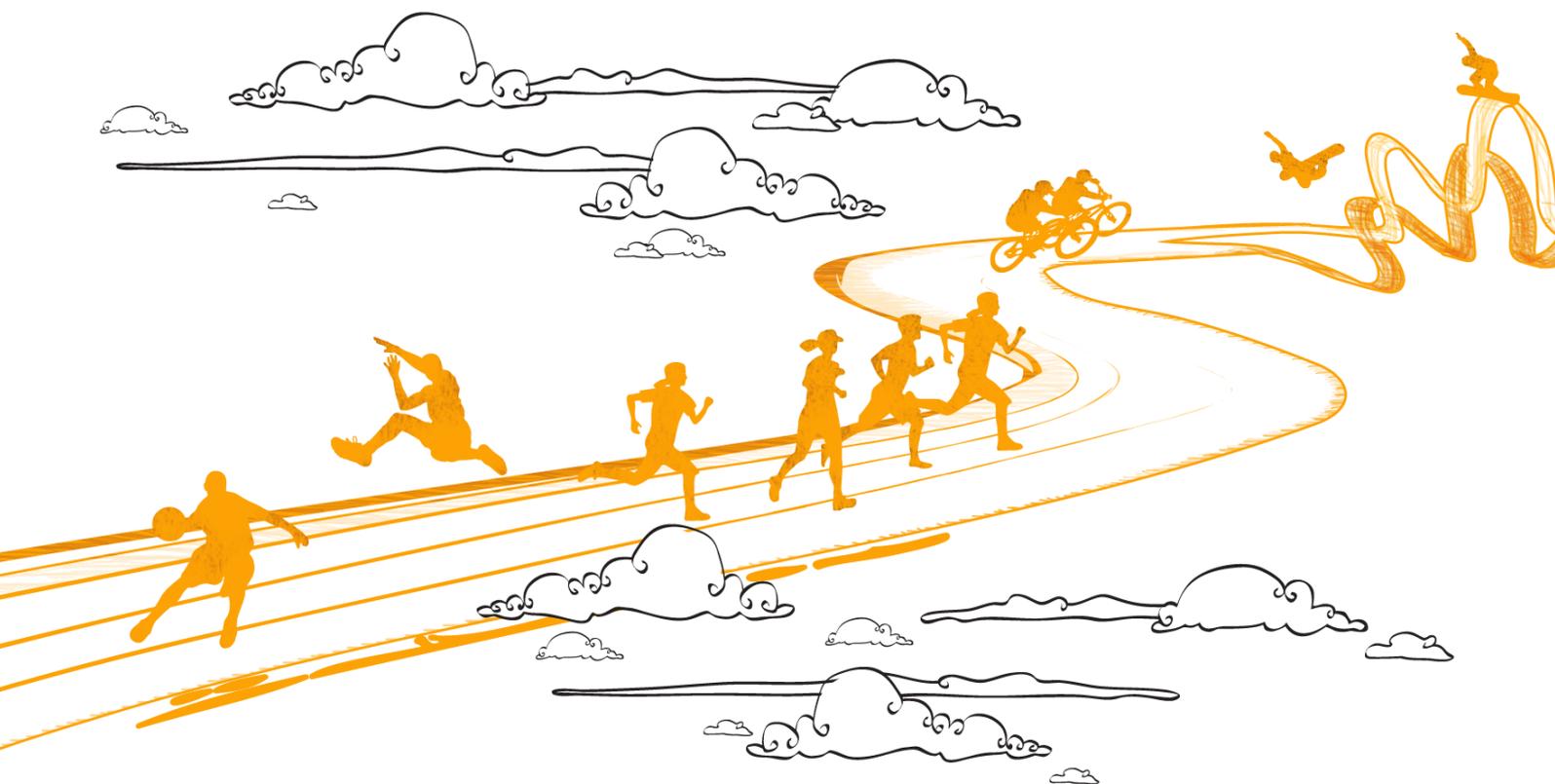




# Measurement modules



# WISE COACH

## Measurement modules



**WISE TECHNOLOGIES**  
Vision of tomorrow

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# WISE COACH: Introduction Measurement modules

**Wise Coach is an original concept aimed to support routine diagnostics and research work in biomechanics, motor control and behavior, rehabilitation medicine, etc.**

**It encompasses three main components:**

- **software for single measurement modules**
- **custom made braces and sensors for measurement stations, and**
- **master integration software for goal directed statistics and reports**

**The process of innovation and upgrade is an ongoing and until now twenty measurement modules have been developed. Goal directed products for acquisition and analyses of biological and biomechanical signals are focused on measurements in the field of strength, power, speed, coordination, balance and flexibility; thereby using force plate, EMG, electronic goniometers, and electronic force sensors.**



## Squat jump

The information about the person, jump type parameter and repetition sequence number is positioned at the top of the window. The **"Measurement"** tab displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed, and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. With the **"Trigger"** option unchecked, the signal acquisition starts immediately, while it is delayed until the force exceeds a pre-defined value if the **"Trigger"** option is selected. The acquisition terminates automatically when the jump is completed, and the cursors are set instantly. **"Live signals"** switches between live signal acquisition and the last acquired signal.

The results of the analysis are displayed on the **"Results tab"** - in the **"Current column"**, which is updated when the T1 (start of push off) cursor is moved. Other columns contain the results of previously saved measurements. The **"Confirm"** button saves the parameters of the current jump, while the **"CMJ:SJ"** button opens a window where CMJ:SJ proportions can be calculated.

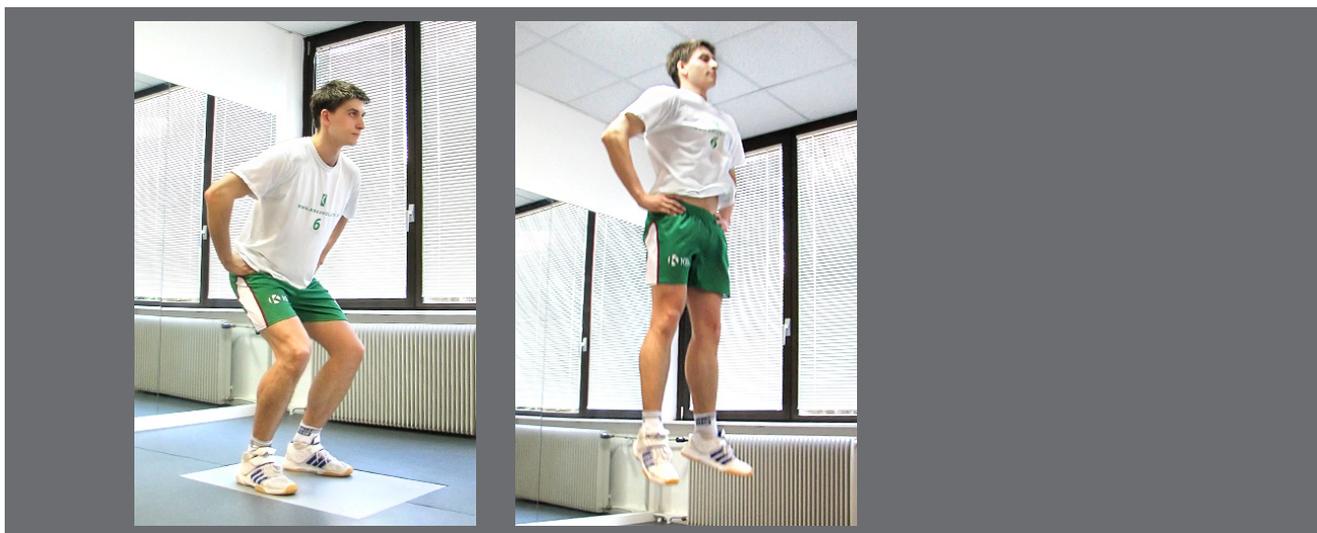


Figure 1  
Squat jump measurement

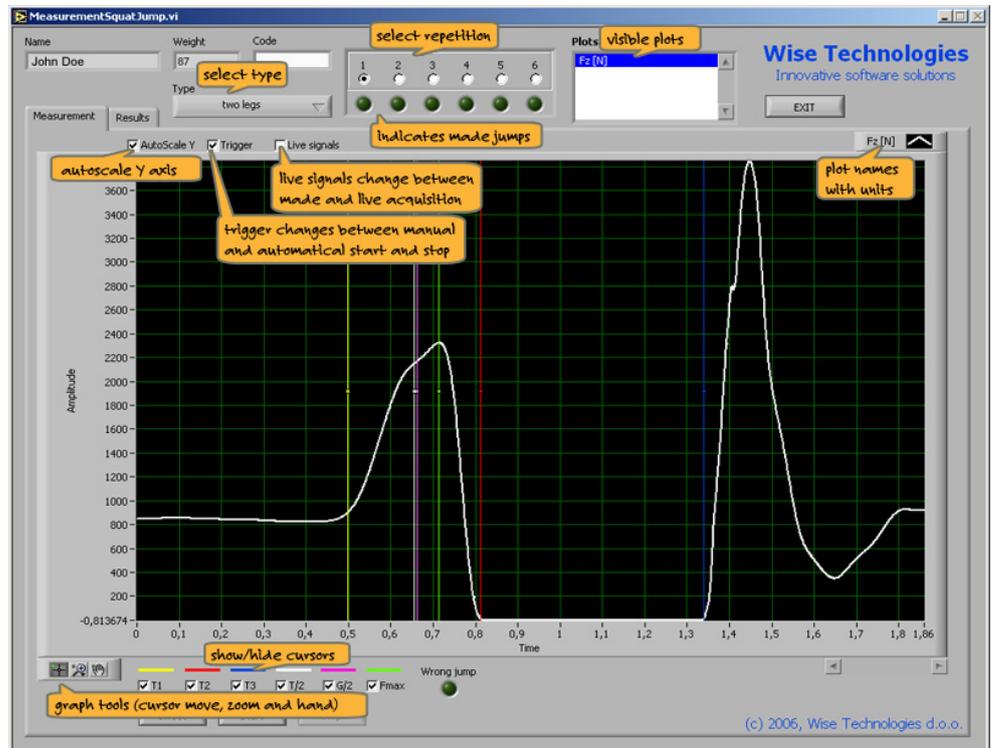
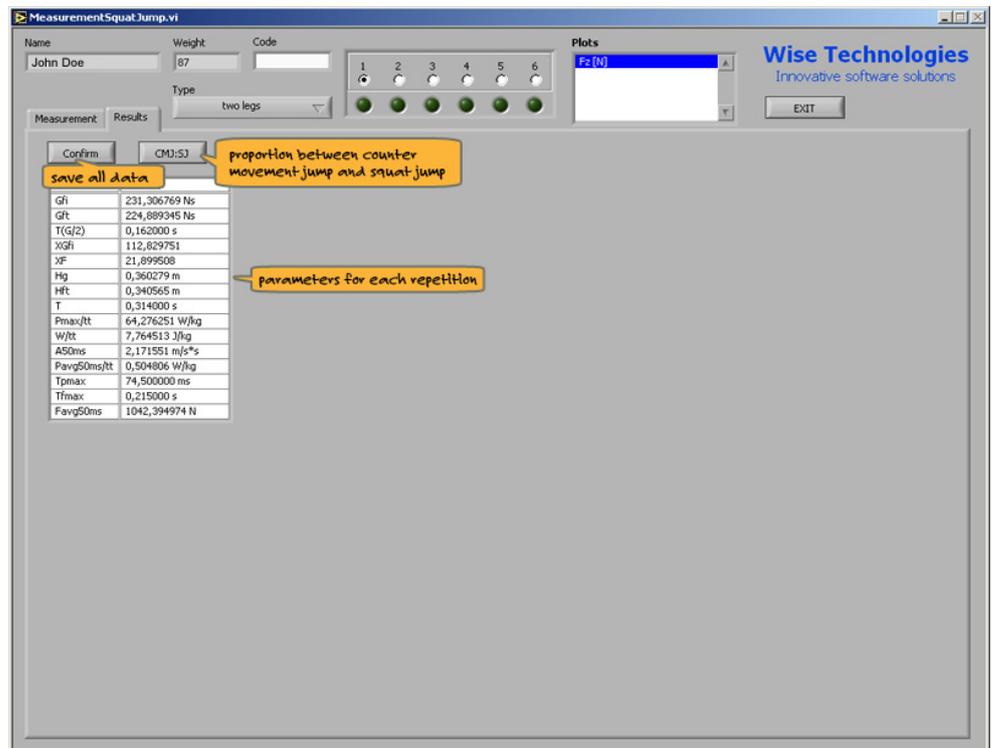


Figure 2  
Results of analysis



Gfi	Force impulse on interval between T1 and T2
Gft	Force impulse computed from fly time
T(G/2)	Time between GF11/2 and T1
XGfi	Ratio between force impulse before T/2 and after T/2
XF	Ratio between force impulse before Fmax and after Fmax
Hg	Height computed from takeoff velocity
Hft	Height computed from fly time
T	Time between T1 and T2
Pmax/tt	Maximal power divided by body weight
W/tt	Energy divided by body weight
A50ms	Start acceleration
Pavg50ms/tt	Start power divided by body weight
Tpmax	Time of maximal power compared to G/2
Tfmax	Time between maximal force occurrence and T1
Favg50ms	Start force
T1	Time between T1 and G/2
T2	Time between G/2 and T2
Gft1	Force impulse on interval between T1 and T/2
Gft2	Force impulse on interval between T/2 and T2
T1F	Time between T1 and Fmax
T2F	Time between Fmax and T2
Gft1F	Force impulse on interval between T1 and Fmax
Gft2F	Force impulse on interval between Fmax and T2
Vv	Vertical takeoff velocity
T1/2	T/2 - T1
Axms	Acceleration on selected interval
Aavg1	Average acceleration on interval between T1 and T/2
Aavg2	Average acceleration on interval between T/2 and T2
Pinte	Power on selected interval
Fmax/tt	Maximal force divided by body weight
Favg1/tt	Maximal force divided by body weight on interval between T1 and T/2
Favg2/tt	Maximal force divided by body weight on interval between T/2 and T2
Vstart	Start velocity
FT	Time between T2 and T3

## Counter movement jump

The information about the person, jump type parameter and repetition sequence number is positioned at the top of the window. The **"Measurement"** tab displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. With the **"Trigger"** option unchecked, the signal acquisition starts immediately, while it is delayed until the force exceeds a pre-defined value if the **"Trigger"** option is selected. The acquisition terminates automatically when jump is completed, and the cursors are set instantly. **"Live signals"** switches between live acquisition and the last acquired signal.

The results of the analysis are displayed on the **"Results"** tab – in the **"Current"** column, which is updated when the T0 (start of moving) cursor is moved. Other columns contain the results of previously saved measurements. The **"Confirm"** button saves the parameters of the current jump, while the **"CMJ:SJ"** button opens a window where CMJ:SJ proportions can be calculated.



Figure 3  
Counter movement jump measurement

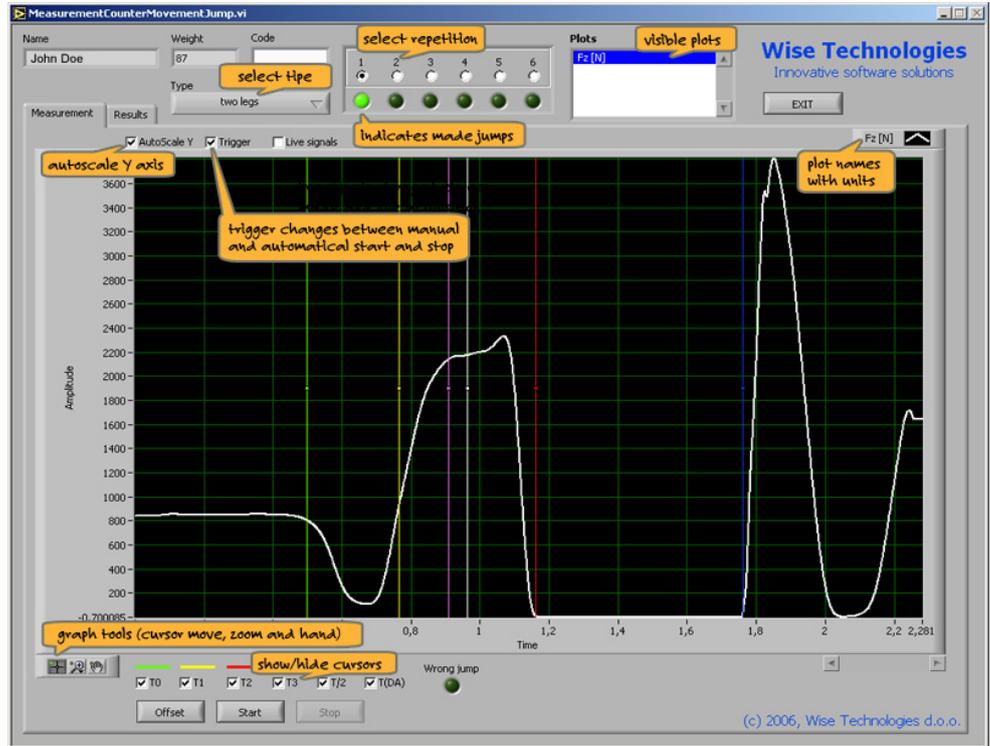
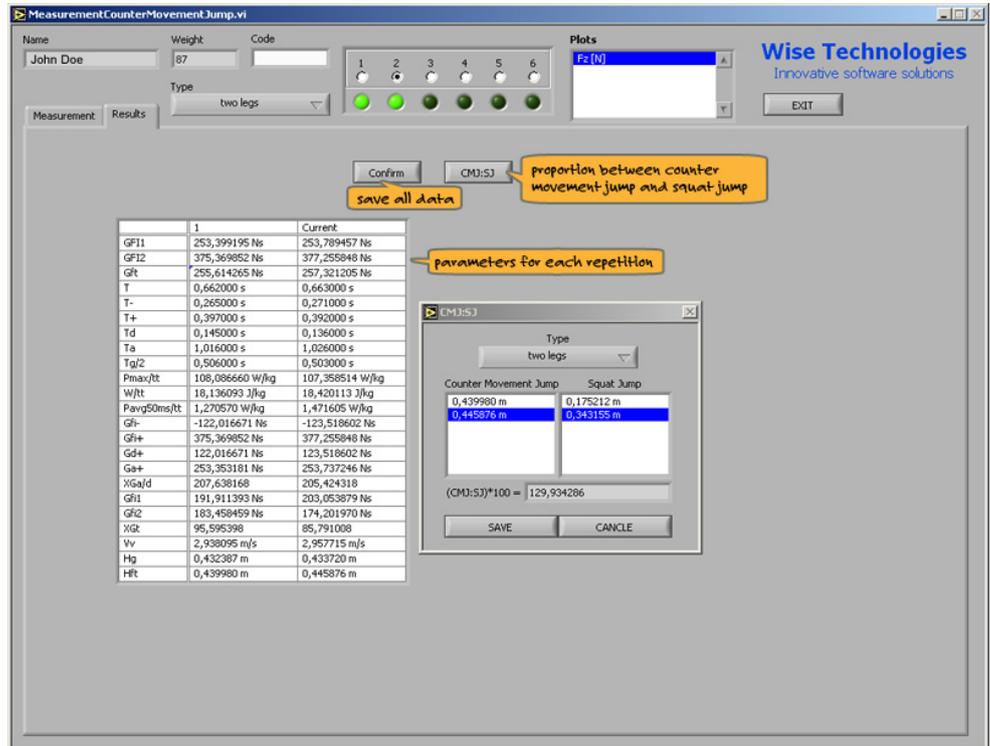


Figure 4  
Results of analysis



GF11	Force impulse on interval between T0 and T2
GF12	Force impulse on interval between T1 and T2
Gft	Force impulse computed from fly time
T	Time between T0 in T2
T-	Time between T0 in T1
T+	Time between T1 in T2
Td	Time of deceleration
Ta	Time of acceleration
Tg/2	Time between GF11/2 and T1
Pmax/tt	Maximal power divided by body weight
W/tt	Energy divided by body weight
Pavg50ms/tt	Start power divided by body weight
Gfi-	Force impulse on interval between T0 and T1
Gfi+	Force impulse on interval between T1 and T2
Gd+	Force impulse on interval of deceleration
Ga+	Force impulse on interval of acceleration
XGa/d	Ratio between Ga and Gd
Gfi1	Force impulse on interval between T1 and T/2
Gft2	Force impulse on interval between T/2 and T2
XGt	Ratio between Gfi2 and Gfi1
Vv	Vertical takeoff velocity
Hg	Height computed from takeoff velocity
Hft	Height computed from fly time
T1/2	T/2 - T1
Aavg1	Average acceleration on interval between T1 and T/2
Aavg2	Average acceleration on interval between T/2 and T2
Fmax/tt	Maximal force divided by body weight
Tfmax	Time between maximal force occurrence and T1
Favg1/tt	Maximal force divided by body weight on interval between T1 and T/2
Favg2/tt	Maximal force divided by body weight on interval between T/2 and T2
FT	Time between T2 and T3

## Drop jump

The information about the person, jump type parameter, initial height and repetition sequence number is positioned at the top of the window. The **“Measurement”** tab displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed, and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **“Plot list”**. By pressing the **“Offset”** button prior to the measurement, the input signal is set to zero. With the **“Trigger”** option unchecked, the signal acquisition starts immediately, while it is delayed until the force exceeds a pre-defined value if the **“Trigger”** option is selected. The acquisition terminates automatically when the jump is completed, and the cursors are set instantly. **“Live signals”** switches between live signal acquisition and the last acquired signal.

The results of the analysis are displayed on the **“Results”** tab – in the **“Current”** column, which is updated when the T1 (start of contact) cursor is moved. Other columns contain the results of previously saved measurements. The **“Confirm”** button saves the parameters of the current jump.

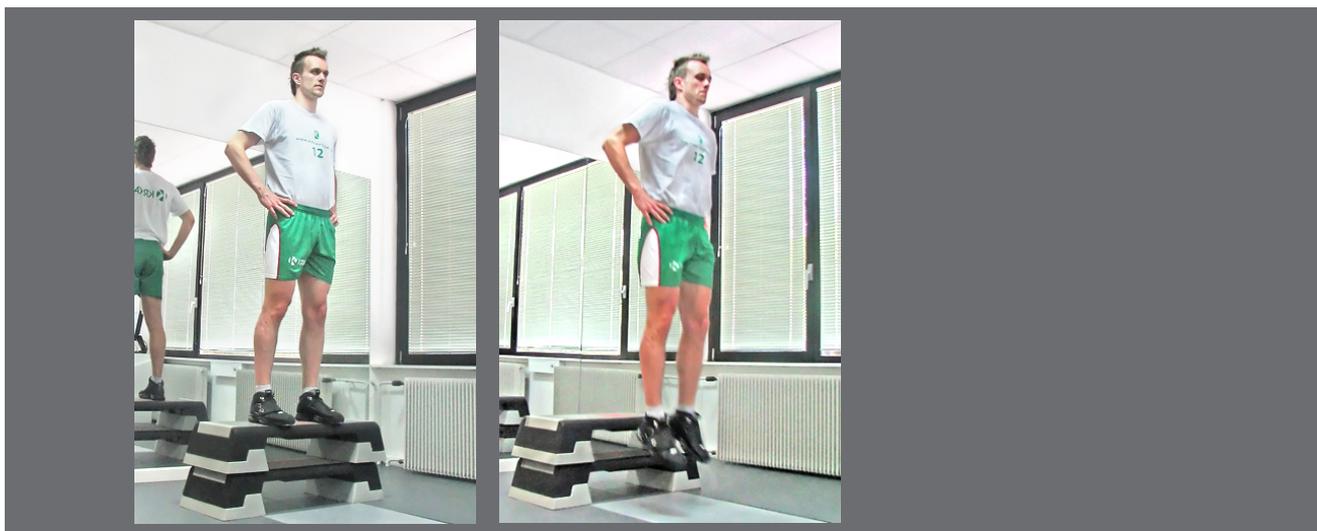


Figure 5  
Drop jump measurement

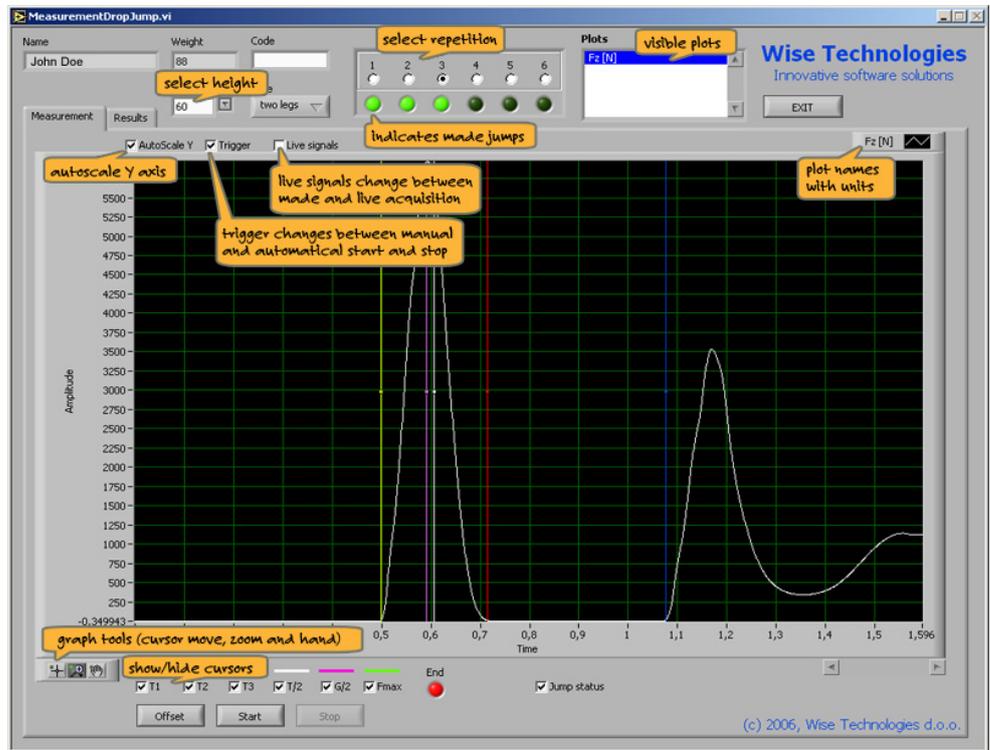
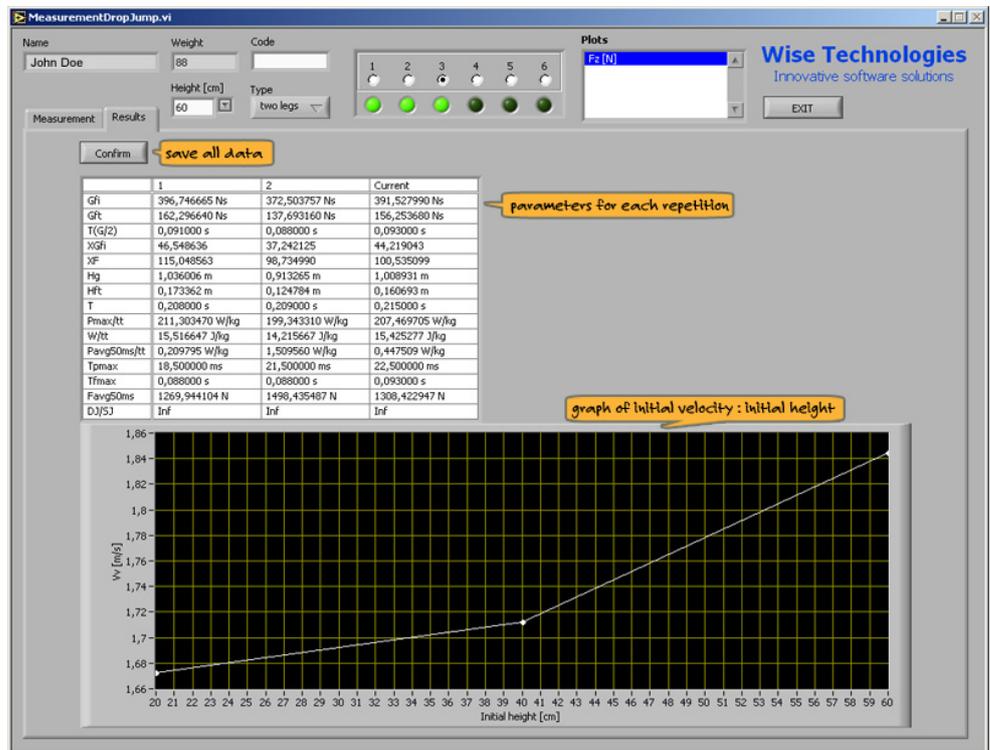


Figure 6  
Results of analysis



Gfi	Force impulse on interval between T1 and T2
Gft	Force impulse computed from fly time
T(G/2)	Time between GF11/2 and T1
XGfi	Ratio between force impulse before T/2 and after T/2
XF	Ratio between force impulse before Fmax and after Fmax
Hg	Height computed from takeoff velocity
Hft	Height computed from fly time
T	Time between T1 and T2
Pmax/tt	Maximal power divided by body weight
W/tt	Energy divided by body weight
Pavg50ms/tt	Start power divided by body weight
Tpmax	Time of maximal power compared to G/2
Tfmax	Time between maximal force occurrence and T1
Favg50ms	Start force
DJ/SJ	Ratio between drop jump height and squat jump height
A50ms	Start acceleration
T1	Time between T1 and G/2
T2	Time between G/2 and T2
Gft1	Force impulse on interval between T1 and T/2
Gft2	Force impulse on interval between T/2 and T2
T1F	Time between T1 and Fmax
T2F	Time between Fmax and T2
Gft1F	Force impulse on interval between T1 and Fmax
Gft2F	Force impulse on interval between Fmax and T2
Vv	Vertical takeoff velocity
T1/2	T/2 - T1
Aavg1	Average acceleration on interval between T1 and T/2
Aavg2	Average acceleration on interval between T/2 and T2
Pinte	Power on selected interval
Fmax/tt	Maximal force divided by body weight
Favg1/tt	Maximal force divided by body weight on interval between T1 and T/2
Favg2/tt	Maximal force divided by body weight on interval between T/2 and T2
Vstart	Start velocity
FT	Time between T2 and T3
Jump status	Jump status

## Jump with additional weights

The information about the person, jump type parameter, additional weight and repetition sequence number is positioned at the top of the window. The **"Measurement"** tab displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed, and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. With the **"Trigger"** option unchecked, the signal acquisition starts immediately, while it is delayed until the force exceeds a pre-defined value if the **"Trigger"** option is selected. The acquisition terminates automatically when the jumps are completed, and the cursors are set instantly. **"Live signals"** switches between live signal acquisition and the last acquired signal.

