



cotesa

AEROTRIANGULACION VUELO PNOA OBLICUO 2025

**SERVICIOS CARTOGRÁFICOS PARA EL ÁREA DE GOBIERNO
DE URBANISMO, MEDIO AMBIENTE Y MOVILIDAD**

Expediente: 300/2024/00110



MADRID

**Urbanismo,
Medio Ambiente
y Movilidad**

Fecha 21 de mayo de 2026

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1. INTRODUCCIÓN

La aerotriangulación digital automática es un complejo proceso que incluye la medición y transferencia de todos los puntos de enlace, la medición de los puntos de apoyo de campo, el cálculo del ajuste y la compensación del bloque de aerotriangulación, en este caso contando con la particularidad de tener un vuelo complejo, con imágenes cenitales y oblicuas. Este proceso finalmente nos proporciona los parámetros de orientación exterior de todas las imágenes y coordenadas tridimensionales de todos los puntos medidos. El método empleado para la realización de la Aerotriangulación ha sido la Integrated Sensor Orientation (ISO) en la que a los parámetros de orientación directa, proporcionados por el sistema GNSS/INS, se utilizan puntos de apoyo, medidos en la fase anterior, realizando con toda esta información, un ajuste simultáneo por haces de rayos con parámetros GNSS/IMU y auto calibración. Haciendo un análisis estadístico riguroso, se presentarán en esta memoria los resultados numéricos usando estrategias de control de calidad sobre todos los bloques de AT. La combinación de información de partida de gran calidad (imágenes digitales cenitales y oblicuas, datos IMU, datos GNSS, apoyo) junto con las más avanzadas estaciones digitales fotogramétricas de aerotriangulación del mercado nos han proporcionado resultados altamente precisos. Para la comprobación del cálculo de la aerotriangulación, se han empleado puntos de la fase anterior como puntos de control para comprobar la precisión de dicho cálculo.

El vuelo tiene las siguientes características técnicas: imágenes cenitales 9 cm, imágenes oblicuas 9 cm. Dirección de las pasadas Este-Oeste. Recubrimiento 80% longitudinal y transversal. Cámara métrica cenital y oblicua VEXCEL Ultracam Osprey 4.1. Metadatos: Coordenadas X e Y del centro de proyección, alturas elipsoidal y ortométrica, Omega, Phi y Kappa en grados sexagesimales, corregidas de convergencia de meridianos

2. MARCO DE REFERENCIA

■ Sistema de Referencia Geodésico

Se ha empleado el sistema geodésico de referencia ETRS89, basándose exclusivamente en vértices GNSS activos de la Red Geodésica Nacional y en clavos NAP, coincidente con el sistema que define a la RTM.

■ Sistema de Referencia altimétrico

Se ha tomado como referencia de altitudes del nivel medio del mar en Alicante. El sistema está materializado por la Red de Nivelación de Alta Precisión.

- Sistema de representación planimétrico

El Sistema de Representación Plana para la cartografía oficial es el sistema de referencia de coordenadas ETRS 89-Transversa de Mercator, estando todo el proyecto englobado en el Huso 30.

3. SOFTWARE EMPLEADO

El software empleado para la medición y el ajuste de la aerotriangulación ha sido el programa Trimble Inpho Match-AT:

- Características:

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 bore sight 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 blocksize, shape or overlap limitations; tested with projects at 90/80 percent overlap and block sizes of up to 40,000 images (20,000 images in one sub-block)
- The tie points are automatically collected in image areas best contributing to the block strength and quality; van 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 bundle detection
- Internal & external reliability measures

Key Features

- Fully automatic tie point matching and tie point transfer with fully integrated robust bundle block adjustment allowing for iterative refinement of complex orientation tasks
- Multi-camera support with full calibration capability
- GNS3/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)



TRANSFORMING THE WAY THE WORLD WORKS





TECHSHEET



MATCH-AT INPHO SOFTWARE

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 polynomial 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, BWNF, 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



4. METODOLOGÍA

4.1. PLANIFICACIÓN

Una vez recibido el vuelo completo, se analizó la cobertura del mismo y el límite de la zona de trabajo, seleccionando el conjunto de fotogramas con suficiente margen de cobertura para garantizar que las fotografías oblicuas cubrían perfectamente el área de trabajo. Seleccionados los fotogramas, se determinaron dos acciones de forma simultánea

- Estrategia de aerotriangulación.
- Estrategia de apoyo de campo.

La estrategia elegida de aerotriangulación determina directamente la estrategia de apoyo de campo; en este caso, se decidió dividir el área de trabajo en tres bloques de aerotriangulación:

- Bloque 1. Contiene todos los fotogramas de la cámara NADIR
- Bloque 2. Contiene todos los fotogramas del vuelo de las cámaras LEFT-RIGHT
- Bloque 3. Contiene todos los fotogramas del vuelo de las cámaras FRONT-BACK

Según se indica en el pliego, el apoyo de campo para cada bloque debería cumplir las siguientes condiciones:

- Puntos dobles en las esquinas del bloque, situados fuera de la zona a cartografiar, cuando se han medido correctamente los centros de proyección.

En nuestro caso, se decidió densificar el apoyo topográfico más allá de lo indicado por pliego, y, siempre, desdoblar los puntos. Además, al disponer de una aerotriangulación aproximada, el operador de aerotriangulación seleccionó estereoscópicamente los entornos más adecuados para la toma de los puntos de apoyo, garantizando de esta forma la máxima utilidad de cada punto de ellos.

A la hora de diseñar esta planificación de la estrategia de aerotriangulación, se tuvo en cuenta la estrategia de ajuste multicono. Debido a las diferencias de resolución entre las imágenes cenitales (GSD 9 cm) y las oblicuas (GSD 20 cm), no se deben ajustar todas las imágenes del bloque en un único ajuste, ya que condicionaría que la precisión final fuese la de menor resolución. Por tanto, las imágenes cenitales se ajustan en un paso, y las oblicuas en otro. Además, dentro de las oblicuas, y por construcción geométrica de la cámara, el ajuste se plantea también en dos pasos: un paso para las imágenes derecha-izquierda (Right-Left), y otro para las Delante-Detrás (Front-Back)

4.2. ESTRATEGIA DE CÁLCULO

El método empleado para la realización de la Aerotriangulación ha sido la Integrated Sensor Orientation (ISO) en la que a los parámetros de orientación directa, proporcionados por el sistema GNSS/IMU, se utilizan puntos de apoyo, medidos en la fase anterior, realizando con toda esta información, un **ajuste simultáneo por haces de rayos**. En general, todos los bloques de imágenes cenitales no han necesitado parámetros de autocalibración para obtener la precisión deseada, siendo buenos los parámetros de calibración de la cámara expresados en el certificado de calibración. En los bloques de imágenes oblicuas se han empleado parámetros de auto calibración, generándose en cada caso un certificado de calibración de cámara para cada ajuste.

La medición y transferencia de puntos de enlace y de paso, se ha llevado a cabo mediante técnicas de correlación densa de puntos uniformemente distribuidos por el bloque.

En la correlación se han empleado las imágenes digitales a las que se les ha creado una estructura piramidal, con el fin de optimizar los procesos. En los primeros niveles de la piramidal (menos resolución) se usa un algoritmo de cálculo basado en la extracción de formas características (Feature-Based Matching, FBM) que da una precisión de 0,3 píxel. En los últimos niveles de la pirámide, se emplea el método de correlación de mínimos cuadrados (Least-Squares Matching, LSM), que permite obtener precisión de 0,1 píxel.

Los puntos de enlace y de paso obtenidos tras la correlación, han sido depurados mediante la ejecución de algoritmos de detección automática de errores que eliminan aquellos puntos cuyo error supera una tolerancia prefijada. Este proceso se ha repetido tantas veces como ha sido necesario hasta cumplir con las exigencias de precisión y de enlace del bloque. Como resultado, se ha obtenido la orientación relativa del bloque y su precisión interna.

El apoyo topográfico se ha medido en todos los casos de manera manual en modo estereoscópico. Una vez medidos, se ha calculado y ajustado el bloque. Si se detectan errores en el apoyo topográfico, se vuelven a medir los puntos necesarios en las imágenes adecuadas, hasta que se cumplan con los requisitos de exactitud.

Para el proceso de cálculo se tomaron como datos de entrada las fotocoordenadas refinadas de los puntos de enlace, apoyo y chequeo, las coordenadas terreno de los puntos de apoyo y chequeo, y los parámetros GNSS/IMU de las imágenes, además de los certificados de cámara. El ajuste del bloque se ha realizado por mínimos cuadrados empleando estimadores robustos. Se ha realizado un ajuste de deriva para los datos GNSS/IMU tomando como unidad homogénea la pasada. Se ha aceptado el cálculo como definitivo cuando se han cumplido todas las exigencias, tolerancias y precisiones señaladas en el pliego de prescripciones técnicas para puntos de apoyo, chequeo, centros de proyección y precisión interna del bloque. Como resultado del proceso se han obtenido las orientaciones externas de los fotogramas, las fotocoordenadas ajustadas de los puntos de enlace, las coordenadas terreno de los puntos de enlace y un fichero descriptivo del proceso con todos los parámetros de configuración, inputs, outputs y precisiones de cada fase del ajuste

4.3. RESULTADOS.

4.3.1. Bloque Nadir



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MATCH-AT

Processing Report

Project name: Madrid-2025

General project information

Flight overview

Tie point distribution

Image points

Camera

Exterior orientation evaluation summary

Block adjustment settings

Block adjustment results

Ground control points

Ground control point statistics

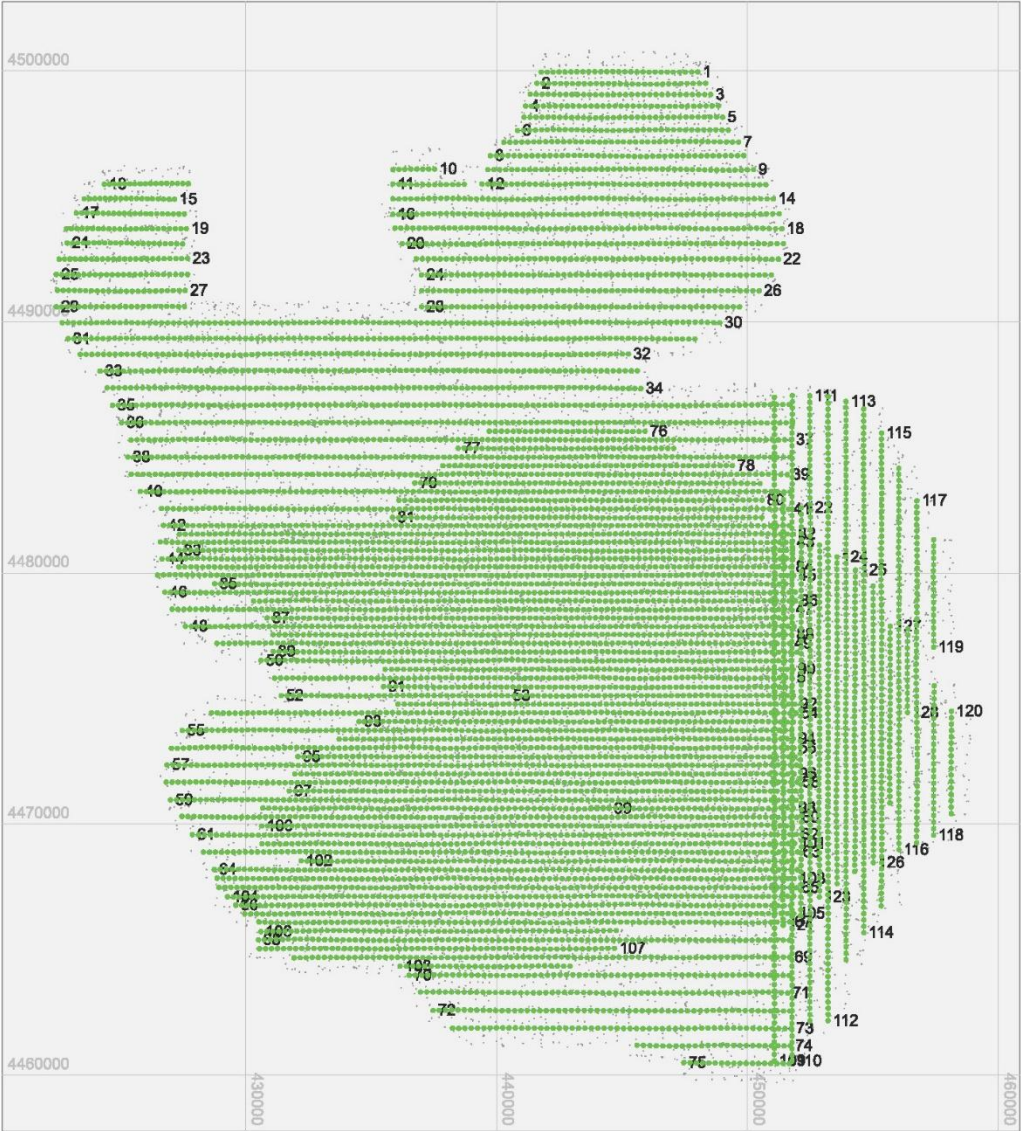


General project information

Project name	Madrid-2025
Process	Geo-referencing
Computer node	RESTITUCION-1
Operating system	Microsoft Windows 10 Professional (build 19045), 64-bit, version 10.0
Machine	12th Gen Intel(R) Core(TM) i700K, 20 cores, 63.7 GByte RAM
Program version	13.2.0.10038
User name	Restitucion-1
Source time (*.sta)	Tue Mar 17 16:30:52 2026
Report time (*.pdf)	Wed Mar 18 06:59:23 2026
Project file	G:/Vuelos/Madrid_2025/AeroNadir_v2_dense/Madrid2025_NADIR.prj
Statistic file	G:/Vuelos/Madrid_2025/AeroNadir_v2_dense/Madrid2025_NADIR.sta
Active block	Complete
Number of used images	8764 of 8764
Number of used cameras	1 of 1
Number of strips	128
Flying height	min=2449.9 / avg=2521.4 / max=2595.2 [m]
Terrain height	min=532.9 / avg=660.9 / max=994.7 [m]
Average photo scale	1 : 23509
Coordinate system	PROJCS["UTM Zone 30 N", GEOGCS["ETRS89",DATUM["European Terrestrial Reference System 1989", SPHEROID["GRS 1980",6378137, 298.2572221011,AUTHORITY["EPSG","7019"]], TOWGS84[0,0,0,0,0,0,0], AUTHORITY["EPSG","6258"]], PRIMEM["Greenwich",0,AUTHORITY["EPSG", "8901"]], UNIT["Degree",0.01745329251994, AUTHORITY["EPSG","9102"]], AXIS["Long",EAST], AXIS["Lat",NORTH], AUTHORITY["EPSG","4258"]], PROJECTION["Transverse_Mercator"], PARAMETER["False_Easting",500000], PARAMETER["False_Northing",0], PARAMETER["Latitude_Of_Origin",0], PARAMETER["Central_Meridian",-3], PARAMETER["Scale_Factor",0.9996], UNIT["Meter",1,AUTHORITY["EPSG","9001"]], AXIS["East",EAST], AXIS["North",NORTH], AUTHORITY["EPSG","25830"]]

MATCH-AT

Flight overview



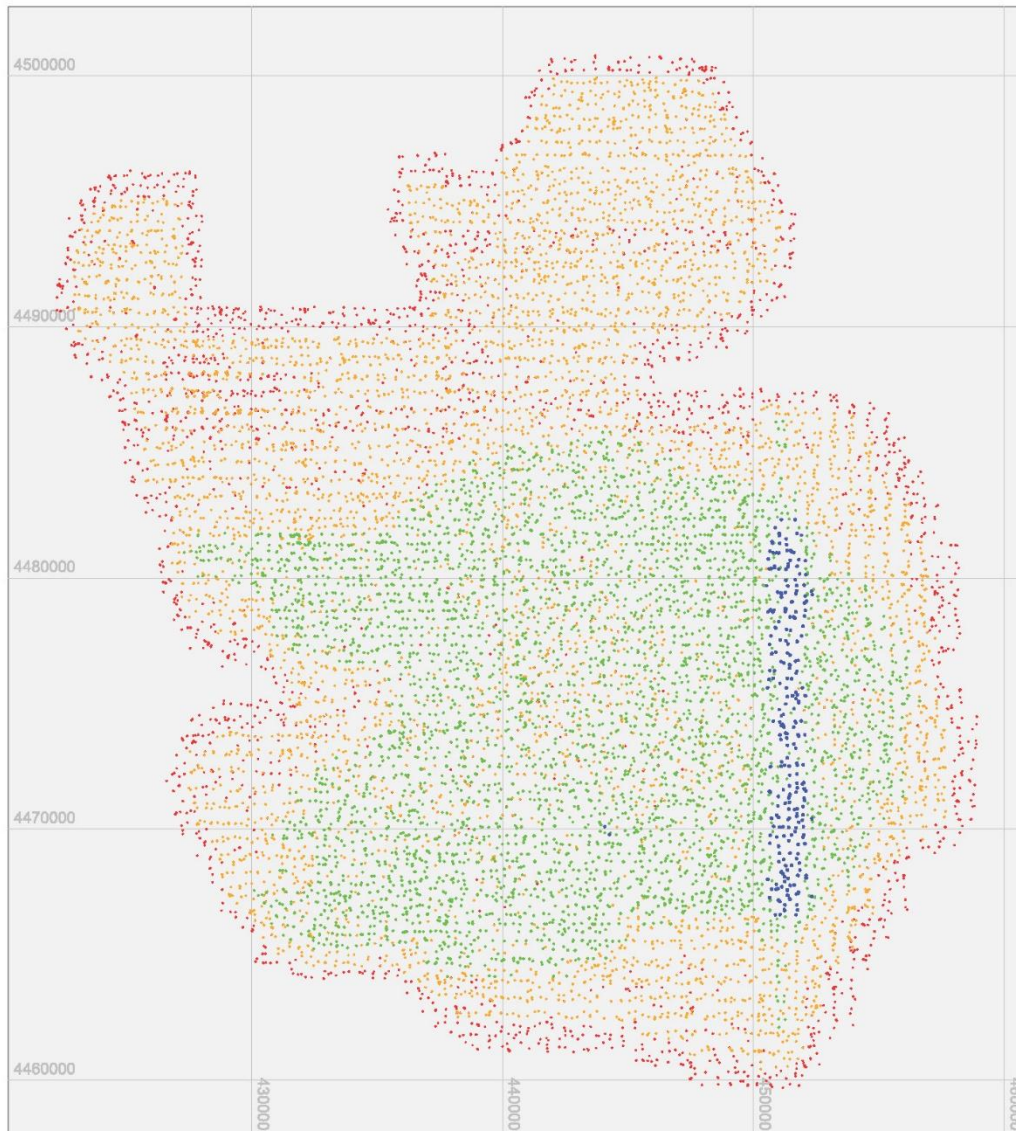
Graphic with 128 strip definitions for the aerial triangulation. The area has a planimetric extent of about: 40566 x 45013 [m].

-  : Camera location for 8764 adjusted photos.
-  : Camera location for 0 eliminated photos.
-  : Defined strip in the project.
-  : Tie point location for 98797 points.



MATCH-AT

Tie point distribution



Tie point distribution of 98797 points in the statistic file. The point size and colour reflects the number of images containing the point. The area has a planimetric extent of about: 40566 x 45013 [m] and a height range of about: 533 - 995 [m].

- : Point found in (0-12) images.
- : Point found in (13-24) images.
- : Point found in (25-36) images.
- : Point found in (>36) images.

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MATCH-AT

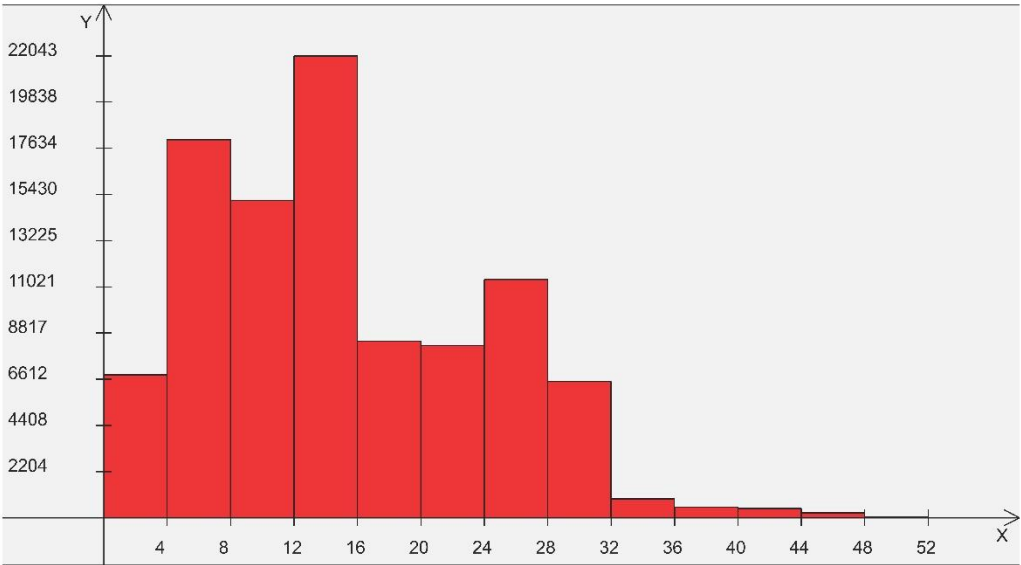
Image points

Frequency of image point observations in the photos

X	Number of image points (Y)	%
>0 - 4	6831	6.91
>4 - 8	18051	18.27
>8 - 12	15154	15.34
>12 - 16	22043	22.31
>16 - 20	8437	8.54
>20 - 24	8229	8.33
>24 - 28	11377	11.52
>28 - 32	6498	6.58
>32 - 36	912	0.92
>36 - 40	514	0.52
>40 - 44	453	0.46
>44 - 48	236	0.24
>48 - 52	62	0.06

Appearance of 98797 image points from the statistic file. The table contains all image observations of the points.

Histogram for image point frequency in the photos



Graphic for 8764 photos and 98797 image points. Number of image points (Y) within a given range for number of photos (X).

MATCH-AT

Camera

Camera data (Madrid2023_nadir)

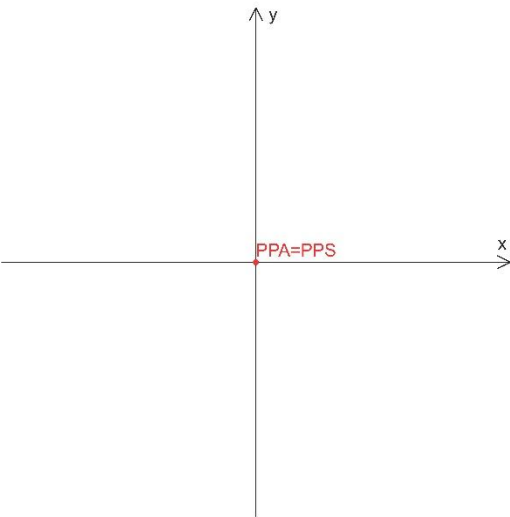
Data source	Madrid2025_NADIR.sta		
Sensor type	CCD sensor		
Manufacturer	Vexcel		
Model	Osprey 4.1		
Serial number	not defined		
Camera UUID	not defined		
Sensor (width / height) [pixel]	20544	14016	
Pixel size (x / y) [micron]	3.7600	3.7600	
Ground sampling distance (x / y) [m]	0.0884	0.0884	
Calibration process	OFF		
Calibration status	Initial		
Calibration direction	INPHO (from ideal to measured)		
Distortion type	Undefined		
Additional parameters	OFF		
Focal length [mm / pixel]	79.6000	21170.2128	
Focal length (Fx / Fy) [pixel]	21170.2128	21170.2128	
Principal point (x / y) [mm pixel]	0.0000 10271.5000	0.0000 7007.5000	

Platform data (Madrid2023_nadir)

	X [m]	Y [m]	Z [m]
GNSS antenna offset	---	---	---
	Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]
IMU boresight alignment	---	---	---
Camera mount rotation	---		

MATCH-AT

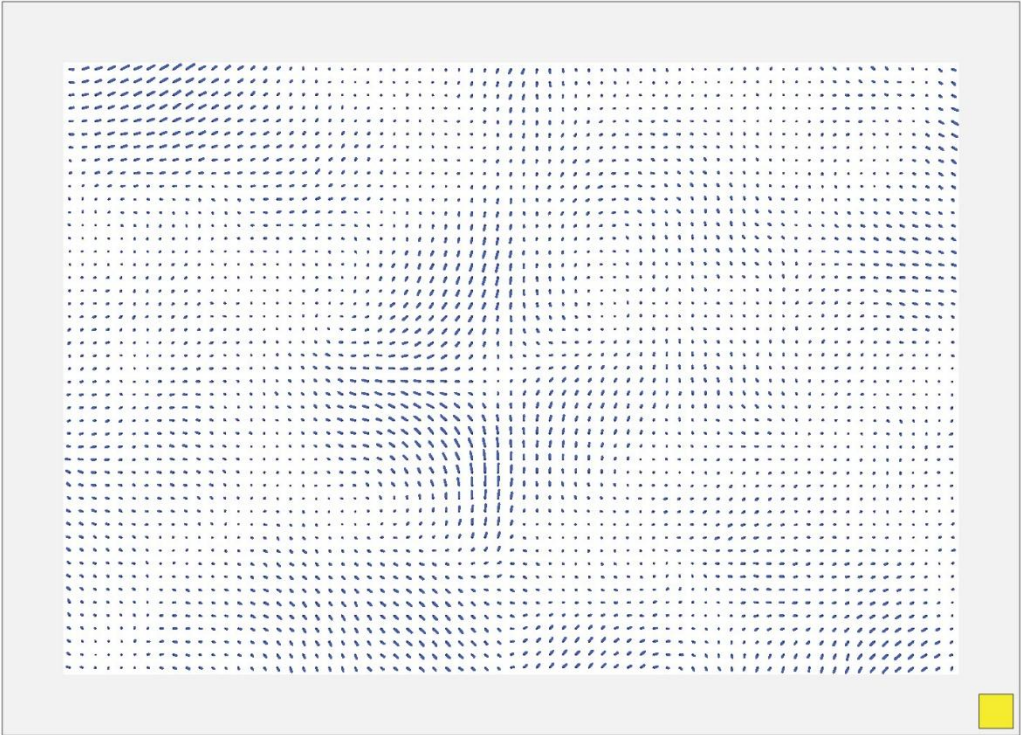
Camera data (Madrid2023_nadir)



Principle point (x=0.0000, y=0.0000 [mm]) in the image.

MATCH-AT

Image residuals (Madrid2023_nadir)



Graphic of 1536285 back-projected adjusted points from the statistic file. Average image residual matrix vectors (min=0.001, avg=0.072, max=0.278 [pixel]) for image matrix elements. An image matrix element is defined with about (300 x 300) pixels. Image residual is defined as: residual = observed - adjusted. Number of invalid image residual vectors outside the graphic: 0.

-  : Scale for the residual vectors. Symbol in the graphic is correlated to 1 [pixel] in the image.
-  : Average image residual vector for points in (0-2) images.
-  : Average image residual vector for points in (3-4) images.
-  : Average image residual vector for points in (5-10) images.
-  : Average image residual vector for points in (>10) images.



