USER MANUAL: ROBOT-AIDED TMS SYSTEM

1. Setup

   //Robot

   1.1 Turn on the robot; fix the coil at the end-effector using the 3d printed flange and check if the coil cable is fixed at the side of the flange. Connect the robot arm to the pc using the ethernet cable. Then on the Desk settings set the right payload and unlock the joints.

   1.2 Connect the robot controller to the pc through Ethernet cable. Set the robot IP on the pc network settings. Check also if the right IP has been set into the main code. To move the robot using your own codes, the emergency button has to be "un-pushed": the lights of the robot are blue.

   //Camera

   1.3 Place the camera in a stable position. Check if the robot useful workspace is completely included into the camera measurement volume.

   1.4 Connect the camera to the power supply and to the pc through the USB cable.

   1.5 Run the Softaxic software 3.2b18. Turn on the connection, selecting the right USB port and the desired baud rate (115k).

   1.6 (Optional: do it only if the stylus is not working well anymore!) Calibrate the stylus tool (item 8700340): use the plexiglass calibration block, put the head reference in its position on the block, put the stylus in the focus point and check if both the tools are in the measurement volume of the camera. Start the NDI Toolbox and Acquire stylus poses while pivoting the stylus in the pivot block.

   Save the x,y,z data and insert them into the "Stylus manual calibration" into the Softaxic software.

   1.7 Calibrate the coil tool (item 8700339): fix the coil tool on the coil; On the softaxic go on "calibrate" and select the "manual" calibration procedure, use the stylus to point and acquire the Focus, Left and Handle points on the coil (points are on the stimulation face of the coil, on the same plane) and save the calibration. Don't move the coil tool until the whole TMS session is finished. Otherwise you must re-calibrate the coil tool on the coil.

2. Calibration

   2.1 Put the head reference marker in a place visible from the camera botu outside the robot workspace. Check if in the Softaxic both the head and coil leds are green.

   2.2 Run the "TMSrobotCalibration" software on the pc. Check if in the built folder there is the "pose.txt" file, where all the calibration points are stored. You can generate this file from the Matlab function "GenerateTrajectory" selecting parameters as the number of points or the radius of the sphere, the offset with respect to the robot base, etc.

   //post-processing

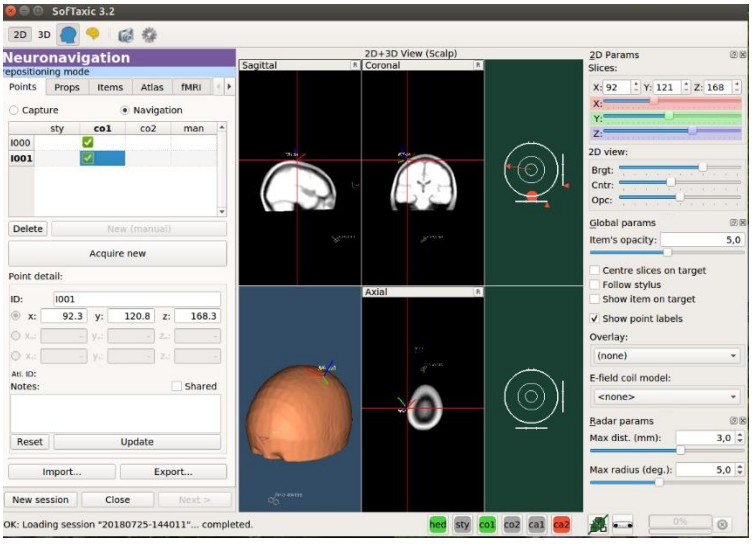
   2.3 Run the "CalibrateTMS_SGO" Matlab function to compute the calibration matrices, saved in the "calibration.txt" file

   2.4 Be sure that the "calibration.txt" file generated by matlab is into the built folder of the "TMS_pandaNeuronavigator" project.

3. TMS session

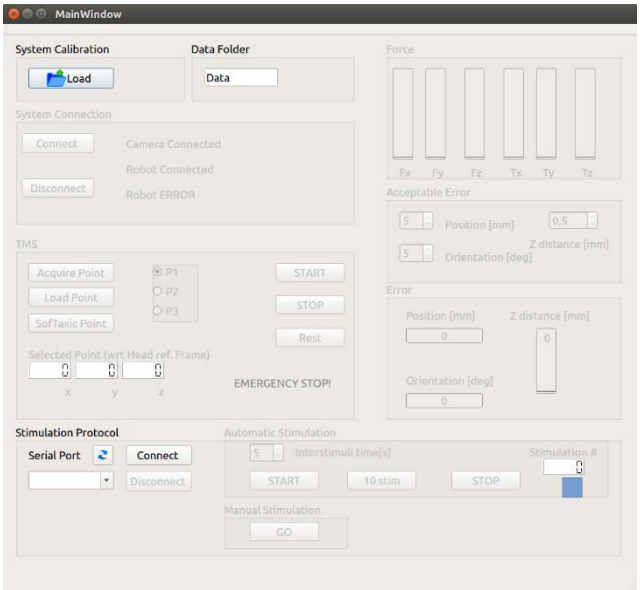
3.1 Acquire the Stimulation Points. When the coil is on the point, click on the “Acquire Point” into the Softaxic software. Don’t move the head reference from that time until the end of the whole session. Otherwise you must reacquire the stimulation points, because they are defined with respect to the head reference tool.

