Center for Robotics and Autonomous Systems

https://robotics.fel.cvut.cz

Karel Zimmermann

CTU
CZECH TECHNICAL UNIVERSITY IN PRAGUE

Department of Cybernetics
Faculty of Electrical Engineering
Czech Technical University in Prague

Department of Cybernetics

Head: Tomáš Svoboda

Research groups:

- Center for Robotics and Autonomous Systems (CRAS)
- Visual Recognition Group (VGL)
- Machine Learning (ML)
- Biomedical Imaging Algorithms (BIA+AID)

Department of Cybernetics

Head: Tomáš Svoboda

Research groups:

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- Visual Recognition Group (VRG)
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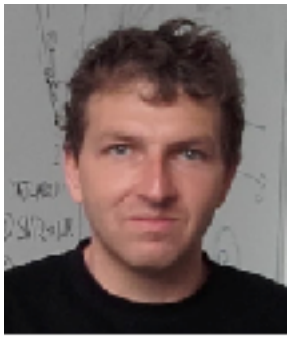
Center for Robotics and Autonomous Systems

https://robotics.fel.cvut.cz/cras/

Tomas Svoboda



Karel Zimmermann

Martin Saska

Jan Faigl

15+ PhD students

Czech Technical University in Prague
Faculty of Electrical Engineering, Department of Cybernetics

Research interests

- Self-driving cars
- Search and Rescue Robotics

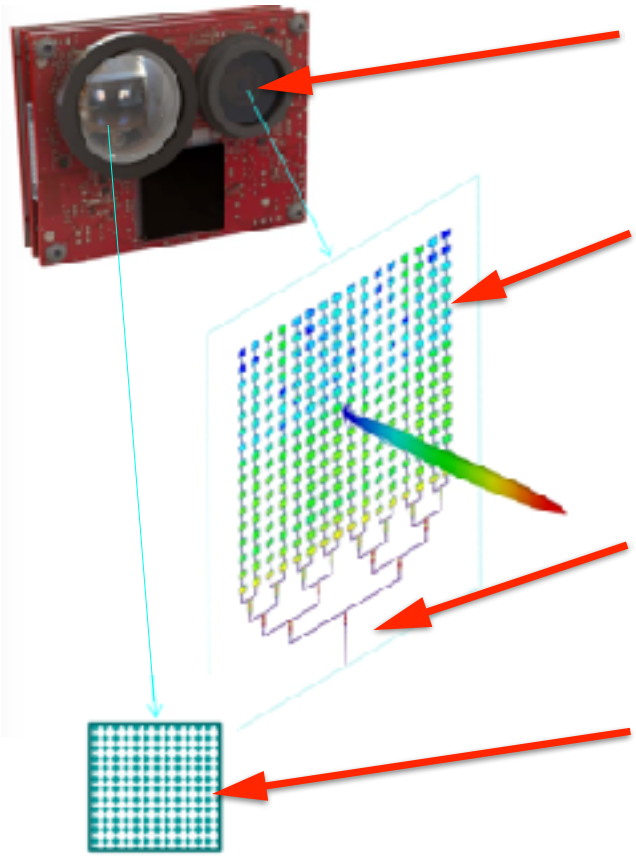
Self driving cars

- Longterm cooperation with Valeo
- H2020 EU research projects (Enable S3)
- Shared datasets and students

Active 3D mapping

Lidar with independent steering of depth-measuring rays

QUANERGY S3 principle



Emitted laser beams

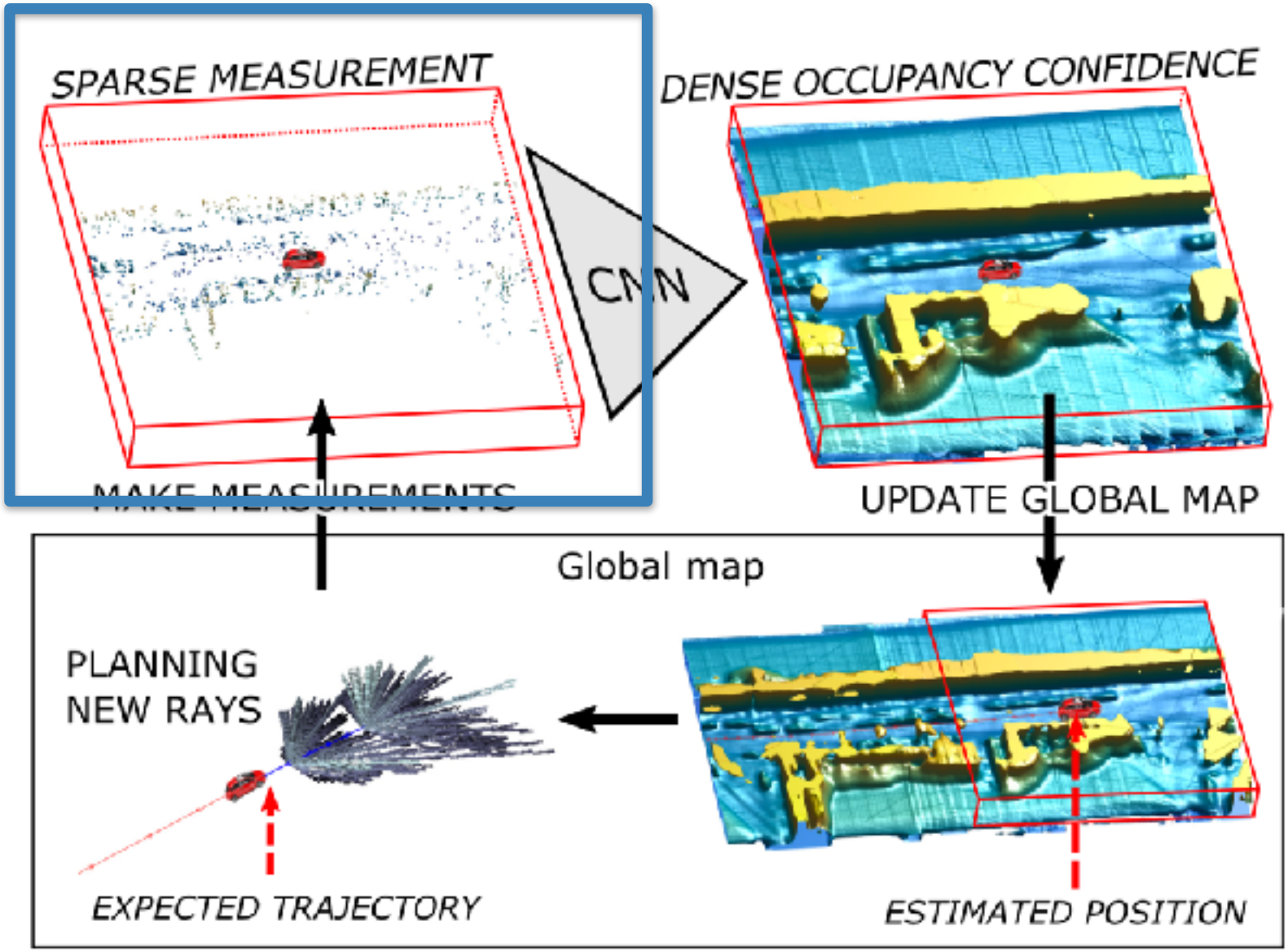
Transmitted through Optical Phased Array

Controlling optical properties of OPA elements, allows to steer laser beams in desired directions

