



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 13, 2023 – 03:07 PM JST

PDB ID : 5XHC
Title : Crystal structure of T2R-TTL-PO10 complex
Authors : Chu, Y.; Wang, Y.; Yang, J.; Li, W.
Deposited on : 2017-04-20
Resolution : 2.75 Å(reported)

This is a Full wwPDB X-ray 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/XrayValidationReportHelp>

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>.

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

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
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

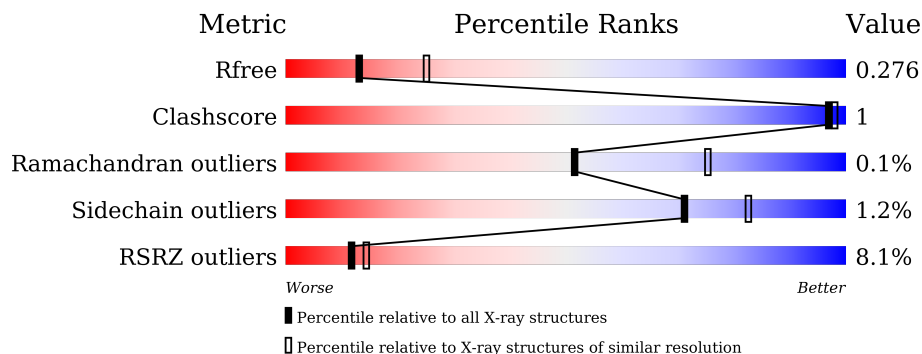
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.75 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	1235 (2.78-2.74)
Clashscore	141614	1277 (2.78-2.74)
Ramachandran outliers	138981	1257 (2.78-2.74)
Sidechain outliers	138945	1257 (2.78-2.74)
RSRZ outliers	127900	1207 (2.78-2.74)

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 $\leq 5\%$. 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	450	
1	C	450	
2	B	445	
2	D	445	
3	E	184	
4	F	384	

2 Entry composition [i](#)

There are 12 unique types of molecules in this entry. The entry contains 17462 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 Tubulin alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	437	Total	C	N	O	S	0	4	0
			3441	2179	586	652	24			
1	C	440	Total	C	N	O	S	0	9	0
			3482	2200	589	668	25			

- Molecule 2 is a protein called Tubulin beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	424	Total	C	N	O	S	0	2	0
			3353	2107	574	645	27			
2	D	421	Total	C	N	O	S	0	1	0
			3306	2079	562	638	27			

- Molecule 3 is a protein called Stathmin-4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	E	120	Total	C	N	O	S	0	2	0
			1004	621	181	196	6			

- Molecule 4 is a protein called TUBULIN TYROSINE LIGASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	F	309	Total	C	N	O	S	0	3	0
			2553	1645	438	455	15			

There are 6 discrepancies between the modelled and reference sequences:

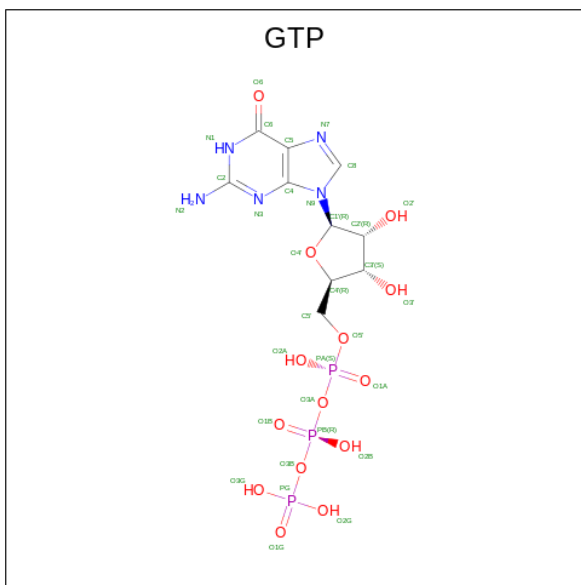
Chain	Residue	Modelled	Actual	Comment	Reference
F	379	HIS	-	expression tag	UNP E1BQ43
F	380	HIS	-	expression tag	UNP E1BQ43
F	381	HIS	-	expression tag	UNP E1BQ43
F	382	HIS	-	expression tag	UNP E1BQ43

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Chain	Residue	Modelled	Actual	Comment	Reference
F	383	HIS	-	expression tag	UNP E1BQ43
F	384	HIS	-	expression tag	UNP E1BQ43

- Molecule 5 is GUANOSINE-5'-TRIPHOSPHATE (three-letter code: GTP) (formula: $C_{10}H_{16}N_5O_{14}P_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	N	O			P
5	A	1	Total	C	N	O	P	0	0
			32	10	5	14	3		
5	C	1	Total	C	N	O	P	0	0
			32	10	5	14	3		
5	D	1	Total	C	N	O	P	0	0
			32	10	5	14	3		

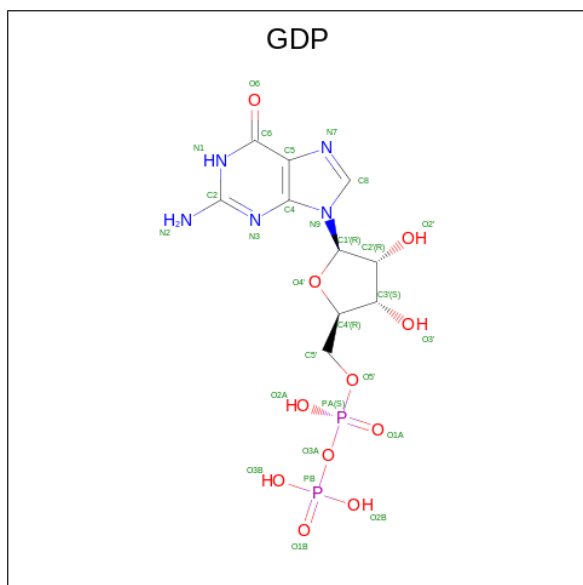
- Molecule 6 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1	Total	Ca	0	0
			1	1		
6	B	1	Total	Ca	0	0
			1	1		
6	C	1	Total	Ca	0	0
			1	1		

- Molecule 7 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	B	2	Total Mg 2 2	0	0
7	C	1	Total Mg 1 1	0	0
7	D	1	Total Mg 1 1	0	0

- Molecule 8 is GUANOSINE-5'-DIPHOSPHATE (three-letter code: GDP) (formula: $C_{10}H_{15}N_5O_{11}P_2$).



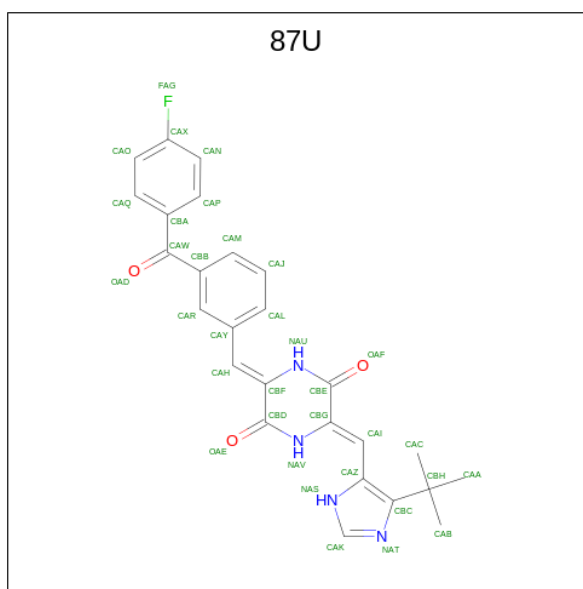
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
8	B	1	Total	C	N	O	P	0	0
			28	10	5	11	2		

- Molecule 9 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (three-letter code: MES) (formula: $C_6H_{13}NO_4S$).



