

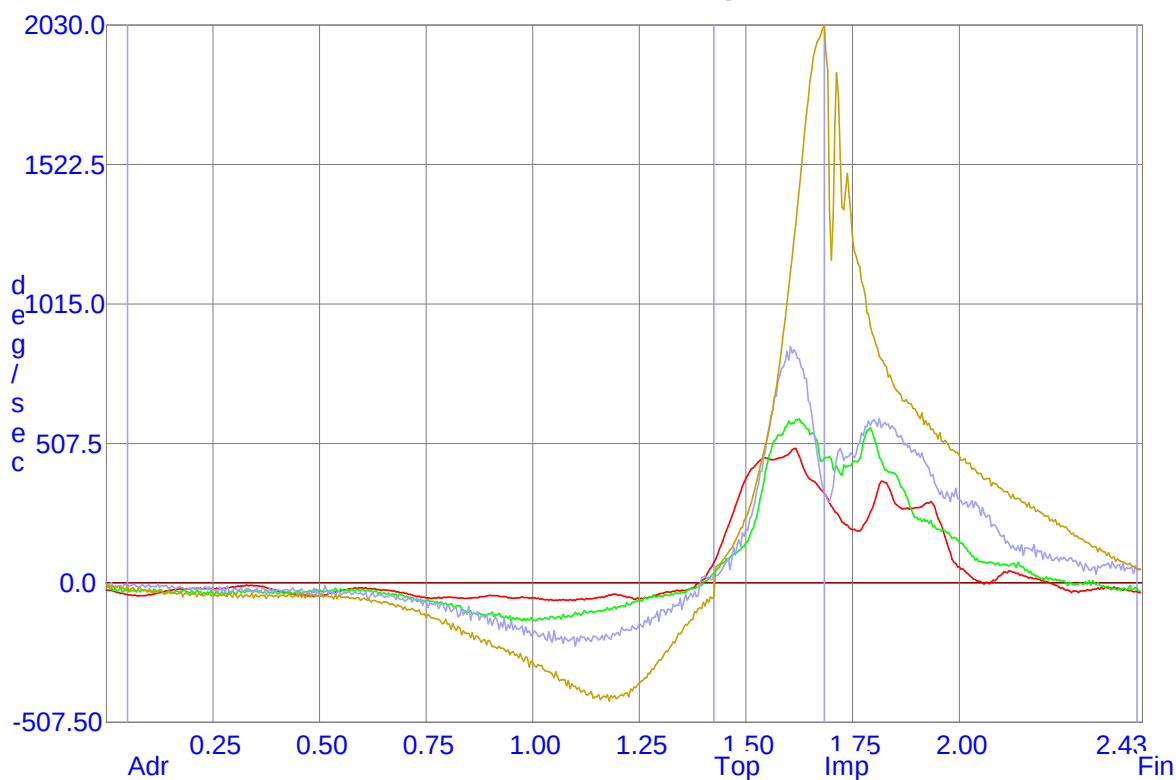
TPI 3D

■ **BIOMECHANICAL SPORTS ANALYSIS**

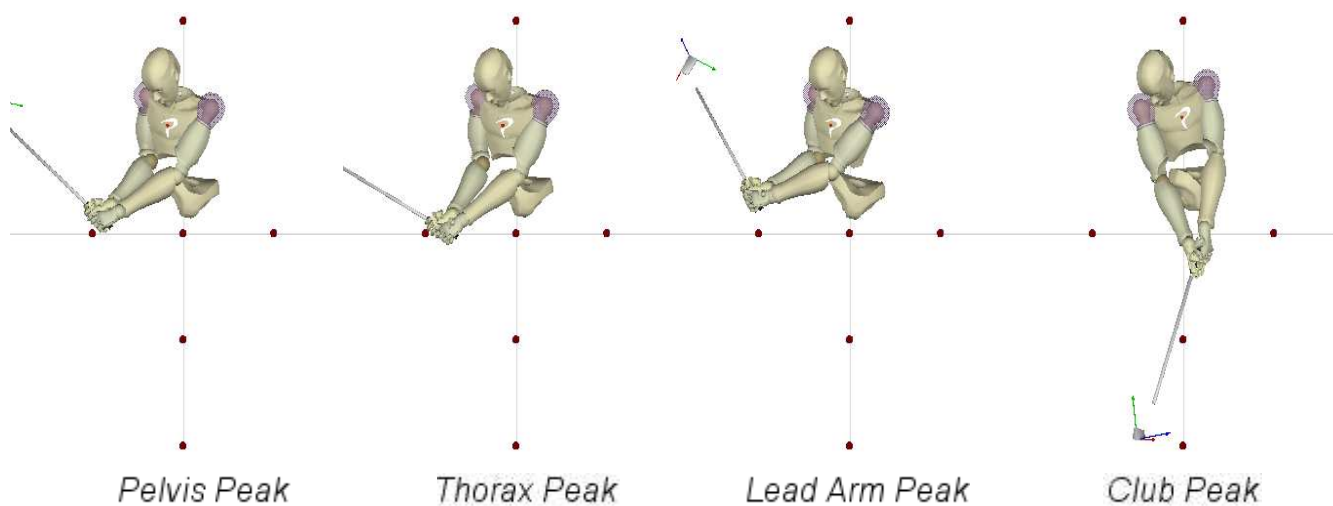


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Kinematic Sequence



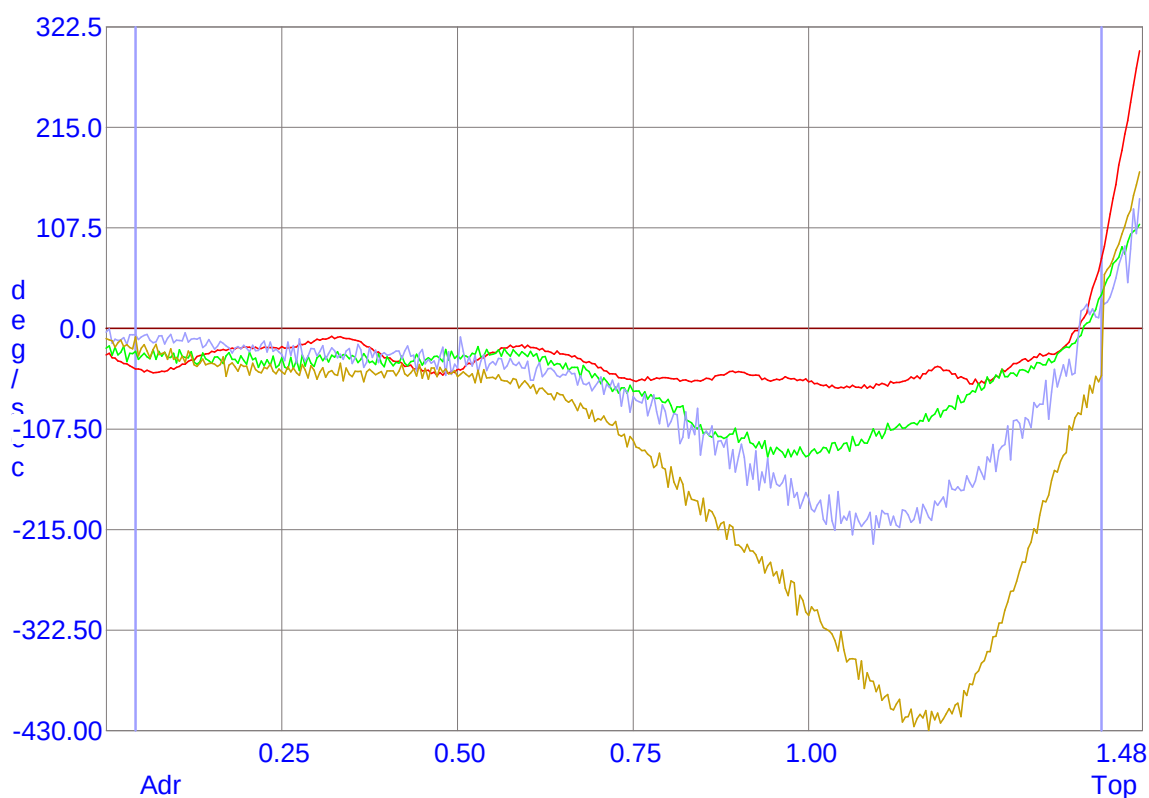
Positions at Peak Segmental Angular Speeds



		Backswing	Downswing	Follow Through
Tempo	ms	1375	258	733

