Full wwPDB X-ray Structure Validation Report ⓘ

Nov 15, 2023 – 02:53 PM JST

PDB ID	:	6JD4
Title	:	ATPase
Authors	:	Wang, S.H.; Li, J.; Rao, Z.H.
Deposited on	:	2019-01-31
Resolution	:	2.10 Å(reported)

The following versions of software and data (see references ⓘ) were used in the production of this report:

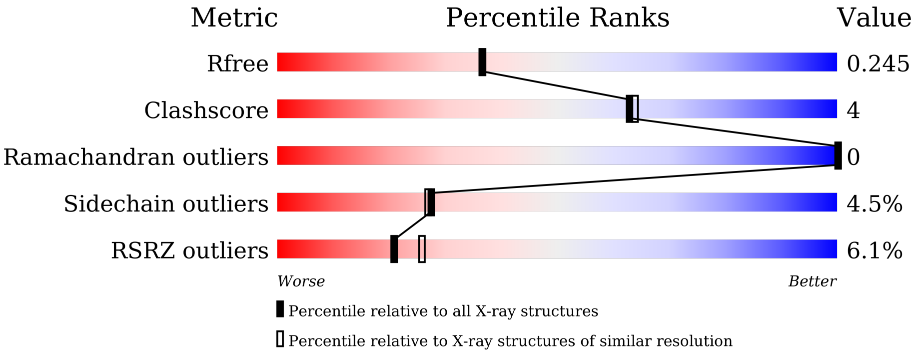
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

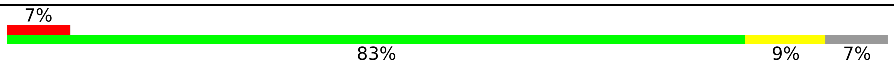
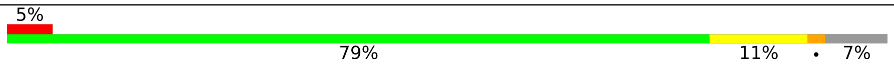
The reported resolution of this entry is 2.10 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	5197 (2.10-2.10)
Clashscore	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)
RSRZ outliers	127900	5083 (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 <=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	281	
1	B	281	

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 4436 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 ESX-1 secretion system protein EccCb1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	261	Total 1993	C 1269	N 355	O 358	S 11	0	0	0
1	B	261	Total 1993	C 1269	N 355	O 358	S 11	0	0	0

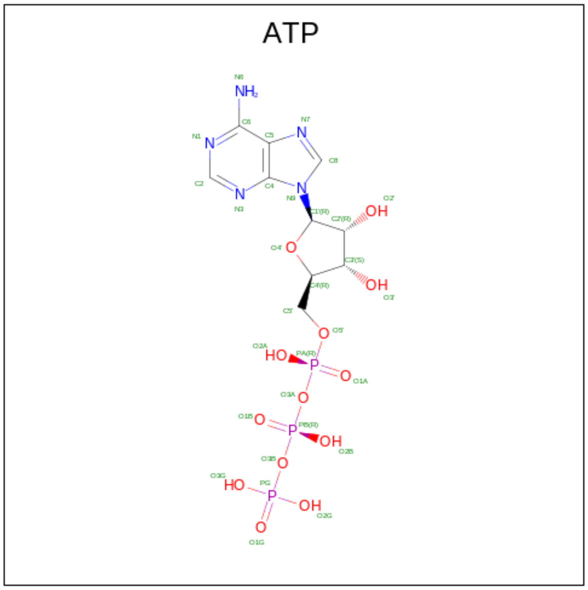
There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	311	GLY	-	expression tag	UNP P9WNB1
A	312	PRO	-	expression tag	UNP P9WNB1
A	313	GLY	-	expression tag	UNP P9WNB1
A	314	SER	-	expression tag	UNP P9WNB1
B	311	GLY	-	expression tag	UNP P9WNB1
B	312	PRO	-	expression tag	UNP P9WNB1
B	313	GLY	-	expression tag	UNP P9WNB1
B	314	SER	-	expression tag	UNP P9WNB1

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total 1	Mg 1	0	0
2	B	1	Total 1	Mg 1	0	0

