



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 08:04 PM UTC

PDB ID : 5T28 / pdb_00005t28
Title : mPI3Kd IN COMPLEX WITH 5k
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Deposited on : 2016-08-23
Resolution : 2.80 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)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

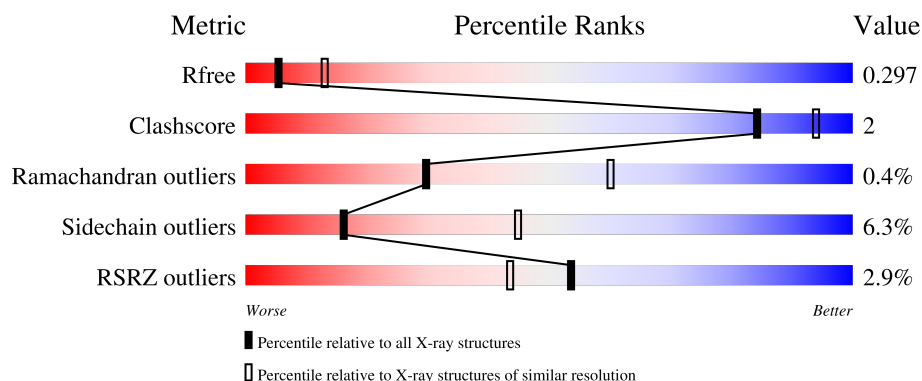
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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	3866 (2.80-2.80)
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)
RSRZ outliers	180081	3869 (2.80-2.80)

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	939	

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 6676 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.

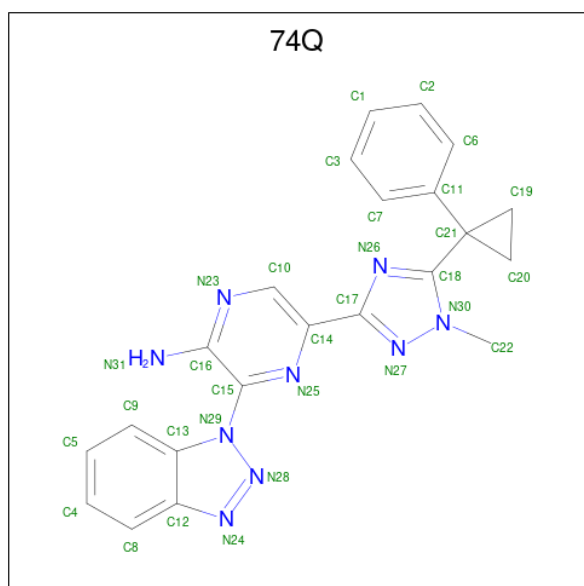
- Molecule 1 is a protein called Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic sub-unit delta isoform.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	822	Total	C	N	O	S	0	0	0
			6633	4254	1126	1199	54			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	508	GLN	-	insertion	UNP O35904

- Molecule 2 is 3-(benzotriazol-1-yl)-5-[1-methyl-5-(1-phenylcyclopropyl)-1,2,4-triazol-3-yl]pyrazin-2-amine (CCD ID: 74Q) (formula: C₂₂H₁₉N₉).

