Electronic Supplementary Material (ESI) for Lab on a Chip

Radiolabelling diverse positron emission tomography (PET) tracers using a single digital microfluidic reactor chip

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ELECTRONIC SUPPLEMENTARY INFORMATION

Radiochemistry requires lead shielding to protect users from harmful radiation. For convenience, a standard radiochemistry "L-block" table shield was used as the main shielding. Further development can reduce the shielding size as it should only be necessary to house the chip and reagents.

It is possible to monitor the on chip radioactivity distribution by imaging Cerenkov radiation [1]. Cerenkov radiation is light that is produced when a beta particle travels faster than the speed that light travels in the surrounding medium. Because the EWOD chip gap (140 µm) is less than the average positron range (1.0 mm in water) most of the beta particles emitted by fluorine-18 are expected to travel through the transparent glass substrate (each plate is 0.7 mm thick), through which they can travel at a faster speed than light would travel in the glass. The emitted Cerenkov radiation is in the UV and visual spectrum and can be detected by a sensitive camera.

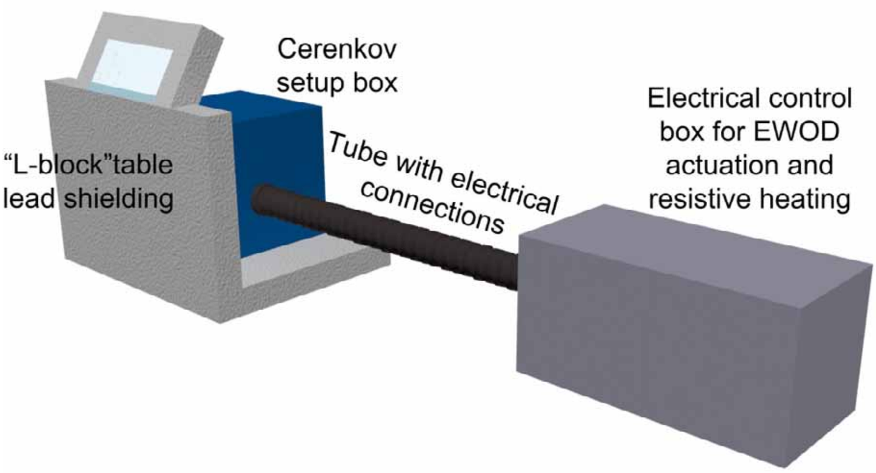

Fig. SI1 Shielding and System-Setup. The "L-block" table shields the Cerenkov setup which is contained in a light-tight box and holds the EWOD chip. Electrical connections to the chip, mirror control, and cameras are passed along ribbon cables in a tube to reduce light exposure into the Cerenkov setup. The electrical control box contains a waveform generator, voltage amplifier, solid-state relays, a multichannel heater driver, and two digital I/O devices. The waveform generator creates a voltage signal that is amplified for EWOD actuation. Solid-state relays controlled by a digital I/O device selectively connect the EWOD actuation voltage to the desired EWOD electrodes. The second digital I/O device controls the multichannel heater driver.

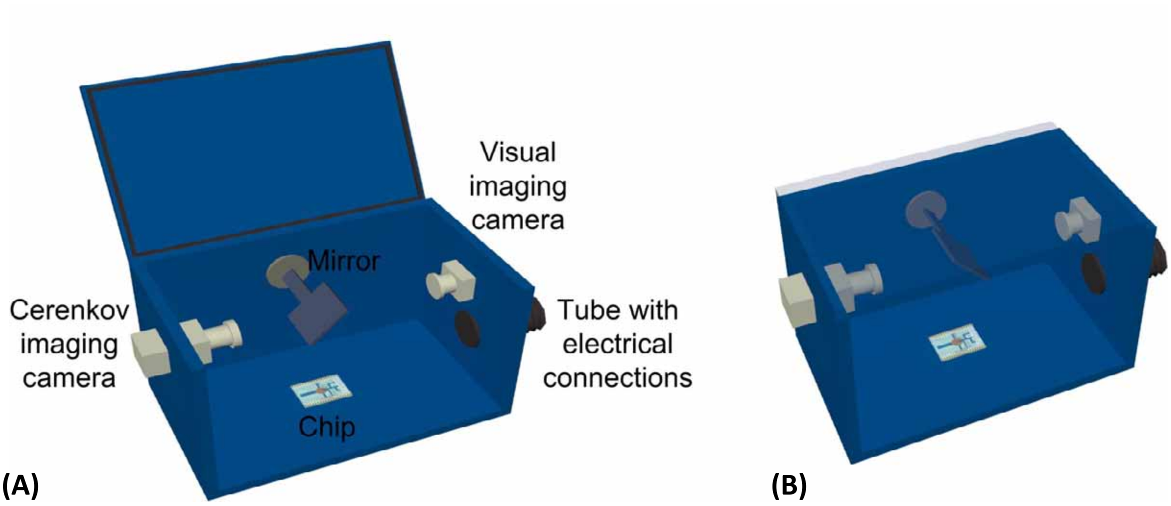

Fig. SI2 Cerenkov imaging setup. The Cerenkov imaging setup presented here is the same used by Dooraghi et al. [1]. It is housed in a light-tight box with a hinged lid that can close over a gasket. The chip was connected to electrical connections placed in the bottom of the box. A mirror was held on a motorized rotation stage above the chip to direct light into one of two cameras. One camera (DFK 21AU04, Imaging Source, Charlotte, NC) was used for standard visible imaging to remotely monitor the on chip processes. The second camera (QSI 540, Quantum Scientific Imaging, Poplarville, MS) was more sensitive and used for imaging Cerenkov radiation. Electrical connections were fed into the box through a tube to minimize interference from exterior light. (A) During regular EWOD operation, the lid was open and the mirror reflected the chip towards the visual imaging camera. (B) To image the on chip radioactivity, the lid was manually closed and the motorized stage directed the mirror towards the Cerenkov imaging camera.

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[1] A.A. Dooraghi, P.Y. Keng, S. Chen, M.R. Javed, C.-J. Kim, A.F. Chatziioannou, R.M. van Dam, *Analyst*, 2013, 138, 5654-5664.