The gaitway-3D is an instrumented treadmill designed by h/p/cosmos and Arsalis. The system shown here is optimized for walking and slow speeds of running.


The treadmill feet and elevation system are replaced with tree-dimensional load cells that can measure forces up to 1 Ton in each direction.

The load cells are mounted to a dedicated frame that is bolted to the floor. This ensures an optimal rigidity and an optimal signal quality. The 3D amplifier mounted at the front delivers the signals to the software via an Ethernet interface.

The system measures the 3D forces applied to the treadmill. Any force applied to the handrails or to the optional safety arch is not measured thanks to the dedicated support that is not in contact with the treadmill frame and load cells
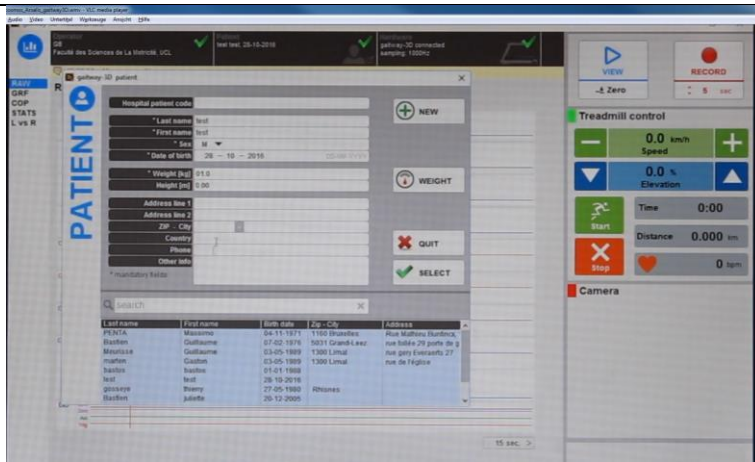
Before recording data we will click in the "Patient" box and select the patient record in the data base. Then, we check the patient body weight using the gaitway system by entering in the "Weighing scale" mode.

The subject is standing next to the treadmill, then we ask the subject to step on the treadmill and stand still.
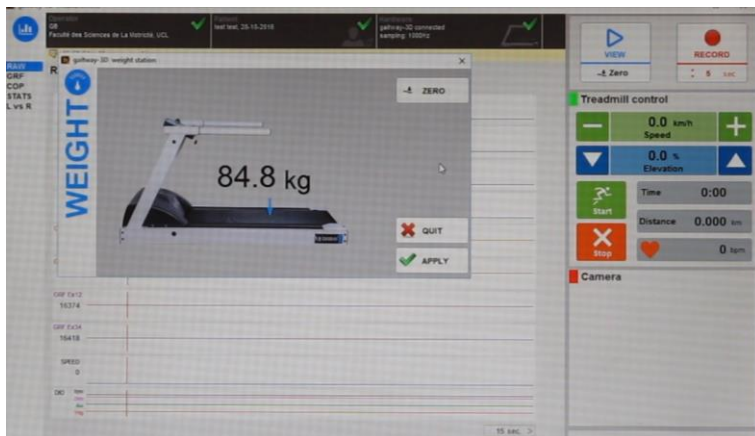

Once the measure is stable, the body weight can be recorded and it will be stored in the database.

The treadmill can be controlled from any screen during the measurements. The software allows the control of the treadmill speed and elevation and it also reports the exercise time, distance and heart rate. The first panel shows the raw data, in bits, as they are sampled from the A to D converter. This includes 8 force signals, one treadmill speed and 4 digital signals. The data monitoring can be started and stopped at any time via the "View" function.


