



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 24, 2024 – 05:02 pm BST

PDB ID : 8S3R
Title : HUMAN PI3KDELTA IN COMPLEX WITH PYRIDAZINONE INHIBITOR
7
Authors : Pala, D.; Bruno, P.; Capelli, A.M.; Biagetti, M.
Deposited on : 2024-02-20
Resolution : 2.28 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 : 4.02b-467
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.37.1
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) : 2.37.1

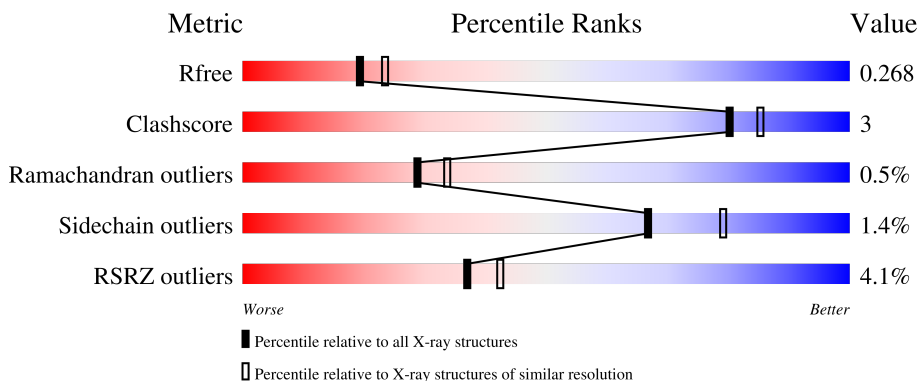
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.28 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	6980 (2.30-2.26)
Clashscore	141614	7711 (2.30-2.26)
Ramachandran outliers	138981	7597 (2.30-2.26)
Sidechain outliers	138945	7598 (2.30-2.26)
RSRZ outliers	127900	6849 (2.30-2.26)

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	1018	 4% 81% 9% 10%
2	B	169	 % 86% 9% 5%

2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 8929 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.

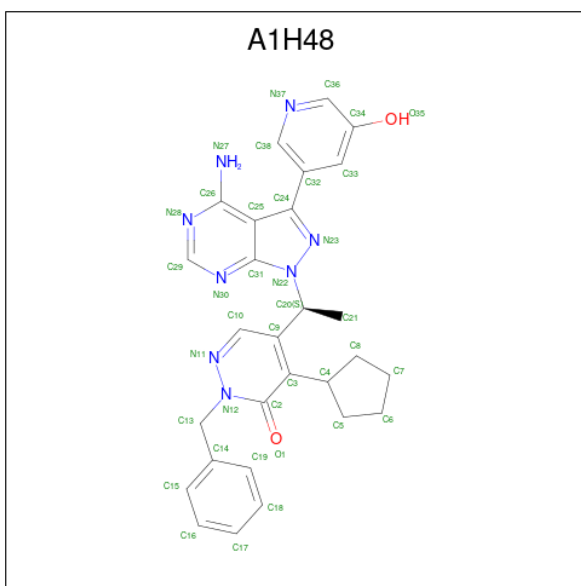
- Molecule 1 is a protein called Phosphatidylinositol 4,5-bisphosphate 3-kinase catalytic subunit delta isoform.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	918	7427	4756	1265	1353	53	164	1	0

- Molecule 2 is a protein called Phosphatidylinositol 3-kinase regulatory subunit alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	161	1395	867	253	270	5	46	0	0

- Molecule 3 is 5-[(1 {S})-1-[4-azanyl-3-(5-oxidanylpyridin-3-yl)pyrazolo[3,4-d]pyrimidin-1-yl]ethyl]-4-cyclopentyl-2-(phenylmethyl)pyridazin-3-one (three-letter code: A1H48) (formula: C₂₈H₂₈N₈O₂) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
3	A	1	38	28	8	2	0	0

