



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 11:22 AM UTC

PDB ID : 4DU6 / pdb_00004du6
Title : Crystal structure of GTP cyclohydrolase I from Yersinia pestis complexed with GTP
Authors : Maltseva, N.; Kim, Y.; Kwon, K.; Anderson, W.F.; Joachimiak, A.; Center for Structural Genomics of Infectious Diseases (CSGID)
Deposited on : 2012-02-21
Resolution : 2.11 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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

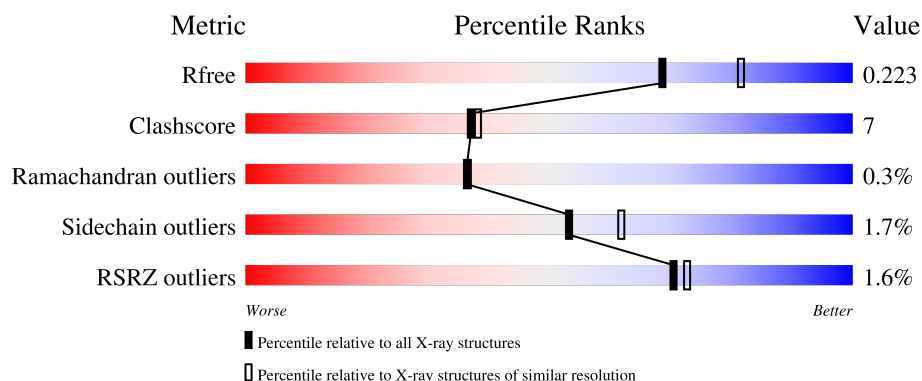
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.11 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}	180053	6658 (2.10-2.10)
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	223	2% 80% 17% ..
1	B	223	83% 13% ..
1	C	223	3% 85% 13% .
1	D	223	% 86% 11% .

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Mol	Chain	Length	Quality of chain
1	E	223	 2% 83% 12%

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
2	GTP	E	302	-	-	X	-
4	PEG	B	302	-	-	X	-

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 9163 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.

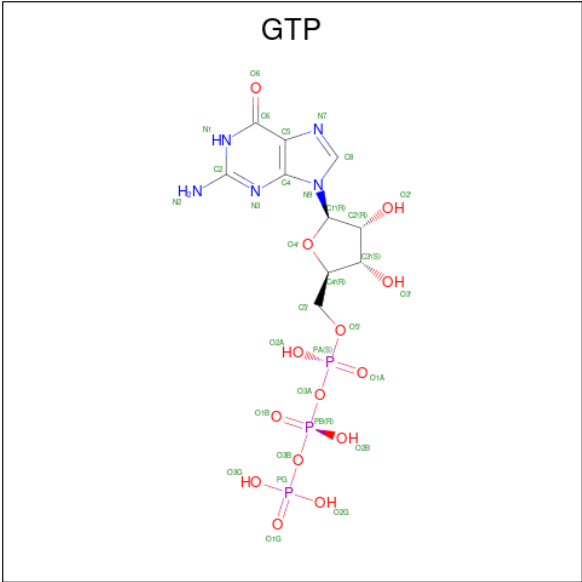
- Molecule 1 is a protein called GTP cyclohydrolase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	219	Total	C	N	O	S	0	6	0
			1778	1110	321	336	11			
1	B	216	Total	C	N	O	S	0	3	0
			1721	1078	307	327	9			
1	C	219	Total	C	N	O	S	0	6	0
			1775	1109	319	339	8			
1	D	216	Total	C	N	O	S	0	4	0
			1730	1081	308	332	9			
1	E	214	Total	C	N	O	S	0	7	0
			1741	1085	312	335	9			

There are 15 discrepancies between the modelled and reference sequences:

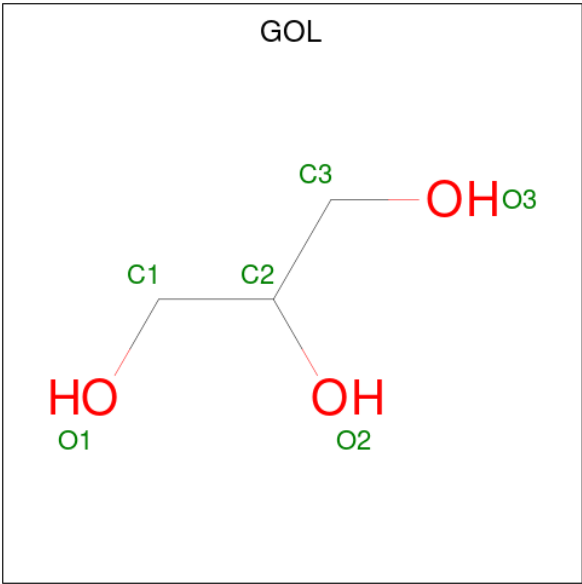
Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	SER	-	expression tag	UNP Q66C86
A	-1	ASN	-	expression tag	UNP Q66C86
A	0	ALA	-	expression tag	UNP Q66C86
B	-2	SER	-	expression tag	UNP Q66C86
B	-1	ASN	-	expression tag	UNP Q66C86
B	0	ALA	-	expression tag	UNP Q66C86
C	-2	SER	-	expression tag	UNP Q66C86
C	-1	ASN	-	expression tag	UNP Q66C86
C	0	ALA	-	expression tag	UNP Q66C86
D	-2	SER	-	expression tag	UNP Q66C86
D	-1	ASN	-	expression tag	UNP Q66C86
D	0	ALA	-	expression tag	UNP Q66C86
E	-2	SER	-	expression tag	UNP Q66C86
E	-1	ASN	-	expression tag	UNP Q66C86
E	0	ALA	-	expression tag	UNP Q66C86

- Molecule 2 is GUANOSINE-5'-TRIPHOSPHATE (CCD ID: GTP) (formula: $C_{10}H_{16}N_5O_{14}P_3$).



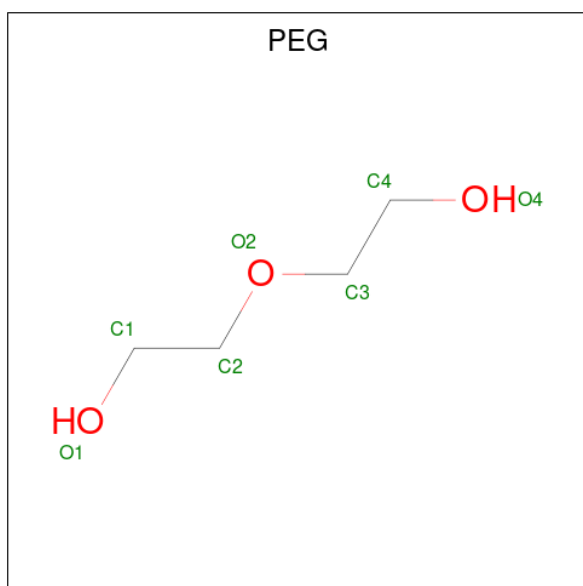
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			32	10	5	14	3		
2	B	1	Total	C	N	O	P	1	0
			32	10	5	14	3		
2	C	1	Total	C	N	O	P	0	0
			32	10	5	14	3		
2	D	1	Total	C	N	O	P	0	0
			32	10	5	14	3		
2	E	1	Total	C	N	O	P	0	0
			32	10	5	14	3		

- Molecule 3 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



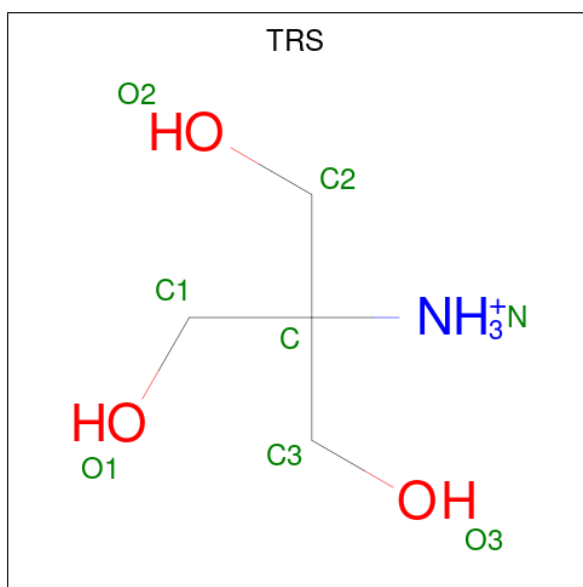
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			6	3	3		
3	B	1	Total	C	O	0	0
			6	3	3		
3	C	1	Total	C	O	0	0
			6	3	3		
3	C	1	Total	C	O	0	0
			6	3	3		
3	C	1	Total	C	O	0	0
			6	3	3		
3	D	1	Total	C	O	0	0
			6	3	3		
3	E	1	Total	C	O	0	0
			6	3	3		

- Molecule 4 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: $C_4H_{10}O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total	C	O	0	0
			7	4	3		

- Molecule 5 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (CCD ID: TRS) (formula: $C_4H_{12}NO_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	B	1	Total	C	N	O	0	0
			8	4	1	3		
5	C	1	Total	C	N	O	0	0
			8	4	1	3		
5	D	1	Total	C	N	O	0	0
			8	4	1	3		

- Molecule 6 is CALCIUM ION (CCD ID: CA) (formula: Ca).

