

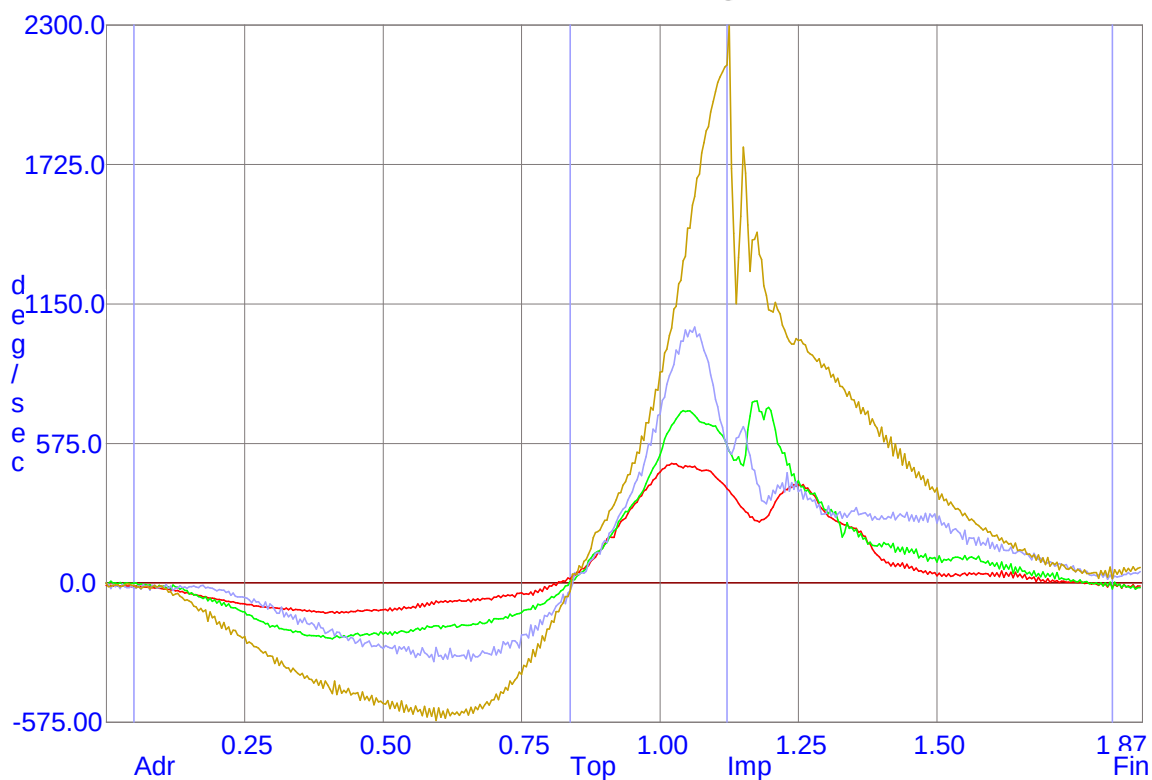
TPI 3D

■ **BIOMECHANICAL SPORTS ANALYSIS**

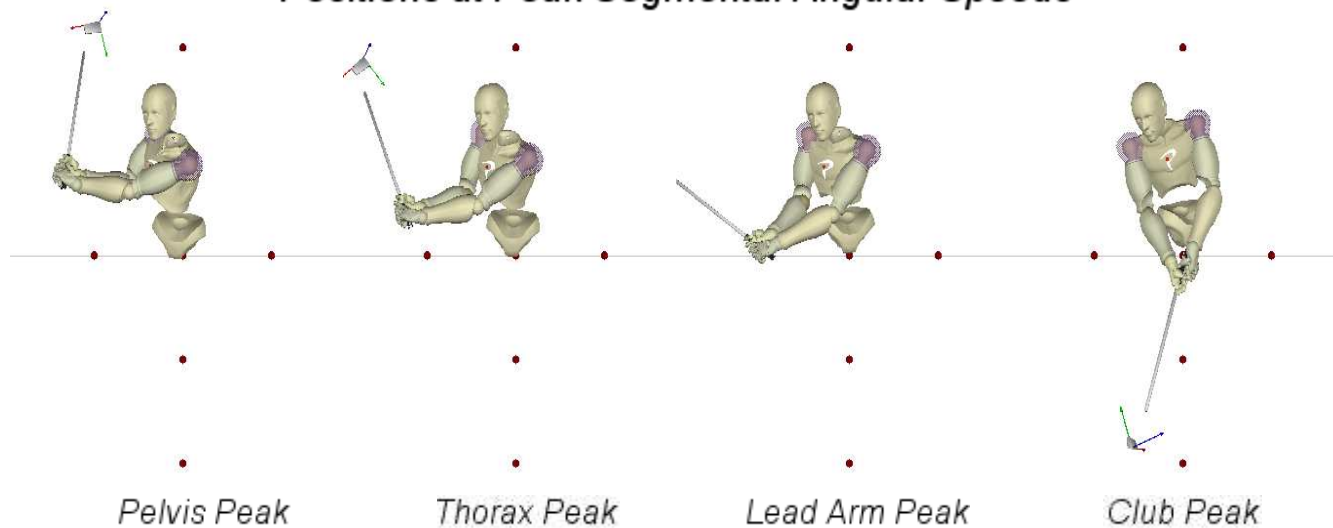


MYTPI.COM

Kinematic Sequence



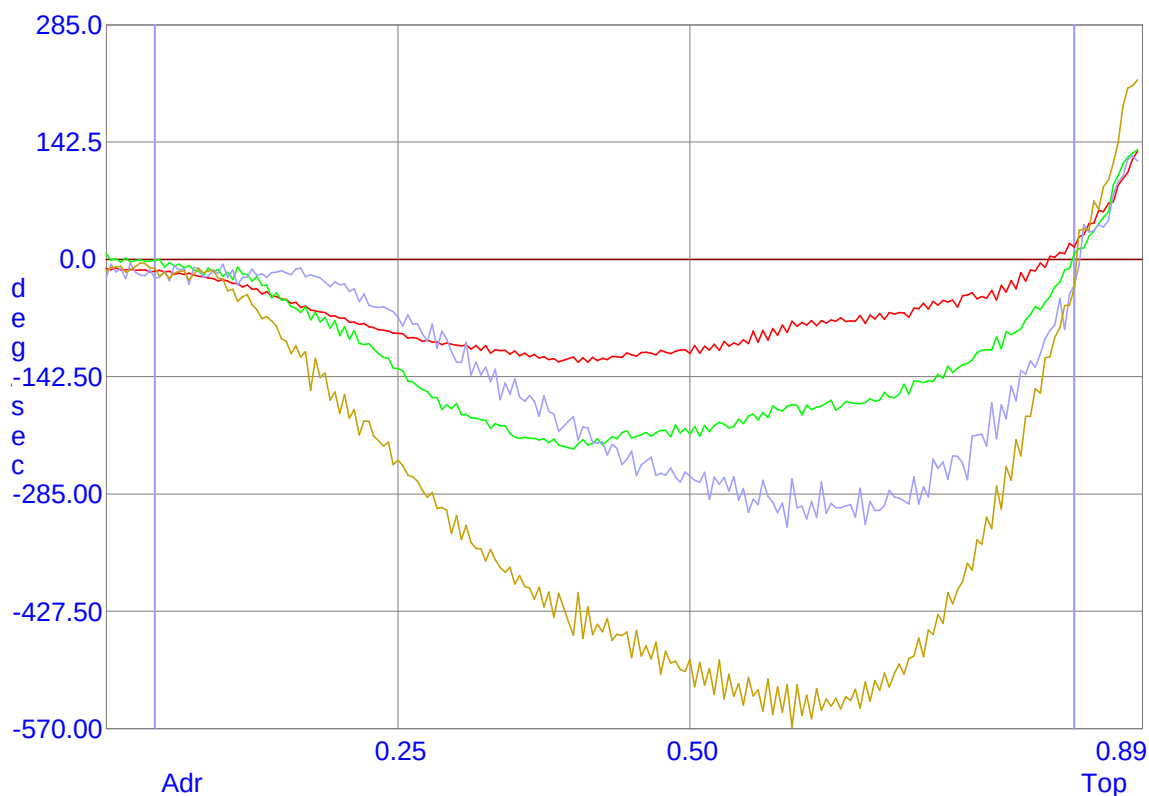
Positions at Peak Segmental Angular Speeds



		Backswing	Downswing	Follow Through
Tempo	ms	788	283	696

Backswing Sequence

