Contents

Tracking setup using PLUS on Windows, no reference tracker:

1. Startup Slicer.
2. Make a copy of the 20200305_Optical_tracking_template found in My Documents and rename it to the current date. This is where all the files from this session will be stored.
3. Load the .mrml file found in the folder.
4. Choose the OpenIGTLinkIF Module in Slicer.
5. Click on the OpenIGTLConnector and change the status to Active using the checkbox.
   - IGTL Type should change from "OFF" to "WAIT".
6. Start Plus Server Launcher application.
7. Navigate to the correct directory where the configuration file is saved and select the .xml file.
   - The file used for optical tracking should be: " PlusDeviceSet_Server_NDIPolaris_H115Setup.xml" found in the ".\PlusApp-2.8.0.20191105-Win64\config" directory and will show up in the dropdown menu as "Plus Server: NDI Polaris Tracking the H115 Transducer".
   - Note: The filename that shows up in the dropdown menu will correspond with the name set in the configuration file, not the name of the file itself.
8. Click "Launch Server".
   - You should hear the camera beep, indicating it is connected.
   - The IGTL Type in Slicer should change from "WAIT" to "ON".
   - If you want to double check that the tools are being tracked, go to the Transforms Module. Change the Active Transform to the appropriate transform. In our configuration file the transform for the Stylus is named "StylusToTracker" and the transform for the transducer tracker is "ToolToTracker". When you select the transform and hold up the respective tool in front of the camera, the transform values should change.
9. Load the CT or MR for the session containing the fiducial markers.
10. Go to the Markups Module.
11. If "DATE_img_pts" have already been collected and loaded with the mrml file, continue to step 12, else continue to 11a.
    a. Create new MarkupsFiducial list and save it as "DATE_img_pts".
    b. From the toolbar at the top select "Use Mouse to Create-and-Place Fiducial".
    c. Scroll through the slices to drop a marker at the center of each fiducial.
       - Be mindful of the order the markers are dropped, as the physical points will have to be selected in the same order.
       - I personally like to show slice intersections and hold shift to change the slices while selecting a point.

      d. Once all markers are dropped lock each one.
12. Under the IGT Module select "Collect Points"
13. Set Sampling_Node as "340_Pivot" and create another MarkupsFiducials list for the output node and name it "DATE_phys_pts".
14. Place the tip of the stylus in the center of each fiducial marker and "Collect Point" when ready.
15. Under the IGT Module select "Fiducial Registration Wizard".
16. The registration will go from "DATE_phys_pts" to "DATE_img_pts". Create output transform as "DATE_phys_to_img".
    - Typically, we aim for a registration error < 3 mm. Can either recollect points if it is a bad registration or throw out the visibly bad point.
17. Go to the Data Module. Click on the Transform Hierarchy tab.
18. Drop the "DATE_phys_pts" and "ToolToTracker" underneath the "DATE_phys_to_img" transform. This applies the calculated transform to get both of these in the correct space.
19. When the transducer tracker is moved, the ellipse representing the focus of the transducer can be seen and used to target the transducer.

Tracking setup using PLUS on Windows, with reference tracker:

1. Startup Slicer.
2. Make a copy of the 20200602_Reference_Tracker_Template found in My Documents and rename it to the current date. This is where all the files from this session will be stored.
3. Load the .mrml file found in the folder.
4. Choose the OpenIGTLinkIF Module in Slicer.
5. Click on the OpenIGTLConnector and change the status to Active using the checkbox.
    - IGTL Type should change from "OFF" to "WAIT".
6. Start Plus Server Launcher application.
7. Navigate to the correct directory where the configuration file is saved and select the .xml file.
    - The file used for optical tracking should be: " PlusDeviceSet_Server_NDIPolaris_H115Setup_withReference.xml" found in the ".\PlusApp-2.8.0.20191105-Win64\config" directory and will show up in the dropdown menu as "Plus Server: NDI Polaris Tracking the H115 Transducer with Reference Tracker".
    - Note: The filename that shows up in the dropdown menu will correspond with the name set in the configuration file, not the name of the file itself.
8. Click "Launch Server".
    - You should hear the camera beep, indicating it is connected.
    - The IGTL Type in Slicer should change from "WAIT" to "ON".
    - If you want to double check that the tools are being tracked, go to the Transforms Module. Change the Active Transform to the appropriate transform. In our configuration file the transform for the Stylus is named "StylusToTracker" and the transform for the transducer tracker is "ToolToTracker". The reference tracker can be checked using "ReferenceToTracker". When you select the transform and hold up the respective tool in front of the camera, the transform values should change.
9. Load the CT or MR for the session containing the fiducial markers.

10. Go to the Markups Module.
11. If the points and transform have already been collected and calculated, then you are finished with optical tracking and can procced to align the transducer. Else, continue to 11a.
    a. Create new MarkupsFiducial list and save it as "DATE_img_pts".
    b. From the toolbar at the top select "Use Mouse to Create-and-Place Fiducial".
    c. Scroll through the slices to drop a marker at the center of each fiducial.
        - Be mindful of the order the markers are dropped, as the physical points will have to be selected in the same order.
        - I personally like to show slice intersections and hold shift to change the slices while selecting a point.
    d. Once all markers are dropped, lock each one.
12. If this is the first time the reference tracker is used or if it has been moved to a new position a new pivot calibration needs to be collected using the stylus. Else, skip to Step 13.
    a. Under the IGT Module select "Pivot Calibration".
    b. Set the Input (ToolToReference) to StylusTipToReference.
    c. Under the Output (ToolTipToTool) create a new linear output transform as "340_pivot_reference".
    d. Change the startup delay if needed. Set the delay and duration to 30 seconds.
    e. Find something with a very small hole that the tip of the stylus can be placed in and will not move when rotated about the hole (i.e the Brainsight block) and is visible in front of the camera.
    f. When ready, start the pivot calibration. Slowly rotate the stylus, ensuring all markers are still clearly visible to the camera.
        - To check that the pivot calibration was successful, go to the Data Hierarchy. Place the needle model under the 340_pivot_reference. You should then rotate the stylus in the hole, and it should rotate about the axis and not move side to side.
13. If this is the first time the reference tracker is used or if it has been moved to a new position new points in physical space will need to be collected. Else, skip to step 14.
    - Under the IGT Module select "Collect Points"
    - Set Sampling_Node as "340_pivot_reference" and create another MarkupsFiducials list for the output node and name it "DATE_phys_pts".
    - Place the tip of the stylus in the center of each fiducial marker and select "Collect Point" when ready.
    - Under the IGT Module select "Fiducial Registration Wizard".
    - The registration will go from "DATE_phys_pts" to "DATE_img_pts". Create output transform as "DATE_phys_to_img".
        i. Typically, we aim for a registration error < 3 mm. You can either recollect points if it is a bad registration or throw out the visibly bad point from both datasets.
    - Go to the Data Module. Click on the Transform Hierarchy tab.
    - Drop the "DATE_phys_pts" and "ToolToReference" underneath the "DATE_phys_to_img" transform. This applies the calculated transform to get them in image space.
    - When the transducer tracker is moved, the ellipse representing the focus of the transducer can be seen and used to target the transducer.

Troubleshooting Tips:

- If you suspect there are connection issues with the NDI Polaris close the Plus Server and Slicer open NDI Track and see if there is a connection established and it's tracking all tools.
- If using a new NDI Tool make sure the .rom file is saved in the correct directory specified in the configuration file.