



Full wwPDB X-ray Structure Validation Report ⓘ

Jan 8, 2024 – 09:08 am GMT

PDB ID : 6H9B
Title : 1,1-Diheterocyclic Ethylenes Derived from Quinaldine and Carbazole as New Tubulin Polymerization Inhibitors: Synthesis, Metabolism, and Biological Evaluation
Authors : Varela, P.F.; Gigant, B.
Deposited on : 2018-08-03
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 : 1.8.4, 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

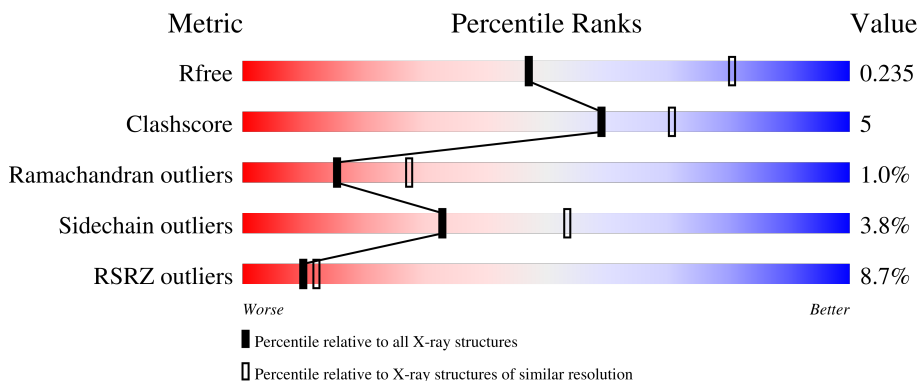
1 Overall quality at a glance

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	433	 9% 89% 9%
1	C	433	 7% 86% 12%
2	B	431	 12% 82% 17%
2	D	431	 2% 83% 15%

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Mol	Chain	Length	Quality of chain
3	E	142	

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

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	SO4	A	502	-	-	-	X

2 Entry composition i

There are 9 unique types of molecules in this entry. The entry contains 15148 atoms, of which 40 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	431	3380	2141	574	643	22	0	0	0
1	C	433	3393	2149	576	646	22	0	0	0

- Molecule 2 is a protein called Tubulin beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	431	3393	2128	580	658	27	0	0	0
2	D	427	3356	2105	572	652	27	0	0	0

- Molecule 3 is a protein called Stathmin-4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	E	136	1125	691	209	221	4	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	4	ALA	SER	conflict	UNP P63043
E	14	ALA	CYS	engineered mutation	UNP P63043
E	20	TRP	PHE	engineered mutation	UNP P63043

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



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

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

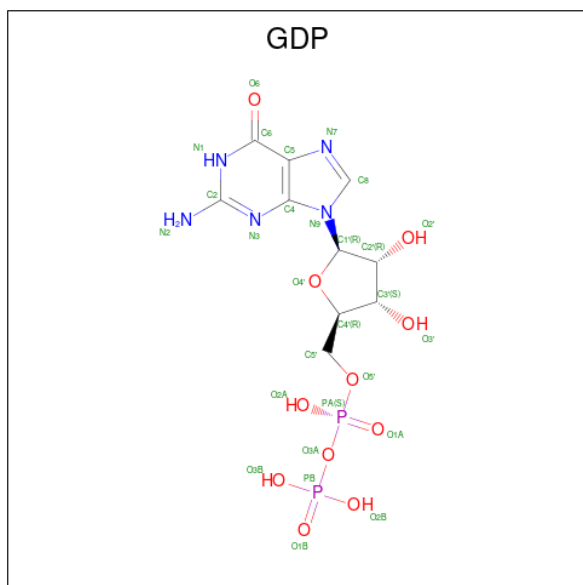


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
5	A	1	Total	C	N	O	P	0	0
			32	10	5	14	3		
5	C	1	Total	C	N	O	P	0	0
			32	10	5	14	3		

- 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	C	1	Total	Mg	0	0
			1	1		

- Molecule 7 is GUANOSINE-5'-DIPHOSPHATE (three-letter code: GDP) (formula: C₁₀H₁₅N₅O₁₁P₂).



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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	H	N		
8	D	1	47	25	20	2	0	0

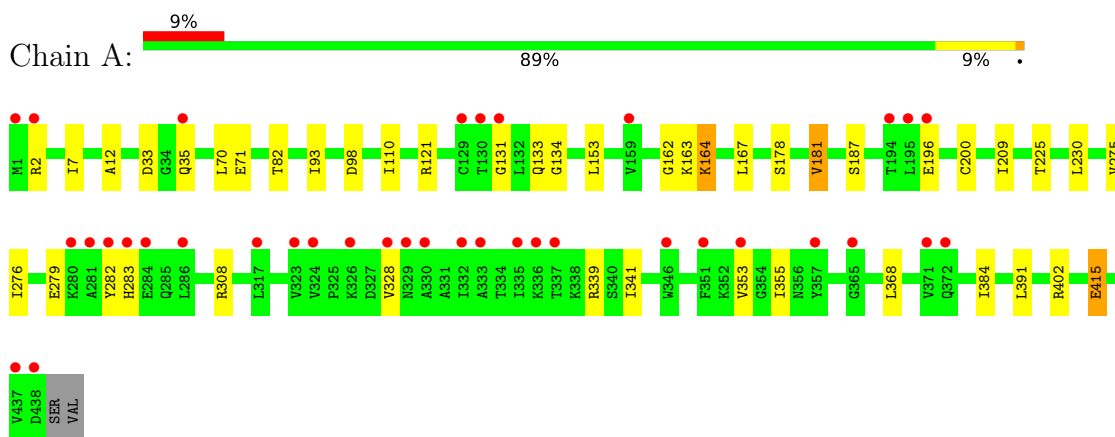
- Molecule 9 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	51	Total	O	0	0
			51	51		
9	B	43	Total	O	0	0
			43	43		
9	C	57	Total	O	0	0
			57	57		
9	D	64	Total	O	0	0
			64	64		
9	E	15	Total	O	0	0
			15	15		

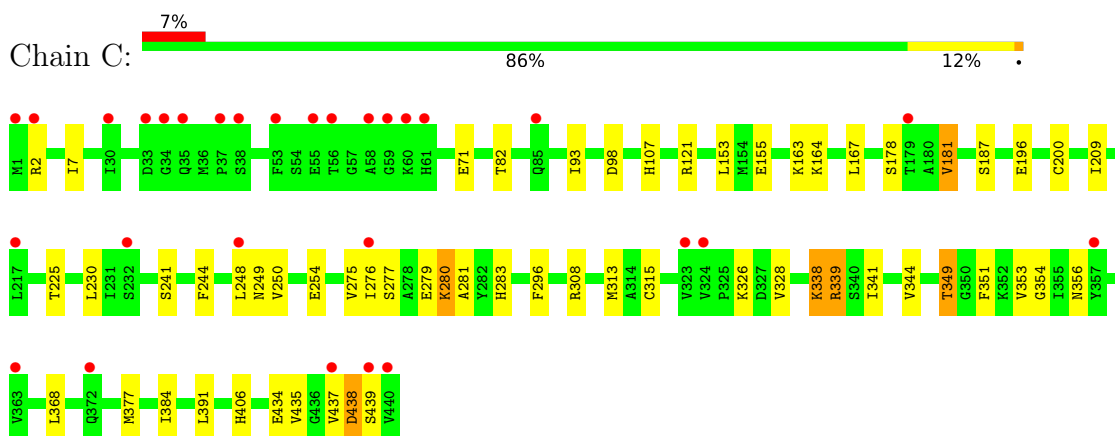
3 Residue-property plots [i](#)

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.

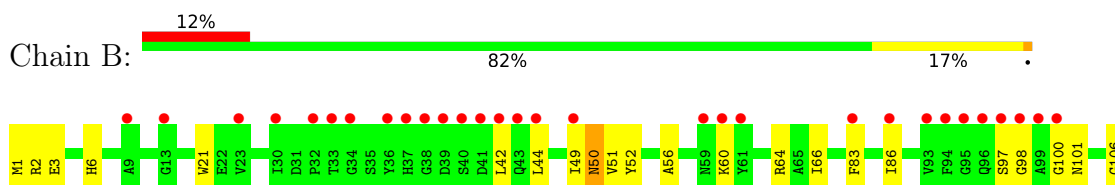
- Molecule 1: Tubulin alpha chain

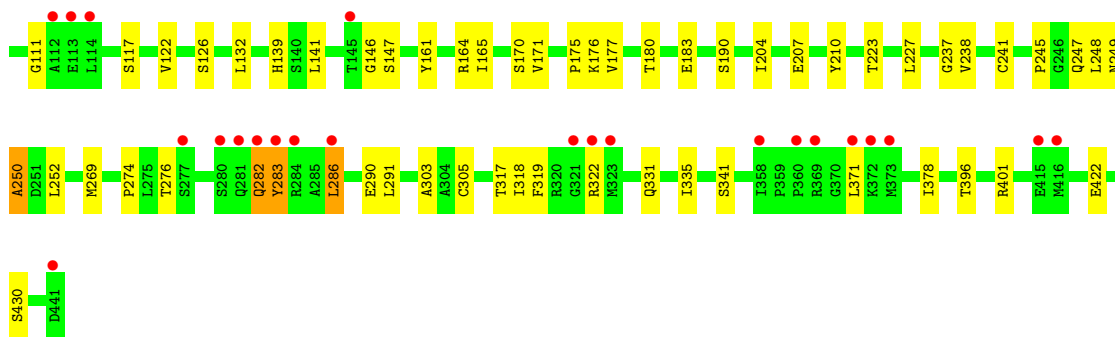


- Molecule 1: Tubulin alpha chain

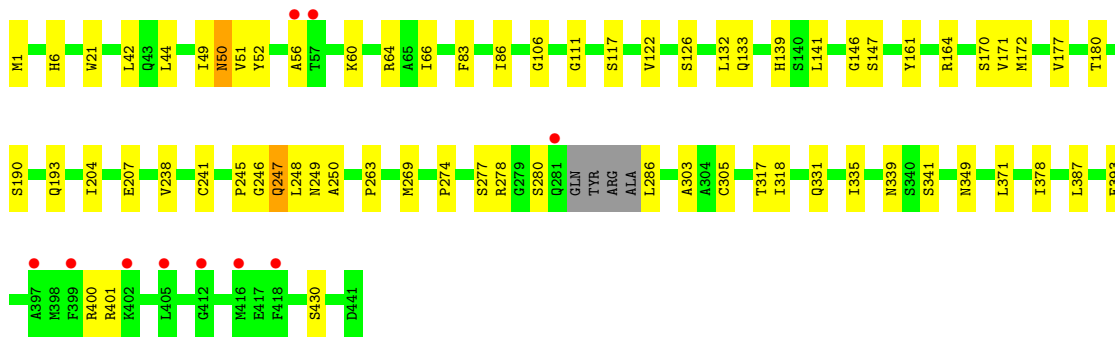
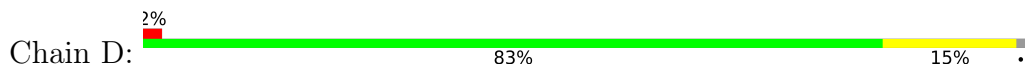


- Molecule 2: Tubulin beta chain

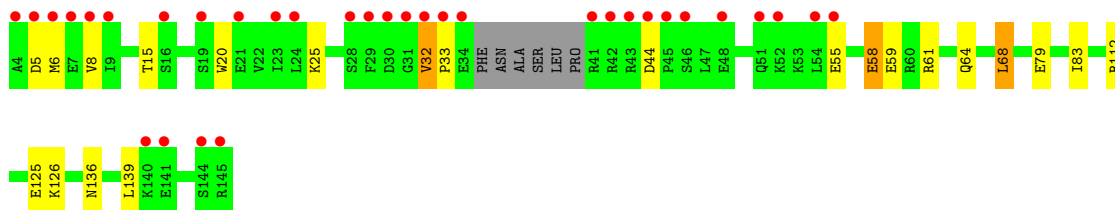
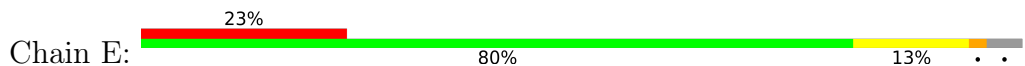




• Molecule 2: Tubulin beta chain



• Molecule 3: Stathmin-4



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	64.94Å 128.48Å 251.04Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.65 – 2.75 47.65 – 2.74	Depositor EDS
% Data completeness (in resolution range)	99.7 (47.65-2.75) 99.7 (47.65-2.74)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.04 (at 2.73Å)	Xtrriage
Refinement program	BUSTER	Depositor
R, R_{free}	0.172 , 0.216 0.189 , 0.235	Depositor DCC
R_{free} test set	2789 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	80.7	Xtrriage
Anisotropy	0.521	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 93.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	15148	wwPDB-VP
Average B, all atoms (Å ²)	108.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.58% 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: SO4, GDP, FWH, MG, GTP

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	0.48	0/3457	0.64	0/4693
1	C	0.52	0/3470	0.68	0/4711
2	B	0.54	0/3468	0.73	0/4697
2	D	0.55	0/3429	0.73	2/4643 (0.0%)
3	E	0.51	0/1136	0.65	0/1510
All	All	0.52	0/14960	0.69	2/20254 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	247	GLN	C-N-CA	8.51	142.98	121.70
2	D	249	ASN	N-CA-C	-5.67	95.68	111.00

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	3380	0	3290	21	0
1	C	3393	0	3304	36	0
2	B	3393	0	3270	46	0
2	D	3356	0	3234	32	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	E	1125	0	1134	12	0
4	A	10	0	0	0	0
4	B	15	0	0	0	0
4	C	10	0	0	0	0
4	D	15	0	0	0	0
4	E	5	0	0	0	0
5	A	32	0	12	0	0
5	C	32	0	12	1	0
6	A	1	0	0	0	0
6	C	1	0	0	0	0
7	B	28	0	12	0	0
7	D	28	0	12	0	0
8	B	27	20	0	2	0
8	D	27	20	0	3	0
9	A	51	0	0	2	0
9	B	43	0	0	0	0
9	C	57	0	0	0	0
9	D	64	0	0	1	0
9	E	15	0	0	0	0
All	All	15108	40	14280	136	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 5.

All (136) 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:C:244:PHE:HB2	1:C:356:ASN:HD21	1.03	1.10
2:B:282:GLN:HB2	2:B:283:TYR:HA	1.48	0.94
1:C:244:PHE:HB2	1:C:356:ASN:ND2	1.87	0.88
1:A:181:VAL:HG13	8:B:505:FWH:C22	2.14	0.77
2:B:98:GLY:H	1:C:2:ARG:NH1	1.85	0.74
2:B:282:GLN:HB2	2:B:283:TYR:CA	2.16	0.74
1:C:313:MET:SD	1:C:435:VAL:HG11	2.27	0.73
3:E:32:VAL:HB	3:E:33:PRO:CD	2.19	0.73
2:B:56:ALA:HB3	2:B:60:LYS:HG3	1.71	0.72
2:D:56:ALA:HB3	2:D:60:LYS:HG3	1.73	0.71
3:E:58:GLU:HG2	3:E:61:ARG:NH2	2.06	0.70
1:C:277:SER:HB3	1:C:280:LYS:HG3	1.79	0.64
1:C:244:PHE:CB	1:C:356:ASN:HD21	1.94	0.63
1:C:313:MET:SD	1:C:435:VAL:CG1	2.86	0.63

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:E:64:GLN:O	3:E:68:LEU:HD12	2.00	0.61
1:C:181:VAL:HG13	8:D:505:FWH:C22	2.31	0.61
2:B:237:GLY:O	2:B:318:ILE:HD12	2.01	0.60
1:A:2:ARG:HB3	1:A:133:GLN:HG2	1.82	0.60
2:B:331:GLN:O	2:B:335:ILE:HG12	2.02	0.60
2:D:331:GLN:O	2:D:335:ILE:HG12	2.02	0.60
2:B:401:ARG:HH22	1:C:438:ASP:H	1.49	0.59
2:D:1:MET:SD	2:D:133:GLN:HA	2.44	0.58
1:C:107:HIS:HE1	1:C:155:GLU:OE2	1.86	0.57
1:A:2:ARG:HB3	1:A:133:GLN:CG	2.35	0.57
2:D:172:MET:HG3	2:D:387:LEU:HD11	1.86	0.57
2:D:400:ARG:HH12	2:D:401:ARG:HH11	1.53	0.57
2:D:161:TYR:HB3	2:D:164:ARG:HG3	1.88	0.56
3:E:136:ASN:HA	3:E:139:LEU:HD12	1.89	0.55
2:B:161:TYR:HB3	2:B:164:ARG:HG3	1.88	0.55
2:B:269:MET:CE	2:B:305:CYS:HB2	2.37	0.55
3:E:8:VAL:HG23	3:E:20:TRP:CD1	2.42	0.55
2:D:51:VAL:HG23	2:D:52:TYR:CD2	2.42	0.55
1:C:248:LEU:O	1:C:354:GLY:HA2	2.07	0.54
2:B:269:MET:HG3	2:B:303:ALA:HB3	1.90	0.54
2:D:44:LEU:O	2:D:49:ILE:HG13	2.08	0.54
2:B:51:VAL:HG23	2:B:52:TYR:CD2	2.42	0.54
1:A:328:VAL:HG11	1:A:353:VAL:HG11	1.90	0.54
2:B:44:LEU:O	2:B:49:ILE:HG13	2.07	0.53
2:B:101:ASN:HB3	2:B:180:THR:HG21	1.90	0.53
2:D:269:MET:HE3	2:D:305:CYS:HB2	1.90	0.52
1:A:308:ARG:CZ	1:A:339:ARG:HD3	2.40	0.52
1:C:437:VAL:O	1:C:438:ASP:HB2	2.09	0.52
1:C:296:PHE:CZ	1:C:377:MET:CE	2.93	0.52
2:B:50:ASN:O	2:B:64:ARG:NH2	2.41	0.51
2:D:171:VAL:HA	2:D:204:ILE:O	2.10	0.51
2:B:42:LEU:HD23	2:B:245:PRO:HG2	1.92	0.50
2:D:241:CYS:SG	2:D:318:ILE:HD13	2.51	0.50
1:A:70:LEU:HD13	1:A:110:ILE:CG2	2.42	0.49
2:B:106:GLY:O	2:B:111:GLY:HA3	2.11	0.49
1:A:355:ILE:HD11	3:E:20:TRP:HH2	1.78	0.49
2:B:282:GLN:CB	2:B:283:TYR:HA	2.32	0.49
1:C:328:VAL:HG11	1:C:353:VAL:HG11	1.95	0.49
2:D:50:ASN:O	2:D:64:ARG:NH2	2.40	0.49
2:D:238:VAL:HG22	2:D:378:ILE:HG12	1.95	0.49
2:B:286:LEU:HA	2:B:290:GLU:OE1	2.12	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:180:THR:HG23	2:B:183:GLU:HG3	1.95	0.48
2:D:106:GLY:O	2:D:111:GLY:HA3	2.12	0.48
2:B:165:ILE:HG21	2:B:252:LEU:HB3	1.95	0.48
3:E:32:VAL:HB	3:E:33:PRO:HD3	1.95	0.48
2:B:223:THR:HG23	1:C:326:LYS:HE2	1.96	0.48
2:B:317:THR:HG22	2:B:319:PHE:CE1	2.49	0.48
1:A:209:ILE:HG23	1:A:230:LEU:HD23	1.97	0.47
2:B:175:PRO:HB3	1:C:349:THR:HG23	1.96	0.47
2:D:6:HIS:CD2	2:D:21:TRP:HE1	2.32	0.47
2:D:139:HIS:HD2	2:D:146:GLY:O	1.96	0.47
2:B:269:MET:HE1	2:B:305:CYS:HB2	1.97	0.47
2:B:401:ARG:HH11	1:C:439:SER:HB2	1.79	0.47
1:C:434:GLU:HA	1:C:437:VAL:HG23	1.96	0.47
1:A:402:ARG:HD2	1:A:415:GLU:OE1	2.15	0.47
2:B:2:ARG:HG3	2:B:3:GLU:OE2	2.15	0.47
2:B:171:VAL:HA	2:B:204:ILE:O	2.15	0.47
1:A:134:GLY:HA2	1:A:164:LYS:HG2	1.96	0.47
3:E:58:GLU:HG2	3:E:61:ARG:HH22	1.79	0.47
1:A:187:SER:HB3	1:A:391:LEU:HD21	1.97	0.46
2:B:249:ASN:O	2:B:250:ALA:CB	2.63	0.46
2:D:139:HIS:HE1	2:D:170:SER:OG	1.98	0.46
2:B:286:LEU:HD23	2:B:291:LEU:HD23	1.97	0.46
2:D:141:LEU:HD22	2:D:190:SER:HB3	1.96	0.46
3:E:32:VAL:HB	3:E:33:PRO:HD2	1.95	0.46
1:A:275:VAL:HG13	1:A:368:LEU:HD21	1.97	0.46
2:B:66:ILE:HD13	2:B:122:VAL:HG12	1.97	0.46
2:B:139:HIS:HE1	2:B:170:SER:OG	1.99	0.46
1:A:12:ALA:HB3	9:A:602:HOH:O	2.16	0.46
1:A:93:ILE:HD11	1:A:121:ARG:HG3	1.97	0.46
1:A:98:ASP:HB2	9:A:603:HOH:O	2.15	0.46
1:A:70:LEU:HD13	1:A:110:ILE:HG22	1.97	0.46
1:C:98:ASP:HB2	5:C:502:GTP:O1G	2.16	0.46
2:D:269:MET:CE	2:D:305:CYS:HB2	2.45	0.46
2:B:126:SER:HB2	2:B:132:LEU:HD22	1.98	0.45
2:B:317:THR:CG2	2:B:319:PHE:CE1	2.99	0.45
2:B:139:HIS:HD2	2:B:146:GLY:O	2.00	0.45
2:B:238:VAL:HG22	2:B:378:ILE:HG12	1.98	0.45
2:B:97:SER:HA	1:C:2:ARG:HD3	1.97	0.45
2:B:249:ASN:O	2:B:250:ALA:HB3	2.16	0.45
2:B:6:HIS:CD2	2:B:21:TRP:HE1	2.33	0.45
1:C:107:HIS:CE1	1:C:155:GLU:OE2	2.69	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:167:LEU:HG	1:C:200:CYS:HB3	1.97	0.45
2:D:66:ILE:HD13	2:D:122:VAL:HG12	1.97	0.45
2:B:141:LEU:HD22	2:B:190:SER:HB3	1.98	0.45
1:C:315:CYS:O	1:C:351:PHE:HA	2.16	0.45
1:C:406:HIS:CG	2:D:263:PRO:HD3	2.51	0.45
2:B:98:GLY:H	1:C:2:ARG:HH11	1.59	0.45
1:C:275:VAL:HG13	1:C:368:LEU:HD21	1.97	0.45
2:D:241:CYS:HB2	8:D:505:FWH:C3	2.47	0.45
2:D:274:PRO:HB3	2:D:286:LEU:HD13	1.98	0.45
2:B:176:LYS:HD3	2:B:210:TYR:CD2	2.52	0.45
1:A:71:GLU:HB2	1:A:98:ASP:HB3	1.99	0.44
2:B:274:PRO:HB3	2:B:286:LEU:HD22	2.00	0.44
1:C:338:LYS:HE2	1:C:339:ARG:HH22	1.83	0.44
1:C:296:PHE:CZ	1:C:377:MET:HE3	2.52	0.44
2:B:241:CYS:HB2	8:B:505:FWH:C3	2.47	0.44
2:B:83:PHE:O	2:B:86:ILE:HG22	2.17	0.44
1:C:241:SER:HB3	1:C:249:ASN:O	2.17	0.44
1:C:209:ILE:HG23	1:C:230:LEU:HD23	1.99	0.44
2:D:393:GLU:HB2	9:D:609:HOH:O	2.18	0.43
1:C:93:ILE:HD11	1:C:121:ARG:HG3	2.00	0.43
3:E:79:GLU:O	3:E:83:ILE:HD12	2.19	0.43
2:D:269:MET:HG3	2:D:303:ALA:HB3	1.99	0.43
1:C:276:ILE:HG23	1:C:280:LYS:HD2	2.01	0.43
2:B:396:THR:HG22	2:B:422:GLU:OE2	2.18	0.43
1:C:338:LYS:HE2	1:C:339:ARG:HH12	1.84	0.42
2:D:126:SER:HB2	2:D:132:LEU:HD22	2.01	0.42
2:D:400:ARG:HH12	2:D:401:ARG:NH1	2.16	0.42
1:C:7:ILE:HG21	1:C:153:LEU:HD21	2.01	0.42
1:A:276:ILE:HG21	1:A:283:HIS:CE1	2.54	0.42
1:A:33:ASP:OD1	1:A:35:GLN:HG2	2.20	0.41
1:C:187:SER:HB3	1:C:391:LEU:HD21	2.01	0.41
3:E:55:GLU:O	3:E:59:GLU:HG2	2.20	0.41
2:D:83:PHE:O	2:D:86:ILE:HG22	2.19	0.41
2:D:42:LEU:HD23	2:D:245:PRO:HG2	2.02	0.41
1:A:7:ILE:HG21	1:A:153:LEU:HD21	2.02	0.41
1:A:167:LEU:HG	1:A:200:CYS:HB3	2.02	0.41
2:B:100:GLY:HA2	1:C:254:GLU:HG3	2.02	0.41
2:D:246:GLY:HA2	2:D:247:GLN:HA	1.83	0.41
2:D:250:ALA:HB1	8:D:505:FWH:C6	2.52	0.40
2:D:193:GLN:HE22	3:E:126:LYS:HE2	1.86	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	427/433 (99%)	412 (96%)	10 (2%)	5 (1%)	13	23
1	C	429/433 (99%)	402 (94%)	21 (5%)	6 (1%)	11	19
2	B	429/431 (100%)	410 (96%)	16 (4%)	3 (1%)	22	39
2	D	423/431 (98%)	411 (97%)	10 (2%)	2 (0%)	29	47
3	E	132/142 (93%)	125 (95%)	4 (3%)	3 (2%)	6	10
All	All	1840/1870 (98%)	1760 (96%)	61 (3%)	19 (1%)	15	27

All (19) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	247	GLN
2	B	250	ALA
2	B	286	LEU
1	C	281	ALA
1	C	349	THR
3	E	32	VAL
1	A	162	GLY
2	D	248	LEU
2	D	278	ARG
1	C	280	LYS
3	E	5	ASP
1	A	282	TYR
1	C	250	VAL
3	E	44	ASP
1	A	163	LYS
1	A	341	ILE
1	C	438	ASP
1	A	131	GLY
1	C	341	ILE

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	365/367 (100%)	356 (98%)	9 (2%)	47 67
1	C	367/367 (100%)	352 (96%)	15 (4%)	30 50
2	B	374/374 (100%)	359 (96%)	15 (4%)	31 51
2	D	371/374 (99%)	357 (96%)	14 (4%)	33 53
3	E	120/125 (96%)	113 (94%)	7 (6%)	20 35
All	All	1597/1607 (99%)	1537 (96%)	60 (4%)	33 53

All (60) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	82	THR
1	A	164	LYS
1	A	178	SER
1	A	181	VAL
1	A	196	GLU
1	A	225	THR
1	A	279	GLU
1	A	384	ILE
1	A	415	GLU
2	B	1	MET
2	B	50	ASN
2	B	117	SER
2	B	147	SER
2	B	177	VAL
2	B	207	GLU
2	B	227	LEU
2	B	248	LEU
2	B	276	THR
2	B	282	GLN
2	B	283	TYR
2	B	322	ARG
2	B	341	SER
2	B	371	LEU

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Mol	Chain	Res	Type
2	B	430	SER
1	C	71	GLU
1	C	82	THR
1	C	163	LYS
1	C	164	LYS
1	C	178	SER
1	C	181	VAL
1	C	196	GLU
1	C	225	THR
1	C	279	GLU
1	C	283	HIS
1	C	308	ARG
1	C	338	LYS
1	C	339	ARG
1	C	344	VAL
1	C	384	ILE
2	D	50	ASN
2	D	117	SER
2	D	147	SER
2	D	177	VAL
2	D	180	THR
2	D	207	GLU
2	D	277	SER
2	D	280	SER
2	D	317	THR
2	D	339	ASN
2	D	341	SER
2	D	349	ASN
2	D	371	LEU
2	D	430	SER
3	E	6	MET
3	E	15	THR
3	E	25	LYS
3	E	58	GLU
3	E	68	LEU
3	E	112	ARG
3	E	125	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	283	HIS

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Mol	Chain	Res	Type
2	B	139	HIS
2	B	294	GLN
1	C	107	HIS
1	C	249	ASN
1	C	356	ASN
2	D	139	HIS
2	D	193	GLN
2	D	247	GLN
2	D	294	GLN
3	E	71	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 19 ligands modelled in this entry, 2 are monoatomic - leaving 17 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
4	SO4	C	504	-	4,4,4	0.19	0	6,6,6	0.13	0
5	GTP	A	503	6	26,34,34	0.75	1 (3%)	32,54,54	0.98	2 (6%)
4	SO4	B	502	-	4,4,4	0.21	0	6,6,6	0.17	0
4	SO4	C	501	-	4,4,4	0.22	0	6,6,6	0.09	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
8	FWH	B	505	-	28,31,31	0.81	1 (3%)	41,46,46	1.09	4 (9%)
7	GDP	B	504	-	24,30,30	0.85	2 (8%)	30,47,47	0.94	2 (6%)
4	SO4	D	502	-	4,4,4	0.12	0	6,6,6	0.28	0
5	GTP	C	502	6	26,34,34	0.82	2 (7%)	32,54,54	0.80	0
4	SO4	B	501	-	4,4,4	0.08	0	6,6,6	0.22	0
4	SO4	B	503	-	4,4,4	0.17	0	6,6,6	0.31	0
4	SO4	A	501	-	4,4,4	0.19	0	6,6,6	0.25	0
4	SO4	E	201	-	4,4,4	0.13	0	6,6,6	0.15	0
7	GDP	D	504	-	24,30,30	0.87	1 (4%)	30,47,47	0.78	1 (3%)
4	SO4	D	503	-	4,4,4	0.18	0	6,6,6	0.56	0
8	FWH	D	505	-	28,31,31	0.78	0	41,46,46	1.04	4 (9%)
4	SO4	A	502	-	4,4,4	0.13	0	6,6,6	0.15	0
4	SO4	D	501	-	4,4,4	0.29	0	6,6,6	0.25	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
5	GTP	A	503	6	-	5/18/38/38	0/3/3/3
8	FWH	B	505	-	-	1/8/8/8	0/5/5/5
7	GDP	B	504	-	-	5/12/32/32	0/3/3/3
5	GTP	C	502	6	-	8/18/38/38	0/3/3/3
7	GDP	D	504	-	-	5/12/32/32	0/3/3/3
8	FWH	D	505	-	-	1/8/8/8	0/5/5/5

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
8	B	505	FWH	C25-N2	-2.52	1.45	1.48
7	B	504	GDP	C8-N7	-2.16	1.31	1.35
7	D	504	GDP	C8-N7	-2.08	1.31	1.35
5	A	503	GTP	C8-N7	-2.06	1.31	1.35
5	C	502	GTP	C8-N7	-2.06	1.31	1.35
5	C	502	GTP	C5-C4	-2.04	1.37	1.43
7	B	504	GDP	C5-C4	-2.00	1.38	1.43

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	B	505	FWH	C9-C16-C11	-4.00	113.34	118.32
8	D	505	FWH	C9-C16-C11	-3.45	114.02	118.32
8	B	505	FWH	C9-C16-C24	3.35	125.58	120.22
8	D	505	FWH	C9-C16-C24	3.05	125.10	120.22
8	D	505	FWH	C22-C18-N2	-2.73	128.99	132.29
7	B	504	GDP	O2A-PA-O5'	2.63	119.97	107.75
5	A	503	GTP	PA-O3A-PB	2.59	141.70	132.83
8	B	505	FWH	C22-C18-N2	-2.53	129.23	132.29
8	D	505	FWH	C13-C14-N2	-2.44	129.34	132.29
8	B	505	FWH	C13-C14-N2	-2.40	129.39	132.29
5	A	503	GTP	O3G-PG-O3B	2.32	112.41	104.64
7	B	504	GDP	O2B-PB-O3A	2.26	112.22	104.64
7	D	504	GDP	O2B-PB-O3A	2.08	111.61	104.64

There are no chirality outliers.

All (25) torsion outliers are listed below:

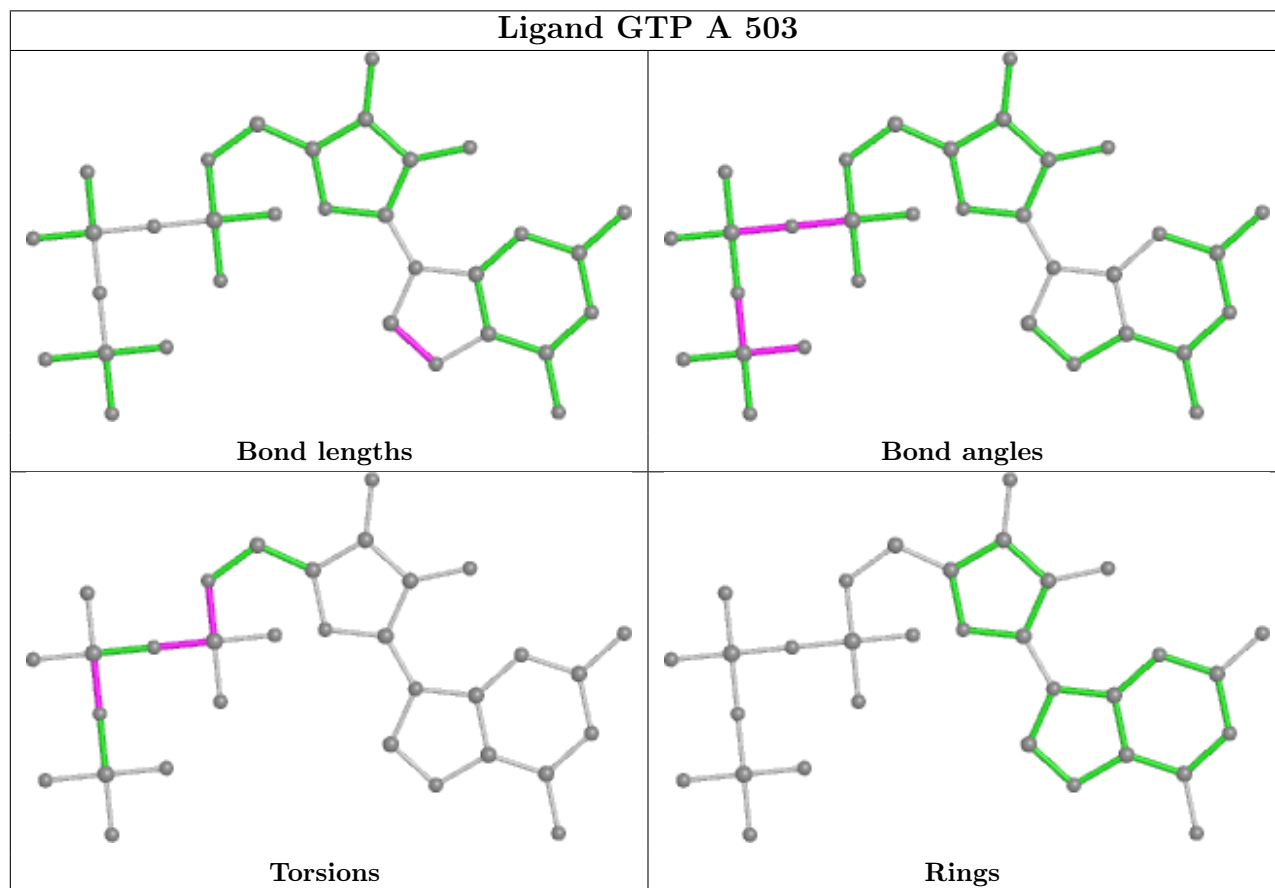
Mol	Chain	Res	Type	Atoms
5	A	503	GTP	C5'-O5'-PA-O1A
5	A	503	GTP	C5'-O5'-PA-O2A
5	C	502	GTP	PB-O3B-PG-O3G
5	C	502	GTP	C5'-O5'-PA-O1A
5	C	502	GTP	C5'-O5'-PA-O2A
7	B	504	GDP	C5'-O5'-PA-O1A
7	B	504	GDP	C5'-O5'-PA-O2A
7	D	504	GDP	C5'-O5'-PA-O1A
7	D	504	GDP	C5'-O5'-PA-O2A
8	B	505	FWH	C10-C11-C16-C9
8	D	505	FWH	C10-C11-C16-C9
5	A	503	GTP	C5'-O5'-PA-O3A
5	A	503	GTP	PB-O3A-PA-O1A
7	B	504	GDP	PB-O3A-PA-O1A
7	D	504	GDP	PB-O3A-PA-O1A
5	A	503	GTP	PG-O3B-PB-O3A
5	C	502	GTP	C3'-C4'-C5'-O5'
5	C	502	GTP	PB-O3B-PG-O1G
5	C	502	GTP	PB-O3B-PG-O2G
5	C	502	GTP	C5'-O5'-PA-O3A
7	B	504	GDP	C5'-O5'-PA-O3A
7	D	504	GDP	C5'-O5'-PA-O3A
7	B	504	GDP	C4'-C5'-O5'-PA
5	C	502	GTP	O4'-C4'-C5'-O5'
7	D	504	GDP	PB-O3A-PA-O2A

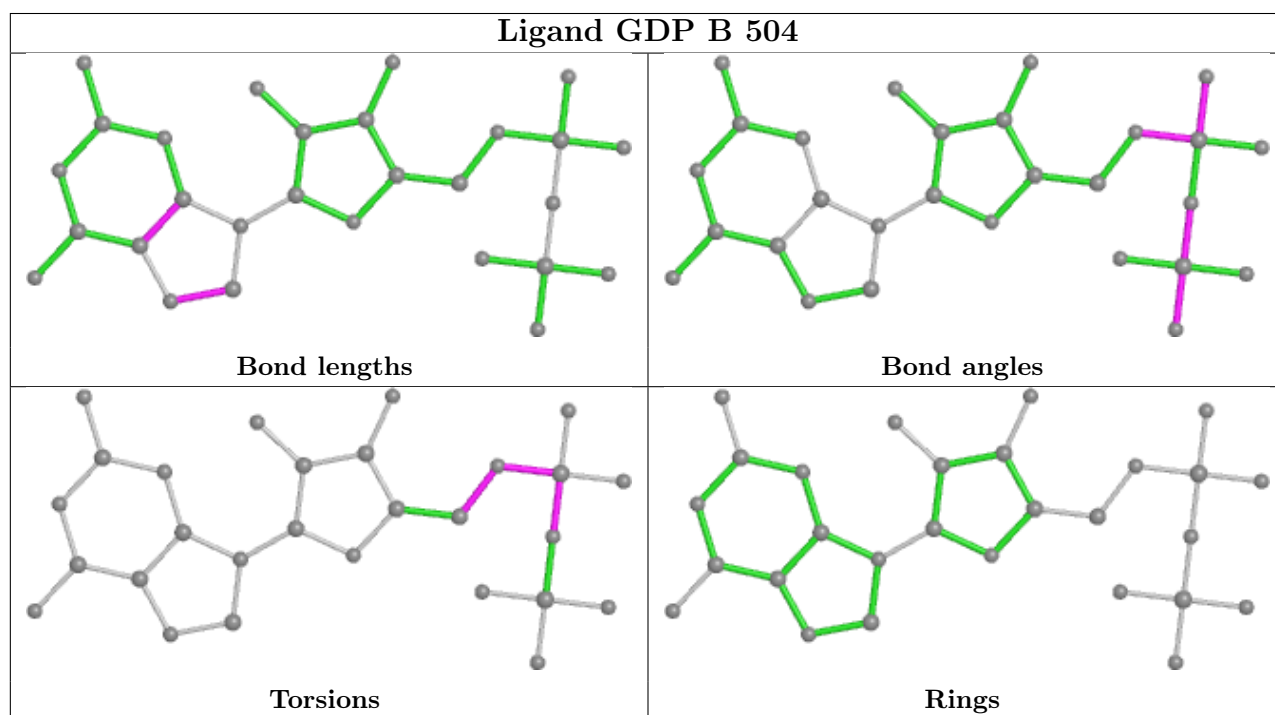
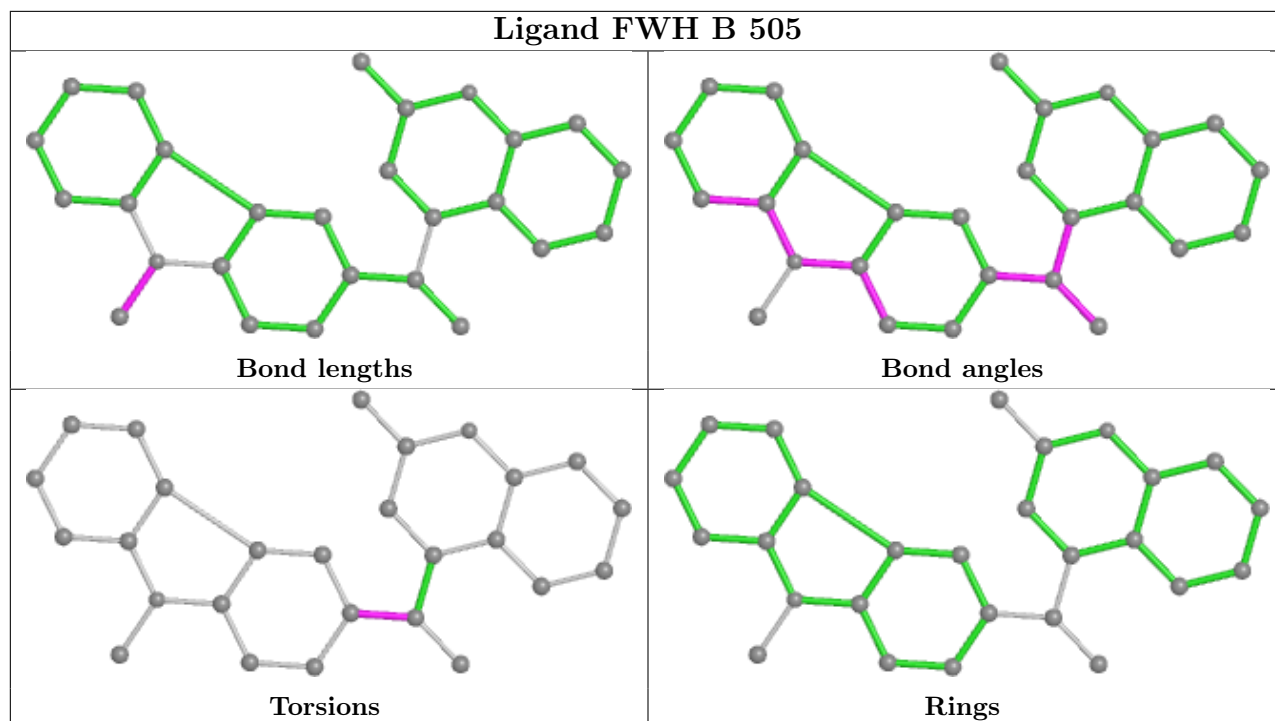
There are no ring outliers.

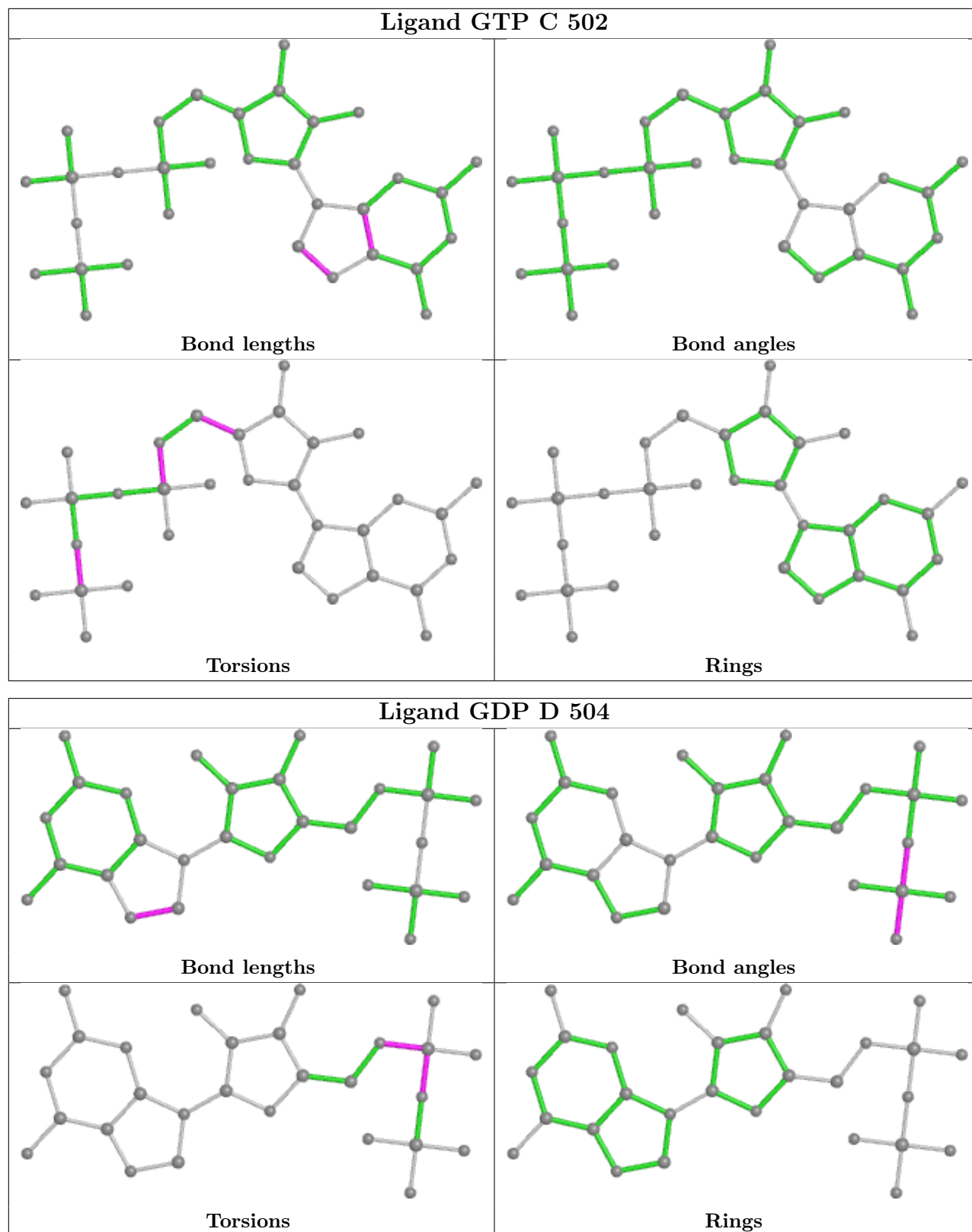
3 monomers are involved in 6 short contacts:

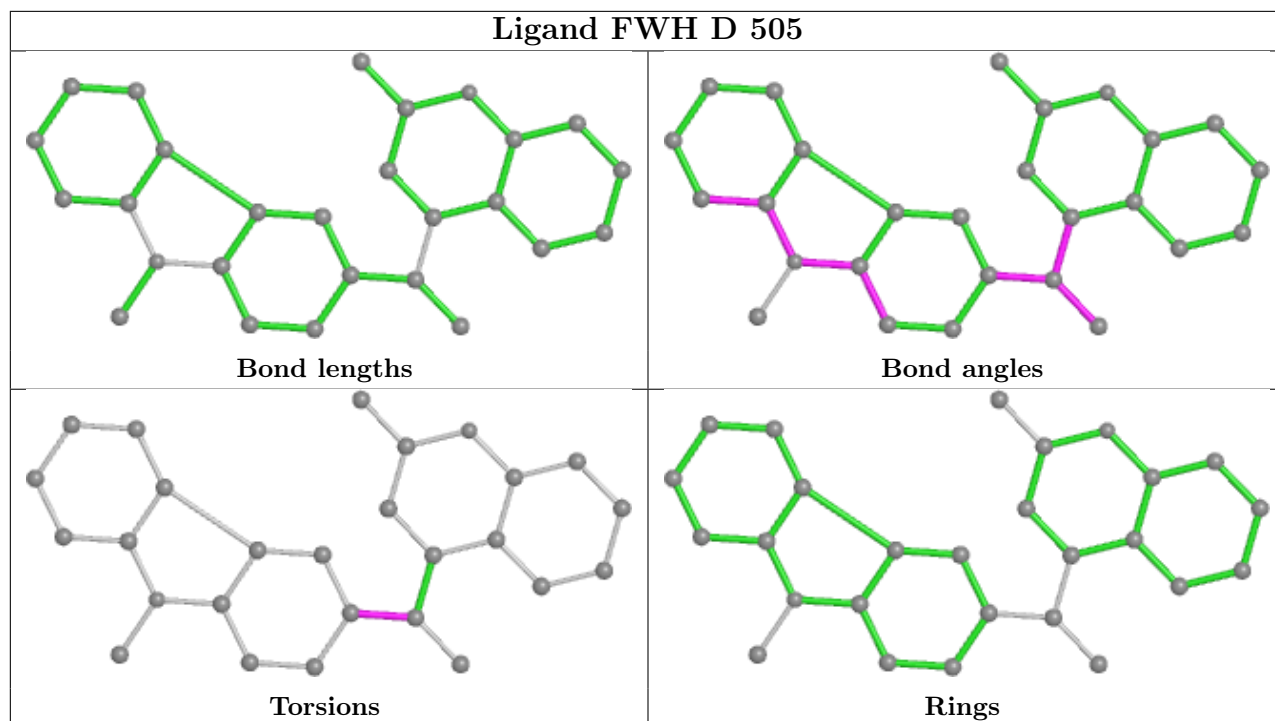
Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	B	505	FWH	2	0
5	C	502	GTP	1	0
8	D	505	FWH	3	0

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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	C	1
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	C	38:SER	C	46:ASP	N	10.49
1	A	38:SER	C	46:ASP	N	10.40

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	431/433 (99%)	0.46	37 (8%) 10 13	79, 107, 150, 186	0
1	C	433/433 (100%)	0.35	29 (6%) 17 21	71, 104, 147, 182	0
2	B	431/431 (100%)	0.61	53 (12%) 4 4	75, 102, 159, 191	0
2	D	427/431 (99%)	0.23	10 (2%) 60 69	67, 93, 141, 171	0
3	E	136/142 (95%)	1.25	33 (24%) 0 0	97, 132, 190, 200	0
All	All	1858/1870 (99%)	0.48	162 (8%) 10 12	67, 105, 155, 200	0

All (162) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	E	4	ALA	14.5
1	A	282	TYR	7.9
3	E	33	PRO	7.7
1	A	130	THR	7.2
1	A	283	HIS	7.0
3	E	6	MET	6.9
3	E	41	ARG	6.6
1	A	336	LYS	6.5
3	E	32	VAL	6.4
2	B	61	TYR	5.8
1	A	281	ALA	5.8
2	B	37	HIS	5.8
3	E	42	ARG	5.7
3	E	145	ARG	5.4
2	B	98	GLY	5.3
3	E	5	ASP	5.2
2	B	280	SER	5.1
1	A	284	GLU	5.1
3	E	24	LEU	5.1
2	B	371	LEU	4.8

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Mol	Chain	Res	Type	RSRZ
2	D	281	GLN	4.4
1	C	440	VAL	4.3
3	E	45	PRO	4.3
1	A	351	PHE	4.3
1	A	131	GLY	4.2
2	B	36	TYR	4.1
1	C	58	ALA	3.9
3	E	34	GLU	3.8
2	B	59	ASN	3.8
1	C	323	VAL	3.8
1	A	129	CYS	3.8
1	A	357	TYR	3.8
2	B	44	LEU	3.7
1	C	217	LEU	3.7
2	B	32	PRO	3.7
3	E	30	ASP	3.6
2	B	42	LEU	3.6
2	D	405	LEU	3.6
1	A	365	GLY	3.6
3	E	44	ASP	3.6
2	D	56	ALA	3.5
2	B	49	ILE	3.5
1	A	280	LYS	3.4
1	C	1	MET	3.4
2	B	96	GLN	3.4
3	E	8	VAL	3.4
1	C	33	ASP	3.3
2	B	95	GLY	3.3
3	E	31	GLY	3.3
2	D	418	PHE	3.3
1	A	371	VAL	3.3
1	A	194	THR	3.3
1	A	323	VAL	3.2
2	B	94	PHE	3.2
3	E	23	ILE	3.2
2	B	284	ARG	3.2
1	A	286	LEU	3.2
1	A	335	ILE	3.1
2	B	282	GLN	3.1
1	A	346	TRP	3.1
2	B	97	SER	3.1
1	A	332	ILE	3.1

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Mol	Chain	Res	Type	RSRZ
3	E	51	GLN	3.1
3	E	48	GLU	3.0
3	E	16	SER	3.0
2	B	358	ILE	3.0
2	B	38	GLY	3.0
2	B	113	GLU	3.0
2	B	39	ASP	3.0
1	A	330	ALA	2.9
2	B	373	MET	2.9
1	C	60	LYS	2.9
2	B	99	ALA	2.9
3	E	140	LYS	2.9
1	C	2	ARG	2.9
1	C	439	SER	2.9
2	D	399	PHE	2.9
1	A	372	GLN	2.8
2	D	416	MET	2.8
2	B	283	TYR	2.8
1	A	2	ARG	2.7
1	A	1	MET	2.7
1	A	437	VAL	2.7
2	B	93	VAL	2.7
2	B	369	ARG	2.7
1	C	85	GLN	2.7
1	A	328	VAL	2.7
3	E	54	LEU	2.7
1	A	337	THR	2.7
1	C	30	ILE	2.7
2	B	40	SER	2.6
2	B	277	SER	2.6
2	B	30	ILE	2.6
1	A	438	ASP	2.6
2	D	57	THR	2.6
1	A	196	GLU	2.6
3	E	55	GLU	2.6
1	C	276	ILE	2.6
1	A	324	VAL	2.6
1	C	232	SER	2.5
1	C	55	GLU	2.5
2	B	41	ASP	2.5
2	B	23	VAL	2.5
3	E	52	LYS	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	353	VAL	2.5
3	E	43	ARG	2.5
3	E	9	ILE	2.5
2	B	281	GLN	2.4
3	E	144	SER	2.4
1	C	61	HIS	2.4
2	B	145	THR	2.4
2	D	412	GLY	2.4
1	A	35	GLN	2.4
2	B	9	ALA	2.4
1	C	179	THR	2.3
3	E	141	GLU	2.3
3	E	29	PHE	2.3
2	B	372	LYS	2.3
1	A	159	VAL	2.3
2	B	441	ASP	2.3
1	A	195	LEU	2.3
3	E	28	SER	2.3
2	B	33	THR	2.3
1	A	317	LEU	2.2
1	C	357	TYR	2.2
2	B	43	GLN	2.2
2	B	112	ALA	2.2
2	B	323	MET	2.2
2	B	360	PRO	2.2
1	C	372	GLN	2.2
3	E	19	SER	2.2
1	C	35	GLN	2.2
2	B	83	PHE	2.2
1	C	324	VAL	2.2
2	D	402	LYS	2.1
3	E	7	GLU	2.1
3	E	21	GLU	2.1
2	B	286	LEU	2.1
2	B	34	GLY	2.1
2	B	100	GLY	2.1
2	B	322	ARG	2.1
1	C	248	LEU	2.1
1	C	53	PHE	2.1
2	B	86	ILE	2.1
2	B	415	GLU	2.1
1	A	333	ALA	2.1

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Mol	Chain	Res	Type	RSRZ
2	D	397	ALA	2.1
2	B	60	LYS	2.1
1	C	38	SER	2.1
1	C	59	GLY	2.1
1	C	363	VAL	2.1
1	A	326	LYS	2.1
1	C	56	THR	2.1
2	B	416	MET	2.1
3	E	46	SER	2.1
1	C	37	PRO	2.1
2	B	114	LEU	2.0
2	B	13	GLY	2.0
2	B	321	GLY	2.0
1	A	329	ASN	2.0
1	C	34	GLY	2.0
1	C	437	VAL	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.

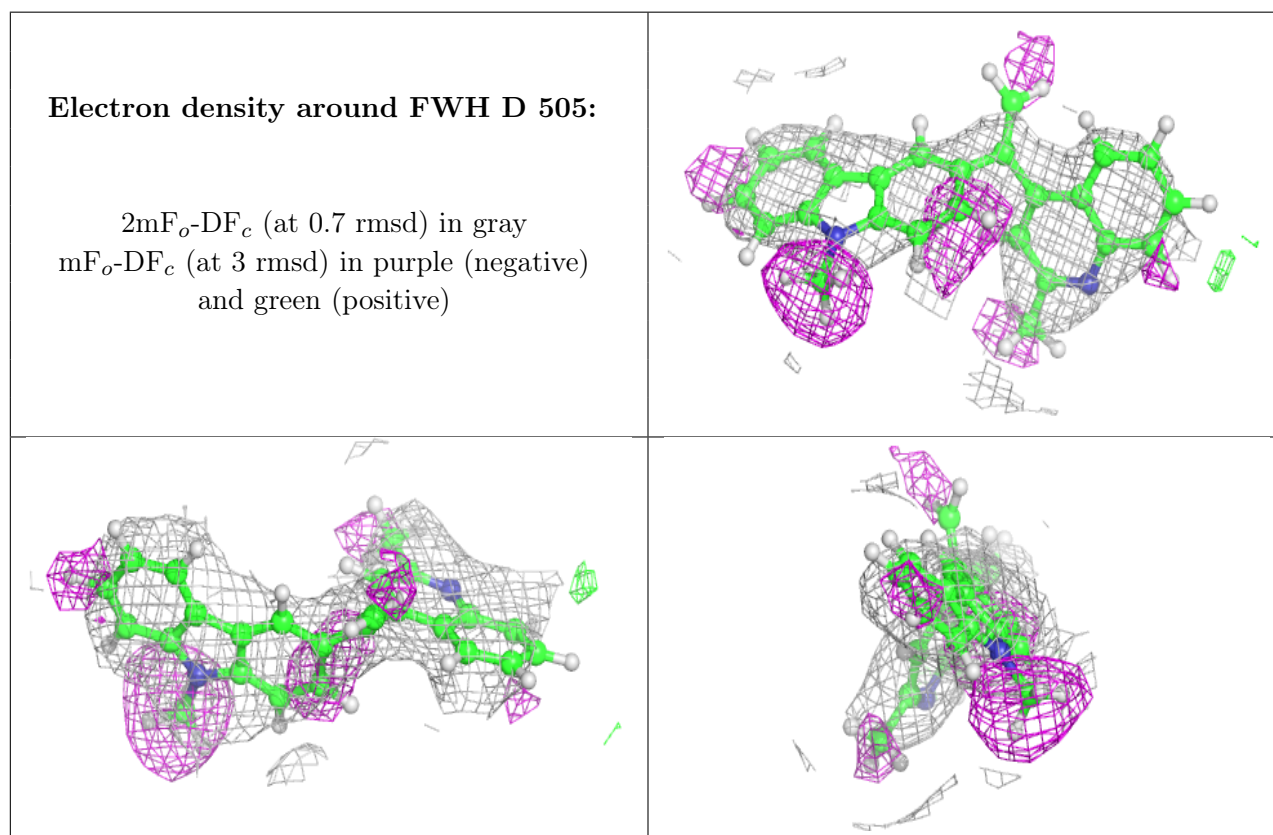
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	SO4	C	501	5/5	0.68	0.32	213,213,214,215	0
4	SO4	D	501	5/5	0.68	0.24	201,201,202,203	0
4	SO4	A	502	5/5	0.78	0.42	215,216,216,217	0
4	SO4	B	503	5/5	0.79	0.40	177,178,178,180	0
4	SO4	E	201	5/5	0.79	0.33	175,177,177,181	0
4	SO4	D	502	5/5	0.87	0.20	170,172,173,174	0
4	SO4	C	504	5/5	0.88	0.13	184,188,191,192	0

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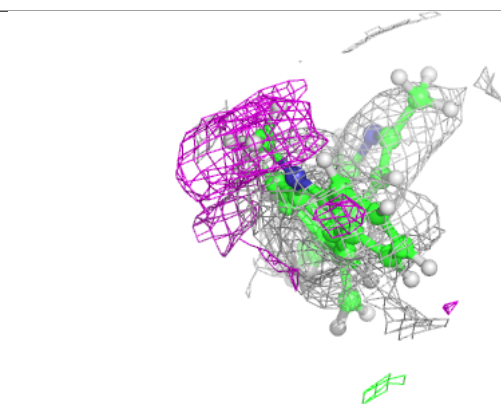
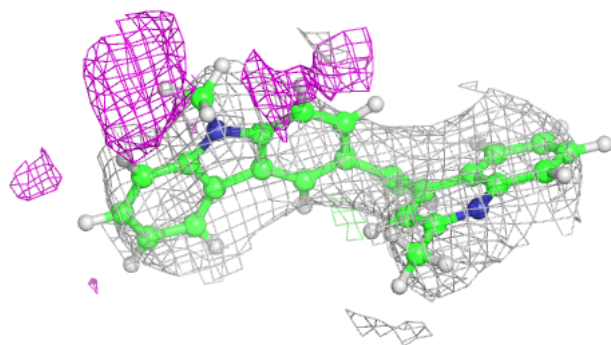
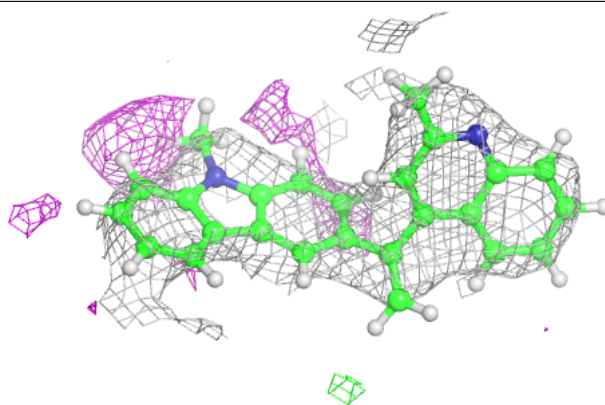
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	SO4	B	502	5/5	0.88	0.22	181,182,183,188	0
4	SO4	A	501	5/5	0.89	0.24	179,179,180,182	0
4	SO4	D	503	5/5	0.91	0.19	146,152,154,156	0
4	SO4	B	501	5/5	0.91	0.11	143,149,150,155	0
6	MG	A	504	1/1	0.93	0.13	86,86,86,86	0
8	FWH	D	505	27/27	0.93	0.20	19,51,63,69	0
8	FWH	B	505	27/27	0.96	0.20	71,80,86,88	0
7	GDP	B	504	28/28	0.97	0.21	85,94,101,104	0
5	GTP	C	502	32/32	0.97	0.20	85,92,98,100	0
5	GTP	A	503	32/32	0.97	0.20	89,96,107,111	0
6	MG	C	503	1/1	0.98	0.10	99,99,99,99	0
7	GDP	D	504	28/28	0.98	0.15	71,82,92,95	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.

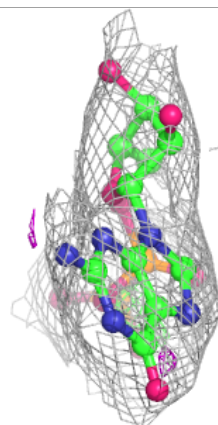
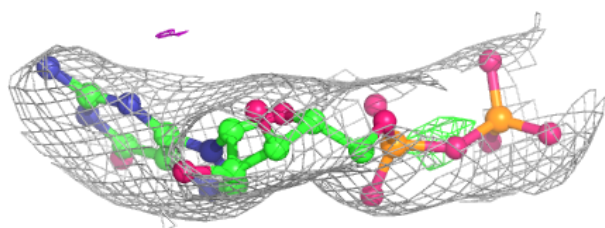
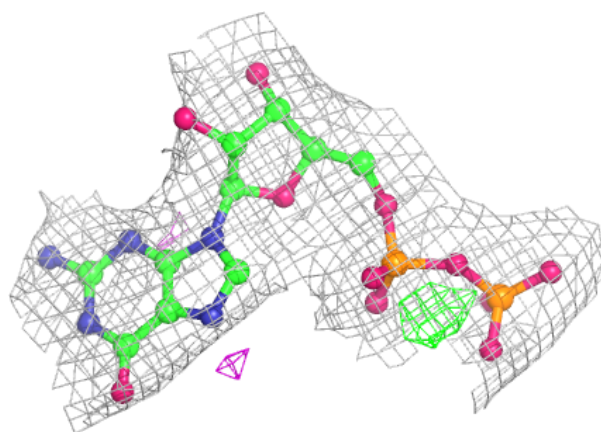


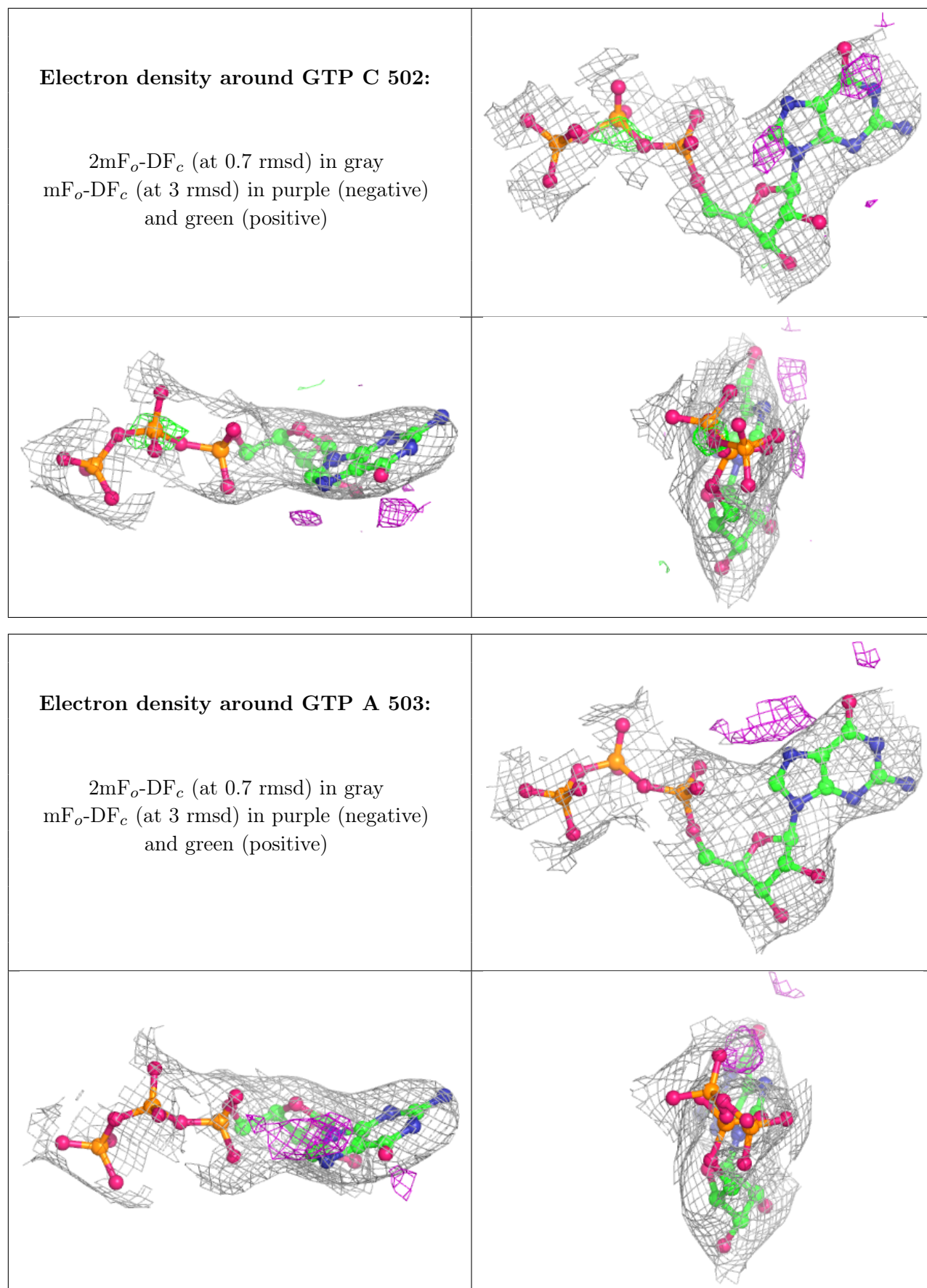
Electron density around FWH B 505:

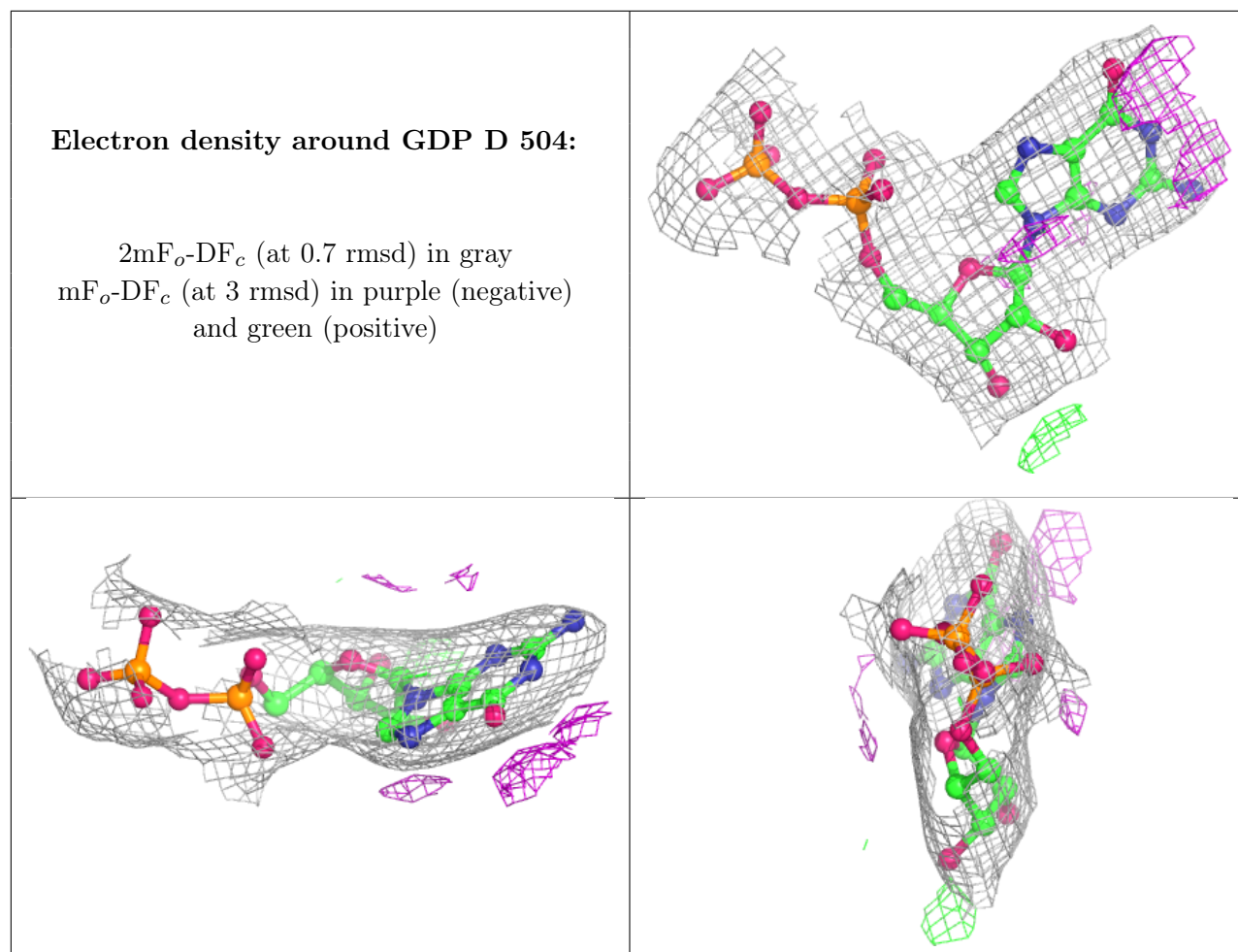
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

**Electron density around GDP B 504:**

$2mF_o-DF_c$ (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.