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



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

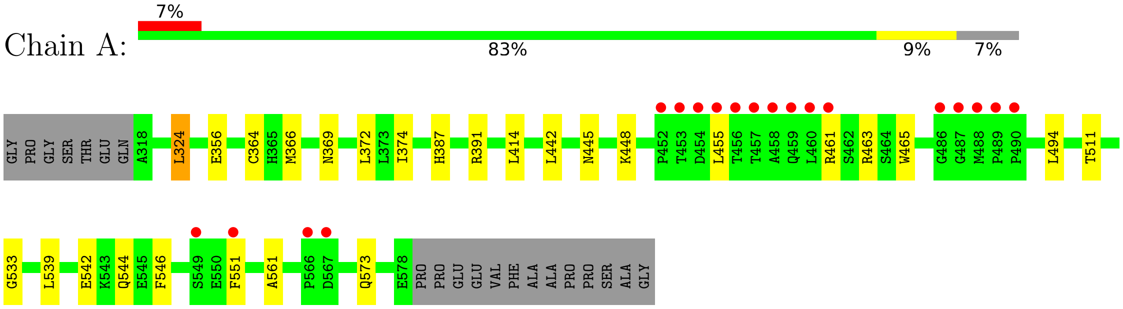
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	196	196	196	0	0
4	B	190	190	190	0	0

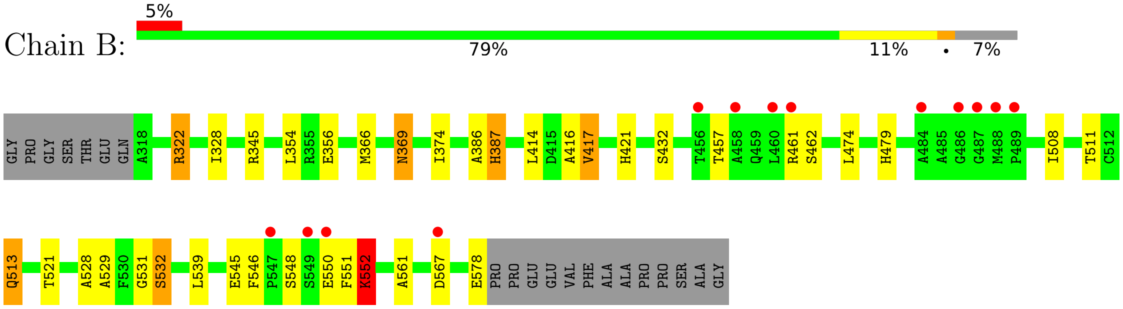
3 Residue-property plots

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: ESX-1 secretion system protein EccCb1



- Molecule 1: ESX-1 secretion system protein EccCb1



4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	61.22Å 77.31Å 106.01Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.72 – 2.10 43.72 – 2.10	Depositor EDS
% Data completeness (in resolution range)	99.7 (43.72-2.10) 100.0 (43.72-2.10)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.13	Depositor
$< I/\sigma(I) >$ [1]	8.71 (at 2.10Å)	Xtriage
Refinement program	PHENIX 1.12_2829	Depositor
R, R_{free}	0.202 , 0.246 0.201 , 0.245	Depositor DCC
R_{free} test set	1435 reflections (4.78%)	wwPDB-VP
Wilson B-factor (Å^2)	16.4	Xtriage
Anisotropy	0.958	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 55.7	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	4436	wwPDB-VP
Average B, all atoms (Å^2)	22.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 50.69 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 6.2452e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: MG, ATP

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	0.25	0/2048	0.47	0/2793
1	B	0.43	1/2048 (0.0%)	0.59	4/2793 (0.1%)
All	All	0.35	1/4096 (0.0%)	0.54	4/5586 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	531	GLY	C-O	-5.58	1.14	1.23

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	369	ASN	N-CA-CB	7.00	123.21	110.60
1	B	548	SER	N-CA-CB	-6.11	101.34	110.50
1	B	548	SER	N-CA-C	5.35	125.44	111.00
1	B	552	LYS	N-CA-CB	-5.10	101.42	110.60

