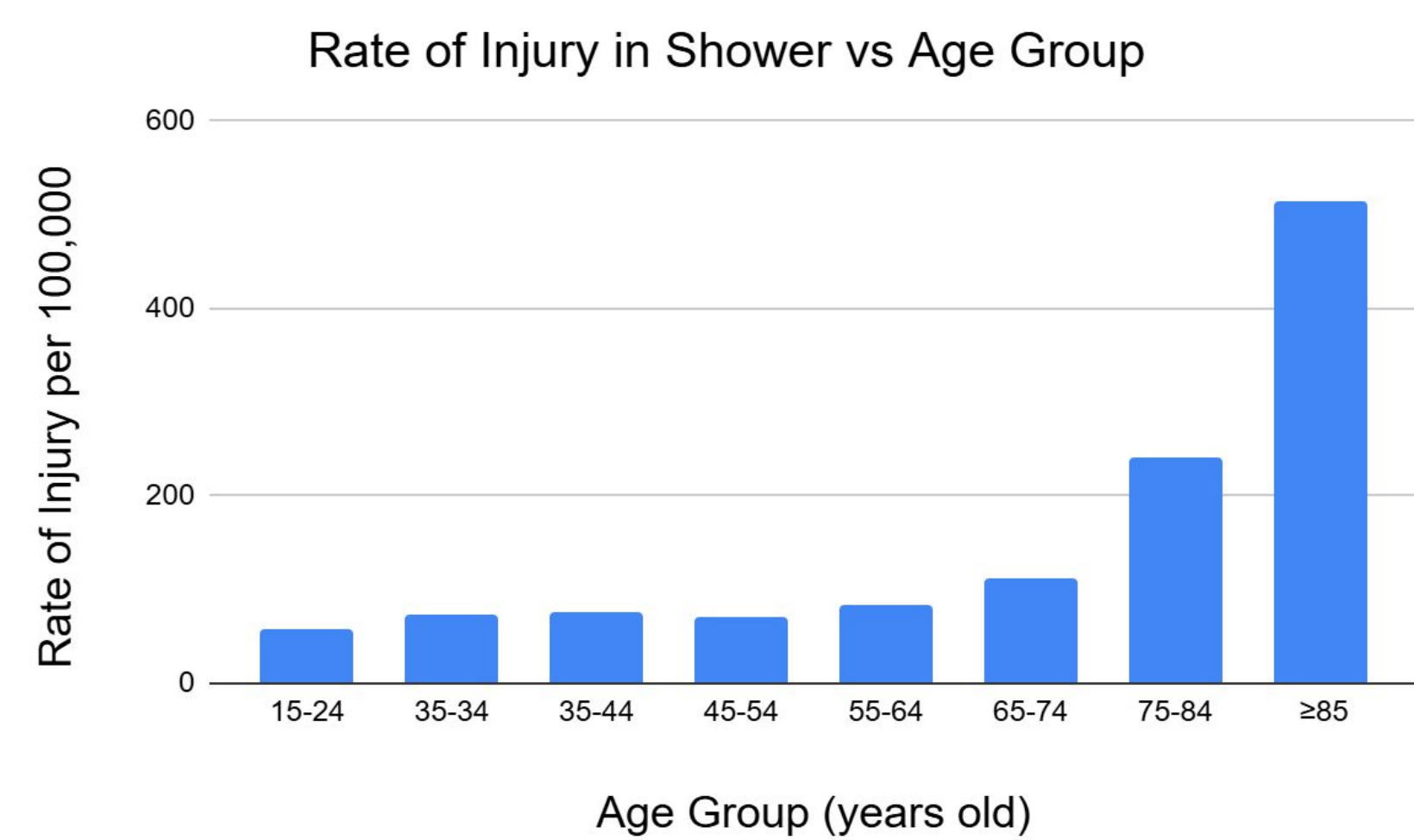


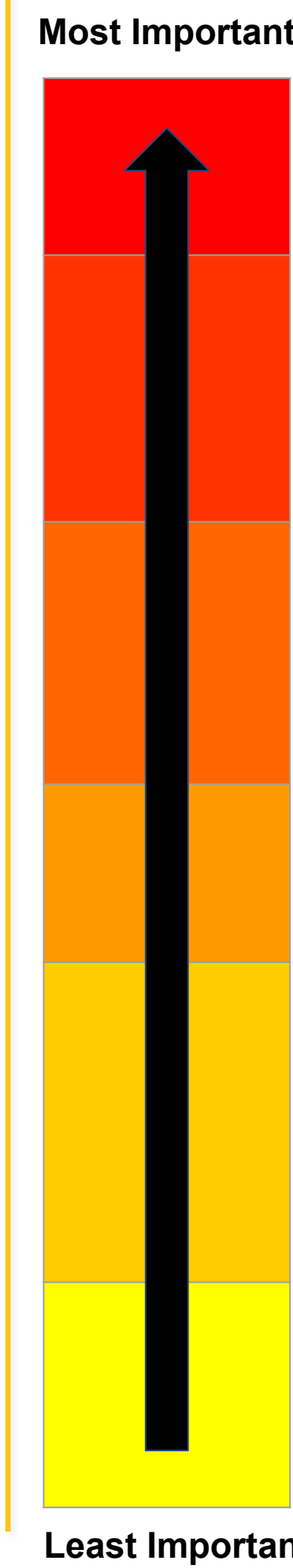
Motivation, Goal, Impact

- Motivation: Elderly struggle to clean themselves in the shower
- Goal: Design & prototype device to help with bathing independently
- Impact: The device will reduce fall risk and improve cleaning experience (ease and quality)



www.cdc.gov, 2011

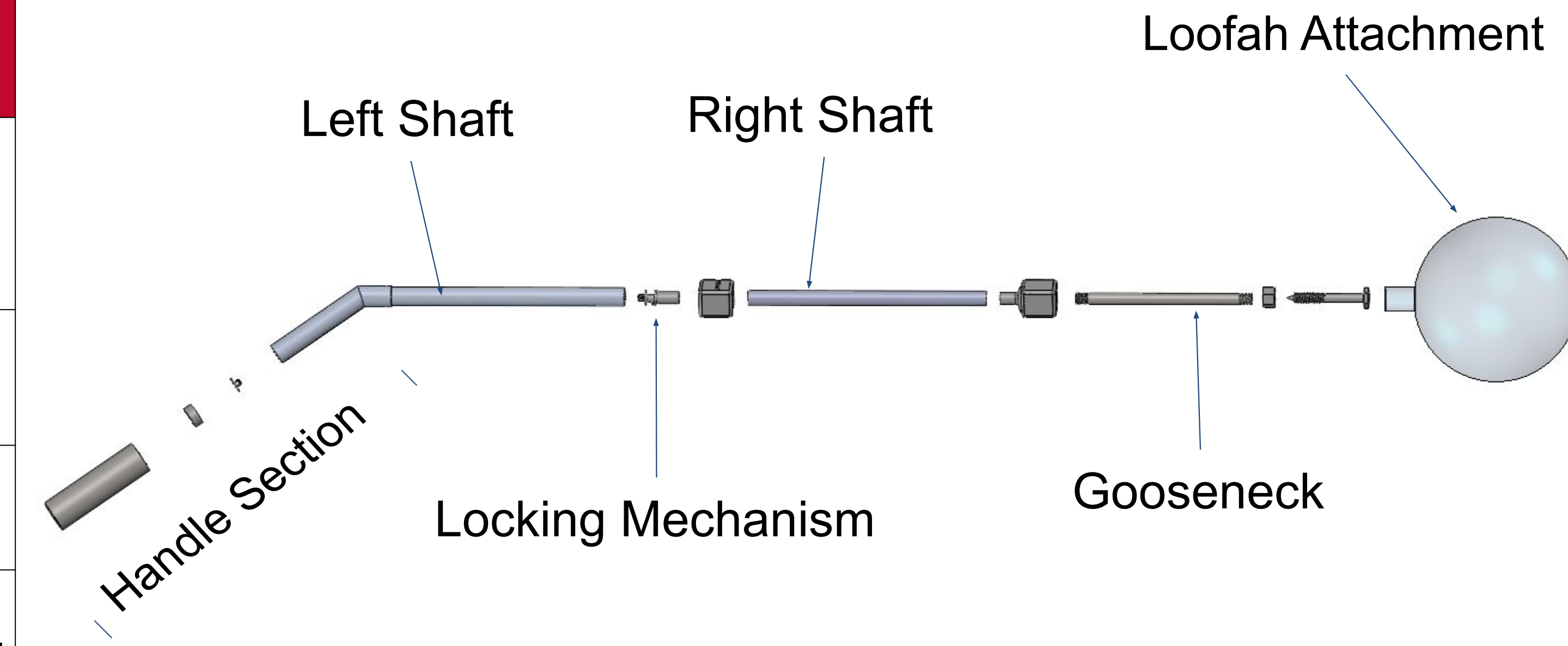
Requirements



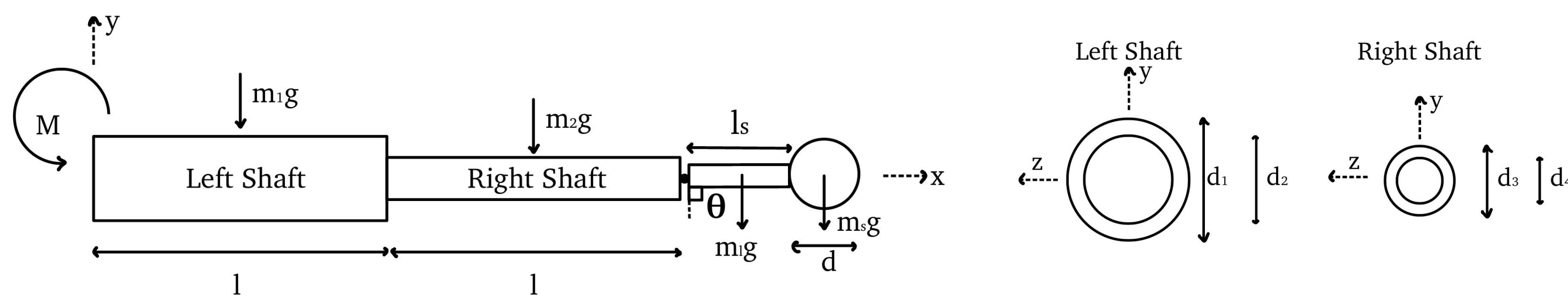
- Needs to operate safely
- Needs to assist the user with effectively cleaning themselves
- Needs to make the user feel comfortable while in use
- Should be easy to install, set up, and use
- Needs to comply with existing shower accessibility and safety standards
- Needs to be low cost

Pros	Cons
Simple/cheap to manufacture	No weight bearing stability
Broad Appeal	Mechanical Wear
Plug and play	Learning curve
Portable	Some physical strength required
Adjustability	Bulkiness

