W O R L D W I D E
wwPDB
P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report (i)

Feb 1, 2016 – 11:49 AM GMT

PDB ID : 3Q23
Title : X-ray crystal structure of the N4 mini-VRNAP and P2_7a promoter tran-
scription initiation complex with GMPCPP and Manganese: sustrate complex
II
Authors : Gleghorn, M.L.; Murakami, K.S.
Deposited on : 2010-12-19
Resolution : 1.80 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

http://wwpdb.org/validation/2016/XrayValidationReportHelp

with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:
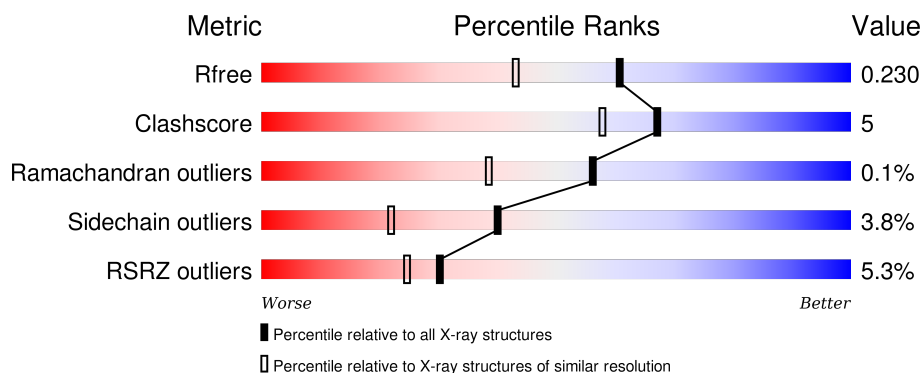
1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 Å.

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	Percentile Ranks	Value
Rfree		0.230
Clashscore		5
Ramachandran outliers		0.1%
Sidechain outliers		3.8%
RSRZ outliers		5.3%

Worse   *Better*

■ Percentile relative to all X-ray structures
▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R$_{free}$	91344	4533 (1.80-1.80)
Clashscore	102246	5383 (1.80-1.80)
Ramachandran outliers	100387	5320 (1.80-1.80)
Sidechain outliers	100360	5319 (1.80-1.80)
RSRZ outliers	91569	4547 (1.80-1.80)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. 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% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	1118	5% / 87% / 9% ··
1	B	1118	5% / 87% / 10% ··
2	C	36	3% / 47% / 8% / 44%
2	D	36	3% / 56% / · / 42%

2 Entry composition (i)

There are 6 unique types of molecules in this entry. The entry contains 20493 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Virion RNA polymerase.

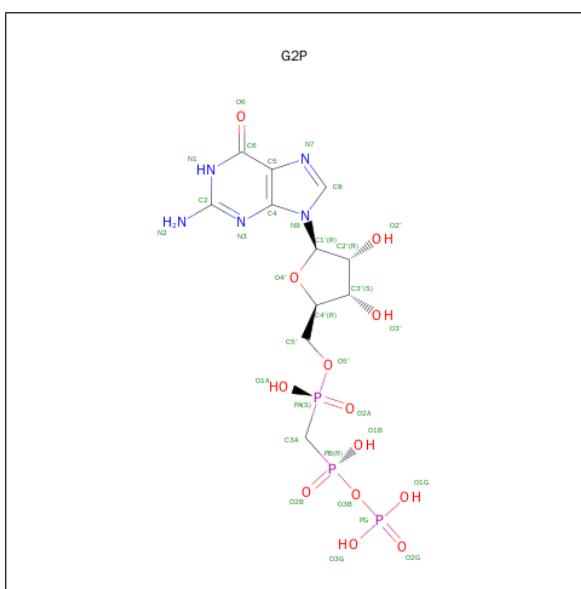| Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	1095	Total	C	N	O	S	0	0	0
			8454	5306	1435	1672	41			
1	B	1094	Total	C	N	O	S	0	0	0
			8443	5299	1432	1671	41			

