

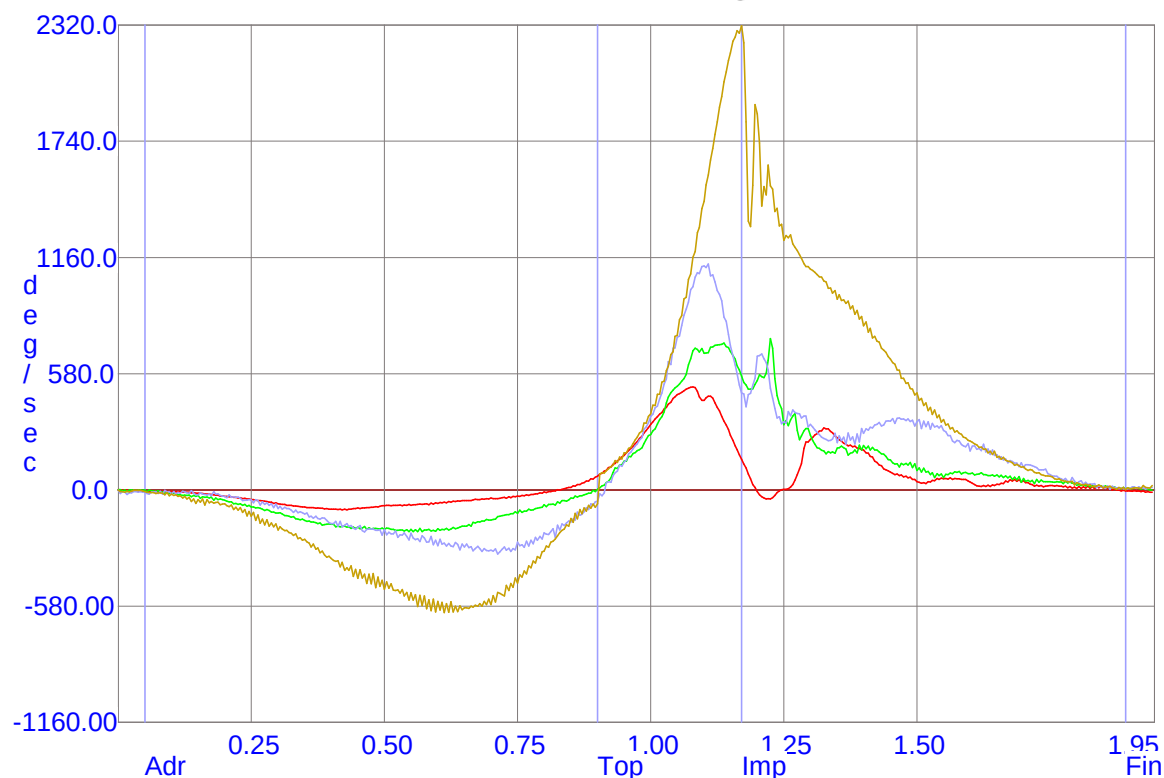
TPI 3D

■ **BIOMECHANICAL SPORTS ANALYSIS**

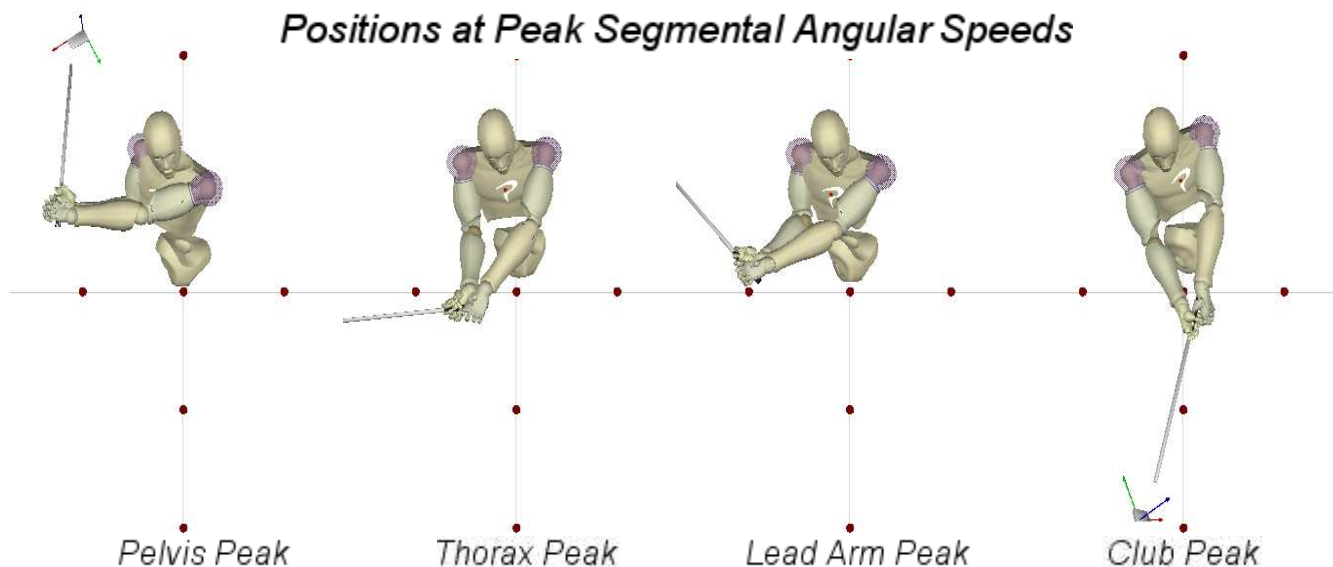


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Kinematic Sequence



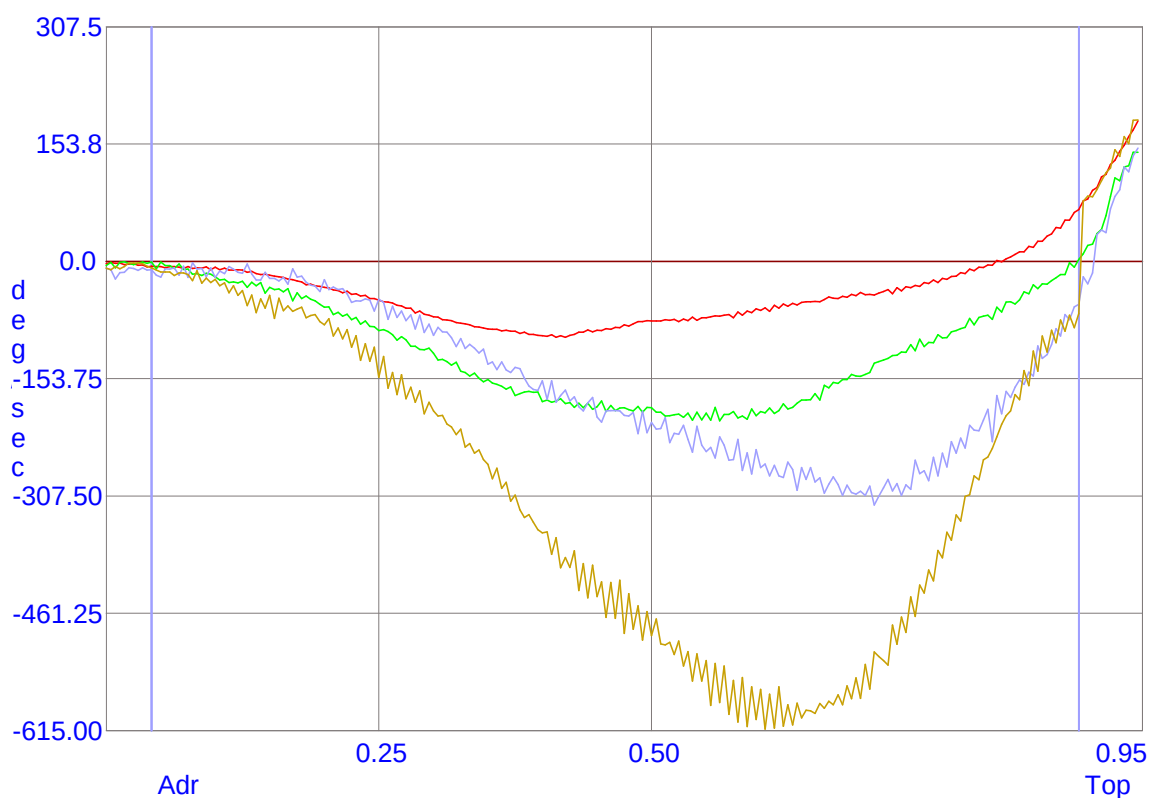
Positions at Peak Segmental Angular Speeds



		Backswing	Downswing	Follow Through
Tempo	ms	850	271	721

