

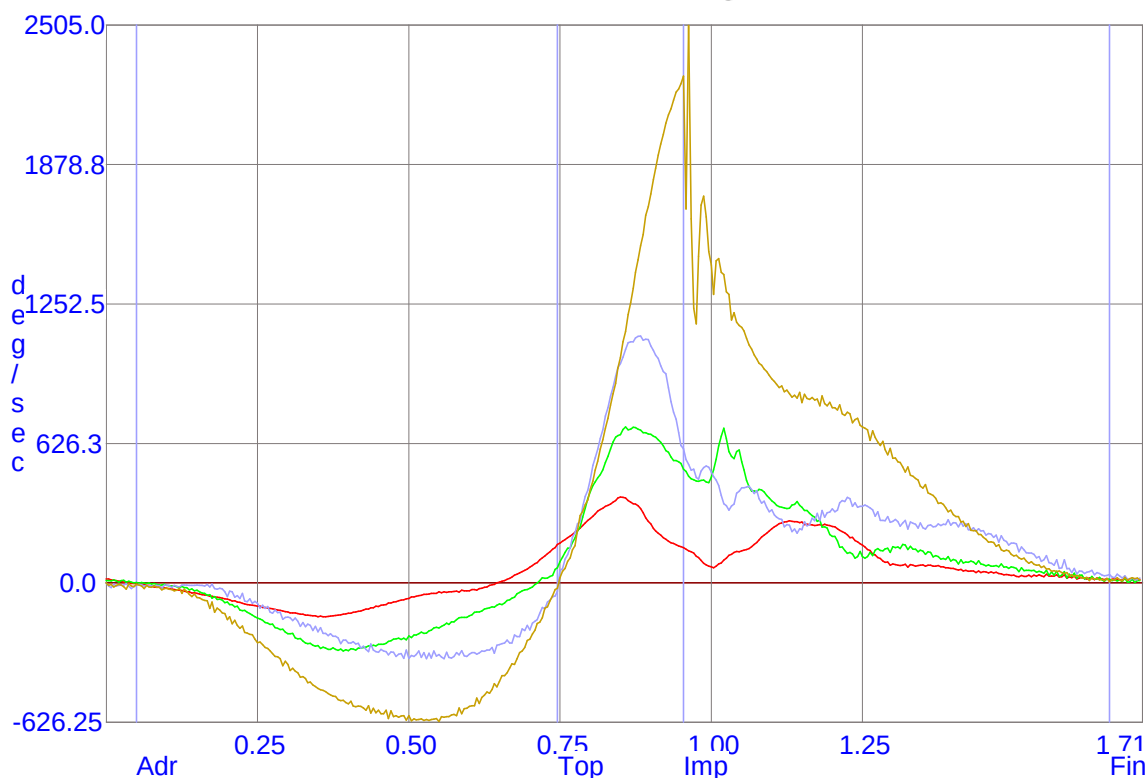
TPI 3D

■ BIOMECHANICAL SPORTS ANALYSIS

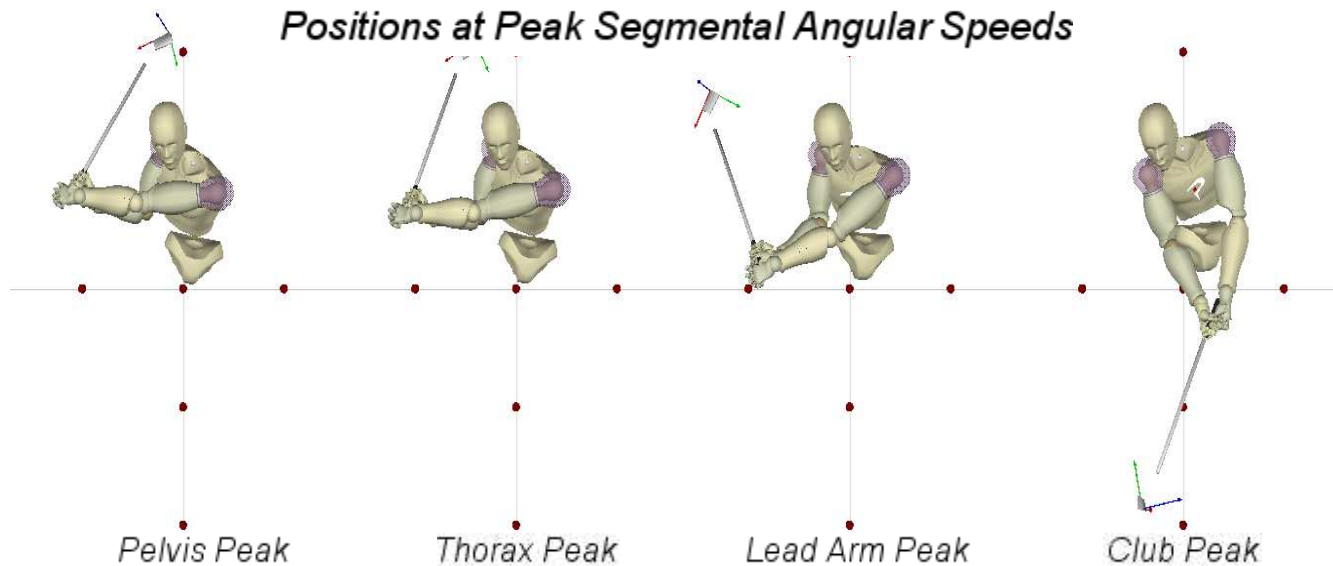


MYTPI.COM

Kinematic Sequence



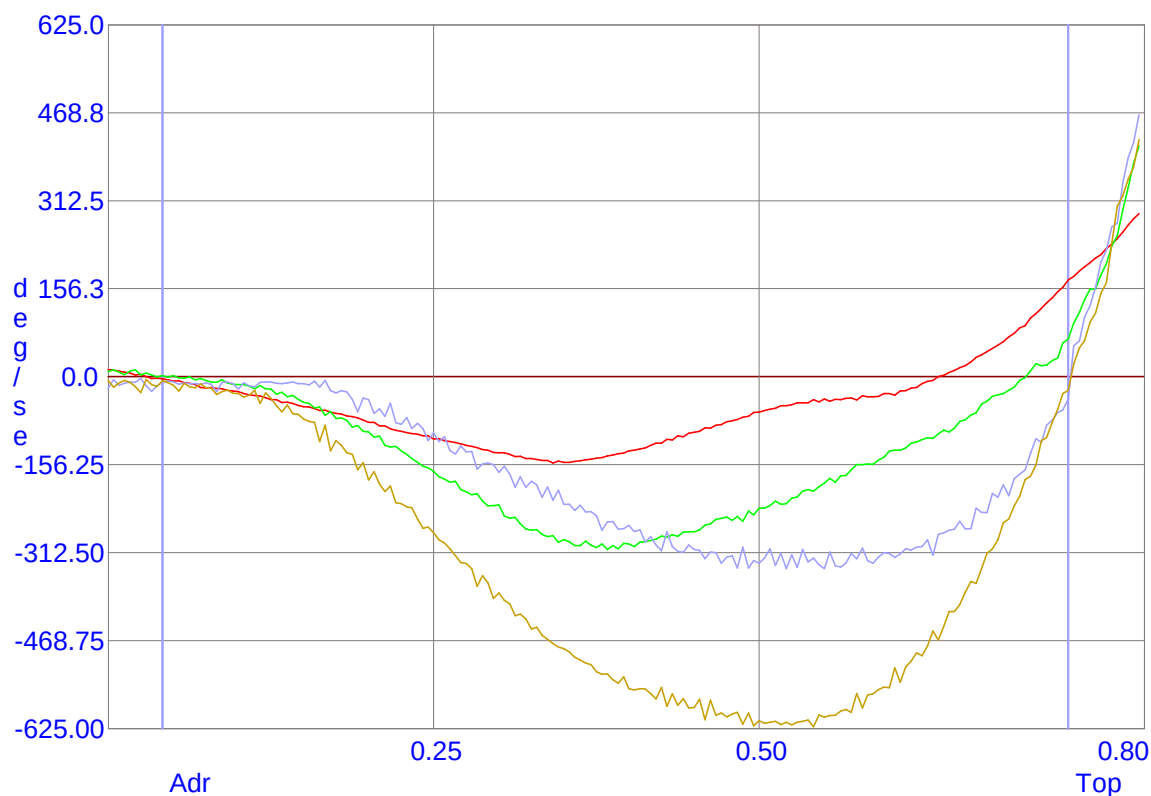
Positions at Peak Segmental Angular Speeds



		Backswing	Downswing	Follow Through
Tempo	ms	696	208	704

Backswing Sequence

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



Backswing Parameters

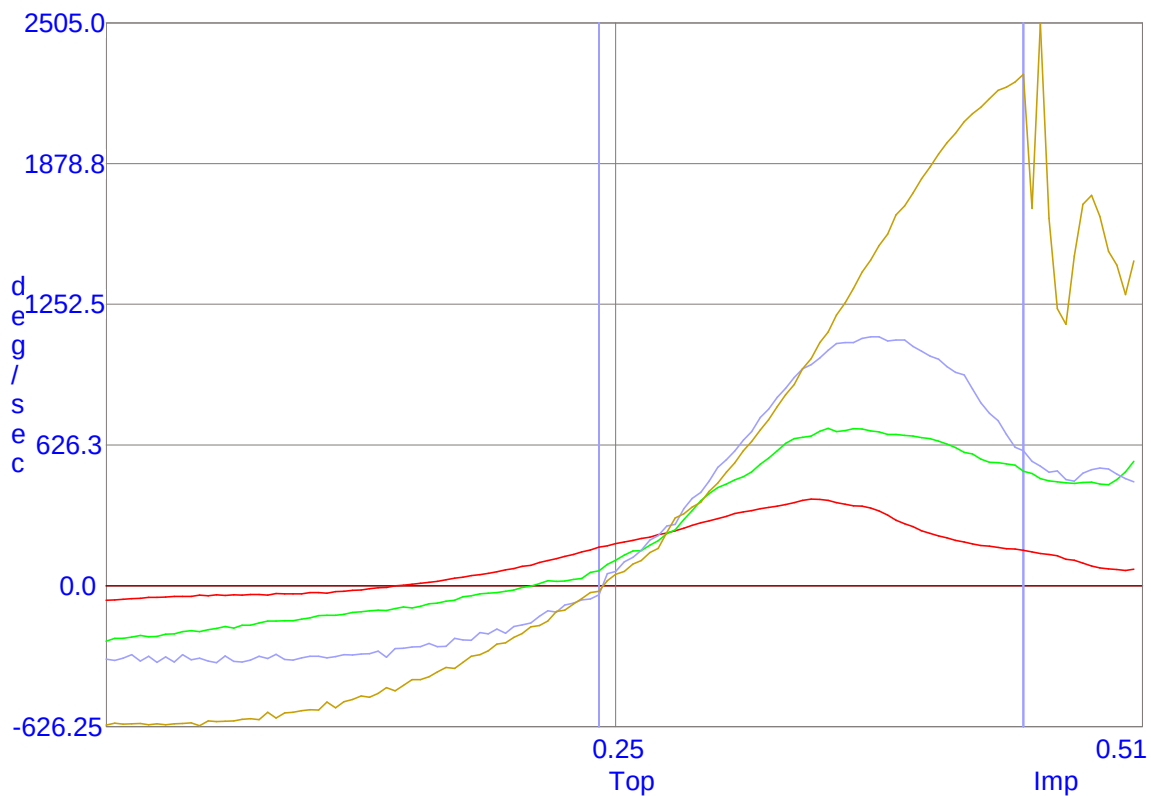
		Pelvis	Thorax	Arm	Club
Peak Order	order	1	2	4	3
Peak to Top	ms	396	354	188	196
Peak to Impact	ms	604	563	396	404
Peak Speed	d/s	153	307	341	622
Acceleration	d/s/s	499	904	653	1229
Deceleration	d/s/s	1083	1095	594	1195

