

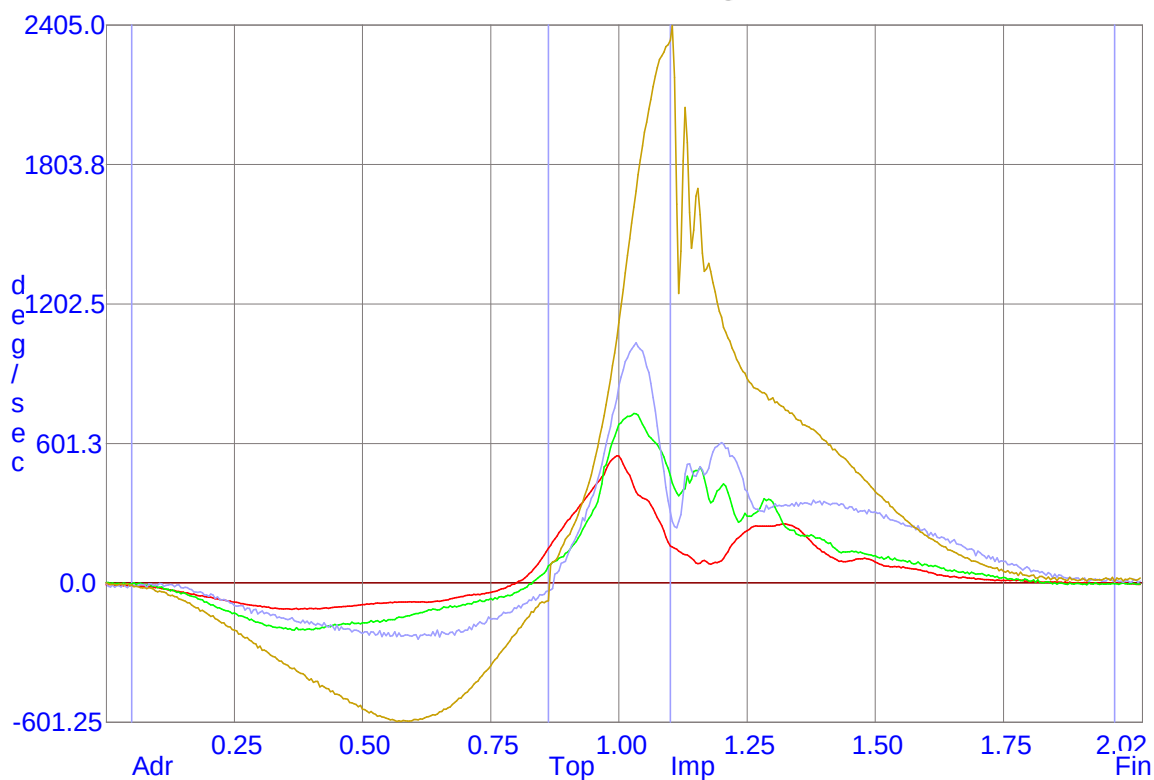
TPI 3D

■ **BIOMECHANICAL SPORTS ANALYSIS**

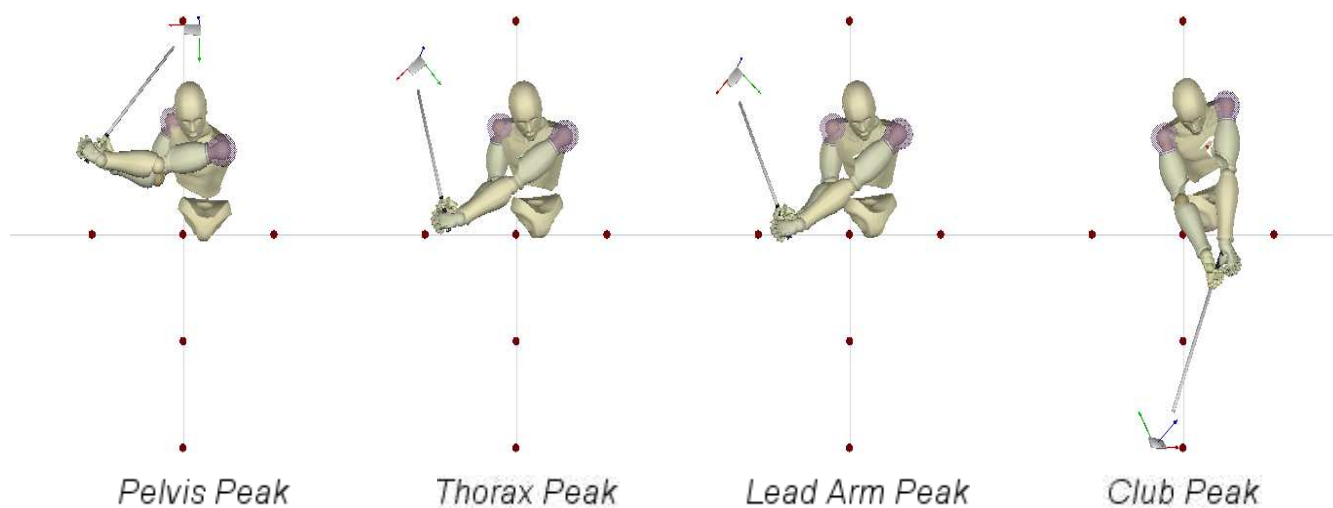


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Kinematic Sequence



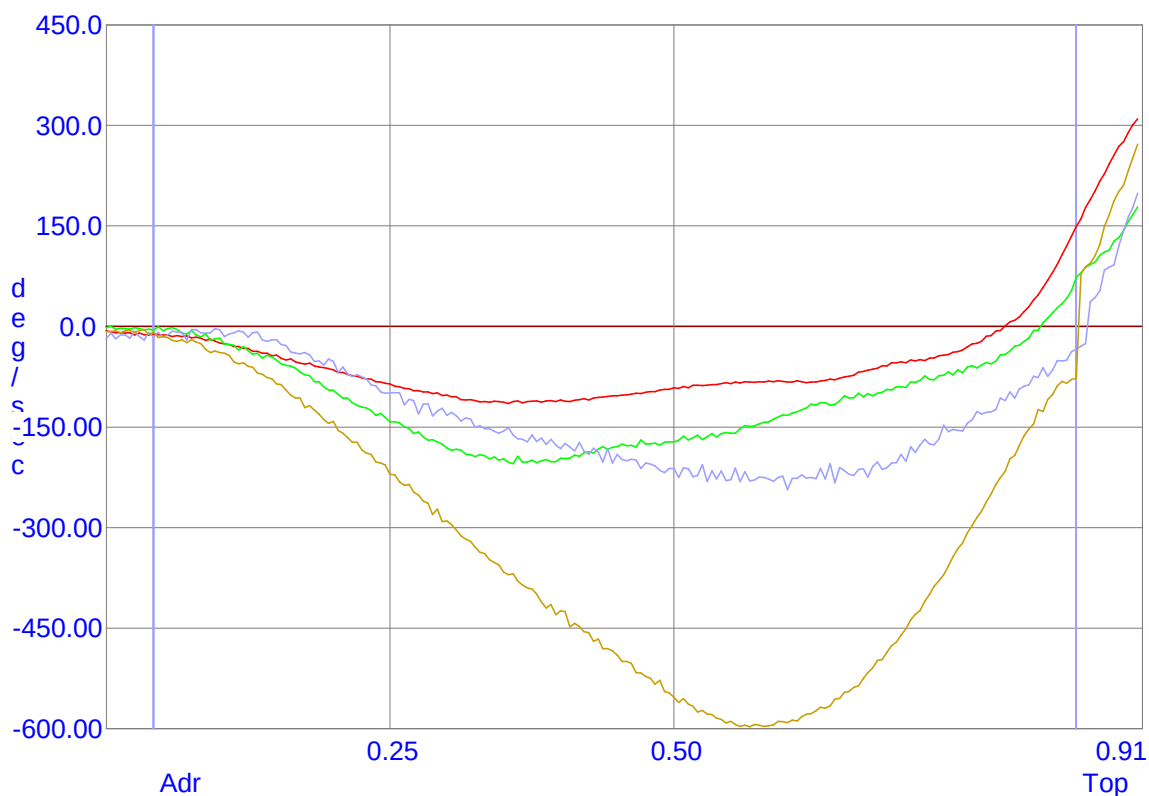
Positions at Peak Segmental Angular Speeds



		Backswing	Downswing	Follow Through
Tempo	ms	813	238	867