The results of the analysis are displayed on the **"Results"** tab – in the **"Current"** column, which is updated when the cursor is moved. Other columns contain the results of previously saved measurements. The **"Confirm"** button saves the parameters of the current jump.



Figure 7  
Jump with additional weights measurement

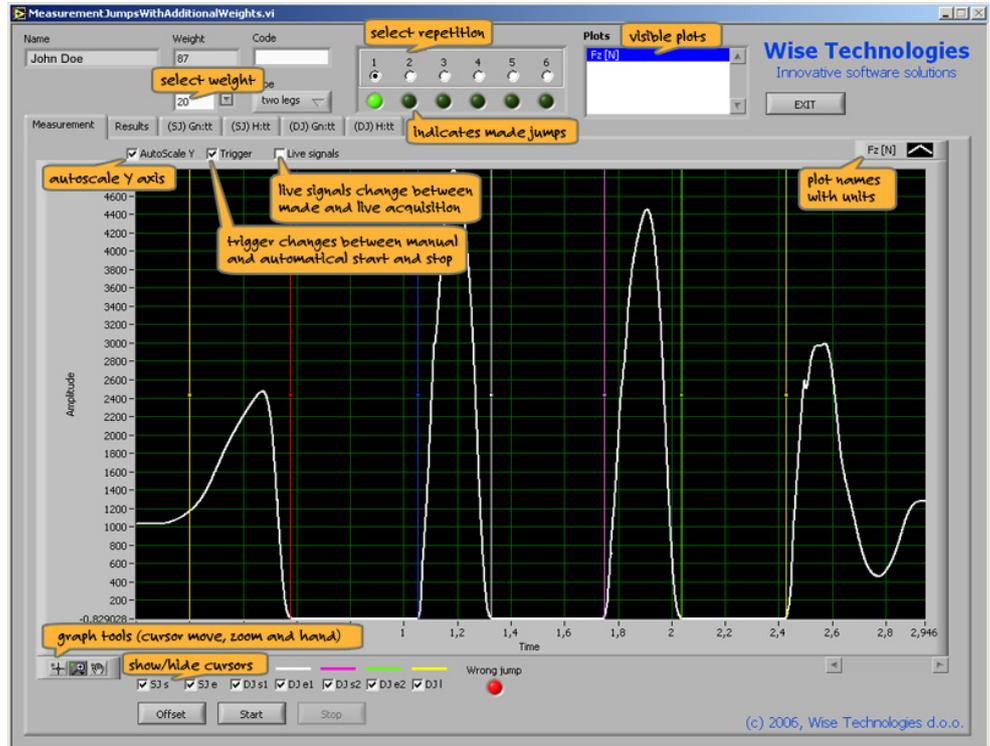
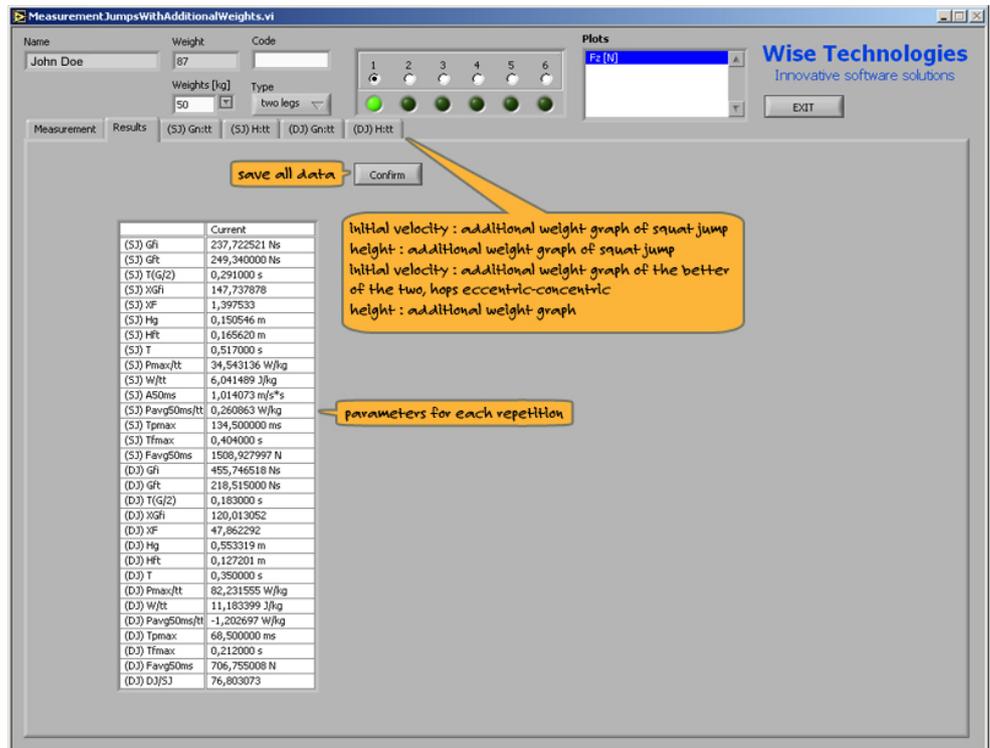


Figure 8  
Results of analysis



The other four tabs display the following graphs:

- **Normalized force impulse : added weight** (1st - concentric squat jump)
- **Height : added weight** (1st - concentric squat jump)
- **Normalized force impulse : added weight** (the batter of the two eccentric-concetric hops)

- **Height : added weight** (the batter of the two eccentric-concetric hops)

Figure 9  
Normalized force  
impulse : added  
weight

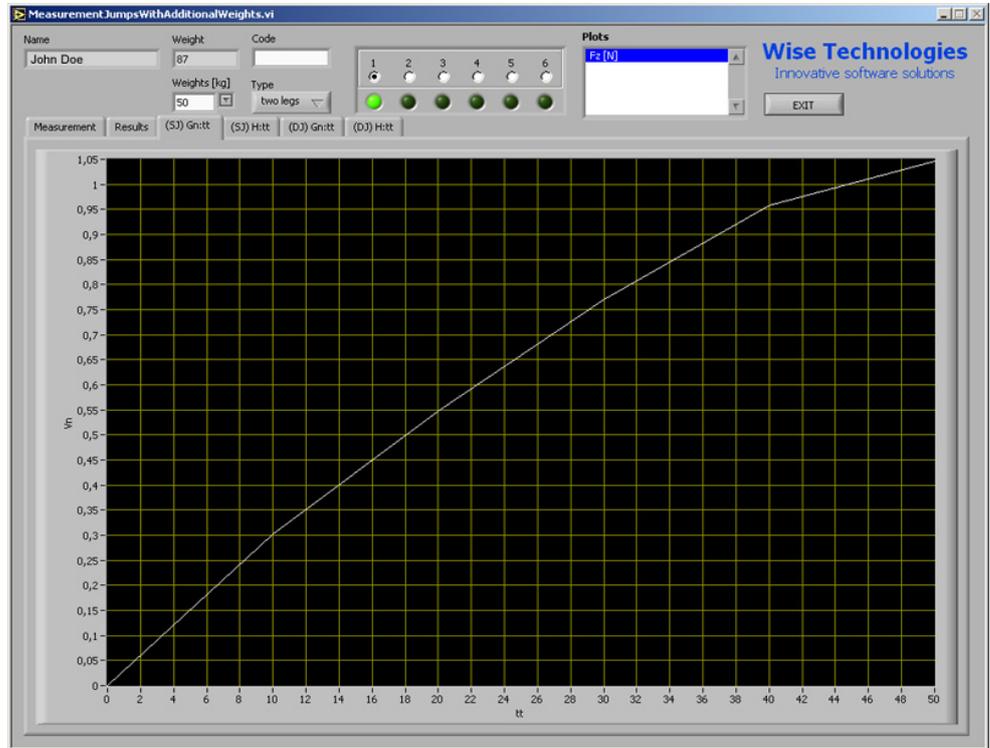


Figure 10  
Height : added weight

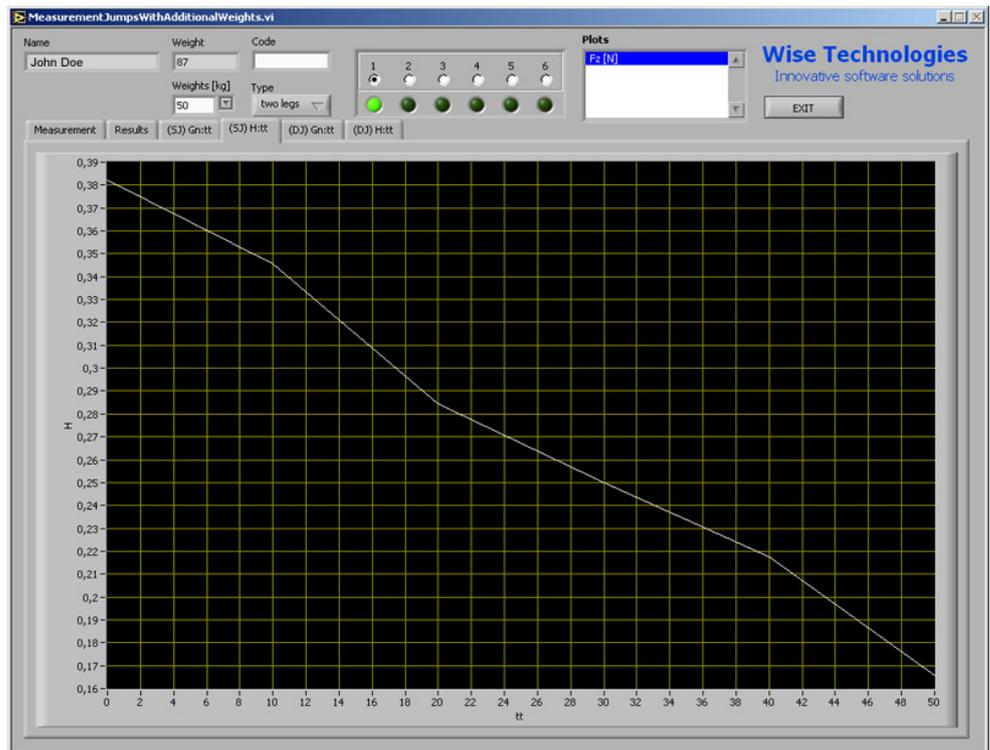


Figure 11  
Normalized force impulse : added weight

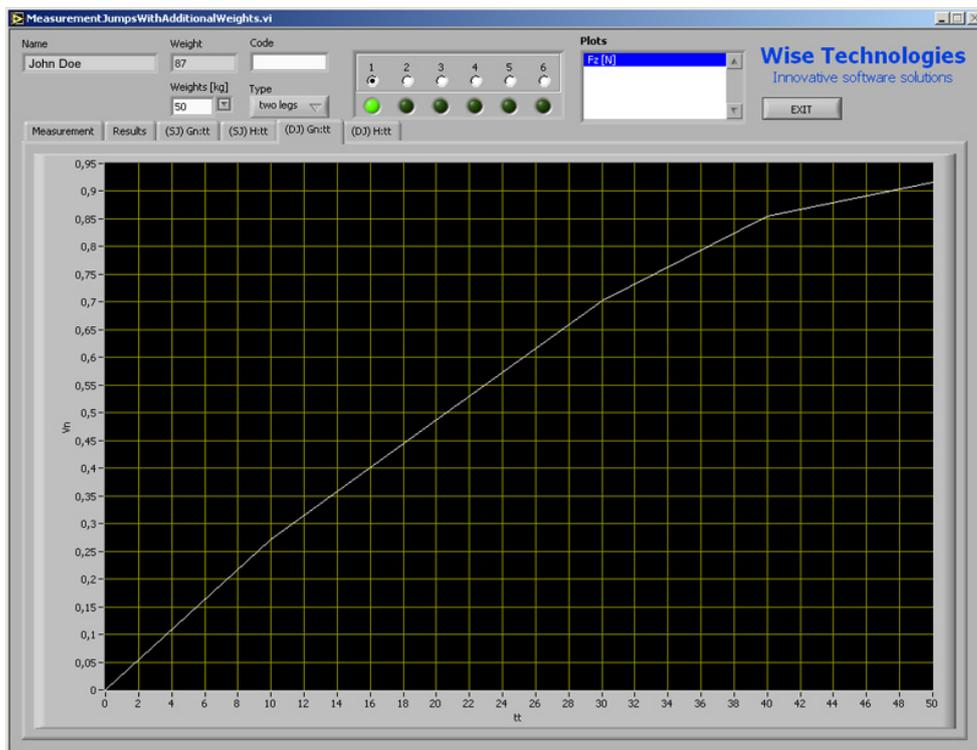
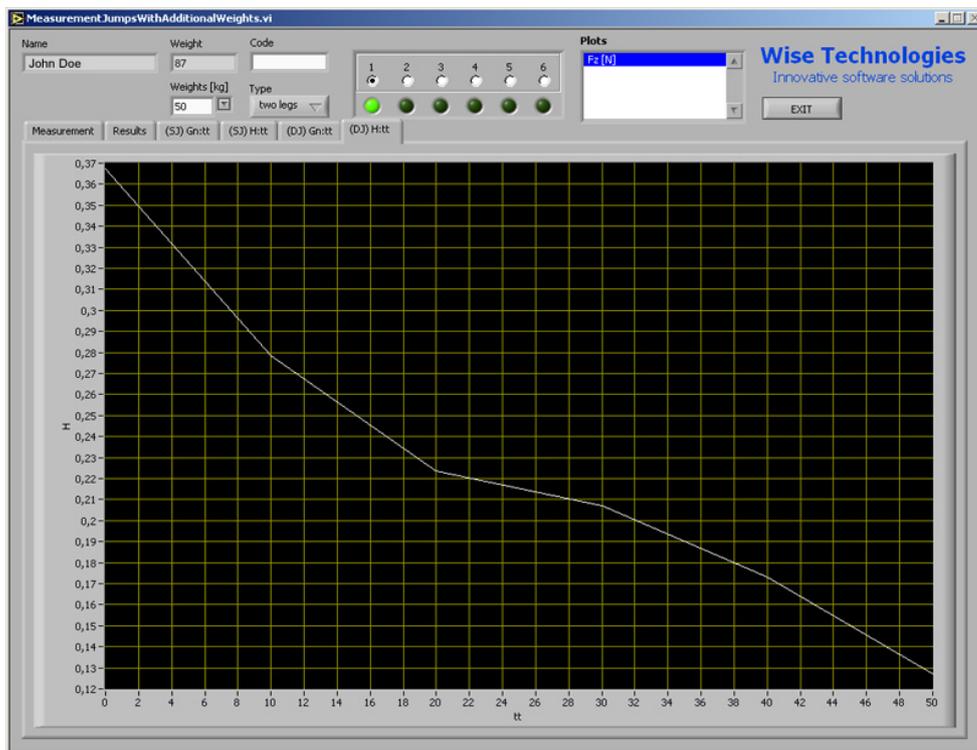


Figure 12  
Height : added weight



(SJ) Gfi	Force impulse on interval between T1 and T2
(SJ) Gft	Force impulse computed from fly time
(SJ) T(G/2)	Time between GF11/2 and T1
(SJ) XGfi	Ratio between force impulse before T/2 and after T/2
(SJ) XF	Ratio between force impulse before Fmax and after Fmax
(SJ) Hg	Height computed from takeoff velocity
(SJ) Hft	Height computed from fly time
(SJ) T	Time between T1 and T2
(SJ) Pmax/tt	Maximal power divided by body weight
(SJ) W/tt	Energy divided by body weight
(SJ) A50ms	Start acceleration
(SJ) Pavg50ms/tt	Start power divided by body weight
(SJ) Tpmx	Time of maximal power compared to G/2
(SJ) Tfmax	Time between maximal force occurrence and T1
(SJ) Favg50ms	Start force
(SJ) T1	Time between T1 and G/2
(SJ) T2	Time between G/2 and T2
(SJ) Gft1	Force impulse on interval between T1 and T/2
(SJ) Gft2	Force impulse on interval between T/2 and T2
(SJ) T1F	Time between T1 and Fmax
(SJ) T2F	Time between Fmax and T2
(SJ) Gft1F	Force impulse on interval between T1 and Fmax
(SJ) Gft2F	Force impulse on interval between Fmax and T2
(SJ) Vv	Vertical takeoff velocity
(SJ) Axms	Acceleration on selected interval
(SJ) Aavg1	Average acceleration on interval between T1 and T/2
(SJ) Aavg2	Average acceleration on interval between T/2 and T2
(SJ) Pinte	Power on selected interval
(SJ) Fmax/tt	Maximal force divided by body weight
(SJ) Favg1/tt	Maximal force divided by body weight on interval between T1 and T/2
(SJ) Favg2/tt	Maximal force divided by body weight on interval between T/2 and T2
(SJ) Vstart	Start velocity
(SJ) FT	Time between T2 and T3

\*(SJ) - Squat jump

(DJ) Gfi	Force impulse on interval between T1 and T2
(DJ) Gft	Force impulse computed from fly time
(DJ) T(G/2)	Time between GF11/2 and T1
(DJ) XGfi	Ratio between force impulse before T/2 and after T/2
(DJ) XF	Ratio between force impulse before Fmax and after Fmax
(DJ) Hg	Height computed from takeoff velocity
(DJ) Hft	Height computed from fly time
(DJ) T	Time between T1 and T2
(DJ) Pmax/tt	Maximal power divided by body weight
(DJ) W/tt	Energy divided by body weight
(DJ) A50ms	Start acceleration
(DJ) Pavg50ms/tt	Start power divided by body weight
(DJ) Tpmx	Time of maximal power compared to G/2
(DJ) Tfmax	Time between maximal force occurrence and T1
(DJ) Fav50ms	Start force
(DJ) T1	Time between T1 and G/2
(DJ) T2	Time between G/2 and T2
(DJ) Gft1	Force impulse on interval between T1 and T/2
(DJ) Gft2	Force impulse on interval between T/2 and T2
(DJ) T1F	Time between T1 and Fmax
(DJ) T2F	Time between Fmax and T2
(DJ) Gft1F	Force impulse on interval between T1 and Fmax
(DJ) Gft2F	Force impulse on interval between Fmax and T2
(DJ) Vv	Vertical takeoff velocity
(DJ) Axms	Acceleration on selected interval
(DJ) Aavg1	Average acceleration on interval between T1 and T/2
(DJ) Aavg2	Average acceleration on interval between T/2 and T2
(DJ) Pinte	Power on selected interval
(DJ) Fmax/tt	Maximal force divided by body weight
(DJ) Fav1/tt	Maximal force divided by body weight on interval between T1 and T/2
(DJ) Fav2/tt	Maximal force divided by body weight on interval between T/2 and T2
(DJ) Vstart	Start velocity
(DJ) FT	Time between T2 and T3

\* (DJ) - Drop jump

## Repetitive counter movement jump

The information about the person, jump type parameter and repetition sequence number is positioned at the top of the window. The **“Measurement”** tab displays the acquired signals. The graph can be zoomed, and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **“Plot list”**. By pressing the **“Offset”** button prior to the measurement, the input signal is set to zero. With the **“Trigger”** option unchecked, the signal acquisition starts immediately, while it is delayed until the force exceeds a pre-defined value if the **“Trigger”** option is selected. The acquisition can be terminated automatically by selecting any combination of the following three parameters: **“Stop time”**, **“Number of jumps”**, and **“Tiredness index”**. It can also be terminated manually by pressing the **“Stop”** button. **“Live signals”** switches between live signal acquisition and the last acquired signal.

The results of the analysis are displayed on the **“Results”** tab – in the **“Current”** column, which is updated when the **“Number of jumps for analysis”** parameter value is changed. Other columns contain the results of previously saved measurements. The **“Confirm”** button saves the parameters of the current jump.

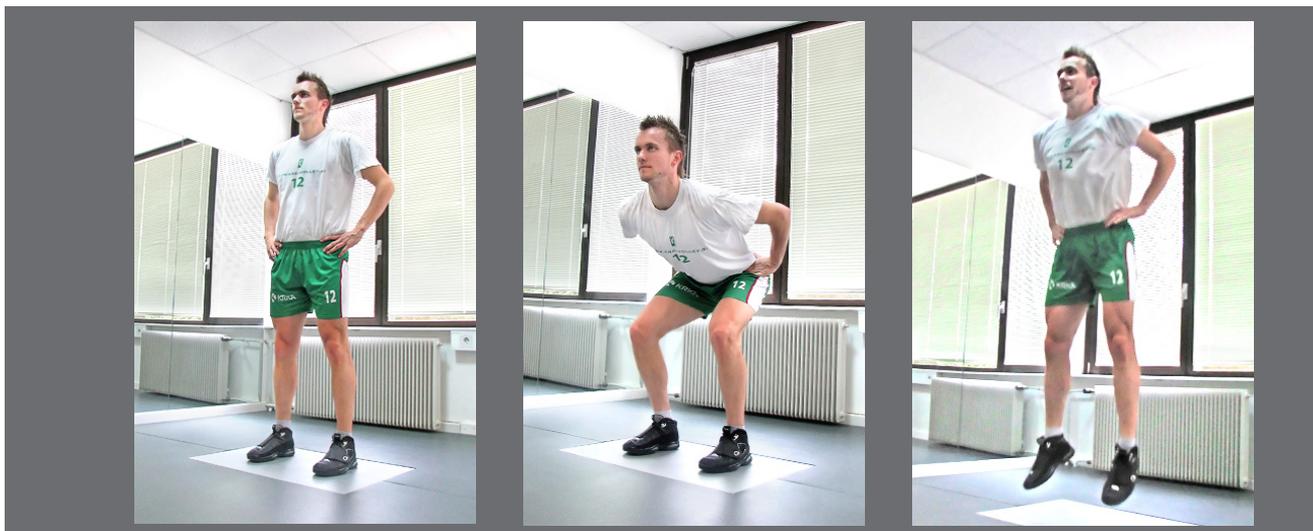


Figure 13  
Repetitive counter movement jump measurement

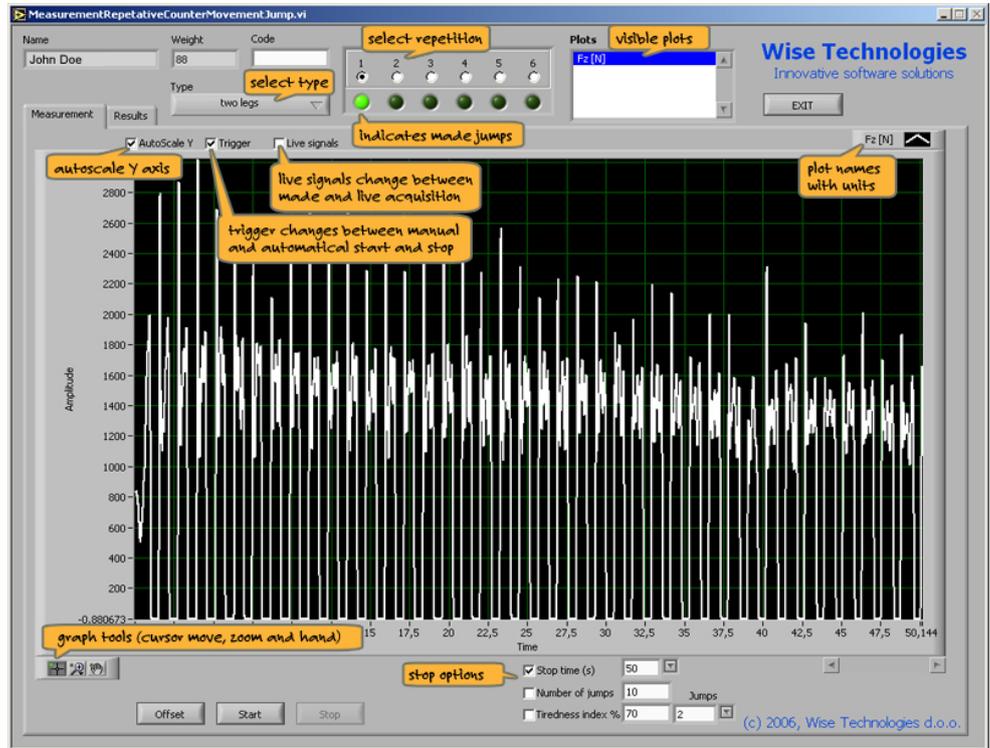
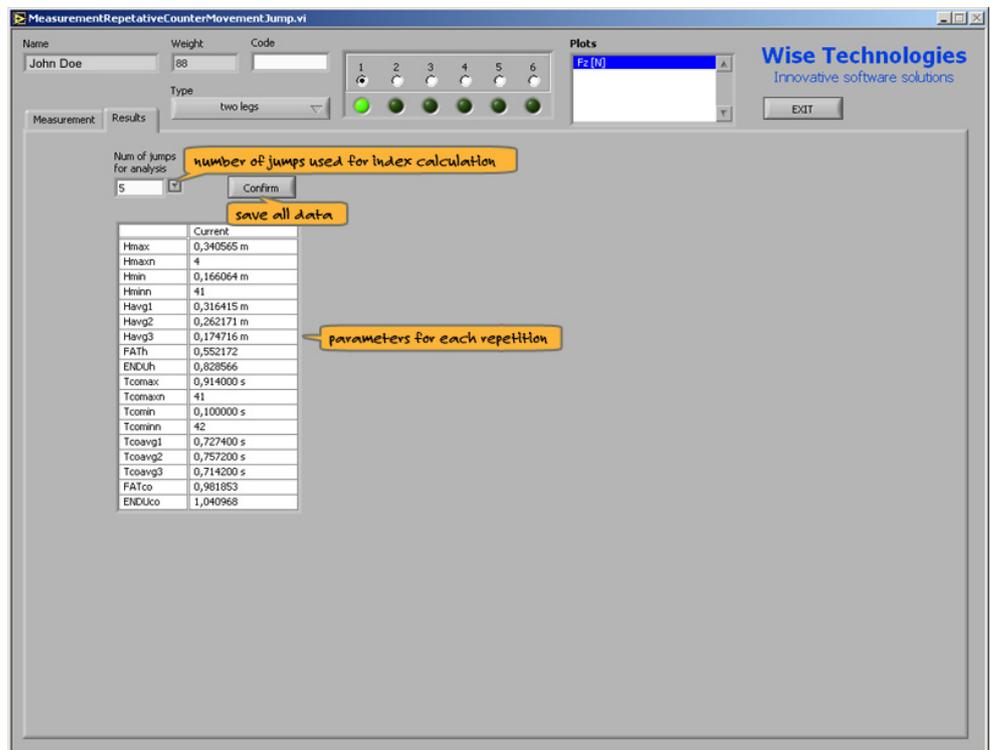


