

## Cornell DEBUT Statement of Intent for Motion Capture Studio

### Relevant Members

Andrew D’Onofrio (ajd323) - Project Manager (Mechanical Engineer ‘26)

Ally Schwartz (als493) - R&D Analyst (Biomedical Engineer ‘26)

Nathan Briard (nb659) - R&D Analyst (Biomedical Engineer ‘28)

**Project Goal:** Acquire motion capture data of low-velocity baseball pitches in conjunction with sEMG / IMU data to verify reliability and accuracy of experimental methods for estimating valgus-elbow torque.

**Relevant Background:** Cornell DEBUT is a biomedical product development group affiliated with Cornell Project Teams under the guidance of Dr. James Antaki (BME). Our group includes multiple early-stage biotechnology projects tackling relevant gaps in healthcare, ranging from hospital equipment, diagnostics, point-of-care, or consumer-based therapeutics. Teams consist of a Project Manager, R&D Analysts, and Business Analysts that evaluate market viability, conduct customer discovery, test prototype feasibility, and follow early stage MedTech product-development (non-regulated / before ISO-13485).

Our specific group (as a part of Cornell DEBUT) is currently developing an accessible and non-invasive method for measuring valgus-elbow torque for high-performance athletes in post-operative recovery. Our device leverages advancements in surface electromyography (sEMG) in accurately contextualizing muscle firing rate with well-known physiological models such as Hills-Musculoskeletal to non-invasively interpret elbow torque in a compact, easy-to-wear, and accessible elbow brace.

**Experiment Description:** Current gold-standard methods involve utilizing Inverse Kinematics in OpenSim to convert motion capture data into estimates of valgus-elbow torque. Our group aims to collect motion capture data (ideally) in conjunction with sEMG/IMU data to create a 1-to-1 comparison method for verification of processing software. Only ONE database (i.e. ONE experiment) is required for our team to reference in the upcoming months to pass early verification. The following is an overview of the experimental process involved with creating a database:

1. Enter the Motion Capture laboratory with the materials outlined in “Cornell DEBUT Materials”
  - One designated pitcher, one designated catcher, one designated data collector
2. Administer the experimental device on the throwing arm of the pitcher, and additionally connect the IR Sensors to the Shoulder (1), Upper Arm (2), Elbow (3), Wrist (4), and Hand (5)
3. Clear around 20’ of linear space for the pitcher to throw with the catcher
4. Data Collector sets up motion capture, and instructs the pitcher on certain pitches (<20 MPH)
5. After data collection, motion capture is disassembled and cleaned

*Estimated Time:* 90-120 minutes

### Cornell DEBUT Materials

1. Experimental Elbow Torque Tracker Device OR Pulse Deline (competitor, timeline dependent)
2. 5 Infrared Motion Capture Trackers
3. External Radar Gun
4. General Pitching/ Catching Equipment (Foam Balls and Baseball Gloves)