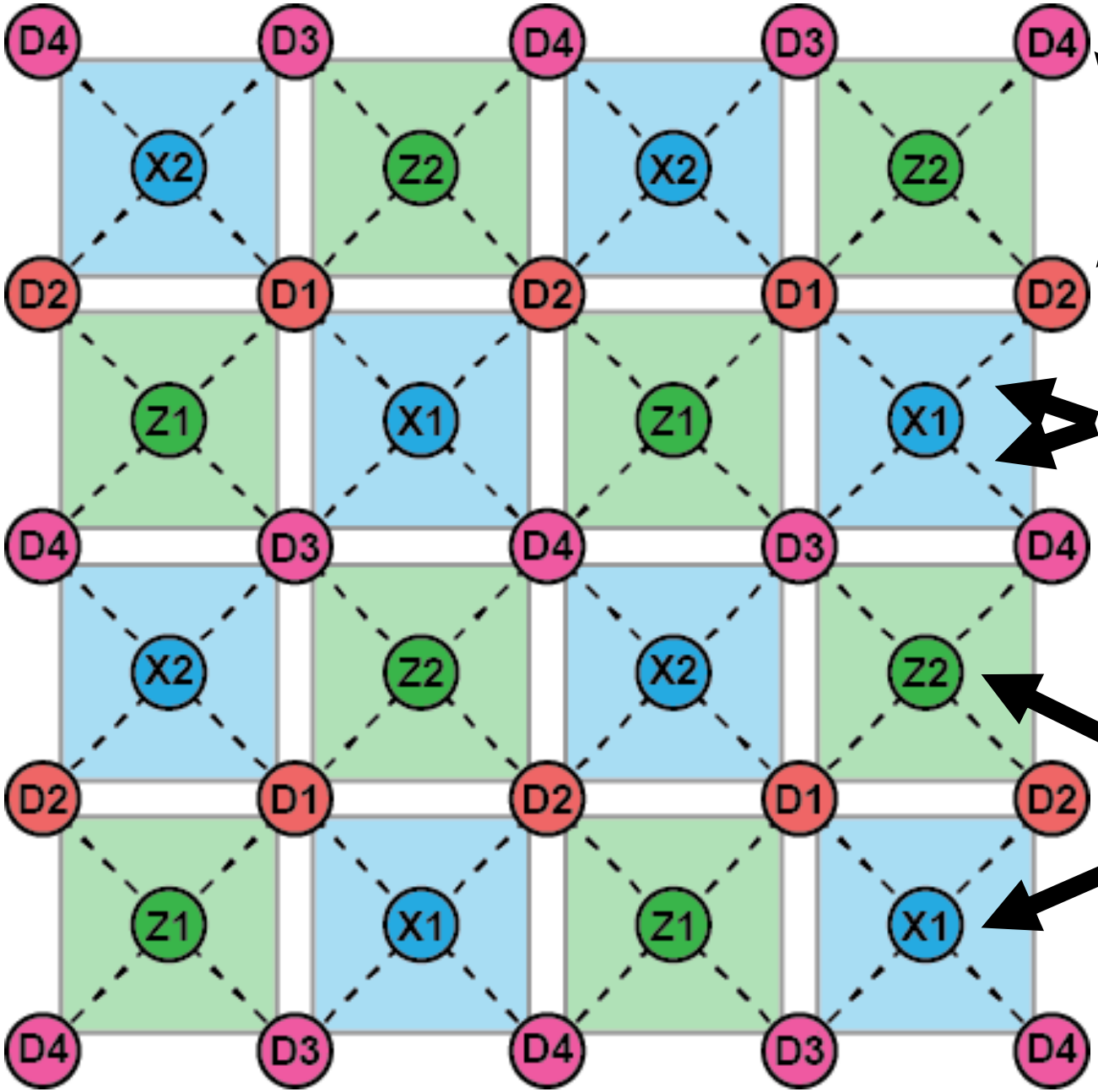
Leonardo DiCarlo

Superconducting quantum circuits: Assembling a quantum processor

The surface code

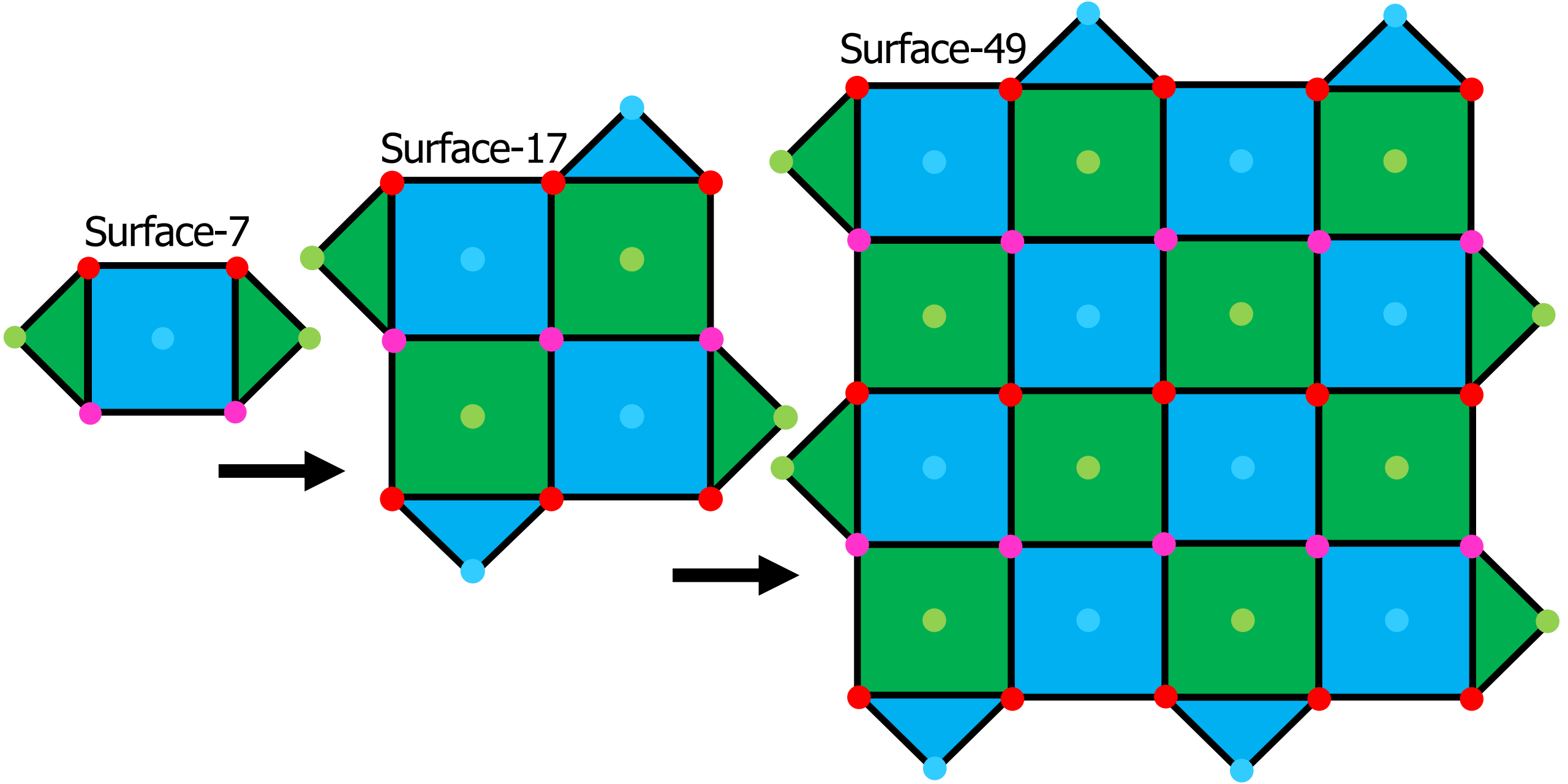


