



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 05:12 PM UTC

PDB ID : 4KF4 / pdb_00004kf4
Title : Crystal Structure of sfCherry
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Deposited on : 2013-04-26
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
Mogul	:	2022.3.0, CSD as543be (2022)
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

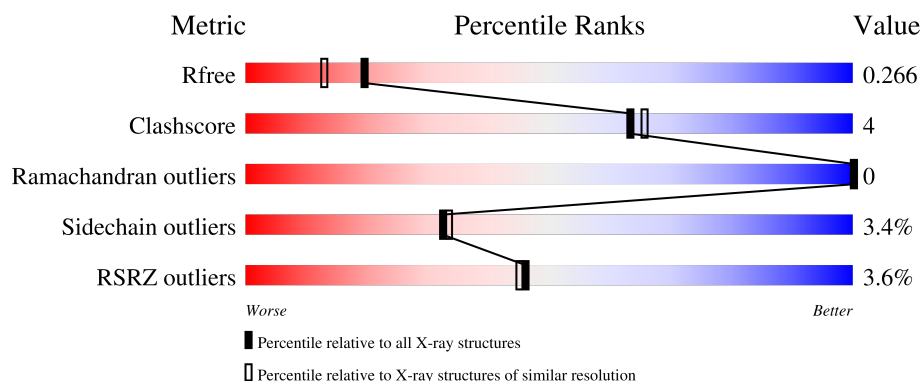
1 Overall quality at a glance

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	223	3% 85% 12%
1	B	223	5% 84% 12%
1	C	223	3% 83% 13%
1	D	223	3% 83% 11%
1	E	223	2% 86% 11%

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Mol	Chain	Length	Quality of chain
1	F	223	3% 86% 9% • •
1	G	223	4% 82% 15% •
1	H	223	6% 83% 13% •

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 14683 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 fluorescent protein sfCherry.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	216	Total	C	N	O	S	0	0	0
			1735	1106	288	335	6			
1	B	215	Total	C	N	O	S	0	1	0
			1735	1106	288	335	6			
1	C	216	Total	C	N	O	S	0	1	0
			1741	1109	289	337	6			
1	D	215	Total	C	N	O	S	0	0	0
			1728	1102	287	333	6			
1	E	216	Total	C	N	O	S	0	0	0
			1735	1106	288	335	6			
1	F	216	Total	C	N	O	S	0	0	0
			1735	1106	288	335	6			
1	G	216	Total	C	N	O	S	0	0	0
			1735	1106	288	335	6			
1	H	216	Total	C	N	O	S	0	0	0
			1735	1106	288	335	6			

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	98	Total	O	0	0
			98	98		
2	B	102	Total	O	0	0
			102	102		
2	C	106	Total	O	0	0
			106	106		
2	D	97	Total	O	0	0
			97	97		
2	E	115	Total	O	0	0
			115	115		
2	F	86	Total	O	0	0
			86	86		

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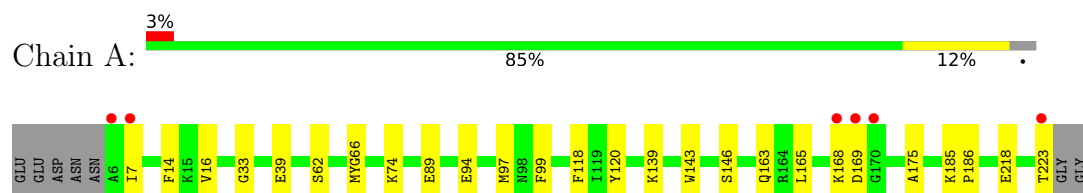
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	G	89	Total 89	O 89	0	0
2	H	111	Total 111	O 111	0	0

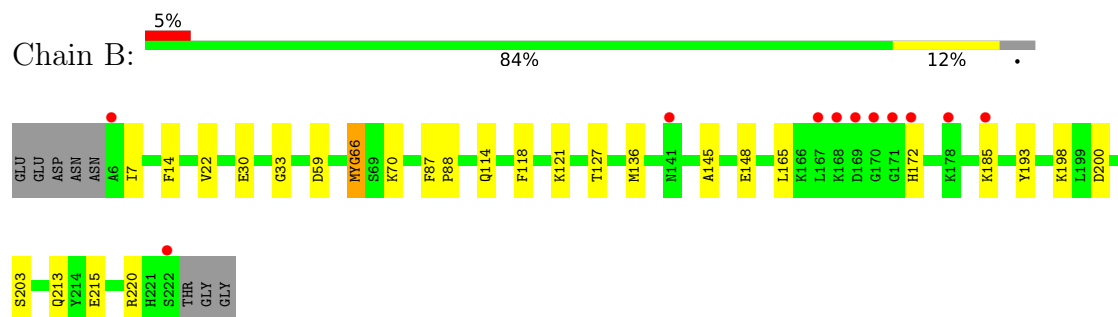
3 Residue-property plots [i](#)

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.

