



Luzern, Switzerland, acquired with GSD=5 cm, 2008.

Leica - 3rd Generation Airborne Digital Sensors

Features / Benefits for Remote Sensing & Environmental Applications

Europe, Middle-East and Africa (EMEA)

- when it has to be **right**

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Leica <> Airborne Digital Sensors – 3rd Generation

Overview

ADS80 - Airborne Digital Sensor

incl. PAV80 - New gyro-stabilized suspension mount

ALS60 - Airborne LIDAR Scanner

incl. RCD105 – Mid Format Digital Frame Camera (for ALS60-CM)

Examples of Applications (Forestry, Agriculture)

Outlook

- when it has to be **right**



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ADS40 – 1st Generation, Cessna Caravan , in 2001 (PASCO, Japan)



- when it has to be **right**

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ADS40 - 2nd Generation in Beech 2006 (*APEI, France*)



- when it has to be **right**

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ADS40 2nd Generation in Learjet 25C *(BLOM - CGR, Italy)*



- when it has to be **right**

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Leica ADS – Airborne Digital Sensor <> History

2001



ADS40

2006



**ADS40
SH51 & SH52**

- when it has to be **right**

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Key factors in Airborne Digital Mapping and Remote Sensing?

Data Acquisition Efficiency?

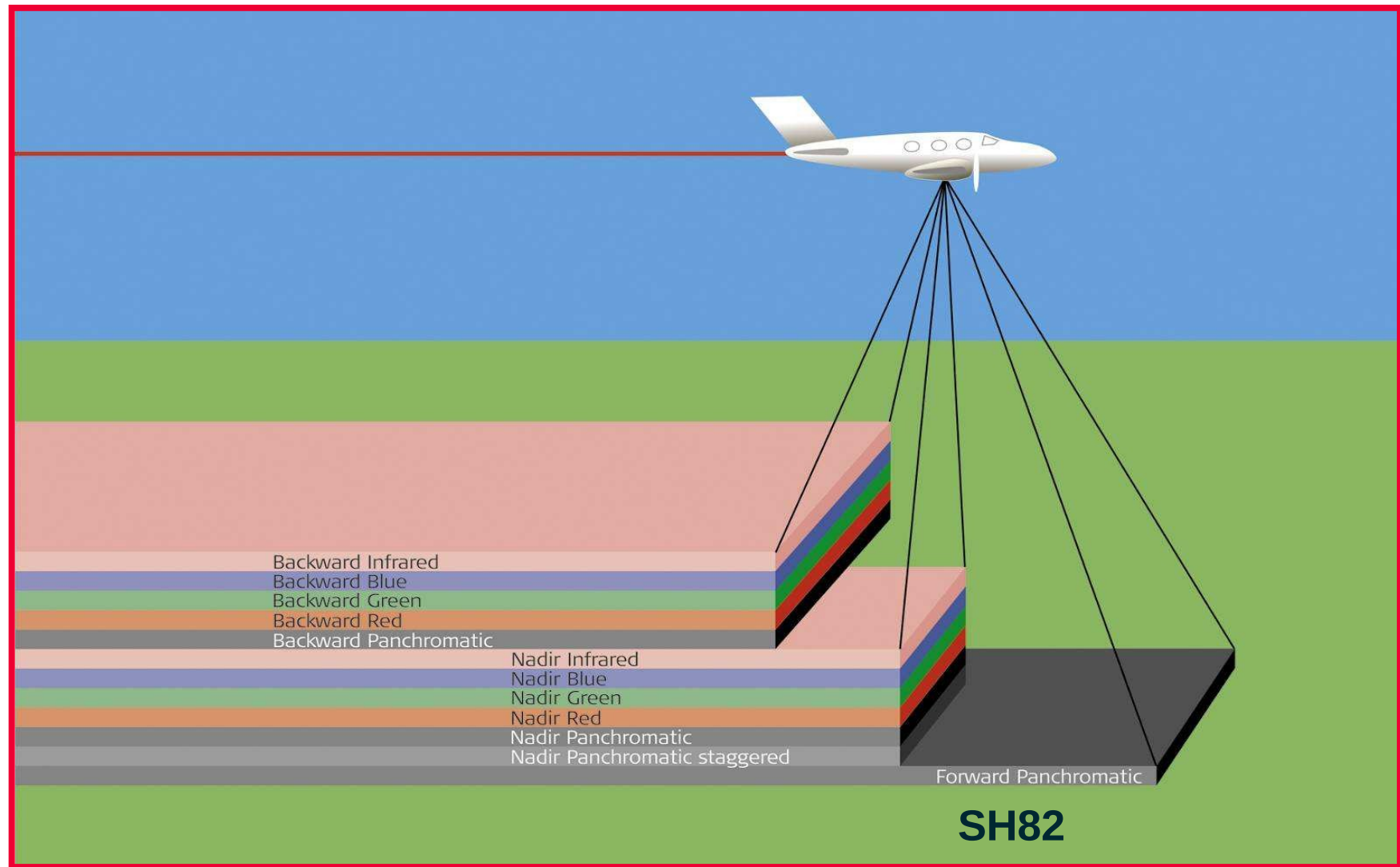
Data Processing Efficiency?

Consistent Technical Performance?

- when it has to be **right**

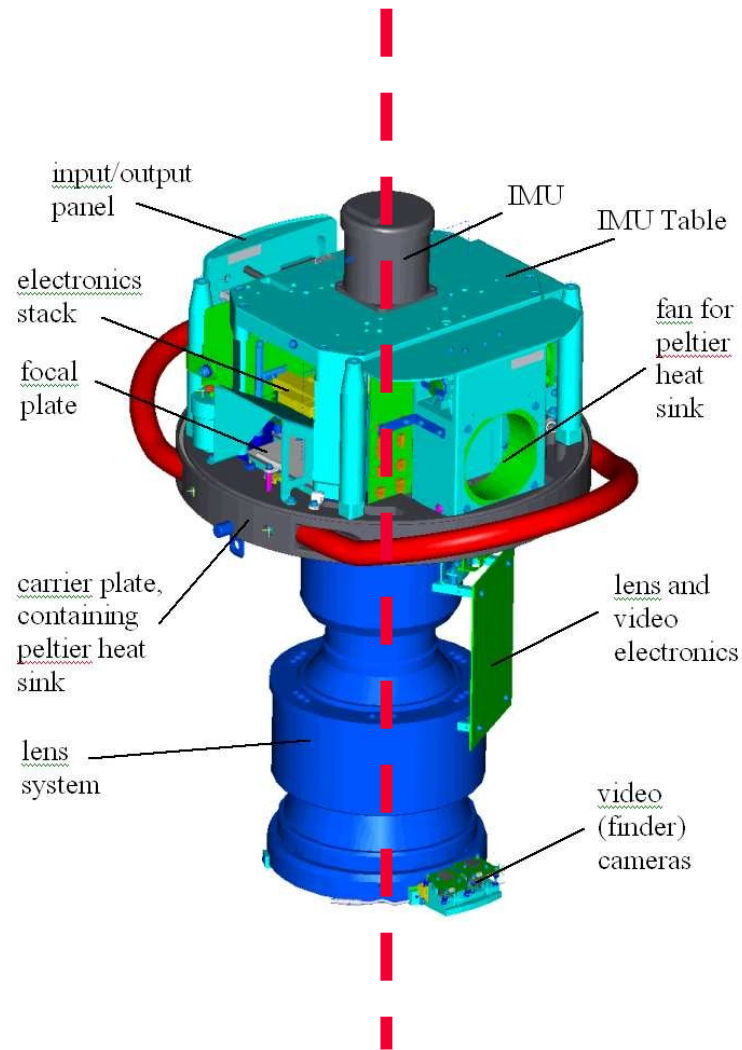
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Leica ADS80 - Pushbroom / CCD layout in focal plane



- when it has to be **right**

Leica ADS80 - System Design / Concept



One optical path

Tight integration

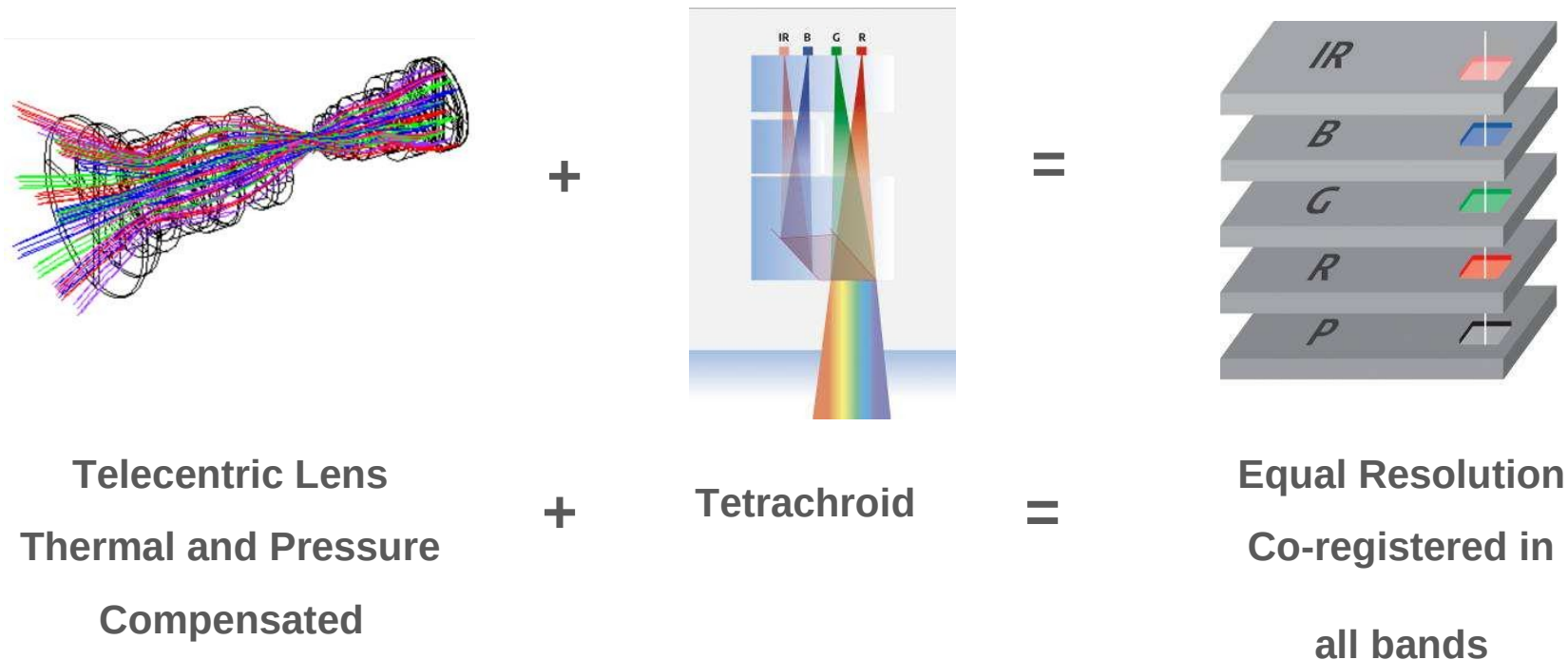
Very few components

=> Highest Stability

- when it has to be **right**

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Leica ADS80 - Optical Design / Performance

