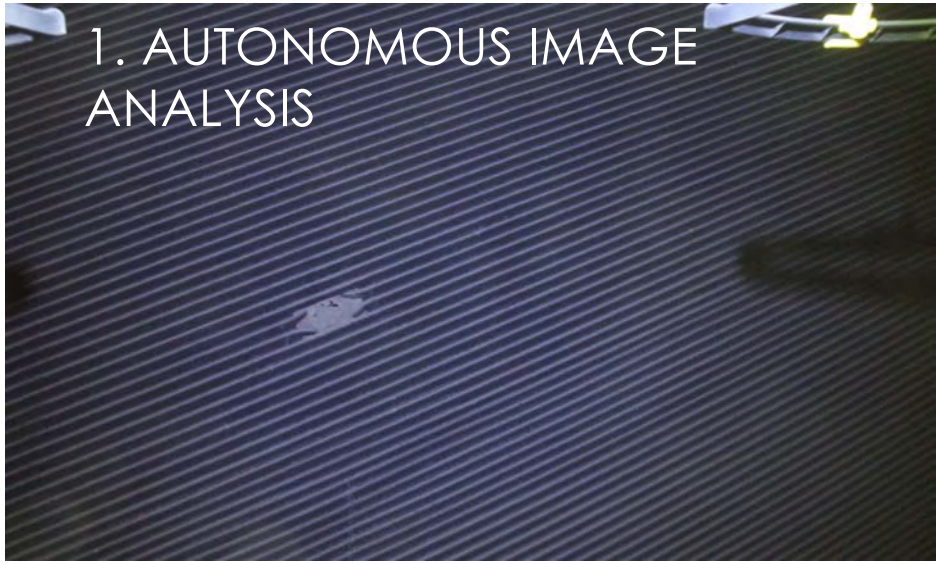
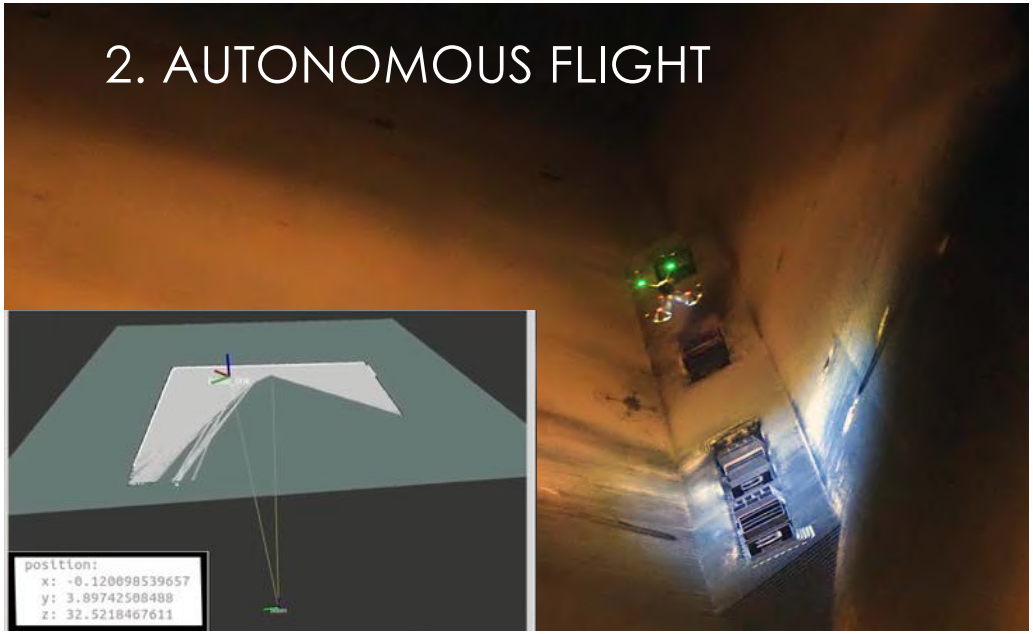
Vision on board drones

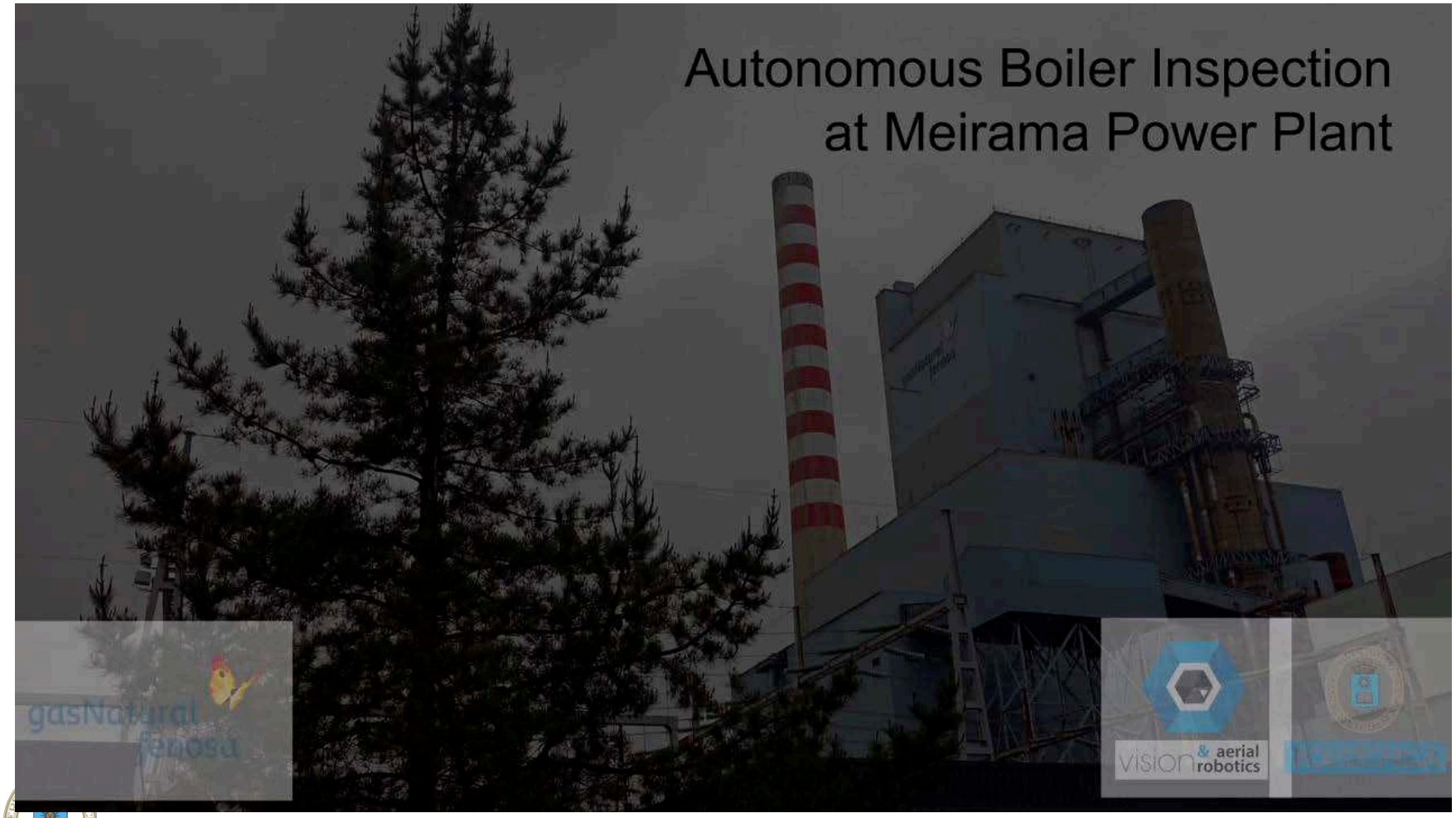


- **Environment understanding**: visual object detection and recognition (off-line or on-line)



