



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 26, 2023 – 12:19 AM EDT

PDB ID : 6AUD  
Title : PI3K-gamma K802T in complex with Cpd 8 10-((1-(tert-butyl)piperidin-4-yl)sulfinyl)-2-(1-isopropyl-1H-1,2,4-triazol-5-yl)-5,6-dihydrobenzo[f]imidazo[1,2-d][1,4]oxazepine  
Authors : Murray, J.M.; Ultsch, M.  
Deposited on : 2017-08-31  
Resolution : 2.02 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](mailto: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>.

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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)  
Xtrriage (Phenix) : 1.13  
EDS : 2.35.1  
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) : 2.35.1

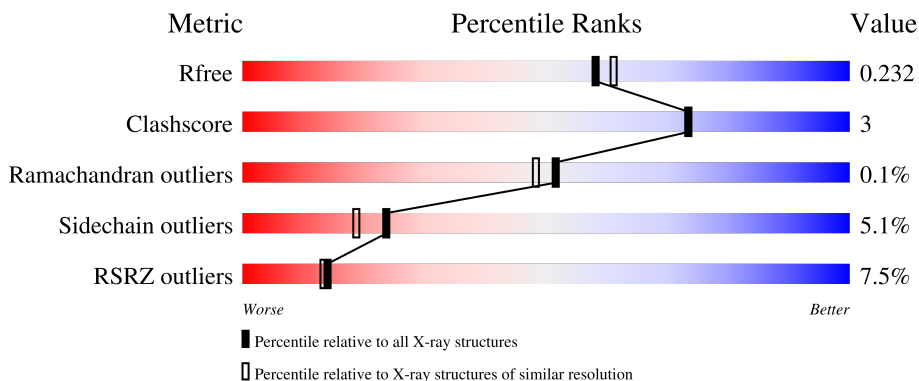
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.02 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	10434 (2.04-2.00)
Clashscore	141614	11643 (2.04-2.00)
Ramachandran outliers	138981	11493 (2.04-2.00)
Sidechain outliers	138945	11492 (2.04-2.00)
RSRZ outliers	127900	10220 (2.04-2.00)

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  $\geq 3$ , 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	966	

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 7121 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.

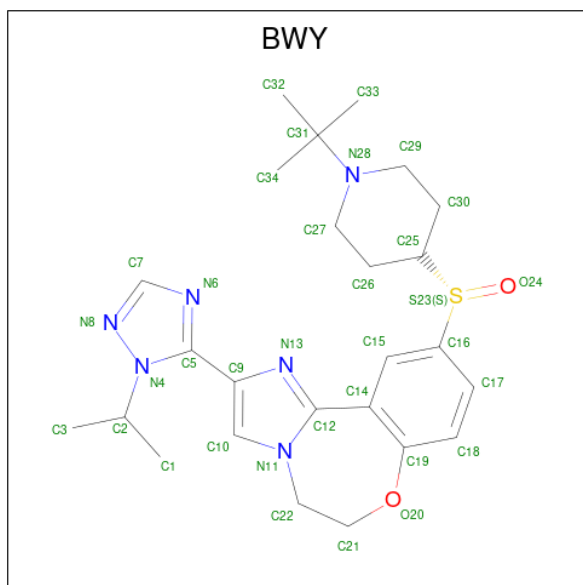
- Molecule 1 is a protein called Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic subunit gamma isoform.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	840	6796	4362	1158	1241	35	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	143	MET	-	initiating methionine	UNP P48736
A	802	THR	LYS	engineered mutation	UNP P48736
A	1103	HIS	-	expression tag	UNP P48736
A	1104	HIS	-	expression tag	UNP P48736
A	1105	HIS	-	expression tag	UNP P48736
A	1106	HIS	-	expression tag	UNP P48736
A	1107	HIS	-	expression tag	UNP P48736
A	1108	HIS	-	expression tag	UNP P48736

- Molecule 2 is 10-[(S)-(1-tert-butylpiperidin-4-yl)sulfinyl]-2-[1-(propan-2-yl)-1H-1,2,4-triazol-5-yl]-5,6-dihydroimidazo[1,2-d][1,4]benzoxazepine (three-letter code: BWY) (formula: C<sub>25</sub>H<sub>34</sub>N<sub>6</sub>O<sub>2</sub>S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
2	A	1	34	25	6	2	1	0	0