The second panel shows the ground reaction forces. The gaitway-3D measures the ground reaction forces in all 3 directions: vertical, horizontal and lateral. The vertical force is computed for the left and right foot and multiple steps can be superimposed to evaluate gait asymmetry. During the double contact period of walking an algorithm is used to separate the vertical force under each foot. The algorithm has been published in Gait & Posture in 2016. It has been validated in 115 subjects including normal and pathological gaits.
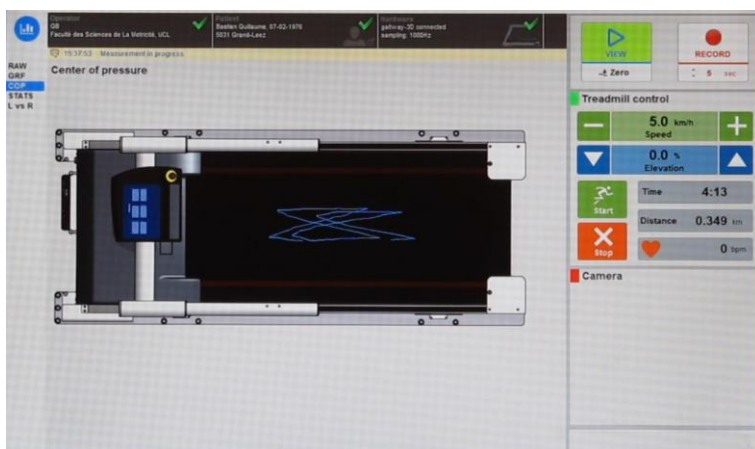
The third panel shows the center of pressure. You can see the butterfly pattern on the treadmill surface and how the system follows the subject as he moves on the locomotion surface.
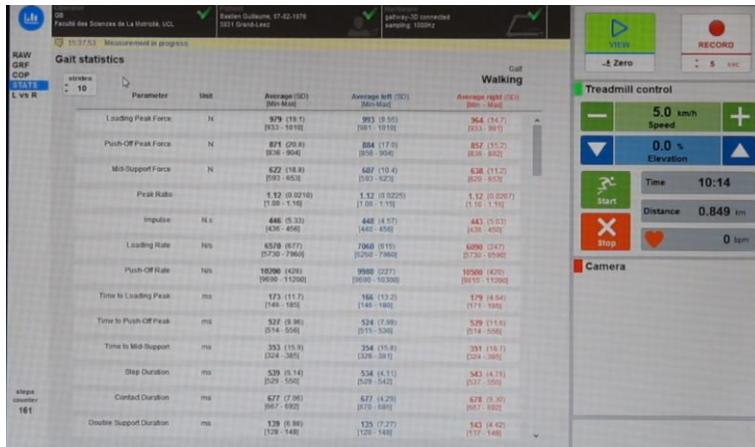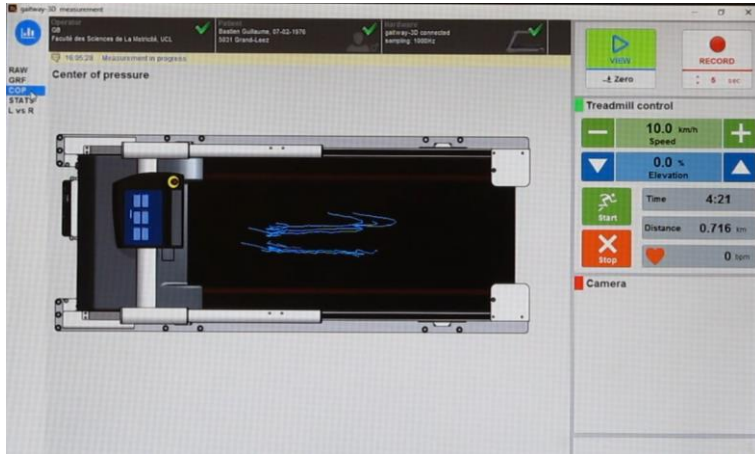

The "Stats" screen shows a number of indices computed for each step. The gaitway system automatically detects the gait. There are time and force parameters and also parameters relative to the position of the center or pressure. The parameter values are computed on the fly for the selected number of strides.
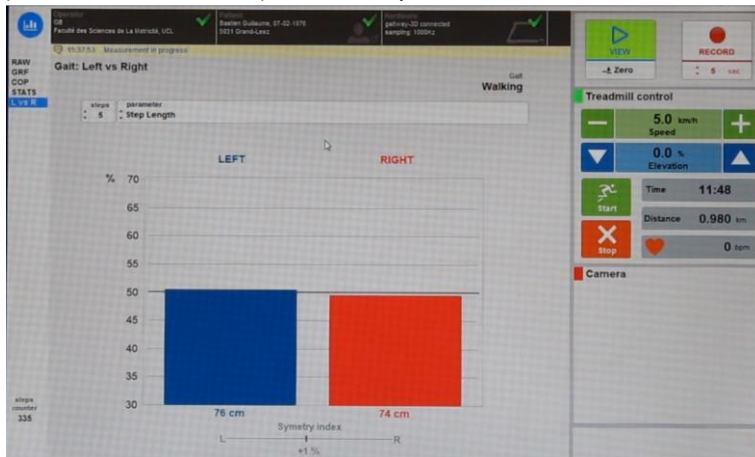
The "Left/Right" screen is used to provide feedback to the operator or to the subject during the exercise. Any parameter can be displayed in a simple left vs right presentation. A symmetry index is also displayed in percentage of the average.

At a higher speed, the gaitway system detects that the subject is now running. The ground reaction forces are also displayed together with the vertical force under each foot. The pattern is now different and also displays a very moderate foot slap for this subject. The scales of the plot can be changed easily by using the mouse wheel.

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The trajectory of the center of pressure is now quasi linear under each foot.

The list of parameters is also adapted to the running gait. It now includes the impact peak force that precedes the active force. The time of contact and aerial phases are also determined during the stride.

Summary

In summary, the new gaitway-3D is a joint design by h/p/cosmos and Arsalis. It measures the ground reaction forces and torques in three directions and comes in three different sizes: each size is optimized for a range of speeds. The gaitway-3D offers a rigid construction to record optimal quality signals. The functionalities include a patient weighing scale, a recording of the ground reaction forces at rates up to 10 kHz, left and right force measurement for the vertical force during walking and an extensive list of biomechanical parameters of normal and pathological gaits. The system also offers biofeedback for gait rehabilitation and performance training. The software is designed for Windows 7, 8, 10 and following. Automatic updates allow and easy expansion of the functionalities and customer support.