3D-SIM and NN

Collected images (of different orientation)
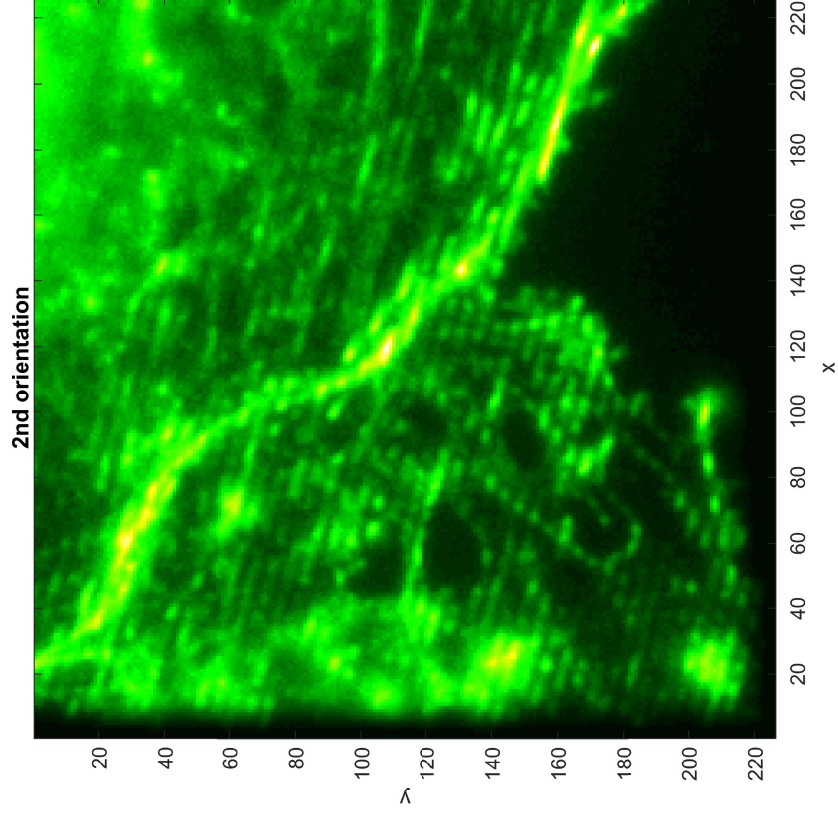