



# Deckers BBStride: Biaxial Bending Machine

Nethra Ashok | Lucky Babcock-Chi | Sean Campbell | Mallory McFall | Joshua Neese

## Background

Deckers Brands makes high performance and casual footwear. The Innovation Team at Deckers sought to create a new system capable of evaluating the bending stiffness of their products in order to improve running performance through shoe design. Existing tests can measure longitudinal stiffness but cannot replicate realistic foot motion in multiple bend directions. The goal of the BB Stride device is to measure the bending stiffness of their shoes in two directions using one device.

## Overview / Design Specs

The BB Stride is an electromechanical test rig that measures the bending stiffness of running shoes in both longitudinal and lateral bending directions. Using actuators, load cells, and displacement sensors, the system performs repeatable bending tests while collecting force and displacement data. Key features include:

- Multi-directional bending
- Automated repeatability testing
- Real time force and displacement measurement
- Adjustable bending range from 0° - 50°

## Electronics Flowchart

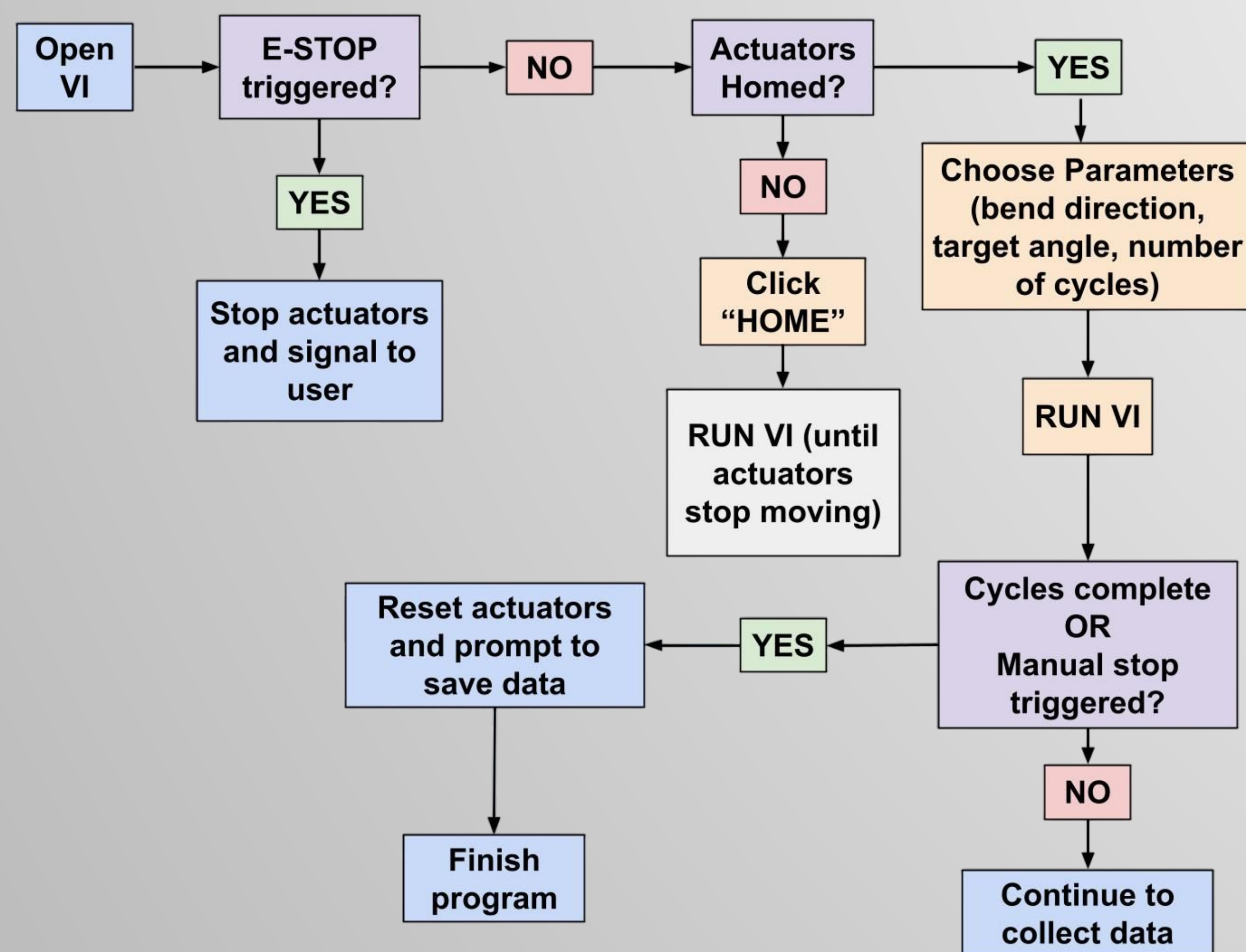


Figure 1: Electronics Baseline Flowchart

## BBStride Final Design

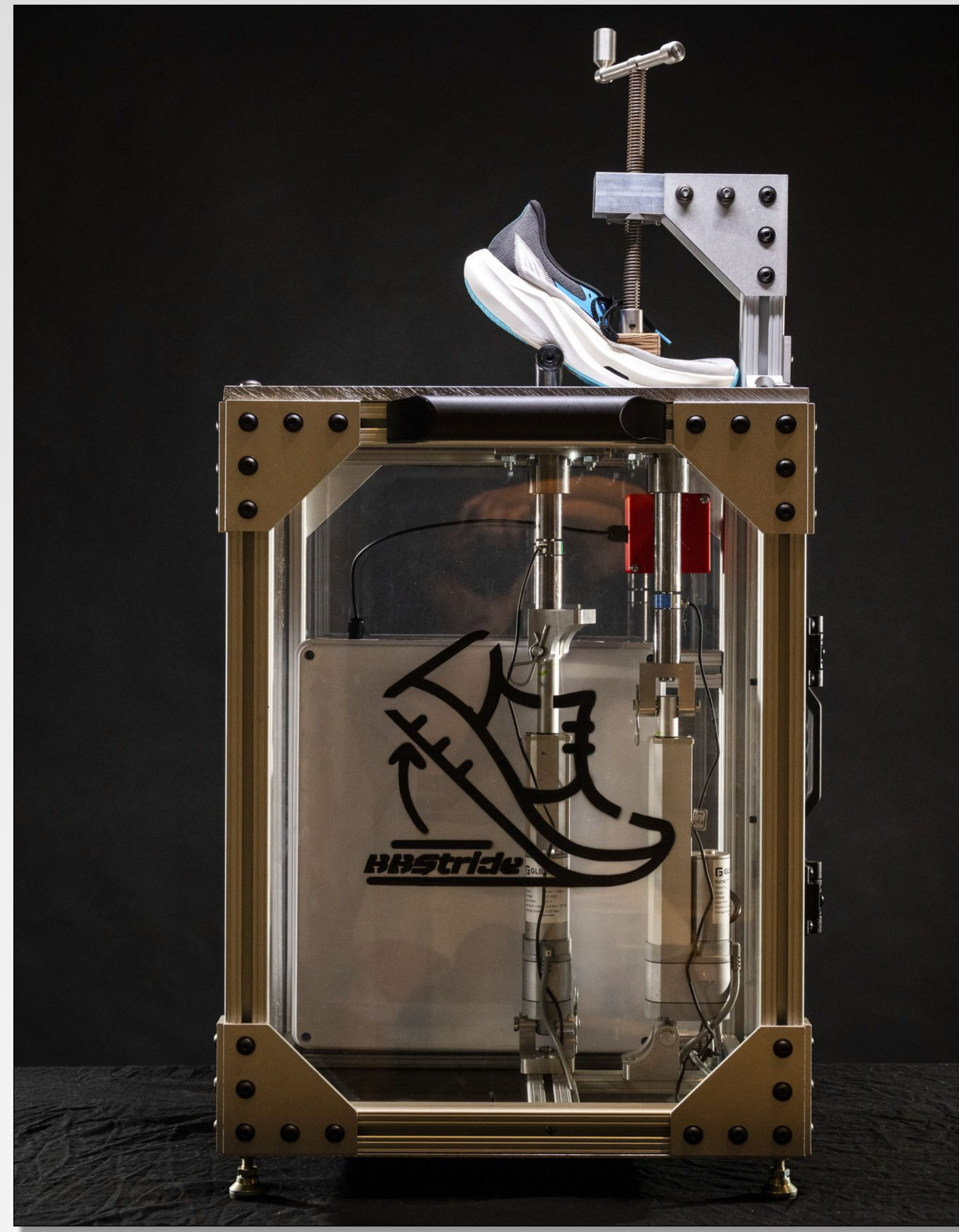


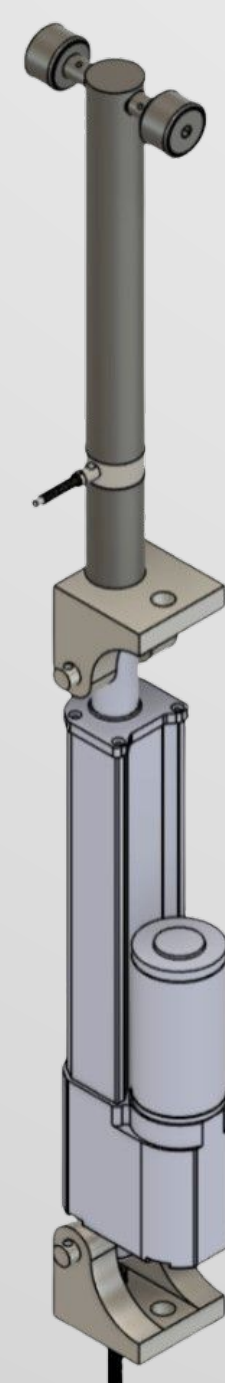
Figure 2: Longitudinal Bend Test

## Hardware / Key Components



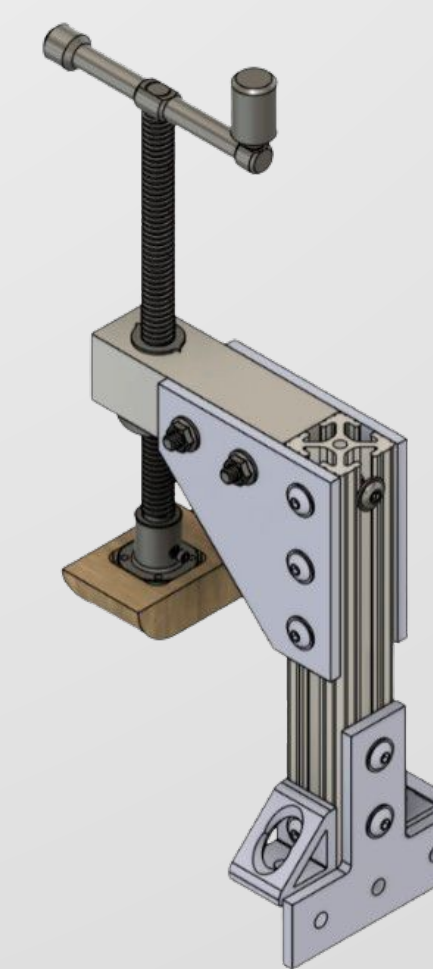
### DAQ (NI-USB 6009)

The DAQ is the electronic component responsible for communication with BBStride, allowing signal transmission to move the actuators, while receiving both load and displacement data



### Clamp System

A screw clamp secures the shoe to the top plate from above. The wood block distributes the force and emulates the ball of a foot.



