Full wwPDB X-ray Structure Validation Report (i)

Jun 11, 2024 – 05:32 PM EDT

PDB ID	:	6MUM
Title	:	Murine PI3K delta kinsae domain - cpd 3
Authors	:	Fischmann, T.O.
Deposited on	:	2018-10-23
Resolution	:	3.06 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:

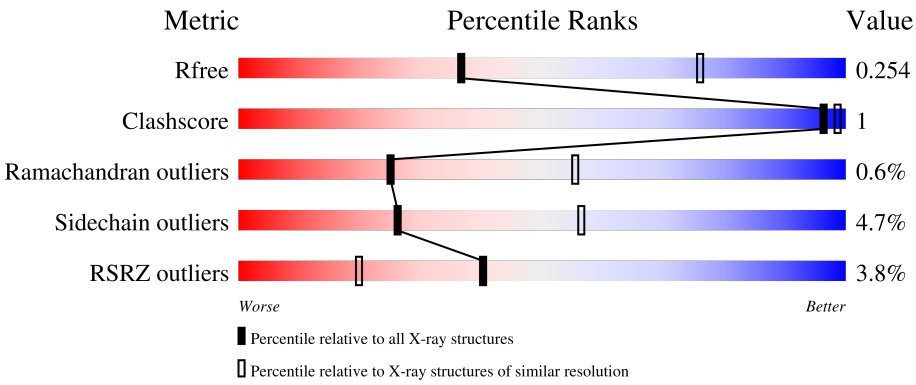
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36.2
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & 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 3.06 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	1754 (3.10-3.02)
Clashscore	141614	1864 (3.10-3.02)
Ramachandran outliers	138981	1794 (3.10-3.02)
Sidechain outliers	138945	1793 (3.10-3.02)
RSRZ outliers	127900	1713 (3.10-3.02)

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	940	4% 82% 5% 12%
1	B	940	3% 83% 5% 13%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 13366 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.

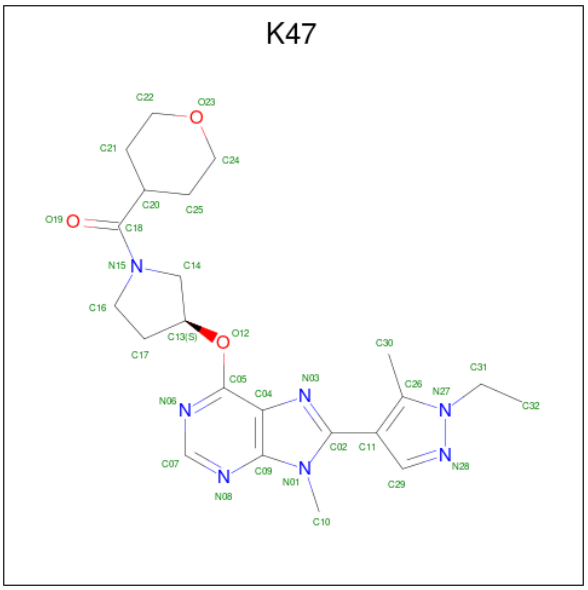
- Molecule 1 is a protein called Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic subunit delta isoform.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	826	6661	4271	1132	1204	54	0	0	1
1	B	822	6641	4259	1127	1200	55	0	1	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	105	GLY	-	expression tag	UNP Q3UDT3
B	105	GLY	-	expression tag	UNP Q3UDT3

- Molecule 2 is [(3S)-3-{[8-(1-ethyl-5-methyl-1H-pyrazol-4-yl)-9-methyl-9H-purin-6-yl]oxy}pyrrolidin-1-yl](oxan-4-yl)methanone (three-letter code: K47) (formula: $C_{22}H_{29}N_7O_3$) (labeled as "Ligand of Interest" by depositor).