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	1993	0	1997	12	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	1993	0	1997	23	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	31	0	12	0	0
3	B	31	0	12	0	0
4	A	196	0	0	0	0
4	B	190	0	0	3	0
All	All	4436	0	4018	35	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 (35) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:552:LYS:NZ	4:B:701:HOH:O	2.21	0.73
1:B:552:LYS:O	1:B:552:LYS:HG2	2.01	0.59
1:B:521:THR:HG21	1:B:546:PHE:HZ	1.69	0.58
1:B:366:MET:HA	1:B:369:ASN:O	2.04	0.57
1:B:508:ILE:HD11	1:B:529:ALA:HB2	1.88	0.56
1:A:442:LEU:HD23	1:A:494:LEU:HD11	1.87	0.55
1:B:479:HIS:CD2	1:B:479:HIS:H	2.23	0.55
1:B:552:LYS:NZ	4:B:710:HOH:O	2.40	0.55
1:B:578:GLU:H	1:B:578:GLU:CD	2.10	0.55
1:B:322:ARG:NH2	1:B:356:GLU:O	2.40	0.54
1:B:552:LYS:HD3	1:B:552:LYS:H	1.72	0.53
1:A:542:GLU:HG3	1:A:544:GLN:H	1.74	0.51
1:A:539:LEU:HD23	1:A:561:ALA:HB2	1.92	0.50
1:B:479:HIS:CD2	1:B:513:GLN:H	2.29	0.50
1:A:463:ARG:HA	1:A:465:TRP:CZ3	2.48	0.49
1:B:457:THR:HG23	1:B:461:ARG:NH1	2.27	0.49
1:A:366:MET:HA	1:A:369:ASN:O	2.15	0.47
1:A:374:ILE:O	1:A:511:THR:HA	2.15	0.46
1:A:324:LEU:HG	1:A:356:GLU:HA	1.98	0.46
1:B:521:THR:HG21	1:B:546:PHE:CZ	2.51	0.45
1:B:417:VAL:HG23	1:B:421:HIS:HB2	1.99	0.45
1:B:374:ILE:O	1:B:511:THR:HA	2.17	0.45
1:B:328:ILE:HD12	1:B:354:LEU:HD22	1.98	0.44
1:B:539:LEU:HD23	1:B:561:ALA:HB2	1.97	0.44
1:B:328:ILE:CD1	1:B:354:LEU:HD22	2.48	0.44
1:A:445:ASN:HA	1:A:448:LYS:HE2	2.01	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:324:LEU:HD13	1:A:573:GLN:HB2	2.01	0.43
1:A:391:ARG:HA	1:A:391:ARG:HD3	1.78	0.43
1:A:364:CYS:SG	1:A:372:LEU:HD13	2.59	0.42
1:B:386:ALA:HB1	1:B:474:LEU:HD11	2.01	0.42
1:A:369:ASN:ND2	1:A:533:GLY:O	2.53	0.42
1:B:528:ALA:O	1:B:532:SER:HB3	2.19	0.42
1:B:387:HIS:ND1	1:B:416:ALA:HA	2.35	0.41
1:B:551:PHE:CD2	1:B:551:PHE:C	2.94	0.41
1:B:545:GLU:OE2	4:B:702:HOH:O	2.22	0.41

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	259/281 (92%)	254 (98%)	5 (2%)	0	100	100
1	B	259/281 (92%)	251 (97%)	8 (3%)	0	100	100
All	All	518/562 (92%)	505 (98%)	13 (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	211/225 (94%)	204 (97%)	7 (3%)	38	40
1	B	211/225 (94%)	199 (94%)	12 (6%)	20	18
All	All	422/450 (94%)	403 (96%)	19 (4%)	27	27

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	324	LEU
1	A	387	HIS
1	A	414	LEU
1	A	455	LEU
1	A	461	ARG
1	A	546	PHE
1	A	551	PHE
1	B	322	ARG
1	B	345	ARG
1	B	387	HIS
1	B	414	LEU
1	B	417	VAL
1	B	432	SER
1	B	462	SER
1	B	513	GLN
1	B	532	SER
1	B	550	GLU
1	B	552	LYS
1	B	567	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	479	HIS

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 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 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	602	2	26,33,33	0.93	1 (3%)	31,52,52	1.52	5 (16%)
3	ATP	A	602	2	26,33,33	0.93	1 (3%)	31,52,52	1.47	5 (16%)

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	602	2	-	0/18/38/38	0/3/3/3
3	ATP	A	602	2	-	1/18/38/38	0/3/3/3

All (2) bond length outliers are listed below:

Mol	**Chain**	**Res**	**Type**	**Atoms**	**Z**	**Observed(Å)**	**Ideal(Å)**
3	A	602	ATP	C5-C4	2.47	1.47	1.40
3	B	602	ATP	C5-C4	2.46	1.47	1.40

All (10) bond angle outliers are listed below:

Mol	**Chain**	**Res**	**Type**	**Atoms**	**Z**	**Observed(^{o})**	**Ideal(^{o})**
3	B	602	ATP	N3-C2-N1	-3.24	123.62	128.68
3	B	602	ATP	PA-O3A-PB	-3.16	121.97	132.83
3	A	602	ATP	C3'-C2'-C1'	3.16	105.74	100.98
3	B	602	ATP	C3'-C2'-C1'	3.15	105.72	100.98
3	A	602	ATP	N3-C2-N1	-3.14	123.77	128.68

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	602	ATP	PA-O3A-PB	-3.05	122.37	132.83
3	B	602	ATP	C4-C5-N7	-2.69	106.59	109.40
3	B	602	ATP	PB-O3B-PG	-2.62	123.85	132.83
3	A	602	ATP	C4-C5-N7	-2.61	106.67	109.40
3	A	602	ATP	PB-O3B-PG	-2.56	124.05	132.83

There are no chirality outliers.

