



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 21, 2022 – 04:19 PM EDT

PDB ID : 5SB7
Title : Tubulin-todalam-18-complex
Authors : Muehlethaler, T.; Milanos, L.; Ortega, J.A.; Blum, T.B.; Gioia, D.; Prota, A.E.; Cavalli, A.; Steinmetz, M.O.
Deposited on : 2021-07-08
Resolution : 2.10 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 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 : 2.27
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) : 2.27

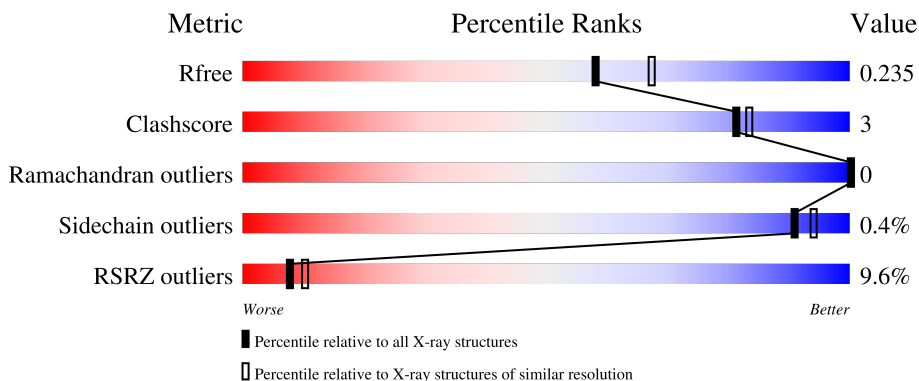
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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	5197 (2.10-2.10)
Clashscore	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)
RSRZ outliers	127900	5083 (2.10-2.10)

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	451	
1	C	451	
2	B	445	
2	D	445	
3	E	143	

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Mol	Chain	Length	Quality of chain
4	F	384	 <p>A horizontal bar chart representing the quality of chain. The bar is divided into four segments: a red segment on the left labeled '29%', a large green segment labeled '83%', a small yellow segment labeled '7%', and a grey segment on the far right labeled '11%'. The segments are stacked horizontally to represent 100% of the chain's quality.</p>

2 Entry composition i

There are 12 unique types of molecules in this entry. The entry contains 18445 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-1B chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	438	Total	C	N	O	S	0	0	0
			3424	2167	582	653	22			
1	C	440	Total	C	N	O	S	0	2	0
			3448	2183	585	657	23			

- Molecule 2 is a protein called Tubulin beta-2B chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	423	Total	C	N	O	S	0	1	0
			3345	2102	572	644	27			
2	D	426	Total	C	N	O	S	1	0	0
			3343	2098	570	648	27			

- Molecule 3 is a protein called Stathmin-4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	E	123	Total	C	N	O	S	0	0	0
			1014	625	183	201	5			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	3	MET	-	initiating methionine	UNP P63043
E	4	ALA	-	expression tag	UNP P63043

- Molecule 4 is a protein called Tubulin-Tyrosine Ligase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	F	343	Total	C	N	O	S	0	0	0
			2813	1804	483	512	14			

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
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		

- Molecule 6 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

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

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	F	1	Total	Mg	0	0
			1	1		

- Molecule 7 is CALCIUM ION (three-letter code: CA) (formula: Ca).

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

- Molecule 8 is GUANOSINE-5'-DIPHOSPHATE (three-letter code: GDP) (formula: C₁₀H₁₅N₅O₁₁P₂).



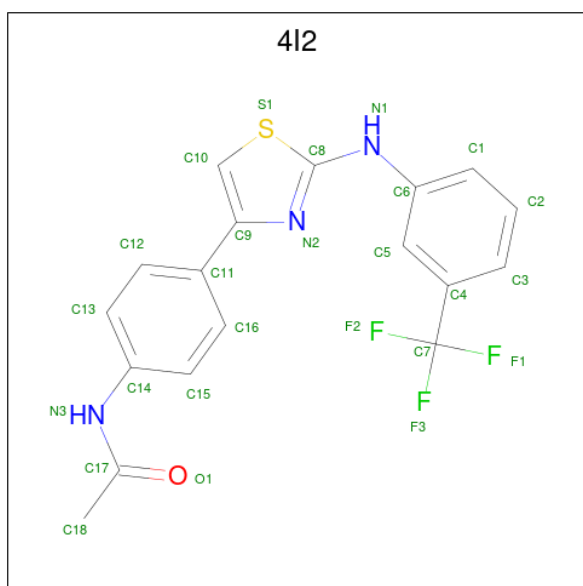
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
8	B	1	Total	C	N	O	P	0	0
			28	10	5	11	2		
8	D	1	Total	C	N	O	P	0	0
			28	10	5	11	2		

- Molecule 9 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (three-letter code: MES) (formula: C₆H₁₃NO₄S).



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

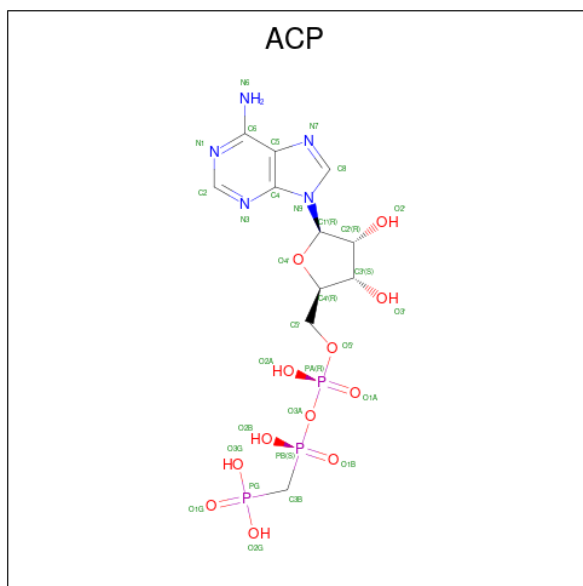
- Molecule 10 is N-(4-{2-[3-(trifluoromethyl)anilino]-1,3-thiazol-4-yl}phenyl)acetamide (three-letter code: 4I2) (formula: C₁₈H₁₄F₃N₃OS) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	F	N	O			S
10	C	1	26	18	3	3	1	1	0	0

- Molecule 11 is PHOSPHOMETHYLPHOSPHONIC ACID ADENYLATE ESTER (three-

letter code: ACP) (formula: C₁₁H₁₈N₅O₁₂P₃).



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

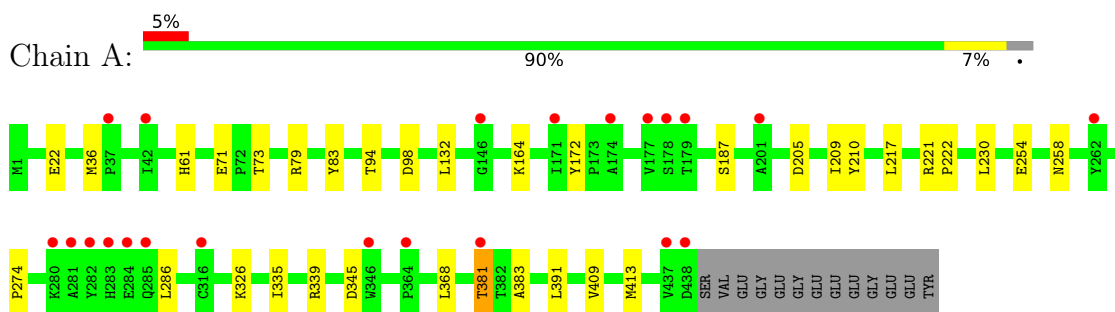
- Molecule 12 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
12	A	160	Total	O	0	0
			160	160		
12	B	164	Total	O	0	0
			164	164		
12	C	305	Total	O	0	0
			305	305		
12	D	113	Total	O	0	0
			113	113		
12	E	50	Total	O	0	0
			50	50		
12	F	68	Total	O	0	0
			68	68		

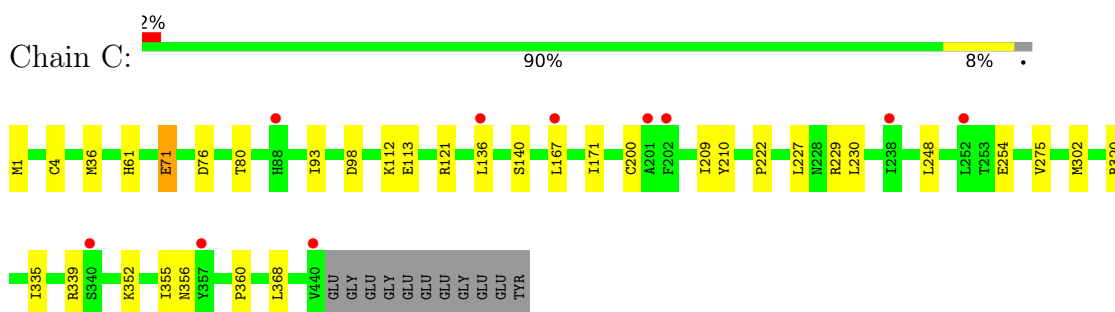
3 Residue-property plots [i](#)

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.

