CLAIMS

1. A method of providing image data for constructing an image of a region of a target object, comprising:

providing a reference diffraction pattern of a reference target object;

determining an initial guess for a probe function based upon the reference diffraction pattern; and

determining, by an iterative process based on the initial guess for the probe function and an initial guess for an object function, image data for a target object responsive to an intensity of radiation detected by at least one detector.

2. The method of claim 1 wherein the reference diffraction pattern is based on an intensity of radiation detected by the at least one detector.

3. The method of claim 1 wherein the radiation detected by the at least one detector is reflected from the reference target object.

4. The method of claim 1 wherein the radiation detected by the at least one detector is transmitted through the reference target object.

5. The method of any of the preceding claims wherein the initial guess for the probe function is used to determine image data for one or a plurality of target objects.

6. The method of any of the preceding claims wherein the reference target object is a first target object for which image data is determined.

7. The method of any of the preceding claims wherein the reference target object is a target object only used for calibration purposes.

8. The method of any of the preceding claims wherein determining an initial guess for a probe function comprises:

estimating, based on the reference diffraction pattern, a power of radiation incident on a probe area of the reference target object, and

selecting the initial guess for the probe function such that the initial guess for the probe function has an average intensity equal to the estimated average intensity.

9. The method of claim 8, wherein estimating an average intensity comprises:

performing a fast Fourier transform on the reference diffraction pattern to produce a matrix of complex numbers, and

summing the absolute values of the complex numbers to produce a real number, and wherein

selecting the initial guess for the probe function comprises:

taking the square-root of the real number to produce a real-valued number, N,

selecting the initial guess for the probe function, $\mathbf{P}$, to be $\mathbf{P} = \mathbf{M}N/K$, where

$\mathbf{M}$ is a matrix representing the probe area, and K is a normalization factor.

10. The method of claim 9, wherein K is the sum of values in matrix $\mathbf{M}$.

11. The method of claim 9, further comprising providing an estimate of the probe area, wherein

values in matrix $\mathbf{M}$ are zero outside of the estimated probe area and are 1 inside the estimated probe area, and

K is equal to the number of 1 values in matrix $\mathbf{M}$.

12. A machine-readable data storage medium comprising computer executable instructions which, when executed by a computer, perform the method according to any of the preceding claim.

CLAIMS

1. A method of providing image data for constructing an image of a region of a target object, comprising:

providing a reference diffraction pattern of a reference target object;

determining an initial guess for a probe function based upon the reference diffraction pattern; and

determining, by an iterative process based on the initial guess for the probe function and an initial guess for an object function, image data for a target object responsive to an intensity of radiation detected by at least one detector.

2. The method of claim 1 wherein the reference diffraction pattern is based on an intensity of radiation detected by the at least one detector.

3. The method of claim 1 wherein the radiation detected by the at least one detector is reflected from the reference target object.

4. The method of claim 1 wherein the radiation detected by the at least one detector is transmitted through the reference target object.

5. The method of claim 1 wherein the initial guess for the probe function is used to determine image data for one or a plurality of target objects.

6. The method of claim 1 wherein the reference target object is a first target object for which image data is determined.

7. The method of claim 1 wherein the reference target object is a target object only used for calibration purposes.

8. The method of claim 1 wherein determining an initial guess for a probe function comprises:

estimating, based on the reference diffraction pattern, a power of radiation incident on a probe area of the reference target object, and

selecting the initial guess for the probe function such that the initial guess for the probe function has an average intensity equal to the estimated average intensity.

9. The method of claim 8, wherein estimating an average intensity comprises:

performing a fast Fourier transform on the reference diffraction pattern to produce a matrix of complex numbers, and

summing the absolute values of the complex numbers to produce a real number, and wherein

selecting the initial guess for the probe function comprises:

taking the square-root of the real number to produce a real-valued number, N,

selecting the initial guess for the probe function, P, to be P=MN/K, where M is a matrix representing the probe area, and K is a normalization factor.

10. The method of claim 9, wherein K is the sum of values in matrix M.

11. The method of claim 9, further comprising providing an estimate of the probe area, wherein values in matrix M are zero outside of the estimated probe area and are 1 inside the estimated probe area, and K is equal to the number of 1 values in matrix M.

12. A non-transitory machine-readable data storage medium comprising computer executable instructions which, when executed by a computer, perform the method according to claim 1.

13. The method of claim 2 wherein determining an initial guess for a probe function comprises:

estimating, based on the reference diffraction pattern, a power of radiation incident on a probe area of the reference target object, and

selecting the initial guess for the probe function such that the initial guess for the probe function has an average intensity equal to the estimated average intensity.

14. The method of claim 13, wherein estimating an average intensity comprises:

performing a fast Fourier transform on the reference diffraction pattern to produce a matrix of complex numbers, and

summing the absolute values of the complex numbers to produce a real number, and wherein

selecting the initial guess for the probe function comprises:

taking the square-root of the real number to produce a real-valued number, N,

selecting the initial guess for the probe function, P, to be P=MN/K where

M is a matrix representing the probe area, and K is a normalization factor.

15. The method of claim 13, further comprising providing an estimate of the probe area, wherein values in matrix M are zero outside of the estimated probe area and are 1 inside the estimated probe area, and K is equal to the number of 1 values in matrix M.

16. The method of claim 4 wherein determining an initial guess for a probe function comprises:

estimating, based on the reference diffraction pattern, a power of radiation incident on a probe area of the reference target object, and

selecting the initial guess for the probe function such that the initial guess for the probe function has an average intensity equal to the estimated average intensity.

17. The method of claim 16, wherein estimating an average intensity comprises:

performing a fast Fourier transform on the reference diffraction pattern to produce a matrix of complex numbers, and

summing the absolute values of the complex numbers to produce a real number, and wherein

selecting the initial guess fur the probe function comprises:

taking the square-root of the real number to produce a real-valued number, N,

selecting the initial guess for the probe function P, to be P=MN/K, where

M is a matrix representing the probe area, and K is a normalization factor.

18. The method of claim 16, further comprising providing an estimate of the probe area, wherein values in matrix M are zero outside of the estimated probe area and are 1 inside the estimated probe area, and K is equal to the number of 1 values in matrix M.

19. The method of claim 6 wherein determining an initial guess for a probe function comprises:

estimating, based on the reference diffraction pattern, a power of radiation incident on a probe area of the reference target object, and

selecting the initial guess for the probe function such that the initial guess for the probe function has an average intensity equal to the estimated average intensity.

20. The method of claim 19, wherein estimating an average intensity comprises:

performing a fast Fourier transform on the reference diffraction pattern to produce a matrix of complex numbers, and

summing the absolute values of the complex numbers to produce a real number, and wherein

selecting the initial guess for the probe function comprises:

taking the square-root of the real number to produce a real-valued number, N,

selecting the initial guess for the probe function, P, to be P=MN/K, where

M is a matrix representing the probe area, and K is a normalization factor.