

MATLAB TRANSLATORS FOR 3DGuidance Tracker

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User's Guide

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1 Introduction

The included script and DLL files take advantage of the MATLAB ability (MATLAB supports dynamic linking) to load and interface with a DLL. This DLL is called "ATC3DG.DLL" (or ATC3DGm.DLL for 3DGuidance medSAFE). To understand the details of the low level I/O, one needs to become familiar with the 3DGuidance driveBAY or 3DGuidance trakSTAR *Installation and Operation Guide*. However, familiarity with the low level I/O is not necessary in use of most of the 3DGuidance features. This documentation assumes that the reader is familiar with MATLAB.

2 Software Requirements

- The attached code has been tested with MATLAB version 7.5.0. (R2007b) running on Windows XP (32 bit)

3 Quick Setup

1. Connect all 3DGuidance cabling as shown in the *Installation and Operation Guide* for the tracker.
2. All the necessary script files are provided in the *.zip file provided by Ascension. Extract the files included in this Zip file to the following sub-directory on the host machine:
c:/matscript or a directory name of your choice
3. Change the MATLAB current directory to this script directory.
4. From the MATLAB command line, type: **run_tracker**
5. Select the **Setup Tracker** option on the GUI window to initialize the system.

NOTE: Execute this option the first time *Run Tracker* is executed, and anytime after *Close Tracker and Unload Library* option is executed. This might take a few minutes.

6. Select any of the following four options from the GUI window to plot and display data:
 - a. **Read Position of Attached Sensor(s) and Display at the MATLAB Command Window**

Use this to display position, angle and quality data records from the attached sensors in the MATLAB command window. Data is collected from the tracker using the *GetAsynchronousRecord* data collection method.

- b. **Stream Data from the Tracker and then Plot**

This option collects data from the tracker using the *GetSynchronousRecord* data collection method. After selecting this option, a second GUI window will open (see *Figure 2*), providing a mechanism for starting and stopping the data collection. Upon STOP, a figure will be generated showing the data.

- c. **Save Stream Data to File**

This option is identical to the previous, but provides a means of saving the collected data to file. Files are saved in the MATLAB working directory (scripts directory). A GUI window similar to that shown in *Figure 2* is again used to start and stop the data collection. Upon STOP, the ascii flat-file can be opened using an editor or word processor.

- d. **Tracker Real-Time Data Animation**

Use this option to display the data as the sensor is moved around in the motion volume. The mechanism for starting and stopping this data collection is via

selection under the drop-down menu called **Run Tracker**. *See Figure 1.*

e. **Tracker Real-Time Graphic Animation**

Similar to **Tracker Real-Time Data Animation** option except instead of displaying the sensors data, a graphical representation of the data is shown.

7. If a connection error is encountered during any of the operations, try:
 - a. *Close Tracker*
 - b. *Exit*

Then restart by typing **run_tracker** on the MATLAB command line.

NOTE that 'Exit' will bring one back to the command line.