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



Backswing Parameters

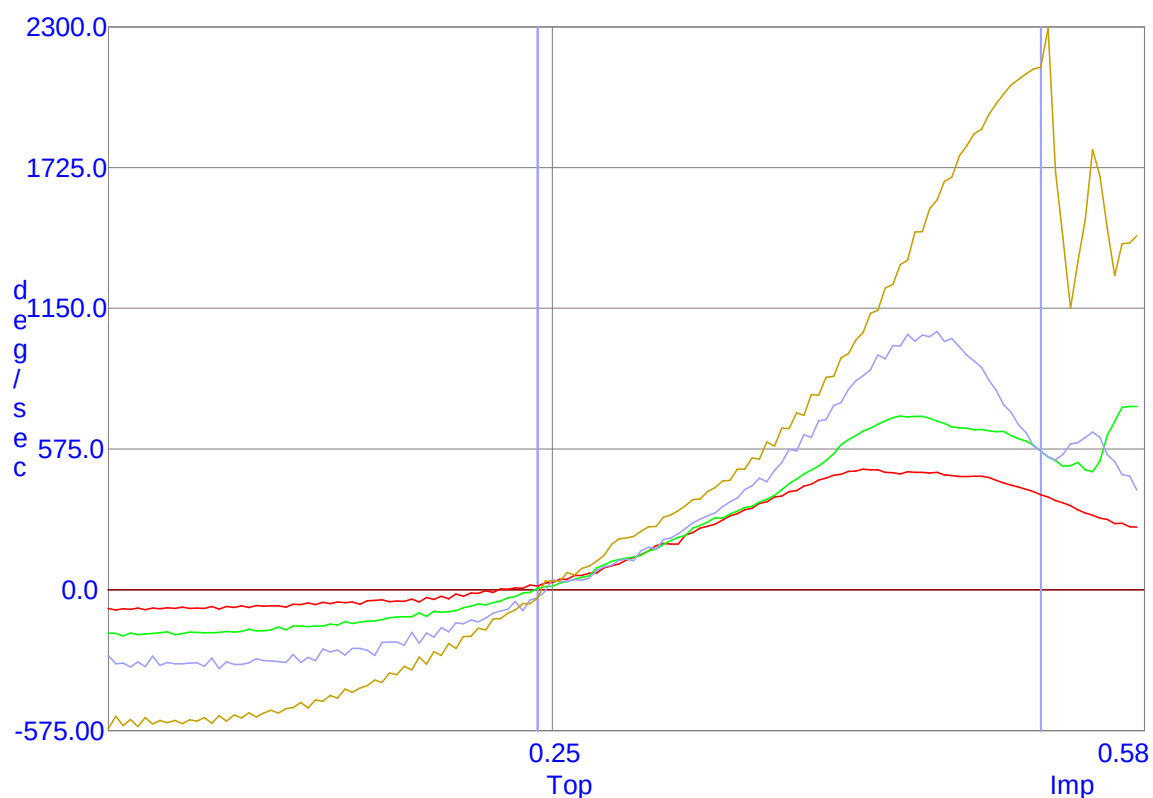
		Pelvis	Thorax	Arm	Club
Peak Order	order	2	1	3	4
Peak to Top	ms	425	429	246	242
Peak to Impact	ms	708	713	529	525
Peak Speed	d/s	125	230	325	568
Acceleration	d/s/s	305	640	559	1021
Deceleration	d/s/s	387	663	542	979

