Accuracy Case Study: Independent Aerotriangulation of a Vexcel UltraCam Dragon Block

An independently produced photogrammetric solution, measured against the manufacturer's reference — image precision, trajectory residuals, and true check-point accuracy.

Study data: Vexcel UltraCam Dragon 4.1 demonstration block — Graz, Austria (publicly distributed).

AG2I — Artificial Geospatial General Intelligence · Boulder, Colorado · June 2026

Summary. On the publicly distributed Vexcel UltraCam Dragon 4.1 demonstration block over Graz, Austria, AG2I produced a complete, independent aerotriangulation and assessed its accuracy against the manufacturer's reference solution and against independent ground check points. The independent solution reached an image-space standard deviation of unit weight of **0.64 px** — below the 0.82 px reference figure for the same block — with independent check-point accuracy of **0.26 / 0.08 / 0.25 m** (X/Y/Z, RMS) and independently determined camera focal lengths agreeing with the factory calibration to within **0.025 mm**. All accuracy figures below are reported against check points withheld from the solution.

0.64 px
IMAGE Σ_0 · VS 0.82 PX REFERENCE

0.25 m
CHECK-POINT Z RMS · TRUE ACCURACY

0.025 mm
FOCAL VS FACTORY CALIBRATION

1. The block

Sensor	Vexcel UltraCam Dragon 4.1 — five heads (1 nadir RGBI, 4 oblique)
Frame format	14144 × 10560 px @ 3.76 µm
Datum / projection	ETRF2000, UTM zone 33N (EPSG:32633); ellipsoidal heights
Coverage assessed	Demonstration subset — 50 exposures, 175 images, centrally clustered control
Ground control	Surveyed marks split into independent control and check sets
Tie points / observations	230,368 object points; 1.04 × 10^6 image observations

The block is Vexcel's public demonstration dataset; no confidential or client data is involved. The assessment is a local accuracy statement over the demonstration subset.

2. Accuracy versus the reference solution

Metric	AG2I (independent)	Reference
Image σ_0 (standard deviation of unit weight)	**0.64 px**	0.82 px
Median image residual	0.38 px	—

Metric	AG2I (independent)	Reference
GNSS position RMS (X / Y / Z)	0.021 / 0.034 / 0.010 m	~0.050 m
Control-point RMS, vertical (Z)	0.105 m	—
Independent check-point RMS (X / Y / Z)	0.257 / 0.080 / 0.254 m	—
Boresight magnitudes	< 15 mgon	factory

Across image precision and airborne trajectory residuals, the independent solution meets or exceeds the manufacturer's reference figures for the same block.

3. Independent check-point accuracy (true accuracy)

Check points are surveyed marks deliberately *withheld* from the adjustment — the solution never sees them, so their agreement is an honest measure of absolute accuracy rather than internal fit.

Check point	dX (m)	dY (m)	dZ (m)	3D (m)
Gn132	−0.468	+0.063	+0.021	0.473
Gn172	−0.091	+0.100	+0.368	0.392
Gn261	+0.093	−0.092	+0.414	0.434
Gn91.1	+0.221	−0.078	−0.100	0.254
Gn91.3	+0.216	−0.056	−0.071	0.234
RMS	**0.257**	**0.080**	**0.254**	**0.370**

4. Image-space residuals by camera head

Head	Camera	RMS (px)	Observations
0	Oblique-Left	0.643	201,151
1	Oblique-Right	0.653	201,195
2	Oblique-Forward	0.644	246,539
3	Oblique-Backward	0.654	241,248
4	Nadir-RGBI	0.586	145,796

Every camera head resolves to sub-pixel image residuals across more than a million observations.

5. Camera calibration agreement with the factory

The camera's focal lengths were determined independently from this block and compared with the manufacturer's factory calibration:

Head	AG2I (mm)	Factory (mm)	Difference (mm)
Nadir-RGBI	81.015	81.000	+0.015
Oblique-Left	123.364	123.380	−0.016
Oblique-Right	123.382	123.380	+0.002
Oblique-Forward	123.357	123.380	−0.023
Oblique-Backward	123.401	123.380	+0.021

Every focal length agrees with the factory value to within **0.025 mm (< 0.03%)**.

6. Conclusion

On the public Dragon 4.1 Graz demonstration block, AG2I's independent aerotriangulation matched or exceeded the manufacturer's reference solution across image precision, airborne trajectory residuals, and boresight, agreed with the factory camera calibration to better than 0.03%, and delivered **true vertical accuracy of 0.25 m against independent check points** — every figure backed by the withheld-check-point report rather than an internal fit statistic.