EXPERIMENTAL CLASSIFICATION OF GROSS ERRORS IN AERIAL BLOCK TRIANGULATION BY INDEPENDENT MODELS

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1. Introduction

In the execution of the Technical Regional Map of Emilia-Romagna (Italy) at the scale 1:5000, several zones have had the ground control established by photogrammetry. In the latter cases, the relative orientation has been performed either by analogical or analytical plotters and the adjustment by independent models. The adjustment of several blocks has been carried out by the "Istituto di Topografia, Fotogrammetria e Geofisica" of the "Politecnico di Milano" by means of the computer program supplied by the Stuttgart University. This is why, in the period 1976-79, about 20 blocks have been cleaned from gross errors, adjusted and tested.
The most meaningful among these blocks are here analyzed as for the types and frequencies of the gross errors. This inquiry has supplied both a classification of blunders and a frequency distribution of the gross errors.

2. Tests on the experimental distribution of the gross errors

The repeated block adjustments have been distinguished between some with blunders (numeration errors, axes incongruences...) and the others without blunders. Starting from the last block adjustment, only those without blunders have been analyzed.
Taking the residuals of the observation equations, after the least squares adjustment, the frequency diagrams of the absolute values have been done according to the classes 0-3 RMS, 3-4 RMS, 4-5 RMS, 5-6 RMS, 6-7 RMS, 7-8 RMS, 8-∞ RMS.
The departure from normal distribution of the gross errors has been tested in the repeated adjustments by means of the kurtosis coefficient (β) and of the central limit theorem.
The former is well-known index useful to study the shape of a probability or frequency distribution, the latter is performed joining the value of a residual ($\leq$3 RMS or >3 RMS) with a binary variable (y=0 or y=1). Let N be the number of the residuals and $n=\Sigma_i y_i$ the number of the residuals out of 3 RMS, the mean of y is Np and the variance of y is Np(1-p), where p is 0.0026 under the hypothesis that this value could be drawn from a normal distribution.
Standardizing n, the expected value z_e is obtained; this is tested against a theoretical value $z_t = 1.96$.
The result supplies a normal analysis: if the test failes, the departure from normality of the experimental distribution of the residuals is significant.

3. Experimental classification of gross errors

In the period 1976-79, the blocks have been cleaned from gross errors, adjusted and tested using as check value only sigma naught.
The acceptance threshold for sigma naught have been fixed to the value 0.50 m, as upper bound; therefore the repetition of the block adjustments has been stopped when this test was satisfied.

Last year the lists of the repeated block adjustments have been reexamined to obtaine the types of blunders and the frequencies of the gross errors.
Tables 1-8 show, for each block, the statistics of adjustment, the final accuracy, the classification of blunders; tables 9-16 give the frequency diagram and the statistical analysis of the gross errors.
The following list of symbols must be used:

- i = iteration number;
- N = number of photogrammetric points;
- $n_{K,L}$ = number of photogrammetric points with residuals from K to L times RMS;
- β = kurtosis coefficient;
- z = expected value for the normal analysis;
- σ_O = sigma naught.

In such a way it has been possible to point out that all the blunders can be ascribed to very few well identifiable sources and the departure from normality of the residuals, after the clearing, becomes less and less meaningful the more repetitions are computed. However, there is evidence that, no matter how many successive adjustments are made, the tests for normality keep failing.

4. Conclusions

The results obtained from the experimental classification of gross errors allow to make some remarks.
Since input errors, false reference system, wrong connection among photogrammetric points, wrong number and/or coordinates in control points are the well-identifiable sources of the blunders, these can be recognized with topological or geometrical tests and cleared before block adjustment.
The gross errors cause a very significant departure from normality of the residuals. However, using as check value only sigma naught, it is possible to detect and eliminate the gross errors but generally the normality is not achieved.
The quicker sigma naught decreases, the less the normality is achieved.
The kurtosis coefficient (β) and the central limit theorem coefficient (z) for normal analysis are big when also sigma naught (σ_O) is big; specially β is bigger for the presence of the mid size gross errors.
The coefficients β and z become smaller when σ_O is small but the presence of some small gross errors leaves a z significantly large.
Indeed the usual phylosophy of gross errors rejection is based on the elimination of biggest residuals. Therefore the decreasing of σ_O aids the decreasing of β, while the decreasing of z is not sure, as the coefficient z depends only on the number of the gross errors and not on their value.
The non normality distribution of the residuals, specially with several gross errors, suggests to distinguish between the gross errors detection and the adjustment. The former needs robust estimates as least modulus sum, the latter uses best linear unbiased estimates (BLUE), i.e. least squares.

