

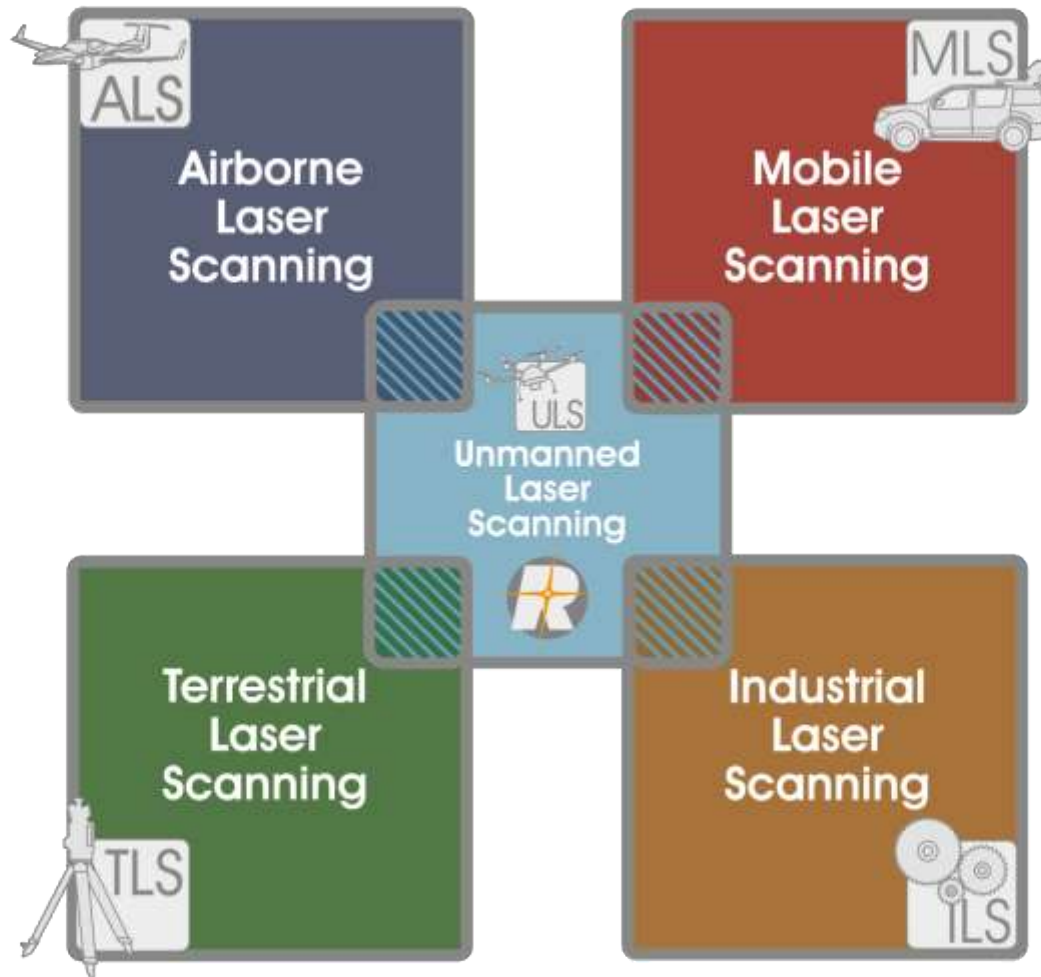


# UAV-based laser scanning system for corridor mapping and industrial inspection

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RIEGL Laser Measurement Systems, Austria



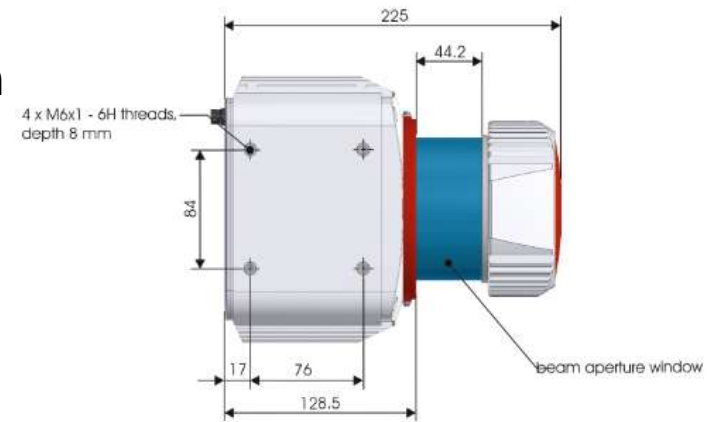
# Unmanned Laser Scanning (ULS) - A new class in Laser Scanning



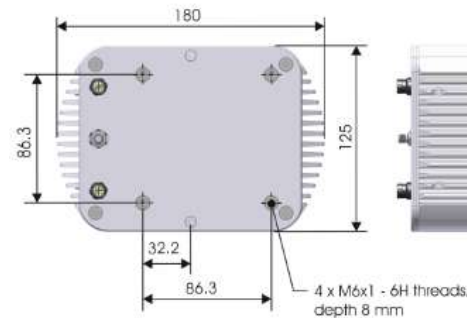
# The VUX-1 laser scanner series



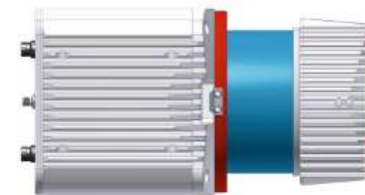
- VUX-1 UAV, VUX-1 HA, VUX-1 LR
- lightweight: only 3.6 kg
- compact package: 227 x 180 x 125 mm



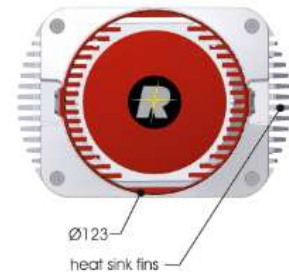
front view



side view



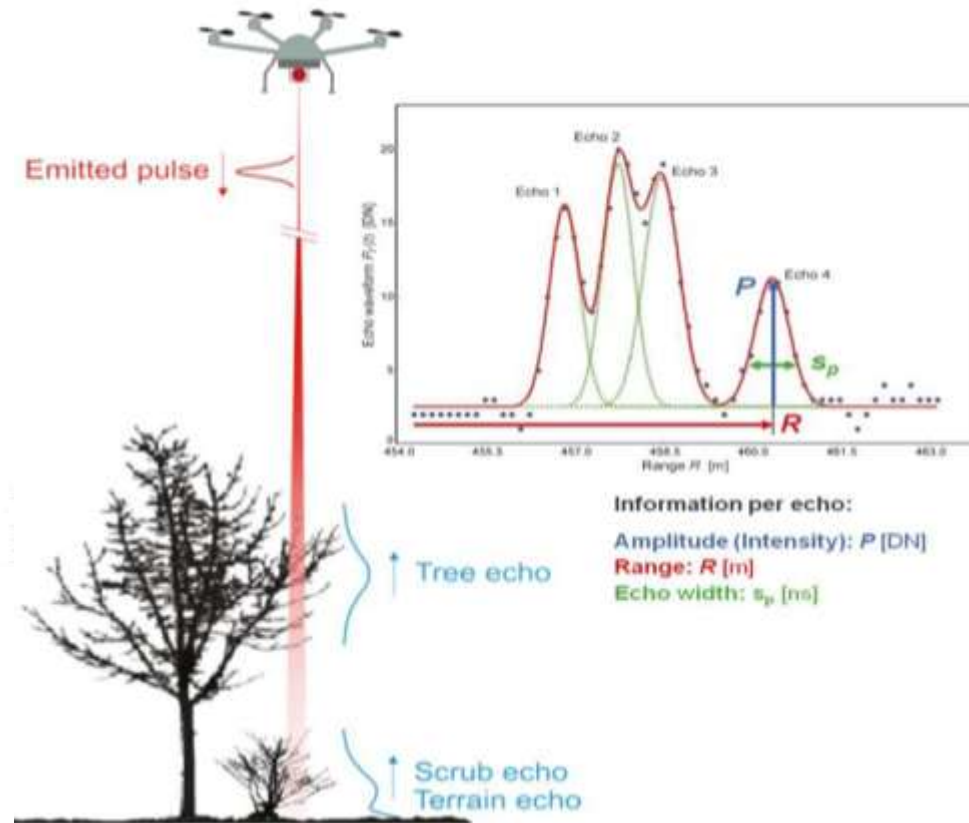
rear view



# The VUX-1 laser scanner series



- online waveform processing technique enables
  - multiple target capability
  - high measurement accuracy
  - calibrated reflectance



# The VUX-1 laser scanner series



## NEW RIEGL VUX®-1HA High Accuracy

- compact, rugged and very lightweight design
- easily mountable to whatsoever type of moving platform
- field of view 355°
- Laser Pulse Repetition Rate PRR > 1 MHz
- high accuracy 5 mm

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Eye Safety Class	Laser Class
Max. Range @ Target Reflectivity 80%	400 m
Max. Range @ Target Reflectivity 10%	150 m
Minimum Range	1.2 m
Accuracy	5 mm
Precision	3 mm
Max. Effective Measurement Rate	1,000,000
Max. Scan Speed	250 scans/s
Field of View (FOV)	355°

### Typical Applications

- indoor and outdoor laser mapping
- tunnel profile measurements
- railway applications like clearance analysis, etc.

Eye Safety Class	Laser Class 1
Max. Range @ Target Reflectivity 80%	400 m
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Minimum Range	1.2 m
Accuracy	5 mm
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Max. Scan Speed	250 scans/sec
Field of View (FOV)	355°

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## RIEGL VUX®-1LR Long Range

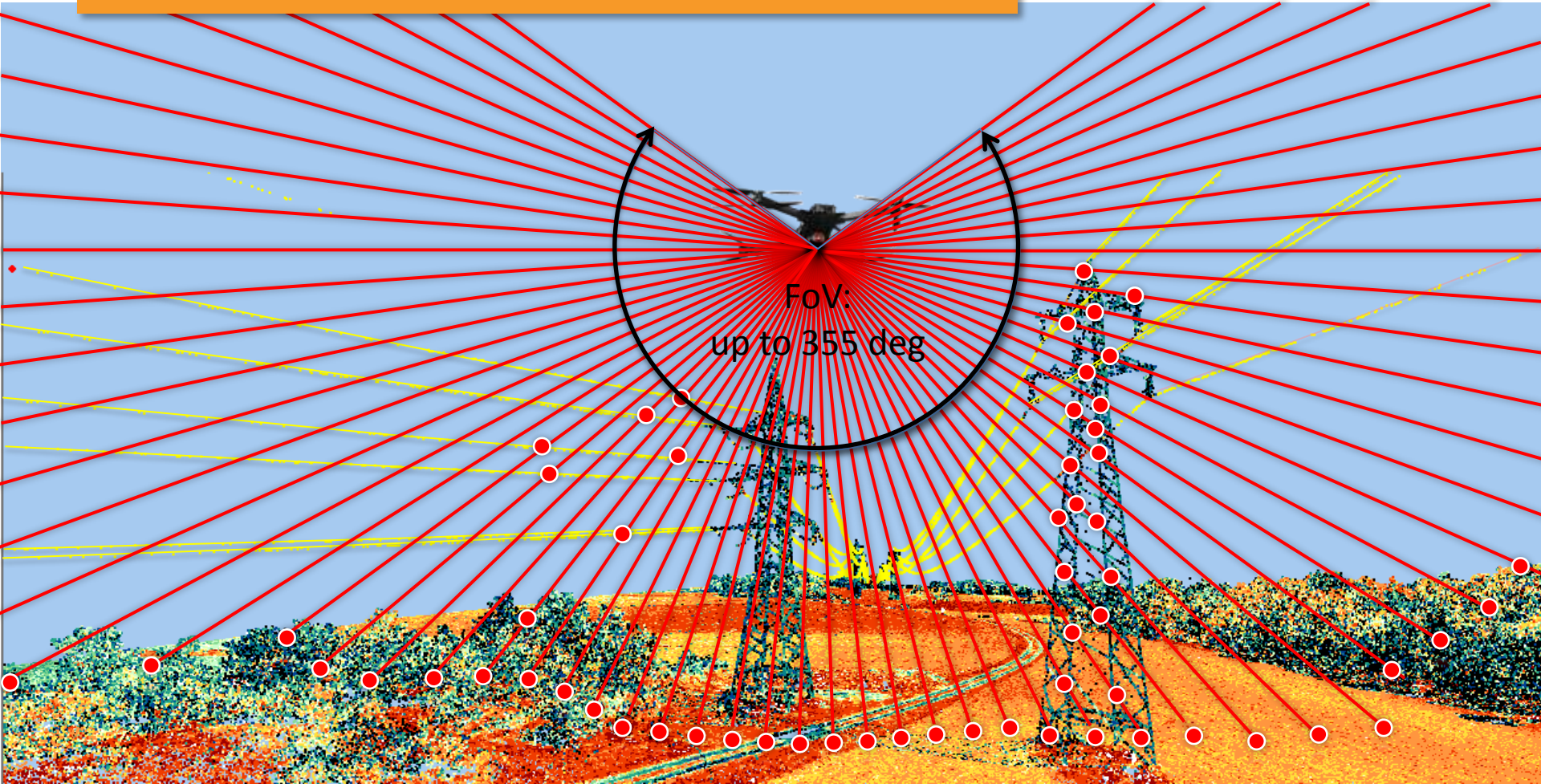
compact, rugged and very lightweight design  
 ideal for airborne surveying from helicopters  
 up to 330°  
 integrated system solution RIEGL VP-1 Helipod  
 for user-friendly mounting to helicopters

Eye Safety Class	Laser Class 1
Max. Range @ Target Reflectivity 60%	1,350 m
Max. Range @ Target Reflectivity 20%	820 m
Minimum Range	5 m
Precision	15 mm / 10 mm
Max. Measurement Rate	750,000 meas./sec
Max. Scan Speed	200 scans/sec
Field of View (FOV)	330°
Max. Flight Altitude AGL	530 m / 1,740 ft

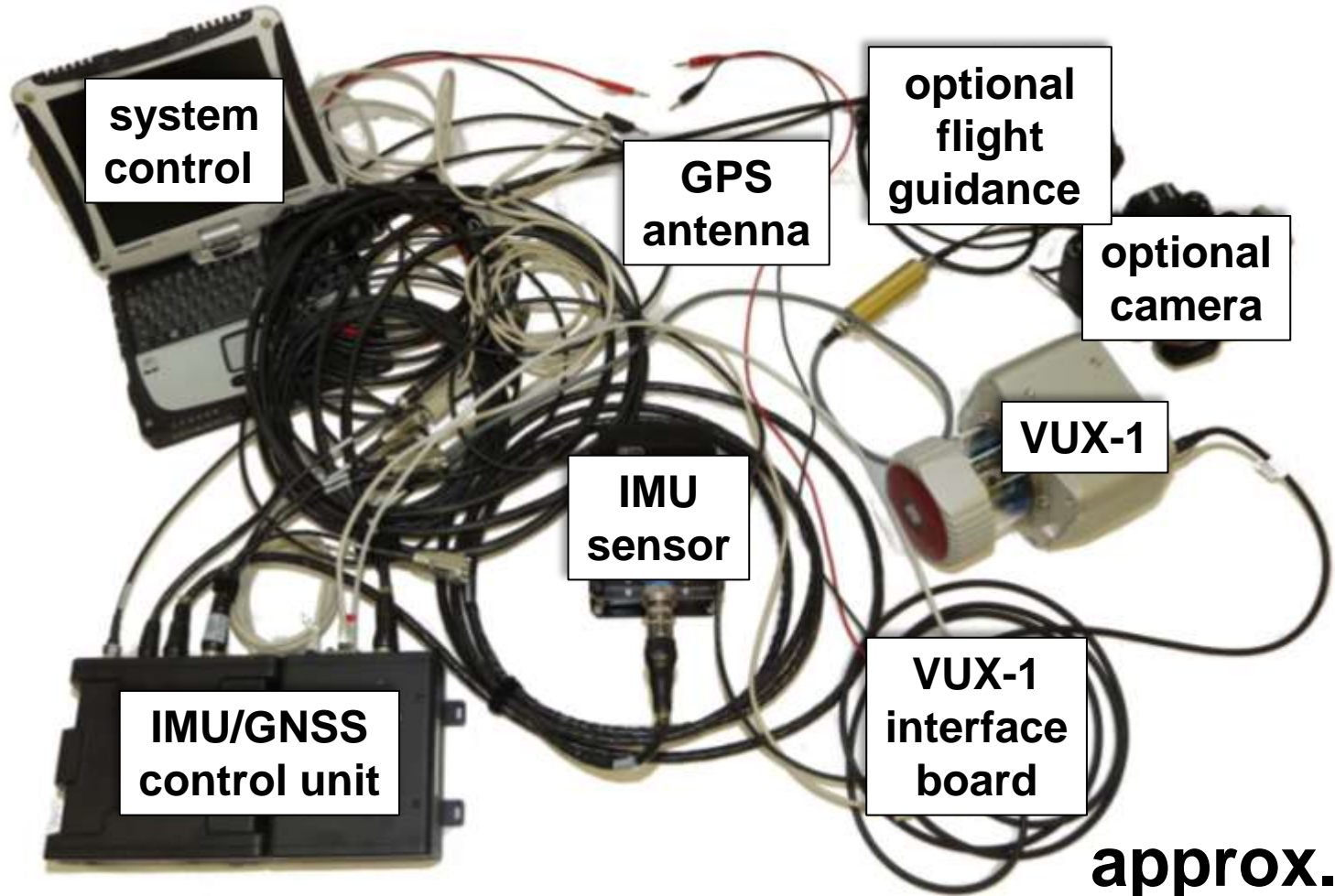
### Typical Applications

- indoor and outdoor laser mapping
- tunnel profile measurements
- railway applications like clearance analysis, etc.

# The VUX-1 measurement principle



# DIY system integration



**approx. 17 kg**

# VUX-SYS conventional setup DIY system integration for ALS

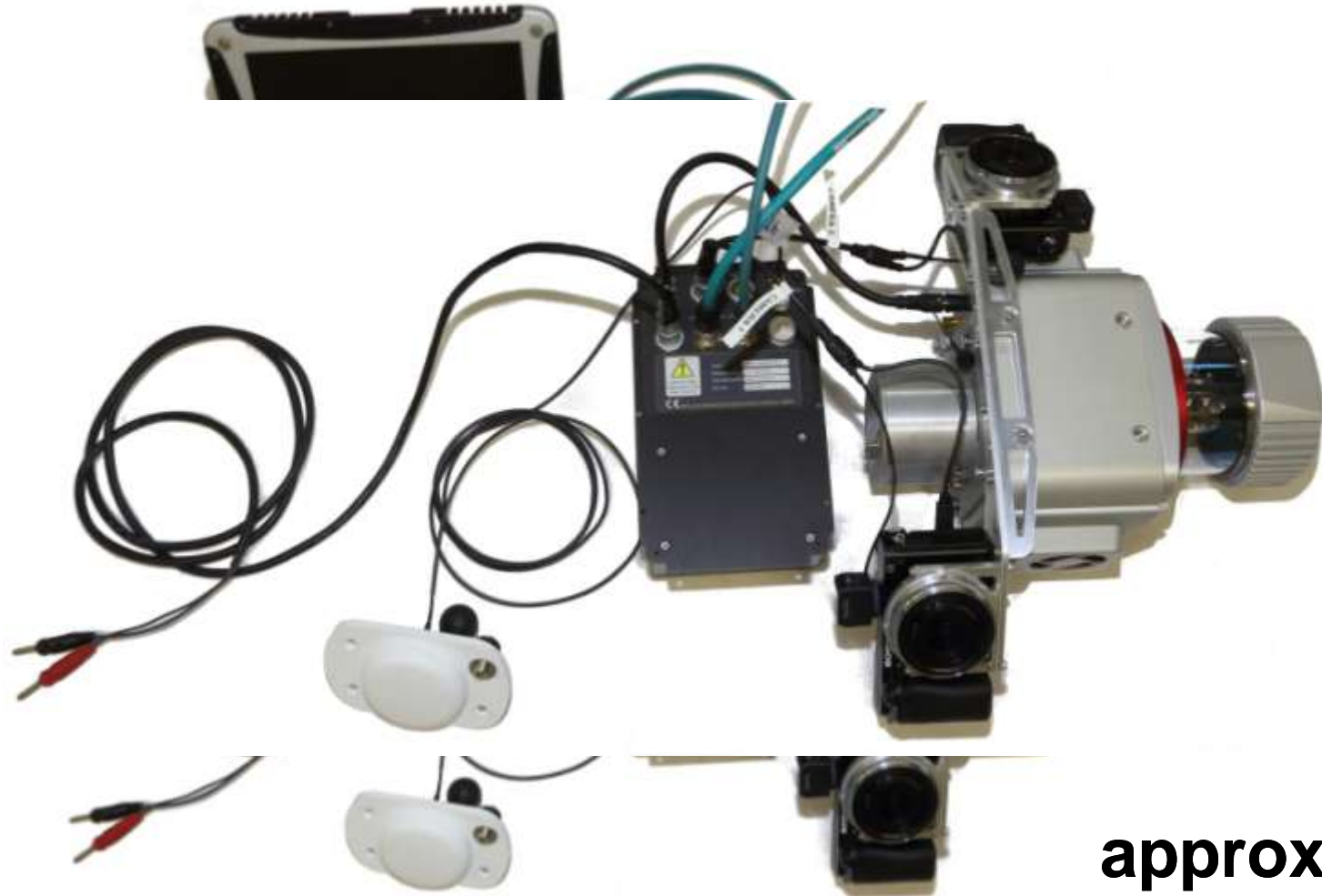


al  
a

**approx. 10 kg**

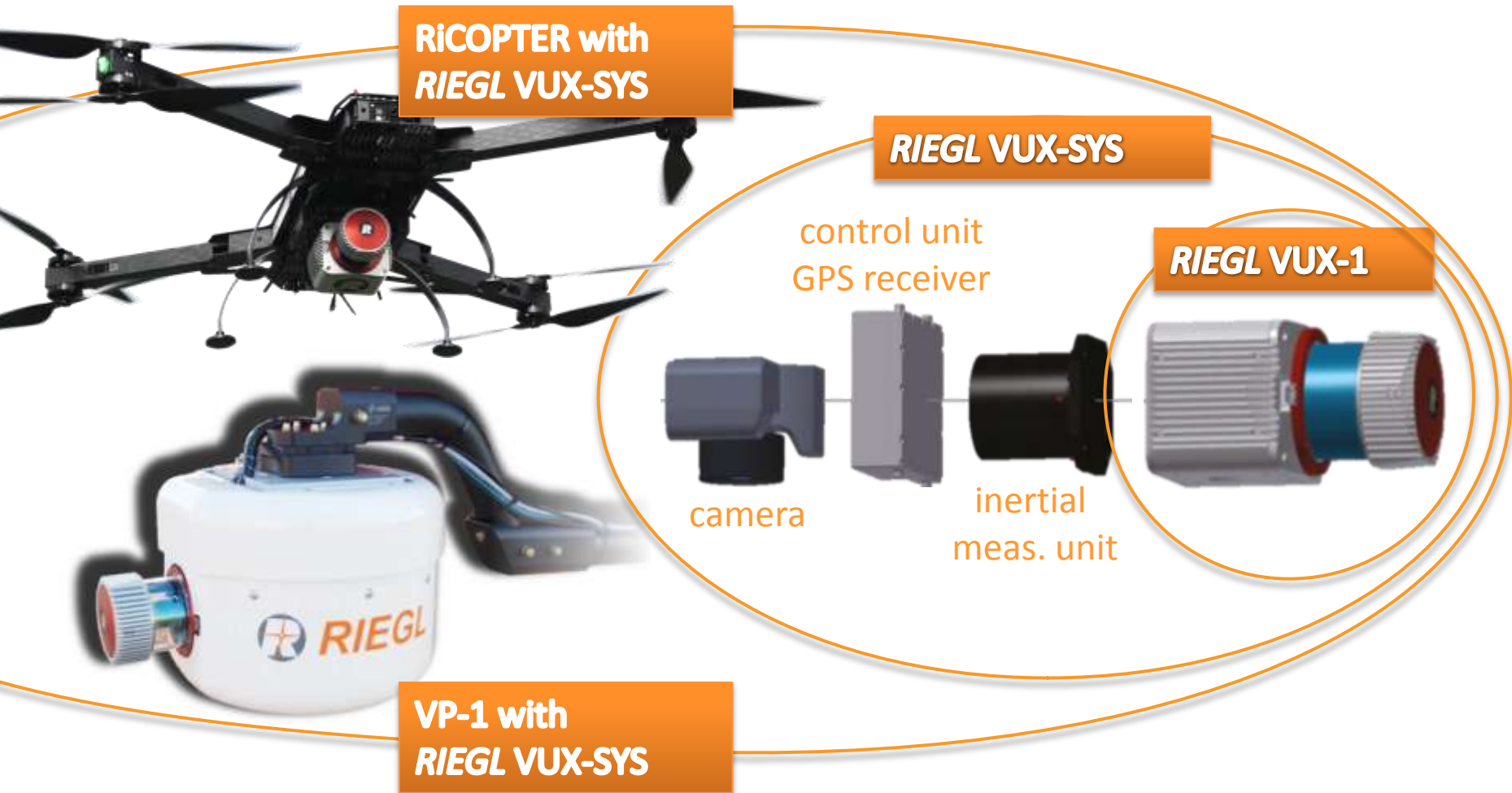


VUX-SYS conventional setup  
VUX-SYS integration for ULS  
for ALS

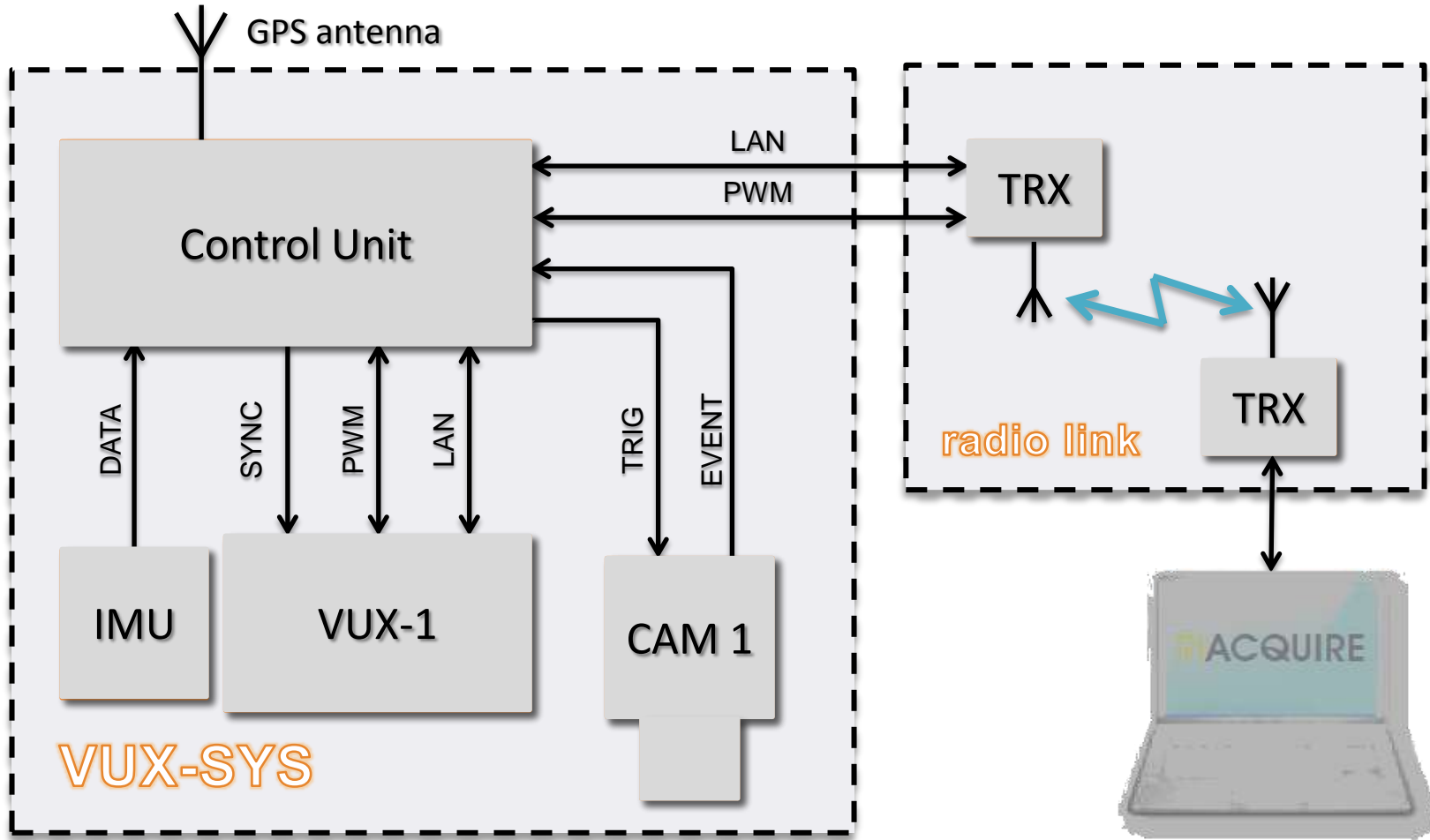


approx. 60kg

# What is the VUX-SYS?



# VUX-SYS remote control capability



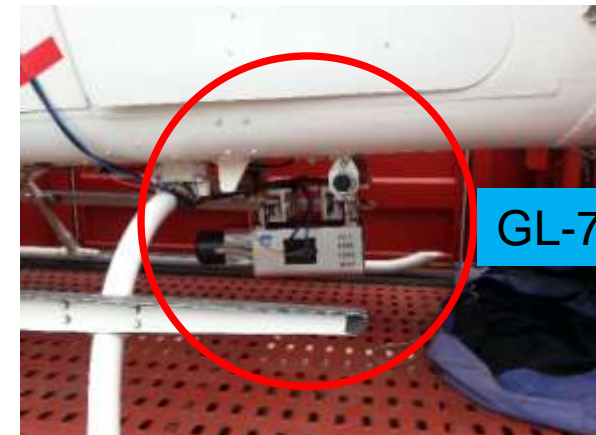
# Typical applications: Power Line Mapping



# Typical Commercial Solution



- Ferry to the project site in a custom-made truck
- 用特制的卡车运输飞机到项目地
- Helicopter is lifted to the top by elevator
- 使用升降梯将直升机升到顶部
- Take-off, land and refuel on the truck
- 起飞、降落及加油在卡车上完成
- Lidar system mounts to sling points .. 130deg FOV
- 激光雷达系统安装在机舱下方...130度视场角
- Approximately 1hr flight time with pilot and operator
- 飞行员及激光雷达操作人员搭载在机上，大约飞行了1小时



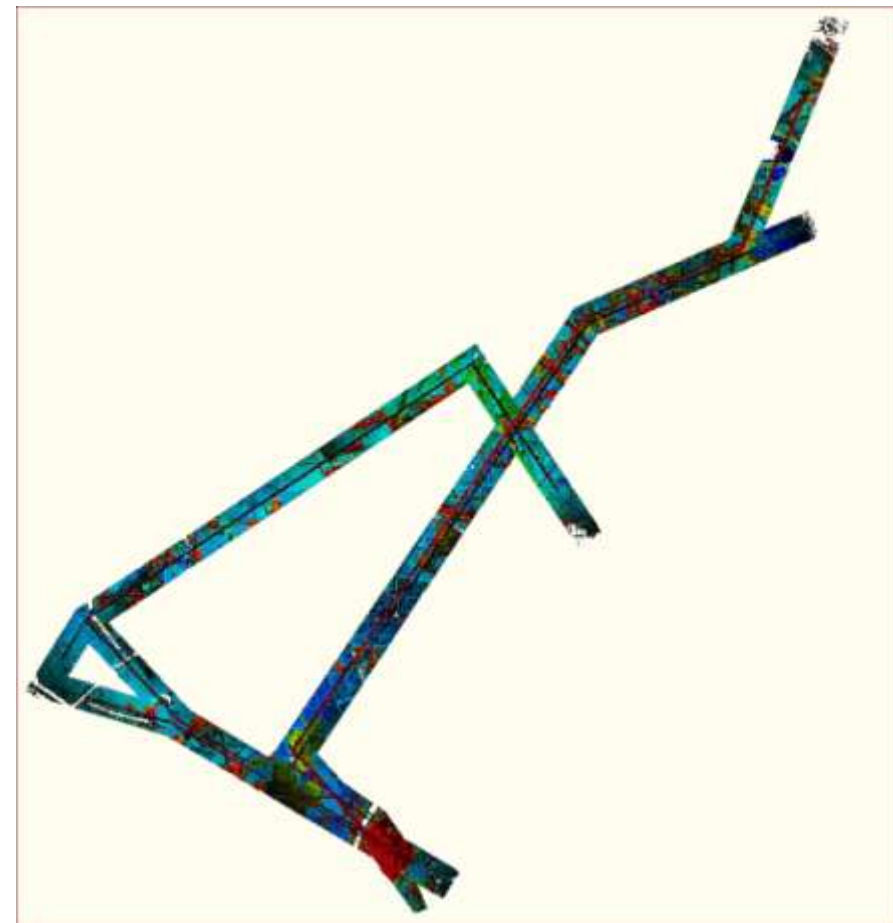
# First High Resolution UAV-Lidar Project



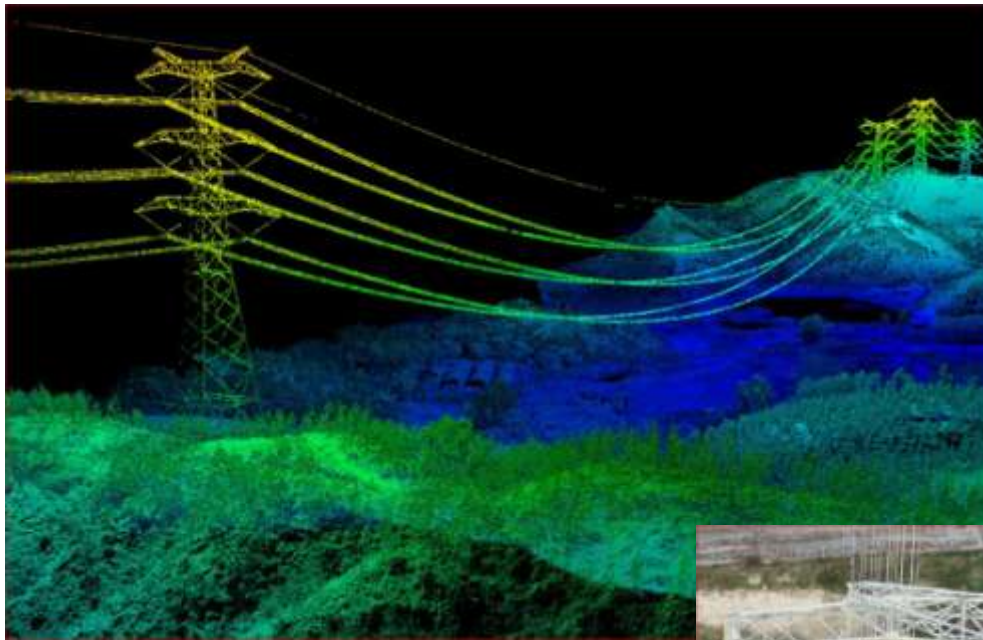
## Power Grid Demo Project

### 电网试验项目

- Approximately 30km of Power Transmission Line  
大约30公里长的输电线路
- Laser point density > 70 pts/ sq m  
激光点密度>70点/平米
- Image ground resolution 5cm  
影像地面分辨率5cm



# First High Resolution UAV-Lidar Project



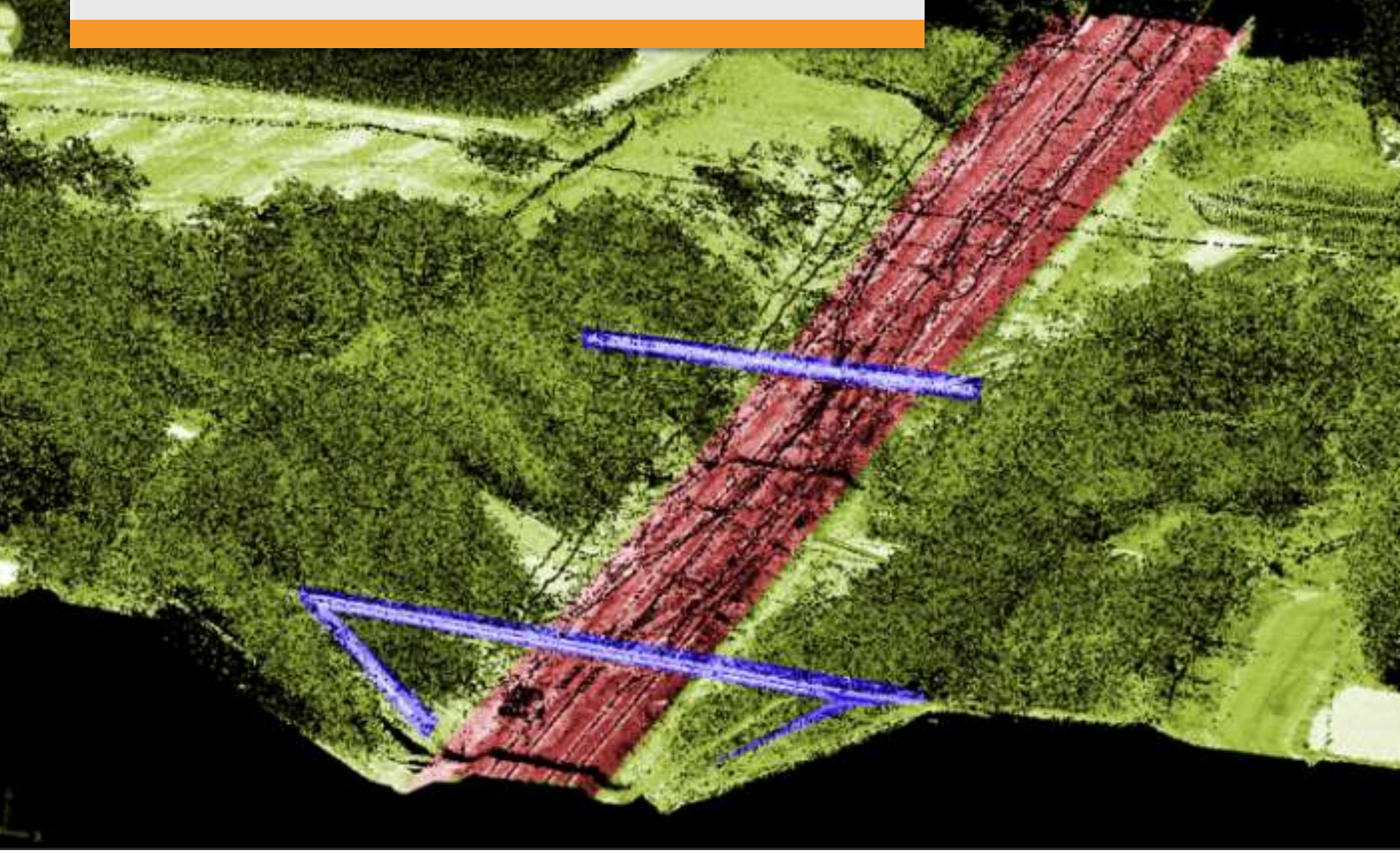
- GL-70 (12kg)  
GL-70 激光雷达 (12kg)
- Riegl VUX-1
  - FOG IMU
  - 23mp RGB camera



Flt is 130m agl @ 40km/hr  
飞行高度离地面130米，速度40公里/小时  
Laser 60 pts/sq m  
数据结果激光点密度为60点/平方米  
Image ground resolution 5cm  
影像地面分辨率为5cm

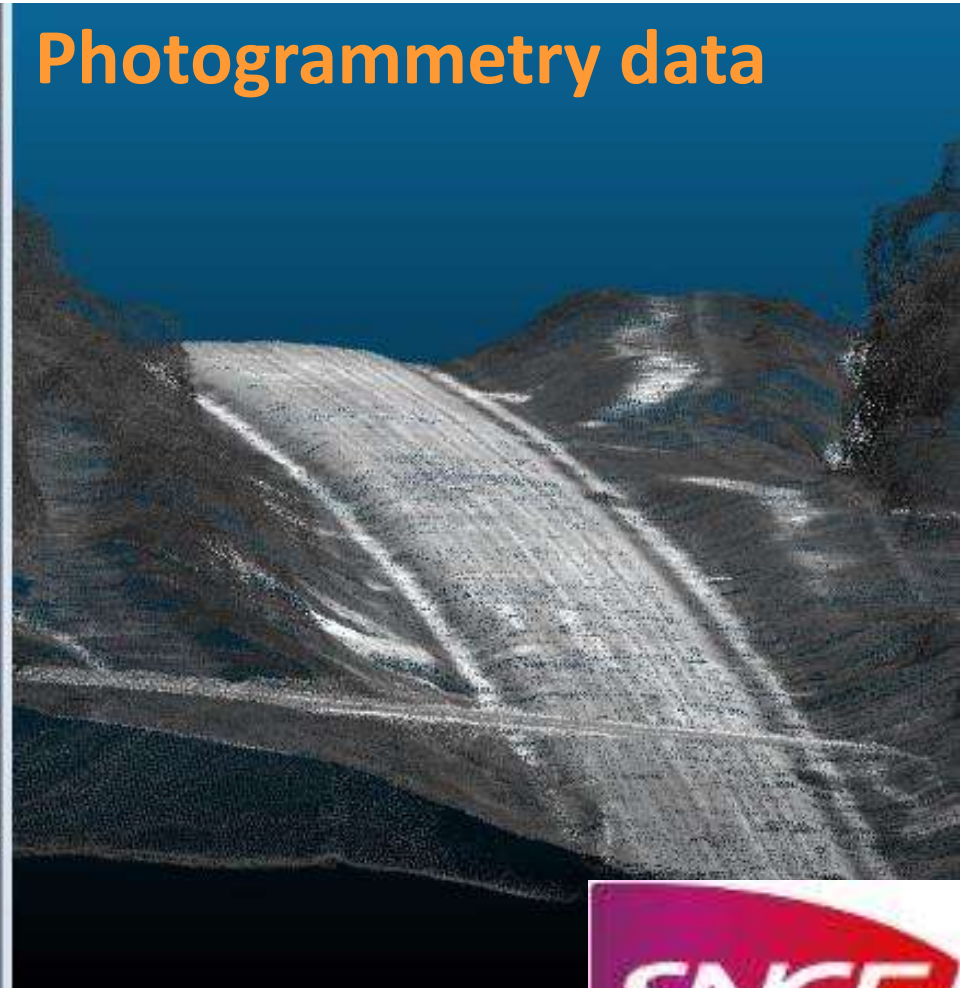
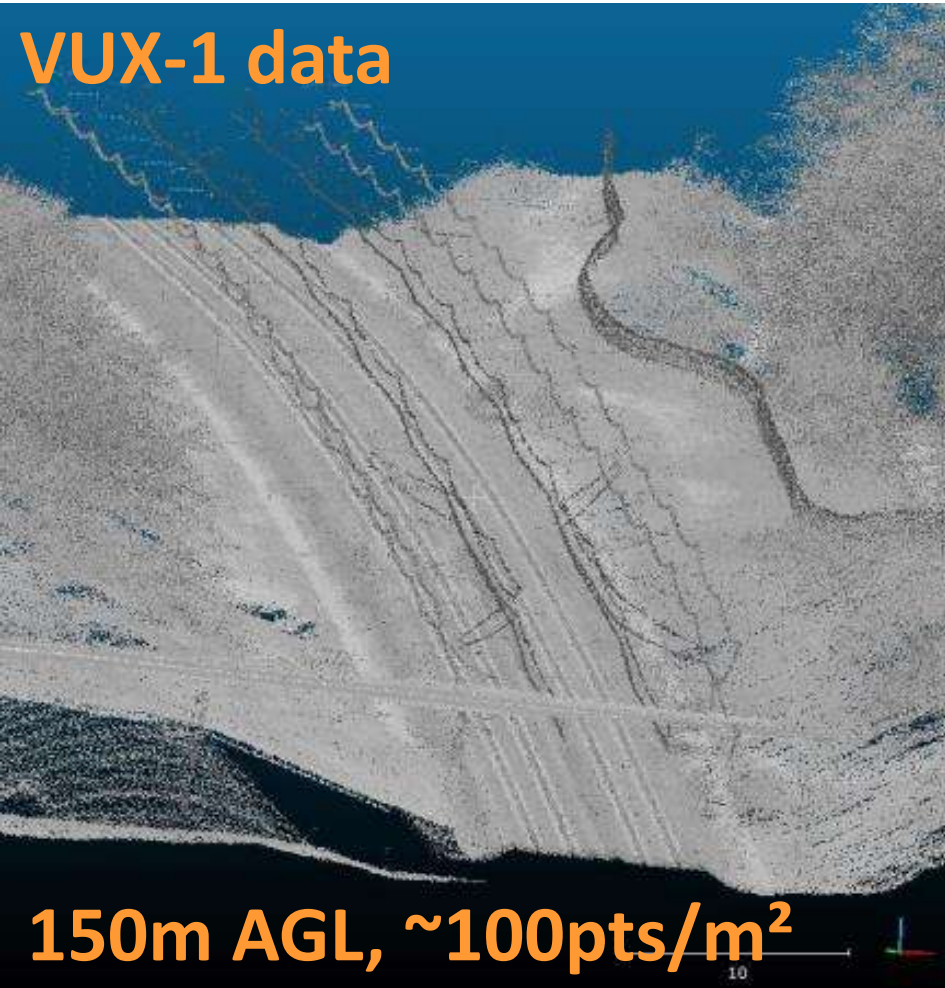


