Rimini, 7 novembre 2018

Francesco Draicchio, Lorenzo Fiori, Antonella Tatarelli, Alessio Silvetti
Laboratorio di Ergonomia e Fisiologia, DIMEILA

Studio degli aspetti fisiologici e biomeccanici dell'attività dell'addetto alla raccolta

INAIL

FONDAZIONE RUBES TRIVA
SICUREZZA, LAVORO, AMBIENTE

INAIL

Autori:

per la Contarp Centrale:
A. GUERCIO, P. FIORETTI, L. FRUSTERI, R. GIOVINAZZO, E. INCOCCIATI, N. TODARO

per la Contarp Lombardia:
B. PRINCIPE, P. SANTUCCIU

per la Contarp Sicilia:
G. GIAQUINTA

per la Consulenza Statistico Attuariale
F. MARRACINO

La sicurezza per gli operatori della raccolta dei rifiuti e dell'igiene urbana

3.2.2.1 – Rischio da Movimentazione Manuale dei Carichi (MMC)

- La maggior parte delle patologie denunciate nell'ambito del comparto della raccolta di rifiuti possono essere ricondotte alla MMC, superate solo dalle patologie risultanti da rischio biologico-infettivo.
- I danni più comunemente riscontrati sono a carico del tratto dorso lombare della colonna vertebrale e dei muscoli annessi (mal di schiena, ernia del disco, artrosi), ma sono rilevate anche patologie a carico delle articolazioni delle braccia o delle gambe.
- occorre considerare il rischio connesso alla necessità di torsioni del busto o di movimenti a strappo (es.: lancio del sacco nel mezzo di raccolta, sollevamento in ambienti ristretti)

3.2.2.1 – Rischio da Movimentazione Manuale dei Carichi (MMC)

- carichi troppo pesanti, o difficili da afferrare o instabili e disomogenei o di contenuto tale da richiedere che la movimentazione avvenga in maniera non ottimale (per esempio, carico lontano dal corpo per evitare il rischio di tagli con oggetti presenti all'interno, presa non sicura per il rischio di schegge)

16th IFAC Symposium on Information Control Problems in Manufacturing
Bergamo, Italy, June 11-13, 2018

Ergonomics and human factors in waste collection: analysis and suggestions for the door-to-door method

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Abstract: Waste collection work is associated with a variety of physical, chemical, and biological hazards. The risk of fatal occupation injuries of waste collectors is higher than in general industry. Despite being a relatively small sector in terms of employment, the fatal injury rate in waste collection is significant. This paper shows a detailed analysis of the door-to-door waste collection system in the historic center of an Italian city. Waste collection in urban areas is characterized by high number of small waste containers that need to be tipped into the waste collection vehicle. The aim is to identify risk factors for work-related musculoskeletal disorders (WMSDs) in waste collection and to provide recommendations for reducing the risk of WMSDs to waste collectors.

The analysis of the waste management strategy, the process characteristics and workers' behavior are described, together with several proposals to improve the ergonomics of the waste collection activity and the safety of waste collectors.

Keywords: Waste collection, door-to-door, manual material handling, human factors, ergonomics.

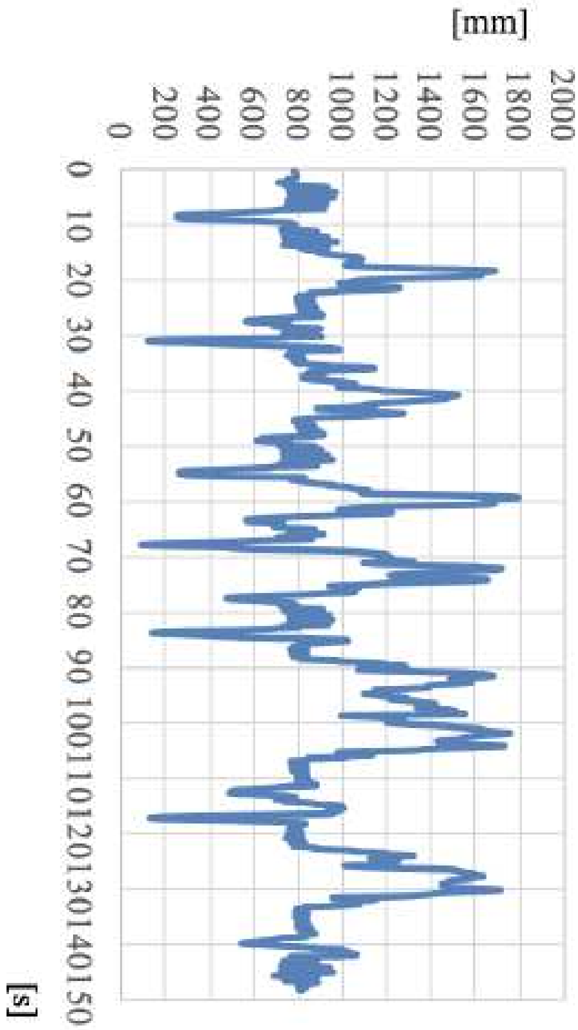
	NIOSH LI Origin (n. of RR)	%	NIOSH LI Destination (n. of RR)	%
Green	12	43%	0	0%
Yellow	11	39%	0	0%
Red	5	18%	13	46%
Purple	0	0%	15	54%
Total	28	100%	28.00	100%

	NIOSH LI Origin (n. of RR)	%	NIOSH LI Destination (n. of RR)	%
Green	25	89%	24	86%
Yellow	1	4%	2	7%
Red	2	7%	2	7%
Purple	0	0%	0	0%
Total	28	100%	28.00	100%

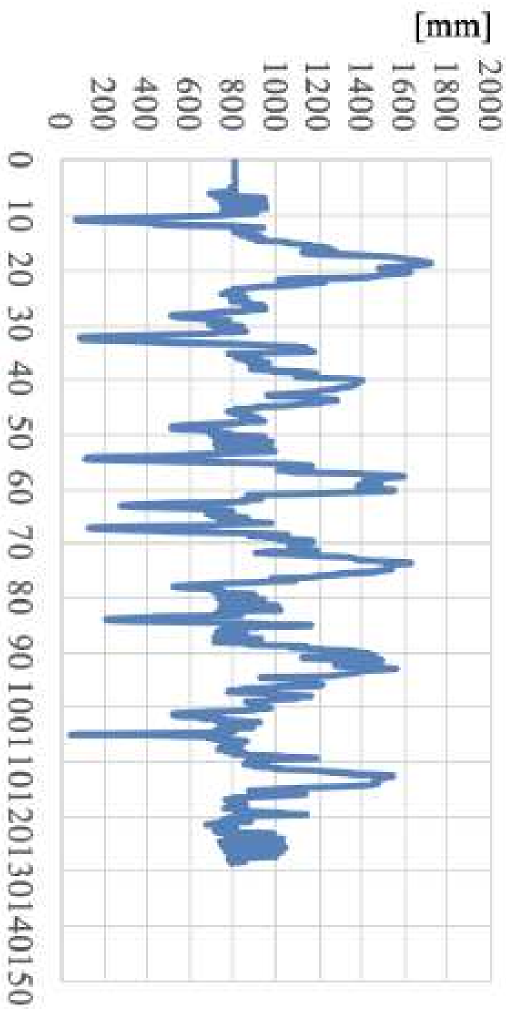
different truck container

- Improve the waste collection process by using a different truck container with a lower height in order to permit to the operators to reduce the fatigue during the unload of the waste bin into the truck container.

fatigue is reduced and also the cycle time to unload 6 bins is reduced (B) respect to the current situation (A).



B. Truck container height from the ground: 100 mm (Hands 120 cm from the ground)



- The postural assessment has revealed very high exposure to postural risk factors for the back in standing posture. These results suggest critical areas of improvement. Specifically, workers should lift the bins keeping the load close to the body and avoiding awkward postures, e.g. torsions and other postures that require the operator to move away from the neutral posture toward the extremes in range of motion.
- Furthermore, workers assume flexed posture with the back when retrieving the kerbside bins, while tipping the bins on the vehicle requires lifting the arms to shoulder height. The adoption of a shorter truck container on the collection vehicle may reduce the vertical distance of the hands from the ground and the overall dislocation of the lifting task

ELSEVIER

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An International Journal for Scientific Research into the Environment and its Relationship with Man

Sorting and recycling of domestic waste. Review of occupational health problems and their possible causes

Otto M. Poulsen*[a], Niels O. Breum[a], Niels Ebbehøj[b], Åse Marie Hansen[a], Ulla I. Ivens[a], Duco van Lelieveld[a], Per Malmros[c], Leo Matthiasen[c], Birgitte H. Nielsen[a], Eva Møller Nielsen[a], Bente Schibye[a], Torsten Skov[a], Eva I. Stenbaek[a], Ken C. Wilkins[a]

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Table 2. Annual incidence rates, per 1000 employees, of reported health problems in Denmark, 1984 to 1992 (after Poulsen *et al.*, 1995)

Diagnostic group	Incidence rate for total work force	Incidence rate for refuse collectors	Relative risk	95% confidence interval
Reported diseases	5.5	8.3	1.5	1.4 - 1.7
Allergic respiratory diseases	0.22	0.58	2.6	1.8 - 3.9
Other respiratory diseases	0.38	0.53	1.4	0.9 - 3.9
With defective hearing	0.95	0.51	0.5	0.09 - 0.8
Musculoskeletal diseases	**1.9**	**3.5**	**1.9**	**1.6 - 2.2**
Skin diseases	0.84	1.3	1.6	1.2 - 2.0
Infectious diseases	0.06	0.36	6.0	3.6 - 10.0
Nerves / senses	0.05	0.1	2.0	0.8 - 5.3
Brain damage	0.39	0.31	0.8	0.5 - 1.4
Circulation	0.08	0.05	0.6	0.2 - 2.5
Gastrointestinal	0.05	0.14	2.8	1.3 - 6.3

ERGONOMICS, 1995, VOL. 38, NO. 10, 1993–2006

Mechanical loading on the low back in three methods of refuse collecting

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The mechanical loading on the low back was studied in three different current methods of refuse collecting: in polythene bags, two-wheeled mini-containers and large four-wheeled containers. To this end the most prominent activities of each collecting method were performed in a laboratory. On the basis of movement analysis, force measurements and biomechanical modelling, spinal compressive and shear forces were estimated. From these forces and from the frequency of activities during the working day (assessed in a preliminary field study) the low-back stress in each collecting method was evaluated. In the bag-method, peak forces when throwing the bags ranged from 3341 to 5179 N (average compression) and from 284 to 673 N (shear) among the different conditions studied. The act of picking up bags also showed rather high forces (exceeding the NIOSH limit for disc compression in most cases). The frequency of exposure to these forces in the field is rather high (workers pick up and throw on average 807 times each day). The mini-container method compares favourably to the bags method. Peak compressive and shear force in tilting/pushing and pulling mini-containers ranged from 1657 to 2654 N and from 123 to 248 N respectively. Also, the frequency of stressful events in the field is lower in this method. In the large container method extremely high peak forces (e.g. compression ranged from 4991 to 5810 N) were observed in the task of putting the empty container back from street level to sidewalk level (surmounting the kerb). The frequency of activities like pushing, pulling and lifting the large container in the field is much lower compared with activities in the other methods. On the basis of the frequency and magnitude of spinal forces it was concluded that the mini-containers should be preferred to the bags. If kerbs are removed at container places and tasks are performed by two instead of a single person, the large container method would form another good alternative to the stressful task of collecting refuse in bags.

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DOI: 10.3233/WOR-2012-0485-248
IOS Pres

Analysis of urban cleanness agents' workstation on the appearance of Work Related Musculoskeletal Disorders

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Abstract This study had as objective to evaluate the workstation of the responsable for the collection of urban garbage in relation to the factors associates with the appearance or aggravation of WMRD, as well as identifying signals and symptoms of these illnesses in the related professionals. For this, was developed a form with open and closed questions, that approached item relative to the identification of the searched, to the organization and execution of the work and to the signals and symptoms of WMRD, e that was applied in 44 agents in a company of collection of urban residues in a Brazilian metropolis. As the results can be evidenced that between the factors that the cleanness' agents are susceptible to the appearance of WMRD can detach the lack of orientation of these professionals as the positions adopted in the work, the lack of training and qualification, as well as the repetitivity of tasks and not use of individual protection equipment. However, yet with the existence of innumerable factors of risk, evidenced a small incidence of pain.

Joint	Number of Agents	Percentile
Shoulder	3	18,8%
Arm	1	6,3%
Hip	2	12,5%
Knee	4	25%
Ankle	1	6,3%
Lower Back	6	38%
Dorsal Region	2	12,5%

Analytical Predictive Bayesian Assessment of Occupational Injury Risk: Municipal Solid Waste Collectors

James D. Englehardt,[1]* Huren An,[2] Lora E. Fleming,[3] and Judy A. Bean[4]

Unlike other waste streams, municipal solid waste (MSW) is collected manually, and MSW collection has recently been found to be among the highest-risk occupations in the United States. However, as for other occupational groups, actual total injury rates, including the great majority of injuries not compensated and those compensated by other insurance, are not known. In this article a predictive Bayesian method of assessing total injury rates from available information without computation is presented, and used to assess the actual numbers of musculoskeletal and dermal injuries requiring clinical care of MSW workers in Florida. Closed-form predictive Bayesian distributions that narrow progressively in response to information, representing both uncertainty and variability, are presented. Available information included workers' compensation (WC) data, worker population data, and safety records for one private and one public collection agency. Subjective input comprised epidemiological and medical judgment based on a review of 165 articles. The number of injuries was assessed at 3,146 annually in Florida, or 54 ± 18 injuries per 100 workers per year with 95% confidence. Further, WC data indicate that the injury rate is 50% higher for garbage collectors specifically, indicating a rate of approximately 80 per 100 workers. Results, though subject to uncertainty in worker numbers and classification and reporting bias, agreed closely with a survey of 251 MSW collectors, of whom 75% reported being injured (and 70% reported illness) within the past 12 months. The approach is recommended for assessment of total injury rates and, where sufficient information exists, for the more difficult assessment of occupational disease rates.

