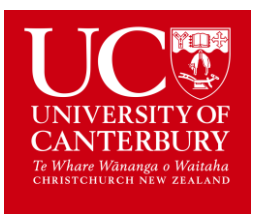


# Advantages and limitations of using positively frequency correlated light in Quantum Optical Coherence Tomography

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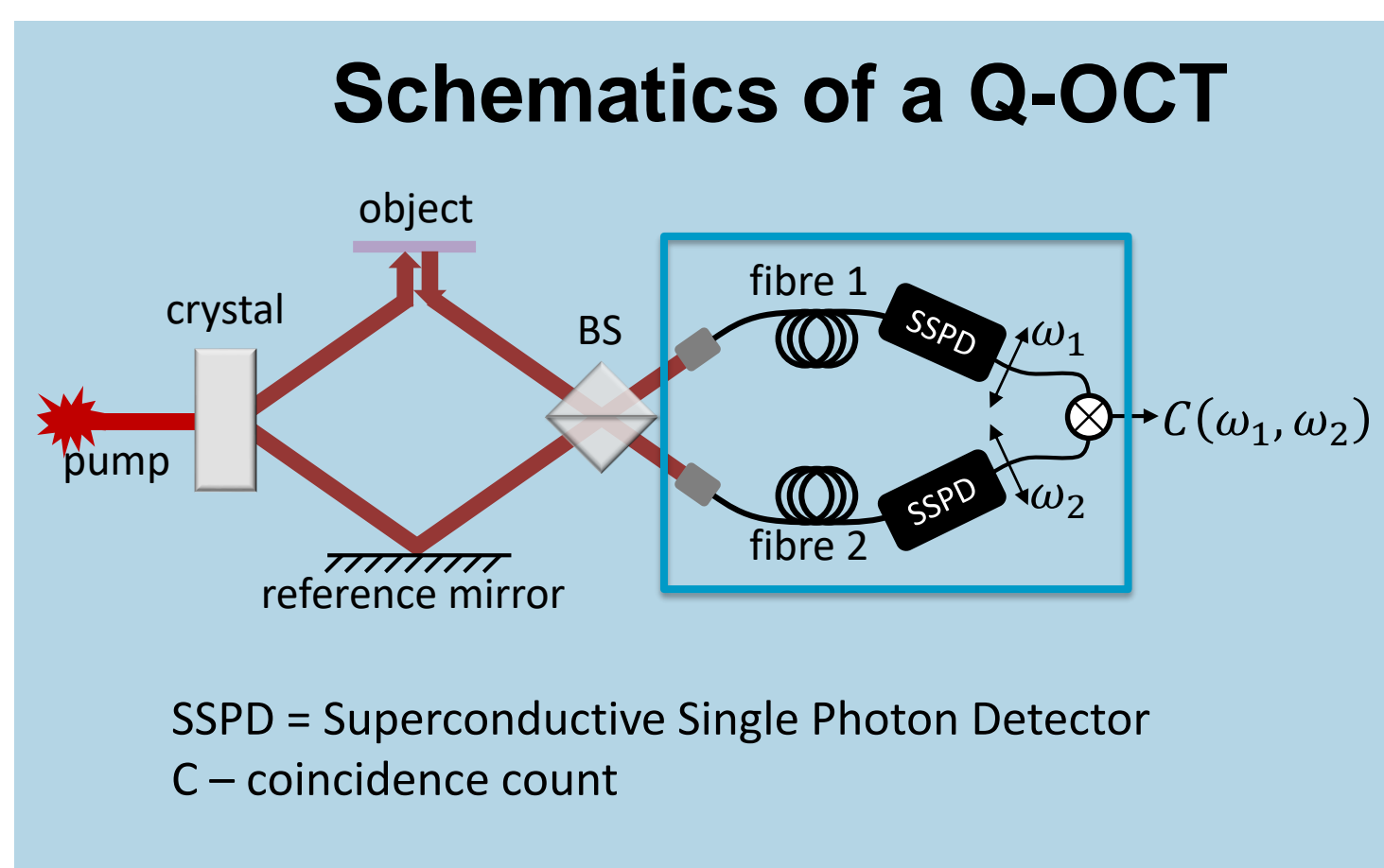
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We characterize Fourier-domain Quantum Optical Coherence Tomography using a source of positively correlated biphotons in terms of key imaging parameters: axial resolution, artefacts.

## INTRODUCTION

Quantum OCT uses entangled photon pairs and their coincidence detection to obtain a joint spectrum [1,2]. The depth profile of the imaged object is obtained by 2D Fourier transforming the joint spectrum and extracting its main diagonal.