Segmental Interactions

		Pelvis-Thorax	Thorax-Arm	Arm-Club
Time Between Peaks	ms	42	167	-8

Transition Sequence

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



Transition Parameters

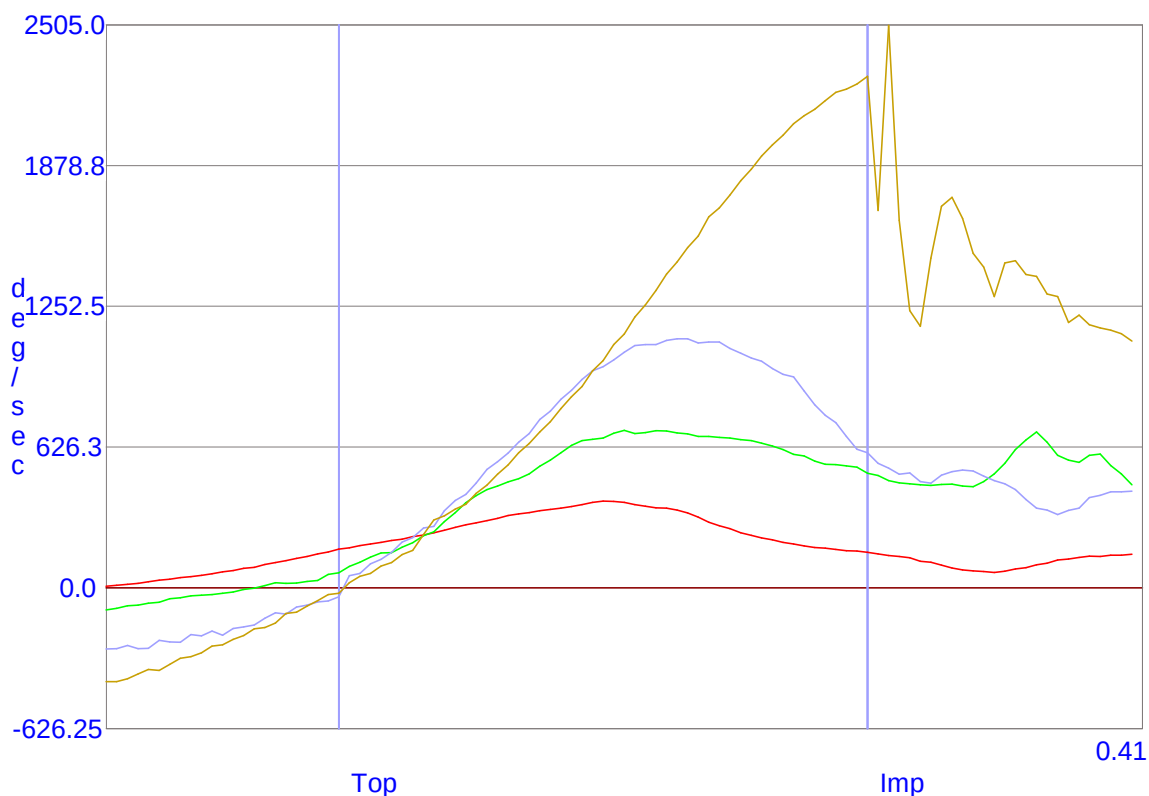
		Pelvis	Thorax	Arm	Club
Transition Order	order	1	2	3	3
Transition to Top	ms	104	33	0	0
Transition to Peak	ms	208	146	138	208
Transition to Impact	ms	313	242	208	208
Transition Acceleration	d/s/s	1049	1537	6792	6493

Segmental Interactions

		Pelvis-Thorax	Thorax-Arm	Arm-Club
Time Between Transitions	ms	71	33	0

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	96	71	0
Peak Speed	d/s	385	700	1108	2276
% of Max	%	17	31	49	100
Acceleration	d/s/s	1882	4812	8343	11043
Deceleration	d/s/s	2179	1986	7144	9147

Segmental Interactions

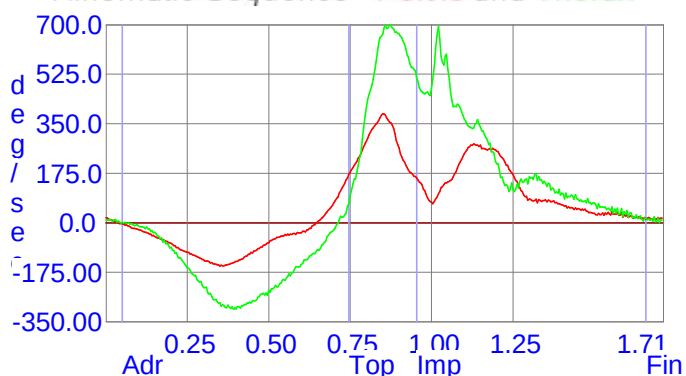
		Plv-Thx	Thx-Arm	Arm-Clb
Time Between Peaks	ms	8	25	71
Angular Speed Gain	d/s	315	408	1168
Gain Factor	ratio	1.8	1.6	2.1

Contribution by Joint

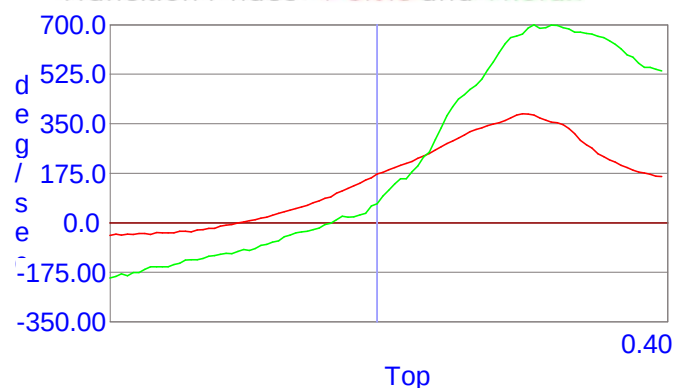
		Legs	Core	Shldr	Wrist
% Contribution	%	17	14	18	51