All (1) torsion outliers are listed below:

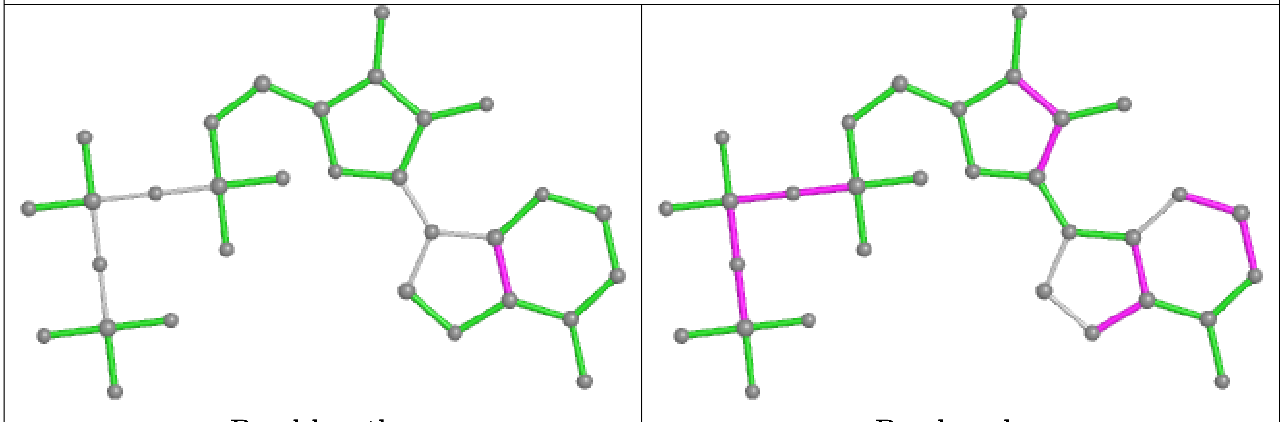
Mol	Chain	Res	Type	Atoms
3	A	602	ATP	PB-O3B-PG-O2G

There are no ring outliers.

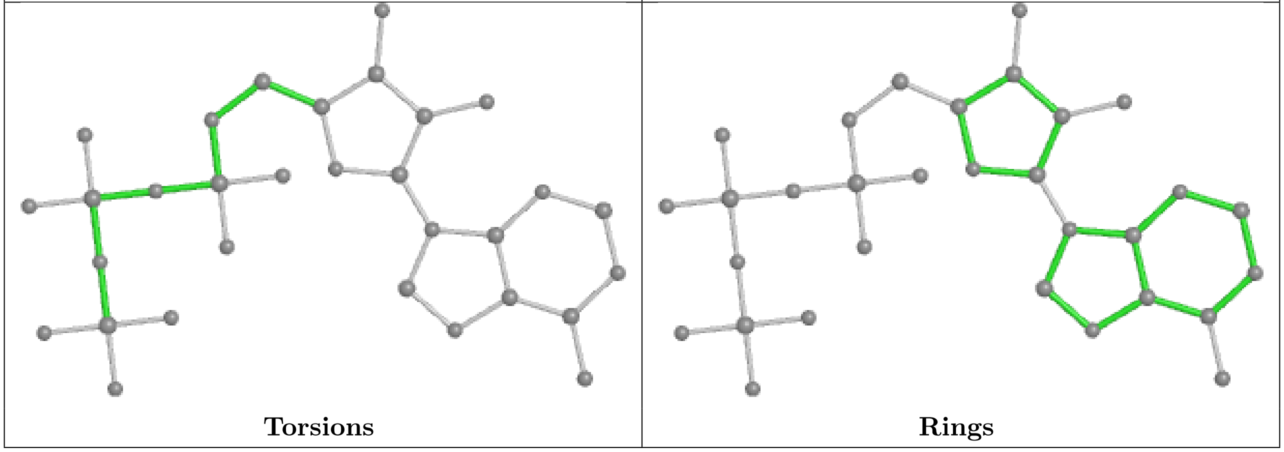
No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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 B 602

