

Design Objectives

- ☐ ● Create telerobotic surgical system
- ☐ ● Provide operator with tactile (or ☐ ☐ ☐ haptic) feedback
- ☐ ● Design miniaturized grippers
- ☐ ● Allow testing of prototype in a simulated ☐ ☐ ☐ medical environment

Mechanical Design

Design Specifications

- ☐ ● Gripper dimensions
- ☐ ☐ 3/4" in length, 1/4" tall, and 1/8" wide
- ☐ ● Force range
- ☐ ☐ 0 to 10 N
- ☐ ● Low friction through bearings
- ☐ ● Low weight acrylic parts

Figure 1: Master Gripper. A: Isometric View
B: Top View

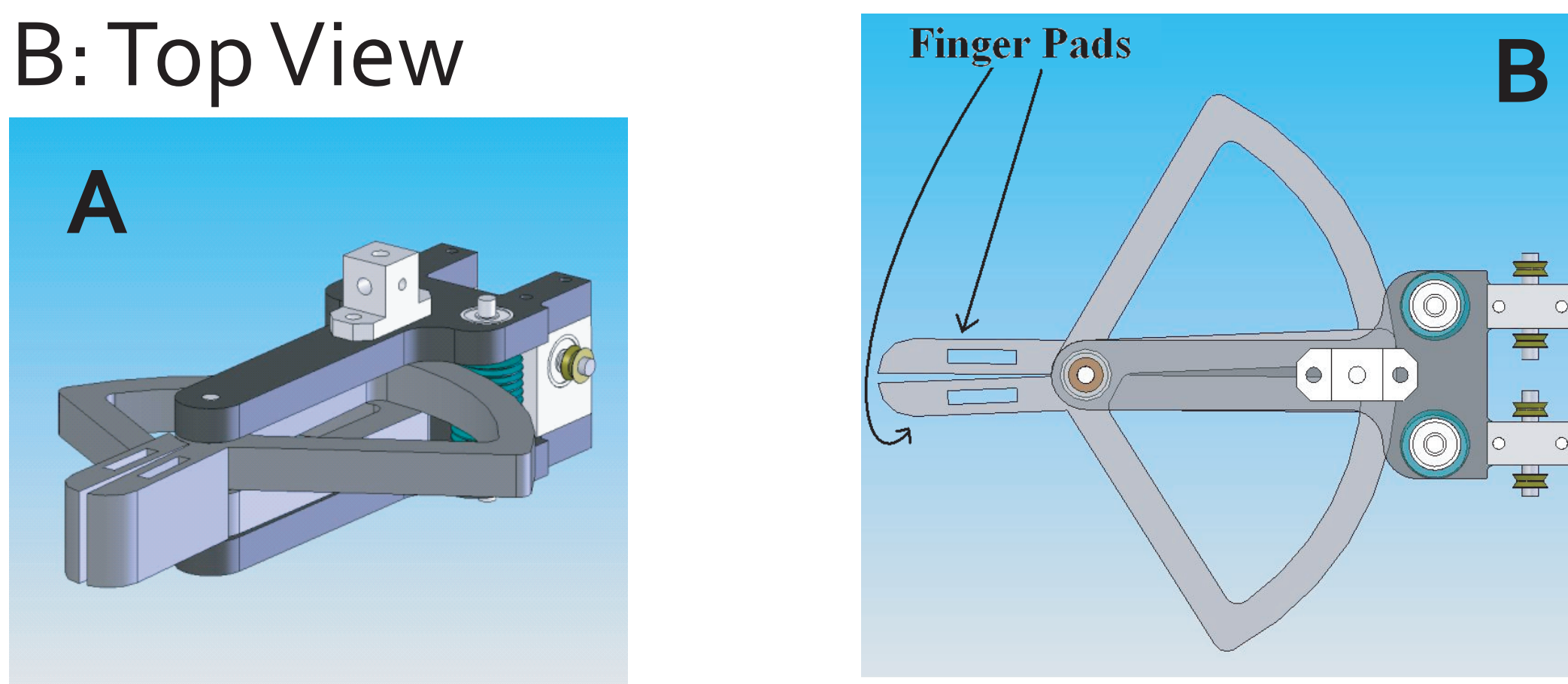
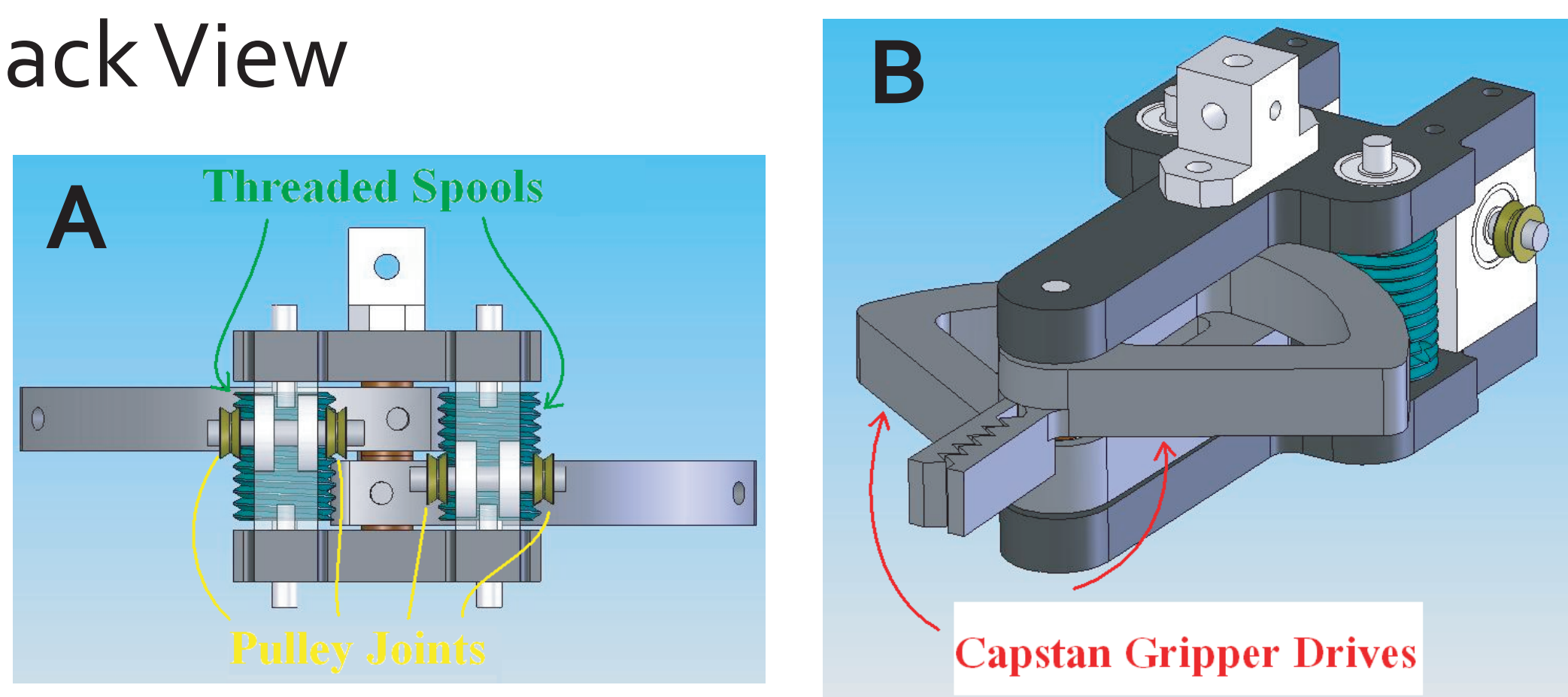


