Full wwPDB NMR Structure Validation Report (i)

Oct 23, 2021 – 05:04 PM EDT

PDB ID	:	1BA9
Title	:	THE SOLUTION STRUCTURE OF REDUCED MONOMERIC SUPEROXIDE DISMUTASE, NMR, 36 STRUCTURES
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Deposited on	:	1998-04-24

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:

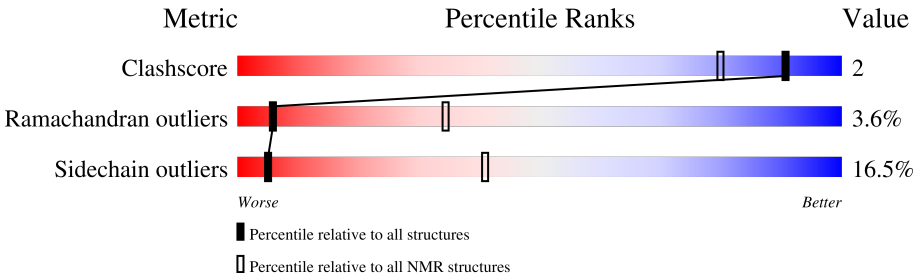
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.23.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

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	153	72% 13% 15%

2 Ensemble composition and analysis

This entry contains 36 models. Model 30 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:3-A:21, A:28-A:49, A:62-A:106, A:110-A:153 (130)	0.34	30

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 5 single-model clusters were found.

Cluster number	Models
1	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 14, 24, 27, 28, 30, 31, 32, 33, 34, 35, 36
2	4, 10, 22, 25
3	13, 15, 21, 29
4	17, 18
Single-model clusters	16; 19; 20; 23; 26

3 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 2194 atoms, of which 1080 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called SUPEROXIDE DISMUTASE.

Mol	Chain	Residues	Atoms						Trace
1	A	153	Total	C	H	N	O	S	0
			2192	678	1080	204	228	2	

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	6	ALA	CYS	engineered mutation	UNP P00441
A	50	GLU	PHE	engineered mutation	UNP P00441
A	51	GLU	GLY	engineered mutation	UNP P00441
A	111	SER	CYS	engineered mutation	UNP P00441
A	133	GLN	GLU	engineered mutation	UNP P00441

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms	
2	A	1	Total	Zn
			1	1

- Molecule 3 is COPPER (I) ION (three-letter code: CU1) (formula: Cu).

Mol	Chain	Residues	Atoms	
3	A	1	Total	Cu
			1	1

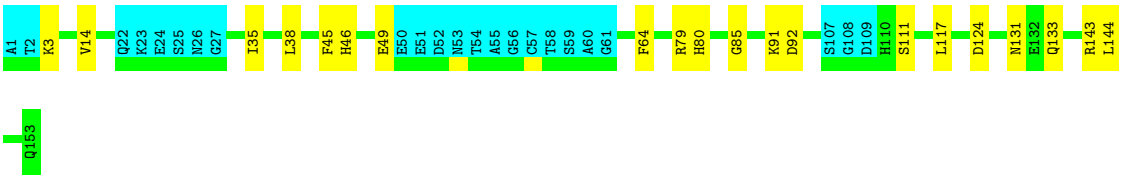
4 Residue-property plots

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: SUPEROXIDE DISMUTASE

Chain A: 



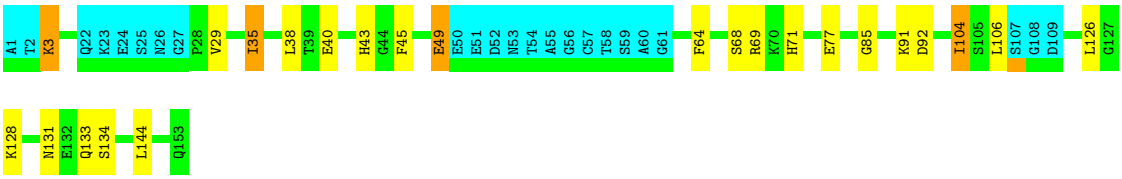
4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

• Molecule 1: SUPEROXIDE DISMUTASE

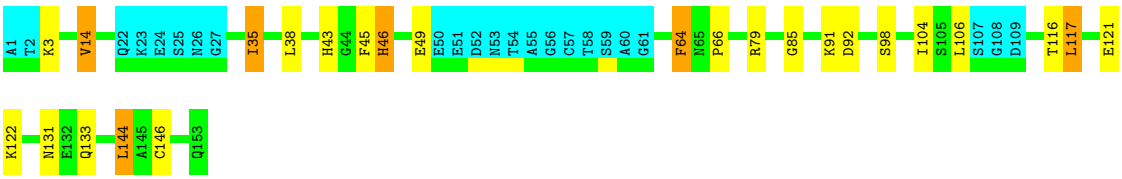
Chain A: 



4.2.2 Score per residue for model 2

• Molecule 1: SUPEROXIDE DISMUTASE

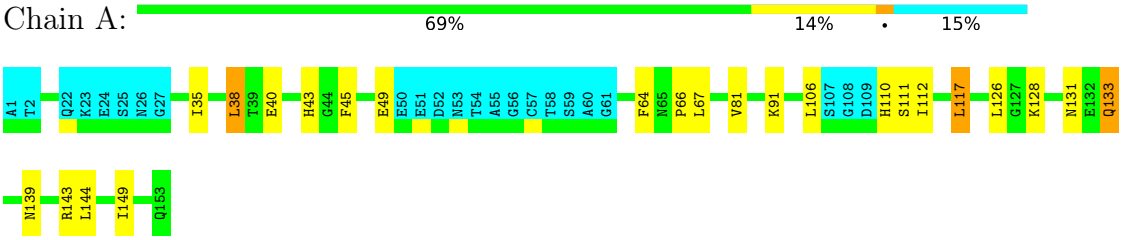
Chain A: 



4.2.3 Score per residue for model 3

• Molecule 1: SUPEROXIDE DISMUTASE

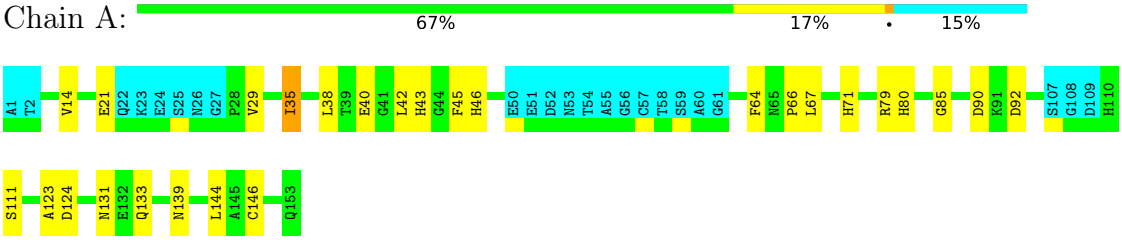
Chain A:



4.2.4 Score per residue for model 4

• Molecule 1: SUPEROXIDE DISMUTASE

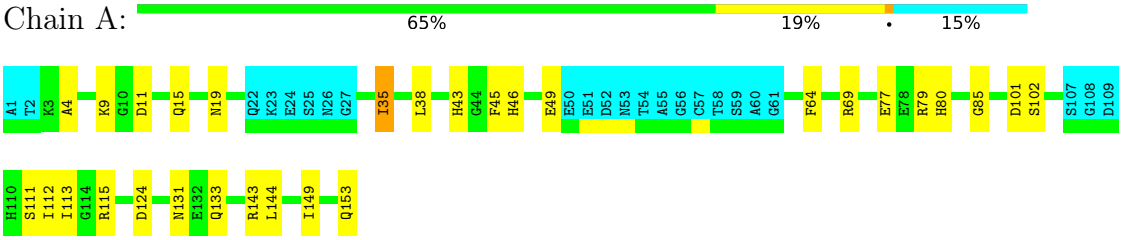
Chain A:



4.2.5 Score per residue for model 5

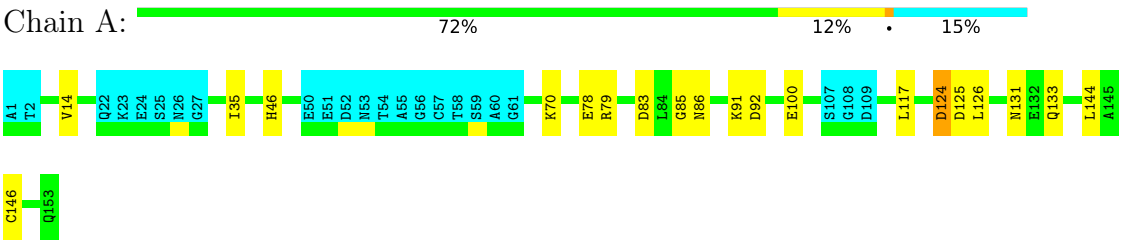
• Molecule 1: SUPEROXIDE DISMUTASE

Chain A:



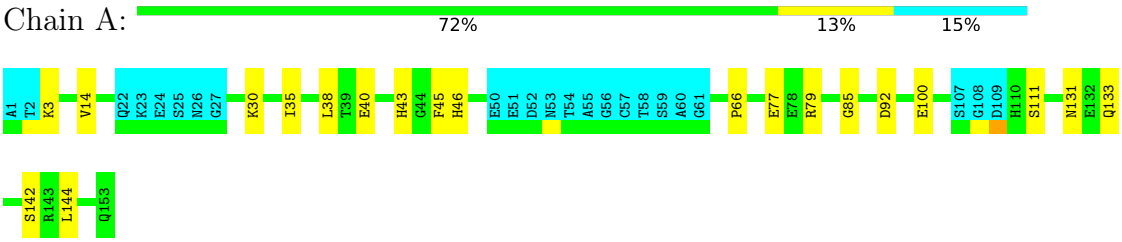
4.2.6 Score per residue for model 6

• Molecule 1: SUPEROXIDE DISMUTASE



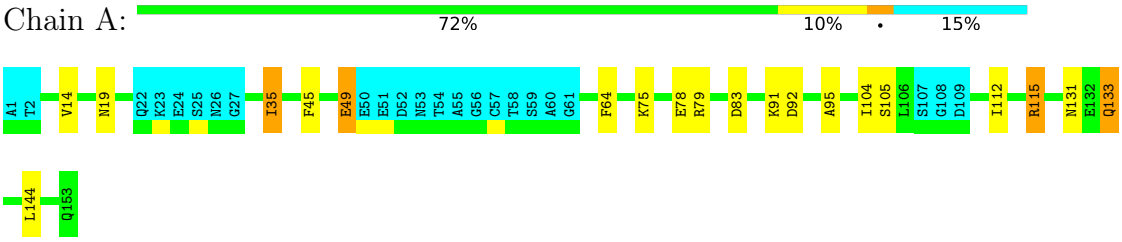
4.2.7 Score per residue for model 7

• Molecule 1: SUPEROXIDE DISMUTASE



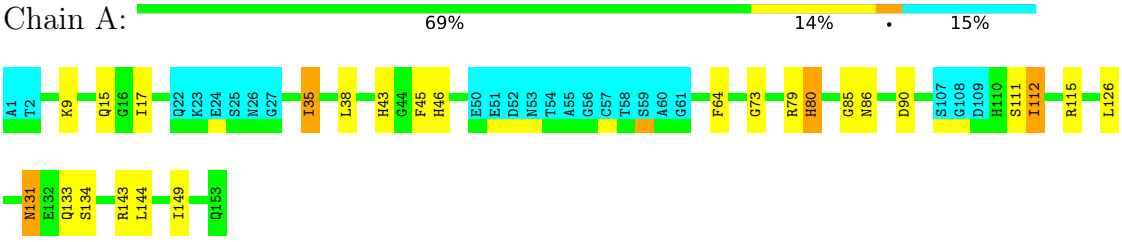
4.2.8 Score per residue for model 8

• Molecule 1: SUPEROXIDE DISMUTASE



4.2.9 Score per residue for model 9

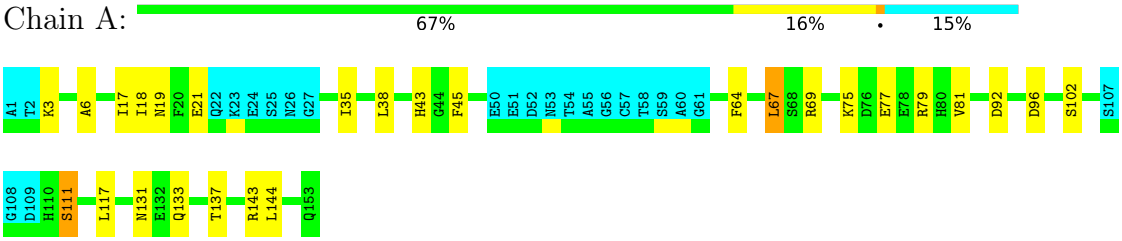
• Molecule 1: SUPEROXIDE DISMUTASE



4.2.10 Score per residue for model 10

• Molecule 1: SUPEROXIDE DISMUTASE

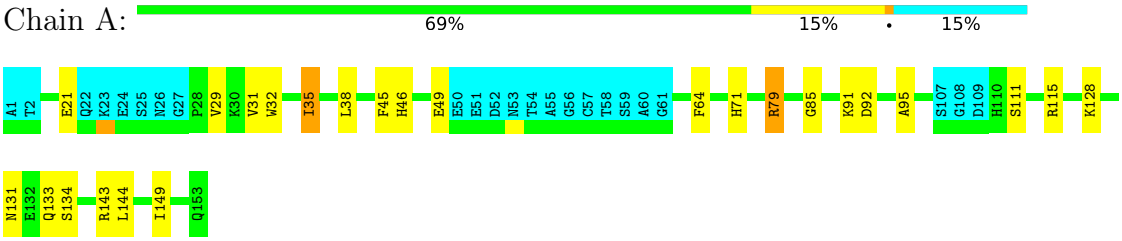
Chain A:



4.2.11 Score per residue for model 11

• Molecule 1: SUPEROXIDE DISMUTASE

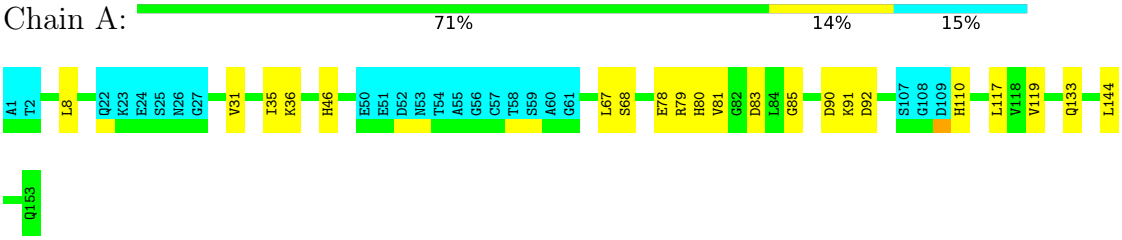
Chain A:



4.2.12 Score per residue for model 12

• Molecule 1: SUPEROXIDE DISMUTASE

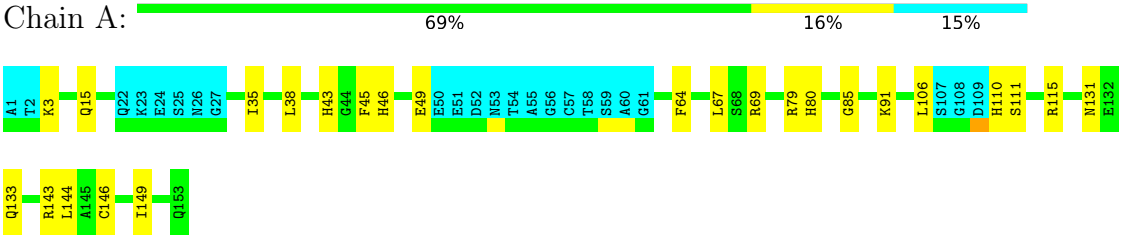
Chain A:



4.2.13 Score per residue for model 13

• Molecule 1: SUPEROXIDE DISMUTASE

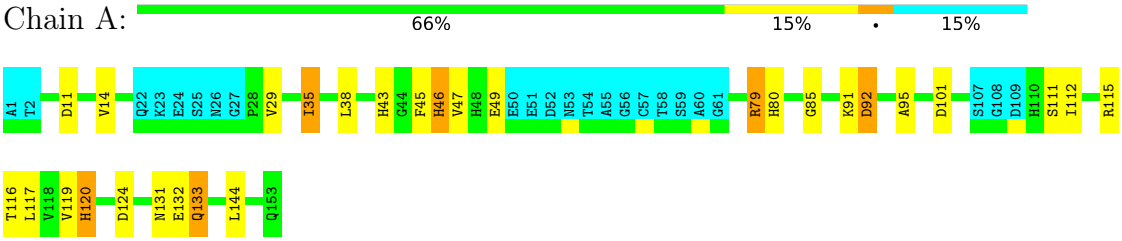
Chain A:



4.2.14 Score per residue for model 14

• Molecule 1: SUPEROXIDE DISMUTASE

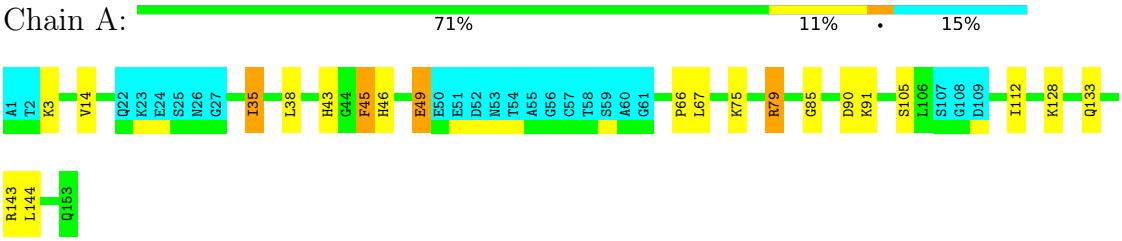
Chain A:



4.2.15 Score per residue for model 15

• Molecule 1: SUPEROXIDE DISMUTASE

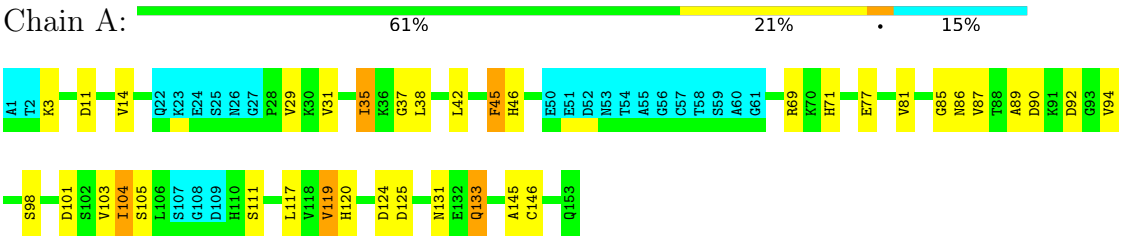
Chain A:



4.2.16 Score per residue for model 16

• Molecule 1: SUPEROXIDE DISMUTASE

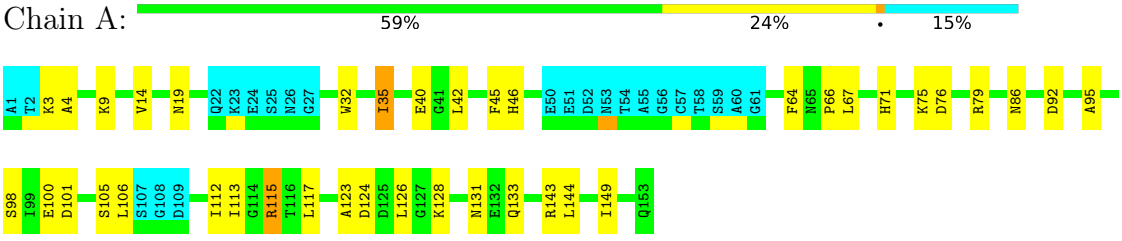
Chain A:



4.2.17 Score per residue for model 17

• Molecule 1: SUPEROXIDE DISMUTASE

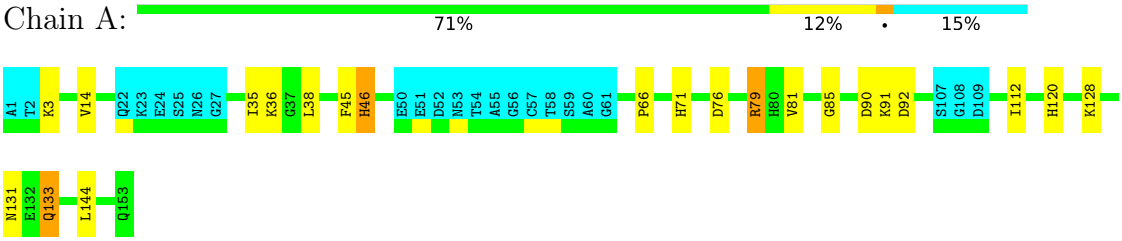
Chain A:



4.2.18 Score per residue for model 18

• Molecule 1: SUPEROXIDE DISMUTASE

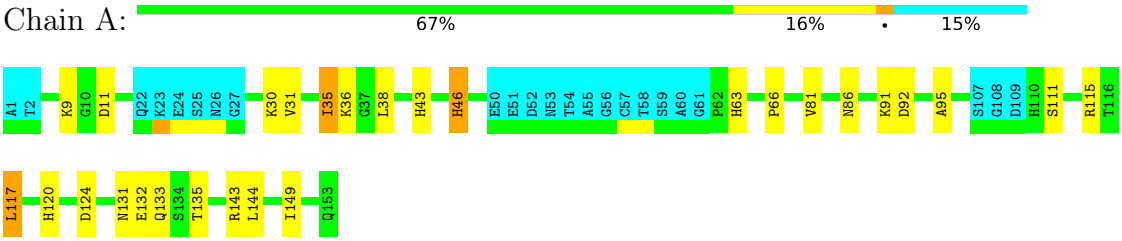
Chain A:



4.2.19 Score per residue for model 19

• Molecule 1: SUPEROXIDE DISMUTASE

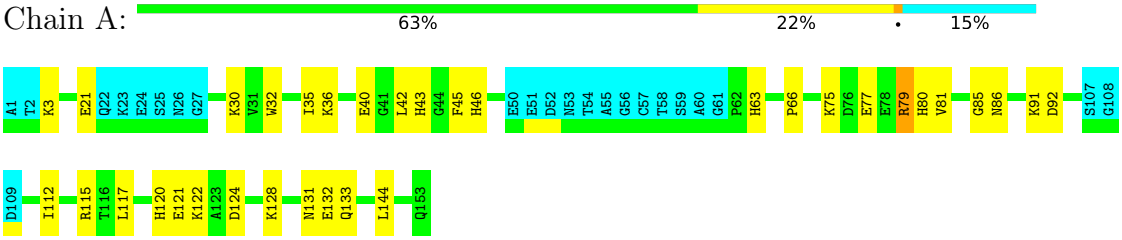
Chain A:



4.2.20 Score per residue for model 20

• Molecule 1: SUPEROXIDE DISMUTASE

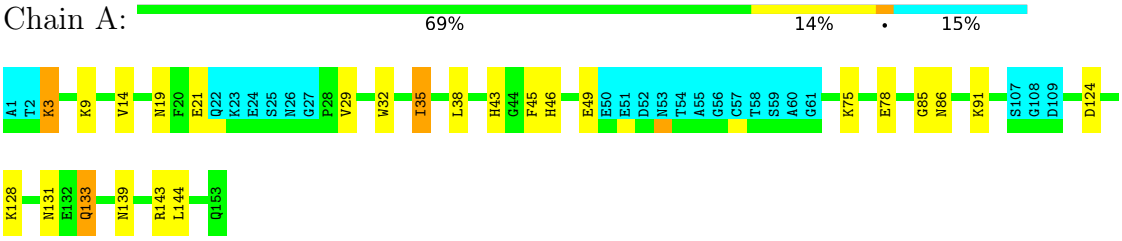
Chain A:



4.2.21 Score per residue for model 21

• Molecule 1: SUPEROXIDE DISMUTASE

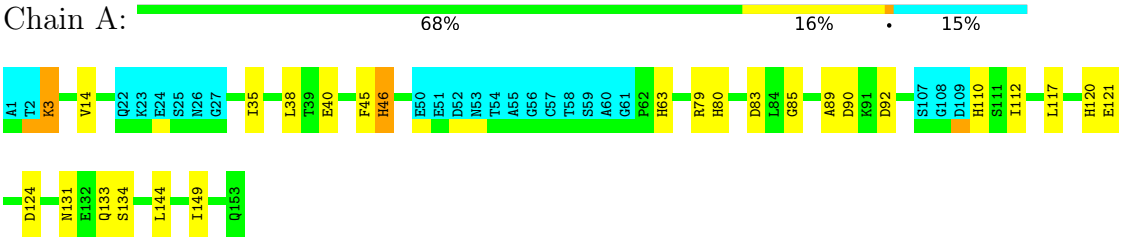
Chain A:



4.2.22 Score per residue for model 22

• Molecule 1: SUPEROXIDE DISMUTASE

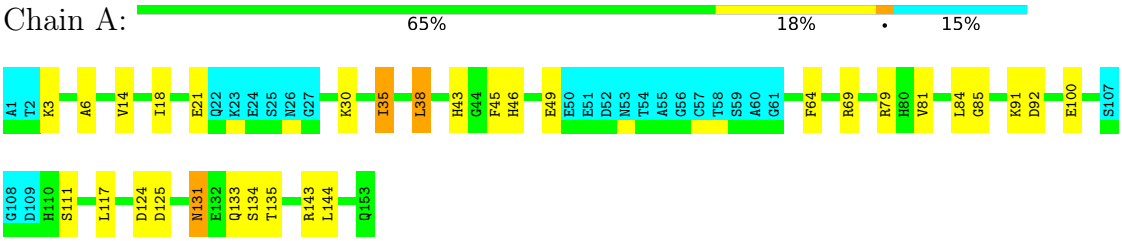
Chain A:



4.2.23 Score per residue for model 23

• Molecule 1: SUPEROXIDE DISMUTASE

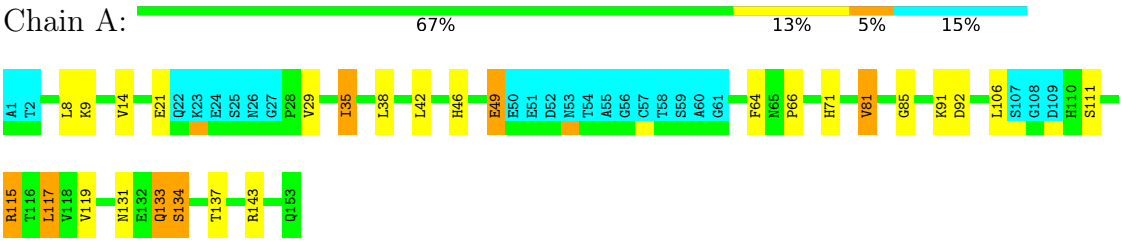
Chain A:



4.2.24 Score per residue for model 24

• Molecule 1: SUPEROXIDE DISMUTASE

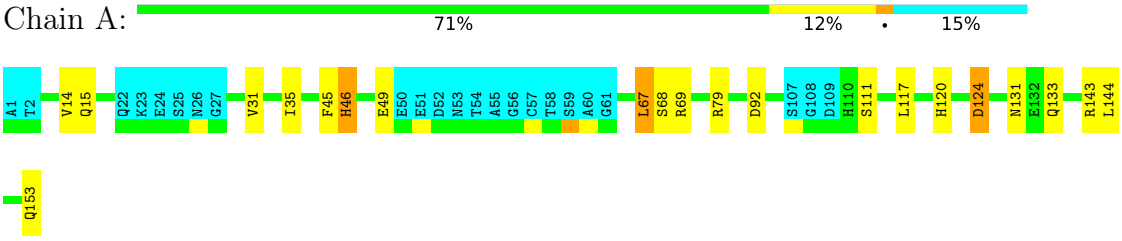
Chain A:



4.2.25 Score per residue for model 25

• Molecule 1: SUPEROXIDE DISMUTASE

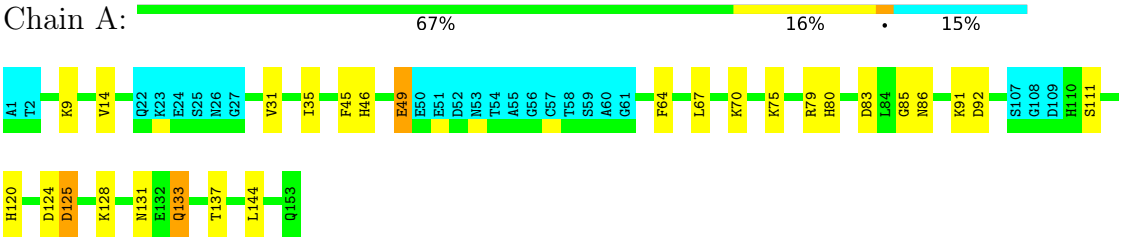
Chain A:



4.2.26 Score per residue for model 26

• Molecule 1: SUPEROXIDE DISMUTASE

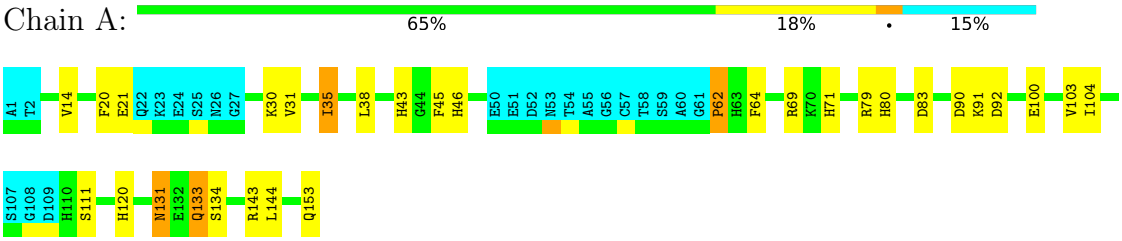
Chain A:



4.2.27 Score per residue for model 27

• Molecule 1: SUPEROXIDE DISMUTASE

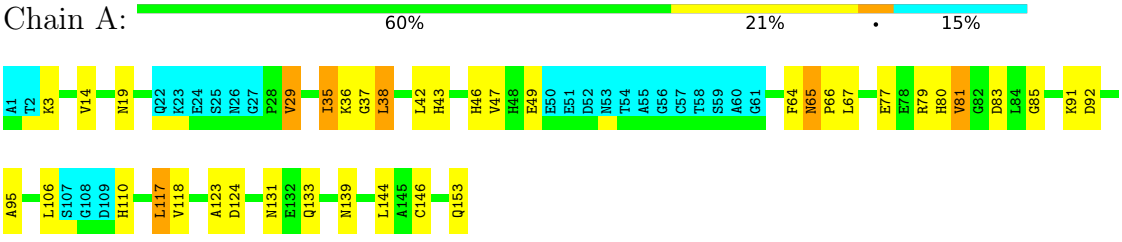
Chain A:



4.2.28 Score per residue for model 28

• Molecule 1: SUPEROXIDE DISMUTASE

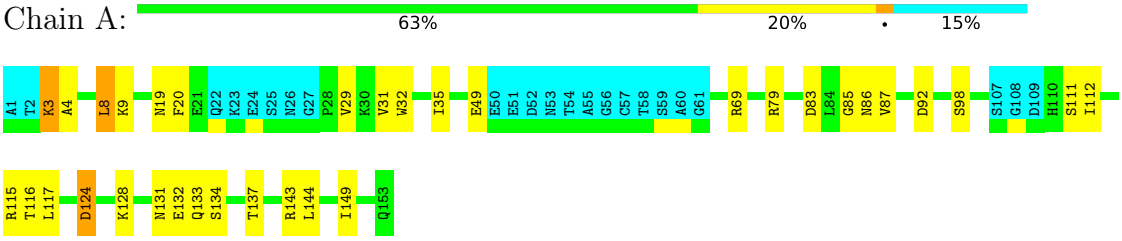
Chain A:



4.2.29 Score per residue for model 29

• Molecule 1: SUPEROXIDE DISMUTASE

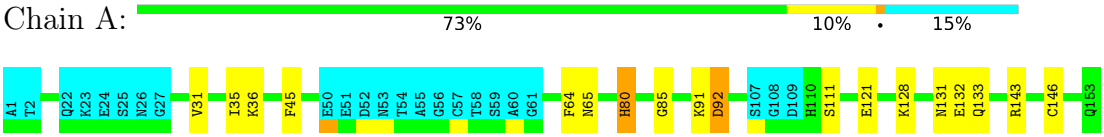
Chain A:



4.2.30 Score per residue for model 30 (medoid)

• Molecule 1: SUPEROXIDE DISMUTASE

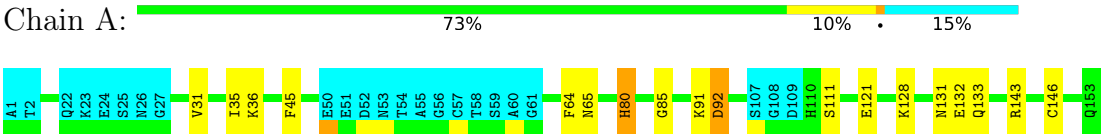
Chain A:



4.2.31 Score per residue for model 31

• Molecule 1: SUPEROXIDE DISMUTASE

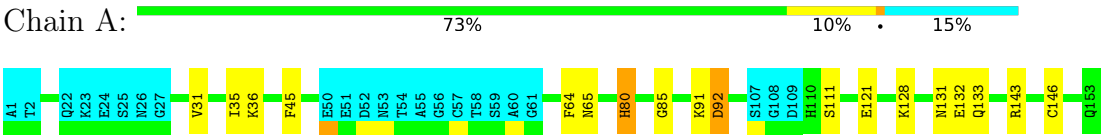
Chain A:



4.2.32 Score per residue for model 32

• Molecule 1: SUPEROXIDE DISMUTASE

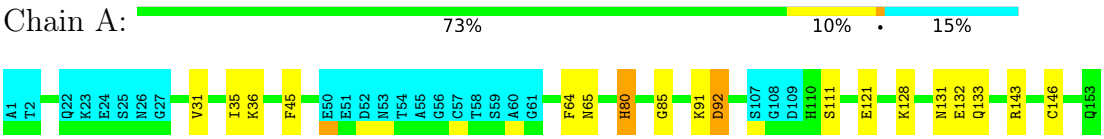
Chain A:



4.2.33 Score per residue for model 33

• Molecule 1: SUPEROXIDE DISMUTASE

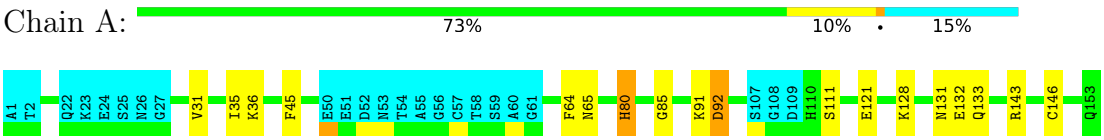
Chain A:



4.2.34 Score per residue for model 34

• Molecule 1: SUPEROXIDE DISMUTASE

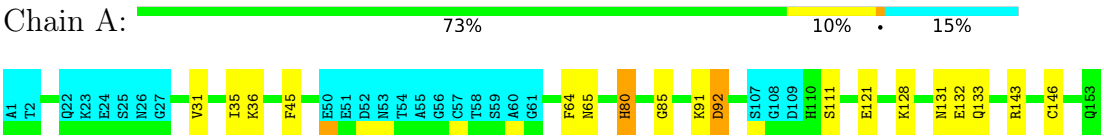
Chain A:



4.2.35 Score per residue for model 35

• Molecule 1: SUPEROXIDE DISMUTASE

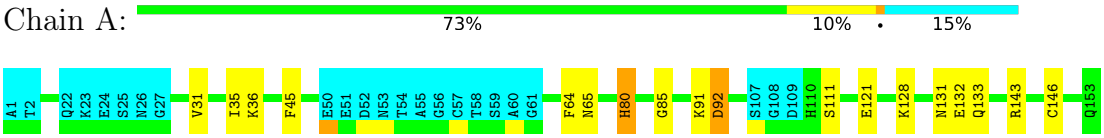
Chain A:



4.2.36 Score per residue for model 36

• Molecule 1: SUPEROXIDE DISMUTASE

Chain A:



5 Refinement protocol and experimental data overview

The models were refined using the following method: *TORTION ANGLES DYNAMIC (DYANA)*.

Of the 36 calculated structures, 36 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
Amber	refinement	4.0
XEASY (ETH	structure solution	(ETH
ZURICH)	structure solution	

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, CU1

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	0.50±0.00	0±0/976 (0.0± 0.0%)	0.94±0.02	0±1/1314 (0.0± 0.0%)
All	All	0.50	0/35136 (0.0%)	0.94	15/47304 (0.0%)

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±0.2	0.8±0.7
All	All	1	28

There are no bond-length outliers.

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(^{o})	Ideal(^{o})	Models	
								Worst	Total
1	A	79	ARG	NE-CZ-NH2	-6.83	116.89	120.30	17	1
1	A	124	ASP	CB-CG-OD2	-6.08	112.82	118.30	5	8
1	A	79	ARG	NE-CZ-NH1	5.51	123.06	120.30	17	1
1	A	69	ARG	NE-CZ-NH2	5.28	122.94	120.30	10	1
1	A	115	ARG	NE-CZ-NH2	-5.27	117.66	120.30	24	2
1	A	8	LEU	CB-CA-C	5.15	119.99	110.20	29	1
1	A	115	ARG	NE-CZ-NH1	5.03	122.81	120.30	24	1

All unique chiral outliers are listed below.

Mol	Chain	Res	Type	Atoms	Models (Total)
1	A	62	PRO	CA	1

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	80	HIS	Sidechain,Peptide	11
1	A	71	HIS	Sidechain	8
1	A	115	ARG	Sidechain	4
1	A	45	PHE	Sidechain	2
1	A	64	PHE	Sidechain	1
1	A	79	ARG	Sidechain	1
1	A	62	PRO	Peptide	1

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	959	952	951	3±2
All	All	34596	34272	34236	111

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 2.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:35:ILE:HG21	1:A:38:LEU:HD23	0.71	1.61	1	12
1:A:38:LEU:HD12	1:A:43:HIS:CE1	0.63	2.27	2	14
1:A:14:VAL:HG23	1:A:38:LEU:HD22	0.62	1.70	2	1
1:A:117:LEU:CD1	1:A:149:ILE:HD11	0.62	2.24	22	1
1:A:117:LEU:HD13	1:A:149:ILE:HD11	0.60	1.74	22	1
1:A:42:LEU:HG	1:A:123:ALA:HB2	0.57	1.76	4	3
1:A:35:ILE:HG22	1:A:95:ALA:H	0.56	1.60	17	6
1:A:8:LEU:HD11	1:A:117:LEU:HD23	0.53	1.80	24	1
1:A:112:ILE:HG12	1:A:149:ILE:HG21	0.51	1.82	9	1
1:A:14:VAL:HG21	1:A:144:LEU:HB3	0.51	1.82	2	1
1:A:81:VAL:HG13	1:A:104:ILE:HG22	0.50	1.82	16	1
1:A:131:ASN:ND2	1:A:134:SER:H	0.49	2.06	23	4
1:A:45:PHE:CE1	1:A:117:LEU:HD12	0.49	2.42	16	1
1:A:115:ARG:HG2	1:A:149:ILE:HD12	0.48	1.86	13	1
1:A:115:ARG:HB2	1:A:149:ILE:HD12	0.47	1.85	11	2

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:70:LYS:NZ	1:A:78:GLU:OE2	0.47	2.47	6	1
1:A:46:HIS:CE1	1:A:63:HIS:CE1	0.46	3.03	19	2
1:A:115:ARG:CG	1:A:149:ILE:HD12	0.46	2.40	13	1
1:A:38:LEU:HD23	1:A:89:ALA:HB2	0.46	1.87	16	2
1:A:35:ILE:HG21	1:A:38:LEU:HD22	0.46	1.86	11	1
1:A:4:ALA:HB3	1:A:20:PHE:HB2	0.46	1.88	29	1
1:A:35:ILE:CG2	1:A:38:LEU:HD23	0.45	2.41	2	2
1:A:35:ILE:O	1:A:94:VAL:HG13	0.45	2.11	16	1
1:A:45:PHE:CZ	1:A:117:LEU:HD22	0.45	2.46	2	1
1:A:46:HIS:O	1:A:117:LEU:HD23	0.45	2.12	2	1
1:A:20:PHE:CE1	1:A:31:VAL:HG22	0.45	2.47	27	1
1:A:117:LEU:HD13	1:A:118:VAL:N	0.45	2.26	28	1
1:A:117:LEU:HD12	1:A:149:ILE:HD11	0.45	1.87	3	1
1:A:6:ALA:HB3	1:A:18:ILE:HB	0.44	1.89	10	2
1:A:91:LYS:NZ	1:A:92:ASP:OD1	0.44	2.50	14	1
1:A:73:GLY:HA3	1:A:126:LEU:HD22	0.43	1.90	9	1
1:A:38:LEU:HD23	1:A:43:HIS:CG	0.43	2.48	13	1
1:A:76:ASP:OD1	1:A:128:LYS:NZ	0.43	2.51	17	1
1:A:84:LEU:N	1:A:84:LEU:HD22	0.43	2.28	23	1
1:A:36:LYS:NZ	1:A:92:ASP:OD2	0.43	2.52	30	7
1:A:43:HIS:CE1	1:A:121:GLU:O	0.42	2.72	20	2
1:A:69:ARG:NH2	1:A:77:GLU:OE2	0.42	2.53	16	1
1:A:115:ARG:O	1:A:149:ILE:HD12	0.42	2.14	17	1
1:A:3:LYS:NZ	1:A:21:GLU:OE2	0.42	2.52	23	1
1:A:30:LYS:NZ	1:A:100:GLU:OE2	0.42	2.46	27	2
1:A:35:ILE:HG21	1:A:38:LEU:HB2	0.42	1.92	23	1
1:A:65:ASN:N	1:A:66:PRO:CD	0.42	2.83	28	1
1:A:65:ASN:HD21	1:A:80:HIS:CD2	0.42	2.33	30	7
1:A:17:ILE:HD12	1:A:17:ILE:N	0.42	2.30	10	1
1:A:46:HIS:CE1	1:A:120:HIS:CD2	0.41	3.08	18	3
1:A:4:ALA:HB2	1:A:113:ILE:CD1	0.41	2.45	5	1
1:A:125:ASP:OD2	1:A:128:LYS:NZ	0.41	2.51	26	1
1:A:38:LEU:HD21	1:A:43:HIS:CG	0.41	2.50	23	1
1:A:76:ASP:OD2	1:A:128:LYS:NZ	0.41	2.53	18	1
1:A:8:LEU:CD1	1:A:117:LEU:HD23	0.41	2.46	12	1
1:A:46:HIS:NE2	1:A:124:ASP:OD2	0.41	2.54	21	1
1:A:45:PHE:CE1	1:A:117:LEU:HD22	0.41	2.51	2	1
1:A:38:LEU:HD12	1:A:43:HIS:NE2	0.41	2.31	10	1
1:A:4:ALA:HB2	1:A:113:ILE:HD11	0.40	1.93	17	1
1:A:119:VAL:CG1	1:A:145:ALA:HB3	0.40	2.46	16	1
1:A:117:LEU:HD12	1:A:149:ILE:CD1	0.40	2.47	19	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	129/153 (84%)	109±3 (84±2%)	16±3 (12±2%)	5±2 (4±1%)	6	34
All	All	4644/5508 (84%)	3909 (84%)	568 (12%)	167 (4%)	6	34

All 26 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	85	GLY	29
1	A	111	SER	23
1	A	14	VAL	18
1	A	79	ARG	18
1	A	66	PRO	10
1	A	132	GLU	10
1	A	133	GLN	9
1	A	80	HIS	8
1	A	49	GLU	7
1	A	120	HIS	7
1	A	3	LYS	4
1	A	81	VAL	3
1	A	110	HIS	3
1	A	67	LEU	2
1	A	68	SER	2
1	A	37	GLY	2
1	A	87	VAL	2
1	A	38	LEU	2
1	A	104	ILE	1
1	A	125	ASP	1
1	A	105	SER	1
1	A	134	SER	1
1	A	62	PRO	1
1	A	65	ASN	1
1	A	8	LEU	1
1	A	9	LYS	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	102/118 (86%)	85±4 (83±4%)	17±4 (17±4%)	5 41
All	All	3672/4248 (86%)	3065 (83%)	607 (17%)	5 41

All 71 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	35	ILE	36
1	A	133	GLN	36
1	A	131	ASN	33
1	A	92	ASP	30
1	A	45	PHE	28
1	A	144	LEU	27
1	A	91	LYS	25
1	A	64	PHE	23
1	A	46	HIS	23
1	A	143	ARG	22
1	A	3	LYS	14
1	A	49	GLU	14
1	A	128	LYS	14
1	A	31	VAL	14
1	A	117	LEU	13
1	A	146	CYS	13
1	A	112	ILE	11
1	A	67	LEU	10
1	A	124	ASP	9
1	A	86	ASN	9
1	A	29	VAL	8
1	A	81	VAL	8
1	A	90	ASP	8
1	A	83	ASP	8
1	A	79	ARG	8
1	A	121	GLU	8
1	A	40	GLU	7
1	A	69	ARG	7
1	A	9	LYS	7

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Mol	Chain	Res	Type	Models (Total)
1	A	19	ASN	7
1	A	75	LYS	7
1	A	77	GLU	6
1	A	106	LEU	6
1	A	104	ILE	5
1	A	21	GLU	5
1	A	32	TRP	5
1	A	36	LYS	5
1	A	126	LEU	4
1	A	134	SER	4
1	A	98	SER	4
1	A	139	ASN	4
1	A	11	ASP	4
1	A	15	GLN	4
1	A	101	ASP	4
1	A	153	GLN	4
1	A	115	ARG	4
1	A	137	THR	4
1	A	119	VAL	4
1	A	100	GLU	3
1	A	125	ASP	3
1	A	78	GLU	3
1	A	105	SER	3
1	A	42	LEU	3
1	A	30	LYS	3
1	A	122	LYS	2
1	A	38	LEU	2
1	A	110	HIS	2
1	A	111	SER	2
1	A	102	SER	2
1	A	47	VAL	2
1	A	116	THR	2
1	A	103	VAL	2
1	A	135	THR	2
1	A	68	SER	1
1	A	142	SER	1
1	A	17	ILE	1
1	A	96	ASP	1
1	A	132	GLU	1
1	A	63	HIS	1
1	A	70	LYS	1
1	A	149	ILE	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 monosaccharides 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

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