



# Full wwPDB NMR Structure Validation Report ⓘ

Apr 26, 2016 – 09:36 PM BST

PDB ID : 2JXL  
Title : Solution structure of cardiac N-domain troponin C mutant F77W-V82A  
Authors : Julien, O.; Sun, Y.; Wang, X.; Lindhout, D.A.; Thiessen, A.; Irving, M.; Sykes, B.D.  
Deposited on : 2007-11-20

This is a Full wwPDB NMR Structure Validation Report for a publicly released PDB entry.  
We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)  
A user guide is available at  
<http://wwpdb.org/validation/2016/NMRValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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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  
Mogul : unknown  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
RCI : v\_1n\_11\_5\_13\_A (Berjanski et al., 2005)  
PANAV : Wang et al. (2010)  
ShiftChecker : rb-20027457  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : rb-20027457

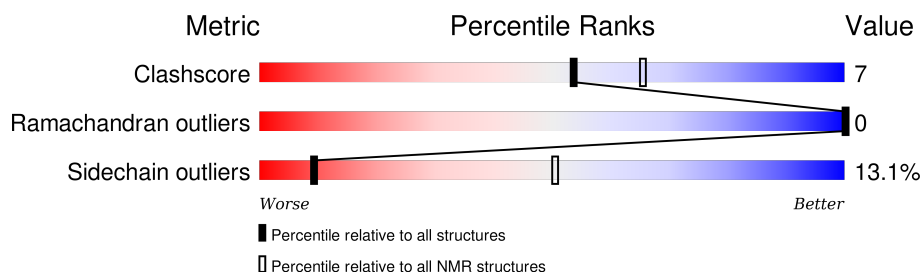
# 1 Overall quality at a glance

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	114402	11133
Ramachandran outliers	111179	9975
Sidechain outliers	111093	9958

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  $\geq 3$ , 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	89	<div> <div style="width: 74%; background-color: green;"></div> <div style="width: 17%; background-color: yellow;"></div> <div style="width: 9%; background-color: cyan;"></div> </div> <div>74% 17% 9%</div>

## 2 Ensemble composition and analysis ⓘ

This entry contains 30 models. Model 25 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *closest to the average*.

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:5-A:85 (81)	0.46	25

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 1 single-model cluster was found.

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

### 3 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 1360 atoms, of which 661 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Troponin C, slow skeletal and cardiac muscles.

Mol	Chain	Residues	Atoms						Trace
1	A	89	Total	C	H	N	O	S	0
			1359	432	661	108	149	9	

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	77	TRP	PHE	ENGINEERED	UNP P63316
A	82	ALA	VAL	ENGINEERED	UNP P63316

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

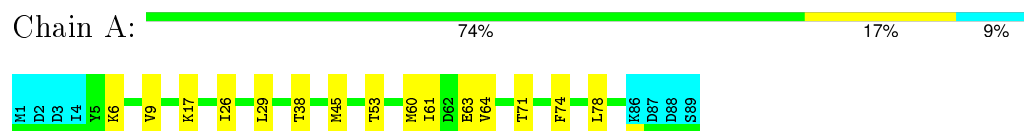
Mol	Chain	Residues	Atoms	
2	A	1	Total	Ca
			1	1

## 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: Troponin C, slow skeletal and cardiac muscles

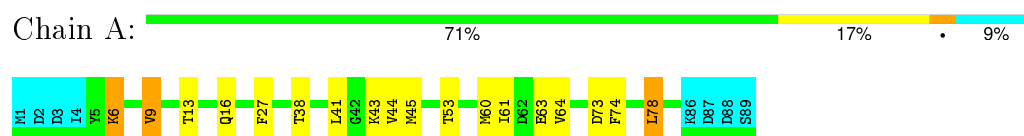


### 4.2 Scores per residue for each member of the ensemble

Colouring as in section [4.1](#) above.

