



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 26, 2026 – 08:37 AM EDT

PDB ID : 7UIQ / pdb_00007uiq
Title : Cocrystal structure of human CaMKII-alpha (CAMK2A)kinase domain and Tiam1
Authors : Ozden, C.; Stratton, M.M.; Garman, S.C.
Deposited on : 2022-03-29
Resolution : 3.11 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:

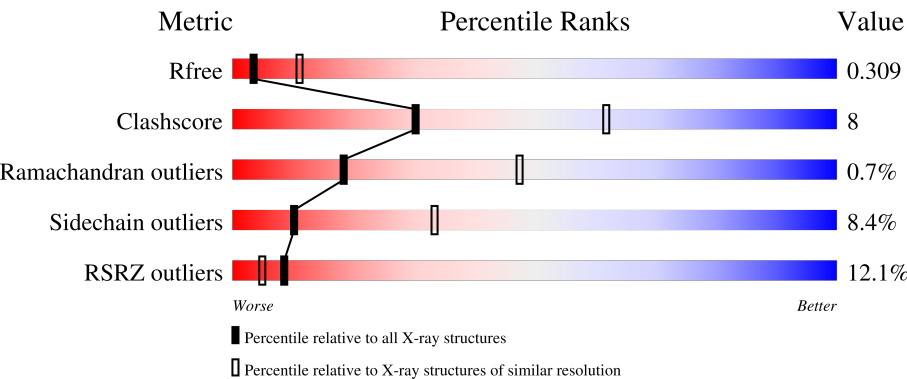
MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 3.11 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	1816 (3.14-3.10)
Clashscore	190562	1906 (3.14-3.10)
Ramachandran outliers	187476	1802 (3.14-3.10)
Sidechain outliers	187428	1802 (3.14-3.10)
RSRZ outliers	180081	1816 (3.14-3.10)

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	268	3% 75% 21% .
1	B	268	21% 73% 22% ..
2	C	19	74% 21% 5%
2	D	19	11% 63% 16% 21%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4430 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 Calcium/calmodulin-dependent protein kinase type II subunit alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	268	Total	C	N	O	S	0	0	0
			2119	1368	362	382	7			
1	B	261	Total	C	N	O	S	0	0	0
			2051	1323	352	369	7			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	135	ASN	ASP	engineered mutation	UNP Q9UQM7
A	223	LYS	GLN	engineered mutation	UNP Q9UQM7
B	135	ASN	ASP	engineered mutation	UNP Q9UQM7
B	223	LYS	GLN	engineered mutation	UNP Q9UQM7

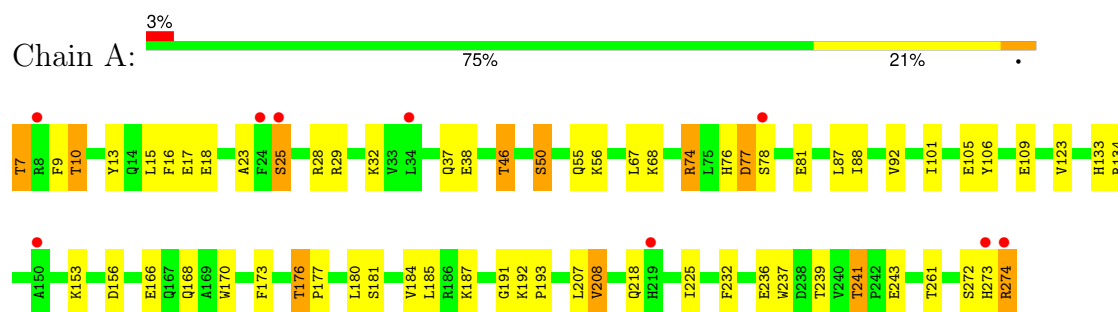
- Molecule 2 is a protein called T-lymphoma invasion and metastasis-inducing protein 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	19	Total	C	N	O	S	0	0	0
			149	90	31	27	1			
2	D	15	Total	C	N	O	S	0	0	0
			111	67	23	20	1			

