Trimble Remote Sensing Suite

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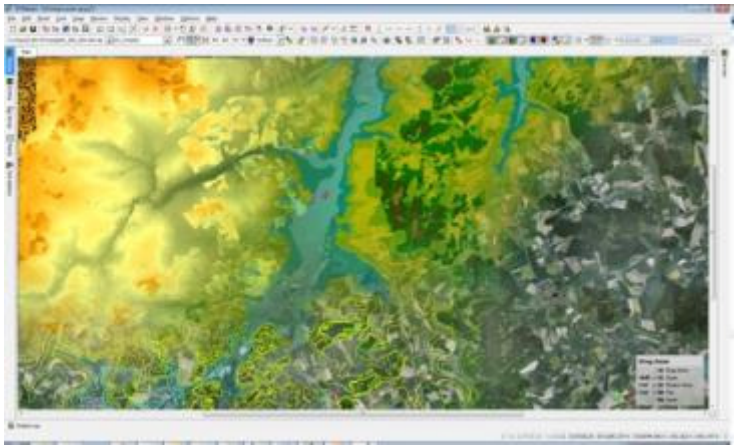
Gyöngyös, october 2015

Remote Sensing Trends

~350 Earth Observation Satellites are expected to be launched over the next decade (excluding the 150+ satellites that PlanetLabs will launch in 2016) *

Increased resolution; accuracy; lower data prices; and data availability are all contributing to increased use of imagery



Geospatial, Energy and Natural Resource Management industries continuing to expand applications using satellite imagery

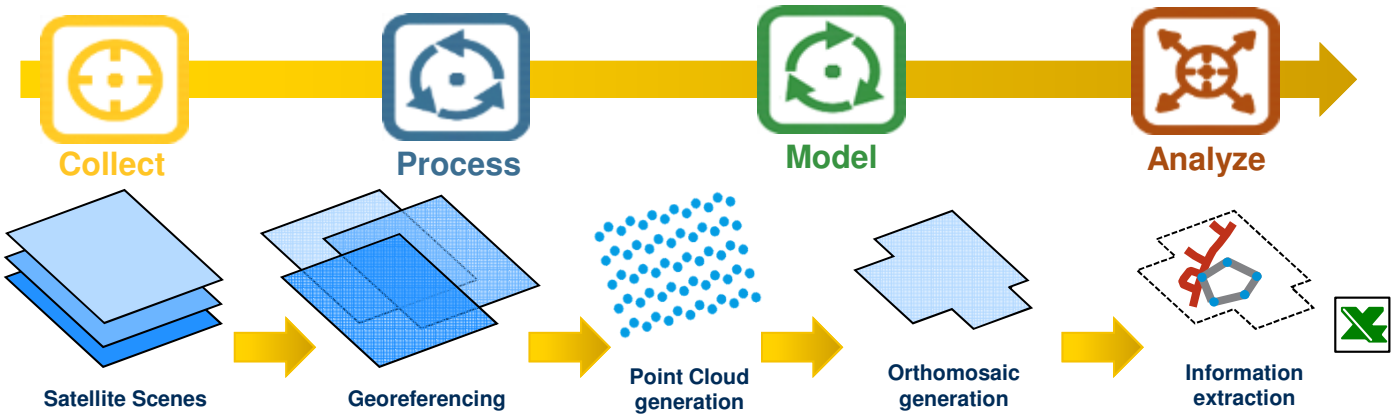
* EUROCONSULT 2014 - SATELLITE-BASED EARTH OBSERVATION MARKET PROSPECTS TO 2023

Trimble

Software Bundle designed to improve, accelerate and automate the creation and interpretation of geospatial information

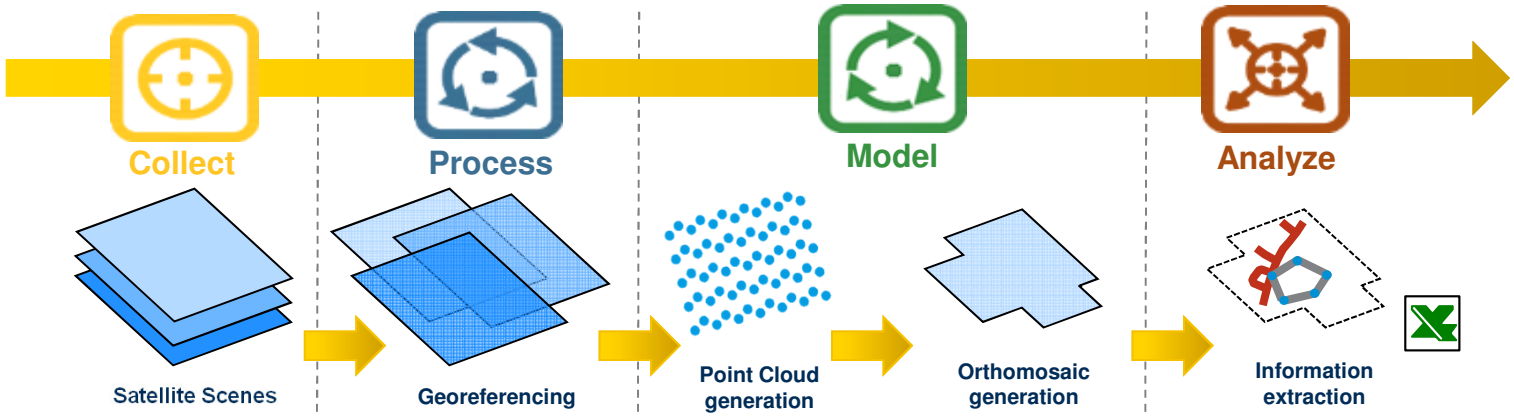
Introducing TRSS

→ Complete Satellite Data Processing, Modeling and Analysis Solution



- Addressing the needs of remote sensing professionals generating high quality data, models and analytics from satellite based imagery
- Streamlined and simplified workflow to efficiently extract highly valued information
- Use Cases: geo-referencing, point cloud generation, orthorectification, mosaicking, land cover mapping, change detection
- Application fields: Environmental, urban planning, agriculture, oil and gas, forestry and mining

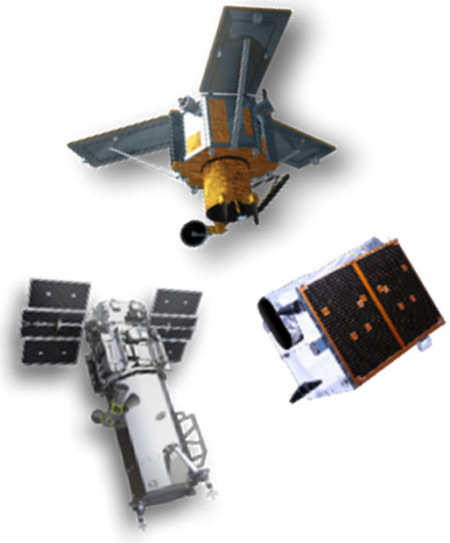
The TRSS Components



- Satellite Triangulation
- Single Scene Orientation

- Elevation Models (DSM/DTM)
- Ortho Images
- Image Mosaics

- GIS Vectors
- Classified Point Clouds
- Statistics/ Reports



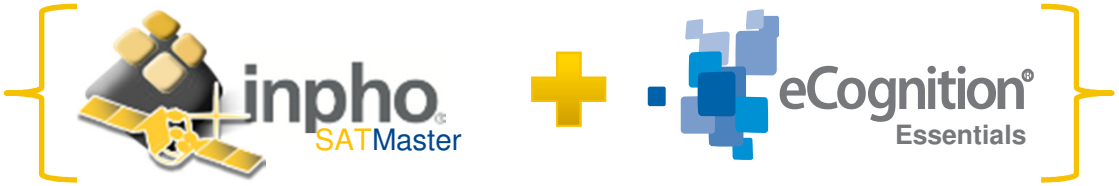
inpho SATMaster

eCognition®

Packaging

Trimble Remote Sensing Suite (TRSS) components:

TRSS BASE:



TRSS ADVANCED:

Upgrade paths from existing licenses available.

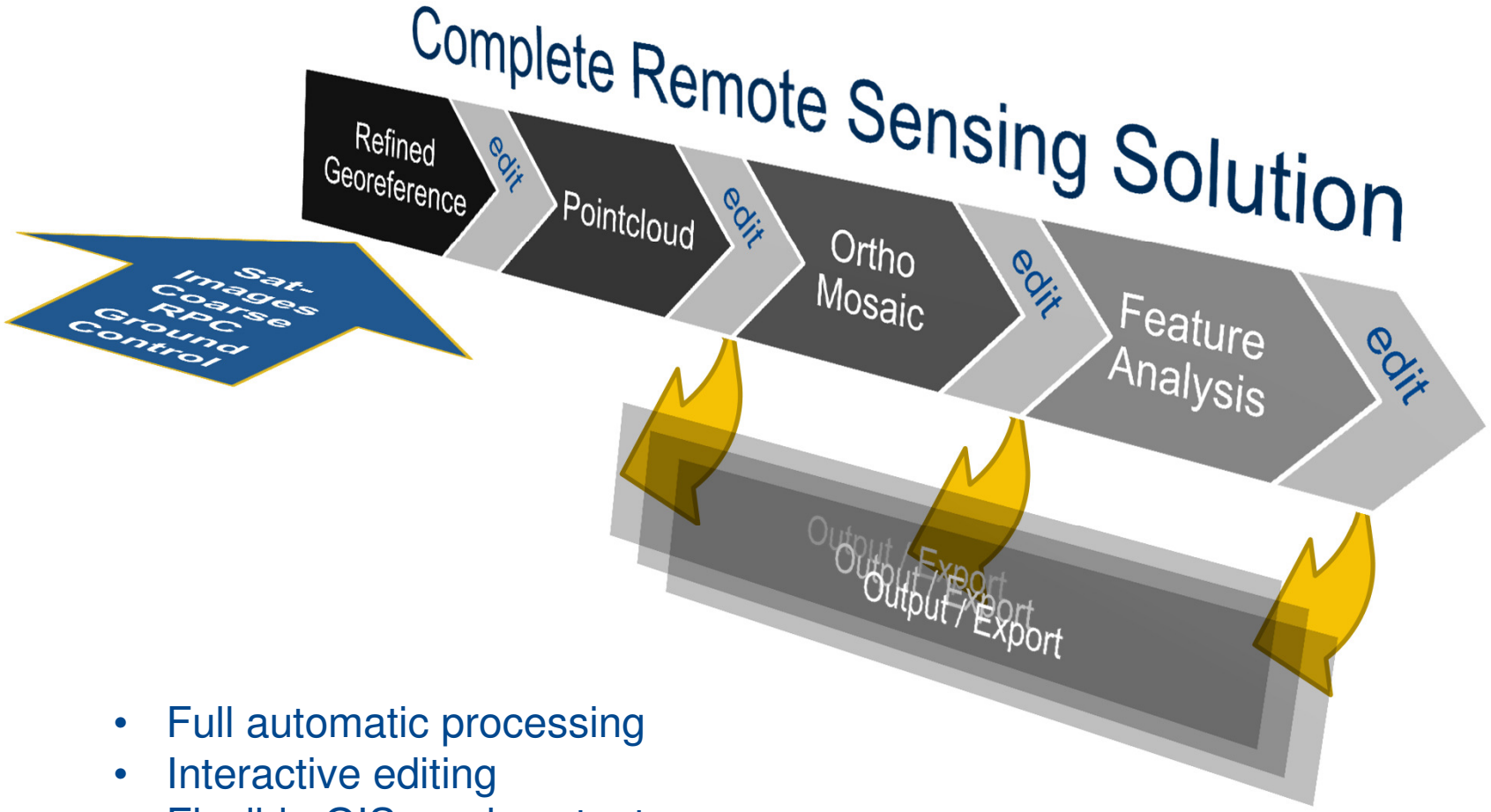
Target Customers & Industries

- Customer Profiles
  - Remote Sensing Professionals
  - Image Analysts & Cartographers
  - GIS Analysts
- Government Organizations
  - Agriculture & Forestry
  - Urban Planning
  - Environmental Monitoring / Climate Change Groups (REDD++ programs)
- Photogrammetry companies extending their business to satellite image processing and value adding
- Existing eCognition customers working with satellite imagery and having the need to
  - increase geospatial accuracy
  - generate DTM/DSM from satellite data
  - Create high quality orthomosaics