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

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	34	Total	O	0	0
			34	34		
7	B	48	Total	O	0	0
			48	48		
7	C	45	Total	O	0	0
			45	45		

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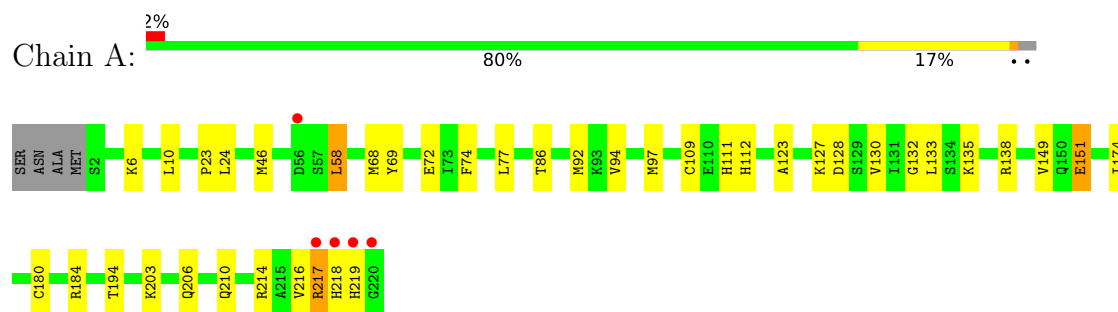
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	D	32	Total 32	O 32	0	0
7	E	23	Total 23	O 23	0	0

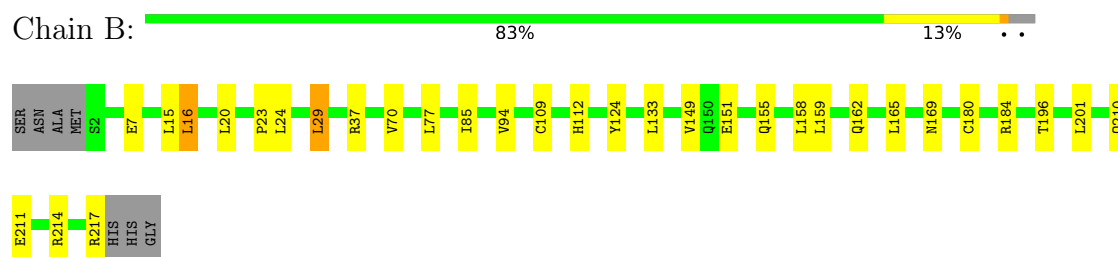
3 Residue-property plots [i](#)

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.

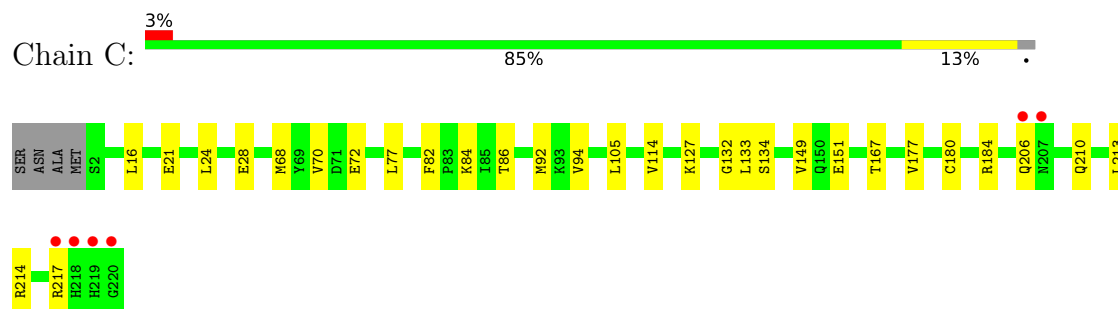
- Molecule 1: GTP cyclohydrolase 1



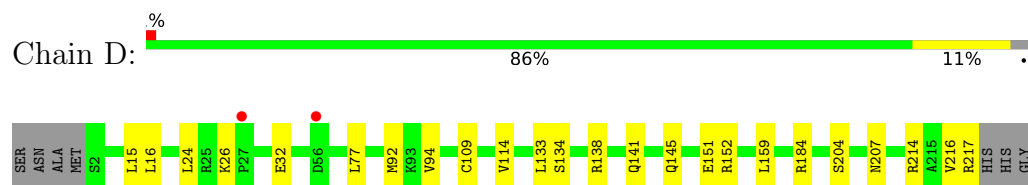
- Molecule 1: GTP cyclohydrolase 1



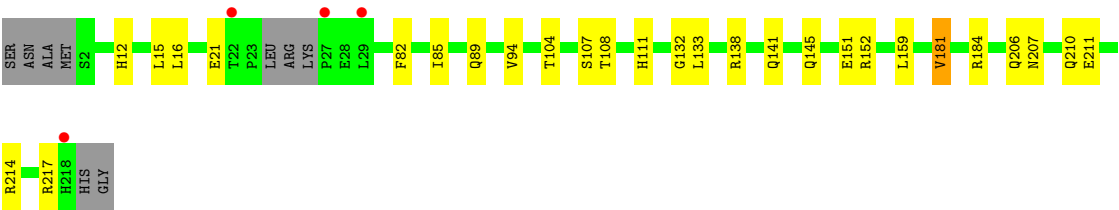
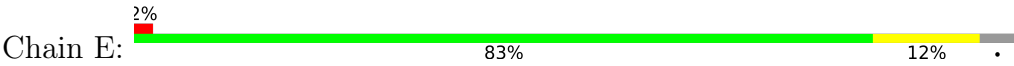
- Molecule 1: GTP cyclohydrolase 1



- Molecule 1: GTP cyclohydrolase 1



● Molecule 1: GTP cyclohydrolase 1



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	174.05Å 104.91Å 70.07Å 90.00° 96.89° 90.00°	Depositor
Resolution (Å)	43.20 – 2.11 43.20 – 2.11	Depositor EDS
% Data completeness (in resolution range)	96.3 (43.20-2.11) 96.4 (43.20-2.11)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.06	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.01 (at 2.10Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.7.3_920)	Depositor
R, R_{free}	0.180 , 0.225 0.179 , 0.223	Depositor DCC
R_{free} test set	3520 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	37.6	Xtriage
Anisotropy	0.934	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 47.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	9163	wwPDB-VP
Average B, all atoms (Å ²)	57.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.21% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, PEG, CA, TRS, 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	0.76	0/1802	0.95	1/2436 (0.0%)
1	B	0.81	0/1743	0.99	1/2358 (0.0%)
1	C	0.78	0/1799	0.96	3/2433 (0.1%)
1	D	0.71	0/1752	0.94	0/2370
1	E	0.62	0/1763	0.88	1/2383 (0.0%)
All	All	0.74	0/8859	0.95	6/11980 (0.1%)

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	70	VAL	N-CA-C	6.69	116.84	110.42
1	C	82	PHE	CA-C-N	-5.78	114.01	119.85
1	C	82	PHE	C-N-CA	-5.78	114.01	119.85
1	E	181	VAL	CB-CA-C	-5.43	106.09	111.30
1	C	70	VAL	N-CA-C	5.20	115.97	110.72
1	A	203	LYS	N-CA-C	-5.14	107.14	113.41

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	1778	0	1814	39	0
1	B	1721	0	1767	28	0
1	C	1775	0	1804	27	0
1	D	1730	0	1765	19	0
1	E	1741	0	1761	26	0
2	A	32	0	12	8	0
2	B	32	0	12	3	0
2	C	32	0	12	8	0
2	D	32	0	12	5	0
2	E	32	0	12	10	0
3	A	6	0	8	0	0
3	B	6	0	8	2	0
3	C	18	0	24	2	0
3	D	6	0	8	0	0
3	E	6	0	8	0	0
4	B	7	0	10	10	0
5	B	8	0	12	1	0
5	C	8	0	12	1	0
5	D	8	0	12	2	0
6	B	1	0	0	0	0
6	C	1	0	0	0	0
6	D	1	0	0	0	0
7	A	34	0	0	6	0
7	B	48	0	0	1	0
7	C	45	0	0	2	0
7	D	32	0	0	1	0
7	E	23	0	0	1	0
All	All	9163	0	9073	128	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 7.