Backswing Sequence

Angular Velocity: **Pelvis** **Thorax** **Arm** **Club**



Backswing Parameters

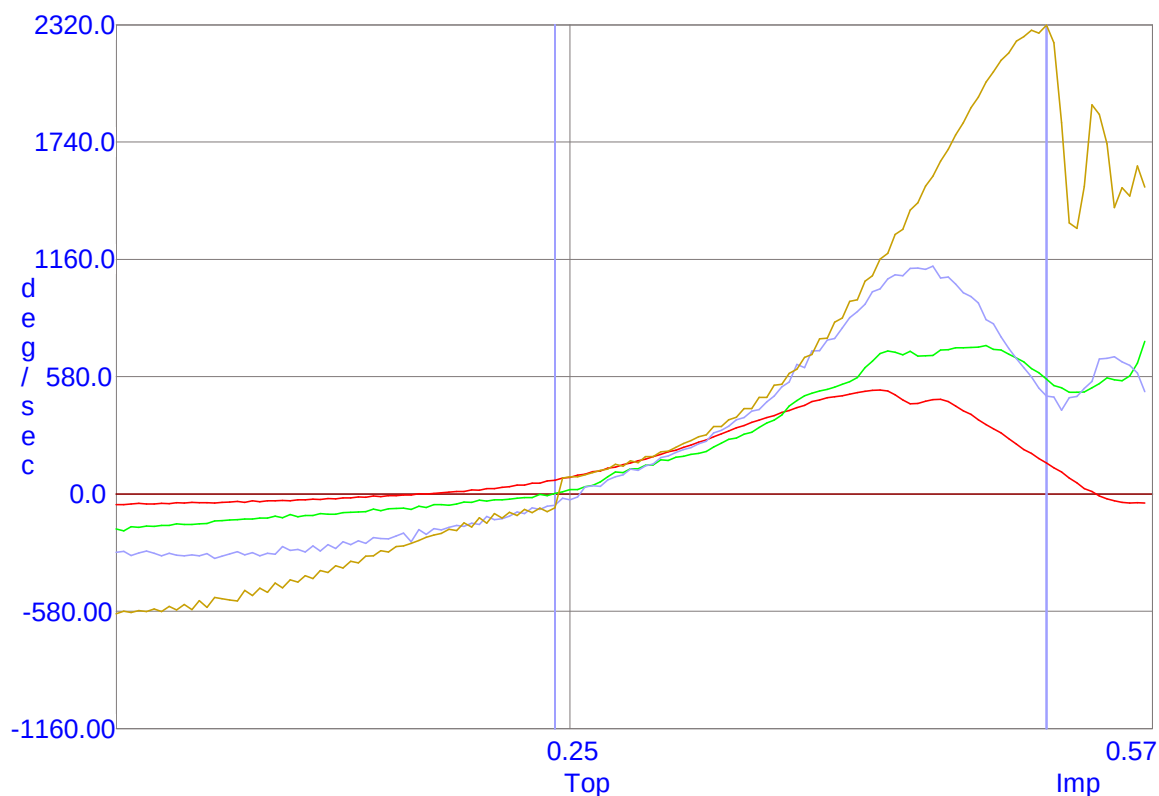
		Pelvis	Thorax	Arm	Club
Peak Order	order	1	2	4	3
Peak to Top	ms	479	329	188	288
Peak to Impact	ms	750	600	458	558
Peak Speed	d/s	99	209	319	613
Acceleration	d/s/s	251	399	466	1074
Deceleration	d/s/s	452	406	397	968

