5 Testing

Testing is an **extremely** important component of most projects, whether it involves a circuit, a process, power system, or software.

The testing plan should connect the requirements and the design to the adopting test strategy and instruments. In this overarching introduction, given an overview of the testing strategy. Emphasize any unique challenges to testing for your system/design.

5.1 Unit Testing

What units are being tested? How? Tools?

The goal for our project is to be able to simulate a trapped Ion Qubit. The implementation we will use will involve a new layout using 2 peregrine traps, where one will serve as a level plane, while the other will be inverted and rotated above to allow for multidimensional movement of qubits. There is no set name, so for now I will simply call it a novel trap. The peregrine tap itself will be a unit to be tested.

As to how, we will be scaling up the design as a proof of concept. To do this we will use pieces of paper as our trapped ion, and high-voltage rails to power our trap. It will be visually apparent if it has been successful, as the paper will float in the air.

We will use a high voltage generator (5kV) to power conductors in our design. No other tools are planned for use in testing.

5.2 Interface Testing

What are the interfaces in your design? Discuss how the composition of two or more units (interfaces) are being tested. Tools?

There are a couple of interfaces in our design. The primary interface will be between the 2 units. 1 will need to be rotated and suspended, and so our suspension will need to be able to support the trap without causing electromagnetic interference capable of ruining the trap. The second interface will be on the smaller electrodes used to move the trapped ions. Tools for this will be limited to things like probes, and again our high voltage generator.

5.3 Integration Testing

What are the critical integration paths in your design? Justification for criticality may come from your requirements. How will they be tested? Tools?

The most critical integration will be between the 2 units. These must work together to provide our required multidimensional control over the trapped ions. The integration will be tested identically to the unit testing. The last thing to be integrated will be the control charges used to move the ions

5.4 System Testing

Describe system level testing strategy. What set of unit tests, interface tests, and integration tests suffice for system level testing? This should be closely tied to the requirements. Tools?

The System testing will involve all components in the novel trap. The above tests, in particular the integration testing, will be able to suffice, as the final integration test will have the entire unit.

5.5 Regression Testing

How are you ensuring that any new additions do not break the old functionality? What implemented critical features do you need to ensure do not break? Is it driven by requirements? Tools?

There are essentially 2 major steps that may break previous steps. The part for concern is when the 2 peregrine traps are combined. These traps must not stop each other from performing. If this breaks, we lose the multidimensionality that the trap has, and will have failed. The other area that is less likely to cause issues but still might would be the charges used to move our simulated trapped ions. It is unlikely, but possible that this could cause a failure in the traps themselves. Luckily, neither steps should be able to cause any actual damage to the unit, meaning if the combination is unsuccessful, they can be taken apart without any harm. This will allow us to change the design without having to go all the way back to stage 0.

5.6 Acceptance Testing

How will you demonstrate that the design requirements, both functional and non-functional are being met? How would you involve your client in the acceptance testing?

Our client intends to be present for this testing, as they are very involved in the criteria. Our for how we will demonstrate, it should be quite apparent. Our design will be able to cause trapped particles to float and allow us to manipulate them. There are not specific criteria for things like height or movement speed, merely a conceptual proof is desired, so a video will suffice.

5.7 Security Testing (if applicable)

5.8 Results

What are the results of your testing? How do they ensure compliance with the requirements? Include figures and tables to explain your testing process better. A summary narrative concluding that your design is as intended is useful.

As stated in 5.6, the result of our testing would be a video proof of successfully trapping particles and moving them around. As these are the requirements, a video will ensure compliance. The use of this product itself will be ___