WORKFLOW & TECHNOLOGY

TRSS BASE

inpho SATMaster + eCognition Essentials

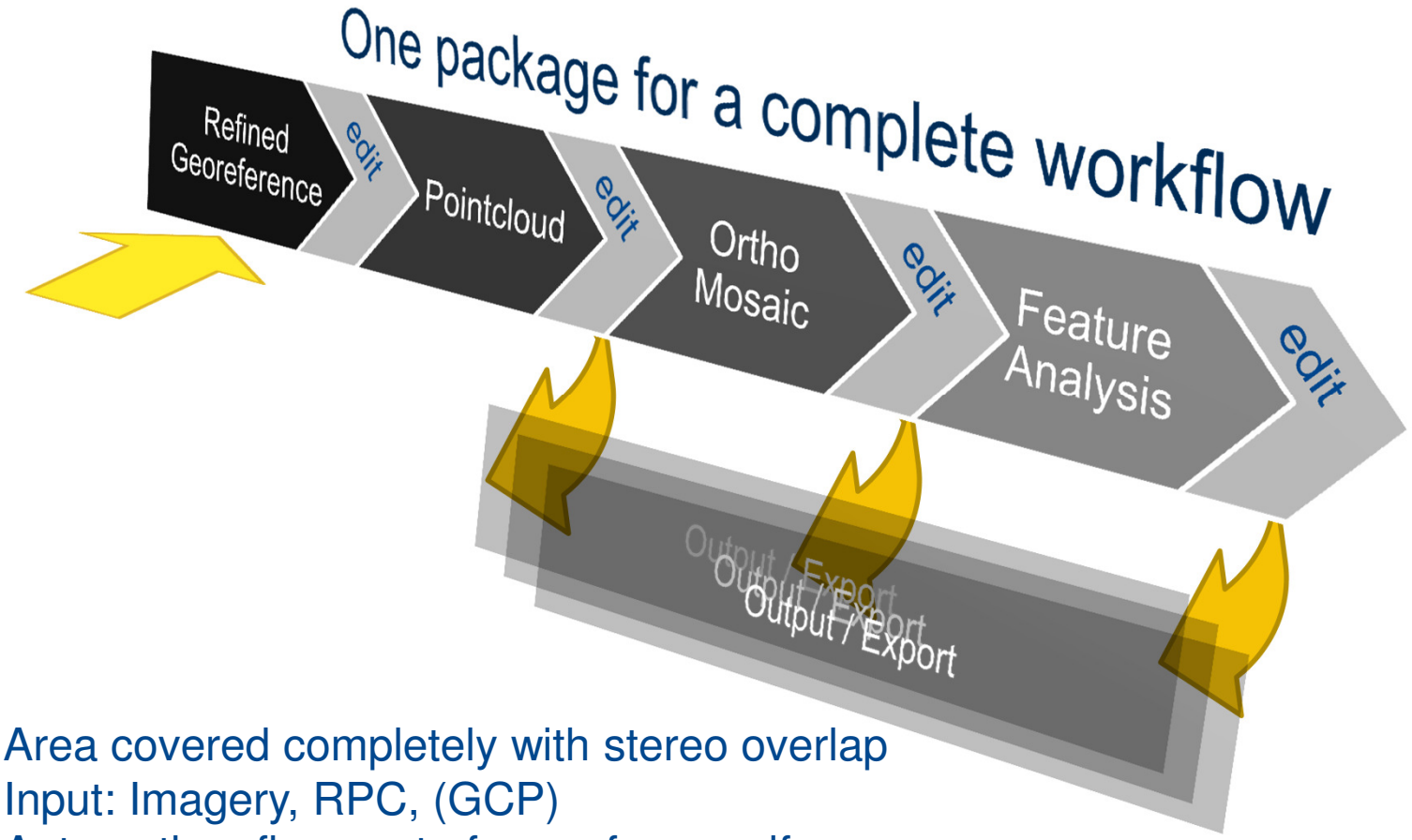


- Full automatic processing
- Interactive editing
- Flexible GIS-ready outputs
- Automatic landcover and change detection analysis

Supported Input Satellite Data

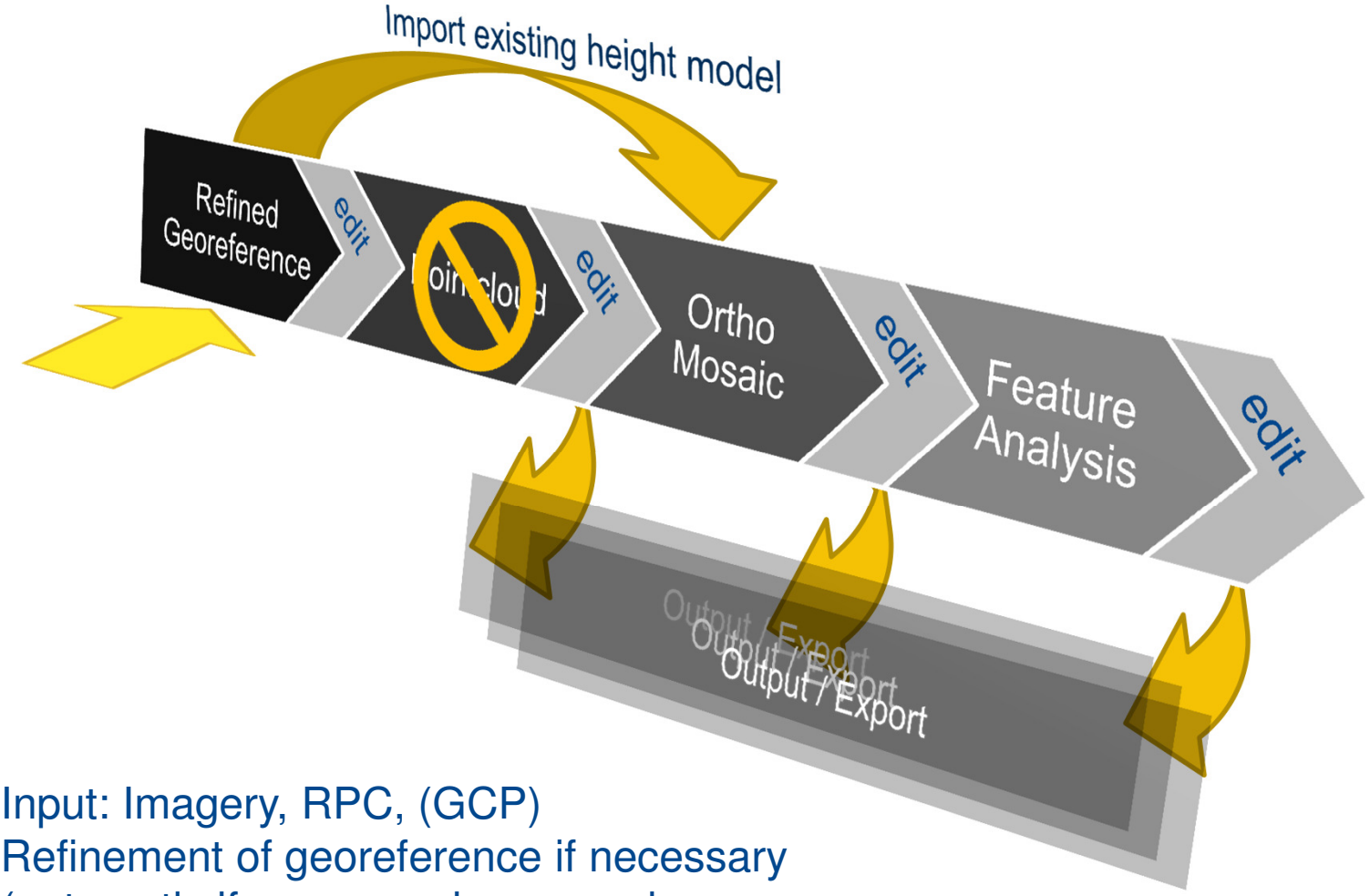
TFW / GeoTIFF satellite orthos, other satellites in RPC formats

Workflows with stereo coverage



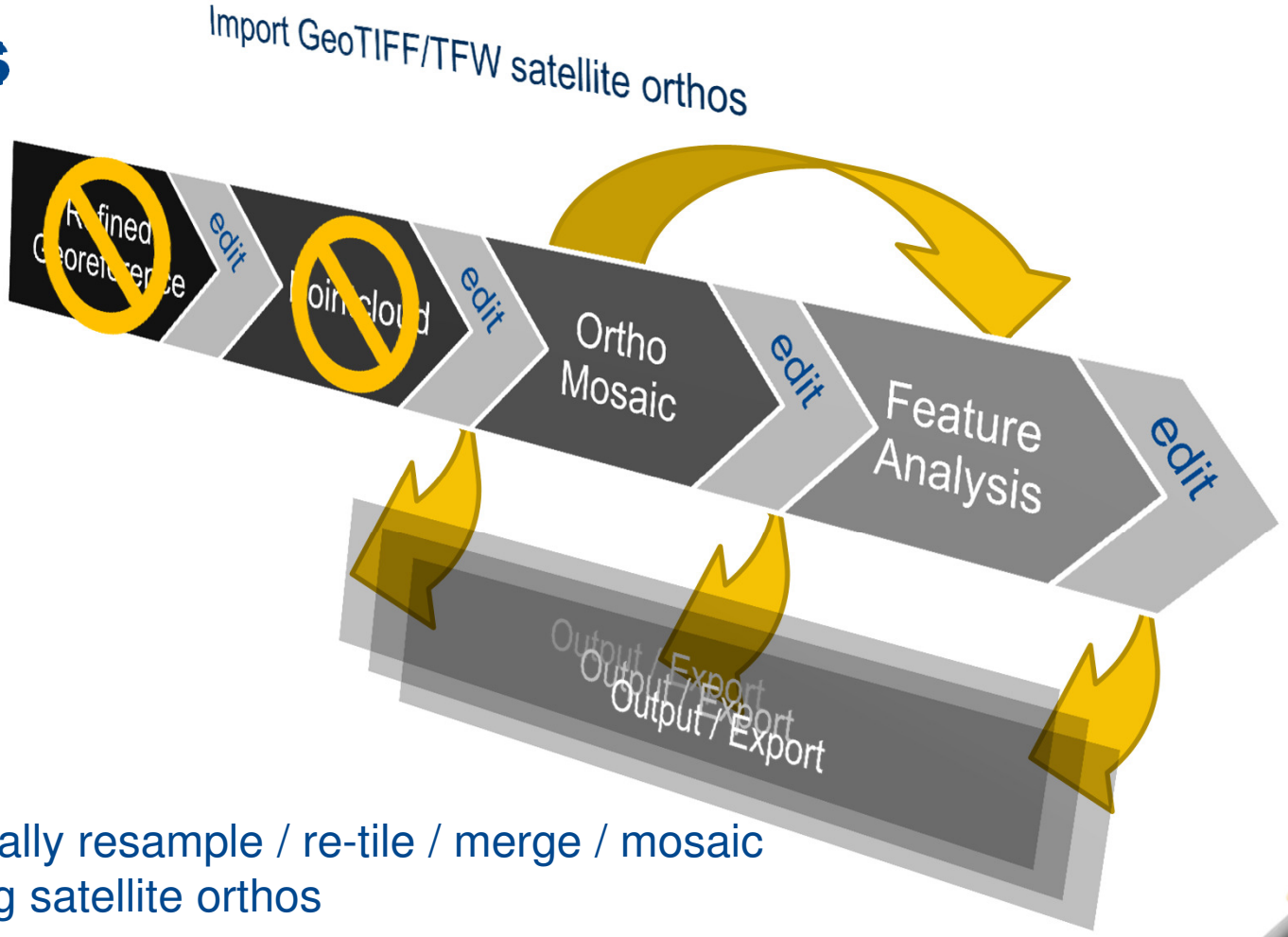
- Area covered completely with stereo overlap
- Input: Imagery, RPC, (GCP)
- Automatic refinement of georeference if necessary

Workflows without stereo coverage



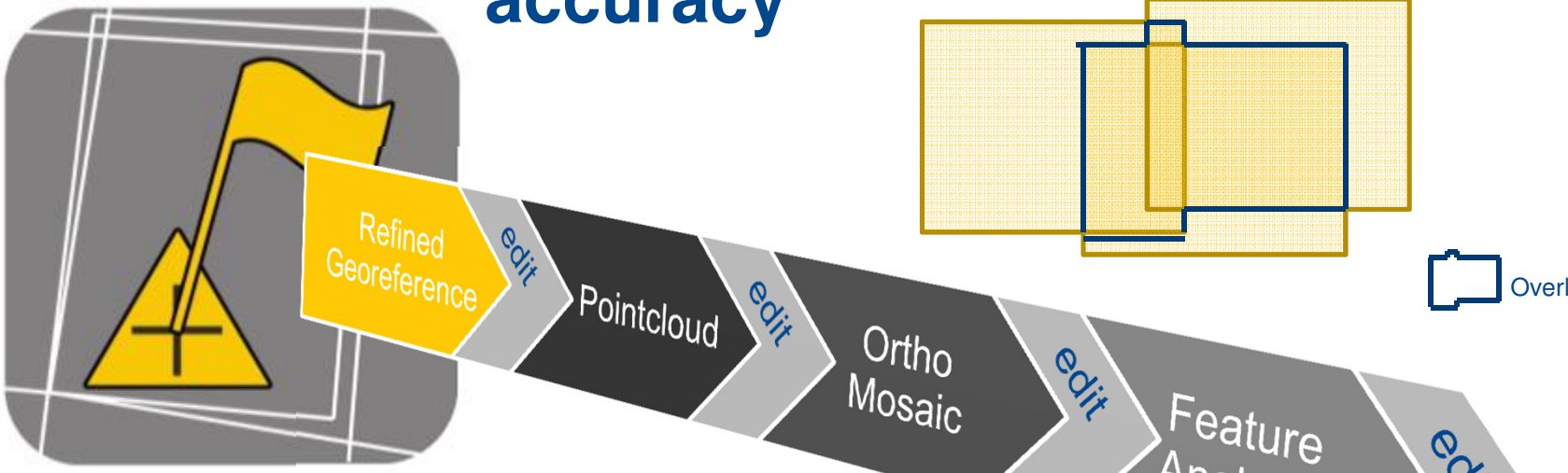
- Input: Imagery, RPC, (GCP)
- Refinement of georeference if necessary (automatic if monoscopic scenes have some overlap, alternative: single scene orientation)
- Alternative input: orthorectified scenes with RPC

Workflows with GeoTiff/TFW satellite orthos



- Optionally resample / re-tile / merge / mosaic existing satellite orthos

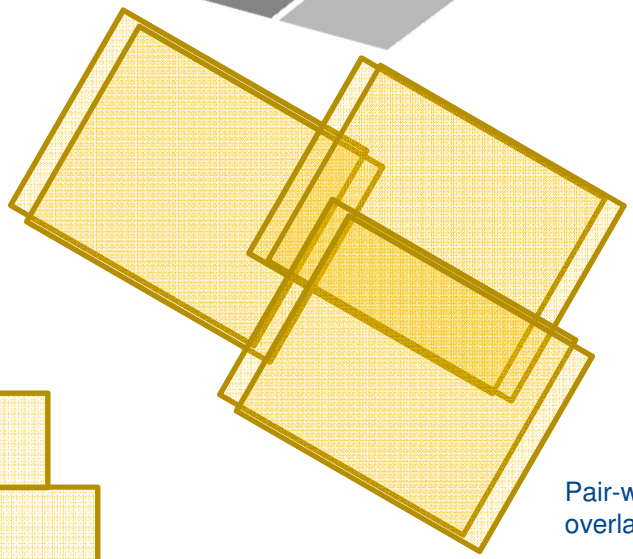
Refine Georeferences to 10x more absolute accuracy