Positively correlated entangled photons produce a joint spectrum broad in the anti-diagonal direction, enabling an extraction of an artefact-free depth profile.



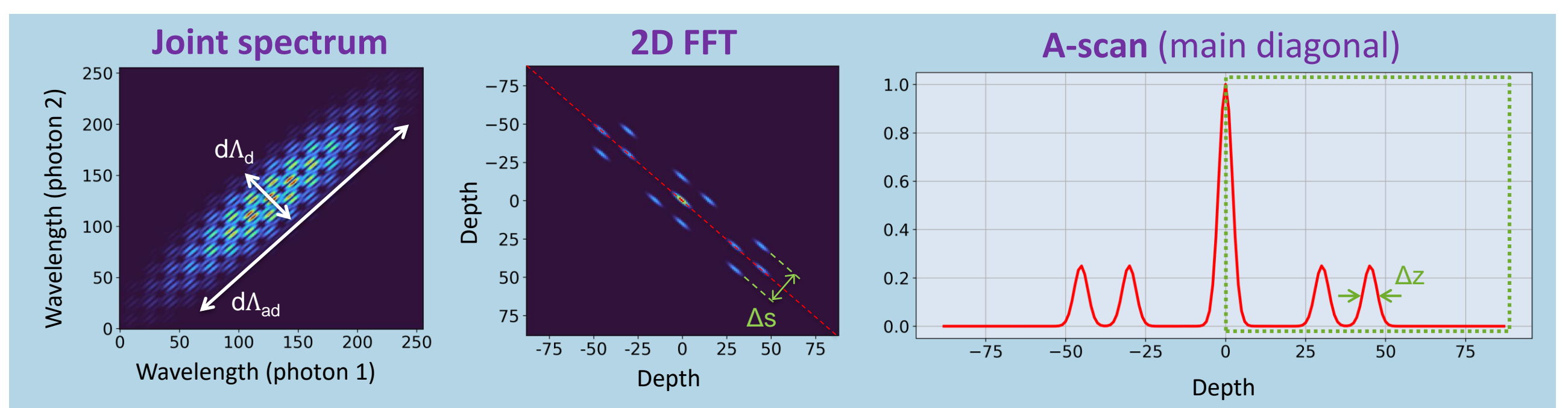
## Axial resolution versus artefact removal

The axial resolution in Q-OCT ( $\Delta z$ ) is inversely proportional to the diagonal width ( $d\Lambda_d$ ):

