wwPDB X-ray Structure Validation Summary Report (i)

Apr 28, 2024 – 11:42 am BST

PDB ID	:	4A3M
Title	:	RNA Polymerase II initial transcribing complex with a 4nt DNA-RNA hybrid and soaked with AMPCPP
Authors	:	Cheung, A.C.M.; Sainsbury, S.; Cramer, P.
Deposited on	:	2011-09-30
Resolution	:	3.90 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
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

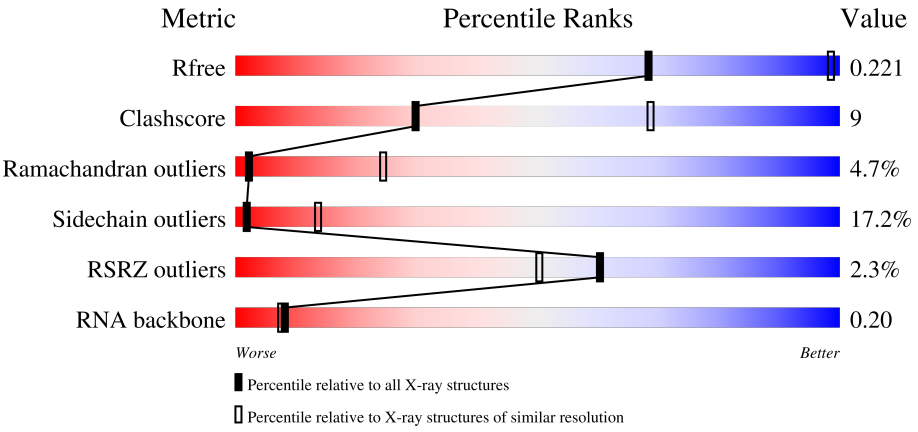
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36.2
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

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 3.90 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	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1002 (4.14-3.66)
Clashscore	141614	1004 (4.12-3.68)
Ramachandran outliers	138981	1021 (4.14-3.66)
Sidechain outliers	138945	1014 (4.14-3.66)
RSRZ outliers	127900	1275 (4.20-3.60)
RNA backbone	3102	1040 (4.76-3.00)

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 of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. 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	1732	2% 51% 26% 5% 18%
2	B	1224	2% 60% 25% 6% 9%
3	C	318	48% 30% 5% 16%
4	D	221	% 53% 24% 19%

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Mol	Chain	Length	Quality of chain
5	E	215	2% 70% 27%
6	F	155	37% 13% 5% 46%
7	G	171	1% 66% 27% 6%
8	H	146	8% 57% 28% 5% 9%
9	I	122	1% 72% 20% 5%
10	J	70	50% 33% 6% 7%
11	K	120	1% 64% 27% 5%
12	L	70	11% 33% 23% 9% 34%
13	N	14	14% 50% 14% 36%
14	P	4	25% 75%
15	T	26	4% 27% 35% 35%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
16	APC	A	2455	-	-	-	X

2 Entry composition (i)

There are 18 unique types of molecules in this entry. The entry contains 31868 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 DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	1425	11197	7051	1958	2126	62	0	0	0

- Molecule 2 is a protein called DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	1115	8859	5609	1554	1641	55	0	0	0

- Molecule 3 is a protein called DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	266	2095	1317	348	417	13	0	0	0

- Molecule 4 is a protein called DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	D	178	1434	887	257	288	2	0	0	0

- Molecule 5 is a protein called DNA-DIRECTED RNA POLYMERASES I, II, AND III SUBUNIT RPABC1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
5	E	214	1752	1111	309	321	11	0	0	0

- Molecule 6 is a protein called DNA-DIRECTED RNA POLYMERASES I, II, AND III SUBUNIT RPABC2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
6	F	84	Total	C	N	O	S	0	0	0
			679	434	115	127	3			

- Molecule 7 is a protein called DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB7.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
7	G	171	Total	C	N	O	S	0	0	0
			1340	861	222	249	8			

- Molecule 8 is a protein called DNA-DIRECTED RNA POLYMERASES I, II, AND III SUBUNIT RPABC3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
8	H	133	Total	C	N	O	S	0	0	0
			1068	673	180	211	4			

- Molecule 9 is a protein called DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB9.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
9	I	119	Total	C	N	O	S	0	0	0
			971	596	179	186	10			

- Molecule 10 is a protein called DNA-DIRECTED RNA POLYMERASES I, II, AND III SUBUNIT RPABC5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
10	J	65	Total	C	N	O	S	0	0	0
			532	339	93	94	6			

- Molecule 11 is a protein called DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB11.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
11	K	115	Total	C	N	O	S	0	0	1
			920	590	157	171	2			

- Molecule 12 is a protein called DNA-DIRECTED RNA POLYMERASES I, II, AND III SUBUNIT RPABC4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
12	L	46	Total	C	N	O	S	0	0	0
			363	224	72	63	4			

- Molecule 13 is a DNA chain called 5'-D(*AP*AP*GP*TP*AP*CP*TP)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
13	N	9	Total	C	N	O	P	0	0	0
			183	89	34	52	8			

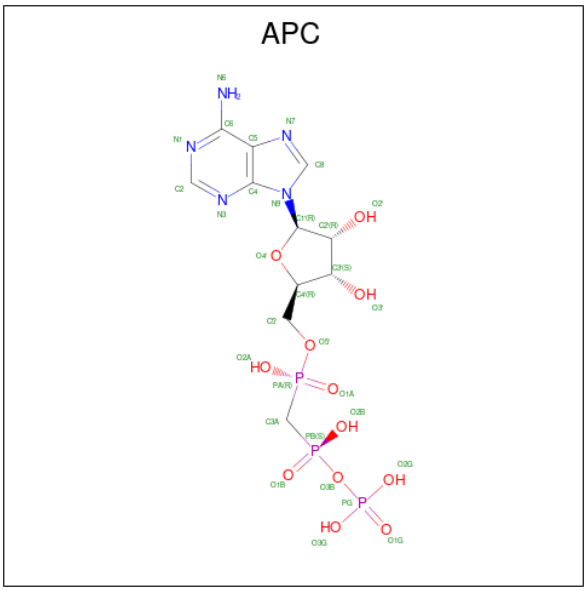
- Molecule 14 is a RNA chain called 5'-R(*AP*GP*GP*A)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
14	P	4	Total	C	N	O	P	0	0	0
			90	40	20	26	4			

- Molecule 15 is a DNA chain called 5'-D(*AP*GP*CP*TP*CP*AP*AP*GP*TP*AP*CP*T P*TP*TP* TP*TP*CP*CP*BRUP*GP*GP*TP*CP*AP*TP*T)-3'.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
15	T	17	Total	Br	C	N	O	P	0	0	0
			345	1	165	56	106	17			

- Molecule 16 is DIPHOSPHOMETHYLPHOSPHONIC ACID ADENOSYL ESTER (three-letter code: APC) (formula: $C_{11}H_{18}N_5O_{12}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
16	A	1	Total	C	N	O	P	0	0
			31	11	5	12	3		

- Molecule 17 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
17	A	2	Total Zn 2 2	0	0
17	B	1	Total Zn 1 1	0	0
17	C	1	Total Zn 1 1	0	0
17	I	2	Total Zn 2 2	0	0
17	J	1	Total Zn 1 1	0	0
17	L	1	Total Zn 1 1	0	0

- Molecule 18 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

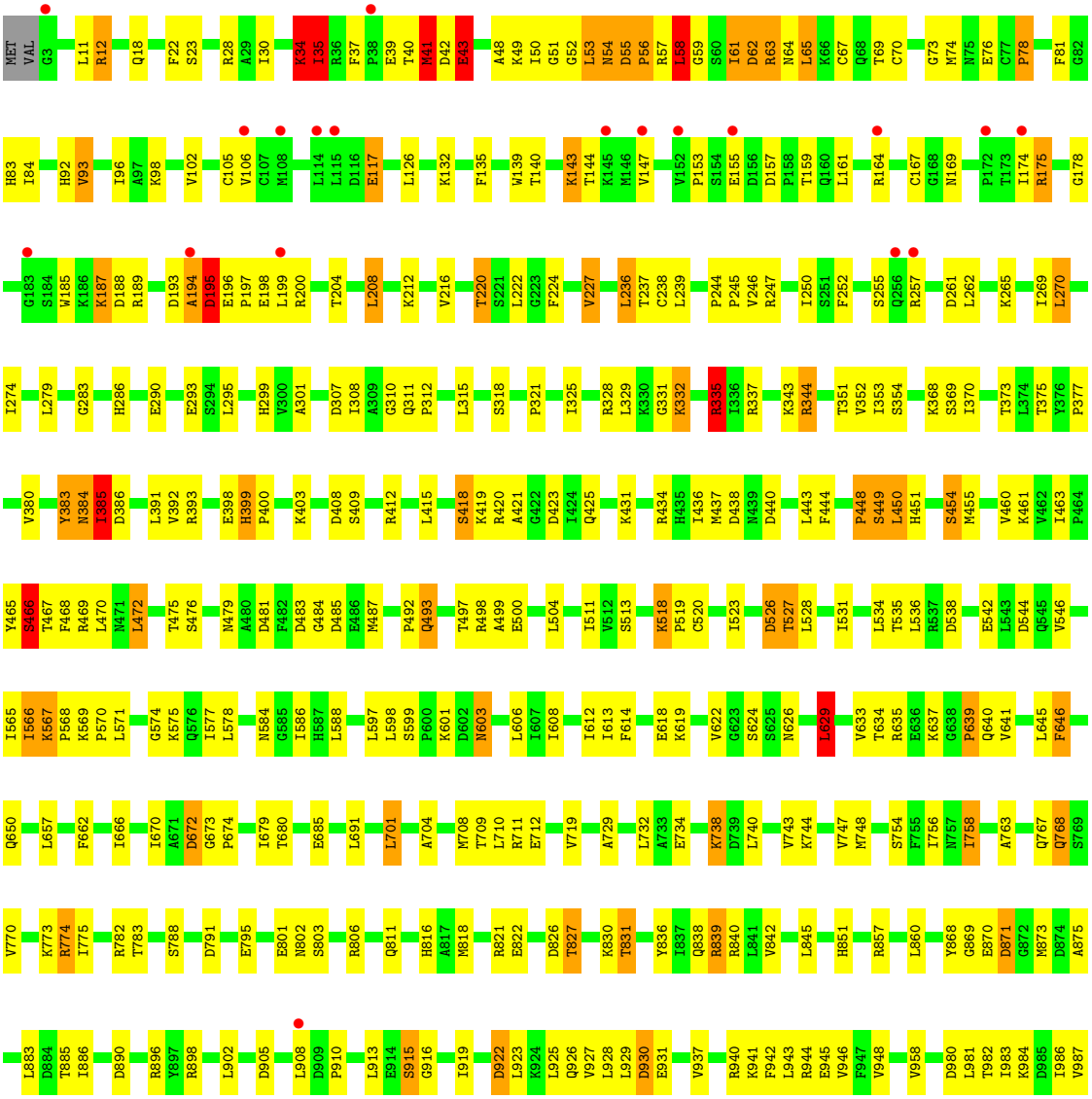
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
18	A	1	Total Mg 1 1	0	0