Overlapping Area

Bulk-Georeferencing / Satellite Triangulation

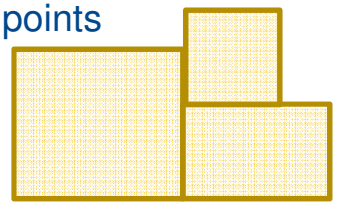
- Suitable for scenes with stereoscopic overlap
- Automatic tie point matching in overlapping areas
- Absolute positioning with ground control reference
- Rigorous quality assessment / visualisations
- Automated and guided interactive tools for picking additional tie points and ground control points



Pair-wise overlap

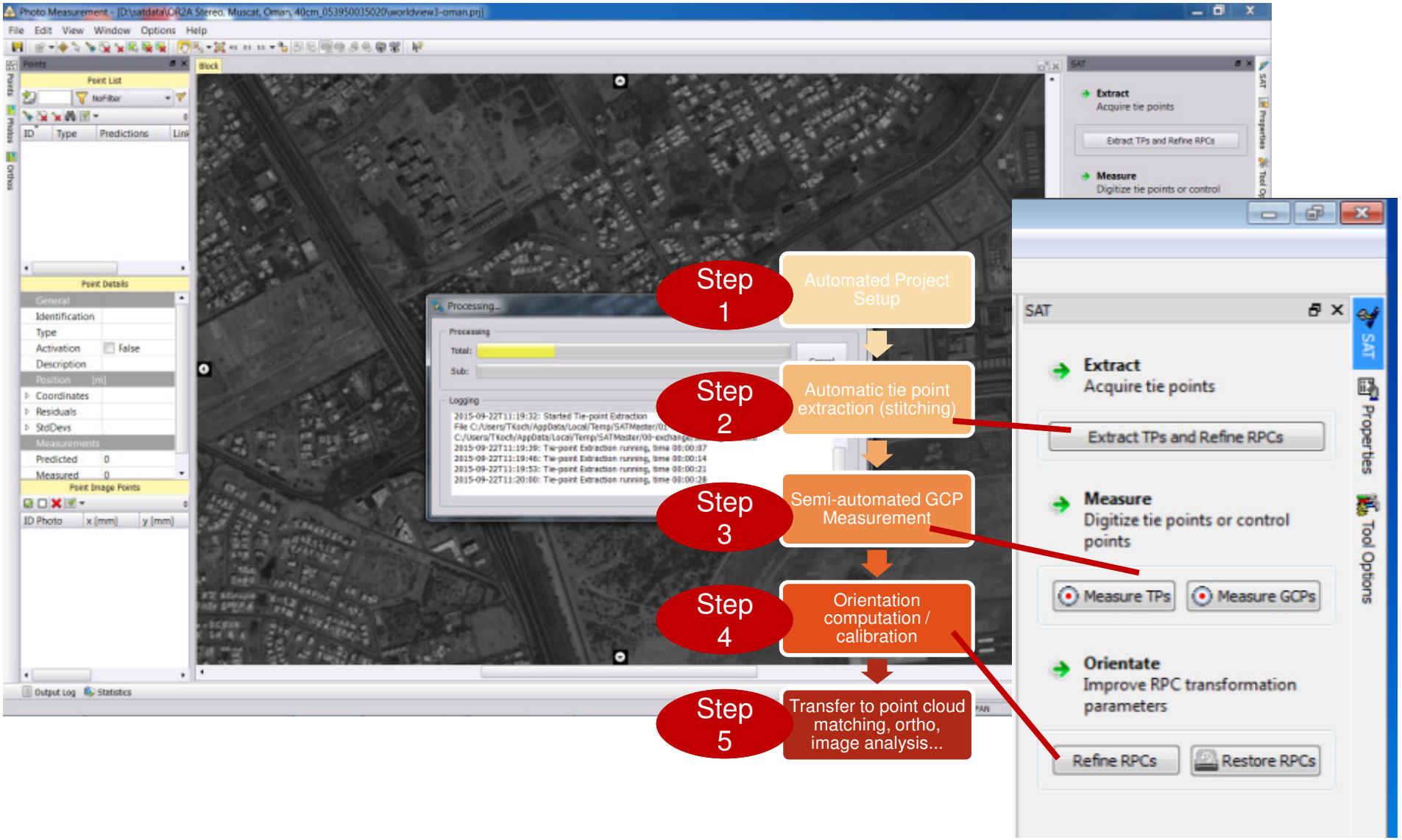
Single Scene Georeferencing

- Suitable for projects without stereoscopic overlap
- Single image adjustment based on ground control points

