

## NON-INVASIVE DIAGNOSIS OF SKIN STRUCTURE AND BIOCHEMISTRY BASED ON NON-LINEAR OPTICAL MICROSCOPY & SPECTROSCOPY

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The study of skin physiology and pathology can be benefit from non-invasive optical imaging of tissue structure and biochemistry. Optical diagnostic of skin is hindered by its high scattering coefficient and its spatially heterogeneous index of refraction. These difficulties have been partially overcome by recent development of in non-linear imaging and spectroscopic technologies. This presentation describes a number of important advances in this field.

On the theoretical area, the degradation of microscope imaging point spread function due to tissue scattering and index of refraction heterogeneity has been carefully quantified (Figure 1). An understanding of image degradation mechanisms is critical to further improve non-invasive imaging techniques for skin structures.

On the instrumentation area, significant progresses have been made in many fronts. One of the most important advances lies in the development of video rate tissue imaging (Figure 2). High speed imaging allows physiologically relevant tissue area to be efficiently sampled allowing statistically significant measurement of skin properties. Another major advance involves the further development of non-linear microscopy based on second harmonic generation. Second harmonic microscopy has been shown to be a powerful method to visualize collagen structures in the dermis.

Another major advance in the instrument area involves the incorporation of spectroscopic measurement into high resolution microscopy. Powerful new instrument has been developed that allows spectral resolved measurement of tissue properties based on fluorescence emission wavelength, lifetime, and polarization.