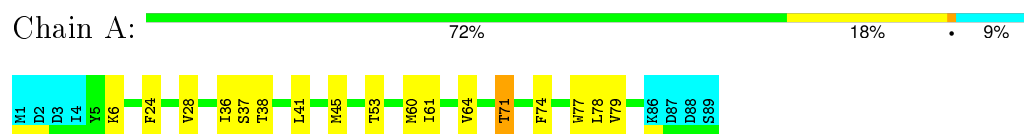
#### 4.2.1 Score per residue for model 1

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



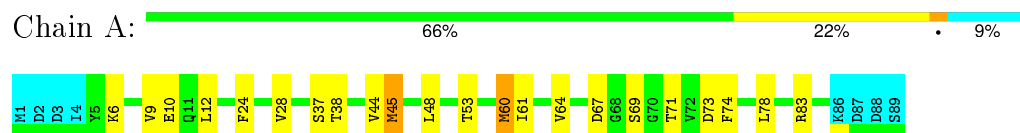
#### 4.2.2 Score per residue for model 2

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



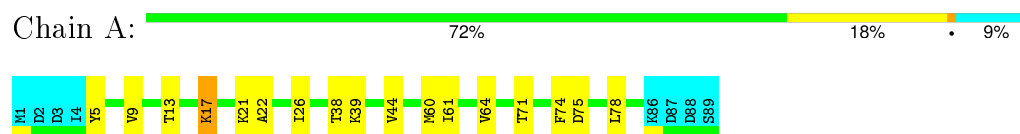
### 4.2.3 Score per residue for model 3

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



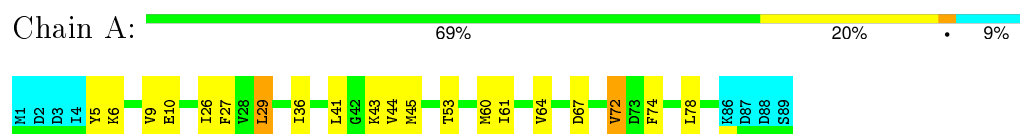
### 4.2.4 Score per residue for model 4

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



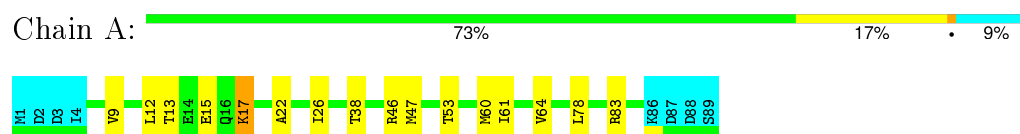
### 4.2.5 Score per residue for model 5

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



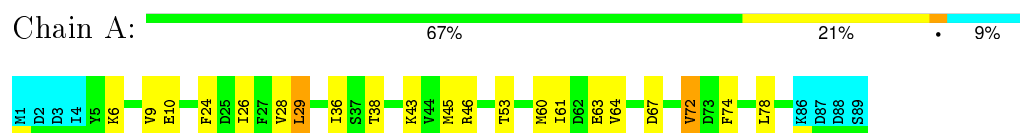
### 4.2.6 Score per residue for model 6

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



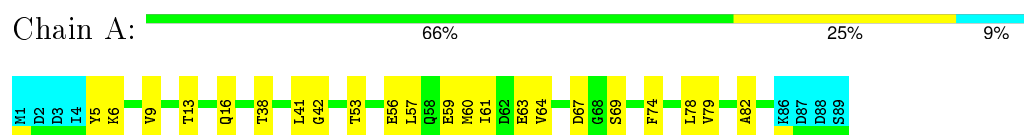
### 4.2.7 Score per residue for model 7

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



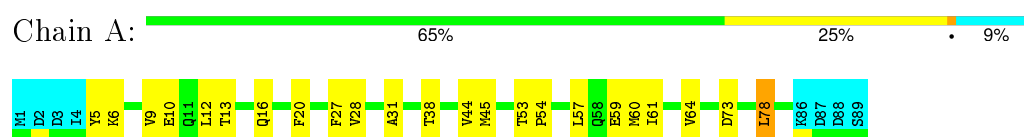
### 4.2.8 Score per residue for model 8

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



