Full wwPDB NMR Structure Validation Report (i)

Mar 11, 2021 – 02:09 am GMT

PDB ID	:	6ZBI
Title	:	Ternary complex of Calmodulin bound to 2 molecules of NHE1
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Deposited on	:	2020-06-08

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:

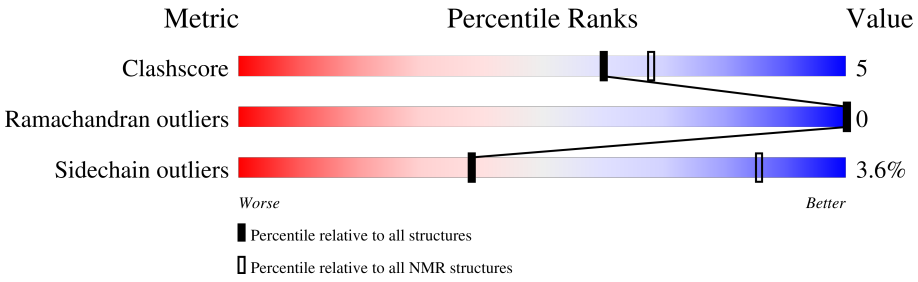
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.17.1
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.17.1

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 is 84%.

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	148	78% 10% 11%
2	B	36	67% . 31%
2	C	36	58% 8% 33%

2 Ensemble composition and analysis

This entry contains 20 models. Model 6 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:7-A:73, C:824-C:847 (91)	0.39	6
2	A:85-A:148, B:622-B:646 (89)	0.43	12

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 2 single-model clusters were found.

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

3 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3537 atoms, of which 1749 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Calmodulin-1.

Mol	Chain	Residues	Atoms						Trace
1	A	148	Total	C	H	N	O	S	0
			2261	714	1095	188	255	9	

- Molecule 2 is a protein called Sodium/hydrogen exchanger 1.

Mol	Chain	Residues	Atoms					Trace
2	B	36	Total	C	H	N	O	0
			636	187	327	65	57	
2	C	36	Total	C	H	N	O	0
			636	187	327	65	57	

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

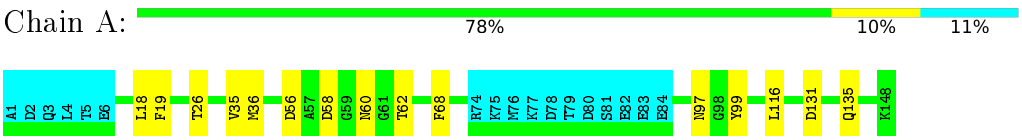
Mol	Chain	Residues	Atoms	
3	A	4	Total	Ca
			4	4

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: Calmodulin-1



• Molecule 2: Sodium/hydrogen exchanger 1

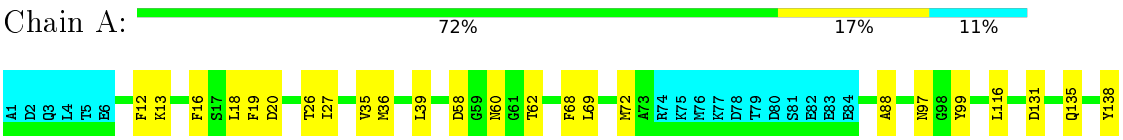
• Molecule 2: Sodium/hydrogen exchanger 1

4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

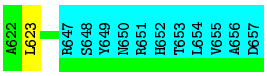
4.2.1 Score per residue for model 1

• Molecule 1: Calmodulin-1



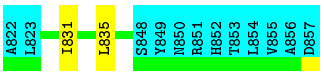
• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:



• Molecule 2: Sodium/hydrogen exchanger 1

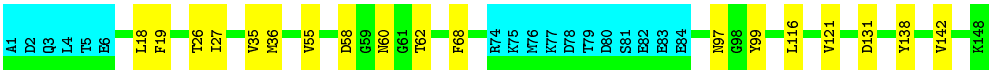
Chain C:



4.2.2 Score per residue for model 2

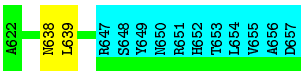
• Molecule 1: Calmodulin-1

Chain A:



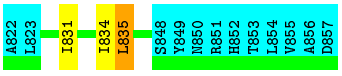
• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:



• Molecule 2: Sodium/hydrogen exchanger 1

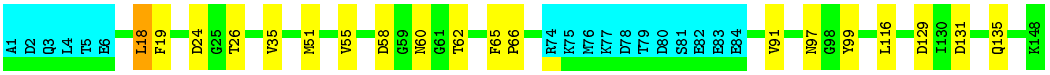
Chain C:



4.2.3 Score per residue for model 3

• Molecule 1: Calmodulin-1

Chain A:



• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

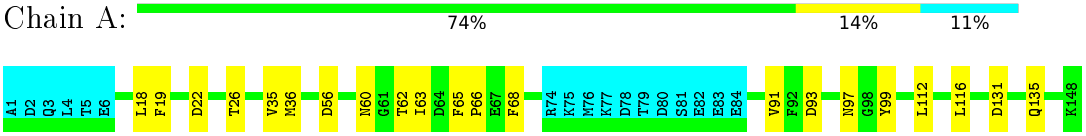
• Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.4 Score per residue for model 4

• Molecule 1: Calmodulin-1

Chain A:



• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

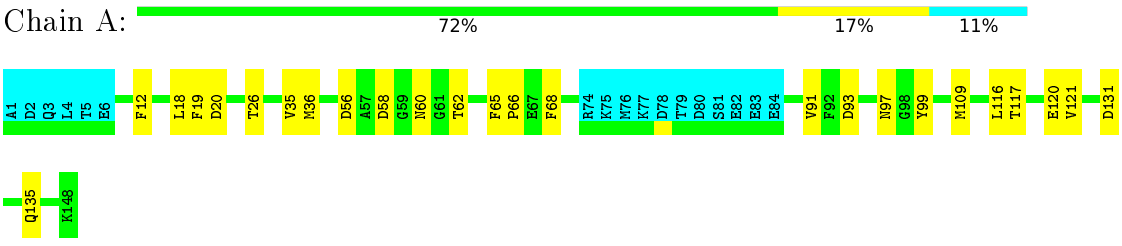
• Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.5 Score per residue for model 5

• Molecule 1: Calmodulin-1

Chain A:



• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

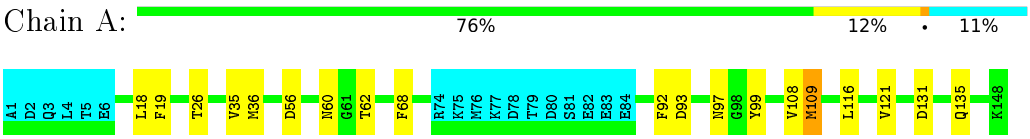
• Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.6 Score per residue for model 6 (medoid)

• Molecule 1: Calmodulin-1

Chain A:



• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

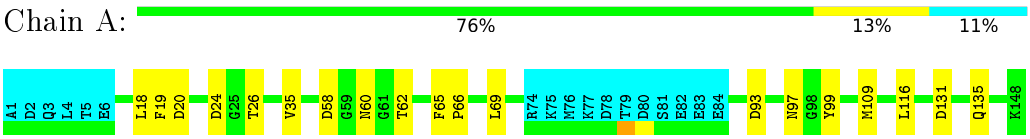
• Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.7 Score per residue for model 7

• Molecule 1: Calmodulin-1

Chain A:



• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

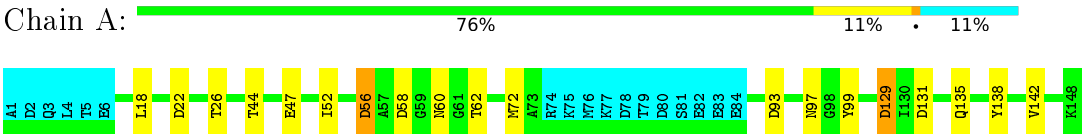
• Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.8 Score per residue for model 8

• Molecule 1: Calmodulin-1

Chain A:



• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

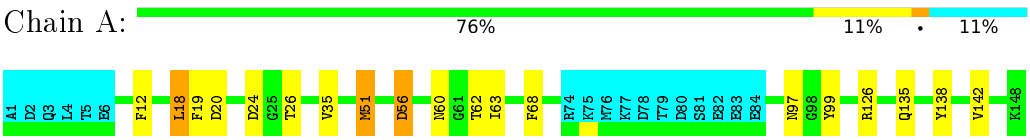
• Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.9 Score per residue for model 9

