Back-scattering Scanning Polarimetric Setups for Medical Applications

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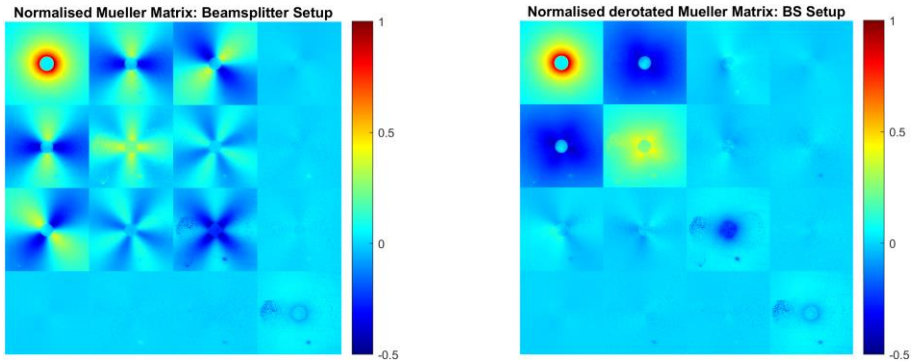
Polarimetric backscattering imaging is a technique used to characterize the optical properties of scattering samples [1]. While Mueller polarimetry is commonly used for surface imaging, we are particularly interested in its application for characterizing the internal structure of a sample beyond the surface. In this presentation, we introduce two backscattering scanning polarimetric configurations, distinguished by their use of a beamsplitter and a mirror to separate incident and back-scattered light with the calibration scheme we employed [2]. This study evaluates their respective strengths and limitations, comparing their effectiveness in deriving the Mueller matrix for a polystyrene suspension and in pig brain sample.



(a) (b)

Fig. 1: (a) represents the normalized Mueller matrix for polystyrene suspension. Fig. 1: (b) represents de-rotated Mueller matrix of polystyrene suspension.

We produced the de-rotated Mueller matrix to remove the angular dependence from the Mueller matrix components and then compare the radial profile for further characterization of the sample.

[1]. Jain, A., Ulrich, L., Jaeger, M., Schucht, P., Frenz, M., & Akarcay, H. G. (2021). Backscattering polarimetric imaging of the human brain to determine the orientation and degree of alignment of nerve fiber bundles. Biomedical optics express, 12(7), 4452-4466.
[2]. V. Stefanov, B. P. Singh, and A. Stefanov, "Calibration features of a polarimetric backscattering setup based on a beamsplitter," Opt. Express 33, 23452-23464 (2025).