High Resolution Research Tomograph
USER COMMUNITY

HRRT_U 1.0 Test Procedure

1. General

This test procedure describes verification tests to validate a HRRT_U 1.0 build against the specifications (document HRRT_U_1_0 Specifications).

1.1. Required Dataset Files

Dataset file	Format
Emission	Listmode
Transmission	Listmode
Normalization	Sinogram

Table 1:Required dataset files.

1.2. Required Hardware and OS

The software should be installed on a Microsoft Windows XP 32 or 64 bit computer. The computer should have 2GB RAM for 32bit OS and 4GB or more for 64bit OS. An additional computer with similar specifications is required to test the cluster reconstruction. The first computer is called **reconserver** and the additional one(s) are called **node**(s).

1.3. Software Installation

The software is distributed as a self-install executable HRRT_U_1_0.exe and should be installed on the reconserver. For 64bit computers, rename the default 32bit executable (hrrt_osem3d.exe, gendelays.exe, lmhitogram.exe, norm_process.exe) to xxx_x32.exe (e.g rename hrrt_osem3d.exe hrrt_osem3d_x32.exe) and rename 64bit executables (hrrt_osem3d_x64.exe, gendelays_x64.exe, lmhistogram_x64.exe, norm_process_x64.exe) to default (e.g. rename hrrt_osem3d_x64.exe hrrt_osem3d.exe).

1.4. Test Preparation

Start ReconGUI (may be named Reconstruction Tool), configure all steps (transmission, attenuation, scatter, reconstruction with OP-OSEM 16 subsets and 6 iterations), start by pressing the 'execute all' button and exit ReconGUI after the reconstruction is complete. The reconstructed image is referred to as **image0**.

2. hrrt_osem3d

2.1 Build Date

Execute hrrt_osem3d with no argument in a command window to get the build ID and the fill the field build date below.

Build date	

Table 2.1: hrrt_osem3d build date.

2.2 tests

Close ReconGUI and start ReconGUI_u to execute tests in table below.

Tag	Verification	Expected results	Actual results	Pass/Fail
T2.1	Configure OP-OSEM with 16 subsets, 6 iterations to reconstruct data files created in 1.4 (Test Preparation) and execute reconstruction only and verify that hrrt_osem3d is used. Image is referred to as **image1**.	Display image0 and image1 in Vinci and compute the ratio. The ratio image values range should be 1.0±0.01.		
T2.2	Configure OP-OSEM 16 subsets, 10 iterations with PSF checked to reconstruct data files created in 1.4 and verify that hrrt_osem3d is used with -B 0,0,0 option. Image is referred to as **image2**.	Display image2 in Vinci and verify if the quality is better than image1 and RoI average is the same on both images.		
T2.3	Configure the scatter process step and push execute all to run both scatter correction and reconstruction. Image is referred to as **image3**.	The scatter file size is 59MB. The ratio image1/image3 values range should be 1.0±0.01.		
T2.4	Delete the random smoothed sinogram (_ra_smo.s) and push execute reconstruction only and verify that the .ch file is used as delayed file. Image is referred as **image4**.	The ratio image4/image2 values range should be 1.0±0.01.		

| T2.5 | Configure and run the reconstruction using the trues sinogram (.tr.s) and select ANW with 16 subsets and 2 iterations. Image is referred as **image5**. | Image 5 should be similar to image 2 (the ratio image5/image2 values range should be 1.0±0.2) | | |

Table 2.2: hrrt_osem3d tests.

3. e7_sino_u

3.1 Build Date

Execute "e7_sino_u -v" in a command window to get the build ID and the fill the field build date below.

Build date	

Table 3.1: e7_sino_u build date.

3.2 Tests

Tag	Verification	Expected results	Actual results	Pass/fail
T3.1	Open recongui.log in c:\cps\\log directory; locate the command e7_sino_u and verify that –os2d was used in test T2.3.	Yes		
T3.0	Remove "–os2d" from e7_sino_u command (T3.1) and execute in a command window.	The output sinogram should be the same as the one created in test preparation (see 1.4).		
T3.2	Add the option –lber b to e7_sino_u command (T3.1) and execute in a command window.	The values used for front and back layer energy background are printed at the end and are the specified ones.		

