Full wwPDB X-ray Structure Validation Report ⓘ

Apr 4, 2026 – 11:25 PM UTC

PDB ID	:	10KZ / pdb_000010kz
Title	:	N-Alkyl & N-Aryl Aminopyrazole Spirocarbamates: A Two-Pronged Lead Optimization Strategy to Identify Orally Bioavailable Plasma Kallikrein Inhibitors
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Deposited on	:	2026-01-26
Resolution	:	1.78 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

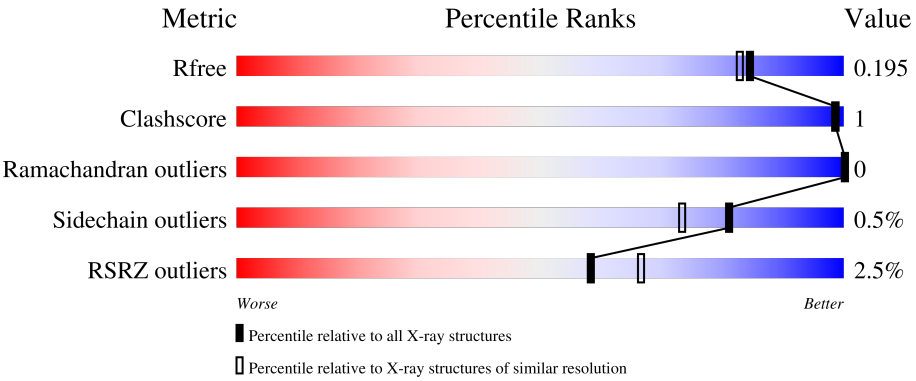
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 1.78 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	1365 (1.78-1.78)
Clashscore	190562	1395 (1.78-1.78)
Ramachandran outliers	187476	1382 (1.78-1.78)
Sidechain outliers	187428	1382 (1.78-1.78)
RSRZ outliers	180081	1365 (1.78-1.78)

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	307	2% 75% . 22%

Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 4048 atoms, of which 1871 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 Plasma kallikrein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	239	3745	1204	1851	323	356	11	0	0	0

There are 49 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	338	MET	-	expression tag	UNP P03952
A	339	LEU	-	expression tag	UNP P03952
A	340	LEU	-	expression tag	UNP P03952
A	341	VAL	-	expression tag	UNP P03952
A	342	ASN	-	expression tag	UNP P03952
A	343	ASP	-	expression tag	UNP P03952
A	344	SER	-	expression tag	UNP P03952
A	345	HIS	-	expression tag	UNP P03952
A	346	GLN	-	expression tag	UNP P03952
A	347	GLY	-	expression tag	UNP P03952
A	348	PHE	-	expression tag	UNP P03952
A	349	ASN	-	expression tag	UNP P03952
A	350	LYS	-	expression tag	UNP P03952
A	351	GLU	-	expression tag	UNP P03952
A	352	HIS	-	expression tag	UNP P03952
A	353	THR	-	expression tag	UNP P03952
A	354	SER	-	expression tag	UNP P03952
A	355	LYS	-	expression tag	UNP P03952
A	356	MET	-	expression tag	UNP P03952
A	357	VAL	-	expression tag	UNP P03952
A	358	SER	-	expression tag	UNP P03952
A	359	ALA	-	expression tag	UNP P03952
A	360	ILE	-	expression tag	UNP P03952
A	361	VAL	-	expression tag	UNP P03952
A	362	LEU	-	expression tag	UNP P03952
A	363	TYR	-	expression tag	UNP P03952
A	364	VAL	-	expression tag	UNP P03952