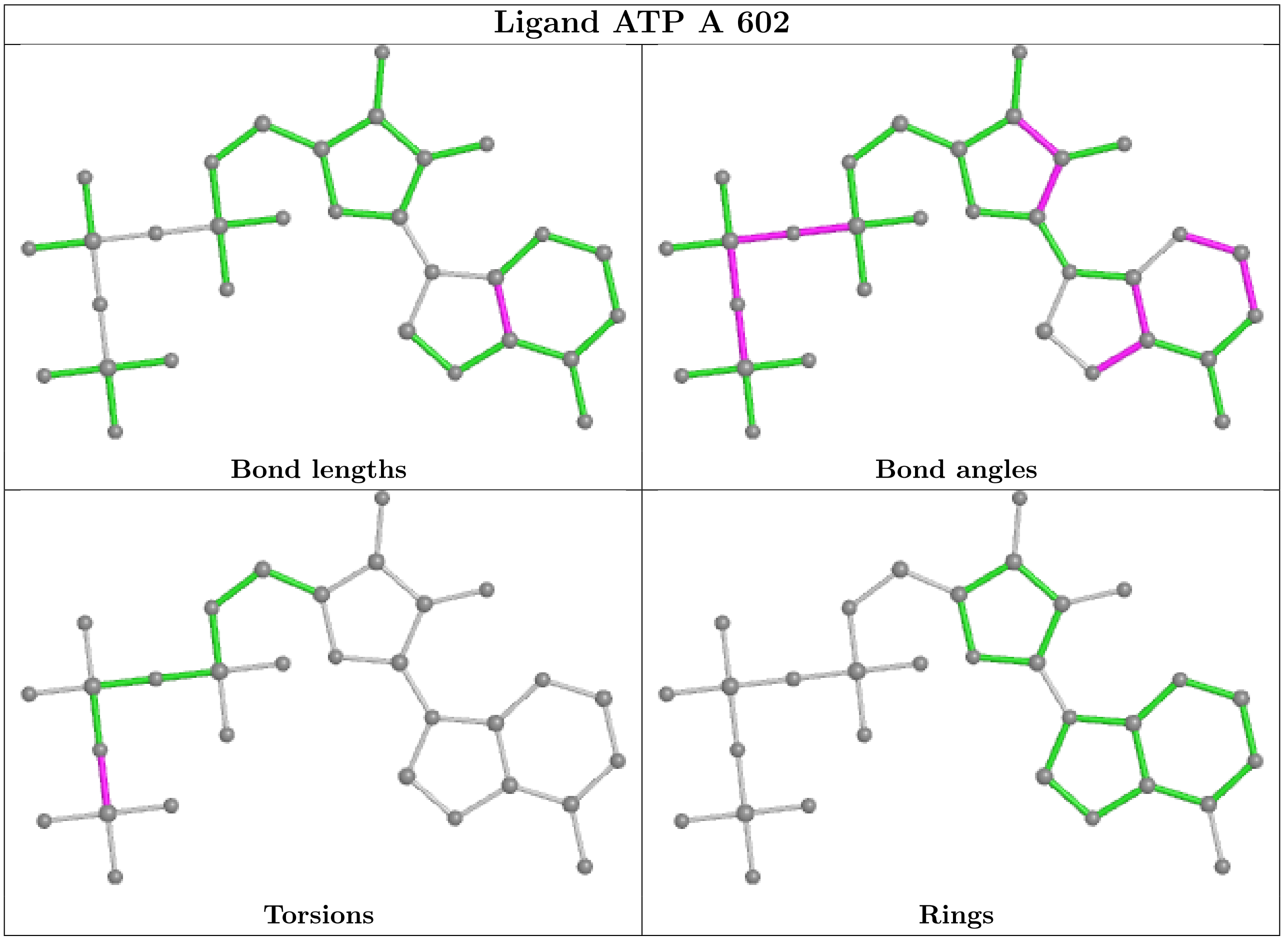


Bond lengths **Bond angles**



Torsions **Rings**

Ligand ATP A 602



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	261/281 (92%)	0.39	19 (7%)	15	19	7, 15, 64, 101	0
1	B	261/281 (92%)	0.26	13 (4%)	28	34	7, 16, 54, 133	0
All	All	522/562 (92%)	0.33	32 (6%)	21	26	7, 16, 60, 133	0

All (32) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	455	LEU	7.1
1	A	458	ALA	6.5
1	B	549	SER	5.9
1	A	453	THR	5.8
1	A	551	PHE	5.7
1	A	488	MET	4.8
1	A	456	THR	4.7
1	B	487	GLY	4.5
1	A	457	THR	4.4
1	B	488	MET	4.3
1	B	550	GLU	4.1
1	A	459	GLN	3.9
1	A	461	ARG	3.6
1	B	486	GLY	3.4
1	A	454	ASP	3.4
1	A	460	LEU	3.3
1	A	566	PRO	3.3
1	B	456	THR	3.2
1	B	547	PRO	3.2
1	A	490	PRO	3.0
1	A	567	ASP	3.0
1	A	486	GLY	2.9
1	A	452	PRO	2.7
1	B	461	ARG	2.7