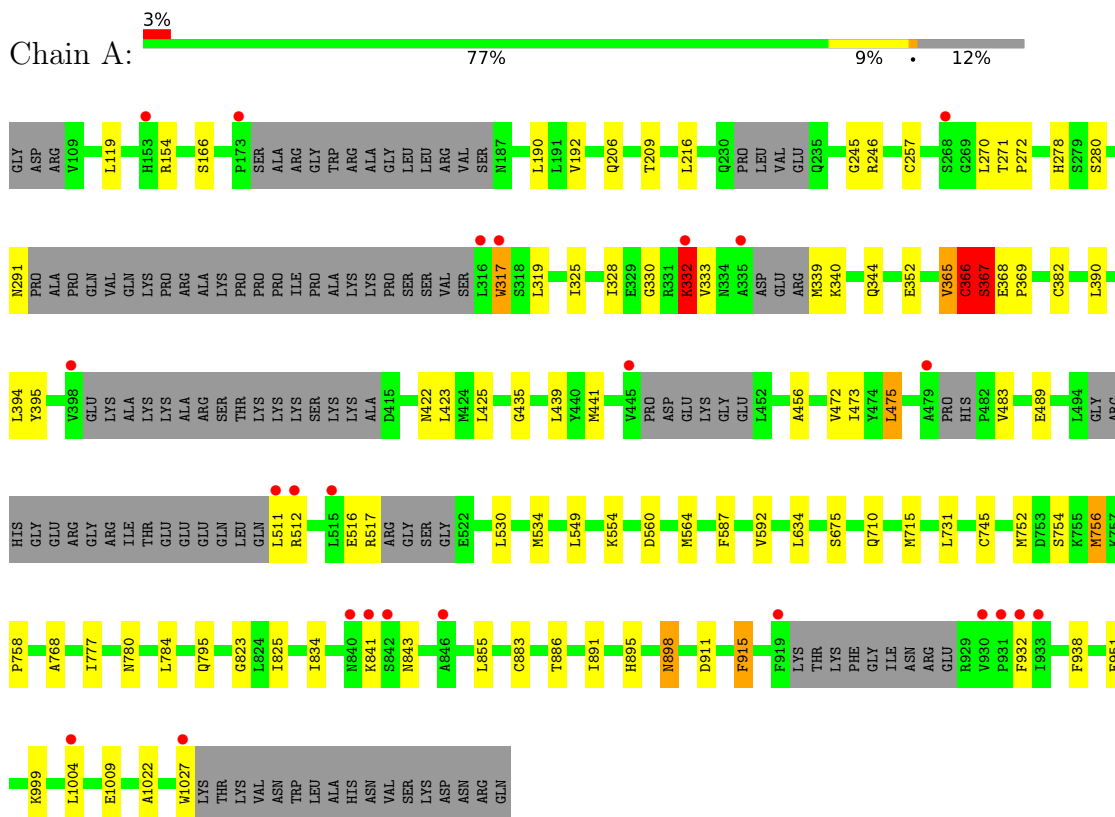


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	N	0	0
			31	22	9		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	12	Total	O	0	0
			12	12		

- Molecule 1: Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic subunit delta isoform



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	63.55Å 142.80Å 220.45Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.63 – 2.80 43.63 – 2.80	Depositor EDS
% Data completeness (in resolution range)	99.9 (43.63-2.80) 99.8 (43.63-2.80)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.18 (at 2.81Å)	Xtriage
Refinement program	BUSTER 2.11.6	Depositor
R, R_{free}	0.228 , 0.286 0.235 , 0.297	Depositor DCC
R_{free} test set	1276 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å ²)	66.7	Xtriage
Anisotropy	0.139	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 36.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	6676	wwPDB-VP
Average B, all atoms (Å ²)	64.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.11% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 74Q

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	0.74	0/6776	1.32	12/9142 (0.1%)

There are no bond length outliers.

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	915	PHE	CA-CB-CG	6.70	120.50	113.80
1	A	715	MET	N-CA-C	-5.95	104.72	111.14
1	A	291	ASN	CA-CB-CG	5.87	118.47	112.60
1	A	422	ASN	CA-CB-CG	5.43	118.03	112.60
1	A	938	PHE	CA-CB-CG	5.34	119.14	113.80
1	A	332	LYS	N-CA-C	5.24	117.97	109.86
1	A	456	ALA	CA-C-N	5.11	124.95	120.10
1	A	456	ALA	C-N-CA	5.11	124.95	120.10
1	A	715	MET	CA-C-N	5.02	126.97	120.44
1	A	715	MET	C-N-CA	5.02	126.97	120.44
1	A	745	CYS	CA-C-N	5.00	127.05	120.60
1	A	745	CYS	C-N-CA	5.00	127.05	120.60

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	6633	0	6612	30	0
2	A	31	0	0	0	0
3	A	12	0	0	0	0
All	All	6676	0	6612	30	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 2.

