



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 17, 2021 – 05:06 AM EDT

PDB ID : 1M9D
Title : X-ray crystal structure of Cyclophilin A/HIV-1 CA N-terminal domain (1-146)
O-type chimera Complex.
Authors : Howard, B.R.; Vajdos, F.F.; Li, S.; Sundquist, W.I.; Hill, C.P.
Deposited on : 2002-07-28
Resolution : 1.90 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 : 2.23.2
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) : 2.23.2

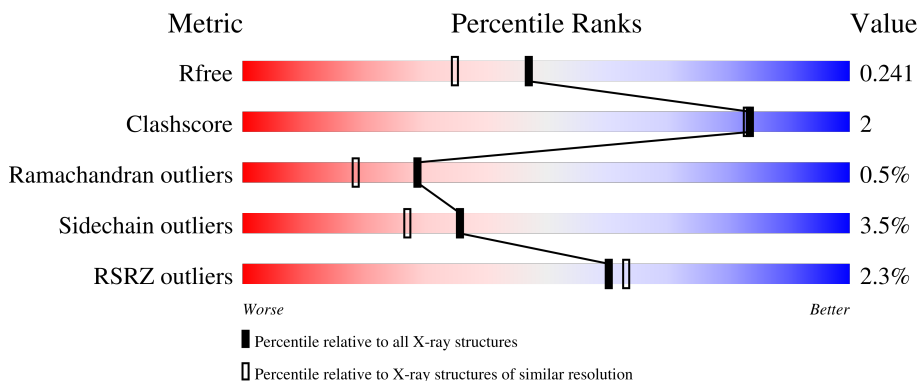
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.90 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	6207 (1.90-1.90)
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)
RSRZ outliers	127900	6082 (1.90-1.90)

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	165	 3% 88% 11% .
1	B	165	 % 84% 14% ..
2	C	146	 2% 86% 14% .
2	D	146	 3% 81% 13% 6%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 5363 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 Cyclophilin A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	165	1266	802	218	237	9	0	0	0
1	B	163	1251	792	216	235	8	0	0	0

- Molecule 2 is a protein called HIV-1 Capsid.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	C	146	1131	716	198	209	8	0	0	0
2	D	146	1131	716	198	209	8	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	83	THR	LEU	engineered mutation	UNP Q72497
C	86	PRO	VAL	engineered mutation	UNP Q72497
C	87	ALA	HIS	engineered mutation	UNP Q72497
C	88	MET	ALA	engineered mutation	UNP Q72497
C	91	LEU	ILE	engineered mutation	UNP Q72497
C	92	PRO	ALA	engineered mutation	UNP Q72497
C	96	ILE	MET	engineered mutation	UNP Q72497
C	120	HIS	ASN	SEE REMARK 999	UNP Q72497
D	83	THR	LEU	engineered mutation	UNP Q72497
D	86	PRO	VAL	engineered mutation	UNP Q72497
D	87	ALA	HIS	engineered mutation	UNP Q72497
D	88	MET	ALA	engineered mutation	UNP Q72497
D	91	LEU	ILE	engineered mutation	UNP Q72497
D	92	PRO	ALA	engineered mutation	UNP Q72497
D	96	ILE	MET	engineered mutation	UNP Q72497
D	120	HIS	ASN	SEE REMARK 999	UNP Q72497

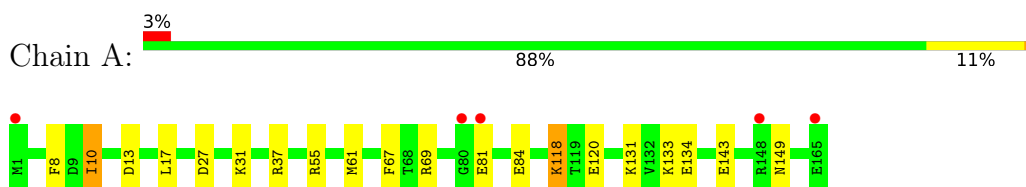
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	172	Total 172	O 172	0	0
3	B	144	Total 144	O 144	0	0
3	C	154	Total 154	O 154	0	0
3	D	114	Total 114	O 114	0	0

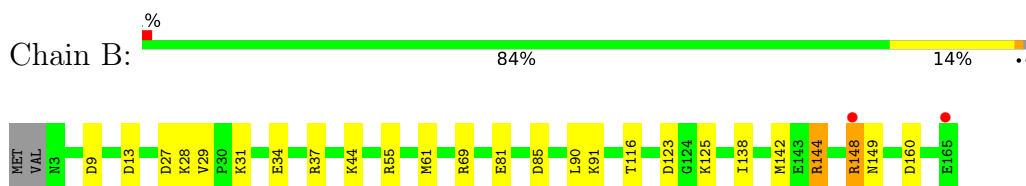
3 Residue-property plots [i](#)

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.

