PhD Internships 2025

Below we describe the areas candidates can apply for. Within each area, there will be several different projects on which an intern could work. The details of the project will be tailored to the candidate's background.

Quantum Error Correction Research

Our Quantum Error Correction research team has several themes, some of which are:

1. Designing and running quantum error correction experiments on quantum processors
2. Inventing new decoding algorithms to catch more errors
3. Speeding up decoders to run faster
4. Designing the quantum error correction architectures for early fault tolerant quantum computers

We've written papers on hardware decoders, parallelised decoding, decoders for quantum LDPC codes, and more. As a Riverlane intern, you will work in one of those areas. Actual projects will vary depending on your background and the exciting work we are focusing on at the time of your internship. Successful candidates will have a background in Quantum Computing, Computer Science, Physics or Maths. You will need to be strong in algorithmic and abstract reasoning. Previous internship projects have been highly successful, as evidenced by interns leading contributions to various publications, for example: "Error-corrected Hadamard gate simulated at the circuit level", G.P. Gehér, *et al.* (2024).

Building the Quantum Error Correction Stack

At Riverlane, we work on the quantum error correction stack required for quantum computers to scale and unlock a vast range of world-changing applications. The central task of the error correction stack is to implement an error correcting scheme to handle errors that occur on qubits, which enables longer and more complex computations. We are looking for interns who are keen to work on the core challenges in developing the error correction stack. Riverlane's roadmap explains how our Deltaflow product will achieve a million reliable quantum operations by 2026, and you could be part of the team building our next big release!

There are several different projects that an intern could work on, including implementing decoders in software or on dedicated hardware, building tools to model noise of different qubit types, or systems integration. Therefore, we are seeking Computer Scientists, Software Engineers, Embedded Engineers, Verification Engineers, Digital Design Engineers, Experimental Physicists, Electrical and Electronic Engineers and related disciplines who have a keen interest in working on challenging problems in quantum error correction.

Quantum Algorithms and Applications Research

Our algorithms research team works on the quantum algorithms that error corrected quantum computers will run. We've published papers on a variety of exciting applications from quantum chemistry to materials simulations for catalysis, as well as papers on generally applicable algorithmic advances in areas such as quantum signal processing, and more. We are seeking candidates with background in physics, quantum chemistry, mathematical physics or applied analysis. The candidates do not have to have an explicit background in quantum computing. Previous internship projects have been highly successful, as evidenced by interns leading contributions to various publications, some examples of which include: "Quantum state preparation via piecewise QSVT" (2024) O. O'Brien and C. Sünderhauf; "Quantum Simulations of Chemistry in First Quantization with any Basis Set" (2024), T.N. Georges, *et al.*