Figure 14  
Results of analysis



Hmax	Maximal jump height
Hmaxn	Consecutive number of maximal jump height
Hmin	Minimal jump height
Hminn	Consecutive number of minimal jump height
Havg1	Average height of first n jumps
Havg2	Average height of n jumps in the middle of series
Havg3	Average height of last n jumps
FATh	Fatigue index of height
ENDUh	Endurance index of height
Tcomax	Maximal jump contact time
Tcomaxn	Consecutive number of maximal jump contact time
Tcomin	Minimal jump contact time
Tcominn	Consecutive number of minimal jump contact time
Tcoavg1	Average contact time of first n jumps
Tcoavg2	Average contact time of n jumps in the middle of series
Tcoavg3	Average contact time of last n jumps
FATco	Fatigue index of contact time
ENDUco	Endurance index of contact time
H/Tmax	Maximal jump ratio between height and contact time
H/Tmaxn	Consecutive number of maximal jump ratio between height and contact time
H/Tmin	Minimal jump ratio between height and contact time
H/Tminn	Consecutive number of minimal jump ratio between height and contact time
H/Tavg1	Average ratio between height and contact time of first n jumps
H/Tavg2	Average ratio between height and contact time of n jumps in the middle of series
H/Tavg3	Average ratio between height and contact time of last n jumps
FAT H/T	Fatigue index of ratio between height and contact time
ENDU H/T	Endurance index of ratio between height and contact time

## Repetitive hooping

The information about the person, jump type parameter and repetition sequence number is positioned at the top of the window. The **“Measurement”** tab displays the acquired signals. The graph can be zoomed, and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **“Plot list”**. By pressing the **“Offset”** button prior to the measurement, the input signal is set to zero. With the **“Trigger”** option unchecked, the signal acquisition starts immediately, while it is delayed until the force exceeds a pre-defined value if the **“Trigger”** option is selected. The acquisition can be terminated automatically by selecting any combination of the following three parameters: **“Stop time”**, **“Number of jumps”**, and Tiredness index. It can also be terminated manually by pressing the **“Stop”** button. **“Live signals”** switches between live signal acquisition and the last acquired signal.

The results of the analysis are displayed on the **“Results”** tab – in the **“Current”** column, which is updated when the **“Number of jumps for analysis”** parameter value is changed. Other columns contain the results of previously saved measurements. The **“Confirm”** button saves the parameters of the current jump.



Figure 15  
Repetitive hopping measurement

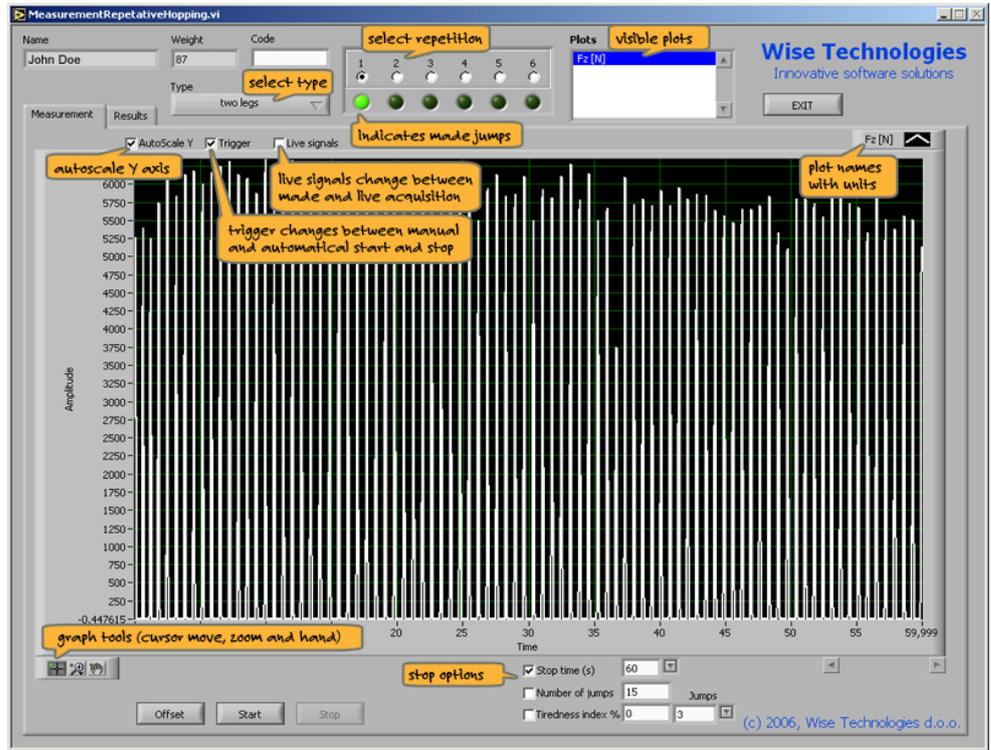
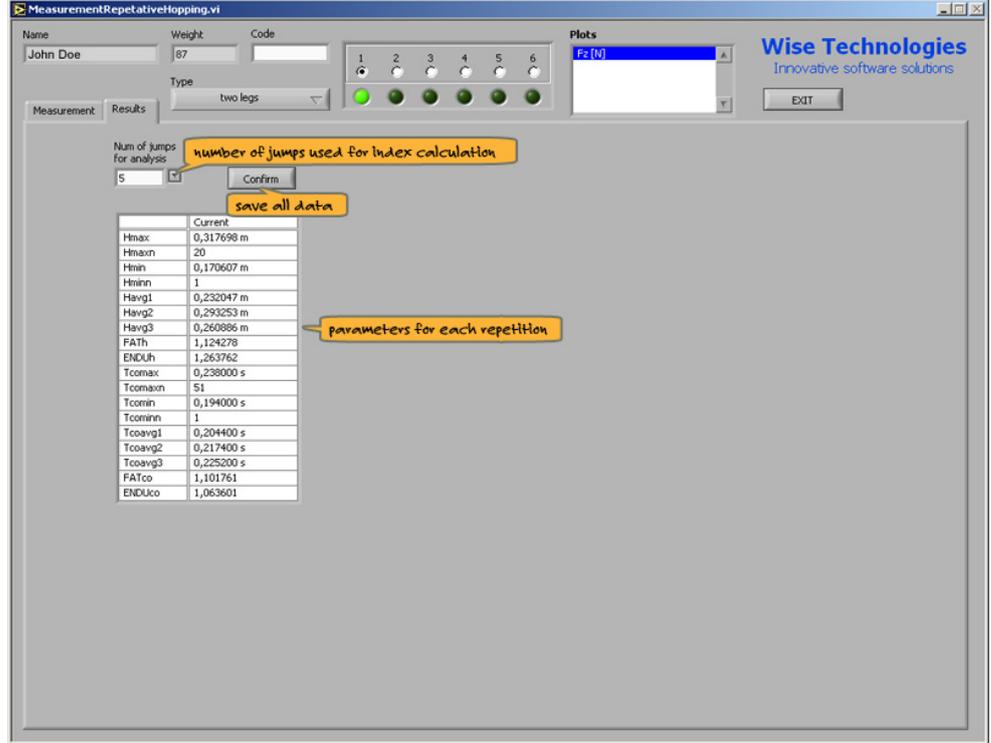


Figure 16  
Results of analysis



Hmax	Maximal jump height
Hmaxn	Consecutive number of maximal jump height
Hmin	Minimal jump height
Hminn	Consecutive number of minimal jump height
Havg1	Average height of first n jumps
Havg2	Average height of n jumps in the middle of series
Havg3	Average height of last n jumps
FATh	Fatigue index of height
ENDUh	Endurance index of height
Tcomax	Maximal jump contact time
Tcomaxn	Consecutive number of maximal jump contact time
Tcomin	Minimal jump contact time
Tcominn	Consecutive number of minimal jump contact time
Tcoavg1	Average contact time of first n jumps
Tcoavg2	Average contact time of n jumps in the middle of series
Tcoavg3	Average contact time of last n jumps
FATco	Fatigue index of contact time
ENDUco	Endurance index of contact time
H/Tmax	Maximal jump ratio between height and contact time
H/Tmaxn	Consecutive number of maximal jump ratio between height and contact time
H/Tmin	Minimal jump ratio between height and contact time
H/Tminn	Consecutive number of minimal jump ratio between height and contact time
H/Tavg1	Average ratio between height and contact time of first n jumps
H/Tavg2	Average ratio between height and contact time of n jumps in the middle of series
H/Tavg3	Average ratio between height and contact time of last n jumps
FAT H/T	Fatigue index of ratio between height and contact time
ENDU H/T	Endurance index of ratio between height and contact time

## Step analysis

The information about the person, jump parameters and repetition sequence number is positioned at the top of the window. The **"Measurement"** tab displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed, and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. With the **"Trigger"** option unchecked, the signal acquisition starts immediately, while it is delayed until the force exceeds a pre-defined value if the **"Trigger"** option is selected. The acquisition terminates automatically or by pressing the **"Stop"** button. **"Live signals"** switches between live signal acquisition and the last acquired signal. **"Change orientation"** switches the Fx and Fy axes. The **"COG"** tab displays the Center of gravity graph.

---

The results of the analysis are displayed on the **"Results"** tab – in the **"Current"** column, which is updated when the **"Analysis"** button is pushed. Other columns contain the results of previously saved measurements. The **"Confirm"** button saves the parameters of the current jump. The 3D vector graph, COG velocity graph and COG acceleration graph are available on the other tabs.

Figure 17  
Step analysis  
measurement

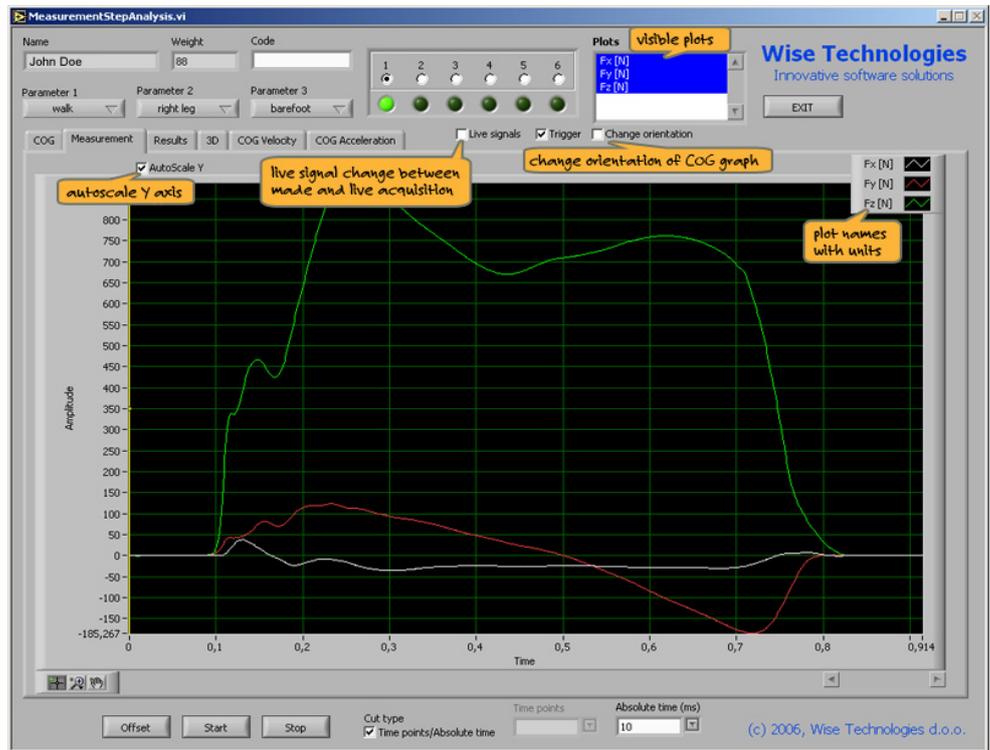


Figure 18  
Results of analysis

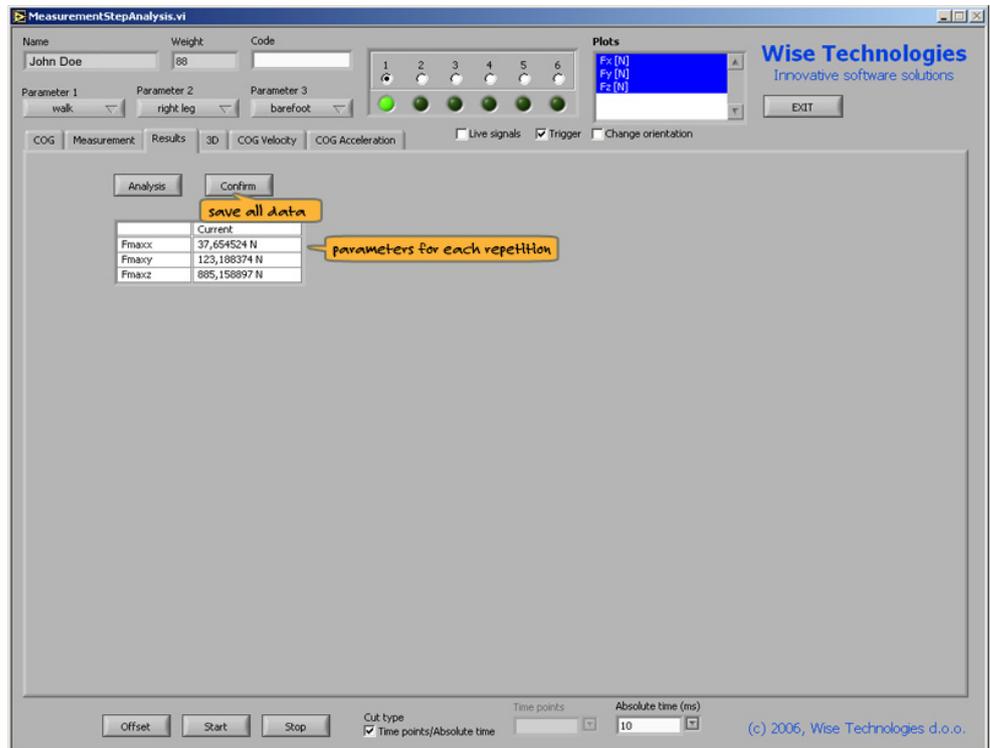


Figure 19  
Step analysis COG

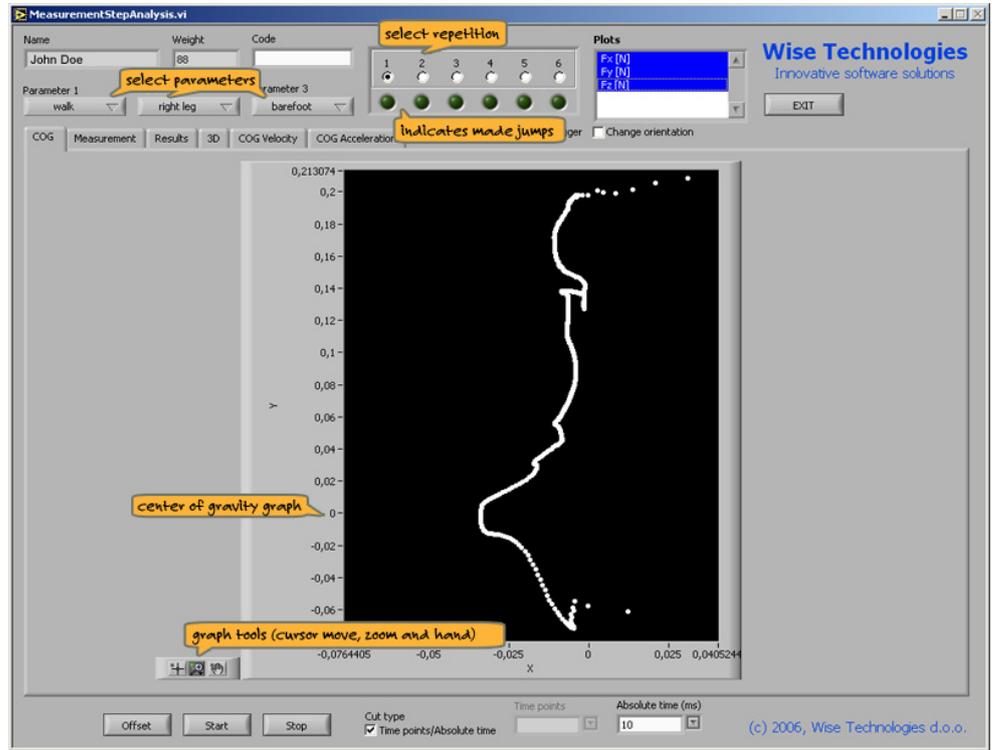
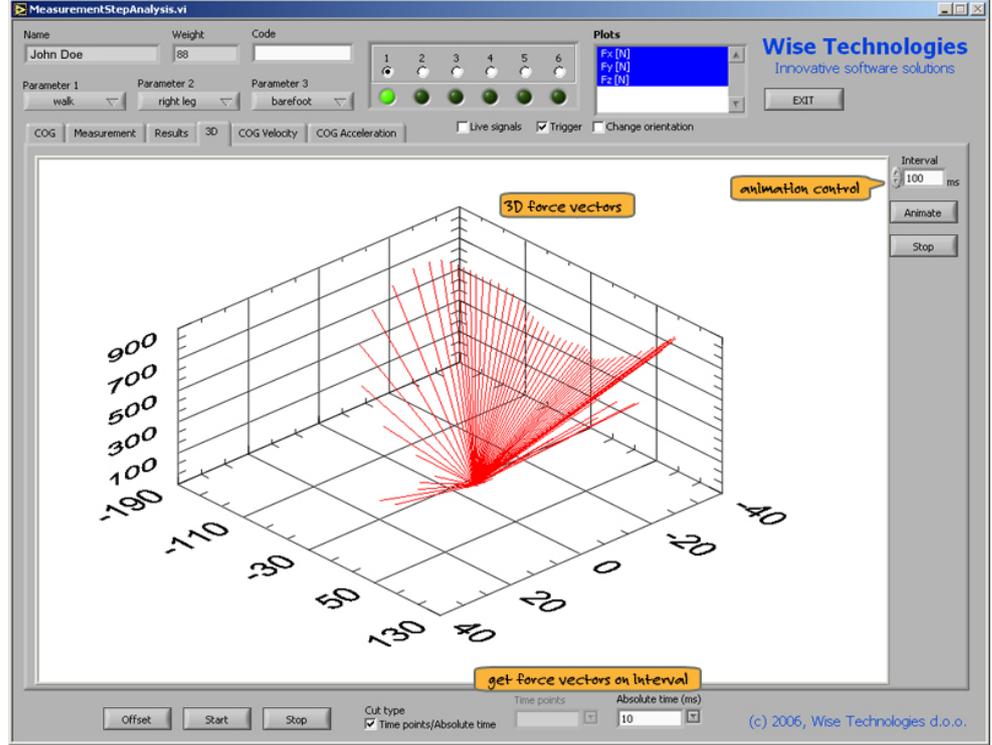


Figure 20  
Step analysis 3D



Fmaxx	Maximal force in x direction
Fmaxy	Maximal force in y direction
Fmaxz	Maximal force in z direction

## Body sway

The information about the person, jump parameters and repetition sequence number is positioned at the top of the window. The **"Measurement"** tab displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed, and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. Signal acquisition starts when pressing the **"Start"** button and terminates automatically or by pressing the **"Stop"** button. **"Live signals"** switches between live signal acquisition and the last acquired signal. **"Change orientation"** switches the Fx and Fy axes. The **"COG"** tab displays the Center of gravity graph.

The results of the analysis are displayed on the **"Results"** tab – in the **"Current"** column. Other columns contain the results of previously saved measurements. The **"Confirm"** button saves the parameters of the current jump. The 3D vector graph, COG velocity graph and COG acceleration graph are available on the other tabs.



Figure 21  
Body sway measurement

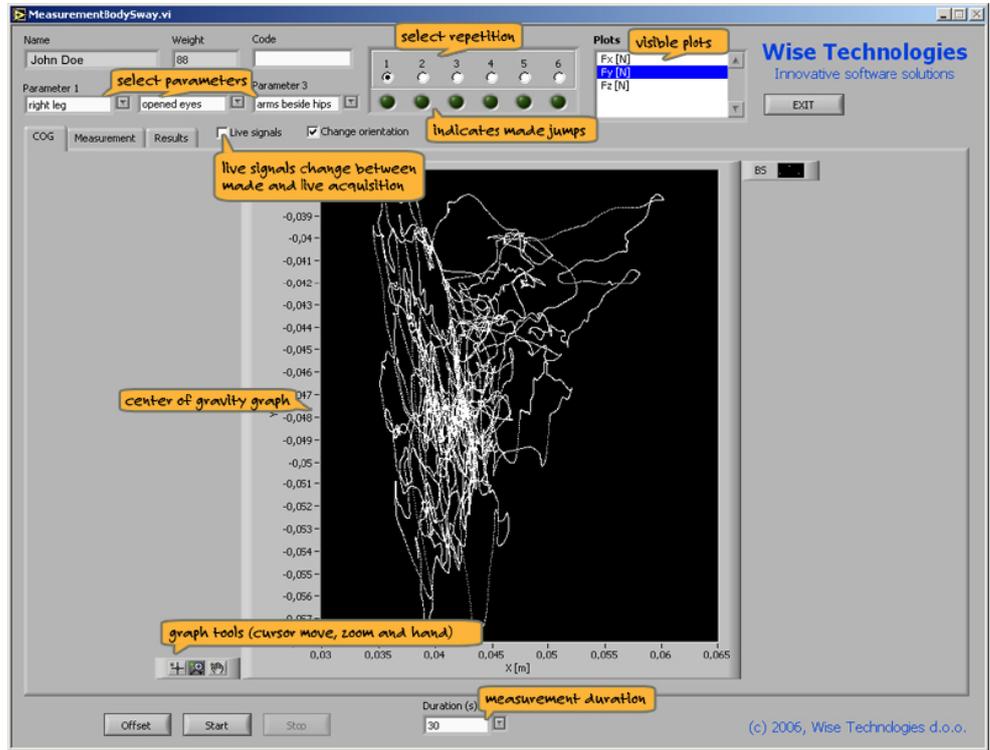
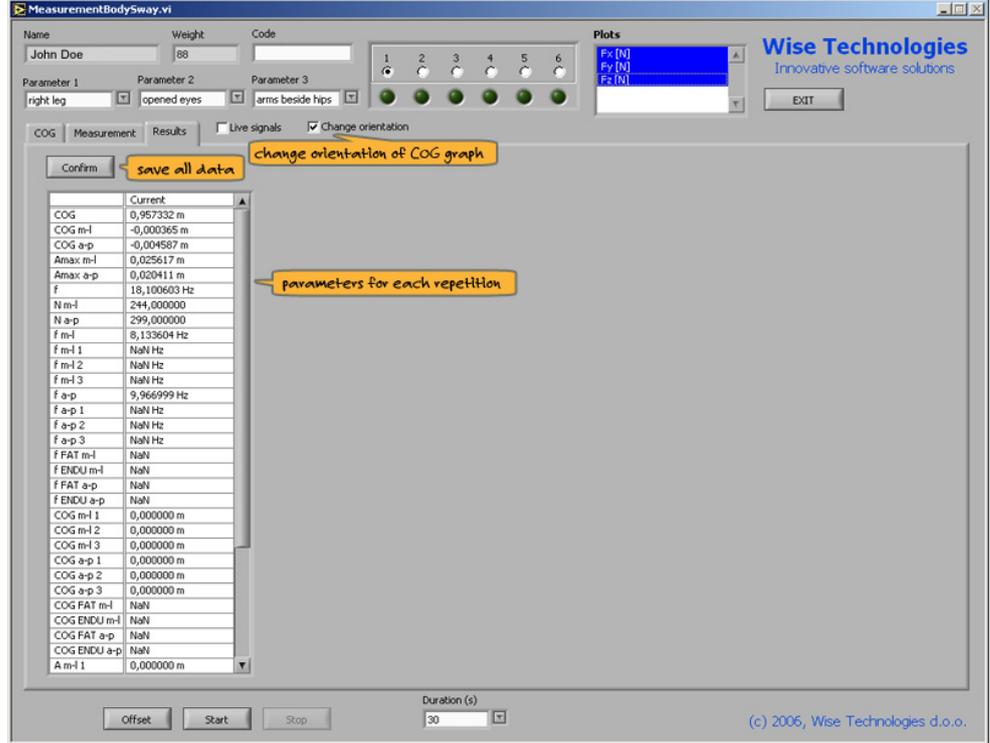


Figure 22  
Results of analysis



COG	COG distance
COG m-l	COG distance in medio-lateral direction
COG a-p	COG distance in anterior-posterior direction
Amax m-l	Maximal amplitude in medio-lateral direction
Amax a-p	Maximal amplitude in anterior-posterior direction
f	Frequency in medio-lateral and anterior-posterior direction
N m-l	Number in oscillations in medio-lateral direction
N a-p	Number in oscillations in anterior-posterior direction
f m-l	Frequency in medio-lateral direction
f m-l 1	Frequency in medio-lateral direction in first 10 seconds
f m-l 2	Frequency in medio-lateral direction in 10 seconds in the middle of test
f m-l 3	Frequency in medio-lateral direction in last 10 seconds
f a-p	Frequency in anterior-posterior direction
f a-p 1	Frequency in anterior-posterior direction in first 10 seconds
f a-p 2	Frequency in anterior-posterior direction in 10 seconds in the middle of test
f a-p 3	Frequency in anterior-posterior direction in last 10 seconds
f FAT m-l	Fatigue index of frequency in medio-lateral direction
f ENDU m-l	Endurance index of frequency in medio-lateral direction
f FAT a-p	Fatigue index of frequency in anterior-posterior direction
f ENDU a-p	Endurance index of frequency in anterior-posterior direction
COG m-l 1	COG distance in medio-lateral direction in first 10 seconds
COG m-l 2	COG distance in medio-lateral direction in 10 seconds in the middle of test
COG m-l 3	COG distance in medio-lateral direction in last 10 seconds
COG a-p 1	COG distance in anterior-posterior direction in first 10 seconds
COG a-p 2	COG distance in anterior-posterior direction in 10 seconds in the middle of test
COG a-p 3	COG distance in anterior-posterior direction in last 10 seconds
COG FAT m-l	Fatigue index of COG distance in medio-lateral direction
COG ENDU m-l	Endurance index of COG distance in medio-lateral direction
COG FAT a-p	Fatigue index of COG distance in anterior-posterior direction
COG ENDU a-p	Endurance index of COG distance in anterior-posterior direction
A m-l 1	Amplitude in medio-lateral direction in first 10 seconds
A m-l 2	Amplitude in medio-lateral direction in 10 seconds in the middle of test
A m-l 3	Amplitude in medio-lateral direction in last 10 seconds
A a-p 1	Amplitude in anterior-posterior direction in first 10 seconds
A a-p 2	Amplitude in anterior-posterior direction in 10 seconds in the middle of test
A a-p 3	Amplitude in anterior-posterior direction in last 10 seconds
A FAT m-l	Fatigue index of COG distance in medio-lateral direction
A ENDU m-l	Endurance index of COG distance in medio-lateral direction
A FAT a-p	Fatigue index of COG distance in anterior-posterior direction
A ENDU a-p	Endurance index of COG distance in anterior-posterior direction

## Dynamic balance test

The information about the person and repetition sequence number is positioned at the top of the window. Graphs allow zooming, and can be viewed along auto-scaled or fixed Y axis. Visible plots are collected in "Plot list". By pressing the "Offset" button prior to the measurement, the input signal is set to zero. Signal acquisition starts by pressing the "Start" button. It is terminated automatically via the pre-selected stop options, or manually by pressing the "Stop" button. "Live signals" switches between live signal acquisition and the last acquired signal. "Change orientation" switches the Fx and Fy axes. The "COG" tab contains the Center of gravity graph, initial settings and types of measurement.

