wwPDB X-ray Structure Validation Summary Report (i)

Apr 28, 2024 – 09:18 pm BST

PDB ID	:	2WA9
Title	:	Structural basis of N-end rule substrate recognition in Escherichia coli by the ClpAP adaptor protein ClpS - Trp peptide structure
Authors	:	Schuenemann, V.J.; Kralik, S.M.; Albrecht, R.; Spall, S.K.; Truscott, K.N.; Dougan, D.A.; Zeth, K.
Deposited on	:	2009-02-03
Resolution	:	2.90 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (1)) were used in the production of this report:

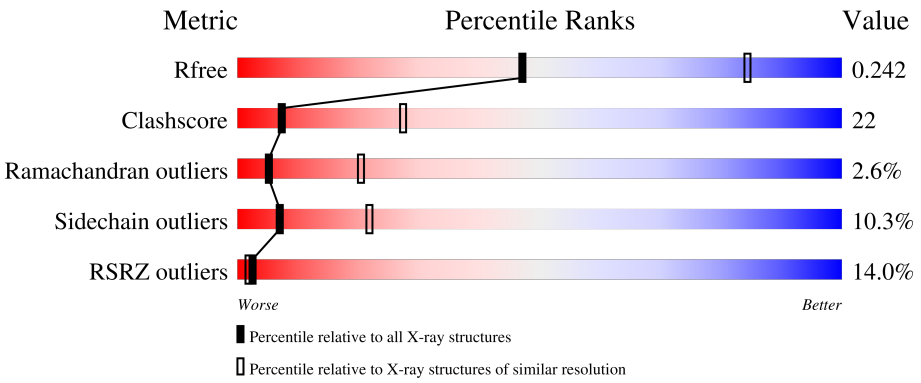
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.90 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	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1957 (2.90-2.90)
Clashscore	141614	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (2.90-2.90)
RSRZ outliers	127900	1906 (2.90-2.90)

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 of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. 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	108	6%; 48%, 23%, 5%, •, 23%
1	B	108	4%; 52%, 23%, •, •, 20%
1	C	108	3%; 52%, 23%, •, •, 20%
1	D	108	5%; 55%, 21%, •, 20%
1	E	108	35%; 52%, 21%, 6%, 20%

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Mol	Chain	Length	Quality of chain
1	F	108	4% 52% 21% 6% 20%
1	G	108	21% 53% 19% 5% 23%
2	H	3	100%
2	I	3	100%
2	J	3	67% 100%
2	K	3	33% 67%
2	L	3	33% 67%
2	M	3	33% 100%
2	N	3	33% 33% 33%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 4880 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 ATP-DEPENDENT CLP PROTEASE ADAPTER PROTEIN CLPS.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	83	658	424	105	123	6	0	0	0
1	B	86	681	440	109	126	6	0	0	0
1	C	86	681	440	109	126	6	0	0	0
1	D	86	681	440	109	126	6	0	0	0
1	E	86	681	440	109	126	6	0	0	0
1	F	86	681	440	109	126	6	0	0	0
1	G	83	663	429	105	123	6	0	0	0

- Molecule 2 is a protein called TRP PEPTIDE.

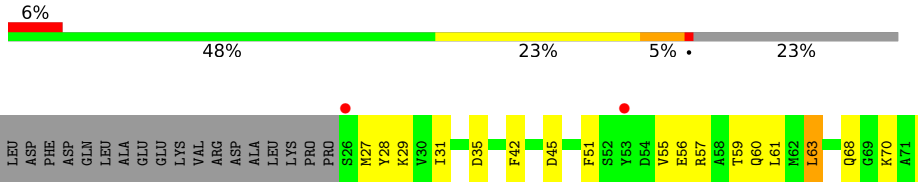
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	H	3	23	16	3	4	0	0	0
2	I	3	23	16	3	4	0	0	0
2	J	3	23	16	3	4	0	0	0
2	K	3	23	16	3	4	0	0	0
2	L	3	23	16	3	4	0	0	0
2	M	3	23	16	3	4	0	0	0
2	N	2	16	12	2	2	0	0	0

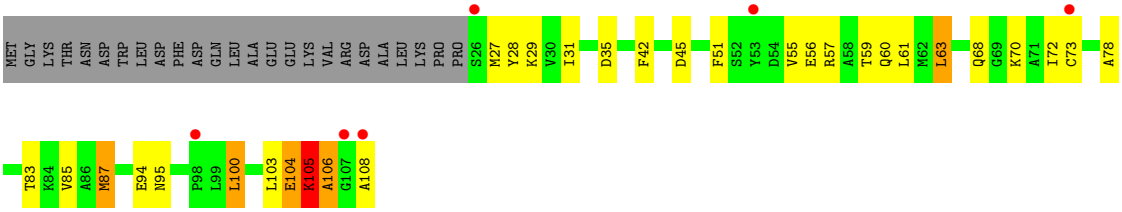
3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes 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: ATP-DEPENDENT CLP PROTEASE ADAPTER PROTEIN CLPS