4. MATLAB Code

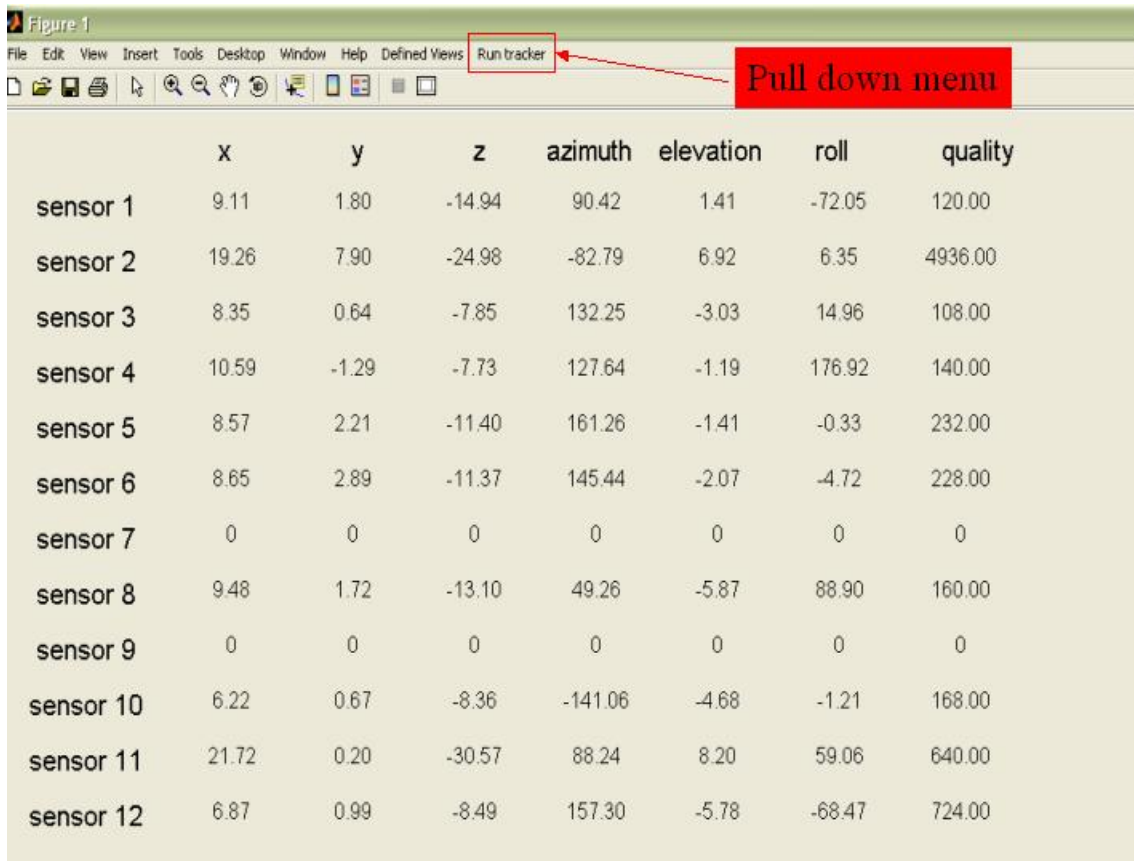
To get started writing your own MATLAB code for the tracker, examine the code in **run_tracker.m**.

FUNCTION CALLS: Some of the key function calls are:

- ***tracker_setup***: This sets up the tracker for data acquisition. It loads the library "ATC3DG.DLL"(or ATC3DGm.DLL), initializes the system and gets the transmitter and the attached sensor configuration.
- ***tracker_position_angles***: Displays attached sensors positions, angles and quality data at the MATLAB command window using the synchronous mode of data collection.
- ***tracker_stream_plot***: is designed to place the tracker in so-called 'stream' or synchronous mode. It plots the sensors position after the data is acquired (MATLAB GUI, see Figure (2)).
- ***save_Stream_Data***: Writes position and angle information from attached sensors to files. The number of files is equal to the number of attached sensors. For example: if sensors 1 and 4 are attached, then the files *Data_Sensor_1.dat* and *Data_Sensor_4.dat* will be created and the data will be saved accordingly.
- ***real_time_Animation***: implements real-time data acquisition and plotting. Data collection is initiated from the drop-down menu **Run tracker** see *Figure 1*.
- ***tracker_close***: turns-off the transmitter and unloads the library

KEY VARIABLES:

- **Pos:** Position vector of the tracker sensor. Columns are x, y, z values in inches; rows are by tracker number. These variables are computed inside the *tracker_stream_plot.m* for stream mode. To access these variables in synchronous mode use the structure **Record1** inside the *tracker_position_angles.m* code.
- **Ang:** Angle vector of the tracker sensor. Columns are in degrees; rows are by tracker number. Similar comments for accessing these variables as for **Pos** and **quality**.
- **TimStam:** is the timestamp for the sensor data record, and is returned as a double value. The integer portion of the variable represents the number of elapsed seconds since midnight, Jan 1, 1970, UTC, and is the standard way of representing time and date. This variable is computed in *save_Stream_Data.m* script.