Backswing Sequence

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



Backswing Parameters

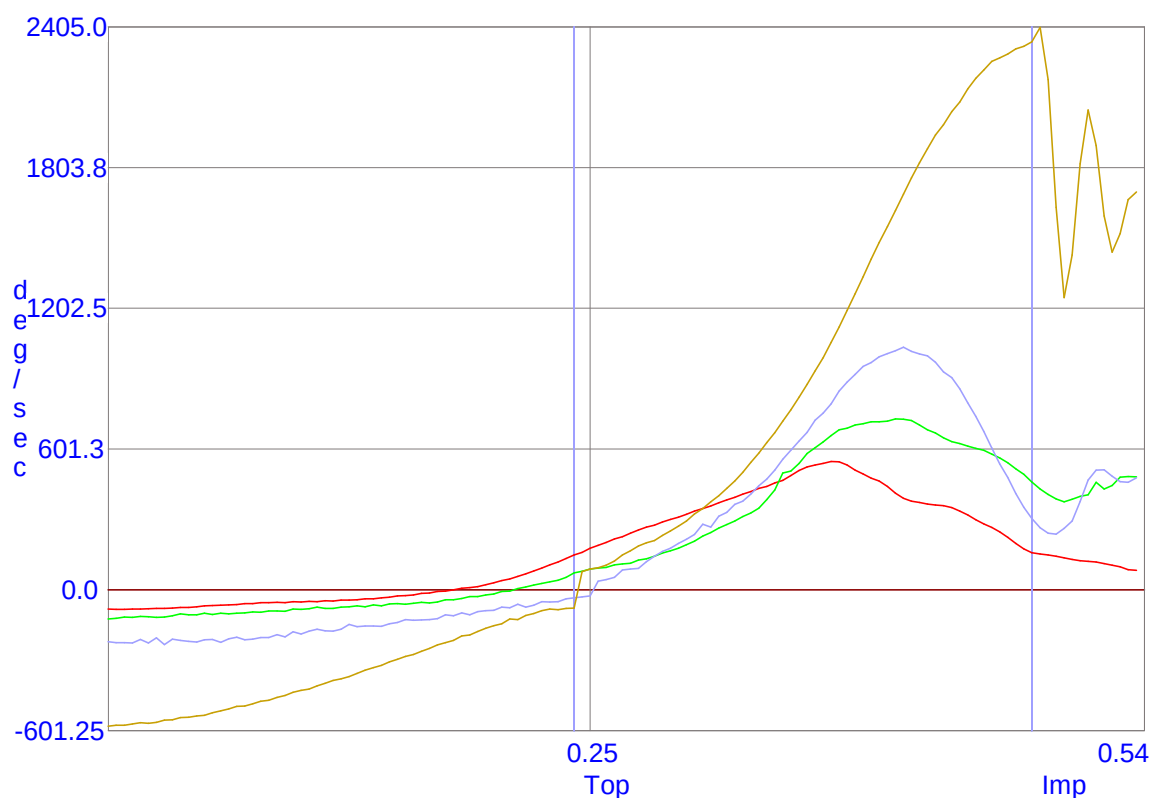
		Pelvis	Thorax	Arm	Club
Peak Order	order	1	2	4	3
Peak to Top	ms	500	496	254	288
Peak to Impact	ms	738	733	492	525
Peak Speed	d/s	115	205	244	597
Acceleration	d/s/s	331	629	409	1121
Deceleration	d/s/s	845	877	375	989

