



Full wwPDB NMR Structure Validation Report ⓘ

May 29, 2020 – 01:45 am BST

PDB ID : 2XY8
Title : Paramagnetic-based NMR structure of the complex between the N- terminal epsilon domain and the theta domain of the DNA polymerase III
Authors : Schmitz, C.; Bonvin, A.M.J.J.
Deposited on : 2010-11-16

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 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 : 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 : 2.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

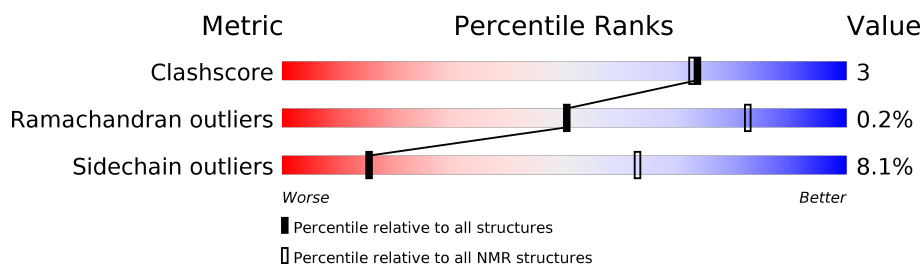
1 Overall quality at a glance

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	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 $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	186	85% 8% • 6%
2	B	76	50% 17% 13% 20%

2 Ensemble composition and analysis

This entry contains 10 models. Model 3 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative.

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:7-A:181, B:14-B:64 (226)	0.49	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 2 clusters. No single-model clusters were found.

Cluster number	Models
1	1, 2, 3, 4, 5, 6, 10
2	7, 8, 9

3 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2291 atoms, of which 419 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called DNA POLYMERASE III SUBUNIT EPSILON.

Mol	Chain	Residues	Atoms					Trace	
			Total	C	H	N	O		S
1	A	175	1676	874	301	237	257	7	1

- Molecule 2 is a protein called DNA POLYMERASE III SUBUNIT THETA.

Mol	Chain	Residues	Atoms					Trace	
			Total	C	H	N	O		S
2	B	61	614	311	118	94	89	2	0

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

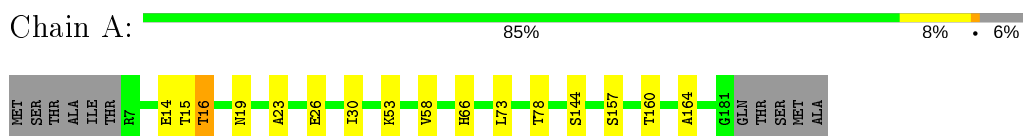
Mol	Chain	Residues	Atoms	
			Total	Ca
3	A	1	1	1

4 Residue-property plots [i](#)

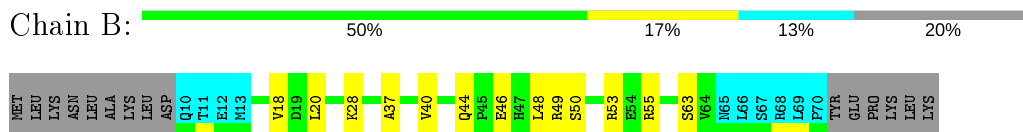
4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA and DNA 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: DNA POLYMERASE III SUBUNIT EPSILON



- Molecule 2: DNA POLYMERASE III SUBUNIT THETA

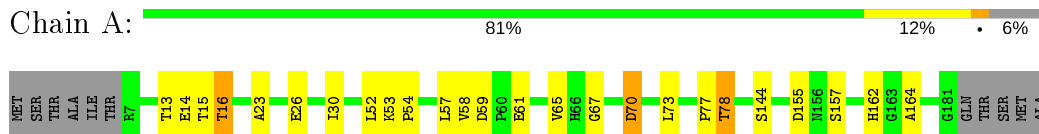


4.2 Scores per residue for each member of the ensemble

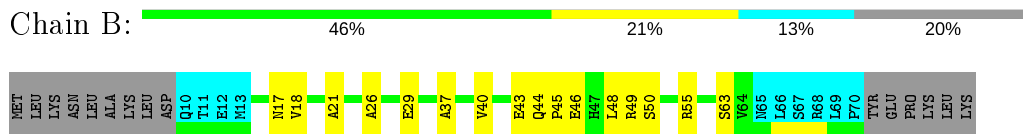
Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

- Molecule 1: DNA POLYMERASE III SUBUNIT EPSILON

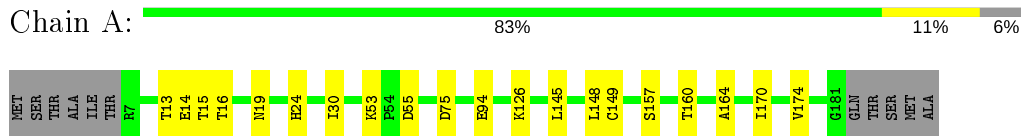


- Molecule 2: DNA POLYMERASE III SUBUNIT THETA

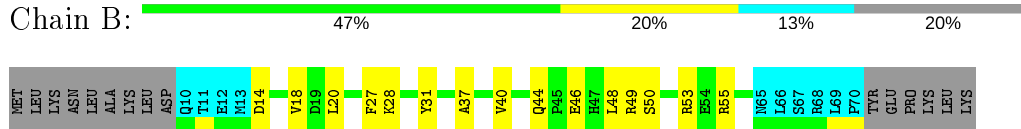


4.2.2 Score per residue for model 2

- Molecule 1: DNA POLYMERASE III SUBUNIT EPSILON

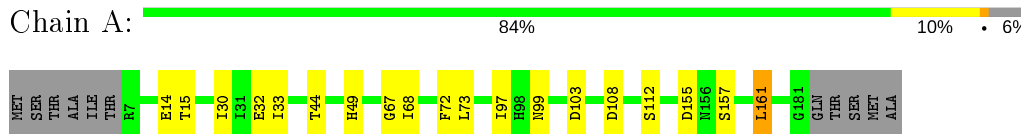


- Molecule 2: DNA POLYMERASE III SUBUNIT THETA

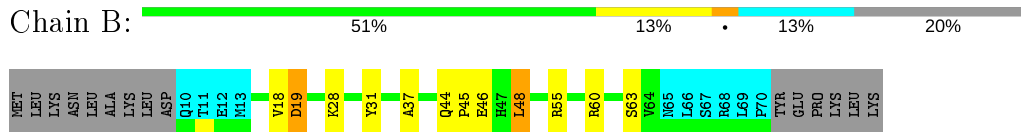


4.2.3 Score per residue for model 3 (medoid)

- Molecule 1: DNA POLYMERASE III SUBUNIT EPSILON

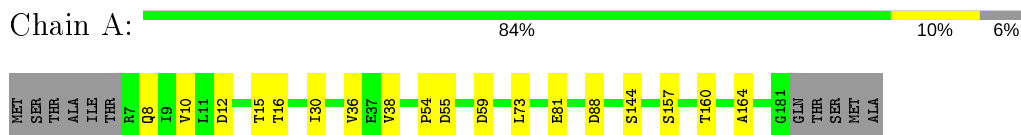


- Molecule 2: DNA POLYMERASE III SUBUNIT THETA

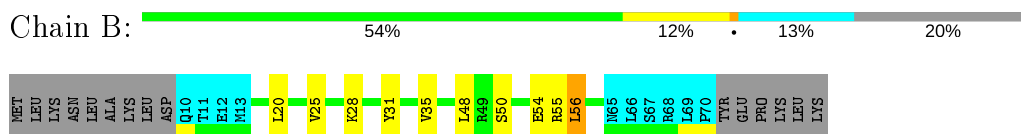


4.2.4 Score per residue for model 4

- Molecule 1: DNA POLYMERASE III SUBUNIT EPSILON

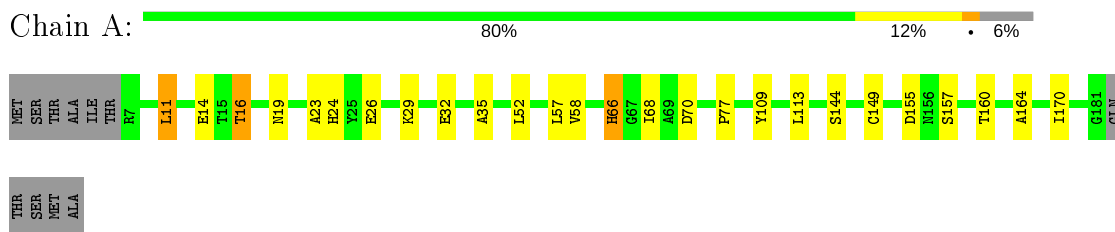


- Molecule 2: DNA POLYMERASE III SUBUNIT THETA

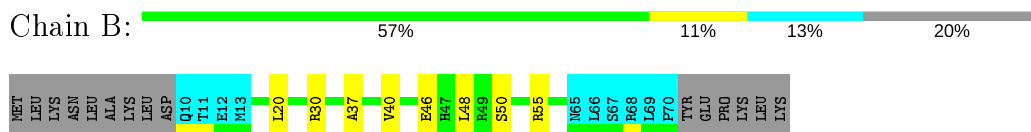


4.2.5 Score per residue for model 5

- Molecule 1: DNA POLYMERASE III SUBUNIT EPSILON

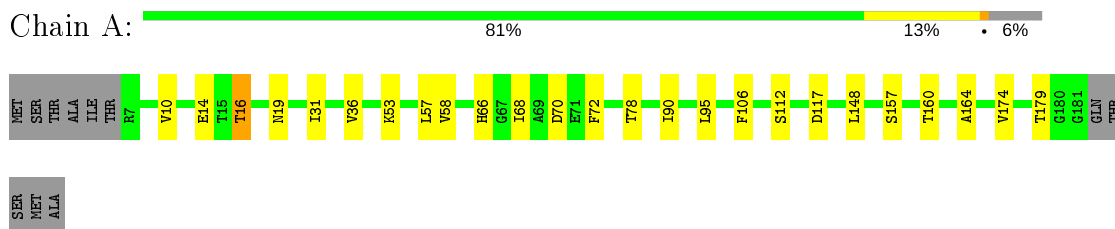


- Molecule 2: DNA POLYMERASE III SUBUNIT THETA

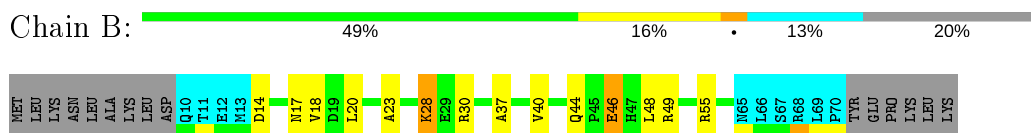


4.2.6 Score per residue for model 6

- Molecule 1: DNA POLYMERASE III SUBUNIT EPSILON

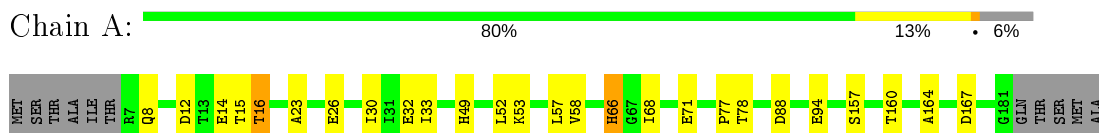


- Molecule 2: DNA POLYMERASE III SUBUNIT THETA



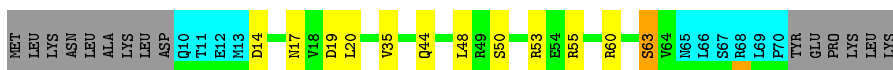
4.2.7 Score per residue for model 7

- Molecule 1: DNA POLYMERASE III SUBUNIT EPSILON



- Molecule 2: DNA POLYMERASE III SUBUNIT THETA





4.2.8 Score per residue for model 8

- Molecule 1: DNA POLYMERASE III SUBUNIT EPSILON

Chain A: 78% 15% 6%



- Molecule 2: DNA POLYMERASE III SUBUNIT THETA

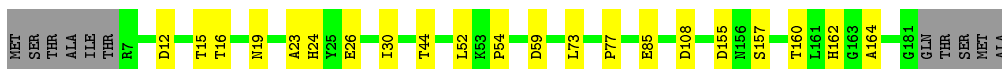
Chain B: 49% 18% 13% 20%



4.2.9 Score per residue for model 9

- Molecule 1: DNA POLYMERASE III SUBUNIT EPSILON

Chain A: 83% 11% 6%



- Molecule 2: DNA POLYMERASE III SUBUNIT THETA

Chain B: 51% 16% 13% 20%



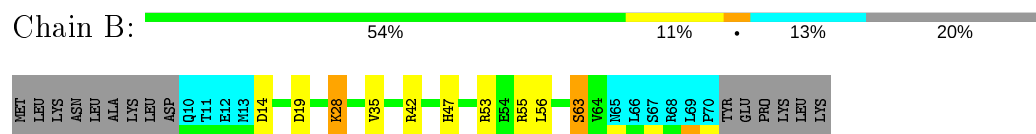
4.2.10 Score per residue for model 10

- Molecule 1: DNA POLYMERASE III SUBUNIT EPSILON

Chain A: 84% 9% 6%



- Molecule 2: DNA POLYMERASE III SUBUNIT THETA



5 Refinement protocol and experimental data overview

The models were refined using the following method: *DATA-DRIVEN FLEXIBLE DOCKING*.

Of the 200 calculated structures, 10 were deposited, based on the following criterion: *TOP 10 STRUCTURES OF THE BEST CLUSTER*.

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

Software name	Classification	Version
CNS1.2	refinement	
HADDOCK2.1-PARA BETA	structure solution	BETA

No chemical shift data was provided. 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

Bond lengths and bond angles in the following residue types are not validated in this section:
CA

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	1375	301	1360	8±2
2	B	415	99	415	4±3
All	All	17910	4000	17750	118

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
2:B:44:GLN:HB3	2:B:48:LEU:HD11	0.79	1.52	6	4
1:A:148:LEU:HB3	1:A:174:VAL:HG11	0.75	1.55	6	3
2:B:46:GLU:HA	2:B:49:ARG:HG2	0.74	1.59	2	3
2:B:28:LYS:HD2	2:B:37:ALA:HB2	0.69	1.63	6	1
1:A:19:ASN:HB2	1:A:24:HIS:HA	0.66	1.68	5	4
1:A:68:ILE:HG12	2:B:20:LEU:HD11	0.64	1.69	5	2
1:A:14:GLU:HG2	1:A:164:ALA:HB2	0.62	1.71	6	5
2:B:28:LYS:HA	2:B:35:VAL:HG11	0.61	1.71	10	1
1:A:15:THR:HG22	1:A:30:ILE:HA	0.60	1.73	9	7
1:A:33:ILE:O	1:A:49:HIS:HA	0.59	1.98	3	2
1:A:97:ILE:HD12	1:A:103:ASP:HB2	0.58	1.75	10	2

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:14:GLU:HB3	1:A:66:HIS:CE1	0.58	2.34	5	2
1:A:71:GLU:HG2	2:B:63:SER:HA	0.57	1.77	10	1
2:B:45:PRO:HD2	2:B:48:LEU:HD21	0.56	1.76	1	1
1:A:31:ILE:HD11	1:A:66:HIS:HE1	0.56	1.61	10	2
1:A:11:LEU:HG	1:A:35:ALA:HB2	0.55	1.76	5	1
1:A:16:THR:HG22	1:A:58:VAL:HG22	0.55	1.78	10	4
1:A:149:CYS:SG	1:A:170:ILE:HG21	0.54	2.42	8	3
1:A:23:ALA:HB3	1:A:26:GLU:HB2	0.52	1.80	8	5
1:A:53:LYS:HB3	1:A:78:THR:HG22	0.52	1.81	7	4
2:B:19:ASP:OD1	2:B:55:ARG:HD3	0.51	2.05	7	2
2:B:45:PRO:HD2	2:B:48:LEU:HD11	0.51	1.81	9	1
1:A:8:GLN:HB2	1:A:38:VAL:HB	0.51	1.83	4	1
2:B:18:VAL:HG22	2:B:44:GLN:HE21	0.51	1.65	3	1
1:A:52:LEU:HA	1:A:77:PRO:O	0.50	2.06	1	4
2:B:37:ALA:O	2:B:40:VAL:HG12	0.50	2.07	2	3
1:A:54:PRO:HD3	1:A:73:LEU:HB2	0.49	1.84	4	2
1:A:53:LYS:HE2	1:A:78:THR:HG22	0.49	1.85	1	1
1:A:94:GLU:HG3	1:A:126:LYS:HD3	0.49	1.83	2	1
1:A:14:GLU:HB2	1:A:32:GLU:HB2	0.47	1.85	7	2
2:B:18:VAL:HG22	2:B:48:LEU:HD22	0.47	1.85	1	1
2:B:25:VAL:HG21	2:B:56:LEU:HD21	0.47	1.85	4	1
1:A:12:ASP:OD2	1:A:164:ALA:HA	0.47	2.09	4	3
2:B:25:VAL:HG11	2:B:56:LEU:HD11	0.47	1.86	4	1
1:A:57:LEU:HA	1:A:70:ASP:OD2	0.46	2.09	1	1
2:B:14:ASP:O	2:B:18:VAL:HG23	0.46	2.11	6	2
2:B:37:ALA:O	2:B:40:VAL:HG22	0.46	2.10	9	2
1:A:72:PHE:HB2	2:B:23:ALA:CB	0.45	2.41	6	1
2:B:18:VAL:HG11	2:B:48:LEU:HD13	0.45	1.88	8	1
2:B:43:GLU:O	2:B:45:PRO:HD3	0.45	2.11	1	1
2:B:26:ALA:HB1	2:B:63:SER:HB3	0.44	1.89	1	1
1:A:54:PRO:HD3	1:A:73:LEU:CB	0.44	2.43	4	3
1:A:68:ILE:HG12	2:B:20:LEU:HD21	0.43	1.89	6	1
1:A:90:ILE:HB	1:A:95:LEU:HD21	0.43	1.89	6	1
1:A:16:THR:HG22	1:A:58:VAL:HA	0.43	1.88	1	2
1:A:109:TYR:O	1:A:113:LEU:HG	0.43	2.14	5	1
1:A:72:PHE:HB2	2:B:23:ALA:HB2	0.43	1.89	6	1
1:A:10:VAL:HB	1:A:36:VAL:HG22	0.43	1.90	4	1
1:A:57:LEU:HA	1:A:70:ASP:OD1	0.42	2.14	5	2
1:A:61:GLU:O	1:A:65:VAL:HG23	0.42	2.14	1	1
2:B:21:ALA:HB1	2:B:40:VAL:HG23	0.42	1.91	1	1
1:A:14:GLU:HB2	1:A:32:GLU:HB3	0.42	1.90	5	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:14:GLU:HB2	1:A:32:GLU:CB	0.42	2.45	7	1
1:A:68:ILE:HD11	1:A:73:LEU:HD21	0.41	1.92	3	1
2:B:28:LYS:HG3	2:B:37:ALA:HB2	0.41	1.92	3	1
1:A:161:LEU:HG	1:A:161:LEU:H	0.41	1.56	3	1
1:A:10:VAL:HB	1:A:36:VAL:CG2	0.41	2.45	4	2
2:B:14:ASP:O	2:B:17:ASN:HB2	0.41	2.15	7	1
2:B:40:VAL:HG22	2:B:44:GLN:HG3	0.41	1.92	1	1
1:A:72:PHE:HE1	2:B:19:ASP:HB3	0.41	1.75	3	1
1:A:8:GLN:HA	1:A:94:GLU:HB3	0.41	1.91	7	1
1:A:12:ASP:CG	1:A:167:ASP:HB2	0.41	2.37	7	1
2:B:60:ARG:HA	2:B:63:SER:OG	0.41	2.16	7	1
2:B:45:PRO:O	2:B:48:LEU:HG	0.40	2.16	3	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	173/186 (93%)	166±2 (96±1%)	7±2 (4±1%)	0±1 (0±0%)	50	82
2	B	51/76 (67%)	48±1 (95±2%)	3±1 (5±2%)	0±0 (0±1%)	50	82
All	All	2240/2620 (85%)	2141 (96%)	95 (4%)	4 (0%)	50	82

All 3 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	67	GLY	2
1	A	99	ASN	1
2	B	35	VAL	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	145/154 (94%)	137±2 (94±1%)	8±2 (6±1%)	24 73
2	B	42/66 (64%)	35±2 (84±5%)	7±2 (16±5%)	5 41
All	All	1870/2200 (85%)	1718 (92%)	152 (8%)	15 63

All 61 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	157	SER	10
1	A	16	THR	9
2	B	55	ARG	8
1	A	160	THR	8
2	B	50	SER	7
1	A	144	SER	5
2	B	63	SER	5
2	B	53	ARG	5
2	B	28	LYS	4
1	A	59	ASP	4
2	B	48	LEU	4
2	B	46	GLU	4
1	A	155	ASP	4
2	B	30	ARG	4
1	A	66	HIS	3
1	A	44	THR	3
1	A	13	THR	3
1	A	112	SER	3
2	B	31	TYR	3
1	A	108	ASP	3
2	B	27	PHE	2
2	B	49	ARG	2
2	B	15	LYS	2
1	A	179	THR	2
2	B	56	LEU	2
1	A	88	ASP	2
1	A	55	ASP	2
1	A	143	ASN	2
2	B	54	GLU	2
1	A	162	HIS	2
2	B	20	LEU	2
2	B	17	ASN	2

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Mol	Chain	Res	Type	Models (Total)
2	B	35	VAL	1
2	B	59	HIS	1
2	B	47	HIS	1
1	A	142	ARG	1
1	A	161	LEU	1
1	A	11	LEU	1
1	A	75	ASP	1
1	A	117	ASP	1
1	A	85	GLU	1
1	A	97	ILE	1
2	B	60	ARG	1
1	A	78	THR	1
2	B	19	ASP	1
2	B	42	ARG	1
1	A	40	ASN	1
1	A	19	ASN	1
2	B	14	ASP	1
2	B	29	GLU	1
1	A	29	LYS	1
1	A	81	GLU	1
1	A	71	GLU	1
1	A	73	LEU	1
1	A	151	ARG	1
1	A	70	ASP	1
2	B	44	GLN	1
2	B	32	ASN	1
1	A	8	GLN	1
1	A	145	LEU	1
1	A	106	PHE	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 carbohydrates in this entry.

6.6 Ligand geometry [i](#)

Of 1 ligands modelled in this entry, 1 is 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