Corp 2: Garrett Thee Biomedical

Mid-Semester Report

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Problem Statement

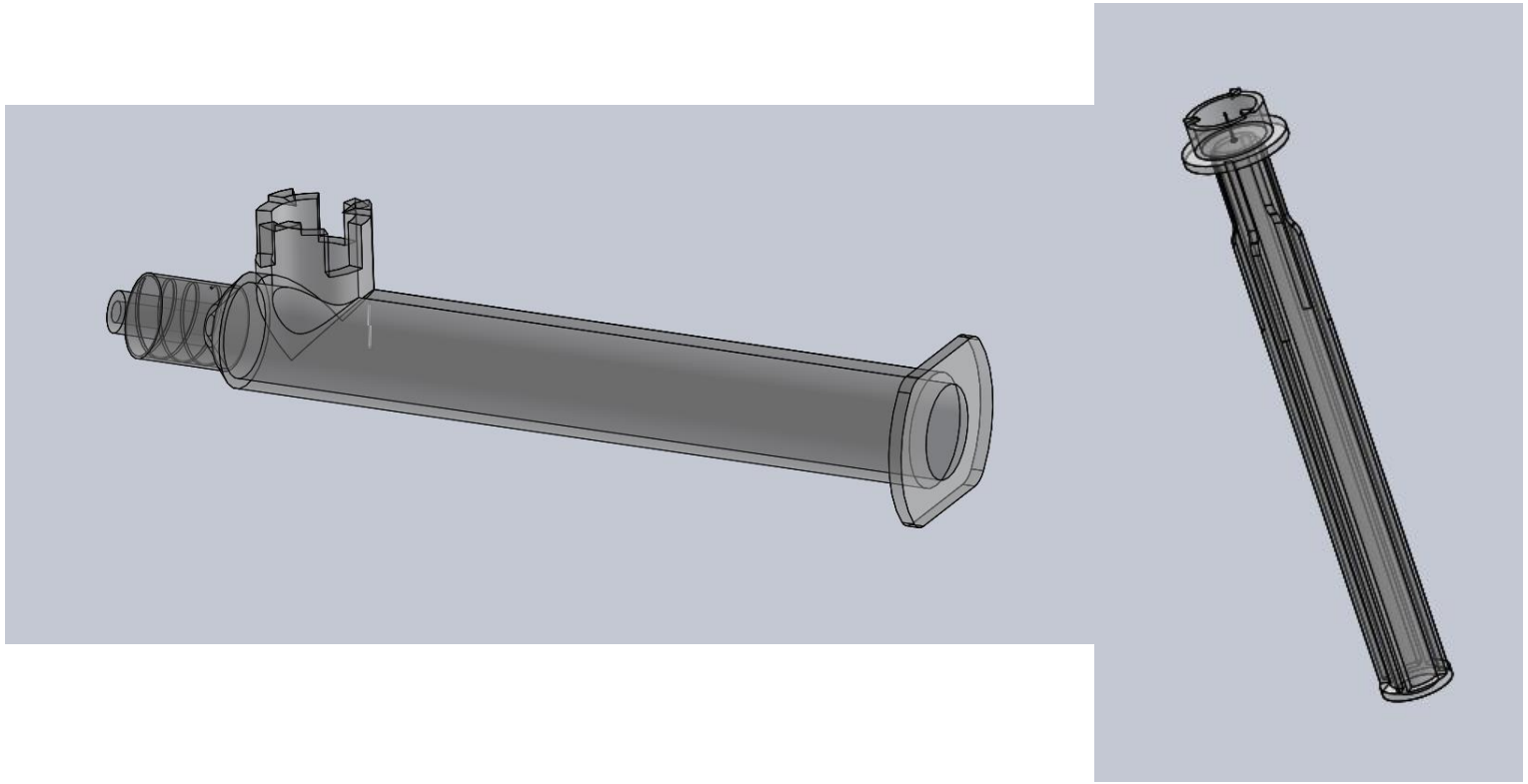
- The goal of this project is to develop a modification for existing Intra-muscular (IM) syringes that would ensure the operators compliance to Jhaco standards (#'s) while reducing the number of process steps it takes to prepare the medicine for injection. When using this apparatus, the medicine vial should be securely stowed to the injection system and 90% of the medicine delivered into the barrel of the syringe. The apparatus shall not impact fill time or injection time, and the overall functionality of the syringe shall not be impaired in any way.

