Processing Airborne Lidar & Images

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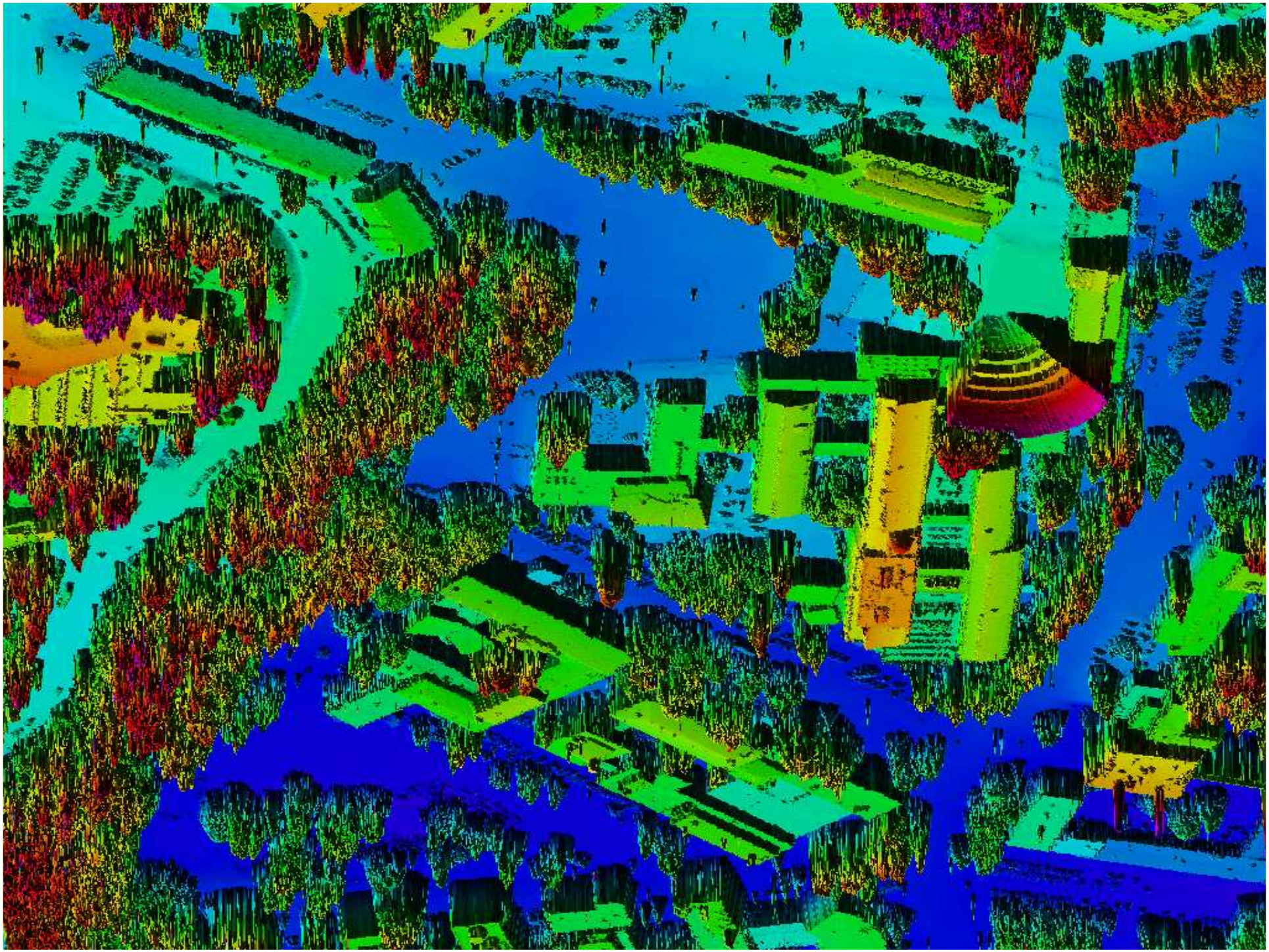
Software developer

Terrasolid Ltd

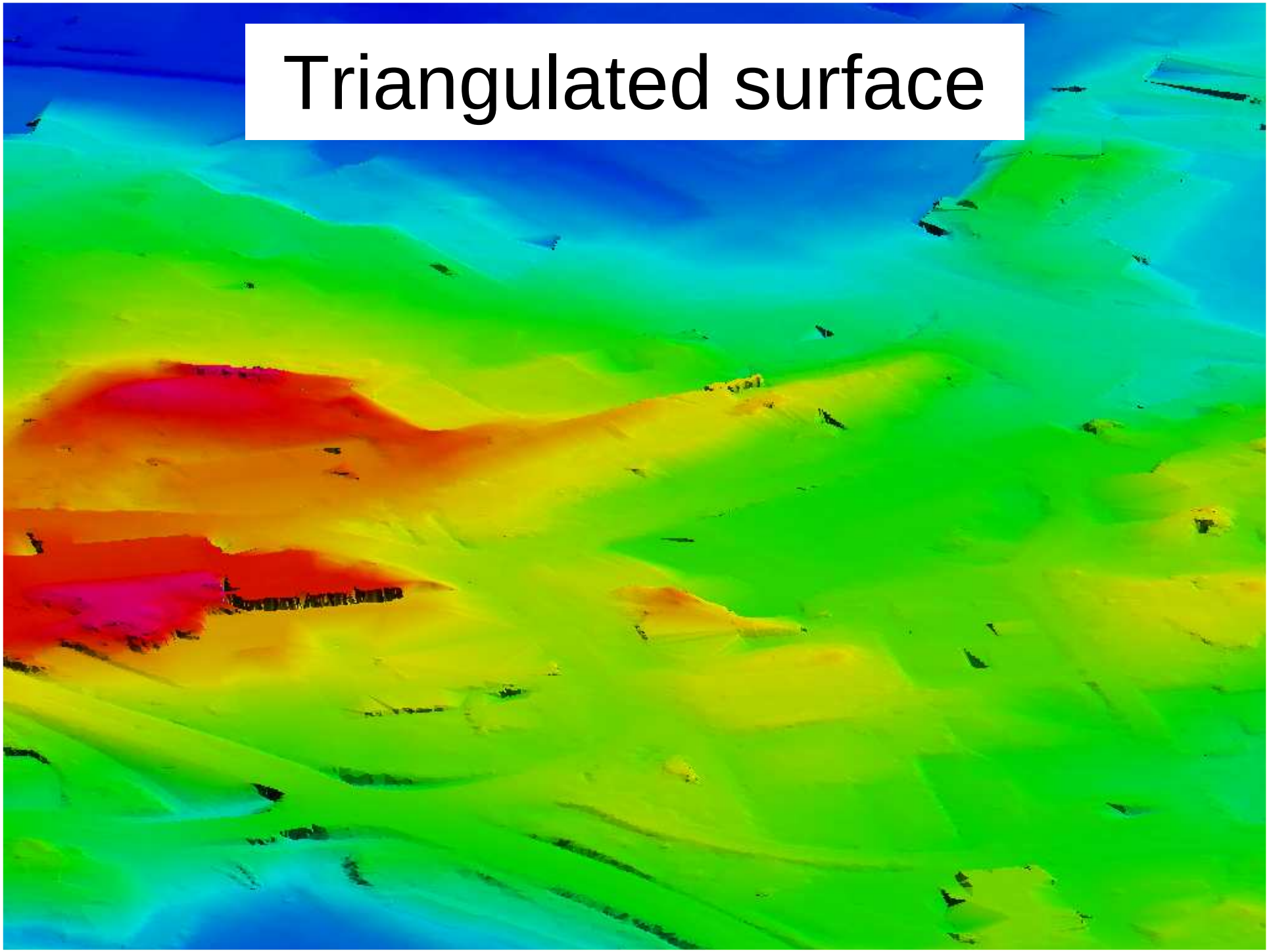
Processing applications

- TerraScan for MicroStation 5 100 €
  - laser data processing
- TerraModeler for MicroStation 3 400 €
  - terrain modeling

- TerraMatch for MicroStation 5 100 €
  - fix systematic errors in laser data
- TerraPhoto for MicroStation 5 100 €
  - orthorectifying images

