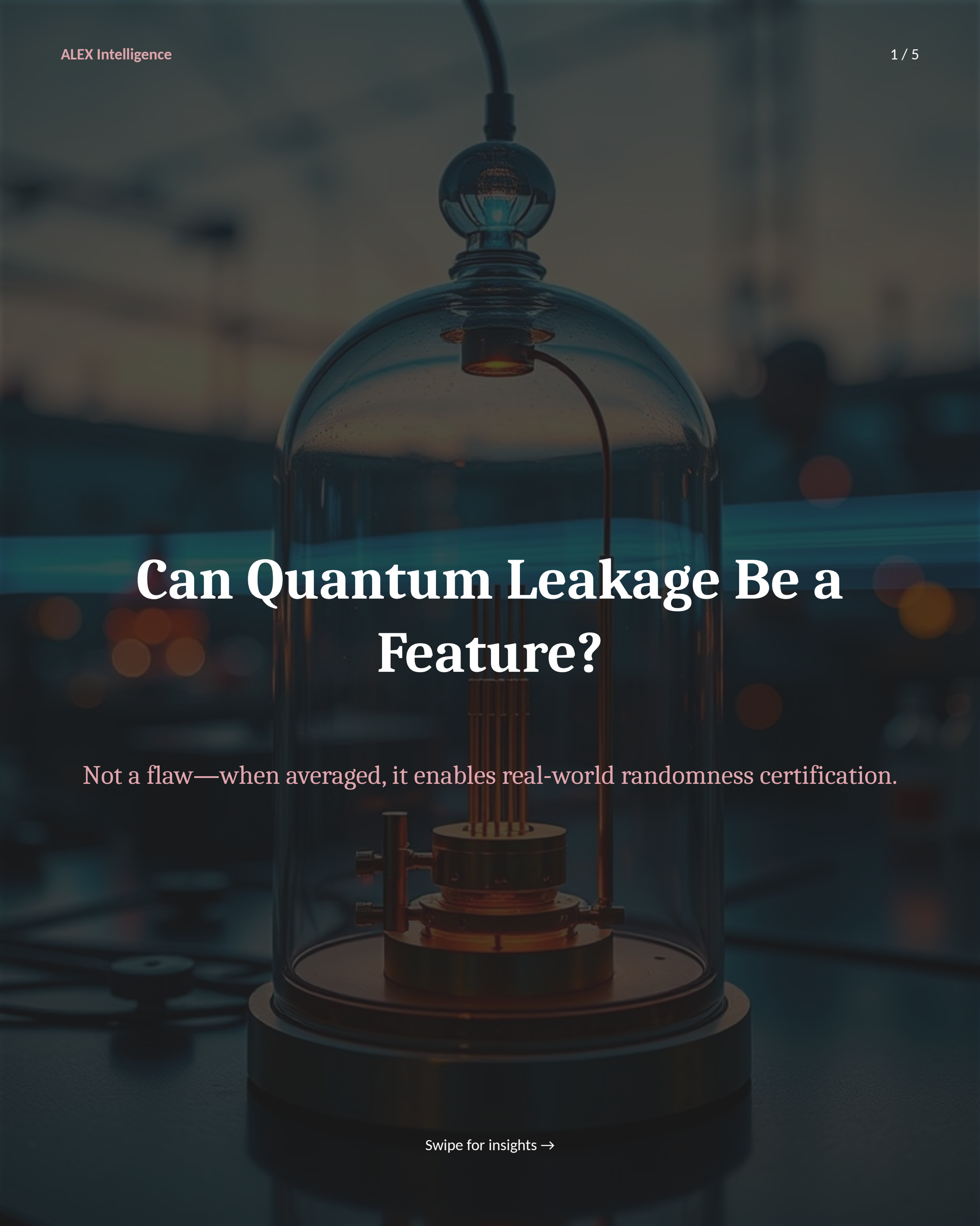


Can Quantum Leakage Be a Feature?

Not a flaw—when averaged, it enables real-world randomness certification.

