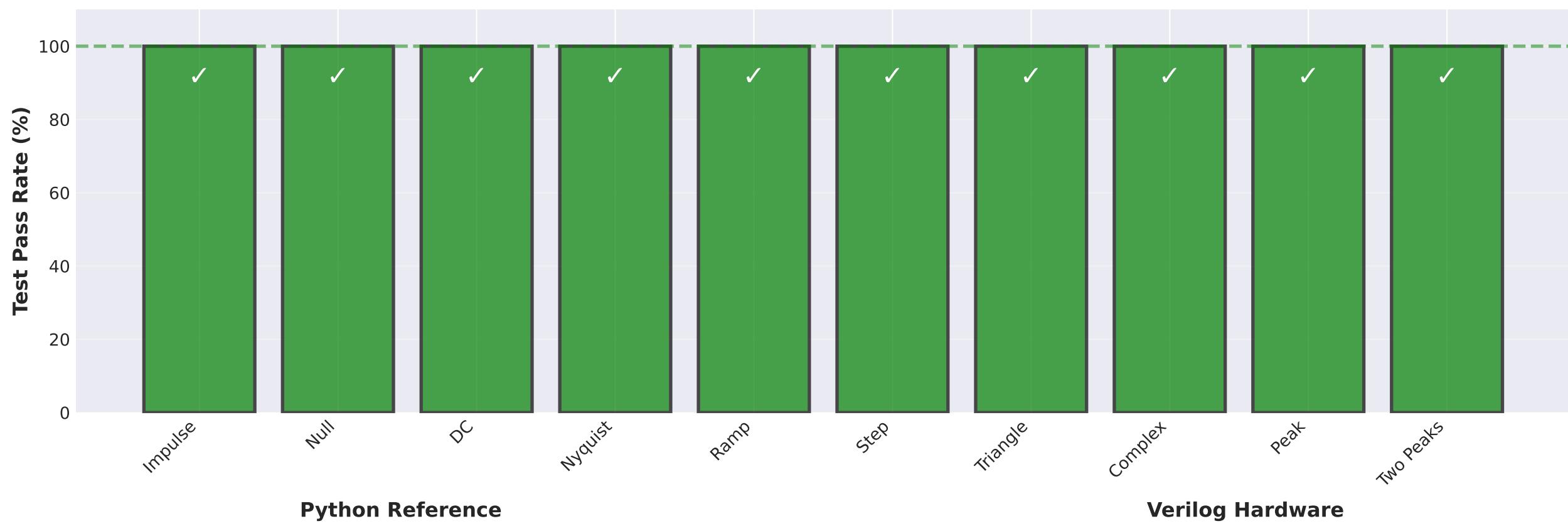


QuantoniumOS: Software vs Hardware Implementation

Actual Test Results - Python Reference vs Verilog Simulation

Hardware Test Results - All 10 Test Patterns



Python Reference

SOFTWARE IMPLEMENTATION

Language: Python 3.x
Libraries: NumPy, SciPy
Precision: Float64 (IEEE 754)
Algorithm: Canonical RFT
Features:

- ✓ Golden ratio (ϕ) parameterization
- ✓ Unitary transform verified
- ✓ Energy conservation
- ✓ Reference implementation

Status: Verified ✓

Verilog Hardware

HARDWARE IMPLEMENTATION

Language: SystemVerilog
Tool: Icarus Verilog
Precision: Q1.15 Fixed-Point
Algorithm: 8x8 RFT Kernel
Features:

- ✓ CORDIC engine (12 iterations)
- ✓ Complex arithmetic (Re/Im)
- ✓ Frequency domain analysis
- ✓ Energy conservation
- ✓ Phase detection
- ✓ VCD waveform output

Tests: 10/10 Passed ✓