



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 12:50 PM UTC

PDB ID : 4U7N / pdb_00004u7n
Title : Inactive structure of histidine kinase
Authors : Cai, Y.; Hu, X.; Sang, J.
Deposited on : 2014-07-31
Resolution : 3.20 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

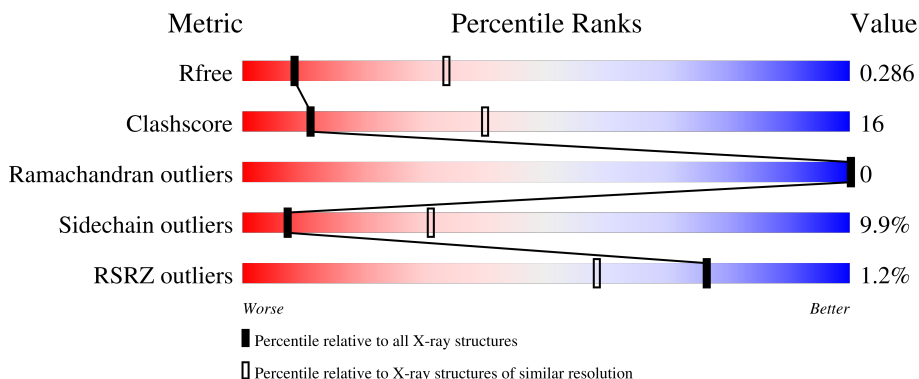
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.20 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	1466 (3.20-3.20)
Clashscore	190562	1573 (3.20-3.20)
Ramachandran outliers	187476	1548 (3.20-3.20)
Sidechain outliers	187428	1547 (3.20-3.20)
RSRZ outliers	180081	1466 (3.20-3.20)

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	277	% 44% 28% • 24%
1	B	277	% 49% 23% • 23%

2 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 3394 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 Histidine protein kinase sensor protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	211	Total	C	N	O	S	0	0	0
			1695	1073	287	326	9			
1	B	212	Total	C	N	O	S	0	0	0
			1699	1075	288	327	9			

There are 44 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	348	MET	-	expression tag	UNP C6VIM1
A	349	GLY	-	expression tag	UNP C6VIM1
A	350	SER	-	expression tag	UNP C6VIM1
A	351	SER	-	expression tag	UNP C6VIM1
A	352	HIS	-	expression tag	UNP C6VIM1
A	353	HIS	-	expression tag	UNP C6VIM1
A	354	HIS	-	expression tag	UNP C6VIM1
A	355	HIS	-	expression tag	UNP C6VIM1
A	356	HIS	-	expression tag	UNP C6VIM1
A	357	HIS	-	expression tag	UNP C6VIM1
A	358	SER	-	expression tag	UNP C6VIM1
A	359	SER	-	expression tag	UNP C6VIM1
A	360	GLY	-	expression tag	UNP C6VIM1
A	361	LEU	-	expression tag	UNP C6VIM1
A	362	VAL	-	expression tag	UNP C6VIM1
A	363	PRO	-	expression tag	UNP C6VIM1
A	364	ARG	-	expression tag	UNP C6VIM1
A	365	GLY	-	expression tag	UNP C6VIM1
A	366	SER	-	expression tag	UNP C6VIM1
A	367	ALA	-	expression tag	UNP C6VIM1
A	368	GLU	-	expression tag	UNP C6VIM1
A	369	PHE	-	expression tag	UNP C6VIM1
B	348	MET	-	expression tag	UNP C6VIM1
B	349	GLY	-	expression tag	UNP C6VIM1
B	350	SER	-	expression tag	UNP C6VIM1

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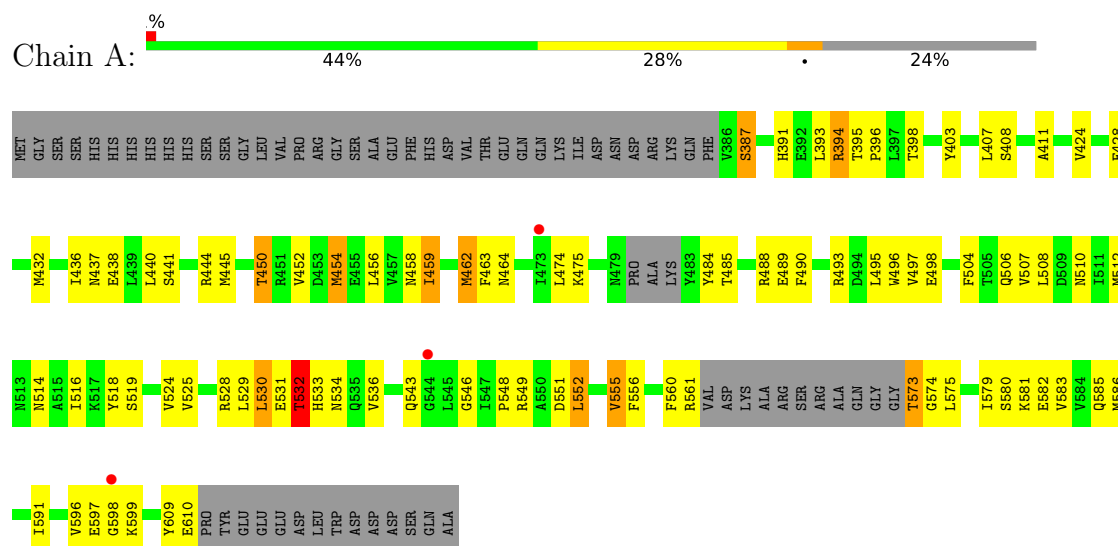
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Chain	Residue	Modelled	Actual	Comment	Reference
B	351	SER	-	expression tag	UNP C6VIM1
B	352	HIS	-	expression tag	UNP C6VIM1
B	353	HIS	-	expression tag	UNP C6VIM1
B	354	HIS	-	expression tag	UNP C6VIM1
B	355	HIS	-	expression tag	UNP C6VIM1
B	356	HIS	-	expression tag	UNP C6VIM1
B	357	HIS	-	expression tag	UNP C6VIM1
B	358	SER	-	expression tag	UNP C6VIM1
B	359	SER	-	expression tag	UNP C6VIM1
B	360	GLY	-	expression tag	UNP C6VIM1
B	361	LEU	-	expression tag	UNP C6VIM1
B	362	VAL	-	expression tag	UNP C6VIM1
B	363	PRO	-	expression tag	UNP C6VIM1
B	364	ARG	-	expression tag	UNP C6VIM1
B	365	GLY	-	expression tag	UNP C6VIM1
B	366	SER	-	expression tag	UNP C6VIM1
B	367	ALA	-	expression tag	UNP C6VIM1
B	368	GLU	-	expression tag	UNP C6VIM1
B	369	PHE	-	expression tag	UNP C6VIM1

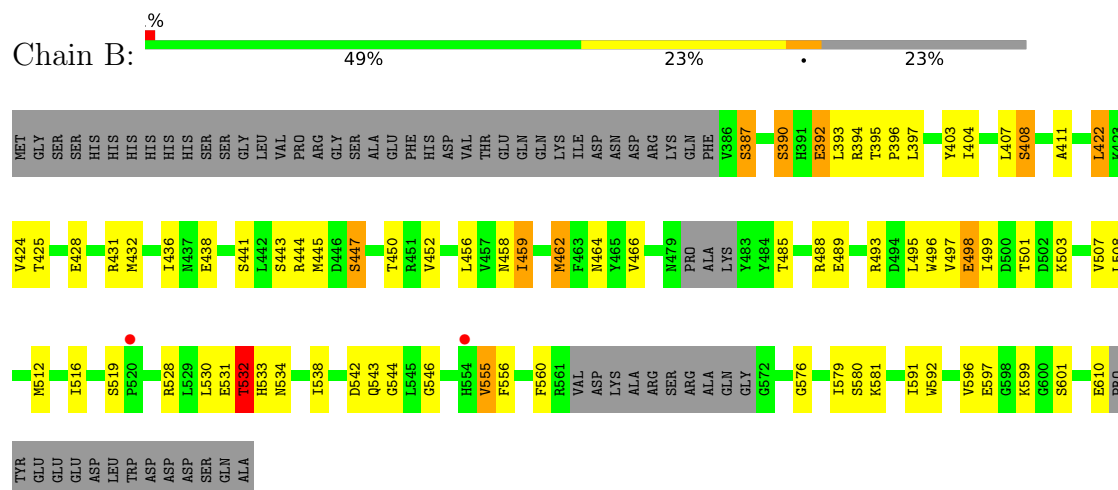
3 Residue-property plots

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: Histidine protein kinase sensor protein



• Molecule 1: Histidine protein kinase sensor protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 31	Depositor
Cell constants a, b, c, α , β , γ	91.60Å 91.60Å 97.90Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	23.39 – 3.20 23.39 – 3.20	Depositor EDS
% Data completeness (in resolution range)	98.9 (23.39-3.20) 94.4 (23.39-3.20)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.34 (at 2.99Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.4_1496)	Depositor
R, R_{free}	0.251 , 0.285 0.257 , 0.286	Depositor DCC
R_{free} test set	1893 reflections (10.29%)	wwPDB-VP
Wilson B-factor (Å ²)	99.1	Xtriage
Anisotropy	0.391	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 186.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.023 for -h,-k,l 0.447 for h,-h-k,-l 0.026 for -k,-h,-l	Xtriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	3394	wwPDB-VP
Average B, all atoms (Å ²)	159.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.00% 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	0.49	0/1723	0.89	1/2326 (0.0%)
1	B	0.51	0/1727	0.95	2/2331 (0.1%)
All	All	0.50	0/3450	0.92	3/4657 (0.1%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	447	SER	N-CA-C	9.18	124.03	113.02
1	A	532	THR	CB-CA-C	-5.40	102.78	110.34
1	B	532	THR	CB-CA-C	-5.06	103.25	110.34

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	1695	0	1684	61	0
1	B	1699	0	1687	54	0
All	All	3394	0	3371	110	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 16.

All (110) 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:407:LEU:HA	1:B:411:ALA:HB3	1.56	0.88
1:A:407:LEU:HA	1:A:411:ALA:HB3	1.59	0.84
1:A:438:GLU:HG2	1:A:579:ILE:HD11	1.57	0.84
1:B:397:LEU:HD23	1:B:432:MET:HE1	1.60	0.83
1:B:581:LYS:HA	1:B:591:ILE:HG21	1.71	0.72
1:A:445:MET:HE1	1:A:583:VAL:HG22	1.74	0.69
1:A:581:LYS:HA	1:A:591:ILE:HG21	1.75	0.68
1:A:403:TYR:CZ	1:A:424:VAL:HG11	2.29	0.68
1:B:489:GLU:OE1	1:B:528:ARG:NH1	2.26	0.68
1:B:403:TYR:CZ	1:B:424:VAL:HG11	2.29	0.67
1:B:493:ARG:NH2	1:B:531:GLU:HB3	2.10	0.66
1:B:493:ARG:CZ	1:B:531:GLU:HB3	2.26	0.65
1:A:445:MET:HG2	1:A:450:THR:HG21	1.78	0.65
1:A:493:ARG:CZ	1:A:531:GLU:HB3	2.27	0.65
1:B:438:GLU:HG2	1:B:579:ILE:HD11	1.79	0.64
1:A:437:ASN:HD21	1:B:394:ARG:HH12	1.47	0.63
1:A:546:GLY:HA3	1:A:597:GLU:HA	1.80	0.62
1:A:454:MET:HG2	1:A:498:GLU:HG2	1.81	0.62
1:A:493:ARG:NH2	1:A:531:GLU:HB3	2.15	0.61
1:B:519:SER:HA	1:B:544:GLY:HA3	1.81	0.61
1:B:596:VAL:O	1:B:599:LYS:N	2.34	0.61
1:A:440:LEU:HD13	1:B:390:SER:HB2	1.83	0.60
1:A:561:ARG:HH12	1:A:574:GLY:HA2	1.66	0.59
1:B:532:THR:O	1:B:532:THR:OG1	2.16	0.59
1:B:445:MET:HG2	1:B:450:THR:HG21	1.85	0.59
1:B:556:PHE:HB3	1:B:581:LYS:HD2	1.83	0.58
1:B:546:GLY:HA3	1:B:597:GLU:HA	1.86	0.57
1:B:464:ASN:OD1	1:B:488:ARG:NH1	2.37	0.57
1:B:462:MET:HE3	1:B:499:ILE:HD11	1.87	0.56
1:A:489:GLU:OE1	1:A:528:ARG:NH1	2.38	0.56
1:A:458:ASN:HB2	1:A:496:TRP:CZ3	2.41	0.55
1:A:596:VAL:O	1:A:599:LYS:N	2.40	0.55
1:A:387:SER:O	1:A:391:HIS:ND1	2.36	0.55
1:A:403:TYR:CE1	1:A:424:VAL:HG11	2.42	0.54
1:B:493:ARG:HD2	1:B:495:LEU:HD21	1.89	0.54
1:A:507:VAL:HG22	1:A:580:SER:HA	1.91	0.54
1:A:437:ASN:OD1	1:B:394:ARG:NH1	2.41	0.53
1:A:445:MET:HG2	1:A:586:MET:HE1	1.90	0.53
1:A:549:ARG:HA	1:A:552:LEU:HB2	1.90	0.52
1:A:393:LEU:O	1:A:396:PRO:HD2	2.10	0.51
1:B:462:MET:HE1	1:B:501:THR:HG23	1.92	0.51
1:A:459:ILE:HD11	1:A:497:VAL:HB	1.93	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:507:VAL:HG13	1:A:580:SER:HB3	1.92	0.51
1:B:445:MET:HA	1:B:450:THR:CG2	2.41	0.50
1:A:458:ASN:HB2	1:A:496:TRP:CH2	2.46	0.50
1:A:474:LEU:HD21	1:A:516:ILE:HD13	1.94	0.50
1:B:533:HIS:O	1:B:534:ASN:HB2	2.12	0.50
1:A:556:PHE:HB3	1:A:581:LYS:HD2	1.93	0.50
1:A:463:PHE:HB3	1:A:490:PHE:CE2	2.47	0.49
1:A:532:THR:O	1:A:532:THR:OG1	2.16	0.49
1:B:422:LEU:O	1:B:425:THR:OG1	2.29	0.49
1:A:441:SER:HA	1:A:444:ARG:HG2	1.95	0.48
1:B:393:LEU:O	1:B:396:PRO:HD2	2.14	0.48
1:B:493:ARG:HH12	1:B:531:GLU:H	1.61	0.48
1:B:443:SER:O	1:B:447:SER:HB3	2.13	0.48
1:A:438:GLU:OE1	1:A:575:LEU:HB2	2.13	0.48
1:A:493:ARG:HH12	1:A:531:GLU:H	1.61	0.48
1:A:495:LEU:HD13	1:A:536:VAL:HG22	1.96	0.48
1:A:533:HIS:O	1:A:534:ASN:HB2	2.14	0.48
1:B:556:PHE:HE2	1:B:592:TRP:HA	1.78	0.47
1:B:542:ASP:OD1	1:B:601:SER:HB2	2.15	0.47
1:A:394:ARG:HH11	1:A:398:THR:HG21	1.80	0.47
1:B:403:TYR:CE1	1:B:424:VAL:HG11	2.50	0.46
1:A:459:ILE:HA	1:A:462:MET:HB3	1.97	0.46
1:B:392:GLU:O	1:B:392:GLU:HG3	2.15	0.46
1:A:512:MET:O	1:A:516:ILE:HG13	2.16	0.46
1:B:458:ASN:HB2	1:B:496:TRP:CH2	2.51	0.46
1:B:459:ILE:HD11	1:B:497:VAL:HB	1.98	0.45
1:A:436:ILE:HD13	1:A:436:ILE:HA	1.79	0.45
1:A:534:ASN:HA	1:A:609:TYR:HB3	1.99	0.45
1:B:441:SER:HA	1:B:444:ARG:HG2	1.99	0.45
1:A:438:GLU:OE1	1:A:573:THR:OG1	2.34	0.45
1:B:576:GLY:HA2	1:B:579:ILE:HD12	1.99	0.45
1:A:394:ARG:HG2	1:B:436:ILE:HG21	1.99	0.44
1:A:548:PRO:HB2	1:A:551:ASP:OD1	2.17	0.44
1:B:428:GLU:OE2	1:B:431:ARG:NH1	2.50	0.43
1:B:458:ASN:HB2	1:B:496:TRP:CZ3	2.53	0.43
1:B:512:MET:HE3	1:B:512:MET:HB3	1.91	0.43
1:A:493:ARG:HD2	1:A:495:LEU:HD21	1.99	0.43
1:A:532:THR:O	1:A:533:HIS:HB2	2.18	0.43
1:A:462:MET:HE2	1:A:504:PHE:CD2	2.54	0.43
1:A:395:THR:HB	1:A:396:PRO:HD3	2.01	0.43
1:B:555:VAL:HA	1:B:560:PHE:CD2	2.54	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:474:LEU:HD22	1:A:484:TYR:HB2	2.01	0.42
1:B:447:SER:O	1:B:447:SER:OG	2.27	0.42
1:B:498:GLU:CD	1:B:498:GLU:H	2.27	0.42
1:B:395:THR:HB	1:B:396:PRO:HD3	2.01	0.42
1:B:512:MET:O	1:B:516:ILE:HG13	2.19	0.42
1:B:459:ILE:HA	1:B:462:MET:HB3	2.01	0.42
1:A:462:MET:HE2	1:A:504:PHE:HD2	1.85	0.41
1:A:529:LEU:C	1:A:530:LEU:HG	2.44	0.41
1:A:485:THR:HB	1:A:524:VAL:HG22	2.03	0.41
1:B:438:GLU:CG	1:B:579:ILE:HD11	2.47	0.41
1:B:503:LYS:O	1:B:507:VAL:HG23	2.20	0.41
1:B:507:VAL:HG22	1:B:580:SER:HA	2.03	0.41
1:A:506:GLN:O	1:A:510:ASN:ND2	2.53	0.41
1:A:597:GLU:HA	1:A:598:GLY:HA2	1.44	0.41
1:A:440:LEU:HD11	1:B:387:SER:HA	2.01	0.41
1:A:555:VAL:HA	1:A:560:PHE:CD2	2.55	0.41
1:A:514:ASN:O	1:A:518:TYR:HB2	2.21	0.41
1:B:404:ILE:O	1:B:408:SER:OG	2.37	0.41
1:A:428:GLU:O	1:A:432:MET:HG3	2.21	0.41
1:A:464:ASN:OD1	1:A:488:ARG:NH1	2.53	0.41
1:B:493:ARG:HH11	1:B:495:LEU:HD21	1.85	0.41
1:B:532:THR:O	1:B:533:HIS:HB2	2.20	0.41
1:B:508:LEU:HD23	1:B:508:LEU:HA	1.81	0.41
1:B:462:MET:O	1:B:466:VAL:HG23	2.21	0.40
1:A:508:LEU:HD23	1:A:508:LEU:HA	1.83	0.40
1:A:531:GLU:HG3	1:A:609:TYR:CD2	2.57	0.40
1:A:534:ASN:CA	1:A:609:TYR:HB3	2.52	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	205/277 (74%)	196 (96%)	9 (4%)	0	100	100
1	B	206/277 (74%)	194 (94%)	12 (6%)	0	100	100
All	All	411/554 (74%)	390 (95%)	21 (5%)	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	191/247 (77%)	170 (89%)	21 (11%)	6	26
1	B	191/247 (77%)	174 (91%)	17 (9%)	9	34
All	All	382/494 (77%)	344 (90%)	38 (10%)	7	31

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	387	SER
1	A	394	ARG
1	A	408	SER
1	A	450	THR
1	A	452	VAL
1	A	454	MET
1	A	456	LEU
1	A	459	ILE
1	A	462	MET
1	A	475	LYS
1	A	519	SER
1	A	525	VAL
1	A	530	LEU
1	A	532	THR
1	A	543	GLN
1	A	552	LEU
1	A	555	VAL
1	A	573	THR

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Mol	Chain	Res	Type
1	A	582	GLU
1	A	585	GLN
1	A	610	GLU
1	B	387	SER
1	B	390	SER
1	B	392	GLU
1	B	408	SER
1	B	422	LEU
1	B	452	VAL
1	B	456	LEU
1	B	459	ILE
1	B	462	MET
1	B	485	THR
1	B	498	GLU
1	B	530	LEU
1	B	532	THR
1	B	538	ILE
1	B	543	GLN
1	B	555	VAL
1	B	610	GLU

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

Mol	Chain	Res	Type
1	B	391	HIS
1	B	514	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

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	211/277 (76%)	-0.18	3 (1%)	73 54	77, 146, 279, 466	0
1	B	212/277 (76%)	-0.29	2 (0%)	81 64	69, 145, 260, 532	0
All	All	423/554 (76%)	-0.24	5 (1%)	76 58	69, 145, 266, 532	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	544	GLY	2.8
1	A	473	ILE	2.4
1	B	554	HIS	2.3
1	A	598	GLY	2.1
1	B	520	PRO	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.