Swipe for insights →

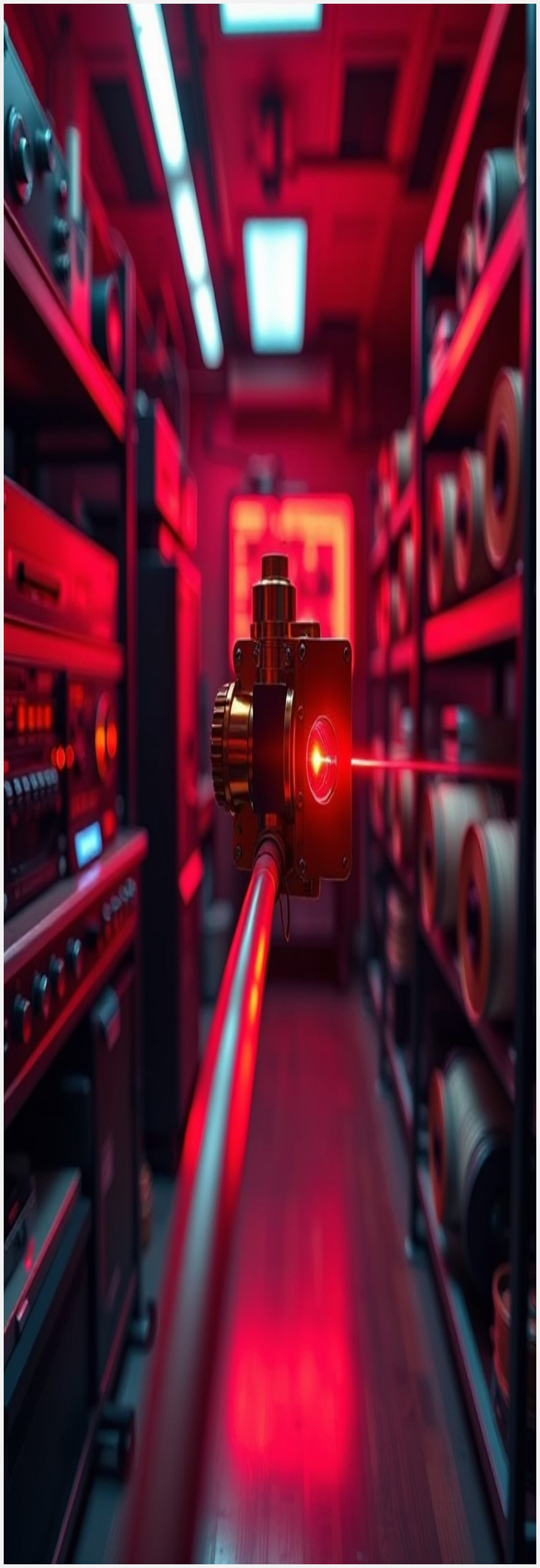
THE DATA

nonzero randomness certification

Certification Feasibility

Achieved using low-squeezing single-mode Gaussian states and homodyne detection—key for practical quantum systems.

This breakthrough shows that dimensional leakage, traditionally seen as a vulnerability in quantum protocols, can be harnessed constructively. By averaging over the full input ensemble, the protocol mitigates the risk of state leakage compromising randomness. This shifts the paradigm from avoiding leakage to leveraging it.



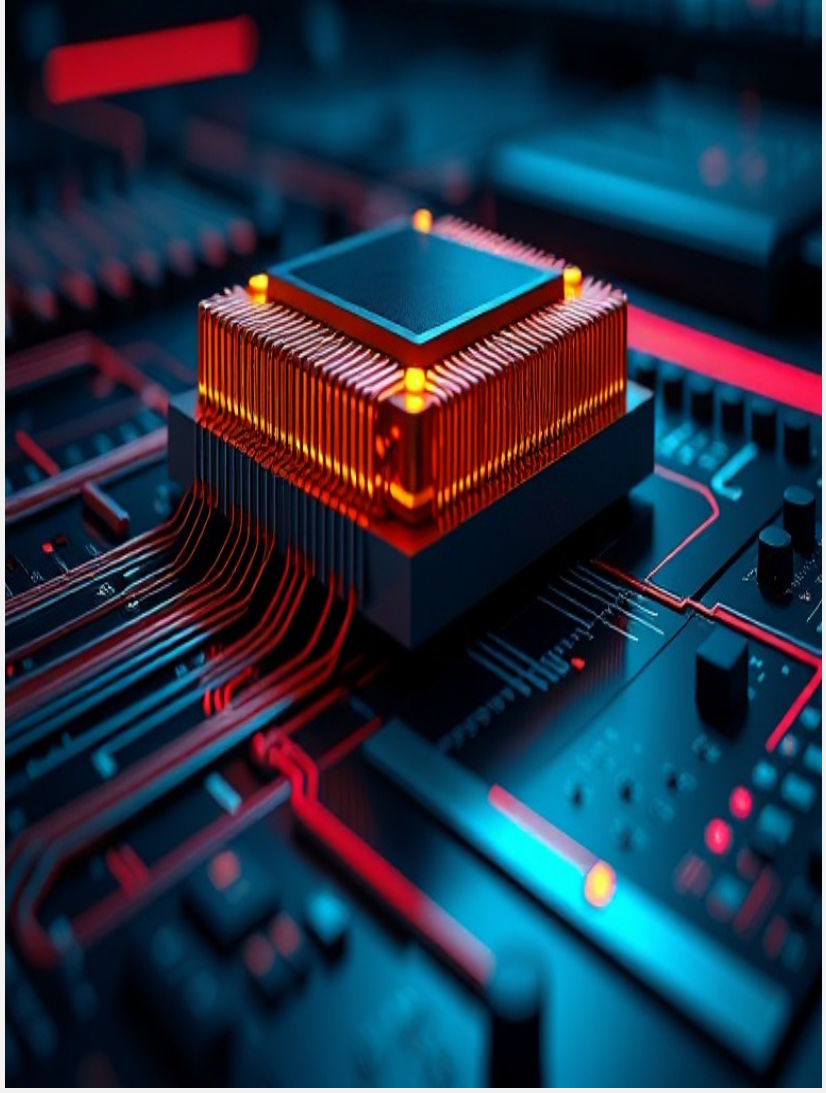
Source: arXiv.org · Published November 05, 2026
https://arxiv.org/abs/2611.08607

01

Leakage is not noise—it’s signal

The paper demonstrates that what was once considered a degradation of quantum fidelity—dimensional leakage—can, under the right conditions, become a source of robustness. This redefines how we design quantum systems: rather than striving for perfect isolation, we can engineer protocols that tolerate and utilize imperfect state confinement. This has direct implications for continuous-variable quantum technologies in real-world deployments.





02

Robustness through averaging

The key innovation lies in the ensemble averaging of inputs, which smooths out the sensitivity to leakage. This approach reduces the need for ultra-precise calibration, making certification viable with current experimental hardware. It suggests a new design principle: resilience in quantum systems may emerge not from perfection, but from statistical averaging across imperfections.

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