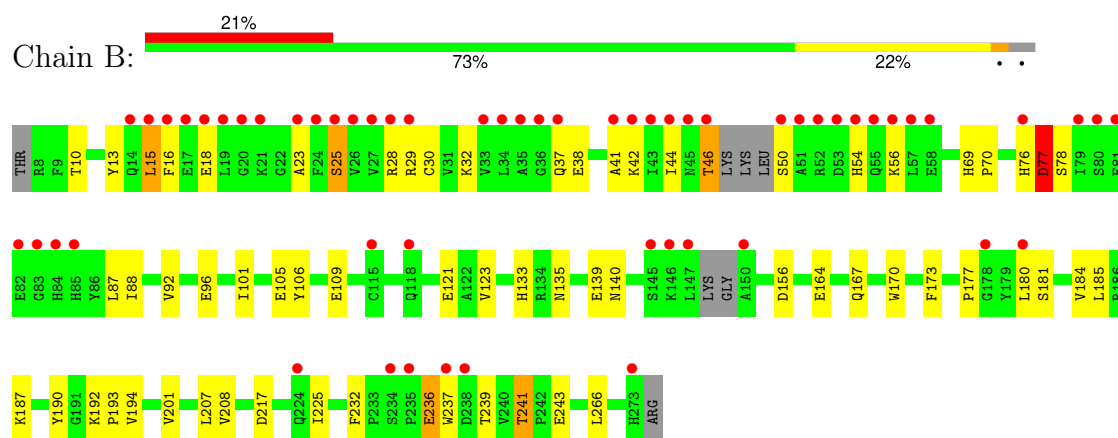
3 Residue-property plots [i](#)

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.

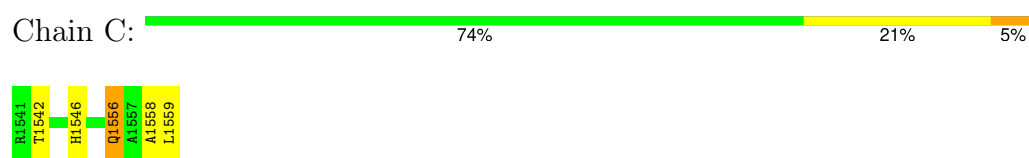
- Molecule 1: Calcium/calmodulin-dependent protein kinase type II subunit alpha



- Molecule 1: Calcium/calmodulin-dependent protein kinase type II subunit alpha

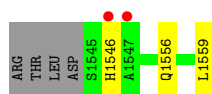


- Molecule 2: T-lymphoma invasion and metastasis-inducing protein 1



- Molecule 2: T-lymphoma invasion and metastasis-inducing protein 1





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	43.43Å 137.42Å 156.47Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	31.54 – 3.11 31.54 – 3.12	Depositor EDS
% Data completeness (in resolution range)	93.1 (31.54-3.11) 93.1 (31.54-3.12)	Depositor EDS
R_{merge}	0.27	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.28 (at 3.12Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.259 , 0.309 0.260 , 0.309	Depositor DCC
R_{free} test set	782 reflections (4.46%)	wwPDB-VP
Wilson B-factor (Å ²)	31.2	Xtriage
Anisotropy	0.202	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 12.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.27$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.83	EDS
Total number of atoms	4430	wwPDB-VP
Average B, all atoms (Å ²)	33.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.23% 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	1.06	1/2174 (0.0%)	1.55	10/2953 (0.3%)
1	B	1.05	0/2102	1.51	5/2855 (0.2%)
2	C	1.00	0/149	1.49	0/197
2	D	1.08	0/111	1.48	0/147
All	All	1.06	1/4536 (0.0%)	1.53	15/6152 (0.2%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	208	VAL	N-CA	5.04	1.50	1.46