Backswing Sequence

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



Backswing Parameters

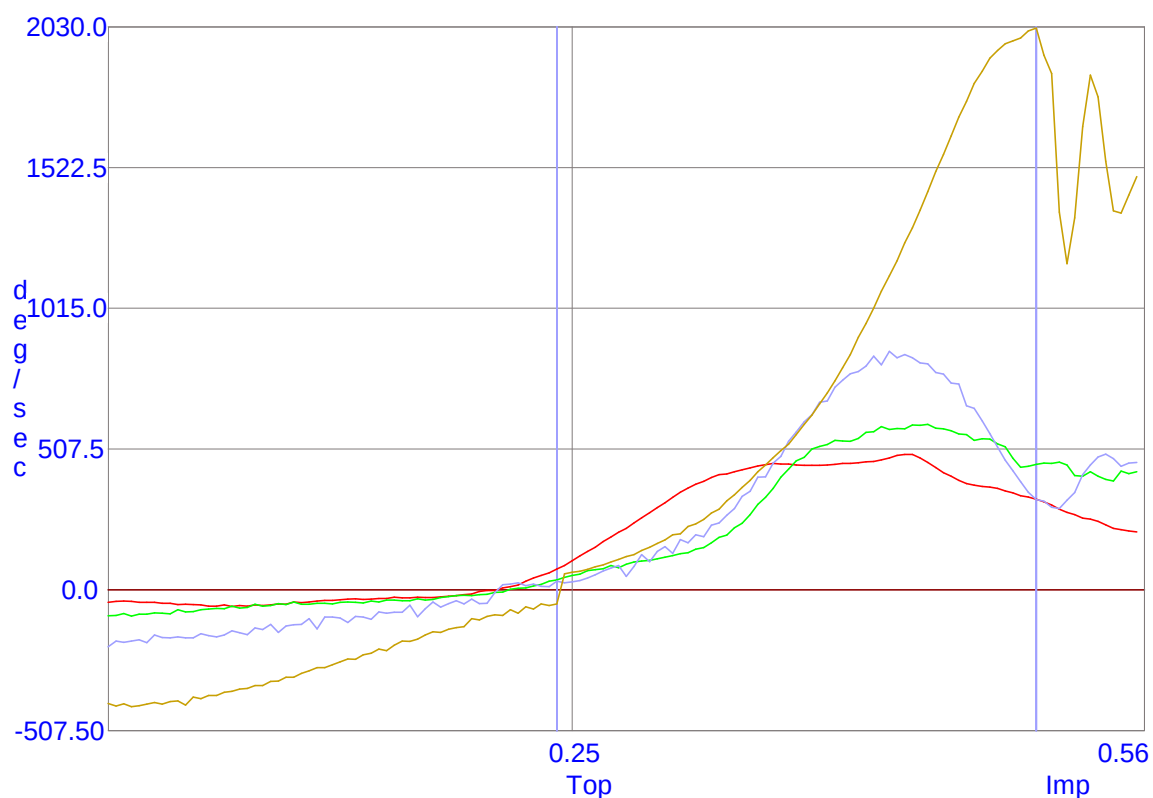
		Pelvis	Thorax	Arm	Club
Peak Order	order	2	1	3	4
Peak to Top	ms	333	450	325	246
Peak to Impact	ms	592	708	583	504
Peak Speed	d/s	64	138	231	430
Acceleration	d/s/s	20	122	213	373
Deceleration	d/s/s	133	188	250	336

Segmental Interactions

		Pelvis-Thorax	Thorax-Arm	Arm-Club
Time Between Peaks	ms	-117	125	79

Transition Sequence

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



Transition Parameters

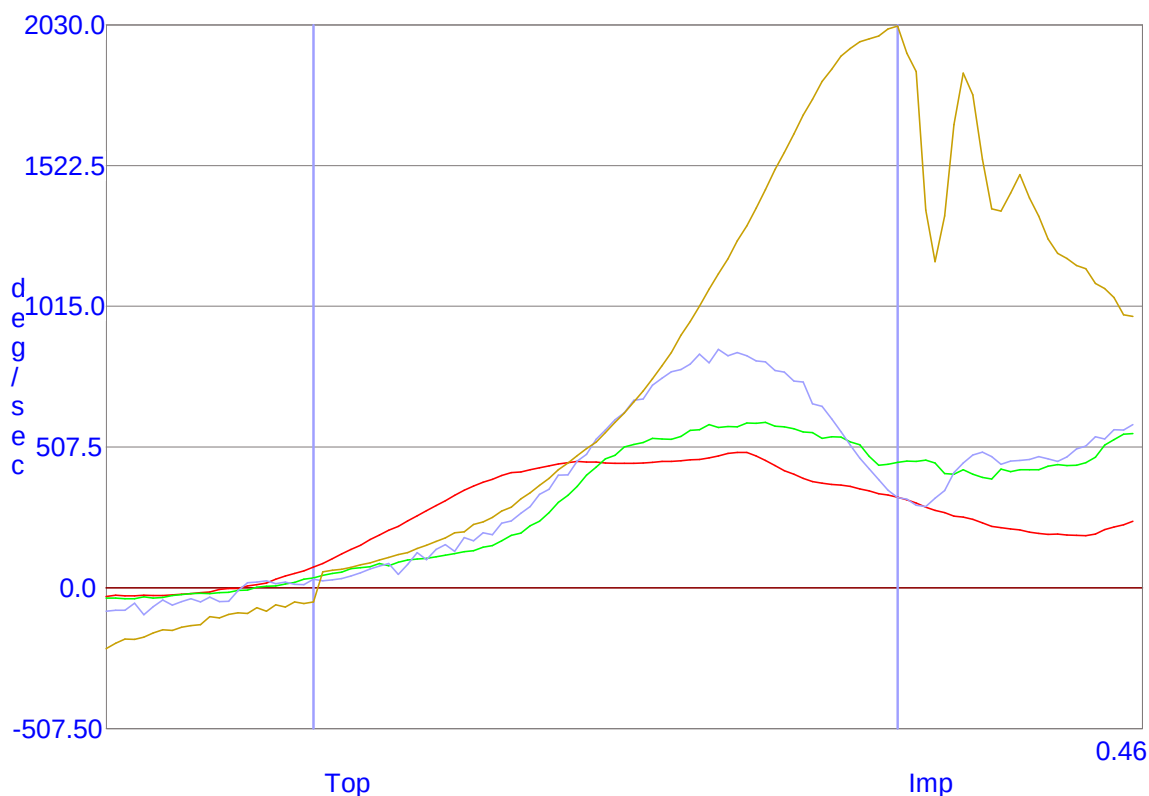
		Pelvis	Thorax	Arm	Club
Transition Order	order	1	2	1	3
Transition to Top	ms	33	29	33	0
Transition to Peak	ms	225	229	213	258
Transition to Impact	ms	292	288	292	258
Transition Acceleration	d/s/s	1564	1109	1495	3640

Segmental Interactions

		Pelvis-Thorax	Thorax-Arm	Arm-Club
Time Between Transitions	ms	4	-4	33

Downswing Sequence

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



Sequence Parameters

		Pelvis	Thorax	Arm	Club
Peak Order	order	2	3	1	4
Peak Time Pre-Impact	ms	67	58	79	0
Peak Speed	d/s	489	596	859	2026
% of Max	%	24	29	42	100
Acceleration	d/s/s	2181	2635	4438	8036
Deceleration	d/s/s	2425	2470	6747	8512

Segmental Interactions

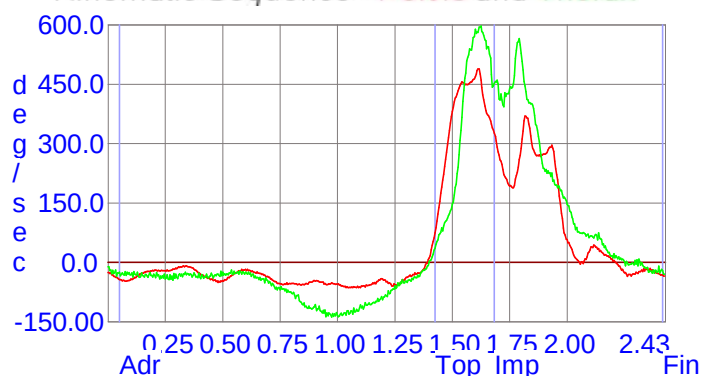
		Plv-Thx	Thx-Arm	Arm-Clb
Time Between Peaks	ms	8	-21	79
Angular Speed Gain	d/s	108	263	1166
Gain Factor	ratio	1.2	1.4	2.4

Contribution by Joint

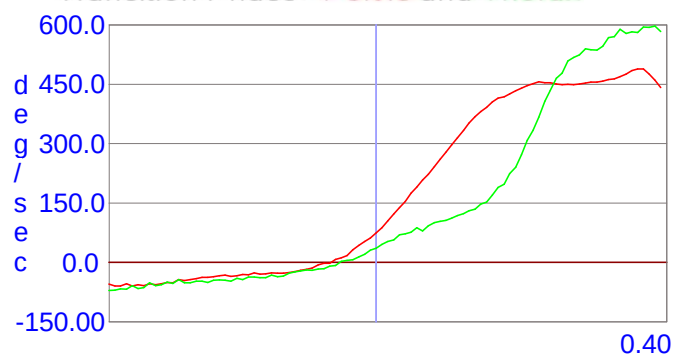
		Legs	Core	Shldr	Wrist
% Contribution	%	24	5	13	58