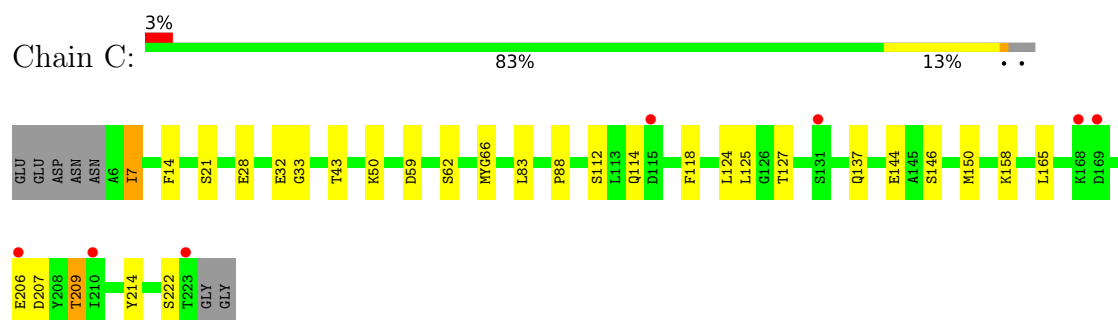
- Molecule 1: fluorescent protein sfCherry



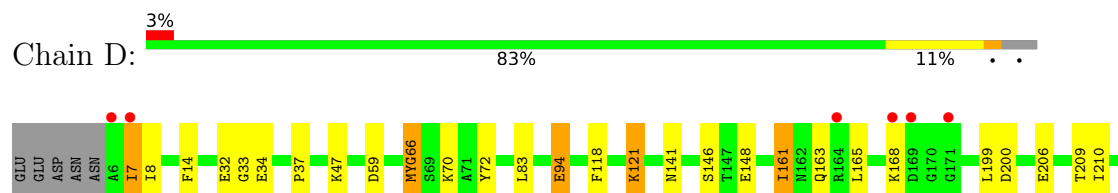
- Molecule 1: fluorescent protein sfCherry

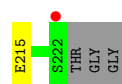


- Molecule 1: fluorescent protein sfCherry

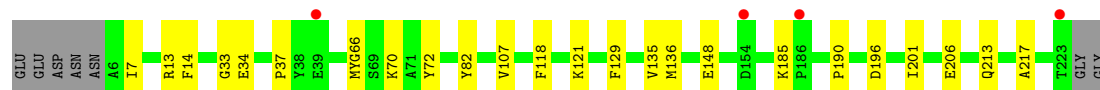
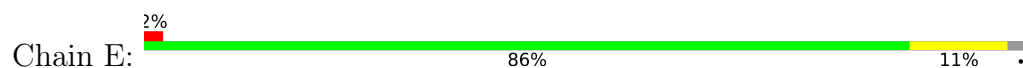


- Molecule 1: fluorescent protein sfCherry

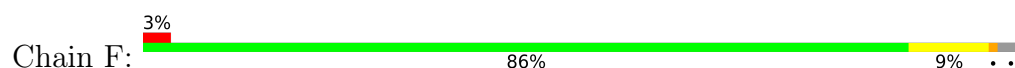




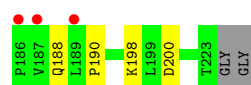
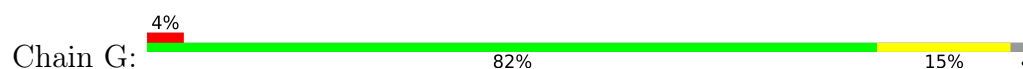
- Molecule 1: fluorescent protein sfCherry



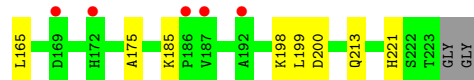
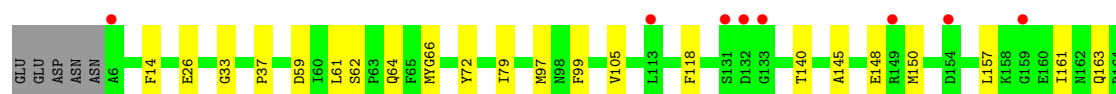
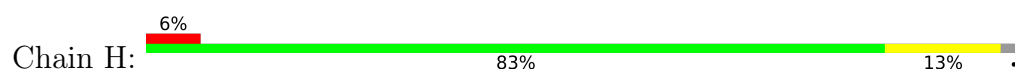
- Molecule 1: fluorescent protein sfCherry



- Molecule 1: fluorescent protein sfCherry



- Molecule 1: fluorescent protein sfCherry



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	85.11Å 96.29Å 105.96Å 90.00° 104.56° 90.00°	Depositor
Resolution (Å)	45.26 – 1.99 45.26 – 1.99	Depositor EDS
% Data completeness (in resolution range)	86.7 (45.26-1.99) 86.7 (45.26-1.99)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	0.10	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.78 (at 2.00Å)	Xtriage
Refinement program	PHENIX (phenix.refine: dev_1338)	Depositor
R, R_{free}	0.222 , 0.265 0.213 , 0.266	Depositor DCC
R_{free} test set	2000 reflections (1.83%)	wwPDB-VP
Wilson B-factor (Å ²)	21.6	Xtriage
Anisotropy	0.401	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 40.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	14683	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 43.72 % 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 1.6925e-04. 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CH6

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	0.36	0/1755	0.74	2/2369 (0.1%)
1	B	0.35	0/1755	0.74	0/2369
1	C	0.37	0/1761	0.75	2/2377 (0.1%)
1	D	0.36	0/1748	0.73	0/2359
1	E	0.37	0/1755	0.71	0/2369
1	F	0.33	0/1755	0.75	2/2369 (0.1%)
1	G	0.36	0/1755	0.75	2/2369 (0.1%)
1	H	0.35	0/1755	0.75	2/2369 (0.1%)
All	All	0.36	0/14039	0.74	10/18950 (0.1%)

There are no bond length outliers.