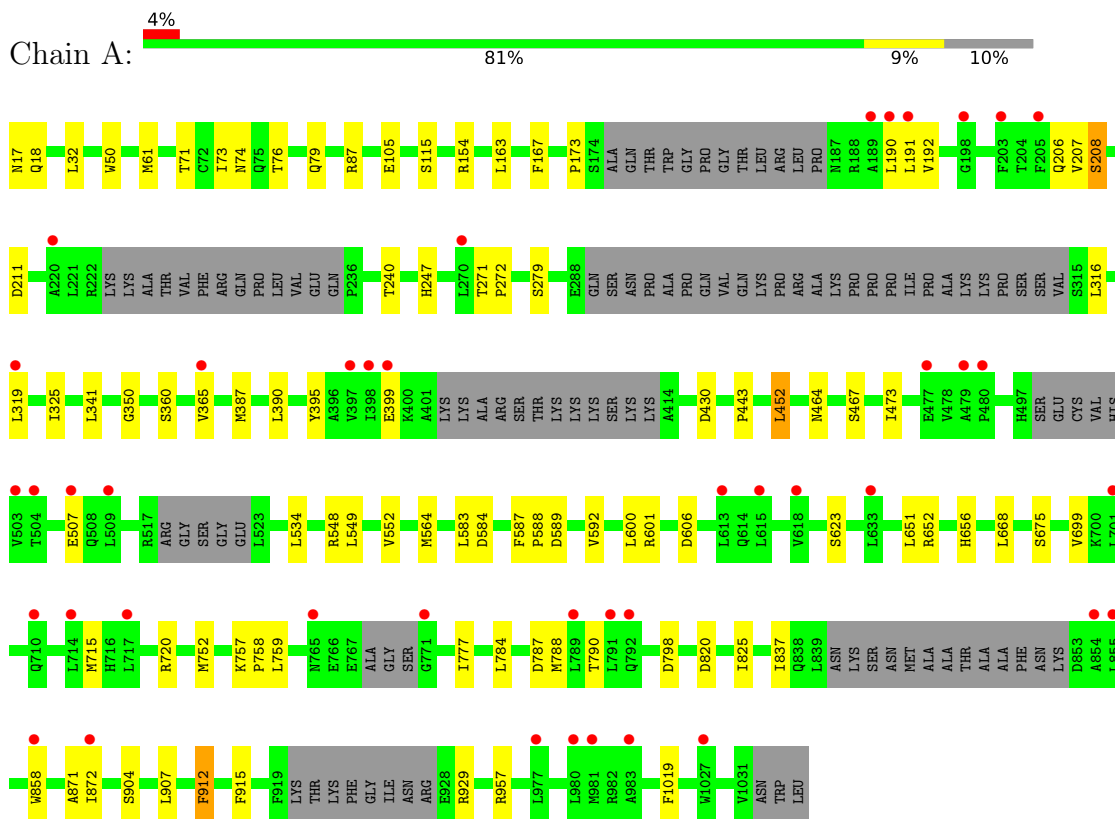
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	62	Total O 62 62	0	0
4	B	7	Total O 7 7	0	0

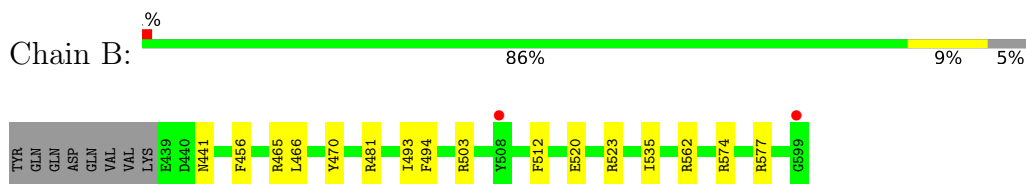
3 Residue-property plots

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



- Molecule 2: Phosphatidylinositol 3-kinase regulatory subunit alpha



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	90.12Å 108.35Å 142.41Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	86.23 – 2.28 49.66 – 2.28	Depositor EDS
% Data completeness (in resolution range)	97.4 (86.23-2.28) 97.4 (49.66-2.28)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.83 (at 2.29Å)	Xtrriage
Refinement program	REFMAC 5.8.0049	Depositor
R, R_{free}	0.203 , 0.270 0.207 , 0.268	Depositor DCC
R_{free} test set	1312 reflections (2.10%)	wwPDB-VP
Wilson B-factor (Å ²)	55.2	Xtrriage
Anisotropy	0.515	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 44.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	8929	wwPDB-VP
Average B, all atoms (Å ²)	74.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.13% 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 i

5.1 Standard geometry i

Bond lengths and bond angles in the following residue types are not validated in this section: A1H48

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	0.77	0/7588	0.92	12/10256 (0.1%)
2	B	0.80	0/1414	0.96	6/1885 (0.3%)
All	All	0.77	0/9002	0.93	18/12141 (0.1%)

There are no bond length outliers.