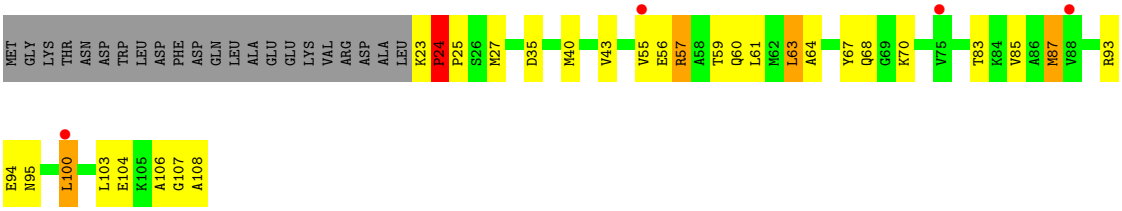
Chain A:





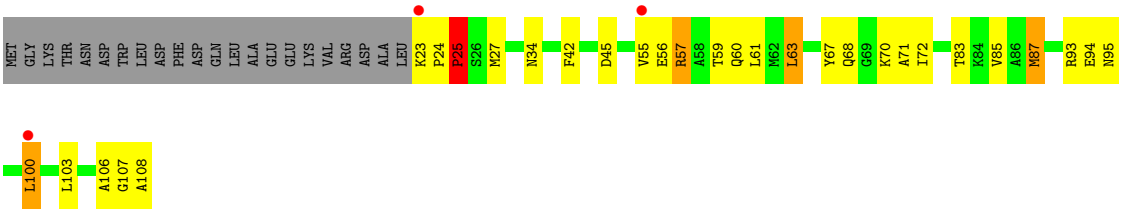
• Molecule 1: ATP-DEPENDENT CLP PROTEASE ADAPTER PROTEIN CLPS

Chain B:



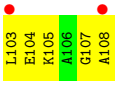
• Molecule 1: ATP-DEPENDENT CLP PROTEASE ADAPTER PROTEIN CLPS

Chain C:



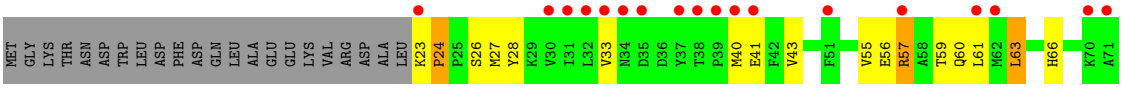
• Molecule 1: ATP-DEPENDENT CLP PROTEASE ADAPTER PROTEIN CLPS

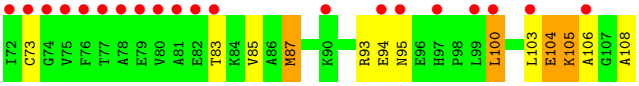
Chain D:



• Molecule 1: ATP-DEPENDENT CLP PROTEASE ADAPTER PROTEIN CLPS

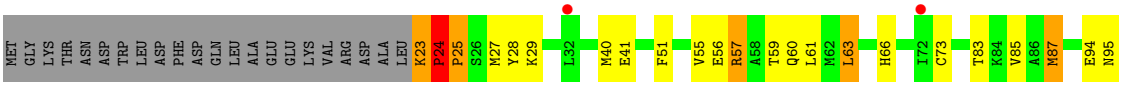
Chain E:

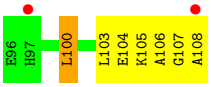




• Molecule 1: ATP-DEPENDENT CLP PROTEASE ADAPTER PROTEIN CLPS

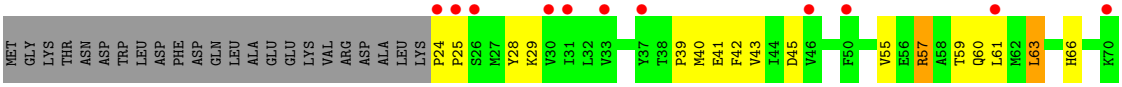
Chain F:

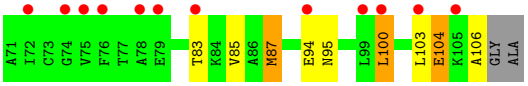




• Molecule 1: ATP-DEPENDENT CLP PROTEASE ADAPTER PROTEIN CLPS

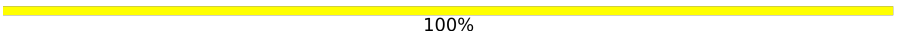
Chain G:





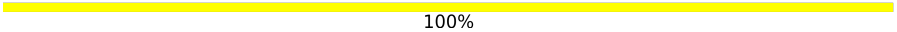
• Molecule 2: TRP PEPTIDE

Chain H:



• Molecule 2: TRP PEPTIDE

Chain I:



• Molecule 2: TRP PEPTIDE

Chain J:

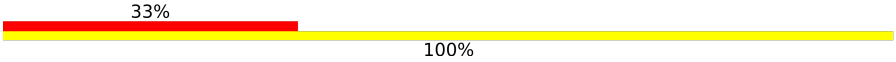
• Molecule 2: TRP PEPTIDE

Chain K:

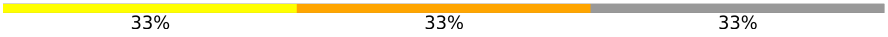
• Molecule 2: TRP PEPTIDE

Chain L:

• Molecule 2: TRP PEPTIDE

Chain M: 

• Molecule 2: TRP PEPTIDE

Chain N: 

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	171.91Å 155.87Å 71.23Å 90.00° 114.64° 90.00°	Depositor
Resolution (Å)	25.00 – 2.90 24.97 – 2.90	Depositor EDS
% Data completeness (in resolution range)	99.9 (25.00-2.90) 98.9 (24.97-2.90)	Depositor EDS
R_{merge}	0.02	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.59 (at 2.89Å)	Xtriage
Refinement program	REFMAC 5.5.0063	Depositor
R, R_{free}	0.236 , 0.248 0.235 , 0.242	Depositor DCC
R_{free} test set	1881 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	62.6	Xtriage
Anisotropy	0.229	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.31 , 14.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.39$, $< L^2 > = 0.22$	Xtriage
Estimated twinning fraction	0.370 for -k+l,-h-l,-l 0.360 for k+l,h+l,-l 0.449 for -h-2*l,-k,l	Xtriage
Reported twinning fraction	0.294 for H, K, L 0.289 for H+2.000L, -K, -L 0.190 for -K+L, -H-L, -L 0.228 for K+L, H+L, -L	Depositor
Outliers	0 of 37634 reflections	Xtriage
F_o,F_c correlation	0.89	EDS
Total number of atoms	4880	wwPDB-VP
Average B, all atoms (Å^2)	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.42% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 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	0.74	0/670	0.81	0/906
1	B	0.69	0/695	0.74	0/941
1	C	0.76	0/695	0.80	1/941 (0.1%)
1	D	0.73	0/695	0.78	0/941
1	E	0.64	1/695 (0.1%)	0.73	0/941
1	F	0.70	0/695	0.77	0/941
1	G	0.59	0/677	0.69	0/917
2	H	0.72	0/22	1.32	1/29 (3.4%)
2	I	1.11	0/22	1.44	0/29
2	J	0.90	0/22	0.91	0/29
2	K	0.90	0/22	1.27	0/29
2	L	0.98	0/22	1.56	0/29
2	M	0.75	0/22	1.55	0/29
2	N	0.76	0/15	0.63	0/19
All	All	0.70	1/4969 (0.0%)	0.78	2/6721 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	C	0	1
1	F	0	1
1	G	0	1
All	All	0	3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	E	73	CYS	CB-SG	-5.98	1.72	1.81

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	93	ARG	NE-CZ-NH2	-5.46	117.57	120.30
2	H	2	LEU	CA-CB-CG	5.19	127.25	115.30

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	25	PRO	Peptide
1	F	24	PRO	Peptide
1	G	24	PRO	Peptide

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	658	0	657	40	0
1	B	681	0	684	70	0
1	C	681	0	684	51	0
1	D	681	0	684	36	0
1	E	681	0	684	31	1
1	F	681	0	684	27	2
1	G	663	0	664	23	0
2	H	23	0	31	1	0
2	I	23	0	31	11	1
2	J	23	0	31	2	0
2	K	23	0	31	4	0
2	L	23	0	31	14	0
2	M	23	0	31	7	0
2	N	16	0	24	9	0
All	All	4880	0	4951	220	2

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 22.

