

6 degree of freedom]] pose of a segment using a least squares fit of the tracking marker locations in the standing trial to the tracking marker locations at each frame of the movement trial. the goodness of fit is described by the residual. the residuals are stored in meters as the segment residual the amount of soft tissue artifact can be explored by computing the residual of the segment pose but it is difficult to claim a meaningful difference between two residuals from different marker sets (e.g. trying to determine a "best" marker placement) because the magnitude of the residual depends on the distribution of the targets. even ignoring soft-tissue artifact the residuals alone often do not supply enough information about how well the targets are tracking the segment: * for example if you have three targets which are fairly close together then small residuals can often equate to large changes in a segments orientations. likewise if the targets are fairly spread out then the same small residuals will not equate to as much change in orientation. * in addition to distance the targets are spread out, how they are arranged often effect how sensitive the kinematics are to the residuals. for an extreme example of this consider a user who arranges their tracking targets in nearly a straight line (a bad practice which i doubt you are employing but i have seen it done.) in this case a small residual will produce a larger rotation about the axis the targets are nearly perpendicular to and the fact there is a small residual is misleading. * let me give another illustrations of how targets residuals are not simply correlated with accuracy: if a users tracks a segment with a cluster of three or more targets which all lie in the same plane then this arrangement will tend to be more accurate tracking rotations about an axis perpendicular to plane of the targets then the other two axis. what i am trying say is that how the targets are arranged will have a large effect on how well the residuals indicate the accuracy of the tracking. thus when you jump between different sets of tracking targets you it is not surprising to see different kinematics but similar residuals. (of course if your measurement system was perfect and the targets where fixed to perfectly rigid bodies all combinations would produced zero residuals and the same kinematics.) this long-winded explanation does not even consider the issue of soft-tissue artifacts. many labs attach their targets to shells which tend to keep the spatial relationship between the targets fairly consistent and thus produce low residuals; however in theory the shells may actually be doing a terrible job actually tracking the bone. in this case since the residuals are low the user has no indication of how bad the soft tissue movement is. i have witnessed a lot of debate on the use of shells (which offer some advantages) without any real conclusions being reached. so my bottom line is that i am not surprised different target combination produce different kinematics. ===== blips caused by marker dropout ===== if you have four markers during calibration visual3d will store the fixed (expected) location of these markers in local space. now let's assume the calibration was perfect, the markers remain fixed to the rigid skeleton during the motion and the motion data is also perfect (which we know will never happen), in this hypothetical case it will not matter if a target drops out. (no blips will occur). however as you have seen blips do occur when a target drops out because: * the spatial relationship between the targets during calibration has some error. * the data during the motion has some error * soft-tissue movement causes the spatial relationship between the targets changes * filters do not work very well at the end points of signals. gaps that occur during the trial exacerbate this problem because the frames(s) just before and after the gap usually aren't very reliable (they were likely just reliable enough), which makes the filtering even worse. it is possible that the blip would be smaller for the unprocessed signals, but unfortunately, these signals aren't particularly useful for kinematics and kinetics. thus as you noted when you change combinations of targets used to track the segment you get the resultants blips. now if you have three targets and try to create a fourth virtual target from the other three, this new virtual target is totally dependent on the information in the other three targets and actually contains no additional information!! thus the new virtual target based on the three remaining targets will not eliminate the blip. (it will appears to decrease the weight of the targets to 25% each among the three real and one virtual target, but since the virtual target is not an independent measure its's 25% is composed entirely of information from the other targets.) so if your question is can you eliminate the blip by a creating landmark (virtual target) from the three remaining tracking targets the answer unfortunately is no. the practical

solution is probably to throw away tracking markers that show these blips during the range of frames that you are interested in. another option is to require that all tracking markers must exist or the pose won't be computed. see [\[\[visual3d:documentation:pipeline:expressions:overview#example:_if_one_tracking_marker_is_no_data.2c_make_all_tracking_markers_no_data|here for an example\]\]](#) } } } } }

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