KEY WORDS: Collector; injury; occupational safety; predictive Bayesian; solid waste worker

Ergonomic Review of Kerbside Collection for Dumfries & Galloway Council, Wigtown Area

18th June 2015

Prepared by:

Elaine J Skilling BSc (Hons) MSc C.ErgHF MCSP HCPC
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3.1	The effects of weight on lifting increased as the box was located closer to ground level.	Encourage households to stack boxes, with the heavier box stacked on top of the lighter box - this will also improve manual handling for householders.	Increased percentage of boxes complying with HSE guidance due to box position when lifting. Reduced likelihood of MSD's resulting from lifting loads.
3.2	Operatives observed undertaking poor manual handling practices when lifting boxes.	Ensure operator manual handling training is task specific and includes advice and guidance on lifting of loads.	Reduced likelihood of MSD's resulting from lifting loads.
3.3	Operatives observed undertaking poor manual handling practices when lifting caddies.	Ensure operator manual handling training is task specific and includes advice and guidance on lifting of loads.	Reduced likelihood of MSD's resulting from lifting loads.
3.4	Operatives were observed to maintain the box at the vehicle with their torso/thigh and hand without attaching it to the lug.	Ensure operator manual handling training is task specific and includes advice and guidance on sorting methods.	Reduced likelihood of MSD's resulting from sorting loads.
3.5	Operatives were required to have to bend their backs and necks to take recyclates from recycling bags due to the low height of the bag when the handles are attached to the lugs.	Consider either shortening the handles on the bags or providing an additional strap at the top of the bag rim which can be used to attached the bag to the lug and thus keep the bag higher for sorting.	Reduced likelihood of MSD's resulting from sorting loads.
3.6	Operatives observed tipping the remaining contents of boxes into a stillage resulting in awkward postures of the shoulder, elbow and wrist.	Ensure operator manual handling training is task specific and includes advice and guidance on sorting methods.	Reduced likelihood of MSD's resulting from sorting loads.
3.7	Operatives were observed to throw the contents of the food caddie into the side opening of the collection vehicle due to the height of the opening. [*The height of the openings are recommended to fall within 780mm and 1115mm above ground height to allow manual handling tasks*.]	1. Liaise with Terberg with regards to the design of the side openings with regards to manual handling activities and potential for retro fitting. 2. Consider the potential for the scuttle to be replaced with a larger container for food caddies to be emptied directly into which can then be operated mechanically to off load into the vehicle.	Reduced likelihood of MSD's resulting from off- loading.

I metodi

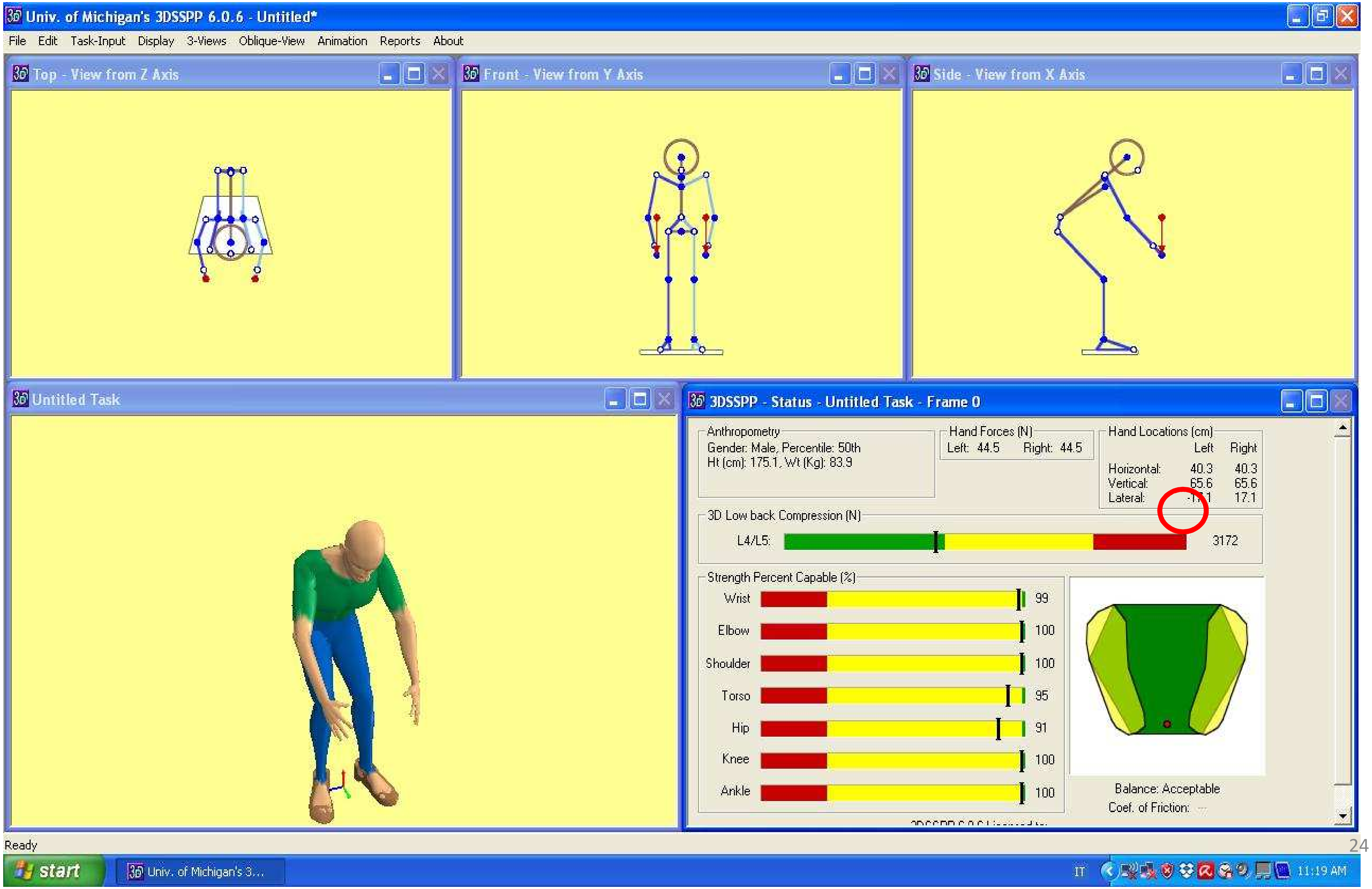
Relative cardiac cost

rCC	
0 – 9	Very light
10 - 19	Light
20 - 29	Moderate
30 - 39	Hard
40 - 49	Very hard

3DSSPP, STATIC STRENGHT PREDICTION PROGRAM

CENTER FOR ERGONOMICS
dedicated to improving human *performance* and *well-being*

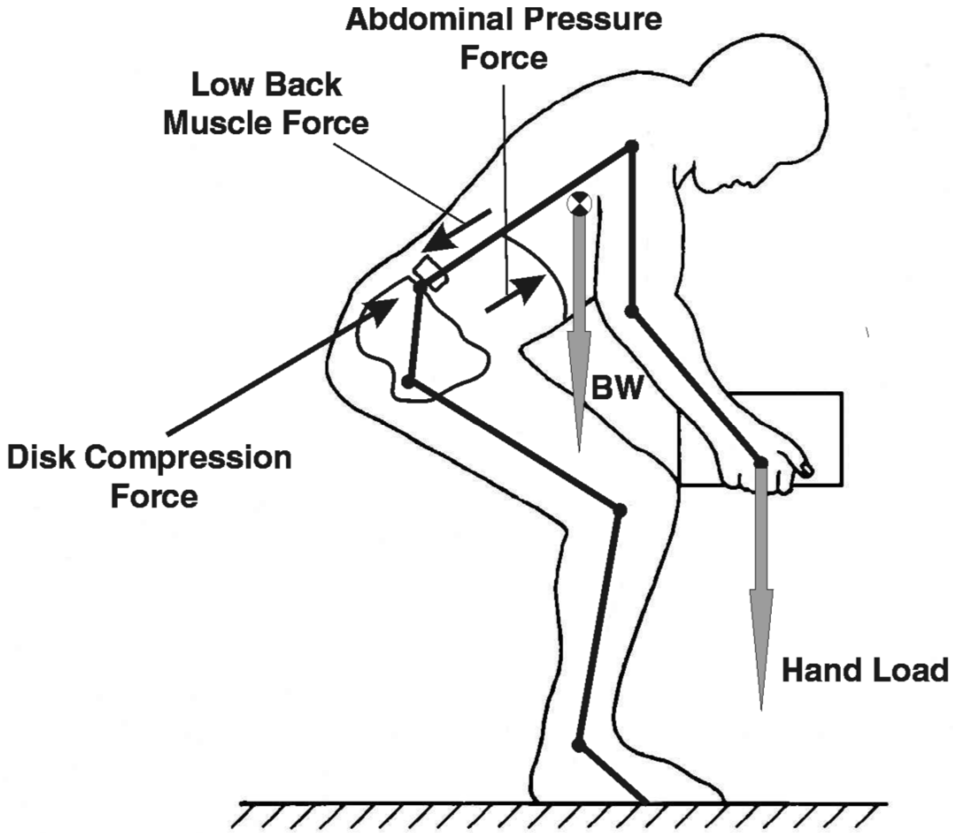
INDUSTRIAL AND OPERATIONS ENGINEERING
UNIVERSITY of MICHIGAN ▪ COLLEGE of ENGINEERING



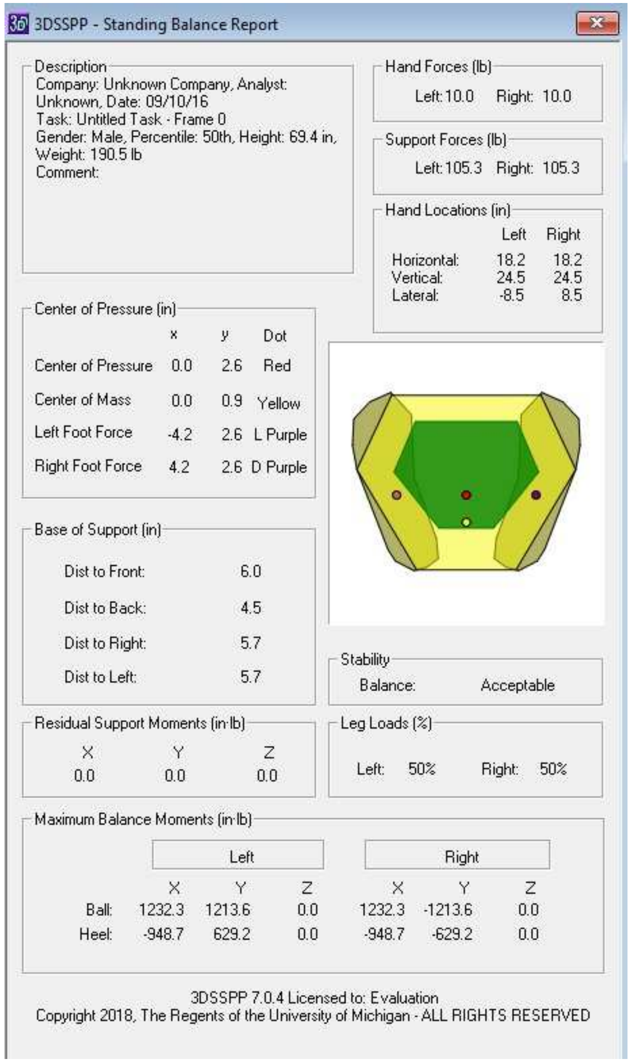
Univ. of Michigan's 3DSSPP 6.0.6 - Untitled*
File Edit Task-Input Display 3-Views Oblique-View Animation Reports About
Top - View from Z Axis
Front - View from Y Axis
Side - View from X Axis
Untitled Task
3DSSPP - Status - Untitled Task - Frame 0
Anthropometry
Gender: Male, Percentile: 50th
Ht (cm): 175.1, Wt (Kg): 83.9
Hand Forces (N)
Left: 44.5 Right: 44.5
Hand Locations (cm)
Left Right
Horizontal: 40.3 40.3
Vertical: 65.6 65.6
Lateral: -17.1 17.1
3D Low back Compression (N)
L4/L5: 3172
Strength Percent Capable (%)
Wrist 99
Elbow 100
Shoulder 100
Torso 95
Hip 91
Knee 100
Ankle 100
Balance: Acceptable
Coef. of Friction: ---
Ready
start
Univ. of Michigan's 3...
11:19 AM

L5/S1 Forces

- The Lumbar Disc Compression Force at L5/S1 disc level is calculated as the sum of Erector Spinae / Rectus Abdominus, abdominal force, upper body weight above L5/S1 level, and hand load