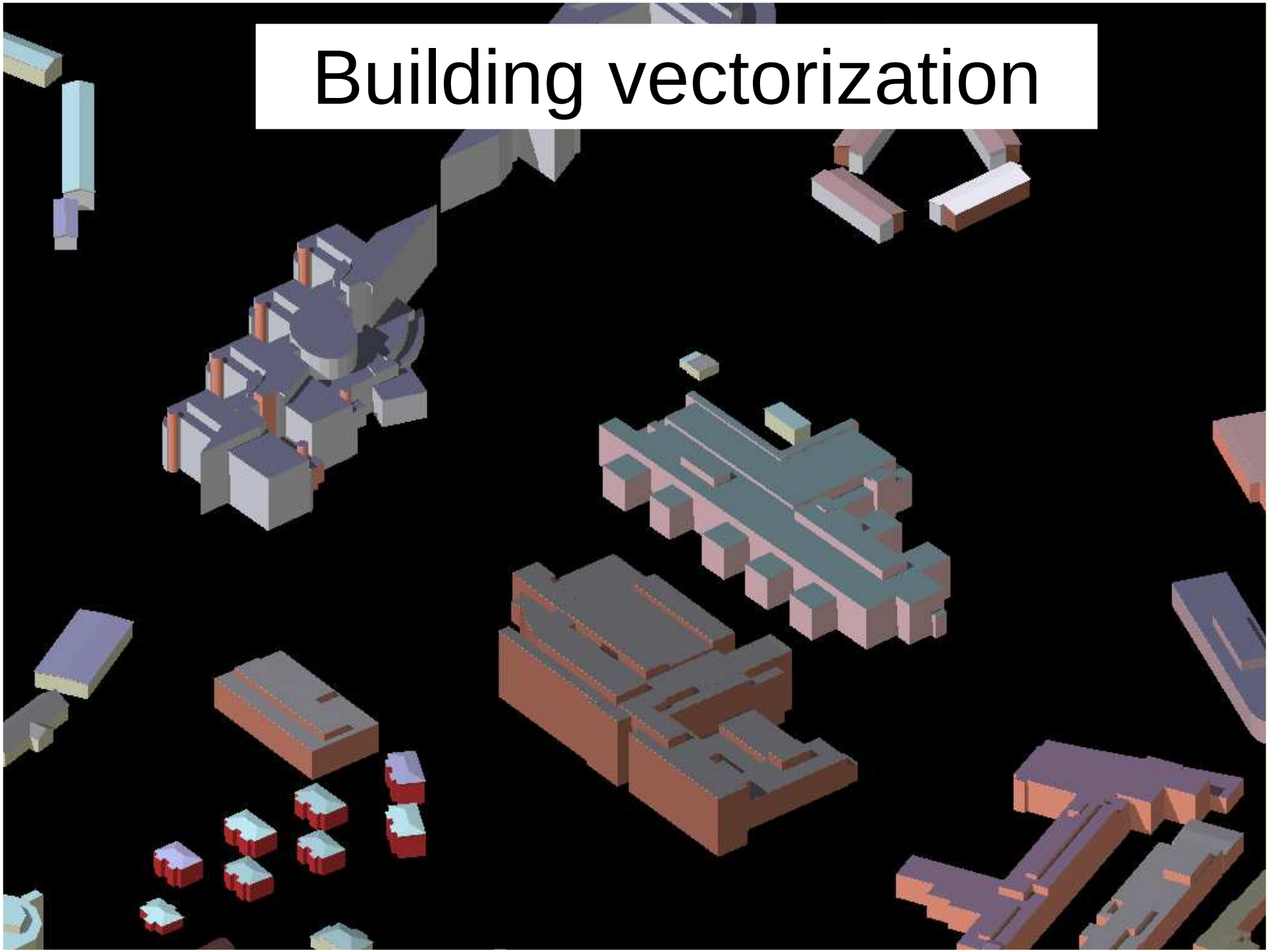


Triangulated surface

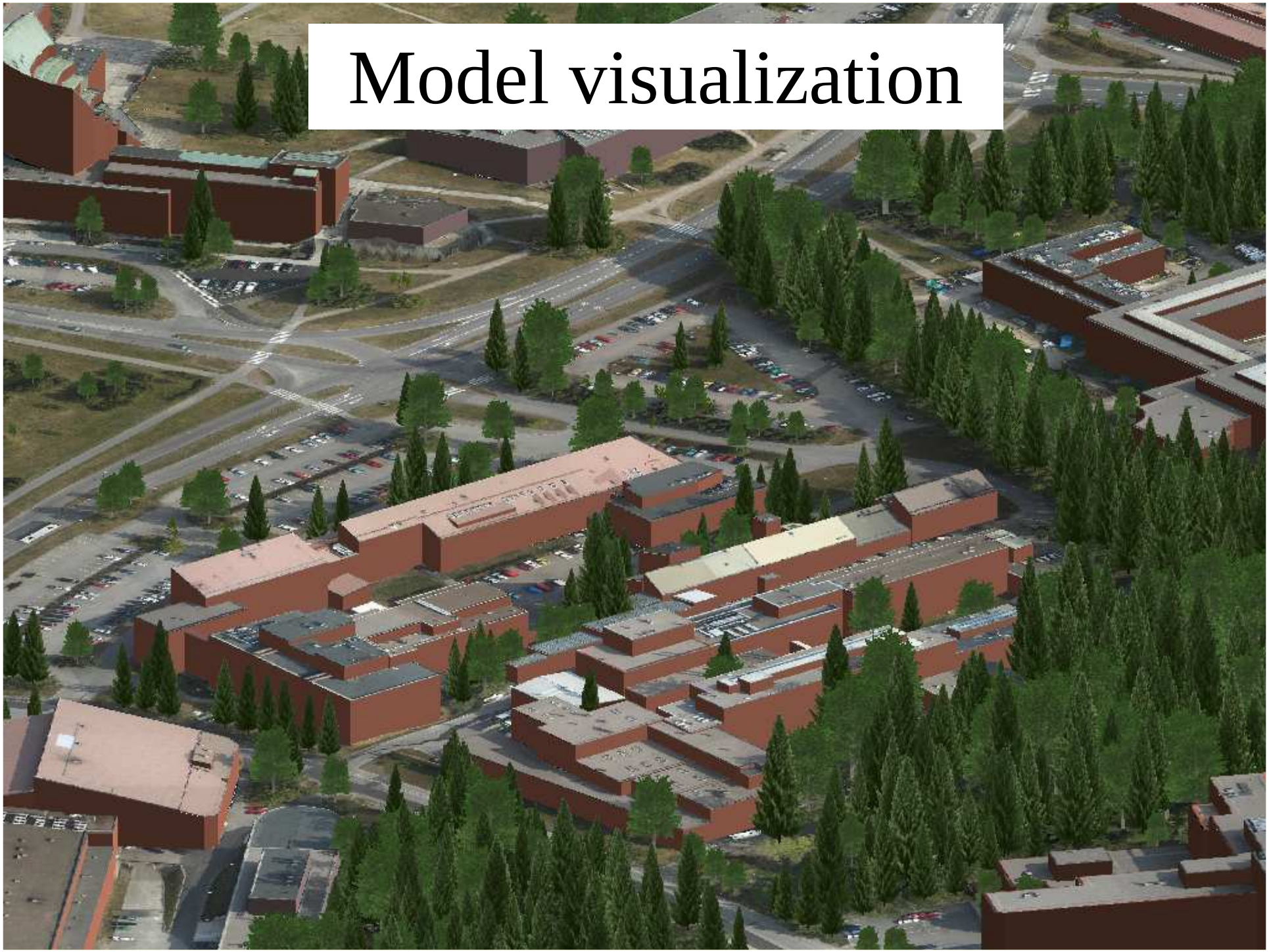



Ortho

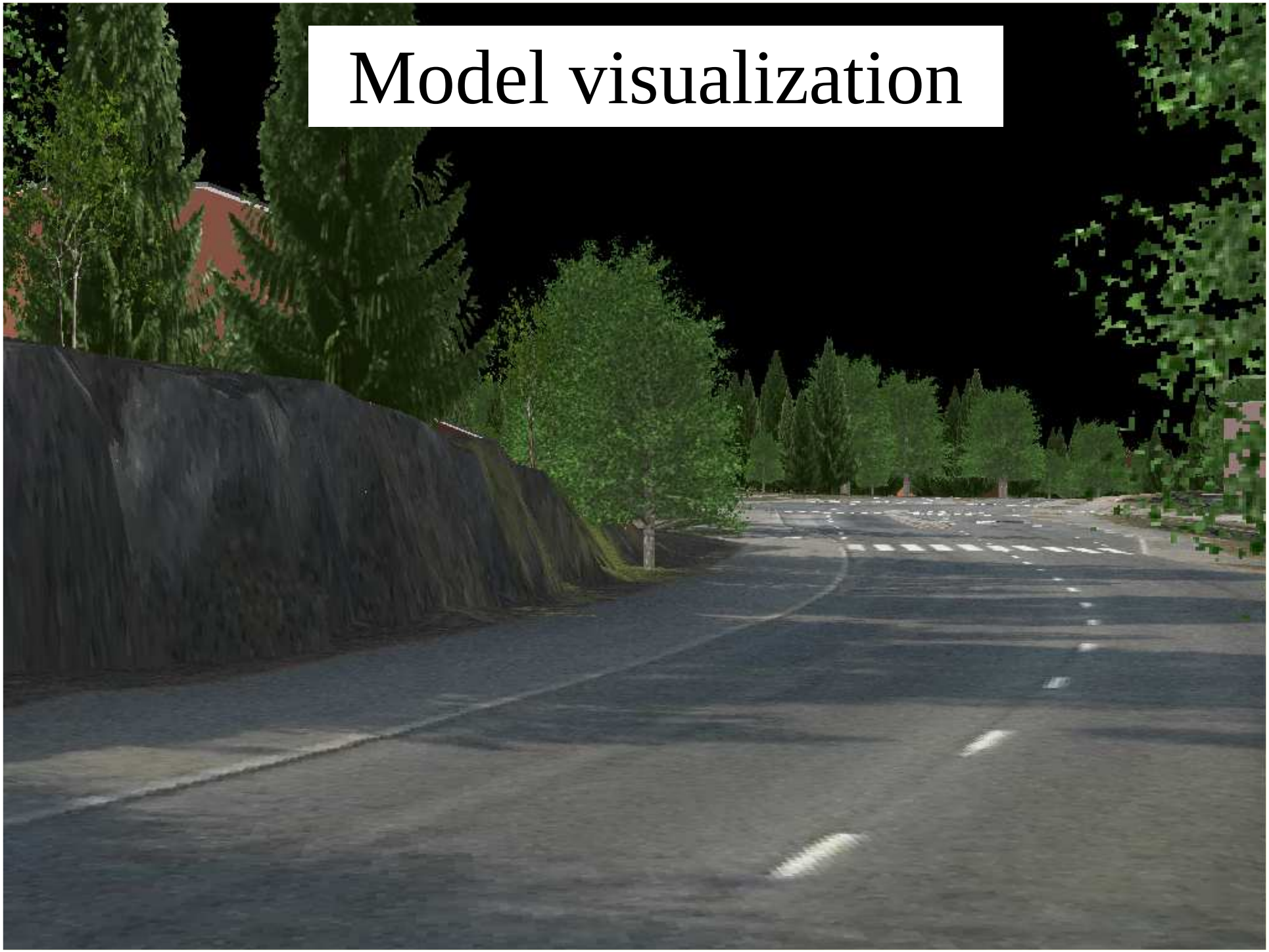
Building vectorization

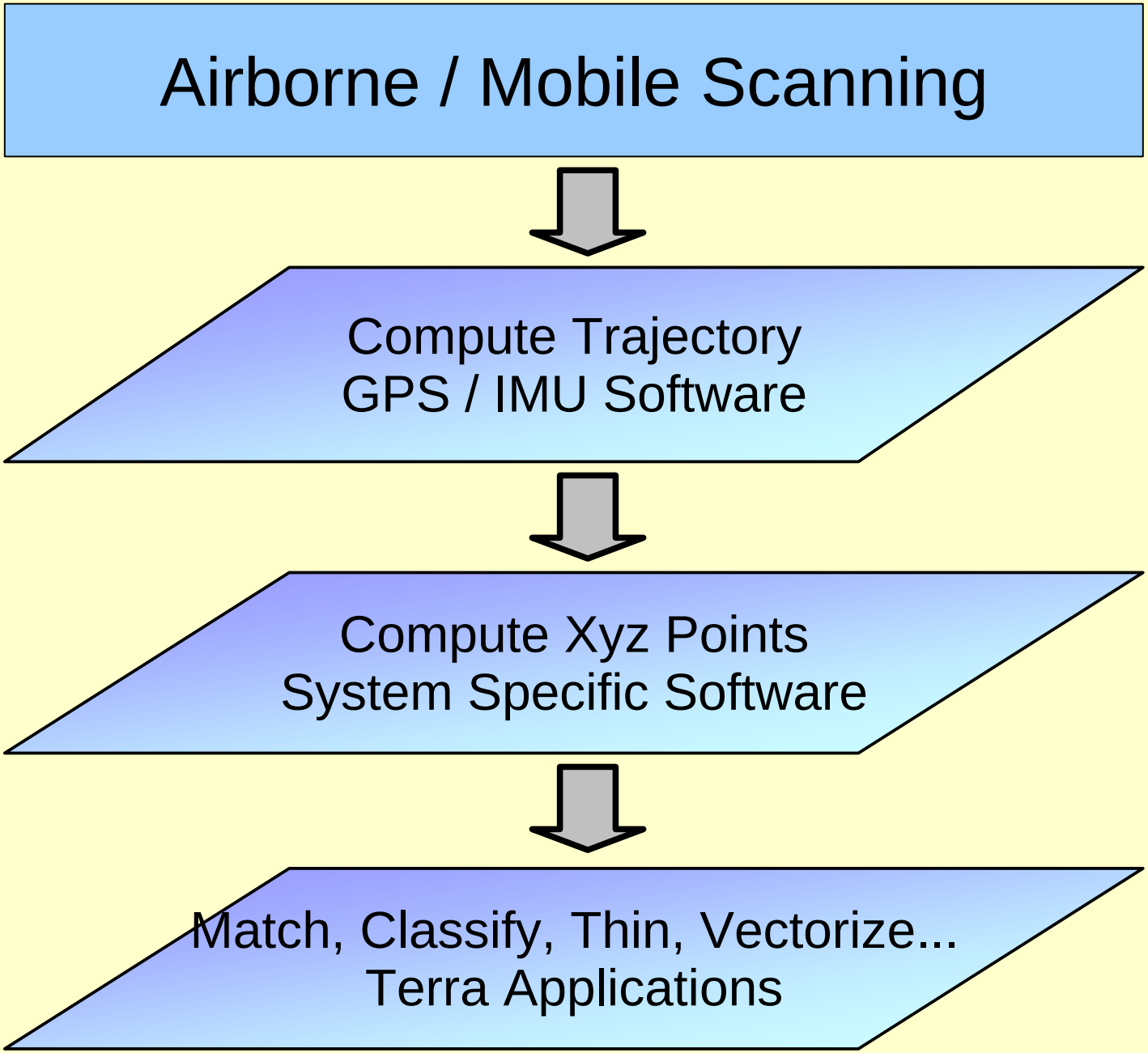


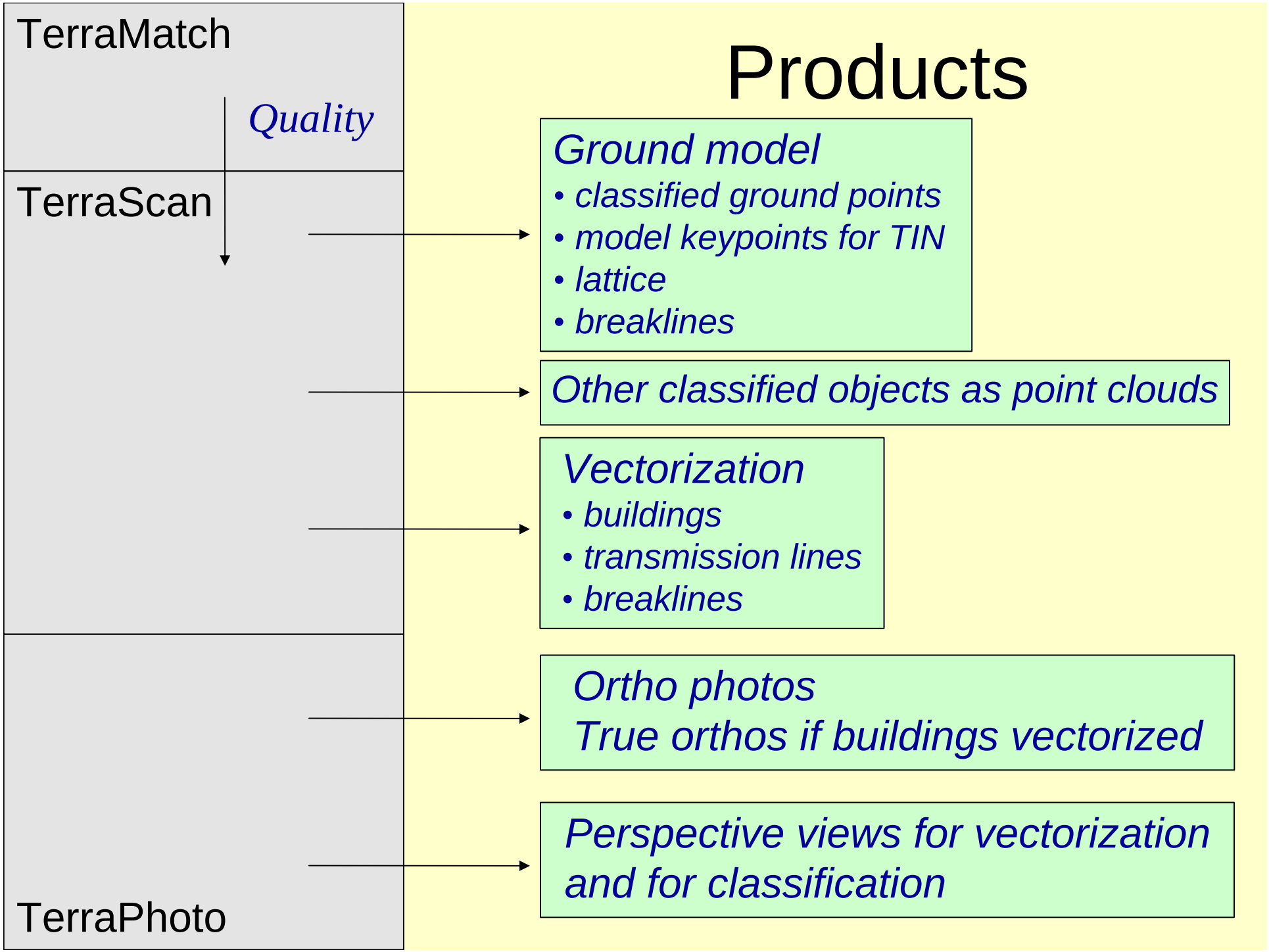
Model visualization



Model visualization




Airborne / Mobile Scanning
Compute Trajectory
GPS / IMU Software
Compute Xyz Points
System Specific Software
Match, Classify, Thin, Vectorize...
Terra Applications


TerraMatch
Quality
TerraScan
TerraPhoto
Products
Ground model
• classified ground points
• model keypoints for TIN
• lattice
• breaklines
Other classified objects as point clouds
Vectorization
• buildings
• transmission lines
• breaklines
Ortho photos
