Demo Workflow

# Physical Setup

1. Sensor #1, plug in L14-5 probe
   1. Ensure the Ultrasonix machine has its setting correct
2. Sensor #2, plug in reference.
   1. Insert sensor into the holder
   2. Place on the breast gel phantom where marked.
3. Sensor #3, plug in needle
   1. Insert sensor into the holder
   2. Insert needle through the holder
4. Sensor #4, plug in catheter
   1. Insert sensor thread into the catheter, take care to not damage it
5. Start PLUS Server on the Ultrasonix machine
   1. Directory S:/SlicerIGT/BreastHDRCatheter/ConfigFiles
   2. File “Breast HDR Catheter phantom L14 50 mm 150227”
   3. Click “Connect”
6. Start 3D Slicer (4.4.0) on the Slicer machine
   1. Load the scene S:\data\SlicerIGT\BreastHDRCatheter\DemoScene\Demo-2015\_02\_27\2015-02-12-Scene.mrml
   2. Ensure that OpenIGTLinkIF shows the correct transforms etc…
   3. The tools should move around on the screen
7. Insert the needle into the tumour using ultrasound guidance

# Slicer Setup

1. Curve Maker Module:
   1. Source Points: “CatheterProgressFiducials”
   2. Curve Model: “CatheterProgressModel”
   3. Radius: 1mm
   4. Interpolation: None
   5. Enable: True
2. Volume clip with model (must be done to avoid a bug):
   1. Clipping surface from markups: None
   2. Clipping surface from markups: T
3. CollectFiducialsSupplement:
   1. Source Transform Node: “CatheterToReference”
   2. Target Transform Node: “NeedleToReference”
   3. Catheter Tip Point List: “CatheterProgressFiducials”
   4. Minimum Point Add Distance: 15mm
4. ViewMaster:
   1. toolCameraToToolTransform “CatheterCameraToCatheter”
   2. Scene Camera: “Right Camera”
   3. Translation:
      1. Left/Right: 0mm
      2. Down/Up: 5 mm (positive)
      3. Front/Back: 25 mm (positive)
5. Ensure correct camera movements:
   1. Click “Enable Tool POV”
   2. Make sure that the camera moves up/down/right/left in synch with your movements
   3. If the camera moves in the wrong direction, loosen the EM sensor, reposition, and tighten. Repeat until the camera movements match
   4. Click “Disable Tool POV” to end this test
6. Change layout to red slice only
7. Change to Fiducial Registration Wizard

# Demo

1. Fiducial Registration Wizard (Tumour Segmentation):
   1. Select “T” in the “From Fiducials”
   2. Click on the red dot with the arrow
   3. **Explain what is happening:**
      1. *We are creating a model of the tumour that we can show on 3D displays*
      2. *We collect points in this tracked ultrasound image, and a model is fit around those points*
   4. Get ultrasound snapshots of the tumour in the red slice
   5. Indicate the tumour with a comfortable margin in the ultrasound images
   6. Deselect red dot with arrow
2. Change layout to dual 3D view
3. ViewMaster (Viewpoint setup)
   1. Click “Enable Tool POV”
   2. **Explain what is happening:**
      1. *What we see in the right scene moves with the catheter*
      2. *Ignore the left 3D scene for now*
      3. *The green blob is the tumour we just segmented*
      4. *The cyan pointer is the localization needle, it is inserted through the tumour*
      5. *Not immediately relevant: The yellow pointer is the catheter tip (might not be very visible just at the moment)*
      6. *Not immediately relevant: The purple line shows the current catheter trajectory*
      7. *We want to set up a view perpendicular to the catheter insertion, so we can visualize the depth of the catheter as it goes in*
      8. *This bit of green tape is going to be “up” on the computer screen*
   3. When surgeon is happy, click “Disable Tool POV”
   4. **Explain**
      1. *I need to do a quick setup for the next phase, this would be streamlined in the final system*
4. ViewMaster (Preparing for Catheter Insertion)
   1. Scene Camera: “Left Camera”
   2. Tick “Parallel Projection”
   3. Set View Scale to about 30
   4. Set Translation
      1. Left/Right: 0 mm
      2. Down/Up: 0 mm
      3. Front/Back: 150 mm (positive)
   5. Set Model Visibility:
      1. Model visible for toolPOV on: CatheterCrosshairs
   6. Click “Enable Tool POV”
   7. **Explain**
      1. *Now we’re looking at the left 3D view*
      2. *The red crosshairs now indicates where the catheter will hit if it moves in a straight line*
      3. *You get another perspective from the right 3D view. This is where the yellow catheter tip and purple trajectory might provide useful information*
      4. *We try to align the red crosshairs with somewhere in the tumour, then insert. Tell me when you start inserting, and I’ll tell the computer to start showing the catheter path in real-time*
      5. *The right view will continue to update as you go, so if the catheter bends, the target will shift.*
      6. *Your current catheter position and catheter path will be shown in dark blue on the left view*
      7. *If the needle is pulled out of the breast, I’ll restart the catheter path calculations*
5. CollectFiducialsSupplement (Catheter Insertion)
   1. When the surgeon is ready to insert, click “Enable Automatic Fiducial Collection”
   2. If the surgeon completely removes the catheter, click “Disable Automatic Fiducial Collection” then “Remove All Points”
   3. **Explain**
      1. *The dark blue line in the left view shows the path the catheter took through the tissue*
      2. *We can verify the path is correct by taking the ultrasound probe and comparing the model position (blue) with where the catheter shows up in the ultrasound image.*