# CustusX System Test

Version 2.4 – 2013/01/11

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| Tester |  | | |
| CustusX version |  | OS |  |
| Date |  | | |

The system test aims to test all major and most minor features of CustusX. It shall be run at least once on one of Win/Mac/Linux as part of each release.

Data sets:

1. Kaisa: Located in ssc/Data/Fantomer/Kaisa. Start with the DICOM set. Use the corresponding doll head in the lab.
2. Person5: Located in ssc/Data/Person5. This set will be registered to Kaisa as part of the test, use to test on real medical data.
3. Accuracy Phantom: Located in CustusX3/config/tool/Tools/Laboratory/AccuracyPhantomNoWalls\_POLARIS. Used for ultrasound accuracy tests.
4. Magdaphantom: Located in medtek.sintef.no\Data\Lap\LiverPhantom(Magda)2012\Magda1-CT (need to make .mhd version before loading into CustusX, use OsiriX)

Each data set is used in parts of the test. Perform as many tests as possible. If any are omitted, say which and why in the Pass/Fail and comment fields.

*When testing, remember that you are a* ***tester*** *and* ***not*** *a programmer. Run through the entire test if at all possible. Do not stop to fix bugs in the middle of the test. If the app crashes: Save the backtrace to disk an write it down in the log and/or in Mantis.*

*Feel free to test* ***more*** *than the test describes. The test might be missing important features. In that case, write it down and update the test afterwards.*

*The same applies to missing/bad features that you find. Insert it into Mantis.*

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| Comments: |
| Test passed: |