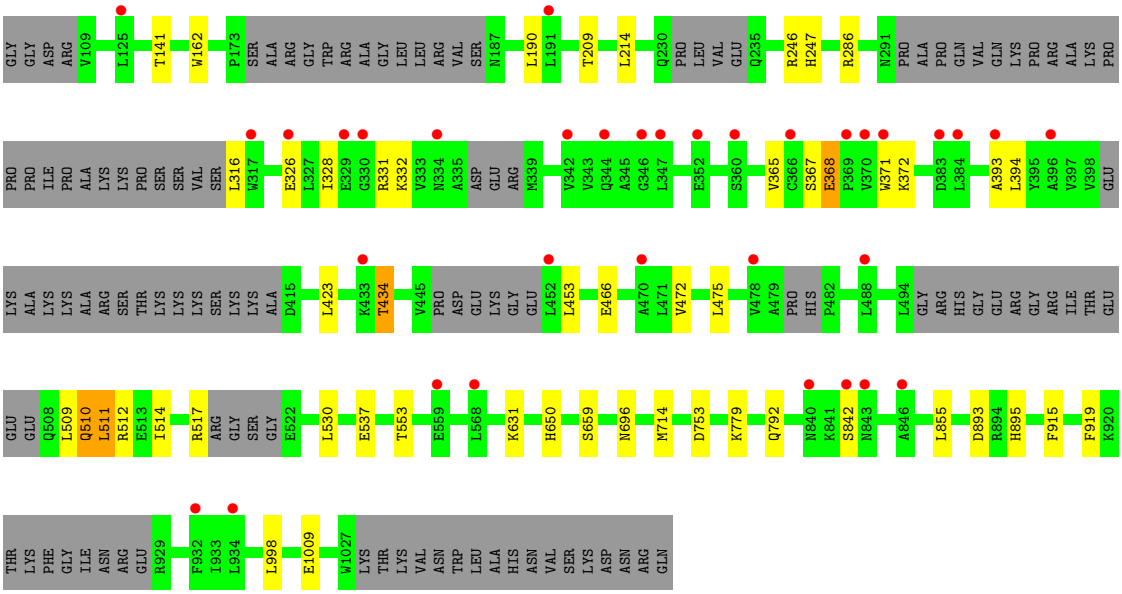
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	32	22	7	3	0	0
			Total	C	N	O		
2	B	1	32	22	7	3	0	0

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.

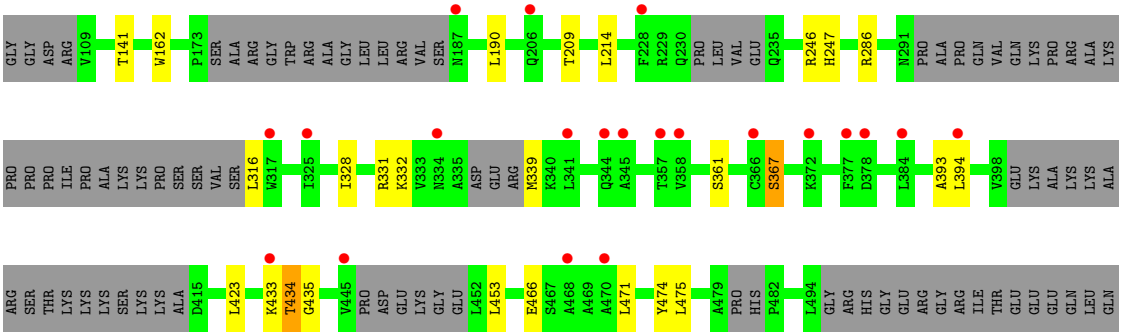
• Molecule 1: Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic subunit delta isoform

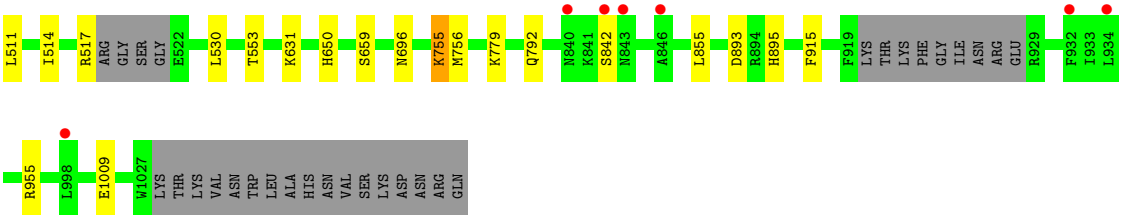
Chain A:



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

Chain B:




L511
I514
R517
ARG GLY SER GLY
E522
L530
T553
K631
H650
S659
N696
K755
M756
K779
Q792
N840
K841
S842
N843
A846
L855
D893
R894
H895
F915
F919
LYS THR LYS PHE GLY ILE ASN ARG GLU
R929
F932
I933
L934
R955
L998
E1009
W1027
LYS THR LYS VAL ASN TRP LEU ALA HIS ASN VAL SER LYS ASP ASN ARG GLN

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	63.35Å 220.68Å 78.19Å 90.00° 114.02° 90.00°	Depositor
Resolution (Å)	30.45 – 3.06 30.45 – 3.06	Depositor EDS
% Data completeness (in resolution range)	93.3 (30.45-3.06) 92.8 (30.45-3.06)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.02 (at 3.06Å)	Xtriage
Refinement program	BUSTER 2.11.7	Depositor
R, R_{free}	0.230 , 0.266 0.233 , 0.254	Depositor DCC
R_{free} test set	1734 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	88.0	Xtriage
Anisotropy	0.182	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 62.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.45$, $< L^2 > = 0.28$	Xtriage
Estimated twinning fraction	0.188 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	13366	wwPDB-VP
Average B, all atoms (Å^2)	98.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.75% 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: K47

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	0.39	0/6804	0.60	2/9180 (0.0%)
1	B	0.39	0/6784	0.59	1/9152 (0.0%)
All	All	0.39	0/13588	0.59	3/18332 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	368	GLU	N-CA-C	-7.23	91.47	111.00
1	A	367	SER	C-N-CA	6.68	138.40	121.70
1	B	367	SER	C-N-CA	5.47	135.37	121.70

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	368	GLU	Mainchain

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	6661	0	6643	7	0
1	B	6641	0	6623	19	0
2	A	32	0	0	0	0
2	B	32	0	0	0	0
All	All	13366	0	13266	26	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 (26) 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:B:435:GLY:O	1:B:474:TYR:HA	1.37	1.20
1:B:434:THR:O	1:B:475:LEU:CB	2.21	0.88
1:B:434:THR:O	1:B:475:LEU:HB3	1.78	0.83
1:B:435:GLY:O	1:B:474:TYR:CA	2.25	0.83
1:B:435:GLY:HA2	1:B:475:LEU:H	1.52	0.74
1:B:434:THR:O	1:B:475:LEU:HB2	1.88	0.72
1:A:434:THR:O	1:A:475:LEU:HB2	1.95	0.66
1:B:435:GLY:HA2	1:B:475:LEU:N	2.11	0.65
1:B:435:GLY:HA2	1:B:475:LEU:O	1.99	0.62
1:A:434:THR:O	1:A:475:LEU:CB	2.52	0.58
1:A:509:LEU:HD21	1:A:537:GLU:HG3	1.88	0.55
1:B:435:GLY:CA	1:B:475:LEU:H	2.18	0.54
1:B:755:LYS:N	1:B:755:LYS:HD2	2.22	0.53
1:B:435:GLY:O	1:B:475:LEU:N	2.44	0.50
1:A:510:GLN:C	1:A:512:ARG:H	2.15	0.49
1:A:326:GLU:OE2	1:A:372:LYS:HG3	2.13	0.49
1:B:435:GLY:HA2	1:B:475:LEU:CA	2.44	0.47
1:A:162:TRP:CE3	1:A:286:ARG:HG3	2.50	0.46
1:B:162:TRP:CE3	1:B:286:ARG:HG3	2.50	0.46
1:B:435:GLY:CA	1:B:475:LEU:O	2.65	0.44
1:B:755:LYS:N	1:B:755:LYS:CD	2.81	0.44
1:B:435:GLY:C	1:B:475:LEU:H	2.21	0.44
1:B:435:GLY:HA3	1:B:474:TYR:CZ	2.54	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:433:LYS:O	1:B:434:THR:O	2.38	0.41
1:B:393:ALA:HB2	1:B:453:LEU:HD12	2.02	0.40
1:A:393:ALA:HB2	1:A:453:LEU:HD12	2.02	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	804/940 (86%)	751 (93%)	47 (6%)	6 (1%)	22	52
1	B	801/940 (85%)	751 (94%)	47 (6%)	3 (0%)	34	64
All	All	1605/1880 (85%)	1502 (94%)	94 (6%)	9 (1%)	25	55