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	F	62	SER	CA-C-N	-7.21	113.48	120.83
1	F	62	SER	C-N-CA	-7.21	113.48	120.83
1	G	62	SER	CA-C-N	-6.68	114.02	120.83
1	G	62	SER	C-N-CA	-6.68	114.02	120.83
1	H	62	SER	CA-C-N	-6.60	114.10	120.83
1	H	62	SER	C-N-CA	-6.60	114.10	120.83
1	C	62	SER	CA-C-N	-5.19	114.69	120.45
1	C	62	SER	C-N-CA	-5.19	114.69	120.45
1	A	62	SER	CA-C-N	-5.09	114.80	120.45
1	A	62	SER	C-N-CA	-5.09	114.80	120.45

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	1735	0	1669	11	0
1	B	1735	0	1668	12	0
1	C	1741	0	1673	17	0
1	D	1728	0	1662	18	0
1	E	1735	0	1669	12	0
1	F	1735	0	1669	11	0
1	G	1735	0	1669	17	0
1	H	1735	0	1669	14	0
2	A	98	0	0	1	0
2	B	102	0	0	0	1
2	C	106	0	0	2	0
2	D	97	0	0	2	1
2	E	115	0	0	0	0
2	F	86	0	0	1	0
2	G	89	0	0	0	0
2	H	111	0	0	0	0
All	All	14683	0	13348	109	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 4.

