



Full wwPDB NMR Structure Validation Report ⓘ

Mar 6, 2026 – 04:44 AM UTC

PDB ID : 1VF9 / pdb_00001vf9
Title : Solution Structure Of Human Trf2
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Deposited on : 2004-04-12

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

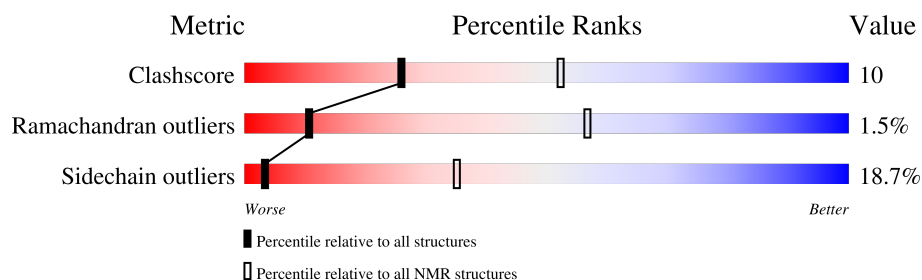
1 Overall quality at a glance

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	64	42% 28% 30%

2 Ensemble composition and analysis

This entry contains 25 models. Model 3 is the overall representative, medoid model (most similar to other models).

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:451-A:495 (45)	0.41	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 2 single-model clusters were found.

Cluster number	Models
1	2, 3, 4, 5, 7, 11, 13, 14, 19, 23
2	6, 8, 9, 10, 20, 25
3	1, 12, 18, 21, 22
4	16, 24
Single-model clusters	15; 17

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 1059 atoms, of which 530 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Telomeric repeat binding factor 2.

Mol	Chain	Residues	Atoms						Trace
1	A	64	Total	C	H	N	O	S	0
			1059	333	530	95	97	4	

There is a discrepancy between the modelled and reference sequences:

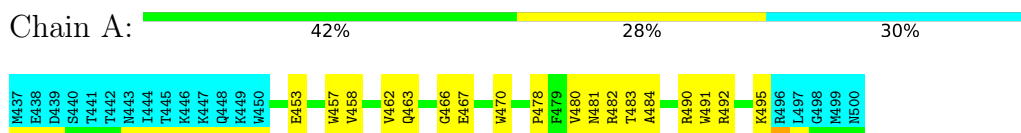
Chain	Residue	Modelled	Actual	Comment	Reference
A	437	MET	-	initiating methionine	UNP Q15554

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: Telomeric repeat binding factor 2

