



# Full wwPDB NMR Structure Validation Report ⓘ

Jul 7, 2022 – 04:30 pm BST

PDB ID : 5OE1  
Title : Im polyamide in complex with 5'CGATGTACATCG3'- hairpin polyamides studies  
Authors : Padroni, G.; Parkinson, J.; Burley, G.A.  
Deposited on : 2017-07-07

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

<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>.

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

MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
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	:	2.29
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.29

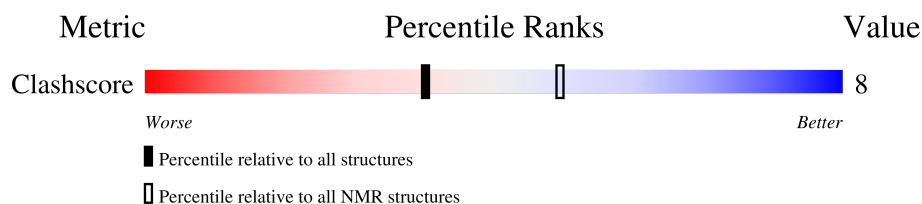
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*SOLUTION NMR*

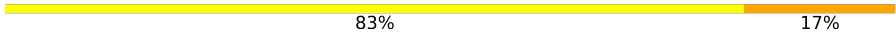

The overall completeness of chemical shifts assignment is 66%.

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

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	12		83% 17%
1	B	12		83% 17%

## 2 Ensemble composition and analysis ⓘ

This entry contains 10 models. This entry does not contain polypeptide chains, therefore identification of well-defined residues and clustering analysis are not possible. All residues are included in the validation scores.

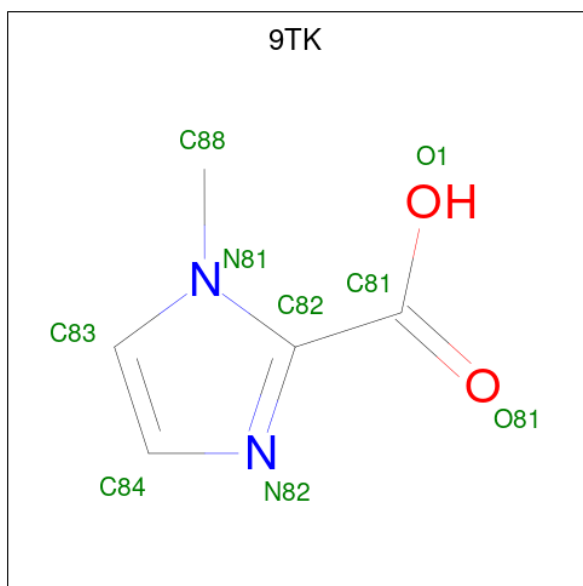
### 3 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 921 atoms, of which 346 are hydrogens and 0 are deuteriums.

- Molecule 1 is a DNA chain called DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3').

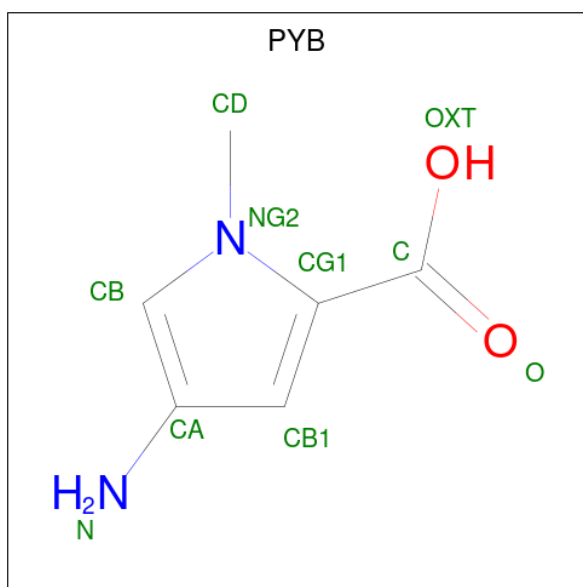
Mol	Chain	Residues	Atoms						Trace
1	A	12	Total	C	H	N	O	P	0
			380	117	137	45	70	11	
1	B	12	Total	C	H	N	O	P	0
			380	117	137	45	70	11	

- Molecule 2 is 1-methylimidazole-2-carboxylic acid (three-letter code: 9TK) (formula: C<sub>5</sub>H<sub>6</sub>N<sub>2</sub>O<sub>2</sub>).



