



Full wwPDB NMR Structure Validation Report ⓘ

Mar 9, 2026 – 12:46 PM UTC

PDB ID : 1LG4 / pdb_00001lg4
Title : NMR structure of the human doppel protein fragment 24-152
Authors : Luhrs, T.; Riek, R.; Guntert, P.; Wuthrich, K.
Deposited on : 2002-04-15

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
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

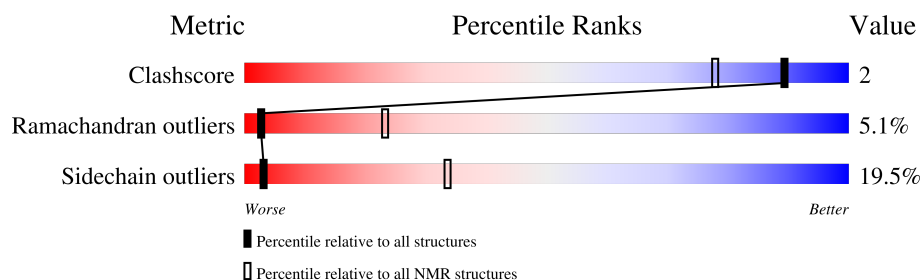
1 Overall quality at a glance

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	129	

2 Ensemble composition and analysis

This entry contains 20 models. Model 8 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *closest to the average*.

The following residues are included in the computation of the global validation metrics.

Well-defined (core) protein residues			
Well-defined core	Residue range (total)	Backbone RMSD (Å)	Medoid model
1	A:52-A:148 (97)	1.08	8

Ill-defined regions of proteins are excluded from the global statistics.

Ligands and non-protein polymers are included in the analysis.

The models can be grouped into 3 clusters and 2 single-model clusters were found.

Cluster number	Models
1	1, 2, 4, 5, 6, 8, 9, 11, 13, 15, 16, 17, 18, 20
2	14, 19
3	3, 12
Single-model clusters	7; 10

3 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 1551 atoms, of which 747 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Prion-like protein.

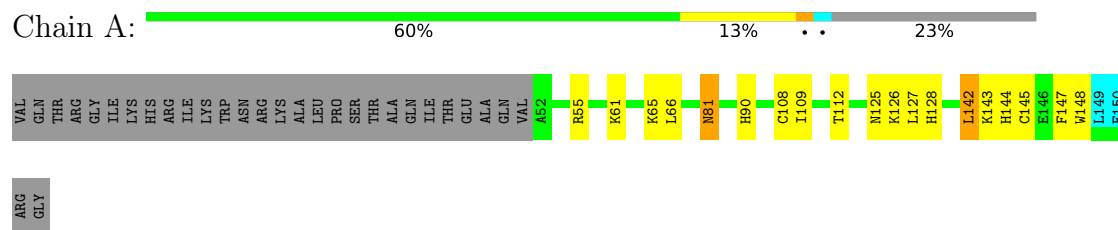
Mol	Chain	Residues	Atoms						Trace
1	A	99	Total	C	H	N	O	S	0
			1551	508	747	142	150	4	

