

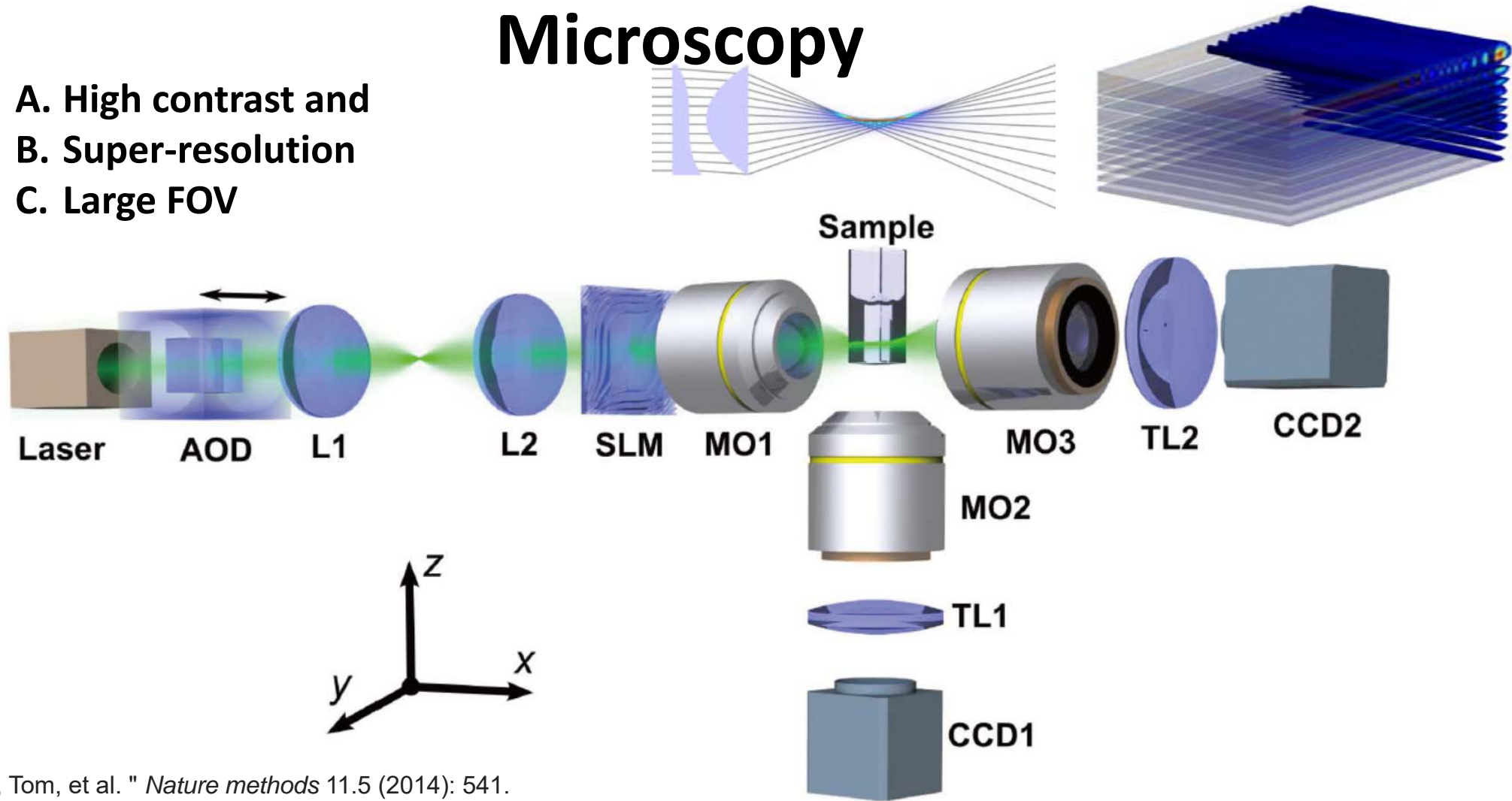
# **Reconstruction of Airy Light-Sheet Microscopy Image by Deconvolution**

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# Principle of Airy Light-Sheet Microscopy

- A. High contrast and
- B. Super-resolution
- C. Large FOV



# Principle of Airy Light-Sheet Microscopy

The imaging function of light-sheet microscopy can be interpreted by

$$Y(x, y, z) = \iiint U(x - x', y - y', z - z')P(x, y, z - z')X(x', y', z') dx' dy' dz' \quad (1)$$

where  $(x', y', z')$  is the coordinate of sample and  $(x, y, z)$  is the coordinate of camera,  $P(x, y, z)$  the illumination pattern,  $U(x, y, z)$  the *PSF* of widefield microscope.

