Full wwPDB X-ray Structure Validation Report ⓘ

May 21, 2020 – 01:40 pm BST

PDB ID	:	2GT1
Title	:	E. coli heptosyltransferase WaaC.
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Deposited on	:	2006-04-27
Resolution	:	1.90 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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 ⓘ symbol.

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

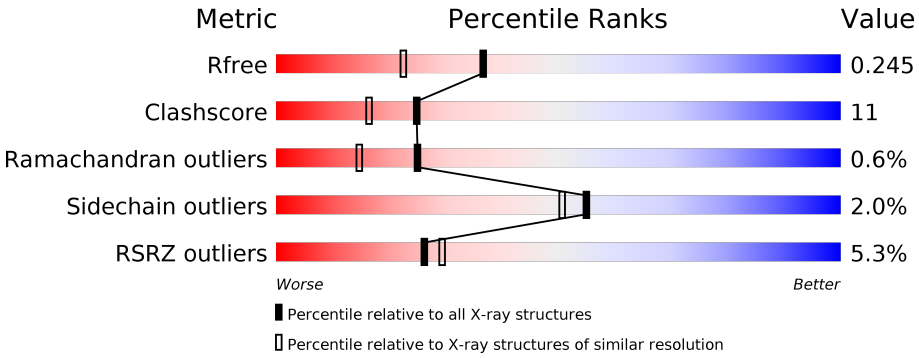
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 1.90 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	6207 (1.90-1.90)
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)
RSRZ outliers	127900	6082 (1.90-1.90)

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 on 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	326	3% 80% 18%
1	B	326	7% 71% 20% 7%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 5322 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 Lipopolysaccharide heptosyltransferase-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	323	Total	C	N	O	S	0	0	0
			2538	1619	459	454	6			
1	B	303	Total	C	N	O	S	0	0	0
			2392	1522	436	427	7			

- Molecule 2 is water.

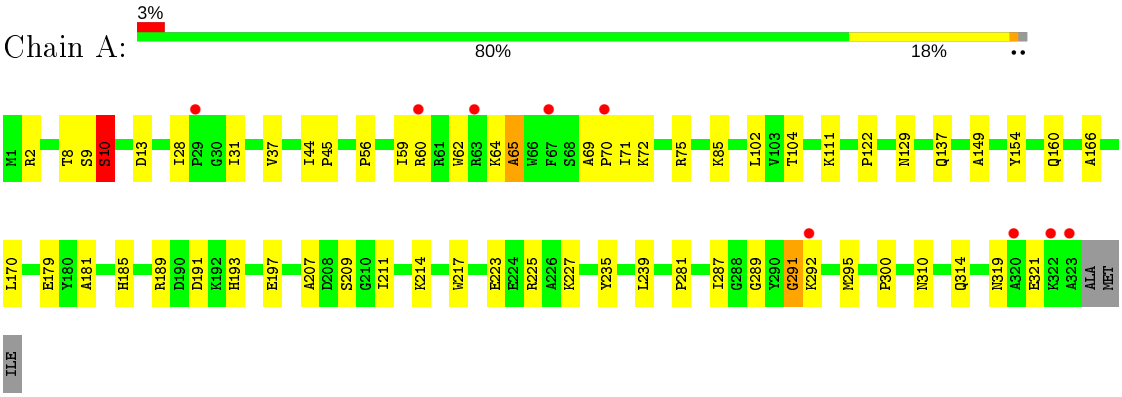
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	237	Total	O	0	0
			237	237		
2	B	155	Total	O	0	0
			155	155		

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA 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.

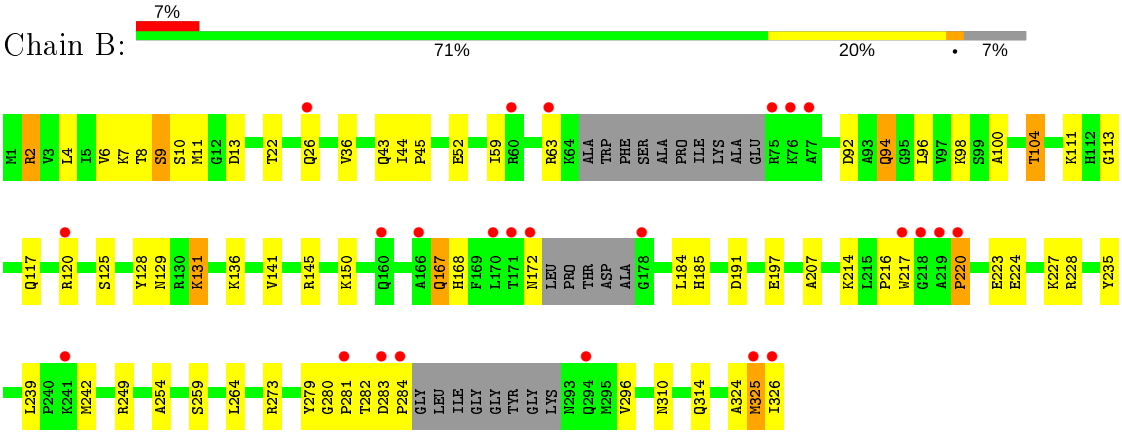
- Molecule 1: Lipopolysaccharide heptosyltransferase-1