All (128) 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:D:109[B]:CYS:SG	7:D:421:HOH:O	2.30	0.90
1:E:16:LEU:HD23	1:E:21[B]:GLU:HG2	1.54	0.87
1:C:180[A]:CYS:SG	7:C:433:HOH:O	2.41	0.79
1:C:177:VAL:HG23	3:C:306:GOL:H31	1.63	0.79
3:B:301:GOL:H31	4:B:302:PEG:H31	1.68	0.75
1:B:16:LEU:HD11	5:B:303:TRS:H11	1.69	0.75
4:B:302:PEG:H11	7:B:411:HOH:O	1.86	0.75

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:109[A]:CYS:SG	7:A:434:HOH:O	2.45	0.74
1:A:151:GLU:HB2	1:E:94:VAL:HG21	1.70	0.72
2:B:304:GTP:O1G	1:C:184:ARG:NH2	2.20	0.72
3:B:301:GOL:H32	4:B:302:PEG:H12	1.72	0.71
1:B:214:ARG:HD3	1:C:217:ARG:NH1	2.07	0.70
1:A:180[B]:CYS:SG	7:A:434:HOH:O	2.51	0.69
7:A:426:HOH:O	1:B:109[A]:CYS:SG	2.51	0.69
1:C:94:VAL:HG21	1:D:151:GLU:HB3	1.75	0.68
1:E:207[B]:ASN:ND2	1:E:211:GLU:OE2	2.27	0.68
1:D:94:VAL:HG21	1:E:151:GLU:HB3	1.77	0.66
1:D:24:LEU:HD21	1:D:77:LEU:HD22	1.77	0.66
1:B:159:LEU:HB2	4:B:302:PEG:H22	1.75	0.66
1:C:16:LEU:HD21	5:C:303:TRS:H11	1.77	0.66
1:E:214:ARG:HG2	1:E:217:ARG:NH1	2.10	0.66
1:D:138:ARG:NH1	2:D:302:GTP:O2G	2.29	0.65
1:A:109[B]:CYS:SG	7:A:425:HOH:O	2.54	0.65
1:B:112:HIS:HB2	1:B:180[B]:CYS:SG	2.37	0.64
1:E:138[A]:ARG:NH1	2:E:302:GTP:O2G	2.29	0.64
1:D:214:ARG:HD2	1:E:217:ARG:NH1	2.14	0.62
1:D:15:LEU:HD23	1:D:159:LEU:HD23	1.82	0.62
1:D:16:LEU:HD11	5:D:303:TRS:H11	1.81	0.61
1:A:112:HIS:HB2	1:A:180[B]:CYS:SG	2.41	0.59
1:A:180[A]:CYS:SG	2:E:302:GTP:H8	2.25	0.59
1:E:15:LEU:HD23	1:E:159:LEU:HD23	1.85	0.59
1:B:162:GLN:HE22	4:B:302:PEG:H32	1.67	0.59
1:A:24:LEU:HD21	1:A:77:LEU:HD22	1.85	0.58
1:C:134:SER:N	2:C:302:GTP:O2'	2.26	0.57
2:C:302:GTP:O1G	1:D:184:ARG:NH1	2.32	0.57
1:B:15:LEU:HD23	1:B:159:LEU:HD23	1.86	0.57
1:A:46:MET:HE1	1:A:58[B]:LEU:HD12	1.86	0.57
1:C:24:LEU:HD21	1:C:77:LEU:HD22	1.86	0.57
1:A:111:HIS:ND1	2:E:302:GTP:H5''	2.21	0.56
3:C:306:GOL:O3	3:C:306:GOL:O1	2.21	0.56
1:B:158:LEU:HG	4:B:302:PEG:H21	1.88	0.56
1:E:133:LEU:N	2:E:302:GTP:H1'	2.20	0.56
1:A:149:VAL:HG12	1:A:151:GLU:HG2	1.88	0.55
1:B:24:LEU:HD21	1:B:77:LEU:HD22	1.88	0.55
1:B:94:VAL:HG21	1:C:151:GLU:HB3	1.89	0.54
1:A:216:VAL:O	1:A:219:HIS:N	2.41	0.54
7:A:434:HOH:O	2:E:302:GTP:H2'	2.08	0.54
1:A:69:TYR:O	1:A:74:PHE:HB2	2.08	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:207[B]:ASN:C	1:E:207[B]:ASN:HD22	2.16	0.54
1:D:92:MET:HE2	1:E:152:ARG:HB2	1.89	0.53
1:B:29:LEU:HD21	1:B:37:ARG:NH1	2.24	0.52
1:C:24:LEU:HD12	7:C:439:HOH:O	2.09	0.52
1:C:92:MET:HE2	1:D:152:ARG:HB2	1.91	0.52
1:A:206:GLN:O	1:A:210:GLN:HG2	2.09	0.52
1:D:141:GLN:O	1:D:145:GLN:HG2	2.10	0.52
1:B:162:GLN:NE2	4:B:302:PEG:H32	2.25	0.51
1:E:133:LEU:H	2:E:302:GTP:H1'	1.75	0.51
1:C:86:THR:HG21	2:C:302:GTP:O5'	2.11	0.50
1:C:132:GLY:HA2	2:C:302:GTP:H1'	1.93	0.50
1:A:214:ARG:HA	1:A:217:ARG:HG3	1.92	0.50
1:E:141[A]:GLN:O	1:E:145:GLN:HG2	2.12	0.50
1:A:132:GLY:HA2	2:A:301:GTP:H1'	1.94	0.49
1:A:94:VAL:HG21	1:B:151:GLU:HB3	1.94	0.49
1:C:114:VAL:HG22	1:C:180[A]:CYS:SG	2.51	0.49
1:A:217:ARG:HE	1:E:214:ARG:HH11	1.58	0.49
1:B:133:LEU:H	2:B:304:GTP:H1'	1.76	0.48
1:B:211:GLU:HG2	1:C:213:LEU:HD13	1.95	0.48
2:D:302:GTP:PG	1:E:184:ARG:HH22	2.36	0.48
1:D:26:LYS:HE2	5:D:303:TRS:H21	1.96	0.48
1:B:158:LEU:HD23	4:B:302:PEG:H12	1.96	0.47
1:A:111:HIS:HD1	2:E:302:GTP:H5''	1.79	0.47
1:A:219:HIS:ND1	7:A:401:HOH:O	2.35	0.47
1:A:214:ARG:HH11	1:B:210:GLN:NE2	2.12	0.46
1:D:216:VAL:O	1:D:217:ARG:HB2	2.16	0.46
1:A:138[A]:ARG:NH1	2:A:301:GTP:O1G	2.48	0.46
1:B:155:GLN:O	4:B:302:PEG:O1	2.33	0.46
1:A:180[B]:CYS:O	1:A:184:ARG:HG3	2.15	0.46
1:A:133:LEU:H	2:A:301:GTP:H1'	1.80	0.46
1:D:134:SER:HB3	1:E:181:VAL:HG22	1.98	0.45
1:E:138[B]:ARG:NE	2:E:302:GTP:O2G	2.44	0.45
1:E:207[A]:ASN:ND2	7:E:423:HOH:O	2.48	0.45
1:C:84:LYS:NZ	2:C:302:GTP:O1B	2.49	0.45
1:A:214:ARG:HD2	1:B:217:ARG:HH12	1.81	0.45
1:B:15:LEU:HD22	1:B:20:LEU:HB3	1.98	0.45
1:A:92:MET:HG2	1:A:94:VAL:HG23	1.98	0.45
1:A:10:LEU:HD12	1:A:10:LEU:HA	1.81	0.45
1:A:132:GLY:CA	2:A:301:GTP:H1'	2.46	0.45
1:C:16:LEU:HA	1:C:21[B]:GLU:CG	2.47	0.44
1:C:16:LEU:HG	1:C:21[B]:GLU:HG2	1.98	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:206:GLN:O	1:E:210:GLN:HG2	2.17	0.44
1:D:133:LEU:HG	2:D:302:GTP:C2	2.52	0.44
1:B:133:LEU:N	2:B:304:GTP:H1'	2.33	0.44
1:A:151:GLU:OE2	2:E:302:GTP:N1	2.35	0.43
1:C:21[B]:GLU:H	1:C:21[B]:GLU:HG3	1.39	0.43
1:A:86:THR:OG1	2:A:301:GTP:O1A	2.28	0.43
1:B:124:TYR:CD2	1:B:165:LEU:HD13	2.54	0.43
1:C:127:LYS:HE3	1:C:167:THR:HB	2.00	0.43
1:B:169:ASN:OD1	1:B:201:LEU:HG	2.19	0.43
1:B:214:ARG:HD3	1:C:217:ARG:HH12	1.81	0.42
1:A:97[A]:MET:HG3	1:A:123:ALA:HB1	2.02	0.42
1:A:174:ILE:O	1:A:194:THR:HA	2.20	0.42
1:B:7:GLU:HG2	1:B:85:ILE:HB	2.02	0.42
1:C:132:GLY:CA	2:C:302:GTP:H1'	2.48	0.42
1:A:217:ARG:HE	1:E:214:ARG:NH1	2.16	0.42
1:B:20:LEU:HD11	1:B:155:GLN:HB3	2.02	0.42
1:E:12:HIS:NE2	1:E:16:LEU:HD11	2.34	0.42
1:C:133:LEU:HG	2:C:302:GTP:C2	2.55	0.41
2:D:302:GTP:H5''	1:E:111:HIS:ND1	2.35	0.41
1:E:132:GLY:HA3	2:E:302:GTP:H4'	2.02	0.41
1:C:149:VAL:HG13	1:C:151:GLU:OE1	2.21	0.41
1:A:133:LEU:N	2:A:301:GTP:H1'	2.36	0.41
1:A:216:VAL:O	1:A:218:HIS:N	2.54	0.41
1:C:68:MET:HA	1:C:72[A]:GLU:OE1	2.20	0.41
1:D:138:ARG:NH1	2:D:302:GTP:O1G	2.54	0.41
1:D:92:MET:HE3	1:D:92:MET:HB3	1.83	0.41
2:C:302:GTP:N2	1:D:151:GLU:OE2	2.43	0.41
1:A:135:LYS:NZ	2:A:301:GTP:O3B	2.51	0.41
1:B:159:LEU:CB	4:B:302:PEG:H22	2.48	0.41
1:E:89:GLN:H	1:E:89:GLN:HG3	1.65	0.41
1:B:210:GLN:HB3	1:B:214:ARG:CZ	2.51	0.40
1:A:68:MET:HA	1:A:72:GLU:OE1	2.21	0.40
1:C:68:MET:HA	1:C:72[A]:GLU:HB2	2.03	0.40
1:C:206[B]:GLN:O	1:C:210:GLN:HG2	2.22	0.40
1:A:130:VAL:HG12	2:A:301:GTP:N2	2.36	0.40
1:E:82:PHE:CE2	1:E:85:ILE:HD11	2.56	0.40
1:E:107:SER:OG	1:E:108:THR:N	2.54	0.40
1:A:216:VAL:O	1:A:219:HIS:HB2	2.21	0.40
1:A:127:LYS:HB3	1:A:128:ASP:H	1.69	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	224/223 (100%)	217 (97%)	5 (2%)	2 (1%)	14	10
1	B	217/223 (97%)	211 (97%)	5 (2%)	1 (0%)	24	22
1	C	223/223 (100%)	217 (97%)	6 (3%)	0	100	100
1	D	218/223 (98%)	212 (97%)	6 (3%)	0	100	100
1	E	217/223 (97%)	211 (97%)	6 (3%)	0	100	100
All	All	1099/1115 (99%)	1068 (97%)	28 (2%)	3 (0%)	36	36