4 Residue-property plots

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: Prion-like protein

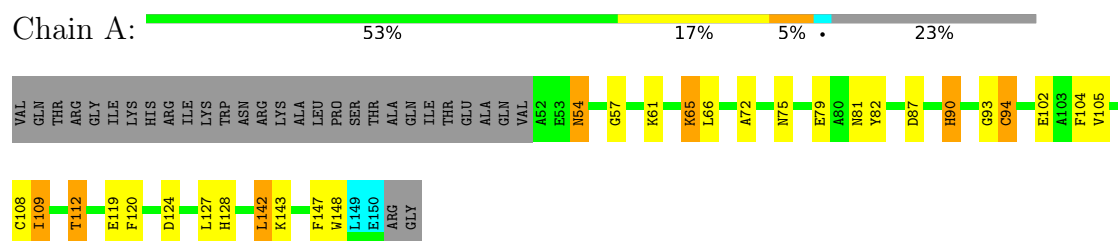


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

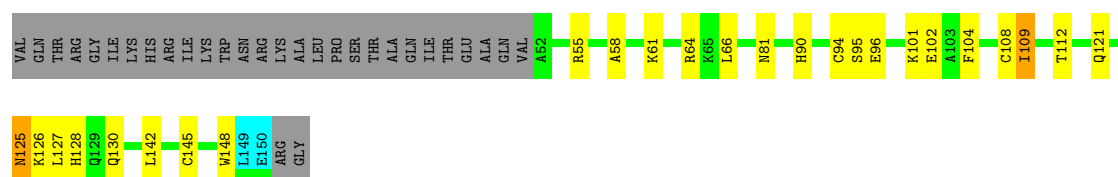
- Molecule 1: Prion-like protein



4.2.2 Score per residue for model 2

- Molecule 1: Prion-like protein

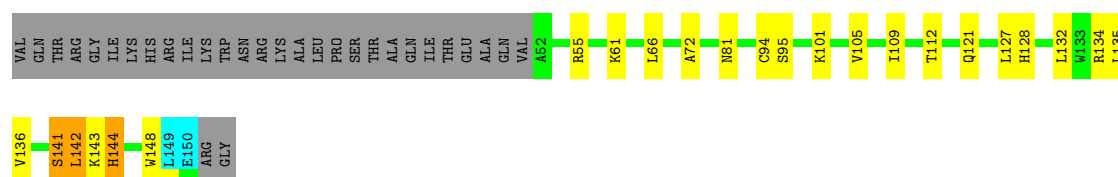




4.2.3 Score per residue for model 3

- Molecule 1: Prion-like protein

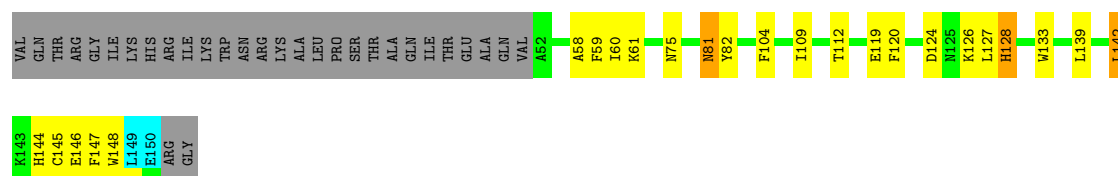
Chain A: 57% 16% 23%



4.2.4 Score per residue for model 4

