

Peristaltic Pump

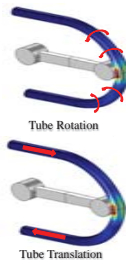
Fall 2015: Danielle Balzano (MECH), Saeed Hakim-Hashemi (MECH), Kori Heisler (MECH), Zachary Konopaske (MTLE), Andrew Welsh (MECH), Lauren Oesterle (MTLE/BME), Kailei Xu (MTLE)

PURPOSE:

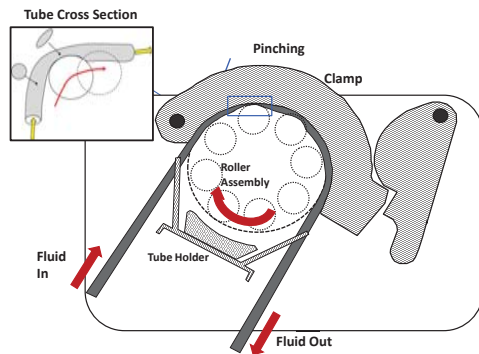
Create a mechanical design to support Perkin Elmer's conceptual plan for extending tube life of a Peristaltic Pump.

SEMESTER OBJECTIVES:

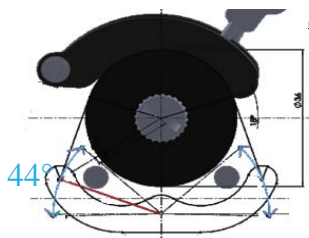
- Design and build a modified peristaltic pump with automated tube rotation during operation
- Determine a viable concept for tube translation using the newest peristaltic pump model



PERISTALTIC PUMP:



TUBE TRANSLATION CONCEPT:



See-Saw Design Features:

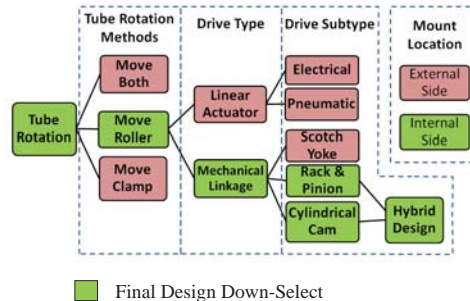
- Tube Travel Distance: 20mm
- Range of motion: 44° (0.77rad)
- Required torque of the new motor: 0.34Nm (single tube)

TUBE ROTATION TECHNICAL APPROACH:

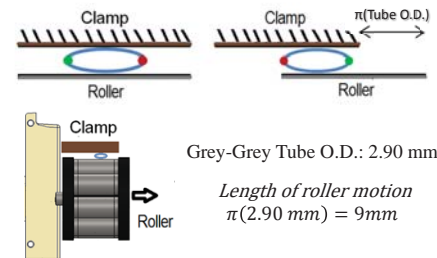
Engineering Requirements:

- Size Constraints:
 - X: 185 mm
 - Y: 156 mm
 - Z: 108 mm
- Tube rotation rate: No more than 180° tube rotation per hour
- Axial movement: Precision: Minimum step size 1mm +/- .5mm
- Prototype Lifetime: 6 months

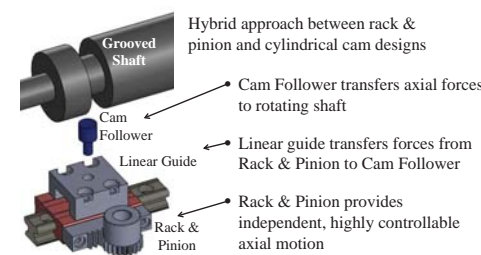
Tube Rotation Concept Designs:



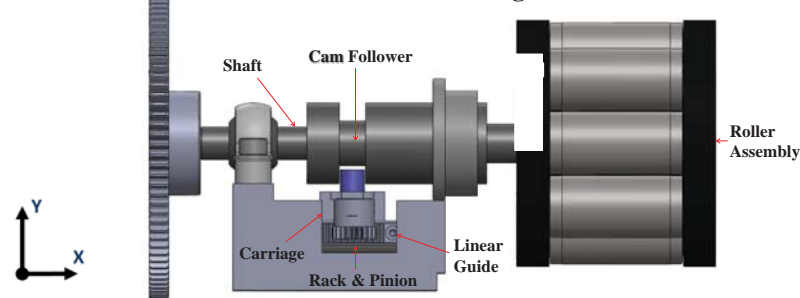
Tube Rotation Distance & Forces:



Tube Rotation Drive System Overview:



Periodic Rotation Design Side View



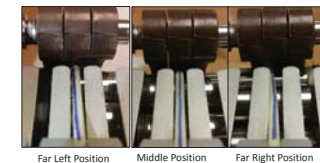
ACCOMPLISHMENTS TO DATE:

- Feasible tube translation concept design was created
- Tube rotation design overcame the challenges of integrating an independent drive system with a rotated shaft in a compact space
- Demonstrated a working prototype that achieved 120° tube rotation
- Adjustable prototype operation can evaluate test parameters for optimization

Design Features:

- Compact: Overall length increased by 2cm
- Front end components unchanged
- Adaptable Drive System: Can control distance, speed, position
- Retained existing shaft drive system for rotation
- Ease of Manufacturing and Assembly
 - 7 additional parts:
 - 4 off the shelf – High Tolerance
 - 3 manufactured – Low Tolerance
 - Linearly stacked assembly

RESULTS:



- Tube rotated 100° while pumping water
- Rate of axial movement affected rotation



- Conducted a test using blue ink
 - Top picture indicates the control test
 - Bottom picture indicates tube rotation test
- Ink smears around the circumference of the tube indicate tube rolling

FUTURE WORK:

- Conduct tube lifetime testing
- Study the affect of the clamp material and the tube holder configuration on tube rolling
- Create tube translation prototype
- Engage in a manufacturability study