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	217	ARG
1	B	23	PRO
1	A	23	PRO

5.3.2 Protein sidechains

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	200/196 (102%)	196 (98%)	4 (2%)	48	56
1	B	194/196 (99%)	189 (97%)	5 (3%)	40	46
1	C	199/196 (102%)	195 (98%)	4 (2%)	48	56
1	D	195/196 (100%)	191 (98%)	4 (2%)	47	54
1	E	196/196 (100%)	195 (100%)	1 (0%)	81	88

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	984/980 (100%)	966 (98%)	18 (2%)	53 60

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	6	LYS
1	A	58[A]	LEU
1	A	58[B]	LEU
1	A	151	GLU
1	B	16	LEU
1	B	29	LEU
1	B	149	VAL
1	B	184	ARG
1	B	196	THR
1	C	28	GLU
1	C	105[A]	LEU
1	C	105[B]	LEU
1	C	214	ARG
1	D	32	GLU
1	D	114	VAL
1	D	204	SER
1	D	207	ASN
1	E	104	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	47	HIS
1	B	207	ASN
1	B	210	GLN
1	C	218	HIS
1	D	207	ASN
1	E	137	ASN
1	E	206	GLN
1	E	210	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 19 ligands modelled in this entry, 3 are monoatomic - leaving 16 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	$\# Z > 2$
3	GOL	A	302	-	5,5,5	0.48	0	5,5,5	0.54	0
5	TRS	C	303	-	7,7,7	0.27	0	9,9,9	0.44	0
5	TRS	B	303	-	7,7,7	0.27	0	9,9,9	0.51	0
2	GTP	D	302	-	33,34,34	1.00	2 (6%)	50,54,54	1.63	11 (22%)
3	GOL	B	301	-	5,5,5	0.28	0	5,5,5	0.90	0
3	GOL	D	301	-	5,5,5	0.47	0	5,5,5	0.95	0
4	PEG	B	302	-	6,6,6	0.45	0	5,5,5	0.46	0
3	GOL	E	301	-	5,5,5	0.48	0	5,5,5	1.00	0
3	GOL	C	306	-	5,5,5	0.34	0	5,5,5	0.56	0
5	TRS	D	303	-	7,7,7	0.34	0	9,9,9	0.38	0
3	GOL	C	301	-	5,5,5	0.35	0	5,5,5	0.54	0
2	GTP	B	304	-	33,34,34	1.18	1 (3%)	50,54,54	1.69	11 (22%)
2	GTP	A	301	-	33,34,34	1.10	1 (3%)	50,54,54	1.66	11 (22%)
3	GOL	C	305	-	5,5,5	0.37	0	5,5,5	0.30	0
2	GTP	C	302	-	33,34,34	1.15	1 (3%)	50,54,54	1.71	12 (24%)
2	GTP	E	302	-	33,34,34	1.16	4 (12%)	50,54,54	1.59	9 (18%)

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
3	GOL	A	302	-	-	2/4/4/4	-
5	TRS	C	303	-	-	3/9/9/9	-
5	TRS	B	303	-	-	9/9/9/9	-
2	GTP	D	302	-	-	4/22/38/38	0/3/3/3
3	GOL	B	301	-	-	0/4/4/4	-
3	GOL	D	301	-	-	0/4/4/4	-
4	PEG	B	302	-	-	1/4/4/4	-
3	GOL	E	301	-	-	0/4/4/4	-
3	GOL	C	306	-	-	2/4/4/4	-
5	TRS	D	303	-	-	0/9/9/9	-
3	GOL	C	301	-	-	2/4/4/4	-
2	GTP	B	304	-	-	5/22/38/38	0/3/3/3
2	GTP	A	301	-	-	8/22/38/38	0/3/3/3
3	GOL	C	305	-	-	2/4/4/4	-
2	GTP	C	302	-	-	6/22/38/38	0/3/3/3
2	GTP	E	302	-	-	7/22/38/38	0/3/3/3

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	304	GTP	PB-O3B	4.33	1.64	1.59
2	C	302	GTP	PB-O3B	4.12	1.63	1.59
2	A	301	GTP	PB-O3B	3.46	1.63	1.59
2	E	302	GTP	PB-O3B	3.30	1.63	1.59
2	E	302	GTP	PA-O3A	2.69	1.62	1.59
2	D	302	GTP	PB-O3B	2.64	1.62	1.59
2	E	302	GTP	PB-O3A	2.44	1.62	1.59
2	E	302	GTP	C2-N3	2.01	1.38	1.33
2	D	302	GTP	C2-N3	2.01	1.38	1.33

All (54) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	E	302	GTP	C5-C4-N3	-4.94	120.53	128.39
2	A	301	GTP	C2-N3-C4	4.49	120.03	112.30
2	C	302	GTP	C2-N3-C4	4.49	120.03	112.30
2	D	302	GTP	C2-N3-C4	4.47	120.00	112.30
2	B	304	GTP	C5-C4-N3	-4.45	121.31	128.39
2	D	302	GTP	C5-C4-N3	-4.40	121.39	128.39
2	E	302	GTP	C2-N3-C4	4.32	119.75	112.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	301	GTP	C5-C4-N3	-4.02	121.99	128.39
2	C	302	GTP	C5-C4-N3	-3.81	122.33	128.39
2	B	304	GTP	C2-N3-C4	3.80	118.85	112.30
2	B	304	GTP	C2-N1-C6	-3.36	119.01	125.11
2	A	301	GTP	C2-N1-C6	-3.30	119.12	125.11
2	A	301	GTP	O6-C6-C5	-3.28	117.89	126.53
2	E	302	GTP	C2-N1-C6	-3.21	119.29	125.11
2	C	302	GTP	N2-C2-N1	3.17	123.44	116.76
2	B	304	GTP	O4'-C1'-N9	3.12	115.43	108.36
2	C	302	GTP	O4'-C1'-N9	3.10	115.39	108.36
2	C	302	GTP	O6-C6-C5	-3.05	118.48	126.53
2	C	302	GTP	C2-N1-C6	-3.05	119.58	125.11
2	E	302	GTP	N9-C4-N3	2.97	131.90	125.95
2	D	302	GTP	C2-N1-C6	-2.90	119.85	125.11
2	A	301	GTP	C5-C6-N1	2.89	120.60	113.25
2	B	304	GTP	O6-C6-C5	-2.86	118.99	126.53
2	B	304	GTP	O2B-PB-O3B	2.71	114.60	107.27
2	D	302	GTP	O6-C6-C5	-2.64	119.56	126.53
2	D	302	GTP	C5-C6-N1	2.61	119.89	113.25
2	E	302	GTP	C5-C6-N1	2.57	119.80	113.25
2	D	302	GTP	N9-C4-N3	2.56	131.08	125.95
2	C	302	GTP	C5-C6-N1	2.52	119.68	113.25
2	D	302	GTP	N9-C8-N7	-2.52	108.73	113.40
2	B	304	GTP	O3G-PG-O3B	2.48	112.94	104.64
2	B	304	GTP	C5-C6-N1	2.46	119.53	113.25
2	D	302	GTP	O4'-C1'-N9	2.44	113.88	108.36
2	A	301	GTP	N9-C8-N7	-2.37	109.00	113.40
2	B	304	GTP	N9-C4-N3	2.33	130.61	125.95
2	A	301	GTP	N9-C4-N3	2.32	130.60	125.95
2	C	302	GTP	C1'-N9-C8	2.30	133.25	126.73
2	E	302	GTP	O6-C6-C5	-2.30	120.47	126.53
2	A	301	GTP	O2B-PB-O3B	2.29	113.46	107.27
2	E	302	GTP	N9-C8-N7	-2.29	109.16	113.40
2	C	302	GTP	O2B-PB-O3B	2.27	113.41	107.27
2	A	301	GTP	N2-C2-N1	2.26	121.53	116.76
2	E	302	GTP	O3G-PG-O3B	2.23	112.10	104.64
2	E	302	GTP	C8-N7-C5	2.22	108.22	104.26
2	C	302	GTP	C1'-N9-C4	-2.20	119.98	126.49
2	B	304	GTP	O4'-C1'-C2'	-2.18	101.96	106.62
2	A	301	GTP	O4'-C1'-N9	2.16	113.25	108.36
2	D	302	GTP	N2-C2-N1	2.14	121.27	116.76
2	D	302	GTP	C8-N7-C5	2.13	108.06	104.26

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	302	GTP	O2B-PB-O3B	2.13	113.03	107.27
2	C	302	GTP	O2G-PG-O3B	2.12	111.75	104.64
2	B	304	GTP	N2-C2-N1	2.08	121.15	116.76
2	C	302	GTP	O2A-PA-O3A	2.07	112.87	107.27
2	A	301	GTP	O2'-C2'-C3'	2.04	118.36	111.82

There are no chirality outliers.