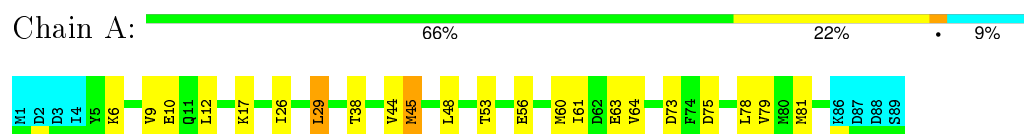
### 4.2.9 Score per residue for model 9

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



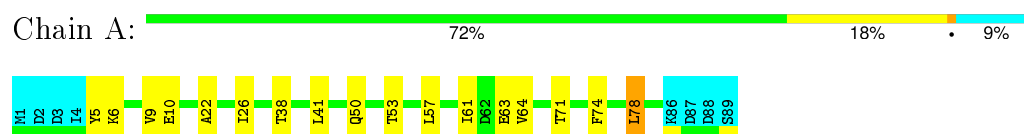
### 4.2.10 Score per residue for model 10

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



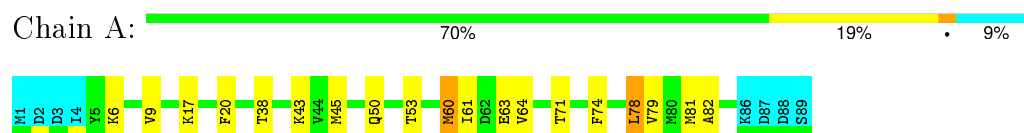
### 4.2.11 Score per residue for model 11

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



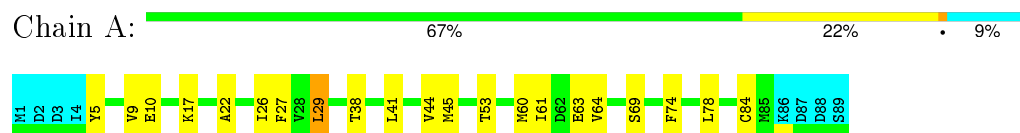
### 4.2.12 Score per residue for model 12

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



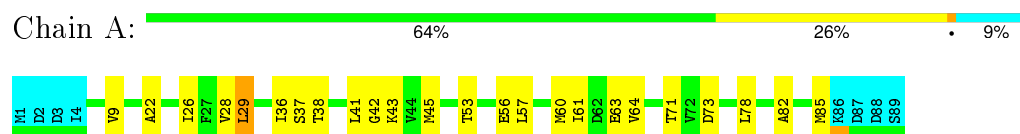
### 4.2.13 Score per residue for model 13

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



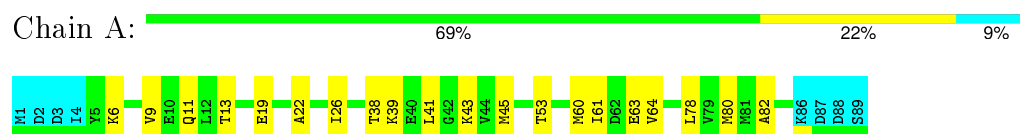
### 4.2.14 Score per residue for model 14

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



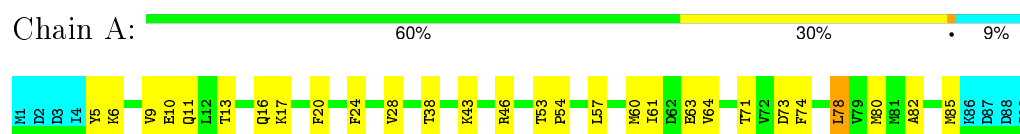
### 4.2.15 Score per residue for model 15

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



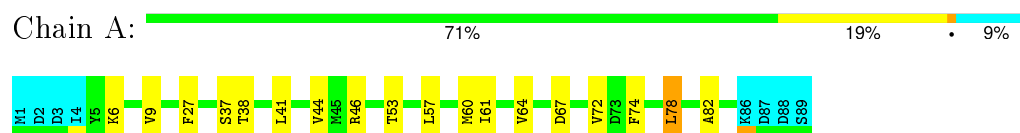
### 4.2.16 Score per residue for model 16