Segmental Interactions

		Pelvis-Thorax	Thorax-Arm	Arm-Club
Time Between Peaks	ms	-4	183	4

Transition Sequence

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



Transition Parameters

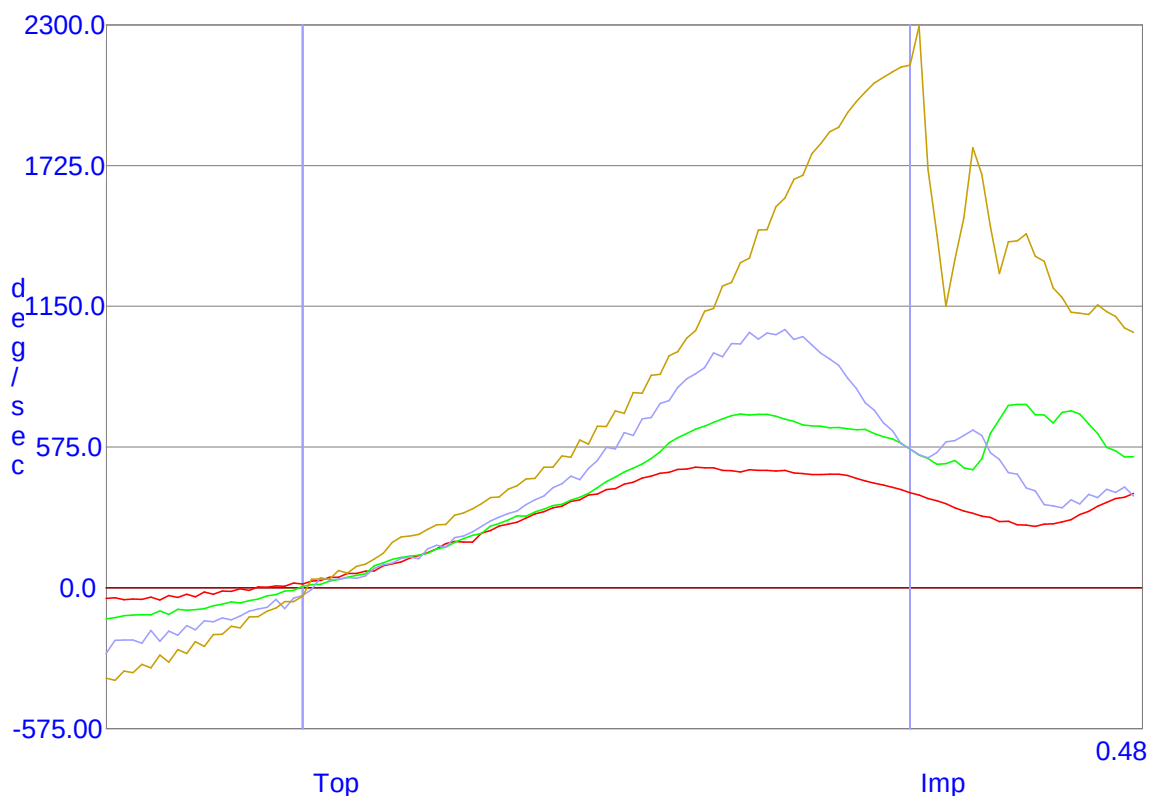
		Pelvis	Thorax	Arm	Club
Transition Order	order	1	2	4	3
Transition to Top	ms	25	4	-4	0
Transition to Peak	ms	208	208	221	283
Transition to Impact	ms	308	288	279	283
Transition Acceleration	d/s/s	820	2017	2881	5019

Segmental Interactions

		Pelvis-Thorax	Thorax-Arm	Arm-Club
Time Between Transitions	ms	21	8	-4

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	100	79	58	0
Peak Speed	d/s	492	710	1054	2135
% of Max	%	23	33	49	100
Acceleration	d/s/s	2409	3459	4993	7656
Deceleration	d/s/s	1040	1815	8359	7945

Segmental Interactions

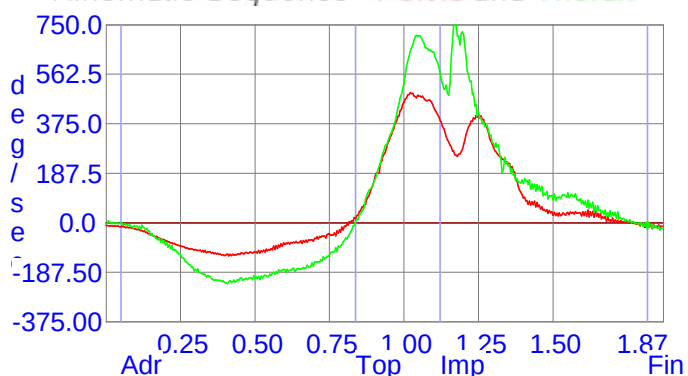
		Plv-Thx	Thx-Arm	Arm-Clb
Time Between Peaks	ms	21	21	58
Angular Speed Gain	d/s	218	345	1081
Gain Factor	ratio	1.4	1.5	2.0

Contribution by Joint

		Legs	Core	Shldr	Wrist
% Contribution	%	23	10	16	51

Spine Link Interactions

Kinematic Sequence - Pelvis and Thorax



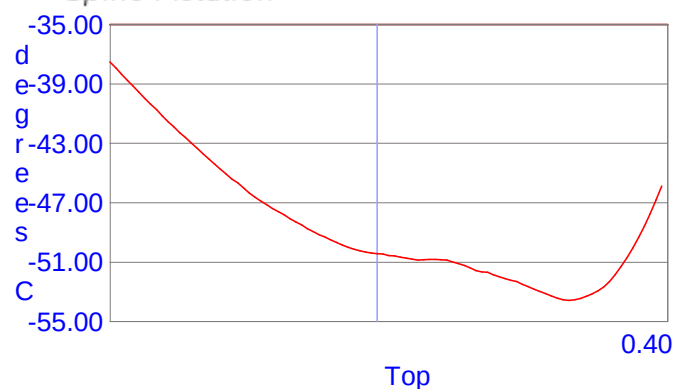
Transition Phase - Pelvis and Thorax



Total Spine Rotation (deg)

	Angle
At Pelvis Transition	50
At Thorax Transition	50
At Maximum	52

Spine Rotation



Transitional Spine Rotation (Stretch)

	Angle (deg)	Time (ms)	Rate (d/s)
Contra-Directional	1	21	26
Ipsi-Directional	1	88	17
Total Stretch	2	108	18

Transitional Timings (ms)

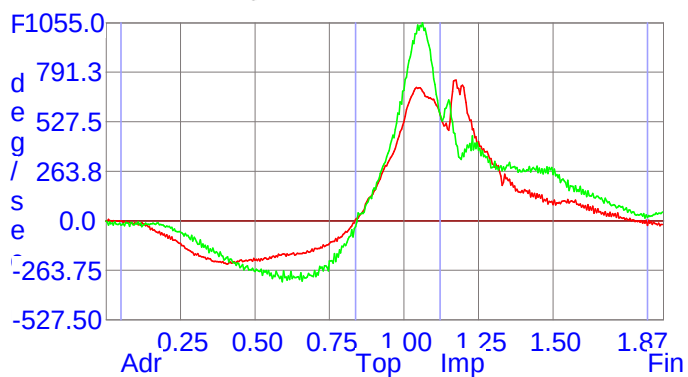
	Pelvis	Thorax
To Club Transition	25	4
To Impact	308	288

Transitional Accelerations (d/s/s)

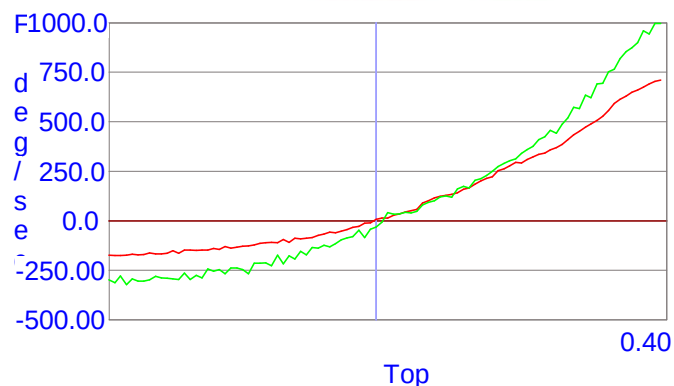
	Pelvis	Thorax
Acceleration	820	2017

Shoulder Link Interactions

Kinematic Sequence - Thorax and Arm



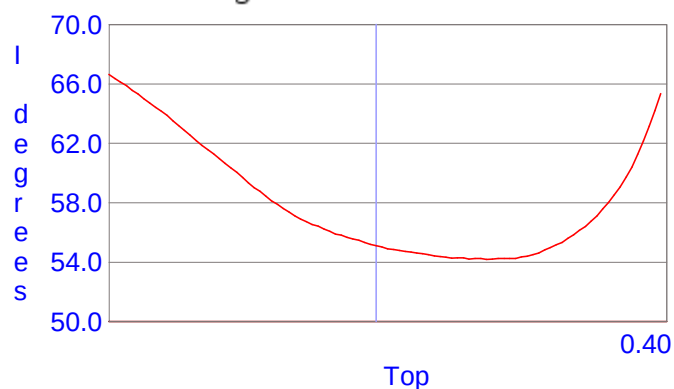
Transition Phase - Thorax and Arm



Total Shoulder Angle (deg)

	Angle
At Thorax Transition	55
At Arm Transition	55
At Min Angle	40

Shoulder Angle



Transitional Shoulder Stretch

	Angle (deg)	Time (ms)	Rate (d/s)
Contra-Directional	0	8	21
Ipsi-Directional	15	-792	-19
Total Stretch	16	-783	-20

Transitional Timings (ms)

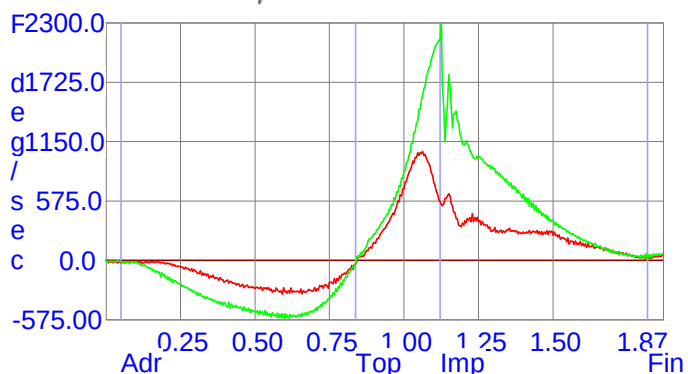
	Thorax	Lead Arm
To Club Transition	4	-4
To Impact	288	279

