SmartHEALTH – Preliminary Results of an Electrochemical Measurement using a Microfluidic-based Cancer Diagnostic Instrument

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Driven by key targeted applications in cancer diagnostics (breast, cervical and colorectal), the European project SmartHEALTH delivered prototype systems with the aim of moving instrumentation from a laboratory platform to portable devices localized at the "point of care". The CSEM contribution to the project was the development of a device allowing a fully automatic electrochemical measurement in serum. Results obtained with this device are presented.

Cancer is a leading cause of death worldwide. The disease accounted for 7.9 million deaths (around 13% of all deaths) in 2007 [1]. Lung, stomach, liver, colon and breast cancers cause the largest number of cancer deaths each year. The most frequent types of cancer differ between men and women.

Most cancers are not "cured" but "managed". Treatment aims to prolong life and improve the quality of life of patients. Some of the most common cancer types have high cure rates when they are detected early and treated according to best practice methods. One of the major areas of progress with cancers such as breast cancer is the benefit of long-term therapies for reducing growth rates. This approach requires regular monitoring, so that the efficiency of maintenance therapy is rapidly ascertained and different therapies can be initiated as required. Moreover, expenditure for diagnosis represents generally less than 1% of the total health care expenditure, so increased testing will not significantly increase the costs of health care, but can significantly contribute to the quality of health care.

Therefore the SmartHEALTH project [2] aims to provide, through an integrated set of technology development, an open platform architecture that meets the needs for integrated biodiagnostics systems: the optimal combinations of instrument hardware platform and disposables, reasonable costs, mass-production capabilities, reliability, and flexibility.

The first prototype of the biochemical measurement system developed by CSEM is illustrated in Figure 1.

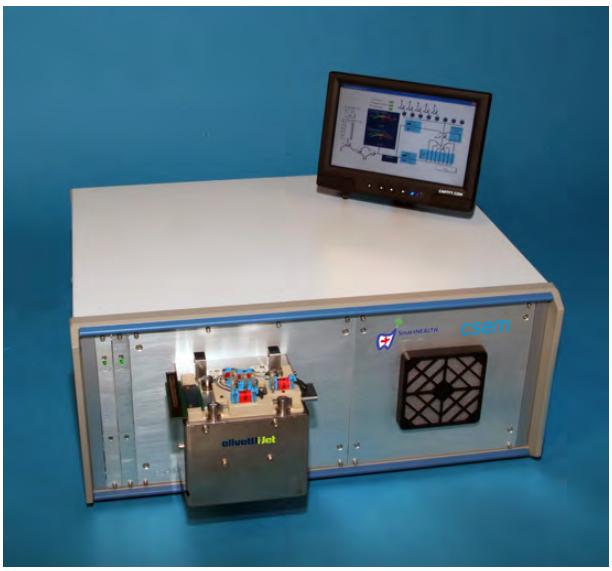

Figure 1: SmartHEALTH instrumentation platform developed by CSEM for electrochemical measurements

The user has to manually insert a serum sample in a special cyclic olefin copolymer microfluidic cartridge and plug the cartridge into a specially designed support. A graphical user interface allows the end user to interact with the system. It has been designed to remain as simple as possible for everyday users, while allowing wider access to more experienced technical personnel. Once a new measurement is run, software execution is fully automatic for the whole measurement protocol. Figure 2 shows an example of the electrochemical responses obtained at calibration and samples channels.

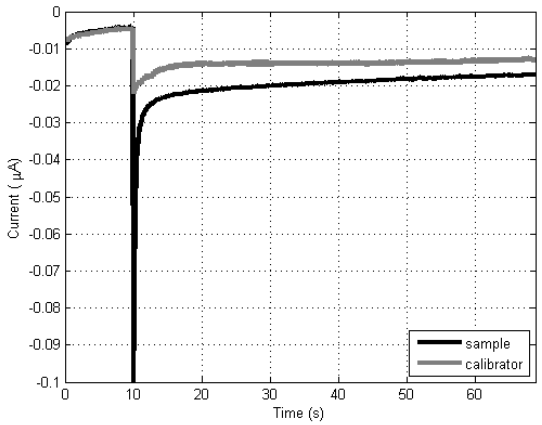

Figure 2: Example of averaged electrochemical measurements obtained with the SmartHEALTH instrument at the calibration channel (grey line) and sample channel (black line)

The concentration of the markers in the serum sample is linear with the asymptotic value of the measured current and is easily estimated since their ratio is equal to the ratio value of the calibrator. As soon as the results are available, they are transferred to a central database if a network connection is active, otherwise they are stored locally.

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[1] World Health Organization, www.who.int

[2] SmartHEALTH, www.smarthealthip.com