



# Full wwPDB NMR Structure Validation Report ⓘ

Apr 26, 2016 – 10:47 PM BST

PDB ID : 2K5B  
Title : Human CDC37-HSP90 docking model based on NMR  
Authors : Sreeramulu, S.; Jonker, H.R.A.; Lancaster, C.R.; Richter, C.; Langer, T.;  
Schwalbe, H.  
Deposited on : 2008-06-26

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.

---

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

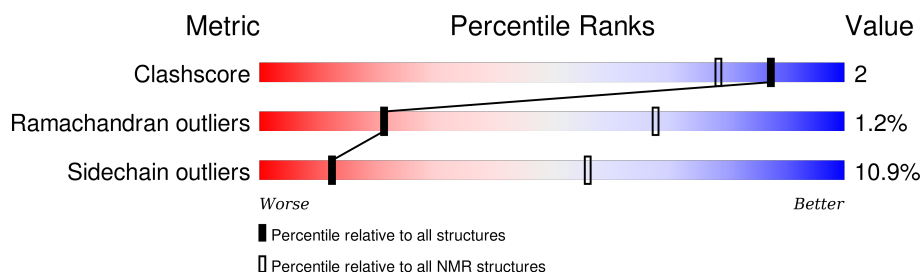
# 1 Overall quality at a glance

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	210	
2	B	129	

## 2 Ensemble composition and analysis

This entry contains 10 models. Model 3 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *best haddock score*.

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:14-A:223, B:158-B:276 (329)	0.53	3

Ill-defined regions of proteins are excluded from the global statistics.

Ligands and non-protein polymers are included in the analysis.

The models can be grouped into 2 clusters and 1 single-model cluster was found.

Cluster number	Models
1	3, 5, 7, 8, 9
2	2, 4, 6, 10
Single-model clusters	1

### 3 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5499 atoms, of which 2757 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Heat shock protein HSP 90-alpha.

Mol	Chain	Residues	Atoms						Trace
1	A	210	Total	C	H	N	O	S	0
			3310	1049	1655	271	330	5	

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	63	THR	SER	SEE REMARK 999	UNP P07900

- Molecule 2 is a protein called Hsp90 co-chaperone Cdc37.

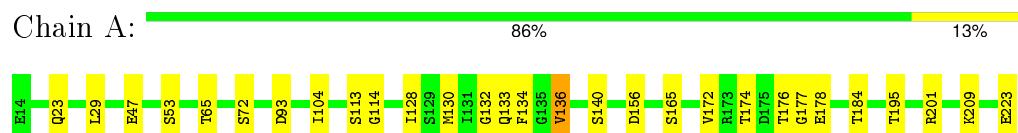
Mol	Chain	Residues	Atoms						Trace
2	B	129	Total	C	H	N	O	S	0
			2189	694	1102	190	194	9	

## 4 Residue-property plots [i](#)

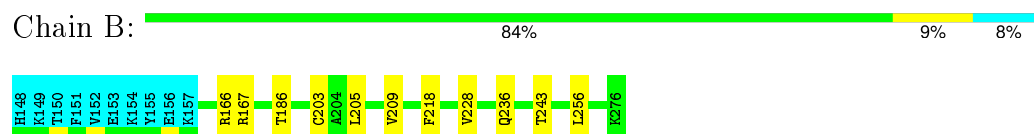
### 4.1 Average score per residue in the NMR ensemble

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: Heat shock protein HSP 90-alpha