Chain A:



- Molecule 1: Lipopolysaccharide heptosyltransferase-1

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	78.65Å 88.79Å 89.81Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 1.90 19.72 – 1.91	Depositor EDS
% Data completeness (in resolution range)	(Not available) (20.00-1.90) 99.4 (19.72-1.91)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.08	Depositor
$< I/\sigma(I) >$ [1]	2.60 (at 1.90Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.214 , 0.245 0.213 , 0.245	Depositor DCC
R_{free} test set	2507 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å^2)	26.4	Xtriage
Anisotropy	0.163	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 47.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.000 for -h,l,k	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	5322	wwPDB-VP
Average B, all atoms (Å^2)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 28.83 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.7198e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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

5.1 Standard geometry

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	0.39	0/2601	0.66	1/3530 (0.0%)
1	B	0.36	0/2446	0.65	1/3313 (0.0%)
All	All	0.37	0/5047	0.65	2/6843 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	10	SER	N-CA-C	-6.09	94.55	111.00
1	B	9	SER	N-CA-C	5.42	125.62	111.00

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	2538	0	2543	49	0
1	B	2392	0	2399	59	0
2	A	237	0	0	4	0
2	B	155	0	0	5	0
All	All	5322	0	4942	107	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 11.

All (107) 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:111:LYS:H	1:B:129:ASN:HD22	1.16	0.92
1:A:111:LYS:H	1:A:129:ASN:HD22	1.17	0.87
1:A:300:PRO:HB3	1:B:43:GLN:HG2	1.63	0.80
1:A:223:GLU:HG2	1:A:227:LYS:HE3	1.66	0.78
1:B:223:GLU:HG2	1:B:227:LYS:HE3	1.66	0.77
1:B:100:ALA:HA	1:B:104:THR:HG23	1.67	0.76
1:B:128:TYR:O	1:B:131:LYS:HE2	1.87	0.75
1:A:310:ASN:O	1:A:314:GLN:HG3	1.87	0.74
1:A:65:ALA:O	1:A:71:ILE:HD12	1.85	0.74
1:B:92:ASP:OD2	1:B:104:THR:HG21	1.86	0.74
1:A:291:GLY:O	1:A:292:LYS:HB3	1.89	0.71
1:B:96:LEU:HD21	1:B:120:ARG:HD2	1.72	0.70
1:B:59:ILE:O	1:B:63:ARG:HG2	1.94	0.68
1:A:185:HIS:HD2	1:A:225:ARG:HE	1.43	0.66
1:B:22:THR:O	1:B:26:GLN:HG2	1.95	0.66
1:B:214:LYS:HD3	1:B:239:LEU:HD21	1.79	0.64
1:A:60:ARG:HH12	1:A:64:LYS:NZ	1.96	0.62
1:A:9:SER:OG	1:A:10:SER:N	2.33	0.62
1:B:9:SER:O	1:B:10:SER:HB3	2.00	0.62
1:B:7:LYS:HE3	1:B:13:ASP:HB3	1.82	0.61
1:A:185:HIS:CD2	1:A:225:ARG:HE	2.19	0.61
1:B:223:GLU:O	1:B:227:LYS:HG3	2.01	0.60
1:A:9:SER:O	1:A:10:SER:HB3	2.00	0.60
1:A:209:SER:OG	1:A:211:ILE:HG22	2.02	0.60
1:A:223:GLU:CG	1:A:227:LYS:HE3	2.34	0.58
1:A:217:TRP:CE3	1:A:223:GLU:HB2	2.39	0.58
1:A:64:LYS:O	1:A:65:ALA:CB	2.50	0.58
1:A:2:ARG:HG2	1:A:85:LYS:HD3	1.86	0.58
1:B:111:LYS:H	1:B:129:ASN:ND2	1.95	0.57
1:A:69:ALA:HB3	1:A:70:PRO:HD3	1.88	0.56
1:A:59:ILE:HD12	1:A:102:LEU:CD2	2.36	0.56
1:B:197:GLU:HG2	2:B:436:HOH:O	2.05	0.55
1:A:2:ARG:NH1	1:A:85:LYS:HE3	2.21	0.55
1:A:104:THR:O	1:A:111:LYS:HD3	2.07	0.55
1:A:60:ARG:NH1	1:A:64:LYS:NZ	2.55	0.54
1:B:224:GLU:O	1:B:228:ARG:HG3	2.07	0.54
1:B:254:ALA:O	1:B:273:ARG:HD3	2.10	0.52
1:A:59:ILE:HD12	1:A:102:LEU:HD23	1.90	0.52
1:B:8:THR:H	1:B:94:GLN:HE22	1.56	0.52
1:B:6:VAL:HG11	1:B:104:THR:HG22	1.91	0.52
1:B:191:ASP:HB2	1:B:281:PRO:HG2	1.91	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:264:LEU:HD13	2:B:350:HOH:O	2.11	0.51
1:B:296:VAL:O	1:B:296:VAL:HG23	2.10	0.51
1:B:2:ARG:NH1	1:B:52:GLU:OE2	2.44	0.51
1:A:189:ARG:HG2	1:A:191:ASP:OD1	2.10	0.51
1:B:207:ALA:HA	1:B:235:TYR:CZ	2.47	0.50
1:A:60:ARG:HH12	1:A:64:LYS:HZ1	1.57	0.50
1:A:289:GLY:HA3	2:A:374:HOH:O	2.10	0.50
1:B:310:ASN:O	1:B:314:GLN:HG3	2.11	0.50
1:B:44:ILE:HB	1:B:45:PRO:HD3	1.94	0.50
1:A:62:TRP:HA	1:A:71:ILE:HD13	1.94	0.49
1:A:207:ALA:HA	1:A:235:TYR:CZ	2.48	0.49
1:B:223:GLU:CG	1:B:227:LYS:HE3	2.40	0.49
1:A:64:LYS:O	1:A:65:ALA:HB3	2.12	0.48
1:B:324:ALA:O	1:B:326:ILE:N	2.47	0.48
1:A:10:SER:HB3	1:A:13:ASP:OD2	2.14	0.48
1:B:8:THR:H	1:B:94:GLN:NE2	2.11	0.48
1:A:217:TRP:CD2	1:A:223:GLU:HB2	2.49	0.47
1:A:44:ILE:HB	1:A:45:PRO:HD3	1.95	0.47
1:B:239:LEU:HD13	1:B:242:MET:HE1	1.96	0.47
1:A:2:ARG:HG2	1:A:85:LYS:CD	2.45	0.47
1:B:184:LEU:HB2	1:B:259:SER:CB	2.45	0.46
1:B:98:LYS:HE2	2:B:415:HOH:O	2.14	0.46
1:B:131:LYS:HD2	2:B:451:HOH:O	2.15	0.46
1:B:141:VAL:O	1:B:145:ARG:HG3	2.15	0.46
1:A:149:ALA:HB1	1:A:154:TYR:O	2.16	0.46
1:A:179:GLU:HG2	2:A:551:HOH:O	2.16	0.44
1:B:239:LEU:HB3	1:B:242:MET:HE1	1.98	0.44
1:A:28:ILE:O	1:A:31:ILE:HG22	2.18	0.44
1:A:292:LYS:HB2	1:A:292:LYS:HE3	1.71	0.44
1:B:324:ALA:C	1:B:326:ILE:H	2.20	0.44
1:A:72:LYS:HD2	1:A:75:ARG:NH1	2.33	0.44
1:B:216:PRO:HB3	1:B:239:LEU:HD12	2.01	0.43
1:B:172:ASN:ND2	1:B:249:ARG:HE	2.17	0.43
1:B:279:TYR:HD2	1:B:282:THR:OG1	2.01	0.43
1:B:220:PRO:O	1:B:223:GLU:HB3	2.17	0.43
1:A:166:ALA:O	1:A:170:LEU:HG	2.17	0.43
1:B:167:GLN:OE1	1:B:168:HIS:N	2.52	0.43
1:B:11:MET:HG3	1:B:44:ILE:HD11	2.01	0.43
1:A:191:ASP:CG	1:A:281:PRO:HG2	2.39	0.42
1:A:214:LYS:HD3	1:A:239:LEU:HD21	2.00	0.42
1:A:295:MET:SD	1:A:319:ASN:HB3	2.59	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:117:GLN:O	1:B:136:LYS:HE3	2.19	0.42
1:B:184:LEU:HB2	1:B:259:SER:HB3	2.02	0.42
1:B:9:SER:O	1:B:10:SER:CB	2.66	0.42
1:B:283:ASP:HA	1:B:284:PRO:HD3	1.86	0.42
1:A:8:THR:HA	1:A:37:VAL:HA	2.00	0.42
1:B:6:VAL:HB	1:B:92:ASP:HA	2.01	0.42
1:B:10:SER:HB3	1:B:13:ASP:OD2	2.19	0.42
1:B:279:TYR:CZ	1:B:284:PRO:HG3	2.55	0.42
1:A:160:GLN:NE2	1:A:292:LYS:HB2	2.35	0.41
1:B:104:THR:O	1:B:111:LYS:HE3	2.19	0.41
1:B:113:GLY:HA3	1:B:128:TYR:CE2	2.54	0.41
1:B:9:SER:O	1:B:13:ASP:HB2	2.20	0.41
1:A:137:GLN:HG2	2:A:398:HOH:O	2.20	0.41
1:B:191:ASP:OD2	1:B:281:PRO:HG2	2.21	0.41
1:A:287:ILE:C	1:A:287:ILE:HD12	2.41	0.41
1:B:280:GLY:HA3	1:B:281:PRO:HD3	1.85	0.41
1:A:193:HIS:HE1	2:A:471:HOH:O	2.03	0.41
1:B:217:TRP:CE3	1:B:223:GLU:HB2	2.55	0.41
1:A:37:VAL:O	1:A:56:PRO:HA	2.21	0.40
1:A:71:ILE:HG22	1:A:75:ARG:HD3	2.01	0.40
1:B:125:SER:HA	1:B:128:TYR:CD2	2.56	0.40
1:B:150:LYS:HA	2:B:389:HOH:O	2.21	0.40
1:A:181:ALA:HB2	1:A:211:ILE:HD11	2.02	0.40
1:B:185:HIS:CD2	1:B:185:HIS:H	2.39	0.40
1:B:4:LEU:HD11	1:B:36:VAL:HG23	2.04	0.40

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	321/326 (98%)	307 (96%)	11 (3%)	3 (1%)	17 7

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	B	295/326 (90%)	281 (95%)	13 (4%)	1 (0%)	41 31
All	All	616/652 (94%)	588 (96%)	24 (4%)	4 (1%)	25 15

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	65	ALA
1	B	325	MET
1	A	10	SER
1	A	291	GLY

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	258/260 (99%)	255 (99%)	3 (1%)	71 70
1	B	245/260 (94%)	238 (97%)	7 (3%)	42 35
All	All	503/520 (97%)	493 (98%)	10 (2%)	55 51

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	122	PRO
1	A	197	GLU
1	A	321	GLU
1	B	2	ARG
1	B	94	GLN
1	B	104	THR
1	B	131	LYS
1	B	167	GLN
1	B	220	PRO
1	B	325	MET

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	43	GLN
1	A	83	GLN
1	A	129	ASN
1	A	160	GLN
1	A	185	HIS
1	A	193	HIS
1	B	16	HIS
1	B	25	GLN
1	B	83	GLN
1	B	94	GLN
1	B	129	ASN
1	B	193	HIS
1	B	275	ASN
1	B	293	ASN
1	B	302	ASN

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

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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, 95^{th} 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	323/326 (99%)	0.16	9 (2%)	53	56	14, 25, 46, 66	0
1	B	303/326 (92%)	0.53	24 (7%)	12	14	17, 31, 54, 71	0
All	All	626/652 (96%)	0.34	33 (5%)	26	29	14, 28, 52, 71	0

All (33) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	326	ILE	6.1
1	B	171	THR	5.5
1	B	172	ASN	5.5
1	B	284	PRO	4.8
1	B	325	MET	4.4
1	B	170	LEU	4.2
1	B	220	PRO	4.1
1	A	292	LYS	4.0
1	B	77	ALA	3.7
1	A	60	ARG	3.7
1	B	294	GLN	3.7
1	A	322	LYS	3.6
1	A	323	ALA	3.5
1	B	218	GLY	3.3
1	A	63	ARG	3.2
1	B	160	GLN	3.1
1	B	283	ASP	3.1
1	B	166	ALA	2.9
1	B	76	LYS	2.7
1	B	75	ARG	2.7
1	B	281	PRO	2.6
1	B	178	GLY	2.6
1	A	67	PHE	2.5
1	B	60	ARG	2.5

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Mol	Chain	Res	Type	RSRZ
1	B	219	ALA	2.5
1	A	70	PRO	2.4
1	A	29	PRO	2.3
1	B	63	ARG	2.2
1	B	120	ARG	2.1
1	B	241	LYS	2.1
1	B	217	TRP	2.1
1	A	320	ALA	2.1
1	B	26	GLN	2.0

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.