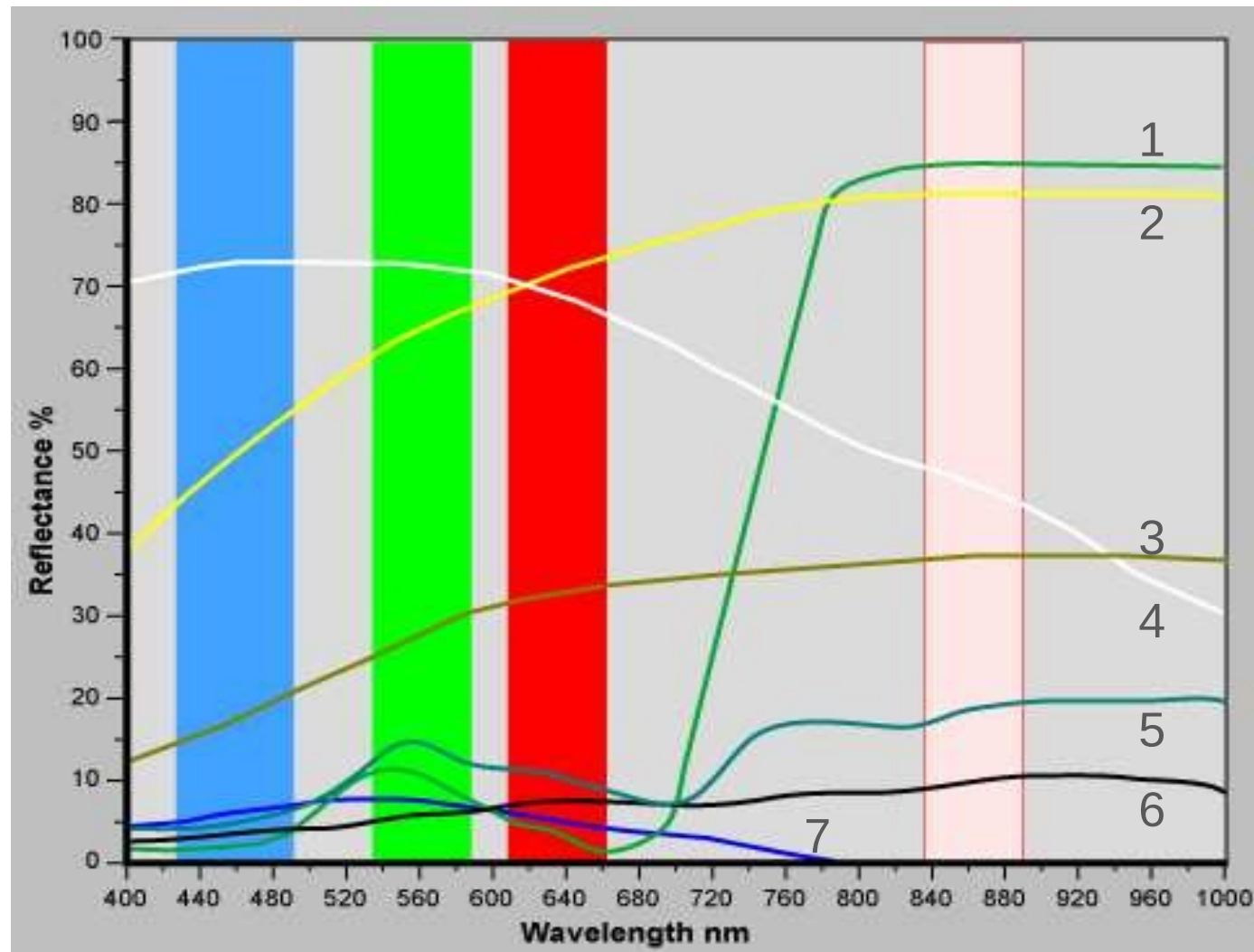


NO PAN-SHARPENING

- when it has to be **right**

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Narrow Spectral band for Remote Sensing



Legend

1 Grass

2 Lime Stone

3 Sand, dry

4 Snow, old

5 Fir tree

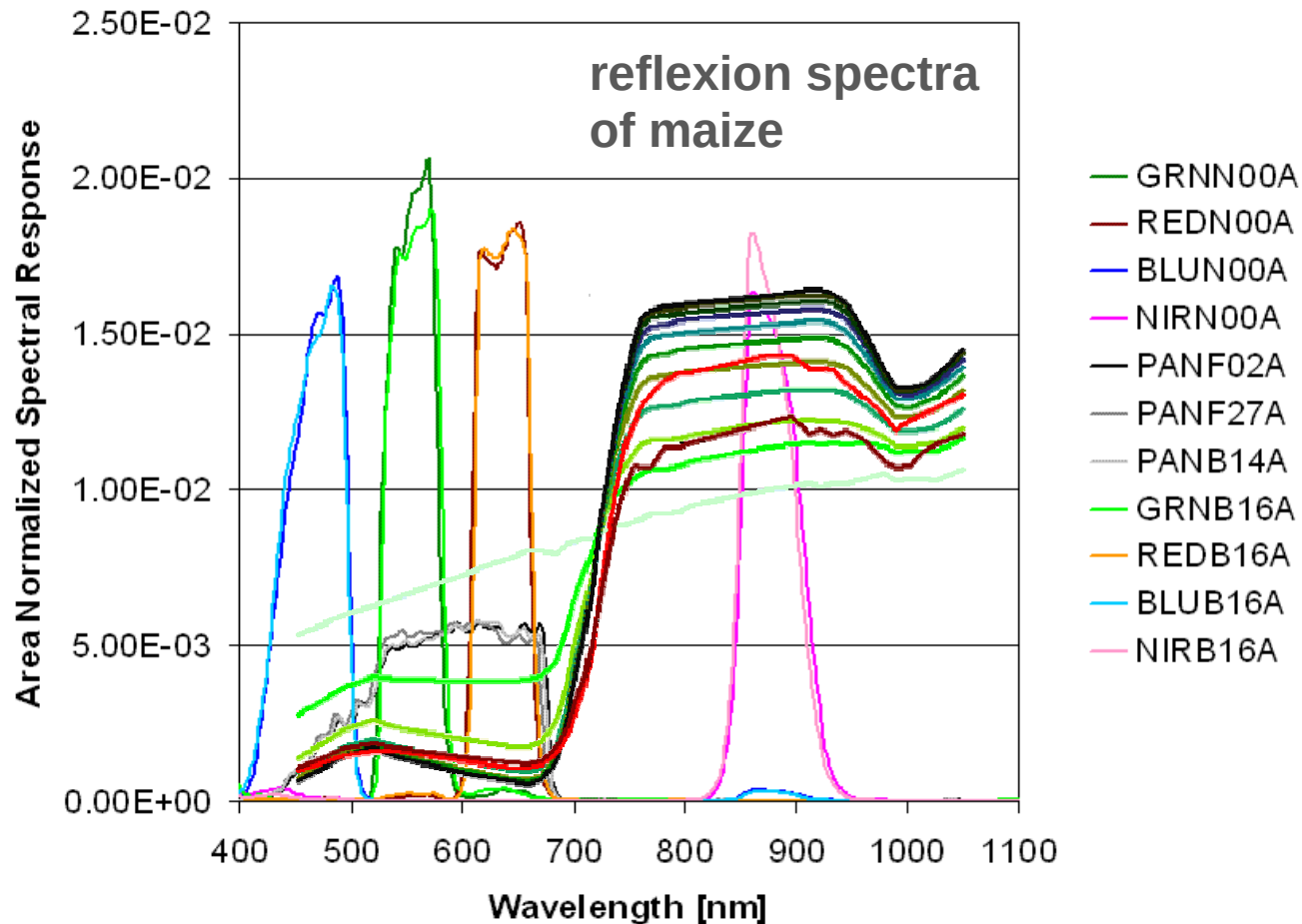
6 Asphalt, wet

7 Water

- when it has to be right

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Co-registered RGB and NIR for Remote Sensing, optimized for vegetation analysis / classification



- when it has to be **right**

Leica ADS80 – Consistent Technical Performance

Control Unit CU80 and MM80



Embedded IPAS20 with GNSS
High data throughput of 130 MB/sec
Radiometric resolution of
compressed data 10-bit and 12-bit
Recording interval ≥ 1 ms
Data modes: ADS80 data format,
raw data, compressed



Highly reliable flash disk technology
364 GB / 768 GB capacity per MM80 /
per pair
Weight 2.5 kg

- when it has to be **right**

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Leica ADS80 - Operational Specs / Performance



GSD 1.2" / 3 cm => 90 kts
384 GB for up to ~5.7 h recording at 2.5 ms
GSD 2" / 5 cm => 140 kts
with 3 pan and 4 spectral bands
GSD 3" / 7.5cm => 190 kts
768 GB for up to ~11.4 h recording at 2.5 ms
GSD 4" / 10cm => 240 kts
with 3 pan and 4 spectral bands
GSD 6" / 15cm => 300 kts

- when it has to be **right**

Leica ADS80 – Consistent Technical Performance

Mapping accuracies vs GSD

		Ground Control [cm]	Check Points [cm]
GSD 5 cm	RMS-X	1.2	1.2
	RMS-Y	1.1	2.1
	RMS-Z	2.7	3.8
GSD 10 cm	RMS-X	1.7	3.4
	RMS-Y	1.3	3.4
	RMS-Z	1.6	8.7
GSD 20 cm	RMS-X	2.1	7.1
	RMS-Y	2.8	8.5
	RMS-Z	3.9	11.7

