(a) Rigetti Novera 9Q Tunable Coupler Topology

Data Qubit (9)
Tunable Coupler (12)
CZ Gate Connection

Hardware Specifications:
• 9 data qubits + 12 tunable couplers = 21 total
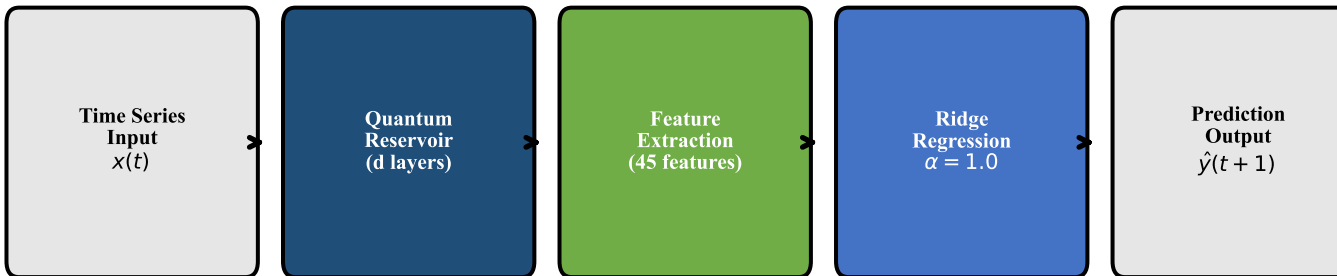• 12 effective CZ gate edges
• $F_{1Q} = 99.9\%$, $F_{2Q} = 99.4\%$
• $T_1 = T_2 = 27$ μs
• Connectivity: 33.3%
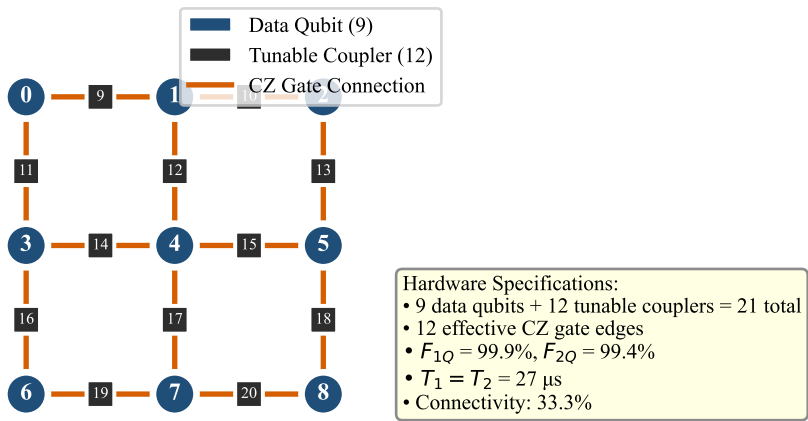
(b) QRC Circuit Structure (Single Layer)

One Layer (repeated d times)

$R_Y(\theta)$ — Input Encoding
$R_Y(\phi_i)$ — Trainable Rotations
CZ Entanglement (12 gates)
M — Z-basis Measurement
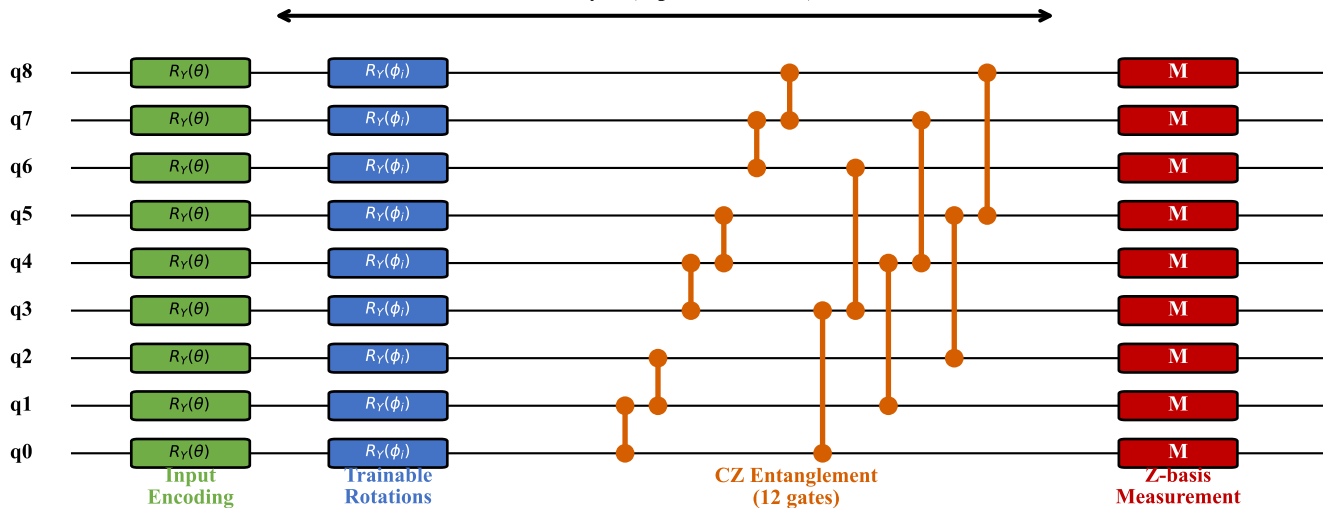
(c) Complete QRC System Pipeline

Optimal: $d = 5$ layers, $R^2 = 0.538$, Walk-forward CV: $R^2 = 0.528 \pm 0.148$

Time Series Input $x(t)$ → Quantum Reservoir (d layers) → Feature Extraction (45 features) → Ridge Regression $\alpha = 1.0$ → Prediction Output $\hat{y}(t+1)$

Features: $\langle Z_i \rangle$ (9) + $\langle Z_i Z_j \rangle$ (36) = 45 total