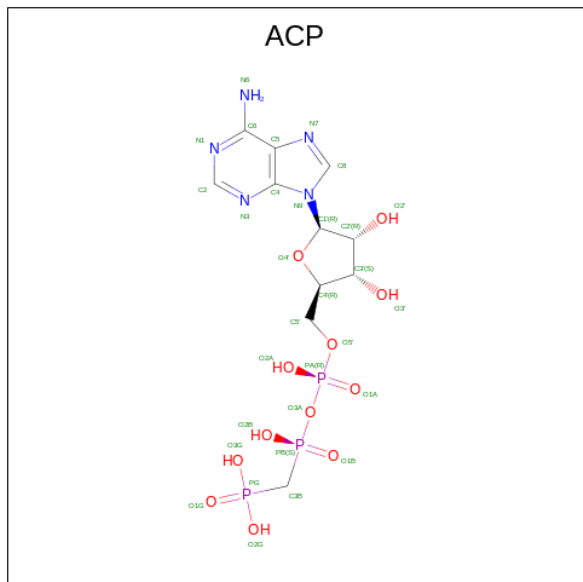
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	N	O	S			
9	B	1	Total	12	6	1	4	1	0	0
9	B	1	Total	12	6	1	4	1	0	0

- Molecule 10 is (3Z,6Z)-3-[(4-tert-butyl-1H-imidazol-5-yl)methylidene]-6-[[3-(4-fluorophenyl)carbonylphenyl]methylidene]piperazine-2,5-dione (three-letter code: 87U) (formula: C₂₆H₂₃FN₄O₃).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	F	N	O			
10	B	1	Total	34	26	1	4	3	0	0

- Molecule 11 is PHOSPHOMETHYLPHOSPHONIC ACID ADENYLATE ESTER (three-letter code: ACP) (formula: $C_{11}H_{18}N_5O_{12}P_3$).



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

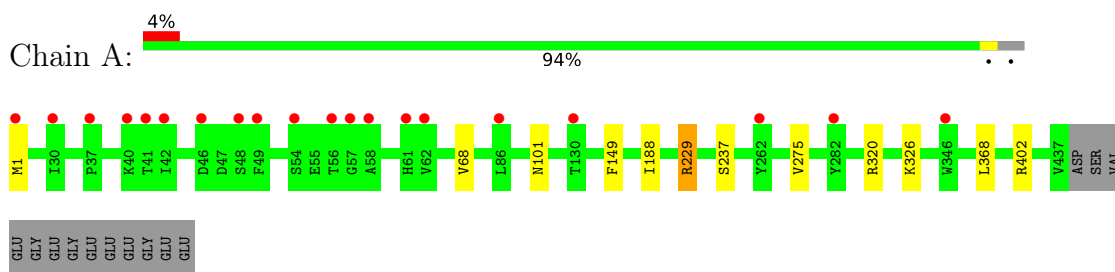
- Molecule 12 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
12	A	20	Total	O	0	0
			20	20		
12	B	22	Total	O	0	0
			22	22		
12	C	55	Total	O	0	0
			55	55		
12	E	2	Total	O	0	0
			2	2		
12	F	4	Total	O	0	0
			4	4		

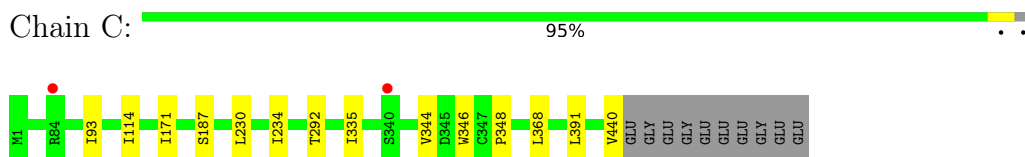
3 Residue-property plots [i](#)

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.

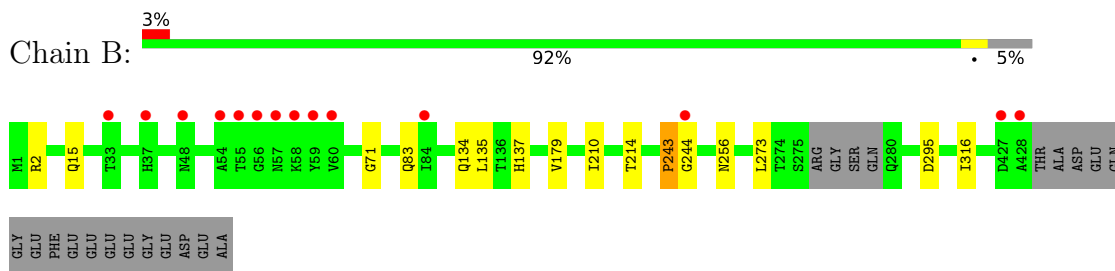
- Molecule 1: Tubulin alpha chain



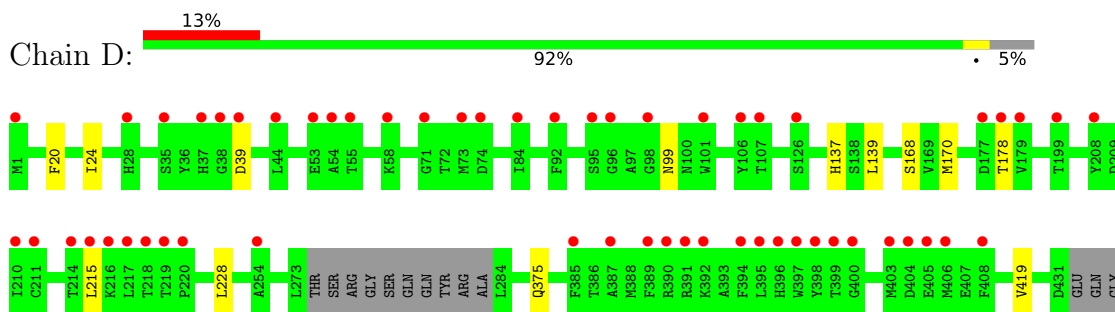
- Molecule 1: Tubulin alpha chain



- Molecule 2: Tubulin beta chain



- Molecule 2: Tubulin beta chain



GLU
PHE
GLU
GLU
GLU
GLU
GLY
GLY
ASP
GLU
ALA

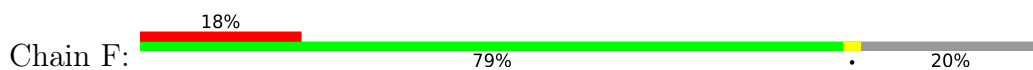
• Molecule 3: Stathmin-4



TYR
LYS
GLU
LYS
MET
LYS
GLU
LEU
PRO
VAL
SER
PHE
CYS
SER
CYS
PHE
LEU
SER
ASP
PRO
LEU
ASN
LYS
SER
SER
TYR
TYR
GLU
ALA
ASP
THR
VAL
ASP
LEU
ASN
TRP
CYS
VAL
ILE
SER
ASP
P6
P26
P27
SER
PHE
ASP
GLY
VAL
PRO
GLU
PHE
ASN
ALA
SER
LEU

PRO
ARG
ARG
ARG
D44
P45
S46
L47
E48
Q49
E50
E59
K128
E131
E132
V133
M136
K137
E138
L139
K140
E141
E144
GLU
ALA
ARG

• Molecule 4: TUBULIN TYROSINE LIGASE



M1
V6
E9
N10
Y14
V17
L20
L21
L22
W27
R31
K32
Y98
Y99
I100
Y101
P102
THR
ASN
LEU
LYS
THR
PRO
VAL
ALA
PRO
ALA
GLN
ASN
GLY
ILE
ARG
HIS
LEU
ILE
ASN
ASN
THR
ARG
THR
ASP
GLU
ARG
VAL
PHE
PHE
LEU
ALA
TYR
ASN
ARG