Segmental Interactions

		Pelvis-Thorax	Thorax-Arm	Arm-Club
Time Between Peaks	ms	150	142	-100

Transition Sequence

Angular Velocity: **Pelvis** **Thorax** **Arm** **Club**



Transition Parameters

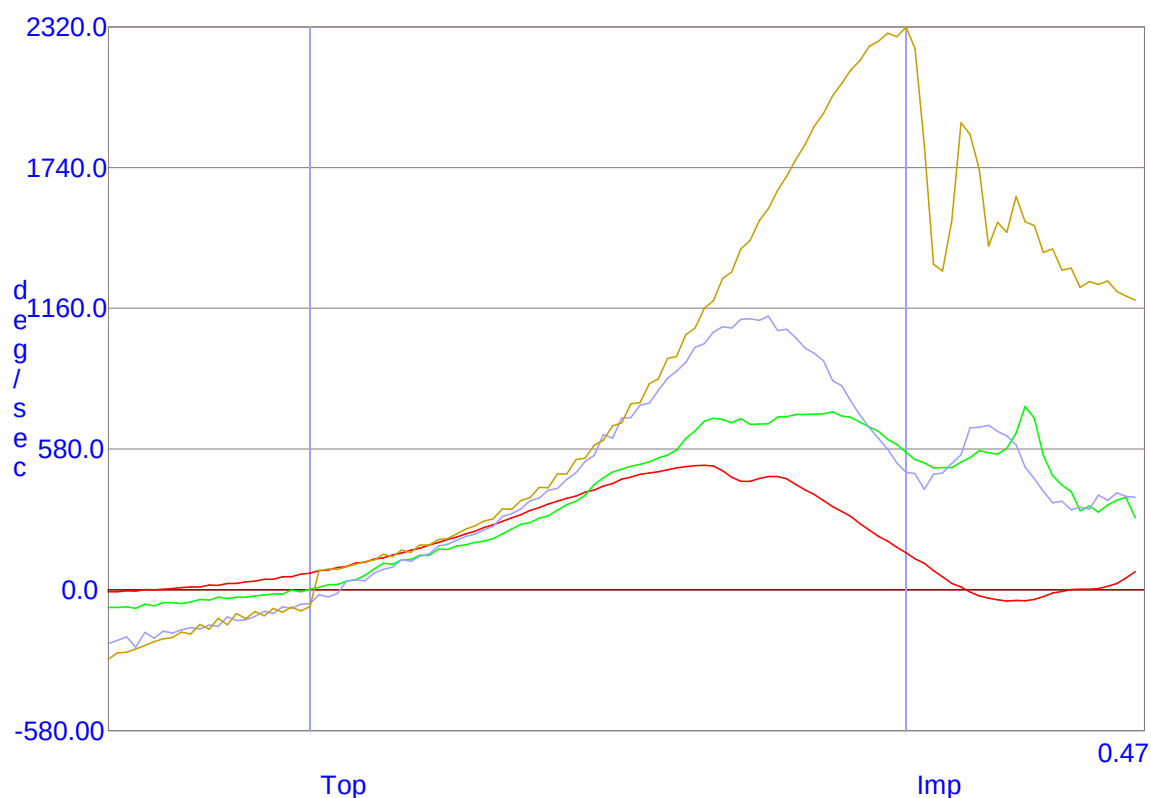
		Pelvis	Thorax	Arm	Club
Transition Order	order	1	2	4	3
Transition to Top	ms	79	4	-13	0
Transition to Peak	ms	258	242	196	271
Transition to Impact	ms	350	275	258	271
Transition Acceleration	d/s/s	542	1427	3834	4703

Segmental Interactions

		Pelvis-Thorax	Thorax-Arm	Arm-Club
Time Between Transitions	ms	75	17	-13

Downswing Sequence

Angular Velocity: **Pelvis** **Thorax** **Arm** **Club**



Sequence Parameters

		Pelvis	Thorax	Arm	Club
Peak Order	order	1	3	2	4
Peak Time Pre-Impact	ms	92	33	63	0
Peak Speed	d/s	513	733	1127	2318
% of Max	%	22	32	49	100
Acceleration	d/s/s	2007	3065	5833	8810
Deceleration	d/s/s	3934	4963	10300	8374

Segmental Interactions

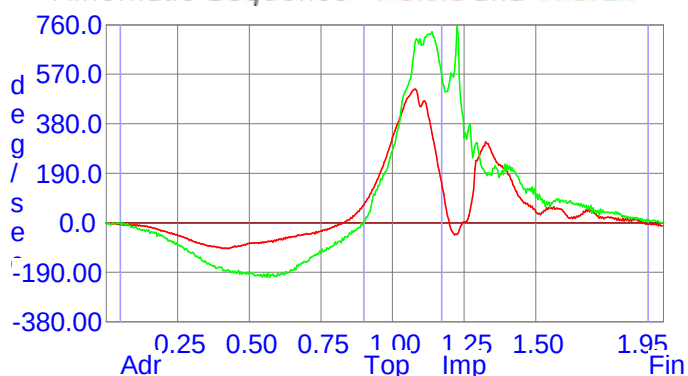
		Plv-Thx	Thx-Arm	Arm-Clb
Time Between Peaks	ms	58	-29	63
Angular Speed Gain	d/s	220	394	1190
Gain Factor	ratio	1.4	1.5	2.1