All (109) 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:D:141:ASN:HD21	1:D:168:LYS:HG3	1.30	0.96
1:A:185:LYS:HD2	1:A:186:PRO:HD2	1.68	0.75
1:E:13:ARG:NH1	1:E:34:GLU:OE1	2.27	0.68
1:D:141:ASN:ND2	1:D:168:LYS:HG3	2.09	0.66
1:G:108:THR:HG22	1:G:123:LYS:HB2	1.81	0.62
1:F:185:LYS:HG3	1:F:186:PRO:HD2	1.82	0.61
1:C:7:ILE:HD13	1:C:88:PRO:HG3	1.83	0.61
1:B:66:CH6:HB2	1:B:70:LYS:HZ3	1.65	0.61
1:E:135:VAL:HG12	1:E:136:MET:HE2	1.84	0.60
1:A:74:LYS:HB3	1:A:218:GLU:HG3	1.85	0.59
1:C:127:THR:HG21	1:D:94:GLU:HB3	1.84	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:G:198:LYS:NZ	1:G:200:ASP:OD1	2.37	0.57
1:F:66:CH6:HB2	1:F:70:LYS:NZ	2.20	0.57
1:C:114:GLN:HG3	2:C:398:HOH:O	2.04	0.56
1:A:139:LYS:HD3	1:A:168:LYS:HE2	1.86	0.56
1:B:59:ASP:HB3	1:B:165:LEU:HD21	1.87	0.56
1:D:47:LYS:HG2	1:D:210:ILE:HG12	1.88	0.55
1:D:14:PHE:HB3	1:D:118:PHE:HB2	1.89	0.55
1:A:14:PHE:HB3	1:A:118:PHE:HB2	1.89	0.54
1:C:14:PHE:HB3	1:C:118:PHE:HB2	1.89	0.54
1:D:59:ASP:HB3	1:D:165:LEU:HD21	1.91	0.53
1:D:14:PHE:CZ	1:D:33:GLY:HA3	2.44	0.53
1:D:83:LEU:HD12	2:D:346:HOH:O	2.09	0.53
1:F:14:PHE:HB3	1:F:118:PHE:HB2	1.90	0.52
1:A:146:SER:HB3	2:A:307:HOH:O	2.09	0.52
1:H:79:ILE:HD11	1:H:221:HIS:CE1	2.45	0.50
1:H:14:PHE:HB3	1:H:118:PHE:HB2	1.94	0.50
1:D:148:GLU:HG3	1:D:161:ILE:HG12	1.93	0.49
1:G:153:GLU:HB3	1:G:158:LYS:HG3	1.94	0.49
1:C:28:GLU:CD	1:C:50:LYS:HE3	2.36	0.49
1:F:137:GLN:HB3	1:F:139:LYS:HG2	1.94	0.49
1:H:140:THR:HG21	1:H:165:LEU:HD13	1.93	0.49
1:F:59:ASP:HB3	1:F:165:LEU:HD21	1.95	0.49
1:C:28:GLU:HB2	1:C:50:LYS:HB3	1.95	0.49
1:E:70:LYS:NZ	1:E:148:GLU:OE1	2.45	0.49
1:G:14:PHE:HB3	1:G:118:PHE:HB2	1.95	0.49
1:H:145:ALA:HB2	1:H:198:LYS:HD3	1.94	0.48
1:H:61:LEU:O	1:H:64:GLN:HG2	2.14	0.48
1:H:97:MET:HB2	1:H:105:VAL:HB	1.95	0.48
1:F:140:THR:O	1:F:168:LYS:NZ	2.45	0.48
1:B:14:PHE:CZ	1:B:33:GLY:HA3	2.49	0.48
1:C:207:ASP:OD1	1:C:209:THR:OG1	2.25	0.48
1:G:14:PHE:CE2	1:G:33:GLY:HA3	2.48	0.48
1:G:37:PRO:HA	1:G:72:TYR:HA	1.96	0.48
1:C:137:GLN:OE1	1:G:188:GLN:HB2	2.13	0.48
1:H:14:PHE:CZ	1:H:33:GLY:HA3	2.48	0.48
1:C:127:THR:CG2	1:D:94:GLU:HB3	2.45	0.47
1:E:37:PRO:HA	1:E:72:TYR:HA	1.96	0.47
1:G:66:CH6:O2	1:G:95:ARG:NH2	2.42	0.47
1:D:37:PRO:HA	1:D:72:TYR:HA	1.96	0.47
1:H:59:ASP:HB3	1:H:165:LEU:HD21	1.96	0.47
1:E:14:PHE:CZ	1:E:33:GLY:HA3	2.50	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:201:ILE:HD13	1:E:213:GLN:HG2	1.96	0.47
1:B:22:VAL:HG12	1:B:136:MET:HE1	1.96	0.46
1:G:66:CH6:HA32	1:G:93:TRP:CZ2	2.51	0.46
1:A:89:GLU:OE1	1:A:89:GLU:N	2.41	0.45
1:F:141:ASN:N	1:F:166:LYS:O	2.46	0.45
1:B:121:LYS:HB3	1:B:121:LYS:HE2	1.77	0.45
1:E:129:PHE:HB2	1:E:136:MET:HE3	1.98	0.45
1:G:7:ILE:HG12	1:G:113:LEU:HD21	1.99	0.45
1:E:185:LYS:HA	1:E:185:LYS:HD3	1.76	0.45
1:G:59:ASP:HB3	1:G:165:LEU:HD21	1.98	0.45
1:E:14:PHE:HB3	1:E:118:PHE:HB2	1.98	0.44
1:C:150:MET:HA	1:C:158:LYS:O	2.18	0.44
1:E:82:TYR:HB2	1:E:190:PRO:HD3	1.99	0.44
1:G:109:GLN:HG2	1:G:122:VAL:HG22	2.00	0.44
1:H:99:PHE:CD2	1:H:175:ALA:HB2	2.52	0.44
1:D:7:ILE:HG22	1:D:8:ILE:HG13	2.00	0.43
1:D:199:LEU:HD23	1:D:200:ASP:N	2.33	0.43
1:E:121:LYS:HB3	1:E:121:LYS:HE2	1.68	0.43
1:B:145:ALA:HB2	1:B:198:LYS:HD3	1.99	0.43
1:F:134:PRO:HA	1:F:139:LYS:HB2	2.00	0.43
1:C:59:ASP:HB3	1:C:165:LEU:HD21	2.01	0.43
1:B:66:CH6:HG11	1:B:215:GLU:CD	2.42	0.43
1:A:14:PHE:CZ	1:A:33:GLY:HA3	2.53	0.43
1:H:148:GLU:HG3	1:H:161:ILE:HG12	2.01	0.43
1:C:146:SER:HB3	2:C:353:HOH:O	2.19	0.43
1:G:18:MET:HB3	1:G:29:ILE:HB	1.99	0.43
1:B:198:LYS:NZ	1:B:200:ASP:OD1	2.51	0.42
1:F:185:LYS:NZ	2:F:360:HOH:O	2.52	0.42
1:G:97:MET:HE2	1:G:97:MET:HB3	1.91	0.42
1:C:50:LYS:HE2	1:C:50:LYS:HB2	1.56	0.42
1:H:150:MET:HB3	1:H:157:LEU:HD11	2.00	0.42
1:A:16:VAL:HG23	1:A:120:TYR:HB2	2.02	0.42
1:A:99:PHE:CD2	1:A:175:ALA:HB2	2.55	0.42
1:D:146:SER:HB3	2:D:359:HOH:O	2.19	0.42
1:F:148:GLU:HG3	1:F:161:ILE:HG12	2.00	0.42
1:C:14:PHE:CZ	1:C:33:GLY:HA3	2.55	0.42
1:A:97:MET:HE2	1:A:97:MET:HB3	1.92	0.42
1:D:66:CH6:HB12	1:D:215:GLU:OE1	2.19	0.42
1:A:143:TRP:CZ3	1:A:165:LEU:HG	2.54	0.42
1:F:199:LEU:HD12	1:F:215:GLU:OE1	2.19	0.42
1:B:14:PHE:CB	1:B:118:PHE:HB2	2.50	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:43:THR:HG22	1:C:214:TYR:HD1	1.85	0.42
1:D:121:LYS:HB3	1:D:121:LYS:HE2	1.81	0.42
1:B:87:PHE:HB3	1:B:88:PRO:HA	2.02	0.41
1:G:82:TYR:HB2	1:G:190:PRO:HD3	2.02	0.41
1:G:14:PHE:CZ	1:G:33:GLY:HA3	2.56	0.41
1:H:37:PRO:HA	1:H:72:TYR:HA	2.02	0.41
1:D:66:CH6:HB2	1:D:70:LYS:NZ	2.35	0.41
1:H:14:PHE:CB	1:H:118:PHE:HB2	2.51	0.41
1:H:199:LEU:HD23	1:H:200:ASP:N	2.36	0.41
1:B:70:LYS:NZ	1:B:148:GLU:OE1	2.48	0.41
1:C:83:LEU:HD23	1:C:83:LEU:HA	1.83	0.40
1:G:28:GLU:HG3	1:G:50:LYS:HG2	2.04	0.40
1:E:196:ASP:O	1:E:217:ALA:HA	2.21	0.40
1:B:193:TYR:HB2	1:B:220:ARG:O	2.22	0.40
1:D:141:ASN:HD21	1:D:168:LYS:CG	2.16	0.40
1:C:124:LEU:O	1:C:125:LEU:HD23	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)
2:B:375:HOH:O	2:D:376:HOH:O[1_455]	2.00	0.20

