



Full wwPDB NMR Structure Validation Report ⓘ

Mar 23, 2026 – 10:09 AM UTC

PDB ID : 2DJA / pdb_00002dja
Title : Solution structure of the B-box domain of the human Midline-2 protein
Authors : Miyamoto, K.; Kigawa, T.; Tomizawa, T.; Koshiba, S.; Inoue, M.; Yokoyama, S.; RIKEN Structural Genomics/Proteomics Initiative (RSGI)
Deposited on : 2006-03-31

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

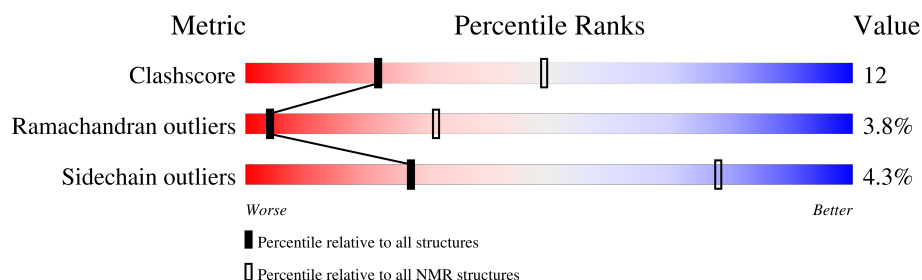
1 Overall quality at a glance

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	84	

2 Ensemble composition and analysis

This entry contains 20 models. Model 11 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:20-A:57 (38)	0.49	11

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

3 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 1265 atoms, of which 625 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Midline-2.

Mol	Chain	Residues	Atoms						Trace
1	A	84	Total	C	H	N	O	S	0
			1263	387	625	117	128	6	

There are 13 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	cloning artifact	UNP Q9UJV3
A	2	SER	-	cloning artifact	UNP Q9UJV3
A	3	SER	-	cloning artifact	UNP Q9UJV3
A	4	GLY	-	cloning artifact	UNP Q9UJV3
A	5	SER	-	cloning artifact	UNP Q9UJV3
A	6	SER	-	cloning artifact	UNP Q9UJV3
A	7	GLY	-	cloning artifact	UNP Q9UJV3
A	79	SER	-	cloning artifact	UNP Q9UJV3
A	80	GLY	-	cloning artifact	UNP Q9UJV3
A	81	PRO	-	cloning artifact	UNP Q9UJV3
A	82	SER	-	cloning artifact	UNP Q9UJV3
A	83	SER	-	cloning artifact	UNP Q9UJV3
A	84	GLY	-	cloning artifact	UNP Q9UJV3

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn).

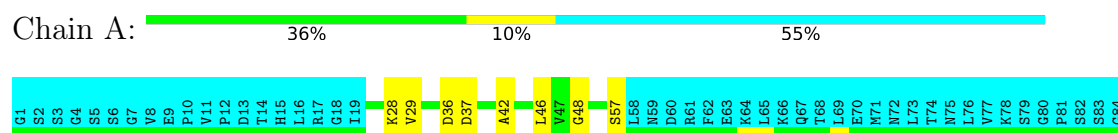
Mol	Chain	Residues	Atoms	
2	A	2	Total	Zn
			2	2

