

Novel radiation hard microfabricated scintillation detectors with high spatial resolution

A. Mapelli^{*1,2}, B. Gorini², M. Haguenauer³, S. Jiguet⁴, N. Vico Triviño¹, P. Renaud¹

¹Microsystems Laboratory, École Polytechnique Fédérale de Lausanne, Switzerland

²PH Department, CERN, Geneva, Switzerland

³École Polytechnique, CNRS/IN2P3, Palaiseau, France

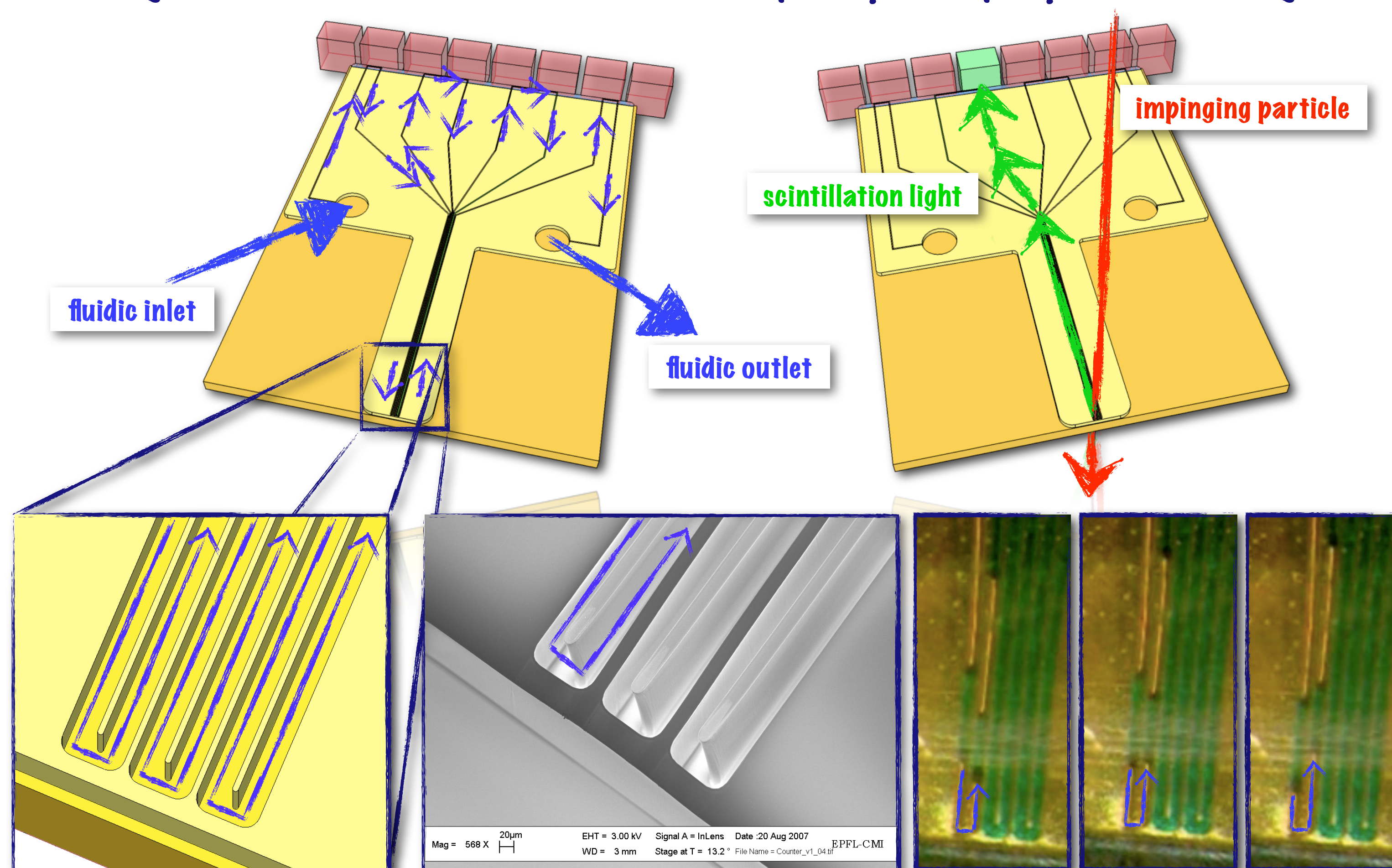
⁴Gersteltec Sàrl, Pully, Switzerland

*Corresponding author: alessandro.mapelli@cern.ch

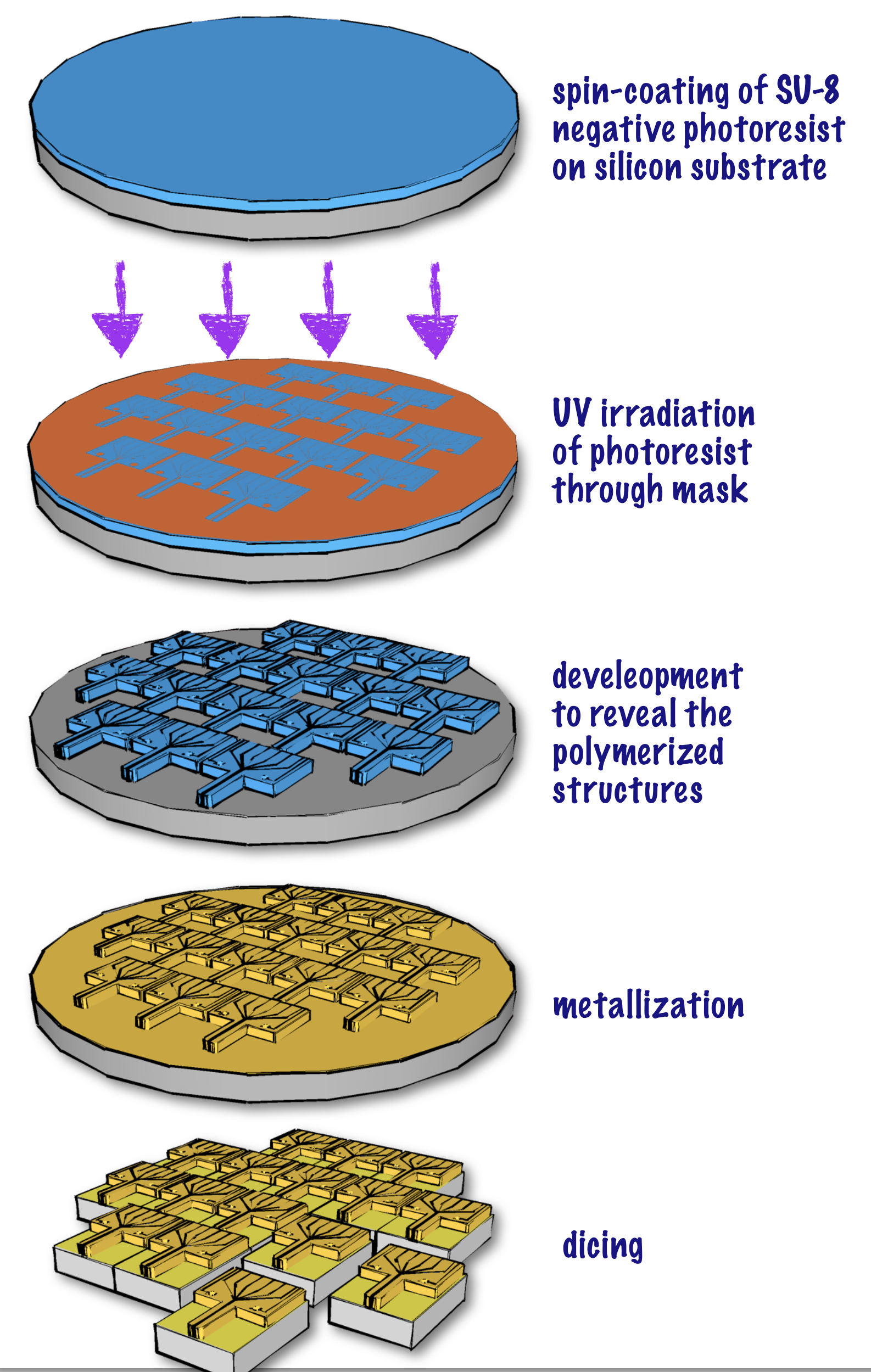
A novel scintillation detector is being developed with standard microfabrication techniques. It consists of a dense array of scintillating waveguides obtained by filling microfluidic channels with an organic liquid scintillator. Such a microfluidic device can be designed and processed to meet the requirements of a wide range of applications like medical imaging, homeland security and high-energy physics. High-spatial resolution miniaturized detectors as well as large-area detectors can easily be fabricated. The fabrication process of a prototype detector and experimental results are presented.

