

Protecting quantum entanglement from leakage and qubit errors via repetitive parity measurements

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Ni Group

Aug. 24, 2020

Transition to outside the qubit space

- Detection of leakage error
- Detection fidelity
- Correction of leakage error

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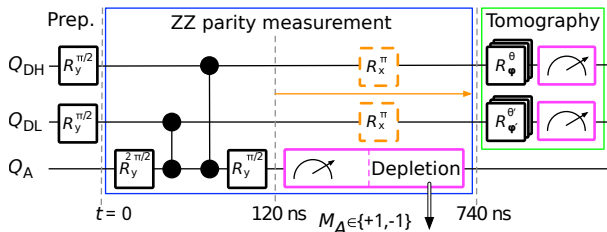
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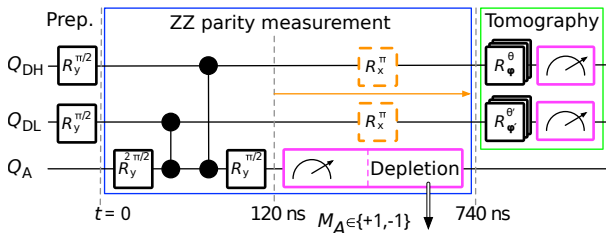
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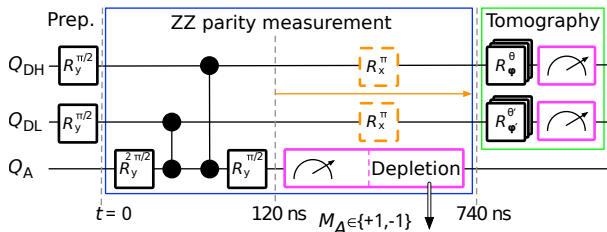
- Q_{DH}, Q_{DL}, Q_A
- Error correction via post-processing
Requires symmetry between states
- $Z \otimes Z$ (and $X \otimes X$)
- $F_{|\Psi^+\rangle|_{M_A=\pm 1}}$, i.e. $P(Z \otimes Z = \pm 1)$.
- $F_{|\Psi^+\rangle}$, i.e. $P(|\Psi^+\rangle)$, i.e. $P(Z \otimes Z = 1 \ \& \ X \otimes X = 1)$

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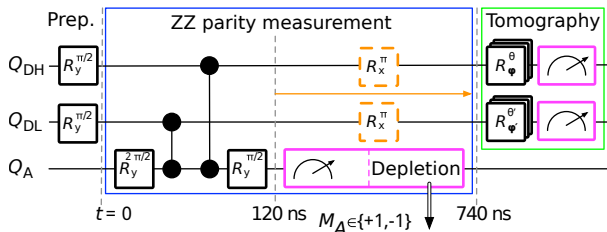
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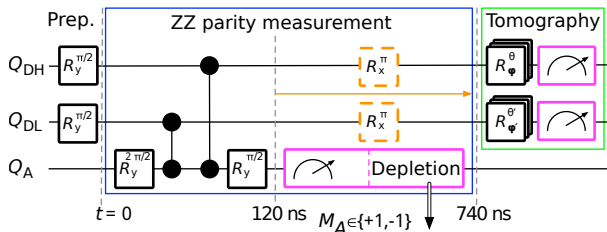
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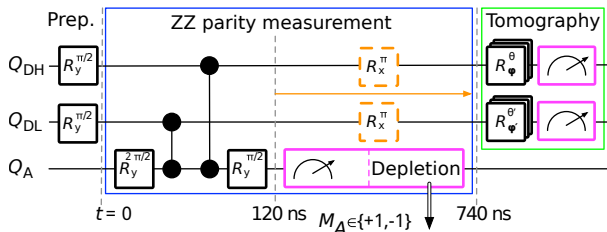
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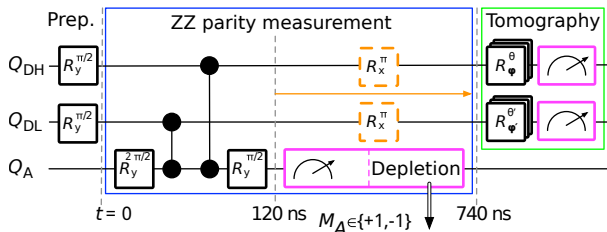
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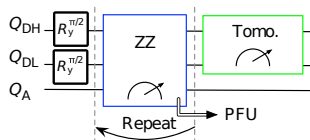
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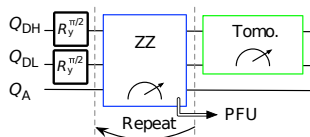
Repeated Z measurement



