Vitreous Optical Tomography for objective diagnosis, monitoring and outcome measures of therapeutic interventions for vitreo-retinal diseases

Vitreous body is the largest component of the human eye filling space between the lens and the retina. Vitreous is a gelatinous connective tissue composed of water, collagen protein (forming fibers) and hyaluronic acid which make it highly transparent. Vitreous allows the light to reach the retina, helps in maintaining the shape of the eye and protects a fragile retina during rapid eye movements. During ageing, the vitreous collagen fibers can aggregate into larger structures called floaters. There are different eye diseases that are associated with the vitreous. These conditions include: floaters in myopia (short-sightedness), eye inflammation, posterior vitreous detachment, cataract surgery etc. Alteration of vitreous structure leads to the loss of its transparency due to the opacifications, and it can be associated with the vision deterioration. Therapeutic intervention such as vitrectomy allow for treating the problems with the vitreous. Optical properties of the vitreous make this part of the eye very challenging to visualize. Consequently, there is a few in vivo studies that image the vitreous in vitreo-retinal diseases.

In this fundamental study, we would like to characterize the vitreous body in vivo in vitreo-retinal diseases and associate the optical properties of the vitreous with vision quality. We will develop a novel optical tool to assess the vitreous micro- and macro-structure. We will describe the status of the vitreous by measuring the scattered light. We will also correlate the vitreous transparency with visual outcome of the patients. Finally, we will check how the vitreous surgery impacts vitreal morphology. The measurements will be enabled by a novel optical imaging tool that will facilitate complete vitreous visualization with high-resolution.

The project will broaden our understanding of the fundamental issues of optical properties of the ocular structures. In particular, the research performed in this project will provide clinically relevant information on different vitreous properties in vitreo-retinal diseases affecting vision. Novel optical diagnostic modality capable of high-resolution vitreous imaging will offer unprecedented insight into the least explored ocular structure. The outcomes of this fundamental study will also allow for investigating the role of vitreous in visual outcome, which can be of great interest to both clinicians and patients.