All (51) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	301	GTP	O4'-C4'-C5'-O5'
2	B	304	GTP	C5'-O5'-PA-O3A
2	B	304	GTP	C5'-O5'-PA-O1A
2	B	304	GTP	C5'-O5'-PA-O2A
2	C	302	GTP	C5'-O5'-PA-O3A
2	C	302	GTP	C5'-O5'-PA-O1A
2	C	302	GTP	C5'-O5'-PA-O2A
2	C	302	GTP	O4'-C4'-C5'-O5'
2	D	302	GTP	C5'-O5'-PA-O3A
2	D	302	GTP	C5'-O5'-PA-O2A
2	E	302	GTP	C5'-O5'-PA-O1A
2	E	302	GTP	C5'-O5'-PA-O2A
3	A	302	GOL	O1-C1-C2-C3
3	C	301	GOL	O1-C1-C2-C3
3	C	305	GOL	O1-C1-C2-C3
5	B	303	TRS	C2-C-C1-O1
5	C	303	TRS	C1-C-C2-O2
5	C	303	TRS	C3-C-C2-O2
2	A	301	GTP	C3'-C4'-C5'-O5'
2	B	304	GTP	O4'-C4'-C5'-O5'
2	C	302	GTP	C3'-C4'-C5'-O5'
2	E	302	GTP	O4'-C4'-C5'-O5'
2	E	302	GTP	C3'-C4'-C5'-O5'
3	C	306	GOL	O1-C1-C2-O2
2	B	304	GTP	C3'-C4'-C5'-O5'
2	D	302	GTP	O4'-C4'-C5'-O5'
2	D	302	GTP	C3'-C4'-C5'-O5'
3	C	306	GOL	O1-C1-C2-C3
3	C	301	GOL	O1-C1-C2-O2
5	B	303	TRS	C1-C-C2-O2
3	C	305	GOL	O1-C1-C2-O2
2	A	301	GTP	PG-O3B-PB-O1B

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Mol	Chain	Res	Type	Atoms
5	B	303	TRS	C3-C-C1-O1
5	B	303	TRS	N-C-C1-O1
5	B	303	TRS	C3-C-C2-O2
5	B	303	TRS	N-C-C3-O3
3	A	302	GOL	O1-C1-C2-O2
5	B	303	TRS	C1-C-C3-O3
5	B	303	TRS	C2-C-C3-O3
2	A	301	GTP	C5'-O5'-PA-O3A
2	A	301	GTP	C5'-O5'-PA-O1A
2	A	301	GTP	C5'-O5'-PA-O2A
2	E	302	GTP	C5'-O5'-PA-O3A
2	A	301	GTP	C4'-C5'-O5'-PA
2	E	302	GTP	C4'-C5'-O5'-PA
5	B	303	TRS	N-C-C2-O2
5	C	303	TRS	N-C-C2-O2
2	A	301	GTP	PG-O3B-PB-O2B
2	C	302	GTP	C4'-C5'-O5'-PA
4	B	302	PEG	O2-C3-C4-O4
2	E	302	GTP	PA-O3A-PB-O2B

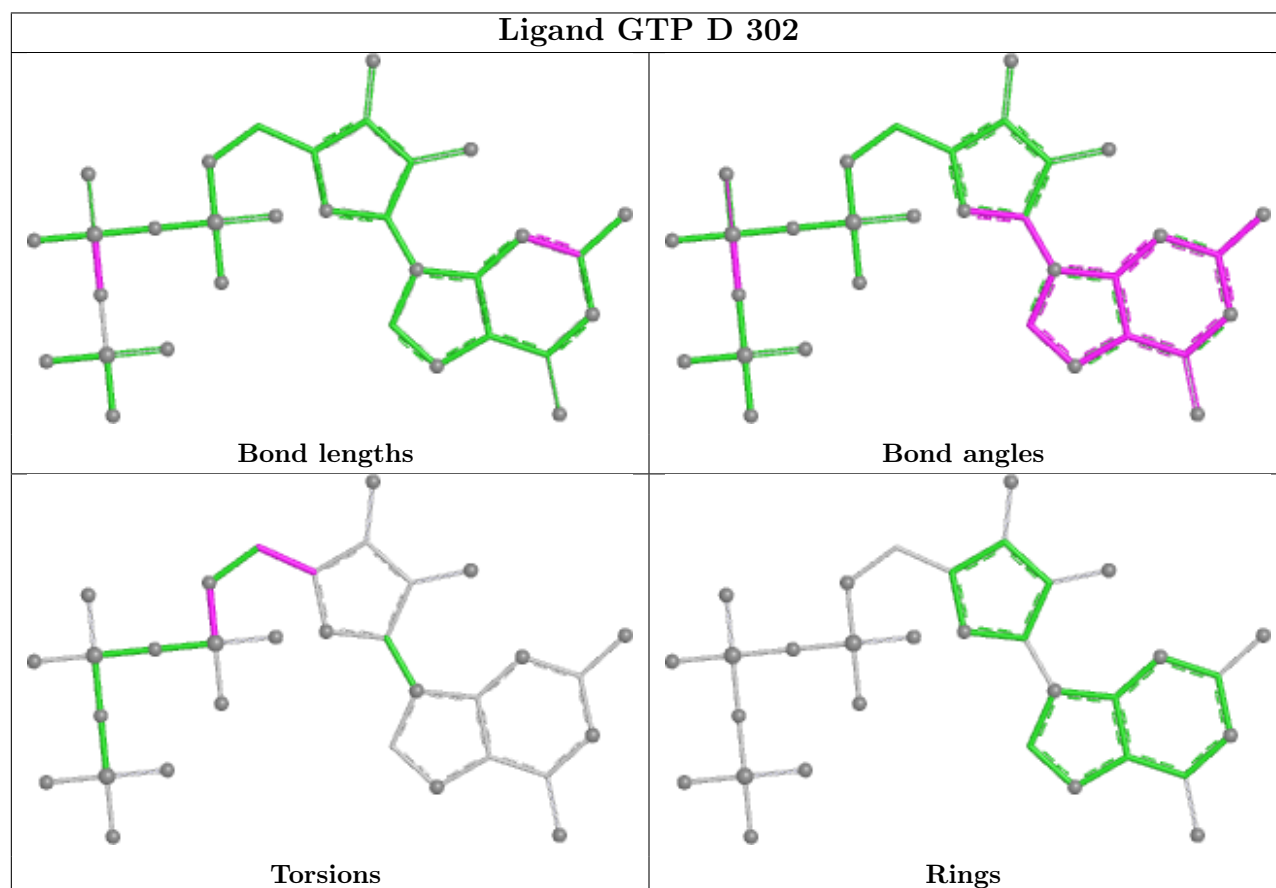
There are no ring outliers.

