



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 26, 2023 – 01:02 AM EDT

PDB ID : 3AW1
Title : Structure of SARS 3CL protease auto-proteolysis resistant mutant in the absence of inhibitor
Authors : Akaji, K.; Konno, H.; Mitsui, H.; Teruya, K.; Hattori, Y.; Ozaki, T.; Kusunoki, M.; Sanjho, A.
Deposited on : 2011-03-09
Resolution : 2.00 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 types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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 : 2.36
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

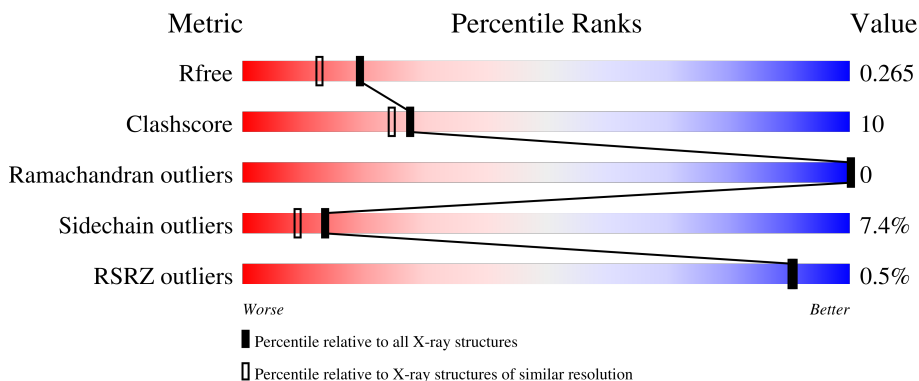
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION



The reported resolution of this entry is 2.00 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	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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 $\leq 5\%$. 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	306	 75% 23% ..
1	B	306	 77% 19% ..

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4792 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 3C-Like Proteinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	301	2329	1474	396	437	22	0	0	0
1	B	300	2323	1471	395	435	22	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	188	ILE	ARG	engineered mutation	UNP P0C6U8
B	188	ILE	ARG	engineered mutation	UNP P0C6U8

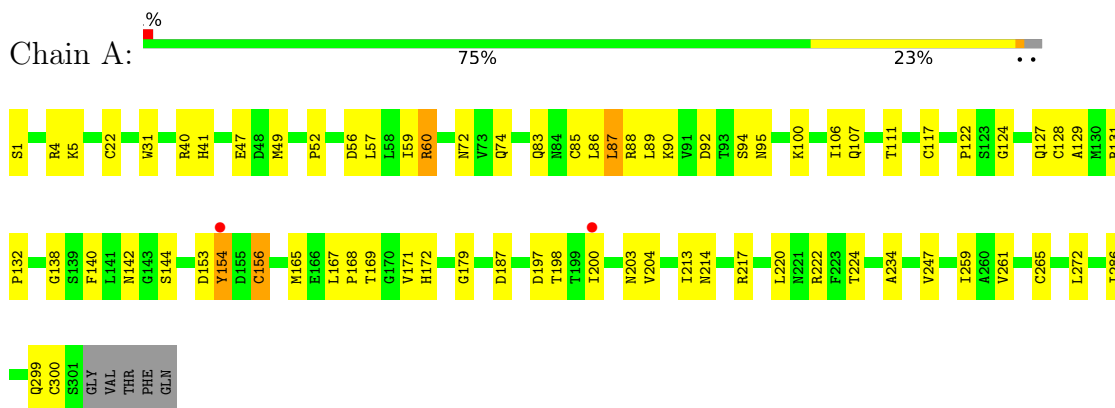
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	56	Total	O	0	0
			56	56		
2	B	84	Total	O	0	0
			84	84		

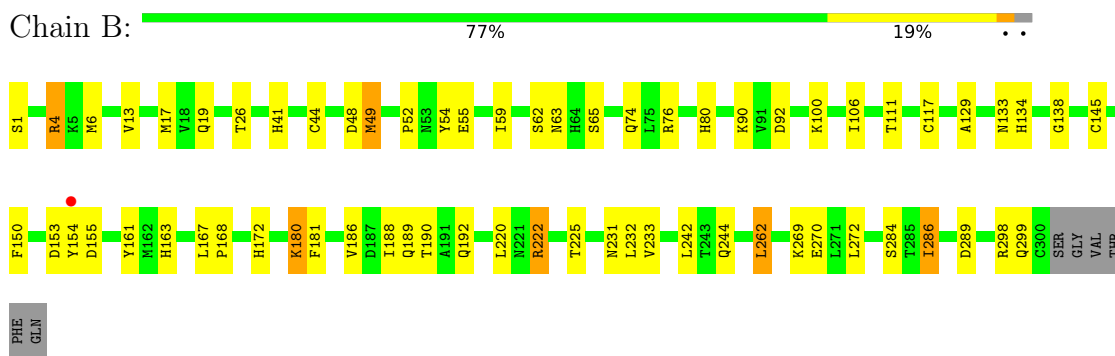
3 Residue-property plots

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: 3C-Like Proteinase



- Molecule 1: 3C-Like Proteinase



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	52.13Å 67.45Å 67.38Å 71.23° 77.46° 81.74°	Depositor
Resolution (Å)	29.95 – 2.00 29.95 – 2.00	Depositor EDS
% Data completeness (in resolution range)	95.2 (29.95-2.00) 95.2 (29.95-2.00)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	0.04	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.17 (at 2.00Å)	Xtrriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.224 , 0.263 0.234 , 0.265	Depositor DCC
R_{free} test set	2779 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å ²)	35.9	Xtrriage
Anisotropy	0.025	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 30.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	4792	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.60% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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	1.48	4/2381 (0.2%)	0.81	0/3236
1	B	1.51	3/2375 (0.1%)	0.79	0/3228
All	All	1.50	7/4756 (0.1%)	0.80	0/6464

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	156	CYS	CB-SG	-5.92	1.72	1.81
1	A	265	CYS	CB-SG	-5.88	1.72	1.81
1	A	300	CYS	CB-SG	-5.71	1.72	1.81
1	A	22	CYS	CB-SG	-5.49	1.72	1.81
1	B	145	CYS	CB-SG	-5.46	1.73	1.81
1	B	244	GLN	CB-CG	-5.19	1.38	1.52
1	B	161	TYR	CD1-CE1	-5.03	1.31	1.39

There are no bond angle outliers.

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	2329	0	2284	50	0
1	B	2323	0	2279	46	0
2	A	56	0	0	3	0
2	B	84	0	0	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	4792	0	4563	92	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 10.