BLOCK	PLOTTER		DATE
BENTIVOGLIO	DS - GALILEO		JUNE 1978
TOPOGRAPHY	SCALE		ITERATIONS
PLATE	1/13500		10
MODELS	(HO) CONTROL POINTS	(VE)	MODEL POINTS
113	100	215	1545

STATISTICS OF ADJUSTMENT - FINAL ACCURACY IN M

BLOCK		OBSERVATIONS	UNKNOWNS	REDUNDANCY
HORIZONTAL		2200	1350	850
VERTICAL		1963	1200	763
	CONTROL POINTS	MODEL POINTS	PROJECT. CENTRES	SIGMA NAUGHT
RMS (x)	0.404	0.219	0.383	0.345
RMS (y)	0.430	0.231	0.702	
RMS (z)	0.362	0.257	0.297	0.405

CLASSIFICATION OF BLUNDERS

1ST ITERATION:	INPUT ERRORS
2ND ITERATION:	INPUT ERRORS
3RD ITERATION:	FALSE REFERENCE SYSTEM (LEFT INSTEAD OF RIGHT SYSTEM)
4TH ITERATION:	-

TAB. 1

BLOCK	PLOTTER		DATE
BOLOGNA EST	SIMPLEX III - GALILEO		JANUARY 1980
TOPOGRAPHY	SCALE		ITERATIONS
90% PLATE - 10% HILLY	1/6000		8
MODELS	(HO) CONTROL POINTS	(VE)	MODEL POINTS
189	67	109	2153

STATISTICS OF ADJUSTMENT - FINAL ACCURACY IN M

BLOCK		OBSERVATIONS	UNKNOWNS	REDUNDANCY
HORIZONTAL		3454	2124	1330
VERTICAL		2812	1778	1034
	CONTROL POINTS	MODEL POINTS	PROJECT. CENTRES	SIGMA NAUGHT
RMS (x)	0.342	0.260	0.327	0.465
RMS (y)	0.426	0.325	0.581	
RMS (z)	0.243	0.243	0.458	0.450

CLASSIFICATION OF BLUNDERS

1ST ITERATION:	INPUT ERRORS
2ND ITERATION:	INPUT ERRORS
3RD ITERATION:	FALSE REFERENCE SYSTEM (LEFT INSTEAD OF RIGHT SYSTEM)
4TH ITERATION:	WRONG CONNECTION AMONG PHOTOGRAMMETRIC POINTS

TAB. 2

BLOCK	PLOTTER		DATE
LOTTO 5	TA3 P - OMI		SEPTEMBER 1977
TOPOGRAPHY	SCALE		ITERATIONS
40% HILLY - 60% MOUNTAINOUS	1/13500		9
MODELS	(HO) CONTROL POINTS (VE)		MODEL POINTS
158	104	125	1688

STATISTICS OF ADJUSTMENT - FINAL ACCURACY IN M

BLOCK		OBSERVATIONS	UNKNOWNS	REDUNDANCY
HORIZONTAL		2646	1698	948
VERTICAL		2221	1457	764
	CONTROL POINTS	MODEL POINTS	PROJECT. CENTRES	SIGMA NAUGHT
RMS (x)	0.530	0.265	0.419	0.445
RMS (y)	0.537	0.290	0.571	
RMS (z)	0.420	0.281	0.201	0.436

CLASSIFICATION OF BLUNDERS

1ST ITERATION:	INPUT ERRORS
2ND ITERATION:	WRONG CONNECTION AMONG PHOTOGRAMMETRIC POINTS
3RD ITERATION:	-
4TH ITERATION:	-

TAB. 3

BLOCK	PLOTTER		DATE
MODENA	DS - GALILEO		FEBRUARY 1979
TOPOGRAPHY	SCALE		ITERATIONS
PLATE	1/13000		4
MODELS	(HO) CONTROL POINTS (VE)		MODEL POINTS
274	97	164	2964