Data-carrying qubits

Only nearest-neighbor interactions needed

Ancillary qubits used for quantum parity checks

Target surface-code quantum hardware



Assembling Surface-17 with circuit QED quantum hardware

Qubits

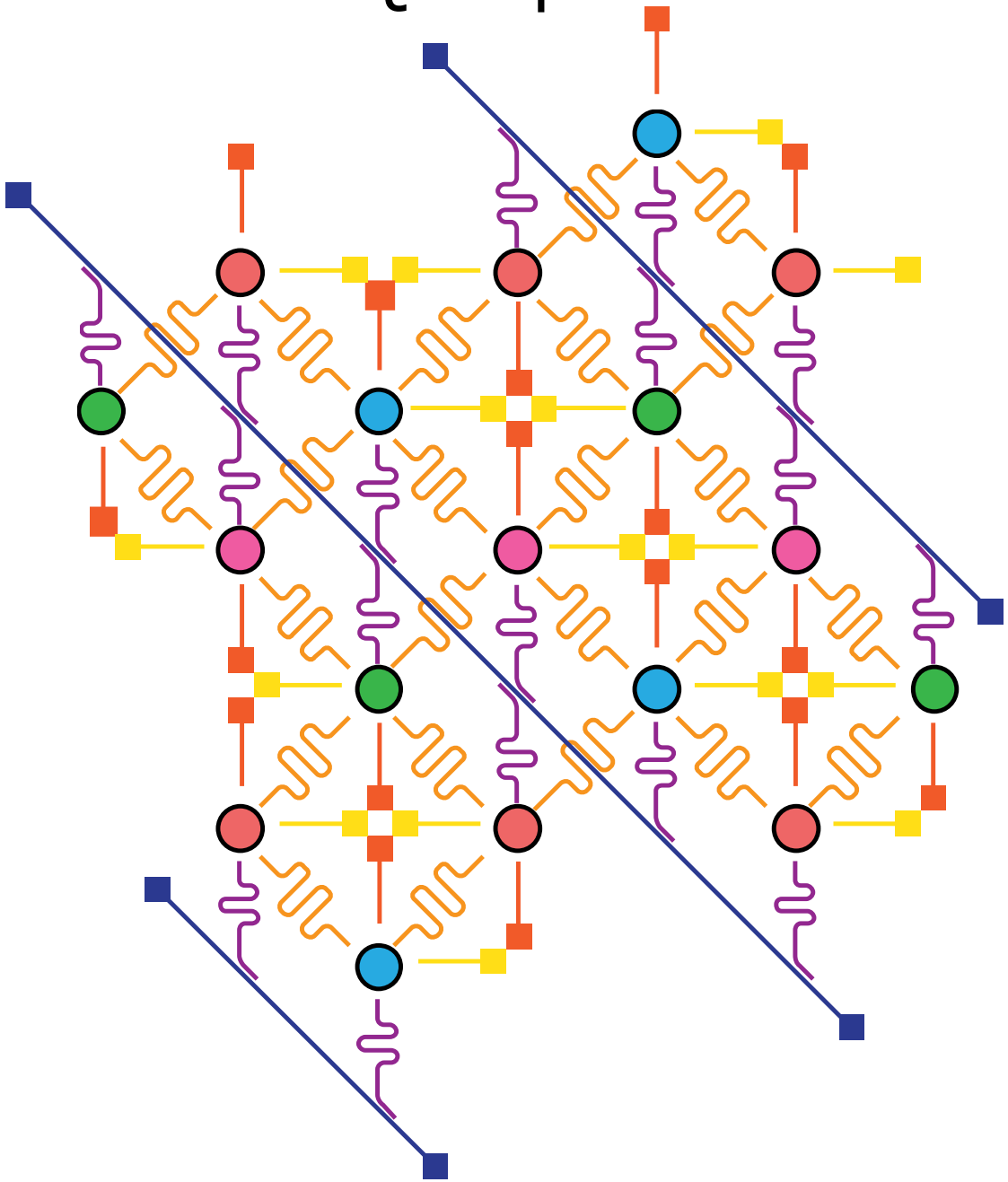
Coupling buses

Flux-bias lines

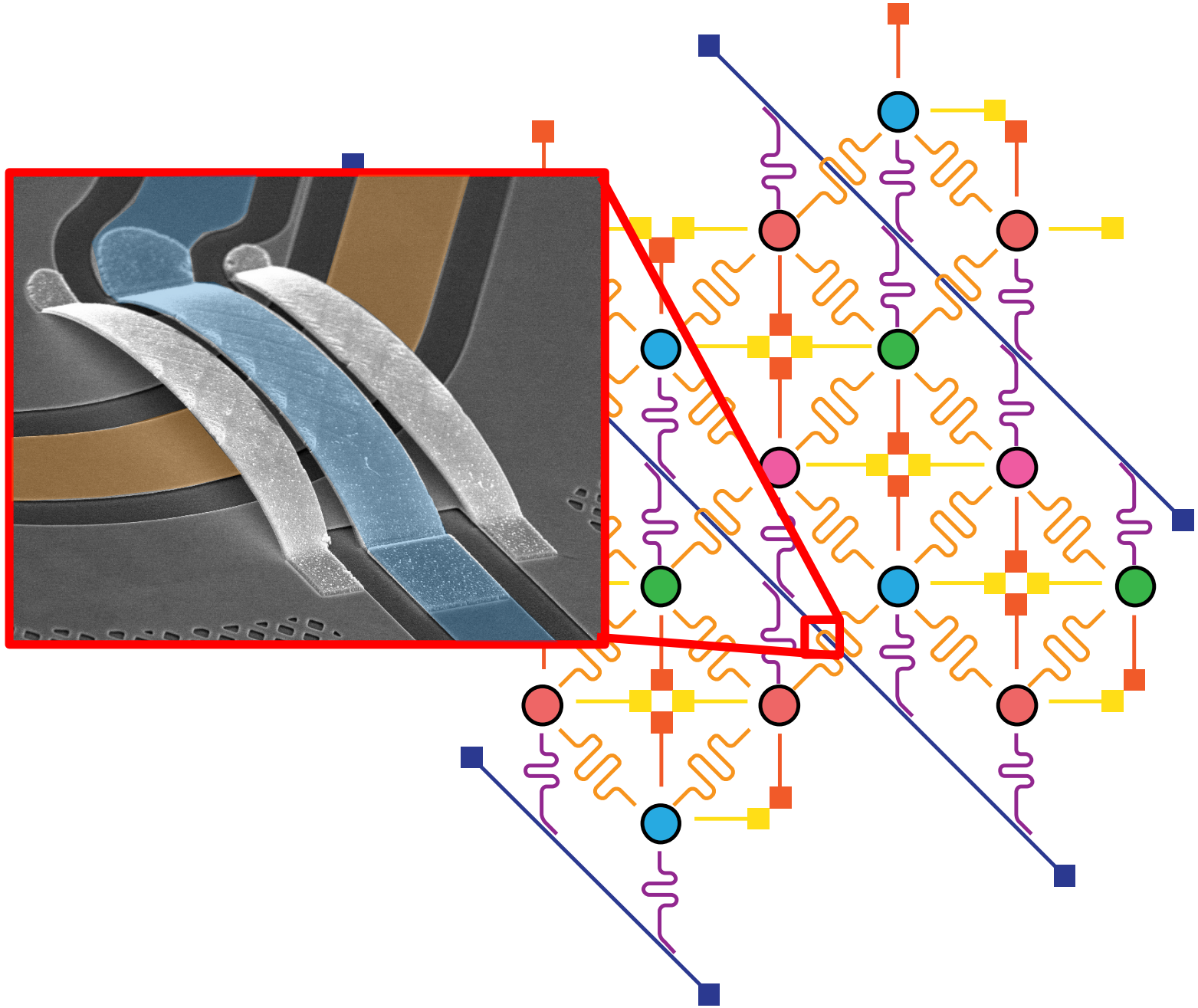
Microwave drive lines