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Mol	Chain	Res	Type	RSRZ
1	B	567	ASP	2.7
1	B	484	ALA	2.5
1	A	487	GLY	2.5
1	B	458	ALA	2.3
1	A	489	PRO	2.2
1	B	460	LEU	2.2
1	B	489	PRO	2.2
1	A	549	SER	2.2

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 ⓘ

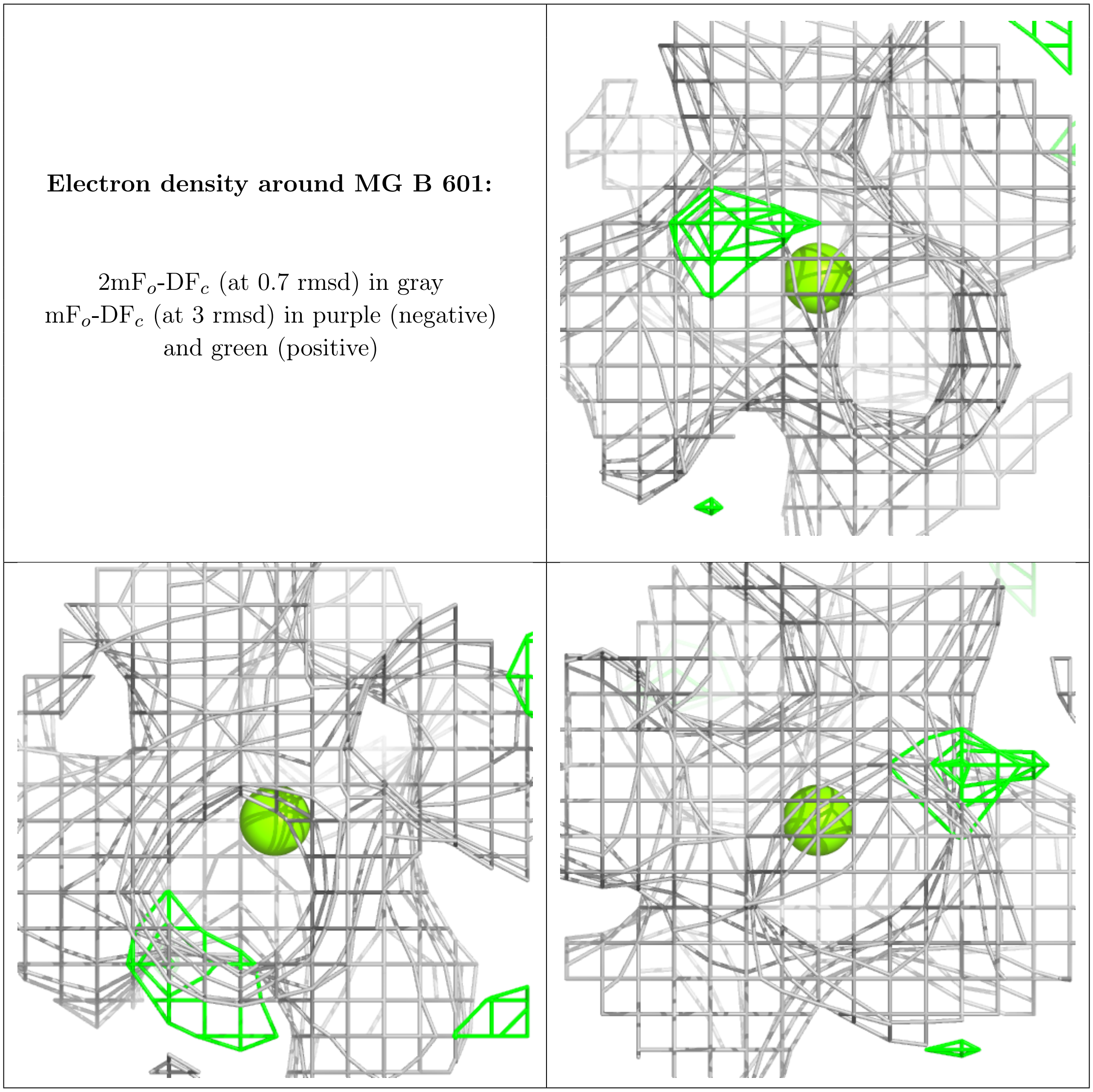
There are no monosaccharides in this entry.

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, 95^{th} 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.

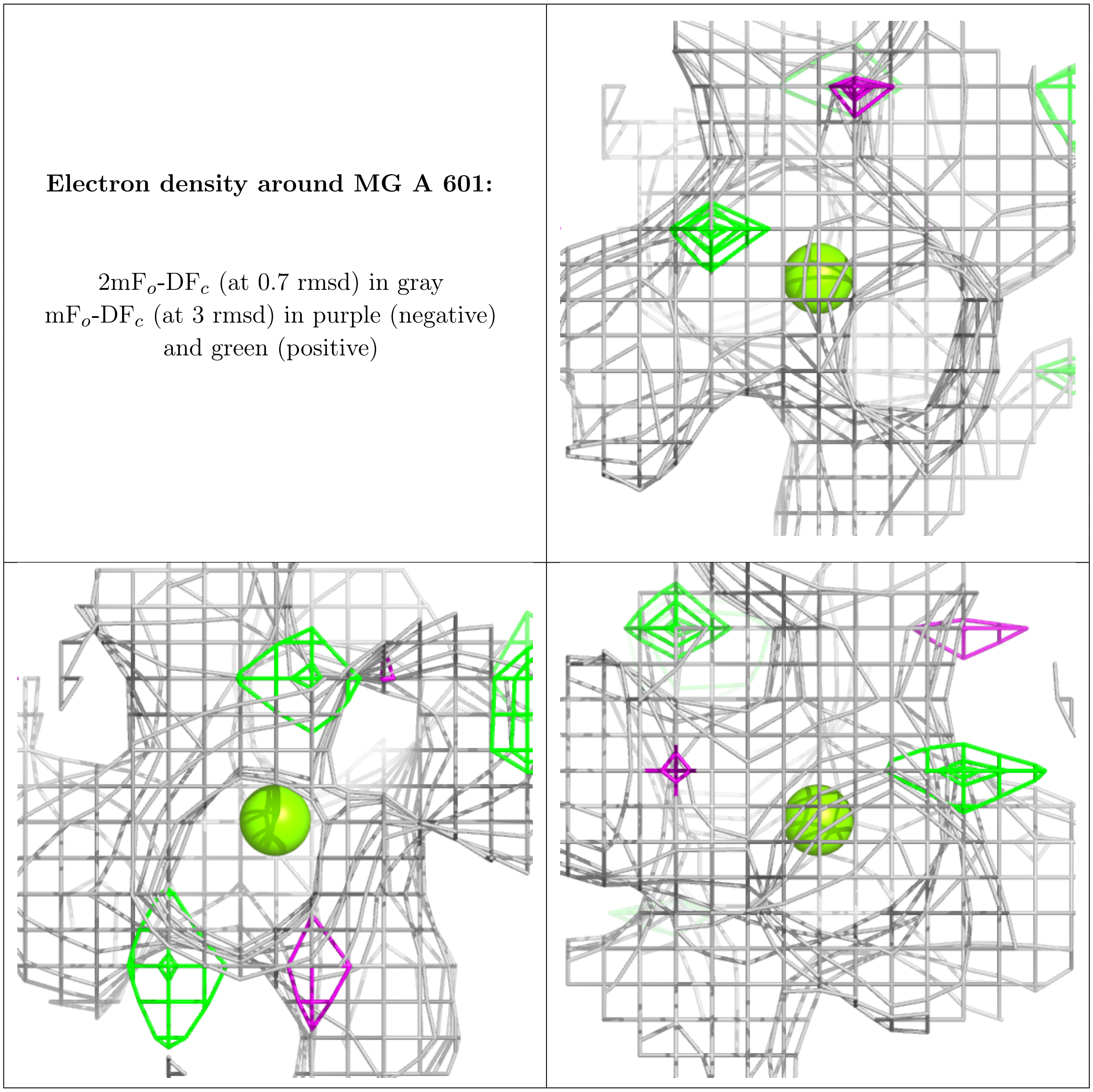
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	MG	B	601	1/1	0.84	0.08	8,8,8,8	0
2	MG	A	601	1/1	0.93	0.06	6,6,6,6	0
3	ATP	A	602	31/31	0.96	0.12	5,12,22,30	0
3	ATP	B	602	31/31	0.96	0.12	5,10,20,29	0

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 MG B 601:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)