STATISTICS OF ADJUSTMENT - FINAL ACCURACY IN M

BLOCK		OBSERVATIONS	UNKNOWNS	REDUNDANCY
HORIZONTAL		4574	2906	1668
VERTICAL		4005	2571	1434
	CONTROL POINTS	MODEL POINTS	PROJECT. CENTRES	SIGMA NAUGHT
RMS (x)	0.397	0.144	0.292	0.232
RMS (y)	0.370	0.143	0.308	
RMS (z)	0.331	0.167	0.107	0.254

CLASSIFICATION OF BLUNDERS

1ST ITERATION:	INPUT ERRORS
2ND ITERATION:	FALSE REFERENCE SYSTEM (LEFT INSTEAD OF RIGHT SYSTEM)
3RD ITERATION:	-
4TH ITERATION:	-

TAB. 4

BLOCK	PLOTTER		DATE
MONTECRETO	SIMPLEX III - GALILEO		AUGUST 1978
TOPOGRAPHY	SCALE		ITERATIONS
MOUNTAINOUS	1/6000		5
MODELS	(HO) CONTROL	POINTS (VE)	MODEL POINTS
101	78	105	1067

STATISTICS OF ADJUSTMENT - FINAL ACCURACY IN M

BLOCK		OBSERVATIONS	UNKNOWNS	REDUNDANCY
HORIZONTAL		1732	1116	616
VERTICAL		1422	934	488
	CONTROL POINTS	MODEL POINTS	PROJECT. CENTRES	SIGMA NAUGHT
RMS (x)	0.373	0.255	0.757	0.401
RMS (y)	0.358	0.243	0.554	
RMS (z)	0.280	0.243	0.411	0.489

CLASSIFICATION OF BLUNDERS

1ST ITERATION:	-
2ND ITERATION:	-
3RD ITERATION:	-
4TH ITERATION:	-

TAB. 5

BLOCK	PLOTTER		DATE
PARMA EST	TA3 P - OMI		DECEMBER 1977
TOPOGRAPHY	SCALE		ITERATIONS
10% PLATE - 80% HILLY - 10% MOUN.	1/13500		7
MODELS	(HO) CONTROL	POINTS (VE)	MODEL POINTS
128	57	119	2464

STATISTICS OF ADJUSTMENT - FINAL ACCURACY IN M

BLOCK		OBSERVATIONS	UNKNOWNS	REDUNDANCY
HORIZONTAL		2162	1376	786
VERTICAL		1939	1232	707
	CONTROL POINTS	MODEL POINTS	PROJECT. CENTRES	SIGMA NAUGHT
RMS (x)	0.426	0.194	0.391	0.330
RMS (y)	0.432	0.214	0.507	
RMS (z)	0.333	0.261	0.205	0.394

CLASSIFICATION OF BLUNDERS

1ST ITERATION:	INPUT ERRORS
2ND ITERATION:	WRONG CONNECTION AMONG PHOTOGRAMMETRIC POINTS
3RD ITERATION:	WRONG NUMBER AND/OR COORDINATES IN CONTROL POINTS
4TH ITERATION:	-

TAB. 6

BLOCK	PLOTTER		DATE
PIACENZA	SIMPLEX III - GALILEO		JULY 1980
TOPOGRAPHY	SCALE		ITERATIONS
50% PLATE - 50% HILLY	1/7500		8
MODELS	(HO) CONTROL	POINTS (VE)	MODEL POINTS
122	62	106	1356

STATISTICS OF ADJUSTMENT - FINAL ACCURACY IN M

BLOCK		OBSERVATIONS	UNKNOWNS	REDUNDANCY
HORIZONTAL		2054	1334	720
VERTICAL		1778	1163	615
	CONTROL POINTS	MODEL POINTS	PROJECT. CENTRES	SIGMA NAUGHT
RMS (x)	0.354	0.251	0.256	0.428
RMS (y)	0.351	0.272	0.487	
RMS (z)	0.195	0.216	0.263	0.358

CLASSIFICATION OF BLUNDERS

1ST ITERATION:	-
2ND ITERATION:	-
3RD ITERATION:	-
4TH ITERATION:	-

TAB. 7

BLOCK	PLOTTER		DATE
RICCIONE	SANTONI IV - GALILEO		JANUARY 1977
TOPOGRAPHY	SCALE		ITERATIONS
HILLY	1/6000		9
MODELS	(HO) CONTROL	POINTS (VE)	MODEL POINTS
84	69	74	898