Readout resonators

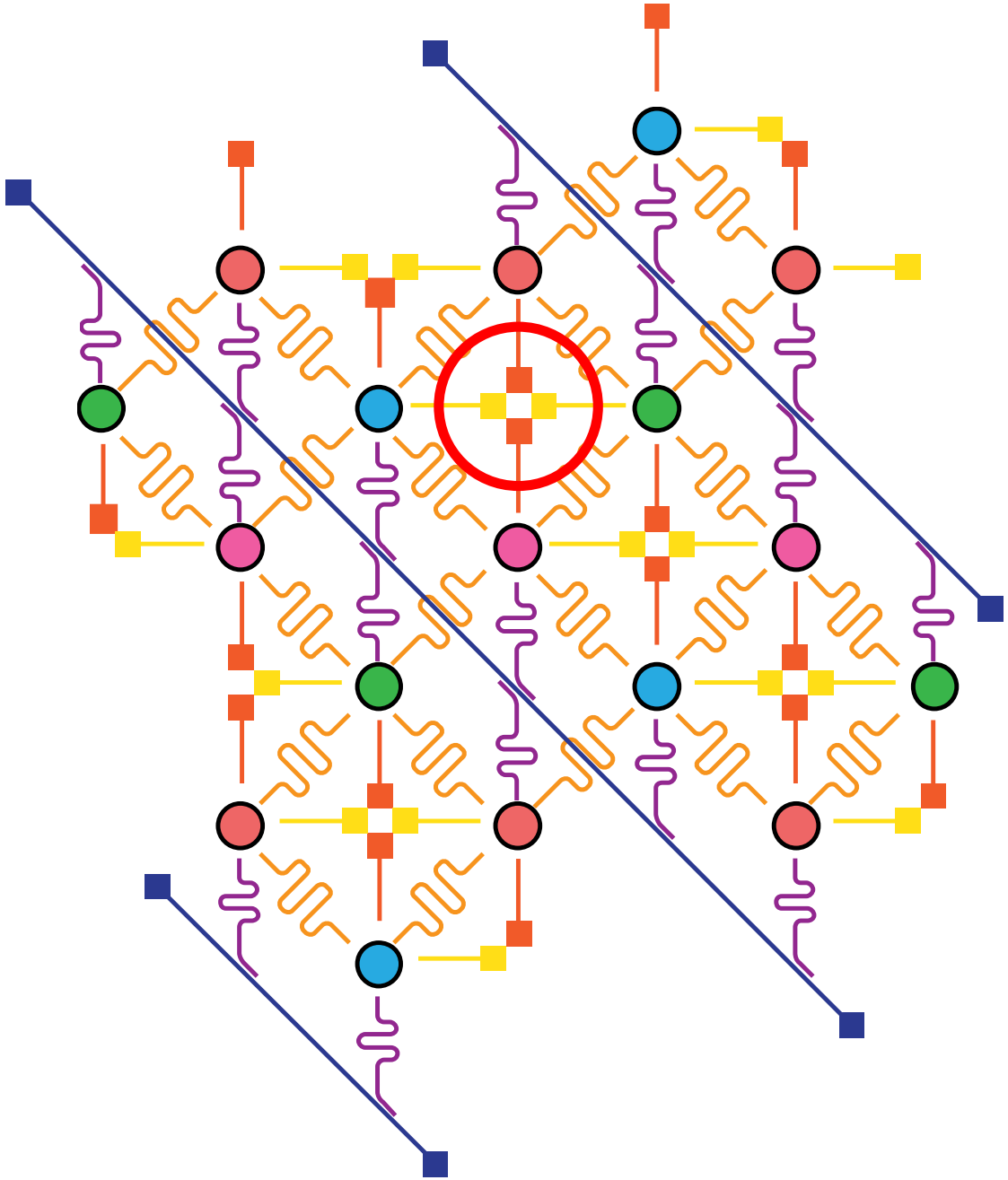
Feedlines



Cross-over technology

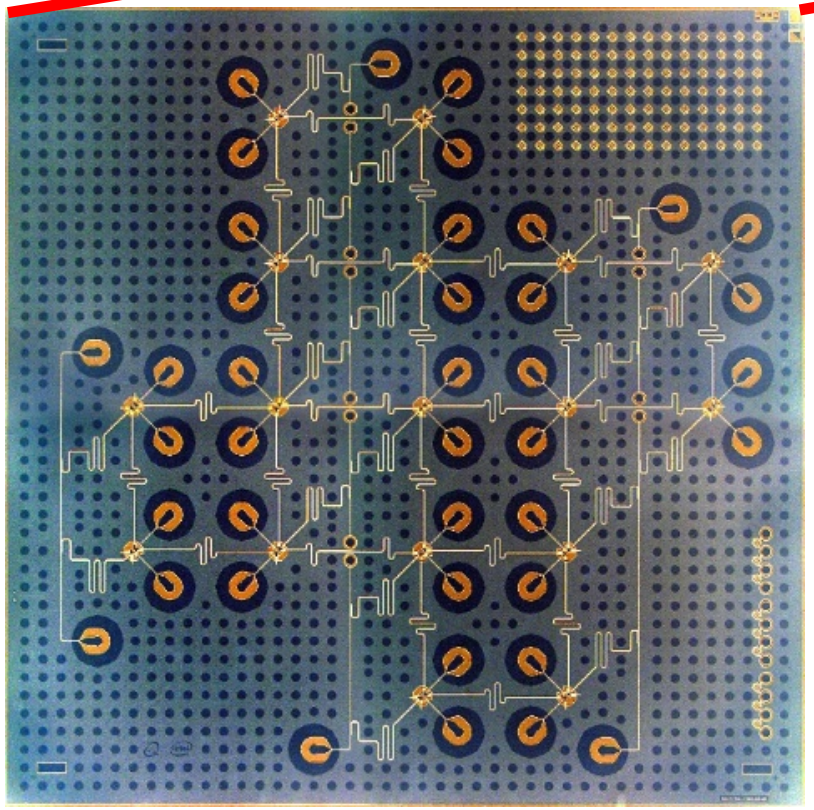


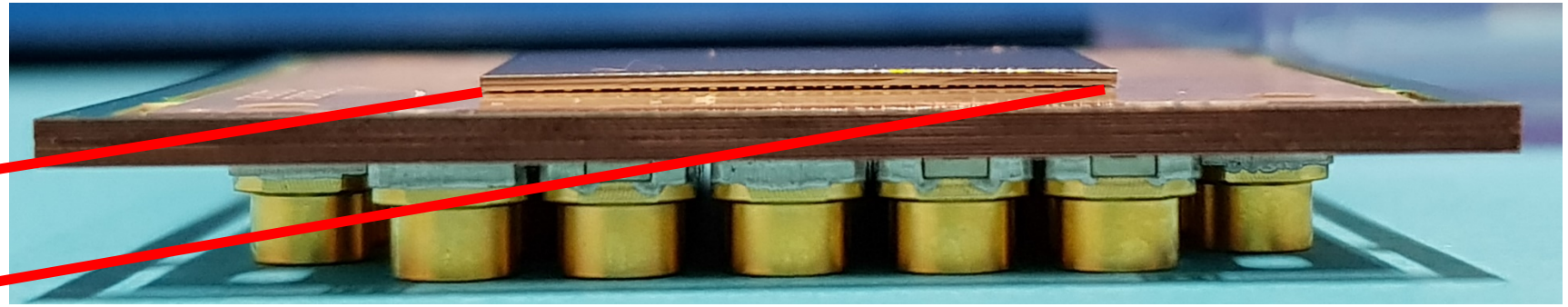
Vertical interconnect