- Molecule 2: Hsp90 co-chaperone Cdc37

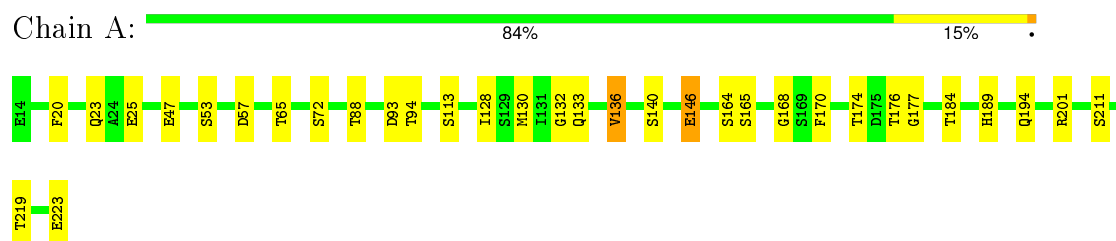


### 4.2 Scores per residue for each member of the ensemble

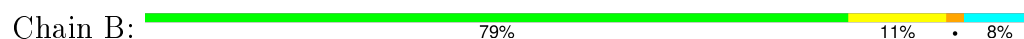
Colouring as in section 4.1 above.

#### 4.2.1 Score per residue for model 1

- Molecule 1: Heat shock protein HSP 90-alpha



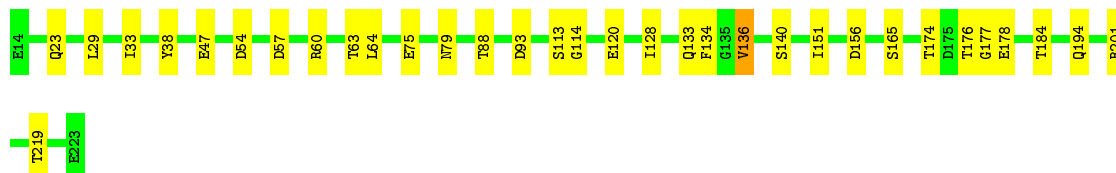
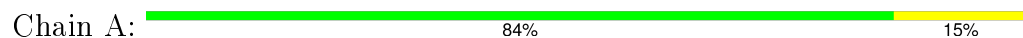
- Molecule 2: Hsp90 co-chaperone Cdc37



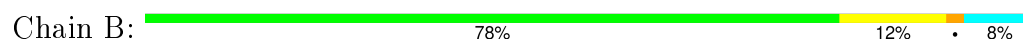


#### 4.2.2 Score per residue for model 2

- Molecule 1: Heat shock protein HSP 90-alpha

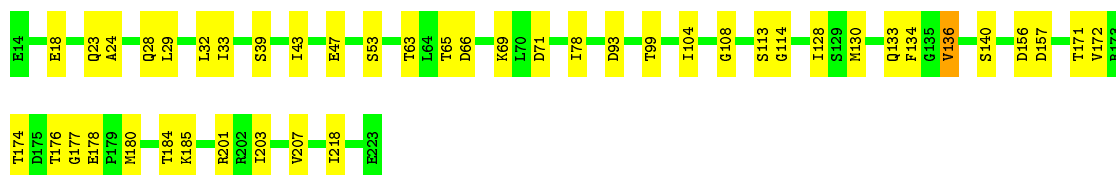
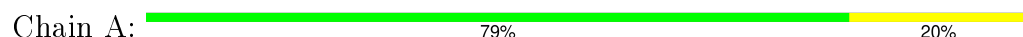


- Molecule 2: Hsp90 co-chaperone Cdc37

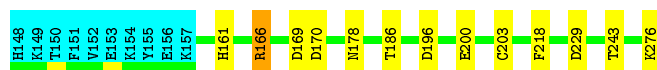
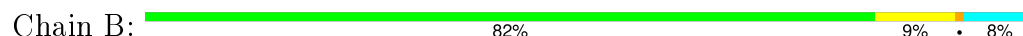