MATCH-AT

Exterior orientation evaluation (Madrid2023_nadir)

ImageID	# of points	Distribution	RMS Ds [pixel]	Max Ds [pixel]	Remark
h50_0534_fot_131-17514_N	119	6 of 9	0.56	4.49	
h50_0534_fot_147-23093_N	197	9 of 9	0.56	3.57	
h50_0534_fot_145-23389_N	257	9 of 9	0.53	3.08	
h50_0534_fot_121-17132_N	140	8 of 9	0.52	3.58	
h50_0559_fot_169-17567_N	189	9 of 9	0.52	4.09	
h50_0558_fot_170-13548_N	86	4 of 9	0.51	3.02	
h50_0534_fot_123-17245_N	150	8 of 9	0.51	5.66	
h50_0582_fot_185-09951_N	121	8 of 9	0.50	3.68	
h50_0534_fot_127-17372_N	157	8 of 9	0.50	3.78	
h50_0559_fot_165-18137_N	140	8 of 9	0.49	4.40	
h50_0559_fot_169-17565_N	102	8 of 9	0.48	3.47	
h50_0559_fot_169-17566_N	137	9 of 9	0.48	3.75	
h50_0534_fot_121-17133_N	162	9 of 9	0.48	4.14	
h50_0534_fot_121-17134_N	170	9 of 9	0.48	4.46	
h50_0534_fot_127-17378_N	139	9 of 9	0.48	4.94	
h50_0534_fot_123-17240_N	175	8 of 9	0.48	3.98	
h50_0534_fot_145-23390_N	264	8 of 9	0.47	2.97	
h50_0534_fot_145-23388_N	164	7 of 9	0.47	2.03	
h50_0534_fot_144-23488_N	80	6 of 9	0.47	1.81	
h50_0534_fot_127-17371_N	172	9 of 9	0.47	4.04	
h50_0534_fot_143-23598_N	122	9 of 9	0.46	4.85	
h50_0533_fot_142-23780_N	139	9 of 9	0.46	2.86	
h50_0534_fot_125-17266_N	111	9 of 9	0.46	3.20	
h50_0559_fot_169-17563_N	148	9 of 9	0.46	3.35	
h50_0558_fot_170-13549_N	52	4 of 9	0.27	1.61	
h50_0534_fot_145-23344_N	64	5 of 9	0.27	1.19	
h50_0534_fot_115-16960_N	143	5 of 9	0.23	1.46	
h50_0534_fot_146-23203_N	88	5 of 9	0.22	1.27	
h50_0559_fot_170-13533_N	80	5 of 9	0.18	0.44	
h50_0559_fot_170-13532_N	62	5 of 9	0.17	0.41	
h50_0534_fot_147-23087_N	138	5 of 9	0.16	0.44	
h50_0559_fot_170-13534_N	87	5 of 9	0.15	0.36	

Statistic of 1536285 back-projected adjusted points from the statistic file. The table list 32 of 32 photos with an EO beyond the thresholds. The project consist of 8764 of 8764 photos from this camera. The table contain differences between the matched image points and back-projected adjusted points. Photos with at least one of the following conditions are visible:

- * # of points : Number of points/photo < 30 [points]
- * Distribution : Number of image tiles with more than 3 points < 6 [Image tiles]
- * RMS Ds [pixel] : RMS difference in pixel > 0.5 [pixel]

MATCH-AT

Exterior orientation evaluation summary

Legend of histogram for number of tie points

X : Range for the number of tie points/photo.
Y : Number of images for the defined range (X).
Thr : Empirical threshold (30 points/photo) for the definition of weaker images.

Legend of histogram for distribution of tie points

X : Number of sufficient occupied image tiles with tie points. The image is divided into 9 equal image tiles.
Y : Number of images for the defined image tile occupation (X).
Thr : Empirical threshold (6 image tiles) for the definition of weaker images.

Legend of histogram for RMS values of tie points

X : Range for the RMS value.
Y : Number of images for the defined range (X).
RMS : RMS value for differences between the matched image points and back-projected adjusted points.
Thr : Statistical threshold ($0.45 \text{ [pixel]} = 3 \cdot \sigma$ naught from the block adjustment) for the definition of weaker images.

Statistical information about used elements for EO evaluation

Data base : Statistic file (*.sta)
 Number of photos : 8764 of 8764
 Number of camera(s) : 1 of 1
 Number of used image observations : 1536285
 Number of adjusted points : 98797

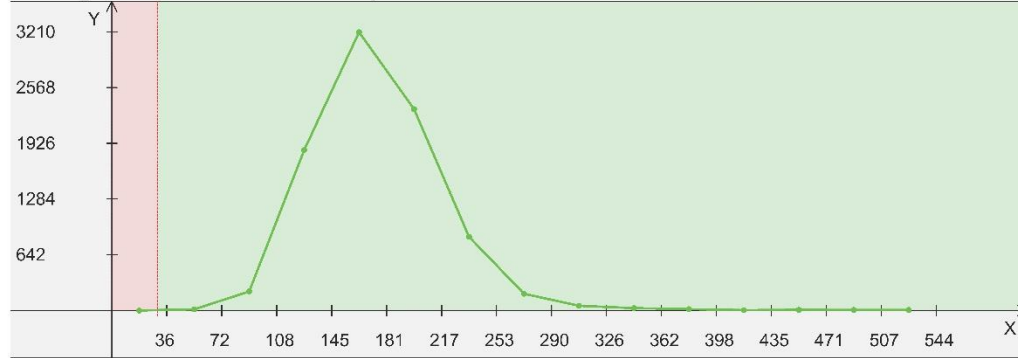
Camera color assignment

 : Threshold (Thr) for the actual evaluation criteria.
 : for Camera : Madrid2023_nadir.
 : Range with acceptable photos.
 : Range with suspect photos.



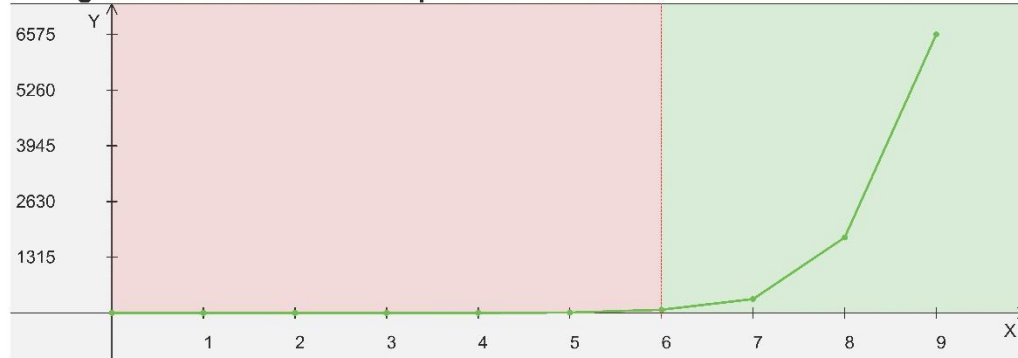
MATCH-AT

Histogram for number of tie points



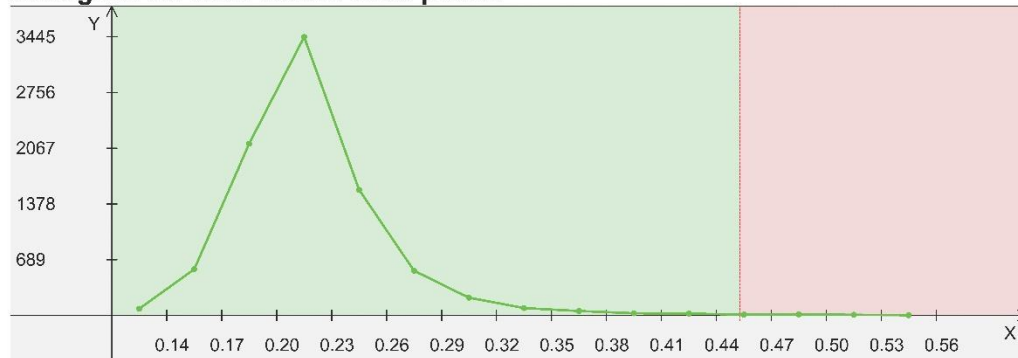
Graphic for 8764 photos with 1 camera(s). Evaluation criteria: [# of points/photo] < Thr (=30 [points/photo]).

Histogram for distribution of tie points



Graphic for 8764 photos with 1 camera(s). Evaluation criteria: [Distribution] < Thr (=6 [image tiles]).

Histogram for RMS values of tie points



Graphic for 8764 photos with 1 camera(s). Evaluation criteria: [RMS] > Thr (=0.45 [pixel]).

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MATCH-AT

Block adjustment settings

Block Parameters

Image standard deviation:	X [mm]	Y [mm]	
automatic	0.001800	0.001800	
manual	0.001800	0.001800	
Object standard deviation:	X [m]	Y [m]	Z [m]
control points	0.030000	0.030000	0.045000
Earth curvature correction	ON		
Refraction correction	ON		

GNSS Parameters

Mode	ON		
Shift/Drift	OFF		
	X [m]	Y [m]	Z [m]
Shift	ON	ON	ON
Drift	OFF	OFF	OFF
Standard deviation	0.300000	0.300000	0.300000

IMU Parameters

Mode	ON		
Shift/Drift	OFF		
Boresight alignment	OFF		
	Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]
Shift	---	---	---
Drift	OFF	OFF	OFF
Standard deviation	0.008000	0.008000	0.008000

MATCH-AT

Block adjustment results

Accuracy

Sigma naught	0.5691 [micron]
	0.1513 [pixel]

Mean standard deviation of translations

X [m]	Y [m]	Z [m]	Total [m]
0.0216	0.0175	0.0078	0.0289

Mean standard deviation of rotations

Omega [deg]	Phi [deg]	Kappa [deg]
0.00079669	0.00076381	0.00021953

Mean standard deviation of terrain points

X [m]	Y [m]	Z [m]	Total [m]
0.0056	0.0062	0.0189	0.0207

RMS values for GNSS

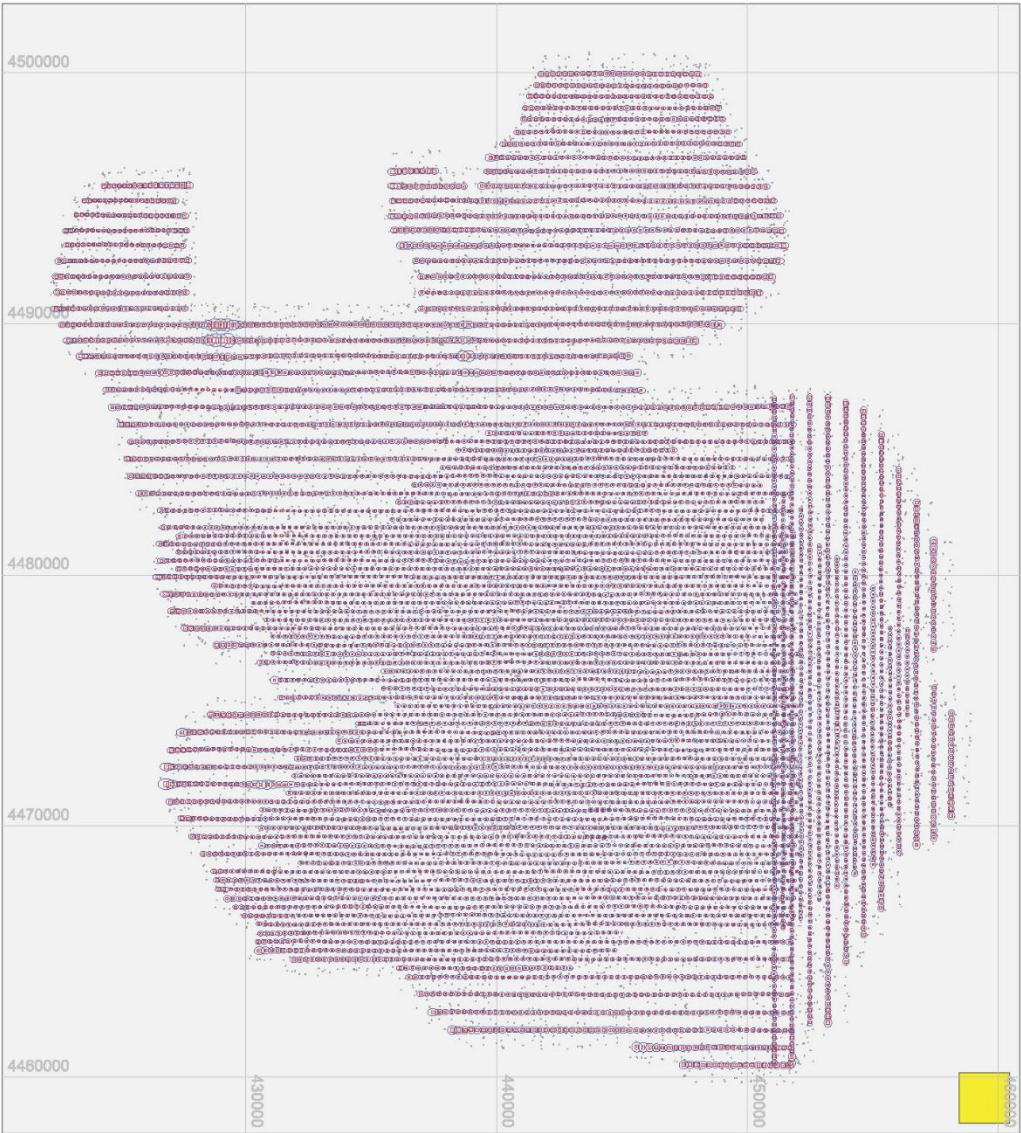
X [m]	Y [m]	Z [m]	Total [m]
0.1925	0.1990	0.1484	0.3141

RMS values for IMU

Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]	Total [deg]
0.00552120	0.00617974	0.00454075	0.00944940



Exterior orientation (X,Y,Z) standard deviations (Madrid2023_nadir)



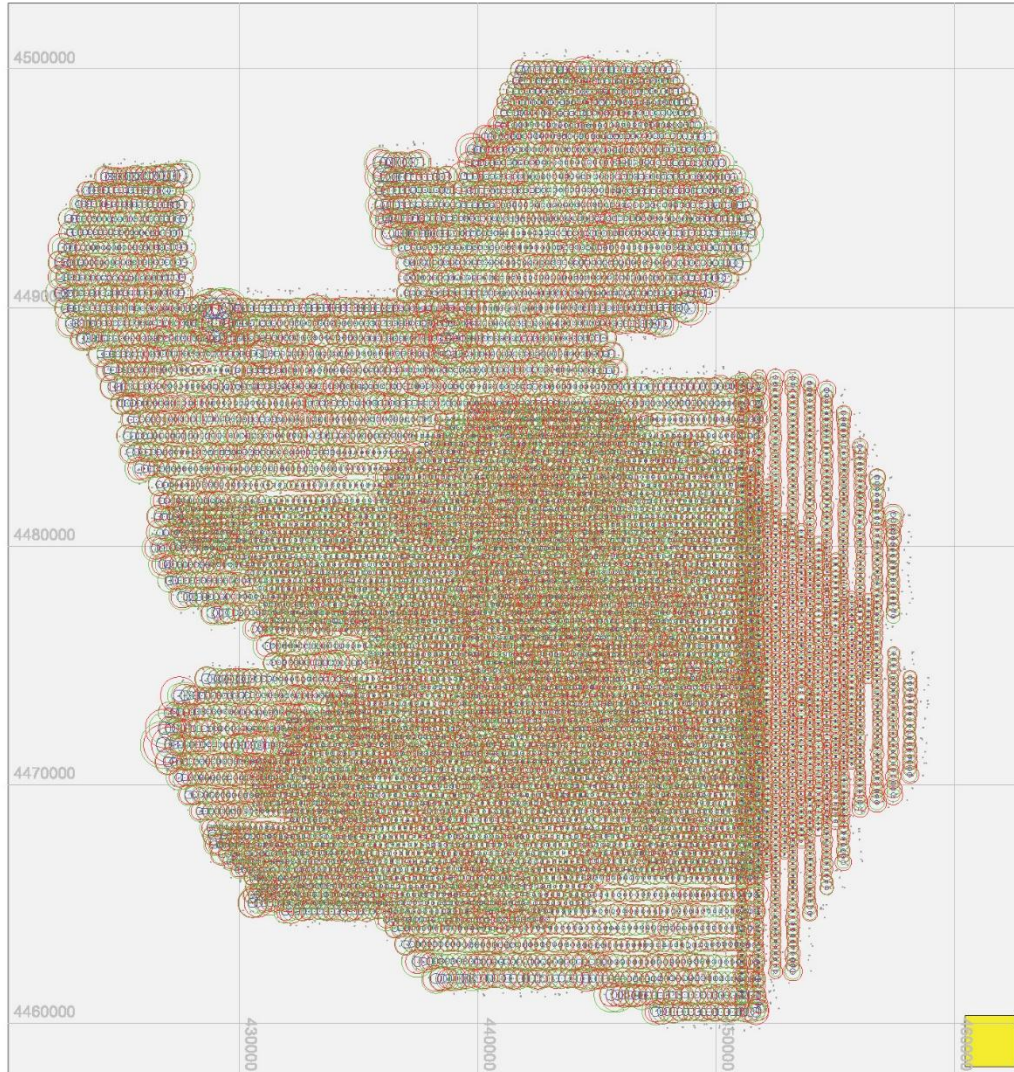
Graphic with 8764 photos from the project. The camera locations are shown with its standard deviations for XYZ. The area has a planimetric extent of about: 40566 x 45013 [m].

- Scale for the symbols. Symbol in the graphic is correlated to 0.221 [m] in the object.
- Standard deviation XY for 8764 projection centers (min=0.0168, avg=0.0279, max=0.0879 [m]).
- Standard deviation Z for 8764 projection centers (min=0.0054, avg=0.0078, max=0.0301 [m]).
- Tie point location for 98797 points.



MATCH-AT

Exterior orientation (Omega,Phi,Kappa) standard deviations (Madrid2023_nadir)



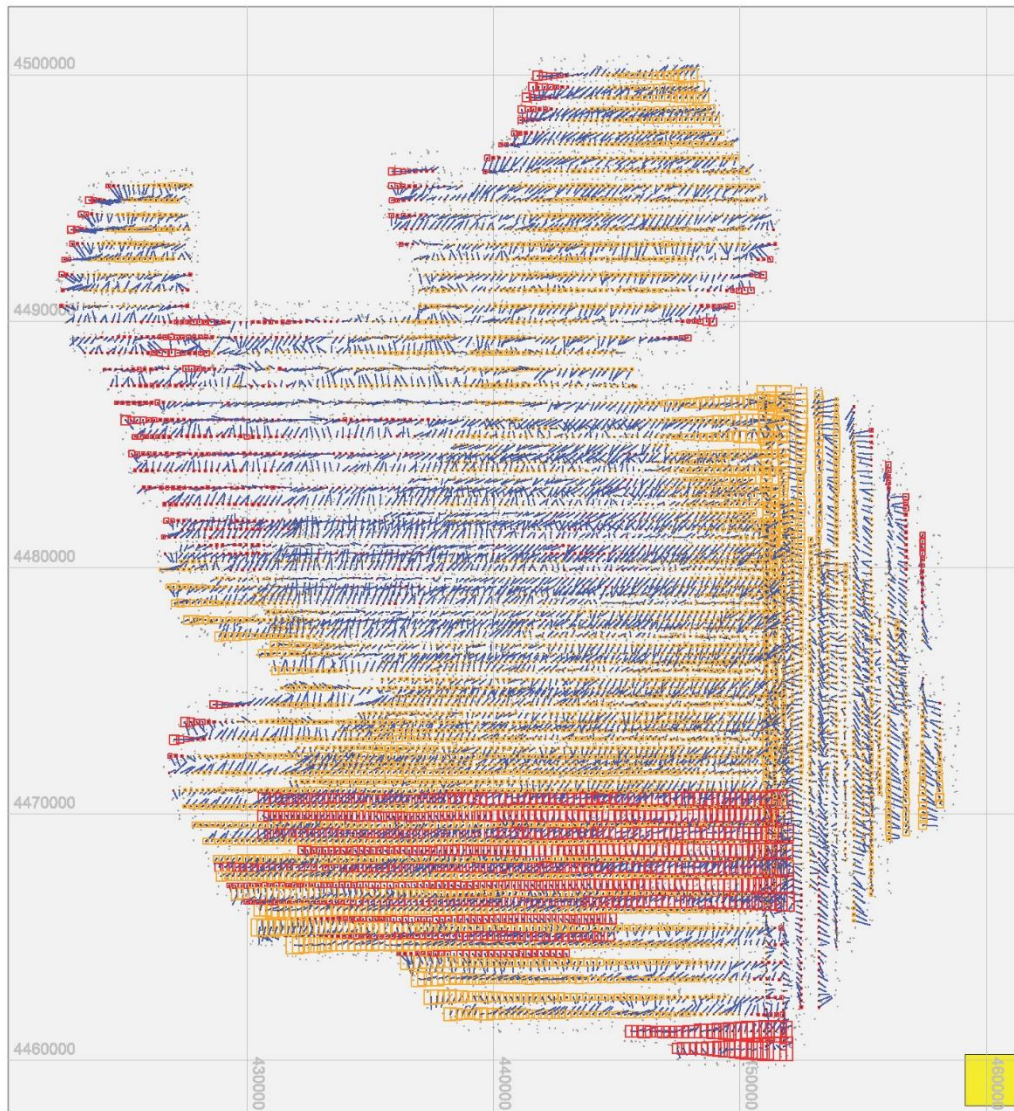
Graphic with 8764 photos from the project. The camera locations are shown with its standard deviations for omega,phi,kappa. The area has a planimetric extent of about: 40566 x 45013 [m].

- : Scale for the symbols. Symbol in the graphic is correlated to 0.00297 [deg] in the object.
- : Standard deviation omega(X) for 8764 projection centers (min=0.00043, avg=0.00080, max=0.00240 [deg]).
- : Standard deviation phi(Y) for 8764 projection centers (min=0.00032, avg=0.00076, max=0.00281 [deg]).
- : Standard deviation kappa(Z) for 8764 projection centers (min=0.00008, avg=0.00022, max=0.00123 [deg]).
- : Tie point location for 98797 points.



MATCH-AT

GNSS residuals (observed - adjusted) (Madrid2023_nadir)



Graphic with 8764 used GNSS locations from the adjustment. The points are shown with its residuals for X,Y,Z from the adjustment. The area has a planimetric extent of about: 40566 x 45013 [m]. Residual is defined as: residual = observed - adjusted.

- Scale for the symbols. Symbol in the graphic is correlated to 1.571 [m] in the object.
- Residual XY for (8764) GNSS positions (min=-0.0039, avg=0.2581, max=0.8250 [m]).
- Residual Z for (pos.:2249/neg.:6515) GNSS positions (min=-0.5651, avg=0.1076, max=0.7268 [m]).
- Number of eliminated GNSS observations: 0 of 8764.
- Tie point location for 98797 points.

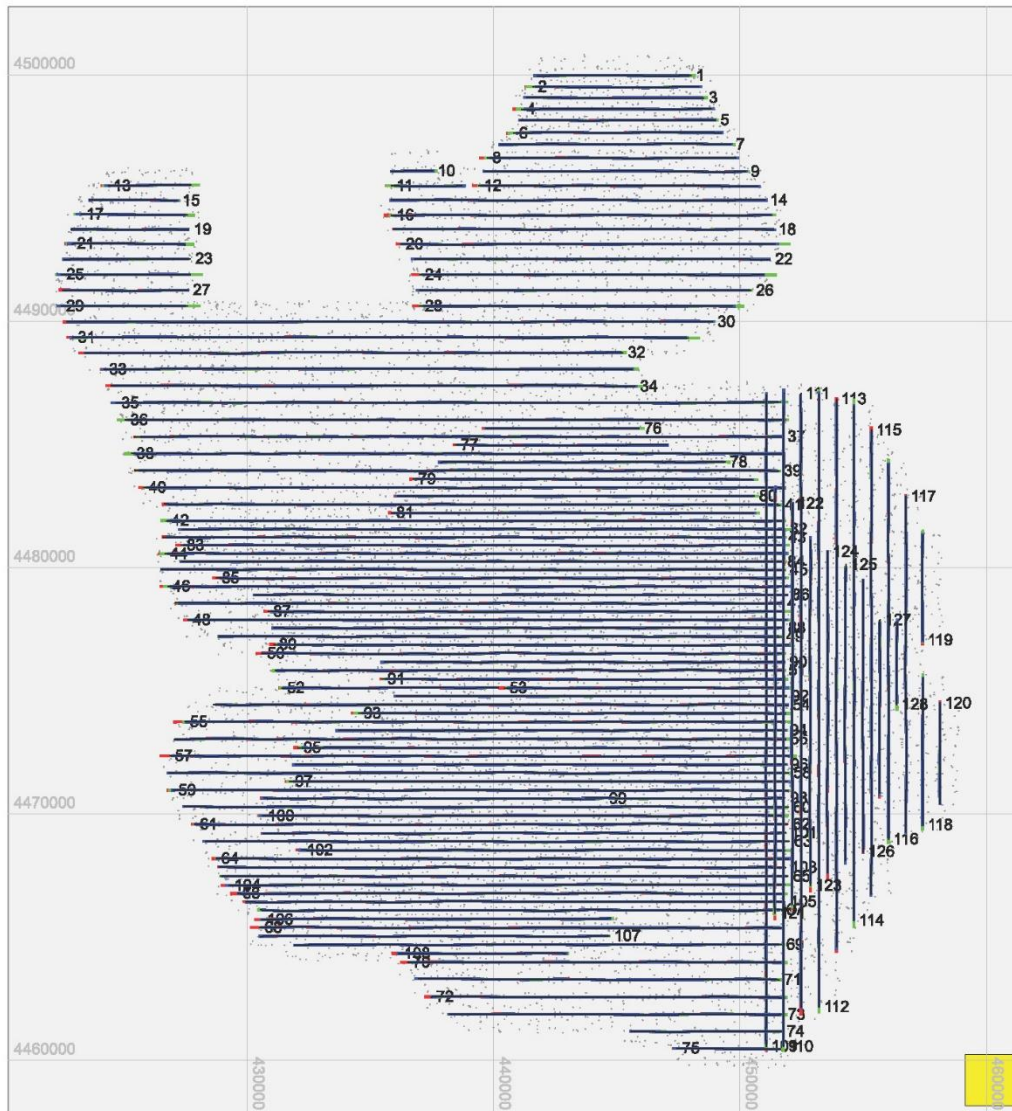
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MATCH-AT

IMU residuals (observed - adjusted) (Madrid2023_nadir)



Graphic with 8764 IMU locations from the adjustment. The points are shown with its residuals for omega, phi, kappa from the adjustment. The area has a planimetric extent of about: 40566 x 45013 [m]. Residual is defined as: residual = observed - adjusted.

- : Scale for the symbols. Symbol in the graphic is correlated to 0.09449 [deg] in the object.
- : Residual omega(X) for (8764) IMU positions (min=-0.01850, avg=0.00029, max=0.02116 [deg]).
- : Residual phi(Y) for (8764) IMU positions (min=-0.02579, avg=-0.00044, max=0.02764 [deg]).
- : Residual kappa(Z) for (8764) IMU positions (min=-0.00990, avg=-0.00186, max=0.01802 [deg]).
- : Tie point location for 98797 points.

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Ground control points

The number of control points (549) exceeds the maximum number of points (500) for the visualization in this context.



Ground control points

The number of control points (549) exceeds the maximum number of points (500) for the visualization in this context.