- when it has to be **right**

Simultaneous Imagery – Luzern, Switz („ Pixel Carpets „)



- when it has to be **right**

Efficient Data Processing with Leica XPro

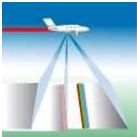

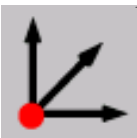

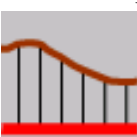


Processing at the Speed of Flight



- when it has to be **right**

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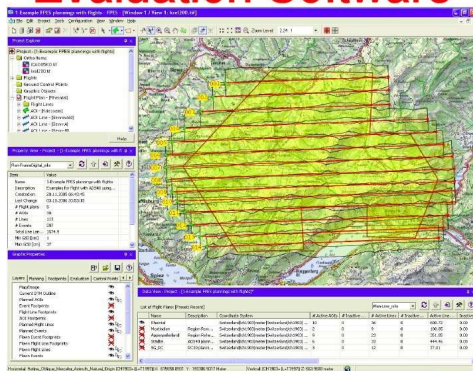
Data post processing time – Leica XPro workflow

	Flight	<u>1,200 km²</u> , <u>15cm GSD</u> 12 lines, each 80 km, 3 Pan and 8 MS Approximately <u>7 h flight</u> at 130 knots	Total time		User action time
			WS with 6 server cluster		
	Download	400 GB ADS data format		4 h	0.5 h
	Geo- referencing	Trajectory calculation geo-referencing of L0 images		0.5 h 0.1 h	0.5 h 0.1 h
	Aerial triangulation	Automatic Point Measurement Bundle Adjustment		0.1 h 0.3 h	0.1 h 0.3 h
	Ortho photo	RGB or FCIR 1,200 km ²		1.7 h	0.1 h
				6.7 h	1.6 h
	Feature extraction	Due to image strips slightly faster than in traditional workflow			
	Fly-through	Similar to traditional workflow			

- when it has to be **right**

ADS80 Workflow

Leica FPES Flight Planning & Evaluation Software



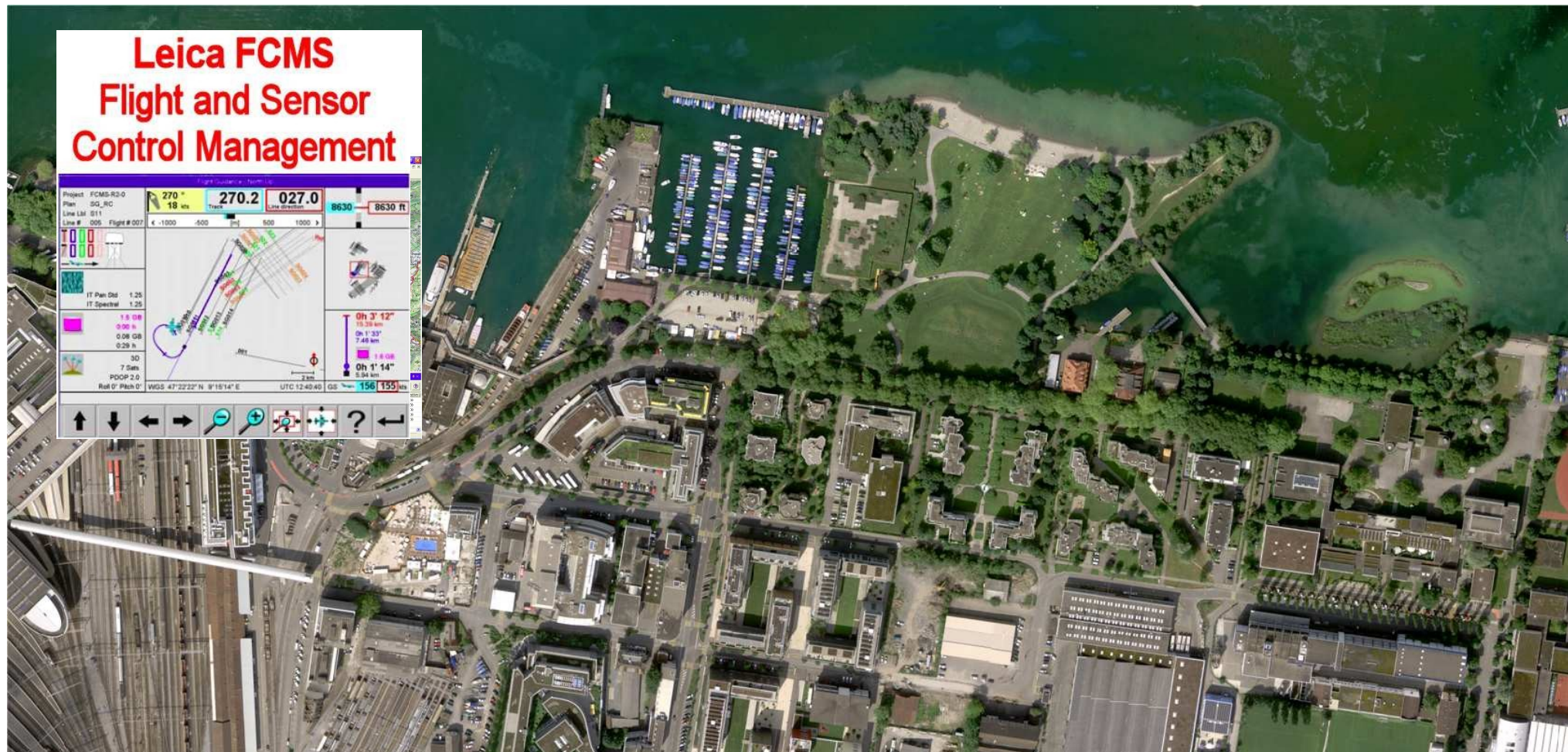
Flight Planning and Evaluation

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ADS80 Workflow



High Collecting and Broadcasting

- when it has to be **right**

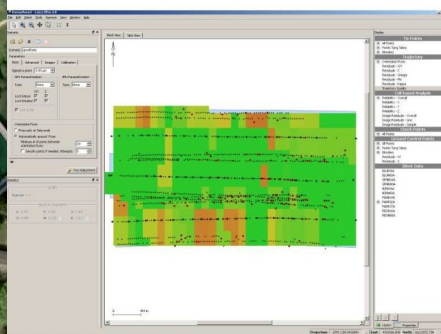
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ADS80 Workflow

Leica IPAS20
Advanced Inertial Position
& Attitude System



Leica XPro
Download and Ground
Processing Software

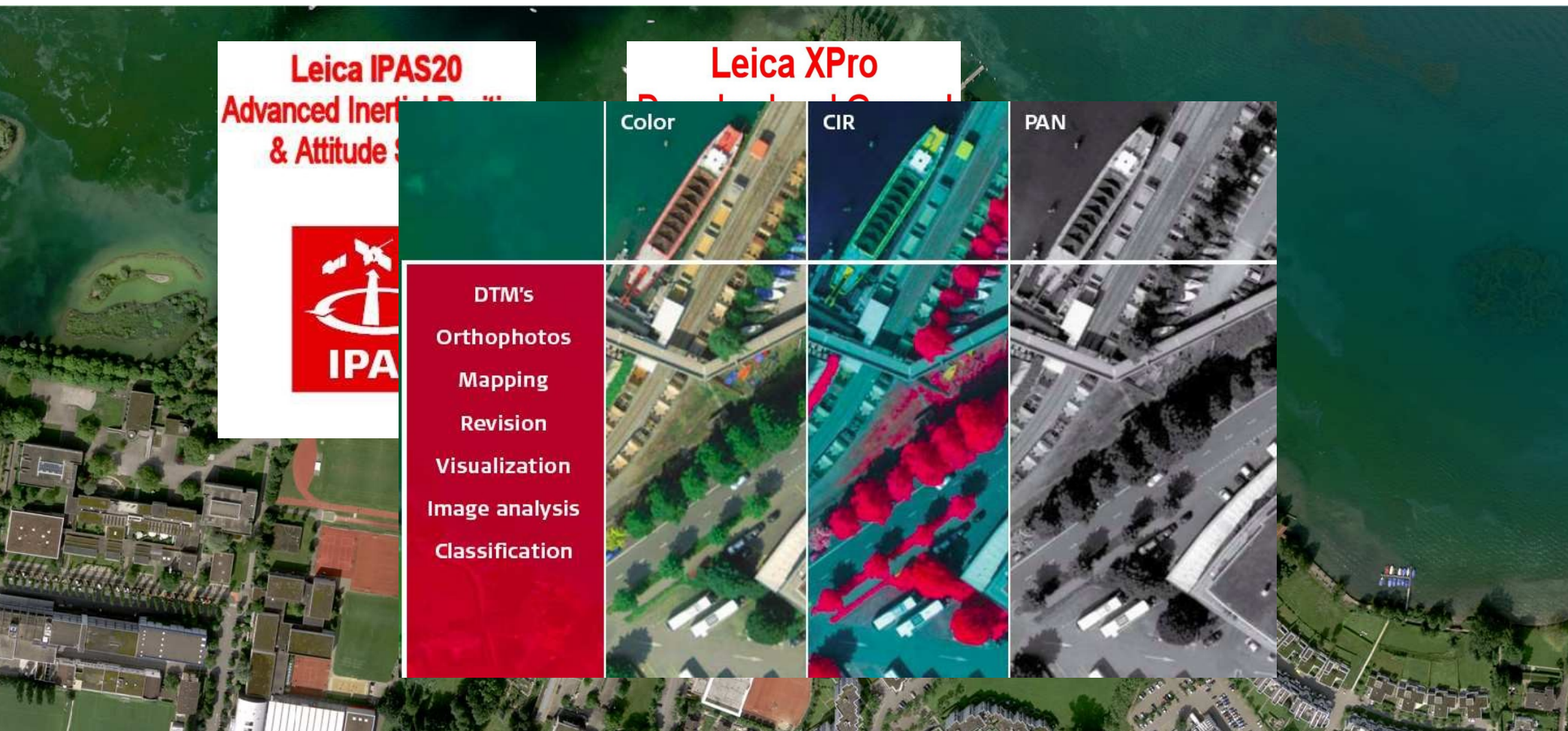


Data Processing Georeferencing

- when it has to be **right**

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ADS80 Workflow



Dragonfly Perception

- when it has to be **right**

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Leica ADS80

The Total Digital Airborne Imaging Solution

Simple and Easy-to-use

Best Image Quality

Highest Flexibility

Highest Productivity

Highest Reliability

Best Investment



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Examples of Applications (Forestry, Agriculture)