Contribution by Joint

		Legs	Core	Shldr	Wrist
% Contribution	%	22	9	17	51

Spine Link Interactions

Kinematic Sequence - Pelvis and Thorax



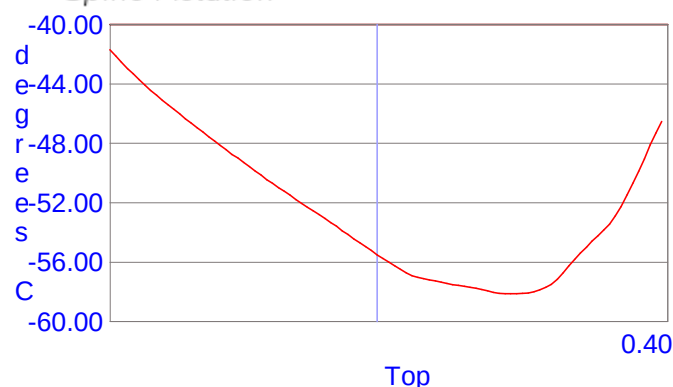
Transition Phase - Pelvis and Thorax



Total Spine Rotation (deg)

	Angle
At Pelvis Transition	50
At Thorax Transition	55
At Maximum	57

Spine Rotation



Transitional Spine Rotation (Stretch)

	Angle (deg)	Time (ms)	Rate (d/s)
Contra-Directional	5	75	64
Ipsi-Directional	2	129	18
Total Stretch	7	204	35

Transitional Timings (ms)

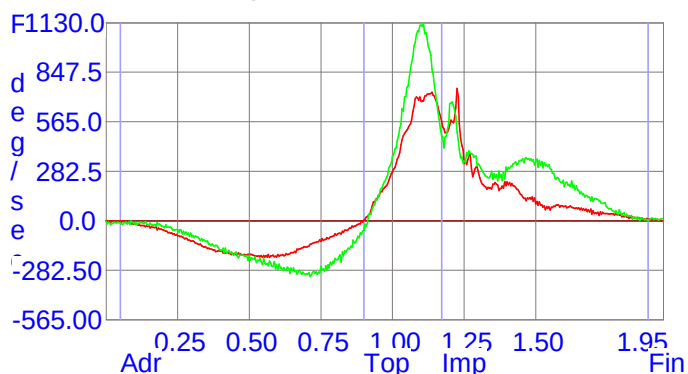
	Pelvis	Thorax
To Club Transition	79	4
To Impact	350	275

Transitional Accelerations (d/s/s)

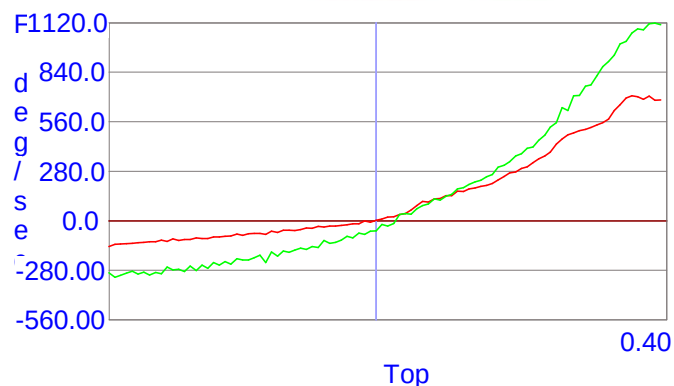
	Pelvis	Thorax
Acceleration	542	1427

Shoulder Link Interactions

Kinematic Sequence - Thorax and Arm



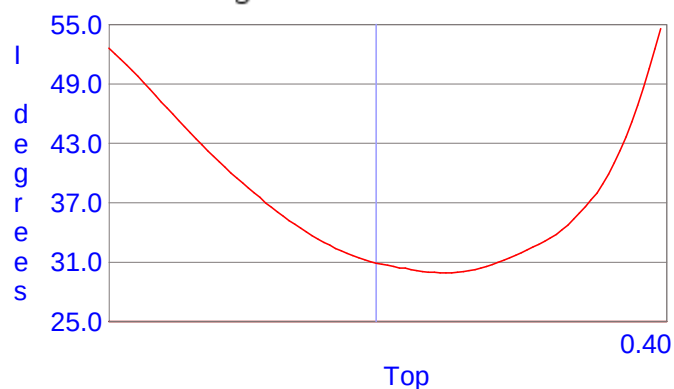
Transition Phase - Thorax and Arm



Total Shoulder Angle (deg)

	Angle
At Thorax Transition	31
At Arm Transition	31
At Min Angle	30

Shoulder Angle



Transitional Shoulder Stretch

	Angle (deg)	Time (ms)	Rate (d/s)
Contra-Directional	0	17	28
Ipsi-Directional	1	38	18
Total Stretch	1	54	21

Transitional Timings (ms)

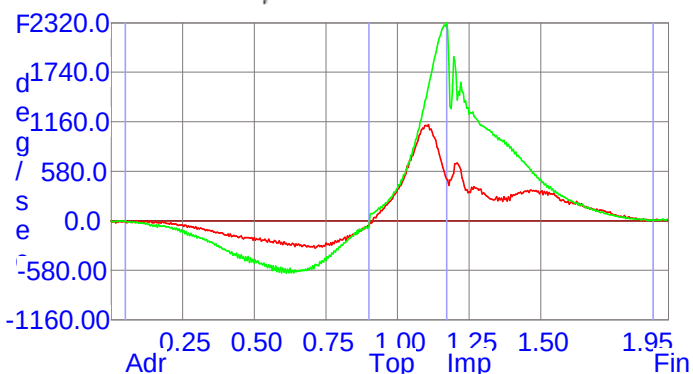
	Thorax	Lead Arm
To Club Transition	4	-13
To Impact	275	258

Transitional Accelerations (d/s/s)