Requirements

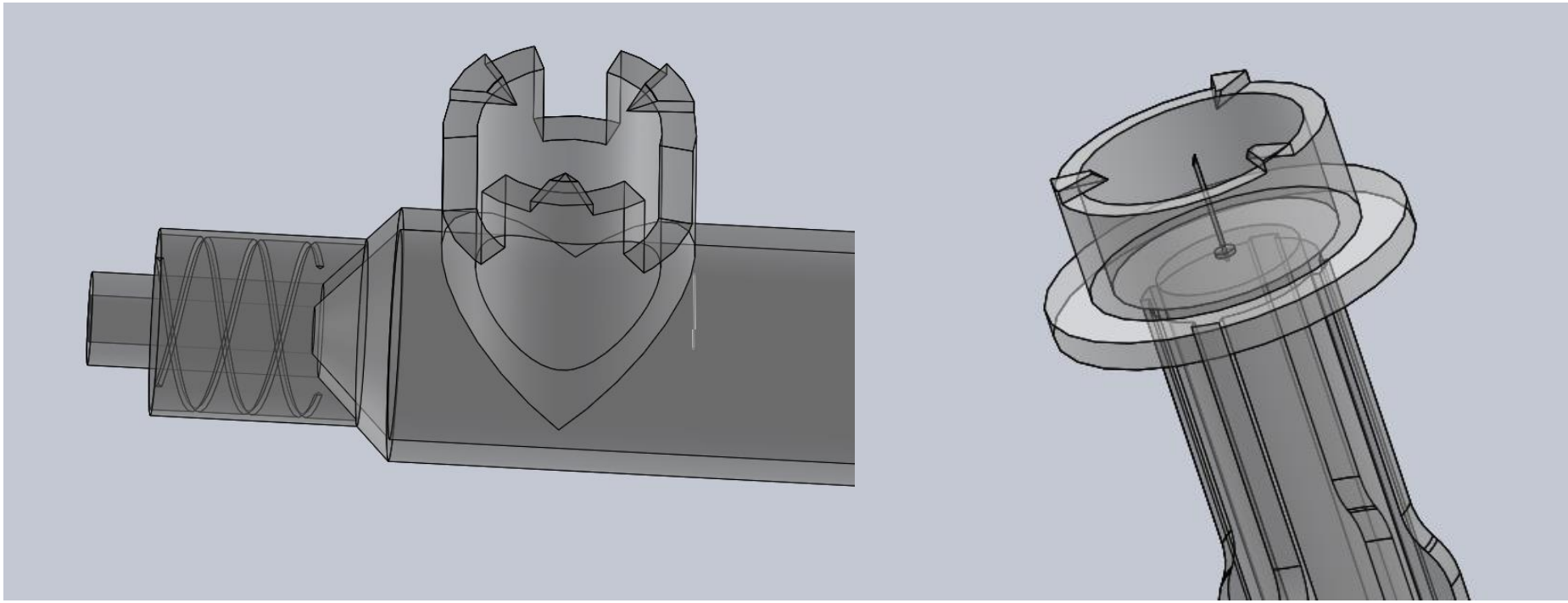
- The sterility of the syringe shall be maintained
- The device shall reduce the number of process steps required to prepare the syringe for injection
- The medicine vial shall be securely stowed
- More than 90% of the medicine shall be delivered to the barrel of the syringe
- The device shall allow the barrel to be filled at a speed similar to that of the existing system
- Back flow shall be prevented while injecting
- The device shall allow the injection to be given at a speed similar to that of the existing system
- The device shall not impact the functionality of the syringe

