Final Presentation:
Tremor Reduction Assessment in Microlaryngeal Surgery
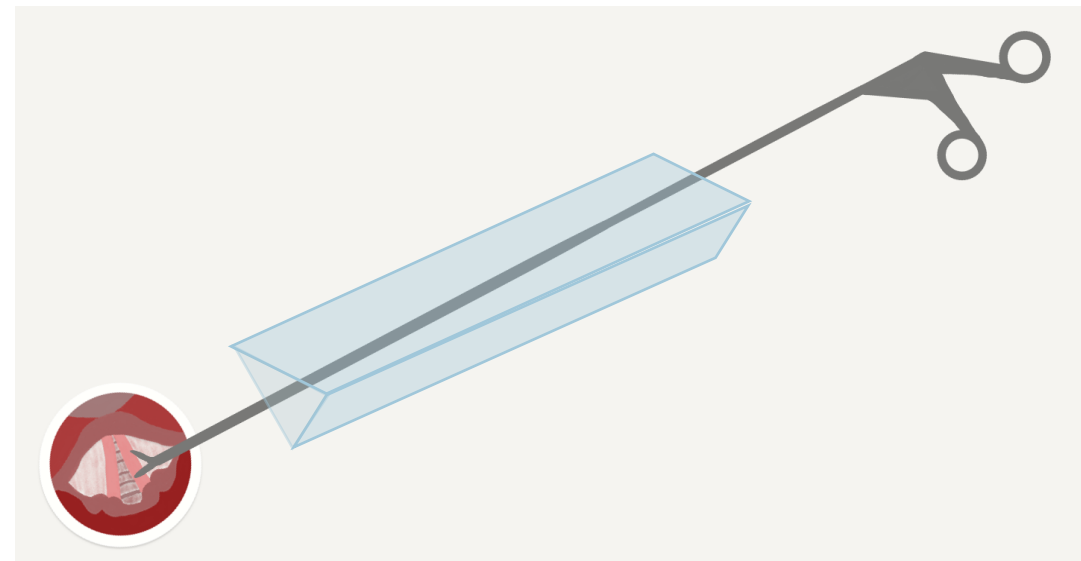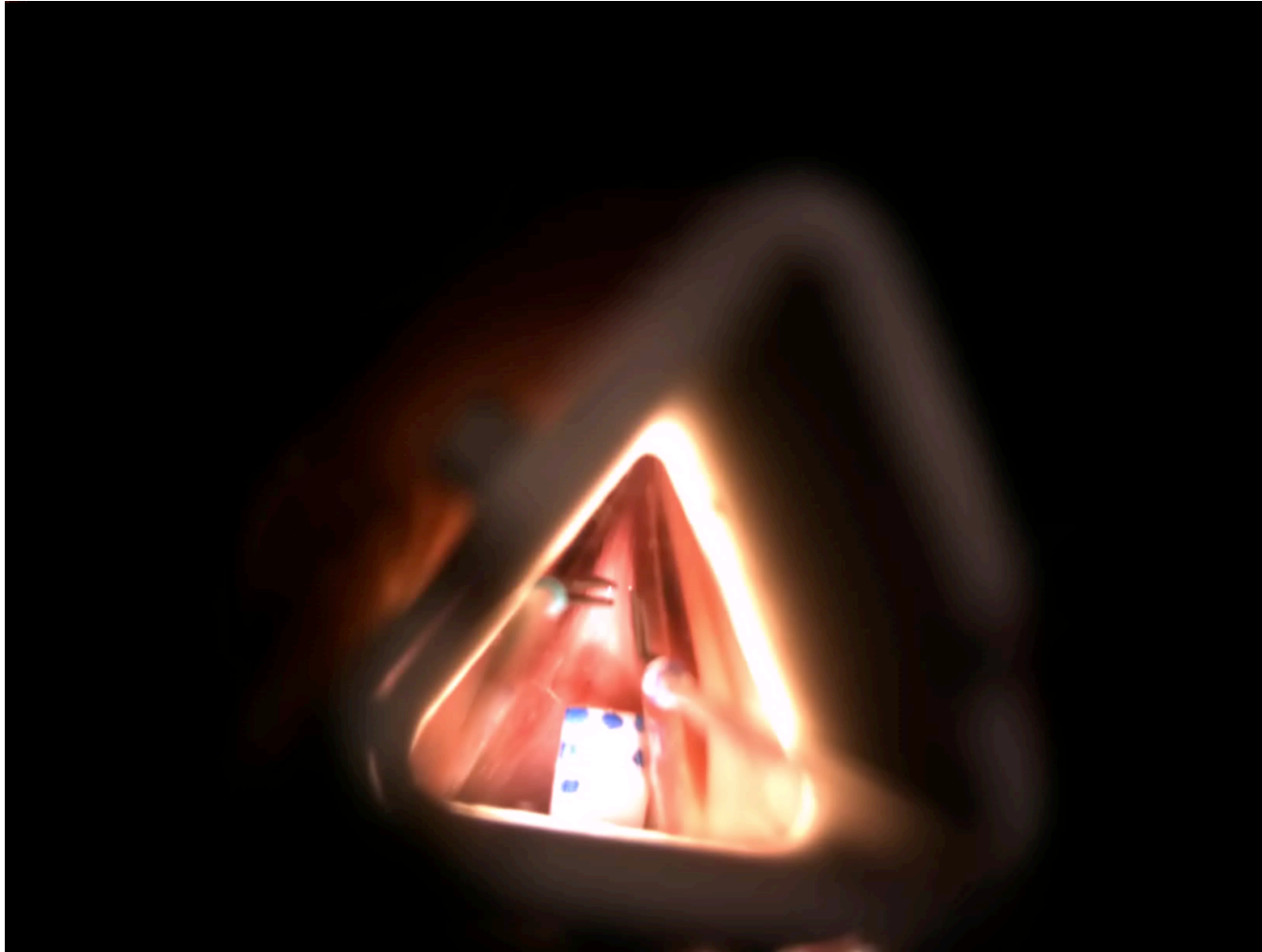
Team