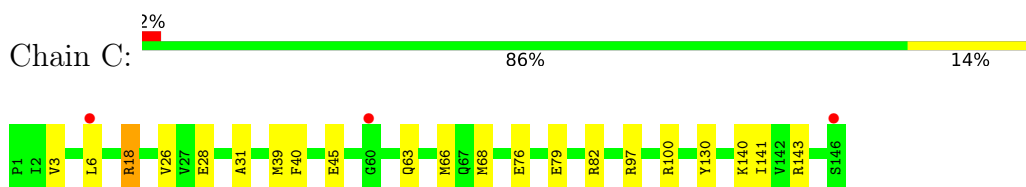
- Molecule 1: Cyclophilin A



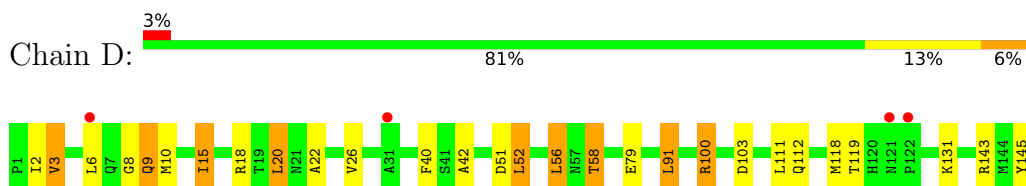
- Molecule 1: Cyclophilin A



- Molecule 2: HIV-1 Capsid



- Molecule 2: HIV-1 Capsid



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	38.90Å 109.30Å 67.70Å 90.00° 99.70° 90.00°	Depositor
Resolution (Å)	67.42 – 1.90 14.94 – 1.90	Depositor EDS
% Data completeness (in resolution range)	94.0 (67.42-1.90) 94.0 (14.94-1.90)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	0.05	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.00 (at 1.89Å)	Xtrriage
Refinement program	REFMAC 5.0	Depositor
R, R_{free}	0.163 , 0.232 0.173 , 0.241	Depositor DCC
R_{free} test set	4031 reflections (9.55%)	wwPDB-VP
Wilson B-factor (Å ²)	24.4	Xtrriage
Anisotropy	0.062	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 43.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	5363	wwPDB-VP
Average B, all atoms (Å ²)	28.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.97% 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	0.80	0/1294	1.51	15/1733 (0.9%)
1	B	0.73	0/1279	1.57	20/1713 (1.2%)
2	C	0.74	0/1160	1.54	17/1580 (1.1%)
2	D	0.75	0/1160	1.72	20/1580 (1.3%)
All	All	0.75	0/4893	1.59	72/6606 (1.1%)

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	C	0	1
2	D	0	2
All	All	0	3

There are no bond length outliers.

