



Full wwPDB NMR Structure Validation Report ⓘ

May 28, 2020 – 11:59 pm BST

PDB ID : 2MU1
Title : NMR structure of the core domain of NP_346487.1, a putative phosphoglycolate phosphatase from *Streptococcus pneumoniae* TIGR4
Authors : Jaudzems, K.; Serrano, P.; Pedrini, B.; Geralt, M.; Wuthrich, K.; Joint Center for Structural Genomics (JCSG)
Deposited on : 2014-09-03

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 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
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 : 2.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

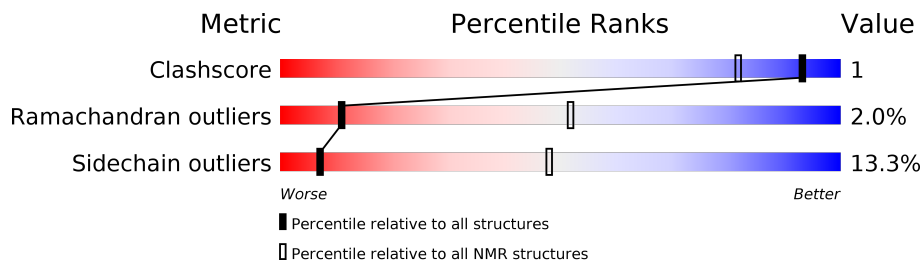
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 74%.

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 $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	208	

2 Ensemble composition and analysis i

This entry contains 20 models. Model 1 is the overall representative, medoid model (most similar to other models).

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:1-A:10, A:89-A:204 (126)	0.43	1

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 6 single-model clusters were found.

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

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 2146 atoms, of which 1050 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Hydrolase, haloacid dehalogenase-like family.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	137	2146	697	1050	181	216	2	0

There are 2 discrepancies between the modelled and reference sequences:

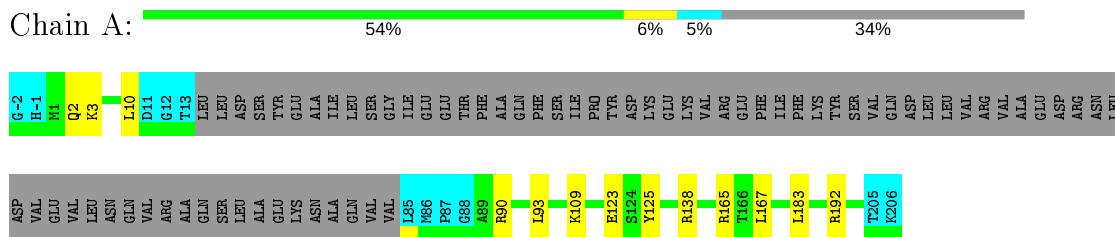
Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	EXPRESSION TAG	UNP Q97NG6
A	-1	HIS	-	EXPRESSION TAG	UNP Q97NG6

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: Hydrolase, haloacid dehalogenase-like family

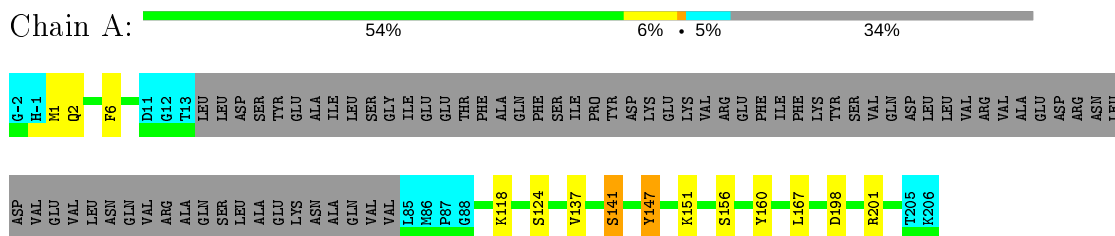


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1 (medoid)