#### 4.2.3 Score per residue for model 3 (medoid)

- Molecule 1: Heat shock protein HSP 90-alpha

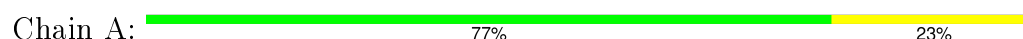


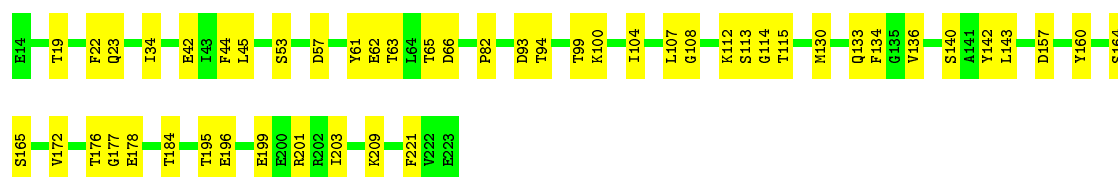
- Molecule 2: Hsp90 co-chaperone Cdc37



#### 4.2.4 Score per residue for model 4

- Molecule 1: Heat shock protein HSP 90-alpha





- Molecule 2: Hsp90 co-chaperone Cdc37

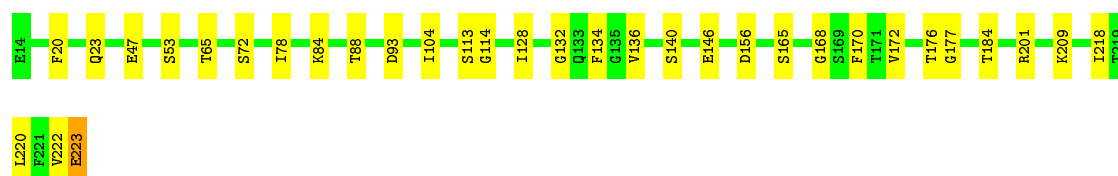
Chain B: 79% 13% 8%



#### 4.2.5 Score per residue for model 5

- Molecule 1: Heat shock protein HSP 90-alpha

Chain A: 84% 15%



- Molecule 2: Hsp90 co-chaperone Cdc37

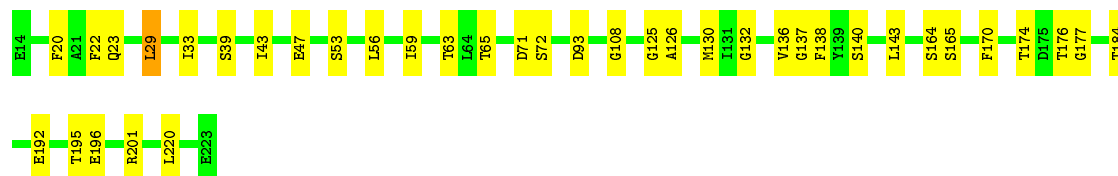
Chain B: 79% 13% 8%



#### 4.2.6 Score per residue for model 6

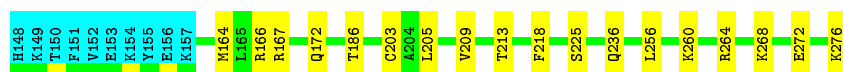
- Molecule 1: Heat shock protein HSP 90-alpha

Chain A: 82% 18%



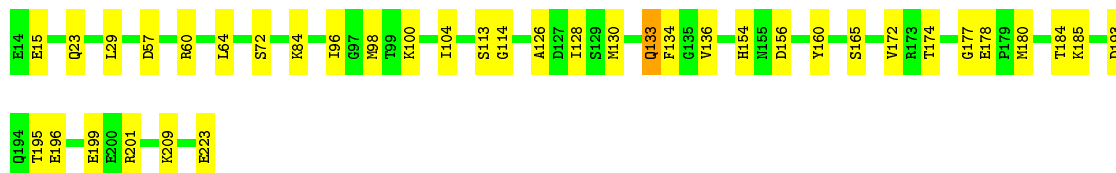
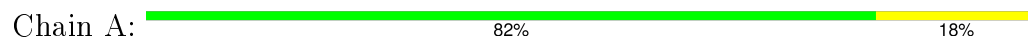
- Molecule 2: Hsp90 co-chaperone Cdc37

Chain B: 78% 14% 8%

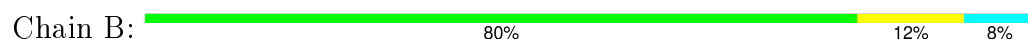


#### 4.2.7 Score per residue for model 7

- Molecule 1: Heat shock protein HSP 90-alpha

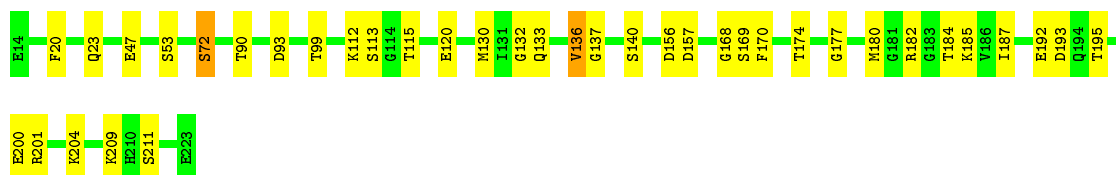
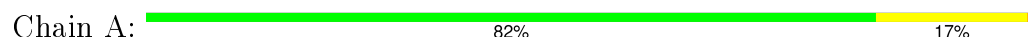


- Molecule 2: Hsp90 co-chaperone Cdc37



#### 4.2.8 Score per residue for model 8

- Molecule 1: Heat shock protein HSP 90-alpha

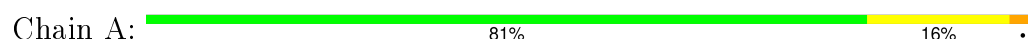


- Molecule 2: Hsp90 co-chaperone Cdc37

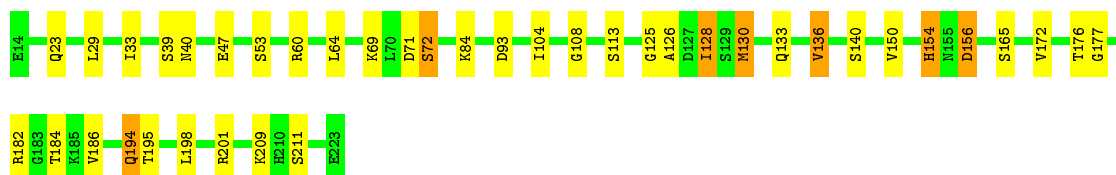


#### 4.2.9 Score per residue for model 9

- Molecule 1: Heat shock protein HSP 90-alpha







- Molecule 2: Hsp90 co-chaperone Cdc37

Chain B: 79% 13% 8%



#### 4.2.10 Score per residue for model 10

- Molecule 1: Heat shock protein HSP 90-alpha

Chain A: 77% 22% 1%



- Molecule 2: Hsp90 co-chaperone Cdc37

Chain B: 76% 14% 8%



## 5 Refinement protocol and experimental data overview

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

Of the 200 calculated structures, 10 were deposited, based on the following criterion: *structures with the best HADDOCK scoring*.

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

Software name	Classification	Version
CNS	structure solution	1.1
CNS	refinement	1.1
HADDOCK	geometry optimization	2.0
HADDOCK	refinement	2.0
HADDOCK	structure solution	2.0

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 ⓘ

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	1655	1655	1648	9±3
2	B	995	1007	1004	5±2
All	All	26500	26620	26520	132