Outlook

- when it has to be **right**



ALS60 and MPiA - 3rd Generation LIDAR Scanner

Performance without compromise



More than ever, one system for all applications

No longer do customers have to choose between high pulse rate and high accuracy

No longer do customers have to choose between small size and high altitude capability

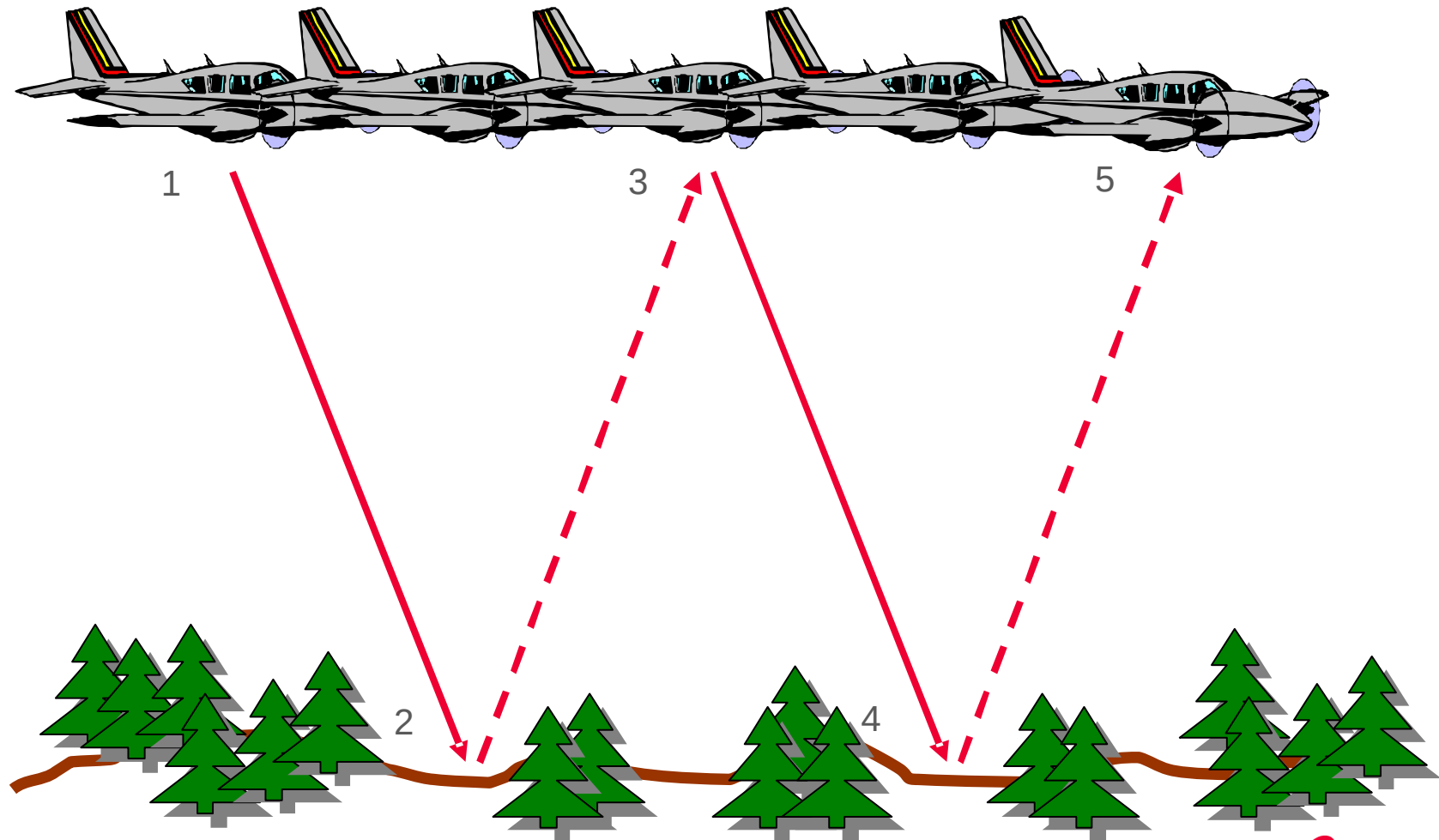
The point density you want, the accuracy you need

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Fundamentals of MPiA technology

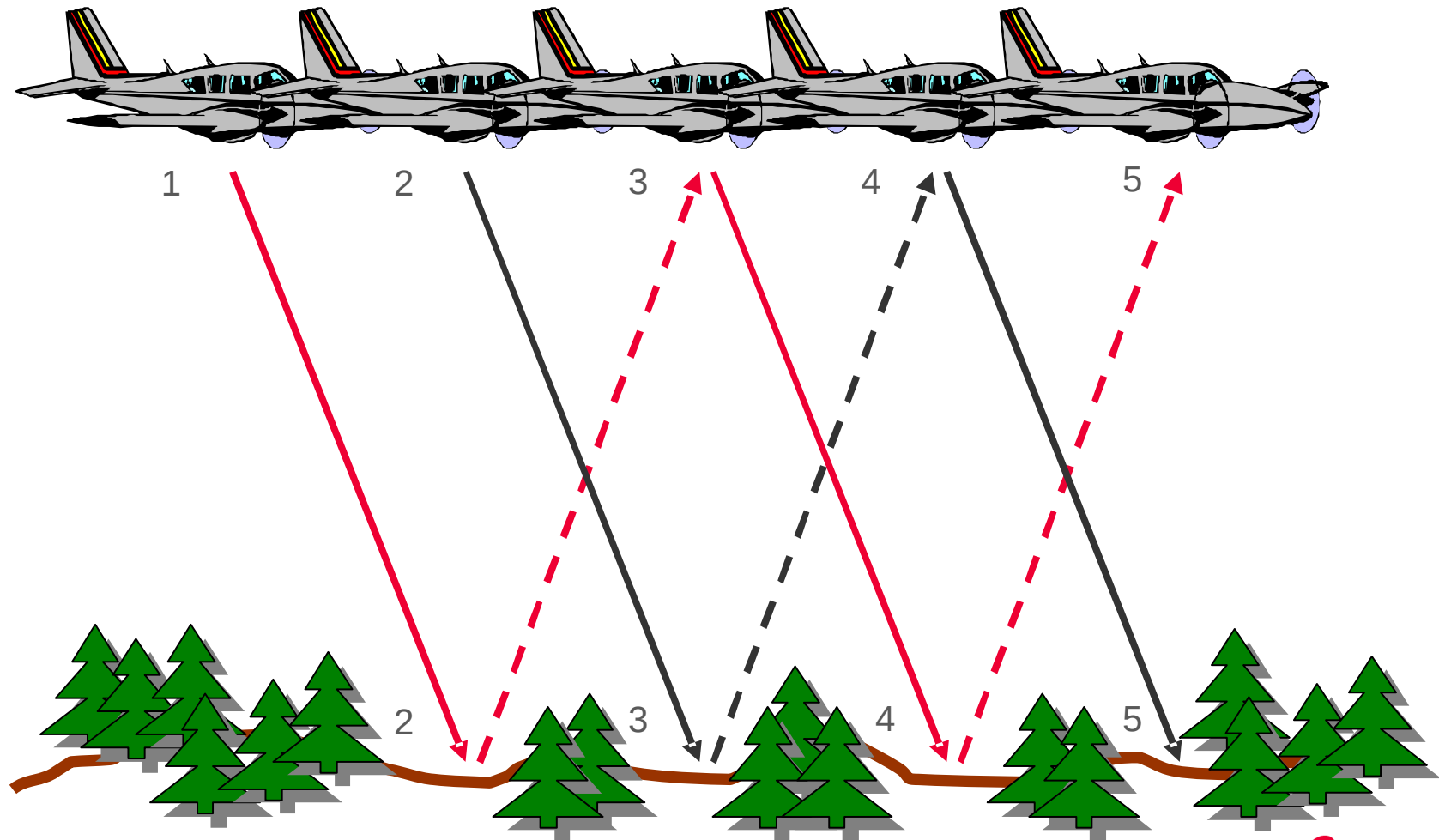
Single-pulse technology limits pulse rate