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	652	ARG	NE-CZ-NH1	7.80	124.20	120.30
2	B	523	ARG	NE-CZ-NH1	6.94	123.77	120.30
1	A	61	MET	CG-SD-CE	6.66	110.86	100.20
1	A	606	ASP	CB-CG-OD2	6.59	124.23	118.30
1	A	720	ARG	NE-CZ-NH1	6.36	123.48	120.30
2	B	577	ARG	NE-CZ-NH2	-6.23	117.19	120.30
1	A	584	ASP	CB-CG-OD1	6.18	123.86	118.30
1	A	788	MET	CG-SD-CE	-6.03	90.55	100.20
2	B	481	ARG	NE-CZ-NH1	5.97	123.28	120.30
1	A	798	ASP	CB-CG-OD1	5.88	123.59	118.30
2	B	577	ARG	NE-CZ-NH1	5.66	123.13	120.30
2	B	465	ARG	NE-CZ-NH1	5.57	123.08	120.30
1	A	929	ARG	NE-CZ-NH1	5.47	123.04	120.30
1	A	154	ARG	NE-CZ-NH1	5.47	123.03	120.30
2	B	503	ARG	NE-CZ-NH1	5.42	123.01	120.30
1	A	32	LEU	CA-CB-CG	5.23	127.33	115.30
1	A	601	ARG	NE-CZ-NH2	-5.13	117.73	120.30
1	A	912	PHE	N-CA-C	5.01	124.52	111.00

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	7427	0	7410	42	0
2	B	1395	0	1388	6	0
3	A	38	0	0	1	0
4	A	62	0	0	1	0
4	B	7	0	0	0	0
All	All	8929	0	8798	46	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 (46) 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:87[B]:ARG:HH11	1:A:87[B]:ARG:HG3	0.99	1.10
1:A:87[B]:ARG:HG3	1:A:87[B]:ARG:NH1	1.79	0.94
1:A:87[B]:ARG:HH11	1:A:87[B]:ARG:CG	1.90	0.78
1:A:325:ILE:HD11	1:A:473:ILE:HD12	1.70	0.73
1:A:699:VAL:HG21	1:A:715:MET:HE2	1.70	0.72
1:A:699:VAL:HG21	1:A:715:MET:CE	2.28	0.63
1:A:507:GLU:HB3	1:A:534:LEU:HD11	1.84	0.59
1:A:163:LEU:CD2	1:A:240:THR:HG21	2.35	0.57
1:A:192:VAL:HG23	1:A:272:PRO:HB2	1.87	0.56
1:A:957:ARG:HG3	1:A:1019:PHE:CE1	2.41	0.56
1:A:167:PHE:CE1	1:A:247:HIS:HB3	2.45	0.52
1:A:191:LEU:HD12	1:A:271:THR:HG23	1.92	0.52
1:A:583:LEU:HD11	1:A:600:LEU:HD11	1.93	0.51
1:A:316:LEU:HA	1:A:319:LEU:HD12	1.95	0.49
1:A:74:ASN:OD1	1:A:76:THR:HG22	2.13	0.48
2:B:512:PHE:CE2	2:B:520:GLU:HB3	2.49	0.47
1:A:871:ALA:HA	1:A:904:SER:O	2.14	0.47
1:A:208:SER:HB2	1:A:211:ASP:CB	2.45	0.47
1:A:759:LEU:O	1:A:777:ILE:HA	2.15	0.46
1:A:587:PHE:HB3	1:A:592:VAL:HG11	1.96	0.46
1:A:837:ILE:HD12	1:A:858:TRP:CD1	2.51	0.46
1:A:548:ARG:O	1:A:552:VAL:HG13	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:387:MET:HG3	1:A:589:ASP:HA	1.97	0.45
1:A:208:SER:CB	1:A:211:ASP:HB2	2.46	0.45
1:A:341:LEU:HG	1:A:365:VAL:HG22	1.98	0.44
1:A:787:ASP:OD2	3:A:1101:A1H48:O35	2.34	0.44
1:A:549:LEU:HG	1:A:564:MET:CE	2.47	0.44
1:A:564:MET:HA	1:A:564:MET:HE2	1.99	0.44
1:A:757:LYS:N	1:A:758:PRO:HD3	2.32	0.44
1:A:395:TYR:OH	1:A:452:LEU:HA	2.18	0.43
1:A:71:THR:HG21	1:A:79:GLN:HE21	1.83	0.43
1:A:350:GLY:N	1:A:588:PRO:HG3	2.34	0.43
2:B:494:PHE:HB3	2:B:535:ILE:HG12	2.01	0.42
1:A:443:PRO:HG3	2:B:470:TYR:CZ	2.54	0.42
1:A:73:ILE:HD11	2:B:493:ILE:HD12	2.02	0.42
1:A:651:LEU:HB2	1:A:668:LEU:HD21	2.01	0.42
1:A:325:ILE:HD13	1:A:390:LEU:HD21	2.01	0.41
1:A:790:THR:HG21	1:A:912:PHE:CG	2.55	0.41
1:A:190:LEU:O	1:A:207:VAL:N	2.51	0.41
1:A:784:LEU:HD21	1:A:825:ILE:HD11	2.01	0.41
1:A:191:LEU:HA	1:A:206:GLN:HA	2.02	0.41
1:A:656:HIS:HD2	4:A:1225:HOH:O	2.03	0.41
2:B:466:LEU:HD21	2:B:562:ARG:NH2	2.36	0.41
1:A:464:ASN:HD21	1:A:467:SER:HB2	1.86	0.40
1:A:752:MET:CE	1:A:777:ILE:HD13	2.51	0.40
2:B:456:PHE:CE1	2:B:574:ARG:HB2	2.56	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	899/1018 (88%)	864 (96%)	30 (3%)	5 (1%)	25 29