Jasmine (Sue Min) Cho
scho72@jhu.edu

Mentors
Dr. Russell Taylor (rht@jhu.edu),
Balazs Vagvolgyi (balazs@jhu.edu),
Dr. Francis Creighton (francis.creighton@jhmi.edu),
Dr. Deepa Galayia (gdeepa1@jhmi.edu),
Dr. Ioan Lina (ilina1@jhmi.edu)

Background

Product rendering of Galen Mark 2 from Galen Robotics Inc.
Retrieved from https://www.artstation.com/artwork/W286BX

Project Goal

Goal: Perform user study to assess the degree of tremor reduction in robotic microlaryngeal surgical procedures on cadaveric phantoms

- **Aim 1:** Develop/adapt surgical tool tracking software using microscope video (with colored instruments)

- **Aim 2:** Conduct user study & reduce data

- **Aim 3:** Write paper with surgeons

Technical Approach

Experimental Apparatus

Surgical Tool Tracking Software
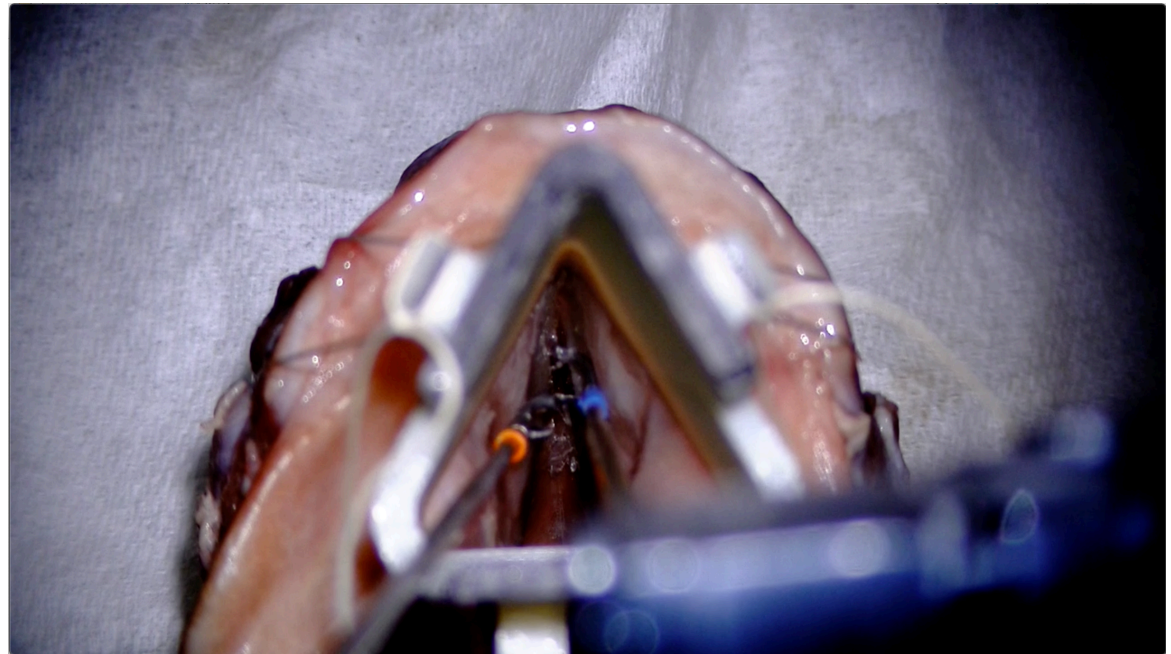
Data Analysis

Technical Approach (cont.)

Experimental Apparatus

- Paint instruments with easily distinguishable colored nail polish
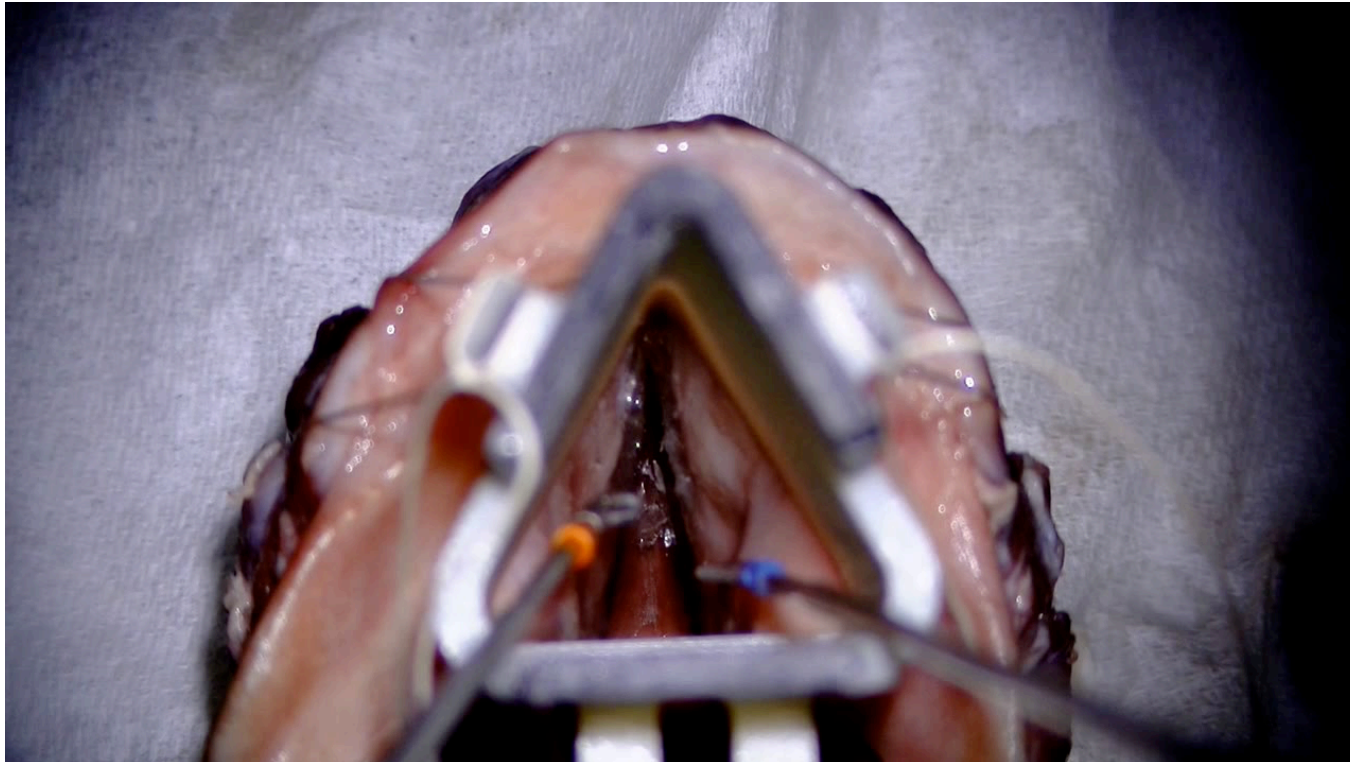

