

# Pelvis Overview

There are many ways to define a segment in Visual3D, which means there are many ways to define a Pelvis segment.

| Model Name                 | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Visual3D Pelvis            | The Visual3D pelvis refers to a pelvis segment defined as a default Visual3D segments. Markers on the Iliac Crest specify the proximal end of the segment. Markers on the Greater Trochanter specify the distal end of the segment. The length of the Pelvis segment is defined as the distance from the proximal end to the distal end. Visual3D inherited this definition from <a href="#">MOVE3D</a> (the precursor software to Visual3D) and has been used by the staff in the Physical Disabilities Branch at the NIH for more than 20 years. |
| CODA Pelvis                | The CODA pelvis refers to a pelvis segment model used by Charnwood Dynamics that they requested that we implement. The pelvis segment is defined using the anatomical locations of the ASIS (Anterior Superior Iliac Spine) and the PSIS (Posterior Superior Iliac Spine). These landmarks are bony protuberances on the Pelvis bones that can be palpated on most (but not all) subjects.                                                                                                                                                         |
| Helen Hayes (Davis) Pelvis | The Helen Hayes pelvis refers to a model defined by Davis et. al. (1991) and used by many manufacturers, including the VCM model by Vicon. The pelvis segment is defined using the anatomical locations of the ASIS (Anterior Superior Iliac Spine) and the midpoint between the PSIS (Posterior Superior Iliac Spine) commonly referred to as the Sacrum marker. These landmarks are bony protuberances on the Pelvis bones that can be palpated on most (but not all) subjects.                                                                  |
| Visual3D Composite Pelvis  | The Visual3D Composite Pelvis has a local coordinate system that is aligned with many of the traditional pelvis definitions (CODA, Helen Hayes, Plugin-Gait), but the origin of the segment is in the middle of the body, which is more representative of the inertial properties.                                                                                                                                                                                                                                                                 |

**NOTE:** the segment coordinate system for the CODA pelvis is the mid-point between the ASIS markers. The anatomical landmarks are actually posterior to the ASIS markers because the motion capture system tracks the center of the marker. This is a modest error, but it can be corrected by [creating landmarks that are posterior to the ASIS markers by the radius of the motion capture marker](#).

## Choosing between Helen Hayes and CODA Pelvis Approaches

We usually recommend choosing the CODA Pelvis family within Visual3D. This is mostly because these definitions do not require an estimate of the Leg Length, which can be a bit of a problem for some patients. The CODA pelvis also does not require the measurement of the ASIS-greater trochanter distance, which we find that very few laboratories ever make.

## Pelvis Segment Angle

The Pelvis Angle typically refers to the orientation of the Pelvis relative to the Laboratory. In Richard Baker's 2001 technical note<sup>1)</sup> he makes a convincing (to us anyway) claim that the sequence of

rotations for the Cardan angle description of the pelvis relative to the laboratory should be:

1. Axial Rotation
2. Obliquity
3. Tilt.

This is the reverse rotation sequence of the conventional Joint Coordinate System definition of a joint angle commonly used to describe the angles of the hip, knee and ankle, which is Flexion/Extension, Abduction/Adduction, Axial Rotation. This recommendation is easily accomplished in Visual3D by following [these examples](#).

1)

Baker R (2001) Pelvic angles: a mathematically rigorous definition which is consistent with a conventional clinical understanding of the terms. Gait and Posture 13, 1-6

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