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	B	159/169 (94%)	155 (98%)	4 (2%)	0	100	100
All	All	1058/1187 (89%)	1019 (96%)	34 (3%)	5 (0%)	29	34

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	399	GLU
1	A	820	ASP
1	A	18	GLN
1	A	430	ASP
1	A	173	PRO

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	821/903 (91%)	808 (98%)	13 (2%)	62	76
2	B	152/160 (95%)	151 (99%)	1 (1%)	84	91
All	All	973/1063 (92%)	959 (99%)	14 (1%)	67	79

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	17	ASN
1	A	50	TRP
1	A	105	GLU
1	A	115	SER
1	A	208	SER
1	A	279	SER
1	A	360	SER
1	A	452	LEU
1	A	623	SER
1	A	675	SER
1	A	872	ILE

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Mol	Chain	Res	Type
1	A	907	LEU
1	A	915	PHE
2	B	441	ASN

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	79	GLN
1	A	187	ASN
1	A	464	ASN
1	A	732	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
3	A1H48	A	1101	-	38,43,43	1.18	3 (7%)	40,62,62	1.67	6 (15%)

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
3	A1H48	A	1101	-	-	1/10/27/27	0/6/6/6

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1101	A1H48	N12-N11	-3.79	1.30	1.36
3	A	1101	A1H48	N23-N22	3.28	1.41	1.37
3	A	1101	A1H48	C24-N23	-2.34	1.33	1.35

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1101	A1H48	C24-N23-N22	6.34	110.23	105.17
3	A	1101	A1H48	N30-C29-N28	-3.69	122.91	128.68
3	A	1101	A1H48	C38-N37-C36	3.36	122.06	117.48
3	A	1101	A1H48	C19-C14-C15	2.44	122.01	118.17
3	A	1101	A1H48	C38-C32-C24	-2.33	117.62	121.68
3	A	1101	A1H48	C13-N12-N11	2.30	117.20	114.40

