

A universal interface ASIC for detector readout, timing, and control.

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We propose the specification and design of a universal interface ASIC infrastructure for particle detectors. This project would develop a structured System-on-Chip (SoC) approach to the assembly of configurable, scalable interface ASICs from a library of verified sub-blocks with associated software tools, enabling experiment tailored ASICs to connect a range of specialised front-end ASICs to a common industry-standard off-detector interface (Ethernet), without the risks and incompatibility associated with multiple experiment-driven developments.

Early-stage objectives include:

- Specification of the architecture and performance from candidate use cases based on requirements from other DRDs.
- Evaluate existing open-source software for suitability and longevity, to determine where software development efforts are best focused.
- Identify and assess existing IP block availability to establish focus for hardware development efforts.
- Define any IP blocks and software requiring development.
- Design, manufacture (via low-cost EURO PRACTICE multi-project-wafer shuttles), and test key IP blocks such as Links and SoC components.
- Emulation of a chosen system architecture (Software and Hardware)
- High-level demonstration of the SoC ASIC architecture and possible co-simulation with chosen system.

A complex undertaking of this kind requires expertise across ASIC design, verification, emulation, co-simulation, software tool chains and software libraries. Collaboration and involvement across most I-DRD7 activities is essential to developing all the elements required, and with many decades of UK experience in the design and build of DAQ systems, we are in a strong position to lead an international consortium in the formulation and development of the next generation of DAQ.

With development times for complex ASICs typically spanning years, this proposal is particularly timely as R&D activities transition towards future detector designs. New experiments such as SOLAIRE will require readout solutions and could benefit from this work. A well-supported flexible readout architecture such as this could serve as a common element of possible future facilities and their experiments.