Full wwPDB NMR Structure Validation Report (i)

Feb 23, 2022 – 09:19 AM EST

PDB ID	:	1X0H
Title	:	Solution structure of the carboxyl-terminal RGC domain in human IQGAP1
Authors	:	Saito, K.; Koshiba, S.; Inoue, M.; Kigawa, T.; Yokoyama, S.; RIKEN Structural Genomics/Proteomics Initiative (RSGI)
Deposited on	:	2005-03-23

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:

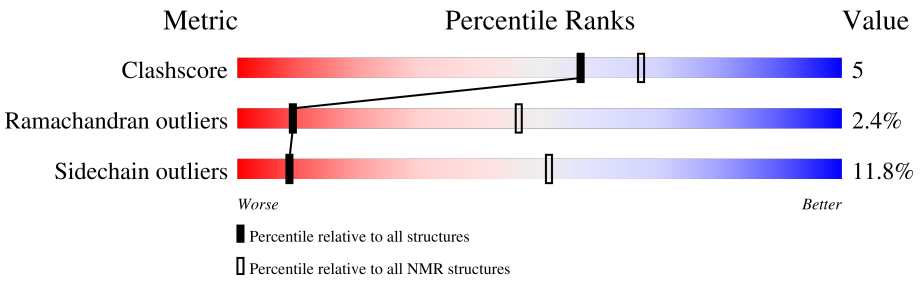
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.26
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.26

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 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	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	112	68% 10% 22%

2 Ensemble composition and analysis (i)

This entry contains 20 models. Model 8 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:9-A:54, A:64-A:104 (87)	0.29	8

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 and 2 single-model clusters were found.

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

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 1784 atoms, of which 900 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Ras GTPase-activating-like protein IQGAP1.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	112	1784	571	900	143	166	4	0

There are 13 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	cloning artifact	UNP P46940
A	2	SER	-	cloning artifact	UNP P46940
A	3	SER	-	cloning artifact	UNP P46940
A	4	GLY	-	cloning artifact	UNP P46940
A	5	SER	-	cloning artifact	UNP P46940
A	6	SER	-	cloning artifact	UNP P46940
A	7	GLY	-	cloning artifact	UNP P46940
A	107	SER	-	cloning artifact	UNP P46940
A	108	GLY	-	cloning artifact	UNP P46940
A	109	PRO	-	cloning artifact	UNP P46940
A	110	SER	-	cloning artifact	UNP P46940
A	111	SER	-	cloning artifact	UNP P46940
A	112	GLY	-	cloning artifact	UNP P46940

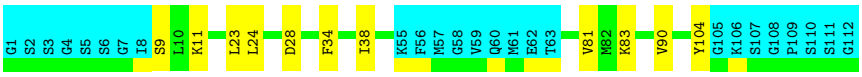
4 Residue-property plots (i)

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: Ras GTPase-activating-like protein IQGAP1

Chain A: 68% 10% 22%



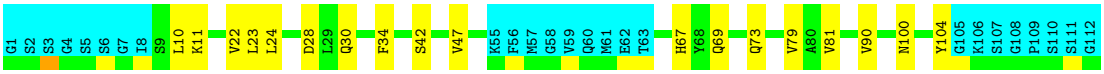
4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