$$Z \otimes Z = 1: M_A = \text{Const}$$

$$Z \otimes Z = -1: M_A^m = -M_A^{m-1}$$

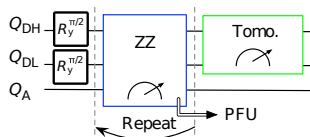
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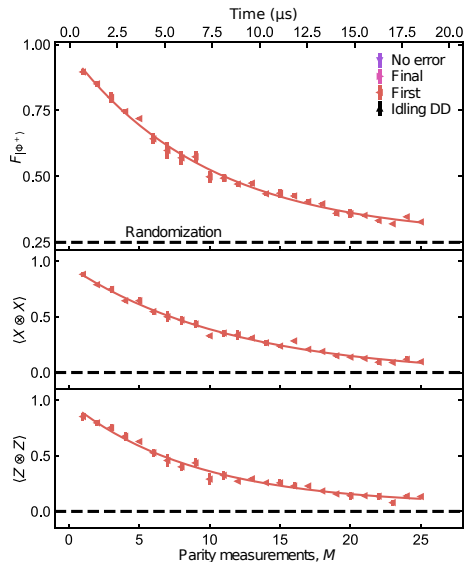
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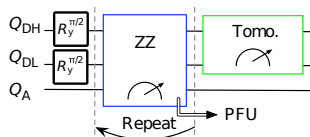


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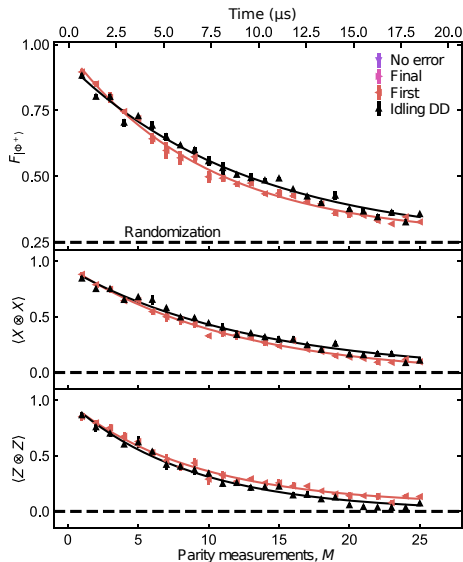


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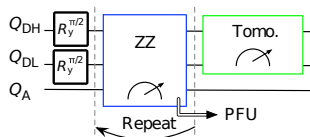


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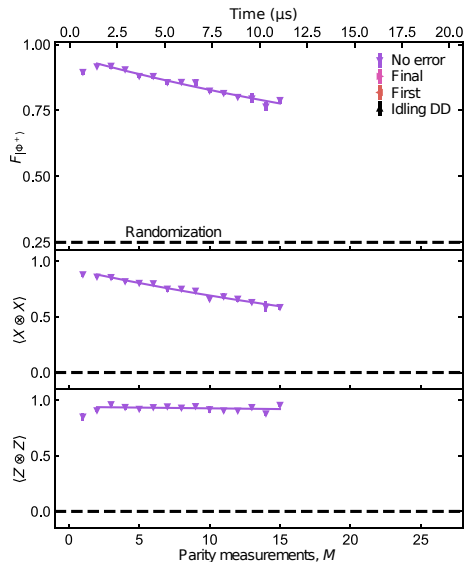


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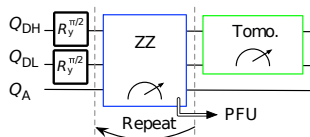


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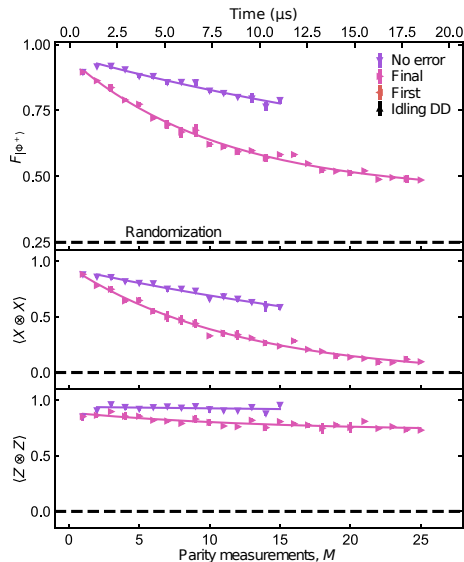


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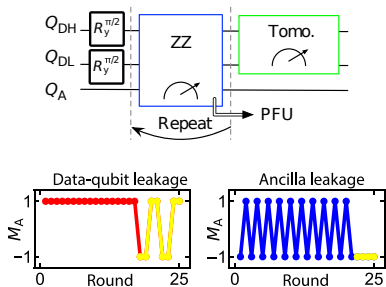


