

Drop Test Protocol and Standard Operating Procedure (SOP)

1. Objective

To evaluate the energy return, stability, and damping characteristics of the fractal hoof compared to a compliant soft foot design when dropped from a consistent height onto a rigid surface.

2. Equipment

- 5 x optitrax flex 2 motion capture cameras and respective hub
- 1x OptiTrax CW-500 calibration wand
- 1x OptiTrax CS-250 leveling marker
- Reflective markers for tracking and black matting to prevent unwanted reflections
- 15x 3D printed hooves (PLA, TPU 95A and TPU 64D), weighing no more than 250g each, inclusive of connective steel bolts.
- Aluminium extrusion to act as a reference for drop point
- Attached is a photo of the motion tracking setup. No specific rig is required.



3. Setup

1. Cameras are positioned for optimal viewing angles
2. Black polyester fabric is laid out and taped down to block background reflections
3. Motion tracking software (Motive:Tracker) and the CW-500 in the 250mm setup position are used to calibrate the setup

4. The CS-250 is used to set the ground plane
5. A PLA terrain topography is taped to the ground under the drop zone
6. Reflective markers are attached to hooves at or near the COM (Centre of Mass)

4. Procedure

- Camera recording is started
- Hoof is brought to a position near the reference drop point, 500mm above the ground.
- Hoof is released into freefall onto the rigid PLA ground topography
- This is repeated 5x for each hoof morphology

5. Data Collection and Analysis

- Initial and final orientation angles after rebound are recorded and exported to CSV
- Motion frames are visualized with a custom python script
- Symmetry and stability of the foot on landing is assessed
- Rebound height and damping characteristics are calculated