Segmental Interactions

		Pelvis-Thorax	Thorax-Arm	Arm-Club
Time Between Peaks	ms	4	242	-33

Transition Sequence

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



Transition Parameters

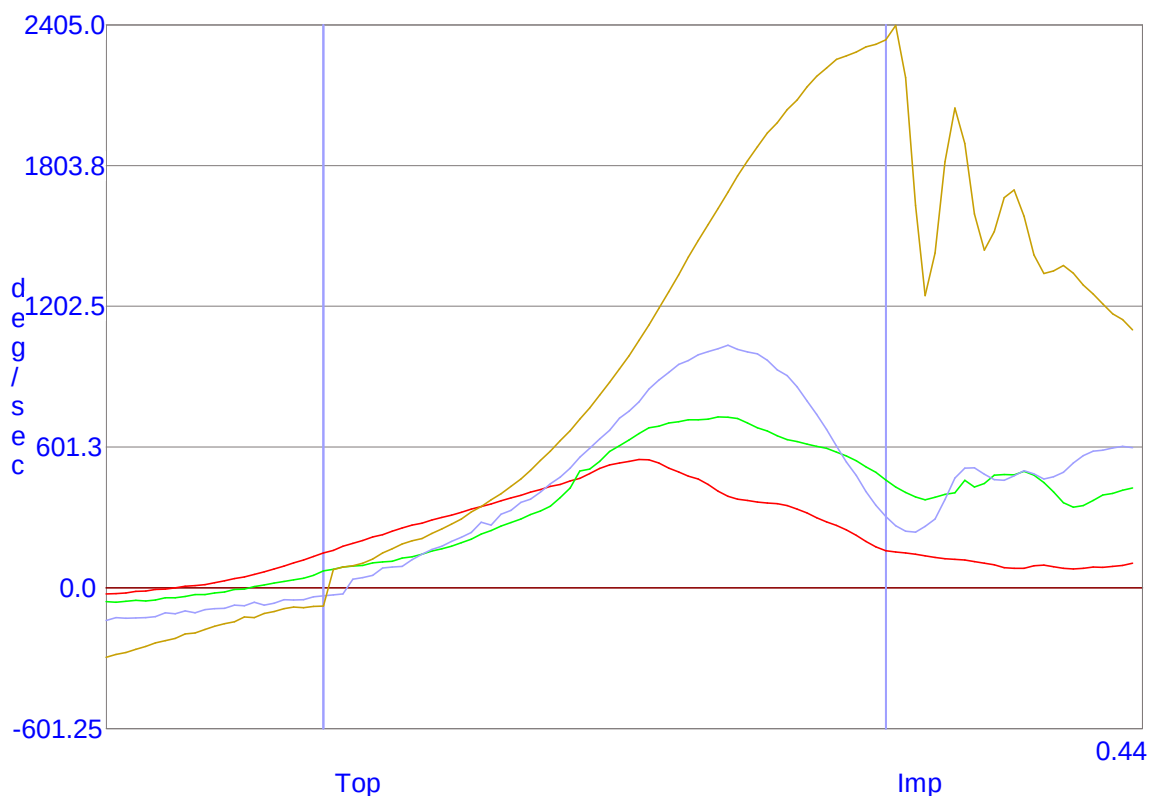
		Pelvis	Thorax	Arm	Club
Transition Order	order	1	2	4	3
Transition to Top	ms	67	33	-8	0
Transition to Peak	ms	200	200	163	238
Transition to Impact	ms	304	271	229	238
Transition Acceleration	d/s/s	1199	1670	3141	5519

Segmental Interactions

		Pelvis-Thorax	Thorax-Arm	Arm-Club
Time Between Transitions	ms	33	42	-8

Downswing Sequence

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



Sequence Parameters

		Pelvis	Thorax	Arm	Club
Peak Order	order	1	2	3	4
Peak Time Pre-Impact	ms	104	71	67	0
Peak Speed	d/s	548	730	1035	2340
% of Max	%	23	31	44	100
Acceleration	d/s/s	2770	3676	6366	10181
Deceleration	d/s/s	3741	3786	10956	9735

Segmental Interactions

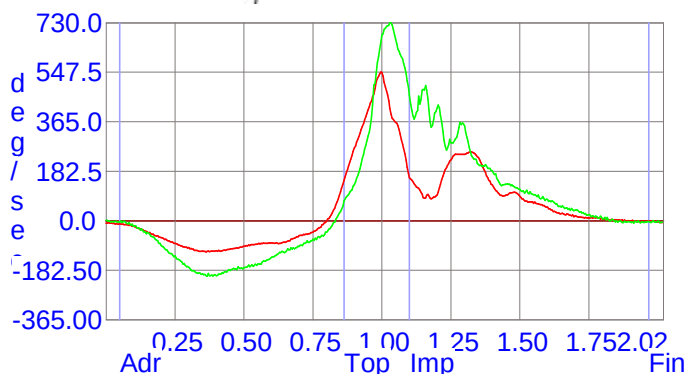
		Plv-Thx	Thx-Arm	Arm-Clb
Time Between Peaks	ms	33	4	67
Angular Speed Gain	d/s	182	306	1305
Gain Factor	ratio	1.3	1.4	2.3

