



Full wwPDB NMR Structure Validation Report ⓘ

Mar 21, 2026 – 03:29 PM UTC

PDB ID : 2FGX / pdb_00002fgx
Title : Solution NMR Structure of Protein Ne2328 from Nitrosomonas europaea.
Northeast Structural Genomics Consortium Target NeT3.
Authors : Eletsky, A.; Liu, G.; Yee, A.; Arrowsmith, C.H.; Szyperski, T.; Northeast
Structural Genomics Consortium (NESG)
Deposited on : 2005-12-22

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

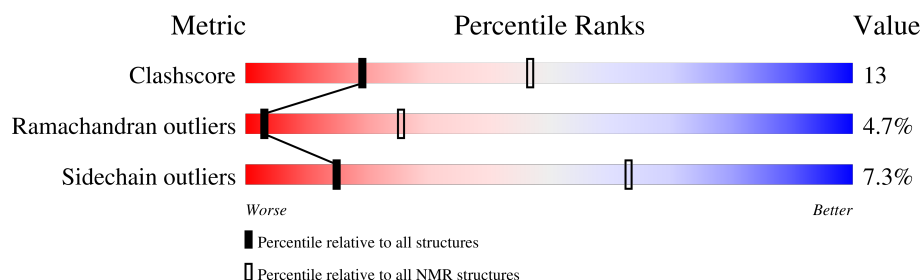
1 Overall quality at a glance

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	107	

2 Ensemble composition and analysis

This entry contains 20 models. Model 3 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *lowest energy*.

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:6-A:85 (80)	0.98	3

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 4 clusters and 1 single-model cluster was found.

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

3 Entry composition

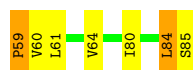
There is only 1 type of molecule in this entry. The entry contains 1272 atoms, of which 576 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called putative thioredoxin.

Mol	Chain	Residues	Atoms						Trace
1	A	85	Total	C	H	N	O	S	0
			1272	442	576	119	130	5	

There are 22 discrepancies between the modelled and reference sequences:

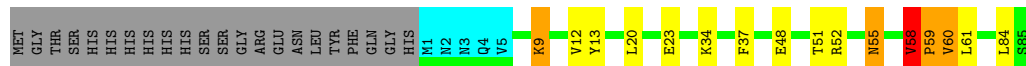
Chain	Residue	Modelled	Actual	Comment	Reference
A	-21	MET	-	cloning artifact	GB 30181050
A	-20	GLY	-	cloning artifact	GB 30181050
A	-19	THR	-	cloning artifact	GB 30181050
A	-18	SER	-	cloning artifact	GB 30181050
A	-17	HIS	-	expression tag	GB 30181050
A	-16	HIS	-	expression tag	GB 30181050
A	-15	HIS	-	expression tag	GB 30181050
A	-14	HIS	-	expression tag	GB 30181050
A	-13	HIS	-	expression tag	GB 30181050
A	-12	HIS	-	expression tag	GB 30181050
A	-11	SER	-	cloning artifact	GB 30181050
A	-10	SER	-	cloning artifact	GB 30181050
A	-9	GLY	-	cloning artifact	GB 30181050
A	-8	ARG	-	cloning artifact	GB 30181050
A	-7	GLU	-	cloning artifact	GB 30181050
A	-6	ASN	-	cloning artifact	GB 30181050
A	-5	LEU	-	cloning artifact	GB 30181050
A	-4	TYR	-	cloning artifact	GB 30181050
A	-3	PHE	-	cloning artifact	GB 30181050
A	-2	GLN	-	cloning artifact	GB 30181050
A	-1	GLY	-	cloning artifact	GB 30181050
A	0	HIS	-	cloning artifact	GB 30181050