Transitional Accelerations (d/s/s)

	Thorax	Lead Arm
Acceleration	2017	2881

Wrist Link Interactions

Kinematic Sequence - Arm and Club



Wrist Set Angles (deg)

	Angle
At Arm Transition	89
At Club Transition	89
At Max Set	88
At Arm 30deg Pre-Impact	125

Shaft Lean (deg)

	Angle
At Impact	17 F

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

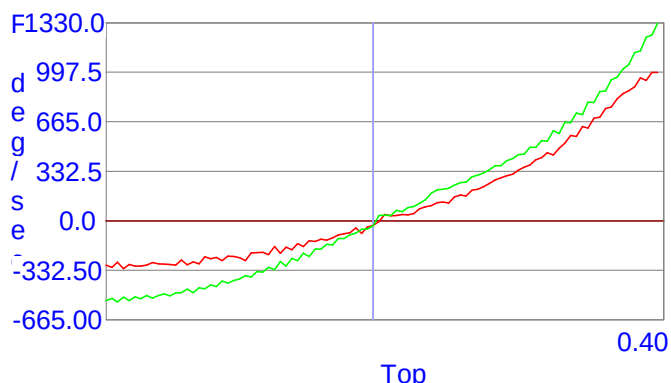
Transitional Timings (ms)

	Lead Arm	Club
To Club Transition	-4	0
To Impact	279	283

Transitional Accelerations (d/s/s)

	Lead Arm	Club
Acceleration	2881	5019

Transition Phase - Arm and Club

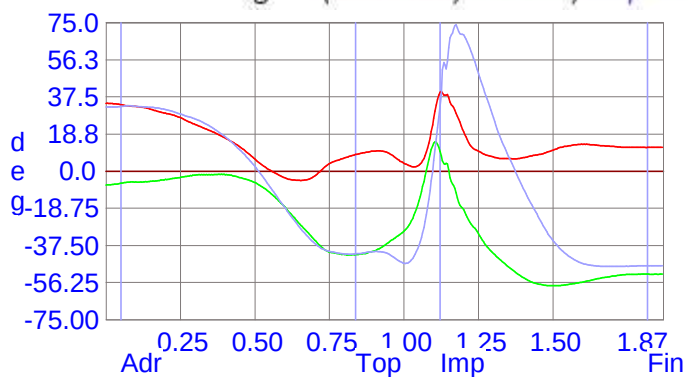


Wrist Set Angle

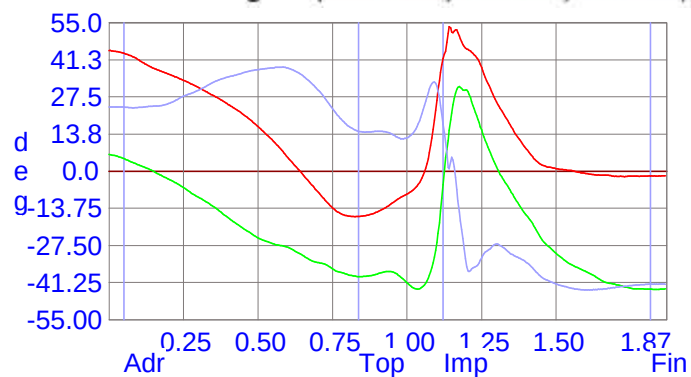


Wrist Link Interactions

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



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



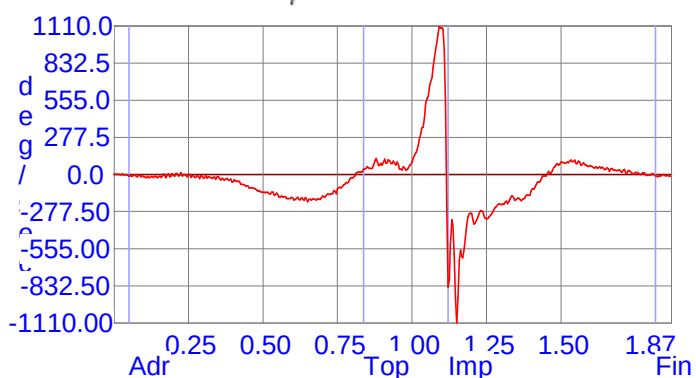
Lead Wrist Angles (Degrees)

	Adr	Top	Imp	Fin
Deviation	34 U	8 U	40 U	12 U
Flexion Extension	6 E	42 E	10 F	52 E
Forearm Sup-Pro	33 S	42 P	33 S	48 P

Trail Wrist Angles (Degrees)

	Adr	Top	Imp	Fin
Deviation	44 U	17 R	42 U	2 R
Flexion Extension	5 F	39 E	5 E	44 E
Forearm Pro-Sup	24 P	15 P	17 P	42 S

Wrist Release Speed



Angular Velocities (Deg/Sec)