Contribution by Joint

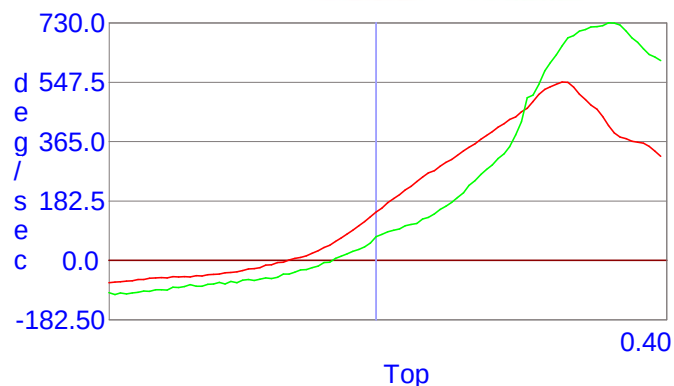
		Legs	Core	Shldr	Wrist
% Contribution	%	23	8	13	56

Spine Link Interactions

Kinematic Sequence - Pelvis and Thorax



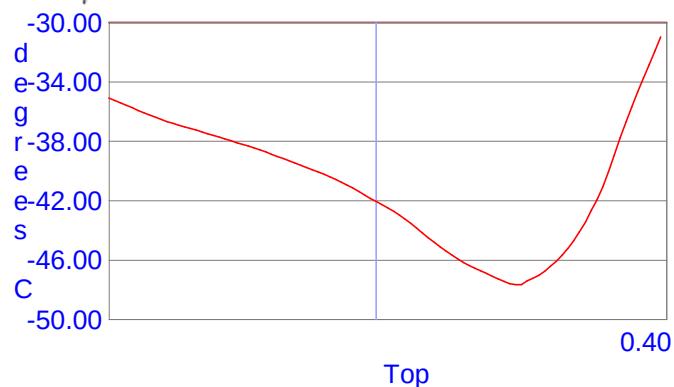
Transition Phase - Pelvis and Thorax



Total Spine Rotation (deg)

	Angle
At Pelvis Transition	39
At Thorax Transition	40
At Maximum	48

Spine Rotation



Transitional Spine Rotation (Stretch)

	Angle (deg)	Time (ms)	Rate (d/s)
Contra-Directional	1	33	37
Ipsi-Directional	7	138	53
Total Stretch	8	171	50

Transitional Timings (ms)

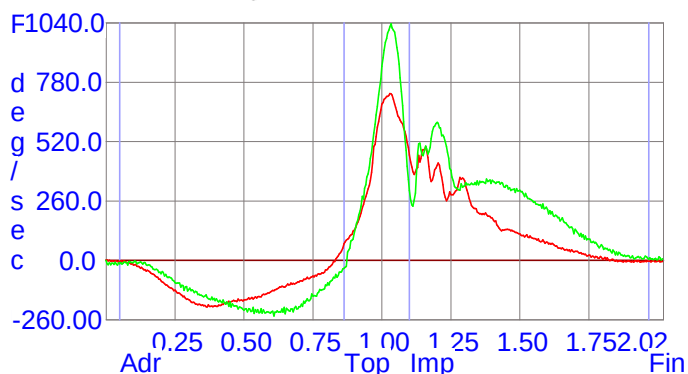
	Pelvis	Thorax
To Club Transition	67	33
To Impact	304	271

Transitional Accelerations (d/s/s)

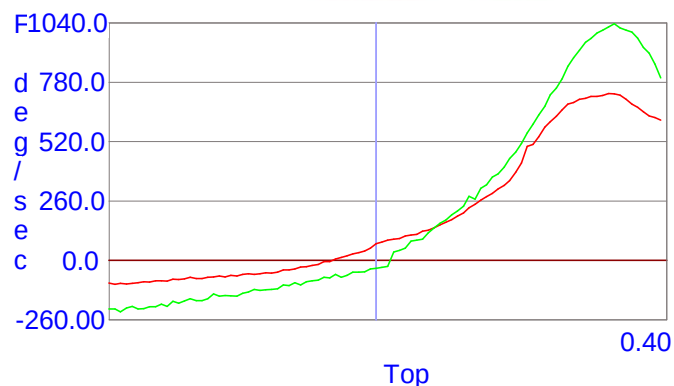
	Pelvis	Thorax
Acceleration	1199	1670

Shoulder Link Interactions

Kinematic Sequence - Thorax and Arm



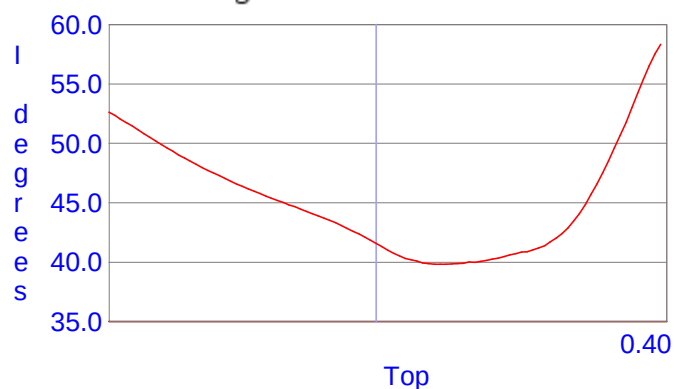
Transition Phase - Thorax and Arm



Total Shoulder Angle (deg)

	Angle
At Thorax Transition	44
At Arm Transition	41
At Min Angle	40

Shoulder Angle



Transitional Shoulder Stretch

	Angle (deg)	Time (ms)	Rate (d/s)
Contra-Directional	3	42	60
Ipsi-Directional	1	42	28
Total Stretch	4	83	44

Transitional Timings (ms)

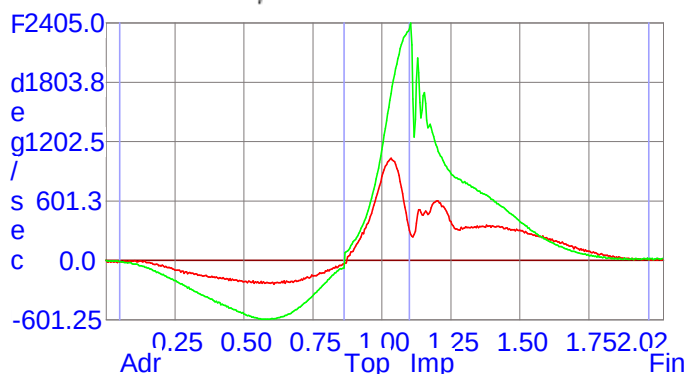
	Thorax	Lead Arm
To Club Transition	33	-8
To Impact	271	229

