

# A Hybrid Retinal Photocoagulation System

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## ABSTRACT

We describe initial *in vivo* experimental results of a new hybrid digital and analog design for retinal tracking and laser beam control. An overview of the design is given. The results show *in vivo* tracking rates which exceed the equivalent of 38 degrees per second in the eye, with automated lesion pattern creation. Robotically-assisted laser surgery to treat conditions such as diabetic retinopathy and retinal breaks may soon be realized under clinical conditions with requisite safety using standard video hardware and inexpensive optical components based on this design.

**Keywords:** retina, photocoagulation, eye tracking, automated surgery

## 1 INTRODUCTION

Laser retinal photocoagulation is used extensively by ophthalmologists to treat retinal disorders such as diabetic retinopathy and retinal breaks [1]. Several thousand therapeutic lesions per eye may be required (to treat diabetic retinopathy) or at best one hundred or so therapeutic lesions in just one eye (to repair retinal breaks). The procedure is currently performed manually and suffers from several drawbacks [2]: it often requires many clinical visits, it is very tedious for both patient and ophthalmologist, the laser pointing accuracy and safety margin are limited by a combination of the ophthalmologist's manual dexterity and the patient's ability to hold their eye still, and there is a large variability in lesion size even with identical irradiation parameters. A computer-assisted system is under development that will rapidly and safely place consistent multiple therapeutic