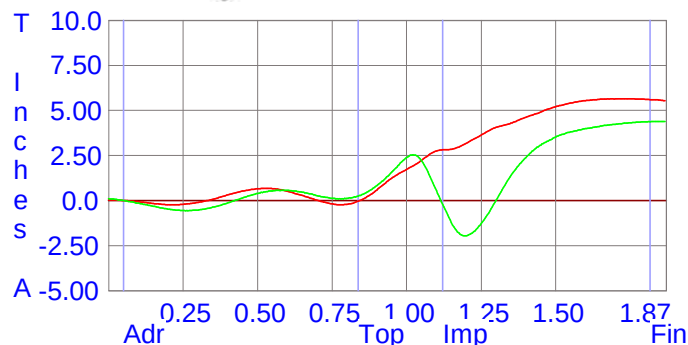
	Imp
Lead Wrist Sup-Pro Vel	1305 S
Lead Wrist Ext-Flex Vel	533 E
Trail Elbow Extn Vel	656 E
Club Handle Axial Vel	1464 C

Max Release Speed deg/sec 1105

Projected Impact Speed mph 98

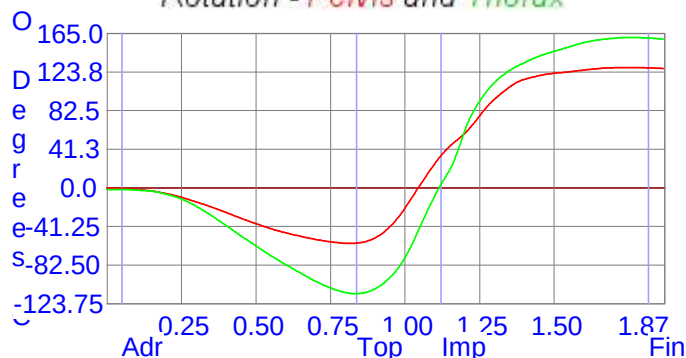
Trunk Dynamic Stability

Sway - Pelvis and Thorax



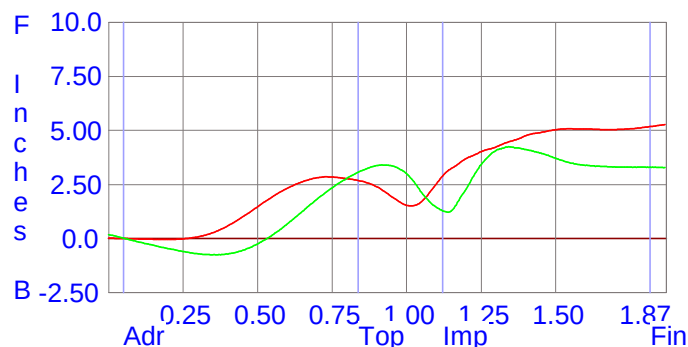
(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 T	0.0 A	2.8 T	5.6 T
Thorax	0.0 T	0.2 T	0.2 A	4.4 T

Rotation - Pelvis and Thorax



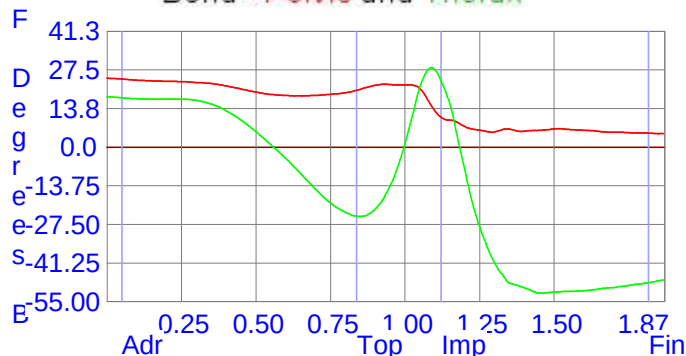
(Degrees)	Adr	Top	Imp	Fin
Pelvis	1 C	59 C	34 O	6 O
Thorax	2 C	113 C	4 O	160 O

Thrust - Pelvis and Thorax



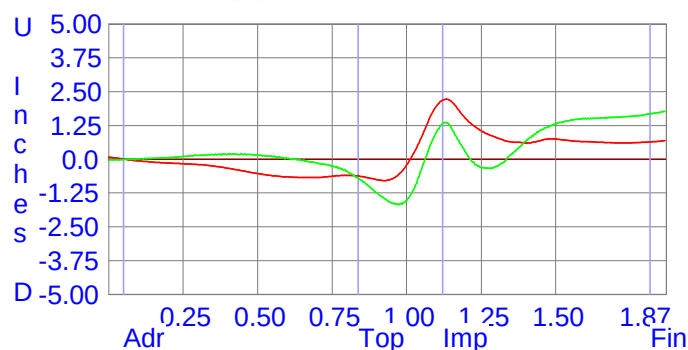
(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 F	2.7 F	2.9 F	5.2 F
Thorax	0.0 F	3.1 F	1.3 F	3.3 F

Bend - Pelvis and Thorax



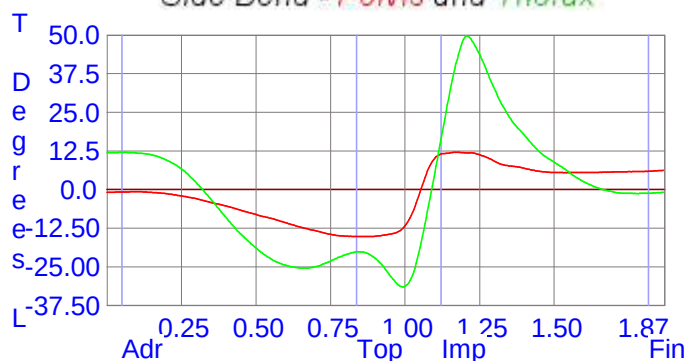
(Degrees)	Adr	Top	Imp	Fin
Pelvis	24 F	20 F	11 F	5 F
Thorax	18 F	25 B	24 F	48 B