Image from:
https://www.amazon.com/gp/product/B07NLL1G6W/ref=ppx_yo_dt_b_asin_title_o00_s00?ie=UTF8&psc=1

Technical Approach (cont.)

Surgical Tool Tracking Software
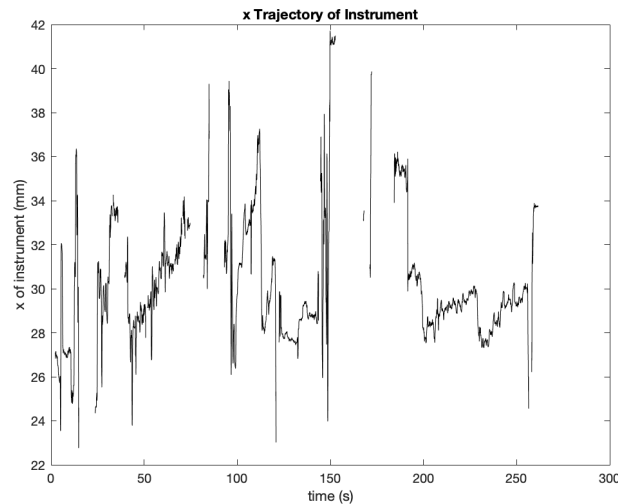
- Use OpenCV CSRT Tracker

Technical Approach (cont.)

Data Analysis
- Perform economy of motion analysis
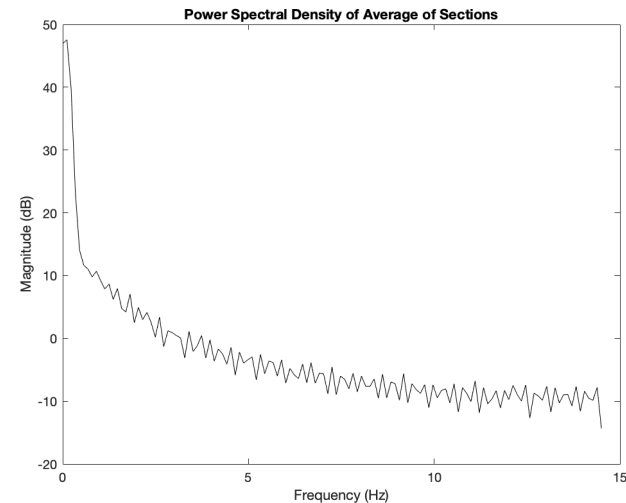- Perform frequency analysis