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-11	MET	-	EXPRESSION TAG	UNP Q859P9
A	-10	GLY	-	EXPRESSION TAG	UNP Q859P9
A	-9	GLY	-	EXPRESSION TAG	UNP Q859P9
A	-8	SER	-	EXPRESSION TAG	UNP Q859P9
A	-7	HIS	-	EXPRESSION TAG	UNP Q859P9
A	-6	HIS	-	EXPRESSION TAG	UNP Q859P9
A	-5	HIS	-	EXPRESSION TAG	UNP Q859P9
A	-4	HIS	-	EXPRESSION TAG	UNP Q859P9
A	-3	HIS	-	EXPRESSION TAG	UNP Q859P9
A	-2	HIS	-	EXPRESSION TAG	UNP Q859P9
A	-1	ARG	-	EXPRESSION TAG	UNP Q859P9
A	0	SER	-	EXPRESSION TAG	UNP Q859P9
B	-11	MET	-	EXPRESSION TAG	UNP Q859P9
B	-10	GLY	-	EXPRESSION TAG	UNP Q859P9
B	-9	GLY	-	EXPRESSION TAG	UNP Q859P9
B	-8	SER	-	EXPRESSION TAG	UNP Q859P9
B	-7	HIS	-	EXPRESSION TAG	UNP Q859P9
B	-6	HIS	-	EXPRESSION TAG	UNP Q859P9
B	-5	HIS	-	EXPRESSION TAG	UNP Q859P9
B	-4	HIS	-	EXPRESSION TAG	UNP Q859P9
B	-3	HIS	-	EXPRESSION TAG	UNP Q859P9
B	-2	HIS	-	EXPRESSION TAG	UNP Q859P9
B	-1	ARG	-	EXPRESSION TAG	UNP Q859P9
B	0	SER	-	EXPRESSION TAG	UNP Q859P9

- Molecule 2 is a DNA chain called DNA (5'-D(*TP*GP*CP*CP*TP*CP*CP*CP*AP*GP* GP*CP*AP*TP*CP*CP*AP*AP*AP*AP*GP*AP*AP*GP*CP*GP*GP*AP*GP*CP*TP *TP*CP*TP*TP*C)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	20	Total 396	C 185	N 79	O 112	P 20	0	0	0
2	D	21	Total 432	C 205	N 83	O 123	P 21	0	0	0

- Molecule 3 is PHOSPHOMETHYLPHOSPHONIC ACID GUANYLATE ESTER (three-letter code: G2P) (formula: $C_{11}H_{18}N_5O_{13}P_3$).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total 32	C 11	N 5	O 13	P 3	0	0
3	A	1	Total 32	C 11	N 5	O 13	P 3	0	0
3	B	1	Total 32	C 11	N 5	O 13	P 3	0	0
3	B	1	Total 32	C 11	N 5	O 13	P 3	0	0

- Molecule 4 is MANGANESE (II) ION (three-letter code: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	2	Total 2	Mn 2	0	0

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	2	Total Mn 2 2		0	0

- Molecule 5 is DIHYDROGENPHOSPHATE ION (three-letter code: 2HP) (formula: H_2O_4P).
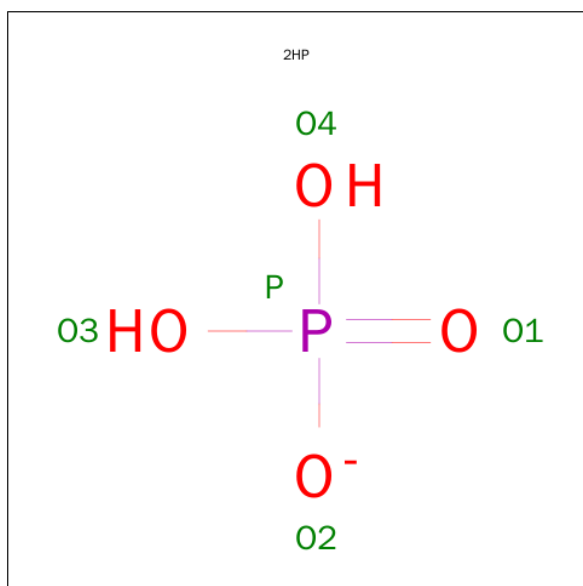
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total O P 5 4 1			0	0
5	B	1	Total O P 5 4 1			0	0

