Full wwPDB X-ray Structure Validation Report (i)

May 4, 2024 – 11:09 am BST

PDB ID	:	6GL3
Title	:	Crystal structure of human Phosphatidylinositol 4-kinase III beta (PI4KIIIbeta) in complex with ligand 44
Authors	:	Lammens, A.; Augustin, M.; Steinbacher, S.; Reuberson, J.
Deposited on	:	2018-05-22
Resolution	:	2.77 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 (i) 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 (i)) were used in the production of this report:

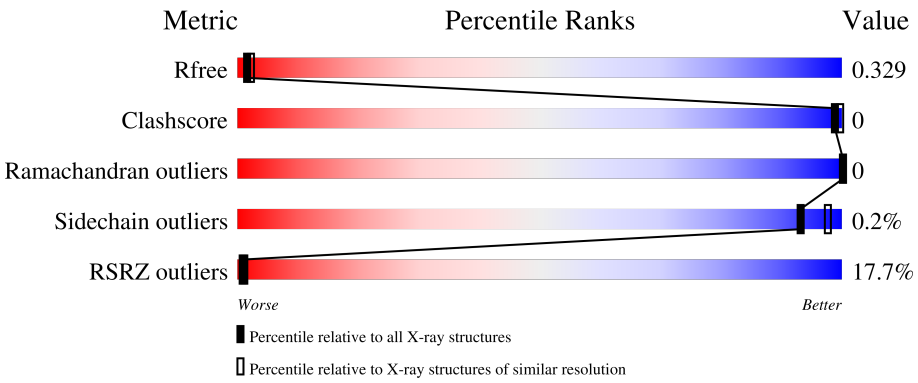
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36.2
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

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 2.77 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	4107 (2.80-2.76)
Clashscore	141614	4575 (2.80-2.76)
Ramachandran outliers	138981	4487 (2.80-2.76)
Sidechain outliers	138945	4489 (2.80-2.76)
RSRZ outliers	127900	4027 (2.80-2.76)

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	386	4% 90% • 8%
1	B	386	26% 76% • 22%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 5333 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.

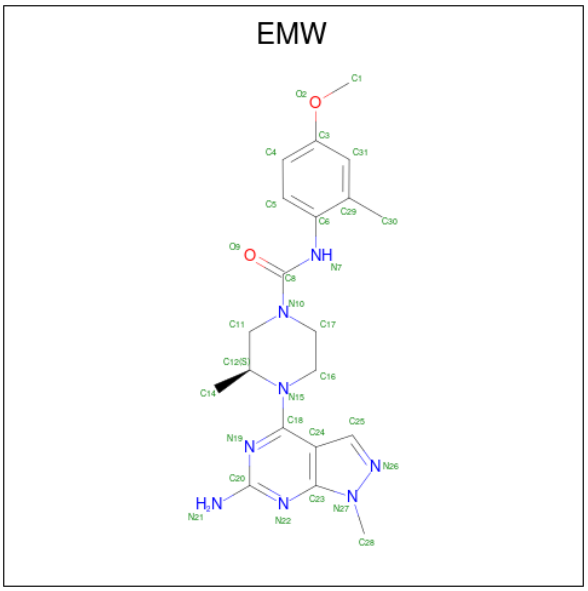
- Molecule 1 is a protein called Phosphatidylinositol 4-kinase beta,Phosphatidylinositol 4-kinase beta.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	354	2845	1821	491	515	18	132	0	0
1	B	301	2443	1578	419	428	18	211	0	0

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	316	GLY	-	expression tag	UNP Q9UBF8
A	526	ASP	-	linker	UNP Q9UBF8
A	527	SER	-	linker	UNP Q9UBF8
A	528	GLY	-	linker	UNP Q9UBF8
A	529	ASP	-	linker	UNP Q9UBF8
A	530	GLY	-	linker	UNP Q9UBF8
A	531	SER	-	linker	UNP Q9UBF8
B	316	GLY	-	expression tag	UNP Q9UBF8
B	526	ASP	-	linker	UNP Q9UBF8
B	527	SER	-	linker	UNP Q9UBF8
B	528	GLY	-	linker	UNP Q9UBF8
B	529	ASP	-	linker	UNP Q9UBF8
B	530	GLY	-	linker	UNP Q9UBF8
B	531	SER	-	linker	UNP Q9UBF8

- Molecule 2 is (3 {S})-4-(6-azanyl-1-methyl-pyrazolo[3,4-d]pyrimidin-4-yl)- {N}-(4-methoxy -2-methyl-phenyl)-3-methyl-piperazine-1-carboxamide (three-letter code: EMW) (formula: $C_{20}H_{26}N_8O_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	30	20	8	2	0	0

- Molecule 3 is water.

