Mobile laser scanning for forestry

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Motive

- Up to date information over the full cycle
- Precise 3D Mapping from the air and ground
- Optimization of harvester operations
- Machine quidance for better yield and cost savings

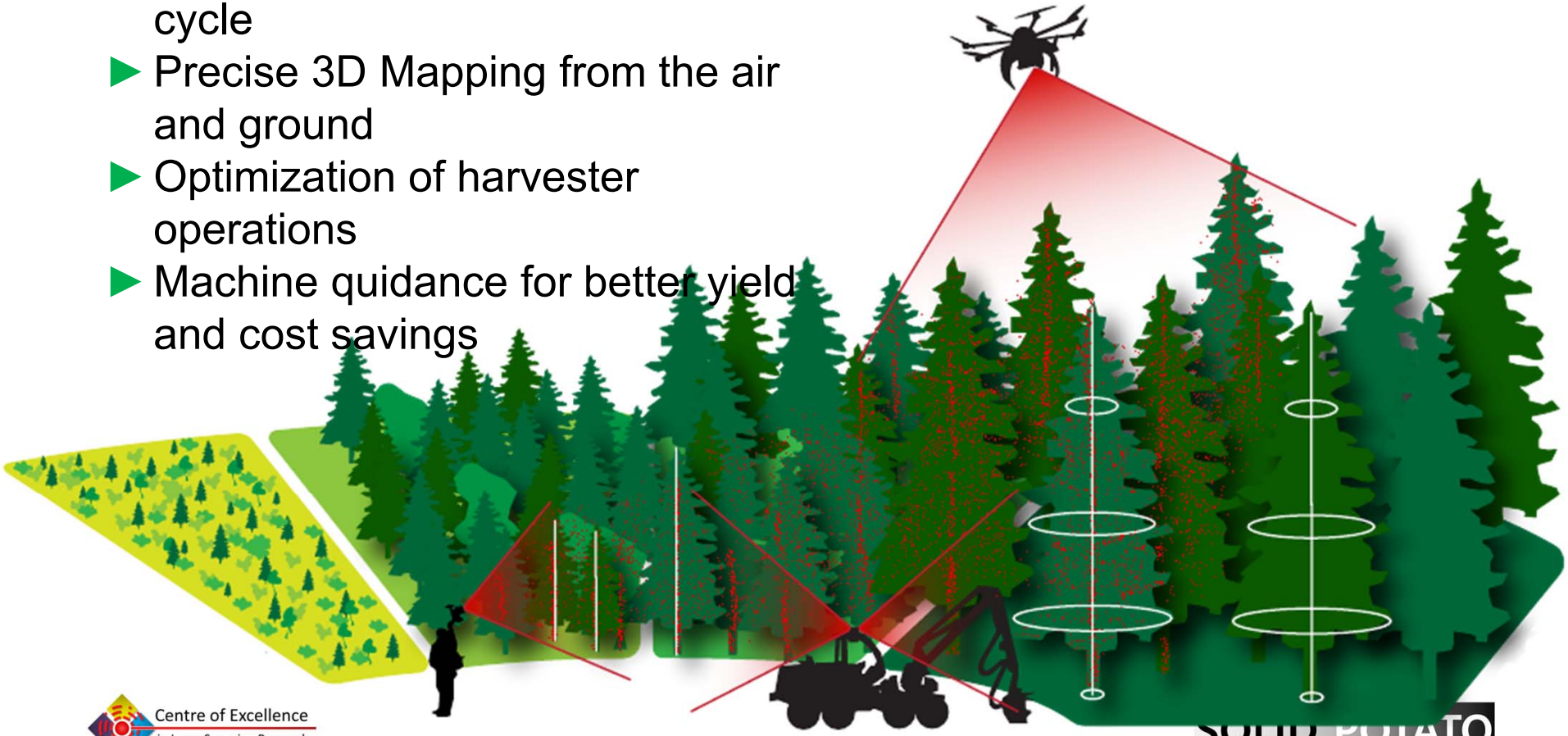

Image by: JP Virtanen 2017

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Technology

To replace traditional field methods

Improve data quality and temporality

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Mobile laser scanning - How it works?

- Mobile laser scanning is a technique to measure objects in 3D as point clouds from a kinematic platform

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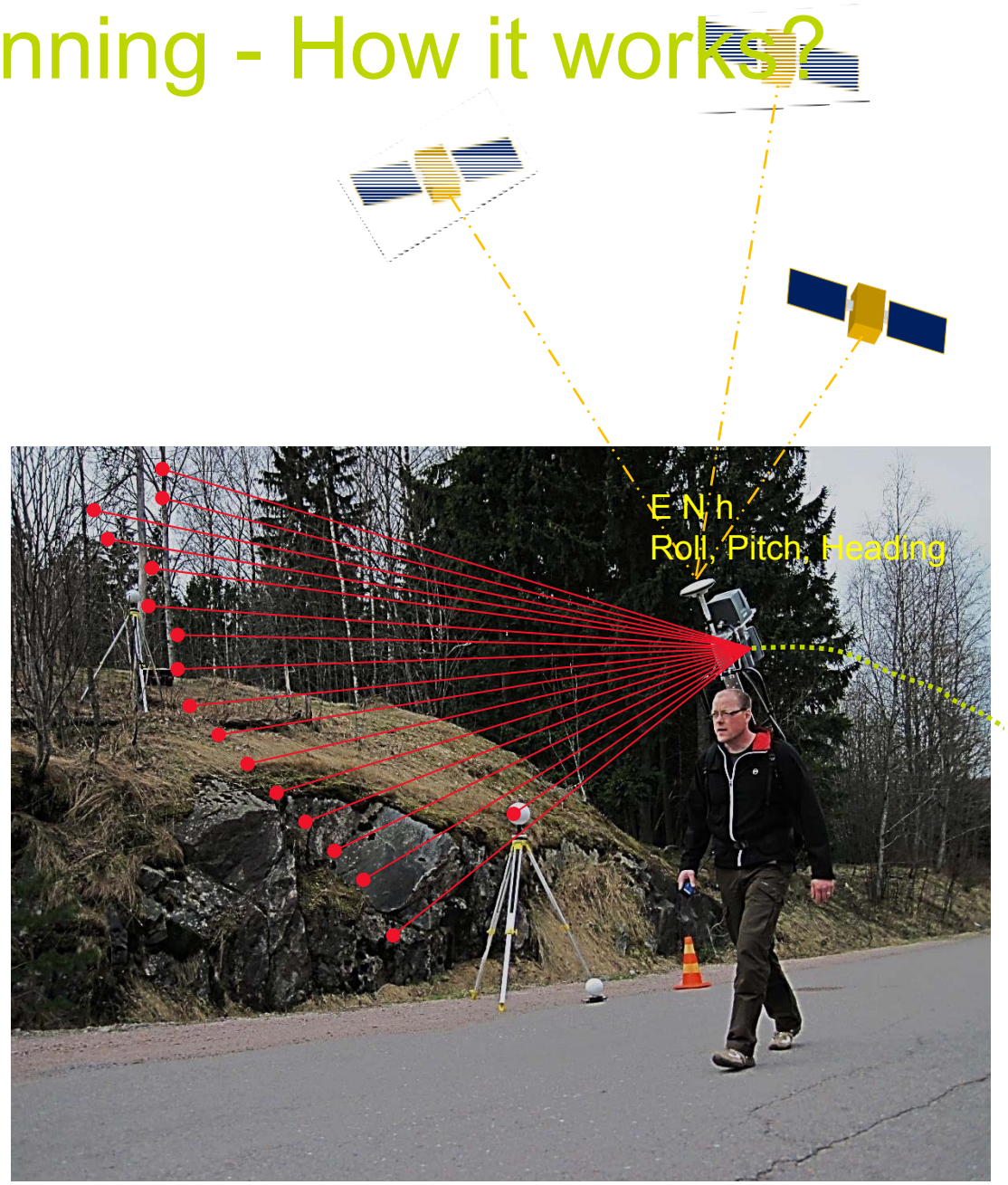
Mobile laser scanning - How it works?

- The location of each new LiDAR range observation is being measured continuously and accurately using an integrated suite of positioning devices – comprising GNSS receiver and IMU



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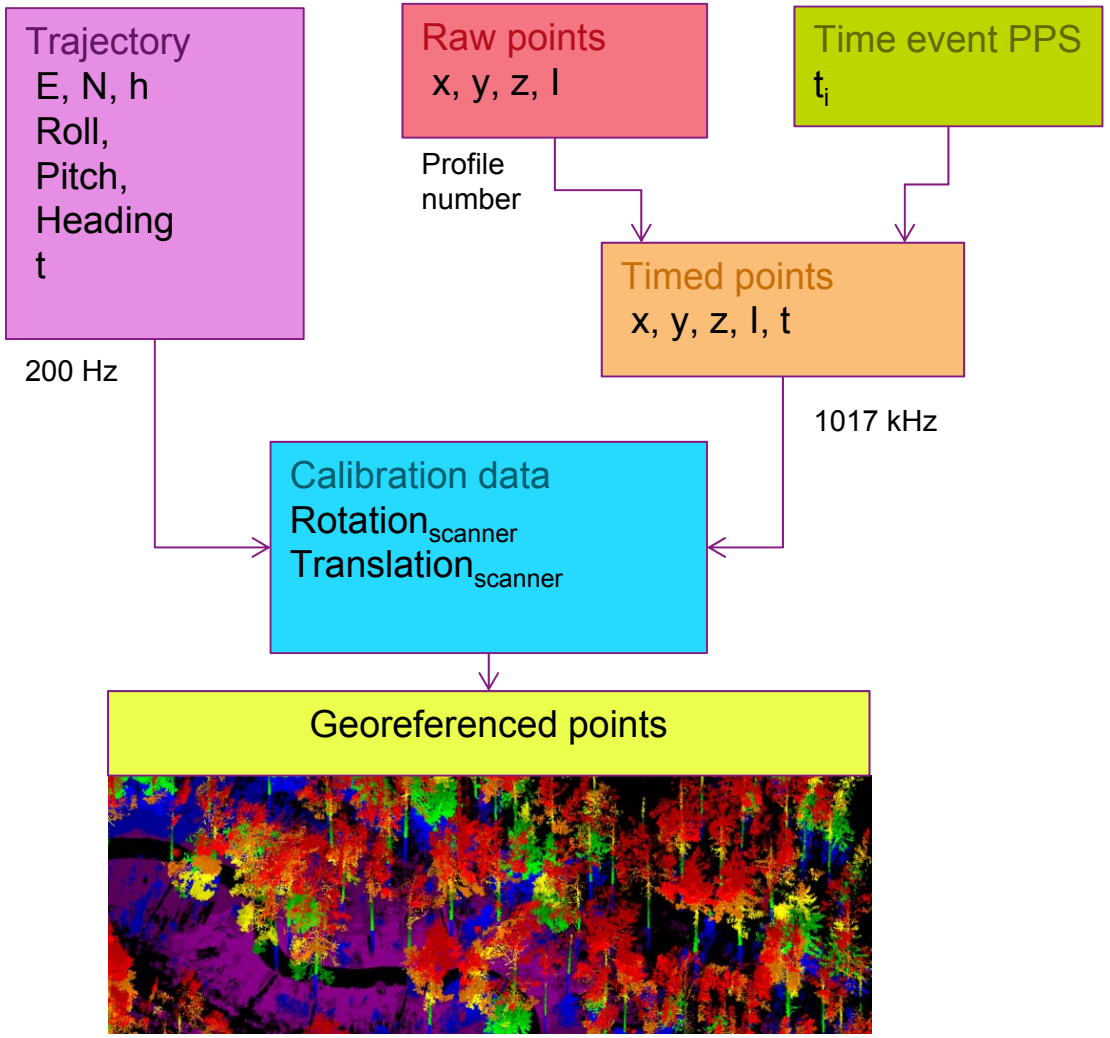
Georeferencing



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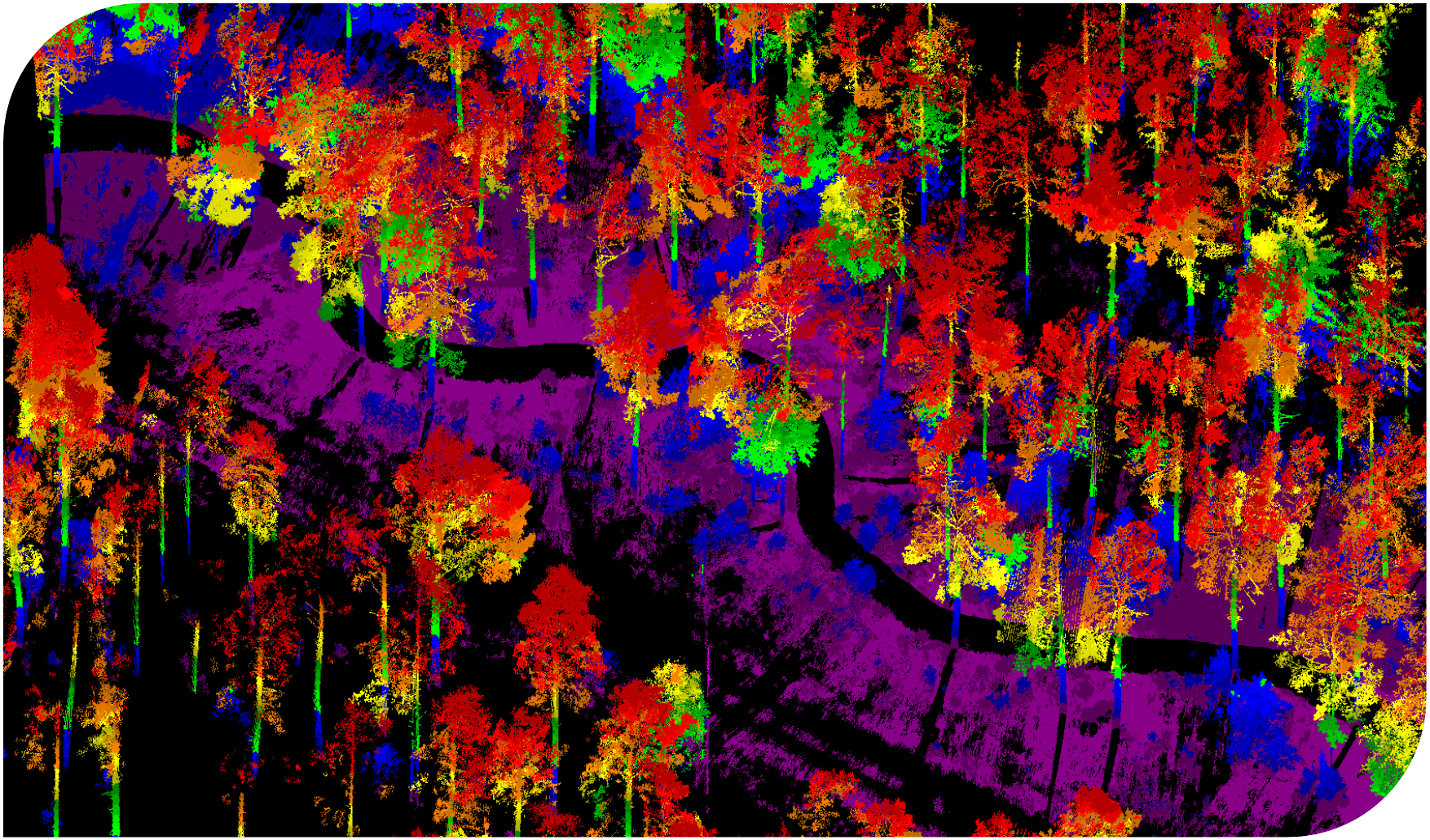
Pointcloud



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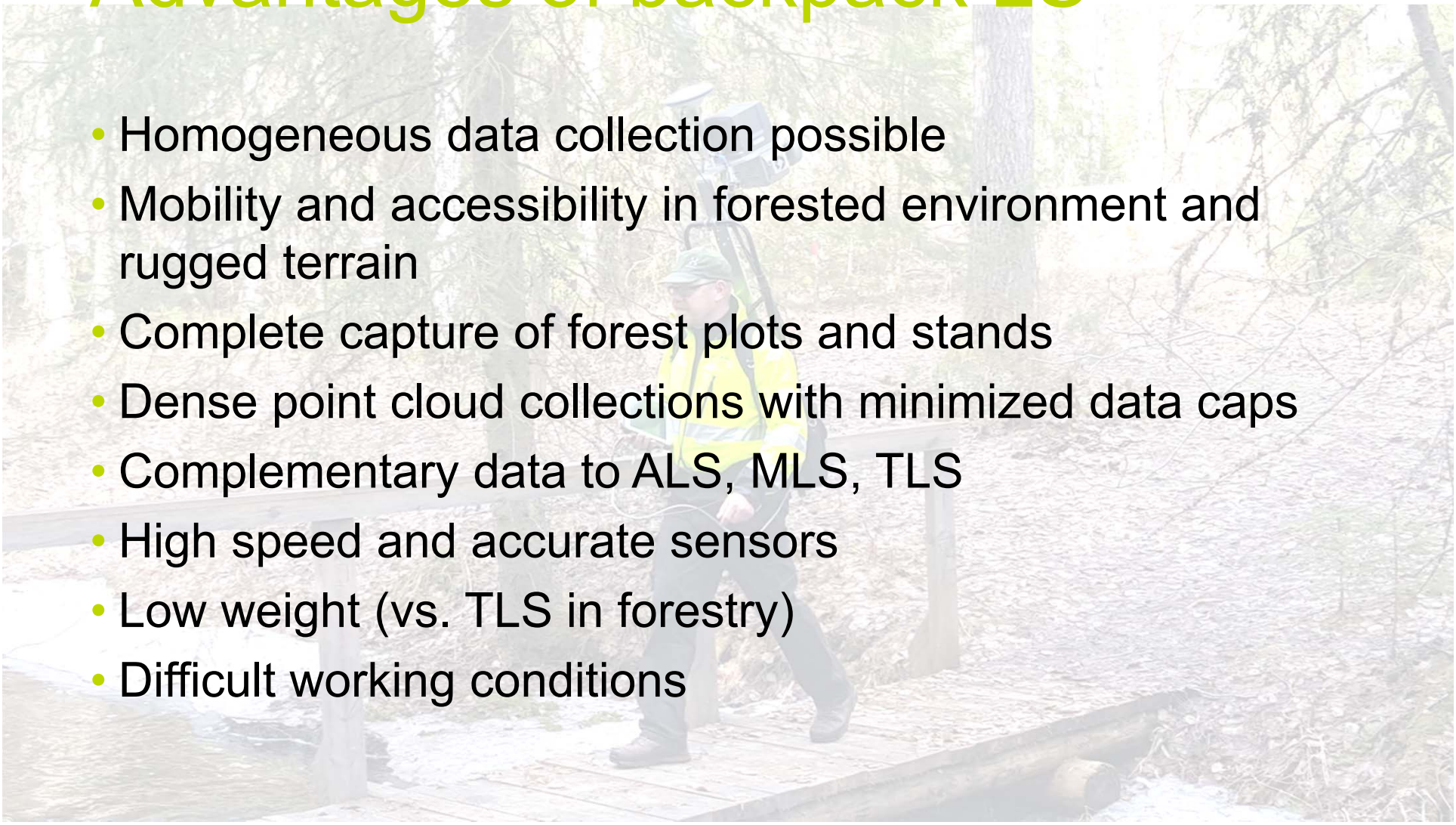
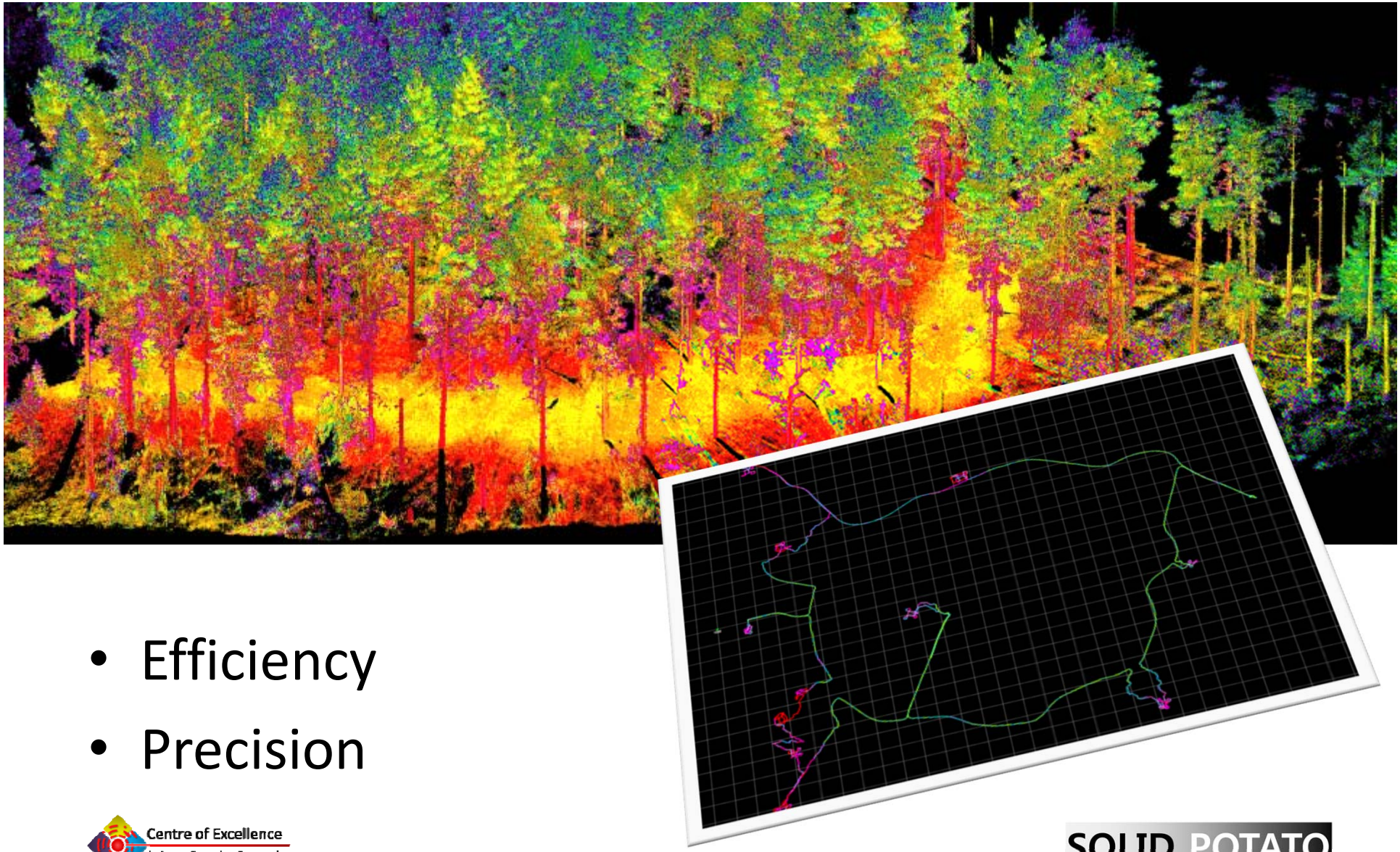
Advantages of backpack LS



- Homogeneous data collection possible
- Mobility and accessibility in forested environment and rugged terrain
- Complete capture of forest plots and stands
- Dense point cloud collections with minimized data caps
- Complementary data to ALS, MLS, TLS
- High speed and accurate sensors
- Low weight (vs. TLS in forestry)
- Difficult working conditions

PLS provides



- Efficiency
- Precision

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AkhkaR4

- **Riegl VUX-1HA**
  - SF 250 Hz
  - PRF upto 1Mio
  - Range 600m*, typical 125 m
  - Precision 2-3 mm
  - ToF, multiple echo detection, up to 7 echoes
- **NovAtel ISA-100C**
  - 200 Hz pos+att.
  - Trajectory post-processing with base station

R. Kaijaluoto 2017

*MTA processing, Multiple Times Around

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AkhkaR4Lite and Sensei

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Riegl MiniVUX
•SF 100Hz
•PRF 100 kHz

NovAtel IMU-μIMU-IC
•200 Hz pos+att.
•Trajectory post-processing with base station

Velodyne VLP-16LITE
•SF 20Hz x 16
•PRF 300 kHz

NovAtel IGM-S1
•125 Hz pos+att

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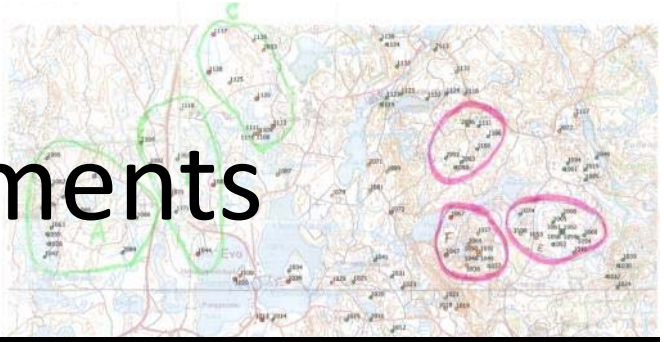
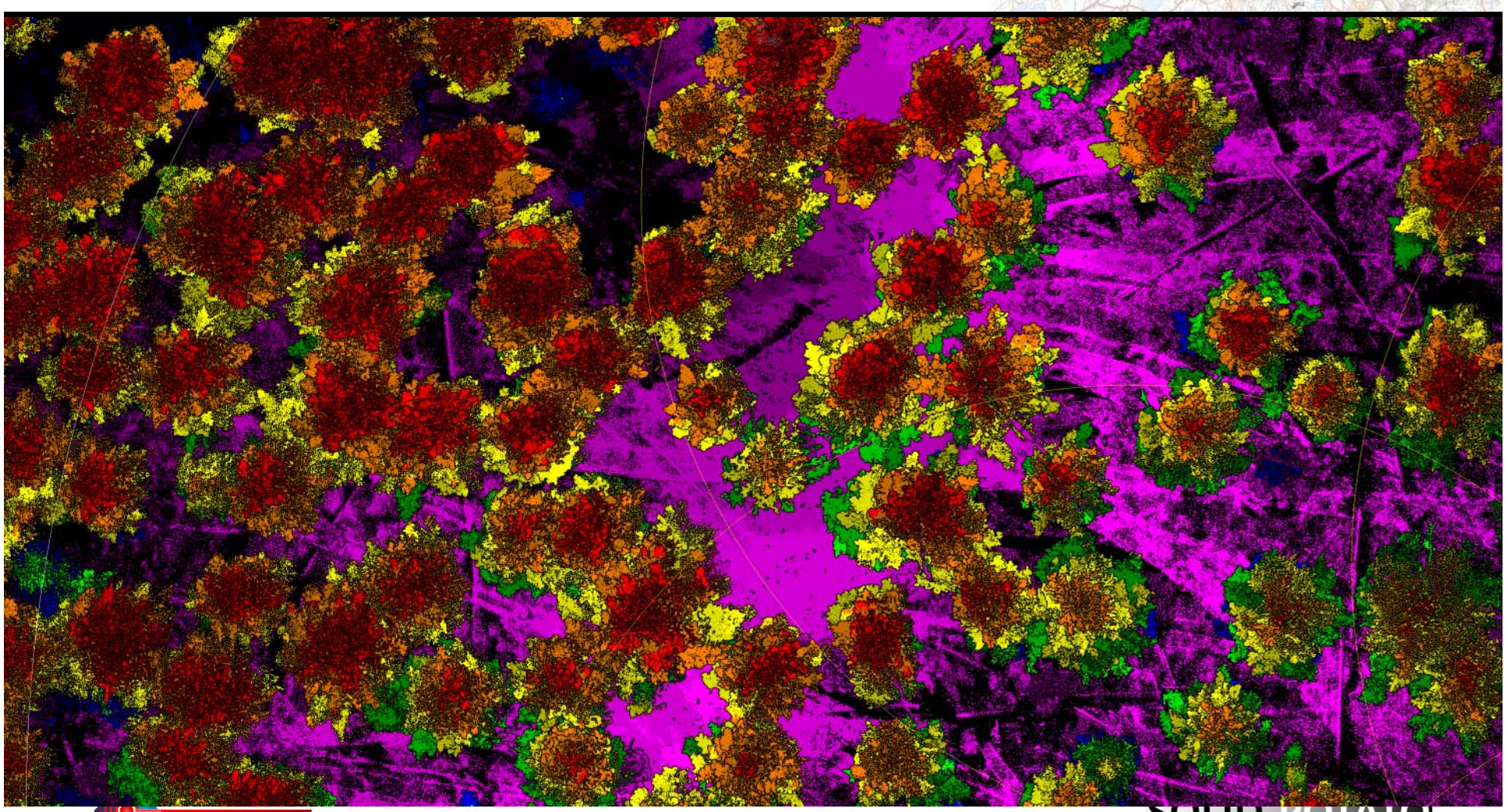
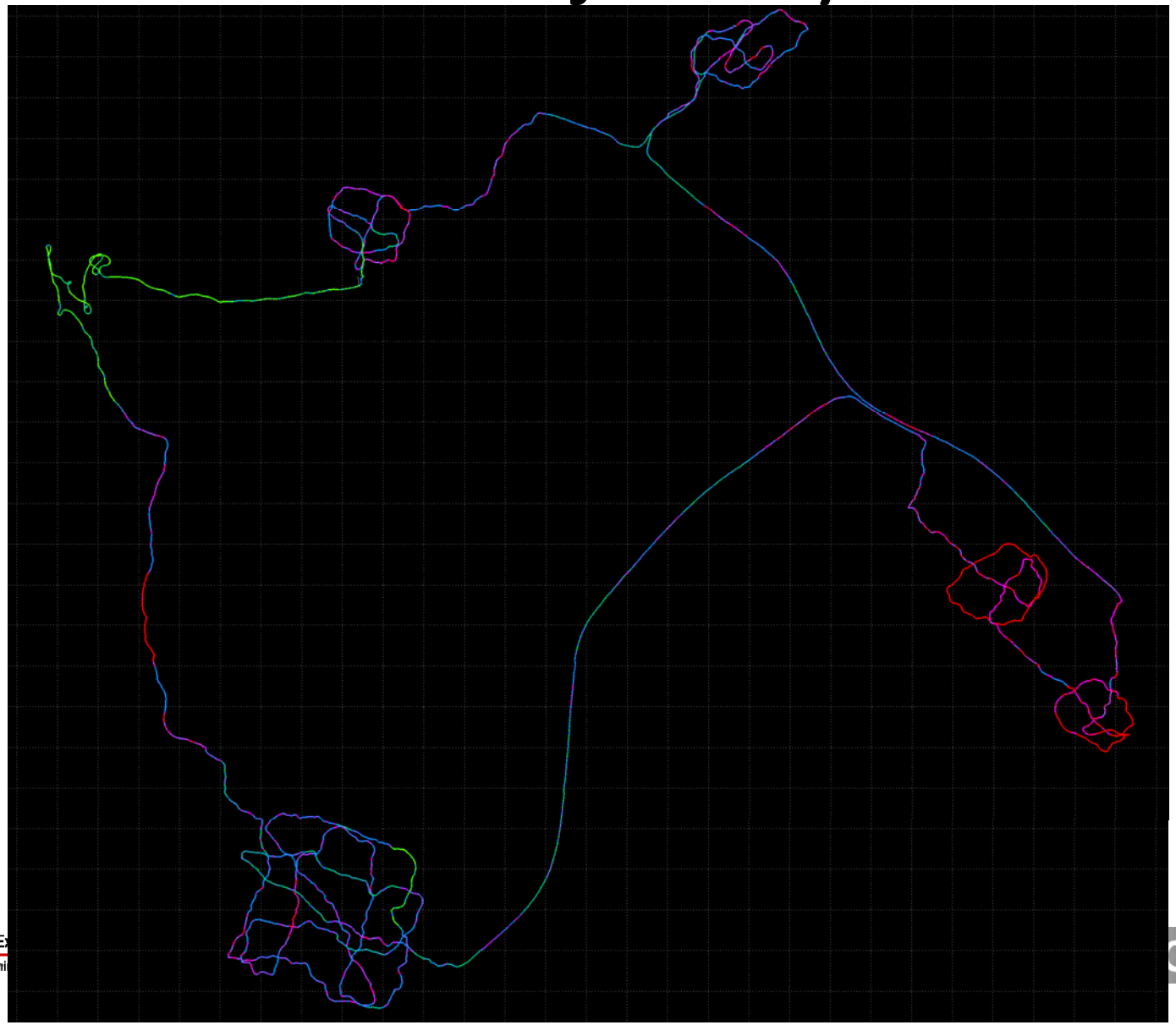
Forestry measurements

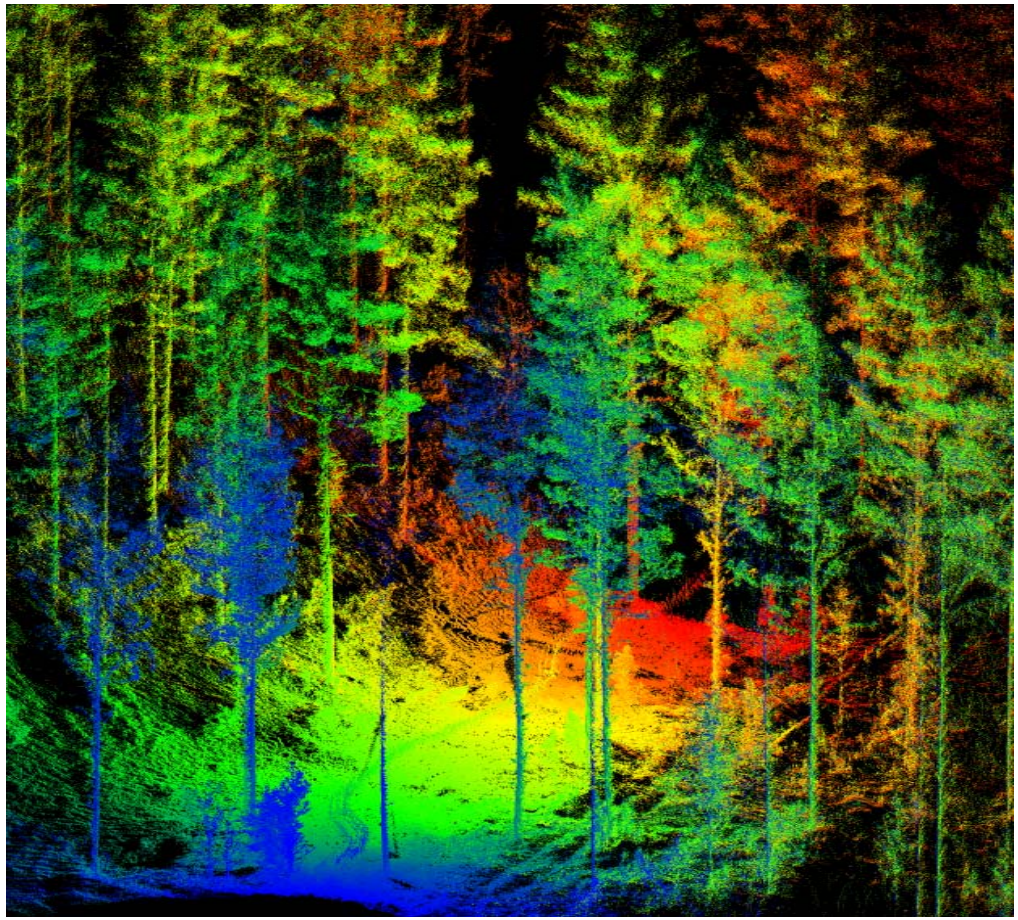


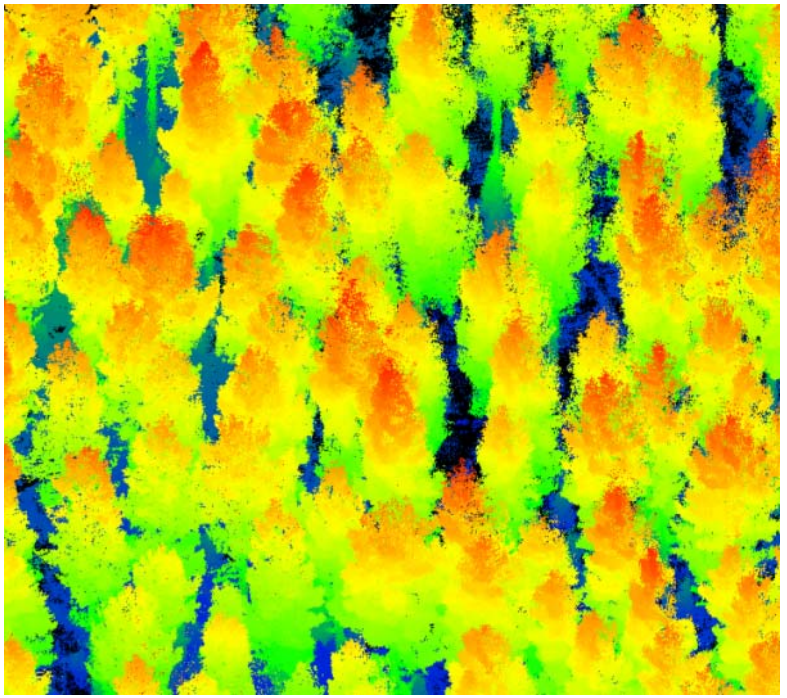


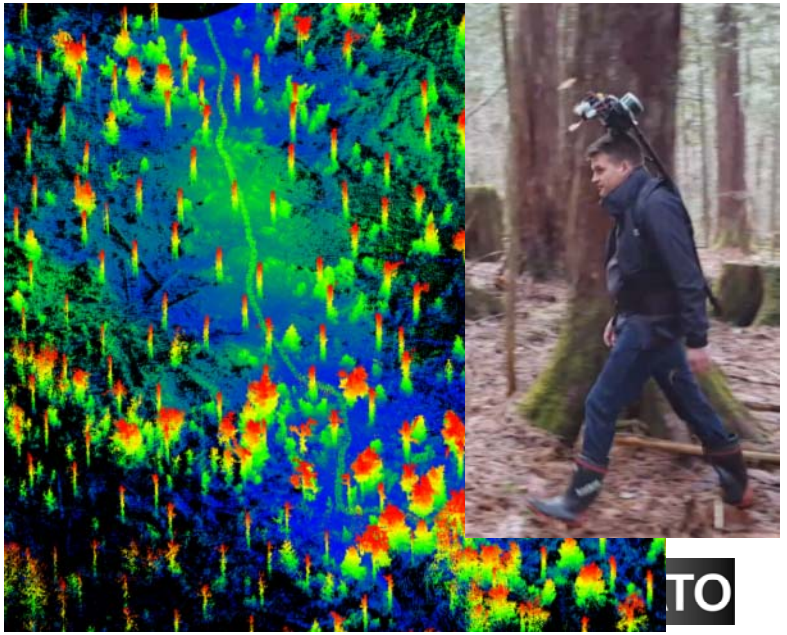
Plot trajectory



Low-cost Backpack







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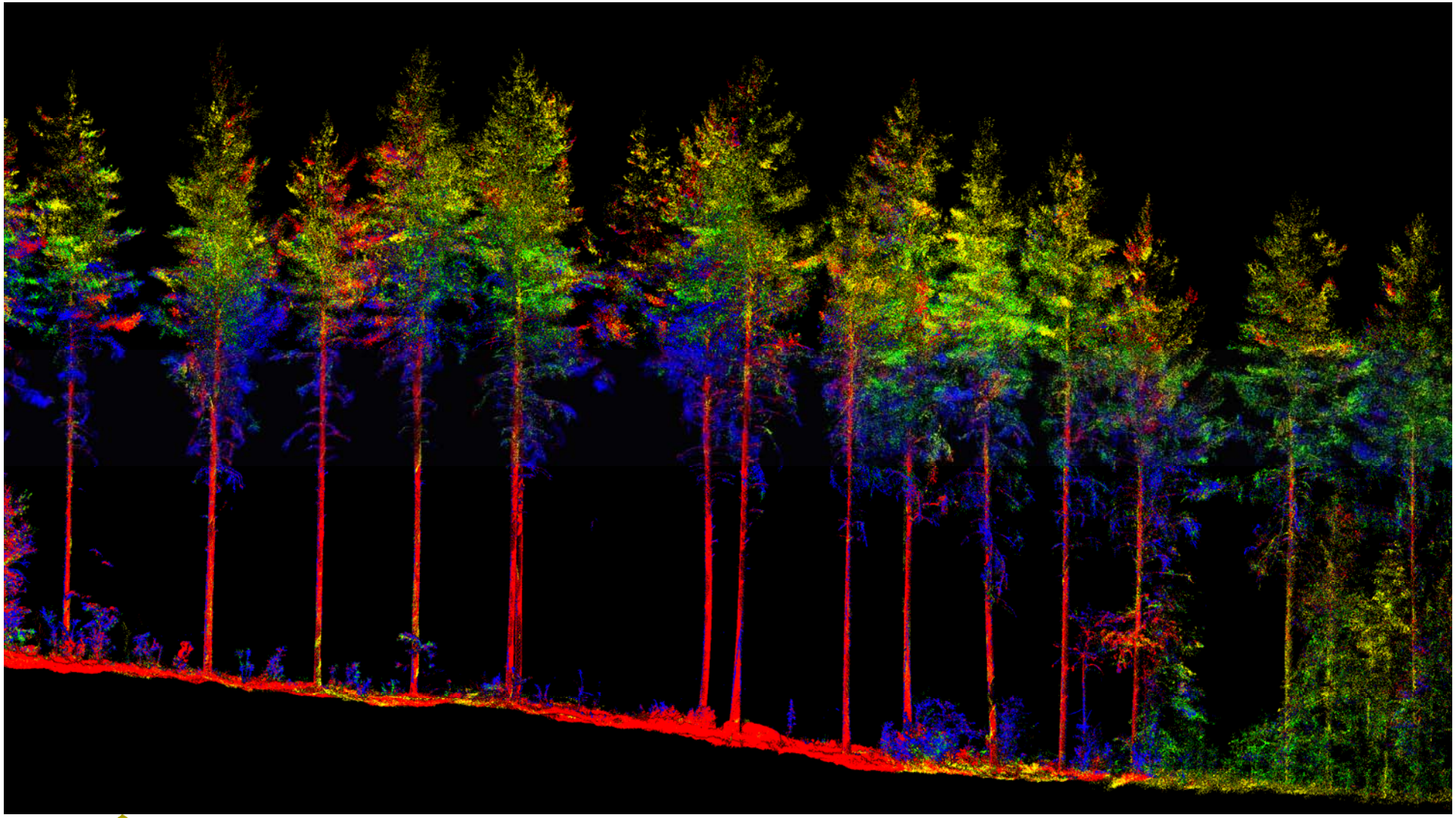
Pointcloud data



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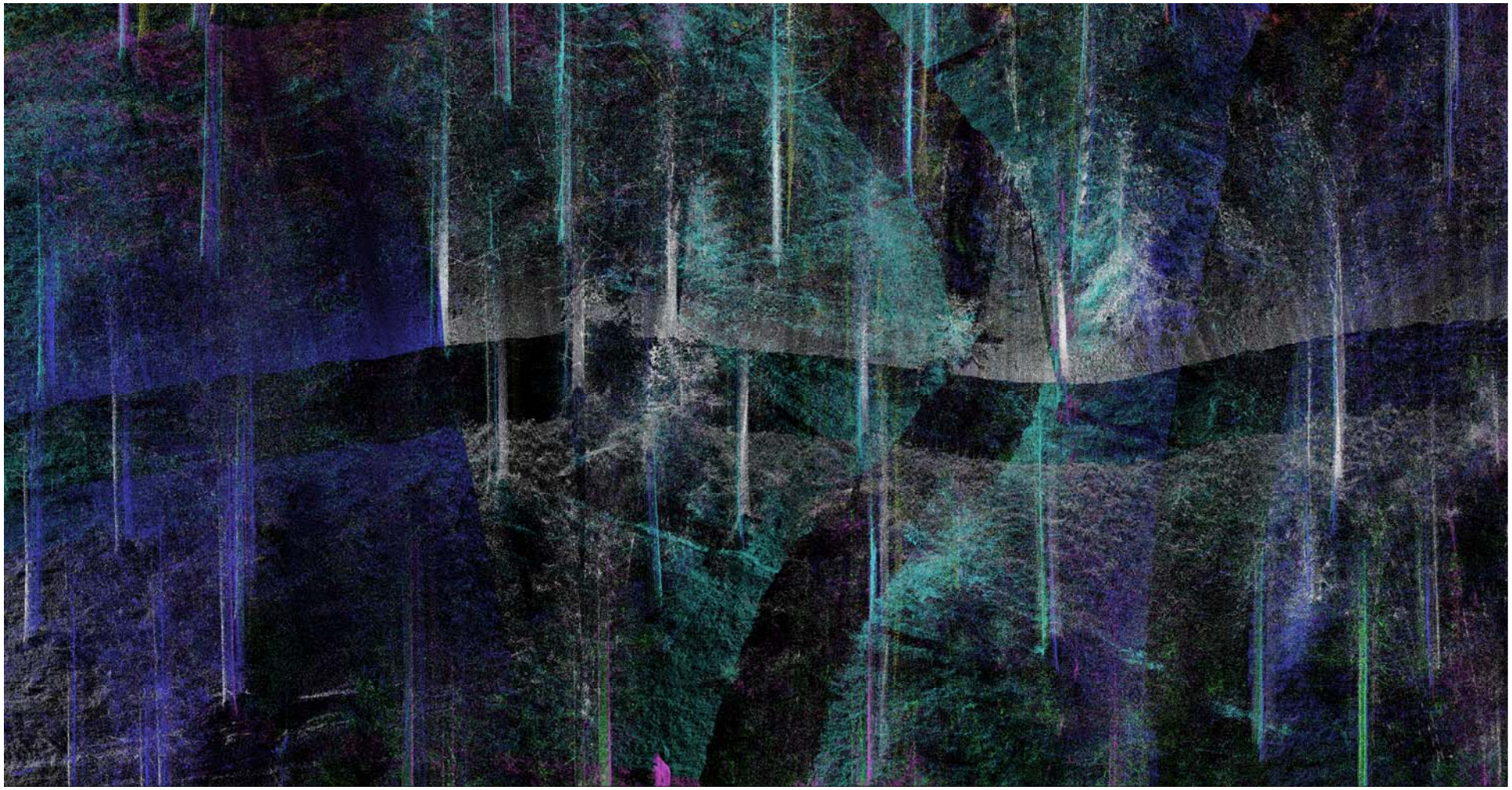
Trajectory optimization

Trajectory deteriorates due to GNSS obstacles in forest
Process to correct for positional drift using the LiDAR data



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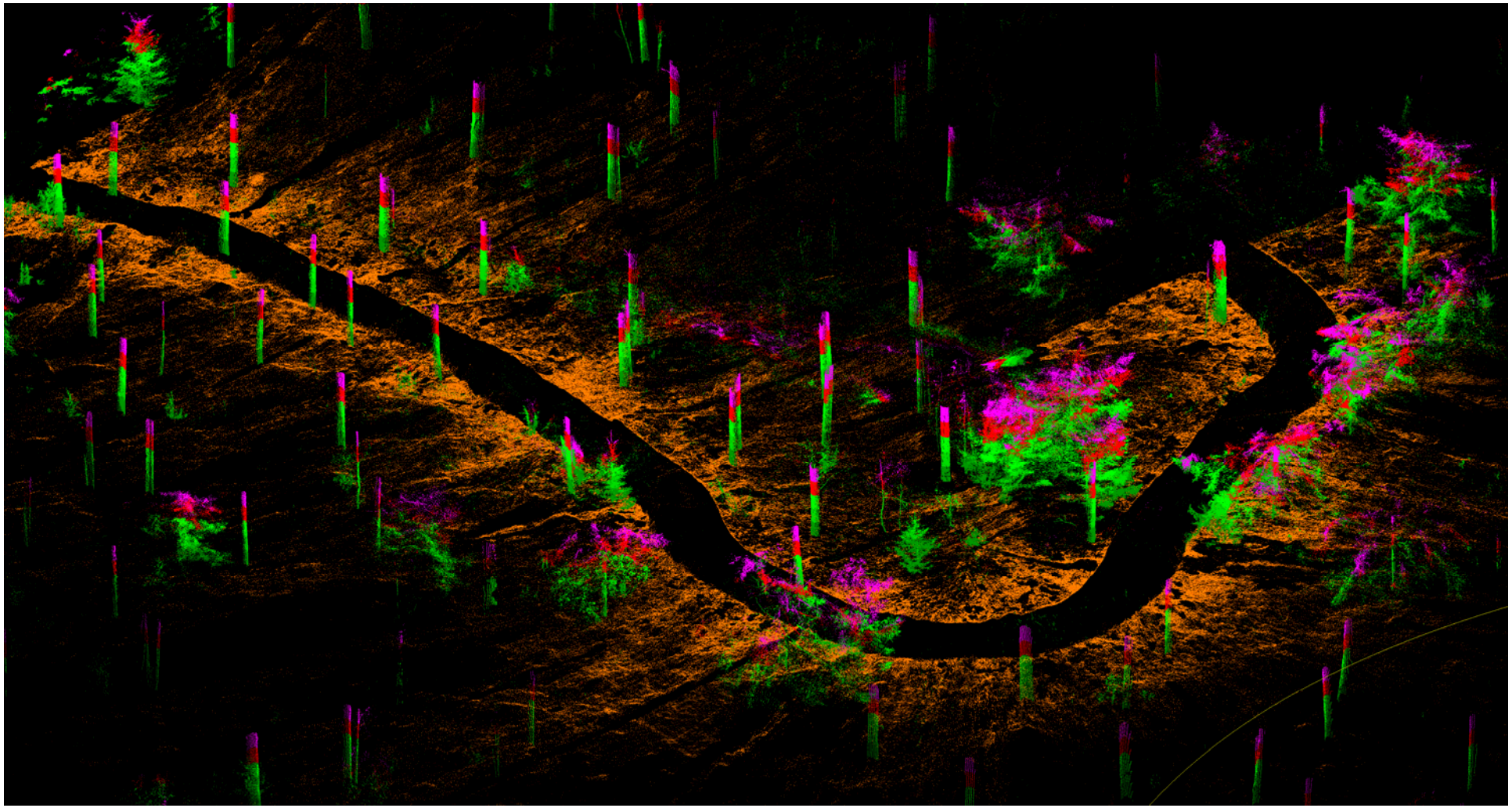

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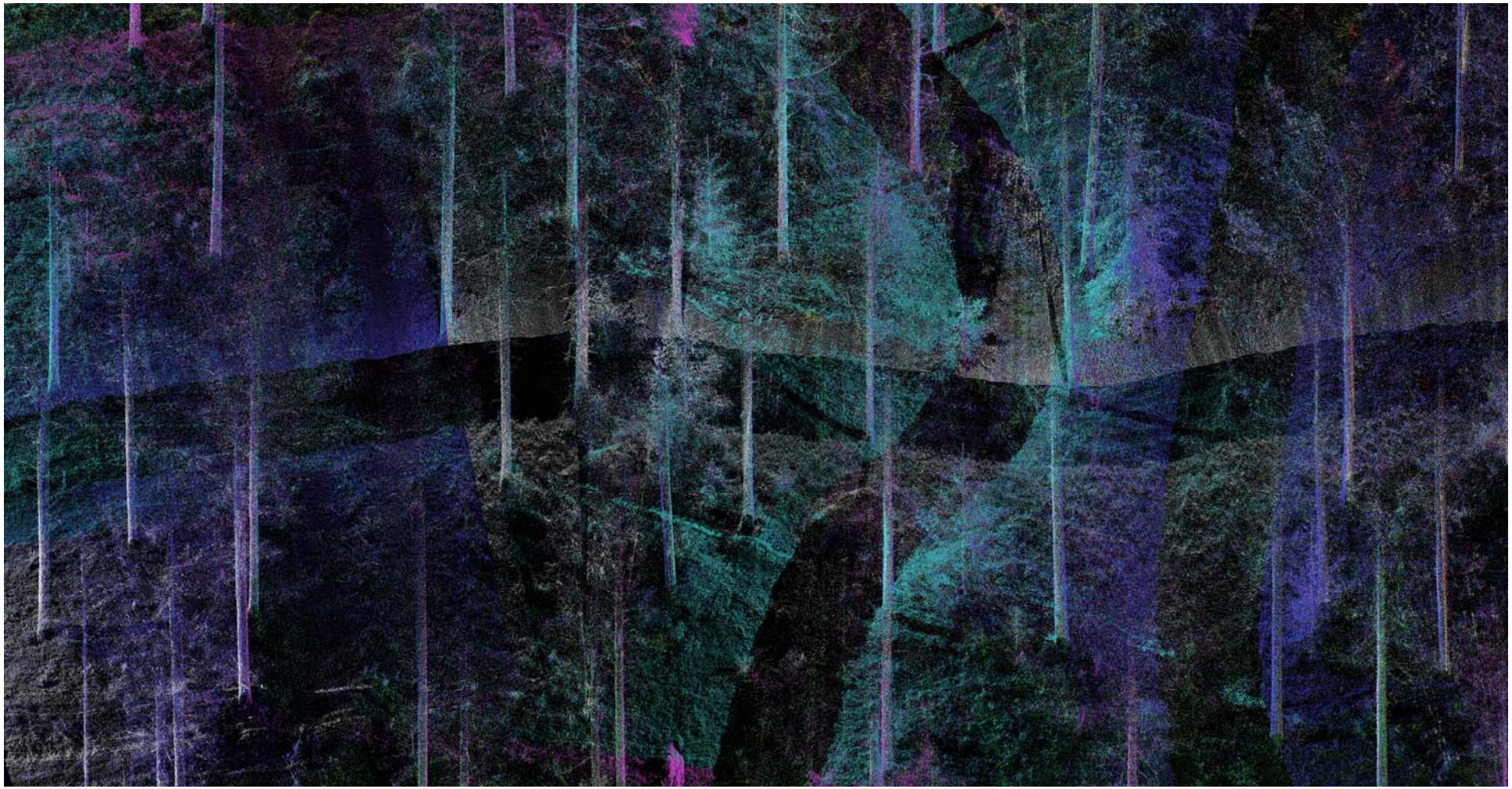

