WORLDWIDE PDB

PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Apr 29, 2024 – 02:38 pm BST

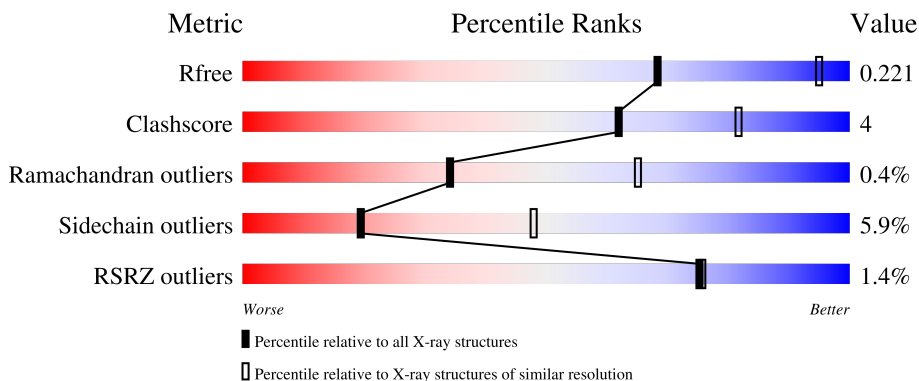|		
PDB ID	:	4A8M
Title	:	Non-Catalytic Ions Direct the RNA-Dependent RNA Polymerase of Bacterial dsRNA virus phi6 from De Novo Initiation to Elongation
Authors	:	Wright, S.; Poranen, M.M.; Bamford, D.H.; Stuart, D.I.; Grimes, J.M.
Deposited on	:	2011-11-21
Resolution	:	2.92 Å(reported)

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 2.92 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	Percentile Ranks	Value
Rfree		0.221
Clashscore		4
Ramachandran outliers		0.4%
Sidechain outliers		5.9%
RSRZ outliers		1.4%

Worse   *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	2307 (2.94-2.90)
Clashscore	141614	2531 (2.94-2.90)
Ramachandran outliers	138981	2462 (2.94-2.90)
Sidechain outliers	138945	2464 (2.94-2.90)
RSRZ outliers	127900	2248 (2.94-2.90)

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 <=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	B	4	75% / 25% / 75%
2	P	665	% / 89% / 9% ·
2	Q	665	% / 85% / 14% ·
2	R	665	2% / 87% / 11% ·

2 Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 16011 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 DNA chain called 5'-D(*AP*AP*TP*CP)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	B	4	Total 78	C 39	N 15	O 21	P 3	0	0	0

- Molecule 2 is a protein called RNA-DIRECTED RNA POLYMERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	P	664	Total 5265	C 3342	N 914	O 977	S 32	0	0	0
2	Q	664	Total 5265	C 3342	N 914	O 977	S 32	0	0	0
2	R	664	Total 5265	C 3342	N 914	O 977	S 32	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
P	456	MET	ILE	SEE REMARK 999	UNP P11124
Q	456	MET	ILE	SEE REMARK 999	UNP P11124
R	456	MET	ILE	SEE REMARK 999	UNP P11124

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

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	P	1	Total 1	Mg 1	0	0
3	Q	1	Total 1	Mg 1	0	0
3	R	1	Total 1	Mg 1	0	0

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

GTP

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

- Molecule 5 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$).

ATP
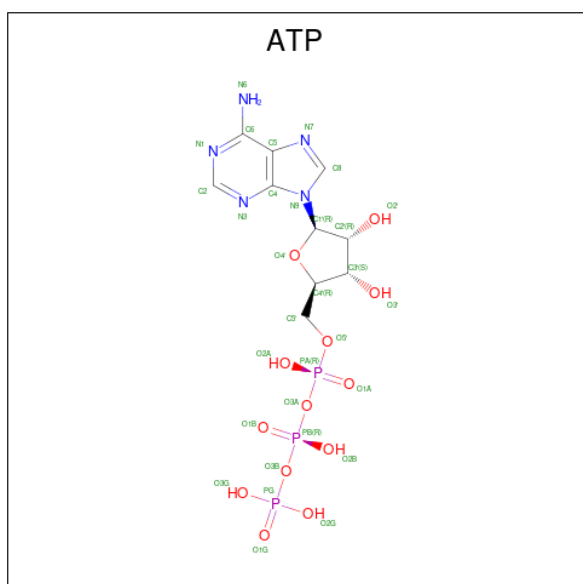
| Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	P	1	Total 13	O 10	P 3	0	0
5	Q	1	Total 13	O 10	P 3	0	0
5	R	1	Total 13	O 10	P 3	0	0

3 Residue-property plots ⓘ

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.
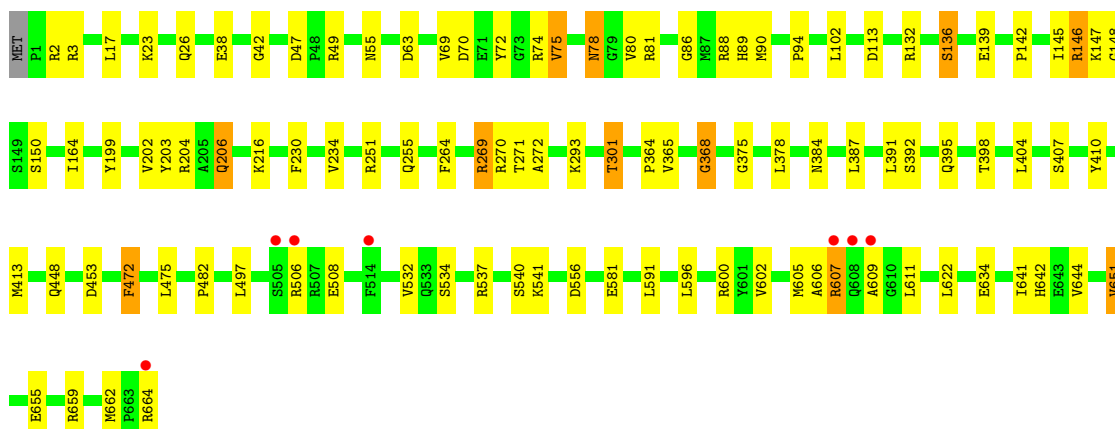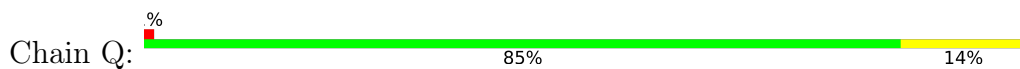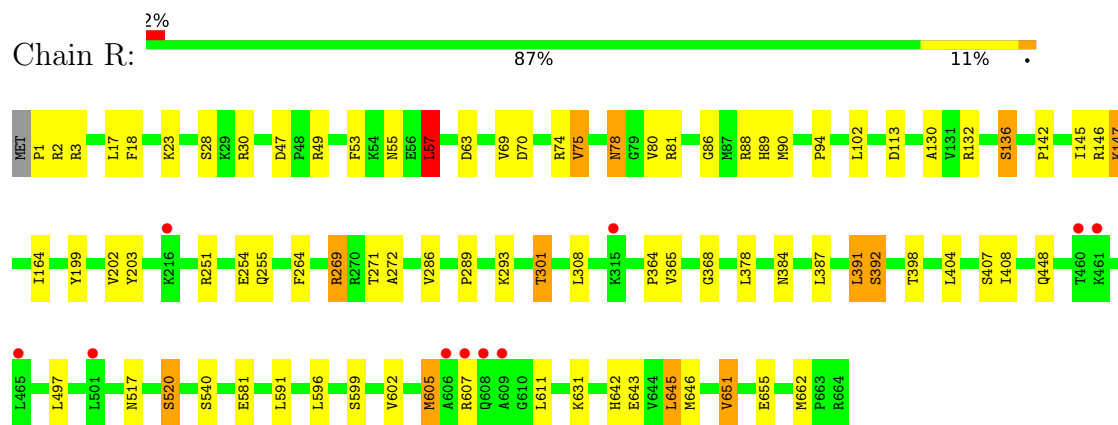
• Molecule 1: 5'-D(*AP*AP*TP*CP)-3'
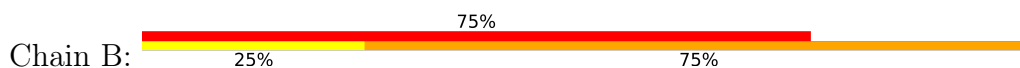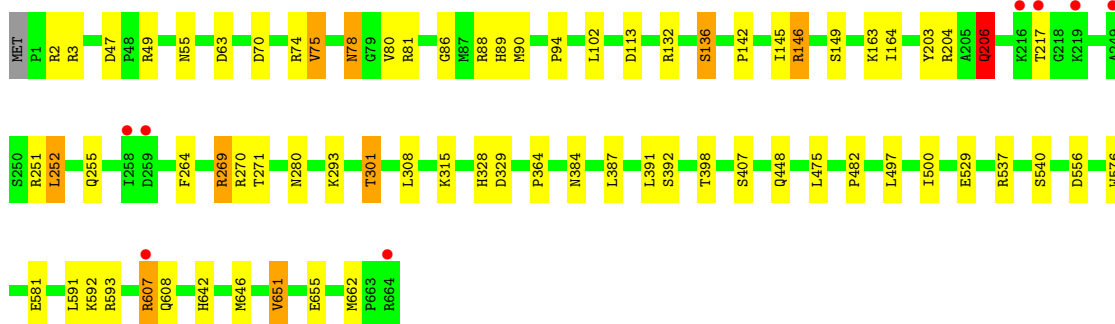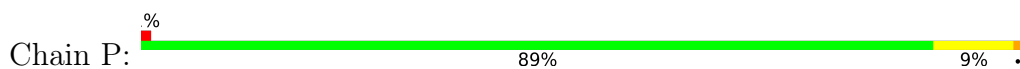
Chain B:

• Molecule 2: RNA-DIRECTED RNA POLYMERASE

Chain P:

• Molecule 2: RNA-DIRECTED RNA POLYMERASE

Chain Q:

• Molecule 2: RNA-DIRECTED RNA POLYMERASE

Chain R:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	106.27Å 92.06Å 140.81Å 90.00° 101.30° 90.00°	Depositor
Resolution (Å)	58.72 – 2.92 58.75 – 2.92	Depositor EDS
% Data completeness (in resolution range)	(Not available) (58.72-2.92) 95.1 (58.75-2.92)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.10 (at 2.91Å)	Xtriage
Refinement program	BUSTER 2.9.2	Depositor
R, R_{free}	0.179 , 0.209 0.189 , 0.221	Depositor DCC
R_{free} test set	2806 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å^2)	62.2	Xtriage
Anisotropy	0.693	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 50.7	EDS
L-test for twinning[2]	$< |L| > = 0.47, < L^2 > = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	16011	wwPDB-VP
Average B, all atoms (Å^2)	66.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.62% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1] Intensities estimated from amplitudes.
[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: ATP, GTP, MG

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	B	1.49	0/87	3.00	9/132 (6.8%)
2	P	0.56	0/5396	0.68	1/7297 (0.0%)
2	Q	0.61	0/5396	0.73	1/7297 (0.0%)
2	R	0.59	0/5396	0.73	2/7297 (0.0%)
All	All	0.60	0/16275	0.75	13/22023 (0.1%)

There are no bond length outliers.

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	6	DT	P-O3'-C3'	11.88	133.96	119.70
1	B	4	DA	O4'-C4'-C3'	-11.40	99.16	106.00
1	B	4	DA	P-O3'-C3'	11.33	133.30	119.70
1	B	6	DT	O4'-C1'-N1	9.21	114.44	108.00
1	B	5	DA	P-O3'-C3'	8.46	129.85	119.70
1	B	7	DC	O4'-C1'-N1	7.24	113.06	108.00
1	B	4	DA	O4'-C1'-N9	6.72	112.70	108.00
2	R	57	LEU	N-CA-CB	6.54	123.47	110.40
1	B	7	DC	N1-C2-O2	5.67	122.30	118.90
1	B	6	DT	N3-C2-O2	-5.40	119.06	122.30
2	R	1	PRO	C-N-CA	5.39	135.17	121.70
2	P	206	GLN	N-CA-C	-5.24	96.86	111.00
2	Q	206	GLN	N-CA-C	-5.00	97.48	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	B	78	0	47	5	0
2	P	5265	0	5165	40	0
2	Q	5265	0	5165	53	0
2	R	5265	0	5165	48	0
3	P	1	0	0	0	0
3	Q	1	0	0	0	0
3	R	1	0	0	0	0
4	P	32	0	12	0	0
4	Q	32	0	12	0	0
4	R	32	0	12	0	0
5	P	13	0	0	0	0
5	Q	13	0	0	1	0
5	R	13	0	0	0	0
All	All	16011	0	15578	138	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 4.

All (138) 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:R:147:LYS:HZ2	2:R:645:LEU:HA	1.23	0.99
2:R:203:TYR:CE1	2:R:271:THR:HG22	2.02	0.95
2:R:147:LYS:NZ	2:R:645:LEU:HA	1.87	0.90
2:R:301:THR:HG22	2:R:448:GLN:O	1.79	0.83
2:R:203:TYR:HE1	2:R:271:THR:HG22	1.39	0.82
2:P:301:THR:HG22	2:P:448:GLN:O	1.82	0.79
2:R:364:PRO:HA	2:R:387:LEU:HD22	1.64	0.79
2:Q:301:THR:HG22	2:Q:448:GLN:O	1.83	0.77
2:P:146:ARG:NH2	2:P:540:SER:O	2.19	0.75
2:P:364:PRO:HA	2:P:387:LEU:HD22	1.67	0.75
2:Q:364:PRO:HA	2:Q:387:LEU:HD22	1.69	0.75
2:Q:146:ARG:NH2	2:Q:540:SER:O	2.19	0.74
2:R:136:SER:HB2	2:R:293:LYS:NZ	2.04	0.73
2:R:147:LYS:HZ2	2:R:645:LEU:HD22	1.54	0.72