4.2.3 Score per residue for model 3 (medoid)

- Molecule 1: putative thioredoxin

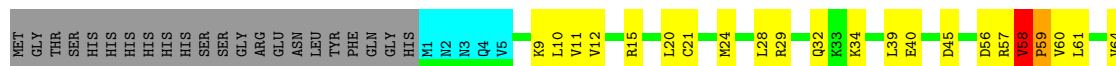
Chain A: 60% 10% • • 5% 21%



4.2.4 Score per residue for model 4

- Molecule 1: putative thioredoxin

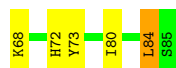
Chain A: 47% 25% • • 5% 21%



4.2.5 Score per residue for model 5

- Molecule 1: putative thioredoxin

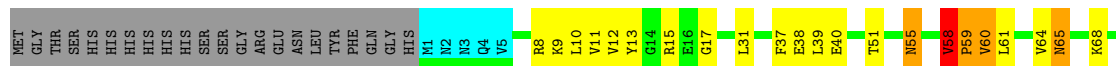
Chain A: 51% 19% • • 5% 21%



4.2.6 Score per residue for model 6

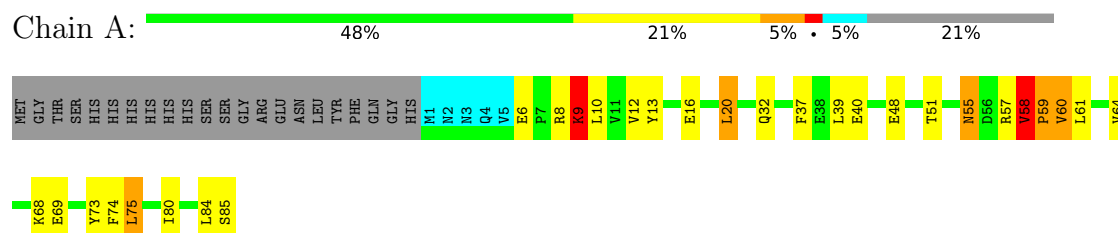
- Molecule 1: putative thioredoxin

Chain A: 52% 17% 5% • 5% 21%



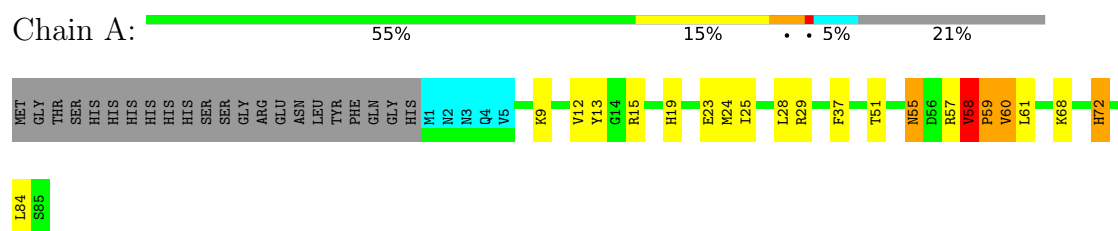
4.2.7 Score per residue for model 7

- Molecule 1: putative thioredoxin



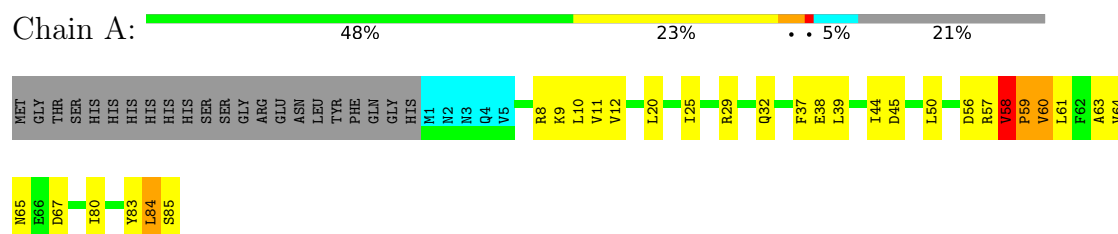
4.2.8 Score per residue for model 8

- Molecule 1: putative thioredoxin



4.2.9 Score per residue for model 9

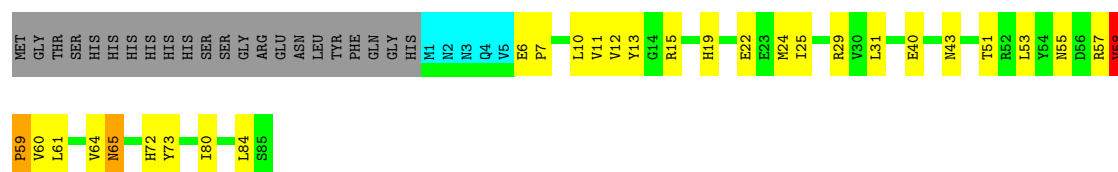
- Molecule 1: putative thioredoxin



4.2.10 Score per residue for model 10

- Molecule 1: putative thioredoxin

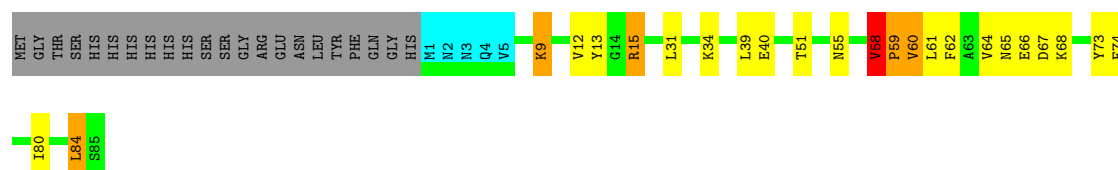