ARG
ARG
GLY
GLY
GLU
G144
N145
V146
W147
I148
A149
K150
S151
SER
ALA
GLY
ALA
LYS
GLY
GLU
G159
I160
L161
I162
S163
S164
E165
A166
SER
GLU
LEU
LEU
ASP
PHE
ILE
ASP
GLU
GLN
GLN
VAL
H180
V181
I182
Q183
K184
L191
L192
E193
P194
G195
H196
R197
K198
F199
Y211

T228
S224
E226
P227
Y228
N229
S230
A231
F233
Q234
Q235
K236
T237
C238
H239
L240
T241
N242
H243
C244
I245
Q246
K247
GLU
TYR
SER
LYS
N252
Y253
G254
R255
Y256
E257
E258
G259
N260
M320
A335
G349
L361
A362
ASP
THR
GLY
GLN
LYS
THR
SER
GLN
PRO
THR
S373
I374

H384

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	105.26Å 157.88Å 182.43Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	119.38 – 2.75 49.93 – 2.75	Depositor EDS
% Data completeness (in resolution range)	98.5 (119.38-2.75) 98.5 (49.93-2.75)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.11 (at 2.77Å)	Xtrriage
Refinement program	REFMAC 5.8.0135	Depositor
R, R_{free}	0.227 , 0.277 0.228 , 0.276	Depositor DCC
R_{free} test set	3932 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	46.9	Xtrriage
Anisotropy	0.027	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 36.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	17462	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.62% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: 87U, ACP, GTP, MG, MES, GDP, CA

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	0.37	0/3525	0.59	0/4784
1	C	0.37	0/3572	0.60	0/4850
2	B	0.39	0/3427	0.60	0/4640
2	D	0.38	0/3379	0.55	0/4577
3	E	0.38	0/1018	0.53	0/1350
4	F	0.38	0/2618	0.54	0/3537
All	All	0.38	0/17539	0.57	0/23738

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

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	3441	0	3363	9	0
1	C	3482	0	3384	7	0
2	B	3353	0	3228	7	0
2	D	3306	0	3181	6	0
3	E	1004	0	1028	0	0
4	F	2553	0	2519	2	0
5	A	32	0	12	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	C	32	0	12	0	0
5	D	32	0	12	0	0
6	A	1	0	0	0	0
6	B	1	0	0	0	0
6	C	1	0	0	0	0
7	B	2	0	0	0	0
7	C	1	0	0	0	0
7	D	1	0	0	0	0
8	B	28	0	12	0	0
9	B	24	0	26	1	0
10	B	34	0	0	2	0
11	F	31	0	14	0	0
12	A	20	0	0	0	0
12	B	22	0	0	0	0
12	C	55	0	0	0	0
12	E	2	0	0	0	0
12	F	4	0	0	0	0
All	All	17462	0	16791	30	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 1.

All (30) 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:A:229[A]:ARG:HG2	1:A:229[A]:ARG:HH11	1.07	1.20
1:A:229[A]:ARG:HH11	1:A:229[A]:ARG:CG	1.75	0.98
1:A:229[A]:ARG:HG2	1:A:229[A]:ARG:NH1	1.87	0.84
2:B:243:PRO:HB2	2:B:244:GLY:HA2	1.67	0.75
2:B:243:PRO:CB	2:B:244:GLY:HA2	2.22	0.69
2:B:295:ASP:HA	9:B:507:MES:O2S	1.96	0.64
1:A:229[A]:ARG:CG	1:A:229[A]:ARG:NH1	2.46	0.63
1:A:368[B]:LEU:HD12	1:A:368[B]:LEU:N	2.13	0.63
1:A:368[B]:LEU:HD12	1:A:368[B]:LEU:H	1.62	0.62
1:C:187:SER:HB3	1:C:391:LEU:HD21	1.91	0.53
1:A:68:VAL:HG11	1:A:149:PHE:CE2	2.50	0.47
2:B:179:VAL:HG12	1:C:348:PRO:HG2	1.96	0.47
1:A:101:ASN:HD22	2:B:256:ASN:HD21	1.61	0.47
2:B:210:ILE:HG23	2:B:273:LEU:HD13	1.97	0.47
2:D:139:LEU:HD12	2:D:170:MET:SD	2.54	0.47
10:B:505:87U:NAS	10:B:505:87U:NAV	2.62	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:230:LEU:O	1:C:234:ILE:HD12	2.15	0.46
1:C:292:THR:HG22	1:C:335:ILE:CD1	2.46	0.45
2:D:139:LEU:HD11	2:D:168:SER:HB3	1.98	0.44
4:F:224:SER:HB2	4:F:241:THR:HG22	2.00	0.43
1:A:275:VAL:HG13	1:A:368[A]:LEU:HD21	2.01	0.43
1:C:344:VAL:HG21	1:C:346:TRP:CE2	2.53	0.43
4:F:349:GLY:HA3	4:F:374:ILE:HD11	2.00	0.42
2:D:375:GLN:HB2	2:D:419:VAL:HG13	2.01	0.42
1:C:171:ILE:N	1:C:171:ILE:HD12	2.35	0.41
2:D:20:PHE:CZ	2:D:24:ILE:HD13	2.55	0.41
1:C:93:ILE:HG22	1:C:114:ILE:HD11	2.02	0.41
2:D:99:ASN:HD22	2:D:178:THR:HG21	1.86	0.41
2:B:134:GLN:HB2	10:B:505:87U:CAP	2.51	0.41
2:D:215:LEU:HD11	2:D:228:LEU:HD21	2.03	0.40

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	439/450 (98%)	426 (97%)	13 (3%)	0	100	100
1	C	446/450 (99%)	435 (98%)	11 (2%)	0	100	100
2	B	422/445 (95%)	407 (96%)	13 (3%)	2 (0%)	29	47
2	D	417/445 (94%)	404 (97%)	12 (3%)	1 (0%)	47	69
3	E	118/184 (64%)	116 (98%)	2 (2%)	0	100	100
4	F	300/384 (78%)	286 (95%)	14 (5%)	0	100	100
All	All	2142/2358 (91%)	2074 (97%)	65 (3%)	3 (0%)	51	75

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	243	PRO
2	B	71	GLY
2	D	39	ASP

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	372/378 (98%)	364 (98%)	8 (2%)	52	70
1	C	379/378 (100%)	377 (100%)	2 (0%)	88	92
2	B	367/383 (96%)	360 (98%)	7 (2%)	57	73
2	D	362/383 (94%)	361 (100%)	1 (0%)	92	95
3	E	110/168 (66%)	107 (97%)	3 (3%)	44	65
4	F	281/342 (82%)	278 (99%)	3 (1%)	73	84
All	All	1871/2032 (92%)	1847 (99%)	24 (1%)	71	81

All (24) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET
1	A	188	ILE
1	A	229[A]	ARG
1	A	229[B]	ARG
1	A	237	SER
1	A	320	ARG
1	A	326	LYS
1	A	402	ARG
2	B	2	ARG
2	B	15	GLN
2	B	83	GLN
2	B	135	LEU
2	B	137	HIS
2	B	214	THR
2	B	316	ILE
1	C	368	LEU

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Mol	Chain	Res	Type
1	C	440	VAL
2	D	137	HIS
3	E	44	ASP
3	E	131	GLU
3	E	136	ASN
4	F	1	MET
4	F	32	LYS
4	F	211	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	101	ASN
2	B	83	GLN
1	C	249	ASN
3	E	136	ASN
4	F	252	ASN