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:P:142:PRO:HG3	2:P:651:VAL:HG22	1.72	0.72
2:R:147:LYS:HE2	2:R:540:SER:O	1.90	0.71
2:P:136:SER:HB2	2:P:293:LYS:NZ	2.07	0.70
2:R:251:ARG:HH11	2:R:255:GLN:HE22	1.39	0.70
2:Q:142:PRO:HG3	2:Q:651:VAL:HG22	1.74	0.69
2:R:142:PRO:HG3	2:R:651:VAL:HG22	1.74	0.68
2:P:251:ARG:HH11	2:P:255:GLN:HE22	1.43	0.67
2:Q:136:SER:HB2	2:Q:293:LYS:NZ	2.08	0.67
2:P:55:ASN:OD1	2:P:88:ARG:NH2	2.29	0.65
2:Q:251:ARG:HH11	2:Q:255:GLN:HE22	1.42	0.65
2:R:55:ASN:OD1	2:R:88:ARG:NH2	2.31	0.63
2:P:251:ARG:HG3	2:P:252:LEU:HD12	1.83	0.61
2:Q:55:ASN:OD1	2:Q:88:ARG:NH2	2.33	0.60
1:B:7:DC:H41	2:Q:150:SER:H	1.48	0.59
2:P:392:SER:O	2:P:398:THR:HG21	2.03	0.59
2:R:391:LEU:HD22	2:R:398:THR:HG22	1.84	0.59
2:P:75:VAL:HG21	2:P:500:ILE:HG21	1.86	0.58
2:Q:147:LYS:HD2	2:Q:644:VAL:O	2.04	0.57
1:B:4:DA:H3'	2:Q:541:LYS:NZ	2.19	0.57
2:Q:606:ALA:HB3	2:Q:609:ALA:HB2	1.87	0.56
1:B:6:DT:H3	2:Q:26:GLN:HB3	1.70	0.56
2:P:47:ASP:OD1	2:P:49:ARG:HD3	2.06	0.56
2:Q:651:VAL:O	2:Q:655:GLU:HB2	2.06	0.56
2:P:593:ARG:HG2	2:Q:42:GLY:HA2	1.88	0.55
2:Q:203:TYR:CE1	2:Q:271:THR:HG22	2.41	0.55
2:R:147:LYS:H	2:R:147:LYS:HD3	1.70	0.55
2:R:651:VAL:O	2:R:655:GLU:HB2	2.07	0.55
2:P:75:VAL:HG11	2:P:500:ILE:HG23	1.89	0.55
2:P:407:SER:HA	2:P:448:GLN:HE22	1.71	0.55
2:P:203:TYR:HE1	2:P:271:THR:HG22	1.72	0.54
2:P:90:MET:CE	2:P:264:PHE:HB3	2.38	0.54
2:R:47:ASP:OD1	2:R:49:ARG:HD3	2.08	0.53
2:P:70:ASP:OD2	2:P:74:ARG:HD2	2.07	0.53
2:R:599:SER:HA	2:R:602:VAL:HG12	1.90	0.53
2:R:136:SER:HB2	2:R:293:LYS:HZ2	1.74	0.52
2:Q:622:LEU:HD11	2:Q:641:ILE:HD12	1.90	0.52
2:P:592:LYS:HE3	2:Q:534:SER:HB3	1.91	0.52
2:P:651:VAL:O	2:P:655:GLU:HB2	2.10	0.52
2:R:90:MET:CE	2:R:264:PHE:HB3	2.39	0.52
2:P:251:ARG:HG3	2:P:252:LEU:CD1	2.40	0.52
2:Q:392:SER:O	2:Q:398:THR:HG21	2.09	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:R:69:VAL:HG22	2:R:75:VAL:HB	1.92	0.52
2:Q:148:GLY:HA2	2:Q:541:LYS:HE2	1.92	0.51
2:Q:230:PHE:O	2:Q:234:VAL:HG22	2.10	0.51
1:B:4:DA:H3'	2:Q:541:LYS:HZ1	1.74	0.51
2:Q:47:ASP:OD1	2:Q:49:ARG:HD3	2.09	0.51
2:R:147:LYS:NZ	2:R:645:LEU:HD22	2.25	0.51
2:R:90:MET:HE2	2:R:264:PHE:HB3	1.92	0.51
2:P:206:GLN:HG3	2:P:270:ARG:HD2	1.92	0.51
2:Q:270:ARG:HH22	5:Q:1667:ATP:PG	2.35	0.50
2:P:537:ARG:HD2	2:Q:49:ARG:HG3	1.94	0.50
2:P:392:SER:O	2:P:398:THR:CG2	2.60	0.49
2:Q:90:MET:CE	2:Q:264:PHE:HB3	2.42	0.49
2:P:132:ARG:O	2:P:136:SER:OG	2.18	0.49
2:P:203:TYR:CE1	2:P:271:THR:HG22	2.46	0.49
2:R:203:TYR:CD1	2:R:271:THR:HG22	2.47	0.49
2:Q:407:SER:HA	2:Q:448:GLN:HE22	1.78	0.49
2:Q:145:ILE:HD12	2:Q:164:ILE:HD13	1.94	0.49
2:R:202:VAL:HG23	2:R:272:ALA:HB3	1.95	0.49
2:R:517:ASN:HB3	2:R:520:SER:OG	2.13	0.48
2:Q:606:ALA:HB3	2:Q:609:ALA:CB	2.43	0.48
2:P:136:SER:HB2	2:P:293:LYS:HZ2	1.77	0.47
2:R:147:LYS:CE	2:R:540:SER:O	2.60	0.47
2:Q:251:ARG:HH11	2:Q:255:GLN:NE2	2.09	0.47
2:Q:69:VAL:HG22	2:Q:75:VAL:HB	1.97	0.47
2:Q:86:GLY:O	2:Q:89:HIS:HD2	1.98	0.47
2:P:149:SER:OG	2:P:163:LYS:HE3	2.15	0.47
2:P:642:HIS:CE1	2:P:646:MET:HG3	2.49	0.47
2:P:251:ARG:HB2	2:P:255:GLN:HE21	1.80	0.46
2:Q:475:LEU:HD21	2:Q:482:PRO:HG3	1.97	0.46
2:P:145:ILE:HD12	2:P:164:ILE:HD13	1.97	0.46
2:R:70:ASP:OD2	2:R:74:ARG:HB2	2.16	0.46
2:R:147:LYS:HZ2	2:R:645:LEU:CA	2.11	0.46
2:R:251:ARG:HH11	2:R:255:GLN:NE2	2.10	0.46
2:R:70:ASP:OD2	2:R:74:ARG:NH1	2.49	0.46
2:Q:506:ARG:NH1	2:Q:508:GLU:OE1	2.49	0.46
2:R:407:SER:HA	2:R:448:GLN:HE22	1.81	0.45
2:P:86:GLY:O	2:P:89:HIS:HD2	1.99	0.45
2:R:132:ARG:O	2:R:136:SER:OG	2.20	0.45
2:P:94:PRO:HB3	2:P:269:ARG:HG3	1.98	0.45
2:Q:70:ASP:OD2	2:Q:74:ARG:HD2	2.17	0.45
2:R:86:GLY:O	2:R:89:HIS:HD2	1.99	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:R:147:LYS:HE3	2:R:540:SER:HB2	1.98	0.45
2:P:90:MET:HE3	2:P:264:PHE:HB3	1.98	0.45
2:P:328:HIS:HD2	2:P:329:ASP:OD1	2.00	0.45
2:Q:602:VAL:HB	2:Q:605:MET:HG3	1.99	0.45
2:R:392:SER:O	2:R:398:THR:CG2	2.65	0.45
2:Q:410:TYR:HA	2:Q:413:MET:HE3	2.00	0.44
2:P:251:ARG:HH11	2:P:255:GLN:NE2	2.14	0.44
2:Q:199:TYR:HB2	2:Q:365:VAL:HG12	2.00	0.44
2:R:199:TYR:HB2	2:R:365:VAL:HG12	1.99	0.44
2:Q:86:GLY:O	2:Q:89:HIS:CD2	2.71	0.44
2:Q:78:ASN:ND2	2:Q:80:VAL:H	2.16	0.44
2:P:90:MET:HE2	2:P:264:PHE:HB3	1.99	0.43
2:Q:132:ARG:O	2:Q:136:SER:OG	2.26	0.43
2:R:78:ASN:ND2	2:R:80:VAL:H	2.17	0.43
2:P:475:LEU:HD21	2:P:482:PRO:HG3	2.01	0.43
2:R:86:GLY:O	2:R:89:HIS:CD2	2.72	0.43
2:Q:395:GLN:HB3	2:Q:398:THR:HG22	2.01	0.42
2:R:147:LYS:CE	2:R:645:LEU:HA	2.48	0.42
2:Q:90:MET:HE2	2:Q:264:PHE:HB3	2.00	0.42
2:Q:136:SER:HB2	2:Q:293:LYS:HZ2	1.82	0.42
2:P:86:GLY:O	2:P:89:HIS:CD2	2.72	0.42
2:Q:72:TYR:HB3	2:Q:472:PHE:CZ	2.55	0.42
2:R:392:SER:O	2:R:398:THR:HG21	2.20	0.42
2:Q:94:PRO:HB3	2:Q:269:ARG:HG3	2.01	0.41
2:R:17:LEU:HD11	2:R:378:LEU:HD13	2.01	0.41
2:R:94:PRO:HB3	2:R:269:ARG:HG3	2.01	0.41
2:Q:17:LEU:HD11	2:Q:378:LEU:HD13	2.01	0.41
2:Q:38:GLU:HB3	2:Q:532:VAL:HG22	2.01	0.41
2:Q:607:ARG:H	2:Q:607:ARG:HG3	1.62	0.41
2:R:145:ILE:HD12	2:R:164:ILE:HD13	2.02	0.41
2:R:602:VAL:HG11	2:R:605:MET:HB3	2.01	0.41
2:Q:655:GLU:HG2	2:Q:659:ARG:NH1	2.35	0.41
2:R:130:ALA:HB2	2:R:408:ILE:HD11	2.03	0.41
2:R:53:PHE:O	2:R:57:LEU:CD1	2.68	0.41
1:B:7:DC:H41	2:Q:150:SER:N	2.18	0.40
2:Q:251:ARG:HB2	2:Q:255:GLN:HE21	1.86	0.40
2:P:252:LEU:CD1	2:P:252:LEU:N	2.84	0.40
2:Q:368:GLY:O	2:Q:375:GLY:HA3	2.20	0.40
2:P:78:ASN:ND2	2:P:80:VAL:H	2.19	0.40
2:Q:202:VAL:HG23	2:Q:272:ALA:HB3	2.04	0.40
2:R:18:PHE:CG	2:R:28:SER:HB3	2.56	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:R:286:VAL:O	2:R:289:PRO:HD2	2.21	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	
2	P	662/665 (100%)	641 (97%)	19 (3%)	2 (0%)	41	70
2	Q	662/665 (100%)	635 (96%)	24 (4%)	3 (0%)	29	60
2	R	662/665 (100%)	636 (96%)	23 (4%)	3 (0%)	29	60
All	All	1986/1995 (100%)	1912 (96%)	66 (3%)	8 (0%)	34	65

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	P	136	SER
2	P	607	ARG
2	Q	136	SER
2	Q	607	ARG
2	R	2	ARG
2	R	136	SER
2	R	368	GLY
2	Q	368	GLY

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	
2	P	557/558 (100%)	527 (95%)	30 (5%)	22	52
2	Q	557/558 (100%)	523 (94%)	34 (6%)	18	46
2	R	557/558 (100%)	522 (94%)	35 (6%)	18	44
All	All	1671/1674 (100%)	1572 (94%)	99 (6%)	19	48

All (99) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	P	2	ARG
2	P	3	ARG
2	P	63	ASP
2	P	75	VAL
2	P	78	ASN
2	P	81	ARG
2	P	102	LEU
2	P	113	ASP
2	P	146	ARG
2	P	204	ARG
2	P	206	GLN
2	P	217	THR
2	P	252	LEU
2	P	269	ARG
2	P	280	ASN
2	P	301	THR
2	P	308	LEU
2	P	315	LYS
2	P	384	ASN
2	P	391	LEU
2	P	497	LEU
2	P	529	GLU
2	P	556	ASP
2	P	576	TRP
2	P	581	GLU
2	P	591	LEU
2	P	607	ARG
2	P	608	GLN
2	P	651	VAL
2	P	662	MET
2	Q	2	ARG
2	Q	3	ARG

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Mol	Chain	Res	Type
2	Q	23	LYS
2	Q	63	ASP
2	Q	75	VAL
2	Q	78	ASN
2	Q	81	ARG
2	Q	102	LEU
2	Q	113	ASP
2	Q	139	GLU
2	Q	146	ARG
2	Q	204	ARG
2	Q	206	GLN
2	Q	216	LYS
2	Q	269	ARG
2	Q	301	THR
2	Q	384	ASN
2	Q	391	LEU
2	Q	404	LEU
2	Q	453	ASP
2	Q	472	PHE
2	Q	497	LEU
2	Q	537	ARG
2	Q	556	ASP
2	Q	581	GLU
2	Q	591	LEU
2	Q	596	LEU
2	Q	600	ARG
2	Q	611	LEU
2	Q	634	GLU
2	Q	642	HIS
2	Q	651	VAL
2	Q	662	MET
2	Q	664	ARG
2	R	3	ARG
2	R	23	LYS
2	R	30	ARG
2	R	57	LEU
2	R	63	ASP
2	R	75	VAL
2	R	78	ASN
2	R	81	ARG
2	R	102	LEU
2	R	113	ASP

