Full wwPDB X-ray Structure Validation Report ⓘ

Aug 7, 2020 – 02:00 AM BST

PDB ID	:	6KL4
Title	:	Crystal structure of MavC-UBE2N-Ub
Authors	:	Ouyang, S.; Guan, H.
Deposited on	:	2019-07-29
Resolution	:	2.85 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:

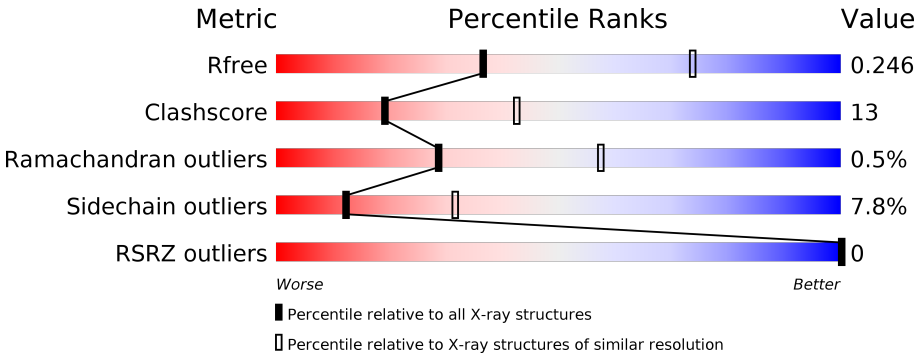
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.13.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.13.1

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 2.85 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	3168 (2.90-2.82)
Clashscore	141614	3438 (2.90-2.82)
Ramachandran outliers	138981	3348 (2.90-2.82)
Sidechain outliers	138945	3351 (2.90-2.82)
RSRZ outliers	127900	3103 (2.90-2.82)

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	378	69% 28% .
2	B	152	68% 28% . .
3	C	76	71% 22% . .

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4779 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 MavC.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	377	Total	C	N	O	S	0	0	0
			3000	1902	492	589	17			

- Molecule 2 is a protein called Ubiquitin-conjugating enzyme E2 N.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	151	Total	C	N	O	S	0	0	0
			1195	767	206	218	4			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	94	ALA	LYS	engineered mutation	UNP P61088

- Molecule 3 is a protein called Ub.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	74	Total	C	N	O	S	0	0	0
			584	369	100	114	1			

3 Residue-property plots (i)

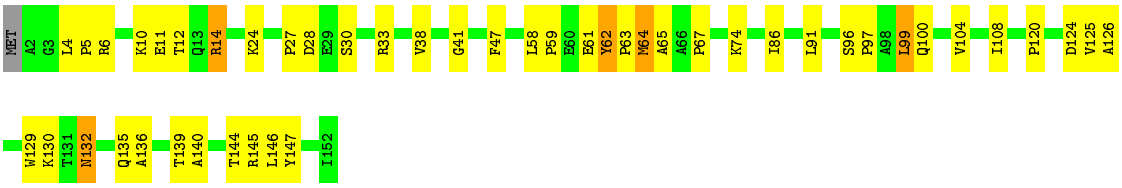
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: MavC

Chain A:

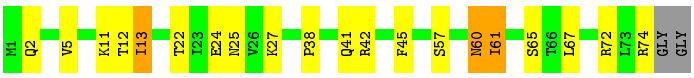
- Molecule 2: Ubiquitin-conjugating enzyme E2 N

Chain B:



- Molecule 3: Ub

Chain C:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 65	Depositor
Cell constants a, b, c, α, β, γ	149.56Å 149.56Å 58.77Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	49.00 – 2.85 48.96 – 2.85	Depositor EDS
% Data completeness (in resolution range)	99.9 (49.00-2.85) 100.0 (48.96-2.85)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.45 (at 2.86Å)	Xtriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.185 , 0.262 0.194 , 0.246	Depositor DCC
R_{free} test set	824 reflections (4.64%)	wwPDB-VP
Wilson B-factor (Å^2)	76.6	Xtriage
Anisotropy	0.044	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.29 , 46.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.030 for h,-h-k,-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	4779	wwPDB-VP
Average B, all atoms (Å^2)	81.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.95% 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

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	0.57	0/3058	0.76	0/4126
2	B	0.58	0/1225	0.80	0/1670
3	C	0.55	0/590	0.75	0/795
All	All	0.57	0/4873	0.77	0/6591

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
2	B	0	4

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	14	ARG	Sidechain
2	B	145	ARG	Sidechain
2	B	33	ARG	Sidechain
2	B	6	ARG	Sidechain

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	3000	0	2949	79	0
2	B	1195	0	1202	34	0
3	C	584	0	604	18	0
All	All	4779	0	4755	123	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 13.