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	211/223 (95%)	207 (98%)	4 (2%)	0	100	100
1	B	211/223 (95%)	206 (98%)	5 (2%)	0	100	100
1	C	212/223 (95%)	209 (99%)	3 (1%)	0	100	100
1	D	210/223 (94%)	206 (98%)	4 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	E	211/223 (95%)	208 (99%)	3 (1%)	0	100	100
1	F	211/223 (95%)	207 (98%)	4 (2%)	0	100	100
1	G	211/223 (95%)	207 (98%)	4 (2%)	0	100	100
1	H	211/223 (95%)	204 (97%)	7 (3%)	0	100	100
All	All	1688/1784 (95%)	1654 (98%)	34 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	183/188 (97%)	177 (97%)	6 (3%)	33	34
1	B	183/188 (97%)	174 (95%)	9 (5%)	22	20
1	C	184/188 (98%)	175 (95%)	9 (5%)	22	20
1	D	182/188 (97%)	173 (95%)	9 (5%)	22	20
1	E	183/188 (97%)	180 (98%)	3 (2%)	55	62
1	F	183/188 (97%)	177 (97%)	6 (3%)	33	34
1	G	183/188 (97%)	178 (97%)	5 (3%)	39	42
1	H	183/188 (97%)	179 (98%)	4 (2%)	45	50
All	All	1464/1504 (97%)	1413 (96%)	51 (4%)	32	32

All (51) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	7	ILE
1	A	39	GLU
1	A	94	GLU
1	A	163	GLN
1	A	169	ASP
1	A	223	THR

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Mol	Chain	Res	Type
1	B	7	ILE
1	B	30	GLU
1	B	114	GLN
1	B	127[A]	THR
1	B	127[B]	THR
1	B	172	HIS
1	B	185	LYS
1	B	203	SER
1	B	213	GLN
1	C	7	ILE
1	C	21	SER
1	C	32	GLU
1	C	112[A]	SER
1	C	112[B]	SER
1	C	144	GLU
1	C	206	GLU
1	C	209	THR
1	C	222	SER
1	D	7	ILE
1	D	32	GLU
1	D	34	GLU
1	D	94	GLU
1	D	121	LYS
1	D	161	ILE
1	D	163	GLN
1	D	206	GLU
1	D	209	THR
1	E	7	ILE
1	E	107	VAL
1	E	206	GLU
1	F	107	VAL
1	F	137	GLN
1	F	161	ILE
1	F	167	LEU
1	F	178	LYS
1	F	206	GLU
1	G	30	GLU
1	G	46	LEU
1	G	96	VAL
1	G	163	GLN
1	G	185	LYS
1	H	26	GLU

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Mol	Chain	Res	Type
1	H	163	GLN
1	H	185	LYS
1	H	213	GLN

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	163	GLN
1	A	194	ASN
1	C	114	GLN
1	C	163	GLN
1	D	141	ASN
1	F	141	ASN
1	H	221	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

8 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
1	CH6	G	66	1	23,24,25	5.02	5 (21%)	28,32,34	3.16	9 (32%)
1	CH6	B	66	1	23,24,25	4.92	5 (21%)	28,32,34	3.22	6 (21%)
1	CH6	D	66	1	23,24,25	4.89	5 (21%)	28,32,34	3.17	8 (28%)
1	CH6	A	66	1	23,24,25	4.95	7 (30%)	28,32,34	3.31	11 (39%)
1	CH6	F	66	1	23,24,25	4.90	5 (21%)	28,32,34	3.19	7 (25%)
1	CH6	E	66	1	23,24,25	4.95	6 (26%)	28,32,34	2.99	7 (25%)
1	CH6	C	66	1	23,24,25	4.91	6 (26%)	28,32,34	3.03	8 (28%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
1	CH6	H	66	1	23,24,25	4.93	5 (21%)	28,32,34	3.01	6 (21%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	CH6	G	66	1	-	5/12/31/32	0/2/2/2
1	CH6	B	66	1	-	5/12/31/32	0/2/2/2
1	CH6	D	66	1	-	4/12/31/32	0/2/2/2
1	CH6	A	66	1	-	7/12/31/32	0/2/2/2
1	CH6	F	66	1	-	5/12/31/32	0/2/2/2
1	CH6	E	66	1	-	6/12/31/32	0/2/2/2
1	CH6	C	66	1	-	7/12/31/32	0/2/2/2
1	CH6	H	66	1	-	6/12/31/32	0/2/2/2