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 15 ligands modelled in this entry, 7 are monoatomic - leaving 8 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
5	GTP	D	501	7	26,34,34	0.91	0	32,54,54	1.20	4 (12%)
10	87U	B	505	-	33,37,37	2.17	9 (27%)	44,54,54	1.75	10 (22%)
8	GDP	B	502	7	24,30,30	0.99	1 (4%)	30,47,47	1.03	2 (6%)
11	ACP	F	401	-	27,33,33	2.01	8 (29%)	32,52,52	1.34	3 (9%)
5	GTP	C	501	7	26,34,34	0.95	1 (3%)	32,54,54	1.06	4 (12%)
5	GTP	A	501	7	26,34,34	0.91	0	32,54,54	1.13	4 (12%)
9	MES	B	507	-	12,12,12	2.04	2 (16%)	14,16,16	6.14	6 (42%)
9	MES	B	504	-	12,12,12	2.03	1 (8%)	14,16,16	7.44	10 (71%)

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
5	GTP	D	501	7	-	4/18/38/38	0/3/3/3
10	87U	B	505	-	-	2/22/22/22	0/4/4/4
8	GDP	B	502	7	-	3/12/32/32	0/3/3/3
11	ACP	F	401	-	-	4/15/38/38	0/3/3/3
5	GTP	C	501	7	-	6/18/38/38	0/3/3/3
5	GTP	A	501	7	-	3/18/38/38	0/3/3/3
9	MES	B	507	-	-	2/6/14/14	0/1/1/1
9	MES	B	504	-	-	3/6/14/14	0/1/1/1

All (22) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	B	504	MES	C8-S	-6.41	1.68	1.77
9	B	507	MES	C8-S	-6.36	1.68	1.77
11	F	401	ACP	PG-O1G	5.46	1.61	1.50
10	B	505	87U	FAG-CAX	-5.44	1.23	1.36
10	B	505	87U	CBA-CAW	-4.93	1.41	1.49
10	B	505	87U	CBB-CAW	-4.19	1.42	1.49
11	F	401	ACP	PB-O1B	4.03	1.61	1.51
10	B	505	87U	CBF-CBD	-3.78	1.41	1.48
10	B	505	87U	CAY-CAH	-3.71	1.39	1.46

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
10	B	505	87U	CBG-CBE	-3.58	1.41	1.48
10	B	505	87U	CAI-CBG	3.57	1.41	1.34
11	F	401	ACP	PB-O3A	3.43	1.62	1.58
11	F	401	ACP	PB-O2B	-3.29	1.48	1.56
11	F	401	ACP	PG-O2G	2.95	1.61	1.54
10	B	505	87U	CAH-CBF	2.87	1.40	1.34
11	F	401	ACP	PG-O3G	-2.72	1.48	1.54
11	F	401	ACP	C5-C4	2.62	1.47	1.40
5	C	501	GTP	C6-N1	-2.39	1.34	1.37
8	B	502	GDP	C6-N1	-2.19	1.34	1.37
11	F	401	ACP	C2-N3	2.17	1.35	1.32
9	B	507	MES	O2S-S	2.09	1.51	1.45
10	B	505	87U	CBE-NAU	2.05	1.42	1.38

All (43) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	B	504	MES	O1S-S-C8	-18.77	84.32	106.92
9	B	507	MES	O3S-S-O1S	-13.37	78.60	111.27
9	B	504	MES	O2S-S-C8	11.41	120.65	106.92
9	B	504	MES	O3S-S-O1S	-10.64	85.27	111.27
9	B	507	MES	O3S-S-C8	10.52	122.79	105.77
9	B	507	MES	O1S-S-C8	-10.18	94.65	106.92
9	B	504	MES	O2S-S-O1S	-8.81	83.47	113.95
9	B	507	MES	O2S-S-O1S	-8.78	83.57	113.95
9	B	504	MES	O3S-S-C8	7.64	118.12	105.77
9	B	507	MES	O3S-S-O2S	6.01	125.96	111.27
10	B	505	87U	CBG-CBE-NAU	4.37	120.32	116.02
10	B	505	87U	CBF-CBD-NAV	4.36	120.30	116.02
9	B	504	MES	C2-C3-N4	4.22	116.50	110.10
11	F	401	ACP	N3-C2-N1	-3.75	122.82	128.68
10	B	505	87U	CAY-CAR-CBB	3.68	124.04	121.13
10	B	505	87U	CBF-NAU-CBE	-3.40	121.51	125.53
11	F	401	ACP	C3'-C2'-C1'	3.14	105.70	100.98
9	B	504	MES	O3S-S-O2S	2.90	118.35	111.27
10	B	505	87U	CAM-CBB-CAR	-2.76	115.97	119.24
11	F	401	ACP	C4-C5-N7	-2.72	106.57	109.40
10	B	505	87U	CAI-CBG-NAV	-2.69	119.89	125.02
10	B	505	87U	CBG-NAV-CBD	-2.67	122.37	125.53
10	B	505	87U	CBH-CBC-NAT	2.63	123.77	120.50
9	B	504	MES	C5-N4-C3	2.53	114.53	108.83
5	D	501	GTP	PA-O3A-PB	-2.39	124.62	132.83

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	501	GTP	O3B-PG-O1G	-2.38	97.99	111.19
5	C	501	GTP	O3G-PG-O2G	2.38	116.73	107.64
8	B	502	GDP	C8-N7-C5	2.37	107.51	102.99
9	B	504	MES	C6-C5-N4	2.32	113.61	110.10
5	D	501	GTP	C8-N7-C5	2.26	107.30	102.99
8	B	502	GDP	C5-C6-N1	2.25	117.93	113.95
5	A	501	GTP	C8-N7-C5	2.23	107.24	102.99
5	C	501	GTP	PA-O3A-PB	-2.19	125.31	132.83
5	A	501	GTP	PA-O3A-PB	-2.19	125.32	132.83
5	D	501	GTP	C5-C6-N1	2.18	117.81	113.95
9	B	504	MES	O1-C6-C5	-2.16	107.03	111.80
10	B	505	87U	CAM-CBB-CAW	2.14	125.27	120.57
5	D	501	GTP	PB-O3B-PG	-2.13	125.51	132.83
5	C	501	GTP	PB-O3B-PG	-2.13	125.53	132.83
9	B	507	MES	C6-C5-N4	2.11	113.31	110.10
10	B	505	87U	CAJ-CAL-CAY	-2.09	118.12	120.65
5	A	501	GTP	C5-C6-N1	2.08	117.62	113.95
5	C	501	GTP	C5-C6-N1	2.01	117.50	113.95

There are no chirality outliers.