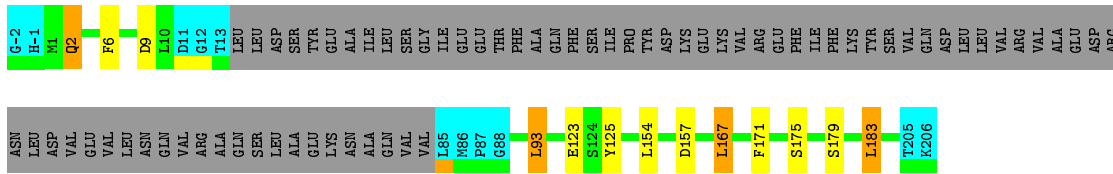
- Molecule 1: Hydrolase, haloacid dehalogenase-like family



4.2.2 Score per residue for model 2

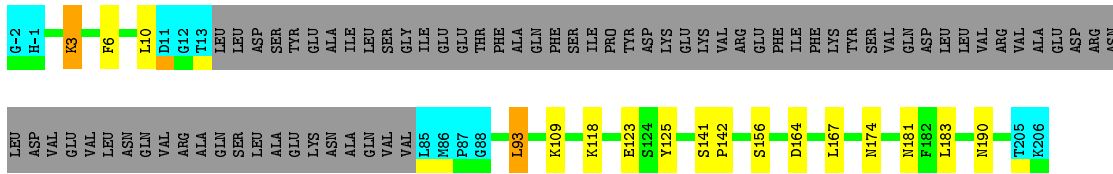
- Molecule 1: Hydrolase, haloacid dehalogenase-like family