- **Pose estimation + Visual Control** and **navigation**

Industrial visual inspection: Boiler of a Thermal Power Plant



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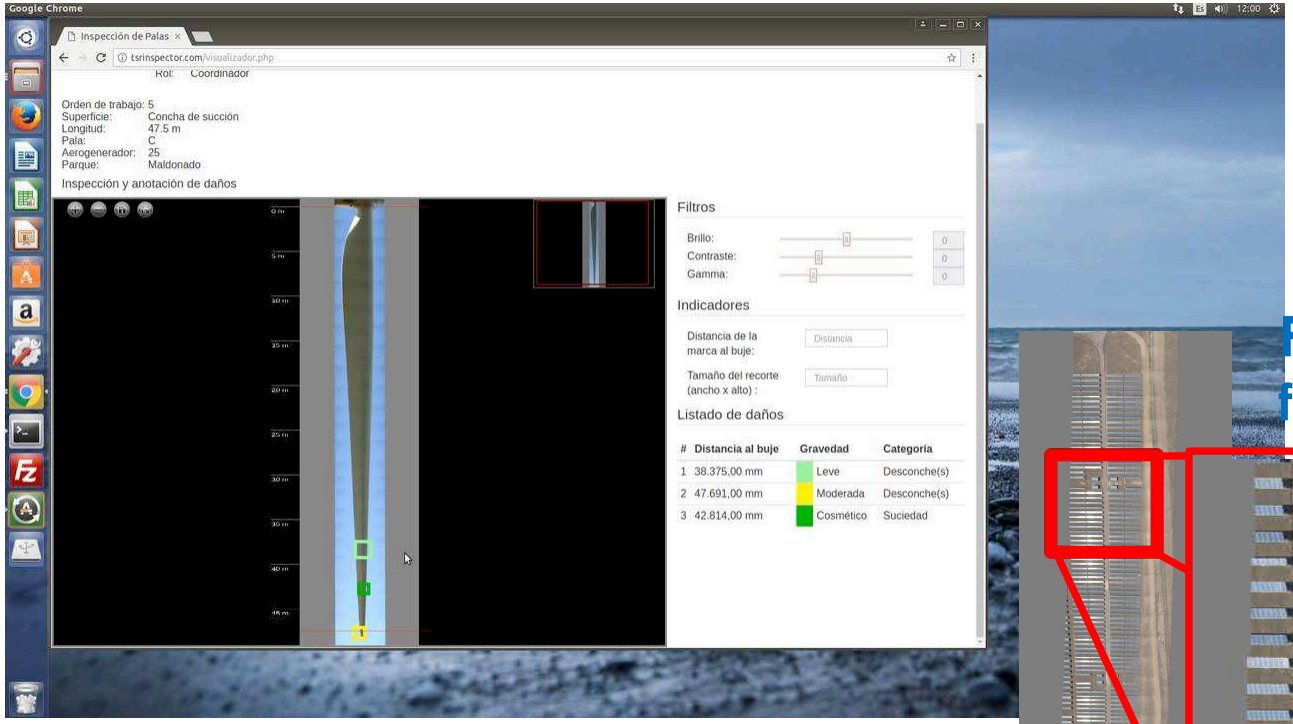
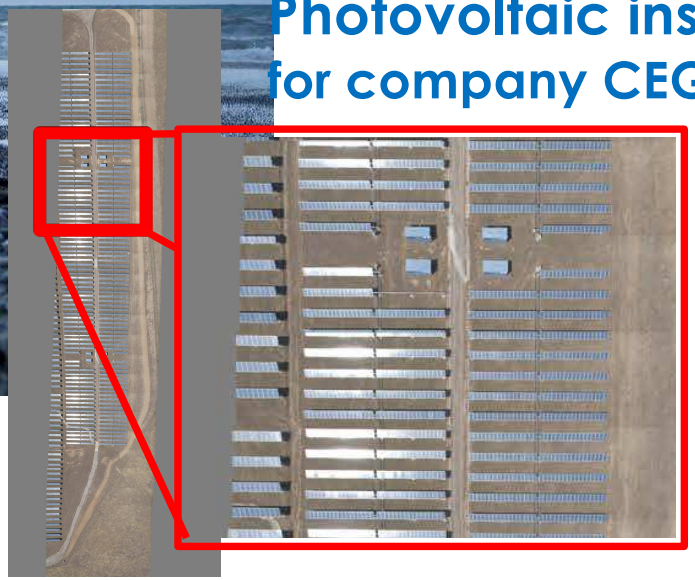
1. Image Analysis:
2D/3D environment reconstruction

Windmill blade inspection
for Company TSR (2017)

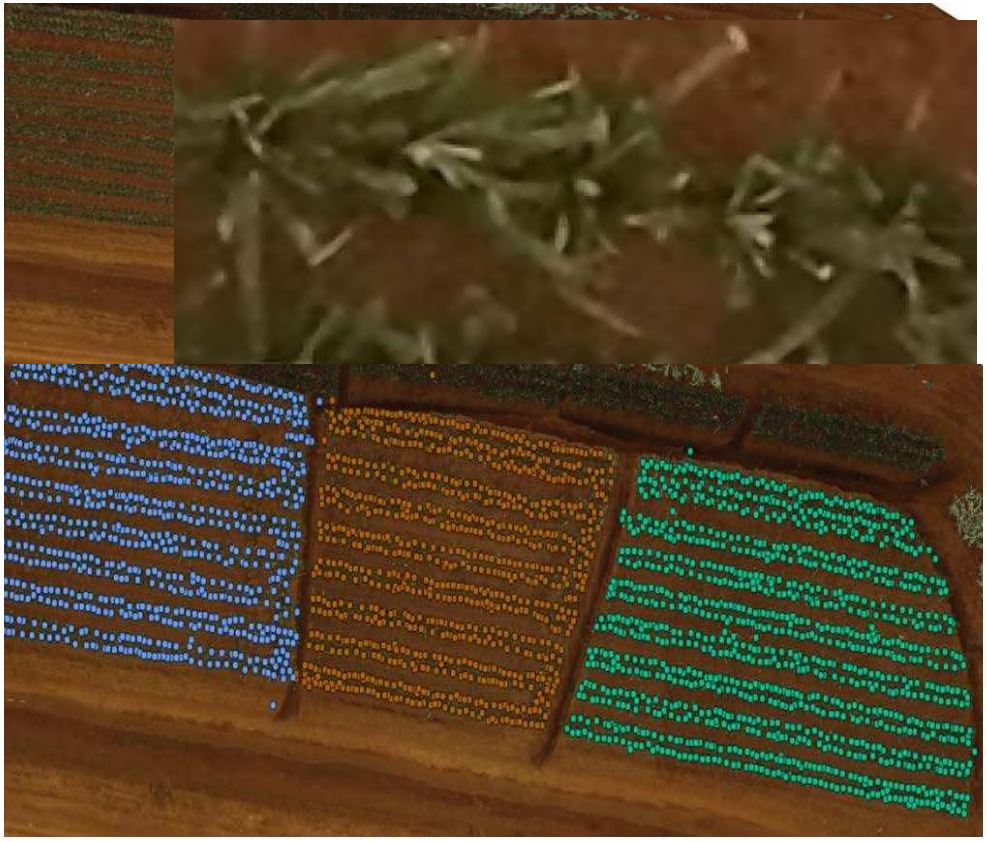


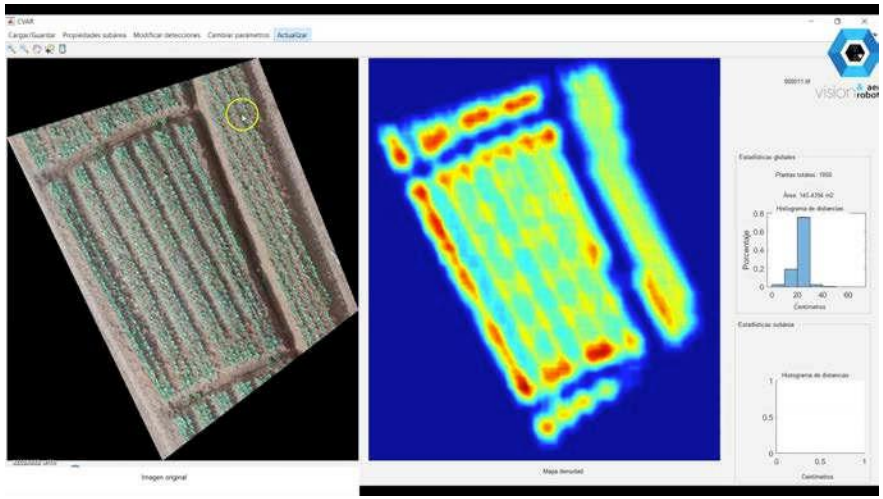
Photovoltaic inspection
for company CEGA drones



1. Image Analysis:
parts recognition

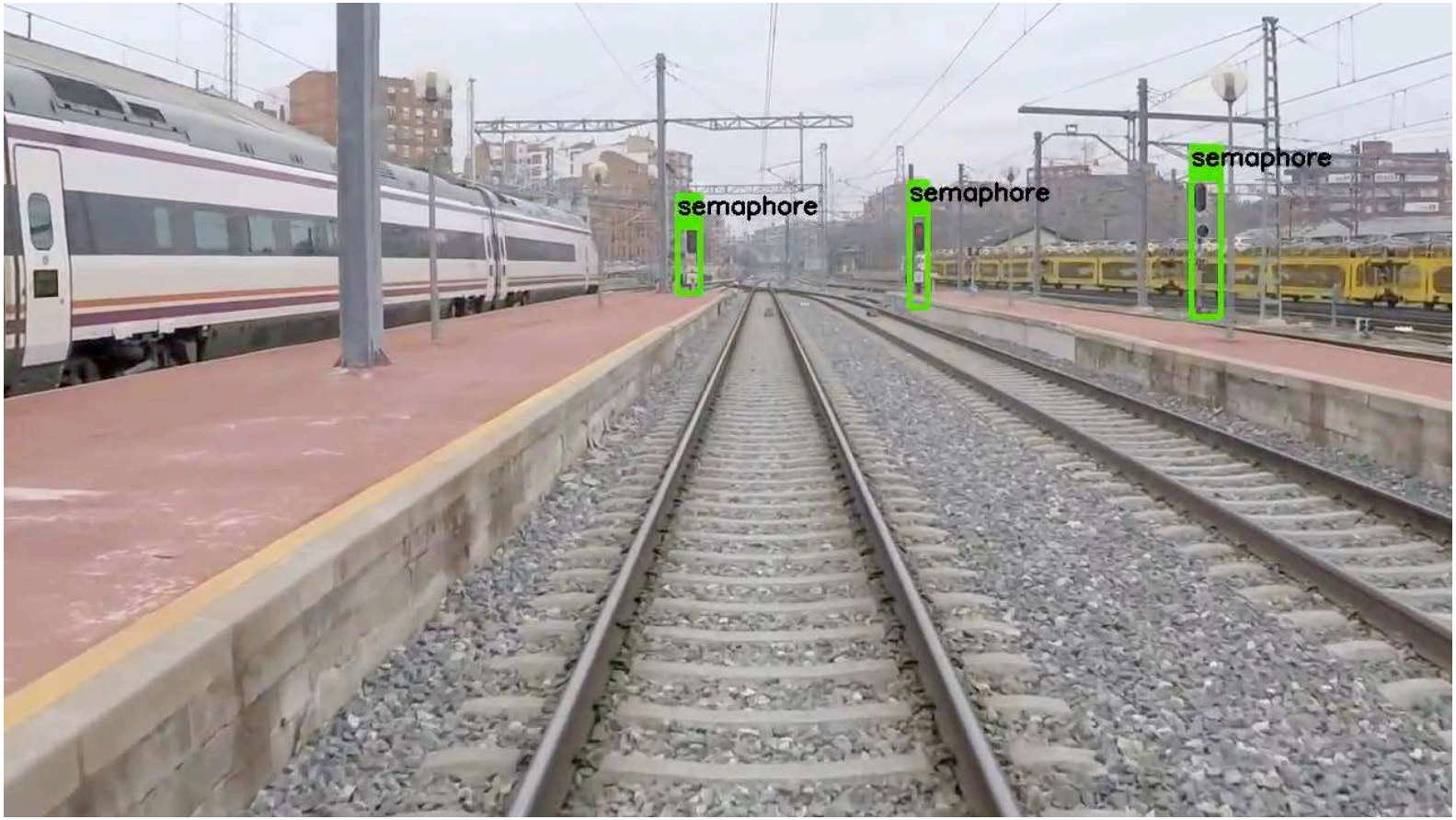
Precision agriculture: plants counting
for company Indigodrones (C.R.) 2018