All (92) 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:4:ARG:H	1:A:299:GLN:HE22	1.09	0.97
1:B:49:MET:HA	1:B:49:MET:CE	1.99	0.92
1:B:231:ASN:HD21	1:B:242:LEU:H	1.16	0.88
1:B:4:ARG:H	1:B:299:GLN:HE22	1.19	0.86
1:B:222:ARG:HH11	1:B:222:ARG:HG2	1.40	0.85
1:B:222:ARG:HH11	1:B:222:ARG:CG	1.91	0.83
1:A:167:LEU:HB3	1:A:168:PRO:HD2	1.61	0.83
1:B:74:GLN:HG2	2:B:364:HOH:O	1.78	0.81
1:A:132:PRO:HD2	1:A:197:ASP:OD1	1.80	0.80
1:A:165:MET:HE3	1:A:187:ASP:CB	2.11	0.79
1:A:111:THR:HG22	1:A:129:ALA:HB2	1.66	0.76
1:B:49:MET:HA	1:B:49:MET:HE3	1.67	0.75
1:B:190:THR:HG23	1:B:192:GLN:H	1.51	0.75
1:B:186:VAL:H	1:B:192:GLN:HE22	1.34	0.74
1:A:138:GLY:H	1:A:172:HIS:HD2	1.36	0.74
1:B:231:ASN:ND2	1:B:242:LEU:H	1.86	0.74
1:A:4:ARG:H	1:A:299:GLN:NE2	1.85	0.73
1:A:165:MET:HE3	1:A:187:ASP:HB3	1.68	0.72
1:A:247:VAL:HG13	1:A:261:VAL:HG11	1.72	0.72
1:B:49:MET:HA	1:B:49:MET:HE2	1.71	0.72
1:B:222:ARG:HG2	1:B:222:ARG:NH1	2.03	0.72
1:B:138:GLY:H	1:B:172:HIS:HD2	1.36	0.71
1:A:153:ASP:O	1:A:154:TYR:CD2	2.46	0.68
1:A:132:PRO:HG2	1:A:198:THR:O	1.93	0.68
1:A:83:GLN:NE2	1:A:88:ARG:HH11	1.92	0.67
1:B:284:SER:OG	1:B:286:ILE:HD13	1.99	0.63
1:B:270:GLU:HG3	2:B:367:HOH:O	1.99	0.62
1:B:189:GLN:HG2	1:B:189:GLN:O	1.99	0.62
1:B:19:GLN:HE21	1:B:26:THR:HG21	1.65	0.61
1:A:213:ILE:HG22	1:A:213:ILE:O	2.00	0.61
1:A:41:HIS:CD2	1:A:165:MET:HE2	2.36	0.60
1:B:92:ASP:C	1:B:92:ASP:OD2	2.38	0.60
1:A:168:PRO:N	2:A:312:HOH:O	2.34	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:83:GLN:HE22	1:A:88:ARG:HH11	1.49	0.59
1:A:5:LYS:HZ1	1:B:4:ARG:HH12	1.51	0.58
1:A:138:GLY:H	1:A:172:HIS:CD2	2.21	0.58
1:A:131:ARG:HB3	1:A:132:PRO:HD2	1.84	0.58
1:B:4:ARG:H	1:B:299:GLN:NE2	1.97	0.57
1:A:168:PRO:CA	2:A:312:HOH:O	2.54	0.54
1:A:131:ARG:NE	1:A:197:ASP:OD2	2.36	0.54
1:A:167:LEU:HB3	1:A:168:PRO:CD	2.37	0.53
1:A:220:LEU:HD11	1:A:259:ILE:CD1	2.39	0.53
1:A:167:LEU:HD12	1:A:171:VAL:HG23	1.89	0.53
1:A:220:LEU:HD11	1:A:259:ILE:HD11	1.91	0.52
1:B:180:LYS:HE2	1:B:181:PHE:O	2.10	0.52
1:A:111:THR:HG22	1:A:129:ALA:CB	2.39	0.51
1:A:87:LEU:HD13	1:A:89:LEU:HD21	1.93	0.51
1:A:31:TRP:CE2	1:A:95:ASN:HB2	2.45	0.50
1:B:62:SER:O	1:B:65:SER:HB2	2.11	0.50
1:A:47:GLU:O	1:A:47:GLU:HG3	2.12	0.49
1:A:165:MET:CE	1:A:187:ASP:CB	2.87	0.49
1:B:63:ASN:ND2	1:B:80:HIS:ND1	2.60	0.49
1:A:131:ARG:HB3	1:A:132:PRO:CD	2.42	0.49
1:B:133:ASN:O	1:B:134:HIS:HB2	2.13	0.48
1:A:40:ARG:HD3	1:A:85:CYS:HA	1.96	0.48
1:B:52:PRO:HD2	1:B:188:ILE:HG12	1.95	0.48
1:A:117:CYS:SG	1:A:122:PRO:HA	2.54	0.48
1:A:100:LYS:HD2	1:A:156:CYS:SG	2.54	0.47
1:B:225:THR:O	1:B:262:LEU:HG	2.15	0.47
1:A:140:PHE:HB3	1:A:144:SER:OG	2.14	0.47
1:A:128:CYS:SG	1:B:4:ARG:NE	2.87	0.47
1:A:200:ILE:HG22	1:A:203:ASN:H	1.79	0.47
1:B:284:SER:OG	1:B:286:ILE:CD1	2.63	0.46
1:B:13:VAL:HG21	1:B:150:PHE:CZ	2.50	0.46
1:B:55:GLU:H	1:B:55:GLU:CD	2.18	0.46
1:A:41:HIS:CD2	1:A:165:MET:CE	2.99	0.46
1:A:213:ILE:O	1:A:213:ILE:CG2	2.62	0.46
1:A:5:LYS:NZ	1:B:4:ARG:NH1	2.65	0.45
1:B:49:MET:HE3	1:B:49:MET:CA	2.42	0.45
1:B:233:VAL:HG11	1:B:269:LYS:HG3	1.98	0.45
1:B:155:ASP:OD1	1:B:155:ASP:N	2.45	0.45
1:B:222:ARG:CG	1:B:222:ARG:NH1	2.60	0.45
1:B:153:ASP:O	1:B:154:TYR:HB2	2.17	0.44
1:A:124:GLY:HA3	1:B:6:MET:HG2	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:76:ARG:HB3	1:B:92:ASP:OD1	2.18	0.43
1:B:17:MET:HG3	1:B:117:CYS:SG	2.58	0.43
1:A:86:LEU:HG	1:A:179:GLY:CA	2.48	0.43
1:B:44:CYS:SG	1:B:54:TYR:CE1	3.12	0.43
1:A:56:ASP:O	1:A:60:ARG:HG3	2.19	0.43
1:A:165:MET:CE	1:A:187:ASP:HB2	2.49	0.43
1:A:31:TRP:CD2	1:A:95:ASN:HB2	2.54	0.43
1:A:200:ILE:O	1:A:204:VAL:HG23	2.19	0.42
1:B:111:THR:HG22	1:B:129:ALA:HB2	2.00	0.42
1:A:57:LEU:HD23	1:A:57:LEU:HA	1.87	0.42
1:A:83:GLN:HE22	1:A:88:ARG:NH1	2.16	0.42
1:B:13:VAL:HG21	1:B:150:PHE:CE2	2.55	0.42
1:B:44:CYS:HB3	1:B:48:ASP:CB	2.50	0.42
1:A:234:ALA:HB3	2:A:333:HOH:O	2.19	0.41
1:B:167:LEU:HB3	1:B:168:PRO:CD	2.51	0.41
1:B:286:ILE:HD13	1:B:286:ILE:C	2.41	0.41
1:A:49:MET:O	1:A:52:PRO:HD3	2.21	0.41
1:B:163:HIS:CE1	1:B:172:HIS:HB3	2.55	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	299/306 (98%)	295 (99%)	4 (1%)	0	100	100
1	B	298/306 (97%)	290 (97%)	8 (3%)	0	100	100
All	All	597/612 (98%)	585 (98%)	12 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	259/263 (98%)	238 (92%)	21 (8%)	11	7
1	B	258/263 (98%)	241 (93%)	17 (7%)	16	12
All	All	517/526 (98%)	479 (93%)	38 (7%)	13	9