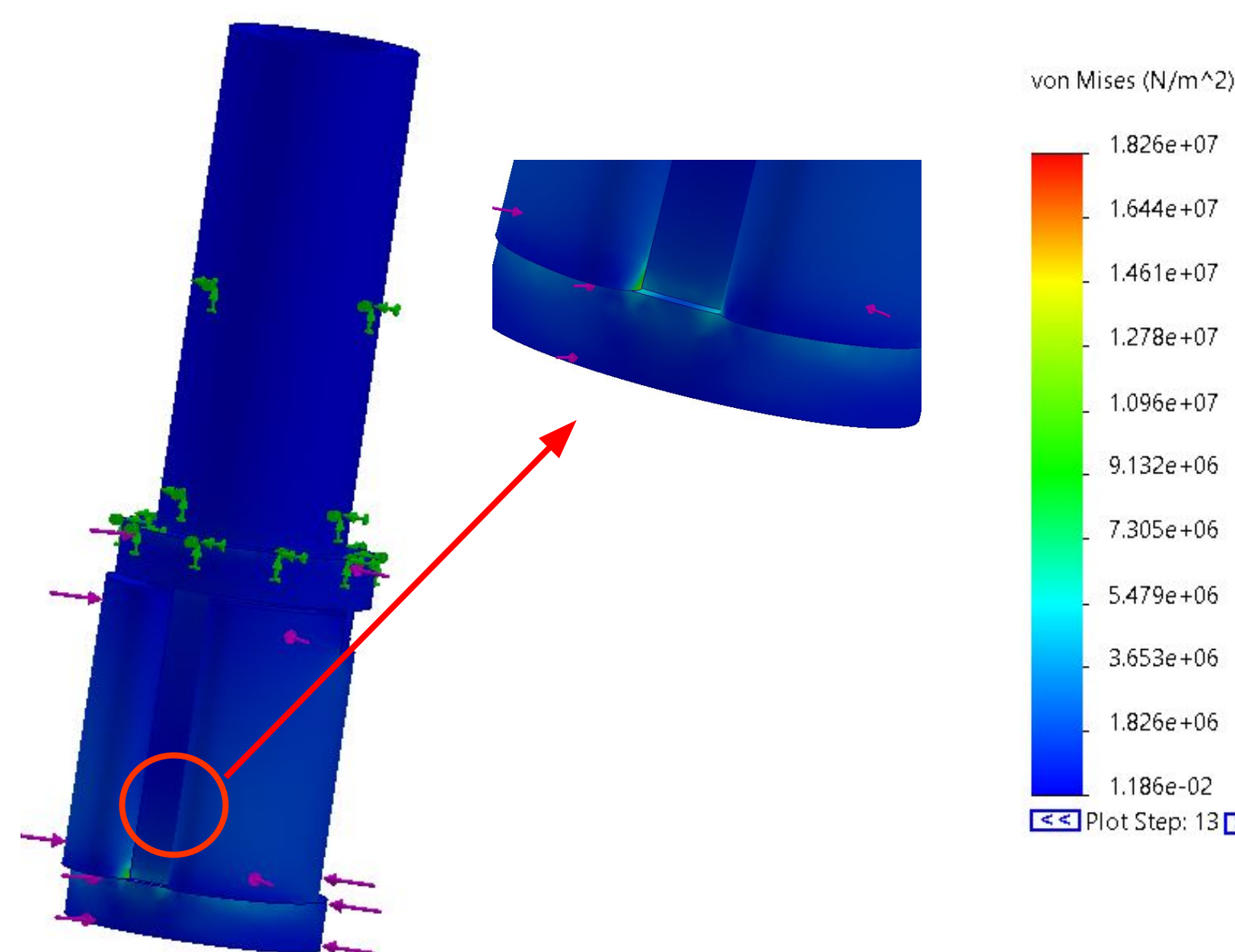
Final Design



Design Calculations & Decisions

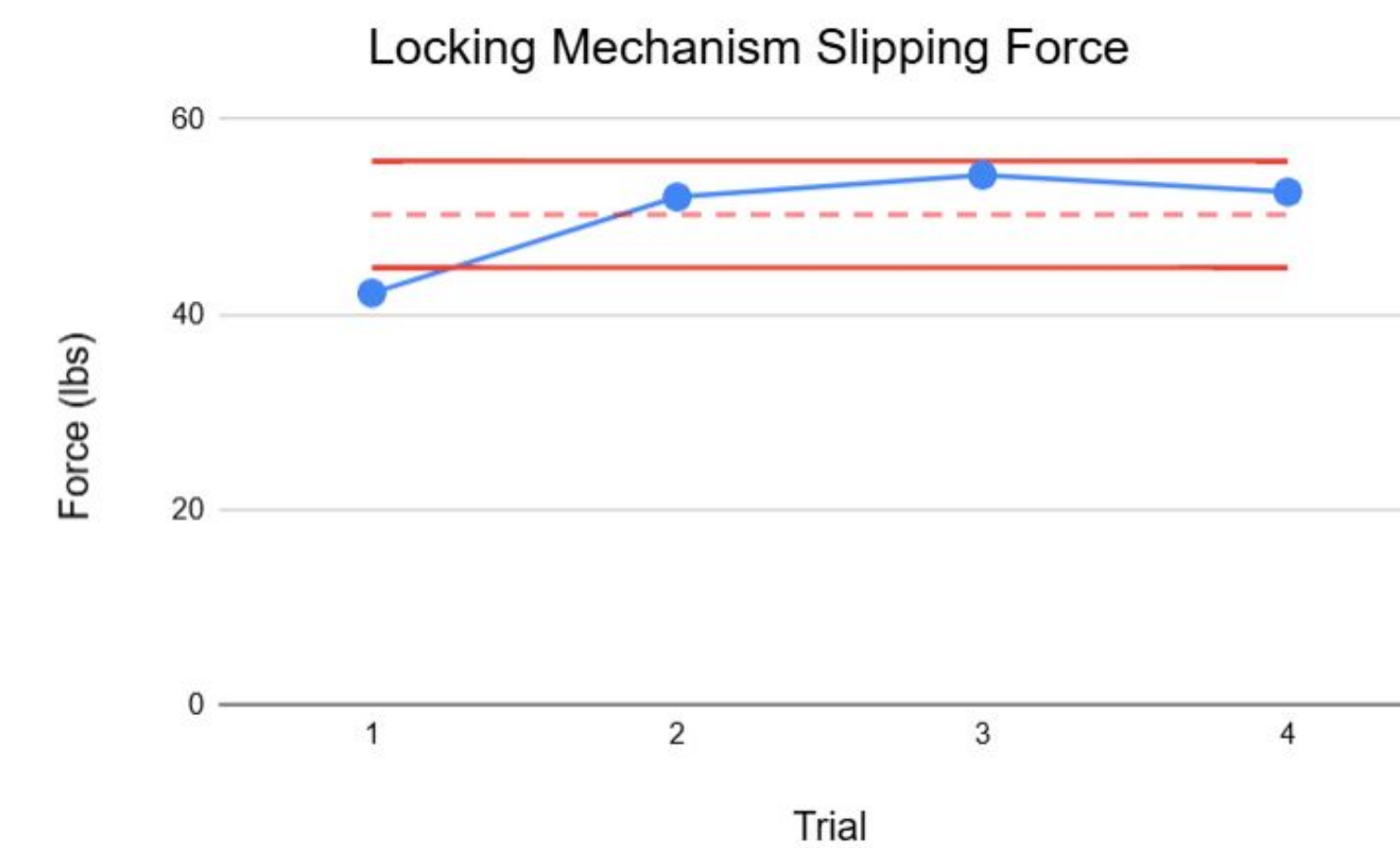


Free body diagram of scrubber, including the left shaft, right shaft, gooseneck, and loofah. First the diameters d_1 , d_2 , and d_3 were computed by using an optimization problem in which we minimized the weight. Then a Matlab script was used to optimize for maximum total length of the system based on the forces defined.

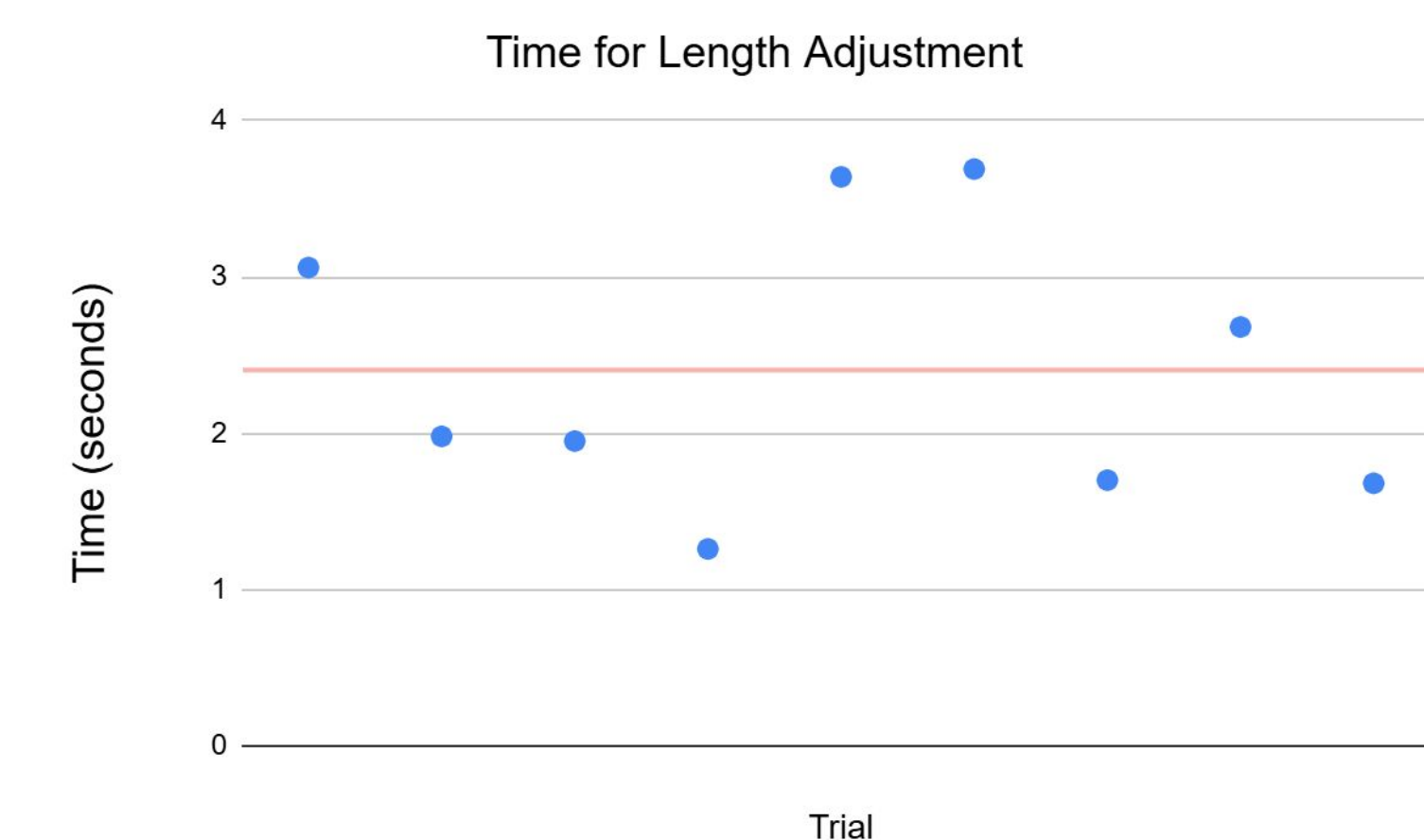


The Von Mises stress results with a force of 28.57 N applied to all surfaces that would be in contact with the pipe. Stress was found to be 18.26 MPa. The yield strength of 3D printed PLA can be conservatively estimated to be around 35 MPa.

