Supplementary Online Material for Characterization of a two-transmon processor with individual single-shot qubit readout

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Animated gif file to be included in the supplementary online material.

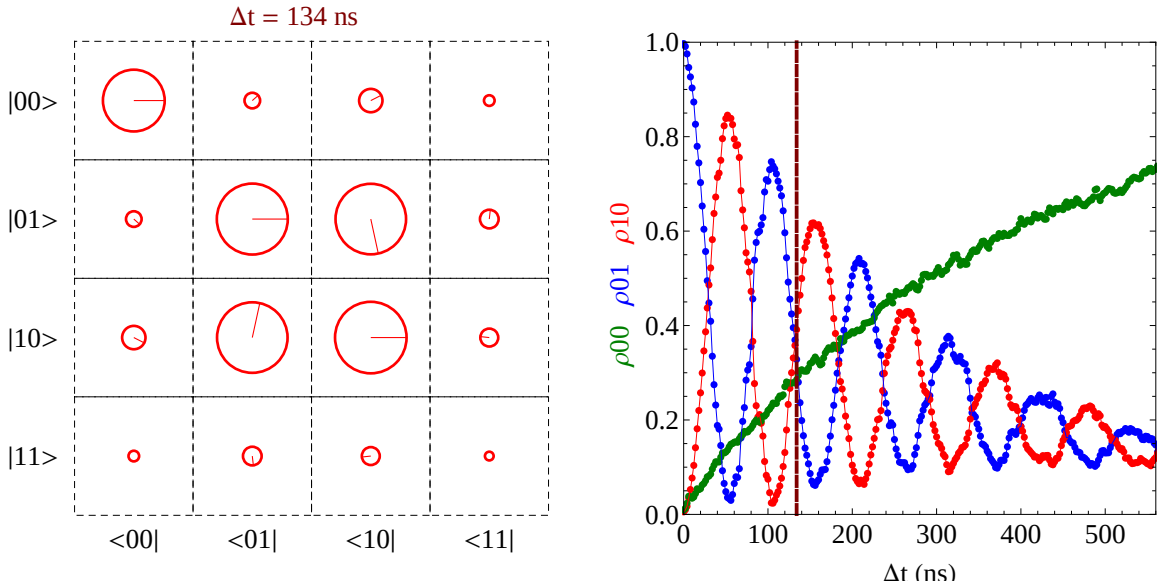

Figure 1: Reconstruction of the two-bit register density matrix by quantum state tomography during the $iSWAP$ gate operation. The working point is slightly different from the one reported in Figs 1 and 2 of our Letter. The main characteristics of the dynamics are clearly visible on the animated density matrix shown on the left, where each matrix element is represented by a circle with area proportional to its modulus (unit modulus for a circle touching the cell borders), and in the plot of the populations $\rho_{00} = \rho_{|00\rangle\langle 00|}$, $\rho_{01} = \rho_{|01\rangle\langle 01|}$, and $\rho_{10} = \rho_{|10\rangle\langle 10|}$ (on the right): we observe the swapping of ρ_{00} and ρ_{01} at frequency $2g$, the oscillations of the coherence amplitude $\left|\rho_{|01\rangle\langle 10|}\right|$ at the double frequency, the fast rotation of its phase $\arg(\rho_{|01\rangle\langle 10|})$, as well as the relaxation towards $|00\rangle$. However, the picture is less quantitative than Fig. 2 due to slow technical drifts that occured during the several hour long data collection. These drifts are responsible for small uncontrolled rotations of the measured operators, which build spurious coherent matrix elements: one sees for instance $\rho_{|00\rangle\langle 01|}$ unexpectedly peaking at 9% at $\Delta t = 8\,\mathrm{ns}$ and $\rho_{|00\rangle\langle 10|}$ reaching about the same error after 350 ns.