SCALLOP: A Scalable CryoCMOS DAC Array in IHP 130nm BiCMOS for Flux-Bias Control of Superconducting Qubits

HEICHIPS 2025
Project Proposal

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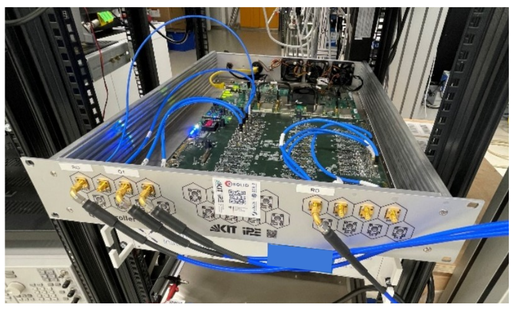
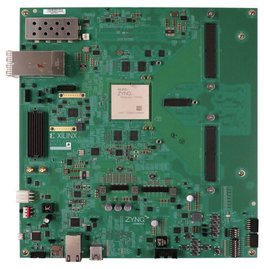
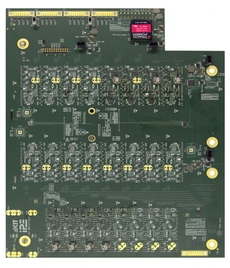
Commercial-off-the-shelf
Semi-custom single boards
< ~20 qubits



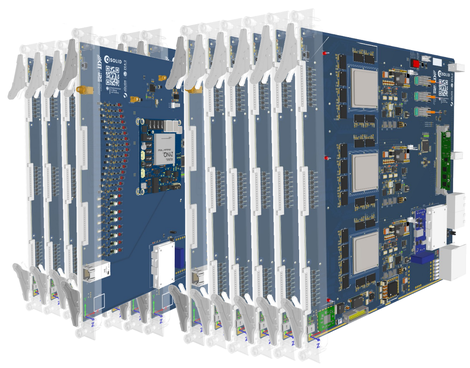


AMD ZCU216



DirectRF FE

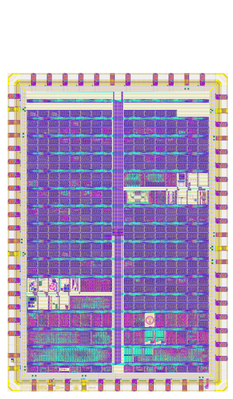
Custom Rack Mounted
< ~1000 qubits



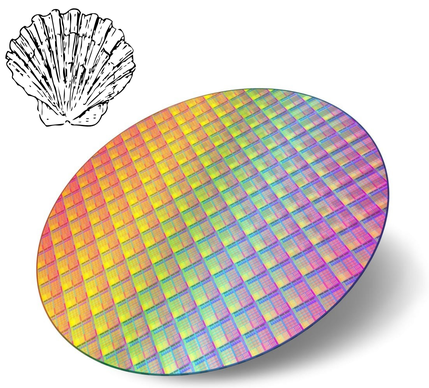
Two types of ATCA boards equivalent to
64x HF outputs (< 8 GHz)
64x HF inputs (< 8 GHz)
320x outputs (DC to 1 GHz)

19-inch rack-mountable ATCA crate with 14 available vertical slots.

Cryo-ASICs
> 1000 qubits



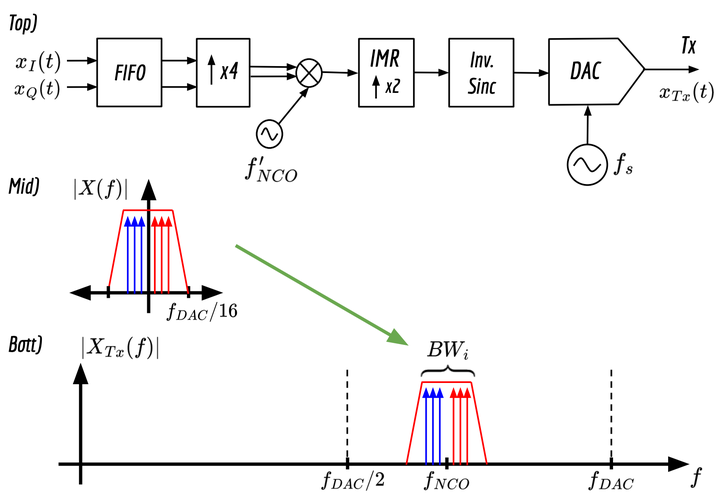
Open Source ASIC using IHP 130nm BiCMOS technology