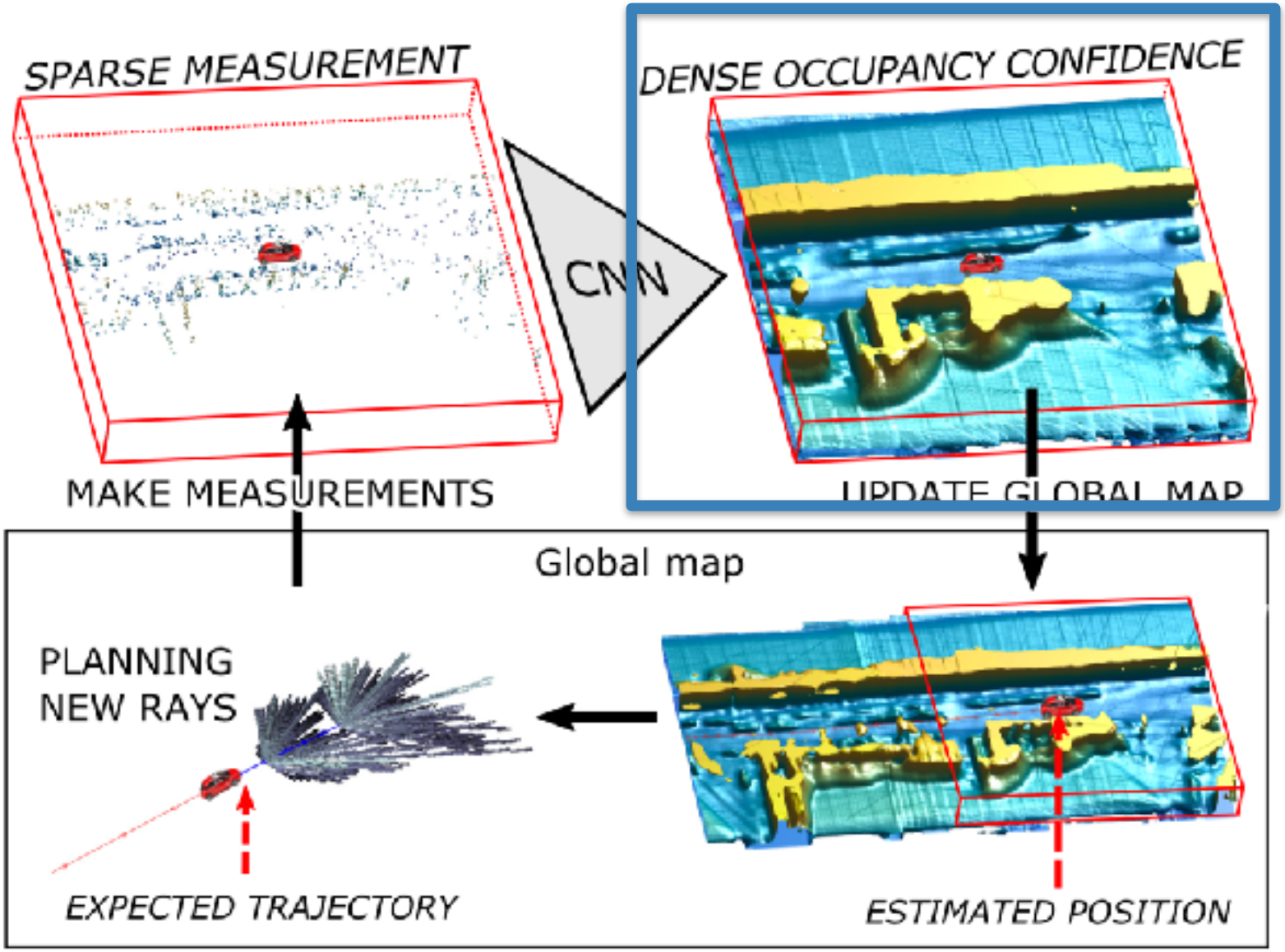
Reflected laser beams are captured by SPAD array

Images of S3 Lidar redistributed with permission of Quanergy Systems (http://quanergy.com)