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:104:ILE:HG12	1:A:172:VAL:HG21	0.70	1.62	5	6
1:A:133:GLN:NE2	2:B:170:ASP:HB3	0.58	2.14	1	1
1:A:114:GLY:HA3	1:A:134:PHE:O	0.58	1.99	5	5
2:B:228:VAL:HB	2:B:233:CYS:SG	0.57	2.39	7	3
1:A:133:GLN:O	2:B:166:ARG:HB3	0.57	2.00	4	7
1:A:180:MET:SD	1:A:185:LYS:HE2	0.57	2.40	3	3
1:A:47:GLU:OE1	1:A:132:GLY:HA3	0.55	2.02	1	3
2:B:194:CYS:SG	2:B:209:VAL:HB	0.55	2.41	1	2
2:B:160:LYS:HE3	2:B:189:TYR:OH	0.55	2.02	7	1
1:A:126:ALA:HA	2:B:164:MET:SD	0.55	2.41	6	1
2:B:222:LEU:O	2:B:226:LEU:HG	0.54	2.01	8	1
1:A:20:PHE:HB2	1:A:170:PHE:CZ	0.54	2.38	8	4
1:A:126:ALA:HB1	1:A:130:MET:SD	0.54	2.42	10	2

*Continued on next page...*

*Continued from previous page...*

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
2:B:186:THR:O	2:B:190:LEU:HG	0.53	2.04	2	1
1:A:99:THR:HB	1:A:157:ASP:OD2	0.52	2.04	4	3
2:B:256:LEU:O	2:B:260:LYS:HG3	0.52	2.04	8	3
1:A:60:ARG:O	1:A:64:LEU:HG	0.51	2.05	7	3
2:B:238:PHE:O	2:B:241:ILE:HG22	0.51	2.05	7	3
1:A:126:ALA:HB1	1:A:130:MET:HG3	0.51	1.82	9	1
1:A:63:THR:HA	1:A:66:ASP:O	0.51	2.06	4	2
1:A:112:LYS:HB2	1:A:115:THR:OG1	0.50	2.07	8	2
1:A:132:GLY:HA2	1:A:137:GLY:CA	0.50	2.36	10	3
1:A:59:ILE:HD13	1:A:96:ILE:HB	0.50	1.83	10	1
1:A:56:LEU:O	1:A:59:ILE:HG22	0.50	2.07	6	1
2:B:216:MET:O	2:B:220:LEU:HG	0.50	2.06	8	2
1:A:128:ILE:O	1:A:131:ILE:HG22	0.50	2.06	10	1
2:B:240:LYS:HA	2:B:243:THR:OG1	0.50	2.07	1	1
2:B:268:LYS:O	2:B:272:GLU:HB2	0.49	2.06	6	1
2:B:205:LEU:O	2:B:209:VAL:HG23	0.49	2.07	6	5
1:A:72:SER:HB2	1:A:182:ARG:HB2	0.49	1.85	9	2
1:A:29:LEU:O	1:A:33:ILE:HG12	0.48	2.09	2	4
2:B:166:ARG:HD3	2:B:208:GLN:OE1	0.47	2.10	8	1
1:A:84:LYS:HD2	1:A:223:GLU:OE2	0.47	2.09	5	1
1:A:200:GLU:O	1:A:204:LYS:HG3	0.47	2.10	8	1
2:B:162:PHE:O	2:B:165:LEU:HD12	0.47	2.09	8	1
2:B:258:ALA:O	2:B:262:ARG:HG3	0.46	2.10	8	2
1:A:100:LYS:HB2	1:A:160:TYR:CD2	0.46	2.46	4	1
1:A:43:ILE:O	1:A:47:GLU:HG2	0.45	2.10	6	3
2:B:165:LEU:HB2	2:B:212:GLN:NE2	0.45	2.26	1	2
2:B:229:ASP:OD2	2:B:231:ARG:HD2	0.45	2.12	5	1
1:A:63:THR:HG22	1:A:69:LYS:HB2	0.44	1.89	3	1
2:B:166:ARG:HD2	2:B:208:GLN:OE1	0.44	2.12	4	1
1:A:194:GLN:HA	1:A:194:GLN:HE21	0.44	1.73	9	1
2:B:188:ASN:O	2:B:192:ILE:HG12	0.44	2.13	5	2
2:B:260:LYS:O	2:B:264:ARG:HD2	0.44	2.13	1	1
1:A:146:GLU:HG3	1:A:189:HIS:O	0.44	2.12	1	1
1:A:82:PRO:HD2	1:A:221:PHE:O	0.44	2.12	4	1
2:B:215:VAL:HG13	2:B:237:PHE:CE2	0.44	2.47	10	1
1:A:24:ALA:O	1:A:28:GLN:HG3	0.43	2.13	3	1
2:B:233:CYS:HA	2:B:236:GLN:OE1	0.43	2.13	10	1
1:A:34:ILE:HD11	1:A:142:TYR:CD1	0.43	2.48	4	1
1:A:130:MET:HA	1:A:133:GLN:CD	0.43	2.34	7	1
2:B:262:ARG:O	2:B:266:ARG:HG2	0.43	2.13	2	1
1:A:96:ILE:O	1:A:154:HIS:HA	0.42	2.14	7	1