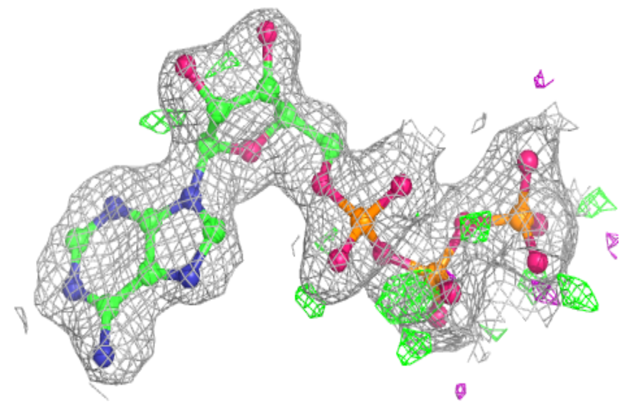


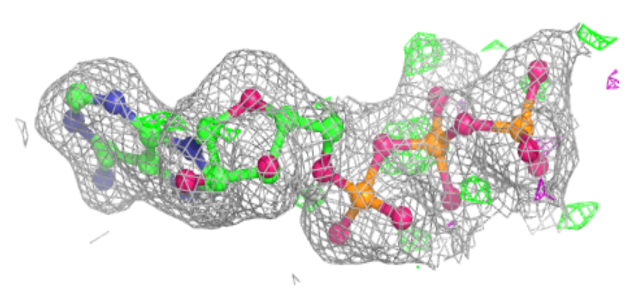
Electron density around MG A 601:

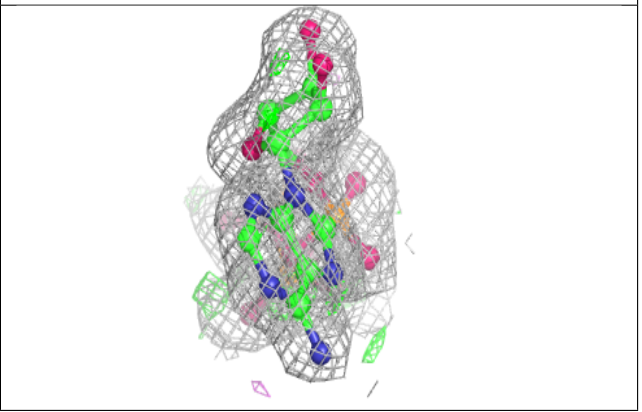
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around ATP A 602:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)

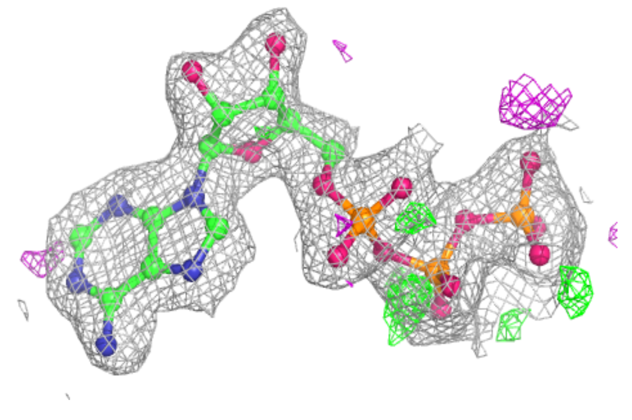


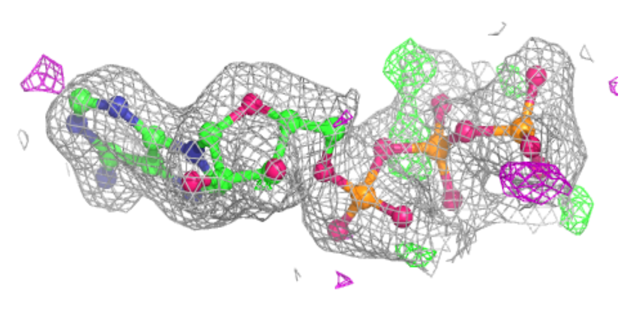


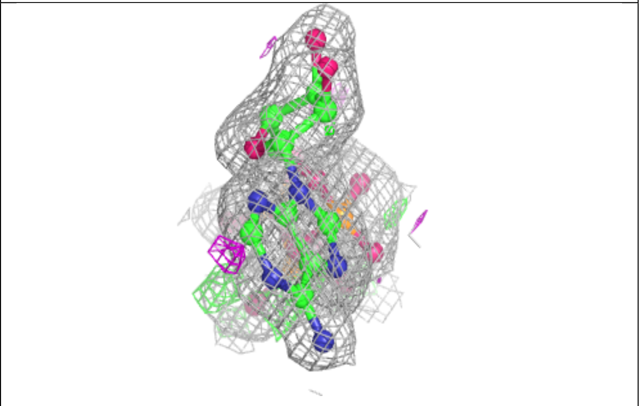


Electron density around ATP B 602:

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.