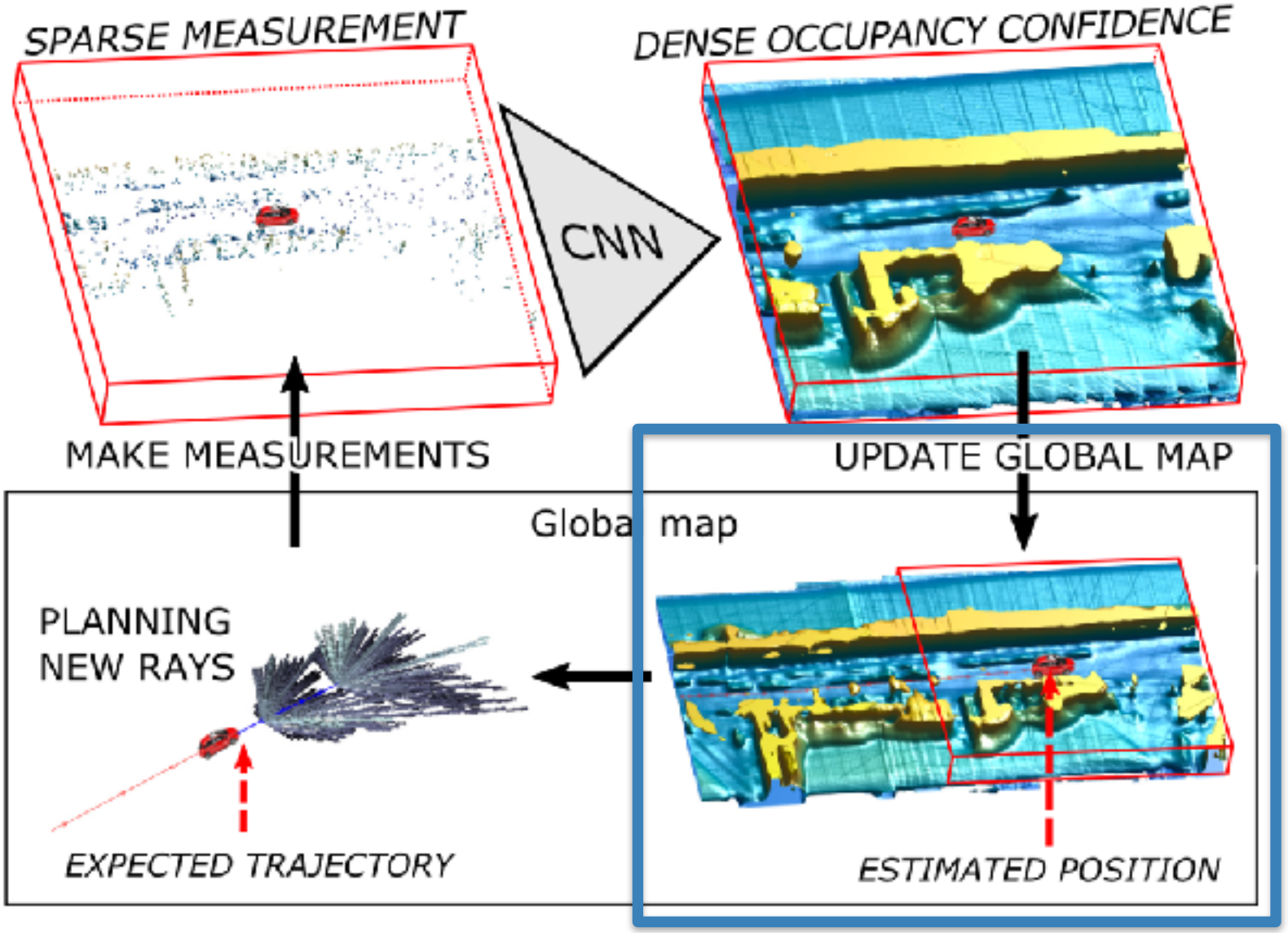
Active 3D mapping



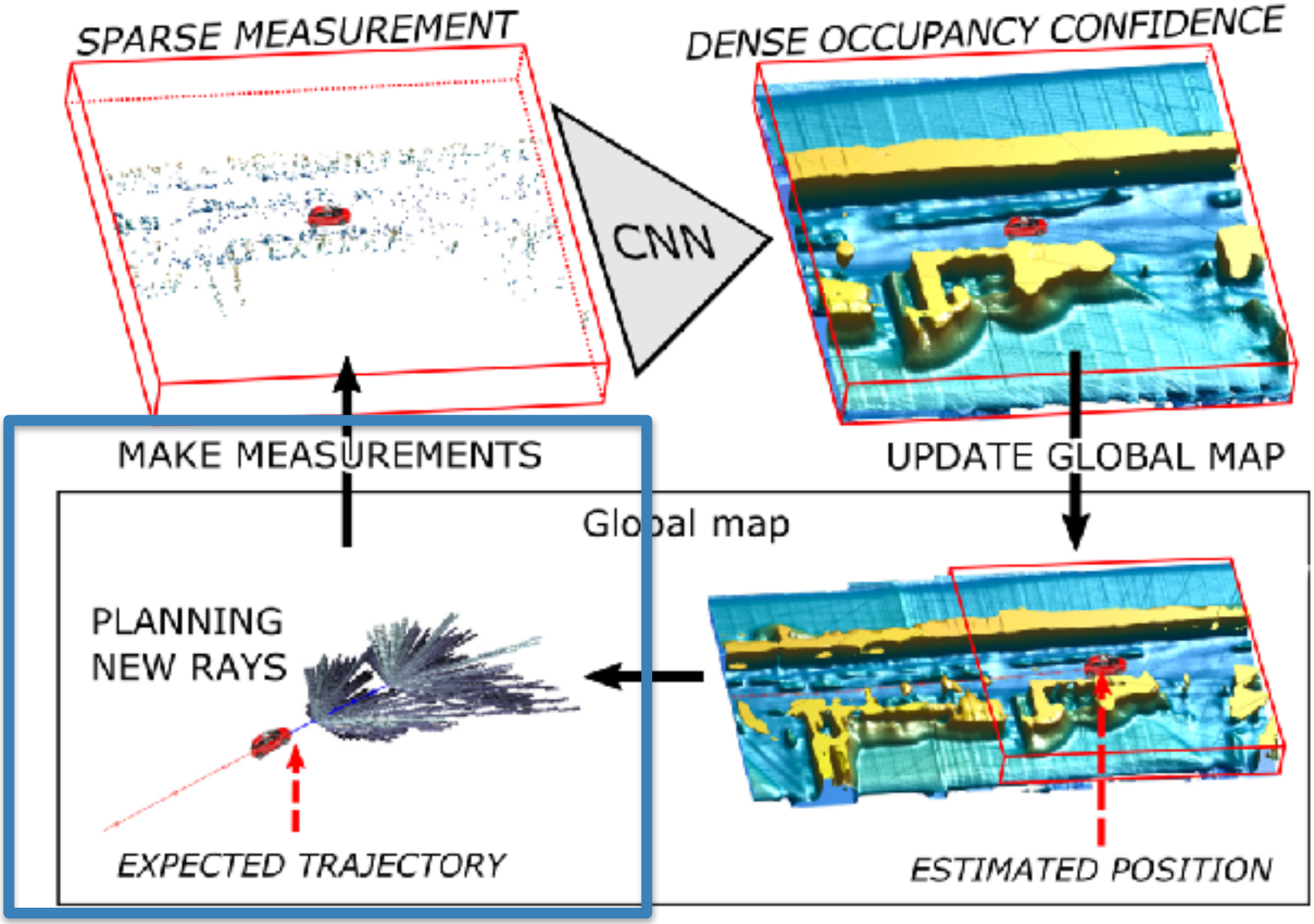
Active 3D mapping



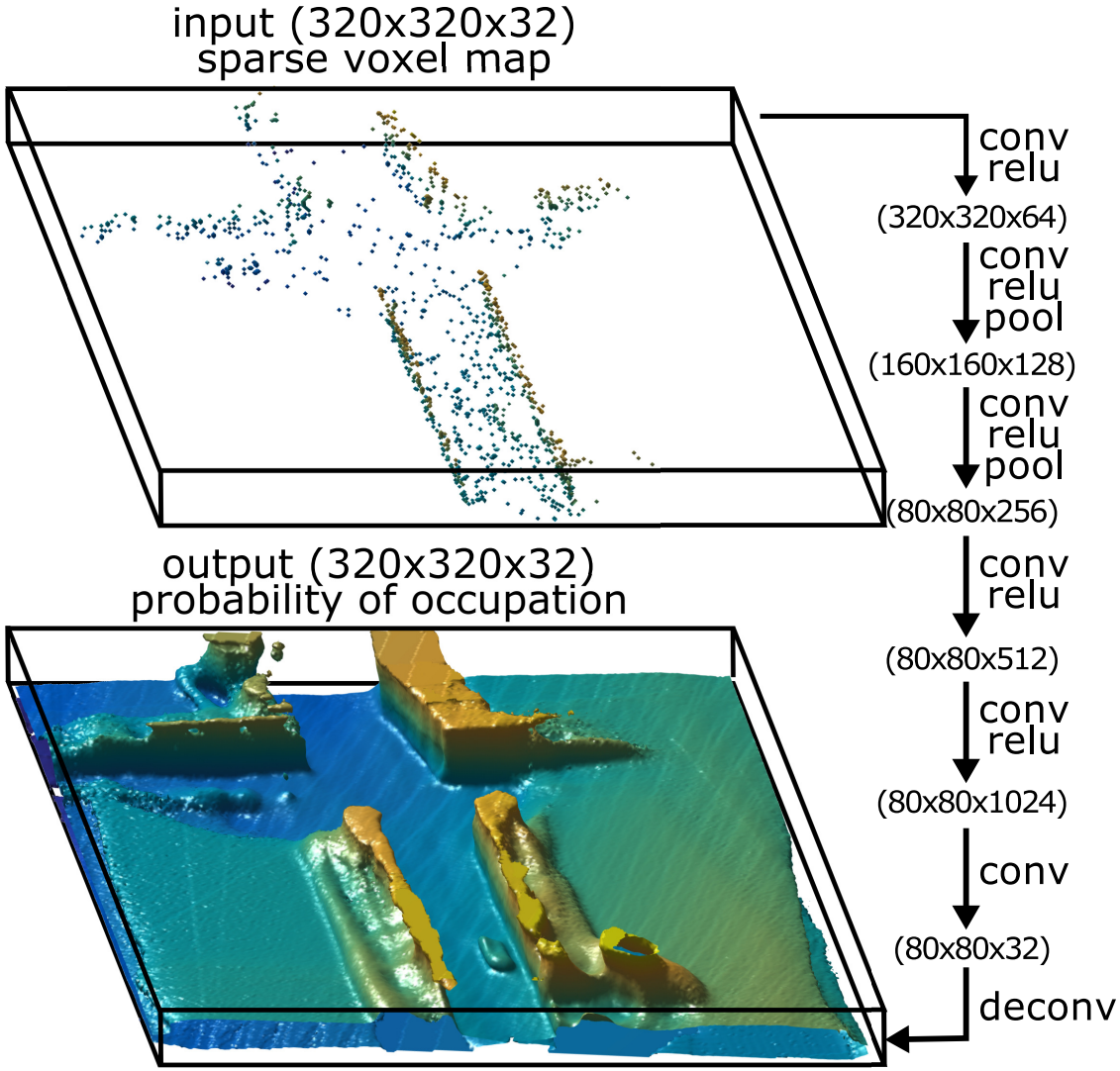
Active 3D mapping



Active 3D mapping



Active 3D mapping



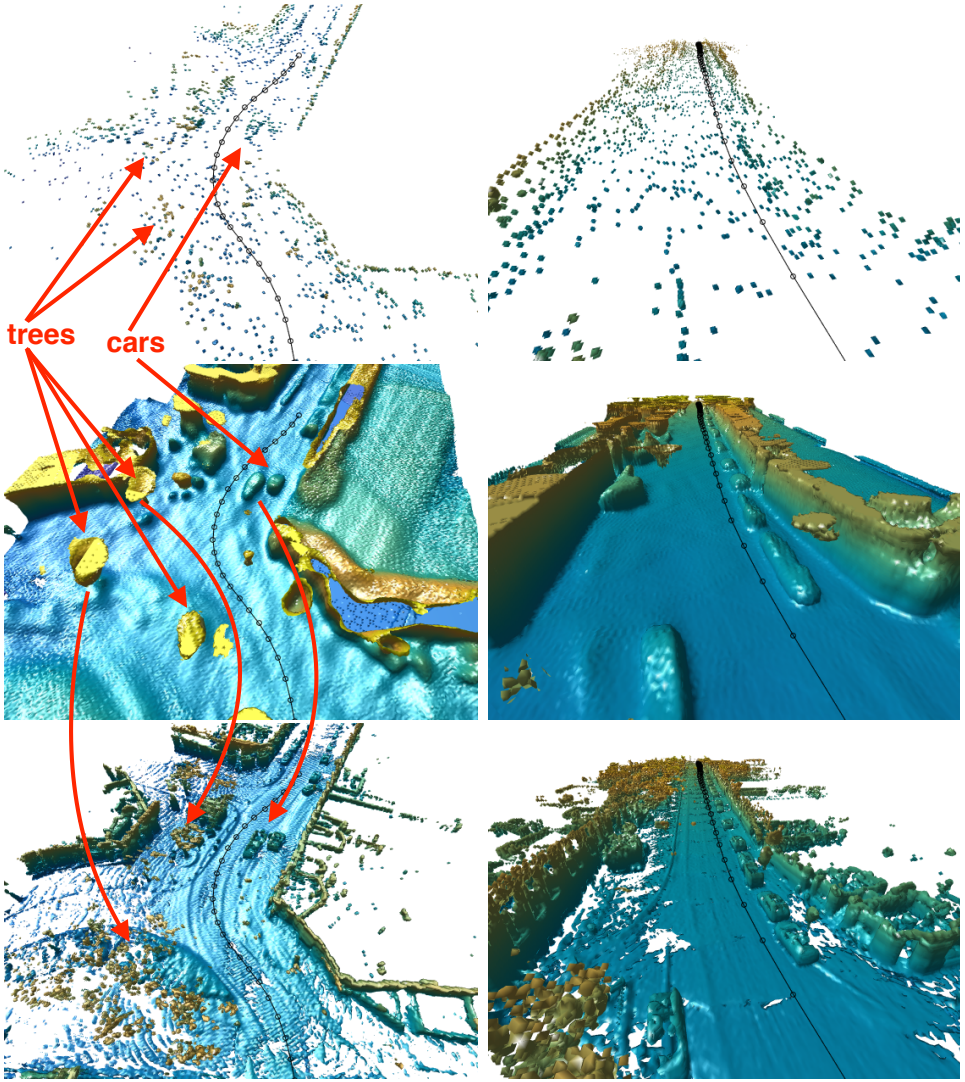
Active 3D mapping

Experiment: Qualitative evaluation

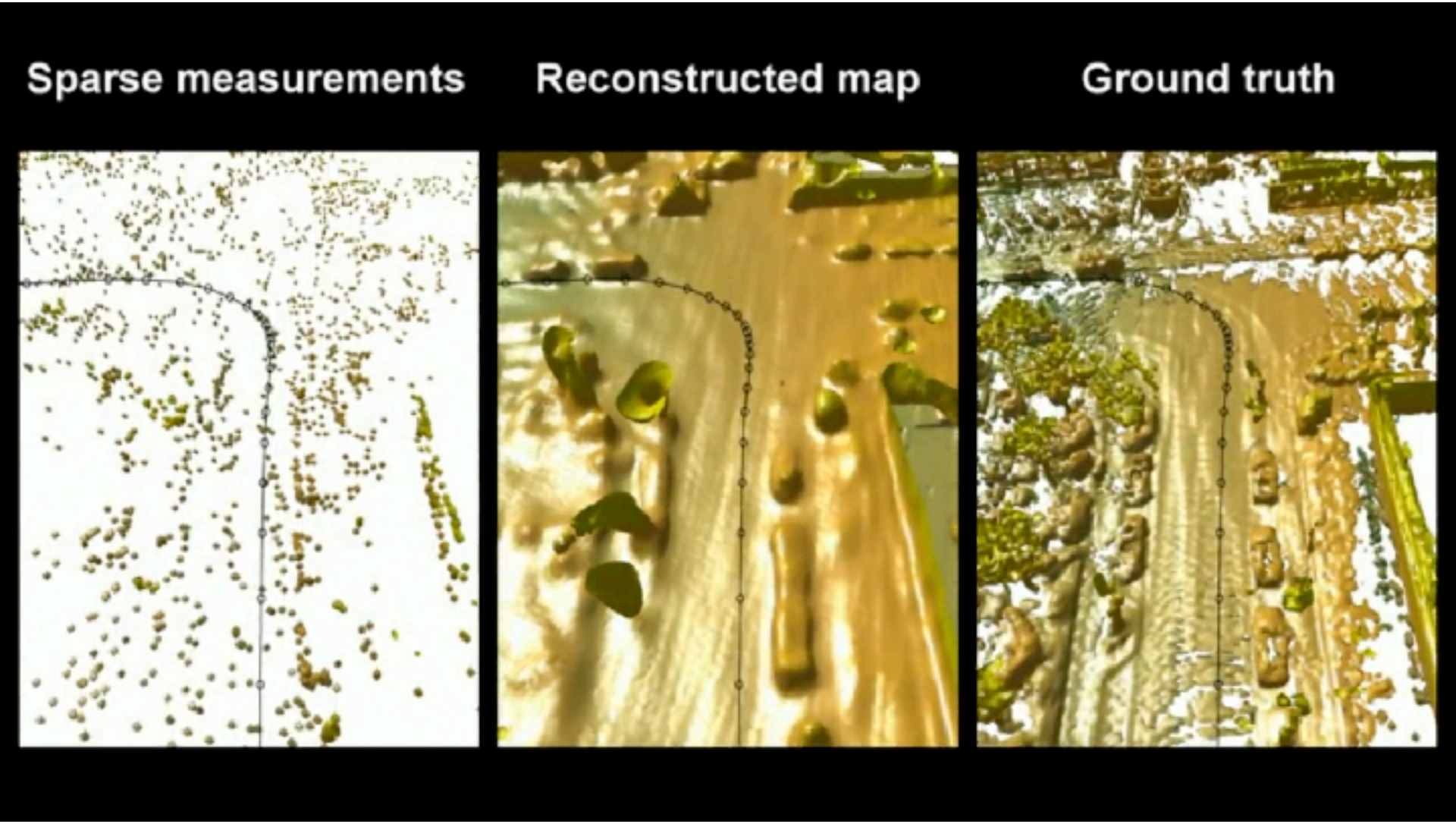
Sparse measurements

Reconstructed map

Ground truth

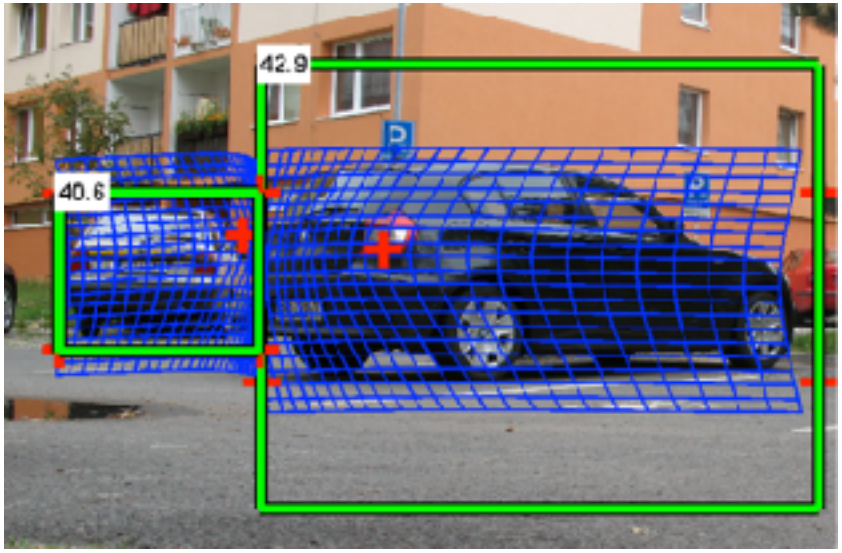


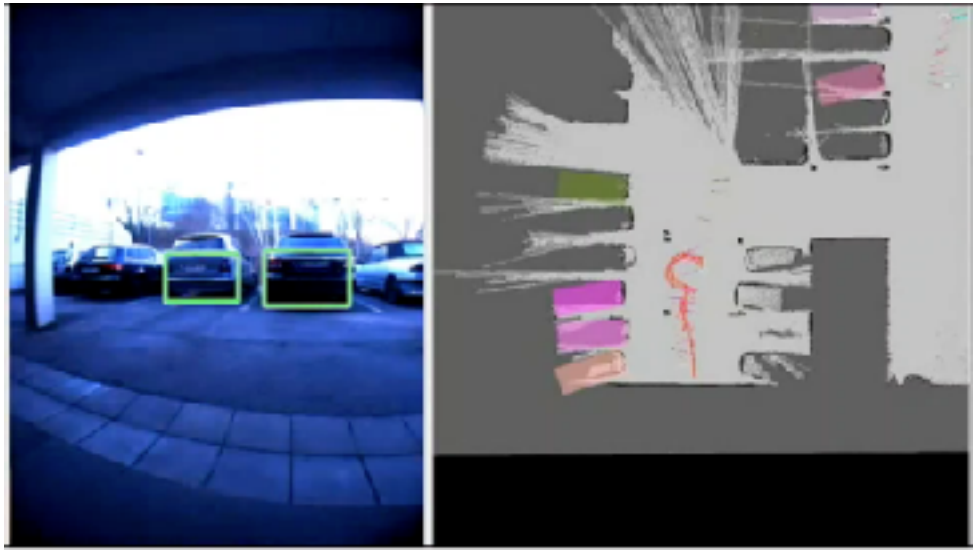
Active 3D mapping



[1] Zimmermann, Petricek, Salansky, Svoboda, Learning for Active 3D Mapping, **ICCV oral**, 2017 https://arxiv.org/abs/1708.02074

Object detection and tracking





[2] K.Zimmermann, D.Hurych, T.Svoboda, Non-Rigid *Object Detection with Local Interleaved Sequential Alignment (LISA),* **TPAMI (IF=5)**, 2014

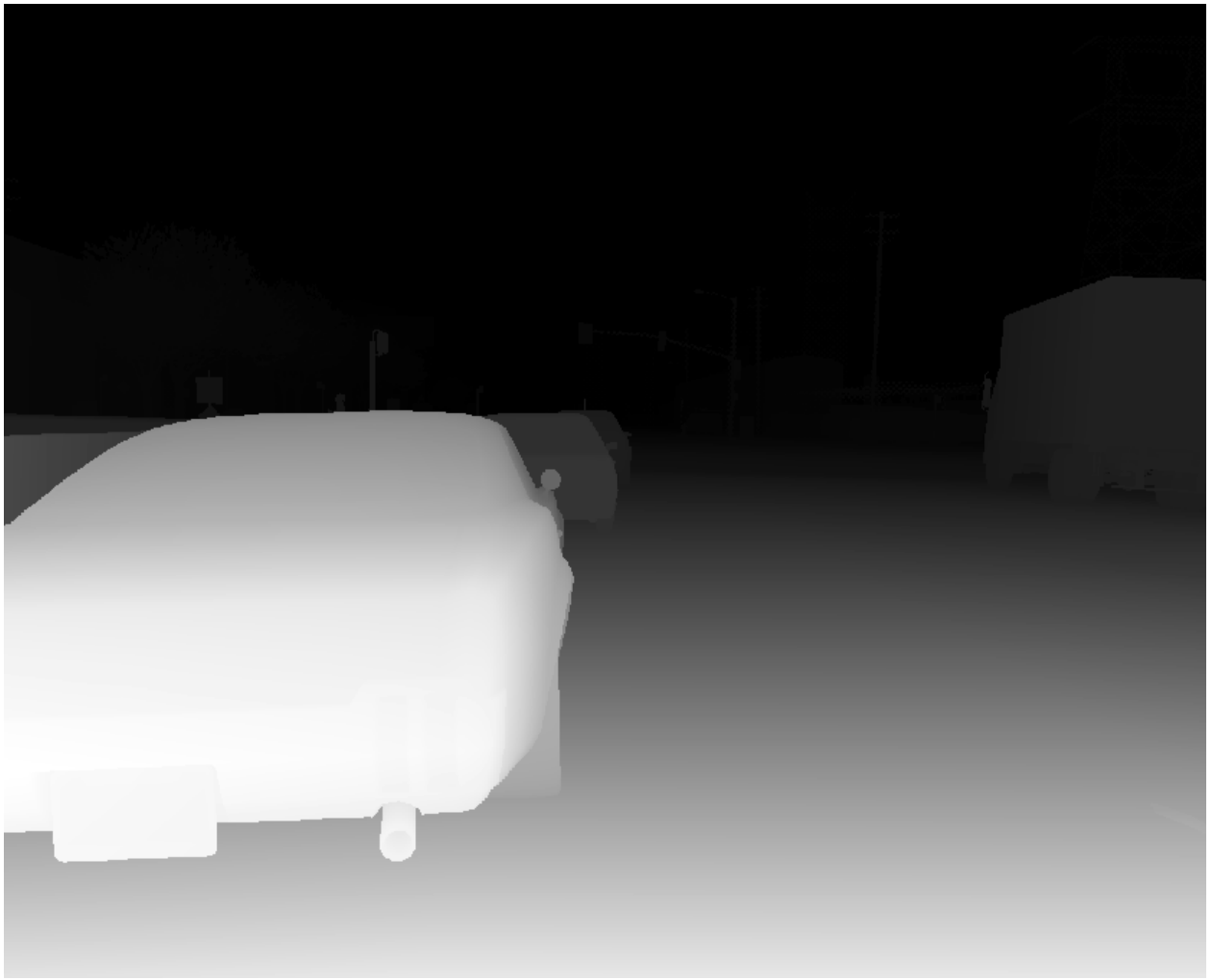
[3] K.Zimmermann, J.Matas, T.Svoboda, *Tracking by an Optimal Sequence of Linear Predictors*,**TPAMI (IF=5 selected for II.pillar evaluation)**, 2009.

