



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 06:53 PM UTC

PDB ID : 6HI1 / pdb_00006hi1
Title : PI3 Kinase Delta in complex with 3[6(morpholin4yl)pyridin2yl]phenol
Authors : Convery, M.A.; Summers, D.; Peace, S.
Deposited on : 2018-08-29
Resolution : 2.07 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

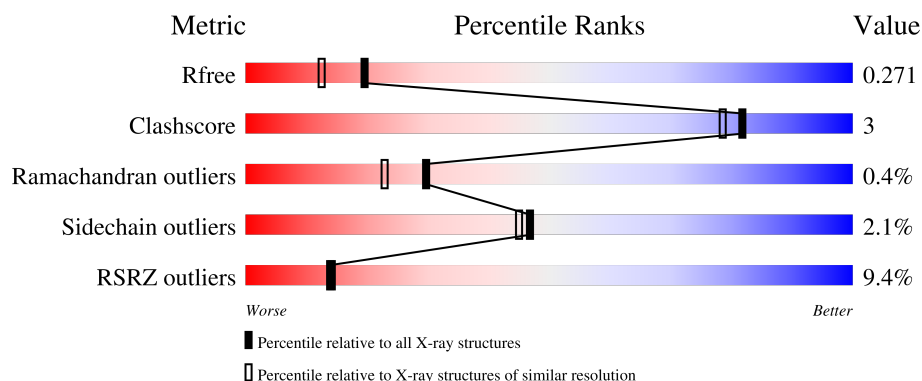
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.07 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	3774 (2.08-2.04)
Clashscore	190562	3883 (2.08-2.04)
Ramachandran outliers	187476	3860 (2.08-2.04)
Sidechain outliers	187428	3860 (2.08-2.04)
RSRZ outliers	180081	3775 (2.08-2.04)

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	940	9% 81% 11% 8%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 7473 atoms, of which 16 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.

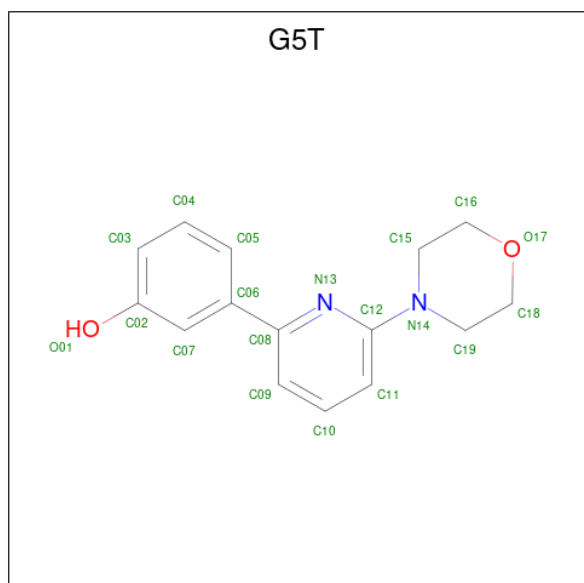
- Molecule 1 is a protein called Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic sub-unit delta isoform.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	863	Total	C	N	O	S	0	0	0
			6944	4438	1191	1261	54			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	105	GLY	GLU	conflict	UNP O35904
A	508	GLN	-	insertion	UNP O35904

- Molecule 2 is 3-(6-morpholin-4-ylpyridin-2-yl)phenol (CCD ID: G5T) (formula: C₁₅H₁₆N₂O₂) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	H	N	O	0	0
			35	15	16	2	2		