Spine Link Interactions

Kinematic Sequence - Pelvis and Thorax



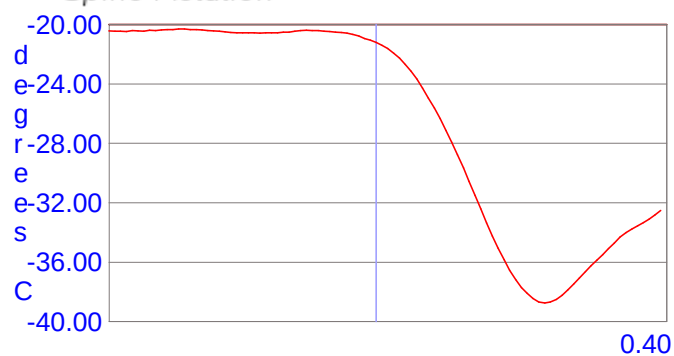
Transition Phase - Pelvis and Thorax



Total Spine Rotation (deg)

	Angle
At Pelvis Transition	20
At Thorax Transition	21
At Maximum	39

Spine Rotation



Transitional Spine Rotation (Stretch)

	Angle (deg)	Time (ms)	Rate (d/s)
Contra-Directional	0	4	7
Ipsi-Directional	18	154	118
Total Stretch	18	158	115

Transitional Timings (ms)

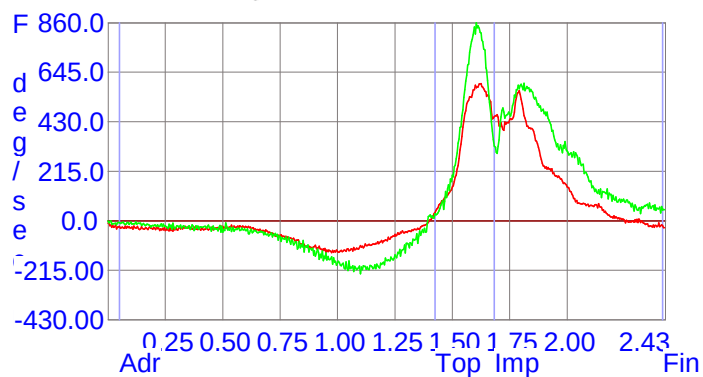
	Pelvis	Thorax
To Club Transition	33	29
To Impact	292	288

Transitional Accelerations (d/s/s)

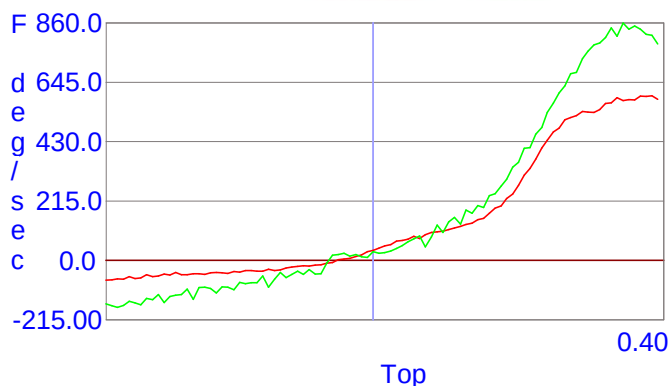
	Pelvis	Thorax
Acceleration	1564	1109

Shoulder Link Interactions

Kinematic Sequence - Thorax and Arm



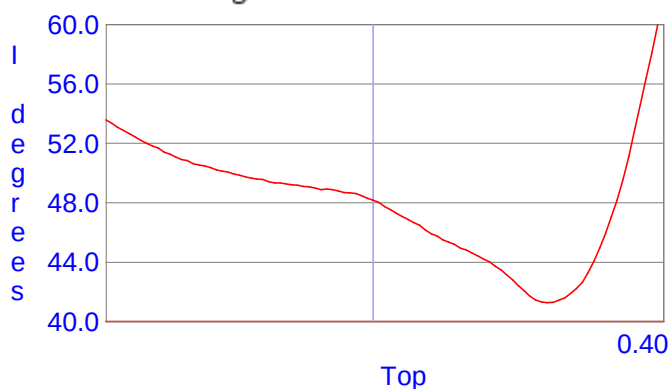
Transition Phase - Thorax and Arm



Total Shoulder Angle (deg)

	Angle
At Thorax Transition	49
At Arm Transition	49
At Min Angle	35

Shoulder Angle



Transitional Shoulder 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)

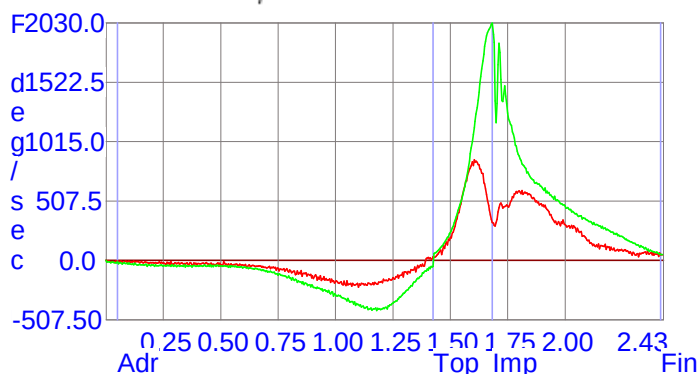
	Thorax	Lead Arm
To Club Transition	29	33
To Impact	288	292

Transitional Accelerations (d/s/s)

	Thorax	Lead Arm
Acceleration	1109	1495

Wrist Link Interactions

Kinematic Sequence - Arm and Club



Wrist Set Angles (deg)

	Angle
At Arm Transition	105
At Club Transition	106
At Max Set	105
At Arm 30deg Pre-Impact	114

Shaft Lean (deg)

	Angle
At Impact	19 F

Transitional Wrist Set Stretch

	Angle (deg)	Time (ms)	Rate (d/s)
Contra-Directional	0	33	-12
Ipsi-Directional	1	-42	-13
Total Stretch	0	-8	-17

