W O R L D W I D E

wwPDB

P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report (i)

Feb 1, 2016 – 07:43 AM GMT

PDB ID	:	3BUA
Title	:	Crystal Structure of TRF2 TRFH domain and APOLLO peptide complex
Authors	:	Chen, Y.; Yang, Y.; van Overbeek, M.; Donigian, J.R.; Baciu, P.; de Lange, T.; Lei, M.
Deposited on	:	2008-01-02
Resolution	:	2.50 Å(reported)

The following versions of software and data (see references (i)) were used in the production of this report:

|		
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.

Metric	Percentile Ranks	Value
Rfree		0.252
Clashscore		26
Ramachandran outliers		3.3%
Sidechain outliers		13.7%
RSRZ outliers		9.3%

Worse   *Better*

■ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution
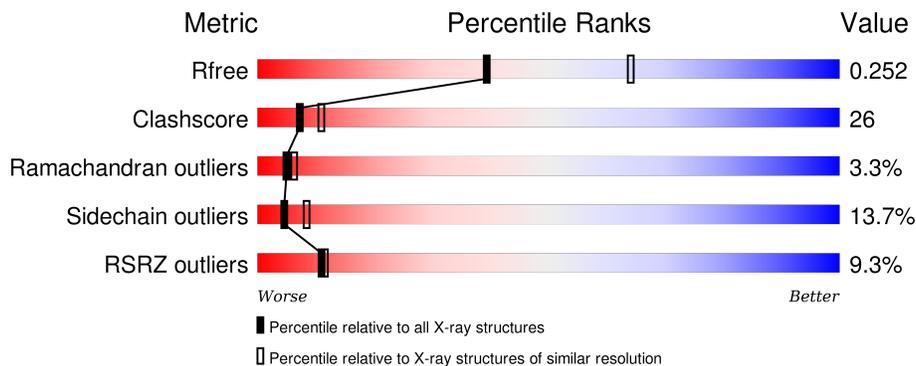
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R$_{free}$	91344	3553 (2.50-2.50)
Clashscore	102246	4242 (2.50-2.50)
Ramachandran outliers	100387	4156 (2.50-2.50)
Sidechain outliers	100360	4158 (2.50-2.50)
RSRZ outliers	91569	3562 (2.50-2.50)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	204	9% 53% 38% 6% ••
1	B	204	5% 60% 29% 8% ••
1	C	204	11% 60% 30% 8% ••
1	D	204	7% 50% 39% 9% •
2	E	36	11% 14% 19% 6% 61%

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Mol	Chain	Length	Quality of chain
2	F	36	6% 17% 8% 8% 67%
2	G	36	19% 17% 19% 8% 56%
2	H	36	6% 19% 11% · 67%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 7148 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Telomeric repeat-binding factor 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	202	Total	C	N	O	S	0	0	0
			1653	1050	291	302	10			
1	B	202	Total	C	N	O	S	0	0	0
			1653	1050	291	302	10			
1	C	202	Total	C	N	O	S	0	0	0
			1653	1050	291	302	10			
1	D	202	Total	C	N	O	S	0	0	0
			1653	1050	291	302	10			

- Molecule 2 is a protein called DNA cross-link repair 1B protein.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	E	14	Total	C	N	O	0	0	0
			113	77	19	17			
2	F	12	Total	C	N	O	0	0	0
			94	64	16	14			
2	G	16	Total	C	N	O	0	0	0
			128	85	21	22			
2	H	12	Total	C	N	O	0	0	0
			91	62	14	15			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	495	SER	THR	SEE REMARK 999	UNP Q9H816
F	495	SER	THR	SEE REMARK 999	UNP Q9H816
G	495	SER	THR	SEE REMARK 999	UNP Q9H816
H	495	SER	THR	SEE REMARK 999	UNP Q9H816

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	24	Total 24	O 24	0	0
3	B	39	Total 39	O 39	0	0
3	C	24	Total 24	O 24	0	0
3	D	20	Total 20	O 20	0	0
3	E	1	Total 1	O 1	0	0
3	G	2	Total 2	O 2	0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Telomeric repeat-binding factor 2
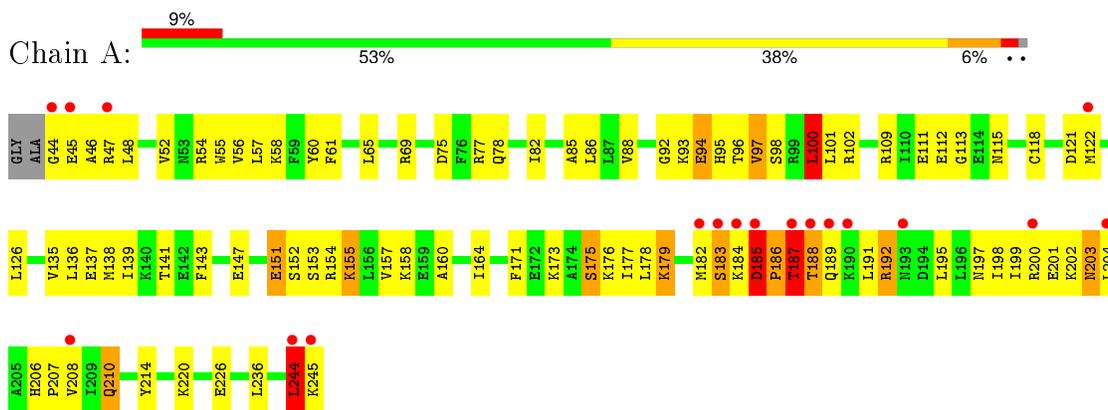
- Molecule 1: Telomeric repeat-binding factor 2