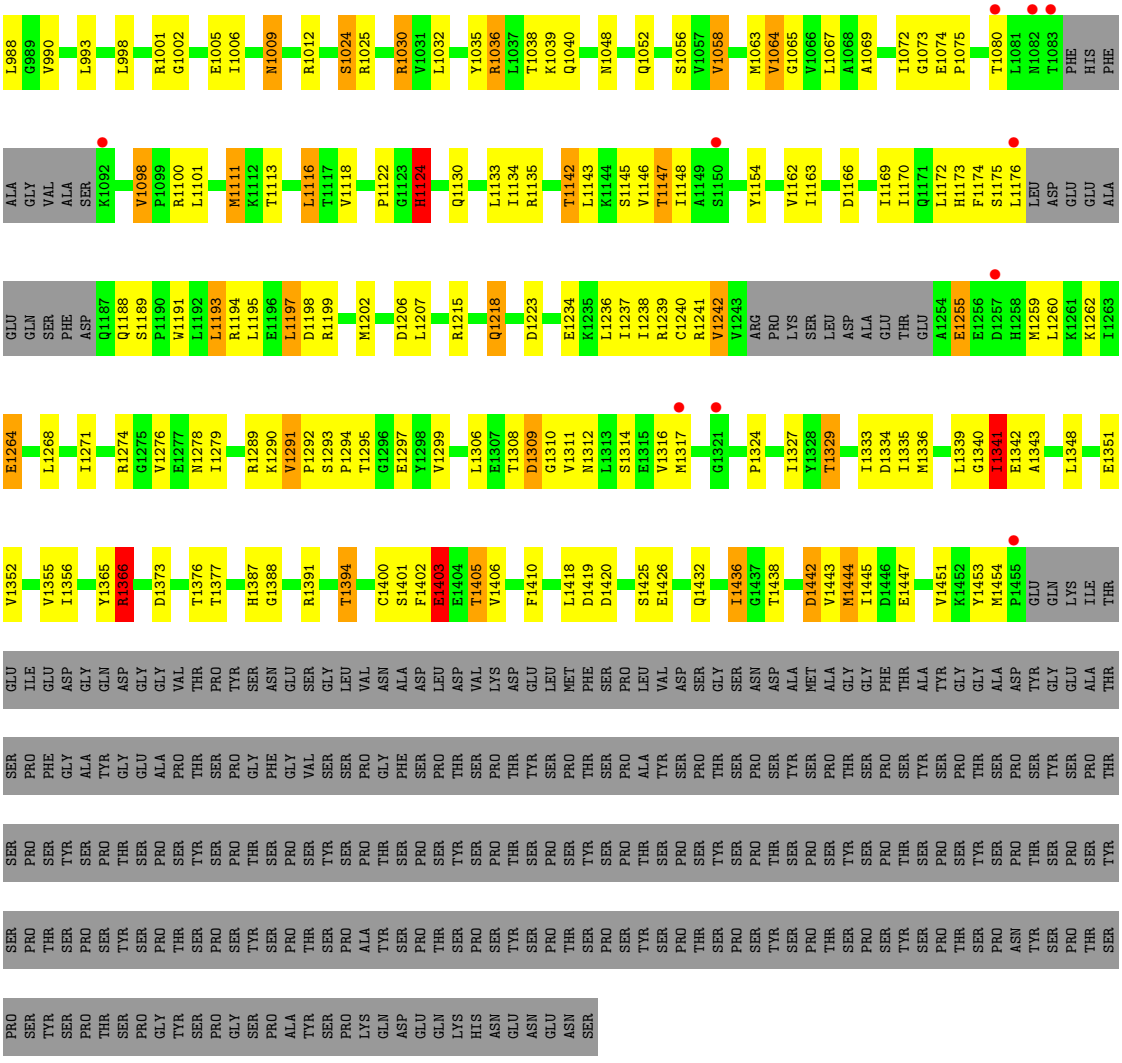
3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes 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: DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB1

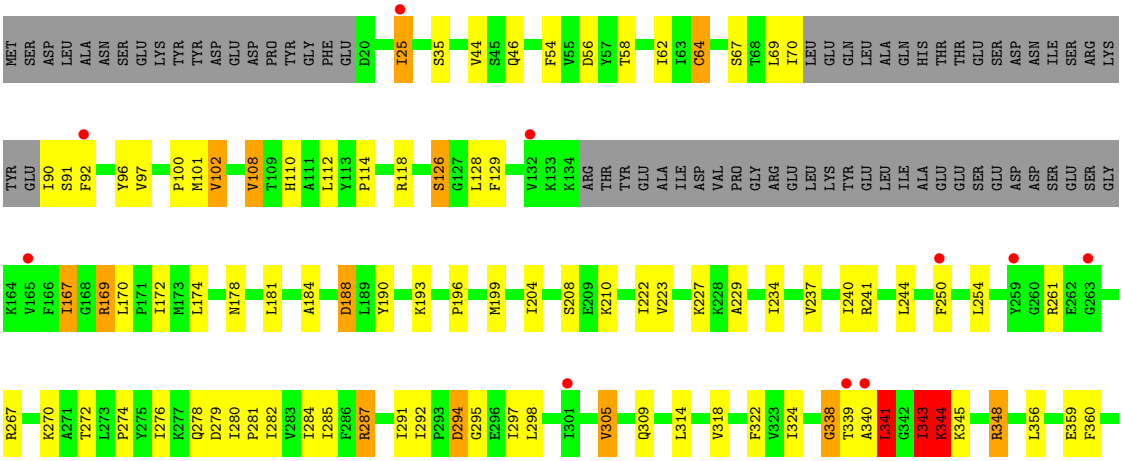
Chain A: 