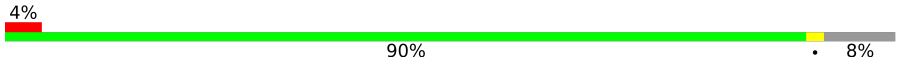
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	15	15	15	0	0

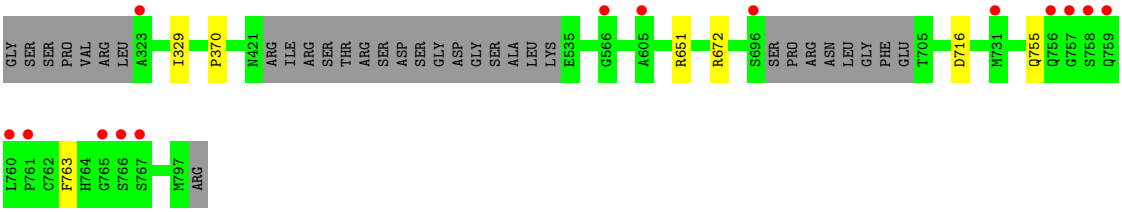
3 Residue-property plots (i)

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: Phosphatidylinositol 4-kinase beta,Phosphatidylinositol 4-kinase beta

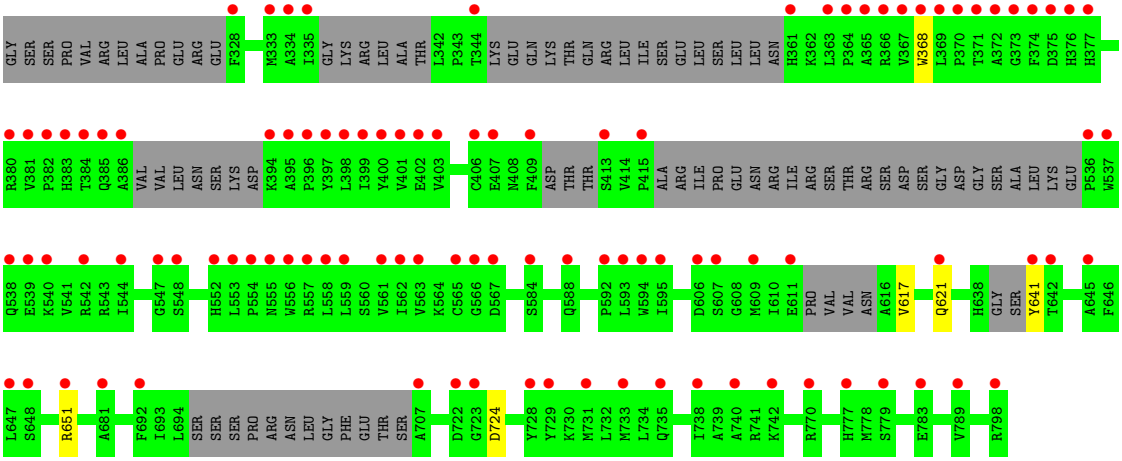
Chain A:





• Molecule 1: Phosphatidylinositol 4-kinase beta,Phosphatidylinositol 4-kinase beta

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	64.47Å 69.48Å 172.84Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	86.42 – 2.77 45.59 – 2.77	Depositor EDS
% Data completeness (in resolution range)	97.0 (86.42-2.77) 97.0 (45.59-2.77)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.26 (at 2.77Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.276 , 0.333 0.278 , 0.329	Depositor DCC
R_{free} test set	742 reflections (3.74%)	wwPDB-VP
Wilson B-factor (Å^2)	52.3	Xtriage
Anisotropy	0.484	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 54.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.88	EDS
Total number of atoms	5333	wwPDB-VP
Average B, all atoms (Å^2)	74.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.83% 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 (i)