11 monomers are involved in 50 short contacts:

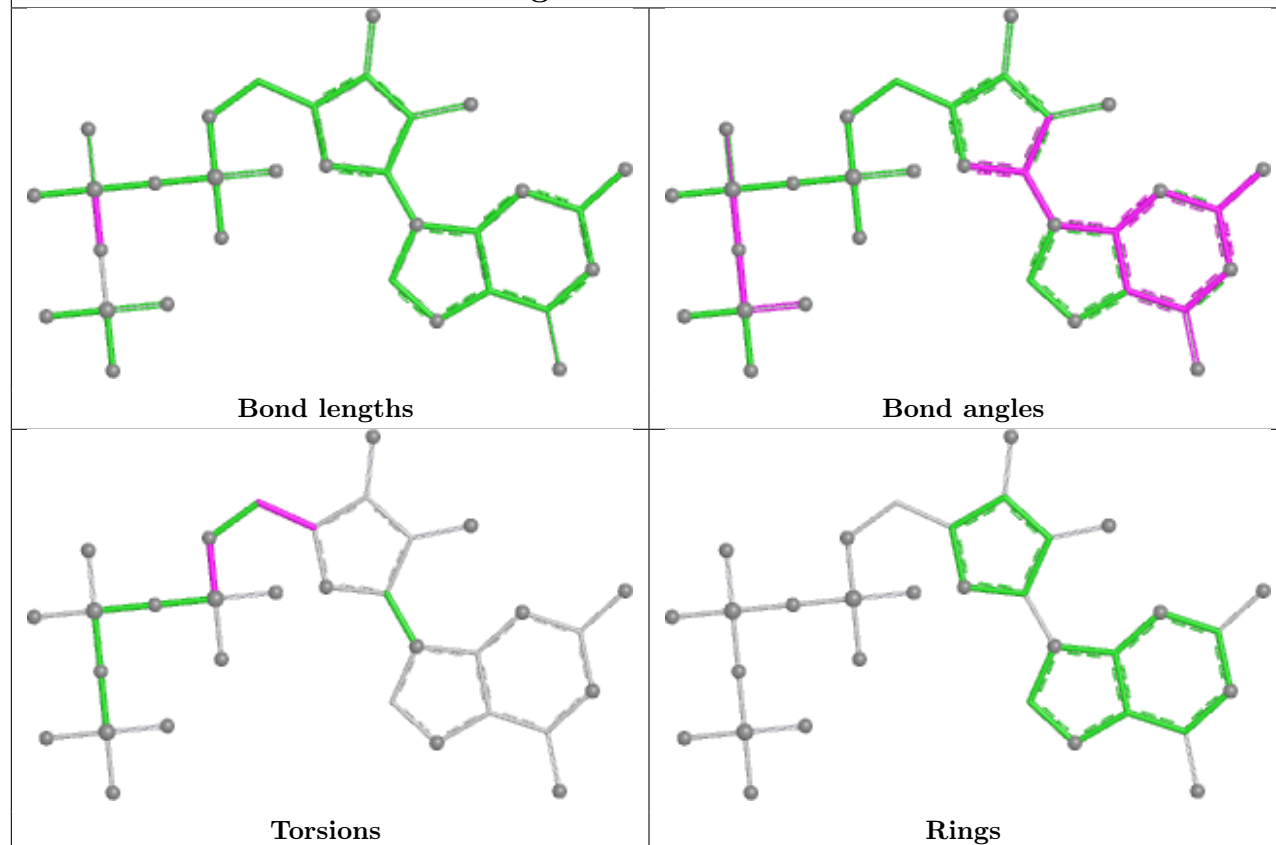
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	C	303	TRS	1	0
5	B	303	TRS	1	0
2	D	302	GTP	5	0
3	B	301	GOL	2	0
4	B	302	PEG	10	0
3	C	306	GOL	2	0
5	D	303	TRS	2	0
2	B	304	GTP	3	0
2	A	301	GTP	8	0
2	C	302	GTP	8	0
2	E	302	GTP	10	0

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

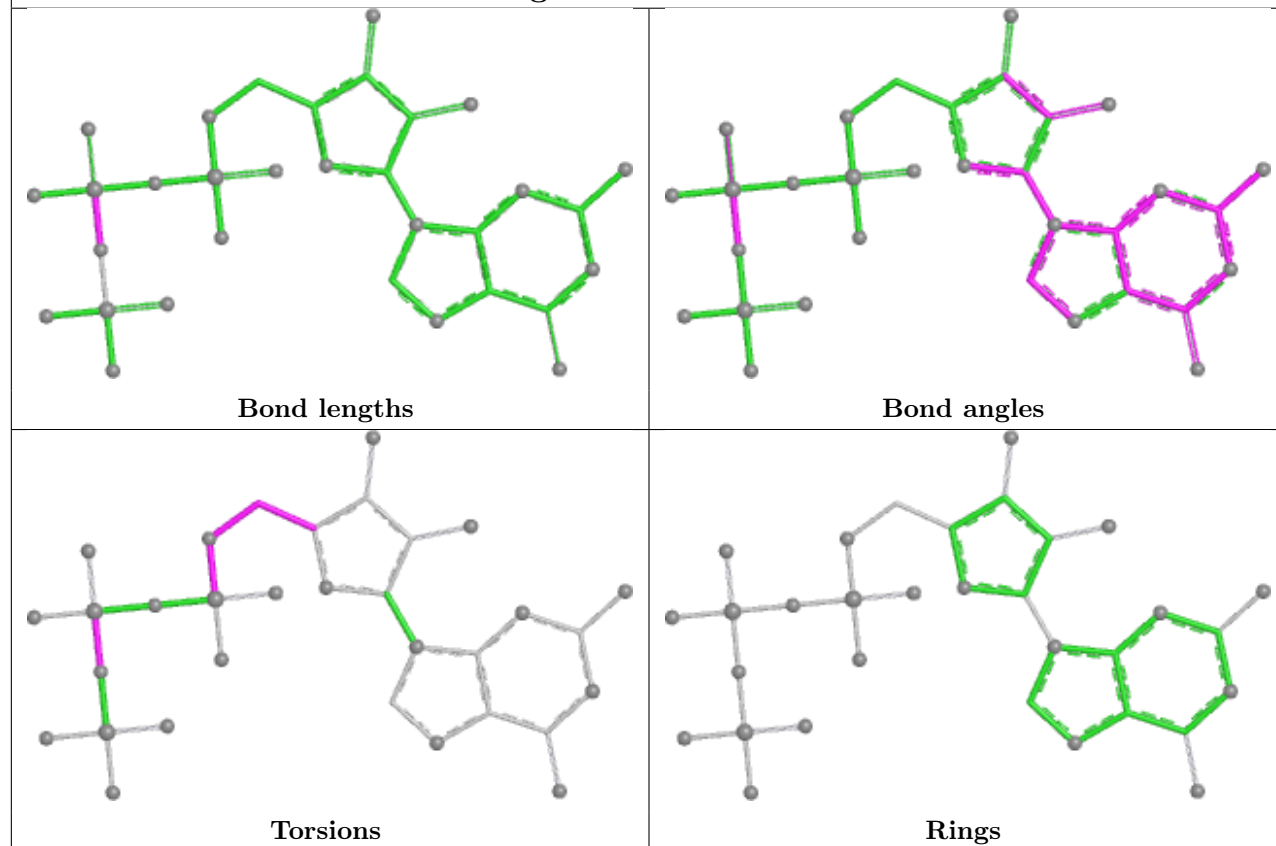
highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified 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.