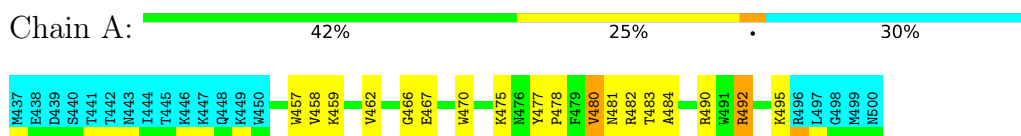


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

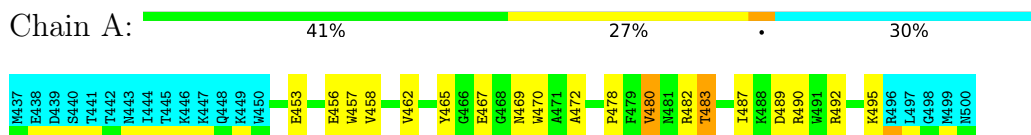
4.2.1 Score per residue for model 1

- Molecule 1: Telomeric repeat binding factor 2



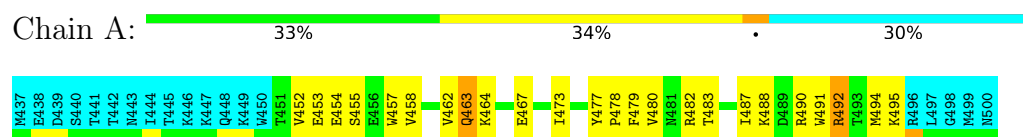
4.2.2 Score per residue for model 2

- Molecule 1: Telomeric repeat binding factor 2



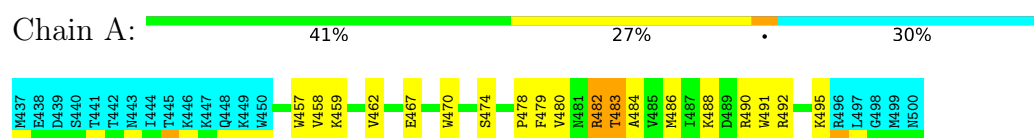
4.2.3 Score per residue for model 3 (medoid)