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	434	THR
1	A	510	GLN
1	B	434	THR
1	A	511	LEU
1	A	919	PHE
1	B	466	GLU
1	A	466	GLU
1	A	328	ILE
1	B	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	731/827 (88%)	697 (95%)	34 (5%)	26	56
1	B	729/827 (88%)	694 (95%)	35 (5%)	25	55
All	All	1460/1654 (88%)	1391 (95%)	69 (5%)	26	56

All (69) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	141	THR
1	A	190	LEU
1	A	209	THR
1	A	214	LEU
1	A	246	ARG
1	A	247	HIS
1	A	316	LEU
1	A	331	ARG
1	A	332	LYS
1	A	365	VAL
1	A	371	TRP
1	A	394	LEU
1	A	423	LEU
1	A	472	VAL
1	A	511	LEU
1	A	514	ILE
1	A	517	ARG
1	A	530	LEU
1	A	553	THR
1	A	631	LYS
1	A	650	HIS
1	A	659	SER
1	A	696	ASN
1	A	714	MET
1	A	753	ASP
1	A	779	LYS
1	A	792	GLN
1	A	842	SER
1	A	855	LEU
1	A	893	ASP
1	A	895	HIS
1	A	915	PHE
1	A	998	LEU

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Mol	Chain	Res	Type
1	A	1009	GLU
1	B	141	THR
1	B	190	LEU
1	B	209	THR
1	B	214	LEU
1	B	246	ARG
1	B	247	HIS
1	B	316	LEU
1	B	331	ARG
1	B	332	LYS
1	B	339	MET
1	B	361	SER
1	B	367	SER
1	B	394	LEU
1	B	423	LEU
1	B	471	LEU
1	B	511	LEU
1	B	514	ILE
1	B	517	ARG
1	B	530	LEU
1	B	553	THR
1	B	631	LYS
1	B	650	HIS
1	B	659	SER
1	B	696	ASN
1	B	755	LYS
1	B	756	MET
1	B	779	LYS
1	B	792	GLN
1	B	842	SER
1	B	855	LEU
1	B	893	ASP
1	B	895	HIS
1	B	915	PHE
1	B	955	ARG
1	B	1009	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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)

2 ligands are 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	K47	B	9001	-	26,36,36	0.61	1 (3%)	35,52,52	1.60	9 (25%)
2	K47	A	9001	-	26,36,36	0.52	0	35,52,52	1.31	5 (14%)

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	K47	B	9001	-	-	0/14/35/35	0/5/5/5
2	K47	A	9001	-	-	0/14/35/35	0/5/5/5

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	9001	K47	C31-N27	2.17	1.53	1.47

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	9001	K47	C10-N01-C02	3.51	131.57	126.14
2	B	9001	K47	C31-N27-N28	3.03	122.75	117.08
2	A	9001	K47	C31-N27-N28	2.92	122.55	117.08
2	B	9001	K47	C32-C31-N27	2.71	116.46	112.16
2	B	9001	K47	O12-C13-C17	-2.46	100.02	108.63
2	B	9001	K47	C05-O12-C13	2.46	122.09	118.56
2	A	9001	K47	C10-N01-C02	2.43	129.90	126.14
2	A	9001	K47	C32-C31-N27	2.43	116.01	112.16
2	A	9001	K47	O12-C05-N06	2.40	122.91	118.89
2	B	9001	K47	C14-N15-C18	2.38	132.15	124.02
2	B	9001	K47	O12-C13-C14	2.27	113.71	108.19
2	B	9001	K47	C16-N15-C18	-2.26	116.25	124.04
2	B	9001	K47	C31-N27-C26	-2.14	126.40	128.97
2	A	9001	K47	C31-N27-C26	-2.03	126.53	128.97

There are no chirality outliers.

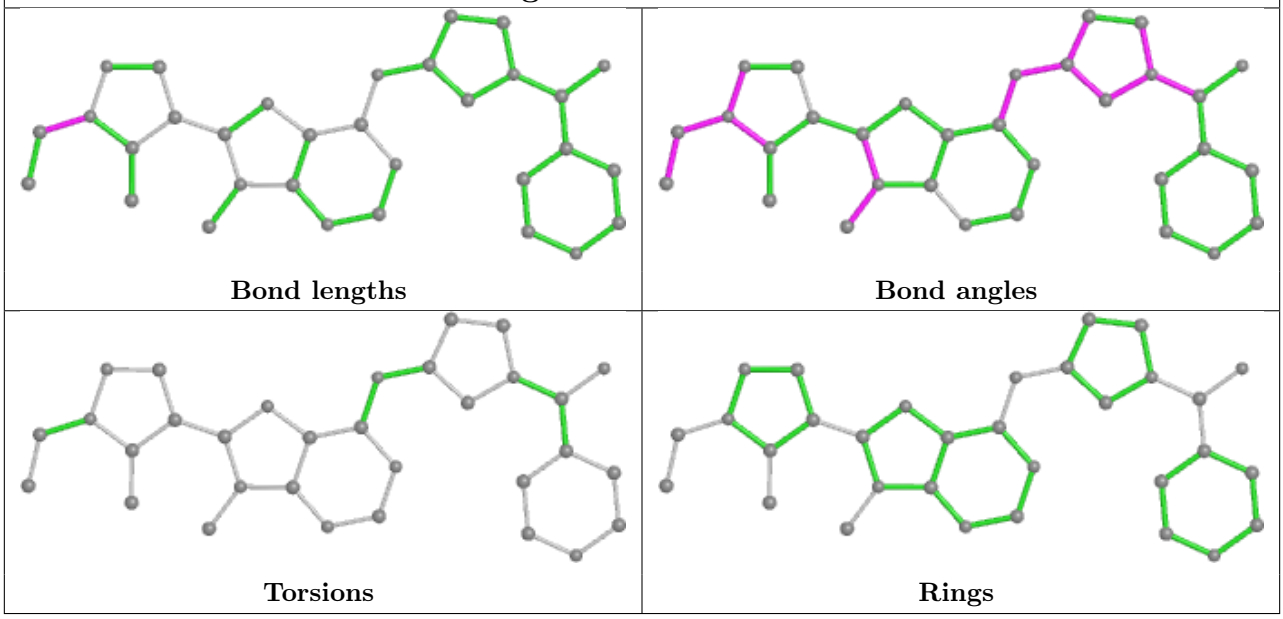
There are no torsion outliers.

There are no ring outliers.

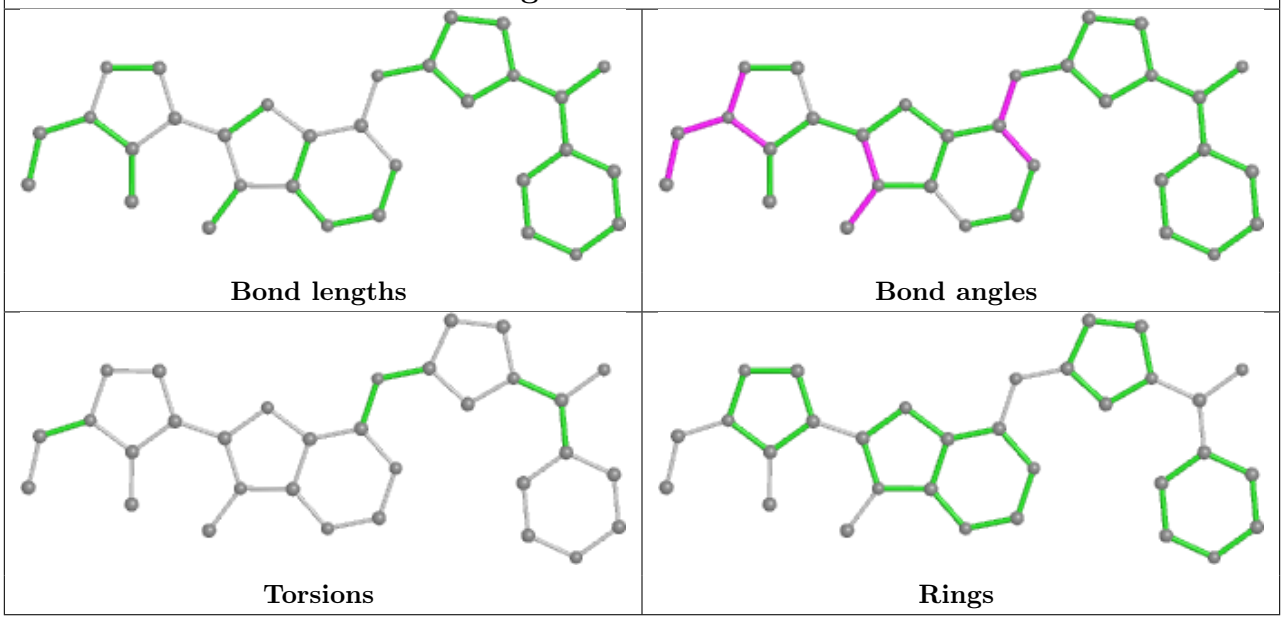
No monomer is involved in short contacts.