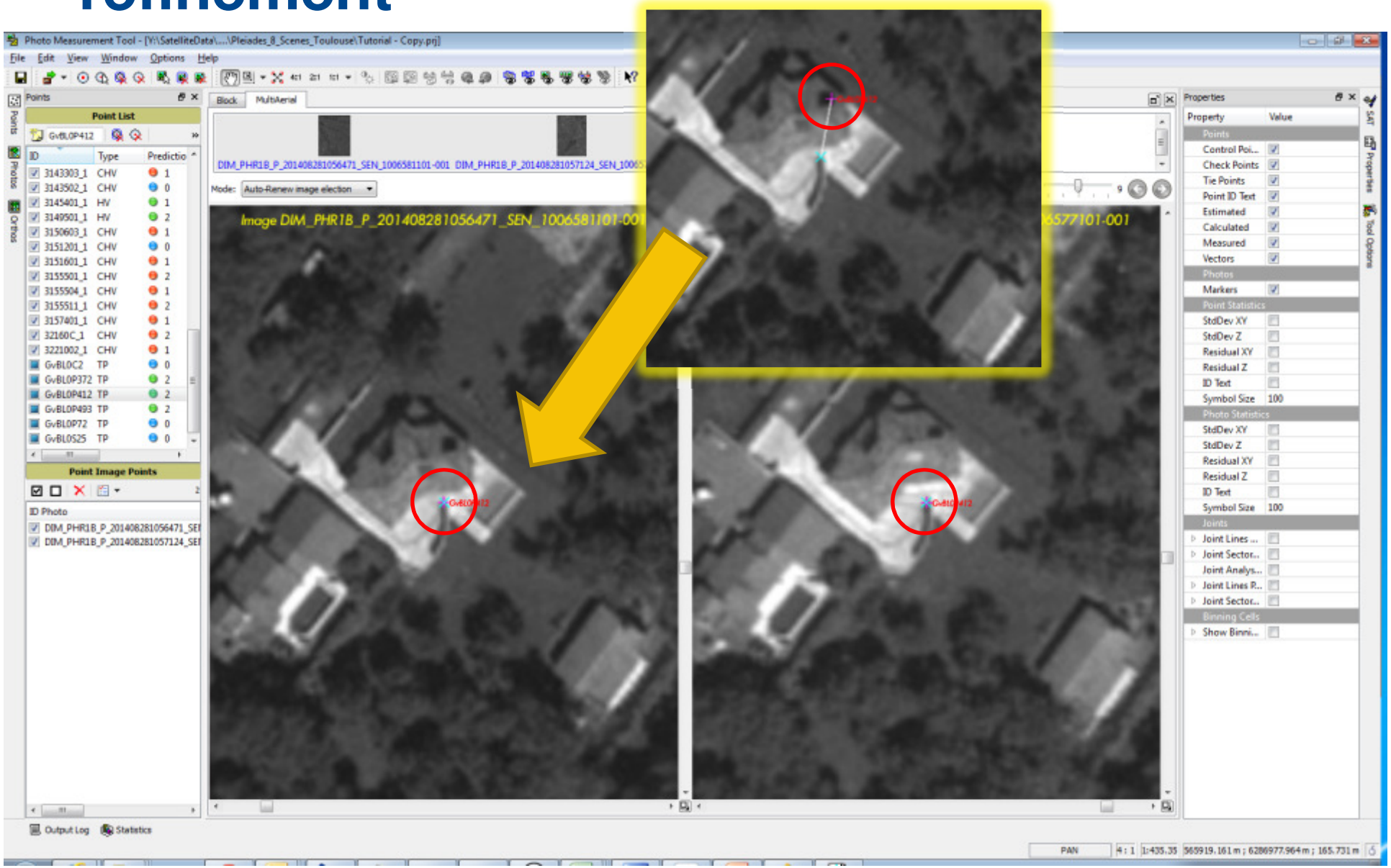


Single-scene Georeferencing

5 Steps To A Perfect Georeference

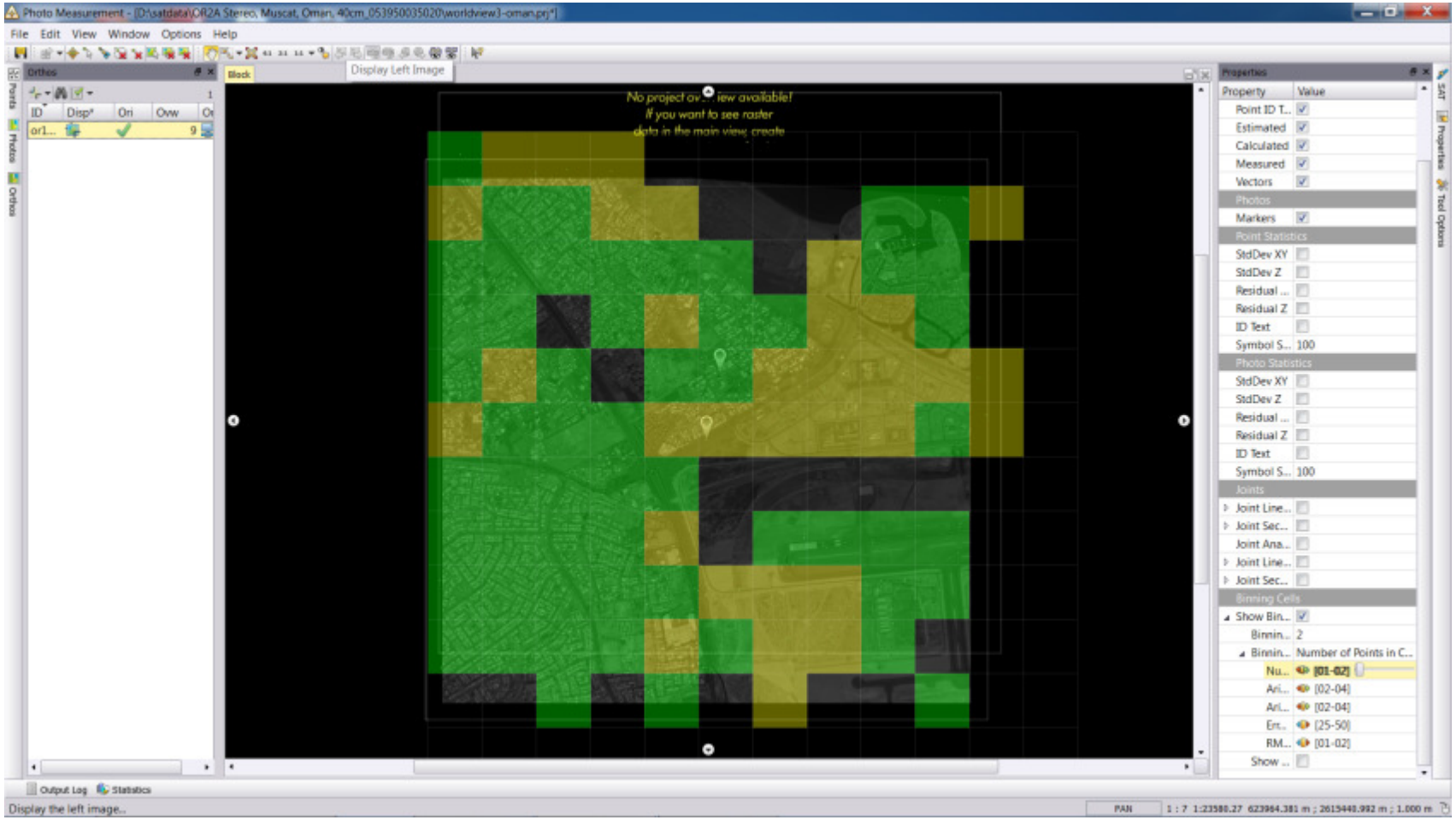


Projected GCP before and after refinement

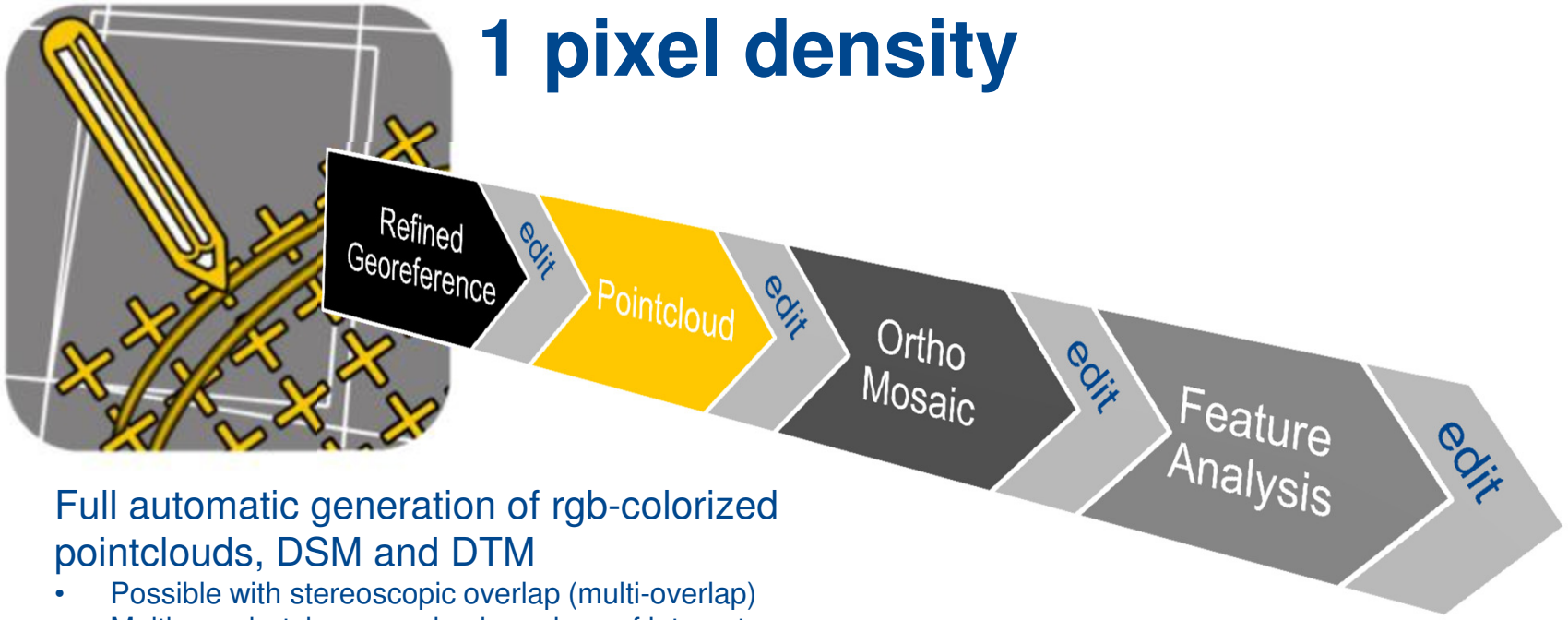


Automatic tie point extraction for georeferencing – Manual QC

- Tie point density analysis



Generate point clouds with up to 1 pixel density



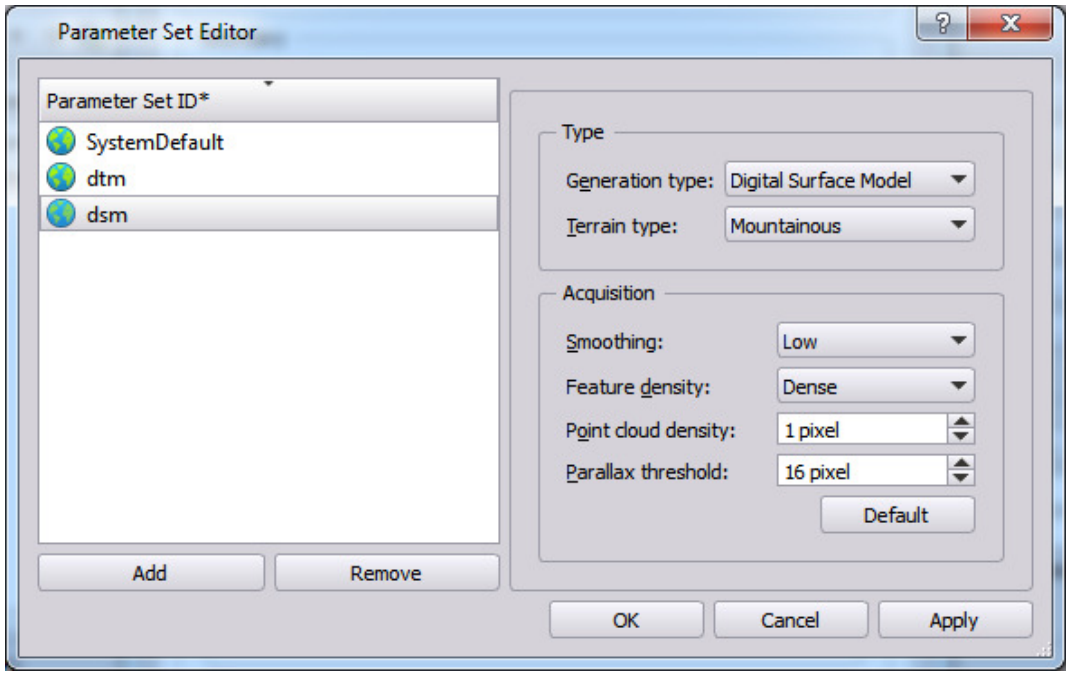
Full automatic generation of rgb-colorized pointclouds, DSM and DTM

- Possible with stereoscopic overlap (multi-overlap)
- Multi-area batch processing in regions of interest
- Optional tiling for huge volumes
- Consideration of morphological data (breaklines, exclusion etc.)
- Speed-optimized parameter sets

Including full featured point cloud editor

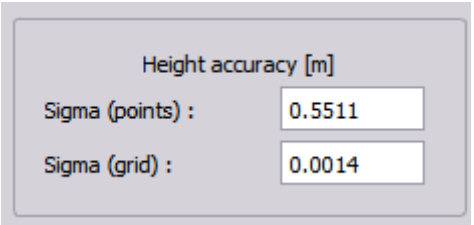
- CAD-like multi-layer/multi-file environment
- Automated and interactive guided mapping and editing tools (lines and points)
- Stereoscopic mapping tools as well as monoplotting capability (ortho+height model)
- Full automatic classification and filtering (project-wide or local brush operation)
- Multi-view high performance visualizations (shadings, online contouring, height coding, profiles, 3D stereo...)
- Mapping-grade contours and grid generation
- Tile-management

Point Cloud Generation – Extraction Types

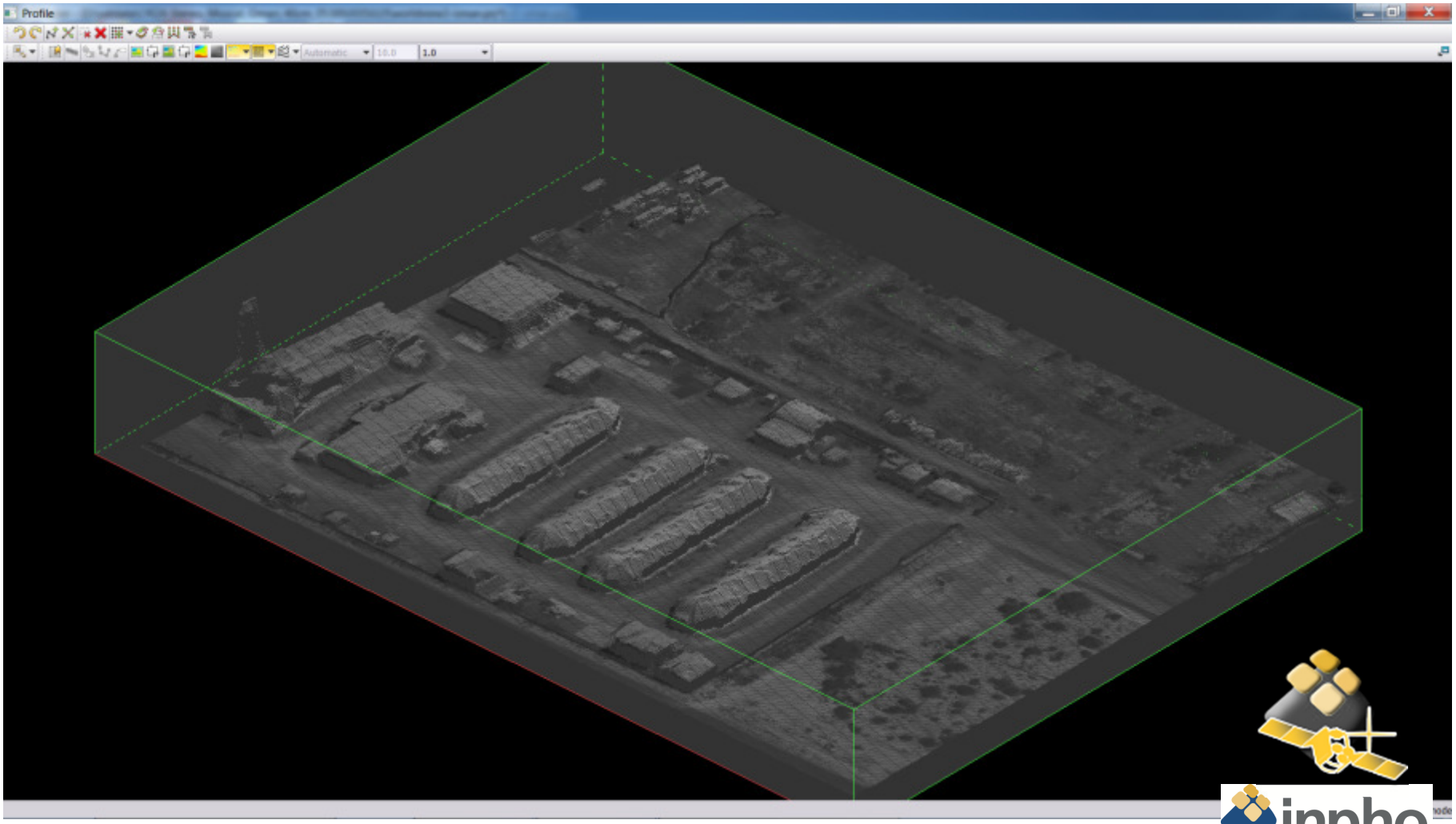


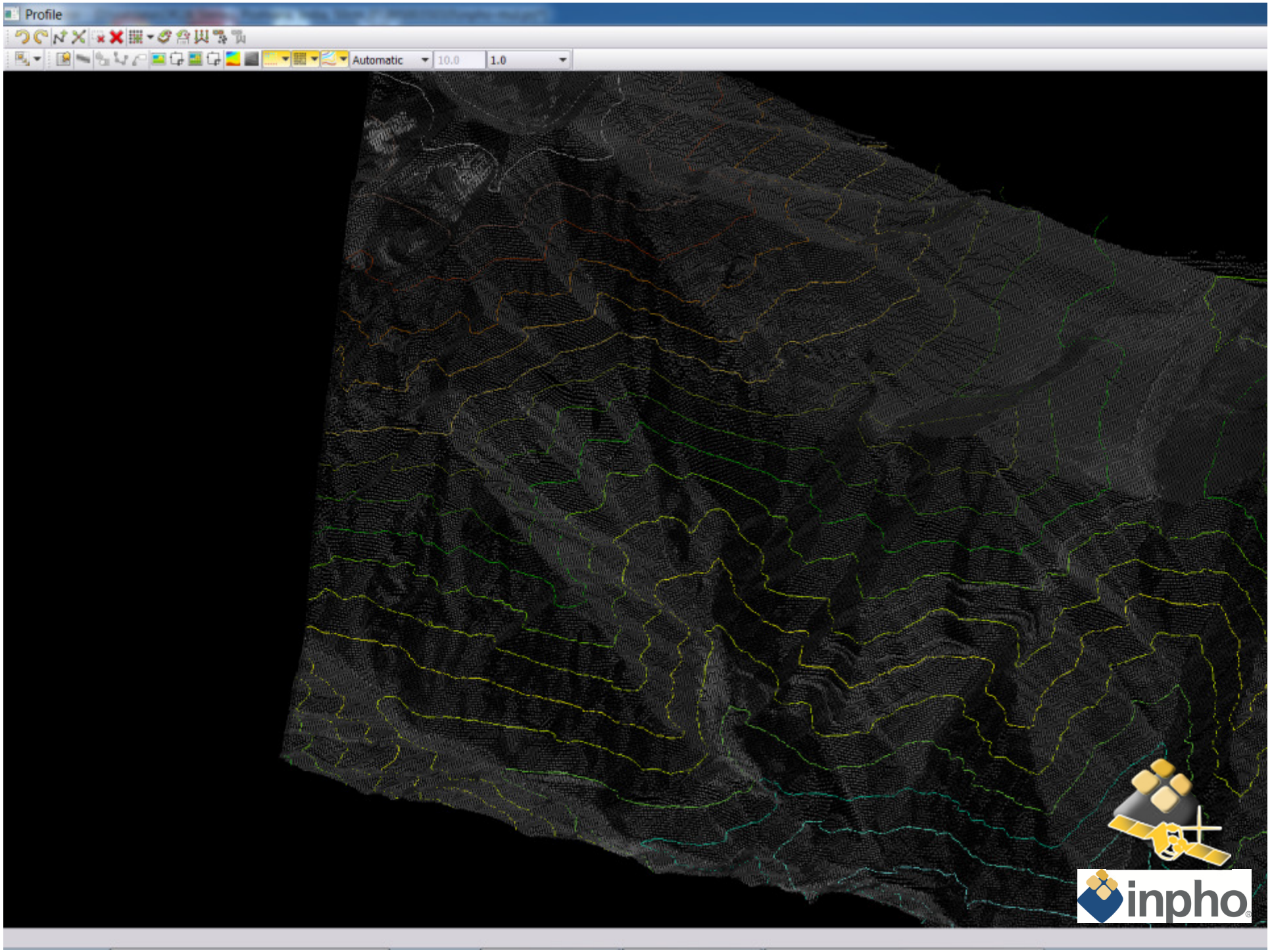
- Predefined and customizable quickselect parametersetup
  - DTM/DSM
  - Flat-undulating-mountainous terrain type
  - Up to 1 pixel dense pointclouds

- Processing with automatic adaptation of matching parameters for best possible results (failsafe strategy)



