

The Quantum Colaboratory

Process for Addressing Oversubscribed Tools



Background

The Quantum Colaboratory, or Quantum Colab, provides a full suite of tools that implement the quantum innovation cycle, which consists of:

- materials growth
- materials characterization
- device fabrication
- device control and testing
- applications

Many of the tools are unique (including some developed in-house), and others are not commonly available through shared resources. This leads to the likelihood that some tools will be oversubscribed. Here we address our processes to accommodate users of oversubscribed tools.

Normal Quantum Colab scheduling and operations

The Quantum Colab uses robust and scalable lab management software platforms to track and manage user access to the facility's tools. Tools are physically interlocked to the software, thus ensuring that they are only operated by trained and authorized users. The system generates detailed tool use reports and enables highly customizable tool reservation rules. This resource enables the staff to monitor the use and upgrade scheduling processes where appropriate.

Quantum Colab three-step process for managing oversubscriptions

In managing oversubscriptions, the goals are three-fold: to enable as much and as high-quality research outcomes as possible; to run the Quantum Colab as an open and welcoming resource to all; and to provide an easy path for new users to access training and tools. With these goals in mind, a three-step process is used to manage oversubscription as follows:

1. increase user efficiency;
2. increase tool availability;
3. making use of the International Scientific Advisory Committee to set scheduling priorities.

The Quantum Colab's processes align well with the Canadian Foundation for Innovation's (CFI's) [recommendations for managing user access for large initiatives](#) and with relevant policies from national facilities, such as the [Canadian Light Source](#).

By **increasing user efficiency**, the Quantum Colab alleviates the potential for oversubscription by enabling greater laboratory throughput and productivity. For context, the fabrication process necessitates a sequence of tool use where each step is dependent on prior outcomes. Therefore, it is common for users to book equipment in advance, anticipating a smooth process flow, and to then discover that a critical step needs to be revisited. This important source of inefficiency can be addressed through the lab management software, which helps optimize the flow. In addition, technical staff are a valuable resource for designing and managing process development. That said, there are always opportunities to improve training resulting in increased efficiencies. Such upgrades are tool and process specific and are one of the ongoing activities of the Quantum Colab. These upgrades are only possible due to the excellence of the technical staff.

Increasing tool availability is an ongoing process of providing experienced users more flexibility for booking time. This alleviates the potential for oversubscription during peak demand hours. Relatively safe, robust and well-protected tools are available on a 24/7 basis. Tools generally in high demand, such as the reactive ion etch and e-beam lithography systems, typically include built-in fail-safe mechanisms that protect operators from malfunctions and/or from human error. Thus, the operation of these tools by well-trained and experienced users does not require the presence of a Safety Buddy, which makes these systems compatible with 24/7 access. For selected labs, the Quantum Colab has hired co-op students to help develop processes and be in the lab after regular hours. This puts in place a Safety Buddy system enabling broader tool use. This can be expanded where appropriate.

(Update: Due to ongoing COVID constraints, labs are currently only operating during restricted hours. These hours of availability will be expanded as the Quantum Colab returns to normal operations).

Making use of the International Scientific Advisory Committee to set scheduling priorities where a conflict arises with oversubscription is utilized, as suggested by the CFI and the Canadian Light Source. The Quantum Colab has a very capable ISAC. The members have substantial experience using and operating shared resources. They are broadly knowledgeable on quantum technologies and span the full quantum innovation cycle. They are also independent of the Quantum Colab and its users.

When a tool is oversubscribed to the extent that priorities need to be set, the Laboratory Operations

Committee brings the situation to the ISAC and solicits their advice to resolve the conflict. The ISAC is provided with the Process Request Forms, tool use history and a short Curriculum Vitae (CV). The ISAC is tasked to advise on how to best maximize a high quality of research outcomes while also providing access for new users and maintaining an equitable, inclusive and diverse user community. The ISAC advises the Lab Operations Committee and reports to the Executive Committee.

As described in the following table, the Quantum Colab aligns with the CFI’s suggested practices.

CFI’S SUGGESTED GENERAL PRACTICES

QUANTUM COLAB IMPLEMENTATIONS

Having policies and procedures that are clear and concise, and that help ensure a fair and transparent process for the potential users;

Policies are available on the website, including how to engage, how to schedule training and use, fees, and policies for oversubscribed tools.

Clearly defining the evaluation criteria and process that will be used to allocate user access;

The ISAC is tasked to advise on how to best maximize a high quality of research outcomes while also providing access for new users and maintaining an equitable, inclusive and diverse user community.

Clearly defining the various classes of users and the associated user fees or rates for equipment;

There is only one class of users for most tools. User fees are listed on the website. Users with less than 150 hours of independent equipment use are restricted to using the facility during normally staffed hours only.

Ensuring that committees or individuals involved in the review or who are responsible for allocating user access are unbiased;

The committee is the ISAC, which is independent of the Quantum Colab and associated participating institutions.

Restricting physical access to the facility and its equipment to registered users only;

This is a key feature of the lab management software. Access to the labs is controlled by FOB access cards and a unique user PIN.

Putting in place an adequate scheduling process and clear communication of schedules for users to avoid conflicts and maximize the use of the facility and its equipment.

The scheduling process is online and the same for most tools. All schedules are posted. The Quantum Colab staff work to maximize tool use.