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: Midline-2

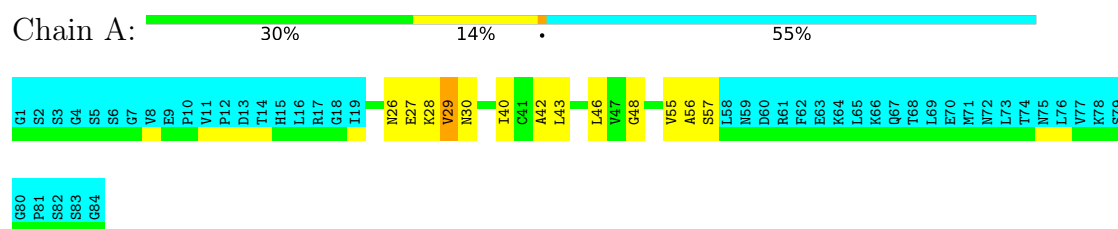


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

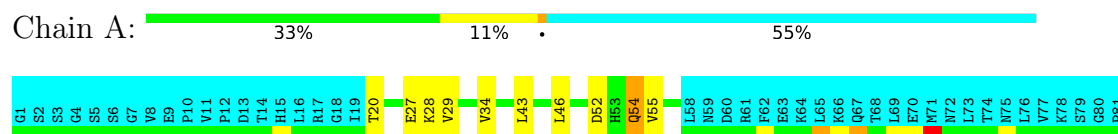
4.2.1 Score per residue for model 1

- Molecule 1: Midline-2



4.2.2 Score per residue for model 2

- Molecule 1: Midline-2



S82
S83
G84

4.2.3 Score per residue for model 3

- Molecule 1: Midline-2

Chain A: 33% 11% . 55%

G1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14 S15 S16 S17 S18 S19 S20 S21 S22 S23 S24 S25 S26 S27 S28 S29 S30 S31 S32 S33 S34 S35 S36 S37 S38 S39 S40 S41 S42 S43 S44 S45 S46 S47 S48 S49 S50 S51 S52 S53 S54 S55 S56 S57 S58 S59 S60 S61 S62 S63 S64 S65 S66 S67 S68 S69 S70 S71 S72 S73 S74 S75 S76 S77 S78 S79 S80 S81 S82 S83 S84

P81
S82
S83
G84

4.2.4 Score per residue for model 4

- Molecule 1: Midline-2

Chain A: 25% 18% . 55%

G1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14 S15 S16 S17 S18 S19 S20 S21 S22 S23 S24 S25 S26 S27 S28 S29 S30 S31 S32 S33 S34 S35 S36 S37 S38 S39 S40 S41 S42 S43 S44 S45 S46 S47 S48 S49 S50 S51 S52 S53 S54 S55 S56 S57 S58 S59 S60 S61 S62 S63 S64 S65 S66 S67 S68 S69 S70 S71 S72 S73 S74 S75 S76 S77 S78 S79 S80 S81 S82 S83 S84

N72
L73
T74
N75
L76
V77
K78
S79
G80
S81
S82
S83
G84

4.2.5 Score per residue for model 5

- Molecule 1: Midline-2

Chain A: 37% 7% . 55%

G1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14 S15 S16 S17 S18 S19 S20 S21 S22 S23 S24 S25 S26 S27 S28 S29 S30 S31 S32 S33 S34 S35 S36 S37 S38 S39 S40 S41 S42 S43 S44 S45 S46 S47 S48 S49 S50 S51 S52 S53 S54 S55 S56 S57 S58 S59 S60 S61 S62 S63 S64 S65 S66 S67 S68 S69 S70 S71 S72 S73 S74 S75 S76 S77 S78 S79 S80 S81 S82 S83 S84

4.2.6 Score per residue for model 6

- Molecule 1: Midline-2

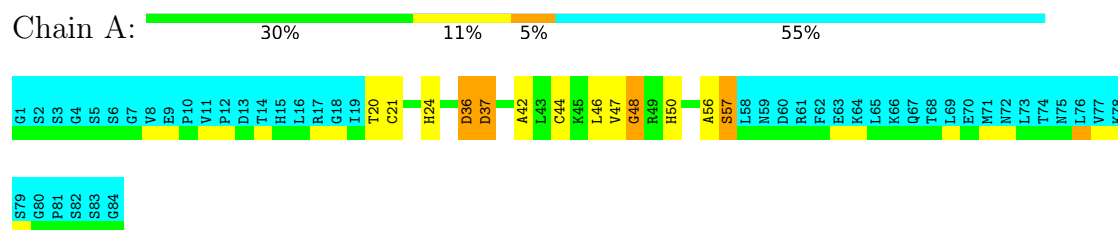
Chain A: 29% 14% . 55%

G1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14 S15 S16 S17 S18 S19 S20 S21 S22 S23 S24 S25 S26 S27 S28 S29 S30 S31 S32 S33 S34 S35 S36 S37 S38 S39 S40 S41 S42 S43 S44 S45 S46 S47 S48 S49 S50 S51 S52 S53 S54 S55 S56 S57 S58 S59 S60 S61 S62 S63 S64 S65 S66 S67 S68 S69 S70 S71 S72 S73 S74 S75 S76 S77