The results of the analysis are displayed on the "Results" tab in the "Current" column. Other columns contain the results of previously saved measurements. The "Confirm" button saves of the parameters of the current jump.



Figure 23  
Dynamic balance test measurement

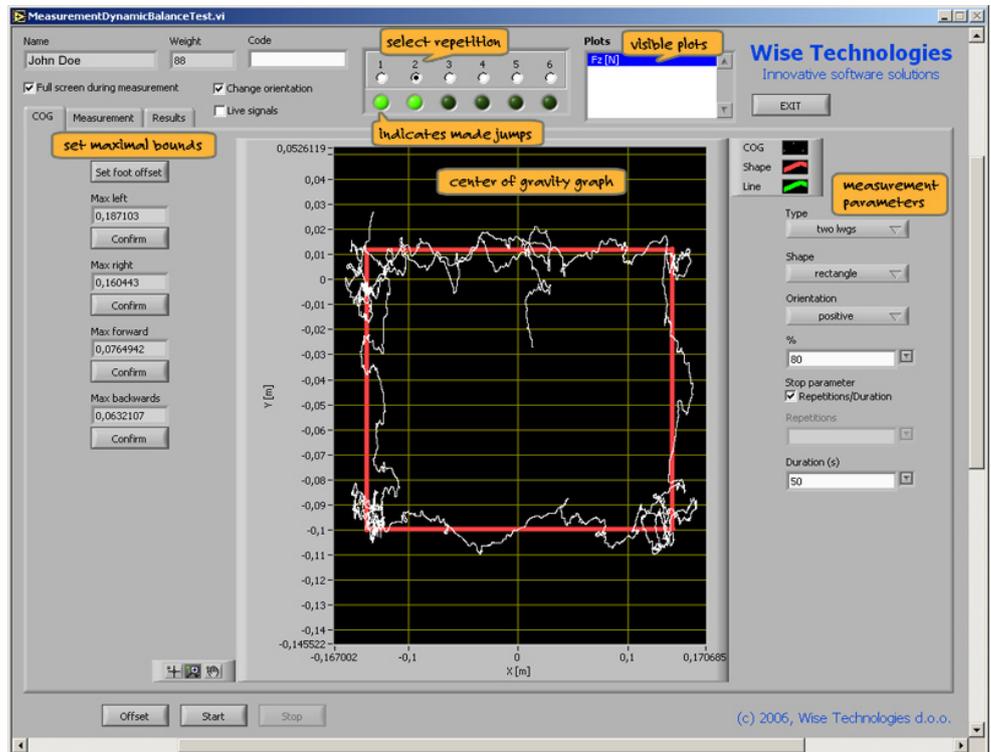


Figure 24  
Vertical force during test

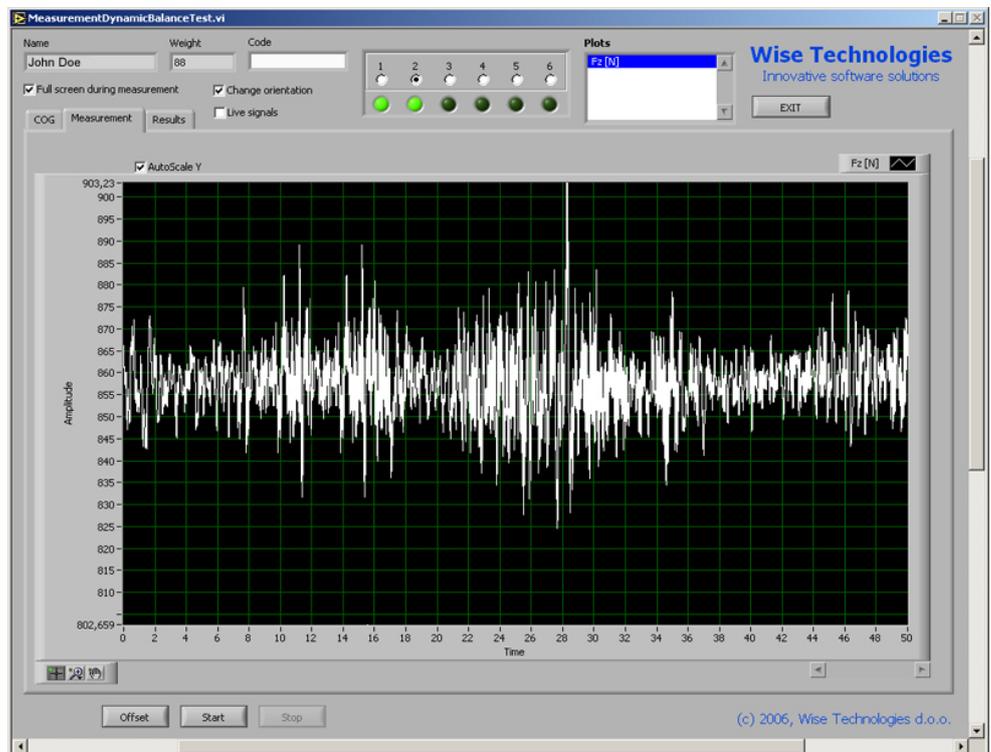
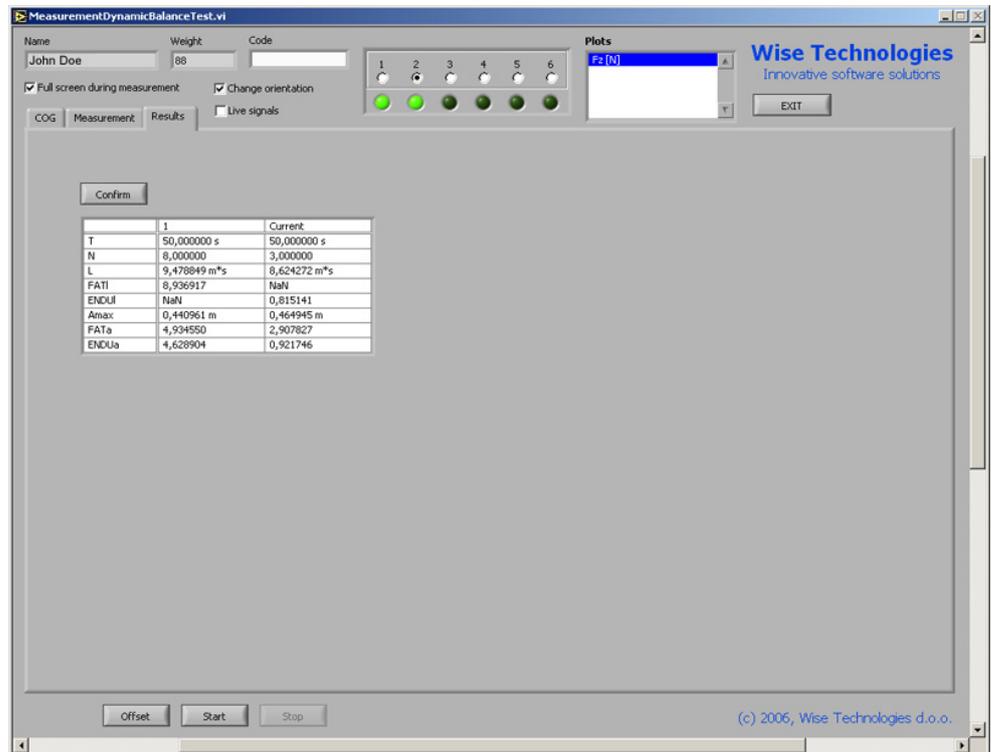




Figure 25  
Results of analysis



T	Time
N	Number of repetitions
L	Area between COG trajectory and generated trajectory
FATI	Fatigue of area index
ENDUI	Endurance of area index
Amax	Maximal amplitude
FATa	Fatigue index of amplitude
ENDUa	Endurance index of amplitude

## Long jump

The information about the person, jump type parameter and repetition sequence number is positioned at the top of the window. The **"Measurement"** tab displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. With the **"Trigger"** option unchecked, the signal acquisition starts immediately, while it is delayed until the force exceeds a pre-defined value if the **"Trigger"** option is selected. The acquisition terminated automatically when the jump is completed, and the cursors are set instantly. **"Live signals"** switches between live acquisition and the last acquired signal.

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The results of the analysis are displayed on the **"Results"** tab – in the **"Current"** column, which is updated when the cursor is moved. Other columns contain the results of previously saved measurements. The **"Confirm"** button saves the parameters of the current jump.

Figure 26  
Long jump  
measurement

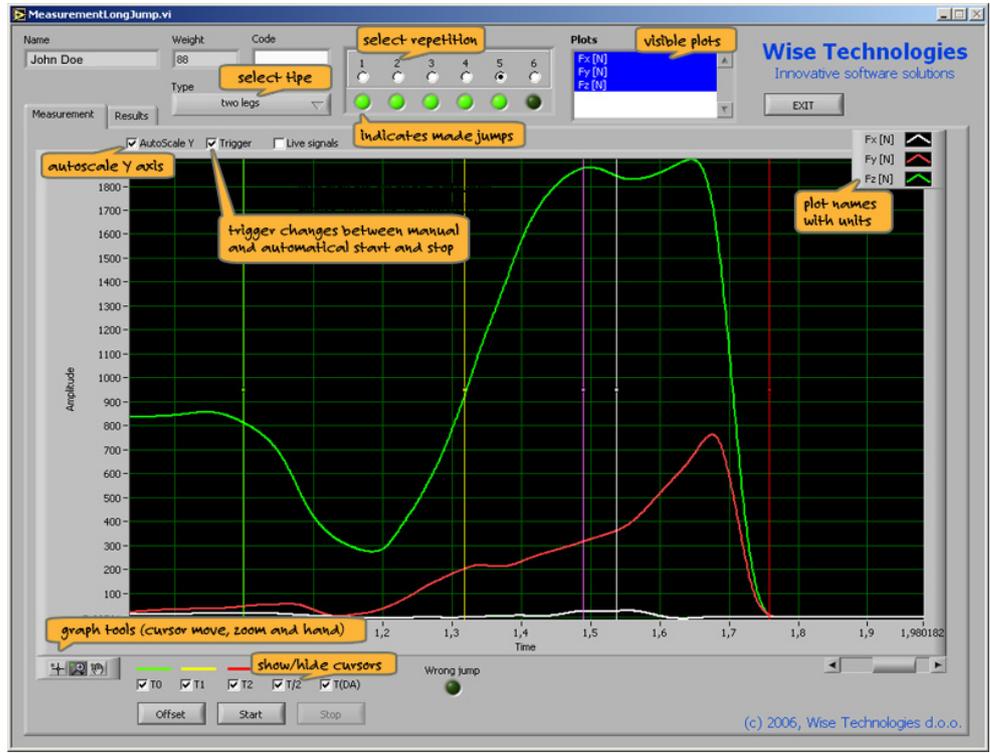
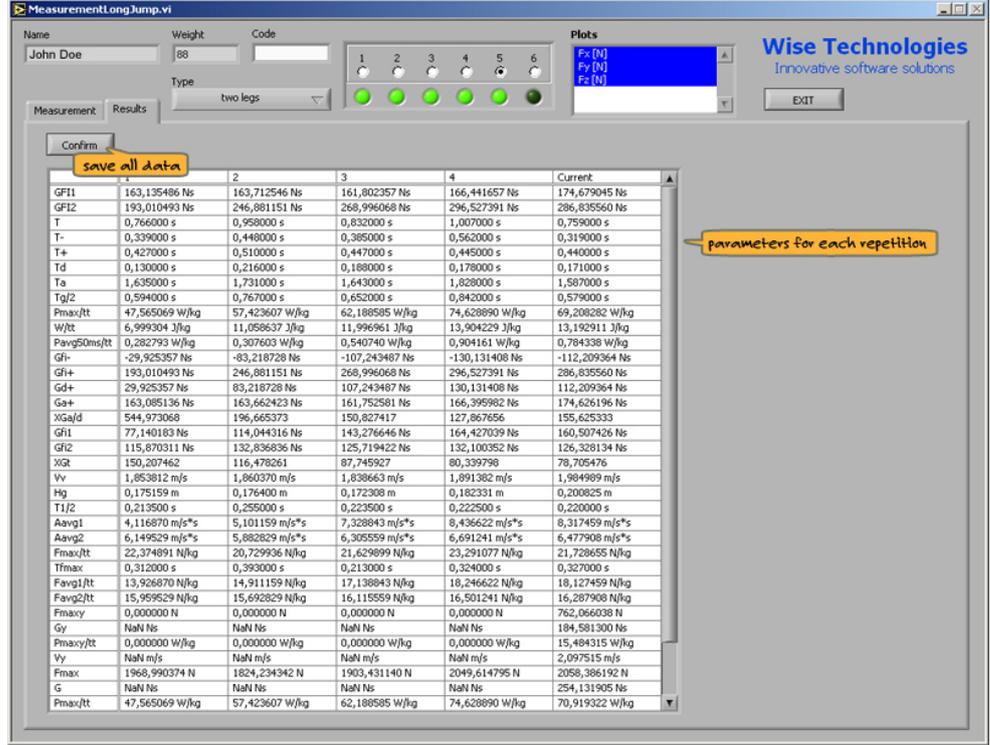


Figure 27  
Results of analysis



Gfi1	Force impulse on interval between T0 and T2
GF12	Force impulse on interval between T1 and T2
T	Time between T0 in T2
T-	Time between T0 in T1
T+	Time between T1 in T2
Td	Time of deceleration
Ta	Time of acceleration
Tg/2	Time between GF11/2 and T1
Pmax/tt	Maximal power divided by body weight
W/tt	Energy divided by body weight
Pavg50ms/tt	Start power divided by body weight
Gfi-	Force impulse on interval between T0 and T1
Gfi+	Force impulse on interval between T1 and T2
Gd+	Force impulse on interval of deceleration
Ga+	Force impulse on interval of acceleration
XGa/d	Ratio between Ga and Gd
Gfi1	Force impulse on interval between T1 and T/2
Gfi2	Force impulse on interval between T/2 and T2
XGt	Ratio between Gfi2 and Gfi1
Vv	Vertical takeoff velocity
Hg	Height computed from takeoff velocity
T1/2	T/2 - T1
Aavg1	Average acceleration on interval between T1 and T/2
Aavg2	Average acceleration on interval between T/2 and T2
Fmax/tt	Maximal force divided by body weight
Tfmax	Time between maximal force occurrence and T1
Favg1/tt	Maximal force divided by body weight on interval between T1 and T/2
Favg2/tt	Maximal force divided by body weight on interval between T/2 and T2
Fmaxy	Maximal force in horizontal direction
Gy	Force impulse in horizontal direction
Pmaxy/tt	Maximal power divided by body weight in horizontal direction
Vy	Horizontal takeoff velocity
Fmax	Maximal force
G	Force impulse
Pmax/tt	Maximal power divided by body weight
V	Takeoff velocity
D	Jump distance
H/D	Ratio between height and distance

## Stamping

The information about the person and repetition sequence number is positioned at the top of the window. The **“Measurement”** tab displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **“Plot list”**. By pressing the **“Offset”** button prior to the measurement, the input signal is set to zero. With the **“Trigger”** option unchecked, the signal acquisition starts immediately, while it is delayed until the force exceeds a pre-defined value if the **“Trigger”** option is selected. The acquisition is terminated automatically or by pressing the **“Stop”** button. **“Live signals”** switches between live acquisition and the last acquired signal.

---

The results of the analysis are displayed on the **“Results”** tab in the **“Current”** column. Other columns contain the results of previously saved measurements. The **“Confirm”** button saves the parameters of the current jump.

Figure 28  
Stamping  
measurement

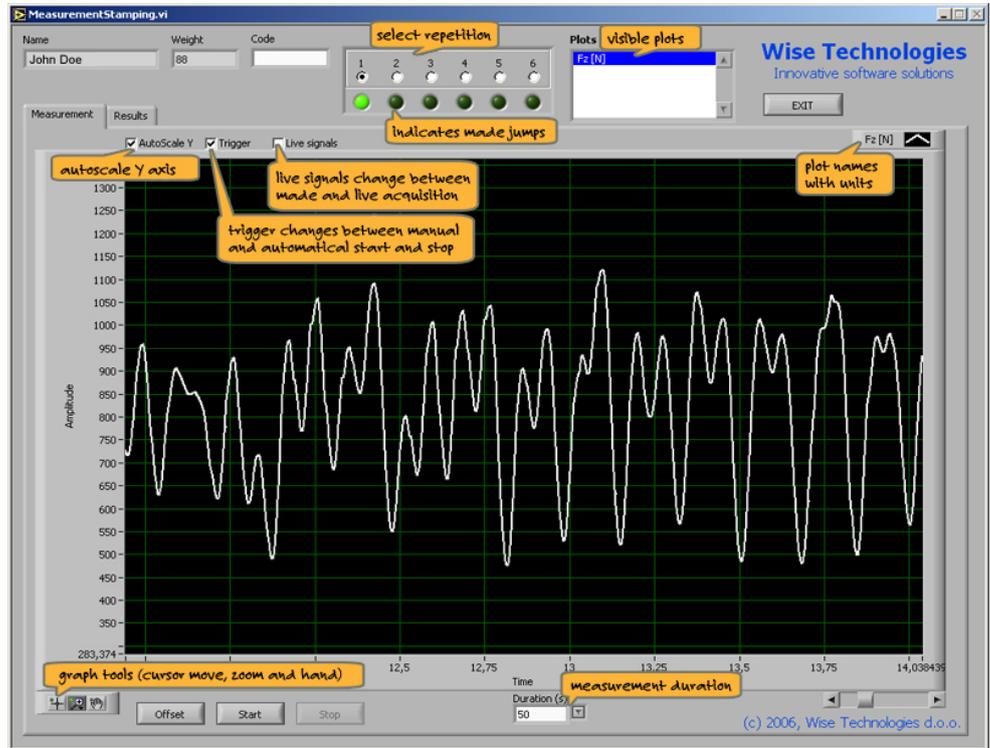
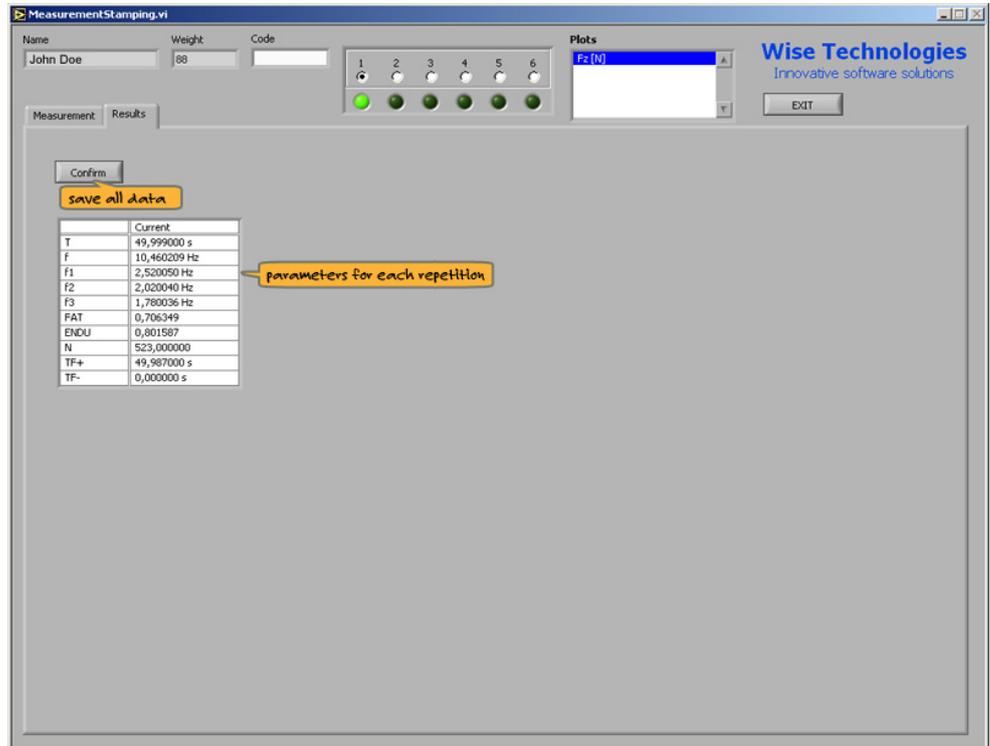


Figure 29  
Results of analysis



T	Time
f	Average frequency
f1	Area between COG trajectory and generated trajectory
f2	Average frequency in n seconds in the middle of series
f3	Average frequency in last n seconds
FAT	Fatigue index of frequency
ENDU	Endurance index of frequency
N	Number of stamps
TF+	Time above selected force value
TF-	Time under selected force value

## Maximal voluntary contraction

The information about the person, type and repetition sequence number is positioned at the top of the window. The main part of the window displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed, and viewed along auto scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. The acquisition starts by pressing the **"Start"** button and stops with the **"Stop"** button. **"Live signal"** switches between live acquisition and the last acquired signal. The maximal voluntary contraction is calculated from the signal within the two cursors. The distance between the cursors can be determined in the cursor window.