# Typical application: Railway Corridor Mapping

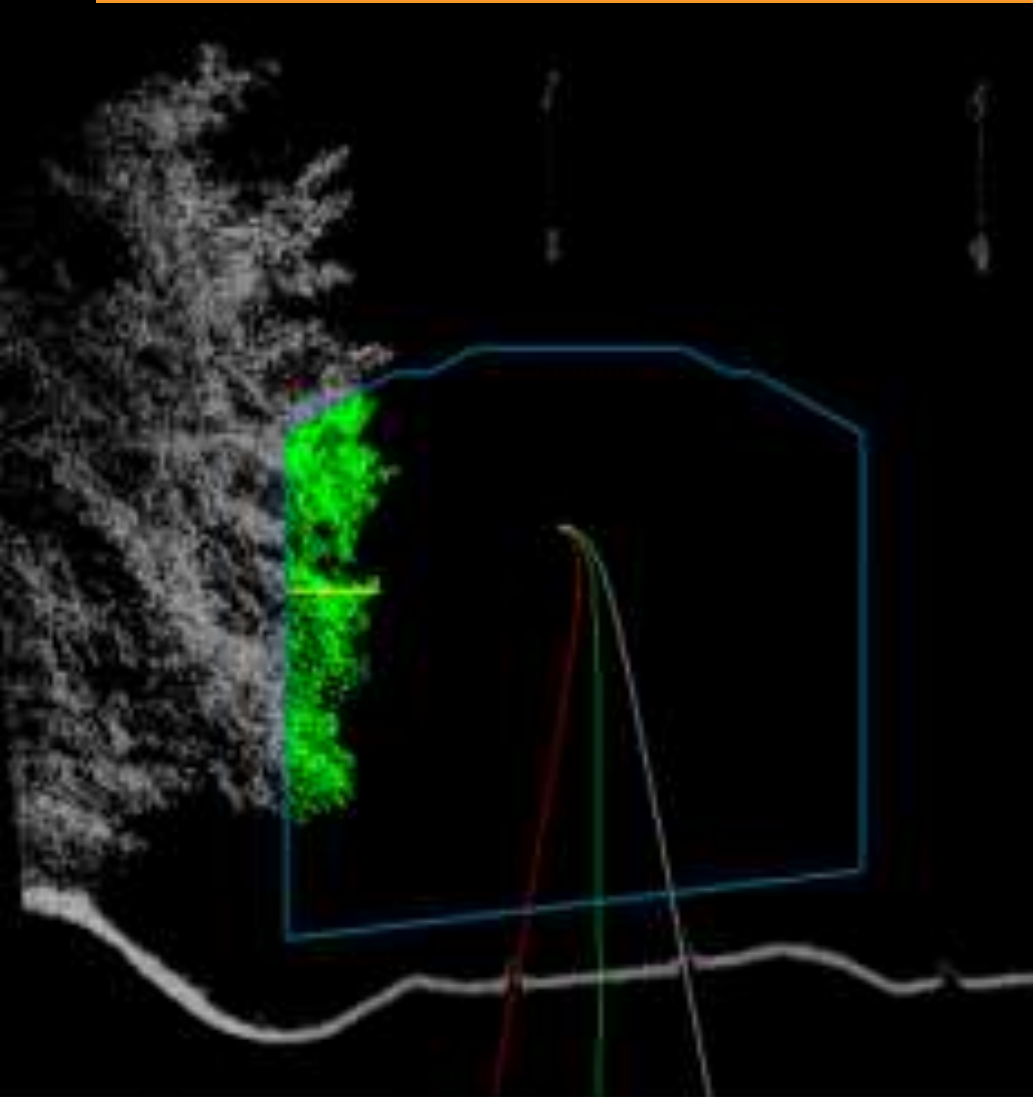




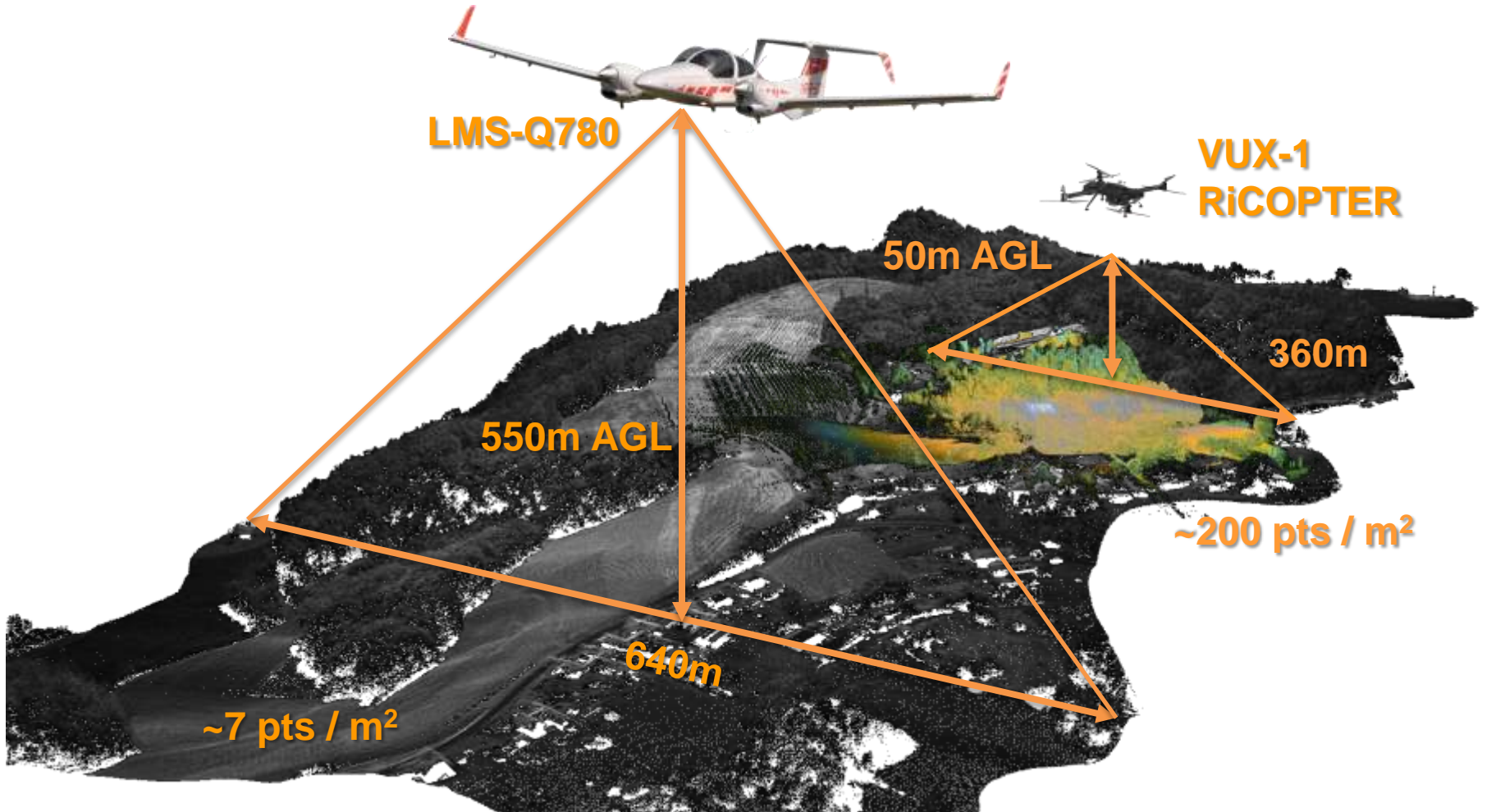
# Comparison by SNCF: LIDAR vs. Photogrammetry point cloud



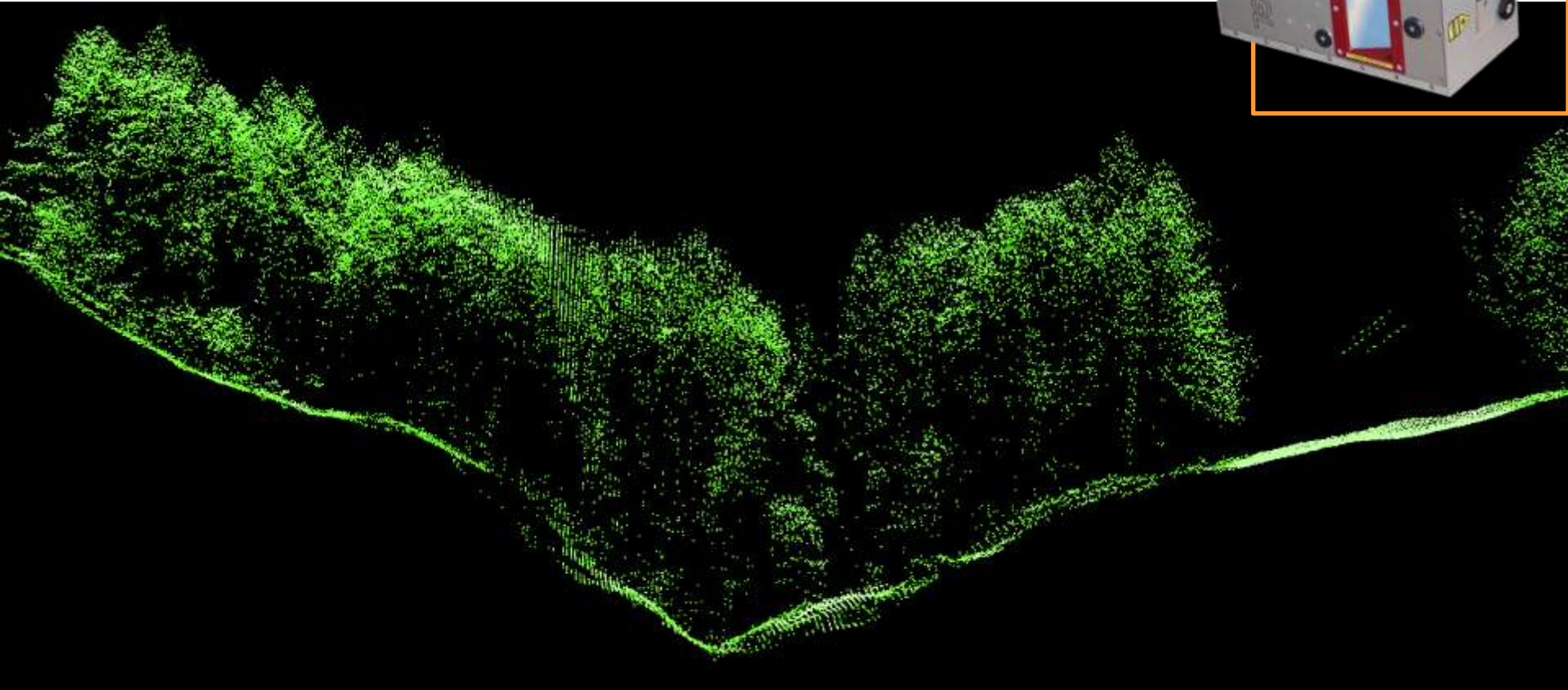
# Application: vegetation monitoring and inspection