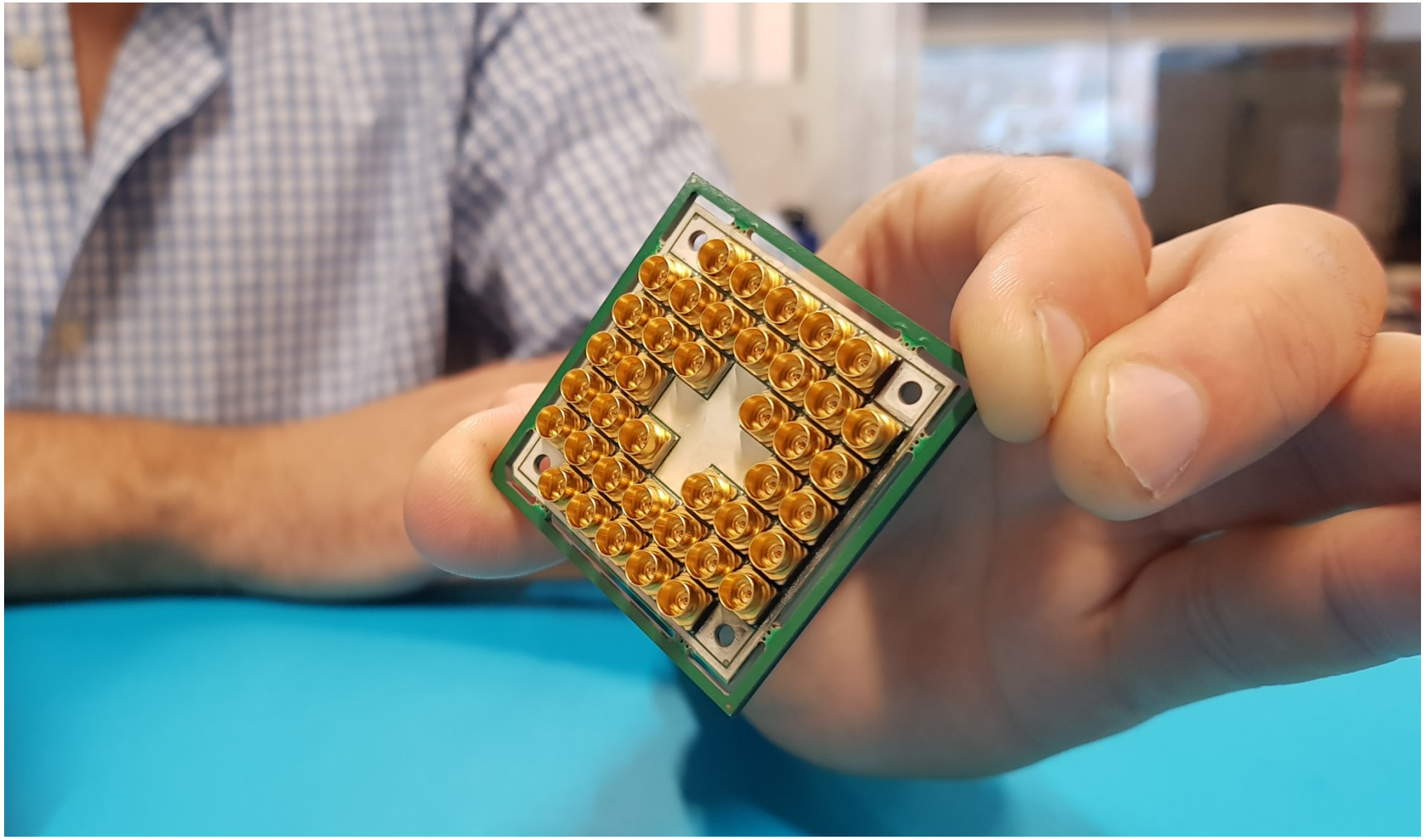


Surface-17:
17 qubits
24 bus resonators
17 readout resonators
17 flux lines
17 microwave lines
3 feedlines
40 input/output ports

