



Full wwPDB NMR Structure Validation Report ⓘ

Apr 26, 2016 – 02:06 PM BST

PDB ID : 1B10
Title : SOLUTION NMR STRUCTURE OF RECOMBINANT SYRIAN HAMSTER PRION PROTEIN RPRP(90-231) , 25 STRUCTURES
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Deposited on : 1998-11-25

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
<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

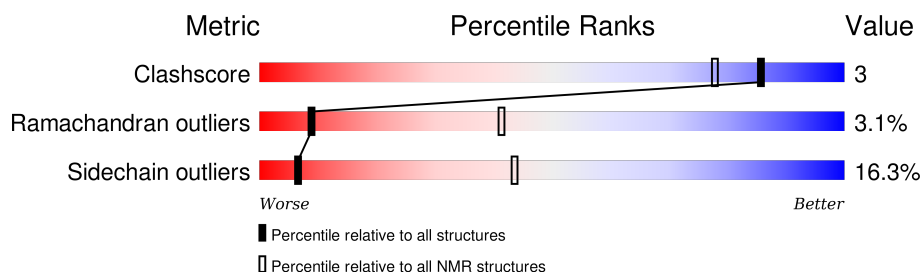
1 Overall quality at a glance

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 ≥ 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	142	 52% 18% • • 27%

2 Ensemble composition and analysis ⓘ

This entry contains 25 models. Model 25 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative.

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:127-A:226 (100)	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 2 clusters and 1 single-model cluster was found.

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

3 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 1675 atoms, of which 805 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called PROTEIN (PRION PROTEIN).

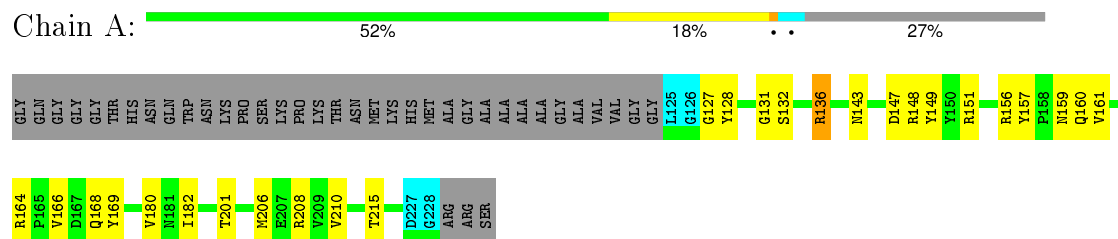
Mol	Chain	Residues	Atoms						Trace
1	A	104	Total	C	H	N	O	S	0
			1675	539	805	151	171	9	

4 Residue-property plots

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: PROTEIN (PRION PROTEIN)

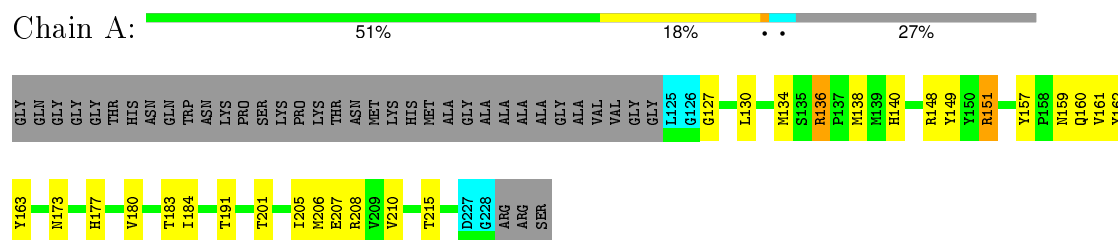


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

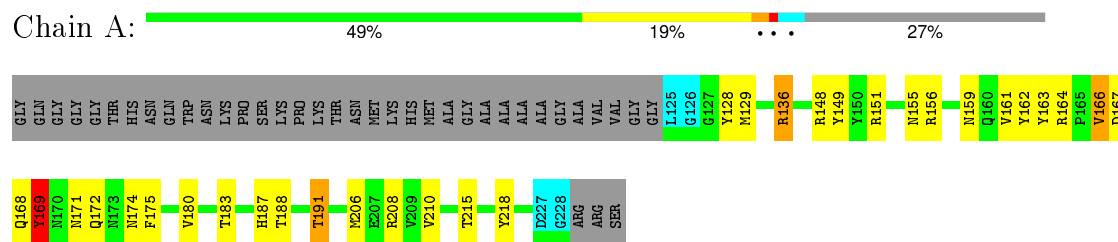
- Molecule 1: PROTEIN (PRION PROTEIN)



4.2.2 Score per residue for model 2

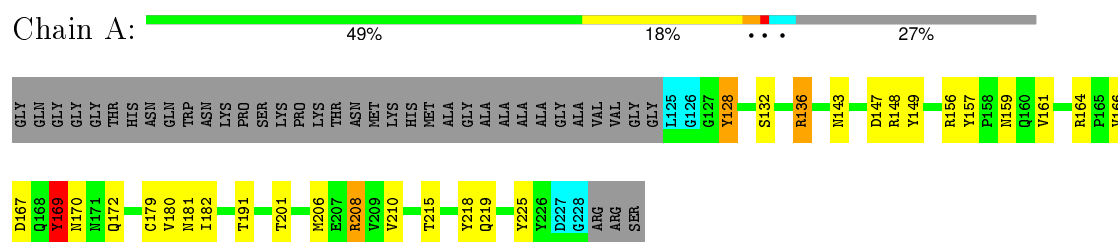
- Molecule 1: PROTEIN (PRION PROTEIN)





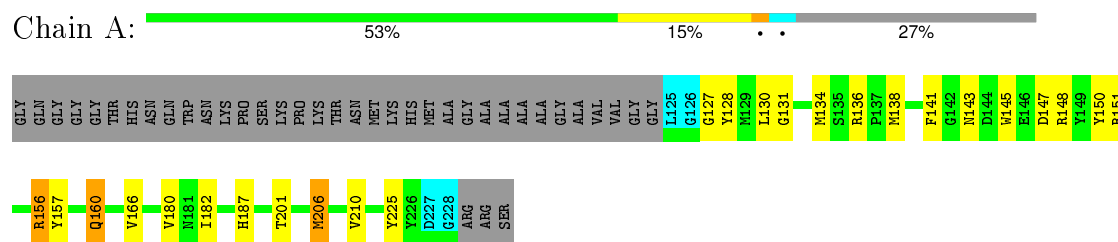
4.2.7 Score per residue for model 7

- Molecule 1: PROTEIN (PRION PROTEIN)



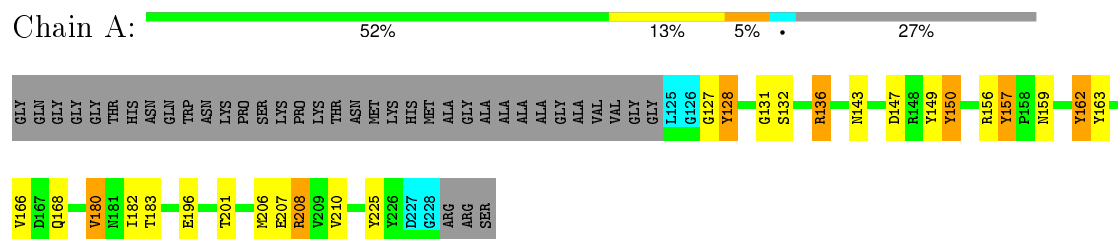
4.2.8 Score per residue for model 8

- Molecule 1: PROTEIN (PRION PROTEIN)



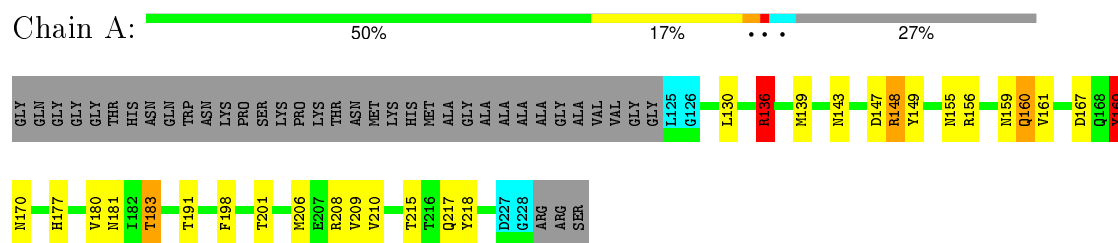
4.2.9 Score per residue for model 9

- Molecule 1: PROTEIN (PRION PROTEIN)



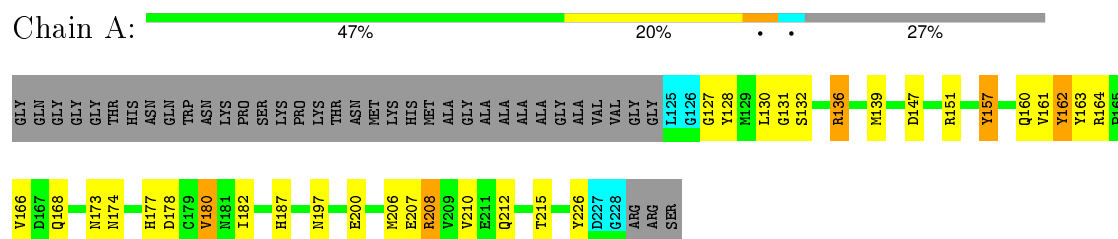
4.2.10 Score per residue for model 10

- Molecule 1: PROTEIN (PRION PROTEIN)



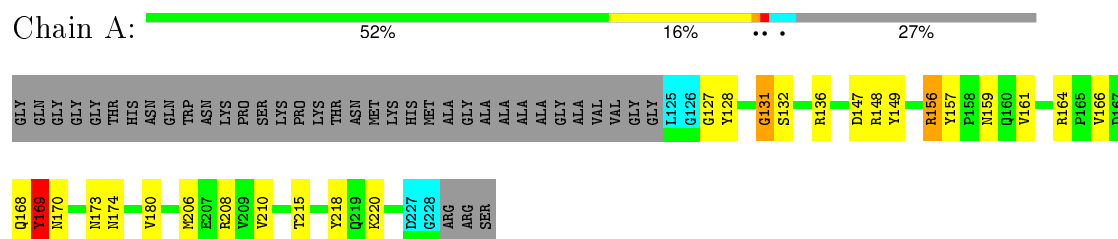
4.2.11 Score per residue for model 11

- Molecule 1: PROTEIN (PRION PROTEIN)



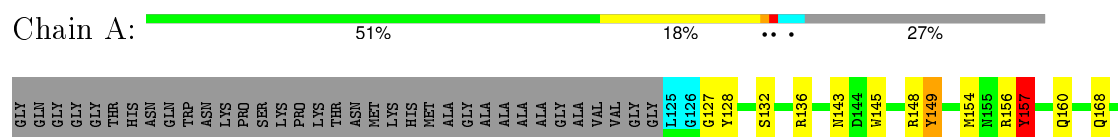
4.2.12 Score per residue for model 12

- Molecule 1: PROTEIN (PRION PROTEIN)



4.2.13 Score per residue for model 13

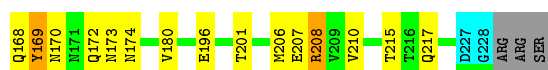
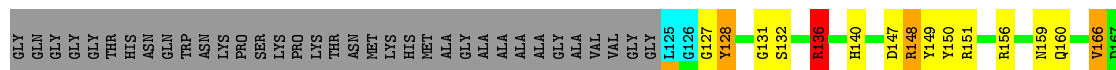
- Molecule 1: PROTEIN (PRION PROTEIN)





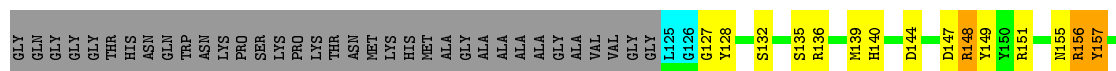
4.2.14 Score per residue for model 14

- Molecule 1: PROTEIN (PRION PROTEIN)



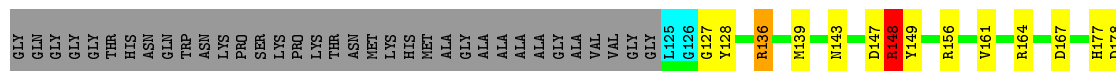
4.2.15 Score per residue for model 15

- Molecule 1: PROTEIN (PRION PROTEIN)



4.2.16 Score per residue for model 16

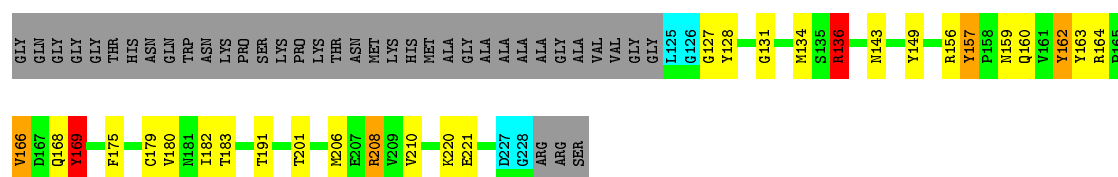
- Molecule 1: PROTEIN (PRION PROTEIN)



4.2.17 Score per residue for model 17

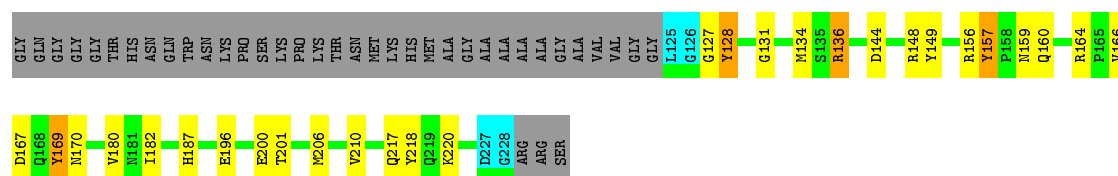
- Molecule 1: PROTEIN (PRION PROTEIN)





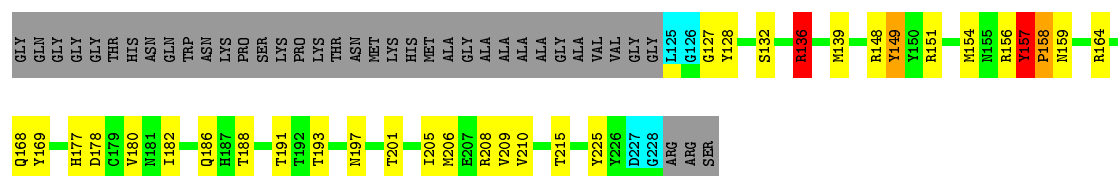
4.2.18 Score per residue for model 18

- Molecule 1: PROTEIN (PRION PROTEIN)



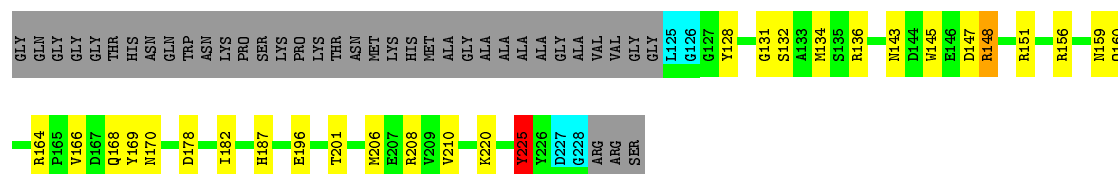
4.2.19 Score per residue for model 19

- Molecule 1: PROTEIN (PRION PROTEIN)



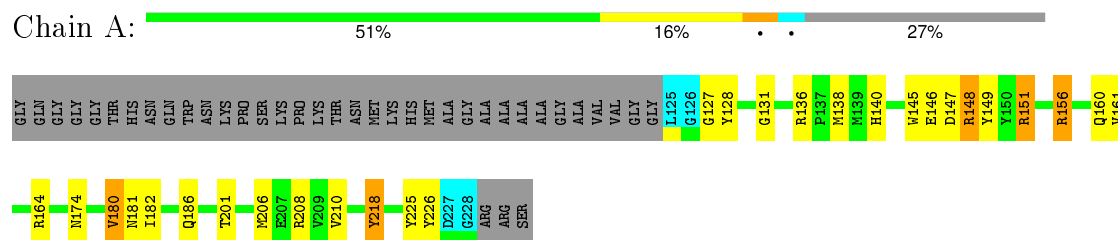
4.2.20 Score per residue for model 20

- Molecule 1: PROTEIN (PRION PROTEIN)



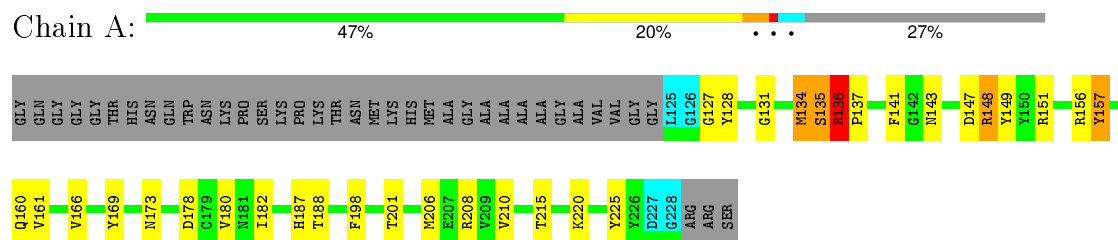
4.2.21 Score per residue for model 21

- Molecule 1: PROTEIN (PRION PROTEIN)



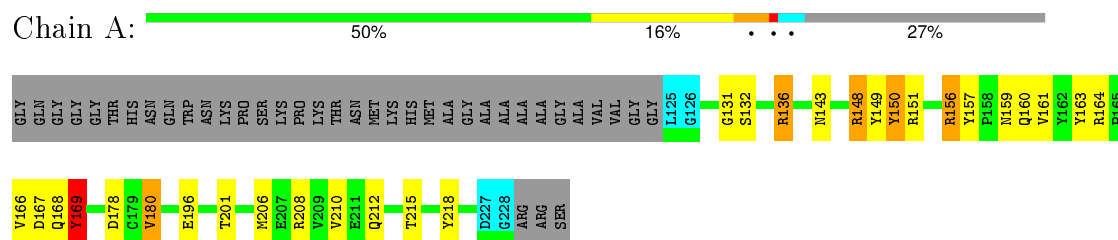
4.2.22 Score per residue for model 22

- Molecule 1: PROTEIN (PRION PROTEIN)



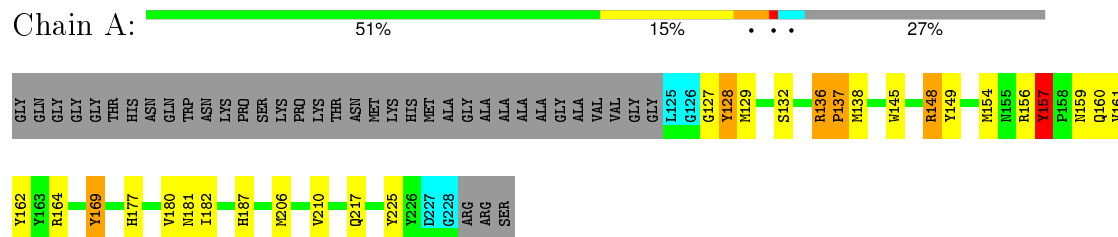
4.2.23 Score per residue for model 23

- Molecule 1: PROTEIN (PRION PROTEIN)



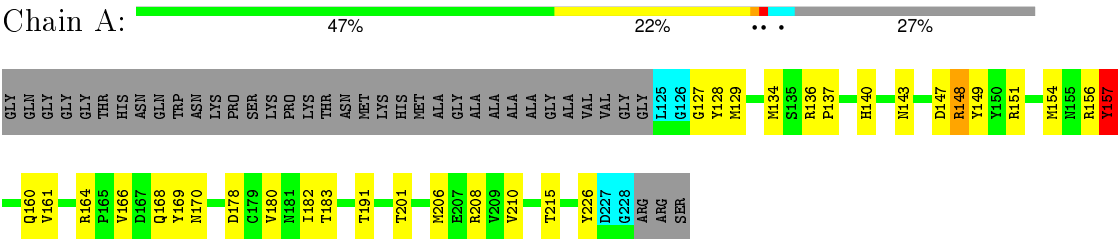
4.2.24 Score per residue for model 24

- Molecule 1: PROTEIN (PRION PROTEIN)



4.2.25 Score per residue for model 25 (medoid)

● Molecule 1: PROTEIN (PRION PROTEIN)



5 Refinement protocol and experimental data overview

The models were refined using the following method: *NMR-RESTRAINED SIMULATED ANNEALING, MOLECULAR DYNAMICS, AND ENERGY MINIMIZATION..*

Of the 100 calculated structures, 25 were deposited, based on the following criterion: *TOTAL ENERGY*.

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

Software name	Classification	Version
ARIA	refinement	
XPLOR	refinement	
AMBER4.1	refinement	
ARIA	structure solution	
XPLOR	structure solution	
AMBER	structure solution	

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 i

6.1 Standard geometry i

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	0.70±0.01	0±0/867 (0.0±0.0%)	1.28±0.04	8±2/1174 (0.7±0.2%)
All	All	0.70	0/21675 (0.0%)	1.28	207/29350 (0.7%)

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	2.2±1.4
All	All	0	55

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(°)	Ideal(°)	Models	
								Worst	Total
1	A	164	ARG	NE-CZ-NH1	10.31	125.45	120.30	4	16
1	A	151	ARG	NE-CZ-NH1	10.15	125.38	120.30	23	14
1	A	156	ARG	NE-CZ-NH1	9.73	125.17	120.30	16	14
1	A	136	ARG	NE-CZ-NH2	-9.45	115.58	120.30	13	6
1	A	151	ARG	NE-CZ-NH2	-9.38	115.61	120.30	1	4
1	A	169	TYR	CB-CG-CD2	-9.04	115.58	121.00	17	7
1	A	148	ARG	NE-CZ-NH1	8.85	124.72	120.30	3	12
1	A	136	ARG	NE-CZ-NH1	8.84	124.72	120.30	23	18
1	A	208	ARG	NE-CZ-NH2	-8.56	116.02	120.30	15	9
1	A	169	TYR	CB-CG-CD1	8.35	126.01	121.00	17	3
1	A	208	ARG	NE-CZ-NH1	8.33	124.47	120.30	22	12
1	A	156	ARG	NE-CZ-NH2	-8.24	116.18	120.30	16	8
1	A	157	TYR	CB-CG-CD2	-7.71	116.37	121.00	19	10
1	A	148	ARG	NE-CZ-NH2	-7.49	116.56	120.30	10	5
1	A	218	TYR	CB-CG-CD2	-7.35	116.59	121.00	21	1

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	225	TYR	CB-CG-CD2	-7.10	116.74	121.00	20	1
1	A	128	TYR	CB-CG-CD2	-6.96	116.83	121.00	14	2
1	A	156	ARG	CD-NE-CZ	6.92	133.28	123.60	16	4
1	A	157	TYR	CA-CB-CG	6.85	126.41	113.40	24	10
1	A	147	ASP	CB-CG-OD1	6.71	124.33	118.30	12	1
1	A	164	ARG	NE-CZ-NH2	-6.65	116.97	120.30	5	2
1	A	180	VAL	CA-CB-CG2	6.45	120.57	110.90	13	19
1	A	164	ARG	CD-NE-CZ	6.24	132.33	123.60	4	1
1	A	150	TYR	CB-CG-CD2	-6.12	117.33	121.00	23	4
1	A	149	TYR	CB-CG-CD1	-5.96	117.42	121.00	13	1
1	A	157	TYR	CB-CG-CD1	5.70	124.42	121.00	24	2
1	A	136	ARG	CD-NE-CZ	5.57	131.40	123.60	5	2
1	A	128	TYR	CB-CG-CD1	5.53	124.32	121.00	14	1
1	A	162	TYR	CB-CG-CD1	-5.38	117.77	121.00	11	1
1	A	225	TYR	CB-CG-CD1	-5.32	117.81	121.00	22	3
1	A	131	GLY	C-N-CA	5.31	134.98	121.70	12	1
1	A	183	THR	CA-CB-CG2	5.31	119.83	112.40	10	3
1	A	180	VAL	CA-CB-CG1	5.27	118.81	110.90	23	1
1	A	157	TYR	N-CA-CB	-5.26	101.13	110.60	18	1
1	A	158	PRO	N-CA-CB	5.25	109.60	103.30	19	1
1	A	169	TYR	CB-CA-C	5.24	120.88	110.40	6	1
1	A	149	TYR	CB-CG-CD2	-5.15	117.91	121.00	22	1
1	A	166	VAL	C-N-CA	5.05	134.32	121.70	6	1
1	A	208	ARG	CD-NE-CZ	5.04	130.66	123.60	9	1
1	A	134	MET	C-N-CA	5.03	134.28	121.70	22	1
1	A	163	TYR	CB-CG-CD2	-5.03	117.98	121.00	15	1
1	A	135	SER	C-N-CA	5.02	134.24	121.70	22	1

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	169	TYR	Sidechain	7
1	A	218	TYR	Sidechain	7
1	A	226	TYR	Sidechain	5
1	A	225	TYR	Sidechain	5
1	A	208	ARG	Sidechain	4
1	A	128	TYR	Sidechain	4
1	A	157	TYR	Sidechain	4
1	A	148	ARG	Sidechain	3

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Mol	Chain	Res	Type	Group	Models (Total)
1	A	163	TYR	Sidechain	3
1	A	150	TYR	Sidechain	2
1	A	151	ARG	Sidechain	2
1	A	156	ARG	Sidechain	2
1	A	149	TYR	Sidechain	2
1	A	162	TYR	Sidechain	2
1	A	141	PHE	Sidechain	2
1	A	175	PHE	Sidechain	1

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	846	784	781	4±2
All	All	21150	19600	19525	108

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 3.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:162:TYR:CD2	1:A:182:ILE:HG22	0.79	2.13	9	2
1:A:180:VAL:HG23	1:A:210:VAL:HG13	0.72	1.59	23	1
1:A:128:TYR:CD2	1:A:182:ILE:HG21	0.67	2.25	2	13
1:A:206:MET:O	1:A:210:VAL:HG12	0.63	1.94	1	23
1:A:166:VAL:HG22	1:A:169:TYR:CD2	0.58	2.33	17	1
1:A:180:VAL:HG12	1:A:210:VAL:HG13	0.54	1.78	7	9
1:A:130:LEU:HD11	1:A:160:GLN:HB2	0.53	1.80	11	4
1:A:128:TYR:CD1	1:A:182:ILE:HG21	0.52	2.40	25	3
1:A:180:VAL:CG2	1:A:210:VAL:HG13	0.52	2.34	23	1
1:A:130:LEU:HD13	1:A:162:TYR:CE1	0.51	2.40	1	2
1:A:162:TYR:CG	1:A:182:ILE:CG2	0.51	2.94	9	2
1:A:166:VAL:HG23	1:A:175:PHE:CZ	0.51	2.40	17	1
1:A:130:LEU:HD13	1:A:162:TYR:CD1	0.50	2.41	1	1
1:A:162:TYR:CD2	1:A:182:ILE:CG2	0.48	2.96	17	2
1:A:206:MET:O	1:A:210:VAL:HG23	0.47	2.09	10	2

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:154:MET:HA	1:A:157:TYR:CG	0.47	2.45	24	4
1:A:162:TYR:CD2	1:A:179:CYS:HA	0.47	2.45	17	1
1:A:139:MET:SD	1:A:209:VAL:HG22	0.47	2.50	2	3
1:A:162:TYR:CD1	1:A:163:TYR:N	0.47	2.83	9	2
1:A:205:ILE:O	1:A:209:VAL:HG23	0.45	2.11	19	2
1:A:130:LEU:HD11	1:A:160:GLN:CB	0.45	2.40	1	1
1:A:188:THR:HA	1:A:191:THR:HG22	0.45	1.88	6	2
1:A:206:MET:C	1:A:210:VAL:HG12	0.44	2.33	23	1
1:A:158:PRO:HD2	1:A:206:MET:HG2	0.44	1.90	19	1
1:A:162:TYR:CG	1:A:182:ILE:HG22	0.44	2.48	9	1
1:A:180:VAL:CG1	1:A:210:VAL:HG13	0.43	2.43	7	4
1:A:172:GLN:HE22	1:A:219:GLN:HE21	0.43	1.56	7	1
1:A:161:VAL:HG23	1:A:179:CYS:SG	0.43	2.54	7	1
1:A:157:TYR:CE2	1:A:205:ILE:HG21	0.42	2.49	1	1
1:A:166:VAL:O	1:A:169:TYR:CD1	0.42	2.72	23	1
1:A:128:TYR:CG	1:A:182:ILE:HG21	0.42	2.50	11	1
1:A:136:ARG:H	1:A:137:PRO:HD2	0.42	1.73	22	1
1:A:198:PHE:CD2	1:A:202:ASP:HB3	0.42	2.50	15	1
1:A:198:PHE:CZ	1:A:203:ILE:HD11	0.42	2.50	3	1
1:A:191:THR:HG21	1:A:198:PHE:CE2	0.41	2.50	10	1
1:A:166:VAL:HG22	1:A:169:TYR:CZ	0.41	2.50	14	1
1:A:183:THR:HG21	1:A:210:VAL:HG21	0.41	1.93	15	2
1:A:203:ILE:HD13	1:A:206:MET:CE	0.41	2.45	2	1
1:A:198:PHE:CD2	1:A:203:ILE:HD11	0.41	2.51	2	1
1:A:128:TYR:HB3	1:A:162:TYR:CD1	0.41	2.51	9	1
1:A:184:ILE:HD11	1:A:210:VAL:HG11	0.41	1.92	1	1
1:A:169:TYR:C	1:A:169:TYR:CD1	0.41	2.94	14	1
1:A:188:THR:HB	1:A:198:PHE:CE1	0.40	2.51	22	1
1:A:180:VAL:HG12	1:A:210:VAL:HG12	0.40	1.93	19	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	100/142 (70%)	84±3 (84±3%)	13±3 (13±3%)	3±1 (3±1%)	9	41

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	2500/3550 (70%)	2097 (84%)	326 (13%)	77 (3%)	9	41

All 15 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	127	GLY	19
1	A	131	GLY	12
1	A	136	ARG	11
1	A	207	GLU	5
1	A	140	HIS	5
1	A	132	SER	5
1	A	170	ASN	3
1	A	169	TYR	3
1	A	137	PRO	3
1	A	138	MET	3
1	A	139	MET	2
1	A	171	ASN	2
1	A	197	ASN	2
1	A	167	ASP	1
1	A	135	SER	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	94/120 (78%)	79±2 (84±2%)	15±2 (16±2%)	6	43
All	All	2350/3000 (78%)	1967 (84%)	383 (16%)	6	43

All 57 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	136	ARG	20
1	A	148	ARG	19
1	A	149	TYR	19
1	A	201	THR	17

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Mol	Chain	Res	Type	Models (Total)
1	A	215	THR	17
1	A	161	VAL	15
1	A	160	GLN	15
1	A	143	ASN	15
1	A	159	ASN	14
1	A	147	ASP	14
1	A	166	VAL	13
1	A	168	GLN	13
1	A	157	TYR	12
1	A	169	TYR	11
1	A	134	MET	9
1	A	178	ASP	9
1	A	156	ARG	9
1	A	187	HIS	9
1	A	191	THR	8
1	A	132	SER	8
1	A	220	LYS	7
1	A	173	ASN	7
1	A	177	HIS	7
1	A	196	GLU	7
1	A	208	ARG	6
1	A	217	GLN	6
1	A	183	THR	5
1	A	174	ASN	5
1	A	167	ASP	5
1	A	145	TRP	5
1	A	170	ASN	5
1	A	129	MET	4
1	A	212	GLN	4
1	A	181	ASN	4
1	A	155	ASN	4
1	A	225	TYR	3
1	A	150	TYR	3
1	A	128	TYR	3
1	A	162	TYR	2
1	A	135	SER	2
1	A	172	GLN	2
1	A	139	MET	2
1	A	140	HIS	2
1	A	144	ASP	2
1	A	137	PRO	2
1	A	200	GLU	2

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Mol	Chain	Res	Type	Models (Total)
1	A	163	TYR	1
1	A	206	MET	1
1	A	226	TYR	1
1	A	221	GLU	1
1	A	151	ARG	1
1	A	141	PHE	1
1	A	193	THR	1
1	A	138	MET	1
1	A	204	LYS	1
1	A	146	GLU	1
1	A	218	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 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