# SU2P Staff Exchange

## Case Study:- Tomas Cizmar

## Title: Holographic activation of photovoltaic retinal prosthesis

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**Introduction**

The development of photovoltaic retinal prosthesis is a successful ongoing project led by Daniel Palanker (Stanford University) that was extensively supported by SU2P collaborative activity with the University of Strathclyde (Keith Mathieson).

The aim of the current staff exchange between St Andrews and Stanford was to investigate the possibility of activating the photovoltaic retinal prosthesis using digital holographic display technology. Excitingly, this solution offers high brightness and much higher power efficiency compared to standard LCD based imaging systems (video goggles), hence allowing significant enhancement in portability of the power supply and associated battery life. Additional benefits include higher speed of the display, electronic adjustment of the focal plane and correction of aberrations.

**Project**

To define the specifications of the eyewear for human use, a system prototype is first being developed for testing in animal trials. The main goal of this exchange was to develop a holographic projection system which will be used to measure visual acuity in rats after implanted with retinal prosthesis. Such system has to be compact, as the system needs to be attached to a slit-lamp for precise positioning of the holographically generated images onto the retinal implants. It also has to operate with the NIR and with the visible laser beams to allow visual guidance and comparison of the visual performance with the implant and with normal sight. Already in the initial stage of discussions a special attention was paid to maximizing energy efficiency of the system. The work was initiated in St Andrews during the visit of G Goetz to T Cizmar's laboratory during which first experimental geometry was proposed, assembled and tested. During the second stage in which T Cizmar visited D Palanker's laboratories the system was significantly modified to address a number of problems identified during the initial animal trials.

**Benefits of the holographic approach**

During the two months of the project a novel high efficiency projection system based on digital holography was developed and successfully tested on living rats. These studies provided both SU2P partners with sufficient amount of data for a joint journal publication. The principles and the initial data were presented to potential commercial partner PIXIUM.fr, who will adopt the photovoltaic retinal prosthesis and the holographic projection system for trials in non-human primates, and ultimately in human patients, starting in the coming year (2013). We anticipate continuation of this collaboration in development of the compact, efficient and ergonomic video goggles for use in human patients.