4.2.11 Score per residue for model 11

- Molecule 1: putative thioredoxin

Chain A: 52% 17% 5% • 5% 21%



4.2.12 Score per residue for model 12

- Molecule 1: putative thioredoxin

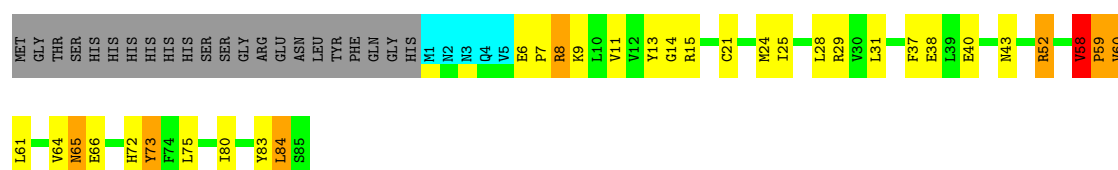
Chain A: 50% 21% • • 5% 21%



4.2.13 Score per residue for model 13

- Molecule 1: putative thioredoxin

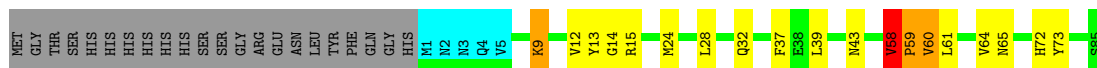
Chain A: 45% 22% 7% • 5% 21%



4.2.14 Score per residue for model 14

- Molecule 1: putative thioredoxin

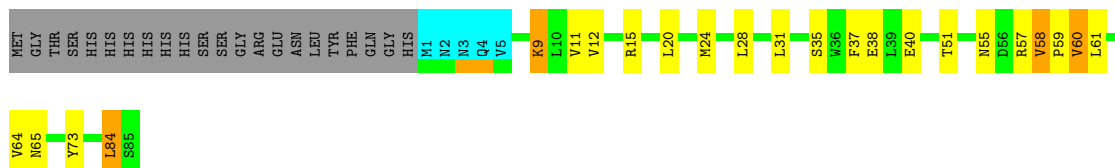
Chain A:  57% 14% • • 5% 21%



4.2.15 Score per residue for model 15

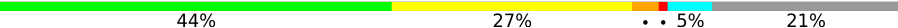
- Molecule 1: putative thioredoxin

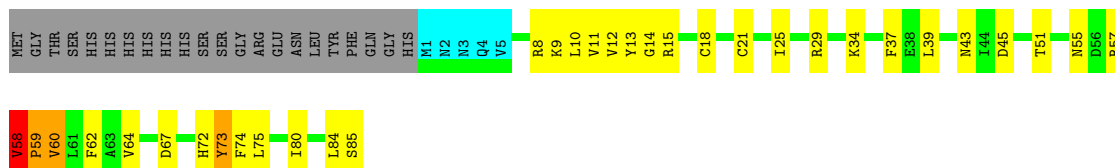
Chain A:  53% 18% • 5% 21%



4.2.16 Score per residue for model 16

- Molecule 1: putative thioredoxin

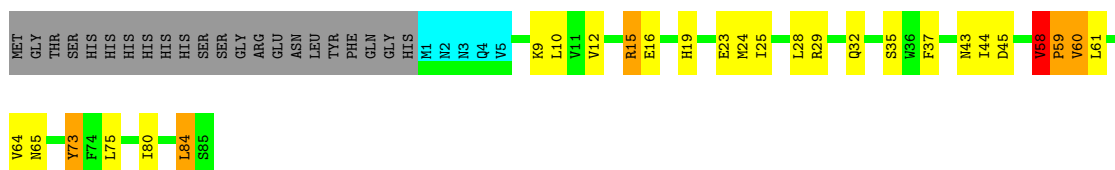
Chain A:  44% 27% • • 5% 21%



4.2.17 Score per residue for model 17

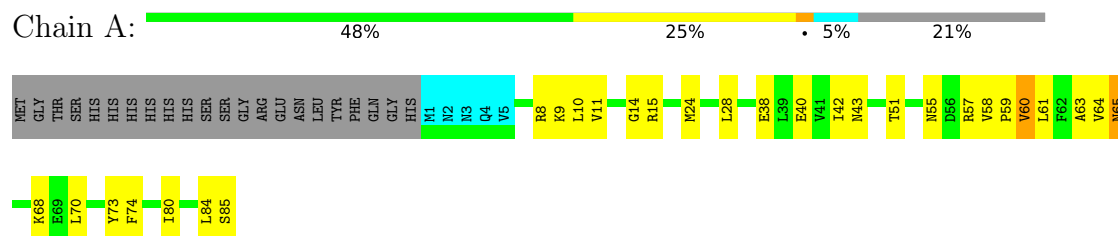
- Molecule 1: putative thioredoxin

Chain A:  50% 20% 5% • 5% 21%