- Molecule 1: Prion-like protein

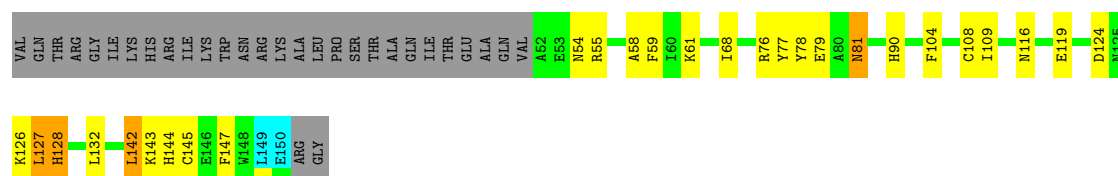
Chain A: 57% 16% 23%



4.2.5 Score per residue for model 5

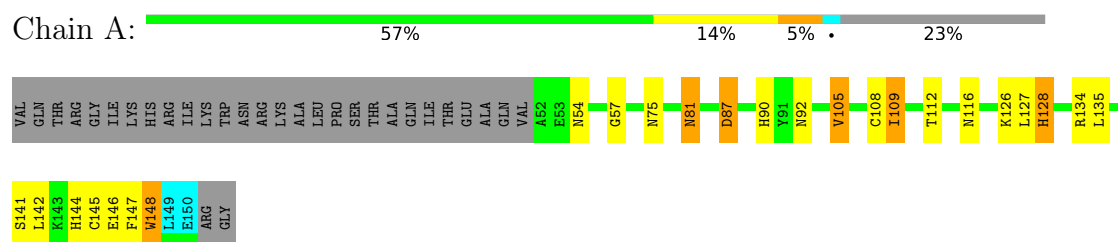
- Molecule 1: Prion-like protein

Chain A: 54% 18% 23%



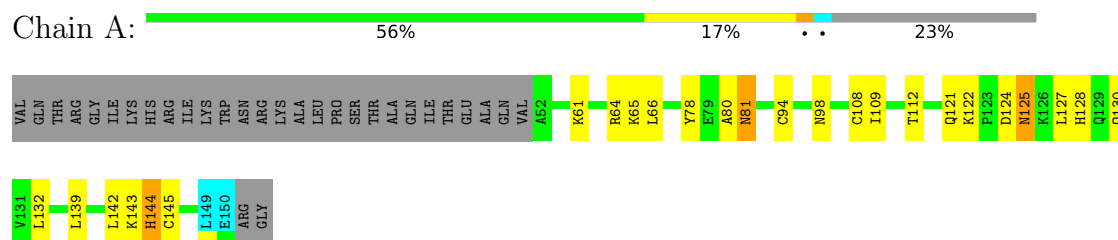
4.2.6 Score per residue for model 6

- Molecule 1: Prion-like protein



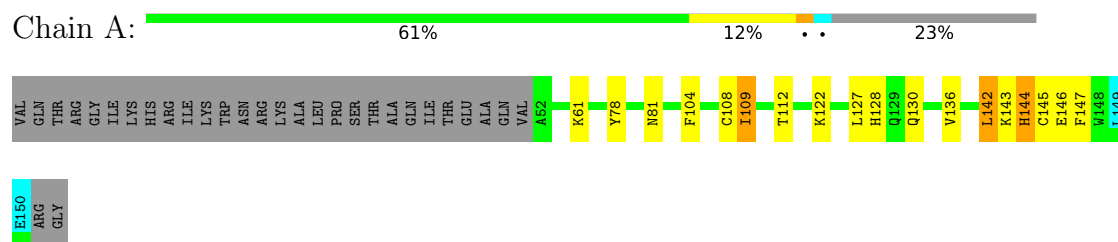
4.2.7 Score per residue for model 7

- Molecule 1: Prion-like protein



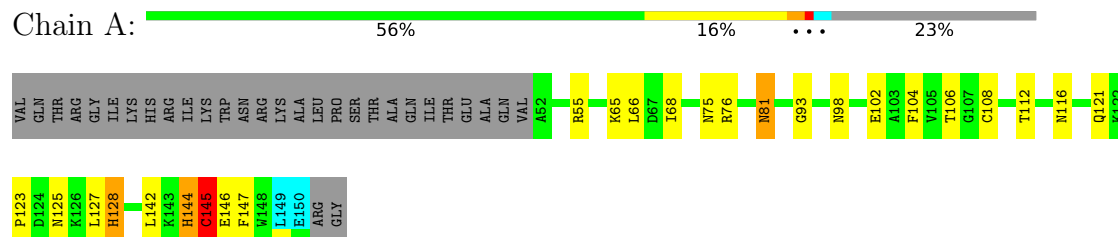
4.2.8 Score per residue for model 8 (medoid)