4.3.2. Bloque Back-Front

	MATCH-AT (Multi-Head)
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Processing Report

Project name: Madrid2025_FB

General project information

Flight overview

Tie point distribution

Image points

Camera

Camera 0

Camera 1

Exterior orientation evaluation summary

Block adjustment settings

Block adjustment results

Ground control points

Ground control point statistics

MATCH-AT (Multi-Head)

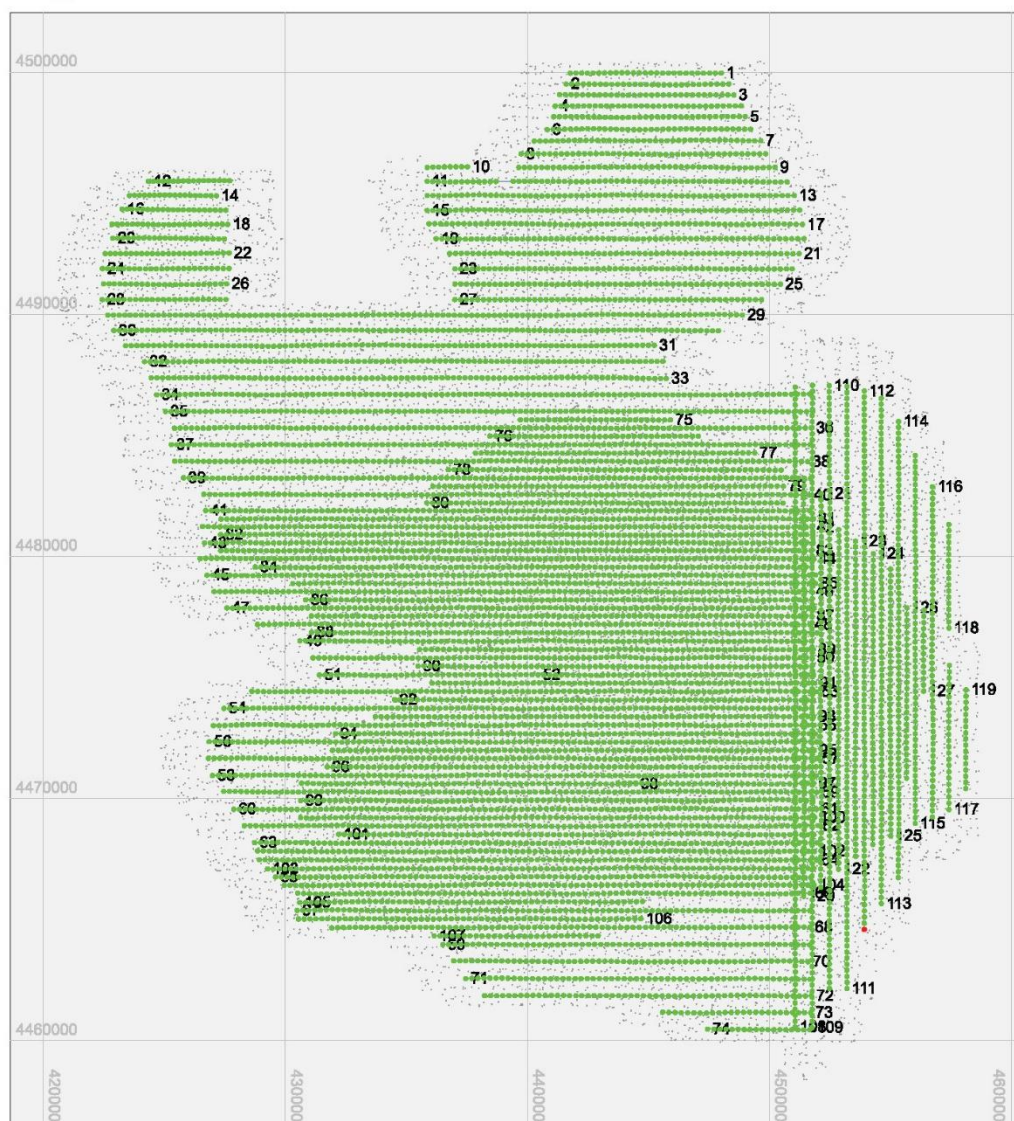
General project information

Project name	Madrid2025_FB
Process	Geo-referencing
Computer node	RESTITUCION-1
Operating system	Microsoft Windows 10 Professional (build 26200), 64-bit, version 10.0
Machine	12th Gen Intel(R) Core(TM) i700K, 20 cores, 63.7 GByte RAM
Program version	13.2.0.10038
User name	Restitucion-1
Source time (*.sta)	Wed May 6 12:30:00 2026
Report time (*.pdf)	Wed May 6 12:58:07 2026
Project file	G:/Vuelos/Madrid_2025/Aero_Front-Back/Madrid2025_FB.prj
Statistic file	G:/Vuelos/Madrid_2025/Aero_Front-Back/Madrid2025_FB.sta
Active block	Complete
Number of used images	17525 of 17528
Number of used cameras	2 of 2
Number of strips	127
Flying height	min=2449.7 / avg=2521.4 / max=2595.0 [m]
Terrain height	min=488.4 / avg=658.1 / max=994.0 [m]
Average photo scale	1 : 15086
Coordinate system	PROJCS["UTM Zone 30 N", GEOGCS["ETRS89",DATUM["European Terrestrial Reference System 1989", SPHEROID["GRS 1980",6378137, 298.2572221011,AUTHORITY["EPSG","7019"]], TOWGS84[0,0,0,0,0,0,0], AUTHORITY["EPSG","6258"]], PRIMEM["Greenwich",0,AUTHORITY["EPSG", "8901"]], UNIT["Degree",0.01745329251994, AUTHORITY["EPSG","9102"]], AXIS["Long",EAST], AXIS["Lat",NORTH], AUTHORITY["EPSG","4258"]], PROJECTION["Transverse_Mercator"], PARAMETER["False_Easting",500000], PARAMETER["False_Northing",0], PARAMETER["Latitude_Of_Origin",0], PARAMETER["Central_Meridian",-3], PARAMETER["Scale_Factor",0.9996], UNIT["Meter",1,AUTHORITY["EPSG","9001"]], AXIS["East",EAST], AXIS["North",NORTH], AUTHORITY["EPSG","25830"]]



MATCH-AT (Multi-Head)

Flight overview



Graphic with 127 strip definitions for the aerial triangulation. The area has a planimetric extent of about: 42046 x 46056 [m].

- : Camera location for 17525 adjusted photos.
- : Camera location for 3 eliminated photos.
- : Defined strip in the project.
- : Tie point location for 181475 points.

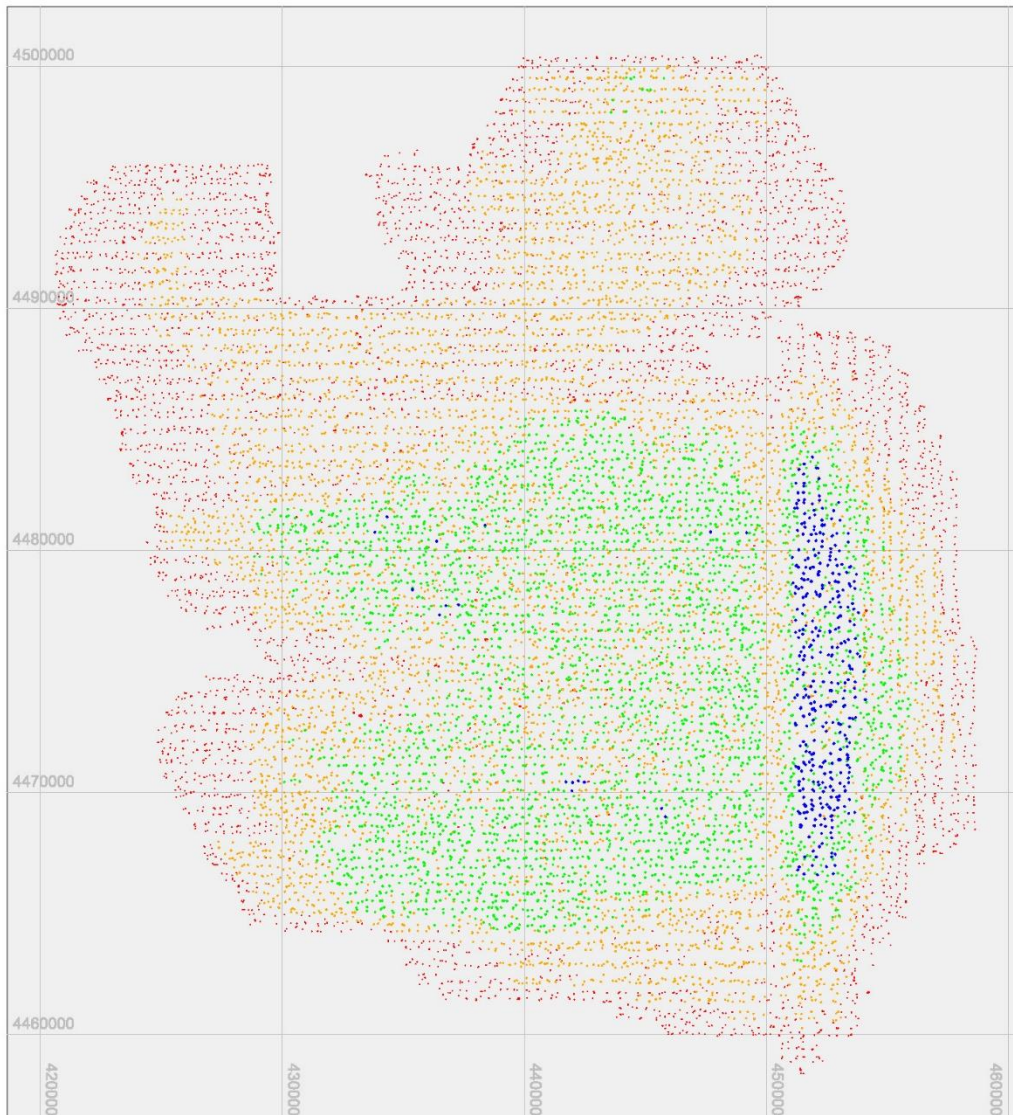
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MATCH-AT (Multi-Head)

Tie point distribution



Tie point distribution of 181475 points in the statistic file. The point size and colour reflects the number of images containing the point. The area has a planimetric extent of about: 42046 x 46056 [m] and a height range of about: 488 - 994 [m].

- : Point found in (0-13) images.
- : Point found in (14-26) images.
- : Point found in (27-39) images.
- : Point found in (>39) images.

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MATCH-AT (Multi-Head)

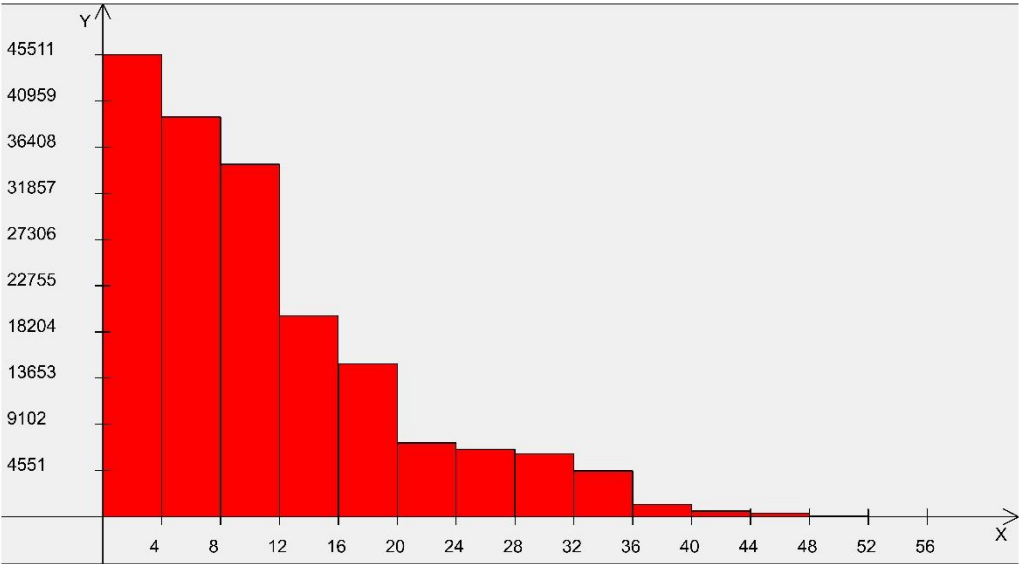
Image points

Frequency of image point observations in the photos

X	Number of image points (Y)	%
>0 - 4	45511	25.08
>4 - 8	39401	21.71
>8 - 12	34722	19.13
>12 - 16	19787	10.90
>16 - 20	15071	8.30
>20 - 24	7292	4.02
>24 - 28	6664	3.67
>28 - 32	6194	3.41
>32 - 36	4528	2.50
>36 - 40	1251	0.69
>40 - 44	583	0.32
>44 - 48	355	0.20
>48 - 52	104	0.06
>52 - 56	12	0.01

Appearance of 181475 image points from the statistic file. The table contains all image observations of the points.

Histogram for image point frequency in the photos



Graphic for 17525 photos and 181475 image points. Number of image points (Y) within a given range for number of photos (X).

MATCH-AT (Multi-Head)

Camera 0

Camera data (Custom_back)

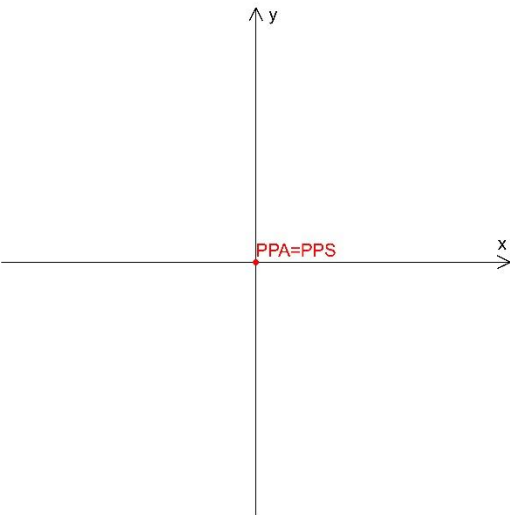
Data source	Madrid2025_FB.sta		
Sensor type	CCD sensor		
Manufacturer	Custom		
Model	Custom		
Serial number	not defined		
Camera UUID	not defined		
Sensor (width / height) [pixel]	14144	10560	
Pixel size (x / y) [micron]	3.7600	3.7600	
Ground sampling distance (x / y) [m]	0.0567	0.0567	
Calibration process	OFF		
Calibration status	Initial		
Calibration direction	INPHO (from ideal to measured)		
Distortion type	Undefined		
Additional parameters	OFF		
Focal length [mm / pixel]	123.3800	32813.8298	
Focal length (Fx / Fy) [pixel]	32813.8298	32813.8298	
Principal point (x / y) [mm pixel]	0.0000 7071.5000	0.0000 5279.5000	

Platform data (Custom_back)

	X [m]	Y [m]	Z [m]
GNSS antenna offset	0.000000	0.000000	0.000000
	Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]
IMU boresight alignment	0.000000	0.000000	0.000000
Camera mount rotation	---		

MATCH-AT (Multi-Head)

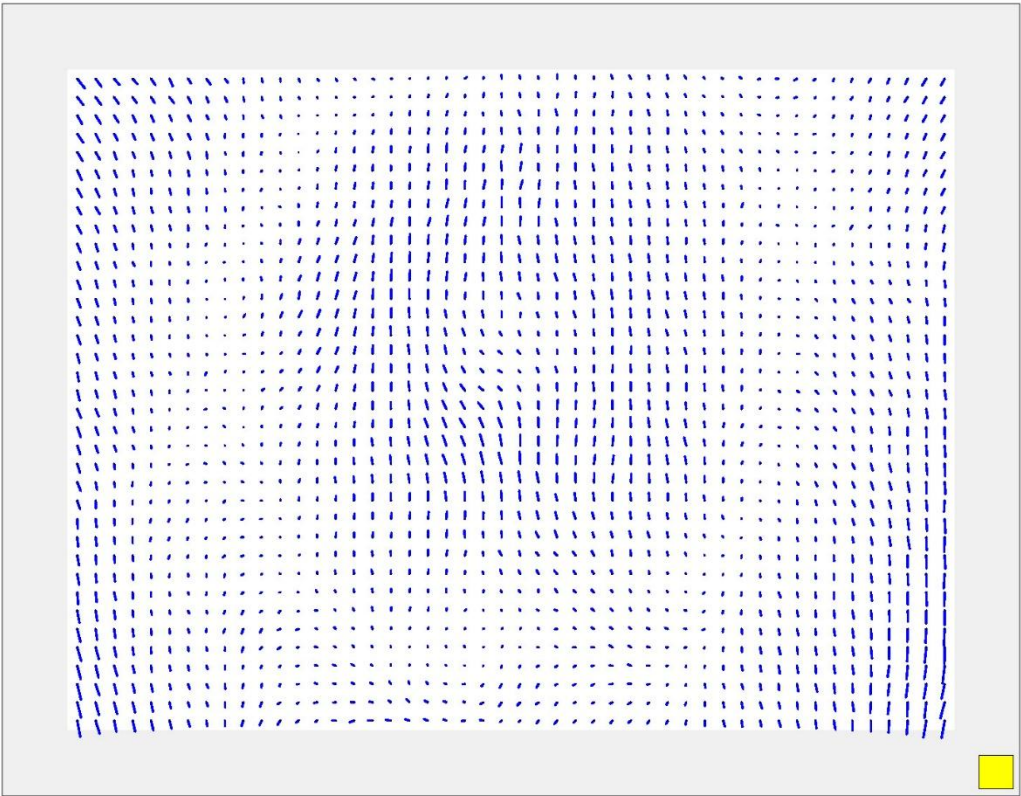
Camera data (Custom_back)



Principle point (x=0.0000, y=0.0000 [mm]) in the image.

MATCH-AT (Multi-Head)

Image residuals (Custom_back)



Graphic of 989416 back-projected adjusted points from the statistic file. Average image residual matrix vectors (min=0.002, avg=0.157, max=0.522 [pixel]) for image matrix elements. An image matrix element is defined with about (300 x 300) pixels. Image residual is defined as: residual = observed - adjusted. Number of invalid image residual vectors outside the graphic: 0.

-  : Scale for the residual vectors. Symbol in the graphic is correlated to 1 [pixel] in the image.
-  : Average image residual vector for points in (0-2) images.
-  : Average image residual vector for points in (3-4) images.
-  : Average image residual vector for points in (5-10) images.
-  : Average image residual vector for points in (>10) images.



MATCH-AT (Multi-Head)

Exterior orientation evaluation (Custom_back)

ImageID	# of points	Distribution	RMS Ds [pixel]	Max Ds [pixel]	Remark
h50_0560_fot_508-20702_B	27	3 of 9	0.50	0.72	
h50_0559_fot_323-11112_B	36	3 of 9	0.49	1.43	
h50_0559_fot_504-20639_B	35	5 of 9	0.46	0.92	
h50_0559_fot_501-20500_B	46	5 of 9	0.46	0.88	
h50_0559_fot_323-11114_B	56	5 of 9	0.45	0.79	
h50_0559_fot_502-20522_B	32	4 of 9	0.45	0.92	
h50_0559_fot_502-20579_B	58	5 of 9	0.45	0.93	
h50_0559_fot_502-20521_B	45	4 of 9	0.45	0.81	
h50_0559_fot_505-20782_B	29	3 of 9	0.44	0.75	
h50_0559_fot_322-22736_B	70	5 of 9	0.44	0.86	
h50_0560_fot_508-20701_B	26	3 of 9	0.44	0.74	
h50_0582_fot_332-10325_B	49	5 of 9	0.44	0.90	
h50_0559_fot_505-20792_B	47	5 of 9	0.43	0.69	
h50_0559_fot_324-11002_B	63	5 of 9	0.43	0.77	
h50_0559_fot_323-11111_B	57	4 of 9	0.43	0.84	
h50_0559_fot_502-20581_B	48	5 of 9	0.43	0.79	
h50_0559_fot_315-22261_B	31	4 of 9	0.43	0.84	
h50_0534_fot_121-17167_B	75	5 of 9	0.43	0.86	
h50_0559_fot_501-20463_B	71	5 of 9	0.43	0.85	
h50_0559_fot_502-20553_B	56	5 of 9	0.43	0.79	
h50_0560_fot_508-20698_B	24	4 of 9	0.43	0.77	
h50_0559_fot_322-22753_B	57	5 of 9	0.42	0.76	
h50_0559_fot_323-11116_B	69	5 of 9	0.42	0.87	
h50_0559_fot_502-20580_B	46	5 of 9	0.42	0.95	
h50_0559_fot_505-20796_B	37	5 of 9	0.42	0.80	
h50_0534_fot_151-20093_B	77	4 of 9	0.42	0.94	
h50_0559_fot_314-22125_B	64	5 of 9	0.41	0.82	
h50_0559_fot_502-20519_B	36	4 of 9	0.41	0.81	
h50_0559_fot_502-20564_B	39	5 of 9	0.41	0.83	
h50_0559_fot_505-20828_B	36	4 of 9	0.41	0.76	
h50_0559_fot_503-20630_B	52	5 of 9	0.41	0.80	
h50_0534_fot_147-23061_B	57	5 of 9	0.41	0.85	
h50_0559_fot_326-10850_B	85	5 of 9	0.41	0.82	
h50_0559_fot_313-22074_B	73	5 of 9	0.41	0.84	
h50_0559_fot_505-20798_B	44	5 of 9	0.41	0.91	
h50_0559_fot_502-20563_B	36	4 of 9	0.41	0.73	
353 more photo(s)	---	---	---	---	

Statistic of 989416 back-projected adjusted points from the statistic file. The table list 36 of 389 photos with an EO beyond the thresholds. The project consist of 8762 of 17528 photos from this camera. The table contain differences between the matched image points and back-projected adjusted points. Photos with at least one of the following conditions are visible:

- * # of points : Number of points/photo < 30 [points]
- * Distribution : Number of image tiles with more than 3 points < 6 [image tiles]
- * RMS Ds [pixel] : RMS difference in pixel > 0.8 [pixel]

MATCH-AT (Multi-Head)

Camera 1

Camera data (Custom_front)

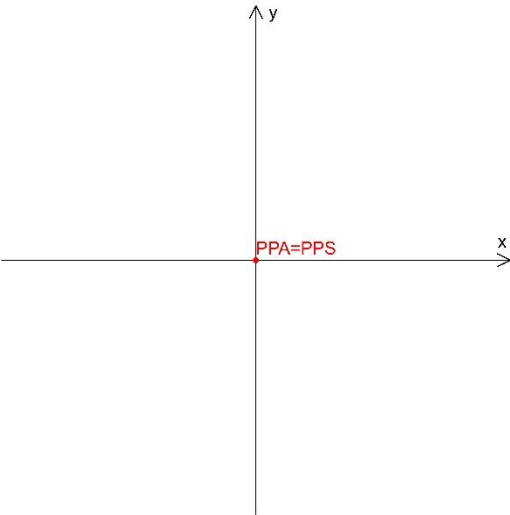
Data source	Madrid2025_FB.sta		
Sensor type	CCD sensor		
Manufacturer	Custom		
Model	Custom		
Serial number	not defined		
Camera UUID	not defined		
Sensor (width / height) [pixel]	14144	10560	
Pixel size (x / y) [micron]	3.7600	3.7600	
Ground sampling distance (x / y) [m]	0.0567	0.0567	
Calibration process	OFF		
Calibration status	Initial		
Calibration direction	INPHO (from ideal to measured)		
Distortion type	Undefined		
Additional parameters	OFF		
Focal length [mm / pixel]	123.3800	32813.8298	
Focal length (Fx / Fy) [pixel]	32813.8298	32813.8298	
Principal point (x / y) [mm pixel]	0.0000 7071.5000	0.0000 5279.5000	

Platform data (Custom_front)

	X [m]	Y [m]	Z [m]
GNSS antenna offset	0.000000	0.000000	0.000000
	Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]
IMU boresight alignment	0.000000	0.000000	0.000000
Camera mount rotation	---		

MATCH-AT (Multi-Head)

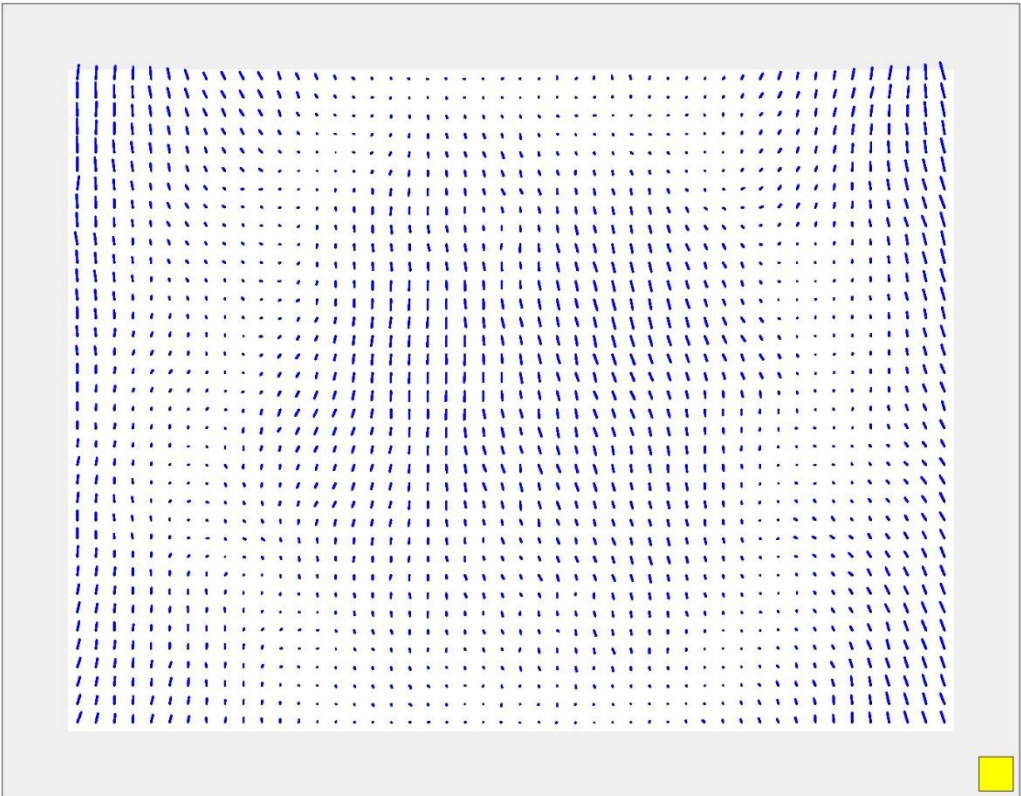
Camera data (Custom_front)



Principle point (x=0.0000, y=0.0000 [mm]) in the image.

MATCH-AT (Multi-Head)

Image residuals (Custom_front)



Graphic of 1088359 back-projected adjusted points from the statistic file. Average image residual matrix vectors (min=0.002, avg=0.152, max=0.507 [pixel]) for image matrix elements. An image matrix element is defined with about (300 x 300) pixels. Image residual is defined as: residual = observed - adjusted. Number of invalid image residual vectors outside the graphic: 0.

-  : Scale for the residual vectors. Symbol in the graphic is correlated to 1 [pixel] in the image.
-  : Average image residual vector for points in (0-2) images.
-  : Average image residual vector for points in (3-4) images.
-  : Average image residual vector for points in (5-10) images.
-  : Average image residual vector for points in (>10) images.