1. Image Analysis:
2D/3D environment reconstruction

Railway signal detection and recognition
Sigma Rail 2019

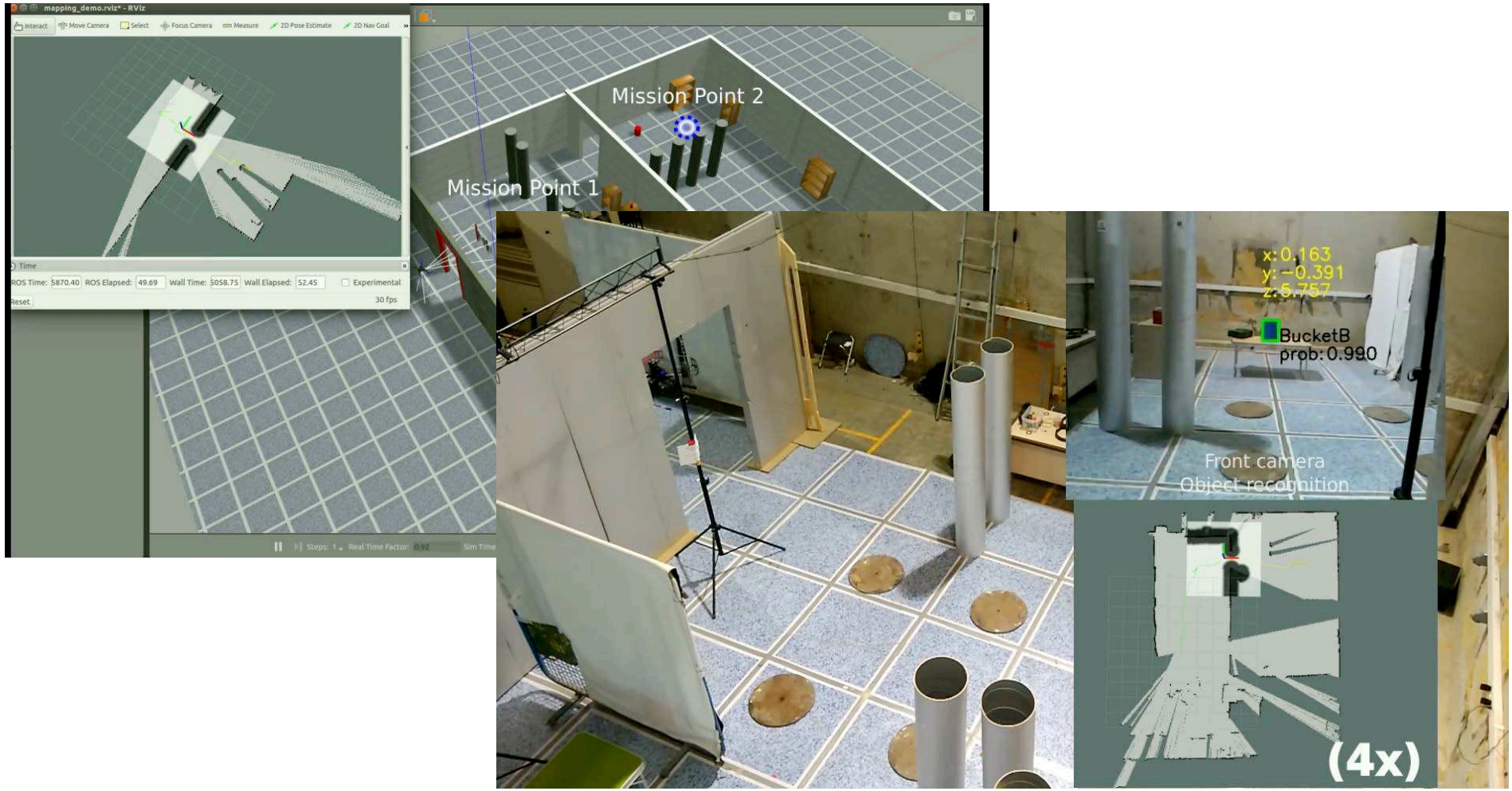


1. Image Analysis:
2D/3D environment reconstruction

Isolator segmentation & defect detection by DL for REE 2018

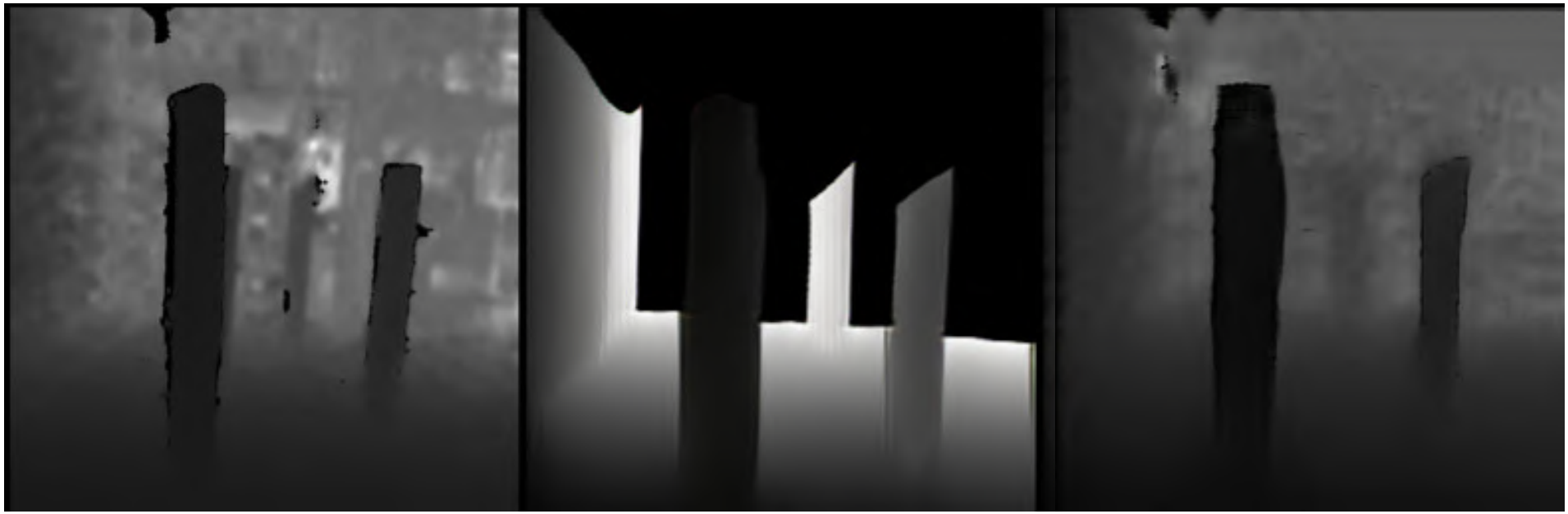
2 Vision in Autonomous Flights

Relevance of simulation



2 Vision in Autonomous Flights

Relevance of simulation



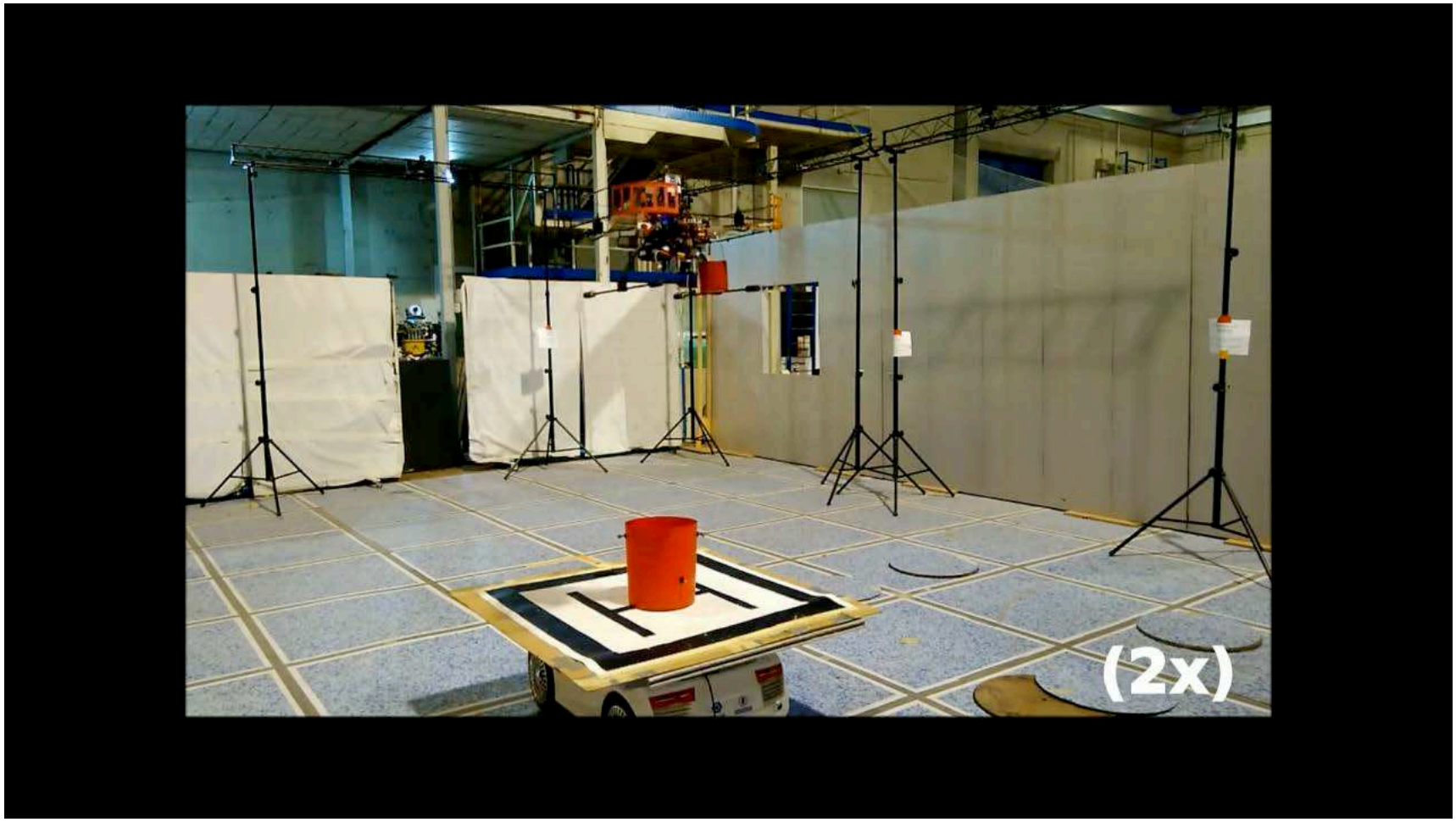