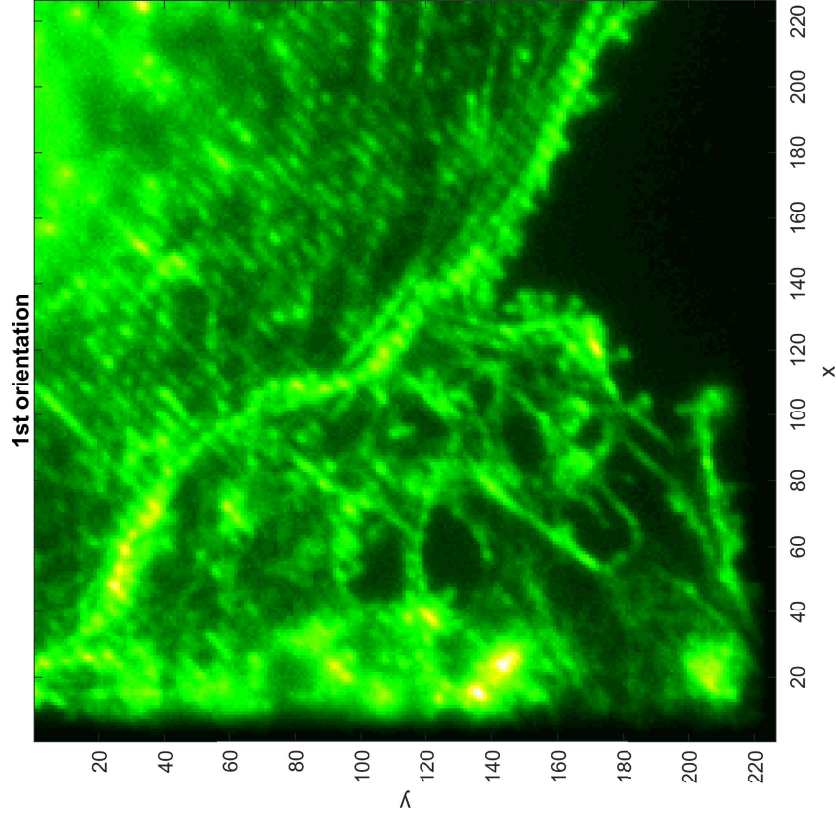
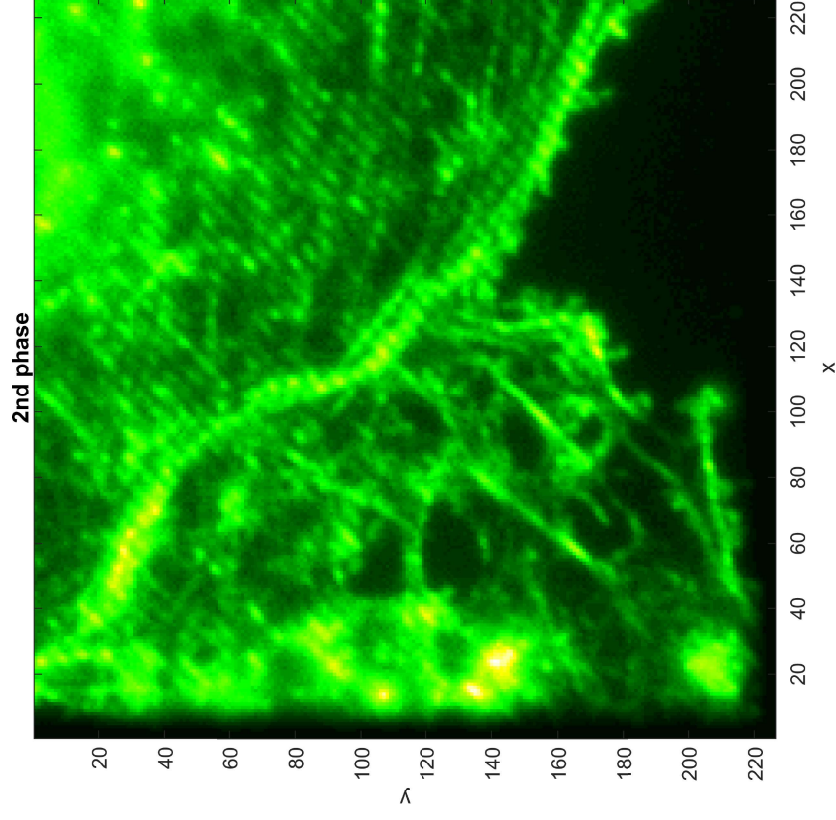