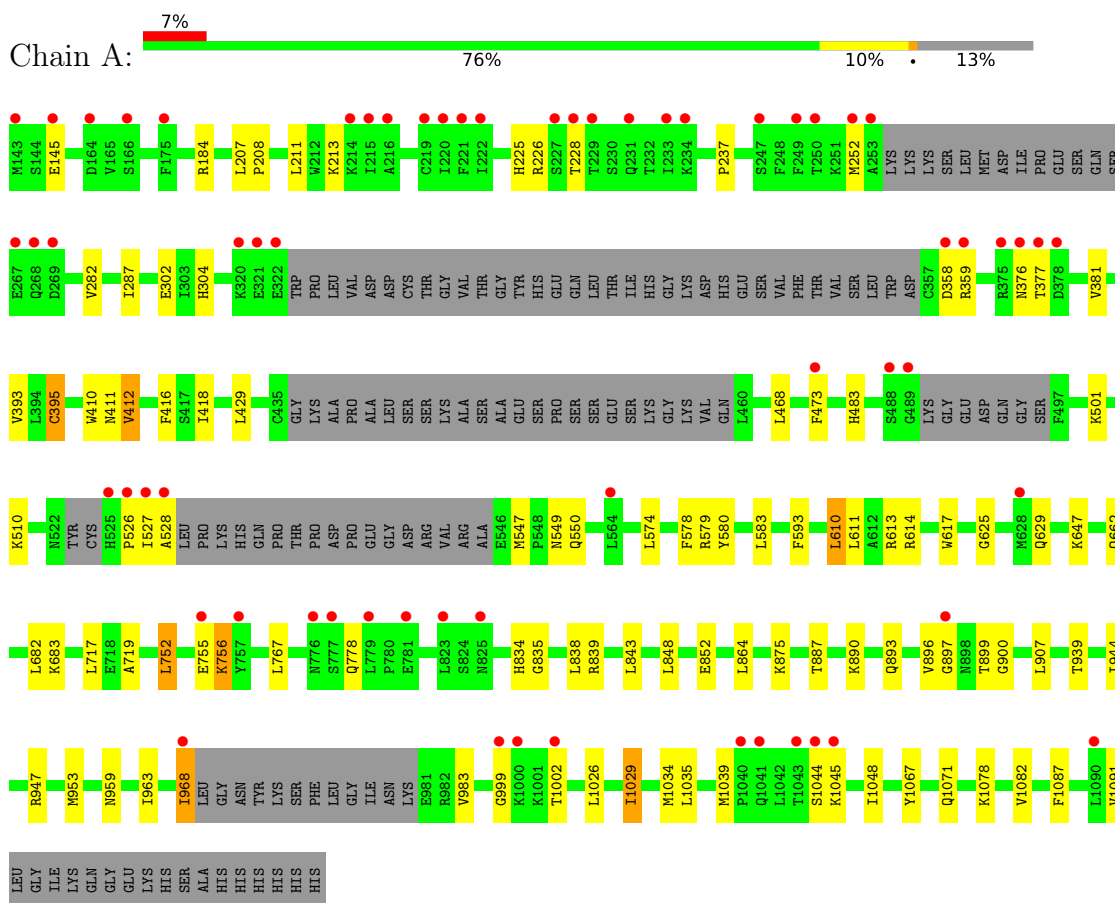
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	290	Total	O	0	1
			291	291		

### 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: Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic subunit gamma isoform



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	139.05Å 66.06Å 102.49Å 90.00° 98.06° 90.00°	Depositor
Resolution (Å)	28.12 – 2.02 39.84 – 2.01	Depositor EDS
% Data completeness (in resolution range)	99.1 (28.12-2.02) 99.1 (39.84-2.01)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.21 (at 2.01Å)	Xtrriage
Refinement program	PHENIX (1.12-2829_final)	Depositor
R, $R_{free}$	0.203 , 0.233 0.203 , 0.232	Depositor DCC
$R_{free}$ test set	3017 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	33.1	Xtrriage
Anisotropy	0.288	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 45.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	7121	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	45.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.41% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: BWY

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	0/6942	0.43	0/9393

There are no bond length outliers.

There are no bond angle outliers.