True orthos if buildings vectorized
Perspective views for vectorization
and for classification

Processing steps

- ☒ Import points into TerraScan (transforming xy)
- ☒ Import trajectories into TerraScan (transforming xy)
- ☒ Adjust from ellipsoidal to geoid based height model
- ☒ Make sure points & trajectories have matching numbering
- ☒ Validate that area is covered
- ☒ Validate that flightlines match
- ☒ Remove points we do not use
- ☒ Classify noise (below ground or in the air)
- ☒ Classify ground
- ☒ Validate ground classification visually
- ☒ Classify by height from ground (low/medium/high vegetation)
- ☐ Classify objects manually
- ☐ Vectorize (buildings, breaklines, powerlines, trees)
- ☒ Classify model keypoints to produce model

Processing Steps

1. Match flightlines
   - Fine tune calibration
   - Improve positional accuracy

Expert work
Computer time

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2. Classify
   - Ground, vegetation, building...

Lower skill work
Human time

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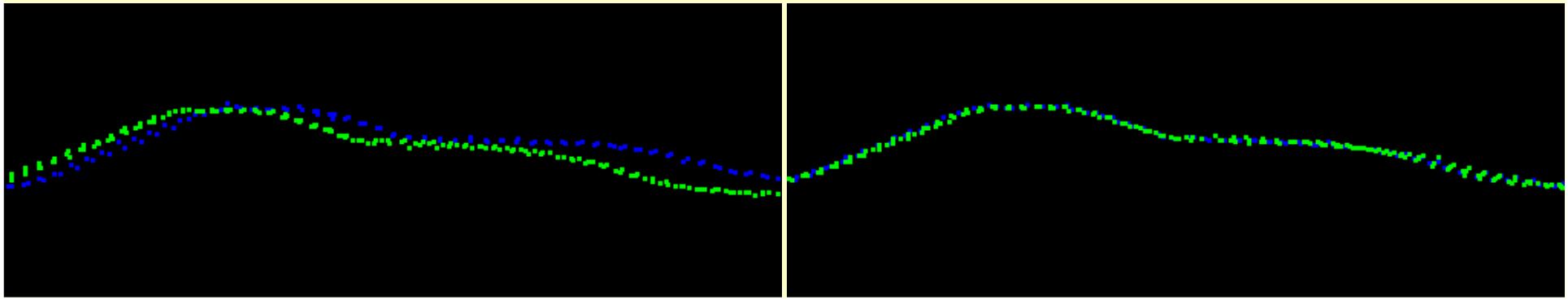
3. Create delivery products
   - Contours
   - Powerline model
   - 3D vector models
   - Timber volume

Application specific expertise

Validating that flightlines match

- Measure a value of how well flightlines match
- Solve/fix misalignment angles & mirror scale
- Solve/fix dz (and optional params) per line
- (Optional) Solve/apply fluctuating z corrections