Table 3.2: e7_sino_u test.

4. Cluster Reconstruction

4.1 Build Dates

Execute "clc_u -v", "clq_u -v", and "clcrecon" in a command window to get the build IDs and the fill the fields build date below.

Executable	Build date
clc_u	
clq_u	
Clcrecon	

Table 4.1: cluster components build dates.

4.2 Cluster configuration

●Create the directory c:\cps\cluster_u on the reconserver if it doesn't exist.

●Edit the cluster and queue configuration files ClusterConfig.txt and QueueConfig.txt in c:\cps\cluster_u. See specifications for format.

●Install the cluster and queue service with the commands "clc_u -i" and "clq_u -i"; or update with the commands "clc_u -U" and "clq_u -U" if the services are already installed.

●Download clcrecon.exe to the nodes with the command "clc_u -d clcrecon.exe"

●Download hrrt_osem3d.exe to the nodes with the command "clc_u -d hrrt_osem3d.exe".

●Download gendelays.exe to the nodes with the command "clc_u -d gendelays.exe "

4.3 Tests

Tag	Verification	Expected results	Actual results	Pass/fail
T4.4	Run clc_u -V	All cluster computers should report the same revision as in 4.1		
T4.4	Run clq_u -V	The command reports the version of the current exe and the running ClusterQueue service. Both revisions should be the same as in 4.1		
T4.5, T4.6, T4.7	Configure an start a multi-frame reconstruction in ReconGUI_u	ReconGUI_u should create corresponding clcrecon reconstruction jobs in the cluster directory. Verify if the files start with "#! clcrecon", the delayed file is the .ch file and the scatter file is in the new 2D format.		

T4.8	N/A	Open c:\cps\cluster_u\serverlog.txt and verify that hrrt_osem3d was started on the nodes with the correct UNC paths.		

Table 4.2: cluster reconstruction tests.

5. Component-Based Normalization: norm_process

5.1 Required Data File

Rotating ^{68}Ge rod normalization scan listmode, minimum 1h with a new rod and 2h for with old rod.

5.2 Build Date

Execute "norm_process" without argument in a command window to get the build ID and the fill the field build date below.

Build date	

Table 5.1: norm_process build date

5.3 Tests

Tag	Verification	Expected results	Actual results	Pass/fail
T5.1	Shortcut on desktop	The installation procedure creates a shortcut to norm_process.exe		
T5.1	Default arguments	Drag and drop the listmode on norm_process shortcut. Norm_process creates span9 normalization and crystal efficiencies files (in the folder of the input file).		
T5.1	Create span3 norm: run norm_process with the efficiencies file created above and "-s 3,67" and "-o norm_span3.n"	norm_process creates a span3 norm from the crystal efficiencies.		
T5.2	-d duration (e.g. -d 1800)	Specify the duration of the listmode to be processed in sec (e.g. 1800). Norm_process displays the listmode time as it is computing		

		the fansum. Verify that only the specified duration is used.		
T5.3	Create Low-Resolution norm: Run norm_process with the crystal efficiencies and "-L 2" and "-o norm_LR.n"	norm_process creates a low resolution norm_LR.n (56MB).		

Table 5.2: norm_process tests

Arguments -L 1, -g, -I, -M, -c, -K, -R, -T are only included in the Specifications document for debugging, not for this test.

6. lmhistogram_u

6.1 Build Date

Execute lmhistogram_u without arguments in a command window to get the build ID and the fill the field build date below.

Build date	

Table 6.1: lmhistogram_u build date

6.2 Tests

Start ReconGUI_u to execute tests in table below.