Tracking data

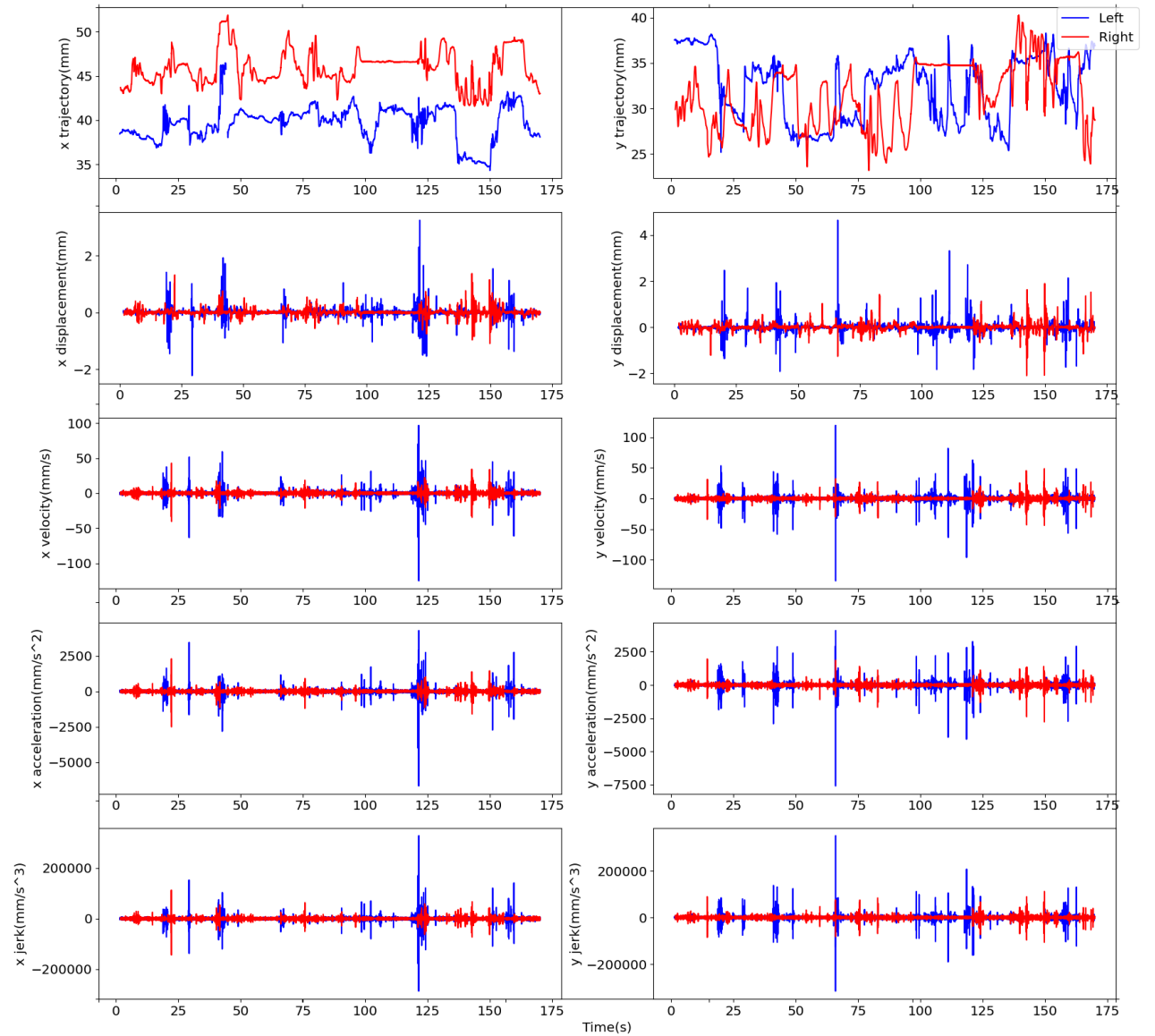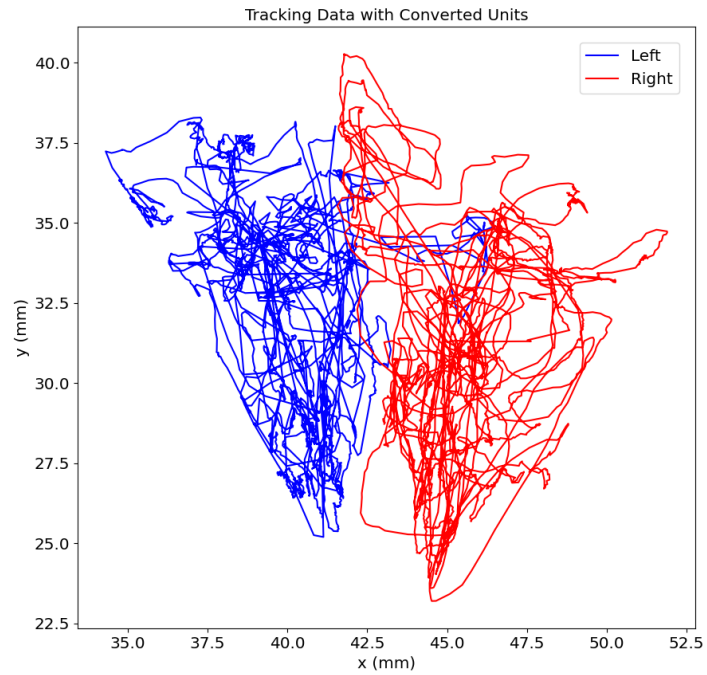**Economy of Motion Analysis**