All (27) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	501	GTP	C5'-O5'-PA-O1A
5	A	501	GTP	C5'-O5'-PA-O2A
5	C	501	GTP	PB-O3B-PG-O3G
5	C	501	GTP	C5'-O5'-PA-O1A
5	C	501	GTP	C5'-O5'-PA-O2A
5	D	501	GTP	C5'-O5'-PA-O1A
5	D	501	GTP	C5'-O5'-PA-O2A
8	B	502	GDP	C5'-O5'-PA-O1A
8	B	502	GDP	C5'-O5'-PA-O2A
9	B	504	MES	N4-C7-C8-S
9	B	504	MES	C7-C8-S-O2S
10	B	505	87U	CBG-CAI-CAZ-NAS
10	B	505	87U	CBG-CAI-CAZ-CBC
11	F	401	ACP	O4'-C4'-C5'-O5'
9	B	504	MES	C7-C8-S-O3S
11	F	401	ACP	C3'-C4'-C5'-O5'
9	B	507	MES	C7-C8-S-O3S
9	B	507	MES	C7-C8-S-O1S
5	C	501	GTP	C4'-C5'-O5'-PA

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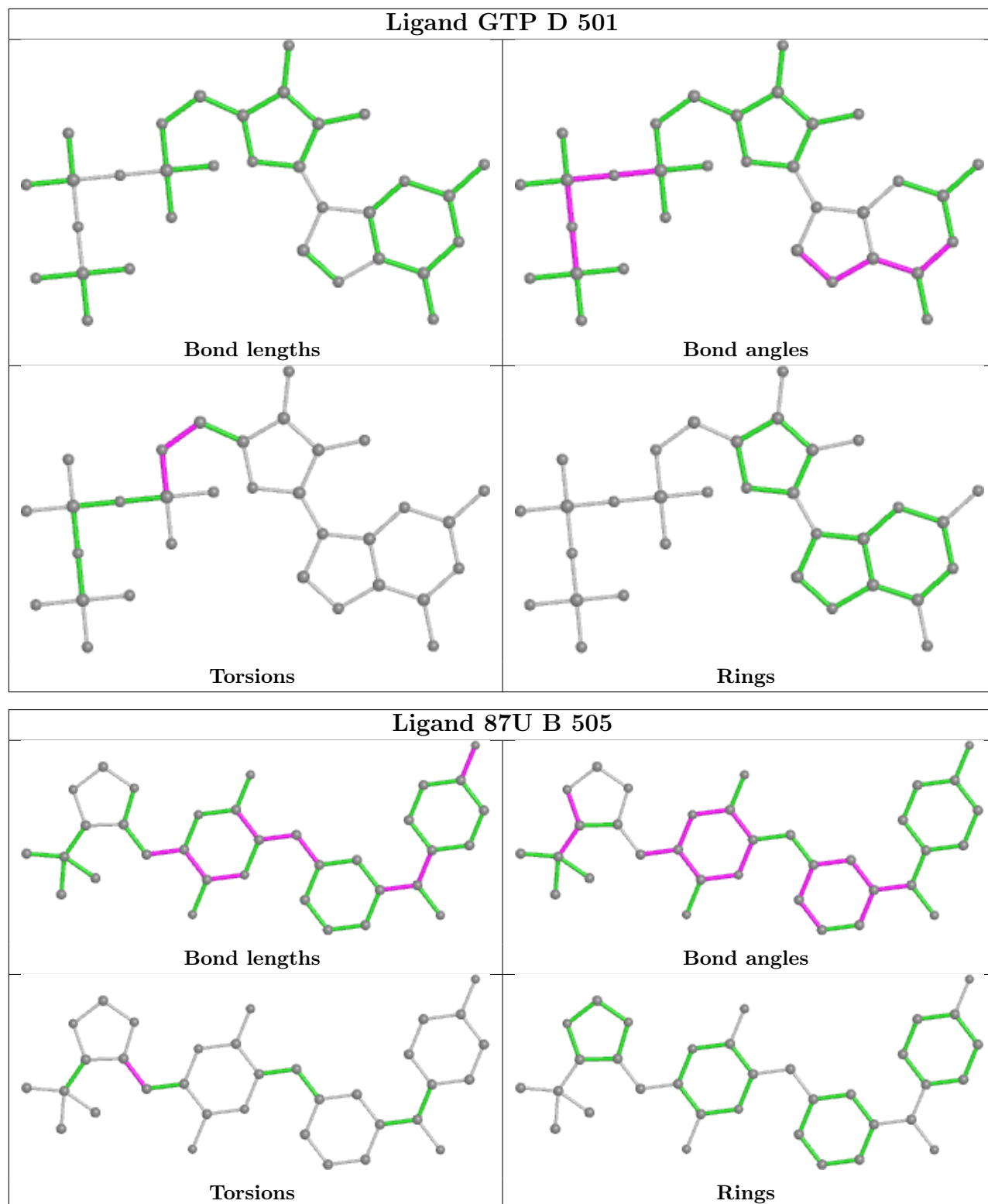
Mol	Chain	Res	Type	Atoms
11	F	401	ACP	PG-C3B-PB-O1B
5	D	501	GTP	C4'-C5'-O5'-PA
5	C	501	GTP	PB-O3B-PG-O1G
5	A	501	GTP	C5'-O5'-PA-O3A
5	C	501	GTP	C5'-O5'-PA-O3A
5	D	501	GTP	C5'-O5'-PA-O3A
8	B	502	GDP	C5'-O5'-PA-O3A
11	F	401	ACP	C4'-C5'-O5'-PA

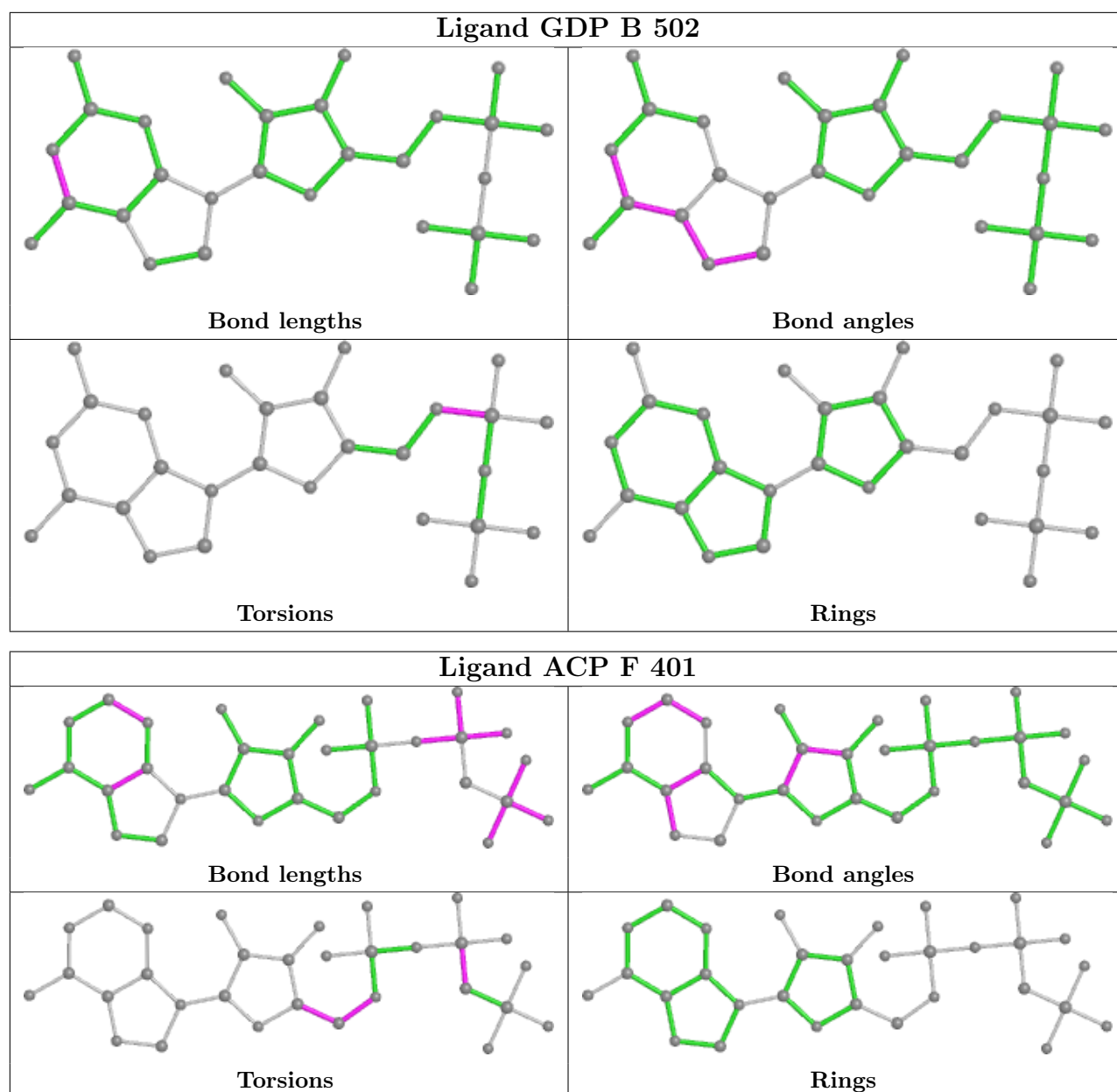
There are no ring outliers.