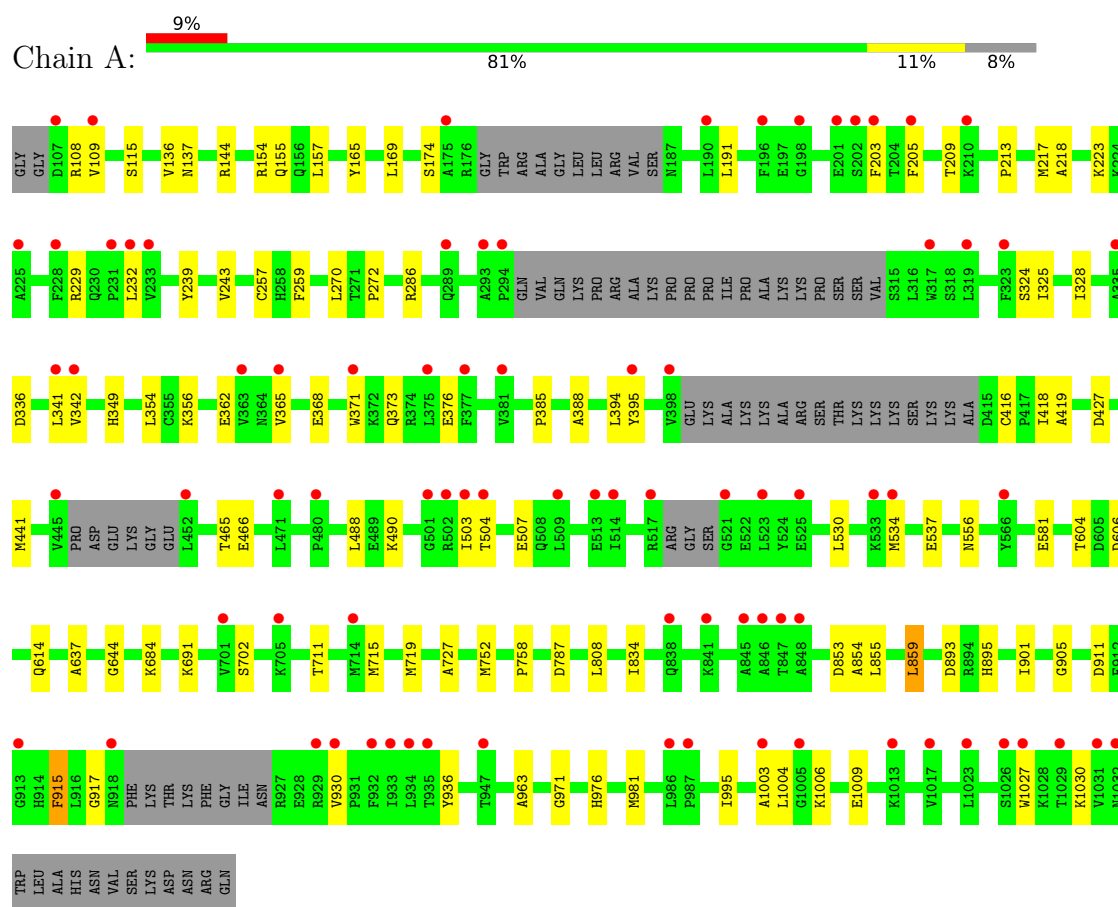
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	494	Total 494	O 494	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: Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic subunit delta isoform



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	141.57Å 64.36Å 116.30Å 90.00° 103.24° 90.00°	Depositor
Resolution (Å)	30.31 – 2.07 30.31 – 2.07	Depositor EDS
% Data completeness (in resolution range)	99.3 (30.31-2.07) 99.3 (30.31-2.07)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.07 (at 2.07Å)	Xtriage
Refinement program	BUSTER 2.11.5	Depositor
R, R_{free}	0.211 , 0.254 0.224 , 0.271	Depositor DCC
R_{free} test set	3126 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	39.6	Xtriage
Anisotropy	0.100	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 64.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.42$, $\langle L^2 \rangle = 0.25$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	7473	wwPDB-VP
Average B, all atoms (Å ²)	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 15.40% 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: G5T

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	0.87	1/7096 (0.0%)	1.32	33/9582 (0.3%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	243	VAL	CA-C	5.08	1.58	1.52