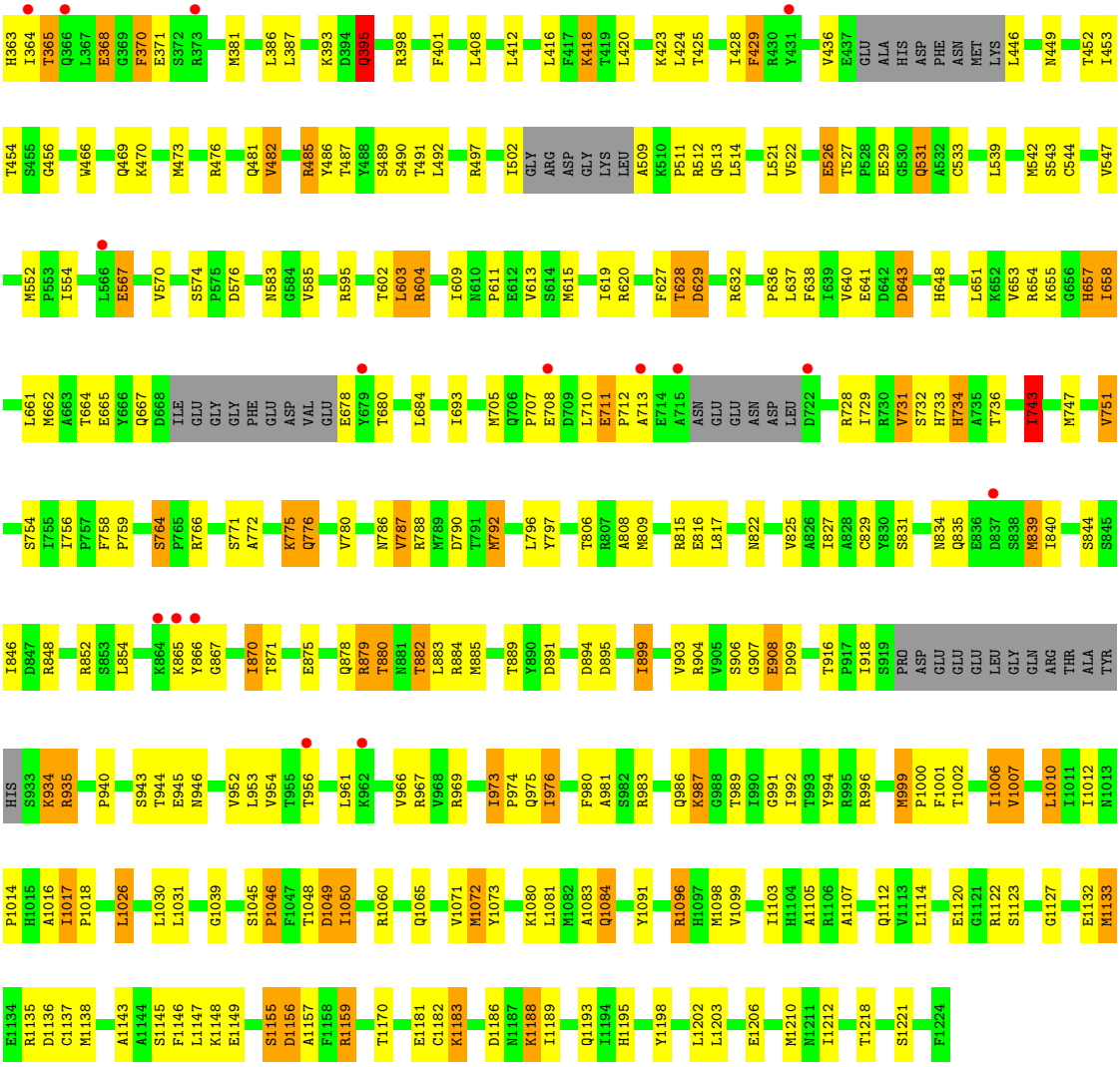




• Molecule 2: DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB2

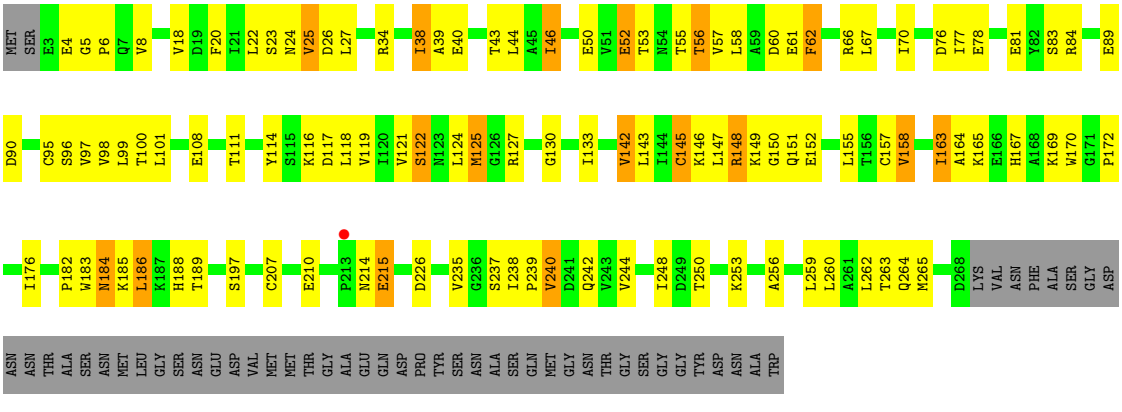
Chain B:





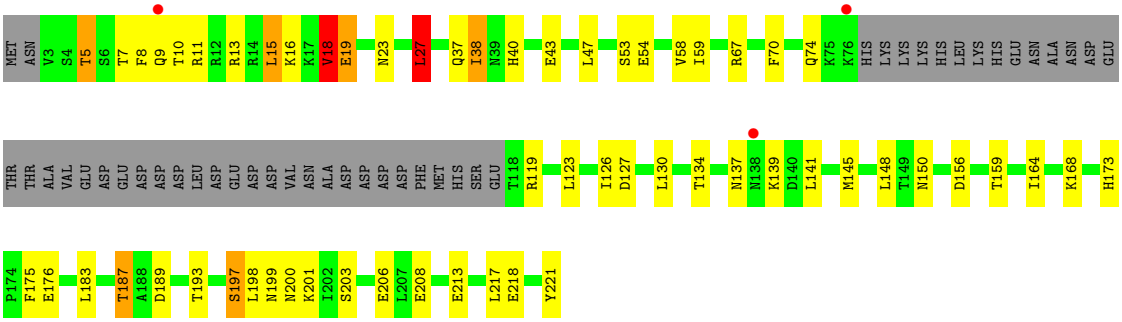
• Molecule 3: DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB3

Chain C:



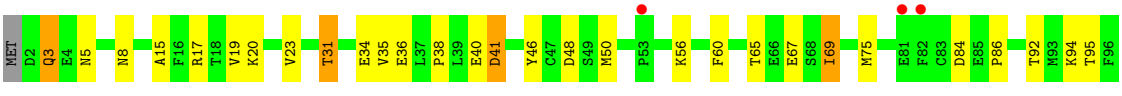
• Molecule 4: DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB4