• Molecule 1: Calmodulin-1

Chain A:

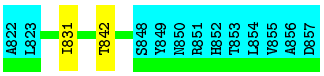


• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

• Molecule 2: Sodium/hydrogen exchanger 1

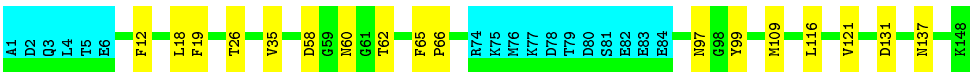
Chain C:



4.2.10 Score per residue for model 10

• Molecule 1: Calmodulin-1

Chain A:

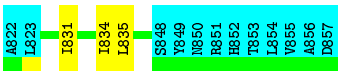


• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

• Molecule 2: Sodium/hydrogen exchanger 1

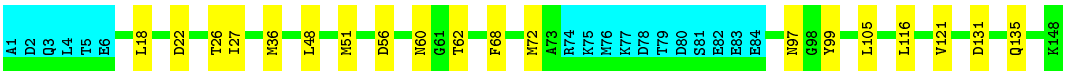
Chain C:



4.2.11 Score per residue for model 11

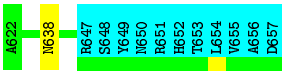
• Molecule 1: Calmodulin-1

Chain A:



• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:



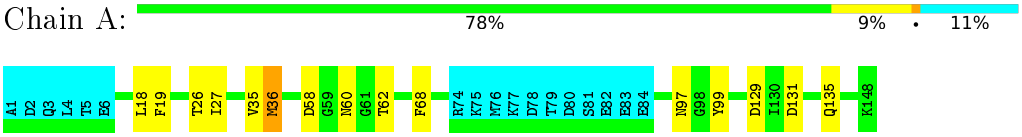
• Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.12 Score per residue for model 12

• Molecule 1: Calmodulin-1

Chain A:



• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

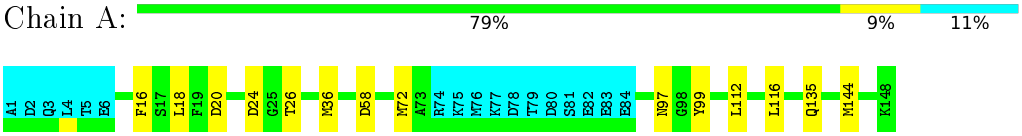
• Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.13 Score per residue for model 13

• Molecule 1: Calmodulin-1

Chain A:



• Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

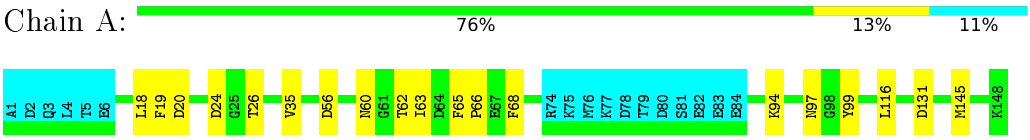
• Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.14 Score per residue for model 14

- Molecule 1: Calmodulin-1

Chain A:



- Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

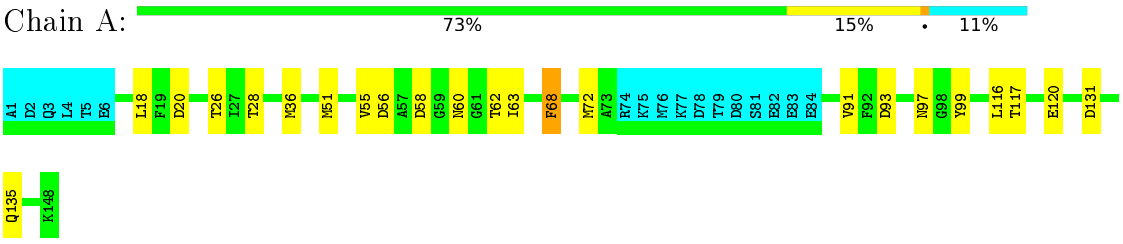
- Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.15 Score per residue for model 15