- when it has to be **right**

Fundamentals of MPiA technology

MPiA allows doubling of pulse rate



- when it has to be **right**

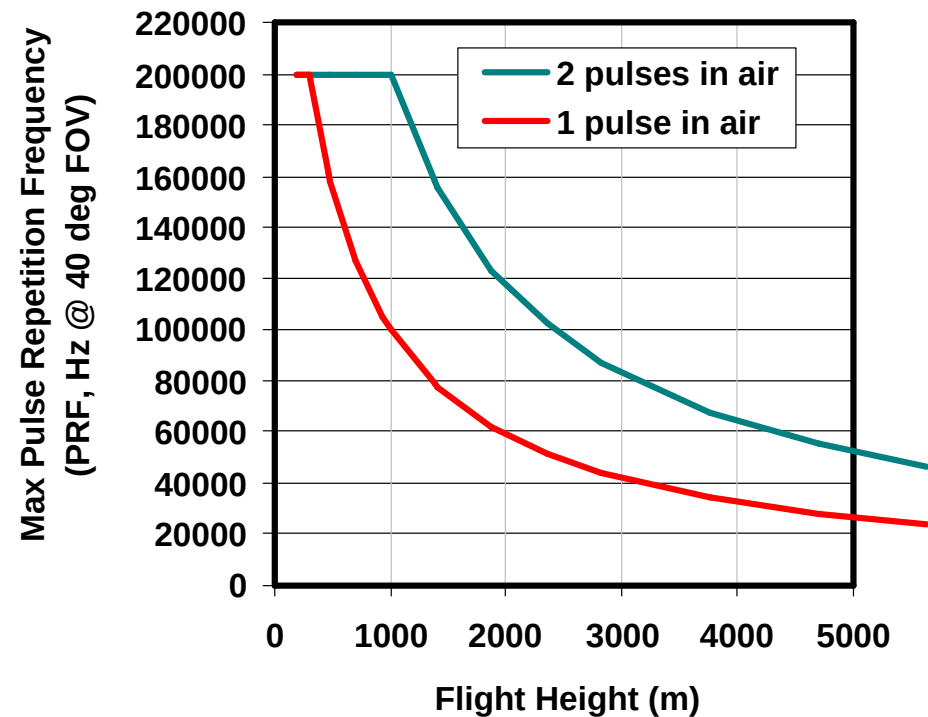
ALS60 - Improvements in max Pulse Rate

making a great LIDAR even better

33% increase in maximum pulse rate

200 kHz at the ground for even higher point density

Smooth operating envelope without discontinuities



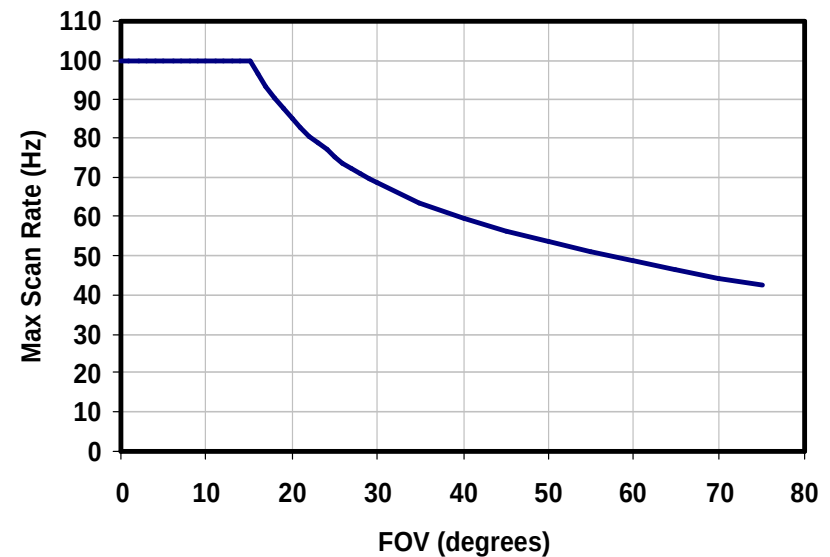
- when it has to be **right**

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ALS60 - Improvements in max Scan Rate *making a great LIDAR even better*

10% increase in maximum scan rate
to 100 Hz

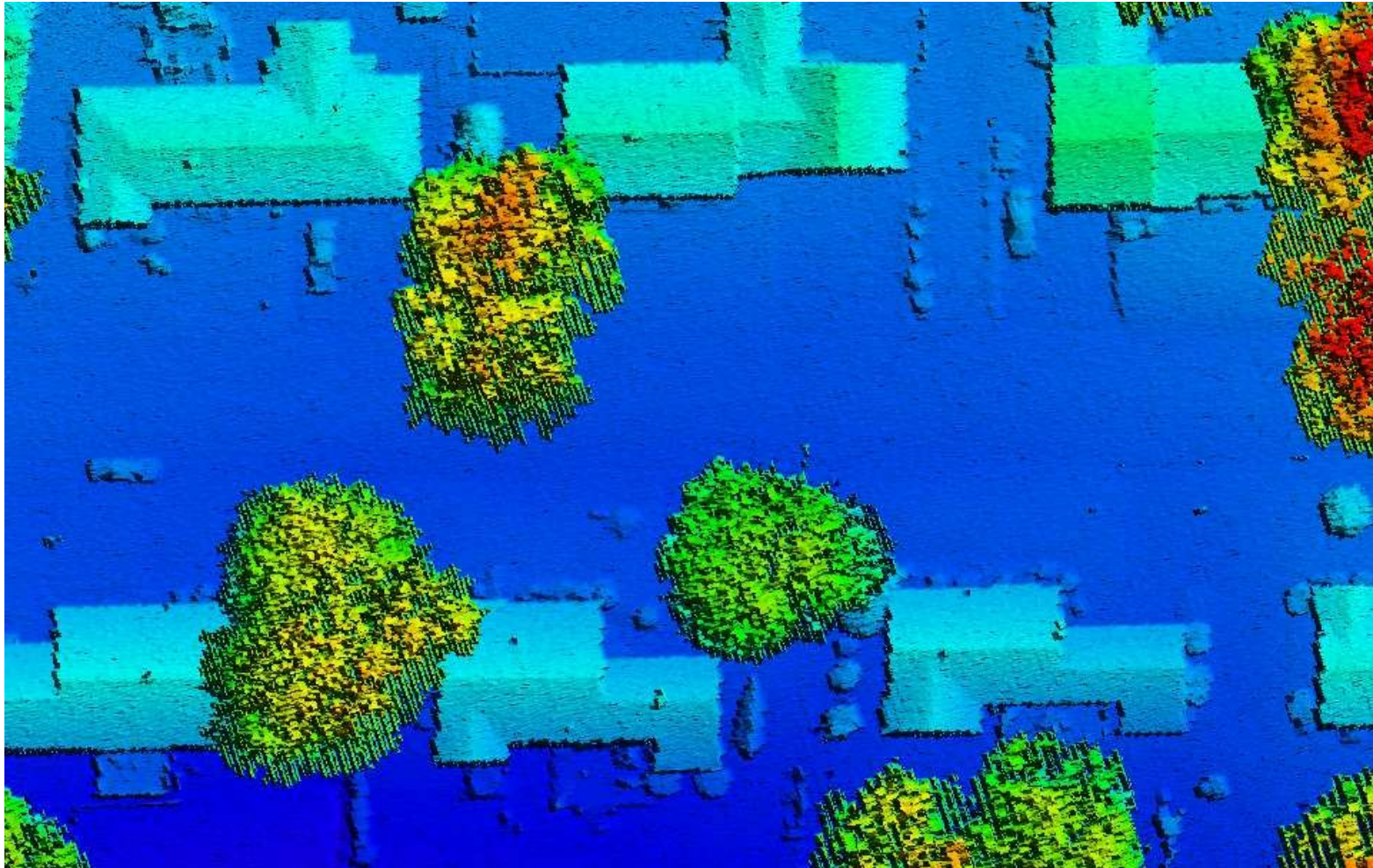
20% increase at most FOVs for optimal
point pattern at all FOVs