Silicon Wafer with multiple SCALLOP ASICs

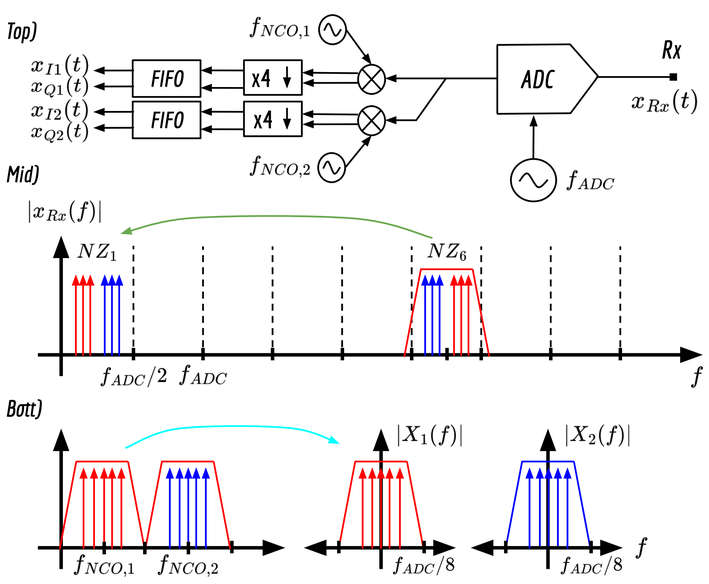
Transmission

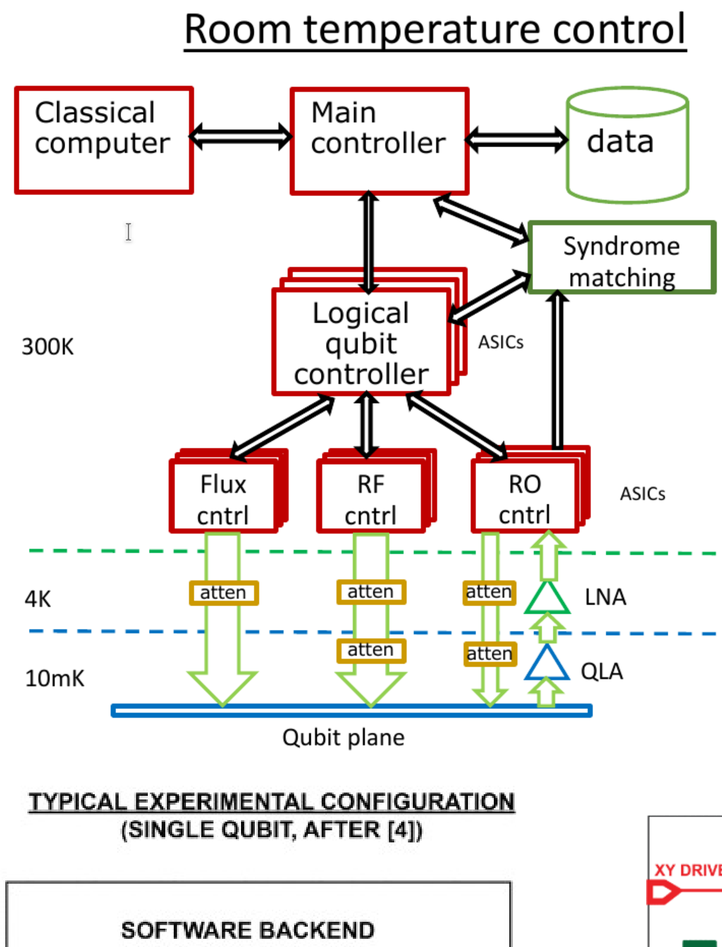
DirectRF signal generation is performed in the second Nyquist zone using a Mixed-Mode reconstructor and with Digital-to-Analog Coverters (DACs) operating at fDAC=8 GHz. A Numerically Controlled Oscillator (NCO) sets the center frequency of the desired sub-band.

