Full wwPDB NMR Structure Validation Report (i)

Feb 20, 2022 – 03:32 AM EST

PDB ID	:	1TL5
Title	:	Solution structure of apoHAH1
Authors	:	Anastassopoulou, I.; Banci, L.; Bertini, I.; Cantini, F.; Katsari, E.; Rosato, A.; Structural Proteomics in Europe (SPINE)
Deposited on	:	2004-06-09

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:

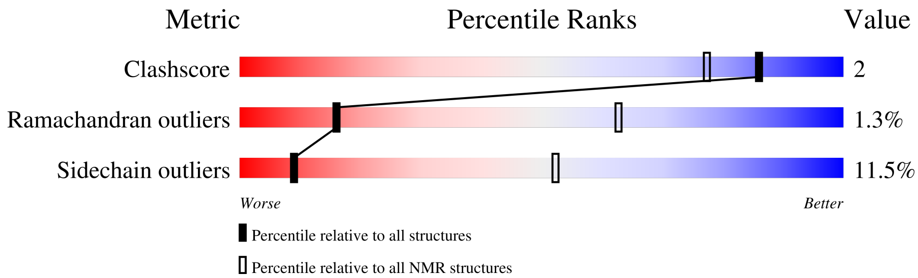
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.26
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.26

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	68	90% • • •

2 Ensemble composition and analysis (i)

This entry contains 30 models. Model 13 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:68 (66)	0.37	13

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 7 clusters and 5 single-model clusters were found.

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

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 1045 atoms, of which 531 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Copper transport protein ATOX1.

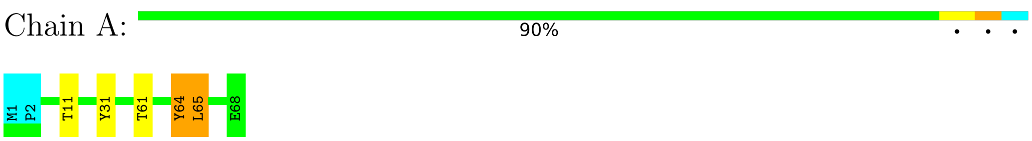
Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	68	1045	322	531	85	101	6	0

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: Copper transport protein ATOX1

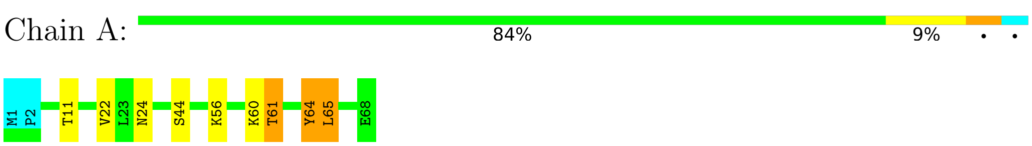


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

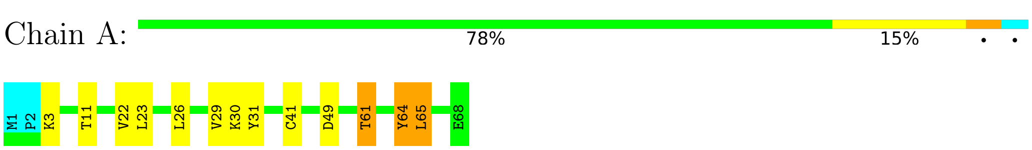
4.2.1 Score per residue for model 1

- Molecule 1: Copper transport protein ATOX1



4.2.2 Score per residue for model 2

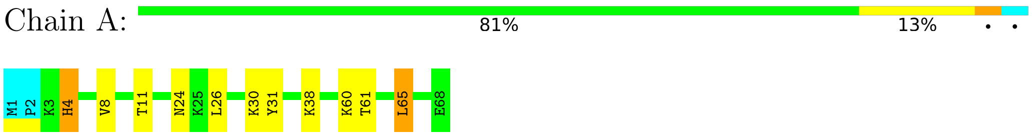
- Molecule 1: Copper transport protein ATOX1



4.2.3 Score per residue for model 3

- Molecule 1: Copper transport protein ATOX1

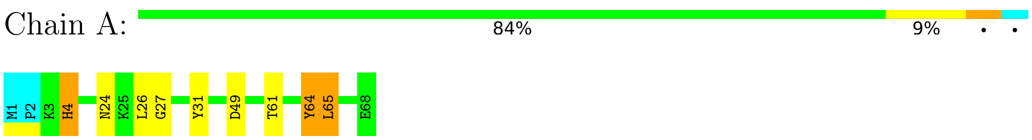
Chain A:



4.2.4 Score per residue for model 4

- Molecule 1: Copper transport protein ATOX1

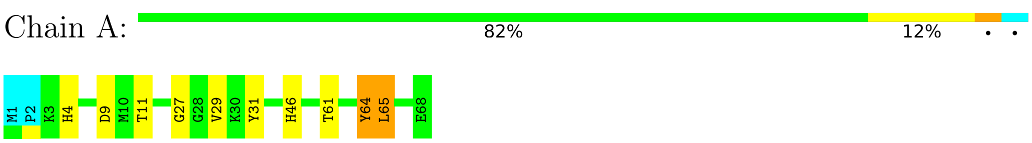
Chain A:



4.2.5 Score per residue for model 5

- Molecule 1: Copper transport protein ATOX1

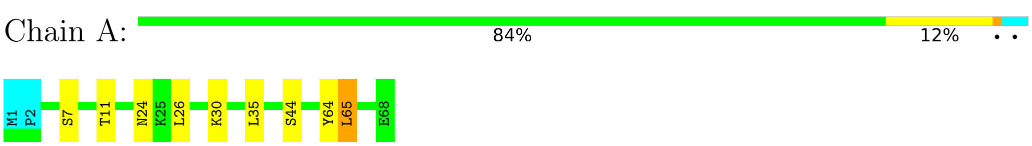
Chain A:



4.2.6 Score per residue for model 6

- Molecule 1: Copper transport protein ATOX1

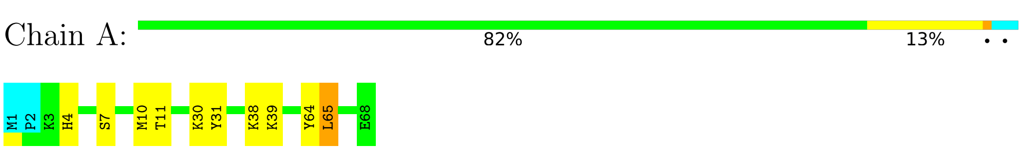
Chain A:



4.2.7 Score per residue for model 7

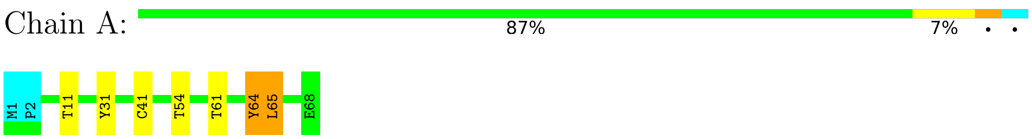
- Molecule 1: Copper transport protein ATOX1

Chain A:



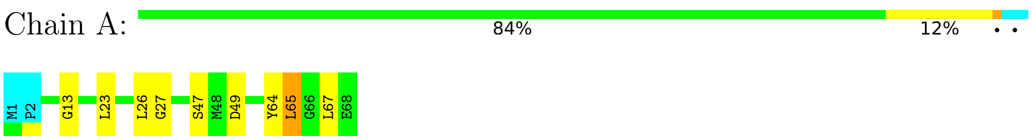
4.2.8 Score per residue for model 8

• Molecule 1: Copper transport protein ATOX1



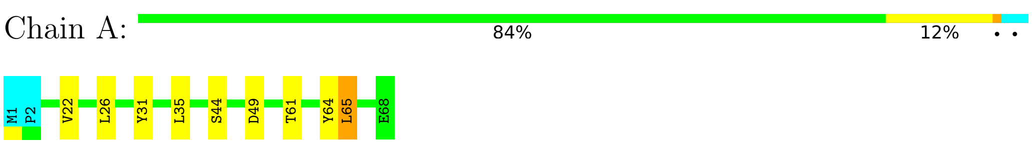
4.2.9 Score per residue for model 9

• Molecule 1: Copper transport protein ATOX1



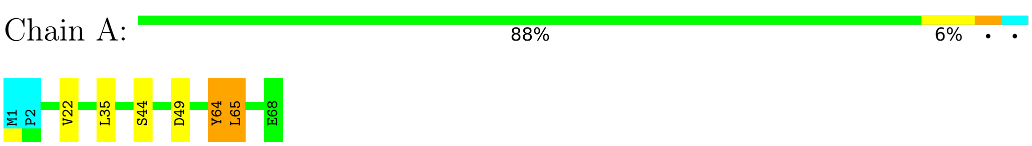
4.2.10 Score per residue for model 10

• Molecule 1: Copper transport protein ATOX1



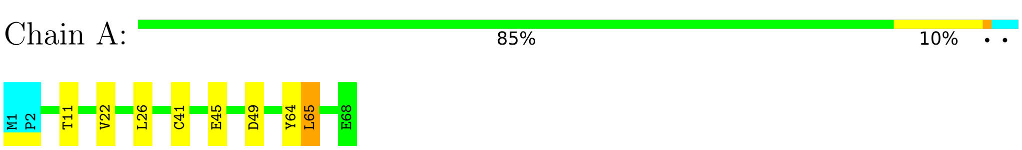
4.2.11 Score per residue for model 11

• Molecule 1: Copper transport protein ATOX1



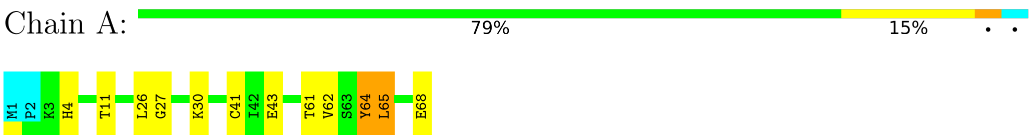
4.2.12 Score per residue for model 12

• Molecule 1: Copper transport protein ATOX1



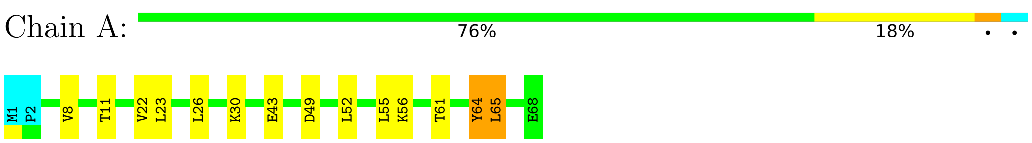
4.2.13 Score per residue for model 13 (medoid)

- Molecule 1: Copper transport protein ATOX1



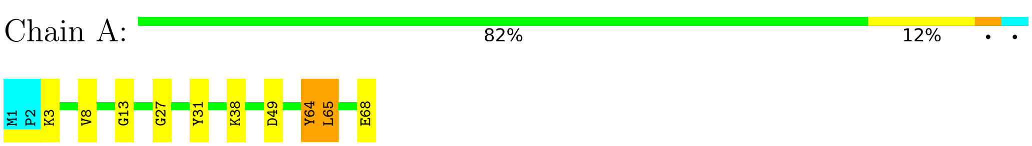
4.2.14 Score per residue for model 14

- Molecule 1: Copper transport protein ATOX1



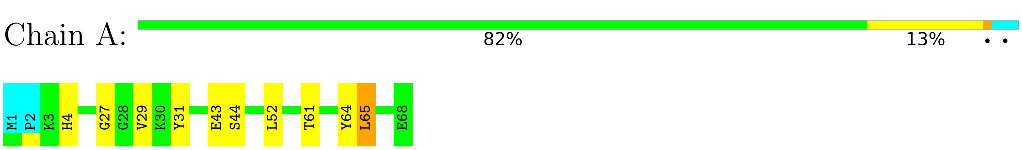
4.2.15 Score per residue for model 15

- Molecule 1: Copper transport protein ATOX1



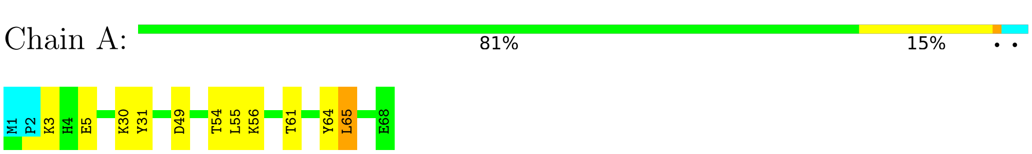
4.2.16 Score per residue for model 16

- Molecule 1: Copper transport protein ATOX1



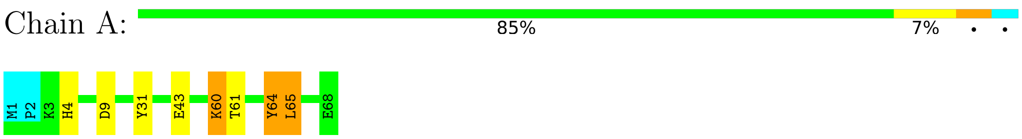
4.2.17 Score per residue for model 17

- Molecule 1: Copper transport protein ATOX1



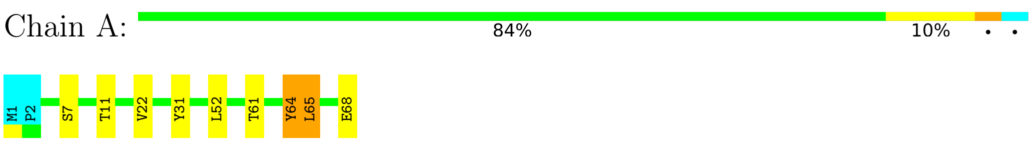
4.2.18 Score per residue for model 18

- Molecule 1: Copper transport protein ATOX1



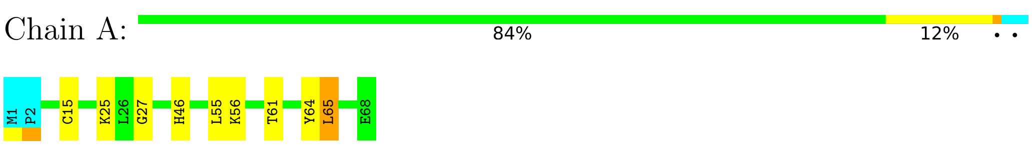
4.2.19 Score per residue for model 19

- Molecule 1: Copper transport protein ATOX1



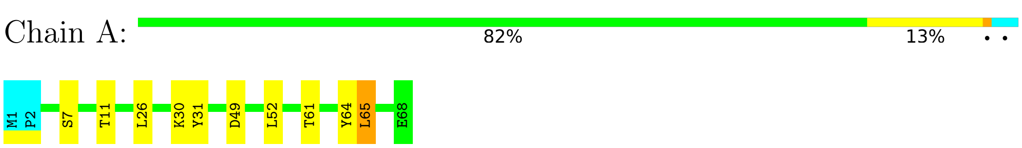
4.2.20 Score per residue for model 20

- Molecule 1: Copper transport protein ATOX1



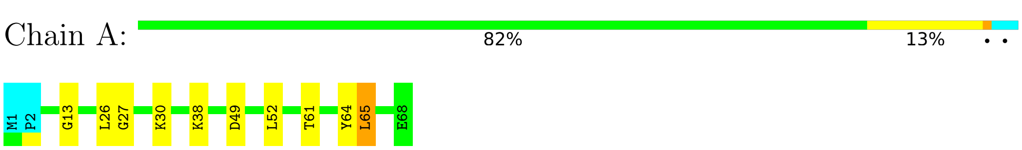
4.2.21 Score per residue for model 21

- Molecule 1: Copper transport protein ATOX1



4.2.22 Score per residue for model 22

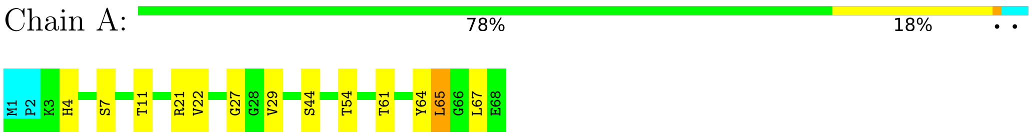
- Molecule 1: Copper transport protein ATOX1



4.2.23 Score per residue for model 23

- Molecule 1: Copper transport protein ATOX1

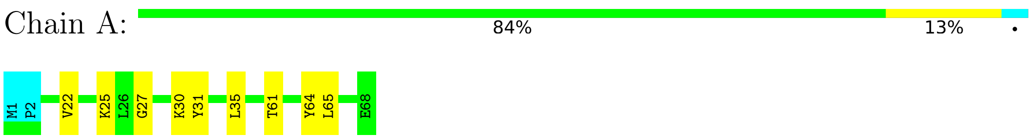
Chain A:



4.2.24 Score per residue for model 24

- Molecule 1: Copper transport protein ATOX1

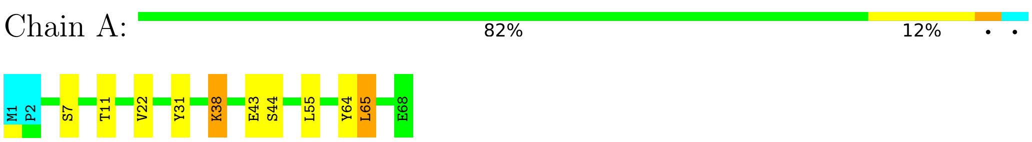
Chain A:



4.2.25 Score per residue for model 25

- Molecule 1: Copper transport protein ATOX1

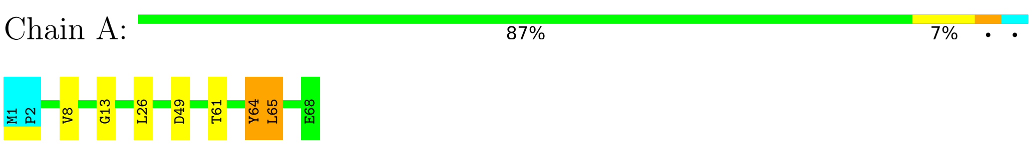
Chain A:



4.2.26 Score per residue for model 26

- Molecule 1: Copper transport protein ATOX1

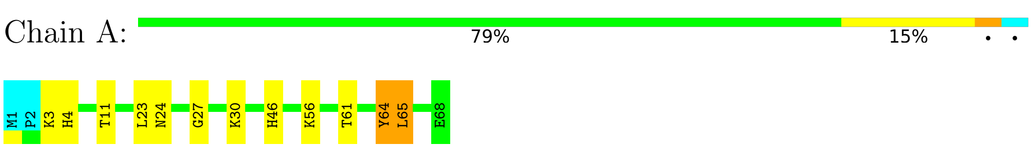
Chain A:



4.2.27 Score per residue for model 27

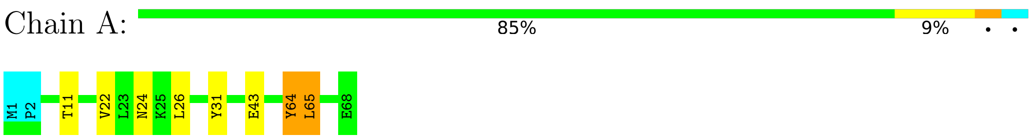
- Molecule 1: Copper transport protein ATOX1

Chain A:



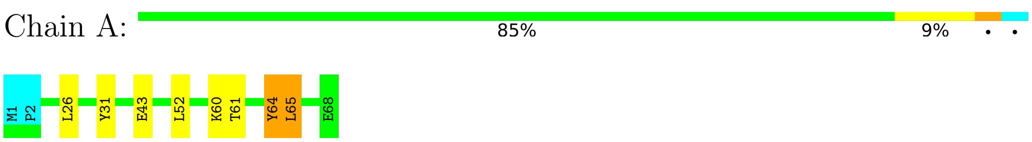
4.2.28 Score per residue for model 28

- Molecule 1: Copper transport protein ATOX1



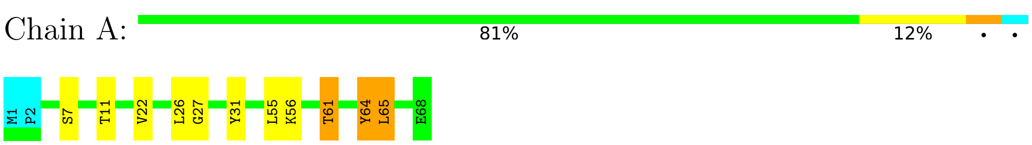
4.2.29 Score per residue for model 29

- Molecule 1: Copper transport protein ATOX1



4.2.30 Score per residue for model 30

- Molecule 1: Copper transport protein ATOX1



5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *torsion angle dynamics coupled with simulated annealing followed by restrained energy minimization*.

Of the 400 calculated structures, 30 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
DIANA	structure solution	1.5
CYANA	structure solution	1.0
Amber	refinement	5.0

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.

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±0.0	1.4±0.8
All	All	0	43

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

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	64	TYR	Sidechain	19
1	A	31	TYR	Sidechain	18
1	A	8	VAL	Peptide	4
1	A	46	HIS	Sidechain	1
1	A	21	ARG	Sidechain	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	499	513	513	2±1
All	All	14970	15390	15390	64

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:64:TYR:C	1:A:65:LEU:HD13	0.53	2.24	8	25
1:A:55:LEU:HD12	1:A:56:LYS:N	0.50	2.21	17	4
1:A:65:LEU:O	1:A:65:LEU:HD22	0.48	2.07	12	3
1:A:65:LEU:HD13	1:A:65:LEU:N	0.48	2.23	7	17
1:A:7:SER:H	1:A:65:LEU:HD11	0.47	1.70	25	6
1:A:65:LEU:CD1	1:A:65:LEU:N	0.47	2.78	17	4
1:A:55:LEU:HD12	1:A:55:LEU:C	0.43	2.34	25	2
1:A:9:ASP:OD2	1:A:60:LYS:NZ	0.42	2.47	18	1
1:A:3:LYS:NZ	1:A:5:GLU:OE2	0.41	2.54	17	1
1:A:65:LEU:HD22	1:A:65:LEU:O	0.41	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	65/68 (96%)	55±2 (85±3%)	9±2 (14±3%)	1±1 (1±1%)	16	63
All	All	1950/2040 (96%)	1653 (85%)	272 (14%)	25 (1%)	16	63

All 7 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	27	GLY	12
1	A	13	GLY	4
1	A	61	THR	3
1	A	38	LYS	3
1	A	29	VAL	1
1	A	9	ASP	1
1	A	56	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	57/59 (97%)	50±2 (88±3%)	7±2 (12±3%)	9	52
All	All	1710/1770 (97%)	1513 (88%)	197 (12%)	9	52

All 32 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	65	LEU	30
1	A	61	THR	22
1	A	11	THR	17
1	A	26	LEU	15
1	A	22	VAL	12
1	A	49	ASP	12
1	A	30	LYS	11
1	A	4	HIS	9
1	A	44	SER	7
1	A	43	GLU	7
1	A	24	ASN	6
1	A	52	LEU	6
1	A	60	LYS	4
1	A	23	LEU	4
1	A	41	CYS	4
1	A	35	LEU	4
1	A	3	LYS	3
1	A	38	LYS	3
1	A	29	VAL	3
1	A	54	THR	3
1	A	67	LEU	2
1	A	25	LYS	2
1	A	46	HIS	2
1	A	56	LYS	1
1	A	10	MET	1
1	A	39	LYS	1
1	A	47	SER	1
1	A	62	VAL	1
1	A	7	SER	1
1	A	68	GLU	1
1	A	15	CYS	1
1	A	64	TYR	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