Lift - Pelvis and Thorax



(Inches)	Adr	Top	Imp	Fin
Pelvis	0.0 U	0.6 D	2.2 U	0.6 U
Thorax	0.0 D	0.7 D	1.3 U	1.7 U

Side Bend - Pelvis and Thorax



(Degrees)	Adr	Top	Imp	Fin
Pelvis	1 L	15 L	12 T	6 T
Thorax	12 T	20 L	16 T	1 L

Dynamic Range of Motion

Head Angles (deg)

Rotation	54 C	91 O	145
Bend	43 F	11 B	55
Side Bend	25 L	44 T	69

Neck Angles (deg)

Rotation	61 C	59 O	120
Flexion-Extension	3 E	47 E	43
Side Bend	25 L	26 T	50

Thorax Angles (deg)

Rotation	113 C	161 O	274
Bend	28 F	52 B	80
Side Bend	32 L	50 T	81

Lead Shoulder Angles (deg)

Elevation	6 B	148 B	142
Horizontal Adduction	39 I	163 I	124

Pelvis Angles (deg)

Rotation	59 C	129 O	188
Bend	25 F	5 F	20
Side Bend	15 L	12 T	27

Spine Angles (deg)

Rotation	54 C	21 O	74
Flexion-Extension	15 F	58 E	73
Side Bend	20 L	38 T	58
Forward Tilt	34 F	22 F	12
Side Tilt	2 T	21 T	19

Trail Elbow Angles (deg)

Flexion-Extension	170 F	91 F	79
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Lead Elbow Angles (deg)

Flexion-Extension	166 F	60 F	105
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Trail Wrist Angles (deg)

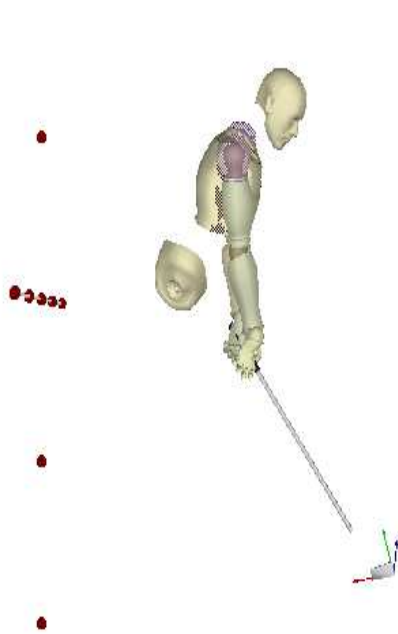
Rotation	39 S	44 P	83
Flexion-Extension	31 E	44 F	75
Deviation	54 U	17 R	70

Lead Wrist Angles (deg)

Rotation	74 S	48 P	122
Flexion-Extension	15 F	58 E	73
Deviation	40 U	5 R	45

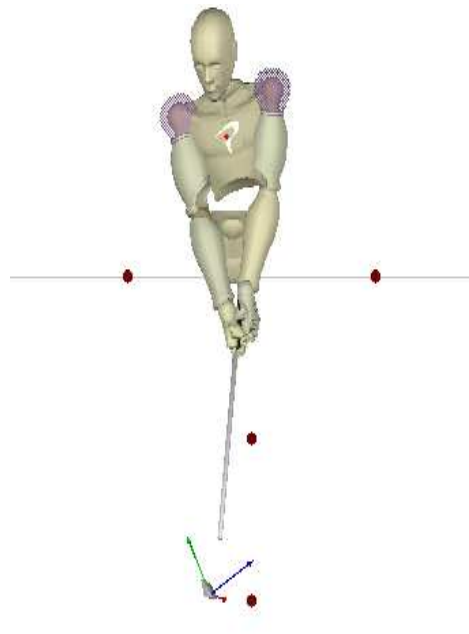
Columns are max range to each side and total range traveled

Position At Address



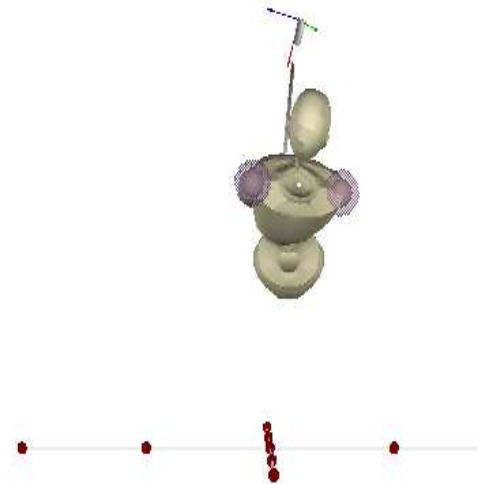
Angles (deg)

	Pelvis	Thorax
Rotation	1 C	2 C
Bend	24 F	18 F
Side Bend	1 L	12 T

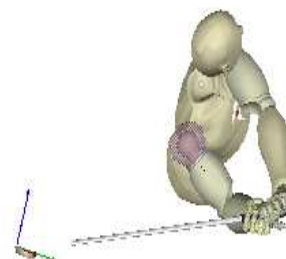
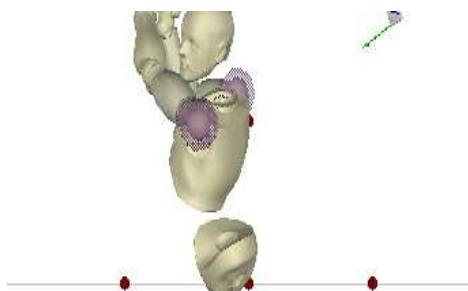
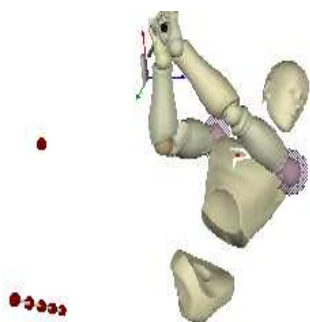