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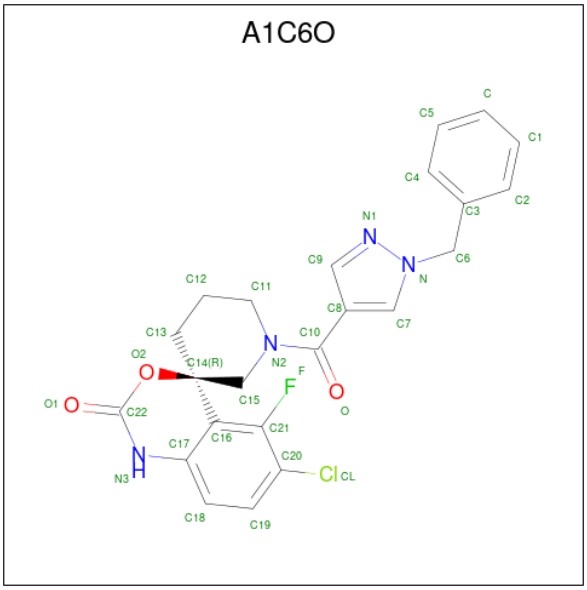
Chain	Residue	Modelled	Actual	Comment	Reference
A	365	LEU	-	expression tag	UNP P03952
A	366	LEU	-	expression tag	UNP P03952
A	367	ALA	-	expression tag	UNP P03952
A	368	ALA	-	expression tag	UNP P03952
A	369	ALA	-	expression tag	UNP P03952
A	370	ALA	-	expression tag	UNP P03952
A	371	HIS	-	expression tag	UNP P03952
A	372	SER	-	expression tag	UNP P03952
A	373	ALA	-	expression tag	UNP P03952
A	374	PHE	-	expression tag	UNP P03952
A	375	ALA	-	expression tag	UNP P03952
A	383	SER	CYS	conflict	UNP P03952
A	396	GLU	ASN	conflict	UNP P03952
A	453	GLU	ASN	conflict	UNP P03952
A	494	GLU	ASN	conflict	UNP P03952
A	503	SER	CYS	conflict	UNP P03952
A	639	HIS	-	expression tag	UNP P03952
A	640	HIS	-	expression tag	UNP P03952
A	641	HIS	-	expression tag	UNP P03952
A	642	HIS	-	expression tag	UNP P03952
A	643	HIS	-	expression tag	UNP P03952
A	644	HIS	-	expression tag	UNP P03952

- Molecule 2 is (3'R)-1'-(1-benzyl-1H-pyrazole-4-carbonyl)-6-chloro-5-fluorospiro[[3,1]benzoxazine-4,3'-piperidin]-2(1H)-one (CCD ID: A1C6O) (formula: $C_{23}H_{20}ClFN_4O_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms							ZeroOcc	AltConf
2	A	1	Total	C	Cl	F	H	N	O	20	0
			52	23	1	1	20	4	3		

- Molecule 3 is water.

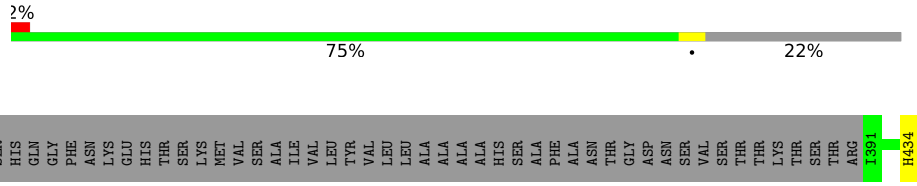
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	251	Total	O	0	0
			251	251		

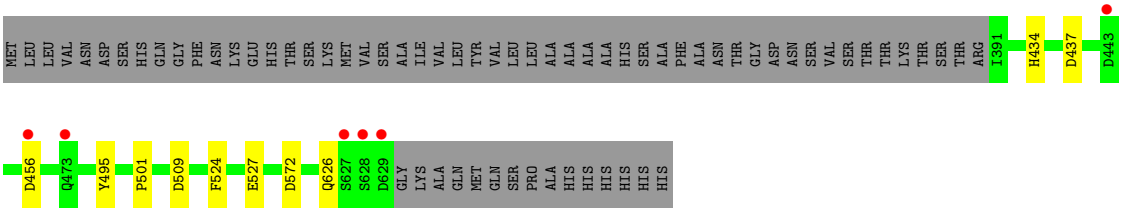
3 Residue-property plots (i)

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: Plasma kallikrein

Chain A:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	41.77Å 59.50Å 105.86Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	21.01 – 1.78 21.01 – 1.78	Depositor EDS
% Data completeness (in resolution range)	99.9 (21.01-1.78) 99.8 (21.01-1.78)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.23 (at 1.78Å)	Xtriage
Refinement program	autoBUSTER 2.11.7	Depositor
R, R_{free}	0.172 , 0.197 0.169 , 0.195	Depositor DCC
R_{free} test set	1245 reflections (4.79%)	wwPDB-VP
Wilson B-factor (Å^2)	20.5	Xtriage
Anisotropy	0.402	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.40 , 46.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	4048	wwPDB-VP
Average B, all atoms (Å^2)	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.02% of the height of the origin peak. No significant pseudotranslation is detected.*

[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: A1C6O

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	0.80	0/1941	1.00	5/2631 (0.2%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	572	ASP	CA-CB-CG	6.71	119.31	112.60
1	A	524	PHE	CA-CB-CG	6.56	120.36	113.80
1	A	456	ASP	CA-CB-CG	6.07	118.67	112.60
1	A	509	ASP	CA-CB-CG	5.77	118.37	112.60
1	A	527	GLU	N-CA-C	5.04	117.16	111.11

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	1894	1851	1850	2	0
2	A	32	20	0	0	0
3	A	251	0	0	0	0
All	All	2177	1871	1850	2	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 1.