K78
S79
G80
P81
S82
S83
G84

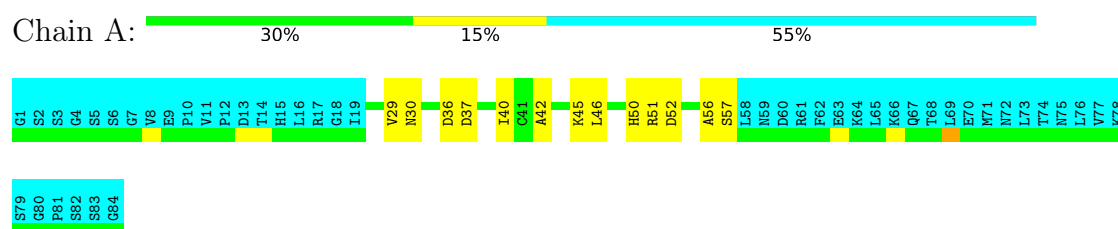
4.2.7 Score per residue for model 7

- Molecule 1: Midline-2



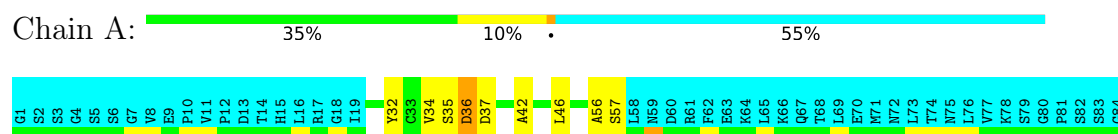
4.2.8 Score per residue for model 8

- Molecule 1: Midline-2



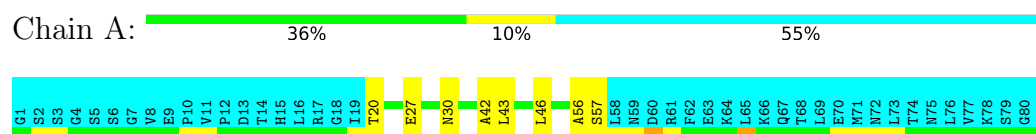
4.2.9 Score per residue for model 9

- Molecule 1: Midline-2



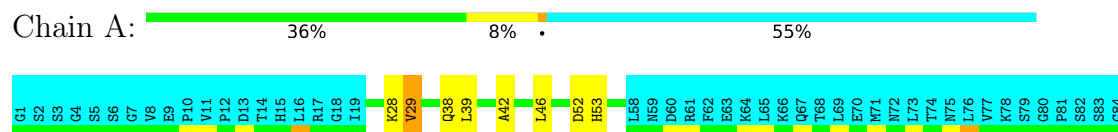
4.2.10 Score per residue for model 10

- Molecule 1: Midline-2



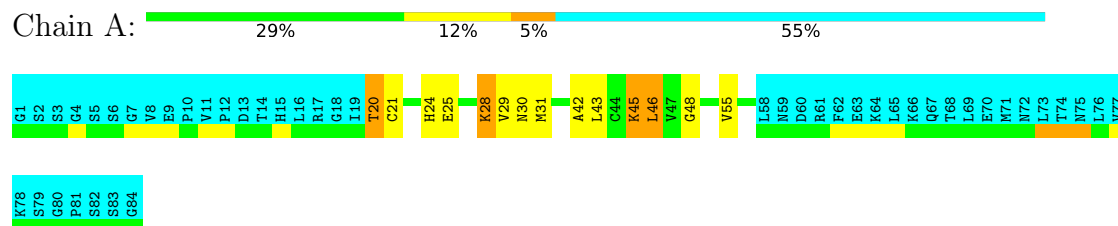
4.2.11 Score per residue for model 11 (medoid)