- Molecule 1: Calmodulin-1

Chain A:



- Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

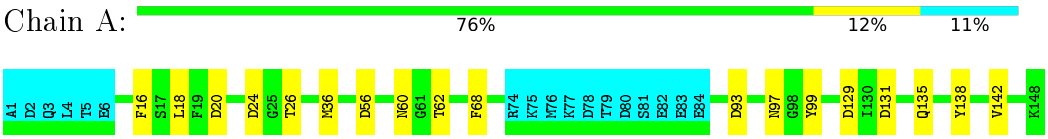
- Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.16 Score per residue for model 16

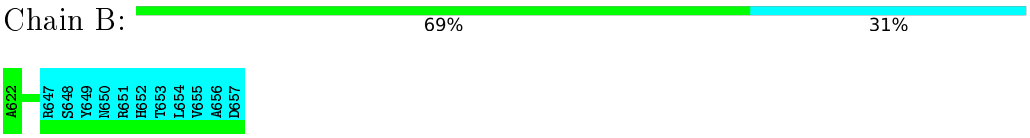
- Molecule 1: Calmodulin-1

Chain A:



- Molecule 2: Sodium/hydrogen exchanger 1

Chain B:



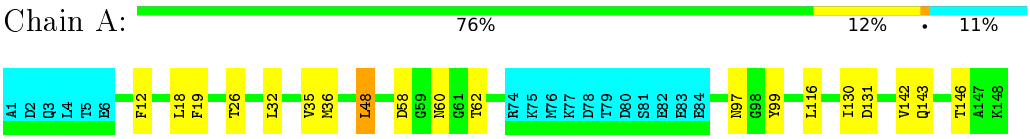
- Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.17 Score per residue for model 17

- Molecule 1: Calmodulin-1

Chain A:

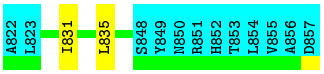


- Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

- Molecule 2: Sodium/hydrogen exchanger 1

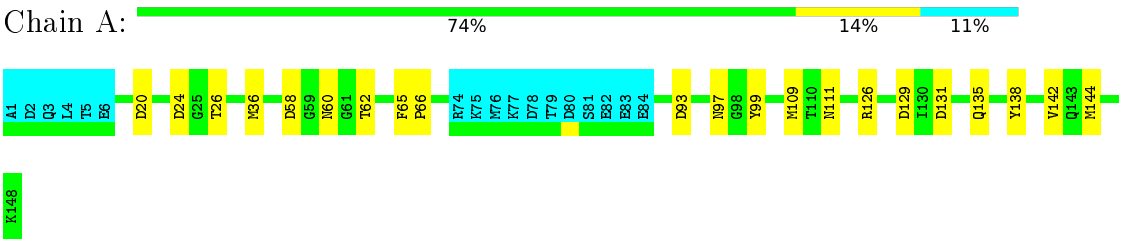
Chain C:



4.2.18 Score per residue for model 18

- Molecule 1: Calmodulin-1

Chain A:



- Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

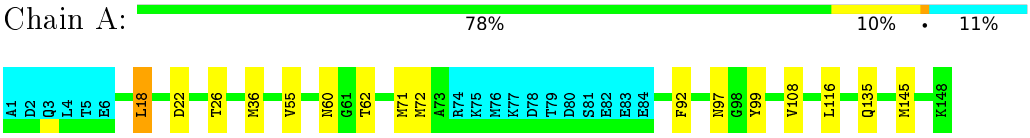
- Molecule 2: Sodium/hydrogen exchanger 1

Chain C:

4.2.19 Score per residue for model 19

- Molecule 1: Calmodulin-1

Chain A:

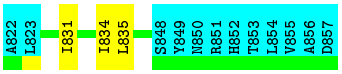


- Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

- Molecule 2: Sodium/hydrogen exchanger 1

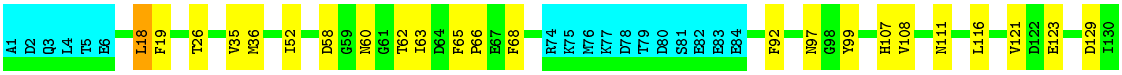
Chain C:



4.2.20 Score per residue for model 20

- Molecule 1: Calmodulin-1

Chain A:

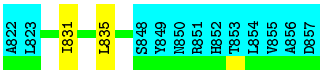


- Molecule 2: Sodium/hydrogen exchanger 1

Chain B:

- Molecule 2: Sodium/hydrogen exchanger 1

Chain C:



GLOBAL-STATISTICS INFOmissingINFO

5 Model quality

5.1 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.

