



Full wwPDB NMR Structure Validation Report ⓘ

Mar 5, 2026 – 03:59 AM UTC

PDB ID : 1X45 / pdb_00001x45
Title : Solution structure of the first PDZ domain of amyloid beta A4 precursor protein-binding family A, member 1
Authors : Qin, X.R.; Hayashi, F.; Yokoyama, S.; RIKEN Structural Genomics/Proteomics Initiative (RSGI)
Deposited on : 2005-05-13

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 ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

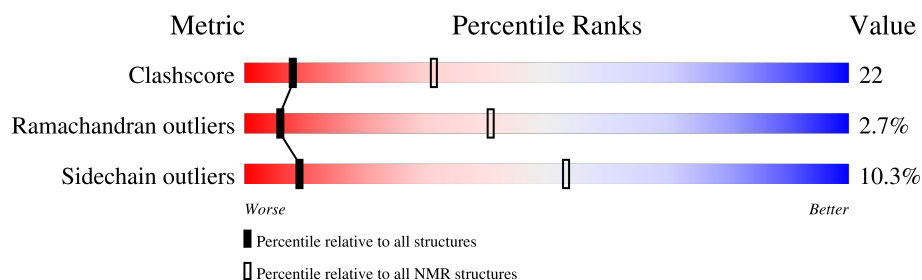
1 Overall quality at a glance

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	229148	14424
Ramachandran outliers	224038	12848
Sidechain outliers	223484	12823

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	98	

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:26, A:32-A:94 (83)	0.23	6

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 3 clusters. No single-model clusters were found.

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

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 1427 atoms, of which 731 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called amyloid beta (A4) precursor protein-binding, family A, member 1 (X11).

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	98	1427	435	731	120	137	4	0

There are 13 discrepancies between the modelled and reference sequences:

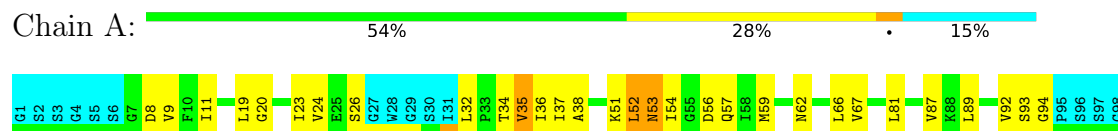
Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	cloning artifact	UNP Q02410
A	2	SER	-	cloning artifact	UNP Q02410
A	3	SER	-	cloning artifact	UNP Q02410
A	4	GLY	-	cloning artifact	UNP Q02410
A	5	SER	-	cloning artifact	UNP Q02410
A	6	SER	-	cloning artifact	UNP Q02410
A	7	GLY	-	cloning artifact	UNP Q02410
A	93	SER	-	cloning artifact	UNP Q02410
A	94	GLY	-	cloning artifact	UNP Q02410
A	95	PRO	-	cloning artifact	UNP Q02410
A	96	SER	-	cloning artifact	UNP Q02410
A	97	SER	-	cloning artifact	UNP Q02410
A	98	GLY	-	cloning artifact	UNP Q02410

4 Residue-property plots

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: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)

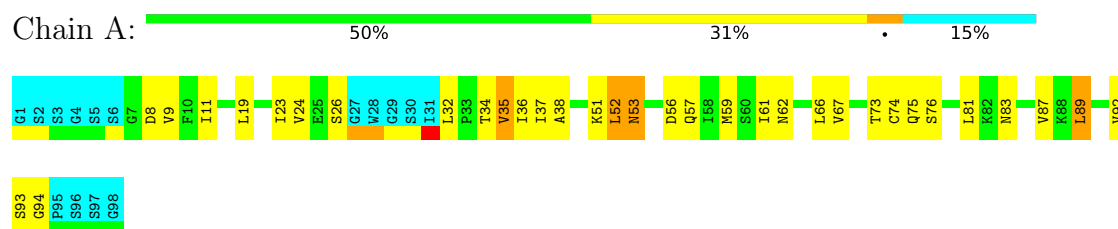


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

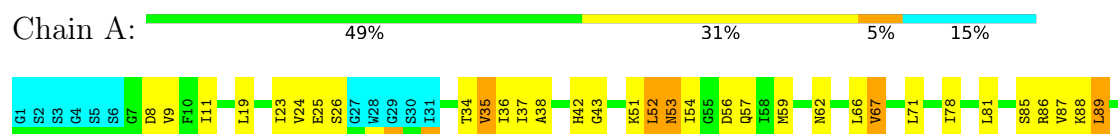
4.2.1 Score per residue for model 1

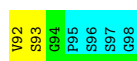
- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)



4.2.2 Score per residue for model 2

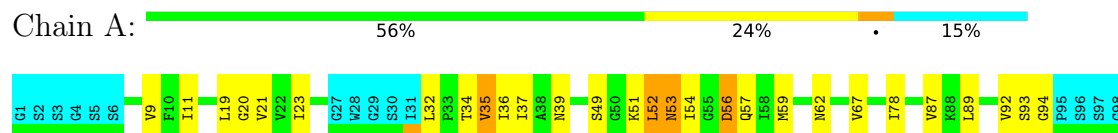
- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)





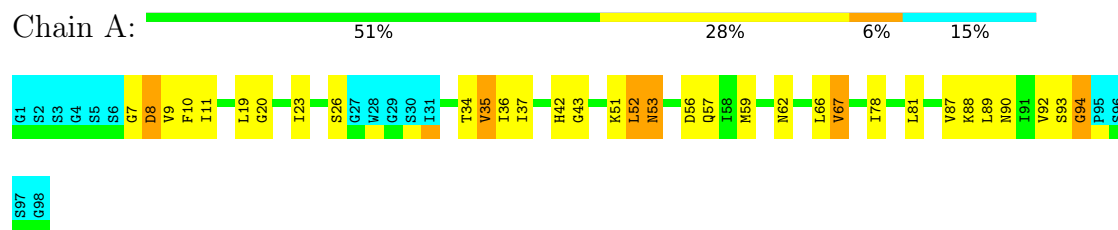
4.2.3 Score per residue for model 3

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)



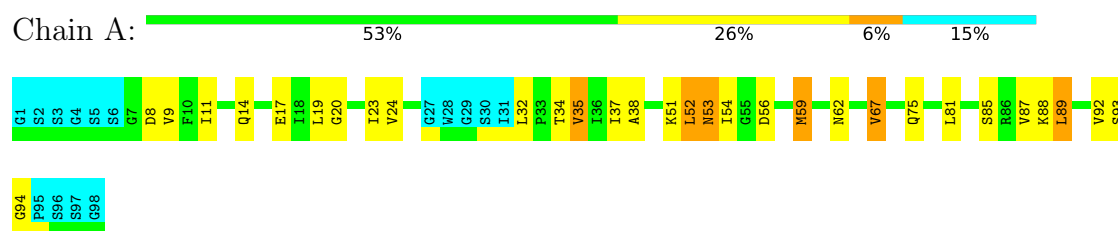
4.2.4 Score per residue for model 4

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)



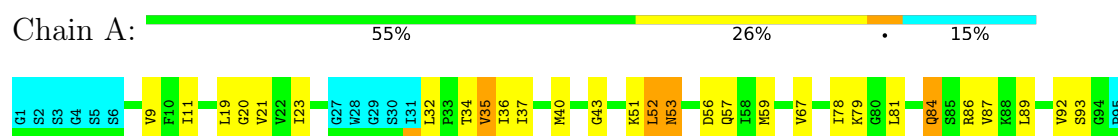
4.2.5 Score per residue for model 5

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)



4.2.6 Score per residue for model 6 (medoid)

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)



S96
S97
G98

4.2.7 Score per residue for model 7

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)

Chain A: 59% 22% 15%

G1 S2 S3 S4 S5 S6 V9 L19 L20 L23 V24 G27 W28 G29 S30 I31 T34 V35 I36 I37 A38 K51 L52 M53 I54 G55 D56 Q57 I58 M59 M62 C74 I77 V87 R88 L89 V92 S93 G94 P95 S96 S97 G98

4.2.8 Score per residue for model 8

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)

Chain A: 50% 32% 15%

G1 S2 S3 S4 S5 S6 V9 F10 I11 L19 L20 G20 I23 V24 E25 S26 G27 W28 G29 S30 I31 I32 I33 T34 V35 I36 I37 A38 M39 H42 K51 L52 M53 I54 S55 D56 Q57 I58 M59 M62 V67 L71 I77 I78 L81 V87 R88 L89 V92

S93 G94 P95 S96 S97 G98

4.2.9 Score per residue for model 9

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)

Chain A: 51% 30% 15%

G1 S2 S3 S4 S5 S6 V9 F10 I11 L19 L20 G20 I23 S26 G27 W28 G29 S30 I31 I32 I33 T34 V35 I36 I37 A38 M39 M40 K51 L52 M53 I54 G55 D56 Q57 I58 M59 M62 L66 V67 G68 L69 L81 K82 R86 V87 R88 L89 S93 G94 P95

S96
S97
G98

4.2.10 Score per residue for model 10

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)

Chain A: 51% 29% 5% 15%

G1 S2 S3 S4 S5 S6 G7 D8 V9 F10 I11 E12 K13 Q14 E17 I18 L19 G20 I23 V24 G27 W28 G29 S30 I31 I32 P33 T34 V35 I36 I37 A38 L52 M53 I54 G55 D56 Q57 I58 M59 V67 Q75 L81 Q84 S85 R86 V87 K88 L89 V92 S93



4.2.11 Score per residue for model 11

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)



4.2.12 Score per residue for model 12

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)



4.2.13 Score per residue for model 13

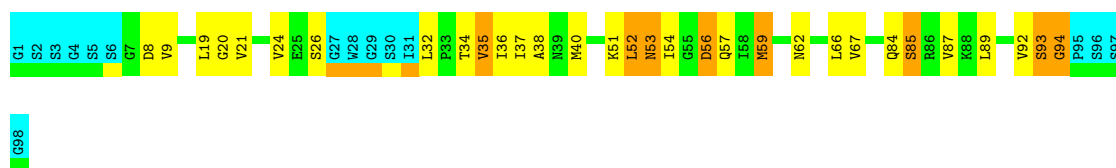
- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)



4.2.14 Score per residue for model 14

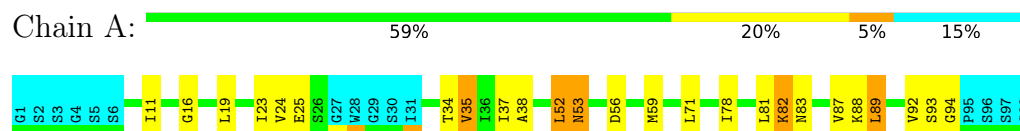
- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)





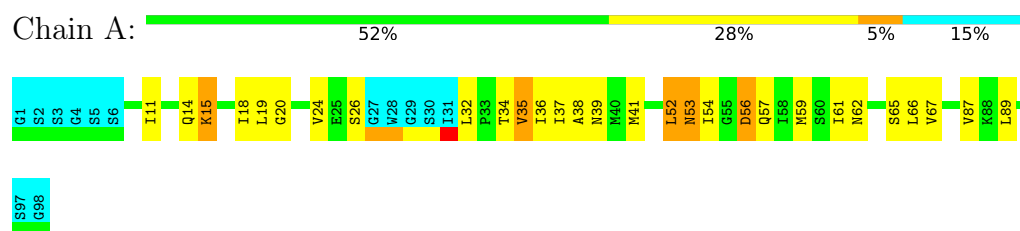
4.2.15 Score per residue for model 15

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)



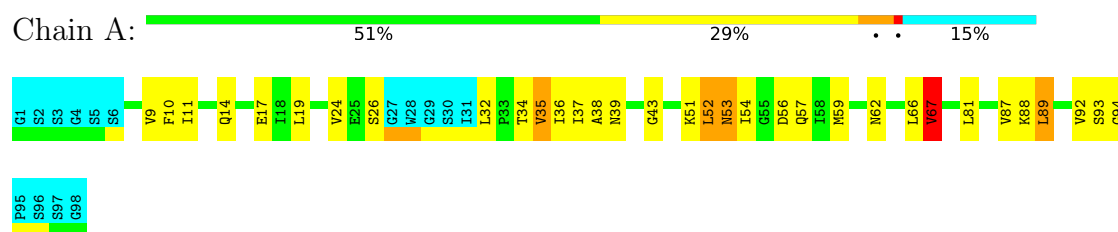
4.2.16 Score per residue for model 16

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)



4.2.17 Score per residue for model 17

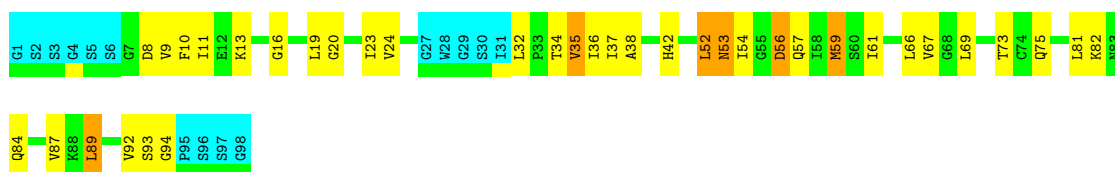
- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)



4.2.18 Score per residue for model 18

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)

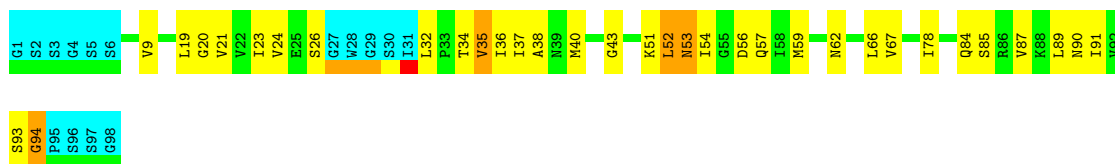




4.2.19 Score per residue for model 19

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)

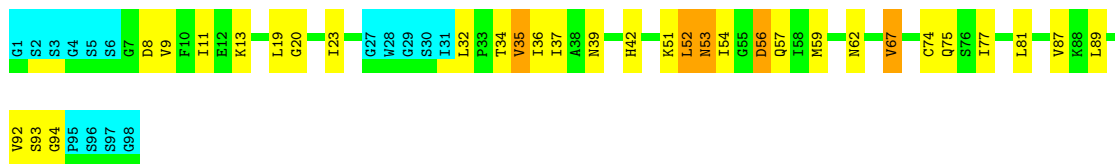
Chain A: 50% 31% 15%



4.2.20 Score per residue for model 20

- Molecule 1: amyloid beta (A4) precursor protein-binding, family A, member 1 (X11)

Chain A: 52% 28% 5% 15%



5 Refinement protocol and experimental data overview ⓘ

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

Of the 100 calculated structures, 20 were deposited, based on the following criterion: *target function, structures with the lowest energy, structures with the least restraint violations*.

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

Software name	Classification	Version
CYANA	structure solution	2.0.17
CYANA	refinement	2.0.17

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.

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 [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	605	653	652	28±3
All	All	12100	13060	13040	557

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 22.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:32:LEU:HD12	1:A:67:VAL:HG21	0.94	1.37	16	3
1:A:81:LEU:HD13	1:A:87:VAL:HG11	0.89	1.41	11	12
1:A:52:LEU:N	1:A:52:LEU:HD13	0.81	1.91	18	20
1:A:34:THR:O	1:A:35:VAL:HG13	0.81	1.75	15	20
1:A:37:ILE:HD12	1:A:56:ASP:O	0.78	1.78	15	20
1:A:11:ILE:HG21	1:A:19:LEU:HD11	0.78	1.55	18	12
1:A:25:GLU:CD	1:A:71:LEU:HD22	0.78	2.03	15	2
1:A:32:LEU:CD1	1:A:67:VAL:HG21	0.72	2.13	16	2
1:A:34:THR:HG22	1:A:67:VAL:CA	0.72	2.14	16	8
1:A:34:THR:HG22	1:A:67:VAL:HA	0.69	1.64	13	14
1:A:11:ILE:HG21	1:A:19:LEU:CD1	0.69	2.17	5	14
1:A:62:ASN:HD21	1:A:87:VAL:HG13	0.67	1.50	19	14
1:A:26:SER:OG	1:A:36:ILE:HG23	0.67	1.90	4	4
1:A:25:GLU:CG	1:A:71:LEU:HD22	0.64	2.23	15	2

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:61:ILE:HD12	1:A:66:LEU:HD21	0.62	1.72	1	4
1:A:24:VAL:HG22	1:A:38:ALA:HB2	0.62	1.70	14	6
1:A:25:GLU:HG3	1:A:71:LEU:HD22	0.61	1.72	15	2
1:A:23:ILE:HD13	1:A:78:ILE:CD1	0.61	2.26	6	6
1:A:62:ASN:ND2	1:A:87:VAL:HG13	0.60	2.11	3	12
1:A:52:LEU:HD13	1:A:52:LEU:H	0.60	1.57	19	13
1:A:52:LEU:C	1:A:53:ASN:ND2	0.60	2.60	16	20
1:A:53:ASN:ND2	1:A:53:ASN:N	0.59	2.50	3	20
1:A:36:ILE:HG22	1:A:57:GLN:CA	0.58	2.28	3	18
1:A:52:LEU:N	1:A:52:LEU:CD1	0.58	2.67	11	18
1:A:23:ILE:HD11	1:A:75:GLN:CG	0.58	2.29	1	8
1:A:9:VAL:HG13	1:A:51:LYS:HB3	0.58	1.76	9	13
1:A:24:VAL:CG2	1:A:38:ALA:HB2	0.58	2.29	14	5
1:A:37:ILE:HD12	1:A:37:ILE:H	0.57	1.59	2	20
1:A:9:VAL:HG13	1:A:51:LYS:CB	0.57	2.29	4	13
1:A:81:LEU:HB3	1:A:87:VAL:HG21	0.57	1.75	2	6
1:A:32:LEU:HD12	1:A:67:VAL:CG1	0.56	2.30	9	5
1:A:61:ILE:HG23	1:A:89:LEU:CD2	0.56	2.30	1	2
1:A:65:SER:OG	1:A:67:VAL:HG12	0.56	1.99	16	1
1:A:32:LEU:HD12	1:A:67:VAL:HG11	0.54	1.78	9	4
1:A:23:ILE:HD11	1:A:75:GLN:HG3	0.53	1.78	18	5
1:A:25:GLU:HG2	1:A:71:LEU:HD22	0.53	1.78	8	1
1:A:32:LEU:HD12	1:A:67:VAL:CG2	0.53	2.33	12	4
1:A:84:GLN:NE2	1:A:87:VAL:HG22	0.52	2.19	18	1
1:A:19:LEU:O	1:A:20:GLY:C	0.51	2.53	16	16
1:A:14:GLN:O	1:A:15:LYS:C	0.51	2.53	16	3
1:A:42:HIS:CG	1:A:42:HIS:O	0.51	2.64	2	3
1:A:93:SER:O	1:A:94:GLY:C	0.51	2.54	14	5
1:A:40:MET:CE	1:A:52:LEU:HD23	0.51	2.36	12	2
1:A:92:VAL:O	1:A:93:SER:C	0.50	2.55	3	17
1:A:18:ILE:HD11	1:A:41:MET:HE3	0.50	1.82	16	1
1:A:40:MET:HE2	1:A:52:LEU:HD23	0.50	1.83	12	1
1:A:11:ILE:HD11	1:A:52:LEU:HD11	0.49	1.84	1	5
1:A:8:ASP:OD1	1:A:8:ASP:C	0.49	2.55	4	1
1:A:14:GLN:N	1:A:14:GLN:CD	0.49	2.71	11	1
1:A:32:LEU:HG	1:A:59:MET:HE1	0.48	1.84	5	1
1:A:87:VAL:CG1	1:A:89:LEU:HD21	0.48	2.38	15	4
1:A:84:GLN:O	1:A:85:SER:C	0.48	2.57	14	2
1:A:21:VAL:HG22	1:A:37:ILE:HG23	0.48	1.84	19	3
1:A:24:VAL:CG1	1:A:38:ALA:HB2	0.48	2.39	15	3
1:A:7:GLY:O	1:A:90:ASN:ND2	0.47	2.47	4	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:32:LEU:CB	1:A:59:MET:HE1	0.47	2.39	16	1
1:A:66:LEU:O	1:A:67:VAL:C	0.47	2.57	17	7
1:A:69:LEU:HD22	1:A:73:THR:HG21	0.47	1.87	18	1
1:A:34:THR:O	1:A:35:VAL:CG1	0.47	2.58	15	20
1:A:23:ILE:HD12	1:A:35:VAL:HG11	0.47	1.87	18	5
1:A:13:LYS:CE	1:A:81:LEU:O	0.47	2.63	18	2
1:A:32:LEU:HD12	1:A:67:VAL:HG22	0.46	1.86	12	1
1:A:88:LYS:O	1:A:89:LEU:HD23	0.46	2.10	17	4
1:A:52:LEU:C	1:A:52:LEU:CD2	0.46	2.88	17	1
1:A:14:GLN:O	1:A:17:GLU:CG	0.46	2.63	10	3
1:A:42:HIS:O	1:A:42:HIS:CG	0.46	2.66	8	1
1:A:9:VAL:CG1	1:A:10:PHE:N	0.46	2.79	18	1
1:A:52:LEU:H	1:A:52:LEU:HD22	0.45	1.71	16	4
1:A:24:VAL:HG13	1:A:38:ALA:HB2	0.45	1.89	18	6
1:A:25:GLU:CD	1:A:71:LEU:CD2	0.45	2.85	15	1
1:A:16:GLY:C	1:A:82:LYS:CG	0.45	2.90	18	1
1:A:10:PHE:CE1	1:A:88:LYS:HB2	0.45	2.47	4	2
1:A:21:VAL:HG23	1:A:40:MET:HG2	0.45	1.89	6	3
1:A:10:PHE:CD1	1:A:86:ARG:NE	0.44	2.85	11	1
1:A:34:THR:HG22	1:A:67:VAL:N	0.44	2.27	16	1
1:A:77:ILE:O	1:A:81:LEU:HD21	0.44	2.12	8	1
1:A:52:LEU:C	1:A:53:ASN:CG	0.44	2.85	10	13
1:A:85:SER:OG	1:A:86:ARG:N	0.44	2.51	2	1
1:A:36:ILE:CG2	1:A:57:GLN:CB	0.44	2.96	3	3
1:A:10:PHE:CD2	1:A:86:ARG:NH1	0.44	2.86	9	1
1:A:52:LEU:C	1:A:52:LEU:HD22	0.44	2.38	17	1
1:A:36:ILE:HG22	1:A:57:GLN:CB	0.43	2.42	4	3
1:A:53:ASN:N	1:A:53:ASN:HD22	0.43	2.10	3	2
1:A:73:THR:O	1:A:76:SER:N	0.43	2.51	1	1
1:A:59:MET:HG3	1:A:92:VAL:HG21	0.43	1.91	14	2
1:A:9:VAL:CG1	1:A:51:LYS:HB3	0.43	2.44	3	3
1:A:87:VAL:HG12	1:A:89:LEU:HD21	0.43	1.89	15	1
1:A:8:ASP:OD2	1:A:10:PHE:CE2	0.42	2.72	4	1
1:A:83:ASN:O	1:A:83:ASN:ND2	0.42	2.52	15	1
1:A:10:PHE:CE2	1:A:88:LYS:HB2	0.42	2.49	17	1
1:A:13:LYS:O	1:A:85:SER:CB	0.42	2.67	10	1
1:A:16:GLY:C	1:A:82:LYS:HG3	0.42	2.40	15	2
1:A:74:CYS:HA	1:A:77:ILE:HD12	0.42	1.90	7	2
1:A:66:LEU:HA	1:A:69:LEU:HD12	0.42	1.92	9	1
1:A:61:ILE:HD12	1:A:66:LEU:CD2	0.42	2.42	1	1
1:A:34:THR:OG1	1:A:35:VAL:N	0.42	2.52	13	6

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:32:LEU:HD22	1:A:32:LEU:N	0.42	2.30	19	1
1:A:32:LEU:CD2	1:A:32:LEU:N	0.42	2.83	20	1
1:A:23:ILE:HD13	1:A:78:ILE:HD12	0.41	1.90	8	2
1:A:62:ASN:N	1:A:88:LYS:O	0.41	2.54	9	1
1:A:11:ILE:HD11	1:A:52:LEU:CD1	0.41	2.45	1	2
1:A:84:GLN:HE21	1:A:87:VAL:HG22	0.41	1.75	6	1
1:A:32:LEU:O	1:A:57:GLN:NE2	0.41	2.53	20	2
1:A:11:ILE:CD1	1:A:49:SER:CB	0.41	2.99	3	1
1:A:81:LEU:HA	1:A:84:GLN:CG	0.41	2.45	6	2
1:A:9:VAL:CG1	1:A:51:LYS:CB	0.41	2.99	9	1
1:A:36:ILE:HG22	1:A:56:ASP:C	0.41	2.41	11	2
1:A:23:ILE:HD11	1:A:75:GLN:HG2	0.41	1.93	1	1
1:A:73:THR:O	1:A:74:CYS:C	0.41	2.62	1	1
1:A:90:ASN:HD22	1:A:91:ILE:N	0.40	2.14	19	1
1:A:86:ARG:HB2	1:A:86:ARG:CZ	0.40	2.46	6	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	83/98 (85%)	70±2 (85±2%)	10±2 (13±2%)	2±1 (3±1%)	6	41
All	All	1660/1960 (85%)	1408 (85%)	208 (13%)	44 (3%)	6	41

All 5 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	94	GLY	17
1	A	54	ILE	16
1	A	43	GLY	7
1	A	15	LYS	3
1	A	67	VAL	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	70/80 (88%)	63±2 (90±2%)	7±2 (10±2%)	9	53
All	All	1400/1600 (88%)	1256 (90%)	144 (10%)	9	53

All 17 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	35	VAL	20
1	A	52	LEU	20
1	A	53	ASN	20
1	A	89	LEU	20
1	A	59	MET	19
1	A	8	ASP	10
1	A	39	ASN	8
1	A	67	VAL	7
1	A	56	ASP	6
1	A	85	SER	3
1	A	83	ASN	2
1	A	84	GLN	2
1	A	82	LYS	2
1	A	42	HIS	2
1	A	79	LYS	1
1	A	86	ARG	1
1	A	93	SER	1

6.3.3 RNA ⓘ

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

6.5 Carbohydrates [i](#)

There are no oligosaccharides 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