# The PSF of Airy Light-Sheet Microscopy

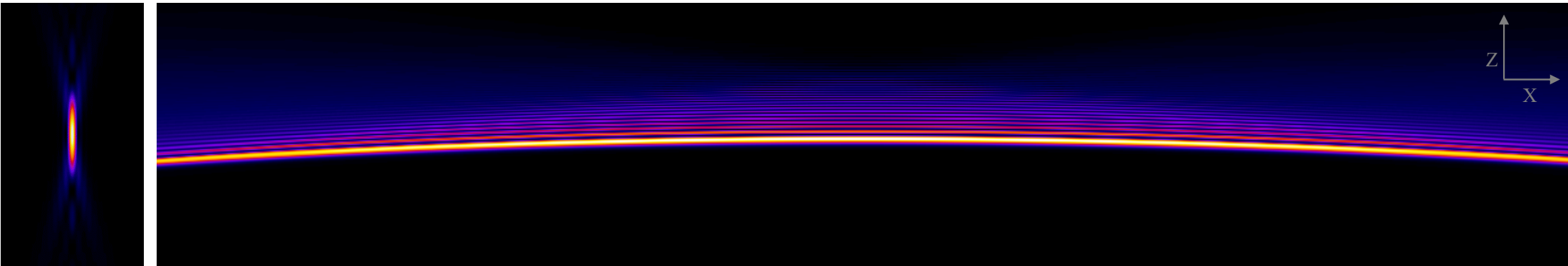
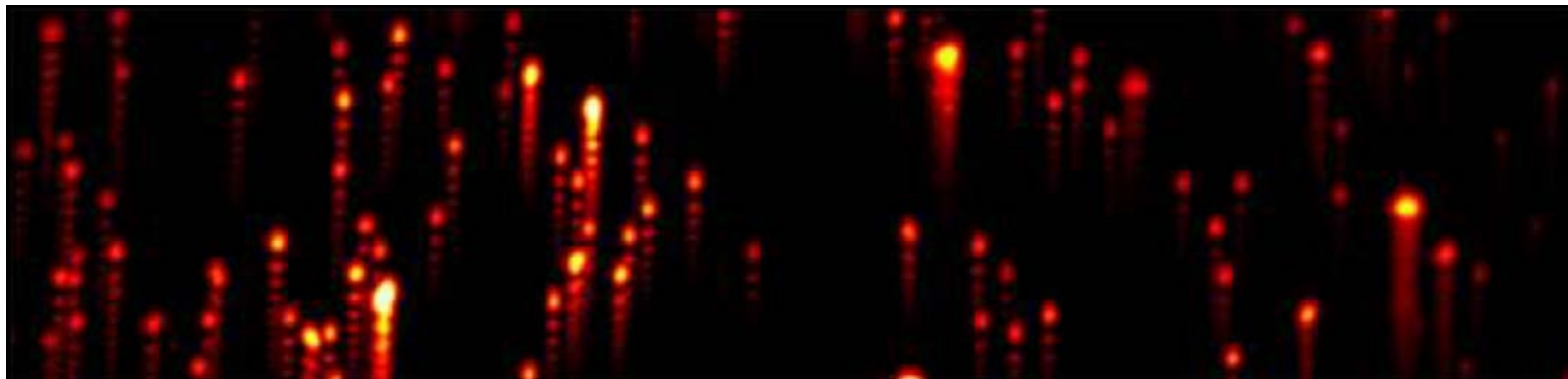
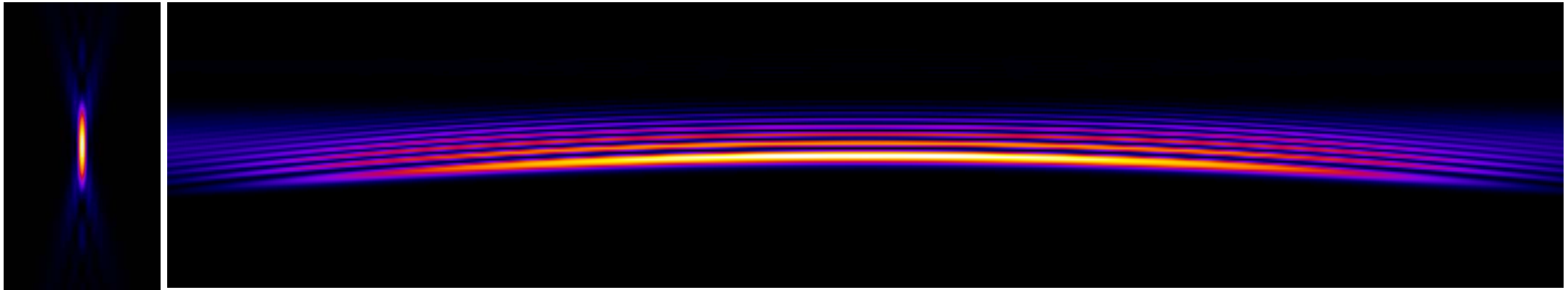


