# TPI 3D Parameter Definitions

## *Pelvis Rotation (Open-Closed) PlvRot*

The turn of the pelvis from the square position; turned away from the target is “Closed”; towards the target is “Open”; calculated as if looking directly along the up-down pelvis axis; measured in degrees.

## *Pelvis Bend (Fwd-Back) PlvBnd*

The forward-backward tilt of the pelvis with respect to a horizontal plane; measured as if a bubble level was put on a forward-back pelvis axis; “Fwd” is when the top of the pelvis moves forward; “Back” is when the top of the pelvis moves backwards; measured in degrees.

## *Pelvis Side Bend (Trail-Lead) PlvSBnd*

The side-to-side tilt of the pelvis with respect to a horizontal plane; measured as if a bubble level was put on a side-to-side pelvis axis; “Trail” is tilting to the side, away from the target at address; “Lead” is tilting to the side nearer the target at address; measured in degrees.

## *Thorax Rotation (Open-Closed) ThxRot*

The turn of the thorax from the square position; turned away from the target is “Closed”; towards the target is “Open”; calculated as if looking directly along the up-down thorax axis; measured in degrees.

## *Thorax Bend (Fwd-Back) ThxBnd*

The forward-backward tilt of the thorax with respect to a horizontal plane; measured as if a bubble level was put on a forward-back thorax axis; “Fwd” is when the top of the thorax moves forward and “Back” is when the top of the thorax moves backwards; measured in degrees.

## *Thorax Side Bend (Trail-Lead) ThxSBnd*

The side-to-side tilt of the thorax (upper body) with respect to a horizontal plane; measured as if a bubble level was put on a side-to-side thorax axis; “Trail” is tilting to the side away from the target at address and “Lead” is tilting to the side nearer the target at address; measured in degrees.

## *Pelvis Sway (To-Away) PlvSwy*

Side-to-side linear motion of the pelvis center (point between the hip joints); “To” is horizontal motion towards the target; “Away” is horizontal motion away from the target; measured in inches

### *Pelvis Thrust (Fwd-Back) PlvThrst*

Forward-backward linear motion of the pelvis center (point between the hip joints); “Fwd” is horizontal motion towards the ball and “Back” is horizontal motion away from the ball; measured in inches.

### *Pelvis Lift (Up-Down) PlvLift*

Up-down linear motion of the pelvis center (point between the hip joints); measured in inches.

### *Thorax Sway (To-Away) ThxSwy*

Side-to-side linear motion of the thorax a center (point between the AC joints); “To” is horizontal motion towards the target; “Away” is horizontal motion away from the target; measured in inches

### *Thorax Thrust (Fwd-Back) ThxThrst*

Forward-backward linear motion of the thorax center (point between the AC joints); “Fwd” is horizontal motion towards the ball and “Back” is motion away from the ball; measured in inches.

### *Thorax Lift (Up-Down) ThxLift*

Up-down linear motion of the thorax center (point between the AC joints); measured in inches.

### *Spine Rotation (Open-Closed) SpnRot*

The turn of the thorax with respect to the pelvis (also known as X-Factor); turned away from the target is “Closed”; towards the target is “Open”; calculated as if looking directly along the up-down thorax axis at the pelvis below; calculated using the JCS method; measured in degrees.

### *Spine (Flex-Ext) SpnFE*

Forward-backward tilting of the thorax measured with respect to the pelvis; measured around a side-to-side axis through the pelvis; “Flex” (flexion) is forward with respect to the pelvis and “Ext” (extension) is backwards with respect to the pelvis; note that the amount of spine rotation is irrelevant to this measurement; it is the measurement of how much an up-down thorax rod is bent forward with respect to the pelvis; this measurement moves with the pelvis; calculated using the JCS method; measured in degrees.

### *Spine Side Bend (Trail-Lead) SpnSBnd*

The side-to-side tilt of the thorax with respect to the pelvis; “Trail” is tilting to the side away from the target at address and “Lead” is tilting to the side nearer the target at address; this measurement moves with the pelvis; calculated using the JCS method; measured in degrees.

### *Head Rotation (Open-Closed) HdRot*

The turn of the head from the square position; turned away from the target is “Closed”; towards the target is “Open”; calculated as if looking directly along the up-down head axis; measured in degrees.