5.1 Standard geometry (i)

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

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	0.60	0/2904	0.80	3/3926 (0.1%)
1	B	0.59	0/2493	0.80	4/3358 (0.1%)
All	All	0.60	0/5397	0.80	7/7284 (0.1%)

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	641	TYR	CB-CG-CD1	-7.82	116.31	121.00
1	B	641	TYR	CB-CG-CD2	7.74	125.64	121.00
1	B	368	TRP	CA-CB-CG	5.61	124.35	113.70
1	A	672	ARG	NE-CZ-NH1	5.36	122.98	120.30
1	A	651	ARG	NE-CZ-NH1	5.13	122.87	120.30
1	A	716	ASP	CB-CG-OD2	-5.05	113.75	118.30
1	B	651	ARG	NE-CZ-NH1	5.01	122.80	120.30

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	2845	0	2878	3	0
1	B	2443	0	2462	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	A	30	0	0	0	0
3	A	15	0	0	0	0
All	All	5333	0	5340	4	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 0.

All (4) 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:755:GLN:HB3	1:A:763:PHE:CZ	2.49	0.48
1:A:755:GLN:HB3	1:A:763:PHE:CE2	2.50	0.47
1:B:617:VAL:HG12	1:B:621:GLN:HB3	2.03	0.40
1:A:329:ILE:HD11	1:A:370:PRO:HG3	2.03	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	348/386 (90%)	333 (96%)	15 (4%)	0	100	100
1	B	283/386 (73%)	275 (97%)	8 (3%)	0	100	100
All	All	631/772 (82%)	608 (96%)	23 (4%)	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	318/345 (92%)	318 (100%)	0	100	100
1	B	270/345 (78%)	269 (100%)	1 (0%)	91	96
All	All	588/690 (85%)	587 (100%)	1 (0%)	93	98

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

Mol	Chain	Res	Type
1	B	724	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	755	GLN
1	A	756	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	EMW	A	801	-	31,33,33	1.11	2 (6%)	38,48,48	2.15	10 (26%)

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	EMW	A	801	-	-	2/13/27/27	0/4/4/4

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	801	EMW	C20-N21	2.37	1.38	1.33
2	A	801	EMW	C17-N10	2.32	1.51	1.47

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	801	EMW	N7-C8-N10	6.16	122.94	115.89
2	A	801	EMW	N22-C20-N19	-4.57	121.13	127.22
2	A	801	EMW	C25-N26-N27	4.14	108.55	104.23
2	A	801	EMW	C20-N22-C23	4.10	120.04	115.36
2	A	801	EMW	C20-N19-C18	4.03	125.09	113.91
2	A	801	EMW	C24-C18-N15	3.82	128.40	120.97
2	A	801	EMW	O9-C8-N10	-3.48	116.89	121.78
2	A	801	EMW	C24-C18-N19	-3.16	115.94	122.66
2	A	801	EMW	C5-C6-C29	-2.35	117.99	120.77
2	A	801	EMW	N21-C20-N22	2.08	121.18	117.79

There are no chirality outliers.

All (2) torsion outliers are listed below:

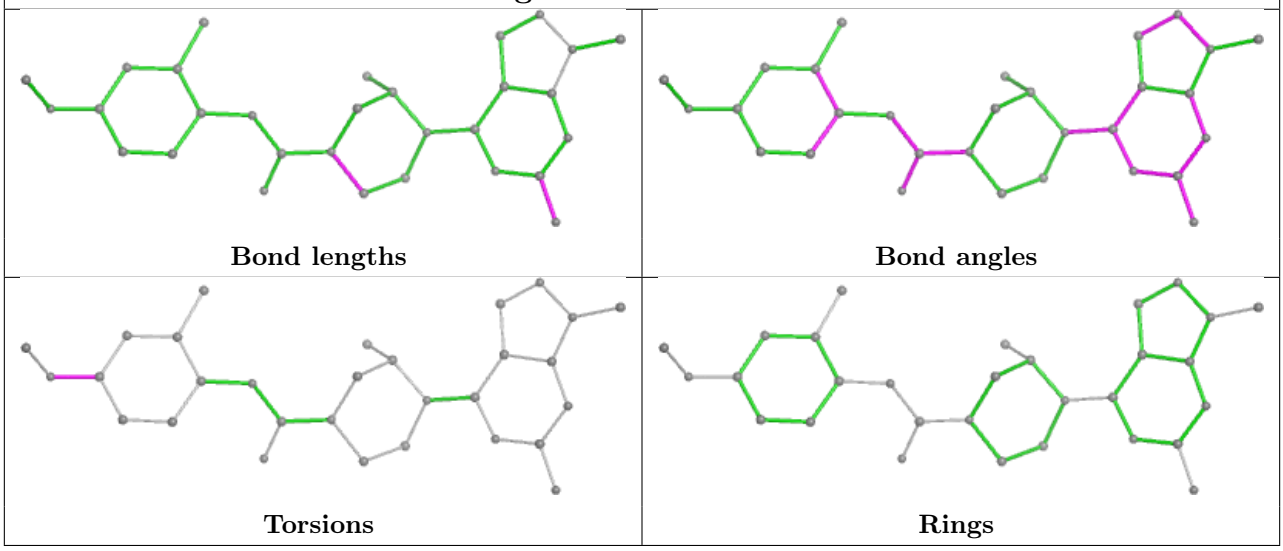
Mol	Chain	Res	Type	Atoms
2	A	801	EMW	C4-C3-O2-C1
2	A	801	EMW	C31-C3-O2-C1

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 EMW 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 (i)

6.1 Protein, DNA and RNA chains (i)

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	354/386 (91%)	0.33	14 (3%)	38	33	27, 50, 102, 126	44 (12%)
1	B	301/386 (77%)	1.82	102 (33%)	0	0	56, 95, 134, 164	58 (19%)
All	All	655/772 (84%)	1.02	116 (17%)	1	1	27, 71, 125, 164	102 (15%)

All (116) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	364	PRO	11.8
1	B	363	LEU	11.7
1	B	398	LEU	9.6
1	B	401	VAL	8.5
1	B	367	VAL	7.2
1	B	397	TYR	7.1
1	B	373	GLY	6.9
1	B	396	PRO	6.8
1	B	368	TRP	6.8
1	B	537	TRP	6.5
1	B	382	PRO	6.5
1	B	383	HIS	6.3
1	B	722	ASP	6.3
1	B	394	LYS	6.0
1	B	328	PHE	6.0
1	B	386	ALA	6.0
1	B	558	LEU	5.8
1	A	759	GLN	5.6
1	B	402	GLU	5.3
1	B	385	GLN	5.1
1	B	366	ARG	5.0
1	B	707	ALA	5.0
1	B	536	PRO	5.0
1	B	409	PHE	4.8

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Mol	Chain	Res	Type	RSRZ
1	B	681	ALA	4.8
1	B	372	ALA	4.7
1	B	384	THR	4.7
1	B	413	SER	4.7
1	B	621	GLN	4.7
1	B	334	ALA	4.7
1	B	798	ARG	4.6
1	B	370	PRO	4.6
1	B	369	LEU	4.6
1	B	371	THR	4.5
1	B	415	PRO	4.5
1	A	765	GLY	4.4
1	B	645	ALA	4.4
1	B	740	ALA	4.3
1	B	556	TRP	4.3
1	B	547	GLY	4.3
1	B	365	ALA	4.2
1	B	377	HIS	4.1
1	B	406	CYS	4.0
1	B	395	ALA	4.0
1	B	555	ASN	4.0
1	B	344	THR	3.8
1	B	783	GLU	3.8
1	B	361	HIS	3.8
1	B	563	VAL	3.8
1	B	374	PHE	3.8
1	B	566	GLY	3.8
1	B	641	TYR	3.7
1	A	758	SER	3.6
1	B	557	ARG	3.6
1	B	540	LYS	3.5
1	B	642	THR	3.5
1	B	400	TYR	3.4
1	A	756	GLN	3.4
1	B	552	HIS	3.4
1	A	766	SER	3.4
1	B	588	GLN	3.4
1	B	548	SER	3.3
1	B	607	SER	3.2
1	B	611	GLU	3.2
1	B	380	ARG	3.2
1	B	553	LEU	3.2