Fig.1 Left: simulated 3D PSF of wide-field microscope; Right: illumination pattern of Airy beam light-sheet microscope (Z-X)

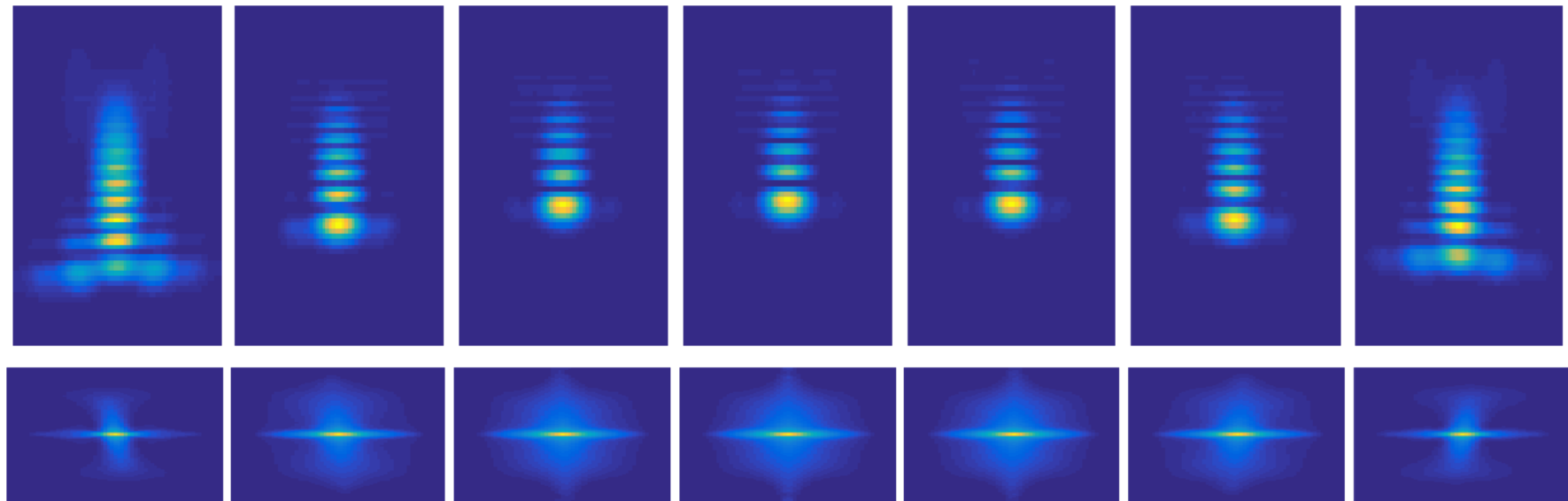


Beads image of Airy Beam Light-Sheet Microscopy( $x = 0 \sim 150 \mu m$ )

# The PSF and OTF of Light-Sheet Microscopy



The apodized illumination pattern



The PSF and OTF at different x-positions

# Deconvolution by 1D Wiener Filtering

## Existing Methods:

Deconvolve raw image by 1D Wiener Filter along z-direction pixel by pixel.

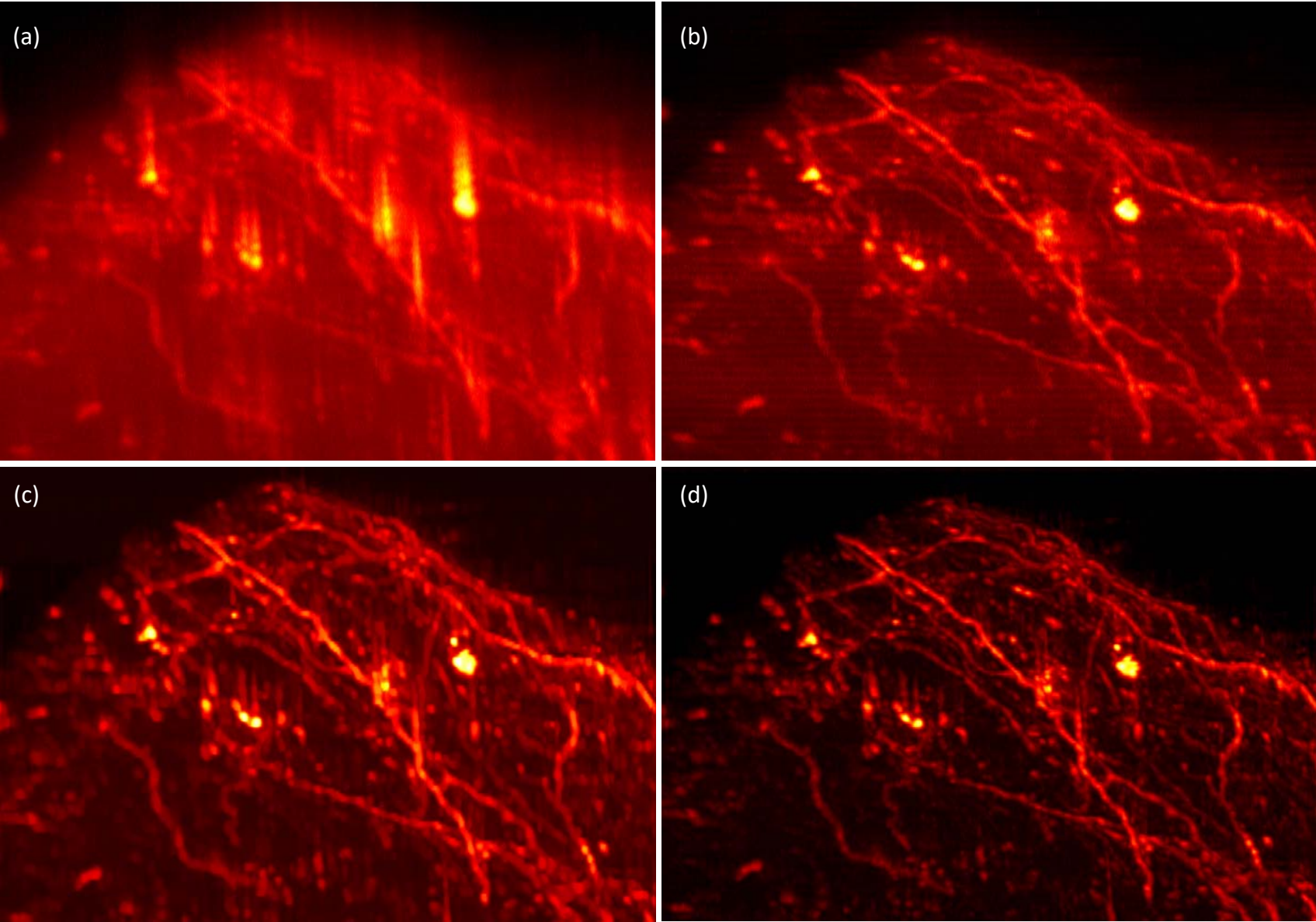
## Advantages:

Simple and fast.

