



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 16, 2024 – 10:16 PM EDT

PDB ID : 5LJ6
Title : Structure of *Aggregatibacter actinomycetemcomitans* MacB bound to ATPyS (P6522)
Authors : Crow, A.
Deposited on : 2016-07-18
Resolution : 3.90 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	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

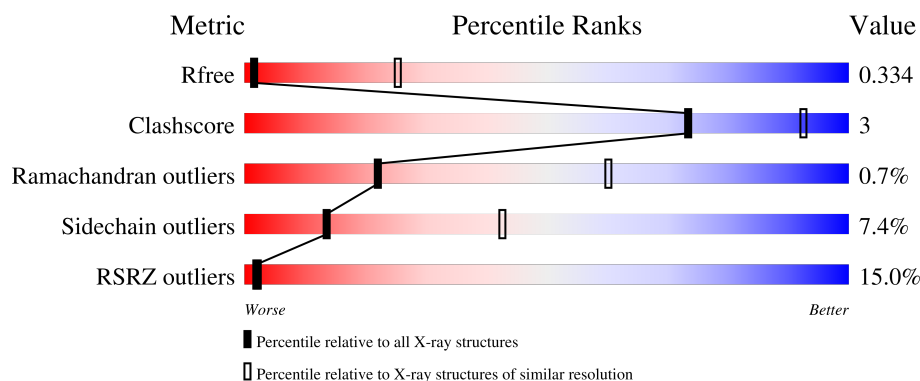
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.90 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	1002 (4.14-3.66)
Clashscore	141614	1004 (4.12-3.68)
Ramachandran outliers	138981	1021 (4.14-3.66)
Sidechain outliers	138945	1014 (4.14-3.66)
RSRZ outliers	127900	1275 (4.20-3.60)

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

Mol	Chain	Length	Quality of chain
1	A	664	<div> <div>14%</div> <div>77%</div> <div>13%</div> <div>10%</div> </div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 9346 atoms, of which 4750 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 Macrolide export ATP-binding/permease protein MacB.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	600	9302	2885	4738	780	878	21	0	0	0

There are 21 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	initiating methionine	UNP Q2EHL8
A	-18	GLY	-	expression tag	UNP Q2EHL8
A	-17	SER	-	expression tag	UNP Q2EHL8
A	-16	SER	-	expression tag	UNP Q2EHL8
A	-15	HIS	-	expression tag	UNP Q2EHL8
A	-14	HIS	-	expression tag	UNP Q2EHL8
A	-13	HIS	-	expression tag	UNP Q2EHL8
A	-12	HIS	-	expression tag	UNP Q2EHL8
A	-11	HIS	-	expression tag	UNP Q2EHL8
A	-10	HIS	-	expression tag	UNP Q2EHL8
A	-9	SER	-	expression tag	UNP Q2EHL8
A	-8	SER	-	expression tag	UNP Q2EHL8
A	-7	GLY	-	expression tag	UNP Q2EHL8
A	-6	LEU	-	expression tag	UNP Q2EHL8
A	-5	VAL	-	expression tag	UNP Q2EHL8
A	-4	PRO	-	expression tag	UNP Q2EHL8
A	-3	ARG	-	expression tag	UNP Q2EHL8
A	-2	GLY	-	expression tag	UNP Q2EHL8
A	-1	SER	-	expression tag	UNP Q2EHL8
A	0	HIS	-	expression tag	UNP Q2EHL8
A	169	GLN	GLU	conflict	UNP Q2EHL8

- Molecule 2 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
2	A	1	Total 43	C 10	H 12	N 5	O 13	P 3	0	0

