



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 15, 2023 – 05:25 AM EDT

PDB ID : 7TTF  
Title : Tubulin-RB3\_SLD in complex with compound 12k  
Authors : White, S.W.; Yun, M.  
Deposited on : 2022-02-01  
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](mailto: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>.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (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

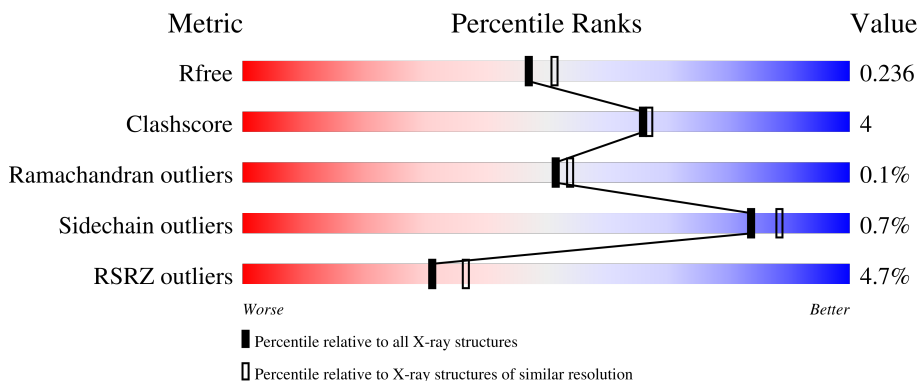
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.10 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  $\geq 3$ , 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	438	 2% 86% 11%
1	C	438	 4% 85% 12%
2	B	433	 7% 90% 8%
2	D	433	 3% 88% 11%
3	E	143	 13% 79% 7% 14%

## 2 Entry composition i

There are 10 unique types of molecules in this entry. The entry contains 14849 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	425	Total	C	N	O	S	0	0	0
			3326	2108	565	631	22			
1	C	427	Total	C	N	O	S	0	0	0
			3343	2118	568	635	22			

- Molecule 2 is a protein called Tubulin beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	423	Total	C	N	O	S	0	0	0
			3319	2086	565	641	27			
2	D	431	Total	C	N	O	S	0	1	0
			3376	2117	576	656	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
			1010	626	184	197	3			

There are 4 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
E	14	ALA	CYS	engineered mutation	UNP P63043
E	20	TRP	PHE	engineered mutation	UNP P63043

- Molecule 4 is GUANOSINE-5'-TRIPHOSPHATE (three-letter code: GTP) (formula:  $C_{10}H_{16}N_5O_{14}P_3$ ).



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

- Molecule 5 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



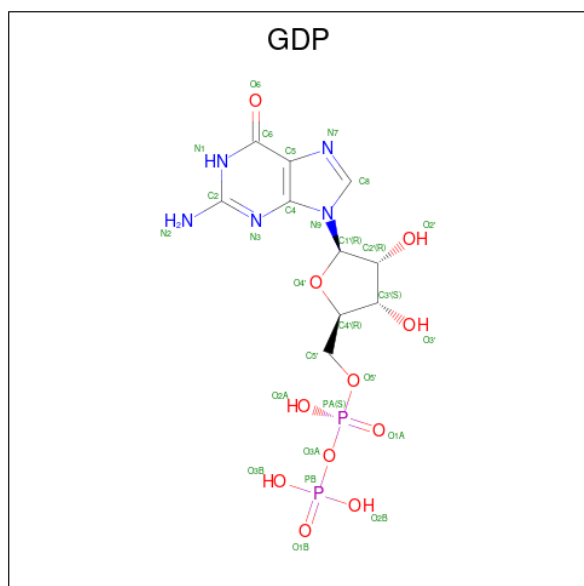
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	O	S	0	0
			5	4	1		

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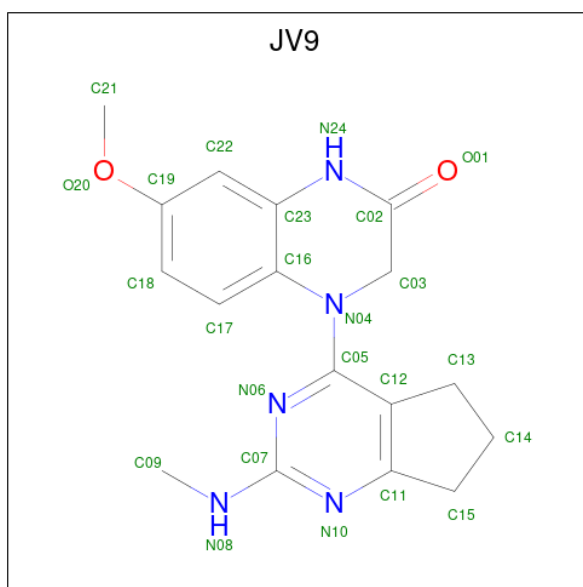
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	O	S	0	0
			5	4	1		
5	B	1	Total	O	S	0	0
			5	4	1		
5	B	1	Total	O	S	0	0
			5	4	1		
5	B	1	Total	O	S	0	0
			5	4	1		
5	D	1	Total	O	S	0	0
			5	4	1		
5	D	1	Total	O	S	0	0
			5	4	1		

- Molecule 6 is GUANOSINE-5'-DIPHOSPHATE (three-letter code: GDP) (formula:  $C_{10}H_{15}N_5O_{11}P_2$ ).



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

- Molecule 7 is 7-methoxy-4-[2-(methylamino)-6,7-dihydro-5H-cyclopenta[d]pyrimidin-4-yl]-3,4-dihydroquinoxalin-2(1H)-one (three-letter code: JV9) (formula:  $C_{17}H_{19}N_5O_2$ ) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	
7	B	1	Total	C	N	O	0	0
			24	17	5	2		
7	D	1	Total	C	N	O	0	0
			24	17	5	2		

- Molecule 8 is GLYCEROL (three-letter code: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	B	1	Total	C O	0	0
			6	3 3		

- Molecule 9 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	C	1	Total Mg 1 1	0	0

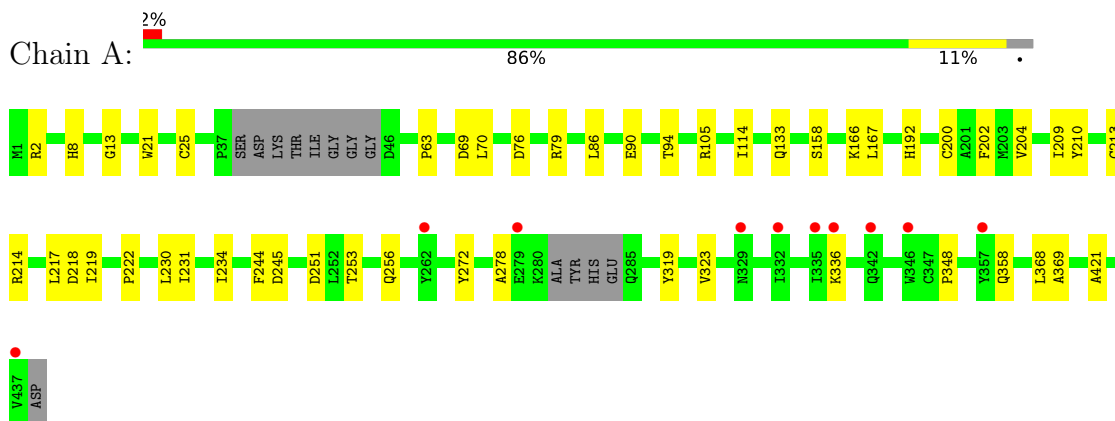
- Molecule 10 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	A	80	Total O 80 80	0	0
10	B	49	Total O 49 49	0	0
10	C	57	Total O 57 57	0	0
10	D	62	Total O 62 62	0	0
10	E	13	Total O 13 13	0	0

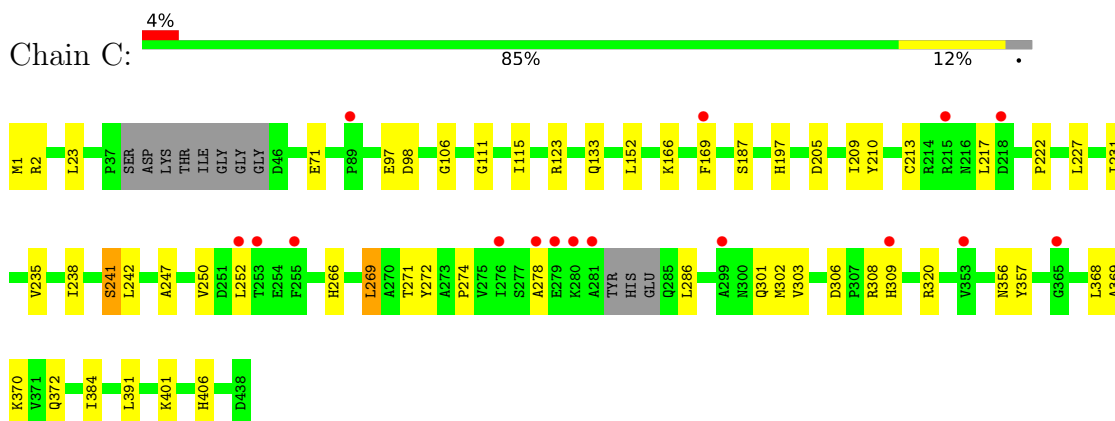
### 3 Residue-property plots [i](#)

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.

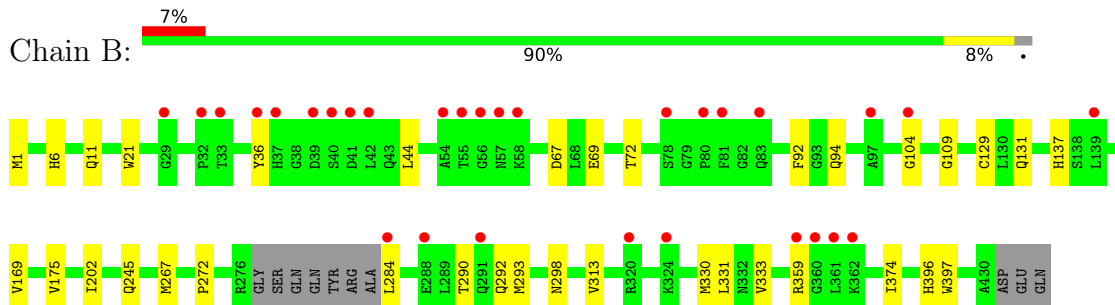
- Molecule 1: Tubulin alpha-1B chain



- Molecule 1: Tubulin alpha-1B chain

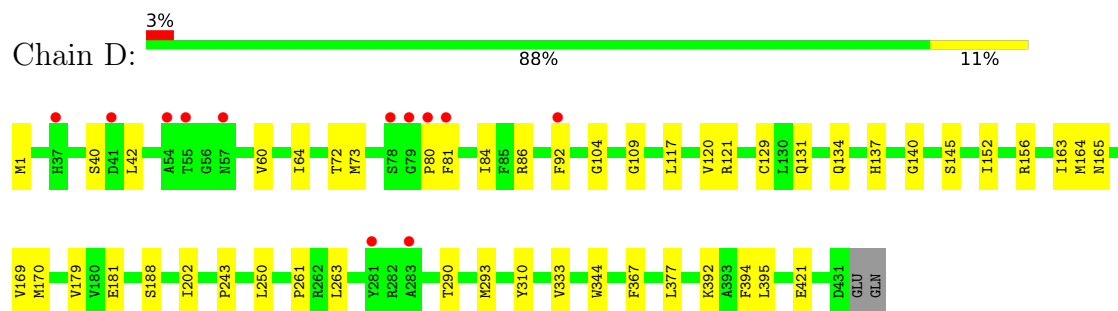


- Molecule 2: Tubulin beta chain

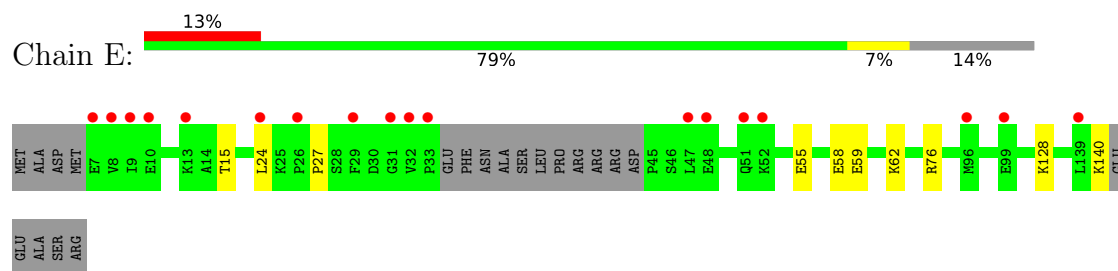




- Molecule 2: Tubulin beta chain



- Molecule 3: Stathmin-4



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	65.69Å 126.41Å 250.06Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	45.55 – 2.10 45.55 – 2.10	Depositor EDS
% Data completeness (in resolution range)	99.9 (45.55-2.10) 100.0 (45.55-2.10)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.68 (at 2.10Å)	Xtrriage
Refinement program	PHENIX 1.14_3260	Depositor
R, $R_{free}$	0.194 , 0.238 0.191 , 0.236	Depositor DCC
$R_{free}$ test set	6004 reflections (4.91%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	37.5	Xtrriage
Anisotropy	0.824	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 49.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	14849	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	56.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.01% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: GTP, GDP, GOL, JV9, MG, SO4

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	0.39	0/3400	0.53	0/4615
1	C	0.36	0/3417	0.52	0/4637
2	B	0.39	0/3391	0.55	0/4592
2	D	0.41	0/3453	0.57	0/4679
3	E	0.32	0/1021	0.42	0/1357
All	All	0.38	0/14682	0.54	0/19880

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	3326	0	3242	31	0
1	C	3343	0	3262	33	0
2	B	3319	0	3202	19	0
2	D	3376	0	3238	30	0
3	E	1010	0	1019	8	0
4	A	32	0	12	0	0
4	C	32	0	12	0	0
4	D	32	0	12	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	10	0	0	0	0
5	B	15	0	0	0	0
5	D	10	0	0	0	0
6	B	28	0	12	0	0
7	B	24	0	0	0	0
7	D	24	0	0	0	0
8	B	6	0	8	0	0
9	C	1	0	0	0	0
10	A	80	0	0	2	0
10	B	49	0	0	0	0
10	C	57	0	0	0	0
10	D	62	0	0	0	0
10	E	13	0	0	0	0
All	All	14849	0	14019	113	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 4.

All (113) 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:1:MET:N	2:D:129:CYS:SG	2.47	0.87
1:A:209:ILE:HG23	1:A:230:LEU:HD23	1.73	0.70
1:A:133:GLN:OE1	1:A:251:ASP:HB2	1.93	0.69
1:C:269:LEU:HD12	1:C:384:ILE:HD12	1.75	0.69
1:C:271:THR:HG22	1:C:301:GLN:HA	1.78	0.65
2:D:42:LEU:HD23	2:D:243:PRO:HG2	1.79	0.63
2:D:310:TYR:CE1	2:D:367:PHE:HZ	2.17	0.63
2:D:170:MET:HG3	2:D:377:LEU:HD11	1.80	0.61
1:C:169:PHE:HE2	1:C:238:ILE:HD12	1.66	0.61
1:C:133:GLN:HE22	1:C:242:LEU:HD23	1.65	0.59
1:C:213:CYS:HA	1:C:217:LEU:HD12	1.84	0.59
2:D:263:LEU:HD21	2:D:421:GLU:HG3	1.83	0.59
2:B:1:MET:HG3	2:B:131:GLN:HG3	1.85	0.57
1:C:320:ARG:HA	1:C:356:ASN:O	2.05	0.56
2:D:60:VAL:HG11	2:D:86:ARG:HG3	1.88	0.55
1:C:97:GLU:HG3	2:D:1:MET:HG2	1.88	0.55
1:C:406:HIS:CG	2:D:261:PRO:HD3	2.42	0.54
1:A:278:ALA:HA	1:A:369:ALA:HB2	1.90	0.54
2:B:1:MET:N	2:B:129:CYS:SG	2.64	0.53
1:C:274:PRO:HB3	1:C:286:LEU:HD12	1.89	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:134:GLN:HA	2:D:165:ASN:O	2.09	0.53
1:A:76:ASP:HA	1:A:79:ARG:HG2	1.91	0.51
1:A:158:SER:OG	1:A:166:LYS:NZ	2.32	0.51
1:C:71:GLU:HB2	1:C:98:ASP:HB3	1.93	0.51
1:A:70:LEU:HD21	1:A:114:ILE:HD13	1.93	0.51
2:D:169:VAL:HA	2:D:202:ILE:O	2.11	0.50
1:C:278:ALA:HA	1:C:369:ALA:HB2	1.93	0.50
2:B:293:MET:HE3	2:B:313:VAL:HG11	1.93	0.49
1:C:272:TYR:HB3	1:C:302:MET:HE3	1.93	0.49
1:A:90:GLU:H	1:A:90:GLU:CD	2.16	0.49
1:A:105:ARG:HD2	10:A:645:HOH:O	2.12	0.49
1:C:247:ALA:HB2	1:C:357:TYR:HE2	1.78	0.49
1:C:210:TYR:CE1	1:C:222:PRO:HD2	2.48	0.49
1:C:217:LEU:HD21	1:C:368:LEU:HD23	1.94	0.49
1:C:166:LYS:HE2	1:C:197:HIS:O	2.13	0.48
2:B:267:MET:HG2	2:B:374:ILE:HD13	1.95	0.48
2:D:64:ILE:HD13	2:D:120:VAL:HG22	1.95	0.48
1:A:319:TYR:HB3	1:A:323:VAL:HG21	1.95	0.48
2:D:104:GLY:O	2:D:109:GLY:HA3	2.14	0.47
2:D:117:LEU:O	2:D:121:ARG:HG3	2.14	0.47
2:B:290:THR:HG22	2:B:333:VAL:HG21	1.96	0.47
2:B:292:GLN:HG2	2:B:298:ASN:CG	2.35	0.47
1:C:209:ILE:HG22	1:C:227:LEU:HD22	1.95	0.47
2:B:331:LEU:HD12	2:B:331:LEU:HA	1.79	0.47
1:A:217:LEU:HD21	1:A:368:LEU:HD23	1.96	0.46
2:B:169:VAL:HA	2:B:202:ILE:O	2.16	0.46
1:A:204:VAL:HG11	1:A:231:ILE:HG12	1.97	0.46
2:D:40:SER:OG	2:D:42:LEU:HB2	2.16	0.46
3:E:55:GLU:O	3:E:59:GLU:HG2	2.15	0.46
1:A:25:CYS:SG	1:A:86:LEU:HD11	2.56	0.45
2:B:36:TYR:CD1	2:B:44:LEU:HD21	2.51	0.45
1:A:336:LYS:HD3	3:E:24:LEU:HD13	1.98	0.45
2:D:395:LEU:HD23	2:D:395:LEU:HA	1.85	0.45
1:A:192:HIS:CG	1:A:421:ALA:HA	2.52	0.45
1:A:234:ILE:HD12	1:A:272:TYR:HB2	1.99	0.45
1:A:244:PHE:CG	1:A:358:GLN:HG3	2.52	0.45
1:A:167:LEU:HG	1:A:200:CYS:HB3	1.98	0.44
1:A:210:TYR:CZ	1:A:222:PRO:HD2	2.52	0.44
1:C:133:GLN:NE2	1:C:242:LEU:HD23	2.33	0.44
2:D:290:THR:HG22	2:D:333:VAL:HG11	2.00	0.44
1:A:214:ARG:HG2	1:A:219:ILE:O	2.18	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:11:GLN:HG3	2:B:72:THR:HG21	2.00	0.44
1:C:401:LYS:HG3	2:D:344:TRP:CE3	2.52	0.44
2:D:152:ILE:HG23	2:D:164:MET:HG2	2.00	0.44
2:D:392:LYS:HB3	2:D:395:LEU:HD12	2.00	0.43
1:A:133:GLN:HE22	1:A:251:ASP:HA	1.83	0.43
1:A:213:CYS:O	1:A:217:LEU:HB2	2.17	0.43
2:D:170:MET:HE2	2:D:377:LEU:HD21	2.00	0.43
2:B:94:GLN:O	1:C:2:ARG:HD2	2.18	0.43
2:B:94:GLN:HG3	1:C:1:MET:HG2	2.00	0.43
1:C:252:LEU:HD23	1:C:252:LEU:HA	1.80	0.43
2:D:163:ILE:HG21	2:D:250:LEU:HB3	1.99	0.43
3:E:140:LYS:HE2	3:E:140:LYS:HB3	1.70	0.43
2:B:6:HIS:CD2	2:B:21:TRP:HE1	2.37	0.43
2:B:67:ASP:O	2:B:92:PHE:HA	2.18	0.43
1:A:253:THR:HG23	10:A:654:HOH:O	2.19	0.43
1:C:241:SER:HB3	1:C:250:VAL:H	1.84	0.42
2:B:290:THR:HG23	2:B:330:MET:SD	2.59	0.42
1:A:245:ASP:HB3	3:E:15:THR:CG2	2.49	0.42
1:C:306:ASP:O	1:C:309:HIS:HB2	2.19	0.42
1:C:187:SER:HB3	1:C:391:LEU:HD21	2.01	0.42
1:C:370:LYS:NZ	1:C:372:GLN:OE1	2.53	0.42
1:A:76:ASP:OD1	1:A:79:ARG:HD2	2.19	0.42
1:A:167:LEU:HD23	1:A:202:PHE:HE2	1.85	0.42
1:A:348:PRO:HB3	3:E:27:PRO:HD3	2.01	0.42
2:B:245:GLN:H	2:B:245:GLN:HG2	1.71	0.41
2:D:80:PRO:O	2:D:81:PHE:HB2	2.19	0.41
2:B:396:HIS:CE1	2:B:397:TRP:CE2	3.07	0.41
2:B:104:GLY:O	2:B:109:GLY:HA3	2.20	0.41
1:C:205:ASP:CB	1:C:303:VAL:HA	2.50	0.41
2:B:272:PRO:HD3	2:B:284:LEU:HD11	2.02	0.41
1:A:21:TRP:CE3	1:A:63:PRO:HB3	2.56	0.41
1:C:115:ILE:HD13	1:C:152:LEU:HG	2.03	0.41
1:C:266:HIS:O	1:C:266:HIS:CD2	2.74	0.41
1:C:308:ARG:HE	1:C:308:ARG:HB2	1.76	0.41
2:D:293:MET:HE2	2:D:293:MET:HB3	1.89	0.41
2:D:293:MET:HG2	2:D:367:PHE:HB2	2.03	0.41
1:A:21:TRP:CZ3	1:A:63:PRO:HB3	2.56	0.41
2:D:81:PHE:O	2:D:84:ILE:HG22	2.21	0.41
2:D:179:VAL:HG21	2:D:394:PHE:CZ	2.56	0.41
2:D:73:MET:HE3	2:D:92:PHE:HB3	2.03	0.41
1:C:106:GLY:O	1:C:111:GLY:HA3	2.22	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:231:ILE:O	1:C:235:VAL:HG23	2.21	0.40
2:D:140:GLY:O	2:D:181:GLU:HG2	2.21	0.40
1:A:69:ASP:O	1:A:94:THR:HA	2.21	0.40
1:C:23:LEU:HA	1:C:23:LEU:HD12	1.85	0.40
3:E:128:LYS:HD2	3:E:128:LYS:HA	1.85	0.40
1:A:2:ARG:HB3	1:A:133:GLN:NE2	2.37	0.40
2:D:1:MET:SD	2:D:131:GLN:HA	2.61	0.40
3:E:58:GLU:O	3:E:62:LYS:HG3	2.21	0.40
1:A:8:HIS:HB3	1:A:13:GLY:O	2.21	0.40
2:D:145:SER:HB2	2:D:188:SER:OG	2.22	0.40
3:E:76:ARG:HA	3:E:76:ARG:HD3	1.95	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	419/438 (96%)	409 (98%)	10 (2%)	0	100	100
1	C	421/438 (96%)	415 (99%)	6 (1%)	0	100	100
2	B	419/433 (97%)	409 (98%)	9 (2%)	1 (0%)	47	49
2	D	430/433 (99%)	421 (98%)	9 (2%)	0	100	100
3	E	119/143 (83%)	119 (100%)	0	0	100	100
All	All	1808/1885 (96%)	1773 (98%)	34 (2%)	1 (0%)	51	54

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	175	VAL

### 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	359/369 (97%)	357 (99%)	2 (1%)	86	90
1	C	361/369 (98%)	358 (99%)	3 (1%)	81	86
2	B	364/374 (97%)	361 (99%)	3 (1%)	81	86
2	D	369/374 (99%)	366 (99%)	3 (1%)	81	86
3	E	107/126 (85%)	107 (100%)	0	100	100
All	All	1560/1612 (97%)	1549 (99%)	11 (1%)	84	88

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	218	ASP
1	A	256	GLN
2	B	69	GLU
2	B	137	HIS
2	B	359	ARG
1	C	123	ARG
1	C	241	SER
1	C	269	LEU
2	D	72	THR
2	D	137	HIS
2	D	156	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	31	GLN
2	B	416	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, 1 is monoatomic - leaving 14 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	SO4	A	503	-	4,4,4	0.18	0	6,6,6	0.33	0
5	SO4	D	503	-	4,4,4	0.14	0	6,6,6	0.09	0
7	JV9	D	502	-	27,27,27	3.45	10 (37%)	33,39,39	2.39	13 (39%)
6	GDP	B	501	-	24,30,30	1.39	5 (20%)	30,47,47	1.34	4 (13%)
5	SO4	B	505	-	4,4,4	0.13	0	6,6,6	0.43	0
4	GTP	A	501	-	26,34,34	1.36	3 (11%)	32,54,54	1.16	2 (6%)
8	GOL	B	506	-	5,5,5	0.66	0	5,5,5	1.14	0
7	JV9	B	502	-	27,27,27	3.57	10 (37%)	33,39,39	2.65	13 (39%)
4	GTP	C	501	9	26,34,34	1.25	3 (11%)	32,54,54	1.23	4 (12%)
5	SO4	D	504	-	4,4,4	0.14	0	6,6,6	0.15	0
5	SO4	A	502	-	4,4,4	0.15	0	6,6,6	0.07	0
5	SO4	B	504	-	4,4,4	0.12	0	6,6,6	0.06	0
4	GTP	D	501	-	26,34,34	1.22	3 (11%)	32,54,54	1.28	4 (12%)
5	SO4	B	503	-	4,4,4	0.15	0	6,6,6	0.08	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
7	JV9	D	502	-	-	2/7/26/26	0/4/4/4
6	GDP	B	501	-	-	6/12/32/32	0/3/3/3
8	GOL	B	506	-	-	0/4/4/4	-
4	GTP	A	501	-	-	1/18/38/38	0/3/3/3
7	JV9	B	502	-	-	2/7/26/26	0/4/4/4
4	GTP	C	501	9	-	6/18/38/38	0/3/3/3
4	GTP	D	501	-	-	6/18/38/38	0/3/3/3

All (34) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	B	502	JV9	C07-N08	11.10	1.43	1.34
7	D	502	JV9	C02-N24	9.10	1.45	1.35
7	D	502	JV9	C07-N08	8.73	1.41	1.34
7	D	502	JV9	C05-N04	7.95	1.48	1.37
7	B	502	JV9	C02-N24	7.32	1.43	1.35
7	B	502	JV9	C05-N04	7.11	1.47	1.37
7	B	502	JV9	C15-C11	5.20	1.54	1.50
7	D	502	JV9	C23-N24	5.00	1.48	1.39
7	B	502	JV9	C23-N24	4.80	1.48	1.39
7	B	502	JV9	C16-N04	4.52	1.47	1.40
7	D	502	JV9	C15-C11	4.31	1.53	1.50
7	D	502	JV9	C03-C02	3.89	1.56	1.51
7	B	502	JV9	C03-C02	3.74	1.56	1.51
7	D	502	JV9	C16-N04	3.20	1.45	1.40
6	B	501	GDP	PB-O1B	3.14	1.60	1.50
4	A	501	GTP	O4'-C1'	2.97	1.45	1.41
7	D	502	JV9	C03-N04	-2.89	1.43	1.46
4	A	501	GTP	C5-C6	-2.79	1.41	1.47
4	A	501	GTP	C8-N7	-2.79	1.30	1.35
4	C	501	GTP	O4'-C1'	2.78	1.45	1.41
6	B	501	GDP	C5-C6	-2.77	1.41	1.47
4	D	501	GTP	C5-C6	-2.62	1.42	1.47
4	D	501	GTP	C8-N7	-2.61	1.30	1.35
6	B	501	GDP	C8-N7	-2.59	1.30	1.35
7	B	502	JV9	C03-N04	-2.58	1.43	1.46
6	B	501	GDP	O4'-C1'	2.58	1.44	1.41
6	B	501	GDP	PA-O1A	2.56	1.60	1.50
4	C	501	GTP	C5-C6	-2.51	1.42	1.47
4	D	501	GTP	O4'-C1'	2.45	1.44	1.41
4	C	501	GTP	C8-N7	-2.40	1.30	1.35
7	D	502	JV9	O01-C02	-2.39	1.18	1.23

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	B	502	JV9	C22-C23	2.15	1.42	1.39
7	B	502	JV9	O01-C02	-2.03	1.19	1.23
7	D	502	JV9	C13-C12	2.01	1.55	1.51

All (40) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	B	502	JV9	C09-N08-C07	-7.34	114.74	123.59
7	B	502	JV9	C14-C15-C11	5.84	108.18	103.93
7	D	502	JV9	C09-N08-C07	-5.43	117.04	123.59
7	D	502	JV9	N08-C07-N06	4.58	121.36	116.96
7	B	502	JV9	N10-C07-N06	-4.40	119.28	126.23
7	B	502	JV9	C15-C11-N10	4.37	129.53	123.41
7	D	502	JV9	C23-N24-C02	-4.14	119.37	124.49
7	D	502	JV9	C15-C11-N10	3.96	128.94	123.41
7	D	502	JV9	C12-C11-N10	-3.90	121.52	125.80
7	D	502	JV9	C14-C15-C11	3.80	106.69	103.93
7	B	502	JV9	C12-C11-N10	-3.75	121.69	125.80
7	B	502	JV9	N08-C07-N10	3.65	120.46	116.96
4	C	501	GTP	C8-N7-C5	3.52	109.69	102.99
7	B	502	JV9	N08-C07-N06	3.43	120.25	116.96
6	B	501	GDP	C8-N7-C5	3.42	109.51	102.99
4	D	501	GTP	C8-N7-C5	3.37	109.41	102.99
4	A	501	GTP	C8-N7-C5	3.35	109.37	102.99
7	D	502	JV9	N06-C05-N04	3.32	119.77	116.26
7	D	502	JV9	N10-C07-N06	-3.23	121.13	126.23
7	B	502	JV9	C15-C11-C12	-3.20	108.78	111.09
7	B	502	JV9	C14-C13-C12	3.03	107.51	103.52
4	D	501	GTP	C2-N1-C6	-2.96	119.64	125.10
7	D	502	JV9	C12-C05-N06	-2.93	118.09	122.61
7	D	502	JV9	C13-C12-C11	-2.88	107.56	110.96
7	D	502	JV9	C14-C13-C12	2.88	107.31	103.52
4	D	501	GTP	C5-C6-N1	2.70	118.73	113.95
6	B	501	GDP	O4'-C1'-C2'	-2.62	103.09	106.93
7	B	502	JV9	C07-N06-C05	2.56	123.18	114.34
7	B	502	JV9	C12-C05-N06	-2.54	118.69	122.61
7	B	502	JV9	N06-C05-N04	2.46	118.86	116.26
4	C	501	GTP	C5'-C4'-C3'	-2.45	106.00	115.18
4	A	501	GTP	C5-C6-N1	2.42	118.22	113.95
4	C	501	GTP	C2-N1-C6	-2.41	120.67	125.10
4	C	501	GTP	C5-C6-N1	2.33	118.06	113.95
4	D	501	GTP	O4'-C1'-C2'	-2.33	103.53	106.93

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	B	501	GDP	C5-C6-N1	2.30	118.00	113.95
6	B	501	GDP	C2-N1-C6	-2.26	120.94	125.10
7	D	502	JV9	C15-C11-C12	-2.16	109.53	111.09
7	D	502	JV9	C07-N06-C05	2.16	121.79	114.34
7	B	502	JV9	C23-N24-C02	-2.08	121.92	124.49

There are no chirality outliers.

All (23) torsion outliers are listed below:

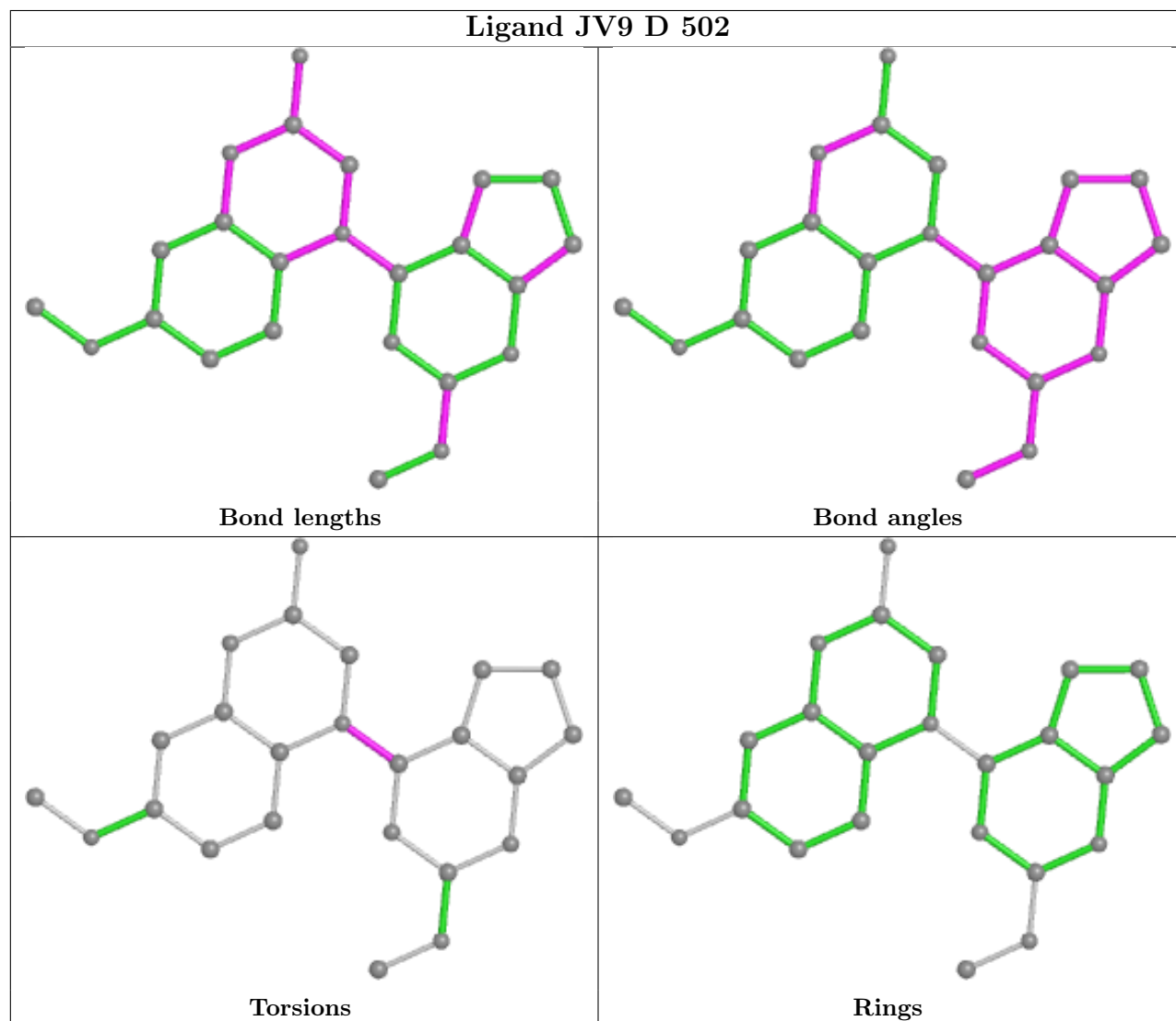
Mol	Chain	Res	Type	Atoms
4	C	501	GTP	PB-O3B-PG-O3G
4	C	501	GTP	C5'-O5'-PA-O1A
4	C	501	GTP	C5'-O5'-PA-O2A
4	D	501	GTP	PB-O3B-PG-O2G
4	D	501	GTP	C5'-O5'-PA-O1A
4	D	501	GTP	C5'-O5'-PA-O2A
6	B	501	GDP	C5'-O5'-PA-O1A
6	B	501	GDP	C5'-O5'-PA-O2A
7	B	502	JV9	C12-C05-N04-C03
7	B	502	JV9	N06-C05-N04-C03
7	D	502	JV9	N06-C05-N04-C03
7	D	502	JV9	C12-C05-N04-C03
6	B	501	GDP	PB-O3A-PA-O2A
4	A	501	GTP	PG-O3B-PB-O1B
4	D	501	GTP	C4'-C5'-O5'-PA
6	B	501	GDP	C4'-C5'-O5'-PA
4	C	501	GTP	PB-O3B-PG-O2G
4	D	501	GTP	PB-O3B-PG-O3G
4	C	501	GTP	C5'-O5'-PA-O3A
4	D	501	GTP	C5'-O5'-PA-O3A
6	B	501	GDP	C5'-O5'-PA-O3A
6	B	501	GDP	PB-O3A-PA-O1A
4	C	501	GTP	C4'-C5'-O5'-PA

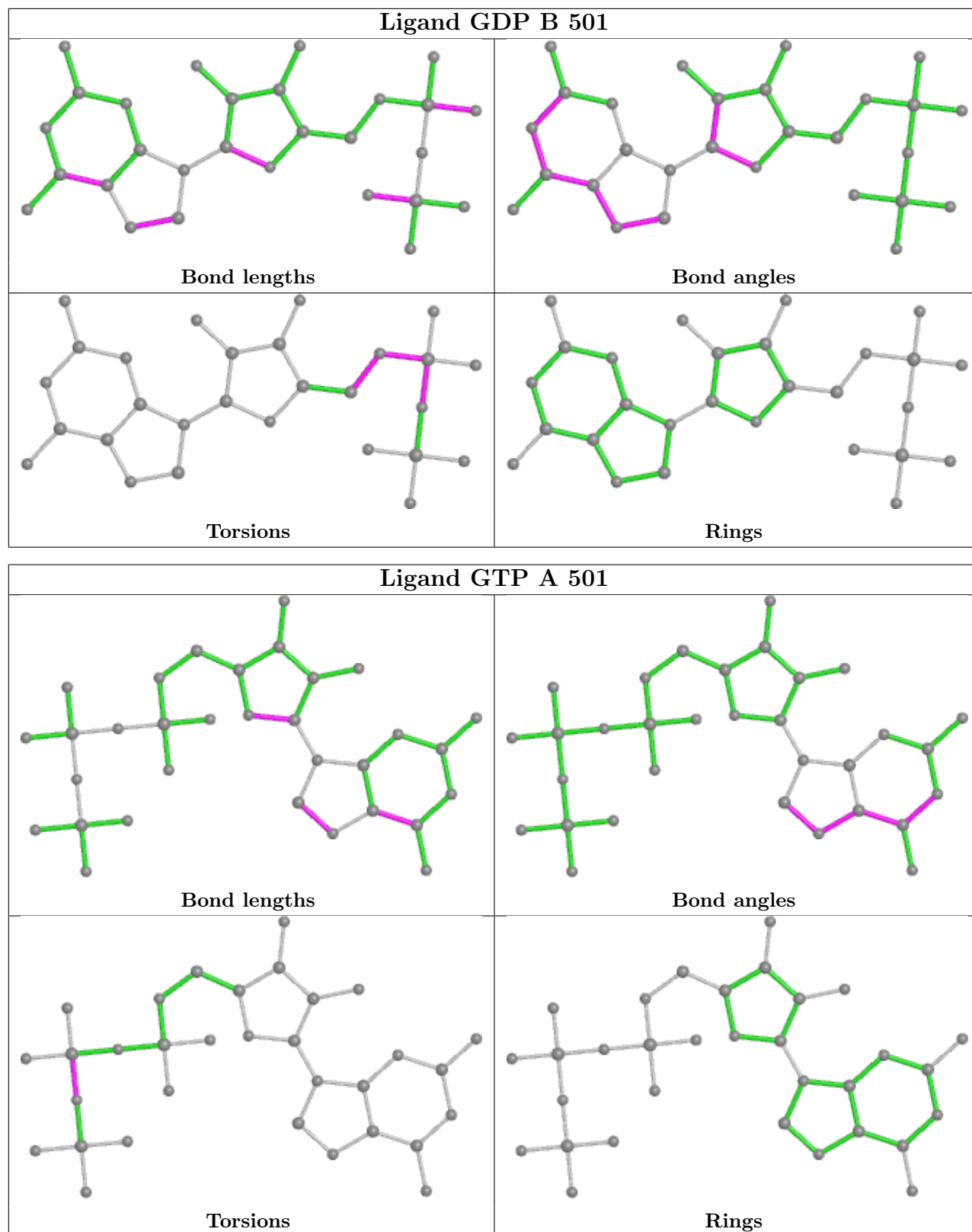
There are no ring outliers.

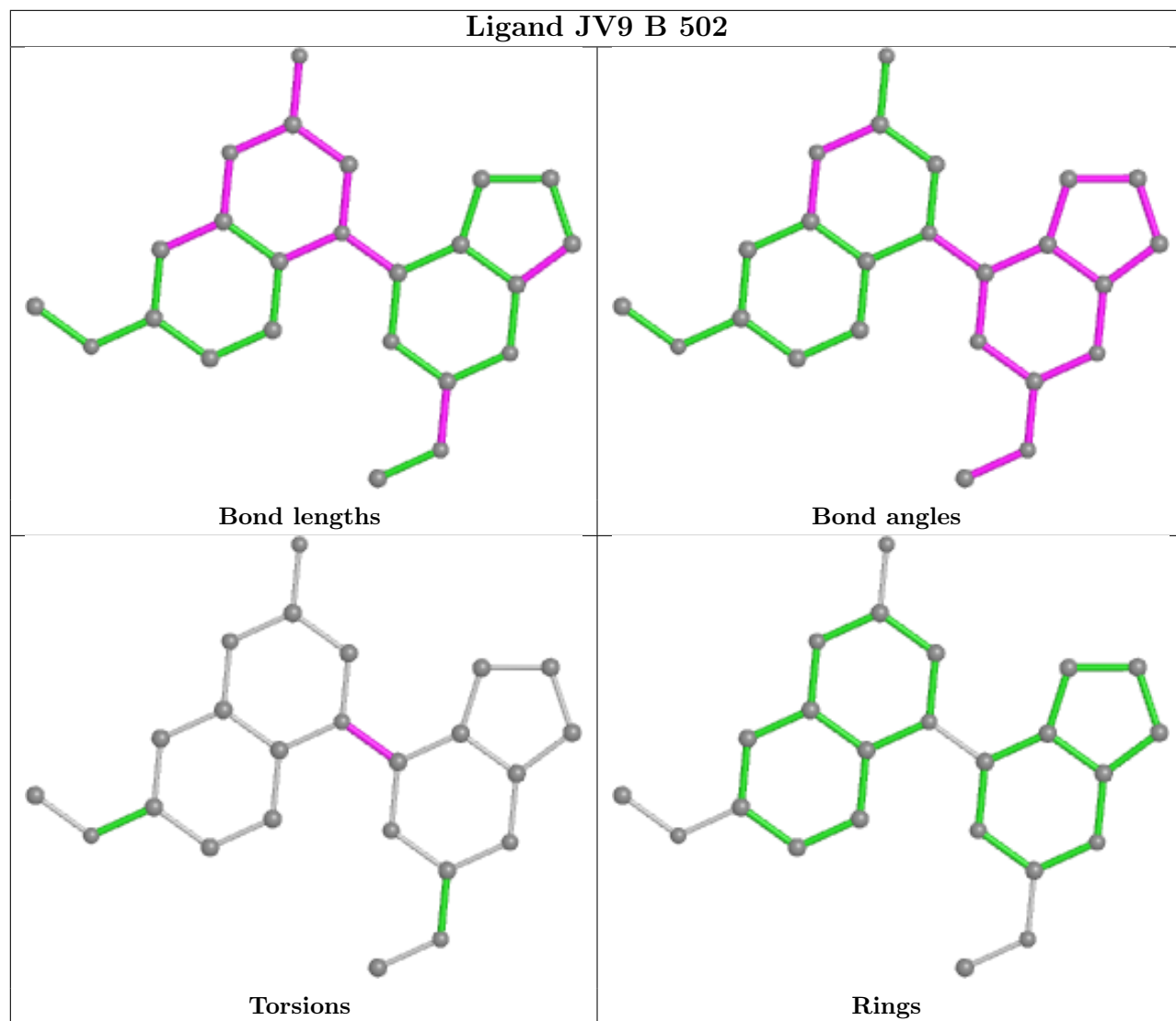
No monomer is involved in short contacts.

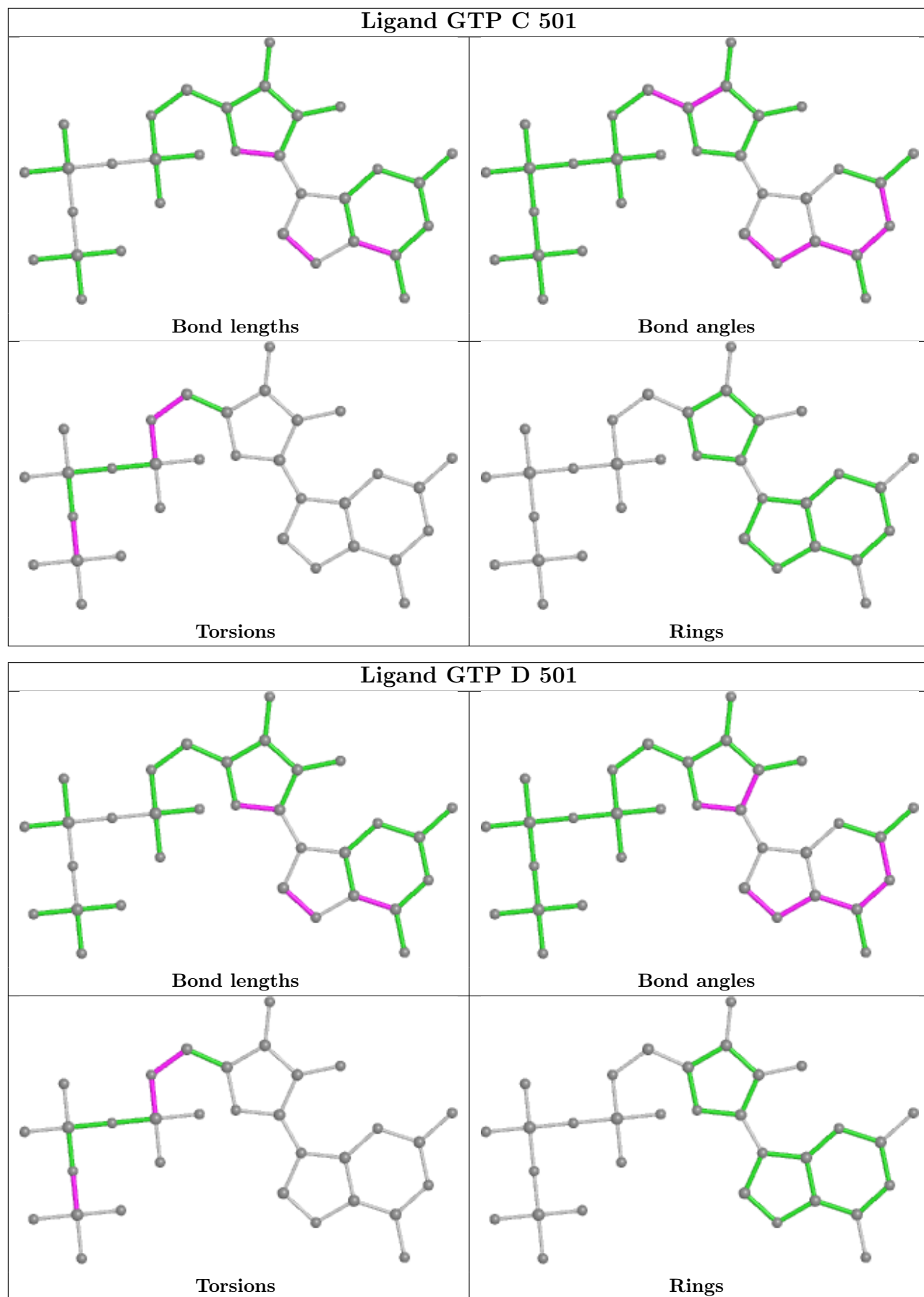
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	425/438 (97%)	0.04	10 (2%) 59 64	34, 53, 85, 105	0
1	C	427/438 (97%)	0.19	16 (3%) 41 48	34, 55, 86, 108	0
2	B	423/433 (97%)	0.37	30 (7%) 16 20	33, 51, 88, 109	0
2	D	431/433 (99%)	0.03	12 (2%) 53 59	31, 48, 86, 110	0
3	E	123/143 (86%)	0.70	18 (14%) 2 3	48, 65, 92, 107	0
All	All	1829/1885 (97%)	0.20	86 (4%) 31 37	31, 53, 88, 110	0

All (86) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	283	ALA	5.0
2	B	361	LEU	4.8
3	E	9	ILE	4.7
1	A	346	TRP	4.6
2	D	281	TYR	4.4
2	B	55	THR	4.4
2	B	39	ASP	4.3
2	B	57	ASN	4.3
2	B	36	TYR	4.3
2	B	284	LEU	4.1
1	A	262	TYR	4.1
3	E	32	VAL	4.0
3	E	48	GLU	3.8
2	B	33	THR	3.8
2	B	320	ARG	3.7
3	E	52	LYS	3.6
3	E	8	VAL	3.6
2	B	83	GLN	3.5
3	E	139	LEU	3.5
2	D	57	ASN	3.5

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	A	279	GLU	3.4
2	B	80	PRO	3.3
1	C	309	HIS	3.2
2	D	55	THR	3.2
3	E	29	PHE	3.2
2	B	56	GLY	3.2
2	B	360	GLY	3.1
2	D	80	PRO	3.1
1	C	279	GLU	3.1
2	B	54	ALA	3.1
1	C	169	PHE	3.1
2	D	78	SER	3.1
2	B	32	PRO	3.0
3	E	33	PRO	2.9
2	B	81	PHE	2.9
2	B	78	SER	2.9
2	B	362	LYS	2.9
2	D	92	PHE	2.9
1	A	332	ILE	2.8
2	B	42	LEU	2.8
1	A	329	ASN	2.8
2	B	359	ARG	2.8
2	B	324	LYS	2.8
1	C	278	ALA	2.7
1	A	357	TYR	2.7
1	C	215	ARG	2.7
2	B	37	HIS	2.6
2	B	288	GLU	2.6
3	E	10	GLU	2.6
3	E	31	GLY	2.6
1	C	299	ALA	2.6
2	B	139	LEU	2.5
3	E	7	GLU	2.5
3	E	96	MET	2.4
1	C	280	LYS	2.4
2	D	54	ALA	2.4
3	E	24	LEU	2.4
3	E	51	GLN	2.4
2	D	37	HIS	2.4
2	B	58	LYS	2.4
1	C	253	THR	2.4
2	B	291	GLN	2.4

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Mol	Chain	Res	Type	RSRZ
2	D	81	PHE	2.3
3	E	47	LEU	2.3
1	C	276	ILE	2.3
2	B	97	ALA	2.3
1	C	252	LEU	2.3
1	A	336	LYS	2.3
2	B	104	GLY	2.2
1	A	437	VAL	2.2
3	E	13	LYS	2.2
1	C	365	GLY	2.2
2	B	29	GLY	2.2
3	E	26	PRO	2.2
1	A	335	ILE	2.1
2	D	41	ASP	2.1
1	C	218	ASP	2.1
1	C	353	VAL	2.1
1	C	255	PHE	2.1
2	B	40	SER	2.0
1	A	342	GLN	2.0
2	D	79	GLY	2.0
1	C	89	PRO	2.0
1	C	281	ALA	2.0
3	E	99	GLU	2.0
2	B	41	ASP	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](#)

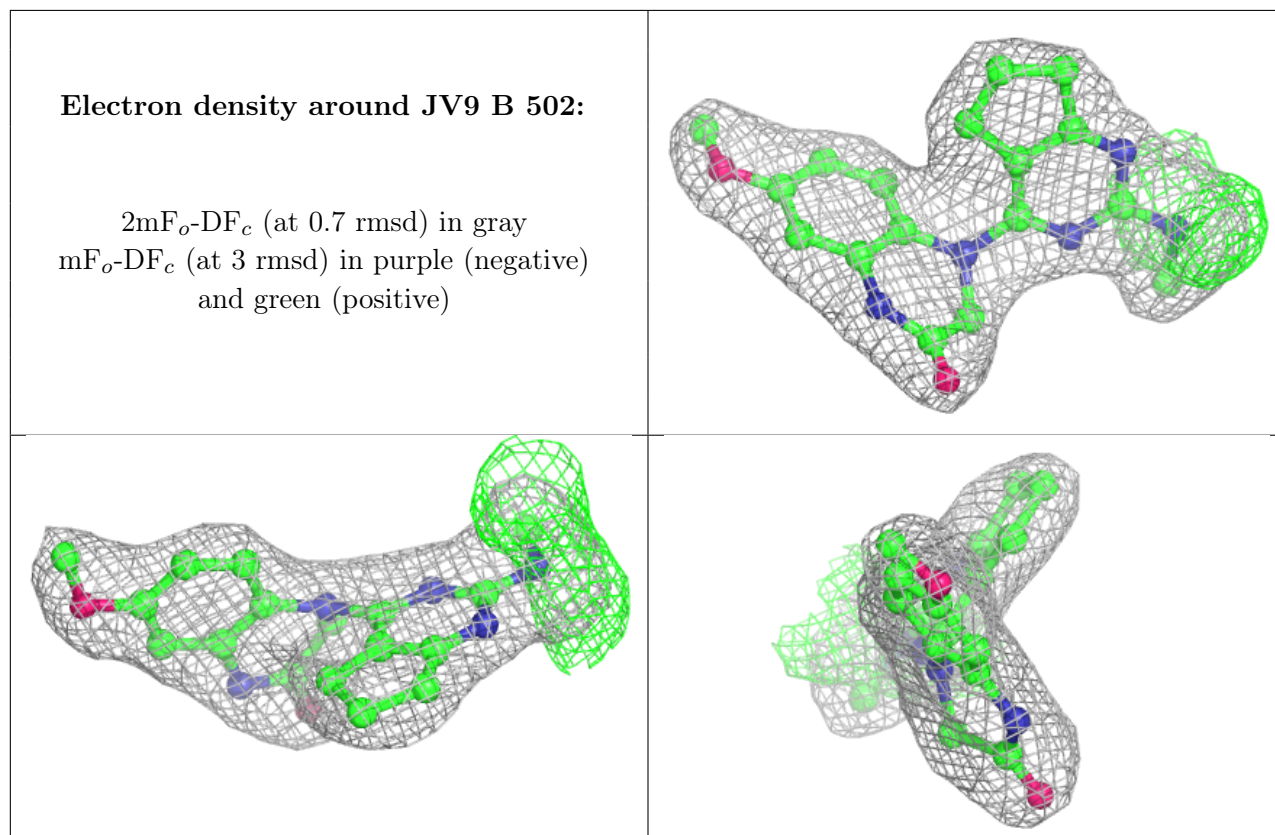
There are no monosaccharides in this entry.

## 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, 95<sup>th</sup> 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.

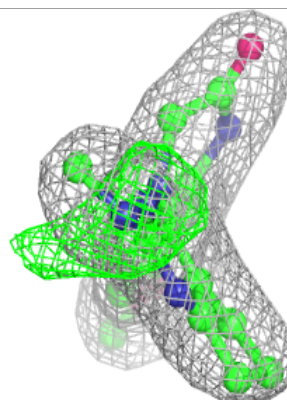
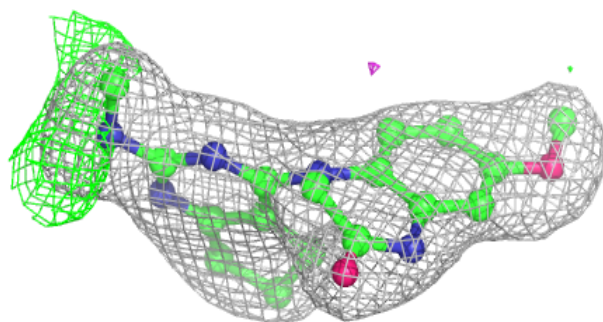
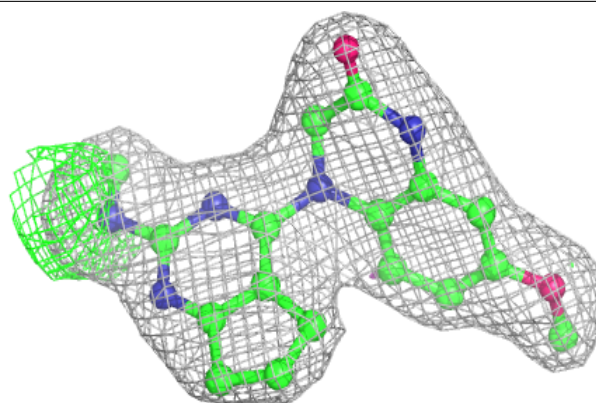
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
5	SO4	D	504	5/5	0.84	0.13	98,99,104,105	0
8	GOL	B	506	6/6	0.84	0.22	51,62,64,64	0
5	SO4	A	503	5/5	0.88	0.32	113,125,127,127	0
5	SO4	B	504	5/5	0.89	0.15	90,98,102,109	0
5	SO4	B	503	5/5	0.91	0.18	93,94,105,105	0
7	JV9	B	502	24/24	0.92	0.18	29,48,56,64	0
5	SO4	B	505	5/5	0.92	0.28	115,118,124,125	0
7	JV9	D	502	24/24	0.94	0.19	35,46,50,50	0
9	MG	C	502	1/1	0.97	0.04	50,50,50,50	0
6	GDP	B	501	28/28	0.98	0.18	31,40,45,46	0
5	SO4	A	502	5/5	0.98	0.08	93,94,100,103	0
4	GTP	C	501	32/32	0.98	0.14	33,45,53,55	0
5	SO4	D	503	5/5	0.98	0.08	74,80,82,86	0
4	GTP	D	501	32/32	0.98	0.10	27,36,60,82	0
4	GTP	A	501	32/32	0.99	0.17	33,40,45,49	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.

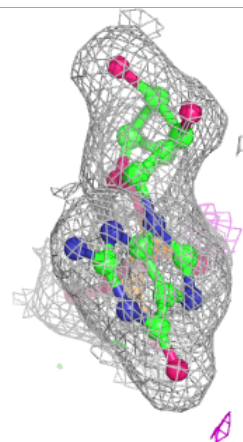
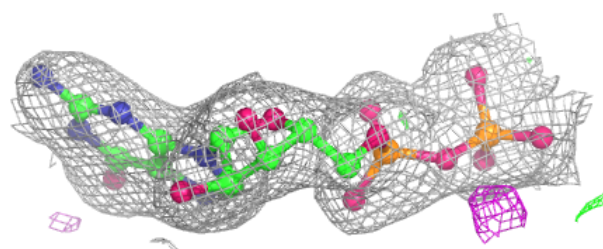
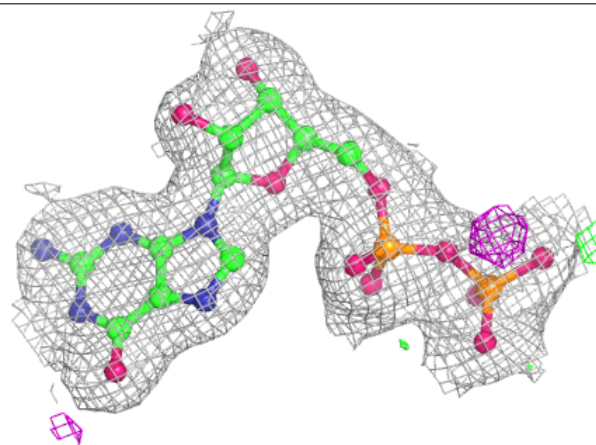


**Electron density around JV9 D 502:**

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

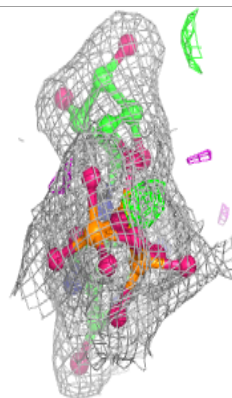
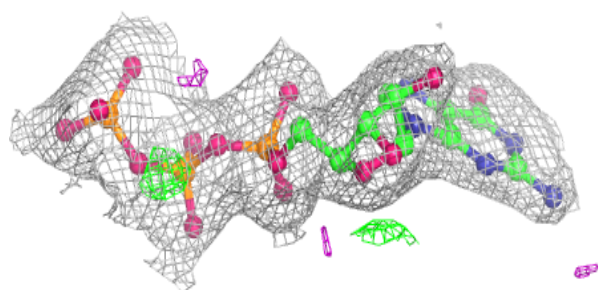
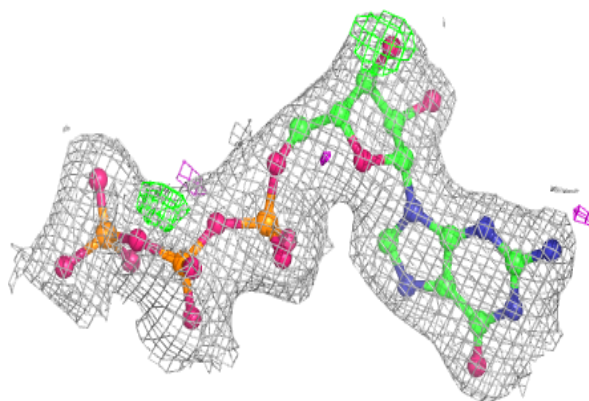
**Electron density around GDP B 501:**

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

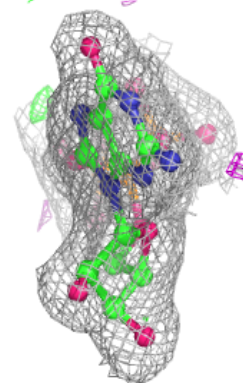
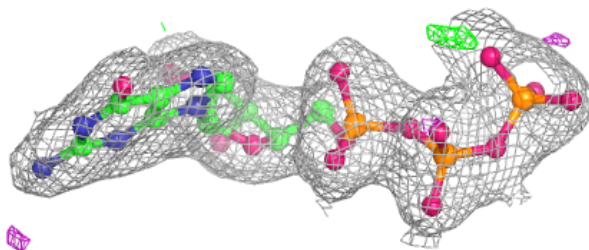
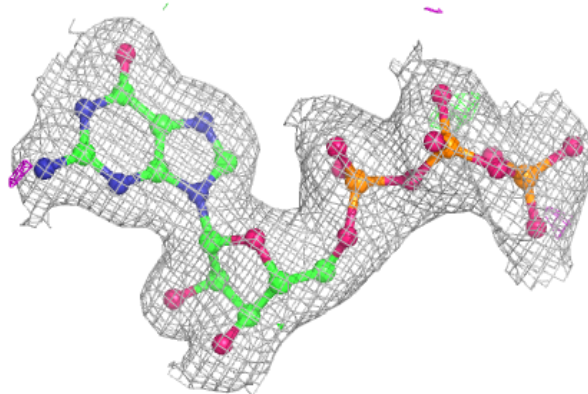


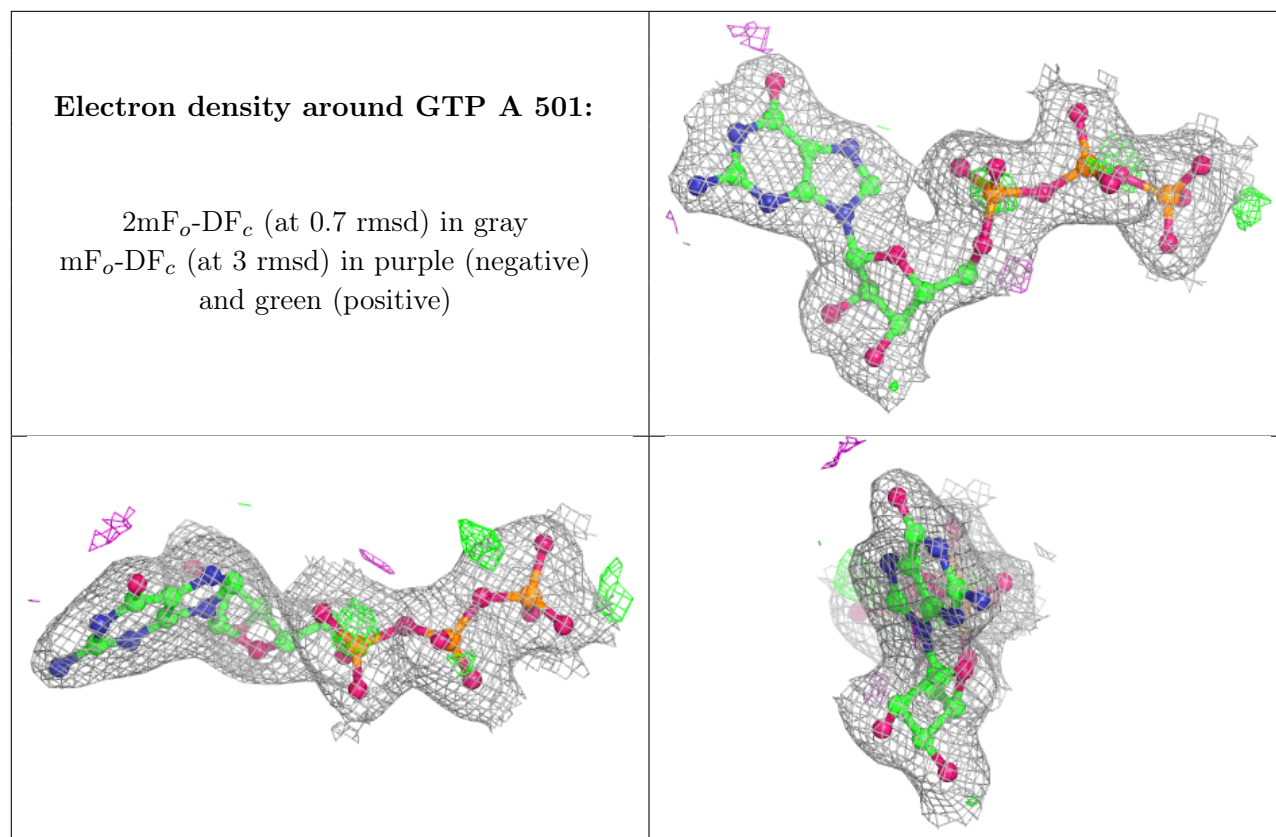
**Electron density around GTP C 501:**

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

**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)





## 6.5 Other polymers [i](#)

There are no such residues in this entry.