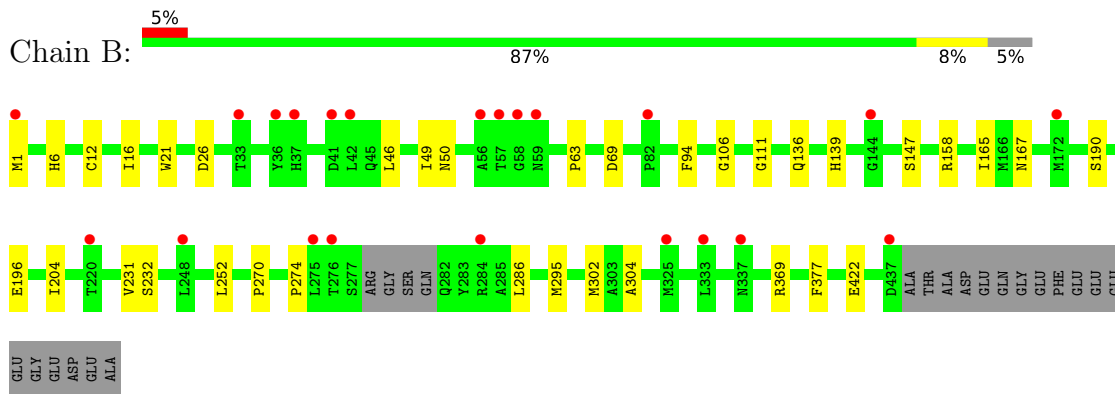
- Molecule 1: Tubulin alpha-1B chain



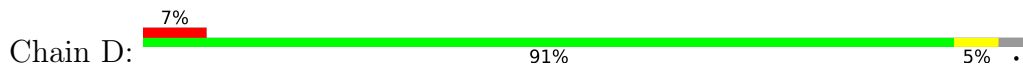
- Molecule 1: Tubulin alpha-1B chain

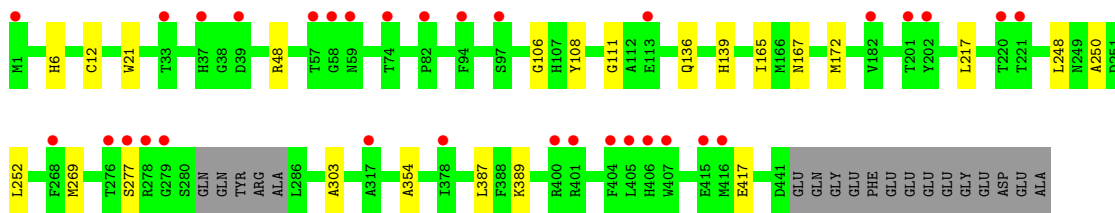


- Molecule 2: Tubulin beta-2B chain

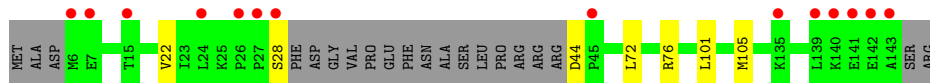
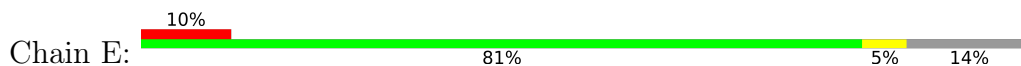


- Molecule 2: Tubulin beta-2B chain

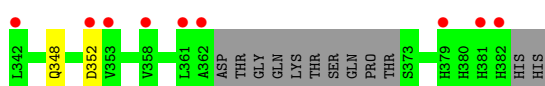
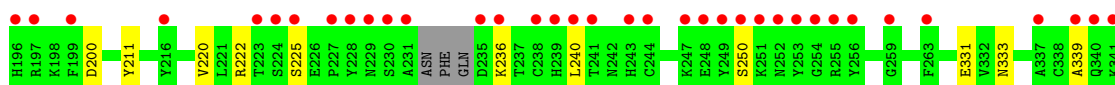
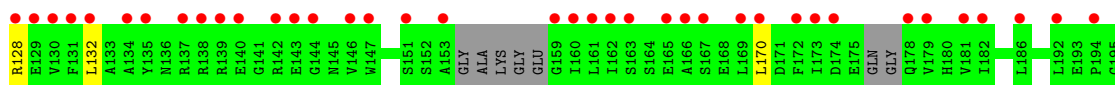
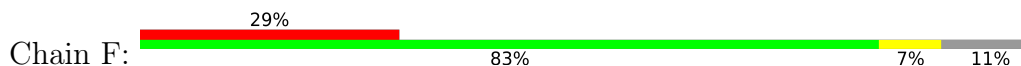




● Molecule 3: Stathmin-4



● Molecule 4: Tubulin-Tyrosine Ligase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	105.15Å 158.29Å 179.99Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.08 – 2.10 48.08 – 2.10	Depositor EDS
% Data completeness (in resolution range)	99.9 (48.08-2.10) 99.9 (48.08-2.10)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.77 (at 2.10Å)	Xtrriage
Refinement program	PHENIX 1.19.1_4122	Depositor
R, R_{free}	0.202 , 0.235 0.202 , 0.235	Depositor DCC
R_{free} test set	8757 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	41.9	Xtrriage
Anisotropy	0.212	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 44.7	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	0.96	EDS
Total number of atoms	18445	wwPDB-VP
Average B, all atoms (Å ²)	51.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.48% 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: ACP, MG, GTP, MES, CA, 4I2, GDP

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	0.25	0/3502	0.48	0/4754
1	C	0.26	0/3529	0.50	0/4791
2	B	0.26	0/3419	0.49	0/4629
2	D	0.25	0/3416	0.47	0/4626
3	E	0.24	0/1022	0.41	0/1356
4	F	0.24	0/2876	0.47	0/3883
All	All	0.25	0/17764	0.48	0/24039

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	3424	0	3334	19	0
1	C	3448	0	3363	21	0
2	B	3345	0	3227	19	0
2	D	3343	0	3222	12	0
3	E	1014	0	1029	4	0
4	F	2813	0	2780	14	0
5	A	32	0	12	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	C	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
6	D	1	0	0	0	0
6	F	1	0	0	0	0
7	A	1	0	0	0	0
7	B	1	0	0	0	0
7	C	1	0	0	0	0
7	E	1	0	0	0	0
8	B	28	0	12	1	0
8	D	28	0	12	1	0
9	B	12	0	12	1	0
10	C	26	0	0	1	0
11	F	31	0	14	2	0
12	A	160	0	0	1	0
12	B	164	0	0	2	0
12	C	305	0	0	2	0
12	D	113	0	0	1	0
12	E	50	0	0	1	0
12	F	68	0	0	0	0
All	All	18445	0	17029	89	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 3.

All (89) 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)
2:D:217:LEU:HA	2:D:277:SER:HB3	1.78	0.66
4:F:10:ASN:HB2	4:F:44:ARG:HH22	1.63	0.63
4:F:102:PRO:HG2	4:F:105:LEU:HD13	1.81	0.62
4:F:236:LYS:HB3	4:F:240:LEU:HD13	1.83	0.60
1:A:71:GLU:O	12:A:601:HOH:O	2.17	0.60
4:F:331:GLU:OE2	11:F:401:ACP:O3G	2.20	0.60
2:B:270:PRO:HG2	2:B:302:MET:HB2	1.84	0.59
1:A:335:ILE:HG23	1:A:339:ARG:HG3	1.85	0.57
1:A:132:LEU:O	1:A:164:LYS:NZ	2.38	0.56
2:B:147:SER:HG	2:B:190:SER:HG	1.52	0.56
1:C:209:ILE:HG23	1:C:230:LEU:HD23	1.88	0.56
1:A:71:GLU:OE2	1:A:73:THR:OG1	2.24	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:274:PRO:HB3	2:B:286:LEU:HD22	1.88	0.55
1:C:112:LYS:NZ	1:C:113:GLU:OE2	2.38	0.55
1:C:1:MET:O	12:C:601:HOH:O	2.18	0.55
1:C:248:LEU:HD13	1:C:355:ILE:HD12	1.89	0.54
2:B:16:ILE:HD13	2:B:231:VAL:HG11	1.90	0.53
1:C:335:ILE:HG23	1:C:339:ARG:HG3	1.91	0.53
1:A:209:ILE:HG23	1:A:230:LEU:HD23	1.91	0.52
1:C:209:ILE:HD11	1:C:302:MET:SD	2.50	0.52
2:D:269:MET:HG3	2:D:303:ALA:HB3	1.92	0.52
2:D:6:HIS:CD2	2:D:21:TRP:HE1	2.27	0.52
2:D:136:GLN:HA	2:D:167:ASN:O	2.10	0.52
3:E:44:ASP:N	12:E:308:HOH:O	2.44	0.51
1:C:136:LEU:HD23	1:C:167:LEU:HB2	1.92	0.50
2:B:6:HIS:CD2	2:B:21:TRP:HE1	2.30	0.50
1:C:4[B]:CYS:SG	10:C:504:4I2:F3	2.54	0.50
1:C:229:ARG:NH1	12:C:620:HOH:O	2.43	0.50
1:C:320:ARG:HA	1:C:356:ASN:O	2.12	0.49
4:F:348:GLN:NE2	4:F:352:ASP:OD1	2.45	0.49
4:F:101:TYR:N	4:F:126:ASP:OD1	2.36	0.49
1:A:381:THR:HG22	1:A:383:ALA:H	1.77	0.49
2:D:48:ARG:NH2	2:D:250:ALA:O	2.43	0.49
4:F:14:TYR:HB3	4:F:41:LEU:HD13	1.95	0.49
4:F:200:ASP:OD2	4:F:222:ARG:NH2	2.44	0.49
1:A:274:PRO:HB3	1:A:286:LEU:HD12	1.95	0.48
1:A:345:ASP:HB3	3:E:28:SER:HB2	1.95	0.48
2:B:106:GLY:O	2:B:111:GLY:HA3	2.14	0.48
2:B:136:GLN:HA	2:B:167:ASN:O	2.14	0.48
4:F:225:SER:OG	4:F:250:SER:OG	2.31	0.48
1:A:210:TYR:CZ	1:A:222:PRO:HD2	2.49	0.47
1:A:36:MET:HB3	1:A:61:HIS:CE1	2.50	0.47
1:A:172:TYR:HB3	1:A:205:ASP:HA	1.97	0.47
2:B:422:GLU:HG3	12:B:610:HOH:O	2.15	0.47
2:B:304:ALA:N	12:B:616:HOH:O	2.47	0.47
2:D:12:CYS:HB2	8:D:501:GDP:C8	2.50	0.47
2:D:172:MET:HG3	2:D:387:LEU:HD11	1.97	0.47
1:C:210:TYR:CZ	1:C:222:PRO:HD2	2.50	0.46
4:F:132:LEU:HD21	4:F:170:LEU:HD11	1.97	0.46
1:C:320:ARG:HG3	1:C:360:PRO:HG3	1.97	0.46
1:A:254:GLU:HG2	1:A:258:ASN:ND2	2.32	0.45
2:B:158:ARG:NH1	2:B:196:GLU:O	2.49	0.45
1:C:275:VAL:HG13	1:C:368:LEU:HD21	1.97	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:106:GLY:O	2:D:111:GLY:HA3	2.17	0.45
1:A:409:VAL:HA	1:A:413:MET:O	2.17	0.45
2:B:46:LEU:HA	2:B:49:ILE:HB	1.99	0.45
1:A:98:ASP:HB2	5:A:501:GTP:O2G	2.17	0.44
4:F:128:ARG:HH12	4:F:170:LEU:HB3	1.82	0.44
4:F:220:VAL:HG11	4:F:339:ALA:HB2	2.00	0.44
2:B:204:ILE:HD13	2:B:231:VAL:HG13	1.98	0.44
1:C:140:SER:HA	1:C:171:ILE:HB	2.00	0.44
1:C:93:ILE:HD11	1:C:121:ARG:HG3	1.99	0.44
1:A:79:ARG:HH12	1:A:94:THR:HG21	1.83	0.43
2:B:1:MET:HA	2:B:50:ASN:HD21	1.83	0.43
4:F:333:ASN:ND2	11:F:401:ACP:O3G	2.51	0.43
2:B:69:ASP:O	2:B:94:PHE:HA	2.19	0.43
2:B:26:ASP:OD1	2:B:369:ARG:NH2	2.51	0.42
1:C:209:ILE:HG22	1:C:227:LEU:HD22	2.00	0.42
2:D:165:ILE:HG21	2:D:252:LEU:HB3	2.00	0.42
1:C:254:GLU:HG2	1:C:352:LYS:HE2	2.02	0.42
2:D:389:LYS:NZ	12:D:616:HOH:O	2.52	0.42
1:C:167:LEU:HG	1:C:200:CYS:HB3	2.01	0.42
2:B:12:CYS:HB2	8:B:501:GDP:C8	2.55	0.42
2:B:295:MET:HG2	2:B:377:PHE:HB2	2.02	0.42
2:B:165:ILE:HG21	2:B:252:LEU:HB3	2.02	0.42
9:B:504:MES:H51	9:B:504:MES:H81	1.61	0.41
2:D:248:LEU:HD23	2:D:354:ALA:HB2	2.02	0.41
1:A:187:SER:HB3	1:A:391:LEU:HD21	2.02	0.41
1:C:71:GLU:HB3	1:C:98:ASP:HB3	2.02	0.41
1:A:217:LEU:HD21	1:A:368:LEU:HD23	2.03	0.41
1:C:36:MET:HB3	1:C:61:HIS:CE1	2.55	0.41
3:E:101:LEU:O	3:E:105:MET:HG2	2.21	0.41
4:F:14:TYR:HA	4:F:17:VAL:HB	2.02	0.41
1:C:76:ASP:O	1:C:80:THR:HG22	2.21	0.40
1:A:326:LYS:HE2	1:A:326:LYS:HB3	1.86	0.40
3:E:72:LEU:O	3:E:76:ARG:HG2	2.20	0.40
2:B:21:TRP:CZ3	2:B:63:PRO:HB3	2.56	0.40
1:A:22:GLU:HG3	1:A:83:TYR:CE1	2.56	0.40
2:D:108:TYR:OH	2:D:417:GLU:OE2	2.27	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	436/451 (97%)	430 (99%)	6 (1%)	0	100	100
1	C	440/451 (98%)	431 (98%)	9 (2%)	0	100	100
2	B	420/445 (94%)	412 (98%)	8 (2%)	0	100	100
2	D	422/445 (95%)	415 (98%)	7 (2%)	0	100	100
3	E	119/143 (83%)	119 (100%)	0	0	100	100
4	F	331/384 (86%)	321 (97%)	10 (3%)	0	100	100
All	All	2168/2319 (94%)	2128 (98%)	40 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	369/379 (97%)	367 (100%)	2 (0%)	88	92
1	C	373/379 (98%)	372 (100%)	1 (0%)	92	95
2	B	368/383 (96%)	366 (100%)	2 (0%)	88	92
2	D	368/383 (96%)	367 (100%)	1 (0%)	92	95
3	E	110/127 (87%)	109 (99%)	1 (1%)	78	84
4	F	309/342 (90%)	308 (100%)	1 (0%)	92	95
All	All	1897/1993 (95%)	1889 (100%)	8 (0%)	91	94

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	221	ARG
1	A	381	THR
2	B	139	HIS
2	B	232	SER
1	C	71	GLU
2	D	139	HIS
3	E	22	VAL
4	F	211	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
2	B	15	GLN
2	B	282	GLN
1	C	285	GLN
4	F	180	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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 16 ligands modelled in this entry, 9 are monoatomic - leaving 7 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	A	501	6	26,34,34	0.96	1 (3%)	33,54,54	1.73	7 (21%)
10	4I2	C	504	-	25,28,28	1.37	3 (12%)	34,40,40	0.86	0
11	ACP	F	401	6	27,33,33	1.38	5 (18%)	32,52,52	1.38	4 (12%)
9	MES	B	504	-	12,12,12	2.16	1 (8%)	14,16,16	2.04	4 (28%)
8	GDP	D	501	6	24,30,30	1.19	2 (8%)	31,47,47	1.94	8 (25%)
5	GTP	C	501	6	26,34,34	0.97	1 (3%)	33,54,54	1.73	6 (18%)
8	GDP	B	501	6	24,30,30	1.16	2 (8%)	31,47,47	1.86	7 (22%)

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	A	501	6	-	7/18/38/38	0/3/3/3
10	4I2	C	504	-	-	0/16/18/18	0/3/3/3
11	ACP	F	401	6	-	5/15/38/38	0/3/3/3
9	MES	B	504	-	-	4/6/14/14	0/1/1/1
8	GDP	D	501	6	-	4/12/32/32	0/3/3/3
5	GTP	C	501	6	-	8/18/38/38	0/3/3/3
8	GDP	B	501	6	-	3/12/32/32	0/3/3/3

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	B	504	MES	C8-S	-7.22	1.67	1.77
8	D	501	GDP	C5-C6	4.22	1.48	1.41
8	B	501	GDP	C5-C6	4.06	1.48	1.41
10	C	504	4I2	C17-N3	3.26	1.42	1.36
10	C	504	4I2	C10-S1	3.25	1.75	1.70
5	C	501	GTP	C6-N1	3.05	1.38	1.33
5	A	501	GTP	C6-N1	2.97	1.38	1.33
11	F	401	ACP	PG-O3G	2.93	1.61	1.54
10	C	504	4I2	C8-N1	2.86	1.41	1.36
11	F	401	ACP	PG-O2G	2.86	1.61	1.54
11	F	401	ACP	PB-O3A	2.59	1.61	1.58

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
11	F	401	ACP	C5-C4	2.56	1.47	1.40
8	D	501	GDP	C5-C4	2.44	1.47	1.40
8	B	501	GDP	C5-C4	2.33	1.47	1.40
11	F	401	ACP	PB-O2B	2.18	1.61	1.56

All (36) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	C	501	GTP	N3-C2-N1	-5.40	120.03	127.22
5	A	501	GTP	N3-C2-N1	-5.36	120.08	127.22
9	B	504	MES	O1S-S-C8	5.00	112.93	106.92
8	D	501	GDP	C2-N3-C4	4.86	120.91	115.36
8	B	501	GDP	C2-N3-C4	4.53	120.53	115.36
8	B	501	GDP	C2-N1-C6	4.14	122.51	115.93
5	A	501	GTP	C2-N3-C4	4.08	120.02	115.36
8	B	501	GDP	C4-C5-C6	-4.07	116.91	120.80
8	D	501	GDP	C2-N1-C6	4.07	122.40	115.93
8	B	501	GDP	C5-C6-N1	-4.04	117.91	123.43
8	D	501	GDP	C5-C6-N1	-4.04	117.91	123.43
8	D	501	GDP	C4-C5-C6	-3.92	117.06	120.80
5	C	501	GTP	C2-N3-C4	3.91	119.83	115.36
9	B	504	MES	C5-N4-C3	3.54	116.80	108.83
8	B	501	GDP	N3-C2-N1	-3.37	122.72	127.22
11	F	401	ACP	C3'-C2'-C1'	3.31	105.97	100.98
8	D	501	GDP	N3-C2-N1	-3.26	122.87	127.22
11	F	401	ACP	PB-O3A-PA	-3.25	122.26	132.56
5	C	501	GTP	C5-C6-N1	-3.21	119.05	123.43
11	F	401	ACP	N3-C2-N1	-3.14	123.77	128.68
5	A	501	GTP	C5-C6-N1	-3.01	119.31	123.43
5	C	501	GTP	PB-O3B-PG	-2.98	122.60	132.83
5	A	501	GTP	PA-O3A-PB	-2.96	122.66	132.83
8	D	501	GDP	PA-O3A-PB	-2.94	122.74	132.83
5	C	501	GTP	C2-N1-C6	2.88	120.51	115.93
8	D	501	GDP	C4-C5-N7	-2.86	106.42	109.40
5	A	501	GTP	PB-O3B-PG	-2.75	123.39	132.83
11	F	401	ACP	C4-C5-N7	-2.71	106.58	109.40
5	A	501	GTP	C2-N1-C6	2.69	120.20	115.93
8	B	501	GDP	C4-C5-N7	-2.65	106.64	109.40
5	C	501	GTP	PA-O3A-PB	-2.61	123.86	132.83
9	B	504	MES	C7-N4-C5	2.39	117.36	111.23
9	B	504	MES	C6-C5-N4	-2.36	106.52	110.10
8	B	501	GDP	PA-O3A-PB	-2.17	125.37	132.83

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	501	GTP	N2-C2-N1	2.07	120.46	117.25
8	D	501	GDP	C3'-C2'-C1'	2.04	104.05	100.98

There are no chirality outliers.

All (31) torsion outliers are listed below:

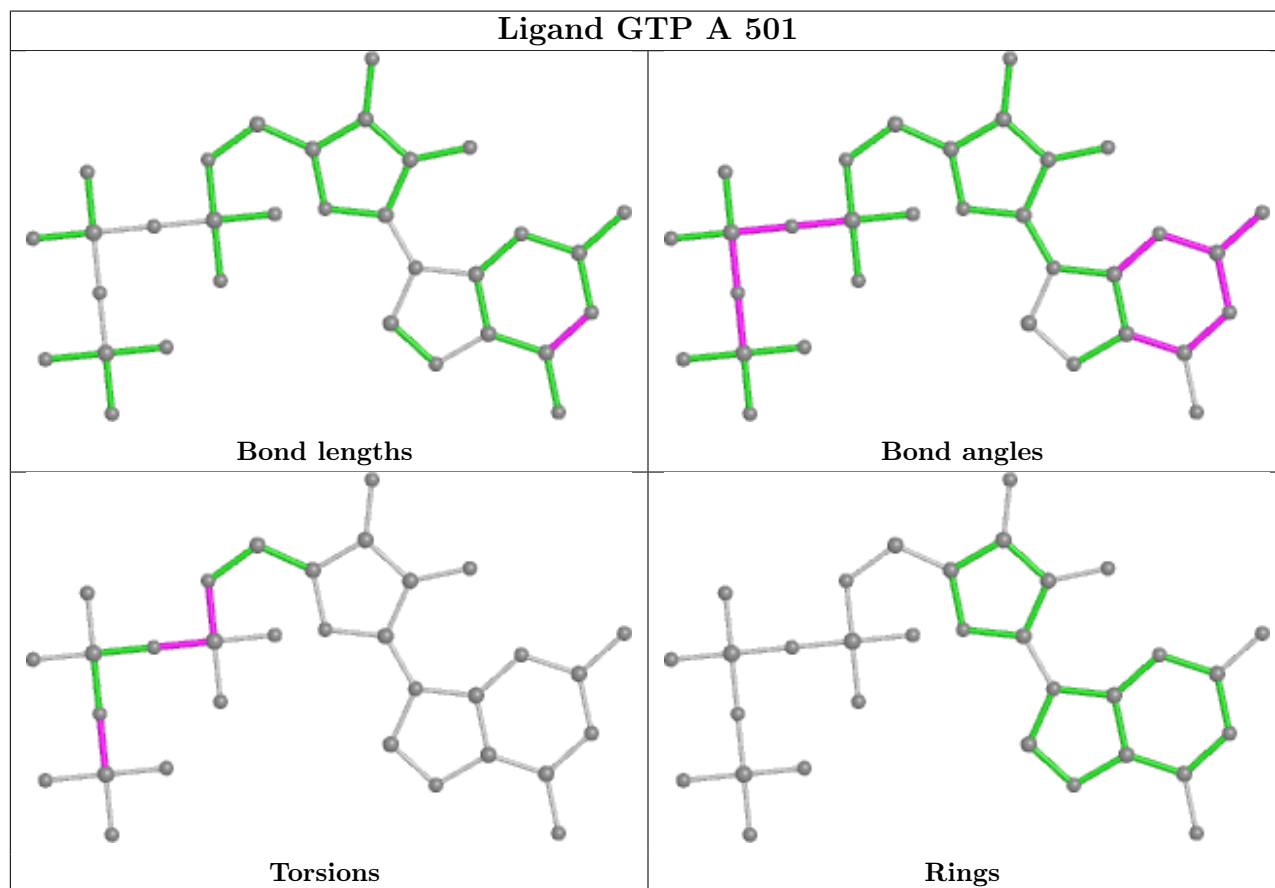
Mol	Chain	Res	Type	Atoms
5	A	501	GTP	C5'-O5'-PA-O1A
5	A	501	GTP	C5'-O5'-PA-O2A
5	C	501	GTP	C5'-O5'-PA-O1A
5	C	501	GTP	C5'-O5'-PA-O2A
8	B	501	GDP	C5'-O5'-PA-O1A
8	B	501	GDP	C5'-O5'-PA-O2A
8	D	501	GDP	C5'-O5'-PA-O1A
8	D	501	GDP	C5'-O5'-PA-O2A
9	B	504	MES	C8-C7-N4-C5
9	B	504	MES	C7-C8-S-O2S
9	B	504	MES	C7-C8-S-O3S
11	F	401	ACP	C5'-O5'-PA-O1A
11	F	401	ACP	C5'-O5'-PA-O2A
11	F	401	ACP	C5'-O5'-PA-O3A
5	A	501	GTP	PB-O3B-PG-O1G
8	D	501	GDP	PA-O3A-PB-O3B
5	A	501	GTP	C5'-O5'-PA-O3A
9	B	504	MES	C7-C8-S-O1S
11	F	401	ACP	PB-C3B-PG-O2G
5	A	501	GTP	PB-O3A-PA-O2A
5	C	501	GTP	PB-O3A-PA-O2A
5	C	501	GTP	PB-O3B-PG-O1G
11	F	401	ACP	PB-C3B-PG-O1G
5	A	501	GTP	PB-O3B-PG-O2G
5	A	501	GTP	PB-O3B-PG-O3G
5	C	501	GTP	PB-O3B-PG-O2G
5	C	501	GTP	PB-O3B-PG-O3G
5	C	501	GTP	C5'-O5'-PA-O3A
8	B	501	GDP	C5'-O5'-PA-O3A
8	D	501	GDP	C5'-O5'-PA-O3A
5	C	501	GTP	C4'-C5'-O5'-PA

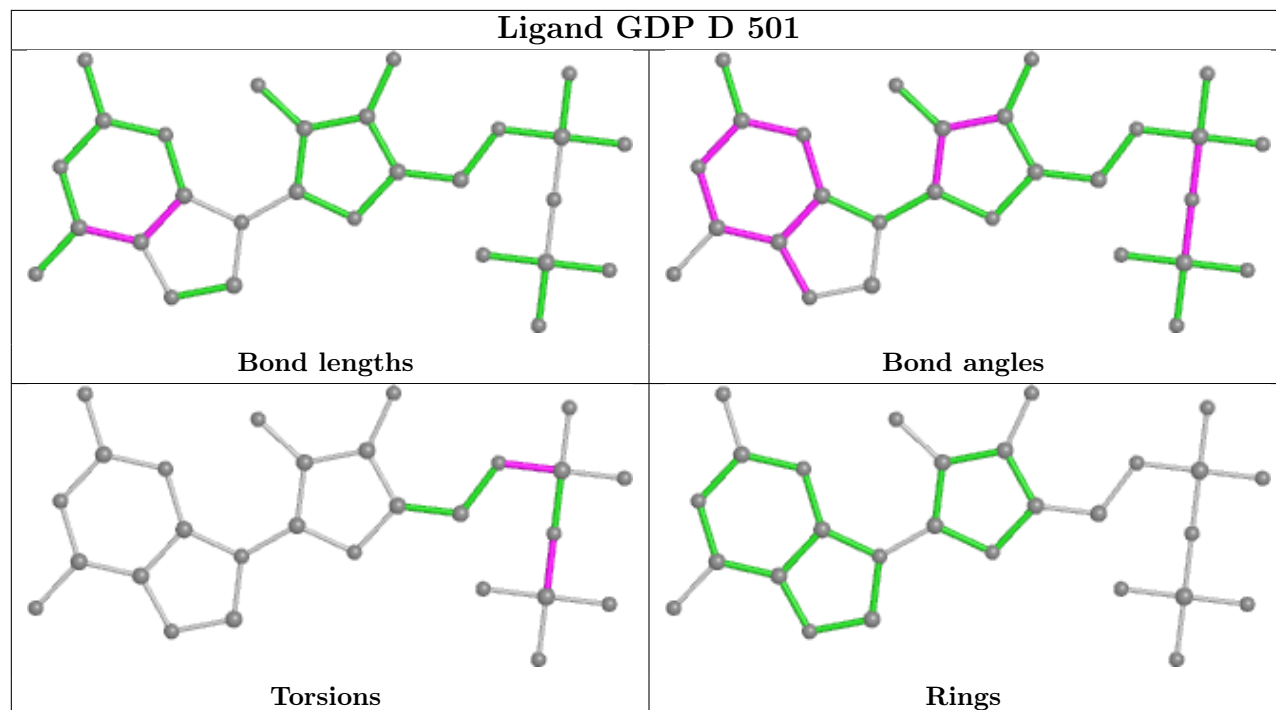
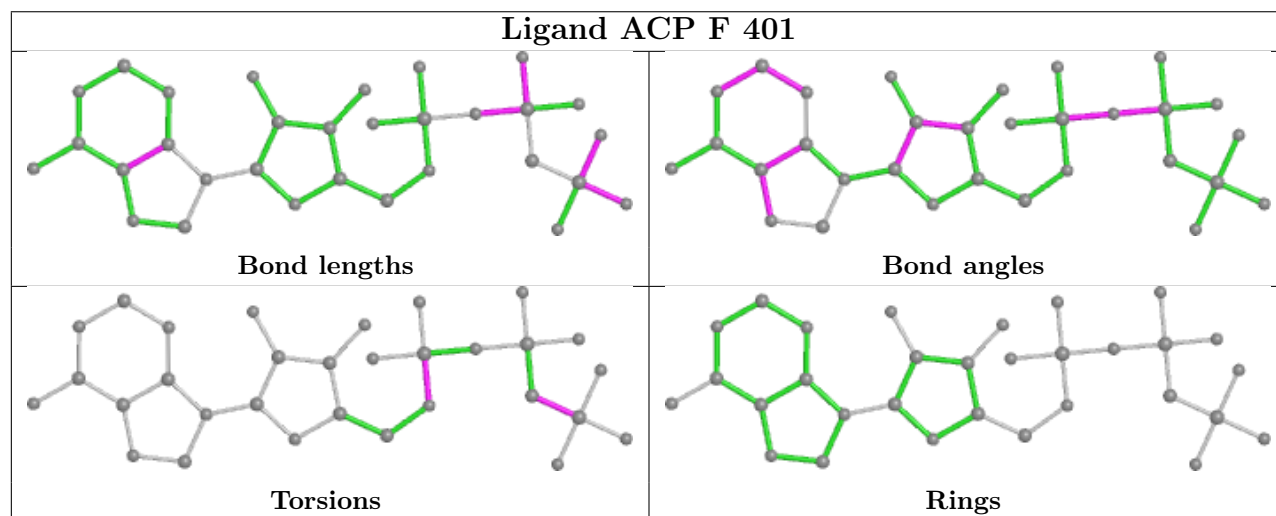
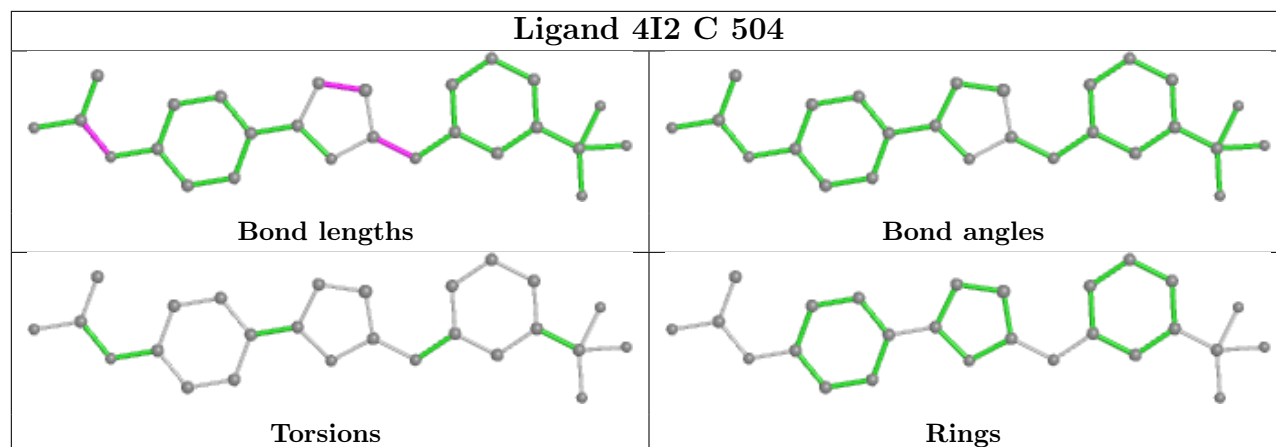
There are no ring outliers.

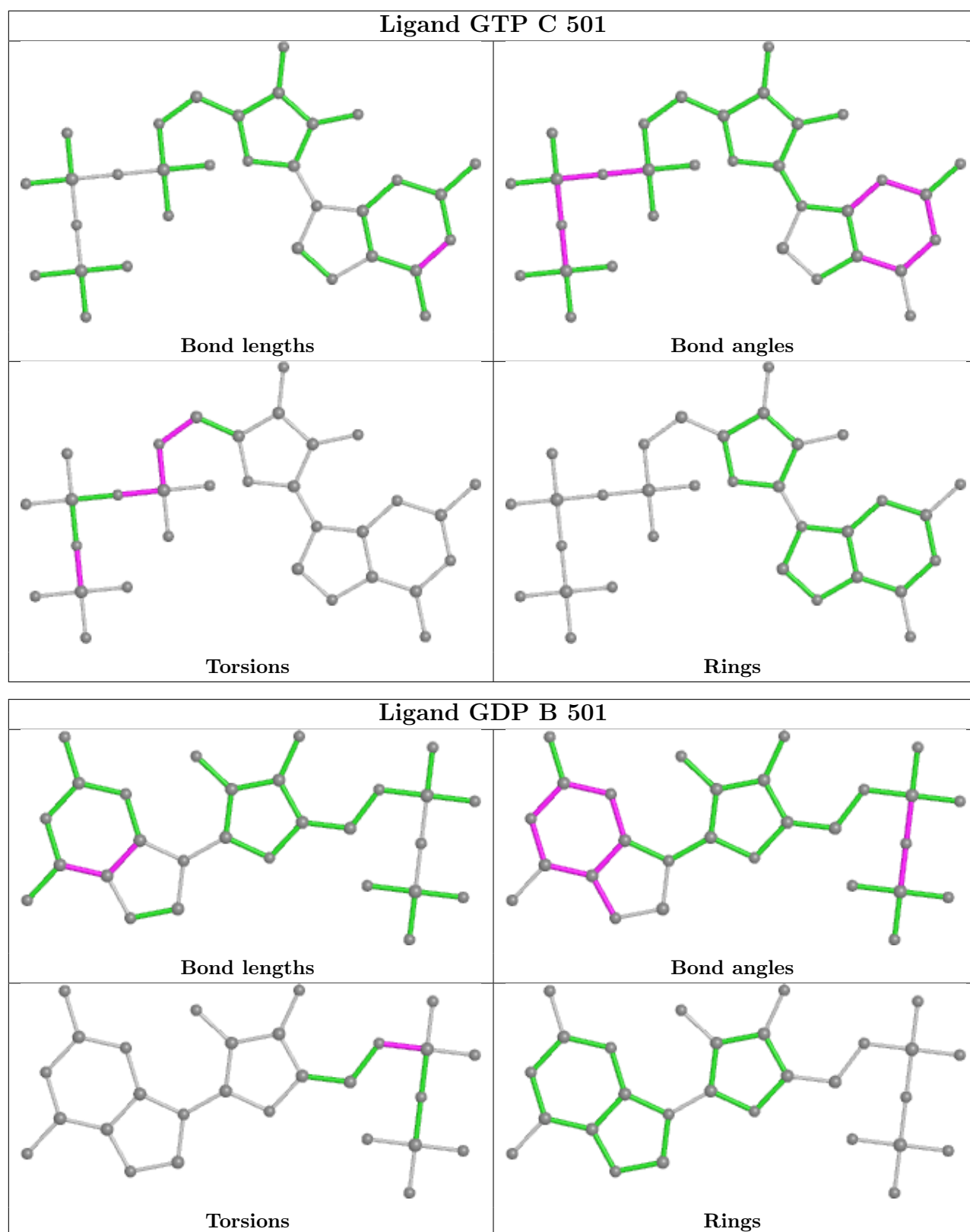
6 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	501	GTP	1	0
10	C	504	4I2	1	0
11	F	401	ACP	2	0
9	B	504	MES	1	0
8	D	501	GDP	1	0
8	B	501	GDP	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

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	438/451 (97%)	0.54	22 (5%) 28 34	31, 46, 67, 99	0
1	C	440/451 (97%)	0.33	10 (2%) 60 65	26, 37, 56, 69	0
2	B	423/445 (95%)	0.49	22 (5%) 27 32	26, 44, 71, 91	0
2	D	426/445 (95%)	0.57	32 (7%) 14 18	32, 51, 75, 94	2 (0%)
3	E	123/143 (86%)	0.68	14 (11%) 5 6	34, 55, 85, 104	0
4	F	343/384 (89%)	1.42	110 (32%) 0 0	41, 65, 112, 122	0
All	All	2193/2319 (94%)	0.64	210 (9%) 8 10	26, 48, 83, 122	2 (0%)

All (210) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	282	TYR	8.2
4	F	103	THR	7.6
4	F	173	ILE	7.5
4	F	240	LEU	7.4
2	D	57	THR	6.7
4	F	105	LEU	6.5
4	F	130	VAL	6.4
2	B	276	THR	6.4
4	F	251	LYS	6.3
3	E	27	PRO	6.2
4	F	20	LEU	5.7
2	B	57	THR	5.6
4	F	244	CYS	5.6
4	F	169	LEU	5.6
4	F	132	LEU	5.5
4	F	104	ASN	5.4
2	B	59	ASN	5.3
4	F	100	ILE	5.2
4	F	249	TYR	5.1

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Mol	Chain	Res	Type	RSRZ
1	A	281	ALA	5.0
4	F	250	SER	5.0
4	F	170	LEU	4.9
3	E	26	PRO	4.8
4	F	361	LEU	4.7
3	E	142	GLU	4.7
3	E	139	LEU	4.6
4	F	181	VAL	4.6
4	F	125	THR	4.5
2	D	276	THR	4.5
4	F	253	TYR	4.5
4	F	161	LEU	4.5
4	F	362	ALA	4.4
4	F	248	GLU	4.3
4	F	142	ARG	4.3
4	F	166	ALA	4.3
4	F	89	GLU	4.3
1	C	440	VAL	4.2
4	F	382	HIS	4.2
3	E	143	ALA	4.1
4	F	182	ILE	4.1
1	A	262	TYR	4.1
2	B	1	MET	4.1
2	D	400	ARG	4.1
1	C	252[A]	LEU	4.0
2	D	94	PHE	4.0
4	F	231	ALA	4.0
4	F	17	VAL	3.9
4	F	179	VAL	3.9
1	C	340	SER	3.8
2	D	279	GLY	3.8
2	B	437	ASP	3.8
4	F	172	PHE	3.7
4	F	131	PHE	3.7
4	F	27	TRP	3.7
4	F	194	PRO	3.7
4	F	239	HIS	3.7
4	F	178	GLN	3.7
4	F	243	HIS	3.6
4	F	241	THR	3.5
4	F	129	GLU	3.5
2	D	401	ARG	3.5

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Mol	Chain	Res	Type	RSRZ
2	B	58	GLY	3.5
1	A	283	HIS	3.4
2	D	37	HIS	3.4
4	F	159	GLY	3.4
1	A	42	ILE	3.3
4	F	138	ARG	3.3
2	D	277	SER	3.3
3	E	6	MET	3.3
4	F	102	PRO	3.3
4	F	256	TYR	3.2
2	B	37	HIS	3.2
1	A	179	THR	3.2
2	D	278	ARG	3.2
4	F	259	GLY	3.2
4	F	101	TYR	3.2
4	F	167	SER	3.2
4	F	90	SER	3.2
4	F	134	ALA	3.1
4	F	381	HIS	3.1
2	D	1	MET	3.1
4	F	25	GLY	3.1
4	F	196	HIS	3.1
4	F	160	ILE	3.1
2	B	333	LEU	3.1
4	F	165	GLU	3.0
4	F	238	CYS	2.9
4	F	11	SER	2.9
2	B	284	ARG	2.9
2	D	404	PHE	2.9
4	F	163	SER	2.9
1	C	357	TYR	2.9
4	F	153	ALA	2.9
4	F	337	ALA	2.9
2	D	407	TRP	2.9
1	A	438	ASP	2.9
4	F	45	ASN	2.8
3	E	28	SER	2.8
4	F	21	LEU	2.8
4	F	19	ARG	2.8
4	F	135	TYR	2.8
1	A	177	VAL	2.8
2	B	41	ASP	2.8

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Mol	Chain	Res	Type	RSRZ
2	D	97	SER	2.8
4	F	263	PHE	2.8
4	F	137	ARG	2.7
1	A	146	GLY	2.7
3	E	135	LYS	2.7
4	F	13	VAL	2.7
3	E	45	PRO	2.7
2	B	220	THR	2.7
4	F	353	VAL	2.7
4	F	26	GLN	2.7
4	F	342	LEU	2.7
2	D	82	PRO	2.7
2	B	42	LEU	2.7
2	B	36	TYR	2.7
2	B	337	ASN	2.7
4	F	151	SER	2.7
4	F	230	SER	2.7
1	A	178	SER	2.6
4	F	99	VAL	2.6
3	E	7	GLU	2.6
4	F	22	LEU	2.6
4	F	147	TRP	2.6
4	F	252	ASN	2.6
4	F	255	ARG	2.6
2	D	59	ASN	2.6
4	F	228	TYR	2.6
2	B	56	ALA	2.6
4	F	192	LEU	2.6
4	F	31	ARG	2.6
4	F	144	GLY	2.6
4	F	140	GLU	2.6
4	F	340	GLN	2.5
2	B	33	THR	2.5
4	F	352	ASP	2.5
1	A	284	GLU	2.5
4	F	139	ARG	2.4
4	F	186	LEU	2.4
4	F	235	ASP	2.4
4	F	199	PHE	2.4
1	C	238	ILE	2.4
2	D	221	THR	2.4
4	F	18	SER	2.4

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Mol	Chain	Res	Type	RSRZ
4	F	229	ASN	2.4
2	D	58	GLY	2.4
1	A	437	VAL	2.3
4	F	32	LYS	2.3
4	F	197	ARG	2.3
2	D	416	MET	2.3
4	F	24	THR	2.3
4	F	254	GLY	2.3
4	F	174	ASP	2.3
2	D	317	ALA	2.3
4	F	1	MET	2.3
4	F	223	THR	2.3
1	A	346	TRP	2.3
2	D	182	VAL	2.3
3	E	141	GLU	2.3
2	D	202	TYR	2.3
4	F	236	LYS	2.3
4	F	339	ALA	2.3
2	B	82	PRO	2.3
2	D	415	GLU	2.3
3	E	15	THR	2.3
4	F	225	SER	2.3
1	A	171	ILE	2.3
4	F	143	GLU	2.3
4	F	162	ILE	2.3
1	A	285	GLN	2.2
2	D	113	GLU	2.2
1	A	316	CYS	2.2
3	E	140	LYS	2.2
2	D	378	ILE	2.2
2	D	39	ASP	2.2
2	D	220	THR	2.2
2	D	405	LEU	2.2
1	C	202	PHE	2.2
1	A	364	PRO	2.2
4	F	146	VAL	2.2
4	F	227	PRO	2.2
1	C	88	HIS	2.2
4	F	341	LYS	2.2
1	A	201	ALA	2.2
2	D	268	PHE	2.2
2	D	33	THR	2.2

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Mol	Chain	Res	Type	RSRZ
2	D	74	THR	2.2
4	F	379	HIS	2.2
1	A	174	ALA	2.2
2	D	201	THR	2.2
4	F	224	SER	2.2
1	A	37	PRO	2.2
2	D	406	HIS	2.1
4	F	216	TYR	2.1
2	B	172	MET	2.1
4	F	247	LYS	2.1
1	A	381	THR	2.1
1	C	136	LEU	2.1
1	C	201	ALA	2.1
1	A	280	LYS	2.1
2	B	275	LEU	2.1
3	E	24	LEU	2.1
4	F	358	VAL	2.1
2	B	325	MET	2.1
1	C	167	LEU	2.0
4	F	128	ARG	2.0
2	B	144	GLY	2.0
4	F	44	ARG	2.0
2	B	248	LEU	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 [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, 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.

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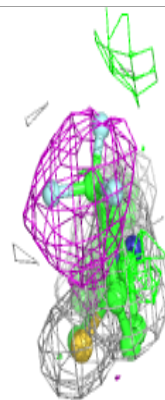
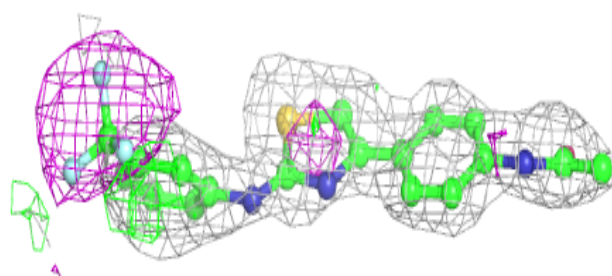
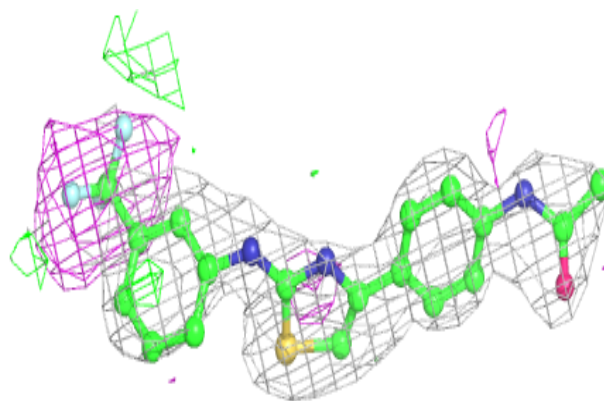
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
10	4I2	C	504	26/26	0.71	0.32	38,53,66,68	0
6	MG	D	502	1/1	0.74	0.14	60,60,60,60	0
7	CA	B	503	1/1	0.86	0.24	87,87,87,87	0
11	ACP	F	401	31/31	0.91	0.14	68,76,91,93	0
7	CA	A	503	1/1	0.93	0.05	53,53,53,53	0
6	MG	C	502	1/1	0.94	0.12	28,28,28,28	0
7	CA	E	201	1/1	0.95	0.05	92,92,92,92	0
8	GDP	D	501	28/28	0.95	0.12	44,50,58,71	0
6	MG	F	402	1/1	0.96	0.08	72,72,72,72	0
9	MES	B	504	12/12	0.96	0.11	38,45,55,55	0
5	GTP	A	501	32/32	0.98	0.19	25,32,38,39	0
7	CA	C	503	1/1	0.98	0.03	49,49,49,49	0
6	MG	A	502	1/1	0.98	0.14	35,35,35,35	0
8	GDP	B	501	28/28	0.98	0.17	27,32,36,40	0
5	GTP	C	501	32/32	0.99	0.17	25,30,34,35	0
6	MG	B	502	1/1	0.99	0.20	27,27,27,27	0

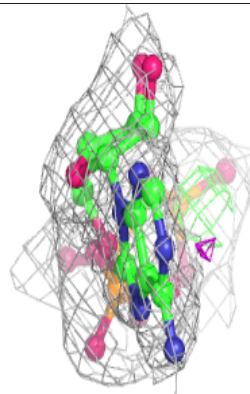
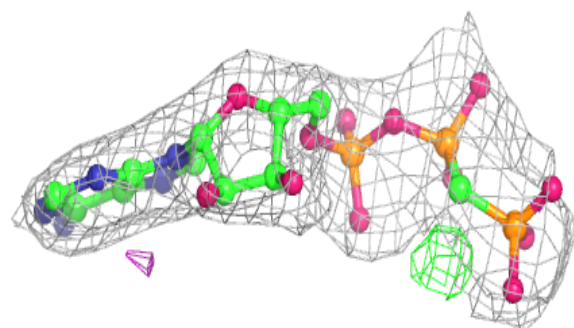
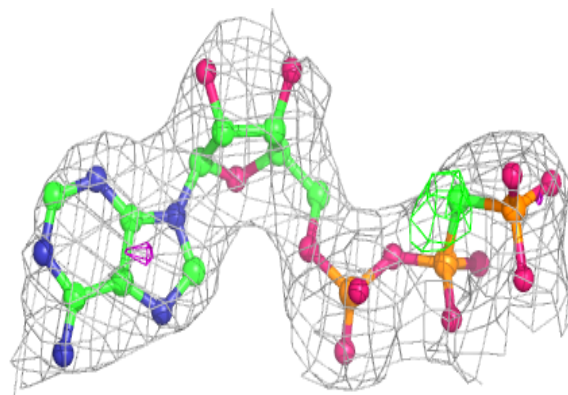
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around 4I2 C 504:

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

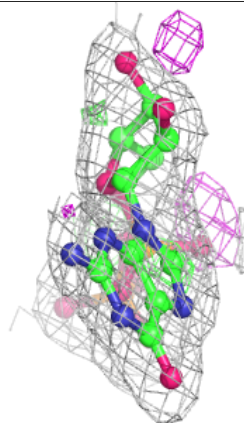
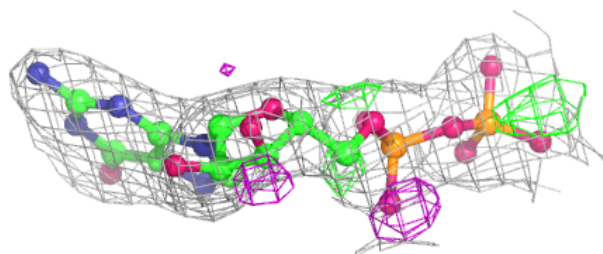
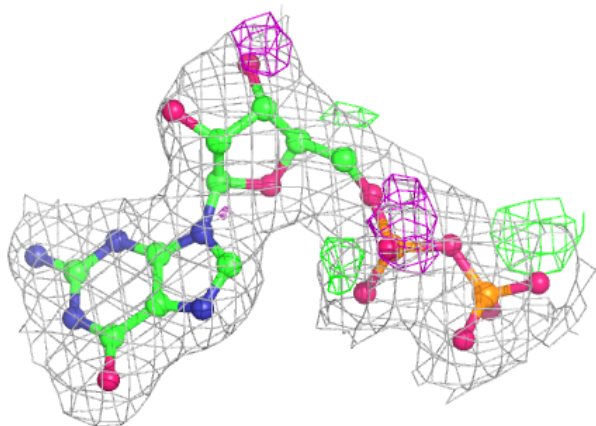
**Electron density around ACP F 401:**

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

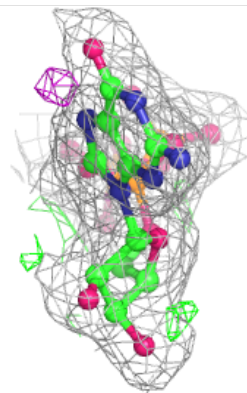
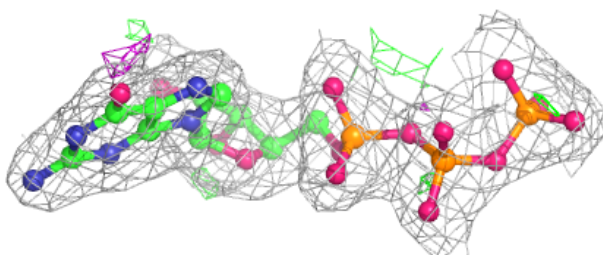
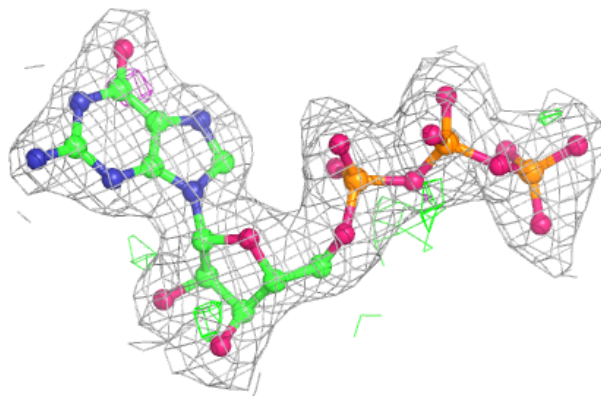


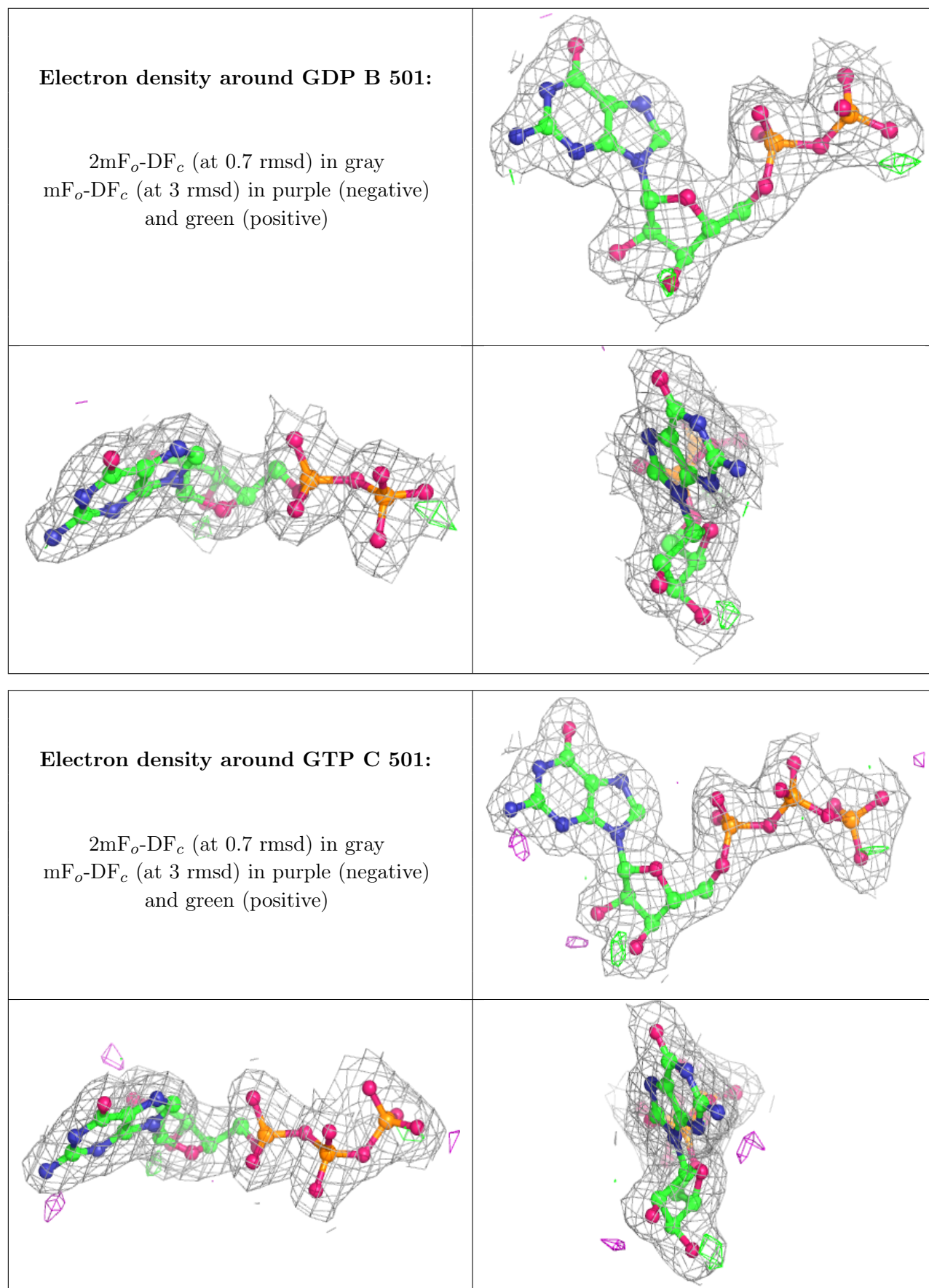
Electron density around GDP D 501:

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

**Electron density around 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)





6.5 Other polymers [i](#)

There are no such residues in this entry.