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1101	A1H48	N23-C24-C32-C33

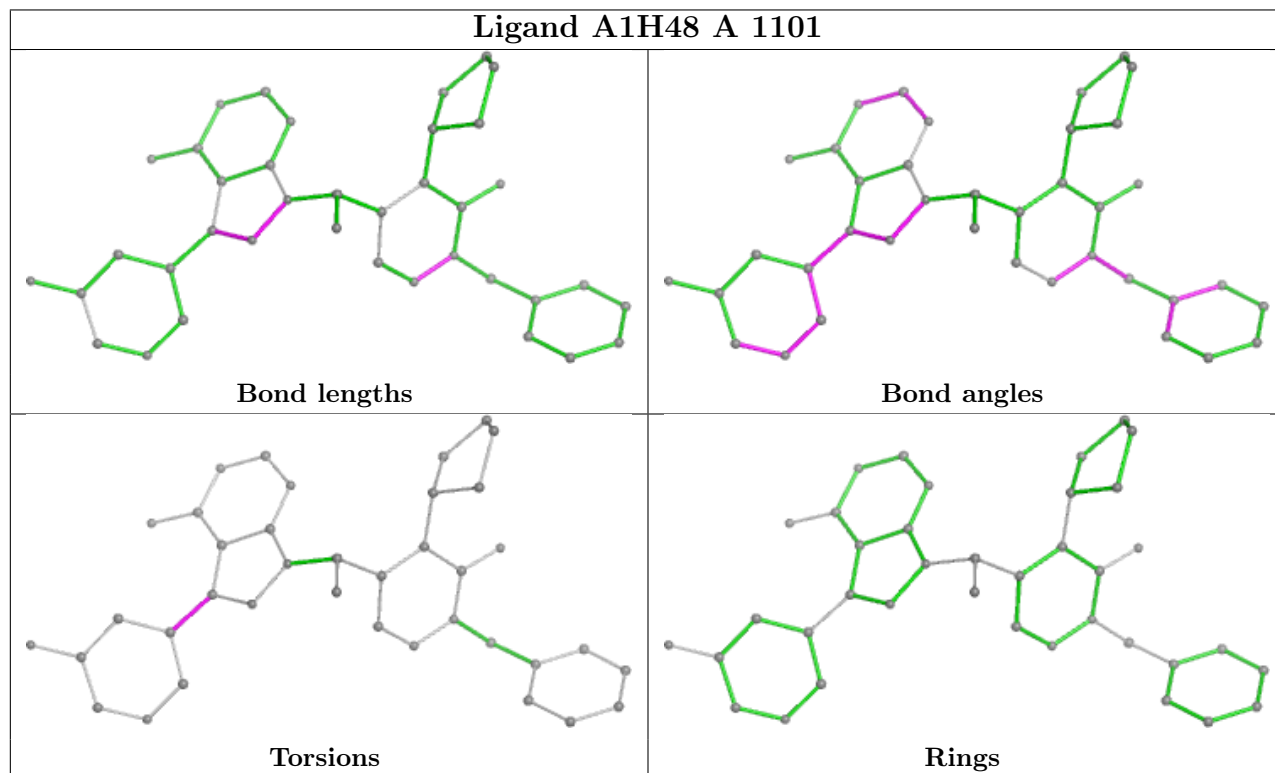
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	1101	A1H48	1	0

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	918/1018 (90%)	0.15	42 (4%) 32 38	37, 70, 119, 172	48 (5%)
2	B	161/169 (95%)	-0.23	2 (1%) 79 82	48, 69, 104, 142	14 (8%)
All	All	1079/1187 (90%)	0.09	44 (4%) 37 42	37, 69, 118, 172	62 (5%)

All (44) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	508	TYR	5.4
1	A	504	THR	5.3
1	A	190	LEU	4.9
1	A	480	PRO	4.1
1	A	855	LEU	4.1
1	A	710	GLN	3.7
1	A	765	ASN	3.7
1	A	613	LEU	3.4
1	A	714	LEU	3.4
1	A	319	LEU	3.3
1	A	189	ALA	3.3
1	A	270	LEU	3.2
1	A	205	PHE	3.2
1	A	198	GLY	3.1
1	A	503	VAL	3.1
1	A	977	LEU	3.1
1	A	858	TRP	3.0
1	A	618	VAL	3.0
1	A	1027	TRP	3.0
1	A	203	PHE	2.9
1	A	717	LEU	2.8
1	A	872	ILE	2.7
1	A	983	ALA	2.7
1	A	615	LEU	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	980	LEU	2.6
1	A	398	ILE	2.5
1	A	854	ALA	2.5
1	A	792	GLN	2.5
1	A	399	GLU	2.2
1	A	477	GLU	2.2
1	A	791	LEU	2.2
1	A	220	ALA	2.2
1	A	365	VAL	2.1
1	A	789	LEU	2.1
1	A	507	GLU	2.1
1	A	479	ALA	2.1
1	A	397	VAL	2.1
2	B	599	GLY	2.1
1	A	509	LEU	2.1
1	A	981	MET	2.1
1	A	191	LEU	2.0
1	A	633	LEU	2.0
1	A	701	LEU	2.0
1	A	771	GLY	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.

