

# Supplementary Materials for A Hybrid Frequency-Spatial Domain Model for Sparse Image Reconstruction in Scanning Transmission Electron Microscopy

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## 1. Supplementary #1

The following images are detailed information of reconstruction results from test dataset with the dose  $\lambda = 10e^-$  per selected pixel and 5% sparse ratio. Figure 1, 2 are the extended version of Figure 5 a,b in the main manuscript, which present the detailed experiment results. Figure 3 is the enlarged version of ablation study, and Figure 4-10 are additional examples to demonstrate the effectiveness of our method.

### 1.1. Extended Version of Images in the Manuscript

When the electron dose is relatively low or below a certain level, the sampling signal may be lost in the detector. Fig. 1 shows such a situation, in which FSHNet generates a relatively complete reconstruction, while the methods such as BPFA, CSNet and ReconNet fail to restore the detailed structures of weak signals. On the other hand, the overlapping structure of different lattice features easily leads to the aliasing and collapsed structure. Fig. 2 shows such a situation, in which FSHNet correctly restores the material structures belonging to different lattices, while the other methods only result in blurry ones of the small lattice structure.

Fig. 3 is the extended version of ablation study (Figure 8 in the main manuscript). Without non-local patch enhancement, our method can only produce a coarse structure (shown in Fig. 3g&l). Excluding the global structure prior, our method easily blurs the shape of edges and results in overlapping structures (shown in Fig. 3h&m). Furthermore, without the initial reconstruction, our method acquires no information in blank region of sampling, just filling in the unknown area with simple repeats of the existing structure (shown in Fig. 3i&n). And linear spatial initial reconstruction also fails to restore detailed structure (shown in Fig. 3j&o).

### 1.2. Additional Experiment Results

The following additional comparisons further demonstrates our method's robustness in restoring detailed image structures in sparse sampling with Poisson noise. The concrete analysis of comparison is divided into several categories according to different image features as follow.

**Sampling with high magnification.** Figure 4, 5 demonstrate the performance of different methods on sampling data with relatively high magnification. The results show that our method can restore clear boundary of these micro structures, while the other methods easily generate rough images without any details. It is reasonable that the traditional methods only interpolate the blank sampling depending on a small range of local information, without considering the global prior. A good reconstruction will have similar pixel distributions to the ground truth. The distribution of pixel values of different methods is also demonstrated here. It can be found that the pixel distribution of the reconstruction by our method is most close to the one of ground truth.

**Sampling with low magnification.** Figure 6, 7 compare the performance of different methods on sampling data with relatively low magnification, whose repetitive structure is extremely small. Because of the extremely sparsity of sampling, traditional methods cannot extract enough information for the tiny cyclic structure, leading to serious aliasing effect during

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the interpolation. Furthermore, the distribution of pixel values shows that traditional methods have significant mean shift compared with ground truth. The smaller mean, the darker image and the less information restored.

**Sampling with gradually changed structure.** Figure 8, 9 show the performance of different methods on sampling data with gradually changed structure. The images are of crystalline lattice form or piled repetitive structure with disrupted boundaries. Because of the abrupt change of pixel values around the boundary, traditional methods lose the accurate cyclic structure and the transition region is full of artifact. Guided by additional frequency information, our method successfully restores the clearly discernible structure. Compared with ground truth in distribution of pixel values, traditional methods have an additional smaller peak, which further demonstrates the powerlessness of traditional methods in complete structure restoration.

**Sampling with signal missing.** Figure 10 provides another case of sampling data missing in some areas like Fig. 1. Traditional methods fail to restore the complete structure with the loss of sampling information, while our method generates a relatively complete one. The distribution of pixel values clearly demonstrates that, traditional methods tend to darken image in sparse sampling case.

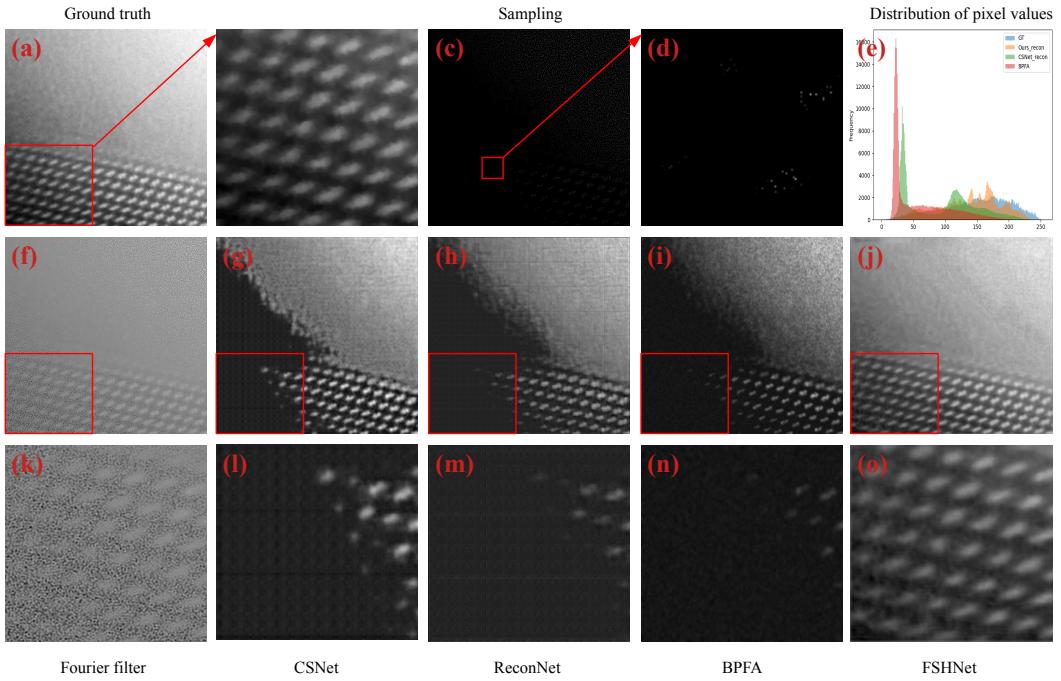


Figure 1: The extended version of the 1<sup>st</sup> experiment results in the manuscript (also the 1<sup>st</sup> in the synthetic dataset). **(a)** Ground truth; **(b)** Enlargement of ground truth; **(c)** Sampling; **(d)** Enlargement of sampling; **(e)** The distribution of pixel values; **(f)** Fourier filter result; **(g)** CSNet result; **(h)** ReconNet result; **(i)** BPFA result; **(j)** FSHNet result; **(k)**, **(l)**, **(m)**, **(n)** and **(o)** are the enlargement of the selected areas by red box in subfigure (f), (g), (h), (i) and (j), respectively.

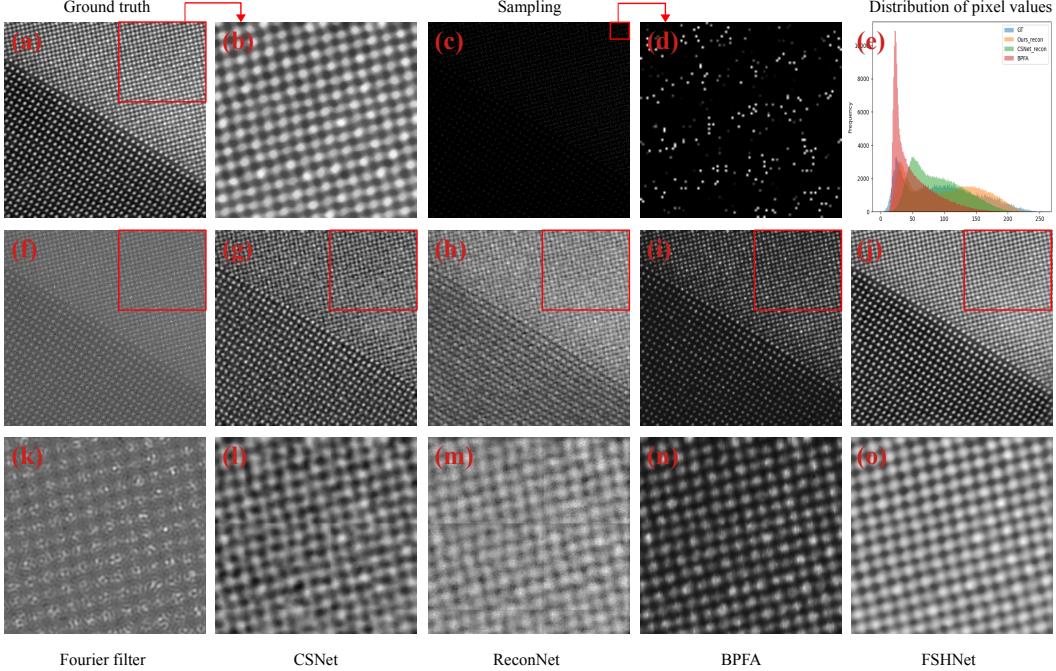


Figure 2: The extended version of the 2<sup>nd</sup> experiment results in the manuscript (also the 2<sup>nd</sup> in the synthetic dataset). **(a)** Ground truth; **(b)** Enlargement of ground truth; **(c)** Sampling; **(d)** Enlargement of sampling; **(e)** The distribution of pixel values; **(f)** Fourier filter result; **(g)** CSNet result; **(h)** ReconNet result; **(i)** BPFA result; **(j)** FSHNet result; **(k)**, **(l)**, **(m)**, **(n)** and **(o)** are the enlargement of the selected areas by red box in subfigure (f), (g), (h), (i) and (j), respectively.

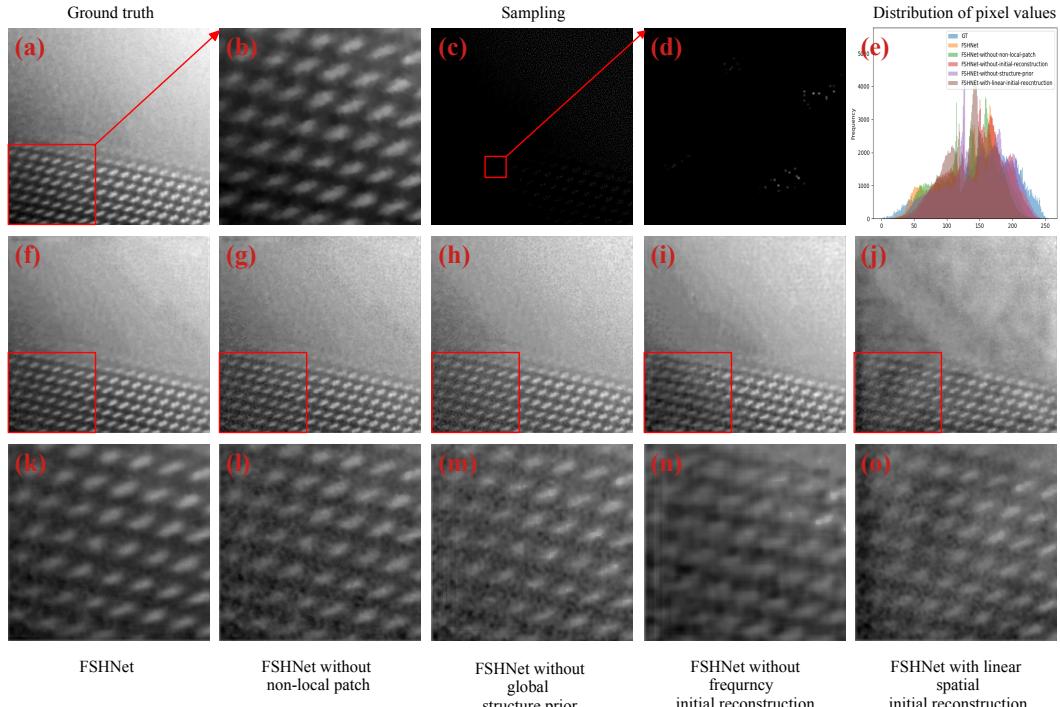


Figure 3: The extended version of ablation study in the manuscript. **(a)** Ground truth; **(b)** Enlargement of ground truth; **(c)** Sampling; **(d)** Enlargement of sampling; **(e)** The distribution of pixel values; **(f)** FSHNet result; **(g)** FSHNet without non-local patch result; **(h)** FSHNet without global structure prior result; **(i)** FSHNet without frequency initial reconstruction result; **(j)** FSHNet with linear spatial initial reconstruction result; **(k)**, **(l)**, **(m)**, **(n)** and **(o)** are the enlargement of the selected areas by red box in subfigure (f), (g), (h), (i) and (j), respectively.