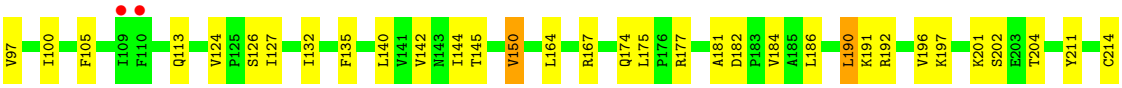
Chain D:



• Molecule 5: DNA-DIRECTED RNA POLYMERASES I, II, AND III SUBUNIT RPABC1

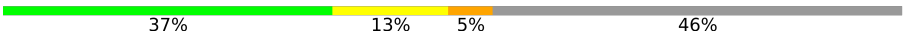
Chain E:

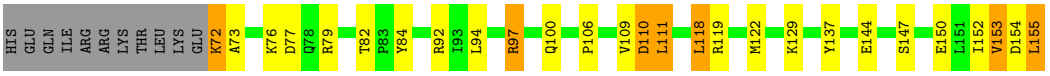




• Molecule 6: DNA-DIRECTED RNA POLYMERASES I, II, AND III SUBUNIT RPABC2

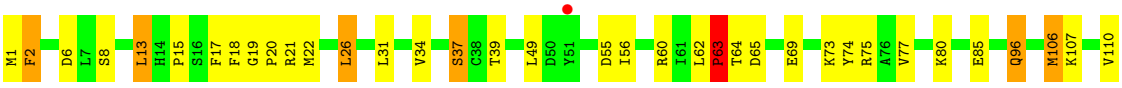
Chain F:





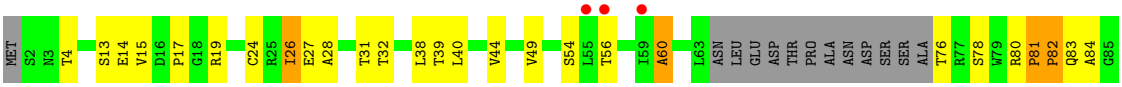
• Molecule 7: DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB7

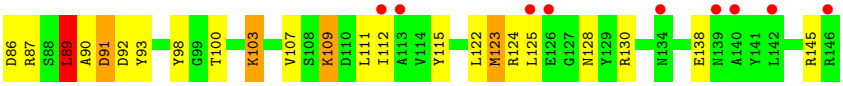
Chain G:



• Molecule 8: DNA-DIRECTED RNA POLYMERASES I, II, AND III SUBUNIT RPABC3

Chain H:





• Molecule 9: DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB9

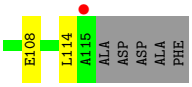
Chain I:

• Molecule 10: DNA-DIRECTED RNA POLYMERASES I, II, AND III SUBUNIT RPABC5

Chain J:

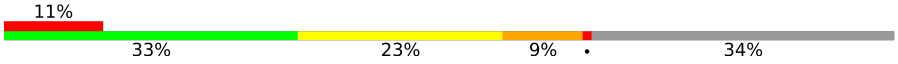
• Molecule 11: DNA-DIRECTED RNA POLYMERASE II SUBUNIT RPB11

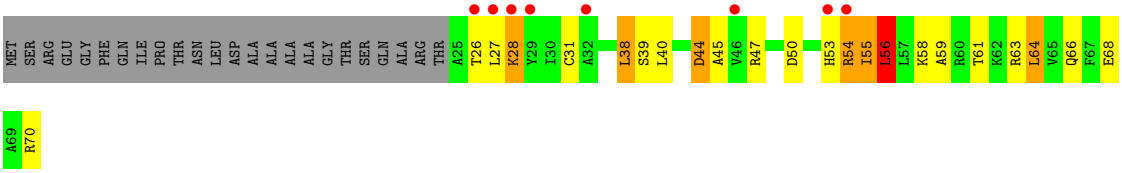
Chain K:



• Molecule 12: DNA-DIRECTED RNA POLYMERASES I, II, AND III SUBUNIT RPABC4

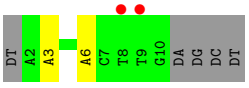
Chain L:





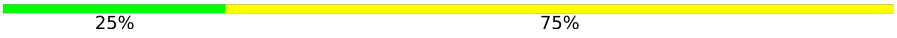
• Molecule 13: 5'-D(*AP*AP*GP*TP*AP*CP*TP)-3'

Chain N:

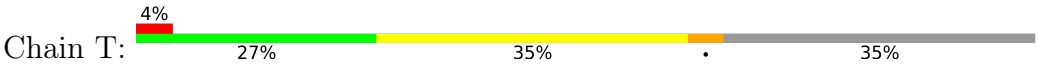


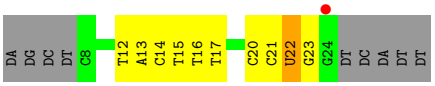
• Molecule 14: 5'-R(*AP*GP*GP*A)-3'

Chain P:



• Molecule 15: 5'-D(*AP*GP*CP*TP*CP*AP*AP*GP*TP*AP*CP*TP*TP*TP* TP*TP*CP* CP*BRUP*GP*GP*TP*CP*AP*TP*T)-3'





4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	222.27Å 392.99Å 282.16Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	58.65 – 3.90 58.65 – 3.90	Depositor EDS
% Data completeness (in resolution range)	99.2 (58.65-3.90) 99.2 (58.65-3.90)	Depositor EDS
R_{merge}	0.87	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.85 (at 3.88Å)	Xtriage
Refinement program	BUSTER 2.11.2	Depositor
R, R_{free}	0.154 , 0.190 0.187 , 0.221	Depositor DCC
R_{free} test set	2247 reflections (2.02%)	wwPDB-VP
Wilson B-factor (Å^2)	131.7	Xtriage
Anisotropy	0.184	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 140.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.42$, $< L^2 > = 0.24$	Xtriage
Estimated twinning fraction	0.057 for 1/2*h-1/2*k,-3/2*h-1/2*k,-l 0.047 for 1/2*h+1/2*k,3/2*h-1/2*k,-l	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	31868	wwPDB-VP
Average B, all atoms (Å^2)	157.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.81% 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, 0.333 respectively for untwinned datasets, and 0.375, 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: APC, BRU, MG, ZN