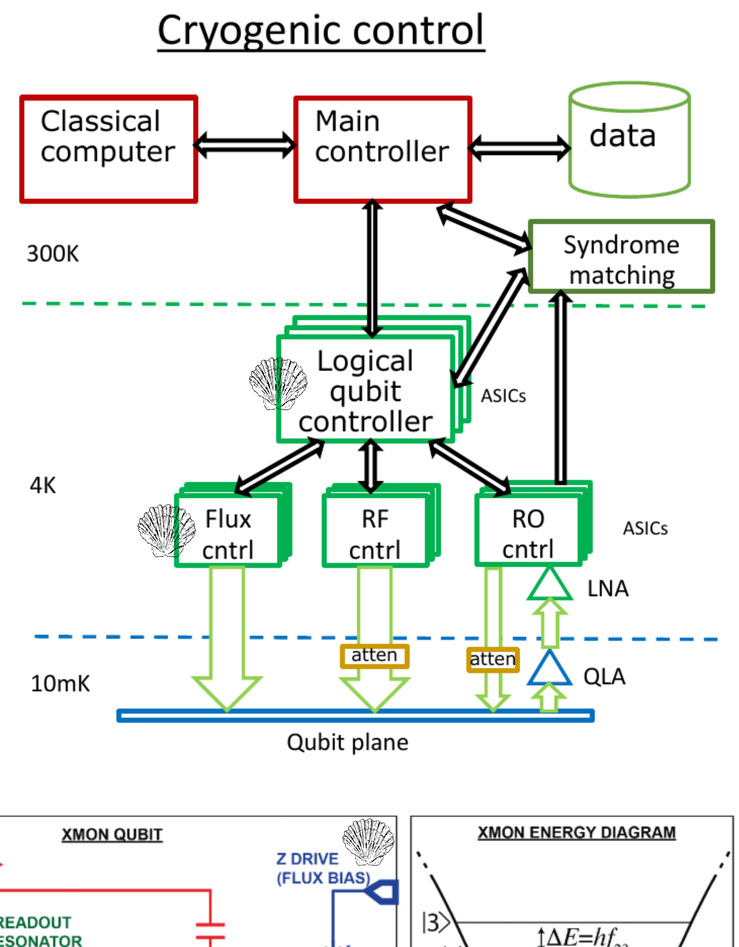


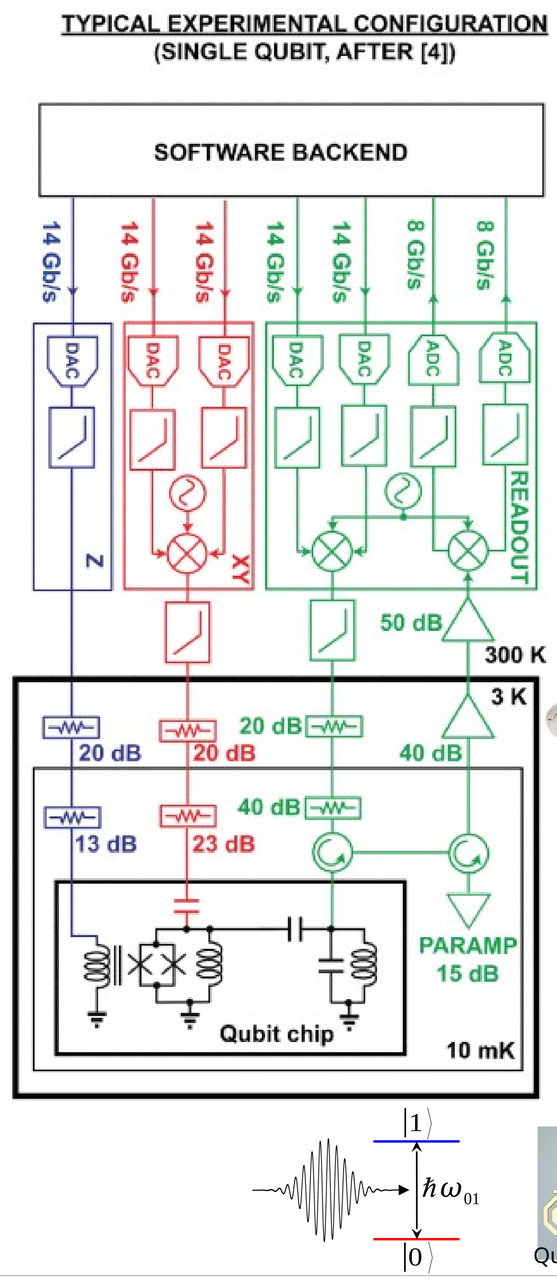
Reception

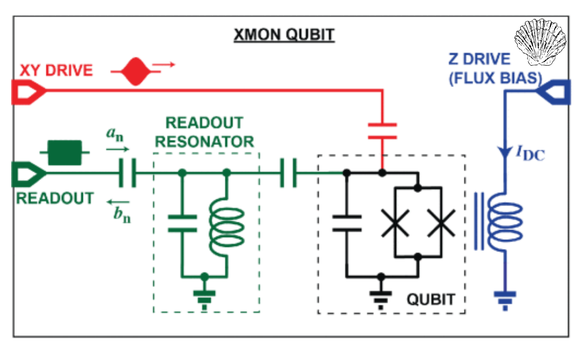
Band-pass sampling is performed in higher-order Nyquist zones using Analog-to-Digital Converters (ADCs) operating at fADC=2 GHz. Each sub-band is divided into two using Digital Down Converters (DDCs) for subsequent processing.

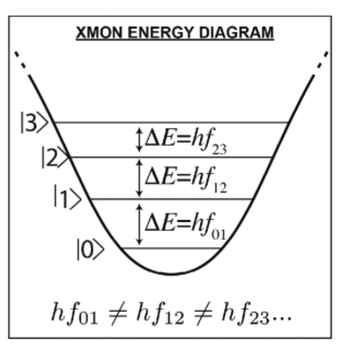


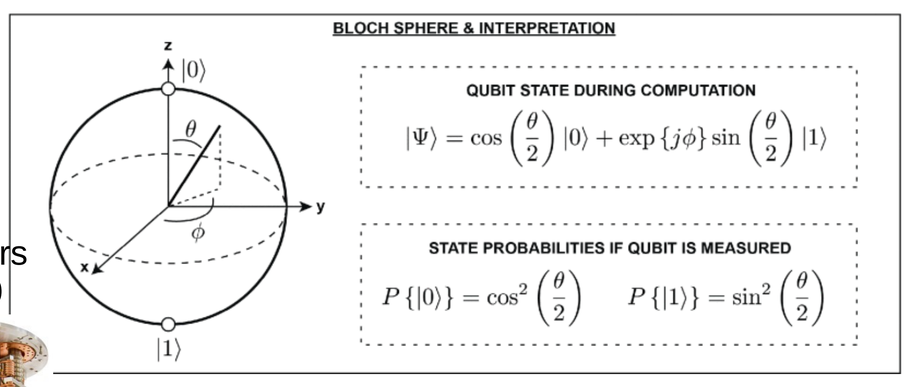




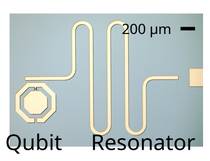


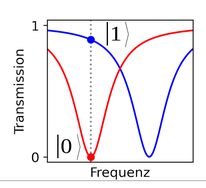


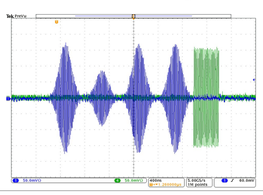


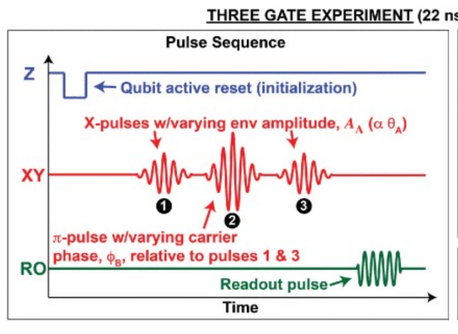


Bluefors LD250









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