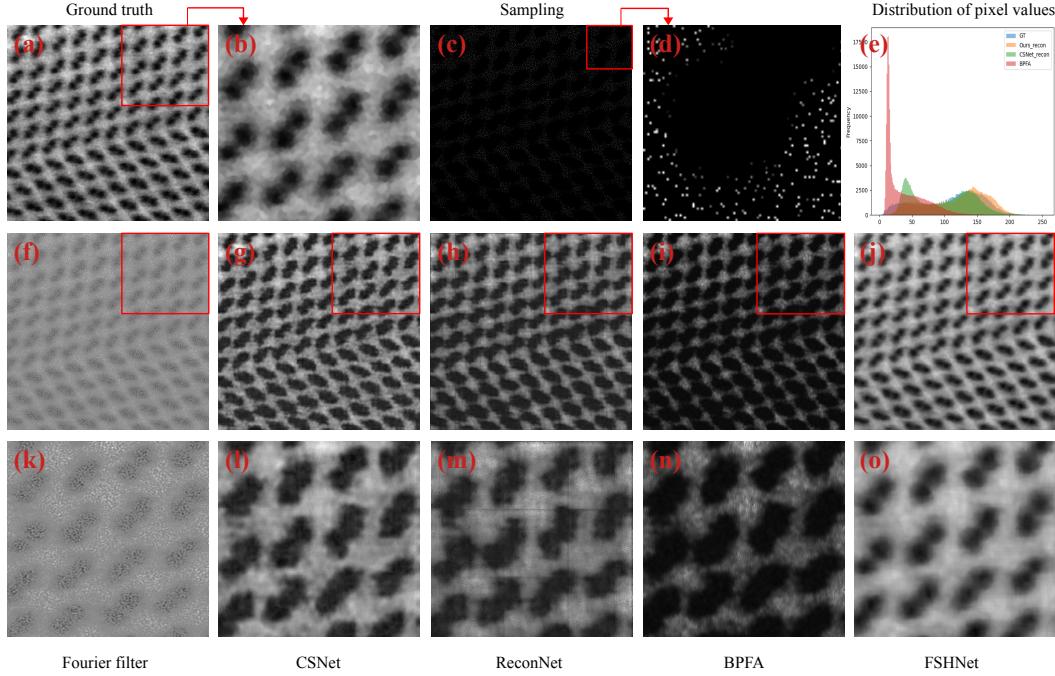


Figure 4: The detailed results of the 3<sup>rd</sup> image in simulated datasets. (a) Ground truth; (b) Enlargement of ground truth; (c) Sampling; (d) Enlargement of sampling; (e) The distribution of pixel values; (f) Fourier filter result; (g) CSNet result; (h) ReconNet result; (i) BPFA result; (j) FSHNet result; (k), (l), (m), (n) and (o) are the enlargement of the selected areas by red box in subfigure (f), (g), (h), (i) and (j), respectively.

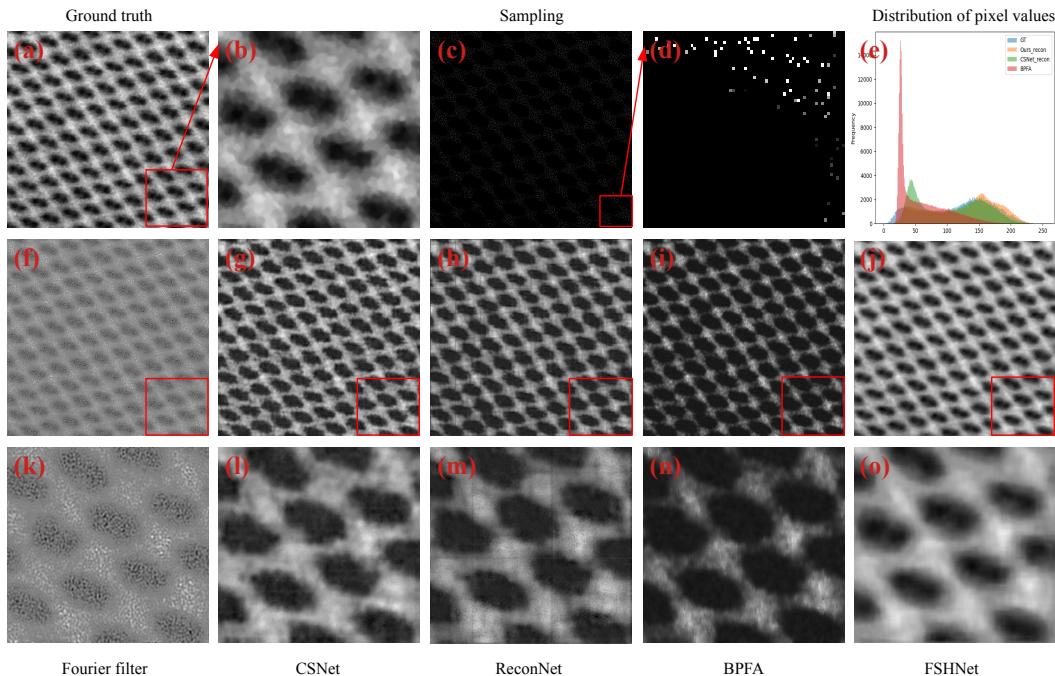


Figure 5: The detailed results of the 4<sup>th</sup> image in simulated datasets. (a) Ground truth; (b) Enlargement of ground truth; (c) Sampling; (d) Enlargement of sampling; (e) The distribution of pixel values; (f) Fourier filter result; (g) CSNet result; (h) ReconNet result; (i) BPFA result; (j) FSHNet result; (k), (l), (m), (n) and (o) are the enlargement of the selected areas by red box in subfigure (f), (g), (h), (i) and (j), respectively.

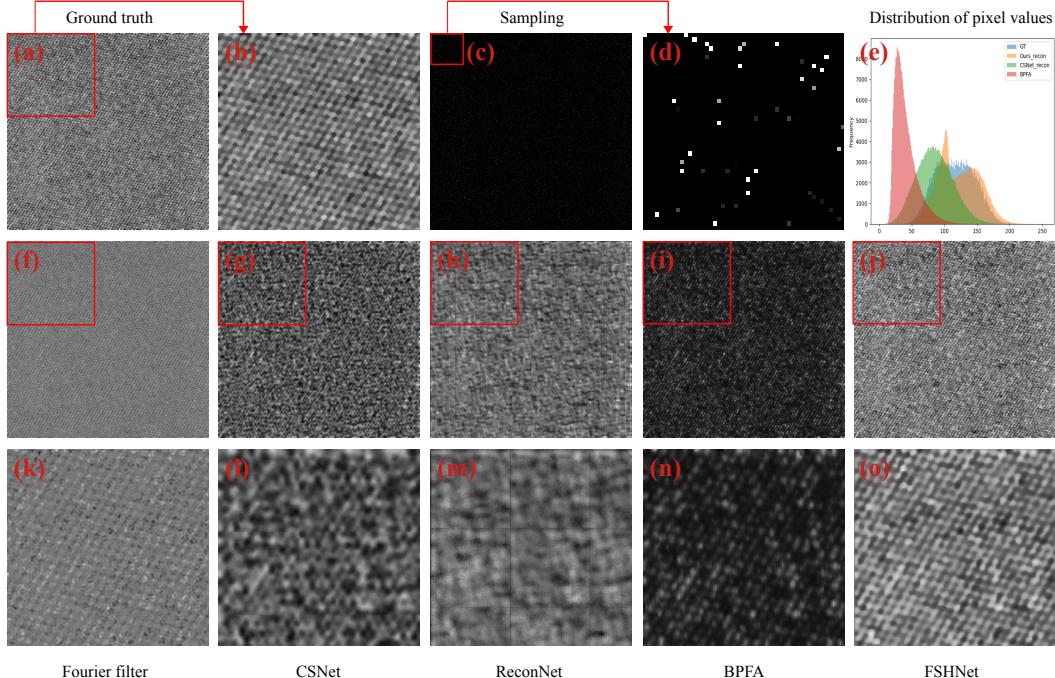


Figure 6: The detailed results of the 5<sup>th</sup> image in simulated datasets. **(a)** Ground truth; **(b)** Enlargement of ground truth; **(c)** Sampling; **(d)** Enlargement of sampling; **(e)** The distribution of pixel values; **(f)** Fourier filter result; **(g)** CSNet result; **(h)** ReconNet result; **(i)** BPFA result; **(j)** FSHNet result; **(k), (l), (m), (n)** and **(o)** are the enlargement of the selected areas by red box in subfigure **(f), (g), (h), (i)** and **(j)**, respectively.

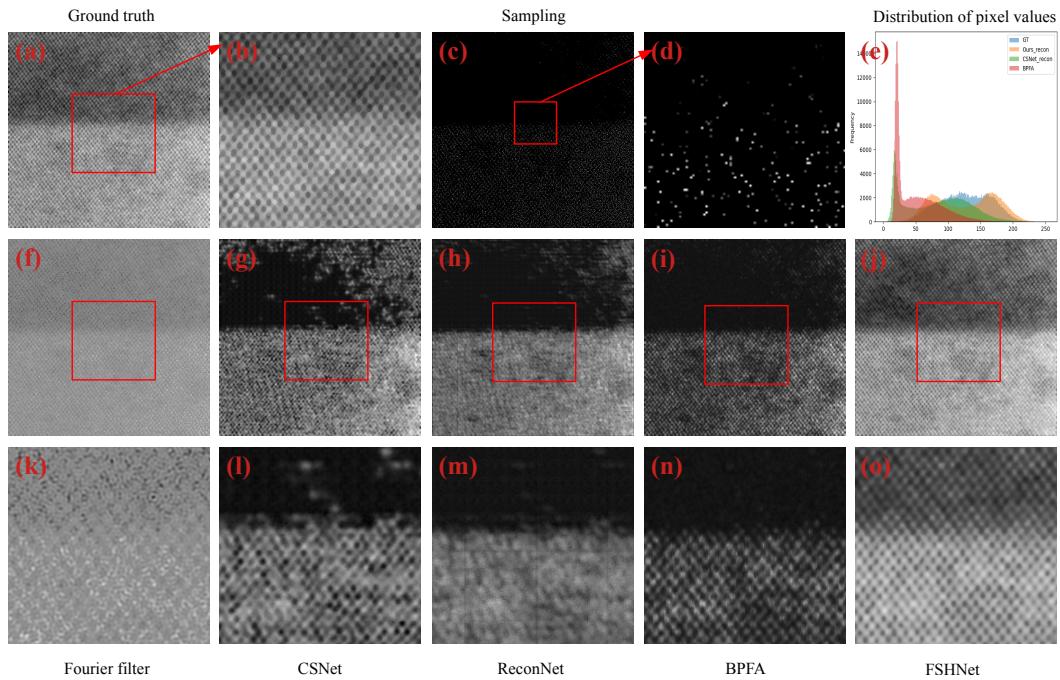


Figure 7: The detailed results of the 6<sup>th</sup> image in simulated datasets. **(a)** Ground truth; **(b)** Enlargement of ground truth; **(c)** Sampling; **(d)** Enlargement of sampling; **(e)** The distribution of pixel values; **(f)** Fourier filter result; **(g)** CSNet result; **(h)** ReconNet result; **(i)** BPFA result; **(j)** FSHNet result; **(k), (l), (m), (n)** and **(o)** are the enlargement of the selected areas by red box in subfigure **(f), (g), (h), (i)** and **(j)**, respectively.