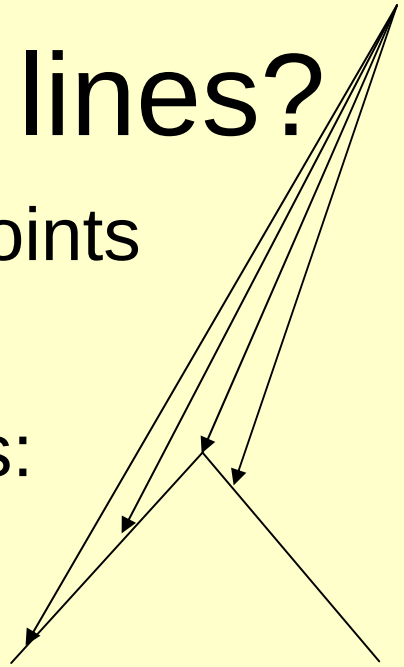


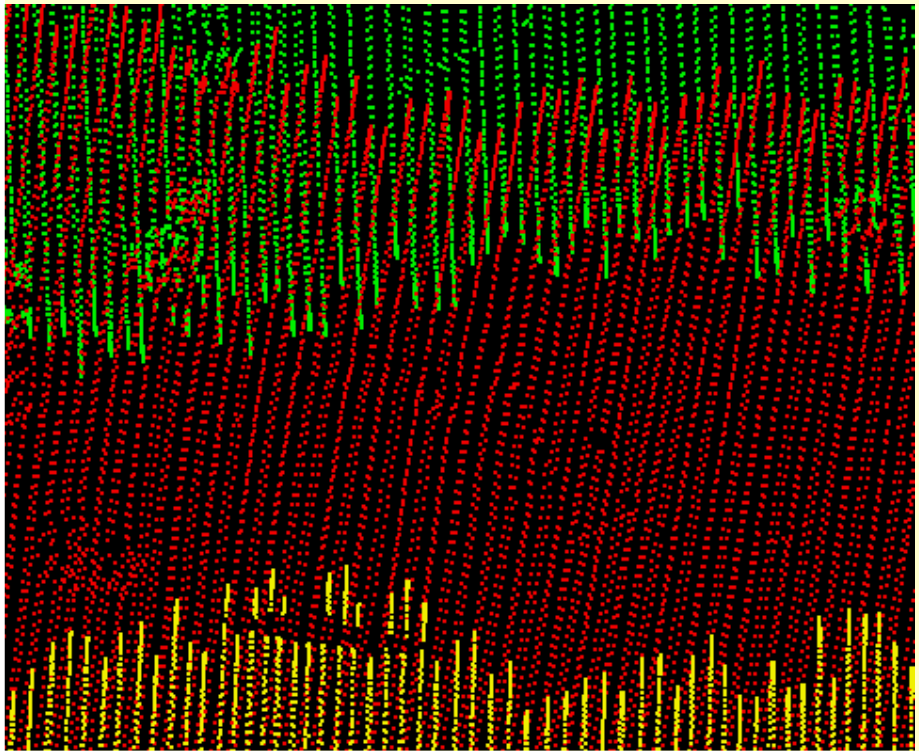
Removing unneeded points

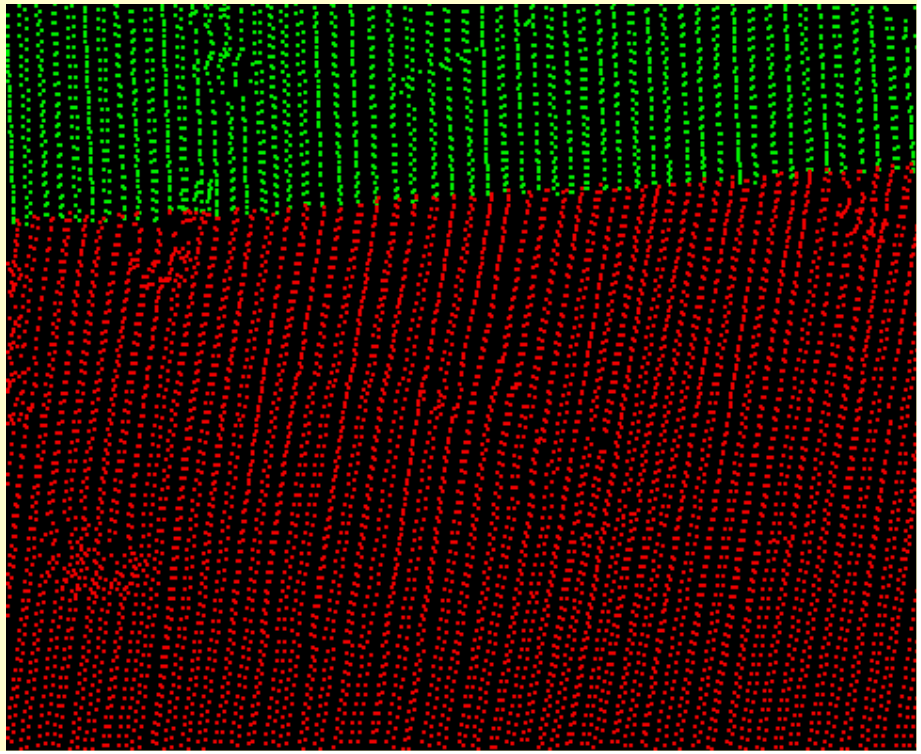
- Outside project area
- Over water bodies
- Collected when aircraft was turning
- Lower quality when better quality is available
- Edges of scan lines

Why to cut edges of scan lines?

- Produce more consistent pattern of points
- Remove less accurate points
- Many error sources increase at edges:
  - heading, roll, mirror scale
  - poor measurement angle



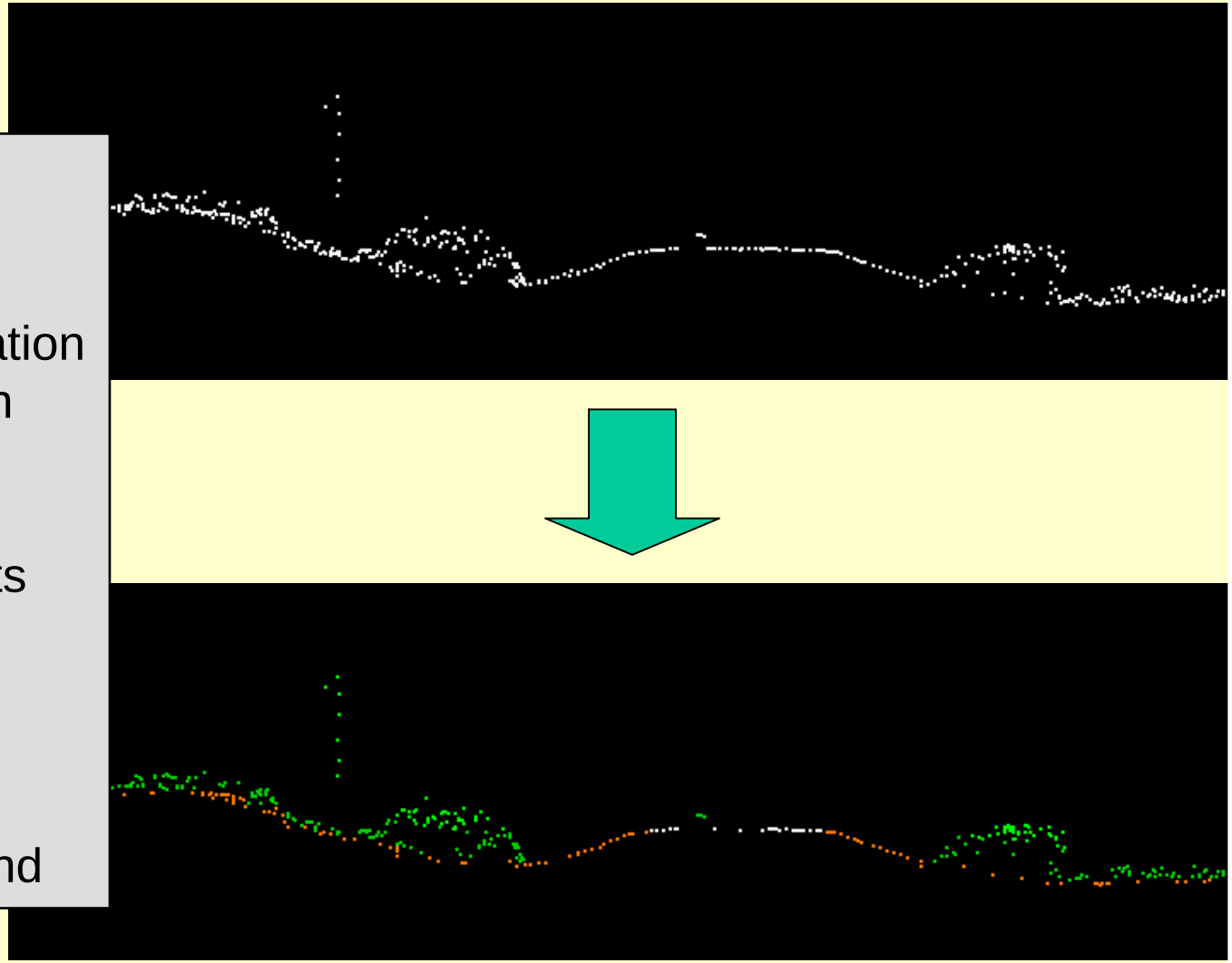




Point classification

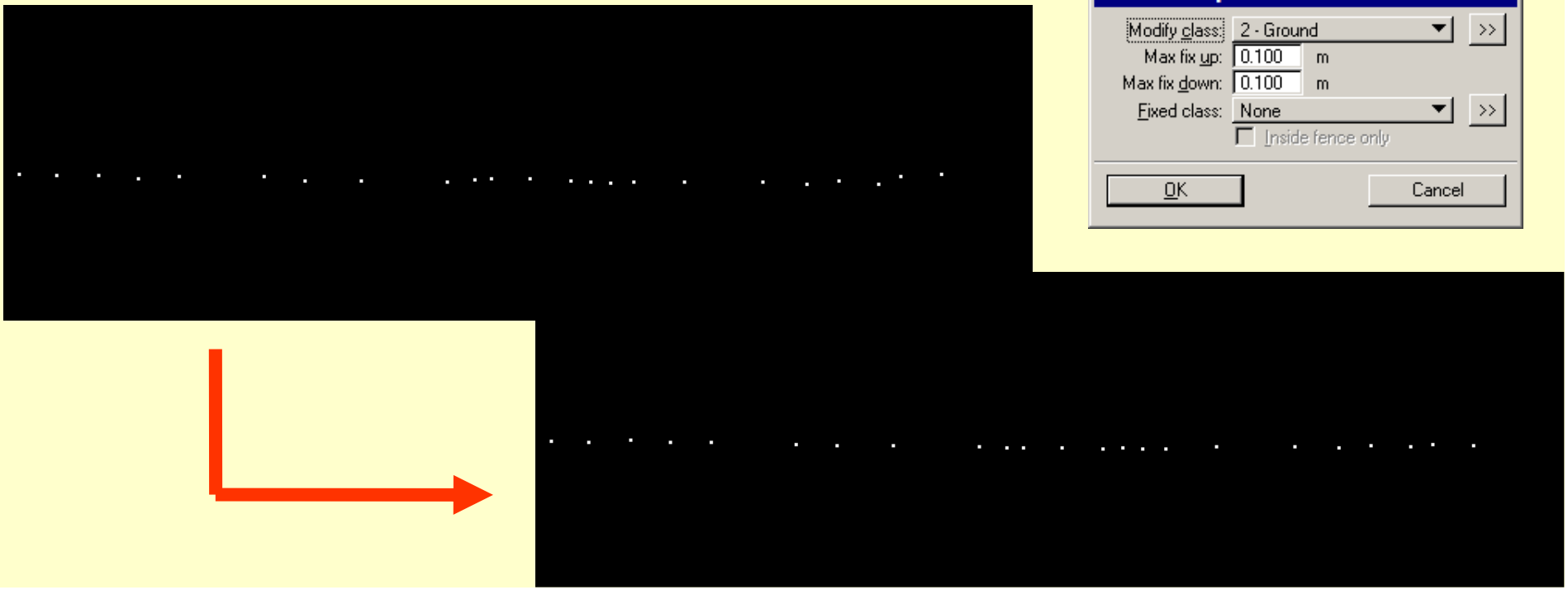
- Automatic and manual routines

1	Default
2	Ground
3	Low vegetation
4	Medium vegetation
5	High vegetation
6	Building
7	Low point
8	Model keypoints
9	Vector building
10	Bridge
11	Wire
12	Tree
13	Breakline ground