MATCH-AT (Multi-Head)

Exterior orientation evaluation (Custom_front)

ImageID	# of points	Distribution	RMS Ds [pixel]	Max Ds [pixel]	Remark
h50_0560_fot_508-20694_F	31	4 of 9	0.48	0.84	
h50_0559_fot_323-11133_F	78	5 of 9	0.45	0.92	
h50_0582_fot_332-10331_F	41	5 of 9	0.45	0.79	
h50_0560_fot_508-20701_F	50	3 of 9	0.44	0.76	
h50_0582_fot_332-10321_F	51	5 of 9	0.43	0.80	
h50_0582_fot_332-10330_F	43	5 of 9	0.43	0.76	
h50_0560_fot_508-20696_F	39	4 of 9	0.42	0.78	
h50_0560_fot_508-20695_F	41	5 of 9	0.42	0.78	
h50_0559_fot_504-20684_F	31	4 of 9	0.42	0.71	
h50_0582_fot_404-13897_F	44	4 of 9	0.42	0.76	
h50_0582_fot_404-13893_F	23	2 of 9	0.41	0.67	
h50_0559_fot_330-10504_F	40	5 of 9	0.41	1.12	
h50_0582_fot_404-13894_F	33	3 of 9	0.41	0.70	
h50_0559_fot_322-22739_F	55	4 of 9	0.41	0.88	
h50_0559_fot_501-20463_F	64	5 of 9	0.41	0.71	
h50_0559_fot_503-20629_F	47	4 of 9	0.40	0.82	
h50_0534_fot_145-23333_F	101	5 of 9	0.40	0.87	
h50_0534_fot_302-21209_F	54	5 of 9	0.40	0.73	
h50_0559_fot_322-22719_F	94	5 of 9	0.40	0.84	
h50_0559_fot_330-10492_F	72	4 of 9	0.40	0.82	
h50_0559_fot_402-13631_F	90	5 of 9	0.40	0.69	
h50_0582_fot_404-13895_F	40	3 of 9	0.39	0.79	
h50_0559_fot_311-21844_F	79	4 of 9	0.39	0.75	
h50_0559_fot_504-20680_F	57	5 of 9	0.39	0.76	
h50_0559_fot_316-22269_F	70	5 of 9	0.39	0.82	
h50_0560_fot_508-20693_F	46	5 of 9	0.38	0.79	
h50_0582_fot_332-10333_F	21	3 of 9	0.38	0.69	
h50_0560_fot_508-20704_F	35	4 of 9	0.38	0.77	
h50_0559_fot_316-22268_F	81	5 of 9	0.38	0.79	
h50_0559_fot_319-22535_F	81	5 of 9	0.38	0.71	
h50_0559_fot_503-20626_F	56	5 of 9	0.38	0.73	
h50_0559_fot_329-10550_F	82	5 of 9	0.37	0.84	
h50_0559_fot_322-22741_F	90	5 of 9	0.37	0.81	
h50_0560_fot_508-20697_F	30	4 of 9	0.37	0.72	
h50_0559_fot_330-10502_F	57	5 of 9	0.37	0.68	
h50_0582_fot_402-13610_F	39	4 of 9	0.37	0.75	
187 more photo(s)	---	---	---	---	

Statistic of 2077775 back-projected adjusted points from the statistic file. The table list 36 of 223 photos with an EO beyond the thresholds. The project consist of 8763 of 17528 photos from this camera. The table contain differences between the matched image points and back-projected adjusted points. Photos with at least one of the following conditions are visible:

- * # of points : Number of points/photo < 30 [points]
- * Distribution : Number of image tiles with more than 3 points < 6 [image tiles]
- * RMS Ds [pixel] : RMS difference in pixel > 0.8 [pixel]



MATCH-AT (Multi-Head)

Exterior orientation evaluation summary

Legend of histogram for number of tie points

X : Range for the number of tie points/photo.
Y : Number of images for the defined range (X).
Thr : Empirical threshold (30 points/photo) for the definition of weaker images.

Legend of histogram for distribution of tie points

X : Number of sufficient occupied image tiles with tie points. The image is divided into 9 equal image tiles.
Y : Number of images for the defined image tile occupation (X).
Thr : Empirical threshold (6 image tiles) for the definition of weaker images.

Legend of histogram for RMS values of tie points

X : Range for the RMS value.
Y : Number of images for the defined range (X).
RMS : RMS value for differences between the matched image points and back-projected adjusted points.
Thr : Statistical threshold ($0.85 \text{ [pixel]} = 3 \cdot \sigma$ naught from the block adjustment) for the definition of weaker images.

Statistical information about used elements for EO evaluation

Data base : Statistic file (*.sta)
Number of photos : 17525 of 17528
Number of camera(s) : 2 of 2
Number of used image observations : 2077775
Number of adjusted points : 181475

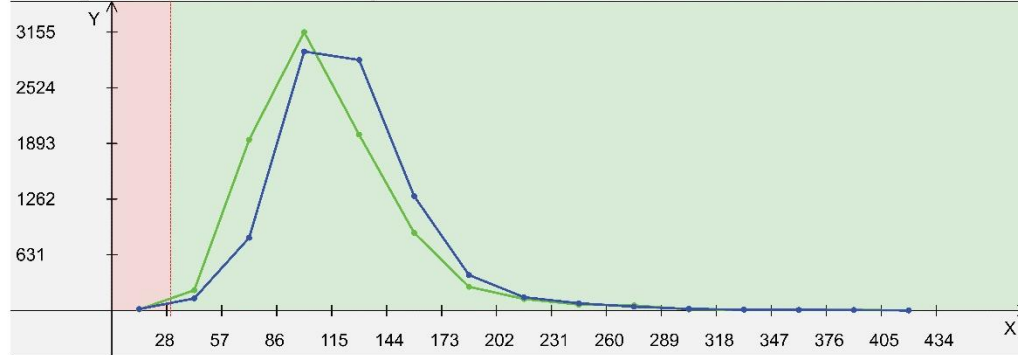
Camera color assignment

 : Threshold (Thr) for the actual evaluation criteria.
 : for Camera : Custom_back.
 : for Camera : Custom_front.
 : Range with acceptable photos.
 : Range with suspect photos.

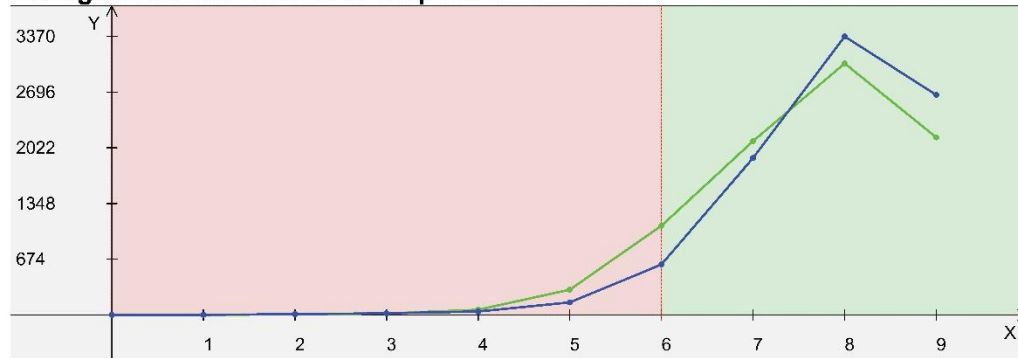


MATCH-AT (Multi-Head)

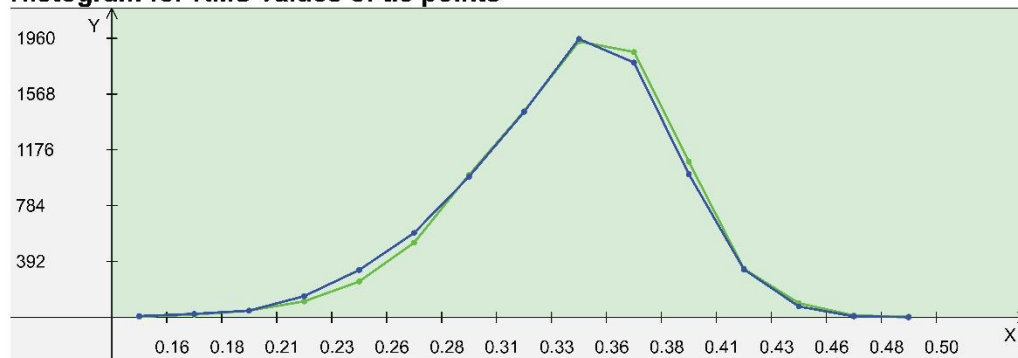
Histogram for number of tie points



Histogram for distribution of tie points



Histogram for RMS values of tie points



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MATCH-AT (Multi-Head)

Block adjustment settings

Block Parameters

Image standard deviation:	X [mm]	Y [mm]	
automatic	0.002000	0.002000	
manual	0.002000	0.002000	
Object standard deviation:	X [m]	Y [m]	Z [m]
control points	0.030000	0.030000	0.045000
Earth curvature correction	OFF		
Refraction correction	OFF		

GNSS Parameters

Mode	ON		
Shift/Drift	OFF		
	X [m]	Y [m]	Z [m]
Shift	ON	ON	ON
Drift	OFF	OFF	OFF
Standard deviation	0.100000	0.100000	0.100000

IMU Parameters

Mode	ON		
Shift/Drift	OFF		
Boresight alignment	OFF		
	Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]
Shift	---	---	---
Drift	OFF	OFF	OFF
Standard deviation	0.008000	0.008000	0.008000



MATCH-AT (Multi-Head)

Block adjustment results

Accuracy

Sigma naught	1.0639 [micron]
	0.2830 [pixel]

Mean standard deviation of translations

X [m]	Y [m]	Z [m]	Total [m]
0.0202	0.0277	0.0287	0.0447

Mean standard deviation of rotations

Omega [deg]	Phi [deg]	Kappa [deg]
0.00101518	0.00097716	0.00072581

Mean standard deviation of terrain points

X [m]	Y [m]	Z [m]	Total [m]
0.0448	0.0185	0.0491	0.0690

RMS values for GNSS

X [m]	Y [m]	Z [m]	Total [m]
0.2184	0.1250	0.1052	0.2728

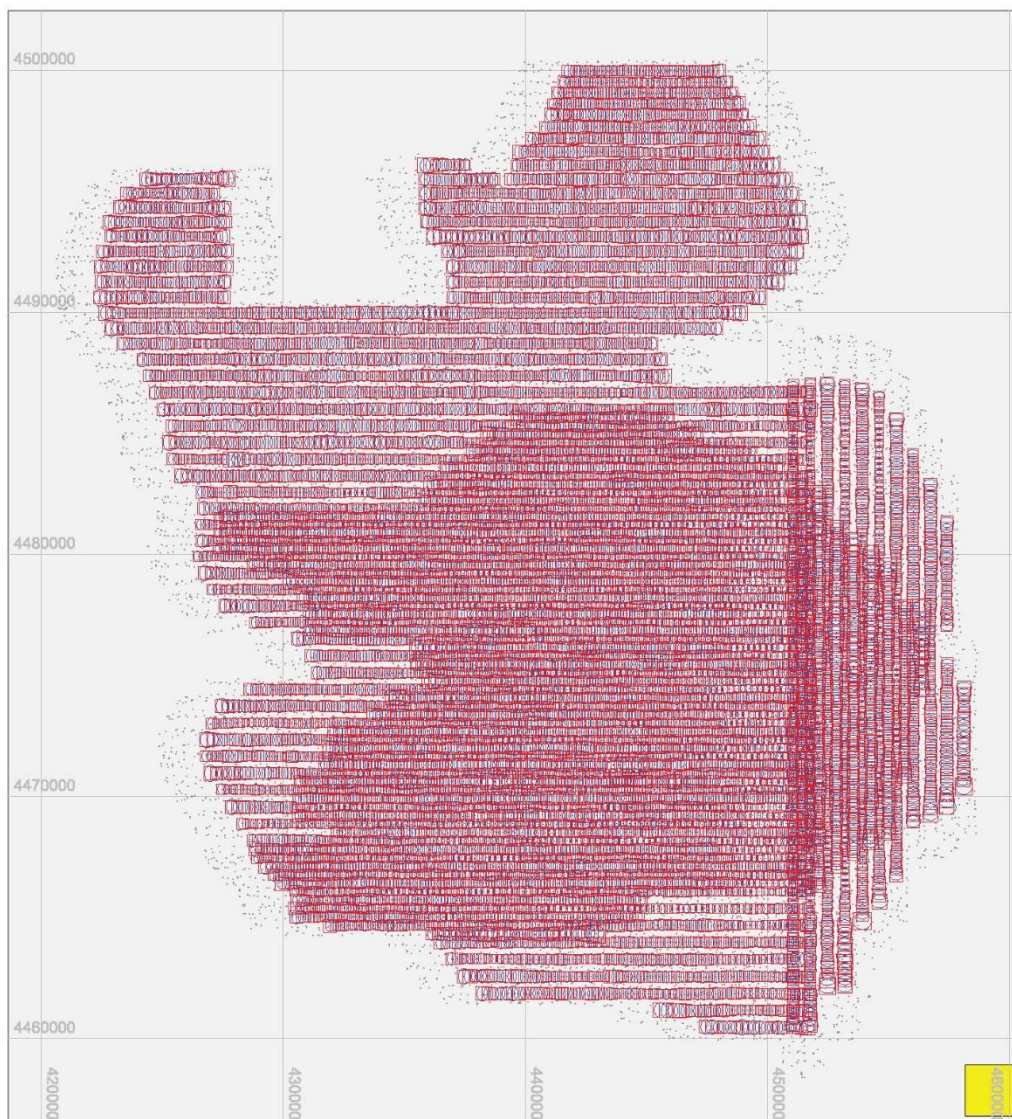
RMS values for IMU

Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]	Total [deg]
0.00639829	0.00491391	0.00688915	0.01060873



MATCH-AT (Multi-Head)

Exterior orientation (X,Y,Z) standard deviations (Custom_back)



Graphic with 7862 photos from the project. The camera locations are shown with its standard deviations for XYZ. The area has a planimetric extent of about: 42046 x 46056 [m].

- : Scale for the symbols. Symbol in the graphic is correlated to 0.142 [m] in the object.
- : Standard deviation XY for 7862 projection centers (min=0.0169, avg=0.0356, max=0.0679 [m]).
- : Standard deviation Z for 7862 projection centers (min=0.0169, avg=0.0292, max=0.0520 [m]).
- : Tie point location for 181475 points.

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MATCH-AT (Multi-Head)

Exterior orientation (Omega,Phi,Kappa) standard deviations (Custom_back)



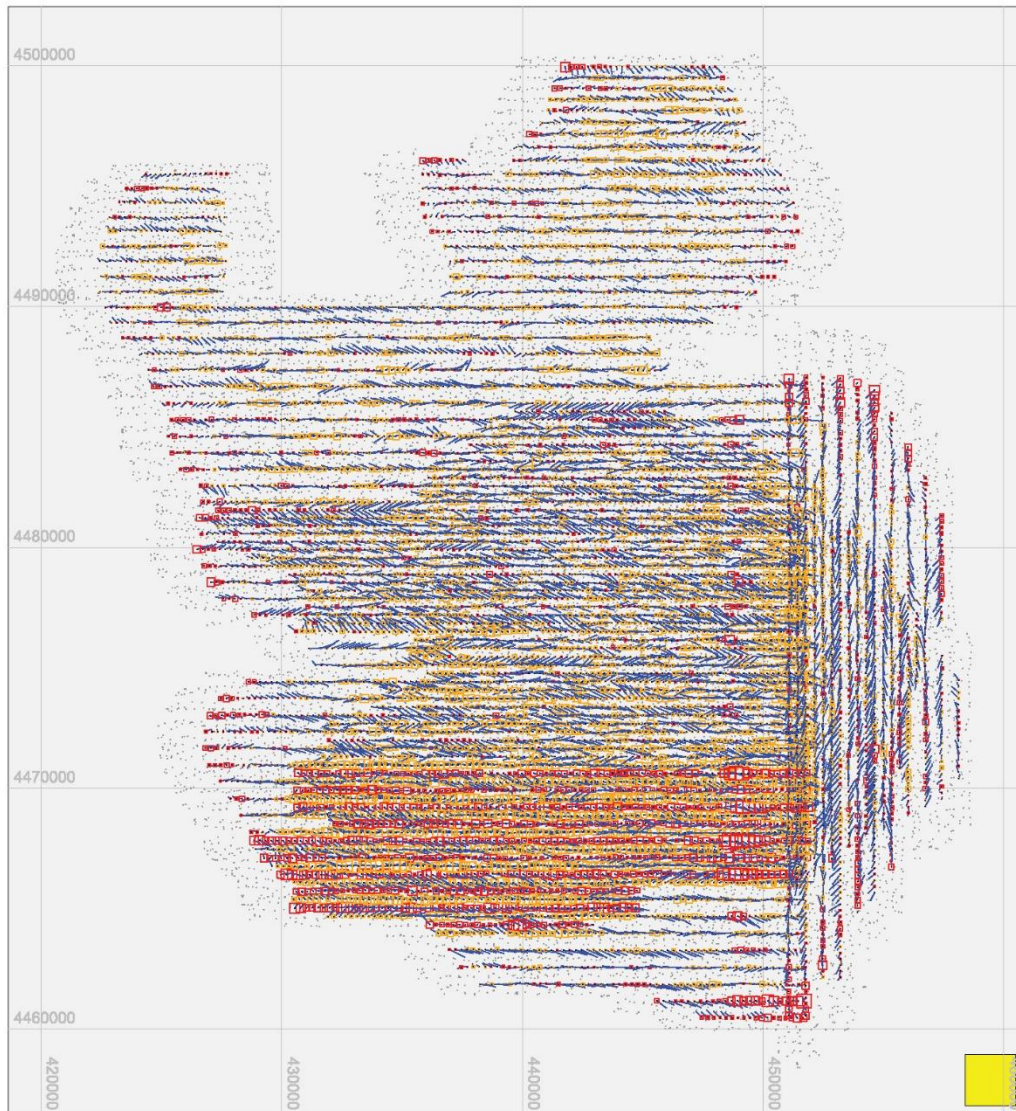
Graphic with 7862 photos from the project. The camera locations are shown with its standard deviations for omega,phi,kappa. The area has a planimetric extent of about: 42046 x 46056 [m].

- : Scale for the symbols. Symbol in the graphic is correlated to 0.00466 [deg] in the object.
- : Standard deviation omega(X) for 7862 projection centers (min=0.00047, avg=0.00104, max=0.00246 [deg]).
- : Standard deviation phi(Y) for 7862 projection centers (min=0.00050, avg=0.00100, max=0.00192 [deg]).
- : Standard deviation kappa(Z) for 7862 projection centers (min=0.00024, avg=0.00075, max=0.00360 [deg]).
- : Tie point location for 181475 points.



MATCH-AT (Multi-Head)

GNSS residuals (observed - adjusted) (Custom_back)



Graphic with 8762 used GNSS locations from the adjustment. The points are shown with its residuals for X,Y,Z from the adjustment. The area has a planimetric extent of about: 42046 x 46056 [m]. Residual is defined as: residual = observed - adjusted.

- Scale for the symbols. Symbol in the graphic is correlated to 1.364 [m] in the object.
- Residual XY for (8762) GNSS positions (min=-0.0129, avg=0.3026, max=0.6450 [m]).
- Residual Z for (pos.:2839/neg.:5923) GNSS positions (min=-0.3716, avg=0.0806, max=0.4138 [m]).
- Number of eliminated GNSS observations: 0 of 8762
- Tie point location for 181475 points.

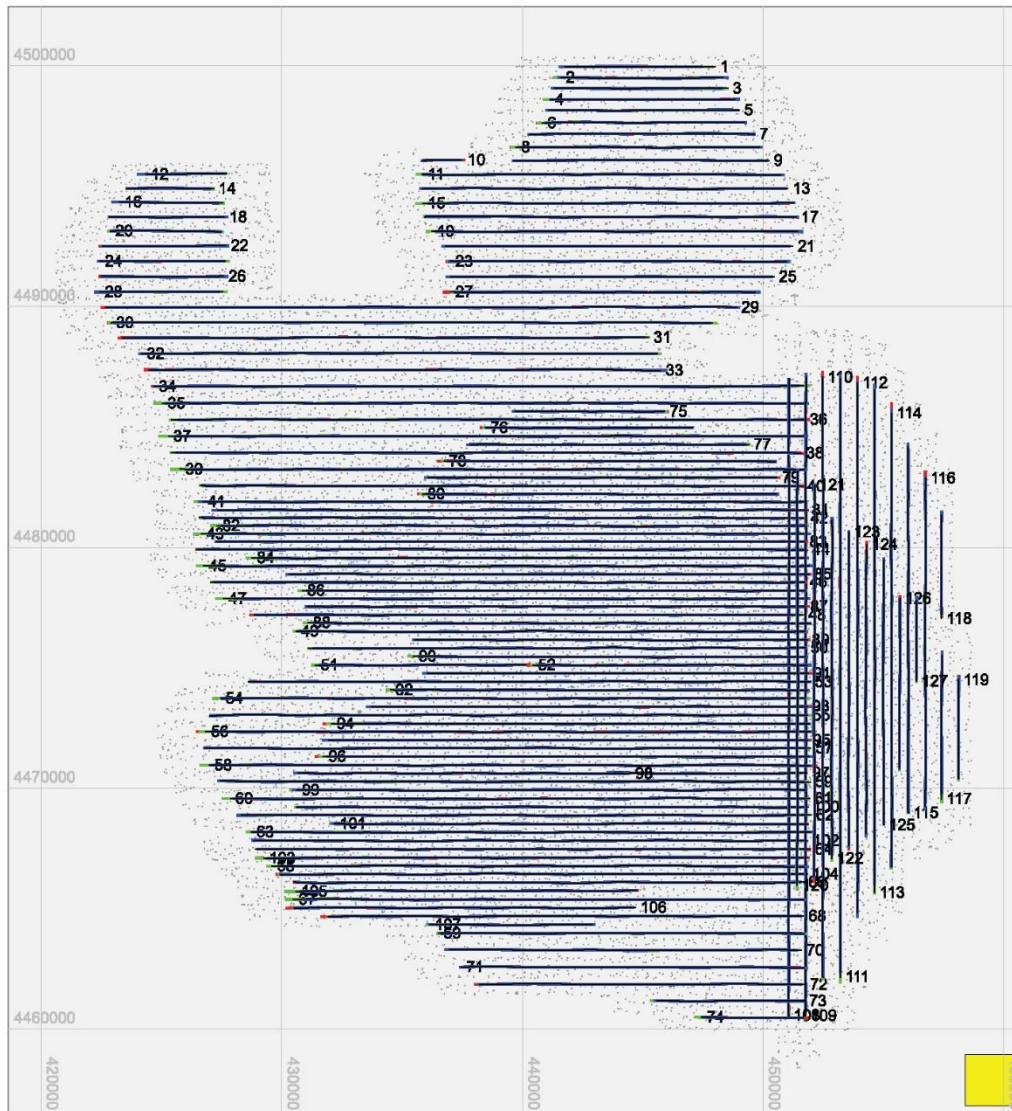
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MATCH-AT (Multi-Head)

IMU residuals (observed - adjusted) (Custom_back)



Graphic with 8762 IMU locations from the adjustment. The points are shown with its residuals for omega,phi,kappa from the adjustment. The area has a planimetric extent of about: 42046 x 46056 [m]. Residual is defined as: residual = observed - adjusted.

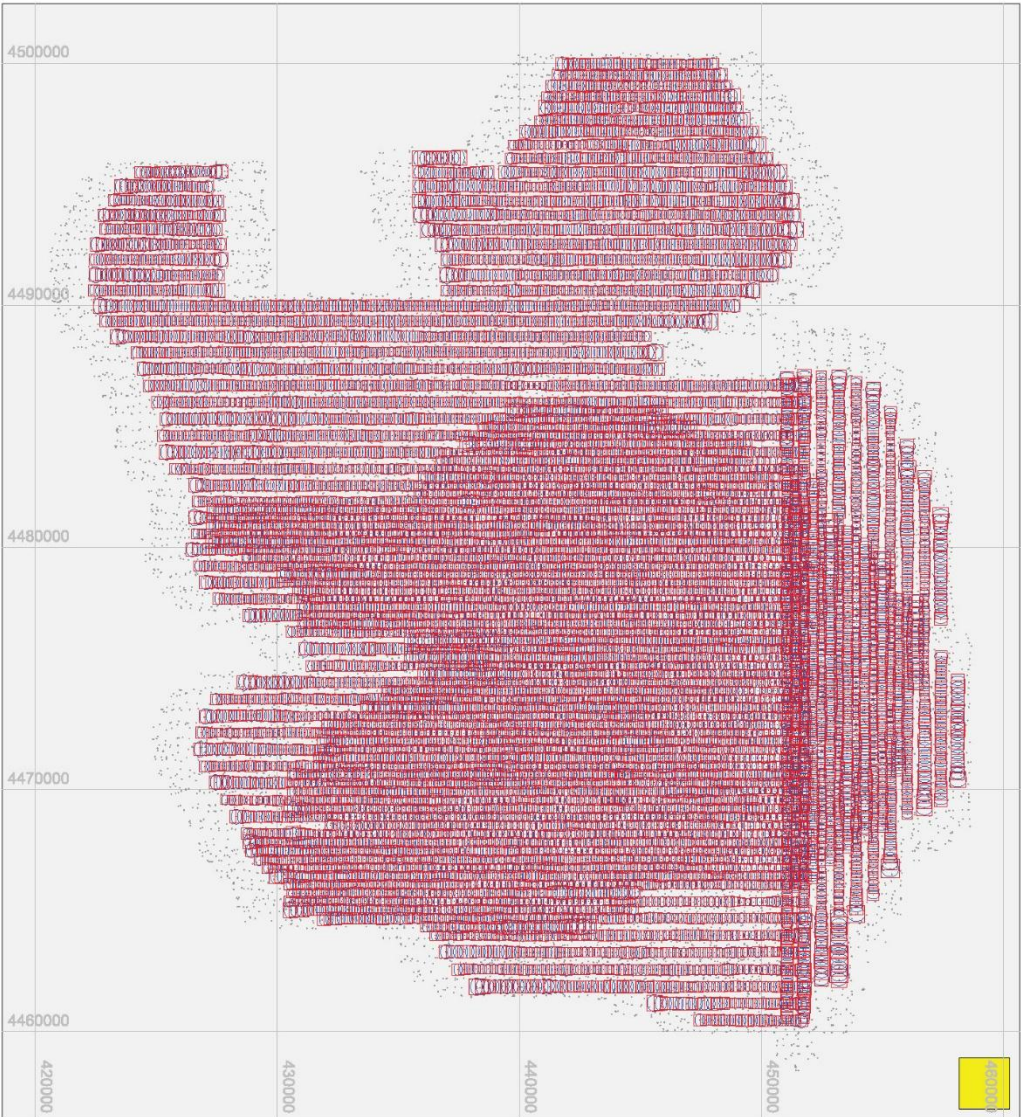
- : Scale for the symbols. Symbol in the graphic is correlated to 0.10609 [deg] in the object.
- : Residual omega(X) for (8762) IMU positions (min=-0.01690, avg=0.00158, max=0.02358 [deg]).
- : Residual phi(Y) for (8762) IMU positions (min=-0.02372, avg=0.00011, max=0.02159 [deg]).
- : Residual kappa(Z) for (8762) IMU positions (min=-0.02984, avg=-0.00299, max=0.02527 [deg]).
- : Tie point location for 181475 points.

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MATCH-AT (Multi-Head)

Exterior orientation (X,Y,Z) standard deviations (Custom_front)



Graphic with 7863 photos from the project. The camera locations are shown with its standard deviations for XYZ. The area has a planimetric extent of about: 42046 x 46056 [m].

-  : Scale for the symbols. Symbol in the graphic is correlated to 0.142 [m] in the object.
-  : Standard deviation XY for 7863 projection centers (min=0.0189, avg=0.0338, max=0.0670 [m]).
-  : Standard deviation Z for 7863 projection centers (min=0.0171, avg=0.0281, max=0.0514 [m]).
-  : Tie point location for 181475 points.