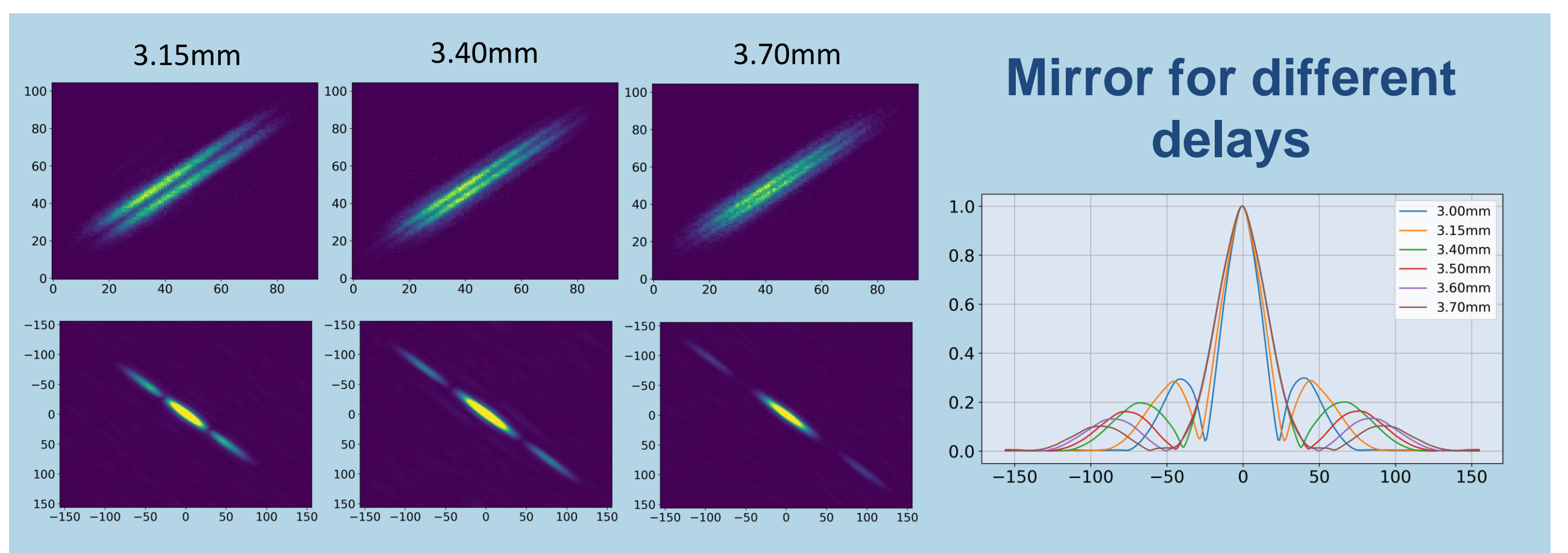
$$\Delta z \sim 1/d\Lambda_d$$

The larger the anti-diagonal width ( $d\Lambda_{ad}$ ), the greater the separation of the artefacts ( $\Delta s$ ):