Principle of operation

A single microchannel defines a dense array of optically separated waveguides.

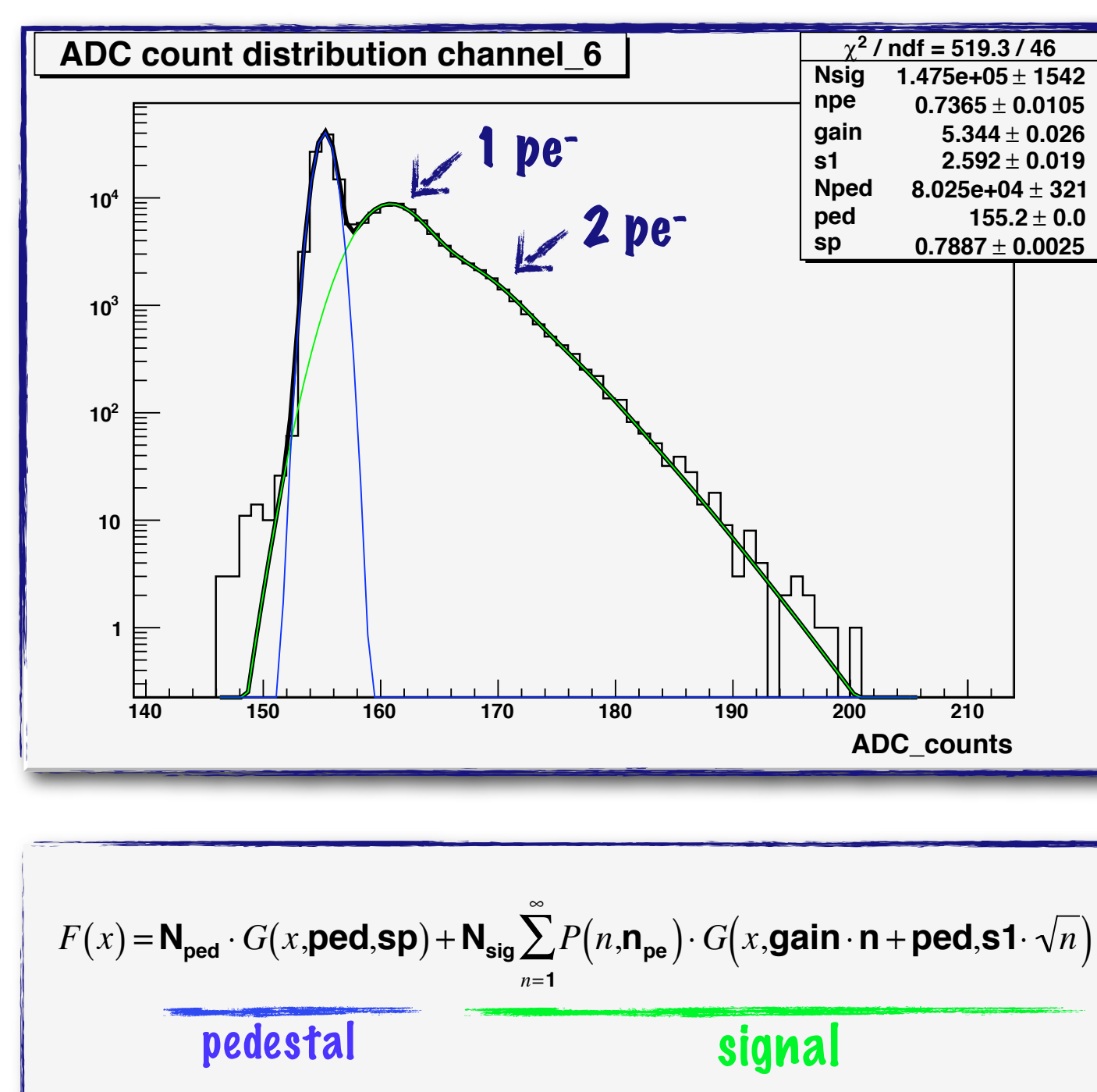
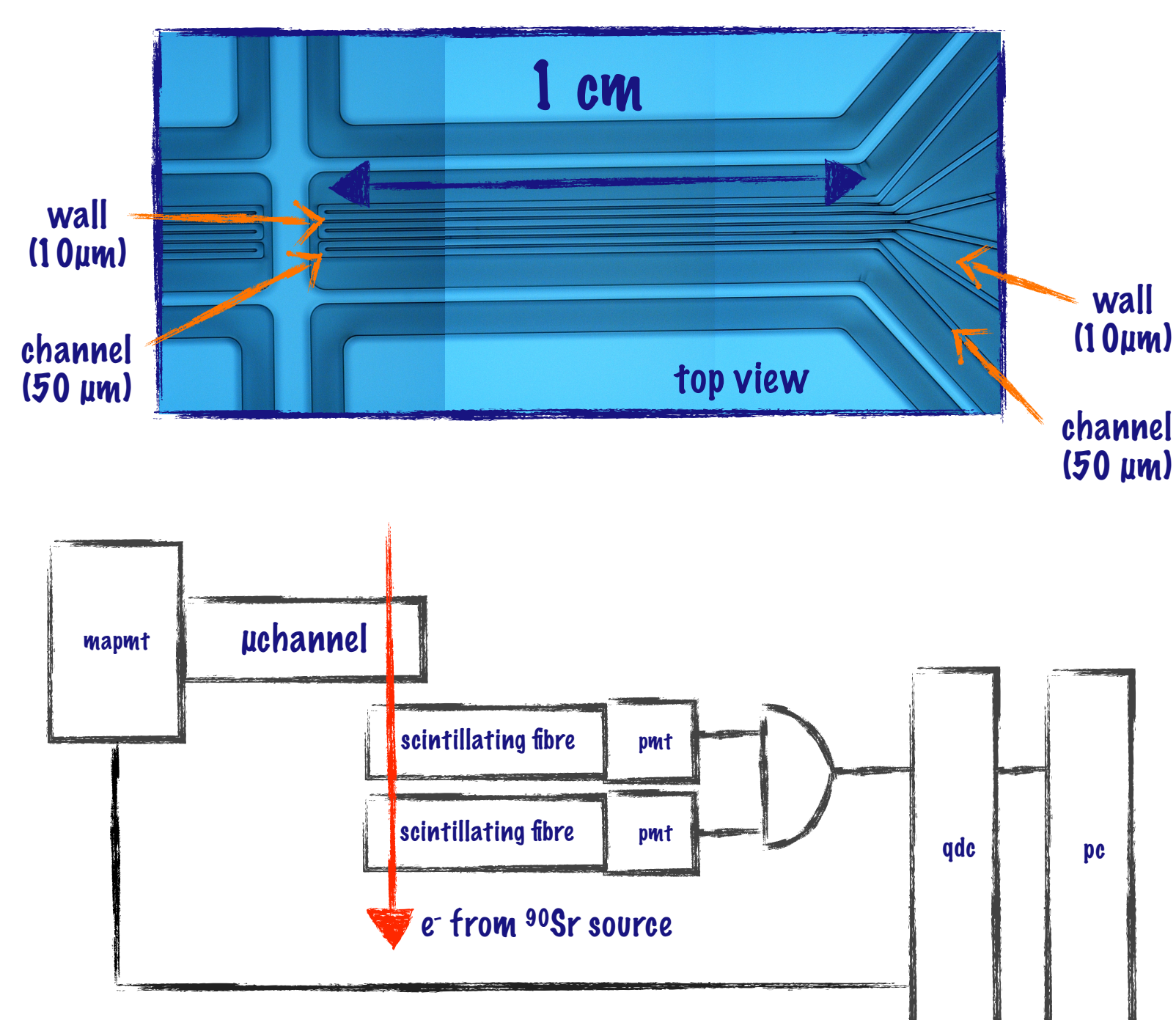


Fabrication process-flow



Experimental

A microfluidic chip fabricated with the radiation hard SU-8 photo-resin and made of channels with rectangular cross-section (50 μm x 200 μm) separated by 10 μm thick walls was filled with the liquid scintillator EJ-305 with high light output (80% of Anthracene). It was exposed to electrons from a ⁹⁰Sr source considered as MIPs. The scintillation light produced by their interaction with the liquid was read-out by a photomultiplier tube (MAPMT H7546B by Hamamatsu). The photoelectric yield of this set-up was measured to be approximately 1 photoelectron per MIP.



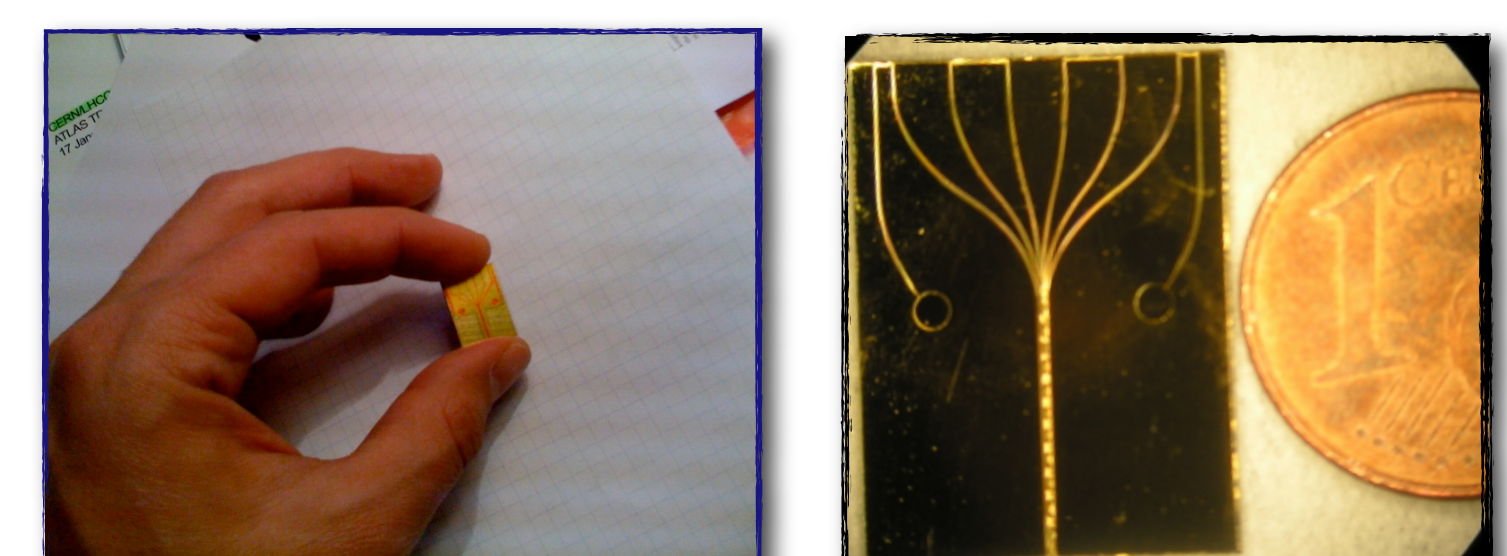
Outlook

Many different standard microfabrication technologies have been envisaged for the development of a new type of scintillation detector with low material budget.

A standard resin photostructuring process was optimized to achieve thin detectors with an intrinsic high spatial resolution.

These detectors are made of a dense array of microfluidic channels filled with liquid scintillator acting as scintillating waveguides upon interaction with charged particles which can be easily exchanged making the detector intrinsically radiation hard.

The concept of a new detection technique applicable to a wide range of energies was demonstrated with these detectors.



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