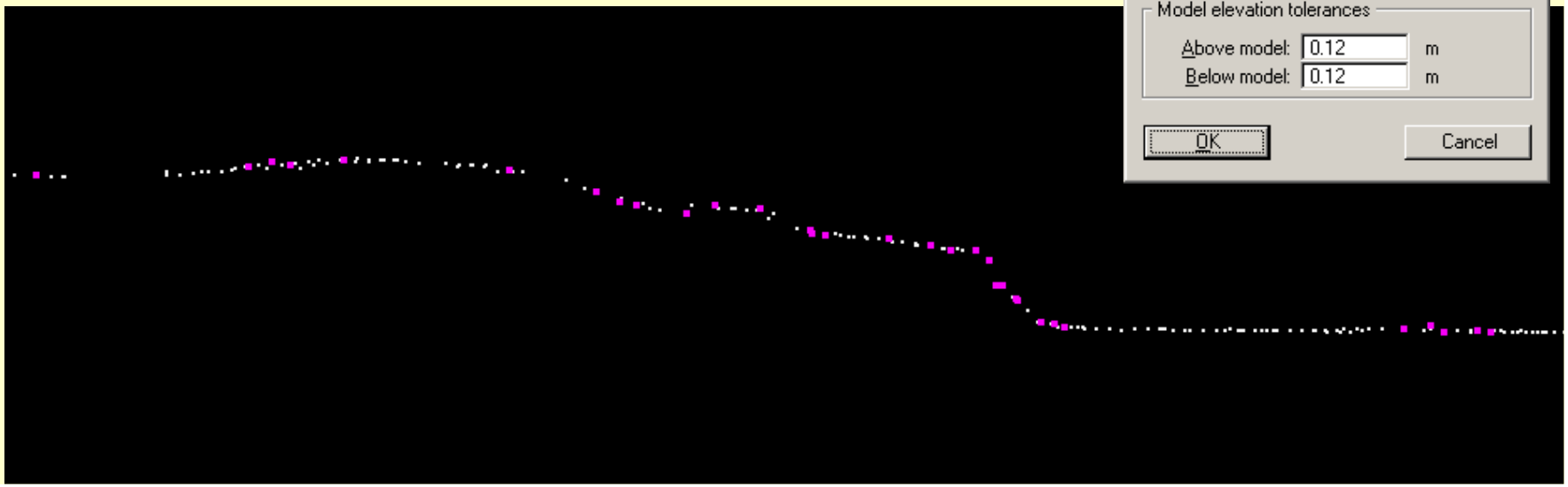
Smoothing

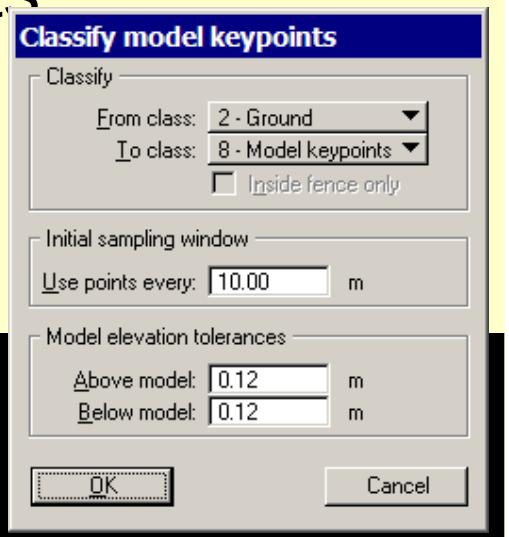
- Laser data is dense but noisy
- Smoothing modifies point elevations in places where that produces a smooth surface
- Produces a prettier surface



Model keypoints

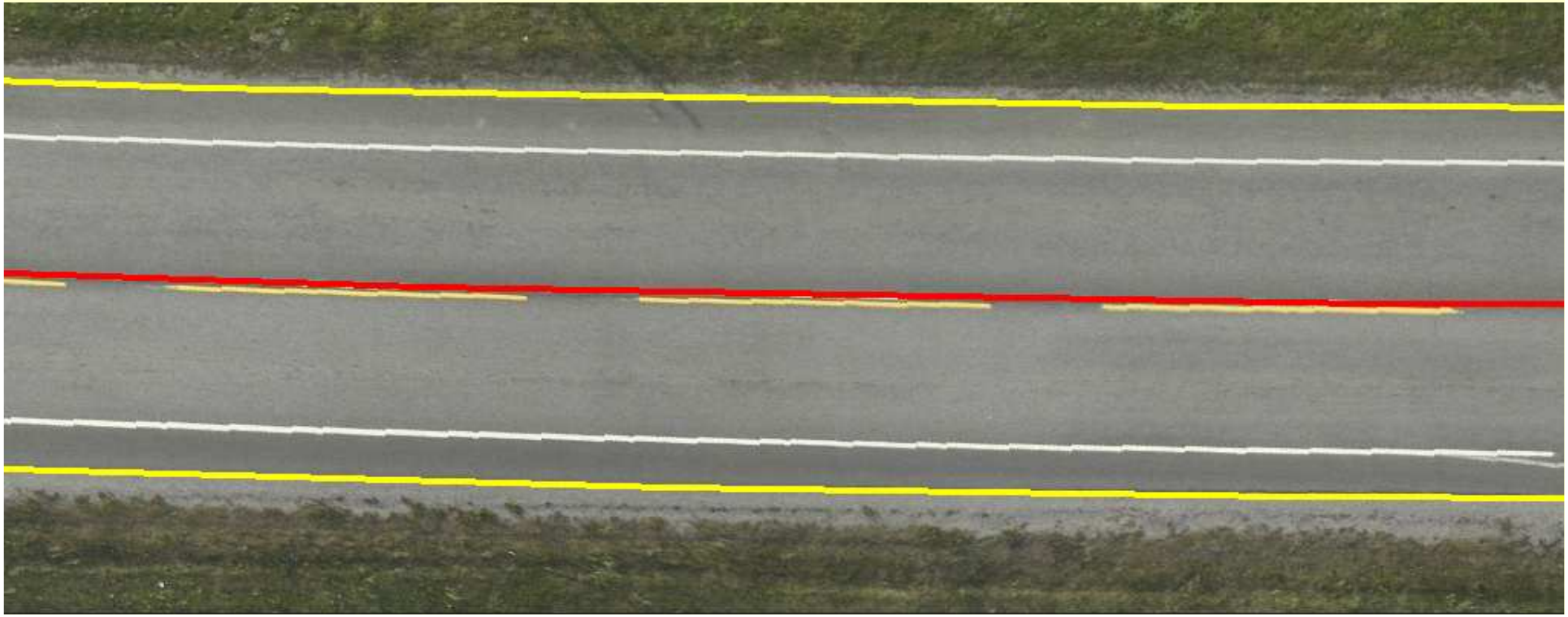
- Selects points which are most relevant for creating a triangulated surface model
- User specifies maximum difference between keypoint TIN and ground laser points





