Device for bending and cutting coaxial wire for cryostat in quantum computing

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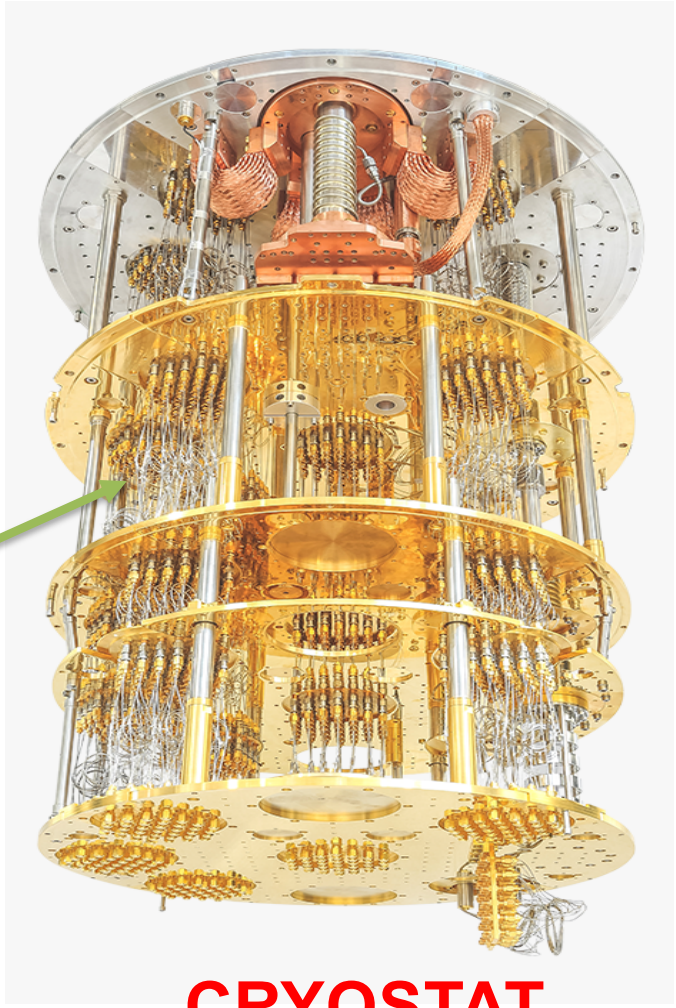
Introduction

- Quantum computing is based on special properties of quantum particles.
- In order for quantum particles to stay stable, the particles have to be as cold as possible.
- Cryostats are used to cool the quantum chip to below 10 mK temperatures.
- In cryostats, coaxial lines are used for communication to and from the quantum chip.
- These coaxial lines have to be bent in order for them to withstand thermal shrinking and expansion.