- Molecule 1: Prion-like protein



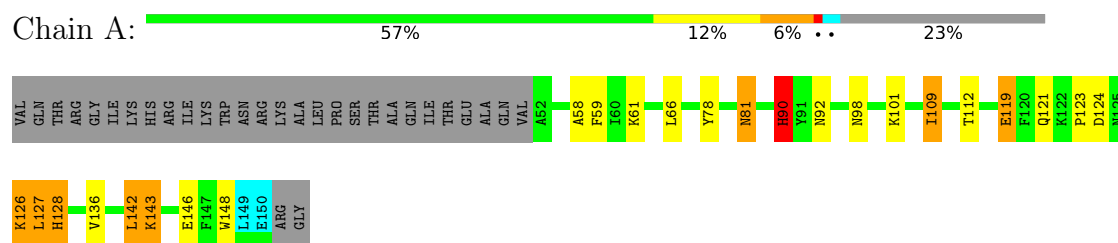
4.2.9 Score per residue for model 9

- Molecule 1: Prion-like protein



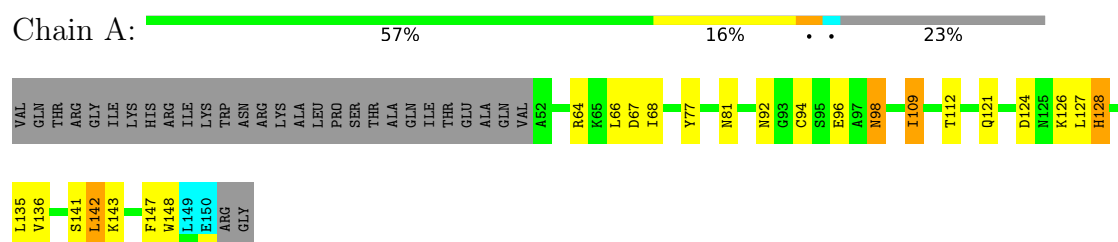
4.2.10 Score per residue for model 10

- Molecule 1: Prion-like protein



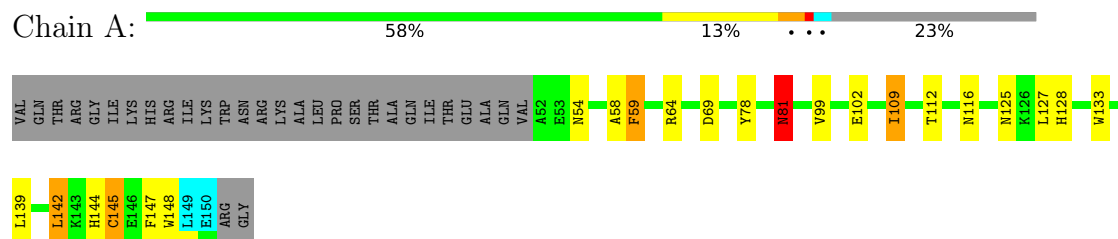
4.2.11 Score per residue for model 11

- Molecule 1: Prion-like protein



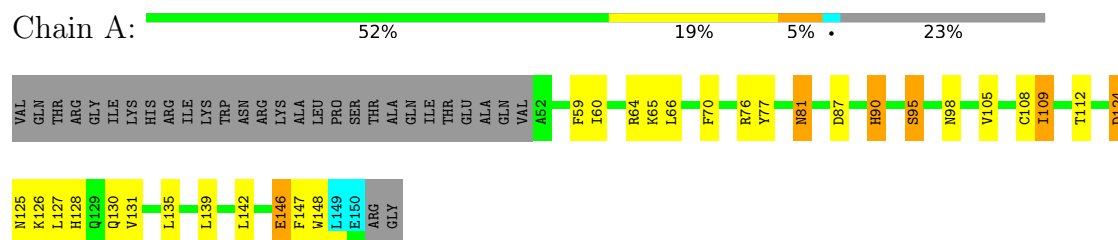
4.2.12 Score per residue for model 12

- Molecule 1: Prion-like protein



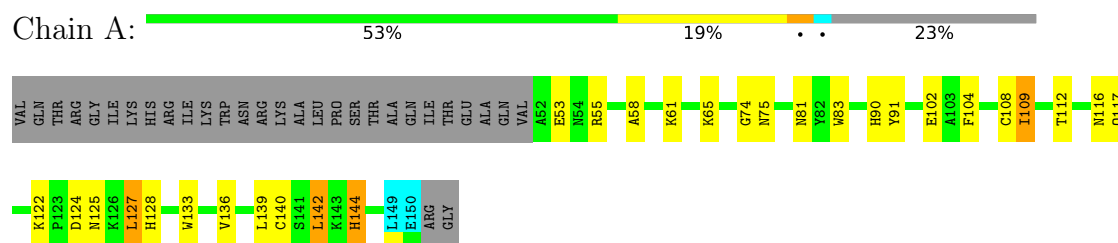
4.2.13 Score per residue for model 13

- Molecule 1: Prion-like protein



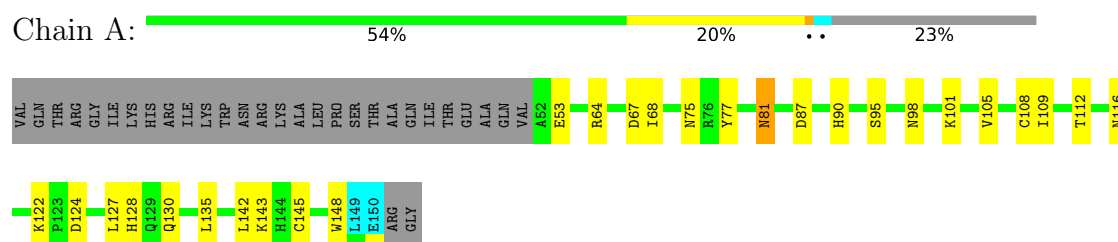
4.2.14 Score per residue for model 14

- Molecule 1: Prion-like protein



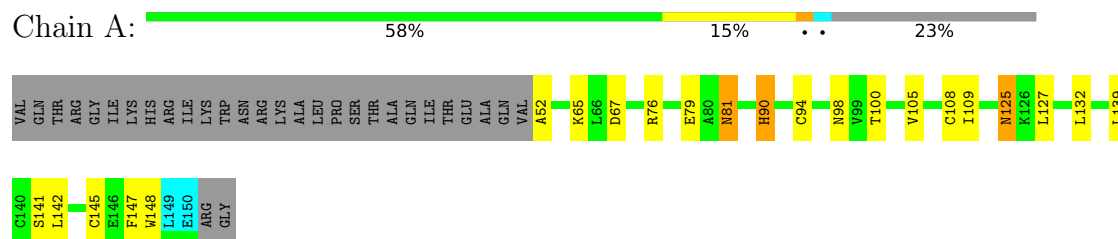
4.2.15 Score per residue for model 15

- Molecule 1: Prion-like protein



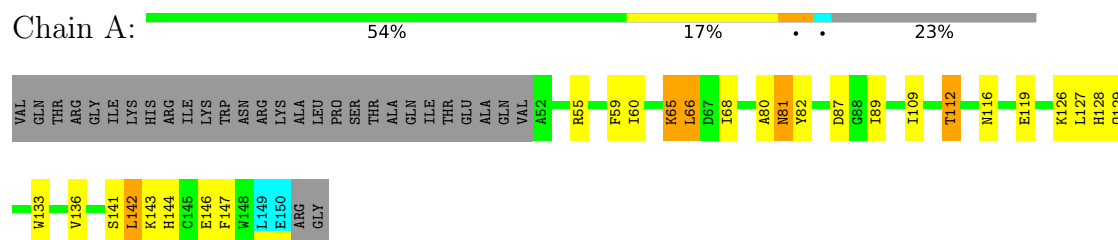
4.2.16 Score per residue for model 16