All (30) 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:365:VAL:O	1:A:367:SER:N	1.86	1.09
1:A:549:LEU:HG	1:A:564:MET:HE1	1.41	0.99
1:A:365:VAL:O	1:A:366:CYS:C	2.19	0.86
1:A:368:GLU:N	1:A:369:PRO:CD	2.53	0.72
1:A:368:GLU:N	1:A:369:PRO:HD3	2.11	0.66
1:A:435:GLY:N	1:A:475:LEU:O	2.25	0.65
1:A:209:THR:HB	1:A:257:CYS:HB3	1.84	0.59
1:A:367:SER:O	1:A:368:GLU:HB3	2.07	0.55
1:A:390:LEU:HB2	1:A:425:LEU:HD21	1.89	0.53
1:A:752:MET:HB2	1:A:758:PRO:HD2	1.92	0.51
1:A:784:LEU:HD12	1:A:823:GLY:HA3	1.92	0.51
1:A:895:HIS:H	1:A:898:ASN:HD21	1.60	0.49
1:A:886:THR:HA	1:A:891:ILE:HD12	1.94	0.48
1:A:777:ILE:HB	1:A:825:ILE:HB	1.98	0.45
1:A:932:PHE:HB3	1:A:1022:ALA:HB2	1.98	0.45
1:A:192:VAL:HG11	1:A:216:LEU:HD11	1.98	0.45
1:A:332:LYS:HG2	1:A:394:LEU:HD21	1.99	0.45
1:A:319:LEU:HD11	1:A:483:VAL:HG11	1.99	0.44
1:A:245:GLY:HA3	1:A:768:ALA:HB2	1.99	0.44
1:A:278:HIS:CD2	1:A:280:SER:H	2.36	0.43
1:A:512:ARG:HD3	1:A:534:MET:HB2	2.00	0.43
1:A:344:GLN:HB2	1:A:395:TYR:HE1	1.84	0.43
1:A:330:GLY:O	1:A:368:GLU:HA	2.18	0.43
1:A:756:MET:HG3	1:A:780:ASN:O	2.18	0.43
1:A:317:TRP:HA	1:A:382:CYS:HB2	2.00	0.42
1:A:394:LEU:HD22	1:A:441:MET:HE1	2.01	0.42
1:A:883:CYS:HB3	1:A:932:PHE:CZ	2.54	0.42
1:A:587:PHE:HB3	1:A:592:VAL:HG11	2.01	0.42
1:A:834:ILE:HD13	1:A:855:LEU:HD21	2.02	0.42
1:A:271:THR:HA	1:A:272:PRO:HD3	1.99	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	800/939 (85%)	764 (96%)	33 (4%)	3 (0%)	30 60

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	366	CYS
1	A	367	SER
1	A	328	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	728/827 (88%)	682 (94%)	46 (6%)	16 45

All (46) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	119	LEU
1	A	154	ARG
1	A	166	SER
1	A	190	LEU
1	A	206	GLN

Continued on next page...

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Mol	Chain	Res	Type
1	A	246	ARG
1	A	270	LEU
1	A	317	TRP
1	A	325	ILE
1	A	332	LYS
1	A	333	VAL
1	A	339	MET
1	A	340	LYS
1	A	352	GLU
1	A	365	VAL
1	A	366	CYS
1	A	367	SER
1	A	423	LEU
1	A	439	LEU
1	A	472	VAL
1	A	473	ILE
1	A	475	LEU
1	A	489	GLU
1	A	511	LEU
1	A	516	GLU
1	A	517	ARG
1	A	530	LEU
1	A	554	LYS
1	A	560	ASP
1	A	634	LEU
1	A	675	SER
1	A	710	GLN
1	A	731	LEU
1	A	754	SER
1	A	756	MET
1	A	795	GLN
1	A	841	LYS
1	A	843	ASN
1	A	898	ASN
1	A	911	ASP
1	A	915	PHE
1	A	951	GLU
1	A	999	LYS
1	A	1004	LEU
1	A	1009	GLU
1	A	1027	TRP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14)

such sidechains are listed below:

Mol	Chain	Res	Type
1	A	126	HIS
1	A	193	ASN
1	A	273	HIS
1	A	278	HIS
1	A	422	ASN
1	A	464	ASN
1	A	617	GLN
1	A	685	GLN
1	A	836	ASN
1	A	898	ASN
1	A	914	HIS
1	A	918	ASN
1	A	944	GLN
1	A	949	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 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	74Q	A	1101	-	34,36,36	1.10	4 (11%)	41,54,54	1.15	4 (9%)

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	74Q	A	1101	-	-	3/14/24/24	0/6/6/6

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1101	74Q	N29-N28	-3.07	1.34	1.38
2	A	1101	74Q	C18-N30	2.86	1.37	1.34
2	A	1101	74Q	C21-C11	-2.39	1.49	1.53
2	A	1101	74Q	C16-N31	2.11	1.39	1.34

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1101	74Q	C10-N23-C16	-2.67	116.06	118.64
2	A	1101	74Q	C2-C6-C11	2.21	123.00	120.75
2	A	1101	74Q	C4-C5-C9	2.06	122.78	120.24
2	A	1101	74Q	C20-C21-C19	2.04	59.36	58.45

There are no chirality outliers.

All (3) torsion outliers are listed below:

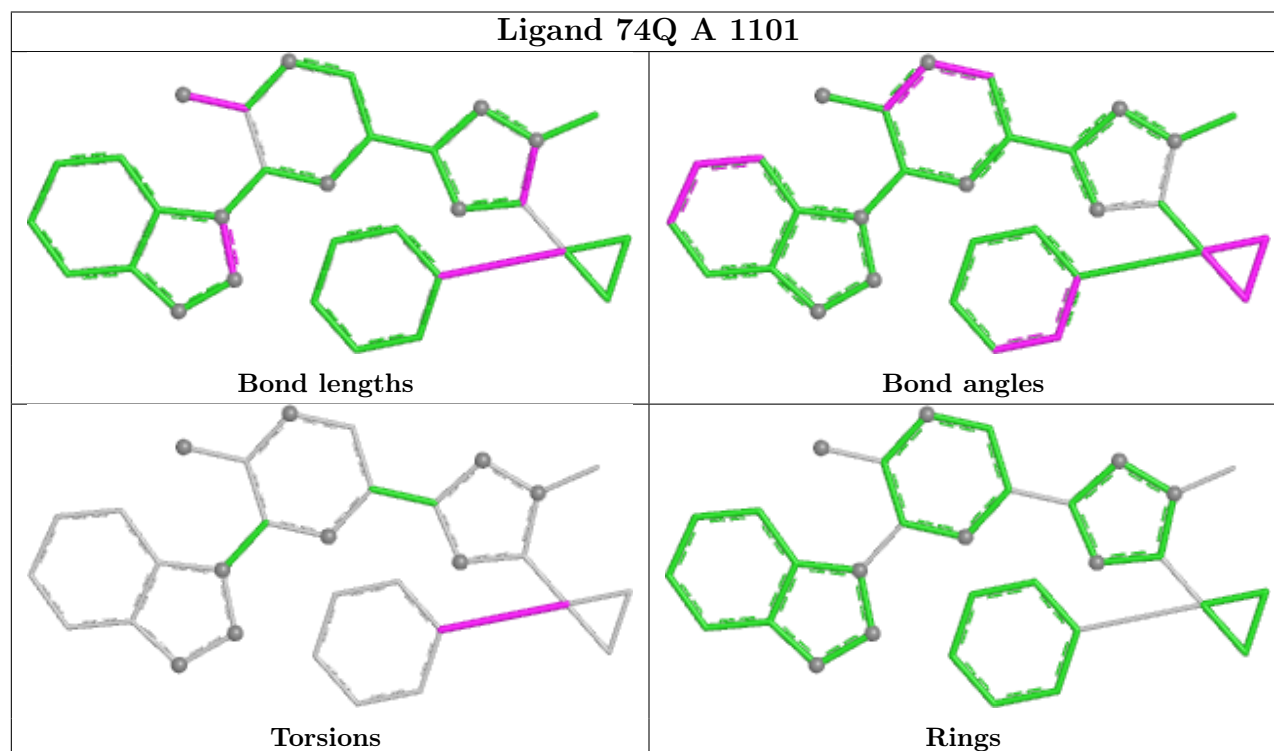
Mol	Chain	Res	Type	Atoms
2	A	1101	74Q	C7-C11-C21-C18
2	A	1101	74Q	C6-C11-C21-C18
2	A	1101	74Q	C6-C11-C21-C19

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 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	822/939 (87%)	0.08	24 (2%)	53 43	34, 61, 101, 171	0

All (24) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	316	LEU	5.2
1	A	335	ALA	4.7
1	A	511	LEU	4.3
1	A	479	ALA	3.9
1	A	317	TRP	3.9
1	A	332	LYS	3.5
1	A	173	PRO	3.2
1	A	840	ASN	3.1
1	A	398	VAL	3.1
1	A	932	PHE	3.1
1	A	512	ARG	3.0
1	A	1027	TRP	3.0
1	A	1004	LEU	2.9
1	A	268	SER	2.9
1	A	445	VAL	2.7
1	A	841	LYS	2.6
1	A	930	VAL	2.4
1	A	842	SER	2.4
1	A	153	HIS	2.3
1	A	919	PHE	2.2
1	A	515	LEU	2.2
1	A	933	ILE	2.2
1	A	931	PRO	2.1
1	A	846	ALA	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](#)

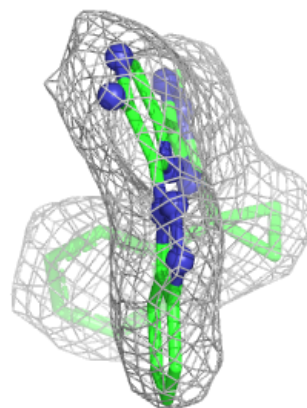
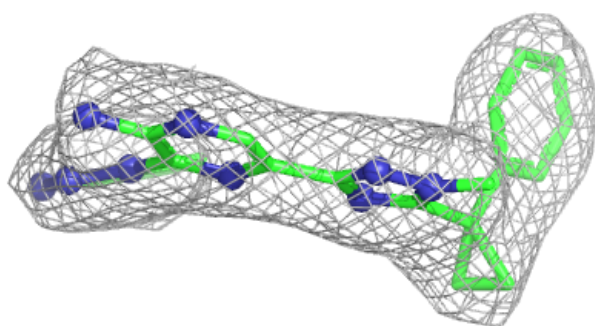
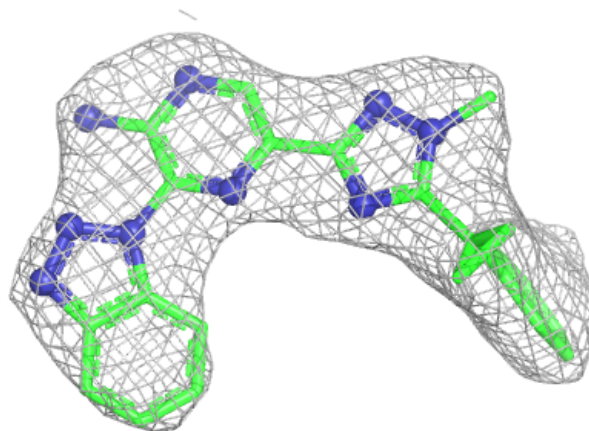
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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	74Q	A	1101	31/31	0.94	0.08	41,47,58,59	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 74Q A 1101:

$2mF_o-DF_c$ (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.