All (123) 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:247:THR:HG21	1:A:273:SER:O	1.77	0.84
2:B:47:PHE:HA	2:B:144:THR:HG21	1.61	0.80
2:B:4:LEU:HB3	2:B:5:PRO:HA	1.65	0.75
1:A:188:PHE:CZ	2:B:4:LEU:HB2	2.22	0.75
1:A:29:THR:OG1	1:A:31:ILE:HD12	1.87	0.74
1:A:120:VAL:HG13	1:A:235:ILE:HB	1.71	0.72
1:A:227:TRP:CD1	1:A:325:ARG:NH1	2.58	0.72
1:A:71:THR:O	1:A:259:THR:HG22	1.93	0.69
1:A:10:GLY:O	1:A:13:VAL:HG23	1.94	0.68
3:C:22:THR:HG23	3:C:24:GLU:HG2	1.76	0.68
1:A:24:TYR:HB3	1:A:27:MET:HB2	1.75	0.66
2:B:74:LYS:HD3	2:B:147:TYR:CE2	2.30	0.66
2:B:61:GLU:HG2	2:B:61:GLU:O	1.96	0.66
1:A:321:PHE:HE2	2:B:99:LEU:HD13	1.61	0.65
2:B:28:ASP:OD1	2:B:30:SER:O	2.14	0.65
1:A:70:PRO:HG2	1:A:259:THR:HG21	1.79	0.65
2:B:140:ALA:O	2:B:144:THR:HG23	1.96	0.65
1:A:142:ASN:HB3	1:A:145:THR:HB	1.78	0.64
1:A:333:VAL:O	1:A:335:PRO:HD3	1.98	0.64
3:C:22:THR:HG22	3:C:25:ASN:ND2	2.14	0.63
1:A:340:GLN:O	1:A:344:GLU:HG3	2.00	0.62
3:C:27:LYS:HB3	3:C:38:PRO:HB3	1.82	0.62
1:A:199:ILE:HD12	1:A:199:ILE:O	1.99	0.62
2:B:62:TYR:O	2:B:64:MET:N	2.33	0.62
1:A:334:ASN:HB3	1:A:337:ILE:HG22	1.81	0.61
1:A:117:ASN:ND2	1:A:335:PRO:HG3	2.17	0.60
3:C:12:THR:O	3:C:13:ILE:HD12	2.01	0.60
1:A:132:LYS:HE3	1:A:147:GLU:OE2	2.01	0.60
1:A:269:ASP:OD1	1:A:270:GLU:N	2.34	0.60
2:B:12:THR:CG2	2:B:27:PRO:HG3	2.33	0.58
3:C:27:LYS:CB	3:C:38:PRO:HB3	2.34	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:263:TRP:CH2	1:A:268:LYS:HG2	2.39	0.57
2:B:11:GLU:OE1	2:B:100:GLN:HB2	2.05	0.57
1:A:132:LYS:CE	1:A:147:GLU:OE2	2.52	0.57
1:A:285:ALA:O	1:A:289:THR:HG23	2.05	0.57
2:B:132:ASN:OD1	2:B:132:ASN:N	2.38	0.56
1:A:117:ASN:HD22	1:A:335:PRO:HG3	1.69	0.56
1:A:254:TYR:HB3	1:A:257:SER:HB3	1.86	0.56
1:A:157:GLN:NE2	1:A:169:ASP:OD2	2.30	0.56
1:A:179:ARG:HH12	1:A:212:GLU:CD	2.09	0.56
1:A:68:THR:HG21	1:A:366:LYS:HA	1.88	0.55
1:A:120:VAL:CG1	1:A:235:ILE:HB	2.37	0.54
1:A:286:LEU:O	1:A:290:THR:HG22	2.08	0.53
1:A:116:LYS:HB2	1:A:118:LEU:HD11	1.89	0.53
3:C:22:THR:CG2	3:C:24:GLU:HG2	2.38	0.53
1:A:179:ARG:NH1	1:A:212:GLU:OE1	2.42	0.53
2:B:12:THR:HG23	2:B:27:PRO:HG3	1.89	0.53
1:A:158:LEU:HD11	1:A:213:MET:CE	2.39	0.53
1:A:80:GLU:O	1:A:84:LEU:HG	2.09	0.53
3:C:45:PHE:CE2	3:C:61:ILE:HG22	2.44	0.52
1:A:72:ASN:HB2	3:C:72:ARG:HA	1.92	0.52
1:A:133:TYR:CD1	1:A:133:TYR:C	2.83	0.52
1:A:114:PRO:O	1:A:246:ARG:NH1	2.32	0.52
3:C:45:PHE:CD1	3:C:67:LEU:HD12	2.45	0.51
2:B:64:MET:O	2:B:64:MET:HG3	2.09	0.51
1:A:189:TYR:CE1	2:B:5:PRO:HB3	2.46	0.51
1:A:192:TYR:CE1	2:B:63:PRO:HG2	2.46	0.50
1:A:353:TYR:HA	1:A:364:LEU:HD23	1.93	0.50
1:A:117:ASN:HD22	1:A:335:PRO:CG	2.24	0.50
1:A:153:LEU:HD13	1:A:158:LEU:HD13	1.93	0.50
1:A:188:PHE:CZ	2:B:4:LEU:CB	2.95	0.50
1:A:284:LEU:HD11	1:A:326:VAL:HG11	1.93	0.50
2:B:61:GLU:O	2:B:62:TYR:C	2.51	0.49
3:C:45:PHE:HD1	3:C:67:LEU:HD12	1.78	0.49