### *Head Bend (Fwd-Back) HdBnd*

The forward-backward tilt of the head with respect to a horizontal plane; measured as if a bubble level was put on a forward-back head axis; “Fwd” is when the top of the head moves forward and “Back” is when the top of the head moves backwards; measured in degrees.

### *Head Side Bend (Trail-Lead) HdSBnd*

The side-to-side tilt of the head with respect to a horizontal plane; measured as if a bubble level was put on a side-to-side head axis; “Trail” is tilting to the side away from the target at address and “Lead” is tilting to the side nearer the target at address; measured in degrees.

### *Head Sway (To-Away) HdSwy*

Side-to-side linear motion of the head with respect to a point in the center of the forehead; “To” is motion towards the target; “Away” is motion away from the target; measured in inches

### *Head Thrust (Fwd-Back) HdThrst*

Forward-backward linear motion of the head with respect to a point in the center of the forehead; “Fwd” is motion towards the ball and “Back” is motion away from the ball; measured in inches.

### *Head Lift (Up-Down) HdLift*

Up-down linear motion of the head with respect to a point in the center of the forehead; measured in inches.

### *Neck Rotation (Open-Closed) NeckRtn*

The turn of the head with respect to the thorax; turned away from the target is “Closed”; towards the target is “Open”; calculated as if looking directly along the up-down head axis at the thorax below; calculated using the JCS method; measured in degrees.

### *Neck (Flex-Ext) NeckFE*

Forward-backward tilting of the head measured with respect to the thorax; measured around a side-to-side axis through the thorax; “Flex” (flexion) is forward with respect to the thorax and “Ext” (extension) is backwards with respect to the thorax; note that the amount of neck rotation is irrelevant to this measurement; it is the measurement of how much an up-down head rod is bent forward with respect to the thorax; this measurement moves with the thorax; calculated using the JCS method; measured in degrees.

### *Neck Side Bend (Trail-Lead) NeckSB*

The side-to-side tilt of the head with respect to the thorax; “Trail” is tilting to the side away from the target at address and “Lead” is tilting to the side nearer the target at address; this measurement moves with the thorax; calculated using the JCS method; measured in degrees.

### *Spine Axis Fwd Tlt (Fwd-Back) SpnAxisFwdTlt*

The forward tilting angle of a line from mid-AC joints (i.e. between the shoulders) to mid-hip joints; measured from a target line view. This is equivalent to the “spine axis” measurement that is often done from a target line view with a video camera; “Fwd” is tipping towards the ball and back is tipping away from the ball; with vertical as the zero point; measured in degrees.

### *Spine Axis Side Tlt (Trail-Lead) SpnAxisSideTlt*

The side tilting angle of a line from mid-AC joints (i.e between the shoulders) to mid hip joints; measured from a target line view. This is equivalent to the “spine axis” measurement that is often done from a face on view with a video camera; “Trail” is tipping away from the target and “Lead” is tipping towards the target; measured in degrees.

### *Shaft FaceOn Angle (Back-Fwd) ShftFcOnAng*

The angle of the shaft of the club with respect to the vertical measured from a face on view of the golfer; mostly used around the address or impact area; “Back” is when hand is behind the club head (as in scooping) and “Fwd” is when the hand is in front of the club head (as in lagging); measured in degrees.

### *Arc Width ArcWdth*

Distance from a point between the shoulders to the mid-hands; bending the arms will reduce this value; measured in inches.

### *Club Head Gap ClbHdGap*

Distance from a point between the shoulders to the club head; a large value at address and impact and a smaller value at top of backswing; measured in inches.

### *Arms-Club Set Angle ArmsClubAng*

Angle between a line from mid-shoulders to mid-hands and the club shaft; can be used as a simple indicator of casting; measured in degrees.

### *Pelvis Bend Vel (Back-Fwd) PlvBndVel*

Pelvis bending velocity is the angular velocity with which the pelvis is rotating around its own side-to-side axis; “Fwd” is when the top of the pelvis is rotating forward and “Back” is when the top of the pelvis is rotating backwards; measured in degrees per second.