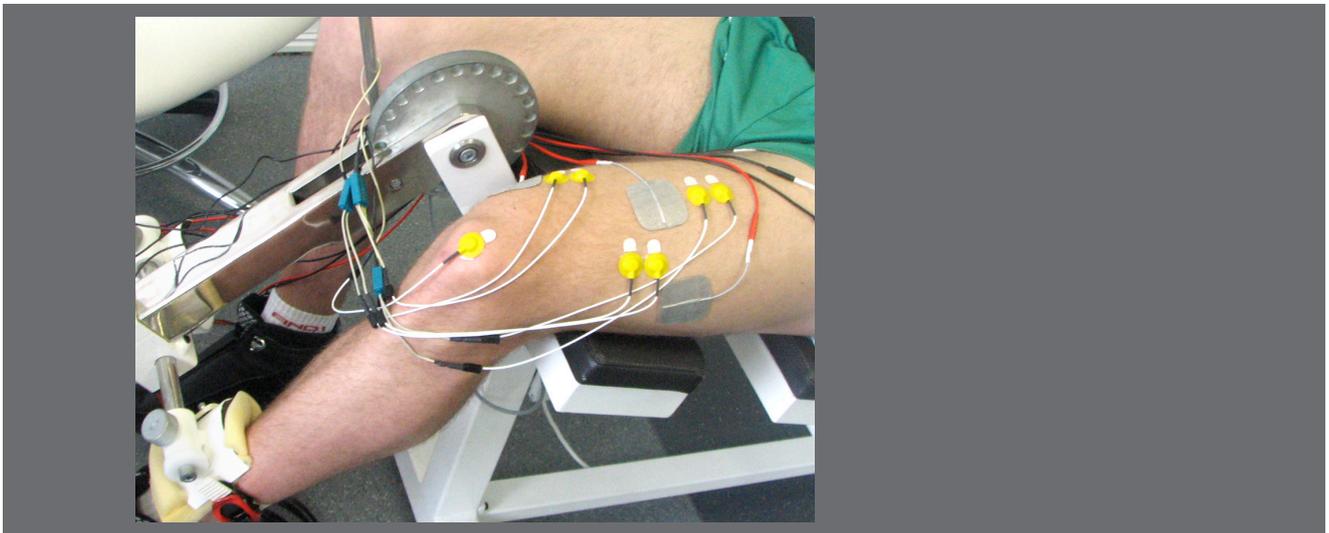


Figure 30  
Maximal voluntary contraction measurement

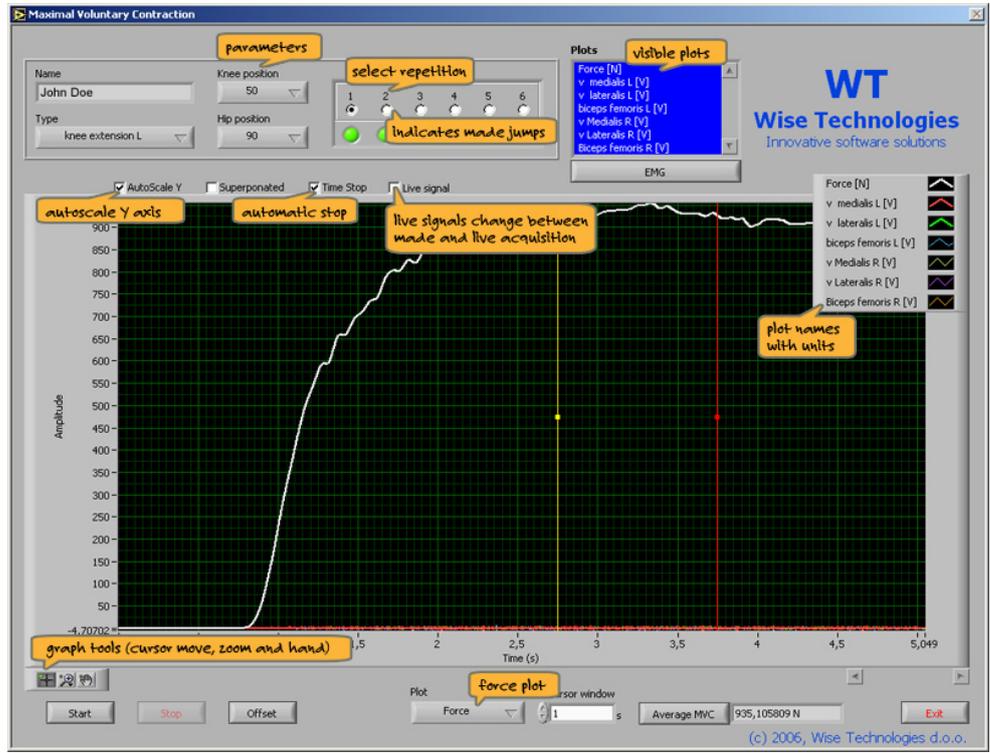


Figure 31  
V medialis L signal

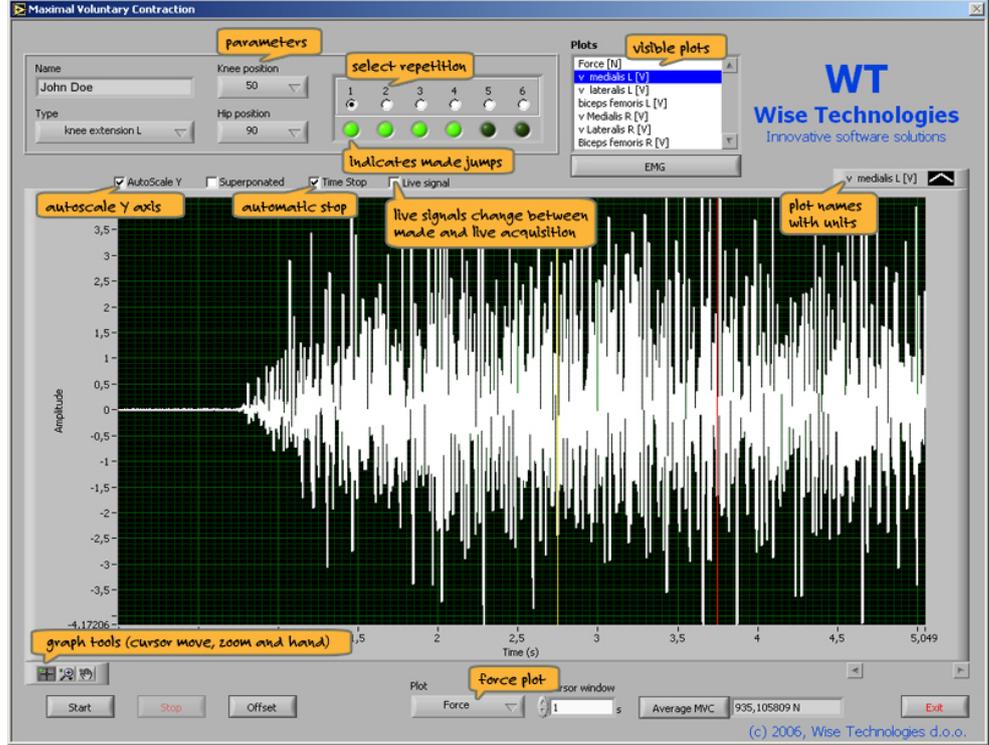
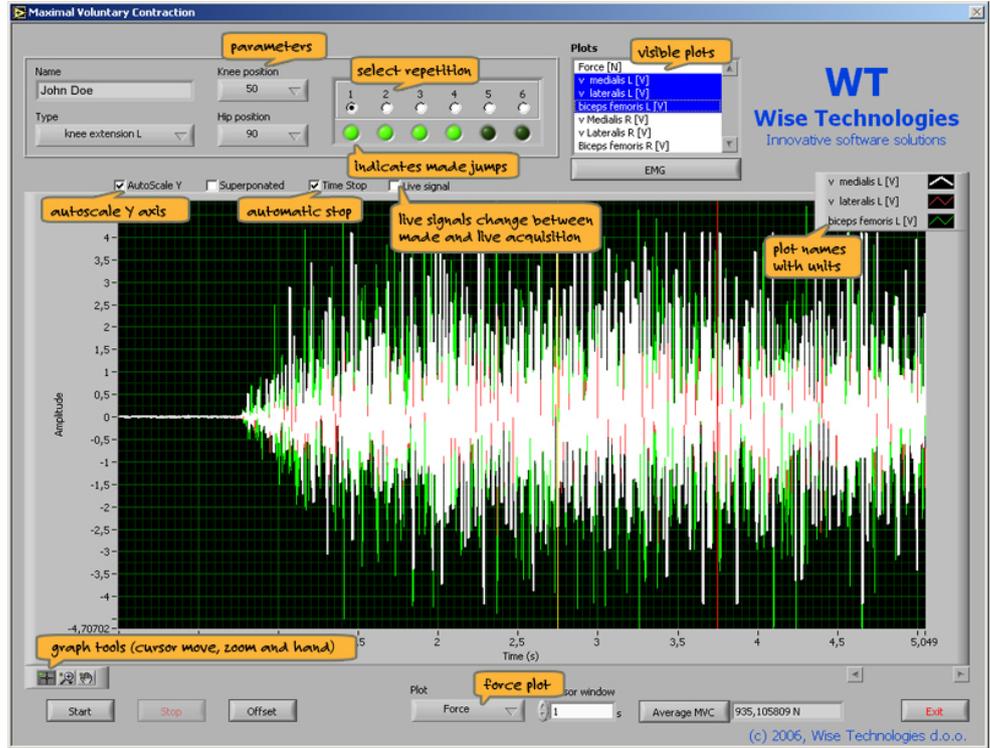


Figure 32  
Maximal voluntary contraction measurement - EMGs signals



EMG signals analysis - optional with Maximal voluntary contraction

Figure 33  
V medialis L signal

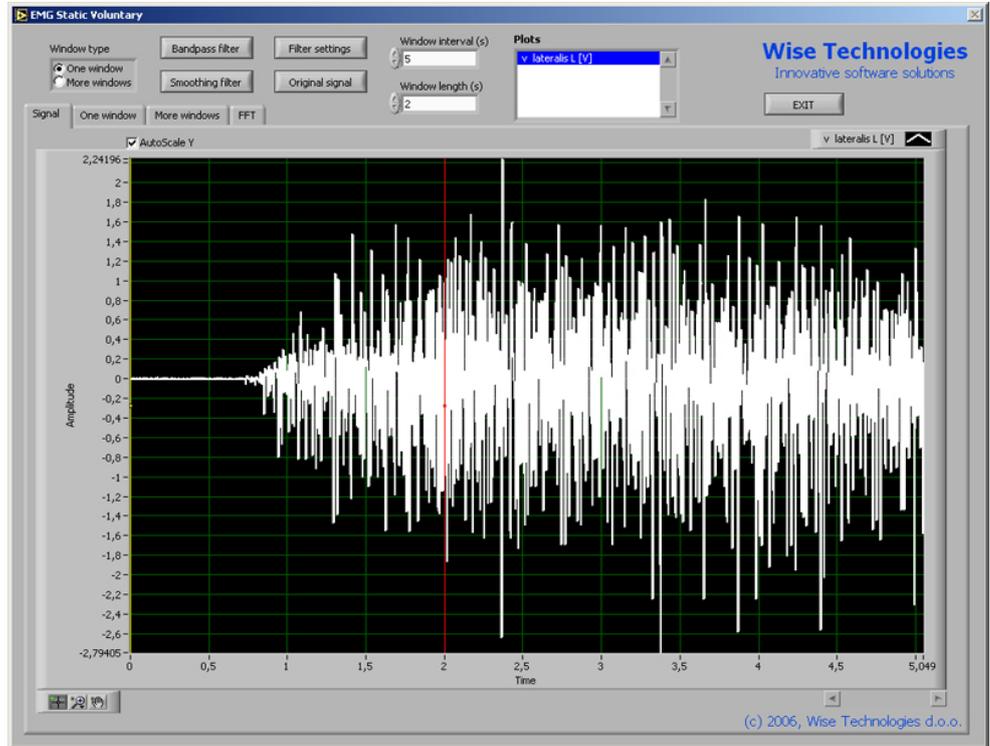


Figure 34  
One window analysis

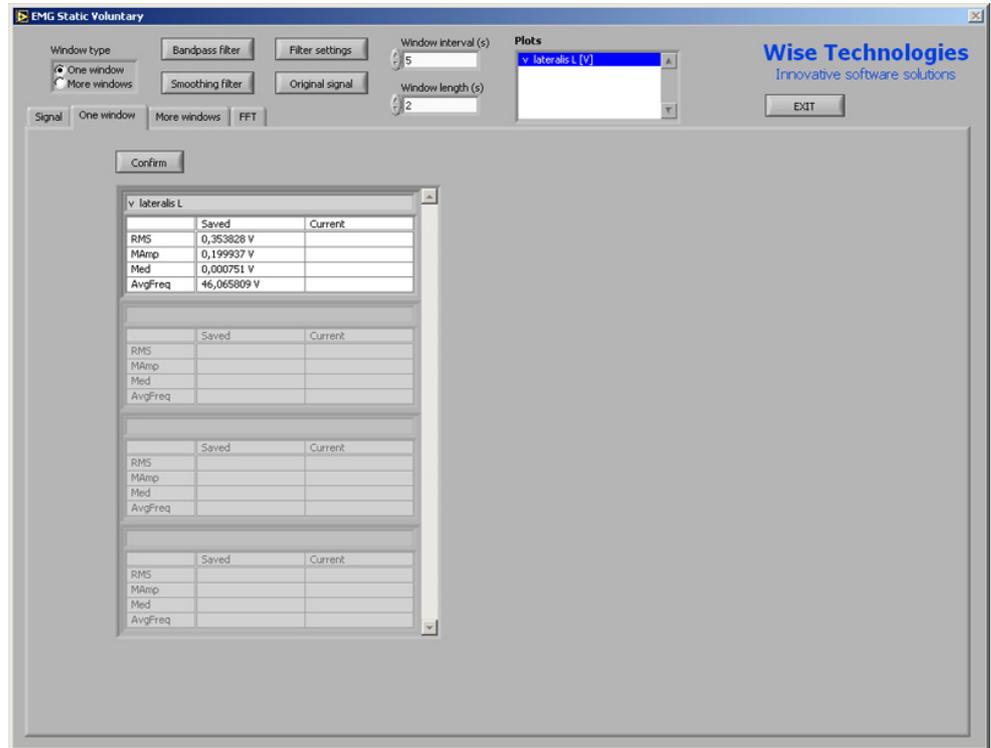


Figure 35  
More windows analysis  
- RMS graph

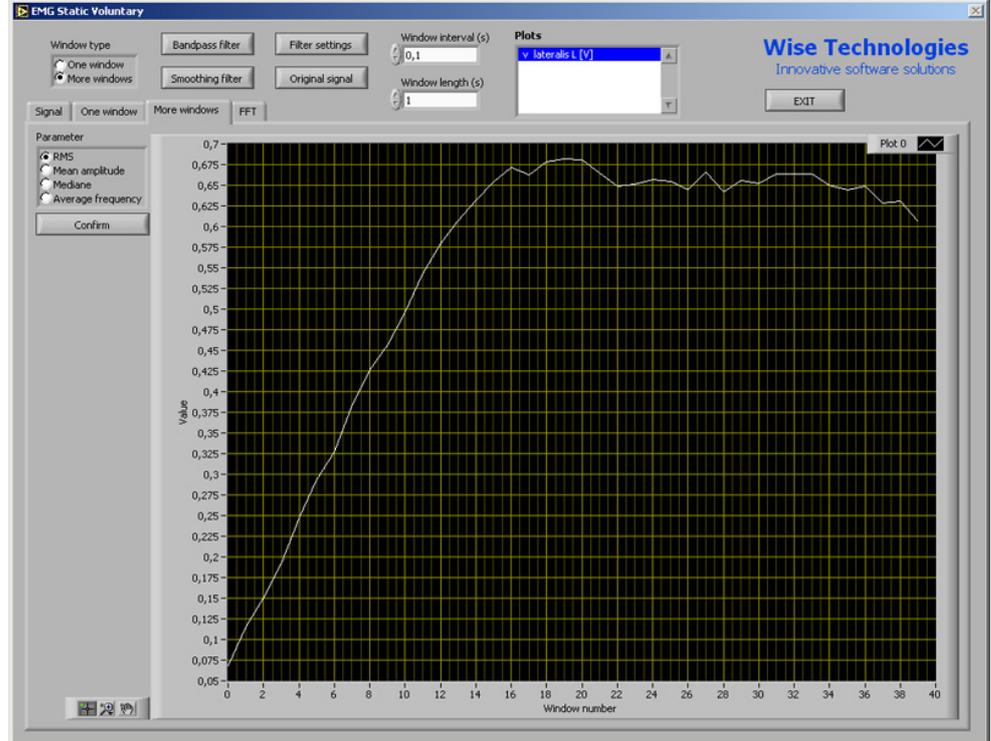


Figure 36  
More windows analysis  
- Median graph

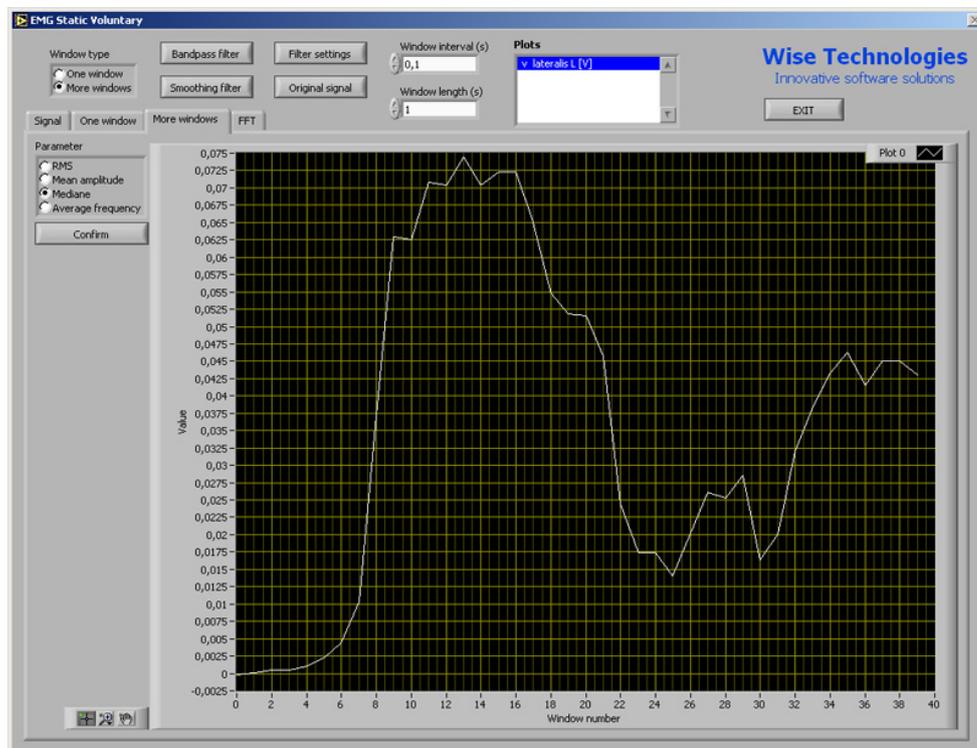


Figure 37  
More windows analysis  
- Average frequency graph

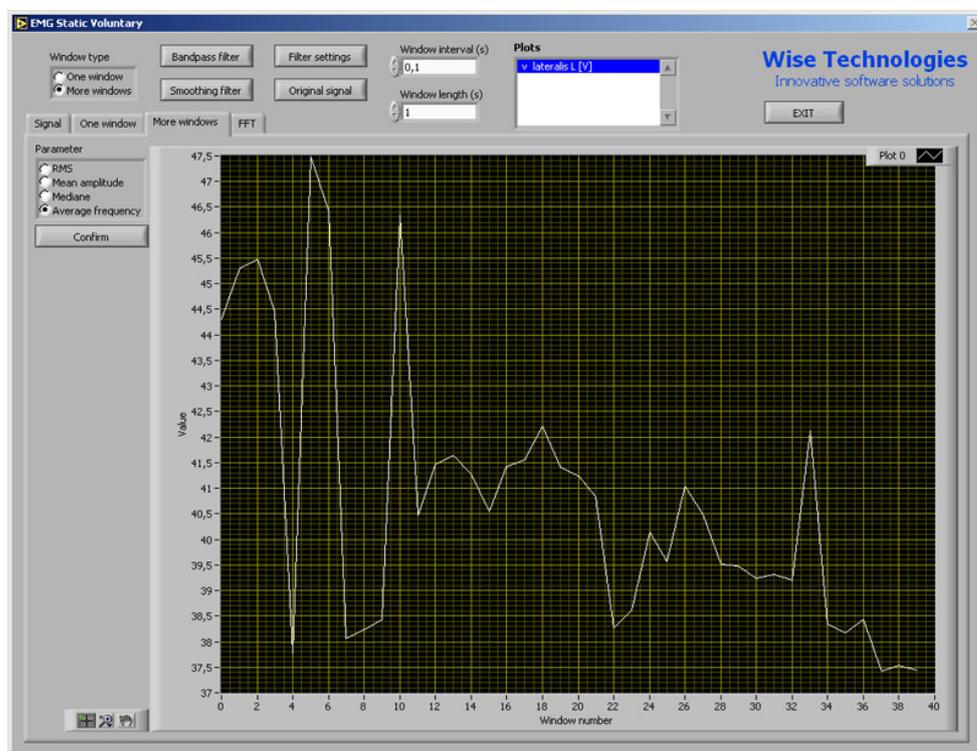
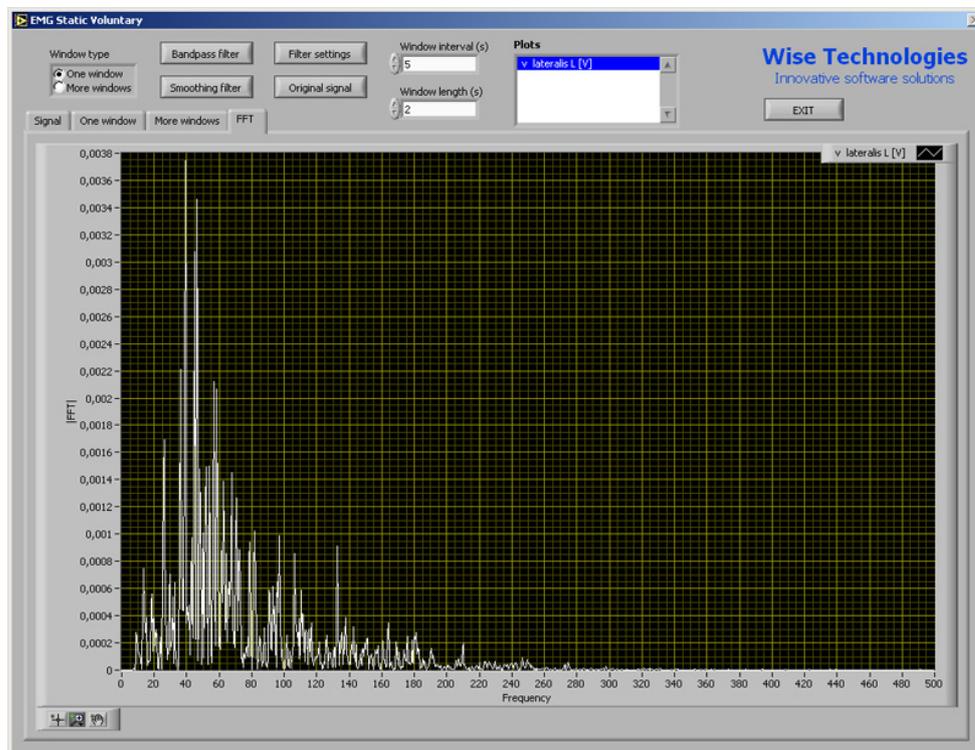




Figure 38  
One window analysis -  
FFT graph



MVC	Average force on selected interval
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## Contraction endurance

The information about the person, type and repetition sequence number is positioned at the top of the window. The main part of the window displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed, and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. The acquisition starts by pressing the **"Start"** button and stops with the **"Stop"** button. **"Live signals"** switches between live acquisition and the last acquired signal. The contraction endurance is calculated from the signal within the two cursors. If the signal drops below the pre-selected limit, the **"Under"** led indicator turns red.

