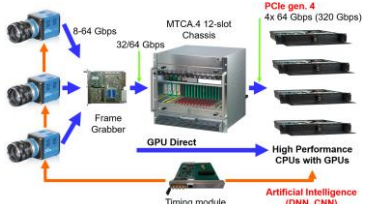
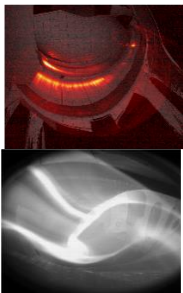
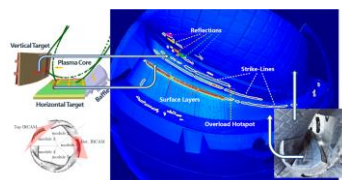




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<p>name of the unit:</p> <p><b>DEPARTMENT OF MICROELECTRONICS AND COMPUTER SCIENCE,</b> Lodz University of Technology</p>		<p>symbol:</p> <p><b>K-22</b> <a href="https://www.dmcs.p.lodz.pl/">https://www.dmcs.p.lodz.pl/</a></p>
<p>head of the unit:</p> <p><b>Wojciech Tylman Ph.D., D.Sc., Assoc. Prof. Lodz University of Technology</b></p>	<p>potential promoters:</p> <p><b>Dariusz Makowski, Ph.D., D.Sc., Assoc. Prof. Lodz University of Technology</b></p>	<p>contact person:</p> <p><b>Dariusz Makowski</b> phone: 48 42 631-27-20 <a href="mailto:dariusz.makowski@p.lodz.pl">dariusz.makowski@p.lodz.pl</a></p>
<p>scope of activities:</p> <p>The main fields of research interests cover the following items:</p> <ul style="list-style-type: none"> <li>Scalable and modular control and data acquisition systems for large scale physics applications</li> <li>Development of new hardware solutions for data acquisition and processing</li> <li>Development of scalable hardware solutions for low-latency image acquisition</li> <li>Real-time data processing for plasma diagnostic systems (imaging, Thomson Scattering, X-ray diagnostics, reflectometry, etc.)</li> <li>Application of programmable devices for plasma control and machine protection</li> <li>Low-power system-on-chip solutions dedicated for parallel data processing</li> <li>Efficient and low-latency data transmission in complex systems</li> </ul>		<p>graphic material</p>  <p>Image acquisition and processing system</p>  <p>VIS and IR image of plasma</p>  <p>Thermal events detected in W7-X stellarator</p>
<p>present activities:</p> <p>Current research activities:</p> <ul style="list-style-type: none"> <li>Hardware architectures for image acquisition and real-time processing</li> <li>Efficient data transmission and hardware compression in complex image processing system supported by FPGA devices and GPU accelerators</li> <li>Hardware solutions for low power, battery-powered embedded system</li> <li>Design and development of Hard X-ray Monitor System diagnostics for ITER</li> <li>Research on algorithms for real-time pulse discrimination for X-ray spectroscopy implemented in programable FPGA devices</li> <li>Design and development of Temporary Pressure Gauge diagnostics for ITER</li> <li>Design and development of VIS/IR Viewing System diagnostics for ITER</li> <li>Real-time machine protection system for Wendelstein 7-X stellarator</li> </ul>		
<p>Future activities:</p> <ul style="list-style-type: none"> <li>Universal image acquisition solutions supported by FPGA partial reconfiguration</li> <li>Data processing framework supported by FPGA partial reconfiguration</li> <li>Thermal protection of fusion devices using Deep Neural Networks and FPGA accelerated systems</li> <li>Fusion devices control using Artificial Intelligence and programmable devices</li> <li>Plasma control for future tokamaks and stellarators</li> <li>Real-time image processing for future tokamaks</li> <li>Loss-less efficient image compression for fusion applications</li> <li>Universal and scalable image acquisition processing framework for modular diagnostic systems</li> </ul>		



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#### Publications/patents, awards, projects:

##### Publications:

1. T. S. Pedersen, D. Makowski et al., „Experimental confirmation of efficient island divertor operation and successful neoclassical transport optimization in Wendelstein 7-X”, Nuclear Fusion, 2022, ISSN: 0029-5515, Impact Factor 3.56 (2020), <https://doi.org/10.1088/1741-4326/ac2cf5>
2. B. Jablonski, D. Makowski, P. Perek, „Evaluation of NVidia Xavier NX platform for real-time image processing for fusion diagnostics”, MDPI, Energies (2022), Impact Factor 3,004 (2020)
3. B. Jabłoński, D. Makowski, P. Perek, „Implementation of Thermal Event Image Processing Algorithms on Nvidia Tegra Jetson TX2 Embedded System-on-a-Chip”, Energies, 14, no. 15, 4416, pp 1-16 (2021), Impact Factor 3,004 (2020), <https://doi.org/10.3390/en14154416>
4. A. Mielczarek, D. Makowski, Ch. Gerth, B. Steffen, M. Caselle, L. Rota, “Real-time Data Acquisition and Processing System for MHz Repetition Rate Image Sensors”, MDPI, Energies, 14, no. 21, 7403, pp 1-14 (2021), Impact Factor 3,004 (2020), <https://doi.org/10.3390/en14217403>
5. P. Perek, A. Mielczarek, D. Makowski, „High-performance Image Acquisition and Processing for Stereoscopic Diagnostic Systems with the Application of Graphical Processing Units”, MDPI Sensors, 2022, 22(2), 471, ISSN 1424-8220, Impact Factor 3.576 (2020), <https://doi.org/10.3390/s22020471>
6. B. Steffen, Ch. Gerth, M. Caselle, M. Felber, T. Kozak, D.R. Makowski, U. Mavrič, A. Mielczarek, P. Peier, K. Przygoda, L. Rota, „Compact single-shot electro-optic detection system for THz pulses with femtosecond time resolution at MHz repetition rates”, Review of Scientific Instruments, 91, pp 045123-1 - 045123-12 (April 2020), Impact Factor 1.587 (2018), <https://doi.org/10.1063/1.5142833>
7. A. Winter, T. Bluhm, H. Bosch, K. Brandt, S. Dumke, M. Grahl, M. Grün, A. Holtz, H. Laqua, M. Lewerentz, D. Makowski, S. Pingel, H. Riemann, J. Schacht, K. Schaumann, A. Spring, „Preparation of W7-X CoDaC for OP2”, Transactions on Plasma Science, vol. 48, no. 6, pp. 1779-1782, June 2020, Impact Factor 1.325 (2019), Print ISSN: 0093-3813, Online ISSN: 1939-9375, <https://doi.org/10.1109/TPS.2020.2992787>
8. Ch. Gerth, G. Brenner, M. Caselle, S. Dusterer, D. Haack, D. Makowski, A. Mielczarek, S. Palutke, L. Rota, V. Rybnikov, C. Schmidt, B. Steffen, K. Tiedtke, “Linear Array Detector for online Wavelengths Diagnostics at MHz Repetition Rates”, Journal of Synchrotron Radiation, Impact factor: 3.232 (2017), ISSN: 1600-5775, Vol. 26, Part 5, pp. 1514-1522, September 2019, <https://doi.org/10.1107/S1600577519007835>

##### Patents:

1. D. Makowski, B. Mukherjee, S. Simrock, M. Grecki, 2013.01.09, „Solid state neutron detector system”, territorial scope of patent protection: Germany, Switzerland, France, European Patent Office, Patent No. 05011654.0-1240, EP20050011654
2. P. Sękalski, K. Grabowski, D. Makowski, M. Chojnacki, W. Jałmużna, H. Błasiński, P. Amrozik, J. Ciapa, B. Sakowicz, filing date: 2016.07.29, „Method for registering of an image and optical device for registering the image”, territorial scope of patent protection: Poland, Patent Office of the Republic of Poland, application no. P.41813

##### Awards:

1. D. Makowski – Prime Minister award for best PhD thesis: „The impact of radiation on electronic devices with the special consideration of neutron and gamma radiation monitoring”, Warsaw, 25.01.2008
2. D. Makowski, A. Piotrowski - 3<sup>rd</sup> degree team award of the Rector of the Lodz University of Technology for "Designing electronic circuits and systems with particular emphasis on nuclear physics experiments, 14.12.2011
3. D. Makowski, G. Jabłoński, M. Orlikowski - Team award of the Rector of the Lodz University of Technology for "Data acquisition and processing systems for the international ITER tokamak project", Lodz, 2015
4. D. Makowski, G. Jabłoński, M. Orlikowski - Team award of the Rector of the Lodz University of Technology for "Acquisition and data processing systems based on MicroTCA.4 technology", Lodz, 2016
5. Rector of the Lodz University of Technology award for research work, Lodz, 2020

##### Projects:



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1. Project under the framework program of the European Union - EURATOM FP8, EUROfusion consortium, 2021-2022, "Participation of the Lodz University of Technology in the Joint European Project of the EUROATOM Community established by the EU Council Regulation No. 2021/765"
2. Project within the framework program of the European Union - EURATOM FP7, EUROfusion consortium, 2020-2021, WPS1 Preparation and exploitation of W7X, task manager: S1-WP19-20.P-T002-D029, "Generic System for Camera Data Acquisition for Nuclear Fusion Devices "
3. Scientific cooperation with the Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V., Greifswald, Germany, "Data acquisition and processing for nuclear fusion devices", 2019-2024
4. Framework Service Contract, "Diagnostic Plant I&C Coordination and Development", ITER Cadarache, 2019-2024, contract number IO / 19 / CT / 6000000261, consortium: Cosylab d.d. from Slovenia (consortium leader), Lodz University of Technology
5. ITER project "Giga-sample Data Acquisition System for Thomson Scattering Diagnostics with Real-Time Framework Interface", ITER Cadarache, 2019-2020, contract number ITER / 19 / PO / 4100008214
6. Framework Service Contract, "Design, supply and Integration of Large Scale Plant I&C systems for Diagnostics - Phase 2", ITER Cadarache, 2017-2021, contract number ITER / 17 / CT / 6000000225
7. European Spallation Source, Poland's in-kind contribution, "Development, construction and installation of the accelerator field parameters control system in superconducting resonance cavities of the European Spallation Source project accelerator", ESS ERIC, 2016 - 2022, head of the working group: Piezo Control System for European Spallation Source

**Keywords:**

Real-time Data Acquisition and Processing Systems, Real-time Image Processing, Real-time Machine Learning, Embedded Systems, Microcontroller Systems, General Purpose Computing on Graphics Processing Units, Field Programmable Gate Arrays, Internet of Things, Plasma Diagnostics, Plasma Control, Tokamak, Stellarators

**List of internship proposal in this research team:**

Accepting PhD candidates from industry and academia.