Angles (deg)

	Spine
Rotation	1 C
Flexion-Extension	7 B
Side Bend	13 T



Position At Top



Angles (deg)

	Pelvis	Thorax
Rotation	59 C	113 C
Bend	20 F	25 B
Side Bend	15 L	20 L

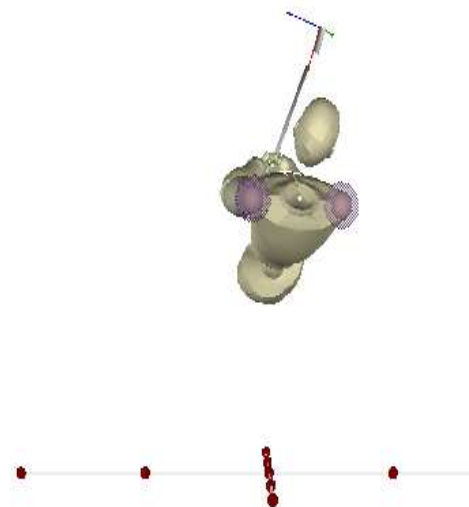
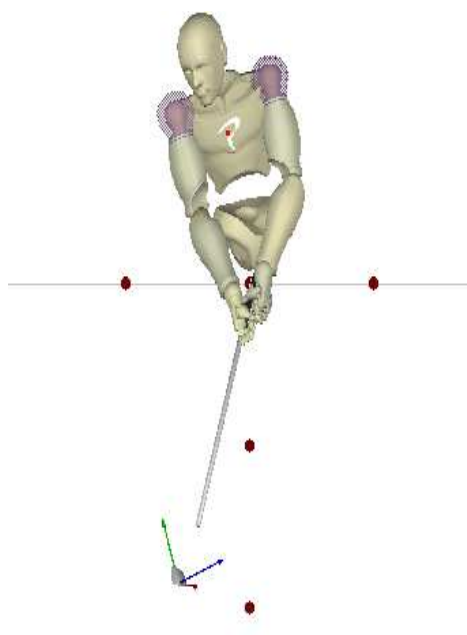
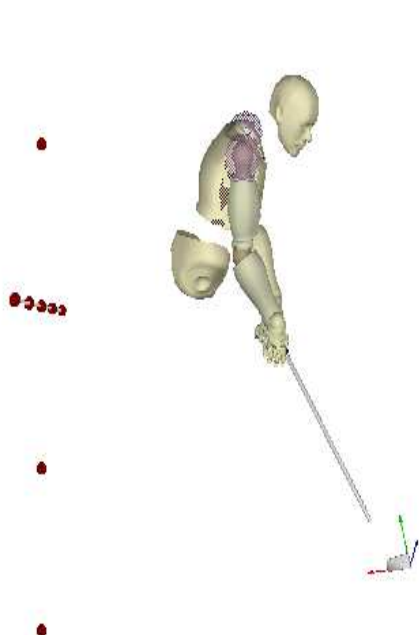
Angles (deg)

	Spine
Rotation	50 C
Flexion-Extension	45 B
Side Bend	5 L

Displacements (inches)

	Pelvis	Thorax
Sway	0.0 A	0.2 T
Thrust	2.7 F	3.1 F
Lift	0.6 D	0.7 D

Position At Impact



Angles (deg)

	Pelvis	Thorax
Rotation	34 O	4 O
Bend	11 F	24 F
Side Bend	12 T	16 T

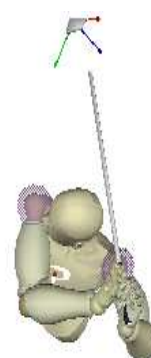
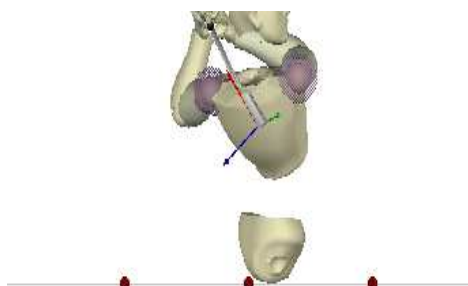
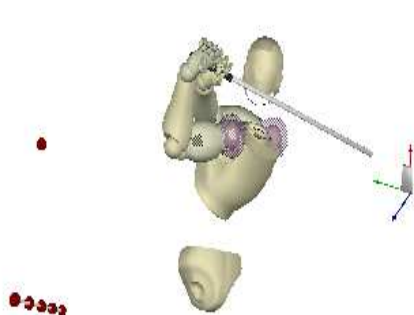
Angles (deg)

	Spine
Rotation	32 C
Flexion-Extension	13 F
Side Bend	5 T

Displacements (inches)

	Pelvis	Thorax
Sway	2.8 T	0.2 A
Thrust	2.9 F	1.3 F
Lift	2.2 U	1.3 U

Position At Finish



Angles (deg)

	Pelvis	Thorax
Rotation	128 O	160 O
Bend	5 F	48 B
Side Bend	6 T	1 L

Angles (deg)

	Spine
Rotation	20 O
Flexion-Extension	53 B
Side Bend	7 L

Displacements (inches)

	Pelvis	Thorax
Sway	5.6 T	4.4 T
Thrust	5.2 F	3.3 F
Lift	0.6 U	1.7 U