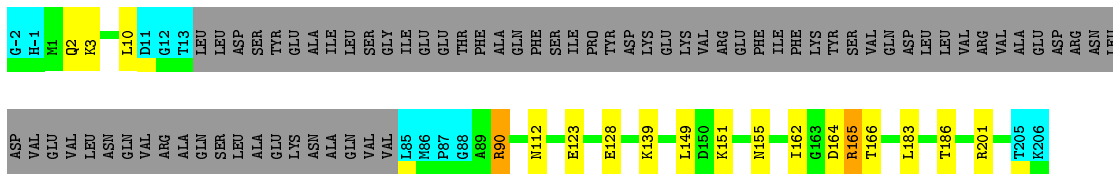
4.2.3 Score per residue for model 3

- Molecule 1: Hydrolase, haloacid dehalogenase-like family



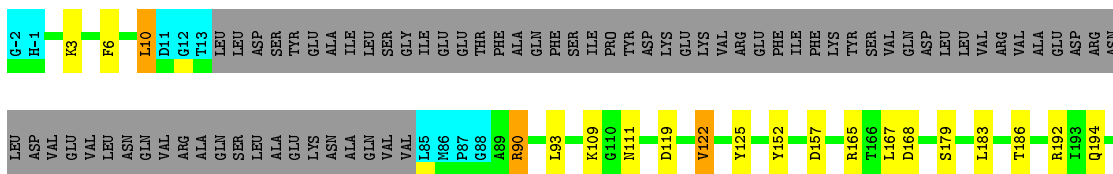
4.2.4 Score per residue for model 4

- Molecule 1: Hydrolase, haloacid dehalogenase-like family



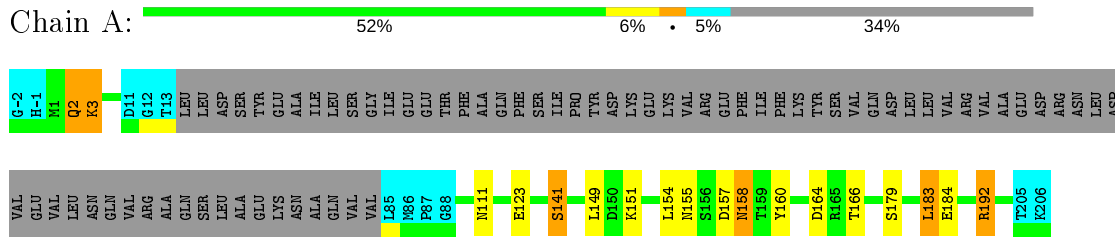
4.2.5 Score per residue for model 5

- Molecule 1: Hydrolase, haloacid dehalogenase-like family



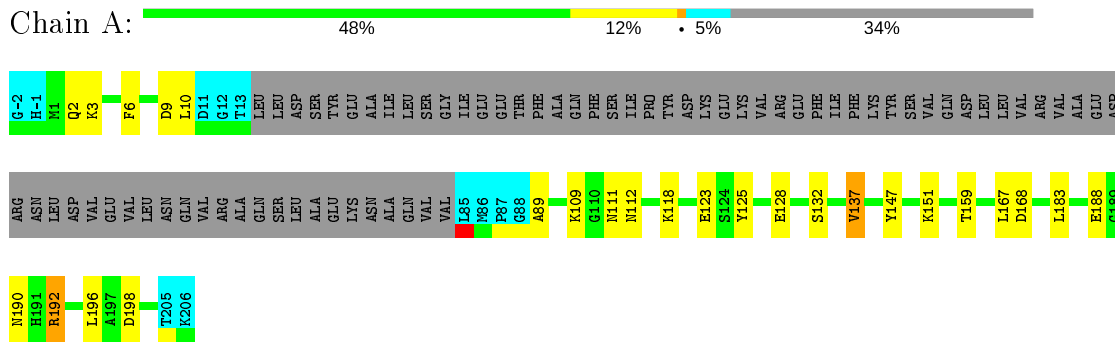
4.2.6 Score per residue for model 6

- Molecule 1: Hydrolase, haloacid dehalogenase-like family



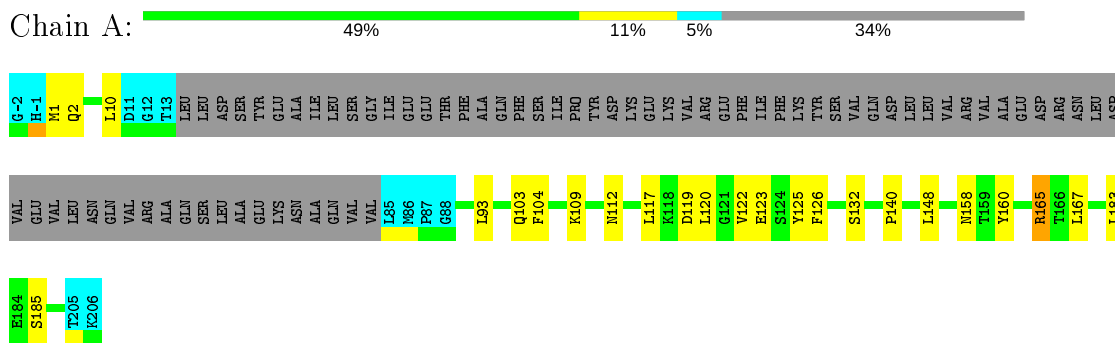
4.2.7 Score per residue for model 7

- Molecule 1: Hydrolase, haloacid dehalogenase-like family



4.2.8 Score per residue for model 8

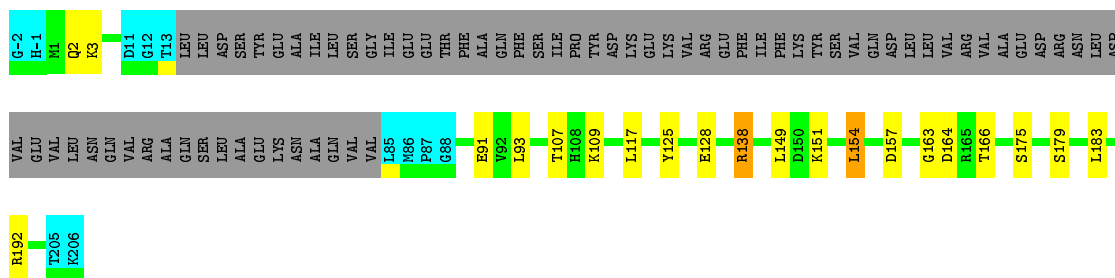
- Molecule 1: Hydrolase, haloacid dehalogenase-like family



4.2.9 Score per residue for model 9

- Molecule 1: Hydrolase, haloacid dehalogenase-like family

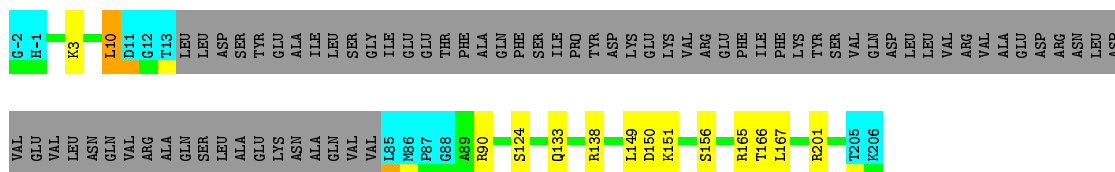




4.2.10 Score per residue for model 10

- Molecule 1: Hydrolase, haloacid dehalogenase-like family

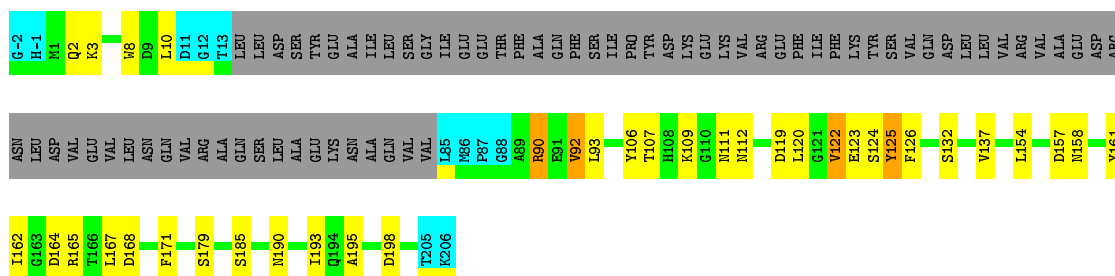
Chain A: 54% 6% 5% 34%



4.2.11 Score per residue for model 11

- Molecule 1: Hydrolase, haloacid dehalogenase-like family

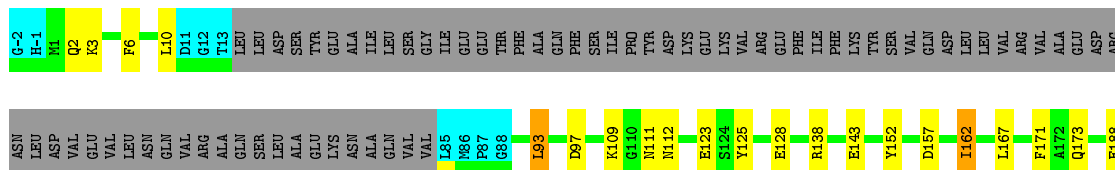
Chain A: 43% 16% 5% 34%



4.2.12 Score per residue for model 12

- Molecule 1: Hydrolase, haloacid dehalogenase-like family

Chain A: 50% 10% 5% 34%

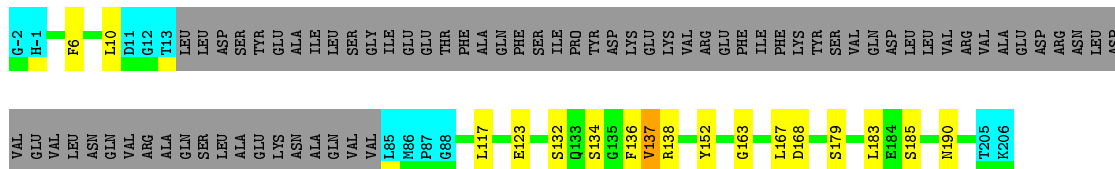