• Molecule 1: Ras GTPase-activating-like protein IQGAP1

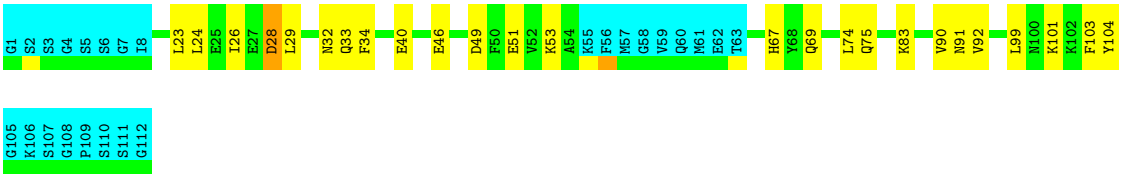
Chain A: 62% 16% 22%



4.2.2 Score per residue for model 2

• Molecule 1: Ref Ras GTPase-activating-like protein IQGAP1

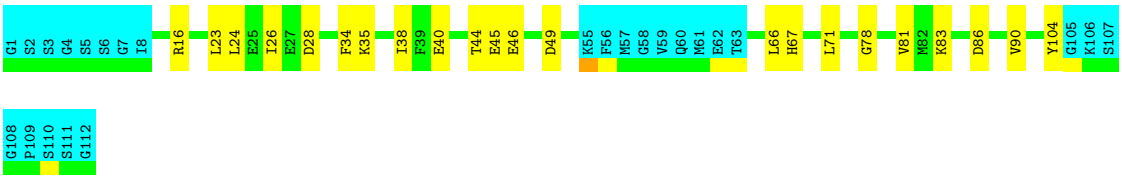
Chain A: 55% 21% • 22%



4.2.3 Score per residue for model 3

• Molecule 1: Ras GTPase-activating-like protein IQGAP1

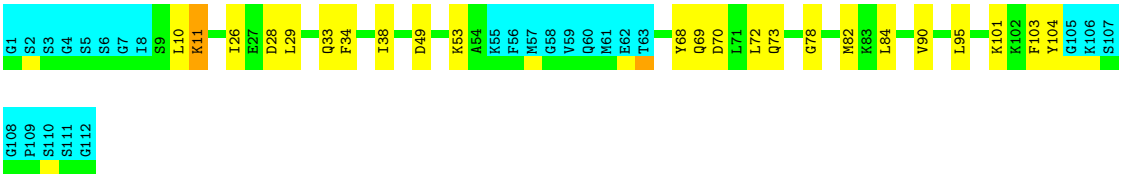
Chain A: 58% 20% 22%



4.2.4 Score per residue for model 4

• Molecule 1: Ras GTPase-activating-like protein IQGAP1

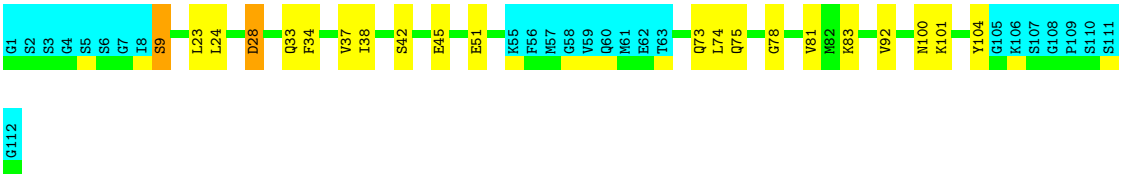
Chain A: 57% 20% • 22%



4.2.5 Score per residue for model 5

• Molecule 1: Ras GTPase-activating-like protein IQGAP1

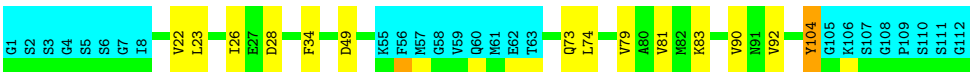
Chain A: 59% 17% • 22%



4.2.6 Score per residue for model 6

• Molecule 1: Ras GTPase-activating-like protein IQGAP1

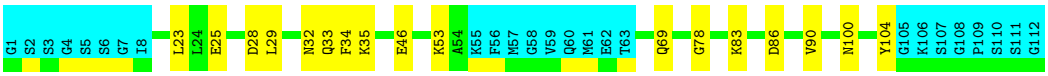
Chain A: 65% 12% • 22%



4.2.7 Score per residue for model 7

• Molecule 1: Ras GTPase-activating-like protein IQGAP1

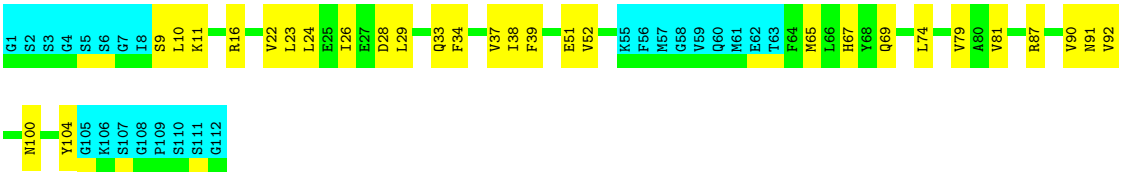
Chain A: 62% 15% 22%



4.2.8 Score per residue for model 8 (medoid)

• Molecule 1: Ras GTPase-activating-like protein IQGAP1

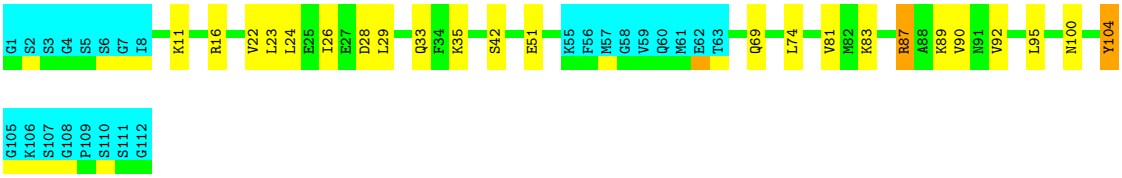
Chain A: 52% 26% 22%