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	0.54	0/11397	0.86	7/15415 (0.0%)
2	B	0.52	0/9029	0.82	1/12171 (0.0%)
3	C	0.50	0/2133	0.80	0/2891
4	D	0.54	0/1444	0.85	0/1935
5	E	0.46	0/1788	0.73	0/2406
6	F	0.59	0/691	0.83	0/933
7	G	0.52	0/1368	0.82	1/1844 (0.1%)
8	H	0.53	0/1086	0.87	0/1470
9	I	0.45	0/989	0.78	0/1331
10	J	0.55	0/541	0.83	0/727
11	K	0.50	0/938	0.76	0/1267
12	L	0.51	0/365	0.91	0/485
13	N	1.32	1/205 (0.5%)	1.16	0/315
14	P	0.85	0/101	0.83	0/156
15	T	1.35	0/361	1.10	1/552 (0.2%)
All	All	0.55	1/32436 (0.0%)	0.84	10/43898 (0.0%)

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 outliers	#Planarity outliers
1	A	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
13	N	3	DA	C3'-O3'	5.74	1.51	1.44

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	56	PRO	C-N-CA	6.96	139.11	121.70
1	A	34	LYS	C-N-CA	5.83	136.27	121.70
1	A	399	HIS	N-CA-CB	5.59	120.66	110.60
1	A	35	ILE	N-CA-CB	5.49	123.43	110.80
1	A	194	ALA	C-N-CA	5.49	135.42	121.70

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	34	LYS	Mainchain

5.2 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 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	11197	0	11257	246	0
2	B	8859	0	8901	176	0
3	C	2095	0	2051	61	0
4	D	1434	0	1460	22	0
5	E	1752	0	1776	27	0
6	F	679	0	701	19	0
7	G	1340	0	1357	31	0
8	H	1068	0	1040	22	0
9	I	971	0	927	14	0
10	J	532	0	542	16	0
11	K	920	0	929	19	0
12	L	363	0	386	6	0
13	N	183	0	104	2	0
14	P	90	0	44	1	0
15	T	345	0	192	10	0
16	A	31	0	14	2	0
17	A	2	0	0	0	0
17	B	1	0	0	0	0
17	C	1	0	0	0	0
17	I	2	0	0	0	0
17	J	1	0	0	0	0
17	L	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
18	A	1	0	0	0	0
All	All	31868	0	31681	594	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 9.

The worst 5 of 594 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)
4:D:40:HIS:HB3	7:G:73:LYS:HE3	1.41	1.02
6:F:76:LYS:HA	6:F:79:ARG:HD3	1.47	0.96
3:C:46:ILE:HD12	3:C:46:ILE:H	1.38	0.87
2:B:1017:ILE:HD13	2:B:1017:ILE:H	1.41	0.86
10:J:48:ARG:O	10:J:52:THR:HG22	1.76	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	1417/1732 (82%)	1198 (84%)	145 (10%)	74 (5%)	2 23
2	B	1095/1224 (90%)	916 (84%)	127 (12%)	52 (5%)	2 24
3	C	264/318 (83%)	236 (89%)	20 (8%)	8 (3%)	4 33
4	D	174/221 (79%)	146 (84%)	19 (11%)	9 (5%)	2 23
5	E	212/215 (99%)	192 (91%)	15 (7%)	5 (2%)	6 37
6	F	82/155 (53%)	74 (90%)	7 (8%)	1 (1%)	13 49
7	G	169/171 (99%)	152 (90%)	14 (8%)	3 (2%)	8 42
8	H	129/146 (88%)	99 (77%)	19 (15%)	11 (8%)	1 13

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
9	I	117/122 (96%)	94 (80%)	20 (17%)	3 (3%)	5 35
10	J	63/70 (90%)	52 (82%)	5 (8%)	6 (10%)	0 11
11	K	113/120 (94%)	106 (94%)	7 (6%)	0	100 100
12	L	44/70 (63%)	21 (48%)	13 (30%)	10 (23%)	0 1
All	All	3879/4564 (85%)	3286 (85%)	411 (11%)	182 (5%)	2 24

5 of 182 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	54	ASN
1	A	57	ARG
1	A	58	LEU
1	A	69	THR
1	A	78	PRO

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	1243/1519 (82%)	1020 (82%)	223 (18%)	2 12
2	B	966/1061 (91%)	803 (83%)	163 (17%)	2 14
3	C	234/274 (85%)	194 (83%)	40 (17%)	2 14
4	D	160/200 (80%)	131 (82%)	29 (18%)	1 12
5	E	196/197 (100%)	170 (87%)	26 (13%)	4 22
6	F	74/137 (54%)	62 (84%)	12 (16%)	2 16
7	G	152/152 (100%)	128 (84%)	24 (16%)	2 17
8	H	117/128 (91%)	98 (84%)	19 (16%)	2 16
9	I	113/116 (97%)	99 (88%)	14 (12%)	4 24
10	J	60/65 (92%)	45 (75%)	15 (25%)	0 4
11	K	99/102 (97%)	82 (83%)	17 (17%)	2 14
12	L	40/57 (70%)	28 (70%)	12 (30%)	0 2

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	3454/4008 (86%)	2860 (83%)	594 (17%)	2 14

5 of 594 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
5	E	67	GLU
11	K	51	LEU
5	E	190	LEU
5	E	65	THR
8	H	39	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 36 such sidechains are listed below:

Mol	Chain	Res	Type
5	E	179	GLN
11	K	76	GLN
8	H	35	GLN
9	I	51	ASN
2	B	47	GLN

5.3.3 RNA (i)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
14	P	3/4 (75%)	2 (66%)	0

All (2) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
14	P	8	G
14	P	10	A

There are no RNA pucker outliers to report.