MATCH-AT (Multi-Head)

Exterior orientation (Omega,Phi,Kappa) standard deviations (Custom_front)

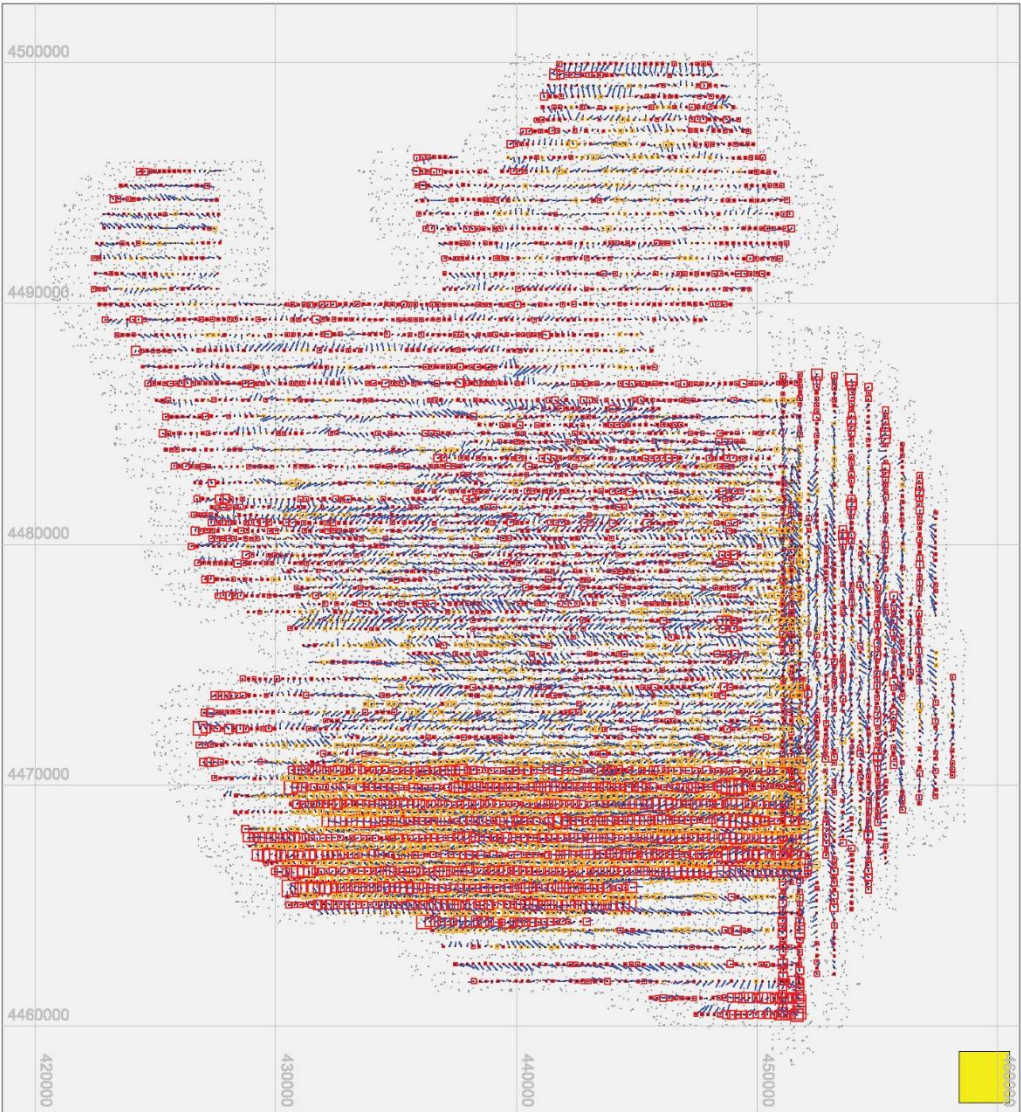


Graphic with 8763 photos from the project. The camera locations are shown with its standard deviations for omega,phi,kappa. The area has a planimetric extent of about: 42046 x 46056 [m].

-  : Scale for the symbols. Symbol in the graphic is correlated to 0.00440 [deg] in the object.
-  : Standard deviation omega(X) for 8763 projection centers (min=0.00047, avg=0.00099, max=0.00259 [deg]).
-  : Standard deviation phi(Y) for 8763 projection centers (min=0.00050, avg=0.00095, max=0.00202 [deg]).
-  : Standard deviation kappa(Z) for 8763 projection centers (min=0.00023, avg=0.00070, max=0.00335 [deg]).
-  : Tie point location for 181475 points.

MATCH-AT (Multi-Head)

GNSS residuals (observed - adjusted) (Custom_front)



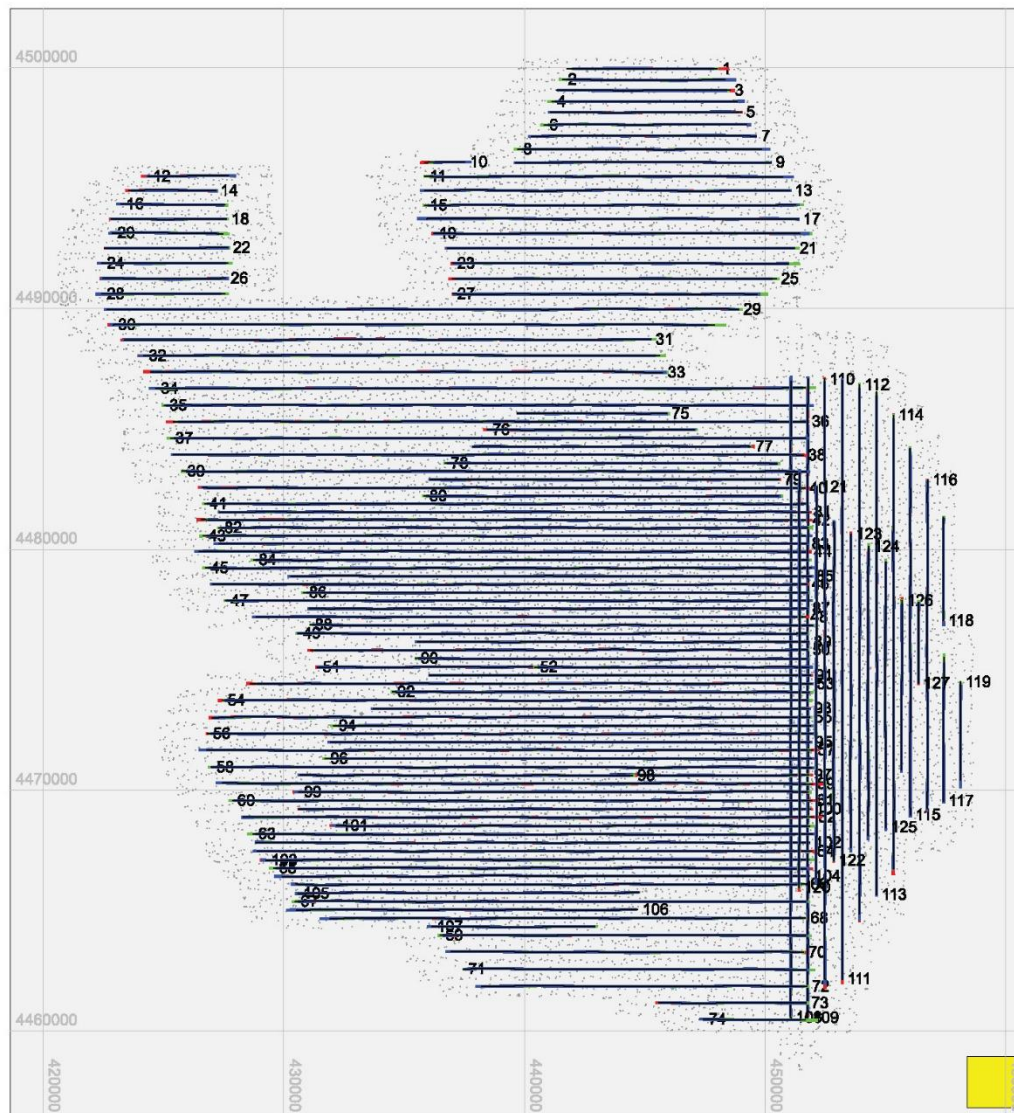
Graphic with 8763 used GNSS locations from the adjustment. The points are shown with its residuals for X,Y,Z from the adjustment. The area has a planimetric extent of about: 42046 x 46056 [m]. Residual is defined as: residual = observed - adjusted.

-  : Scale for the symbols. Symbol in the graphic is correlated to 1.364 [m] in the object.
-  : Residual XY for (8763) GNSS positions (min=0.0033, avg=0.1486, max=0.4833 [m]).
-  : Residual Z for (pos.:5580/neg.:3183) GNSS positions (min=-0.3370, avg=0.0803, max=0.4333 [m]).
-  : Number of eliminated GNSS observations: 0 of 8763
-  : Tie point location for 181475 points.



MATCH-AT (Multi-Head)

IMU residuals (observed - adjusted) (Custom_front)



Graphic with 8763 IMU locations from the adjustment. The points are shown with its residuals for omega,phi,kappa from the adjustment. The area has a planimetric extent of about: 42046 x 46056 [m]. Residual is defined as: residual = observed - adjusted.

- Scale for the symbols. Symbol in the graphic is correlated to 0.10609 [deg] in the object.
- Residual omega(X) for (8763) IMU positions (min=-0.02046, avg=-0.00058, max=0.02586 [deg]).
- Residual phi(Y) for (8763) IMU positions (min=-0.02558, avg=-0.00020, max=0.02301 [deg]).
- Residual kappa(Z) for (8763) IMU positions (min=-0.02291, avg=-0.00244, max=0.02672 [deg]).
- Tie point location for 181475 points.

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MATCH-AT (Multi-Head)

Ground control points

Ground control points from statistic file

ID	Type	X	Y	Z	Unit	Remark
PA1003	Full	428254.6900	4477344.9770	713.8480	m	
PA1007	Full	431700.9900	4474869.3730	696.5530	m	
PA1009	Vertical			713.9180	m	
PA1011	Full	427729.9790	4473476.2760	710.0290	m	
PA1013	Full	430018.1670	4465939.8580	714.1930	m	
PA1015	Full	433409.2680	4465354.5270	678.6370	m	
PA1017	Full	436032.7700	4465182.3830	638.8820	m	
PA1018	Full	436041.6240	4465182.5810	638.6160	m	
PA1023	Full	445612.8540	4460764.7620	560.7010	m	
PA1027	Full	453182.0110	4463691.2980	539.3530	m	
PA1031	Full	450098.2250	4466329.4940	626.2170	m	
PA1033	Full	450375.4520	4468741.8360	648.8050	m	
PA1034	Full	450379.6100	4468749.7060	648.6660	m	
PA1035	Full	455056.9300	4466400.5070	594.9900	m	
PA1036	Full	455068.5880	4466418.0480	596.3110	m	
PA1037	Full	455970.8210	4468161.4220	642.9910	m	
PA1042	Full	458143.1610	4471127.8880	553.7170	m	
PA1043	Full	457865.7240	4474841.5350	561.2060	m	
PA1045	Full	457238.6960	4479464.4060	598.8840	m	
PA1050	Full	455966.2520	4482102.0820	668.8740	m	
PA1051	Full	456199.8670	4484667.7240	711.9650	m	
PA1057	Full	448739.5800	4489569.4180	636.0170	m	
PA1059	Full	445248.0740	4489778.7810	687.0410	m	
PA1066	Full	440745.0710	4478232.4560	700.9110	m	
PA107	Full	453822.2580	4486633.9740	590.1760	m	
PA147	Full	432707.7900	4485869.9790	681.8830	m	
PA148	Full	432738.7600	4485862.8300	682.1500	m	
PA158	Full	445952.7310	4488407.9690	676.9220	m	
PA194	Full	432208.1150	4474289.6850	701.0360	m	
PA196	Full	431900.8250	4475029.8010	691.7510	m	
PA2001	Full	424296.7830	4495961.2060	933.7970	m	
PA2001_BIS	Full	424299.6010	4495978.2260	938.6500	m	
PA2001_BIS2	Full	424293.5850	4495973.9610	937.0120	m	
PA2003	Full	427729.4360	4495828.1890	878.0720	m	
PA2003_BIS	Full	427729.1830	4495826.6310	878.1230	m	
PA2003_BIS2	Full	427751.4610	4495832.3880	877.1400	m	
PA2004	Full	423761.2350	4495527.6620	933.9180	m	
PA2004_BIS	Full	423769.2100	4495555.4560	934.0580	m	

MATCH-AT (Multi-Head)

Ground control points from statistic file

ID	Type	X	Y	Z	Unit	Remark
PA2016	Full	422659.3130	4492771.6140	860.9600	m	
PA2016_BIS	Full	422643.6070	4492778.4530	862.4170	m	
PA2033	Full	441962.9260	4500565.9870	748.7280	m	
PA2039	Full	448109.4600	4500286.0330	635.5270	m	
PA2039_BIS	Full	448058.9640	4500221.3560	641.6810	m	
PA2043	Full	437332.0590	4496866.8120	683.7310	m	
PA2043_BIS	Full	437294.2560	4496946.0790	682.3640	m	
PA2051	Full	439600.5760	4496086.3790	718.0170	m	
PA2051_BIS	Full	439594.5000	4496104.4810	718.0110	m	
PA2060	Full	450787.7210	4495420.5950	605.3540	m	
PA2068	Full	451179.9010	4493499.0090	597.5890	m	
PA2087	Full	422974.9900	4489304.3970	742.0880	m	
PA2087_BIS	Full	422969.4440	4489288.4180	742.5360	m	
PA2099	Full	425733.3570	4483176.5950	704.6340	m	
PA2108	Full	430955.8700	4475829.1160	707.1780	m	
PA2115	Full	434312.3650	4464277.4090	671.5670	m	
PA2132	Full	436476.4260	4490677.2550	694.1110	m	
PA2132_BIS	Full	436466.3090	4490661.5390	694.5760	m	
PA409	Full	438190.2580	4462709.5570	627.7410	m	
PA416	Full	451895.8380	4460586.9640	643.9500	m	
PA417	Full	452041.5360	4460588.5390	647.2900	m	
Minimum		422643.6070	4460586.9640	539.3530	m	selected system
Maximum		458143.1610	4500565.9870	938.6500	m	selected system
Area extent		35499.5540	39979.0230	399.2970	m	selected system

List of 59 ground control points defined in the statistic file. Statistics defined in the selected coordinate system.

MATCH-AT (Multi-Head)

Ground control points

Ground control point residuals (given - adjusted)

ID	#	X [m]	Y [m]	Z [m]	Total [m]	Remark
PA1003	9	-0.0487	-0.0075	0.1435	0.1517	
PA1007	15	0.0028	0.0040	0.0076	0.0090	
PA1009	5			0.0037	0.0037	
PA1011	10	-0.1238	0.0797	0.2648	0.3029	
PA1013	19	-0.0426	0.0112	0.1807	0.1860	
PA1015	31	-0.1267	-0.0553	-0.0097	0.1386	
PA1017	37	0.0071	-0.0109	-0.0187	0.0228	
PA1018	38	0.0071	-0.0112	-0.0188	0.0229	
PA1023	9	-0.0042	-0.0829	0.1122	0.1396	
PA1027	16	0.0051	-0.0045	0.0356	0.0362	
PA1031	20	0.1497	-0.0383	-0.0999	0.1840	
PA1033	21	0.0102	-0.0414	-0.2351	0.2389	
PA1034	21	0.0497	-0.0059	-0.1985	0.2047	
PA1035	13	0.1522	-0.0924	0.2348	0.2947	
PA1036	13	0.1199	-0.0607	0.1779	0.2229	
PA1037	6	0.0002	-0.0248	0.1385	0.1407	
PA1042	5	0.1239	-0.0783	0.1810	0.2329	
PA1043	12	0.1270	0.0879	0.1972	0.2505	
PA1045	18	0.1610	0.0565	0.1642	0.2369	
PA1050	10	0.0059	0.0340	0.0033	0.0347	
PA1051	8	0.1127	0.1307	0.3094	0.3543	
PA1057	10	0.0933	-0.1166	0.1890	0.2409	
PA1059	20	0.0753	-0.0246	-0.0417	0.0895	
PA1066	20	-0.0201	0.0918	-0.0871	0.1281	
PA107	13	0.0411	0.2086	0.2734	0.3464	
PA147	14	0.1603	0.0828	0.0905	0.2019	
PA148	15	-0.0000	0.0000	-0.0001	0.0002	
PA158	10	-0.0128	0.0396	0.0559	0.0697	
PA194	17	0.0352	0.0356	0.0810	0.0952	
PA196	8	0.0123	0.0572	0.1240	0.1371	
PA2001	4	-0.0003	0.0026	0.0026	0.0037	
PA2001_BIS	3	-0.0001	0.0223	0.0145	0.0266	
PA2001_BIS2	4	-0.0094	0.0503	0.0559	0.0758	
PA2003	5	0.0171	0.0048	0.0398	0.0436	
PA2003_BIS	5	0.0167	0.0046	0.0397	0.0433	
PA2003_BIS2	5	0.0166	0.0047	0.0397	0.0432	
PA2004	5	0.0223	0.0754	-0.0423	0.0893	
PA2004_BIS	5	0.0093	-0.0059	-0.0170	0.0202	



MATCH-AT (Multi-Head)

Ground control point residuals (given - adjusted)

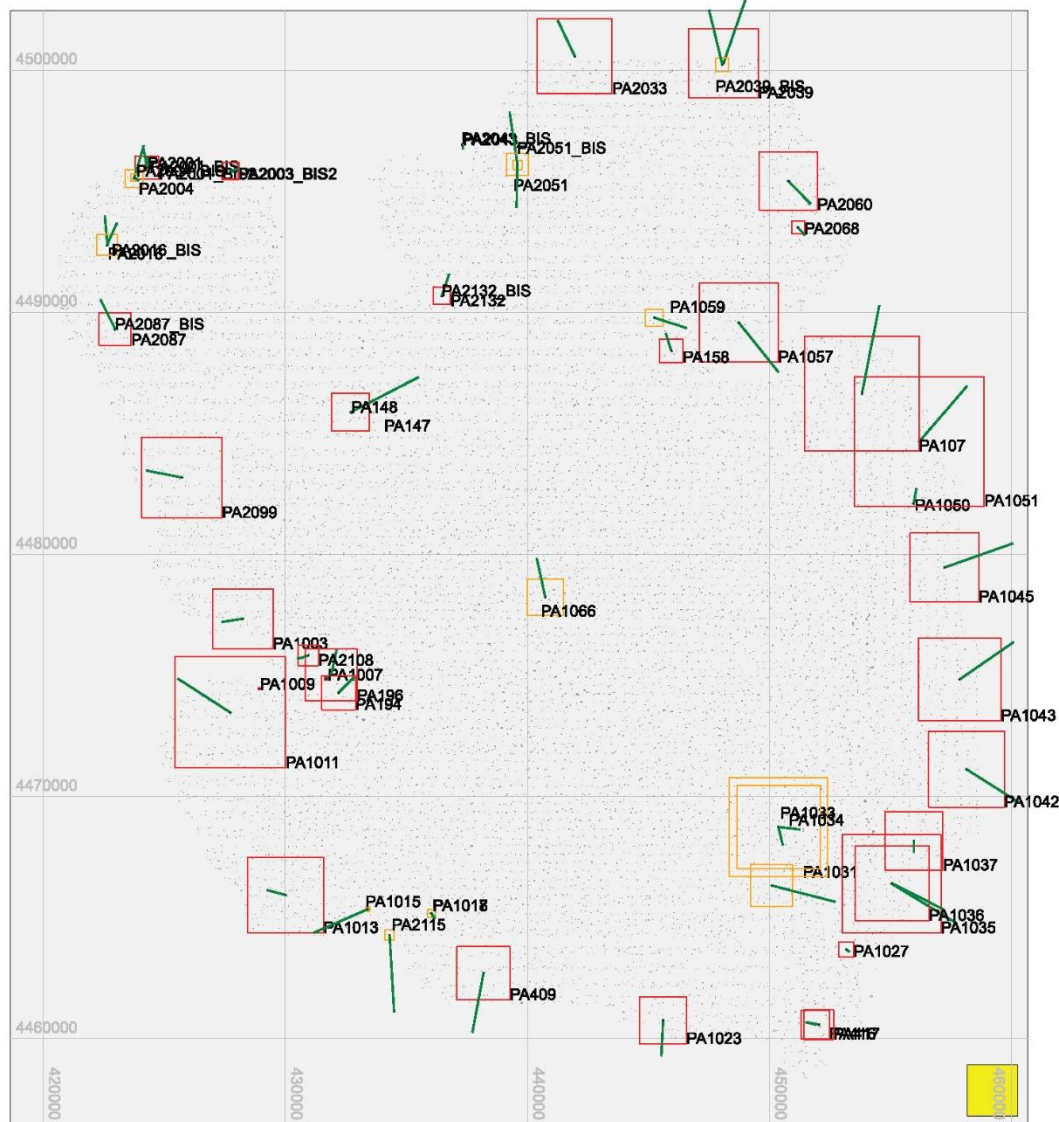
ID	#	X [m]	Y [m]	Z [m]	Total [m]	Remark
PA2016	10	-0.0062	0.0679	0.0025	0.0682	
PA2016_BIS	10	0.0228	0.0509	-0.0498	0.0748	
PA2033	2	-0.0394	0.0834	0.1787	0.2011	
PA2039	5	0.0510	0.1483	0.1657	0.2281	
PA2039_BIS	5	-0.0314	0.1292	-0.0312	0.1366	
PA2043	1	0.0007	-0.0054	-0.0038	0.0066	
PA2043_BIS	1	0.0001	-0.0001	-0.0004	0.0005	
PA2051	12	-0.0189	0.1238	-0.0219	0.1272	
PA2051_BIS	11	-0.0019	-0.1010	-0.0523	0.1138	
PA2060	11	0.0521	-0.0537	0.1385	0.1575	
PA2068	10	0.0159	-0.0170	0.0309	0.0387	
PA2087	6	-0.0340	0.0684	0.0771	0.1085	
PA2087_BIS	7	0.0009	0.0008	-0.0016	0.0020	
PA2099	5	-0.0830	0.0163	0.1920	0.2098	
PA2108	5	-0.0243	-0.0077	0.0491	0.0553	
PA2115	15	0.0109	-0.1816	-0.0235	0.1834	
PA2132	8	0.0161	0.0496	0.0410	0.0663	
PA2132_BIS	7	0.0003	0.0001	0.0004	0.0005	
PA409	7	-0.0260	-0.1393	0.1268	0.1901	
PA416	15	-0.0210	0.0055	0.0690	0.0723	
PA417	16	-0.0252	0.0050	0.0705	0.0751	
Maximum		0.1610	0.2086	0.3084		
Mean		0.0173	0.0115	0.0568		
Sigma		0.0616	0.0713	0.1079		
RMSE(x,y,z)		0.0634	0.0716	0.1211		
RMSEr		0.0957	SQRT(RMSEx * RMSEx + RMSEy * RMSEy)			
ACCr (at 95% Confidence Level)		0.1656	RMSEr * 1.7308			
ACCz (at 95% Confidence Level)		0.2374	RMSEz * 1.9600			

List of 59 considered ground control points defined in the statistic file.



MATCH-AT (Multi-Head)

Ground control point residuals



Graphic with 59 ground control points from the project. The points are shown with its residuals for XYZ from the adjustment. The area has a planimetric extent of about: 42046 x 46056 [m]. Residual is defined as: residual = given - adjusted.

-  : Scale for the symbols. Symbol in the graphic is correlated to 0.121 [m] in the object.
-  : Residual XY (58) for ground control points (min=0.0000, avg=0.0740, max=0.2126 [m]).
-  : Residual Z (pos.:40/neg.:19) for ground control points (min=-0.2351, avg=0.0568, max=0.3094 [m]).
-  : Tie point location for 181475 points.

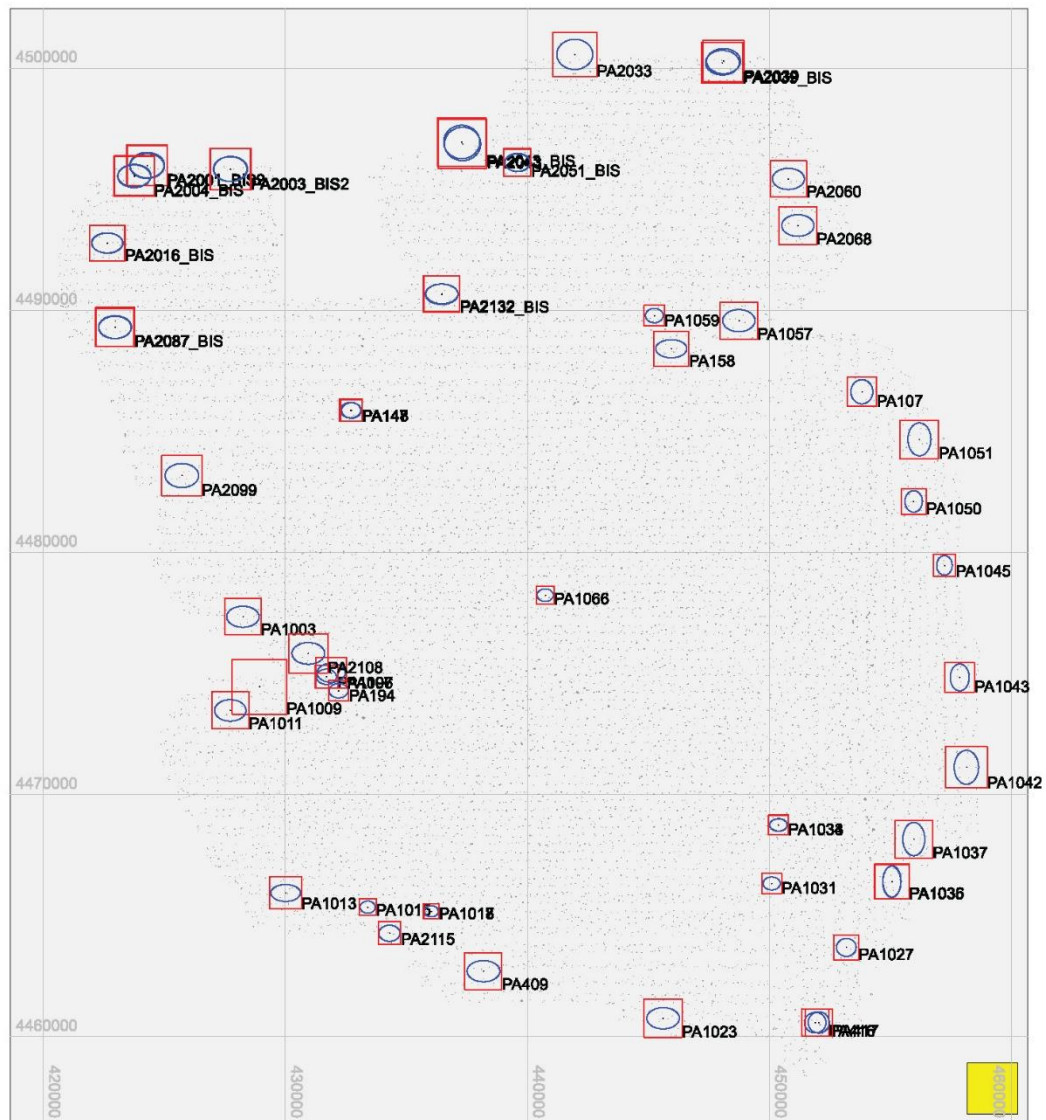
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MATCH-AT (Multi-Head)

Ground control point standard deviations



Graphic with 59 ground control points from the project. The points are shown with its standard deviations for XYZ from the adjustment. The area has a planimetric extent of about: 42046 x 46056 [m].

- : Scale for the symbols. Symbol in the graphic is correlated to 0.021 [m] in the object.
- : Standard deviation XY for 58 ground control points (min=0.0075, avg=0.0144, max=0.0206 [m]).
- : Standard deviation Z for 59 ground control points (min=0.0065, avg=0.0138, max=0.0229 [m]).
- : Tie point location for 181475 points.