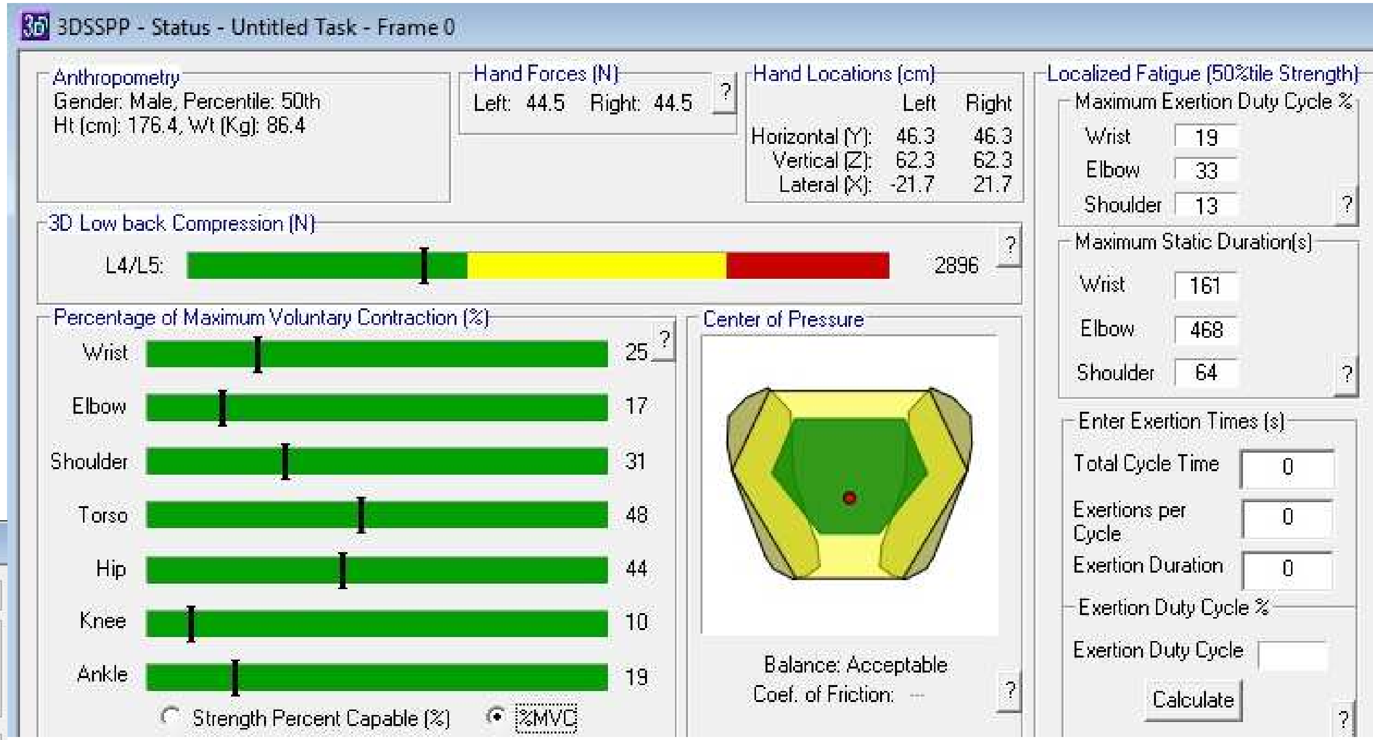
Reports - Balance

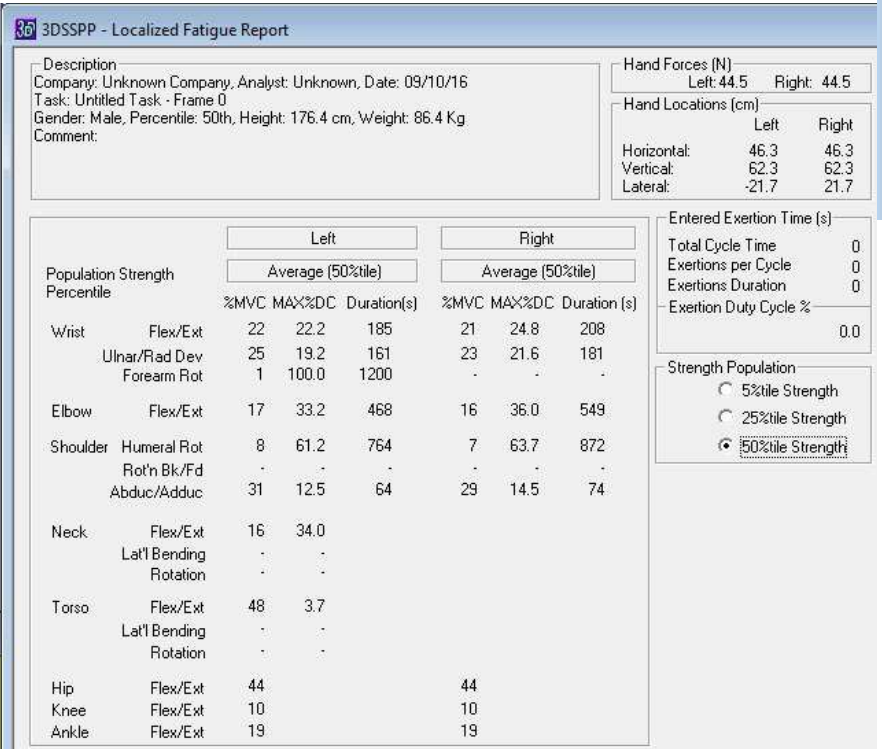


The *Center of Body Mass is defined as the center of body mass projected downward and can also be called Center of Gravity (CoG). In 3DSSPP this is calculated for the body part masses only, not including the mass of objects which might be in the hands. No external forces or moments are included. The Center of Body Mass is shown on the balance* graphic as a yellow dot. The reported measurements are the location of the center with respect to the center of ankles as projected onto the supporting surface.

The *Center of Pressure (COP) is defined as the center of the supporting forces. It is calculated similar to the COG, but includes all external forces and moments as well as the body part masses. The Center of Pressure is shown on the balance graphic as a red dot. The reported measurements are the location* of the center with respect to the center of ankles. As projected onto the supporting surface.

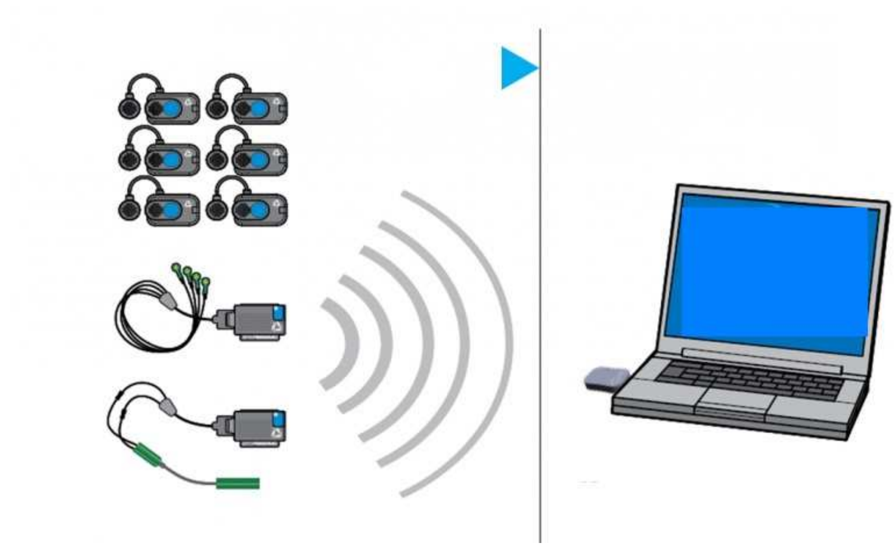
Percentage of Maximum Voluntary Contraction



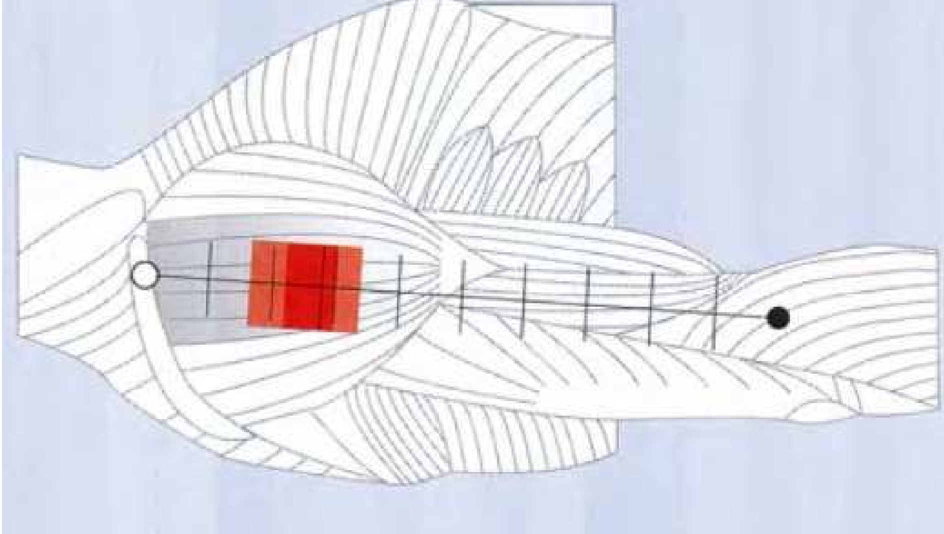


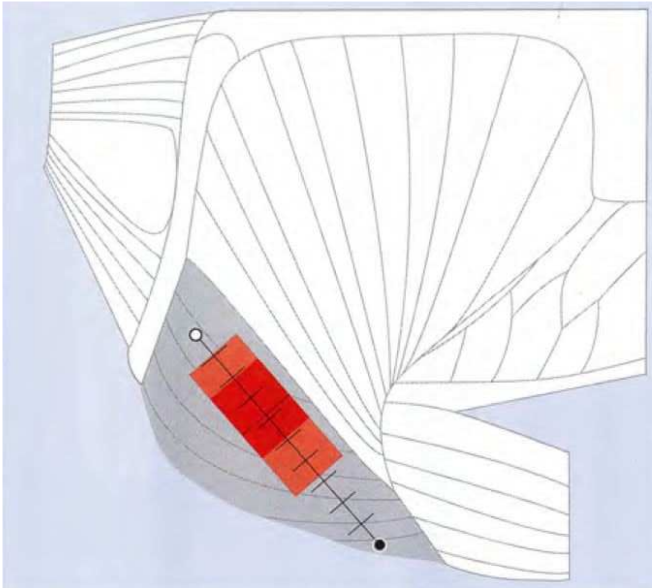
Fatigue analysis according to new ACGIH (American Conference of Governmental Industrial Hygienists) limits

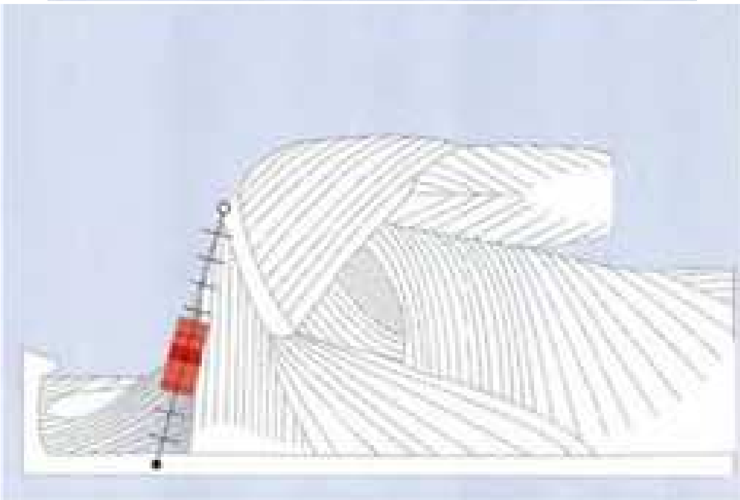
Surface electromyography (sEMG)

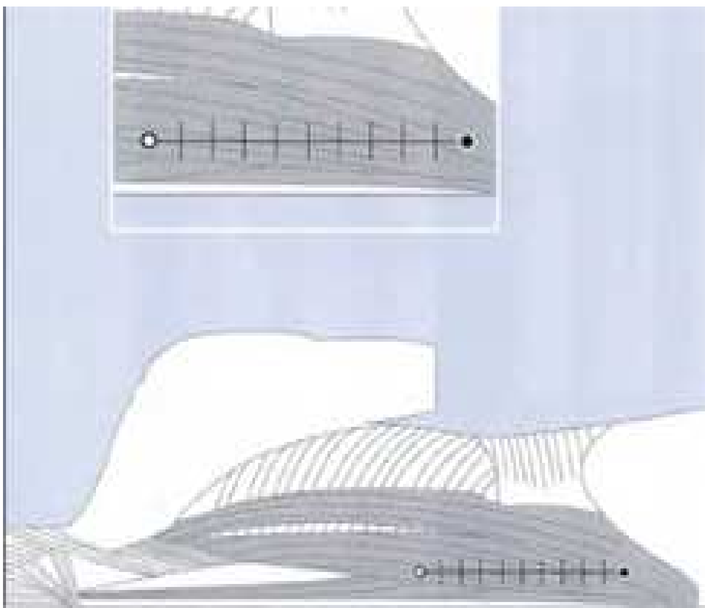


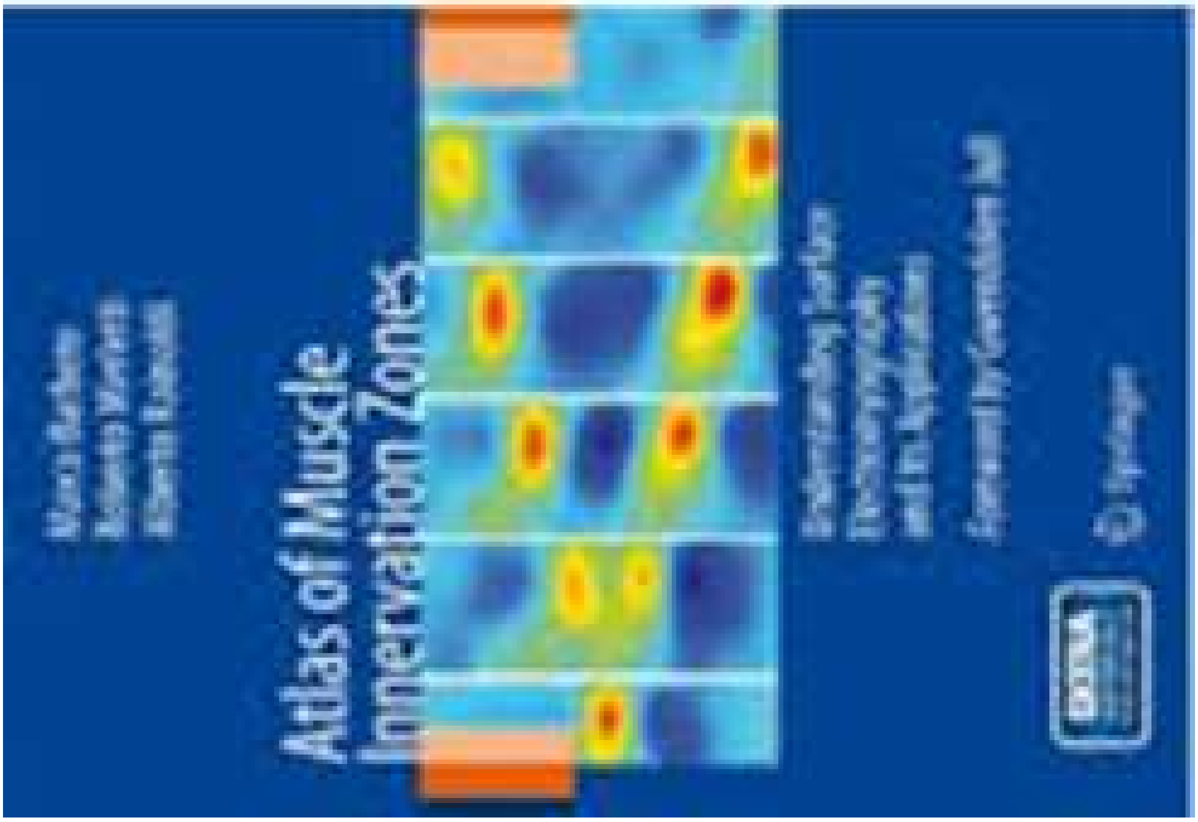
Instrumental procedure that records electrical activity of muscles involved in the task investigated by means of the maximal voluntary contraction (%MCV) in isometric conditions of target muscles.



