



Contribution ID: 354

Type: **Poster**

## **【575】 Qubit-losses in topological quantum computers: An experimental toolbox**

*Wednesday 28 August 2019 19:26 (1 minute)*

The loss of qubits - the elementary carriers of quantum information - poses one of the fundamental obstacles towards large-scale and fault-tolerant quantum information processors. We demonstrate an experimental toolbox for ion-qubit control and implement a full cycle of qubit-loss detection and correction on a minimal instance of the topological surface code. This includes a quantum non-demolition measurement of a qubit-loss event, triggering an in-circuit conditional code-switching operation. This enables the restoration of encoded logical information by mapping it onto a new quantum correcting code on a reduced number of qubits. Together with techniques to correct computational errors, this constitutes essential building blocks for complete and scalable quantum error correction.

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**Session Classification:** Poster Session

**Track Classification:** Quantum Science and Technology