Distance, velocity, acceleration, jerk
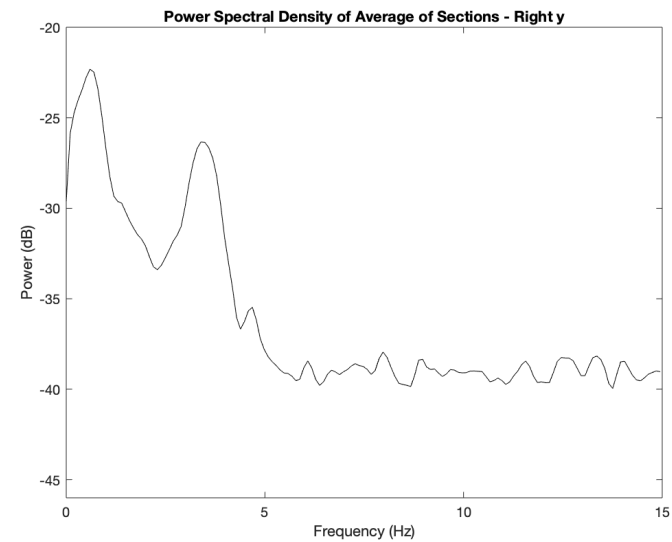
Frequency Analysis

# Results – Economy of Motion Analysis

Results – Economy of Motion Analysis

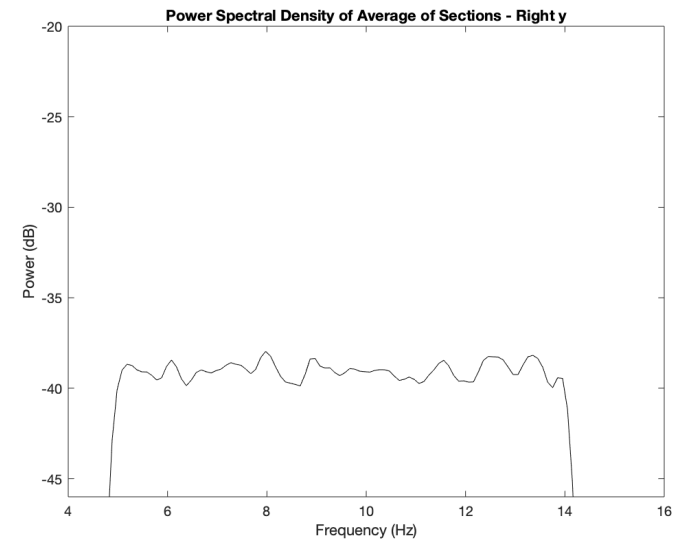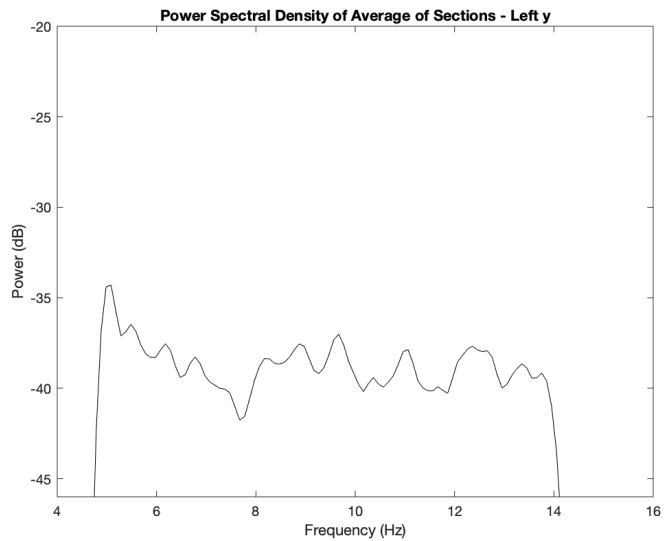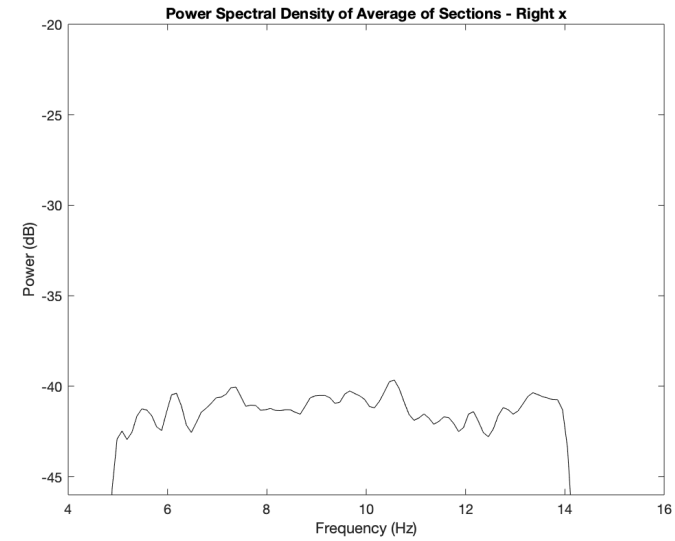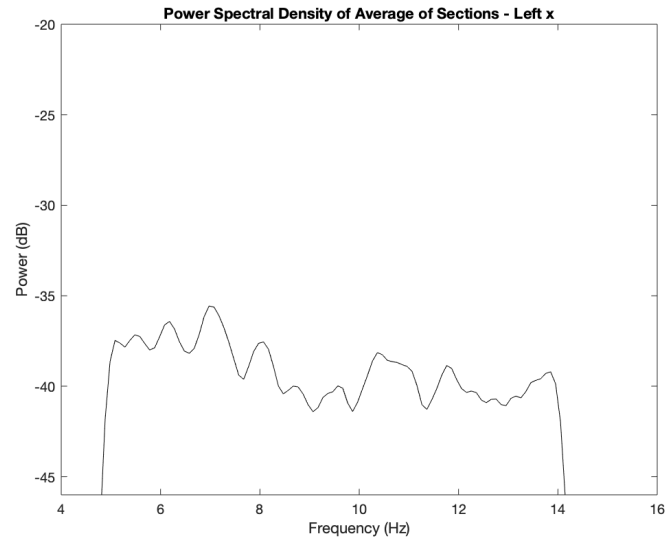|	Normalized x displacement (mm/s)	Normalized x distance (mm/s)	Normalized y displacement (mm/s)	Normalized y distance (mm/s)
Freehand (Mean ± SD)	0.2255 ± 0.18	2.8316 ± 0.35	-0.0845 ± 0.20	3.1033 ± 0.50
Robot (Mean ± SD)	-0.0037 ± 0.05	**1.8042 ± 0.80**	0.0651 ± 0.07	**2.1302 ± 0.73**