- Molecule 1: Telomeric repeat binding factor 2



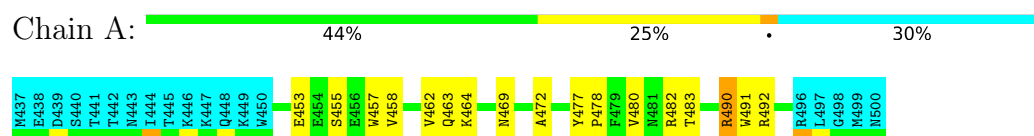
4.2.4 Score per residue for model 4

- Molecule 1: Telomeric repeat binding factor 2



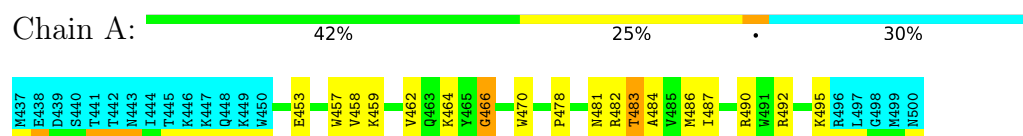
4.2.5 Score per residue for model 5

- Molecule 1: Telomeric repeat binding factor 2



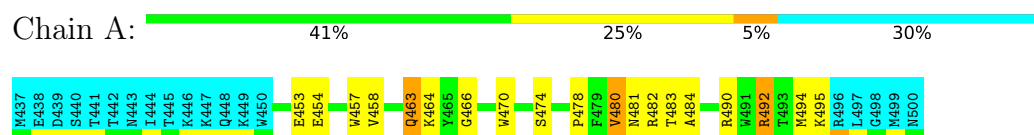
4.2.6 Score per residue for model 6

- Molecule 1: Telomeric repeat binding factor 2



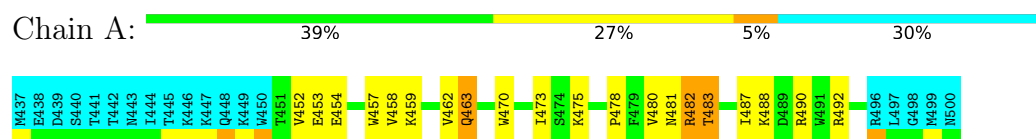
4.2.7 Score per residue for model 7

- Molecule 1: Telomeric repeat binding factor 2



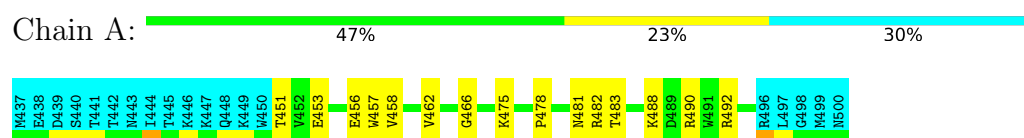
4.2.8 Score per residue for model 8

- Molecule 1: Telomeric repeat binding factor 2



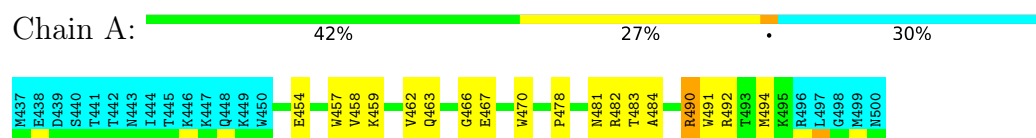
4.2.9 Score per residue for model 9

- Molecule 1: Telomeric repeat binding factor 2



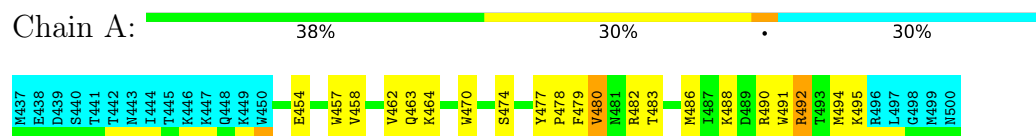
4.2.10 Score per residue for model 10

- Molecule 1: Telomeric repeat binding factor 2



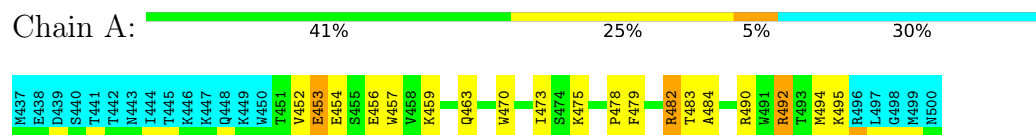
4.2.11 Score per residue for model 11

- Molecule 1: Telomeric repeat binding factor 2



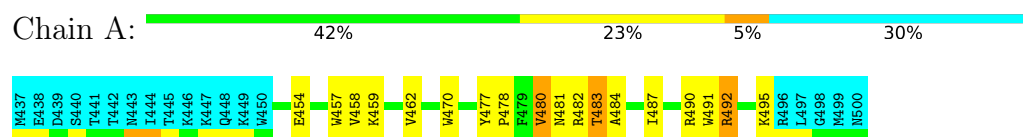
4.2.12 Score per residue for model 12

- Molecule 1: Telomeric repeat binding factor 2



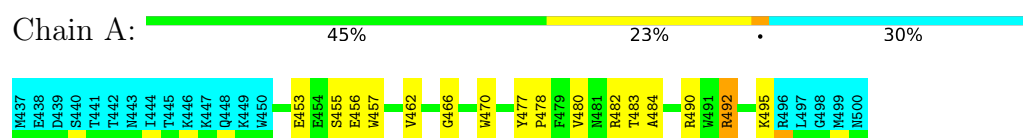
4.2.13 Score per residue for model 13

- Molecule 1: Telomeric repeat binding factor 2



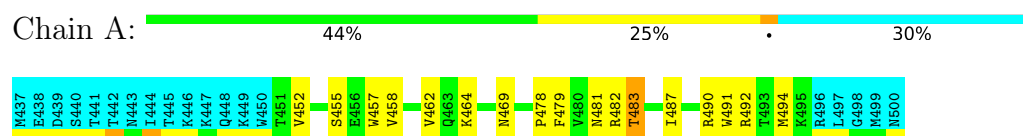
4.2.14 Score per residue for model 14

- Molecule 1: Telomeric repeat binding factor 2



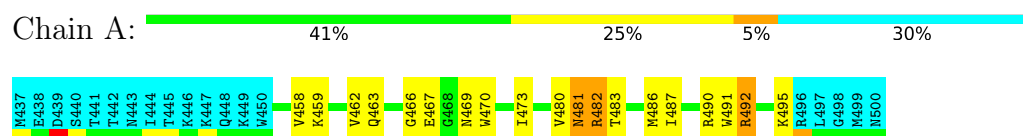
4.2.15 Score per residue for model 15

- Molecule 1: Telomeric repeat binding factor 2



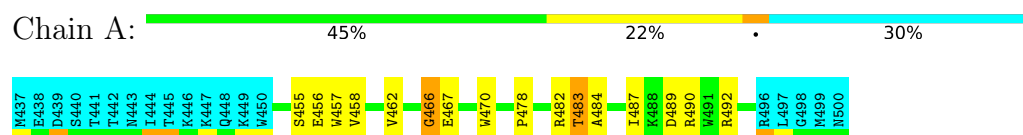
4.2.16 Score per residue for model 16

- Molecule 1: Telomeric repeat binding factor 2



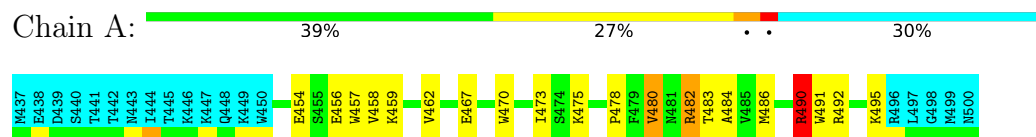
