



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 5, 2022 – 01:28 pm BST

PDB ID : 7Z0G
Title : CPAP:TUBULIN:IE5 ALPHAREP COMPLEX P1 SPACE GROUP
Authors : Gigant, B.; Campanacci, V.
Deposited on : 2022-02-22
Resolution : 3.49 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 : 1.8.4, 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 : 5.8.0267
CCP4 : 7.1.010 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.27

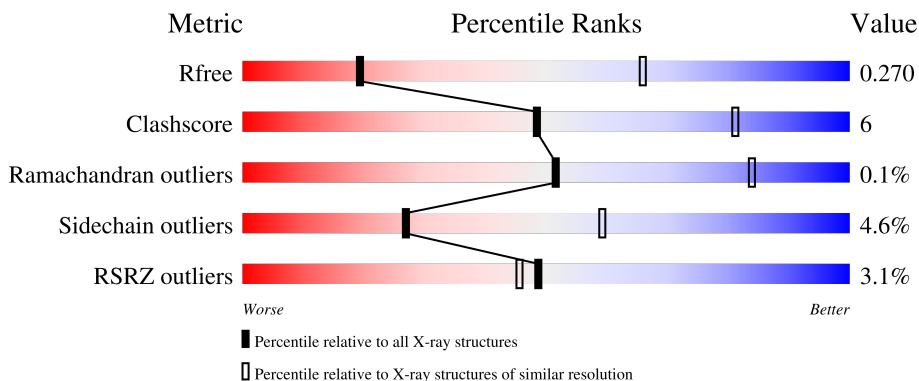
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.49 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	1379 (3.56-3.40)
Clashscore	141614	1461 (3.56-3.40)
Ramachandran outliers	138981	1424 (3.56-3.40)
Sidechain outliers	138945	1425 (3.56-3.40)
RSRZ outliers	127900	1289 (3.56-3.40)

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	77% 18% . .
1	R	451	78% 17% . .
2	B	445	82% 11% 7%
2	S	445	82% 13% .
3	C	232	80% 14% 6%

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Mol	Chain	Length	Quality of chain
3	T	232	<p>% 81% 12% 6%</p>
4	P	79	<p>% 44% 6% 49%</p>
4	U	79	<p>% 34% 6% 59%</p>

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 16473 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Tubulin alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	434	Total 3295	C 2088	N 558	O 627	S 22	0	0	0
1	R	436	Total 3305	C 2097	N 561	O 626	S 21	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	416	Total 3010	C 1898	N 494	O 598	S 20	0	0	0
2	S	425	Total 3094	C 1948	N 516	O 608	S 22	0	0	0

- Molecule 3 is a protein called IE5 ALPHAREP.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	218	Total 1563	C 965	N 282	O 314	S 2	0	0	0
3	T	219	Total 1575	C 974	N 286	O 313	S 2	0	0	0

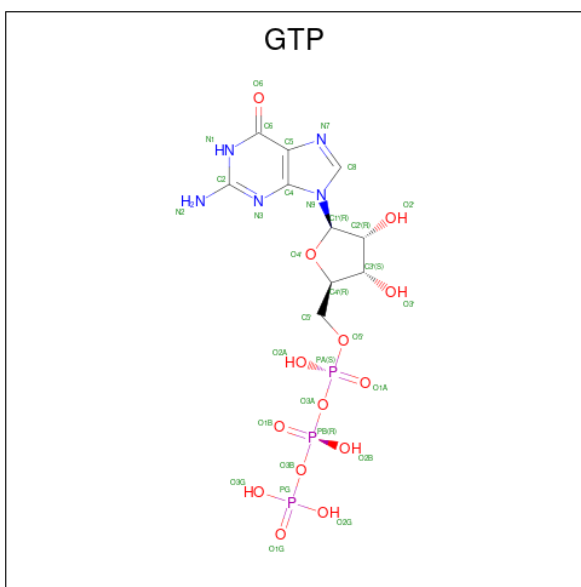
- Molecule 4 is a protein called Centromere protein J.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
4	P	40	Total 284	C 182	N 48	O 54	0	0	0
4	U	32	Total 201	C 127	N 37	O 37	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
P	319	MET	-	initiating methionine	UNP Q9HC77
P	320	VAL	ALA	engineered mutation	UNP Q9HC77
U	319	MET	-	initiating methionine	UNP Q9HC77
U	320	VAL	ALA	engineered mutation	UNP Q9HC77

- 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	R	1	Total	C	N	O	P	0	0
			32	10	5	14	3		

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

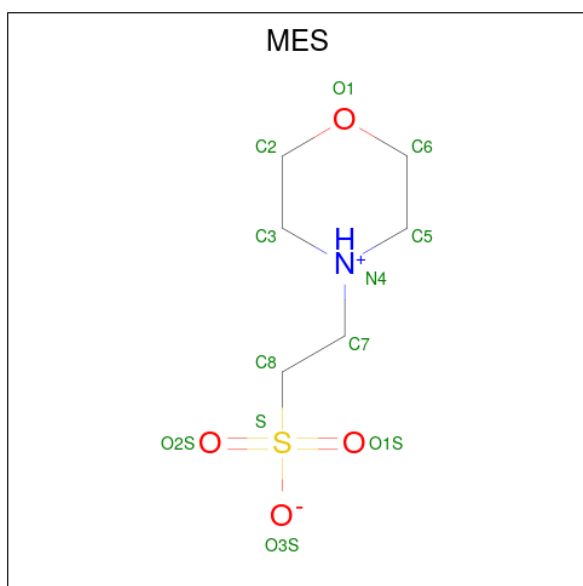
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
6	A	1	Total	Mg	0	0
			1	1		
6	R	1	Total	Mg	0	0
			1	1		

- Molecule 7 is GUANOSINE-5'-DIPHOSPHATE (three-letter code: GDP) (formula: $C_{10}H_{15}N_5O_{11}P_2$).



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

- Molecule 8 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (three-letter code: MES) (formula: C₆H₁₃NO₄S).



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

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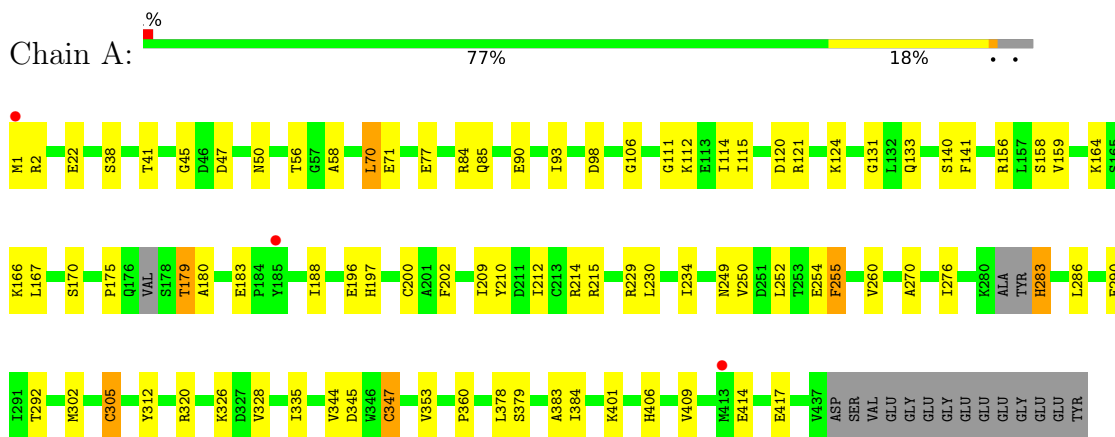
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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
8	S	1	12	6	1	4	1	0	0

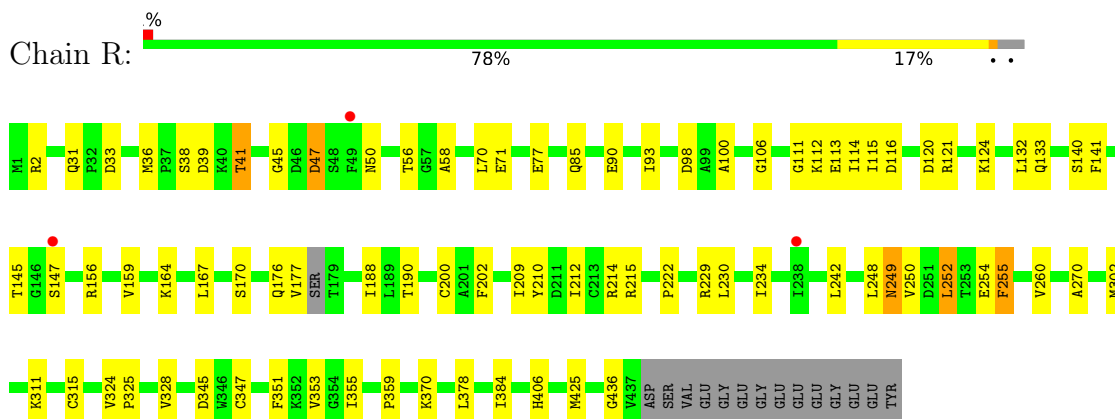
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

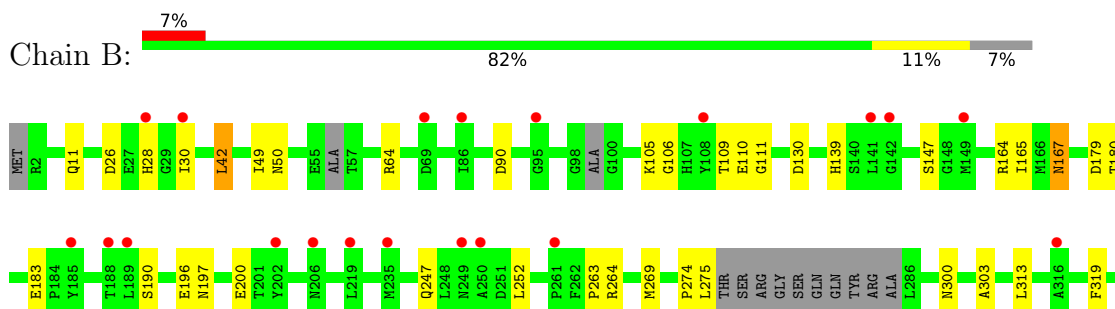
- Molecule 1: Tubulin alpha chain



- Molecule 1: Tubulin alpha chain

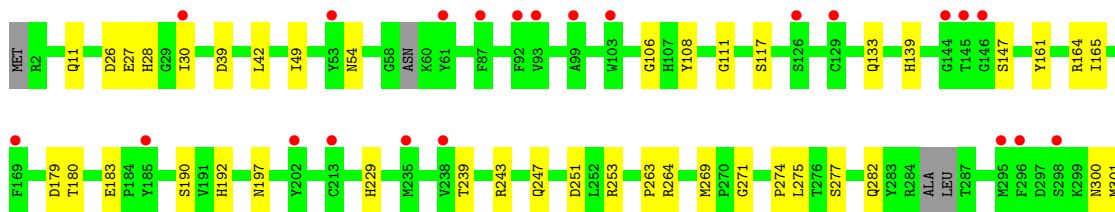
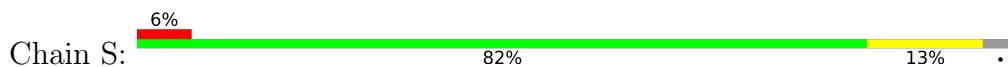


- Molecule 2: Tubulin beta chain

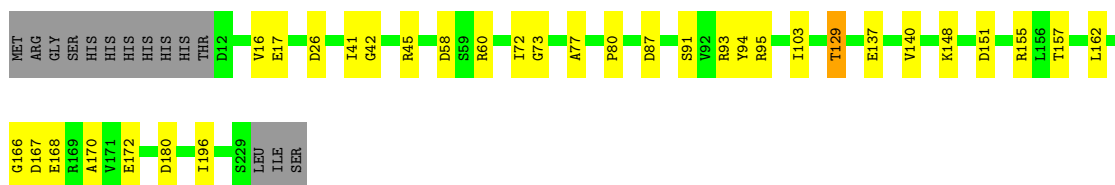
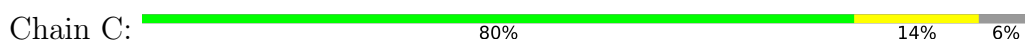




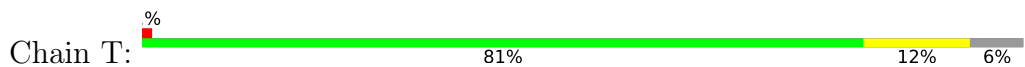
• Molecule 2: Tubulin beta chain



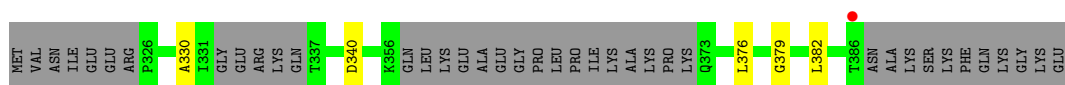
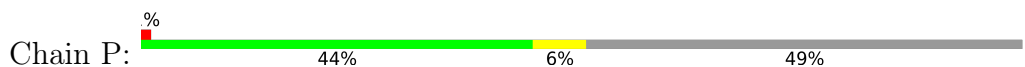
• Molecule 3: IE5 ALPHAREP



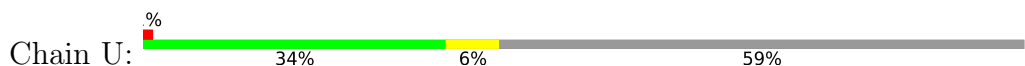
• Molecule 3: IE5 ALPHAREP



• Molecule 4: Centromere protein J



• Molecule 4: Centromere protein J



4 Data and refinement statistics i

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	57.11Å 75.90Å 151.32Å 96.19° 98.28° 111.60°	Depositor
Resolution (Å)	48.54 – 3.49 48.54 – 3.49	Depositor EDS
% Data completeness (in resolution range)	97.0 (48.54-3.49) 97.0 (48.54-3.49)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.25 (at 3.48Å)	Xtrriage
Refinement program	BUSTER 2.10.4	Depositor
R, R_{free}	0.236 , 0.276 0.235 , 0.270	Depositor DCC
R_{free} test set	1401 reflections (4.92%)	wwPDB-VP
Wilson B-factor (Å ²)	95.3	Xtrriage
Anisotropy	0.169	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	(Not available) , (Not available)	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.27$	Xtrriage
Estimated twinning fraction	0.069 for h,-h-k,-h-l	Xtrriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	16473	wwPDB-VP
Average B, all atoms (Å ²)	109.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.99% 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: MES, GDP, 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	0.45	0/3370	0.62	0/4589
1	R	0.46	0/3380	0.62	0/4605
2	B	0.38	0/3076	0.56	0/4210
2	S	0.38	0/3163	0.56	0/4325
3	C	0.47	0/1575	0.57	0/2140
3	T	0.48	0/1587	0.57	0/2154
4	P	0.41	0/286	0.49	0/384
4	U	0.37	0/201	0.50	0/269
All	All	0.43	0/16638	0.59	0/22676

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	3295	0	3123	50	0
1	R	3305	0	3147	45	0
2	B	3010	0	2672	33	0
2	S	3094	0	2773	38	0
3	C	1563	0	1523	15	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	T	1575	0	1552	14	0
4	P	284	0	249	5	0
4	U	201	0	161	6	0
5	A	32	0	12	0	0
5	R	32	0	12	0	0
6	A	1	0	0	0	0
6	R	1	0	0	0	0
7	B	28	0	12	1	0
7	S	28	0	12	1	0
8	B	12	0	13	1	0
8	S	12	0	13	2	0
All	All	16473	0	15274	190	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 6.

All (190) 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:S:179:ASP:HA	4:U:330:ALA:HB2	1.19	1.14
2:B:179:ASP:HA	4:P:330:ALA:HB2	1.19	1.13
1:A:344:VAL:CG2	1:A:347:CYS:HB2	2.06	0.85
2:B:404:PHE:HB3	2:B:407:TRP:HE1	1.42	0.84
1:A:344:VAL:HG22	1:A:347:CYS:HB2	1.62	0.79
2:B:404:PHE:HB3	2:B:407:TRP:NE1	1.97	0.78
1:A:56:THR:HG22	1:A:58:ALA:H	1.51	0.76
1:A:1:MET:HG2	1:A:2:ARG:H	1.51	0.74
2:S:229:HIS:CD2	2:S:277:SER:HA	2.21	0.74
1:A:175:PRO:HA	1:A:179:THR:HB	1.68	0.74
2:B:11:GLN:HB3	7:B:600:GDP:O1A	1.87	0.74
2:S:11:GLN:HB3	7:S:600:GDP:O2A	1.88	0.73
2:B:105:LYS:HA	2:B:109:THR:HB	1.73	0.71
1:R:47:ASP:HA	1:R:50:ASN:HB2	1.72	0.71
1:R:156:ARG:O	1:R:159:VAL:HG22	1.92	0.68
1:R:71:GLU:HB3	1:R:98:ASP:HB3	1.76	0.68
2:S:27:GLU:OE2	2:S:243:ARG:NH2	2.27	0.68
1:A:41:THR:HB	1:A:45:GLY:N	2.10	0.67
1:A:156:ARG:O	1:A:159:VAL:HG22	1.94	0.67
1:A:93:ILE:HG22	1:A:114:ILE:HD11	1.77	0.66
1:A:71:GLU:HB2	1:A:98:ASP:HB3	1.78	0.65
1:R:56:THR:HG22	1:R:58:ALA:H	1.61	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:R:93:ILE:HG22	1:R:114:ILE:HD11	1.77	0.65
1:A:1:MET:HG2	1:A:2:ARG:N	2.12	0.64
1:R:210:TYR:CE1	1:R:214:ARG:HD2	2.34	0.63
1:A:70:LEU:HB3	1:A:98:ASP:HA	1.80	0.63
2:B:269:MET:HG3	2:B:303:ALA:HB3	1.80	0.63
1:R:177:VAL:HB	2:S:353:THR:H	1.63	0.63
1:R:41:THR:HB	1:R:45:GLY:N	2.13	0.62
1:A:47:ASP:HA	1:A:50:ASN:HB2	1.81	0.62
2:S:269:MET:HG3	2:S:303:ALA:HB3	1.81	0.62
1:A:255:PHE:HE1	1:A:378:LEU:HD12	1.63	0.62
1:R:328:VAL:HG11	1:R:353:VAL:HG11	1.81	0.62
1:R:100:ALA:CB	2:S:253:ARG:HG2	2.30	0.62
1:R:255:PHE:HE1	1:R:378:LEU:HD12	1.63	0.62
1:A:210:TYR:CE1	1:A:214:ARG:HD2	2.35	0.62
1:A:234:ILE:HD13	1:A:302:MET:HE1	1.82	0.61
2:S:319:PHE:HB2	2:S:355:VAL:HG22	1.83	0.61
4:U:379:GLY:HA2	4:U:382:LEU:HD13	1.83	0.61
2:B:167:ASN:ND2	2:B:200:GLU:OE2	2.30	0.61
2:B:319:PHE:HB2	2:B:355:VAL:HG22	1.84	0.60
2:S:147:SER:HG	2:S:190:SER:HG	1.46	0.60
3:C:16:VAL:HG22	3:C:41:ILE:HG21	1.83	0.60
3:T:172:GLU:H	3:T:172:GLU:CD	2.05	0.60
2:B:50:ASN:O	2:B:64:ARG:NH2	2.35	0.60
1:A:41:THR:HB	1:A:45:GLY:H	1.66	0.60
3:C:172:GLU:H	3:C:172:GLU:CD	2.05	0.60
3:T:155:ARG:NH1	3:T:180:ASP:OD2	2.35	0.60
3:C:155:ARG:NH1	3:C:180:ASP:OD2	2.35	0.59
4:P:379:GLY:HA2	4:P:382:LEU:HD13	1.85	0.59
1:R:234:ILE:HD13	1:R:302:MET:HE1	1.85	0.59
3:T:16:VAL:HG22	3:T:41:ILE:HG21	1.84	0.59
2:B:147:SER:HG	2:B:190:SER:HG	1.47	0.59
2:B:109:THR:HG22	2:B:110:GLU:H	1.68	0.58
2:B:179:ASP:HA	4:P:330:ALA:CB	2.13	0.57
2:S:179:ASP:HA	4:U:330:ALA:CB	2.13	0.57
2:B:30:ILE:HD11	2:B:49:ILE:HD11	1.87	0.56
3:C:168:GLU:H	3:C:168:GLU:CD	2.08	0.56
2:S:30:ILE:HD11	2:S:49:ILE:HD11	1.87	0.56
1:R:270:ALA:HB3	1:R:302:MET:HG3	1.87	0.56
1:A:112:LYS:O	1:A:115:ILE:HG22	2.06	0.56
1:A:406:HIS:HA	1:A:409:VAL:HG22	1.86	0.56
1:R:270:ALA:O	1:R:302:MET:HG2	2.06	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:270:ALA:O	1:A:302:MET:HG2	2.06	0.55
2:S:264:ARG:HD2	4:U:382:LEU:HD11	1.89	0.55
1:A:270:ALA:HB3	1:A:302:MET:HG3	1.88	0.55
2:S:165:ILE:HD13	8:S:601:MES:H82	1.87	0.55
2:S:313:LEU:HD23	2:S:344:VAL:HG21	1.88	0.54
2:B:313:LEU:HD23	2:B:344:VAL:HG21	1.88	0.54
2:S:301:MET:SD	2:S:377:PHE:CE2	3.01	0.54
2:S:301:MET:SD	2:S:377:PHE:HE2	2.31	0.54
1:R:70:LEU:HD13	1:R:145:THR:HG23	1.91	0.53
2:S:180:THR:HB	2:S:183:GLU:HG3	1.90	0.53
1:A:344:VAL:HG23	1:A:347:CYS:HB2	1.89	0.53
2:B:109:THR:HG22	2:B:110:GLU:N	2.23	0.53
2:B:180:THR:HB	2:B:183:GLU:HG3	1.90	0.53
1:R:406:HIS:CG	2:S:263:PRO:HD3	2.43	0.53
1:R:209:ILE:HG23	1:R:230:LEU:HD23	1.90	0.53
2:S:161:TYR:HB3	2:S:164:ARG:HG3	1.90	0.53
3:C:17:GLU:HG3	3:C:45:ARG:HH22	1.73	0.53
3:C:166:GLY:HA2	3:C:196:ILE:HG12	1.91	0.52
2:B:196:GLU:HB2	4:P:376:LEU:HD21	1.90	0.52
3:T:166:GLY:HA2	3:T:196:ILE:HG12	1.92	0.52
2:B:395:PHE:CE2	2:B:422:GLU:HB2	2.45	0.52
3:T:17:GLU:HG3	3:T:45:ARG:HH22	1.74	0.52
2:S:197:ASN:O	8:S:601:MES:H62	2.09	0.52
2:S:404:PHE:CB	2:S:407:TRP:HE1	2.23	0.52
1:A:71:GLU:CB	1:A:98:ASP:HB3	2.40	0.51
1:A:209:ILE:HG23	1:A:230:LEU:HD23	1.92	0.51
1:A:305:CYS:SG	1:A:383:ALA:O	2.69	0.51
2:B:167:ASN:ND2	2:B:252:LEU:HD22	2.26	0.51
1:R:200:CYS:HB2	1:R:260:VAL:HG21	1.91	0.51
1:R:230:LEU:O	1:R:234:ILE:HD12	2.11	0.51
3:C:77:ALA:HA	3:C:80:PRO:HG2	1.92	0.51
1:R:41:THR:HB	1:R:45:GLY:H	1.74	0.51
1:A:406:HIS:CG	2:B:263:PRO:HD3	2.46	0.50
3:T:77:ALA:HA	3:T:80:PRO:HG2	1.92	0.50
1:A:200:CYS:HB2	1:A:260:VAL:HG21	1.92	0.50
1:R:359:PRO:HB2	1:R:370:LYS:HZ1	1.75	0.50
1:R:112:LYS:O	1:R:115:ILE:HG22	2.11	0.49
2:S:271:GLY:HA3	2:S:377:PHE:HD2	1.77	0.49
2:S:239:THR:OG1	2:S:243:ARG:NH1	2.45	0.49
1:A:286:LEU:HD22	1:A:290:GLU:HB3	1.93	0.49
3:T:137:GLU:OE2	3:T:167:ASP:OD1	2.30	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:234:ILE:HD13	1:A:302:MET:CE	2.42	0.49
1:A:2:ARG:HD3	1:A:131:GLY:O	2.13	0.49
1:A:121:ARG:HH21	1:A:124:LYS:HG3	1.78	0.49
3:C:73:GLY:HA2	3:C:103:ILE:HG12	1.93	0.49
1:R:2:ARG:HB3	1:R:133:GLN:HB2	1.95	0.49
3:T:58:ASP:OD2	3:T:60:ARG:HG3	2.13	0.48
3:C:129:THR:HG23	3:C:157:THR:HB	1.96	0.48
3:C:137:GLU:OE2	3:C:167:ASP:OD1	2.31	0.48
1:R:324:VAL:CG1	1:R:325:PRO:HD2	2.44	0.47
1:R:212:ILE:HG12	1:R:215:ARG:HH12	1.80	0.47
1:A:210:TYR:O	1:A:214:ARG:HG3	2.14	0.47
1:A:276:ILE:HG21	1:A:283:HIS:HD2	1.80	0.47
1:R:210:TYR:O	1:R:214:ARG:HG3	2.14	0.47
1:A:320:ARG:HG3	1:A:360:PRO:HD3	1.96	0.47
1:R:234:ILE:HD13	1:R:302:MET:CE	2.44	0.47
1:A:212:ILE:HG12	1:A:215:ARG:HH12	1.80	0.47
1:R:36:MET:HG2	1:R:39:ASP:H	1.80	0.47
1:R:121:ARG:HH21	1:R:124:LYS:HG3	1.80	0.46
2:S:347:ILE:HG22	2:S:350:ASN:HB3	1.97	0.46
2:B:28:HIS:HB2	2:B:30:ILE:HD12	1.97	0.46
3:T:162:LEU:HD22	3:T:170:ALA:HB2	1.97	0.46
1:R:167:LEU:HD23	1:R:202:PHE:HE1	1.81	0.46
1:R:249:ASN:OD1	1:R:355:ILE:O	2.34	0.46
3:C:42:GLY:HA2	3:C:72:ILE:HG12	1.97	0.46
2:B:347:ILE:HG22	2:B:350:ASN:HB3	1.97	0.46
1:A:344:VAL:HG23	1:A:347:CYS:H	1.81	0.46
2:B:397:ALA:HA	2:B:400:ARG:HE	1.80	0.46
3:C:162:LEU:HD22	3:C:170:ALA:HB2	1.98	0.46
2:S:28:HIS:HB2	2:S:30:ILE:HD12	1.98	0.46
3:T:140:VAL:HG21	3:T:167:ASP:HB3	1.98	0.46
3:T:129:THR:HG23	3:T:157:THR:HB	1.98	0.45
1:A:230:LEU:O	1:A:234:ILE:HD12	2.16	0.45
3:C:58:ASP:OD2	3:C:60:ARG:HG3	2.16	0.45
1:A:2:ARG:HB3	1:A:133:GLN:HB2	1.98	0.45
2:B:406:HIS:CE1	2:B:407:TRP:HD1	2.35	0.45
1:R:141:PHE:CE1	1:R:170:SER:HB3	2.52	0.45
2:B:275:LEU:HD11	2:B:300:ASN:HA	1.98	0.45
3:C:140:VAL:HG21	3:C:167:ASP:HB3	1.99	0.45
2:S:192:HIS:CD2	4:U:376:LEU:HD23	2.51	0.45
1:A:401:LYS:HD3	2:B:346:TRP:HB2	1.98	0.45
1:A:326:LYS:HE2	1:A:326:LYS:HB3	1.86	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:S:275:LEU:HD11	2:S:300:ASN:HA	1.99	0.45
1:A:141:PHE:CE1	1:A:170:SER:HB3	2.52	0.45
1:A:167:LEU:HD23	1:A:202:PHE:HE1	1.82	0.45
1:R:188:ILE:HG23	1:R:425:MET:HG3	1.99	0.45
2:S:406:HIS:CE1	2:S:407:TRP:HD1	2.35	0.45
1:R:112:LYS:HG3	1:R:113:GLU:HG3	1.98	0.44
1:R:315:CYS:SG	1:R:351:PHE:CE1	3.09	0.44
1:R:250:VAL:HG13	1:R:254:GLU:HB3	1.98	0.44
1:A:414:GLU:HB3	1:A:417:GLU:OE2	2.17	0.44
1:A:180:ALA:HB3	1:A:183:GLU:HG3	2.00	0.44
2:B:167:ASN:CG	2:B:200:GLU:HG3	2.38	0.44
1:A:106:GLY:O	1:A:111:GLY:HA3	2.18	0.44
2:B:197:ASN:O	8:B:601:MES:H62	2.18	0.44
1:A:328:VAL:HG11	1:A:353:VAL:HG11	1.99	0.44
2:S:274:PRO:HD2	2:S:371:LEU:HD13	1.98	0.44
2:B:165:ILE:HG21	2:B:252:LEU:HB3	2.00	0.43
1:R:106:GLY:O	1:R:111:GLY:HA3	2.19	0.43
1:R:132:LEU:O	1:R:164:LYS:HD2	2.18	0.43
2:B:274:PRO:HD2	2:B:371:LEU:HD13	1.99	0.43
1:R:248:LEU:HD11	3:T:184:TYR:CE2	2.54	0.43
2:S:108:TYR:HE1	2:S:413:MET:HG2	1.83	0.43
2:S:108:TYR:CE1	2:S:413:MET:HG2	2.54	0.43
3:T:42:GLY:HA2	3:T:72:ILE:HG12	2.00	0.43
1:A:292:THR:HG22	1:A:335:ILE:HD12	2.00	0.43
2:S:147:SER:OG	2:S:190:SER:OG	2.25	0.43
2:S:192:HIS:HD2	4:U:376:LEU:HD23	1.84	0.43
1:A:250:VAL:HG13	1:A:254:GLU:HB3	2.00	0.43
2:B:106:GLY:O	2:B:111:GLY:HA3	2.20	0.42
1:R:100:ALA:HB1	2:S:253:ARG:HG2	2.01	0.42
2:S:106:GLY:O	2:S:111:GLY:HA3	2.20	0.42
3:T:73:GLY:HA2	3:T:103:ILE:HG12	2.01	0.42
2:B:264:ARG:HD2	4:P:382:LEU:HD11	2.02	0.42
3:C:87:ASP:O	3:C:93:ARG:HD3	2.19	0.42
1:A:312:TYR:CE2	1:A:379:SER:HB2	2.54	0.41
2:S:274:PRO:HG3	2:S:282:GLN:CB	2.49	0.41
1:R:311:LYS:HD2	1:R:436:GLY:HA2	2.01	0.41
2:S:229:HIS:NE2	2:S:277:SER:HA	2.34	0.41
1:R:31:GLN:HB3	1:R:33:ASP:OD1	2.21	0.41
1:A:312:TYR:HE2	1:A:379:SER:HB2	1.86	0.41
2:B:42:LEU:HD13	2:B:358:ILE:HD11	2.02	0.41
1:R:147:SER:HB2	1:R:190:THR:HB	2.03	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:197:HIS:CD2	1:A:197:HIS:N	2.86	0.40
1:R:242:LEU:HD11	1:R:252:LEU:HB2	2.04	0.40
1:R:210:TYR:CE2	1:R:222:PRO:HD2	2.57	0.40
2:S:344:VAL:HG13	2:S:346:TRP:CE2	2.57	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	428/451 (95%)	417 (97%)	11 (3%)	0	100	100
1	R	432/451 (96%)	417 (96%)	14 (3%)	1 (0%)	47	80
2	B	408/445 (92%)	397 (97%)	10 (2%)	1 (0%)	47	80
2	S	419/445 (94%)	407 (97%)	11 (3%)	1 (0%)	47	80
3	C	216/232 (93%)	216 (100%)	0	0	100	100
3	T	217/232 (94%)	217 (100%)	0	0	100	100
4	P	34/79 (43%)	32 (94%)	2 (6%)	0	100	100
4	U	26/79 (33%)	26 (100%)	0	0	100	100
All	All	2180/2414 (90%)	2129 (98%)	48 (2%)	3 (0%)	51	84

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	S	247	GLN
2	B	247	GLN
1	R	47	ASP

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	342/379 (90%)	318 (93%)	24 (7%)	15	46
1	R	342/379 (90%)	326 (95%)	16 (5%)	26	59
2	B	300/383 (78%)	292 (97%)	8 (3%)	44	72
2	S	310/383 (81%)	299 (96%)	11 (4%)	36	66
3	C	143/176 (81%)	136 (95%)	7 (5%)	25	57
3	T	145/176 (82%)	139 (96%)	6 (4%)	30	62
4	P	23/68 (34%)	22 (96%)	1 (4%)	29	61
4	U	12/68 (18%)	11 (92%)	1 (8%)	11	38
All	All	1617/2012 (80%)	1543 (95%)	74 (5%)	27	59

All (74) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	22	GLU
1	A	38	SER
1	A	70	LEU
1	A	77	GLU
1	A	84	ARG
1	A	85	GLN
1	A	90	GLU
1	A	120	ASP
1	A	140	SER
1	A	158	SER
1	A	164	LYS
1	A	166	LYS
1	A	179	THR
1	A	188	ILE
1	A	196	GLU
1	A	229	ARG
1	A	249	ASN
1	A	252	LEU
1	A	255	PHE

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Mol	Chain	Res	Type
1	A	283	HIS
1	A	305	CYS
1	A	345	ASP
1	A	347	CYS
1	A	384	ILE
2	B	26	ASP
2	B	42	LEU
2	B	90	ASP
2	B	130	ASP
2	B	139	HIS
2	B	164	ARG
2	B	167	ASN
2	B	427	ASP
3	C	26	ASP
3	C	91	SER
3	C	94	TYR
3	C	95	ARG
3	C	129	THR
3	C	148	LYS
3	C	151	ASP
4	P	340	ASP
1	R	38	SER
1	R	41	THR
1	R	77	GLU
1	R	85	GLN
1	R	90	GLU
1	R	116	ASP
1	R	120	ASP
1	R	140	SER
1	R	176	GLN
1	R	229	ARG
1	R	249	ASN
1	R	252	LEU
1	R	255	PHE
1	R	345	ASP
1	R	347	CYS
1	R	384	ILE
2	S	26	ASP
2	S	39	ASP
2	S	42	LEU
2	S	54	ASN
2	S	117	SER

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Mol	Chain	Res	Type
2	S	133	GLN
2	S	139	HIS
2	S	251	ASP
2	S	357	ASP
2	S	377	PHE
2	S	427	ASP
3	T	91	SER
3	T	94	TYR
3	T	95	ARG
3	T	129	THR
3	T	148	LYS
3	T	151	ASP
4	U	340	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 8 ligands modelled in this entry, 2 are monoatomic - leaving 6 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	R	600	6	26,34,34	0.91	1 (3%)	33,54,54	2.00	5 (15%)
8	MES	B	601	-	12,12,12	0.71	0	14,16,16	0.39	0
5	GTP	A	600	6	26,34,34	0.85	1 (3%)	33,54,54	2.01	5 (15%)
7	GDP	S	600	-	24,30,30	0.96	1 (4%)	31,47,47	2.13	6 (19%)
7	GDP	B	600	-	24,30,30	0.93	1 (4%)	31,47,47	2.15	6 (19%)
8	MES	S	601	-	12,12,12	0.69	0	14,16,16	0.45	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	R	600	6	-	4/18/38/38	0/3/3/3
8	MES	B	601	-	-	6/6/14/14	0/1/1/1
5	GTP	A	600	6	-	4/18/38/38	0/3/3/3
7	GDP	S	600	-	-	8/12/32/32	0/3/3/3
7	GDP	B	600	-	-	10/12/32/32	0/3/3/3
8	MES	S	601	-	-	6/6/14/14	0/1/1/1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	R	600	GTP	C6-N1	3.14	1.38	1.33
7	B	600	GDP	C6-N1	3.03	1.38	1.33
5	A	600	GTP	C6-N1	2.93	1.38	1.33
7	S	600	GDP	C6-N1	2.91	1.38	1.33

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	B	600	GDP	C5-C6-N1	-8.33	112.03	123.43
7	S	600	GDP	C5-C6-N1	-8.26	112.13	123.43
5	A	600	GTP	C5-C6-N1	-8.10	112.35	123.43
5	R	600	GTP	C5-C6-N1	-8.05	112.42	123.43
5	A	600	GTP	C2-N1-C6	5.88	125.27	115.93
5	R	600	GTP	C2-N1-C6	5.85	125.22	115.93
7	B	600	GDP	C2-N1-C6	5.74	125.05	115.93
7	S	600	GDP	C2-N1-C6	5.71	125.01	115.93
7	B	600	GDP	O2B-PB-O3A	3.34	115.85	104.64

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	S	600	GDP	O3B-PB-O3A	3.32	115.76	104.64
5	R	600	GTP	C4-C5-C6	-2.95	117.98	120.80
5	A	600	GTP	N3-C2-N1	-2.84	123.44	127.22
7	B	600	GDP	N3-C2-N1	-2.84	123.44	127.22
7	S	600	GDP	N3-C2-N1	-2.83	123.45	127.22
5	A	600	GTP	C4-C5-C6	-2.79	118.13	120.80
5	R	600	GTP	N3-C2-N1	-2.77	123.53	127.22
7	B	600	GDP	C2-N3-C4	-2.49	112.52	115.36
7	S	600	GDP	C2-N3-C4	-2.43	112.58	115.36
7	S	600	GDP	C4-C5-C6	-2.24	118.66	120.80
5	A	600	GTP	C2-N3-C4	-2.22	112.82	115.36
7	B	600	GDP	C4-C5-C6	-2.18	118.72	120.80
5	R	600	GTP	C2-N3-C4	-2.11	112.94	115.36

There are no chirality outliers.

All (38) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	600	GTP	C5'-O5'-PA-O1A
5	A	600	GTP	C5'-O5'-PA-O2A
5	R	600	GTP	C5'-O5'-PA-O1A
5	R	600	GTP	C5'-O5'-PA-O2A
7	B	600	GDP	PA-O3A-PB-O3B
7	B	600	GDP	C5'-O5'-PA-O1A
7	S	600	GDP	C5'-O5'-PA-O1A
7	S	600	GDP	C5'-O5'-PA-O2A
8	B	601	MES	N4-C7-C8-S
8	B	601	MES	C7-C8-S-O1S
8	B	601	MES	C7-C8-S-O3S
8	S	601	MES	N4-C7-C8-S
8	S	601	MES	C7-C8-S-O2S
8	S	601	MES	C7-C8-S-O3S
7	B	600	GDP	C3'-C4'-C5'-O5'
7	S	600	GDP	C3'-C4'-C5'-O5'
8	B	601	MES	C8-C7-N4-C3
8	B	601	MES	C8-C7-N4-C5
8	S	601	MES	C8-C7-N4-C3
8	S	601	MES	C8-C7-N4-C5
7	B	600	GDP	C4'-C5'-O5'-PA
7	S	600	GDP	C4'-C5'-O5'-PA
7	B	600	GDP	PA-O3A-PB-O2B
7	S	600	GDP	PA-O3A-PB-O3B

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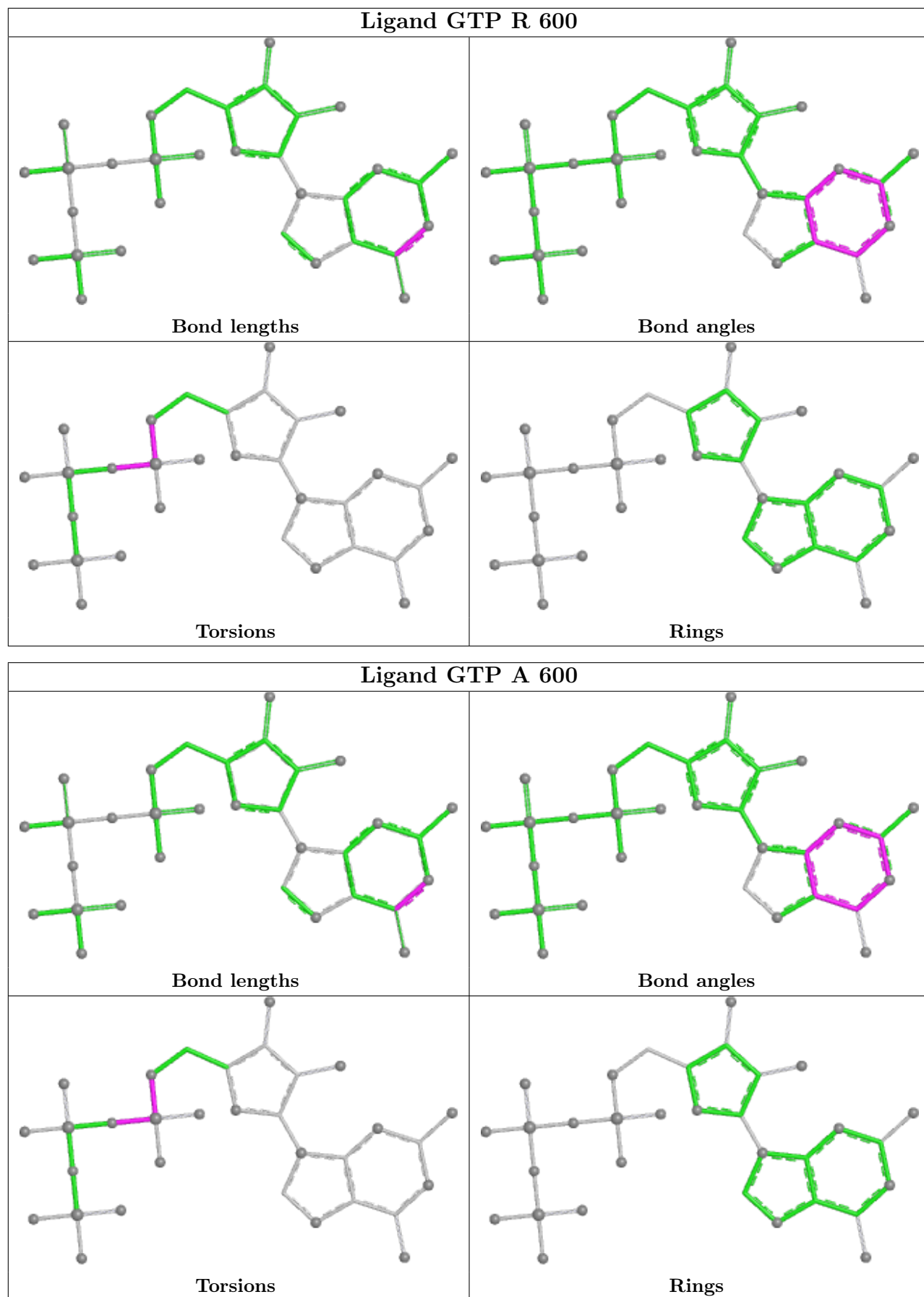
Mol	Chain	Res	Type	Atoms
7	B	600	GDP	C5'-O5'-PA-O3A
7	S	600	GDP	C5'-O5'-PA-O3A
7	B	600	GDP	C5'-O5'-PA-O2A
8	B	601	MES	C7-C8-S-O2S
8	S	601	MES	C7-C8-S-O1S
7	B	600	GDP	PB-O3A-PA-O1A
5	A	600	GTP	PB-O3A-PA-O2A
7	B	600	GDP	O4'-C4'-C5'-O5'
7	S	600	GDP	O4'-C4'-C5'-O5'
5	A	600	GTP	C5'-O5'-PA-O3A
5	R	600	GTP	C5'-O5'-PA-O3A
5	R	600	GTP	PB-O3A-PA-O2A
7	B	600	GDP	PB-O3A-PA-O2A
7	S	600	GDP	PB-O3A-PA-O2A

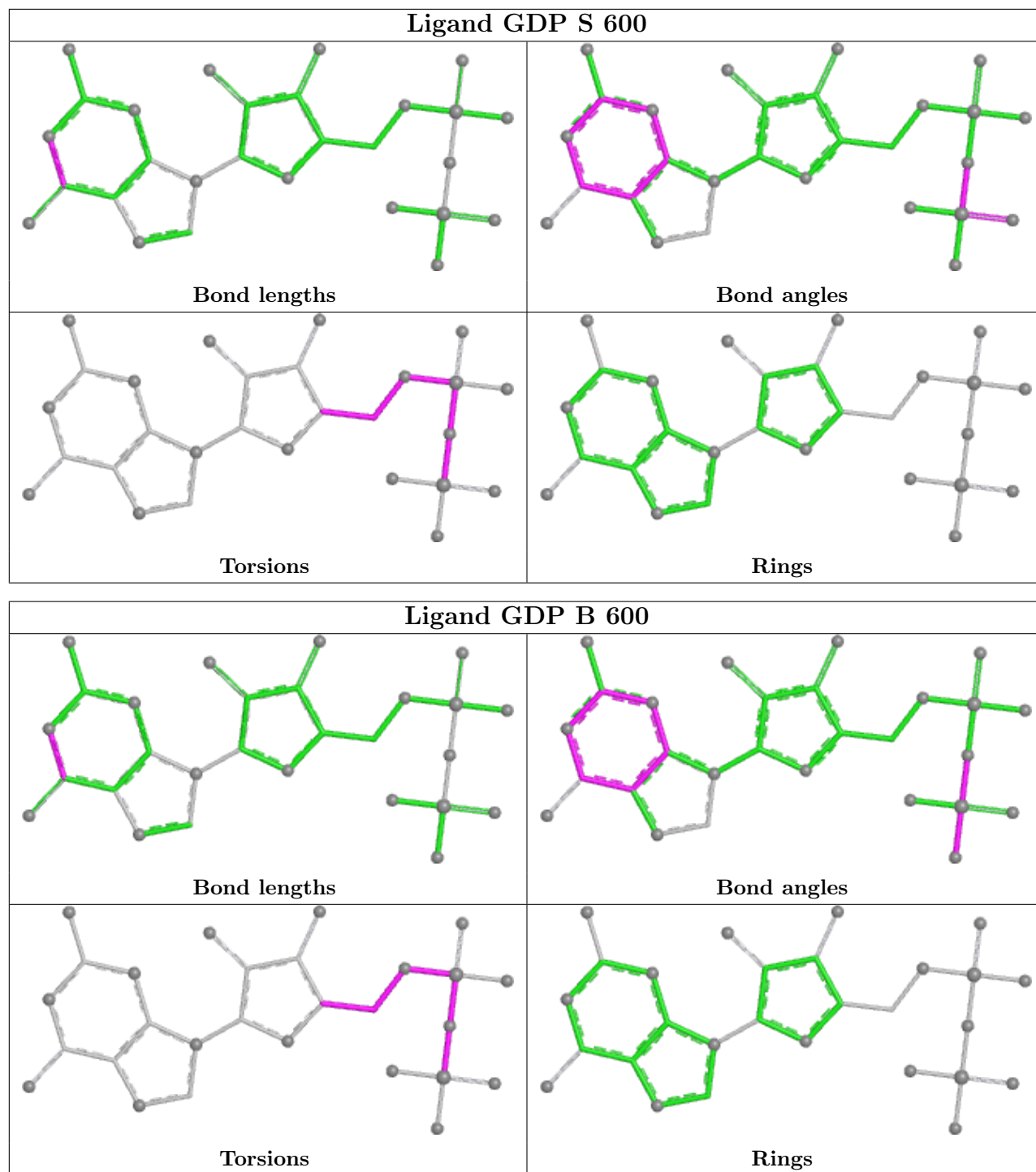
There are no ring outliers.

4 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
8	B	601	MES	1	0
7	S	600	GDP	1	0
7	B	600	GDP	1	0
8	S	601	MES	2	0

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





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	434/451 (96%)	0.08	3 (0%) 87 84	64, 99, 124, 138	0
1	R	436/451 (96%)	0.08	3 (0%) 87 84	68, 97, 125, 149	0
2	B	416/445 (93%)	0.36	30 (7%) 15 17	81, 124, 161, 175	0
2	S	425/445 (95%)	0.29	28 (6%) 18 18	82, 124, 156, 171	0
3	C	218/232 (93%)	-0.08	0 100 100	64, 90, 139, 165	0
3	T	219/232 (94%)	0.03	2 (0%) 84 80	63, 91, 135, 154	0
4	P	40/79 (50%)	0.25	1 (2%) 57 53	107, 148, 190, 195	0
4	U	32/79 (40%)	0.03	1 (3%) 49 45	113, 140, 190, 193	0
All	All	2220/2414 (91%)	0.16	68 (3%) 49 45	63, 107, 153, 195	0

All (68) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	S	145	THR	5.4
2	S	295	MET	5.2
2	S	61	TYR	5.1
2	B	408	TYR	4.8
2	B	250	ALA	4.2
2	B	335	VAL	4.0
2	S	332	MET	3.6
2	B	399	PHE	3.3
2	B	30	ILE	3.3
2	S	93	VAL	3.2
1	A	413	MET	3.2
2	S	99	ALA	3.1
2	B	316	ALA	3.0
1	R	147	SER	3.0
4	P	386	THR	2.9
2	S	87	PHE	2.8

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Mol	Chain	Res	Type	RSRZ
2	S	92	PHE	2.8
1	A	1	MET	2.8
2	S	126	SER	2.8
2	S	378	ILE	2.7
2	B	439	THR	2.7
2	B	206	ASN	2.7
2	B	336	GLN	2.7
2	S	146	GLY	2.7
2	B	95	GLY	2.6
2	S	305	CYS	2.5
2	B	202	TYR	2.5
2	S	296	PHE	2.5
4	U	351	GLN	2.5
2	B	28	HIS	2.5
2	S	202	TYR	2.4
2	B	189	LEU	2.4
3	T	11	THR	2.4
2	B	355	VAL	2.4
2	B	249	ASN	2.4
2	S	432	TYR	2.4
2	S	238	VAL	2.4
2	B	353	THR	2.4
2	S	185	TYR	2.3
3	T	23	LEU	2.3
2	B	86	ILE	2.3
2	B	425	MET	2.3
2	S	377	PHE	2.3
2	B	149	MET	2.2
2	S	298	SER	2.2
2	B	261	PRO	2.2
2	S	53	TYR	2.2
2	S	129	CYS	2.2
2	S	169	PHE	2.2
1	A	185	TYR	2.1
2	B	108	TYR	2.1
2	S	30	ILE	2.1
2	S	213	CYS	2.1
2	B	142	GLY	2.1
2	B	219	LEU	2.1
2	B	188	THR	2.1
2	B	185	TYR	2.1
2	B	69	ASP	2.1

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Mol	Chain	Res	Type	RSRZ
2	S	103	TRP	2.1
1	R	238	ILE	2.1
2	B	141	LEU	2.1
2	B	332	MET	2.1
2	S	408	TYR	2.1
2	B	235	MET	2.1
2	S	235	MET	2.0
2	B	354	ALA	2.0
2	S	144	GLY	2.0
1	R	49	PHE	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](#)

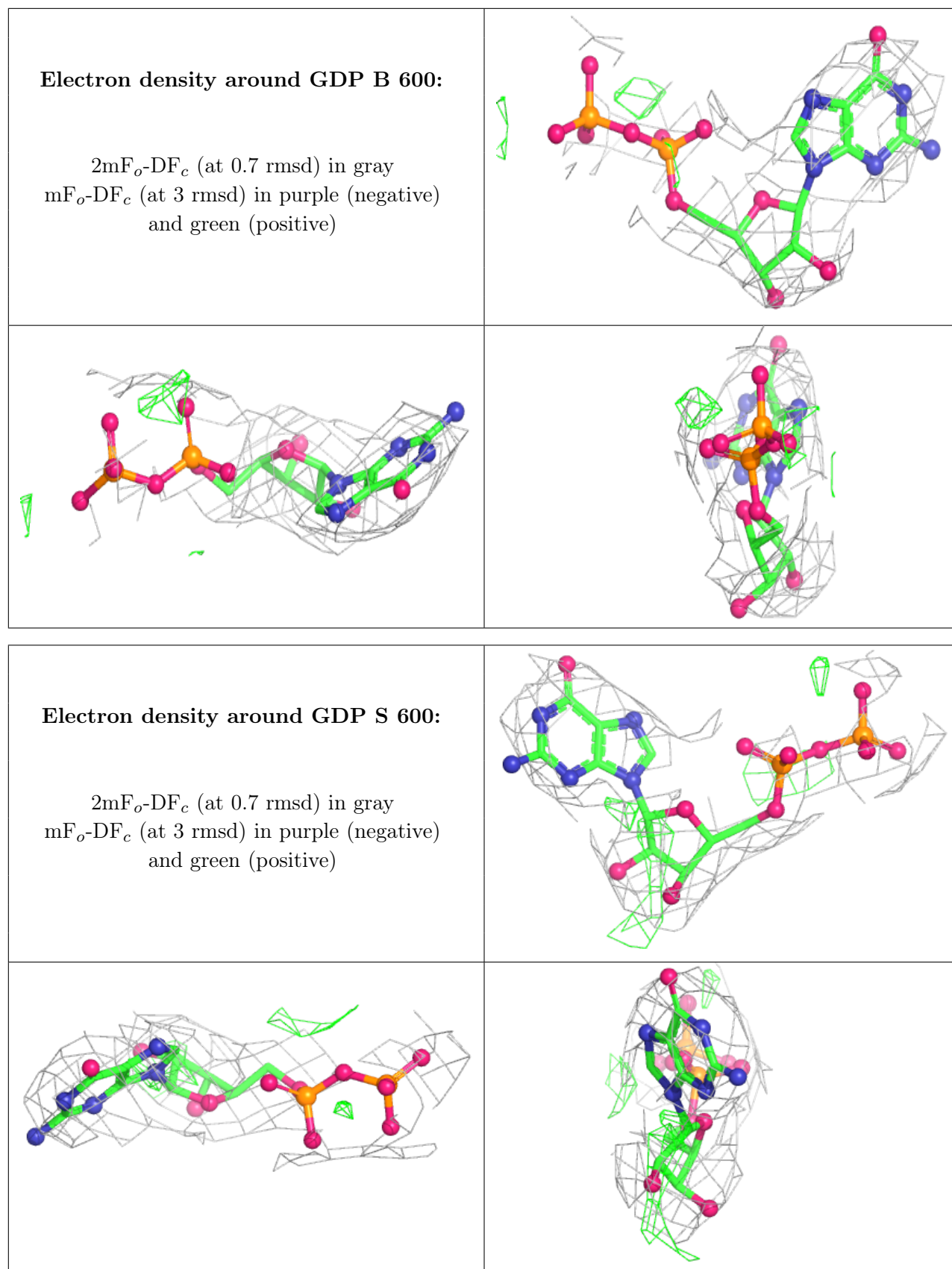
There are no monosaccharides in this entry.

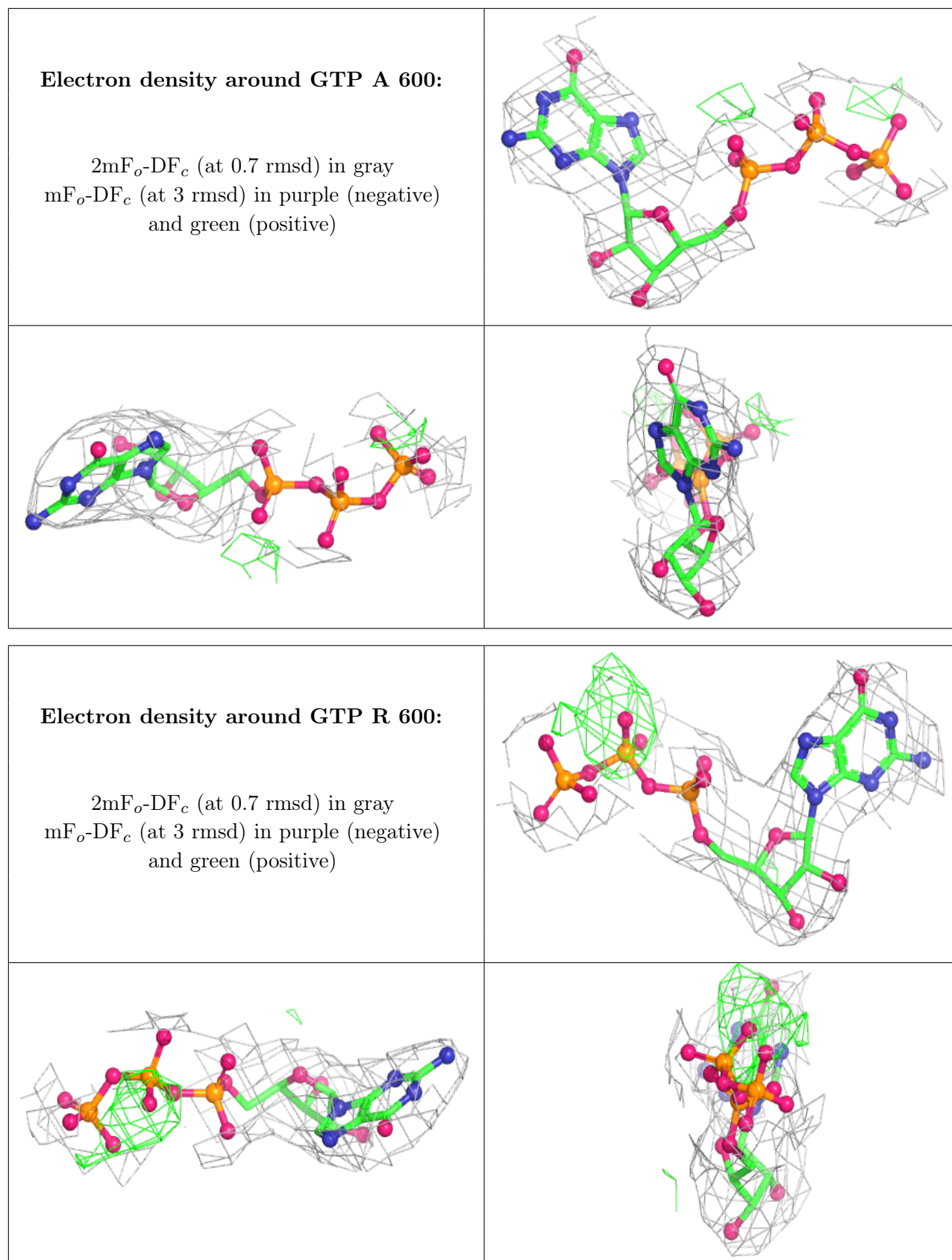
6.4 Ligands [i](#)

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
7	GDP	B	600	28/28	0.90	0.23	130,132,140,140	0
8	MES	S	601	12/12	0.91	0.24	108,108,110,111	0
8	MES	B	601	12/12	0.93	0.25	100,101,103,104	0
7	GDP	S	600	28/28	0.94	0.22	129,129,136,136	0
5	GTP	A	600	32/32	0.96	0.20	103,106,108,108	0
5	GTP	R	600	32/32	0.96	0.21	99,102,107,108	0
6	MG	A	601	1/1	0.99	0.21	38,38,38,38	0
6	MG	R	601	1/1	0.99	0.24	38,38,38,38	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.





6.5 Other polymers [i](#)

There are no such residues in this entry.