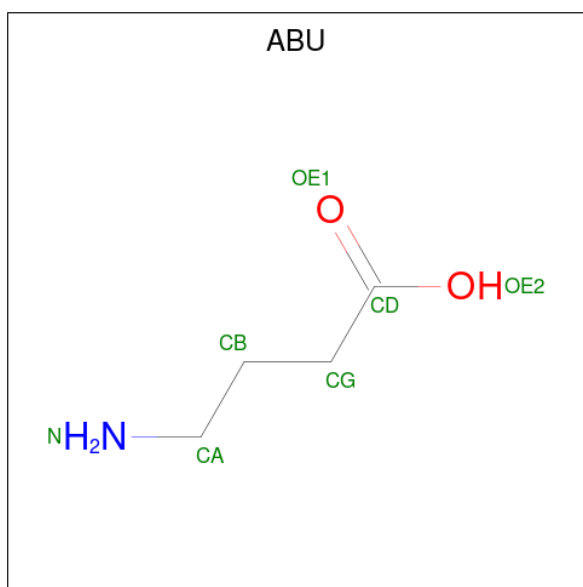
Mol	Chain	Residues	Atoms				
2	A	1	Total	C	H	N	O
			13	5	5	2	1

- Molecule 3 is 4-AMINO-(1-METHYLPYRROLE)-2-CARBOXYLIC ACID (three-letter code: PYB) (formula: C<sub>6</sub>H<sub>8</sub>N<sub>2</sub>O<sub>2</sub>).



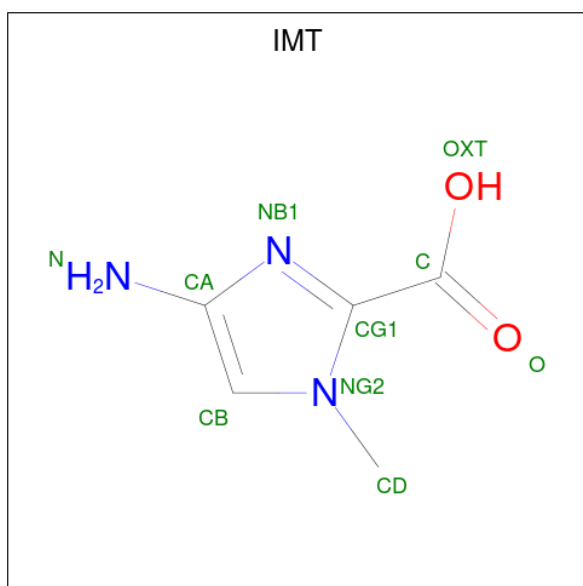
Mol	Chain	Residues	Atoms				
3	A	1	Total	C	H	N	O
			15	6	6	2	1
3	A	1	Total	C	H	N	O
			15	6	6	2	1
3	A	1	Total	C	H	N	O
			15	6	6	2	1
3	A	1	Total	C	H	N	O
			15	6	6	2	1
3	A	1	Total	C	H	N	O
			15	6	6	2	1

- Molecule 4 is GAMMA-AMINO-BUTANOIC ACID (three-letter code: ABU) (formula:  $C_4H_9NO_2$ ).



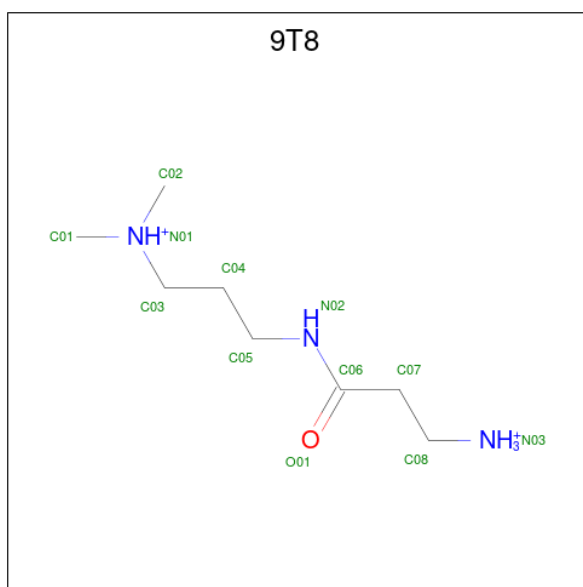
Mol	Chain	Residues	Atoms				
4	A	1	Total	C	H	N	O
			13	4	7	1	1

- Molecule 5 is 4-AMINO-(1-METHYLIMIDAZOLE)-2-CARBOXYLIC ACID (three-letter code: IMT) (formula:  $C_5H_7N_3O_2$ ).



Mol	Chain	Residues	Atoms				
5	A	1	Total	C	H	N	O
			14	5	5	3	1

- Molecule 6 is 3-(3-azaniumylpropanoylamino)propyl-dimethyl-azanium (three-letter code: 9T8) (formula:  $C_8H_{21}N_3O$ ).




