



# Full wwPDB X-ray Structure Validation Report ⓘ

May 22, 2020 – 02:18 am BST

PDB ID : 4K9S  
Title : Peptidoglycan O-acetylerase in action, setmet  
Authors : Williams, A.H.; Gompert Boneca, I.  
Deposited on : 2013-04-21  
Resolution : 2.33 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](mailto: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.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
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

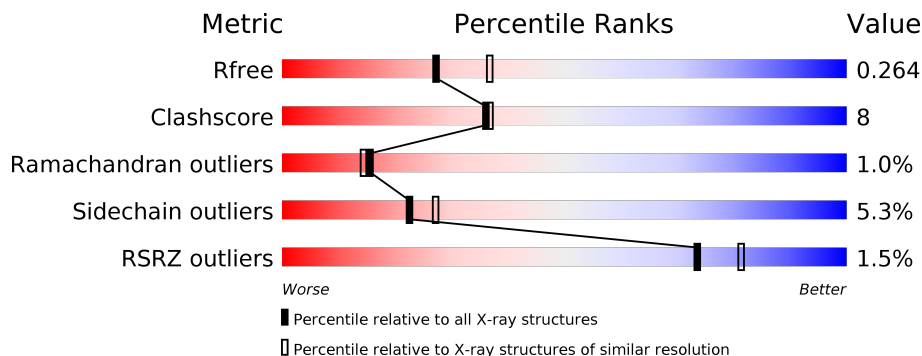
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.33 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	2096 (2.36-2.32)
Clashscore	141614	2193 (2.36-2.32)
Ramachandran outliers	138981	2159 (2.36-2.32)
Sidechain outliers	138945	2160 (2.36-2.32)
RSRZ outliers	127900	2067 (2.36-2.32)

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  $\geq 3$ , 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  $\leq 5\%$ . 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	379	 % 75% 15% • 8%
1	B	379	 % 77% 13% •• 8%

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5721 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 GDSL-like Lipase/Acylhydrolase family protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	349	2670	1664	487	506	2	11	0	2	0
1	B	349	2655	1655	484	503	2	11	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	19	GLY	-	EXPRESSION TAG	UNP L5SU74
A	20	SER	-	EXPRESSION TAG	UNP L5SU74
B	19	GLY	-	EXPRESSION TAG	UNP L5SU74
B	20	SER	-	EXPRESSION TAG	UNP L5SU74

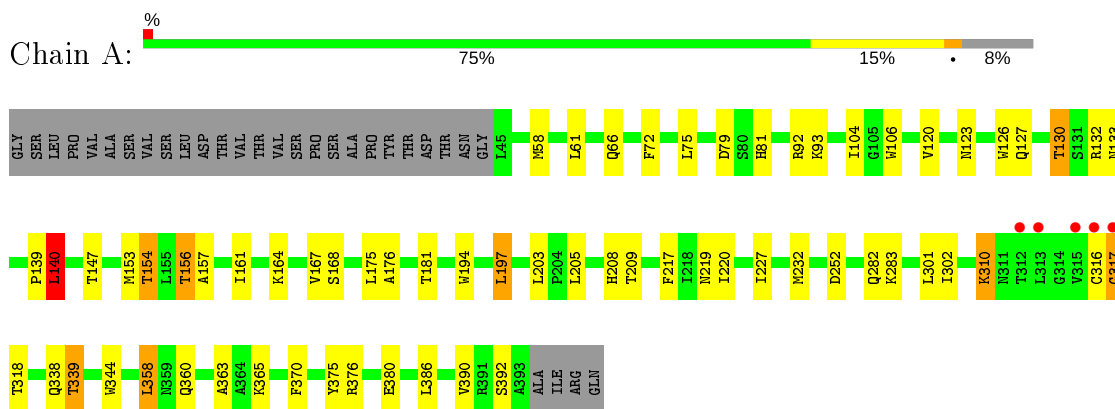
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	203	Total	O	0	0
			203	203		
2	B	193	Total	O	0	0
			193	193		

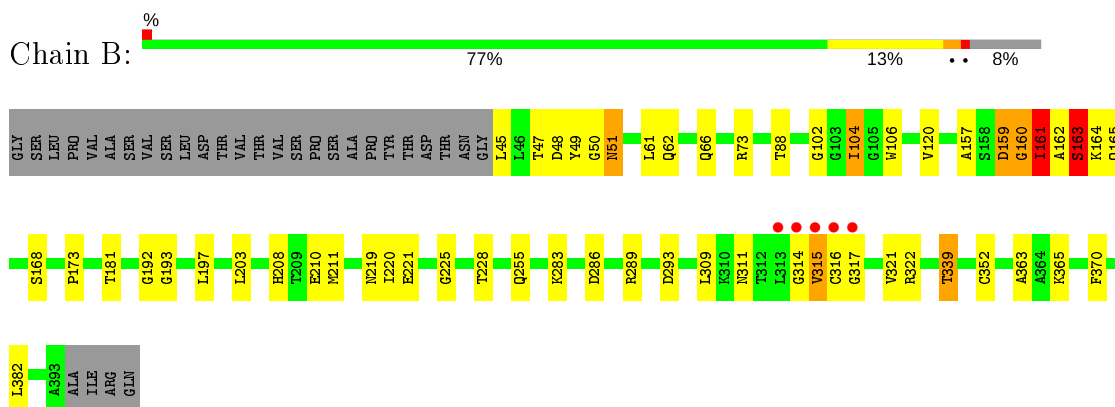
### 3 Residue-property plots [i](#)

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: GDSL-like Lipase/Acylhydrolase family protein



- Molecule 1: GDSL-like Lipase/Acylhydrolase family protein



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	72.19Å 79.07Å 123.91Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.41 – 2.33 40.41 – 2.33	Depositor EDS
% Data completeness (in resolution range)	98.1 (40.41-2.33) 98.1 (40.41-2.33)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.05 (at 2.34Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.8_1069)	Depositor
R, $R_{free}$	0.173 , 0.264 0.173 , 0.264	Depositor DCC
$R_{free}$ test set	1516 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	24.7	Xtrriage
Anisotropy	0.081	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 35.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	5721	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	16.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.23% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup> Intensities estimated from amplitudes.

<sup>2</sup> Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  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	0.38	0/2712	0.59	2/3658 (0.1%)
1	B	0.39	0/2697	0.63	1/3639 (0.0%)
All	All	0.38	0/5409	0.61	3/7297 (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	B	0	1

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	B	317	GLY	N-CA-C	-5.76	98.69	113.10
1	A	140	LEU	CA-CB-CG	5.71	128.44	115.30
1	A	317	GLY	N-CA-C	-5.04	100.49	113.10

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	315	VAL	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	2670	0	2624	46	0
1	B	2655	0	2608	38	0
2	A	203	0	0	10	0
2	B	193	0	0	7	1
All	All	5721	0	5232	84	1

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 8.

All (84) 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:A:130:THR:HG23	1:A:132:ARG:H	1.45	0.81
1:B:48:ASP:HB2	1:B:50:GLY:H	1.48	0.79
1:A:157:ALA:HB2	1:A:203:LEU:HD23	1.65	0.78
1:B:255:GLN:NE2	2:B:440:HOH:O	2.17	0.76
1:B:161:ILE:HG12	1:B:203:LEU:HB2	1.72	0.71
1:B:157:ALA:HB3	1:B:161:ILE:HG13	1.72	0.71
1:B:193:GLY:N	2:B:520:HOH:O	2.23	0.71
1:A:130:THR:HG21	2:A:438:HOH:O	1.93	0.69
1:A:104:ILE:HD11	1:A:220:ILE:HD12	1.74	0.68
1:B:45:LEU:N	2:B:445:HOH:O	2.27	0.68
1:A:164[B]:LYS:H	1:A:164[B]:LYS:HE2	1.62	0.65
1:B:314:GLY:N	2:B:548:HOH:O	2.27	0.65
1:B:51:ASN:OD1	2:B:528:HOH:O	2.14	0.64
1:B:104:ILE:HD11	1:B:220:ILE:HD12	1.83	0.60
1:A:338:GLN:NE2	2:A:466:HOH:O	2.33	0.60
1:A:147:THR:HB	1:A:209:THR:HG21	1.82	0.60
1:A:282:GLN:OE1	2:A:553:HOH:O	2.16	0.59
1:B:321:VAL:HG12	1:B:322:ARG:HD2	1.86	0.57
1:B:192:GLY:N	2:B:520:HOH:O	2.39	0.56
1:B:173:PRO:HD2	1:B:193:GLY:HA3	1.88	0.55
1:A:147:THR:CB	1:A:209:THR:HG21	2.35	0.55
1:B:45:LEU:HB3	2:B:482:HOH:O	2.06	0.55
1:B:286:ASP:OD1	1:B:289:ARG:NH2	2.40	0.54
1:A:130:THR:CG2	1:A:132:ARG:H	2.18	0.54
1:A:123:ASN:N	1:A:153:MSE:HE1	2.23	0.53
1:A:203:LEU:HD11	1:A:220:ILE:HD13	1.90	0.53
1:B:50:GLY:CA	1:B:51:ASN:HB2	2.39	0.53
1:A:132:ARG:NH1	1:A:133:ASN:OD1	2.44	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:130:THR:HG22	2:A:504:HOH:O	2.11	0.50
1:B:49:TYR:HB2	1:B:339:THR:O	2.10	0.50
1:B:48:ASP:HA	1:B:49:TYR:HB2	1.93	0.50
1:A:140:LEU:HD13	1:A:232:MSE:SE	2.63	0.49
1:B:162:ALA:HB3	1:B:165:GLN:NE2	2.28	0.48
1:B:210:GLU:HG3	1:B:211:MSE:HG2	1.96	0.48
1:B:62:GLN:O	1:B:66:GLN:HG2	2.14	0.48
1:A:363:ALA:HA	1:A:370:PHE:HA	1.96	0.47
1:B:309:LEU:HB3	1:B:311:ASN:O	2.15	0.47
1:B:106:TRP:CD2	1:B:219:ASN:HB2	2.49	0.47
1:A:72:PHE:HB3	1:A:227:ILE:HD13	1.96	0.47
1:A:154:THR:HA	1:A:205:LEU:O	2.14	0.46
1:B:104:ILE:HG12	1:B:220:ILE:HB	1.97	0.46
1:A:147:THR:OG1	1:A:209:THR:HG21	2.16	0.46
1:B:73:ARG:HA	1:B:228:THR:HG22	1.98	0.46
1:B:316:CYS:HB3	1:B:352:CYS:HG	1.81	0.45
1:A:123:ASN:H	1:A:153:MSE:HE1	1.82	0.45
1:A:181:THR:OG1	1:A:208:HIS:HB2	2.17	0.45
1:A:92:ARG:HD2	2:A:579:HOH:O	2.16	0.44
1:B:163:SER:HB2	1:B:164:LYS:H	1.58	0.44
1:B:363:ALA:HA	1:B:370:PHE:HA	1.98	0.44
1:A:156:THR:HG23	2:A:511:HOH:O	2.17	0.44
1:B:314:GLY:O	1:B:316:CYS:N	2.50	0.43
1:A:283:LYS:NZ	2:A:416:HOH:O	2.24	0.43
1:B:161:ILE:HG12	1:B:203:LEU:CB	2.45	0.43
1:A:153:MSE:HE3	1:A:154:THR:N	2.34	0.43
1:A:140:LEU:HB2	1:A:252:ASP:HB2	2.00	0.43
1:B:160:GLY:O	1:B:161:ILE:HB	2.19	0.43
1:A:58:MSE:SE	1:A:390:VAL:HG22	2.69	0.43
1:B:73:ARG:NE	1:B:221:GLU:OE2	2.29	0.43
1:A:127:GLN:HB2	2:A:546:HOH:O	2.18	0.43
1:A:79:ASP:OD2	2:A:584:HOH:O	2.22	0.43
1:A:167:VAL:HA	1:A:219:ASN:O	2.19	0.42
1:A:126:TRP:CE2	1:A:153:MSE:HB2	2.54	0.42
1:A:93:LYS:HZ3	1:A:93:LYS:HG2	1.72	0.42
1:A:302:ILE:HG13	1:A:339:THR:HG21	2.02	0.42
1:A:126:TRP:CD2	1:A:147:THR:HG22	2.55	0.42
1:A:81:HIS:HB2	2:A:580:HOH:O	2.19	0.42
1:B:316:CYS:CB	1:B:352:CYS:HG	2.33	0.42
1:A:376:ARG:O	1:A:380:GLU:HG3	2.21	0.41
1:A:139:PRO:HD3	1:A:194:TRP:CZ2	2.55	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:370:PHE:HB2	1:A:375:TYR:CZ	2.56	0.41
1:B:181:THR:OG1	1:B:208:HIS:HB2	2.20	0.41
1:A:168:SER:HA	1:A:197:LEU:O	2.21	0.41
1:B:365:LYS:HD3	1:B:365:LYS:O	2.20	0.41
1:A:75:LEU:HD11	1:A:232:MSE:SE	2.70	0.41
1:B:159:ASP:OD1	1:B:160:GLY:N	2.53	0.41
1:B:102:GLY:HA2	1:B:225:GLY:O	2.21	0.41
1:A:310:LYS:N	1:A:318:THR:O	2.51	0.41
1:B:168:SER:HA	1:B:197:LEU:O	2.21	0.41
1:A:358:LEU:HD21	1:A:365:LYS:HA	2.01	0.40
1:A:106:TRP:CE3	1:A:219:ASN:HB2	2.56	0.40
1:A:344:TRP:HD1	1:A:344:TRP:O	2.04	0.40
1:B:106:TRP:CE3	1:B:219:ASN:HB2	2.56	0.40
1:A:217:PHE:CZ	1:A:232:MSE:HG2	2.57	0.40
1:A:317:GLY:HA2	1:A:318:THR:HA	1.85	0.40

All (1) 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)
2:B:425:HOH:O	2:B:453:HOH:O[4_556]	2.16	0.04

## 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	349/379 (92%)	333 (95%)	14 (4%)	2 (1%)	25 26
1	B	347/379 (92%)	334 (96%)	8 (2%)	5 (1%)	11 8
All	All	696/758 (92%)	667 (96%)	22 (3%)	7 (1%)	15 14

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	161	ILE
1	A	176	ALA
1	B	51	ASN
1	B	160	GLY
1	B	159	ASP
1	B	163	SER
1	A	161	ILE

### 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	276/288 (96%)	259 (94%)	17 (6%)	18	20
1	B	274/288 (95%)	262 (96%)	12 (4%)	28	35
All	All	550/576 (96%)	521 (95%)	29 (5%)	22	27

All (29) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	61	LEU
1	A	66	GLN
1	A	120	VAL
1	A	130	THR
1	A	140	LEU
1	A	154	THR
1	A	156	THR
1	A	175	LEU
1	A	197	LEU
1	A	301	LEU
1	A	310	LYS
1	A	316	CYS
1	A	339	THR
1	A	358	LEU
1	A	360	GLN
1	A	386	LEU
1	A	392	SER

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Mol	Chain	Res	Type
1	B	47	THR
1	B	61	LEU
1	B	88	THR
1	B	104	ILE
1	B	120	VAL
1	B	161	ILE
1	B	163	SER
1	B	283	LYS
1	B	293	ASP
1	B	315	VAL
1	B	339	THR
1	B	382	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	255	GLN

### 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 carbohydrates 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

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	338/379 (89%)	-0.51	5 (1%) 73 81	7, 14, 32, 59	0
1	B	338/379 (89%)	-0.51	5 (1%) 73 81	6, 14, 29, 57	0
All	All	676/758 (89%)	-0.51	10 (1%) 73 81	6, 14, 31, 59	0

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	316	CYS	5.1
1	A	316	CYS	5.0
1	B	315	VAL	4.0
1	B	313	LEU	4.0
1	A	315	VAL	3.5
1	B	314	GLY	3.2
1	A	313	LEU	2.8
1	B	317	GLY	2.8
1	A	312	THR	2.5
1	A	317	GLY	2.1

### 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

There are no such residues in this entry.