### *Pelvis SBend Vel (Trail-Lead) PlvSBndVel*

Pelvis side bending velocity is the angular velocity with which the pelvis is rotating around its own forward-backward axis; “Trail” is when the pelvis is tipping to the trailing side and “Lead” is when the pelvis is tipping to the leading side; measured in degrees per second.

### *Pelvis Rot Vel (Fwd-Back) PlvRotVel*

Pelvis rotational velocity is the angular velocity with which the pelvis is rotating around its own up-down axis; “Fwd” is when the pelvis is rotating in the forward swing and “Back” is when the pelvis is rotating in the backswing; this is one curve in the Kinematic Sequence; measured in degrees per second.

### *Thorax Bend Vel (Back-Fwd) ThxBndVel*

Thorax bending velocity is the angular velocity with which the thorax is rotating around its own side-to-side axis; “Fwd” is when the top of the thorax is rotating forward and “Back” is when the top of the thorax is rotating backwards; measured in degrees per second.

### *Thorax SBend Vel (Trail-Lead) ThxSBndVel*

Thorax side bending velocity is the angular velocity with which the thorax is rotating around its own forward-backward axis; “Trail” is when the thorax is tipping to the trailing side and “Lead” is when the thorax is tipping to the leading side; measured in degrees per second.

### *Thorax Rot Vel (Fwd-Back) ThxRotVel*

Thorax rotational velocity is the angular velocity with which the thorax is rotating around its own up-down axis; “Fwd” is when the thorax is rotating in the forward swing and “Back” is when the thorax is rotating in the backswing; this is one curve in the Kinematic Sequence; measured in degrees per second.

### *Arms Swng Ang Vel (Fwd-Back) ArmsSwngAngVel*

The angular velocity component in the instantaneous swing plane of a line from mid-shoulders to mid-hands; this line represents the arms as a group; “Back” means moving in the backswing direction and “Fwd” means moving in the forward swing direction; measured in degrees per second.

### *Club Swng Ang Vel (Fwd-Back) ClbSwngAngVel*

The angular velocity component in the instantaneous swing plane of the club shaft; “Fwd” means moving in the forward swing and “Back” means moving in the backswing; it is used as one of the curves in the kinematic sequence; measured in degrees per second.

### *Club Axial Ang Vel (Close-Open) ClbAxlAngVel*

The angular velocity component of the club shaft around its long axis; “Close” is in the direction of the club face closing and “Open” is in the direction of the club face opening; of most interest when nearing impact; measured in degrees per second.

### *Club Head Spd (To-Away) ClbHdSpdTA*

Linear speed of the club head in the direction of the target; “To” means the club head is moving towards the target and “Away” means it is moving away from the target; note that this is measured as projection from the sensor at the bottom of the grip; it does not take shaft flex and twist into account; measured in miles per hour.

### *Club Head Spd (Out-In) ClbHdSpdOI*

Linear speed of the club head in a horizontal direction towards and away from the golfer; “Out” is moving away from the golfer and “In” is moving towards the golfer; useful to see if the club is moving out-to-in or in-to-out before impact; note that this is measured as projection from the sensor at the bottom of the grip; it does not take shaft flex and twist into account; measured in miles per hour.

### *Club Head Spd (Up-Down) ClbHdSpdUD*

Linear speed of the club head in a vertical direction; useful to see if the club head it hitting the ball with an ascending or descending blow; note that this is measured as projection from the sensor at the bottom of the grip; it does not take shaft flex and twist into account; measured in miles per hour.

### *Club Head Spd ClbHdSpd*

Total (resultant) linear speed of the club head; is either positive or zero; note that this is measured as projection from the sensor at the bottom of the grip; it does not take shaft flex and twist into account; measured in miles per hour.

### *Pelvis Spd (To-Away) PlvsSpdTA*

Linear speed of the pelvis center (point between the hip joints) in the horizontal direction of the target; “To” means the pelvis center is moving towards the target and “Away” means it is moving away from the target; measured in miles per hour.

### *Pelvis Spd (Fwd-Back) PlvsSpdFB*

Linear speed of the pelvis center (point between the hip joints) in the horizontal direction of the ball; “Fwd” means the pelvis center is moving towards the ball and “Back” means it is moving away from the ball; measured in miles per hour.