Real depth image

Synthetic image

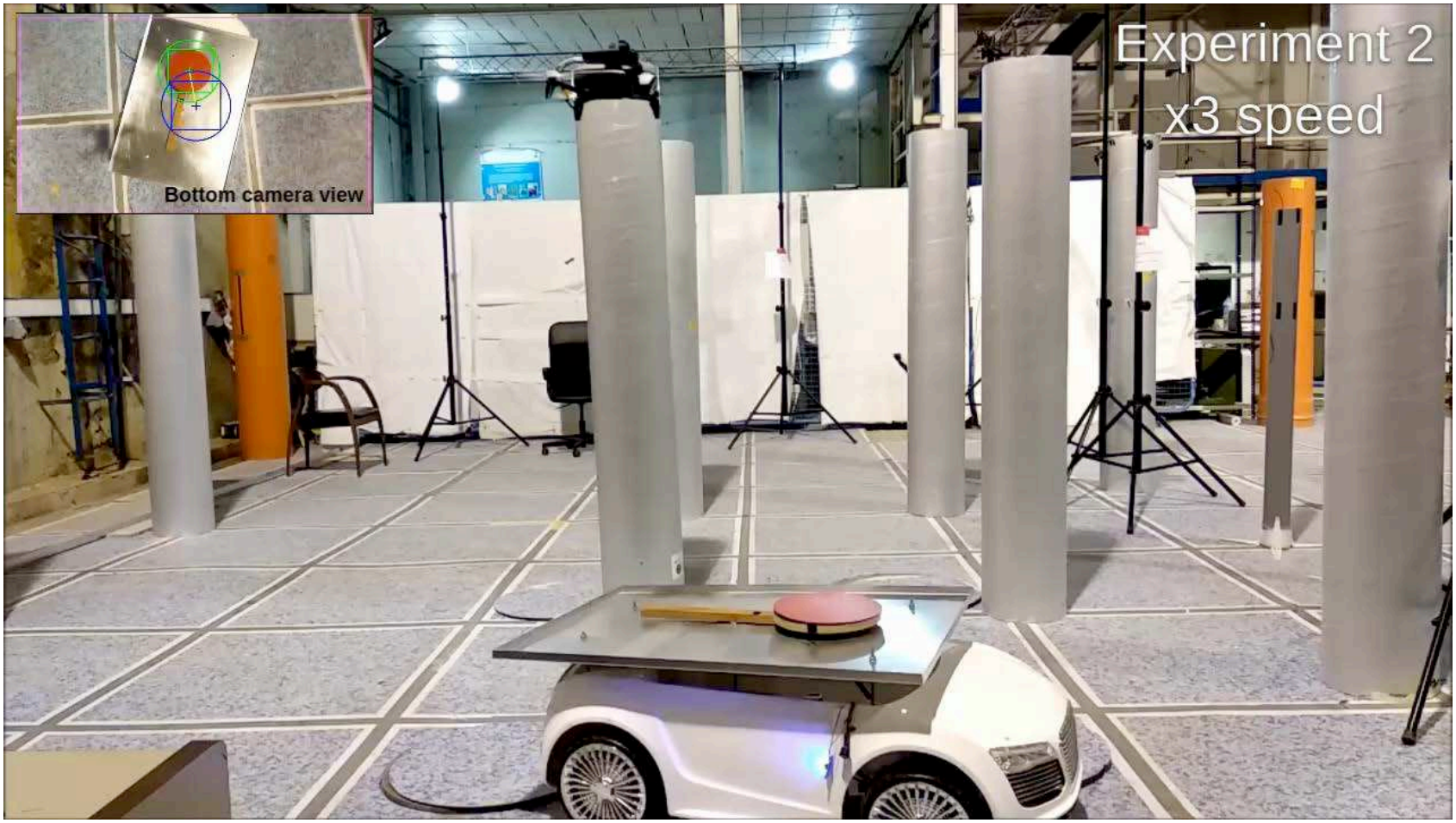
→ Realistic image
by DL autoencoder

2 Vision in Autonomous Flights:

Dynamic Visual Servoing

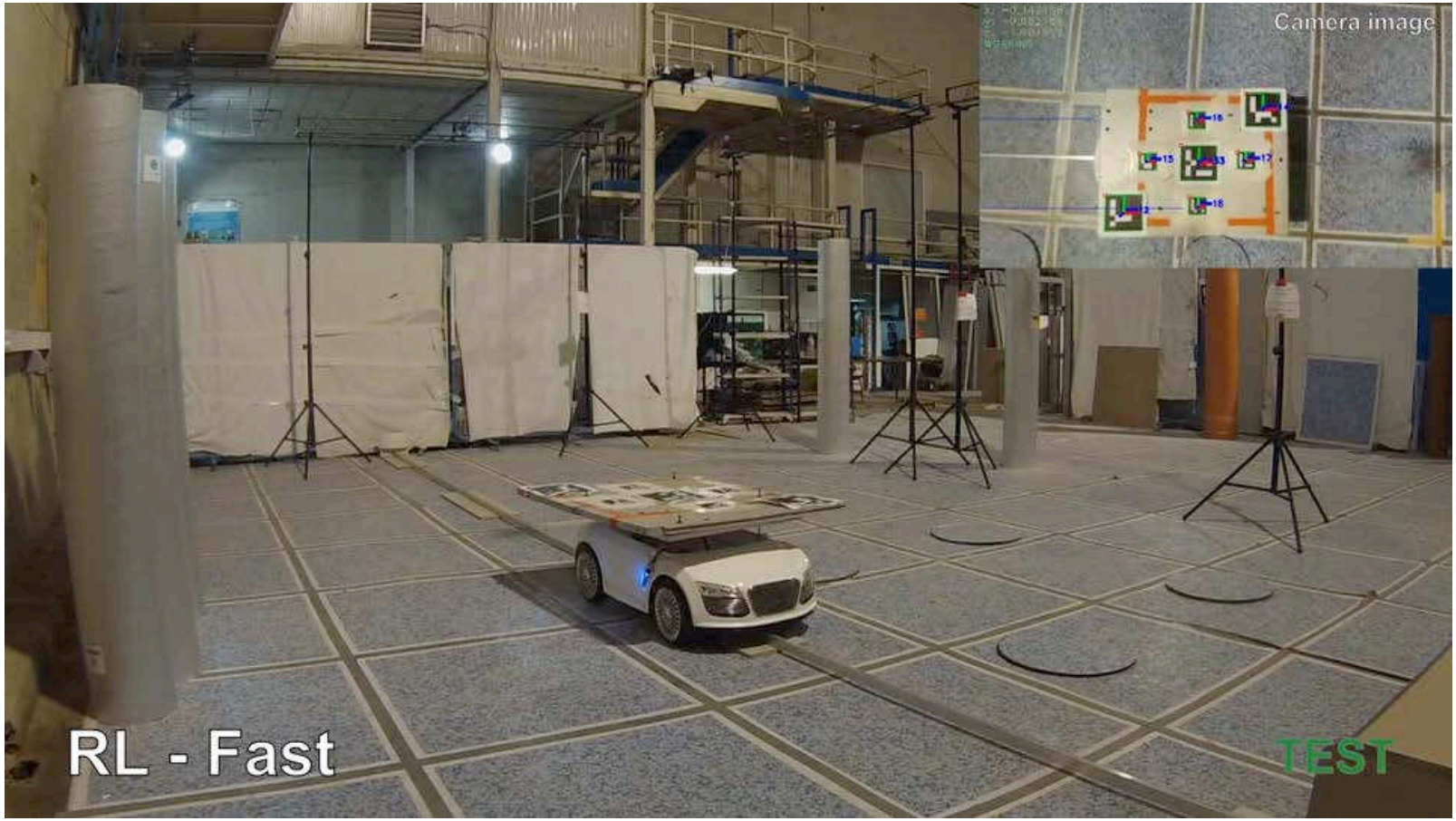


2 Vision in Autonomous Flights:
Image Visual Servoing by RL



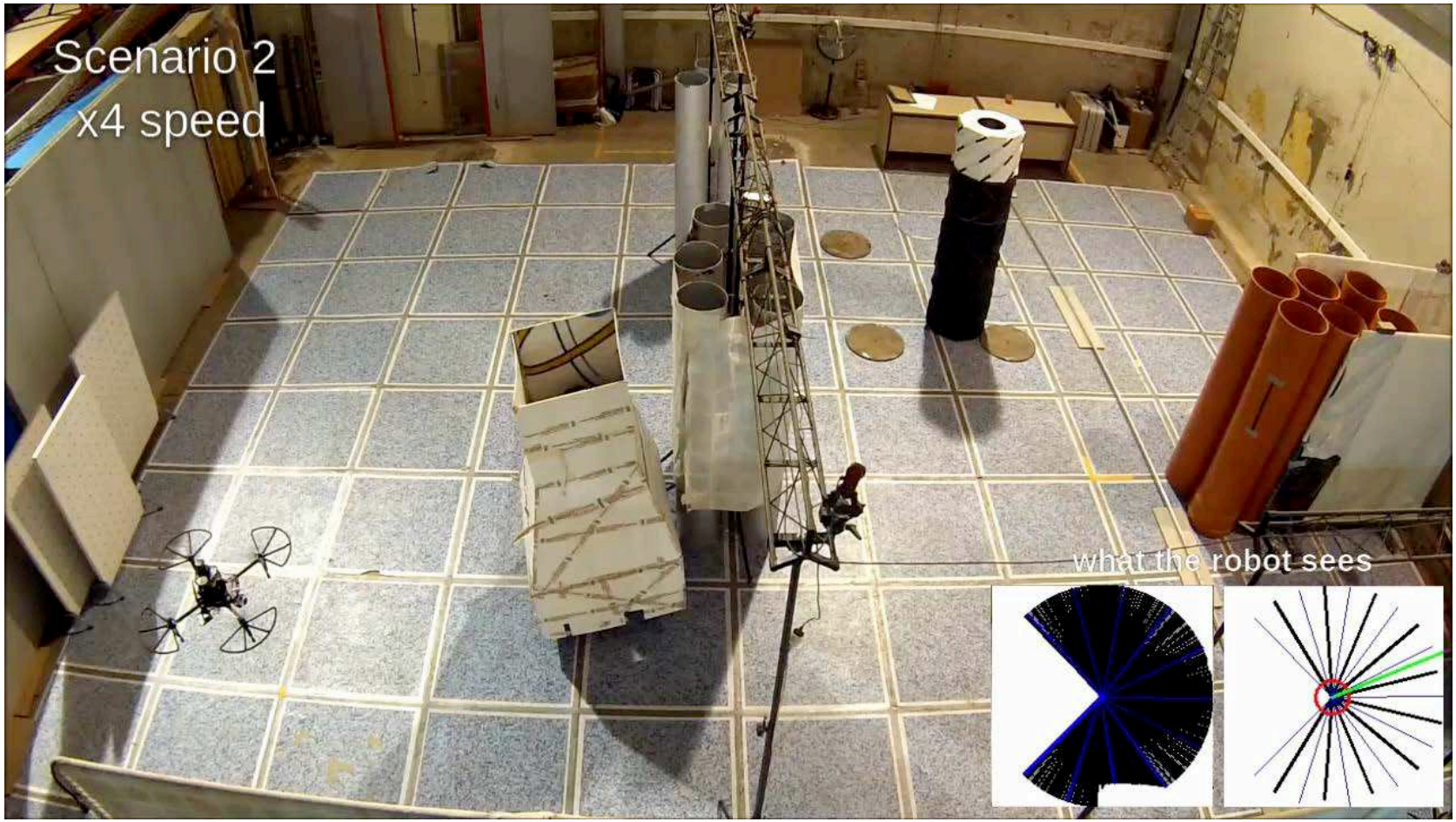
"Image-Based Visual Servoing Controller for Multirotor Aerial Robots Using Deep Reinforcement Learning" by Carlos Sampedro et altersat IROS 2018