Tag	Verification	Expected results	Actual results	Pass/Fail
T6.1	Configure mu-map, attenuation, scatter and OP-OSEM reconstruct (16 subsets, 6 iterations) from test listmode files (emission and transmission) and execute "execute all". Image is referred to as **image6**.	Emission is histogrammed with –pr option and the random sinogram "_ra.s" is not created. Display image1 and image6 in Vinci and compute the ratio. The ratio image values range should be 1.0±0.01.		
T6.2	Select span3 in	Verify that the prompt		

	ReconGUI_U interface. Conigure the scatter process with the emission listmode and "start execute only".	sinogram is in span3 and trues sinogram used for scatter is in span9.		
T 6.3	Execute lmhistogram with –"L 1"	Open the header and verify that sinogram size is 160x144, the bin size is 2mm, the plane separation is 2.4375mm the span is 7 and maximum ring difference is 38.		
T 6.4	Execute lmhistogram with –"L 2"	Open the header and verify that sinogram size is 128x144, the bin size and plane separation are 2.4375mm, the span is 7 and maximum ring difference is 38.		

Table 6.2: lmhistogram tests.

7. ReconGUI_u

7.1 Build Date

Start ReconGUI_u and fill the build date below with the date displayed in the window title.

Build date	

Table 7.1: ReconGUI_u build date

7.2 Tests

Exit ReconGUI_u, edit C:\cps\USERS_SW\recon.ini to change Mu Zoom and TX Scatter factors as below:

> *Mu Zoom : 2,1*
> *TX Scatter Factors: -0.1,1.18*

Restart ReconGUI_u to execute tests in table below.

Tag	Verification	Expected results	Actual results	Pass/Fail
T7.1	Done in T2.1	See T2.1	See T2.1	

T7.2	Done in T2.1	See T2.1	See T2.1	
T7.3	Done in T4.5 – T4.7	See T4.5-T4.7	See T4.5-T4.7	
T7.4	Done in T2.2	Done in T2.2	See T2.2	
T7.5	Configure and execute mu-map processing.	Verify that e7_atten_u is executed with "—uzoom 2,1".		
T7.6	Done in T7.5	Verify that e7_atten_u was executed with "—txsc –0.1, 1.18" in T7.2		

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8. if2e7

8.1 Build Date

Execute "if2e7 –version" in a command window to get the build ID and the fill the field build date below. If you are already using if2e7, fill the dates for current and the new test version.

| Current version build date | |
| Test version build date | |

Table 8.1: if2e7 build date

8.2 Tests

Tag	Verification	Expected results	Actual results	Pass/Fail
T8.0	If you are already using if2e7, run this version and the new version with same arguments. Output files are referred as image0.v and image1.v	Display image0.v and image1.v in Vinci and compute the ratio. The ratio image values range should be 1.0±0.01.		
T8.1	Use –F option to create image2.v with your insitution in the facility name field.	See T2.1	See T2.1	
T8.2	Use –D dirname	The output file is duplicated in dirname		
T8.3	-T	The output image is truncated , empty slices		

		are discarded.		

Table 8.2: if2e7 tests

9. calcringroiratio

9.1 Build Date

Execute calcringroiratio without arguments in a command window to get the build ID and the fill the field build date below. If you are already using calcringroiratio, fill the dates for current and the new test version.

Current version build date	
Test version build date	

Table 9.1: calcringroiratio build date

9.2 Tests

Tag	Verification	Expected results	Actual results	Pass/Fail
T9.0	If you are already using calcringroiratio, run this version and the new version with same arguments.	The computed ratio should be the same within 0.1%.		

Table 9.2: calcringroiratio tests

10. e7_atten_u

9.1 Build Date

Execute e7_atten_u –v to get the build ID and the fill the field build date below.

Build date	

Table 10.1: e7_atten_u build date

10.2 Tests

Tag	Verification	Expected results	Actual results	Pass/Fail
T10.0	Done in 6.2.	See 6.2		
T10.1	Done in 7.5	See 7.5		

Table 10.2: calcringroiratio tests