Spine Link Interactions

Kinematic Sequence - Pelvis and Thorax



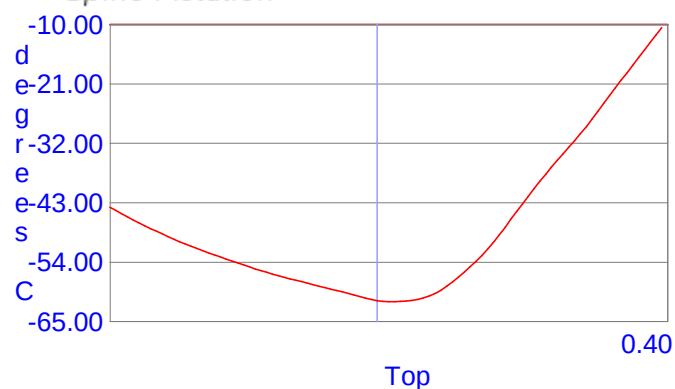
Transition Phase - Pelvis and Thorax



Total Spine Rotation (deg)

	Angle
At Pelvis Transition	54
At Thorax Transition	59
At Maximum	61

Spine Rotation



Transitional Spine Rotation (Stretch)

	Angle (deg)	Time (ms)	Rate (d/s)
Contra-Directional	5	71	74
Ipsi-Directional	2	67	23
Total Stretch	7	138	49

Transitional Timings (ms)

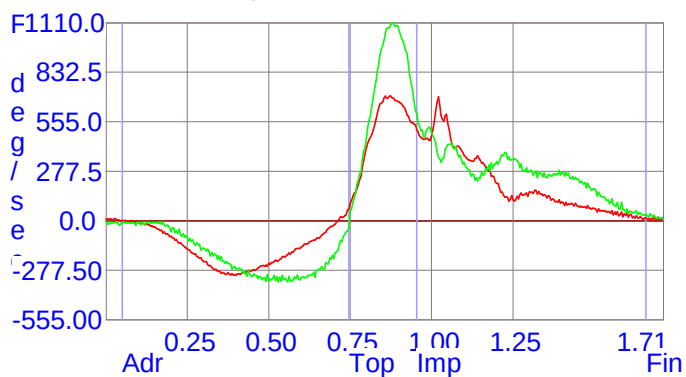
	Pelvis	Thorax
To Club Transition	104	33
To Impact	313	242

Transitional Accelerations (d/s/s)

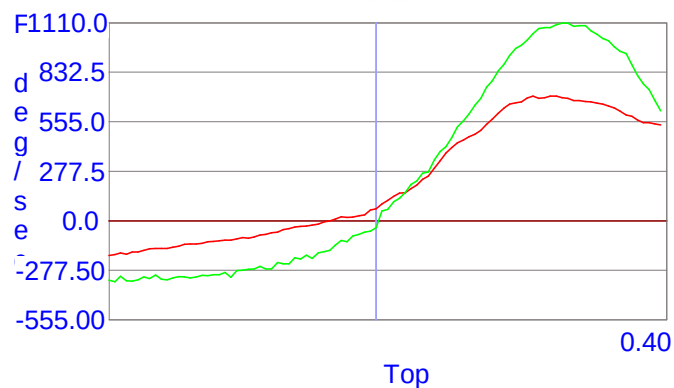
	Pelvis	Thorax
Acceleration	1049	1537

Shoulder Link Interactions

Kinematic Sequence - Thorax and Arm



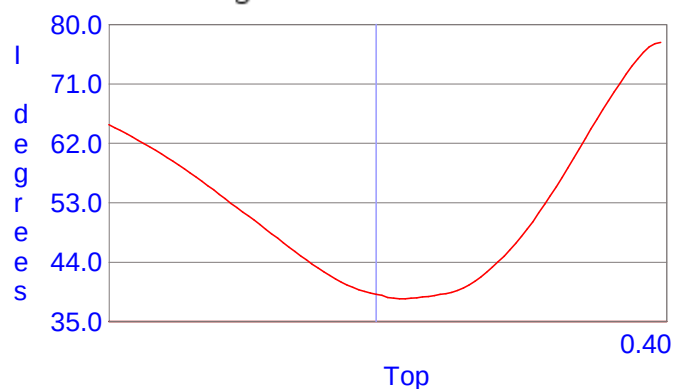
Transition Phase - Thorax and Arm



Total Shoulder Angle (deg)

	Angle
At Thorax Transition	42
At Arm Transition	39
At Min Angle	38

Shoulder Angle



Transitional Shoulder Stretch

	Angle (deg)	Time (ms)	Rate (d/s)
Contra-Directional	3	33	85
Ipsi-Directional	1	17	41
Total Stretch	4	50	71

Transitional Timings (ms)

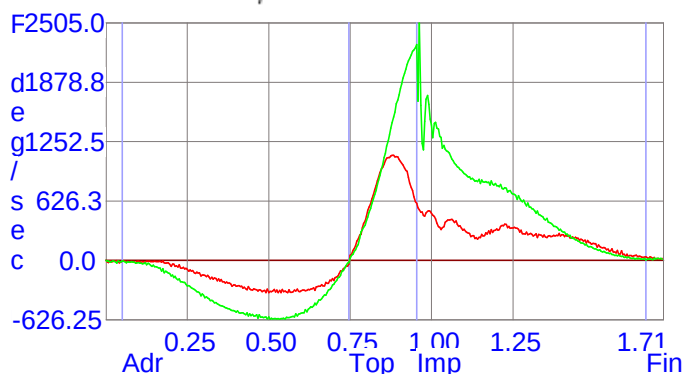
	Thorax	Lead Arm
To Club Transition	33	0
To Impact	242	208

Transitional Accelerations (d/s/s)