- Molecule 1: Telomeric repeat-binding factor 2

K241 K242 A243 L244 K245

- Molecule 1: Telomeric repeat-binding factor 2

Chain D:

- Molecule 2: DNA cross-link repair 1B protein

Chain E:

- Molecule 2: DNA cross-link repair 1B protein

Chain F:

- Molecule 2: DNA cross-link repair 1B protein

Chain G:

- Molecule 2: DNA cross-link repair 1B protein

Chain H:
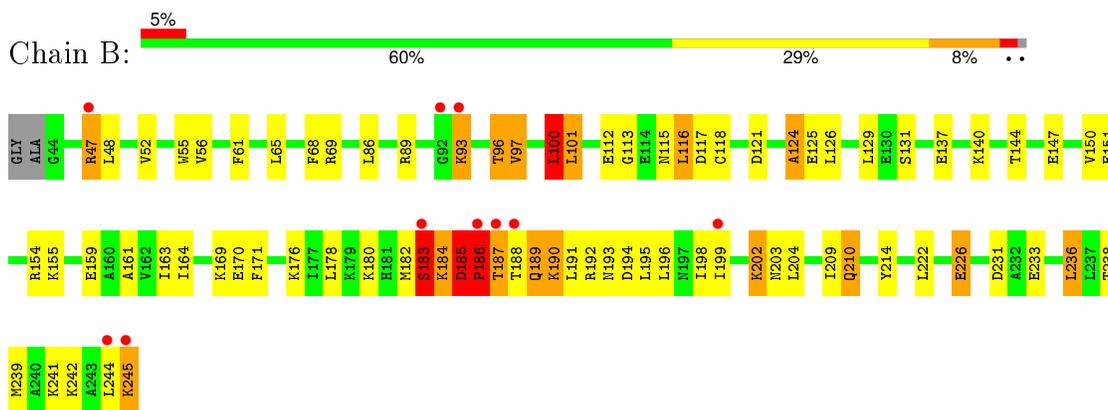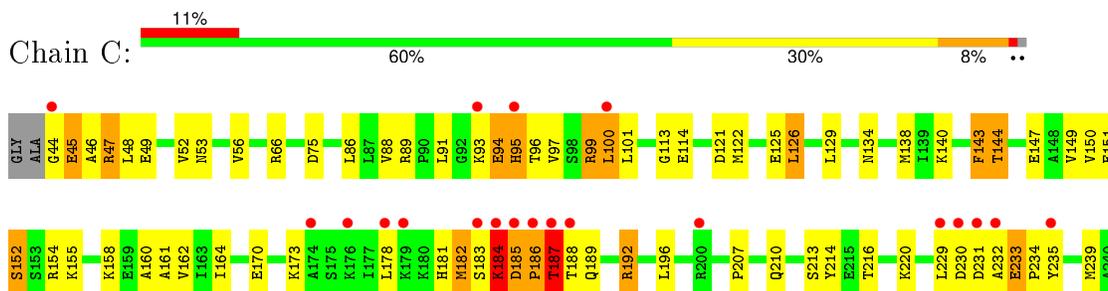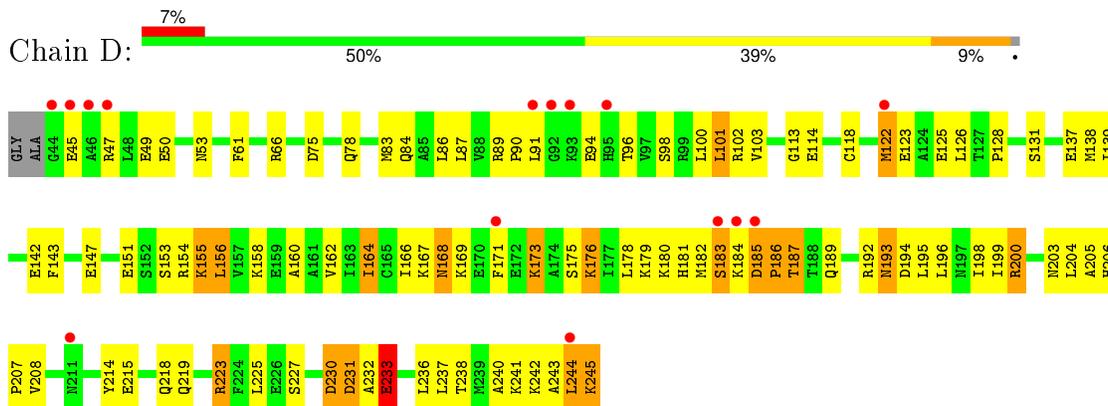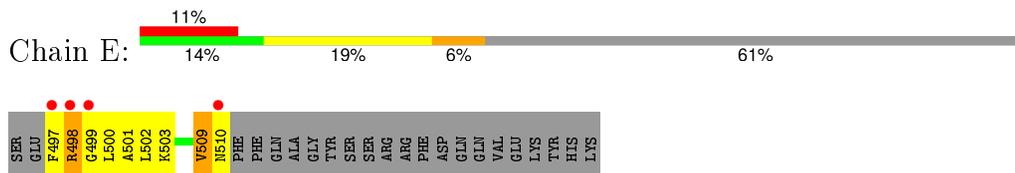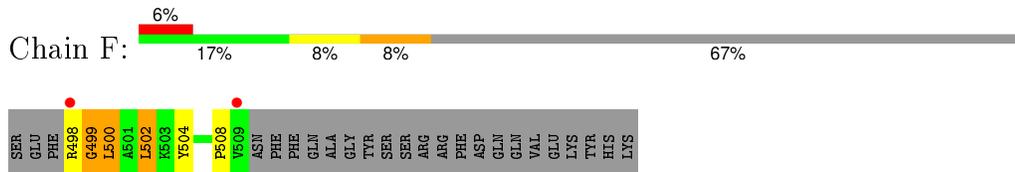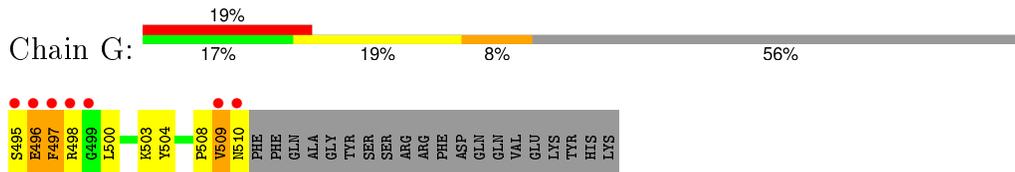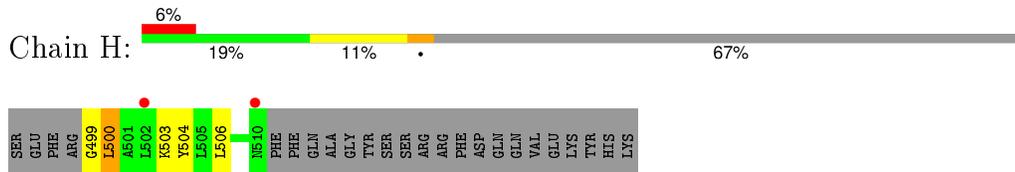
4   Data and refinement statistics (i)

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α, β, γ	109.95Å 109.95Å 130.83Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	50.00 – 2.50 42.09 – 2.50	Depositor EDS
% Data completeness (in resolution range)	95.3 (50.00-2.50) 95.8 (42.09-2.50)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.39 (at 2.51Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.229 , 0.254 0.228 , 0.252	Depositor DCC
R_{free} test set	3069 reflections (10.01%)	DCC
Wilson B-factor (Å^2)	46.0	Xtriage
Anisotropy	0.059	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.38 , 46.6	EDS
Estimated twinning fraction	0.026 for -h,-k,l	Xtriage
L-test for twinning[2]	$< |L| > = 0.50, < L^2 > = 0.33$	Xtriage
Outliers	0 of 31885 reflections	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	7148	wwPDB-VP
Average B, all atoms (Å^2)	49.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.22% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

5 Model quality (i)

5.1 Standard geometry (i)

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$|Z|$>5	RMSZ	#$|Z|$>5
1	A	0.37	0/1678	0.75	3/2249 (0.1%)
1	B	0.36	0/1678	0.73	4/2249 (0.2%)
1	C	0.33	0/1678	0.70	2/2249 (0.1%)
1	D	0.37	0/1678	0.74	2/2249 (0.1%)
2	E	0.51	0/115	0.87	0/155
2	F	0.36	0/95	0.79	1/128 (0.8%)
2	G	0.49	0/130	1.44	3/175 (1.7%)
2	H	0.39	0/92	0.83	0/125
All	All	0.36	0/7144	0.75	15/9579 (0.2%)

There are no bond length outliers.