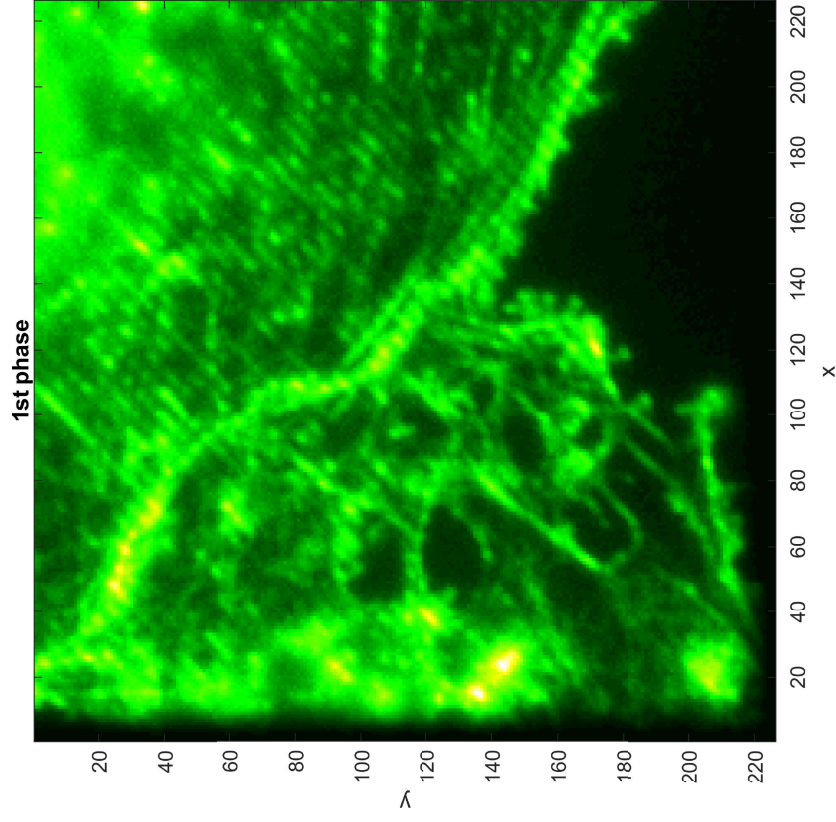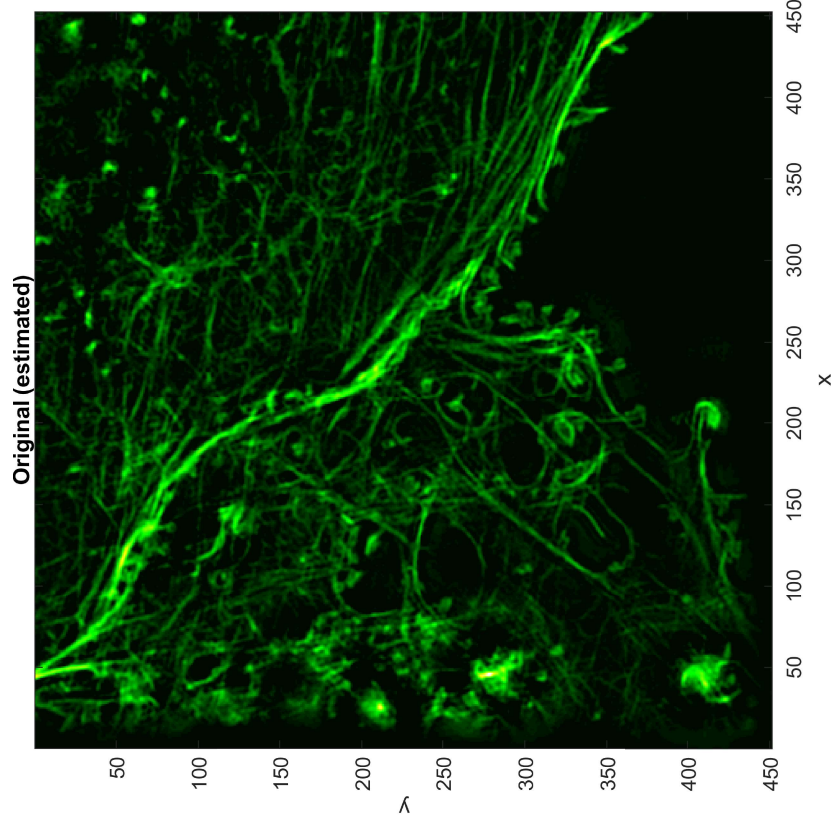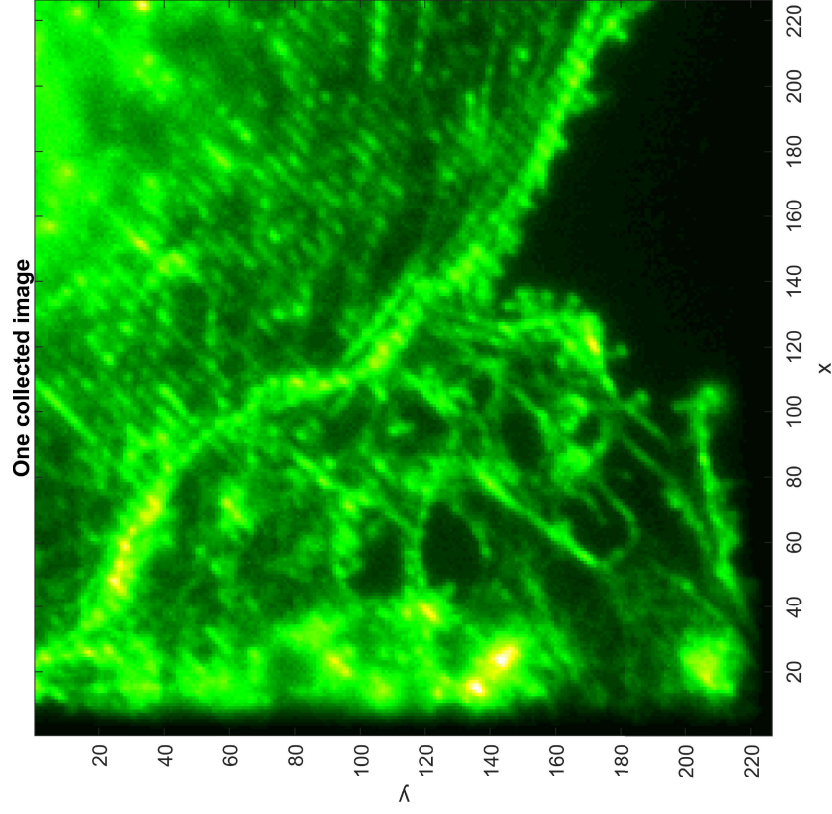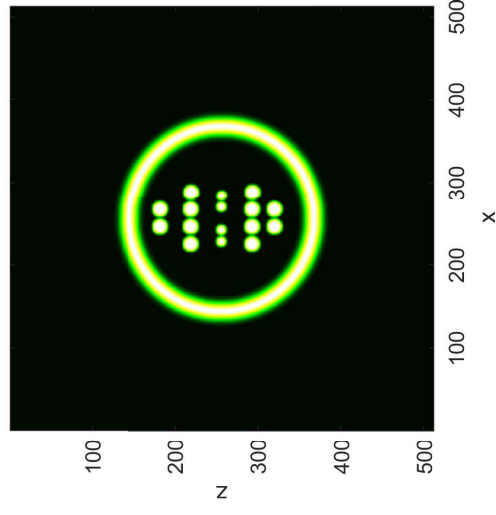# Collected images (of different phases)

