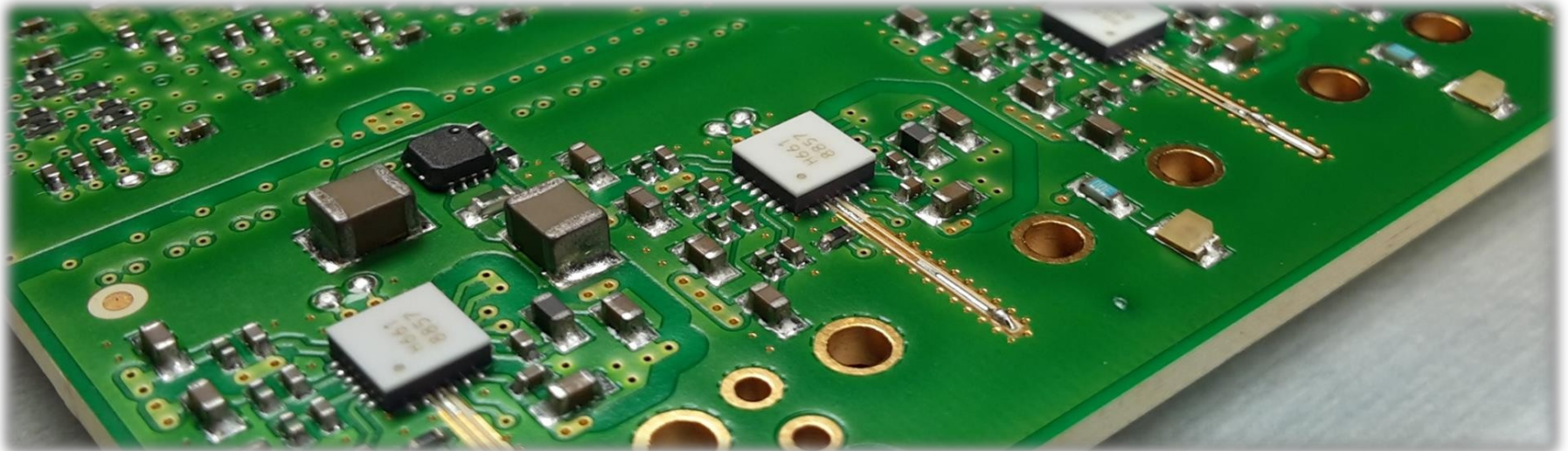


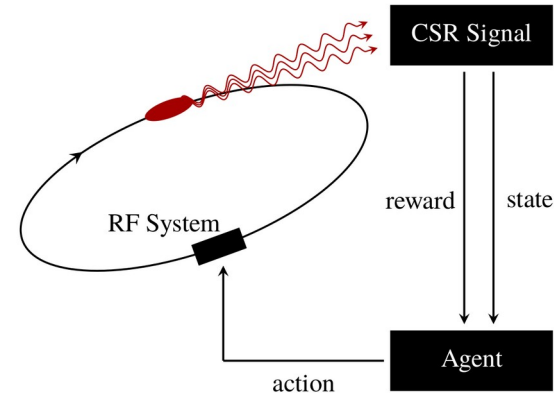
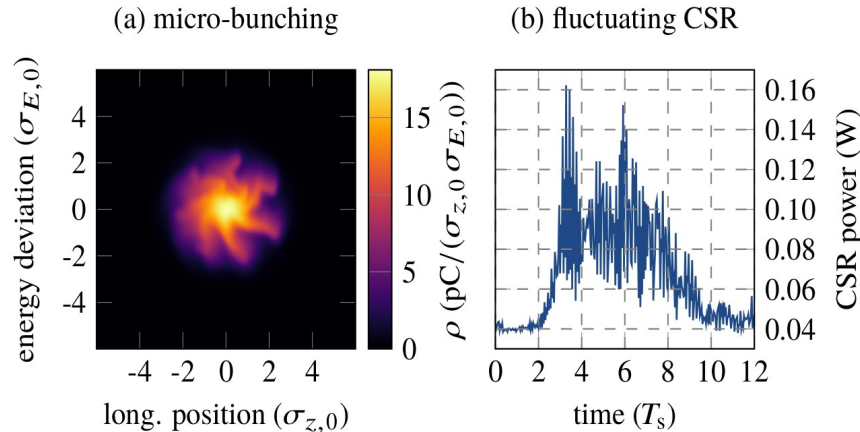
KINGFISHER: Fast Machine Learning Inference for Autonomous Accelerator Systems

Luca Scomparin



Control of Longitudinal Beam dynamics at KARA

Interaction of beam with emitted radiation creates **instabilities** making **power fluctuate** (micro-bunching instability) → **limits user operation**



Control loop to limit this effect, **but** control problem not solved → can we use ML methods?
 Yes, but inference must be at dynamics timescale $O(\text{tens of } \mu\text{s})$

Specialized hardware is needed

Xilinx Versal ACAPs

Adaptive Compute Acceleration Platform (ACAP)

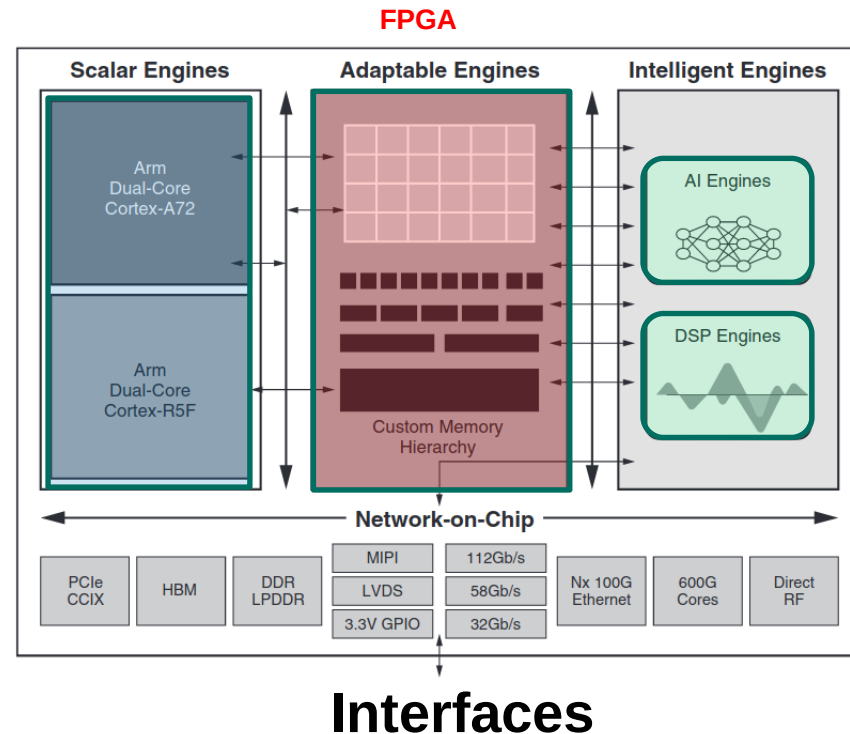
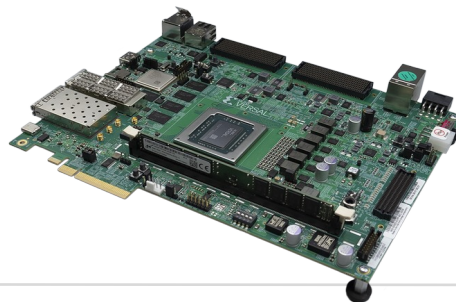
Which combines:

- ARM processors (Scalar Engines)
- FPGA (Adaptable Engines)
- AI Engines
- DSP Engines
- Advance interfaces

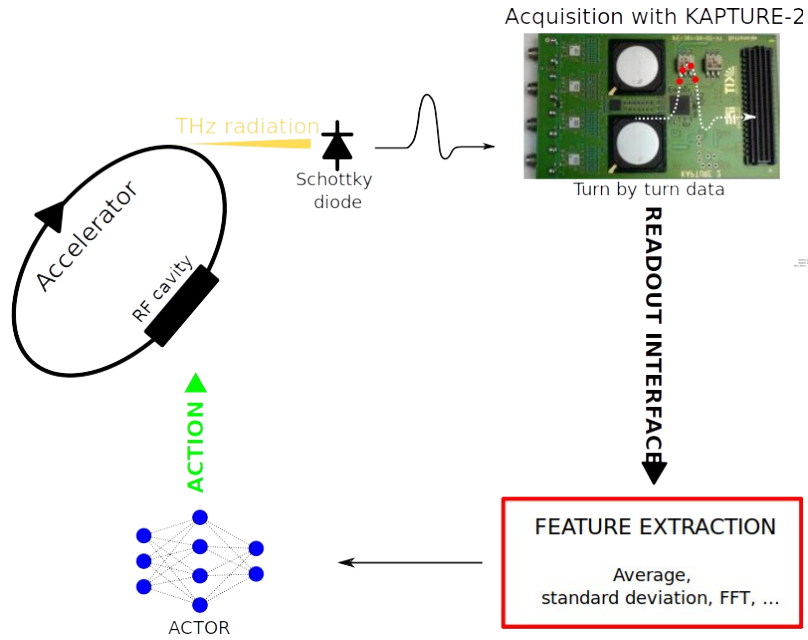
All linked by high bandwidth Network on a Chip (NoC)

Allows full customization of the dataflow depending on the application

VCK190 Evaluation Kit



KINGFISHER: the structure



KIT Versal implementation