Architectural Design Development

- Primary Round of Concept Selection
  - Side Attachment vs. Rear Attachment



Concept Comparison

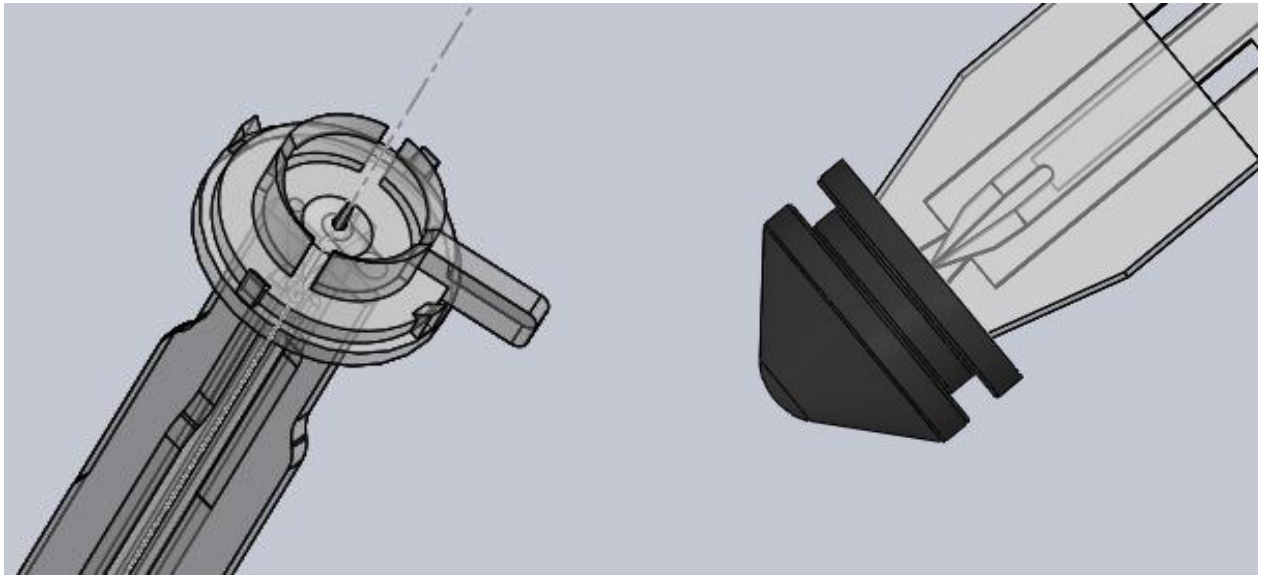


Architectural Design Development

- Rear Attachment Selected
  - Fewer ergonomic issues
  - Possible intellectual property conflicts with side attachment

Architectural Design Development

- Secondary Round of Concept Selection: Backflow Prevention
  - Check Valve, Rotating Valve, Pinch Valve, Plug Valve

