



Full wwPDB X-ray Structure Validation Report ⓘ

Jul 27, 2026 – 01:34 pm BST

PDB ID : 9SA5 / pdb_00009sa5
Title : Inhibition by ATP regulates the activity of a CBASS antiphage nucleotide cyclase
Authors : McMahon, S.A.; Gaskell-Mew, L.; Wotherspoon, P.; McQuarrie, S.; Graham, S.; Gloster, T.M.; White, M.F.
Deposited on : 2025-08-07
Resolution : 2.09 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	:	1.8.4, CSD as541be (2020)
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	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

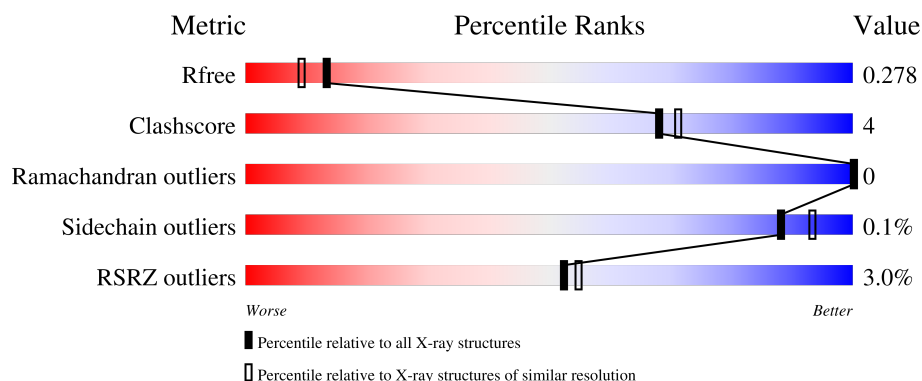
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.09 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	340	5% 80% 11% 9%
1	B	340	3% 84% 6% 9%
1	C	340	% 82% 6% 12%
1	D	340	2% 80% 8% 12%

2 Entry composition [i](#)

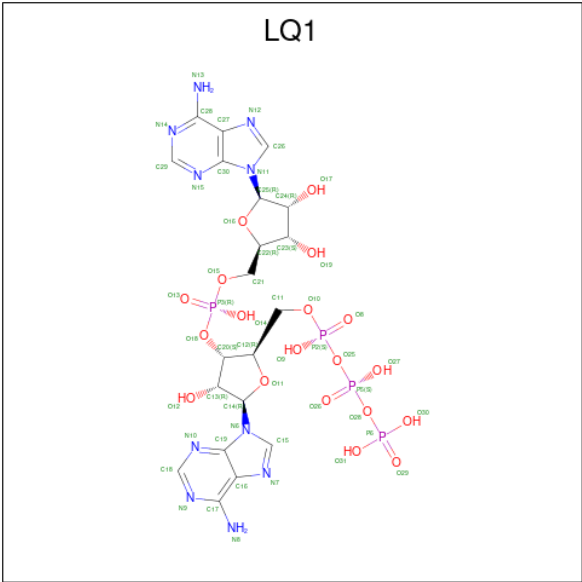
There are 5 unique types of molecules in this entry. The entry contains 10279 atoms, of which 0 are hydrogens and 0 are deuteriums.

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
1	A	311	Total	C	N	O	S	0	0	0
			2484	1591	424	459	10			
1	B	308	Total	C	N	O	S	0	0	0
			2464	1579	420	455	10			
1	C	299	Total	C	N	O	S	0	1	0
			2409	1542	413	444	10			
1	D	299	Total	C	N	O	S	0	0	0
			2397	1536	408	443	10			

- Molecule 2 is NC1=NC2=C(N1)N=CN=C2C3=C(N)N=CN=C3[C@@H]4O[C@H](COP(=O)(O)OP(=O)(O)OP(=O)(O)OP(=O)(O)O)[C@H](O)[C@@H](O)[C@H]4O-5-(6-aminopurin-9-yl)-3-[[[(2 {R},3 {S},4 {R},5 {R})-5-(6-aminopurin-9-yl)-3,4-bis(oxidanyl)oxolan-2-yl]methoxy-oxidanyl-phosphoryl]oxy-4-oxidanyl-oxolan-2-yl]methoxy-oxidanyl-phosphoryl] phosphono hydrogen phosphate (CCD ID: LQ1) (formula: C₂₀H₂₈N₁₀O₁₉P₄) (labeled as "Ligand of Interest" by depositor).



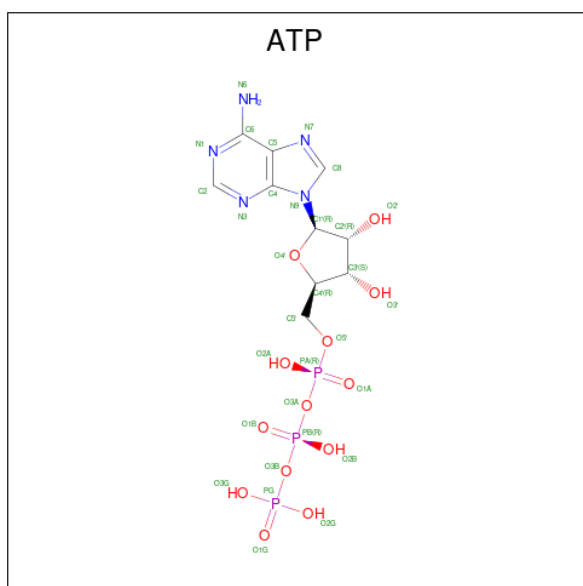
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			53	20	10	19	4		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	B	1	Total	C	N	O	P	0	0
			53	20	10	19	4		
2	C	1	Total	C	N	O	P	0	0
			32	15	6	10	1		
2	D	1	Total	C	N	O	P	0	0
			53	20	10	19	4		

- Molecule 3 is ADENOSINE-5'-TRIPHOSPHATE (CCD ID: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			31	10	5	13	3		
3	B	1	Total	C	N	O	P	0	0
			31	10	5	13	3		
3	D	1	Total	C	N	O	P	0	0
			31	10	5	13	3		

- Molecule 4 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	2	Total	Mg	0	0
			2	2		
4	B	2	Total	Mg	0	0
			2	2		
4	D	2	Total	Mg	0	0
			2	2		

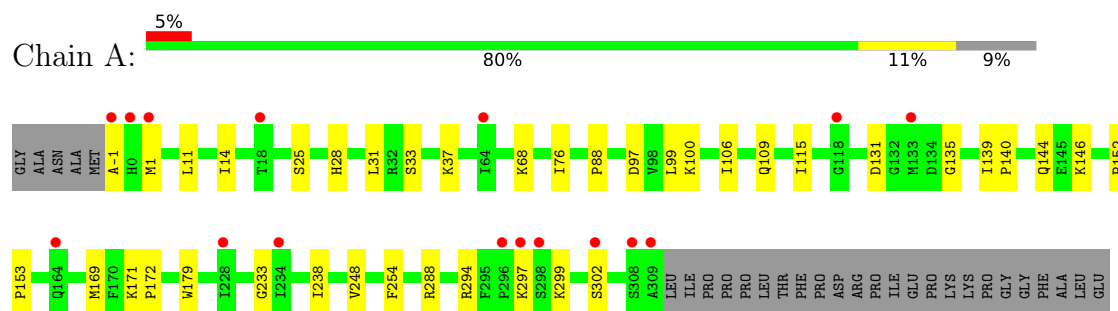
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	88	Total 88	O 88	0	0
5	B	47	Total 47	O 47	0	0
5	C	62	Total 62	O 62	0	0
5	D	38	Total 38	O 38	0	0

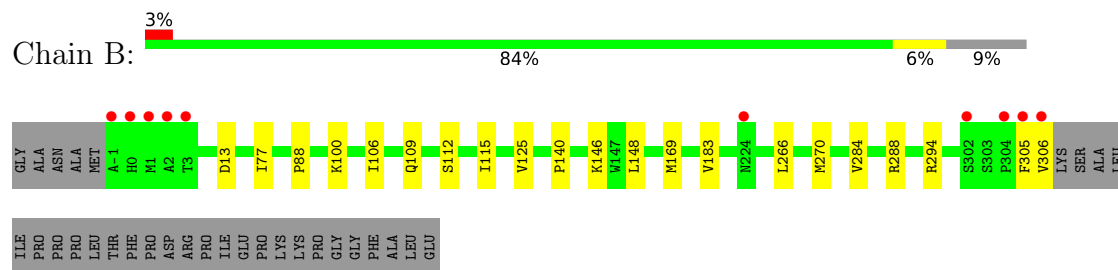
3 Residue-property plots

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.

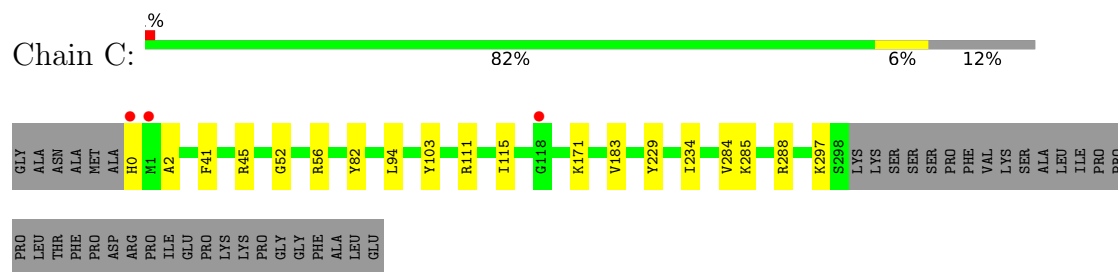
• Molecule 1: CD-NTase



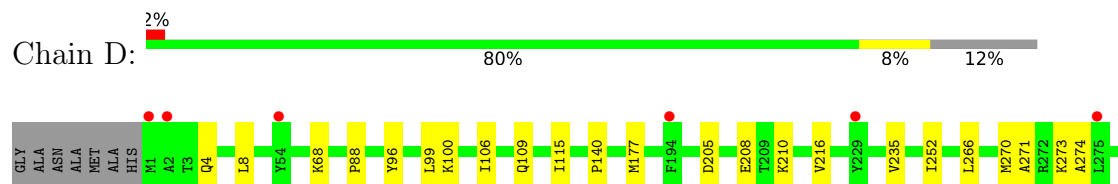
• Molecule 1: CD-NTase



• Molecule 1: CD-NTase



• Molecule 1: CD-NTase



N279	E280	D281	E282	L286	R294	K299	LYS	SER	SER	SER	PRO	PHE	VAL	LYS	SER	ALA	LEU	ILE	PRO	PRO	PRO	LEU	THR	PHE	PRO	ASP	ARG	PRO	ILE	GLU	PRO	LYS	LYS	PRO	GLY	GLY	PHE	ALA	LEU	GLU
------	------	------	------	------	------	------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	87.30Å 116.70Å 156.57Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	76.25 – 2.09 76.25 – 2.09	Depositor EDS
% Data completeness (in resolution range)	93.0 (76.25-2.09) 93.2 (76.25-2.09)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.98 (at 2.08Å)	Xtriage
Refinement program	PHENIX 1.21.2_5419	Depositor
R, R_{free}	0.218 , 0.277 0.218 , 0.278	Depositor DCC
R_{free} test set	1986 reflections (2.17%)	wwPDB-VP
Wilson B-factor (Å ²)	45.3	Xtriage
Anisotropy	0.259	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 40.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	10279	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.90% 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: ATP, MG, LQ1

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.48	0/2541	0.66	0/3433
1	B	0.47	0/2521	0.71	0/3407
1	C	0.42	0/2464	0.61	0/3331
1	D	0.44	0/2451	0.64	0/3312
All	All	0.45	0/9977	0.66	0/13483

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	2484	0	2530	23	0
1	B	2464	0	2507	14	0
1	C	2409	0	2449	14	0
1	D	2397	0	2442	21	0
2	A	53	0	0	2	0
2	B	53	0	0	1	0
2	C	32	0	0	1	0
2	D	53	0	0	1	0
3	A	31	0	12	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	31	0	12	0	0
3	D	31	0	12	0	0
4	A	2	0	0	0	0
4	B	2	0	0	0	0
4	D	2	0	0	0	0
5	A	88	0	0	0	0
5	B	47	0	0	0	0
5	C	62	0	0	1	0
5	D	38	0	0	0	0
All	All	10279	0	9964	72	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 (72) 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:99:LEU:HD13	1:D:115:ILE:HD11	1.72	0.71
1:B:13:ASP:HB3	1:B:294:ARG:HH12	1.62	0.63
1:B:77:ILE:HD13	1:B:125:VAL:HB	1.81	0.62
1:C:0:HIS:CD2	1:C:2:ALA:H	2.18	0.62
1:D:274:ALA:HA	1:D:286:LEU:HD13	1.80	0.62
1:A:97:ASP:HA	1:A:100:LYS:HD3	1.81	0.62
1:D:274:ALA:HB2	1:D:286:LEU:HB3	1.81	0.61
1:A:31:LEU:HD22	1:A:76:ILE:HD13	1.84	0.60
1:C:41:PHE:CE2	1:C:45:ARG:HB2	2.38	0.59
1:D:109:GLN:HG2	2:D:401:LQ1:N10	2.18	0.58
1:D:208:GLU:OE2	1:D:210:LYS:HE2	2.03	0.58
1:A:1:MET:HE2	1:A:302:SER:HB3	1.86	0.57
1:D:4:GLN:O	1:D:8:LEU:HD12	2.06	0.56
1:A:288:ARG:NH1	1:A:297:LYS:HB2	2.21	0.56
1:C:183:VAL:HG22	1:D:68:LYS:HD3	1.88	0.56
1:B:146:LYS:HD3	1:B:148:LEU:HD23	1.88	0.56
1:C:284:VAL:HG22	1:C:288:ARG:HE	1.71	0.56
1:B:100:LYS:HG3	1:B:106:ILE:HG21	1.87	0.55
1:B:266:LEU:O	1:B:270:MET:HG3	2.06	0.55
3:A:402:ATP:H5'1	3:A:402:ATP:H8	1.71	0.55
1:D:216:VAL:HG22	1:D:271:ALA:HB1	1.90	0.53
1:D:273:LYS:HZ2	1:D:286:LEU:HD11	1.74	0.53
1:C:41:PHE:CD2	1:C:45:ARG:HB2	2.43	0.53
1:A:179:TRP:HZ2	1:A:294:ARG:HG3	1.73	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:288:ARG:HH21	1:C:297:LYS:HG3	1.76	0.50
1:D:88:PRO:HB3	1:D:140:PRO:HB2	1.94	0.49
1:B:106:ILE:HG13	1:B:115:ILE:CD1	2.42	0.49
2:A:401:LQ1:C24	3:A:402:ATP:H5'2	2.42	0.49
1:D:266:LEU:O	1:D:270:MET:HG3	2.12	0.49
1:A:233:GLY:HA2	1:A:254:PHE:CZ	2.48	0.48
1:C:229:TYR:HB3	1:C:234:ILE:O	2.14	0.48
1:D:279:ASN:O	1:D:282:GLU:N	2.47	0.48
1:A:88:PRO:HB3	1:A:140:PRO:HB2	1.97	0.47
1:A:139:ILE:HG13	1:A:140:PRO:HD2	1.97	0.47
1:D:205:ASP:OD2	1:D:208:GLU:HB2	2.15	0.47
1:D:279:ASN:HB3	1:D:282:GLU:HB2	1.96	0.47
1:A:-1:ALA:C	1:A:299:LYS:HG2	2.39	0.47
1:D:106:ILE:HG22	1:D:115:ILE:HG12	1.97	0.46
1:B:106:ILE:HG13	1:B:115:ILE:HD13	1.97	0.46
1:B:284:VAL:O	1:B:288:ARG:HG3	2.16	0.45
1:C:0:HIS:HD2	1:C:2:ALA:HB3	1.81	0.45
1:B:109:GLN:NE2	1:B:112:SER:OG	2.48	0.45
1:C:285:LYS:HB3	1:C:285:LYS:HE3	1.54	0.45
1:C:171:LYS:HE3	5:C:557:HOH:O	2.17	0.45
1:A:31:LEU:CD2	1:A:76:ILE:HD13	2.46	0.45
1:B:169:MET:HB3	1:B:169:MET:HE3	1.69	0.45
1:C:82:TYR:OH	1:C:94:LEU:HD22	2.17	0.44
1:D:177:MET:HE2	1:D:177:MET:HB2	1.75	0.44
1:A:99:LEU:HD13	1:A:115:ILE:HD11	2.00	0.44
1:B:88:PRO:HB3	1:B:140:PRO:HB2	2.01	0.43
1:A:109:GLN:HG2	2:A:401:LQ1:N10	2.33	0.43
1:B:305:PHE:CE1	1:B:306:VAL:HB	2.53	0.43
1:A:171:LYS:HB2	1:A:172:PRO:HD3	2.01	0.43
1:A:169:MET:HE3	1:A:169:MET:HB3	1.83	0.43
1:A:25:SER:HA	1:A:28:HIS:CD2	2.54	0.42
1:D:235:VAL:HG21	1:D:252:ILE:O	2.19	0.42
1:A:1:MET:CE	1:A:302:SER:HB3	2.49	0.42
1:D:294:ARG:HH11	1:D:294:ARG:HA	1.85	0.42
1:A:68:LYS:HD3	1:B:183:VAL:HG13	2.01	0.41
1:A:33:SER:O	1:A:37:LYS:HG3	2.19	0.41
1:B:109:GLN:HG2	2:B:401:LQ1:N10	2.34	0.41
1:C:52:GLY:O	1:C:56:ARG:HG3	2.20	0.41
1:D:279:ASN:O	1:D:280:GLU:C	2.62	0.41
1:C:103:TYR:CB	1:C:115:ILE:HD12	2.50	0.41
1:D:294:ARG:HA	1:D:294:ARG:HD2	1.74	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:11:LEU:HA	1:A:14:ILE:HG12	2.02	0.41
1:A:131:ASP:HB2	1:A:135:GLY:HA3	2.02	0.41
1:A:238:ILE:O	1:A:248:VAL:HG22	2.20	0.41
1:A:144:GLN:OE1	1:A:146:LYS:HE2	2.21	0.41
1:C:111:ARG:HD2	2:C:401:LQ1:O13	2.21	0.41
1:D:96:TYR:OH	1:D:100:LYS:HE3	2.21	0.40
1:A:152:PRO:N	1:A:153:PRO:HD2	2.37	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	309/340 (91%)	303 (98%)	6 (2%)	0	100	100
1	B	306/340 (90%)	301 (98%)	5 (2%)	0	100	100
1	C	298/340 (88%)	295 (99%)	3 (1%)	0	100	100
1	D	297/340 (87%)	292 (98%)	5 (2%)	0	100	100
All	All	1210/1360 (89%)	1191 (98%)	19 (2%)	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	274/297 (92%)	273 (100%)	1 (0%)	84	89
1	B	272/297 (92%)	272 (100%)	0	100	100
1	C	265/297 (89%)	265 (100%)	0	100	100
1	D	264/297 (89%)	264 (100%)	0	100	100
All	All	1075/1188 (90%)	1074 (100%)	1 (0%)	88	93

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	106	ILE

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

Mol	Chain	Res	Type
1	A	6	GLN
1	A	73	ASN
1	A	81	ASN
1	B	109	GLN
1	B	246	ASN
1	C	6	GLN
1	C	81	ASN
1	C	109	GLN

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 13 ligands modelled in this entry, 6 are monoatomic - leaving 7 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	ATP	B	402	4	29,33,33	0.49	0	44,52,52	0.55	0
2	LQ1	A	401	4	54,58,58	3.88	25 (46%)	82,91,91	4.08	25 (30%)
2	LQ1	C	401	-	34,35,58	3.57	17 (50%)	49,53,91	3.73	17 (34%)
2	LQ1	B	401	4	54,58,58	3.89	27 (50%)	82,91,91	4.07	30 (36%)
2	LQ1	D	401	4	54,58,58	3.88	26 (48%)	82,91,91	4.11	26 (31%)
3	ATP	A	402	4	29,33,33	0.50	0	44,52,52	0.54	0
3	ATP	D	402	4	29,33,33	0.51	0	44,52,52	0.57	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
3	ATP	B	402	4	-	2/22/38/38	0/3/3/3
2	LQ1	A	401	4	-	8/37/69/69	0/6/6/6
2	LQ1	C	401	-	-	11/17/49/69	0/4/4/6
2	LQ1	B	401	4	-	2/37/69/69	0/6/6/6
2	LQ1	D	401	4	-	0/37/69/69	0/6/6/6
3	ATP	A	402	4	-	8/22/38/38	0/3/3/3
3	ATP	D	402	4	-	6/22/38/38	0/3/3/3

All (95) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	401	LQ1	C15-N6	-11.54	1.16	1.37
2	A	401	LQ1	C15-N6	-11.51	1.17	1.37
2	B	401	LQ1	C15-N6	-11.48	1.17	1.37
2	A	401	LQ1	C26-N11	-10.81	1.18	1.37
2	D	401	LQ1	C26-N11	-10.62	1.18	1.37
2	C	401	LQ1	C26-N11	-10.60	1.18	1.37
2	B	401	LQ1	C26-N11	-10.58	1.18	1.37

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	401	LQ1	C19-N6	-10.55	1.14	1.37
2	A	401	LQ1	C19-N6	-10.43	1.14	1.37
2	B	401	LQ1	C19-N6	-10.26	1.15	1.37
2	A	401	LQ1	C30-N11	-9.71	1.16	1.37
2	B	401	LQ1	C30-N11	-9.67	1.16	1.37
2	D	401	LQ1	C30-N11	-9.62	1.16	1.37
2	C	401	LQ1	C30-N11	-9.59	1.16	1.37
2	C	401	LQ1	C27-N12	7.57	1.53	1.39
2	D	401	LQ1	C27-N12	7.57	1.53	1.39
2	B	401	LQ1	C27-N12	7.46	1.53	1.39
2	A	401	LQ1	C27-N12	7.46	1.53	1.39
2	A	401	LQ1	C17-N8	5.99	1.49	1.34
2	D	401	LQ1	C17-N8	5.97	1.49	1.34
2	B	401	LQ1	C17-N8	5.90	1.48	1.34
2	B	401	LQ1	O11-C12	5.63	1.57	1.45
2	B	401	LQ1	C16-N7	5.57	1.49	1.39
2	A	401	LQ1	C16-N7	5.50	1.49	1.39
2	D	401	LQ1	C16-N7	5.46	1.49	1.39
2	D	401	LQ1	O11-C12	5.44	1.57	1.45
2	A	401	LQ1	O11-C12	5.35	1.56	1.45
2	C	401	LQ1	O11-C12	5.29	1.56	1.45
2	B	401	LQ1	C20-C12	-4.59	1.40	1.52
2	B	401	LQ1	O11-C14	4.54	1.52	1.42
2	D	401	LQ1	C28-N13	4.49	1.45	1.34
2	B	401	LQ1	C28-N13	4.48	1.45	1.34
2	C	401	LQ1	C28-N13	4.44	1.45	1.34
2	A	401	LQ1	C28-N13	4.41	1.45	1.34
2	D	401	LQ1	O11-C14	4.28	1.52	1.42
2	C	401	LQ1	O11-C14	4.26	1.51	1.42
2	A	401	LQ1	O11-C14	4.20	1.52	1.42
2	D	401	LQ1	P6-O31	4.16	1.70	1.54
2	A	401	LQ1	P6-O31	4.15	1.70	1.54
2	C	401	LQ1	C20-C12	-4.14	1.41	1.52
2	B	401	LQ1	P6-O31	4.08	1.70	1.54
2	C	401	LQ1	O16-C22	3.94	1.53	1.45
2	B	401	LQ1	O16-C22	3.65	1.53	1.45
2	D	401	LQ1	O16-C22	3.63	1.53	1.45
2	A	401	LQ1	C20-C12	-3.63	1.43	1.52
2	A	401	LQ1	O16-C22	3.62	1.53	1.45
2	D	401	LQ1	C20-C12	-3.54	1.43	1.52
2	B	401	LQ1	P6-O30	3.53	1.68	1.54
2	D	401	LQ1	P6-O30	3.51	1.68	1.54

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	401	LQ1	P6-O30	3.47	1.68	1.54
2	A	401	LQ1	O16-C25	2.98	1.49	1.42
2	D	401	LQ1	O16-C25	2.96	1.49	1.42
2	C	401	LQ1	O16-C25	2.95	1.49	1.42
2	B	401	LQ1	O16-C25	2.91	1.48	1.42
2	B	401	LQ1	C23-C22	-2.87	1.45	1.53
2	A	401	LQ1	C23-C22	-2.86	1.45	1.53
2	A	401	LQ1	P2-O8	-2.82	1.40	1.50
2	B	401	LQ1	P2-O8	-2.72	1.41	1.50
2	D	401	LQ1	P2-O8	-2.71	1.41	1.50
2	A	401	LQ1	C13-C14	-2.70	1.44	1.53
2	D	401	LQ1	C16-C17	-2.70	1.33	1.41
2	A	401	LQ1	C16-C17	-2.66	1.33	1.41
2	D	401	LQ1	C23-C22	-2.62	1.46	1.53
2	C	401	LQ1	C29-N15	2.61	1.38	1.33
2	C	401	LQ1	C23-C22	-2.60	1.46	1.53
2	B	401	LQ1	C13-C14	-2.58	1.45	1.53
2	B	401	LQ1	C15-N7	2.53	1.36	1.31
2	B	401	LQ1	C16-C17	-2.49	1.34	1.41
2	B	401	LQ1	P5-O27	2.47	1.66	1.55
2	C	401	LQ1	C13-C14	-2.46	1.45	1.53
2	B	401	LQ1	C16-C19	2.46	1.43	1.39
2	A	401	LQ1	C16-C19	2.46	1.43	1.39
2	A	401	LQ1	C29-N15	2.44	1.38	1.33
2	D	401	LQ1	C13-C14	-2.43	1.45	1.53
2	A	401	LQ1	P5-O27	2.43	1.66	1.55
2	D	401	LQ1	C29-N15	2.40	1.38	1.33
2	D	401	LQ1	P5-O27	2.39	1.66	1.55
2	B	401	LQ1	C13-C20	-2.38	1.47	1.52
2	D	401	LQ1	C16-C19	2.37	1.43	1.39
2	B	401	LQ1	C29-N15	2.31	1.38	1.33
2	A	401	LQ1	C13-C20	-2.30	1.47	1.52
2	A	401	LQ1	C15-N7	2.27	1.35	1.31
2	D	401	LQ1	C15-N7	2.27	1.35	1.31
2	C	401	LQ1	P3-O14	2.24	1.65	1.55
2	B	401	LQ1	C26-N12	2.22	1.35	1.31
2	C	401	LQ1	C26-N12	2.20	1.35	1.31
2	C	401	LQ1	C27-C30	2.19	1.43	1.39
2	D	401	LQ1	C26-N12	2.18	1.35	1.31
2	C	401	LQ1	P3-O13	-2.15	1.43	1.50
2	A	401	LQ1	C26-N12	2.12	1.35	1.31
2	C	401	LQ1	C13-C20	-2.12	1.48	1.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	401	LQ1	P6-O29	-2.08	1.43	1.50
2	D	401	LQ1	C24-C23	-2.08	1.47	1.53
2	B	401	LQ1	C24-C23	-2.07	1.47	1.53
2	D	401	LQ1	C13-C20	-2.06	1.48	1.52

