CLAIMS

We claim:

1. A system for registration, comprising:

a robotic arm operably connected to a histotripsy system;

a phantom operable connected to the robotic arm; and

a computing device operably connected to histotripsy system, the computing device including a processor and a memory, the memory storing therein instructions that when executed by the processor cause the computing device to perform steps of:

driving the robotic arm to an imaging location;

imports cone-beam computed tomography (CT) images of the phantom;

determines a number and orientation of markers within at least one of the imported cone-beam CT images; and

registers a coordinate system of the histotripsy system with a coordinate system of a cone-beam CT imaging device.

2. The system of claim 1, wherein the instructions when executed by the processor cause the computing device to display instruction via a user-interface to drive the phantom to an iso-center of the cone-beam CT imaging device.

3. The system of claim 2, wherein the instruction when executed by the processor cause the computing device to display instructions via a user interface to align a light alignment feature of the cone-beam CT imaging device with an iso-center alignment feature on the phantom.

4. The system of claim 1, wherein the instructions when executed by the processor cause the computing device to display instructions via a user interface to adjust a position of the phantom to a center of the cone-beam CT imaging device field of view, prior to capturing images of the phantom.

5. The system of claim 4, wherein the instructions when executed by the processor cause the computing device to display instructions via the user interface to align a light alignment feature of the cone-beam CT imaging device with one or more crosshairs on the phantom.

6. The system of claim 1, wherein the instructions when executed by the processor cause the computing device to display instructions via a user interface to attach the phantom to the robotic arm; and/or

wherein the instructions when executed by the processor cause the computing device to display instructions via a user interface to arrange the cone-beam CT imaging device and the histotripsy system perpendicular to a patient bed.

7. The system of claim 6, wherein the instructions when executed by the processor cause the computing device to display instructions via the user interface to lock wheels of the cone-beam CT imaging device and the histotripsy system.

8. The system of claim 1, wherein the instructions when executed by the processor cause the computing device to display instructions via a user interface to confirm clearance of the cone-beam CT imaging device and the robotic arm; and/or

wherein the instructions when executed by the processor cause the computing device to display instructions via a user interface to confirm a quality of the cone-beam CT images prior to importing the cone-beam CT images.

9. A method of registering a coordinate system of a cone-beam computed tomography (CT) imaging device and a robotic histotripsy system, comprising:

robotically driving a phantom connected to a robotic arm to an imaging location; importing cone-beam CT images captured by a cone-beam CT imaging device of the phantom;

displaying an image from the imported cone-beam CT images of the phantom, wherein the displayed image depicts at least one marker in the phantom;

assessing a number and orientation of the at least one marker in the imported cone-beam CT images compared to a known number and orientation of the at least one marker in the phantom; and

registering a coordinate system of the cone-beam CT imaging device to a coordinate system of the histotripsy system.

10. The method of claim 9, further comprising: driving the phantom to an iso-center of the cone-beam CT imaging device; or

driving the phantom to a non-iso-center location of the cone-beam CT imaging device.

11. The method of claim 9, further comprising: driving the phantom to a pre-determined location of the cone-beam CT imaging device; and/or

aligning a light alignment feature of the cone-beam CT imaging device with an iso-center alignment marker on the phantom; and/or

adjusting a position of the phantom to a center of the cone-beam CT imaging device field of view, prior to capturing images of the phantom.

12. The method of claim 11, wherein a light alignment feature of the cone-beam CT imaging device is aligned with one or more crosshairs on the phantom.

13. The method of claim 9, further comprising: attaching the phantom to the robotic arm of the histotripsy system; and/or

arranging the cone-beam CT imaging device and the histotripsy system perpendicular to a patient bed.

14. The method of claim 9, further comprising: confirming clearance of the cone-beam CT imaging device and the robotic arm of the histotripsy system.

15. The method of claim 9, further comprising confirming a quality of the cone-beam CT images prior to importing the cone-beam CT images.