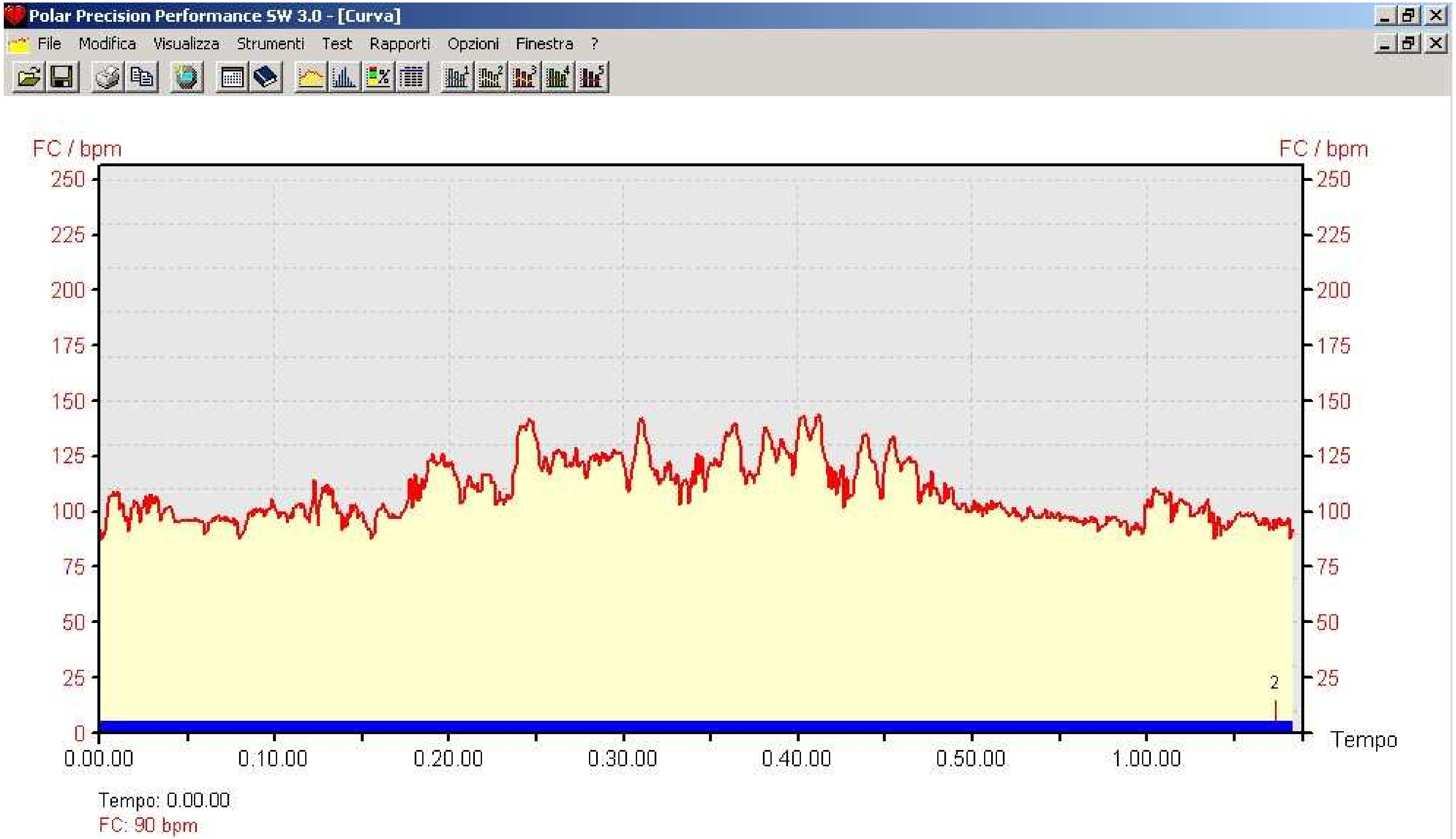







Atlas of Muscle Innervation Zones

risultati

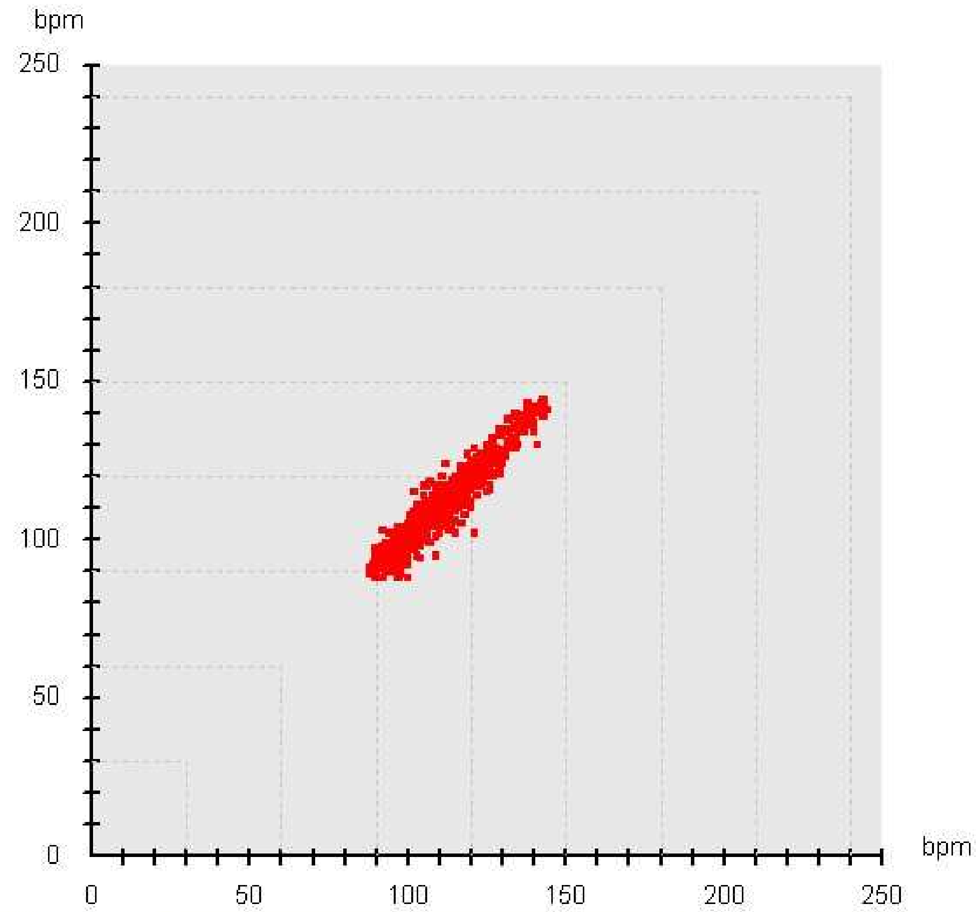


56 anni, peso 77, altezza 178 24% (Frequenza media 108) 90,5% tra 90 e 130bpm

Utente	alessio	Data	27/09/2018	FC Media/Max	108 / 144		
Esercizio	27/09/2018 9.24	Ora	9.24.34	FC max	180		
Sport	Corsa	Durata	1.08.25.9	Distanza			
Nota				Selezione	0.00.00 - 1.08.25 (1.08.25.0)		

Polar Precision Performance SW 3.0 - [Scatterogramma]

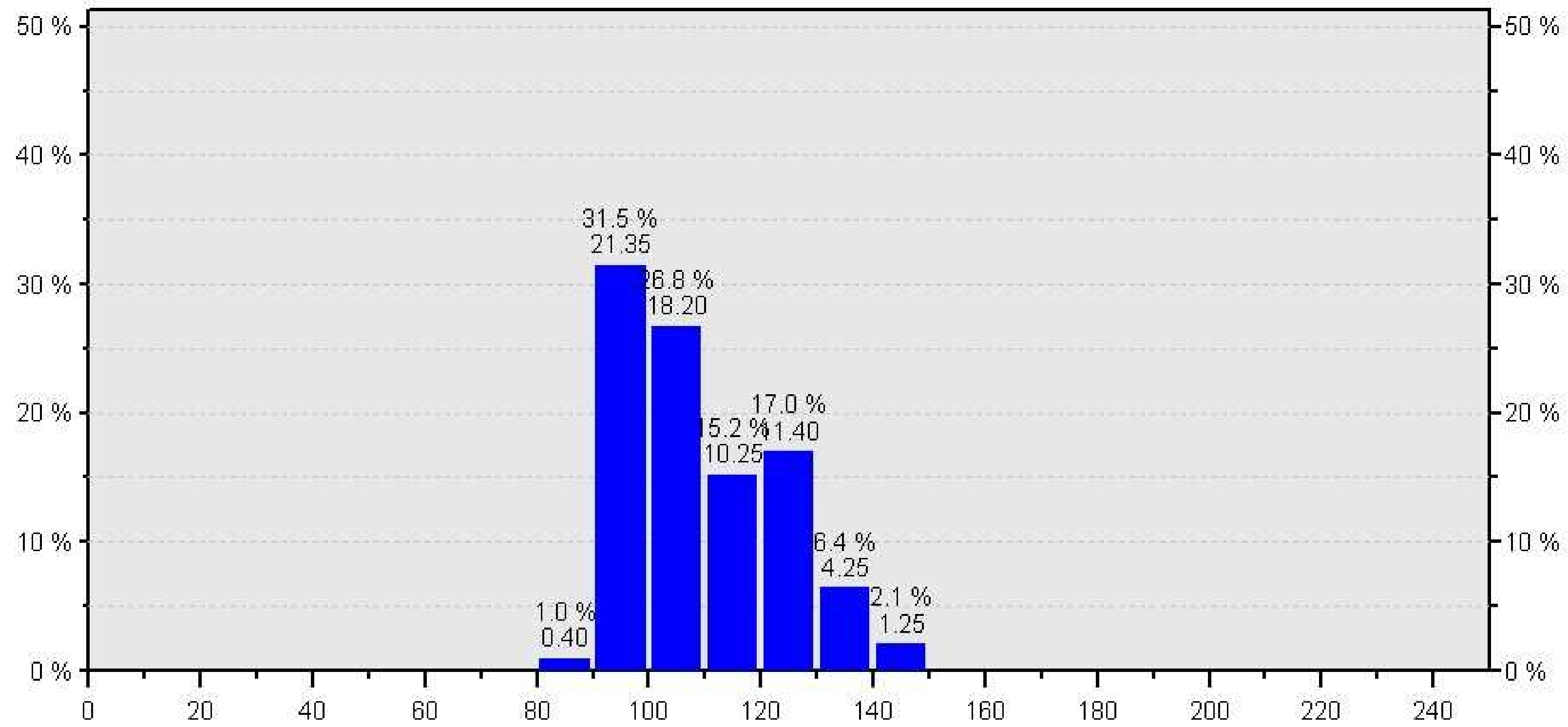
File Modifica Visualizza Strumenti Test Rapporti Opzioni Finestra ?



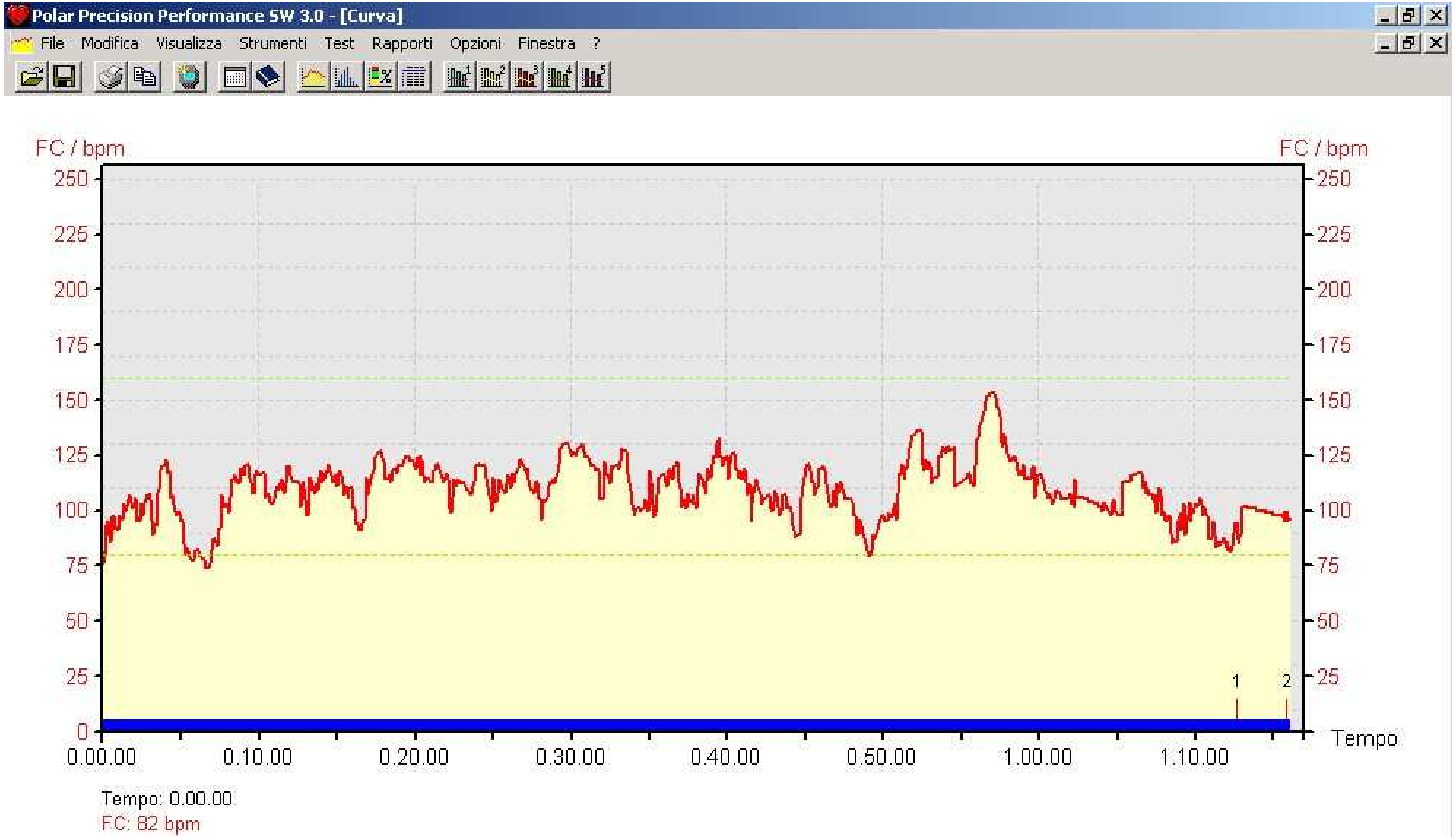
Utente	alessio	Data	27/09/2018
Esercizio	27/09/2018 9.24	Ora	9.24.34
Nota		SD 1	0.0 ms
Selezione	0.00.00 - 1.08.25 (1.08.25.0)	SD 2	0.0 ms

Polar Precision Performance SW 3.0 - [Distribuzione]

File Modifica Visualizza Strumenti Test Rapporti Opzioni Finestra ?