All (72) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	100	ARG	NE-CZ-NH2	-19.84	110.38	120.30
2	D	100	ARG	NE-CZ-NH1	15.07	127.84	120.30
2	C	100	ARG	NE-CZ-NH1	14.32	127.46	120.30
2	D	52	LEU	CB-CG-CD1	10.97	129.64	111.00
1	A	55	ARG	NE-CZ-NH2	-10.32	115.14	120.30
1	B	37	ARG	NE-CZ-NH2	-10.09	115.25	120.30
1	B	55	ARG	NE-CZ-NH2	-9.68	115.46	120.30
1	B	144	ARG	NE-CZ-NH1	9.32	124.96	120.30
1	B	123	ASP	CB-CG-OD2	8.80	126.22	118.30
2	D	143	ARG	NE-CZ-NH1	8.75	124.67	120.30
2	D	91	LEU	CB-CG-CD1	8.41	125.30	111.00
2	C	82	ARG	NE-CZ-NH1	7.81	124.20	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	82	ARG	NE-CZ-NH2	-7.78	116.41	120.30
2	D	18	ARG	NE-CZ-NH2	-7.77	116.42	120.30
1	B	160	ASP	CB-CG-OD2	7.71	125.24	118.30
2	C	18	ARG	NE-CZ-NH2	-7.67	116.46	120.30
2	D	143	ARG	NE-CZ-NH2	-7.48	116.56	120.30
1	B	148	ARG	NE-CZ-NH1	7.46	124.03	120.30
1	A	131	LYS	CD-CE-NZ	7.45	128.82	111.70
2	D	145	TYR	OH-CZ-CE2	7.29	139.77	120.10
1	A	13	ASP	CB-CG-OD1	7.04	124.63	118.30
1	A	10	ILE	CG1-CB-CG2	-6.94	96.14	111.40
2	D	20	LEU	CB-CG-CD2	6.89	122.71	111.00
2	D	145	TYR	CB-CG-CD2	6.85	125.11	121.00
1	A	118	LYS	CD-CE-NZ	-6.81	96.05	111.70
2	D	111	LEU	CB-CG-CD1	6.65	122.30	111.00
1	B	69	ARG	NE-CZ-NH1	6.61	123.60	120.30
2	C	39	MET	CG-SD-CE	-6.52	89.77	100.20
2	C	97	ARG	NE-CZ-NH1	6.39	123.50	120.30
2	D	145	TYR	CD1-CE1-CZ	6.21	125.39	119.80
2	C	3	VAL	CA-CB-CG2	6.21	120.22	110.90
2	D	40	PHE	CB-CG-CD1	-6.19	116.47	120.80
1	A	8	PHE	CB-CG-CD1	6.12	125.09	120.80
1	A	69	ARG	NE-CZ-NH2	-6.06	117.27	120.30
1	B	55	ARG	NE-CZ-NH1	5.99	123.30	120.30
2	D	103	ASP	CB-CG-OD2	5.97	123.67	118.30
1	B	44	LYS	CD-CE-NZ	5.95	125.39	111.70
1	B	9	ASP	CB-CG-OD1	5.93	123.64	118.30
1	B	27	ASP	CB-CG-OD1	5.83	123.55	118.30
2	D	79	GLU	CG-CD-OE2	-5.81	106.69	118.30
2	D	100	ARG	CG-CD-NE	-5.80	99.61	111.80
1	A	17	LEU	CB-CG-CD1	5.77	120.81	111.00
1	B	29	VAL	CG1-CB-CG2	-5.75	101.70	110.90
2	C	79	GLU	CG-CD-OE1	-5.71	106.89	118.30
2	C	143	ARG	NE-CZ-NH2	-5.70	117.45	120.30
1	B	13	ASP	CB-CG-OD2	5.67	123.40	118.30
1	B	37	ARG	NE-CZ-NH1	5.65	123.13	120.30
1	A	143	GLU	CB-CA-C	-5.65	99.11	110.40
1	A	27	ASP	CB-CG-OD1	5.64	123.38	118.30
2	D	58	THR	OG1-CB-CG2	-5.61	97.09	110.00
1	B	34	GLU	OE1-CD-OE2	-5.58	116.61	123.30
2	C	26	VAL	CG1-CB-CG2	-5.58	101.98	110.90
2	C	130	TYR	CB-CG-CD1	5.54	124.32	121.00
1	A	37	ARG	NE-CZ-NH1	5.51	123.06	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	56	LEU	CB-CG-CD1	5.48	120.32	111.00
2	C	66	MET	CG-SD-CE	-5.42	91.54	100.20
1	B	90	LEU	CB-CG-CD2	5.41	120.20	111.00
2	C	76	GLU	OE1-CD-OE2	-5.37	116.85	123.30
2	C	45	GLU	OE1-CD-OE2	-5.33	116.90	123.30
1	A	55	ARG	NE-CZ-NH1	5.32	122.96	120.30
2	C	100	ARG	NH1-CZ-NH2	-5.30	113.57	119.40
1	B	144	ARG	NE-CZ-NH2	-5.28	117.66	120.30
1	B	149	ASN	CB-CA-C	-5.25	99.89	110.40
2	C	143	ARG	NE-CZ-NH1	5.23	122.92	120.30
2	C	18	ARG	NE-CZ-NH1	5.22	122.91	120.30
2	D	100	ARG	CD-NE-CZ	5.16	130.82	123.60
2	D	3	VAL	CB-CA-C	-5.14	101.63	111.40
1	B	85	ASP	CB-CG-OD1	-5.14	113.68	118.30
1	B	116	THR	OG1-CB-CG2	-5.14	98.19	110.00
1	A	67	PHE	CB-CG-CD2	-5.13	117.21	120.80
1	A	69	ARG	NE-CZ-NH1	5.13	122.86	120.30
1	A	37	ARG	NE-CZ-NH2	-5.07	117.76	120.30

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	C	40	PHE	Sidechain
2	D	118	MET	Mainchain
2	D	42	ALA	Mainchain

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	1266	0	1237	6	0
1	B	1251	0	1216	4	0
2	C	1131	0	1131	6	0
2	D	1131	0	1131	7	0
3	A	172	0	0	2	0
3	B	144	0	0	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	154	0	0	2	0
3	D	114	0	0	0	0
All	All	5363	0	4715	23	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 2.

All (23) 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:134:GLU:OE1	3:A:312:HOH:O	2.12	0.66
2:D:8:GLY:O	2:D:9:GLN:HG2	1.97	0.64
2:D:2:ILE:HD12	2:D:119:THR:HG22	1.79	0.64
2:D:20:LEU:HD11	2:D:58:THR:HG21	1.80	0.63
2:C:68:MET:CE	2:C:141:ILE:HG22	2.28	0.63
2:C:68:MET:HE2	2:C:141:ILE:HG22	1.83	0.61
2:D:15:ILE:HG23	2:D:51:ASP:OD1	2.02	0.60
1:B:125:LYS:NZ	3:B:280:HOH:O	2.39	0.54
1:A:10:ILE:HD12	1:A:10:ILE:N	2.24	0.52
2:C:18:ARG:NH1	3:C:299:HOH:O	2.35	0.50
1:B:81:GLU:HG3	3:B:182:HOH:O	2.12	0.50
1:A:31:LYS:NZ	1:A:84:GLU:OE2	2.35	0.50
1:A:84:GLU:H	1:A:84:GLU:CD	2.16	0.49
1:A:149:ASN:ND2	3:A:266:HOH:O	2.30	0.47
2:C:68:MET:HE1	2:C:141:ILE:HG22	1.97	0.47
1:B:138:ILE:HG22	1:B:142:MET:CE	2.45	0.47
2:C:6:LEU:HD12	2:C:6:LEU:H	1.83	0.43
2:D:2:ILE:CD1	2:D:119:THR:HG22	2.46	0.43
2:D:2:ILE:HD11	2:D:10:MET:CB	2.48	0.43
1:A:118:LYS:HD3	1:A:120:GLU:HG3	2.01	0.43
2:C:140:LYS:NZ	3:C:289:HOH:O	2.38	0.43
2:D:22:ALA:O	2:D:26:VAL:HG23	2.20	0.42
1:B:31:LYS:NZ	3:B:241:HOH:O	2.54	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	163/165 (99%)	155 (95%)	7 (4%)	1 (1%)	25	15
1	B	161/165 (98%)	155 (96%)	6 (4%)	0	100	100
2	C	144/146 (99%)	140 (97%)	3 (2%)	1 (1%)	22	12
2	D	144/146 (99%)	140 (97%)	3 (2%)	1 (1%)	22	12
All	All	612/622 (98%)	590 (96%)	19 (3%)	3 (0%)	29	18

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	C	31	ALA
1	A	81	GLU
2	D	9	GLN

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	133/133 (100%)	131 (98%)	2 (2%)	65	62
1	B	131/133 (98%)	126 (96%)	5 (4%)	33	24
2	C	123/124 (99%)	121 (98%)	2 (2%)	62	60
2	D	123/124 (99%)	114 (93%)	9 (7%)	14	6
All	All	510/514 (99%)	492 (96%)	18 (4%)	36	27

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	61	MET
1	A	133	LYS
1	B	28	LYS
1	B	61	MET
1	B	91	LYS
1	B	144	ARG
1	B	148	ARG
2	C	28	GLU
2	C	63	GLN
2	D	3	VAL
2	D	6	LEU
2	D	15	ILE
2	D	52	LEU
2	D	56	LEU
2	D	91	LEU
2	D	100	ARG
2	D	112	GLN
2	D	131	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
2	C	57	ASN
2	D	7	GLN
2	D	95	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	165/165 (100%)	-0.23	5 (3%) 50 53	15, 22, 36, 61	0
1	B	163/165 (98%)	-0.22	2 (1%) 79 81	18, 28, 38, 60	0
2	C	146/146 (100%)	-0.07	3 (2%) 63 66	14, 26, 50, 63	0
2	D	146/146 (100%)	0.04	4 (2%) 54 57	15, 29, 48, 60	0
All	All	620/622 (99%)	-0.12	14 (2%) 60 63	14, 26, 44, 63	0

All (14) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	165	GLU	5.1
2	C	6	LEU	4.1
2	C	146	SER	3.9
2	D	121	ASN	3.4
2	D	31	ALA	3.2
2	C	60	GLY	3.0
2	D	6	LEU	2.9
1	A	80	GLY	2.9
2	D	122	PRO	2.9
1	A	81	GLU	2.6
1	B	148	ARG	2.6
1	A	165	GLU	2.5
1	A	148	ARG	2.4
1	A	1	MET	2.2

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.