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Development of integrated dual-mode tomography for free-floating single live cell label-free analysis

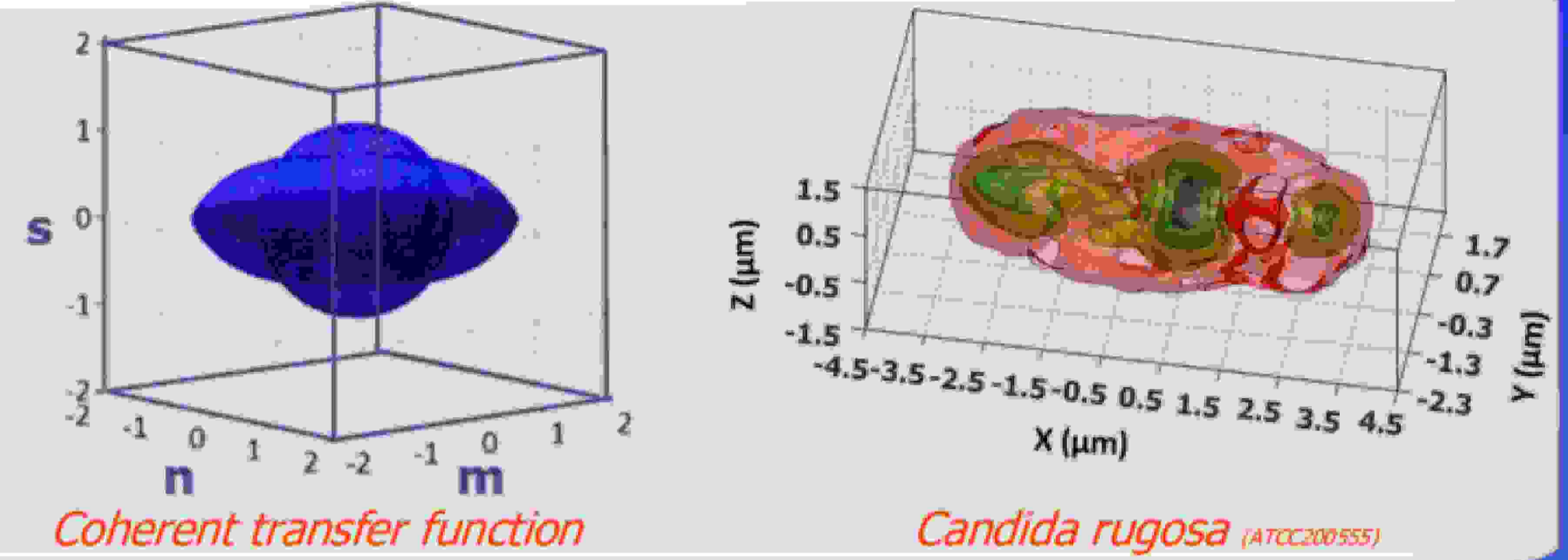


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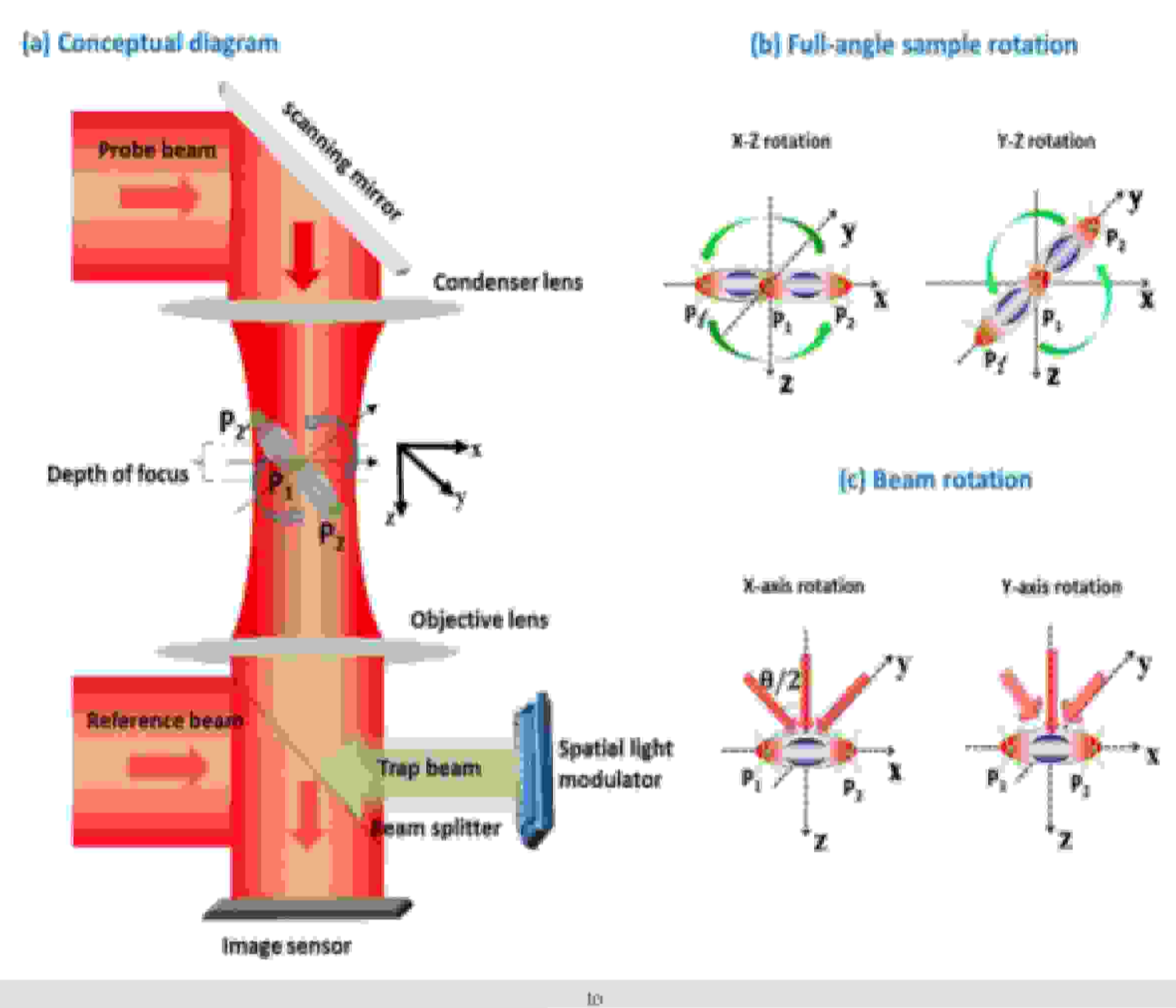
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Abstract

- This study focused on the development of integrated dual-mode tomography (IDT) system, which combines both beam rotation and full-angle sample rotation tomographic methods.
- The spatial frequencies corresponding to the beam rotation and the full-angle sample rotation methods are collected and combined. Consequently an 'UFO' (unidentified flying object) like shaped enlarged coherent transfer function is obtained.
- Label-free three-dimensional refractive index profile of live single cell is generated at sub-cellular level without using complex algorithms.

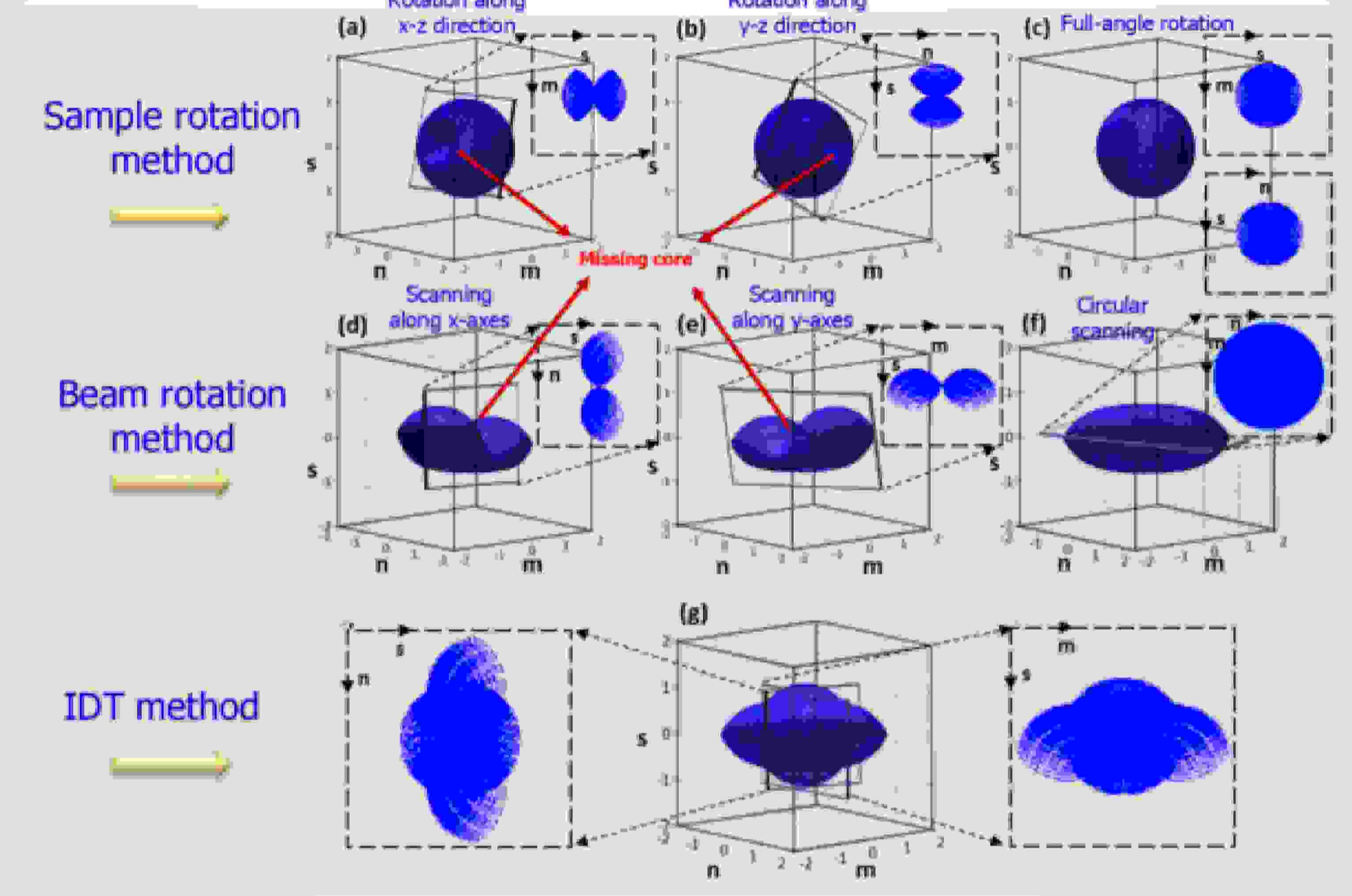


Conceptual Representation

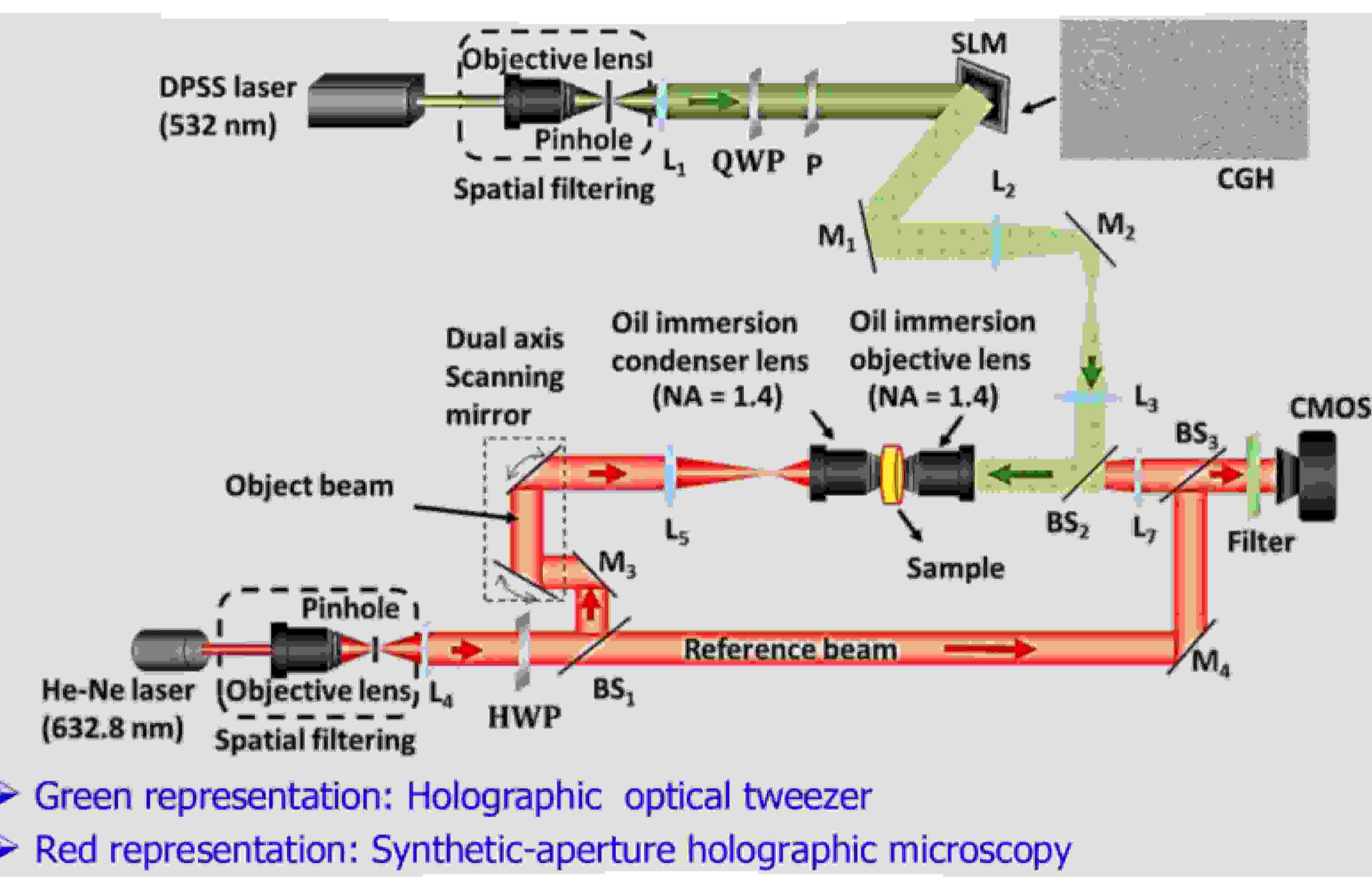


- IDT system is developed by combining holographic optical tweezer (HOT) with synthetic aperture-digital holographic microscopy (SA-DHM) imaging system
- In HOT system, a series of computer-generated holograms are designed based on Gerchberg-Saxton algorithm to generate two trapping points namely P_1 (fixed trap) and P_2 (rotation trap) respectively.
- Using the HOT system, the sample is rotated in full-angle directions and the corresponding holograms are recorded using DHM.
- The probe beam of the imaging system is rotated to collect the beam rotation holograms.
- The recorded holograms are reconstructed and mapped to Ewald's sphere to generate the three-dimensional RI profile of the sample

Coherent transfer functions (CTF)



Integrated dual-mode tomography – Experimental system



Conclusions

- A novel IDT system is developed and demonstrated for free-floating single living cell analysis.
- A novel experimental coherent transfer function ('UFO') is reported.
- Free-floating single live candida rugosa is imaged by the developed IDT imaging system with isotropic superresolution
- IDT imaging system is a potential tool for free-floating single live sample analysis at subcellular level.