4.2.9 Score per residue for model 9

• Molecule 1: Ras GTPase-activating-like protein IQGAP1

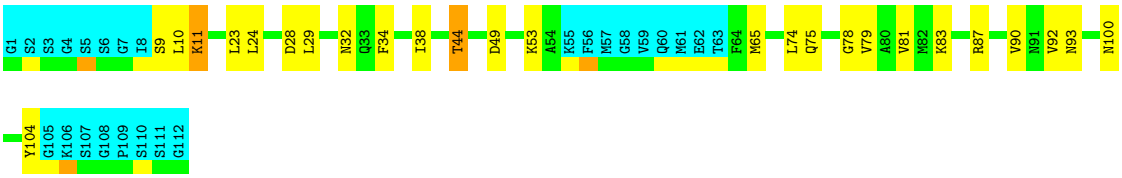
Chain A: 57% 19% • 22%



4.2.10 Score per residue for model 10

• Molecule 1: Ras GTPase-activating-like protein IQGAP1

Chain A: 54% 21% • 22%



4.2.11 Score per residue for model 11

- Molecule 1: Ras GTPase-activating-like protein IQGAP1

Chain A: 58% 18% • 22%

G1 S2 S3 G4 S5 S6 G7 I8 S9 L10 K11 V22 D28 V37 I38 F39 E40 V52 K53 A54 K55 F56 M57 G58 V59 Q60 M61 E62 T63 F64 M65 L66 H67 Y68 Q69 D70 L71 L72 Q73 V79 A80 V81 M82 V90 K101 Y104 G105 K106 S107 G108 P109 S110

S111 G112

4.2.12 Score per residue for model 12

- Molecule 1: Ras GTPase-activating-like protein IQGAP1

Chain A: 57% 21% 22%

G1 S2 S3 G4 S5 S6 G7 I8 V22 L23 L24 E25 I26 E27 D28 L29 F34 K35 N36 V37 I38 T44 V47 G48 D49 F50 K55 F56 M57 G58 V59 Q60 M61 E62 T63 F64 M65 L66 H67 Y68 E77 V81 L84 V90 N93 F103 Y104 G105 K106

S107 G108 P109 S110 S111 G112

4.2.13 Score per residue for model 13

- Molecule 1: Ras GTPase-activating-like protein IQGAP1

Chain A: 64% 13% 22%

G1 S2 S3 G4 S5 S6 G7 I8 S9 L10 K11 R16 V22 L23 D28 E51 K55 F56 M57 G58 V59 Q60 M61 E62 T63 D70 Q73 V79 K83 V90 N100 K101 Y104 G105 K106 S107 G108 P109 S110 S111 G112

4.2.14 Score per residue for model 14

- Molecule 1: Ras GTPase-activating-like protein IQGAP1

Chain A: 59% 19% 22%

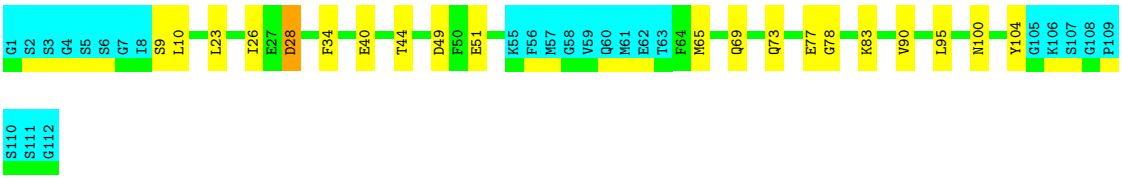
G1 S2 S3 G4 S5 S6 G7 I8 K11 G21 V22 L23 D28 L29 F34 I38 E46 K53 A54 K55 F56 M57 G58 V59 Q60 M61 E62 T63 H67 Y68 Q69 Q73 G78 V79 A80 V81 L84 F85 D86 V90 L94 K101 Y104 G105 K106

S107 G108 P109 S110 S111 G112

4.2.15 Score per residue for model 15

- Molecule 1: Ras GTPase-activating-like protein IQGAP1

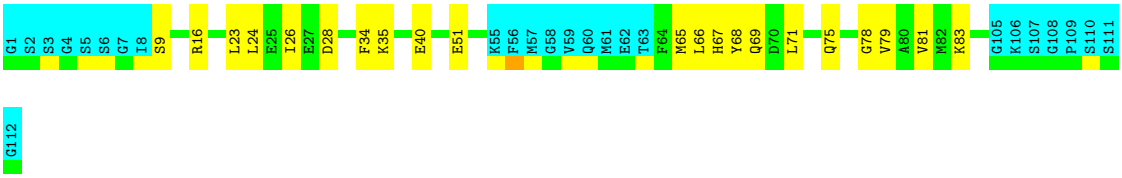
Chain A: 60% 17% • 22%



4.2.16 Score per residue for model 16

- Molecule 1: Ras GTPase-activating-like protein IQGAP1

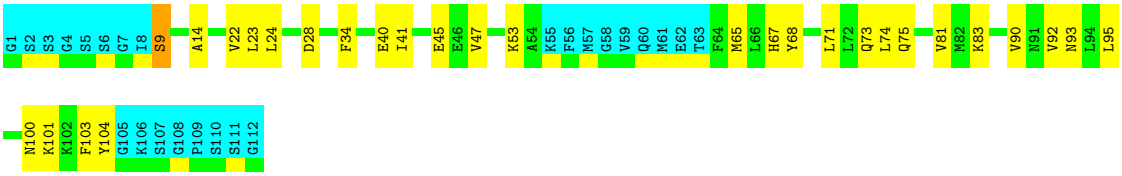
Chain A: 59% 19% 22%



4.2.17 Score per residue for model 17

- Molecule 1: Ras GTPase-activating-like protein IQGAP1

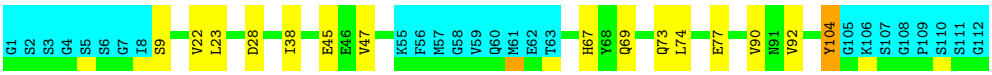
Chain A: 52% 25% • 22%



4.2.18 Score per residue for model 18

- Molecule 1: Ras GTPase-activating-like protein IQGAP1

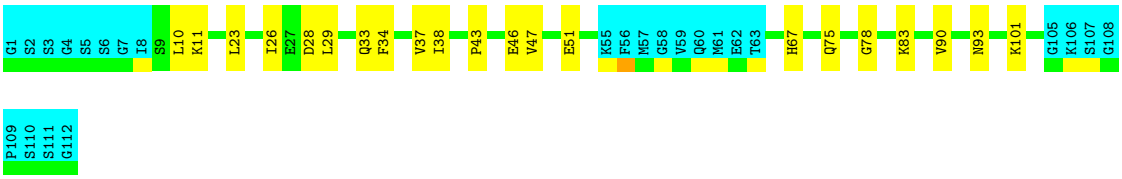
Chain A: 64% 12% • 22%



4.2.19 Score per residue for model 19

- Molecule 1: Ras GTPase-activating-like protein IQGAP1

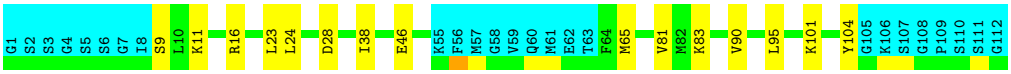
Chain A: 59% 19% 22%



4.2.20 Score per residue for model 20

- Molecule 1: Ras GTPase-activating-like protein IQGAP1

Chain A: 64% 13% 22%



5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *simulated annealing*.

Of the 100 calculated structures, 20 were deposited, based on the following criterion: *structures with the lowest energy*.

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

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	721	741	739	7±3
All	All	14420	14820	14780	148

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:23:LEU:HD12	1:A:90:VAL:HG22	0.77	1.52	6	14
1:A:23:LEU:CD1	1:A:90:VAL:HG22	0.75	2.12	10	9
1:A:23:LEU:HD23	1:A:34:PHE:CE2	0.73	2.18	5	10
1:A:90:VAL:HG11	1:A:95:LEU:HD13	0.72	1.60	9	4
1:A:11:LYS:CG	1:A:38:ILE:HD11	0.70	2.16	11	2
1:A:22:VAL:HG12	1:A:90:VAL:CG1	0.69	2.16	17	8
1:A:11:LYS:HG3	1:A:38:ILE:HD11	0.64	1.68	4	5
1:A:26:ILE:HD12	1:A:34:PHE:CE1	0.62	2.29	12	7
1:A:21:GLY:O	1:A:94:LEU:HD13	0.61	1.94	14	1
1:A:22:VAL:HG12	1:A:90:VAL:HG13	0.61	1.70	9	6
1:A:74:LEU:HD13	1:A:92:VAL:HG21	0.61	1.72	2	6
1:A:79:VAL:HG12	1:A:81:VAL:O	0.59	1.98	11	6
1:A:24:LEU:HD12	1:A:81:VAL:HG13	0.58	1.74	9	5
1:A:33:GLN:O	1:A:37:VAL:HG23	0.55	2.00	19	2