CRYOSTAT

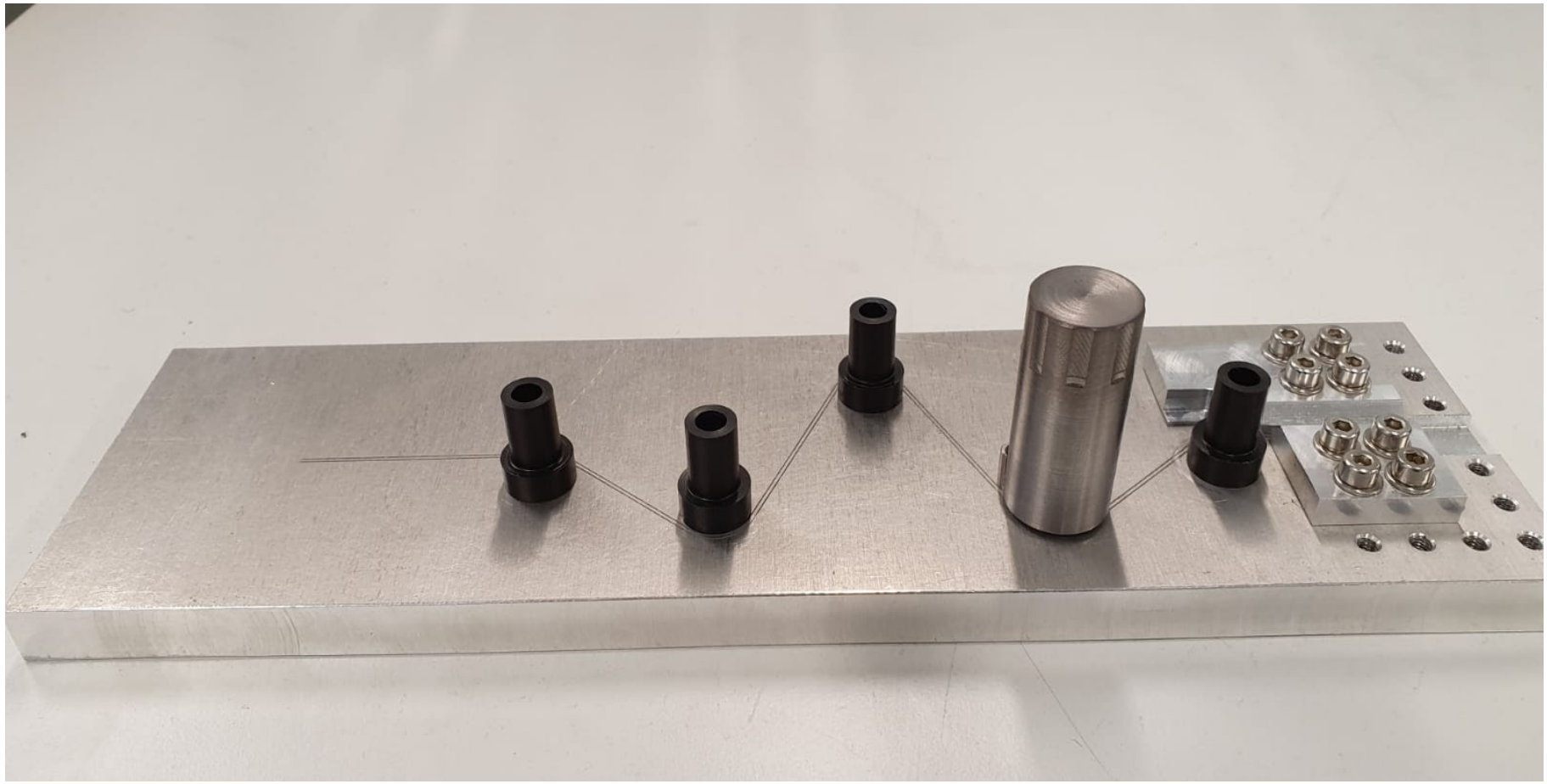
Problem

Coaxial lines are bent manually.

- The number of cryostats that can be manufactured cannot be increased because of the amount of manual labor required.

- Currently available machines in the market do not have the accuracy or the ability to handle such small and delicate wire.