- Molecule 1: Prion-like protein



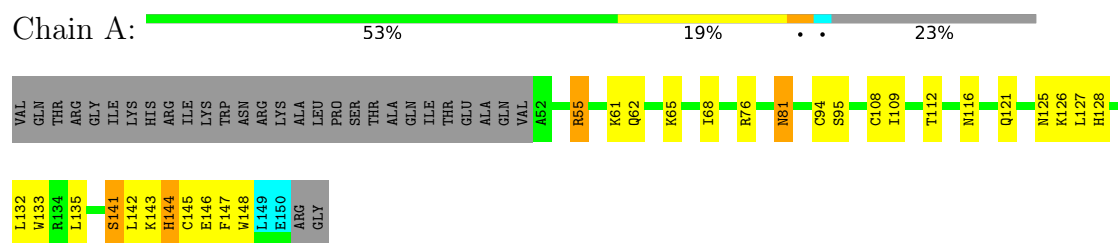
4.2.17 Score per residue for model 17

- Molecule 1: Prion-like protein



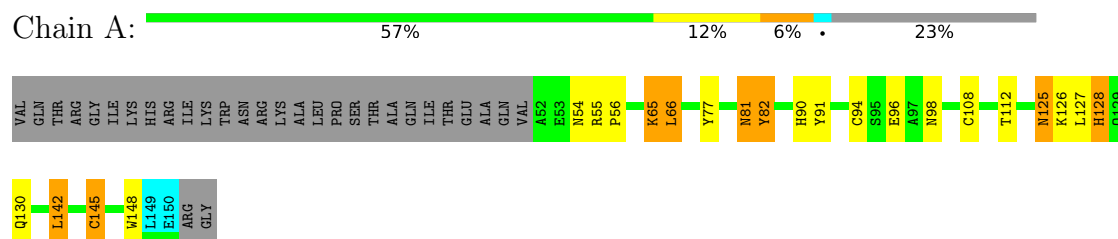
4.2.18 Score per residue for model 18

- Molecule 1: Prion-like protein



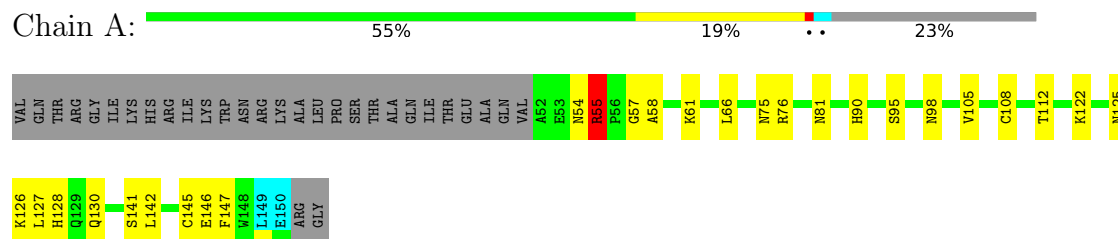
4.2.19 Score per residue for model 19

- Molecule 1: Prion-like protein



4.2.20 Score per residue for model 20

- Molecule 1: Prion-like protein



5 Refinement protocol and experimental data overview

Of the 100 calculated structures, 20 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
DYANA	structure solution	1.65
OPALp	refinement	1.3

No chemical shift data was provided.

6 Model quality i

6.1 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 (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	0.69±0.02	0±0/809 (0.0± 0.0%)	1.48±0.04	5±2/1095 (0.5± 0.2%)
