



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 27, 2023 – 02:05 PM EDT

PDB ID : 3E9T
Title : Crystal structure of Apo-form Calx CBD1 domain
Authors : Wu, M.; Zheng, L.
Deposited on : 2008-08-23
Resolution : 1.60 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 : 2.33
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) : 2.33

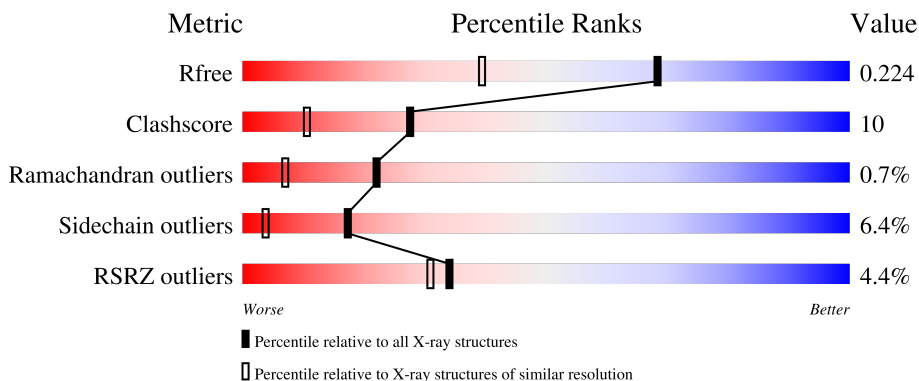
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.60 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	3398 (1.60-1.60)
Clashscore	141614	3665 (1.60-1.60)
Ramachandran outliers	138981	3564 (1.60-1.60)
Sidechain outliers	138945	3563 (1.60-1.60)
RSRZ outliers	127900	3321 (1.60-1.60)

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	114	 5% 81% 13% ...
1	B	114	 5% 84% 12% ...
1	C	114	 3% 77% 10% ... 8%
1	D	114	 4% 71% 14% ... 10%

2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 3949 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 Na/Ca exchange protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	112	Total 905	C 576	N 144	O 178	S 7	0	2	0
1	B	113	Total 917	C 584	N 145	O 181	S 7	0	3	0
1	C	105	Total 838	C 535	N 136	O 161	S 6	0	0	0
1	D	103	Total 822	C 525	N 134	O 157	S 6	0	1	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	440	GLU	-	EXPRESSION TAG	UNP Q24413
A	441	PHE	-	EXPRESSION TAG	UNP Q24413
B	440	GLU	-	EXPRESSION TAG	UNP Q24413
B	441	PHE	-	EXPRESSION TAG	UNP Q24413
C	440	GLU	-	EXPRESSION TAG	UNP Q24413
C	441	PHE	-	EXPRESSION TAG	UNP Q24413
D	440	GLU	-	EXPRESSION TAG	UNP Q24413
D	441	PHE	-	EXPRESSION TAG	UNP Q24413

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total 2	Ca 2	0	0
2	B	4	Total 4	Ca 4	0	0

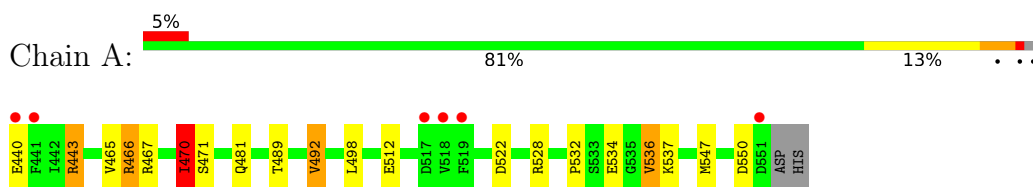
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	156	Total 156	O 156	0	0
3	B	118	Total 118	O 118	0	0
3	C	111	Total 111	O 111	0	0
3	D	76	Total 76	O 76	0	0

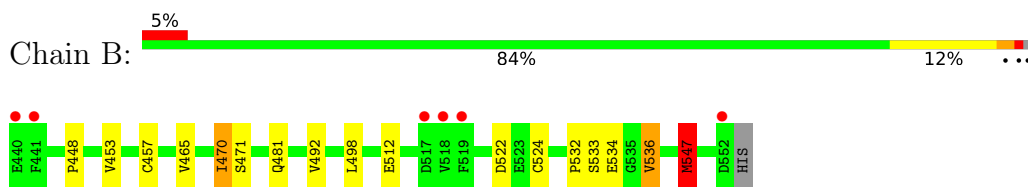
3 Residue-property plots [i](#)

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.

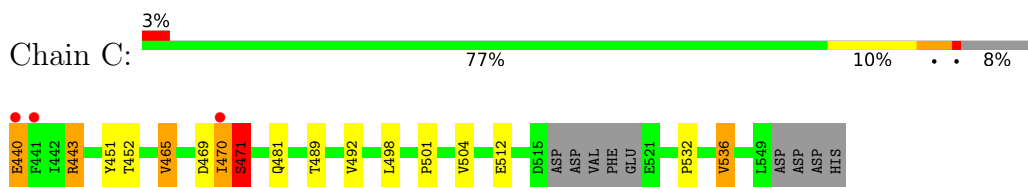
- Molecule 1: Na/Ca exchange protein



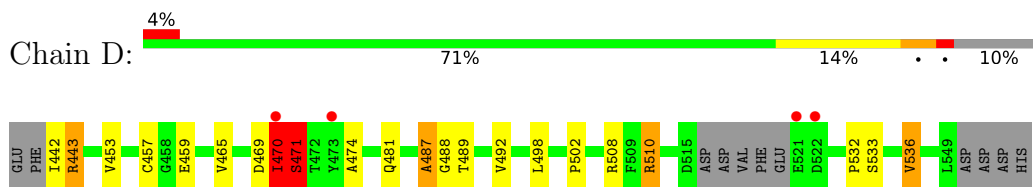
- Molecule 1: Na/Ca exchange protein



- Molecule 1: Na/Ca exchange protein



- Molecule 1: Na/Ca exchange protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	59.09Å 76.43Å 128.92Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.73 – 1.60 46.75 – 1.60	Depositor EDS
% Data completeness (in resolution range)	100.0 (46.73-1.60) 99.5 (46.75-1.60)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.34 (at 1.60Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.193 , 0.223 0.194 , 0.224	Depositor DCC
R_{free} test set	3868 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	17.6	Xtrriage
Anisotropy	0.117	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 43.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3949	wwPDB-VP
Average B, all atoms (Å ²)	22.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.96% 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](#)

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	0.59	0/930	0.74	1/1258 (0.1%)
1	B	0.63	0/945	0.79	2/1279 (0.2%)
1	C	0.62	0/855	0.92	5/1153 (0.4%)
1	D	0.57	0/841	0.84	4/1135 (0.4%)
All	All	0.60	0/3571	0.82	12/4825 (0.2%)

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
1	B	0	1
1	C	0	2
1	D	0	1
All	All	0	5

There are no bond length outliers.

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	443	ARG	NE-CZ-NH2	-10.15	115.22	120.30
1	C	443	ARG	NE-CZ-NH1	8.31	124.45	120.30
1	D	443	ARG	NE-CZ-NH2	-7.45	116.58	120.30
1	B	471	SER	N-CA-C	-7.24	91.46	111.00
1	C	452	THR	N-CA-C	6.99	129.87	111.00
1	C	471	SER	N-CA-C	-6.73	92.84	111.00
1	D	443	ARG	NE-CZ-NH1	6.04	123.32	120.30
1	A	471	SER	N-CA-C	-5.87	95.15	111.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	471	SER	N-CA-C	-5.56	95.98	111.00
1	C	465	VAL	CG1-CB-CG2	5.38	119.51	110.90
1	B	547	MET	CG-SD-CE	-5.20	91.89	100.20
1	D	470	ILE	C-N-CA	5.01	134.23	121.70

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	470	ILE	Peptide
1	B	470	ILE	Peptide
1	C	451	TYR	Peptide
1	C	470	ILE	Peptide
1	D	470	ILE	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	905	0	862	22	1
1	B	917	0	875	12	2
1	C	838	0	806	19	1
1	D	822	0	800	18	3
2	A	2	0	0	0	0
2	B	4	0	0	0	0
3	A	156	0	0	3	1
3	B	118	0	0	1	2
3	C	111	0	0	6	0
3	D	76	0	0	6	0
All	All	3949	0	3343	68	5

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 (68) 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:C:492:VAL:HB	3:C:647:HOH:O	1.41	1.18
1:A:443:ARG:HH11	1:A:443:ARG:HG2	1.03	1.12
1:A:492:VAL:HG13	1:A:512:GLU:HB2	1.50	0.93
1:C:501:PRO:HD2	1:C:504:VAL:HG21	1.54	0.89
1:A:443:ARG:HG2	1:A:443:ARG:NH1	1.84	0.89
1:C:501:PRO:O	1:C:504:VAL:HG22	1.78	0.84
1:A:443:ARG:HH11	1:A:443:ARG:CG	1.92	0.80
1:B:492[A]:VAL:HG22	1:B:512:GLU:HB2	1.69	0.75
1:D:469:ASP:OD1	1:D:471:SER:HB3	1.89	0.72
1:C:469:ASP:OD1	1:C:471:SER:HB3	1.90	0.71
1:D:469:ASP:OD1	1:D:471:SER:CB	2.39	0.71
1:C:492:VAL:HG22	1:C:512:GLU:HB2	1.72	0.71
1:B:453:VAL:CG1	1:B:457:CYS:SG	2.79	0.71
1:C:492:VAL:HG23	3:C:563:HOH:O	1.90	0.70
1:B:453:VAL:HG11	1:B:457:CYS:SG	2.32	0.69
1:C:481:GLN:OE1	3:C:569:HOH:O	2.09	0.69
1:C:492:VAL:CG2	1:C:512:GLU:HB2	2.24	0.68
1:A:481:GLN:HE22	1:C:481:GLN:HE22	1.41	0.67
1:A:443:ARG:HH12	1:A:537:LYS:HB3	1.59	0.66
1:A:465[A]:VAL:HG11	1:A:467:ARG:CZ	2.26	0.65
1:A:481:GLN:NE2	1:C:481:GLN:HE22	2.00	0.60
1:B:492[A]:VAL:CG2	1:B:512:GLU:HB2	2.31	0.59
1:D:488:GLY:N	3:D:339:HOH:O	2.36	0.58
1:A:489:THR:HG23	3:A:600:HOH:O	2.03	0.58
1:D:453:VAL:CG2	1:D:457:CYS:SG	2.92	0.58
1:B:524[B]:CYS:SG	1:B:547:MET:HE3	2.44	0.57
1:B:448:PRO:HG3	3:B:668:HOH:O	2.09	0.53
1:D:453:VAL:HG22	1:D:457:CYS:SG	2.49	0.53
1:A:481:GLN:HE22	1:A:528:ARG:HD2	1.73	0.53
1:D:532:PRO:HB2	1:D:536:VAL:HG22	1.91	0.52
1:D:470:ILE:O	1:D:470:ILE:HG22	2.10	0.51
1:D:508:ARG:NH1	3:D:360:HOH:O	2.44	0.51
1:A:532:PRO:HB2	1:A:536:VAL:HG22	1.92	0.51
1:A:534:GLU:HG2	3:A:677:HOH:O	2.11	0.51
1:D:470:ILE:H	1:D:471:SER:HB2	1.75	0.51
1:D:487:ALA:C	3:D:339:HOH:O	2.48	0.51
1:D:533:SER:O	1:D:536:VAL:HG13	2.12	0.50
1:C:532:PRO:HB2	1:C:536:VAL:HG22	1.93	0.49
1:C:501:PRO:CD	1:C:504:VAL:HG21	2.32	0.49
1:D:470:ILE:O	1:D:470:ILE:CG2	2.60	0.48
1:A:443:ARG:NH1	1:A:443:ARG:CG	2.62	0.48
1:A:465[A]:VAL:HG12	1:A:466:ARG:N	2.29	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:492:VAL:CG2	3:C:563:HOH:O	2.57	0.47
1:D:442:ILE:N	3:D:229:HOH:O	2.48	0.47
1:D:474:ALA:HB2	3:D:380:HOH:O	2.14	0.47
1:A:443:ARG:NH1	1:A:537:LYS:HB3	2.29	0.46
1:B:524[B]:CYS:SG	1:B:547:MET:CE	3.03	0.46
1:A:440:GLU:HB2	3:A:617:HOH:O	2.15	0.45
1:D:453:VAL:HG21	1:D:457:CYS:SG	2.56	0.45
1:A:465[A]:VAL:HG11	1:A:467:ARG:NH2	2.33	0.44
1:C:504:VAL:HB	3:C:611:HOH:O	2.16	0.44
1:A:465[A]:VAL:CG1	1:A:467:ARG:CZ	2.94	0.43
1:D:459:GLU:HG2	1:D:510:ARG:HB3	1.99	0.43
1:B:453:VAL:HG12	1:B:457:CYS:SG	2.57	0.43
1:B:533:SER:O	1:B:536:VAL:HG13	2.18	0.43
1:C:440:GLU:N	3:C:613:HOH:O	2.51	0.43
1:D:487:ALA:O	3:D:329:HOH:O	2.21	0.43
1:A:481:GLN:NE2	1:A:528:ARG:HD2	2.34	0.42
1:B:534:GLU:HB3	1:D:502:PRO:HB2	2.02	0.42
1:A:470:ILE:O	1:A:470:ILE:HG23	2.19	0.42
1:B:532:PRO:HB2	1:B:536:VAL:HG22	2.01	0.42
1:C:469:ASP:OD1	1:C:471:SER:CB	2.65	0.42
1:C:470:ILE:HG23	1:C:470:ILE:O	2.20	0.41
1:B:522:ASP:HB3	1:B:547:MET:HE1	2.03	0.41
1:A:466:ARG:HH11	1:A:466:ARG:HD3	1.69	0.41
1:C:492:VAL:HG21	1:C:512:GLU:HB2	2.03	0.40
1:C:504:VAL:HG23	1:C:504:VAL:O	2.20	0.40
1:A:443:ARG:HA	1:A:537:LYS:O	2.21	0.40

All (5) 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)
1:B:522:ASP:OD1	1:C:443:ARG:NH2[1_655]	1.92	0.28
1:B:481:GLN:NE2	1:D:481:GLN:NE2[4_555]	2.01	0.19
1:D:481:GLN:OE1	3:B:656:HOH:O[4_455]	2.06	0.14
1:A:522:ASP:OD1	1:D:443:ARG:NH2[4_455]	2.12	0.08
3:A:690:HOH:O	3:B:668:HOH:O[1_455]	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	112/114 (98%)	112 (100%)	0	0	100	100
1	B	114/114 (100%)	112 (98%)	1 (1%)	1 (1%)	17	4
1	C	101/114 (89%)	100 (99%)	1 (1%)	0	100	100
1	D	100/114 (88%)	97 (97%)	1 (1%)	2 (2%)	7	1
All	All	427/456 (94%)	421 (99%)	3 (1%)	3 (1%)	22	7

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	471	SER
1	D	487	ALA
1	B	470	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	100/100 (100%)	92 (92%)	8 (8%)	12	2
1	B	102/100 (102%)	97 (95%)	5 (5%)	25	6
1	C	90/100 (90%)	84 (93%)	6 (7%)	16	3
1	D	89/100 (89%)	82 (92%)	7 (8%)	12	2
All	All	381/400 (95%)	355 (93%)	26 (7%)	17	3

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	443	ARG
1	A	466	ARG
1	A	470	ILE
1	A	492	VAL
1	A	498	LEU
1	A	536	VAL
1	A	547	MET
1	A	550	ASP
1	B	465[A]	VAL
1	B	465[B]	VAL
1	B	498	LEU
1	B	536	VAL
1	B	547	MET
1	C	440	GLU
1	C	465	VAL
1	C	471	SER
1	C	489	THR
1	C	498	LEU
1	C	536	VAL
1	D	465[A]	VAL
1	D	465[B]	VAL
1	D	489	THR
1	D	492	VAL
1	D	498	LEU
1	D	510	ARG
1	D	536	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	481	GLN
1	B	507	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](#)

Of 6 ligands modelled in this entry, 6 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

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, 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	112/114 (98%)	0.28	6 (5%) 25 23	14, 18, 33, 39	0
1	B	113/114 (99%)	0.19	6 (5%) 26 24	13, 17, 28, 39	0
1	C	105/114 (92%)	0.05	3 (2%) 51 49	15, 20, 28, 40	0
1	D	103/114 (90%)	0.43	4 (3%) 39 36	18, 22, 30, 43	0
All	All	433/456 (94%)	0.23	19 (4%) 34 31	13, 20, 31, 43	0

All (19) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	519	PHE	8.6
1	A	441	PHE	7.8
1	C	441	PHE	7.6
1	B	441	PHE	6.0
1	D	470	ILE	5.3
1	B	519	PHE	5.0
1	D	521	GLU	4.9
1	A	518	VAL	3.9
1	D	522	ASP	3.8
1	C	470	ILE	3.7
1	A	440	GLU	3.3
1	D	473	TYR	3.3
1	B	517	ASP	3.2
1	B	552	ASP	3.1
1	B	518	VAL	3.0
1	A	551	ASP	2.9
1	A	517	ASP	2.6
1	B	440	GLU	2.4
1	C	440	GLU	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](#)

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(Å ²)	Q<0.9
2	CA	B	4	1/1	0.94	0.24	20,20,20,20	0
2	CA	A	6	1/1	0.96	0.33	31,31,31,31	0
2	CA	B	2	1/1	0.98	0.38	30,30,30,30	0
2	CA	B	3	1/1	0.98	0.29	24,24,24,24	0
2	CA	A	1	1/1	0.98	0.25	23,23,23,23	0
2	CA	B	5	1/1	0.99	0.29	23,23,23,23	0

6.5 Other polymers [i](#)

There are no such residues in this entry.