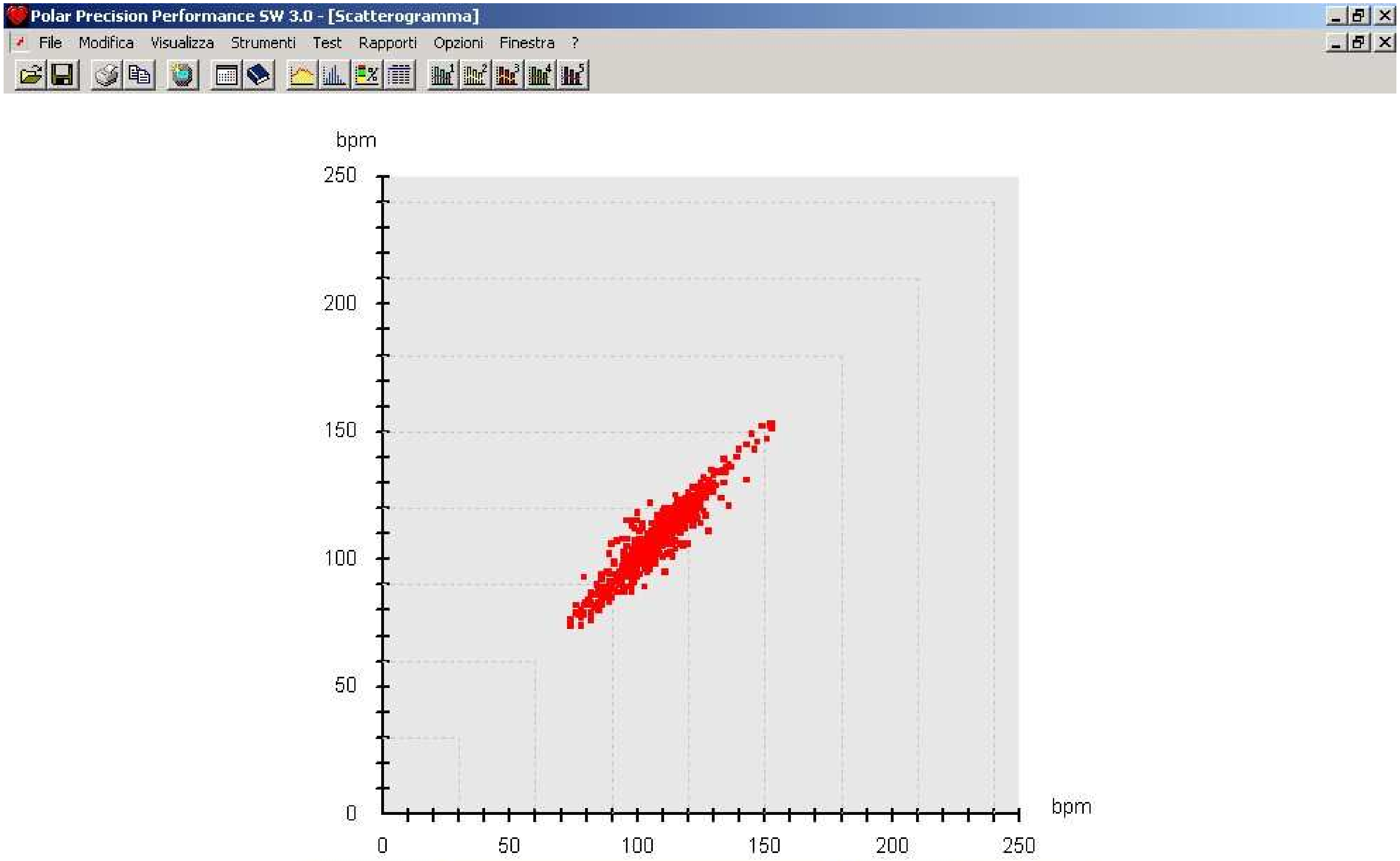


Utente	alessio	Data	27/09/2018	FC Media/Max	108 / 144		
Esercizio	27/09/2018 9.24	Ora	9.24.34	FC max	180		
Sport	Corsa	Durata	1.08.25.9	Distanza			
Nota				Selezione	0.00.00 - 1.08.25 (1.08.25.0)		



42 anni, peso 89 altezza 171 33% (Frequenza media 109) 87,4% tra 90 e 130bpm

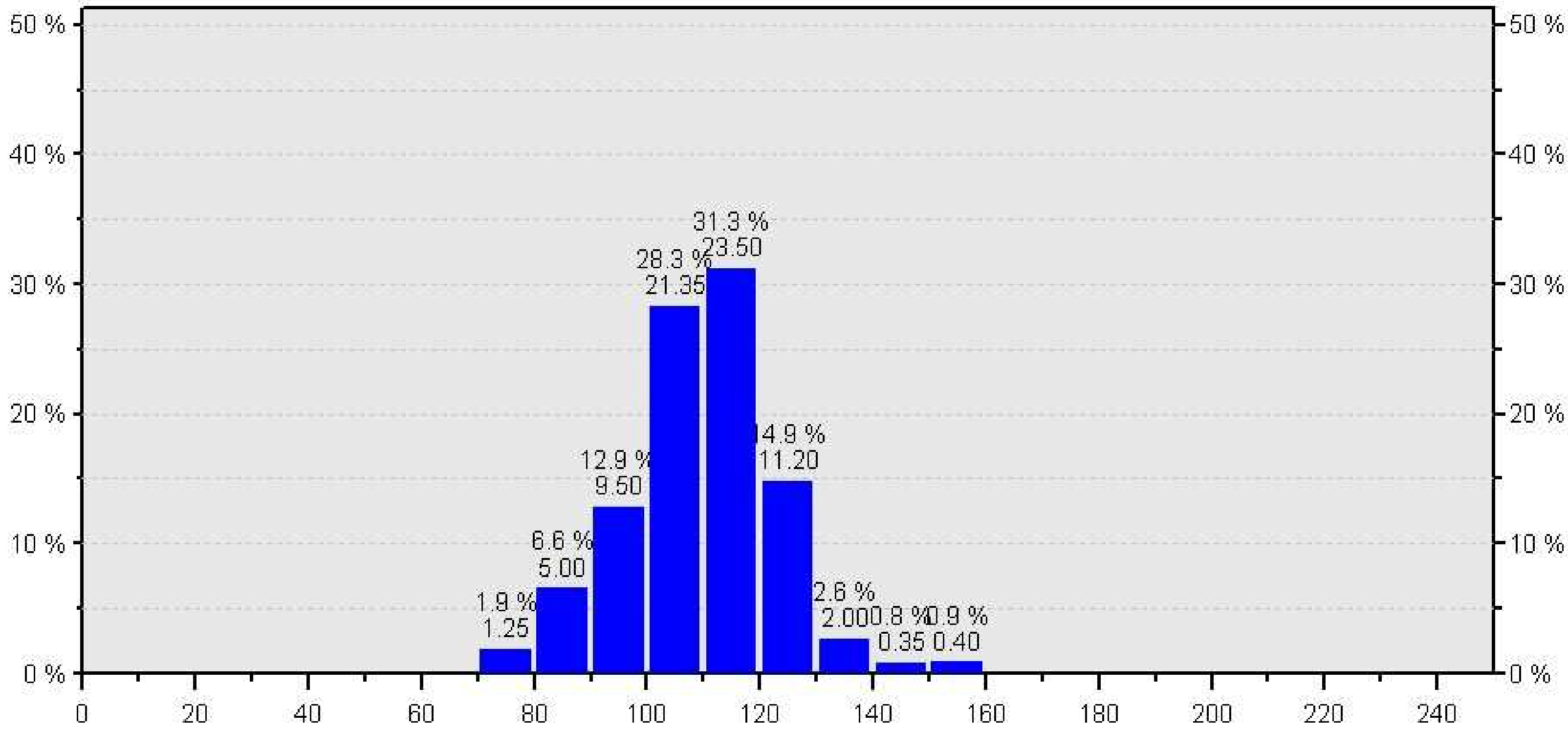
Utente	alessio	Data	27/09/2018	FC Media/Max	109 / 153	Zona 1	80 - 160
Esercizio	27/09/2018 9.15	Ora	9.15.16	FC max	180	Zona 2	80 - 160
Sport	Corsa	Durata	1.16.11.9	Distanza		Zona 3	80 - 160
Nota				Selezione	0.00.00 - 1.16.10 (1.16.10.0)		



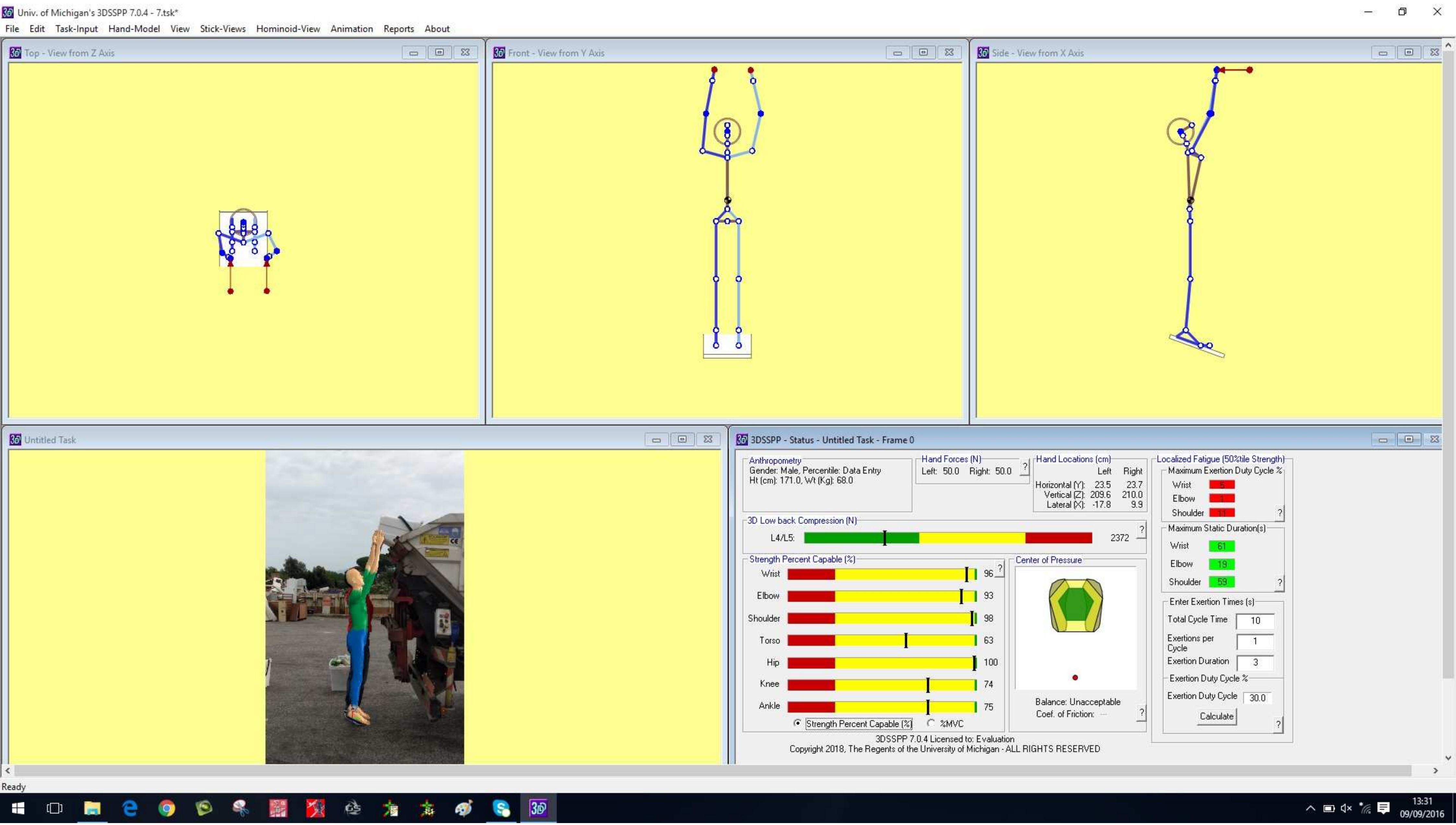
Utente	alessio	Data	27/09/2018
Esercizio	27/09/2018 9.15	Ora	9.15.16
Nota		SD 1	0.0 ms
Selezione	0.00.00 - 1.16.10 (1.16.10.0)	SD 2	0.0 ms

Polar Precision Performance SW 3.0 - [Distribuzione]

File Modifica Visualizza Strumenti Test Rapporti Opzioni Finestra ?



Utente	alessio	Data	27/09/2018	FC Media/Max	109 / 153	Zona 1	80 - 160
Esercizio	27/09/2018 9.15	Ora	9.15.16	FC max	180	Zona 2	80 - 160
Sport	Corsa	Durata	1.16.11.9	Distanza		Zona 3	80 - 160
Nota				Selezione	0.00.00 - 1.16.10 (1.16.10.0)		


Univ. of Michigan's 3DSSPP 7.0.4 - 7.tsk*
File Edit Task-Input Hand-Model View Stick-Views Hominoid-View Animation Reports About
Top - View from Z Axis
Front - View from Y Axis
Side - View from X Axis
Untitled Task
3DSSPP - Status - Untitled Task - Frame 0
Anthropometry
Gender: Male, Percentile: Data Entry
Ht (cm): 171.0, Wt (Kg): 68.0
Hand Forces (N)
Left: 50.0 Right: 50.0
Hand Locations (cm)
Left Right
Horizontal (Y): 23.5 23.7
Vertical (Z): 209.6 210.0
Lateral (X): -17.8 9.9
Localized Fatigue (50%tile Strength)
Maximum Exertion Duty Cycle %
Wrist 5
Elbow 1
Shoulder 11
Maximum Static Duration(s)
Wrist 61
Elbow 19
Shoulder 59
3D Low back Compression (N)
L4/L5: 2372
Strength Percent Capable (%)
Wrist 96
Elbow 93
Shoulder 98
Torso 63
Hip 100
Knee 74
Ankle 75
Strength Percent Capable (%)
%MVC
Center of Pressure
Balance: Unacceptable
Coef. of Friction: ---
Enter Exertion Times (s)
Total Cycle Time 10
Exertions per Cycle 1
Exertion Duration 3
Exertion Duty Cycle %
Exertion Duty Cycle 30.0
Calculate
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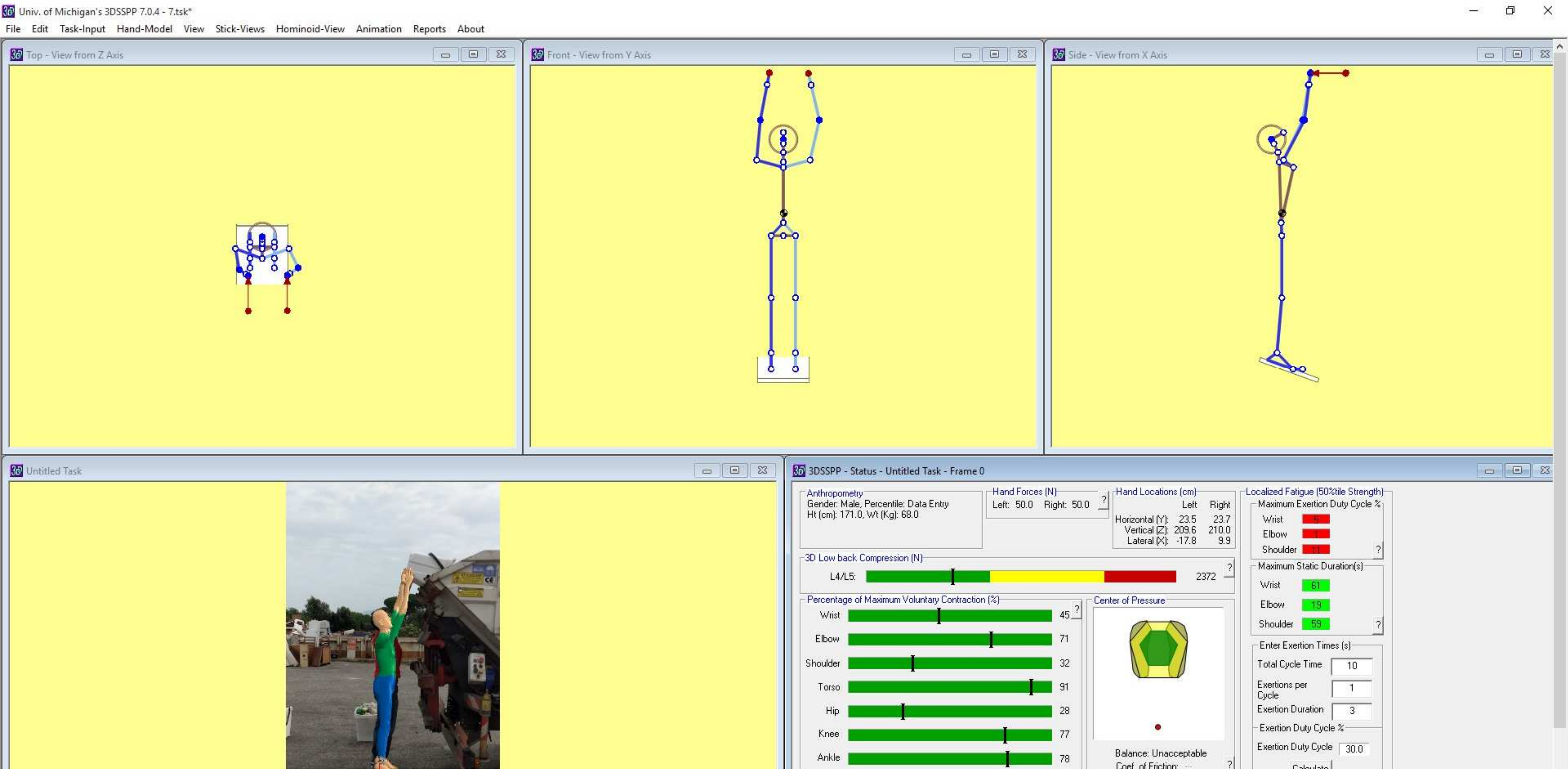
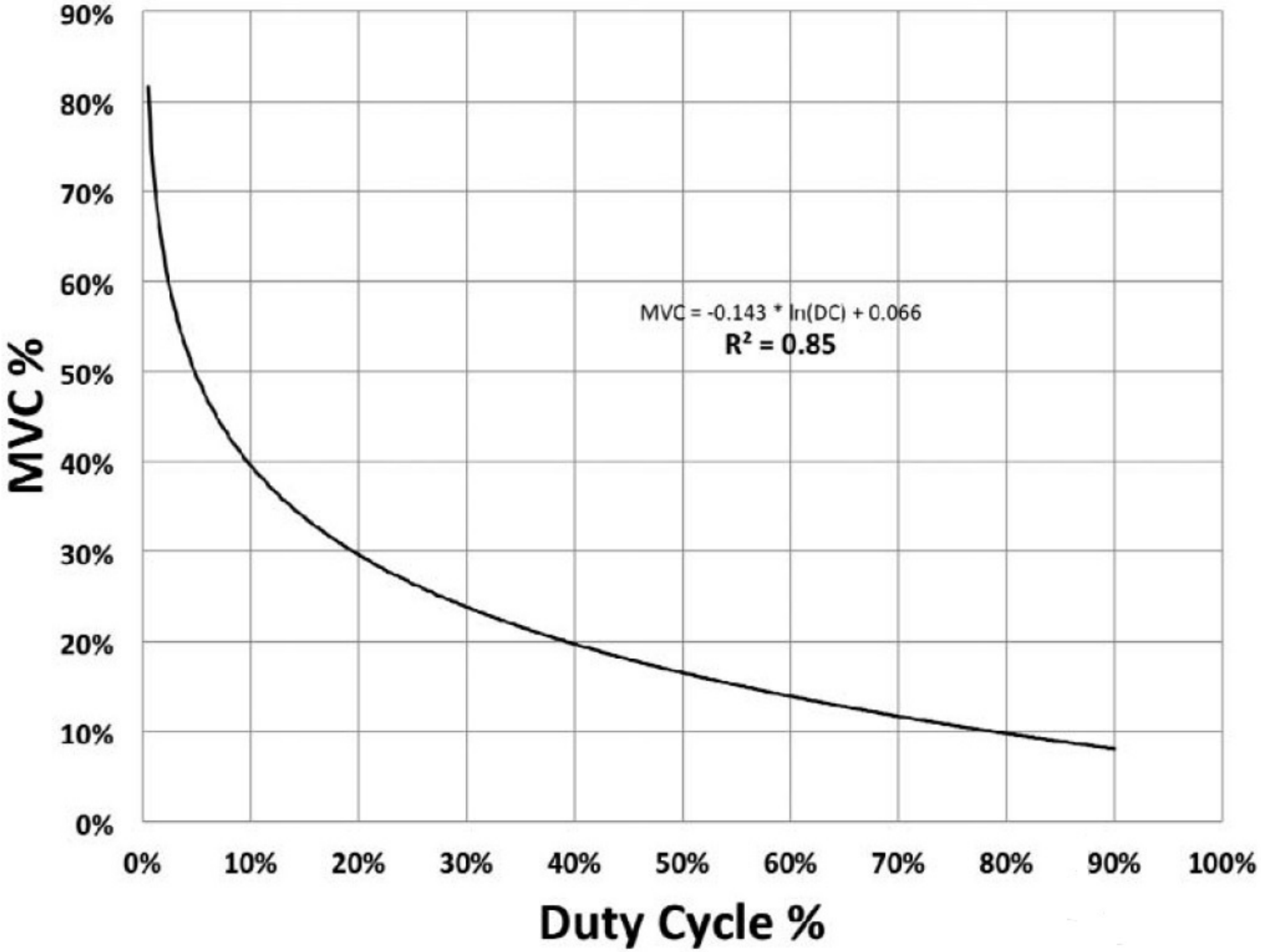
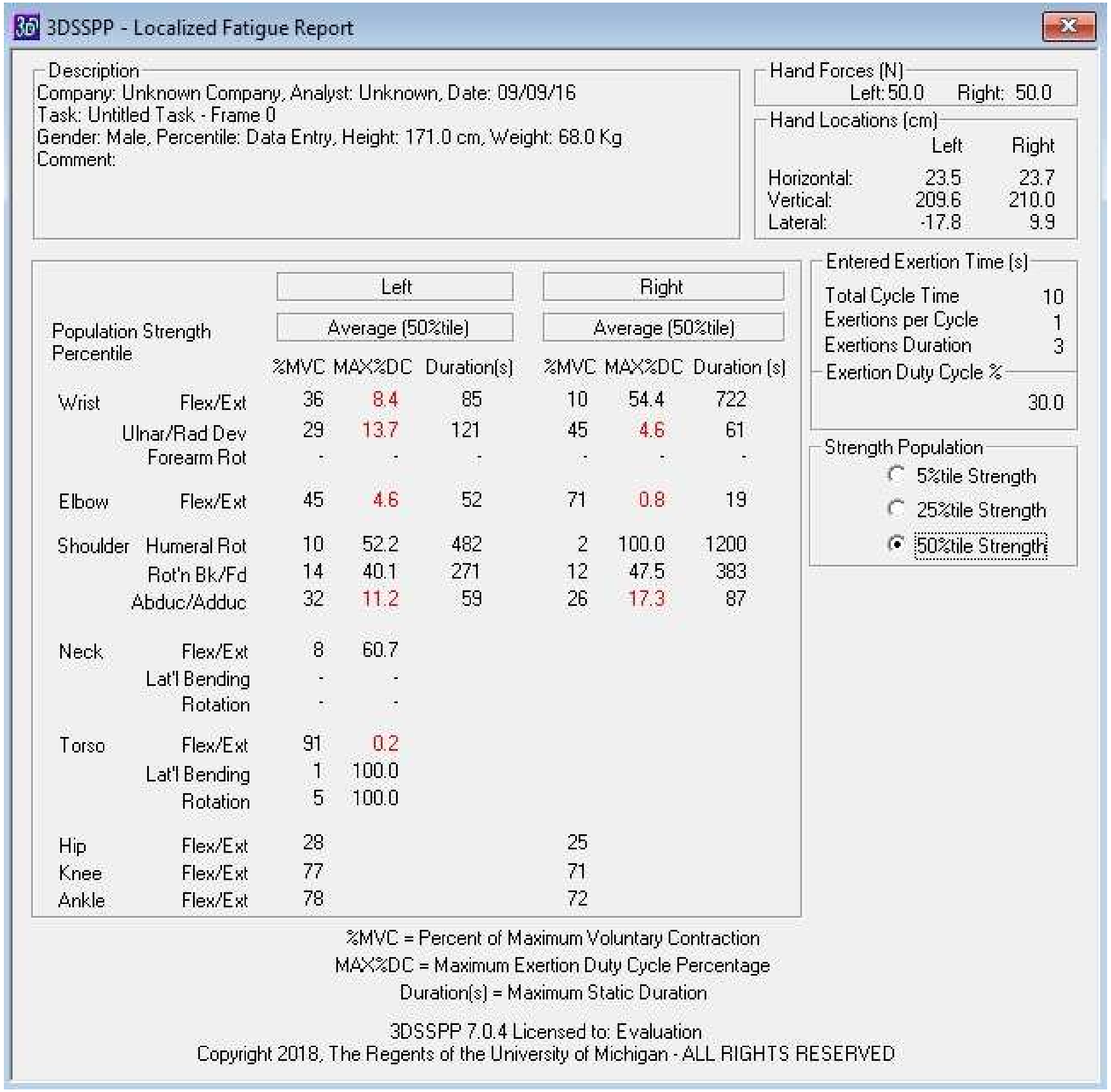
Ready
13:31
09/09/2016


Univ. of Michigan's 3DSSPP 7.0.4 - 7.tsk*
File Edit Task-Input Hand-Model View Stick-Views Hominoid-View Animation Reports About
Top - View from Z Axis
Front - View from Y Axis
Side - View from X Axis
Untitled Task
3DSSPP - Status - Untitled Task - Frame 0
Anthropometry
Gender: Male, Percentile: Data Entry
Ht (cm): 171.0, Wt (Kg): 68.0
Hand Forces (N)
Left: 50.0 Right: 50.0
Hand Locations (cm)
Left Right
Horizontal (Y): 23.5 23.7
Vertical (Z): 209.6 210.0
Lateral (X): -17.8 9.9
Localized Fatigue (50%tile Strength)
Maximum Exertion Duty Cycle %
Wrist 5
Elbow 1
Shoulder 11
Maximum Static Duration(s)
Wrist 61
Elbow 19
Shoulder 59
3D Low back Compression (N)
L4/L5: 2372
Percentage of Maximum Voluntary Contraction (%)
Wrist 45
Elbow 71
Shoulder 32
Torso 91
Hip 28
Knee 77
Ankle 78
Center of Pressure
Balance: Unacceptable
Enter Exertion Times (s)
Total Cycle Time 10
Exertions per Cycle 1
Exertion Duration 3
Exertion Duty Cycle %
Exertion Duty Cycle 30.0

Reports – localized fatigue



%MVC = (100%) • (-0.143 ln (DC/100%) + 0.066)



3DSSPP - Localized Fatigue Report

Description
Company: Unknown Company, Analyst: Unknown, Date: 09/09/16
Task: Untitled Task - Frame 0
Gender: Male, Percentile: Data Entry, Height: 171.0 cm, Weight: 68.0 Kg
Comment:

Hand Forces (N)
Left: 50.0 Right: 50.0

Hand Locations (cm)

	Left	Right
Horizontal:	23.5	23.7
Vertical:	209.6	210.0
Lateral:	-17.8	9.9

Entered Exertion Time (s)

Total Cycle Time	10
Exertions per Cycle	1
Exertions Duration	3
Exertion Duty Cycle %	30.0

