

Claims:

1. An imaging device for acquiring a time series of in vivo images of a region of a subject's body, the imaging device including:
 - 5 at least three energy sources;
at least three detectors for detecting energy from the at least three energy sources passing through the region of the subject's body located between the energy sources and detectors, wherein at least two pairs of energy sources and detectors are spatially positioned around the subject's
 - 10 body in a first plane, and at least one pair of energy sources and detectors is spatially positioned around the subject's body in a second plane, wherein the first plane and the second plane intersect through the region of the subject's body to be imaged; and
a controller configured to operate the energy sources and detectors to
 - 15 acquire a time series of in vivo images of the region of the subject's body.
2. The imaging device according to claim 1, wherein the controller is configured to acquire the images using at least three imaging angles through the region of the subject's body, wherein at least two imaging angles are provided in the first plane through the subject's body, and at least one imaging angle is provided in
- 20 the second plane through the subject's body.
3. The imaging device according to claim 2, wherein the at least two imaging angles in the first plane are spaced apart in a range of about 45 to 90 degrees.
4. The imaging device according to any one of the preceding claims, wherein at least one of the detectors is angled relative to the respective energy source.
- 25 5. The imaging device according to any one of the preceding claims, wherein at least one of the detectors is substantially aligned with the respective energy source.
6. The imaging device according to any one of the preceding claims, wherein the at least two energy sources and the at least two detectors in the first plane are

each located on a respective common arc in the first plane through the subject's body.

7. The imaging device according to any one of the preceding claims, further including at least four energy sources and at least four detectors, wherein at least three pairs of energy sources and detectors are spatially positioned in the first plane, and at least one pair of energy sources and detectors is spatially positioned in the second plane.
8. The imaging device according to claim 7, wherein the controller is configured to acquire the images using at least four imaging angles through the region of the subject's body, wherein at least three imaging angles are provided in the first plane through the subject's body, and at least one imaging angle is provided in the second plane through the subject's body.
9. The imaging device according to claim 8, wherein the at least three imaging angles in the first plane are spaced apart from each other in a range of about 45 to 90 degrees.
10. The imaging device according to any one of claims 7 to 9, wherein the at least three energy sources and the at least three detectors in the first plane are each located on a respective common arc in the first plane through the subject's body.
11. The imaging device according to any one of the preceding claims, wherein at least one pair of energy sources and detectors is located in both of the first and second planes.
12. The imaging device according to any one of claims 1 to 6, further including at least four energy sources and at least four detectors, wherein at least two pairs of energy sources and detectors are spatially positioned in the first plane and at least two pairs of energy sources and detectors are spatially positioned in the second plane.
13. The imaging device according to claim 12, wherein the controller is configured to acquire the images using at least four imaging angles through the region of

the subject's body, wherein at least two imaging angles are provided in the first plane through the subject's body, and at least two imaging angles are provided in the second plane through the subject's body.

- 5 14. The imaging device according to claim 13, wherein the at least two imaging angles in the second plane are spaced apart in a range of about 45 to 70 degrees.
- 10 15. The imaging device according to any one of claims 12 to 14, wherein at least two of the detectors are angled relative to the respective energy sources, and at least two of the detectors are substantially aligned with the respective energy sources.
- 15 16. The imaging device according to any one of claims 12 to 14, wherein the at least two energy sources and the at least two detectors in the second plane are each located on a respective common arc in the second plane.
17. The imaging device according to any one of the preceding claims, wherein the second plane is offset at an angle of about 70 to 90 degrees relative to the first plane.
18. The imaging device according to claim 17, wherein the first plane is a transverse plane through the subject's body, and the second plane is a sagittal plane through the subject's body.
- 20 19. The imaging device according to any one of the preceding claims, configured for accommodating the subject in an upright orientation between the energy sources and detectors.
20. The imaging device according to any one of the preceding claims, configured for accommodating the subject between the energy sources and detectors in a position that is closer to the detectors than the energy sources.
- 25 21. The imaging device according to any one of the preceding claims, wherein the controller is configured to operate the energy sources and detectors to acquire

a time series of in vivo images of the region of the subject's body simultaneously or at substantially the same time from each of the detectors.

22. The imaging device according to claim 21, further including a processor configured to reconstruct a three-dimensional motion field based on the time series of images acquired from each of the detectors.
23. The imaging device according to any one of the preceding claims, configured for use with one or more of x-ray imaging, ultrasound imaging, and magnetic resonance imaging (MRI).
24. The imaging device according to any one of the preceding claims, wherein the region of the subject's body to be imaged includes at least part of the lungs of the subject.
25. A method for acquiring a time series of in vivo images of a region of a subject's body, the method including the steps of:
- providing an imaging device including:
 - at least three energy sources;
 - at least three detectors for detecting energy from the at least three energy sources passing through the region of the subject's body located between the energy sources and detectors, wherein at least two pairs of energy sources and detectors are spatially positioned around the subject's body in a first plane, and at least one pair of energy sources and detectors is spatially positioned around the subject's body in a second plane, wherein the first plane and the second plane intersect through the region of the subject's body to be imaged; and
 - a controller configured to operate the energy sources and the detectors to acquire a time series of in vivo images of the region of the subject's body; and
 - operating the controller to acquire the time series of in vivo images of the region of the subject's body.

26. The method according to claim 25, further including the step of:

operating the controller to acquire a time series of in vivo images of the region of the subject's body simultaneously or at substantially the same time from each of the detectors.

27. The method according to claim 26, further including the step of:
5 reconstructing, using a processor, a three-dimensional motion field based on the time series of images acquired from each of the detectors.
28. The method according to any one of claims 25 to 27, further including the step of:
10 prior to operating the controller to acquire the images, positioning the subject in the imaging device in an upright orientation between the energy sources and detectors.
29. The method according to any one of claims 25 to 28, wherein the imaging device is configured for use with one or more of x-ray imaging, ultrasound imaging, and magnetic resonance imaging (MRI).
- 15 30. The method according to any one of claims 25 to 29, wherein the region of the subject's body to be imaged includes at least part of the lungs of the subject.