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4.3.3. Bloque Left-Right

	MATCH-AT (Multi-Head)
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Processing Report

Project name: Madrid2025_Left-Right

General project information

Flight overview

Tie point distribution

Image points

Camera

Camera 0

Camera 1

Exterior orientation evaluation summary

Block adjustment settings

Block adjustment results

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Ground control points

Ground control point statistics

MATCH-AT (Multi-Head)

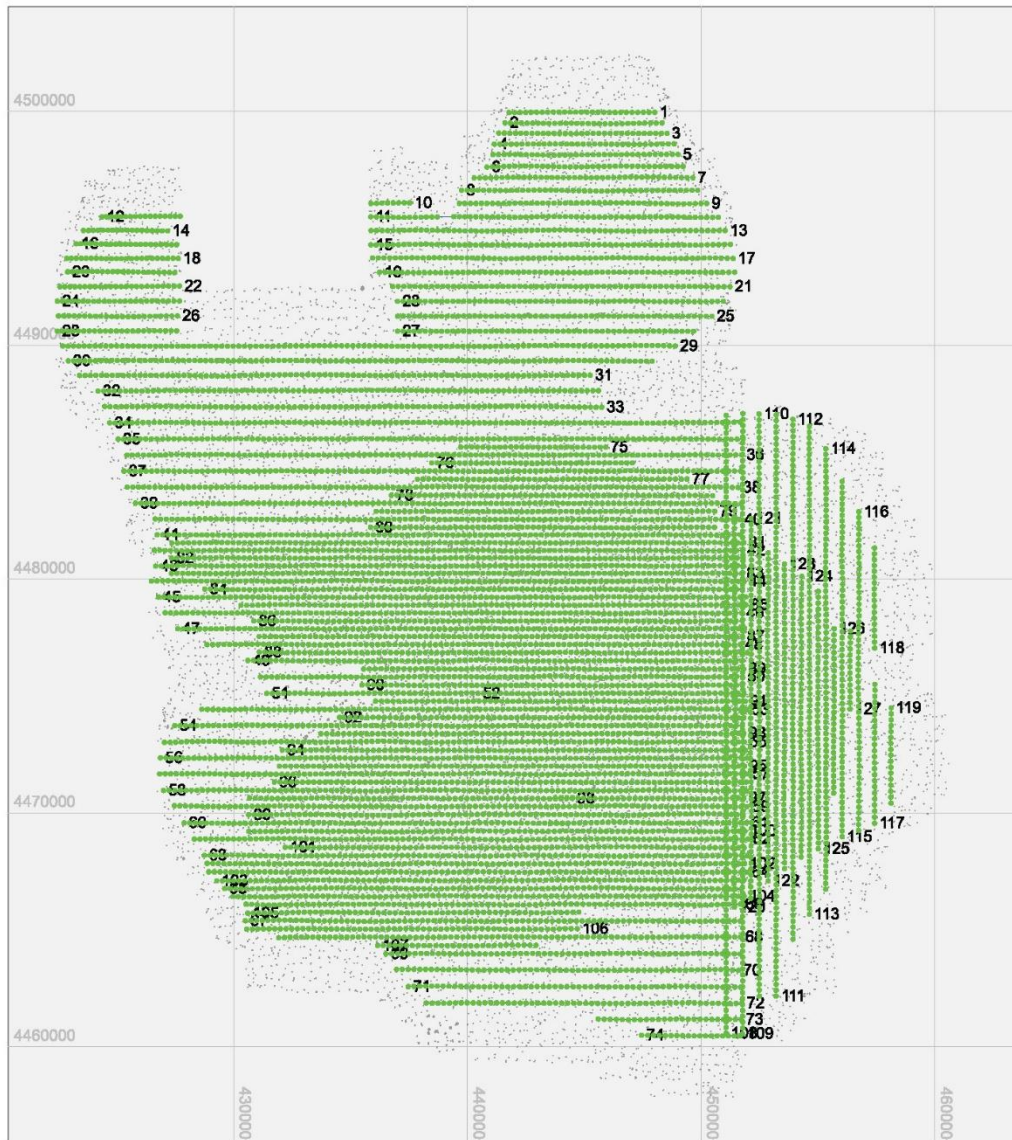
General project information

Project name	Madrid2025_Left-Right
Process	Geo-referencing
Computer node	RESTITUCION-1
Operating system	Microsoft Windows 10 Professional (build 26200), 64-bit, version 10.0
Machine	12th Gen Intel(R) Core(TM) i700K, 20 cores, 63.7 GByte RAM
Program version	13.2.0.10038
User name	Restitucion-1
Source time (*.sta)	Tue May 19 15:14:09 2026
Report time (*.pdf)	Wed May 20 06:59:15 2026
Project file	G:/Vuelos/Madrid_2025/Aero_Left-Right/Madrid2025_LR.prj
Statistic file	G:/Vuelos/Madrid_2025/Aero_Left-Right/Madrid2025_LR.sta
Active block	Complete
Number of used images	17527 of 17528
Number of used cameras	2 of 2
Number of strips	127
Flying height	min=2449.4 / avg=2521.2 / max=2594.9 [m]
Terrain height	min=505.8 / avg=661.6 / max=1022.9 [m]
Average photo scale	1 : 15166
Coordinate system	PROJCS["UTM Zone 30 N", GEOGCS["ETRS89",DATUM["European Terrestrial Reference System 1989", SPHEROID["GRS 1980",6378137, 298.2572221011,AUTHORITY["EPSG","7019"]], TOWGS84[0,0,0,0,0,0,0], AUTHORITY["EPSG","6258"]], PRIMEM["Greenwich",0,AUTHORITY["EPSG", "8901"]], UNIT["Degree",0.01745329251994, AUTHORITY["EPSG","9102"]], AXIS["Long",EAST], AXIS["Lat",NORTH], AUTHORITY["EPSG","4258"]], PROJECTION["Transverse_Mercator"], PARAMETER["False_Easting",500000], PARAMETER["False_Northing",0], PARAMETER["Latitude_Of_Origin",0], PARAMETER["Central_Meridian",-3], PARAMETER["Scale_Factor",0.9996], UNIT["Meter",1,AUTHORITY["EPSG","9001"]], AXIS["East",EAST], AXIS["North",NORTH], AUTHORITY["EPSG","25830"]]



MATCH-AT (Multi-Head)

Flight overview



Graphic with 127 strip definitions for the aerial triangulation. The area has a planimetric extent of about: 42305 x 48706 [m].

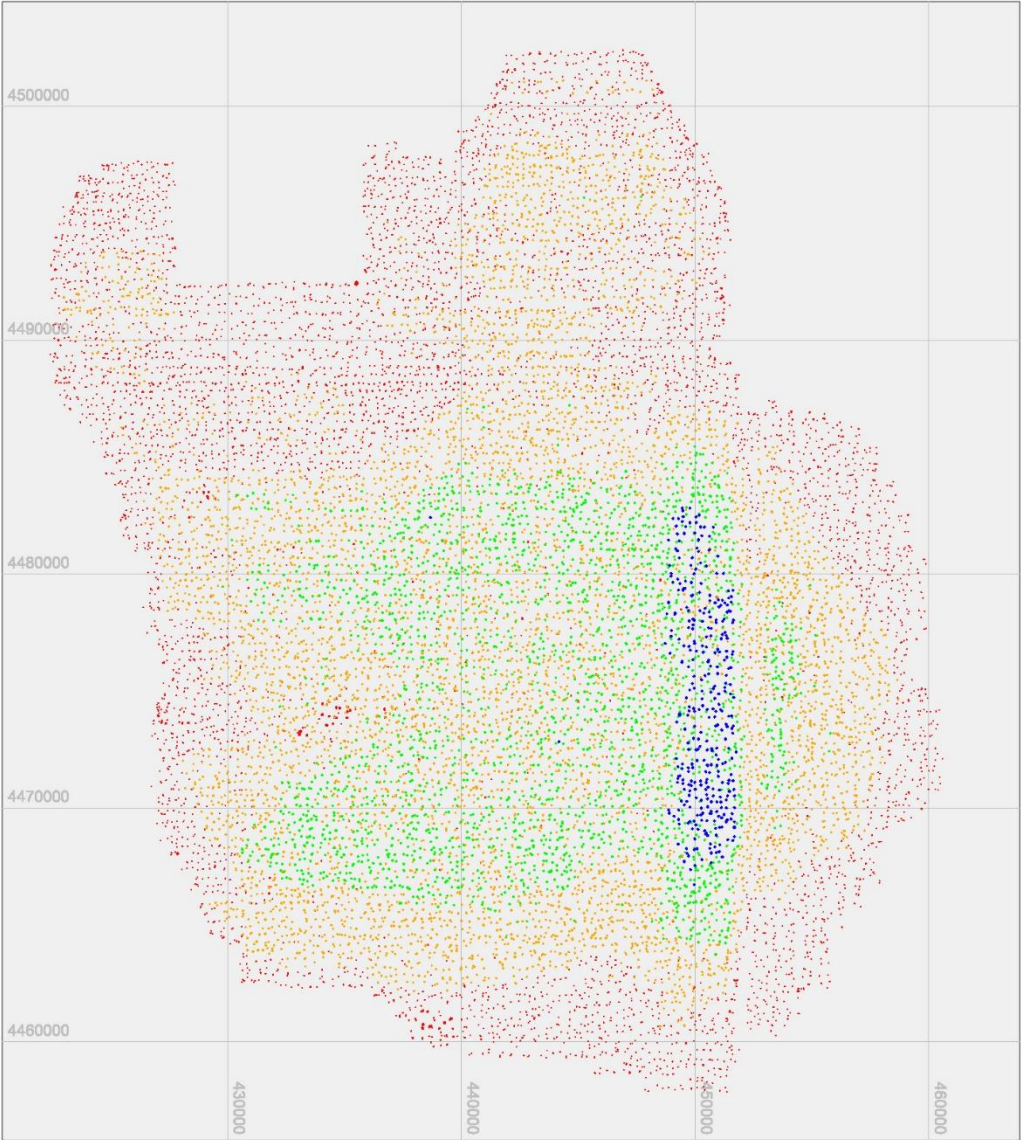
- : Camera location for 17527 adjusted photos.
- : Camera location for 1 eliminated photos.
- : Defined strip in the project.
- : Tie point location for 213790 points.

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Page 3

MATCH-AT (Multi-Head)

Tie point distribution



Tie point distribution of 213790 points in the statistic file. The point size and colour reflects the number of images containing the point. The area has a planimetric extent of about: 42305 x 48706 [m] and a height range of about: 506 - 1023 [m].

- : Point found in (0-12) images.
- : Point found in (13-24) images.
- : Point found in (25-36) images.
- : Point found in (>36) images.

MATCH-AT (Multi-Head)

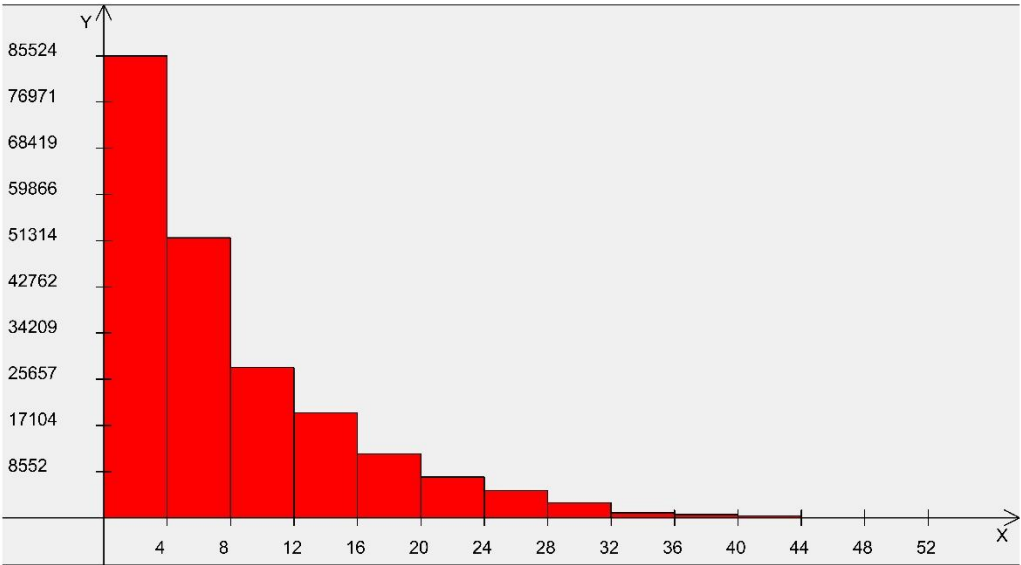
Image points

Frequency of image point observations in the photos

X	Number of image points (Y)	%
>0 - 4	85524	40.00
>4 - 8	51861	24.26
>8 - 12	27826	13.02
>12 - 16	19403	9.08
>16 - 20	11824	5.53
>20 - 24	7569	3.54
>24 - 28	5047	2.36
>28 - 32	2753	1.29
>32 - 36	945	0.44
>36 - 40	601	0.28
>40 - 44	362	0.17
>44 - 48	71	0.03
>48 - 52	4	0.00

Appearance of 213790 image points from the statistic file. The table contains all image observations of the points.

Histogram for image point frequency in the photos



Graphic for 17527 photos and 213790 image points. Number of image points (Y) within a given range for number of photos (X).

MATCH-AT (Multi-Head)

Camera 0

Camera data (Custom_right)

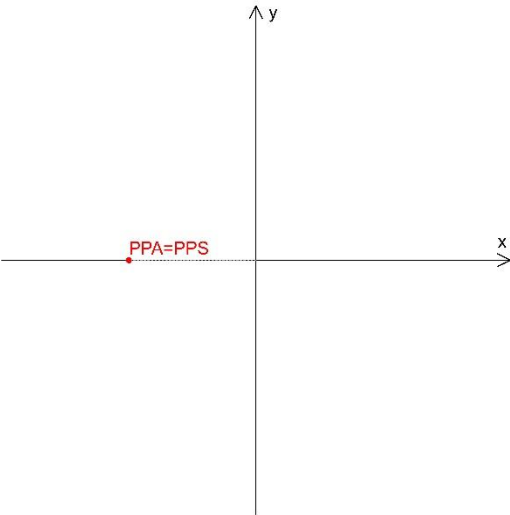
Data source	Madrid2025_LR.sta		
Sensor type	CCD sensor		
Manufacturer	Vexcel		
Model	Osprey		
Serial number	not defined		
Camera UUID	not defined		
Sensor (width / height) [pixel]	14144	10560	
Pixel size (x / y) [micron]	3.7600	3.7600	
Ground sampling distance (x / y) [m]	0.0570	0.0570	
Calibration process	OFF		
Calibration status	Initial		
Calibration direction	INPHO (from ideal to measured)		
Distortion type	Undefined		
Additional parameters	OFF		
Focal length [mm / pixel]	123.3800	32813.8298	
Focal length (Fx / Fy) [pixel]	32813.8298	32813.8298	
Principal point (x / y) [mm pixel]	-6.6800 5294.9043	0.0000 5279.5000	

Platform data (Custom_right)

	X [m]	Y [m]	Z [m]
GNSS antenna offset	---	---	---
	Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]
IMU boresight alignment	---	---	---
Camera mount rotation	---		

MATCH-AT (Multi-Head)

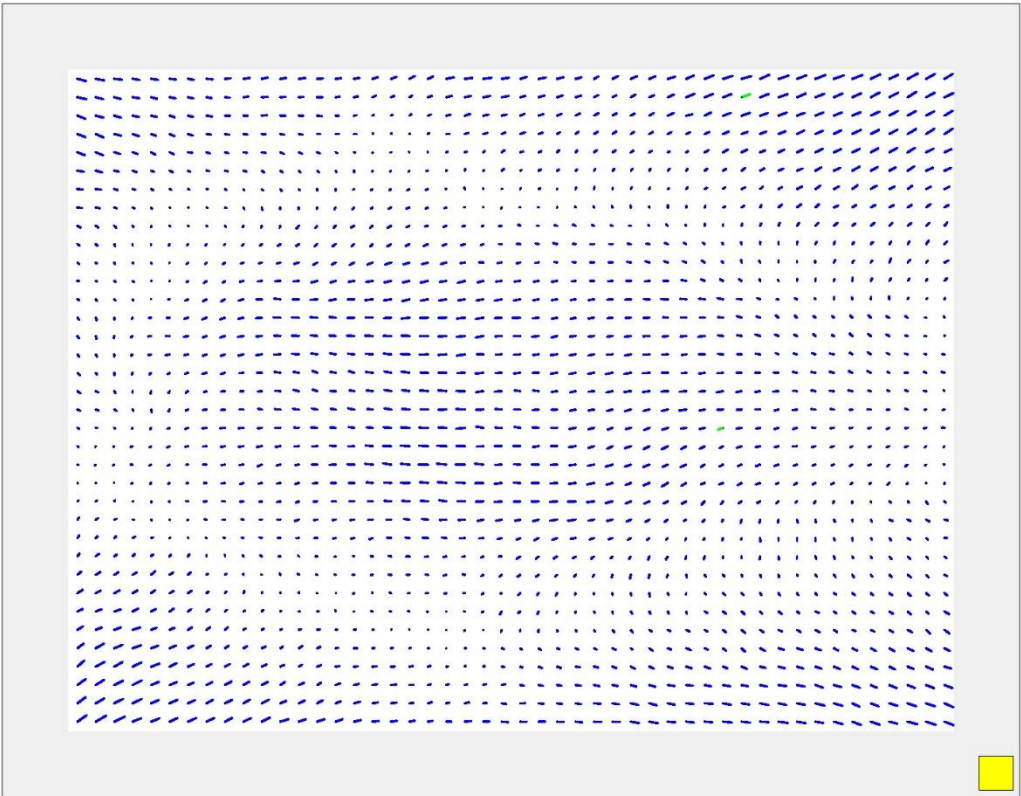
Camera data (Custom_right)



Principle point (x=-6.6800, y=0.0000 [mm]) in the image.

MATCH-AT (Multi-Head)

Image residuals (Custom_right)



Graphic of 911372 back-projected adjusted points from the statistic file. Average image residual matrix vectors (min=0.008, avg=0.131, max=0.350 [pixel]) for image matrix elements. An image matrix element is defined with about (300 x 300) pixels. Image residual is defined as: residual = observed - adjusted. Number of invalid image residual vectors outside the graphic: 0.

-  : Scale for the residual vectors. Symbol in the graphic is correlated to 1 [pixel] in the image.
-  : Average image residual vector for points in (0-2) images.
-  : Average image residual vector for points in (3-4) images.
-  : Average image residual vector for points in (5-10) images.
-  : Average image residual vector for points in (>10) images.



MATCH-AT (Multi-Head)

Exterior orientation evaluation (Custom_right)

ImageID	# of points	Distribution	RMS Ds [pixel]	Max Ds [pixel]	Remark
h50_0534_fot_123-17205_R	36	5 of 9	0.38	0.62	
h50_0582_fot_182-11779_R	54	5 of 9	0.38	0.72	
h50_0559_fot_506-20763_R	66	5 of 9	0.38	0.72	
h50_0559_fot_319-22498_R	46	5 of 9	0.36	0.67	
h50_0559_fot_315-22259_R	52	5 of 9	0.36	0.68	
h50_0582_fot_184-11494_R	41	5 of 9	0.36	0.67	
h50_0559_fot_320-22597_R	116	5 of 9	0.36	0.69	
h50_0559_fot_159-19019_R	76	5 of 9	0.36	0.73	
h50_0582_fot_184-11491_R	27	4 of 9	0.36	0.62	
h50_0559_fot_329-10566_R	42	5 of 9	0.36	0.65	
h50_0582_fot_184-11490_R	31	5 of 9	0.36	0.73	
h50_0582_fot_184-11493_R	33	4 of 9	0.36	0.62	
h50_0559_fot_319-22523_R	49	4 of 9	0.35	0.66	
h50_0559_fot_504-20656_R	48	5 of 9	0.35	0.68	
h50_0559_fot_307-21507_R	80	5 of 9	0.35	0.63	
h50_0582_fot_180-12028_R	39	5 of 9	0.35	0.65	
h50_0559_fot_329-10544_R	41	5 of 9	0.35	0.66	
h50_0559_fot_405-14098_R	95	5 of 9	0.35	0.67	
h50_0534_fot_302-21206_R	63	4 of 9	0.35	0.65	
h50_0559_fot_319-22542_R	46	5 of 9	0.35	0.63	
h50_0559_fot_321-22652_R	67	5 of 9	0.35	0.63	
h50_0559_fot_327-10739_R	51	5 of 9	0.35	0.68	
h50_0582_fot_184-11502_R	23	3 of 9	0.35	0.66	
h50_0559_fot_305-21330_R	66	5 of 9	0.35	0.74	
h50_0582_fot_182-11770_R	46	5 of 9	0.35	0.61	
h50_0582_fot_184-11509_R	46	5 of 9	0.34	0.62	
h50_0559_fot_319-22517_R	48	4 of 9	0.34	0.67	
h50_0559_fot_309-21729_R	53	4 of 9	0.34	0.72	
h50_0559_fot_404-13915_R	80	5 of 9	0.34	0.69	
h50_0559_fot_325-10925_R	59	5 of 9	0.34	0.65	
h50_0559_fot_313-22041_R	50	5 of 9	0.34	0.67	
h50_0559_fot_405-14103_R	102	5 of 9	0.34	0.72	
h50_0582_fot_182-11801_R	45	5 of 9	0.34	0.67	
h50_0559_fot_306-21417_R	66	5 of 9	0.34	0.69	
h50_0582_fot_180-12026_R	44	5 of 9	0.34	0.72	
h50_0533_fot_143-23690_R	51	5 of 9	0.34	0.65	
514 more photo(s)	---	---	---	---	

Statistic of 911372 back-projected adjusted points from the statistic file. The table list 36 of 550 photos with an EO beyond the thresholds. The project consist of 8764 of 17528 photos from this camera. The table contain differences between the matched image points and back-projected adjusted points. Photos with at least one of the following conditions are visible:

- * # of points : Number of points/photo < 30 [points]
- * Distribution : Number of image tiles with more than 3 points < 6 [image tiles]
- * RMS Ds [pixel] : RMS difference in pixel > 0.7 [pixel]

MATCH-AT (Multi-Head)

Camera 1

Camera data (Custom_left)

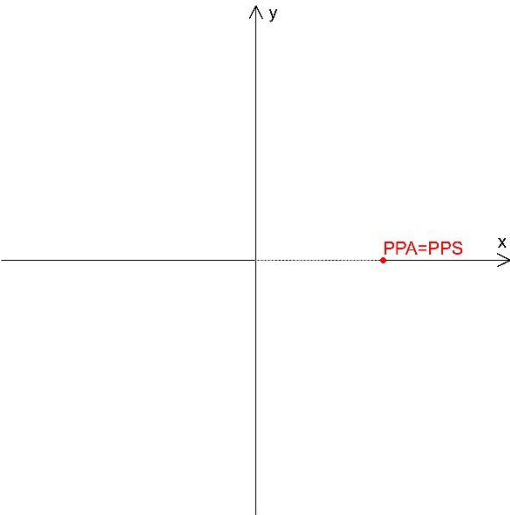
Data source	Madrid2025_LR.sta		
Sensor type	CCD sensor		
Manufacturer	Vexcel		
Model	Osprey		
Serial number	not defined		
Camera UUID	not defined		
Sensor (width / height) [pixel]	14144	10560	
Pixel size (x / y) [micron]	3.7600	3.7600	
Ground sampling distance (x / y) [m]	0.0570	0.0570	
Calibration process	OFF		
Calibration status	Initial		
Calibration direction	INPHO (from ideal to measured)		
Distortion type	Undefined		
Additional parameters	OFF		
Focal length [mm / pixel]	123.3800	32813.8298	
Focal length (Fx / Fy) [pixel]	32813.8298	32813.8298	
Principal point (x / y) [mm pixel]	6.6800 8848.0957	0.0000 5279.5000	

Platform data (Custom_left)

	X [m]	Y [m]	Z [m]
GNSS antenna offset	---	---	---
	Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]
IMU boresight alignment	---	---	---
Camera mount rotation	---		

	MATCH-AT (Multi-Head)
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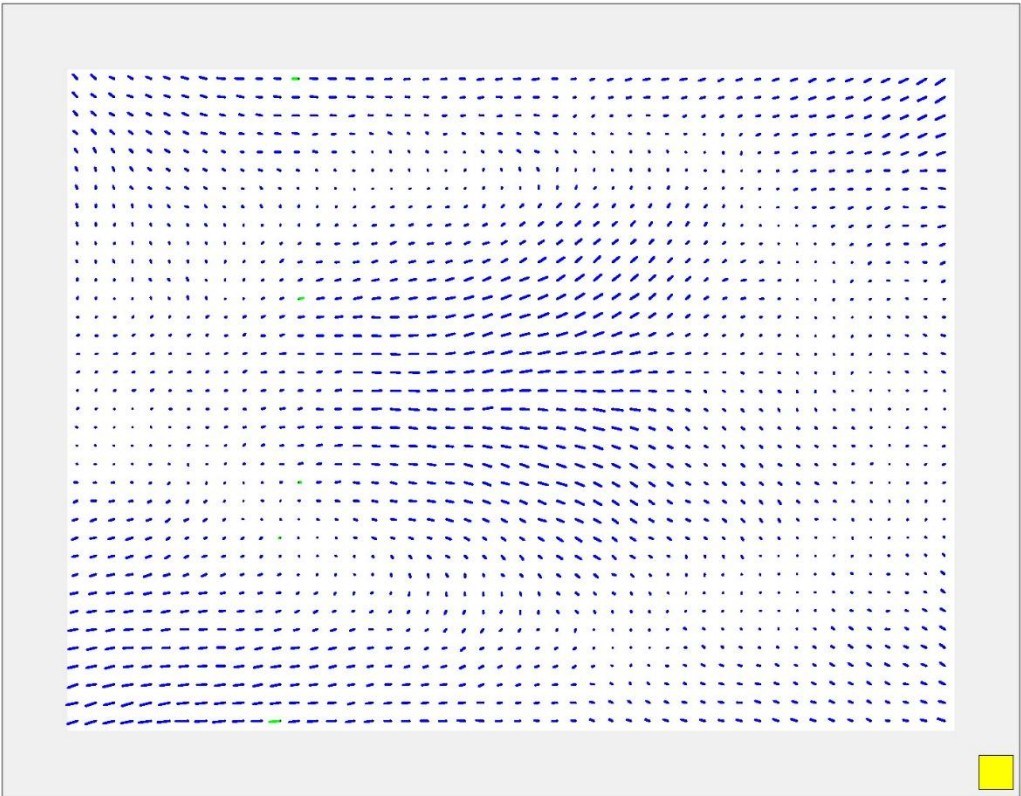
Camera data (Custom_left)



Principle point (x=6.6800, y=0.0000 [mm]) in the image.

MATCH-AT (Multi-Head)

Image residuals (Custom_left)



Graphic of 909169 back-projected adjusted points from the statistic file. Average image residual matrix vectors (min=0.002, avg=0.124, max=0.363 [pixel]) for image matrix elements. An image matrix element is defined with about (300 x 300) pixels. Image residual is defined as: residual = observed - adjusted. Number of invalid image residual vectors outside the graphic: 0.

-  : Scale for the residual vectors. Symbol in the graphic is correlated to 1 [pixel] in the image.
-  : Average image residual vector for points in (0-2) images.
-  : Average image residual vector for points in (3-4) images.
-  : Average image residual vector for points in (5-10) images.
-  : Average image residual vector for points in (>10) images.



MATCH-AT (Multi-Head)

Exterior orientation evaluation (Custom_left)

ImageID	# of points	Distribution	RMS Ds [pixel]	Max Ds [pixel]	Remark
h50_0534_fot_137-21020_L	36	5 of 9	0.43	2.06	
h50_0559_fot_320-22595_L	39	5 of 9	0.38	0.69	
h50_0559_fot_318-22433_L	47	5 of 9	0.37	0.73	
h50_0559_fot_328-10657_L	56	5 of 9	0.37	0.71	
h50_0559_fot_308-21801_L	38	3 of 9	0.37	0.71	
h50_0559_fot_320-22594_L	46	5 of 9	0.36	0.67	
h50_0559_fot_326-10837_L	75	5 of 9	0.36	0.69	
h50_0559_fot_316-22308_L	37	5 of 9	0.36	0.71	
h50_0559_fot_326-10857_L	47	4 of 9	0.36	0.65	
h50_0559_fot_501-20476_L	48	4 of 9	0.36	0.63	
h50_0559_fot_308-21802_L	45	4 of 9	0.36	0.59	
h50_0559_fot_318-22435_L	39	4 of 9	0.36	0.60	
h50_0534_fot_146-23263_L	51	5 of 9	0.36	1.36	
h50_0534_fot_139-21077_L	83	5 of 9	0.36	0.65	
h50_0559_fot_404-13904_L	66	5 of 9	0.36	0.63	
h50_0559_fot_322-22769_L	66	5 of 9	0.35	0.73	
h50_0560_fot_508-20701_L	28	3 of 9	0.35	0.60	
h50_0559_fot_326-10825_L	51	5 of 9	0.35	0.71	
h50_0559_fot_328-10632_L	66	5 of 9	0.35	0.66	
h50_0559_fot_401-11216_L	49	5 of 9	0.35	0.72	
h50_0534_fot_151-20110_L	53	4 of 9	0.35	0.71	
h50_0559_fot_153-19826_L	57	5 of 9	0.35	0.69	
h50_0582_fot_183-11702_L	46	4 of 9	0.35	0.68	
h50_0559_fot_316-22303_L	51	4 of 9	0.35	0.78	
h50_0559_fot_318-22400_L	13	1 of 9	0.34	0.66	
h50_0559_fot_318-22429_L	62	5 of 9	0.34	0.71	
h50_0534_fot_304-21307_L	48	5 of 9	0.34	0.72	
h50_0559_fot_179-12246_L	78	5 of 9	0.34	0.75	
h50_0560_fot_508-20700_L	30	4 of 9	0.34	0.55	
h50_0559_fot_320-22601_L	65	5 of 9	0.34	0.69	
h50_0559_fot_324-11002_L	54	5 of 9	0.34	0.69	
h50_0559_fot_502-20581_L	17	3 of 9	0.34	0.61	
h50_0559_fot_309-21670_L	88	5 of 9	0.34	0.72	
h50_0582_fot_181-11986_L	41	4 of 9	0.34	0.66	
h50_0533_fot_151-20048_L	35	5 of 9	0.34	0.60	
h50_0559_fot_316-22299_L	46	5 of 9	0.34	0.64	
504 more photo(s)	---	---	---	---	

Statistic of 1820541 back-projected adjusted points from the statistic file. The table list 36 of 540 photos with an EO beyond the thresholds. The project consist of 8763 of 17528 photos from this camera. The table contain differences between the matched image points and back-projected adjusted points. Photos with at least one of the following conditions are visible:

- * # of points : Number of points/photo < 30 [points]
- * Distribution : Number of image tiles with more than 3 points < 6 [image tiles]
- * RMS Ds [pixel] : RMS difference in pixel > 0.7 [pixel]

MATCH-AT (Multi-Head)

Exterior orientation evaluation summary

Legend of histogram for number of tie points

X : Range for the number of tie points/photo.
Y : Number of images for the defined range (X).
Thr : Empirical threshold (30 points/photo) for the definition of weaker images.

Legend of histogram for distribution of tie points

X : Number of sufficient occupied image tiles with tie points. The image is divided into 9 equal image tiles.
Y : Number of images for the defined image tile occupation (X).
Thr : Empirical threshold (6 image tiles) for the definition of weaker images.

Legend of histogram for RMS values of tie points

X : Range for the RMS value.
Y : Number of images for the defined range (X).
RMS : RMS value for differences between the matched image points and back-projected adjusted points.
Thr : Statistical threshold (0.72 [pixel]=3*sigma naught from the block adjustment) for the definition of weaker images.

Statistical information about used elements for EO evaluation

Data base : Statistic file (*.sta)
 Number of photos : 17527 of 17528
 Number of camera(s) : 2 of 2
 Number of used image observations : 1820541
 Number of adjusted points : 213790

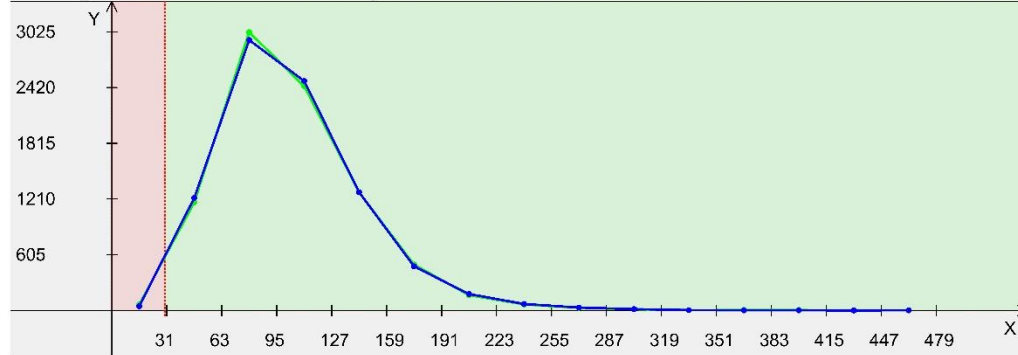
Camera color assignment

 : Threshold (Thr) for the actual evaluation criteria.
 : for Camera : Custom_right.
 : for Camera : Custom_left.
 : Range with acceptable photos.
 : Range with suspect photos.



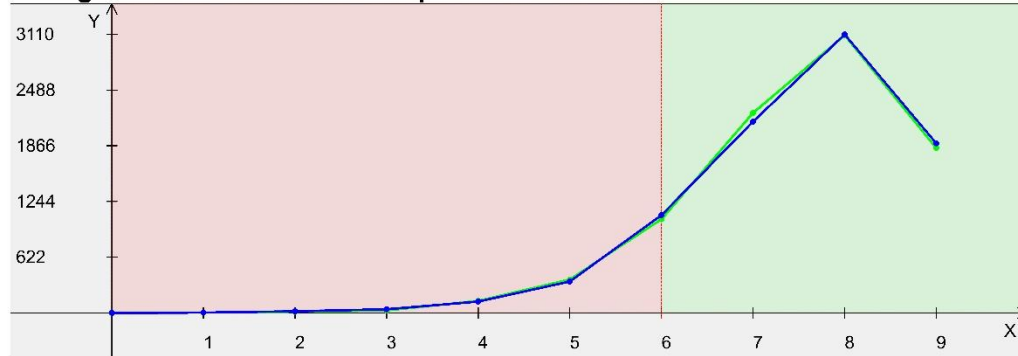
MATCH-AT (Multi-Head)

Histogram for number of tie points



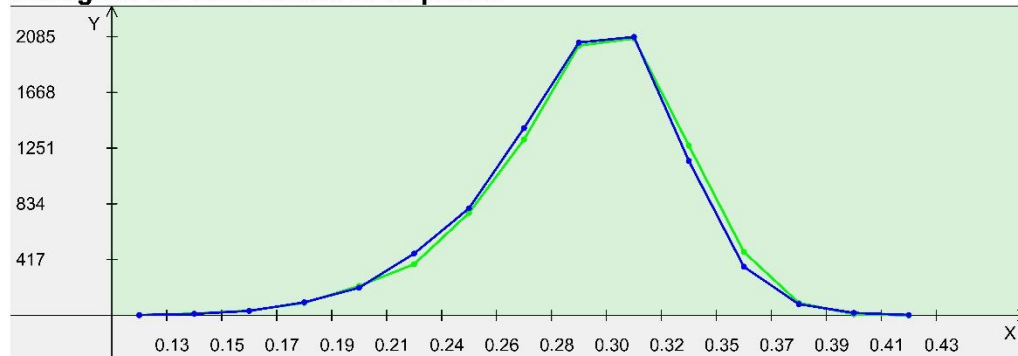
Graphic for 17527 photos with 2 camera(s). Evaluation criteria: [# of points/photo] < Thr (=30 [points/photo]).

Histogram for distribution of tie points



Graphic for 17527 photos with 2 camera(s). Evaluation criteria: [Distribution] < Thr (=6 [image tiles]).

Histogram for RMS values of tie points



Graphic for 17527 photos with 2 camera(s). Evaluation criteria: [RMS] > Thr (=0.72 [pixel]).

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MATCH-AT (Multi-Head)

Block adjustment settings

Block Parameters

Image standard deviation:	X [mm]	Y [mm]	
automatic	0.002000	0.002000	
manual	0.002000	0.002000	
Object standard deviation:	X [m]	Y [m]	Z [m]
control points	0.030000	0.030000	0.045000
Earth curvature correction	OFF		
Refraction correction	OFF		

GNSS Parameters

Mode	ON		
Shift/Drift	Correction for complete block		
	X [m]	Y [m]	Z [m]
Shift	ON	ON	ON
Drift	OFF	OFF	OFF
Standard deviation	0.300000	0.300000	0.300000

IMU Parameters

Mode	ON		
Shift/Drift	OFF		
Boresight alignment	ON		
	Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]
Shift	---	---	---
Drift	OFF	OFF	OFF
Standard deviation	0.008000	0.008000	0.008000



MATCH-AT (Multi-Head)

Block adjustment results

Accuracy

Sigma naught	0.9053 [micron]
	0.2408 [pixel]

Mean standard deviation of translations

X [m]	Y [m]	Z [m]	Total [m]
0.0343	0.0217	0.0400	0.0570

Mean standard deviation of rotations

Omega [deg]	Phi [deg]	Kappa [deg]
0.00127003	0.00137492	0.00082405

Mean standard deviation of terrain points

X [m]	Y [m]	Z [m]	Total [m]
0.0143	0.0469	0.0549	0.0736

RMS values for GNSS

X [m]	Y [m]	Z [m]	Total [m]
0.2092	0.2626	0.1647	0.3739

RMS values for IMU

Omega (X) [deg]	Phi (Y) [deg]	Kappa (Z) [deg]	Total [deg]
0.00476980	0.00531649	0.00513934	0.00879937

MATCH-AT (Multi-Head)

GNSS shift/drift results

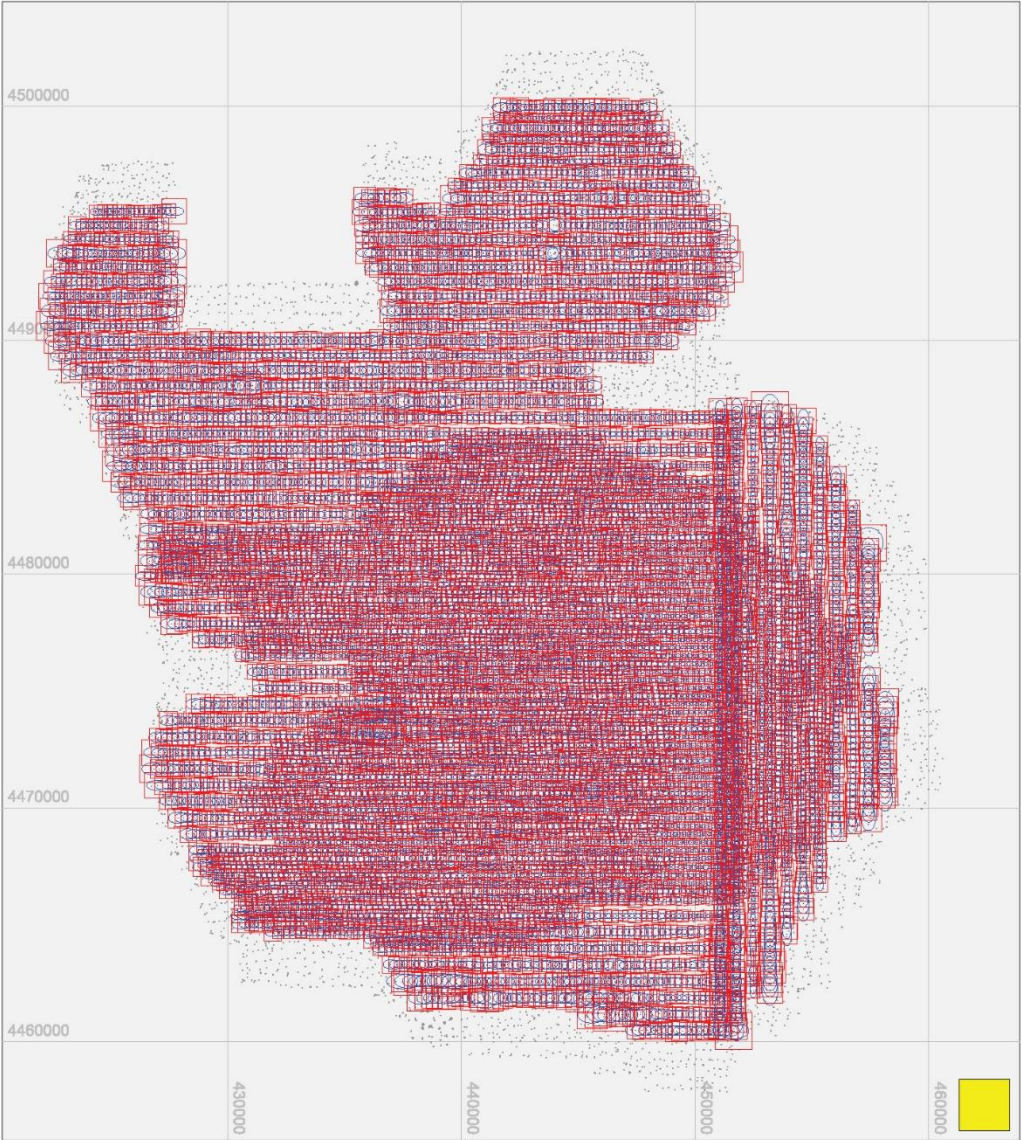
GNSS results

Profile	Order	X [m]	Y [m]	Z [m]
Block	constant	-0.0002	-0.0578	0.0892
	linear	0.0000	0.0000	-0.0000

constant : systematic shift
linear : time dependent drift

MATCH-AT (Multi-Head)

Exterior orientation (X,Y,Z) standard deviations (Custom_right)

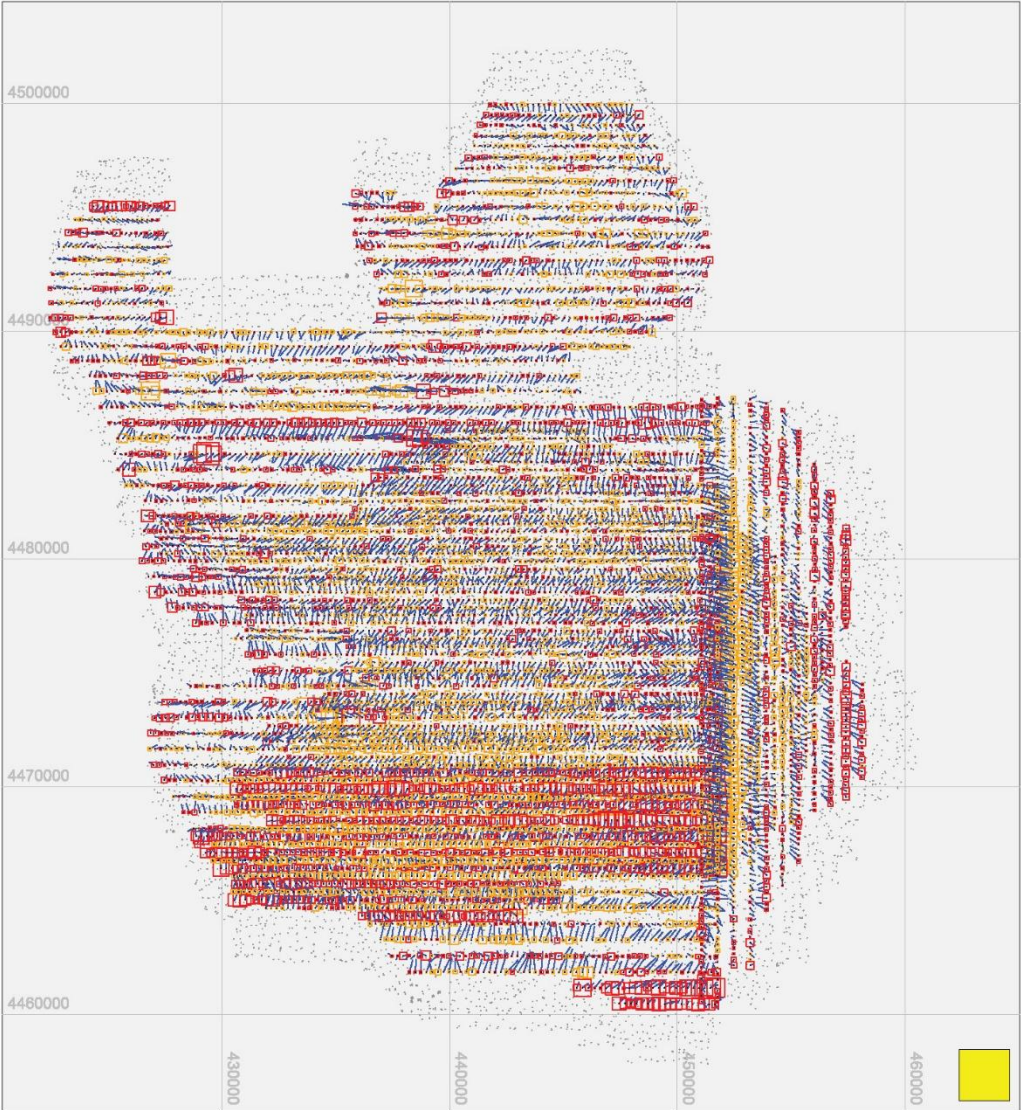


Graphic with 8764 photos from the project. The camera locations are shown with its standard deviations for XYZ. The area has a planimetric extent of about: 42305 x 48706 [m].

-  : Scale for the symbols. Symbol in the graphic is correlated to 0.160 [m] in the object.
-  : Standard deviation XY for 8764 projection centers (min=0.0201, avg=0.0416, max=0.1330 [m]).
-  : Standard deviation Z for 8764 projection centers (min=0.0192, avg=0.0399, max=0.1164 [m]).
-  : Tie point location for 213790 points.

MATCH-AT (Multi-Head)

GNSS residuals (observed - adjusted) (Custom_right)



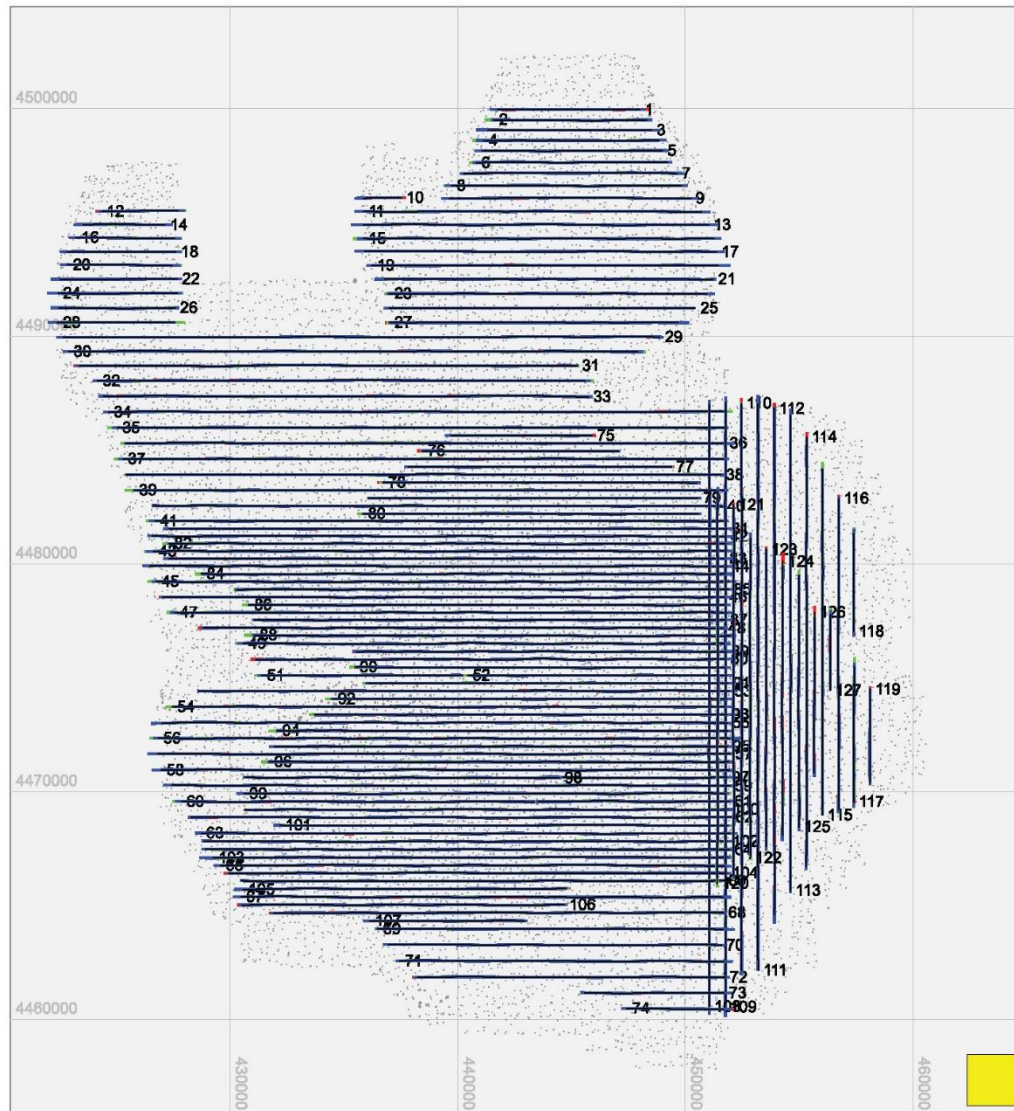
Graphic with 8764 used GNSS locations from the adjustment. The points are shown with its residuals for X,Y,Z from the adjustment. The area has a planimetric extent of about: 42305 x 48706 [m]. Residual is defined as: residual = observed - adjusted.

-  : Scale for the symbols. Symbol in the graphic is correlated to 1.870 [m] in the object.
-  : Residual XY for (8764) GNSS positions (min=-0.0049, avg=0.2544, max=1.6890 [m]).
-  : Residual Z for (pos.:4089/neg.:4675) GNSS positions (min=-1.4558, avg=0.1236, max=0.8192 [m]).
-  : Number of eliminated GNSS observations: 0 of 8764
-  : Tie point location for 213790 points.



MATCH-AT (Multi-Head)

IMU residuals (observed - adjusted) (Custom_right)



Graphic with 8764 IMU locations from the adjustment. The points are shown with its residuals for omega,phi,kappa from the adjustment. The area has a planimetric extent of about: 42305 x 48706 [m]. Residual is defined as: residual = observed - adjusted.

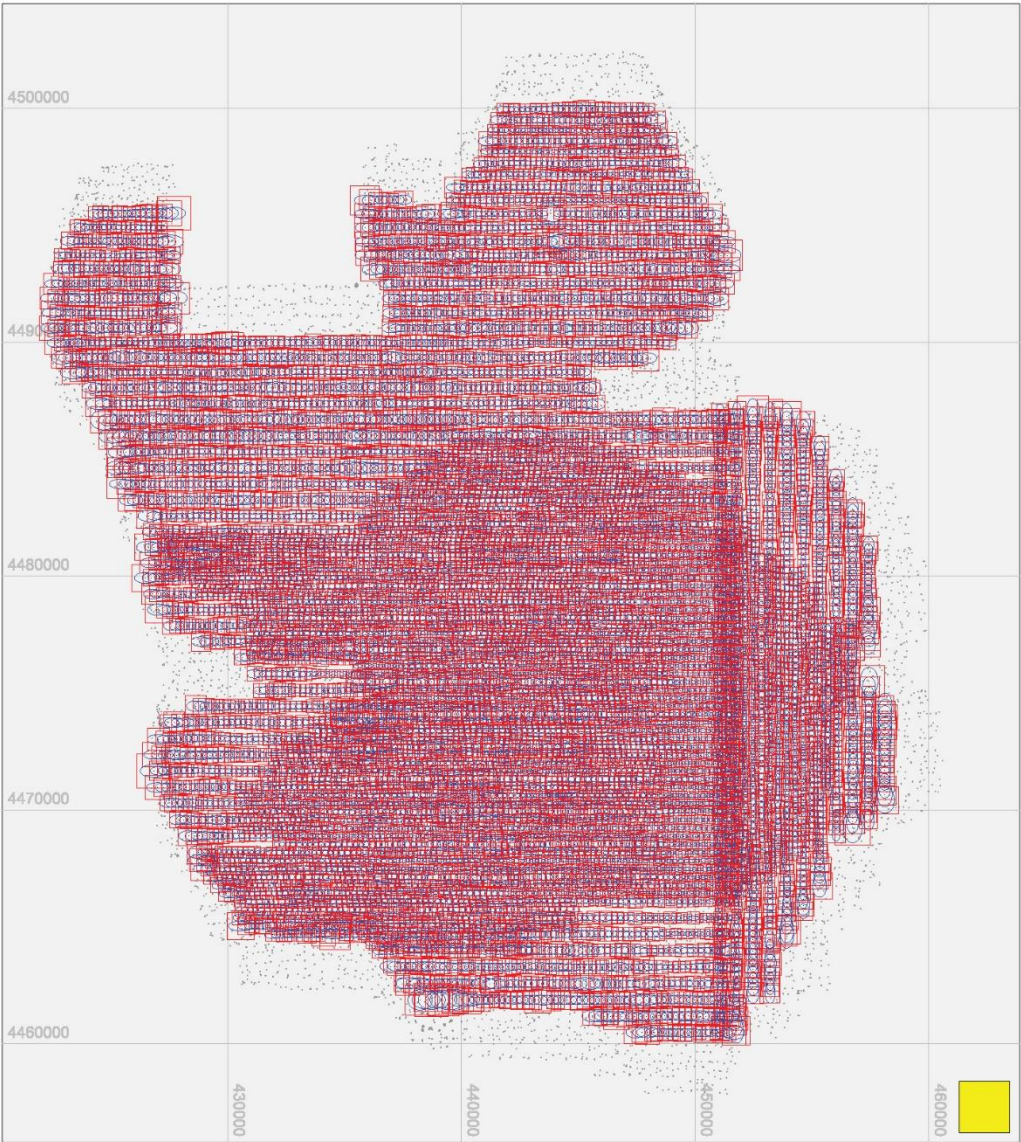
- : Scale for the symbols. Symbol in the graphic is correlated to 0.08799 [deg] in the object.
- : Residual omega(X) for (8764) IMU positions (min=-0.01681, avg=0.00045, max=0.01647 [deg]).
- : Residual phi(Y) for (8764) IMU positions (min=-0.03130, avg=0.00008, max=0.01813 [deg]).
- : Residual kappa(Z) for (8764) IMU positions (min=-0.02084, avg=-0.00066, max=0.02158 [deg]).
- : Tie point location for 213790 points.

