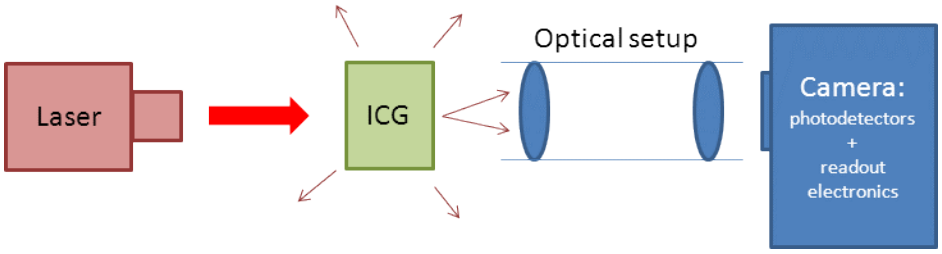
Development of a miniaturized Camera prototype for Fluorescence spectroscopy application

Place: EPFL www.epfl.ch (Lausanne, Switzerland) - group AQUA http://aqua.epfl.ch/
Duration: 6 months. Starting date: February - March 2013.

General project description

The project would be part of a multidisciplinary program for cancer research. The final goal is to provide physicians an operational probe for the local detection of IndoCyanine Green (ICG) in the patients' organs.
In this context, a setup has been developed at EPFL. It is composed of a Laser, the different ICG solutions to characterize, an optical setup and a camera based on homemade photodetectors.
The camera should provide both an intensity picture (structural information) and the ICG fluorescence time constant seen on each pixel (metabolic information)



The laser used excites ICG molecules which then emit fluorescence photons. The optical setup permits to carry a maximum of these photons to the camera.

The camera is a matrix of 48x60 pixels. Each pixel is composed of a photodetector (SPAD) and its readout electronics. The whole is driven by a FPGA containing a NIOS2 processor that runs the firmware.
Firmware (C) and Software (C#, C++) code is already written to run the camera and to perform data acquisition. Matlab program is used to analyze data offline.
The technique chosen to calculate the time constant of ICG implies the use of external delay lines with a minimum step of 10ps.

Master project description

The chosen candidate will be in charge of the firmware and software optimization. Good knowledge in electronics and programming is required. His main objective is to achieve an optimal control of the camera. His work will be composed as follows:

Electronics and programming (75%):

- Understanding of the camera operation.
- Optimization of the software for an optimum control of the camera.
- Optimization of the Hardware: new delay lines configuration, possible implementation on new boards.
- Integration of the system in a probe: miniaturization, Board design, power management, data rate management, real time data analysis.

Physics (25%):

- Understanding of the optical setup, mechanisms of fluorescence emission in ICG, basic physics of lasers, principles of photodetection and of SPAD operation.
- Run test and characterize the ICG images and time constant. Compare with data published in specialized journals.

If you are interested, please send your letter and CV to francois.powolny@epfl.ch