1st phase

2nd phase

Collected images vs Original object (estimated)

One collected image

Original (estimated)

Simulated data
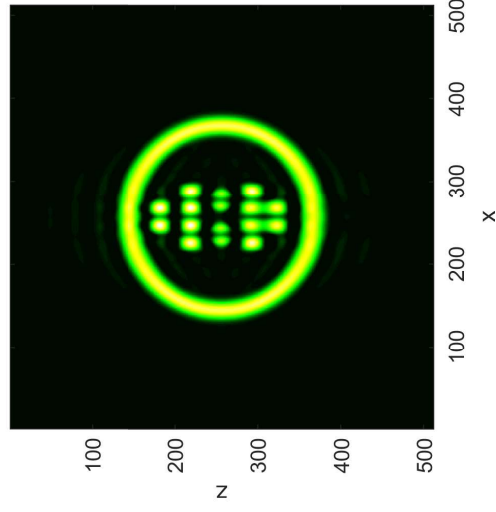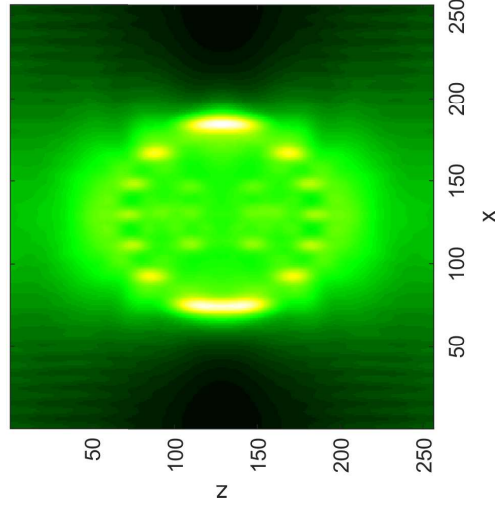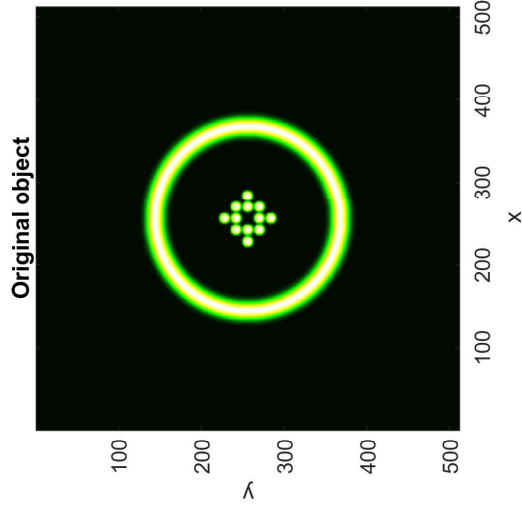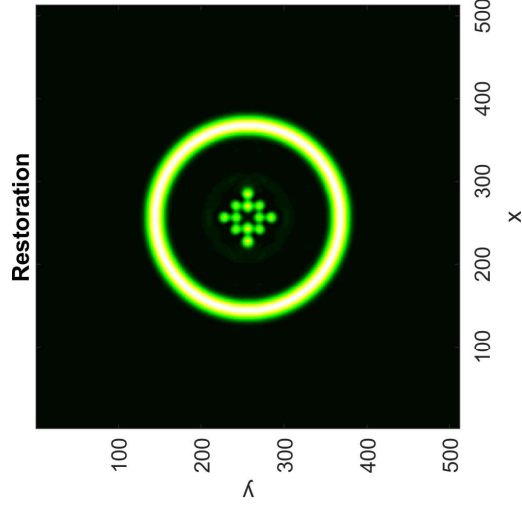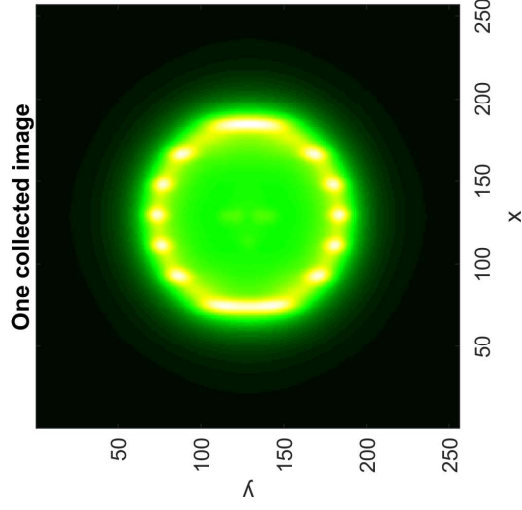
Original object

Restoration

One collected image

Problem statement & MB optimization

Forward model:

$$g(\mathbf{x}, z) = \sum_{m=1}^{N_m} [o(\mathbf{x}, z)j_m(\mathbf{x})] \circledast [h(\mathbf{x}, z)i_m(z)]. \qquad (1.1)$$

Problem statement: given $g(\mathbf{x}, z)$, find $o(\mathbf{x}, z)$?

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Problem statement: given $g(\mathbf{x}, z)$, find $o(\mathbf{x}, z)$?

Model-based optimization method:

$$\tilde{o}(\mathbf{x}, z) = \min_{o(\mathbf{x}, z)} \left(\sum_m \| \|g_m^0(\mathbf{x}, z) - [o(\mathbf{x}, z)j_m(\mathbf{x})] \circledast [h(\mathbf{x}, z)i_m(z)] \|\|^2 \right). \qquad (1.2)$$

Current challenges

Forward model:

$$g(\mathbf{x}, z) = \sum_{m=1}^{N_m} [o(\mathbf{x}, z) j_m(\mathbf{x})] \circledast [h(\mathbf{x}, z) i_m(z)]. \qquad (2.1)$$

Challenges:

1. Noisy $g(\mathbf{x}, z)$ (caused by photon collection?).

2. Estimated values of phases and orientation angles, affecting $j_m(\mathbf{x}), i_m(z)$.

3. Distorted $j_m(\mathbf{x}), h(\mathbf{x}, z), i_m(z)$: non-uniform amplitude of $j_m(\mathbf{x}), i_m(z)$, z-aberration of $h(\mathbf{x}, z)$.