4.2.13 Score per residue for model 13

- Molecule 1: Hydrolase, haloacid dehalogenase-like family

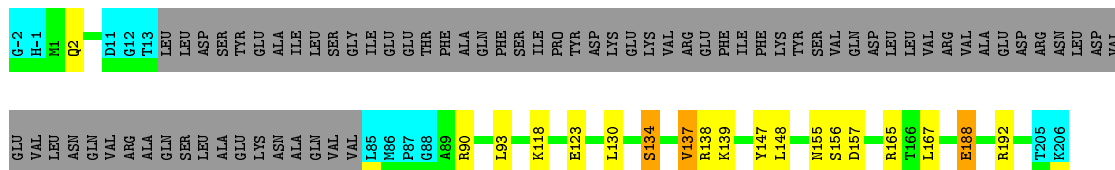
Chain A: 52% 8% 5% 34%



4.2.14 Score per residue for model 14

- Molecule 1: Hydrolase, haloacid dehalogenase-like family

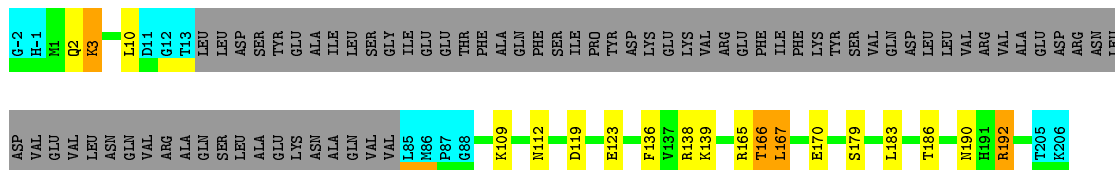
Chain A: 51% 8% 5% 34%



4.2.15 Score per residue for model 15

- Molecule 1: Hydrolase, haloacid dehalogenase-like family

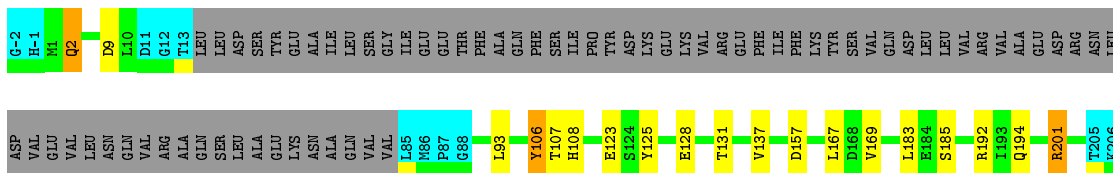
Chain A: 51% 7% 5% 34%



4.2.16 Score per residue for model 16

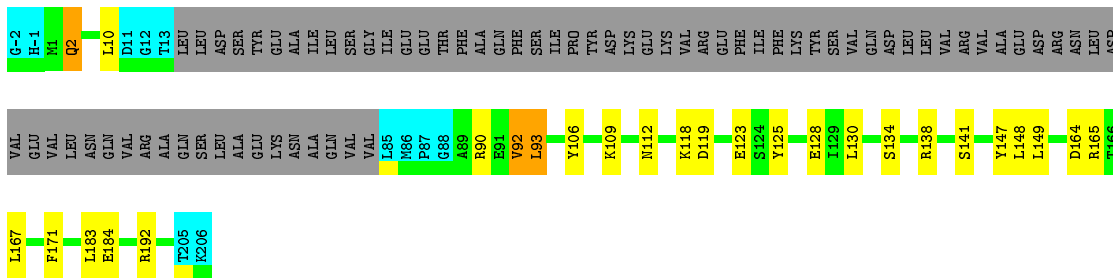
- Molecule 1: Hydrolase, haloacid dehalogenase-like family

Chain A: 51% 8% 5% 34%



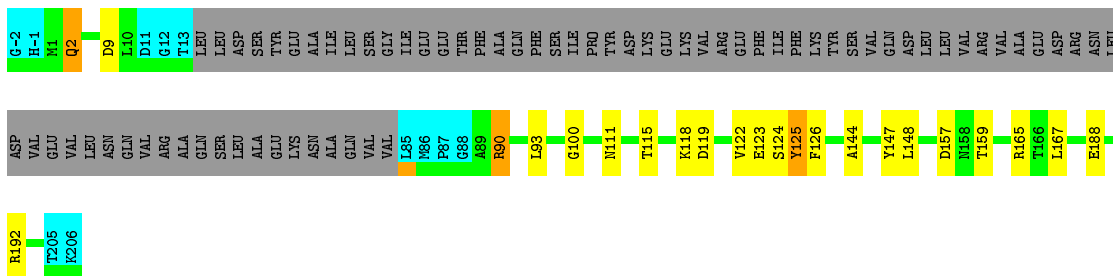
4.2.17 Score per residue for model 17

- Molecule 1: Hydrolase, haloacid dehalogenase-like family



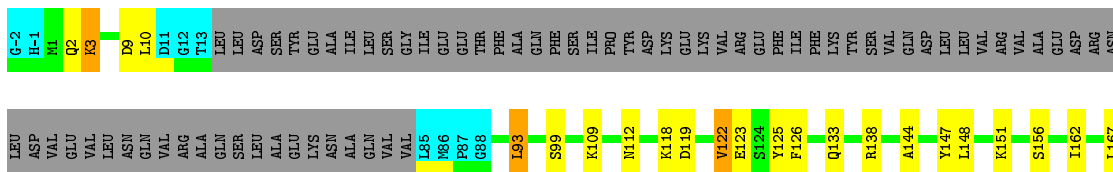
4.2.18 Score per residue for model 18

- Molecule 1: Hydrolase, haloacid dehalogenase-like family



4.2.19 Score per residue for model 19

- Molecule 1: Hydrolase, haloacid dehalogenase-like family

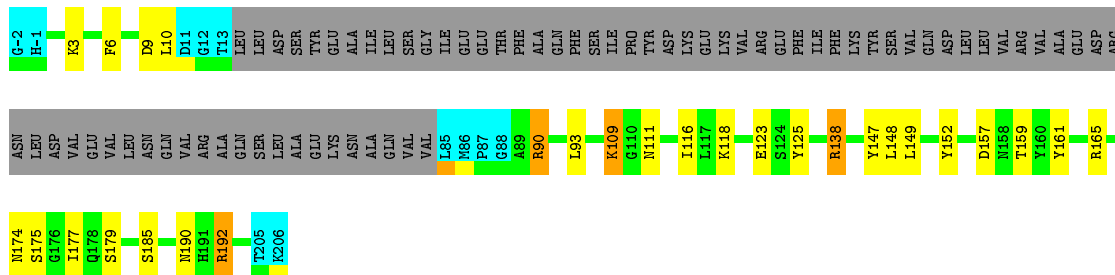




4.2.20 Score per residue for model 20

- Molecule 1: Hydrolase, haloacid dehalogenase-like family

Chain A: 47% 12% 5% 34%



5 Refinement protocol and experimental data overview

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

Of the 100 calculated structures, 20 were deposited, based on the following criterion: *target function*.

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

Software name	Classification	Version
CYANA	structure solution	3.0
OPAL	refinement	
UNIO-ATNOS/CANDID	structure solution	
CYANA	refinement	3.0

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 6 of this report.

Chemical shift file(s)	input_cs.cif
Number of chemical shift lists	1
Total number of shifts	2213
Number of shifts mapped to atoms	2213
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	74%

No validations of the models with respect to experimental NMR restraints is performed at this time.

COVALENT-GEOMETRY INFOmissingINFO

5.1 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	1020	976	976	3±2
All	All	20400	19520	19520	52