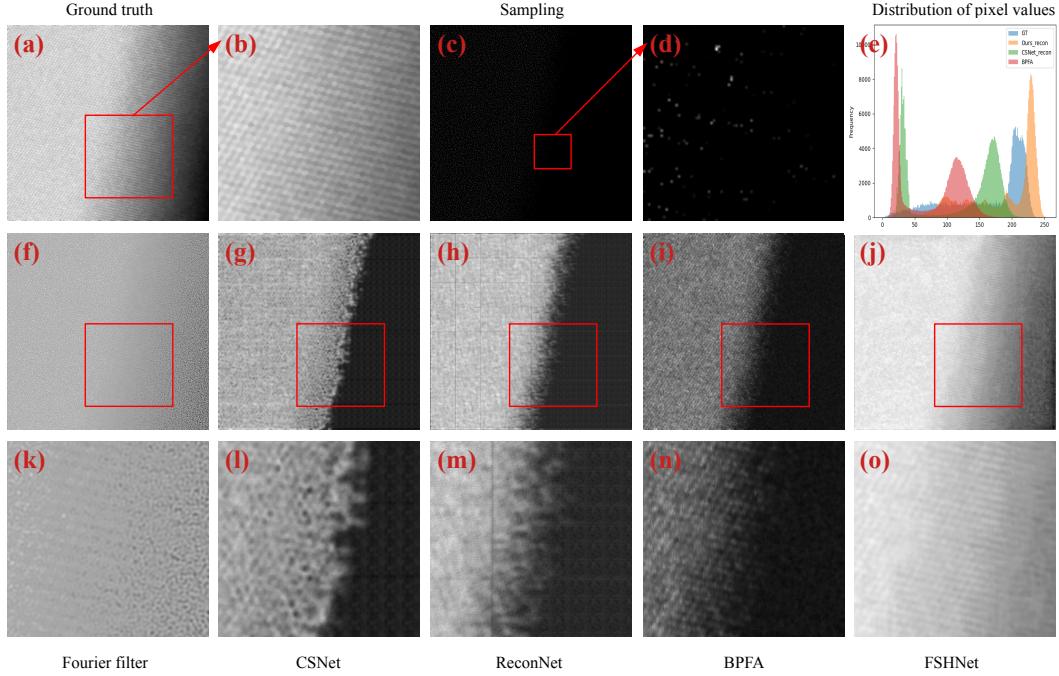


Figure 8: The detailed results of the 7<sup>th</sup> image in simulated datasets. (a) Ground truth; (b) Enlargement of ground truth; (c) Sampling; (d) Enlargement of sampling; (e) The distribution of pixel values; (f) Fourier filter result; (g) CSNet result; (h) ReconNet result; (i) BPFA result; (j) FSHNet result; (k), (l), (m), (n) and (o) are the enlargement of the selected areas by red box in subfigure (f), (g), (h), (i) and (j), respectively.

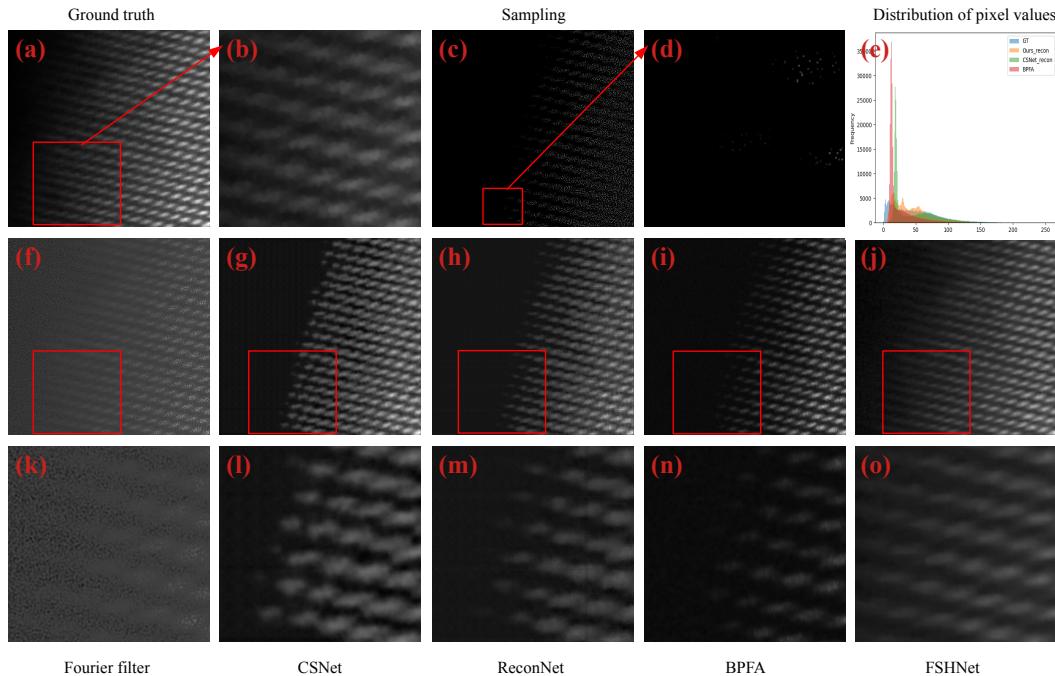


Figure 9: The detailed results of the 8<sup>th</sup> image in simulated datasets. (a) Ground truth; (b) Enlargement of ground truth; (c) Sampling; (d) Enlargement of sampling; (e) The distribution of pixel values; (f) Fourier filter result; (g) CSNet result; (h) ReconNet result; (i) BPFA result; (j) FSHNet result; (k), (l), (m), (n) and (o) are the enlargement of the selected areas by red box in subfigure (f), (g), (h), (i) and (j), respectively.

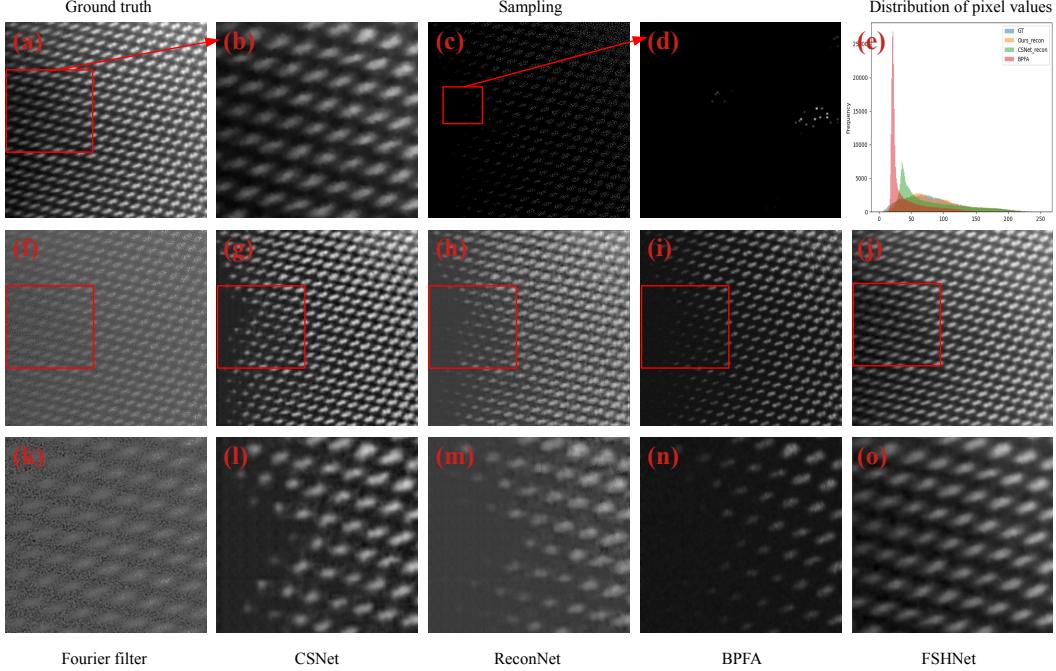


Figure 10: The detailed results of the 9<sup>th</sup> image in simulated datasets. (a) Ground truth; (b) Enlargement of ground truth; (c) Sampling; (d) Enlargement of sampling; (e) The distribution of pixel values; (f) Fourier filter result; (g) CSNet result; (h) ReconNet result; (i) BPFA result; (j) FSHNet result; (k), (l), (m), (n) and (o) are the enlargement of the selected areas by red box in subfigure (f), (g), (h), (i) and (j), respectively.

## 2. Supplementary #2

The following tables demonstrate the PSNR/SSIM results for each image in the test dataset. Similar with the experiment in the main manuscript, all the experiments are carried out with model trained on a NVIDIA RTX 3080 GPU. The batch size is set to 4 with  $4 \times 1024 \times 1024$  input during total 100 epochs. The optimizer of model is Adam with default parameters and the learning rate is 0.0001. For non-local patch module, the control parameter are set as  $h = 0.5$  if the sampling ratio lower than 3%, otherwise  $h = 1$ . For the initial reconstruction, the max frequency domain threshold is set as  $r_i = 150$ . For the global structure features extraction, the max frequency domain threshold is set as  $r_g = 100$  and the number of selected amplitude component is set as  $k = 200$ . For the non-local patch enhancement, the region of interest is set as  $\mathcal{R} = 128 \times 128$  and the stride step is set to the quarter of patch sizes. The parameters in the loss function takes  $\lambda_1 = 0.2$  and  $\lambda_2 = 0.01$ .