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MATCH-AT (Multi-Head)

Exterior orientation (X,Y,Z) standard deviations (Custom_left)

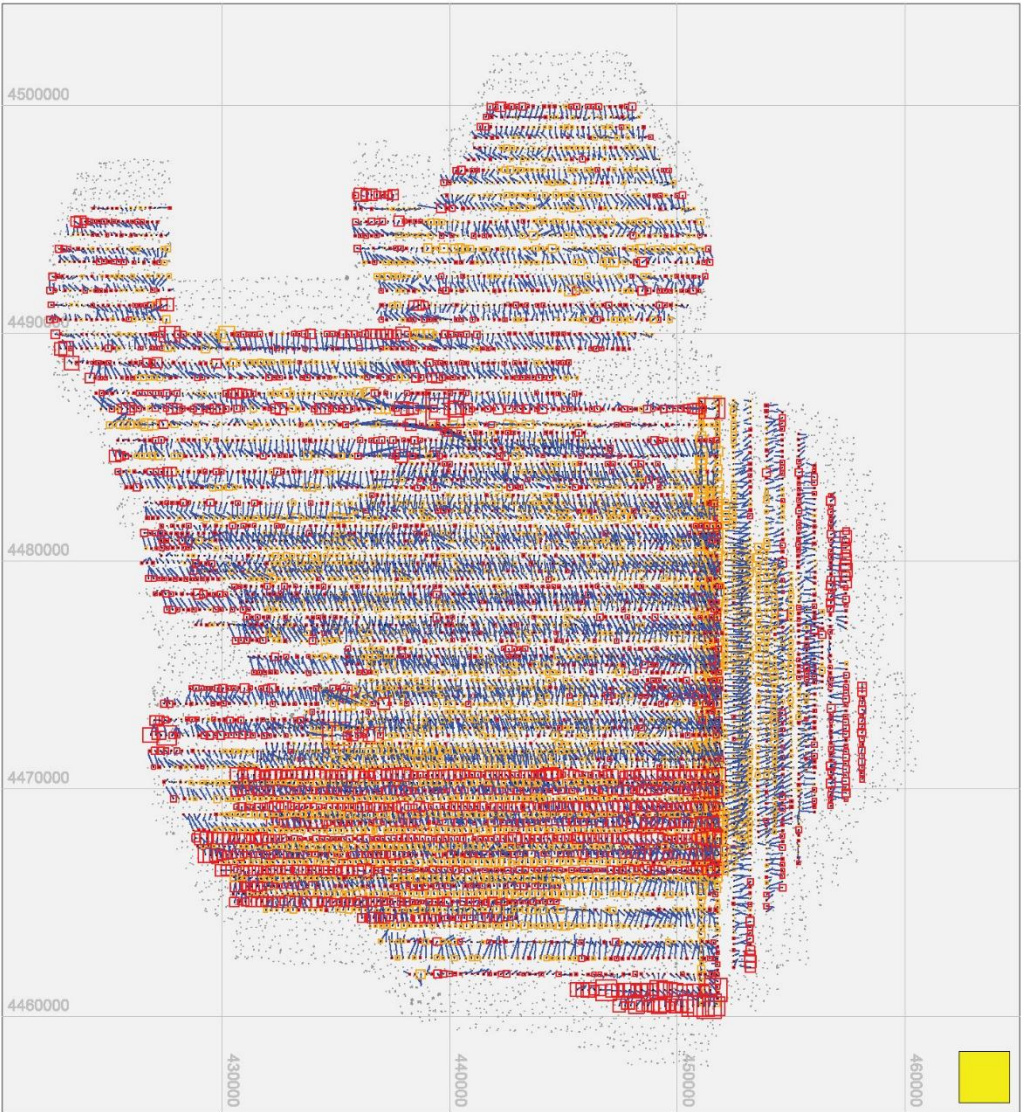


Graphic with 8763 photos from the project. The camera locations are shown with its standard deviations for XYZ. The area has a planimetric extent of about: 42305 x 48706 [m].

-  : Scale for the symbols. Symbol in the graphic is correlated to 0.160 [m] in the object.
-  : Standard deviation XY for 8763 projection centers (min=0.0208, avg=0.0416, max=0.1148 [m]).
-  : Standard deviation Z for 8763 projection centers (min=0.0189, avg=0.0401, max=0.1113 [m]).
-  : Tie point location for 213790 points.

MATCH-AT (Multi-Head)

GNSS residuals (observed - adjusted) (Custom_left)



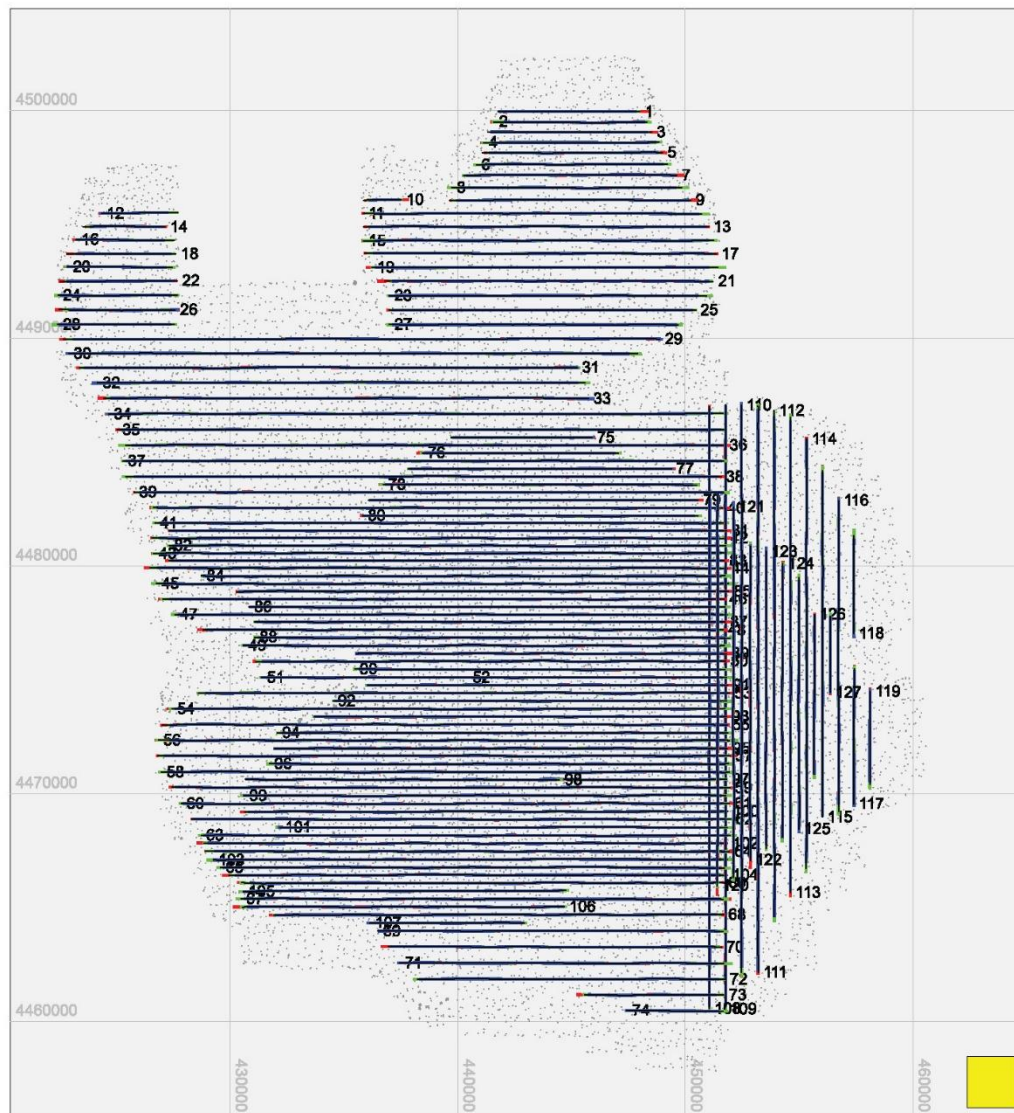
Graphic with 8763 used GNSS locations from the adjustment. The points are shown with its residuals for X,Y,Z from the adjustment. The area has a planimetric extent of about: 42305 x 48706 [m]. Residual is defined as: residual = observed - adjusted.

- Scale for the symbols. Symbol in the graphic is correlated to 1.870 [m] in the object.
- Residual XY for (8763) GNSS positions (min=0.0044, avg=0.3425, max=1.8982 [m]).
- Residual Z for (pos.:4106/neg.:4657) GNSS positions (min=-0.5808, avg=0.1251, max=1.3909 [m]).
- Number of eliminated GNSS observations: 0 of 8763
- Tie point location for 213790 points.



MATCH-AT (Multi-Head)

IMU residuals (observed - adjusted) (Custom_left)



Graphic with 8763 IMU locations from the adjustment. The points are shown with its residuals for omega,phi,kappa from the adjustment. The area has a planimetric extent of about: 42305 x 48706 [m]. Residual is defined as: residual = observed - adjusted.

- : Scale for the symbols. Symbol in the graphic is correlated to 0.08799 [deg] in the object.
- : Residual omega(X) for (8763) IMU positions (min=-0.01659, avg=0.00050, max=0.02015 [deg]).
- : Residual phi(Y) for (8763) IMU positions (min=-0.03234, avg=-0.00099, max=0.03614 [deg]).
- : Residual kappa(Z) for (8763) IMU positions (min=-0.02257, avg=0.00165, max=0.02524 [deg]).
- : Tie point location for 213790 points.

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MATCH-AT (Multi-Head)

Ground control points

Ground control points from statistic file

ID	Type	X	Y	Z	Unit	Remark
PA1003	Full	428254.6900	4477344.9770	713.8480	m	
PA1007	Full	431700.9900	4474869.3730	696.5530	m	
PA1009	Vertical			713.9180	m	
PA1011	Full	427729.9790	4473476.2760	710.0290	m	
PA1013	Full	430018.1670	4465939.8580	714.1930	m	
PA1015	Full	433409.2680	4465354.5270	678.6370	m	
PA1017	Full	436032.7700	4465182.3830	638.8820	m	
PA1018	Full	436041.6240	4465182.5810	638.6160	m	
PA1023	Full	445612.8540	4460764.7620	560.7010	m	
PA1027	Full	453182.0110	4463691.2980	539.3530	m	
PA1031	Full	450098.2250	4466329.4940	626.2170	m	
PA1033	Full	450375.4520	4468741.8360	648.8050	m	
PA1034	Full	450379.6100	4468749.7060	648.6660	m	
PA1035	Full	455056.9300	4466400.5070	594.9900	m	
PA1036	Full	455068.5880	4466418.0480	596.3110	m	
PA1037	Full	455970.8210	4468161.4220	642.9910	m	
PA1042	Full	458143.1610	4471127.8880	553.7170	m	
PA1043	Full	457865.7240	4474841.5350	561.2060	m	
PA1045	Full	457238.6960	4479464.4060	598.8840	m	
PA1050	Full	455966.2520	4482102.0820	668.8740	m	
PA1051	Vertical			711.9650	m	
PA1057	Full	448739.5800	4489569.4180	636.0170	m	
PA1059	Full	445248.0740	4489778.7810	687.0410	m	
PA1065	Full	440705.8470	4478233.5230	701.5380	m	
PA1066	Full	440745.0710	4478232.4560	700.9110	m	
PA107	Full	453822.2580	4486633.9740	590.1760	m	
PA147	Full	432707.7900	4485869.9790	681.8830	m	
PA148	Full	432738.7600	4485862.8300	682.1500	m	
PA157	Full	445947.8080	4488441.5550	676.9650	m	
PA158	Full	445952.7310	4488407.9690	676.9220	m	
PA194	Full	432208.1150	4474289.6850	701.0360	m	
PA196	Full	431900.8250	4475029.8010	691.7510	m	
PA2001	Full	424296.7830	4495961.2060	933.7970	m	
PA2001_BIS	Full	424299.6010	4495978.2260	938.6500	m	
PA2001_BIS2	Full	424293.5850	4495973.9610	937.0120	m	
PA2003_BIS	Full	427729.1830	4495826.6310	878.1230	m	
PA2003_BIS2	Full	427751.4610	4495832.3880	877.1400	m	
PA2004	Full	423761.2350	4495527.6620	933.9180	m	

MATCH-AT (Multi-Head)

Ground control points from statistic file

ID	Type	X	Y	Z	Unit	Remark
PA2004_BIS	Full	423769.2100	4495555.4560	934.0580	m	
PA2016	Full	422659.3130	4492771.6140	860.9600	m	
PA2016_BIS	Full	422643.6070	4492778.4530	862.4170	m	
PA2033	Full	441962.9260	4500565.9870	748.7280	m	
PA2035	Full	446269.3030	4500754.6760	645.1950	m	
PA2035_BIS	Full	446273.0000	4500760.6840	646.6980	m	
PA2039	Full	448109.4600	4500286.0330	635.5270	m	
PA2039_BIS	Full	448058.9640	4500221.3560	641.6810	m	
PA2042	Full	435869.7680	4496766.7770	716.1660	m	
PA2043	Full	437332.0590	4496866.8120	683.7310	m	
PA2043_BIS	Full	437294.2560	4496946.0790	682.3640	m	
PA2051	Full	439600.5760	4496086.3790	718.0170	m	
PA2051_BIS	Vertical			718.0110	m	
PA2060	Full	450787.7210	4495420.5950	605.3540	m	
PA2068	Full	451179.9010	4493499.0090	597.5890	m	
PA2087	Full	422974.9900	4489304.3970	742.0880	m	
PA2087_BIS	Full	422969.4440	4489288.4180	742.5360	m	
PA2099	Full	425733.3570	4483176.5950	704.6340	m	
PA2108	Full	430955.8700	4475829.1160	707.1780	m	
PA2115	Full	434312.3650	4464277.4090	671.5670	m	
PA2132	Full	436476.4260	4490677.2550	694.1110	m	
PA2132_BIS	Vertical			694.5760	m	
PA407	Full	440276.0130	4461163.3770	600.9450	m	
PA408	Full	440262.8400	4461150.2060	601.0130	m	
PA409	Full	438190.2580	4462709.5570	627.7410	m	
PA416	Vertical			643.9500	m	
PA417	Vertical			647.2900	m	
Minimum		422643.6070	4460764.7620	539.3530	m	selected system
Maximum		458143.1610	4500760.6840	938.6500	m	selected system
Area extent		35499.5540	39995.9220	399.2970	m	selected system

List of 65 ground control points defined in the statistic file. Statistics defined in the selected coordinate system.

MATCH-AT (Multi-Head)

Ground control points

Ground control point residuals (given - adjusted)

ID	#	X [m]	Y [m]	Z [m]	Total [m]	Remark
PA1003	7	0.0163	0.0384	-0.0242	0.0482	
PA1007	23	-0.1309	-0.0200	0.0149	0.1333	
PA1009	7			0.0410	0.0410	
PA1011	6	-0.1390	0.0320	0.0275	0.1452	
PA1013	13	-0.1102	0.0512	-0.0548	0.1333	
PA1015	18	-0.0338	0.0900	-0.1445	0.1736	
PA1017	3	-0.0031	0.0136	-0.0221	0.0261	
PA1018	17	-0.0033	0.0127	-0.0384	0.0406	
PA1023	7	0.1090	-0.0152	0.0734	0.1323	
PA1027	7	0.1076	0.0977	0.1289	0.1943	
PA1031	35	0.2193	-0.0245	-0.1617	0.2736	
PA1033	44	0.2144	-0.0316	-0.2788	0.3531	
PA1034	45	0.2271	-0.0395	-0.2438	0.3356	
PA1035	10	0.0600	-0.0316	0.1448	0.1599	
PA1036	9	0.0452	-0.0304	0.1238	0.1352	
PA1037	12	0.0200	-0.0144	0.1001	0.1031	
PA1042	11	0.0452	0.0489	0.2369	0.2461	
PA1043	18	0.0659	0.0742	0.1587	0.1872	
PA1045	12	0.0907	-0.0188	0.2177	0.2366	
PA1050	6	-0.0384	-0.0228	-0.0701	0.0832	
PA1051	7			0.0161	0.0161	
PA1057	7	0.0858	-0.0215	0.0327	0.0943	
PA1059	17	0.0755	-0.0471	-0.1083	0.1402	
PA1065	24	-0.0612	-0.0685	-0.1238	0.1541	
PA1066	17	-0.0133	0.0154	-0.1145	0.1163	
PA107	7	0.0470	0.0055	0.0696	0.0842	
PA147	11	-0.1254	-0.0231	-0.0461	0.1355	
PA148	7	-0.0881	-0.0305	-0.0590	0.1103	
PA157	15	0.0901	-0.0410	0.0002	0.0990	
PA158	11	0.0563	-0.0399	-0.0068	0.0693	
PA194	25	-0.1440	-0.0137	0.0088	0.1449	
PA196	19	-0.1741	0.0464	-0.0402	0.1846	
PA2001	5	-0.0144	-0.0240	-0.0208	0.0349	
PA2001_BIS	5	-0.0001	-0.0294	-0.0547	0.0621	
PA2001_BIS2	5	0.0369	0.0014	-0.0198	0.0419	
PA2003_BIS	3	0.0311	0.0677	0.1833	0.1979	
PA2003_BIS2	3	-0.0073	-0.0517	-0.1204	0.1312	
PA2004	7	0.0696	0.0732	0.1250	0.1607	

MATCH-AT (Multi-Head)

Ground control point residuals (given - adjusted)

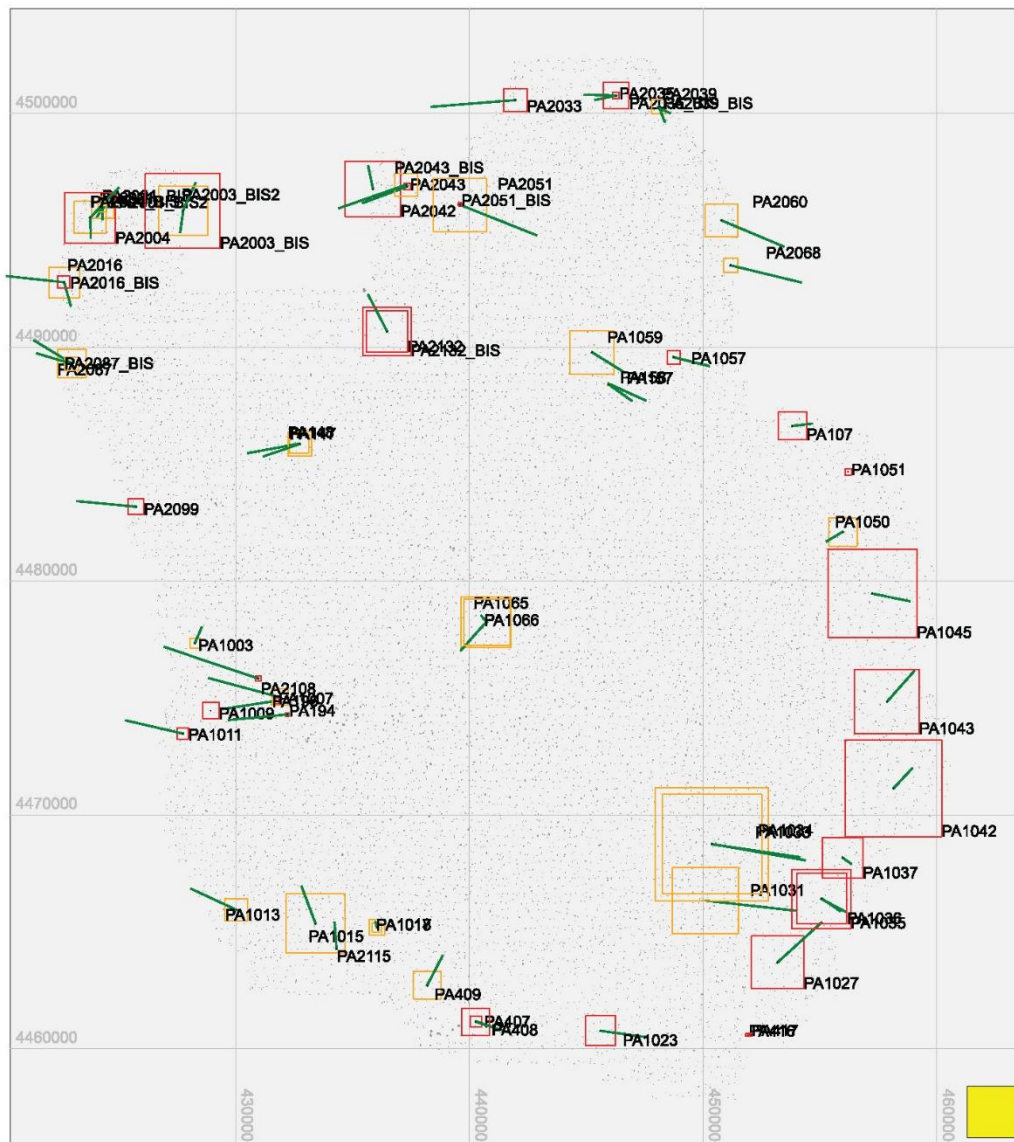
ID	#	X [m]	Y [m]	Z [m]	Total [m]	Remark
PA2004_BIS	7	0.0016	-0.0493	-0.0786	0.0928	
PA2016	6	0.0160	-0.0573	-0.0751	0.0958	
PA2016_BIS	6	-0.1392	0.0147	0.0301	0.1432	
PA2033	13	-0.2057	-0.0165	0.0566	0.2139	
PA2035	10	-0.0503	-0.0104	0.0159	0.0537	
PA2035_BIS	10	-0.0766	0.0021	0.0643	0.1000	
PA2039	10	0.0137	-0.0371	-0.0355	0.0532	
PA2039_BIS	12	0.0296	-0.0117	0.0023	0.0319	
PA2042	4	-0.0115	0.0560	0.1363	0.1478	
PA2043	7	-0.1080	-0.0398	0.0163	0.1162	
PA2043_BIS	6	-0.1641	-0.0572	-0.0569	0.1829	
PA2051	10	0.1864	-0.0741	-0.1310	0.2396	
PA2051_BIS	11			0.0076	0.0076	
PA2060	10	0.1519	-0.0638	-0.0802	0.1832	
PA2068	2	0.1721	-0.0418	-0.0345	0.1804	
PA2087	7	-0.0913	0.0561	-0.0702	0.1281	
PA2087_BIS	7	-0.0843	0.0254	-0.0340	0.0944	
PA2099	8	-0.1442	0.0136	0.0383	0.1498	
PA2108	18	-0.2294	0.0771	0.0138	0.2424	
PA2115	12	-0.0049	0.0636	0.0022	0.0638	
PA2132	12	-0.0460	0.0889	0.1016	0.1427	
PA2132_BIS	12			0.1193	0.1193	
PA407	7	0.0412	-0.0140	0.0271	0.0512	
PA408	7	0.0792	-0.0254	0.0672	0.1069	
PA409	14	0.0373	0.0716	-0.0673	0.1051	
PA416	2			0.0076	0.0076	
PA417	2			0.0061	0.0061	
Maximum		-0.2294	0.0977	-0.2788		
Mean		0.0000	0.0000	-0.0000		
Sigma		0.1060	0.0458	0.0989		
RMSE(x,y,z)		0.1051	0.0454	0.0982		
RMSEr		0.1145	SQRT(RMSEx * RMSEx + RMSEy * RMSEy)			
ACCr (at 95% Confidence Level)		0.1981	RMSEr * 1.7308			
ACCz (at 95% Confidence Level)		0.1924	RMSEz * 1.9600			

List of 65 considered ground control points defined in the statistic file.



MATCH-AT (Multi-Head)

Ground control point residuals



Graphic with 65 ground control points from the project. The points are shown with its residuals for XYZ from the adjustment. The area has a planimetric extent of about: 42305 x 48708 [m]. Residual is defined as: residual = given - adjusted.

-  : Scale for the symbols. Symbol in the graphic is correlated to 0.125 [m] in the object.
-  : Residual XY (59) for ground control points (min=0.0131, avg=0.0984, max=0.2420 [m]).
-  : Residual Z (pos.:35/neg.:30) for ground control points (min=-0.2788, avg=-0.0000, max=0.2369 [m]).
-  : Tie point location for 213790 points.

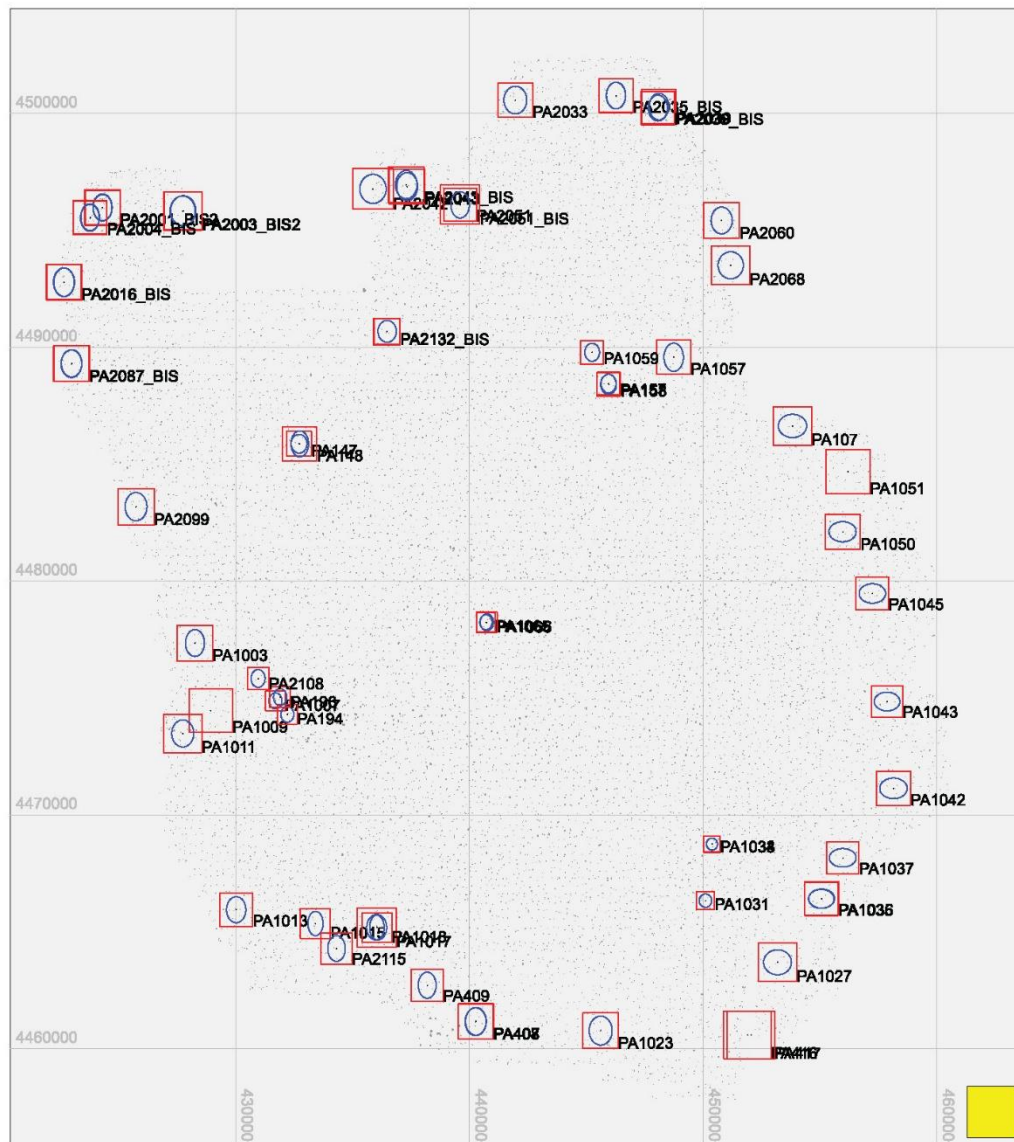
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MATCH-AT (Multi-Head)

Ground control point standard deviations



Graphic with 65 ground control points from the project. The points are shown with its standard deviations for XYZ from the adjustment. The area has a planimetric extent of about: 42305 x 48706 [m].

- : Scale for the symbols. Symbol in the graphic is correlated to 0.021 [m] in the object.
- : Standard deviation XY for 59 ground control points (min=0.0069, avg=0.0130, max=0.0165 [m]).
- : Standard deviation Z for 65 ground control points (min=0.0068, avg=0.0137, max=0.0200 [m]).
- : Tie point location for 213790 points.

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5. ESTRUCTURA INFORMÁTICA DE LA INFORMACIÓN ENTREGADA

A continuación se describe en detalle la información que se adjunta a esta memoria:

- Carpeta 1. MEMORIA. Contiene este documento
- Carpeta 2. RESULTADOS. Contiene la siguiente información:
 - 2-1-BLOQUE NADIR
 - Fichero ASCII de definición de cámara
 - Ficheros de orientación exterior en formato ASCII (EO y ORI)
 - Fichero PRJ de Match-AT
 - Informe en PDF
 - 2-2-BLOQUE LEFT-RIGHT
 - Fichero ASCII de definición de cámara
 - Ficheros de orientación exterior en formato ASCII (EO y ORI)
 - Fichero PRJ de Match-AT
 - Informe en PDF
 - 2-3-BLOQUE FRONT-BACK
 - Fichero ASCII de definición de cámara
 - Ficheros de orientación exterior en formato ASCII (EO y ORI)
 - Fichero PRJ de Match-AT
 - Informe en PDF

- Carpeta 3.AT EN FORMATO PNOA Contiene toda la información de la aerotriangulación en formato PNOA