



Full wwPDB NMR Structure Validation Report ⓘ

Feb 12, 2017 – 10:03 pm GMT

PDB ID : 2HG7
Title : Solution NMR structure of Phage-like element PBSX protein xkdW, Northeast Structural Genomics Consortium Target SR355
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Deposited on : 2006-06-26

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A user guide is available at

<http://wwpdb.org/validation/2016/NMRValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

Cyrange	:	Kirchner and Güntert (2011)
NmrClust	:	Kelley et al. (1996)
MolProbity	:	4.02b-467
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	trunk28760
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	recalc28949

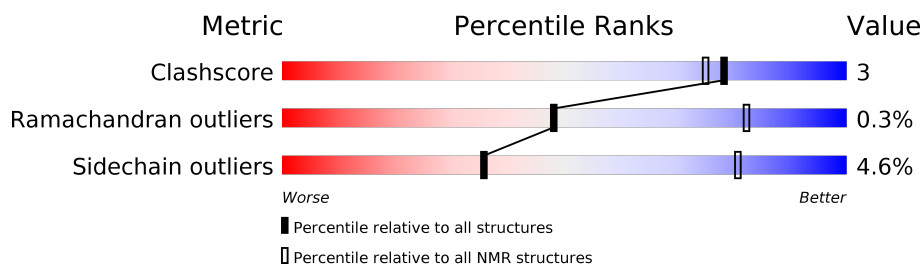
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 83%.

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	125131	11601
Ramachandran outliers	121729	10391
Sidechain outliers	121581	10367

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	110	

2 Ensemble composition and analysis

This entry contains 20 models. Model 5 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *fewest violations*.

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:1-A:56 (56)	0.50	5

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. No single-model clusters were found.

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

3 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 999 atoms, of which 488 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Phage-like element PBSX protein xkdW.

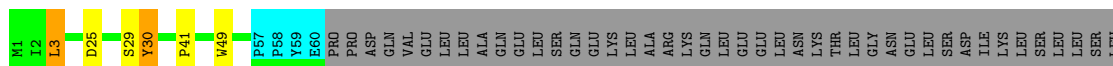
Mol	Chain	Residues	Atoms						Trace
1	A	60	Total	C	H	N	O	S	0
			999	330	488	83	96	2	

GLU
LEU
SER
ASP
ILE
LYS
LEU
SER
LEU
SER
LEU
GLU
HIS
HIS
HIS
HIS
HIS

4.2.3 Score per residue for model 3

- Molecule 1: Phage-like element PBSX protein xkdW

Chain A: 

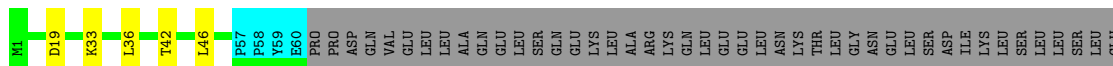


GLU
HIS
HIS
HIS
HIS
HIS
HIS

4.2.4 Score per residue for model 4

- Molecule 1: Phage-like element PBSX protein xkdW

Chain A: 

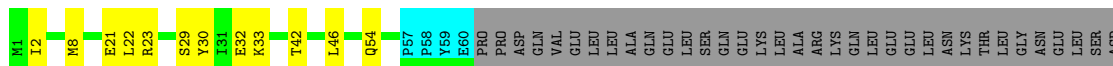


HIS
HIS
HIS
HIS
HIS
HIS
HIS

4.2.5 Score per residue for model 5 (medoid)

- Molecule 1: Phage-like element PBSX protein xkdW


Chain A: 

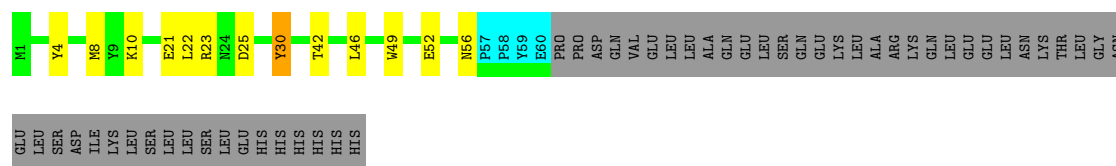


ILE
LYS
LEU
SER
LEU
LEU
SER
GLU
HIS
HIS
HIS
HIS
HIS
HIS

4.2.6 Score per residue for model 6

- Molecule 1: Phage-like element PBSX protein xkdW

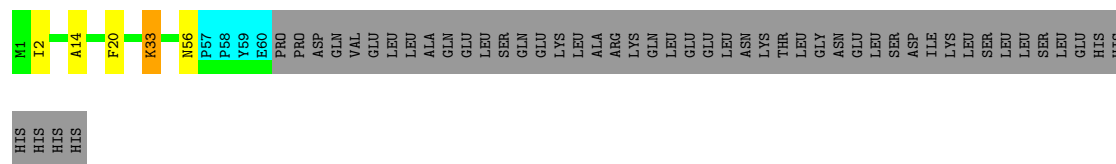
Chain A: 



4.2.7 Score per residue for model 7

- Molecule 1: Phage-like element PBSX protein xkdW

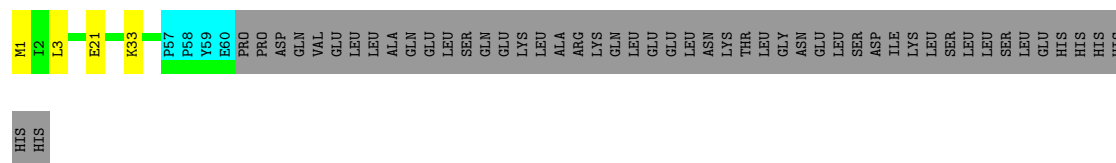
Chain A: 46% 45%



4.2.8 Score per residue for model 8

- Molecule 1: Phage-like element PBSX protein xkdW

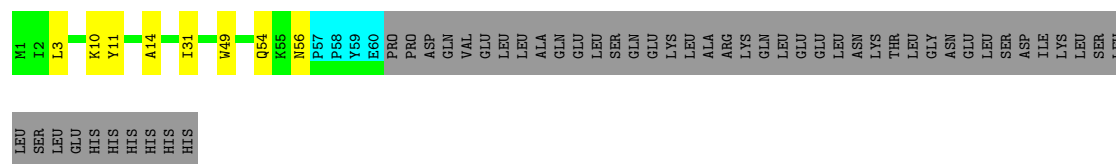
Chain A: 47% 45%



4.2.9 Score per residue for model 9

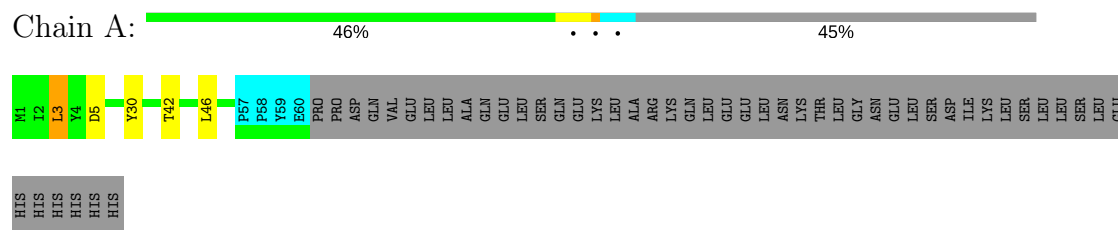
- Molecule 1: Phage-like element PBSX protein xkdW

Chain A: 44% 7% 45%



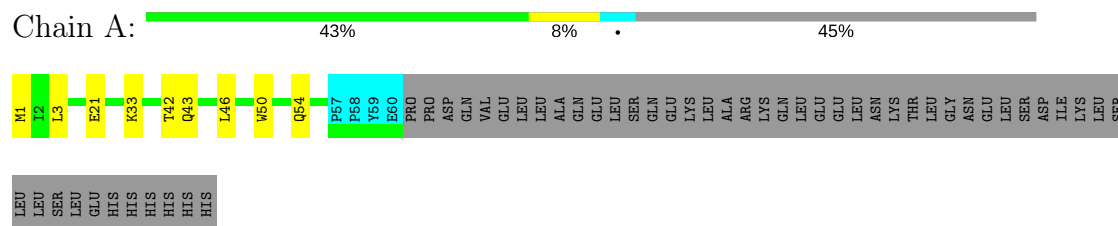
4.2.10 Score per residue for model 10

- Molecule 1: Phage-like element PBSX protein xkdW



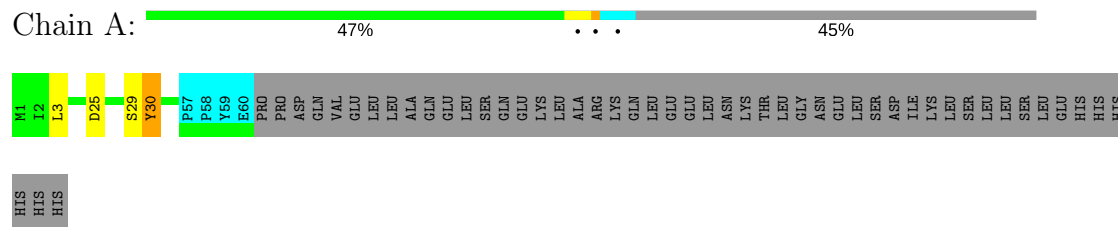
4.2.11 Score per residue for model 11

- Molecule 1: Phage-like element PBSX protein xkdW



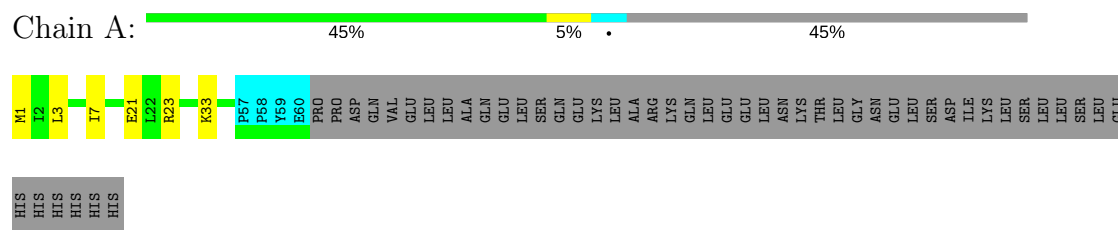
4.2.12 Score per residue for model 12

- Molecule 1: Phage-like element PBSX protein xkdW



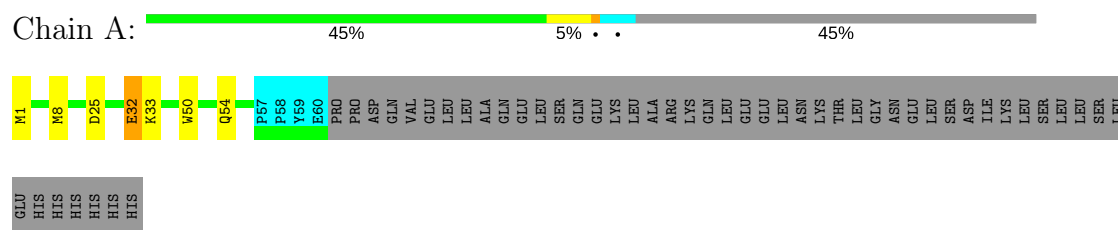
4.2.13 Score per residue for model 13

- Molecule 1: Phage-like element PBSX protein xkdW



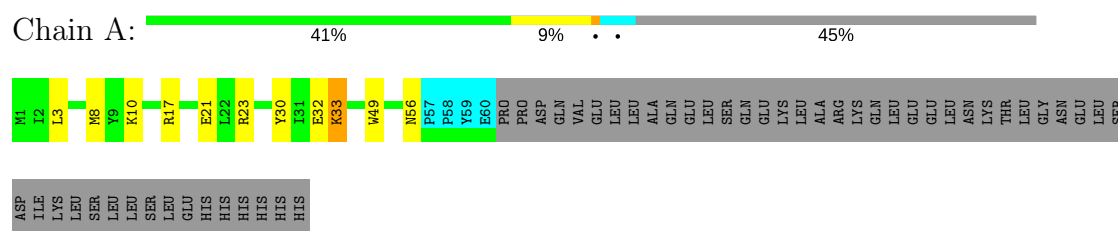
4.2.14 Score per residue for model 14

- Molecule 1: Phage-like element PBSX protein xkdW



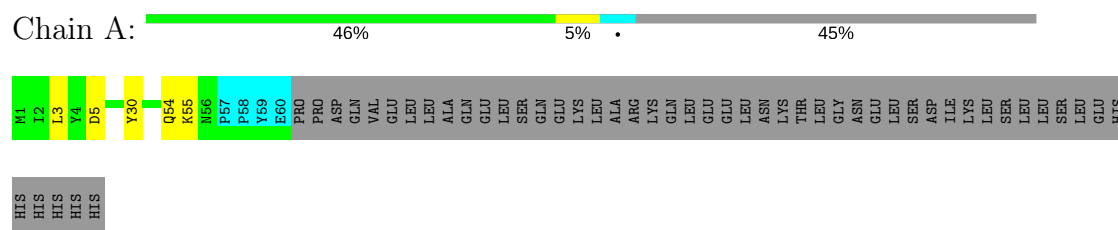
4.2.15 Score per residue for model 15

- Molecule 1: Phage-like element PBSX protein xkdW



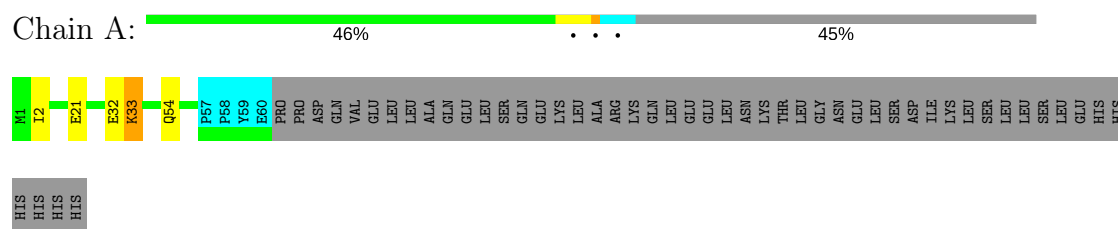
