



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 10, 2026 – 09:40 AM UTC

PDB ID : 1S1E / pdb_00001s1e
Title : Crystal Structure of Kv Channel-interacting protein 1 (KChIP-1)
Authors : Scannevin, R.H.; Wang, K.-W.; Jow, F.; Megules, J.; Kopsco, D.C.; Edris, W.; Carroll, K.C.; Lu, Q.; Xu, W.-X.; Xu, Z.-B.; Katz, A.H.; Olland, S.; Lin, L.; Taylor, M.; Stahl, M.; Malakian, K.; Somers, W.; Mosyak, L.; Bowlby, M.R.; Chanda, P.; Rhodes, K.J.
Deposited on : 2004-01-06
Resolution : 2.30 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	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

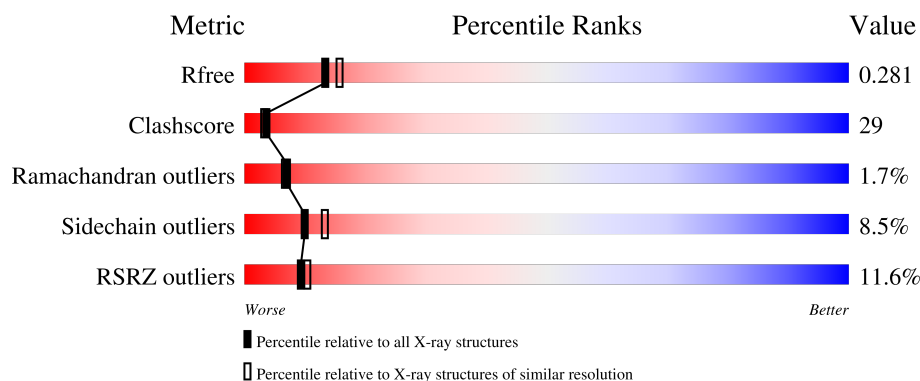
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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}	180053	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	224	9% 37% 35% 8% 19%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 1619 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 Kv channel interacting protein 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	181	Total	C	N	O	S	0	0	0
			1494	955	242	288	9			

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	72	GLU	ASP	conflict	UNP Q9NZI2
A	217	VAL	-	expression tag	UNP Q9NZI2
A	218	GLU	-	expression tag	UNP Q9NZI2
A	219	HIS	-	expression tag	UNP Q9NZI2
A	220	HIS	-	expression tag	UNP Q9NZI2
A	221	HIS	-	expression tag	UNP Q9NZI2
A	222	HIS	-	expression tag	UNP Q9NZI2
A	223	HIS	-	expression tag	UNP Q9NZI2
A	224	HIS	-	expression tag	UNP Q9NZI2

- Molecule 2 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Ca	0	0
			2	2		

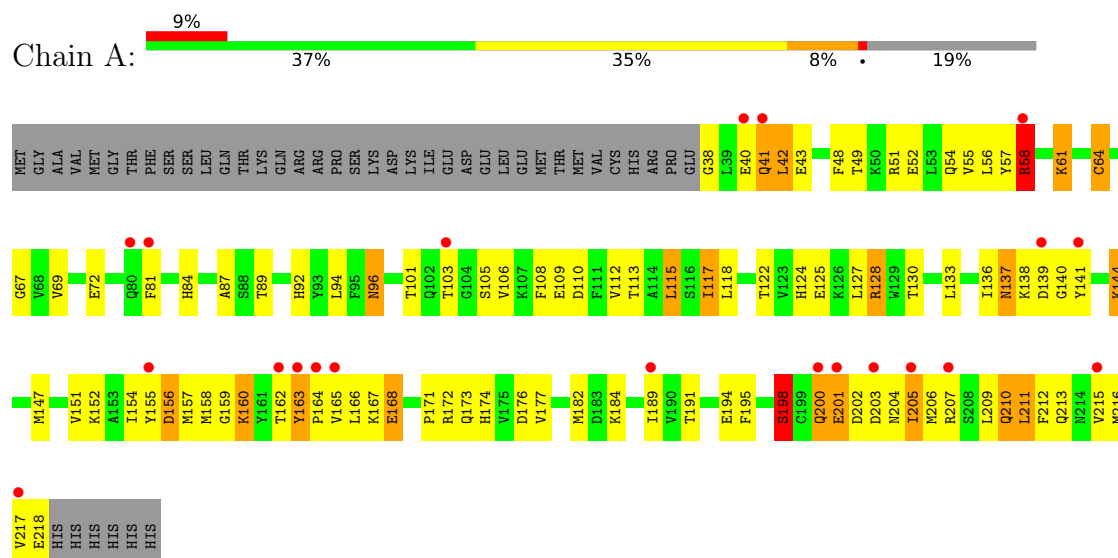
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	123	Total	O	0	0
			123	123		

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: Kv channel interacting protein 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	50.13Å 50.13Å 177.33Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.30 20.00 – 2.30	Depositor EDS
% Data completeness (in resolution range)	(Not available) (20.00-2.30) 93.2 (20.00-2.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.88 (at 2.28Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.224 , 0.273 0.267 , 0.281	Depositor DCC
R_{free} test set	509 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å ²)	39.9	Xtriage
Anisotropy	0.142	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 31.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	1619	wwPDB-VP
Average B, all atoms (Å ²)	44.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.62% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section:
CA

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	0.46	0/1526	1.50	37/2058 (1.8%)

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	A	0	1

There are no bond length outliers.

All (37) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	203	ASP	CA-CB-CG	-19.57	93.03	112.60
1	A	58	ARG	CD-NE-CZ	-16.47	101.34	124.40
1	A	200	GLN	CG-CD-NE2	-12.78	97.23	116.40
1	A	156	ASP	CA-CB-CG	12.49	125.09	112.60
1	A	200	GLN	CB-CG-CD	-11.89	92.38	112.60
1	A	201	GLU	CB-CG-CD	-11.56	92.95	112.60
1	A	41	GLN	CG-CD-NE2	-11.39	99.32	116.40
1	A	96	ASN	CB-CG-ND2	-11.16	99.66	116.40
1	A	205	ILE	CA-CB-CG1	-9.92	93.54	110.40
1	A	117	ILE	CA-CB-CG1	9.33	126.27	110.40
1	A	200	GLN	CG-CD-OE1	8.80	138.40	120.80
1	A	140	GLY	N-CA-C	-8.22	103.16	115.00
1	A	41	GLN	CB-CG-CD	7.54	125.41	112.60
1	A	41	GLN	CG-CD-OE1	7.44	135.68	120.80
1	A	184	LYS	N-CA-C	7.42	120.31	111.33
1	A	205	ILE	CB-CG1-CD1	-7.40	98.27	113.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	96	ASN	CB-CG-OD1	7.32	135.44	120.80
1	A	203	ASP	CB-CG-OD2	-7.26	101.69	118.40
1	A	41	GLN	CA-CB-CG	-7.26	99.59	114.10
1	A	40	GLU	CB-CG-CD	6.83	124.20	112.60
1	A	117	ILE	CB-CG1-CD1	6.80	128.08	113.80
1	A	58	ARG	CG-CD-NE	6.72	126.79	112.00
1	A	40	GLU	CA-CB-CG	6.71	127.53	114.10
1	A	203	ASP	CB-CG-OD1	6.52	133.41	118.40
1	A	40	GLU	CG-CD-OE1	6.45	133.24	118.40
1	A	40	GLU	CG-CD-OE2	-6.44	103.58	118.40
1	A	61	LYS	CB-CG-CD	-6.42	96.54	111.30
1	A	61	LYS	CG-CD-CE	6.26	125.69	111.30
1	A	64	CYS	CA-C-N	6.15	126.33	119.32
1	A	64	CYS	C-N-CA	6.15	126.33	119.32
1	A	210	GLN	N-CA-C	6.04	117.94	111.36
1	A	198	SER	CA-CB-OG	6.01	123.12	111.10
1	A	201	GLU	CG-CD-OE1	-5.80	105.07	118.40
1	A	201	GLU	CG-CD-OE2	5.66	131.43	118.40
1	A	136	ILE	N-CA-C	5.22	115.84	110.36
1	A	207	ARG	CD-NE-CZ	-5.07	117.30	124.40
1	A	152	LYS	N-CA-C	-5.05	105.90	111.71

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	58	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	1494	0	1438	86	0
2	A	2	0	0	0	0
3	A	123	0	0	12	0
All	All	1619	0	1438	86	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 29.

All (86) 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:163:TYR:HB3	1:A:164:PRO:HD2	1.25	1.15
1:A:182:MET:HG3	1:A:198:SER:OG	1.54	1.06
1:A:41:GLN:HE21	1:A:41:GLN:HA	1.29	0.96
1:A:55:VAL:HA	1:A:58:ARG:HD2	1.49	0.92
1:A:156:ASP:OD1	3:A:323:HOH:O	1.95	0.83
1:A:163:TYR:HB3	1:A:164:PRO:CD	2.06	0.83
1:A:55:VAL:O	1:A:58:ARG:HG2	1.83	0.78
1:A:182:MET:CE	1:A:205:ILE:HG21	2.16	0.76
1:A:41:GLN:HA	1:A:41:GLN:NE2	2.00	0.76
1:A:137:ASN:ND2	1:A:139:ASP:HB2	2.05	0.70
1:A:49:THR:OG1	1:A:52:GLU:HG3	1.91	0.70
1:A:182:MET:CG	1:A:198:SER:OG	2.35	0.69
1:A:54:GLN:HG3	3:A:290:HOH:O	1.91	0.68
1:A:127:LEU:HD11	1:A:206:MET:HE2	1.77	0.66
1:A:87:ALA:HB2	1:A:157:MET:HG3	1.77	0.66
1:A:182:MET:CE	1:A:205:ILE:CG2	2.75	0.64
1:A:57:TYR:OH	1:A:61:LYS:HE3	2.01	0.61
1:A:167:LYS:O	1:A:168:GLU:HB2	1.99	0.61
1:A:182:MET:HE2	1:A:198:SER:HB2	1.83	0.60
1:A:41:GLN:HE21	1:A:41:GLN:CA	2.07	0.60
1:A:124:HIS:HB3	1:A:128:ARG:NH2	2.17	0.60
1:A:64:CYS:SG	1:A:69:VAL:HG22	2.42	0.60
1:A:109:GLU:HA	1:A:112:VAL:CG2	2.34	0.58
1:A:182:MET:HE1	1:A:205:ILE:CG2	2.35	0.57
1:A:108:PHE:O	1:A:112:VAL:HG22	2.05	0.56
1:A:182:MET:HG3	1:A:198:SER:CB	2.35	0.56
1:A:158:MET:HE2	1:A:162:THR:HA	1.89	0.55
1:A:89:THR:O	1:A:92:HIS:HB3	2.06	0.54
1:A:101:THR:OG1	1:A:103:THR:HG22	2.08	0.54
1:A:218:GLU:HA	1:A:218:GLU:OE1	2.05	0.54
1:A:106:VAL:HG13	1:A:110:ASP:HB2	1.89	0.54
1:A:211:LEU:C	1:A:211:LEU:HD13	2.33	0.53
1:A:89:THR:HG22	3:A:308:HOH:O	2.09	0.53
1:A:41:GLN:O	1:A:41:GLN:HG3	2.08	0.52
1:A:162:THR:O	1:A:163:TYR:O	2.28	0.51
1:A:103:THR:HG23	1:A:105:SER:H	1.74	0.51
1:A:89:THR:HG23	3:A:229:HOH:O	2.11	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:194:GLU:O	1:A:198:SER:OG	2.24	0.50
1:A:94:LEU:HD21	1:A:216:MET:SD	2.52	0.50
1:A:137:ASN:C	1:A:137:ASN:HD22	2.19	0.50
1:A:155:TYR:CG	1:A:171:PRO:HG3	2.47	0.50
1:A:130:THR:OG1	1:A:210:GLN:NE2	2.45	0.50
1:A:81:PHE:HB3	1:A:215:VAL:HG11	1.94	0.49
1:A:43:GLU:HG3	1:A:48:PHE:O	2.13	0.49
1:A:141:TYR:HB3	1:A:189:ILE:HG23	1.94	0.49
1:A:144:LYS:HE3	1:A:176:ASP:OD1	2.13	0.48
1:A:166:LEU:HD22	1:A:174:HIS:NE2	2.28	0.48
1:A:115:LEU:HD23	1:A:217:VAL:HG12	1.97	0.47
1:A:137:ASN:ND2	1:A:137:ASN:C	2.72	0.47
1:A:202:ASP:OD1	1:A:204:ASN:HB2	2.15	0.47
1:A:138:LYS:HD2	1:A:138:LYS:N	2.30	0.46
1:A:127:LEU:HD23	1:A:210:GLN:HE21	1.80	0.46
1:A:109:GLU:HA	1:A:112:VAL:HG22	1.97	0.46
1:A:124:HIS:HB3	1:A:128:ARG:HH21	1.80	0.46
1:A:174:HIS:HE1	3:A:230:HOH:O	1.98	0.46
1:A:211:LEU:HD22	3:A:332:HOH:O	2.16	0.45
1:A:137:ASN:ND2	1:A:139:ASP:H	2.14	0.45
1:A:210:GLN:O	1:A:211:LEU:C	2.59	0.45
1:A:147:MET:O	1:A:151:VAL:HG23	2.17	0.45
1:A:84:HIS:CE1	3:A:248:HOH:O	2.70	0.45
1:A:113:THR:O	1:A:117:ILE:HD12	2.17	0.44
1:A:195:PHE:CZ	1:A:209:LEU:HD13	2.52	0.44
1:A:115:LEU:CD2	1:A:217:VAL:HG12	2.48	0.44
1:A:122:THR:OG1	1:A:125:GLU:HG3	2.18	0.44
1:A:154:ILE:HD13	1:A:212:PHE:CE2	2.53	0.44
1:A:162:THR:O	1:A:162:THR:HG23	2.17	0.44
1:A:173:GLN:O	1:A:177:VAL:HG23	2.18	0.43
1:A:42:LEU:HD11	1:A:112:VAL:HG21	2.00	0.43
1:A:72:GLU:HG2	3:A:251:HOH:O	2.18	0.43
1:A:56:LEU:HD13	1:A:112:VAL:HG12	2.01	0.42
1:A:51:ARG:HD2	3:A:280:HOH:O	2.20	0.42
1:A:160:LYS:NZ	1:A:160:LYS:HB2	2.35	0.42
1:A:58:ARG:HH11	1:A:58:ARG:HD3	1.69	0.41
1:A:94:LEU:HD12	1:A:94:LEU:HA	1.90	0.41
1:A:173:GLN:NE2	3:A:242:HOH:O	2.53	0.41
1:A:96:ASN:HD22	1:A:96:ASN:HA	1.10	0.41
1:A:55:VAL:HG23	3:A:297:HOH:O	2.20	0.41
1:A:61:LYS:HE2	1:A:67:GLY:HA2	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:159:GLY:HA3	3:A:286:HOH:O	2.21	0.41
1:A:211:LEU:C	1:A:211:LEU:CD1	2.93	0.41
1:A:163:TYR:CB	1:A:164:PRO:CD	2.87	0.40
1:A:147:MET:HE3	1:A:151:VAL:CG2	2.52	0.40
1:A:38:GLY:O	1:A:42:LEU:HB2	2.21	0.40
1:A:167:LYS:O	1:A:168:GLU:CB	2.66	0.40
1:A:141:TYR:CD1	1:A:191:THR:HG22	2.57	0.40
1:A:163:TYR:C	1:A:165:VAL:N	2.79	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	179/224 (80%)	171 (96%)	5 (3%)	3 (2%)	7 7

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	163	TYR
1	A	168	GLU
1	A	211	LEU

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	165/205 (80%)	151 (92%)	14 (8%)	10	13

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	42	LEU
1	A	58	ARG
1	A	115	LEU
1	A	118	LEU
1	A	128	ARG
1	A	133	LEU
1	A	137	ASN
1	A	144	LYS
1	A	160	LYS
1	A	172	ARG
1	A	198	SER
1	A	200	GLN
1	A	201	GLU
1	A	213	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	41	GLN
1	A	45	GLN
1	A	62	ASN
1	A	80	GLN
1	A	96	ASN
1	A	132	ASN
1	A	173	GLN
1	A	174	HIS
1	A	210	GLN
1	A	213	GLN

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 [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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	181/224 (80%)	0.89	21 (11%) 9 10	24, 43, 65, 86	0

All (21) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	41	GLN	5.0
1	A	162	THR	4.4
1	A	207	ARG	4.4
1	A	203	ASP	4.2
1	A	40	GLU	4.2
1	A	201	GLU	3.7
1	A	205	ILE	3.0
1	A	58	ARG	2.7
1	A	80	GLN	2.7
1	A	215	VAL	2.6
1	A	163	TYR	2.5
1	A	200	GLN	2.4
1	A	164	PRO	2.4
1	A	103	THR	2.4
1	A	141	TYR	2.2
1	A	217	VAL	2.2
1	A	155	TYR	2.1
1	A	165	VAL	2.1
1	A	189	ILE	2.1
1	A	81	PHE	2.0
1	A	139	ASP	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 oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	CA	A	225	1/1	0.92	0.06	39,39,39,39	0
2	CA	A	226	1/1	0.95	0.04	29,29,29,29	0

6.5 Other polymers [i](#)

There are no such residues in this entry.