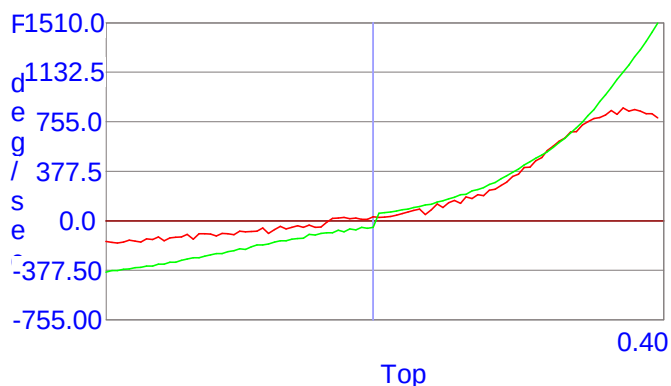
Transitional Timings (ms)

	Lead Arm	Club
To Club Transition	33	0
To Impact	292	258

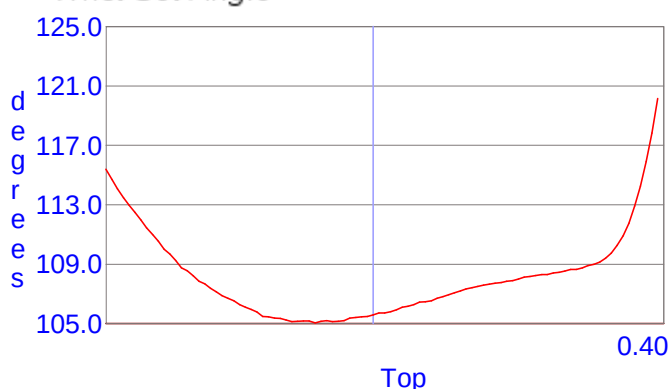
Transitional Accelerations (d/s/s)

	Lead Arm	Club
Acceleration	1495	3640

Transition Phase - Arm and Club

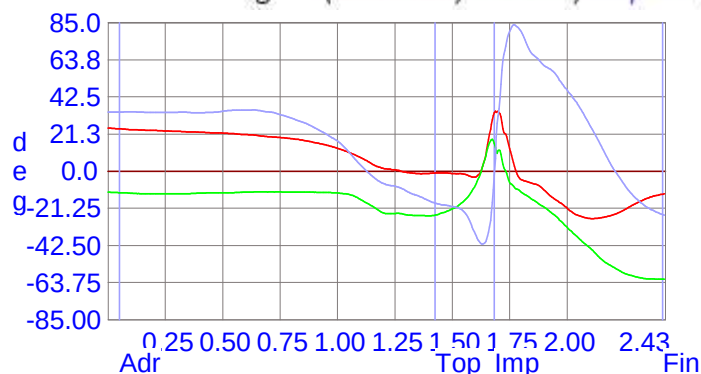


Wrist Set Angle

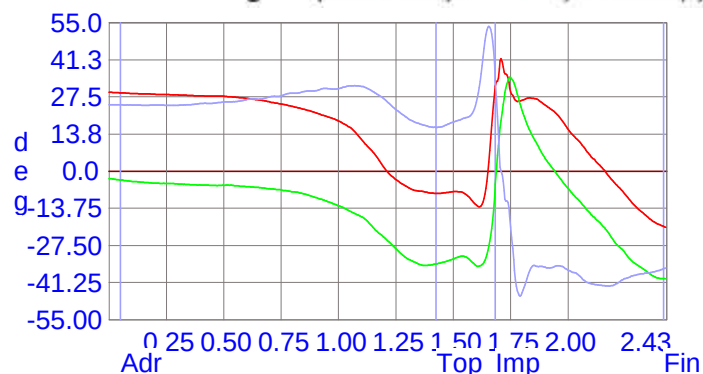


Wrist Link Interactions

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



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



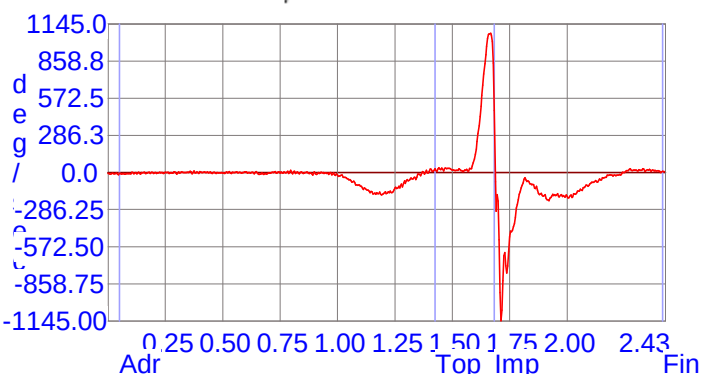
Lead Wrist Angles (Degrees)

	Adr	Top	Imp	Fin
Deviation	24 U	1 R	34 U	13 R
Flexion Extension	12 E	25 E	16 F	62 E
Forearm Sup-Pro	34 S	18 P	2 P	25 P

Trail Wrist Angles (Degrees)

	Adr	Top	Imp	Fin
Deviation	29 U	8 R	32 U	20 R
Flexion Extension	3 E	34 E	5 E	40 E
Forearm Pro-Sup	25 P	16 P	34 P	36 S

Wrist Release Speed



Angular Velocities (Deg/Sec)

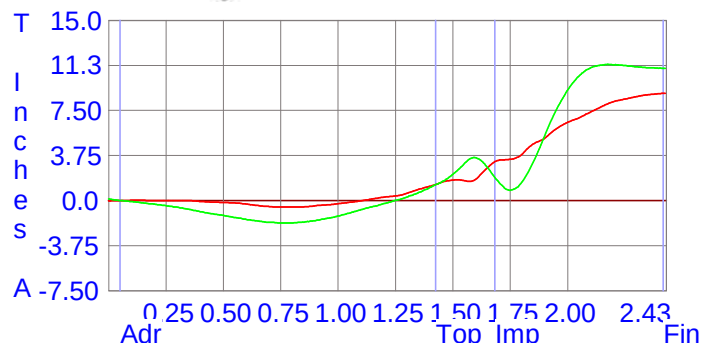
	Imp
Lead Wrist Sup-Pro Vel	1998 S
Lead Wrist Ext-Flex Vel	483 E
Trail Elbow Extn Vel	724 E
Club Handle Axial Vel	1894 C