Figure 2: Slave Gripper. A: Isometric View
B: Back View



Electrical Design

Base system

- Phantom Premium

Electrical Components for Gripping Assemblies

- Entran ELFS Load Cell

- ☐ ● Maxon RE 25 Motor

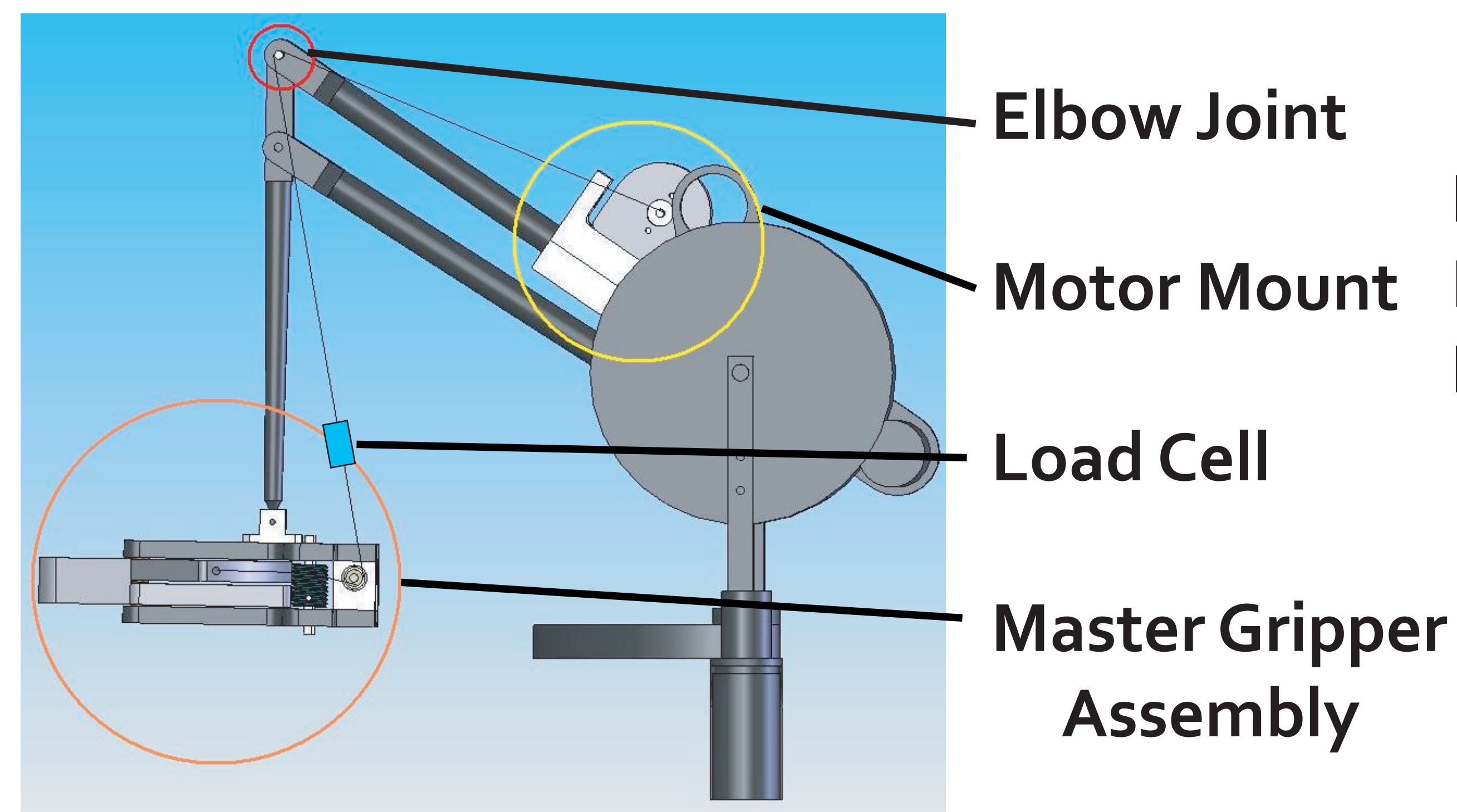
Device Controller (NI PXI 7831R)

- ☐ ● Motor actuation and calibration
- ☐ ● Interface with Phantom
- ☐ ● Interface with virtual environment
- ☐ ● Teleoperation Code
- ☐ ☐ ○ Match position of slave to master
- ☐ ☐ ○ Match force output of master to force sensed by slave
- ☐ ● Allow switching of slave device for ☐ ☐ virtual environment input