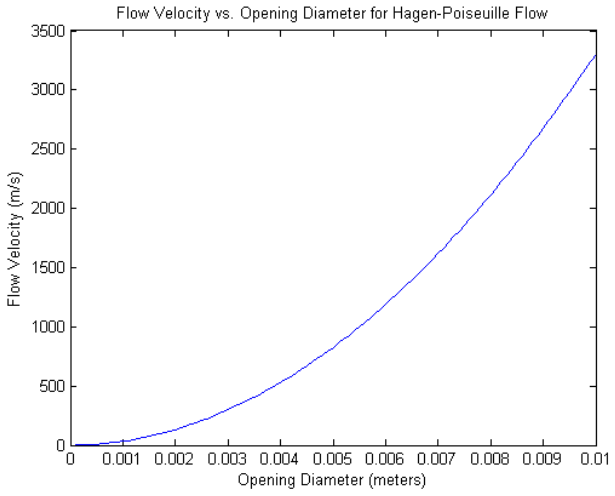


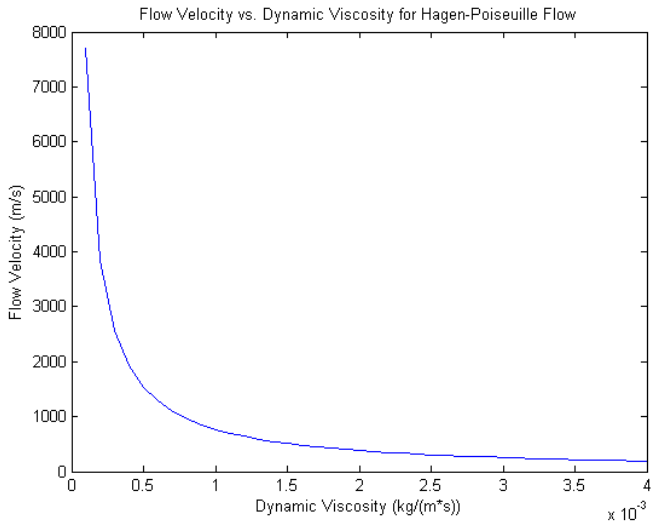
Check Valve

- Main challenge is finite pressure gradient
- Qualifies as Hagen-Poiseuille Flow

(delta)P = (128(mu)(L)(Q_dot))/(D^4)

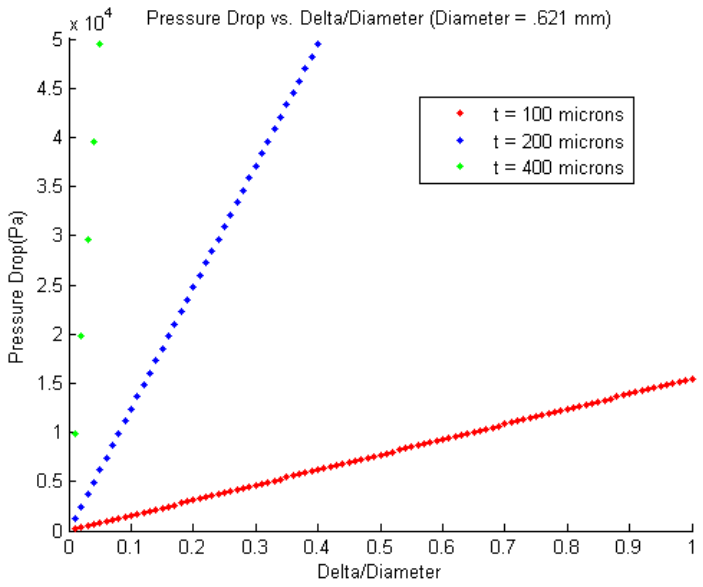
- Plotted Velocity vs. Diameter, Viscosity

