



Full wwPDB NMR Structure Validation Report ⓘ

Mar 10, 2026 – 02:02 AM UTC

PDB ID : 1CB3 / pdb_00001cb3
Title : LOCAL INTERACTIONS DRIVE THE FORMATION OF NON-NATIVE
STRUCTURE IN THE DENATURED STATE OF HUMAN ALPHA-
LACTALBUMIN: A HIGH RESOLUTION STRUCTURAL CHARACTERI-
ZATION OF A PEPTIDE MODEL IN AQUEOUS SOLUTION
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Deposited on : 1999-02-26

This is a Full wwPDB NMR 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/NMRValidationReportHelp>

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)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

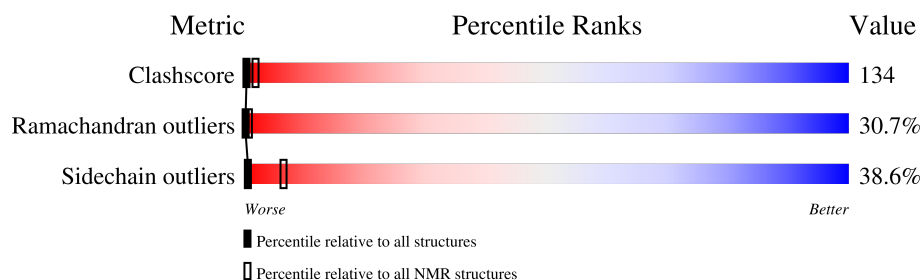
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment was not calculated.

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)	NMR archive (#Entries)
Clashscore	229148	14424
Ramachandran outliers	224038	12848
Sidechain outliers	223484	12823

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and 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 $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	13	15% 46% 31% 8%

2 Ensemble composition and analysis ⓘ

This entry contains 40 models.

Cyrange was unable to find well-defined residues.

Error message: Only domains with < 8 residues could be identified.

NmrClust was unable to cluster the ensemble.

Error message: Wrapper check: not enough residues in core to run NmrClust

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 193 atoms, of which 97 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called LCA.

Mol	Chain	Residues	Atoms					Trace
1	A	13	Total	C	H	N	O	1
			193	65	97	16	15	

There is a discrepancy between the modelled and reference sequences:

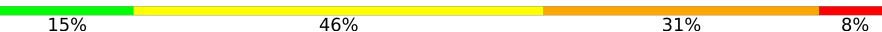
Chain	Residue	Modelled	Actual	Comment	Reference
A	11	ALA	CYS	SEE REMARK 999	UNP P00709

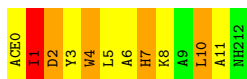
4 Residue-property plots [i](#)

4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-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. Stretches of 2 or more consecutive residues without any outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

- Molecule 1: LCA

Chain A: 



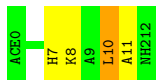
4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

- Molecule 1: LCA

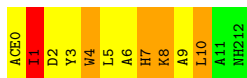
Chain A: 



4.2.2 Score per residue for model 2

- Molecule 1: LCA

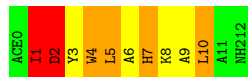
Chain A: 