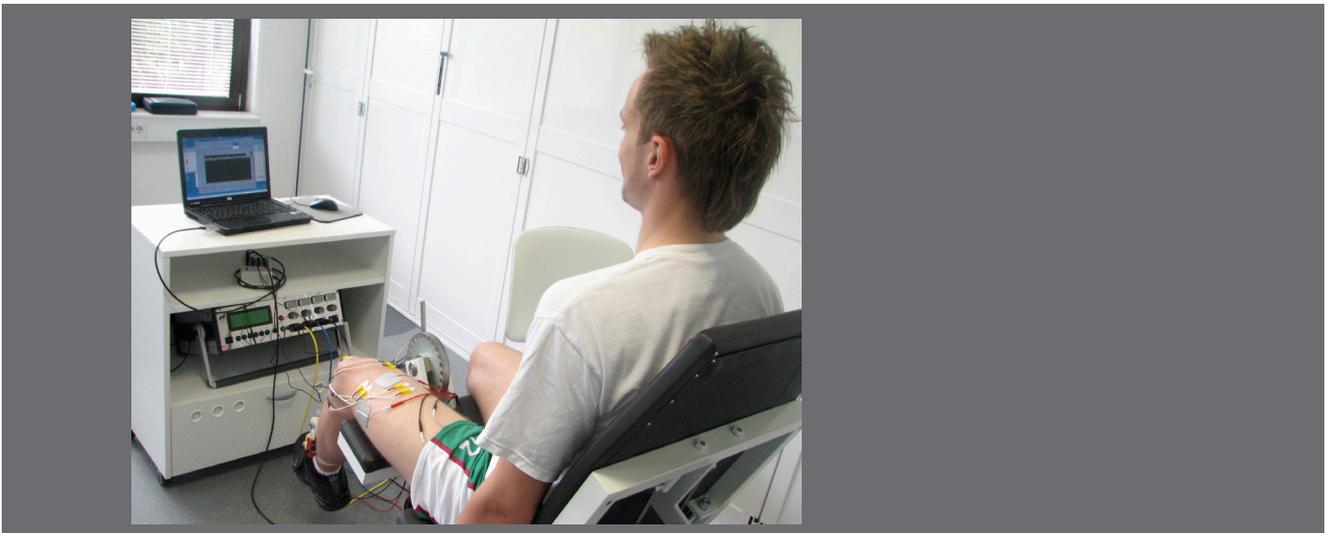


Figure 39  
Contraction endurance measurement



Figure 40  
Measurement with fitted polynomial



EMG signals analysis - optional with Contraction endurance



Figure 41  
Signal

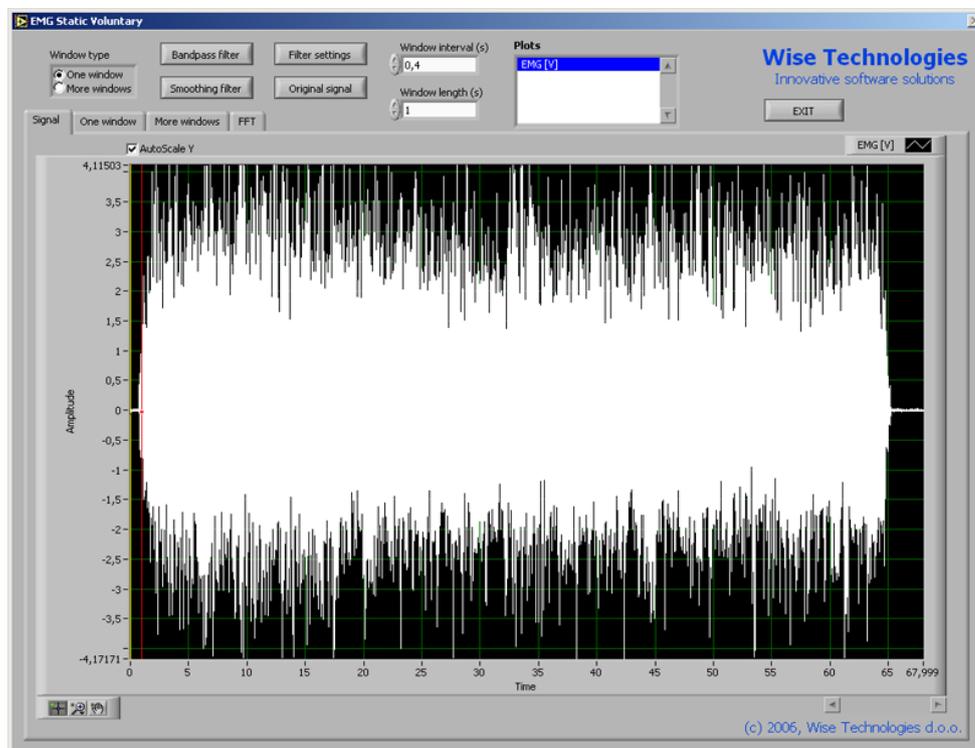


Figure 42  
One window analysis

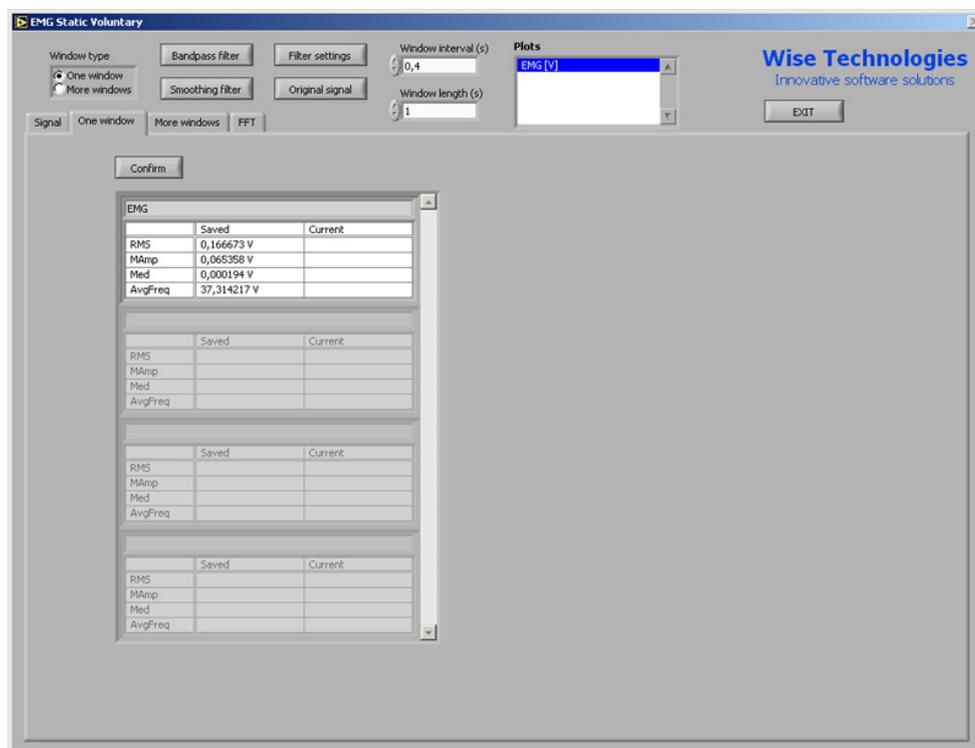


Figure 43  
More windows analysis  
- RMS graph

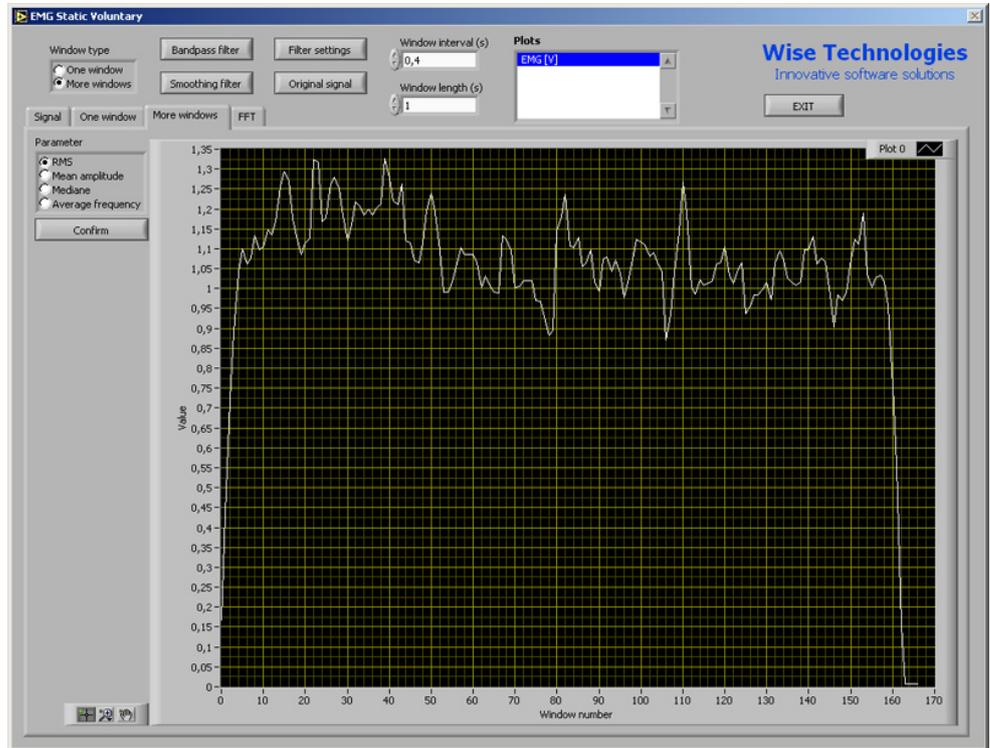


Figure 44  
More windows analysis  
- Mean amplitude graph

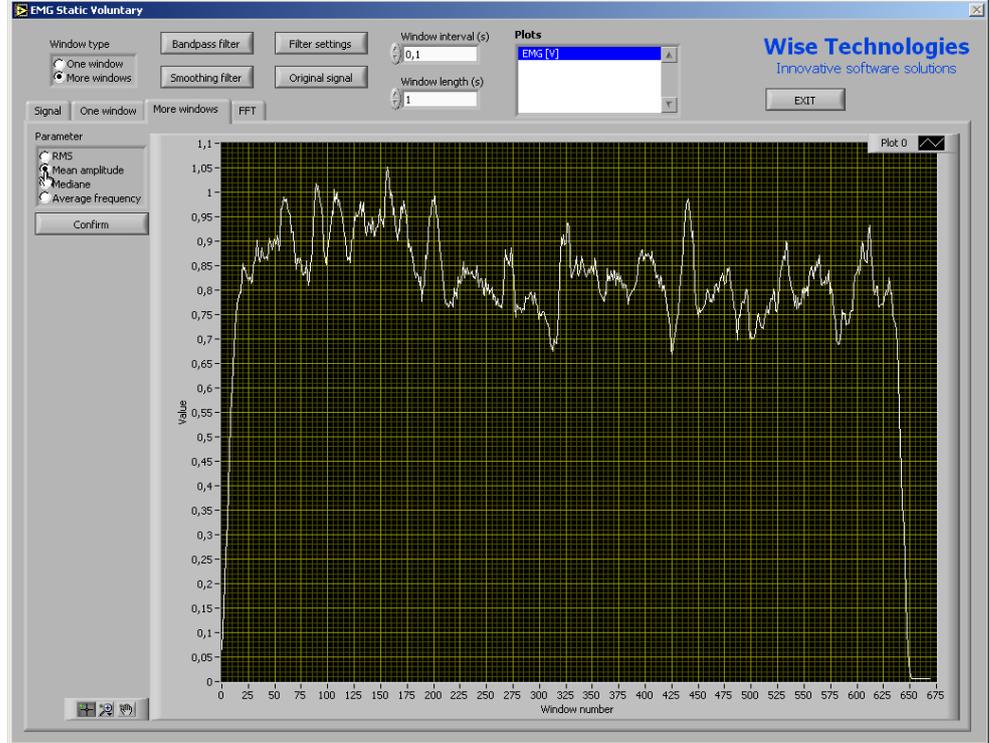


Figure 45  
More windows analysis  
- Mediane graph

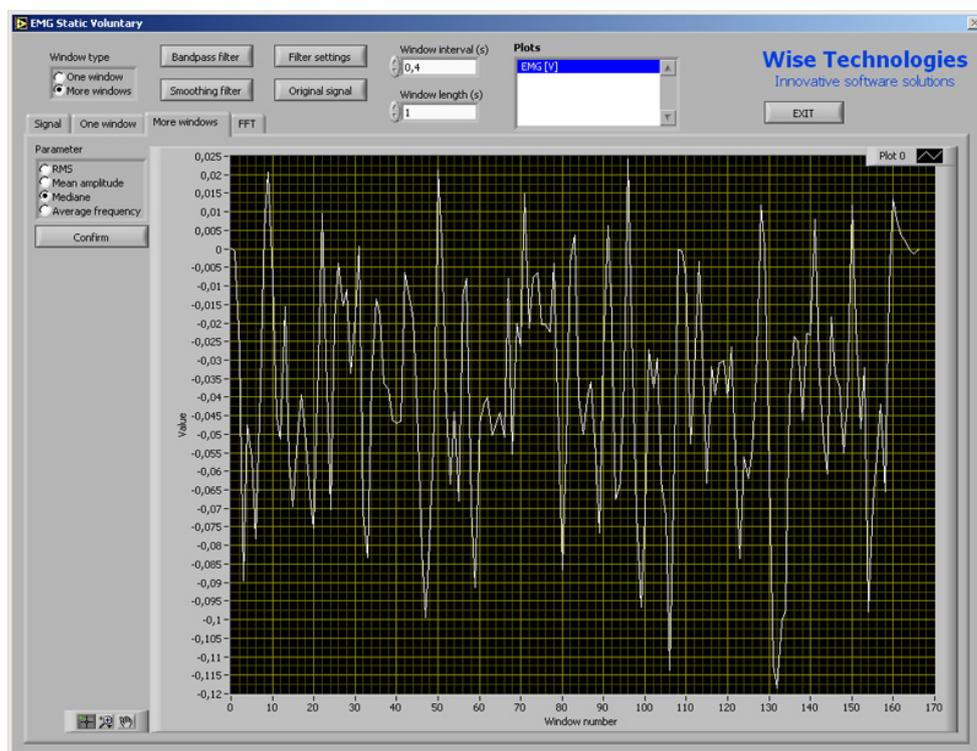


Figure 46  
More windows analysis  
- Average frequency graph

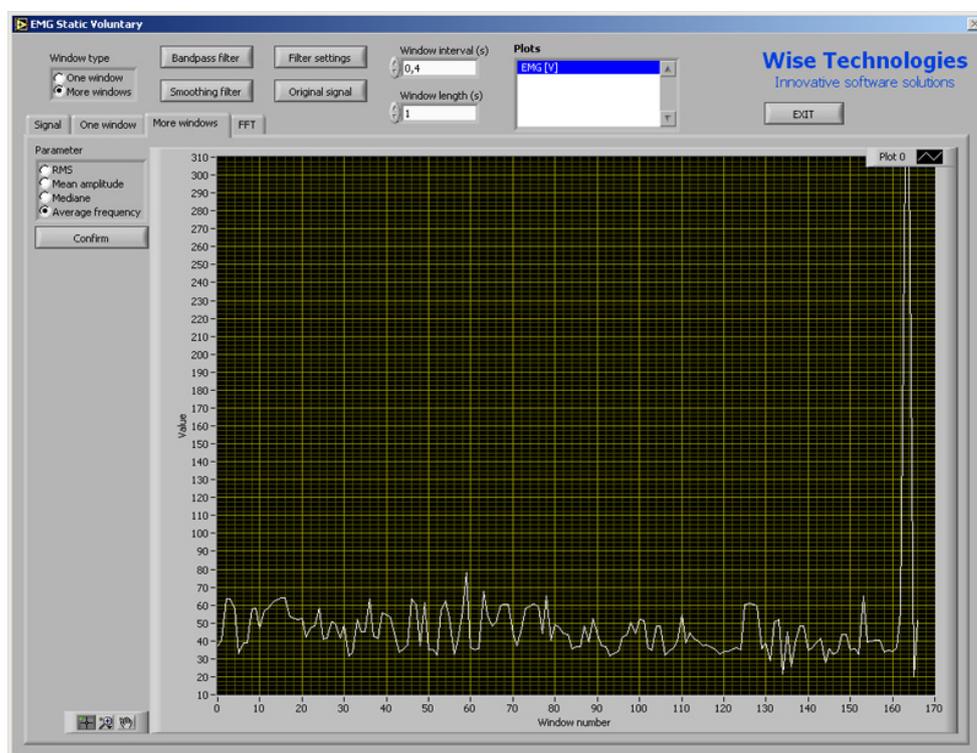
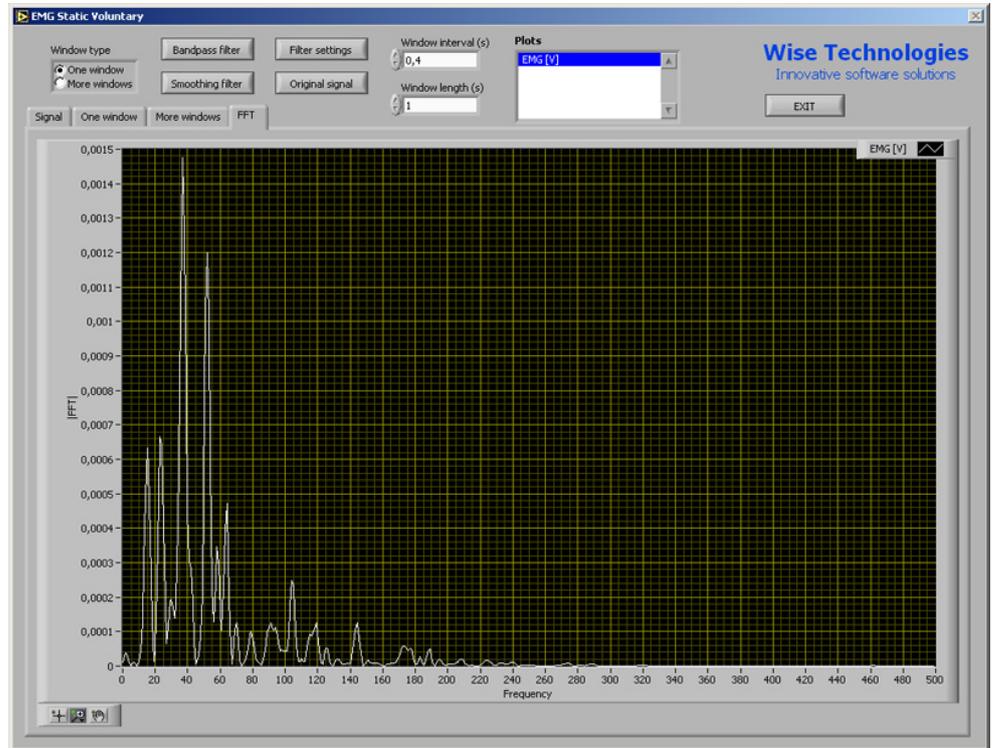




Figure 47  
One window analysis -  
FFT graph



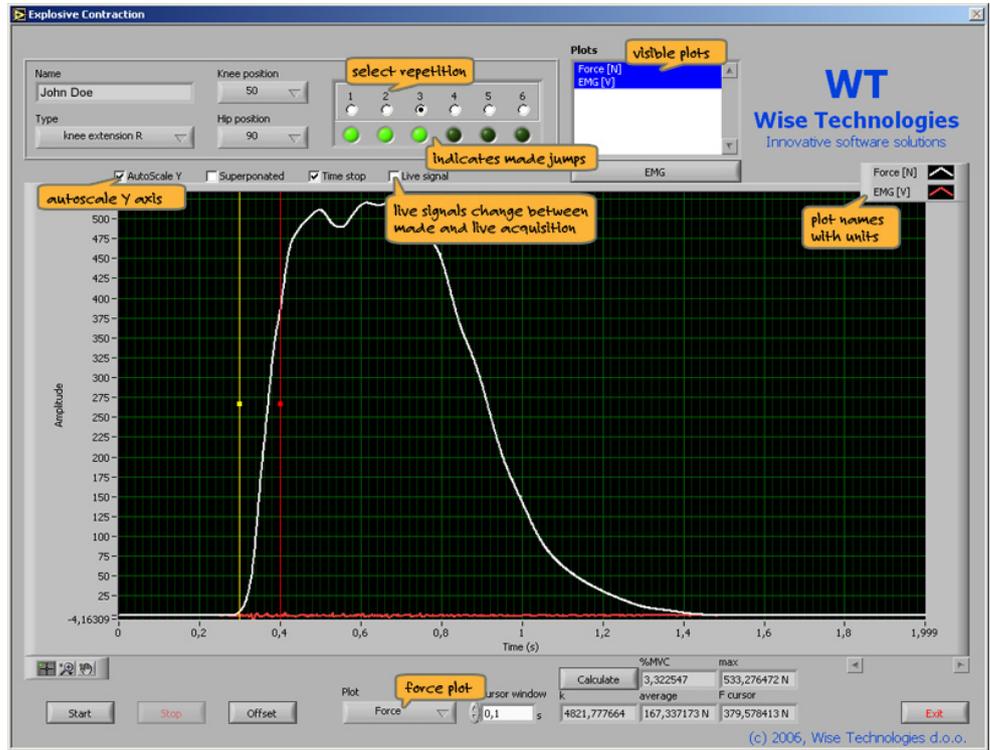
Time	Time of endurance
------	-------------------

## Explosive contraction

The information about the person, type and repetition sequence number is positioned at the top of the window. The main part of the window displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed, and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. The acquisition starts by pressing the **"Start"** button and stops with the **"Stop"** button. **"Live signals"** switches between live acquisition and the last acquired signal. The explosive contraction parameters are calculated from the signal within the two cursors. The distance between the cursors can be determined in the cursor window.



Figure 48  
Explosive contraction measurement



EMG signals analysis - optional with Explosive contraction

Figure 49  
Signal

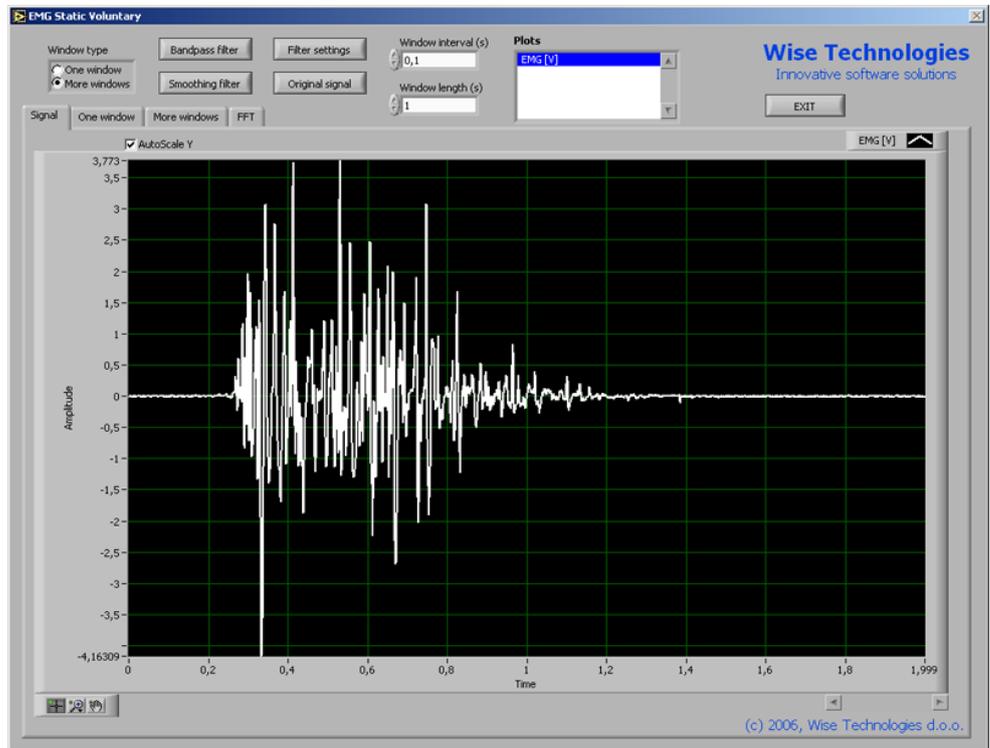


Figure 50  
One window analysis

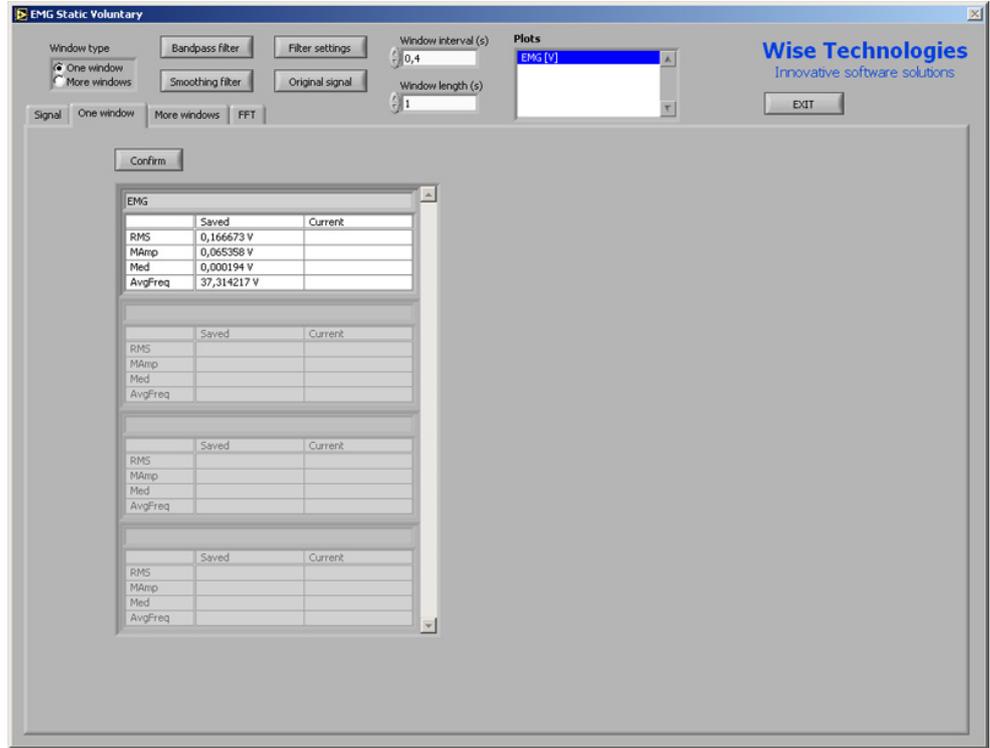


Figure 51  
More windows analysis  
- RMS graph

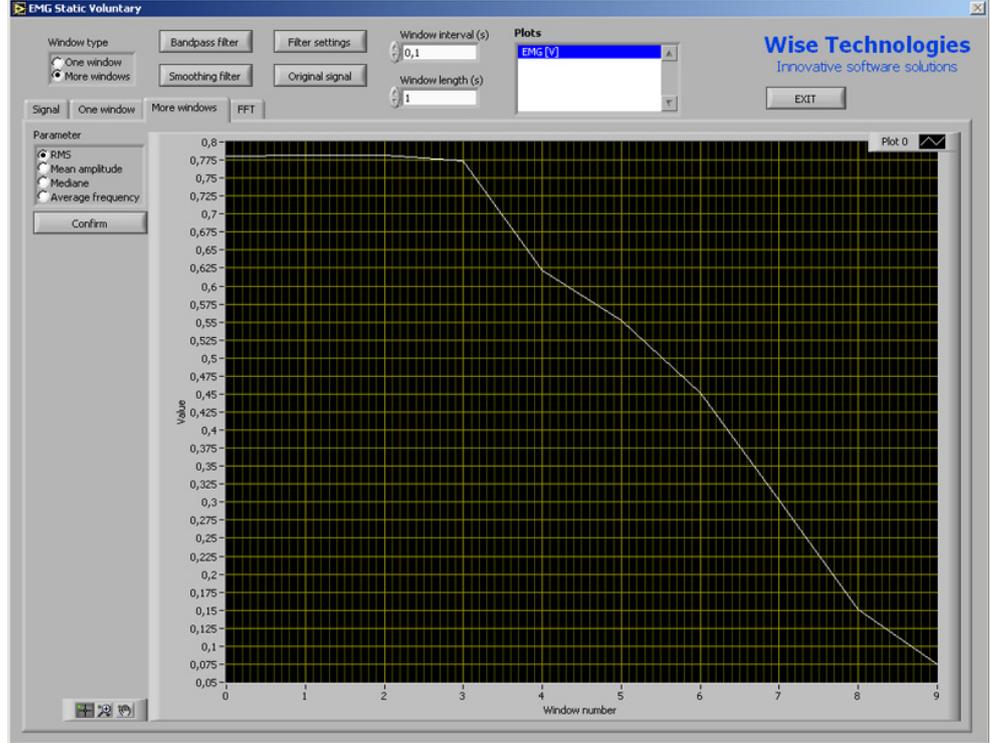
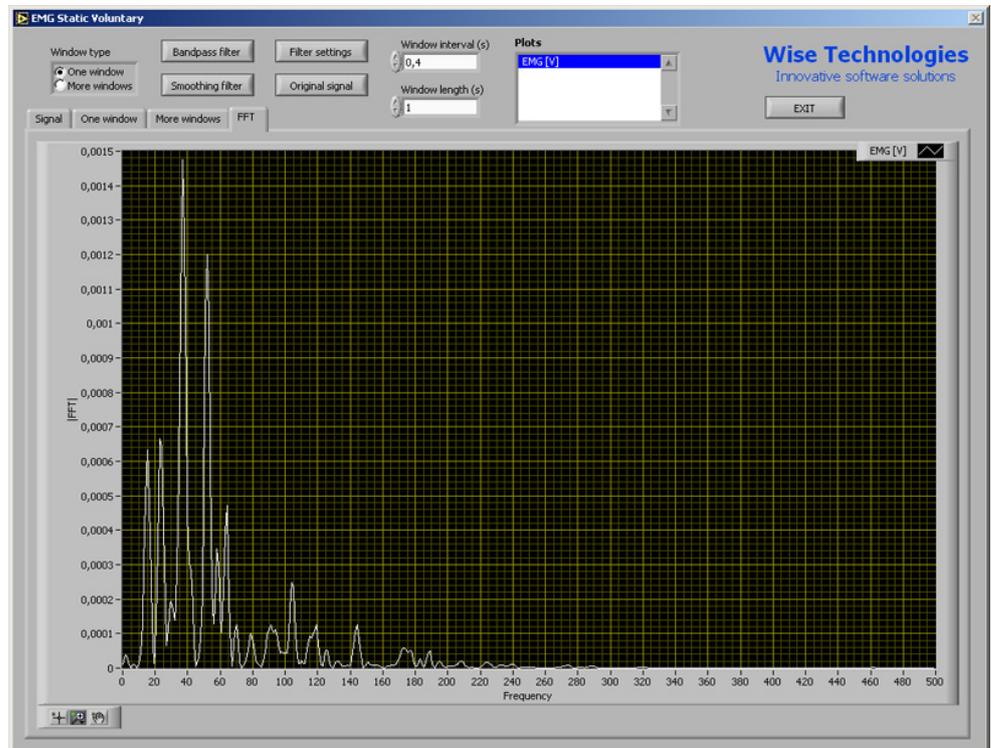




Figure 52  
More windows analysis  
- Average frequency  
graph



k	Slope on selected interval
%MVC	Ratio between force at end cursor and maximal voluntary contraction
max	Maximal force
average	Average force on selected interval
F cursor	Force at end cursor

## Twitch

The information about the person, type and repetition sequence number is displayed at the top of the window. The **"Graph"** tab displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed, and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. The acquisition starts by pressing the **"Start"** button and stops with the **"Stop"** button. **"Live signals"** switches between live acquisition and the last acquired signal. The results of the analysis are displayed on the **"Results"** tab.