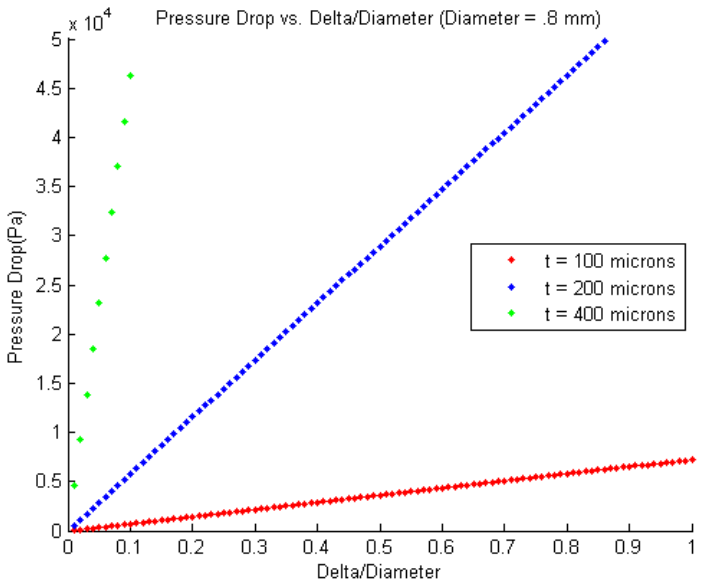




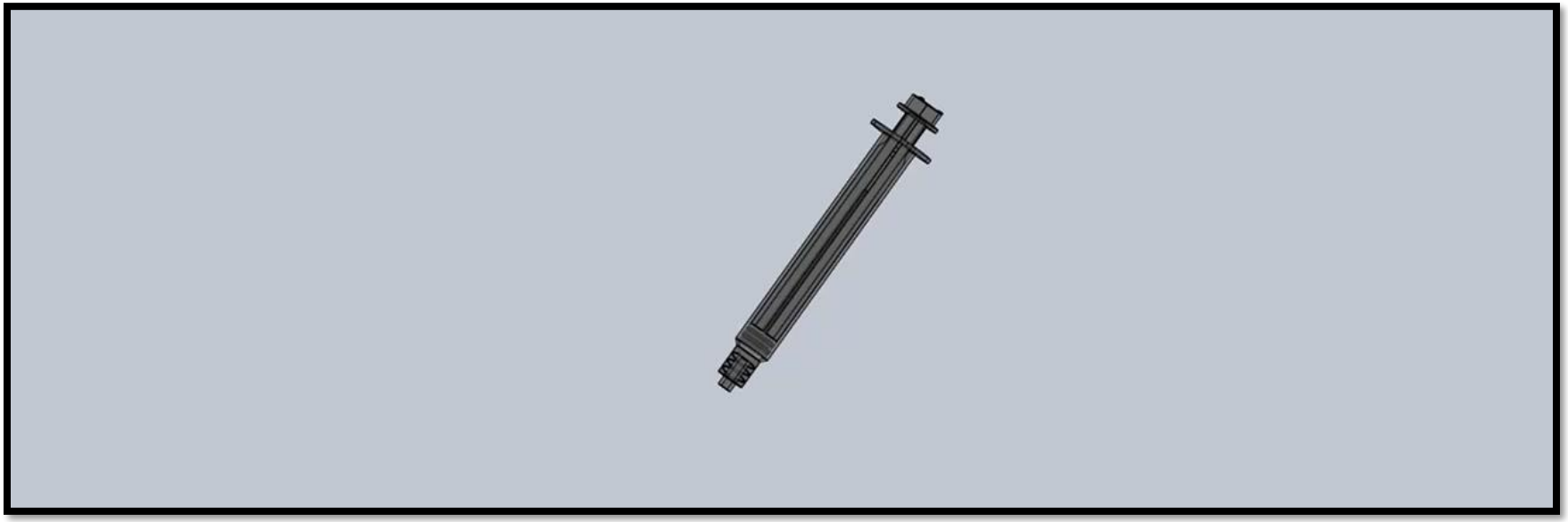
Check Valve (cont'd)

- Check valve requires pressure to activate
- Scale of design may be problematic
- Plotted Pressure Drop vs. Normalized Disp.





