

OBJECT SPACE

Let's start with the file structure for control points, driveback points or EO points, which basically has each record as label, X,Y,Z; SX,SY,SZ.

If units implicit in this file (they never have to be stated) will be the units for all subsequent object space parameter values in Australis. We'll call these units **BB**

Label	X (BB)	Y (BB)	Z (BB)	SX(BB)	SY(BB)	SZ(BB)
A1	-115.508155	220.139503	24.695827	0.0083	0.0080	0.0194
A2	-90.088485	220.431165	24.288995	0.0082	0.0080	0.0194
A3	-215.395541	185.892949	52.402830	0.0084	0.0077	0.0190
A4	-64.725336	220.760848	23.915030	0.0082	0.0080	0.0195
A5	-39.416301	221.074085	23.523167	0.0081	0.0079	0.0195
A6	-234.856330	172.644090	61.696458	0.0084	0.0077	0.0188
A7	-13.975159	221.411051	23.154397	0.0081	0.0079	0.0195
A8	11.567998	221.775450	22.687972	0.0081	0.0080	0.0195
A9	36.847671	222.035354	22.248873	0.0080	0.0080	0.0196
A11	140.823531	222.119091	21.647424	0.0079	0.0080	0.0196

...

... ETC.

...

Note: *Australis* only asks for object space units in order to correctly scale the symbols in the screen graphics.

IMAGE SPACE

Basically, all units in image space which are related to image x,y coords and interior orientation are in **mm**.

All coefficients are in units such that when their dx,dy effect is computed, it will also be in **mm**.

Take the file camera.txt:

Australis Bundle Adjustment Results: Camera Parameters

10 May, 2001 00:49:08

Project: C:\AustralisDemo\Demo2\Project.apf

Adjustment is Free-Network -- There are no explicit control points ***

Results for Camera 1 DCS420 Lens f:20mm

Camera Variable	Initial Value	Total Adjustment	Final Value	Initial Std. Error	Final Std. Error
C	20.4914	-0.00106	20.4924	1.0e+003	1.618e-003 (mm)
XP	-0.0563	0.01017	-0.0664	1.0e+003	1.330e-003 (mm)
YP	0.0889	0.00996	0.0789	1.0e+003	1.436e-003 (mm)
K1	2.75003e-004	-1.362e-005	2.88622e-004	1.0e+003	5.911e-006
K2	-8.60227e-007	8.789e-008	-9.48118e-007	1.0e+003	3.228e-007
K3	7.36406e-009	4.456e-009	2.90807e-009	1.0e+003	5.488e-009
P1	6.29376e-006	-5.571e-006	1.18647e-005	1.0e+003	1.257e-006
P2	1.72264e-005	-6.950e-006	2.41766e-005	1.0e+003	1.411e-006
B1	3.24803e-027	-1.040e-027	4.28841e-027	1.0e-016	2.997e-017
B2	-8.74800e-027	7.712e-028	-9.51915e-027	1.0e-016	2.997e-017

Units of K1, K2, K3, P1, P2, B1 & B2 are such that their corrn. Values will be in mm.

Maximum Observational Radial Distance Encountered: 5.9 mm

Camera Station Summary

Station Image	Xc (BB)	Yc (BB)	Zc (BB)	Alpha deg.	Elev. deg	Roll deg.
1 Image001	1065.1151	-66.7199	2159.9765	101.90660	-59.94678	-8.2621
2 Image002	96.2183	-327.5450	2504.4838	43.03629	-86.67410	-44.4385
3 Image003	-1061.1105	-178.8248	2392.3562	-90.40588	-63.56887	1.479
4 Image004	-1051.5905	574.7299	2472.3074	-129.33187	-59.55828	-140.469
5 Image005	292.0134	508.6965	2547.7448	158.53013	-71.82166	-159.836
6 Image006	1094.2583	564.0156	2130.2841	124.84899	-55.03110	-30.312

The file Residuals.txt

Australis Bundle Adjustment Results: Image Coordinate Residuals
10 May, 2001 00:49:08

Project: C:\AustralisDemo\Demo2\Project.apf

Adjustment is Free-Network -- There are no explicit control points ***

Triangulated residuals

All these values are in micrometres

Sta #	Pt A1		Pt A2		Pt A3	
	x	y	x	y	x	y
1	-0.1um	0.0	0.0	-0.0	-0.2	-0.1
2	-0.1um	-0.0	-0.0	-0.0	0.1	0.2
3	-0.1	-0.1	-0.0	-0.1	-0.4	-0.5
4	0.0	-0.2	-0.0	-0.1	0.1	-0.3
5	-0.1	-0.1	-0.1	-0.0	-0.0	-0.1
6	0.0	-0.1	0.0	0.0	-0.4	0.0

...
 ... etc.
 ...

Summary of Residuals					
Sta #	Station		Residuals		Number of Points
	x	y	Total		
Image001	0.14	0.11	0.13 um		134
Image002	0.18	0.16	0.17 um		136
Image003	0.18	0.16	0.17 um		134
Image004	0.13	0.14	0.14		135
Image005	0.14	0.13	0.14		136
Image006	0.16	0.13	0.15		132

Also, the values above are in micrometres

Total Residuals			Observ.	Constraints	Parameters	Degrees of Freedom	Mean Err.
x	y	Total				Unit	Weight
0.16 um	0.14 um	0.15 um	1614	420	454	1580	0.300 unit-less

The 'total residuals' are singularly important quality indicators as they give the RMS observational error within the x,y image coords. Ideally, they should be equivalent in value to 0.03 to 0.05 pixels (ie 1/30th to 1/20th of a pixel).

