The programme was designed to bring together specialists from diverse fields working on quantum control, so as to bridge the various discipline boundaries. We had tutorial lectures (about 2 per day) during the first two weeks, gradually working up to the current state-of-the-art and main challenges in the field. In week three, we held the Principles & Applications of Control to Quantum Systems (PRACQSYS) workshop which moved the focus more to experimental applications.

We put particular emphasis on underpinning mathematical framework, such as the quantum stochastic calculus, quantum open systems modelling, quantum statistics and estimation. This proved to be enormously helpful in clarifying the necessary background and structure, especially with participants who would already have been using some of these concepts in their work. Our programme differed substantively from other quantum control meetings insofar as it placed most attention on the use of feedback – both on the theoretical and experimental side. Indeed, one of the most satisfying, and potentially valuable, outcomes of the meeting was the extent to which participants started to see how classical feedback control gave a foundation on which to better understand the current developments in quantum control, system identification and parameter estimation.

Specific experimental realizations were also represented during the programme with talks by Joseph Kerckhoff (superconducting microwave networks), Liang Jiang (circuit QED systems), Akira Furusawa (photonic networks), Eran Ginossar and Mazyar Mirrahimi (non-linear superconducting qubits). Their talks lead to collaboration with theorists (for instance engineering coupled cavities and stabilization of quantum optical cavities by Furusawa): however, the programme enabled these researchers to explore new proposals for hybrid quantum systems through combining their expertise. This particular topic was pursued to an even extent during the PRACQSYS meeting itself when further set-ups that are now amenable to quantum control such as ion traps, opto-mechanical systems, superconducting qubit systems, magnon modes, and NV centres in diamonds were presented. The state-of-the-art in several areas (integrated quantum optics being a prime example) was realized to have developed to greater extent than individual researchers had realised, and the programme enabled experts to share recent progress in a manner that would not have been possible in a conference setting. Researchers from industry included Mohan Sarovar (Sandia National Labs), Charles Santori (HP Labs) and Robert Kosut (SC Solutions), and we ran a Turing Gateway meeting to hear about some of the resources already available for Quantum Technologies, and about suggestions for future directions for researchers to explore. The final week was used to consolidate on the research collaborations that had been fostered during the previous weeks.

There where a number of lectures on the "SLH" formalism (the Hudson-Parthasarathy quantum stochastic calculus applied to unitary system-noise models and the associated theory of quantum feedback networks due to Gough and James). Supporting this was a tutorial on Quantum Hardware Description Language (QHDL) by its developer Nikolas Tezak (MabuchiLab, Stanford University) which enables modelling and design of interconnected quantum systems.

The lectures on Quantum Statistics and Estimation proved valuable with topics such as quantum Fisher information and quantum Cramer-Rao bounds receiving attention from researchers investigating quantum system identification problems, as well as quantum metrology and sensing.

Pierre Rouchon spoke on the design of the discrete quantum filter which was used in the Nobel prize-winning experiment of Serge Haroche. With Jason Ralph, he developed an improved numerical schemes for integrating stochastic master equations and this implies that filtering and control of quantum systems should now be feasible for existing experimental systems. The new techniques should also be applicable to the simulation of quantum trajectories (Rouchon and Ralph, Phys. Rev. A **91**, 012118).

New collaborations formed include: work between control theorist Matthew James and experimentalist Akira Furusawa concerning deterministic photon sources, and the reduction of randomness of photon emissions using measurement feedback; Ralph on broadening previous work with Jacob Dunningham on quantum inertial sensing for gyroscopes so as to cover general quantum metrology problems in collaboration with Pieter Kok; between Ian Petersen, John Gough and Guofeng Zhang on control theoretic features of transfer functions for quantum linear systems; Birgitta Whaley and Sophie Schirmer on control of entanglement by reservoir engineering; Petersen, Naoki Yamamoto, Madalin Guta and Gough on quantum system identification. In addition, many of the younger participants have begun collaborations with the experienced researchers. The programme lead to a number of research grant applications including several EPSRC standard and fellowship applications, an Australian Research Council grant application by Elanor Huntingdon on Integrated Optical Devices for Quantum Networks which includes several particpants, and a application on quantum filtering to the Polish research council.

There were a number of interesting mathematical spin-offs emerging from the programme. For instance, the applied geometers Tudor Ratiu and Anthony Bloch brought the perspective of geometric mechanics and global analysis to bear on a number of issues, in particular relating to the understanding of the role of quantum dissipation, making new connections with work on metriplectic systems, interconnected Hamiltonian systems and geometric methods for classical and quantum stochastic dissipative systems. Gerard Milburn and Jacob Taylor developed regularizing feedback models as a novel approach to describe non-renormalizable field theories. Mathematical and functional analysis techniques were investigated with Tryphon Georgiou (Schrödinger bridges) and Oleg Smolyanov (Feynman Path Integrals) which provide highly relevant and promising approaches to quantum control which will be further developed with programme particpants.

The programme coincided with the consolidation of the EPSRC's National Quantum Technologies programme into central hubs. We therefore had a timely opportunity to bring to attention some of the prominent ideas and directions in quantum control, which we believe will be increasing importance to the development of Quantum Technologies. The Turing Gateway event also allowed UK researchers to hear about quantum-based knowledge transfer initiatives from technology strategy board Innovate UK.

There will be a thematic issue of the journal EPJ Quantum Technology devoted to the programme. Books on Quantum Feedback Networks (Gough and James), and Quantum Linear Control Systems (Nurdin and Yamamoto) are in preparation, and benefited greatly from the interactions and discussions throughout the programme.