- Molecule 6 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1187	Total O 1187 1187		0	0
6	C	92	Total O 92 92		0	0
6	B	1240	Total O 1240 1240		0	0
6	D	107	Total O 107 107		0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-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. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.
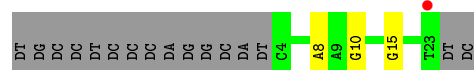
- Molecule 1: Virion RNA polymerase
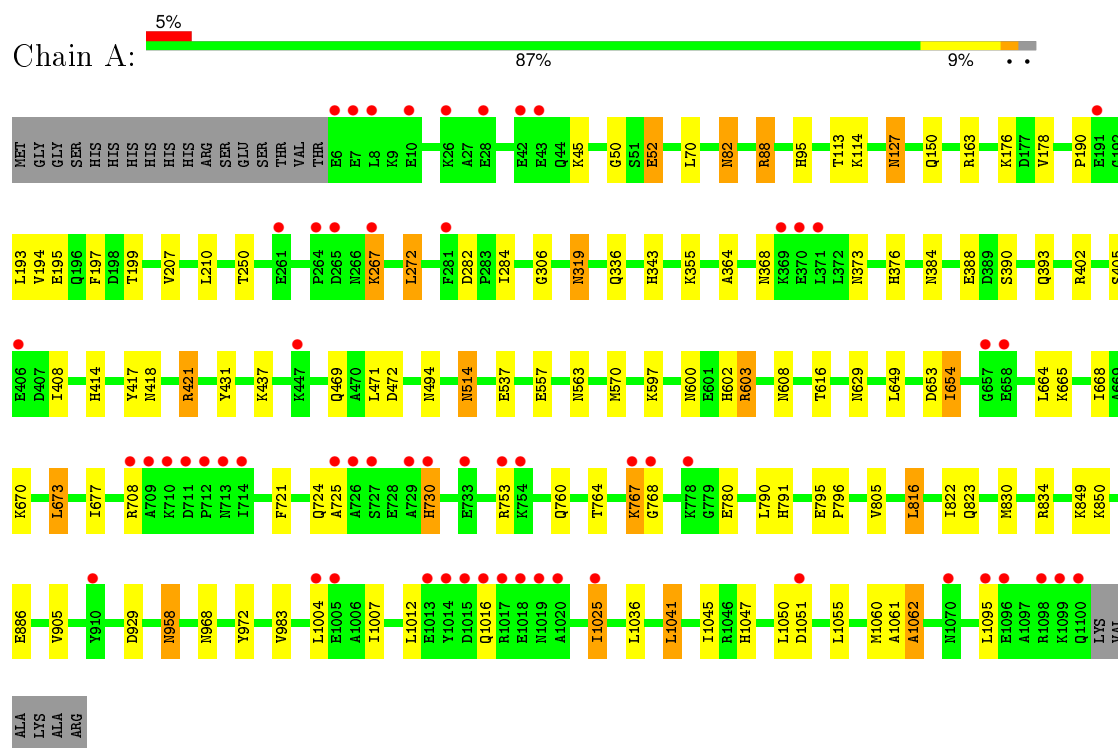
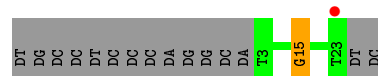- Molecule 1: Virion RNA polymerase
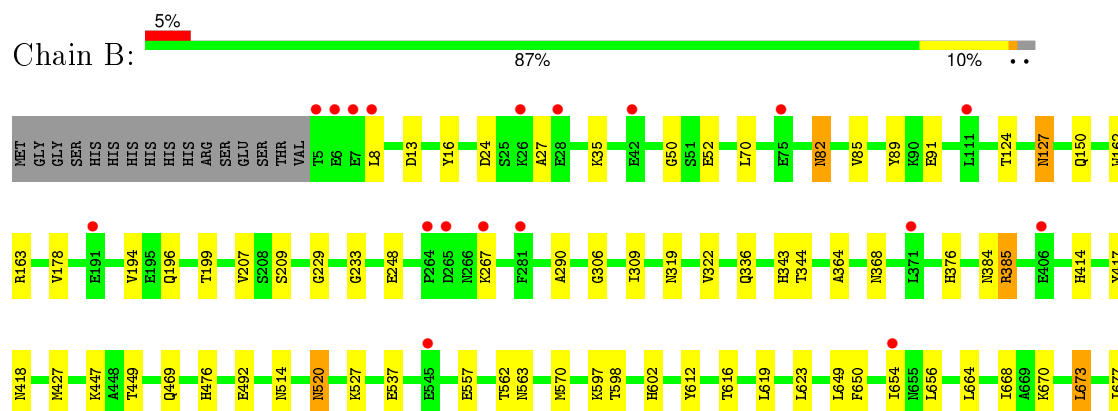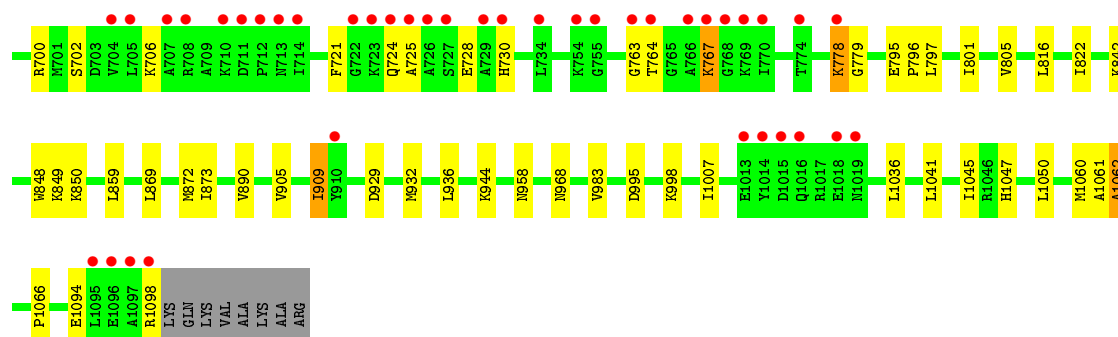
• Molecule 2: DNA (5'-D(*TP*GP*CP*CP*TP*CP*CP*CP*AP*GP*GP*CP*AP*TP*CP*CP
*AP*AP*AP*AP*GP*AP*AP*GP*CP*GP*GP*AP*GP*CP*TP*TP*CP*TP*TP*C)-3')