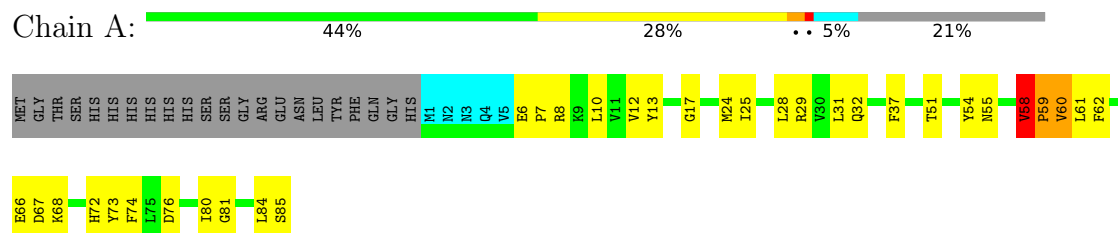
4.2.18 Score per residue for model 18

- Molecule 1: putative thioredoxin



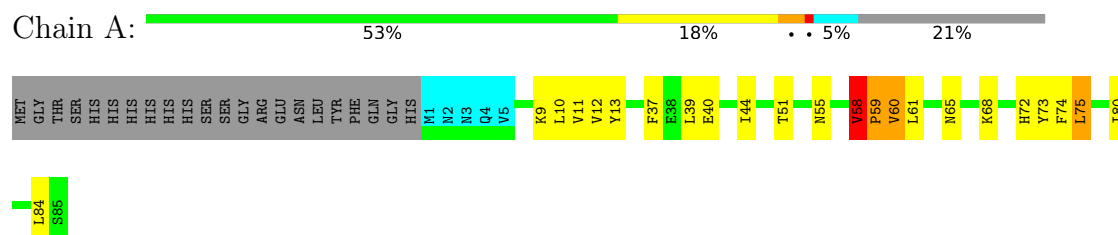
4.2.19 Score per residue for model 19

- Molecule 1: putative thioredoxin



4.2.20 Score per residue for model 20

- Molecule 1: putative thioredoxin



5 Refinement protocol and experimental data overview

The models were refined using the following method: *simulated annealing, torsion angle dynamics, explicit water bath refinement*.

Of the 100 calculated structures, 20 were deposited, based on the following criterion: *target function*.

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

Software name	Classification	Version
CYANA	structure solution	2.1
CNS	refinement	1.1

No chemical shift data was provided.

6 Model quality [i](#)

6.1 Standard geometry [i](#)

There are no covalent bond-length or bond-angle outliers.

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	0.9±0.3
All	All	0	18

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

All unique planar outliers are listed below.

