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Ultrafast laser scanning cellular microscopy by spatiotemporally encoded virtual sources

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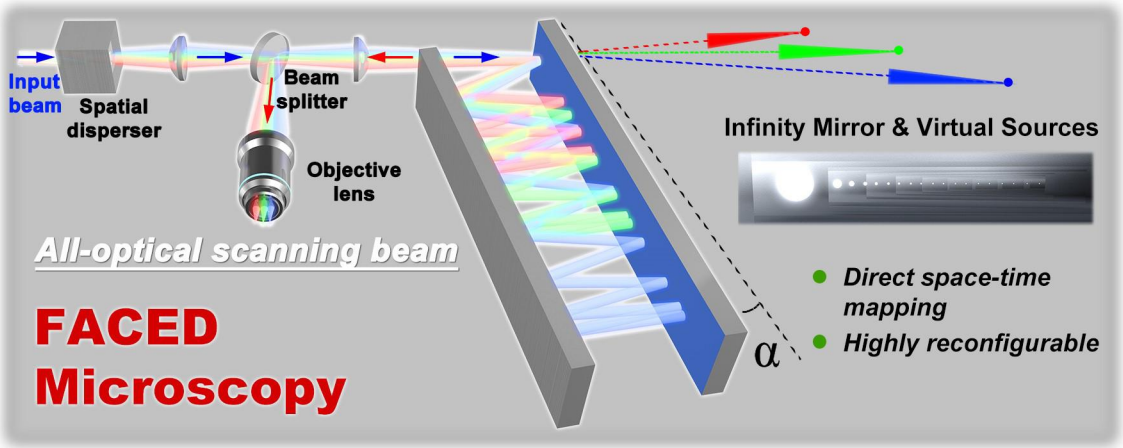
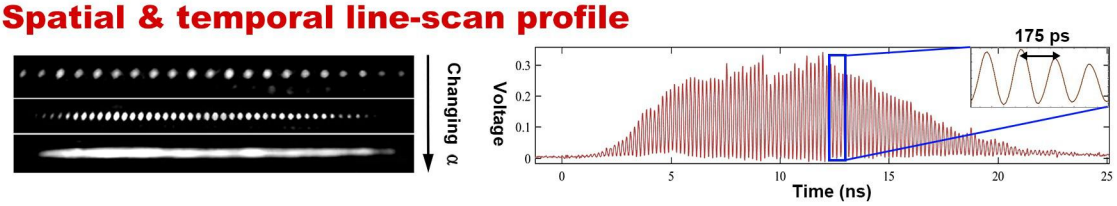
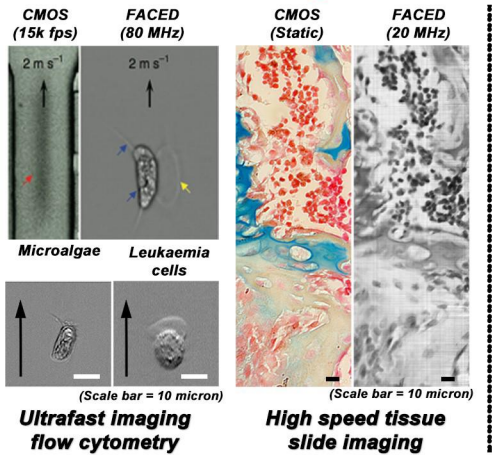
Introduction We report a new type of **all-optical ultrafast laser-scanning microscopy** (at a line-scan rate of 20 MHz) based on a phenomenon called *free-space angular-chirp-enhanced delay* **(FACED)**. It results in the generation of a reconfigurable array of spatiotemporally encoded virtual pulsed sources, which acts as a scanning laser beam. We demonstrate its application in high-throughput multivariate image-based single-cell analysis (10,000 cells/sec).



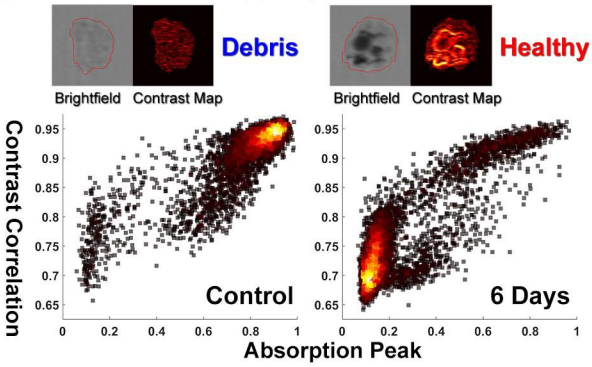
Spatial & temporal line-scan profile



From ultrafast single-cell imaging to analysis



- High speed microfluidic flow (>1 m/s)
- Human leukaemia cells labelled to visualize lysosome
- Nutrient starvation for 2,4,6 days



References:
[1] Wu, J., et al., "Ultrafast laser-scanning time-stretch imaging at visible wavelengths," Light: Science & Applications 6, e16196 (2017).

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