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



### 4.2.17 Score per residue for model 17

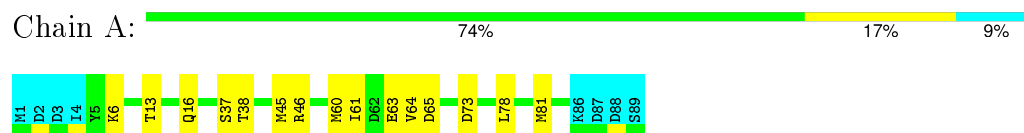
- Molecule 1: Troponin C, slow skeletal and cardiac muscles





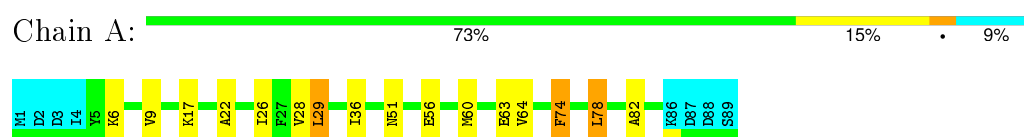
#### 4.2.18 Score per residue for model 18

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



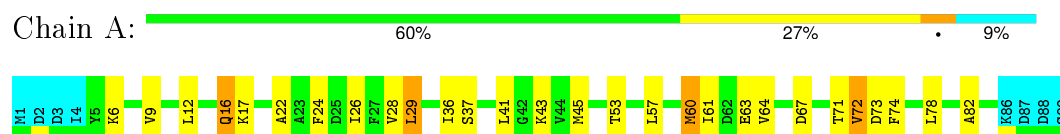
#### 4.2.19 Score per residue for model 19

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



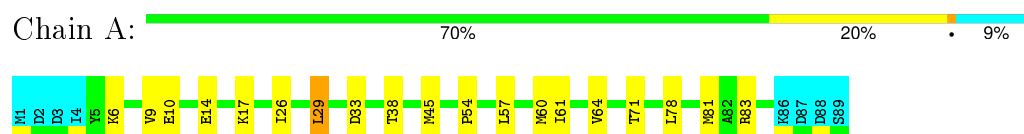
#### 4.2.20 Score per residue for model 20

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



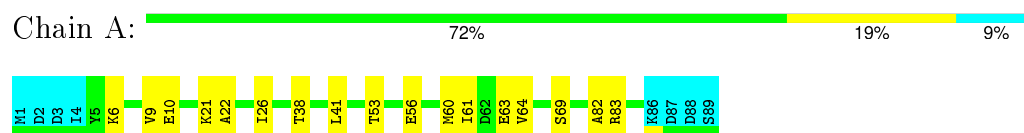
#### 4.2.21 Score per residue for model 21

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



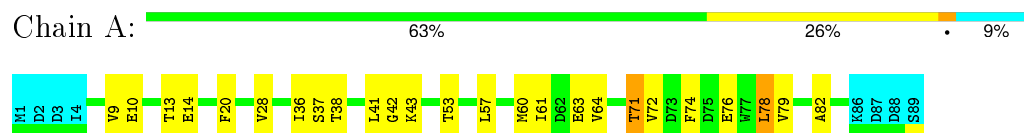
#### 4.2.22 Score per residue for model 22

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



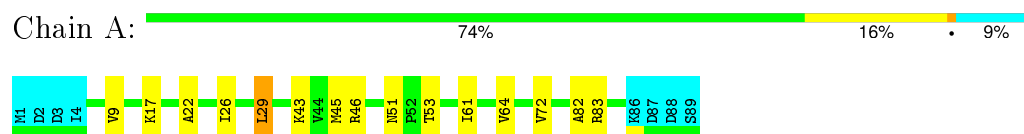
#### 4.2.23 Score per residue for model 23