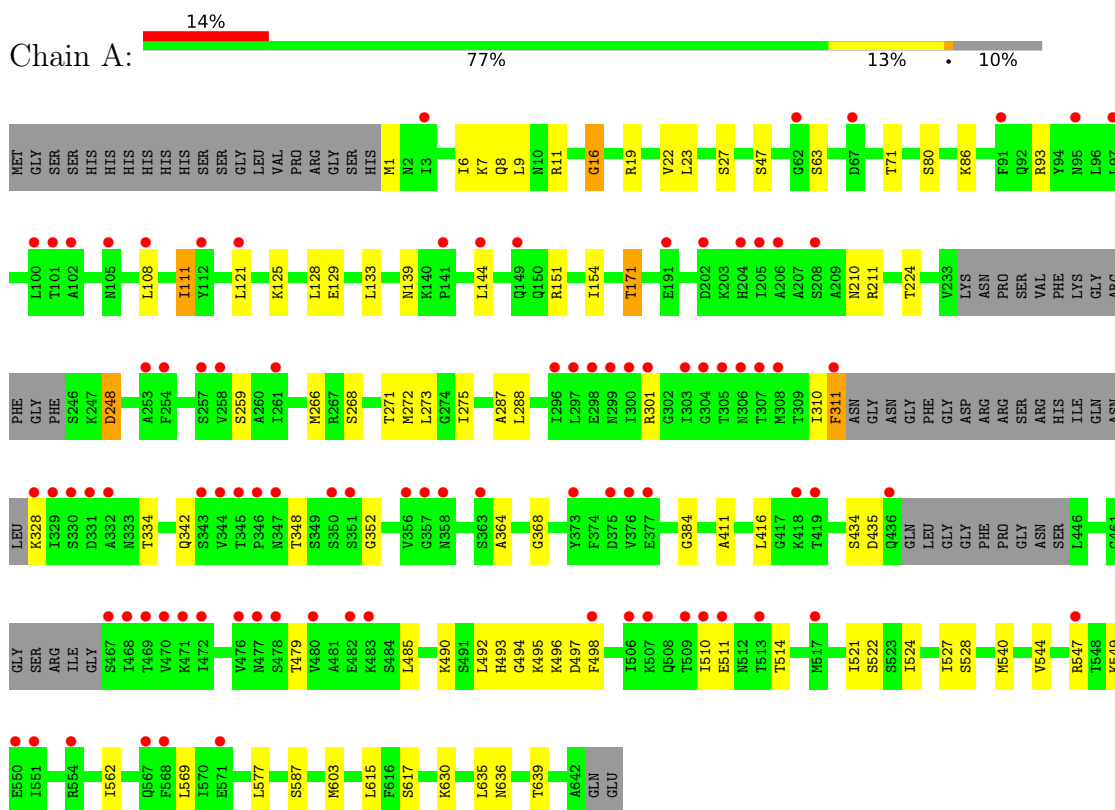
- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

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

3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Macrolide export ATP-binding/permease protein MacB



4 Data and refinement statistics

Property	Value	Source
Space group	P 65 2 2	Depositor
Cell constants a, b, c, α , β , γ	119.57Å 119.57Å 307.78Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	59.78 – 3.90 59.79 – 3.90	Depositor EDS
% Data completeness (in resolution range)	97.8 (59.78-3.90) 97.8 (59.79-3.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.10	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.79 (at 3.88Å)	Xtriage
Refinement program	PHENIX (dev_2196: ???)	Depositor
R, R_{free}	0.268 , 0.322 0.277 , 0.334	Depositor DCC
R_{free} test set	680 reflections (5.52%)	wwPDB-VP
Wilson B-factor (Å ²)	182.5	Xtriage
Anisotropy	0.133	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 145.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.42$, $\langle L^2 \rangle = 0.24$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.72	EDS
Total number of atoms	9346	wwPDB-VP
Average B, all atoms (Å ²)	238.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.06% 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

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	0.26	0/4610	0.59	2/6210 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	248	ASP	CB-CG-OD1	5.13	122.92	118.30
1	A	248	ASP	CB-CG-OD2	-5.10	113.71	118.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	93	ARG	Peptide

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	4564	4738	4741	31	0
2	A	31	12	12	1	0
3	A	1	0	0	0	0
All	All	4596	4750	4753	31	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 3.

All (31) 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:A:16:GLY:H	1:A:19:ARG:HB3	1.66	0.61
1:A:496:LYS:HB3	1:A:497:ASP:HA	1.91	0.52
1:A:211:ARG:HA	1:A:224:THR:O	2.12	0.50
1:A:310:ILE:O	1:A:310:ILE:HG22	2.13	0.49
1:A:492:LEU:O	1:A:494:GLY:N	2.46	0.48
1:A:7:LYS:HG2	1:A:8:GLN:HG2	1.95	0.48
1:A:275:ILE:HG23	1:A:617:SER:HB3	1.94	0.48
1:A:496:LYS:CB	1:A:497:ASP:HA	2.44	0.47
1:A:540:MET:O	1:A:544:VAL:HG22	2.15	0.47
1:A:510:ILE:HG13	1:A:511:GLU:H	1.81	0.45
1:A:521:ILE:HG13	1:A:522:SER:N	2.32	0.44
1:A:496:LYS:HG2	1:A:498:PHE:H	1.81	0.44
1:A:171:THR:HG23	1:A:171:THR:O	2.17	0.44
1:A:7:LYS:HE2	1:A:8:GLN:HG3	2.00	0.43
1:A:125:LYS:O	1:A:129:GLU:HG2	2.17	0.43
1:A:128:LEU:O	1:A:133:LEU:N	2.45	0.43
1:A:171:THR:O	1:A:171:THR:CG2	2.66	0.43
1:A:348:THR:O	1:A:368:GLY:N	2.48	0.43
1:A:384:GLY:HA3	1:A:416:LEU:HD21	2.01	0.43
1:A:108:LEU:O	1:A:111:ILE:HG12	2.18	0.43
1:A:11:ARG:HB3	1:A:23:LEU:HB2	2.01	0.43
1:A:268:SER:O	1:A:271:THR:OG1	2.30	0.42
1:A:310:ILE:O	1:A:311:PHE:C	2.57	0.42
1:A:490:LYS:HE2	1:A:495:LYS:HA	2.02	0.42
1:A:151:ARG:HA	1:A:154:ILE:HD12	2.02	0.41
1:A:636:ASN:O	1:A:639:THR:OG1	2.35	0.41
1:A:287:ALA:HB1	1:A:603:MET:HG2	2.03	0.41
1:A:47:SER:OG	2:A:701:ATP:O1B	2.39	0.41
1:A:352:GLY:O	1:A:364:ALA:N	2.55	0.40
1:A:139:ASN:HB2	1:A:144:LEU:HD21	2.03	0.40
1:A:6:ILE:O	1:A:27:SER:HA	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
1	A	590/664 (89%)	541 (92%)	45 (8%)	4 (1%)	22 60

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	16	GLY
1	A	493	HIS
1	A	411	ALA
1	A	527	ILE

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	512/563 (91%)	474 (93%)	38 (7%)	13 43

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET
1	A	9	LEU
1	A	22	VAL
1	A	63	SER

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Mol	Chain	Res	Type
1	A	71	THR
1	A	80	SER
1	A	86	LYS
1	A	111	ILE
1	A	121	LEU
1	A	171	THR
1	A	210	ASN
1	A	248	ASP
1	A	259	SER
1	A	266	MET
1	A	272	MET
1	A	273	LEU
1	A	288	LEU
1	A	301	ARG
1	A	311	PHE
1	A	328	LYS
1	A	334	THR
1	A	342	GLN
1	A	434	SER
1	A	435	ASP
1	A	479	THR
1	A	485	LEU
1	A	514	THR
1	A	524	ILE
1	A	528	SER
1	A	547	ARG
1	A	549	LYS
1	A	562	ILE
1	A	569	LEU
1	A	577	LEU
1	A	587	SER
1	A	615	LEU
1	A	630	LYS
1	A	635	LEU

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

Mol	Chain	Res	Type
1	A	2	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
2	ATP	A	701	3	26,33,33	0.91	1 (3%)	31,52,52	1.51	6 (19%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	ATP	A	701	3	-	3/18/38/38	0/3/3/3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	701	ATP	C5-C4	2.35	1.47	1.40