Transitional Accelerations (d/s/s)

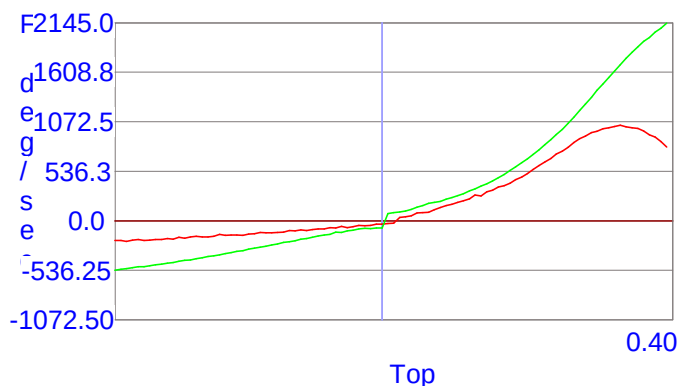
	Thorax	Lead Arm
Acceleration	1670	3141

Wrist Link Interactions

Kinematic Sequence - Arm and Club



Transition Phase - Arm and Club



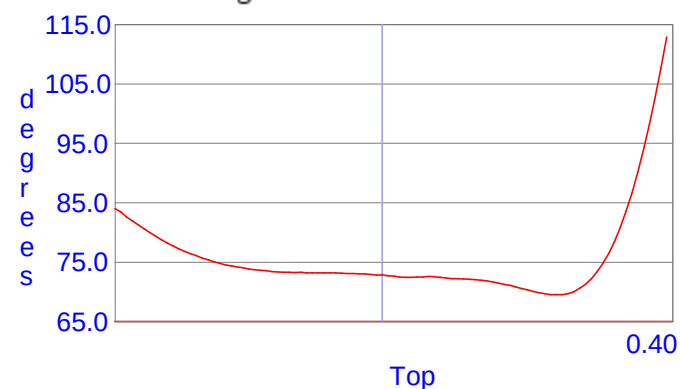
Wrist Set Angles (deg)

	Angle
At Arm Transition	73
At Club Transition	73
At Max Set	70
At Arm 30deg Pre-Impact	94

Shaft Lean (deg)

	Angle
At Impact	21 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)

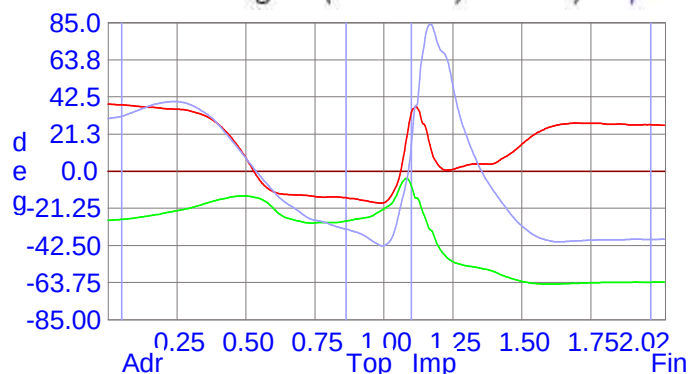
	Lead Arm	Club
To Club Transition	-8	0
To Impact	229	238

Transitional Accelerations (d/s/s)

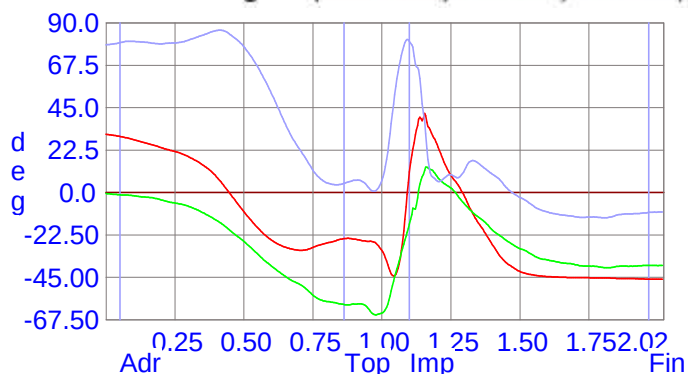
	Lead Arm	Club
Acceleration	3141	5519

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	15 R	34 U	27 U
Flexion Extension	28 E	28 E	9 E	64 E
Forearm Sup-Pro	31 S	33 P	15 S	39 P

Trail Wrist Angles (Degrees)

	Adr	Top	Imp	Fin
Deviation	30 U	24 R	11 U	46 R
Flexion Extension	1 E	59 E	17 E	39 E
Forearm Pro-Sup	79 P	5 P	80 P	11 S

Wrist Release Speed



Angular Velocities (Deg/Sec)

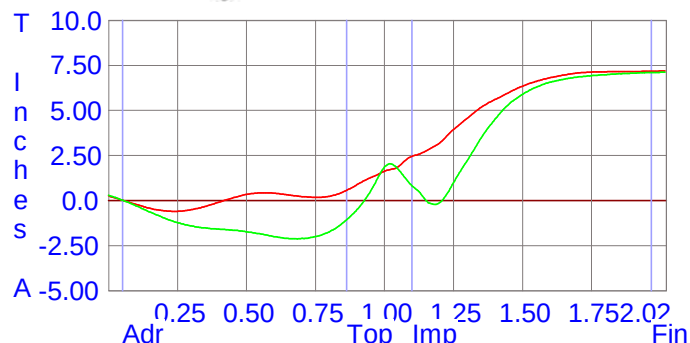
	Imp
Lead Wrist Sup-Pro Vel	1554 S
Lead Wrist Ext-Flex Vel	451 E
Trail Elbow Extn Vel	849 E
Club Handle Axial Vel	1347 C

