



MATCH-AT

INPHO SOFTWARE

High throughput aerial triangulation with automated tie point selection, multi-ray point matching and bundle adjustment, GNSS and IMU support and calibration of camera and bore-sight misalignment. Processes frame sensors, satellite imagery and pushbroom data.

Precise aerial image triangulation with exceptional performance:

- ▶ Geo-reference blocks of aerial imagery based on the advanced and unique image processing algorithms for both frame and with MATCH-AT Pushbroom, line sensor data
- ▶ Fully automated processing even for large projects
- ▶ Processing is independent of flight geometry and supports completely arbitrary flight patterns
- ▶ Automatically extract tie points in frame images at optimal locations using multi-ray image matching
- ▶ Measure or verify control and tie points, guided by graphical block analysis
- ▶ Orient image blocks using proven bundle block adjustment and quality control tools
- ▶ Rigorous GNSS and IMU data support, including calibration of boresight misalignment and shift and drift corrections
- ▶ Due to its flexible data exchange capability MATCH-AT easily integrates into the workflow of any third-party photogrammetric system.

Everything you need in one package

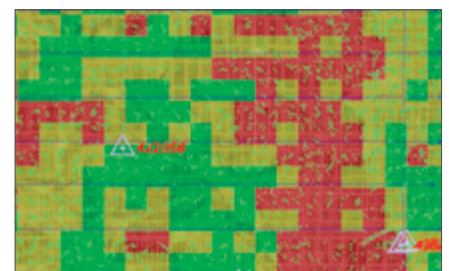
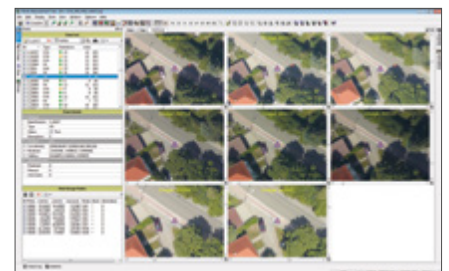
- ▶ Tie point measurement
- ▶ Robust bundle adjustment
- ▶ Thorough intuitive QA/QC
- ▶ Complete camera calibration
- ▶ Exports/Imports
- ▶ includes inBLOCK for most flexible parameters, correction strategies and analyzing capabilities

Product Highlights

- ▶ Single, automatic process for point selection, point transfer and measurement, along with an integrated and robust bundle block adjustment requires minimum user interaction
- ▶ Support of any film or digital frame sensor, satellite data and pushbroom sensors (MATCH-AT pushbroom)
- ▶ No block size, shape or overlap limitations; tested with projects at 90/80 percent overlap and block sizes of up to 40000 images (20000 images in one sub-block)
- ▶ Tie points are automatically collected in image areas best contributing to the block strength and quality; Von Gruber positions can be used, or other patterns in case of rectangular image formats or special image overlap situations
- ▶ High precision tie point correlation (0.1 pixel) is achieved using an advanced combination of feature-based and least-squares matching, with multi-threading support
- ▶ Effective tie point matching also in poorly textured, as well as mountainous areas
- ▶ Strong internal tie point quality control achieved by performing robust bundle block adjustment in each level of the image pyramid
- ▶ Flexible weighting schemes for all types of observations
- ▶ Multi-phase blunder detection
- ▶ Internal & external reliability measures

Key Features

- ▶ Fully automatic tie point matching and tie point transfer with a fully integrated robust bundle block adjustment allowing for iterative refinement of complex orientation tasks
- ▶ Multi-camera support with full calibration capability
- ▶ GNSS/IMU trajectory corrections
- ▶ Repeatable quality ensured by thorough, reliable and easy to understand graphical as well as statistical analysis
- ▶ Support for frame imagery, satellite imagery and pushbroom sensors (with MATCH-AT pushbroom)



TECHNICAL SPECIFICATIONS

FEATURES OVERVIEW

Multi-camera support in one block and camera specific self-calibration

- Self-calibration results are made available as a dense correction grid for further use in any subsequent applications
- Full camera calibration with inBLOCK camera calibration mode (focal length, principal point, distortion, non-squared pixels) including calibration report. Physical (5), Brown (16), Ebner (12) or 44 parameter distortion models.
- Powerful adjustment engine:
- Free block adjustment possible
- Flexible weighting schemes
- Sparse matrix technology
- Bandwidth minimization
- Reduced normal equations
- Fully automatic interior orientation for film cameras
- Project-wide photo display with correct topology, and auto image-selection for interactive, guided control point measurement.
- Multiple stereoscopic display for easiest stereoscopic manual point measurement
- Advanced sub-block handling
 - Sub-blocks enable easy administration, visualization and analysis of large blocks
 - Free block adjustment allow sub-blocks adjustment without control points
 - Sub-blocks as well as complete sub-projects can be merged
- GNSS data handling with shift and drift determination
- IMU data handling:
 - Preprocessed GNSS/IMU data from POS AV/POSEO by Applanix and AEROCtrl by IGI or similar
 - Attitude data are used as constraints in the integrated block adjustment
 - Bore-sight misalignment calibration (correction with up to 3rd polynom order)
- Calculation of ray intersections to check accuracy in specific stereo pairs
- Transform projects between different datums and projections, grid-based transformations, 7-parameters transformations and geoid application available
- Optionally the triangulation can be made in a local space rectangular coordinate system to avoid tensions caused by map projections
- Powerful intuitive graphical block analyzer:
 - Easy visual checking of large data sets
 - Visualizations: image footprints; overlaps; ground control and tie points; point and photo connections; residuals; error ellipses; geometric sector analysis for points and images; binning cell analysis for point density/connectivity; useful display filters, for example multi-strip connections and more; Statistical data tables directly linked to graphics
 - Internal and external reliability values for all observations and unknowns
 - Sensitivity analysis for undetectable gross errors, and their possible influence onto the block
- Specialized UAV/UAS mode for full automatic successful triangulation of challenging UAS projects
- Specialized satellite triangulation mode with automatic tie point matching and positioning refinement
- Smooth transfer of exterior orientation data to stereoplotters (e.g. Summit Evolution) and other photogrammetric applications, such as OrthoMaster or MATCH-T DSM
- High performance with multithreading