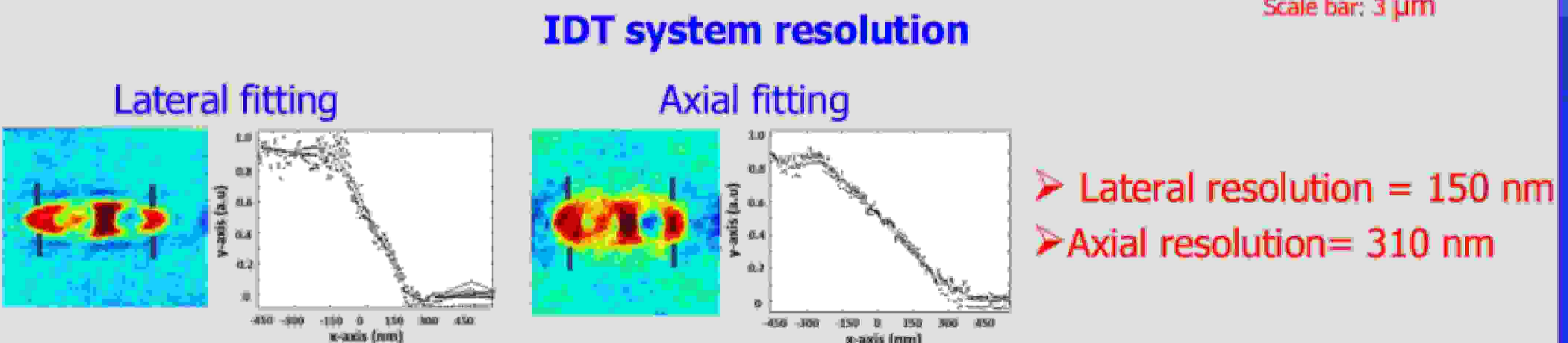
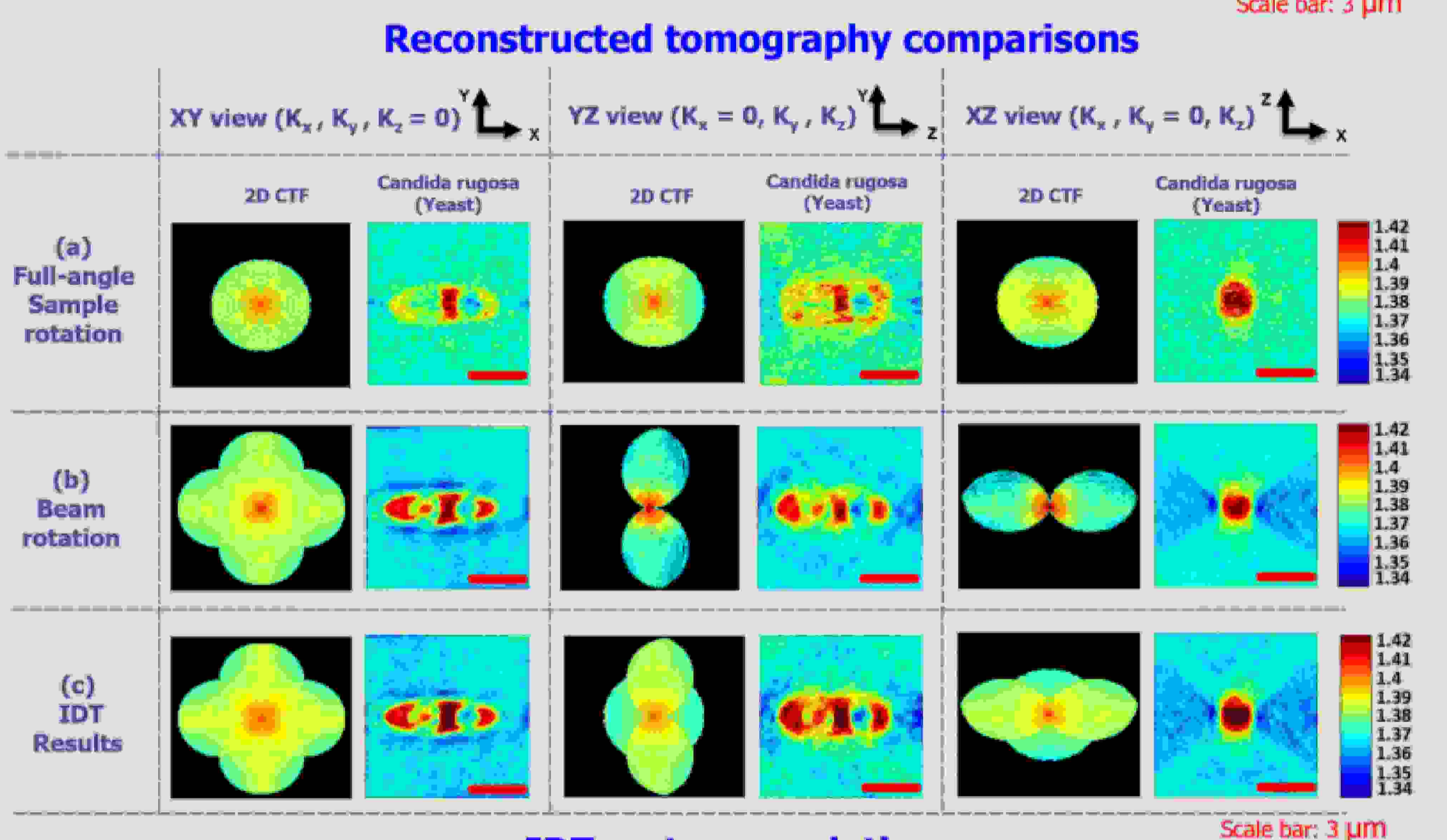
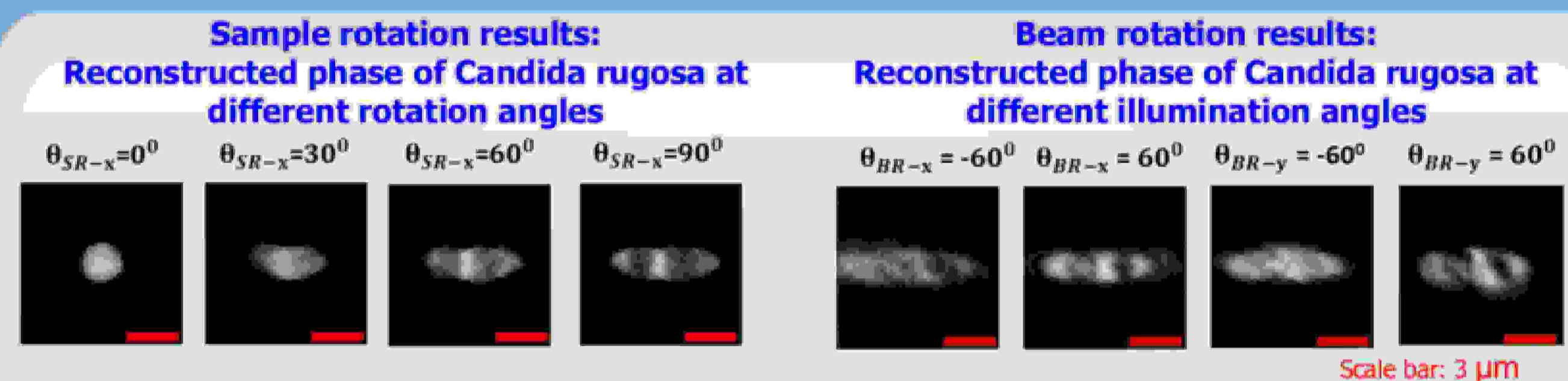
Acknowledgements