4.2.17 Score per residue for model 17

- Molecule 1: Telomeric repeat binding factor 2



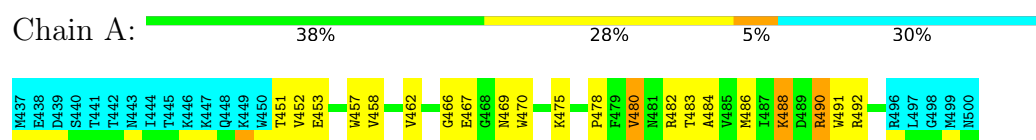
4.2.18 Score per residue for model 18

- Molecule 1: Telomeric repeat binding factor 2



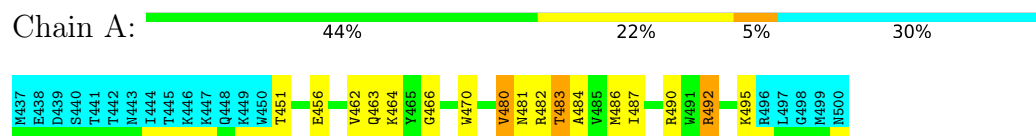
4.2.19 Score per residue for model 19

- Molecule 1: Telomeric repeat binding factor 2



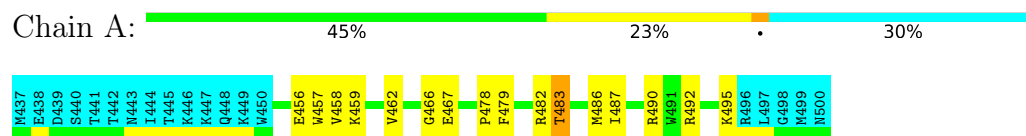
4.2.20 Score per residue for model 20

- Molecule 1: Telomeric repeat binding factor 2



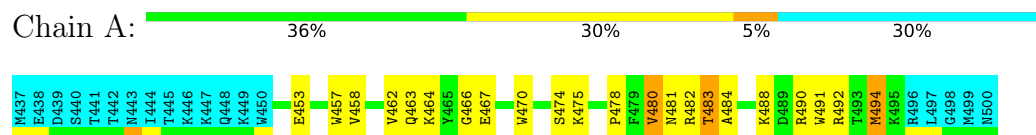
4.2.21 Score per residue for model 21

- Molecule 1: Telomeric repeat binding factor 2



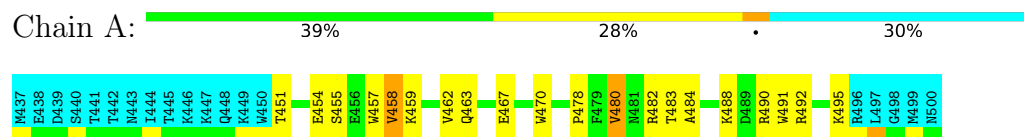
4.2.22 Score per residue for model 22

- Molecule 1: Telomeric repeat binding factor 2



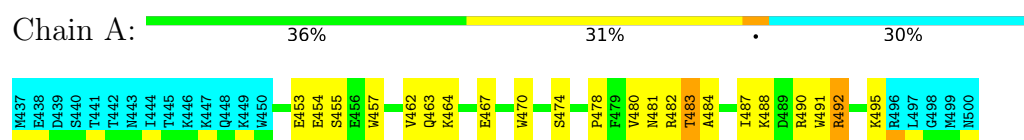
4.2.23 Score per residue for model 23

- Molecule 1: Telomeric repeat binding factor 2



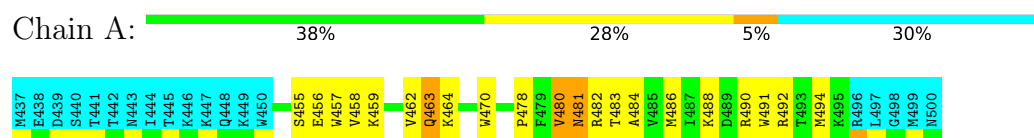
4.2.24 Score per residue for model 24

- Molecule 1: Telomeric repeat binding factor 2



4.2.25 Score per residue for model 25

- Molecule 1: Telomeric repeat binding factor 2



5 Refinement protocol and experimental data overview ⓘ

The models were refined using the following method: *distance geometry, simulated annealing*.

Of the 100 calculated structures, 25 were deposited, based on the following criterion: *structures with the lowest energy*.

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

Software name	Classification	Version
CNS	structure solution	1.0
CNS	refinement	1.0

No chemical shift data was provided.

6 Model quality

6.1 Standard geometry

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	1.42±0.01	0±0/381 (0.1± 0.1%)	1.53±0.02	0±1/515 (0.1± 0.1%)
All	All	1.42	6/9525 (0.1%)	1.53	11/12875 (0.1%)