Mol	Chain	Residues	Atoms				
			Total	C	H	N	O
6	A	1	31	8	19	3	1

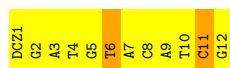
## 4 Residue-property plots

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

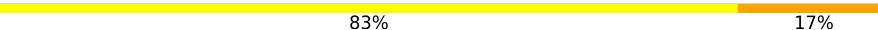
These plots are provided for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-coded according to the number of geometric quality criteria for 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.

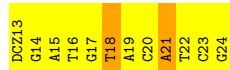
- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain A: 



- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain B: 

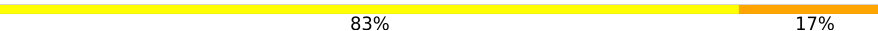


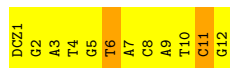
### 4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.


#### 4.2.1 Score per residue for model 1

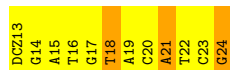
- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain A: 



- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

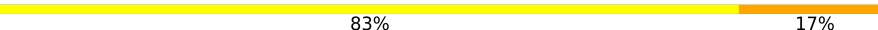
Chain B: 

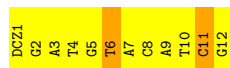




### 4.2.2 Score per residue for model 2

- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain A:  83% 17%



- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

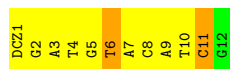
Chain B:  67% 33%



### 4.2.3 Score per residue for model 3

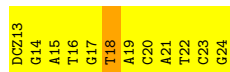
- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain A:  8% 75% 17%




- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

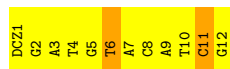
Chain B:  92% 8%



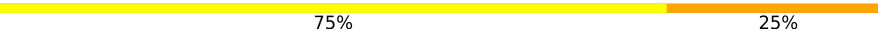
### 4.2.4 Score per residue for model 4

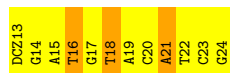
- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain A:  83% 17%



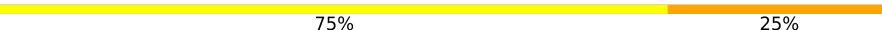
- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

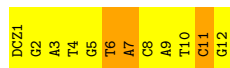
Chain B:  75% 25%



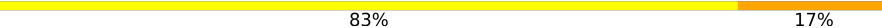
#### 4.2.5 Score per residue for model 5

- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain A:  75% 25%



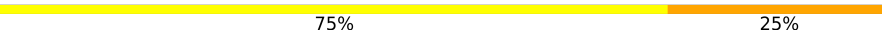
- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

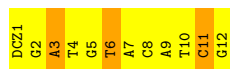
Chain B:  83% 17%



#### 4.2.6 Score per residue for model 6

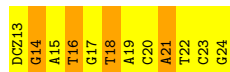
- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain A:  75% 25%




- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

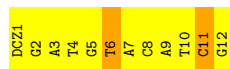
Chain B:  67% 33%



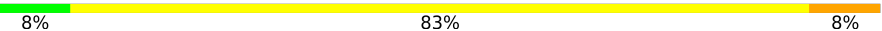
#### 4.2.7 Score per residue for model 7

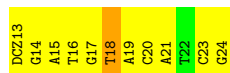
- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain A:  83% 17%



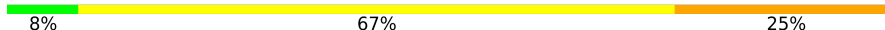
- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

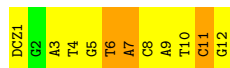
Chain B:  8% 83% 8%



### 4.2.8 Score per residue for model 8

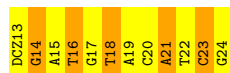
- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain A:  8% 67% 25%



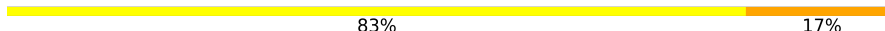
- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

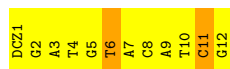
Chain B:  58% 42%




### 4.2.9 Score per residue for model 9

- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain A:  83% 17%



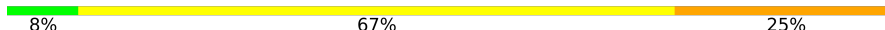
- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

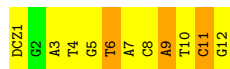
Chain B:  75% 25%



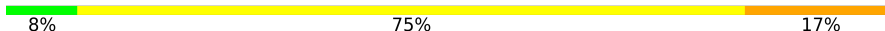
### 4.2.10 Score per residue for model 10

- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain A:  8% 67% 25%



- Molecule 1: DNA (5'-D(\*CP\*GP\*AP\*TP\*GP\*TP\*AP\*CP\*AP\*TP\*CP\*G)-3')

Chain B:  8% 75% 17%



## 5 Refinement protocol and experimental data overview

The models were refined using the following method: *molecular dynamics, matrix relaxation*.