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



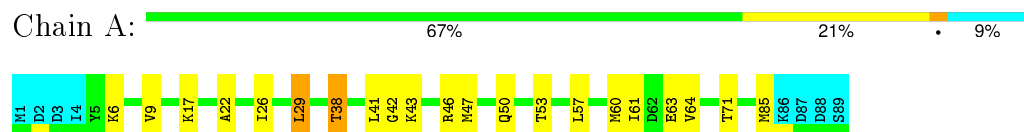
#### 4.2.24 Score per residue for model 24

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



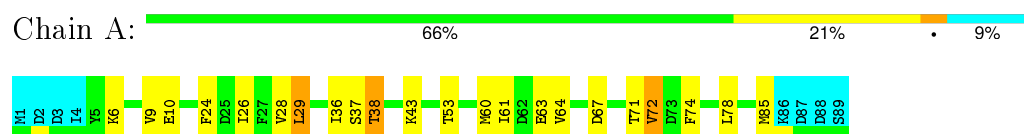
#### 4.2.25 Score per residue for model 25 (medoid)

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



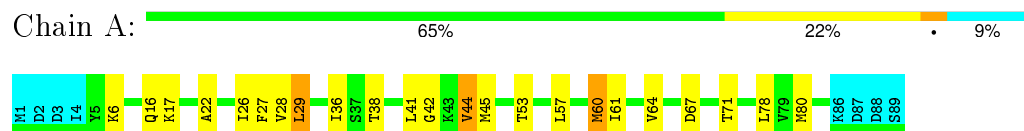
#### 4.2.26 Score per residue for model 26

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



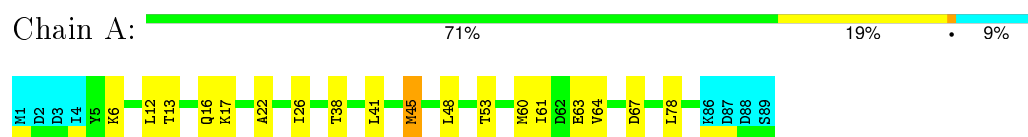
#### 4.2.27 Score per residue for model 27

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



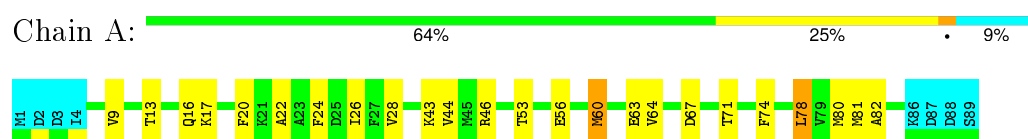
#### 4.2.28 Score per residue for model 28

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



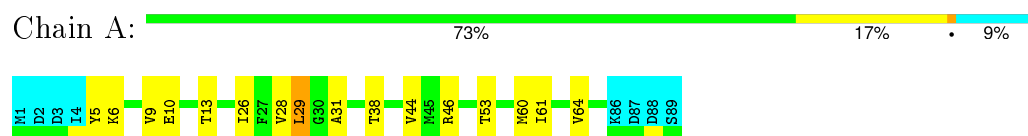
#### 4.2.29 Score per residue for model 29

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



#### 4.2.30 Score per residue for model 30

- Molecule 1: Troponin C, slow skeletal and cardiac muscles



## 5 Refinement protocol and experimental data overview

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

Of the 50 calculated structures, 30 were deposited, based on the following criterion: *structures with the lowest RMSD*.

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

Software name	Classification	Version
CYANA	refinement	2.1

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 ⓘ

### 6.1 Standard geometry ⓘ

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 ⓘ

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	635	607	607	8±3
All	All	19080	18210	18200	251