1:A:206:GLU:O	1:A:210:MET:HG3	2.13	0.48
1:A:108:ASN:O	1:A:112:SER:HB2	2.13	0.48
3:C:61:ILE:HG12	3:C:61:ILE:O	2.14	0.48
1:A:217:VAL:O	1:A:221:MET:HB2	2.13	0.48
2:B:86:ILE:HD13	2:B:108:ILE:HG12	1.96	0.47
1:A:33:ALA:HB2	1:A:365:TYR:CD1	2.49	0.47
3:C:38:PRO:HA	3:C:41:GLN:HG2	1.94	0.47
1:A:244:ASP:C	1:A:246:ARG:H	2.18	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:29:THR:OG1	1:A:31:ILE:CD1	2.62	0.47
2:B:64:MET:CE	2:B:97:PRO:HD3	2.44	0.47
1:A:234:THR:OG1	1:A:251:TYR:HB2	2.15	0.47
1:A:118:LEU:HA	1:A:332:GLU:HA	1.96	0.47
1:A:217:VAL:HG13	1:A:221:MET:CE	2.45	0.47
2:B:135:GLN:O	2:B:139:THR:HG23	2.15	0.46
1:A:144:GLU:OE1	1:A:144:GLU:N	2.47	0.46
2:B:62:TYR:HB3	2:B:63:PRO:HD3	1.98	0.46
1:A:10:GLY:O	1:A:13:VAL:CG2	2.63	0.45
1:A:33:ALA:HB2	1:A:365:TYR:CE1	2.52	0.45
1:A:247:THR:HG22	1:A:248:LEU:H	1.82	0.45
1:A:157:GLN:HG2	1:A:159:VAL:HG13	1.98	0.45
1:A:117:ASN:OD1	1:A:239:GLU:N	2.46	0.45
1:A:142:ASN:HB3	1:A:145:THR:CB	2.46	0.44
2:B:24:LYS:HB3	2:B:38:VAL:HG23	1.99	0.44
3:C:11:LYS:HG2	3:C:13:ILE:HD13	2.00	0.44
1:A:78:SER:HB2	1:A:234:THR:HG23	1.99	0.44
1:A:158:LEU:O	1:A:170:LEU:HB2	2.17	0.44
2:B:41:GLY:HA3	2:B:47:PHE:O	2.18	0.44
3:C:5:VAL:HA	3:C:67:LEU:O	2.17	0.44
1:A:321:PHE:HE2	2:B:99:LEU:CD1	2.29	0.44
1:A:330:VAL:HG12	1:A:331:THR:H	1.83	0.43
1:A:334:ASN:O	1:A:335:PRO:C	2.57	0.43
2:B:62:TYR:O	2:B:63:PRO:C	2.57	0.43
2:B:58:LEU:HD23	2:B:67:PRO:HB3	2.00	0.43
1:A:21:VAL:HG11	1:A:260:LEU:HG	2.00	0.43
1:A:132:LYS:HB2	1:A:150:LYS:HG3	2.01	0.43
2:B:129:TRP:CE3	2:B:136:ALA:HB1	2.54	0.43
3:C:60:ASN:O	3:C:60:ASN:ND2	2.52	0.43
1:A:124:MET:CE	1:A:287:LEU:HD23	2.49	0.42
1:A:24:TYR:CE1	1:A:349:ILE:HG21	2.54	0.42
1:A:124:MET:HE1	1:A:287:LEU:HD23	2.01	0.42
2:B:62:TYR:C	2:B:62:TYR:CD1	2.92	0.42
1:A:59:ALA:O	1:A:63:ARG:HG3	2.20	0.42
1:A:16:LYS:O	1:A:20:MET:HG3	2.19	0.42
2:B:146:LEU:HD23	2:B:146:LEU:HA	1.88	0.42
1:A:227:TRP:CH2	1:A:325:ARG:HB2	2.54	0.42
1:A:237:VAL:O	1:A:237:VAL:HG23	2.20	0.42
1:A:44:SER:O	1:A:45:VAL:C	2.57	0.42
3:C:38:PRO:HA	3:C:41:GLN:CG	2.50	0.42
1:A:256:THR:OG1	2:B:91:LEU:HD21	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:45:PHE:CE2	3:C:61:ILE:CG2	3.03	0.41
3:C:74:ARG:HD3	3:C:74:ARG:HA	1.95	0.41
1:A:116:LYS:HB2	1:A:118:LEU:CD1	2.50	0.41
1:A:260:LEU:O	1:A:263:TRP:HB3	2.20	0.41
2:B:120:PRO:HB3	2:B:126:ALA:CB	2.50	0.41
1:A:158:LEU:HD11	1:A:213:MET:HE3	2.03	0.41
1:A:134:GLN:HE21	1:A:136:ILE:HD13	1.86	0.41
2:B:59:PRO:HD3	2:B:67:PRO:HA	2.02	0.40
2:B:62:TYR:O	2:B:65:ALA:N	2.55	0.40
1:A:330:VAL:HG12	1:A:331:THR:N	2.37	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	375/378 (99%)	339 (90%)	33 (9%)	3 (1%)	19 46
2	B	149/152 (98%)	138 (93%)	11 (7%)	0	100 100
3	C	72/76 (95%)	67 (93%)	5 (7%)	0	100 100
All	All	596/606 (98%)	544 (91%)	49 (8%)	3 (0%)	29 57

