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Visual prostheses based on Silicon PhotoMultiplier: the SPEye project

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Several hereditary disesases due to retina degeneration affect
one over ~4000 persons resulting in total or partial blindness.
These disesases cannot be cured and the only chance of improving
the quality of life in the patients is a visual prostheses replacing
the damaged layers in the retina.
Some prostheses prototypes already exist and have been implanted.
Nevetherless the improvements in visual acuity is stillbvery limited.
SPEye proposes a novel approach based on a subretinal
implant of a matrix of silicon photodetector with inner amplification
SiPM (Silicon PhotoMultiplier).
The advantage over solutions employing traditional silicon diodes is
that the large inner amplification avoids the need of preamplifier
reducing power consumption to much lower level.
That makes also possible to reduce the size of the single photodiode
down to the size of the cones and rods increasing visual acuity without
increasing power consumption.
A number of preliminary tests have been performed on commercial SiPMs
including electric field calculations, simulation of cell response to
electrical stimuli, detailed measurement of SiPM response to focalized
light response, biocompatibility of the material involved, mechanical
matching to a spherical surface designing and test of a remote power
system, cell deposition on SiPM surface.
Those results are presented together with ideas on how to proceed in
designing optimized custom photodetector for surgical implantation in
animal and humans.

Collaboration

SPEye

Primary author: CATTANEO, Paolo Walter (Istituto Nazionale di Fisica Nucleare)

Presenter: CATTANEO, Paolo Walter (Istituto Nazionale di Fisica Nucleare)

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