



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 03:49 AM UTC

PDB ID : 1WP8 / pdb_00001wp8
Title : crystal structure of Hendra Virus fusion core
Authors : Xu, Y.; Liu, Y.; Lou, Z.; Su, N.; Bai, Z.; Gao, G.F.; Rao, Z.
Deposited on : 2004-08-31
Resolution : 2.20 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

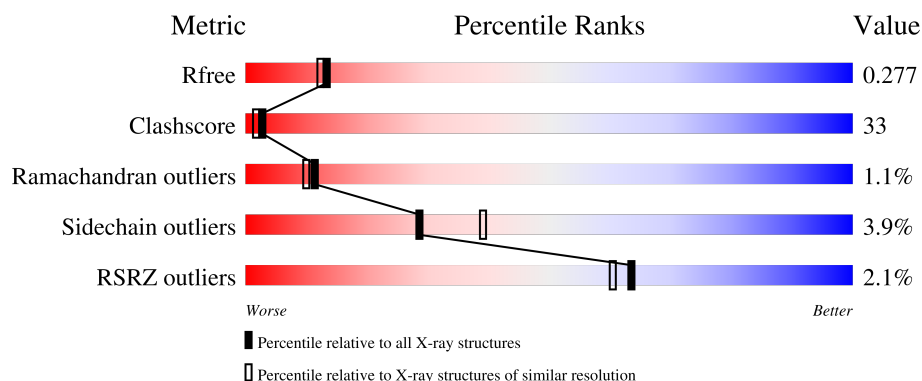
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	89	% 37% 33% • 28%
1	B	89	2% 39% 29% • 28%
1	C	89	% 42% 27% • 29%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 1670 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 Fusion glycoprotein F0,Fusion glycoprotein F0.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	64	Total	C	N	O	S	0	0	0
			499	309	82	107	1			
1	B	64	Total	C	N	O	S	0	0	0
			497	309	81	106	1			
1	C	63	Total	C	N	O	S	0	0	0
			491	303	81	106	1			

There are 42 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	200	GLY	-	linker	UNP O89342
A	201	GLY	-	linker	UNP O89342
A	202	SER	-	linker	UNP O89342
A	203	GLY	-	linker	UNP O89342
A	204	GLY	-	linker	UNP O89342
A	205	SER	-	linker	UNP O89342
A	206	GLY	-	linker	UNP O89342
A	207	GLY	-	linker	UNP O89342
A	486	HIS	-	expression tag	UNP O89342
A	487	HIS	-	expression tag	UNP O89342
A	488	HIS	-	expression tag	UNP O89342
A	489	HIS	-	expression tag	UNP O89342
A	490	HIS	-	expression tag	UNP O89342
A	491	HIS	-	expression tag	UNP O89342
B	200	GLY	-	linker	UNP O89342
B	201	GLY	-	linker	UNP O89342
B	202	SER	-	linker	UNP O89342
B	203	GLY	-	linker	UNP O89342
B	204	GLY	-	linker	UNP O89342
B	205	SER	-	linker	UNP O89342
B	206	GLY	-	linker	UNP O89342
B	207	GLY	-	linker	UNP O89342
B	486	HIS	-	expression tag	UNP O89342

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Chain	Residue	Modelled	Actual	Comment	Reference
B	487	HIS	-	expression tag	UNP O89342
B	488	HIS	-	expression tag	UNP O89342
B	489	HIS	-	expression tag	UNP O89342
B	490	HIS	-	expression tag	UNP O89342
B	491	HIS	-	expression tag	UNP O89342
C	200	GLY	-	linker	UNP O89342
C	201	GLY	-	linker	UNP O89342
C	202	SER	-	linker	UNP O89342
C	203	GLY	-	linker	UNP O89342
C	204	GLY	-	linker	UNP O89342
C	205	SER	-	linker	UNP O89342
C	206	GLY	-	linker	UNP O89342
C	207	GLY	-	linker	UNP O89342
C	486	HIS	-	expression tag	UNP O89342
C	487	HIS	-	expression tag	UNP O89342
C	488	HIS	-	expression tag	UNP O89342
C	489	HIS	-	expression tag	UNP O89342
C	490	HIS	-	expression tag	UNP O89342
C	491	HIS	-	expression tag	UNP O89342

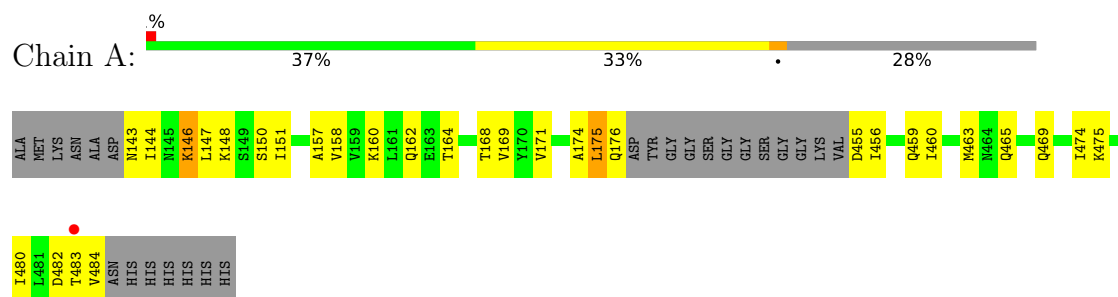
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	58	Total O 58 58	0	0
2	B	65	Total O 65 65	0	0
2	C	60	Total O 60 60	0	0

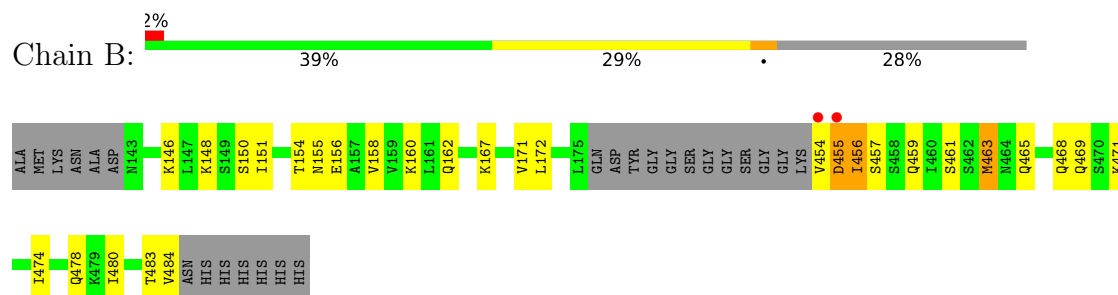
3 Residue-property plots [i](#)

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.

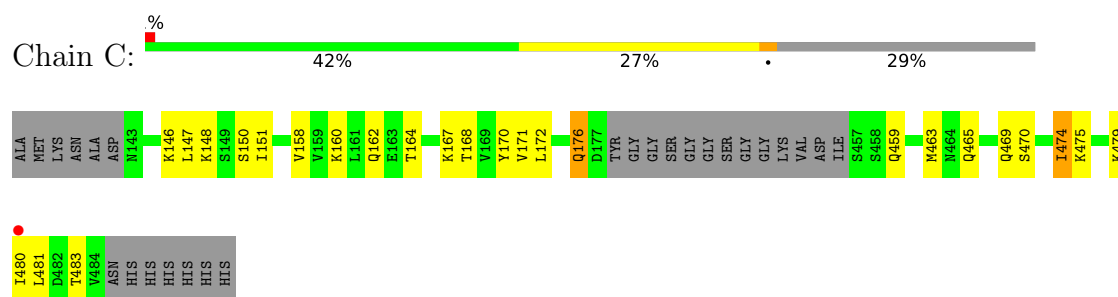
- Molecule 1: Fusion glycoprotein F0,Fusion glycoprotein F0



- Molecule 1: Fusion glycoprotein F0,Fusion glycoprotein F0



- Molecule 1: Fusion glycoprotein F0,Fusion glycoprotein F0



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	32.19Å 31.90Å 53.87Å 86.33° 86.16° 67.98°	Depositor
Resolution (Å)	35.00 – 2.20 35.00 – 2.20	Depositor EDS
% Data completeness (in resolution range)	(Not available) (35.00-2.20) 94.1 (35.00-2.20)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.57 (at 2.20Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.213 , 0.274 0.213 , 0.277	Depositor DCC
R_{free} test set	525 reflections (5.32%)	wwPDB-VP
Wilson B-factor (Å ²)	17.6	Xtriage
Anisotropy	0.640	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 71.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.52$, $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	0.009 for -k,-h,-l	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	1670	wwPDB-VP
Average B, all atoms (Å ²)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 20.56 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 8.4554e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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	0.44	0/499	0.87	1/670 (0.1%)
1	B	0.51	1/497 (0.2%)	0.81	0/668
1	C	0.47	0/491	0.86	1/659 (0.2%)
All	All	0.47	1/1487 (0.1%)	0.85	2/1997 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	463	MET	SD-CE	-6.40	1.63	1.79

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	459	GLN	N-CA-C	-7.02	103.71	111.36
1	A	144	ILE	N-CA-C	-6.47	104.18	110.72

There are no chirality outliers.

There are no planarity outliers.

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	499	0	515	44	0
1	B	497	0	516	34	0
1	C	491	0	504	31	0
2	A	58	0	0	12	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	65	0	0	15	0
2	C	60	0	0	11	0
All	All	1670	0	1535	100	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 33.

All (100) 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:151:ILE:HD13	1:C:151:ILE:HD11	1.37	1.07
1:A:146:LYS:HG2	1:A:484:VAL:HG22	1.43	0.98
1:A:146:LYS:HB2	1:A:146:LYS:HZ3	1.39	0.88
1:A:146:LYS:HE2	1:A:484:VAL:HA	1.56	0.88
1:C:164:THR:HA	2:C:549:HOH:O	1.76	0.86
1:A:147:LEU:O	1:A:151:ILE:HG12	1.78	0.82
1:B:151:ILE:HB	2:B:512:HOH:O	1.80	0.82
1:A:168:THR:HA	2:A:519:HOH:O	1.82	0.79
1:A:474:ILE:HG12	2:C:538:HOH:O	1.84	0.77
1:C:158:VAL:O	1:C:162:GLN:HG3	1.85	0.76
1:B:146:LYS:HB3	2:B:501:HOH:O	1.89	0.72
1:A:455:ASP:O	1:A:459:GLN:HG2	1.90	0.71
1:C:150:SER:HB2	1:C:480:ILE:HG22	1.75	0.69
1:A:174:ALA:O	1:A:176:GLN:N	2.26	0.67
1:A:463:MET:SD	2:A:545:HOH:O	2.53	0.67
1:C:463:MET:HG2	2:C:549:HOH:O	1.94	0.66
1:A:169:VAL:HG22	1:B:463:MET:HE2	1.80	0.64
1:A:143:ASN:HA	1:A:146:LYS:NZ	2.13	0.64
1:B:151:ILE:CD1	1:C:151:ILE:HD11	2.21	0.64
1:B:474:ILE:HA	2:B:538:HOH:O	1.98	0.63
1:B:480:ILE:HG12	2:B:547:HOH:O	1.97	0.63
1:A:460:ILE:HA	1:A:463:MET:HE2	1.81	0.62
1:B:172:LEU:HD13	1:C:171:VAL:HG21	1.81	0.62
1:B:148:LYS:HG3	1:C:481:LEU:HD11	1.81	0.61
1:B:154:THR:HA	2:B:538:HOH:O	1.99	0.61
1:B:154:THR:HG22	2:B:536:HOH:O	2.00	0.61
1:B:167:LYS:O	1:B:171:VAL:HG23	2.01	0.60
1:A:143:ASN:HA	1:A:146:LYS:HZ1	1.67	0.59
1:B:459:GLN:HA	2:B:543:HOH:O	2.00	0.59
1:C:167:LYS:HA	1:C:170:TYR:CD1	2.36	0.59
1:A:158:VAL:O	1:A:162:GLN:HG3	2.03	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:474:ILE:O	1:B:478:GLN:HG3	2.03	0.58
1:A:175:LEU:O	1:A:176:GLN:HG3	2.03	0.58
1:C:475:LYS:HD3	2:C:508:HOH:O	2.04	0.58
1:A:146:LYS:HD2	1:A:483:THR:HB	1.86	0.58
2:A:521:HOH:O	1:C:162:GLN:HG2	2.04	0.56
1:B:454:VAL:HG12	1:B:455:ASP:OD2	2.05	0.56
1:B:461:SER:O	1:B:465:GLN:HG3	2.05	0.56
1:A:147:LEU:HD21	2:C:525:HOH:O	2.06	0.56
1:A:146:LYS:HG2	1:A:484:VAL:CG2	2.26	0.55
1:B:468:GLN:HA	1:B:471:LYS:HE2	1.87	0.55
1:B:468:GLN:HA	1:B:471:LYS:CE	2.36	0.55
1:C:463:MET:HA	2:C:549:HOH:O	2.07	0.54
1:B:167:LYS:HD2	2:B:543:HOH:O	2.06	0.54
1:C:465:GLN:O	1:C:469:GLN:HG3	2.08	0.54
1:C:168:THR:O	1:C:171:VAL:HG22	2.08	0.54
1:C:146:LYS:NZ	1:C:483:THR:HB	2.23	0.53
1:B:158:VAL:O	1:B:162:GLN:HG3	2.09	0.53
1:A:475:LYS:HE3	2:A:501:HOH:O	2.11	0.51
1:C:147:LEU:O	1:C:151:ILE:HG12	2.09	0.51
1:B:146:LYS:HB2	2:B:542:HOH:O	2.10	0.51
1:A:456:ILE:HB	1:C:176:GLN:NE2	2.26	0.51
1:A:150:SER:HB2	1:A:480:ILE:HG22	1.91	0.51
1:A:465:GLN:HG3	1:A:469:GLN:HE21	1.76	0.51
1:A:459:GLN:O	1:A:463:MET:HG3	2.11	0.50
1:A:175:LEU:C	1:A:176:GLN:HG3	2.37	0.50
1:B:454:VAL:HG12	1:B:455:ASP:N	2.26	0.50
1:C:160:LYS:HB3	1:C:470:SER:HB2	1.93	0.50
1:A:455:ASP:HB2	2:A:506:HOH:O	2.11	0.50
1:C:171:VAL:HG23	1:C:172:LEU:N	2.27	0.50
1:A:456:ILE:O	1:A:460:ILE:HG13	2.13	0.48
1:B:155:ASN:HA	2:B:536:HOH:O	2.12	0.48
1:A:146:LYS:HD2	1:A:483:THR:CB	2.44	0.48
1:A:463:MET:HB2	2:A:531:HOH:O	2.13	0.47
1:A:150:SER:HB2	1:A:480:ILE:CG2	2.45	0.47
2:A:546:HOH:O	1:C:158:VAL:HG21	2.14	0.46
1:A:146:LYS:HZ3	1:A:146:LYS:CB	2.21	0.46
1:B:480:ILE:HG13	2:B:500:HOH:O	2.15	0.46
1:A:174:ALA:C	1:A:176:GLN:H	2.17	0.46
1:C:481:LEU:HD13	2:C:550:HOH:O	2.15	0.45
1:A:463:MET:HE1	1:C:172:LEU:HD12	1.99	0.45
1:C:172:LEU:HB2	2:C:544:HOH:O	2.15	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:474:ILE:HD13	2:A:546:HOH:O	2.17	0.45
1:C:146:LYS:HD3	1:C:483:THR:OG1	2.16	0.45
1:B:146:LYS:HD3	1:B:483:THR:HG22	1.99	0.44
1:B:484:VAL:HG22	2:B:542:HOH:O	2.17	0.44
1:B:454:VAL:HA	2:B:522:HOH:O	2.17	0.44
1:A:146:LYS:HB2	1:A:146:LYS:NZ	2.20	0.44
1:A:150:SER:HB3	2:A:532:HOH:O	2.18	0.44
1:C:483:THR:HG21	2:C:546:HOH:O	2.18	0.44
1:A:146:LYS:HD2	1:A:483:THR:C	2.43	0.43
1:B:150:SER:HB3	1:B:480:ILE:CG2	2.48	0.43
1:B:455:ASP:O	1:B:456:ILE:C	2.61	0.43
1:A:164:THR:O	2:A:545:HOH:O	2.21	0.43
1:A:160:LYS:HA	1:A:160:LYS:HD3	1.68	0.43
2:B:494:HOH:O	1:C:481:LEU:HD23	2.17	0.43
1:C:474:ILE:CG2	1:C:475:LYS:N	2.81	0.43
1:A:146:LYS:CE	1:A:484:VAL:HA	2.39	0.43
1:B:156:GLU:OE1	1:B:156:GLU:HA	2.18	0.42
1:A:157:ALA:HB3	2:A:546:HOH:O	2.20	0.42
1:A:148:LYS:HD2	1:B:484:VAL:HB	2.02	0.41
1:A:174:ALA:C	1:A:176:GLN:N	2.77	0.41
1:A:171:VAL:HB	2:A:519:HOH:O	2.20	0.41
1:B:483:THR:HG22	1:B:483:THR:O	2.20	0.41
1:C:146:LYS:HZ2	1:C:483:THR:HB	1.85	0.41
1:C:160:LYS:HE3	2:C:505:HOH:O	2.21	0.41
2:B:512:HOH:O	1:C:481:LEU:HD11	2.20	0.41
1:A:169:VAL:CG2	1:B:463:MET:HE2	2.48	0.41
1:C:148:LYS:HB2	2:C:525:HOH:O	2.21	0.40
1:B:160:LYS:HE3	1:B:469:GLN:OE1	2.21	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	60/89 (67%)	59 (98%)	0	1 (2%)	7	5
1	B	60/89 (67%)	58 (97%)	1 (2%)	1 (2%)	7	5
1	C	59/89 (66%)	59 (100%)	0	0	100	100
All	All	179/267 (67%)	176 (98%)	1 (1%)	2 (1%)	11	10

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	175	LEU
1	B	456	ILE

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	60/77 (78%)	58 (97%)	2 (3%)	33	45
1	B	60/77 (78%)	58 (97%)	2 (3%)	33	45
1	C	59/77 (77%)	56 (95%)	3 (5%)	21	27
All	All	179/231 (78%)	172 (96%)	7 (4%)	28	39

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	146	LYS
1	A	482	ASP
1	B	455	ASP
1	B	457	SER
1	C	176	GLN
1	C	474	ILE
1	C	479	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	145	ASN
1	A	176	GLN
1	A	469	GLN
1	B	162	GLN
1	B	465	GLN
1	B	478	GLN
1	C	176	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 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	64/89 (71%)	-0.03	1 (1%) 70 67	14, 23, 43, 48	0
1	B	64/89 (71%)	0.15	2 (3%) 51 48	12, 25, 37, 54	0
1	C	63/89 (70%)	0.02	1 (1%) 70 67	13, 24, 37, 54	0
All	All	191/267 (71%)	0.05	4 (2%) 63 60	12, 24, 39, 54	0

All (4) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	454	VAL	2.2
1	B	455	ASP	2.2
1	C	480	ILE	2.1
1	A	483	THR	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.