### *Pelvis Spd (Up-Down) PlvsSpdUD*

Linear speed of the pelvis center (point between the hip joints) in a vertical direction, up and down; measured in miles per hour.

### *Pelvis Spd PlvsSpd*

Total (resultant) linear speed of the pelvis center (point between the hip joints); it is either positive or zero; measured in miles per hour.

### *Thorax Spd (To-Away) ThxSpdTA*

Linear speed of the thorax center (point between the AC joints) in the horizontal direction of the target; “To” means the thorax center is moving towards the target and “Away” means it is moving away from the target; measured in miles per hour.

### *Thorax Spd (Fwd-Back) ThxSpdFB*

Linear speed of the thorax center (point between the AC joints) in the horizontal direction of the ball; “Fwd” means the thorax center is moving towards the ball and “Back” means it is moving away from the ball; measured in miles per hour.

### *Thorax Spd (Up-Down) ThxSpdUD*

Linear speed of the thorax center (point between the AC joints) in a vertical direction, up and down; measured in miles per hour.

### *Thorax Spd ThxSpd*

Total (resultant) linear speed of the thorax center (point between the AC joints); it is either positive or zero; measured in miles per hour.

### *MidHnds Spd (To-Away) MHndsSpdTA*

Linear speed of a point between the hands (in the shaft) in the horizontal direction of the target; “To” means the point is moving towards the target and “Away” means it is moving away from the target; measured in miles per hour.

### *MidHnds Spd (Fwd-Back) MHndsSpdFB*

Linear speed of a point between the hands (in the shaft) in the horizontal direction of the ball; “Fwd” means the point is moving towards the ball and “Back” means it is moving away from the ball; measured in miles per hour.

### *MidHnds Spd (Up-Down) MHndsSpdUD*

Linear speed of point between the hands (in the shaft) in a vertical direction, up and down; measured in miles per hour.

### *MidHnds Spd MHndsSpd*

Total (resultant) linear speed of a point between the hands (in the shaft); it is either positive or zero; measured in miles per hour.

### *Lead Wrist (Rad-Ulna) LdWrstDev*

Radial-ulna deviation of the lead wrist; the lead wrist is the one closest to the target side at address; “Rad” is bending of the wrist towards the little finger; “Ulna” is bending of the wrist towards the thumb; calculated using the JCS method; measured in degrees.

### *Lead Wrist (Flex-Ext) LdWrstFE*

Flexion-extension of the lead wrist; the lead wrist is the one closest to the target side at address; “Flex” is bending of the wrist in the direction of the palm; “Ext” is bending of the wrist in the direction of the back of the hand; calculated using the JCS method; measured in degrees.

### *Lead FArm (Sup-Pronation) LdFArmRot*

Supination-Pronation of the lead forearm; the lead forearm is the one closest to the target side at address; “Sup” is rotation in the direction of palm up with forearm horizontal; “Pronation” is rotation in the direction of palm down; calculated using the JCS method; measured in degrees.

***Lead Elbow (Flex-Ext) LdElbFlex***

***Trail Wrist (Rad-Ulna) TrlWrstDev***

***Trail Wrist (Flex-Ext) TrlWrstFE***

***Trail FArm (Sup-Pronation) TrlFArmRot***

***Trail Elbow (Flex-Ext) TrlElbFlex***

***Lead Wrist Vel(Rad-Ulna) LdWristRUVel***

***Lead Wrist Vel (Flex-Ext) LdWristFEVel***

***Lead Wrist Vel (Sup-Pronation) LdWristPSVel***

***Lead Elbow Vel (Flex-Ext) LdElbFEVel***

***Trail Wrist Vel (Rad-Ulna) TrlWristRUVel***

***Trail Wrist Vel (Flex-Ext) TrlWristFEVel***

***Trail Wrist Vel (Sup-Pronation) TrlWristPSVel***

***Trail Elbow Vel (Flex-Ext) TrlElbFEVel***

***Lead Wrist Set Angle LWrstAng***

***Lead Shldr Lift Ang (Above-Below) LShldrLiftAng***

***Lead Shldr Ang (Infront-Behind) LShldrAng***

***Lead Wrist Ang Vel (Release-Set) LWrstAngVel***

***Lead Forearm Ang Vel (Fwd-Back) LFArmAngVel***

***Lead Upr Arm Ang Vel (Fwd-Back) LUArmAngVel***

***Trail Forearm Ang Vel (Fwd-Back) TFArmAngVel***

***Arms-Club Ang Vel (Release-Set) ArmsClbAngVel***

***Spine FE Vel (Flex-Ext) SpnFEVel***

Spine flexing-extending velocity is the angular velocity component with which the thorax is rotating around the pelvis side-to-side axis; flexing is bending forward as if to touch

your toes; extending is bending backwards as if to look at the sky; measured in degrees per second.