How It Works

☐ Master-Slave Teleoperation

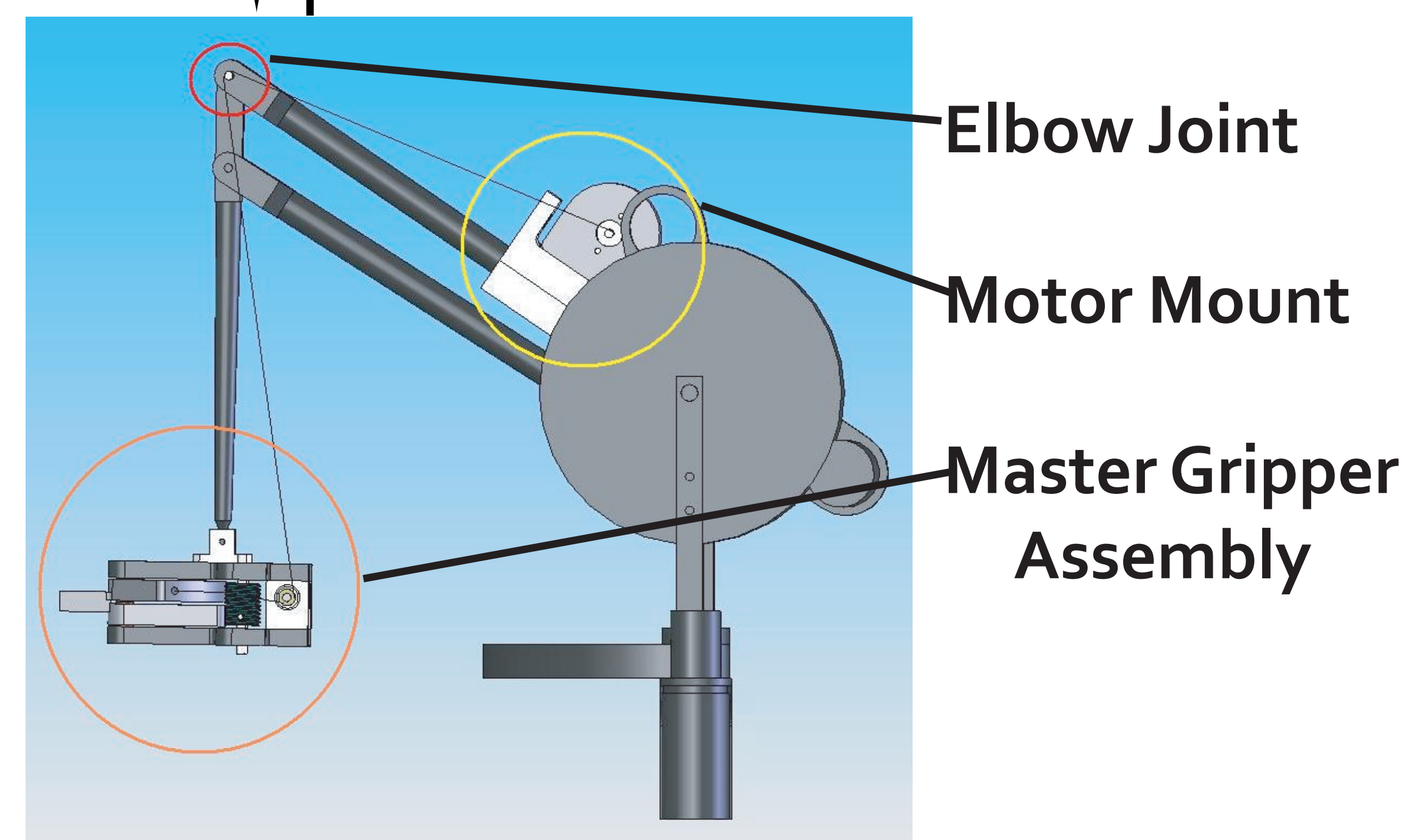
Figure 3: Master Interface



Match the slave position