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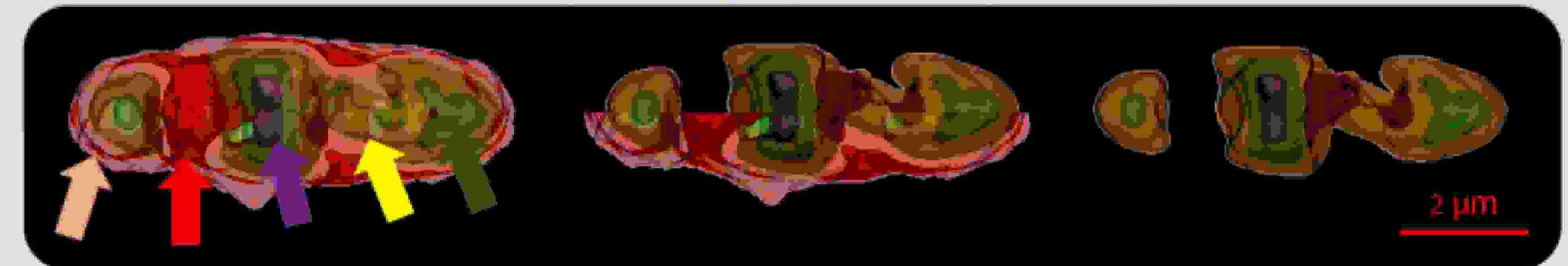
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Experimental results



Sub-cellular tomography of candida rugosa



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