

Dear Editor,

Although the guidelines for implementing a quantum processor in an electrical circuit are well known by now, existing realizations do not meet all their requirements at the same time. In our work, we demonstrate for the first time a quantum processor that meets them, which will be necessary for demonstrating the speed-up of quantum algorithms. Indeed, our processor is fitted with independent non-destructive single-shot readouts of its two qubits. We demonstrate in this processor the entanglement of the two qubits with the violation a Bell inequality, reconstruct the dynamics of the two-bit register by state tomography, and demonstrate a 90% fidelity of the universal iSWAP two-qubit gate that we fully characterize by quantum process tomography. We think our work is an important step towards a first demonstration of quantum speed-up and submit it as a Letter to your journal.

Best regards,

The authors