Table 1: PSNR(dB)/SSIM results of different methods on the 1<sup>st</sup> test data

| Sampling ratio \ Method |    | Dose per Pixel     | CSNet       | ReconNet           | FSHNet |
|-------------------------|----|--------------------|-------------|--------------------|--------|
| 1.56%                   | 10 | <b>13.30/0.646</b> | 11.31/0.463 | <b>24.96/0.857</b> |        |
|                         | 25 | <b>11.86/0.567</b> | 10.68/0.494 | <b>25.20/0.877</b> |        |
| 3.125%                  | 10 | <b>14.48/0.680</b> | 11.13/0.516 | <b>27.26/0.847</b> |        |
|                         | 25 | <b>12.68/0.629</b> | 10.69/0.502 | <b>26.42/0.890</b> |        |
| 5%                      | 10 | <b>12.47/0.602</b> | 11.45/0.519 | <b>28.50/0.894</b> |        |
|                         | 25 | <b>13.70/0.660</b> | 10.51/0.506 | <b>29.32/0.899</b> |        |
| 6.25%                   | 10 | <b>13.41/0.648</b> | 10.93/0.517 | <b>27.33/0.889</b> |        |
|                         | 25 | <b>13.00/0.649</b> | 11.05/0.528 | <b>29.21/0.874</b> |        |
| 8%                      | 10 | <b>12.89/0.628</b> | 10.14/0.469 | <b>27.36/0.911</b> |        |
|                         | 25 | <b>12.86/0.650</b> | 11.94/0.583 | <b>27.61/0.910</b> |        |
| 9.375%                  | 10 | <b>13.89/0.645</b> | 11.49/0.559 | <b>22.02/0.894</b> |        |
|                         | 25 | <b>13.24/0.663</b> | 11.84/0.582 | <b>28.84/0.911</b> |        |

Table 2: PSNR(dB)/SSIM results of different methods on the 2<sup>nd</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 18.55/0.743 | 15.98/0.398 | 24.61/0.907 |
|                         | 25             | 17.61/0.723 | 17.96/0.604 | 24.59/0.914 |
| 3.125%                  | 10             | 19.01/0.771 | 16.45/0.495 | 26.12/0.927 |
|                         | 25             | 17.99/0.753 | 18.10/0.635 | 25.95/0.930 |
| 5%                      | 10             | 19.30/0.778 | 14.55/0.465 | 22.73/0.916 |
|                         | 25             | 18.94/0.765 | 16.55/0.620 | 26.16/0.929 |
| 6.25%                   | 10             | 19.18/0.776 | 14.76/0.426 | 23.41/0.926 |
|                         | 25             | 19.07/0.764 | 17.96/0.631 | 27.01/0.942 |
| 8%                      | 10             | 19.11/0.793 | 17.16/0.566 | 23.88/0.928 |
|                         | 25             | 19.17/0.760 | 17.28/0.624 | 28.17/0.950 |
| 9.375%                  | 10             | 18.73/0.758 | 15.48/0.502 | 26.84/0.948 |
|                         | 25             | 19.14/0.755 | 16.82/0.611 | 27.96/0.950 |

Table 3: PSNR(dB)/SSIM results of different methods on the 3<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 22.12/0.677 | 15.80/0.561 | 23.56/0.832 |
|                         | 25             | 20.91/0.666 | 15.24/0.576 | 25.72/0.850 |
| 3.125%                  | 10             | 20.58/0.682 | 16.51/0.591 | 20.41/0.834 |
|                         | 25             | 21.01/0.688 | 16.49/0.614 | 28.72/0.862 |
| 5%                      | 10             | 19.05/0.690 | 18.39/0.588 | 26.51/0.857 |
|                         | 25             | 21.12/0.696 | 17.29/0.629 | 27.18/0.870 |
| 6.25%                   | 10             | 20.43/0.686 | 19.40/0.629 | 26.51/0.865 |
|                         | 25             | 22.83/0.703 | 17.27/0.633 | 28.83/0.877 |
| 8%                      | 10             | 22.56/0.711 | 15.79/0.585 | 28.18/0.873 |
|                         | 25             | 21.93/0.709 | 16.79/0.628 | 27.06/0.885 |
| 9.375%                  | 10             | 21.08/0.696 | 18.56/0.616 | 29.98/0.885 |
|                         | 25             | 21.62/0.712 | 16.03/0.621 | 30.38/0.882 |

Table 4: PSNR(dB)/SSIM results of different methods on the 4<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 22.44/0.664 | 18.56/0.583 | 24.54/0.823 |
|                         | 25             | 20.75/0.642 | 16.39/0.603 | 25.98/0.845 |
| 3.125%                  | 10             | 22.45/0.680 | 18.18/0.599 | 26.86/0.847 |
|                         | 25             | 22.18/0.675 | 17.90/0.630 | 27.76/0.851 |
| 5%                      | 10             | 21.20/0.691 | 20.05/0.586 | 25.46/0.849 |
|                         | 25             | 20.80/0.682 | 17.90/0.637 | 28.08/0.855 |
| 6.25%                   | 10             | 20.28/0.688 | 14.50/0.577 | 25.70/0.857 |
|                         | 25             | 20.97/0.687 | 17.46/0.634 | 29.24/0.865 |
| 8%                      | 10             | 21.37/0.693 | 17.25/0.606 | 24.00/0.861 |
|                         | 25             | 22.51/0.694 | 18.58/0.641 | 29.58/0.875 |
| 9.375%                  | 10             | 21.38/0.684 | 18.37/0.612 | 29.64/0.876 |
|                         | 25             | 22.47/0.695 | 18.31/0.644 | 28.81/0.875 |

Table 5: PSNR(dB)/SSIM results of different methods on the 5<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 16.09/0.353 | 13.78/0.133 | 21.02/0.737 |
|                         | 25             | 14.76/0.369 | 17.26/0.194 | 21.08/0.751 |
| 3.125%                  | 10             | 14.89/0.372 | 18.54/0.226 | 22.96/0.819 |
|                         | 25             | 16.27/0.419 | 15.55/0.201 | 23.01/0.844 |
| 5%                      | 10             | 16.68/0.405 | 17.49/0.166 | 24.78/0.853 |
|                         | 25             | 15.56/0.414 | 16.09/0.198 | 24.69/0.878 |
| 6.25%                   | 10             | 15.88/0.395 | 15.84/0.173 | 21.88/0.874 |
|                         | 25             | 16.26/0.419 | 16.35/0.206 | 25.45/0.888 |
| 8%                      | 10             | 16.80/0.408 | 17.14/0.190 | 22.48/0.888 |
|                         | 25             | 15.36/0.390 | 14.60/0.190 | 25.33/0.894 |
| 9.375%                  | 10             | 16.24/0.386 | 16.88/0.185 | 23.64/0.895 |
|                         | 25             | 16.12/0.391 | 15.53/0.197 | 24.70/0.895 |

Table 6: PSNR(dB)/SSIM results of different methods on the 6<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 14.03/0.404 | 12.89/0.180 | 22.27/0.722 |
|                         | 25             | 12.06/0.417 | 11.68/0.212 | 22.50/0.733 |
| 3.125%                  | 10             | 15.08/0.450 | 13.11/0.232 | 21.95/0.801 |
|                         | 25             | 14.21/0.478 | 11.92/0.217 | 23.73/0.819 |
| 5%                      | 10             | 14.78/0.459 | 14.28/0.200 | 23.76/0.831 |
|                         | 25             | 14.16/0.472 | 12.87/0.233 | 24.36/0.841 |
| 6.25%                   | 10             | 15.58/0.476 | 13.75/0.211 | 24.94/0.852 |
|                         | 25             | 15.02/0.481 | 12.63/0.225 | 25.55/0.874 |
| 8%                      | 10             | 14.66/0.470 | 13.71/0.222 | 23.79/0.858 |
|                         | 25             | 14.22/0.463 | 12.67/0.224 | 24.70/0.863 |
| 9.375%                  | 10             | 15.66/0.481 | 13.42/0.197 | 24.61/0.874 |
|                         | 25             | 16.53/0.482 | 12.95/0.226 | 25.28/0.870 |

Table 7: PSNR(dB)/SSIM results of different methods on the 7<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 12.14/0.470 | 14.14/0.324 | 22.31/0.622 |
|                         | 25             | 14.51/0.482 | 12.26/0.324 | 22.12/0.642 |
| 3.125%                  | 10             | 11.95/0.462 | 13.15/0.367 | 23.78/0.653 |
|                         | 25             | 13.32/0.510 | 12.95/0.355 | 24.30/0.690 |
| 5%                      | 10             | 13.73/0.500 | 13.80/0.336 | 19.92/0.649 |
|                         | 25             | 13.44/0.518 | 12.98/0.343 | 25.22/0.724 |
| 6.25%                   | 10             | 12.23/0.459 | 13.39/0.335 | 21.75/0.703 |
|                         | 25             | 13.88/0.522 | 13.06/0.346 | 25.70/0.732 |
| 8%                      | 10             | 13.27/0.457 | 14.24/0.380 | 21.84/0.734 |
|                         | 25             | 14.10/0.522 | 12.87/0.353 | 23.59/0.746 |
| 9.375%                  | 10             | 13.91/0.506 | 13.25/0.376 | 23.40/0.734 |
|                         | 25             | 13.09/0.519 | 12.81/0.339 | 24.01/0.769 |

Table 8: PSNR(dB)/SSIM results of different methods on the 8<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 26.23/0.784 | 22.28/0.705 | 27.13/0.820 |
|                         | 25             | 25.41/0.750 | 22.57/0.725 | 32.19/0.887 |
| 3.125%                  | 10             | 25.61/0.763 | 24.35/0.720 | 27.55/0.850 |
|                         | 25             | 26.75/0.774 | 21.90/0.729 | 26.56/0.877 |
| 5%                      | 10             | 26.07/0.797 | 24.74/0.716 | 29.98/0.867 |
|                         | 25             | 27.09/0.784 | 20.59/0.700 | 30.68/0.878 |
| 6.25%                   | 10             | 25.70/0.798 | 19.84/0.690 | 30.05/0.868 |
|                         | 25             | 27.18/0.786 | 20.75/0.703 | 31.81/0.880 |
| 8%                      | 10             | 26.64/0.803 | 24.04/0.728 | 31.80/0.883 |
|                         | 25             | 27.22/0.786 | 20.70/0.701 | 31.39/0.893 |
| 9.375%                  | 10             | 26.90/0.785 | 24.31/0.751 | 30.32/0.902 |
|                         | 25             | 27.28/0.785 | 21.05/0.717 | 31.84/0.914 |

Table 9: PSNR(dB)/SSIM results of different methods on the 9<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 22.70/0.779 | 19.56/0.625 | 25.33/0.893 |
|                         | 25             | 22.42/0.766 | 21.73/0.708 | 27.10/0.919 |
| 3.125%                  | 10             | 22.43/0.785 | 21.22/0.654 | 30.34/0.931 |
|                         | 25             | 22.80/0.775 | 22.60/0.715 | 29.85/0.925 |
| 5%                      | 10             | 22.91/0.788 | 21.34/0.663 | 29.20/0.927 |
|                         | 25             | 22.90/0.778 | 22.50/0.721 | 29.15/0.930 |
| 6.25%                   | 10             | 22.79/0.782 | 21.39/0.678 | 30.43/0.931 |
|                         | 25             | 22.61/0.777 | 21.53/0.721 | 28.15/0.924 |
| 8%                      | 10             | 22.69/0.790 | 22.02/0.691 | 31.89/0.939 |
|                         | 25             | 22.84/0.776 | 23.02/0.723 | 29.18/0.938 |
| 9.375%                  | 10             | 22.48/0.784 | 19.85/0.668 | 30.84/0.940 |
|                         | 25             | 23.08/0.781 | 22.73/0.719 | 30.97/0.942 |

Table 10: PSNR(dB)/SSIM results of different methods on the 10<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 19.55/0.666 | 15.04/0.551 | 28.19/0.835 |
|                         | 25             | 19.44/0.643 | 15.37/0.591 | 25.11/0.844 |
| 3.125%                  | 10             | 19.00/0.669 | 14.41/0.558 | 26.53/0.855 |
|                         | 25             | 22.05/0.679 | 16.48/0.612 | 26.33/0.851 |
| 5%                      | 10             | 18.76/0.683 | 16.68/0.569 | 27.60/0.851 |
|                         | 25             | 21.24/0.686 | 16.55/0.622 | 24.29/0.855 |
| 6.25%                   | 10             | 19.42/0.679 | 16.69/0.605 | 28.04/0.864 |
|                         | 25             | 20.66/0.693 | 17.06/0.633 | 29.44/0.871 |
| 8%                      | 10             | 19.22/0.686 | 15.82/0.590 | 28.91/0.870 |
|                         | 25             | 21.84/0.697 | 17.18/0.633 | 27.44/0.874 |
| 9.375%                  | 10             | 21.05/0.689 | 15.33/0.583 | 30.03/0.876 |
|                         | 25             | 20.21/0.698 | 16.00/0.625 | 29.17/0.873 |

Table 11: PSNR(dB)/SSIM results of different methods on the 11<sup>th</sup> test data

| Sampling ratio \ Method |    | Dose per Pixel | CSNet       | ReconNet    | FSHNet |
|-------------------------|----|----------------|-------------|-------------|--------|
| 1.56%                   | 10 | 18.91/0.678    | 18.93/0.607 | 28.17/0.847 |        |
|                         | 25 | 20.31/0.662    | 18.95/0.640 | 26.07/0.854 |        |
| 3.125%                  | 10 | 20.66/0.695    | 15.25/0.580 | 28.19/0.870 |        |
|                         | 25 | 20.62/0.690    | 19.37/0.660 | 27.54/0.867 |        |
| 5%                      | 10 | 21.83/0.714    | 18.82/0.604 | 25.44/0.871 |        |
|                         | 25 | 20.49/0.701    | 19.89/0.667 | 27.85/0.877 |        |
| 6.25%                   | 10 | 19.66/0.705    | 16.76/0.617 | 29.72/0.875 |        |
|                         | 25 | 21.17/0.710    | 19.58/0.668 | 26.18/0.877 |        |
| 8%                      | 10 | 21.54/0.721    | 15.36/0.589 | 30.22/0.884 |        |
|                         | 25 | 21.25/0.714    | 17.87/0.657 | 30.93/0.894 |        |
| 9.375%                  | 10 | 21.60/0.707    | 16.36/0.603 | 31.32/0.893 |        |
|                         | 25 | 20.66/0.716    | 18.13/0.662 | 30.26/0.886 |        |

Table 12: PSNR(dB)/SSIM results of different methods on the 12<sup>th</sup> test data

| Sampling ratio \ Method |    | Dose per Pixel | CSNet       | ReconNet    | FSHNet |
|-------------------------|----|----------------|-------------|-------------|--------|
| 1.56%                   | 10 | 21.52/0.658    | 16.89/0.570 | 27.52/0.831 |        |
|                         | 25 | 20.00/0.634    | 14.80/0.569 | 23.71/0.837 |        |
| 3.125%                  | 10 | 20.01/0.666    | 16.48/0.582 | 26.64/0.848 |        |
|                         | 25 | 19.95/0.670    | 15.49/0.603 | 23.85/0.846 |        |
| 5%                      | 10 | 20.49/0.685    | 19.28/0.582 | 24.01/0.842 |        |
|                         | 25 | 21.22/0.681    | 17.41/0.626 | 25.66/0.853 |        |
| 6.25%                   | 10 | 21.15/0.678    | 16.38/0.597 | 23.32/0.848 |        |
|                         | 25 | 21.54/0.687    | 17.78/0.632 | 29.11/0.871 |        |
| 8%                      | 10 | 22.04/0.691    | 16.93/0.596 | 25.43/0.865 |        |
|                         | 25 | 21.46/0.692    | 18.31/0.640 | 24.71/0.868 |        |
| 9.375%                  | 10 | 21.62/0.681    | 17.16/0.600 | 27.25/0.876 |        |
|                         | 25 | 21.72/0.695    | 18.64/0.644 | 28.96/0.875 |        |

Table 13: PSNR(dB)/SSIM results of different methods on the 13<sup>th</sup> test data

| Sampling ratio \ Method |    | Dose per Pixel | CSNet       | ReconNet    | FSHNet |
|-------------------------|----|----------------|-------------|-------------|--------|
| 1.56%                   | 10 | 21.68/0.664    | 21.77/0.605 | 19.15/0.812 |        |
|                         | 25 | 23.16/0.658    | 21.18/0.640 | 18.96/0.828 |        |
| 3.125%                  | 10 | 23.92/0.699    | 17.44/0.606 | 20.86/0.848 |        |
|                         | 25 | 23.02/0.681    | 20.09/0.643 | 19.13/0.836 |        |
| 5%                      | 10 | 24.22/0.711    | 21.46/0.610 | 19.92/0.844 |        |
|                         | 25 | 23.02/0.702    | 20.99/0.661 | 23.47/0.861 |        |
| 6.25%                   | 10 | 24.10/0.701    | 18.01/0.629 | 17.45/0.824 |        |
|                         | 25 | 24.19/0.706    | 19.36/0.659 | 23.06/0.867 |        |
| 8%                      | 10 | 24.01/0.709    | 19.56/0.639 | 21.60/0.861 |        |
|                         | 25 | 24.38/0.708    | 20.00/0.661 | 23.08/0.877 |        |
| 9.375%                  | 10 | 23.96/0.694    | 22.33/0.640 | 19.76/0.861 |        |
|                         | 25 | 23.82/0.707    | 20.65/0.664 | 21.84/0.872 |        |

Table 14: PSNR(dB)/SSIM results of different methods on the 14<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 19.38/0.654 | 15.34/0.553 | 26.65/0.825 |
|                         | 25             | 20.60/0.638 | 15.73/0.586 | 27.39/0.841 |
| 3.125%                  | 10             | 20.61/0.666 | 16.95/0.582 | 26.90/0.837 |
|                         | 25             | 19.65/0.664 | 15.39/0.595 | 26.21/0.842 |
| 5%                      | 10             | 20.78/0.683 | 18.77/0.575 | 27.59/0.845 |
|                         | 25             | 20.91/0.679 | 15.65/0.607 | 26.43/0.846 |
| 6.25%                   | 10             | 20.55/0.672 | 18.19/0.607 | 24.37/0.846 |
|                         | 25             | 21.17/0.684 | 15.46/0.605 | 28.06/0.862 |
| 8%                      | 10             | 21.80/0.692 | 18.46/0.601 | 27.60/0.863 |
|                         | 25             | 21.75/0.688 | 15.43/0.605 | 29.10/0.869 |
| 9.375%                  | 10             | 20.49/0.675 | 16.30/0.589 | 28.51/0.872 |
|                         | 25             | 21.75/0.693 | 16.05/0.618 | 28.52/0.861 |

Table 15: PSNR(dB)/SSIM results of different methods on the 15<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 21.07/0.658 | 16.71/0.567 | 26.60/0.821 |
|                         | 25             | 21.12/0.635 | 18.09/0.608 | 23.87/0.832 |
| 3.125%                  | 10             | 22.10/0.673 | 16.98/0.577 | 24.85/0.843 |
|                         | 25             | 21.49/0.663 | 17.43/0.619 | 27.67/0.850 |
| 5%                      | 10             | 21.24/0.689 | 18.75/0.575 | 27.88/0.850 |
|                         | 25             | 21.61/0.677 | 17.51/0.625 | 25.90/0.850 |
| 6.25%                   | 10             | 21.05/0.679 | 18.76/0.611 | 25.99/0.854 |
|                         | 25             | 22.24/0.685 | 18.34/0.633 | 25.86/0.861 |
| 8%                      | 10             | 22.78/0.693 | 17.65/0.594 | 23.12/0.851 |
|                         | 25             | 22.04/0.685 | 18.84/0.637 | 26.34/0.873 |
| 9.375%                  | 10             | 22.10/0.679 | 17.42/0.596 | 27.87/0.870 |
|                         | 25             | 22.06/0.692 | 18.32/0.636 | 27.77/0.868 |

Table 16: PSNR(dB)/SSIM results of different methods on the 16<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet   | FSHNet      |
|-------------------------|----------------|-------------|------------|-------------|
| 1.56%                   | 10             | 11.79/0.551 | 8.86/0.429 | 24.66/0.880 |
|                         | 25             | 11.33/0.512 | 8.34/0.442 | 28.15/0.897 |
| 3.125%                  | 10             | 10.76/0.540 | 8.64/0.432 | 31.72/0.906 |
|                         | 25             | 11.75/0.533 | 8.61/0.460 | 28.90/0.906 |
| 5%                      | 10             | 11.19/0.544 | 9.62/0.477 | 28.81/0.905 |
|                         | 25             | 12.39/0.558 | 9.17/0.479 | 31.29/0.911 |
| 6.25%                   | 10             | 11.29/0.527 | 9.07/0.476 | 29.77/0.906 |
|                         | 25             | 11.99/0.576 | 9.05/0.480 | 30.72/0.900 |
| 8%                      | 10             | 11.30/0.532 | 9.26/0.461 | 30.64/0.918 |
|                         | 25             | 12.54/0.577 | 9.13/0.488 | 28.38/0.927 |
| 9.375%                  | 10             | 10.87/0.526 | 8.99/0.471 | 32.54/0.921 |
|                         | 25             | 11.64/0.569 | 9.09/0.483 | 31.21/0.923 |

Table 17: PSNR(dB)/SSIM results of different methods on the 17<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 19.78/0.657 | 15.74/0.562 | 26.33/0.823 |
|                         | 25             | 19.22/0.635 | 15.33/0.585 | 24.92/0.835 |
| 3.125%                  | 10             | 19.80/0.670 | 15.53/0.569 | 25.59/0.845 |
|                         | 25             | 20.28/0.663 | 17.80/0.628 | 24.92/0.843 |
| 5%                      | 10             | 20.17/0.689 | 19.15/0.578 | 27.44/0.849 |
|                         | 25             | 21.20/0.680 | 17.02/0.628 | 28.05/0.852 |
| 6.25%                   | 10             | 20.25/0.680 | 17.07/0.602 | 26.36/0.857 |
|                         | 25             | 20.52/0.683 | 17.20/0.632 | 28.65/0.867 |
| 8%                      | 10             | 20.51/0.693 | 16.18/0.591 | 25.60/0.860 |
|                         | 25             | 21.42/0.691 | 17.21/0.631 | 29.29/0.875 |
| 9.375%                  | 10             | 20.35/0.678 | 16.94/0.597 | 29.72/0.872 |
|                         | 25             | 21.80/0.695 | 17.60/0.638 | 27.92/0.865 |

Table 18: PSNR(dB)/SSIM results of different methods on the 18<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 20.34/0.649 | 16.57/0.565 | 27.01/0.828 |
|                         | 25             | 20.19/0.631 | 16.11/0.594 | 25.56/0.840 |
| 3.125%                  | 10             | 19.55/0.660 | 17.08/0.583 | 23.73/0.841 |
|                         | 25             | 20.72/0.663 | 17.21/0.620 | 27.16/0.852 |
| 5%                      | 10             | 21.04/0.679 | 17.93/0.566 | 27.70/0.853 |
|                         | 25             | 20.09/0.672 | 16.23/0.617 | 25.64/0.845 |
| 6.25%                   | 10             | 19.60/0.671 | 19.29/0.611 | 25.83/0.854 |
|                         | 25             | 22.32/0.684 | 17.45/0.630 | 28.76/0.869 |
| 8%                      | 10             | 21.36/0.688 | 17.55/0.598 | 24.52/0.858 |
|                         | 25             | 20.96/0.685 | 16.32/0.622 | 26.82/0.877 |
| 9.375%                  | 10             | 21.69/0.677 | 19.04/0.608 | 26.19/0.870 |
|                         | 25             | 21.82/0.692 | 18.40/0.640 | 29.34/0.872 |

Table 19: PSNR(dB)/SSIM results of different methods on the 19<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 20.86/0.663 | 16.84/0.573 | 27.91/0.832 |
|                         | 25             | 21.31/0.636 | 16.27/0.595 | 26.65/0.846 |
| 3.125%                  | 10             | 20.50/0.668 | 16.37/0.583 | 27.21/0.846 |
|                         | 25             | 19.81/0.672 | 16.98/0.619 | 27.82/0.850 |
| 5%                      | 10             | 21.14/0.692 | 19.23/0.576 | 26.03/0.852 |
|                         | 25             | 20.80/0.678 | 16.70/0.615 | 26.77/0.844 |
| 6.25%                   | 10             | 21.97/0.684 | 17.37/0.603 | 29.05/0.861 |
|                         | 25             | 21.57/0.690 | 17.10/0.631 | 28.82/0.866 |
| 8%                      | 10             | 21.41/0.689 | 17.45/0.602 | 25.86/0.860 |
|                         | 25             | 21.39/0.694 | 16.46/0.625 | 29.58/0.878 |
| 9.375%                  | 10             | 22.18/0.682 | 18.82/0.609 | 29.14/0.875 |
|                         | 25             | 20.97/0.694 | 18.21/0.640 | 26.81/0.871 |