- Molecule 1: Midline-2



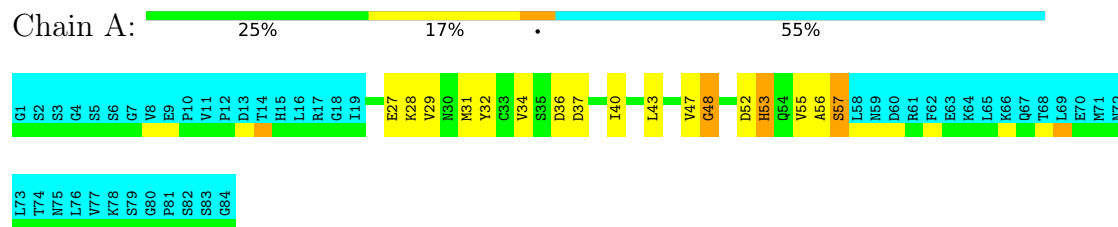
4.2.12 Score per residue for model 12

- Molecule 1: Midline-2



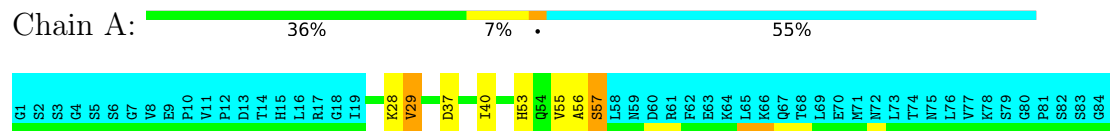
4.2.13 Score per residue for model 13

- Molecule 1: Midline-2



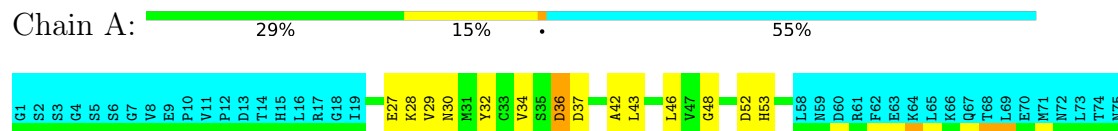
4.2.14 Score per residue for model 14

- Molecule 1: Midline-2



4.2.15 Score per residue for model 15

- Molecule 1: Midline-2



L76
V77
K78
S79
G80
P81
S82
S83
G84

4.2.16 Score per residue for model 16

- Molecule 1: Midline-2

Chain A: 31% 12% 55%

G1 S2 S3 G4 S5 S6 G7 V8 E9 E10 P10 P11 V11 P12 P13 D13 T14 H15 L16 L17 G18 G19 I19 T20 K28 V29 V34 L39 A42 L43 C44 K45 L46 V47 G48 Q54 L58 N59 D60 R61 F62 E63 K64 L65 K66 Q67 T68 L69 M71 M72 L73 T74 N75 L76 V77 K78 S79

G80
P81
S82
S83
G84

4.2.17 Score per residue for model 17

- Molecule 1: Midline-2

Chain A: 32% 11% 55%

G1 S2 S3 G4 S5 S6 G7 V8 E9 E10 P10 P11 V11 P12 P13 D13 T14 H15 L16 L17 G18 G19 I19 T20 E25 N26 E27 K28 V29 R30 R31 A42 L43 L46 V47 G48 V55 L58 N59 D60 R61 F62 E63 K64 L65 K66 Q67 T68 L69 M71 M72 L73 T74 N75 L76 V77 K78 S79

G80
P81
S82
S83
G84

4.2.18 Score per residue for model 18

- Molecule 1: Midline-2

Chain A: 30% 13% 55%

G1 S2 S3 G4 S5 S6 G7 V8 E9 E10 P10 P11 V11 P12 P13 D13 T14 H15 L16 L17 G18 G19 I19 T20 C21 L22 D23 H24 V29 N30 M31 I40 C41 A42 L43 C44 K45 L46 V47 G48 R49 H50 V55 L58 N59 D60 R61 F62 E63 K64 L65 K66 Q67 T68 L69 M71 M72 L73 T74