STATISTICS OF ADJUSTMENT - FINAL ACCURACY IN M

BLOCK		OBSERVATIONS	UNKNOWNS	REDUNDANCY
HORIZONTAL		1504	928	576
VERTICAL		1220	780	440
	CONTROL POINTS	MODEL POINTS	PROJECT. CENTRES	SIGMA NAUGHT
RMS (x)	0.395	0.310	0.592	0.441
RMS (y)	0.383	0.261	0.408	
RMS (z)	0.266	0.217	0.339	0.392

CLASSIFICATION OF BLUNDERS

1ST ITERATION:	INPUT ERRORS
2ND ITERATION:	FALSE REFERENCE SYSTEM (LEFT INSTEAD OF RIGHT SYSTEM)
3RD ITERATION:	WRONG CONNECTION AMONG PHOTOGRAMMETRIC POINTS
4TH ITERATION:	-

TAB. 8

"STATISTICAL ANALYSIS OF THE GROSS ERRORS" TAB. 9 - BLOCK: BENTIVOGLIO

i	dir	N	$n_{3,4}$	$n_{4,5}$	$n_{5,6}$	$n_{6,7}$	$n_{7,8}$	$n_{8,\infty}$	$n_{3,\infty}$	β	z	σ_o
	x		9	9	2	2	-	-	22	9.57	8.98	0.35
10	y	1545	4	1	2	1	-	-	8	5.84	1.99	
	z		23	9	-	-	-	-	32	7.42	13.98	0.41
	x		11	7	1	1	-	-	20	7.47	7.96	0.35
9	y	1552	7	2	2	1	-	-	12	6.37	3.97	
	z		14	1	6	-	-	2	23	20.86	9.45	0.50
	x		13	5	-	4	-	-	22	9.96	8.92	0.40
8	y	1560	5	5	2	-	-	2	14	18.62	4.94	
	z		14	8	-	2	2	2	28	25.42	11.91	1.19
	x		2	1	3	1	-	3	10	25.30	2.94	0.95
7	y	1569	6	2	4	-	-	3	15	25.38	5.41	
	z		5	4	1	5	2	1	18	21.03	6.90	2.97
	x		10	6	2	5	3	1	27	24.60	11.36	11.25
6	y	1570	4	3	4	-	-	1	12	12.70	3.92	
	z		6	3	5	2	1	2	19	24.12	7.39	4.61
	x		10	3	2	1	2	3	21	29.96	8.38	14.10
5	y	1572	4	6	4	-	1	2	17	21.84	6.40	
	z		6	3	5	2	1	2	19	24.09	7.39	4.73
	x		3	2	1	1	2	4	13	34.79	4.41	64.16
4	y	1574	10	3	1	4	-	2	20	22.38	7.87	
	z		17	12	4	-	-	1	34	16.22	14.80	10.37

"STATISTICAL ANALYSIS OF THE GROSS ERRORS" TAB. 10 - BLOCK: BOLOGNA EST

i	dir	N	$n_{3,4}$	$n_{4,5}$	$n_{5,6}$	$n_{6,7}$	$n_{7,8}$	$n_{8,\infty}$	$n_{3,\infty}$	β	z	σ_o
	x		14	-	-	-	-	-	14	3.81	3.56	0.47
8	y	2153	7	4	-	-	-	-	11	4.09	2.29	
	z		6	2	-	-	-	-	8	3.65	1.02	0.45
	x		15	-	-	-	-	-	15	3.88	3.97	0.48
7	y	2157	9	5	1	-	-	-	15	4.84	3.97	
	z		6	2	-	-	-	-	8	3.64	1.01	0.45
	x		3	5	2	1	-	6	17	33.35	4.79	2.59
6	y	2166	7	9	3	3	2	-	24	11.68	7.75	
	z		7	3	-	1	1	3	15	20.03	3.95	1.03
	x		5	1	6	2	1	8	23	45.90	7.32	5.99
5	y	2168	2	5	3	3	2	3	18	24.41	5.21	
	z		15	2	2	3	3	7	32	44.21	11.12	1.66

"STATISTICAL ANALYSIS OF THE GROSS ERRORS" TAB. 11 - BLOCK: LOTTO 5

i	dir	N	$n_{3,4}$	$n_{4,5}$	$n_{5,6}$	$n_{6,7}$	$n_{7,8}$	$n_{8,\infty}$	$n_{3,\infty}$	β	z	σ_0
9	x	1688	16	5	1	-	-	-	22	6.00	8.42	0.45
	y		11	4	1	-	-	-	16	5.32	5.55	
	z		14	1	-	-	-	-	15	4.32	5.07	0.44
8	x	1692	14	6	-	-	-	-	20	5.52	7.45	0.41
	y		11	2	-	-	-	-	13	4.29	4.11	
	z		15	1	-	-	-	-	16	4.40	5.54	0.43
7	x	1704	12	2	2	2	1	-	19	9.39	6.93	0.60
	y		13	7	-	1	-	2	23	18.43	8.83	
	z		12	2	2	-	1	1	18	13.16	6.46	0.56
6	x	1707	8	7	-	1	-	2	18	17.97	6.45	1.01
	y		4	1	1	1	-	2	9	16.73	2.17	
	z		13	3	4	3	-	2	25	21.68	9.77	0.81
5	x	1708	1	-	3	1	-	5	10	34.85	2.64	2.26
	y		4	2	-	2	1	6	15	42.73	5.02	
	z		7	4	-	1	-	4	16	28.87	5.49	1.91
4	x	1708	9	3	-	2	1	3	18	25.84	6.44	33.85
	y		4	5	1	1	1	3	15	25.38	5.02	
	z		15	10	4	10	-	1	40	24.96	16.90	9.42
3	x	1712	3	1	1	2	1	6	14	42.85	4.53	238.22
	y		5	3	1	1	2	4	16	32.62	5.48	
	z		7	4	4	4	1	5	25	41.75	9.75	100.52

"STATISTICAL ANALYSIS OF THE GROSS ERRORS" TAB. 12 - BLOCK: PARMA EST

i	dir	N	$n_{3,4}$	$n_{4,5}$	$n_{5,6}$	$n_{6,7}$	$n_{7,8}$	$n_{8,\infty}$	$n_{3,\infty}$	β	z	σ_0
7	x	2464	6	4	2	1	-	-	13	5.34	2.60	0.33
	y		11	1	1	2	-	-	15	5.50	3.40	
	z		6	2	-	-	-	-	8	3.55	0.63	0.39
6	x	2467	6	6	2	-	-	2	16	13.05	3.79	0.43
	y		4	3	2	2	-	2	13	13.88	2.60	
	z		8	4	2	-	-	-	14	4.73	3.00	0.42
5	x	2470	5	5	1	2	2	2	17	16.45	4.18	0.96
	y		-	-	3	2	1	7	13	35.02	2.60	
	z		1	4	-	2	1	3	11	18.44	1.81	0.96
4	x	2472	2	1	8	1	5	3	20	25.34	5.36	11.75
	y		2	-	-	-	-	4	6	19.15	-0.17	
	z		5	4	6	3	1	2	21	17.56	5.76	4.63

"STATISTICAL ANALYSIS OF THE GROSS ERRORS" TAB. 13 - BLOCK: MODENA

i	dir	N	$n_{3,4}$	$n_{4,5}$	$n_{5,6}$	$n_{6,7}$	$n_{7,8}$	$n_{8,\infty}$	$n_{3,\infty}$	β	z	σ_o
	x		23	12	3	3	3	1	45	14.95	13.45	0.24
4	y	2964	20	7	4	2	1	-	34	8.31	9.48	
	z		19	7	4	-	-	2	32	12.74	8.76	0.30
	x		22	12	4	2	3	1	44	14.59	13.08	0.23
3	y	2968	25	8	7	2	1	1	19	12.98	13.08	
	z		8	9	-	3	-	4	24	19.76	5.87	0.25