All	All	0.69	0/16180 (0.0%)	1.48	106/21900 (0.5%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	Chirality	Planarity
1	A	0.0±0.0	1.2±0.8
All	All	0	25

There are no bond-length outliers.

All unique angle outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	125	ASN	CA-CB-CG	10.05	122.65	112.60	7	4
1	A	90	HIS	CA-CB-CG	8.63	122.43	113.80	1	1
1	A	81	ASN	CA-C-N	7.45	130.59	120.38	18	10
1	A	81	ASN	C-N-CA	7.45	130.59	120.38	18	10
1	A	90	HIS	CB-CG-CD2	-7.21	121.82	131.20	1	4
1	A	144	HIS	CB-CG-CD2	-7.12	121.95	131.20	14	5
1	A	98	ASN	CA-CB-CG	7.08	119.68	112.60	11	1
1	A	141	SER	CA-C-N	6.56	134.07	121.54	3	5
1	A	141	SER	C-N-CA	6.56	134.07	121.54	3	5
1	A	59	PHE	CA-CB-CG	6.50	120.31	113.80	4	5
1	A	87	ASP	CA-C-N	6.43	128.29	121.48	6	4
1	A	87	ASP	C-N-CA	6.43	128.29	121.48	6	4
1	A	123	PRO	CA-C-N	6.41	133.78	121.54	9	2
1	A	123	PRO	C-N-CA	6.41	133.78	121.54	9	2
1	A	144	HIS	CA-CB-CG	6.41	120.21	113.80	14	1