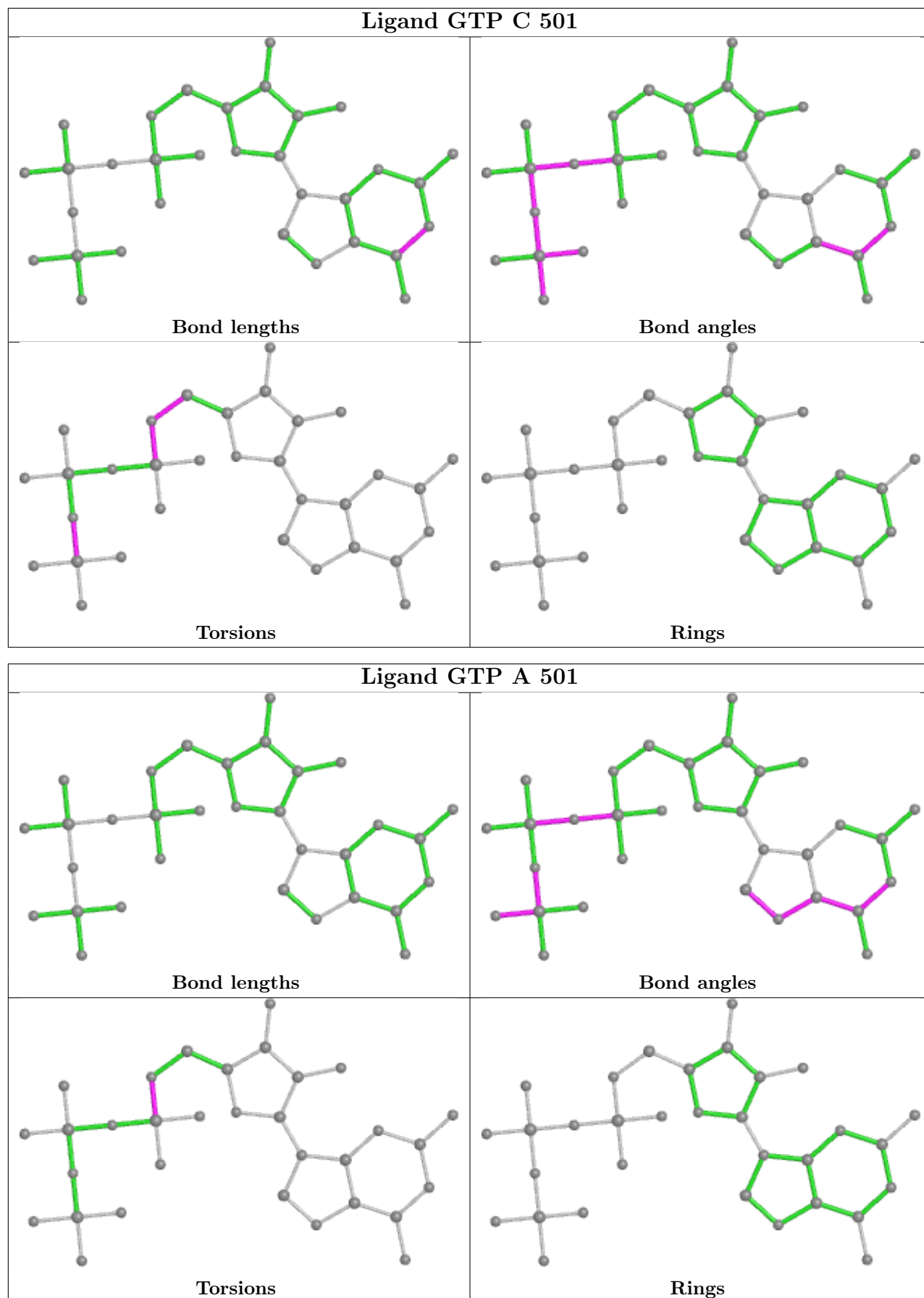
2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
10	B	505	87U	2	0
9	B	507	MES	1	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 than 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.







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

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, 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	437/450 (97%)	0.20	20 (4%) 32 39	23, 45, 71, 91	0
1	C	440/450 (97%)	-0.08	2 (0%) 91 94	19, 36, 58, 80	1 (0%)
2	B	424/445 (95%)	0.21	14 (3%) 46 54	25, 45, 75, 102	1 (0%)
2	D	421/445 (94%)	0.79	56 (13%) 3 4	35, 64, 96, 126	4 (0%)
3	E	120/184 (65%)	0.64	11 (9%) 9 10	34, 64, 95, 106	0
4	F	309/384 (80%)	1.06	71 (22%) 0 0	35, 68, 107, 122	0
All	All	2151/2358 (91%)	0.41	174 (8%) 12 14	19, 51, 92, 126	6 (0%)

All (174) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	F	182	ILE	9.1
2	D	37	HIS	8.3
4	F	233	PHE	6.4
2	D	395	LEU	5.7
4	F	100	ILE	5.5
4	F	244	CYS	5.4
4	F	253	TYR	5.4
4	F	194	PRO	5.2
4	F	256	TYR	5.1
4	F	161	LEU	4.9
2	D	92	PHE	4.8
4	F	240	LEU	4.6
4	F	245	ILE	4.6
4	F	149	ALA	4.6
4	F	225	SER	4.6
2	D	403	MET	4.6
2	B	54	ALA	4.5
4	F	180	HIS	4.4
4	F	191	LEU	4.4

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Mol	Chain	Res	Type	RSRZ
1	A	1	MET	4.4
2	D	405	GLU	4.4
4	F	362	ALA	4.4
2	D	215	LEU	4.3
2	D	398	TYR	4.1
4	F	20	LEU	4.1
4	F	227	PRO	4.1
3	E	139	LEU	4.1
4	F	21	LEU	4.1
2	D	95	SER	4.0
2	B	57	ASN	4.0
2	B	60	VAL	4.0
2	B	55	THR	3.9
4	F	232	ASN	3.9
4	F	163	SER	3.9
4	F	255	ARG	3.9
1	A	42	ILE	3.9
4	F	22	LEU	3.8
2	D	98	GLY	3.8
2	D	73	MET	3.8
2	D	106	TYR	3.8
2	D	390	ARG	3.8
4	F	162	ILE	3.8
4	F	234	GLN	3.7
2	D	38	GLY	3.7
4	F	242	ASN	3.7
2	D	55	THR	3.7
4	F	147	TRP	3.6
2	D	406	MET	3.5
2	D	218	THR	3.5
2	D	391	ARG	3.5
4	F	226	GLU	3.5
4	F	192	LEU	3.4
4	F	102	PRO	3.4
2	D	400	GLY	3.4
3	E	140	LYS	3.3
2	B	428	ALA	3.3
4	F	98	TYR	3.3
4	F	145	ASN	3.2
4	F	259	GLY	3.2
4	F	199	PHE	3.2
4	F	27	TRP	3.2

