WHAT IS CLAIMED IS:

1. A ray scanning apparatus, comprising:

a conveying device, for conveying an object under inspection to pass through a scanning area of the ray scanning apparatus;

a ray source assembly, comprising a plurality of ray source modules, each ray source module comprising at least one ray source point emitting a ray beam, and the plurality of ray source modules being arranged around the scanning area on an upper side of the conveying device and fixed in a plane perpendicular to a conveying direction of the object under inspection; and

a detector assembly, for detecting rays transmitting through the object under inspection during scanning and comprising a plurality of detector sets, end portions of the plurality of detector sets being connected to each other to surround the scanning area, and the plurality of detector sets being fixed in a plane perpendicular to the conveying direction of the object under inspection,

wherein the detector assembly is located between the ray source assembly and the scanning area in a direction perpendicular to the conveying direction of the object under inspection, the ray source assembly and the detector assembly are arranged to overlap at least partially in the conveying direction of the object under inspection, and the plurality of ray source modules can be mounted and detached independently of each other.

2. The ray scanning apparatus according to claim 1, wherein the ray source module is a distributed ray source, and the plurality of ray source modules are arranged around the scanning area and form a non-enclosed structure opened on a lower side of the conveying device.

3. The ray scanning apparatus according to claim 2, wherein each of the plurality of ray source modules is a straight line distributed ray source, and the plurality of straight line distributed ray sources are arranged on upper, left, and right sides of the scanning area, wherein end portions of the plurality of straight line distributed ray sources are directly connected to or spaced apart from each other.

4. The ray scanning apparatus according to claim 2, wherein the plurality of ray source modules comprise a plurality of first distributed ray sources and a plurality of second distributed ray sources, the plurality of first distributed ray sources are arranged alternately with the plurality of second distributed ray sources, and their end portions are directly connected to or spaced apart from each other.

5. The ray scanning apparatus according to claim 4, wherein the first distributed ray sources are straight line distributed ray sources, and the second distributed ray sources are straight line distributed ray sources or arc-shaped distributed ray sources shorter than the first distributed ray sources.

6. The ray scanning apparatus according to claim 1, wherein each of the plurality of ray source modules is a single-point source group, a plurality of single-point source groups are arranged at least on a left view angle, a right view angle, a top view angle, and corner squint angles on the upper side of the conveying device, and each single-point source group comprises at least two single-point sources.

7. The ray scanning apparatus according to claim 1, wherein each ray source module comprises a separate chamber to accommodate a respective ray generating device, and the separate chamber of each ray source module is provided with a mounting-positioning structure, which is adapted for mounting and positioning the ray source module and rotating the ray source module to adjust an output angle of the ray beam.

8. The ray scanning apparatus according to claim 1, wherein each detector set is a detector array comprising a plurality of detector units, and the plurality of detector sets are arranged in an enclosed square, rectangular, polygonal, or elliptical structure surrounding the scanning area.

9. The ray scanning apparatus according to claim 8, wherein each detector set is a straight line detector array, and the detector assembly comprises four straight line detector arrays, which are arranged on the upper, lower, left, and right sides of the scanning area respectively to form the rectangular or square structure.

10. The ray scanning apparatus according to claim 8, wherein each detector set is a straight line detector array, the detector assembly comprises a plurality of first straight line detector arrays and a plurality of second straight line detector arrays, the second straight line detector arrays are shorter than the first straight line detector arrays, and the first straight line detector arrays and the second straight line detector arrays are arranged alternately around the scanning area to form a polygonal structure.

11. The ray scanning apparatus according to claim 8, wherein the respective detector sets of the detector assembly can be mounted and detached independently of each other.

12. The ray scanning apparatus according to claim 11, wherein the respective detector sets of the detector assembly are configured to move in the conveying direction of the object under inspection for being mounted and detached.

13. The ray scanning apparatus according to claim 11, wherein some of the detector sets of the detector assembly are configured to move in the conveying direction of the object under inspection for being mounted and detached, and other detector sets are configured to move in the direction perpendicular to the conveying direction of the object under inspection for being mounted and detached.

14. The ray scanning apparatus according to claim 12, wherein each detector set of the detector assembly comprises a detector arm, the ray scanning apparatus comprises a support frame being stationary relative to a mounting platform of the ray scanning apparatus, and the detector set moves in the conveying direction of the object under inspection or the direction perpendicular to the conveying direction of the object under inspection through the detector arm, so as to be mounted to the support frame or detached from the support frame.

15. The ray scanning apparatus according to claim 8, wherein each detector set of the detector assembly on the same side as a ray source module relative to the scanning area is configured to avoid the ray beam of said ray source module and to receive rays from the ray source modules on all the remaining sides except said ray source module.

16. The ray scanning apparatus according to claim 8, wherein each detector unit of the detector set comprises a detector crystal for receiving the rays transmitting through the object under inspection during scanning, and the detector crystal is arranged at an end portion of the detector unit in the conveying direction of the object under inspection and arranged to be, in the conveying direction of the object under inspection, immediately adjacent to emission area of the ray beam of the ray source module on the same side relative to the scanning area while not to obstruct the ray beam.

17. The ray scanning apparatus according to claim 16, wherein each ray source module of the ray source assembly on the same side as a detector set relative to the scanning area is arranged so that its ray beam avoids said detector set and illuminates the detector crystal of the detector set on the opposite side of the ray source module.

18. The ray scanning apparatus according to claim 17, wherein each ray source module is configured to rotate around a target spot axis so as to illuminate the detector crystal of the detector set on the opposite side of the ray source module with a center position of the ray beam.

19. The ray scanning apparatus according to claim 1, further comprising:

an image processing module configured to compensate for missing projection data at end portions of the ray source modules and/or repair a reconstructed image to obtain a complete reconstructed image.

20. The ray scanning apparatus according to claim 19, wherein the image processing module is configured to perform image reconstruction by an iterative method, an image domain repair method, or a combination of the both.