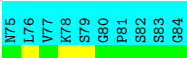
N75
L76
V77
K78
S79
G80
P81
S82
S83
G84

4.2.19 Score per residue for model 19

- Molecule 1: Midline-2

Chain A: 27% 15% 55%

G1 S2 S3 G4 S5 S6 G7 V8 E9 E10 P10 P11 V11 P12 P13 D13 T14 H15 L16 L17 G18 G19 I19 T20 C21 H24 K28 V29 V34 I40 C41 A42 L46 R49 H50 R51 D52 H53 Q54 V55 L58 N59 D60 R61 F62 E63 K64 L65 K66 Q67 T68 L69 M71 M72 L73 T74



4.2.20 Score per residue for model 20

● Molecule 1: Midline-2



5 Refinement protocol and experimental data overview ⓘ

The models were refined using the following method: *torsion angle dynamics*.

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

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

Software name	Classification	Version
CYANA	structure solution	2.0.17
CYANA	refinement	2.0.17

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:
ZN

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

There are no bond-length outliers.

There are no bond-angle outliers.

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	299	284	284	7±2
All	All	6020	5680	5680	136

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 12.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:42:ALA:O	1:A:46:LEU:HD13	0.82	1.74	15	11
1:A:40:ILE:HD11	1:A:55:VAL:HG11	0.79	1.54	18	7
1:A:27:GLU:HG2	1:A:43:LEU:HD12	0.76	1.57	17	1
1:A:34:VAL:HG21	1:A:54:GLN:OE1	0.74	1.82	2	2
1:A:27:GLU:CG	1:A:43:LEU:HD12	0.66	2.19	17	1
1:A:42:ALA:C	1:A:46:LEU:HD23	0.63	2.18	7	3
1:A:45:LYS:HG3	1:A:55:VAL:HG21	0.58	1.74	12	1
1:A:49:ARG:CG	1:A:50:HIS:CD2	0.58	2.86	3	1
1:A:27:GLU:HG3	1:A:43:LEU:HD12	0.58	1.75	2	6
1:A:31:MET:SD	1:A:55:VAL:HG21	0.58	2.39	13	2
1:A:42:ALA:O	1:A:46:LEU:HD23	0.56	2.00	7	1
1:A:45:LYS:O	1:A:46:LEU:C	0.54	2.51	16	4