"STATISTICAL ANALYSIS OF THE GROSS ERRORS" TAB. 14 - BLOCK: PIACENZA

i	dir	N	$n_{3,4}$	$n_{4,5}$	$n_{5,6}$	$n_{6,7}$	$n_{7,8}$	$n_{8,\infty}$	$n_{3,\infty}$	β	z	σ_o
	x		1	3	1	-	-	-	5	4.54	0.79	0.43
8	y	1354	10	2	3	-	-	-	15	6.54	6.09	
	z		4	1	2	-	-	-	7	4.94	1.86	0.36
	x		-	2	2	3	-	2	9	23.49	2.92	0.69
7	y	1356	5	5	2	-	-	2	14	20.99	5.59	
	z		4	1	2	-	-	-	7	4.94	1.85	0.37
	x		1	2	-	1	1	2	7	21.94	1.85	4.84
6	y	1357	7	6	2	3	5	-	23	22.35	10.38	
	z		11	7	4	3	1	-	26	15.10	11.98	0.81
	x		11	1	1	-	1	6	20	51.70	8.80	1.33
5	y	1353	3	2	-	1	1	4	11	36.99	3.99	
	z		9	4	3	-	1	3	20	31.57	8.80	1.01
	x		4	3	2	3	5	2	19	35.91	8.26	1.89
4	y	1355	2	-	2	-	2	6	12	53.35	4.52	
	z		7	6	3	2	-	3	21	32.20	9.32	0.95
	x		2	1	-	1	1	4	9	36.48	2.92	3.06
3	y	1357	5	5	2	1	3	1	17	21.91	7.18	
	z		9	2	5	2	1	1	20	20.12	8.78	0.95
	x		6	-	6	3	1	2	18	28.53	7.71	7.42
2	y	1358	4	3	2	1	-	4	14	36.29	5.58	
	z		12	3	3	2	2	3	25	36.44	11.44	2.94
	x		4	3	1	2	1	2	13	24.47	5.03	28.32
1	y	1362	5	7	4	1	1	1	19	19.14	8.23	
	z		18	6	6	2	1	-	33	15.55	15.68	5.77

"STATISTICAL ANALYSIS OF THE GROSS ERRORS" TAB. 15 - BLOCK: MONTECRETO

i	dir	N	$n_{3,4}$	$n_{4,5}$	$n_{5,6}$	$n_{6,7}$	$n_{7,8}$	$n_{8,\infty}$	$n_{3,\infty}$	β	z	σ_o
	x		8	-	-	-	-	-	8	3.96	3.14	0.40
5	y	1067	7	-	2	-	-	-	9	5.53	3.74	
	z		5	-	-	-	-	-	5	3.55	1.34	0.49
	x		7	-	1	1	-	-	9	6.35	3.74	0.42
4	y	1067	6	-	-	2	-	-	8	7.02	3.14	
	z		5	-	-	-	-	-	5	3.55	1.34	0.49
	x		8	1	-	1	1	3	14	36.83	6.71	0.47
3	y	1075	11	5	1	1	-	-	18	8.76	9.11	
	z		-	5	-	-	-	2	7	23.35	2.52	0.66
	x		5	1	-	1	-	4	11	42.67	4.90	2.52
2	y	1078	6	5	3	-	1	1	16	20.31	7.89	
	z		2	2	1	1	2	2	10	30.80	4.31	2.48
	x		7	2	3	2	-	3	17	38.14	8.47	97.36
1	y	1081	7	3	1	-	1	3	15	36.45	7.28	
	z		9	3	1	-	3	2	18	33.33	9.07	31.35

"STATISTICAL ANALYSIS OF THE GROSS ERRORS" TAB. 16 - BLOCK: RICCIONE

i	dir	N	$n_{3,4}$	$n_{4,5}$	$n_{5,6}$	$n_{6,7}$	$n_{7,8}$	$n_{8,\infty}$	$n_{3,\infty}$	β	z	σ_o
	x		2	1	-	-	-	-	3	3.64	0.44	0.44
9	y	898	6	3	-	-	-	-	9	5.20	4.37	
	z		2	-	1	-	-	-	3	4.20	0.44	0.39
	x		2	1	-	-	-	-	3	3.64	0.44	0.44
8	y	898	6	3	-	-	-	-	9	5.20	4.37	
	z		5	1	-	-	-	-	6	4.13	2.40	0.41
	x		2	1	-	-	-	-	3	3.64	0.44	0.44
7	y	898	6	3	-	-	-	-	9	5.20	4.37	
	z		5	1	-	-	-	-	6	4.13	2.40	0.41
	x		7	2	-	-	-	-	9	4.89	4.32	0.53
6	y	909	7	2	-	1	1	-	11	10.32	5.63	
	z		7	-	1	1	1	-	10	10.43	4.97	0.51
	x		1	5	-	-	-	2	8	27.20	3.66	1.32
5	y	911	6	2	3	1	-	-	12	9.68	6.27	
	z		2	1	1	1	-	1	6	17.56	2.36	0.68
	x		6	3	-	1	-	2	12	29.04	6.26	4.04
4	y	912	20	6	3	1	-	-	30	13.72	17.97	
	z		16	3	3	-	1	-	23	13.25	13.41	1.63

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