Table 20: PSNR(dB)/SSIM results of different methods on the 20<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 15.42/0.521 | 14.22/0.388 | 23.92/0.651 |
|                         | 25             | 15.36/0.527 | 12.50/0.357 | 24.84/0.685 |
| 3.125%                  | 10             | 15.13/0.511 | 14.08/0.407 | 21.82/0.645 |
|                         | 25             | 15.84/0.547 | 12.66/0.353 | 23.73/0.706 |
| 5%                      | 10             | 15.65/0.530 | 15.32/0.418 | 23.86/0.682 |
|                         | 25             | 16.40/0.554 | 13.12/0.379 | 24.81/0.728 |
| 6.25%                   | 10             | 13.98/0.492 | 13.23/0.375 | 24.77/0.703 |
|                         | 25             | 15.46/0.559 | 13.06/0.367 | 22.66/0.694 |
| 8%                      | 10             | 15.14/0.501 | 14.54/0.408 | 22.10/0.725 |
|                         | 25             | 16.06/0.559 | 12.97/0.371 | 23.44/0.721 |
| 9.375%                  | 10             | 15.32/0.531 | 13.85/0.418 | 25.61/0.740 |
|                         | 25             | 15.85/0.560 | 12.52/0.376 | 23.11/0.746 |

Table 21: PSNR(dB)/SSIM results of different methods on the 21<sup>st</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 22.58/0.737 | 17.65/0.564 | 30.13/0.923 |
|                         | 25             | 23.23/0.728 | 16.70/0.575 | 32.53/0.939 |
| 3.125%                  | 10             | 21.83/0.730 | 14.98/0.509 | 30.08/0.936 |
|                         | 25             | 24.97/0.755 | 20.61/0.645 | 25.73/0.909 |
| 5%                      | 10             | 25.76/0.783 | 12.16/0.433 | 32.12/0.934 |
|                         | 25             | 26.04/0.773 | 17.88/0.599 | 30.52/0.929 |
| 6.25%                   | 10             | 23.70/0.750 | 13.86/0.490 | 30.88/0.941 |
|                         | 25             | 25.35/0.765 | 17.13/0.583 | 27.32/0.927 |
| 8%                      | 10             | 26.24/0.789 | 17.61/0.572 | 30.07/0.938 |
|                         | 25             | 24.80/0.760 | 18.17/0.601 | 30.25/0.941 |
| 9.375%                  | 10             | 23.79/0.753 | 16.21/0.545 | 33.00/0.951 |
|                         | 25             | 25.88/0.775 | 16.55/0.571 | 29.47/0.919 |

Table 22: PSNR(dB)/SSIM results of different methods on the 22<sup>nd</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 13.96/0.451 | 11.87/0.296 | 18.69/0.620 |
|                         | 25             | 11.17/0.423 | 11.34/0.335 | 18.67/0.653 |
| 3.125%                  | 10             | 11.90/0.443 | 12.59/0.362 | 19.45/0.703 |
|                         | 25             | 11.85/0.451 | 11.82/0.351 | 18.53/0.702 |
| 5%                      | 10             | 13.28/0.480 | 12.86/0.327 | 18.44/0.710 |
|                         | 25             | 12.08/0.467 | 12.26/0.350 | 19.27/0.776 |
| 6.25%                   | 10             | 13.15/0.442 | 12.79/0.343 | 20.07/0.768 |
|                         | 25             | 12.84/0.464 | 12.36/0.359 | 19.56/0.781 |
| 8%                      | 10             | 11.54/0.437 | 11.36/0.324 | 24.10/0.759 |
|                         | 25             | 11.69/0.467 | 11.60/0.345 | 22.02/0.802 |
| 9.375%                  | 10             | 13.26/0.463 | 11.27/0.347 | 20.46/0.757 |
|                         | 25             | 11.12/0.450 | 11.79/0.356 | 17.64/0.787 |

Table 23: PSNR(dB)/SSIM results of different methods on the 23<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet     | FSHNet      |
|-------------------------|----------------|-------------|--------------|-------------|
| 1.56%                   | 10             | 25.23/0.451 | 20.45/0.372  | 18.31/0.439 |
|                         | 25             | 24.72/0.432 | 23.67/0.392  | 24.14/0.486 |
| 3.125%                  | 10             | 26.46/0.446 | 22.35/0.396  | 26.95/0.440 |
|                         | 25             | 25.34/0.449 | 22.700/0.403 | 16.93/0.374 |
| 5%                      | 10             | 24.82/0.456 | 19.06/0.378  | 25.23/0.455 |
|                         | 25             | 25.76/0.453 | 22.57/0.406  | 22.98/0.511 |
| 6.25%                   | 10             | 25.11/0.461 | 18.07/0.397  | 21.75/0.478 |
|                         | 25             | 25.71/0.458 | 22.31/0.407  | 27.46/0.461 |
| 8%                      | 10             | 25.82/0.462 | 21.36/0.404  | 26.65/0.485 |
|                         | 25             | 25.93/0.460 | 21.90/0.409  | 29.12/0.511 |
| 9.375%                  | 10             | 24.66/0.444 | 20.70/0.402  | 19.25/0.518 |
|                         | 25             | 26.12/0.460 | 22.03/0.409  | 27.44/0.508 |

Table 24: PSNR(dB)/SSIM results of different methods on the 24<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 12.99/0.451 | 12.90/0.322 | 23.75/0.615 |
|                         | 25             | 12.85/0.470 | 11.55/0.328 | 23.14/0.636 |
| 3.125%                  | 10             | 12.98/0.447 | 12.93/0.349 | 23.52/0.656 |
|                         | 25             | 13.05/0.491 | 11.47/0.318 | 25.72/0.692 |
| 5%                      | 10             | 13.23/0.476 | 14.51/0.351 | 25.13/0.660 |
|                         | 25             | 13.08/0.495 | 11.89/0.329 | 25.63/0.722 |
| 6.25%                   | 10             | 12.71/0.438 | 12.86/0.316 | 23.66/0.707 |
|                         | 25             | 12.69/0.497 | 11.84/0.341 | 25.59/0.729 |
| 8%                      | 10             | 12.39/0.444 | 12.82/0.349 | 25.46/0.741 |
|                         | 25             | 12.93/0.499 | 11.63/0.331 | 23.27/0.736 |
| 9.375%                  | 10             | 11.76/0.468 | 12.63/0.356 | 24.95/0.736 |
|                         | 25             | 13.51/0.499 | 12.05/0.339 | 22.51/0.752 |

Table 25: PSNR(dB)/SSIM results of different methods on the 25<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 17.08/0.371 | 17.33/0.157 | 22.22/0.732 |
|                         | 25             | 15.59/0.383 | 19.15/0.190 | 21.44/0.752 |
| 3.125%                  | 10             | 16.81/0.392 | 17.53/0.225 | 20.09/0.817 |
|                         | 25             | 16.54/0.424 | 17.85/0.205 | 23.36/0.836 |
| 5%                      | 10             | 17.17/0.412 | 18.50/0.174 | 24.60/0.859 |
|                         | 25             | 16.70/0.413 | 17.98/0.208 | 25.26/0.881 |
| 6.25%                   | 10             | 17.90/0.412 | 18.56/0.190 | 26.27/0.885 |
|                         | 25             | 15.86/0.401 | 19.11/0.209 | 24.70/0.887 |
| 8%                      | 10             | 17.90/0.419 | 18.67/0.199 | 25.65/0.899 |
|                         | 25             | 16.43/0.402 | 17.91/0.205 | 20.17/0.882 |
| 9.375%                  | 10             | 17.57/0.401 | 18.34/0.187 | 25.69/0.901 |
|                         | 25             | 17.25/0.395 | 17.77/0.205 | 25.75/0.898 |

Table 26: PSNR(dB)/SSIM results of different methods on the 26<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet              | ReconNet           | FSHNet             |
|-------------------------|----------------|--------------------|--------------------|--------------------|
| 1.56%                   | 10             | <b>16.75/0.687</b> | 11.89/0.473        | <b>27.86/0.861</b> |
|                         | 25             | <b>16.29/0.677</b> | <b>16.59/0.647</b> | <b>27.72/0.868</b> |
| 3.125%                  | 10             | <b>17.59/0.708</b> | <b>18.44/0.609</b> | <b>28.96/0.881</b> |
|                         | 25             | <b>17.47/0.699</b> | 15.24/0.637        | <b>25.96/0.876</b> |
| 5%                      | 10             | <b>17.01/0.690</b> | <b>18.02/0.599</b> | <b>29.74/0.885</b> |
|                         | 25             | <b>17.47/0.694</b> | 15.88/0.648        | <b>28.25/0.884</b> |
| 6.25%                   | 10             | <b>17.84/0.697</b> | 15.49/0.602        | <b>30.12/0.891</b> |
|                         | 25             | <b>17.14/0.693</b> | 16.82/0.660        | <b>30.24/0.893</b> |
| 8%                      | 10             | <b>17.01/0.696</b> | 15.96/0.620        | <b>28.93/0.889</b> |
|                         | 25             | <b>17.18/0.695</b> | 16.38/0.656        | <b>30.42/0.898</b> |
| 9.375%                  | 10             | <b>17.42/0.699</b> | 16.88/0.632        | <b>28.51/0.897</b> |
|                         | 25             | <b>17.64/0.701</b> | <b>18.11/0.676</b> | <b>29.15/0.896</b> |

Table 27: PSNR(dB)/SSIM results of different methods on the 27<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet              | ReconNet    | FSHNet             |
|-------------------------|----------------|--------------------|-------------|--------------------|
| 1.56%                   | 10             | <b>21.77/0.674</b> | 17.58/0.594 | <b>28.49/0.836</b> |
|                         | 25             | <b>21.55/0.671</b> | 16.93/0.588 | <b>29.28/0.852</b> |
| 3.125%                  | 10             | <b>20.90/0.673</b> | 20.63/0.630 | <b>28.25/0.858</b> |
|                         | 25             | <b>21.79/0.681</b> | 17.60/0.607 | <b>27.12/0.863</b> |
| 5%                      | 10             | <b>22.20/0.704</b> | 21.03/0.608 | <b>29.57/0.863</b> |
|                         | 25             | <b>22.35/0.687</b> | 19.94/0.649 | <b>29.40/0.859</b> |
| 6.25%                   | 10             | <b>20.47/0.685</b> | 18.25/0.625 | <b>27.43/0.861</b> |
|                         | 25             | <b>22.15/0.689</b> | 18.30/0.628 | <b>27.64/0.871</b> |
| 8%                      | 10             | <b>21.79/0.697</b> | 21.47/0.635 | <b>27.66/0.857</b> |
|                         | 25             | <b>21.98/0.689</b> | 18.08/0.623 | <b>30.97/0.884</b> |
| 9.375%                  | 10             | <b>22.18/0.691</b> | 18.96/0.633 | <b>30.46/0.881</b> |
|                         | 25             | <b>22.13/0.691</b> | 18.43/0.639 | <b>28.59/0.869</b> |