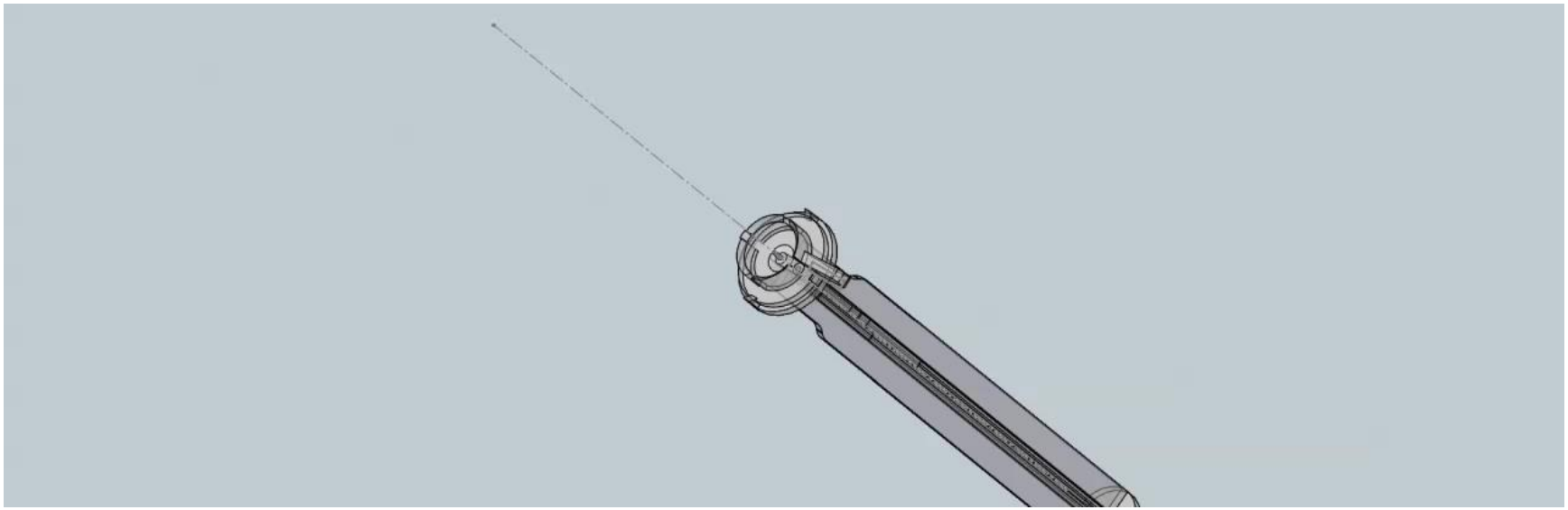
Check Valve Animation



Rotating Valve

- Requires user activation
- Activated by applying a moment to the valve
- Main Challenge is new component interfaces

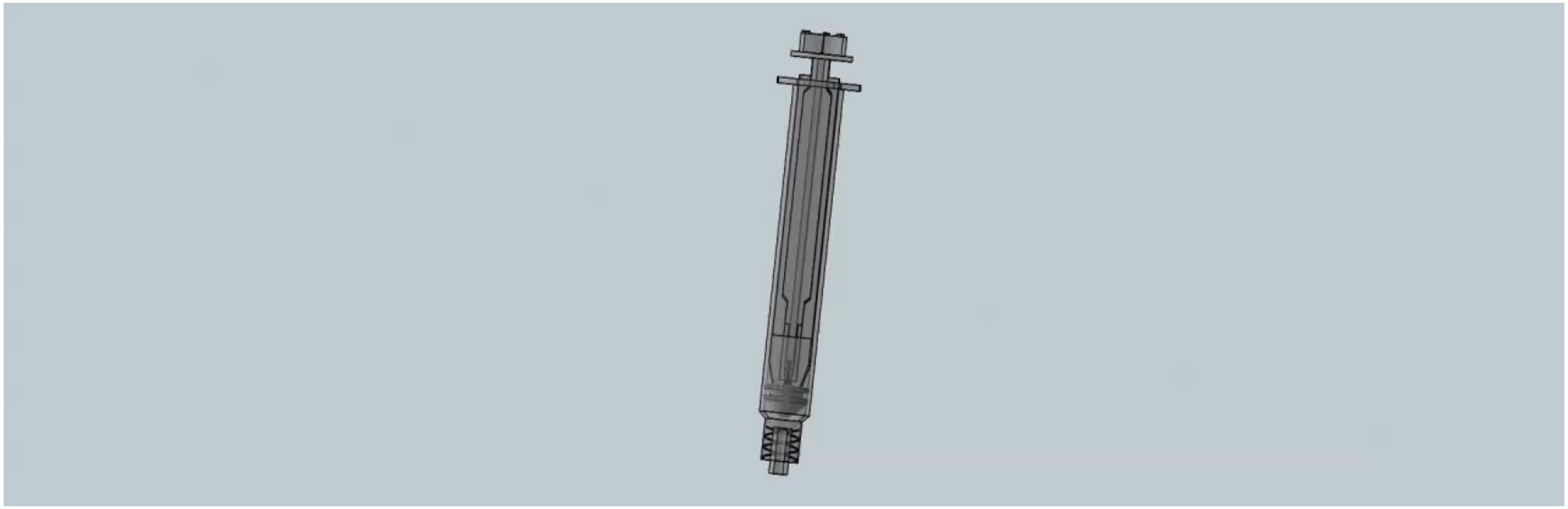
Rotating Valve Animation



Pinch Valve

- Direction of force applied to plunger opens and closes the fluid path
- Main challenge is controlling flow

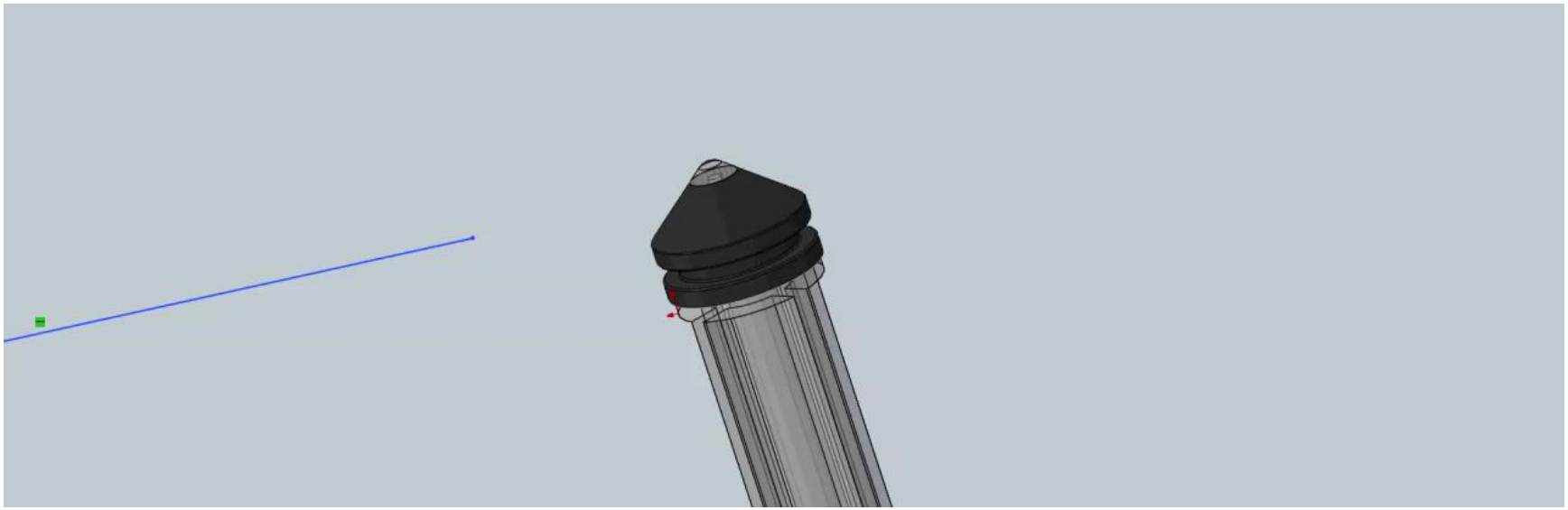
Pinch Valve Animation



Plug Valve

- Requires user activation
- Activated by applying a force parallel to the syringe
- Main Challenge is new component interfaces

Plug Valve Activation



Plug Valve Animation

Selecting a Concept

Concept	Confidence (3)	Process Steps (Few) (1)	Ergonomics (1)	Prototype-ability (2)	Number of Components (Few) (2)
Check	1	3	3	1	3
Rotating	3	1	3	2	2
Pinch	2	2	3	1	3
Plug	3	1	3	2	3

Concept Selection

Concept	Total Points	
Check	17	Out
Rotating	21	Consider
Pinch	19	Out
Plug	23	Consider