Data-driven simulation from GTA

RGB images

Data-driven simulation from GTA

Depth images



Data-driven simulation from GTA

Stencil layer

Data-driven simulation from GTA

Stencil layer - **cars**

Data-driven simulation from GTA

Stencil layer - **humans**

Data-driven simulation from GTA

Stencil layer - **vegetation**

Data-driven simulation from GTA

Stencil layer - **sky**

Data-driven simulation from GTA

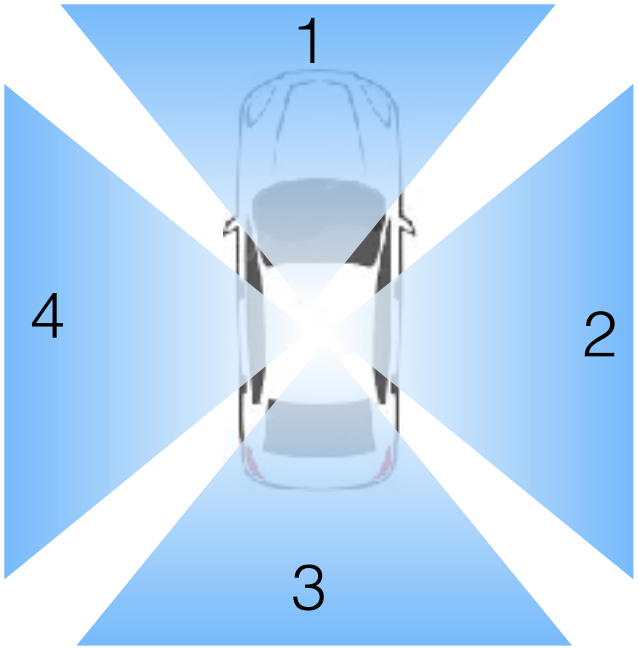
Stencil layer - **artificial light**

Data-driven simulation from GTA

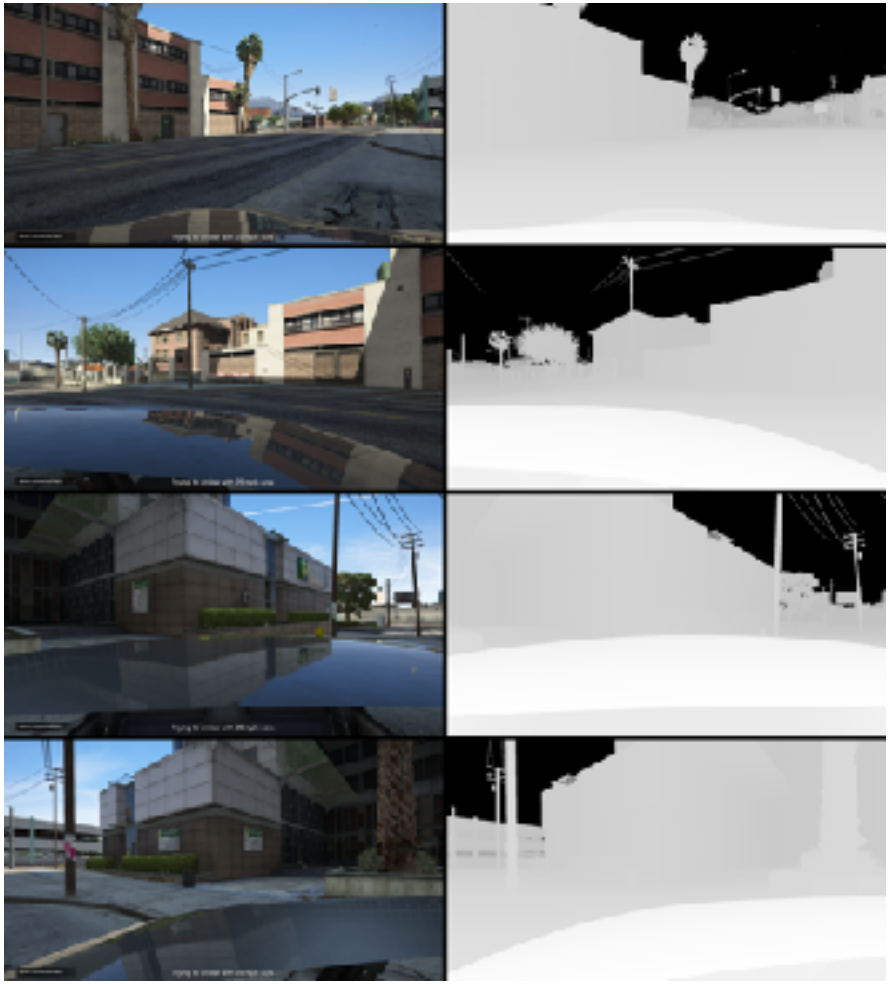
Stencil layer - **artificial light**

Data-driven simulation from GTA

virtual car in GTA environment



ideal RGBD images



Data-driven simulation from GTA

Input

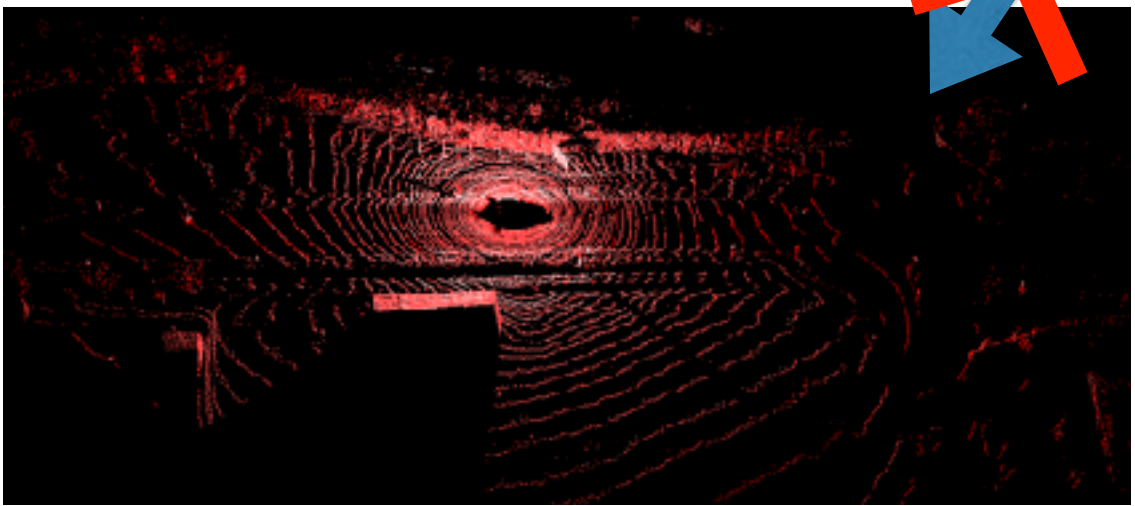
Geometric simulation of lidar from depth