Strength Population
- 5%tile Strength
- 25%tile Strength
- (selected) 50%tile Strength

Population Strength Percentile		Left %MVC	Left MAX%DC	Left Duration(s)	Right %MVC	Right MAX%DC	Right Duration (s)
		Average (50%tile)			Average (50%tile)		
Wrist	Flex/Ext	36	8.4	85	10	54.4	722
	Ulnar/Rad Dev	29	13.7	121	45	4.6	61
	Forearm Rot	-	-	-	-	-	-
Elbow	Flex/Ext	45	4.6	52	71	0.8	19
Shoulder	Humeral Rot	10	52.2	482	2	100.0	1200
	Rot'n Bk/Fd	14	40.1	271	12	47.5	383
	Abduc/Adduc	32	11.2	59	26	17.3	87
Neck	Flex/Ext	8	60.7				
	Lat'l Bending	-	-				
	Rotation	-	-				
Torso	Flex/Ext	91	0.2				
	Lat'l Bending	1	100.0				
	Rotation	5	100.0				
Hip	Flex/Ext	28			25		
Knee	Flex/Ext	77			71		
Ankle	Flex/Ext	78			72		

%MVC = Percent of Maximum Voluntary Contraction
MAX%DC = Maximum Exertion Duty Cycle Percentage
Duration(s) = Maximum Static Duration

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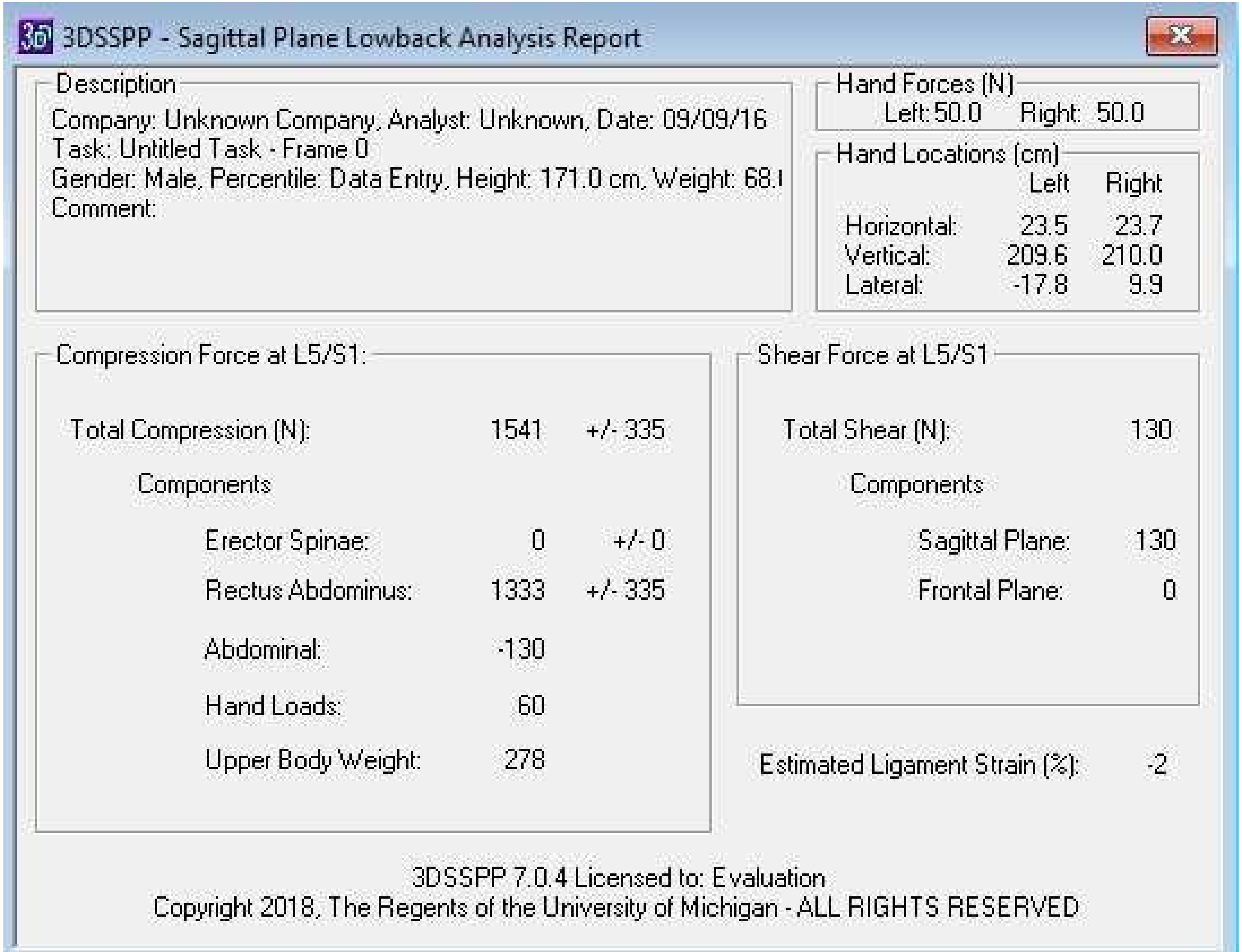
3DSSPP - Sagittal Plane Lowback Analysis Report
Description
Company: Unknown Company, Analyst: Unknown, Date: 09/09/16
Task: Untitled Task - Frame 0
Gender: Male, Percentile: Data Entry, Height: 171.0 cm, Weight: 68.
Comment:
Hand Forces (N)
Left: 50.0 Right: 50.0
Hand Locations (cm)
Left Right
Horizontal: 23.5 23.7
Vertical: 209.6 210.0
Lateral: -17.8 9.9
Compression Force at L5/S1:
Total Compression (N): 1541 +/- 335
Components
Erector Spinae: 0 +/- 0
Rectus Abdominus: 1333 +/- 335
Abdominal: -130
Hand Loads: 60
Upper Body Weight: 278
Shear Force at L5/S1
Total Shear (N): 130
Components
Sagittal Plane: 130
Frontal Plane: 0
Estimated Ligament Strain (%): -2
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3DSSPP - Standing Balance Report

Description
Company: Unknown Company, Analyst: Unknown, Date: 09/09/16
Task: Untitled Task - Frame 0
Gender: Male, Percentile: Data Entry, Height: 171.0 cm, Weight: 68.0 Kg
Comment:

Hand Forces (N)
Left: 50.0 Right: 50.0

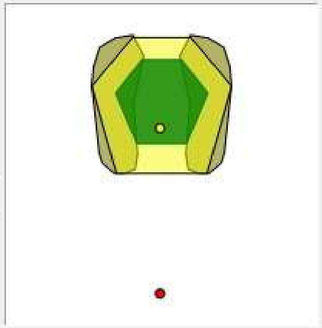
Support Forces (N)
Left: 350.6 Right: 324.0

Hand Locations (cm)

	Left	Right
Horizontal:	23.5	23.7
Vertical:	209.6	210.0
Lateral:	-17.8	9.9

Center of Pressure (cm)

	x	y	Dot
Center of Pressure	-0.3	-27.8	Red
Center of Mass	-0.3	3.7	Yellow
Left Foot Force	-8.6	-6.9	L Purple
Right Foot Force	8.6	-6.9	D Purple



Base of Support (cm)

Dist to Front:	48.8
Dist to Back:	outside
Dist to Right:	outside
Dist to Left:	outside

Stability
Balance: Unacceptable

Residual Support Moments (N·m)

X	Y	Z
135.0	-0.0	3.6

Leg Loads (%)
Left: 51% Right: 48%

Maximum Balance Moments (N·m)

	Left			Right		
	X	Y	Z	X	Y	Z
Ball:	306.7	55.3	-4.7	306.7	-59.9	12.6
Heel:	131.7	55.3	-4.7	131.7	-59.9	12.6

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3DSSPP - Posture (Local Angles) Report

Description
Company: Unknown Company, Analyst: Unknown, Date: 09/09/16
Task: Untitled Task - Frame 0
Gender: Male, Percentile: Data Entry, Height: 171.0 cm, Weight: 68.0 Kg
Comment:

Hand Forces (N)
Left: 50.0 Right: 50.0

Hand Locations (cm)

	Left	Right
Horizontal:	23.5	23.7
Vertical:	209.6	210.0
Lateral:	-17.8	9.9

Limb Angles (degrees)

	Calculated Posture Angles		Range of Motion Limits	
	Left	Right	Min	Max
Wrist:				
Flexion	0	0	-63	0
Extension	0	0	0	66
Ulnar deviation	0	0	0	38
Radial deviation	0	0	-21	0
Arm:				
Forearm Rotation	0	0	-90	90
Elbow Included	150	159	15	180
Shoulder Vertical	150	150	0	180
Shoulder Horizontal	65	99	-100	180
Humeral Rotation	35	26	-5	180
Upper leg:				
Hip Included	182	182	0	210
Hip Vertical	3	3	0	180
Hip Horizontal	-90	-90	-120	120
Femoral Rotation	0	0	-90	90
Lower leg:				
Leg Rotation	0	0	-90	90
Knee Included	175	175	15	180
Ankle Included	105	105	72	138
Toe:				
Ball Flexion/Extension	20	20	-40	90

Head and Trunk Angles (degrees)

	Calculated Posture Angles	Range of Motion Limits	
		Min	Max
Head/Torso:			
Flexion/Extension	-28	-56	49
Axial Rotation	0	-63	63
Lateral Bending	0	-34	34
Head/Upper Neck:			
Flexion/Extension	-5	-12	10
Upper Neck/Lower Neck:			
Flexion/Extension	-17	-34	30
Axial Rotation	0	-53	53
Lateral Bending	0	-19	19
Lower Neck/Torso:			
Flexion/Extension	-6	-10	9
Axial Rotation	0	-10	10
Lateral Bending	0	-15	15
Torso/Pelvis (L5S1):			
Flexion/Extension	92	-90	180
Axial Rotation	0	-45	45
Lateral Bending	0	-40	40
Pelvis:			
Forward Rotation	-3	-90	90
Lateral Rotation	0	-45	45
L5S1 Forward Tilt	37	---	---

3DSSPP 7.0.4 Licensed to: Evaluation

3DSSPP - 3D Lowback Analysis Report

Description

Company: Unknown Company, Analyst: Unknown, Date: 09/09/16
Task: Untitled Task - Frame 0
Gender: Male, Percentile: Data Entry, Height: 171.0 cm, Weight: 68.0 Kg
Comment:

Hand Forces (N)

Left: 50.0 Right: 50.0

Hand Locations (cm)

	Left	Right
Horizontal:	23.5	23.7
Vertical:	209.6	210.0
Lateral:	-17.8	9.9

Muscles

Muscle	Forces (N)					Mom. Arms (cm)	
	Result	Shear	X	Y	Z	X	Y
L.Erector Spi.	0	0	0	0	0	3.3	5.9
R.Erector Spi.	0	0	0	0	0	3.3	5.9
L.Rectus Abdo.	392	0	0	0	392	4.1	8.3
R.Rectus Abdo.	410	0	0	0	410	4.1	8.3
L.Internal Ob.	417	296	0	296	296	11.7	3.5
R.Internal Ob.	451	320	0	320	320	11.7	3.5
L.External Ob.	514	365	0	-365	365	13.2	3.3
R.External Ob.	515	366	0	-366	366	13.2	3.3
L.Latis. Dorsi.	0	0	-0	0	0	7.2	5.4
R.Latis. Dorsi.	0	0	0	0	0	7.2	5.4

