

## The importance of motion capture testing

The quality of your motion capture data can vary based on the system, calibration method, camera locations, camera settings, lens characteristics, and lighting. Because of all of these variables, there is a need for standardized testing to ensure your system is working up to par. This testing should be carried out on a regular basis along with system tweaks to keep accuracy and visibility as high as possible. Regular testing of your system may be required by some authority in your field - such as the GCMAS standards for accreditation - but more likely than not it is simply an assumption (by journal reviewers, hospitals, clients, etc.) that you took appropriate measures to ensure accuracy.

## SAMSA

While there are many different ways for gauging the quality of a motion capture system, a device and procedure designed by Professor Jim Richards<sup>1</sup> and further detailed by the GCMAS standards board<sup>2</sup> is one of the most thorough while still being simple to administer. The device, termed SAMSA for **Standard Assessment of Motion System Accuracy**, tests the system on three basic principles:

- Spatial mapping should be consistent throughout the portion of the volume used during motion analysis
- The motion analysis system should be able to distinguish between markers that pass close to one another
- System performance should be minimally affected when different camera subsets can view individual markers.

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<sup>1</sup> Richards JG. The measurement of human motion: a comparison of commercially available systems. Human movement science. 1999 Oct 31;18(5):589-602.

<sup>2</sup> Piazza SJ, Chou LS, Denniston NL, McMulkin ML, Quigley EJ, Richards JG, Schwartz MH. A proposed standard for assessing the marker-location accuracy of video-based motion analysis systems. In Gait and Clinical Movement Analysis Society, Springfield, MA 2007.

## The Device



(Piazza et al., 2007)

The SAMSA device moves markers around the capture space in a way that addresses all three of these concerns. The device (pictured above) is comprised of a base, motor, rotating arm, and 7 motion capture markers. 5-10 second trials are collected with the device located at different parts of the lab and with marker 7 set different intervals away from marker 6.

## Analysis of results

In the analysis of results, four measures are computed to assess the three principles mentioned above:

1. RMSE of horizontal distance (marker 1 to 2)
2. RMSE of vertical distance (marker 3 to 5)
3. Mean error of angle formed by two vectors: marker 4 to 3, marker 4 to 5
4. Maximum deviation of marker 6 from average position

Recommended thresholds to obtain for these four measures, to be confident your system is giving you high quality data, are:

1. 1mm
2. 1mm
3. 2°
4. 2mm (4mm when marker 7 is  $\leq 10$ mm from marker 6)

If your lab needs help building a SAMSA device or writing the code to collect and analyze the data, contact me at [kylepchad@gmail.com](mailto:kylepchad@gmail.com) and I can help out as much or as little as you want!