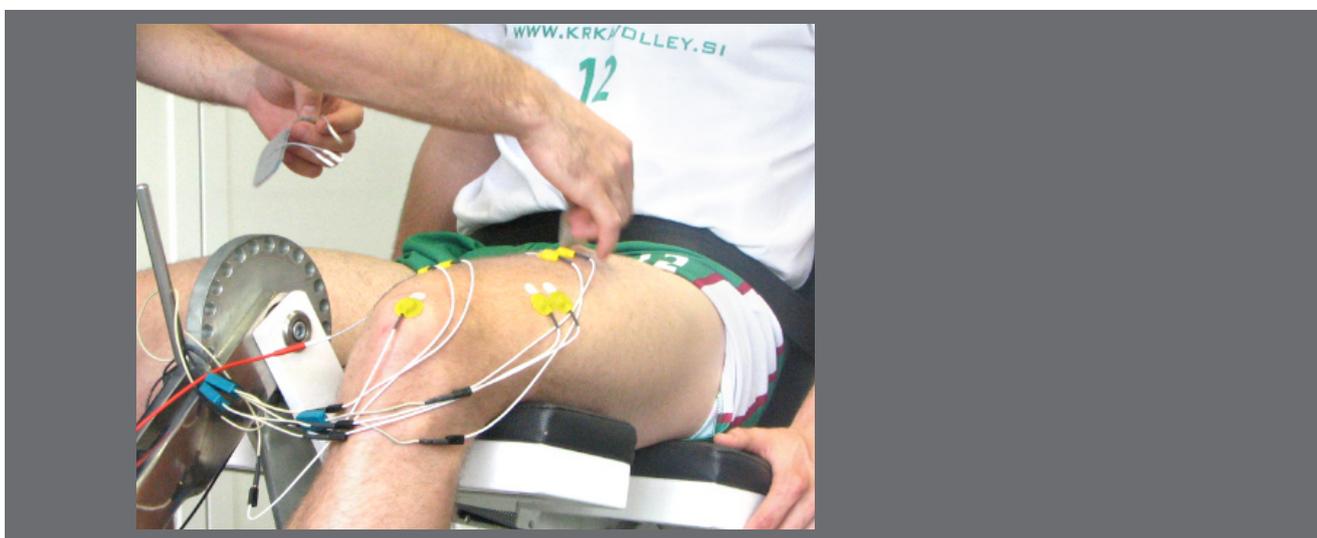


Figure 53  
Twitch measurement

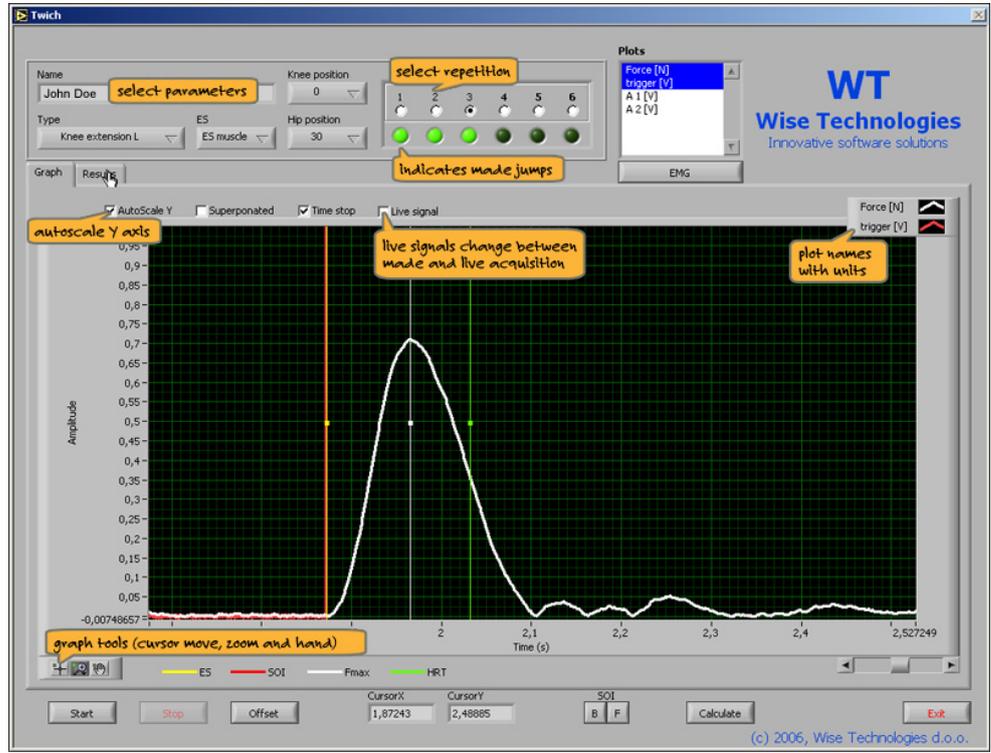
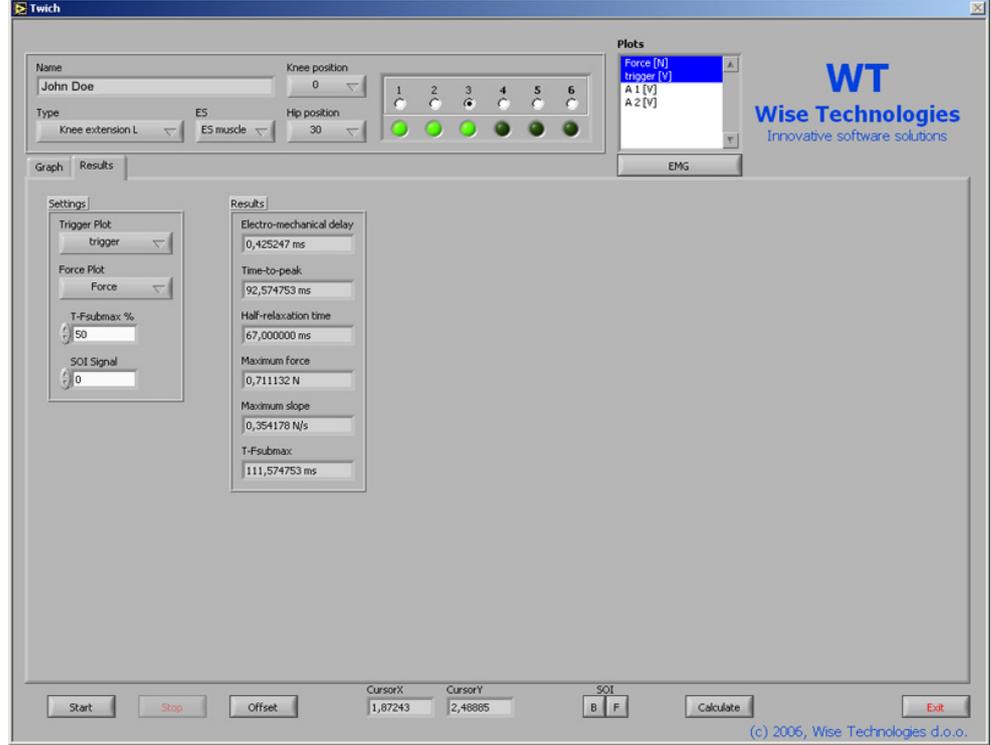


Figure 54  
Results of analysis



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Electromechanical delay	Time between electro stimulation and force increasing
Time-to-peak	Time between force increasing and maximal force
Half-relaxation time	Time to half of maximal force
Maximum force	Maximal force
Maximum slop	Maximal slope
T-Fsubmax	Time when force is above selected value

---

## Activation level

The information about the person, type and repetition sequence number is displayed at the top of the window. The **"Graph"** tab displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed, and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. The acquisition starts by pressing the **"Start"** button and stops with the **"Stop"** button. **"Live signals"** switches between live acquisition and the last acquired signal. The results of the analysis are displayed on the **"Results"** tab. The distances between the cursors can be changed in the MVC and ES windows.

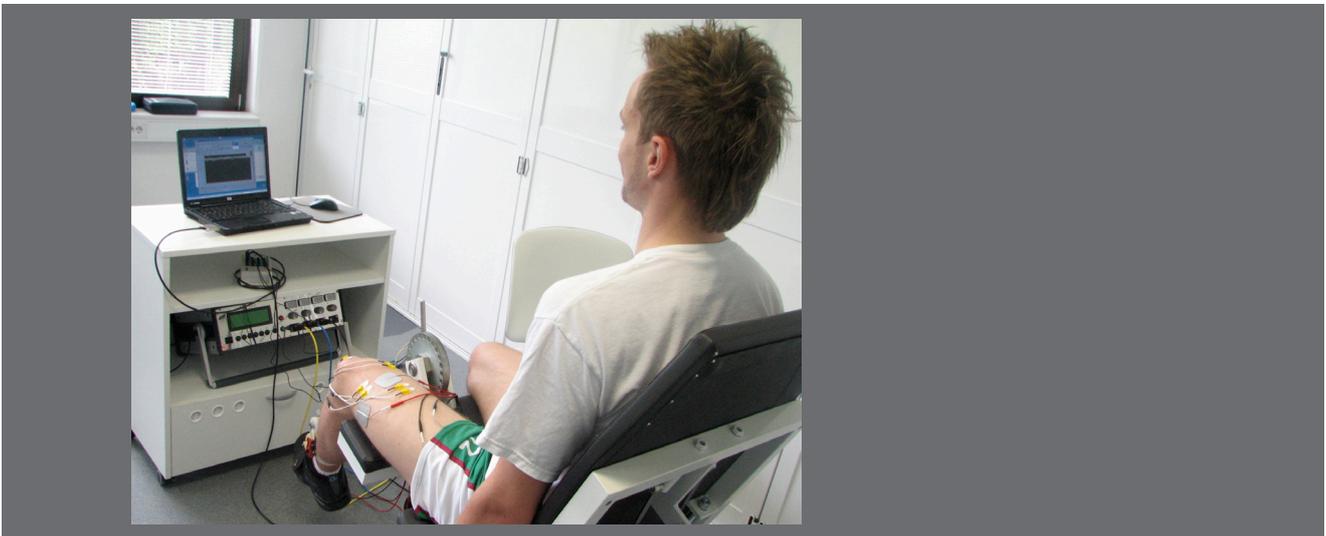


Figure 55  
Activation level  
measurement

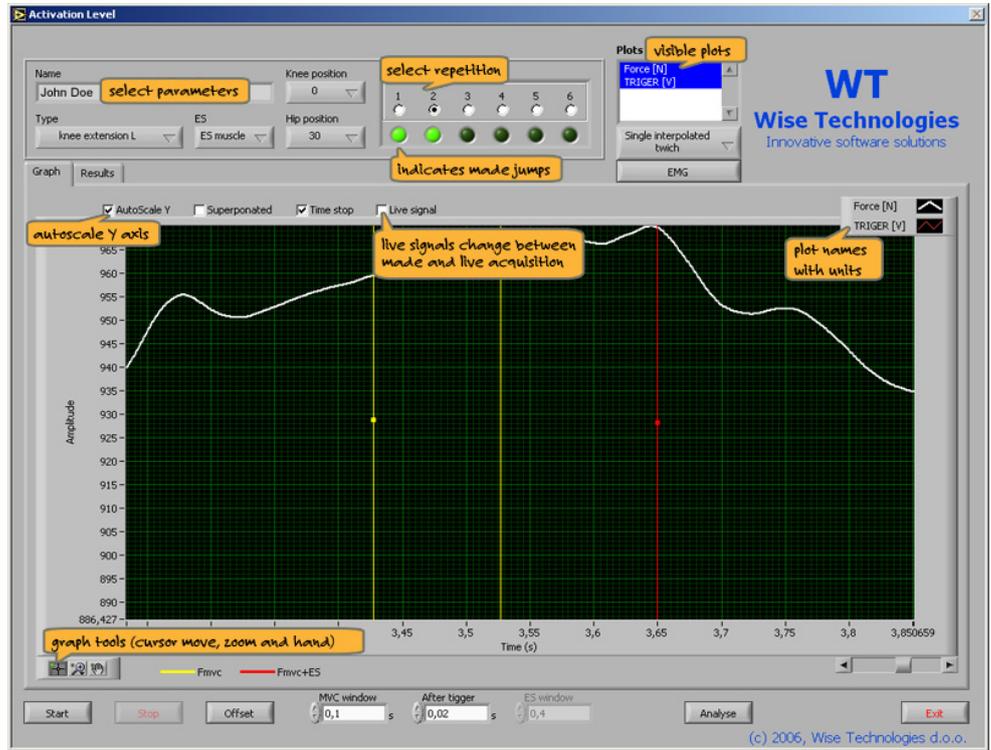
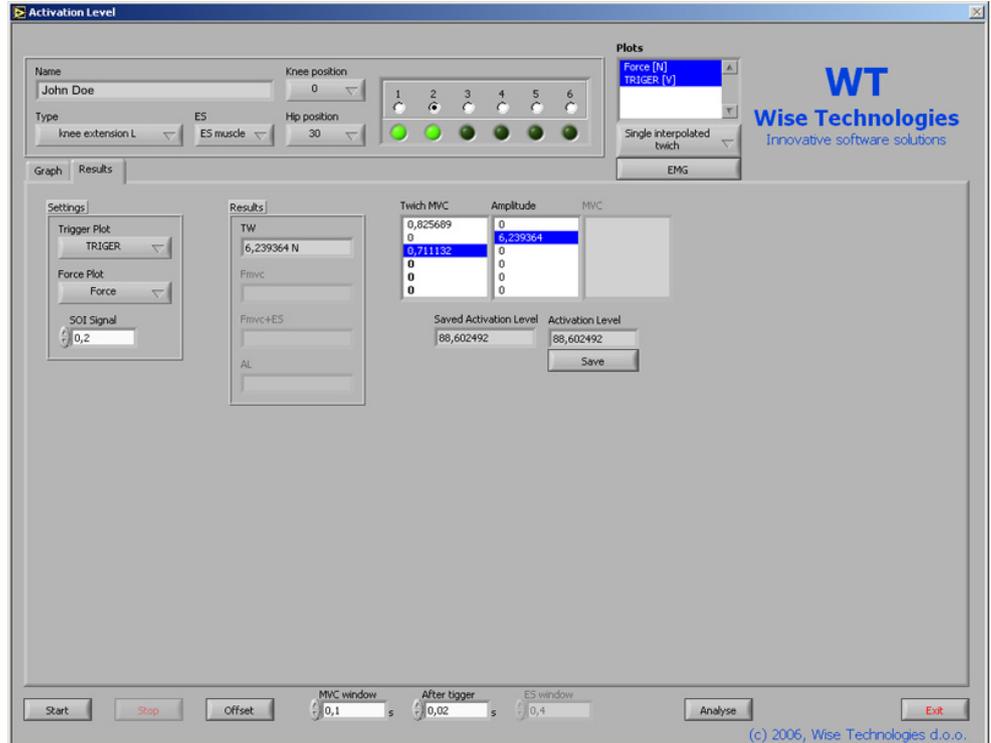


Figure 56  
Results of analysis

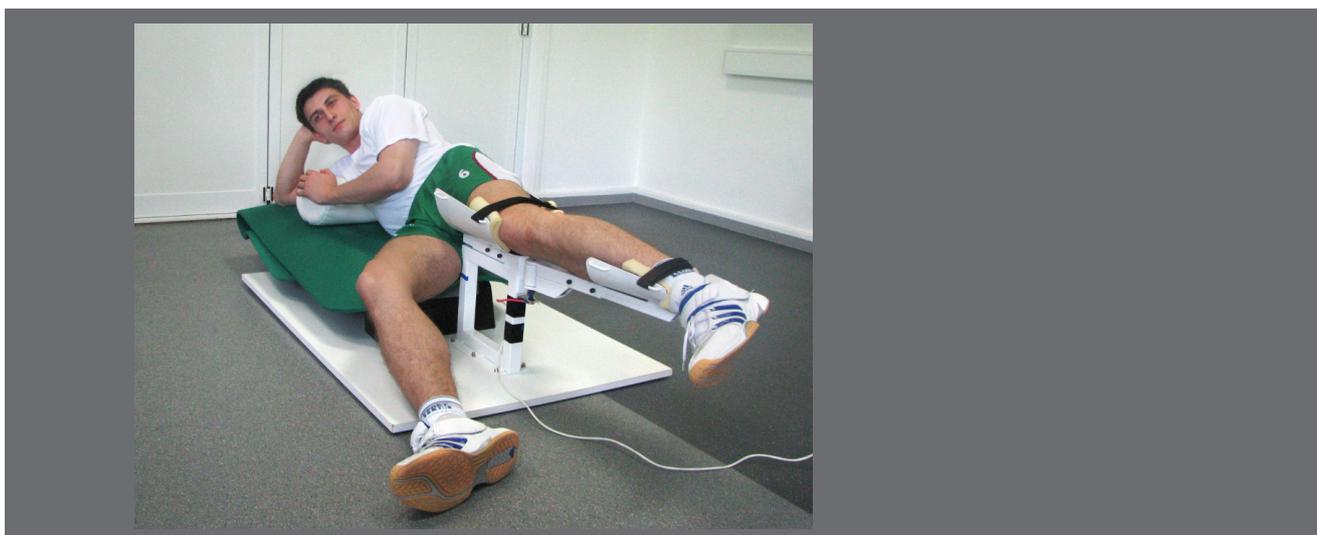


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TW	Twitch amplitude
Fmvc	Maximal voluntary contraction
Fmvc+ES	Maximal voluntary contraction with electro stimulation
AL	Activation level

## Tracking

The information about the person, type, plot for analysis and repetition sequence number is displayed at the top of the window. The **"Measurement"** tab displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed, and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. The acquisition starts by pressing the **"Start"** button. It is terminated with the **"Stop"** button or via the preselected stop options. **"Live signals"** switches between live acquisition and the last acquired signal. The **"Generate signal"** option offers the functionality for track signal generation. Time intervals and amplitude ranges are managed by **"Add interval"**, **"Edit intervals"** and **"Amplitude ranges"**. The strip and scope types of the graph update are available. The **"Leveled signal"** tab displays the distance between the real and the tracking signal. The results of the analysis are displayed on the **"Results"** tab.



Tracking force

Figure 57  
Tracking force measurement

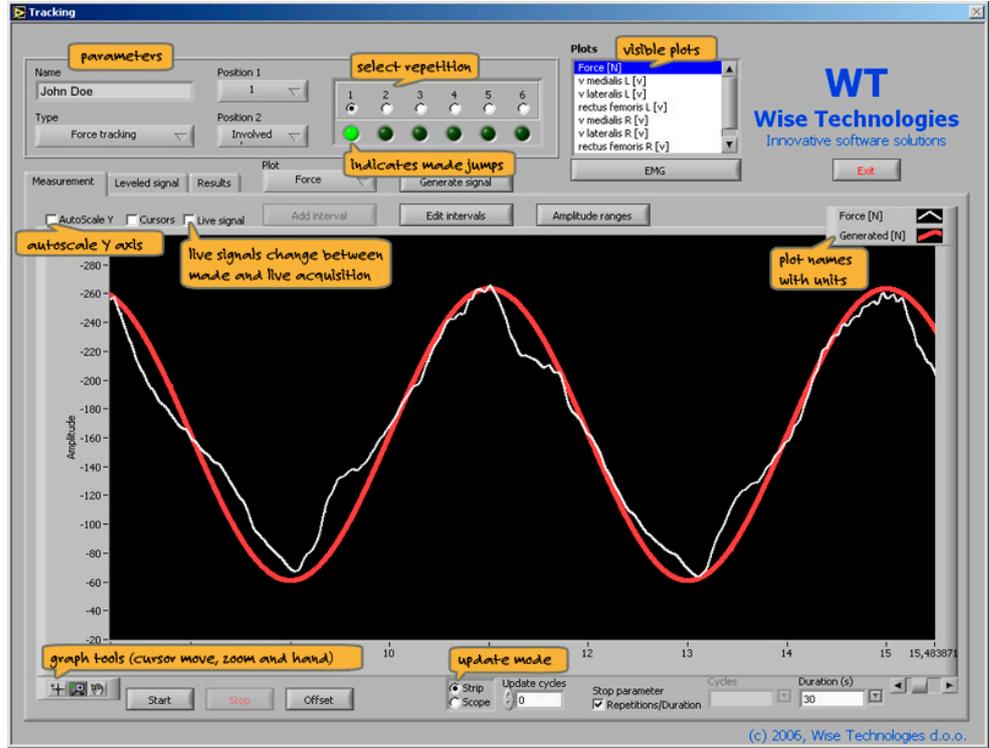


Figure 58  
Results of analysis

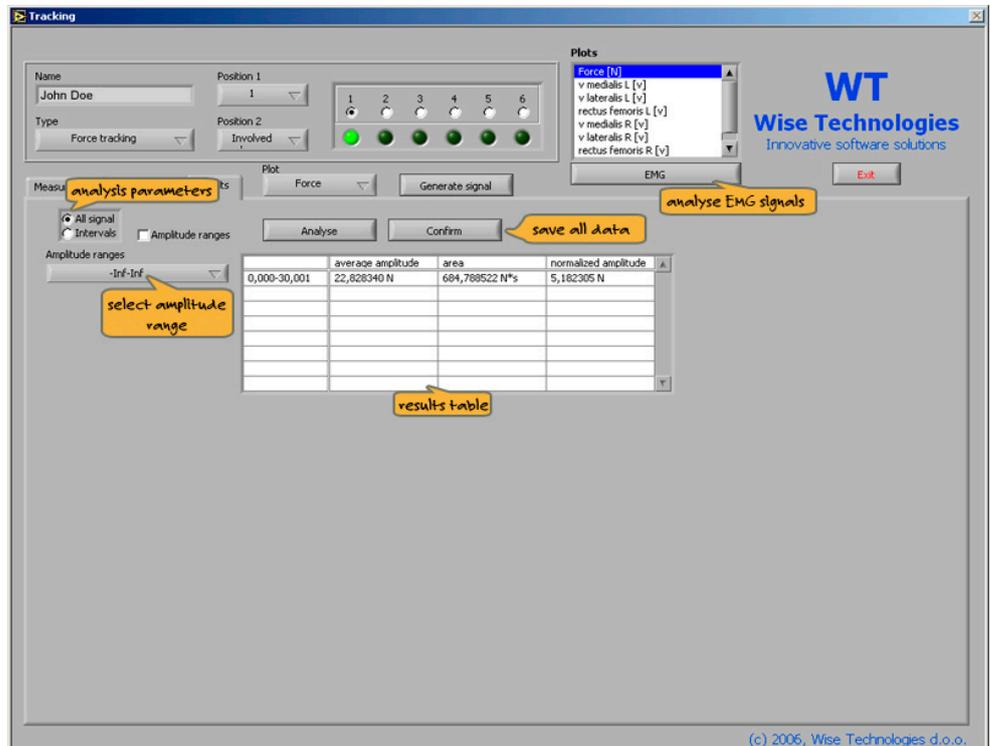
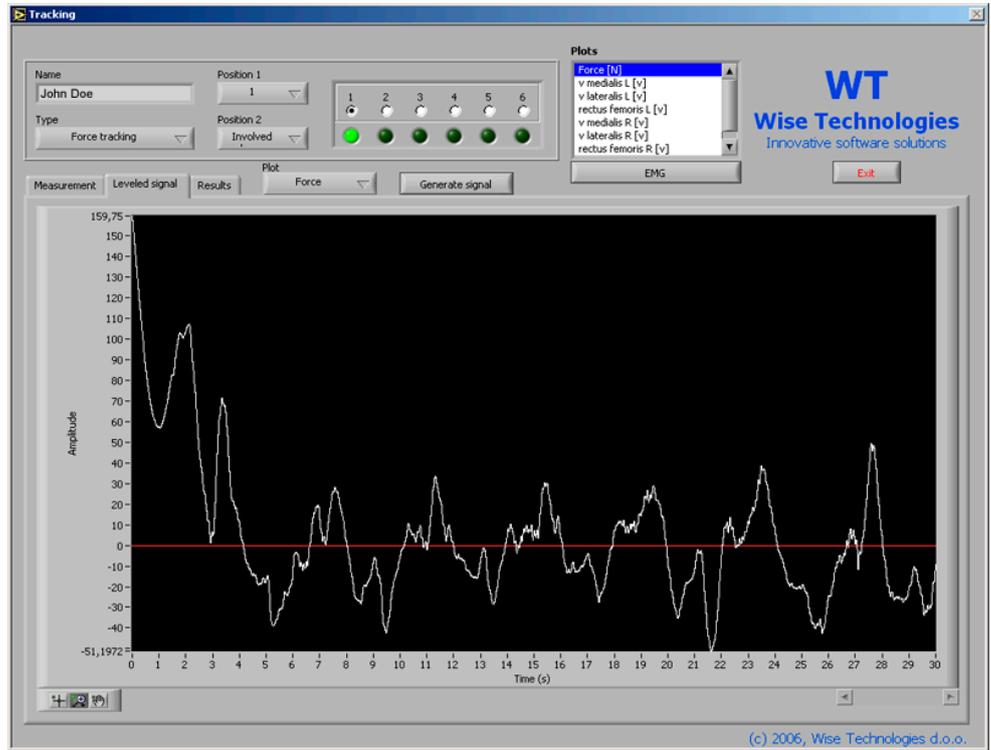
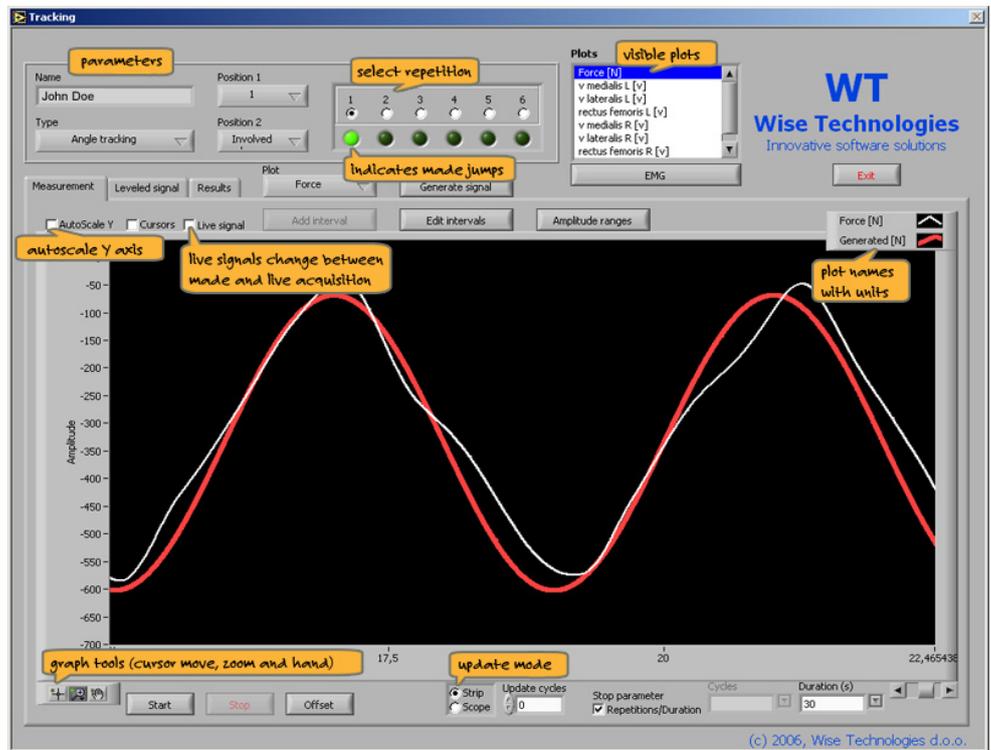


Figure 59  
Signal



Tracking angle

Figure 60  
Tracking angle measurement





## Evoked potentials

The information about the person, type, plot for analysis and repetition sequence number is positioned at the top of the window. The **"Measurement"** tab displays the acquired signals as well as the selected cursors, and allows fine cursor positioning. The graph can be zoomed and viewed along auto-scaled or fixed Y axis. Visible plots are collected in the **"Plot list"**. By pressing the **"Offset"** button prior to the measurement, the input signal is set to zero. With the **"Trigger"** option unchecked, the signal acquisition starts immediately, while it is delayed until the force exceeds a pre-defined value if the **"Trigger"** option is selected. The acquisition terminates by pressing the **"Stop"** button. **"Live signals"** switches between live acquisition and the last acquired signal.

The results of the analysis of traces and store are displayed on the **"Results"** tab. The **"Confirm"** button saves the results of the current jump. Each trace and store can be manually processed on the **"Trace and Store"** tab.

Txy	Time between cursors x and y
Sxy	Area on interval x and y
Axy	Amplitude between cursors x and y

## Static voluntary

Certain measurement modules also include a module for static voluntary analysis of the EMG signals. The module supports signal analysis with results displayed on the **“One window”** and **“More windows”** tabs. Signals can be processed with the band-pass or smoothing filter.



