ARCTIC

Cryogenic Microsystems to ignite the Quantum Era

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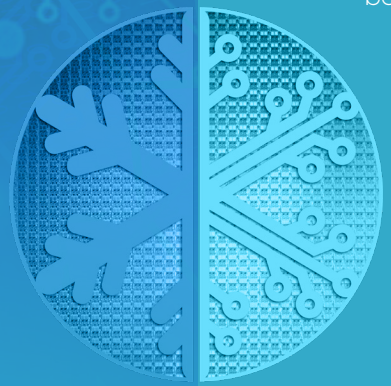
Application and technology driven objectives of the project are:

- Development of semiconductor materials and technologies tailored for quantum technology requirements and cryogenic applications filling technology gaps to fully capture the benefits of quantum and associated technologies.
- Development of multi-scale physics and data driven models to support the development of cryo-technologies providing tools for further technology users for application driven development.
- Design and characterization of microelectronic devices and circuits customized for cryogenic operation including the effects of self-heating and thermalization deepening our understanding and limiting design overheads to save power.
- Customized semiconductor qubit and quantum processor platforms for quantum computation to improve technology scalability.
- Development of semiconductor packaging processes and heterogeneous-integration assembly technologies tailored for arge-scale quantum technology and cryogenic applications with focus on system integration providing technology to combine components whenever needed.
- Development of cryogenics and cryogenic infrastructure with help of cryo-electronics and electric coolers to avoid limitations in cooling power and to accurately predict the total power budgets of future cryogenic systems.
- High-throughput cryogenic metrology systems for efficient wafer-level screening of devices to speed-up device testing with application specific specifications.



To scale up quantum computing systems, it is not sufficient to only build better qubits (the physical 'heart' of the quantum computer), but also major innovations in all other parts (control, interface, physical embedding, ...) of a quantum computer are required, reaching from efficient thermalization to optimizing classical circuits and components for qubit manipulation and readout. The mere benefit of the holistic approach of ARCTIC is that many of the components and technologies developed here are not only relevant to quantum computing systems but can also be used in other cryogenic applications like space, optical spectroscopy, cold-CMOS high-performance computing, or the improvement of cryogenic systems as such.

These challenges are addressed in ARCTIC by using six key technologies:

- Cryogenic materials and substrates
- Multi-scale physics and data driven modelling of cryogenic technologies.
- Cryogenic CMOS electronics components and circuits,
- Emerging devices and components tailored for cryogenic systems,
- Heterogeneous-integration assembly technologies tailored for cryogenic applications, and
- High-throughput cryogenic metrology systems

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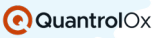

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The project is supported by the Chips Joint Undertaking and its members (including top-up funding by Belgium, Austria, Germany, Estonia, Finland, France, Ireland, The Netherlands and Sweden). ARCTIC gratefully acknowledges the support of the Canadian and the Swiss federal governments.

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