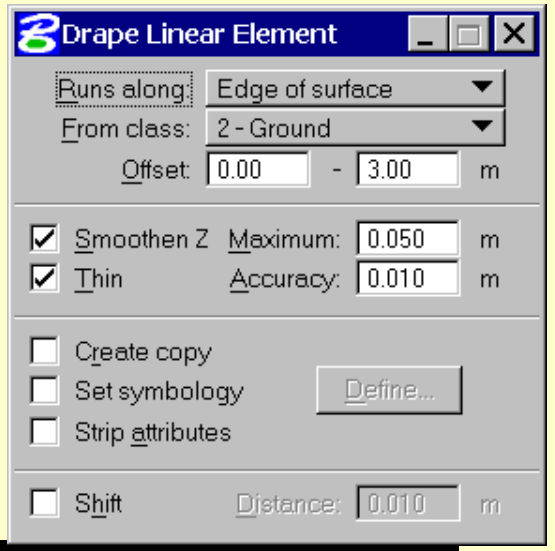
Vectorizing Breakline Features

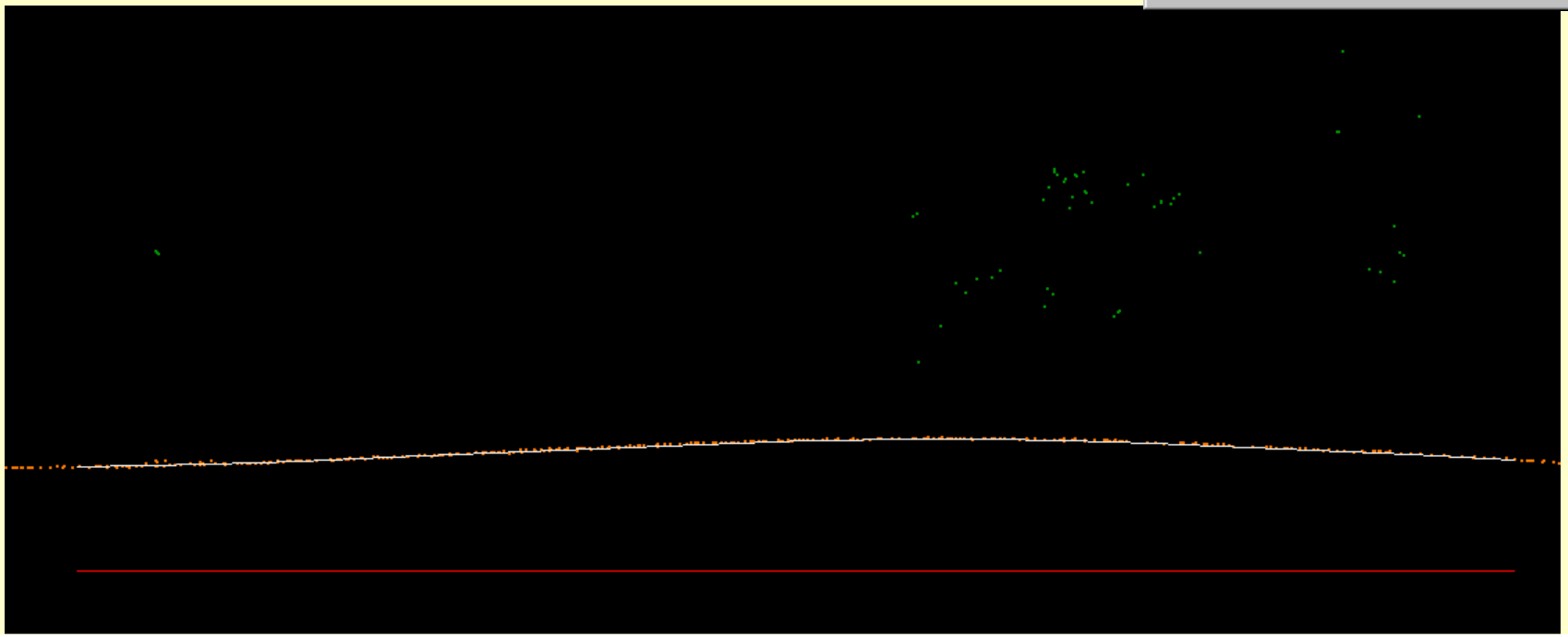
- Draw road feature in 2D using on top of ortho
- Drape to follow laser surface



Vectorizing Breakline Features

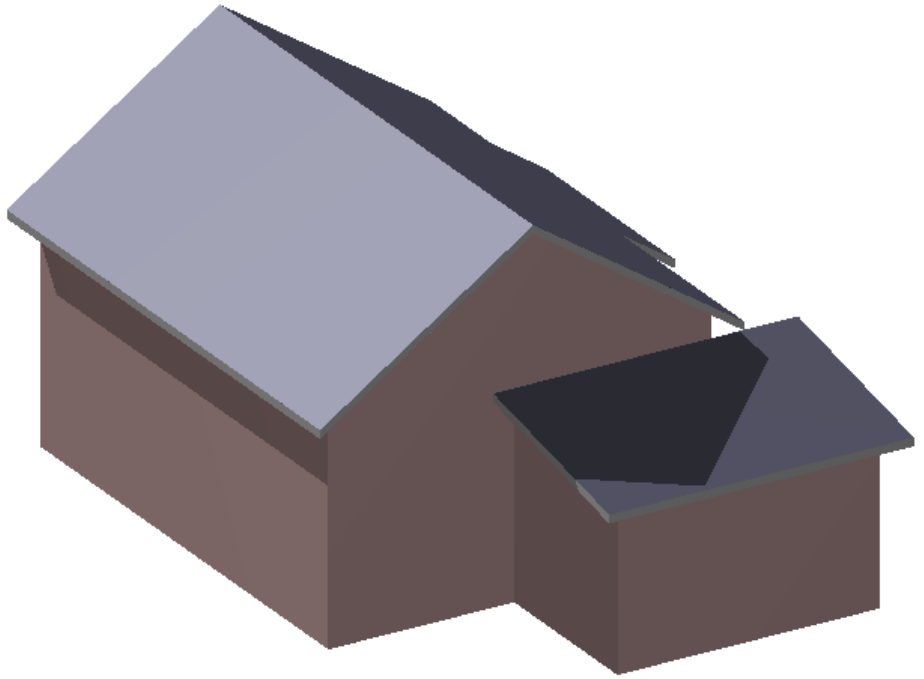
- End result is a 3D vector which follows the general laser surface
- Logic written for and makes use of high density of laser data





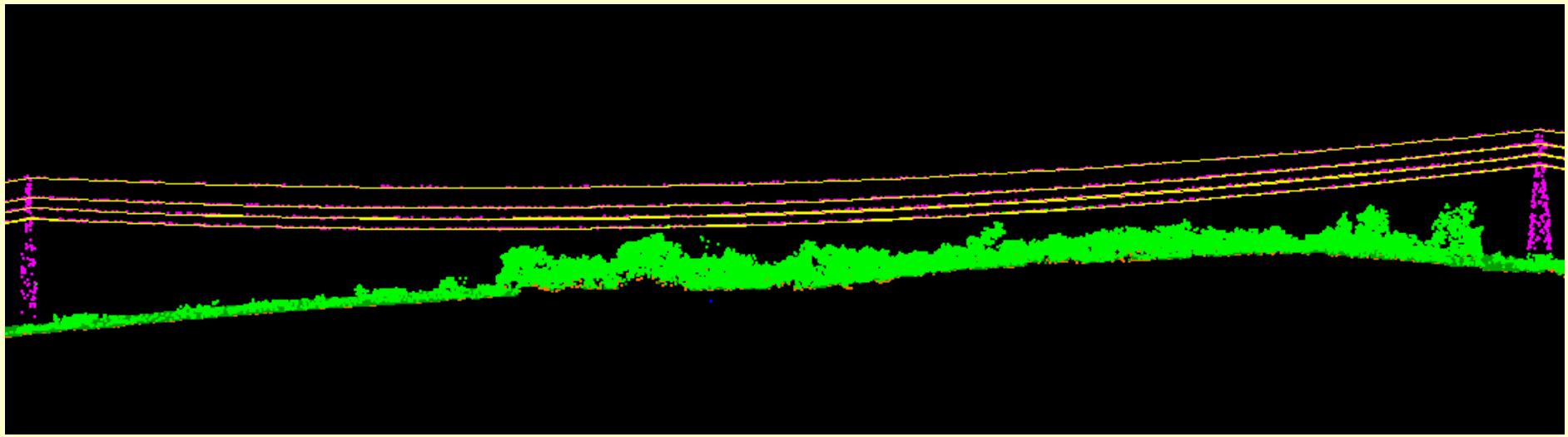
Vectorizing buildings

- Approximate models -- automatic
- Accurate models – require manual work
- User modifies edges
  with the help of
  camera images
- Resulting 3D model
  has walls starting from
  below ground