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	142	LEU	CA-C-N	6.18	133.34	121.54	10	1
1	A	142	LEU	C-N-CA	6.18	133.34	121.54	10	1
1	A	124	ASP	CA-C-N	6.03	133.06	121.54	13	1
1	A	124	ASP	C-N-CA	6.03	133.06	121.54	13	1
1	A	52	ALA	CA-C-N	6.01	132.17	120.99	16	1
1	A	52	ALA	C-N-CA	6.01	132.17	120.99	16	1
1	A	105	VAL	CA-C-N	5.99	128.62	120.54	6	1
1	A	105	VAL	C-N-CA	5.99	128.62	120.54	6	1
1	A	128	HIS	CB-CG-CD2	-5.97	123.44	131.20	11	8
1	A	124	ASP	CA-CB-CG	5.97	118.57	112.60	1	2
1	A	72	ALA	CA-C-N	5.63	128.09	120.38	3	1
1	A	72	ALA	C-N-CA	5.63	128.09	120.38	3	1
1	A	105	VAL	CA-CB-CG1	5.59	119.90	110.40	6	1
1	A	81	ASN	CA-CB-CG	5.54	118.14	112.60	17	1
1	A	55	ARG	CA-C-N	5.51	126.73	119.84	20	1
1	A	55	ARG	C-N-CA	5.51	126.73	119.84	20	1
1	A	125	ASN	N-CA-C	5.49	117.33	110.91	12	1
1	A	93	GLY	CA-C-N	5.46	131.97	121.54	1	1
1	A	93	GLY	C-N-CA	5.46	131.97	121.54	1	1
1	A	136	VAL	CA-CB-CG1	5.40	119.58	110.40	8	3
1	A	54	ASN	CA-CB-CG	5.36	117.96	112.60	1	1
1	A	143	LYS	CA-C-N	5.31	131.68	121.54	8	2
1	A	143	LYS	C-N-CA	5.31	131.68	121.54	8	2
1	A	55	ARG	CD-NE-CZ	5.10	131.54	124.40	9	1
1	A	75	ASN	CA-CB-CG	5.09	117.69	112.60	9	1
1	A	124	ASP	N-CA-C	-5.08	105.39	111.03	15	1
1	A	119	GLU	CB-CA-C	5.08	118.18	109.65	10	1
1	A	145	CYS	CA-C-N	5.03	131.81	121.95	12	1
1	A	145	CYS	C-N-CA	5.03	131.81	121.95	12	1
1	A	144	HIS	CA-C-N	5.03	131.14	121.54	8	1
1	A	144	HIS	C-N-CA	5.03	131.14	121.54	8	1

There are no chirality outliers.

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

Mol	Chain	Res	Type	Group	Models (Total)
1	A	76	ARG	Sidechain	5
1	A	78	TYR	Sidechain	5
1	A	55	ARG	Sidechain	4
1	A	134	ARG	Sidechain	2

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Mol	Chain	Res	Type	Group	Models (Total)
1	A	82	TYR	Sidechain	2
1	A	121	GLN	Peptide	1
1	A	92	ASN	Peptide	1
1	A	148	TRP	Peptide	1
1	A	66	LEU	Peptide	1
1	A	124	ASP	Peptide	1
1	A	64	ARG	Sidechain	1
1	A	87	ASP	Peptide	1

6.2 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 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	787	730	729	3±1
All	All	15740	14600	14580	54

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 2.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:55:ARG:HB2	1:A:58:ALA:HB2	0.64	1.68	20	4
1:A:109:ILE:HA	1:A:112:THR:HG22	0.57	1.76	7	14
1:A:148:TRP:H	1:A:148:TRP:CD1	0.56	2.17	15	10
1:A:65:LYS:HE3	1:A:82:TYR:CE2	0.51	2.40	17	1
1:A:126:LYS:HD2	1:A:127:LEU:HD22	0.51	1.81	10	1
1:A:144:HIS:HA	1:A:148:TRP:CH2	0.50	2.42	18	1
1:A:94:CYS:HB2	1:A:104:PHE:CE1	0.47	2.44	1	1
1:A:77:TYR:CD2	1:A:127:LEU:HB3	0.47	2.45	5	1
1:A:112:THR:HG21	1:A:136:VAL:HG11	0.46	1.87	17	3
1:A:68:ILE:CD1	1:A:135:LEU:HD22	0.46	2.39	18	1
1:A:58:ALA:HB3	1:A:90:HIS:CD2	0.45	2.46	10	1
1:A:105:VAL:HG12	1:A:109:ILE:HD12	0.44	1.88	3	1
1:A:68:ILE:HD13	1:A:135:LEU:HD22	0.44	1.90	11	1
1:A:66:LEU:HD22	1:A:66:LEU:N	0.44	2.28	19	1
1:A:144:HIS:HA	1:A:148:TRP:CZ2	0.43	2.48	6	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:65:LYS:HE2	1:A:82:TYR:CD2	0.43	2.48	19	1
1:A:65:LYS:HE2	1:A:82:TYR:CE2	0.43	2.49	19	1
1:A:65:LYS:HG3	1:A:82:TYR:CG	0.43	2.49	1	1
1:A:70:PHE:CZ	1:A:131:VAL:HG13	0.42	2.49	13	1
1:A:74:GLY:HA2	1:A:127:LEU:HD12	0.42	1.92	14	1
1:A:148:TRP:CD1	1:A:148:TRP:H	0.41	2.32	3	2
1:A:144:HIS:CG	1:A:145:CYS:H	0.41	2.34	9	1
1:A:89:ILE:HG13	1:A:136:VAL:HG13	0.41	1.93	17	1
1:A:60:ILE:HG13	1:A:90:HIS:CE1	0.41	2.51	13	1
1:A:68:ILE:CD1	1:A:135:LEU:CD2	0.40	2.99	18	1
1:A:68:ILE:HD12	1:A:135:LEU:HD12	0.40	1.94	15	1