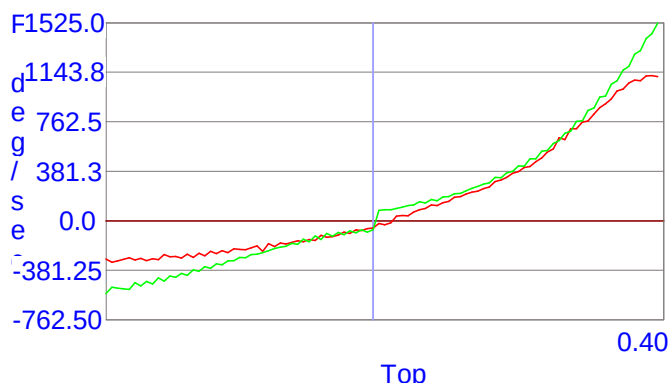
	Thorax	Lead Arm
Acceleration	1427	3834

Wrist Link Interactions

Kinematic Sequence - Arm and Club



Transition Phase - Arm and Club



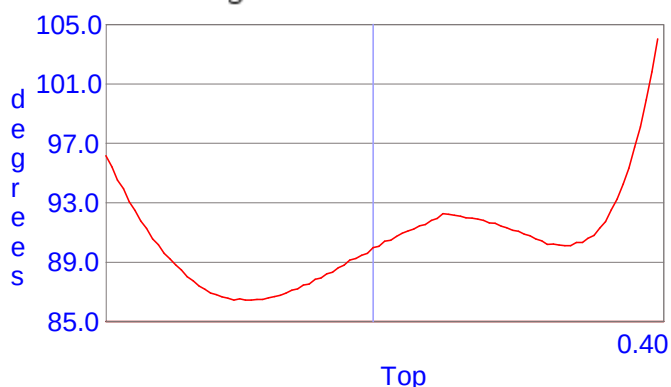
Wrist Set Angles (deg)

	Angle
At Arm Transition	90
At Club Transition	90
At Max Set	86
At Arm 30deg Pre-Impact	115

Shaft Lean (deg)

	Angle
At Impact	16 F

Wrist Set Angle



Transitional Wrist Set Stretch

	Angle (deg)	Time (ms)	Rate (d/s)
Contra-Directional	0	0	0
Ipsi-Directional	0	0	0
Total Stretch	0	0	0

Transitional Timings (ms)

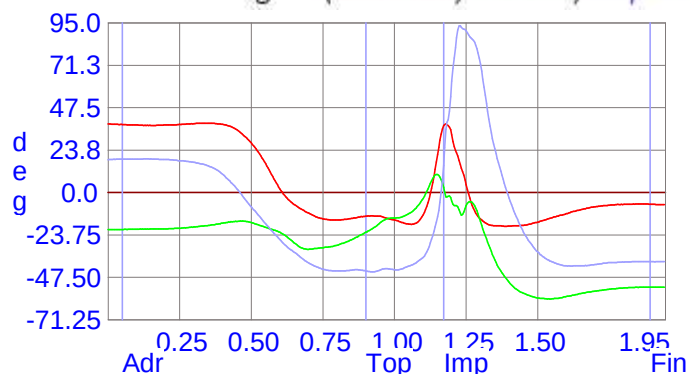
	Lead Arm	Club
To Club Transition	-13	0
To Impact	258	271

Transitional Accelerations (d/s/s)

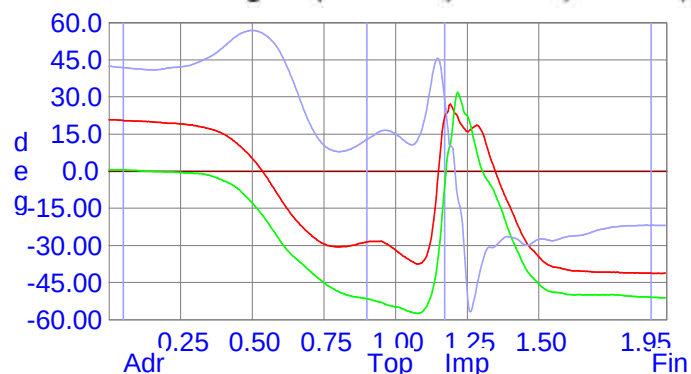
	Lead Arm	Club
Acceleration	3834	4703

Wrist Link Interactions

Lead Wrist Angles (Uln-Rad, Flx-Ext, Sup-Pro)



Trail Wrist Angles (Uln-Rad, Flx-Ext, Pro-Sup)



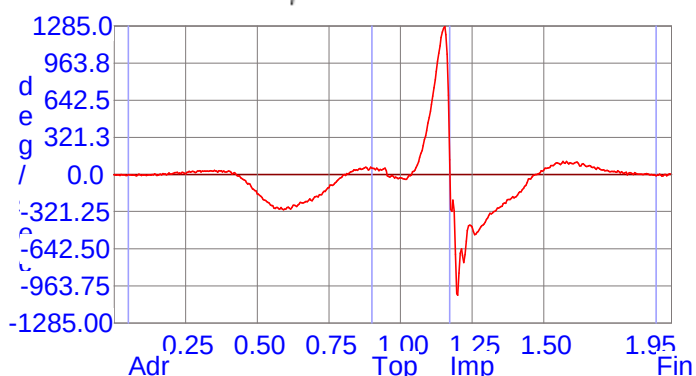
Lead Wrist Angles (Degrees)

	Adr	Top	Imp	Fin
Deviation	38 U	13 R	37 U	7 R
Flexion Extension	21 E	22 E	3 F	53 E
Forearm Sup-Pro	19 S	44 P	15 S	39 P

Trail Wrist Angles (Degrees)

	Adr	Top	Imp	Fin
Deviation	20 U	29 R	22 U	41 R
Flexion Extension	1 F	52 E	6 E	51 E
Forearm Pro-Sup	42 P	13 P	29 P	22 S

Wrist Release Speed



Angular Velocities (Deg/Sec)