All (98) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	401	LQ1	C19-N6-C15	21.40	128.92	105.73
2	D	401	LQ1	C30-N11-C26	21.23	128.74	105.73
2	C	401	LQ1	C30-N11-C26	21.20	128.70	105.73
2	A	401	LQ1	C30-N11-C26	21.18	128.68	105.73
2	A	401	LQ1	C19-N6-C15	21.16	128.66	105.73
2	B	401	LQ1	C30-N11-C26	20.97	128.45	105.73
2	B	401	LQ1	C19-N6-C15	20.48	127.93	105.73
2	B	401	LQ1	P5-O25-P2	-6.36	111.00	132.83
2	A	401	LQ1	P5-O25-P2	-6.25	111.39	132.83
2	A	401	LQ1	P5-O28-P6	-6.22	111.47	132.83
2	D	401	LQ1	P5-O25-P2	-6.19	111.59	132.83
2	D	401	LQ1	P5-O28-P6	-6.07	112.01	132.83
2	C	401	LQ1	C27-C30-N11	-5.80	99.04	105.78
2	D	401	LQ1	C16-C19-N6	-5.75	99.10	105.78
2	B	401	LQ1	C27-C30-N11	-5.58	99.30	105.78
2	A	401	LQ1	C16-C19-N6	-5.53	99.35	105.78
2	B	401	LQ1	P5-O28-P6	-5.52	113.89	132.83
2	D	401	LQ1	C27-C30-N11	-5.49	99.40	105.78
2	A	401	LQ1	C27-C30-N11	-5.48	99.41	105.78
2	B	401	LQ1	C30-N11-C25	-5.24	114.11	126.59
2	D	401	LQ1	C30-N11-C25	-5.20	114.19	126.59
2	D	401	LQ1	C14-N6-C15	-5.10	115.62	127.14
2	A	401	LQ1	C30-N11-C25	-4.98	114.73	126.59
2	B	401	LQ1	C16-C19-N6	-4.93	100.05	105.78
2	B	401	LQ1	C14-N6-C15	-4.93	116.01	127.14
2	C	401	LQ1	N15-C30-N11	4.87	135.10	127.08
2	C	401	LQ1	C25-N11-C26	-4.86	116.17	127.14
2	A	401	LQ1	C19-N6-C14	-4.83	115.09	126.59
2	A	401	LQ1	C14-N6-C15	-4.82	116.24	127.14
2	C	401	LQ1	C30-N11-C25	-4.81	115.12	126.59
2	D	401	LQ1	N10-C19-N6	4.70	134.82	127.08
2	A	401	LQ1	N15-C30-N11	4.68	134.80	127.08
2	D	401	LQ1	C19-N6-C14	-4.67	115.46	126.59
2	A	401	LQ1	C25-N11-C26	-4.67	116.59	127.14

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	401	LQ1	N15-C30-N11	4.59	134.65	127.08
2	D	401	LQ1	N6-C15-N7	-4.56	107.68	113.91
2	A	401	LQ1	N6-C15-N7	-4.54	107.70	113.91
2	B	401	LQ1	N10-C19-N6	4.51	134.51	127.08
2	B	401	LQ1	C19-C16-N7	-4.48	105.16	110.62
2	D	401	LQ1	N11-C26-N12	-4.47	107.80	113.91
2	D	401	LQ1	C25-N11-C26	-4.46	117.07	127.14
2	B	401	LQ1	N15-C30-N11	4.45	134.42	127.08
2	A	401	LQ1	N10-C19-N6	4.44	134.40	127.08
2	B	401	LQ1	C19-N6-C14	-4.42	116.06	126.59
2	B	401	LQ1	N6-C15-N7	-4.38	107.93	113.91
2	A	401	LQ1	N11-C26-N12	-4.35	107.96	113.91
2	B	401	LQ1	C25-N11-C26	-4.30	117.43	127.14
2	A	401	LQ1	C19-C16-N7	-4.22	105.47	110.62
2	C	401	LQ1	N11-C26-N12	-4.15	108.23	113.91
2	B	401	LQ1	N11-C26-N12	-4.15	108.24	113.91
2	D	401	LQ1	C30-C27-N12	-4.11	105.61	110.62
2	A	401	LQ1	C30-C27-N12	-4.07	105.66	110.62
2	D	401	LQ1	C19-C16-N7	-4.01	105.73	110.62
2	B	401	LQ1	C27-N12-C26	-3.89	97.98	103.51
2	C	401	LQ1	C27-N12-C26	-3.87	98.01	103.51
2	C	401	LQ1	C30-C27-N12	-3.78	106.02	110.62
2	B	401	LQ1	C30-C27-N12	-3.76	106.03	110.62
2	B	401	LQ1	C12-O11-C14	-3.71	101.29	109.47
2	A	401	LQ1	C27-N12-C26	-3.67	98.29	103.51
2	B	401	LQ1	C11-C12-C20	-3.63	102.38	114.40
2	D	401	LQ1	C27-N12-C26	-3.56	98.45	103.51
2	B	401	LQ1	C17-C16-N7	3.49	138.53	132.02
2	D	401	LQ1	C16-N7-C15	-3.47	98.57	103.51
2	A	401	LQ1	C17-C16-N7	3.41	138.38	132.02
2	D	401	LQ1	C12-O11-C14	-3.37	102.03	109.47
2	A	401	LQ1	C12-O11-C14	-3.35	102.08	109.47
2	D	401	LQ1	C28-C27-N12	3.32	138.20	132.02
2	A	401	LQ1	C16-N7-C15	-3.30	98.81	103.51
2	D	401	LQ1	C17-C16-N7	3.26	138.09	132.02
2	B	401	LQ1	P2-O10-C11	-3.24	102.67	121.68
2	B	401	LQ1	C16-N7-C15	-3.22	98.93	103.51
2	A	401	LQ1	C28-C27-N12	3.13	137.86	132.02
2	C	401	LQ1	C12-O11-C14	-3.11	101.79	108.49
2	A	401	LQ1	C23-C24-C25	3.11	107.34	101.43
2	B	401	LQ1	C28-C27-N12	3.07	137.74	132.02
2	B	401	LQ1	C23-C24-C25	3.05	107.22	101.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	401	LQ1	C22-O16-C25	-3.03	102.80	109.47
2	C	401	LQ1	C28-C27-N12	2.92	137.47	132.02
2	B	401	LQ1	O11-C14-N6	2.83	113.63	108.06
2	C	401	LQ1	C23-C24-C25	2.80	106.75	101.43
2	B	401	LQ1	P3-O18-C20	-2.78	109.30	119.41
2	D	401	LQ1	C23-C24-C25	2.72	106.59	101.43
2	C	401	LQ1	C20-C13-C14	2.57	105.61	99.91
2	B	401	LQ1	C13-C20-C12	-2.47	98.85	103.22
2	B	401	LQ1	O11-C14-C13	-2.40	101.40	106.64
2	D	401	LQ1	C20-C13-C14	2.33	105.06	99.89
2	C	401	LQ1	P3-O18-C20	-2.32	110.97	119.41
2	A	401	LQ1	C22-O16-C25	-2.30	104.40	109.47
2	C	401	LQ1	C11-C12-C20	-2.29	107.55	114.85
2	D	401	LQ1	C22-O16-C25	-2.26	104.48	109.47
2	A	401	LQ1	C20-C13-C14	2.23	104.83	99.89
2	B	401	LQ1	O30-P6-O28	2.20	112.03	104.64
2	A	401	LQ1	P3-O15-C21	-2.19	108.86	121.68
2	C	401	LQ1	P3-O15-C21	-2.15	109.08	121.68
2	C	401	LQ1	C27-C28-N13	-2.07	118.93	123.43
2	D	401	LQ1	C16-C17-N8	-2.02	119.02	123.43
2	B	401	LQ1	C22-O16-C25	-2.02	105.01	109.47
2	D	401	LQ1	P2-O10-C11	-2.00	109.95	121.68

There are no chirality outliers.

All (37) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	401	LQ1	O10-C11-C12-C20
2	A	401	LQ1	O10-C11-C12-O11
2	A	401	LQ1	C11-O10-P2-O8
2	A	401	LQ1	C11-O10-P2-O9
2	A	401	LQ1	C11-O10-P2-O25
2	C	401	LQ1	C20-O18-P3-O15
2	C	401	LQ1	C21-O15-P3-O18
2	C	401	LQ1	C21-O15-P3-O13
2	C	401	LQ1	C21-O15-P3-O14
3	A	402	ATP	PB-O3B-PG-O3G
3	A	402	ATP	PB-O3A-PA-O5'
3	A	402	ATP	C5'-O5'-PA-O1A
3	B	402	ATP	PB-O3B-PG-O2G
3	D	402	ATP	PB-O3B-PG-O3G
3	D	402	ATP	C5'-O5'-PA-O2A

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Mol	Chain	Res	Type	Atoms
2	C	401	LQ1	O10-C11-C12-O11
2	C	401	LQ1	O10-C11-C12-C20
2	C	401	LQ1	C12-C20-O18-P3
2	C	401	LQ1	C13-C20-O18-P3
2	C	401	LQ1	C20-O18-P3-O13
2	C	401	LQ1	C20-O18-P3-O14
3	D	402	ATP	PB-O3A-PA-O5'
3	A	402	ATP	C5'-O5'-PA-O3A
3	D	402	ATP	C5'-O5'-PA-O3A
2	C	401	LQ1	C22-C21-O15-P3
3	A	402	ATP	C5'-O5'-PA-O2A
3	A	402	ATP	PA-O3A-PB-O2B
2	A	401	LQ1	P5-O25-P2-O8
3	B	402	ATP	PB-O3B-PG-O1G
3	D	402	ATP	PB-O3B-PG-O1G
2	B	401	LQ1	O10-C11-C12-O11
3	A	402	ATP	O4'-C4'-C5'-O5'
2	A	401	LQ1	P5-O25-P2-O9
3	A	402	ATP	PA-O3A-PB-O1B
2	A	401	LQ1	C22-C21-O15-P3
3	D	402	ATP	C5'-O5'-PA-O1A
2	B	401	LQ1	O10-C11-C12-C20