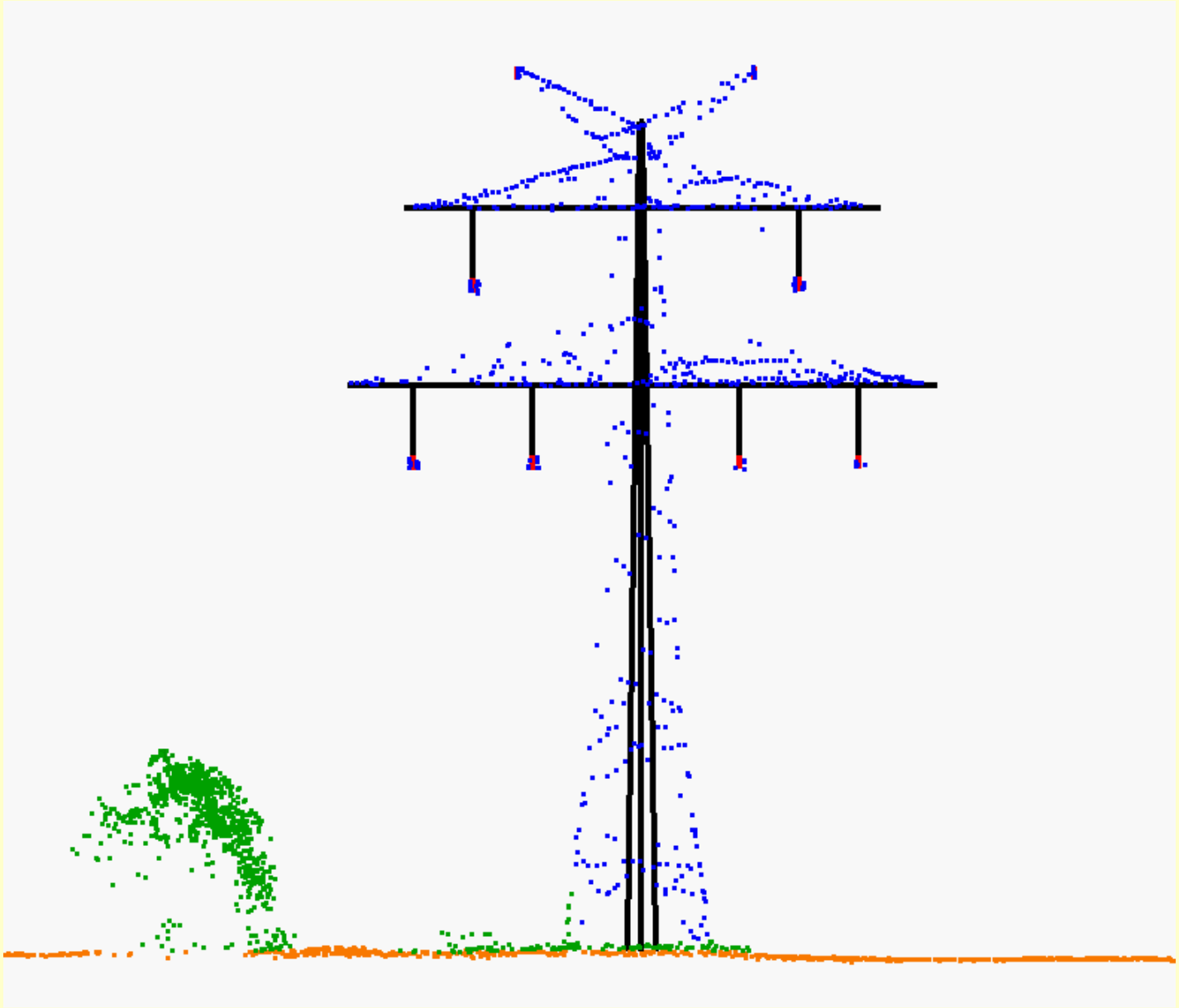


Vectorizing transmission lines

- Goals:
  - Mapping of towers and wires
  - Search danger trees
  - Modeling for increased capacity
- One or more cameras during flight



Tower & laser points



Tower & vertical facing camera

TerraPhoto task

TerraPhoto for MicroStation

- Produce orthorectified images
- Provide perspective views for
  - laser data classification
  - building vectorization
  - powerline tower vectorization

TerraPhoto for MicroStation or TerraPhoto Viewer

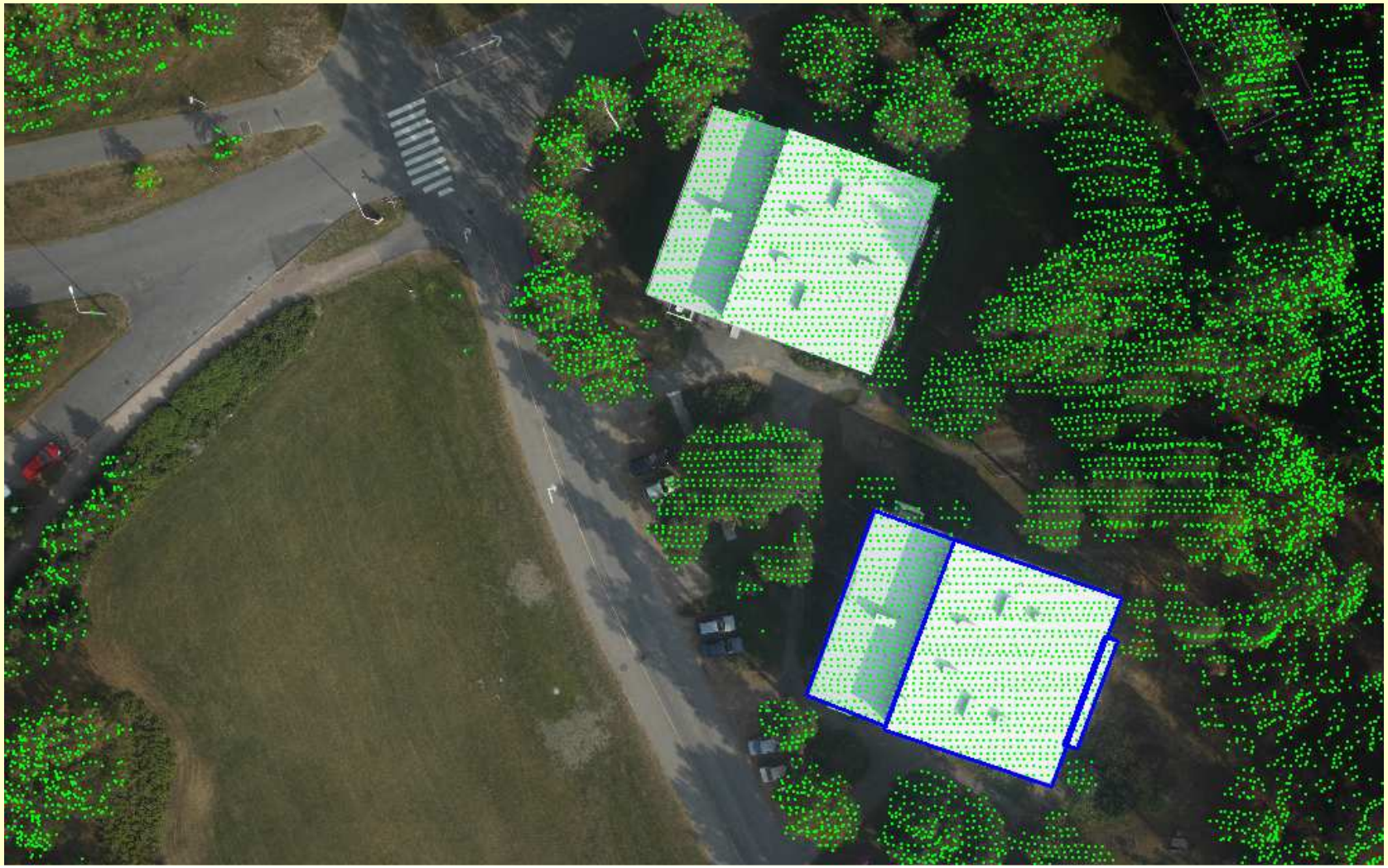
- Display background raster images
- Render scenes with large image volume
- Produce flythru animations

TerraPhoto

- Written for digital cameras integrated with laser scanners
- Assumes raw positioning for images is good
  - computed from GPS/IMU
  - best systems provide one pixel level raw positioning
- Does not need any known points
- Uses laser surface as the rectification surface
- Can derive all camera parameters

Perspective view principle

- View the world as seen by one camera image
- Viewer eye is at camera focal point xyz
- Compare any 3D information against the image



Perspective views

Building vectorization