### *Spine SBnd Vel (Trail-Lead) SpnSBndVel*

Spine side bending velocity is the angular velocity component with which the thorax is rotating around the pelvis forward-backward axis; trail is when the thorax is rotating toward the trailing side of the pelvis and lead is when the thorax is rotation toward the leading side of the pelvis; measured in degrees per second.

### *Spine Rot Vel (Fwd-Back) SpnRotVel*

Spine rotational velocity is the angular velocity component with which the thorax is rotating around the pelvis up-down axis; forward is when the thorax is rotating in the forward swing with respect to the pelvis and back is when the thorax is rotating in the backswing with respect to the pelvis; measured in degrees per second.

***Elbow Separation ElbSep***

***Knee Separation KneeSep***

***Foot Separation FootSep***

***Lead Knee Sway (To-Away) LdKneeSwy***

***Lead Knee Thrust (Fwd-Back) LdKneeThrst***

***Lead Knee Lift (Up-Down) LdKneeLft***

***Lead Foot Sway (To-Away) LdFootSwy***

***Lead Foot Thrust (Fwd-Back) LdFootThrst***

***Lead Foot Lift (Up-Down) LdFootLft***

***Trail Knee Sway (To-Away) TrlKneeSwy***

***Trail Knee Thrust (Fwd-Back) TrlKneeThrst***

***Trail Knee Lift (Up-Down) TrlKneeLft***

***Trail Foot Sway (To-Away) TrlFootSwy***

***Trail Foot Thrust (Fwd-Back) TrlFootThrst***

***Trail Foot Lift (Up-Down) TrlFootLft***

***Lead Hip (Flex-Ext) LdHpFlx***

***Lead Knee (Flex-Ext) LdKnFlx***

***Lead Ankle (Dorsi-Plant) LdAnkFlx***

***Trail Hip (Flex-Ext) TrlHpFlx***

***Trail Knee (Flex-Ext) TrlKnFlx***

***Trail Ankle (Dorsi-Plant) TrlAnkFlx***

***Lead Hip (Ad-Abduction) LdHpAdAb***

***Lead Knee (Ad-Abduction) LdKnAdAb***

***Lead Ankle (Sup-Pronation) LdAnkS/P***

***Trail Hip (Ad-Abduction) TrlHpAdAb***

***Trail Knee (Ad-Abduction) TrlKnAdAb***

***Trail Ankle (Sup-Pronation) TrlAnkS/P***

***Lead Hip Rot (Int-Ext) LdHpI/ERot***

***Trail Hip Rot (Int-Ext) TrlHpI/ERot***

***Lead Knee Rot (Int-Ext) LdKnI/ERot***

***Trail Knee Rot (Int-Ext) TrlKnI/ERot***

***Lead Ankle Rot (Int-Ext) LdAnkI/ERot***

***Trail Ankle Rot (Int-Ext) TrlAnkI/ERot***

***Pelvis Rotn L (Open-Closed) PlvRtn***

***Spine Rotn L (Open-Closed) XFctrL***

***Upr Body Rotn L (Open-Closed) UBdyRtn***

***Spine Bend P (Fwd-Back) SpnBndP***

***Spine Side Bend P (Trail-Lead) SpnSBndP***

***Head Rotn L (Open-Closed) HdRtnL***

***Pelvis Rotn A (Open-Closed) PlvRtnA***

***Spine Rotn A (Open-Closed) XFctrA***

***Upr Body Rotn A (Open-Closed) UBdyRtnA***

***Pelvis Rotn Speed LV PlvRtSpLV***

***Upr Body Rotn Speed LV UBdyRtSpLV***

***Arms Rotn Speed V ArmsRtSpV***

***Club Rotn Speed V ClbRtSpV***

*Plv-Gnd-SAS Plv-Gnd-SAS*