All (44) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	G	66	CH6	CB2-CA2	19.47	1.53	1.35
1	H	66	CH6	CB2-CA2	19.11	1.53	1.35
1	D	66	CH6	CB2-CA2	18.94	1.53	1.35
1	E	66	CH6	CB2-CA2	18.92	1.53	1.35
1	B	66	CH6	CB2-CA2	18.89	1.53	1.35
1	F	66	CH6	CB2-CA2	18.82	1.53	1.35
1	A	66	CH6	CB2-CA2	18.82	1.53	1.35
1	C	66	CH6	CB2-CA2	18.59	1.53	1.35
1	C	66	CH6	O2-C2	8.51	1.40	1.23
1	F	66	CH6	O2-C2	8.49	1.40	1.23
1	E	66	CH6	O2-C2	8.46	1.40	1.23
1	A	66	CH6	O2-C2	8.45	1.40	1.23
1	D	66	CH6	O2-C2	8.44	1.40	1.23
1	H	66	CH6	O2-C2	8.32	1.40	1.23
1	B	66	CH6	O2-C2	8.29	1.40	1.23
1	G	66	CH6	O2-C2	8.25	1.39	1.23
1	C	66	CH6	C1-N2	8.18	1.44	1.32
1	E	66	CH6	C1-N2	8.12	1.44	1.32
1	A	66	CH6	C1-N2	8.08	1.44	1.32
1	G	66	CH6	C1-N2	8.07	1.44	1.32

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	F	66	CH6	C1-N2	7.84	1.43	1.32
1	B	66	CH6	C1-N2	7.79	1.43	1.32
1	H	66	CH6	C1-N2	7.79	1.43	1.32
1	D	66	CH6	C1-N2	7.37	1.43	1.32
1	A	66	CH6	C1-N3	5.84	1.47	1.37
1	E	66	CH6	C1-N3	5.73	1.46	1.37
1	B	66	CH6	C1-N3	5.69	1.46	1.37
1	C	66	CH6	C1-N3	5.65	1.46	1.37
1	G	66	CH6	C1-N3	5.38	1.46	1.37
1	D	66	CH6	C1-N3	5.36	1.46	1.37
1	F	66	CH6	C1-N3	5.29	1.46	1.37
1	H	66	CH6	C1-N3	5.17	1.45	1.37
1	D	66	CH6	CG2-CB2	4.38	1.54	1.46
1	G	66	CH6	CG2-CB2	4.32	1.54	1.46
1	B	66	CH6	CG2-CB2	4.29	1.54	1.46
1	H	66	CH6	CG2-CB2	4.24	1.54	1.46
1	E	66	CH6	CG2-CB2	4.17	1.54	1.46
1	F	66	CH6	CG2-CB2	4.15	1.54	1.46
1	C	66	CH6	CG2-CB2	4.13	1.54	1.46
1	A	66	CH6	CG2-CB2	4.09	1.54	1.46
1	E	66	CH6	C2-N3	-2.04	1.35	1.40
1	A	66	CH6	OH-CZ	2.03	1.41	1.37
1	A	66	CH6	C2-N3	-2.01	1.35	1.40
1	C	66	CH6	C2-N3	-2.01	1.35	1.40