to the master position

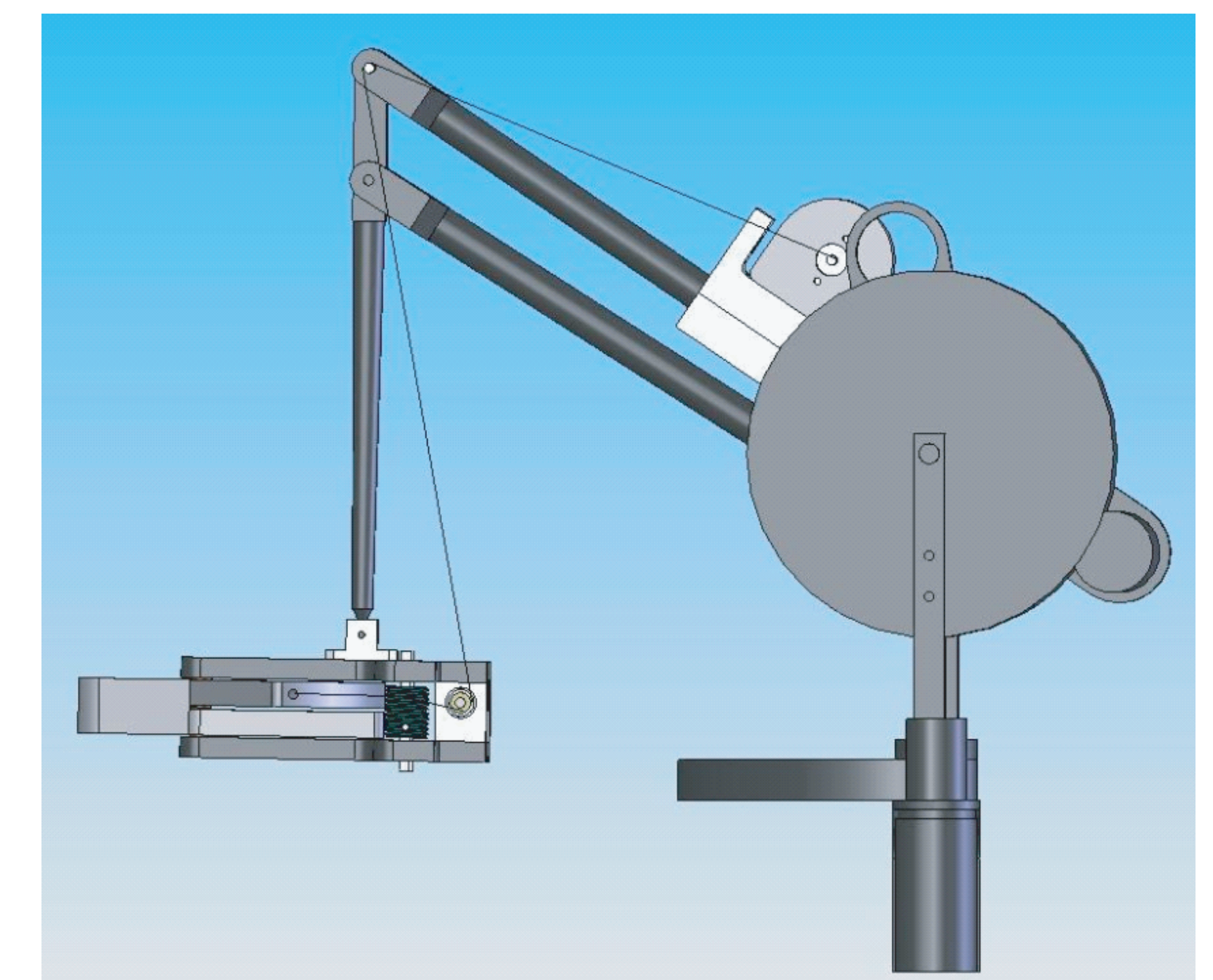
Match the force output of the master to the force detected by the slave