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:29:LEU:HD12	1:A:33:GLN:CB	0.55	2.32	2	2
1:A:29:LEU:HD12	1:A:33:GLN:HB3	0.55	1.77	2	2
1:A:66:LEU:HD11	1:A:71:LEU:HD21	0.54	1.79	16	1
1:A:24:LEU:CD1	1:A:81:VAL:HG13	0.54	2.32	12	5
1:A:99:LEU:HD22	1:A:103:PHE:CD1	0.51	2.40	2	1
1:A:47:VAL:HG13	1:A:47:VAL:O	0.50	2.06	17	5
1:A:38:ILE:O	1:A:38:ILE:HG23	0.50	2.07	14	2
1:A:14:ALA:HB1	1:A:23:LEU:CD2	0.48	2.39	17	1
1:A:21:GLY:C	1:A:94:LEU:HD13	0.47	2.29	14	1
1:A:82:MET:CE	1:A:84:LEU:HD11	0.47	2.39	4	1
1:A:10:LEU:HD12	1:A:103:PHE:CE2	0.47	2.43	4	1
1:A:81:VAL:HG11	1:A:89:LYS:HD3	0.47	1.86	9	1
1:A:29:LEU:HD22	1:A:33:GLN:OE1	0.47	2.10	4	1
1:A:29:LEU:HD12	1:A:37:VAL:CG2	0.46	2.40	12	1
1:A:24:LEU:HD21	1:A:91:ASN:HB2	0.46	1.88	2	1
1:A:68:TYR:HA	1:A:71:LEU:HD12	0.45	1.86	11	1
1:A:66:LEU:HD21	1:A:71:LEU:HD11	0.45	1.87	3	1
1:A:74:LEU:HB2	1:A:92:VAL:HG11	0.45	1.87	17	1
1:A:23:LEU:CD2	1:A:34:PHE:CE2	0.45	3.00	17	2
1:A:24:LEU:HD13	1:A:81:VAL:HG22	0.45	1.88	17	1
1:A:41:ILE:CG2	1:A:103:PHE:CZ	0.45	3.00	17	1
1:A:68:TYR:CE2	1:A:72:LEU:HD11	0.44	2.47	4	1
1:A:66:LEU:HD11	1:A:82:MET:CE	0.44	2.43	11	1
1:A:26:ILE:CD1	1:A:34:PHE:CE1	0.44	3.00	4	4
1:A:28:ASP:OD2	1:A:29:LEU:HD23	0.44	2.13	2	1
1:A:23:LEU:HD23	1:A:34:PHE:CD2	0.43	2.48	17	1
1:A:29:LEU:HD22	1:A:29:LEU:N	0.43	2.29	10	3
1:A:29:LEU:HD22	1:A:33:GLN:NE2	0.43	2.27	7	1
1:A:23:LEU:HD21	1:A:26:ILE:HD11	0.43	1.91	9	1
1:A:50:PHE:CE1	1:A:103:PHE:CD2	0.43	3.07	12	1
1:A:29:LEU:HD22	1:A:33:GLN:CB	0.43	2.44	8	1
1:A:84:LEU:HD12	1:A:90:VAL:CG2	0.43	2.44	12	2
1:A:24:LEU:HD13	1:A:81:VAL:HG13	0.42	1.90	3	1
1:A:24:LEU:CD1	1:A:81:VAL:HG22	0.42	2.44	10	1
1:A:26:ILE:HG22	1:A:28:ASP:OD1	0.42	2.13	15	1
1:A:71:LEU:HD22	1:A:95:LEU:HD23	0.42	1.90	17	1
1:A:52:VAL:HG12	1:A:53:LYS:N	0.41	2.30	11	1
1:A:10:LEU:HD12	1:A:103:PHE:CZ	0.41	2.50	4	1
1:A:44:THR:HG21	1:A:49:ASP:HB3	0.41	1.91	10	1
1:A:29:LEU:HD13	1:A:33:GLN:NE2	0.41	2.30	2	1
1:A:37:VAL:HG12	1:A:38:ILE:N	0.41	2.30	11	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:74:LEU:CD1	1:A:92:VAL:HG21	0.41	2.46	8	1
1:A:37:VAL:HG12	1:A:39:PHE:CE1	0.41	2.51	8	1
1:A:29:LEU:N	1:A:29:LEU:CD2	0.40	2.84	19	1
1:A:90:VAL:HG12	1:A:91:ASN:N	0.40	2.31	8	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	87/112 (78%)	78±1 (90±2%)	7±2 (8±2%)	2±1 (2±1%)	9	46
All	All	1740/2240 (78%)	1564 (90%)	135 (8%)	41 (2%)	9	46

All 7 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	28	ASP	20
1	A	78	GLY	9
1	A	104	TYR	4
1	A	9	SER	4
1	A	79	VAL	2
1	A	87	ARG	1
1	A	43	PRO	1

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	79/97 (81%)	70±2 (88±3%)	9±2 (12±3%)	8	51

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	1580/1940 (81%)	1393 (88%)	187 (12%)	8 51

All 33 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	104	TYR	17
1	A	83	LYS	13
1	A	67	HIS	10
1	A	69	GLN	10
1	A	73	GLN	10
1	A	100	ASN	9
1	A	101	LYS	9
1	A	11	LYS	8
1	A	65	MET	8
1	A	10	LEU	7
1	A	51	GLU	7
1	A	40	GLU	6
1	A	46	GLU	6
1	A	49	ASP	6
1	A	75	GLN	6
1	A	16	ARG	6
1	A	35	LYS	5
1	A	44	THR	4
1	A	45	GLU	4
1	A	93	ASN	4
1	A	68	TYR	4
1	A	42	SER	3
1	A	32	ASN	3
1	A	86	ASP	3
1	A	70	ASP	3
1	A	87	ARG	3
1	A	9	SER	3
1	A	77	GLU	3
1	A	38	ILE	2
1	A	53	LYS	2
1	A	30	GLN	1
1	A	28	ASP	1
1	A	25	GLU	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 monosaccharides 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 (i)

No chemical shift data were provided