5.2 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	1027	966	967	13±2
2	B	215	239	236	1±1
2	C	213	234	234	2±1
3	A	4	0	0	8±2
All	All	29180	28780	28740	273

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 5.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:116:LEU:HD23	1:A:121:VAL:HG22	0.72	1.62	20	5
1:A:18:LEU:HG	2:C:831:ILE:HD11	0.67	1.65	5	6
1:A:97:ASN:OD1	3:A:203:CA:CA	0.66	1.73	4	20
1:A:60:ASN:OD1	3:A:202:CA:CA	0.66	1.72	16	19
1:A:135:GLN:O	3:A:204:CA:CA	0.65	1.74	3	16
1:A:62:THR:O	3:A:202:CA:CA	0.64	1.75	11	19
1:A:55:VAL:HG11	1:A:71:MET:SD	0.64	2.32	19	1
1:A:26:THR:O	3:A:201:CA:CA	0.64	1.75	18	20
1:A:99:TYR:O	3:A:203:CA:CA	0.64	1.75	7	20

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:93:ASP:OD1	3:A:203:CA:CA	0.63	1.76	7	8
1:A:20:ASP:OD1	3:A:201:CA:CA	0.62	1.77	14	9
1:A:129:ASP:OD1	3:A:204:CA:CA	0.62	1.77	16	5
1:A:24:ASP:OD1	3:A:201:CA:CA	0.62	1.77	7	7
1:A:56:ASP:OD1	3:A:202:CA:CA	0.61	1.78	15	9
1:A:18:LEU:HB3	2:C:831:ILE:HD11	0.61	1.70	15	7
1:A:91:VAL:HG21	2:B:623:LEU:HD22	0.61	1.73	15	3
1:A:137:ASN:OD1	3:A:204:CA:CA	0.60	1.78	10	1
1:A:36:MET:HG2	2:C:835:LEU:HD13	0.60	1.72	1	7
1:A:18:LEU:HD13	2:C:831:ILE:HD11	0.58	1.75	10	4
2:B:639:LEU:HD21	2:B:643:ARG:HE	0.57	1.59	12	1
1:A:27:ILE:HD12	1:A:68:PHE:CE1	0.56	2.34	1	3
1:A:19:PHE:HA	1:A:35:VAL:HG21	0.56	1.75	20	13
1:A:63:ILE:HG21	1:A:68:PHE:CE1	0.56	2.36	14	3
1:A:116:LEU:HD13	2:B:639:LEU:HD11	0.53	1.80	2	1
1:A:36:MET:SD	2:C:835:LEU:HD13	0.50	2.47	15	5
1:A:32:LEU:HD22	1:A:48:LEU:HD11	0.49	1.85	17	1
1:A:44:THR:HG23	1:A:47:GLU:H	0.49	1.66	8	1
1:A:109:MET:CE	2:B:635:LEU:HD12	0.49	2.37	7	1
1:A:92:PHE:CD2	1:A:108:VAL:HG21	0.48	2.44	6	3
1:A:117:THR:HG23	1:A:120:GLU:H	0.48	1.69	5	2
1:A:12:PHE:CD2	1:A:69:LEU:HD12	0.48	2.44	1	1
1:A:105:LEU:HD23	1:A:121:VAL:HG13	0.48	1.86	11	1
1:A:142:VAL:O	1:A:146:THR:HG23	0.47	2.09	17	1
1:A:138:TYR:O	1:A:142:VAL:HG23	0.46	2.10	9	6
1:A:63:ILE:HG21	1:A:68:PHE:CD1	0.46	2.45	9	2
1:A:36:MET:HG3	2:C:835:LEU:HD13	0.46	1.86	12	1
1:A:91:VAL:HG21	2:B:623:LEU:HD11	0.45	1.88	5	1
1:A:107:HIS:CE1	1:A:111:ASN:HD21	0.45	2.29	20	1
1:A:144:MET:SD	2:B:635:LEU:HD21	0.45	2.52	18	2
1:A:145:MET:O	2:B:634:ILE:HD13	0.45	2.12	20	2
1:A:52:ILE:HG23	1:A:63:ILE:HD11	0.45	1.89	20	1
1:A:123:GLU:OE1	2:B:646:LEU:HD13	0.45	2.12	20	1
1:A:12:PHE:CE2	1:A:69:LEU:HD12	0.44	2.48	1	1
1:A:109:MET:HG2	1:A:116:LEU:HD22	0.44	1.88	6	1
1:A:51:MET:HG2	2:C:842:THR:HG21	0.44	1.90	15	4
1:A:18:LEU:HD23	2:C:831:ILE:HD11	0.44	1.89	9	1
1:A:88:ALA:HA	2:B:623:LEU:HD11	0.43	1.89	1	1
1:A:51:MET:O	1:A:55:VAL:HG23	0.43	2.12	3	2
2:B:639:LEU:O	2:B:639:LEU:HD13	0.43	2.13	19	1
1:A:72:MET:CE	2:C:834:ILE:CG2	0.43	2.96	19	4