Mol	Chain	Res	Type	Group	Models (Total)
1	A	58	VAL	Peptide	18

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	656	545	646	17±4
All	All	13120	10900	12920	331

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 13.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:8:ARG:NH1	1:A:85:SER:O	1.00	1.94	2	4
1:A:13:TYR:HB2	1:A:60:VAL:HG23	0.89	1.41	20	11

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:15:ARG:HB2	1:A:58:VAL:HG11	0.84	1.46	18	1
1:A:61:LEU:HG	1:A:72:HIS:HD2	0.83	1.34	13	1
1:A:58:VAL:HB	1:A:59:PRO:CD	0.82	2.05	16	17
1:A:15:ARG:HG2	1:A:58:VAL:HG11	0.76	1.56	2	5
1:A:9:LYS:HB3	1:A:64:VAL:HB	0.74	1.59	15	2
1:A:12:VAL:HA	1:A:60:VAL:O	0.74	1.82	16	3
1:A:13:TYR:HB2	1:A:60:VAL:HG12	0.71	1.61	10	1
1:A:8:ARG:NH2	1:A:85:SER:O	0.70	2.23	7	1
1:A:59:PRO:HG2	1:A:73:TYR:HB3	0.68	1.65	18	1
1:A:66:GLU:HB3	1:A:68:LYS:HG2	0.66	1.67	12	2
1:A:37:PHE:HB3	1:A:84:LEU:HD11	0.66	1.66	6	3
1:A:80:ILE:HD11	1:A:84:LEU:HD23	0.65	1.66	17	8
1:A:52:ARG:HA	1:A:52:ARG:HE	0.65	1.51	13	1
1:A:81:GLY:O	1:A:85:SER:O	0.65	2.14	1	1
1:A:13:TYR:O	1:A:59:PRO:HA	0.65	1.92	13	2
1:A:57:ARG:O	1:A:60:VAL:HB	0.63	1.94	18	3
1:A:32:GLN:HE22	1:A:39:LEU:HB2	0.63	1.53	7	4
1:A:57:ARG:O	1:A:60:VAL:HG22	0.62	1.94	16	3
1:A:12:VAL:HG22	1:A:61:LEU:HD23	0.62	1.71	3	10
1:A:52:ARG:HA	1:A:52:ARG:NE	0.62	2.10	13	1
1:A:59:PRO:O	1:A:72:HIS:HA	0.61	1.96	20	3
1:A:13:TYR:HB2	1:A:60:VAL:CG1	0.60	2.26	10	1
1:A:8:ARG:NE	1:A:85:SER:O	0.60	2.35	16	1
1:A:58:VAL:HB	1:A:59:PRO:HD3	0.58	1.76	16	16
1:A:25:ILE:O	1:A:29:ARG:HG2	0.58	1.99	19	9
1:A:61:LEU:HB2	1:A:70:LEU:HB2	0.58	1.74	18	1
1:A:51:THR:O	1:A:55:ASN:HB2	0.58	1.99	7	13
1:A:24:MET:SD	1:A:73:TYR:HA	0.57	2.40	4	1
1:A:20:LEU:HD13	1:A:73:TYR:HB2	0.57	1.75	1	1
1:A:13:TYR:HB2	1:A:60:VAL:CG2	0.57	2.29	3	3
1:A:32:GLN:NE2	1:A:39:LEU:HB2	0.56	2.14	7	4
1:A:24:MET:HG3	1:A:59:PRO:HB3	0.56	1.76	10	1
1:A:51:THR:O	1:A:55:ASN:HB3	0.56	2.01	20	1
1:A:58:VAL:CB	1:A:59:PRO:CD	0.55	2.83	13	15
1:A:9:LYS:HA	1:A:37:PHE:O	0.55	2.01	14	11
1:A:66:GLU:HB3	1:A:68:LYS:HD3	0.55	1.77	19	1
1:A:9:LYS:HE2	1:A:40:GLU:HB2	0.55	1.78	6	6
1:A:21:CYS:HB2	1:A:59:PRO:HG3	0.55	1.78	4	1
1:A:18:CYS:HB3	1:A:59:PRO:HG2	0.54	1.77	16	1
1:A:10:LEU:HD12	1:A:37:PHE:CD1	0.54	2.36	6	4
1:A:16:GLU:HA	1:A:43:ASN:ND2	0.54	2.18	17	1