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 1.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:93:LEU:HD23	1:A:125:TYR:CD2	0.81	2.09	20	7
1:A:122:VAL:HG23	1:A:125:TYR:CD2	0.66	2.25	11	3
1:A:137:VAL:HG23	1:A:141:SER:HB2	0.62	1.71	1	1
1:A:167:LEU:HD12	1:A:171:PHE:CE1	0.62	2.30	2	1
1:A:130:LEU:HD12	1:A:134:SER:CB	0.61	2.25	14	2
1:A:137:VAL:HG23	1:A:141:SER:CB	0.61	2.26	1	1
1:A:183:LEU:HD22	1:A:183:LEU:N	0.58	2.13	2	1
1:A:130:LEU:HD12	1:A:134:SER:HB3	0.57	1.76	17	2
1:A:144:ALA:O	1:A:148:LEU:HD13	0.55	2.00	18	2
1:A:183:LEU:H	1:A:183:LEU:HD22	0.55	1.62	2	1
1:A:193:ILE:HD12	1:A:195:ALA:O	0.52	2.04	11	1
1:A:122:VAL:HG23	1:A:125:TYR:HD2	0.52	1.63	19	2
1:A:93:LEU:HD13	1:A:122:VAL:HG21	0.52	1.80	11	1
1:A:6:PHE:CD2	1:A:162:ILE:HD11	0.51	2.40	12	1
1:A:159:THR:HG23	1:A:177:ILE:HB	0.51	1.81	20	1
1:A:90:ARG:HA	1:A:93:LEU:HD12	0.51	1.81	11	2
1:A:93:LEU:HD23	1:A:125:TYR:CG	0.50	2.41	18	1
1:A:137:VAL:HG12	1:A:138:ARG:H	0.50	1.66	14	1
1:A:147:TYR:HD1	1:A:148:LEU:HD12	0.49	1.67	19	2
1:A:141:SER:H	1:A:171:PHE:HB3	0.47	1.69	17	1
1:A:93:LEU:HD13	1:A:122:VAL:CG2	0.47	2.38	11	1
1:A:8:TRP:CD2	1:A:162:ILE:HD13	0.47	2.44	11	1
1:A:147:TYR:CZ	1:A:151:LYS:HE3	0.47	2.45	1	1
1:A:122:VAL:HG22	1:A:126:PHE:CE2	0.46	2.45	19	2
1:A:107:THR:HG23	1:A:109:LYS:H	0.45	1.71	9	2
1:A:93:LEU:CD2	1:A:125:TYR:CD2	0.45	2.98	18	1
1:A:155:ASN:ND2	1:A:158:ASN:HD21	0.45	2.09	6	1
1:A:106:TYR:O	1:A:107:THR:HG22	0.44	2.12	16	1
1:A:104:PHE:CD2	1:A:148:LEU:HD22	0.43	2.48	8	1
1:A:93:LEU:HD21	1:A:126:PHE:CE1	0.43	2.48	8	1
1:A:169:VAL:HG21	1:A:185:SER:HB2	0.42	1.90	16	1
1:A:89:ALA:N	1:A:196:LEU:HD11	0.42	2.29	7	1
1:A:93:LEU:HD21	1:A:126:PHE:CZ	0.42	2.50	18	2
1:A:183:LEU:HD13	1:A:183:LEU:N	0.41	2.29	19	1
1:A:109:LYS:HE2	1:A:116:ILE:CD1	0.41	2.45	20	1

5.2 Torsion angles [i](#)

5.2.1 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	126/208 (61%)	111±3 (88±3%)	12±3 (10±2%)	3±1 (2±1%)	11	52
All	All	2520/4160 (61%)	2222 (88%)	247 (10%)	51 (2%)	11	52

All 19 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	3	LYS	10
1	A	2	GLN	8
1	A	137	VAL	5
1	A	10	LEU	4
1	A	162	ILE	3
1	A	166	THR	3
1	A	1	MET	2
1	A	141	SER	2
1	A	122	VAL	2
1	A	163	GLY	2
1	A	136	PHE	2
1	A	138	ARG	1
1	A	184	GLU	1
1	A	186	THR	1
1	A	188	GLU	1
1	A	140	PRO	1
1	A	139	LYS	1
1	A	142	PRO	1
1	A	167	LEU	1

5.2.2 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	109/181 (60%)	95±4 (87±4%)	15±4 (13±4%)	7	48
All	All	2180/3620 (60%)	1890 (87%)	290 (13%)	7	48

All 63 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	123	GLU	16
1	A	167	LEU	16
1	A	183	LEU	13
1	A	2	GLN	12
1	A	165	ARG	10
1	A	157	ASP	10
1	A	10	LEU	10
1	A	192	ARG	9
1	A	109	LYS	9
1	A	179	SER	9
1	A	190	ASN	8
1	A	90	ARG	8
1	A	118	LYS	8
1	A	112	ASN	8
1	A	119	ASP	7
1	A	111	ASN	7
1	A	149	LEU	6
1	A	164	ASP	6
1	A	3	LYS	6
1	A	128	GLU	6
1	A	151	LYS	6
1	A	9	ASP	6
1	A	156	SER	5
1	A	6	PHE	5
1	A	168	ASP	5
1	A	188	GLU	4
1	A	132	SER	4
1	A	185	SER	4
1	A	138	ARG	4
1	A	124	SER	4
1	A	152	TYR	4
1	A	198	ASP	3
1	A	154	LEU	3
1	A	166	THR	3
1	A	117	LEU	3
1	A	158	ASN	3

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Mol	Chain	Res	Type	Models (Total)
1	A	175	SER	3
1	A	186	THR	2
1	A	92	VAL	2
1	A	137	VAL	2
1	A	133	GLN	2
1	A	139	LYS	2
1	A	194	GLN	2
1	A	171	PHE	2
1	A	181	ASN	2
1	A	141	SER	2
1	A	155	ASN	2
1	A	174	ASN	2
1	A	115	THR	1
1	A	150	ASP	1
1	A	173	GLN	1
1	A	134	SER	1
1	A	143	GLU	1
1	A	97	ASP	1
1	A	93	LEU	1
1	A	170	GLU	1
1	A	108	HIS	1
1	A	131	THR	1
1	A	91	GLU	1
1	A	99	SER	1
1	A	201	ARG	1
1	A	184	GLU	1
1	A	103	GLN	1

5.2.3 RNA [i](#)

There are no RNA molecules in this entry.