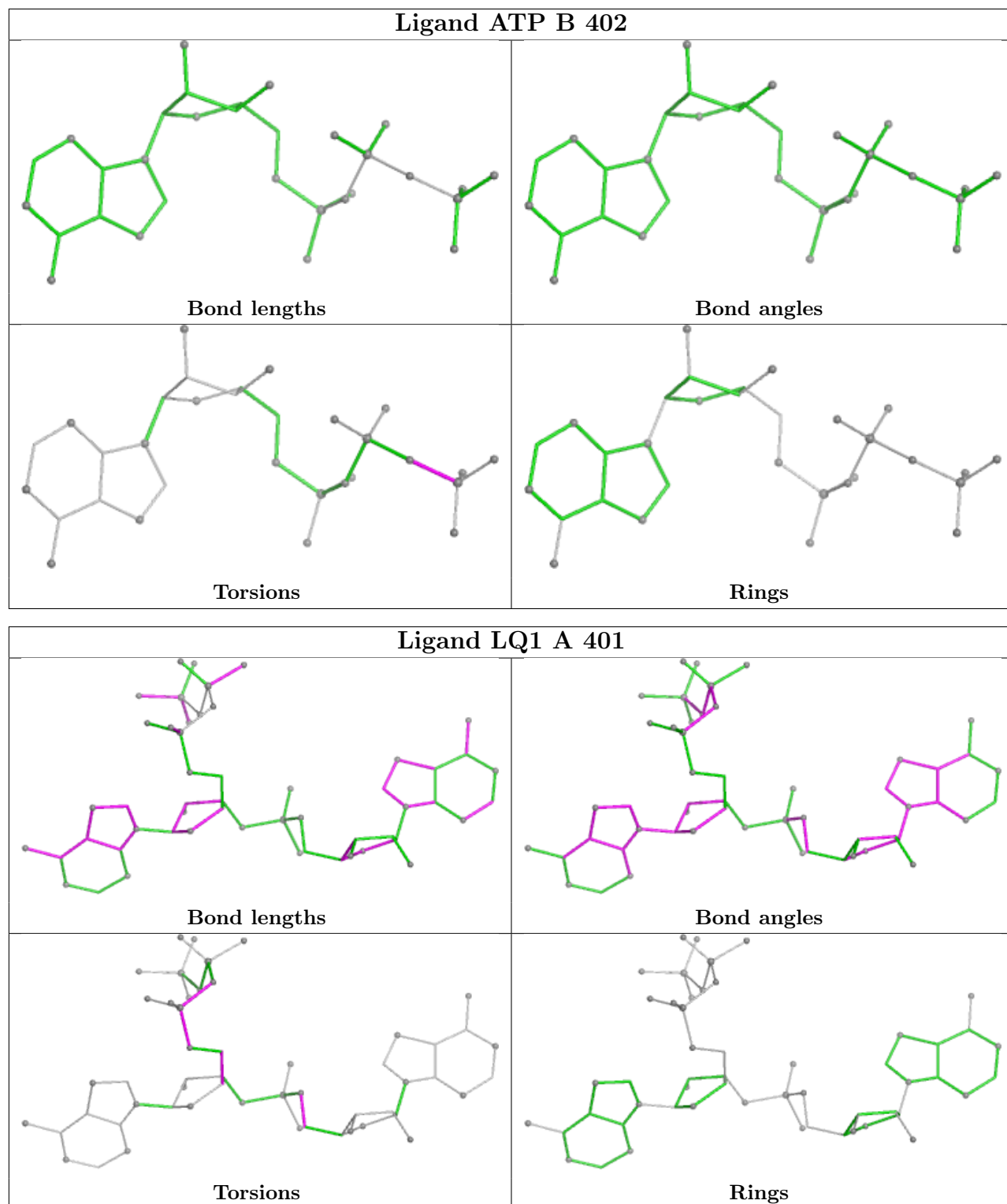
There are no ring outliers.

5 monomers are involved in 6 short contacts:

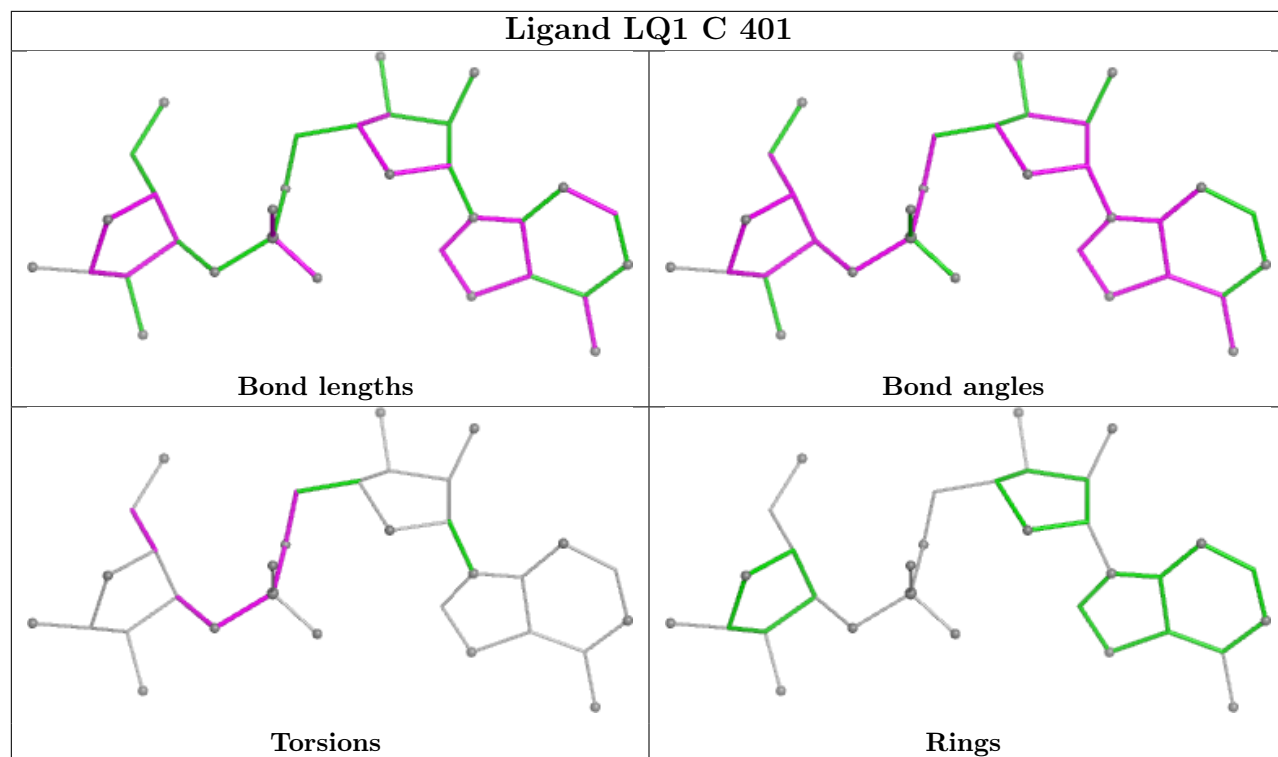
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	401	LQ1	2	0
2	C	401	LQ1	1	0
2	B	401	LQ1	1	0
2	D	401	LQ1	1	0
3	A	402	ATP	2	0

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

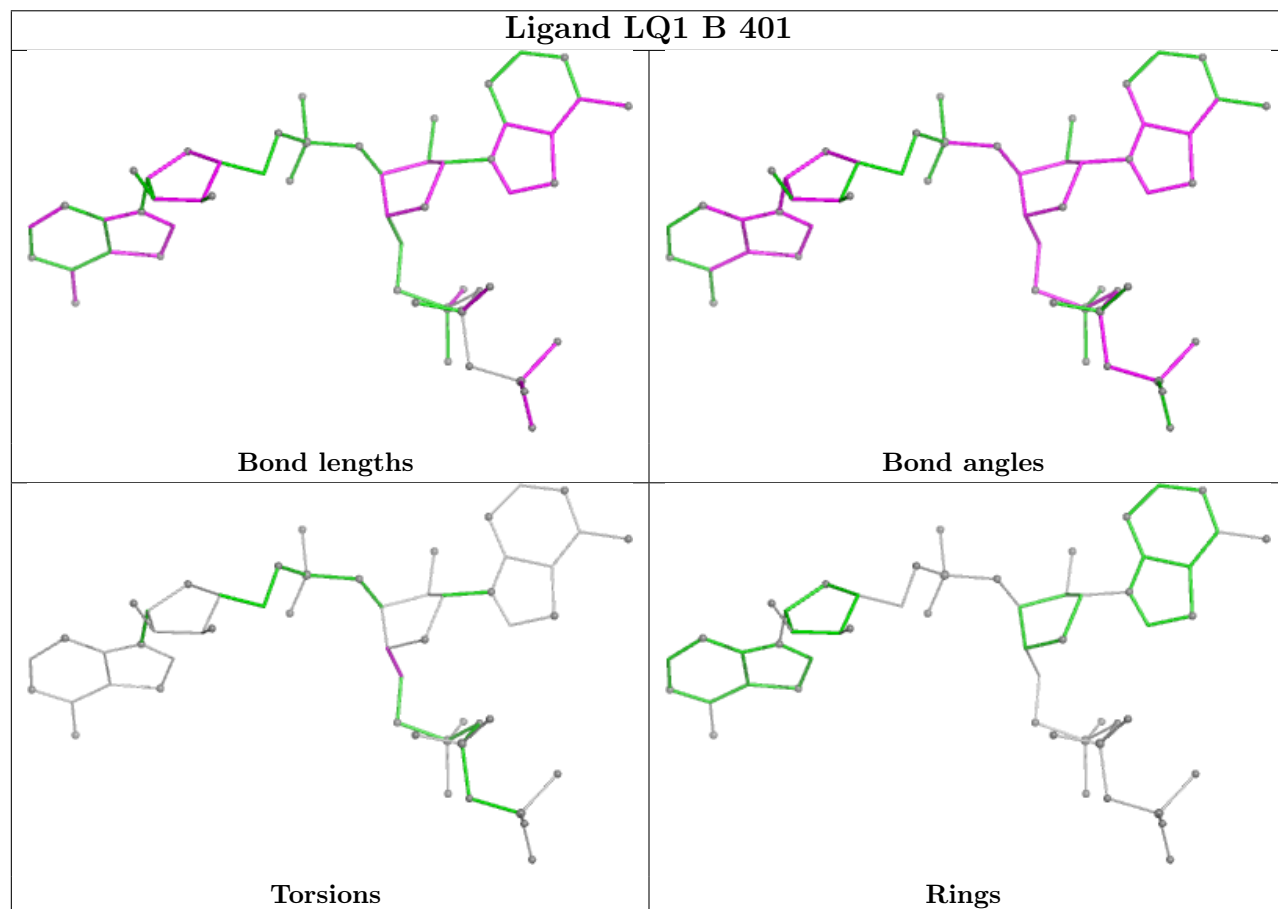
any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



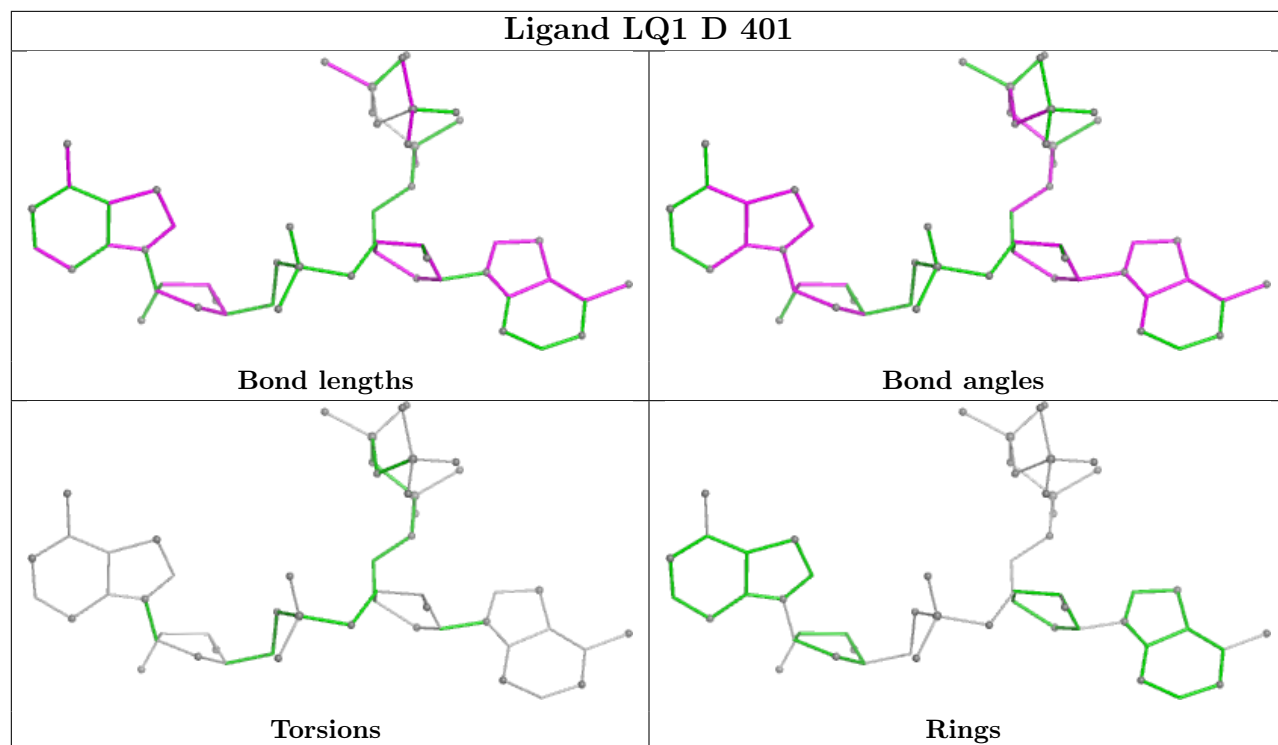
Ligand LQ1 C 401



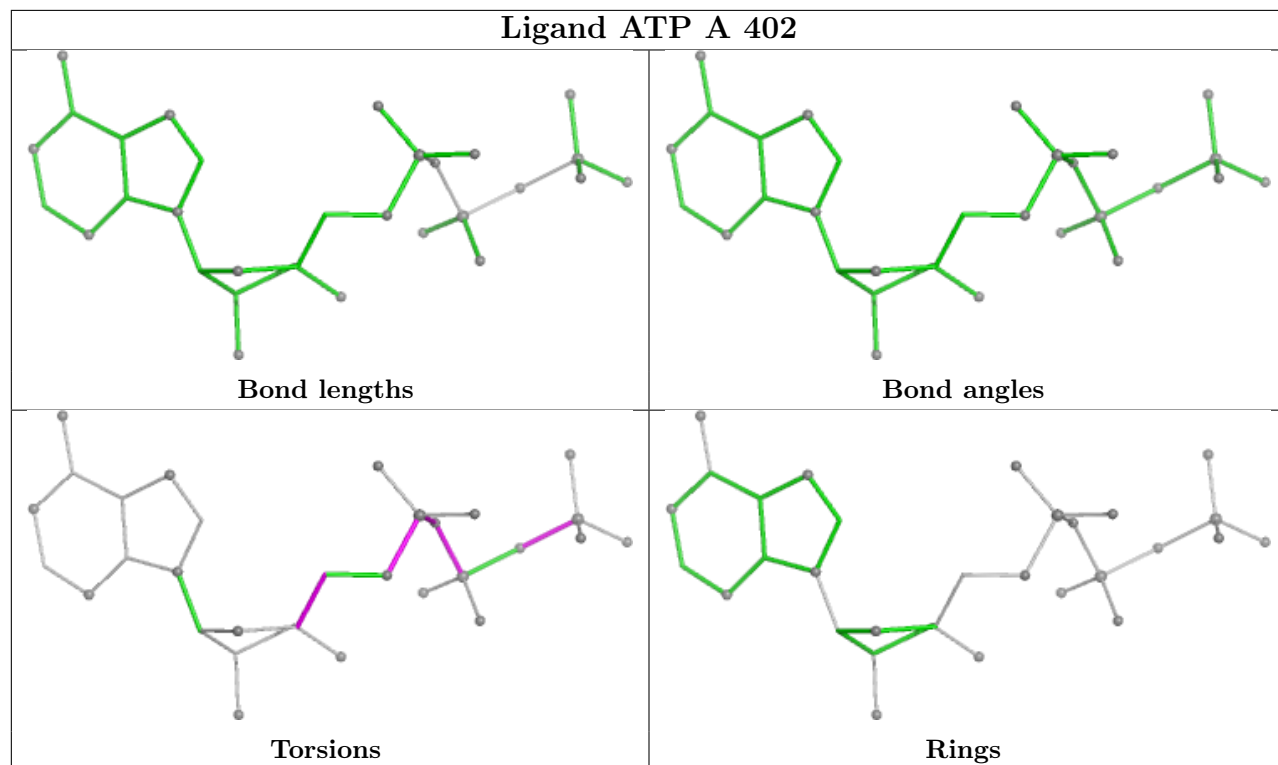
Ligand LQ1 B 401

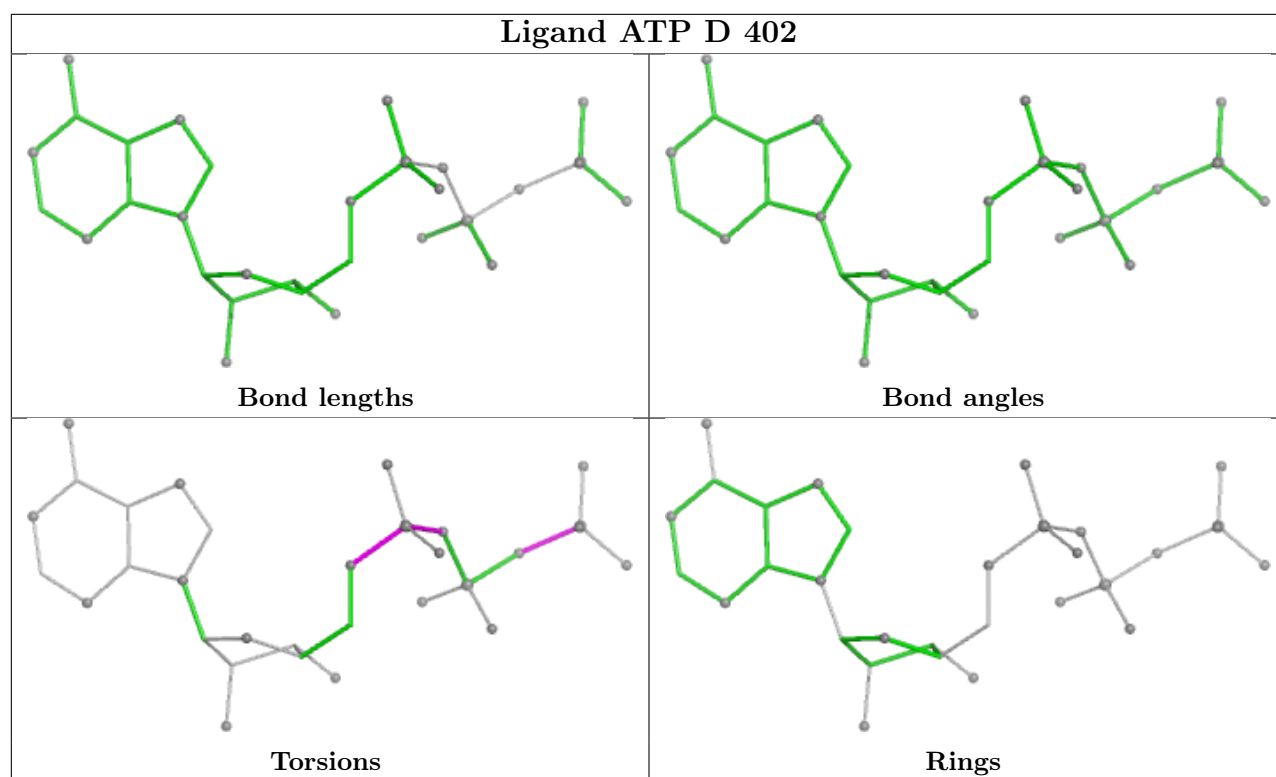


Ligand LQ1 D 401



Ligand ATP A 402





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	311/340 (91%)	0.44	16 (5%)	33 35	38, 48, 73, 93	1 (0%)
1	B	308/340 (90%)	0.55	10 (3%)	50 53	37, 50, 75, 102	0
1	C	299/340 (87%)	0.41	3 (1%)	79 81	23, 49, 67, 91	1 (0%)
1	D	299/340 (87%)	0.59	7 (2%)	61 64	39, 53, 82, 109	0
All	All	1217/1360 (89%)	0.50	36 (2%)	52 55	23, 50, 74, 109	2 (0%)

All (36) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	306	VAL	4.2
1	B	-1	ALA	3.8
1	A	302	SER	3.7
1	B	1	MET	3.6
1	B	2	ALA	3.6
1	C	0	HIS	3.4
1	A	297	LYS	3.3
1	A	1	MET	3.3
1	D	1	MET	3.2
1	A	0	HIS	3.2
1	A	-1	ALA	3.1
1	A	309	ALA	3.0
1	D	2	ALA	3.0
1	B	0	HIS	2.8
1	B	224	ASN	2.7
1	A	298	SER	2.6
1	C	1	MET	2.6
1	D	229	TYR	2.5
1	A	234	ILE	2.5
1	B	3	THR	2.5
1	A	228	ILE	2.4

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Mol	Chain	Res	Type	RSRZ
1	D	275	LEU	2.3
1	A	133	MET	2.3
1	D	280	GLU	2.3
1	A	118	GLY	2.3
1	C	118	GLY	2.3
1	B	304	PRO	2.2
1	D	194	PHE	2.2
1	A	308	SER	2.1
1	A	64	ILE	2.1
1	B	305	PHE	2.1