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:11:VAL:HG23	1:A:64:VAL:HG21	0.53	1.77	6	2
1:A:14:GLY:O	1:A:43:ASN:HA	0.53	2.03	16	4
1:A:10:LEU:HD11	1:A:80:ILE:HD11	0.52	1.80	18	7
1:A:61:LEU:HG	1:A:72:HIS:CD2	0.52	2.26	13	1
1:A:15:ARG:HA	1:A:43:ASN:OD1	0.52	2.05	13	2
1:A:60:VAL:HG23	1:A:72:HIS:HB3	0.51	1.81	10	1
1:A:8:ARG:CZ	1:A:85:SER:O	0.51	2.58	2	2
1:A:19:HIS:O	1:A:22:GLU:HG2	0.51	2.06	10	2
1:A:72:HIS:O	1:A:73:TYR:HB2	0.51	2.06	13	2
1:A:24:MET:O	1:A:28:LEU:HG	0.50	2.07	12	8
1:A:14:GLY:HA2	1:A:59:PRO:HD3	0.49	1.83	16	1
1:A:63:ALA:HB1	1:A:83:TYR:CZ	0.49	2.42	9	1
1:A:11:VAL:HG22	1:A:40:GLU:HB3	0.48	1.84	15	5
1:A:11:VAL:HG23	1:A:64:VAL:CG2	0.48	2.39	13	4
1:A:60:VAL:HG12	1:A:72:HIS:HB3	0.48	1.84	5	1
1:A:66:GLU:HB2	1:A:83:TYR:HE1	0.48	1.69	4	1
1:A:81:GLY:O	1:A:85:SER:HB2	0.48	2.09	19	1
1:A:21:CYS:O	1:A:25:ILE:HG13	0.48	2.09	13	3
1:A:62:PHE:CZ	1:A:67:ASP:HA	0.47	2.44	19	4
1:A:9:LYS:HG2	1:A:38:GLU:HG3	0.47	1.86	18	1
1:A:54:TYR:HA	1:A:57:ARG:HB2	0.47	1.87	5	1
1:A:72:HIS:HD2	1:A:73:TYR:CD2	0.47	2.27	12	1
1:A:44:ILE:HG22	1:A:50:LEU:HB3	0.47	1.87	9	1
1:A:19:HIS:O	1:A:23:GLU:HG2	0.47	2.10	1	3
1:A:13:TYR:O	1:A:60:VAL:HG23	0.46	2.10	8	1
1:A:64:VAL:O	1:A:65:ASN:HB2	0.46	2.10	10	7
1:A:24:MET:SD	1:A:59:PRO:HB3	0.46	2.50	19	1
1:A:56:ASP:O	1:A:57:ARG:HG3	0.46	2.10	4	1
1:A:18:CYS:HB3	1:A:21:CYS:SG	0.46	2.50	5	1
1:A:63:ALA:HB3	1:A:68:LYS:HG2	0.46	1.88	18	1
1:A:58:VAL:O	1:A:60:VAL:HG13	0.46	2.10	19	2
1:A:44:ILE:HG12	1:A:58:VAL:CG1	0.46	2.41	20	1
1:A:10:LEU:HD13	1:A:61:LEU:HD11	0.46	1.88	2	1
1:A:35:SER:HB3	1:A:84:LEU:HD12	0.46	1.87	17	3
1:A:6:GLU:HB2	1:A:7:PRO:HD2	0.45	1.86	19	4
1:A:74:PHE:O	1:A:75:LEU:HB2	0.45	2.11	20	3
1:A:54:TYR:O	1:A:58:VAL:HG13	0.45	2.11	2	1
1:A:8:ARG:HG3	1:A:83:TYR:CE2	0.45	2.47	13	1
1:A:12:VAL:HG22	1:A:61:LEU:CD2	0.45	2.41	4	6
1:A:16:GLU:HA	1:A:43:ASN:HD22	0.45	1.71	17	1
1:A:15:ARG:HA	1:A:44:ILE:HG12	0.45	1.87	17	1