*UT-Plv-SAS UT-Plv-SAS*

*Arms-UT-SAS Arms-UT-SAS*

*Plv-Gnd-JA Plv-Gnd-JA*

*UT-Plv-JA UT-Plv-JA*

*Arms-UT-JA Arms-UT-JA*

*Clb-Arms-JA Clb-Arms-JA*

*PlvRt-S (Open-Closed) PlvRt-S*

*UTrsoRt-S (Open-Closed) UTrsoRt-S*

*ArmRt-S (Open-Closed) ArmRt-S*

*ClubRt-S (Open-Closed) ClubRt-S*

*SpnRt-S (Open-Closed) SpnRt-S*

*ShldrRt-S (Open-Closed) ShldrRt-S*

*WrstRt-S (Open-Closed) WrstRt-S*

*PlvRtSpd-S (Open-Closed) PlvRtSpd-S*

*UTrsoRtSpd-S (Open-Closed) UTrsoRtSpd-S*

*ArmRtSpd-S (Open-Closed) ArmRtSpd-S*

*ClubRtSpd-S (Open-Closed) ClubRtSpd-S*

*SpnRtSpd-S (Open-Closed) SpnRtSpd-S*

*ShldrRtSpd-S (Open-Closed) ShldrRtSpd-S*

*WrstRtSpd-S (Open-Closed) WrstRtSpd-S*

*Pelv-UBdy Ang Pelv-UBdy Ang*

*Pelv-UBdy AngV Pelv-UBdy AngV*

### *Lead Thigh Rotn (Open-Closed) LdThighRtn*

### *Lead Thigh Bend (Fwd-Back) LdThighBnd*

### *Lead Thigh Side Bend (Trail-Lead) LdThighSBnd*

### *Trail Thigh Rotn (Open-Closed) TrThighRtn*

### *Trail Thigh Bend (Fwd-Back) TrThighBnd*

### *Trail Thigh Side Bend (Trail-Lead) TrThighSBnd*

### *Lead Foot Rotn (Open-Closed) LdFootRtn*

### *Lead Foot Bend (Fwd-Back) LdFootBnd*

### *Lead Foot Side Bend (Trail-Lead) LdFootSBnd*

### *Trail Foot Rotn (Open-Closed) TrFootRtn*

### *Trail Foot Bend (Fwd-Back) TrFootBnd*

### *Trail Foot Side Bend (Trail-Lead) TrFootSBnd*

### *Pelvis Rslt Ang Vel PlvRsltAngVel*

Pelvis resultant angular velocity is the magnitude of the total angular velocity of the pelvis; it is the (Pythagorean) combination of all the component velocities and is always positive; measured in degrees per second.

### *Thorax Rslt Ang Vel ThxRsltAngVel*

Thorax resultant angular velocity is the magnitude of the total angular velocity of the thorax; it is the (Pythagorean) combination of all the component velocities and is always positive; measured in degrees per second.

***Arms Rslt Ang Vel ArmsRsltAngVel***

***Club Rslt Ang Vel ClbRsltAngVel***

***Lead Arm Prj Ang LArmPrjAng***

***Club Ang Vel AP ClbAngVelAP***

***Club Ang Vel ML ClbAngVelML***

***ShldrsAngVelLocAP ShldAngVelLocAP***

***ShldrsAngVelLocML ShldAngVelLocML***

***ShldrsAngVelLocAx ShldAngVelLocAx***

***ShldrsAngVelLocR ShldAngVelLocR***

***XThxAngV-wrt-Plv XThxAngV-wrt-Plv***

***YThxAngV-wrt-Plv YThxAngV-wrt-Plv***

***ZThxAngV-wrt-Plv ZThxAngV-wrt-Plv***

***RThxAngV-wrt-Plv RThxAngV-wrt-Plv***

***XArmsAngV-wrt-Thx XArmsAngV-wrt-Thx***

***YArmsAngV-wrt-Thx YArmsAngV-wrt-Thx***

***ZArmsAngV-wrt-Thx ZArmsAngV-wrt-Thx***

***RArmsAngV-wrt-Thx RArmsAngV-wrt-Thx***