All (2) 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:434:HIS:HD2	1:A:437:ASP:OD2	1.91	0.54
1:A:495:TYR:CE1	1:A:501:PRO:HD3	2.53	0.43

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	237/307 (77%)	232 (98%)	5 (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	206/262 (79%)	205 (100%)	1 (0%)	81	73

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

Mol	Chain	Res	Type
1	A	626	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	415	GLN
1	A	434	HIS
1	A	474	ASN
1	A	481	ASN
1	A	536	GLN
1	A	559	GLN
1	A	626	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)

1 ligand is modelled in this entry.

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	A1C6O	A	801	-	33,36,36	0.75	1 (3%)	39,53,53	0.76	1 (2%)

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	A1C6O	A	801	-	-	2/12/39/39	0/5/5/5

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	801	A1C6O	C17-C16	3.70	1.46	1.40

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	801	A1C6O	C19-C20-C21	3.90	121.67	119.37

There are no chirality outliers.

All (2) torsion outliers are listed below:

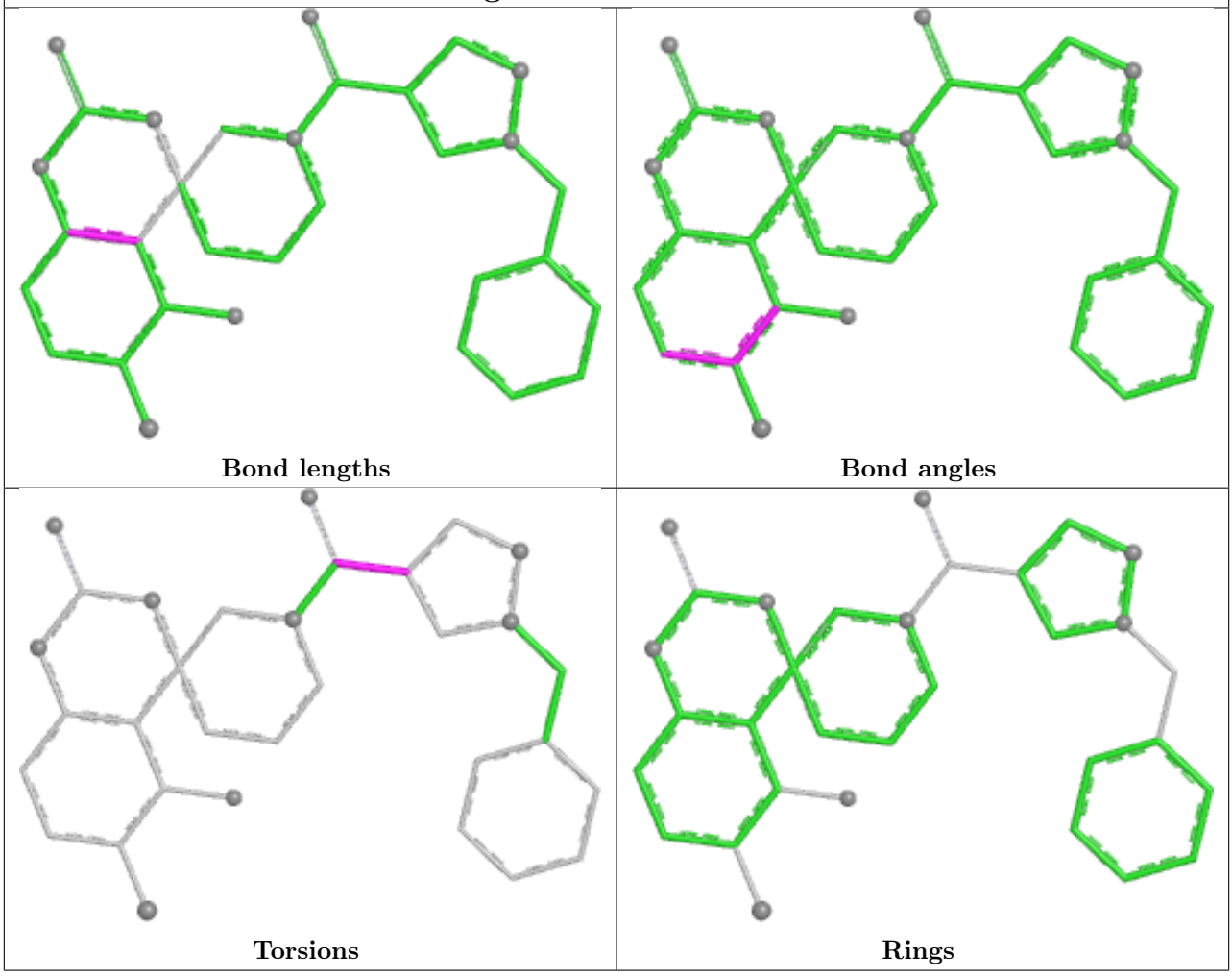
Mol	Chain	Res	Type	Atoms
2	A	801	A1C6O	N2-C10-C8-C7
2	A	801	A1C6O	O-C10-C8-C7

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 A1C6O A 801



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, 95^{th} 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	239/307 (77%)	-0.27	6 (2%)	58 66	13, 23, 47, 104	0

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	629	ASP	3.7
1	A	456	ASP	3.6
1	A	627	SER	2.8
1	A	628	SER	2.8
1	A	443	ASP	2.2
1	A	473	GLN	2.1

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 oligosaccharides in this entry.

6.4 Ligands

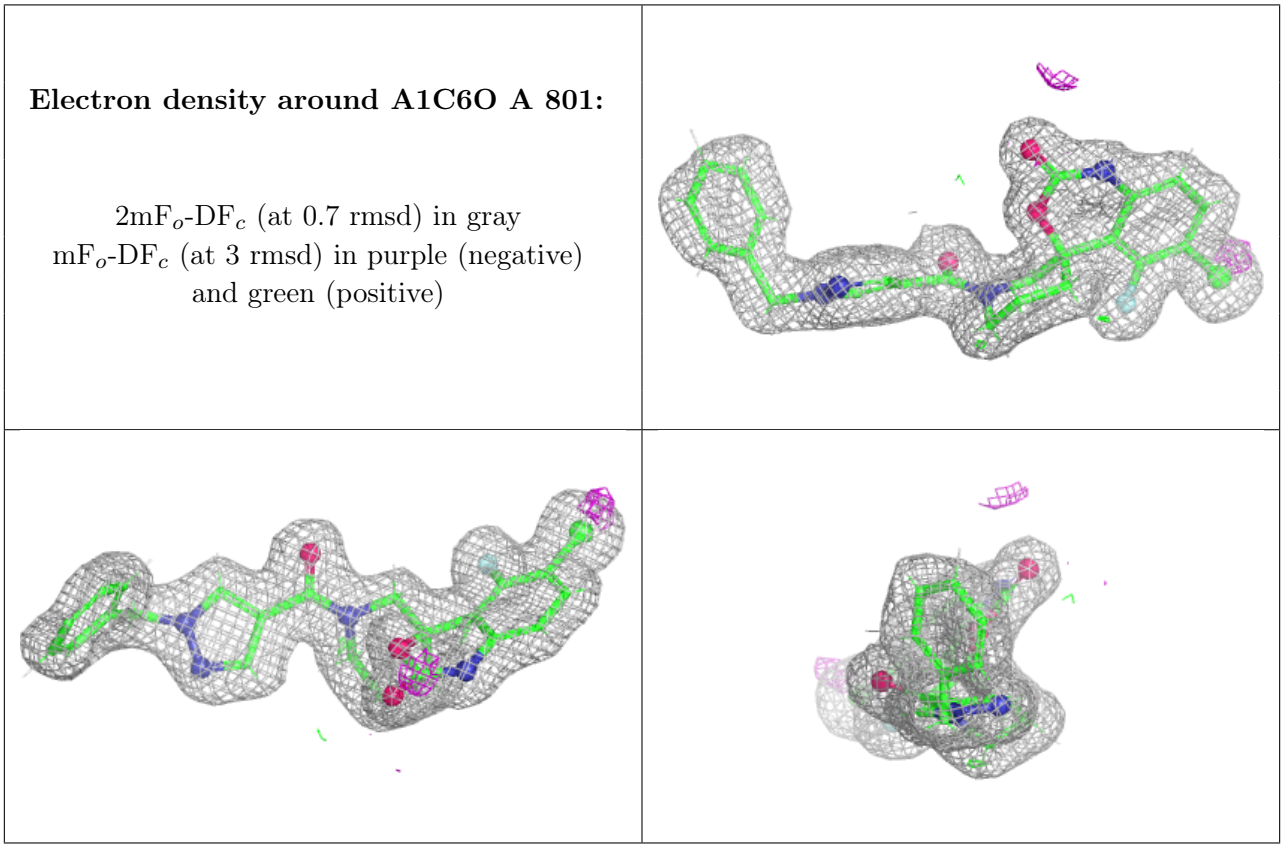
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' 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	A1C6O	A	801	32/32	0.96	0.07	16,20,39,41	20

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 A1C6O A 801:

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



6.5 Other polymers (i)

There are no such residues in this entry.