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	236	GLU	CB-CA-C	-5.99	101.74	110.96
1	B	56	LYS	CA-C-N	5.57	127.74	120.28
1	B	56	LYS	C-N-CA	5.57	127.74	120.28
1	B	77	ASP	CA-CB-CG	5.45	118.05	112.60
1	A	153	LYS	CA-C-N	5.41	128.55	120.87
1	A	153	LYS	C-N-CA	5.41	128.55	120.87
1	A	10	THR	CA-C-N	5.29	127.31	120.44
1	A	10	THR	C-N-CA	5.29	127.31	120.44
1	A	56	LYS	CA-C-N	5.24	127.73	120.29
1	A	56	LYS	C-N-CA	5.24	127.73	120.29
1	B	164	GLU	CB-CA-C	5.21	119.11	110.78
1	A	243	GLU	CB-CG-CD	5.16	121.38	112.60
1	A	176	THR	CB-CA-C	5.13	115.81	108.68
1	A	46	THR	CA-CB-OG1	-5.10	101.94	109.60
1	A	55	GLN	CB-CA-C	5.09	119.35	110.79

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	2119	0	2072	34	0
1	B	2051	0	1997	39	0
2	C	149	0	159	5	0
2	D	111	0	113	3	0
All	All	4430	0	4341	74	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 8.