Dense Point cloud from WorldView 3

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Automatic
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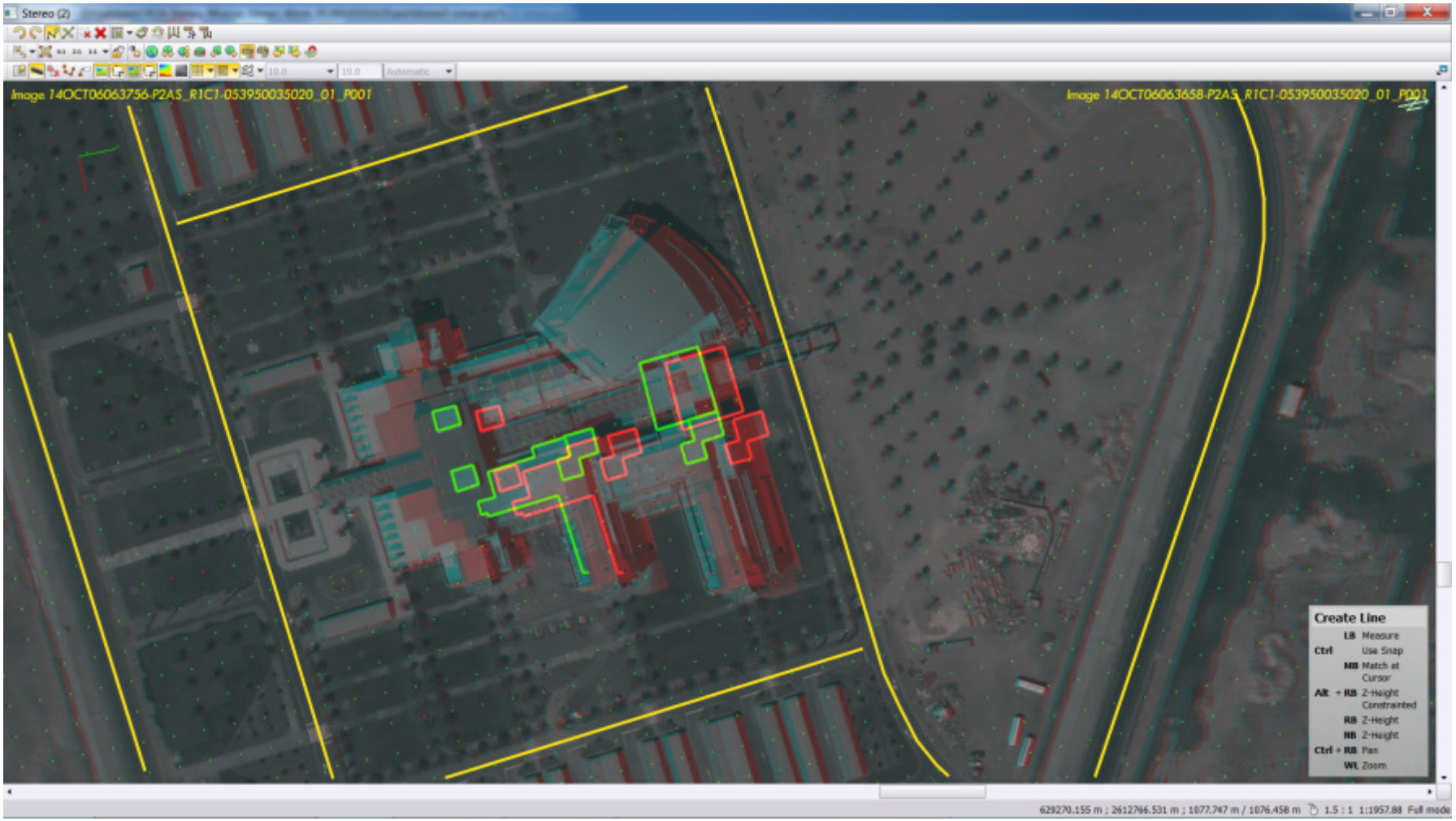
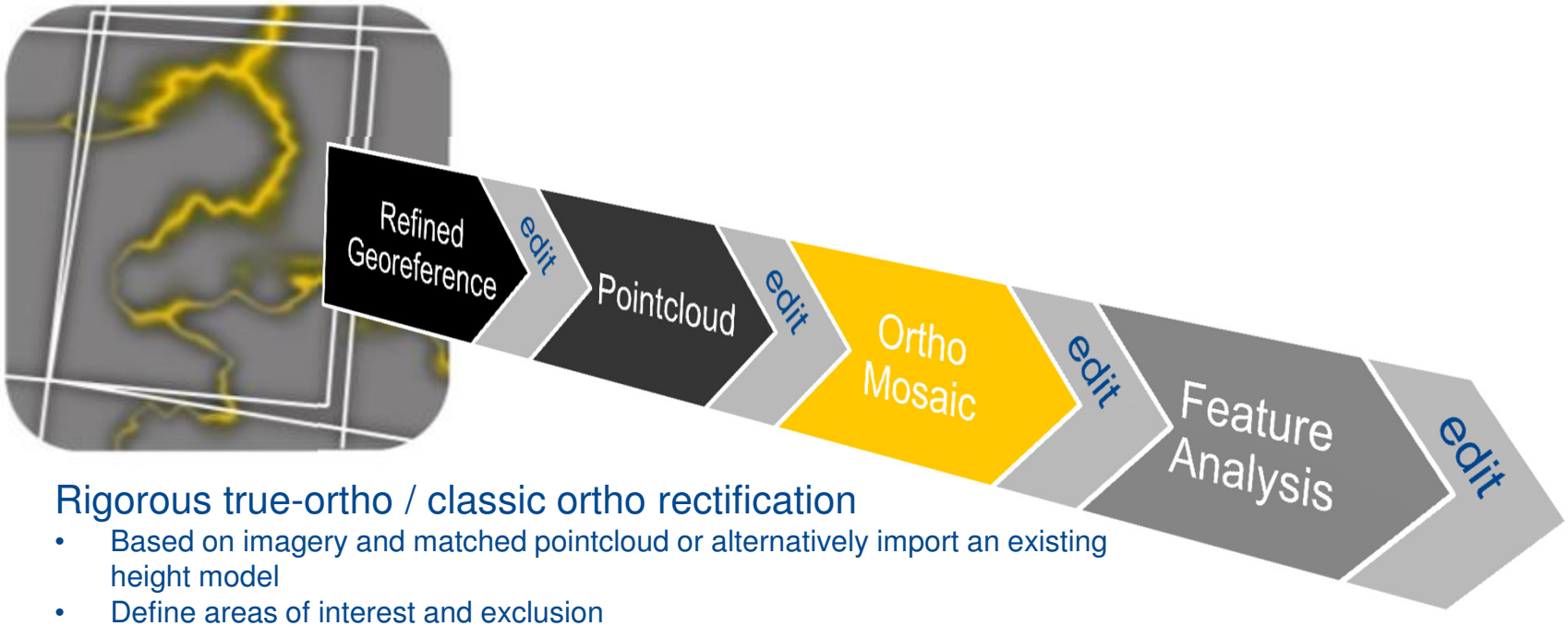
Stereoscopic or monoscopic data capturing and mapping



Homogeneous and seamless orthos



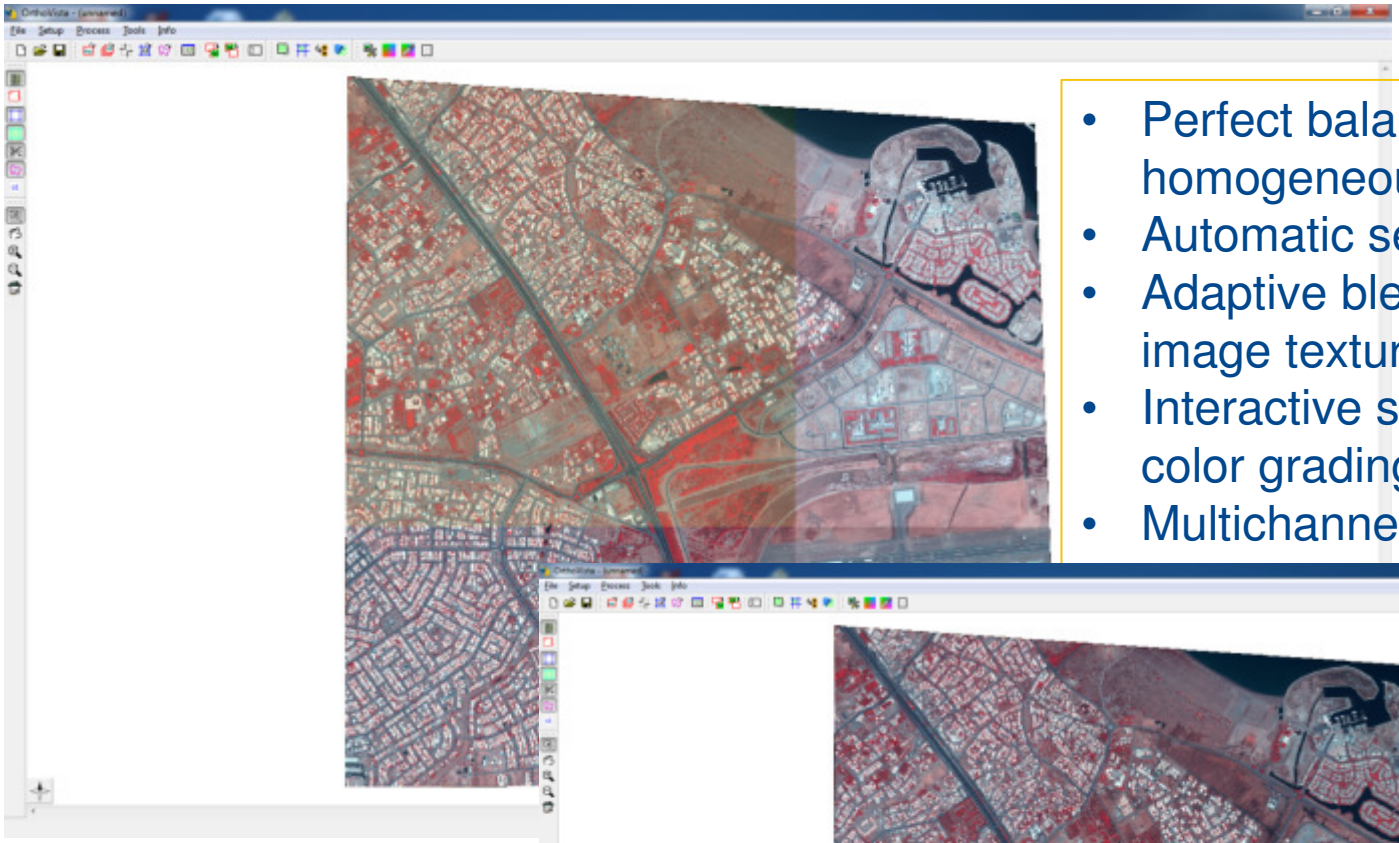
Rigorous true-ortho / classic ortho rectification

- Based on imagery and matched pointcloud or alternatively import an existing height model
- Define areas of interest and exclusion
- Full automatic batch operation

Homogeneous color-balanced mosaicking with automatic seam generation

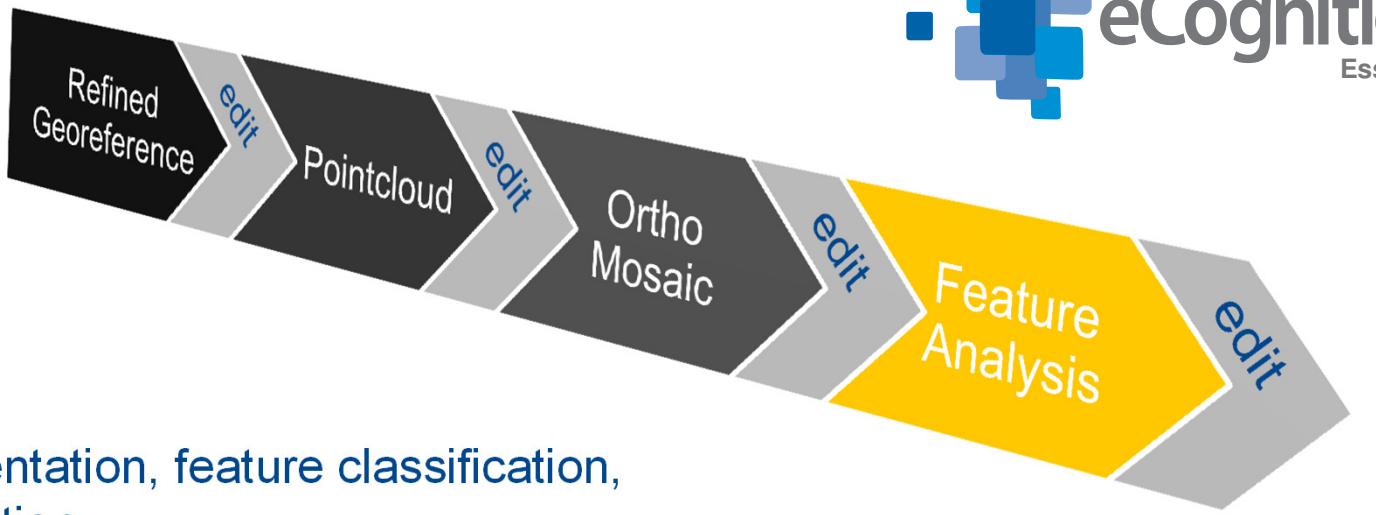
- Combine, merge, resample, color-edit orthos (from SATMaster workflow or alternatively import satellite orthos from other sources)
- Interactive and automated color grading
- Full automatic color matching and feature detection based seamline finding
- Adaptive mosaic blending through image texture analysis
- Flexible mapsheet definition
- Intuitive mosaic (seam-) editing workflow

Orthomosaic generation



- Perfect balancing for homogeneous mosaics
- Automatic seam detection
- Adaptive blending through image texture analysis
- Interactive seam editing and color grading
- Multichannel support