	Thorax	Lead Arm
Acceleration	1537	6792

Wrist Link Interactions

Kinematic Sequence - Arm and Club



Transition Phase - Arm and Club



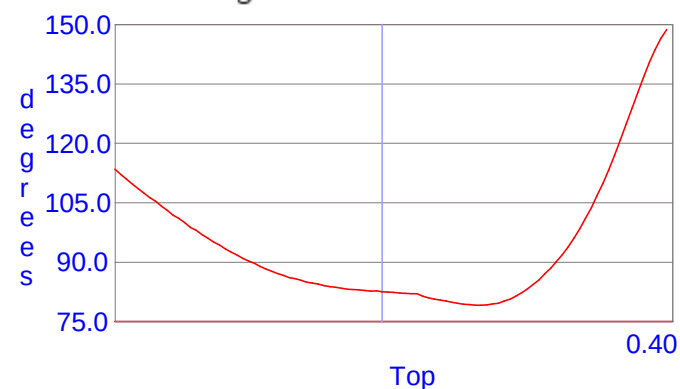
Wrist Set Angles (deg)

	Angle
At Arm Transition	83
At Club Transition	83
At Max Set	79
At Arm 30deg Pre-Impact	110

Shaft Lean (deg)

	Angle
At Impact	23 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)

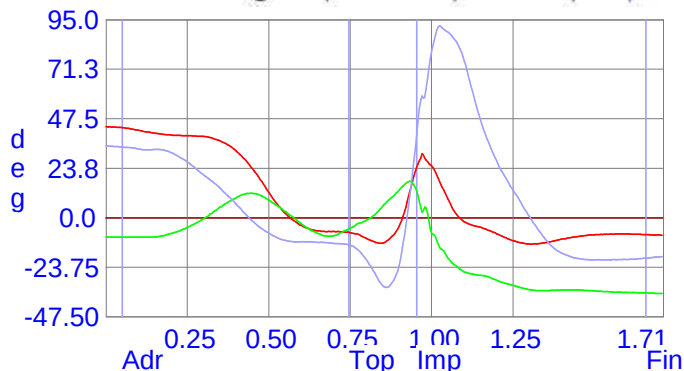
	Lead Arm	Club
To Club Transition	0	0
To Impact	208	208

Transitional Accelerations (d/s/s)

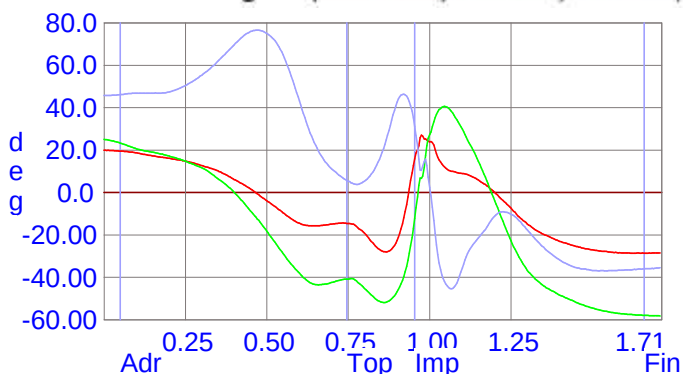
	Lead Arm	Club
Acceleration	6792	6493

Wrist Link Interactions

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



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



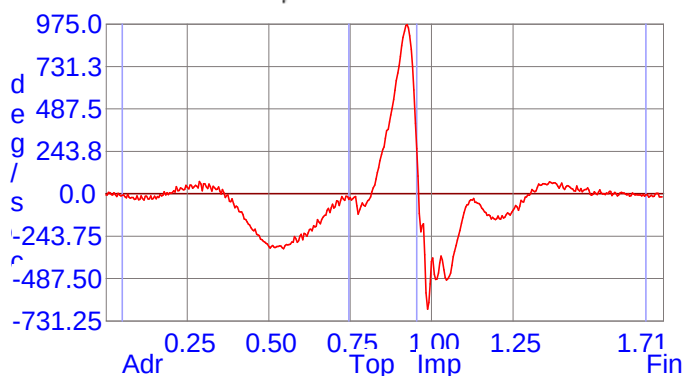
Lead Wrist Angles (Degrees)

	Adr	Top	Imp	Fin
Deviation	43 U	7 R	24 U	8 R
Flexion Extension	9 E	5 E	13 F	36 E
Forearm Sup-Pro	34 S	13 P	40 S	19 P

Trail Wrist Angles (Degrees)

	Adr	Top	Imp	Fin
Deviation	20 U	15 R	16 U	29 R
Flexion Extension	23 F	41 E	12 E	58 E
Forearm Pro-Sup	46 P	6 P	31 P	36 S

Wrist Release Speed



Angular Velocities (Deg/Sec)

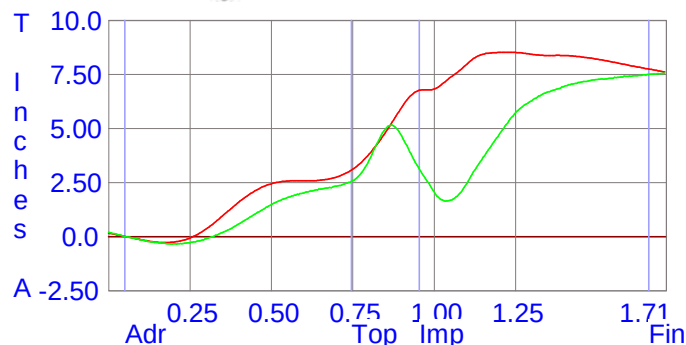
	Imp
Lead Wrist Sup-Pro Vel	1522 S
Lead Wrist Ext-Flex Vel	608 E
Trail Elbow Extn Vel	515 E
Club Handle Axial Vel	1188 C