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	701	ATP	N3-C2-N1	-3.62	123.03	128.68
2	A	701	ATP	PB-O3B-PG	-3.07	122.29	132.83
2	A	701	ATP	PA-O3A-PB	-2.97	122.65	132.83
2	A	701	ATP	C4-C5-N7	-2.66	106.63	109.40
2	A	701	ATP	C3'-C2'-C1'	2.64	104.96	100.98
2	A	701	ATP	C2-N1-C6	2.02	122.20	118.75

There are no chirality outliers.

All (3) torsion outliers are listed below:

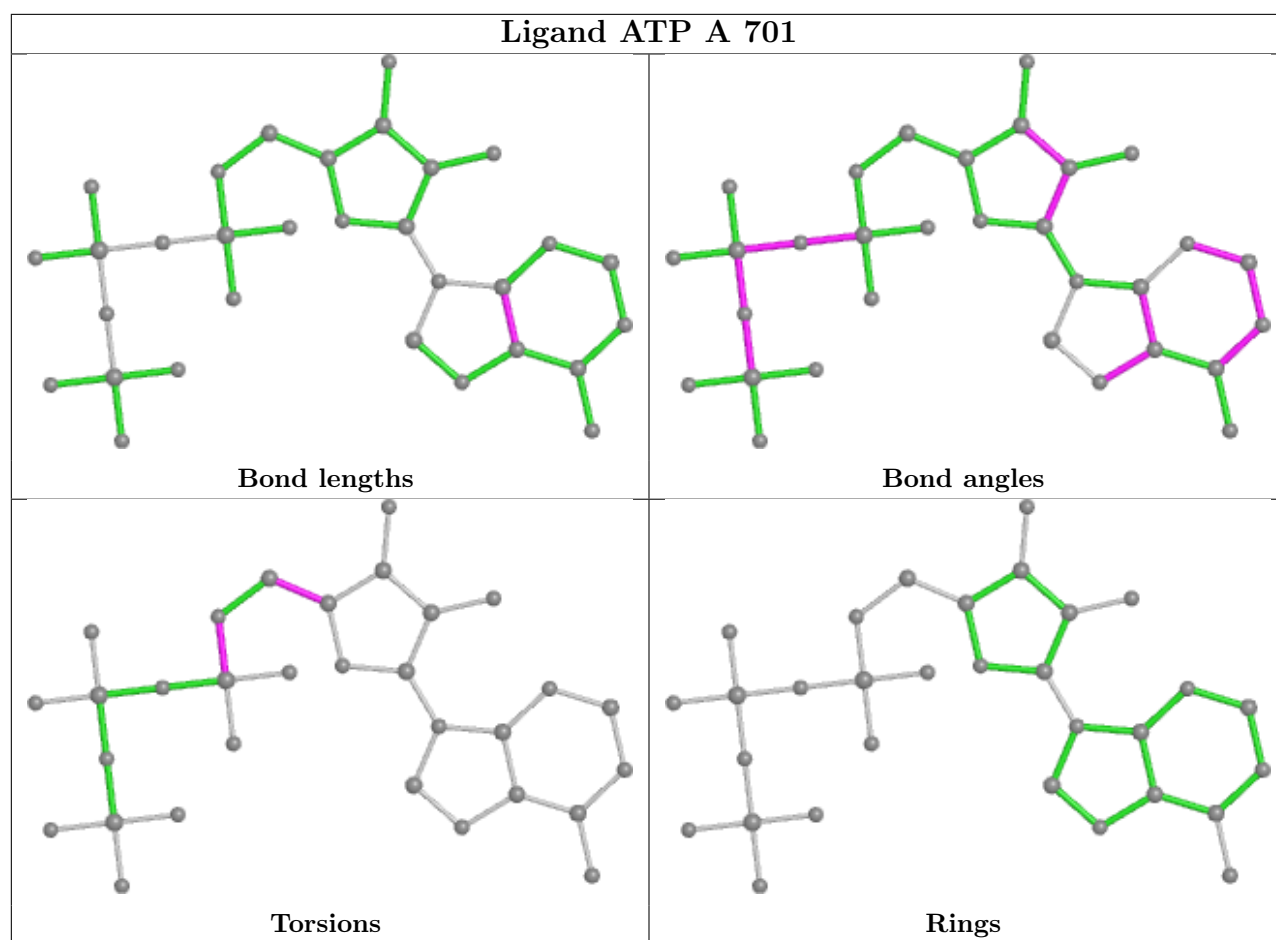
Mol	Chain	Res	Type	Atoms
2	A	701	ATP	C5'-O5'-PA-O3A
2	A	701	ATP	C5'-O5'-PA-O2A
2	A	701	ATP	O4'-C4'-C5'-O5'

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	701	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 than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

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	600/664 (90%)	0.67	90 (15%) 2 2	138, 215, 278, 313	0

All (90) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	305	THR	10.8
1	A	306	ASN	8.6
1	A	301	ARG	7.9
1	A	344	VAL	7.8
1	A	376	VAL	7.1
1	A	300	ILE	6.6
1	A	470	VAL	6.0
1	A	304	GLY	6.0
1	A	332	ALA	5.7
1	A	303	ILE	5.7
1	A	202	ASP	5.7
1	A	205	ILE	5.6
1	A	571	GLU	5.5
1	A	377	GLU	5.5
1	A	297	LEU	5.2
1	A	296	ILE	5.1
1	A	328	LYS	4.8
1	A	345	THR	4.5
1	A	509	THR	4.5
1	A	568	PHE	4.5
1	A	507	LYS	4.3
1	A	469	THR	4.1
1	A	257	SER	4.0
1	A	468	ILE	3.9
1	A	204	HIS	3.9
1	A	506	ILE	3.8
1	A	567	GLN	3.8

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Mol	Chain	Res	Type	RSRZ
1	A	510	ILE	3.8
1	A	471	LYS	3.7
1	A	299	ASN	3.7
1	A	351	SER	3.7
1	A	311	PHE	3.7
1	A	346	PRO	3.7
1	A	480	VAL	3.5
1	A	343	SER	3.5
1	A	547	ARG	3.5
1	A	261	ILE	3.4
1	A	206	ALA	3.4
1	A	472	ILE	3.4
1	A	331	ASP	3.2
1	A	554	ARG	3.2
1	A	258	VAL	3.2
1	A	308	MET	3.1
1	A	330	SER	3.1
1	A	347	ASN	3.1
1	A	498	PHE	3.0
1	A	477	ASN	3.0
1	A	467	SER	2.8
1	A	418	LYS	2.8
1	A	298	GLU	2.8
1	A	254	PHE	2.8
1	A	373	TYR	2.8
1	A	141	PRO	2.8
1	A	144	LEU	2.7
1	A	356	VAL	2.7
1	A	108	LEU	2.6
1	A	208	SER	2.6
1	A	67	ASP	2.6
1	A	550	GLU	2.5
1	A	513	THR	2.5
1	A	482	GLU	2.5
1	A	419	THR	2.4
1	A	3	ILE	2.4
1	A	100	LEU	2.4
1	A	329	ILE	2.4
1	A	102	ALA	2.4
1	A	375	ASP	2.3
1	A	101	THR	2.3
1	A	95	ASN	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	62	GLY	2.3
1	A	483	LYS	2.3
1	A	253	ALA	2.2
1	A	517	MET	2.2
1	A	478	SER	2.2
1	A	476	VAL	2.2
1	A	112	TYR	2.2
1	A	511	GLU	2.2
1	A	91	PHE	2.1
1	A	105	ASN	2.1
1	A	358	ASN	2.1
1	A	357	GLY	2.1
1	A	97	LEU	2.1
1	A	551	ILE	2.1
1	A	307	THR	2.1
1	A	436	GLN	2.1
1	A	350	SER	2.0
1	A	363	SER	2.0
1	A	149	GLN	2.0
1	A	121	LEU	2.0
1	A	191	GLU	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 ⓘ

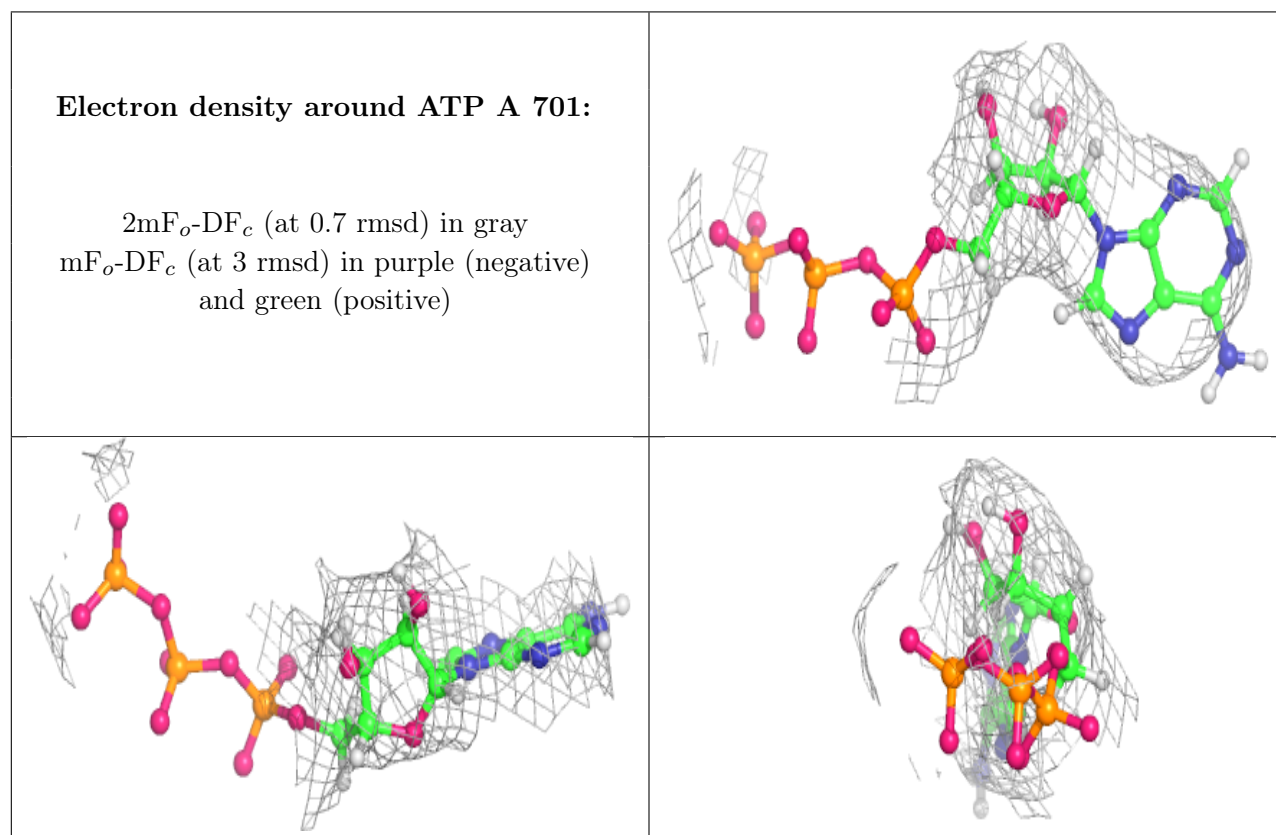
There are no monosaccharides in this entry.

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(\AA^2)	Q<0.9
2	ATP	A	701	31/31	0.90	0.19	127,223,268,293	0
3	MG	A	702	1/1	0.96	0.16	159,159,159,159	0

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



6.5 Other polymers [i](#)

There are no such residues in this entry.