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# Modelling the Behaviour of Dielectric Breakdown during Damage of Scanhead Mirrors using Picosecond Laser Pulses

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Master Thesis

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## Motivation

It has long been the motivation of industry and research institutions alike to determine the damage behaviour of optical elements used by lasers. Presently, there is inconclusive knowledge to the degree of effectiveness that an optical element has when designed for picosecond laser pulses. Specifically, scanhead mirrors consists of a substrate (e.g. quartz) coated by a multilayer of dielectric material (e.g. a dioxide). The recent advent and common usage of picosecond lasers has resulted in the need to understand the damage behaviour of these mirrors. That is to say, to predict at what fluence causes damage, to define the damage characteristics and to understand the dielectric breakdown damage mechanism of these mirrors is highly sought after. In doing so allows one to use a laser scanhead and related optical elements in a safe manner.



Fig. 1: Laser scanhead with dielectric mirrors

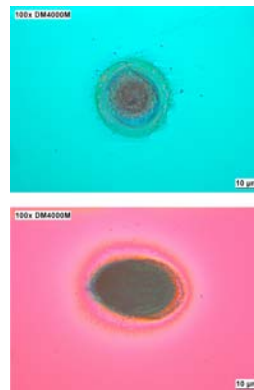


Fig. 2: Examples of damage on a UV-coated dielectric mirror

## Task

- Literature review of picosecond pulses, dielectric breakdown and modelling thereof
- Modelling of dielectric breakdown
- Validation and verification of model through laser-induced damage of mirrors
- Documentation

## Peripherals

The project offers insight into modelling and simulation, and laser technology. A picosecond laser, optical components and modelling assistance, are available in our laser micromachining lab and IWF simulation group at Technopark Zurich. An ideal candidate may have interest in modelling and laser technology. Previous knowledge in one or more of the above mentioned fields is preferred, but not mandatory. Time to become familiar with the topic will be given. Documentation may be in English or German. Teamwork available.

## Start

FS 2012 or upon agreement

## Contact

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06.12.2011 / gme