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:9:VAL:HG13	1:A:82:ALA:HB2	0.82	1.51	29	8
1:A:41:LEU:HD23	1:A:61:ILE:HD11	0.78	1.53	8	13
1:A:76:GLU:O	1:A:79:VAL:HG22	0.66	1.91	23	1
1:A:5:TYR:O	1:A:9:VAL:HG23	0.65	1.92	13	7
1:A:27:PHE:CZ	1:A:44:VAL:HG11	0.65	2.26	9	1
1:A:75:ASP:O	1:A:79:VAL:HG23	0.62	1.94	10	1
1:A:27:PHE:CE2	1:A:44:VAL:HG11	0.62	2.28	17	4
1:A:27:PHE:CE2	1:A:44:VAL:HG21	0.62	2.29	27	1
1:A:9:VAL:CG1	1:A:82:ALA:HB2	0.61	2.25	29	9
1:A:54:PRO:HA	1:A:57:LEU:HD12	0.60	1.73	16	3
1:A:26:ILE:O	1:A:29:LEU:HD23	0.59	1.97	30	13
1:A:45:MET:HE3	1:A:48:LEU:HD12	0.58	1.74	10	3

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:6:LYS:NZ	1:A:79:VAL:HG11	0.58	2.14	2	1
1:A:17:LYS:HG3	1:A:78:LEU:HD11	0.58	1.76	6	1
1:A:74:PHE:CZ	1:A:78:LEU:HD11	0.56	2.35	26	6
1:A:61:ILE:HG23	1:A:72:VAL:HG23	0.56	1.75	17	3
1:A:60:MET:O	1:A:64:VAL:HG23	0.56	2.00	4	28
1:A:12:LEU:HD22	1:A:16:GLN:HG2	0.56	1.78	20	1
1:A:74:PHE:CE1	1:A:78:LEU:HD12	0.55	2.36	1	3
1:A:9:VAL:HG22	1:A:82:ALA:HB2	0.55	1.76	16	2
1:A:17:LYS:NZ	1:A:78:LEU:HD13	0.55	2.14	28	1
1:A:37:SER:HA	1:A:71:THR:HG22	0.55	1.78	2	5
1:A:37:SER:CA	1:A:71:THR:HG22	0.54	2.33	20	1
1:A:12:LEU:HD22	1:A:16:GLN:NE2	0.54	2.17	28	1
1:A:38:THR:HB	1:A:61:ILE:HD12	0.54	1.79	6	24
1:A:22:ALA:O	1:A:26:ILE:HD12	0.53	2.03	20	14
1:A:45:MET:CE	1:A:48:LEU:HD12	0.53	2.33	28	1
1:A:29:LEU:O	1:A:29:LEU:HD12	0.52	2.05	7	7
1:A:28:VAL:HG12	1:A:36:ILE:HG13	0.52	1.82	14	4
1:A:20:PHE:CZ	1:A:78:LEU:HD11	0.52	2.39	29	3
1:A:28:VAL:O	1:A:28:VAL:HG22	0.51	2.06	9	1
1:A:29:LEU:HD12	1:A:29:LEU:O	0.51	2.05	10	5
1:A:5:TYR:O	1:A:9:VAL:HG12	0.51	2.05	9	1
1:A:12:LEU:HD12	1:A:17:LYS:HE2	0.50	1.82	28	1
1:A:41:LEU:HG	1:A:57:LEU:HD12	0.49	1.83	14	7
1:A:9:VAL:HG13	1:A:82:ALA:CB	0.49	2.34	29	4
1:A:9:VAL:HG23	1:A:12:LEU:HD12	0.49	1.84	10	3
1:A:20:PHE:CZ	1:A:78:LEU:HD21	0.48	2.43	23	2
1:A:9:VAL:CG2	1:A:78:LEU:HD22	0.48	2.38	9	1
1:A:28:VAL:HG22	1:A:28:VAL:O	0.48	2.07	30	1
1:A:28:VAL:HG23	1:A:31:ALA:HB3	0.47	1.86	9	2
1:A:5:TYR:HB3	1:A:79:VAL:HG13	0.47	1.87	8	1
1:A:20:PHE:C	1:A:20:PHE:CD1	0.47	2.88	23	2
1:A:13:THR:HG23	1:A:16:GLN:H	0.47	1.71	9	6
1:A:24:PHE:O	1:A:28:VAL:HG22	0.46	2.10	20	1
1:A:36:ILE:HD13	1:A:77:TRP:CD1	0.46	2.46	2	1
1:A:36:ILE:HD12	1:A:72:VAL:HG12	0.46	1.86	5	4
1:A:9:VAL:CG2	1:A:82:ALA:HB2	0.45	2.41	16	2
1:A:24:PHE:CZ	1:A:28:VAL:HG11	0.45	2.45	7	6
1:A:24:PHE:CE2	1:A:28:VAL:HG11	0.45	2.46	2	1
1:A:9:VAL:HG22	1:A:17:LYS:HE2	0.44	1.90	10	1
1:A:42:GLY:HA2	1:A:57:LEU:HD11	0.43	1.91	23	5
1:A:74:PHE:CE1	1:A:78:LEU:HD11	0.43	2.49	8	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:9:VAL:HG23	1:A:12:LEU:CD1	0.43	2.43	10	2
1:A:53:THR:HG23	1:A:56:GLU:H	0.43	1.72	22	2
1:A:9:VAL:HG12	1:A:17:LYS:HE2	0.43	1.90	4	1
1:A:74:PHE:O	1:A:78:LEU:HD12	0.43	2.14	7	2
1:A:13:THR:HG22	1:A:16:GLN:OE1	0.42	2.13	28	1
1:A:41:LEU:CD2	1:A:61:ILE:HD11	0.42	2.42	25	1
1:A:41:LEU:O	1:A:41:LEU:HD12	0.42	2.14	22	1
1:A:61:ILE:HA	1:A:64:VAL:HG22	0.41	1.92	11	2
1:A:46:ARG:CG	1:A:47:MET:N	0.41	2.83	25	2
1:A:74:PHE:CZ	1:A:78:LEU:HD12	0.41	2.50	1	1
1:A:37:SER:CB	1:A:71:THR:HG22	0.41	2.45	20	1
1:A:6:LYS:HA	1:A:9:VAL:HG12	0.41	1.92	7	2
1:A:20:PHE:CG	1:A:78:LEU:HD21	0.40	2.51	12	1
1:A:41:LEU:HD12	1:A:41:LEU:O	0.40	2.16	27	2
1:A:20:PHE:CD2	1:A:78:LEU:HD21	0.40	2.50	9	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	81/89 (91%)	77±1 (96±1%)	4±1 (4±1%)	0±0 (0±0%)	100	100
All	All	2430/2670 (91%)	2321 (96%)	109 (4%)	0 (0%)	100	100