4.2.3 Score per residue for model 3

- Molecule 1: LCA

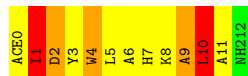
Chain A: 23% 31% 31% 15%



4.2.4 Score per residue for model 4

- Molecule 1: LCA

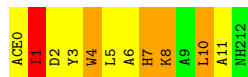
Chain A: 8% 54% 23% 15%



4.2.5 Score per residue for model 5

- Molecule 1: LCA

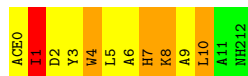
Chain A: 15% 46% 31% 8%



4.2.6 Score per residue for model 6

- Molecule 1: LCA

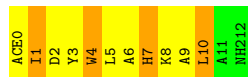
Chain A: 15% 46% 31% 8%



4.2.7 Score per residue for model 7

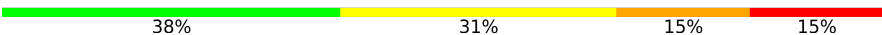
- Molecule 1: LCA

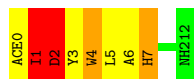
Chain A: 15% 54% 31%



4.2.8 Score per residue for model 8

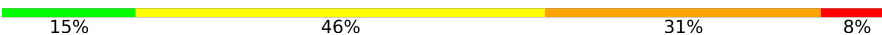
- Molecule 1: LCA

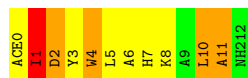
Chain A:  38% 31% 15% 15%



4.2.9 Score per residue for model 9

- Molecule 1: LCA

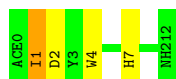
Chain A:  15% 46% 31% 8%



4.2.10 Score per residue for model 10

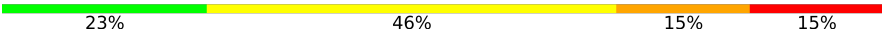
- Molecule 1: LCA

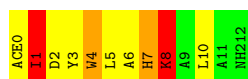
Chain A:  69% 23% 8%



4.2.11 Score per residue for model 11

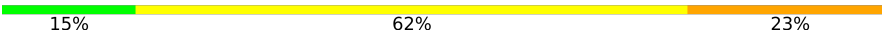
- Molecule 1: LCA

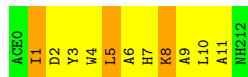
Chain A:  23% 46% 15% 15%



4.2.12 Score per residue for model 12

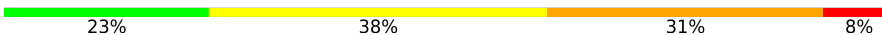
- Molecule 1: LCA

Chain A:  15% 62% 23%



4.2.13 Score per residue for model 13

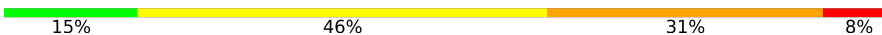
- Molecule 1: LCA

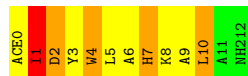
Chain A:  23% 38% 31% 8%



4.2.14 Score per residue for model 14

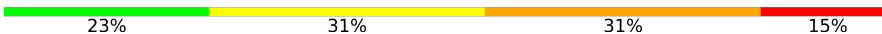
- Molecule 1: LCA

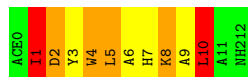
Chain A:  15% 46% 31% 8%



4.2.15 Score per residue for model 15

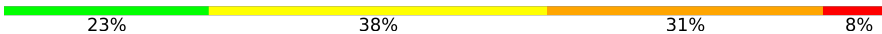
- Molecule 1: LCA

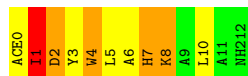
Chain A:  23% 31% 31% 15%



4.2.16 Score per residue for model 16

- Molecule 1: LCA

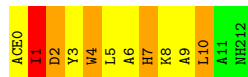
Chain A:  23% 38% 31% 8%



4.2.17 Score per residue for model 17

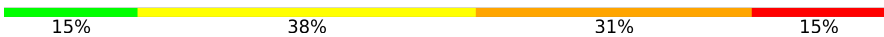
- Molecule 1: LCA

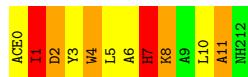
Chain A:  15% 46% 31% 8%



4.2.18 Score per residue for model 18

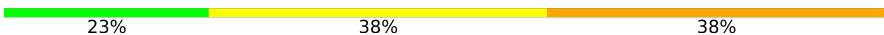
- Molecule 1: LCA

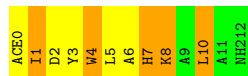
Chain A:  15% 38% 31% 15%



4.2.19 Score per residue for model 19

- Molecule 1: LCA

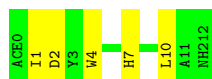
Chain A:  23% 38% 38%



4.2.20 Score per residue for model 20

- Molecule 1: LCA

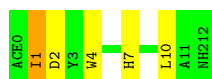
Chain A:  62% 38%



4.2.21 Score per residue for model 21

- Molecule 1: LCA

Chain A:  62% 31% 8%



4.2.22 Score per residue for model 22

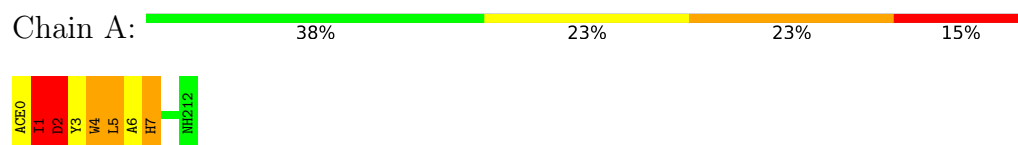
- Molecule 1: LCA

Chain A:  69% 23% 8%



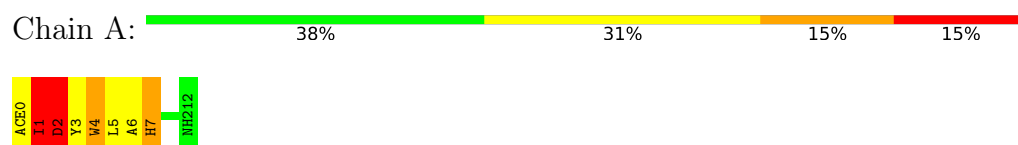
4.2.23 Score per residue for model 23

- Molecule 1: LCA



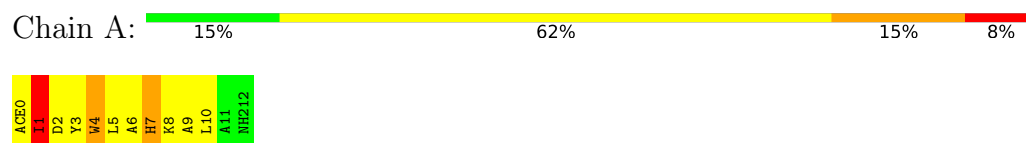
4.2.24 Score per residue for model 24

- Molecule 1: LCA



4.2.25 Score per residue for model 25

- Molecule 1: LCA



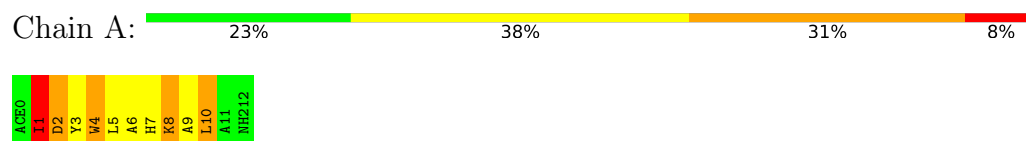
4.2.26 Score per residue for model 26

- Molecule 1: LCA



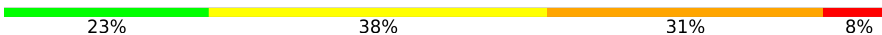
4.2.27 Score per residue for model 27

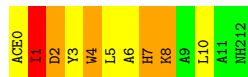
- Molecule 1: LCA



4.2.28 Score per residue for model 28

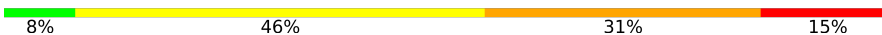
- Molecule 1: LCA

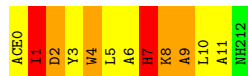
Chain A:  23% 38% 31% 8%



4.2.29 Score per residue for model 29

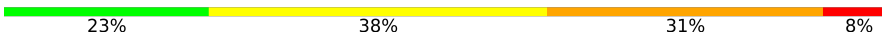
- Molecule 1: LCA

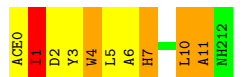
Chain A:  8% 46% 31% 15%



4.2.30 Score per residue for model 30

- Molecule 1: LCA

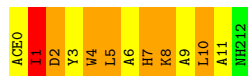
Chain A:  23% 38% 31% 8%



4.2.31 Score per residue for model 31

- Molecule 1: LCA

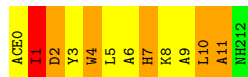
Chain A:  8% 38% 46% 8%



4.2.32 Score per residue for model 32

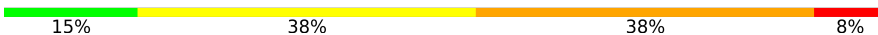
- Molecule 1: LCA

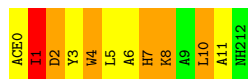
Chain A:  8% 46% 38% 8%



4.2.33 Score per residue for model 33

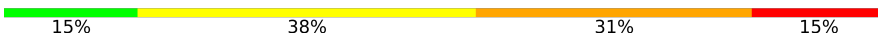
- Molecule 1: LCA

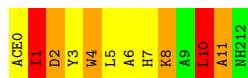
Chain A:  15% 38% 38% 8%



4.2.34 Score per residue for model 34

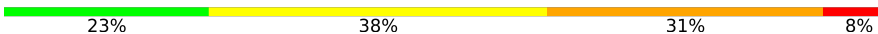
- Molecule 1: LCA

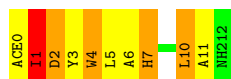
Chain A:  15% 38% 31% 15%



4.2.35 Score per residue for model 35

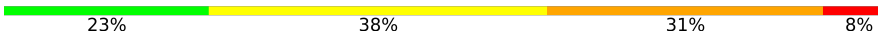
- Molecule 1: LCA

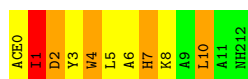
Chain A:  23% 38% 31% 8%



4.2.36 Score per residue for model 36

- Molecule 1: LCA

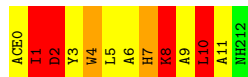
Chain A:  23% 38% 31% 8%



4.2.37 Score per residue for model 37

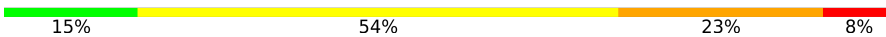
- Molecule 1: LCA

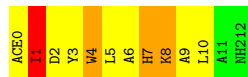
Chain A:  8% 46% 15% 31%



4.2.38 Score per residue for model 38

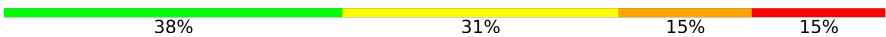
- Molecule 1: LCA

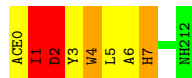
Chain A:  15% 54% 23% 8%



4.2.39 Score per residue for model 39

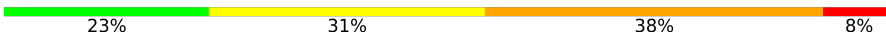
- Molecule 1: LCA

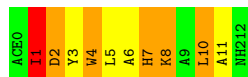
Chain A:  38% 31% 15% 15%



4.2.40 Score per residue for model 40

- Molecule 1: LCA

Chain A:  23% 31% 38% 8%



5 Refinement protocol and experimental data overview

The models were refined using the following method: *DISTANCE GEOMETRY AND SIMULATED ANNEALING*.

Of the 200 calculated structures, 40 were deposited, based on the following criterion: *structures with the least restraint violations*.

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
X-PLOR	refinement	3.851
X-PLOR	structure solution	3.851

No chemical shift data was provided.

6 Model quality

6.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NH2, ACE

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 (average) 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	1.38±0.03	0±0/70 (0.1± 0.4%)	1.49±0.06	0±0/93 (0.1± 0.3%)
All	All	1.38	3/3800 (0.1%)	1.49	3/5180 (0.1%)

All unique bond outliers are listed below.

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)	Models	
								Worst	Total
1	A	7	HIS	N-CA	5.19	1.49	1.46	18	3

All unique angle outliers are listed below.

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	7	HIS	N-CA-CB	-7.29	104.81	111.59	38	3

There are no chirality outliers.

There are no planarity outliers.

6.2 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 each 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 averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	96	97	94	24±10
All	All	3840	3880	3285	953

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 134.

All unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:1:ILE:HG23	1:A:4:TRP:HB2	0.92	1.41	3	35
1:A:1:ILE:HG22	1:A:2:ASP:N	0.81	1.91	25	35
1:A:5:LEU:O	1:A:10:LEU:HD13	0.74	1.83	31	1
1:A:3:TYR:CZ	1:A:4:TRP:CD1	0.74	2.76	34	35
1:A:10:LEU:HD13	1:A:10:LEU:O	0.73	1.84	28	2
1:A:10:LEU:HD13	1:A:10:LEU:C	0.72	2.10	28	1
1:A:1:ILE:HD13	1:A:4:TRP:CG	0.71	2.21	7	2
1:A:7:HIS:O	1:A:10:LEU:HD23	0.70	1.86	29	1
1:A:1:ILE:HA	1:A:4:TRP:CD1	0.68	2.24	15	35
1:A:7:HIS:CD2	1:A:7:HIS:N	0.68	2.60	31	35
1:A:3:TYR:CZ	1:A:4:TRP:NE1	0.68	2.62	5	35
1:A:3:TYR:CE2	1:A:4:TRP:CD1	0.67	2.82	12	17
1:A:1:ILE:HD13	1:A:4:TRP:CD1	0.66	2.26	7	2
1:A:1:ILE:CD1	1:A:4:TRP:CG	0.65	2.80	7	2
1:A:3:TYR:O	1:A:7:HIS:CD2	0.64	2.51	31	35
1:A:3:TYR:CE1	1:A:4:TRP:CD1	0.64	2.86	3	20
1:A:3:TYR:CD1	1:A:4:TRP:N	0.64	2.66	27	11
1:A:1:ILE:CG2	1:A:2:ASP:N	0.63	2.62	3	35
1:A:3:TYR:O	1:A:4:TRP:C	0.63	2.41	33	35
1:A:10:LEU:HD23	1:A:10:LEU:O	0.62	1.93	3	1
1:A:5:LEU:C	1:A:5:LEU:HD12	0.62	2.19	31	1
1:A:6:ALA:C	1:A:7:HIS:CD2	0.62	2.78	23	34
1:A:3:TYR:CD2	1:A:4:TRP:N	0.61	2.69	38	24
1:A:10:LEU:O	1:A:11:ALA:HB3	0.60	1.96	35	6
1:A:5:LEU:O	1:A:5:LEU:HD12	0.60	1.97	31	1
1:A:10:LEU:HD12	1:A:10:LEU:O	0.60	1.97	34	1
1:A:1:ILE:O	1:A:3:TYR:N	0.59	2.36	13	35
1:A:1:ILE:O	1:A:3:TYR:CD1	0.58	2.57	5	24
1:A:3:TYR:CG	1:A:4:TRP:N	0.58	2.72	12	35
1:A:3:TYR:O	1:A:5:LEU:N	0.57	2.37	31	35
1:A:10:LEU:O	1:A:11:ALA:HB2	0.56	1.98	9	2
1:A:1:ILE:HG22	1:A:2:ASP:H	0.56	1.60	13	33
1:A:6:ALA:O	1:A:8:LYS:N	0.56	2.38	29	1
1:A:3:TYR:OH	1:A:4:TRP:NE1	0.55	2.40	17	35
1:A:5:LEU:C	1:A:5:LEU:CD1	0.54	2.80	31	2
1:A:8:LYS:O	1:A:10:LEU:HD23	0.54	2.02	36	1
1:A:10:LEU:C	1:A:10:LEU:CD1	0.54	2.81	28	1
1:A:4:TRP:O	1:A:8:LYS:CG	0.53	2.56	9	9

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:10:LEU:O	1:A:10:LEU:CD1	0.53	2.57	30	1
1:A:4:TRP:O	1:A:5:LEU:C	0.53	2.51	17	31
1:A:6:ALA:O	1:A:8:LYS:CG	0.53	2.56	29	1
1:A:1:ILE:O	1:A:3:TYR:CD2	0.53	2.62	29	11
1:A:6:ALA:HB3	1:A:7:HIS:CD2	0.53	2.39	15	7
1:A:6:ALA:O	1:A:7:HIS:C	0.53	2.51	17	3
1:A:8:LYS:O	1:A:10:LEU:N	0.52	2.42	32	11
1:A:3:TYR:HH	1:A:4:TRP:NE1	0.51	2.03	13	1
1:A:2:ASP:N	1:A:2:ASP:OD1	0.51	2.42	32	3
1:A:9:ALA:O	1:A:11:ALA:N	0.51	2.43	31	3
1:A:4:TRP:O	1:A:8:LYS:CD	0.51	2.58	13	1
1:A:10:LEU:HD23	1:A:10:LEU:C	0.51	2.31	13	1
1:A:1:ILE:HD13	1:A:4:TRP:CD2	0.50	2.42	7	2
1:A:3:TYR:O	1:A:6:ALA:N	0.49	2.43	13	9
1:A:4:TRP:O	1:A:8:LYS:N	0.49	2.45	11	2
1:A:3:TYR:HB2	1:A:7:HIS:CE1	0.49	2.43	35	23
1:A:9:ALA:O	1:A:10:LEU:C	0.49	2.56	29	3
1:A:4:TRP:O	1:A:7:HIS:N	0.48	2.43	23	6
1:A:1:ILE:HG13	1:A:4:TRP:CG	0.48	2.44	13	17
1:A:0:ACE:O	1:A:1:ILE:C	0.48	2.57	14	29
1:A:7:HIS:O	1:A:8:LYS:C	0.48	2.57	9	6
1:A:1:ILE:CD1	1:A:4:TRP:CD2	0.48	2.97	7	2
1:A:8:LYS:O	1:A:9:ALA:C	0.47	2.56	7	8
1:A:1:ILE:HG12	1:A:4:TRP:CG	0.47	2.44	15	4
1:A:4:TRP:CZ3	1:A:8:LYS:HD2	0.47	2.43	16	1
1:A:4:TRP:CE3	1:A:8:LYS:HD2	0.47	2.45	36	2
1:A:10:LEU:O	1:A:11:ALA:C	0.47	2.57	4	3
1:A:7:HIS:O	1:A:8:LYS:O	0.47	2.33	27	4
1:A:3:TYR:HB2	1:A:7:HIS:NE2	0.47	2.25	9	29
1:A:7:HIS:O	1:A:8:LYS:CB	0.46	2.63	4	5
1:A:10:LEU:O	1:A:11:ALA:O	0.46	2.34	32	2
1:A:10:LEU:O	1:A:11:ALA:CB	0.46	2.64	35	3
1:A:9:ALA:O	1:A:10:LEU:O	0.46	2.33	3	1
1:A:4:TRP:O	1:A:8:LYS:HD2	0.46	2.11	13	1
1:A:4:TRP:O	1:A:8:LYS:HG2	0.45	2.11	27	3
1:A:8:LYS:O	1:A:9:ALA:O	0.45	2.34	4	1
1:A:3:TYR:C	1:A:7:HIS:CD2	0.45	2.94	23	9
1:A:4:TRP:O	1:A:8:LYS:HG3	0.45	2.11	34	8
1:A:6:ALA:O	1:A:8:LYS:HG2	0.44	2.11	29	1
1:A:8:LYS:HE3	1:A:8:LYS:CA	0.44	2.43	16	1
1:A:7:HIS:O	1:A:8:LYS:HB2	0.44	2.13	4	8

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:5:LEU:HG	1:A:6:ALA:N	0.44	2.28	15	1
1:A:1:ILE:HG23	1:A:4:TRP:CB	0.43	2.31	34	1
1:A:1:ILE:O	1:A:2:ASP:HB3	0.43	2.14	35	8
1:A:0:ACE:C	1:A:2:ASP:OD1	0.43	2.62	32	1
1:A:8:LYS:C	1:A:10:LEU:N	0.42	2.76	7	4
1:A:3:TYR:C	1:A:5:LEU:N	0.42	2.78	17	2
1:A:10:LEU:HD13	1:A:11:ALA:N	0.42	2.29	5	1
1:A:10:LEU:HG	1:A:11:ALA:N	0.42	2.29	12	1
1:A:3:TYR:CE2	1:A:4:TRP:NE1	0.41	2.88	12	2
1:A:1:ILE:O	1:A:2:ASP:HB2	0.41	2.15	39	4
1:A:7:HIS:C	1:A:8:LYS:HG3	0.41	2.40	7	2
1:A:4:TRP:C	1:A:8:LYS:HD2	0.41	2.41	13	1
1:A:1:ILE:O	1:A:2:ASP:CB	0.41	2.69	19	1
1:A:9:ALA:O	1:A:10:LEU:HB3	0.40	2.16	3	2

6.3 Torsion angles ⓘ

6.3.1 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 PDB entries followed by that with respect to all NMR entries. 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	11/13 (85%)	4±1 (34±12%)	4±1 (33±12%)	3±1 (30±9%)	0	1
All	All	423/520 (81%)	149 (35%)	144 (34%)	130 (31%)	0	1

All 8 unique Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	4	TRP	38
1	A	1	ILE	37
1	A	2	ASP	24
1	A	8	LYS	9
1	A	9	ALA	8
1	A	10	LEU	7
1	A	11	ALA	6
1	A	7	HIS	1

6.3.2 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 PDB entries followed by that with respect to all NMR entries. 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	8/8 (100%)	5±1 (61±10%)	3±1 (38±10%)	0	7
All	All	316/320 (99%)	194 (61%)	122 (39%)	0	6

All 6 unique residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	1	ILE	36
1	A	7	HIS	31
1	A	10	LEU	26
1	A	8	LYS	13
1	A	2	ASP	10
1	A	5	LEU	6

6.3.3 RNA [i](#)

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

6.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.6 Ligand geometry [i](#)

There are no ligands in this entry.

6.7 Other polymers [i](#)

There are no such molecules in this entry.

6.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

7 Chemical shift validation

No chemical shift data were provided