2 Vision in Autonomous Flights:
RL for visual autonomous landing



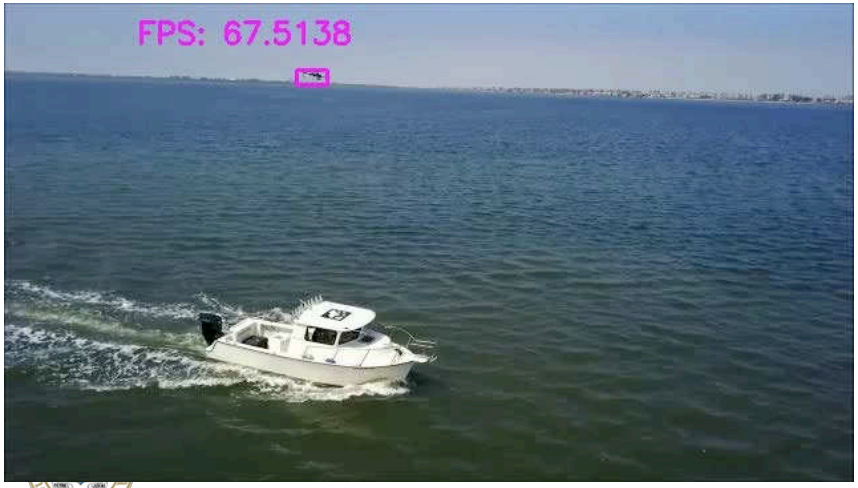
"A Deep Reinforcement Learning Technique for Vision-Based Autonomous Multirotor Landing on a Moving Platform" by Alejandro Rodriguez Ramos et alters at IROS 2018

2 Vision in Autonomous Flights:
Reactive Obstacle avoidance by RL



"Laser-Based Reactive Navigation for Multirotor Aerial Robots Using Deep Reinforcement Learning" by Carlos Sampedro et alters at IROS 2018

2 Vision in Autonomous Flights:
Drone detection by Learning



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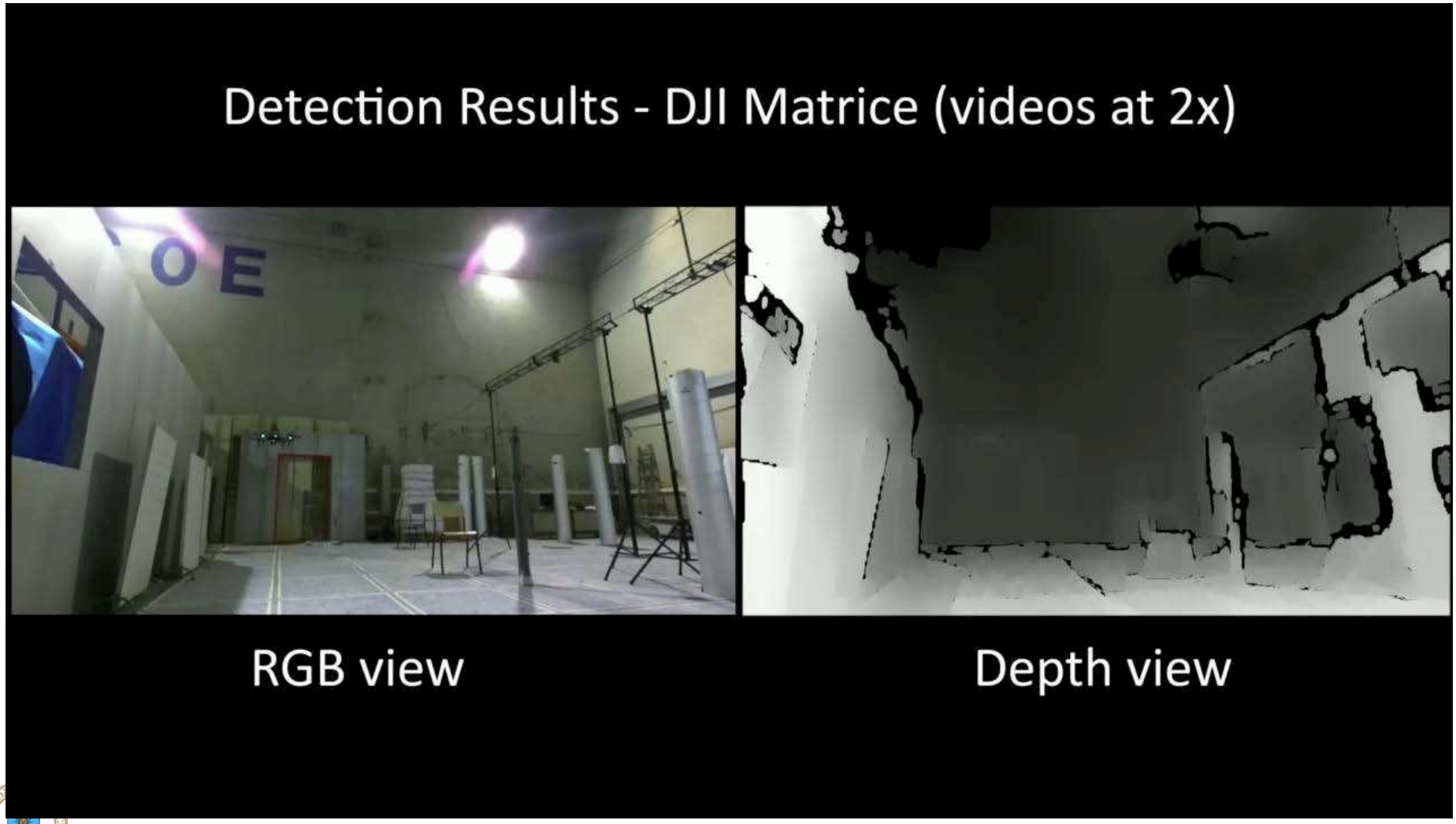
2 Vision in Autonomous Flights:
Dynamic obstacle detection

Dynamic object detection for see&avoid
By DL from depth map
for project with M.I.T. (2018)

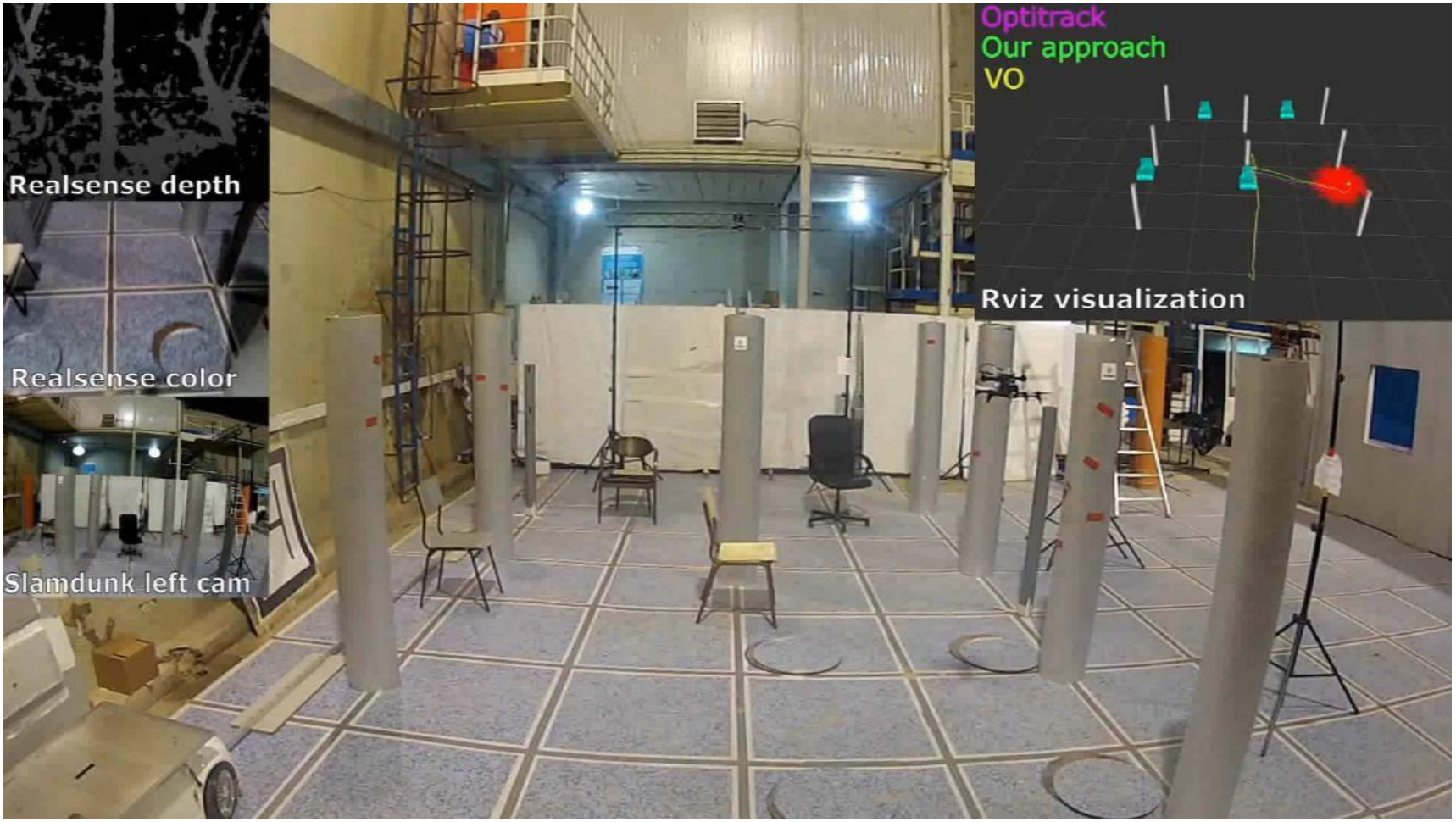
"Drone Detection Using Depth Maps" by Adrian Carrio et altres at IROS 2018