The worst 5 of 15 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	244	LEU	CA-CB-CG	13.30	145.90	115.30
2	G	509	VAL	CB-CA-C	8.99	128.48	111.40
1	A	185	ASP	N-CA-C	7.58	131.48	111.00
1	B	185	ASP	N-CA-C	7.11	130.20	111.00
1	A	100	LEU	CA-CB-CG	6.46	130.17	115.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1653	0	1705	87	0
1	B	1653	0	1705	77	0
1	C	1653	0	1705	89	0
1	D	1653	0	1705	105	0
2	E	113	0	124	8	0
2	F	94	0	109	6	0
2	G	128	0	135	14	0
2	H	91	0	102	8	0
3	A	24	0	0	2	0
3	B	39	0	0	0	0
3	C	24	0	0	2	0
3	D	20	0	0	1	0
3	E	1	0	0	0	0
3	G	2	0	0	0	0
All	All	7148	0	7290	373	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 26.

The worst 5 of 373 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:185:ASP:HB3	1:D:186:PRO:CD	1.74	1.17
2:G:508:PRO:HB2	2:G:510:ASN:ND2	1.64	1.11
1:D:185:ASP:HB3	1:D:186:PRO:HD3	1.17	1.10
1:A:185:ASP:O	1:A:189:GLN:HG3	1.52	1.10
1:C:93:LYS:HE3	1:C:95:HIS:ND1	1.69	1.05

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	200/204 (98%)	187 (94%)	6 (3%)	7 (4%)	4	6
1	B	200/204 (98%)	183 (92%)	12 (6%)	5 (2%)	7	10
1	C	200/204 (98%)	178 (89%)	12 (6%)	10 (5%)	3	3
1	D	200/204 (98%)	185 (92%)	10 (5%)	5 (2%)	7	10
2	E	12/36 (33%)	11 (92%)	1 (8%)	0	100	100
2	F	10/36 (28%)	8 (80%)	2 (20%)	0	100	100
2	G	14/36 (39%)	11 (79%)	2 (14%)	1 (7%)	1	1
2	H	10/36 (28%)	9 (90%)	1 (10%)	0	100	100
All	All	846/960 (88%)	772 (91%)	46 (5%)	28 (3%)	5	6

5 of 28 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	185	ASP
1	A	186	PRO
1	B	183	SER
1	B	186	PRO
1	B	189	GLN

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	182/182 (100%)	158 (87%)	24 (13%)	5	9
1	B	182/182 (100%)	155 (85%)	27 (15%)	4	7
1	C	182/182 (100%)	162 (89%)	20 (11%)	8	14
1	D	182/182 (100%)	154 (85%)	28 (15%)	3	6
2	E	12/32 (38%)	9 (75%)	3 (25%)	1	1
2	F	10/32 (31%)	8 (80%)	2 (20%)	1	3
2	G	14/32 (44%)	13 (93%)	1 (7%)	18	34
2	H	10/32 (31%)	9 (90%)	1 (10%)	9	18

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	774/856 (90%)	668 (86%)	106 (14%)	4 8

5 of 106 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	231	ASP
1	C	143	PHE
1	D	244	LEU
1	B	244	LEU
1	C	95	HIS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	210	GLN
1	B	211	ASN
1	D	193	ASN
1	A	218	GLN
1	D	84	GLN

5.3.3   RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	202/204 (99%)	0.40	18 (8%)	12	13	29, 44, 72, 94	0
1	B	202/204 (99%)	0.32	10 (4%)	32	37	28, 43, 66, 86	0
1	C	202/204 (99%)	0.59	22 (10%)	7	7	29, 47, 78, 91	0
1	D	202/204 (99%)	0.46	15 (7%)	17	19	33, 56, 77, 88	0
2	E	14/36 (38%)	1.50	4 (28%)	1	0	35, 42, 78, 84	0
2	F	12/36 (33%)	0.71	2 (16%)	2	2	33, 42, 69, 83	0
2	G	16/36 (44%)	2.11	7 (43%)	0	0	33, 49, 82, 85	0
2	H	12/36 (33%)	0.73	2 (16%)	2	2	38, 45, 59, 69	0
All	All	862/960 (89%)	0.50	80 (9%)	11	11	28, 48, 77, 94	0

The worst 5 of 80 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	G	510	ASN	8.2
1	A	183	SER	6.5
2	E	497	PHE	6.5
2	G	495	SER	5.8
1	C	184	LYS	5.7

6.2 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates (i)

There are no carbohydrates in this entry.

6.4 Ligands (i)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.