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

1 non-standard protein/DNA/RNA residue is modelled in this entry.

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	$\#\|Z\| > 2$
15	BRU	T	22	15,14	18,21,22	0.79	0	26,30,33	2.29	10 (38%)

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
15	BRU	T	22	15,14	-	4/7/21/22	0/2/2/2

There are no bond length outliers.

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
15	T	22	BRU	C5-C4-N3	5.20	119.32	113.34
15	T	22	BRU	O4-C4-C5	-4.81	119.80	125.84
15	T	22	BRU	C4-N3-C2	-4.13	122.00	127.35
15	T	22	BRU	N3-C2-N1	3.59	119.66	114.89
15	T	22	BRU	C1'-N1-C2	3.50	124.55	117.64

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
15	T	22	BRU	O4'-C4'-C5'-O5'
15	T	22	BRU	C3'-C4'-C5'-O5'
15	T	22	BRU	C2'-C1'-N1-C2
15	T	22	BRU	C2'-C1'-N1-C6

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
15	T	22	BRU	1	0

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 10 ligands modelled in this entry, 9 are monoatomic - leaving 1 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	$\#\|Z\| > 2$
16	APC	A	2455	-	27,33,33	2.40	9 (33%)	31,52,52	1.64	6 (19%)

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
16	APC	A	2455	-	-	2/15/38/38	0/3/3/3

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
16	A	2455	APC	PA-O5'	5.42	1.65	1.57
16	A	2455	APC	PB-O3B	4.92	1.63	1.58
16	A	2455	APC	O4'-C1'	4.36	1.47	1.41
16	A	2455	APC	PA-O1A	3.86	1.60	1.51
16	A	2455	APC	PA-O2A	-3.73	1.47	1.56

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
16	A	2455	APC	PB-O3B-PG	-5.23	114.20	132.62
16	A	2455	APC	C4-C5-N7	-2.98	106.29	109.40
16	A	2455	APC	C3'-C2'-C1'	2.75	105.12	100.98
16	A	2455	APC	N3-C2-N1	-2.42	124.89	128.68

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
16	A	2455	APC	O5'-C5'-C4'	2.20	116.55	108.99

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
16	A	2455	APC	C5'-O5'-PA-O1A
16	A	2455	APC	PB-O3B-PG-O1G

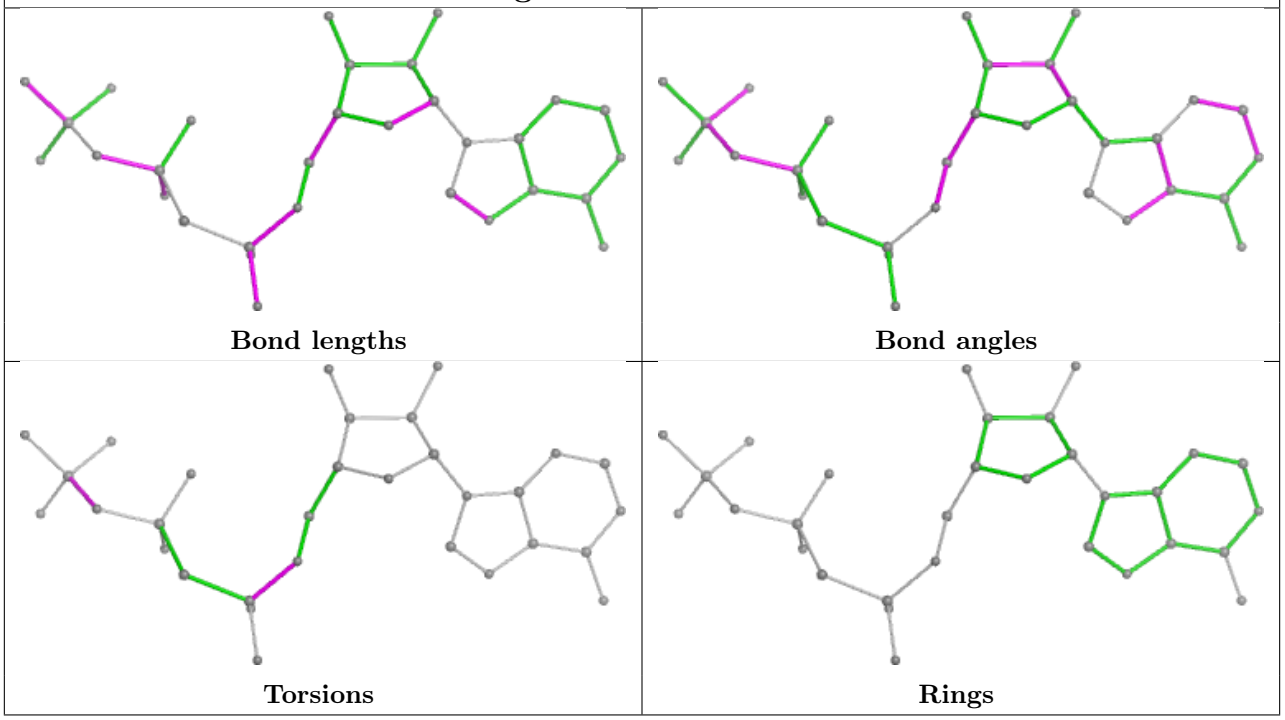
There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
16	A	2455	APC	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand APC A 2455



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
2	B	2

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	934:LYS	C	935:ARG	N	5.72
1	B	351:TYR	C	352:ALA	N	3.12