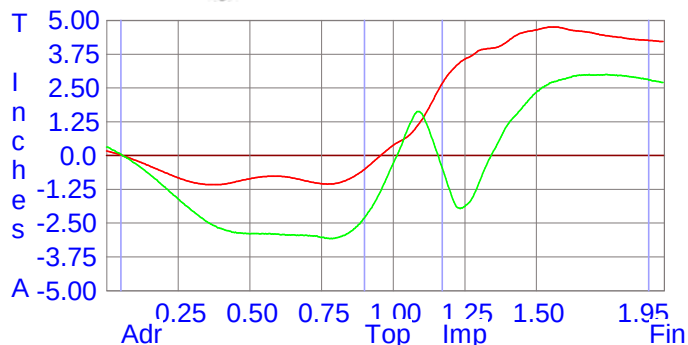
	Imp
Lead Wrist Sup-Pro Vel	1916 S
Lead Wrist Ext-Flex Vel	683 E
Trail Elbow Extn Vel	1080 E
Club Handle Axial Vel	1677 C

Max Release Speed deg/sec 1280

Projected Impact Speed mph 98

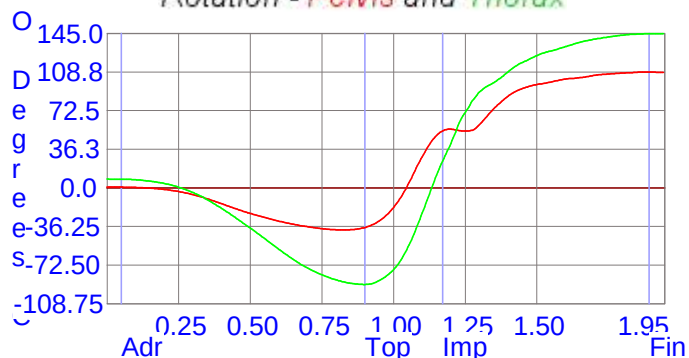
Trunk Dynamic Stability

Sway - Pelvis and Thorax



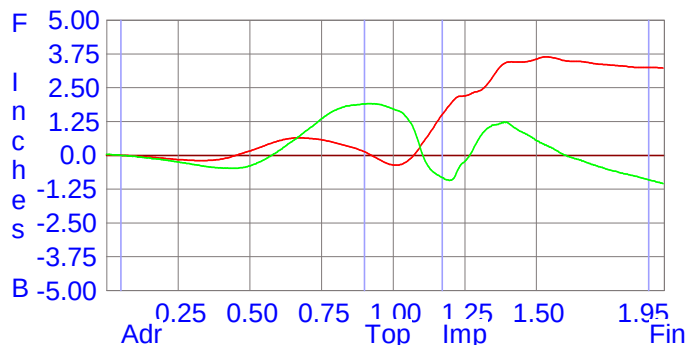
(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 T	0.5 A	2.7 T	4.3 T
Thorax	0.0 T	2.3 A	0.5 A	2.8 T

Rotation - Pelvis and Thorax



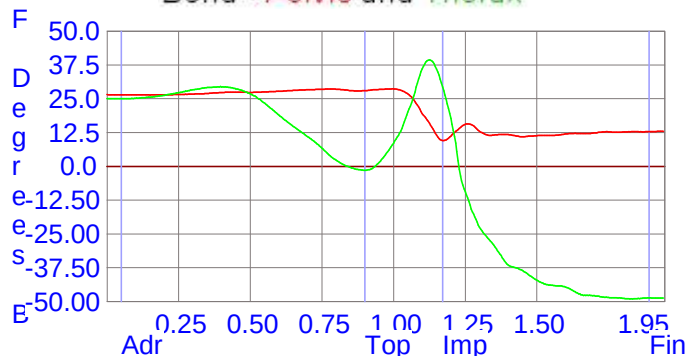
(Degrees)	Adr	Top	Imp	Fin
Pelvis	1 O	37 C	53 O	4 O
Thorax	8 O	91 C	25 O	145 O

Thrust - Pelvis and Thorax



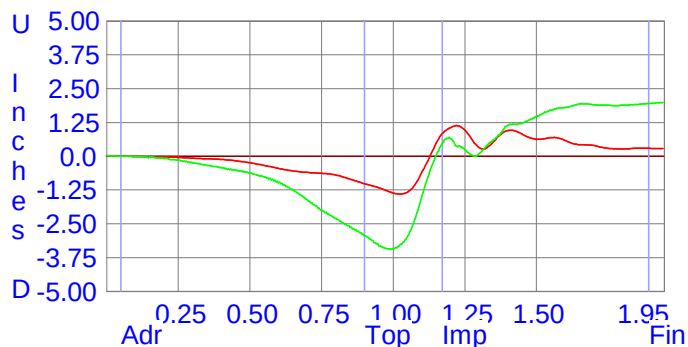
(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 F	0.1 F	1.5 F	3.3 F
Thorax	0.0 B	1.9 F	0.8 B	0.9 B

Bend - Pelvis and Thorax



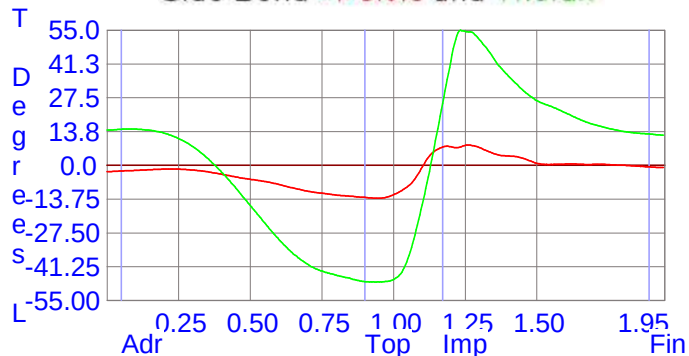
(Degrees)	Adr	Top	Imp	Fin
Pelvis	27 F	28 F	10 F	13 F
Thorax	25 F	1 B	29 F	49 B