## Drawback:

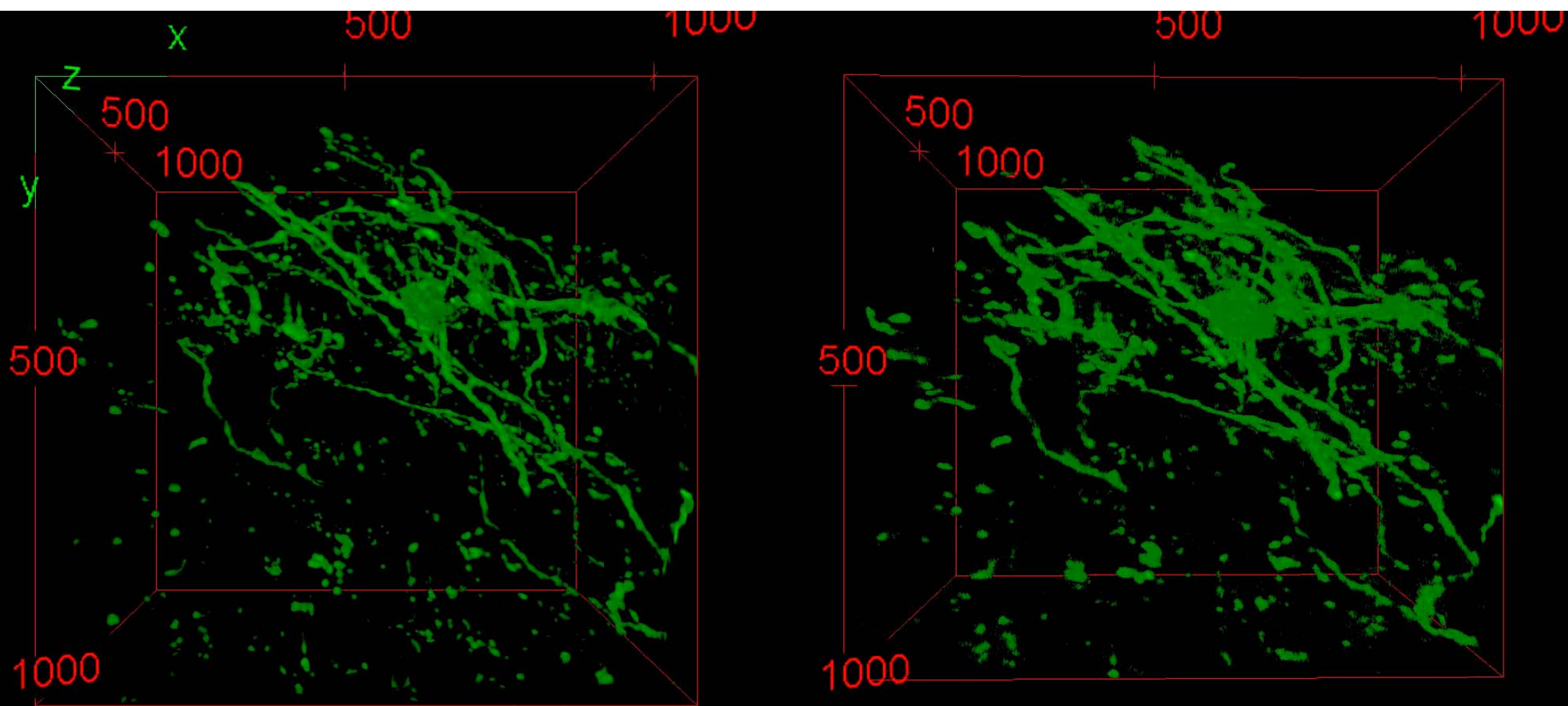
It is not sufficient for a 3D image reconstruction, as the resulting image is still convolved: blurred and noisy, which could be better.

# Result



(a) measured image, (b) 1D deconvolved, (c) 3D deconvolved by RLTV, (d) 3D deconvolved by RLRF





Left: 3D deconvolved image, Right: 1D deconvolved image



**Thank you For your attention.**