Of the 2000 calculated structures, 10 were deposited, based on the following criterion: *clustering*.

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

Software name	Classification	Version
Amber	refinement	
Amber	structure calculation	
MARDIGRAS	structure calculation	

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 7 of this report.

Chemical shift file(s)	working_cs.cif
Number of chemical shift lists	2
Total number of shifts	572
Number of shifts mapped to atoms	572
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	66%

## 6 Model quality [i](#)

### 6.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: 9T8, PYB, DCZ, ABU, IMT, 9TK

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	1.60±0.01	0±0/254 ( 0.0± 0.0%)	2.61±0.05	29±2/390 ( 7.4± 0.5%)
1	B	1.59±0.01	0±0/254 ( 0.0± 0.0%)	2.56±0.04	24±2/390 ( 6.1± 0.4%)
All	All	1.59	0/5080 ( 0.0%)	2.58	527/7800 ( 6.8%)

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	2.5±0.5
1	B	0.0±0.0	2.0±1.0
All	All	0	45

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	B	15	DA	O4'-C1'-N9	11.52	116.06	108.00	1	10
1	B	21	DA	N1-C6-N6	-10.71	112.17	118.60	3	10
1	A	3	DA	N1-C6-N6	-10.06	112.56	118.60	1	10
1	A	4	DT	O4'-C1'-N1	9.74	114.82	108.00	7	8
1	B	15	DA	N1-C6-N6	-9.70	112.78	118.60	7	10
1	A	9	DA	N1-C6-N6	-9.67	112.80	118.60	7	10
1	A	9	DA	O4'-C1'-N9	9.49	114.64	108.00	1	9
1	B	14	DG	O4'-C1'-N9	8.88	114.21	108.00	6	10
1	B	19	DA	C5-C6-N1	8.24	121.82	117.70	7	10
1	A	4	DT	O4'-C4'-C3'	-8.18	101.09	106.00	6	7

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	7	DA	C5-C6-N1	8.05	121.73	117.70	8	10
1	B	21	DA	C5-C6-N1	8.05	121.73	117.70	2	10
1	B	19	DA	N1-C6-N6	-7.91	113.86	118.60	6	10
1	B	24	DG	O4'-C1'-N9	7.86	113.50	108.00	6	9
1	A	8	DC	N3-C2-O2	-7.82	116.43	121.90	4	10
1	A	11	DC	N3-C2-O2	-7.68	116.53	121.90	3	10
1	B	23	DC	N3-C2-O2	-7.67	116.53	121.90	2	10
1	A	9	DA	C5-C6-N1	7.66	121.53	117.70	1	10
1	A	7	DA	N1-C6-N6	-7.57	114.06	118.60	10	10
1	A	11	DC	O4'-C1'-N1	7.57	113.30	108.00	7	9
1	B	15	DA	C5-C6-N1	7.52	121.46	117.70	8	10
1	A	3	DA	C5-C6-N1	7.47	121.44	117.70	10	10
1	B	20	DC	N3-C2-O2	-7.46	116.67	121.90	4	10
1	B	21	DA	C4-C5-C6	-7.21	113.40	117.00	3	10
1	A	9	DA	C4-C5-C6	-7.20	113.40	117.00	7	10
1	B	20	DC	O4'-C1'-N1	7.17	113.02	108.00	2	4
1	B	15	DA	C4-C5-C6	-7.12	113.44	117.00	7	10
1	A	10	DT	O4'-C1'-N1	7.06	112.94	108.00	9	8
1	A	10	DT	C6-C5-C7	-6.93	118.74	122.90	10	10
1	B	22	DT	C6-C5-C7	-6.88	118.77	122.90	9	9
1	A	4	DT	N3-C2-O2	-6.77	118.24	122.30	1	10
1	A	3	DA	C4-C5-C6	-6.70	113.65	117.00	4	10
1	A	3	DA	O4'-C1'-N9	6.69	112.68	108.00	1	5
1	A	2	DG	O4'-C1'-N9	6.59	112.61	108.00	9	6
1	B	19	DA	C4-C5-C6	-6.53	113.74	117.00	8	10
1	A	12	DG	O4'-C1'-N9	6.51	112.56	108.00	10	7
1	B	18	DT	N3-C2-O2	-6.51	118.40	122.30	9	10
1	B	21	DA	O4'-C1'-N9	6.44	112.51	108.00	1	5
1	A	8	DC	N1-C2-O2	6.42	122.75	118.90	6	10
1	B	14	DG	O4'-C1'-C2'	-6.38	100.79	105.90	4	7
1	A	11	DC	N1-C2-O2	6.30	122.68	118.90	2	10
1	A	5	DG	N1-C6-O6	-6.29	116.13	119.90	2	10
1	B	23	DC	N1-C2-O2	6.27	122.66	118.90	3	10
1	B	16	DT	C6-C5-C7	-6.24	119.16	122.90	4	10
1	A	4	DT	C6-C5-C7	-6.16	119.21	122.90	3	10
1	A	7	DA	C4-C5-C6	-6.10	113.95	117.00	9	10
1	B	17	DG	N1-C6-O6	-6.01	116.29	119.90	1	10
1	A	11	DC	P-O3'-C3'	5.98	126.87	119.70	7	10
1	B	22	DT	O4'-C1'-N1	5.84	112.09	108.00	1	1
1	A	6	DT	C6-C5-C7	-5.83	119.40	122.90	7	7
1	B	20	DC	N1-C2-O2	5.79	122.38	118.90	10	10

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	3	DA	P-O3'-C3'	5.61	126.44	119.70	2	6
1	B	15	DA	C1'-O4'-C4'	-5.59	104.51	110.10	8	7
1	A	6	DT	N3-C2-O2	-5.57	118.96	122.30	9	10
1	B	14	DG	N1-C6-O6	-5.55	116.57	119.90	8	2
1	A	11	DC	O4'-C4'-C3'	-5.53	102.29	104.50	7	1
1	B	20	DC	N3-C4-C5	5.42	124.07	121.90	7	1
1	A	5	DG	O4'-C1'-N9	5.36	111.75	108.00	1	1
1	A	12	DG	N1-C6-O6	-5.35	116.69	119.90	1	5
1	B	18	DT	C5-C6-N1	-5.33	120.50	123.70	1	6
1	A	5	DG	P-O3'-C3'	5.30	126.06	119.70	1	9
1	A	3	DA	C1'-O4'-C4'	-5.28	104.82	110.10	1	1
1	A	2	DG	N1-C6-O6	-5.26	116.75	119.90	4	2
1	B	18	DT	C6-C5-C7	-5.21	119.77	122.90	10	1
1	A	8	DC	N3-C4-C5	5.17	123.97	121.90	10	4
1	B	16	DT	N3-C2-O2	-5.17	119.20	122.30	9	6
1	A	6	DT	C5-C6-N1	-5.13	120.62	123.70	4	1
1	A	4	DT	N1-C2-N3	5.04	117.62	114.60	1	1
1	A	5	DG	N9-C4-C5	5.03	107.41	105.40	2	2

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	6	DT	Sidechain	10
1	A	11	DC	Sidechain	10
1	B	18	DT	Sidechain	10
1	B	16	DT	Sidechain	4
1	B	14	DG	Sidechain	3
1	A	7	DA	Sidechain	2
1	B	23	DC	Sidechain	2
1	B	24	DG	Sidechain	1
1	A	2	DG	Sidechain	1
1	A	3	DA	Sidechain	1
1	A	9	DA	Sidechain	1

## 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	B	243	137	137	1±0
3	A	54	36	36	6±1
5	A	9	5	5	1±0
All	All	5750	3460	3210	68

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 8.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
3:A:103:PYB:HD1	3:A:103:PYB:O	0.53	2.04	3	10
3:A:107:PYB:O	3:A:107:PYB:HD1	0.53	2.04	1	10
3:A:108:PYB:O	3:A:108:PYB:HD1	0.52	2.04	5	10
3:A:102:PYB:HD1	3:A:102:PYB:O	0.49	2.06	7	10
5:A:106:IMT:HD1	5:A:106:IMT:O	0.47	2.09	7	10
3:A:104:PYB:O	3:A:104:PYB:HD1	0.47	2.10	9	9
3:A:109:PYB:CB1	1:B:21:DA:H1'	0.46	2.41	1	8
3:A:109:PYB:HD1	3:A:109:PYB:O	0.41	2.15	5	1

## 6.3 Torsion angles [i](#)

### 6.3.1 Protein backbone [i](#)

There are no protein molecules in this entry.

### 6.3.2 Protein sidechains [i](#)

There are no protein molecules in this entry.

### 6.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

2 non-standard protein/DNA/RNA residues are modelled in this entry.



In the following table, the Counts columns list the number of bonds for which Mogul statistics could be retrieved, the number of bonds that are observed in the model and the number of bonds that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length is the number of standard deviations the observed value is removed from the expected value. A bond length with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the average root-mean-square of all Z scores of the bond lengths.

Mol	Type	Chain	Res	Link	Bond lengths		
					Counts	RMSZ	#Z>2
1	DCZ	A	1	1	17,17,17	0.63±0.01	0±0 (0±0%)
1	DCZ	B	13	1	17,17,17	0.59±0.01	0±0 (0±0%)

In the following table, the Counts columns list the number of angles for which Mogul statistics could be retrieved, the number of angles that are observed in the model and the number of angles that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond angle is the number of standard deviations the observed value is removed from the expected value. A bond angle with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the average root-mean-square of all Z scores of the bond angles.