	x	y	z	azimuth	elevation	roll	quality
sensor 1	9.11	1.80	-14.94	90.42	1.41	-72.05	120.00
sensor 2	19.26	7.90	-24.98	-82.79	6.92	6.35	4936.00
sensor 3	8.35	0.64	-7.85	132.25	-3.03	14.96	108.00
sensor 4	10.59	-1.29	-7.73	127.64	-1.19	176.92	140.00
sensor 5	8.57	2.21	-11.40	161.26	-1.41	-0.33	232.00
sensor 6	8.65	2.89	-11.37	145.44	-2.07	-4.72	228.00
sensor 7	0	0	0	0	0	0	0
sensor 8	9.48	1.72	-13.10	49.26	-5.87	88.90	160.00
sensor 9	0	0	0	0	0	0	0
sensor 10	6.22	0.67	-8.36	-141.06	-4.68	-1.21	168.00
sensor 11	21.72	0.20	-30.57	88.24	8.20	59.06	640.00
sensor 12	6.87	0.99	-8.49	157.30	-5.78	-68.47	724.00

Figure 1 Pull Down menu for start/stop of data collection using the *real_time_Animation* option

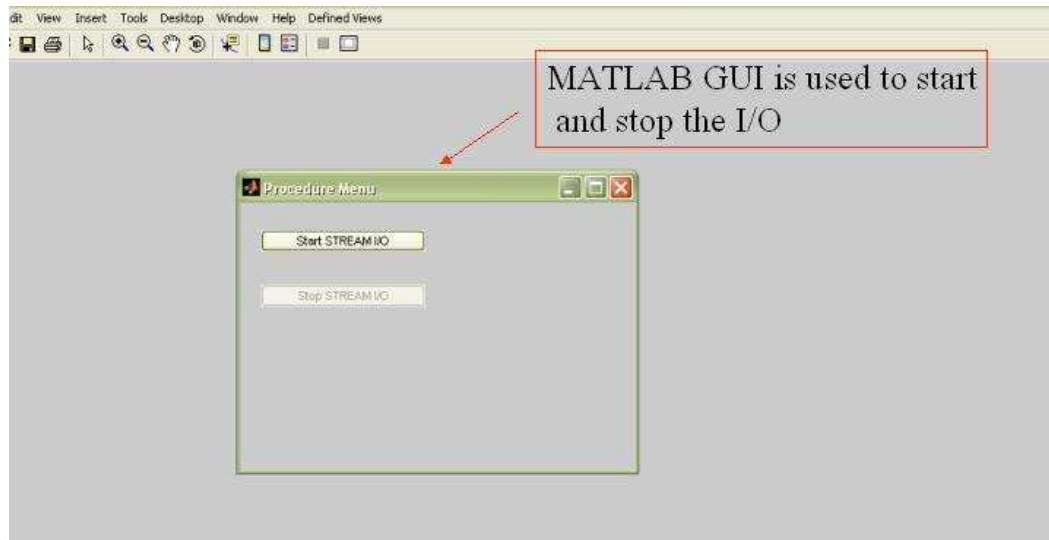


Figure 2 MATLAB GUI for start/stop of stream data options.

KEY LIBRARY FUNCTIONS

For more information about the following functions, check the *3DGuidance trakSTAR* or *3DGuidance driveBAY Installation and Operation Guide*.

- **GetAsynchronousRecord:** allows an application to acquire a position and orientation data record from an individual sensor or all possible sensors.
- **GetSynchronousRecord:** allows an application to acquire unique position and orientation data records for a given sensor (or from all possible sensors), only as they are computed by the tracker and become available once per data acquisition cycle.

For both methods of continuous data acquisition, a Matlab GUI is used to start and stop the I/O, *see Figure 2*. MATLAB does not have a function to monitor the keyboard (such as `kbhit` in C). Accordingly, the command line does not provide a convenient way to stop a loop with a keyboard input. The GUI approach opens a figure with a pushbutton commands. Implementing the `drawnow` Matlab command within the loop, forces MATLAB to monitor the GUI for mouse and button activity.