• Molecule 2: DNA (5'-D(*TP*GP*CP*CP*TP*CP*CP*CP*AP*GP*GP*CP*AP*TP*CP*CP
*AP*AP*AP*AP*GP*AP*AP*GP*CP*GP*GP*AP*GP*CP*TP*TP*CP*TP*TP*C)-3')

4   Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	82.83Å 111.86Å 276.09Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 1.80 42.56 – 1.80	Depositor EDS
% Data completeness (in resolution range)	99.0 (50.00-1.80) 99.0 (42.56-1.80)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.44 (at 1.81Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.200 , 0.231 0.198 , 0.230	Depositor DCC
R_{free} test set	11758 reflections (5.28%)	DCC
Wilson B-factor (Å^2)	23.9	Xtriage
Anisotropy	0.288	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 48.0	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning[2]	$< |L| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Outliers	0 of 234301 reflections	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	20493	wwPDB-VP
Average B, all atoms (Å^2)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.83% of the height of the origin peak. No significant pseudotranslation is detected.*

---

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: 2HP, MN, G2P

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 root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$|Z|$ >5	RMSZ	#$|Z|$ >5
1	A	0.35	0/8583	0.51	1/11609 (0.0%)
1	B	0.36	0/8572	0.51	0/11596
2	C	0.61	0/445	1.13	1/685 (0.1%)
2	D	0.61	0/485	1.18	1/746 (0.1%)
All	All	0.37	0/18085	0.57	3/24636 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	673	LEU	CA-CB-CG	5.85	128.75	115.30
2	D	15	DG	P-O3'-C3'	5.32	126.08	119.70
2	C	15	DG	P-O3'-C3'	5.25	126.00	119.70

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the 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 within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	8454	0	8479	84	0
1	B	8443	0	8465	83	0
2	C	396	0	211	2	0
2	D	432	0	236	1	0

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	64	0	27	4	0
3	B	64	0	27	1	0
4	A	2	0	0	0	0
4	B	2	0	0	0	0
5	A	5	0	0	0	0
5	B	5	0	0	1	0
6	A	1187	0	0	9	0
6	B	1240	0	0	13	0
6	C	92	0	0	2	0
6	D	107	0	0	1	0
All	All	20493	0	17445	170	0

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.

The worst 5 of 170 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:385:ARG:HG2	1:B:385:ARG:HH11	1.14	1.12
1:B:469:GLN:HE22	1:B:557:GLU:H	1.10	1.00
1:A:469:GLN:HE22	1:A:557:GLU:H	1.13	0.97
1:A:603:ARG:NH1	1:A:608:ASN:OD1	2.06	0.89
1:A:753:ARG:HH11	1:A:753:ARG:HG2	1.41	0.85

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 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 X-ray entries followed by that with respect to entries of similar resolution.

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	1093/1118 (98%)	1072 (98%)	20 (2%)	1 (0%)	56 38
1	B	1092/1118 (98%)	1074 (98%)	17 (2%)	1 (0%)	56 38

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	2185/2236 (98%)	2146 (98%)	37 (2%)	2 (0%)	56 38

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	1062	ALA
1	A	1062	ALA

5.3.2 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 X-ray entries followed by that with respect to entries of similar resolution.

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	916/935 (98%)	876 (96%)	40 (4%)	35	17
1	B	915/935 (98%)	886 (97%)	29 (3%)	46	29
All	All	1831/1870 (98%)	1762 (96%)	69 (4%)	40	22

5 of 69 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	816	LEU
1	A	1055	LEU
1	B	909	ILE
1	A	958	ASN
1	A	1036	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 83 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	954	ASN
1	B	150	GLN
1	B	914	GLN
1	A	958	ASN
1	A	1047	HIS

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

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

5.5 Carbohydrates (i)

There are no carbohydrates in this entry.