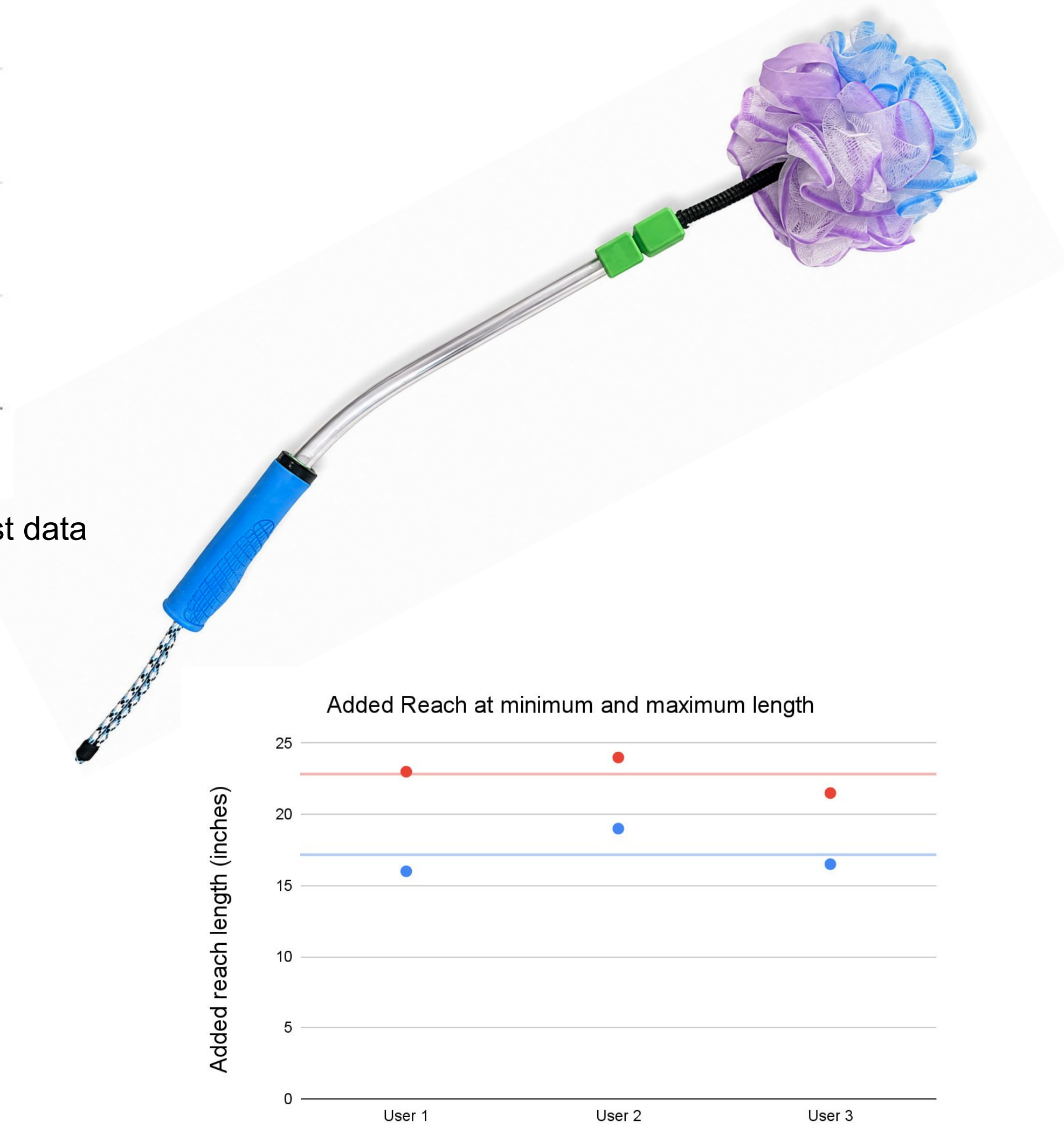
Prototype & Test Results



Red lines depict mean and +/- 1 sigma, blue line is test data mean slipping force approximately 50 lbs



Testing data for adjustment time, time to unlock, adjust, and relock. Average time to adjust 2.40 seconds



Added reach for user with wand. Average added reach at minimum length is 17.2 inches and 22.8 inches at max length