In the last years the needs for miniature photo-spectrometers (< 250cm³) has significantly increased. The main drivers are: reduced time for results, analyzing in situ, decreasing cost and increasing ease-of-use of systems for use by non experts. A prominent manufacturer of such spectrometers is Hamamatsu. Such a spectrometer e.g. for the visible has a size of 20.1 × 12.5 × 10.1mm³ and resolution 15nm. A promising application of such miniature spectrometer was recently reported as non-destructive testing of fruit ripeness (Scientific Report 6 32504 2016 Das “Ultra-portable, wireless smartphone spectrometer for rapid, non-destructive testing of fruit ripeness”).

CSEM carried out a first phase optics development of a miniature photo-spectrometer. The data processing is not yet established.

The core components of the photo-spectrometer are N transmissive filters of a few micrometer size mounted on top of a N photo-sensor array. An sketchy illustration of the optical set-up is shown in Figure 1.

**Figure 1** miniature photo-spectrometer based on optical filters $f_1$ – $f_N$, with its filter transmissions $T_i$ depending on wavelength $\lambda$.

**Characterization of the filter / detector system**

First the filter / detector system is characterized by acquiring the photo-sensor signals when the system is exposed to scanning narrow-band light from a monochromator illuminated with a broadband light source. For a wavelength range from $\lambda_{lo}$ to $\lambda_{hi}$ and a fixed narrow-bandwidth of $\Delta\lambda$, $M = (\lambda_{hi} - \lambda_{lo})/\Delta\lambda$ measurements are carried out. Thus a “filter matrix” $F$ with $M \times N$ measurement points are generated.

**Measurement of a unknown light source**

For a modest number of filters/photodetectors $N < M$ an unknown light source is illuminating the spectrometer and N photodetector signals are acquired $Y_i$, $i = 1..N$. The true spectrum of the light source is $X(\lambda)$.

**Objective**

The objective is now to estimate the spectrum of the unknown light source as good as possible by processing the “filter matrix” and the measurement $Y_i$, $i = 1..N$. 