All (62) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	66	CH6	O2-C2-CA2	-10.69	124.20	131.02
1	G	66	CH6	O2-C2-CA2	-10.58	124.27	131.02
1	F	66	CH6	O2-C2-CA2	-10.56	124.28	131.02
1	B	66	CH6	O2-C2-CA2	-10.36	124.41	131.02
1	D	66	CH6	O2-C2-CA2	-10.11	124.57	131.02
1	H	66	CH6	O2-C2-CA2	-9.72	124.82	131.02
1	E	66	CH6	O2-C2-CA2	-9.56	124.92	131.02
1	C	66	CH6	O2-C2-CA2	-9.44	125.00	131.02
1	B	66	CH6	CG2-CB2-CA2	-8.46	119.81	129.87
1	F	66	CH6	CG2-CB2-CA2	-7.84	120.55	129.87
1	D	66	CH6	CG2-CB2-CA2	-7.54	120.91	129.87
1	H	66	CH6	CG2-CB2-CA2	-7.45	121.01	129.87
1	A	66	CH6	CA2-C2-N3	7.31	109.64	103.50
1	C	66	CH6	CA2-C2-N3	7.15	109.50	103.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	66	CH6	CG2-CB2-CA2	-7.08	121.45	129.87
1	E	66	CH6	CG2-CB2-CA2	-7.02	121.52	129.87
1	E	66	CH6	CA2-C2-N3	7.01	109.39	103.50
1	C	66	CH6	CG2-CB2-CA2	-6.94	121.61	129.87
1	B	66	CH6	CA2-C2-N3	6.91	109.31	103.50
1	D	66	CH6	CA2-C2-N3	6.82	109.22	103.50
1	F	66	CH6	CA2-C2-N3	6.81	109.22	103.50
1	G	66	CH6	CA2-C2-N3	6.77	109.19	103.50
1	G	66	CH6	CG2-CB2-CA2	-6.76	121.83	129.87
1	H	66	CH6	CA2-C2-N3	6.75	109.17	103.50
1	A	66	CH6	N3-C1-N2	-4.92	107.61	111.48
1	B	66	CH6	N3-C1-N2	-4.87	107.65	111.48
1	G	66	CH6	N3-C1-N2	-4.83	107.68	111.48
1	C	66	CH6	N3-C1-N2	-4.74	107.75	111.48
1	D	66	CH6	N3-C1-N2	-4.61	107.85	111.48
1	F	66	CH6	N3-C1-N2	-4.61	107.85	111.48
1	E	66	CH6	N3-C1-N2	-4.10	108.25	111.48
1	H	66	CH6	N3-C1-N2	-3.68	108.58	111.48
1	D	66	CH6	CE1-CZ-CE2	-3.21	114.66	119.77
1	G	66	CH6	CE1-CZ-CE2	-3.20	114.67	119.77
1	A	66	CH6	CE1-CZ-CE2	-3.18	114.71	119.77
1	D	66	CH6	CA2-N2-C1	3.06	108.19	105.80
1	H	66	CH6	CE1-CZ-CE2	-3.01	114.98	119.77
1	F	66	CH6	CE1-CZ-CE2	-2.99	115.01	119.77
1	C	66	CH6	CE1-CZ-CE2	-2.90	115.14	119.77
1	A	66	CH6	CB2-CA2-N2	2.89	132.69	128.76
1	E	66	CH6	CE1-CZ-CE2	-2.87	115.19	119.77
1	B	66	CH6	CE1-CZ-CE2	-2.85	115.23	119.77
1	G	66	CH6	CD1-CE1-CZ	2.61	122.63	119.88
1	B	66	CH6	CA2-N2-C1	2.56	107.80	105.80
1	D	66	CH6	CD1-CE1-CZ	2.48	122.50	119.88
1	G	66	CH6	CA2-N2-C1	2.39	107.67	105.80
1	F	66	CH6	CA2-N2-C1	2.36	107.65	105.80
1	A	66	CH6	CD2-CE2-CZ	2.36	122.37	119.88
1	H	66	CH6	CD1-CE1-CZ	2.35	122.36	119.88
1	A	66	CH6	CA2-N2-C1	2.32	107.61	105.80
1	D	66	CH6	C2-CA2-N2	-2.31	107.29	108.95
1	A	66	CH6	C3-CA3-N3	2.27	117.59	112.43
1	G	66	CH6	CB2-CA2-N2	2.23	131.79	128.76
1	A	66	CH6	CD1-CE1-CZ	2.21	122.22	119.88
1	E	66	CH6	CD1-CE1-CZ	2.18	122.19	119.88
1	A	66	CH6	CB2-CA2-C2	-2.16	119.74	122.36

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	66	CH6	CB2-CA2-N2	2.15	131.68	128.76
1	F	66	CH6	CD1-CE1-CZ	2.11	122.11	119.88
1	C	66	CH6	CA2-N2-C1	2.11	107.45	105.80
1	E	66	CH6	CB2-CA2-N2	2.10	131.61	128.76
1	C	66	CH6	CD1-CE1-CZ	2.03	122.02	119.88
1	G	66	CH6	C2-CA2-N2	-2.02	107.50	108.95

There are no chirality outliers.

All (45) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	66	CH6	N1-CA1-CB1-CG1
1	A	66	CH6	C1-CA1-CB1-CG1
1	A	66	CH6	N2-CA2-CB2-CG2
1	A	66	CH6	C2-CA2-CB2-CG2
1	A	66	CH6	C3-CA3-N3-C1
1	A	66	CH6	C3-CA3-N3-C2
1	B	66	CH6	N1-CA1-CB1-CG1
1	B	66	CH6	N2-CA2-CB2-CG2
1	B	66	CH6	C2-CA2-CB2-CG2
1	C	66	CH6	N1-CA1-CB1-CG1
1	C	66	CH6	C1-CA1-CB1-CG1
1	C	66	CH6	N2-CA2-CB2-CG2
1	C	66	CH6	C2-CA2-CB2-CG2
1	C	66	CH6	C3-CA3-N3-C1
1	D	66	CH6	N2-CA2-CB2-CG2
1	D	66	CH6	C2-CA2-CB2-CG2
1	E	66	CH6	N1-CA1-CB1-CG1
1	E	66	CH6	C1-CA1-CB1-CG1
1	E	66	CH6	N2-CA2-CB2-CG2
1	E	66	CH6	C2-CA2-CB2-CG2
1	F	66	CH6	N1-CA1-CB1-CG1
1	F	66	CH6	C1-CA1-CB1-CG1
1	F	66	CH6	N2-CA2-CB2-CG2
1	F	66	CH6	C2-CA2-CB2-CG2
1	G	66	CH6	N1-CA1-CB1-CG1
1	G	66	CH6	C1-CA1-CB1-CG1
1	G	66	CH6	N2-CA2-CB2-CG2
1	G	66	CH6	C2-CA2-CB2-CG2
1	H	66	CH6	N1-CA1-CB1-CG1
1	H	66	CH6	C1-CA1-CB1-CG1
1	H	66	CH6	N2-CA2-CB2-CG2