6.3 Torsion angles [i](#)

6.3.1 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 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	96/129 (74%)	71±3 (74±3%)	20±3 (21±3%)	5±1 (5±1%)	3	23
All	All	1920/2580 (74%)	1425 (74%)	397 (21%)	98 (5%)	3	23

All 30 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	142	LEU	13
1	A	145	CYS	8
1	A	90	HIS	7
1	A	143	LYS	6
1	A	125	ASN	5
1	A	144	HIS	5
1	A	66	LEU	4
1	A	146	GLU	4
1	A	147	PHE	4
1	A	126	LYS	4
1	A	57	GLY	3

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Mol	Chain	Res	Type	Models (Total)
1	A	94	CYS	3
1	A	141	SER	3
1	A	81	ASN	3
1	A	124	ASP	3
1	A	122	LYS	3
1	A	120	PHE	2
1	A	95	SER	2
1	A	58	ALA	2
1	A	61	LYS	2
1	A	80	ALA	2
1	A	91	TYR	2
1	A	72	ALA	1
1	A	121	GLN	1
1	A	93	GLY	1
1	A	83	TRP	1
1	A	101	LYS	1
1	A	62	GLN	1
1	A	56	PRO	1
1	A	96	GLU	1

6.3.2 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 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	80/107 (75%)	64±2 (81±3%)	16±2 (20±3%)	3	33
All	All	1600/2140 (75%)	1288 (80%)	312 (20%)	3	33

All 58 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	81	ASN	20
1	A	127	LEU	20
1	A	128	HIS	18
1	A	142	LEU	17
1	A	108	CYS	14
1	A	109	ILE	12

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Mol	Chain	Res	Type	Models (Total)
1	A	61	LYS	9
1	A	65	LYS	9
1	A	147	PHE	9
1	A	98	ASN	9
1	A	116	ASN	8
1	A	66	LEU	7
1	A	126	LYS	7
1	A	130	GLN	7
1	A	145	CYS	7
1	A	54	ASN	6
1	A	75	ASN	6
1	A	105	VAL	6
1	A	104	PHE	6
1	A	139	LEU	6
1	A	146	GLU	6
1	A	102	GLU	5
1	A	112	THR	5
1	A	119	GLU	5
1	A	64	ARG	5
1	A	94	CYS	5
1	A	95	SER	5
1	A	121	GLN	5
1	A	132	LEU	5
1	A	133	TRP	5
1	A	125	ASN	4
1	A	77	TYR	4
1	A	79	GLU	3
1	A	90	HIS	3
1	A	101	LYS	3
1	A	135	LEU	3
1	A	144	HIS	3
1	A	68	ILE	3
1	A	143	LYS	3
1	A	67	ASP	3
1	A	96	GLU	2
1	A	60	ILE	2
1	A	124	ASP	2
1	A	92	ASN	2
1	A	59	PHE	2
1	A	53	GLU	2
1	A	122	LYS	2
1	A	55	ARG	2

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Mol	Chain	Res	Type	Models (Total)
1	A	87	ASP	1
1	A	76	ARG	1
1	A	106	THR	1
1	A	69	ASP	1
1	A	99	VAL	1
1	A	117	GLN	1
1	A	140	CYS	1
1	A	100	THR	1
1	A	129	GLN	1
1	A	141	SER	1

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 [i](#)

There are no chain breaks in this entry.

7 Chemical shift validation

No chemical shift data were provided