MATCH-AT for pushbroom sensors

- MATCH-AT Pushbroom supports ADS line sensors
- Processing supports completely arbitrary flight patterns, including: arbitrary directions (non-cardinal flights), overlaps, crossings and elevations – even turns and changes in elevation during ongoing acquisition
- The sophisticated math model includes simultaneous rigorous photogrammetric sensor modeling and advanced vehicle/platform dynamics modeling of IPAS or Applanix navigation data
- 3rd party compatibility is provided through generation of adjusted Leica GPro compatible SUP- and ODF-files

BENEFITS

- Accurate and reliable results in just few seconds per image High degree of process automation
- Perfectly designed matching strategies lead to maximum ray connections for tie points

VERSIONS

- MATCH-AT:
 - Geo-referencing of frame images
 - Unrestricted number of images
 - Camera Calibration available
 - Including inBLOCK
 - Satellite triangulation
- MATCH-AT Pushbroom:
 - Geo-referencing of pushbroom sensor data
 - Unrestricted number of images
- MATCH-AT Box:
 - Combines MATCH-AT with MATCH-AT Pushbroom
- MATCH-AT Lite:
 - Geo-referencing of frame images
 - Block size restricted to 250 images
 - Handling and merging of sub-blocks is not available
 - Multithreading is not available

OPTIONS

- MATCH-AT pushbroom add-on: adds pushbroom adjustment capability to existing MATCH-AT software
- Monthly rental and upgrades for MATCH-AT versions available
- Maintenance (1st year included in software price) includes support and version updates
- Update of previous versions
- Upgrade from lite version
- Network licensing available

SYSTEM REQUIREMENTS

- Multicore PC workstation (1 license supports up to 16 cores)
- 8 GB RAM
- High-capacity disk system
- Windows 7, 64 bit
- Special hardware for state of the art stereoscopic point measurement:
 - Stereo-capable graphics card(s) supporting OpenGL quad-buffered stereo (e.g. Nvidia quadro series)
 - Stereo viewing system
 - Optional color anaglyphs for systems without stereoscopic hardware

SUPPORTED SENSOR TYPES

- Imaging sensors:
 - Analogue and digital frame sensors
 - Panchromatic or multichannel
 - ADS Pushbroom sensors (MATCH-AT pushbroom)
 - Thermal images
 - Satellite sensors (including SPOT 1-7, Pleiades, Quickbird, IKONOS, ALOS, ASTER, CARTOSAT, IRS, GeoEye, Landsat, OrbView, RapidEye, WorldView, Resurs-P...)

PERFORMANCE

- Suited for massive data volumes: tested with projects up to 40000 images
- About 10 seconds computation time per frame
- Theoretical accuracy about 0.1 pixel

SUPPORTED FORMATS

- Supported image formats:
 - Georeferenced orthos: GeoTIFF, TiffWorld (tfw), ADS+tif/tfw
 - TIFF, JPG, BigTiff
 - JPEG2000, TIFFjpeg
 - EXIF
 - 8/12/16 bit
- Height model / morphology data formats
 - Grid-operations:
 - ◊ *.dtm *.rdh *.bil *.fit *.tol *.grd *.tif *.tiff *.smti *.tpix.shp, BIL, BWNp, BXYZ, DTM, DXF, DXF_TIN, FLT, GRD, LAS, LASZip, SHP_TIN, TIFF16, TIFF32, VRML, VRML_TIN, WNP, XYZ
 - Point-cloud operations:
 - ◊ LAS, LASZip, XYZ, BXYZ

Contact your local Trimble Authorized Distribution Partner for more information

NORTH AMERICA

Trimble Navigation Limited
10368 Westmoor Dr
Westminster CO 80021
USA

EUROPE

Trimble Germany GmbH
Am Prime Parc 11
65479 Raunheim
GERMANY

ASIA-PACIFIC

Trimble Navigation
Singapore Pty Limited
80 Marine Parade Road
#22-06, Parkway Parade
Singapore 449269
SINGAPORE