Laser Illumination for emerging imaging technologies

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Key words: Live Cell Imaging, STORM, PALM, SIM, TIRF, Confocal, FRAP.

The recent development in laser optical nanoscopy approaches in microscopy have allowed the breaking of the conventional optical resolution restriction of around 200nm laterally and 600nm axially. TIRF imaging has reduced the axial resolution down to around 100nm and the newer super resolution imaging techniques such as stochastic optical reconstruction microscopy (STORM)\(^1\) and photoactivation localization microscopy (PALM)\(^2\) have reduced the lateral resolution down as low as 10nm. However the imaging techniques of STORM\(^1\) and PALM\(^2\) require complex laser illumination sources. Both techniques require that fluorochromes be entered into the dark state using high power longer wavelength light whilst imaging fluorochromes requires shorter wavelengths at very low illumination levels to ensure sensitivity. Further structured illumination microscopy (SIM)\(^3\) due to the requirements of imaging the same area repeatedly requires a highly stable and powerful laser source.

Traditional laser combiners are restricted to combining individual laser beams via an intricate and complex series of dichroics and mirrors. Each of these mirrors and dichroics adds an air/glass interface reducing coupling efficiency leading to reduced power output from the optical fibre into the microscope. Due to the use of Complex Monolithic Optics (CMO) allowing the combination of various laser wavelengths with extremely high efficiency due to the reduced number of air/glass interfaces the Monolithic Laser Combiner is capable of controlling wavelength power from >100mW down to <100nW. This huge dynamic range in illumination makes it an ideal partner for far field light microscopy.

References: