



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 20, 2026 – 02:49 PM UTC

PDB ID : 6MQC / pdb_00006mqc
Title : Vaccine-elicited NHP FP-targeting neutralizing antibody 0PV-c.01 in complex with FP (residue 512-519)
Authors : Xu, K.; Wang, Y.; Kwong, P.D.
Deposited on : 2018-10-09
Resolution : 1.99 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

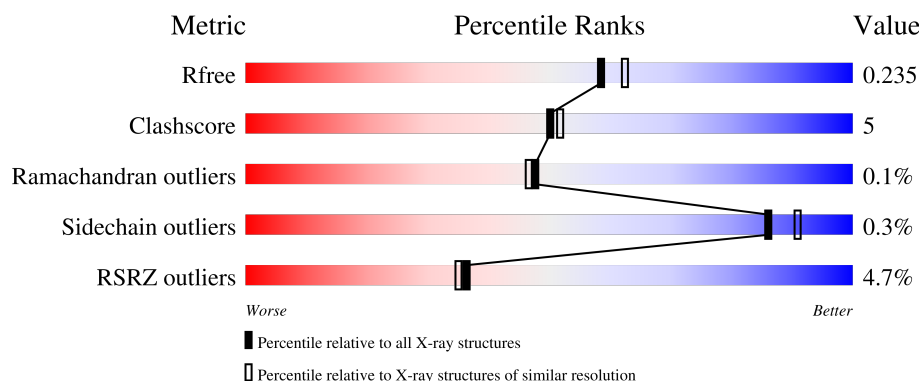
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.99 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	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

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	230	10% 82% 14% .
1	H	230	5% 84% 11% 5%
2	B	219	2% 90% 9% .
2	L	219	2% 82% 16% .
3	C	8	12% 62% 38%

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Mol	Chain	Length	Quality of chain
3	D	8	 88% 12%

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 7169 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 0PV-C.01 antibody Fab heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	222	Total	C	N	O	S	0	0	0
			1660	1050	280	326	4			
1	H	219	Total	C	N	O	S	0	0	0
			1642	1039	277	322	4			

- Molecule 2 is a protein called 0PV-C.01 antibody Fab light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	217	Total	C	N	O	S	0	0	0
			1660	1039	275	339	7			
2	L	217	Total	C	N	O	S	0	0	0
			1660	1039	275	339	7			

- Molecule 3 is a protein called HIV fusion peptide residue 512-519.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	8	Total	C	N	O	0	0	0
			51	35	8	8			
3	D	8	Total	C	N	O	0	0	0
			51	35	8	8			

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	74	Total	O	0	0
			74	74		
4	B	145	Total	O	0	0
			145	145		
4	H	96	Total	O	0	0
			96	96		
4	L	125	Total	O	0	0
			125	125		

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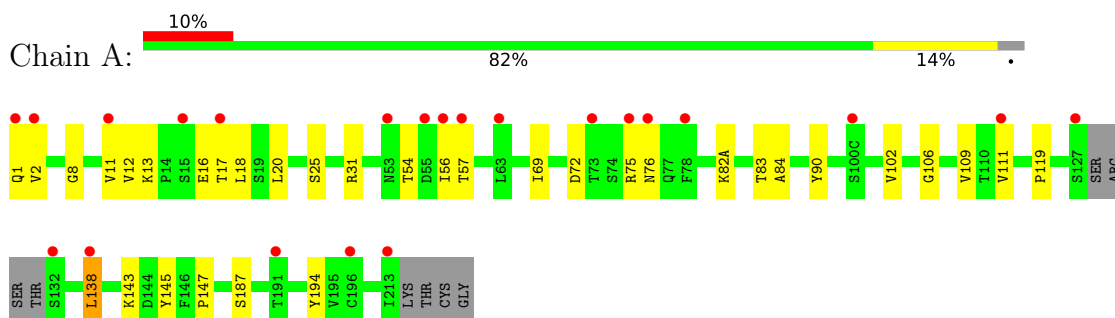
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	C	1	Total	O	0	0
			1	1		
4	D	4	Total	O	0	0
			4	4		

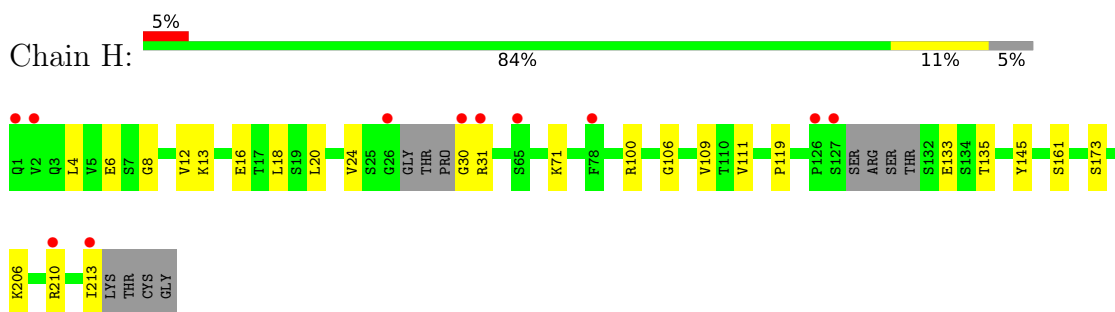
3 Residue-property plots [i](#)

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.

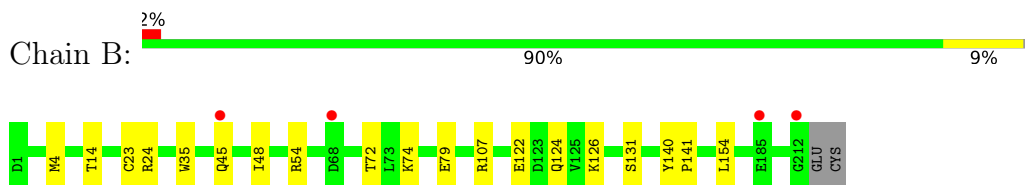
- Molecule 1: 0PV-C.01 antibody Fab heavy chain



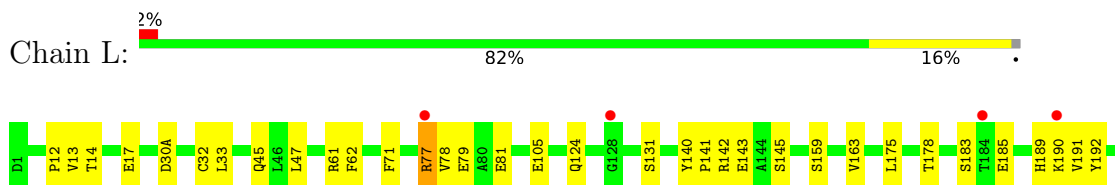
- Molecule 1: 0PV-C.01 antibody Fab heavy chain



- Molecule 2: 0PV-C.01 antibody Fab light chain

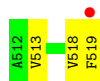


- Molecule 2: 0PV-C.01 antibody Fab light chain

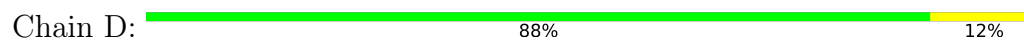




- Molecule 3: HIV fusion peptide residue 512-519



- Molecule 3: HIV fusion peptide residue 512-519



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	73.12Å 72.90Å 169.31Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	44.62 – 1.99 44.62 – 1.99	Depositor EDS
% Data completeness (in resolution range)	98.7 (44.62-1.99) 94.6 (44.62-1.99)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.28 (at 2.00Å)	Xtriage
Refinement program	PHENIX (1.13_2998: ???)	Depositor
R, R_{free}	0.199 , 0.234 (Not available) , 0.235	Depositor DCC
R_{free} test set	3061 reflections (4.87%)	wwPDB-VP
Wilson B-factor (Å ²)	33.6	Xtriage
Anisotropy	0.442	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 35.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.020 for k,h,-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	7169	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.52% 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 ⓘ

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	0.25	0/1701	0.58	2/2327 (0.1%)
1	H	0.26	0/1681	0.63	3/2297 (0.1%)
2	B	0.38	0/1695	0.59	4/2306 (0.2%)
2	L	0.70	7/1695 (0.4%)	0.65	4/2306 (0.2%)
3	C	1.18	1/51 (2.0%)	0.45	0/68
3	D	0.14	0/51	0.27	0/68
All	All	0.45	8/6874 (0.1%)	0.61	13/9372 (0.1%)

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	L	183	SER	C-O	-8.07	1.14	1.24
2	L	192	TYR	C-O	-6.78	1.15	1.24
2	L	191	VAL	C-O	-6.60	1.16	1.24
3	C	513	VAL	C-O	-6.36	1.16	1.23
2	L	185	GLU	C-O	-6.32	1.16	1.24
2	L	32	CYS	C-O	-5.84	1.17	1.23
2	L	189	HIS	C-O	-5.62	1.17	1.23
2	L	211	ARG	C-O	-5.19	1.17	1.23

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	H	210	ARG	CB-CG-CD	-11.15	85.66	111.30
2	L	77	ARG	CG-CD-NE	10.15	134.32	112.00
1	H	206	LYS	CB-CG-CD	8.97	131.93	111.30
2	B	24	ARG	NE-CZ-NH1	-7.12	114.38	121.50
2	L	77	ARG	CB-CA-C	6.37	119.53	110.24
2	B	24	ARG	CB-CA-C	-5.54	97.27	109.56
1	H	206	LYS	CA-CB-CG	5.42	124.94	114.10
1	A	138	LEU	CB-CA-C	-5.37	98.79	109.79
2	L	30(A)	ASP	CA-C-O	-5.36	115.33	121.82
2	L	190	LYS	N-CA-C	5.22	119.65	113.12

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	138	LEU	CB-CG-CD1	-5.21	95.08	110.70
2	B	24	ARG	CD-NE-CZ	5.19	131.67	124.40
2	B	24	ARG	NE-CZ-NH2	5.03	123.73	119.20

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	1660	0	1648	22	1
1	H	1642	0	1630	16	1
2	B	1660	0	1613	14	0
2	L	1660	0	1613	19	0
3	C	51	0	53	3	0
3	D	51	0	53	1	0
4	A	74	0	0	2	0
4	B	145	0	0	7	0
4	C	1	0	0	0	0
4	D	4	0	0	0	0
4	H	96	0	0	5	0
4	L	125	0	0	4	0
All	All	7169	0	6610	71	1

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 5.

All (71) 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)
2:B:54:ARG:NH2	4:B:302:HOH:O	1.83	1.12
2:B:79:GLU:OE2	4:B:301:HOH:O	1.82	0.95
1:H:213:ILE:O	4:H:301:HOH:O	1.98	0.80
1:H:30:GLY:N	4:H:303:HOH:O	2.23	0.70
2:L:13:VAL:HG11	2:L:78:VAL:HG21	1.73	0.70

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:187:SER:O	4:A:301:HOH:O	2.10	0.69
2:B:124:GLN:OE1	2:B:131:SER:N	2.25	0.69
1:A:18:LEU:HD13	1:A:109:VAL:HG11	1.75	0.67
1:H:173:SER:OG	4:H:302:HOH:O	2.04	0.67
1:A:11:VAL:HG21	1:A:147:PRO:HG3	1.81	0.63
2:L:105:GLU:HB3	4:L:406:HOH:O	2.01	0.61
2:B:14:THR:HG22	2:B:107:ARG:HD2	1.84	0.58
2:B:72:THR:HG21	2:B:74:LYS:HE3	1.83	0.58
1:A:54:THR:OG1	1:A:56:ILE:HG13	2.02	0.58
1:H:31:ARG:NH2	4:H:306:HOH:O	2.37	0.57
1:H:119:PRO:HB3	1:H:145:TYR:HB3	1.87	0.57
1:A:83:THR:O	1:A:111:VAL:HG21	2.05	0.56
1:A:13:LYS:NZ	4:A:302:HOH:O	2.38	0.56
2:L:45:GLN:HB2	4:L:417:HOH:O	2.06	0.55
2:L:143:GLU:OE1	4:L:301:HOH:O	2.18	0.55
2:L:124:GLN:OE1	2:L:131:SER:N	2.34	0.55
1:H:133:GLU:HG3	1:H:135:THR:H	1.72	0.54
1:A:12:VAL:HG23	1:A:111:VAL:HG12	1.90	0.53
1:A:84:ALA:HA	1:A:111:VAL:HG23	1.91	0.53
1:H:8:GLY:HA3	1:H:20:LEU:HD23	1.90	0.53
2:B:54:ARG:NH2	4:B:307:HOH:O	2.43	0.52
2:B:45:GLN:HB2	4:B:335:HOH:O	2.11	0.51
1:A:12:VAL:CG2	1:A:111:VAL:HG12	2.41	0.51
2:L:81:GLU:H	2:L:81:GLU:CD	2.19	0.50
1:A:8:GLY:HA3	1:A:20:LEU:HD23	1.94	0.49
1:H:6:GLU:OE2	1:H:106:GLY:N	2.45	0.48
2:L:47:LEU:HD21	2:L:62:PHE:CD1	2.48	0.48
2:L:199:GLN:NE2	4:L:303:HOH:O	2.34	0.48
1:A:13:LYS:HB2	1:A:16:GLU:HG3	1.96	0.47
1:A:57:THR:HG21	1:A:69:ILE:HB	1.95	0.47
2:L:12:PRO:HA	2:L:105:GLU:HG3	1.96	0.46
1:H:31:ARG:HG2	3:C:519:PHE:CE1	2.51	0.46
1:A:138:LEU:HD11	1:A:194:TYR:CB	2.46	0.46
1:H:18:LEU:HD13	1:H:109:VAL:HG11	1.96	0.46
1:A:17:THR:OG1	1:A:82(A):LYS:HD2	2.17	0.45
2:L:145:SER:HB2	2:L:197:THR:HB	1.97	0.45
2:L:77:ARG:HH21	2:L:77:ARG:HD2	1.56	0.45
1:H:4:LEU:HD22	1:H:24:VAL:HG22	1.99	0.45
2:L:61:ARG:CZ	2:L:79:GLU:HG3	2.47	0.45
2:L:159:SER:HA	2:L:178:THR:O	2.17	0.44
1:A:119:PRO:HB3	1:A:145:TYR:HB3	2.00	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:2:VAL:HG12	1:A:25:SER:O	2.16	0.44
2:B:45:GLN:NE2	4:B:309:HOH:O	2.50	0.44
1:H:31:ARG:O	3:C:518:VAL:HA	2.17	0.44
2:L:163:VAL:HG22	2:L:175:LEU:HD12	2.00	0.44
2:B:122:GLU:O	2:B:126:LYS:HG3	2.18	0.44
2:B:140:TYR:CG	2:B:141:PRO:HA	2.53	0.44
2:L:142:ARG:CZ	2:L:163:VAL:HG21	2.47	0.44
2:B:45:GLN:NE2	4:B:304:HOH:O	2.34	0.43
2:B:35:TRP:HB2	2:B:48:ILE:HB	2.02	0.42
1:A:143:LYS:HB2	1:A:143:LYS:HE2	1.75	0.42
2:L:14:THR:HB	2:L:17:GLU:HG3	2.01	0.42
2:L:142:ARG:NH2	2:L:163:VAL:HG21	2.35	0.42
2:B:74:LYS:HD2	4:B:336:HOH:O	2.20	0.42
1:H:13:LYS:HB2	1:H:16:GLU:HG3	2.02	0.42
1:H:100:ARG:HG2	3:C:519:PHE:C	2.44	0.42
1:H:12:VAL:O	1:H:111:VAL:HA	2.20	0.41
2:L:140:TYR:CG	2:L:141:PRO:HA	2.55	0.41
1:A:1:GLN:O	1:A:102:VAL:HG21	2.20	0.41
1:A:72:ASP:HB3	1:A:75:ARG:HB2	2.02	0.41
1:A:90:TYR:O	1:A:106:GLY:HA2	2.22	0.41
1:H:31:ARG:CZ	4:H:306:HOH:O	2.68	0.40
2:L:33:LEU:HD13	2:L:71:PHE:CD1	2.56	0.40
1:A:138:LEU:HD11	1:A:194:TYR:CG	2.56	0.40
2:B:4:MET:HE3	2:B:23:CYS:SG	2.62	0.40
1:A:31:ARG:O	3:D:518:VAL:HA	2.22	0.40

All (1) 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:A:75:ARG:NH1	1:H:161:SER:OG[1_545]	1.98	0.22

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	218/230 (95%)	214 (98%)	3 (1%)	1 (0%)	24	21
1	H	213/230 (93%)	212 (100%)	1 (0%)	0	100	100
2	B	215/219 (98%)	211 (98%)	4 (2%)	0	100	100
2	L	215/219 (98%)	211 (98%)	4 (2%)	0	100	100
3	C	6/8 (75%)	6 (100%)	0	0	100	100
3	D	6/8 (75%)	6 (100%)	0	0	100	100
All	All	873/914 (96%)	860 (98%)	12 (1%)	1 (0%)	48	46

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	76	ASN

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	191/198 (96%)	191 (100%)	0	100	100
1	H	189/198 (96%)	188 (100%)	1 (0%)	81	87
2	B	195/197 (99%)	194 (100%)	1 (0%)	81	87
2	L	195/197 (99%)	195 (100%)	0	100	100
3	C	4/4 (100%)	4 (100%)	0	100	100
3	D	4/4 (100%)	4 (100%)	0	100	100
All	All	778/798 (98%)	776 (100%)	2 (0%)	86	91

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	154	LEU

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Mol	Chain	Res	Type
1	H	71	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	39	GLN
1	A	77	GLN
2	B	38	GLN
1	H	171	GLN
2	L	42	GLN
2	L	137	ASN
2	L	160	GLN
2	L	210	ASN

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 ⓘ

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	222/230 (96%)	0.94	22 (9%) 13 11	28, 46, 64, 74	0
1	H	219/230 (95%)	0.51	11 (5%) 34 33	26, 39, 61, 79	0
2	B	217/219 (99%)	0.21	4 (1%) 67 67	23, 33, 49, 59	0
2	L	217/219 (99%)	0.29	4 (1%) 67 67	22, 33, 49, 64	0
3	C	8/8 (100%)	0.65	1 (12%) 8 7	26, 29, 43, 54	0
3	D	8/8 (100%)	0.53	0 100 100	29, 33, 39, 39	0
All	All	891/914 (97%)	0.49	42 (4%) 36 35	22, 37, 59, 79	0

All (42) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	213	ILE	5.8
1	A	56	ILE	4.6
1	A	1	GLN	4.1
3	C	519	PHE	3.7
2	L	128	GLY	3.6
2	B	45	GLN	3.4
1	A	75	ARG	3.3
1	A	63	LEU	3.3
1	A	191	THR	3.3
1	H	26	GLY	3.2
1	H	213	ILE	3.2
1	A	53	ASN	3.2
1	H	127	SER	3.2
1	A	2	VAL	3.1
1	A	138	LEU	3.1
1	H	126	PRO	3.0
1	A	55	ASP	2.9
1	H	2	VAL	2.8
1	A	78	PHE	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	76	ASN	2.7
1	A	132	SER	2.6
1	H	31	ARG	2.6
1	A	11	VAL	2.6
1	H	30	GLY	2.5
2	L	77	ARG	2.5
1	A	196	CYS	2.5
1	H	1	GLN	2.5
2	B	68	ASP	2.5
2	L	190	LYS	2.4
1	A	17	THR	2.4
1	H	78	PHE	2.3
2	L	184	THR	2.2
1	A	127	SER	2.2
1	A	57	THR	2.2
1	A	100(C)	SER	2.2
1	A	73	THR	2.1
1	A	15	SER	2.1
1	H	65	SER	2.1
1	H	210	ARG	2.1
2	B	212	GLY	2.1
2	B	185	GLU	2.1
1	A	111	VAL	2.1

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.