Manual bending JIG



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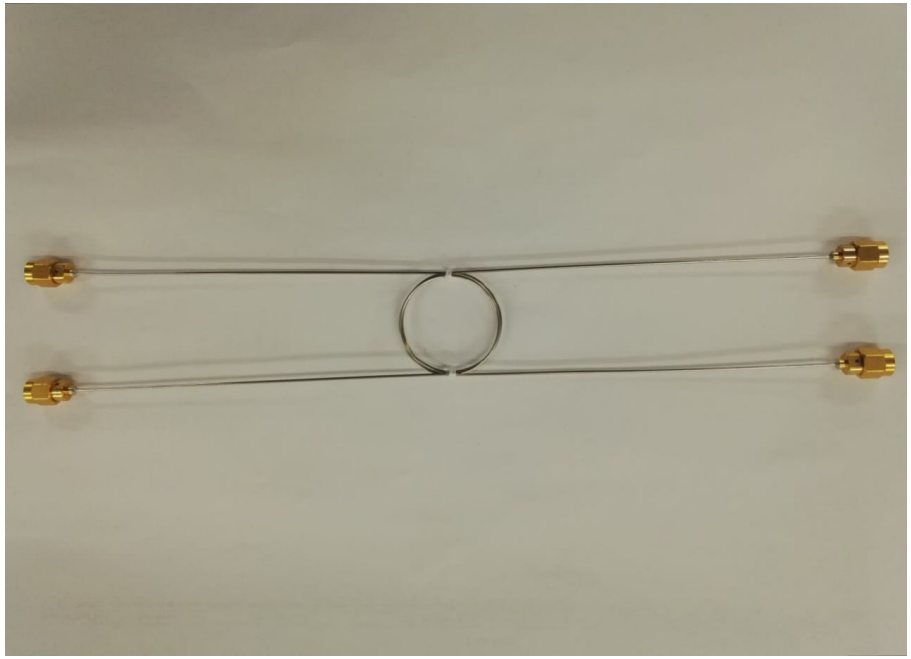
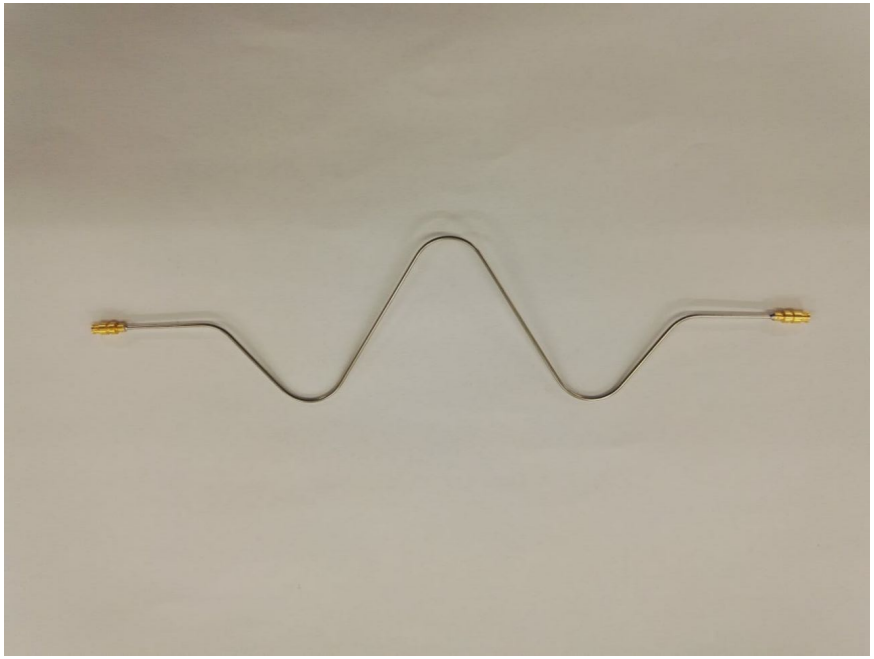
Before and after