Automatic Feature Analysis



eCognition® Essentials

Image segmentation, feature classification, change detection

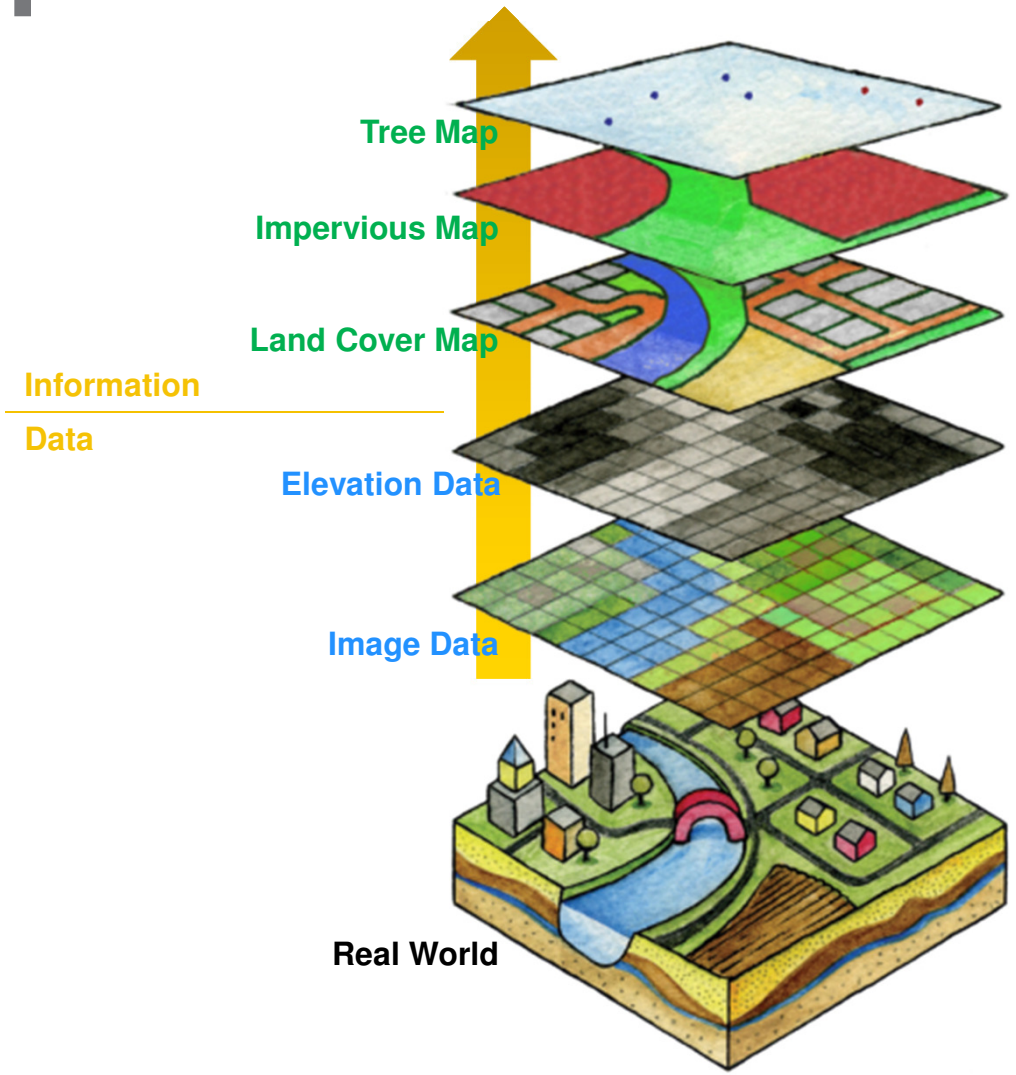
- The SATMaster process saves and provides all deliverables in an eCognition optimized format in order to guarantee a seamless processing to analyze workflow.
- Rely on pre-defined workflows and rule-sets from eCognition Essentials for landcover and change detection analysis.
- Optionally take full benefit of creating your own customized analysis rule-sets with eCognition developer/server – upgrading to the Trimble Remote Sensing Suite bundle.

eCognition Essentials and eCognition Suite

WORKFLOW & TECHNOLOGY

eCognition®

- **Analysis software for geospatial applications**
- **Enables users to automate the interpretation of geospatial data**



eCognition Products

eCognition® Suite

Developing & Analysis Platform

→ Enables users to develop and execute solutions to transform geospatial data into geo-information

eCognition® Essentials

Out-of-the-box Application

→ Allows users at any skill level to quickly produce GIS-ready land cover information from imagery

ECOGNITION ESSENTIALS

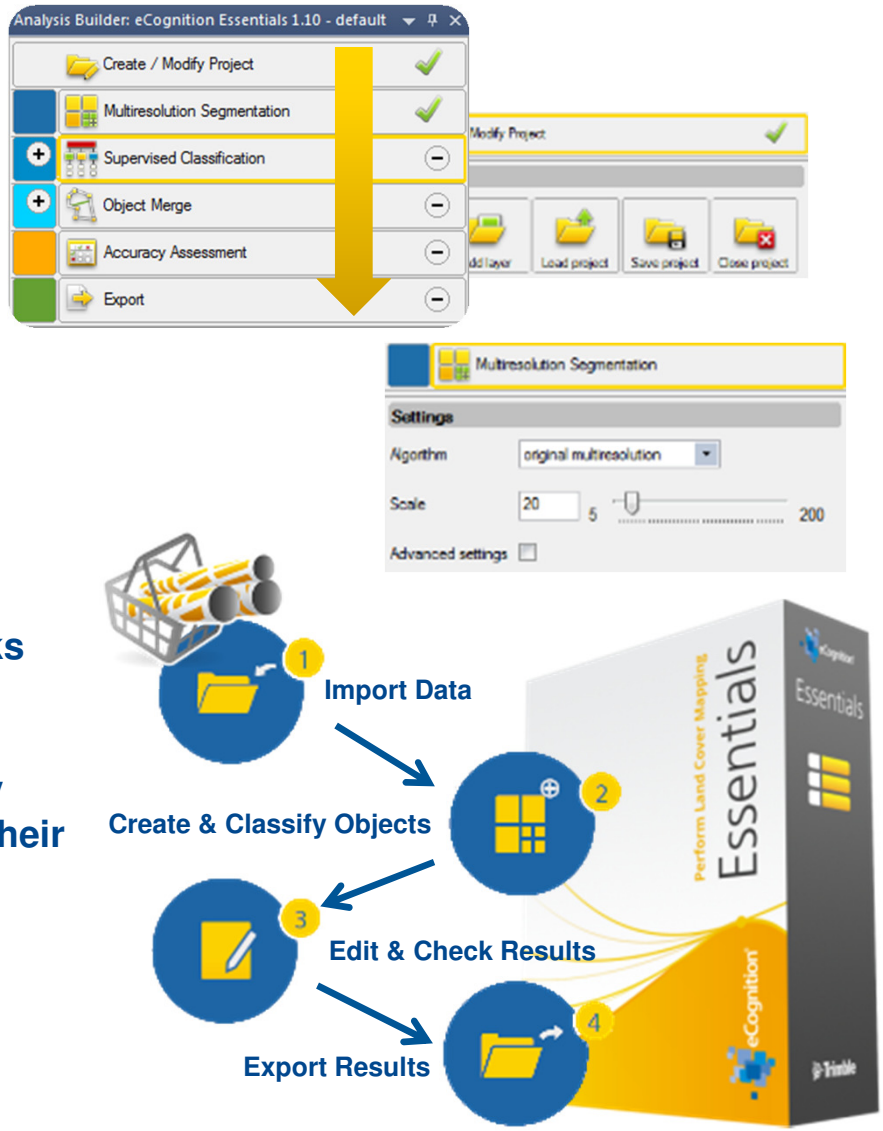
eCognition Essentials

- **Powerful out-of-the-box Land Cover and Change Detection Mapping solution**
- **Enables users at any skill level to quickly produce high-quality, GIS-ready deliverables from imagery**

eCognition Essentials

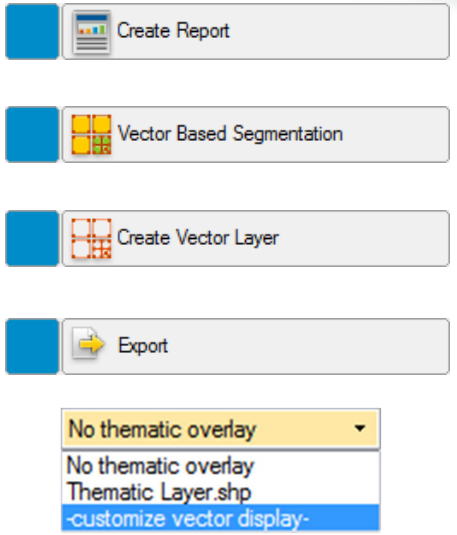
Key Features

- **Efficient Mapping**
  - Intuitive and easy-to-use mapping UI
  - Covers all mapping steps so that no additional analysis tools needed
  - → Little ramp-up time
  - → Rapid discovery and easy access to geospatial data via InSphere Data Marketplace
- **Guided Analysis**
  - Predefined and structured workflow blocks streamlines the efforts of imagery-based mapping tasks
  - The available components are specifically designed for the particular purpose, and their sequence is predefined as well
  - → Reduce complexity and focuses users on their specific tasks
  - → Increase productivity by UI guidance

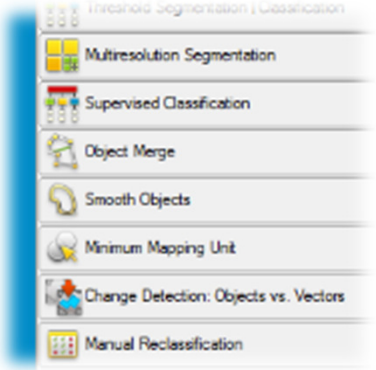


Customer Benefits

- **Low Ramp-up Time** → **Intuitive graphical user interface to perform land cover mapping and change detection on imagery**



- **Get work done faster** → **Guided and automated workflows for effectively transforming image data into actionable intelligence**

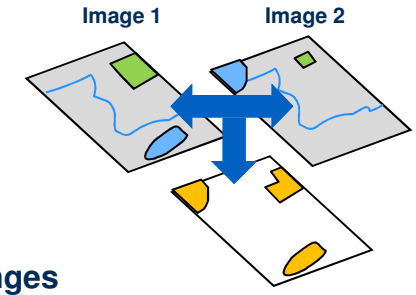


- **InSphere Data Marketplace** →**Rapid discovery and easy access to geospatial data**

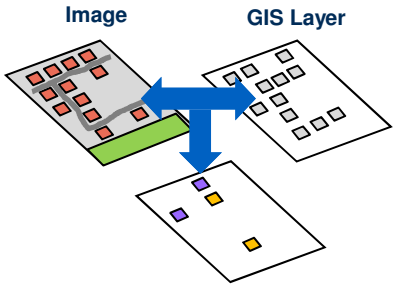
Features

- Intuitive, easy to use solution for land cover & change detection mapping
- Change detection / temporal analysis to monitor deforestation, urban development, rapid disaster assessment
  - Image to Image
  - Image to GIS layer
- Batch and parallel processing for multi scene imagery with eCognition Server