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	3.0±0.0
All	All	0	75

All unique bond outliers are listed below.

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)	Models	
								Worst	Total
1	A	463	GLN	C-N	-5.33	1.25	1.33	5	6

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	480	VAL	N-CA-CB	-5.99	105.23	112.35	18	7
1	A	452	VAL	N-CA-CB	-5.82	105.01	111.41	8	2
1	A	481	ASN	N-CA-CB	-5.65	105.01	111.79	16	1
1	A	458	VAL	N-CA-CB	-5.09	105.07	110.62	23	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	482	ARG	Sidechain	25
1	A	490	ARG	Sidechain	25
1	A	492	ARG	Sidechain	25

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	371	367	367	8±2
All	All	9275	9175	9175	189

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 10.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:483:THR:O	1:A:487:ILE:HD12	0.77	1.79	20	9
1:A:458:VAL:O	1:A:462:VAL:HG23	0.76	1.80	25	20
1:A:454:GLU:O	1:A:458:VAL:HG23	0.74	1.82	23	6
1:A:462:VAL:HG11	1:A:491:TRP:CZ2	0.72	2.19	4	9
1:A:463:GLN:CA	1:A:463:GLN:HE21	0.72	1.96	25	1
1:A:470:TRP:HB2	1:A:484:ALA:HB1	0.71	1.63	1	15
1:A:470:TRP:CB	1:A:484:ALA:HB1	0.65	2.21	1	13
1:A:480:VAL:HG23	1:A:480:VAL:O	0.62	1.95	23	7
1:A:463:GLN:HE21	1:A:463:GLN:HA	0.62	1.52	25	1
1:A:465:TYR:CE2	1:A:472:ALA:HB1	0.55	2.36	2	1
1:A:463:GLN:HA	1:A:463:GLN:NE2	0.54	2.18	25	1
1:A:463:GLN:CA	1:A:463:GLN:NE2	0.53	2.69	25	1
1:A:469:ASN:O	1:A:472:ALA:HB3	0.51	2.06	5	1
1:A:458:VAL:HG23	1:A:479:PHE:HZ	0.51	1.66	4	2
1:A:470:TRP:CE3	1:A:473:ILE:HD12	0.50	2.41	18	1
1:A:458:VAL:HG22	1:A:487:ILE:HG23	0.49	1.83	15	3
1:A:458:VAL:HG23	1:A:479:PHE:CZ	0.49	2.41	4	1
1:A:480:VAL:HG23	1:A:481:ASN:N	0.48	2.24	1	2
1:A:491:TRP:CE3	1:A:494:MET:HE2	0.48	2.44	22	1
1:A:480:VAL:HG13	1:A:481:ASN:N	0.47	2.24	25	5
1:A:457:TRP:CZ3	1:A:478:PRO:O	0.47	2.67	1	18

