MATTER AND TECHNOLOGIES

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KINGFISHER: A Framework for Fast Machine Learning Inference for Autonomous Accelerator Systems

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Modern particle accelerator facilities allow new and exciting beam properties and operation modes. Traditional real-time control systems, albeit powerful, have bandwidth and latency constraints that limit the range of operating conditions currently made available to users. The capability of Reinforcement Learning to perform self-learning control policies by interacting with the accelerator is intriguing. The extreme dynamic conditions require fast real-time feedback throughout the whole control loop from the diagnostic, with novel and intelligent detector systems, all the way to the interaction with the accelerator components. In this contribution, the novel KINGFISHER framework based on the modern Xilinx Versal devices will be presented. Versal combines several computational engines, specifically combining powerful FPGA logic with programmable AI Engines in a single device. Furthermore, this system can be natively integrated with the fastest beam diagnostic tools already available, e.g. KAPTURE and KALYPSO.

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