Lift - Pelvis and Thorax



(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 U	1.0 D	0.8 U	0.3 U
Thorax	0.0 U	2.9 D	0.5 U	1.9 U

Side Bend - Pelvis and Thorax



(Degrees)	Adr	Top	Imp	Fin
Pelvis	2 L	13 L	7 T	1 L
Thorax	15 T	47 L	25 T	13 T

Dynamic Range of Motion

Head Angles (deg)

Rotation	22 C	79 O	100
Bend	67 F	1 B	68
Side Bend	19 L	44 T	63

Neck Angles (deg)

Rotation	62 C	71 O	133
Flexion-Extension	18 E	71 E	53
Side Bend	45 L	42 T	87

Thorax Angles (deg)

Rotation	91 C	145 O	236
Bend	39 F	49 B	88
Side Bend	48 L	55 T	102

Lead Shoulder Angles (deg)

Elevation	0 B	154 B	155
Horizontal Adduction	30 I	174 I	144

Pelvis Angles (deg)

Rotation	40 C	109 O	148
Bend	29 F	10 F	19
Side Bend	13 L	8 T	22

Spine Angles (deg)

Rotation	58 C	14 O	72
Flexion-Extension	25 F	62 E	87
Side Bend	35 L	47 T	82
Forward Tilt	44 F	23 F	21
Side Tilt	1 T	22 T	20

Trail Elbow Angles (deg)

Flexion-Extension	173 F	75 F	99
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Lead Elbow Angles (deg)

Flexion-Extension	168 F	68 F	100
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Trail Wrist Angles (deg)

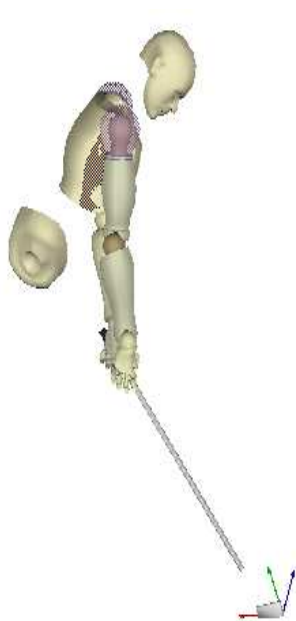
Rotation	57 S	57 P	114
Flexion-Extension	32 E	57 F	89
Deviation	27 U	41 R	68

Lead Wrist Angles (deg)

Rotation	93 S	44 P	138
Flexion-Extension	10 F	60 E	70
Deviation	39 U	19 R	58

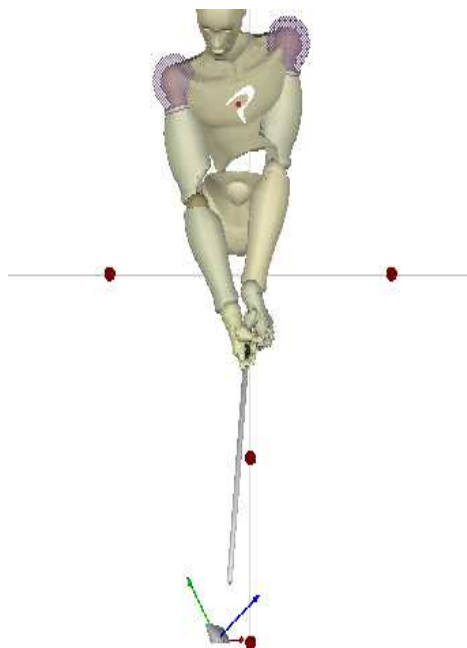
Columns are max range to each side and total range traveled

Position At Address



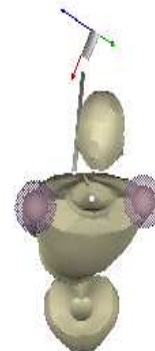
Angles (deg)

	Pelvis	Thorax
Rotation	1 O	8 O
Bend	27 F	25 F
Side Bend	2 L	15 T

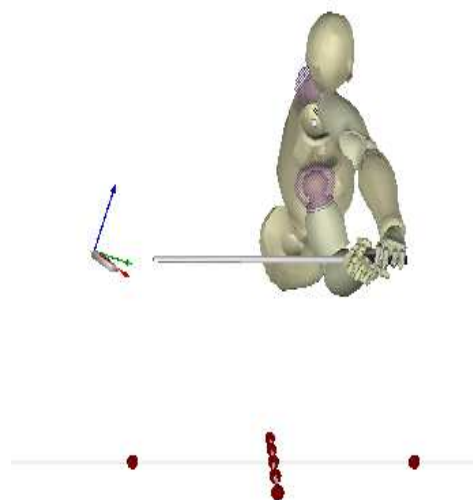
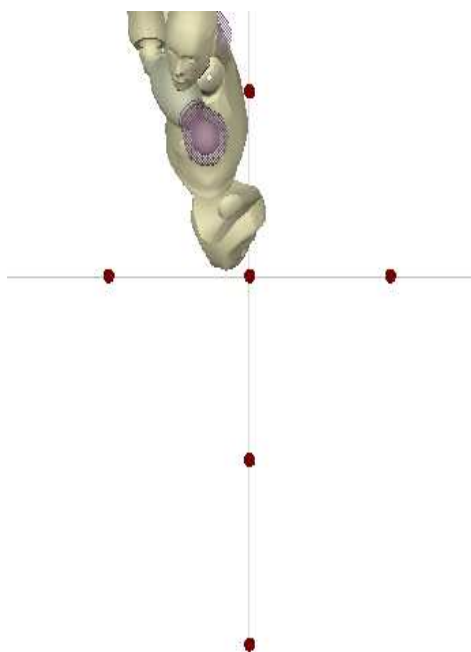
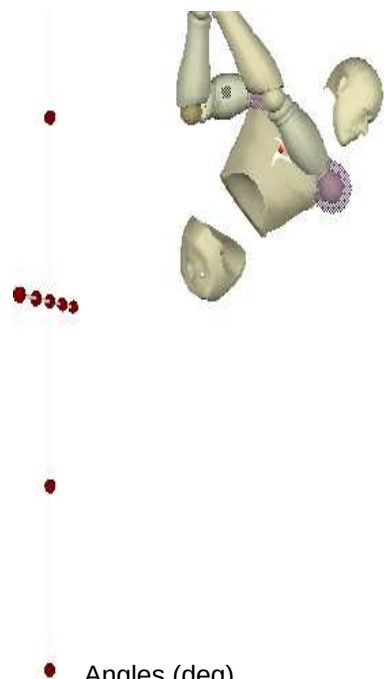