### Actuation System

The actuator is connected to a load cell to collect force measurements while the actuator is able to track displacement. Track rollers make contact with the shoe to minimize friction.

## Operational Procedure

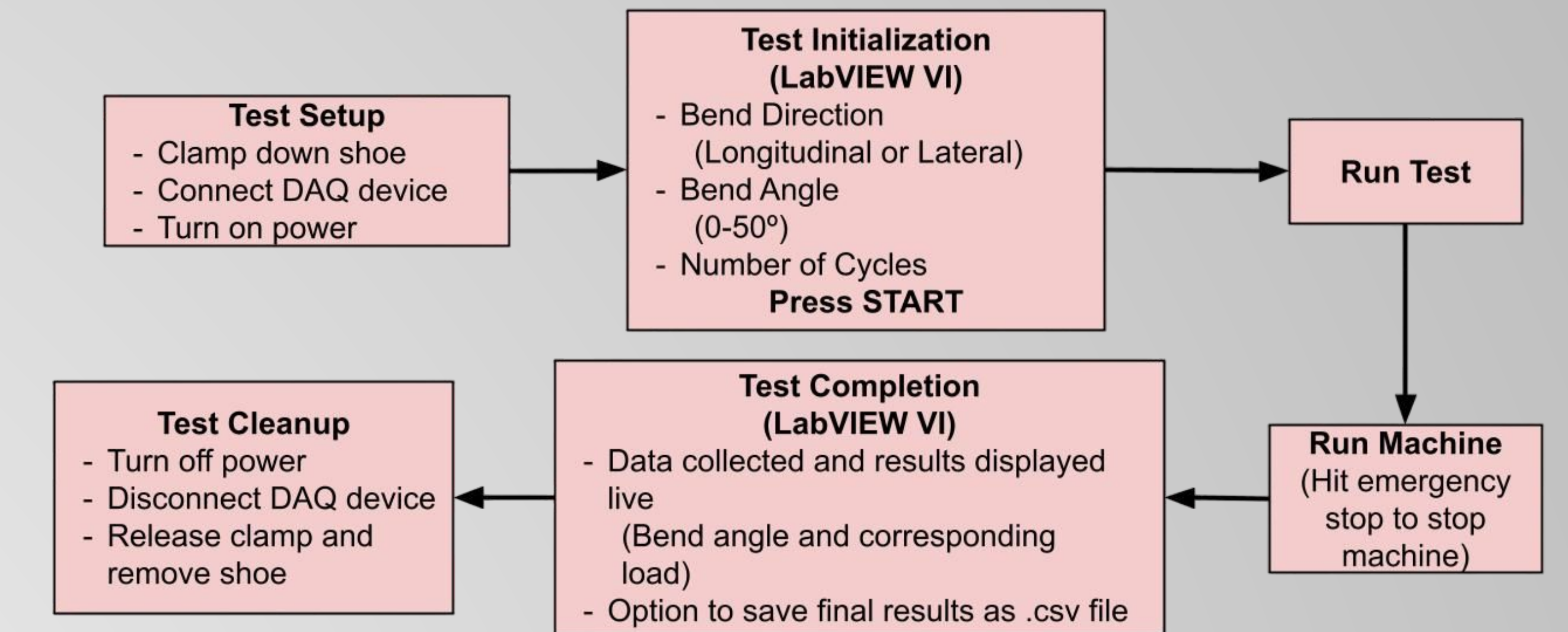