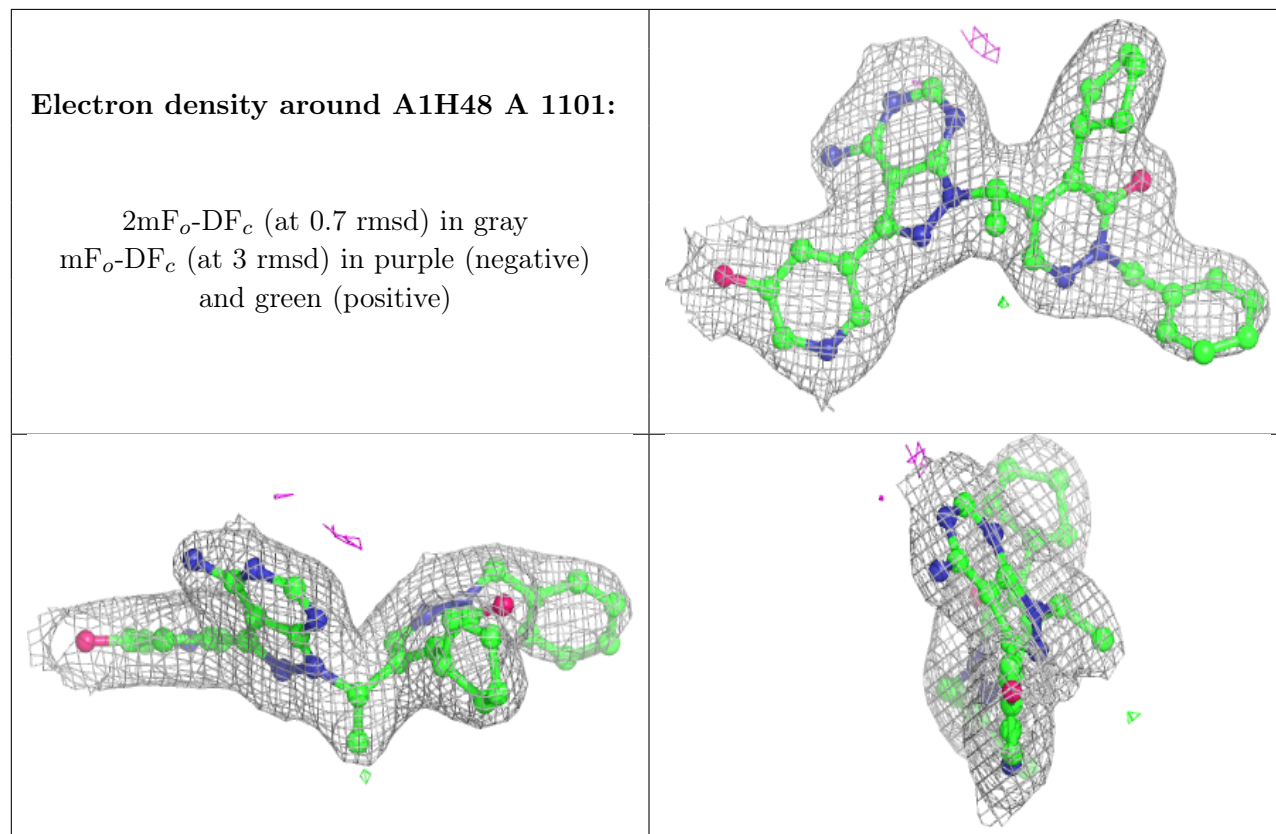
6.4 Ligands [i](#)

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
3	A1H48	A	1101	38/38	0.95	0.13	35,57,80,90	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.