**Memorandum**

**To:** John Doe

**From:** Caleb Groves and Jack Casdorph

**Date:** 10/13/2017

**Subject:** Accuracy of image-based particle tracking using a 1-camera (2D) method versus a 2-camera (3D) method.

**Introduction**

The 3D position of a particle or point can be tracked over time by capturing the movement of the particle with 2 video cameras. If the motion of the particle is mostly planar, it is possible to accurately track its movement with just 1 camera. This method requires 2 things: (1) the movement of the particle must be completely planar, and (2) the plane of the camera must be perfectly parallel with the plane of motion. It is extremely unlikely that both of these conditions would exist in a real-world study, so it can be assumed that the 1-camera method will produce errors that could be avoided by using the 2 camera method.

The question is how large can we expect the errors of the 1-camera method to be? If they are small then its benefits of being easier, cheaper, and faster than the 2-camera method may outweigh its costs in accuracy loss. If the errors are large, however, then the 2 camera approach is most likely better.

**Methods**

In order to test the accuracy of the 1-camera motion capture method vs the 2-camera method, we decided to track a real-world planar motion using both methods. The motion that we chose to track was the motion of a ball connected to the shaft of a spinning motor. We can expect the path of that ball to be circular, and therefore planar.

To see how the angle of the plane of motion relative to the place of the camera affects the accuracy of the 1-camera method, we tracked the motion of the ball under 2 scenarios. In the first scenario, the plane of motion of the ball was nearly parallel to the plane of the camera. In the second scenario, there was an angle of 30-45 degrees between the 2 planes.

**Results**

**Discussion**