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Mol	Chain	Res	Type	RSRZ
1	B	544	ILE	3.1
1	B	779	SER	3.1
1	A	605	ALA	3.0
1	B	561	VAL	3.0
1	B	407	GLU	3.0
1	B	565	CYS	3.0
1	B	559	LEU	3.0
1	B	554	PRO	3.0
1	B	333	MET	2.9
1	A	323	ALA	2.8
1	B	567	ASP	2.8
1	B	381	VAL	2.7
1	B	738	ILE	2.7
1	B	770	ARG	2.7
1	A	696	SER	2.7
1	B	542	ARG	2.6
1	B	335	ILE	2.6
1	B	735	GLN	2.6
1	B	609	MET	2.6
1	B	777	HIS	2.5
1	B	403	VAL	2.5
1	B	723	GLY	2.5
1	A	761	PRO	2.5
1	A	767	SER	2.4
1	B	648	SER	2.4
1	B	728	TYR	2.4
1	B	562	ILE	2.4
1	B	584	SER	2.4
1	B	733	MET	2.3
1	B	375	ASP	2.3
1	A	760	LEU	2.3
1	B	692	PHE	2.3
1	A	566	GLY	2.3
1	B	538	GLN	2.3
1	B	594	TRP	2.2
1	B	651	ARG	2.2
1	B	729	TYR	2.2
1	B	592	PRO	2.2
1	B	399	ILE	2.2
1	A	731	MET	2.2
1	B	595	ILE	2.2
1	B	539	GLU	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	731	MET	2.1
1	B	593	LEU	2.1
1	A	757	GLY	2.1
1	B	606	ASP	2.1
1	B	647	LEU	2.0
1	B	376	HIS	2.0
1	B	789	VAL	2.0
1	B	742	LYS	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 monosaccharides in this entry.

6.4 Ligands (i)

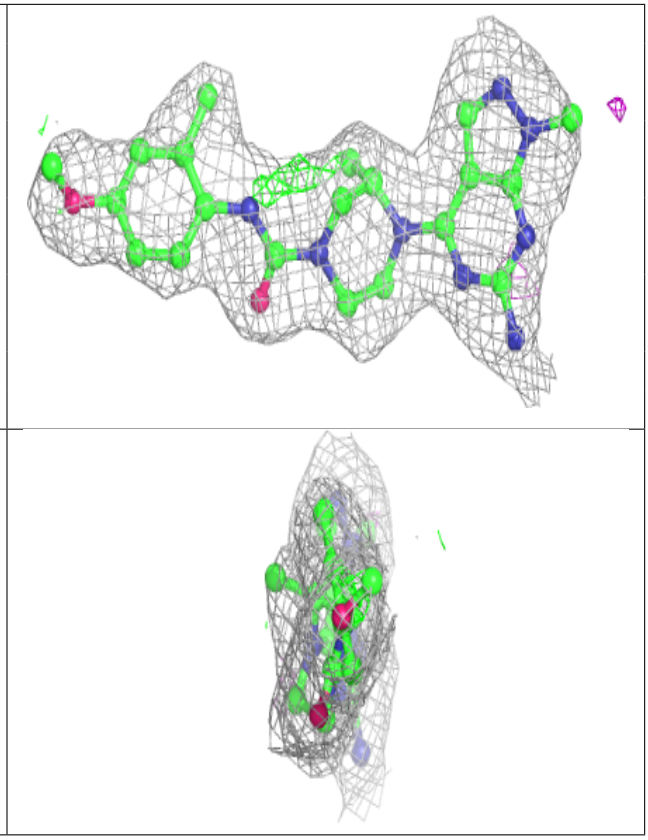
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	EMW	A	801	30/30	0.95	0.20	25,30,45,60	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 EMW 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.