

Development of Frequency Domain System for optical characterization of biological media.

Background

Optical techniques can be used to characterize biological media and tissue oxygenation, hemoglobin concentration(s), water content as well as exogeneous chromophores or fluorophores. In the Medical Laser Physics Group at Atomic Physics methods based on time-resolved instrumentation have been developed during the past decade. A short laser pulse is sent into, or onto, the tissue and the photons are collected after propagation through the medium. Tissue absorption and scattering cause the laser pulse to be broadened in time and fitting mathematical models to the "temporal dispersion curve" the absorption and scattering can be quantified. The system has been used to characterize prostatic tissue as well as breast tissue at the Lund University Hospital.

Project scope

A similar technique utilizes an amplitude modulated laser instead of a laser emitting a short laser pulse. A Frequency Domain System utilizes the amplitude and phase demodulation of the light, after propagating through the tissue, to assess the optical properties. The scope of the project is to develop such a system using two fibers for light delivery and collection. The project should be initiated by a literature search covering the present state-of-the-art of Frequency Domain Systems. The next step is to define hardware requirements in order to build a system. Following the completion of the system the functionality should be tested in phantom in order to characterize the system performance. The system will be tested in reference with the present Time Domain System.

Note: The literature search sub-project could preferably be made during the course in Tissue Optics given during the last study period VT08.

Student requirements

Interest in practical development of highly advanced optical systems.

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