*Continued on next page...*

Continued from previous page...

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:84:LYS:HA	1:A:198:LEU:HD13	0.42	1.91	9	1
1:A:203:ILE:O	1:A:207:VAL:HG23	0.42	2.14	10	2
1:A:133:GLN:OE1	2:B:165:LEU:HB3	0.42	2.15	10	1
1:A:154:HIS:HD2	1:A:156:ASP:OD1	0.42	1.98	9	1
1:A:199:GLU:O	1:A:203:ILE:HG13	0.42	2.15	4	1
1:A:79:ASN:ND2	1:A:219:THR:HB	0.42	2.30	2	1
1:A:150:VAL:HG22	1:A:186:VAL:HG13	0.42	1.92	9	1
1:A:40:ASN:O	1:A:128:ILE:HD13	0.42	2.15	9	1
1:A:78:ILE:O	1:A:218:ILE:HA	0.42	2.15	5	2
1:A:200:GLU:CD	1:A:200:GLU:H	0.41	2.19	8	1
1:A:84:LYS:HE3	1:A:199:GLU:OE2	0.41	2.15	7	1
1:A:100:LYS:HE3	1:A:160:TYR:CE1	0.41	2.51	10	1
1:A:98:MET:O	1:A:154:HIS:HB2	0.41	2.15	7	1
1:A:133:GLN:HA	2:B:167:ARG:CG	0.41	2.46	10	1
2:B:260:LYS:O	2:B:264:ARG:HG3	0.41	2.16	8	1
1:A:90:THR:HA	1:A:186:VAL:O	0.41	2.16	10	1
1:A:44:PHE:CZ	1:A:45:LEU:HG	0.41	2.50	4	1
1:A:100:LYS:HB2	1:A:160:TYR:CE2	0.40	2.51	7	1
1:A:22:PHE:CD1	1:A:108:GLY:HA2	0.40	2.51	4	2
2:B:163:GLY:O	2:B:212:GLN:HG3	0.40	2.17	4	1
1:A:120:GLU:HA	1:A:120:GLU:OE1	0.40	2.16	2	1
1:A:133:GLN:NE2	2:B:165:LEU:HD22	0.40	2.31	1	1
2:B:259:PHE:O	2:B:263:VAL:HG23	0.40	2.16	10	1

## 6.3 Torsion angles ⓘ

### 6.3.1 Protein backbone ⓘ

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	208/210 (99%)	180±3 (87±1%)	25±3 (12±1%)	3±1 (2±0%)	17	61
2	B	118/129 (91%)	109±1 (92±1%)	9±2 (7±1%)	1±0 (1±0%)	34	78
All	All	3260/3390 (96%)	2887 (89%)	333 (10%)	40 (1%)	21	68

All 9 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	177	GLY	10
1	A	136	VAL	8
2	B	166	ARG	7
1	A	168	GLY	4
1	A	209	LYS	4
1	A	125	GLY	2
1	A	108	GLY	2
1	A	196	GLU	2
1	A	146	GLU	1

### 6.3.2 Protein sidechains ⓘ

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	181/181 (100%)	159±3 (88±2%)	22±3 (12±2%)	10	52
2	B	107/117 (91%)	98±2 (91±2%)	9±2 (9±2%)	17	62
All	All	2880/2980 (97%)	2566 (89%)	314 (11%)	12	56

All 107 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	201	ARG	10
1	A	23	GLN	10
1	A	184	THR	10
1	A	93	ASP	9
1	A	140	SER	9
2	B	186	THR	9
1	A	176	THR	8
1	A	136	VAL	8
1	A	113	SER	8
1	A	53	SER	8
2	B	218	PHE	7
2	B	236	GLN	7
1	A	156	ASP	7
1	A	165	SER	7
1	A	195	THR	6
1	A	72	SER	6

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	Models (Total)
1	A	130	MET	6
2	B	203	CYS	6
1	A	128	ILE	6
1	A	65	THR	6
1	A	174	THR	6
1	A	178	GLU	5
1	A	164	SER	4
1	A	57	ASP	4
2	B	167	ARG	4
1	A	211	SER	4
2	B	243	THR	4
2	B	196	ASP	4
1	A	39	SER	4
1	A	223	GLU	4
1	A	193	ASP	3
1	A	47	GLU	3
2	B	169	ASP	3
1	A	88	THR	3
1	A	71	ASP	3
2	B	172	GLN	3
2	B	276	LYS	3
2	B	170	ASP	3
1	A	194	GLN	3
2	B	256	LEU	2
2	B	171	SER	2
1	A	63	THR	2
2	B	228	VAL	2
1	A	61	TYR	2
1	A	143	LEU	2
2	B	177	ASP	2
2	B	255	GLU	2
2	B	272	GLU	2
1	A	94	THR	2
2	B	246	ARG	2
2	B	200	GLU	2
1	A	19	THR	2
1	A	29	LEU	2
2	B	188	ASN	2
1	A	220	LEU	2
1	A	146	GLU	2
2	B	184	GLU	2
2	B	245	ASP	2

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	Models (Total)
2	B	240	LYS	2
1	A	192	GLU	2
1	A	32	LEU	2
1	A	138	PHE	2
1	A	154	HIS	1
1	A	209	LYS	1
1	A	219	THR	1
2	B	185	GLU	1
1	A	133	GLN	1
1	A	151	ILE	1
1	A	187	ILE	1
1	A	173	ARG	1
1	A	120	GLU	1
1	A	75	GLU	1
1	A	127	ASP	1
2	B	178	ASN	1
2	B	193	TRP	1
2	B	165	LEU	1
2	B	231	ARG	1
1	A	62	GLU	1
1	A	107	LEU	1
2	B	239	THR	1
1	A	25	GLU	1
1	A	90	THR	1
2	B	264	ARG	1
1	A	28	GLN	1
1	A	196	GLU	1
2	B	179	VAL	1
1	A	169	SER	1
1	A	38	TYR	1
2	B	250	GLU	1
2	B	183	CYS	1
1	A	14	GLU	1
1	A	18	GLU	1
2	B	161	HIS	1
1	A	171	THR	1
1	A	69	LYS	1
2	B	213	THR	1
1	A	54	ASP	1
2	B	168	TRP	1
2	B	269	LEU	1
2	B	227	LYS	1

*Continued on next page...*



*Continued from previous page...*

Mol	Chain	Res	Type	Models (Total)
1	A	163	GLU	1
2	B	225	SER	1
1	A	42	GLU	1
2	B	229	ASP	1
1	A	15	GLU	1
1	A	58	LYS	1
1	A	222	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](#)

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

No chemical shift data were provided