5.3 Non-standard residues in protein, DNA, RNA chains [i](#)

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

5.4 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.5 Ligand geometry [i](#)

There are no ligands in this entry.

5.6 Other polymers [i](#)

There are no such molecules in this entry.

5.7 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Chemical shift validation [i](#)

The completeness of assignment taking into account all chemical shift lists is 74% for the well-defined parts and 73% for the entire structure.

6.1 Chemical shift list 1

File name: input_cs.cif

Chemical shift list name: *assigned_chem_shift_list_1*

6.1.1 Bookkeeping [i](#)

The following table shows the results of parsing the chemical shift list and reports the number of nuclei with statistically unusual chemical shifts.

Total number of shifts	2213
Number of shifts mapped to atoms	2213
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	7

6.1.2 Chemical shift referencing [i](#)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction \pm precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	205	-0.12 ± 0.14	None needed (< 0.5 ppm)
$^{13}\text{C}_\beta$	196	0.41 ± 0.09	None needed (< 0.5 ppm)
$^{13}\text{C}'$	0	—	None (insufficient data)
^{15}N	196	0.23 ± 0.34	None needed (< 0.5 ppm)

6.1.3 Completeness of resonance assignments [i](#)

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 74%, i.e. 1150 atoms were assigned a chemical shift out of a possible 1562. 15 out of 15 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	360/626 (58%)	117/250 (47%)	123/252 (49%)	120/124 (97%)
Sidechain	668/770 (87%)	411/448 (92%)	237/287 (83%)	20/35 (57%)

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	Total	¹ H	¹³ C	¹⁵ N
Aromatic	122/166 (73%)	78/88 (89%)	42/74 (57%)	2/4 (50%)
Overall	1150/1562 (74%)	606/786 (77%)	402/613 (66%)	142/163 (87%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 73%, i.e. 1223 atoms were assigned a chemical shift out of a possible 1676. 16 out of 16 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹ H	¹³ C	¹⁵ N
Backbone	387/679 (57%)	126/271 (46%)	134/274 (49%)	127/134 (95%)
Sidechain	710/824 (86%)	437/480 (91%)	253/308 (82%)	20/36 (56%)
Aromatic	126/173 (73%)	80/92 (87%)	44/76 (58%)	2/5 (40%)
Overall	1223/1676 (73%)	643/843 (76%)	431/658 (66%)	149/175 (85%)

6.1.4 Statistically unusual chemical shifts [i](#)

The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

Mol	Chain	Res	Type	Atom	Shift, ppm	Expected range, ppm	Z-score
1	A	162	ILE	HD12	-1.47	2.13 – -0.77	-7.4
1	A	162	ILE	HD11	-1.47	2.13 – -0.77	-7.4
1	A	162	ILE	HD13	-1.47	2.13 – -0.77	-7.4
1	A	200	SER	HB2	2.12	5.18 – 2.58	-6.8
1	A	151	LYS	HG2	-0.37	2.67 – 0.07	-6.7
1	A	173	GLN	HB2	0.59	3.30 – 0.80	-5.9
1	A	93	LEU	HB2	-0.14	3.32 – -0.08	-5.2

6.1.5 Random Coil Index (RCI) plots [i](#)

The image below reports *random coil index* values for the protein chains in the structure. The height of each bar gives a probability of a given residue to be disordered, as predicted from the available chemical shifts and the amino acid sequence. A value above 0.2 is an indication of significant predicted disorder. The colour of the bar shows whether the residue is in the well-defined core (black) or in the ill-defined residue ranges (cyan), as described in section 2 on ensemble composition.

Random coil index (RCI) for chain A:

