**DiVincenzo Criteria**

The DiVincenzo criteria define the minimal conditions needed for implementing a quantum computer and for quantum communications. The criteria for quantum computing are the following

1. A scalable physical system with well characterized qubits
2. The ability to initialize the state of the qubits to a simple fiducial state
3. Long relevant decoherence times
4. A “universal” set of quantum gates
5. A qubit-specific measurement capability

Quantum communications needs in addition

6. The ability to interconvert stationary and flying qubits.
7. The ability to faithfully transmit flying qubits between specified locations.

Building a scalable quantum computer requires however much more than meeting the DiVincenzo criteria. It is a monumental task that involves several level of complexity, many of which are at the moment completely open problems. The relevance of the DiVincenzo criteria is that they clearly define a guideline for engineering components that work the way they need for being the elementary building blocks of a quantum computer.

| **DiVincenzo criteria, as interpreted for spin qubits** | |
|---|---|
| **1. A scalable physical system with well characterized qubits** | Single electrons trapped in gate-defined quantum dots |
| **2. The ability to initialize the state of the qubits to a simple fiducial state** | Cool the system so that the electron spins are in their ground state (aligned with the external magnetic field) |
| **3. Long relevant decoherence times** | Use dynamical decoupling to extend decoherence times in GaAs, and/or move to materials that promise long decoherence times |
| **4. A “universal” set of quantum gates** | Single-spin Rabi driving and exchange-based entangling operations |
| **5. A qubit-specific measurement capability** | Spin-to-charge conversion and single-shot readout |
| **6. The ability to interconvert stationary and flying qubits.** | Still work in progress - GaAs and ZnSe might be play a crucial role for this scope |
| **7. The ability to faithfully transmit flying qubits between specified locations.** | An open point, but not strictly needed to build a quantum computer |