DEVELOPMENT OF A FAST, LARGE AREA SCANNING MULTIPHOTON MICROSCOPE FOR SKIN IMAGING

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There is an important clinical need to enhance the diagnostic accuracy of skin diseases, to understand dynamic cellular and molecular processes during treatment procedures and to guide effective treatment. Among technologies that can provide non-invasive solutions to these longstanding clinical challenges, MPM imaging is unique in that it provides sub-micron resolution images with contrast that closely resembles the histological sections dermatopathologists use for diagnosis. MPM contrast in skin is derived from second harmonic generation of collagen and two-photon excited fluorescence of NADH and FAD+, elastin, keratin, and melanin. Clinical examination crucially relies on the ability to quickly examine large tissue areas and rapidly zoom in to regions of interest. In this presentation, I will discuss the recent advances on the development of an MPM-based imaging platform that provides high-speed, high-resolution mesoscopic images of humans skin.

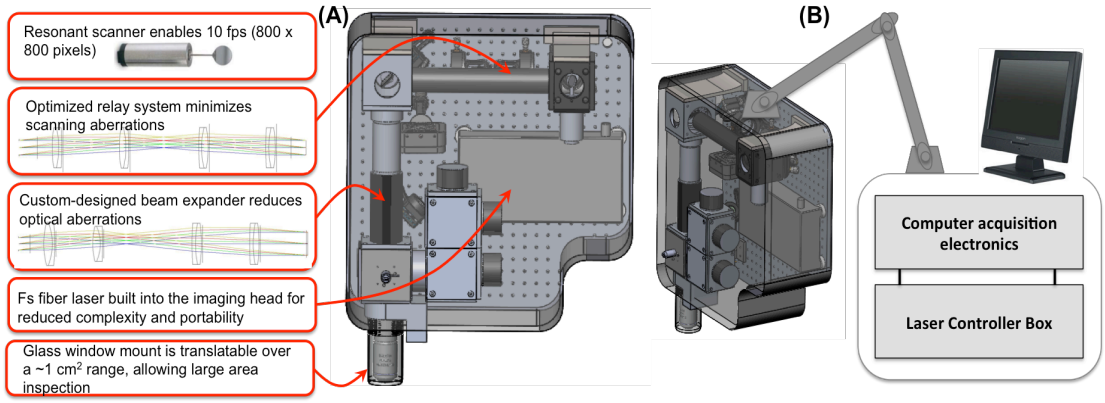

Figure 1. (A) Schematic and overview of the main elements of the scan head. The laser source is built into the scan head, which also contains a laser scanner, relay optics, objective and detectors. (B) Basic layout of the proposed clinical microscope. Sketch is not to scale.

This imaging system combines mechanical and optical scanning with image restoration neural network computational approaches to allow millimeter-to-centimeter scale imaging within minutes, while maintaining sub-cellular resolution. This imaging system also features time-resolved single photon counting detection with sufficient temporal resolution to distinguish fluorophores, such as melanin. Selective detection of melanin facilitates its quantitative assessment, important in the diagnosis and the treatment evaluation of many skin conditions. This unique combination of features provides this imaging platform with highly optimized functionality that enhances its potential for routine clinical use.