Mol	Type	Chain	Res	Link	Bond angles		
					Counts	RMSZ	#Z>2
1	DCZ	A	1	1	24,24,24	1.24±0.03	2±0 (9±1%)
1	DCZ	B	13	1	24,24,24	1.11±0.03	1±0 (4±1%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the chemical component dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	DCZ	B	13	1	-	0±0,6,18,18	0±0,2,2,2
1	DCZ	A	1	1	-	0±0,6,18,18	0±0,2,2,2

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	B	13	DCZ	O2-C2-N3	3.54	116.56	122.33	2	10
1	A	1	DCZ	O2-C2-N3	3.45	116.72	122.33	1	10
1	A	1	DCZ	O4'-C1'-C2'	2.85	100.86	106.25	1	10

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	B	13	DCZ	O4'-C1'-N1	2.25	111.88	107.86	3	1
1	A	1	DCZ	O4'-C1'-N1	2.22	111.83	107.86	10	3

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 6.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 6.6 Ligand geometry [i](#)

10 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds for which Mogul statistics could be retrieved, the number of bonds that are observed in the model and the number of bonds that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length is the number of standard deviations the observed value is removed from the expected value. A bond length with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the average root-mean-square of all Z scores of the bond lengths.

Mol	Type	Chain	Res	Link	Bond lengths		
					Counts	RMSZ	#Z>2
2	9TK	A	101	3	7,8,9	0.58±0.01	0±0 (0±0%)
4	ABU	A	105	3,5	5,5,6	0.66±0.01	0±0 (0±0%)
5	IMT	A	106	3,4	5,9,10	0.76±0.01	0±0 (0±0%)
3	PYB	A	109	3,6	7,9,10	1.31±0.05	1±0 (14±0%)
3	PYB	A	108	3	7,9,10	1.75±0.03	1±0 (18±6%)
3	PYB	A	104	3,4	7,9,10	1.49±0.07	1±0 (14±0%)
6	9T8	A	110	3	11,11,11	1.43±0.02	3±0 (29±3%)
3	PYB	A	107	3,5	7,9,10	1.74±0.04	2±0 (28±0%)
3	PYB	A	102	2,3	7,9,10	1.59±0.04	1±0 (17±5%)
3	PYB	A	103	3	7,9,10	1.64±0.04	2±0 (25±5%)

In the following table, the Counts columns list the number of angles for which Mogul statistics could be retrieved, the number of angles that are observed in the model and the number of angles

that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond angle is the number of standard deviations the observed value is removed from the expected value. A bond angle with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the average root-mean-square of all Z scores of the bond angles.

Mol	Type	Chain	Res	Link	Counts	Bond angles	
						RMSZ	#Z>2
2	9TK	A	101	3	5,10,12	1.49±0.11	2±0 (36±8%)
4	ABU	A	105	3,5	4,4,6	0.53±0.06	0±0 (0±0%)
5	IMT	A	106	3,4	5,12,14	1.46±0.06	2±0 (36±8%)
3	PYB	A	109	3,6	3,12,14	2.03±0.11	1±0 (33±0%)
3	PYB	A	108	3	3,12,14	2.53±0.17	1±0 (36±10%)
3	PYB	A	104	3,4	3,12,14	2.23±0.16	1±0 (33±0%)
6	9T8	A	110	3	12,12,12	0.53±0.08	0±0 (0±0%)
3	PYB	A	107	3,5	3,12,14	3.39±0.13	2±0 (66±0%)
3	PYB	A	102	2,3	3,12,14	3.51±0.11	2±0 (53±16%)
3	PYB	A	103	3	3,12,14	2.97±0.21	2±0 (56±15%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the chemical component dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	PYB	A	103	3	-	0±0,0,2,4	0±0,1,1,1
3	PYB	A	104	3,4	-	0±0,0,2,4	0±0,1,1,1
3	PYB	A	108	3	-	0±0,0,2,4	0±0,1,1,1
3	PYB	A	107	3,5	-	0±0,0,2,4	0±0,1,1,1
5	IMT	A	106	3,4	-	0±0,0,2,4	0±0,1,1,1
4	ABU	A	105	3,5	-	0±0,2,3,4	-
3	PYB	A	102	2,3	-	0±0,0,2,4	0±0,1,1,1
6	9T8	A	110	3	-	0±0,10,10,10	-
2	9TK	A	101	3	-	0±0,0,2,4	0±0,1,1,1
3	PYB	A	109	3,6	-	0±0,0,2,4	0±0,1,1,1

All unique bond 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(Å)	Ideal(Å)	Models	
								Worst	Total
3	A	108	PYB	CB1-CA	4.11	1.43	1.39	6	10
3	A	107	PYB	CB1-CA	4.06	1.43	1.39	1	10