Max Release Speed deg/sec 972

Projected Impact Speed mph 87

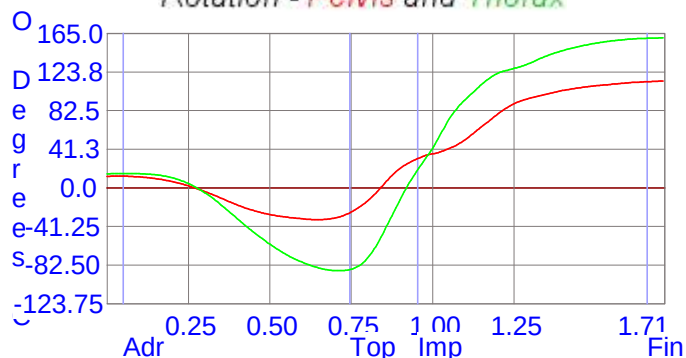
Trunk Dynamic Stability

Sway - Pelvis and Thorax



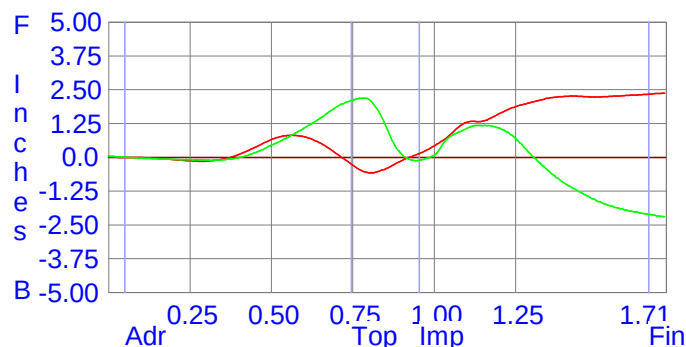
(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 T	3.1 T	6.8 T	7.8 T
Thorax	0.0 T	2.6 T	3.1 T	7.5 T

Rotation - Pelvis and Thorax



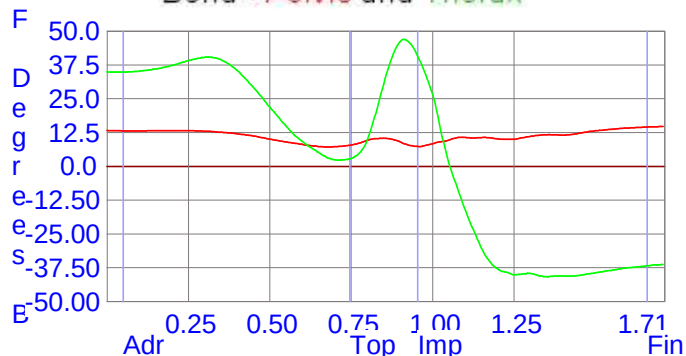
(Degrees)	Adr	Top	Imp	Fin
Pelvis	12 O	27 C	31 O	8 O
Thorax	15 O	87 C	19 O	160 O

Thrust - Pelvis and Thorax



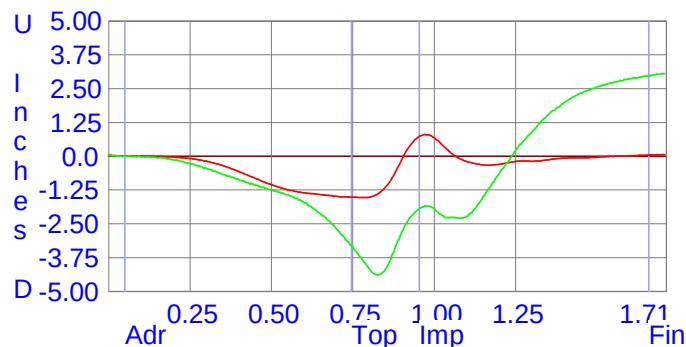
(Inches)	Adr	Top	Imp	Fin
Pelvis	-0.0 B	0.3 B	0.1 F	2.3 F
Thorax	0.0 F	2.1 F	0.1 B	2.1 B

Bend - Pelvis and Thorax



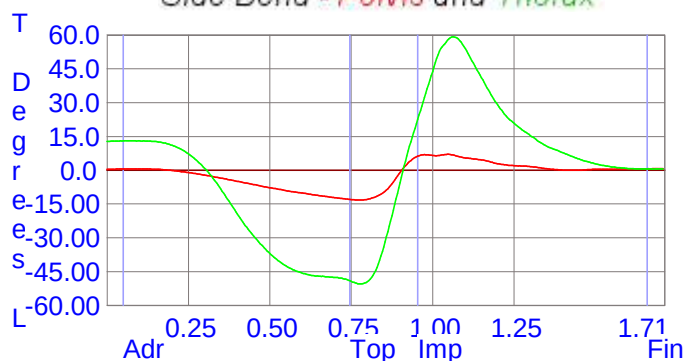
(Degrees)	Adr	Top	Imp	Fin
Pelvis	13 F	8 F	7 F	15 F
Thorax	35 F	3 F	41 F	37 B

Lift - Pelvis and Thorax



(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 U	1.5 D	0.7 U	0.0 U
Thorax	0.0 D	3.3 D	1.9 D	3.0 U

Side Bend - Pelvis and Thorax



(Degrees)	Adr	Top	Imp	Fin
Pelvis	1 T	13 L	6 T	1 T
Thorax	13 T	49 L	23 T	1 T

Dynamic Range of Motion

Head Angles (deg)

Rotation	10 C	84 O	94
Bend	57 F	5 B	62
Side Bend	7 L	46 T	52

Neck Angles (deg)

Rotation	76 C	79 O	154
Flexion-Extension	3 E	62 E	59
Side Bend	50 L	39 T	90

Thorax Angles (deg)

Rotation	88 C	160 O	249
Bend	47 F	41 B	88
Side Bend	50 L	59 T	110

Lead Shoulder Angles (deg)

Elevation	10 A	178 B	188
Horizontal Adduction	38 I	176 I	138

Pelvis Angles (deg)

Rotation	34 C	114 O	148
Bend	15 F	7 F	8
Side Bend	13 L	7 T	20

Spine Angles (deg)

Rotation	61 C	39 O	100
Flexion-Extension	39 F	53 E	91
Side Bend	37 L	53 T	90
Forward Tilt	44 F	20 F	24
Side Tilt	1 L	20 T	21

Trail Elbow Angles (deg)

Flexion-Extension	166 F	79 F	87
-------------------	-------	------	----

Lead Elbow Angles (deg)

Flexion-Extension	177 F	67 F	109
-------------------	-------	------	-----

Trail Wrist Angles (deg)

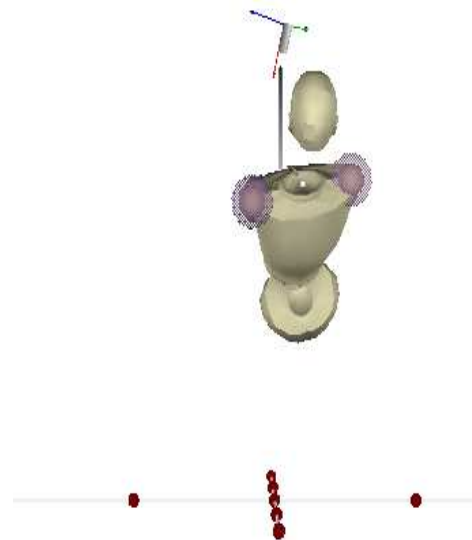
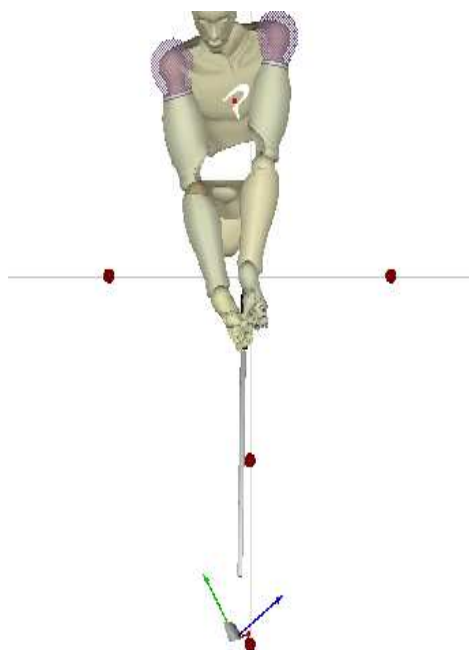
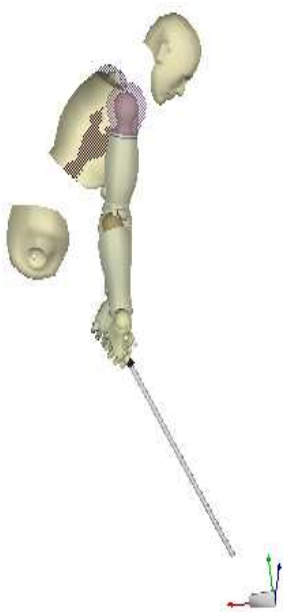
Rotation	77 S	46 P	122
Flexion-Extension	41 E	58 F	99
Deviation	27 U	29 R	56

Lead Wrist Angles (deg)

Rotation	92 S	33 P	126
Flexion-Extension	17 F	36 E	54
Deviation	44 U	13 R	56

Columns are max range to each side and total range traveled

Position At Address



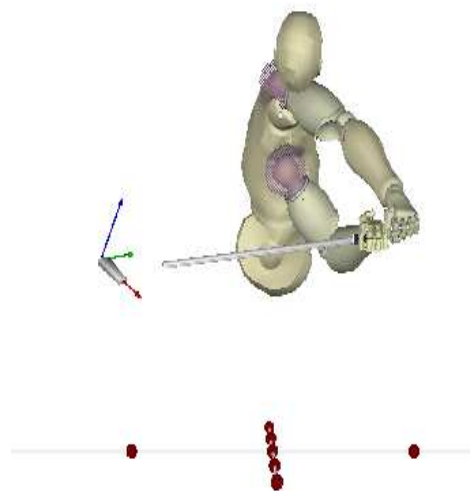
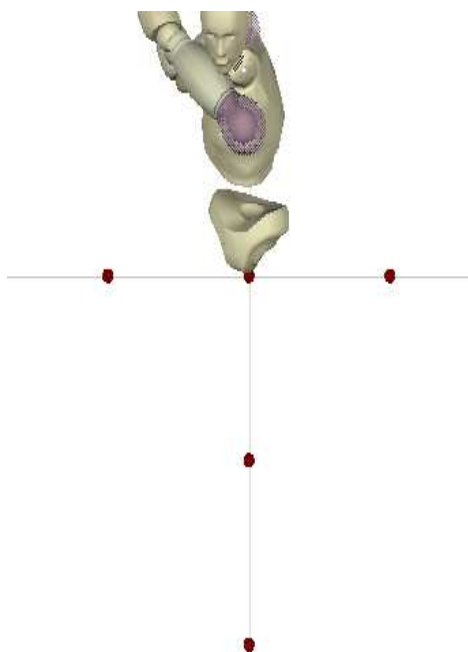
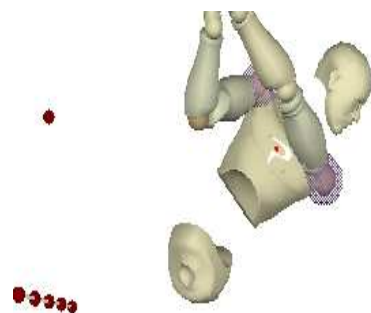
Angles (deg)

	Pelvis	Thorax
Rotation	12 O	15 O
Bend	13 F	35 F
Side Bend	1 T	13 T

Angles (deg)

	Spine
Rotation	5 O
Flexion-Extension	22 F
Side Bend	12 T

Position At Top



Angles (deg)

	Pelvis	Thorax
Rotation	27 C	87 C
Bend	8 F	3 F
Side Bend	13 L	49 L

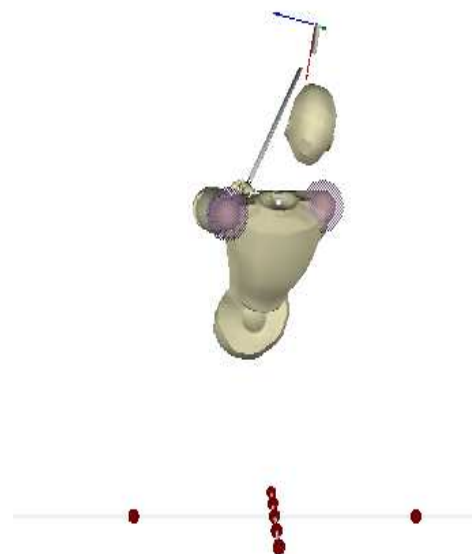
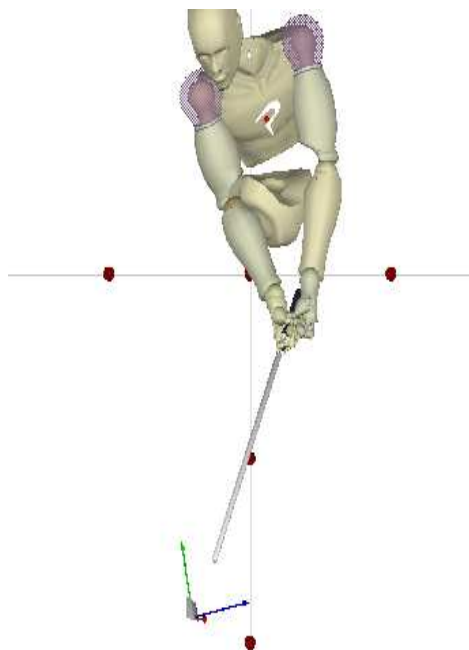
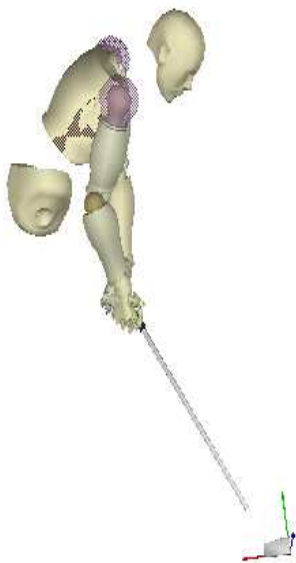
Angles (deg)

	Spine
Rotation	61 C
Flexion-Extension	5 B
Side Bend	36 L

Displacements (inches)

	Pelvis	Thorax
Sway	3.1 T	2.6 T
Thrust	0.3 B	2.1 F
Lift	1.5 D	3.3 D

Position At Impact



Angles (deg)

	Pelvis	Thorax
Rotation	31 O	19 O
Bend	7 F	41 F
Side Bend	6 T	23 T

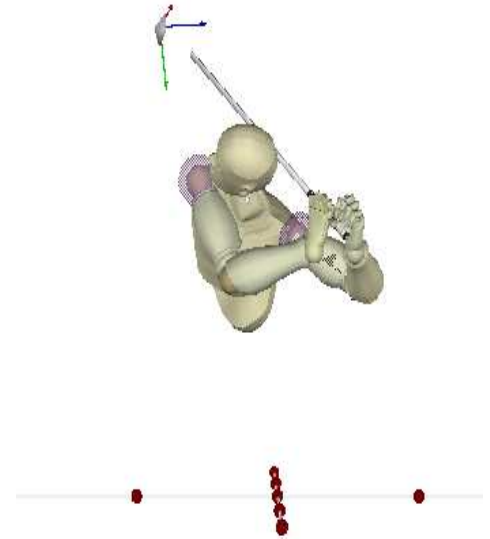
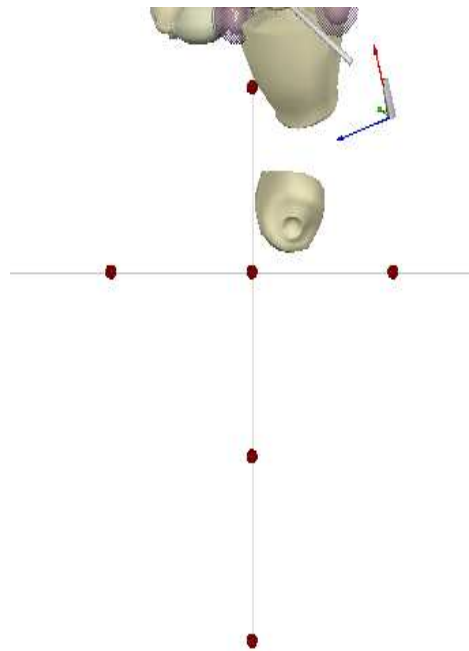
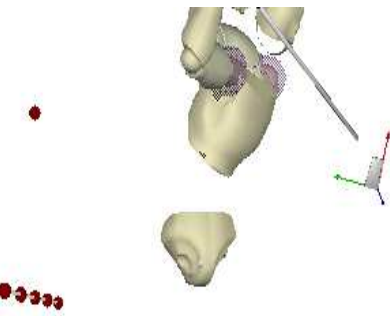
Angles (deg)

	Spine
Rotation	9 C
Flexion-Extension	33 F
Side Bend	16 T

Displacements (inches)

	Pelvis	Thorax
Sway	6.8 T	3.1 T
Thrust	0.1 F	0.1 B
Lift	0.7 U	1.9 D

Position At Finish



Angles (deg)

	Pelvis	Thorax
Rotation	113 O	160 O
Bend	15 F	37 B
Side Bend	1 T	1 T

Angles (deg)

	Spine
Rotation	37 O
Flexion-Extension	51 B
Side Bend	0 L

Displacements (inches)

	Pelvis	Thorax
Sway	7.8 T	7.5 T
Thrust	2.3 F	2.1 B
Lift	0.0 U	3.0 U