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	114	PRO
1	A	245	THR
1	A	104	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	330/336 (98%)	307 (93%)	23 (7%)	15 37
2	B	127/128 (99%)	116 (91%)	11 (9%)	10 27
3	C	66/68 (97%)	59 (89%)	7 (11%)	6 18
All	All	523/532 (98%)	482 (92%)	41 (8%)	12 32

All (41) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	9	THR
1	A	12	HIS
1	A	13	VAL
1	A	36	LEU
1	A	66	GLU
1	A	72	ASN
1	A	107	SER
1	A	108	ASN
1	A	112	SER
1	A	120	VAL
1	A	137	LYS
1	A	185	THR
1	A	228	THR
1	A	230	THR
1	A	241	ASP
1	A	243	GLU
1	A	244	ASP
1	A	246	ARG
1	A	248	LEU
1	A	275	LEU
1	A	368	LYS
1	A	375	LYS
1	A	382	LEU
2	B	10	LYS
2	B	14	ARG
2	B	62	TYR

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Mol	Chain	Res	Type
2	B	64	MET
2	B	96	SER
2	B	99	LEU
2	B	104	VAL
2	B	124	ASP
2	B	125	VAL
2	B	130	LYS
2	B	132	ASN
3	C	2	GLN
3	C	13	ILE
3	C	42	ARG
3	C	57	SER
3	C	60	ASN
3	C	61	ILE
3	C	65	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	134	GLN
1	A	149	ASN
1	A	190	GLN
3	C	60	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 monosaccharides 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	377/378 (99%)	-0.31	0	100	100	43, 80, 114, 146	0
2	B	151/152 (99%)	-0.33	0	100	100	44, 72, 108, 123	0
3	C	74/76 (97%)	-0.29	0	100	100	60, 89, 123, 130	0
All	All	602/606 (99%)	-0.32	0	100	100	43, 80, 115, 146	0

There are no RSRZ outliers to report.

6.2 Non-standard residues in protein, DNA, RNA chains

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

6.3 Carbohydrates

There are no monosaccharides in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.