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 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 K47 B 9001



Ligand K47 A 9001



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	826/940 (87%)	0.15	34 (4%)	37	18	39, 94, 141, 168	0
1	B	822/940 (87%)	0.15	28 (3%)	45	22	42, 98, 146, 196	0
All	All	1648/1880 (87%)	0.15	62 (3%)	40	20	39, 96, 143, 196	0

All (62) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	346	GLY	6.5
1	B	366	CYS	6.1
1	A	840	ASN	5.4
1	B	842	SER	5.3
1	A	330	GLY	4.9
1	B	317	TRP	4.7
1	A	366	CYS	4.7
1	A	370	VAL	4.5
1	A	842	SER	4.5
1	B	470	ALA	4.3
1	B	846	ALA	4.3
1	B	433	LYS	4.0
1	A	344	GLN	4.0
1	B	334	ASN	3.8
1	A	396	ALA	3.7
1	A	478	VAL	3.5
1	B	840	ASN	3.5
1	B	843	ASN	3.3
1	A	352	GLU	3.3
1	A	393	ALA	3.2
1	B	384	LEU	3.0
1	A	932	PHE	3.0
1	A	568	LEU	2.9
1	A	317	TRP	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	360	SER	2.8
1	A	371	TRP	2.7
1	A	369	PRO	2.7
1	B	187	ASN	2.7
1	B	206	GLN	2.7
1	A	488	LEU	2.7
1	A	433	LYS	2.6
1	A	347	LEU	2.6
1	A	846	ALA	2.6
1	A	843	ASN	2.6
1	A	334	ASN	2.6
1	A	342	VAL	2.5
1	A	470	ALA	2.5
1	B	357	THR	2.5
1	B	377	PHE	2.5
1	B	344	GLN	2.4
1	B	394	LEU	2.4
1	A	559	GLU	2.4
1	B	378	ASP	2.4
1	B	358	VAL	2.4
1	A	383	ASP	2.3
1	A	452	LEU	2.3
1	A	191	LEU	2.3
1	B	345	ALA	2.2
1	B	934	LEU	2.2
1	B	932	PHE	2.2
1	B	341	LEU	2.2
1	A	384	LEU	2.2
1	B	468	ALA	2.1
1	B	998	LEU	2.1
1	B	228	PHE	2.1
1	A	326	GLU	2.1
1	B	325	ILE	2.0
1	A	329	GLU	2.0
1	B	372	LYS	2.0
1	B	445	VAL	2.0
1	A	125	LEU	2.0
1	A	934	LEU	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)