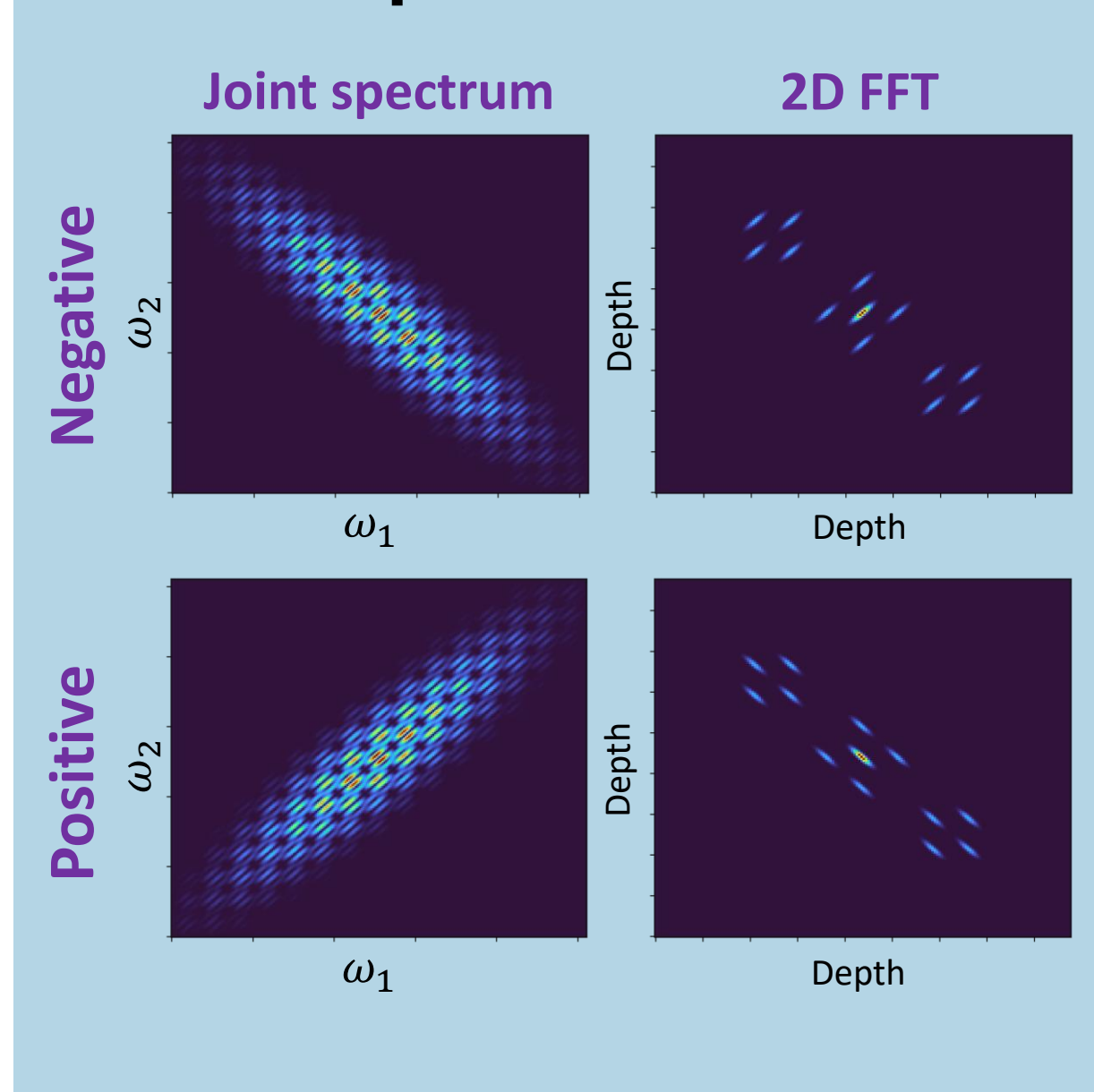
$$\Delta s \sim d\Lambda_{ad}$$



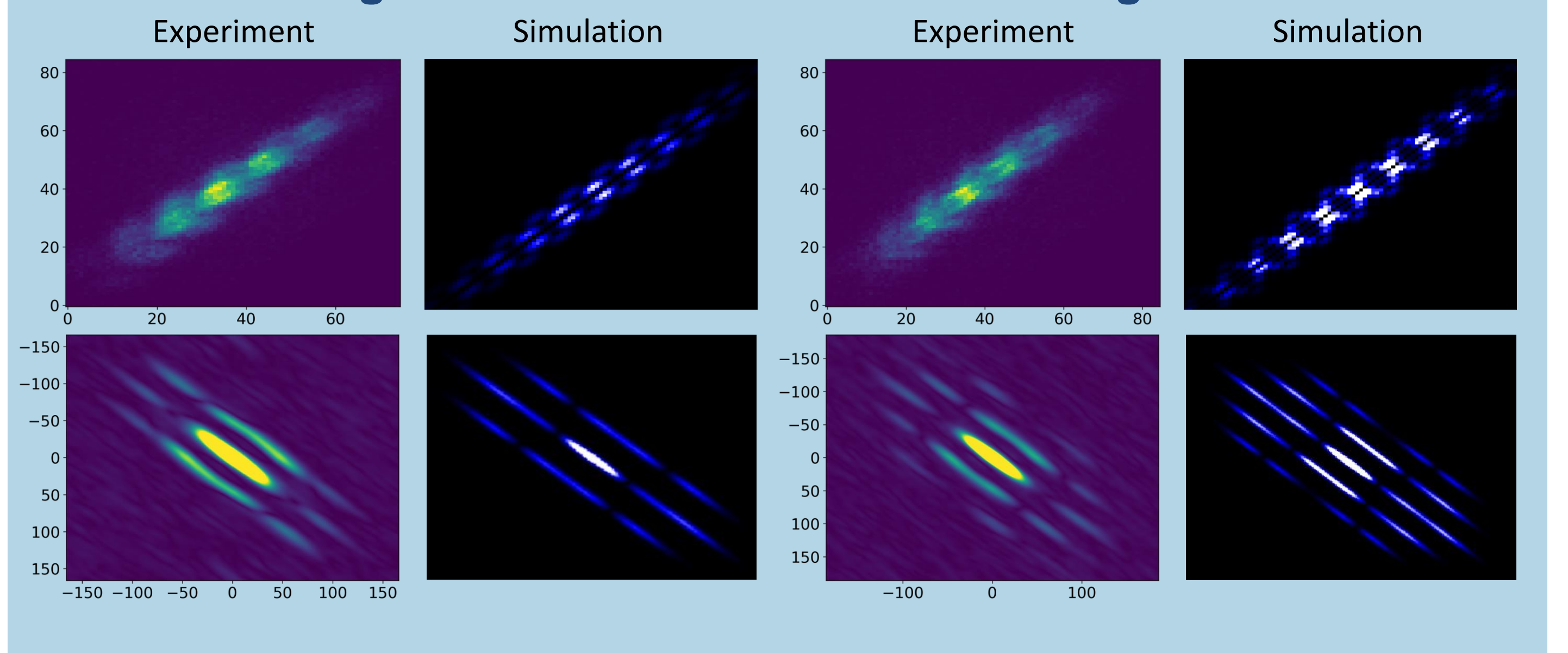
## RESULTS



## Joint spectra & 2D FFT



## 1 glass



## 2 glasses

## CONCLUSIONS

- Positively correlated entangled photons enable a better separation of the artefacts from the structural elements, but produce worse resolution
- Dispersion in the experimental system (mainly fibres) affects the quality of the joint spectra

## REFERENCES

- Nasr, Maged B., Bahaa EA Saleh, Alexander V. Sergienko, and Malvin C. Teich. "Demonstration of dispersion-canceled quantum-optical coherence tomography." *Physical review letters* 91, no. 8 (2003): 083601.
- Kolenderska, Sylwia M., Frédérique Vanholsbeeck, and Piotr Kolenderski. "Fourier domain quantum optical coherence tomography." *Optics Express* 28, no. 20 (2020): 29576-29589.

## Fibre dispersion?