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Mol	Chain	Res	Type	RSRZ
4	F	181	VAL	3.2
2	B	59	TYR	3.2
4	F	235	ASP	3.1
4	F	252	ASN	3.1
1	A	61	HIS	3.1
2	B	58	LYS	3.1
1	A	282	TYR	3.0
2	D	396	HIS	3.0
4	F	237	THR	3.0
3	E	26	PRO	3.0
2	D	216	LYS	3.0
3	E	138	GLU	3.0
1	C	340	SER	3.0
4	F	196	HIS	2.9
1	A	86	LEU	2.9
4	F	101	TYR	2.9
3	E	132	GLU	2.9
2	D	217	LEU	2.8
1	A	41	THR	2.8
1	A	37	PRO	2.8
2	D	219	THR	2.8
4	F	246	GLN	2.8
2	D	74	ASP	2.8
2	B	56	GLY	2.8
2	D	177	ASP	2.8
4	F	335	ALA	2.8
2	D	1	MET	2.8
4	F	223	THR	2.8
1	A	54	SER	2.7
1	A	49	PHE	2.7
4	F	31	ARG	2.7
4	F	243	HIS	2.7
2	D	179	VAL	2.7
2	D	44	LEU	2.7
4	F	236	LYS	2.7
4	F	10	ASN	2.6
2	D	392	LYS	2.6
1	A	57	GLY	2.6
2	D	399	THR	2.6
2	D	210	ILE	2.6
2	D	214	THR	2.6
3	E	128	LYS	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	58	ALA	2.6
1	A	30	ILE	2.6
2	D	211	CYS	2.6
4	F	228	TYR	2.5
4	F	258	GLU	2.5
4	F	229	ASN	2.5
1	A	46	ASP	2.5
4	F	260	ASN	2.5
2	D	220	PRO	2.5
2	D	101	TRP	2.5
2	D	96	GLY	2.5
4	F	148	ILE	2.5
4	F	150	LYS	2.5
4	F	165	GLU	2.4
4	F	361	LEU	2.4
3	E	48	GLU	2.4
2	D	28	HIS	2.4
2	D	394	PHE	2.4
2	D	404	ASP	2.4
4	F	14	TYR	2.4
4	F	231	ALA	2.4
2	B	84	ILE	2.4
3	E	59	GLU	2.4
4	F	164	SER	2.4
1	A	56	THR	2.4
2	B	48	ASN	2.4
4	F	151	SER	2.3
2	B	427	ASP	2.3
1	A	48	SER	2.3
1	C	84	ARG	2.3
2	B	37	HIS	2.3
4	F	254	GLY	2.3
4	F	320	MET	2.3
4	F	6	VAL	2.3
4	F	146	VAL	2.3
1	A	130	THR	2.3
2	D	54	ALA	2.3
4	F	184	LYS	2.3
2	B	244	GLY	2.3
2	D	254	ALA	2.3
2	D	84	ILE	2.3
2	D	408	PHE	2.3

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Mol	Chain	Res	Type	RSRZ
3	E	51	GLN	2.2
2	B	33	THR	2.2
2	D	53	GLU	2.2
2	D	387	ALA	2.2
2	D	397	TRP	2.2
4	F	239	HIS	2.2
2	D	389	PHE	2.2
3	E	133	VAL	2.2
2	D	385	PHE	2.2
2	D	35	SER	2.2
1	A	262	TYR	2.2
4	F	9	GLU	2.2
2	D	199	THR	2.2
2	D	58	LYS	2.1
4	F	195	GLY	2.1
4	F	197	ARG	2.1
3	E	46	SER	2.1
1	A	40	LYS	2.1
2	D	107	THR	2.1
4	F	198	LYS	2.1
2	D	39	ASP	2.1
4	F	17	VAL	2.1
2	D	208	TYR	2.1
1	A	346	TRP	2.1
2	D	126	SER	2.0
4	F	224	SER	2.0
1	A	62	VAL	2.0
2	D	71	GLY	2.0
2	D	178	THR	2.0

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 monosaccharides in this entry.

6.4 Ligands

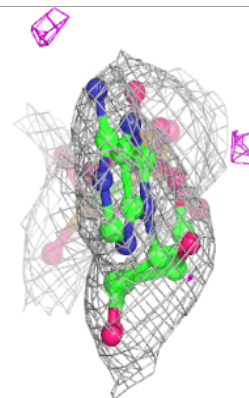
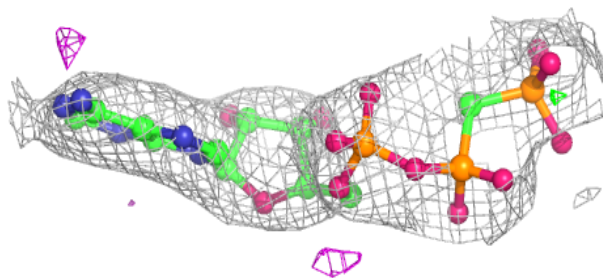
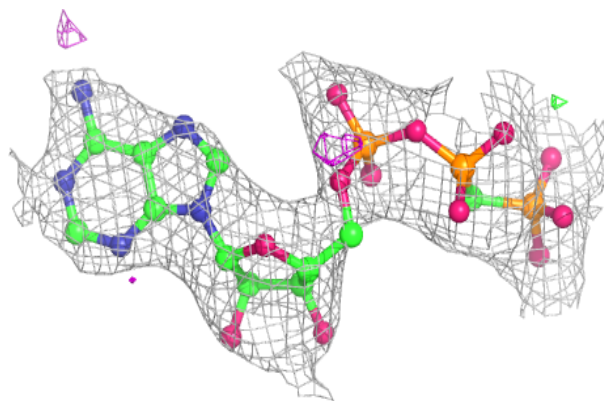
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
7	MG	D	502	1/1	0.85	0.13	52,52,52,52	0
11	ACP	F	401	31/31	0.85	0.29	79,83,112,115	0
9	MES	B	507	12/12	0.88	0.44	95,97,101,104	0
6	CA	B	506	1/1	0.88	0.15	78,78,78,78	0
6	CA	C	503	1/1	0.89	0.10	56,56,56,56	0
9	MES	B	504	12/12	0.89	0.21	70,74,76,78	0
5	GTP	D	501	32/32	0.93	0.17	45,49,67,70	0
10	87U	B	505	34/34	0.94	0.20	48,54,55,55	0
6	CA	A	502	1/1	0.96	0.13	67,67,67,67	0
7	MG	B	503	1/1	0.97	0.11	24,24,24,24	0
8	GDP	B	502	28/28	0.98	0.15	22,25,26,28	0
7	MG	B	501	1/1	0.98	0.18	22,22,22,22	0
5	GTP	A	501	32/32	0.98	0.15	26,28,30,30	0
7	MG	C	502	1/1	0.98	0.11	24,24,24,24	0
5	GTP	C	501	32/32	0.98	0.14	24,26,28,30	0

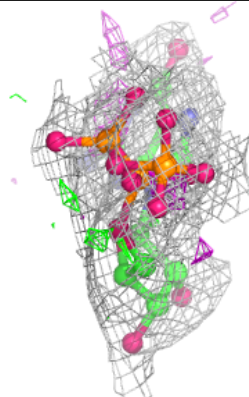
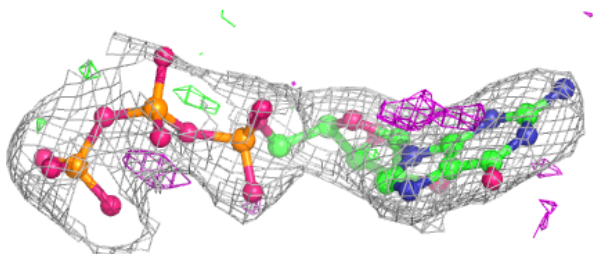
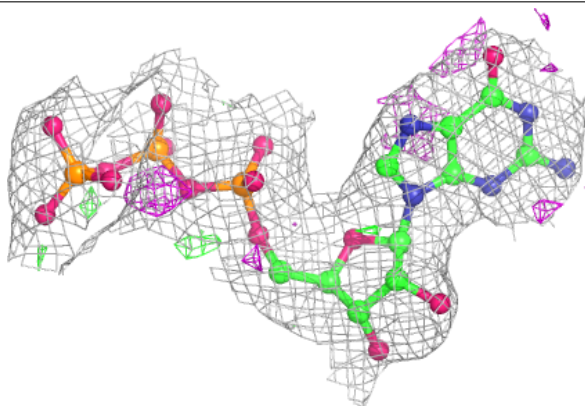
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around ACP F 401:

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

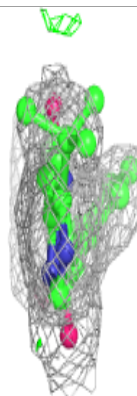
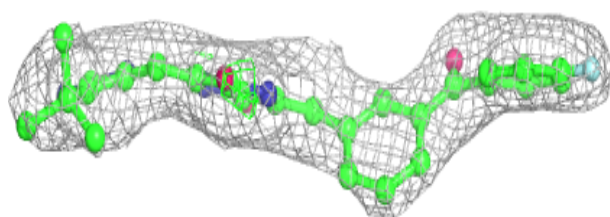
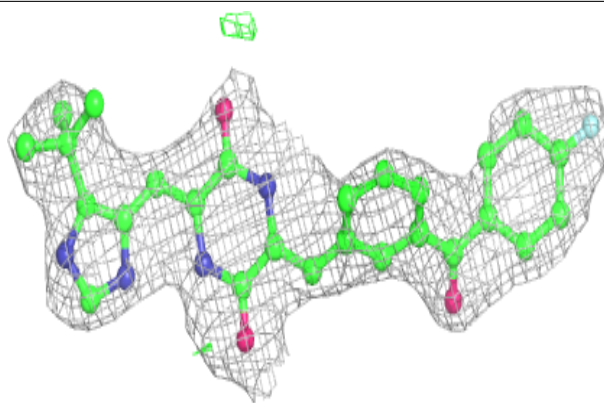
**Electron density around GTP D 501:**

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

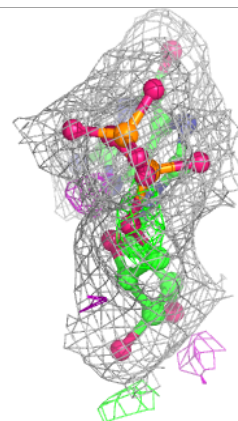
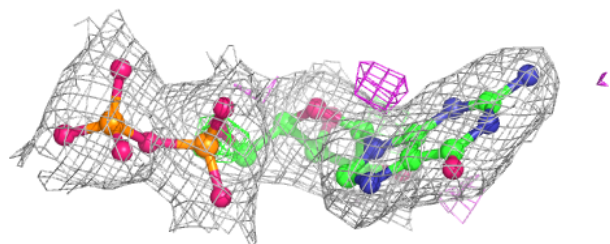
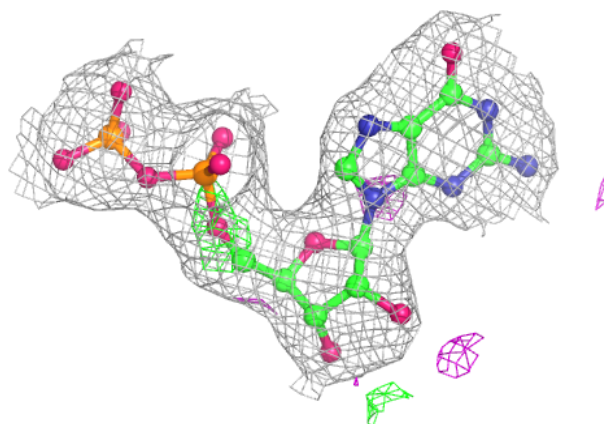


Electron density around 87U B 505:

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

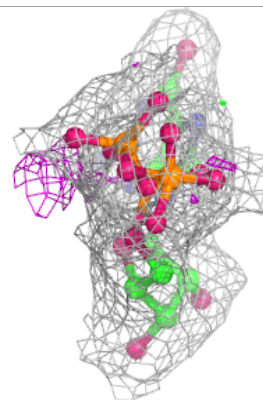
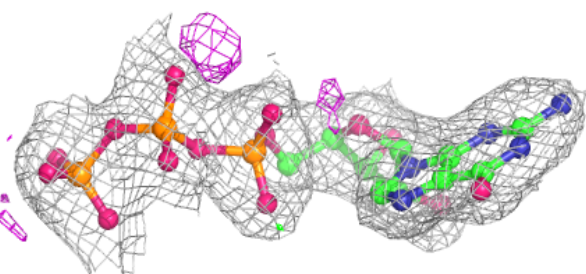
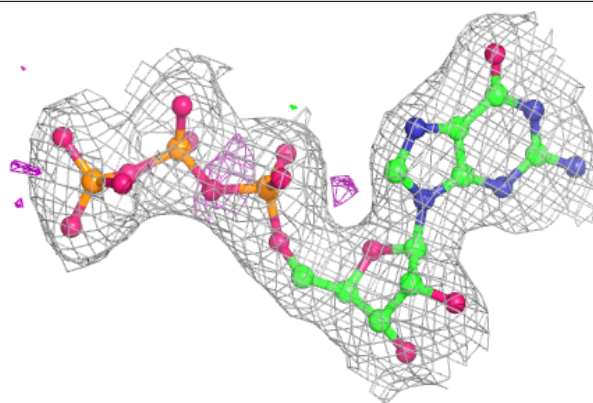
**Electron density around GDP B 502:**

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

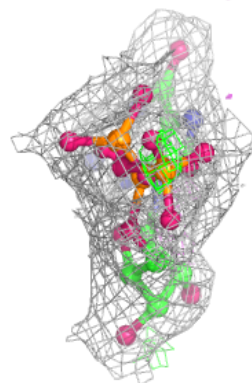
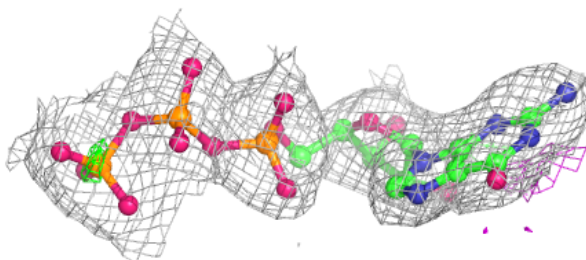
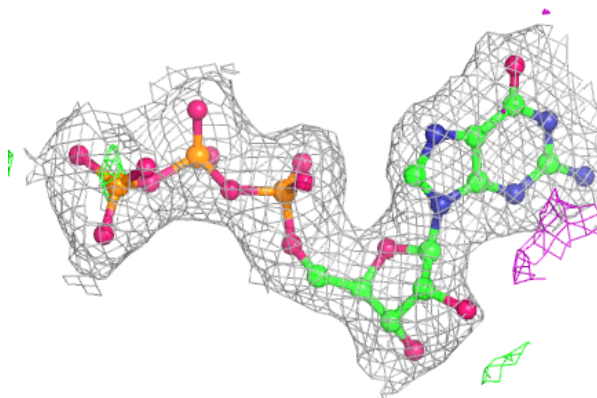


Electron density around GTP A 501:

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

**Electron density around GTP C 501:**

$2mF_o-DF_c$ (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.