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)	Models	
								Worst	Total
3	A	103	PYB	CB1-CA	3.83	1.42	1.39	6	10
3	A	104	PYB	CB1-CA	3.59	1.42	1.39	4	10
3	A	102	PYB	CB1-CA	3.53	1.42	1.39	6	10
3	A	109	PYB	CB1-CA	3.09	1.42	1.39	5	10
6	A	110	9T8	C02-N01	2.45	1.53	1.46	5	10
6	A	110	9T8	C01-N01	2.43	1.53	1.46	7	10
6	A	110	9T8	C06-N02	2.27	1.38	1.33	9	10
3	A	107	PYB	CG1-NG2	2.19	1.41	1.36	6	10
3	A	103	PYB	CG1-NG2	2.13	1.41	1.36	4	8
3	A	102	PYB	CG1-NG2	2.04	1.40	1.36	1	2
3	A	108	PYB	CG1-NG2	2.02	1.40	1.36	3	3
6	A	110	9T8	C03-N01	2.01	1.53	1.46	7	2

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
3	A	102	PYB	CB1-CA-CB	5.86	108.92	106.05	1	10
3	A	107	PYB	CB1-CA-CB	5.42	108.70	106.05	9	10
3	A	103	PYB	CB1-CA-CB	5.04	108.52	106.05	8	10
3	A	108	PYB	CB1-CA-CB	4.21	108.11	106.05	3	10
3	A	104	PYB	CB1-CA-CB	4.17	108.09	106.05	2	10
3	A	109	PYB	CB1-CA-CB	3.45	107.74	106.05	1	10
2	A	101	9TK	C88-N81-C82	2.98	130.70	126.50	6	10
3	A	107	PYB	O-C-CG1	2.57	120.53	124.17	6	10
5	A	106	IMT	CD-NG2-CG1	2.42	129.91	126.50	2	8
3	A	102	PYB	O-C-CG1	2.25	120.99	124.17	6	6
5	A	106	IMT	CB-NG2-CG1	2.24	106.00	108.47	2	10
3	A	103	PYB	O-C-CG1	2.23	121.02	124.17	8	7
2	A	101	9TK	C83-N81-C82	2.20	105.86	108.45	5	8
3	A	108	PYB	O-C-CG1	2.05	121.27	124.17	5	1

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 6.7 Other polymers ⓘ

There are no such molecules in this entry.

## 6.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

## 7 Chemical shift validation [i](#)

The completeness of assignment taking into account all chemical shift lists is 66% for the well-defined parts and 66% for the entire structure.

### 7.1 Chemical shift list 1

File name: working\_cs.cif

Chemical shift list name: *NMRstar\_D2O\_pa8*

#### 7.1.1 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	298
Number of shifts mapped to atoms	298
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	49

#### 7.1.2 Chemical shift referencing [i](#)

No chemical shift referencing corrections were calculated (not enough data).

#### 7.1.3 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 44%, i.e. 193 atoms were assigned a chemical shift out of a possible 434. 0 out of 0 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	<sup>1</sup> H	<sup>13</sup> C	<sup>15</sup> N
Backbone	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Sidechain	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Aromatic	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Overall	193/434 (44%)	97/258 (38%)	96/148 (65%)	0/28 (0%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 44%, i.e. 193 atoms were assigned a chemical shift out of a possible 434. 0 out of 0 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	<sup>1</sup> H	<sup>13</sup> C	<sup>15</sup> N
Backbone	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Sidechain	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Aromatic	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Overall	193/434 (44%)	97/258 (38%)	96/148 (65%)	0/28 (0%)