1	A	18	THR	2.1
1	A	296	PRO	2.1
1	B	302	SER	2.1
1	A	164	GLN	2.0
1	D	54	TYR	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 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
2	LQ1	B	401	53/53	0.73	0.14	66,88,121,139	0
2	LQ1	D	401	53/53	0.74	0.13	53,78,142,159	0
2	LQ1	C	401	32/53	0.75	0.18	42,64,78,81	32
4	MG	D	404	1/1	0.78	0.23	60,60,60,60	0
4	MG	B	403	1/1	0.81	0.12	68,68,68,68	0
3	ATP	D	402	31/31	0.82	0.12	57,72,84,95	0
3	ATP	B	402	31/31	0.84	0.11	60,80,92,106	0
2	LQ1	A	401	53/53	0.85	0.11	54,68,125,151	0

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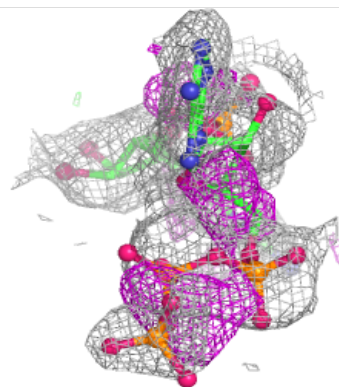
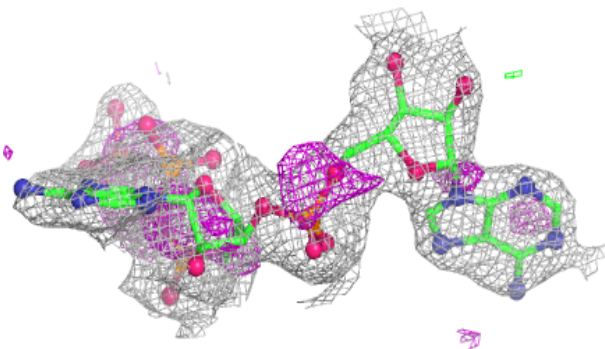
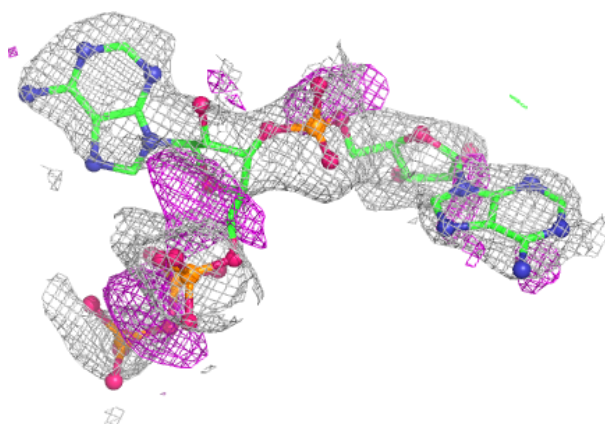
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	MG	B	404	1/1	0.87	0.13	67,67,67,67	0
3	ATP	A	402	31/31	0.88	0.11	48,67,77,82	0
4	MG	A	404	1/1	0.89	0.10	61,61,61,61	0
4	MG	D	403	1/1	0.93	0.10	56,56,56,56	0
4	MG	A	403	1/1	0.93	0.08	56,56,56,56	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.

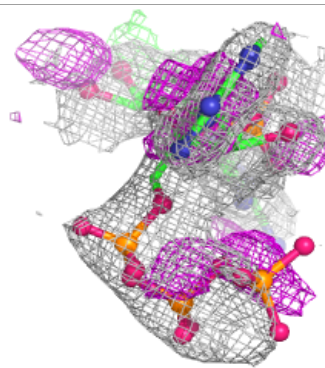
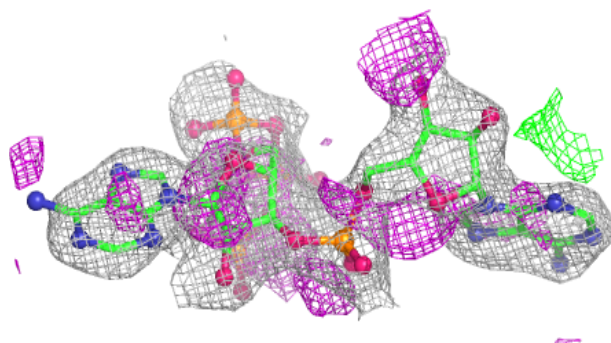
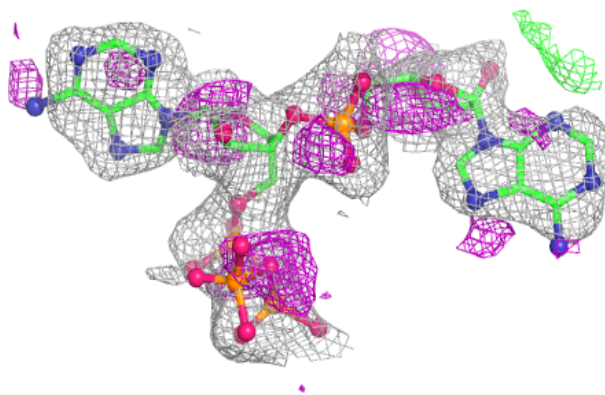
Electron density around LQ1 B 401:

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

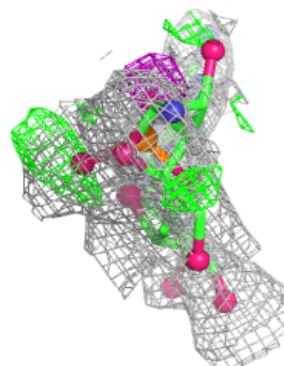
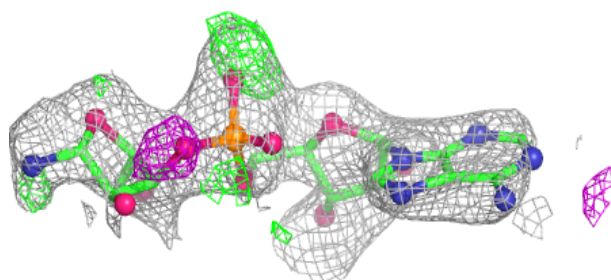
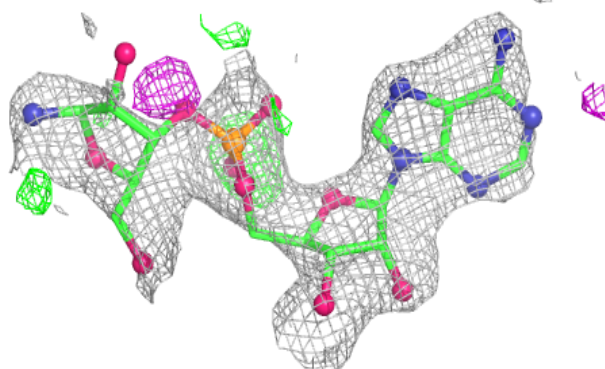


Electron density around LQ1 D 401:

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

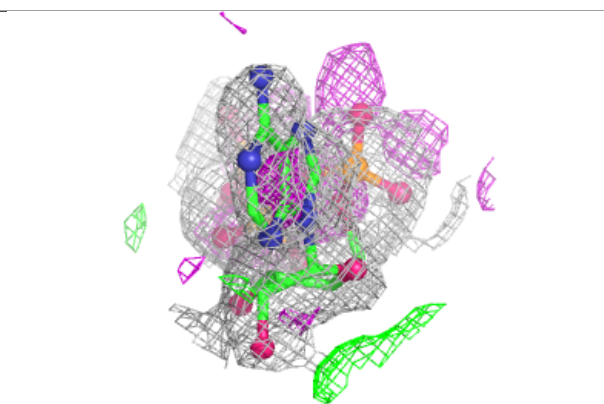
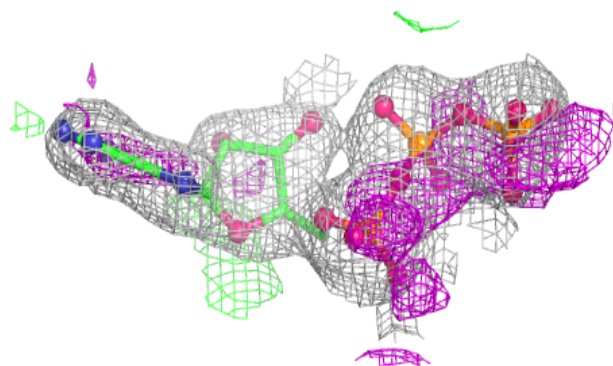
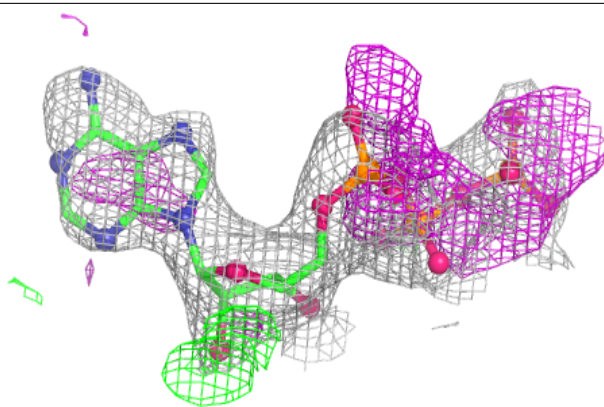
**Electron density around LQ1 C 401:**

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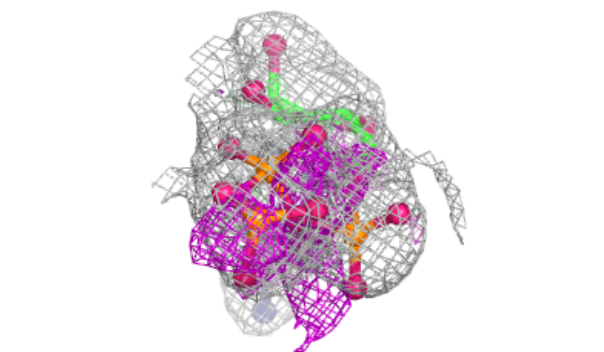
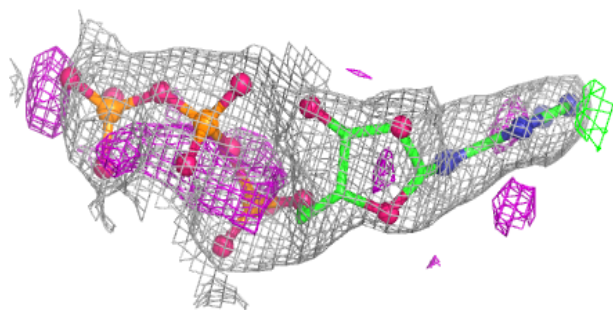
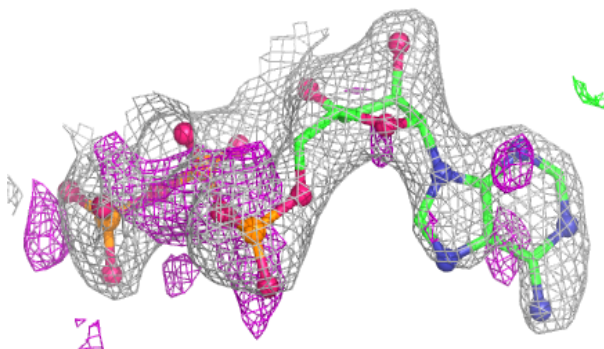


Electron density around ATP D 402:

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and green (positive)

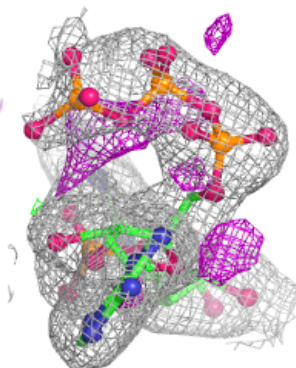
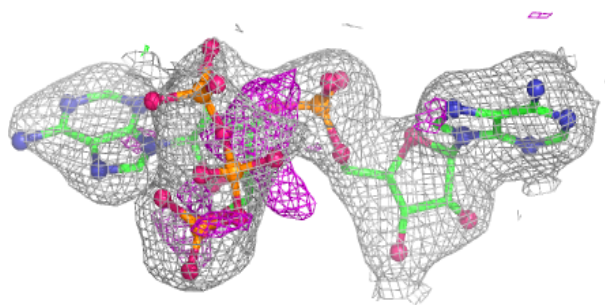
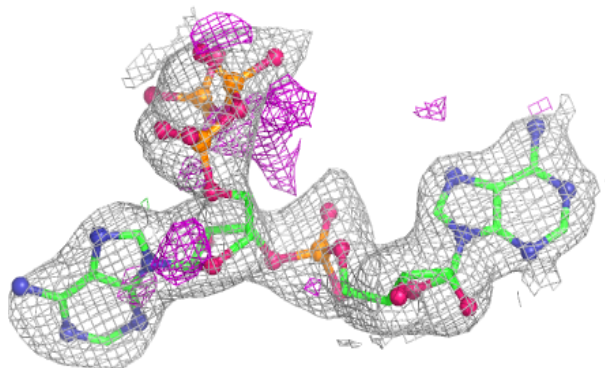
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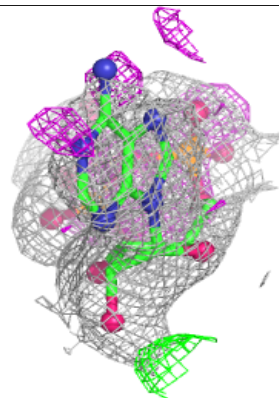
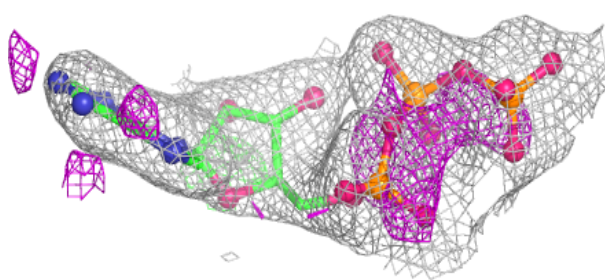
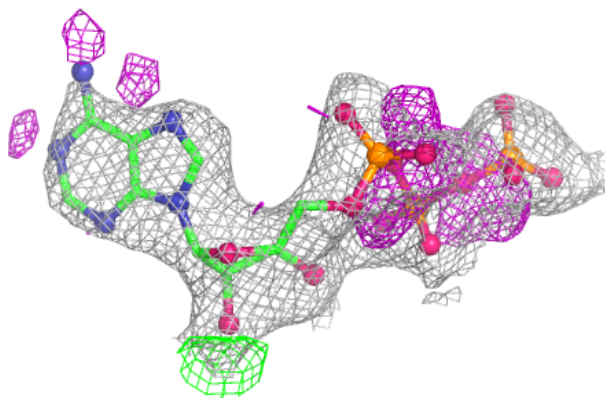


Electron density around LQ1 A 401:

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

**Electron density around ATP A 402:**

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



6.5 Other polymers

There are no such residues in this entry.