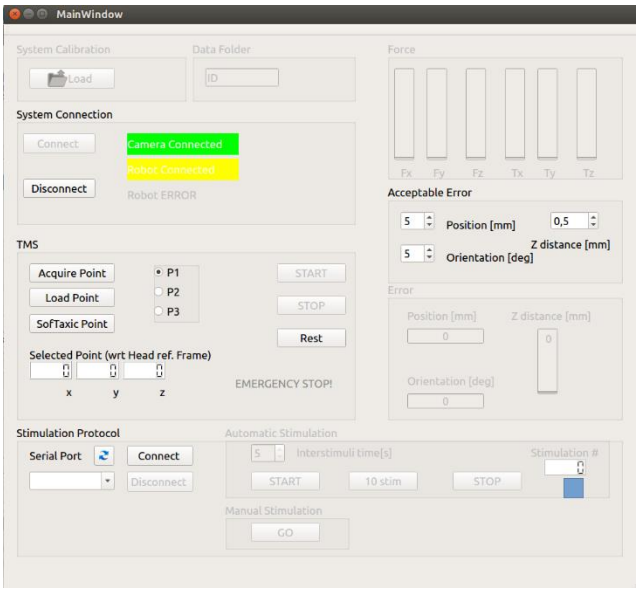
3.2 Check if the “Neuronavigation” checkbox is checked in the softaxic.



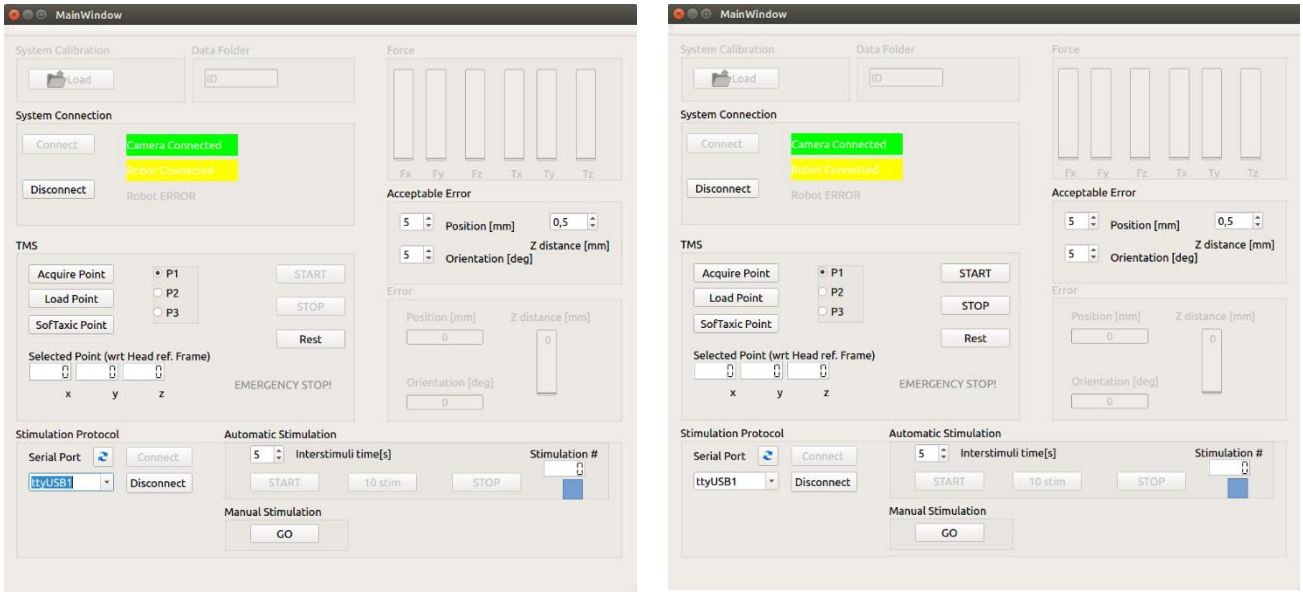
3.3 Run the TMS_pandaNeuronavigator. Write the name of the subject into the “Data Folder” space to create a new folder with the data. Click on Load to load the calibration file.

3.4 Click on Connect to open the connection with both the camera and the robot. The leds will became green for the camera and yellow for the robot (the robot led became green if the robot is moving).





3.5 Then click on “Softaxic Point” button to acquire the point highlighted into the softaxic software. Be sure that when you press the button the coil is visible and the coil led is green.



3.6 Set the threshold for the accuracy in the “Acceptable Error” box.

3.7 Connect the electronic board to the pc through the serial port and to the stimulator using the connector. Then, on the main application, click on the “connect” button into the serial port box. Click on “GO” to give a single trigger.

3.8 Select the point you want to stimulate (P1/P2/P3) and then click on “START” in the TMS box. The robot will move on the head, 10 cm over the scalp and then slowly down on the scalp. During the whole session the robot will follow the head. Ask the subject to be still, looking in front of him and to avoid fast movements and especially fast rotation of the head.

3.9 Once the robot is on the stimulation point (the “Acceptable Error” box became not enabled while the “Error” box start showing the current coil positioning error) you can click on “START” in the “Automatic Stimulation” box, after setting the desired interstimuli time.

* *AUTHOR: Alessia Noccaro, PhD student*
* *Research Unit of Neurophysiology and Neuroengineering of Human-Technology Interaction*
* *Università Campus Bio-Medico di Roma*
* *Via Alvaro del Portillo, 21*
* *00128 Roma, Italy*
* *email: a.noccaro@unicampus.it*