Table 28: PSNR(dB)/SSIM results of different methods on the 28<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet              | ReconNet    | FSHNet             |
|-------------------------|----------------|--------------------|-------------|--------------------|
| 1.56%                   | 10             | <b>22.12/0.677</b> | 15.80/0.561 | <b>23.56/0.832</b> |
|                         | 25             | <b>20.91/0.666</b> | 15.24/0.576 | <b>25.72/0.850</b> |
| 3.125%                  | 10             | <b>20.58/0.682</b> | 16.51/0.591 | <b>20.41/0.834</b> |
|                         | 25             | <b>21.01/0.688</b> | 16.49/0.614 | <b>28.72/0.862</b> |
| 5%                      | 10             | <b>19.05/0.690</b> | 18.39/0.588 | <b>26.51/0.857</b> |
|                         | 25             | <b>21.12/0.696</b> | 17.29/0.629 | <b>27.18/0.870</b> |
| 6.25%                   | 10             | <b>20.43/0.686</b> | 19.40/0.629 | <b>26.51/0.865</b> |
|                         | 25             | <b>22.83/0.703</b> | 17.27/0.633 | <b>28.83/0.877</b> |
| 8%                      | 10             | <b>22.56/0.711</b> | 15.79/0.585 | <b>28.18/0.873</b> |
|                         | 25             | <b>21.93/0.709</b> | 16.79/0.628 | <b>27.06/0.885</b> |
| 9.375%                  | 10             | <b>21.08/0.696</b> | 18.56/0.616 | <b>29.98/0.885</b> |
|                         | 25             | <b>21.62/0.712</b> | 16.03/0.621 | <b>30.38/0.882</b> |

Table 29: PSNR(dB)/SSIM results of different methods on the 29<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet     | FSHNet      |
|-------------------------|----------------|-------------|--------------|-------------|
| 1.56%                   | 10             | 17.32/0.739 | 13.95/0.605  | 28.42/0.898 |
|                         | 25             | 15.74/0.713 | 15.98/0.704  | 25.42/0.908 |
| 3.125%                  | 10             | 16.42/0.737 | 16.54/0.663  | 22.86/0.907 |
|                         | 25             | 16.87/0.739 | 18.280/0.740 | 29.15/0.914 |
| 5%                      | 10             | 19.41/0.787 | 16.17/0.674  | 23.26/0.909 |
|                         | 25             | 17.18/0.765 | 14.66/0.691  | 25.44/0.919 |
| 6.25%                   | 10             | 17.86/0.758 | 15.38/0.674  | 30.52/0.918 |
|                         | 25             | 16.92/0.758 | 18.85/0.750  | 29.43/0.924 |
| 8%                      | 10             | 15.88/0.742 | 14.50/0.670  | 25.33/0.919 |
|                         | 25             | 17.13/0.760 | 16.01/0.718  | 26.62/0.931 |
| 9.375%                  | 10             | 17.46/0.749 | 17.24/0.700  | 31.27/0.927 |
|                         | 25             | 17.13/0.769 | 17.20/0.740  | 30.18/0.933 |

Table 30: PSNR(dB)/SSIM results of different methods on the 30<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 14.48/0.527 | 12.55/0.374 | 20.59/0.814 |
|                         | 25             | 14.91/0.507 | 12.28/0.359 | 29.04/0.864 |
| 3.125%                  | 10             | 15.84/0.579 | 15.24/0.534 | 33.25/0.878 |
|                         | 25             | 16.10/0.577 | 12.68/0.378 | 18.82/0.833 |
| 5%                      | 10             | 15.54/0.558 | 13.56/0.450 | 30.63/0.886 |
|                         | 25             | 16.46/0.590 | 13.00/0.410 | 23.98/0.870 |
| 6.25%                   | 10             | 16.49/0.593 | 12.10/0.369 | 26.33/0.886 |
|                         | 25             | 16.38/0.598 | 12.68/0.380 | 31.51/0.886 |
| 8%                      | 10             | 15.20/0.539 | 12.53/0.376 | 27.96/0.890 |
|                         | 25             | 16.70/0.612 | 12.43/0.363 | 34.73/0.910 |
| 9.375%                  | 10             | 16.86/0.616 | 13.78/0.482 | 20.27/0.830 |
|                         | 25             | 17.31/0.633 | 12.32/0.363 | 30.91/0.902 |

Table 31: PSNR(dB)/SSIM results of different methods on the 31<sup>st</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 14.01/0.648 | 11.76/0.512 | 27.67/0.846 |
|                         | 25             | 13.52/0.639 | 13.40/0.602 | 28.82/0.859 |
| 3.125%                  | 10             | 14.48/0.652 | 15.46/0.590 | 28.53/0.867 |
|                         | 25             | 14.98/0.667 | 13.02/0.592 | 27.10/0.865 |
| 5%                      | 10             | 13.63/0.663 | 16.10/0.598 | 27.57/0.872 |
|                         | 25             | 15.04/0.670 | 13.86/0.613 | 29.21/0.875 |
| 6.25%                   | 10             | 14.50/0.660 | 13.55/0.597 | 25.98/0.880 |
|                         | 25             | 14.19/0.679 | 13.14/0.608 | 28.55/0.887 |
| 8%                      | 10             | 14.79/0.663 | 13.52/0.586 | 28.52/0.880 |
|                         | 25             | 15.18/0.683 | 14.60/0.635 | 29.47/0.895 |
| 9.375%                  | 10             | 14.01/0.655 | 14.24/0.605 | 28.85/0.888 |
|                         | 25             | 14.35/0.673 | 13.28/0.614 | 29.93/0.887 |

Table 32: PSNR(dB)/SSIM results of different methods on the 32<sup>nd</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 22.39/0.797 | 19.94/0.626 | 27.34/0.910 |
|                         | 25             | 20.54/0.778 | 20.63/0.706 | 29.77/0.924 |
| 3.125%                  | 10             | 20.14/0.793 | 17.85/0.622 | 29.51/0.929 |
|                         | 25             | 21.91/0.797 | 21.22/0.721 | 28.48/0.926 |
| 5%                      | 10             | 22.55/0.809 | 21.09/0.668 | 30.44/0.932 |
|                         | 25             | 21.81/0.799 | 21.13/0.722 | 30.12/0.932 |
| 6.25%                   | 10             | 21.98/0.802 | 17.84/0.666 | 29.48/0.930 |
|                         | 25             | 21.83/0.799 | 20.95/0.714 | 25.26/0.927 |
| 8%                      | 10             | 22.51/0.810 | 21.87/0.694 | 30.87/0.937 |
|                         | 25             | 21.93/0.800 | 21.52/0.726 | 30.95/0.943 |
| 9.375%                  | 10             | 21.97/0.796 | 19.77/0.669 | 27.99/0.938 |
|                         | 25             | 22.32/0.804 | 20.93/0.724 | 30.93/0.942 |

Table 33: PSNR(dB)/SSIM results of different methods on the 33<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 14.35/0.703 | 12.29/0.568 | 26.91/0.877 |
|                         | 25             | 16.09/0.705 | 12.81/0.624 | 26.65/0.894 |
| 3.125%                  | 10             | 16.19/0.728 | 15.11/0.627 | 25.16/0.896 |
|                         | 25             | 15.10/0.720 | 13.24/0.656 | 28.39/0.906 |
| 5%                      | 10             | 16.72/0.736 | 16.55/0.650 | 25.18/0.899 |
|                         | 25             | 16.33/0.731 | 14.32/0.678 | 27.59/0.908 |
| 6.25%                   | 10             | 16.10/0.727 | 14.18/0.645 | 29.09/0.907 |
|                         | 25             | 16.62/0.746 | 14.36/0.681 | 26.80/0.914 |
| 8%                      | 10             | 16.51/0.736 | 13.19/0.630 | 27.39/0.913 |
|                         | 25             | 16.94/0.744 | 14.44/0.689 | 29.30/0.917 |
| 9.375%                  | 10             | 14.91/0.716 | 16.06/0.674 | 30.66/0.920 |
|                         | 25             | 16.46/0.752 | 15.60/0.709 | 30.68/0.921 |

Table 34: PSNR(dB)/SSIM results of different methods on the 34<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 12.95/0.415 | 11.25/0.166 | 20.15/0.743 |
|                         | 25             | 14.68/0.481 | 11.80/0.243 | 20.45/0.766 |
| 3.125%                  | 10             | 13.48/0.469 | 12.58/0.212 | 21.00/0.821 |
|                         | 25             | 13.91/0.501 | 12.81/0.267 | 22.05/0.841 |
| 5%                      | 10             | 14.67/0.497 | 13.34/0.152 | 21.20/0.832 |
|                         | 25             | 14.96/0.525 | 12.94/0.266 | 20.74/0.851 |
| 6.25%                   | 10             | 13.72/0.499 | 12.96/0.196 | 20.91/0.856 |
|                         | 25             | 14.69/0.520 | 12.17/0.248 | 24.66/0.887 |
| 8%                      | 10             | 14.02/0.506 | 12.04/0.214 | 21.37/0.862 |
|                         | 25             | 14.99/0.520 | 12.59/0.253 | 21.97/0.875 |
| 9.375%                  | 10             | 14.58/0.509 | 12.79/0.194 | 24.16/0.888 |
|                         | 25             | 14.93/0.518 | 12.15/0.244 | 23.78/0.882 |

Table 35: PSNR(dB)/SSIM results of different methods on the 35<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 14.66/0.372 | 14.38/0.153 | 21.28/0.685 |
|                         | 25             | 13.02/0.419 | 12.83/0.195 | 20.79/0.704 |
| 3.125%                  | 10             | 15.70/0.419 | 12.84/0.190 | 21.54/0.788 |
|                         | 25             | 14.59/0.454 | 14.04/0.212 | 21.88/0.812 |
| 5%                      | 10             | 15.84/0.426 | 14.20/0.162 | 22.37/0.824 |
|                         | 25             | 15.11/0.452 | 13.76/0.205 | 22.17/0.834 |
| 6.25%                   | 10             | 15.24/0.441 | 12.54/0.158 | 23.38/0.856 |
|                         | 25             | 14.46/0.440 | 13.63/0.203 | 24.24/0.870 |
| 8%                      | 10             | 15.08/0.441 | 14.02/0.182 | 21.70/0.850 |
|                         | 25             | 14.80/0.436 | 13.96/0.202 | 24.62/0.863 |
| 9.375%                  | 10             | 14.60/0.431 | 12.57/0.147 | 22.79/0.873 |
|                         | 25             | 15.75/0.437 | 14.26/0.203 | 24.01/0.876 |

Table 36: PSNR(dB)/SSIM results of different methods on the 36<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 15.49/0.618 | 12.45/0.472 | 31.94/0.848 |
|                         | 25             | 15.30/0.571 | 13.12/0.507 | 22.21/0.855 |
| 3.125%                  | 10             | 16.27/0.644 | 13.31/0.487 | 26.09/0.863 |
|                         | 25             | 15.43/0.589 | 13.21/0.506 | 30.65/0.872 |
| 5%                      | 10             | 14.58/0.568 | 13.94/0.532 | 31.98/0.878 |
|                         | 25             | 15.54/0.617 | 12.88/0.488 | 30.30/0.885 |
| 6.25%                   | 10             | 15.86/0.598 | 12.83/0.488 | 30.16/0.880 |
|                         | 25             | 16.03/0.642 | 12.74/0.482 | 30.08/0.881 |
| 8%                      | 10             | 15.44/0.600 | 13.97/0.514 | 30.30/0.889 |
|                         | 25             | 16.06/0.656 | 12.53/0.467 | 32.46/0.898 |
| 9.375%                  | 10             | 15.38/0.625 | 12.42/0.462 | 32.01/0.891 |
|                         | 25             | 15.93/0.634 | 12.63/0.463 | 31.83/0.900 |