Angles (deg)

	Spine
Rotation	7 O
Flexion-Extension	1 B
Side Bend	17 T



Position At Top



Angles (deg)

	Pelvis	Thorax
Rotation	37 C	91 C
Bend	28 F	1 B
Side Bend	13 L	47 L

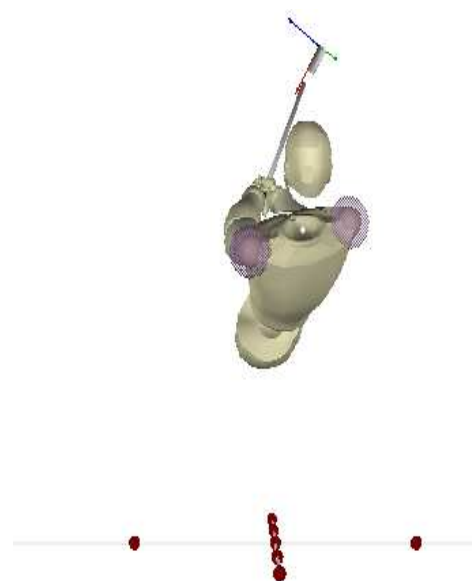
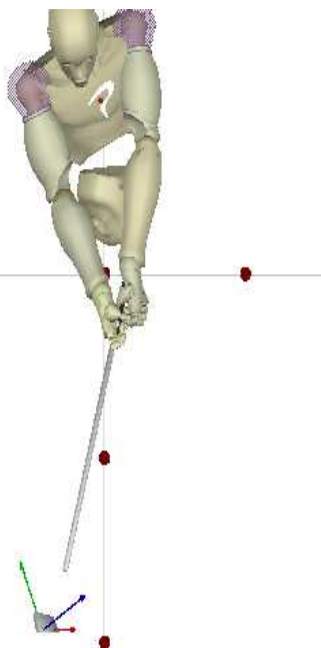
Angles (deg)

	Spine
Rotation	56 C
Flexion-Extension	29 B
Side Bend	34 L

Displacements (inches)

	Pelvis	Thorax
Sway	0.5 A	2.3 A
Thrust	0.1 F	1.9 F
Lift	1.0 D	2.9 D

Position At Impact



Angles (deg)

	Pelvis	Thorax
Rotation	53 O	25 O
Bend	10 F	29 F
Side Bend	7 T	25 T

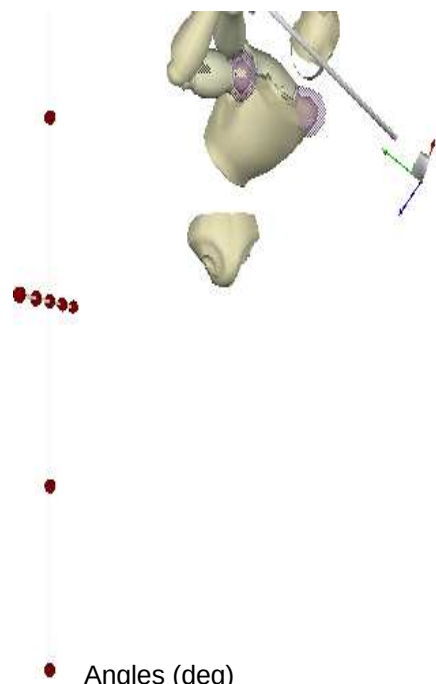
Angles (deg)

	Spine
Rotation	30 C
Flexion-Extension	20 F
Side Bend	18 T

Displacements (inches)

	Pelvis	Thorax
Sway	2.7 T	0.5 A
Thrust	1.5 F	0.8 B
Lift	0.8 U	0.5 U

Position At Finish

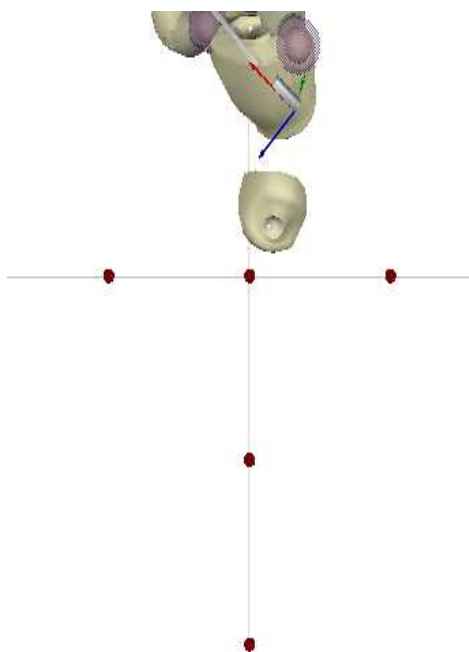


Angles (deg)

	Pelvis	Thorax
Rotation	109 O	145 O
Bend	13 F	49 B
Side Bend	1 L	13 T

Displacements (inches)

	Pelvis	Thorax
Sway	4.3 T	2.8 T
Thrust	3.3 F	0.9 B
Lift	0.3 U	1.9 U



Angles (deg)

	Spine
Rotation	13 O
Flexion-Extension	61 B
Side Bend	13 T