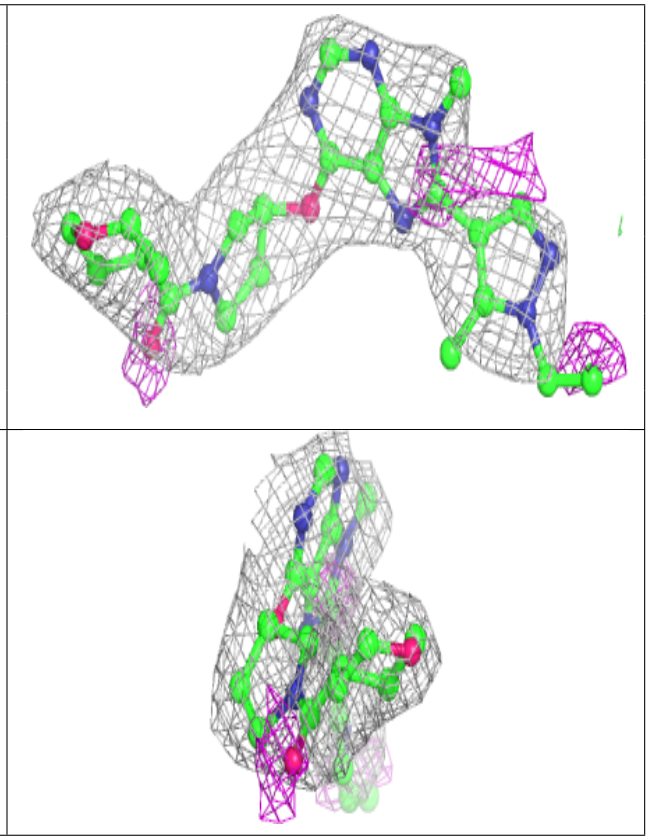
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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	K47	B	9001	32/32	0.89	0.33	48,67,72,75	0
2	K47	A	9001	32/32	0.91	0.30	61,72,79,82	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.

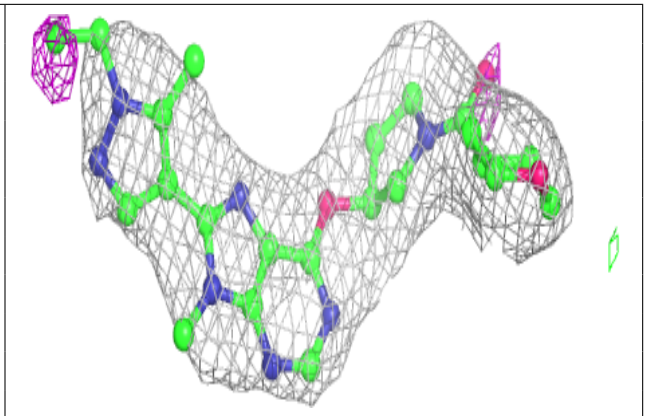
Electron density around K47 B 9001:

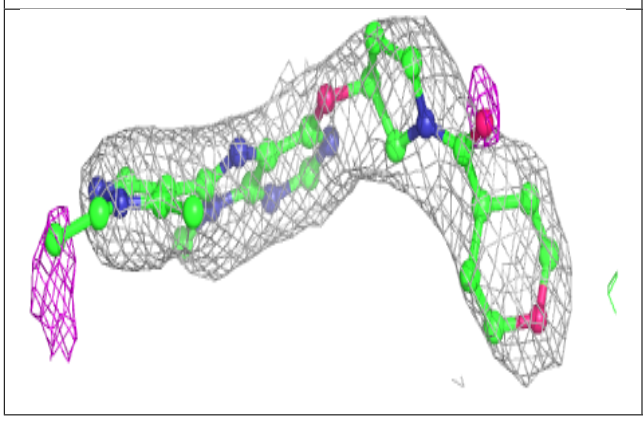
2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)

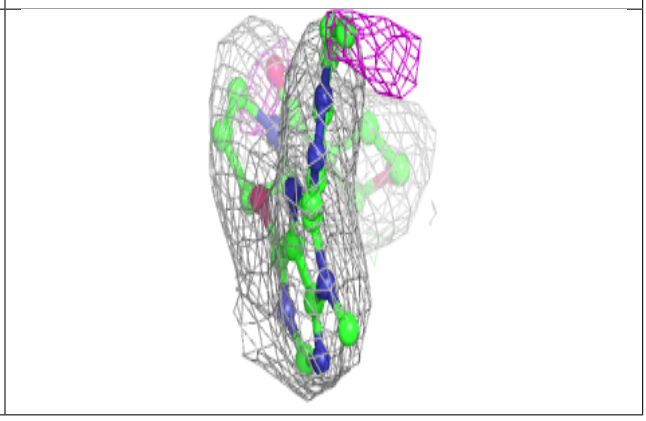


Electron density around K47 A 9001:

$2mF_o$-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.