5.6 Ligand geometry (i)

Of 10 ligands modelled in this entry, 4 are monoatomic - leaving 6 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or 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 length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#|Z| > 2$	Counts	RMSZ	$\#|Z| > 2$
3	G2P	A	1108	4	26,34,34	1.28	3 (11%)	33,54,54	2.14	12 (36%)
5	2HP	A	1110	-	4,4,4	4.22	2 (50%)	6,6,6	0.61	0
3	G2P	A	1111	4	26,34,34	1.30	4 (15%)	33,54,54	1.81	8 (24%)
3	G2P	B	1108	4	26,34,34	1.31	4 (15%)	33,54,54	1.79	9 (27%)
3	G2P	B	1109	4	26,34,34	1.42	5 (19%)	33,54,54	2.14	9 (27%)
5	2HP	B	1111	-	4,4,4	4.28	2 (50%)	6,6,6	0.74	0

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	G2P	A	1108	4	-	0/15/38/38	0/3/3/3
5	2HP	A	1110	-	-	0/0/0/0	0/0/0/0
3	G2P	A	1111	4	-	0/15/38/38	0/3/3/3

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	G2P	B	1108	4	-	0/15/38/38	0/3/3/3
3	G2P	B	1109	4	-	0/15/38/38	0/3/3/3
5	2HP	B	1111	-	-	0/0/0/0	0/0/0/0

The worst 5 of 20 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	1109	G2P	PA-O1A	-2.22	1.50	1.56
3	B	1108	G2P	PA-O1A	-2.10	1.51	1.56
3	A	1108	G2P	PA-O1A	-2.07	1.51	1.56
3	B	1109	G2P	PB-O1B	-2.03	1.51	1.56
3	A	1111	G2P	PA-O1A	-2.03	1.51	1.56

The worst 5 of 38 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	B	1109	G2P	C2'-C1'-N9	-6.94	103.69	114.29
3	A	1108	G2P	C2'-C1'-N9	-6.69	104.08	114.29
3	A	1108	G2P	N3-C2-N1	-4.63	120.40	127.44
3	B	1108	G2P	N3-C2-N1	-4.48	120.62	127.44
3	A	1111	G2P	N3-C2-N1	-4.38	120.78	127.44

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	1108	G2P	2	0
3	A	1111	G2P	2	0
3	B	1108	G2P	1	0
5	B	1111	2HP	1	0

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	1095/1118 (97%)	0.19	58 (5%)	30	25	13, 25, 47, 75	0
1	B	1094/1118 (97%)	0.21	58 (5%)	30	25	14, 23, 44, 71	0
2	C	20/36 (55%)	-0.30	1 (5%)	32	27	19, 29, 50, 55	0
2	D	21/36 (58%)	-0.09	1 (4%)	34	28	21, 25, 43, 75	0
All	All	2230/2308 (96%)	0.19	118 (5%)	30	25	13, 24, 46, 75	0

The worst 5 of 118 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	725	ALA	7.4
1	A	1018	GLU	6.3
1	A	1014	TYR	5.9
1	A	1016	GLN	5.9
1	A	1019	ASN	5.5

6.2 Non-standard residues in protein, DNA, RNA chains (i)

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

6.3 Carbohydrates (i)

There are no carbohydrates in this entry.

6.4 Ligands (i)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors

of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	LLDF	B-factors(Å²)	Q<0.9
5	2HP	B	1111	5/5	0.95	0.13	1.93	33,33,34,34	0
5	2HP	A	1110	5/5	0.96	0.12	1.51	30,30,31,31	0
3	G2P	B	1108	32/32	0.93	0.11	-0.35	21,24,34,34	0
3	G2P	A	1108	32/32	0.97	0.10	-0.71	15,17,18,19	0
3	G2P	B	1109	32/32	0.97	0.10	-0.75	17,19,22,22	0
3	G2P	A	1111	32/32	0.95	0.10	-1.17	18,20,27,28	0
4	MN	A	1109	1/1	0.99	0.07	-1.80	17,17,17,17	0
4	MN	B	1110	1/1	1.00	0.04	-5.35	19,19,19,19	0
4	MN	A	1107	1/1	1.00	0.05	-	16,16,16,16	0
4	MN	B	1107	1/1	1.00	0.05	-	20,20,20,20	0

6.5 Other polymers (i)

There are no such residues in this entry.