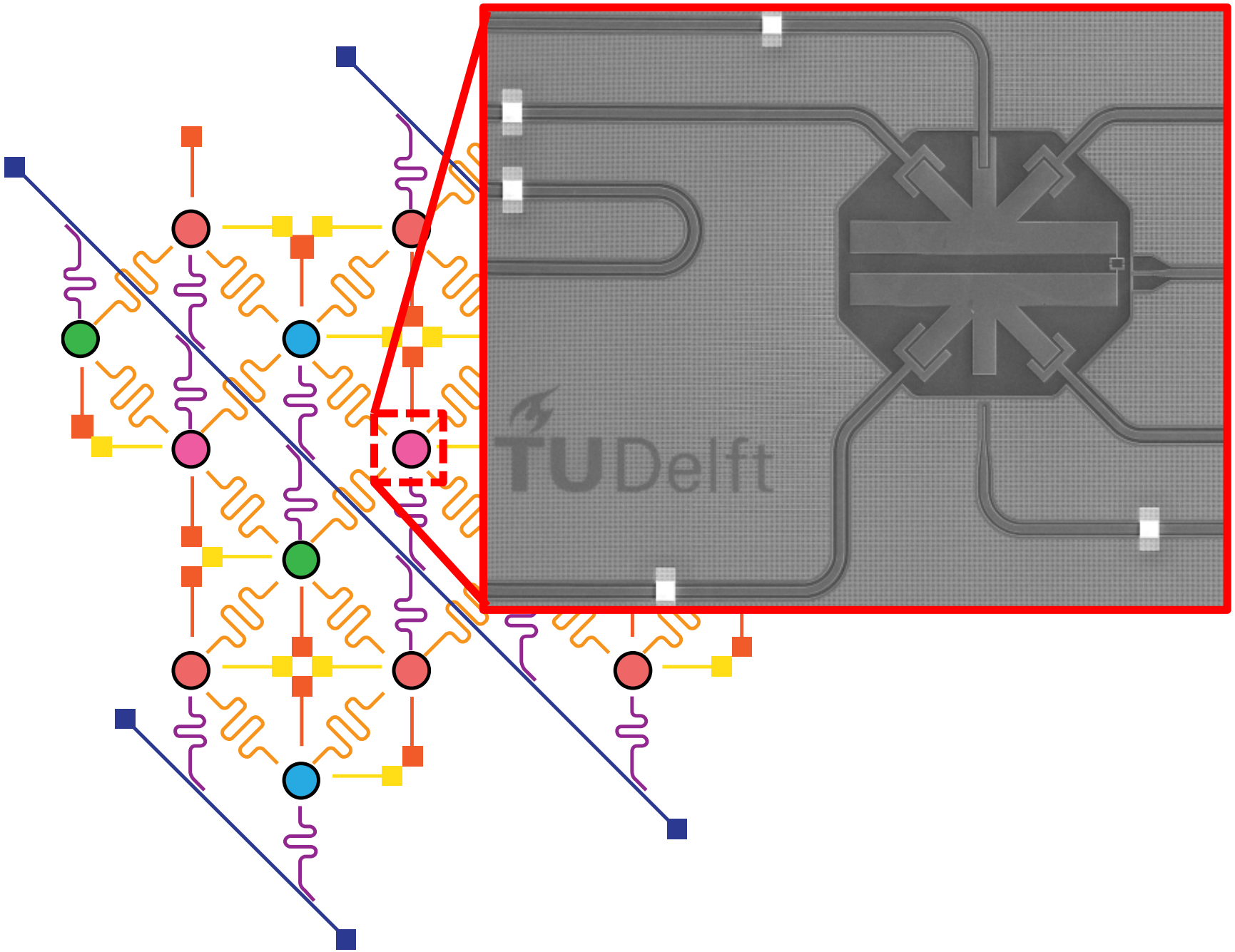
Flip-chip configuration



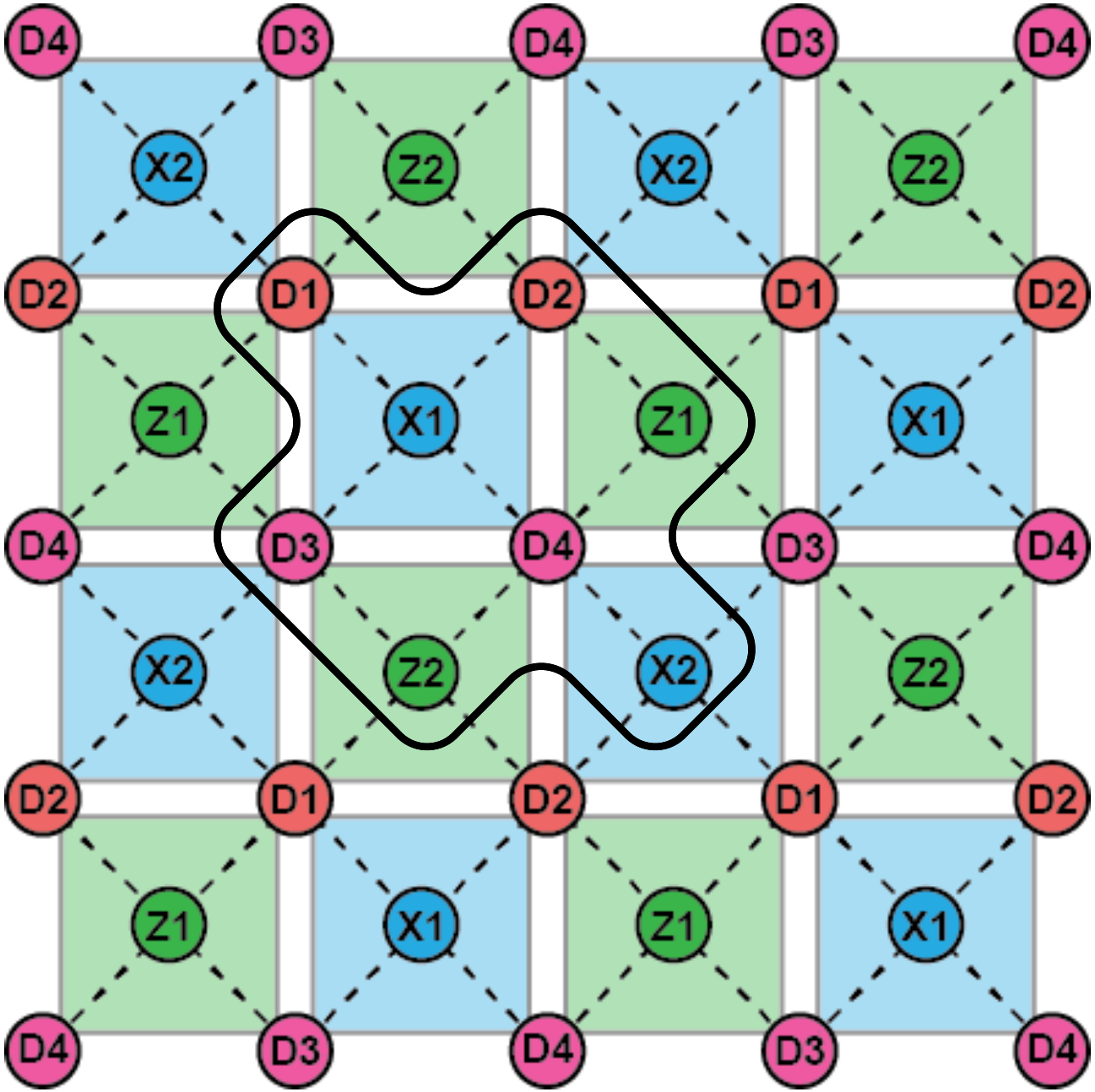




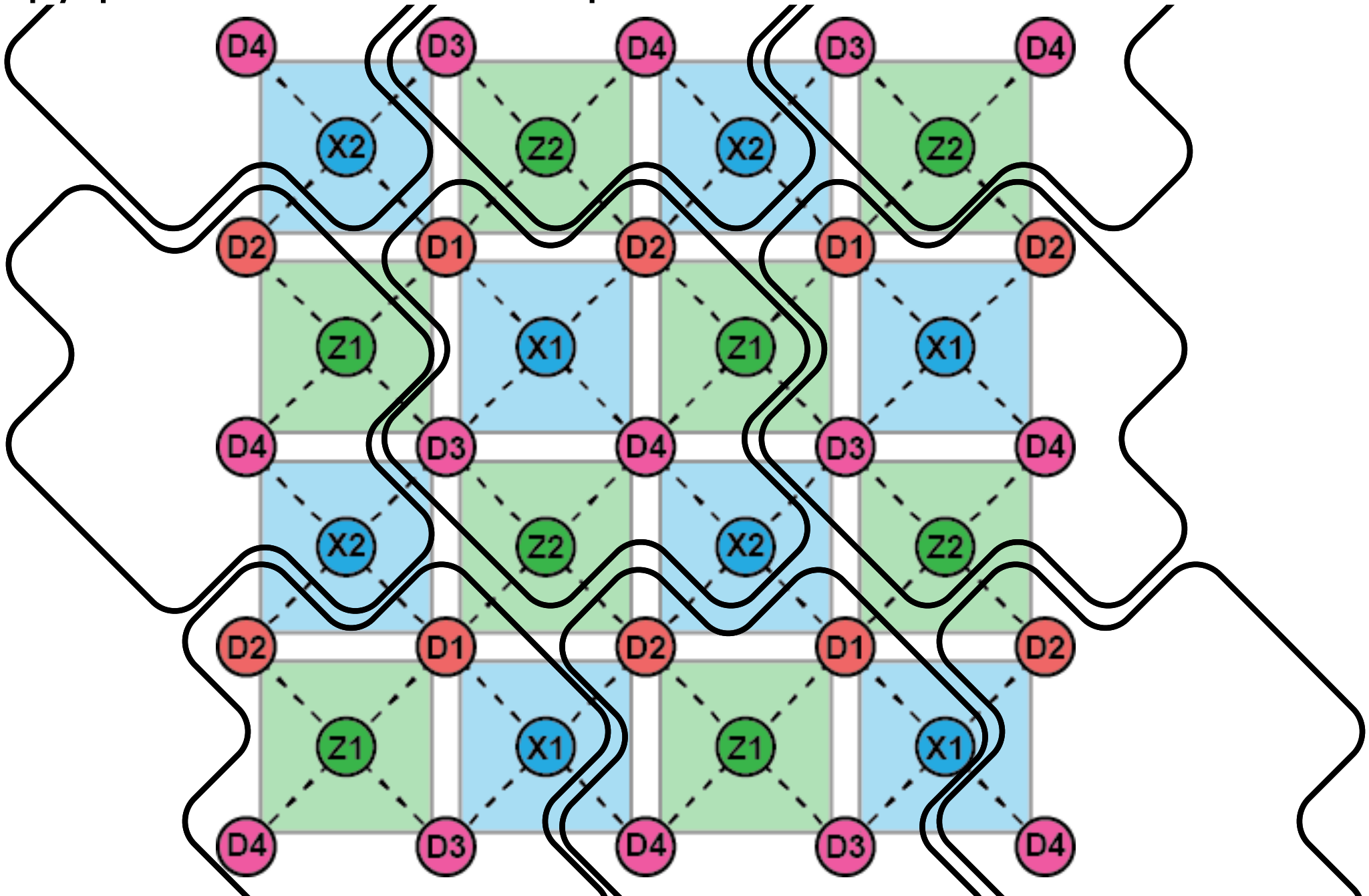
The *Starmon*: a 7-port transmon



A copy-pasteable unit cell of quantum hardware

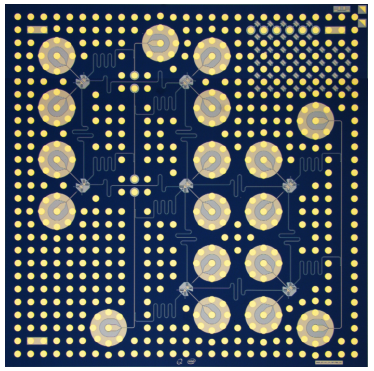


A copy-pasteable unit cell of quantum hardware



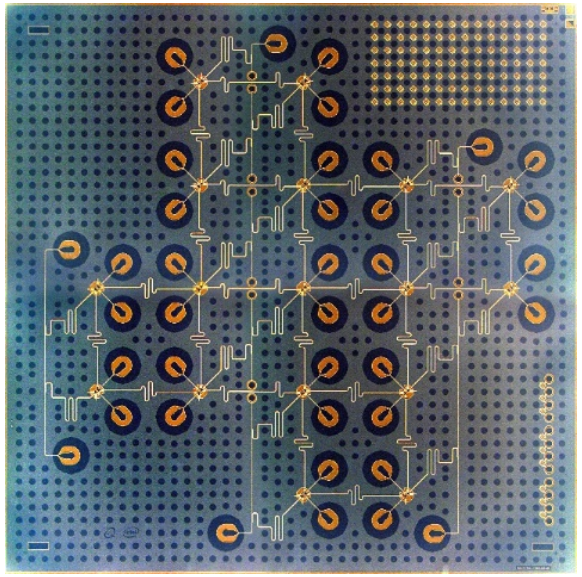