Max Release Speed	deg/sec	1428
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Projected Impact Speed	mph	98
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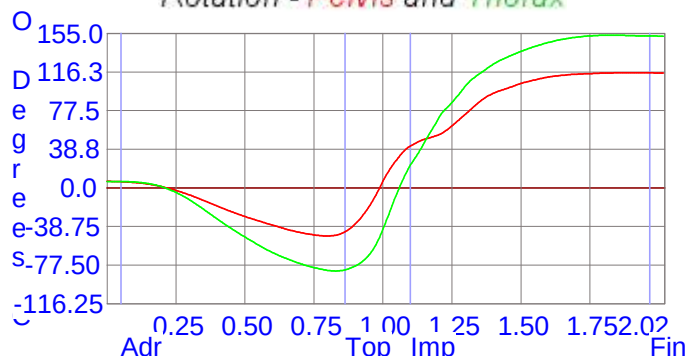
Trunk Dynamic Stability

Sway - Pelvis and Thorax



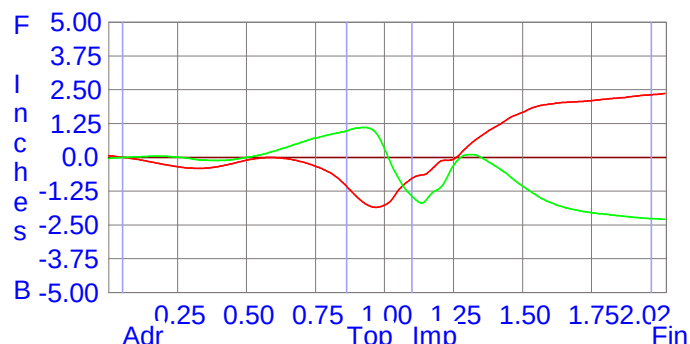
(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 T	0.6 T	2.5 T	7.2 T
Thorax	0.0 T	1.1 A	0.8 T	7.1 T

Rotation - Pelvis and Thorax



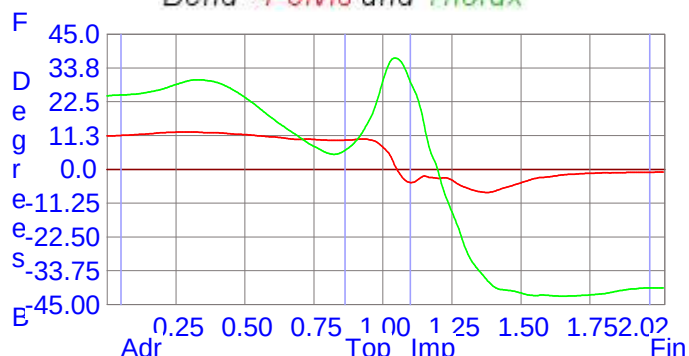
(Degrees)	Adr	Top	Imp	Fin
Pelvis	6 O	44 C	42 O	7 O
Thorax	6 O	82 C	23 O	152 O

Thrust - Pelvis and Thorax



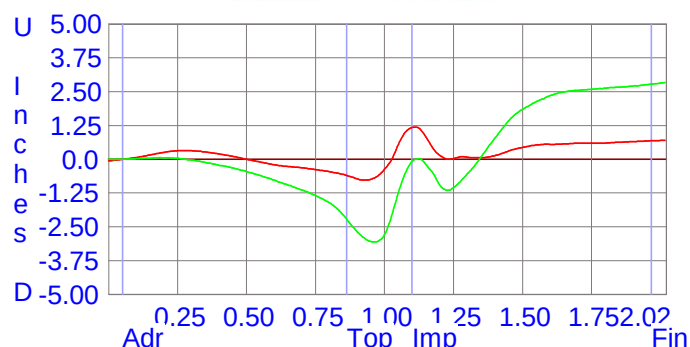
(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 F	1.1 B	0.8 B	2.3 F
Thorax	0.0 B	1.0 F	1.4 B	2.3 B

Bend - Pelvis and Thorax



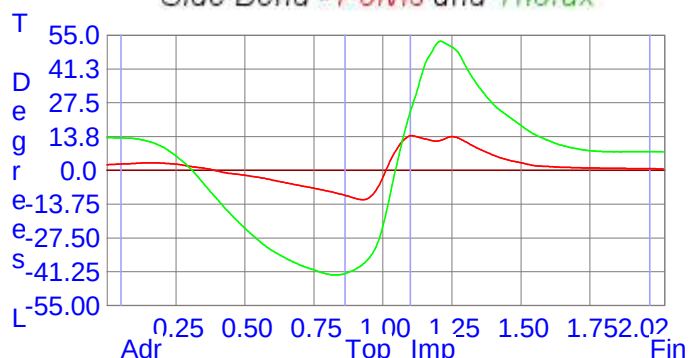
(Degrees)	Adr	Top	Imp	Fin
Pelvis	11 F	10 F	4 B	1 B
Thorax	25 F	6 F	29 F	39 B

Lift - Pelvis and Thorax



(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 D	0.6 D	1.2 U	0.7 U
Thorax	0.0 U	2.2 D	0.1 D	2.8 U

Side Bend - Pelvis and Thorax



(Degrees)	Adr	Top	Imp	Fin
Pelvis	3 T	10 L	14 T	1 T
Thorax	13 T	42 L	24 T	8 T

Dynamic Range of Motion

Head Angles (deg)

Rotation	14 C	101 O	115
Bend	65 F	16 B	81
Side Bend	13 L	48 T	61

Thorax Angles (deg)