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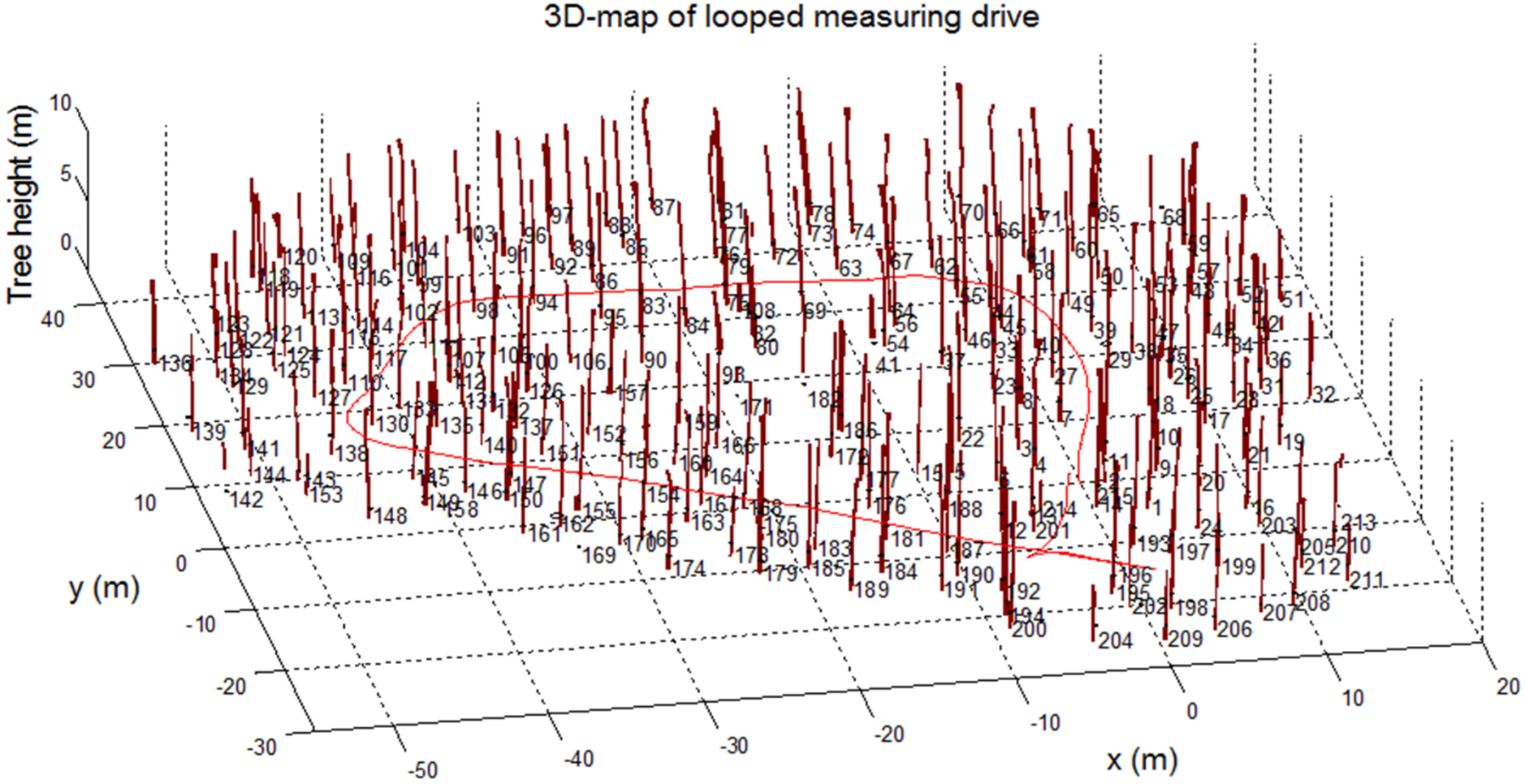

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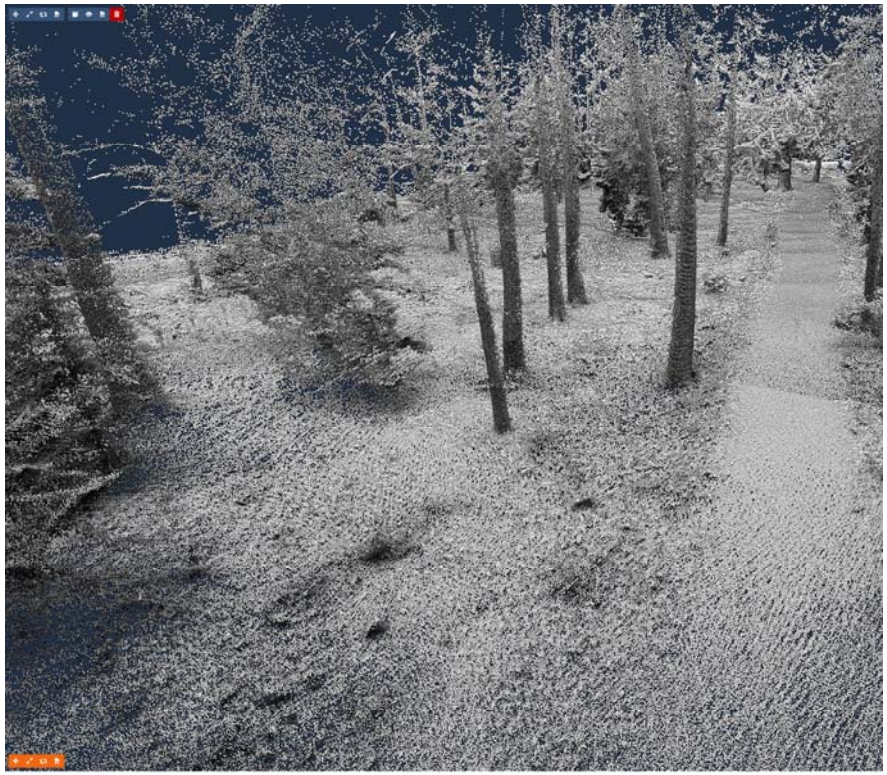
Alternatives

Simultaneous Localization And Mapping



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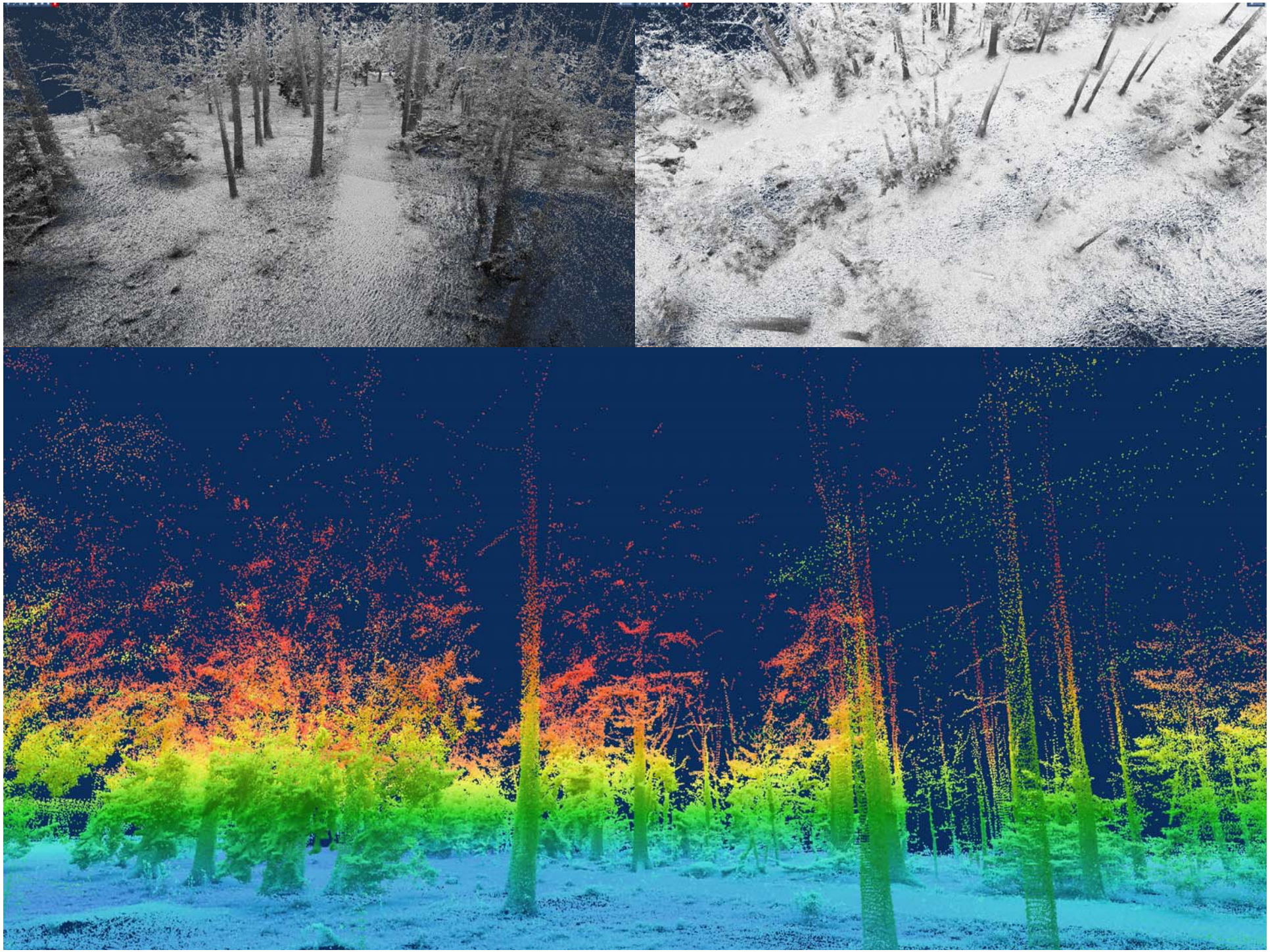
+ Advantages