Image Changes



Thematic Changes

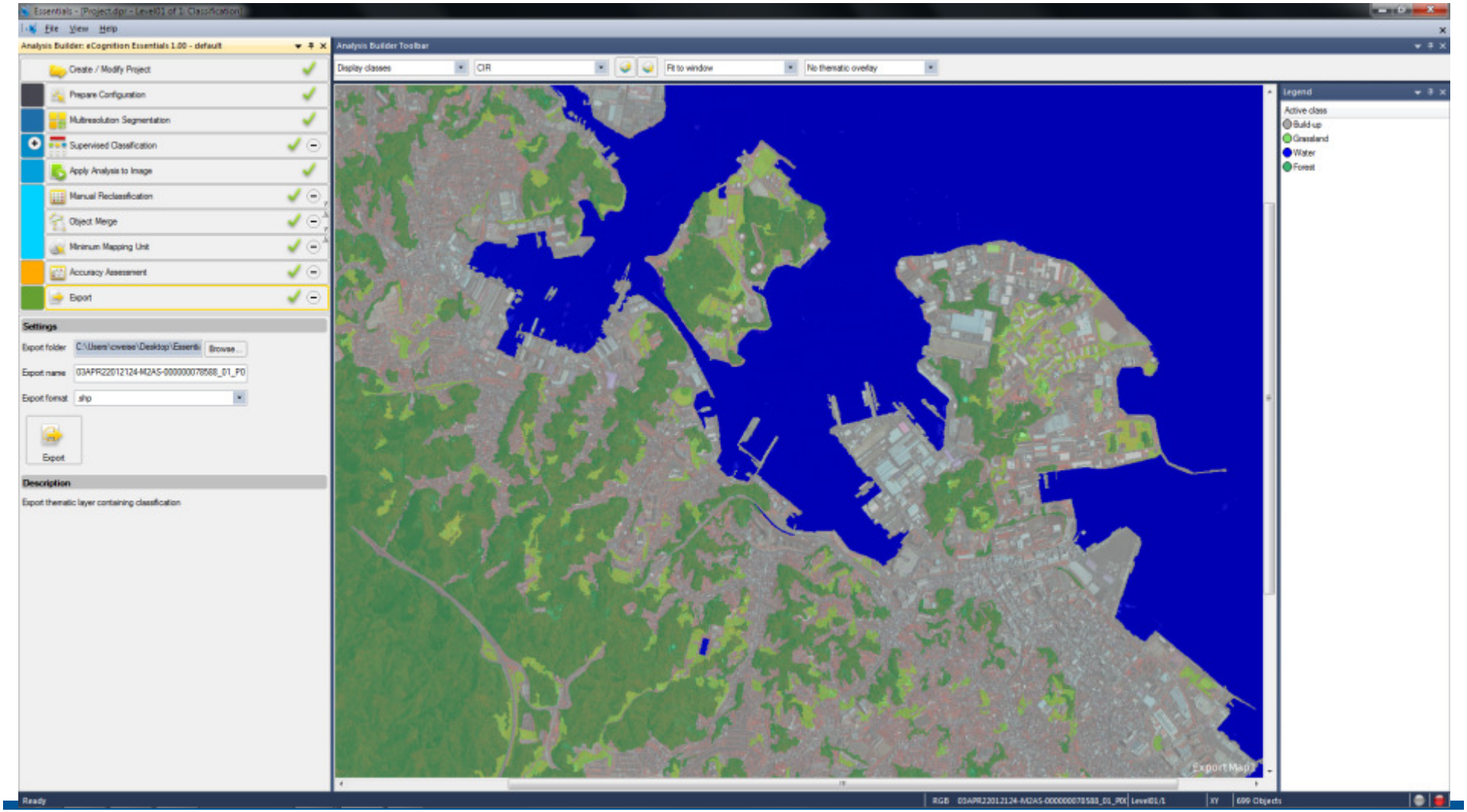


Batch- and Parallel Processing

Use Case Examples

Basic Land Cover Mapping

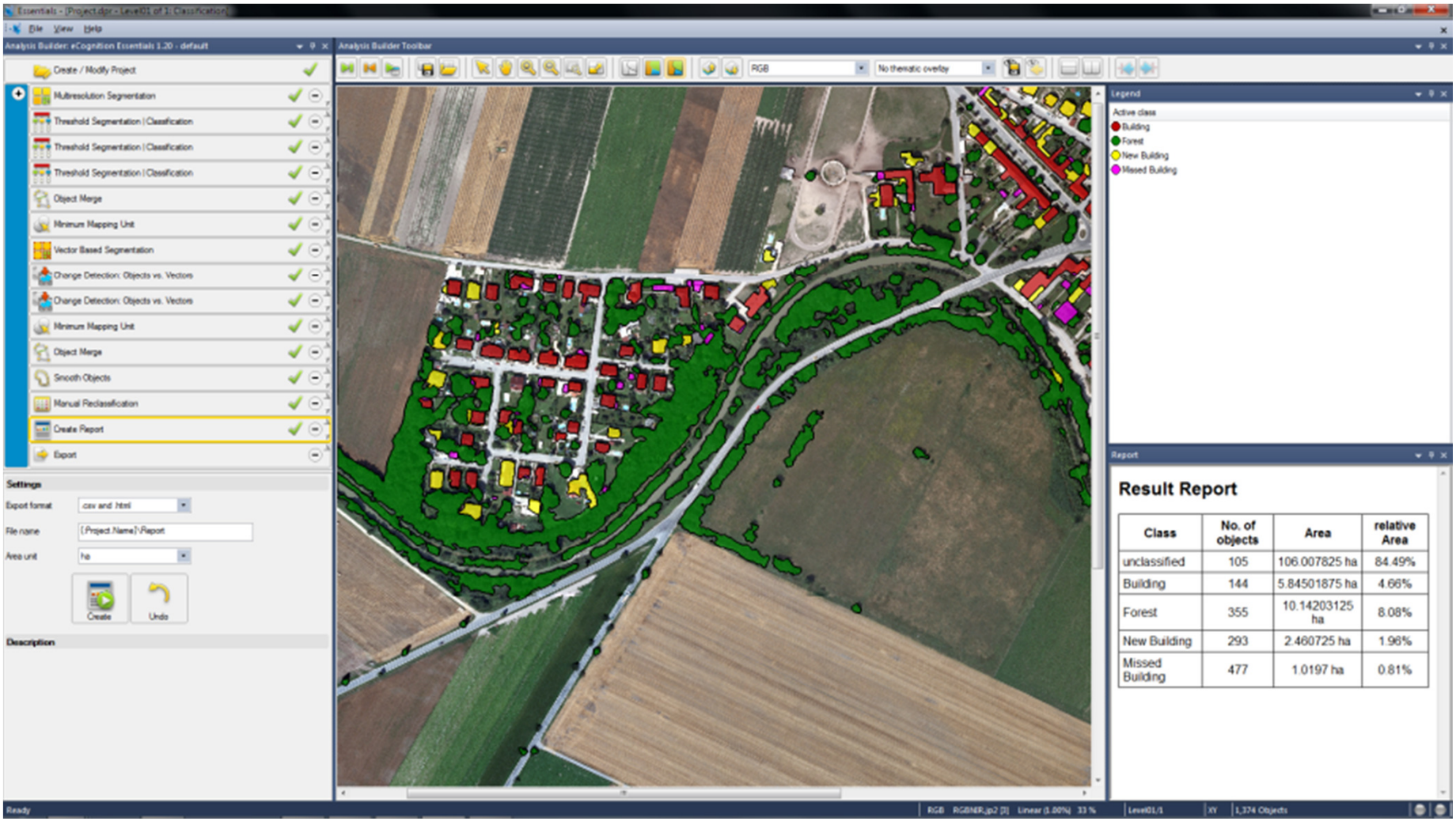
(1) Import Data (2) Create & Classify Objects (3) Edit & Check Results (4) Export Results



Use Case Examples

Thematic Change Detection (i.e. Buildings)

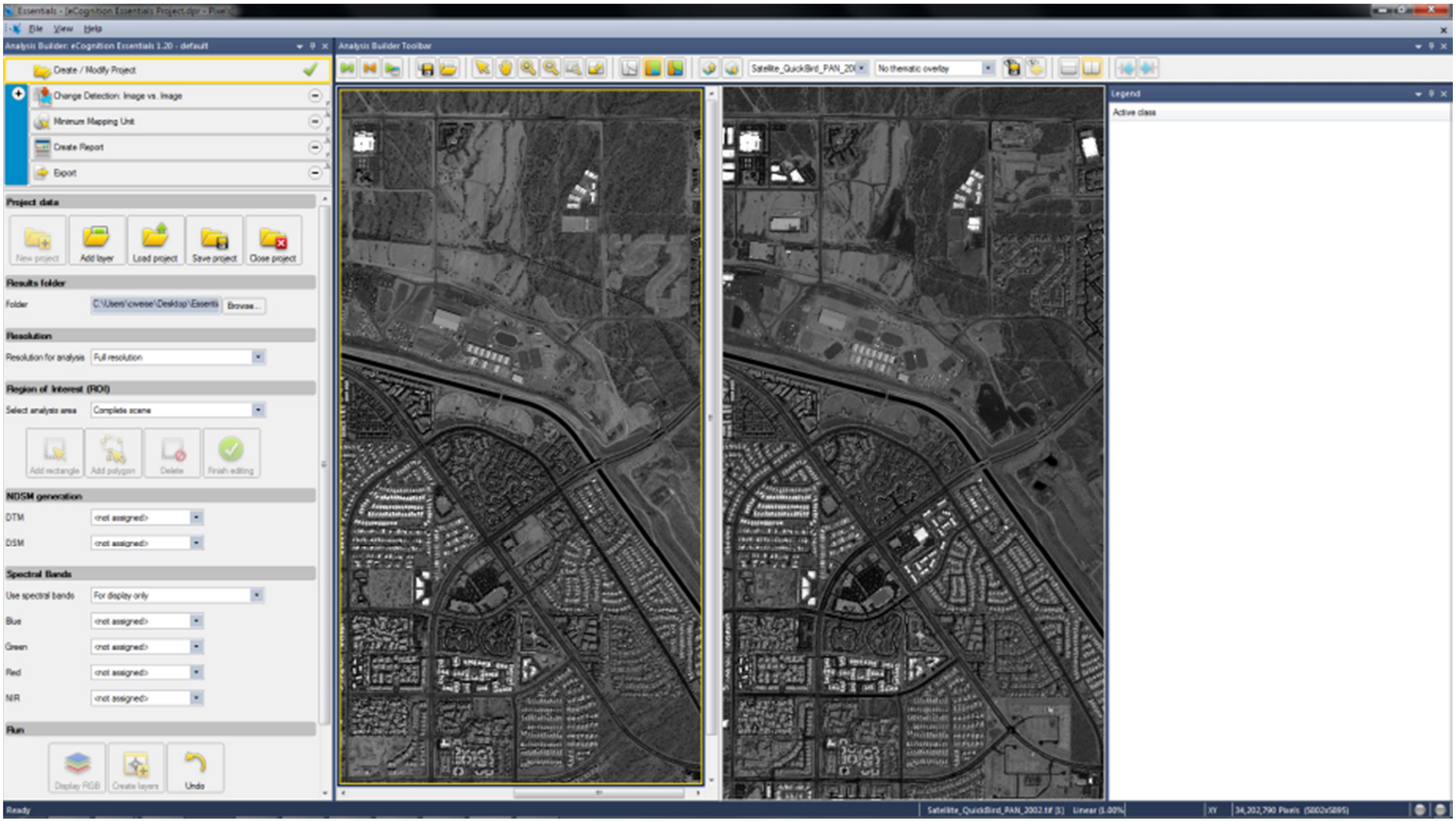
(1) Load Image and GIS layers **(2) Classify Image Data** **(3) Compare Classification with GIS Layer** **(4) Export Results**



Use Case Examples

Image Change Detection

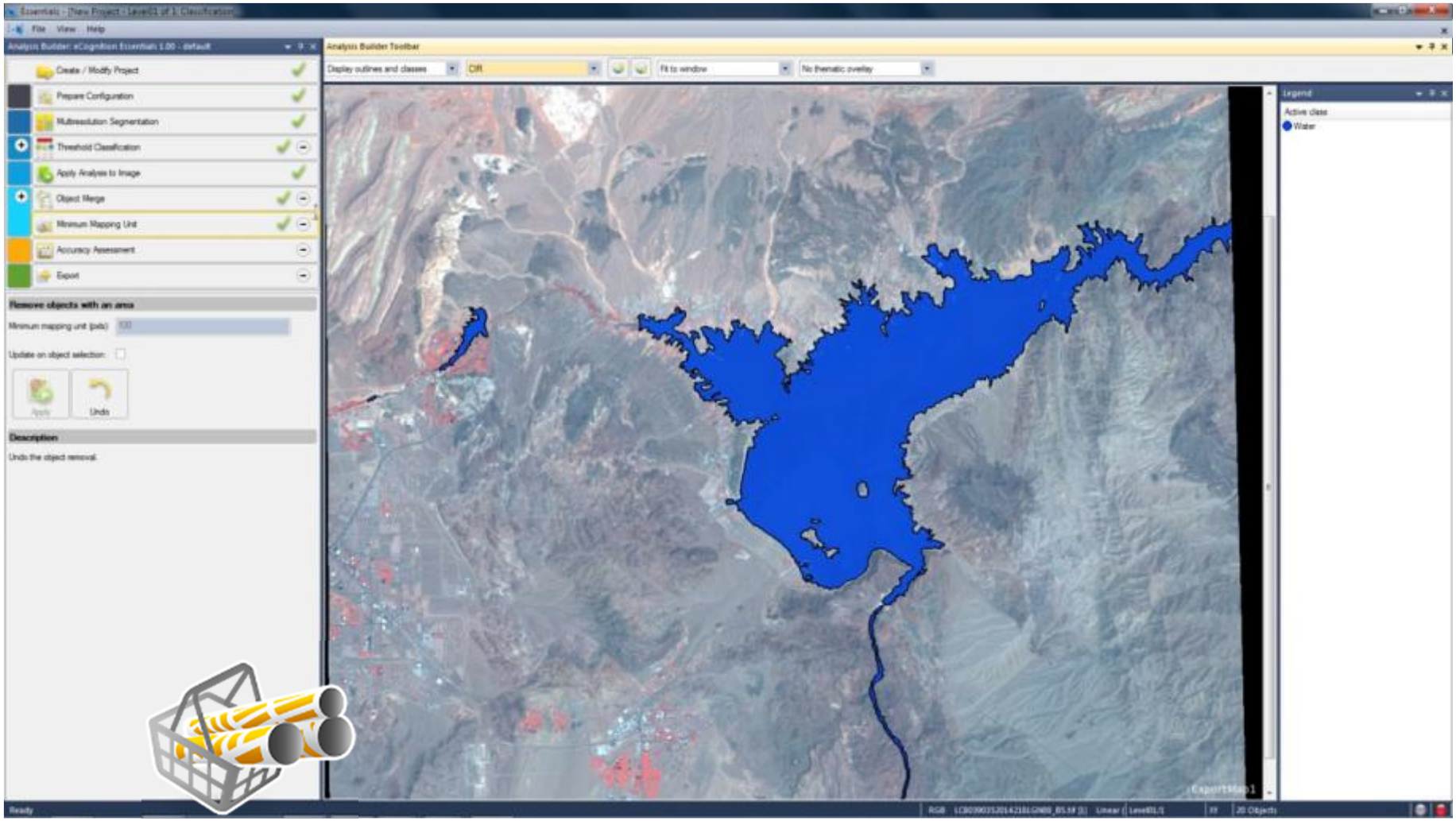
(1) Load Images **(2) Create Difference Layer(s)** **(3) Classify Changes** **(4) Export Results**



Use Case Examples

Rapid discovery and easy access to geospatial data via InSphere Data Marketplace

(1) Search & Download Images **(2) Load Data** **(3) Create and Classify Objects** **(4) Export Results**



ECOGNITION SUITE

eCognition Developer & Server

- **Advanced Analysis Software Suite available for geospatial applications**
- **Designed to improve, accelerate and automate the interpretation of geospatial data**
- **Enables users to create feature extraction or change detection solutions to transform geospatial data into geo-information**

eCognition Developer:
development & analysis environment for applications

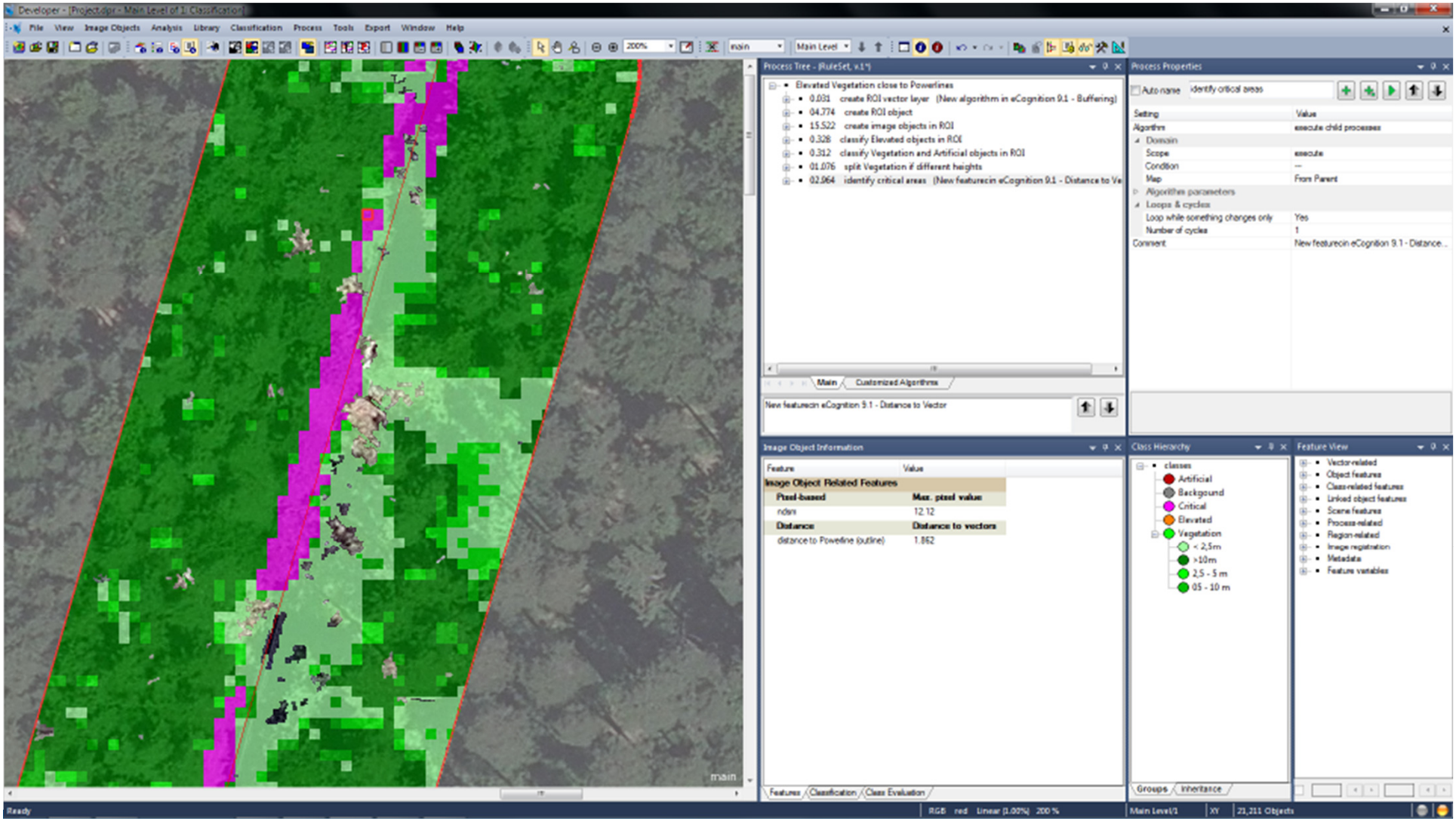
eCognition Server:
processing environment