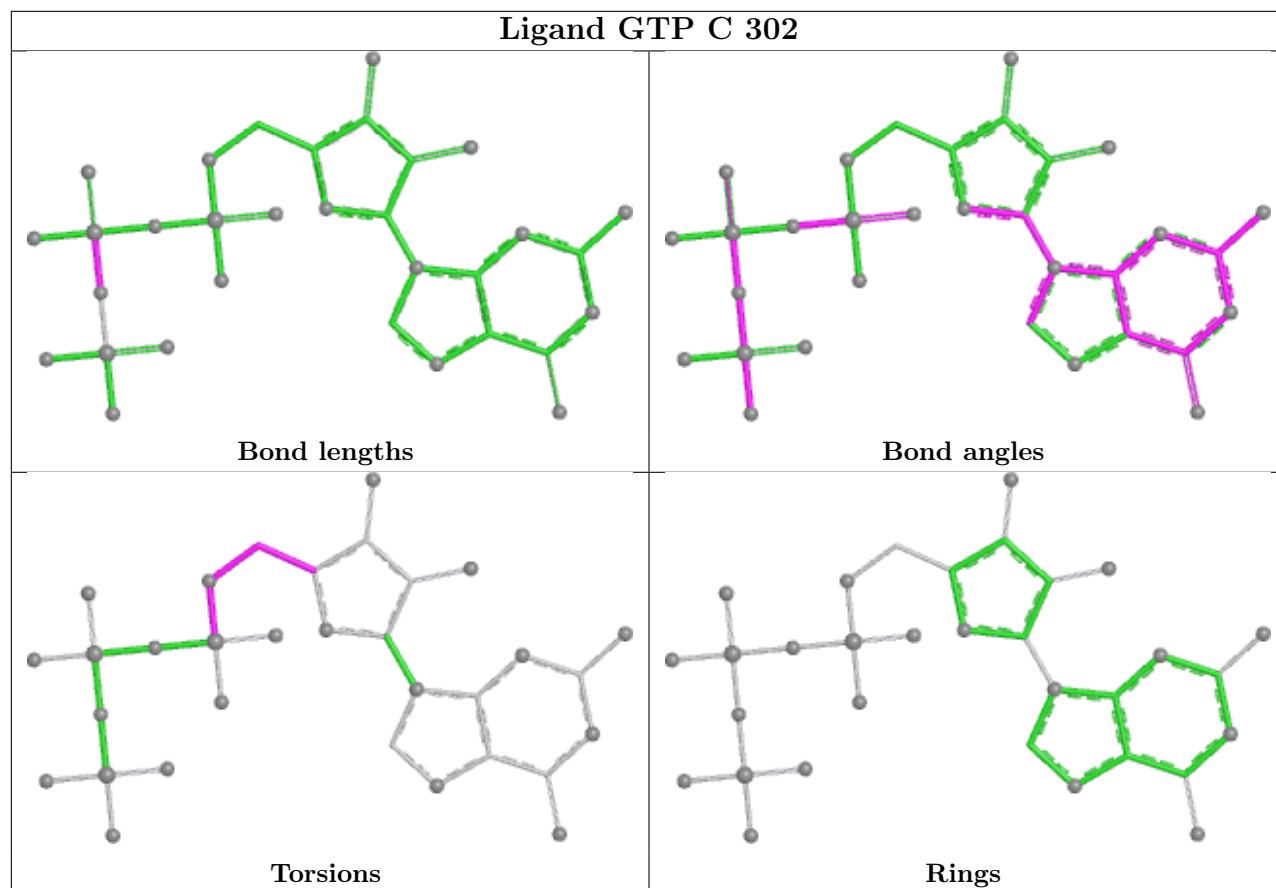
Ligand GTP B 304



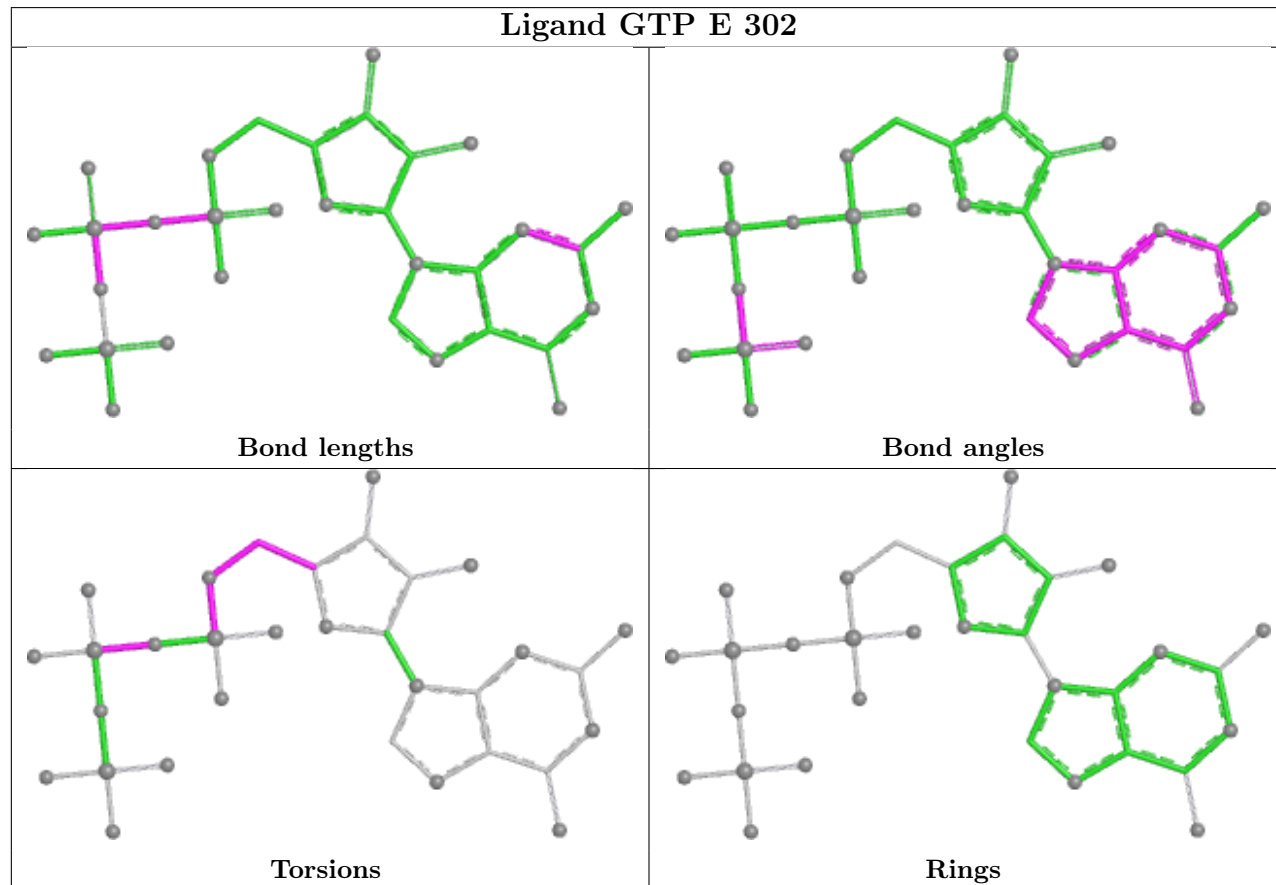
Ligand GTP A 301



Ligand GTP C 302



Ligand GTP E 302



5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data

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	219/223 (98%)	-0.05	5 (2%) 61 64	16, 50, 73, 108	8 (3%)
1	B	216/223 (96%)	-0.24	0 100 100	19, 46, 71, 108	5 (2%)
1	C	219/223 (98%)	-0.05	6 (2%) 56 59	20, 48, 75, 117	10 (4%)
1	D	216/223 (96%)	-0.09	2 (0%) 81 83	23, 53, 87, 116	4 (1%)
1	E	214/223 (95%)	0.13	4 (1%) 66 69	27, 61, 102, 124	8 (3%)
All	All	1084/1115 (97%)	-0.06	17 (1%) 70 73	16, 51, 90, 124	35 (3%)

All (17) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	219	HIS	6.0
1	C	206[A]	GLN	5.1
1	C	220	GLY	3.9
1	D	56[A]	ASP	3.5
1	C	218	HIS	3.4
1	A	219	HIS	3.2
1	A	217	ARG	2.6
1	A	220	GLY	2.5
1	A	56[A]	ASP	2.5
1	E	27	PRO	2.5
1	E	29	LEU	2.5
1	E	218	HIS	2.5
1	E	22	THR	2.4
1	C	217	ARG	2.4
1	D	27	PRO	2.4
1	A	218	HIS	2.2
1	C	207	ASN	2.1

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 oligosaccharides in this entry.

6.4 Ligands [i](#)

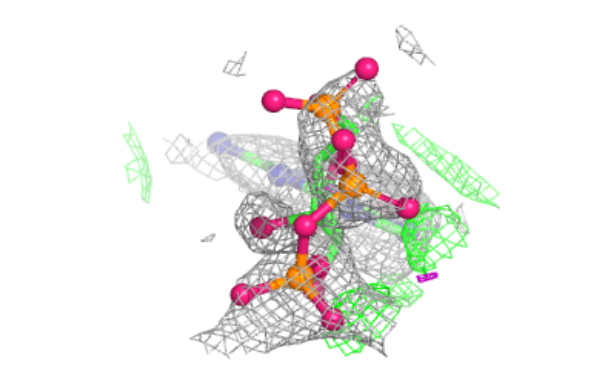
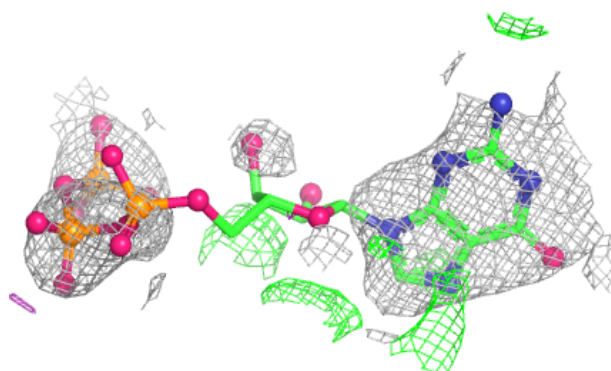
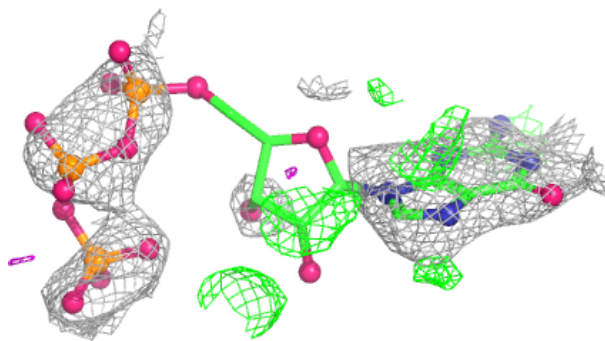
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	TRS	C	303	8/8	0.52	0.16	94,96,97,97	0
6	CA	C	304	1/1	0.54	0.28	146,146,146,146	0
5	TRS	D	303	8/8	0.55	0.13	99,102,103,103	0
6	CA	B	305	1/1	0.67	0.31	170,170,170,170	0
5	TRS	B	303	8/8	0.67	0.15	94,96,97,97	0
6	CA	D	304	1/1	0.70	0.23	140,140,140,140	0
2	GTP	D	302	32/32	0.84	0.14	63,82,105,155	25
4	PEG	B	302	7/7	0.84	0.15	50,53,69,71	0
3	GOL	E	301	6/6	0.85	0.12	58,61,65,67	0
3	GOL	C	305	6/6	0.87	0.11	71,72,74,74	0
2	GTP	C	302	32/32	0.87	0.12	58,72,139,150	23
2	GTP	A	301	32/32	0.87	0.12	37,62,140,140	22
2	GTP	E	302	32/32	0.89	0.12	53,72,125,139	30
2	GTP	B	304	32/32	0.89	0.12	50,59,95,96	26
3	GOL	D	301	6/6	0.90	0.09	53,55,60,63	0
3	GOL	C	306	6/6	0.91	0.11	74,77,78,80	0
3	GOL	B	301	6/6	0.91	0.08	44,50,52,55	0
3	GOL	A	302	6/6	0.92	0.09	38,41,45,48	6
3	GOL	C	301	6/6	0.93	0.08	53,55,57,58	0