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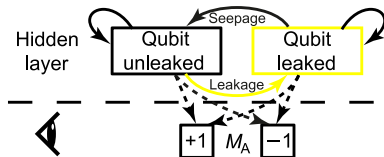
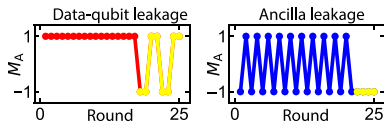
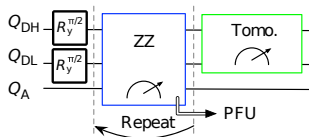
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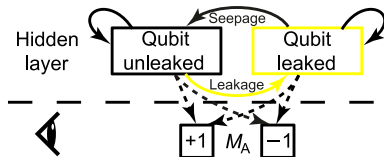
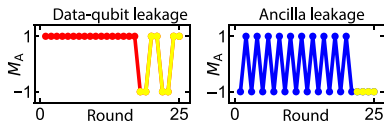
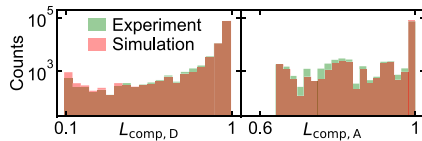
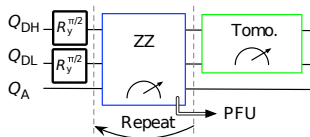
Leakage detection and correction



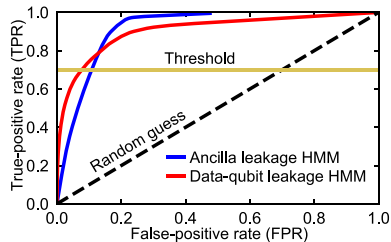
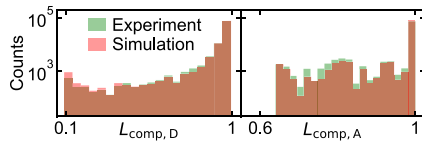
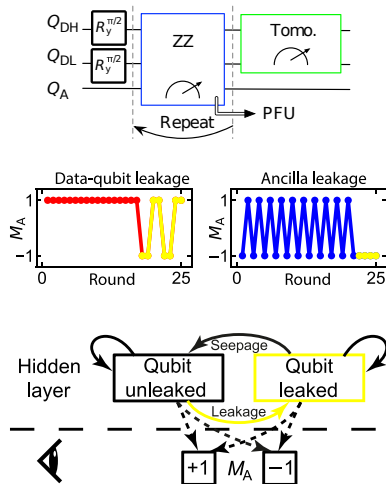
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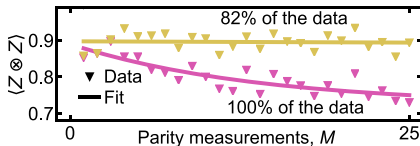
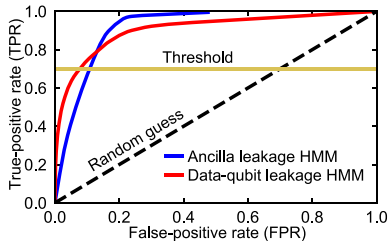
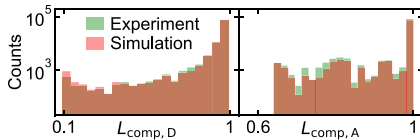
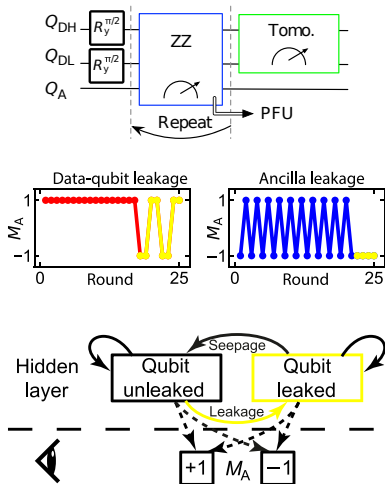
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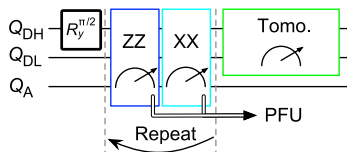
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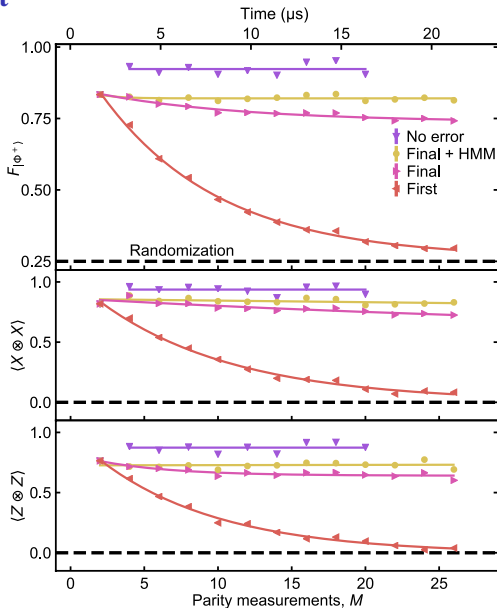
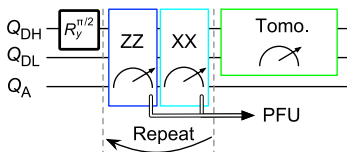
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