Table 37: PSNR(dB)/SSIM results of different methods on the 37<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 10.74/0.474 | 10.87/0.387 | 19.81/0.760 |
|                         | 25             | 12.01/0.490 | 10.05/0.370 | 27.71/0.820 |
| 3.125%                  | 10             | 11.24/0.478 | 9.92/0.377  | 26.91/0.800 |
|                         | 25             | 11.55/0.503 | 10.92/0.424 | 26.00/0.844 |
| 5%                      | 10             | 11.22/0.492 | 10.41/0.380 | 30.12/0.851 |
|                         | 25             | 11.42/0.506 | 10.61/0.399 | 29.15/0.851 |
| 6.25%                   | 10             | 10.56/0.445 | 9.73/0.365  | 27.50/0.837 |
|                         | 25             | 11.29/0.507 | 10.73/0.404 | 30.50/0.851 |
| 8%                      | 10             | 10.65/0.455 | 10.01/0.411 | 30.37/0.877 |
|                         | 25             | 11.37/0.509 | 10.59/0.392 | 30.62/0.871 |
| 9.375%                  | 10             | 11.55/0.507 | 9.63/0.371  | 18.68/0.823 |
|                         | 25             | 11.29/0.509 | 10.52/0.404 | 29.81/0.879 |

Table 38: PSNR(dB)/SSIM results of different methods on the 38<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 17.65/0.750 | 14.26/0.539 | 27.10/0.916 |
|                         | 25             | 18.06/0.737 | 19.50/0.697 | 28.68/0.924 |
| 3.125%                  | 10             | 18.53/0.766 | 17.81/0.607 | 29.63/0.929 |
|                         | 25             | 17.95/0.759 | 19.14/0.715 | 29.41/0.930 |
| 5%                      | 10             | 19.92/0.795 | 17.23/0.653 | 29.20/0.934 |
|                         | 25             | 17.51/0.764 | 17.70/0.698 | 28.62/0.932 |
| 6.25%                   | 10             | 18.72/0.779 | 19.88/0.661 | 29.78/0.937 |
|                         | 25             | 19.13/0.789 | 18.83/0.711 | 30.41/0.943 |
| 8%                      | 10             | 17.95/0.781 | 18.89/0.680 | 29.88/0.939 |
|                         | 25             | 19.95/0.797 | 18.71/0.715 | 31.22/0.948 |
| 9.375%                  | 10             | 17.36/0.770 | 18.78/0.659 | 30.73/0.945 |
|                         | 25             | 19.19/0.793 | 18.42/0.713 | 29.42/0.942 |

Table 39: PSNR(dB)/SSIM results of different methods on the 39<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 15.11/0.740 | 16.01/0.416 | 25.23/0.902 |
|                         | 25             | 13.30/0.674 | 17.91/0.644 | 21.74/0.893 |
| 3.125%                  | 10             | 14.36/0.747 | 18.73/0.533 | 21.95/0.924 |
|                         | 25             | 15.15/0.749 | 19.77/0.684 | 24.77/0.927 |
| 5%                      | 10             | 16.45/0.785 | 18.54/0.544 | 21.23/0.933 |
|                         | 25             | 16.66/0.769 | 17.73/0.697 | 27.20/0.947 |
| 6.25%                   | 10             | 15.01/0.761 | 18.22/0.470 | 24.33/0.950 |
|                         | 25             | 15.26/0.758 | 17.47/0.693 | 24.91/0.949 |
| 8%                      | 10             | 15.48/0.785 | 19.11/0.600 | 22.01/0.941 |
|                         | 25             | 14.97/0.749 | 15.62/0.666 | 23.32/0.954 |
| 9.375%                  | 10             | 16.94/0.792 | 16.88/0.573 | 23.77/0.957 |
|                         | 25             | 15.10/0.747 | 16.52/0.680 | 26.29/0.957 |

Table 40: PSNR(dB)/SSIM results of different methods on the 40<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 21.26/0.788 | 15.85/0.430 | 25.92/0.926 |
|                         | 25             | 21.62/0.774 | 16.27/0.616 | 27.18/0.935 |
| 3.125%                  | 10             | 22.61/0.816 | 13.27/0.468 | 25.04/0.929 |
|                         | 25             | 22.78/0.813 | 15.07/0.612 | 27.29/0.942 |
| 5%                      | 10             | 21.31/0.810 | 14.04/0.518 | 27.82/0.945 |
|                         | 25             | 22.56/0.814 | 15.03/0.613 | 25.41/0.929 |
| 6.25%                   | 10             | 21.86/0.816 | 12.02/0.450 | 28.69/0.953 |
|                         | 25             | 22.10/0.815 | 13.57/0.584 | 26.68/0.941 |
| 8%                      | 10             | 22.22/0.828 | 12.19/0.500 | 27.16/0.948 |
|                         | 25             | 21.79/0.814 | 13.27/0.587 | 28.79/0.956 |
| 9.375%                  | 10             | 21.95/0.813 | 11.90/0.473 | 28.82/0.957 |
|                         | 25             | 21.53/0.810 | 14.12/0.602 | 27.40/0.943 |

Table 41: PSNR(dB)/SSIM results of different methods on the 41<sup>st</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 21.01/0.688 | 18.36/0.416 | 26.03/0.856 |
|                         | 25             | 18.53/0.705 | 20.36/0.611 | 26.06/0.899 |
| 3.125%                  | 10             | 20.89/0.738 | 17.82/0.497 | 27.37/0.898 |
|                         | 25             | 19.41/0.733 | 20.64/0.638 | 26.42/0.912 |
| 5%                      | 10             | 20.78/0.748 | 18.83/0.503 | 27.83/0.902 |
|                         | 25             | 20.26/0.748 | 20.61/0.646 | 28.07/0.920 |
| 6.25%                   | 10             | 19.94/0.741 | 16.82/0.471 | 27.02/0.906 |
|                         | 25             | 19.88/0.743 | 20.55/0.650 | 28.72/0.926 |
| 8%                      | 10             | 20.05/0.776 | 19.76/0.590 | 26.93/0.912 |
|                         | 25             | 19.80/0.738 | 20.27/0.650 | 29.02/0.930 |
| 9.375%                  | 10             | 19.67/0.748 | 19.46/0.571 | 28.94/0.929 |
|                         | 25             | 20.26/0.745 | 20.33/0.656 | 28.14/0.931 |

Table 42: PSNR(dB)/SSIM results of different methods on the 42<sup>nd</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 22.75/0.859 | 18.52/0.552 | 27.29/0.943 |
|                         | 25             | 21.72/0.832 | 16.23/0.640 | 27.04/0.945 |
| 3.125%                  | 10             | 23.36/0.875 | 15.41/0.548 | 28.35/0.951 |
|                         | 25             | 22.99/0.864 | 19.30/0.698 | 25.25/0.950 |
| 5%                      | 10             | 22.89/0.878 | 19.12/0.668 | 26.13/0.954 |
|                         | 25             | 23.12/0.873 | 17.32/0.689 | 26.10/0.952 |
| 6.25%                   | 10             | 23.56/0.882 | 19.60/0.613 | 28.87/0.960 |
|                         | 25             | 22.86/0.874 | 18.53/0.685 | 29.14/0.961 |
| 8%                      | 10             | 23.20/0.884 | 18.18/0.656 | 22.77/0.943 |
|                         | 25             | 23.60/0.880 | 18.89/0.716 | 30.53/0.966 |
| 9.375%                  | 10             | 23.55/0.880 | 18.08/0.642 | 30.33/0.968 |
|                         | 25             | 23.84/0.881 | 18.71/0.695 | 30.21/0.968 |

Table 43: PSNR(dB)/SSIM results of different methods on the 43<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 20.90/0.848 | 17.71/0.543 | 26.74/0.936 |
|                         | 25             | 19.40/0.818 | 15.93/0.605 | 27.12/0.945 |
| 3.125%                  | 10             | 20.38/0.862 | 15.05/0.526 | 26.34/0.943 |
|                         | 25             | 20.69/0.856 | 19.84/0.724 | 25.35/0.952 |
| 5%                      | 10             | 21.14/0.871 | 19.48/0.659 | 22.80/0.943 |
|                         | 25             | 21.23/0.865 | 19.58/0.718 | 27.88/0.955 |
| 6.25%                   | 10             | 21.04/0.872 | 18.81/0.597 | 28.26/0.956 |
|                         | 25             | 21.24/0.870 | 20.73/0.742 | 29.13/0.963 |
| 8%                      | 10             | 21.92/0.881 | 16.94/0.617 | 21.52/0.936 |
|                         | 25             | 22.13/0.877 | 20.09/0.726 | 29.09/0.964 |
| 9.375%                  | 10             | 21.61/0.876 | 19.51/0.671 | 29.76/0.968 |
|                         | 25             | 21.43/0.874 | 19.94/0.739 | 28.93/0.968 |

Table 44: PSNR(dB)/SSIM results of different methods on the 44<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 21.90/0.785 | 18.49/0.539 | 26.56/0.908 |
|                         | 25             | 20.93/0.762 | 17.59/0.631 | 26.24/0.924 |
| 3.125%                  | 10             | 22.75/0.801 | 16.34/0.535 | 28.37/0.936 |
|                         | 25             | 21.69/0.785 | 18.94/0.659 | 26.89/0.941 |
| 5%                      | 10             | 21.73/0.796 | 16.32/0.545 | 22.93/0.921 |
|                         | 25             | 21.63/0.787 | 20.06/0.685 | 28.23/0.938 |
| 6.25%                   | 10             | 21.84/0.799 | 13.11/0.476 | 26.21/0.934 |
|                         | 25             | 21.66/0.787 | 19.40/0.671 | 29.16/0.948 |
| 8%                      | 10             | 20.79/0.793 | 17.22/0.580 | 27.64/0.941 |
|                         | 25             | 21.79/0.787 | 19.58/0.669 | 29.95/0.951 |
| 9.375%                  | 10             | 22.53/0.797 | 17.91/0.589 | 29.07/0.953 |
|                         | 25             | 22.15/0.791 | 19.68/0.678 | 29.56/0.953 |

 Table 45: PSNR(dB)/SSIM results of different methods on the 45<sup>th</sup> test data

| Sampling ratio \ Method | Dose per Pixel | CSNet       | ReconNet    | FSHNet      |
|-------------------------|----------------|-------------|-------------|-------------|
| 1.56%                   | 10             | 19.61/0.841 | 19.10/0.627 | 27.05/0.937 |
|                         | 25             | 17.26/0.797 | 19.13/0.710 | 20.52/0.919 |
| 3.125%                  | 10             | 19.39/0.849 | 15.12/0.572 | 24.97/0.945 |
|                         | 25             | 20.19/0.848 | 20.91/0.772 | 25.24/0.949 |
| 5%                      | 10             | 21.21/0.863 | 18.37/0.662 | 22.45/0.942 |
|                         | 25             | 19.56/0.850 | 21.04/0.752 | 26.63/0.952 |
| 6.25%                   | 10             | 19.67/0.855 | 17.24/0.631 | 27.98/0.955 |
|                         | 25             | 20.09/0.858 | 21.86/0.786 | 27.25/0.959 |
| 8%                      | 10             | 20.39/0.859 | 20.02/0.727 | 25.39/0.956 |
|                         | 25             | 19.23/0.852 | 21.94/0.786 | 29.89/0.959 |
| 9.375%                  | 10             | 20.66/0.858 | 20.12/0.697 | 26.11/0.959 |
|                         | 25             | 20.55/0.864 | 21.85/0.796 | 28.30/0.964 |