Figure 63  
Signal

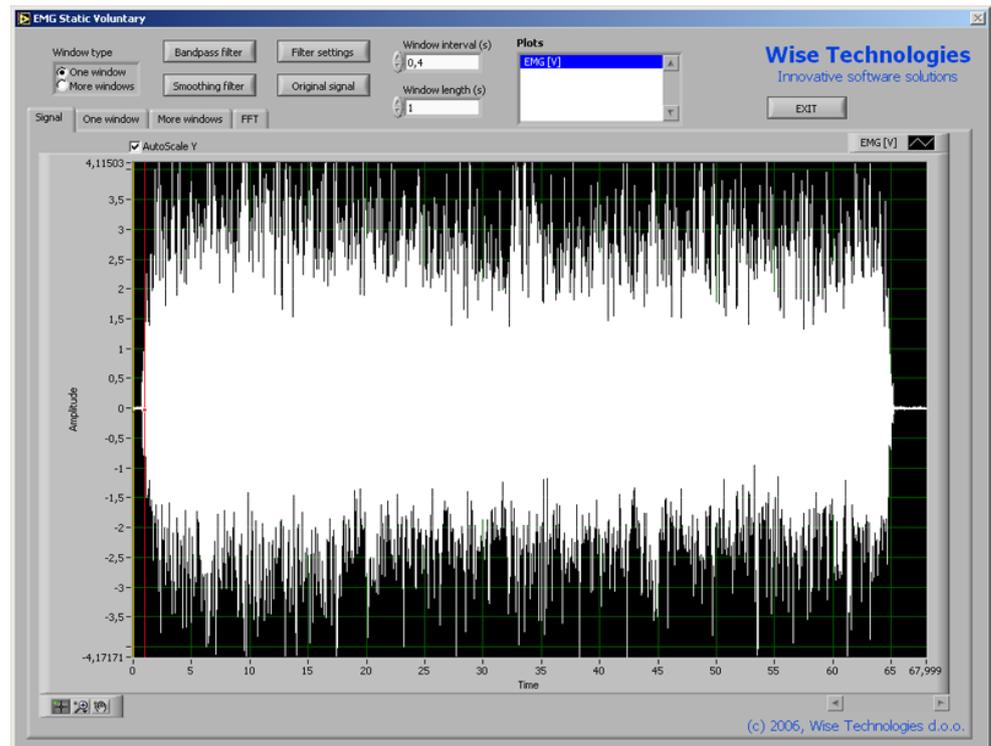


Figure 64  
One window analysis

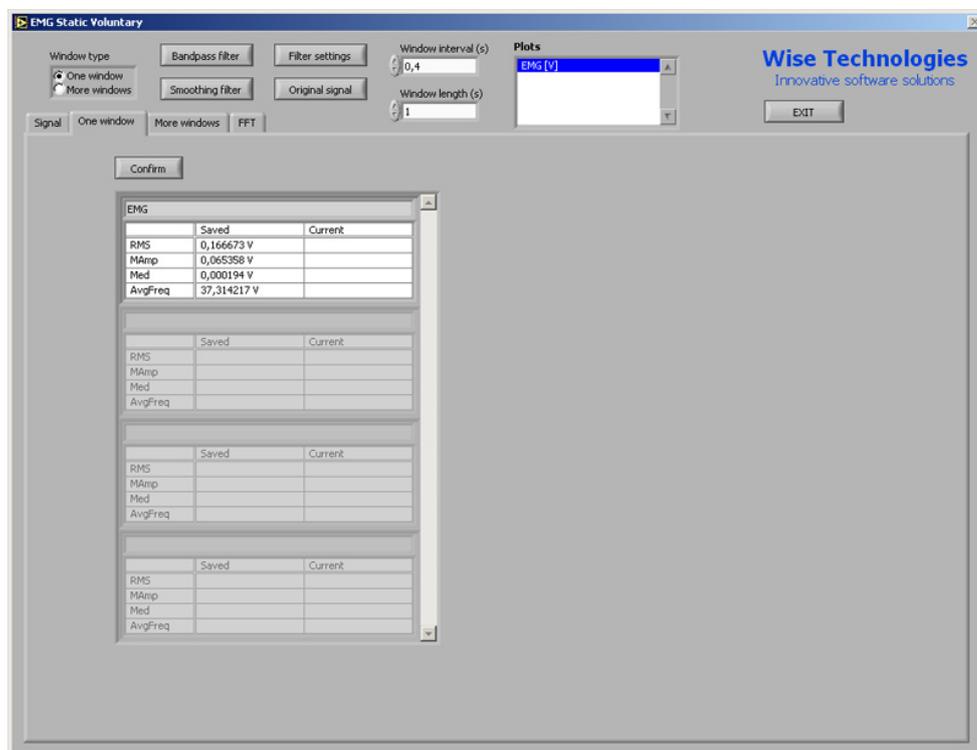


Figure 65  
More windows analysis  
- RMS graph

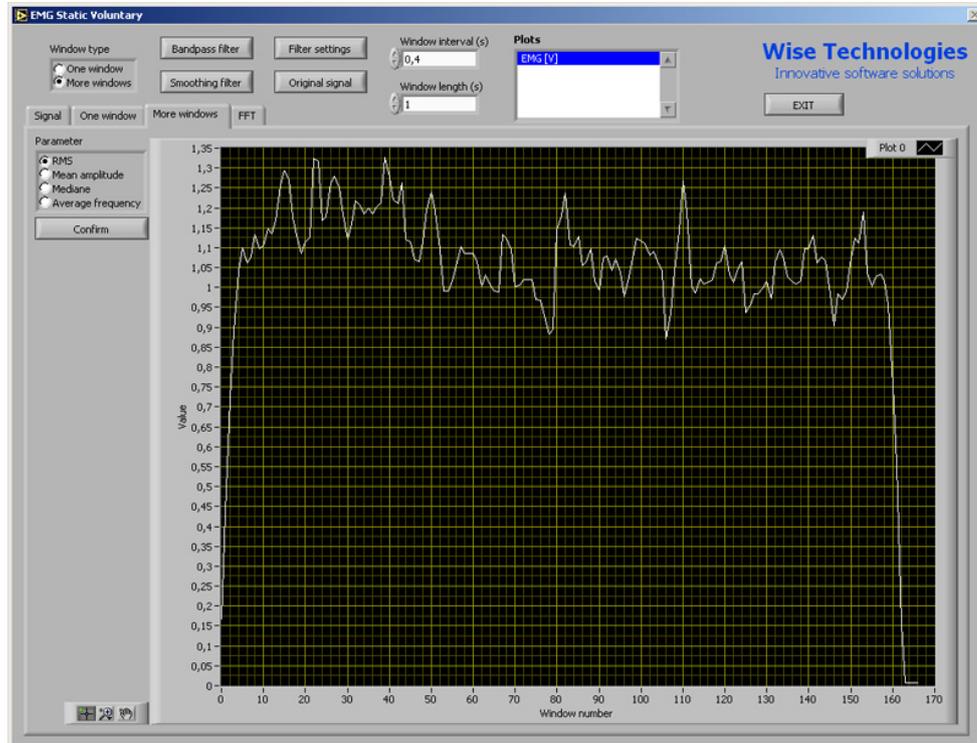


Figure 66  
More windows analysis  
- Mean amplitude  
graph

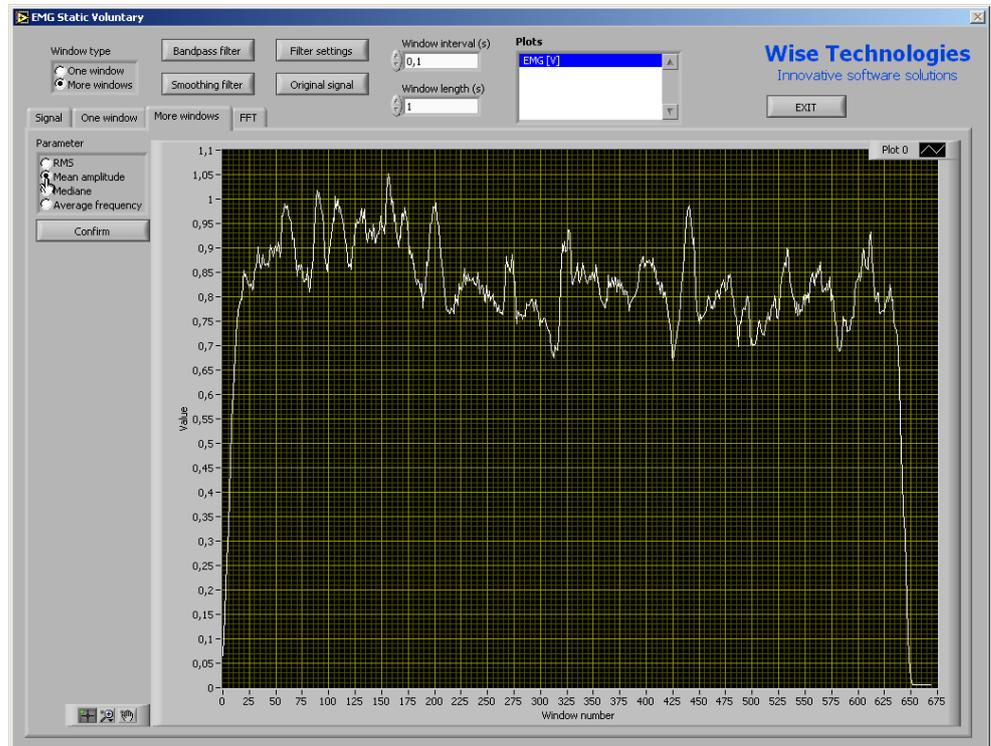


Figure 67  
More windows analysis  
- Mediane graph

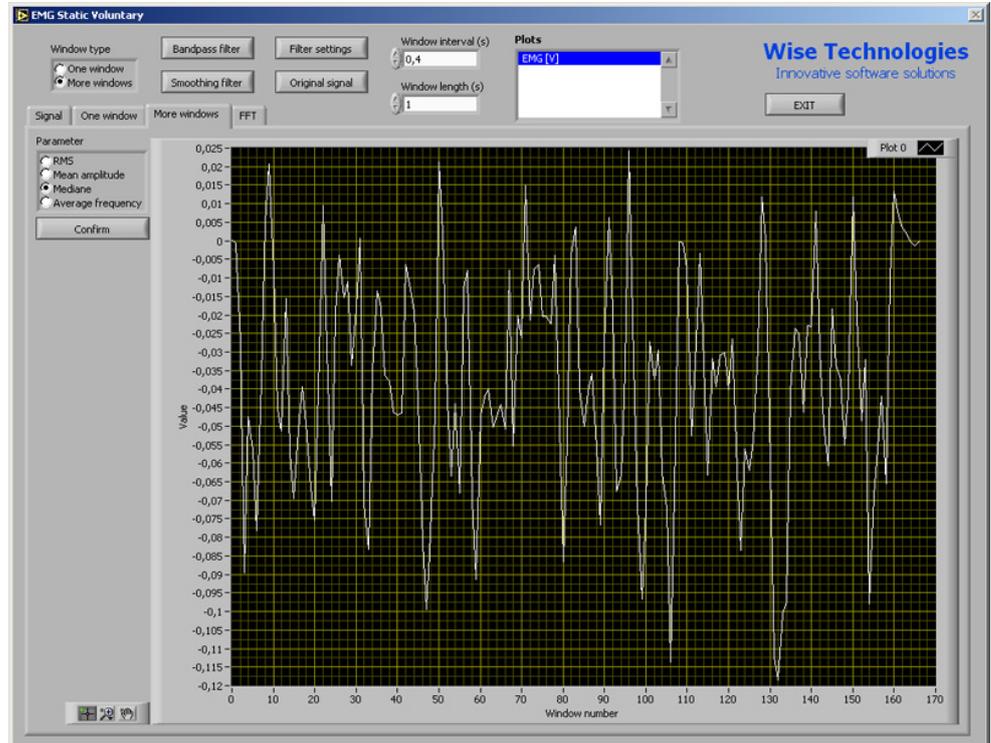


Figure 66  
More windows analysis  
- Average frequency  
graph

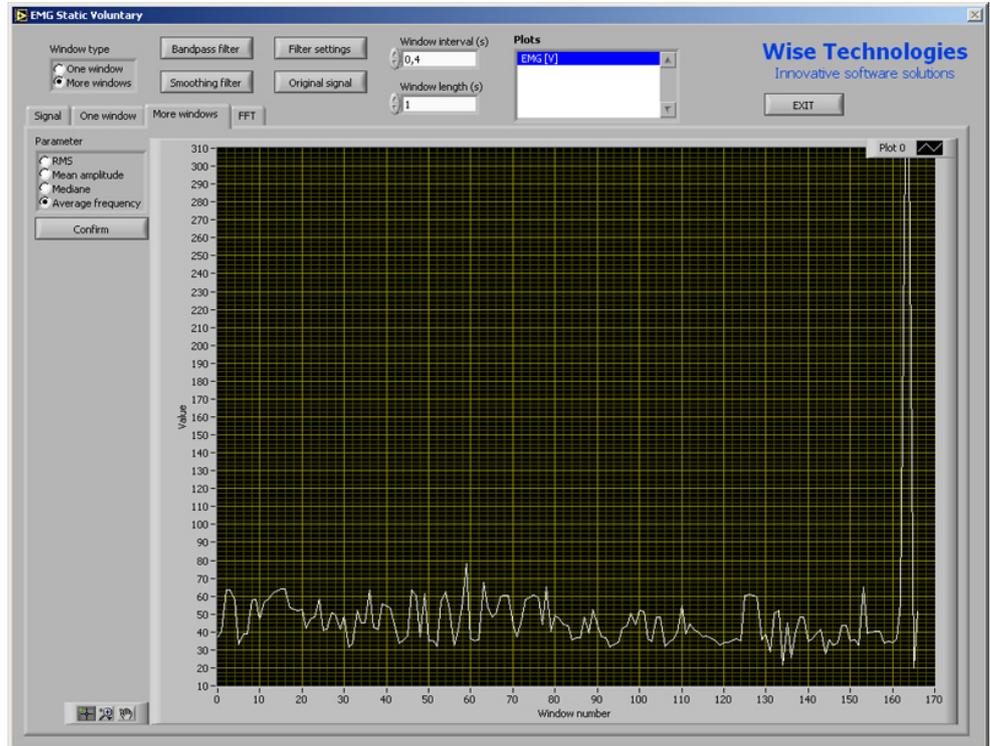
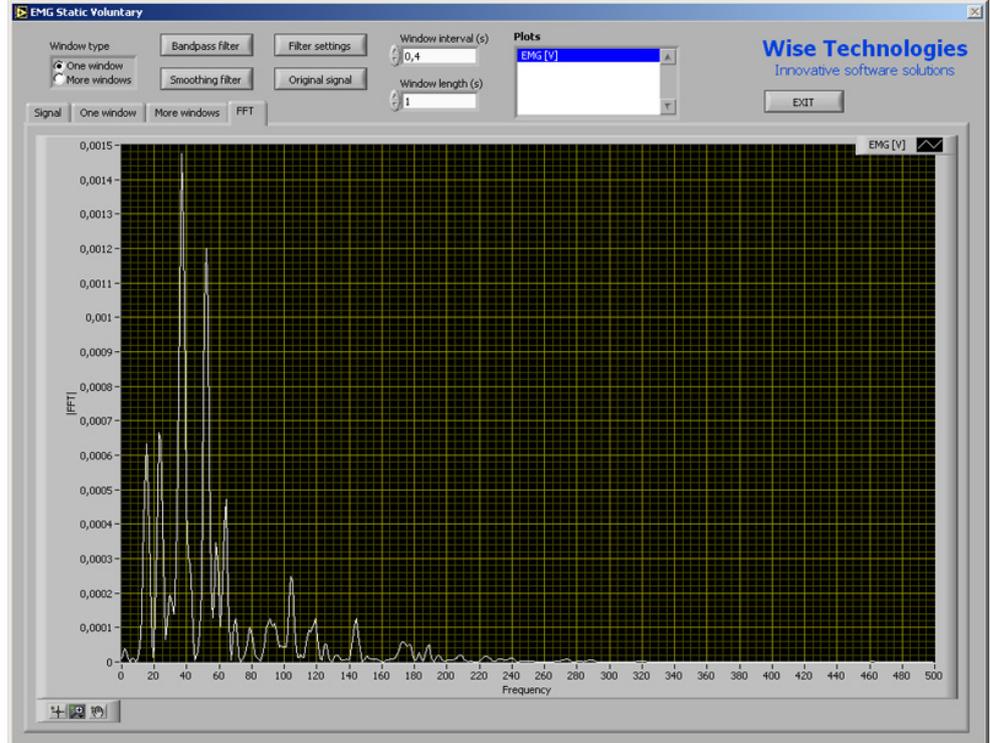


Figure 67  
One window analysis -  
FFT graph



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RMS	Root mean square on selected interval
MAmp	Mean amplitude on selected interval
Med	Median on selected interval
AvgFreq	Average frequency on selected interval

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## 4ROW

It is a complex system of mechanical sensors built in a “**Concept2**” rowing-ergometer. It can, however, be adapted for the use on other types and models of machines in order to carry out a complete analysis of rowing dynamics.

The system consists of:

- Three electronic strain gauge based force sensors (handle pull force sensor and two separate sensors for leg push force);
- Two electronic potentiometer based position sensors (seat position and handle position sensors);
- Input box for signals with A/D conversion and amplification functions;
- PC with software for acquisition and analysis of the signals

In addition to all the above listed sensor signals also internally registered ergometer data can be transferred, acquired and analysed by the 4ROW software.



4ROW software is comprised of four modules. First module is the main window, through which the operator controls a live measurement. It contains of the “**Start Measuring**” button for starting the measurement. During the measurement, live data can be observed on a graph under the “**Live Signals**” tab. The table beneath the graph displays the calculated parameters for the last completed stroke. Same data can be observed under the tab “**Last Stroke Data**”. The tab “**PM Data**” displays the data collected from the PM3 module on the rowing machine, associated to the last completed stroke. To conclude the measurement, “**Stop Measuring**” button has to be pressed.

The acquired data can be saved by pressing the “Save Data” button. For loading data, the “Load Data” button needs to be pressed. Besides the fore mentioned controls, three other buttons, “Edit Info”, “Analyse Data” and “Settings”, are available, allowing the user to access the other three software modules. Button “Edit Info” starts the module where measurement description can be edited, such as the rower personal data and description of conditions under which the measurement was taken. Pressing the “Analyse Data” button, a module is started where post-measurement analysis can be performed, such as observing the measurement parameters and signals inside the user specified measurement intervals. The measurement data can as well be exported as a text file. For sensor calibration, settings module can be started from the main window, by pressing the “Settings” button.

Figure 68

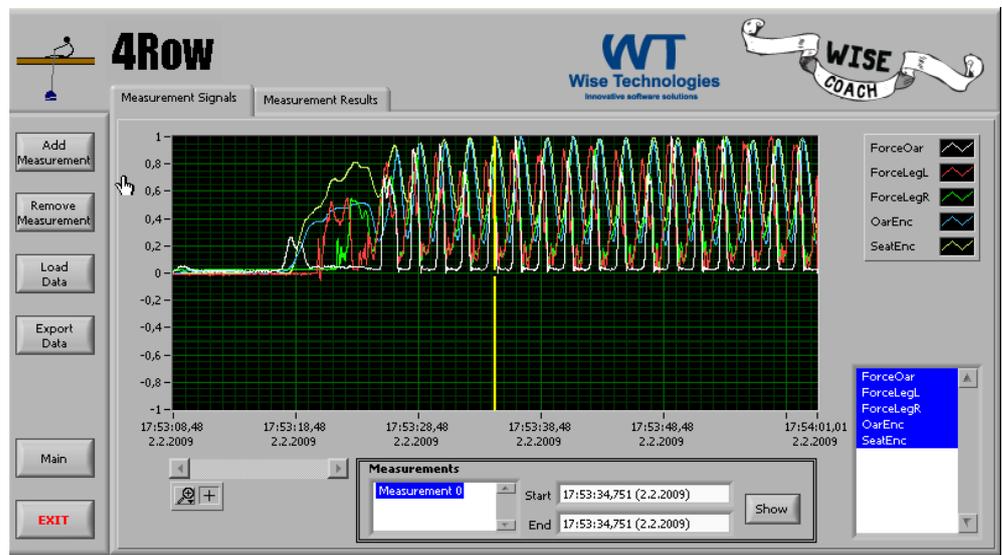
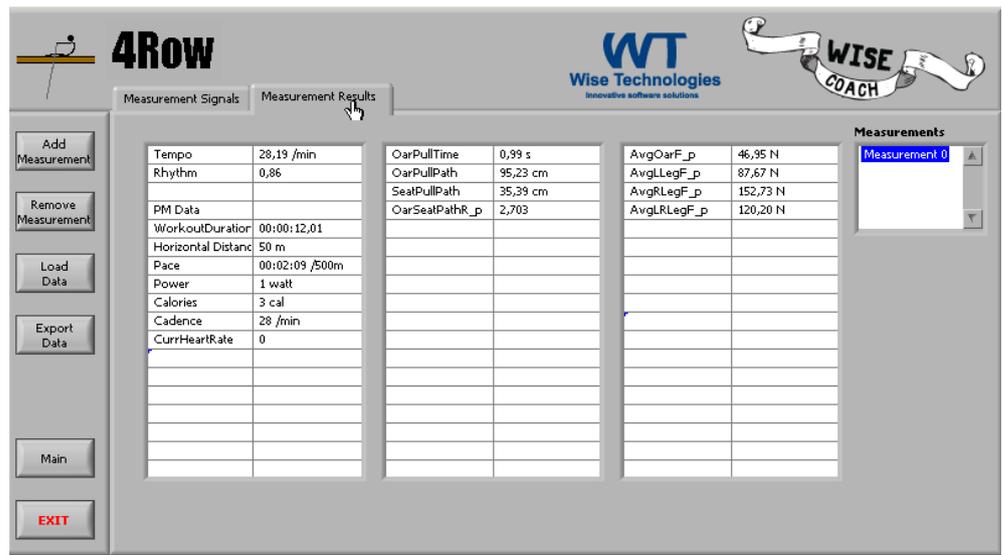


Figure 69



**Measured Data**

Signals	Description
Force Oar	Oar pull force
ForceLegL	Left leg push force
ForceLegR	Right leg push force
Oar Enc	Oar position
Seat Enc	Seat position
Calculated Parameters	Description
Tempo	Strokes per minute
Rhythm	Ratio between time of pull and release phase of stroke
OarPullTime	Time of pull phase of the stroke
OarPullPath	Distance covered by oar during pull phase of stroke
SeatPullPath	Distance covered by seat during pull phase of stroke
OarSeatPathR_p	Ratio between distance covered by oar and seat during pull phase of stroke
AvgOarF_p	Averaged oar force during pull phase of stroke
AvgLLegF_p	Averaged left leg force during pull phase of stroke
AvgRLegF_p	Averaged right leg force during pull phase of stroke
AvgLRLegF_p	Averaged left and right leg force during pull phase of stroke
PM Data	Description
WorkoutDuration	Work time duration of workout
Horizontal Distance	Work distance of workout
Pace	Time elapsed per unit distance for a given stroke
Power	Power generated based on the pace per stroke
Calories	Accumulated calories burned
Cadence	Strokes per minute per stroke
CurrHeartRate	Current heart beats per minute

## Auto-Q

It is a multi-purpose questionnaire software which offers wide variety of options. It was primarily build for sports and rehabilitation anamnestic data purposes, although its application can be much broader.

Main characteristics of the product are:

- Possibility of administator triggered and number code blinded use;
- User defined questions, question sets and score calculations;
- Four possible question types (multiple choice, text, scale, yes/no);
- Saving and recalling of the acquired data;
- Export of data, basic statistical analyses.

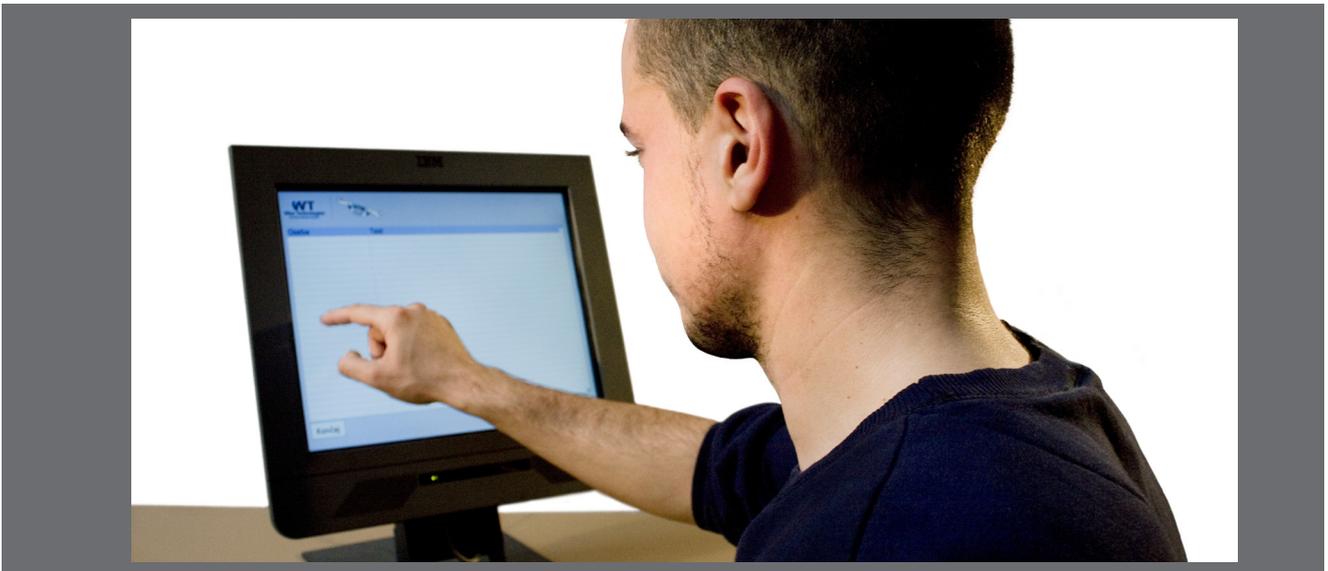




Figure 70  
Pre-defining the questionnaire

**Uredi Vprašanje**

**Vprašanje**

Ali je imel kdo v vaši družini rakasto bolezen?

Tip 1      Tip 2      Tip 3      Tip 4

Število odgovorov  
2

**Izbirni odgovori**

DA	Točke	1
NE	Točke	0

PS

Potrdi      Razveljavi



Figure 71  
Pre-defining the questionnaire

**Uredi Vprašanje**

**Vprašanje**

Ali je imel kdo v vaši družini rakasto bolezen?

Tip 1      Tip 2      Tip 3      Tip 4

Število odgovorov  
2

**Izbirni odgovori s točkami**

DA	Točke	1
NE	Točke	0

PS

Potrdi      Razveljavi



Figure 71  
Pre-defining the questionnaire

**Uredi Vprašanje**

Vprašanje

Izberite stopnjo bolečine v kolenu?

Tip 1 Tip 2 Tip 3 Tip 4

**Lestvica**

Min	Opis
0	neboleče
5	zelo boleče

PS

Potrdi Razveljavi



Figure 72  
Pre-defining the questionnaire

**Uredi Vprašanje**

Vprašanje

Opišite tip bolečine?

Tip 1 Tip 2 Tip 3 Tip 4

**Prosti vnos teksta**

PS

Potrdi Razveljavi



*Figure 72*  
Answering GUI  
- Filling-in the  
questionnaire

Vprašanje	
Ali je imel kdo v vaši družini rakasto bolezen?	
Izbran odgovor	
DA	
▶	
	DA
	NE



*Figure 73*  
Answering GUI  
- Filling-in the  
questionnaire

Vprašanje		
Ali je imel kdo v vaši družini rakasto bolezen?		
Izbran odgovor		
DA		
◀	▶	
	DA	TOČKE
		1
	NE	TOČKE
		0



*Figure 74*  
Answering GUI  
- Filling-in the  
questionnaire

Vprašanje	
Izberite stopnjo bolečine v kolenu?	
Izbran odgovor	
4	
◀	▶
	5- zelo boleče
	4-
	3-
	2-
	1-
	0- neboleče



Figure 75  
Answering GUI  
- Filling-in the  
questionnaire

Vprašanje  
Opišite tip bolečine?

Izbran odgovor  
bolečine pri delanju počepov

◀