Max Release Speed	deg/sec	1073
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Projected Impact Speed	mph	88
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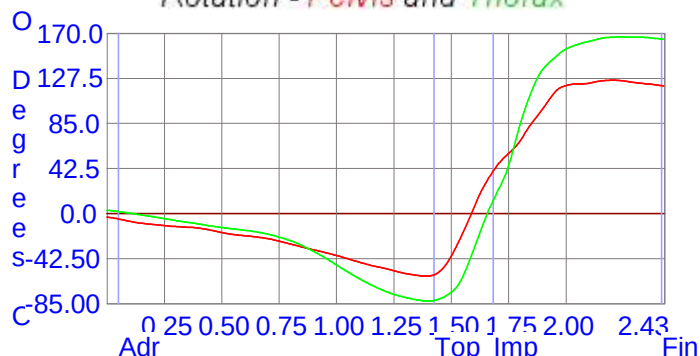
Trunk Dynamic Stability

Sway - Pelvis and Thorax



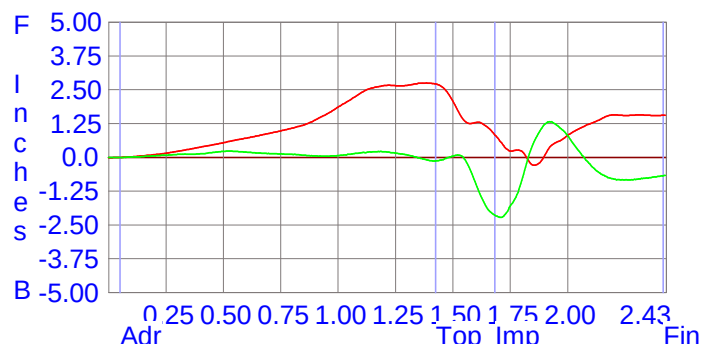
(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 A	1.3 T	3.2 T	8.9 T
Thorax	0.0 T	1.3 T	1.9 T	11.0 T

Rotation - Pelvis and Thorax



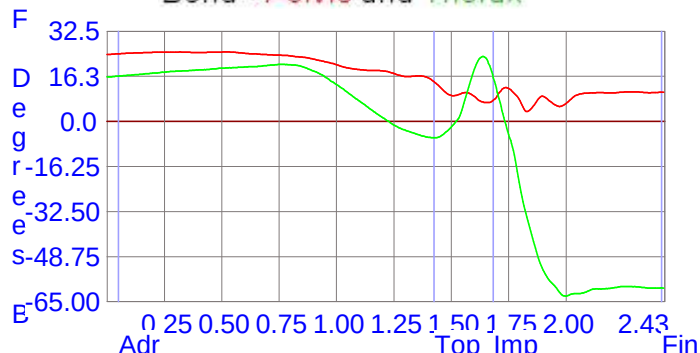
(Degrees)	Adr	Top	Imp	Fin
Pelvis	5 C	58 C	41 O	9 O
Thorax	2 O	82 C	13 O	165 O

Thrust - Pelvis and Thorax



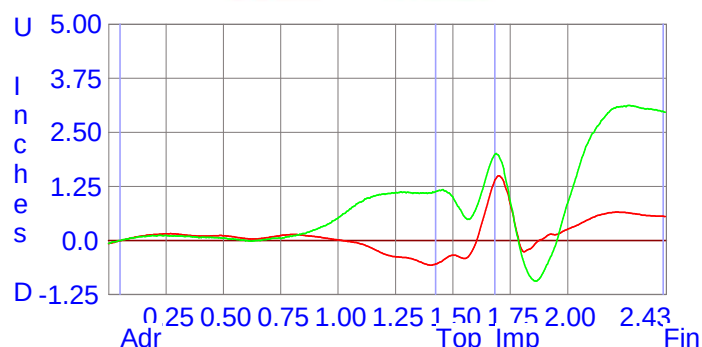
(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 B	2.7 F	0.8 F	1.6 F
Thorax	0.0 B	0.1 B	2.1 B	0.7 B

Bend - Pelvis and Thorax



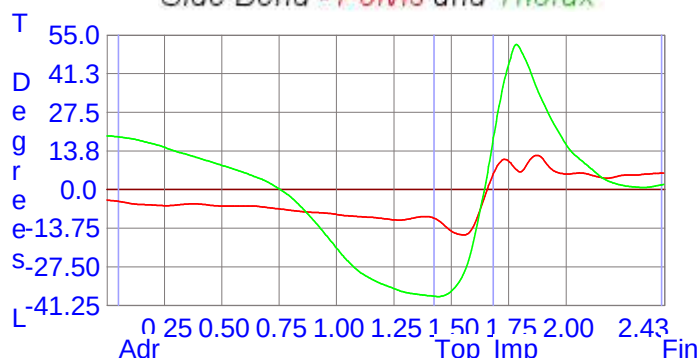
(Degrees)	Adr	Top	Imp	Fin
Pelvis	24 F	14 F	8 F	10 F
Thorax	16 F	6 B	16 F	60 B

Lift - Pelvis and Thorax



(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 D	0.5 D	1.4 U	0.6 U
Thorax	0.0 D	1.1 U	2.0 U	3.0 U

Side Bend - Pelvis and Thorax



(Degrees)	Adr	Top	Imp	Fin
Pelvis	4 L	10 L	6 T	6 T
Thorax	19 T	38 L	18 T	2 T

Dynamic Range of Motion

Head Angles (deg)

Rotation	36 C	100 O	136
Bend	74 F	19 B	93
Side Bend	12 L	57 T	69

Thorax Angles (deg)

Rotation	82 C	167 O	249
Bend	23 F	63 B	86
Side Bend	38 L	52 T	90

Pelvis Angles (deg)

Rotation	59 C	126 O	185
Bend	25 F	4 F	22
Side Bend	16 L	12 T	28

Trail Elbow Angles (deg)

Flexion-Extension	169 F	82 F	86
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Trail Wrist Angles (deg)