2 Vision in Autonomous Flights:
Dynamic obstacle detection



"Drone Detection Using Depth Maps" by Adrian Carrio et altres at IROS 2018

2 Vision in Autonomous Flights
Semantic SLAM



"Stereo Visual Odometry and Semantics based Localization of Aerial Robots in Indoor Environments" by Hriday Bavle et altres

2 Vision in Autonomous Flights
Semantic SLAM

Semantic SLAM on-board Aerial Robots using Planar Objects

"Stereo Visual Odometry and Semantics based Localization of Aerial Robots in Indoor Environments" by Hriday Bavle et altres

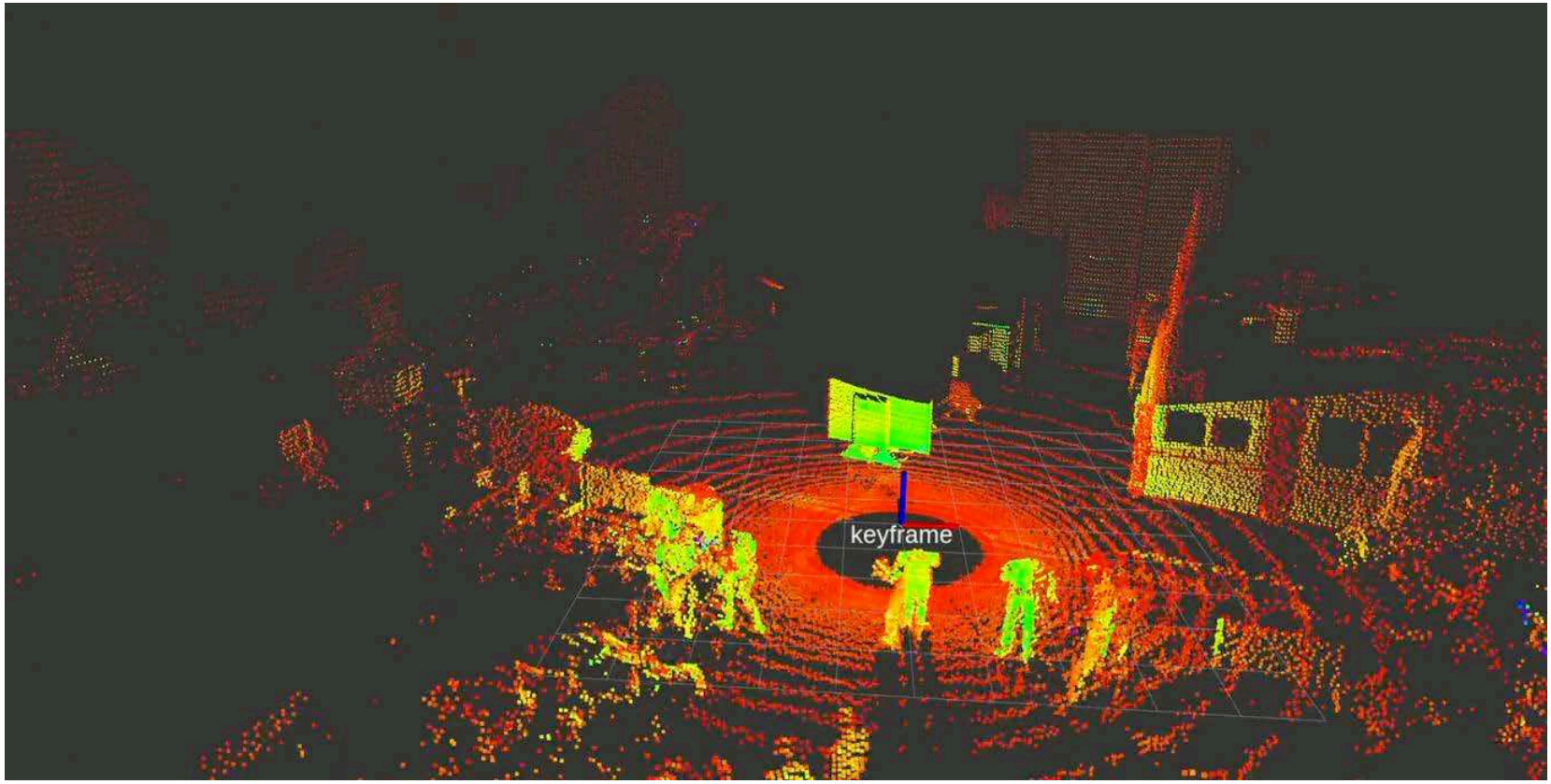
3D Laser on board UAV

vision & aerial robotics

Aircraft inspection for Airbus 2018-19

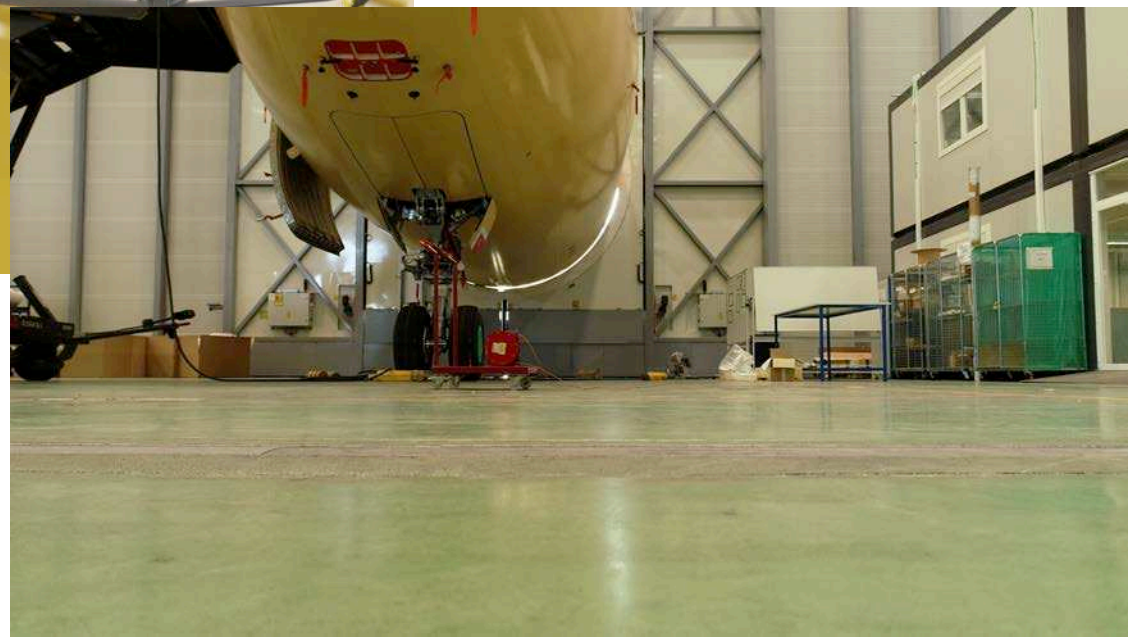
3D Laser on board UAV

Aircraft inspection for Airbus 2018-19



3D Laser on board UAV

Aircraft inspection for Airbus 2018-19

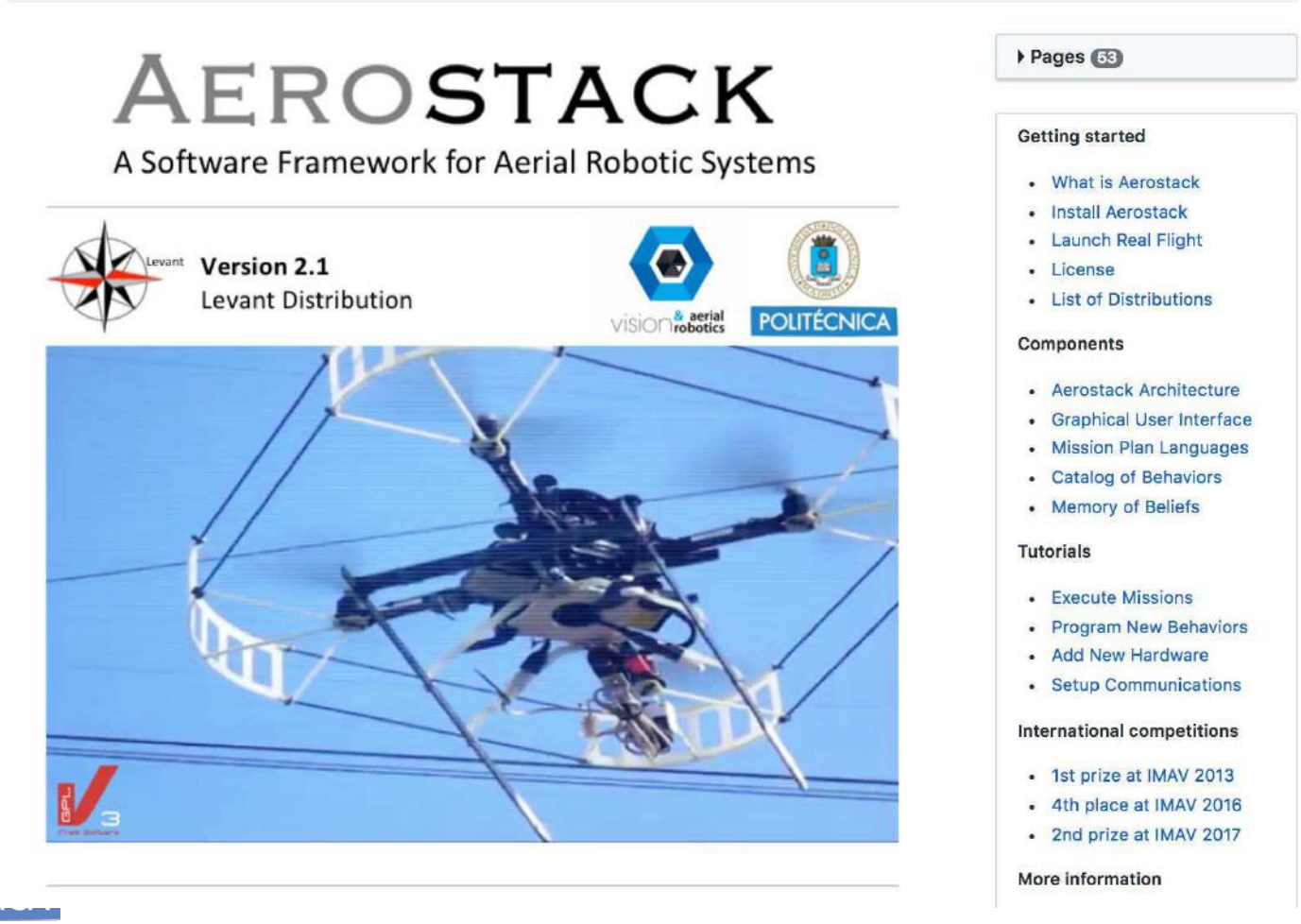


3D Laser on board UAV

Aircraft inspection for Airbus 2018-19

Vision for UAV:
Own framework

www.aerostack.org

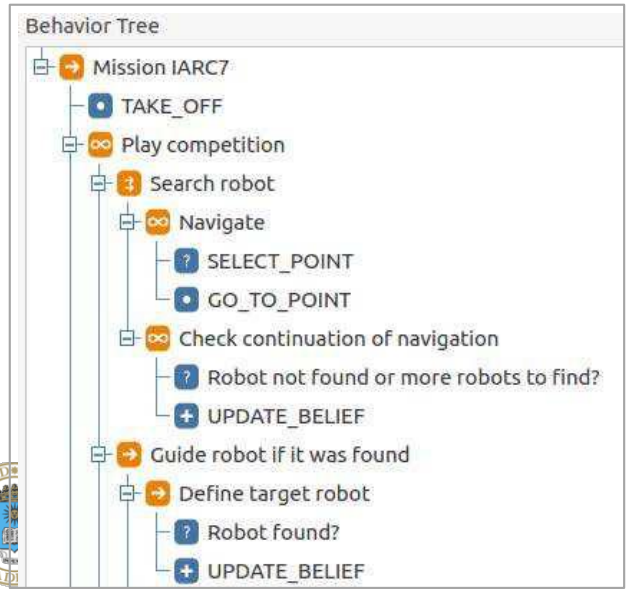


- 1st version released July 2016
- 2nd version released September 2017