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Mol	Chain	Res	Type
2	R	146	ARG
2	R	147	LYS
2	R	254	GLU
2	R	269	ARG
2	R	301	THR
2	R	308	LEU
2	R	384	ASN
2	R	391	LEU
2	R	392	SER
2	R	404	LEU
2	R	497	LEU
2	R	520	SER
2	R	581	GLU
2	R	591	LEU
2	R	596	LEU
2	R	605	MET
2	R	607	ARG
2	R	611	LEU
2	R	631	LYS
2	R	642	HIS
2	R	643	GLU
2	R	645	LEU
2	R	646	MET
2	R	651	VAL
2	R	662	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (30) such sidechains are listed below:

Mol	Chain	Res	Type
2	P	15	GLN
2	P	26	GLN
2	P	78	ASN
2	P	89	HIS
2	P	91	ASN
2	P	255	GLN
2	P	280	ASN
2	P	309	ASN
2	P	328	HIS
2	P	448	GLN
2	P	525	GLN
2	Q	15	GLN
2	Q	26	GLN

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Mol	Chain	Res	Type
2	Q	78	ASN
2	Q	89	HIS
2	Q	255	GLN
2	Q	309	ASN
2	Q	448	GLN
2	Q	525	GLN
2	Q	608	GLN
2	R	15	GLN
2	R	26	GLN
2	R	78	ASN
2	R	89	HIS
2	R	91	ASN
2	R	255	GLN
2	R	280	ASN
2	R	309	ASN
2	R	448	GLN
2	R	525	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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 9 ligands modelled in this entry, 3 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	ATP	P	1667	-	8,12,33	1.08	1 (12%)	15,20,52	1.18	2 (13%)
4	GTP	R	1665	-	26,34,34	1.52	4 (15%)	32,54,54	1.89	7 (21%)
4	GTP	P	1666	-	26,34,34	1.87	8 (30%)	32,54,54	1.77	8 (25%)
5	ATP	Q	1667	-	8,12,33	1.28	1 (12%)	15,20,52	1.09	1 (6%)
5	ATP	R	1667	-	8,12,33	1.17	1 (12%)	15,20,52	1.34	2 (13%)
4	GTP	Q	1666	3	26,34,34	1.87	9 (34%)	32,54,54	1.41	4 (12%)

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	ATP	P	1667	-	-	1/12/12/38	-
4	GTP	R	1665	-	-	7/18/38/38	0/3/3/3
4	GTP	P	1666	-	-	8/18/38/38	0/3/3/3
5	ATP	Q	1667	-	-	0/12/12/38	-
5	ATP	R	1667	-	-	0/12/12/38	-
4	GTP	Q	1666	3	-	6/18/38/38	0/3/3/3

All (24) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	Q	1666	GTP	C2'-C1'	4.62	1.60	1.53
4	Q	1666	GTP	PG-O1G	3.87	1.63	1.50
4	P	1666	GTP	O4'-C1'	3.82	1.46	1.41
4	P	1666	GTP	C2'-C1'	3.56	1.59	1.53
4	P	1666	GTP	C2-N2	3.23	1.41	1.34
4	R	1665	GTP	O4'-C1'	3.12	1.45	1.41
4	R	1665	GTP	PA-O5'	2.64	1.70	1.59
5	R	1667	ATP	PG-O3G	2.62	1.64	1.54
4	P	1666	GTP	C2-N3	2.59	1.39	1.33
5	Q	1667	ATP	PG-O3G	2.52	1.64	1.54
4	Q	1666	GTP	C2-N2	2.39	1.39	1.34
4	Q	1666	GTP	O4'-C1'	2.37	1.44	1.41
4	P	1666	GTP	C8-N7	-2.28	1.31	1.35
4	P	1666	GTP	PA-O2A	2.28	1.66	1.55
4	R	1665	GTP	C5'-C4'	2.26	1.58	1.51
4	Q	1666	GTP	PA-O5'	2.25	1.68	1.59
4	Q	1666	GTP	C3'-C4'	2.20	1.58	1.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	Q	1666	GTP	C8-N7	-2.10	1.31	1.35
4	Q	1666	GTP	PA-O2A	2.08	1.65	1.55
5	P	1667	ATP	PG-O3G	2.07	1.62	1.54
4	P	1666	GTP	C6-N1	2.05	1.40	1.37
4	Q	1666	GTP	C2-N1	2.04	1.42	1.37
4	R	1665	GTP	C8-N7	-2.03	1.31	1.35
4	P	1666	GTP	PA-O5'	2.02	1.67	1.59

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	P	1666	GTP	C8-N7-C5	4.76	112.06	102.99
4	Q	1666	GTP	C8-N7-C5	3.77	110.17	102.99
4	R	1665	GTP	O2G-PG-O3B	3.68	116.98	104.64
4	R	1665	GTP	C8-N7-C5	3.46	109.59	102.99
4	R	1665	GTP	C3'-C2'-C1'	3.45	106.17	100.98
4	R	1665	GTP	PA-O3A-PB	-3.29	121.55	132.83
4	R	1665	GTP	PB-O3B-PG	-3.21	121.80	132.83
4	Q	1666	GTP	O3G-PG-O3B	3.07	114.93	104.64
4	R	1665	GTP	O5'-C5'-C4'	2.94	119.12	108.99
4	R	1665	GTP	N2-C2-N1	2.89	122.87	116.71
4	P	1666	GTP	PA-O3A-PB	-2.86	123.00	132.83
4	P	1666	GTP	C5-C6-N1	2.75	118.82	113.95
5	R	1667	ATP	O2G-PG-O3B	2.72	113.75	104.64
4	P	1666	GTP	C3'-C2'-C1'	2.68	105.01	100.98
4	P	1666	GTP	O3G-PG-O3B	2.67	113.59	104.64
5	P	1667	ATP	PB-O3B-PG	-2.60	123.91	132.83
4	P	1666	GTP	PB-O3B-PG	-2.58	123.97	132.83
4	P	1666	GTP	N1-C2-N3	-2.48	118.69	123.32
4	Q	1666	GTP	O2'-C2'-C1'	2.39	119.68	110.85
4	Q	1666	GTP	PA-O3A-PB	-2.36	124.74	132.83
5	Q	1667	ATP	O2G-PG-O3B	2.16	111.89	104.64
5	R	1667	ATP	O3G-PG-O3B	2.13	111.76	104.64
5	P	1667	ATP	O5'-PA-O3A	2.04	111.49	104.64
4	P	1666	GTP	O2A-PA-O5'	2.02	117.11	107.75

There are no chirality outliers.

All (22) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	P	1666	GTP	C5'-O5'-PA-O1A
4	P	1666	GTP	C5'-O5'-PA-O2A

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Mol	Chain	Res	Type	Atoms
4	P	1666	GTP	C3'-C4'-C5'-O5'
4	Q	1666	GTP	C4'-C5'-O5'-PA
4	R	1665	GTP	PB-O3B-PG-O2G
4	R	1665	GTP	PB-O3A-PA-O5'
4	R	1665	GTP	C4'-C5'-O5'-PA
4	R	1665	GTP	C3'-C4'-C5'-O5'
4	Q	1666	GTP	O4'-C4'-C5'-O5'
4	Q	1666	GTP	C3'-C4'-C5'-O5'
4	P	1666	GTP	O4'-C4'-C5'-O5'
4	R	1665	GTP	O4'-C4'-C5'-O5'
4	P	1666	GTP	PB-O3A-PA-O1A
4	P	1666	GTP	PB-O3A-PA-O5'
4	Q	1666	GTP	PB-O3A-PA-O1A
4	Q	1666	GTP	PB-O3A-PA-O2A
4	R	1665	GTP	PB-O3B-PG-O3G
4	P	1666	GTP	C5'-O5'-PA-O3A
4	P	1666	GTP	PA-O3A-PB-O2B
4	Q	1666	GTP	PA-O3A-PB-O2B
4	R	1665	GTP	PA-O3A-PB-O2B
5	P	1667	ATP	PB-O3A-PA-O1A

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	Q	1667	ATP	1	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 then 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 ATP P 1667