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Mol	Chain	Res	Type	Atoms
1	H	66	CH6	C2-CA2-CB2-CG2
1	B	66	CH6	CA1-CB1-CG1-SD
1	B	66	CH6	C1-CA1-CB1-CG1
1	H	66	CH6	CB1-CG1-SD-CE
1	A	66	CH6	CB1-CG1-SD-CE
1	C	66	CH6	C3-CA3-N3-C2
1	C	66	CH6	CB1-CG1-SD-CE
1	D	66	CH6	CB1-CG1-SD-CE
1	E	66	CH6	CB1-CG1-SD-CE
1	E	66	CH6	C3-CA3-N3-C1
1	F	66	CH6	CB1-CG1-SD-CE
1	H	66	CH6	CA1-CB1-CG1-SD
1	D	66	CH6	CA1-CB1-CG1-SD
1	G	66	CH6	CA1-CB1-CG1-SD

There are no ring outliers.

4 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	G	66	CH6	2	0
1	B	66	CH6	2	0
1	D	66	CH6	2	0
1	F	66	CH6	1	0

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	215/223 (96%)	0.43	6 (2%) 55 54	15, 26, 46, 73	0
1	B	214/223 (95%)	0.58	11 (5%) 33 32	11, 28, 48, 75	1 (0%)
1	C	215/223 (96%)	0.38	7 (3%) 49 48	12, 24, 46, 68	1 (0%)
1	D	214/223 (95%)	0.48	7 (3%) 49 48	13, 27, 46, 63	0
1	E	215/223 (96%)	0.31	4 (1%) 66 66	12, 24, 42, 71	0
1	F	215/223 (96%)	0.63	6 (2%) 55 54	13, 29, 50, 80	0
1	G	215/223 (96%)	0.58	8 (3%) 45 44	13, 27, 50, 70	0
1	H	215/223 (96%)	0.73	13 (6%) 27 26	14, 31, 54, 73	0
All	All	1718/1784 (96%)	0.51	62 (3%) 46 45	11, 27, 48, 80	2 (0%)

All (62) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	168	LYS	5.7
1	E	223	THR	4.7
1	F	6	ALA	4.5
1	B	6	ALA	4.4
1	G	6	ALA	4.3
1	H	6	ALA	4.2
1	F	223	THR	4.0
1	C	223	THR	3.7
1	B	171	GLY	3.4
1	F	7	ILE	3.3
1	A	169	ASP	3.1
1	D	6	ALA	3.0
1	B	170	GLY	2.9
1	G	185	LYS	2.9
1	C	168	LYS	2.9
1	H	186	PRO	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	170	GLY	2.9
1	A	6	ALA	2.8
1	D	7	ILE	2.7
1	B	222	SER	2.7
1	H	113	LEU	2.7
1	A	223	THR	2.6
1	A	7	ILE	2.6
1	F	185	LYS	2.6
1	H	132	ASP	2.5
1	B	172	HIS	2.5
1	F	186	PRO	2.5
1	C	210	ILE	2.5
1	H	133	GLY	2.5
1	D	222	SER	2.5
1	G	187	VAL	2.5
1	D	168	LYS	2.5
1	E	39	GLU	2.4
1	D	169	ASP	2.4
1	H	159	GLY	2.4
1	B	169	ASP	2.4
1	C	206	GLU	2.4
1	E	186	PRO	2.3
1	H	187	VAL	2.3
1	B	141	ASN	2.3
1	B	185	LYS	2.3
1	B	168	LYS	2.3
1	B	178	LYS	2.2
1	H	149	ARG	2.2
1	G	113	LEU	2.2
1	G	189	LEU	2.2
1	H	192	ALA	2.2
1	H	131	SER	2.2
1	B	167	LEU	2.2
1	H	172	HIS	2.1
1	F	141	ASN	2.1
1	H	154	ASP	2.1
1	C	115	ASP	2.1
1	C	169	ASP	2.1
1	G	7	ILE	2.1
1	G	8	ILE	2.1
1	C	131	SER	2.1
1	D	164	ARG	2.1

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Mol	Chain	Res	Type	RSRZ
1	G	186	PRO	2.1
1	D	171	GLY	2.0
1	E	154	ASP	2.0
1	H	169	ASP	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [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
1	CH6	D	66	23/24	0.86	0.14	28,40,51,54	0
1	CH6	A	66	23/24	0.87	0.13	18,28,37,47	0
1	CH6	B	66	23/24	0.89	0.12	9,31,40,44	0
1	CH6	E	66	23/24	0.89	0.11	16,29,37,44	0
1	CH6	F	66	23/24	0.90	0.11	16,25,56,59	0
1	CH6	H	66	23/24	0.90	0.12	24,34,42,45	0
1	CH6	G	66	23/24	0.91	0.12	26,36,42,45	0
1	CH6	C	66	23/24	0.92	0.11	16,25,35,48	0

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.