- 3rd version, ROSIN project April 2019

Vision for UAV:
Own framework

Missions in Aerostack can be programmed:

- TML language
- Decision trees
- Python apps




```
import executive_engine_api as api

def runMission():
  api.executeBehavior('TAKE_OFF')

  api.activateBehavior('PAY_ATTENTION_TO_VISUAL_MARKERS')

  success, unification = api.consultBelief('position(self, (?x,?y,?z))')

  if success:
     x, y, z = unification['x'], unification['y'], unification['z'],
  else:
     print "Position unknown"

  api.executeBehavior('GO_TO_POINT',point=[2,5,1.3])

  api.executeBehavior('GO_TO_POINT',point=[x,y,z])

  api.inhibitBehavior('PAY_ATTENTION_TO_VISUAL_MARKERS')

  api.executeBehavior('LAND')
```

```
    </task>
  </task>
```

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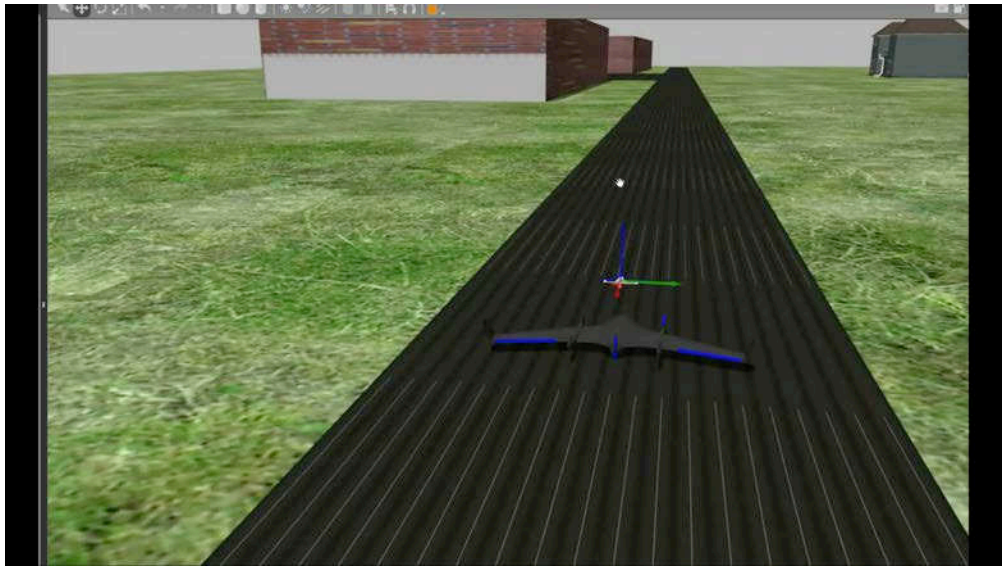
imav2019

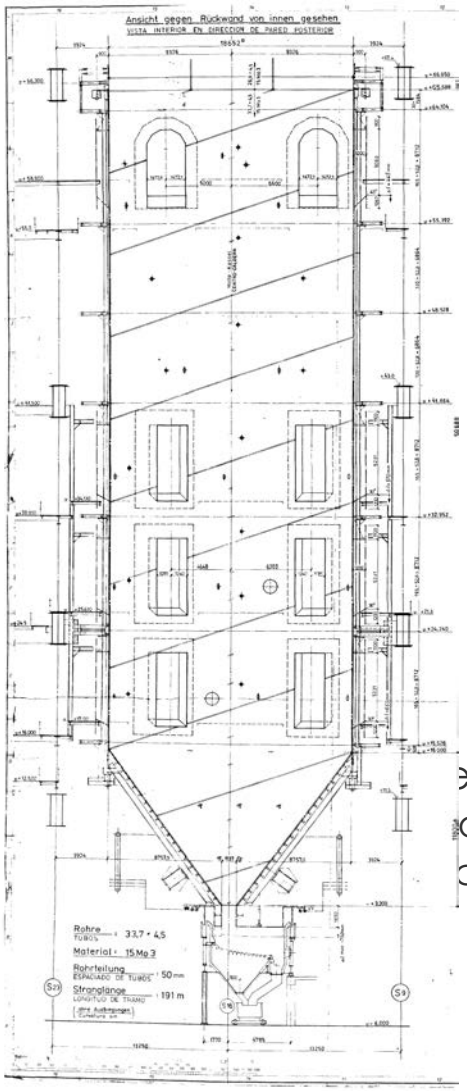
11th International Micro Air Vehicle Competition and Conference
30th September to 4th October 2019 in Madrid

imav2019



vision & aerial robotics

Visual inspection using drones: Questions ?



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