Bond lengths

Bond angles

Torsions

Rings

Ligand GTP R 1665

Bond lengths

Bond angles

Torsions

Rings

Ligand GTP P 1666

Bond lengths

Bond angles

Torsions

Rings

Ligand ATP Q 1667

Bond lengths

Bond angles

Torsions

Rings

Ligand ATP R 1667

Bond lengths

Bond angles

Torsions

Rings

Ligand GTP Q 1666
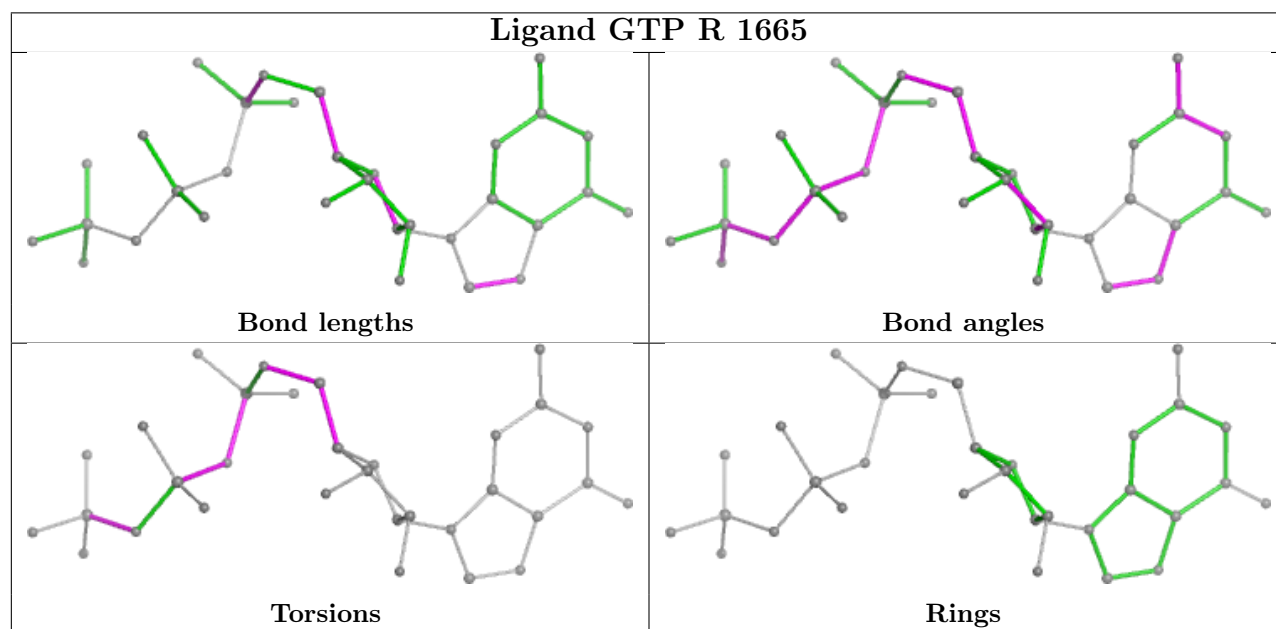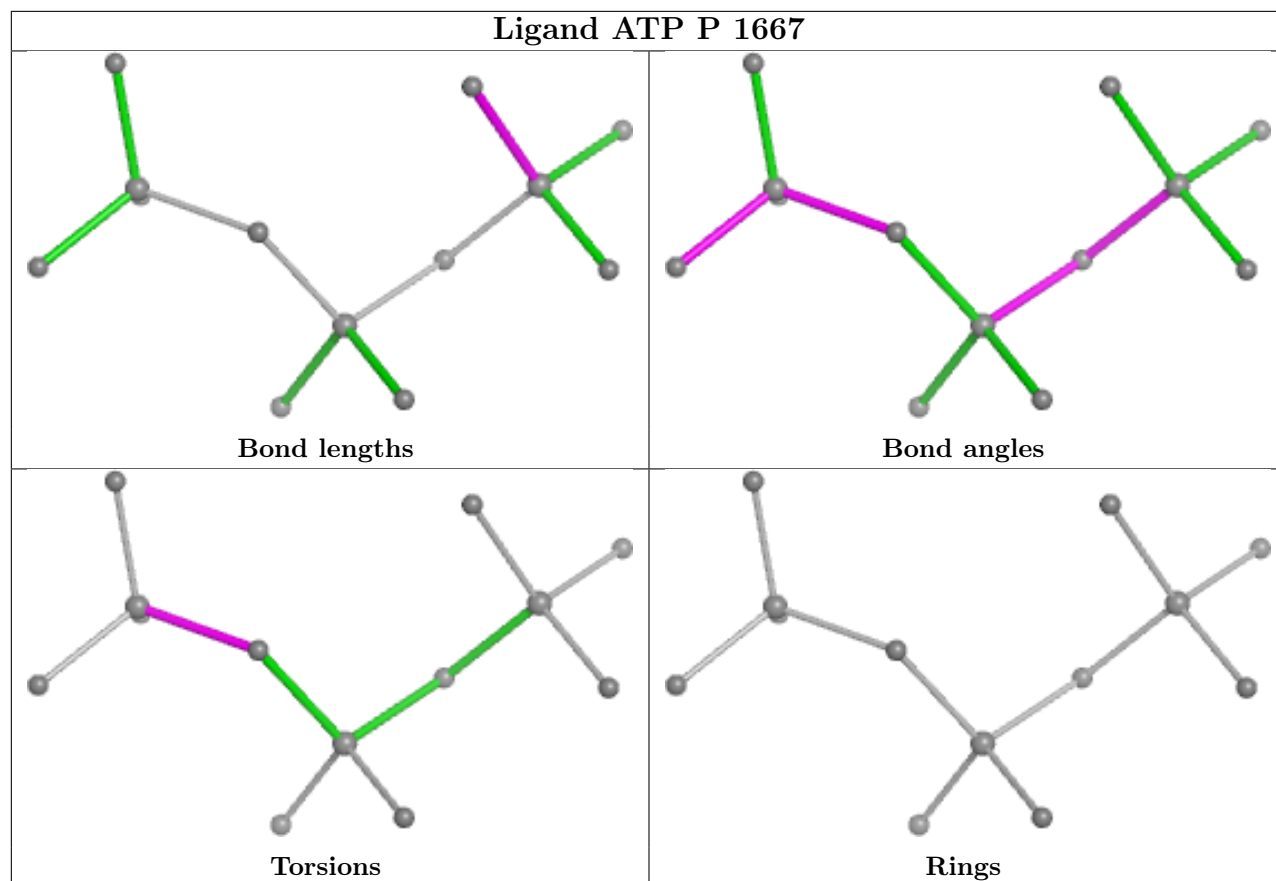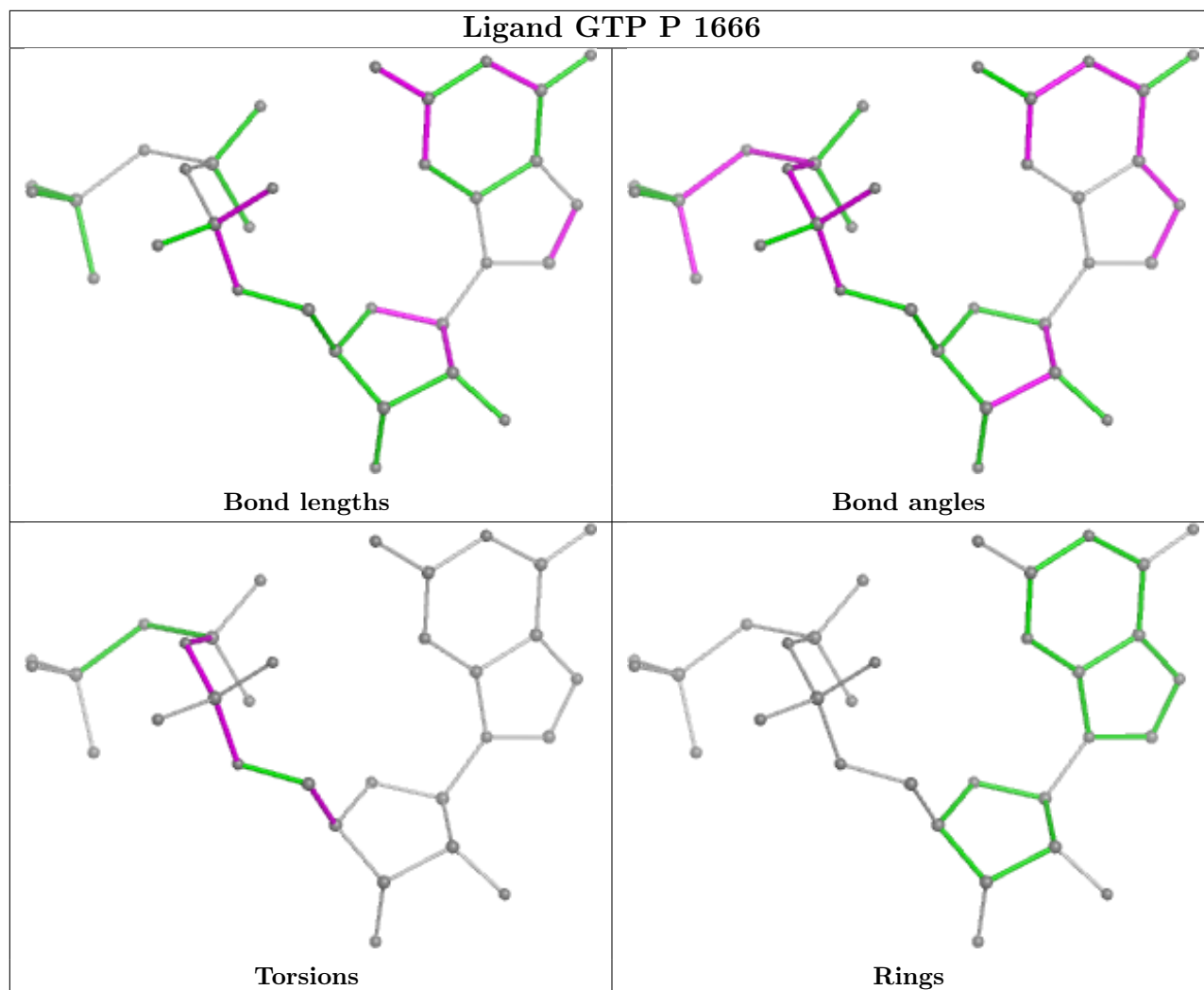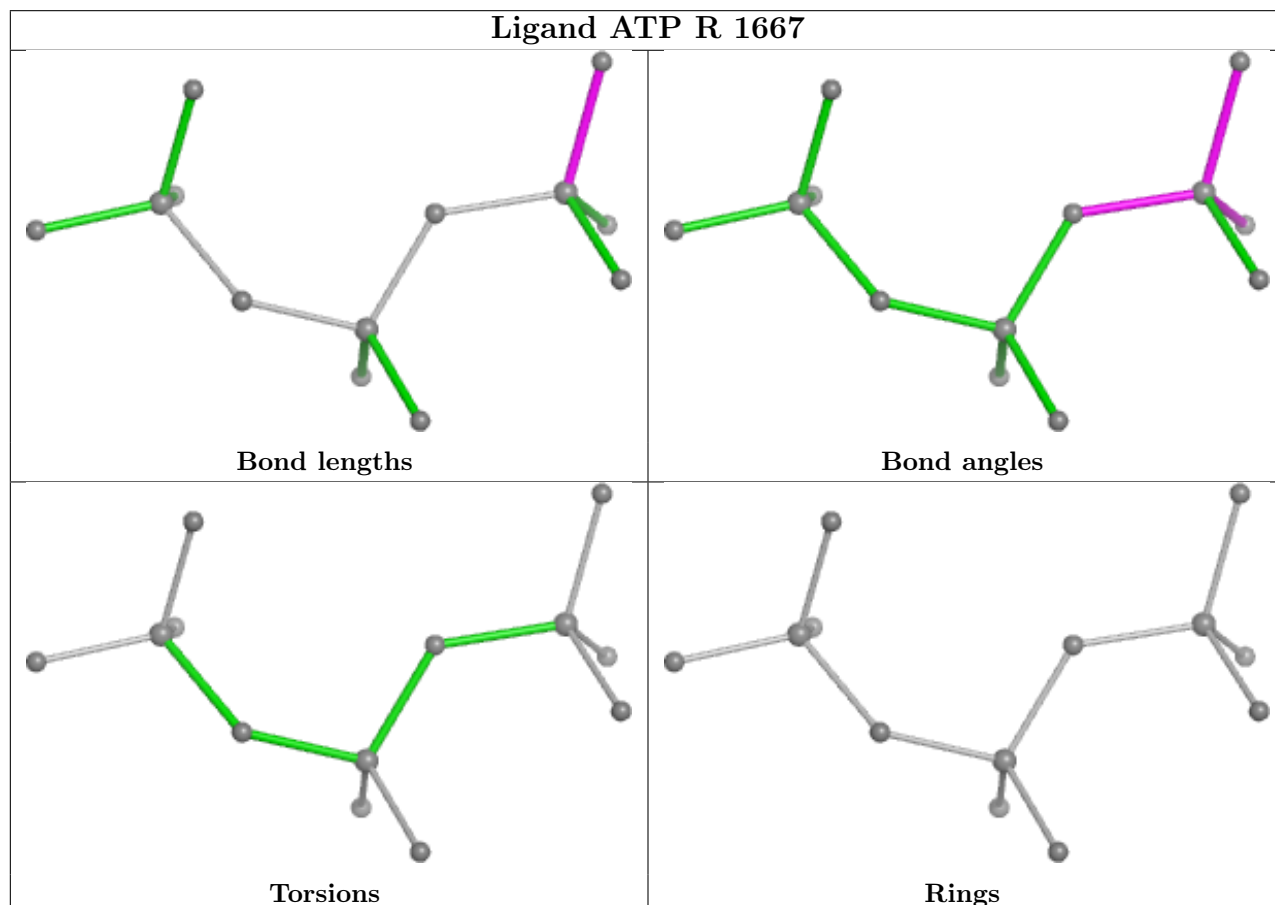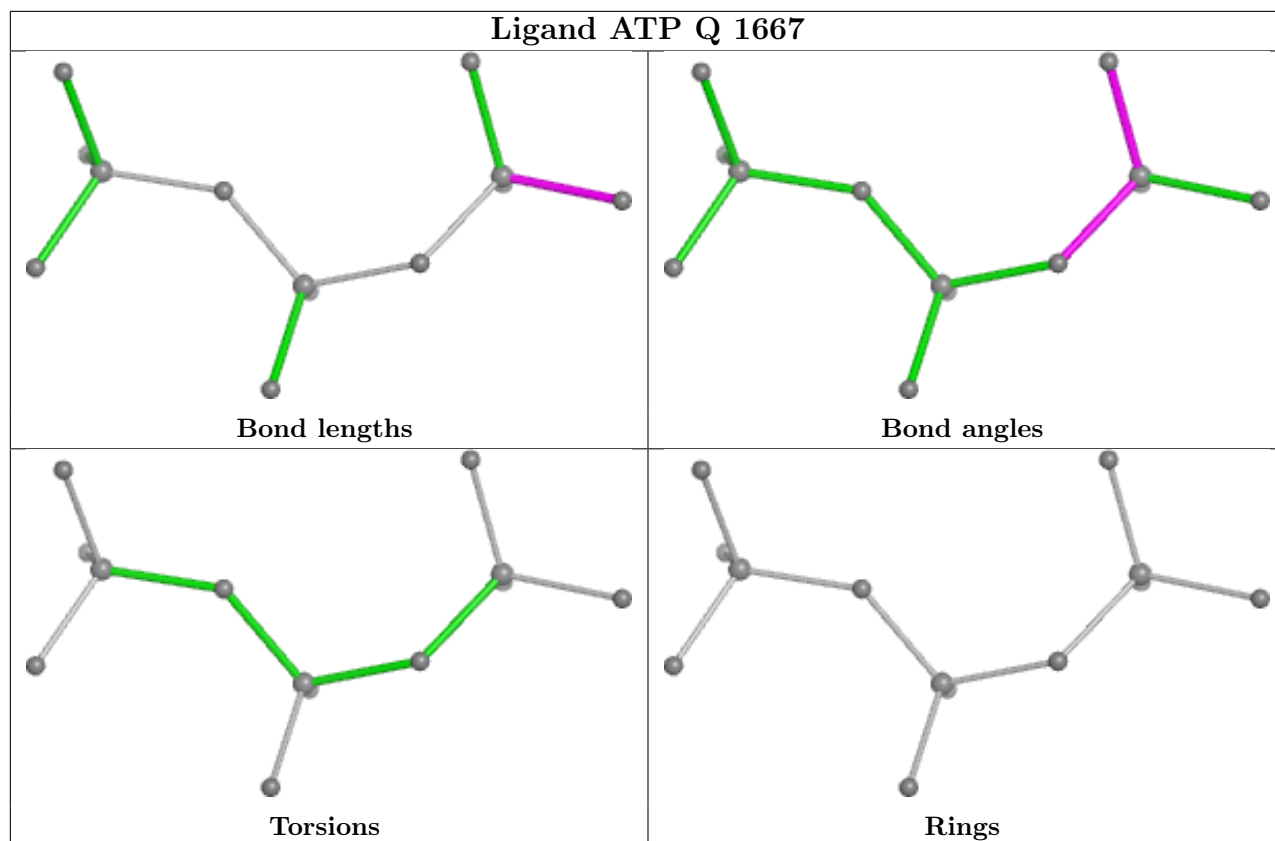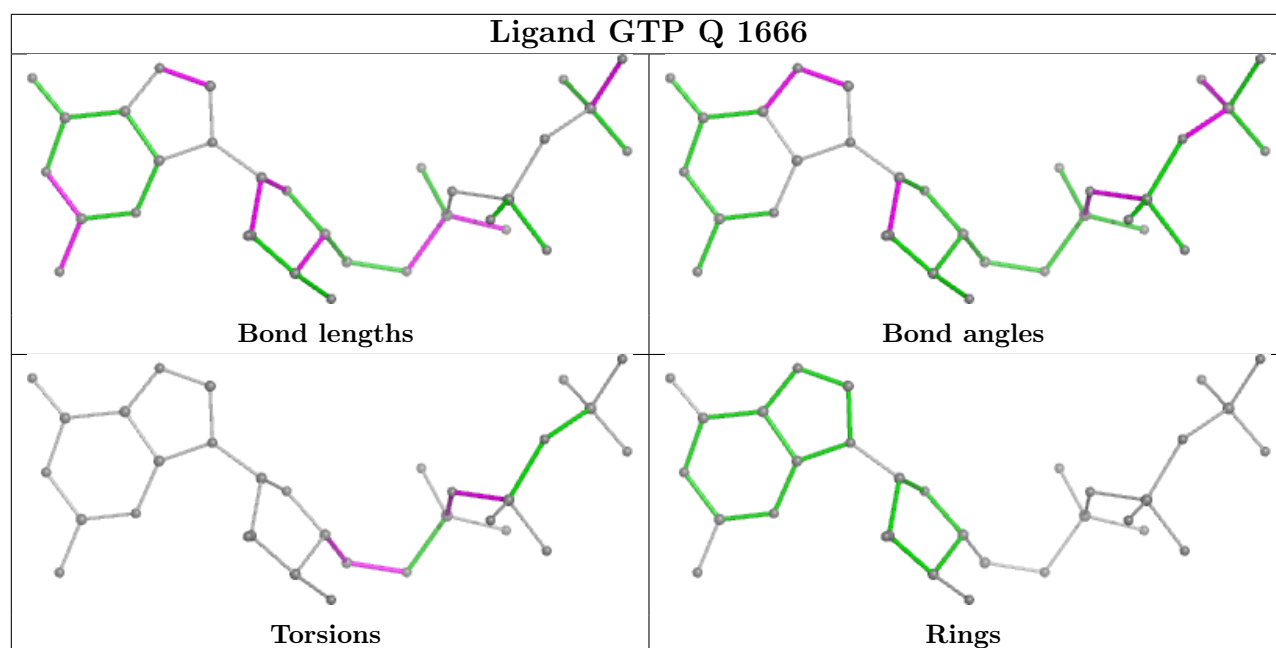
5.7 Other polymers ⓘ