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	6796	0	6817	45	0
2	A	34	0	0	0	0
3	A	291	0	0	1	0
All	All	7121	0	6817	45	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 (45) 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:947:ARG:NH2	1:A:963:ILE:O	2.21	0.73

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:410:TRP:HB3	1:A:412:VAL:HG22	1.70	0.72
1:A:1035:LEU:HD12	1:A:1048:ILE:HD13	1.72	0.70
1:A:395:CYS:HB3	1:A:416:PHE:HD2	1.56	0.69
1:A:593:PHE:HZ	1:A:611:LEU:HD21	1.64	0.62
1:A:579:ARG:HG2	1:A:610:LEU:HG	1.82	0.61
1:A:225:HIS:HE1	1:A:304:HIS:HD2	1.48	0.60
1:A:843:LEU:HD23	1:A:1034:MET:HG3	1.85	0.59
1:A:614:ARG:HG2	1:A:617:TRP:HB3	1.87	0.56
1:A:629:GLN:HG2	1:A:1029:ILE:HG13	1.87	0.56
1:A:302:GLU:HB2	1:A:304:HIS:CE1	2.40	0.56
1:A:983:VAL:HG13	1:A:1082:VAL:HG21	1.88	0.54
1:A:547:MET:HG2	1:A:578:PHE:CD2	2.44	0.53
1:A:890:LYS:HA	1:A:893:GLN:HG2	1.91	0.52
1:A:899:THR:HB	1:A:900:GLY:HA3	1.92	0.51
1:A:852:GLU:HG3	1:A:864:LEU:HD12	1.91	0.51
1:A:208:PRO:HD2	1:A:211:LEU:HD12	1.94	0.50
1:A:755:GLU:H	1:A:755:GLU:CD	2.15	0.50
1:A:625:GLY:O	1:A:629:GLN:HG3	2.13	0.49
1:A:893:GLN:HA	1:A:897:GLY:H	1.78	0.48
1:A:410:TRP:HB3	1:A:412:VAL:CG2	2.42	0.48
1:A:839:ARG:NH1	3:A:1313:HOH:O	2.46	0.48
1:A:1087:PHE:O	1:A:1091:VAL:HG13	2.14	0.47
1:A:593:PHE:CZ	1:A:611:LEU:HD21	2.47	0.46
1:A:184:ARG:HD3	1:A:719:ALA:O	2.15	0.46
1:A:835:GLY:HA2	1:A:875:LYS:O	2.14	0.46
1:A:429:LEU:HB2	1:A:468:LEU:HD21	1.98	0.46
1:A:834:HIS:HA	1:A:835:GLY:HA2	1.67	0.46
1:A:583:LEU:HD22	1:A:610:LEU:HD22	1.97	0.46
1:A:237:PRO:HA	1:A:287:ILE:HD11	1.98	0.45
1:A:473:PHE:HB3	1:A:526:PRO:HG2	1.98	0.45
1:A:580:TYR:HE2	1:A:613:ARG:HD3	1.82	0.45
1:A:527:ILE:HA	1:A:528:ALA:HA	1.75	0.44
1:A:756:LYS:HB3	1:A:756:LYS:HE2	1.86	0.43
1:A:1067:TYR:O	1:A:1071:GLN:HG2	2.19	0.43
1:A:376:ASN:O	1:A:377:THR:OG1	2.30	0.43
1:A:939:THR:OG1	1:A:944:ILE:HG13	2.19	0.43
1:A:968:ILE:H	1:A:968:ILE:HD13	1.83	0.42
1:A:683:LYS:HB2	1:A:683:LYS:HE3	1.86	0.42
1:A:887:THR:HG22	1:A:953:MET:HG2	2.02	0.42
1:A:395:CYS:SG	1:A:418:ILE:HG12	2.60	0.41
1:A:483:HIS:CE1	1:A:510:LYS:HG2	2.56	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:752:LEU:HD12	1:A:752:LEU:HA	1.87	0.41
1:A:1044:SER:O	1:A:1048:ILE:HG13	2.21	0.41
1:A:501:LYS:HE3	1:A:501:LYS:HB3	1.91	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	824/966 (85%)	789 (96%)	34 (4%)	1 (0%)	51 48

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	999	GLY

### 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	752/864 (87%)	714 (95%)	38 (5%)	24 19

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

Mol	Chain	Res	Type
1	A	145	GLU
1	A	207	LEU
1	A	213	LYS
1	A	226	ARG
1	A	228	THR
1	A	252	MET
1	A	282	VAL
1	A	358	ASP
1	A	359	ARG
1	A	381	VAL
1	A	393	VAL
1	A	395	CYS
1	A	411	ASN
1	A	412	VAL
1	A	549	ASN
1	A	550	GLN
1	A	574	LEU
1	A	610	LEU
1	A	647	LYS
1	A	662	GLN
1	A	682	LEU
1	A	717	LEU
1	A	752	LEU
1	A	756	LYS
1	A	767	LEU
1	A	778	GLN
1	A	838	LEU
1	A	848	LEU
1	A	896	VAL
1	A	907	LEU
1	A	959	ASN
1	A	968	ILE
1	A	1002	THR
1	A	1026	LEU
1	A	1029	ILE
1	A	1039	MET
1	A	1045	LYS
1	A	1078	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	225	HIS

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Mol	Chain	Res	Type
1	A	304	HIS
1	A	743	GLN
1	A	1041	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 monosaccharides 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	BWY	A	1201	-	32,38,38	1.46	6 (18%)	35,57,57	2.30	8 (22%)

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. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	BWY	A	1201	-	-	8/18/42/42	0/4/5/5

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1201	BWY	O24-S23	-4.53	1.42	1.49
2	A	1201	BWY	C22-N11	-3.23	1.46	1.49
2	A	1201	BWY	N8-N4	2.49	1.40	1.36
2	A	1201	BWY	C10-N11	-2.37	1.35	1.38
2	A	1201	BWY	O20-C19	-2.31	1.34	1.38
2	A	1201	BWY	C12-N13	-2.17	1.31	1.35

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1201	BWY	O20-C21-C22	-8.37	106.74	112.62
2	A	1201	BWY	C16-S23-C25	5.64	104.62	97.67
2	A	1201	BWY	C30-C25-C26	-5.35	106.51	111.59
2	A	1201	BWY	O24-S23-C16	-3.49	102.62	106.93
2	A	1201	BWY	C21-C22-N11	3.07	113.65	111.17
2	A	1201	BWY	C29-N28-C27	2.46	112.26	109.06
2	A	1201	BWY	C29-N28-C31	-2.04	112.36	113.74
2	A	1201	BWY	C14-C15-C16	2.01	121.08	120.51

There are no chirality outliers.

All (8) torsion outliers are listed below:

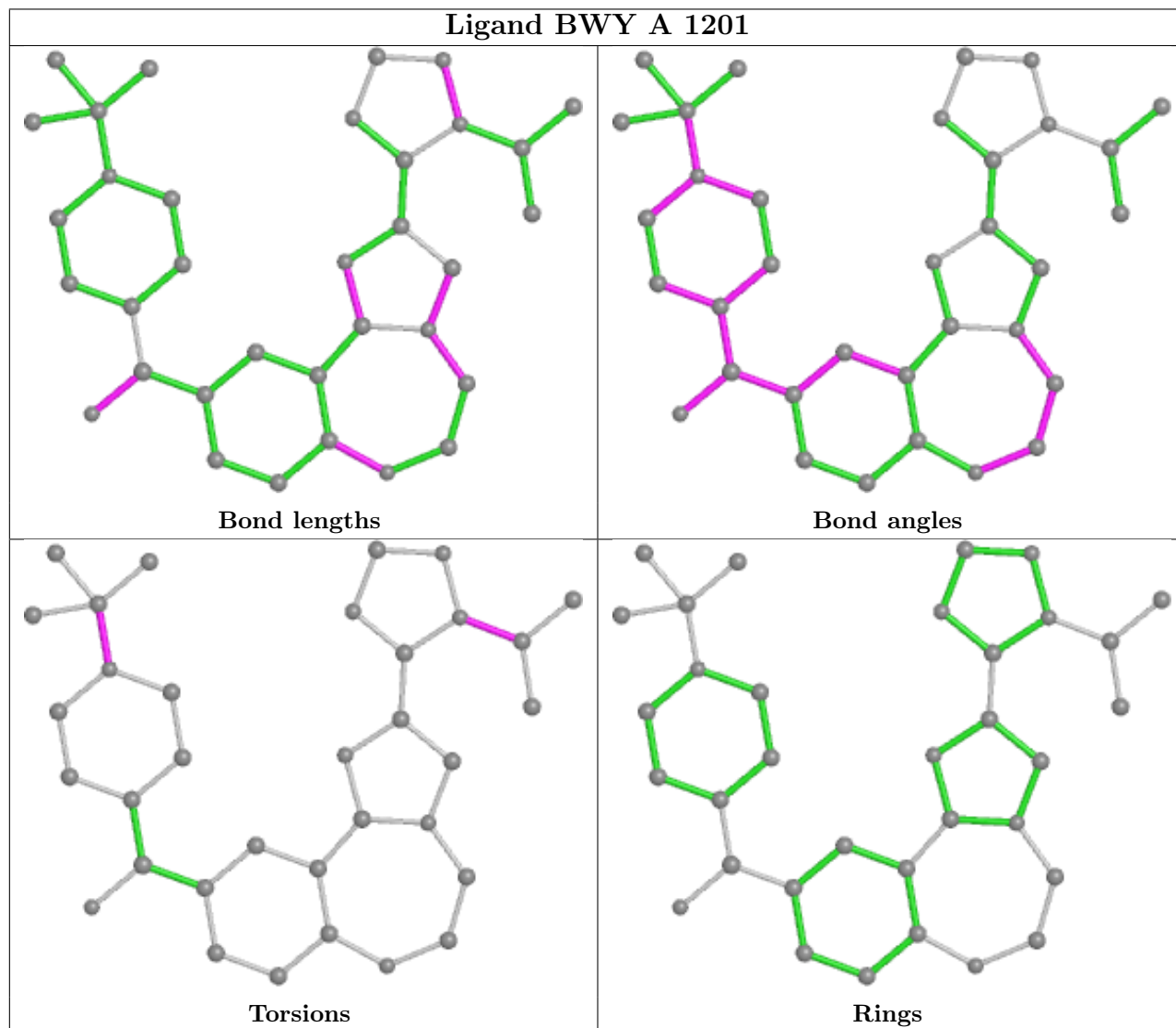
Mol	Chain	Res	Type	Atoms
2	A	1201	BWY	C1-C2-N4-N8
2	A	1201	BWY	C32-C31-N28-C27
2	A	1201	BWY	C32-C31-N28-C29
2	A	1201	BWY	C33-C31-N28-C27
2	A	1201	BWY	C33-C31-N28-C29
2	A	1201	BWY	C34-C31-N28-C27
2	A	1201	BWY	C34-C31-N28-C29
2	A	1201	BWY	C1-C2-N4-C5

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	840/966 (86%)	0.35	63 (7%) <b>14</b> <b>13</b>	21, 40, 90, 132	0

All (63) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	528	ALA	20.9
1	A	253	ALA	15.9
1	A	1044	SER	12.1
1	A	143	MET	11.2
1	A	527	ILE	8.2
1	A	968	ILE	6.9
1	A	268	GLN	6.9
1	A	249	PHE	5.8
1	A	377	THR	5.2
1	A	825	ASN	4.8
1	A	776	ASN	4.5
1	A	250	THR	4.5
1	A	322	GLU	4.2
1	A	1041	GLN	4.1
1	A	233	ILE	4.0
1	A	526	PRO	4.0
1	A	1045	LYS	3.8
1	A	252	MET	3.8
1	A	525	HIS	3.7
1	A	267	GLU	3.6
1	A	227	SER	3.6
1	A	779	LEU	3.5
1	A	489	GLY	3.5
1	A	222	ILE	3.3
1	A	777	SER	3.3
1	A	897	GLY	3.3
1	A	1090	LEU	3.2

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Mol	Chain	Res	Type	RSRZ
1	A	228	THR	3.1
1	A	231	GLN	3.1
1	A	376	ASN	3.1
1	A	359	ARG	2.9
1	A	757	TYR	2.9
1	A	220	ILE	2.8
1	A	999	GLY	2.8
1	A	321	GLU	2.8
1	A	755	GLU	2.8
1	A	628	MET	2.7
1	A	229	THR	2.7
1	A	221	PHE	2.7
1	A	247	SER	2.6
1	A	1000	LYS	2.6
1	A	564	LEU	2.6
1	A	1002	THR	2.6
1	A	358	ASP	2.5
1	A	488	SER	2.5
1	A	823	LEU	2.5
1	A	375	ARG	2.5
1	A	1040	PRO	2.4
1	A	378	ASP	2.4
1	A	216	ALA	2.3
1	A	269	ASP	2.3
1	A	214	LYS	2.3
1	A	145	GLU	2.3
1	A	215	ILE	2.3
1	A	164	ASP	2.3
1	A	473	PHE	2.2
1	A	166	SER	2.2
1	A	219	CYS	2.2
1	A	175	PHE	2.1
1	A	1043	THR	2.1
1	A	781	GLU	2.1
1	A	234	LYS	2.1
1	A	320	LYS	2.1

## 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](#)

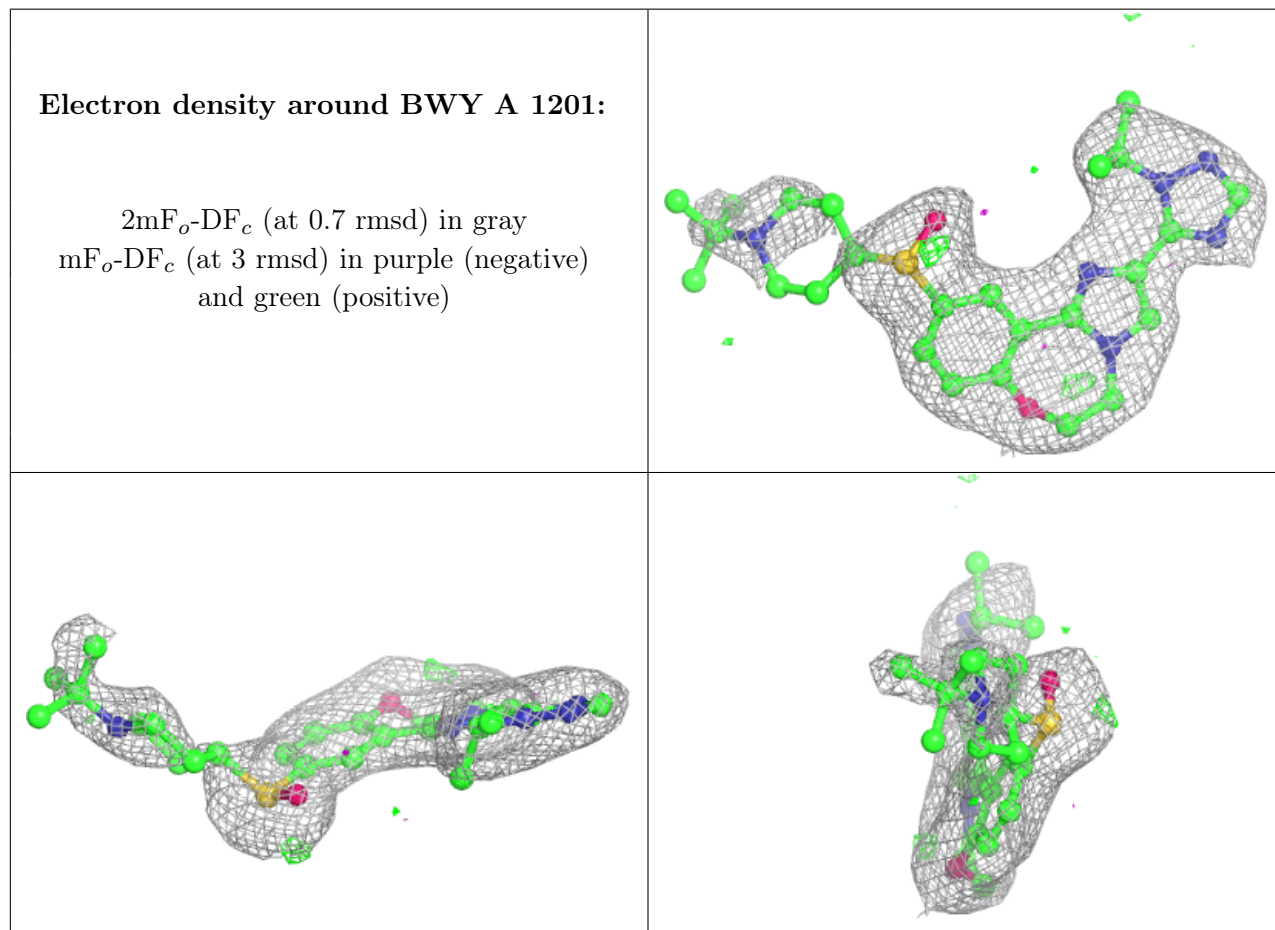
There are no monosaccharides in this entry.

### 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, 95<sup>th</sup> 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	BWY	A	1201	34/34	0.92	0.17	30,41,74,76	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.