www.eCognition.com

Use Case Examples

Vegetation Analysis closed to Powerlines

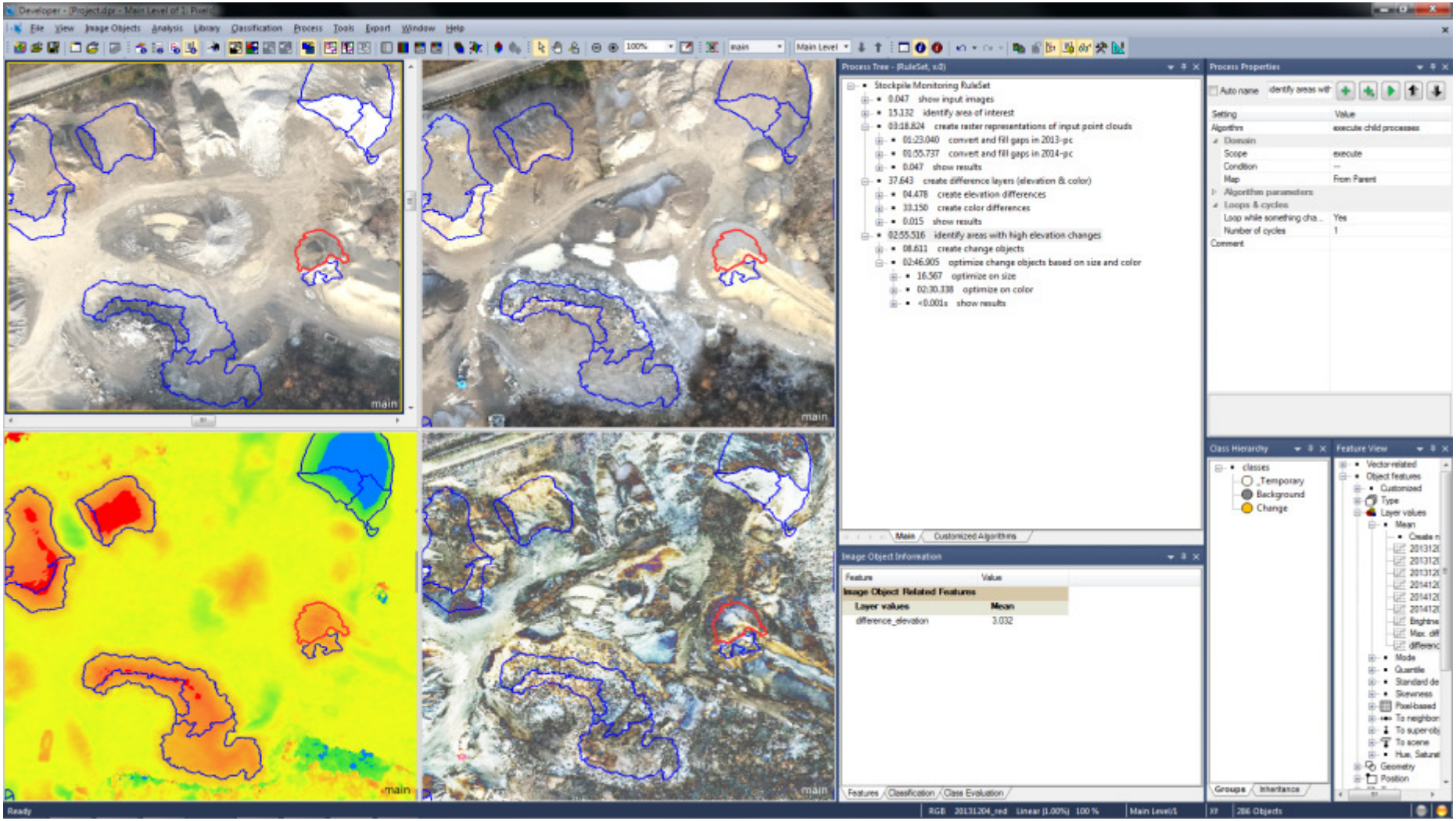
(1) Load Data (2) Buffer Powerline (3) Restrict Analysis (4) Using LiDAR (5) Using Images (6) Using Context



Use Case Examples

Change Detection Analysis on UAV data

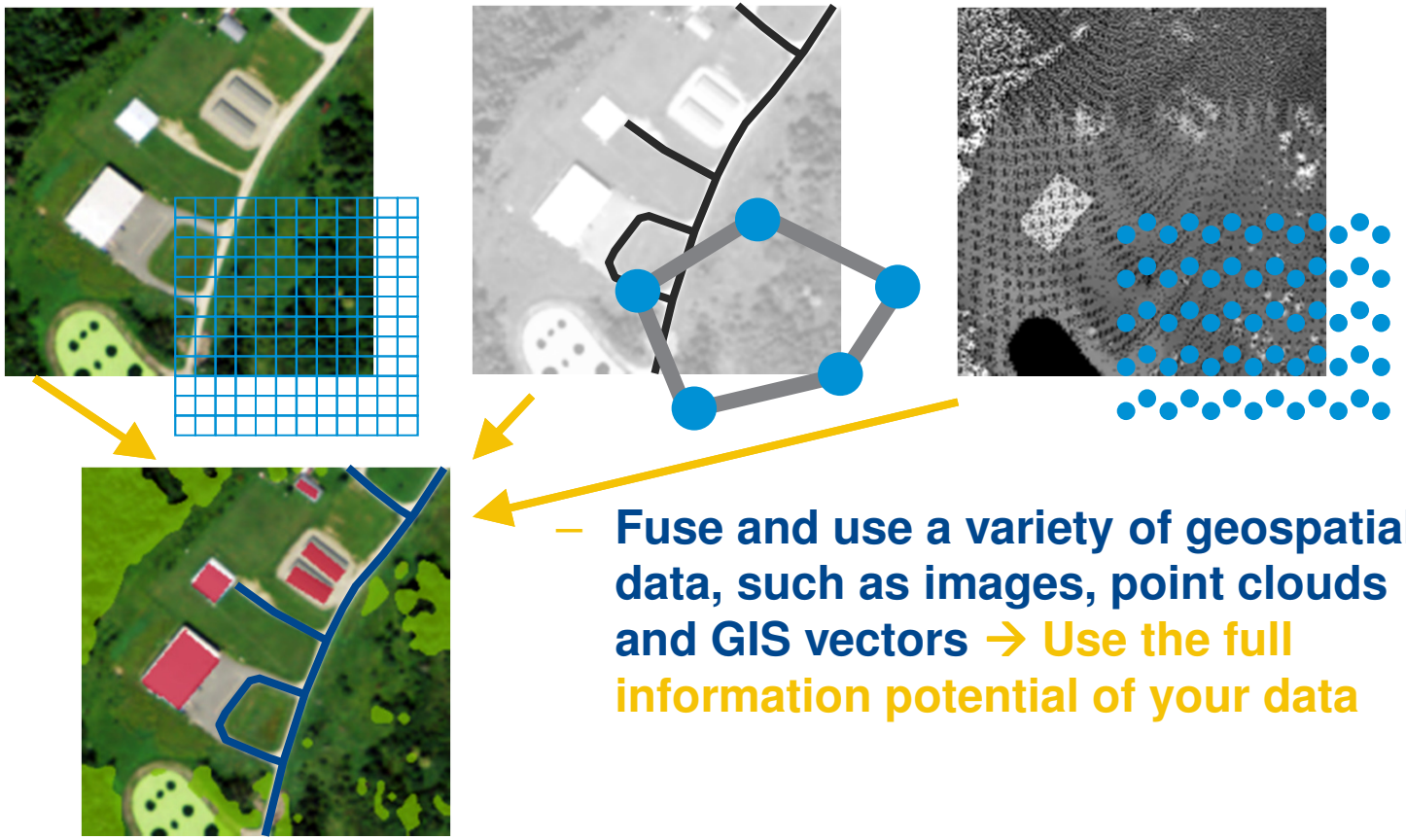
(1) Load Project (2) Find ROI (3) Convert Point Clouds (4) Compute Differences (5) Classify Change Objects



eCognition

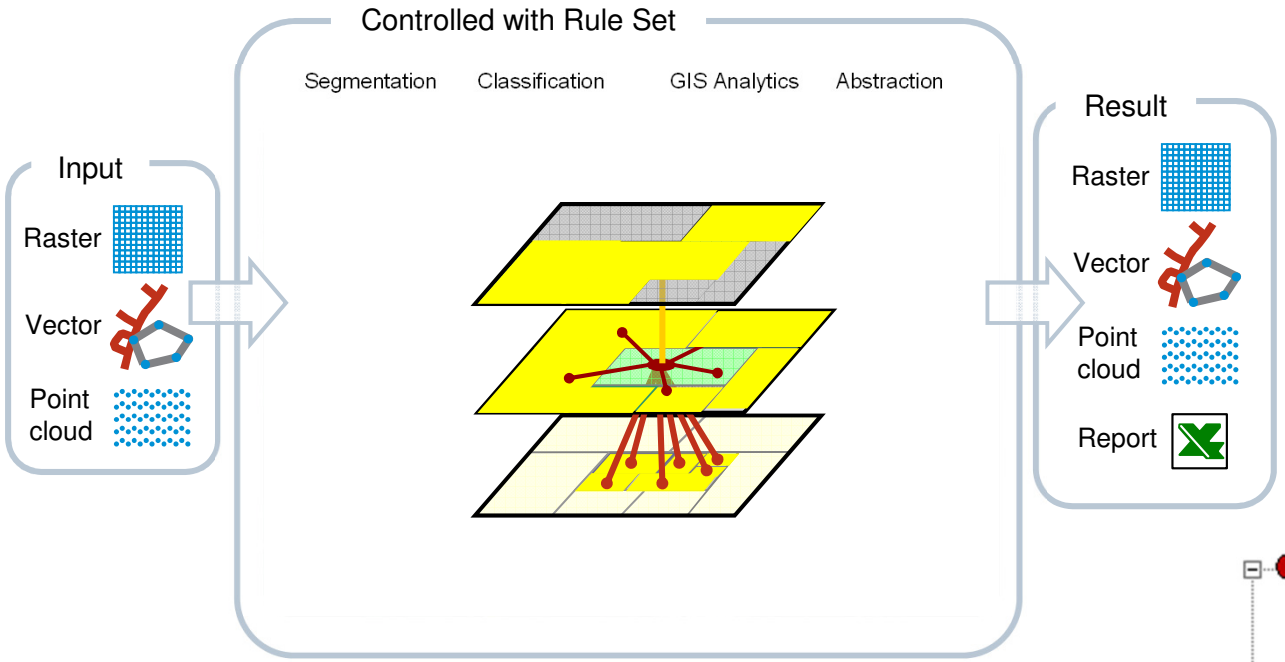
UNIQUE FEATURES

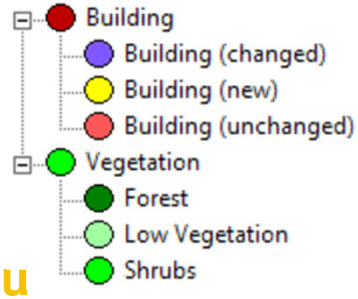
Geospatial Data Fusion



- Fuse and use a variety of geospatial data, such as images, point clouds and GIS vectors → Use the full information potential of your data

Dynamic Analysis



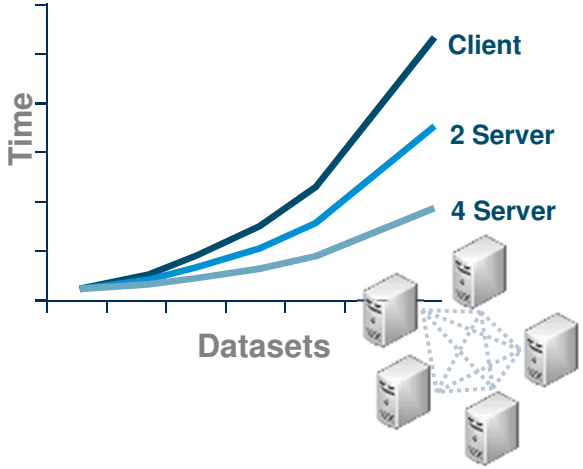


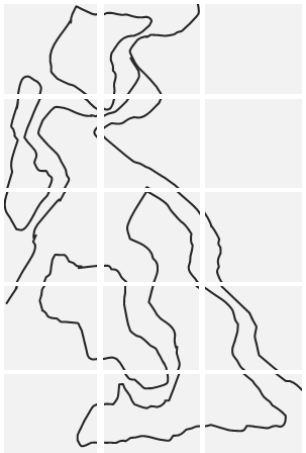
- **Combines analysis steps Segmentation, Classification, Object Manipulation, and GIS Analytics dynamically**
  →Unique approach to translate your mind model (why you see something in the data) into computer understandable code (eCognition Solution [Rule Set])

eCognition Server

Production Environment

- **Automatic data import**
- **Batch Processing**
- **Load Balancing**
- **Parallel Processing**





Designed to improve, accelerate and automate the creation and interpretation of geospatial information