Data-driven simulation from GTA

Input

Geometric simulation of lidar from depth

Valeo lidar dataset



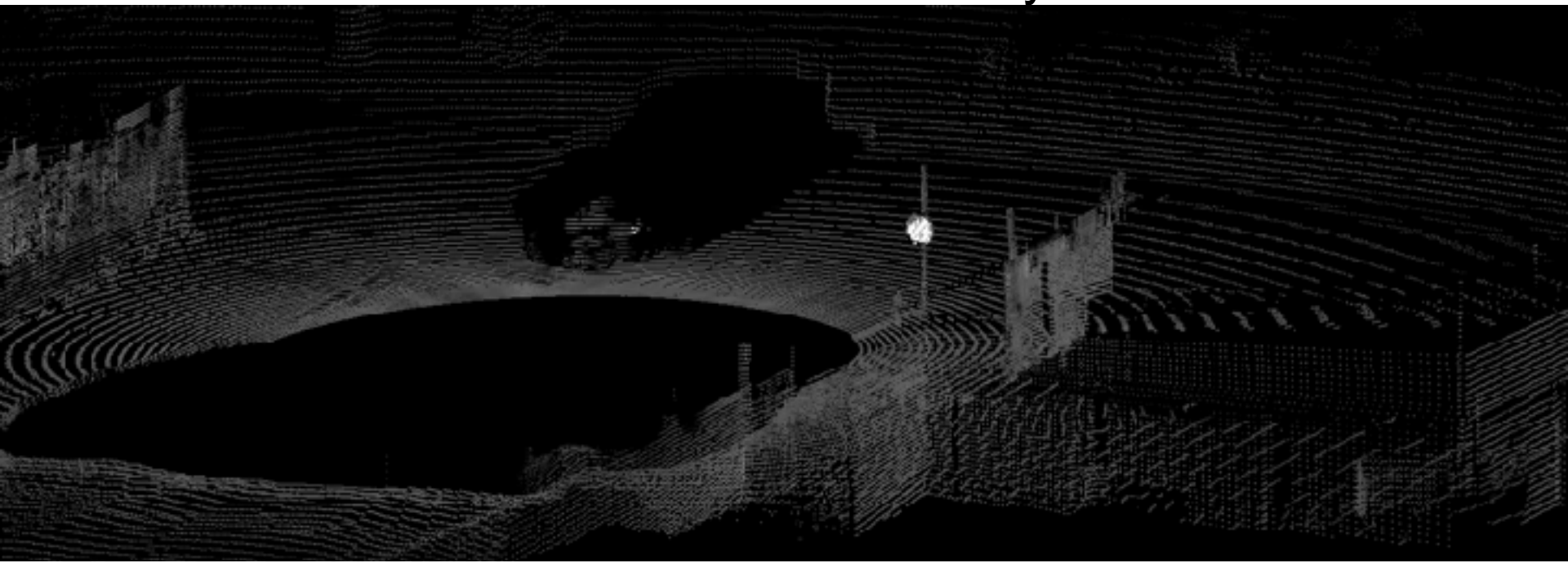
Data-driven refinement

strong response

weak response

Data-driven simulation from GTA

Learned reflectivity



Data-driven simulation from GTA

Preparing publicly available dataset with Valeo R&D

Research topic outline

- Self-driving cars
- Search and Rescue Robotics

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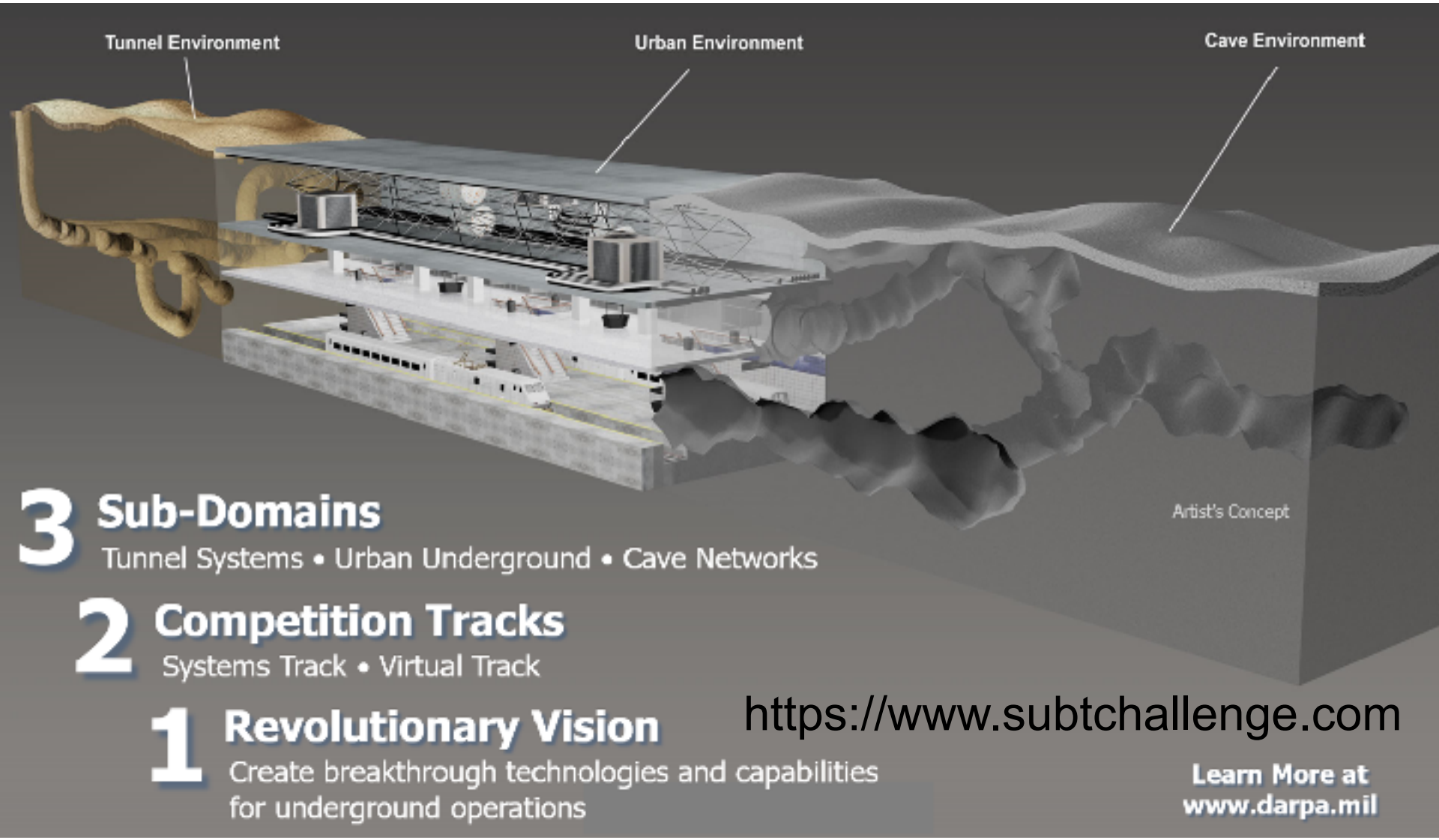
DARPA Subterranean challenge

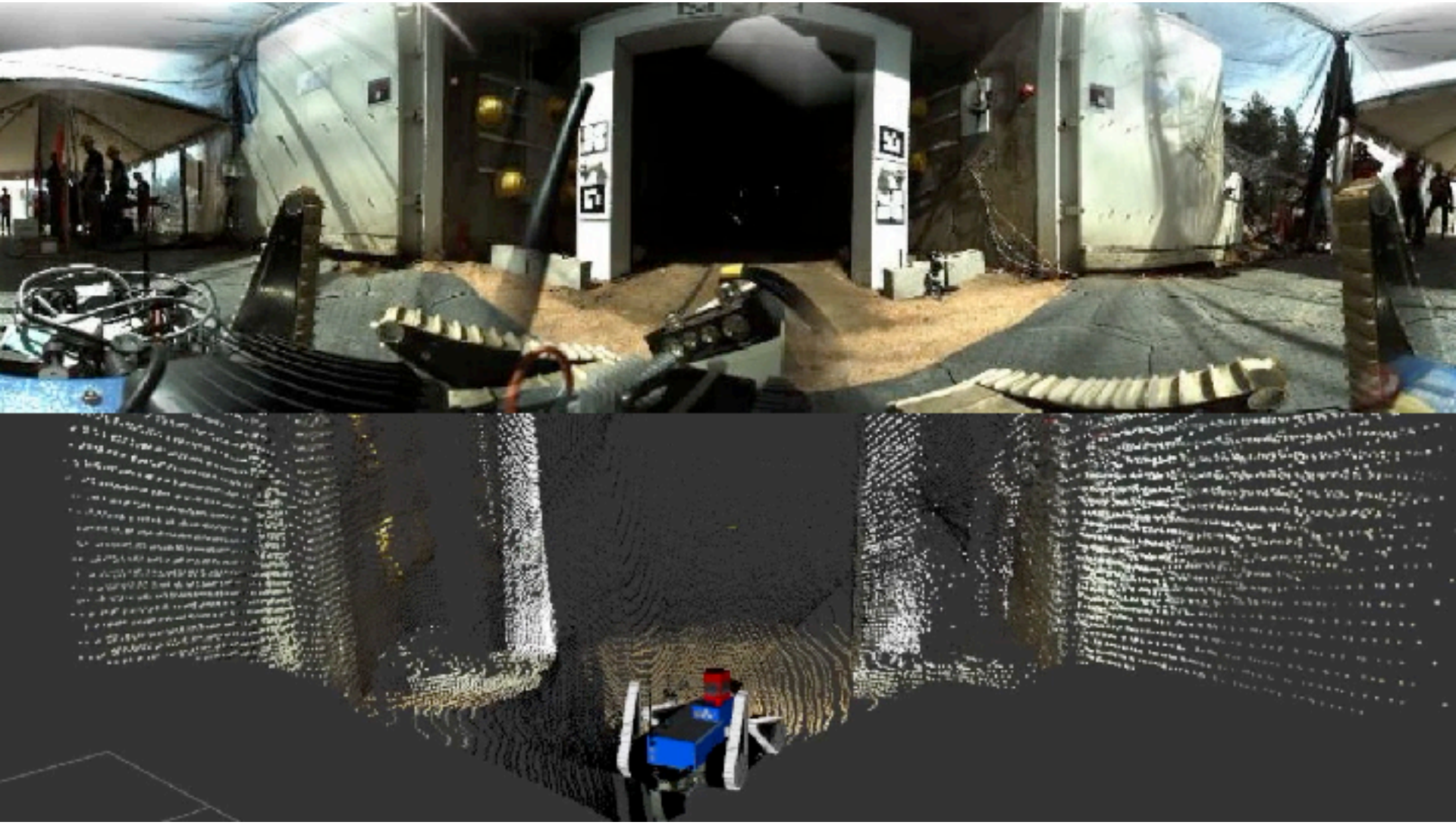


DARPA SubT integration exercise

Motion and compliant control

[3] Pecka, Zimmermann, Svoboda, Hlavac, et al.
IROS/RAL/TIE(IF=6), 2015-2018

DARPA SubT integration exercise



- Our team achieved best score in our group

Mohamed bin Zayed International Robotics Challenge

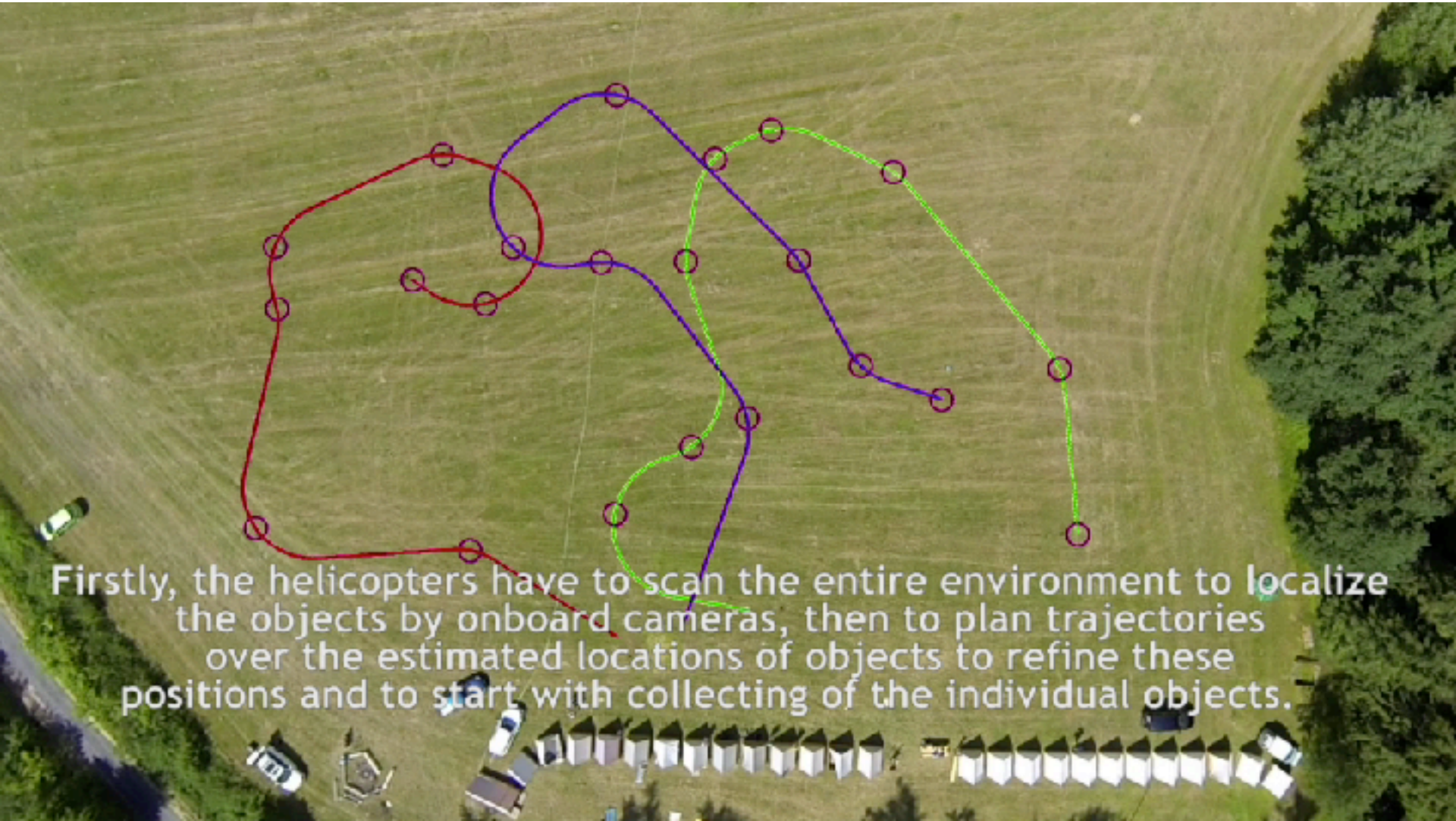
2017 + 2020

UAV - Landing on a moving target

Contact: Martin Saska

coordinate UAVs – Treasure hunt

Contact: Martin Saska



MBZIRC – Victory

We search for collaboration opportunities

- PostDocs
- PhD students
- EU project partners

in

- aerial and ground robotics
- self-driving cars
- humanoid robotics and grasping
- computer vision
- machine learning

- We are building consortium for the new EU project (besides research organization firefighters and first responders are needed)

https://cyber.felk.cvut.cz

http://robotics.fel.cvut.cz

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