*Data from right-side instruments only

Results – Frequency Analysis
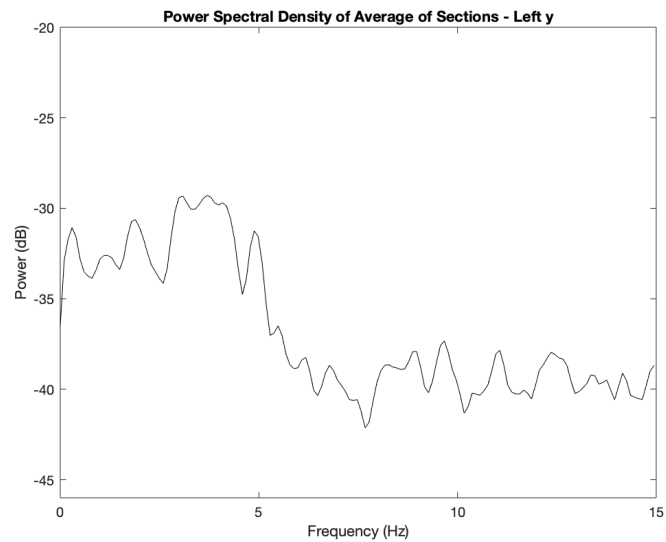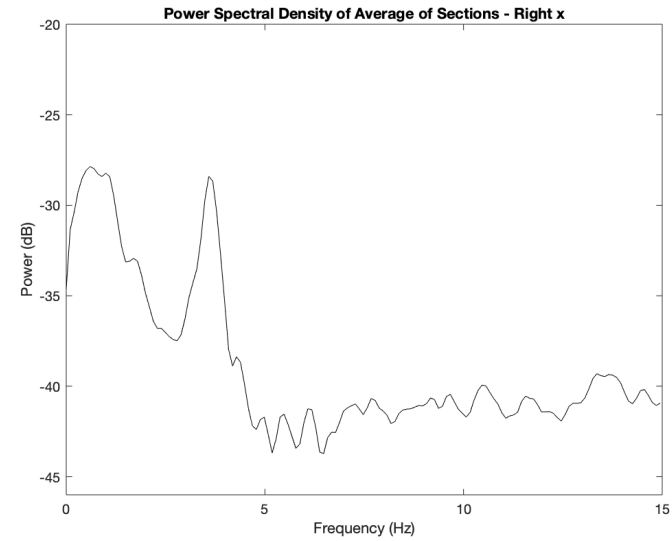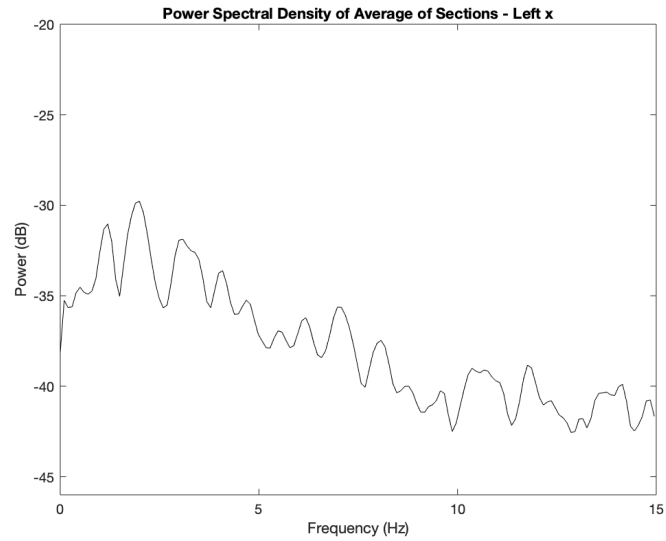
Left – Freehand
Right - Robot

Results – Frequency Analysis

Left – Freehand
Right - Robot

Discussion

- Significance
  - Adapted surgical tool tracking software to facilitate acquisition of instrument tracking data
  - Provided meaningful data for analysis
  - Shared quantitative assessment results of tremor reduction in robotic microsurgical procedures
  - Provided assessment for usefulness for tremor-eliminating robots (e.g. Galen)

- Future work
  - Analysis between freehand+robot and freehand+freehand videos based on task category
  - Validation for surgical tool tracking software
  - More extensive user study
  - Use stereo vision

Management Summary

- Who did what
- Participated in weekly meetings and consulted with mentors as needed
- What was accomplished versus planned

Deliverables		Date	Status
Minimum	Experimental apparatus	03/15/2020	Met
	Documented code for surgical tool tracking software	03/25/2020	Met
Expected	Experimental data	04/07/2020	Met
	Documented code for tremor reduction assessment	04/07/2020	Delayed → Met
	Report	04/30/2020	Delayed
Maximum	Academic paper	05/13/2020	On schedule

- Lessons learned

Thank you