Figure 3: Machine Operation Flowchart

## Basic Test Data

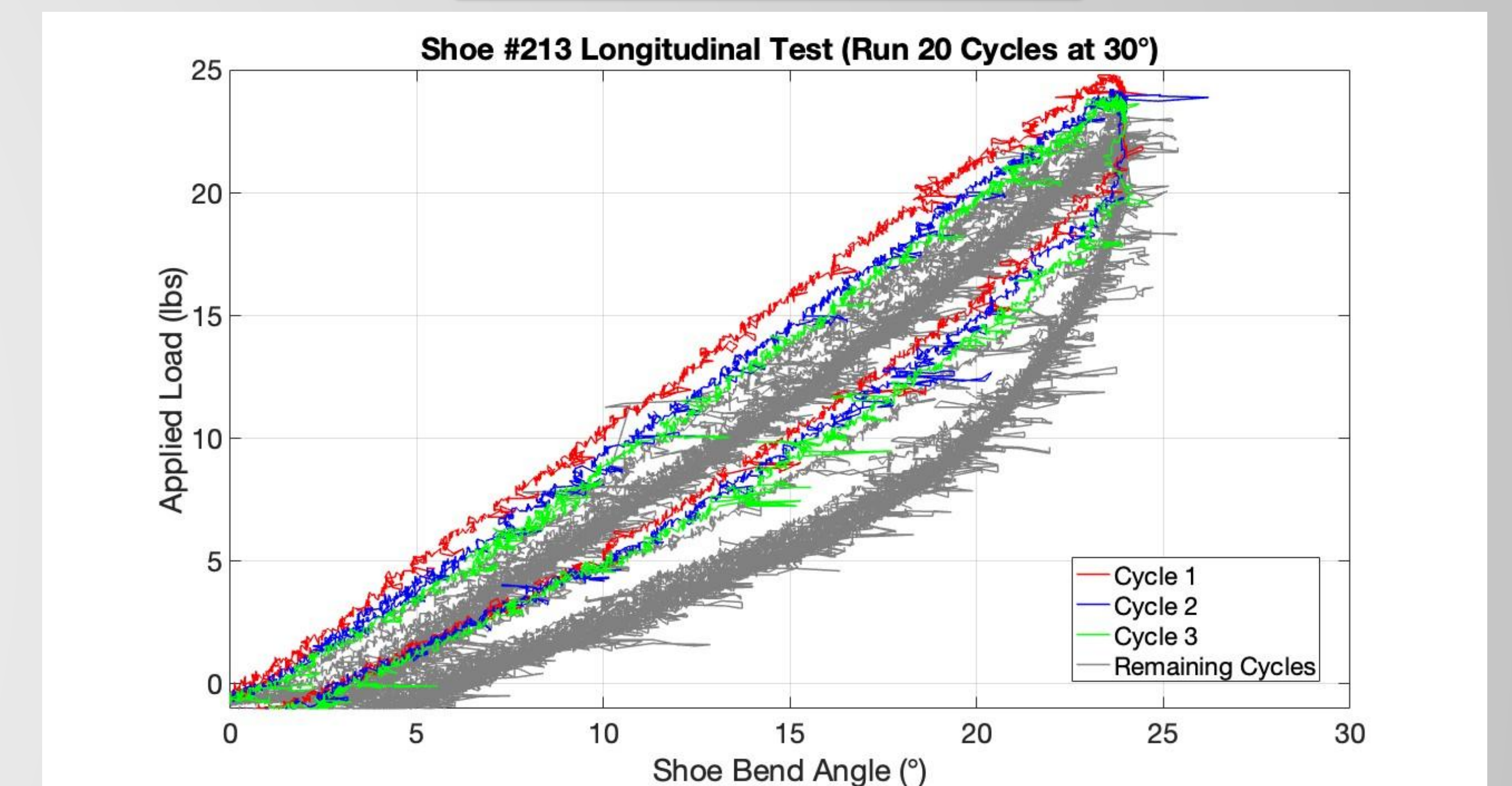


Figure 4: Longitudinal Cycle Data  
Data collected after Rocket X 3 shoe was run for 20 cycles at a 30° bend angle

## Repeatability Testing

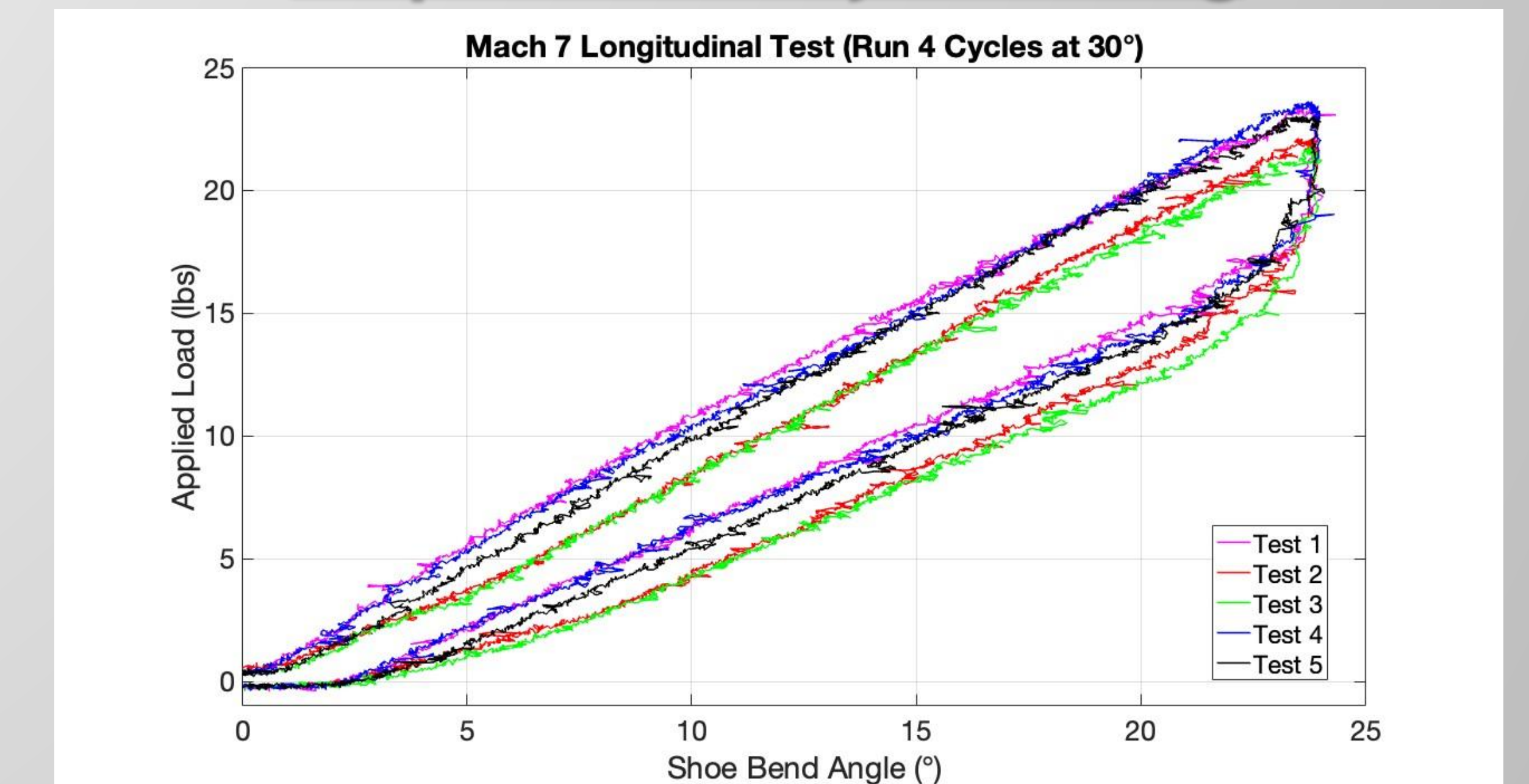


Figure 5: Mach 7 Repeatability Results  
Data collected (average cycle shape) when the same test was ran by five different people