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:491:TRP:CZ3	1:A:494:MET:CE	0.47	2.98	22	2
1:A:458:VAL:HG13	1:A:487:ILE:HG23	0.47	1.86	16	1
1:A:452:VAL:HG23	1:A:453:GLU:N	0.46	2.24	3	3
1:A:470:TRP:HA	1:A:473:ILE:HD12	0.46	1.88	8	3
1:A:473:ILE:HG22	1:A:479:PHE:CE2	0.45	2.46	3	2
1:A:470:TRP:CE3	1:A:487:ILE:HG22	0.45	2.46	17	1
1:A:491:TRP:CE3	1:A:494:MET:CE	0.45	3.00	22	1
1:A:477:TYR:N	1:A:477:TYR:CD1	0.44	2.85	1	2
1:A:465:TYR:CD2	1:A:472:ALA:HB1	0.44	2.47	2	1
1:A:457:TRP:CZ2	1:A:478:PRO:HG2	0.43	2.48	5	16
1:A:462:VAL:HG22	1:A:470:TRP:CZ3	0.43	2.49	2	5
1:A:462:VAL:O	1:A:466:GLY:N	0.43	2.52	16	10
1:A:477:TYR:HB2	1:A:479:PHE:CD1	0.43	2.48	11	1
1:A:454:GLU:OE1	1:A:479:PHE:CE1	0.43	2.72	12	1
1:A:480:VAL:O	1:A:480:VAL:CG2	0.43	2.66	18	4
1:A:482:ARG:O	1:A:486:MET:CG	0.42	2.67	4	1
1:A:458:VAL:HG12	1:A:491:TRP:CE3	0.42	2.48	18	2
1:A:457:TRP:HB2	1:A:479:PHE:CZ	0.42	2.49	21	1
1:A:491:TRP:CE3	1:A:494:MET:SD	0.41	3.13	3	1
1:A:458:VAL:O	1:A:462:VAL:CG2	0.41	2.67	3	1
1:A:477:TYR:HB2	1:A:479:PHE:CD2	0.41	2.50	3	1
1:A:457:TRP:CH2	1:A:478:PRO:HG2	0.41	2.50	12	4
1:A:477:TYR:CD1	1:A:477:TYR:N	0.41	2.88	14	2
1:A:457:TRP:CE2	1:A:478:PRO:HG2	0.41	2.51	17	1
1:A:488:LYS:CD	1:A:488:LYS:C	0.41	2.94	19	1
1:A:481:ASN:O	1:A:481:ASN:ND2	0.41	2.53	15	1
1:A:453:GLU:HG2	1:A:457:TRP:CZ2	0.41	2.50	14	1
1:A:454:GLU:CD	1:A:482:ARG:NH2	0.40	2.79	12	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	45/64 (70%)	41±1 (90±3%)	4±1 (8±2%)	1±1 (2±2%)	11	57

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	1125/1600 (70%)	1013 (90%)	95 (8%)	17 (2%)	11	57

All 4 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	480	VAL	8
1	A	466	GLY	4
1	A	483	THR	3
1	A	481	ASN	2

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	38/56 (68%)	31±2 (81±4%)	7±2 (19±4%)	3	35
All	All	950/1400 (68%)	772 (81%)	178 (19%)	3	35

All 22 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	483	THR	24
1	A	495	LYS	16
1	A	467	GLU	13
1	A	459	LYS	12
1	A	492	ARG	10
1	A	463	GLN	10
1	A	464	LYS	10
1	A	488	LYS	10
1	A	453	GLU	9
1	A	456	GLU	9
1	A	455	SER	8
1	A	486	MET	8
1	A	475	LYS	7
1	A	474	SER	5
1	A	494	MET	5

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Mol	Chain	Res	Type	Models (Total)
1	A	469	ASN	4
1	A	490	ARG	4
1	A	481	ASN	4
1	A	454	GLU	3
1	A	451	THR	3
1	A	489	ASP	2
1	A	482	ARG	2

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