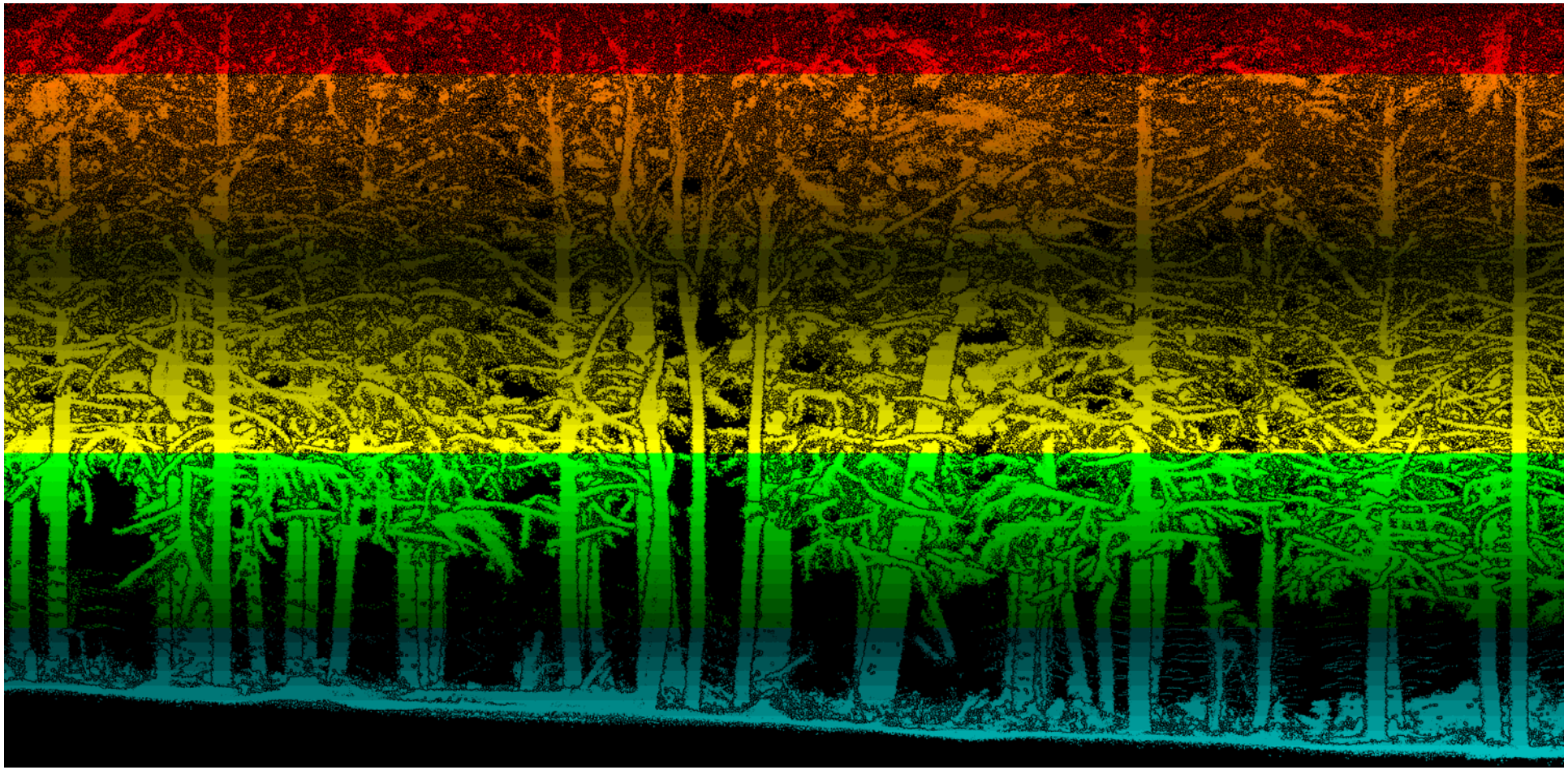
Usually real-time data processing
No need for additional sensors and data
Good visibility at the site
Low-cost solution
Ubiquitous availability

- Disadvantages

No global coordinates and orientation
Comparison with multitemporal data takes effort
Use with geospatial data needs registration
Low-cost sensors limit performance

- Low precision
- Short range





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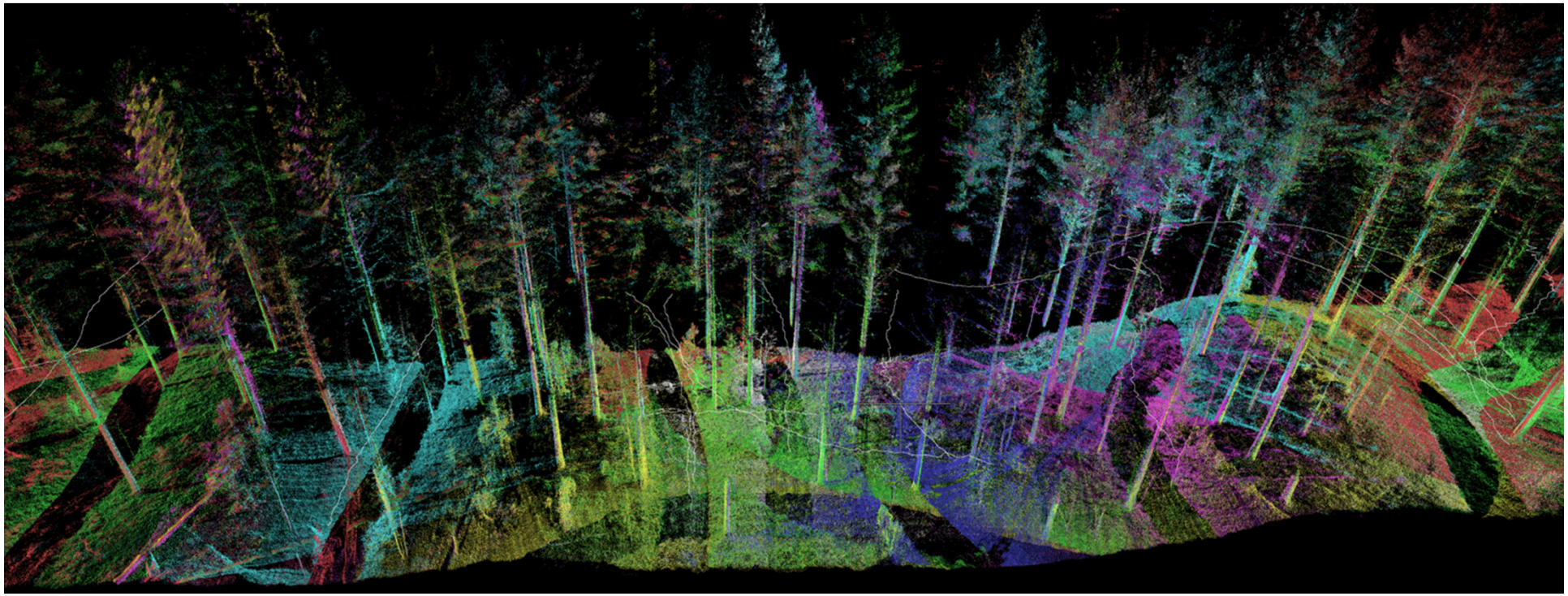

Thank you!
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