Figure 4: Slave Interface



Master-Virtual Environment Operation

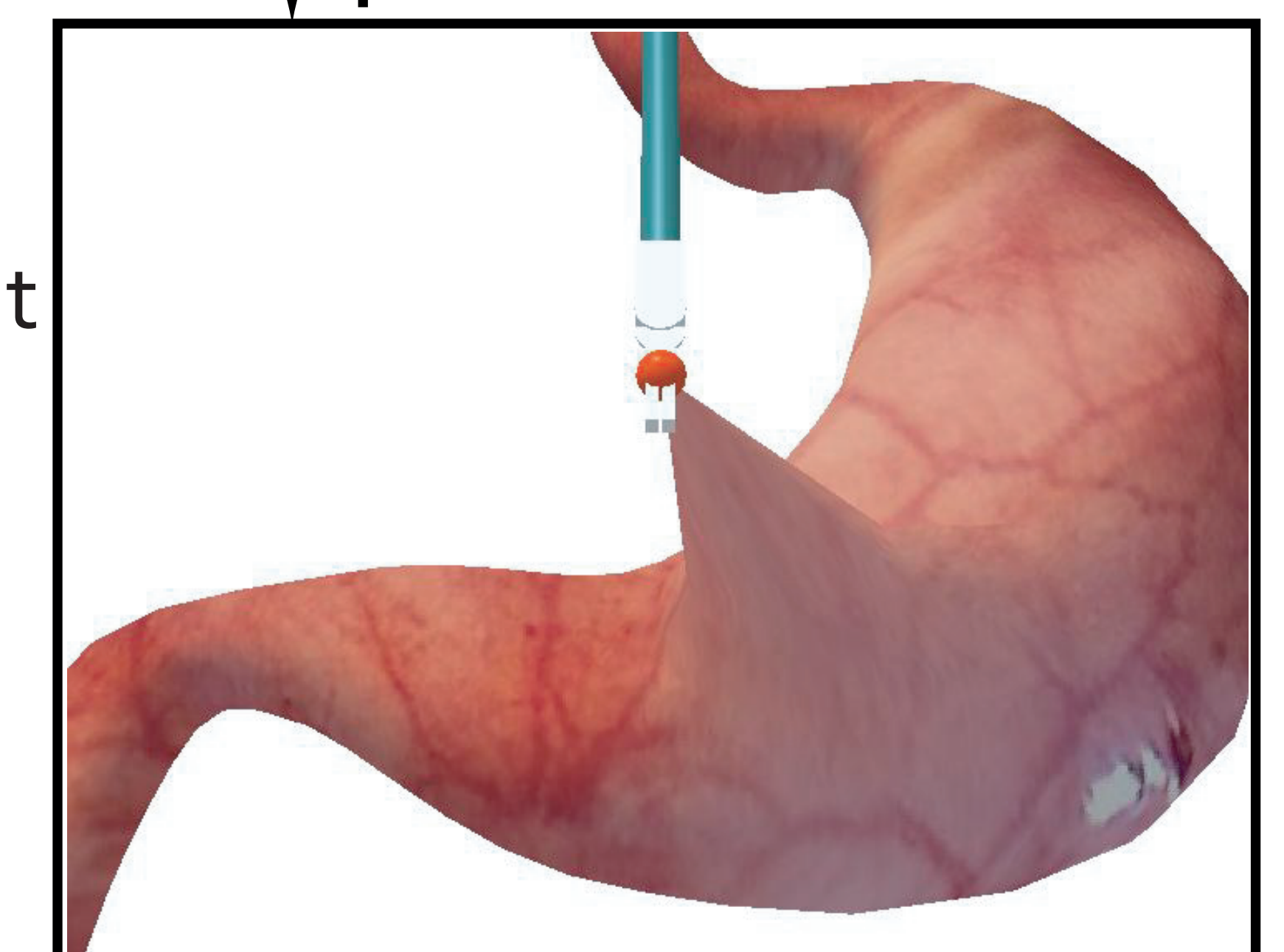
Figure 5: Master Interface



Match the virtual gripper position to the master position

Match the force output of the master to the force computed by the virtual environment

Figure 6: Virtual Environment



Virtual Environment Design

- Modeling Virtual Organ
 - ☐ ○ Stomach
 - Gallbladder
- Modeling Virtual Devices
 - ☐ ○ Gripper/Spreader
 - Scissors
- Collision Detection
 - ☐ ○ Axis aligned bound box (AABB) Tree
- Biomechanical Model
 - ☐ ○ Nonlinear Springs
 - ☐ ○ Viscous Damping
- 3D Graphical Rendering Using CHAI3D ☐

Design Testing