Full wwPDB NMR Structure Validation Report (i)

Mar 3, 2022 – 07:47 AM EST

PDB ID	:	2HGC
Title	:	Solution NMR structure of the YjcQ protein from Bacillus subtilis. Northeast Structural Genomics target SR346.
Authors	:	Rossi, P.; Cort, J.R.; Ho, C.K.; Janjua, H.; Cunningham, K.; Ma, L.-C.; Xiao, R.; Liu, J.; Baran, M.; Swapna, G.V.T.; Acton, T.B.; Rost, B.; Kennedy, M.A.; Montelione, G.T.; Northeast Structural Genomics Consortium (NESG)
Deposited on	:	2006-06-26

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 (i) symbol.

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

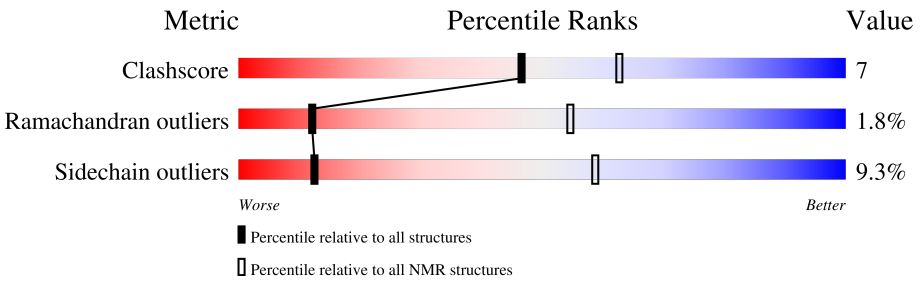
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.27
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.27

1 Overall quality at a glance (i)

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	158937	12864
Ramachandran outliers	154571	11451
Sidechain outliers	154315	11428

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 <=5%

Mol	Chain	Length	Quality of chain
1	A	102	51% 13% • 12% 24%

2 Ensemble composition and analysis (i)

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: *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:51, A:55-A:74 (66)	0.40	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 3 single-model clusters were found.

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

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 1250 atoms, of which 614 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called YjcQ protein.

Mol	Chain	Residues	Atoms					Trace
			Total	C	H	N	O	
1	A	78	1250	405	614	105	126	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	95	LEU	-	cloning artifact	UNP O31639
A	96	GLU	-	cloning artifact	UNP O31639
A	97	HIS	-	expression tag	UNP O31639
A	98	HIS	-	expression tag	UNP O31639
A	99	HIS	-	expression tag	UNP O31639
A	100	HIS	-	expression tag	UNP O31639
A	101	HIS	-	expression tag	UNP O31639
A	102	HIS	-	expression tag	UNP O31639

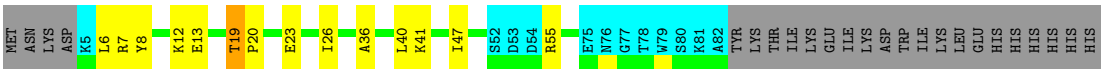
4 Residue-property plots (i)

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: YjcQ protein

Chain A: 51% 13% • 12% 24%



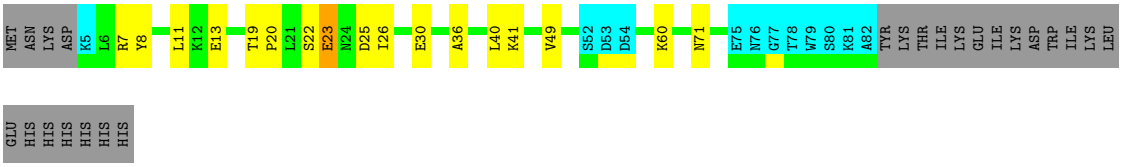
4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