- when it has to be **right**

ALS60

the point density you want, the accuracy you need



- when it has to be **right**

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ALS60

the point density you want, the accuracy you need

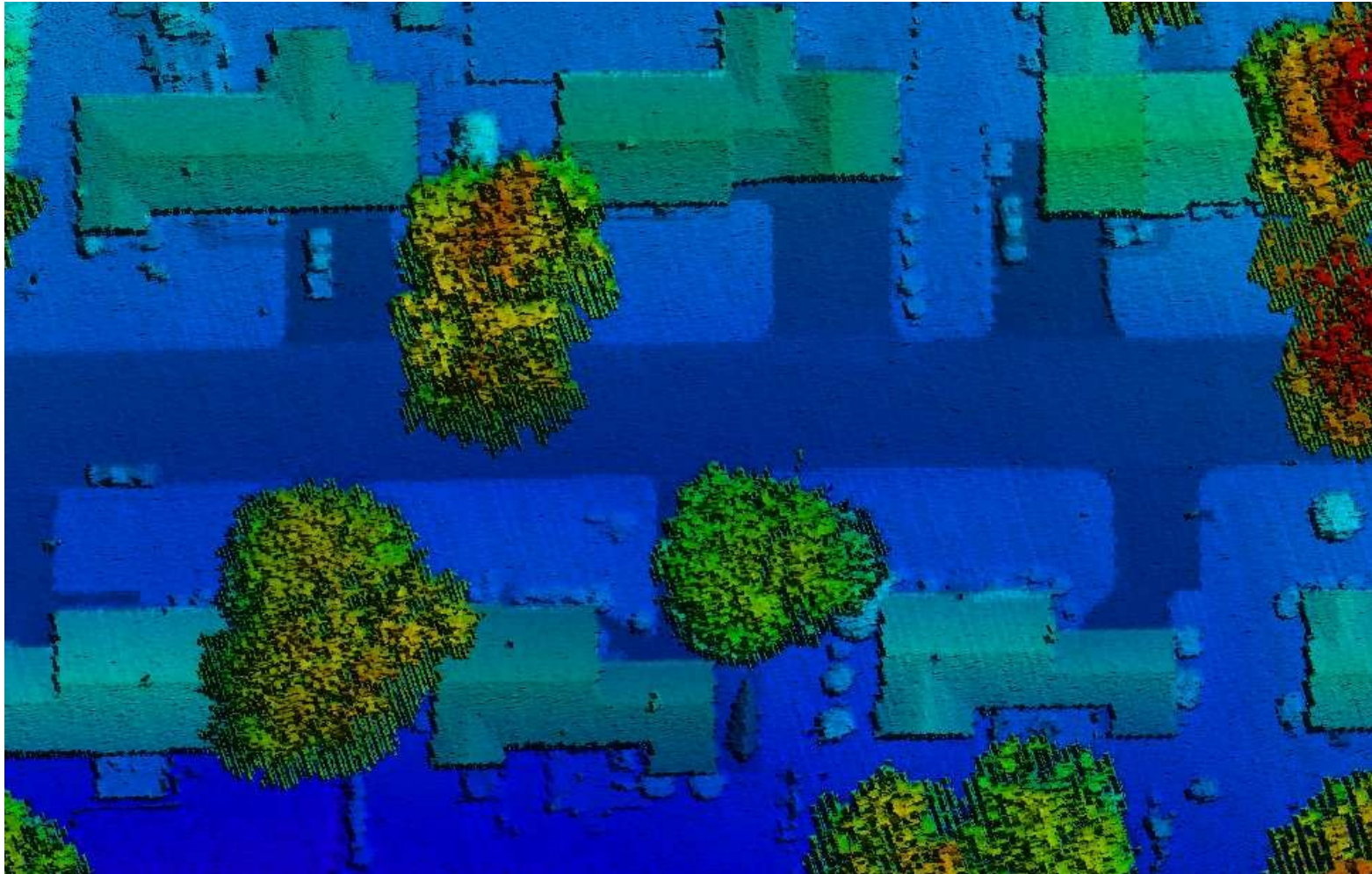


- when it has to be **right**

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ALS60

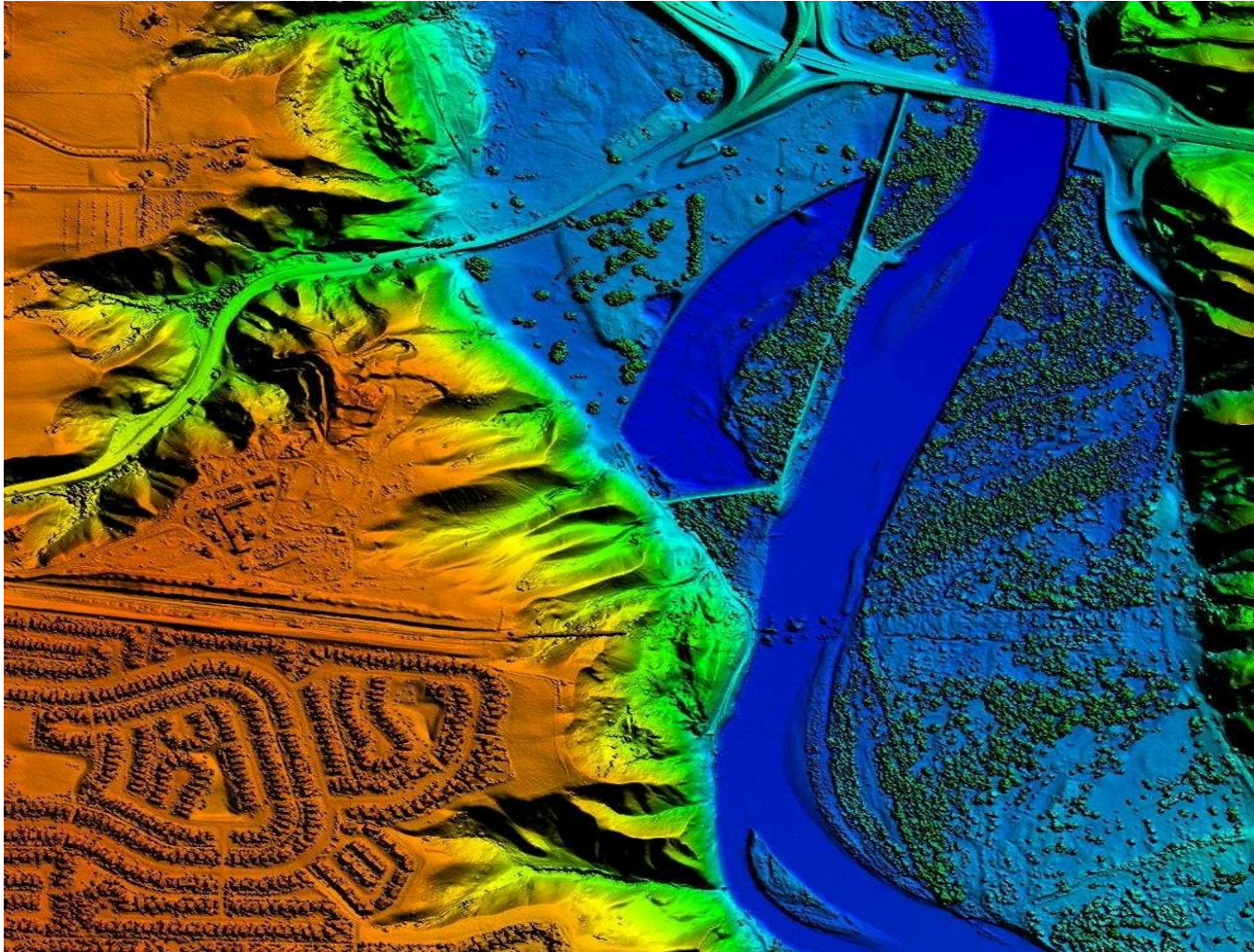
the point density you want, the accuracy you need



- when it has to be **right**

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Large optical aperture *the heart of a flexible system*

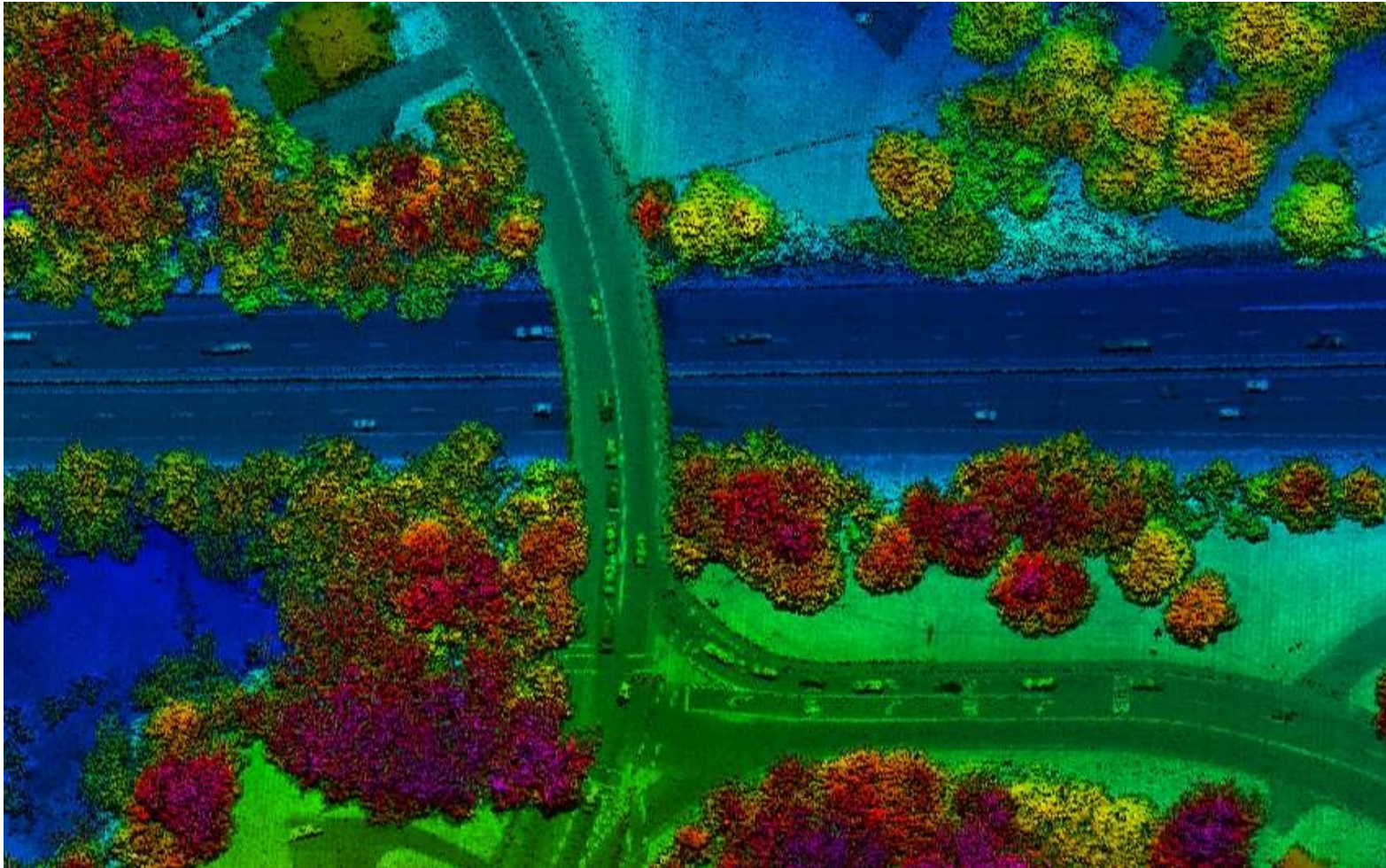


- when it has to be **right**

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ALS60-CM Corridor Mapper

Performance for corridor applications



- when it has to be **right**

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RCD105 - Digital Frame Camera (39 MPx)

Fast, flexible, plug-and-play with ALS60-CM

Purpose-designed airborne camera

RGB or CIR operation

35, 60 and 100 mm lenses

Fast 2.2 second frame interval

User-replaceable 1/3600-sec shutter

Up to 2 camera heads per controller



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RCD105 - Medium format imagery (with ALS60-CM)

An ideal combination

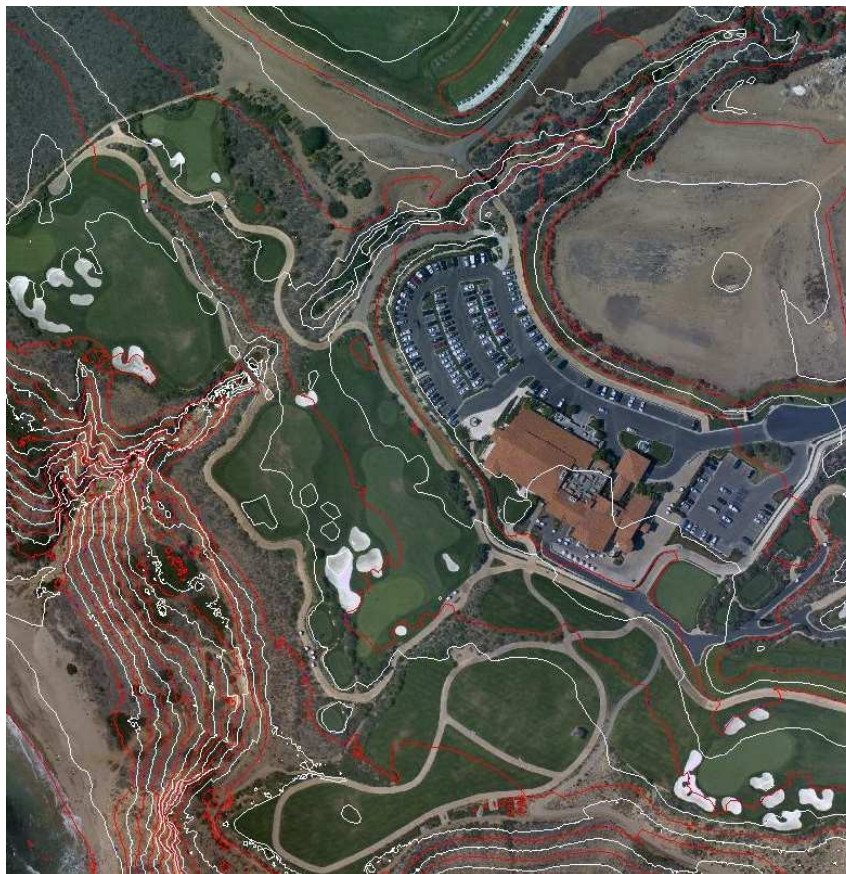
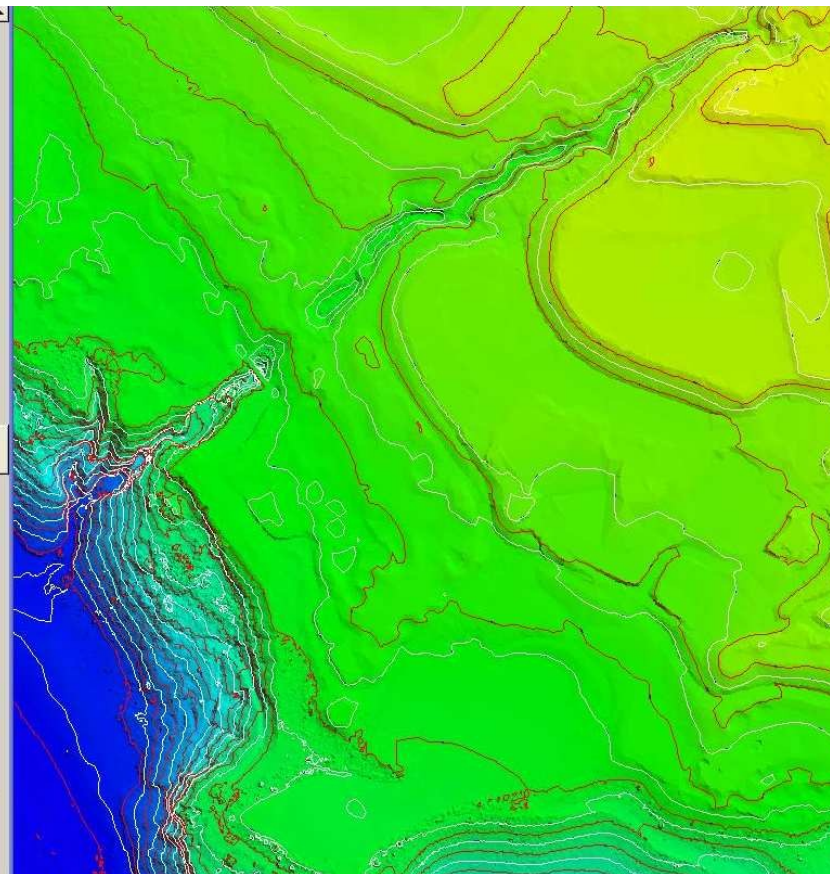


Image / Orthophotomap



DEM - Digital Elevation Model

- when it has to be **right**

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RCD105 - Medium Format Digital Camera

Product configuration

CH39 Camera Head (39 MPx)

Lens (35, 60 or 100 mm)

CC105 Camera Controller (shown
mounted to SC50 System Controller)

Isolated Interface Plate Assembly



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PAV80 – Gyro Suspension Mount

Application Examples (Forestry, Agriculture)

Outlook

- when it has to be **right**

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New gyro-stabilized sensor mount – PAV80

- Fastest in stabilizing speed
- Larger tilt angles available
- Different payloads accepted



Stabilization range in roll - 7 ° to + 7 °

Stabilization range in pitch - 8 ° to + 6 °

Stabilization range in drift - 30 ° to + 30 °

- when it has to be **right**

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Leica PAV80 – Use with different Sensors

Key Benefits

Several control loops optimized for different sensor weights can be selected:

> Leica Geosystems Sensors:

ADS40 and ADS80 Sensor Heads 51, 52, 81 and 82

ALS50 and ALS60 Laser Scanners

> Other, 3rd party Sensors (Thermal, Hyperspectral, etc)

Range 1: 5 kg to 30 kg

Range 2: 25 kg to 50 kg

Range 3: 45 kg to 75 kg

Range 4: 70 kg to 100 kg

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ADS80 - Airborne Digital Sensor - Application

Large Area Forestry Mapping

OMNR (Ontario Ministry of Natural Resources)

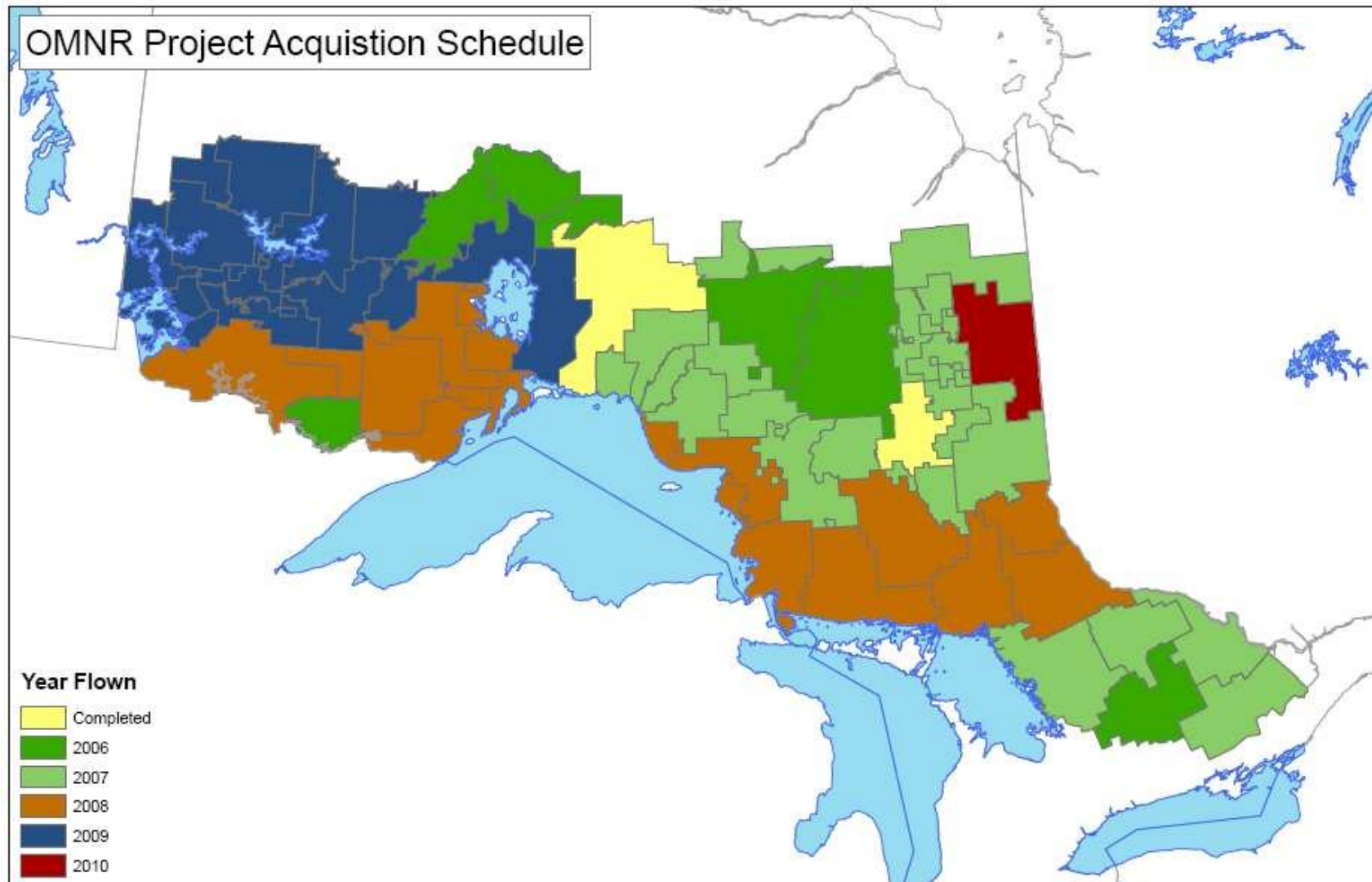
Project Description / Purpose

- To update the forest inventory base map that is then used as the foundation layer for the next 10 year cycle.
- The plan is to repeat this process every 10 years with smaller sample areas done from year to year.

- when it has to be **right**

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Ontario Forestry Project - Data Acquisition



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Project Size / Parameters

- 600'000 sq / km
- Forestry area of the entire Province of Ontario was monitored over a 5 year period
- All imagery (Pan, R, G, B, N) acquired with GSD = 20cm (Ground Sampling Distance)

Biggest project of its kind.....ever!

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Project - Deliverables (1/2)

This project is using everything that can be created by the ADS80 – Airborne Digital Sensor:

Total project: approximately 280TB of data delivered!

For remote sensing/interpretation:

20cm 4 band L1 stereo imagery, 16 bit

20cm 4 band ortho products, 16 bit

20cm Panchromatic L1 stereo products, 16 bit

20cm Panchromatic ortho products, 16 bit

- when it has to be right

Project - Deliverables (2/2)

For GIS:

20cm 3 band RGB ortho, 8 bit, mosaiced and radiometrically corrected

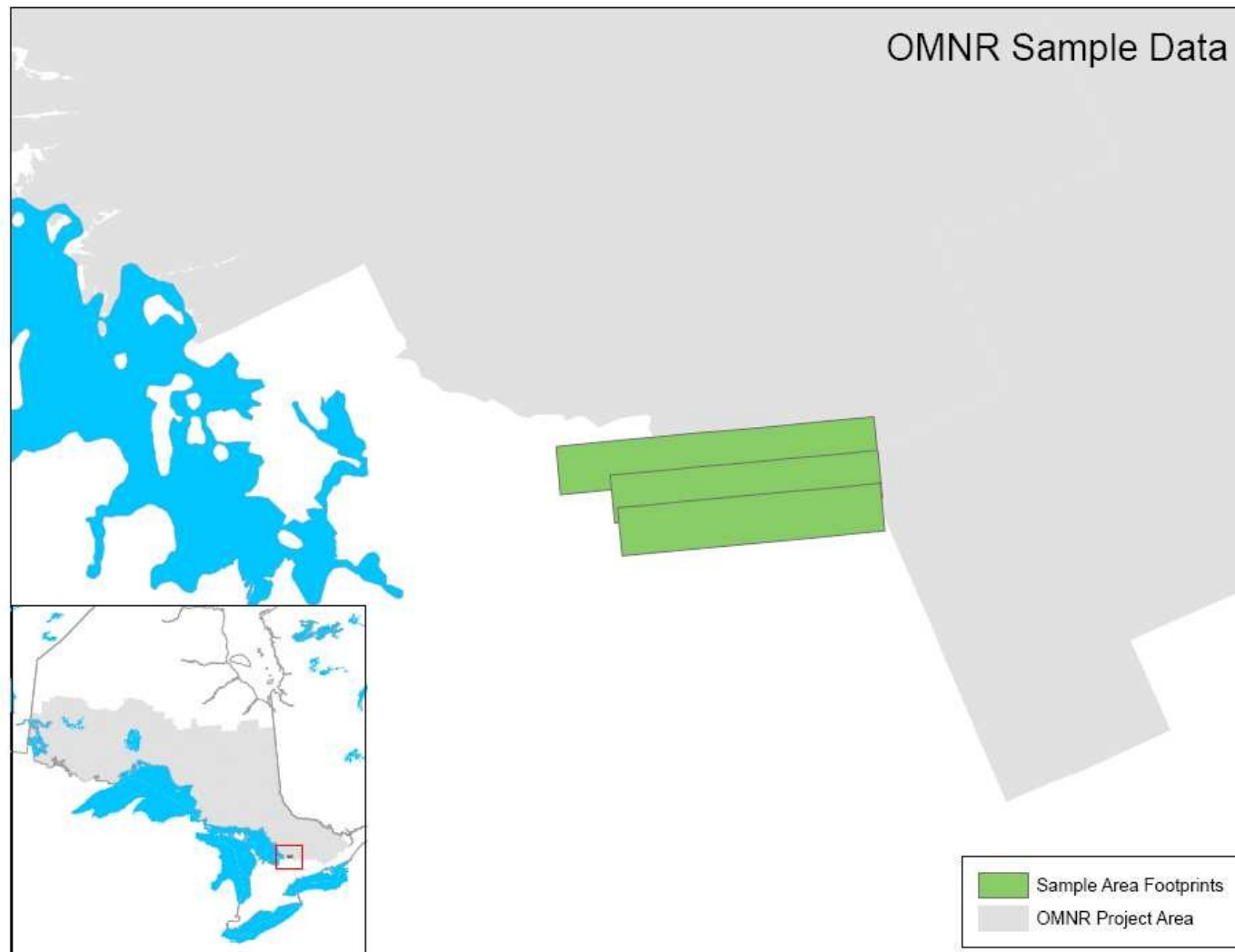
20cm 3 band RGN ortho, 8 bit, mosaiced and radiometrically corrected

Other:

DSM generated at ~1m post spacing for rough canopy surface modeling

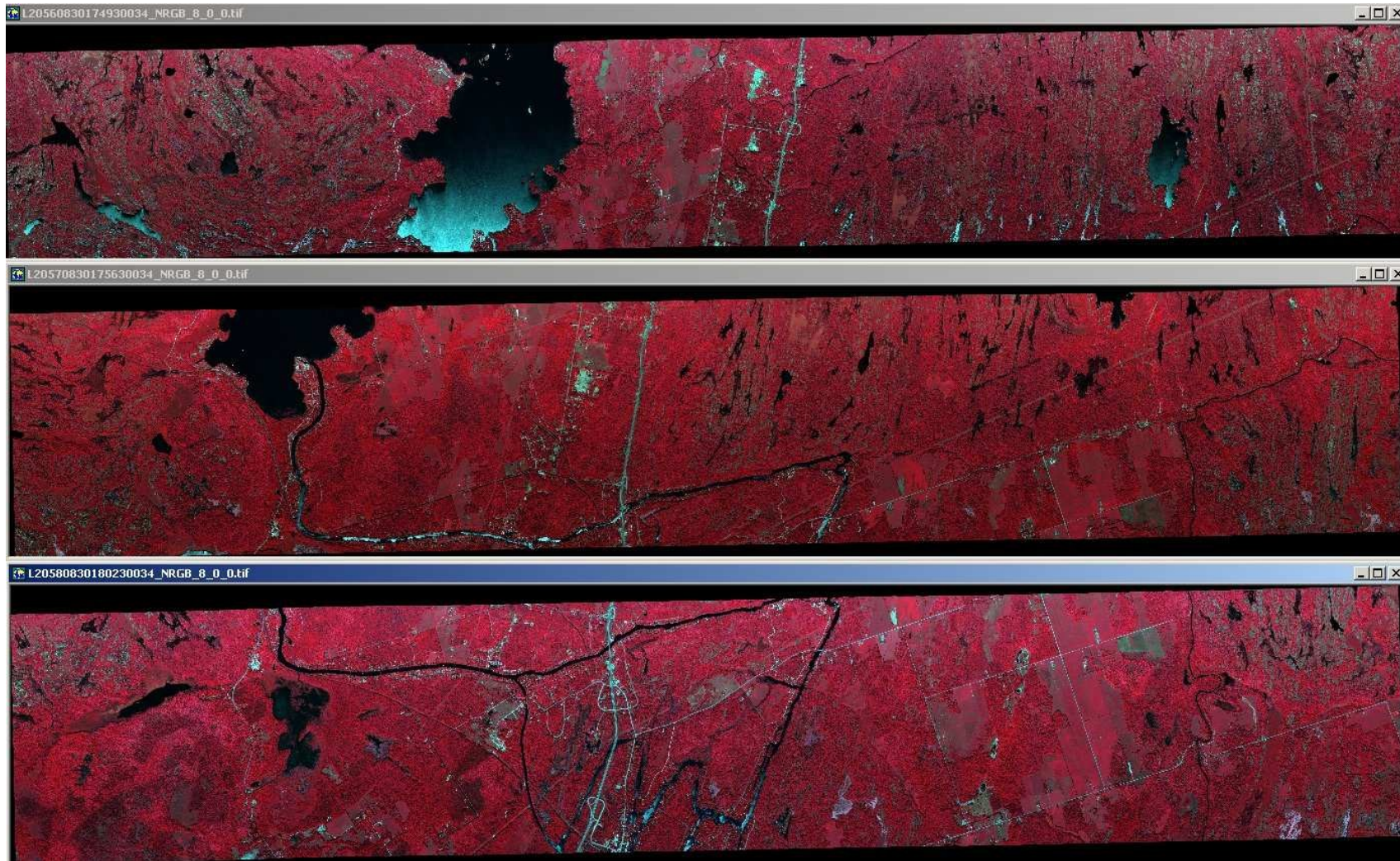
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OMNR - Example Data



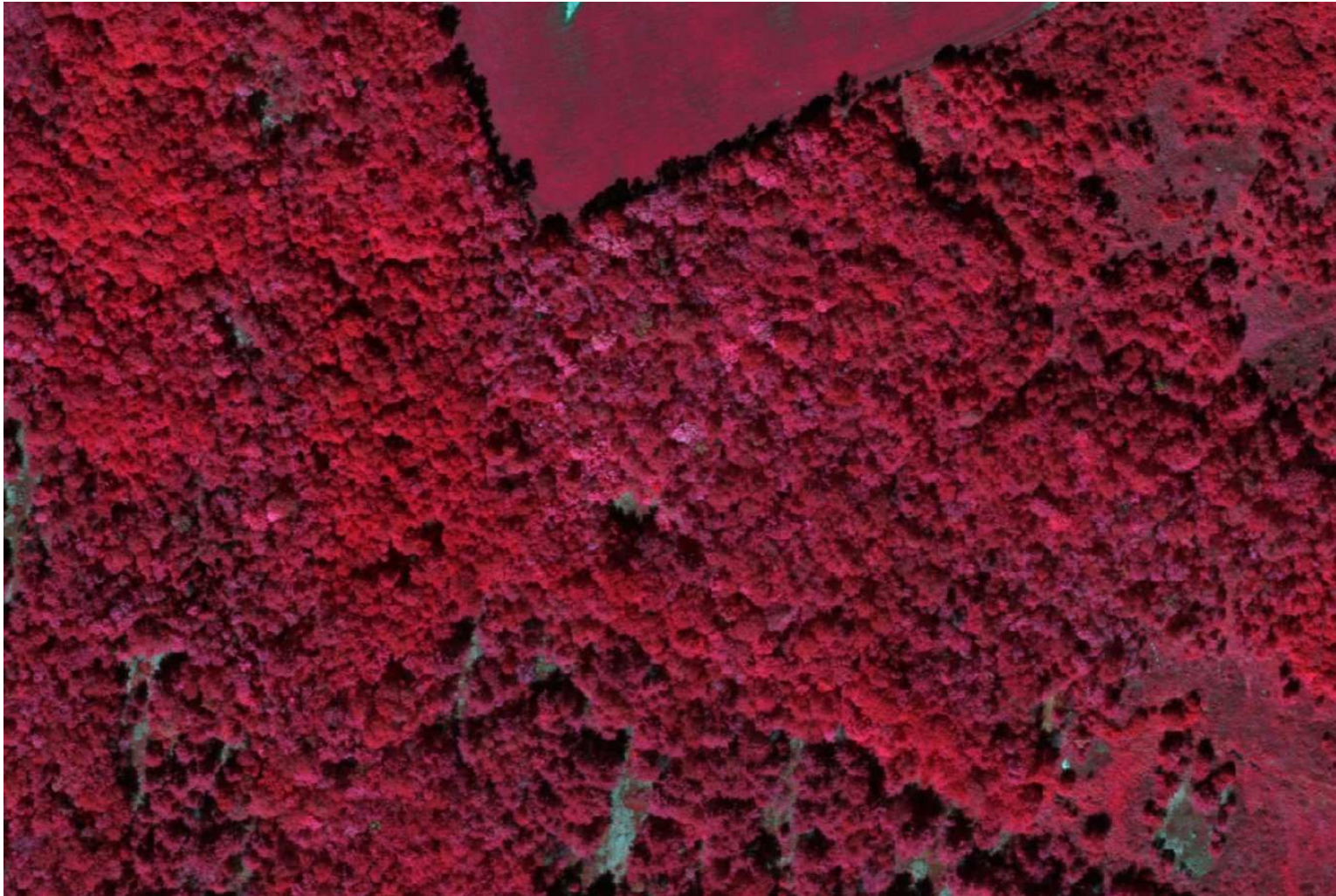
- when it has to be **right**

OMNR - Three Pixel Carpets



- when it has to be **right**

OMNR - Example Data L2



- when it has to be **right**

Future Work planned / Expectations

- Stereo products will be used in PurView-SW to perform detailed digitizing of the forest stands.
- Raw L2 ortho strips will be used for automated processing to identify water and dead forest areas.
- Over the program, it is hoped that more automation can be introduced to start to remove the stereo digitizing of the forest stands and identification of tree species.

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Dual Leica Sensor System “ ADS40 – ALS50 ”

(Estonian Land Board)



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Thank you

