STSM REPORT

COST STSM Reference Number: COST-STSM-BM1205-27417
STSM application number: ECOST-STSM-BM1205-180515-060653
STSM Grantee: Dr Irmantas Kašalynas
STSM title: The need and use of the THz OCT
Home Institution: State research institute Center for Physical Sciences and Technology (CPST), Vilnius (LT)
Host Institution: Dr. Daniel Martijn de Bruin, Academic Medical Center (AMC), Amsterdam (NL)
STSM period: from 18-05-2015 to 24-05-2015
STSM purpose: Development of THz OCT based methods appropriate for skin cancer detection and imaging

Description of the work carried out during the STSM:
During the visit main emphasis was put on collaboration establishment to develop the THz OCT systems. More specifically, figured out differences of the frequency-domain and time-domain OCT systems working with open-air setups; discussed requirements for the components giving preference to the thermal THz emitters and/or photo-conductive THz antennas as broad band THz sources; selected appropriate materials for calibration of THz OCT setup.

Description of the main results obtained:
1. Most appropriate configuration of the time-domain THz OCT system selected by means of the broad band THz source and the FTIR Michelson interferometer.

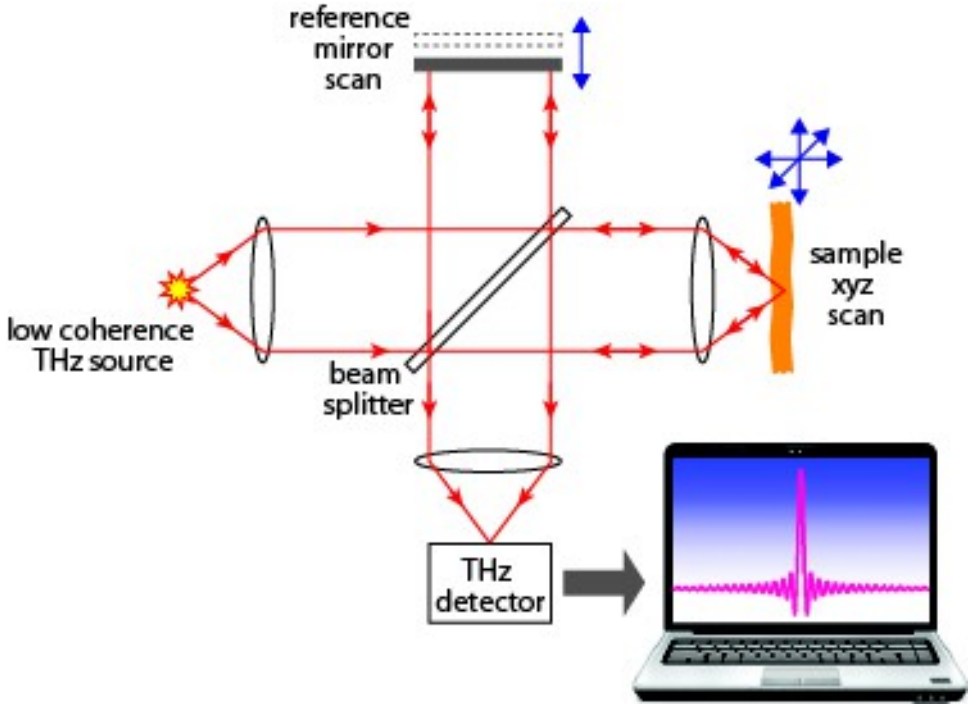

Fig. 1. Setup of the time-domain THz OCT system.

Proposed free-space time-domain THz OCT system setup is shown in Fig. 1. The setup is based on Michelson interferometer consisting of beam splitter and two mirrors: one is fixed (signal arm) and the second is scanned to obtain coherence signal (reference arm). In a proposed case, the fixed mirror is replaced with the biological sample under test. An interferometer modulated THz radiation is

measured after with the fast room-temperature THz detector. In order to obtain the THz optical coherent tomogram, the sample under test is scanned in XYZ-coordinates. The spatial resolution up to 0.1 mm is estimated by using a commercially available low-coherence THz source with the bandwidth of 1 THz, for example photoconductive THz antennas, thermal THz emitters, and similar.

2. Most appropriate materials (HDPE, PTFE, Silicon) selected to calibrate the THz OCT setup.

The HDPE, PTFE, and high-resistivity Silicon are commercially available materials with a refractive index varying from 1.4 to 3 and exhibiting low absorption coefficient at THz and IR bands.

3. PDMS as most suitable material for skin phantoms development selected for the THz and far-infrared spectroscopy.

The PDMS is a commercially available two component silicone product, hydrophobic, capable of curing at room temperature, and transparent at low side of the THz band in accordance to literature. Unfortunately, there are not available absorption and reflection data of the PDMS at higher frequencies up to IR spectrum.

4. Plans for further collaboration agreed: prospective time-domain THz OCT setups and results analysis in June-August; skin phantoms development in September, return visit to Vilnius in September-October.

Mutual benefits for the Home and Host institutions:
The partner's technologies for skin cancer assessment are different, so this visit helped to figure out optimal approaches to develop time-domain THz OCT methods appropriate for skin cancer research with terahertz waves.

Future collaboration with the Host institution (if applicable):
Prospective time-domain THz OCT setups and measurements data analysis in June-August; skin phantoms development in September-October, return visit to Vilnius in September-October; participation at the next COST events in Split, Croatia.

Foreseen journal publications or conference presentations expected to result from the STSM (if applicable):
Eventually possible after an idea of the time-domain THz OCT validation in Vilnius, proper skin phantoms design in Amsterdam and measurements in Vilnius, will be processed.

Connect this to the results.

STSM outcome form STSM application number	Home institution & country	Host institution & country	BM1205 WG	Objective of the collaboration	Results of the collaboration
ECOST-STSM-BM1205-180515-060653	Center for Physical Sciences and Technology, Lithuania	Academic Medical Center (AMC), the Netherlands	WG 4: Validation and evaluation of combined sensing modalities	Development of THz OCT based methods appropriate for skin cancer imaging	Progress both in time-domain OCT setups and phantoms development for skin cancer detection with THz waves.

I acknowledge that the described short term scientific mission was successfully carried out in the conditions here specified, and prospects for potential collaborations are expected in the coming months out of the agreements reached.

Amsterdam, 27 May 2015

Director, AMC

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D.M.deBruin, AMC