# Sample data: VUX1 and LMS-Q780



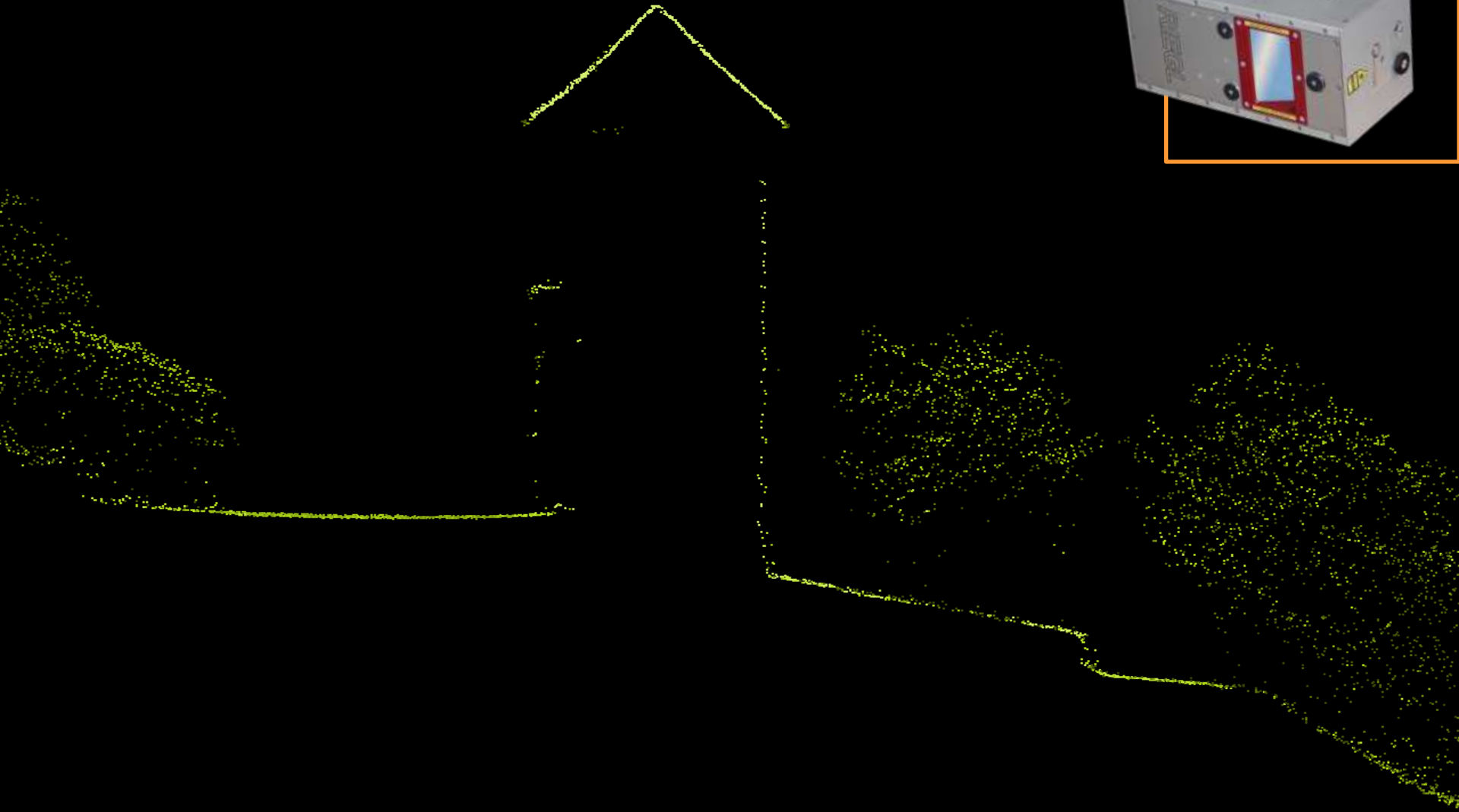
LMS-Q780, approx. 10 pts/m<sup>2</sup>



VUX-1, >> 100 pts/m<sup>2</sup>

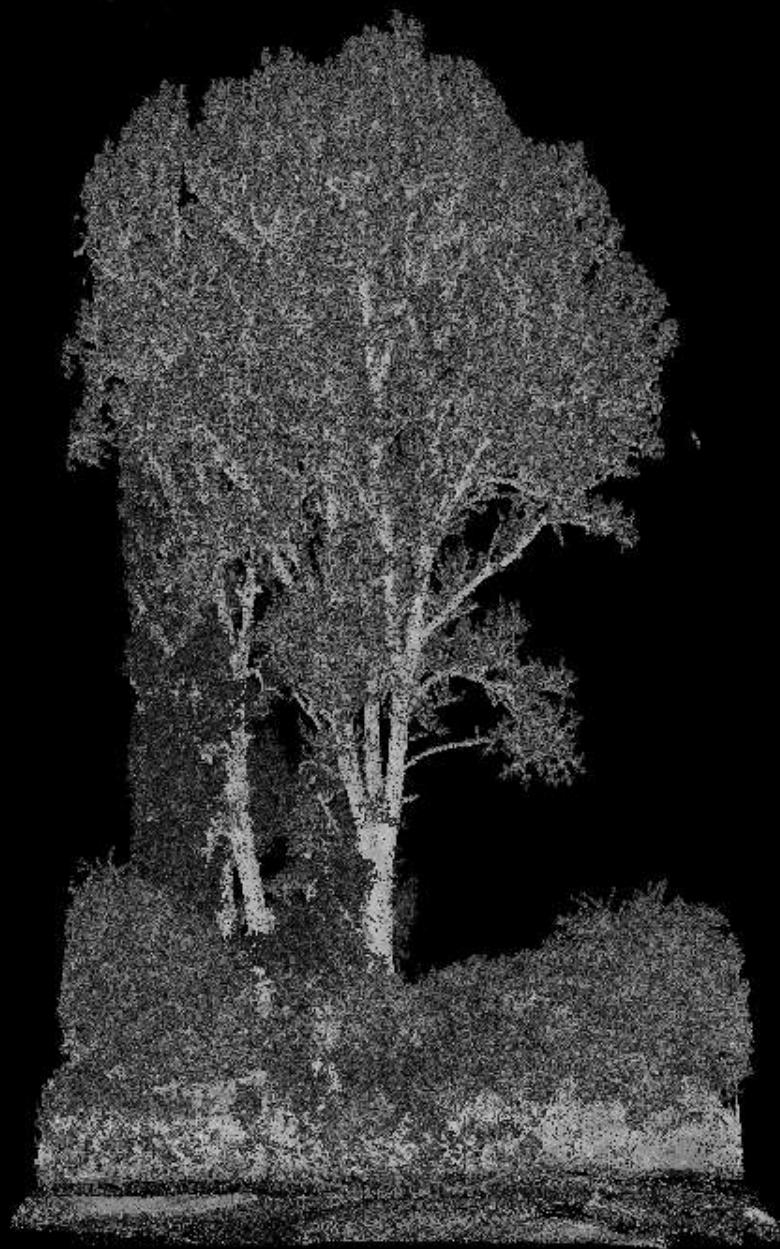


LMS-Q780, approx. 10 pts/m<sup>2</sup>



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Thank you



Innovation in 3D