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	SER
1	A	59	ILE
1	A	60	ARG
1	A	72	ASN
1	A	74	GLN
1	A	87	LEU
1	A	90	LYS
1	A	92	ASP
1	A	94	SER
1	A	106	ILE
1	A	107	GLN
1	A	127	GLN
1	A	142	ASN
1	A	154	TYR
1	A	169	THR
1	A	214	ASN
1	A	217	ARG
1	A	222	ARG
1	A	224	THR
1	A	272	LEU
1	A	286	ILE
1	B	1	SER
1	B	4	ARG
1	B	41	HIS
1	B	49	MET
1	B	59	ILE
1	B	90	LYS

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Mol	Chain	Res	Type
1	B	100	LYS
1	B	106	ILE
1	B	180	LYS
1	B	220	LEU
1	B	222	ARG
1	B	232	LEU
1	B	262	LEU
1	B	272	LEU
1	B	286	ILE
1	B	289	ASP
1	B	298	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	19	GLN
1	A	41	HIS
1	A	83	GLN
1	A	127	GLN
1	A	142	ASN
1	A	172	HIS
1	A	299	GLN
1	B	19	GLN
1	B	41	HIS
1	B	63	ASN
1	B	69	GLN
1	B	72	ASN
1	B	142	ASN
1	B	172	HIS
1	B	192	GLN
1	B	231	ASN
1	B	299	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 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	301/306 (98%)	-0.29	2 (0%) 87 87	24, 39, 55, 64	0
1	B	300/306 (98%)	-0.47	1 (0%) 94 93	20, 34, 52, 65	0
All	All	601/612 (98%)	-0.38	3 (0%) 91 90	20, 36, 55, 65	0

All (3) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	154	TYR	3.1
1	A	200	ILE	2.5
1	A	154	TYR	2.4

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.