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
2:C:834:ILE:CG2	2:C:835:LEU:N	0.42	2.82	4	2
1:A:130:ILE:HD11	1:A:143:GLN:HG2	0.42	1.90	17	1
1:A:65:PHE:N	1:A:66:PRO:HD2	0.42	2.30	5	6
1:A:32:LEU:O	1:A:32:LEU:HD23	0.41	2.16	17	1
1:A:39:LEU:HD11	2:C:831:ILE:CG2	0.41	2.46	1	1
1:A:65:PHE:N	1:A:66:PRO:CD	0.41	2.84	20	2
1:A:27:ILE:HD12	1:A:68:PHE:CD1	0.41	2.51	12	1
1:A:109:MET:CE	2:B:635:LEU:HD23	0.40	2.45	5	1
1:A:13:LYS:HA	1:A:16:PHE:CD1	0.40	2.51	1	1
1:A:55:VAL:HG12	1:A:55:VAL:O	0.40	2.16	2	1
1:A:112:LEU:HD22	2:B:632:ARG:HE	0.40	1.76	4	1

5.3 Torsion angles (i)

5.3.1 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	130/148 (88%)	130±0 (100±0%)	0±0 (0±0%)	0±0 (0±0%)	100	100
2	B	24/36 (67%)	24±0 (100±0%)	0±0 (0±0%)	0±0 (0±0%)	100	100
2	C	24/36 (67%)	24±0 (100±0%)	0±0 (0±0%)	0±0 (0±0%)	100	100
All	All	3560/4400 (81%)	3560 (100%)	0 (0%)	0 (0%)	100	100

There are no Ramachandran outliers.

5.3.2 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	110/126 (87%)	106±1 (96±1%)	4±1 (4±1%)	36	84

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
2	B	24/34 (71%)	23±1 (96±3%)	1±1 (4±3%)	36 84
2	C	24/34 (71%)	23±1 (98±3%)	1±1 (2±3%)	53 92
All	All	3160/3880 (81%)	3047 (96%)	113 (4%)	38 86

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	131	ASP	17
1	A	58	ASP	13
2	B	638	ASN	13
1	A	116	LEU	10
2	C	834	ILE	8
1	A	18	LEU	5
1	A	68	PHE	5
1	A	22	ASP	4
1	A	12	PHE	4
1	A	109	MET	3
1	A	72	MET	2
2	C	835	LEU	2
1	A	36	MET	2
2	B	646	LEU	2
2	B	635	LEU	2
1	A	56	ASP	2
1	A	129	ASP	2
1	A	126	ARG	2
1	A	48	LEU	2
1	A	16	PHE	2
1	A	145	MET	2
1	A	69	LEU	1
1	A	52	ILE	1
2	B	639	LEU	1
1	A	51	MET	1
1	A	112	LEU	1
2	C	825	LYS	1
1	A	94	LYS	1
1	A	28	THR	1
1	A	111	ASN	1

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates

There are no monosaccharides in this entry.

5.6 Ligand geometry

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

5.7 Other polymers

There are no such molecules in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

CHEMICAL-SHIFTS INFOmissingINFO