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:73:TYR:O	1:A:74:PHE:HB2	0.44	2.12	11	4
1:A:9:LYS:O	1:A:64:VAL:HB	0.44	2.12	14	1
1:A:48:GLU:O	1:A:52:ARG:HG2	0.44	2.12	2	2
1:A:58:VAL:N	1:A:59:PRO:CD	0.44	2.81	15	2
1:A:80:ILE:O	1:A:84:LEU:HB2	0.44	2.13	9	1
1:A:15:ARG:O	1:A:15:ARG:HG3	0.44	2.13	16	1
1:A:54:TYR:CD2	1:A:60:VAL:HG21	0.44	2.48	19	1
1:A:24:MET:HG2	1:A:74:PHE:O	0.43	2.13	19	1
1:A:10:LEU:HD11	1:A:80:ILE:CD1	0.43	2.43	17	3
1:A:60:VAL:HG13	1:A:72:HIS:CD2	0.43	2.48	8	1
1:A:28:LEU:O	1:A:32:GLN:HG3	0.43	2.13	17	3
1:A:9:LYS:HD2	1:A:64:VAL:HG21	0.43	1.90	11	2
1:A:20:LEU:HD23	1:A:23:GLU:OE2	0.43	2.13	3	1
1:A:58:VAL:O	1:A:59:PRO:C	0.43	2.61	19	8
1:A:9:LYS:HD3	1:A:10:LEU:N	0.43	2.28	6	1
1:A:14:GLY:HA2	1:A:58:VAL:HG12	0.43	1.91	13	1
1:A:19:HIS:O	1:A:23:GLU:HG3	0.42	2.13	8	1
1:A:60:VAL:HA	1:A:72:HIS:HB2	0.42	1.90	13	1
1:A:18:CYS:CB	1:A:59:PRO:HG2	0.42	2.44	16	1
1:A:63:ALA:HB2	1:A:70:LEU:HD21	0.42	1.90	18	1
1:A:20:LEU:HD11	1:A:74:PHE:H	0.42	1.75	7	1
1:A:14:GLY:HA2	1:A:59:PRO:CD	0.42	2.44	16	1
1:A:20:LEU:HD12	1:A:73:TYR:HB2	0.41	1.92	4	1
1:A:44:ILE:HD12	1:A:51:THR:HA	0.41	1.92	12	1
1:A:9:LYS:HD3	1:A:38:GLU:HB2	0.41	1.91	1	1
1:A:15:ARG:HD2	1:A:45:ASP:OD1	0.41	2.16	4	1
1:A:71:CYS:SG	1:A:76:ASP:HB2	0.41	2.56	4	1
1:A:9:LYS:HG2	1:A:38:GLU:HB2	0.41	1.93	6	1
1:A:13:TYR:CE2	1:A:62:PHE:HB2	0.41	2.50	11	1
1:A:9:LYS:HG3	1:A:38:GLU:HB2	0.41	1.92	9	1
1:A:66:GLU:HB2	1:A:83:TYR:CE1	0.41	2.51	4	1
1:A:72:HIS:O	1:A:73:TYR:CG	0.41	2.74	16	1
1:A:76:ASP:O	1:A:80:ILE:HG22	0.41	2.16	19	1
1:A:29:ARG:HD2	1:A:32:GLN:OE1	0.40	2.16	4	1
1:A:58:VAL:O	1:A:72:HIS:HB2	0.40	2.17	6	1
1:A:11:VAL:HG11	1:A:42:ILE:HD12	0.40	1.92	18	1
1:A:14:GLY:HA2	1:A:58:VAL:CG1	0.40	2.47	14	1
1:A:58:VAL:HG23	1:A:59:PRO:HD2	0.40	1.92	6	1
1:A:37:PHE:HB3	1:A:84:LEU:HD21	0.40	1.93	17	1

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	79/107 (74%)	67±2 (84±3%)	9±2 (11±2%)	4±1 (5±2%)	3	25
All	All	1580/2140 (74%)	1333 (84%)	172 (11%)	75 (5%)	3	25

All 14 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	58	VAL	18
1	A	59	PRO	18
1	A	65	ASN	9
1	A	73	TYR	9
1	A	55	ASN	5
1	A	75	LEU	4
1	A	16	GLU	2
1	A	17	GLY	2
1	A	38	GLU	2
1	A	45	ASP	2
1	A	9	LYS	1
1	A	56	ASP	1
1	A	67	ASP	1
1	A	15	ARG	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	73/97 (75%)	68±2 (93±2%)	5±2 (7±2%)	15	63
All	All	1460/1940 (75%)	1354 (93%)	106 (7%)	15	63

All 24 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	60	VAL	19
1	A	58	VAL	18
1	A	84	LEU	18
1	A	31	LEU	8
1	A	9	LYS	6
1	A	68	LYS	6
1	A	20	LEU	5
1	A	34	LYS	4
1	A	39	LEU	4
1	A	52	ARG	2
1	A	8	ARG	2
1	A	15	ARG	2
1	A	65	ASN	1
1	A	6	GLU	1
1	A	48	GLU	1
1	A	57	ARG	1
1	A	69	GLU	1
1	A	72	HIS	1
1	A	45	ASP	1
1	A	43	ASN	1
1	A	53	LEU	1
1	A	67	ASP	1
1	A	66	GLU	1
1	A	73	TYR	1

6.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

6.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

6.6 Ligand geometry

There are no ligands in this entry.

6.7 Other polymers

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