatching sub-system and optimized C/C++ based implementation of algorithms used for computations.

The throughput of the hardware acquisition part of the system was tested earlier in [3]. That work included the data path up to the storage in the PC memory. Such a solution, along with the new software processing, provides good low-latency processing capabilities. Present work will show performance study of whole processing pipeline - throughput and latency for raw-data acquisition and global trigger (a single channel triggers data acquisition from all the channels). Latency will be measured between an acquisition start of the GEM detector and spectral histogram output at the end of computational part along with the storage.

Our work would present results of the tests, which were done with measurements of radiation generated by X-ray tube with different flux levels. Discussion about the system usage in real case scenario with tokamak device will be presented.

REFERENCES

[1] Mazon, D. et al., ''Design of soft-X-ray tomographic system in WEST using GEM detectors" Fusion Engineering and Design (2015). Proceedings of the 28th Symposium On Fusion Technology (SOFT-28).

[2] A. Wojenski, et al., ''Multichannel measurement system for extended SXR plasma diagnostics based on novel radiation-hard electronics", Fusion Engineering and Design.

[3] Linczuk, P. et al., ''Performance evaluation of developed GEM-based X-Ray diagnostic system" Acta Physica Polonica B, Proceedings Supplement [in press].

Summary

Primary author: Mr LINCZUK, Paweł (Institute of Plasma Physics and Laser Microfusion)

Co-authors: Mr WOJEŃSKI, Andrzej (Institute of Electronic Systems, Warsaw University of Technology); Dr KOWALSKA-STRZĘCIWILK, Ewa (IPPLM); Dr KASPROWICZ, Grzegorz (Institute of Electronic Systems, Warsaw University of Technology); Dr MALINOWSKI, Karol (Institute of Plasma Physics and Laser Microfusion); Dr POŹNIAK, Krzysztof (Institute of Electronic Systems, Warsaw University of Technology); Dr CHERNYSHOVA, Maryna (Institute of Plasma Physics and Laser Microfusion); Mr GĄSKA, Michał (Institute of Electronic Systems, Warsaw University of Technology); Mr KOLASIŃSKI, Piotr (Institute of Electronic Systems, Warsaw University of Technology); Mr KRAWCZYK, Rafał (Institute of Electronic Systems, Warsaw University of Technology); Dr CZARSKI, Tomasz (Institute of Plasma Physics and Laser Microfusion); Dr ZABOŁOTNY, Wojciech (Institute of Electronic Systems, Warsaw University of Technology)

Presenter: Mr LINCZUK, Paweł (Institute of Plasma Physics and Laser Microfusion)

Session Classification: POSTER SESSION