4.2.16 Score per residue for model 16

- Molecule 1: Phage-like element PBSX protein xkdW



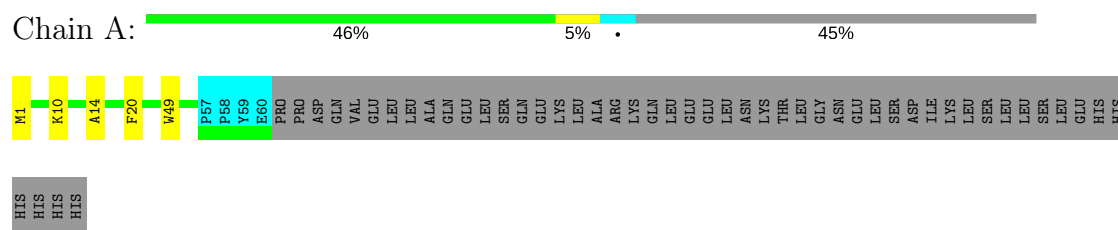
4.2.17 Score per residue for model 17

- Molecule 1: Phage-like element PBSX protein xkdW



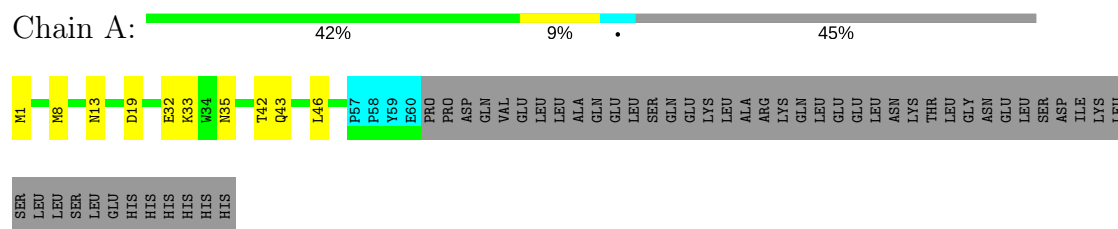
4.2.18 Score per residue for model 18

- Molecule 1: Phage-like element PBSX protein xkdW



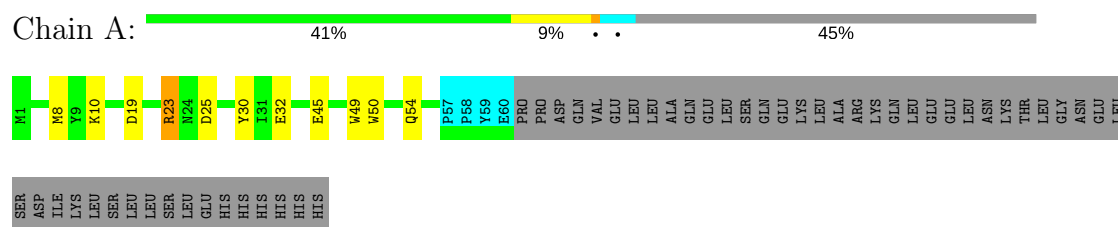
4.2.19 Score per residue for model 19

- Molecule 1: Phage-like element PBSX protein xkdW



4.2.20 Score per residue for model 20

- Molecule 1: Phage-like element PBSX protein xkdW



5 Refinement protocol and experimental data overview

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

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	21
CNS	refinement	1.1

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 7 of this report.

Chemical shift file(s)	BMRB entry 7224
Number of chemical shift lists	1
Total number of shifts	724
Number of shifts mapped to atoms	724
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	83%

No validations of the models with respect to experimental NMR restraints is performed at this time.

6 Model quality [i](#)

6.1 Standard geometry [i](#)

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 [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	476	459	459	3±2
All	All	9520	9180	9180	62

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 3.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:21:GLU:HB3	1:A:33:LYS:HB3	0.68	1.62	5	3
1:A:21:GLU:HB3	1:A:33:LYS:HB2	0.68	1.65	13	3
1:A:14:ALA:HB1	1:A:20:PHE:HZ	0.63	1.52	18	1
1:A:10:LYS:HD2	1:A:49:TRP:CZ2	0.61	2.29	18	4
1:A:21:GLU:HB2	1:A:33:LYS:HB2	0.60	1.73	2	1
1:A:23:ARG:HH11	1:A:32:GLU:HG2	0.59	1.57	20	1
1:A:20:PHE:HA	1:A:33:LYS:O	0.55	2.01	2	1
1:A:3:LEU:HB2	1:A:30:TYR:HA	0.53	1.80	16	3
1:A:33:LYS:HA	1:A:33:LYS:HE3	0.53	1.80	7	1
1:A:14:ALA:HB1	1:A:20:PHE:CZ	0.52	2.37	18	1
1:A:3:LEU:HG	1:A:31:ILE:HG13	0.52	1.82	9	1
1:A:33:LYS:HB2	1:A:33:LYS:HZ2	0.52	1.64	14	1
1:A:19:ASP:O	1:A:35:ASN:HB2	0.51	2.04	19	1
1:A:25:ASP:HB2	1:A:30:TYR:CD1	0.50	2.41	2	3

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:42:THR:O	1:A:46:LEU:HG	0.50	2.06	19	6
1:A:19:ASP:OD1	1:A:36:LEU:HG	0.49	2.06	4	1
1:A:25:ASP:HB2	1:A:30:TYR:CE1	0.48	2.44	6	2
1:A:50:TRP:O	1:A:54:GLN:HG2	0.47	2.10	14	3
1:A:45:GLU:HB3	1:A:49:TRP:CZ2	0.47	2.45	20	1
1:A:2:ILE:HG23	1:A:29:SER:HB2	0.47	1.86	5	1
1:A:21:GLU:HB2	1:A:33:LYS:HB3	0.47	1.86	17	1
1:A:22:LEU:O	1:A:23:ARG:HD2	0.46	2.10	5	1
1:A:23:ARG:HB2	1:A:32:GLU:HB2	0.46	1.88	2	2
1:A:52:GLU:O	1:A:56:ASN:HB3	0.46	2.11	6	1
1:A:4:TYR:HB2	1:A:22:LEU:HD11	0.45	1.87	2	1
1:A:52:GLU:O	1:A:56:ASN:HB2	0.45	2.11	2	1
1:A:10:LYS:HD2	1:A:11:TYR:CE2	0.44	2.47	2	1
1:A:3:LEU:HB2	1:A:29:SER:O	0.43	2.14	3	2
1:A:21:GLU:HB3	1:A:33:LYS:CG	0.43	2.44	8	1
1:A:14:ALA:HB1	1:A:20:PHE:CE1	0.42	2.49	7	1
1:A:21:GLU:CB	1:A:33:LYS:HB3	0.42	2.45	1	1
1:A:3:LEU:O	1:A:7:ILE:HG13	0.42	2.14	13	1
1:A:41:PRO:HG3	1:A:49:TRP:CH2	0.41	2.50	3	1
1:A:4:TYR:CD1	1:A:22:LEU:HD11	0.41	2.50	6	1
1:A:33:LYS:HB2	1:A:33:LYS:NZ	0.41	2.30	15	1
1:A:32:GLU:OE2	1:A:33:LYS:HB2	0.41	2.16	14	1
1:A:11:TYR:HB2	1:A:14:ALA:HB2	0.41	1.93	9	1
1:A:32:GLU:HG3	1:A:33:LYS:HD2	0.41	1.92	19	1
1:A:2:ILE:HD12	1:A:2:ILE:N	0.40	2.32	7	1
1:A:2:ILE:H	1:A:2:ILE:HD12	0.40	1.77	17	1
1:A:19:ASP:HA	1:A:35:ASN:HB2	0.40	1.94	2	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	55/110 (50%)	52±1 (94±2%)	3±1 (6±2%)	0±0 (0±1%)	48	82
All	All	1100/2200 (50%)	1032 (94%)	65 (6%)	3 (0%)	48	82

All 1 unique Ramachandran outliers are listed below.

Mol	Chain	Res	Type	Models (Total)
1	A	56	ASN	3

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	50/101 (50%)	48±1 (95±3%)	2±1 (5±3%)	36	81
All	All	1000/2020 (50%)	954 (95%)	46 (5%)	36	81

All 17 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	MET	7
1	A	8	MET	6
1	A	30	TYR	4
1	A	33	LYS	4
1	A	3	LEU	4
1	A	54	GLN	4
1	A	32	GLU	3
1	A	23	ARG	3
1	A	5	ASP	2
1	A	43	GLN	2
1	A	17	ARG	1
1	A	13	ASN	1
1	A	19	ASP	1
1	A	10	LYS	1
1	A	25	ASP	1
1	A	55	LYS	1
1	A	21	GLU	1

6.3.3 RNA ⓘ

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 carbohydrates 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

The completeness of assignment taking into account all chemical shift lists is 83% for the well-defined parts and 83% for the entire structure.

7.1 Chemical shift list 1

File name: BMRB entry 7224

Chemical shift list name: *assigned_chem_shift_list_1*

7.1.1 Bookkeeping

The following table shows the results of parsing the chemical shift list and reports the number of nuclei with statistically unusual chemical shifts.

Total number of shifts	724
Number of shifts mapped to atoms	724
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	4

7.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction \pm precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	59	0.06 ± 0.24	None needed (< 0.5 ppm)
$^{13}\text{C}_\beta$	57	0.12 ± 0.15	None needed (< 0.5 ppm)
$^{13}\text{C}'$	0	—	None (insufficient data)
^{15}N	53	0.28 ± 0.39	None needed (< 0.5 ppm)

7.1.3 Completeness of resonance assignments

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 83%, i.e. 616 atoms were assigned a chemical shift out of a possible 742. 7 out of 7 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	212/274 (77%)	106/109 (97%)	55/112 (49%)	51/53 (96%)
Sidechain	337/391 (86%)	212/231 (92%)	118/140 (84%)	7/20 (35%)

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	Total	¹ H	¹³ C	¹⁵ N
Aromatic	67/77 (87%)	39/39 (100%)	25/35 (71%)	3/3 (100%)
Overall	616/742 (83%)	357/379 (94%)	198/287 (69%)	61/76 (80%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 83%, i.e. 661 atoms were assigned a chemical shift out of a possible 794. 7 out of 7 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹ H	¹³ C	¹⁵ N
Backbone	224/290 (77%)	112/115 (97%)	59/120 (49%)	53/55 (96%)
Sidechain	364/419 (87%)	230/249 (92%)	127/150 (85%)	7/20 (35%)
Aromatic	73/85 (86%)	43/43 (100%)	27/39 (69%)	3/3 (100%)
Overall	661/794 (83%)	385/407 (95%)	213/309 (69%)	63/78 (81%)

7.1.4 Statistically unusual chemical shifts ⓘ

The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

Mol	Chain	Res	Type	Atom	Shift, ppm	Expected range, ppm	Z-score
1	A	10	LYS	HG2	-0.77	2.67 – 0.07	-8.2
1	A	10	LYS	HG3	-0.53	2.76 – -0.04	-6.8
1	A	10	LYS	HB2	0.17	3.03 – 0.53	-6.4
1	A	10	LYS	HD2	0.27	2.76 – 0.46	-5.8

7.1.5 Random Coil Index (RCI) plots ⓘ

The image below reports *random coil index* values for the protein chains in the structure. The height of each bar gives a probability of a given residue to be disordered, as predicted from the available chemical shifts and the amino acid sequence. A value above 0.2 is an indication of significant predicted disorder. The colour of the bar shows whether the residue is in the well-defined core (black) or in the ill-defined residue ranges (cyan), as described in section 2 on ensemble composition.

Random coil index (RCI) for chain A:

