



wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 24, 2024 – 05:47 PM EDT

PDB ID : 7LJN
Title : Structure of the Bradyrhizobium diazoefficiens CD-NTase CdnG in complex with GTP
Authors : Govande, A.; Lowey, B.; Eaglesham, J.B.; Whiteley, A.T.; Kranzusch, P.J.
Deposited on : 2021-01-29
Resolution : 1.60 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 1.20.1
EDS : 2.37.1
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) : 2.37.1

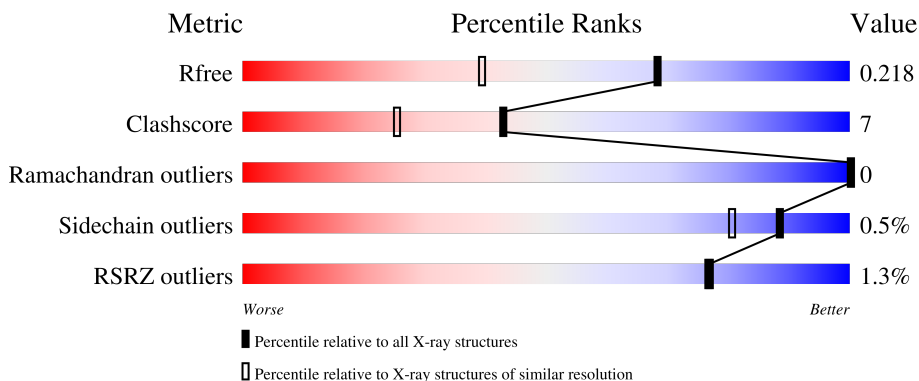
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.60 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	3398 (1.60-1.60)
Clashscore	141614	3665 (1.60-1.60)
Ramachandran outliers	138981	3564 (1.60-1.60)
Sidechain outliers	138945	3563 (1.60-1.60)
RSRZ outliers	127900	3321 (1.60-1.60)

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	416	
1	B	416	
1	C	416	
1	D	416	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 12830 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 CD-NTase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	342	2696	1697	486	503	10	0	0	0
1	B	335	2640	1661	479	490	10	0	0	0
1	C	337	2651	1668	479	494	10	0	0	0
1	D	339	2673	1683	483	497	10	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	SER	-	expression tag	UNP Q89Y83
B	1	SER	-	expression tag	UNP Q89Y83
C	1	SER	-	expression tag	UNP Q89Y83
D	1	SER	-	expression tag	UNP Q89Y83

- Molecule 2 is GUANOSINE-5'-TRIPHOSPHATE (three-letter code: GTP) (formula: $C_{10}H_{16}N_5O_{14}P_3$) (labeled as "Ligand of Interest" by depositor).



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

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

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

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	531	Total	O	0	0
			531	531		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	508	Total 508	O 508	0	0
4	C	512	Total 512	O 512	0	0
4	D	487	Total 487	O 487	0	0

ALA
ALA
PRO
ALA
ILE
ILE
GLY
ALA
ALA
THR
SER
SER
LEU
ALA
PRO
VAL
ALA
ALA
ARG
ALA
ALA
HIS
THR
THR
ASN
MET
GLY
GLU
ARG
ARG

● Molecule 1: CD-NTase



SER
SER
ASN
PHE
PRO
SER
LEU
ARG
ARG
ASP
ASP
ARG
PRO
ASP
ASP
P16
L21
E27
L28
E44
E54
R63
T81
Y88
D89
L107
D108
Y117
P118
R124
D140
E151
K152
A159
LYS
GLY
THR
ARG
SER
ASP
P167
M173
Y176

K180
R185
V213
L222
V227
R265
P266
G267
M268
E272
R283
E301
R306
R323
R336
THR
GLY
ASP
VAL
GLN
LEU
E343
F353
R356
S361
W362
K363
A364
F365
R366
Q367
ARG
LEU
GLY
ARG
GLN
VAL
GLN
SER
ARG
GLN
HIS
GLY
TYR
THR
ARG

SER
GLY
GLY
LEU
PHE
VAL
PRO
ALA
ALA
PRO
ALA
ILE
ILE
GLY
ALA
ALA
THR
SER
LEU
ALA
PRO
VAL
ALA
ALA
ARG
ALA
HIS
THR
MET
MET
GLY
GLU
ARG
ARG

4 Data and refinement statistics i

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	112.00Å 68.69Å 112.43Å 90.00° 108.41° 90.00°	Depositor
Resolution (Å)	37.94 – 1.60 37.94 – 1.60	Depositor EDS
% Data completeness (in resolution range)	98.9 (37.94-1.60) 98.2 (37.94-1.60)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.99 (at 1.60Å)	Xtrriage
Refinement program	PHENIX 1.18.2_3874	Depositor
R, R_{free}	0.197 , 0.218 0.198 , 0.218	Depositor DCC
R_{free} test set	2018 reflections (0.95%)	wwPDB-VP
Wilson B-factor (Å ²)	17.4	Xtrriage
Anisotropy	0.104	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 30.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.43$, $\langle L^2 \rangle = 0.26$	Xtrriage
Estimated twinning fraction	0.366 for l,-k,h	Xtrriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	12830	wwPDB-VP
Average B, all atoms (Å ²)	23.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 52.78 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 4.6345e-05.*

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: 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	0.33	0/2757	0.51	0/3750
1	B	0.35	0/2699	0.51	0/3670
1	C	0.34	0/2711	0.52	0/3689
1	D	0.33	0/2734	0.52	0/3717
All	All	0.34	0/10901	0.51	0/14826

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	2696	0	2666	30	0
1	B	2640	0	2620	54	0
1	C	2651	0	2625	27	0
1	D	2673	0	2645	34	0
2	A	32	0	12	0	0
2	B	32	0	12	0	0
2	C	32	0	12	0	0
2	D	32	0	12	0	0
3	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	A	531	0	0	16	3
4	B	508	0	0	22	6
4	C	512	0	0	13	3
4	D	487	0	0	21	1
All	All	12830	0	10604	145	7

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 7.

The worst 5 of 145 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:B:367:GLN:O	4:B:601:HOH:O	1.82	0.97
1:D:124:ARG:NH1	4:D:604:HOH:O	2.01	0.92
1:A:336:ARG:NH1	4:A:601:HOH:O	2.01	0.91
1:C:265:ARG:NH2	4:C:603:HOH:O	2.04	0.91
1:D:301:GLU:OE2	4:D:601:HOH:O	1.88	0.91

The worst 5 of 7 symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:1069:HOH:O	4:B:969:HOH:O[1_545]	1.94	0.26
4:B:1016:HOH:O	4:C:993:HOH:O[2_454]	2.00	0.20
4:A:1126:HOH:O	4:D:1014:HOH:O[2_545]	2.13	0.07
4:B:861:HOH:O	4:C:919:HOH:O[2_454]	2.13	0.07
4:B:1055:HOH:O	4:B:1085:HOH:O[2_454]	2.15	0.05

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	336/416 (81%)	333 (99%)	3 (1%)	0	100	100
1	B	329/416 (79%)	324 (98%)	5 (2%)	0	100	100
1	C	331/416 (80%)	330 (100%)	1 (0%)	0	100	100
1	D	333/416 (80%)	330 (99%)	3 (1%)	0	100	100
All	All	1329/1664 (80%)	1317 (99%)	12 (1%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	281/338 (83%)	279 (99%)	2 (1%)	84	73
1	B	275/338 (81%)	274 (100%)	1 (0%)	91	84
1	C	276/338 (82%)	274 (99%)	2 (1%)	84	73
1	D	278/338 (82%)	277 (100%)	1 (0%)	91	84
All	All	1110/1352 (82%)	1104 (100%)	6 (0%)	88	80

5 of 6 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	51	ARG
1	C	173	MET
1	D	173	MET
1	A	173	MET
1	A	67	PHE

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, 4 are monoatomic - leaving 4 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
2	GTP	A	501	3	29,34,34	1.23	2 (6%)	35,54,54	1.08	3 (8%)
2	GTP	C	501	3	29,34,34	1.19	3 (10%)	35,54,54	1.14	3 (8%)
2	GTP	B	501	3	29,34,34	1.15	2 (6%)	35,54,54	1.18	4 (11%)
2	GTP	D	501	3	29,34,34	1.22	2 (6%)	35,54,54	1.04	2 (5%)

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
2	GTP	A	501	3	-	3/18/38/38	0/3/3/3
2	GTP	C	501	3	-	2/18/38/38	0/3/3/3
2	GTP	B	501	3	-	1/18/38/38	0/3/3/3
2	GTP	D	501	3	-	2/18/38/38	0/3/3/3

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	501	GTP	C5-C6	-4.14	1.39	1.47
2	A	501	GTP	C5-C6	-4.01	1.39	1.47
2	C	501	GTP	C5-C6	-3.84	1.39	1.47
2	B	501	GTP	C5-C6	-3.80	1.39	1.47
2	A	501	GTP	PA-O3A	3.02	1.62	1.59

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	501	GTP	C8-N7-C5	3.71	108.87	102.55
2	B	501	GTP	C8-N7-C5	3.27	108.11	102.55
2	D	501	GTP	C8-N7-C5	3.11	107.85	102.55
2	A	501	GTP	C8-N7-C5	3.04	107.73	102.55
2	B	501	GTP	O4'-C1'-N9	-2.97	104.81	108.75

There are no chirality outliers.

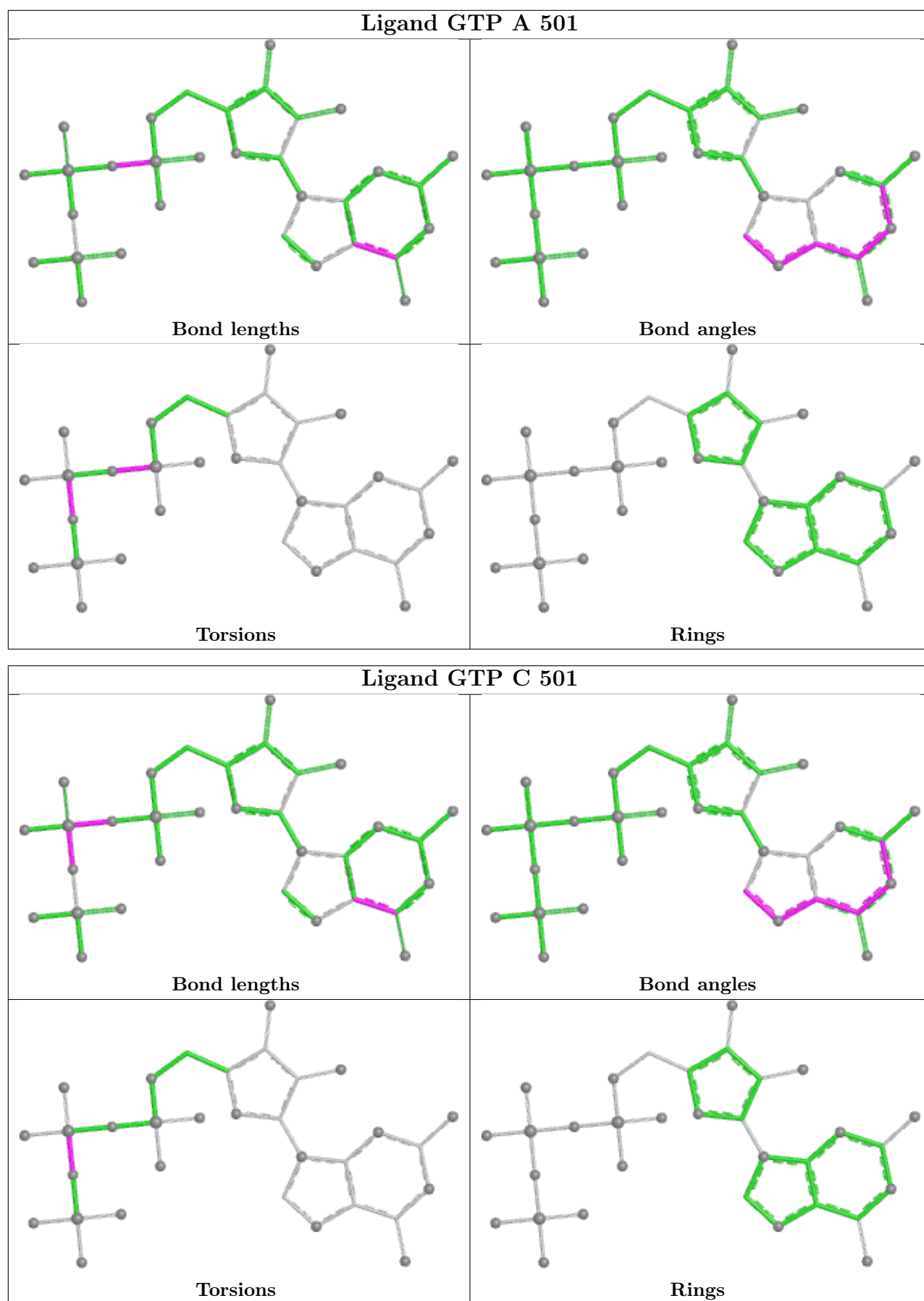
5 of 8 torsion outliers are listed below:

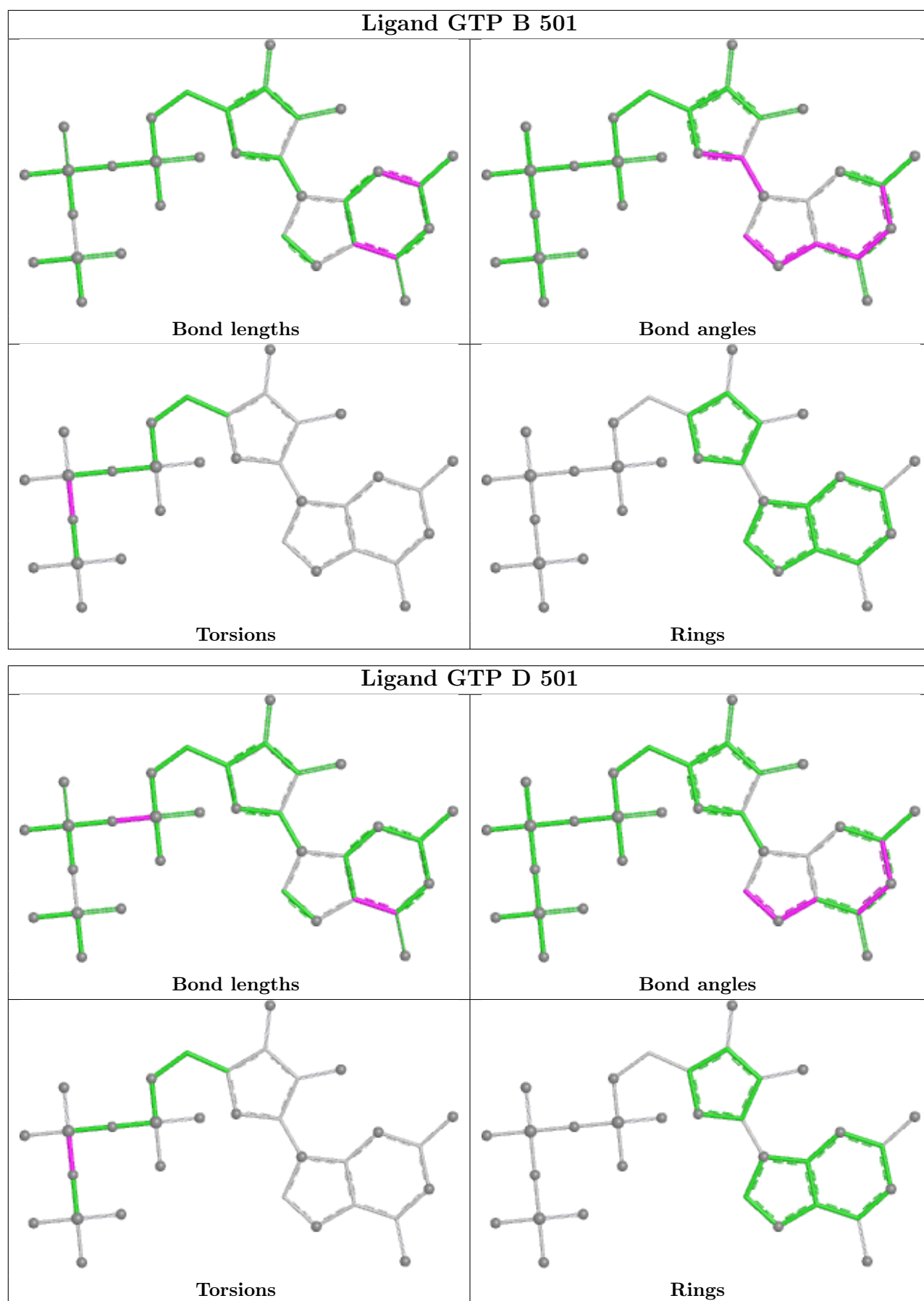
Mol	Chain	Res	Type	Atoms
2	A	501	GTP	PG-O3B-PB-O2B
2	B	501	GTP	PG-O3B-PB-O1B
2	C	501	GTP	PG-O3B-PB-O2B
2	D	501	GTP	PG-O3B-PB-O2B
2	A	501	GTP	PG-O3B-PB-O1B

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	342/416 (82%)	-0.47	3 (0%) 84 84	11, 19, 41, 63	0
1	B	335/416 (80%)	-0.49	4 (1%) 79 78	11, 20, 40, 58	0
1	C	337/416 (81%)	-0.51	5 (1%) 73 73	12, 20, 38, 50	0
1	D	339/416 (81%)	-0.50	6 (1%) 68 67	11, 20, 42, 65	0
All	All	1353/1664 (81%)	-0.49	18 (1%) 77 77	11, 20, 40, 65	0

The worst 5 of 18 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	365	PHE	10.0
1	A	342	LEU	4.9
1	D	267	GLY	4.4
1	B	367	GLN	3.6
1	D	363	LYS	3.4

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](#)

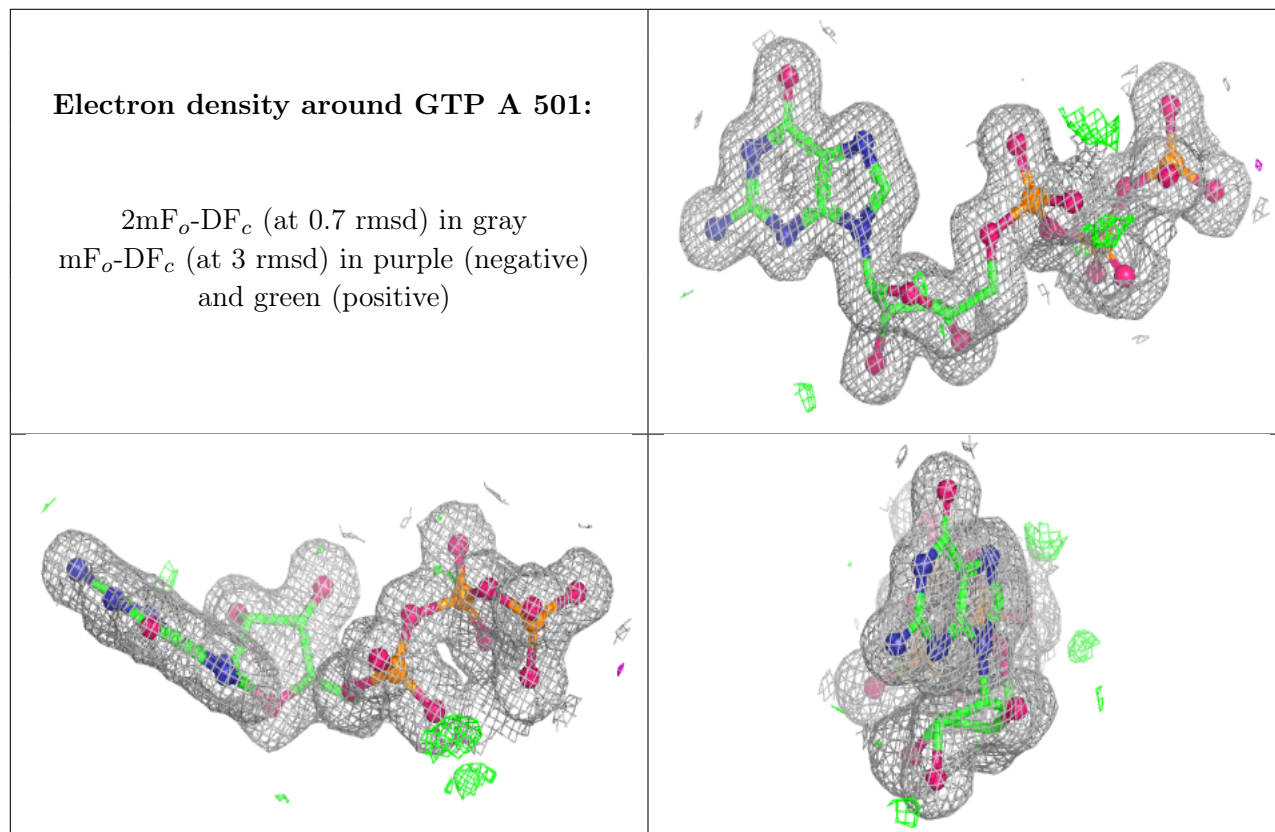
There are no monosaccharides in this entry.

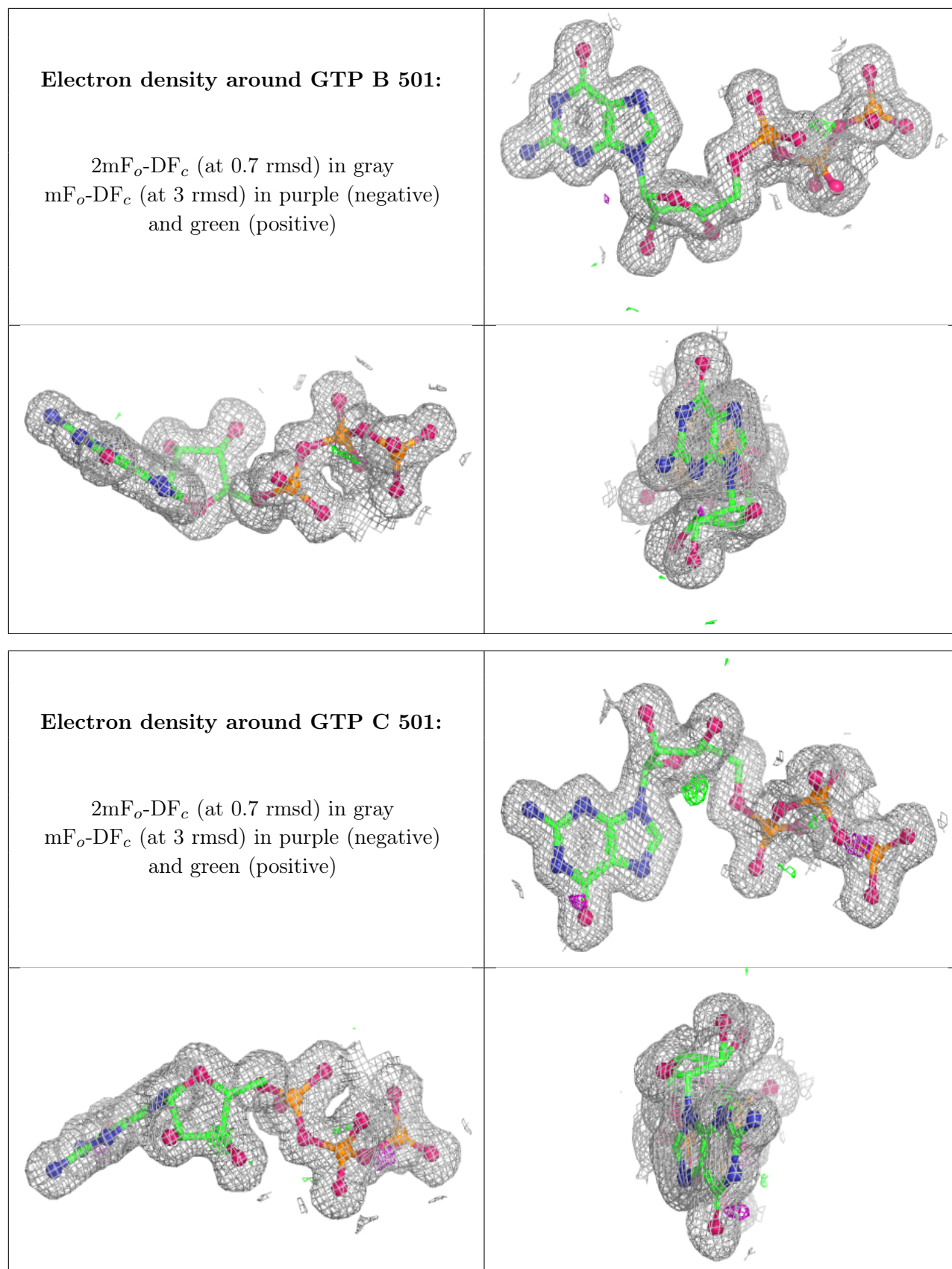
6.4 Ligands [i](#)

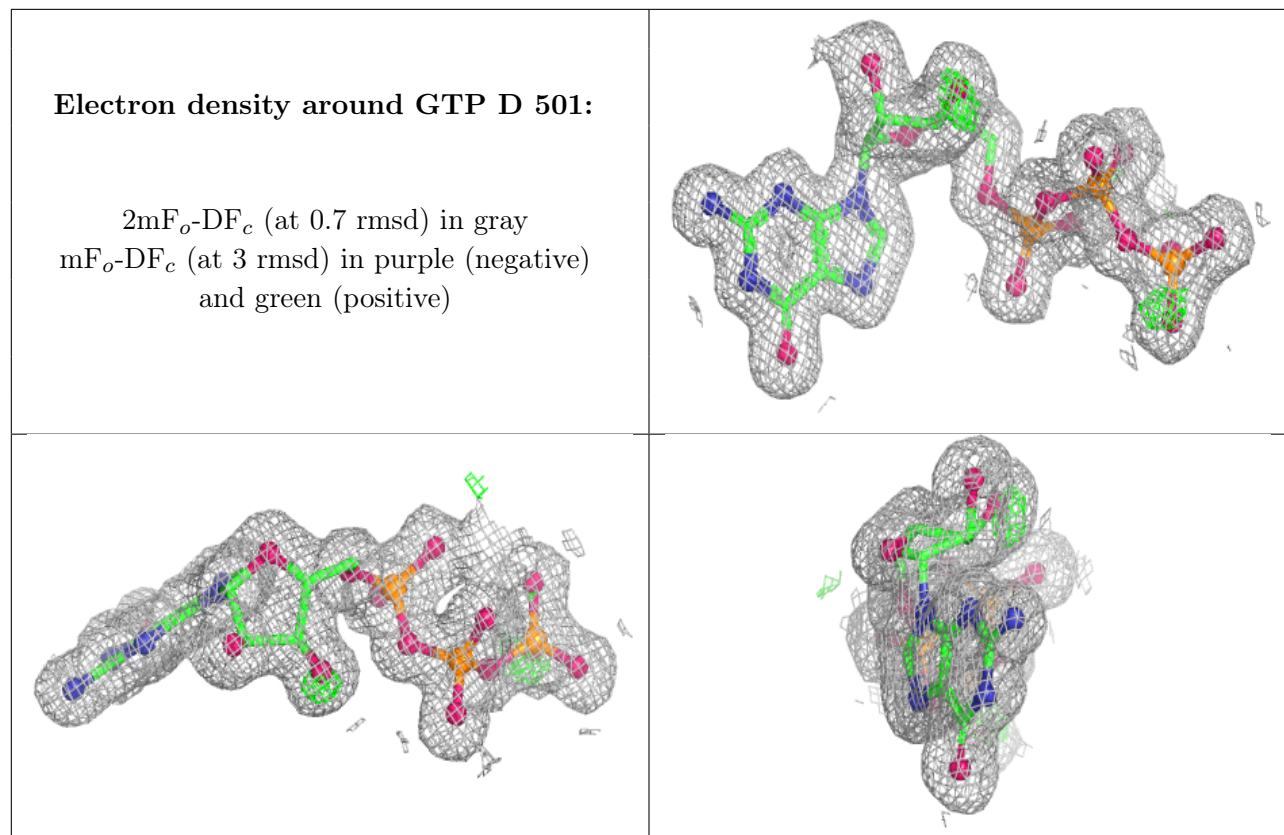
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	GTP	A	501	32/32	0.99	0.06	10,13,15,16	0
2	GTP	B	501	32/32	0.99	0.05	9,12,15,16	0
2	GTP	C	501	32/32	0.99	0.06	10,13,16,18	0
2	GTP	D	501	32/32	0.99	0.06	9,13,17,23	0
3	MG	B	502	1/1	0.99	0.04	12,12,12,12	0
3	MG	C	502	1/1	0.99	0.04	11,11,11,11	0
3	MG	D	502	1/1	0.99	0.04	12,12,12,12	0
3	MG	A	502	1/1	1.00	0.06	12,12,12,12	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.