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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, 95^{th} 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	1425/1732 (82%)	0.07	29 (2%) 65 55	84, 142, 199, 264	0
2	B	1115/1224 (91%)	0.13	26 (2%) 60 50	87, 157, 218, 237	0
3	C	266/318 (83%)	-0.09	1 (0%) 92 87	107, 144, 187, 216	0
4	D	178/221 (80%)	0.13	3 (1%) 70 60	115, 158, 205, 225	0
5	E	214/215 (99%)	0.13	5 (2%) 60 50	116, 177, 224, 236	0
6	F	84/155 (54%)	-0.12	0 100 100	85, 121, 151, 168	0
7	G	171/171 (100%)	0.14	1 (0%) 89 84	111, 139, 176, 198	0
8	H	133/146 (91%)	0.57	12 (9%) 9 7	151, 186, 222, 233	0
9	I	119/122 (97%)	0.18	1 (0%) 86 79	144, 192, 223, 236	0
10	J	65/70 (92%)	0.01	0 100 100	119, 137, 182, 189	0
11	K	115/120 (95%)	-0.13	1 (0%) 84 77	112, 138, 180, 193	0
12	L	46/70 (65%)	0.87	8 (17%) 1 1	143, 208, 222, 231	0
13	N	9/14 (64%)	0.63	2 (22%) 0 0	271, 282, 299, 300	0
14	P	4/4 (100%)	1.25	0 100 100	208, 215, 222, 235	0
15	T	16/26 (61%)	0.03	1 (6%) 20 14	200, 241, 295, 296	0
All	All	3960/4608 (85%)	0.10	90 (2%) 60 50	84, 151, 215, 300	0

The worst 5 of 90 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1082	ASN	5.4
1	A	1083	THR	5.1
5	E	110	PHE	4.4
1	A	1176	LEU	4.1
2	B	715	ALA	3.5

6.2 Non-standard residues in protein, DNA, RNA chains (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. The B-factors column lists the minimum, median, 95^{th} 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	B-factors(Å^2)	Q<0.9
15	BRU	T	22	20/21	0.93	0.12	222,232,237,237	0

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

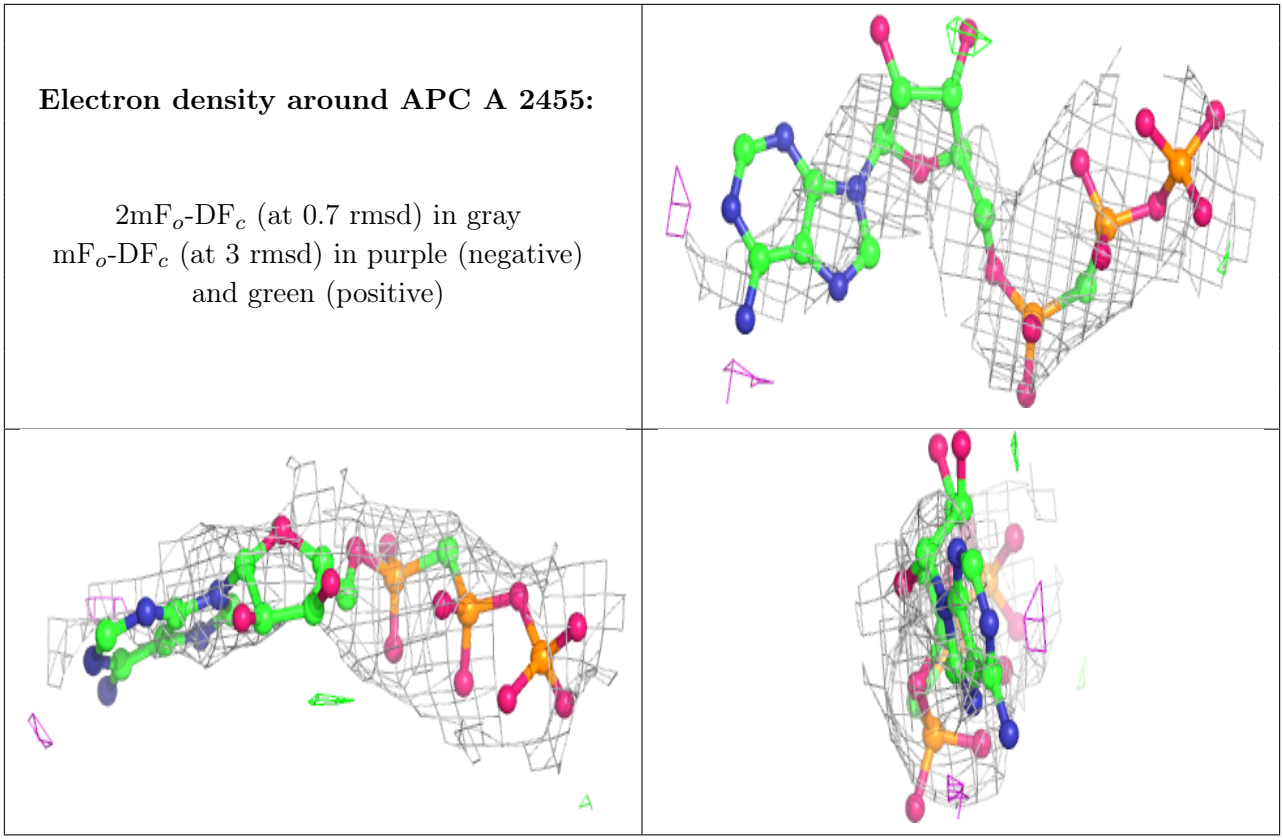
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
16	APC	A	2455	31/31	0.59	0.49	265,268,278,278	0
18	MG	A	2458	1/1	0.94	0.15	230,230,230,230	0
17	ZN	I	1122	1/1	0.98	0.05	248,248,248,248	0
17	ZN	L	1071	1/1	0.98	0.07	235,235,235,235	0
17	ZN	A	2456	1/1	0.98	0.04	177,177,177,177	0
17	ZN	I	1121	1/1	0.99	0.13	155,155,155,155	0
17	ZN	B	2225	1/1	0.99	0.22	112,112,112,112	0
17	ZN	J	1066	1/1	1.00	0.26	124,124,124,124	0
17	ZN	A	2457	1/1	1.00	0.17	101,101,101,101	0
17	ZN	C	1269	1/1	1.00	0.17	129,129,129,129	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around APC A 2455:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



6.5 Other polymers (i)

There are no such residues in this entry.