All (74) 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:190:TYR:HD2	1:B:194:VAL:HG11	1.26	0.99
1:B:190:TYR:CD2	1:B:194:VAL:HG11	2.13	0.84
1:A:37:GLN:HE21	1:A:38:GLU:N	1.81	0.79
1:B:236:GLU:HG3	2:D:1546:HIS:ND1	1.98	0.77
1:B:208:VAL:HG11	1:B:237:TRP:CE2	2.20	0.77
1:A:37:GLN:HE21	1:A:38:GLU:H	1.29	0.76
1:A:177:PRO:HA	1:A:180:LEU:HD12	1.75	0.68
1:A:208:VAL:HG11	1:A:237:TRP:CE2	2.28	0.68
1:B:76:HIS:O	1:B:77:ASP:HB2	1.92	0.67
1:B:18:GLU:HA	1:B:28:ARG:HG2	1.79	0.65
1:A:76:HIS:O	1:A:77:ASP:HB2	1.97	0.64
1:B:135:ASN:O	1:B:140:ASN:ND2	2.30	0.62
1:A:168:GLN:OE1	1:A:191:GLY:HA3	2.00	0.61
1:A:176:THR:CG2	2:C:1556:GLN:HB2	2.30	0.60
1:A:181:SER:OG	1:A:184:VAL:HG23	2.03	0.58
1:B:133:HIS:HD1	1:B:133:HIS:C	2.13	0.57
1:A:7:THR:HB	1:A:81:GLU:HG2	1.87	0.56
1:A:192:LYS:N	1:A:193:PRO:CD	2.69	0.55
1:B:177:PRO:HA	1:B:180:LEU:HD12	1.87	0.55
1:A:273:HIS:C	1:A:274:ARG:HG2	2.31	0.54
1:B:37:GLN:HE21	1:B:38:GLU:H	1.53	0.54
1:A:109:GLU:OE1	1:A:241:THR:OG1	2.25	0.54
1:A:177:PRO:HA	1:A:180:LEU:CD1	2.38	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:18:GLU:HA	1:A:28:ARG:HG2	1.90	0.54
1:B:192:LYS:N	1:B:193:PRO:CD	2.71	0.53
1:B:106:TYR:HB2	1:B:207:LEU:O	2.09	0.53
1:B:109:GLU:OE1	1:B:241:THR:OG1	2.27	0.53
1:B:217:ASP:HA	2:C:1542:THR:OG1	2.09	0.52
1:B:101:ILE:O	1:B:105:GLU:N	2.43	0.52
2:C:1558:ALA:O	2:C:1559:LEU:HB2	2.10	0.52
1:B:181:SER:OG	1:B:184:VAL:HG23	2.10	0.51
1:A:273:HIS:HB2	1:A:274:ARG:NH1	2.26	0.51
1:B:236:GLU:HG3	2:D:1546:HIS:CG	2.46	0.51
1:A:23:ALA:HB3	1:A:25:SER:OG	2.11	0.50
1:A:170:TRP:CZ3	1:A:187:LYS:HA	2.47	0.50
1:B:37:GLN:HE21	1:B:38:GLU:N	2.09	0.50
1:B:46:THR:HG23	1:B:54:HIS:NE2	2.27	0.49
1:B:236:GLU:CG	2:D:1546:HIS:ND1	2.72	0.49
1:B:16:PHE:O	1:B:28:ARG:NE	2.40	0.49
1:B:78:SER:HB2	1:B:87:LEU:CD2	2.42	0.49
1:A:13:TYR:CE2	1:A:88:ILE:HD13	2.47	0.49
1:A:17:GLU:OE1	1:A:29:ARG:NH2	2.39	0.48
1:A:236:GLU:HB3	2:C:1546:HIS:ND1	2.29	0.48
1:A:67:LEU:O	1:A:74:ARG:NH1	2.47	0.47
1:A:192:LYS:N	1:A:193:PRO:HD3	2.29	0.47
1:A:9:PHE:HB3	1:A:81:GLU:OE1	2.14	0.47
1:B:173:PHE:HE1	1:B:185:LEU:HD23	1.79	0.47
1:A:176:THR:O	1:A:180:LEU:HG	2.15	0.46
1:B:208:VAL:HG11	1:B:237:TRP:NE1	2.31	0.46
1:B:232:PHE:HB3	1:B:237:TRP:HB3	1.98	0.46
1:B:135:ASN:ND2	1:B:140:ASN:HD21	2.13	0.46
1:B:133:HIS:C	1:B:133:HIS:ND1	2.73	0.46
1:B:23:ALA:HB3	1:B:25:SER:OG	2.16	0.45
1:B:13:TYR:CE2	1:B:88:ILE:CD1	2.99	0.45
1:B:15:LEU:HD13	1:B:15:LEU:N	2.32	0.44
1:B:46:THR:HG23	1:B:54:HIS:HE2	1.82	0.44
1:B:192:LYS:N	1:B:193:PRO:HD3	2.32	0.44
1:A:232:PHE:HB3	1:A:237:TRP:HB3	1.99	0.44
1:A:78:SER:HB2	1:A:87:LEU:CD2	2.47	0.44
1:A:133:HIS:O	1:A:134:ARG:HB2	2.18	0.43
1:B:18:GLU:HA	1:B:28:ARG:CG	2.47	0.43
1:A:101:ILE:O	1:A:105:GLU:N	2.53	0.42
1:A:16:PHE:O	1:A:28:ARG:NE	2.40	0.42
1:B:42:LYS:O	1:B:44:ILE:HD12	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:170:TRP:CZ3	1:B:187:LYS:HA	2.54	0.42
1:A:173:PHE:HE1	1:A:185:LEU:HD23	1.84	0.42
1:A:176:THR:HG23	2:C:1556:GLN:HB2	2.02	0.42
1:A:106:TYR:HB2	1:A:207:LEU:O	2.20	0.41
1:B:121:GLU:HG2	1:B:266:LEU:HD21	2.02	0.41
1:A:181:SER:HG	1:A:184:VAL:HG23	1.84	0.41
1:B:30:CYS:SG	1:B:41:ALA:HB2	2.61	0.41
1:B:96:GLU:HG2	1:B:139:GLU:O	2.21	0.41
1:B:69:HIS:CG	1:B:70:PRO:HD2	2.56	0.40
1:A:170:TRP:CH2	1:A:187:LYS:HA	2.57	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	266/268 (99%)	246 (92%)	18 (7%)	2 (1%)	16	45
1	B	255/268 (95%)	233 (91%)	20 (8%)	2 (1%)	16	45
2	C	17/19 (90%)	13 (76%)	4 (24%)	0	100	100
2	D	13/19 (68%)	10 (77%)	3 (23%)	0	100	100
All	All	551/574 (96%)	502 (91%)	45 (8%)	4 (1%)	18	47

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	50	SER
1	A	77	ASP
1	B	77	ASP
1	B	201	VAL

5.3.2 Protein sidechains ⓘ

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	216/227 (95%)	196 (91%)	20 (9%)	8	29
1	B	208/227 (92%)	193 (93%)	15 (7%)	13	39
2	C	16/16 (100%)	15 (94%)	1 (6%)	16	43
2	D	11/16 (69%)	9 (82%)	2 (18%)	2	8
All	All	451/486 (93%)	413 (92%)	38 (8%)	10	33

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

Mol	Chain	Res	Type
1	A	7	THR
1	A	10	THR
1	A	15	LEU
1	A	25	SER
1	A	32	LYS
1	A	46	THR
1	A	50	SER
1	A	68	LYS
1	A	74	ARG
1	A	92	VAL
1	A	123	VAL
1	A	156	ASP
1	A	166	GLU
1	A	218	GLN
1	A	225	ILE
1	A	239	THR
1	A	241	THR
1	A	261	THR
1	A	272	SER
1	A	274	ARG
1	B	10	THR
1	B	15	LEU
1	B	25	SER
1	B	29	ARG

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Mol	Chain	Res	Type
1	B	32	LYS
1	B	46	THR
1	B	50	SER
1	B	92	VAL
1	B	123	VAL
1	B	156	ASP
1	B	167	GLN
1	B	225	ILE
1	B	239	THR
1	B	241	THR
1	B	243	GLU
2	C	1556	GLN
2	D	1556	GLN
2	D	1559	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	37	GLN
1	A	84	HIS
1	A	127	HIS
1	A	128	GLN
1	A	219	HIS
1	B	37	GLN
1	B	71	ASN
1	B	84	HIS
1	B	128	GLN
1	B	135	ASN
2	C	1552	GLN
2	D	1552	GLN
2	D	1556	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](#)

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	268/268 (100%)	0.02	9 (3%) 48 28	7, 17, 41, 76	0
1	B	261/268 (97%)	1.20	57 (21%) 2 1	23, 40, 91, 134	0
2	C	19/19 (100%)	-0.04	0 100 100	14, 22, 41, 65	0
2	D	15/19 (78%)	0.84	2 (13%) 7 4	26, 43, 100, 107	0
All	All	563/574 (98%)	0.59	68 (12%) 8 5	7, 29, 79, 134	0

All (68) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	54	HIS	7.7
1	B	24	PHE	6.6
1	B	147	LEU	6.2
1	B	51	ALA	5.6
1	B	20	GLY	5.3
1	B	34	LEU	4.9
1	B	45	ASN	4.4
1	B	81	GLU	4.3
1	B	44	ILE	4.3
1	B	83	GLY	4.2
1	B	19	LEU	4.1
1	B	273	HIS	4.0
1	B	35	ALA	3.9
1	B	37	GLN	3.7
1	B	23	ALA	3.7
1	B	145	SER	3.7
1	B	150	ALA	3.7
2	D	1547	ALA	3.6
1	B	46	THR	3.6
1	B	43	ILE	3.5
1	B	234	SER	3.4

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Mol	Chain	Res	Type	RSRZ
1	B	235	PRO	3.4
1	B	26	VAL	3.3
1	B	16	PHE	3.3
1	B	53	ASP	3.3
1	B	57	LEU	3.2
1	B	50	SER	3.2
1	B	14	GLN	3.2
1	B	33	VAL	3.0
1	B	18	GLU	3.0
1	B	80	SER	3.0
1	B	27	VAL	3.0
1	B	52	ARG	3.0
1	A	273	HIS	2.8
1	B	56	LYS	2.8
1	B	15	LEU	2.8
1	B	84	HIS	2.8
1	A	24	PHE	2.7
1	B	146	LYS	2.7
1	A	34	LEU	2.7
1	B	42	LYS	2.7
1	B	55	GLN	2.7
1	B	17	GLU	2.7
1	A	150	ALA	2.6
2	D	1546	HIS	2.6
1	B	28	ARG	2.6
1	B	58	GLU	2.5
1	B	41	ALA	2.4
1	B	178	GLY	2.4
1	B	82	GLU	2.4
1	B	76	HIS	2.3
1	A	219	HIS	2.3
1	B	118	GLN	2.3
1	B	21	LYS	2.3
1	A	8	ARG	2.3
1	B	29	ARG	2.3
1	B	237	TRP	2.2
1	B	25	SER	2.2
1	A	25	SER	2.2
1	B	36	GLY	2.2
1	A	274	ARG	2.1
1	B	115	CYS	2.1
1	B	79	ILE	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	180	LEU	2.1
1	B	85	HIS	2.1
1	B	224	GLN	2.1
1	B	238	ASP	2.0
1	A	78	SER	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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.