There are no Ramachandran outliers.

### 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	69/77 (90%)	60±3 (87±4%)	9±3 (13±4%)	9	50
All	All	2070/2310 (90%)	1798 (87%)	272 (13%)	9	50

All 43 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	53	THR	24
1	A	6	LYS	21
1	A	63	GLU	19
1	A	78	LEU	18
1	A	45	MET	17
1	A	43	LYS	13
1	A	29	LEU	13
1	A	10	GLU	13
1	A	17	LYS	12
1	A	71	THR	10
1	A	67	ASP	10
1	A	73	ASP	8
1	A	74	PHE	8
1	A	46	ARG	7
1	A	44	VAL	6
1	A	60	MET	5
1	A	13	THR	5
1	A	81	MET	5
1	A	83	ARG	5
1	A	56	GLU	4
1	A	80	MET	4
1	A	69	SER	4
1	A	72	VAL	4
1	A	9	VAL	4
1	A	50	GLN	3
1	A	85	MET	3
1	A	38	THR	3
1	A	11	GLN	2
1	A	14	GLU	2
1	A	59	GLU	2
1	A	16	GLN	2
1	A	51	ASN	2
1	A	37	SER	2
1	A	21	LYS	2
1	A	39	LYS	2
1	A	15	GLU	1

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Mol	Chain	Res	Type	Models (Total)
1	A	19	GLU	1
1	A	57	LEU	1
1	A	84	CYS	1
1	A	65	ASP	1
1	A	75	ASP	1
1	A	33	ASP	1
1	A	79	VAL	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