Rotation	54 S	46 P	100
Flexion-Extension	35 E	40 F	75
Deviation	42 U	21 R	63

Neck Angles (deg)

Rotation	67 C	48 O	115
Flexion-Extension	39 E	72 E	33
Side Bend	35 L	33 T	68

Lead Shoulder Angles (deg)

Elevation	24 B	148 B	124
Horizontal Adduction	35 I	184 I	148

Spine Angles (deg)

Rotation	39 C	22 O	61
Flexion-Extension	16 F	72 E	88
Side Bend	28 L	45 T	73
Forward Tilt	39 F	26 F	13
Side Tilt	2 L	18 T	20

Lead Elbow Angles (deg)

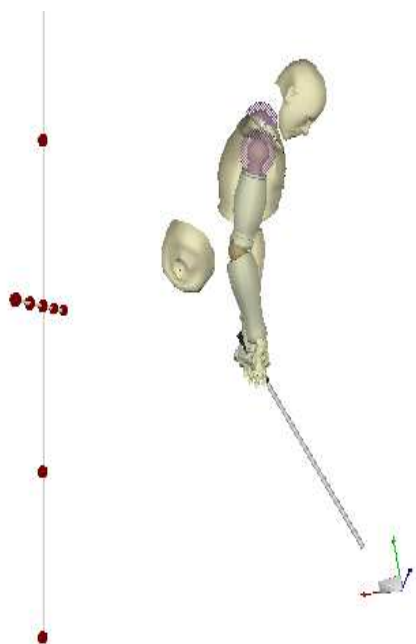
Flexion-Extension	162 F	74 F	89
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Lead Wrist Angles (deg)

Rotation	84 S	42 P	126
Flexion-Extension	18 F	62 E	80
Deviation	34 U	27 R	62

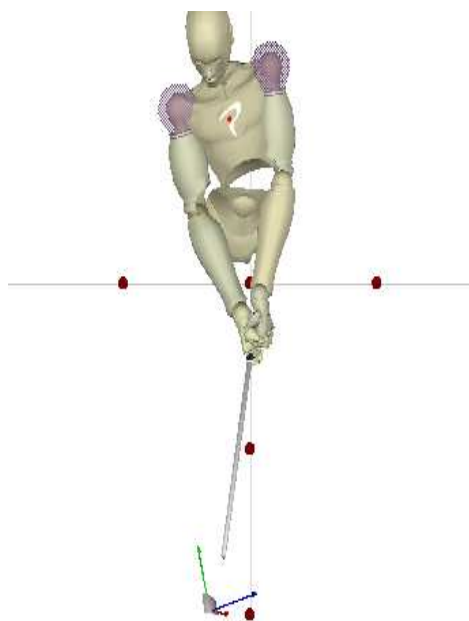
Columns are max range to each side and total range traveled

Position At Address



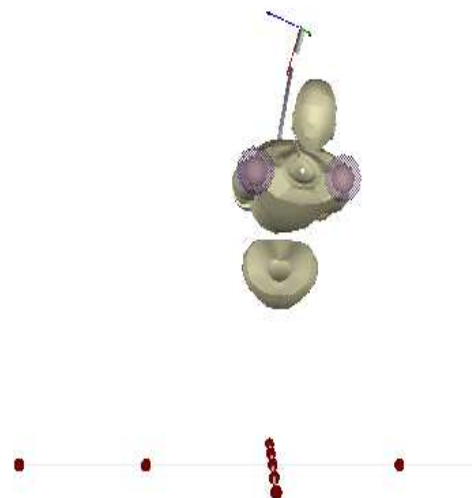
Angles (deg)

	Pelvis	Thorax
Rotation	5 C	2 O
Bend	24 F	16 F
Side Bend	4 L	19 T

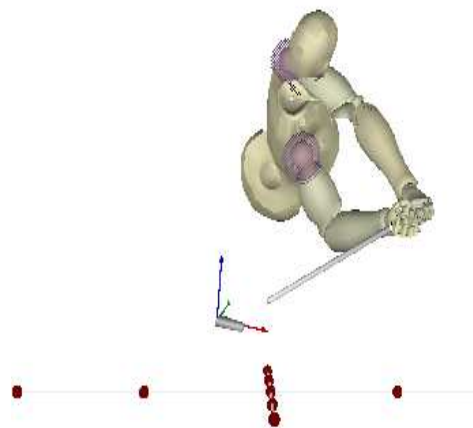
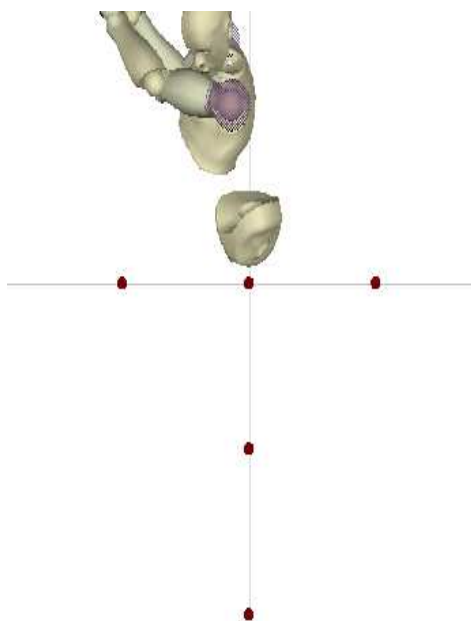
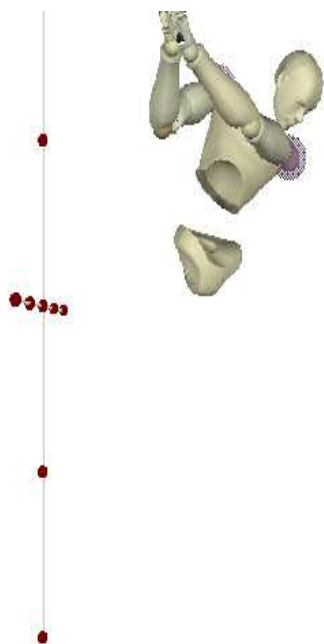


Angles (deg)

	Spine
Rotation	7 O
Flexion-Extension	8 B
Side Bend	23 T



Position At Top



Angles (deg)

	Pelvis	Thorax
Rotation	58 C	82 C
Bend	14 F	6 B
Side Bend	10 L	38 L

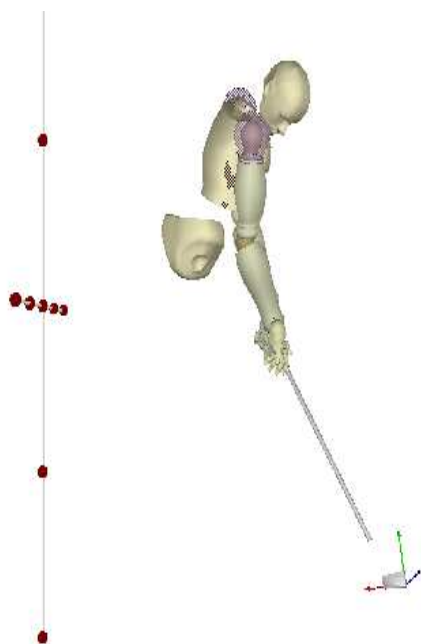
Angles (deg)

	Spine
Rotation	21 C
Flexion-Extension	20 B
Side Bend	28 L

Displacements (inches)

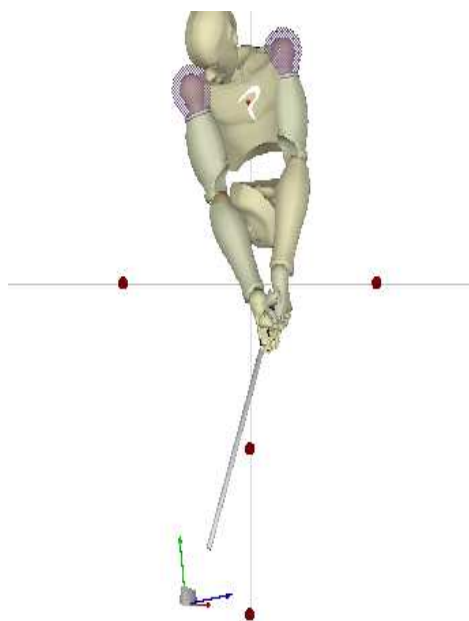
	Pelvis	Thorax
Sway	1.3 T	1.3 T
Thrust	2.7 F	0.1 B
Lift	0.5 D	1.1 U

Position At Impact



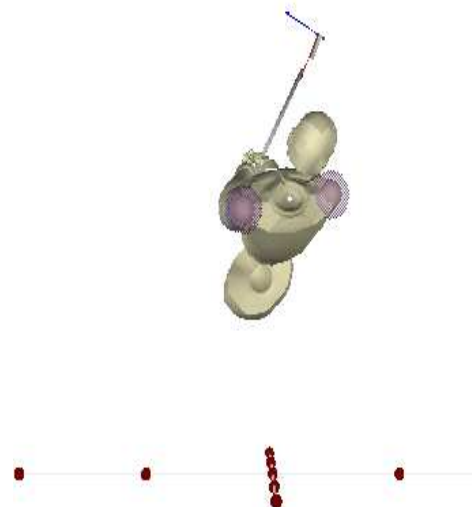
Angles (deg)

	Pelvis	Thorax
Rotation	41 O	13 O
Bend	8 F	16 F
Side Bend	6 T	18 T



Angles (deg)

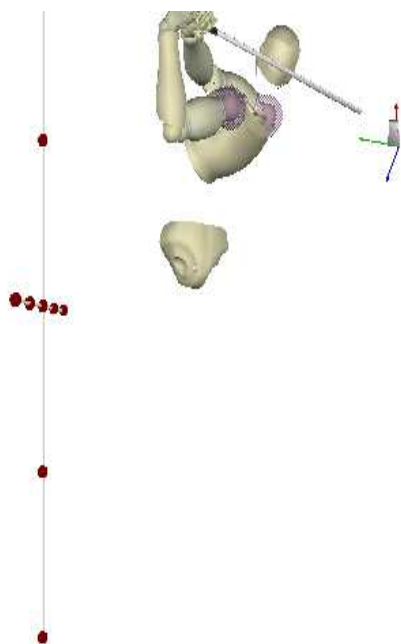
	Spine
Rotation	30 C
Flexion-Extension	8 F
Side Bend	13 T



Displacements (inches)

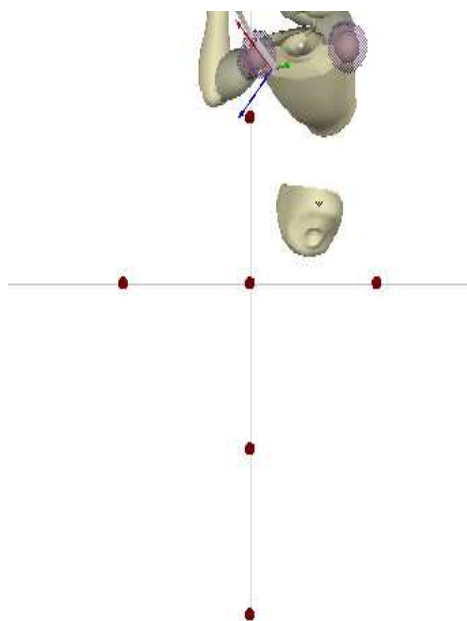
	Pelvis	Thorax
Sway	3.2 T	1.9 T
Thrust	0.8 F	2.1 B
Lift	1.4 U	2.0 U

Position At Finish



Angles (deg)

	Pelvis	Thorax
Rotation	121 O	165 O
Bend	10 F	60 B
Side Bend	6 T	2 T



Angles (deg)

	Spine
Rotation	22 O
Flexion-Extension	71 B
Side Bend	4 L

Displacements (inches)

	Pelvis	Thorax
Sway	8.9 T	11.0 T
Thrust	1.6 F	0.7 B
Lift	0.6 U	3.0 U