Growing by copy-pasting

Surface-7



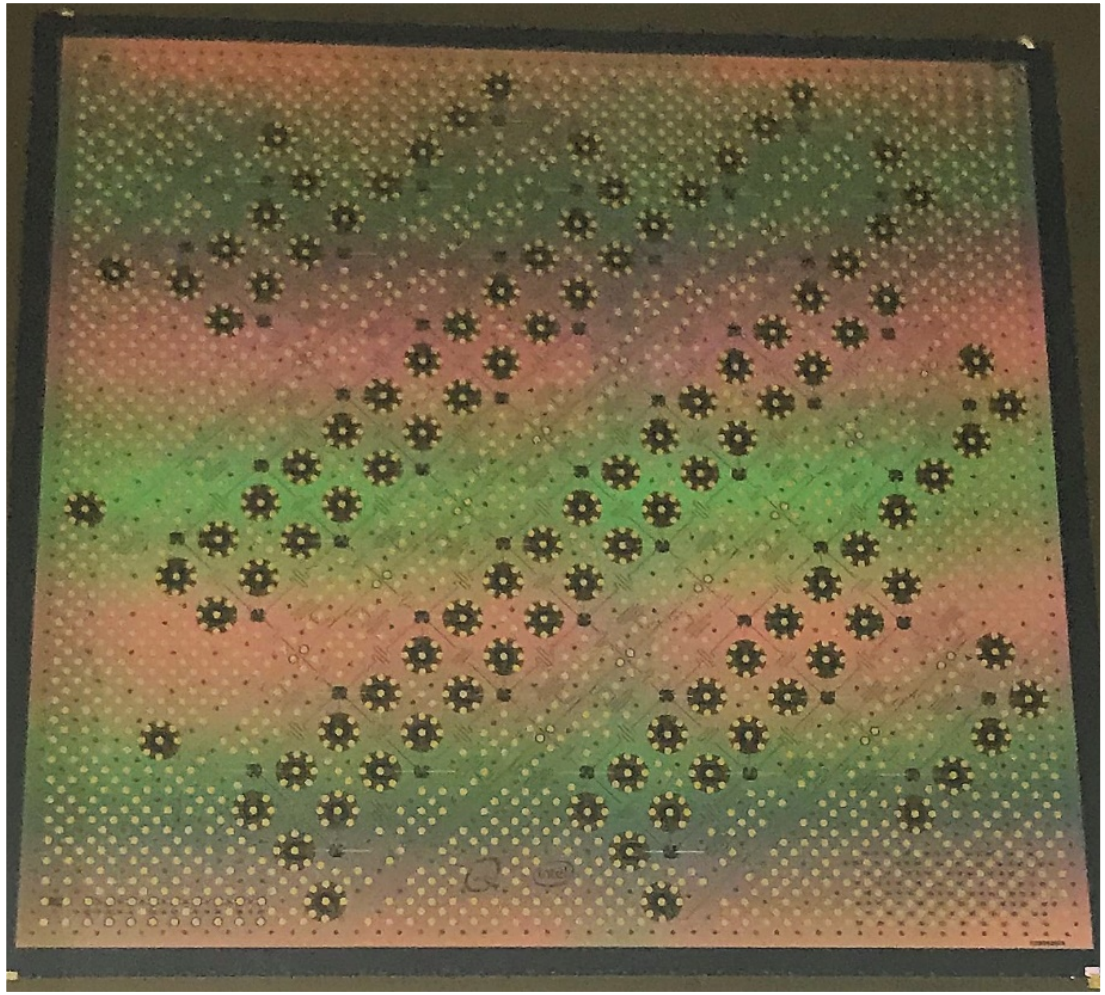
14mm x 14mm

Surface-17



22mm x 22mm

Surface-49



36mm x 36mm

Growing by copy-pasting

Surface-97