The worst 5 of 220 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:B:40:MET:SD	2:I:3:THR:HA	1.73	1.27
1:B:68:GLN:HG2	1:C:24:PRO:CB	1.68	1.24
1:F:23:LYS:HB3	1:F:24:PRO:HD3	1.26	1.12
1:B:68:GLN:HG2	1:C:24:PRO:HB3	1.31	1.11
1:B:70:LYS:HG3	1:C:108:ALA:HB1	1.33	1.08

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:57:ARG:NH2	1:F:27:MET:CE[4_545]	1.75	0.45
1:F:23:LYS:N	2:I:1:LEU:O[4_555]	2.09	0.11

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	81/108 (75%)	72 (89%)	5 (6%)	4 (5%)	2 8
1	B	84/108 (78%)	78 (93%)	4 (5%)	2 (2%)	6 22
1	C	84/108 (78%)	75 (89%)	7 (8%)	2 (2%)	6 22
1	D	84/108 (78%)	77 (92%)	7 (8%)	0	100 100
1	E	84/108 (78%)	75 (89%)	5 (6%)	4 (5%)	2 8
1	F	84/108 (78%)	76 (90%)	5 (6%)	3 (4%)	3 14
1	G	81/108 (75%)	77 (95%)	4 (5%)	0	100 100
2	H	1/3 (33%)	0	1 (100%)	0	100 100
2	I	1/3 (33%)	1 (100%)	0	0	100 100
2	J	1/3 (33%)	1 (100%)	0	0	100 100
2	K	1/3 (33%)	1 (100%)	0	0	100 100
2	L	1/3 (33%)	0	1 (100%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	M	1/3 (33%)	1 (100%)	0	0	100	100
All	All	588/774 (76%)	534 (91%)	39 (7%)	15 (3%)	5	20

5 of 15 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	105	LYS
1	A	106	ALA
1	B	24	PRO
1	E	24	PRO
1	E	104	GLU

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	71/93 (76%)	65 (92%)	6 (8%)	10	31
1	B	74/93 (80%)	66 (89%)	8 (11%)	6	20
1	C	74/93 (80%)	68 (92%)	6 (8%)	11	33
1	D	74/93 (80%)	68 (92%)	6 (8%)	11	33
1	E	74/93 (80%)	67 (90%)	7 (10%)	8	26
1	F	74/93 (80%)	66 (89%)	8 (11%)	6	20
1	G	73/93 (78%)	65 (89%)	8 (11%)	6	19
2	H	3/3 (100%)	2 (67%)	1 (33%)	0	0
2	I	3/3 (100%)	3 (100%)	0	100	100
2	J	3/3 (100%)	3 (100%)	0	100	100
2	K	3/3 (100%)	2 (67%)	1 (33%)	0	0
2	L	3/3 (100%)	1 (33%)	2 (67%)	0	0
2	M	3/3 (100%)	2 (67%)	1 (33%)	0	0
2	N	2/3 (67%)	1 (50%)	1 (50%)	0	0
All	All	534/672 (80%)	479 (90%)	55 (10%)	7	22

5 of 55 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	57	ARG
1	F	55	VAL
2	N	2	LEU
2	H	3	THR
1	E	61	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 16 such sidechains are listed below:

Mol	Chain	Res	Type
1	G	66	HIS
1	F	95	ASN
1	D	68	GLN
1	F	66	HIS
1	D	66	HIS

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

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	83/108 (76%)	0.73	6 (7%)	15	11	42, 46, 67, 81	1 (1%)
1	B	86/108 (79%)	0.76	4 (4%)	31	28	42, 47, 74, 80	1 (1%)
1	C	86/108 (79%)	0.66	3 (3%)	44	38	42, 47, 71, 76	1 (1%)
1	D	86/108 (79%)	0.64	5 (5%)	23	19	42, 47, 67, 84	1 (1%)
1	E	86/108 (79%)	2.00	38 (44%)	0	0	41, 46, 72, 75	1 (1%)
1	F	86/108 (79%)	0.95	4 (4%)	31	28	41, 46, 73, 77	1 (1%)
1	G	83/108 (76%)	1.65	23 (27%)	0	0	41, 46, 67, 79	0
2	H	3/3 (100%)	0.72	0	100	100	63, 63, 66, 69	0
2	I	3/3 (100%)	1.09	0	100	100	60, 60, 62, 66	0
2	J	3/3 (100%)	1.48	2 (66%)	0	0	60, 60, 61, 65	0
2	K	3/3 (100%)	0.37	0	100	100	53, 53, 53, 55	0
2	L	3/3 (100%)	1.03	0	100	100	57, 57, 59, 60	0
2	M	3/3 (100%)	1.90	1 (33%)	0	0	59, 59, 61, 61	0
2	N	2/3 (66%)	1.00	0	100	100	55, 55, 55, 56	0
All	All	616/777 (79%)	1.06	86 (13%)	2	2	41, 47, 73, 84	6 (0%)

The worst 5 of 86 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	72	ILE	6.9
1	G	76	PHE	6.8
1	E	100	LEU	6.5
1	E	32	LEU	6.0
1	G	79	GLU	5.4

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 monosaccharides 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.