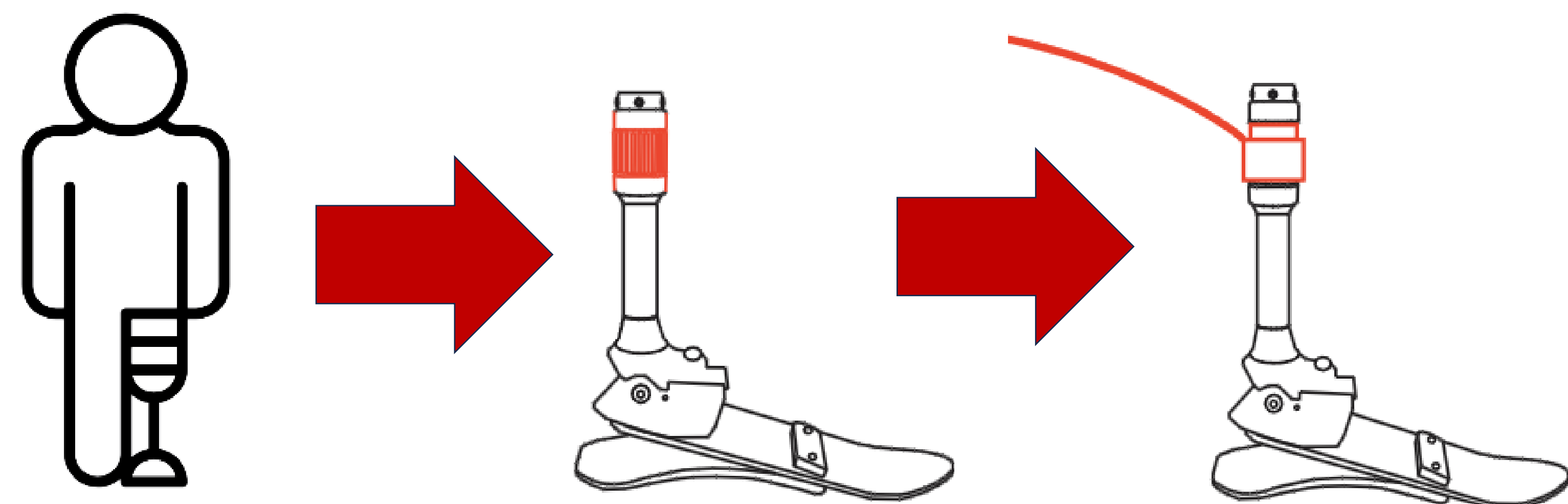


## 1. Introduction



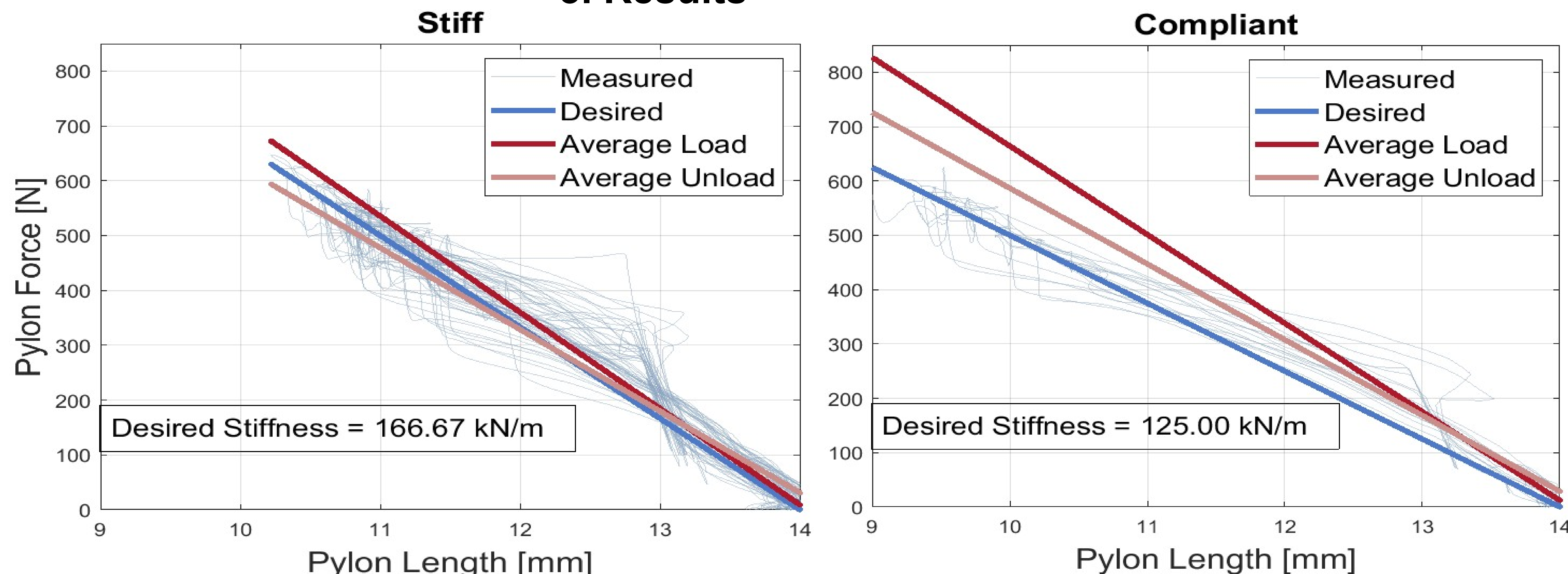
Prosthetic shock-absorbing pylons (SAPs) have been shown to reduce work done on the sound limb<sup>1</sup> and reduce impact forces on the prosthetic limb<sup>2</sup>. Considering the implications of SAP stiffness on gait performance<sup>1</sup>, there is a critical need for systematic evaluation of SAP properties and end-user outcomes. This need can be filled by **expanding prosthetic emulator technology, currently available for foot-ankle components, to include prosthetic pylons.**

### Purpose:

- 1) Design a new pylon emulator (PE)
- 2) Perform preliminary testing to evaluate the PE's capacity to vary stiffness under gait loading

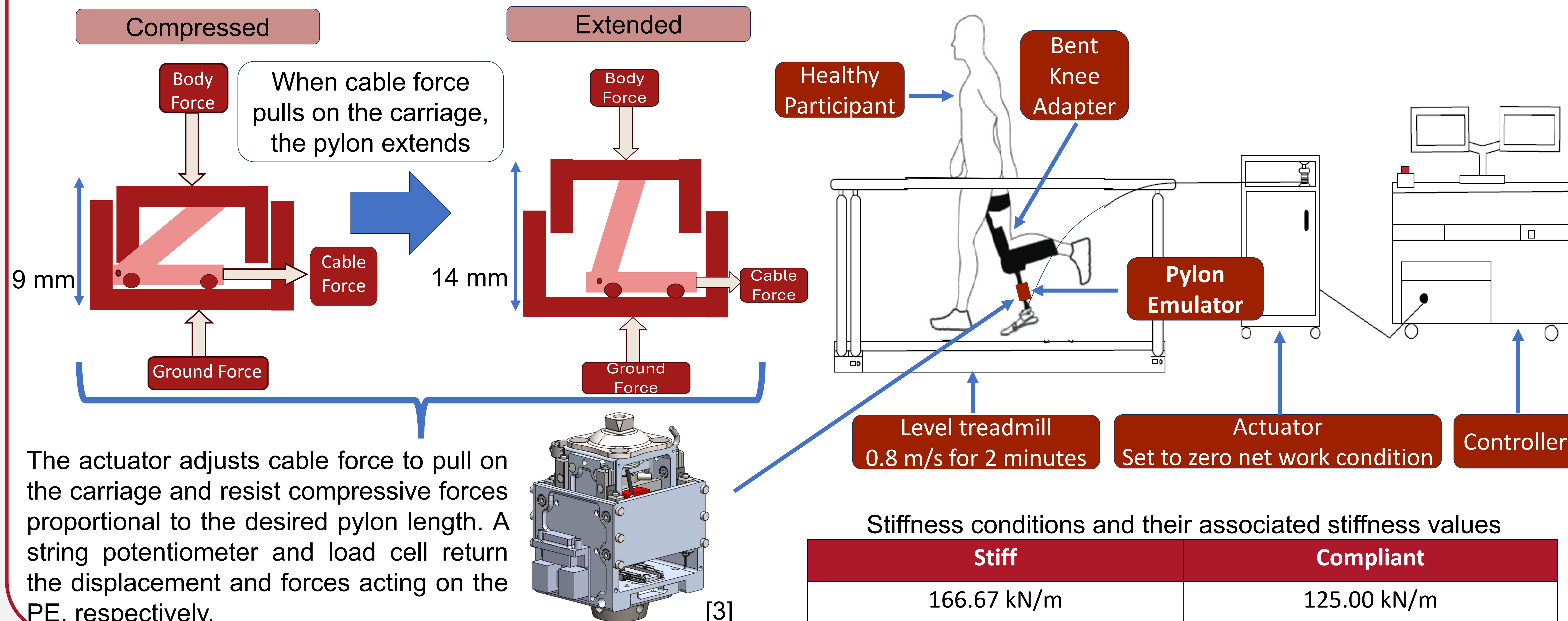
## 3. Results

Length of the pylon vs measured force for stiff (left) and compliant (right) desired stiffness conditions. The desired and average loading and unloading slopes are overlaid on the measured values.



Desired Stiffness [kN/m]	Stiff: 166.67	Compliant: 125.00
Measured Stiffness (SD) [kN/m]	175.5 (13.3)	163.0 (26.4)
Percent Error (SD) [%]	5.1 (0.4)	30.4 (4.9)
Energy Return (SD) [%]	89.6 (22.0)	94.6 (240.6)

## 2. Methods



Stiffness conditions and their associated stiffness values

Stiff	Compliant
166.67 kN/m	125.00 kN/m

## 4. Conclusions

1) The greater percent error in the desired stiffness for the more compliant pylon may be explained by gain error.

2) Decreased energy return is likely due to underdamped tuning of the controller gains and Coulomb damping.

**Next Steps:** The controllers' proportional and damping gain is being further tuned to improve accuracy in achieving a desired stiffness and energy return.

## 5. Significance

This proof of concept will lay the foundation for further **systematic studies on PEs**. Validation of the PE will open doors for **clinical use** and more effective individualized SAP prescription to **reduce the risk of musculoskeletal disorders**.

## Acknowledgments

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