All (33) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	915	PHE	CA-CB-CG	7.80	121.60	113.80
1	A	218	ALA	CA-C-N	6.57	128.98	120.44
1	A	218	ALA	C-N-CA	6.57	128.98	120.44
1	A	336	ASP	CA-C-N	6.29	129.33	120.28
1	A	336	ASP	C-N-CA	6.29	129.33	120.28
1	A	427	ASP	CA-CB-CG	6.26	118.86	112.60
1	A	488	LEU	CA-C-N	6.12	128.48	120.28
1	A	488	LEU	C-N-CA	6.12	128.48	120.28
1	A	465	THR	CA-C-N	5.98	128.22	120.44
1	A	465	THR	C-N-CA	5.98	128.22	120.44
1	A	854	ALA	N-CA-C	5.59	117.05	111.07
1	A	137	ASN	CA-CB-CG	5.57	118.17	112.60
1	A	232	LEU	CA-C-N	5.54	128.29	120.42
1	A	232	LEU	C-N-CA	5.54	128.29	120.42
1	A	853	ASP	CA-CB-CG	5.42	118.03	112.60
1	A	136	VAL	CA-C-N	5.34	127.44	120.28
1	A	136	VAL	C-N-CA	5.34	127.44	120.28
1	A	606	ASP	CA-CB-CG	5.34	117.94	112.60
1	A	490	LYS	CA-C-N	5.30	127.44	120.60
1	A	490	LYS	C-N-CA	5.30	127.44	120.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	286	ARG	CA-C-N	5.30	127.33	120.44
1	A	286	ARG	C-N-CA	5.30	127.33	120.44
1	A	859	LEU	CA-C-N	5.28	127.30	120.44
1	A	859	LEU	C-N-CA	5.28	127.30	120.44
1	A	144	ARG	CA-C-N	5.27	127.29	120.44
1	A	144	ARG	C-N-CA	5.27	127.29	120.44
1	A	604	THR	N-CA-C	-5.26	103.74	110.53
1	A	174	SER	CA-C-N	5.09	127.09	120.28
1	A	174	SER	C-N-CA	5.09	127.09	120.28
1	A	893	ASP	CA-CB-CG	5.08	117.68	112.60
1	A	239	TYR	N-CA-C	5.07	117.56	109.81
1	A	203	PHE	CA-CB-CG	5.04	118.84	113.80
1	A	556	ASN	CA-CB-CG	5.03	117.63	112.60

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	6944	0	6918	35	0
2	A	19	16	0	0	0
3	A	494	0	0	1	0
All	All	7457	16	6918	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 3.

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:A:324:SER:HB3	1:A:376:GLU:HG3	1.83	0.59
1:A:859:LEU:HD21	1:A:901:ILE:HD11	1.86	0.57
1:A:209:THR:HB	1:A:257:CYS:HB3	1.87	0.56
1:A:752:MET:HB2	1:A:758:PRO:HG2	1.89	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:371:TRP:HB3	1:A:373:GLN:HG2	1.92	0.51
1:A:169:LEU:HD22	1:A:259:PHE:HE1	1.75	0.50
1:A:715:MET:O	1:A:719:MET:HG3	2.11	0.50
1:A:154:ARG:HD2	1:A:165:TYR:CE2	2.47	0.49
1:A:971:GLY:HA3	1:A:1004:LEU:HD21	1.96	0.48
1:A:834:ILE:HG23	1:A:855:LEU:HD21	1.96	0.48
1:A:419:ALA:HB1	1:A:441:MET:HB3	1.96	0.47
1:A:342:VAL:HG22	1:A:362:GLU:HG2	1.96	0.47
1:A:356:LYS:HG3	3:A:1375:HOH:O	2.13	0.47
1:A:917:GLY:HA2	1:A:930:VAL:HG23	1.97	0.47
1:A:503:ILE:HG22	1:A:504:THR:H	1.80	0.46
1:A:936:TYR:HD1	1:A:1030:LYS:HE3	1.81	0.46
1:A:154:ARG:HA	1:A:157:LEU:HG	1.99	0.45
1:A:614:GLN:HG3	1:A:981:MET:HG2	1.99	0.45
1:A:808:LEU:HD11	1:A:963:ALA:HB2	1.99	0.44
1:A:213:PRO:O	1:A:217:MET:HG3	2.17	0.44
1:A:385:PRO:HD2	1:A:388:ALA:HB2	1.98	0.44
1:A:395:TYR:HA	1:A:418:ILE:HG12	2.00	0.44
1:A:205:PHE:HB3	1:A:223:LYS:HE3	2.00	0.44
1:A:191:LEU:O	1:A:272:PRO:HD2	2.18	0.43
1:A:534:MET:HE3	1:A:537:GLU:HG3	2.00	0.43
1:A:691:LYS:HG3	1:A:727:ALA:HB3	2.01	0.43
1:A:859:LEU:HD21	1:A:905:GLY:HA2	2.01	0.43
1:A:507:GLU:HB2	1:A:530:LEU:HD11	2.02	0.42
1:A:702:SER:HB3	1:A:711:THR:HG23	2.01	0.42
1:A:1003:ALA:HB1	1:A:1006:LYS:HD2	2.02	0.41
1:A:1027:TRP:CD1	1:A:1030:LYS:HD2	2.55	0.41
1:A:349:HIS:HB2	1:A:354:LEU:HD21	2.01	0.41
1:A:637:ALA:HB1	1:A:644:GLY:HA2	2.02	0.41
1:A:581:GLU:HB2	1:A:976:HIS:NE2	2.35	0.40
1:A:341:LEU:HG	1:A:365:VAL:HG22	2.04	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	849/940 (90%)	825 (97%)	21 (2%)	3 (0%)	30	23

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	229	ARG
1	A	911	ASP
1	A	328	ILE

5.3.2 Protein sidechains ⓘ

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	760/827 (92%)	744 (98%)	16 (2%)	47	45

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	108	ARG
1	A	109	VAL
1	A	115	SER
1	A	155	GLN
1	A	270	LEU
1	A	325	ILE
1	A	368	GLU
1	A	394	LEU
1	A	416	CYS
1	A	466	GLU
1	A	684	LYS
1	A	787	ASP
1	A	895	HIS
1	A	915	PHE
1	A	995	ILE
1	A	1009	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	116	GLN
1	A	193	ASN
1	A	247	HIS
1	A	289	GLN
1	A	349	HIS
1	A	364	ASN
1	A	464	ASN
1	A	539	GLN
1	A	710	GLN
1	A	918	ASN
1	A	970	HIS

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	G5T	A	1101	-	21,21,21	0.87	1 (4%)	28,28,28	0.86	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
2	G5T	A	1101	-	-	0/8/16/16	0/3/3/3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1101	G5T	C12-N13	2.26	1.37	1.34

There are no bond angle outliers.

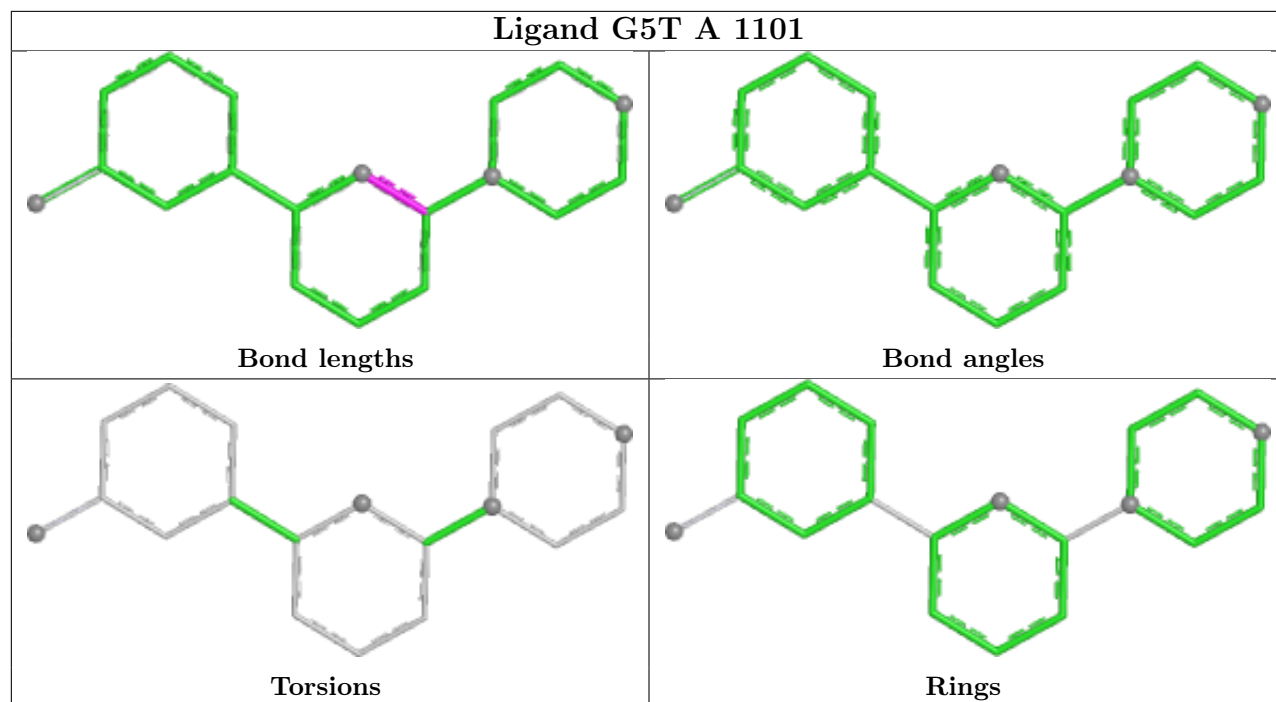
There are no chirality outliers.

There are no torsion outliers.

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	863/940 (91%)	0.76	81 (9%) 14 14	26, 49, 85, 123	0

All (81) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	934	LEU	7.9
1	A	501	GLY	5.1
1	A	445	VAL	4.7
1	A	232	LEU	4.3
1	A	933	ILE	4.1
1	A	233	VAL	3.9
1	A	503	ILE	3.6
1	A	509	LEU	3.5
1	A	109	VAL	3.5
1	A	341	LEU	3.5
1	A	294	PRO	3.3
1	A	1032	ASN	3.3
1	A	930	VAL	3.1
1	A	521	GLY	3.1
1	A	918	ASN	3.1
1	A	398	VAL	3.0
1	A	317	TRP	2.9
1	A	1026	SER	2.8
1	A	375	LEU	2.8
1	A	1023	LEU	2.8
1	A	848	ALA	2.8
1	A	190	LEU	2.8
1	A	705	LYS	2.8
1	A	1027	TRP	2.8
1	A	107	ASP	2.7
1	A	377	PHE	2.7
1	A	846	ALA	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	395	TYR	2.7
1	A	566	TYR	2.7
1	A	293	ALA	2.7
1	A	381	VAL	2.7
1	A	175	ALA	2.7
1	A	935	THR	2.6
1	A	452	LEU	2.6
1	A	1003	ALA	2.6
1	A	1029	THR	2.6
1	A	365	VAL	2.5
1	A	504	THR	2.5
1	A	205	PHE	2.5
1	A	363	VAL	2.5
1	A	845	ALA	2.5
1	A	517	ARG	2.5
1	A	289	GLN	2.5
1	A	231	PRO	2.4
1	A	932	PHE	2.4
1	A	502	ARG	2.4
1	A	986	LEU	2.4
1	A	203	PHE	2.4
1	A	913	GLY	2.3
1	A	210	LYS	2.3
1	A	847	THR	2.3
1	A	225	ALA	2.3
1	A	319	LEU	2.3
1	A	1005	GLY	2.3
1	A	228	PHE	2.3
1	A	514	ILE	2.3
1	A	714	MET	2.3
1	A	701	VAL	2.2
1	A	1031	VAL	2.2
1	A	841	LYS	2.2
1	A	198	GLY	2.2
1	A	1013	LYS	2.2
1	A	201	GLU	2.2
1	A	202	SER	2.2
1	A	987	PRO	2.2
1	A	1017	VAL	2.2
1	A	533	LYS	2.2
1	A	371	TRP	2.2
1	A	947	THR	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	471	LEU	2.1
1	A	534	MET	2.1
1	A	513	GLU	2.1
1	A	480	PRO	2.1
1	A	196	PHE	2.1
1	A	342	VAL	2.1
1	A	929	ARG	2.1
1	A	335	ALA	2.1
1	A	523	LEU	2.1
1	A	525	GLU	2.1
1	A	323	PHE	2.0
1	A	838	GLN	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](#)

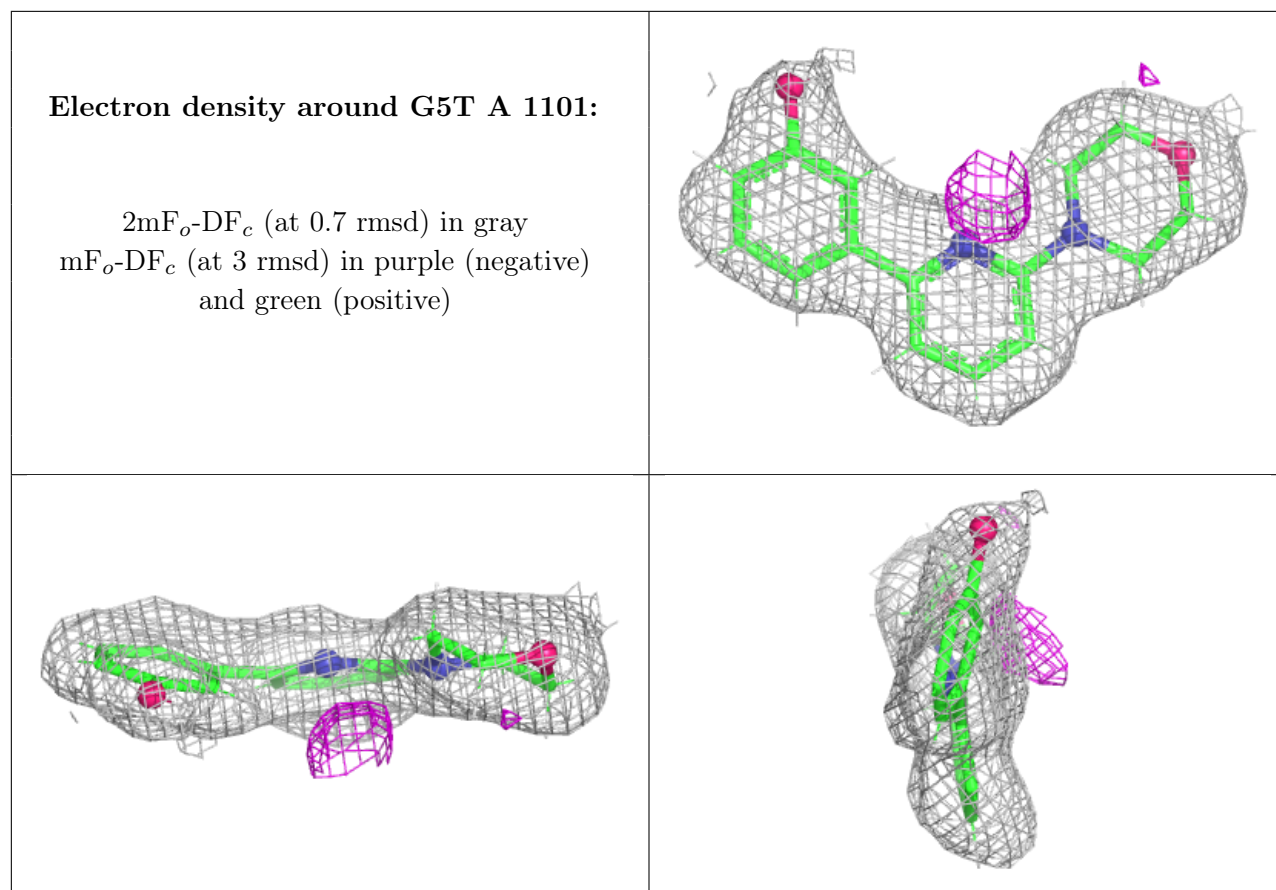
There are no oligosaccharides in this entry.

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	G5T	A	1101	19/19	0.91	0.09	29,37,41,44	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 ⓘ

There are no such residues in this entry.