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| --- | --- | --- | --- |
| **ID** | **Description** | **Pass/ Fail** | **Comment** |
| 1 | Data Import |  |  |
| 1.1 | OsiriX |  | Available on Mac only. |
| 1.1.1 | Import Kaisas DICOM volume into OsiriX. |  |  |
| 1.1.2 | Segment out some interesting features. (Set output value > 300, because of Osirix bug) |  |  |
| 1.1.3 | Save volume and segmented volume to .mhd format (use CustusX plugin). |  |  |
| 1.1.4 | Save surface to .stl format by using ”Surface rendering”. Add .stl as file ending in Finder afterwards. |  |  |
| 1.2 | ITK\_snap |  |  |
| 1.2.1 | Import a volume (P5). |  |  |
| 1.2.2 | Segment out features. Use the Snake tool. |  |  |
| 1.2.3 | Save segmented volume (.mhd). |  |  |
| 1.2.4 | Save surface mesh (.stl and .vtk). |  |  |
| 1.3 | CX3 volume import |  |  |
| 1.3.1 | Run CustusX3. |  |  |
| 1.3.2 | Create new patient. |  |  |
| 1.3.3 | Import volumes Kaisa and P5. |  |  |
| 1.3.4 | Add both Kaisa and P5 to view. |  |  |
| 1.3.5 | Import segmented volume (1.2.1). Verify correct placement relative to other P5. |  |  |
| 1.3.6 | Set 3D transfer function (color + alpha + shading) on P5. |  |  |
| 1.3.7 | Set 2D window+level+color on P5. |  |  |
| 1.3.8 | Save transfer function as Preset. Load that preset and other presets. |  |  |
| 1.4 | CX3 mesh import |  |  |
| 1.4.1 | Import mesh (.stl and .vtk) made in ITKSnap. Align it to P5 (set parent, use NifTI). |  |  |
| 1.4.2 | Add to view. Verify correct placement. |  |  |
| 1.4.3 | Change the color of the mesh. |  |  |
| 1.4.4 | Repeat 1.4.1-3 for all meshes. |  |  |
| 2 | Preop planning |  |  |
| 2.1 | Enter Preoperative Planning Workflow. |  |  |
| 2.2 | Navigate using drag and zoom in 2D. |  |  |
| 2.3 | Navigate in 3D with pan, zoom and rotate. |  |  |
| 2.4 | Add a cropping box. Create a cropped volume from the box. |  |  |
| 2.5 | Add two clip planes. First add one, then save, then add another one. |  |  |
| 2.6 | Cycle through all available layouts. |  |  |
| 2.7 | Create a custom layout with  group0: 3D+ACS+Any+Dual+Radial  group1: 3D+Any+Dual |  |  |
| 2.8 | Open the Camera Control Widget and manipulate the camera. |  |  |
| 2.9 | Open the Eraser Sphere and erase parts of a volume. |  |  |
| 3 | Registration |  |  |
| 3.1 | Go to Registration Workflow.  Perform Landmarks Image2Image registration between Kaisa(fixed) and P5(moving). |  |  |
| 3.2 | Give each landmark a name. |  |  |
| 3.3 | Check that the two landmark set (in the two images) are connected by lines and display accuracy. |  |  |
| 3.4 | Go back and forth in Registration History. |  |  |
| 3.5 | Connect a tracking system (chose one). Define a new Tool Configuration and start tracking. |  |  |
| 3.6 | Perform a Fast Registration (orientation and Image2Patient) on Kaisa versus the doll head. |  |  |
| 3.7 | Verify accuracy using a pointer, on both Kaisa and P5. |  |  |
| 3.8 | Delete the fast registration using the Registration history. |  |  |
| 3.9 | Perform Landmark Image2Patient Registration with Kaisa and the doll head. |  |  |
| 3.10 | Verify the accuracy using a pointer. |  |  |
| 3.11 | Modify both the image and patient registration using the Manual Registration. Verify. Use Registration History to revert the changes. |  |  |
| 3.12 | Save the patient. |  |  |
| 4 | US Acquisition |  |  |
| 4.1 | Select a configuration on the scanner (depth, scanner, probe etc.). |  |  |
| 4.2 | Go to Intraoperative Imaging Workflow. Use Kaisa filled with water and the green phantom inside. |  |  |
| 4.3 | Verify that yellow box encompasses the US image. |  |  |
| 4.4 | Verify that the US image is attached to the 3D visualization of the probe, and that the image is correct. |  |  |
| 4.5 | Perform an acquisition of the entire volume, using the PNN algorithm. |  |  |
| 4.6 | Add volume to view, set transfer function and window/level. |  |  |
| 4.7 | Go to Intraoperative Planning Workflow. Verify the accuracy using the Kaisa CT volume. Check both in 2D and 3D. (This is a rough accuracy test.) |  |  |
| 4.8 | Verify the accuracy using a pointer. Check both in 2D and 3D. |  |  |
| 4.9 | Perform new reconstruction: Select VNN algorithm, 20Mb volume size. Repeat 4.4 and 4.5. |  |  |
| 4.10 | Angio test:   * Create new patient. * Turn on Doppler on the US scanner and select angio data in the “US Reconstruction” widget. * Scan a suitable area – like the coronary artery. * Verify that two volumes are created: One B-mode and one angio. The angio only contains information from the colored(angio) part of the input data. |  |  |
| 4.10 | Stress test:   * Perform 3 consecutive acquisitions. Autoreconstruct on, compression on, 24bit. * Start a new acquisition immediately when the last reconstruction is finished. * Don’t wait for previous acq data to finish saving. * Durations: 30s, 60s, 45s. |  |  |
| 5 | US accuracy / Metrics |  | Requires the wire phantom. |
| 5.1 | Perform a Temporal Calibration an verify that the value is below a few tens of ms. Use a separate water tank for this. |  |  |
| 5.2 | Define a Tool Configuration for the Accuracy phantom, scan the accuracy phantom. |  |  |
| 5.3 | Load a model of the wire: config/models/ wire\_phantom\_cross\_pts.vtk. |  |  |
| 5.4 | Add metrics:   * Add point metric to model center, by loading the reference points of the phantom. * Add point metric to tooltip. * Add point metric to observed center of US cross. |  |  |
| 5.5 | Add distances between model center and the two other points. |  |  |
| 5.6 | Verify accuracy using pointer and metrics:   * Point with the navigation pointer on the physical cross and find accuracy from the distance metric. * Find accuracy of US data from the other distance metric. |  |  |
| 5.7 | Verify visually that the reconstruction gives straight lines (this verifies the temporal calibration).  Use the Wire Phantom Test widget to get the accuracy. |  |  |
| 5.8 | Test vessel-vessel registration:   * Run the smooth-segment-centerline pipeline on the US data, then register the centerline to the wire model. * Verify that the two match after registration, and that the distance metric added earlier are close to zero. |  |  |
| 5.9 | Create new patient,  open the Wire Phantom Test Widget,  perform 3 accuracy tests. Should be small and stable. |  |  |
| 6 | Navigation |  |  |
| 6.1 | Enter Navigation workflow. |  |  |
| 6.2 | Navigate on Kaisa and P5 using pointer in various layouts. |  |  |
| 6.3 | Add an interactive clip plane to one of the volumes, navigate. |  |  |
| 6.7 | Navigate simultaneously in volume and surface data. |  |  |
| 6.8 | Test overlay. (Linux only) View Kaisa CT and US in same 2D slice. |  |  |
| 6.9 | Change to Tool View and verify navigation. |  |  |
| 6.10 | Take a snapshot, open it in an external application. |  |  |
| 6.11 | Perform a tool tip calibration of the broken intraoperative navigator. Backup the .cal file first! |  |  |
| 6.12 | Perform a tool manual calibration of the same navigator. Verify. Revert to old .cal file. |  |  |
| 6.13 | Connect Polaris hardware. Make Polaris Toolconfiguration. Verify that tracking works. |  |  |
| 6.14 | Connect Aurora hardware. Make Aurora Toolconfiguration. Verify that tracking works. |  |  |
| 7 | Session / Desktop |  |  |
| 7.1 | Enter each workflow state, verify that the default dektop is ok. |  |  |
| 7.2 | Add some widgets. |  |  |
| 7.3 | Change workflow, then go back and verify that the widgets you added are still there. |  |  |
| 7.4 | Reset desktop to get back to initial desktop. |  |  |
| 7.5 | Save the patient. |  |  |
| 7.6 | Restart CustusX and load open the saved patient. Navigate. |  |  |
| 7.7 | Select new patient. Verify that nothing remains of the previous patient, and that all volumes/meshes are in the correct position. |  |  |
| 8 | Stereo |  | Nevro rack only. |
| 8.1 | Connect the stereo equipment, glasses and receiver. |  |  |
| 8.2 | * Run CustusX. * Load P5. * Preferences -> Visualization -> Frame-sequential -> Ok. * Activate stereo (press 3). * Verify stereo by putting on the glasses. |  |  |
| 9 | Playback |  |  |
| 9.1 | Start Playback:   * Restart CustusX. * Load one on the patients used earlier in the test, containing US recordings and tool navigation. * Verify that the tool configuration is the same as when navigation on that patient. * Start Playback mode (Tool->Configure, Playback->Start). |  |  |
| 9.2 | Verify:   * Both tracking tools and US video can be seen by running the playback. * Inspect the timeline too see a visualization of tools, video and events. * Change speed, start/stop, forward/backward. |  |  |