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	B	4/4 (100%)	3.19	3 (75%)	0	0	159, 162, 170, 174	0
2	P	664/665 (99%)	-0.14	8 (1%)	79	79	41, 62, 89, 116	0
2	Q	664/665 (99%)	-0.08	7 (1%)	80	81	41, 61, 89, 127	0
2	R	664/665 (99%)	-0.04	10 (1%)	73	73	36, 64, 96, 146	0
All	All	1996/1999 (99%)	-0.08	28 (1%)	75	76	36, 62, 92, 174	0

All (28) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	R	608	GLN	9.2
2	Q	608	GLN	6.9
2	R	607	ARG	4.4
1	B	5	DA	4.4
2	R	609	ALA	4.1
1	B	7	DC	3.6
2	R	461	LYS	3.2
2	P	219	LYS	3.1
1	B	4	DA	2.9
2	P	216	LYS	2.9
2	R	315	LYS	2.8
2	Q	505	SER	2.8
2	Q	607	ARG	2.7
2	R	460	THR	2.5
2	R	606	ALA	2.5
2	R	465	LEU	2.5
2	P	249	ALA	2.4
2	Q	609	ALA	2.4
2	Q	664	ARG	2.4
2	R	501	LEU	2.4
2	P	664	ARG	2.3

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Mol	Chain	Res	Type	RSRZ
2	P	259	ASP	2.3
2	P	217	THR	2.2
2	P	607	ARG	2.1
2	P	258	ILE	2.1
2	Q	506	ARG	2.0
2	Q	514	PHE	2.0
2	R	216	LYS	2.0

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

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

6.3　Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4　Ligands ⓘ

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	GTP	P	1666	32/32	0.63	0.29	154,158,160,162	0
4	GTP	Q	1666	32/32	0.78	0.23	146,149,152,154	0
4	GTP	R	1665	32/32	0.79	0.21	146,149,151,153	0
5	ATP	Q	1667	13/31	0.79	0.25	170,171,174,175	0
5	ATP	R	1667	13/31	0.79	0.23	159,162,168,169	0
5	ATP	P	1667	13/31	0.81	0.15	169,174,176,177	0
3	MG	Q	1665	1/1	0.90	0.11	73,73,73,73	0
3	MG	P	1665	1/1	0.96	0.05	92,92,92,92	0
3	MG	R	1666	1/1	0.96	0.09	76,76,76,76	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.
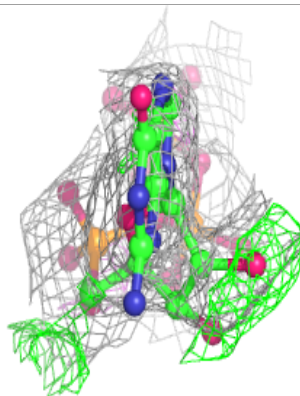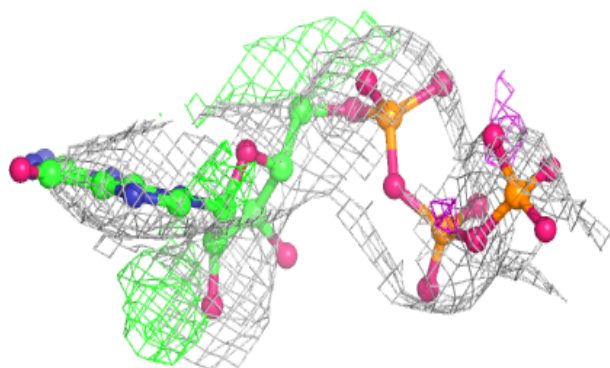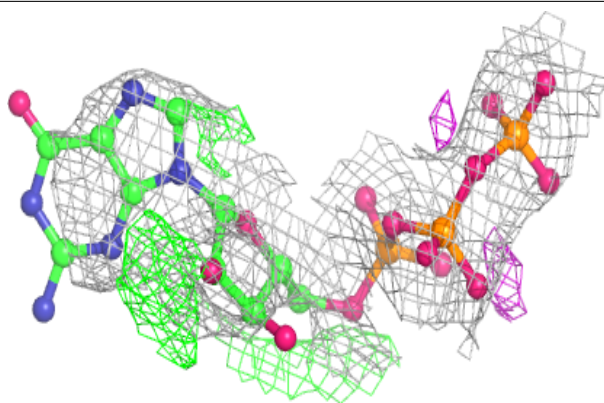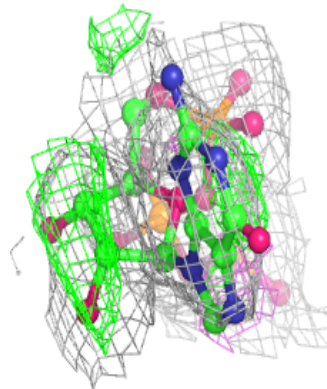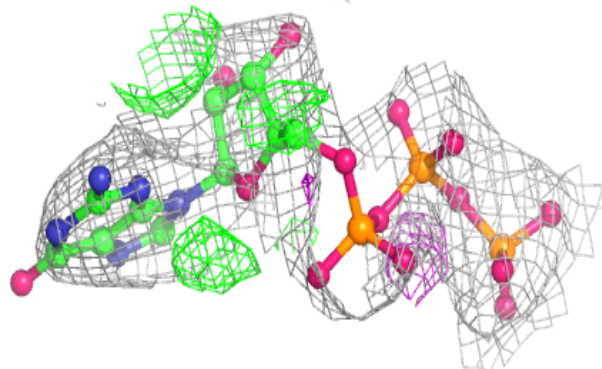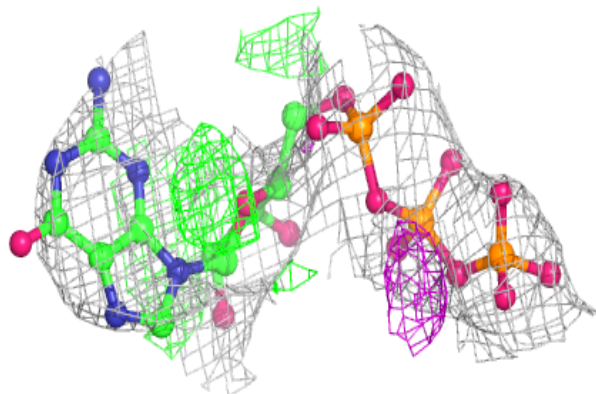
Electron density around GTP P 1666:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
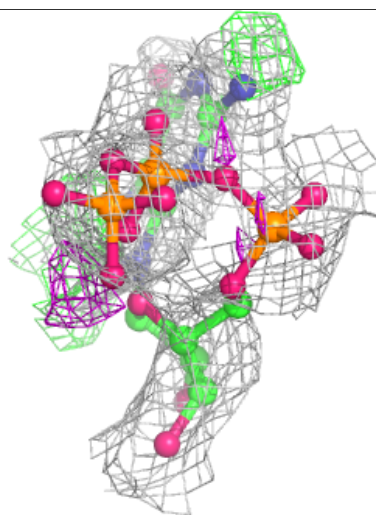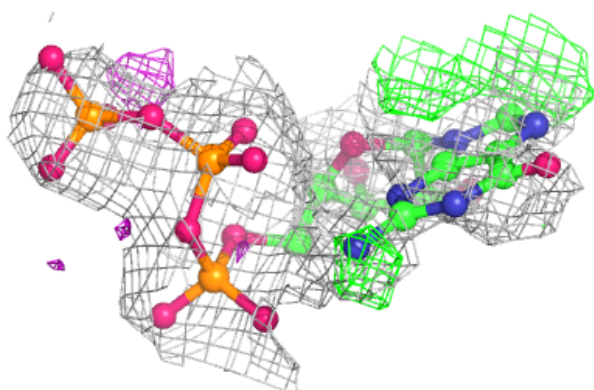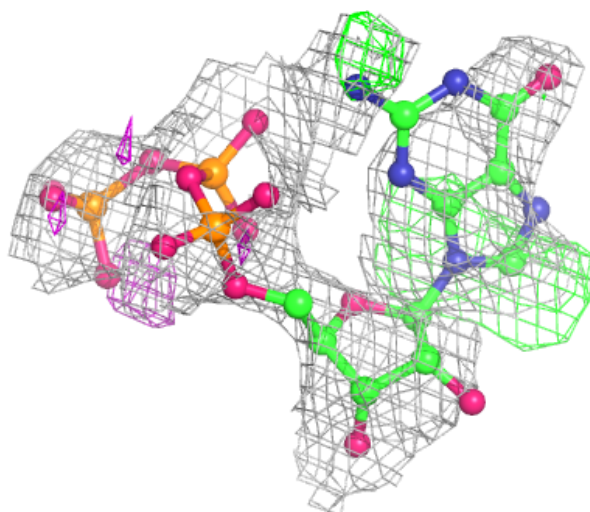
Electron density around GTP Q 1666:

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

Electron density around GTP R 1665:

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

Electron density around ATP Q 1667:

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

Electron density around ATP R 1667:

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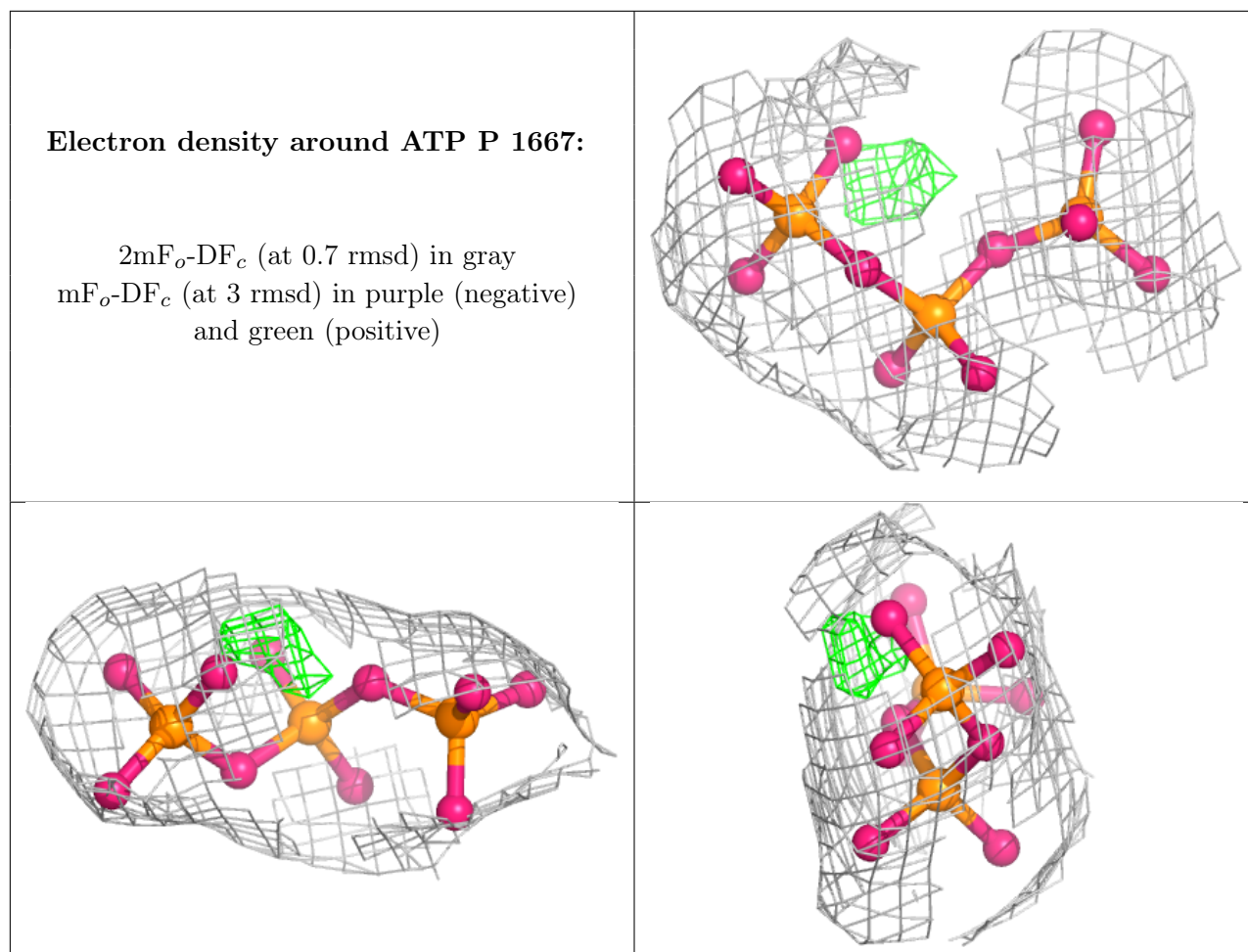mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around ATP P 1667:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
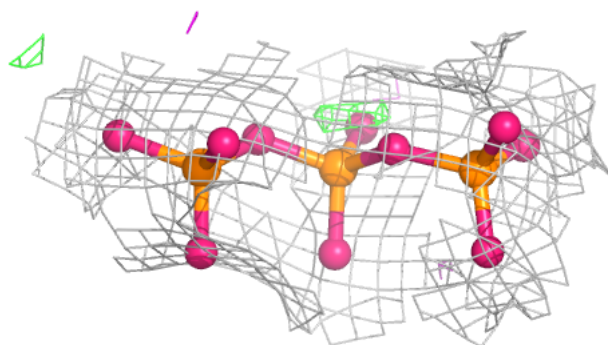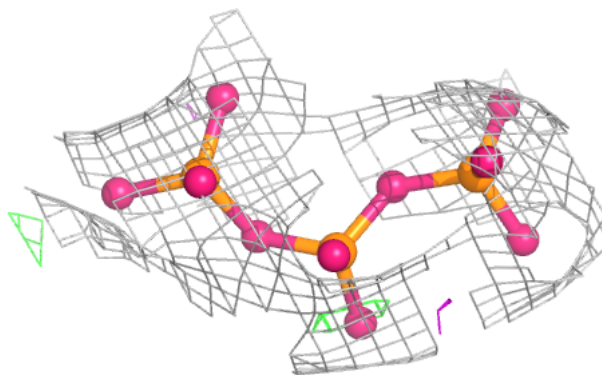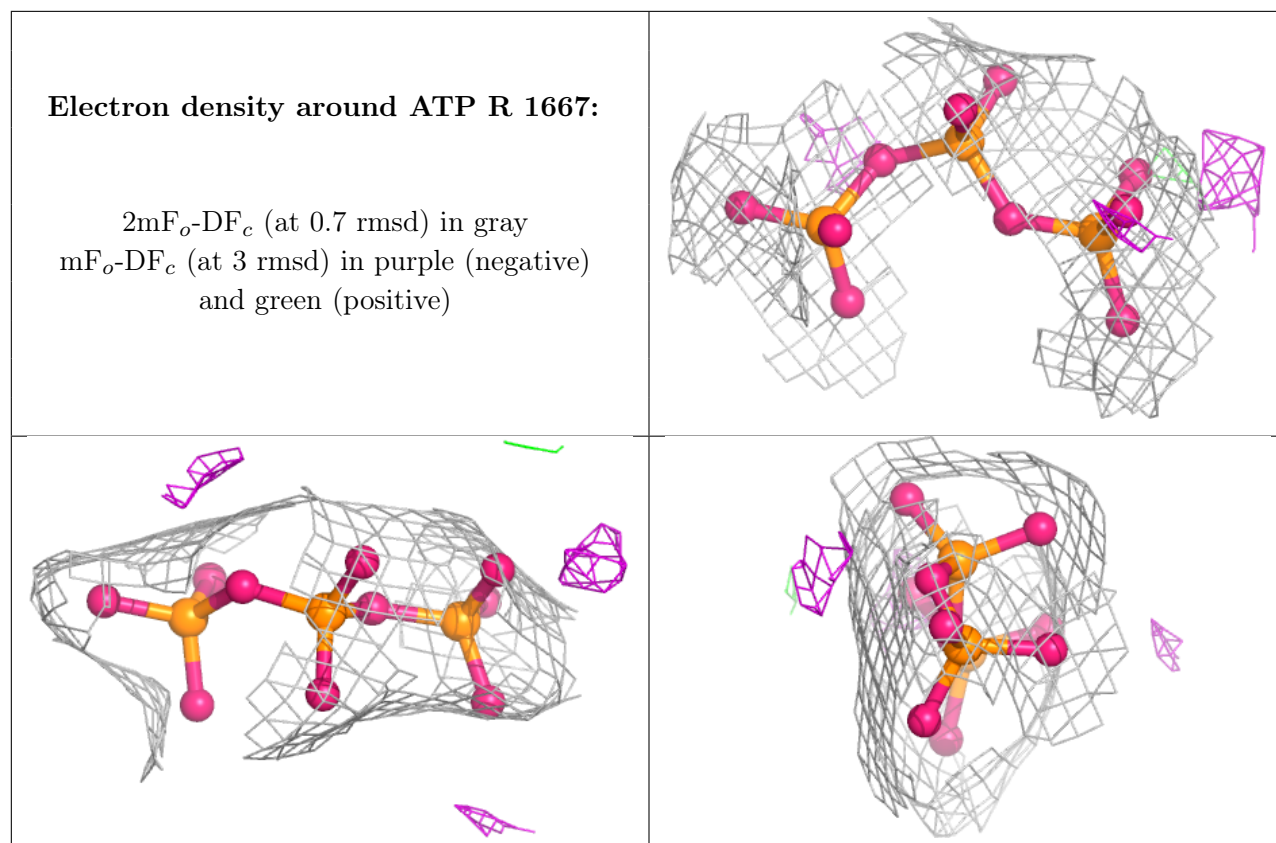
6.5 Other polymers (i)

There are no such residues in this entry.