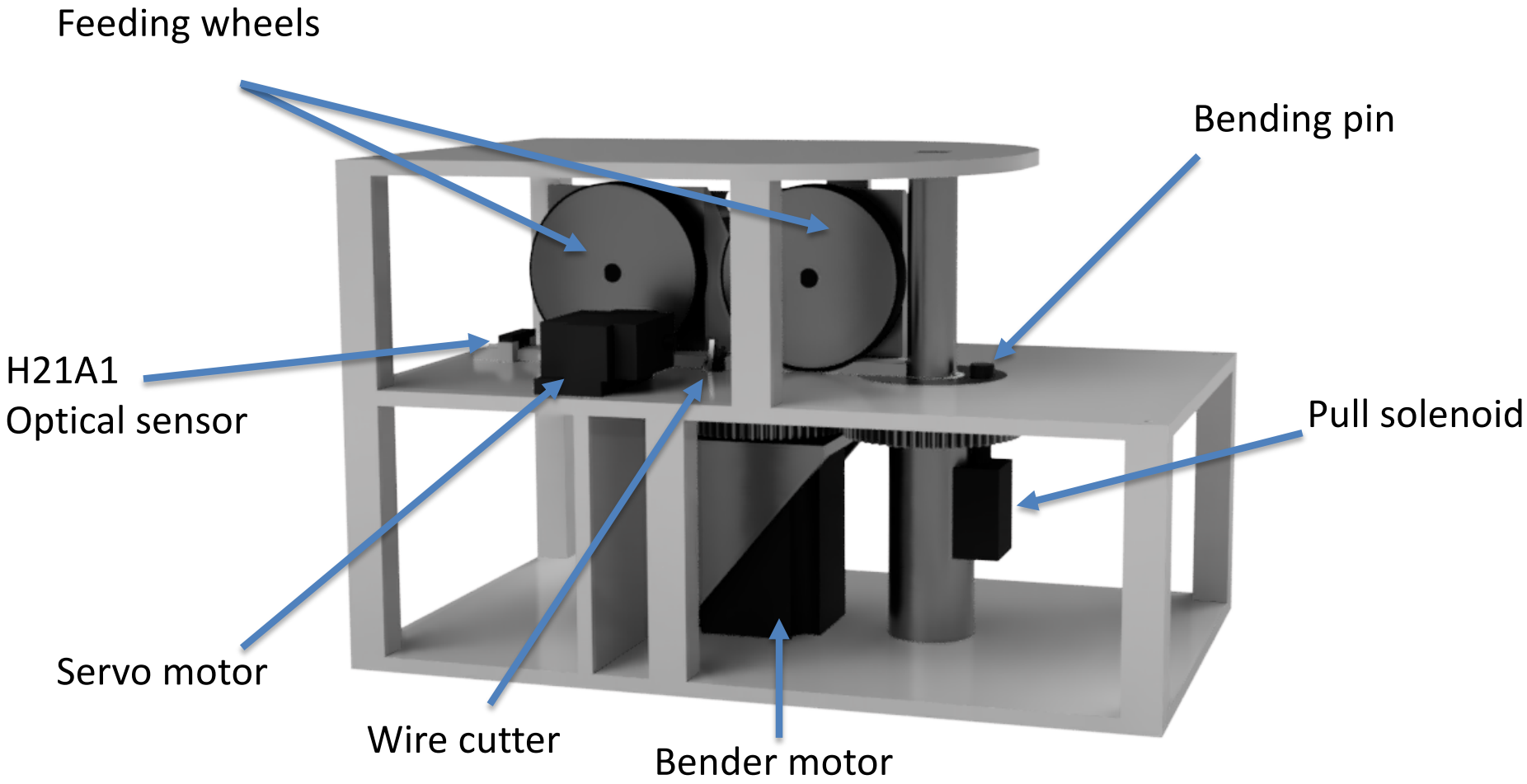


- Currently, a loop is done to the wire and the loop is tied with another line using a cotton thread.
- Proposed geometry for machine to bend the coaxial.

The proposed machine

- Ability to make up to 480 lines per day.
- Fully automated.
- Economical solution.
- Saves labour time.
- Increases accuracy.

Picture of the design



Machine functions

- Feeder rollers feed the wire to the bender, which bends the coaxial using a rotating wheel with a pin.
- The pin pushes the coaxial against the counterpart to bend it.
- The line is fed forward, bent, fed more, bent again and that is repeated until the decided radius for the complete bend is achieved.
- Coaxial is fed until the starting point of the second bend.
- Pin is retracted and rotated to the other side of the coaxial, because next bend will be to opposite direction.
- This is repeated until the desired geometry is achieved.
- Finally the blades cut the line and line is fed out.

Results

- The device design is finely tweaked at this point, with no upcoming changes required to increase the functionality.
- The code is in a rough state and large amounts of testing are required before the expensive coaxial line can be put through.

Conclusion

- This machine is required to meet the demand of cryostats that the quantum future needs.
- This is a very profitable machine and it is expected to pay for itself thousands of times over.

Thank you