Rotation	83 C	153 O	237
Bend	37 F	42 B	79
Side Bend	43 L	53 T	95

Pelvis Angles (deg)

Rotation	48 C	115 O	164
Bend	12 F	8 B	20
Side Bend	12 L	14 T	26

Trail Elbow Angles (deg)

Flexion-Extension	173 F	68 F	105
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Trail Wrist Angles (deg)

Rotation	86 S	13 P	99
Flexion-Extension	13 E	65 F	78
Deviation	42 U	46 R	88

Neck Angles (deg)

Rotation	51 C	71 O	121
Flexion-Extension	15 E	55 E	40
Side Bend	34 L	30 T	64

Lead Shoulder Angles (deg)

Elevation	4 A	159 B	163
Horizontal Adduction	40 I	186 I	146

Spine Angles (deg)

Rotation	48 C	25 O	73
Flexion-Extension	38 F	41 E	79
Side Bend	34 L	40 T	74
Forward Tilt	41 F	17 F	24
Side Tilt	3 T	15 T	12

Lead Elbow Angles (deg)

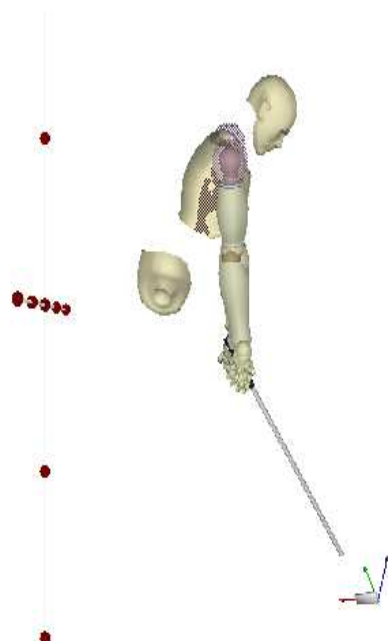
Flexion-Extension	179 F	55 F	124
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Lead Wrist Angles (deg)

Rotation	84 S	43 P	127
Flexion-Extension	4 E	65 E	60
Deviation	38 U	18 R	57

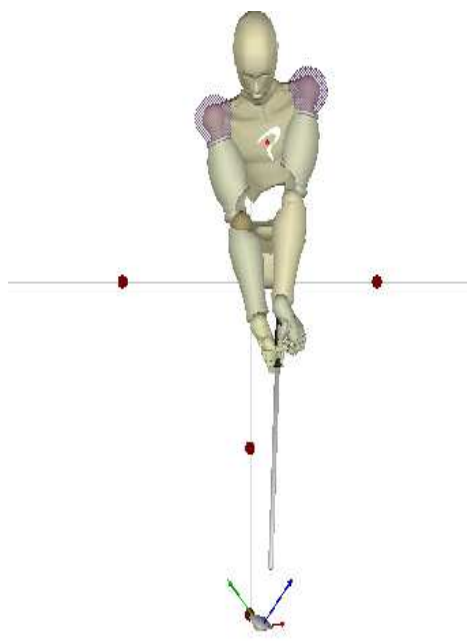
Columns are max range to each side and total range traveled

Position At Address



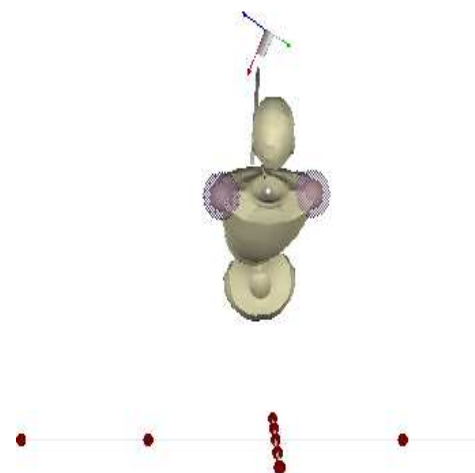
Angles (deg)

	Pelvis	Thorax
Rotation	6 O	6 O
Bend	11 F	25 F
Side Bend	3 T	13 T

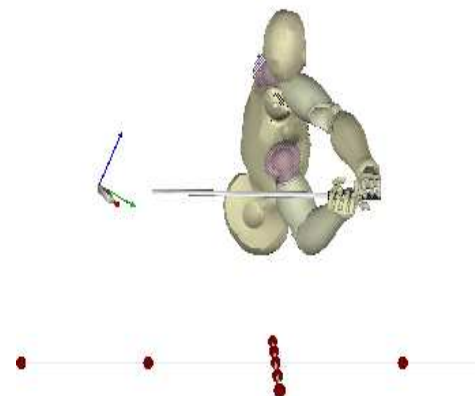
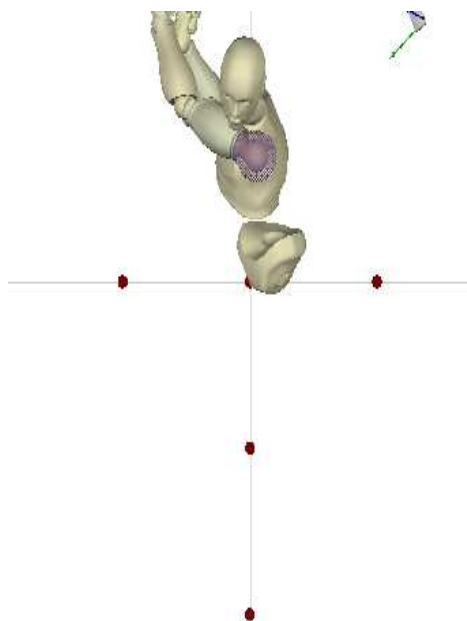
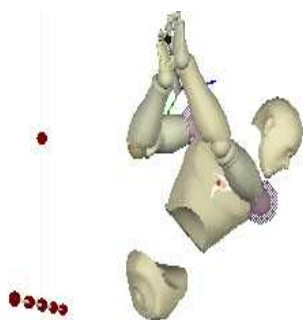


Angles (deg)

	Spine
Rotation	0 C
Flexion-Extension	13 F
Side Bend	11 T



Position At Top



Angles (deg)

	Pelvis	Thorax
Rotation	44 C	82 C
Bend	10 F	6 F
Side Bend	10 L	42 L

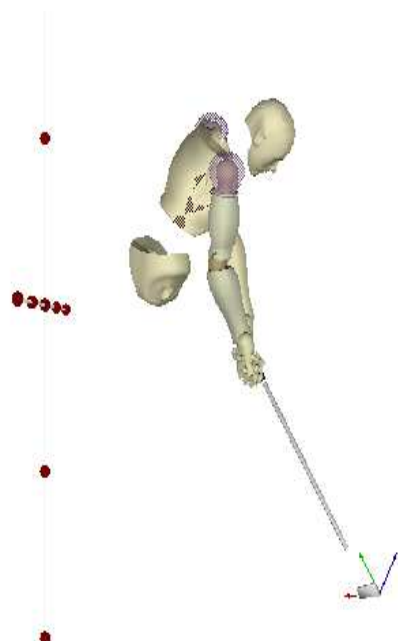
Angles (deg)

	Spine
Rotation	42 C
Flexion-Extension	3 B
Side Bend	32 L

Displacements (inches)

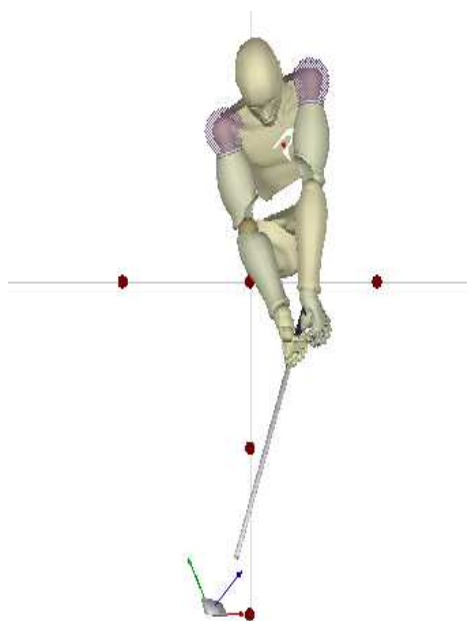
	Pelvis	Thorax
Sway	0.6 T	1.1 A
Thrust	1.1 B	1.0 F
Lift	0.6 D	2.2 D

Position At Impact



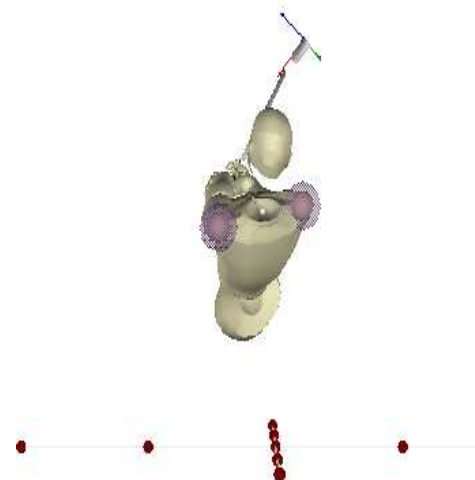
Angles (deg)

	Pelvis	Thorax
Rotation	42 O	23 O
Bend	4 B	29 F
Side Bend	14 T	24 T



Angles (deg)

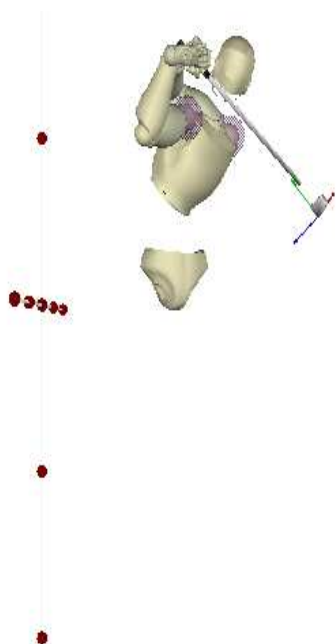
	Spine
Rotation	22 C
Flexion-Extension	34 F
Side Bend	10 T



Displacements (inches)

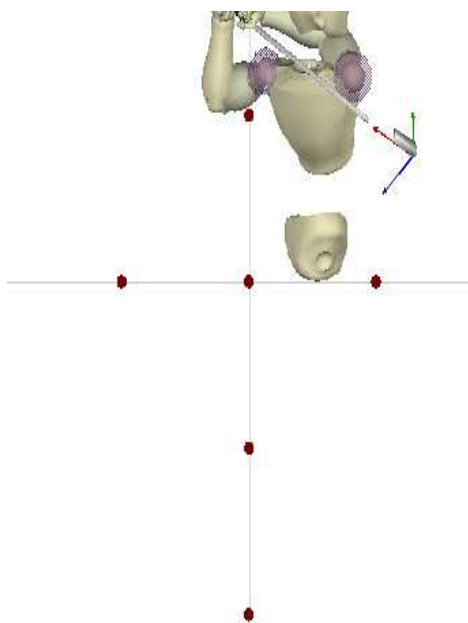
	Pelvis	Thorax
Sway	2.5 T	0.8 T
Thrust	0.8 B	1.4 B
Lift	1.2 U	0.1 D

Position At Finish



Angles (deg)

	Pelvis	Thorax
Rotation	115 O	152 O
Bend	1 B	39 B
Side Bend	1 T	8 T



Angles (deg)

	Spine
Rotation	25 O
Flexion-Extension	38 B
Side Bend	7 T

Displacements (inches)

	Pelvis	Thorax
Sway	7.2 T	7.1 T
Thrust	2.3 F	2.3 B
Lift	0.7 U	2.8 U