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:27:GLU:N	1:A:27:GLU:CD	0.54	2.66	17	1
1:A:49:ARG:HG3	1:A:50:HIS:CD2	0.53	2.39	3	1
1:A:31:MET:HE1	1:A:42:ALA:HA	0.52	1.81	20	3
1:A:52:ASP:O	1:A:53:HIS:C	0.51	2.54	13	3
1:A:30:ASN:ND2	1:A:31:MET:SD	0.50	2.85	12	3
1:A:36:ASP:O	1:A:37:ASP:C	0.50	2.55	5	8
1:A:28:LYS:O	1:A:29:VAL:C	0.50	2.55	11	11
1:A:27:GLU:N	1:A:27:GLU:OE1	0.50	2.45	17	1
1:A:29:VAL:HG23	1:A:29:VAL:O	0.49	2.07	6	3
1:A:40:ILE:HG21	1:A:50:HIS:CE1	0.49	2.43	8	2
1:A:43:LEU:O	1:A:44:CYS:C	0.49	2.55	16	1
1:A:34:VAL:HG23	1:A:54:GLN:O	0.48	2.08	19	2
1:A:36:ASP:OD1	1:A:53:HIS:CE1	0.48	2.65	3	1
1:A:34:VAL:O	1:A:35:SER:C	0.48	2.55	9	3
1:A:20:THR:HG21	1:A:25:GLU:O	0.48	2.08	17	1
1:A:56:ALA:O	1:A:57:SER:C	0.48	2.55	9	6
1:A:33:CYS:N	1:A:38:GLN:O	0.47	2.47	20	1
1:A:36:ASP:C	1:A:37:ASP:OD1	0.47	2.57	15	2
1:A:44:CYS:O	1:A:48:GLY:CA	0.46	2.64	7	2
1:A:29:VAL:HG11	1:A:39:LEU:HB3	0.46	1.87	16	1
1:A:51:ARG:O	1:A:52:ASP:CG	0.46	2.59	8	1
1:A:32:TYR:CE1	1:A:37:ASP:HA	0.46	2.46	20	2
1:A:47:VAL:O	1:A:48:GLY:C	0.46	2.58	13	3
1:A:40:ILE:HG21	1:A:50:HIS:CD2	0.46	2.46	20	1
1:A:52:ASP:O	1:A:52:ASP:CG	0.46	2.58	2	2
1:A:36:ASP:C	1:A:37:ASP:CG	0.45	2.84	6	1
1:A:38:GLN:NE2	1:A:39:LEU:O	0.45	2.49	11	1
1:A:42:ALA:C	1:A:46:LEU:HD13	0.45	2.37	17	1
1:A:21:CYS:O	1:A:24:HIS:C	0.45	2.60	7	3
1:A:53:HIS:H	1:A:53:HIS:CD2	0.44	2.30	19	1
1:A:32:TYR:CE2	1:A:34:VAL:HG22	0.44	2.48	15	2
1:A:40:ILE:CD1	1:A:55:VAL:HG11	0.43	2.42	19	1
1:A:21:CYS:O	1:A:22:LEU:C	0.43	2.60	18	1
1:A:29:VAL:HG12	1:A:40:ILE:C	0.43	2.38	18	1
1:A:27:GLU:CD	1:A:43:LEU:HD12	0.42	2.40	17	1
1:A:52:ASP:O	1:A:53:HIS:CD2	0.42	2.73	15	1
1:A:48:GLY:C	1:A:50:HIS:N	0.42	2.77	4	3
1:A:30:ASN:OD1	1:A:30:ASN:N	0.42	2.52	8	1
1:A:43:LEU:C	1:A:45:LYS:N	0.42	2.76	12	1
1:A:30:ASN:O	1:A:30:ASN:CG	0.42	2.62	15	1
1:A:51:ARG:CZ	1:A:51:ARG:HB3	0.41	2.45	19	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:40:ILE:HD11	1:A:55:VAL:CG1	0.41	2.44	14	1
1:A:30:ASN:CG	1:A:31:MET:SD	0.41	3.04	18	2
1:A:21:CYS:O	1:A:24:HIS:O	0.41	2.39	18	3
1:A:49:ARG:HA	1:A:49:ARG:CZ	0.41	2.46	19	1
1:A:54:GLN:HE21	1:A:55:VAL:N	0.41	2.14	2	1
1:A:28:LYS:N	1:A:28:LYS:HD2	0.40	2.31	3	1
1:A:37:ASP:O	1:A:37:ASP:CG	0.40	2.65	14	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	38/84 (45%)	28±2 (74±6%)	9±2 (23±6%)	1±1 (4±2%)	4	31
All	All	760/1680 (45%)	559 (74%)	172 (23%)	29 (4%)	4	31

All 6 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	48	GLY	10
1	A	29	VAL	6
1	A	20	THR	5
1	A	53	HIS	4
1	A	57	SER	3
1	A	33	CYS	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	35/75 (47%)	34±1 (96±3%)	2±1 (4±3%)	27	78
All	All	700/1500 (47%)	670 (96%)	30 (4%)	27	78

All 13 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	36	ASP	6
1	A	46	LEU	4
1	A	30	ASN	3
1	A	28	LYS	3
1	A	45	LYS	3
1	A	29	VAL	2
1	A	37	ASP	2
1	A	20	THR	2
1	A	26	ASN	1
1	A	54	GLN	1
1	A	25	GLU	1
1	A	27	GLU	1
1	A	49	ARG	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 ⓘ

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

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