Finally, the file bundle.txt

Australis Bundle Adjustment Results
 10 May, 2001 00:49:07

Quick Summary

Project: C:\AustralisDemo\Demo2\Project.apf
 Adjustment: Free Network
 Folding Method: Standard
 Scaling: N/A
 Number of Points: 136
 Number of Images: 6
 Number of Scale Bars: 0
 Number of Iterations: 4
 Elapsed CPU Time: 2.59 seconds

Results for Station Image001 FileName Image1.tif Camera DCS420 Lens f:20mm

Station Variable	Initial Value	Total Adjustment	Final Value	Initial Standard Error	Final Standard Error
X	1065.1639	0.0488	1065.1151	1.0000E+003	2.9775E-001 (BB)
Y	-66.7972	-0.0773	-66.7199	1.0000E+003	1.8900E-001 (BB)
Z	2160.2049	0.2284	2159.9765	1.0000E+003	3.6430E-001 (BB)
AZ	101.8376	-0.0690	101.9066	1.0000E+003	6.5918E-001 deg

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    EL      -59.9254      0.0214      -59.9468      1.0000E+003      4.9095E-001  deg
    ROLL     -8.2004      0.0618      -8.2622      1.0000E+003      6.2015E-001  deg

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... etc.

Results for Station Image006 FileName Image6.tif Camera DCS420 Lens f:20mm

Station Variable	Initial Value	Total Adjustment	Final Value	Initial Standard Error	Final Standard Error
X	1094.3092	0.0508	1094.2583	1.0000E+003	3.1211E-001 (BB)
Y	564.1238	0.1082	564.0156	1.0000E+003	2.6336E-001 (BB)
Z	2130.4992	0.2151	2130.2841	1.0000E+003	3.5405E-001 (BB)
AZ	124.7836	-0.0654	124.8490	1.0000E+003	6.0603E-001 (deg)
EL	-55.0222	0.0089	-55.0311	1.0000E+003	5.0602E-001 (deg)
ROLL	-30.2584	0.0537	-30.3121	1.0000E+003	5.5393E-001 (deg)

All image coord. Residual values are in microns (um)

Sta #	Summary of Residuals			Number of Points
	Station X	Residuals Y	Total	
Image001	0.14	0.11	0.13 (um)	134
Image002	0.18	0.16	0.17 (um)	136
Image003	0.18	0.16	0.17 (um)	134
Image004	0.13	0.14	0.14 (um)	135
Image005	0.14	0.13	0.14 (um)	136
Image006	0.16	0.13	0.15 (um)	132

Total Residuals			Degrees of Freedom				
X	Y	Total	Sigma0	Freedom	Observations	Parameters	Constraints
0.16 (um)	0.14 (um)	0.15 (um)	0.300 rest are unit-less	1580	1614	454	420

As above, the 'total residuals' are singularly important quality indicators as they give the RMS observational error within the x,y image coords. Ideally, they should be equivalent in value to 0.03 to 0.05 pixels (ie 1/30th to 1/20th of a pixel).

Limiting and total error sigmas

Label	Point Coordinates			Limiting Sigma Estimates			Total Sigma Estimates			Sightings	
	X	Y	Z	X	Y	Z	X	Y	Z	RMS	Rays
A1	-115.5082	220.1395	24.6958	0.0082	0.0074	0.0195	0.0083	0.0080	0.0194	0.1	6
A2	-90.0885	220.4312	24.2890	0.0082	0.0074	0.0195	0.0082	0.0080	0.0194	0.1	6
A3	-215.3955	185.8929	52.4028	0.0083	0.0074	0.0191	0.0084	0.0077	0.0190	0.2	6
	(BB)	(BB)	(BB)	(BB)	(BB)	(BB)	(BB)	(BB)	(BB)		
...											
...											
A34	340.1318	32.4971	146.8955	0.0074	0.0072	0.0184	0.0075	0.0073	0.0183	0.1	6
A35	-469.2761	-172.4042	274.9418	0.0081	0.0074	0.0167	0.0088	0.0075	0.0167	0.2	6

All values below have units of BB, the object space units

	Summary of Limiting STD Error Estimates				Summary of Total STD Error Estimates		
	X	Y	Z	X	Y	Z	
RMS is	0.0077	0.0079 (BB)	0.0182	0.0080	0.0081	0.0182 (BB)	
Minimum is	0.0071	0.0072	0.0163	0.0074	0.0073	0.0162 (BB)	
at point	A117	A31	A69	A114	A34	A69	
Maximum is	0.0122	0.0160	0.0625	0.0124	0.0160	0.0622 (BB)	
at point	A131	A131	A131	A131	A131	A131	

Image Coordinate Rejections

Image Number Image001
A17
Image Number Image002
A132
Image Number Image003
A131 A132
Image Number Image004

Image Number Image005
A132
Image Number Image006
A130
Total Rejections 6