### 7.1.4 Statistically unusual chemical shifts ⓘ

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	10	DT	C7	11.27	15.29 – 13.69	-20.1
1	B	22	DT	C7	11.30	15.29 – 13.69	-20.0
1	A	4	DT	C7	11.36	15.29 – 13.69	-19.6
1	B	16	DT	C7	11.36	15.29 – 13.69	-19.5
1	A	6	DT	C7	11.54	15.29 – 13.69	-18.5
1	B	18	DT	C7	12.16	15.29 – 13.69	-14.6
1	A	9	DA	C4'	82.41	90.20 – 84.60	-8.9
1	B	21	DA	C4'	82.48	90.20 – 84.60	-8.8
1	B	19	DA	C4'	82.68	90.20 – 84.60	-8.4
1	A	9	DA	C1'	80.52	88.48 – 82.48	-8.3
1	B	21	DA	C1'	80.56	88.48 – 82.48	-8.2
1	A	7	DA	C1'	80.74	88.48 – 82.48	-7.9
1	A	10	DT	C1'	81.40	90.81 – 83.51	-7.9
1	A	7	DA	C4'	82.99	90.20 – 84.60	-7.9
1	B	22	DT	C1'	81.42	90.81 – 83.51	-7.9
1	A	6	DT	C1'	81.83	90.81 – 83.51	-7.3
1	B	18	DT	C1'	81.90	90.81 – 83.51	-7.2
1	B	22	DT	C6	135.86	141.81 – 136.91	-7.1
1	A	10	DT	C6	135.88	141.81 – 136.91	-7.1
1	B	19	DA	C1'	81.28	88.48 – 82.48	-7.0
1	B	20	DC	C1'	81.56	92.11 – 83.21	-6.9
1	A	8	DC	C1'	81.58	92.11 – 83.21	-6.8
1	A	11	DC	C5	95.96	100.78 – 96.68	-6.8
1	B	18	DT	H4'	2.06	5.65 – 2.55	-6.6
1	A	6	DT	H4'	2.07	5.65 – 2.55	-6.6
1	B	16	DT	C6	136.16	141.81 – 136.91	-6.5
1	B	16	DT	C1'	82.40	90.81 – 83.51	-6.5
1	B	20	DC	C5	96.12	100.78 – 96.68	-6.4
1	A	8	DC	C5	96.14	100.78 – 96.68	-6.3
1	B	23	DC	C5	96.15	100.78 – 96.68	-6.3
1	A	4	DT	C6	136.28	141.81 – 136.91	-6.3

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Mol	Chain	Res	Type	Atom	Shift, ppm	Expected range, ppm	Z-score
1	B	21	DA	C2	150.88	158.48 – 151.68	-6.2
1	B	20	DC	C6	139.55	146.45 – 140.25	-6.1
1	B	18	DT	C6	136.40	141.81 – 136.91	-6.1
1	A	6	DT	C4'	80.83	90.79 – 81.59	-5.8
1	A	6	DT	C6	136.53	141.81 – 136.91	-5.8
1	A	3	DA	C1'	82.05	88.48 – 82.48	-5.7
1	A	8	DC	C6	139.82	146.45 – 140.25	-5.7
1	B	15	DA	C8	138.56	144.55 – 138.85	-5.5
1	B	15	DA	C1'	82.20	88.48 – 82.48	-5.5
1	B	19	DA	H4'	2.61	5.86 – 2.76	-5.5
1	A	9	DA	C2	151.45	158.48 – 151.68	-5.3
1	A	2	DG	C1'	81.38	89.32 – 81.62	-5.3
1	A	8	DC	H4'	2.21	5.92 – 2.32	-5.3
1	A	9	DA	H4'	2.68	5.86 – 2.76	-5.3
1	B	20	DC	H4'	2.23	5.92 – 2.32	-5.2
1	A	4	DT	C1'	83.34	90.81 – 83.51	-5.2
1	A	3	DA	C8	138.74	144.55 – 138.85	-5.2
1	B	18	DT	C4'	81.50	90.79 – 81.59	-5.1

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

No *random coil index* (RCI) plot could be generated from the current chemical shift list (NMRstar\_D2O\_pa8). RCI is only applicable to proteins.

## 7.2 Chemical shift list 2

File name: working\_cs.cif

Chemical shift list name: NMRstar\_H2O\_pa8

### 7.2.1 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	274
Number of shifts mapped to atoms	274
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	6



### 7.2.2 Chemical shift referencing [i](#)

No chemical shift referencing corrections were calculated (not enough data).

### 7.2.3 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 44%, i.e. 191 atoms were assigned a chemical shift out of a possible 434. 0 out of 0 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	<sup>1</sup> H	<sup>13</sup> C	<sup>15</sup> N
Backbone	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Sidechain	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Aromatic	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Overall	191/434 (44%)	191/258 (74%)	0/148 (0%)	0/28 (0%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 44%, i.e. 191 atoms were assigned a chemical shift out of a possible 434. 0 out of 0 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	<sup>1</sup> H	<sup>13</sup> C	<sup>15</sup> N
Backbone	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Sidechain	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Aromatic	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Overall	191/434 (44%)	191/258 (74%)	0/148 (0%)	0/28 (0%)

### 7.2.4 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	B	18	DT	H4'	2.05	5.65 – 2.55	-6.6
1	A	6	DT	H4'	2.05	5.65 – 2.55	-6.6
1	B	19	DA	H4'	2.61	5.86 – 2.76	-5.5
1	A	8	DC	H4'	2.19	5.92 – 2.32	-5.4
1	A	9	DA	H4'	2.67	5.86 – 2.76	-5.3
1	B	20	DC	H4'	2.22	5.92 – 2.32	-5.3

### 7.2.5 Random Coil Index (RCI) plots

No *random coil index* (RCI) plot could be generated from the current chemical shift list (NMRstar\_H2O\_pa8). RCI is only applicable to proteins.