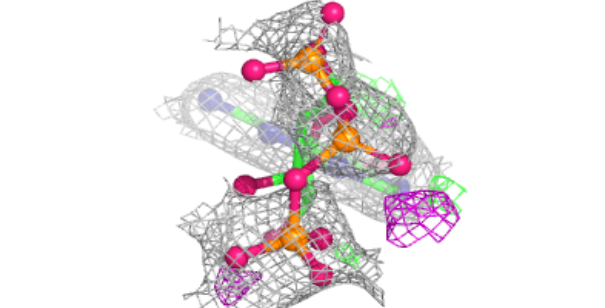
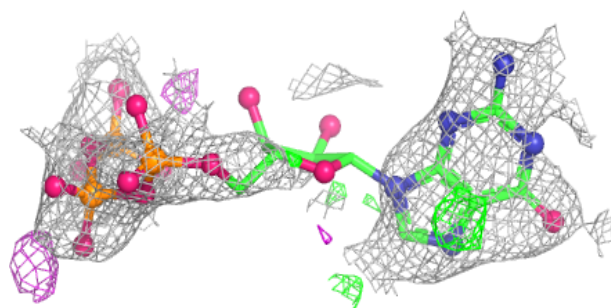
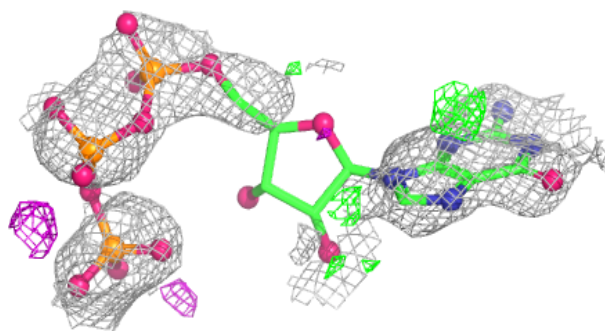
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around GTP D 302:

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

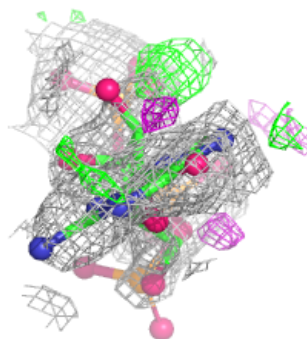
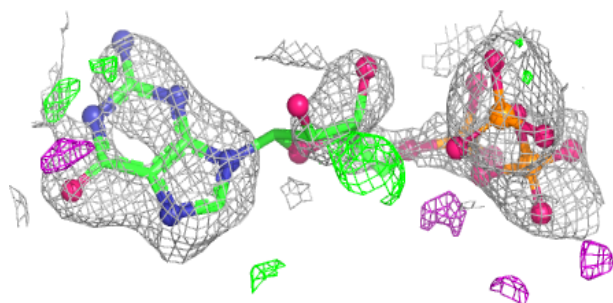
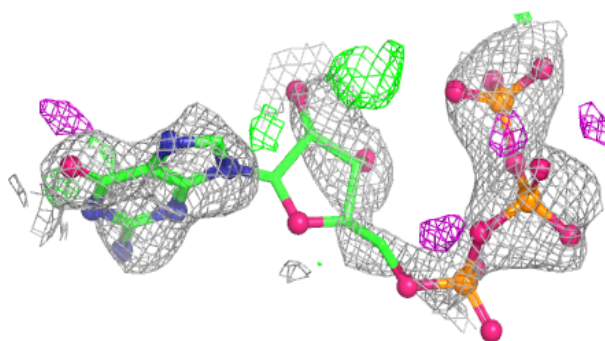
**Electron density around GTP C 302:**

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

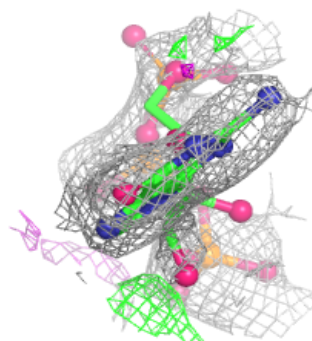
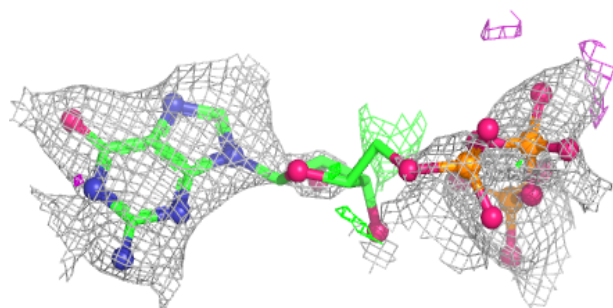
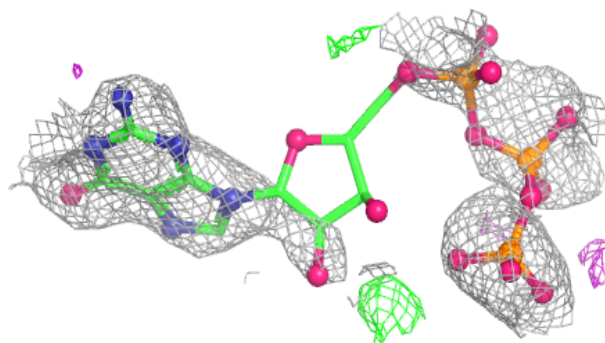


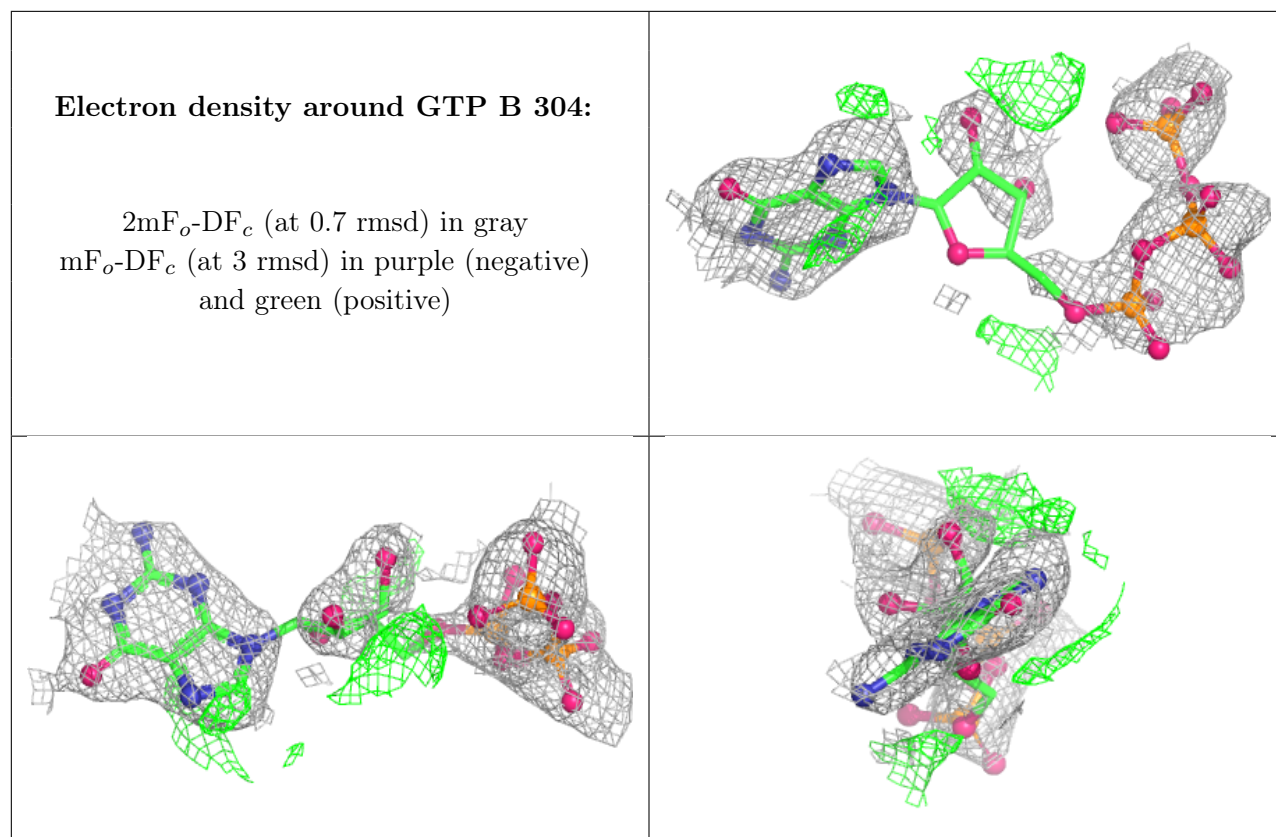
Electron density around GTP A 301:

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

**Electron density around GTP E 302:**

$2mF_o-DF_c$ (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.