Robot-Assisted Vitreo-retinal Surgery via Sensor-Integrated Instruments

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<table>
<thead>
<tr>
<th>Project reference</th>
<th>GA No 645331</th>
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<tr>
<td>Status:</td>
<td>Started</td>
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<tr>
<td>Contract type:</td>
<td>Collaborative Project</td>
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<td>Robotic Uses Cases</td>
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<td>3.219.000 EUR</td>
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**Started 01.01.2015**

- Katholieke Universiteit Leuven (KUL)
- Technische Universiteit Eindhoven (TUE)
- ACMIT GmbH (ACMIT)
- PRECEYES Medical Robotics (PREC)
- Rotterdam Eye Hospital (ROI)
- ETH Zurich (ETHZ)
- OPMedT GmbH (OPM)
- Medizinisches Laserzentrum Lübeck GmbH (MLL)
- Universita degli studi di Milano (MIL)

- Real use-cases addressed
- Real outcome expected!
2 Procedures

- Epi-Retinal Membrane
- Retinal Vein Occlusion

- Peeling
- Cannulation and infusion
Force Sensing for Improved Cannulation

- Fiber-bragg grating fibers integrated along shaft of cannulation needle
Force Sensing for Improved Cannulation

**Goal**: detect puncture, avoid double puncture
Auditory Feedback upon Cannulation

- Cannulation of open-sky pig eye
- Auditory signal indicates when puncture is detected
- Visual confirmation by washout of blood upon injection
Distance Sensing for Creating Virtual Bounds on-the-Fly

On site-OCT probe Retinal layers measurement

Stereo Vision

Vein detection

Depth map
Robotic Guidance

Distance sensor

distance

Retina estimation

retina pose

Haptic guidance controller

desired force

Human operator

input velocity

robot force

Comanipulation robot

instrument pose
Conclusion

• Several miniature ultra-precise sensors for real-time feedback
• Shared control schemes under development to enhance human precision and increase success rate
• Target – clinical validation within the framework (timeline) of EurEyeCase