• Molecule 1: YjcQ protein

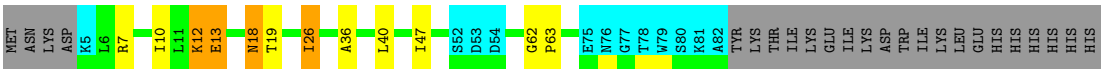
Chain A: 48% 16% • 12% 24%



4.2.2 Score per residue for model 2

• Molecule 1: YjcQ protein

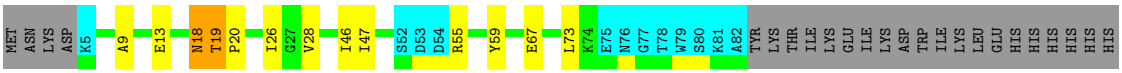
Chain A: 53% 8% • 12% 24%



4.2.3 Score per residue for model 3

- Molecule 1: YjcQ protein

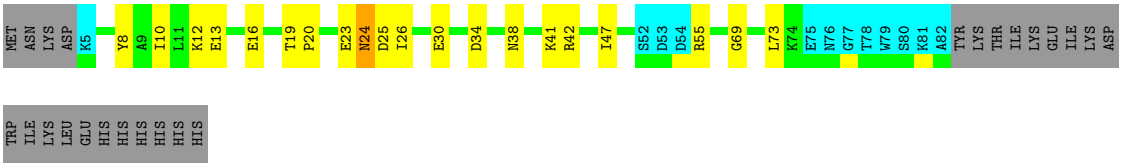
Chain A: 52% 11% • 12% 24%



4.2.4 Score per residue for model 4

- Molecule 1: YjcQ protein

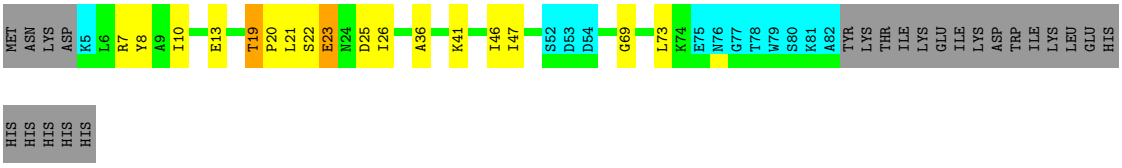
Chain A: 45% 19% • 12% 24%



4.2.5 Score per residue for model 5

- Molecule 1: YjcQ protein

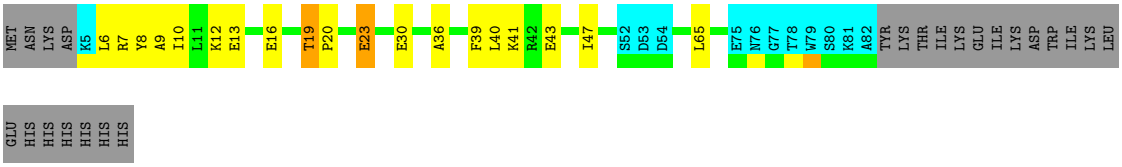
Chain A: 48% 15% • 12% 24%



4.2.6 Score per residue for model 6

- Molecule 1: YjcQ protein

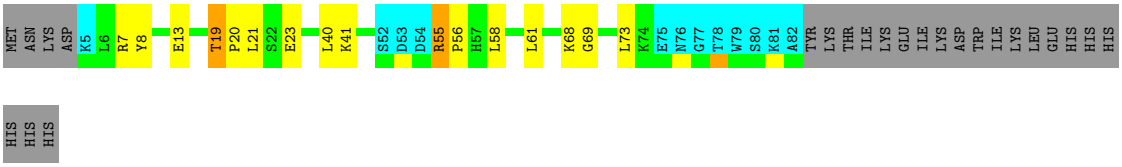
Chain A: 46% 17% • 12% 24%



4.2.7 Score per residue for model 7

- Molecule 1: YjcQ protein

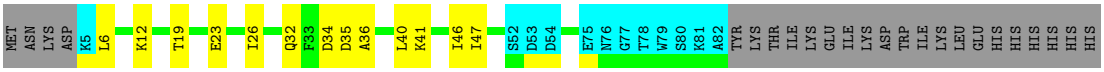
Chain A: 49% 14% • 12% 24%



4.2.8 Score per residue for model 8 (medoid)

- Molecule 1: YjcQ protein

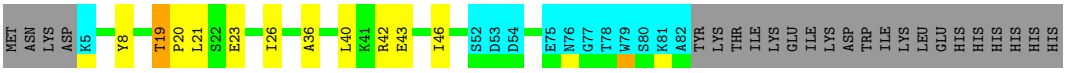
Chain A: 52% 13% 12% 24%



4.2.9 Score per residue for model 9

- Molecule 1: YjcQ protein

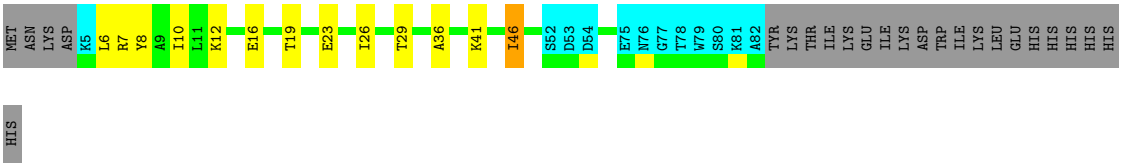
Chain A: 54% 10% • 12% 24%



4.2.10 Score per residue for model 10

- Molecule 1: YjcQ protein

Chain A: 52% 12% • 12% 24%



4.2.11 Score per residue for model 11

- Molecule 1: YjcQ protein

Chain A: 51% 13% • 12% 24%

MET ASN LYS ASP K5 L6 R7 T19 P20 E23 I26 D31 A36 L40 K41 I46 I47 S52 D53 D54 K60 P63 E75 N76 G77 T78 W79 S80 K81 A82 TYR LYS THR ILE LYS GLU ILE LYS ASP TRP ILE LYS LEU GLU HIS HIS HIS HIS HIS

HIS

4.2.12 Score per residue for model 12

- Molecule 1: YjcQ protein

Chain A: 50% 12% • 12% 24%

MET ASN LYS ASP K5 L6 R7 Y8 K12 T19 P20 E23 I26 C27 V28 L40 E43 C44 Y45 I46 I47 Y51 S52 D53 D54 K60 E75 N76 G77 T78 W79 S80 K81 A82 TYR LYS THR ILE LYS GLU ILE LYS ASP TRP ILE LYS LEU GLU HIS HIS HIS

HIS HIS HIS

4.2.13 Score per residue for model 13

- Molecule 1: YjcQ protein

Chain A: 47% 16% • 12% 24%

MET ASN LYS ASP K5 L6 R7 Y8 A9 I10 E13 I14 T19 P20 E23 I26 E30 A36 K41 I47 S52 D53 D54 R55 P56 H57 K60 L61 L73 K74 E75 N76 G77 T78 W79 S80 K81 A82 TYR LYS THR ILE LYS GLU ILE LYS ASP TRP ILE

LYS LEU GLU HIS HIS HIS HIS HIS HIS

4.2.14 Score per residue for model 14

- Molecule 1: YjcQ protein

Chain A: 49% 16% 12% 24%

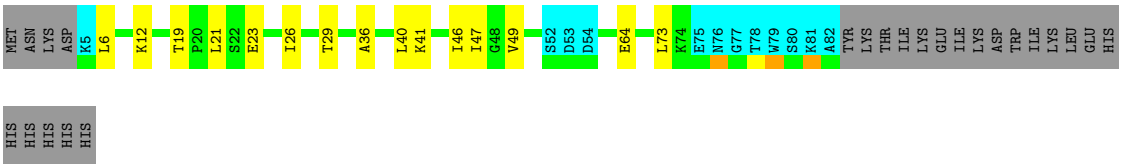
MET ASN LYS ASP K5 L6 R7 Y8 A9 I10 N18 T19 P20 E23 I26 D34 D35 A36 V37 N38 K41 S52 D53 D54 R55 K60 L65 E75 N76 G77 T78 W79 S80 K81 A82 TYR LYS THR ILE LYS GLU ILE LYS ASP TRP ILE LYS LEU GLU HIS HIS

HIS HIS HIS HIS

4.2.15 Score per residue for model 15

- Molecule 1: YjcQ protein

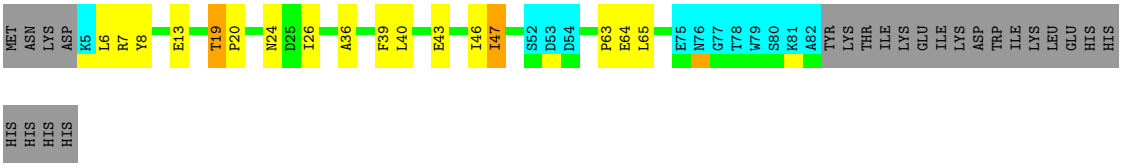
Chain A: 50% 15% 12% 24%



4.2.16 Score per residue for model 16

- Molecule 1: YjcQ protein

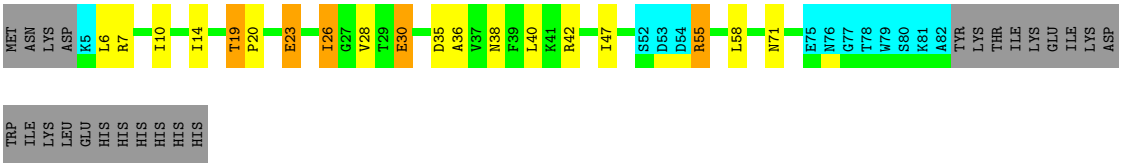
Chain A: 48% 15% • 12% 24%



4.2.17 Score per residue for model 17

- Molecule 1: YjcQ protein

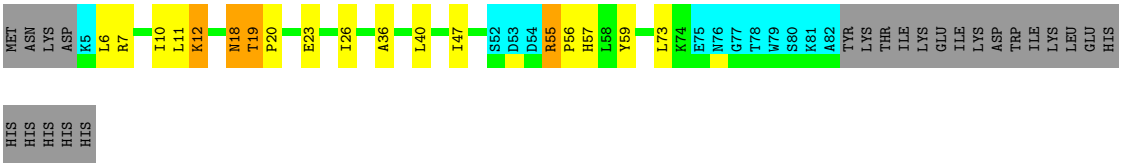
Chain A: 46% 14% 5% 12% 24%



4.2.18 Score per residue for model 18

- Molecule 1: YjcQ protein

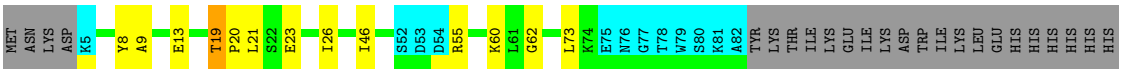
Chain A: 47% 14% • 12% 24%



4.2.19 Score per residue for model 19

- Molecule 1: YjcQ protein

Chain A: 52% 12% • 12% 24%



4.2.20 Score per residue for model 20

- Molecule 1: YjcQ protein

Chain A: 47% 15% • 12% 24%

5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *Noesy assignments made with iterative method using CS, 3J, Hyper (dihedral), and Dyana for simulated annealing MD. Converged structures are further refined using NIH-xplor followed by CNS in explicit water shell (Nielges) . Full lenght sequence was carried through the refinement protocol, the disordered regions and hexHIS tag are not reported. Structure based on 595 constraints, 249 long range, 163 dihedral constraints and 36 H-bond constraints..*

Of the 100 calculated structures, 20 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
DYANA	structure solution	1.2
X-PLOR	refinement	2.11.2
AutoStructure	structure solution	2.1.1
HYPER	structure solution	2.1
PSVS	refinement	1.3
Procheck NMR	refinement	3.51
MolProbity	refinement	3.01

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.

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	543	533	531	7±2
All	All	10860	10660	10620	140

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 7.

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:TYR:HE1	1:A:73:LEU:HA	0.75	1.42	13	4
1:A:55:ARG:HG3	1:A:56:PRO:HD2	0.68	1.65	18	2
1:A:19:THR:HB	1:A:20:PRO:HA	0.68	1.64	9	11
1:A:7:ARG:NH1	1:A:36:ALA:HA	0.64	2.07	2	3
1:A:41:LYS:HB3	1:A:41:LYS:HZ2	0.64	1.52	13	1
1:A:20:PRO:HB3	1:A:59:TYR:HA	0.63	1.70	3	2
1:A:23:GLU:HG2	1:A:30:GLU:HB3	0.63	1.69	17	1
1:A:21:LEU:HD21	1:A:26:ILE:HD12	0.62	1.72	5	1
1:A:7:ARG:NH2	1:A:36:ALA:HA	0.61	2.10	6	1
1:A:20:PRO:HD3	1:A:60:LYS:HG2	0.60	1.71	19	3
1:A:21:LEU:HD12	1:A:26:ILE:HB	0.59	1.73	9	2
1:A:7:ARG:HH11	1:A:36:ALA:HA	0.56	1.59	1	2
1:A:18:ASN:O	1:A:19:THR:HG23	0.56	2.01	3	2
1:A:47:ILE:O	1:A:63:PRO:HA	0.55	2.01	2	3

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:7:ARG:HD2	1:A:36:ALA:HA	0.55	1.78	13	2
1:A:36:ALA:O	1:A:40:LEU:HG	0.54	2.03	16	10
1:A:22:SER:HB3	1:A:25:ASP:HB2	0.54	1.79	1	1
1:A:19:THR:CB	1:A:20:PRO:HA	0.54	2.32	9	6
1:A:12:LYS:O	1:A:16:GLU:HG2	0.53	2.03	10	2
1:A:30:GLU:H	1:A:30:GLU:CD	0.52	2.08	6	1
1:A:6:LEU:O	1:A:10:ILE:HG13	0.52	2.04	18	4
1:A:21:LEU:HD11	1:A:26:ILE:HB	0.52	1.79	5	1
1:A:7:ARG:HB3	1:A:36:ALA:HB1	0.51	1.81	10	1
1:A:20:PRO:HB3	1:A:58:LEU:O	0.51	2.06	17	1
1:A:12:LYS:O	1:A:16:GLU:HG3	0.50	2.07	6	1
1:A:30:GLU:HB3	1:A:55:ARG:NH2	0.49	2.21	13	2
1:A:23:GLU:H	1:A:23:GLU:CD	0.49	2.10	20	4
1:A:8:TYR:CE1	1:A:73:LEU:HA	0.49	2.42	19	2
1:A:23:GLU:HG2	1:A:30:GLU:HA	0.49	1.85	6	2
1:A:41:LYS:HD2	1:A:49:VAL:HB	0.49	1.83	15	2
1:A:20:PRO:HD3	1:A:60:LYS:HA	0.49	1.84	11	2
1:A:7:ARG:HG3	1:A:40:LEU:HD21	0.48	1.85	16	1
1:A:7:ARG:O	1:A:11:LEU:HG	0.48	2.08	20	1
1:A:19:THR:HB	1:A:20:PRO:CA	0.48	2.37	9	2
1:A:10:ILE:HA	1:A:13:GLU:HG2	0.48	1.86	4	1
1:A:7:ARG:HA	1:A:10:ILE:HD12	0.48	1.85	6	2
1:A:11:LEU:CB	1:A:73:LEU:HD21	0.47	2.39	18	1
1:A:20:PRO:HD3	1:A:60:LYS:HG3	0.47	1.86	20	2
1:A:10:ILE:HA	1:A:26:ILE:HD11	0.47	1.85	18	1
1:A:7:ARG:HH21	1:A:39:PHE:HB3	0.47	1.69	6	1
1:A:20:PRO:HG3	1:A:59:TYR:HA	0.47	1.85	20	1
1:A:46:ILE:HG22	1:A:65:LEU:HA	0.47	1.86	16	1
1:A:11:LEU:HG	1:A:40:LEU:HD13	0.46	1.87	1	1
1:A:21:LEU:H	1:A:21:LEU:HD23	0.46	1.71	7	2
1:A:12:LYS:HD3	1:A:13:GLU:N	0.46	2.25	2	1
1:A:19:THR:HB	1:A:59:TYR:O	0.46	2.10	18	2
1:A:22:SER:HB2	1:A:25:ASP:OD1	0.46	2.11	5	1
1:A:10:ILE:HD13	1:A:26:ILE:HG13	0.46	1.87	17	2
1:A:7:ARG:HG2	1:A:40:LEU:HD21	0.46	1.88	12	1
1:A:43:GLU:HB2	1:A:45:TYR:CE1	0.45	2.45	12	1
1:A:7:ARG:HB2	1:A:40:LEU:HD21	0.45	1.88	7	1
1:A:7:ARG:HG3	1:A:36:ALA:HB1	0.45	1.88	11	1
1:A:10:ILE:O	1:A:14:ILE:HG13	0.45	2.11	13	2
1:A:38:ASN:O	1:A:42:ARG:HG3	0.44	2.13	4	2
1:A:23:GLU:HB2	1:A:28:VAL:O	0.44	2.13	12	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:13:GLU:HG3	1:A:26:ILE:HG13	0.44	1.90	19	1
1:A:69:GLY:O	1:A:73:LEU:HG	0.44	2.13	4	3
1:A:39:PHE:O	1:A:43:GLU:HG2	0.44	2.13	16	1
1:A:22:SER:HB3	1:A:25:ASP:CB	0.43	2.43	1	1
1:A:7:ARG:HG2	1:A:36:ALA:HB1	0.43	1.89	5	1
1:A:26:ILE:HG23	1:A:28:VAL:HG22	0.43	1.90	17	3
1:A:41:LYS:HD3	1:A:41:LYS:O	0.43	2.13	6	1
1:A:32:GLN:HA	1:A:35:ASP:HB3	0.43	1.90	8	1
1:A:41:LYS:HZ3	1:A:41:LYS:HB3	0.43	1.73	8	1
1:A:41:LYS:HD2	1:A:46:ILE:O	0.42	2.14	11	1
1:A:7:ARG:HG3	1:A:36:ALA:CB	0.42	2.45	11	1
1:A:34:ASP:O	1:A:38:ASN:HB2	0.42	2.13	14	1
1:A:9:ALA:O	1:A:13:GLU:HG2	0.42	2.15	3	2
1:A:24:ASN:HD22	1:A:24:ASN:C	0.42	2.18	4	1
1:A:8:TYR:O	1:A:12:LYS:HG3	0.41	2.15	12	1
1:A:24:ASN:HD22	1:A:25:ASP:N	0.41	2.14	4	1
1:A:46:ILE:HD12	1:A:46:ILE:O	0.41	2.15	15	1
1:A:19:THR:O	1:A:60:LYS:HA	0.41	2.16	20	1
1:A:6:LEU:O	1:A:10:ILE:HG12	0.40	2.16	17	1
1:A:7:ARG:HG3	1:A:8:TYR:N	0.40	2.30	10	1
1:A:46:ILE:HD13	1:A:46:ILE:N	0.40	2.32	10	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	66/102 (65%)	62±1 (94±2%)	3±1 (4±2%)	1±1 (2±1%)	12	54
All	All	1320/2040 (65%)	1245 (94%)	51 (4%)	24 (2%)	12	54

All 5 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	19	THR	16

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Mol	Chain	Res	Type	Models (Total)
1	A	18	ASN	3
1	A	62	GLY	2
1	A	58	LEU	2
1	A	55	ARG	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	58/92 (63%)	53±1 (91±2%)	5±1 (9±2%)	12	59
All	All	1160/1840 (63%)	1052 (91%)	108 (9%)	12	59

All 30 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	23	GLU	16
1	A	26	ILE	12
1	A	47	ILE	12
1	A	13	GLU	7
1	A	12	LYS	6
1	A	46	ILE	6
1	A	41	LYS	6
1	A	55	ARG	4
1	A	7	ARG	4
1	A	19	THR	3
1	A	29	THR	3
1	A	71	ASN	2
1	A	18	ASN	2
1	A	24	ASN	2
1	A	34	ASP	2
1	A	43	GLU	2
1	A	65	LEU	2
1	A	61	LEU	2
1	A	57	HIS	2
1	A	64	GLU	2
1	A	30	GLU	2

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Mol	Chain	Res	Type	Models (Total)
1	A	67	GLU	1
1	A	8	TYR	1
1	A	68	LYS	1
1	A	42	ARG	1
1	A	31	ASP	1
1	A	51	TYR	1
1	A	6	LEU	1
1	A	21	LEU	1
1	A	35	ASP	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 monosaccharides 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 (i)

No chemical shift data were provided