L4/L5 Disc

Compression (N)	
Total	2372

Shear (N)	
Total	133
Components	
Anterior Posterior	-133
Lateral	0

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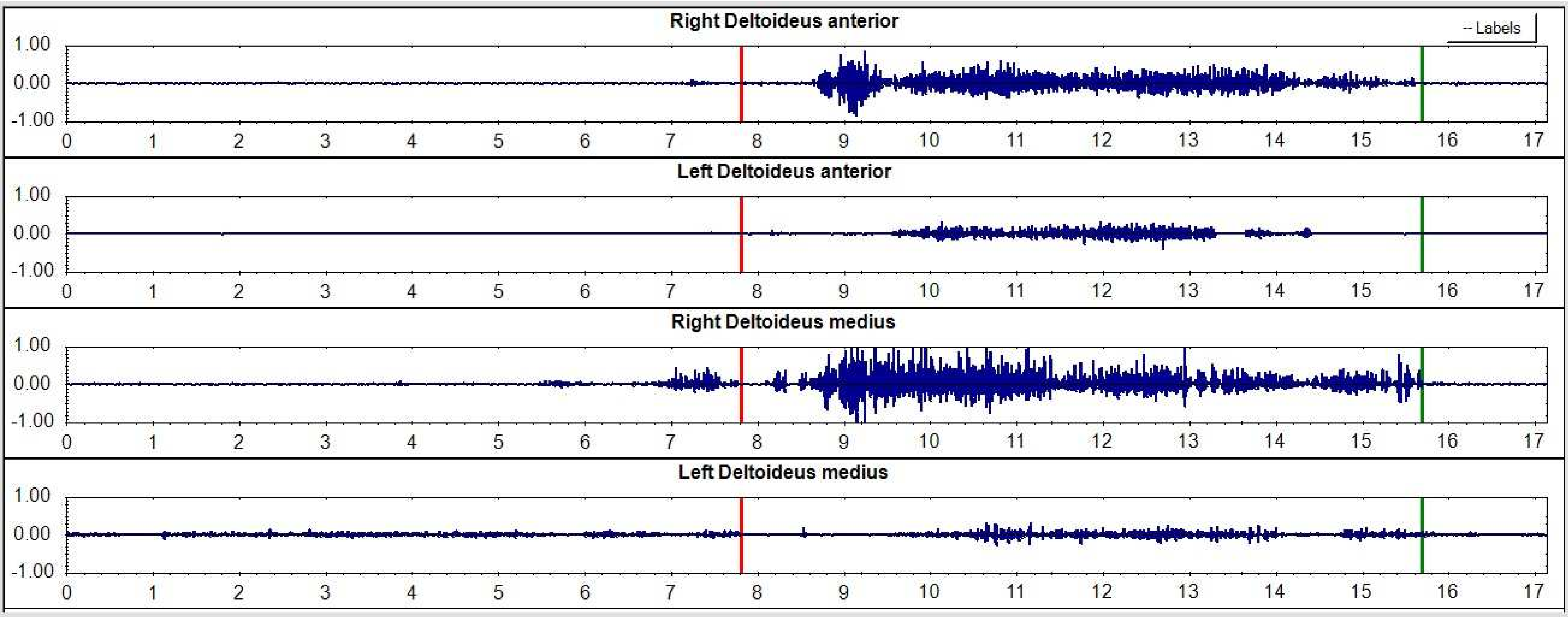
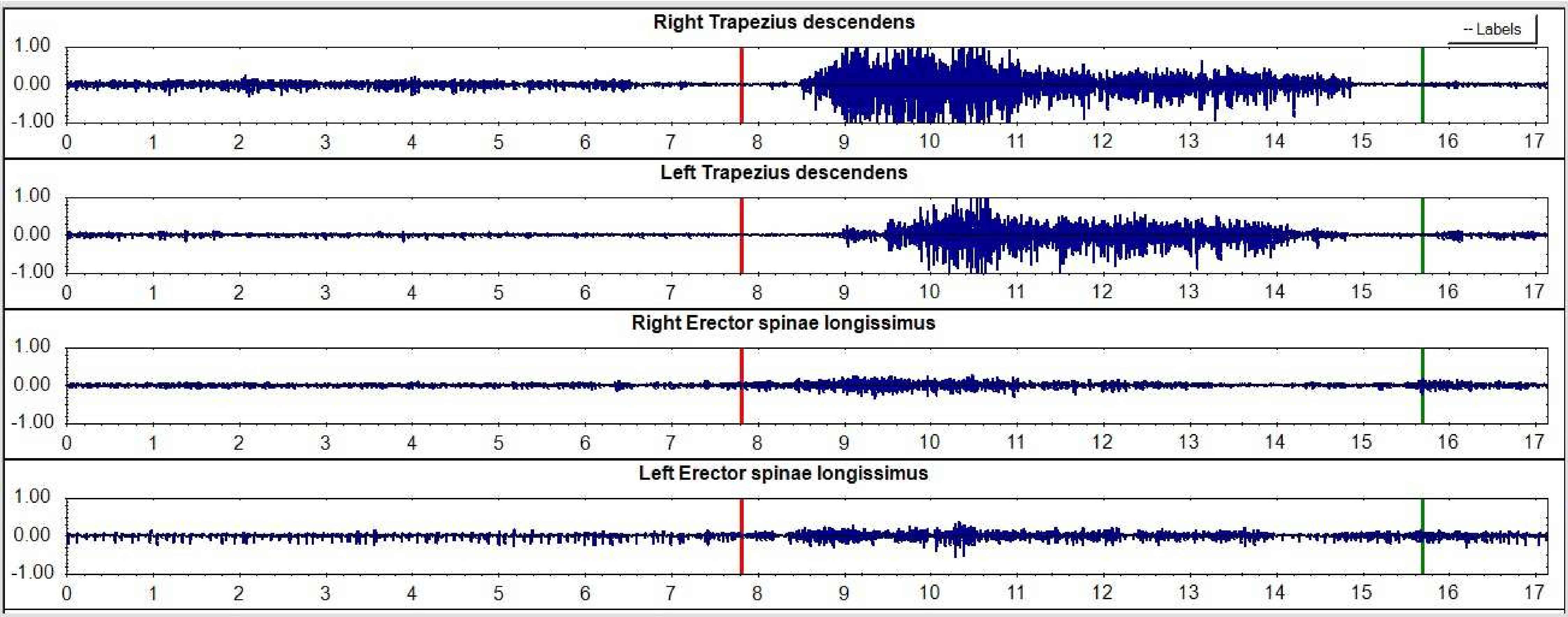
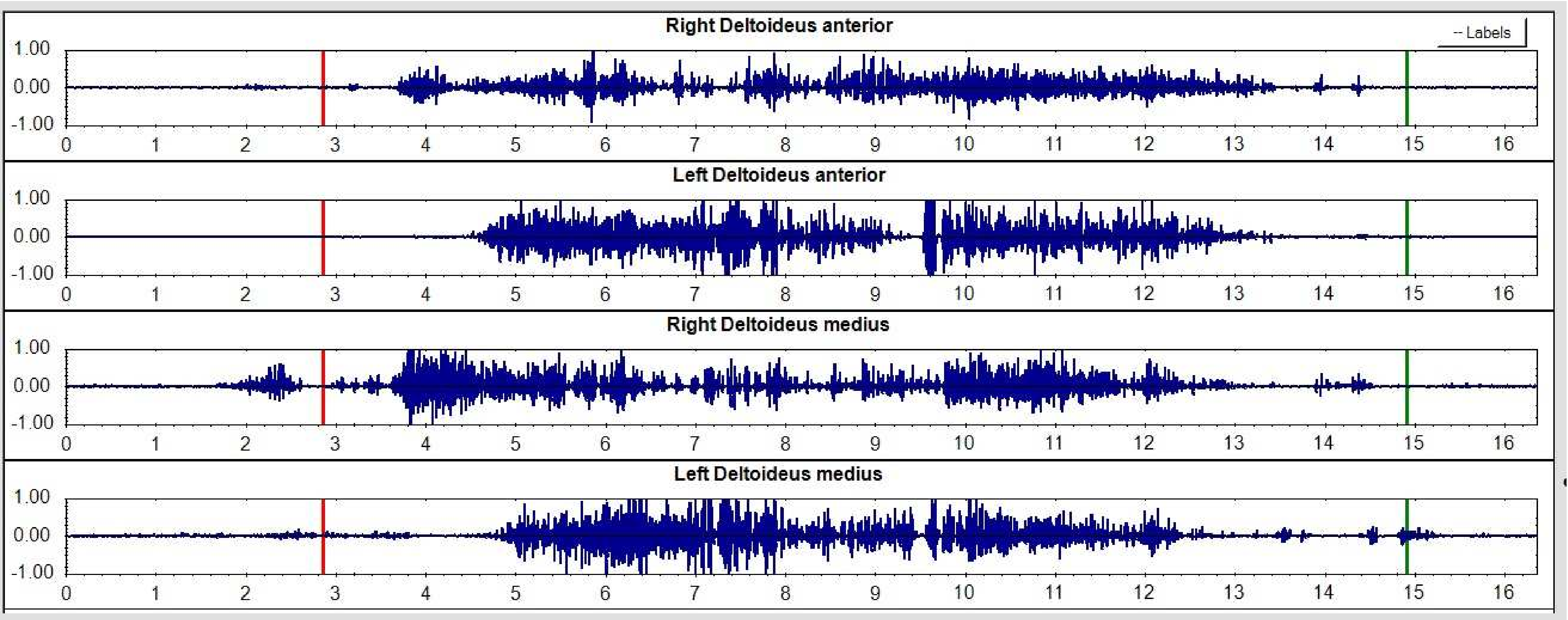
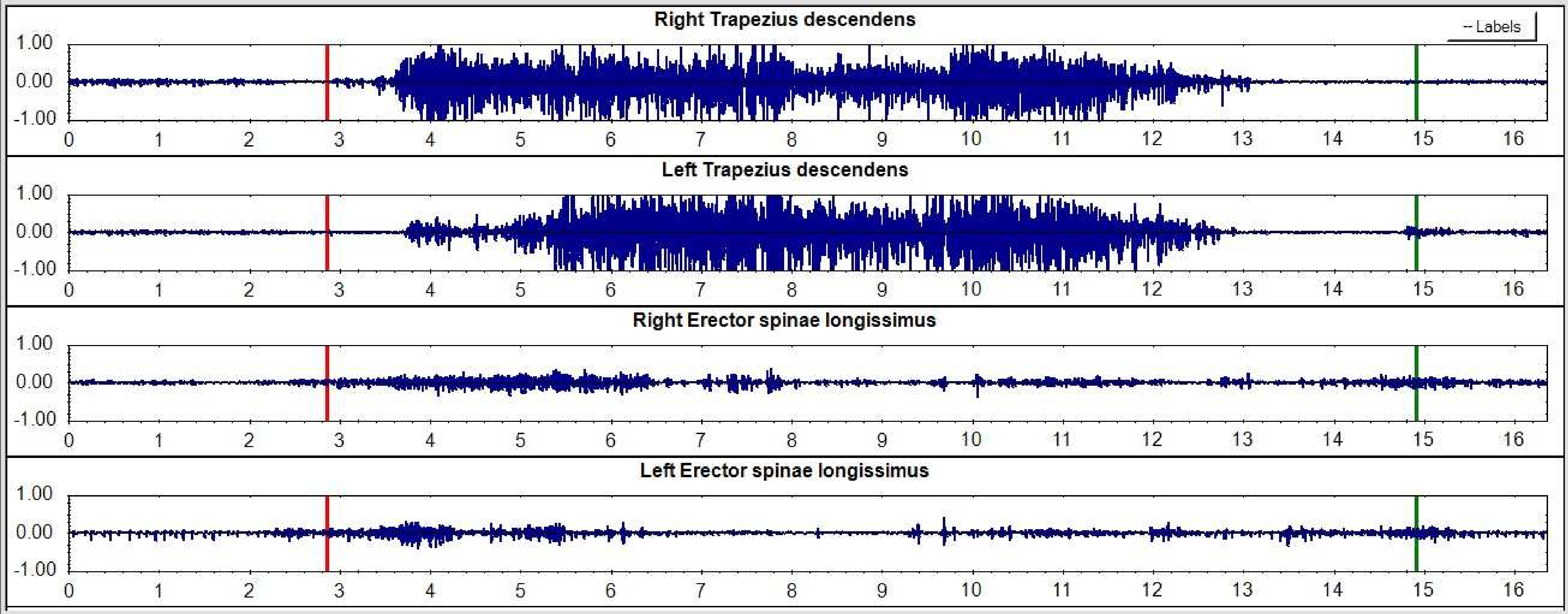
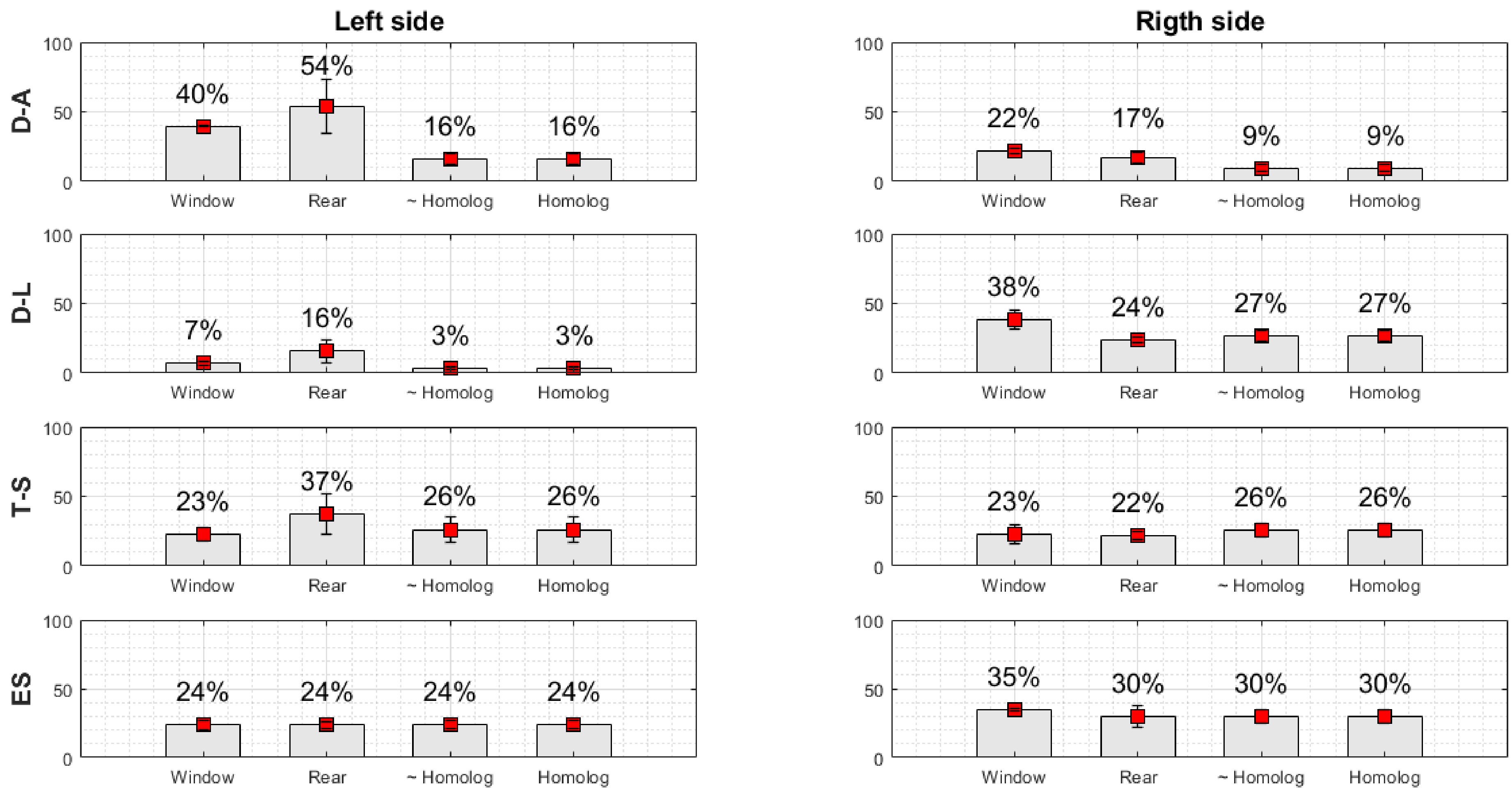


Right Deltoideus anterior
-- Labels
Left Deltoideus anterior
Right Deltoideus medius
Left Deltoideus medius
1.00
0.00
-1.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17


Right Trapezius descendens
Left Trapezius descendens
Right Erector spinae longissimus
Left Erector spinae longissimus
-- Labels
1.00
0.00
-1.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17


Right Deltoideus anterior
-- Labels
Left Deltoideus anterior
Right Deltoideus medius
Left Deltoideus medius
1.00
0.00
-1.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16


Right Trapezius descendens
Left Trapezius descendens
Right Erector spinae longissimus
Left Erector spinae longissimus
-- Labels



Left side
Rigth side
D-A
D-L
T-S
ES
100
50
0
Window
Rear
~ Homolog
Homolog
40%
54%
16%
16%
22%
17%
9%
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misurare per identificare gli interventi correttivi

misurare per verificare l’efficacia degli interventi grazie per l’attenzione