



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 05:01 PM UTC

PDB ID : 5FTQ / pdb_00005ftq
Title : Crystal structure of the ALK kinase domain in complex with Cmpd 17
Authors : Bossi, R.; Canevari, G.; Fasolini, M.; Menichincheri, M.; Ardini, E.; Magnaghi, P.; Avanzi, N.; Banfi, P.; Buffa, L.; Ceriani, L.; Colombo, M.; Corti, L.; Donati, D.; Felder, E.; Fiorelli, C.; Fiorentini, F.; Galvani, A.; Isacchi, A.; Lombardi Borgia, A.; Marchionni, C.; Nesi, M.; Orrenius, C.; Panzeri, A.; Perrone, E.; Pesenti, E.; Rusconi, L.; Saccardo, M.B.; Vanotti, E.; Orsini, P.
Deposited on : 2016-01-14
Resolution : 1.70 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)

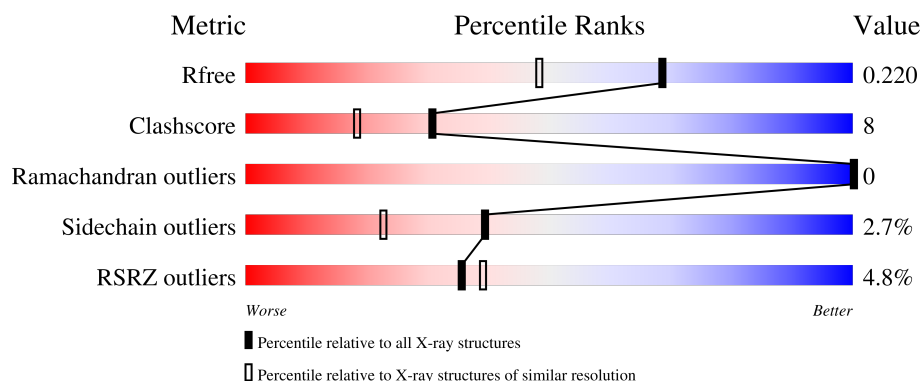
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.70 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	5551 (1.70-1.70)
Clashscore	190562	5924 (1.70-1.70)
Ramachandran outliers	187476	5846 (1.70-1.70)
Sidechain outliers	187428	5846 (1.70-1.70)
RSRZ outliers	180081	5554 (1.70-1.70)

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	315	

Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 2733 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.

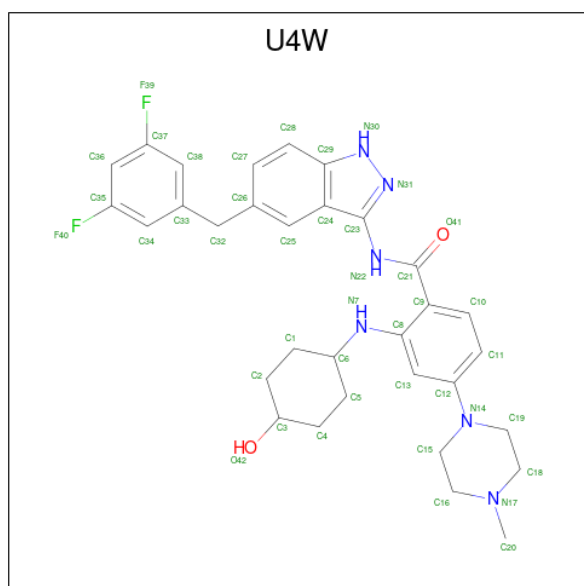
- Molecule 1 is a protein called ALK TYROSINE KINASE RECEPTOR.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	293	Total	C	N	O	S	0	4	0
			2326	1486	393	425	22			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1093	GLY	-	expression tag	UNP Q9UM73

- Molecule 2 is N-[5-(3,5-DIFLUOROBENZYL)-1H-INDAZOL-3-YL]-2-[(4-HYDROXYCYCLOHEXYL)AMINO]-4-(4-METHYLPIPERAZIN-1-YL) BENZAMIDE (CCD ID: U4W) (formula: C₃₂H₃₆F₂N₆O₂).





Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			6	3	3		

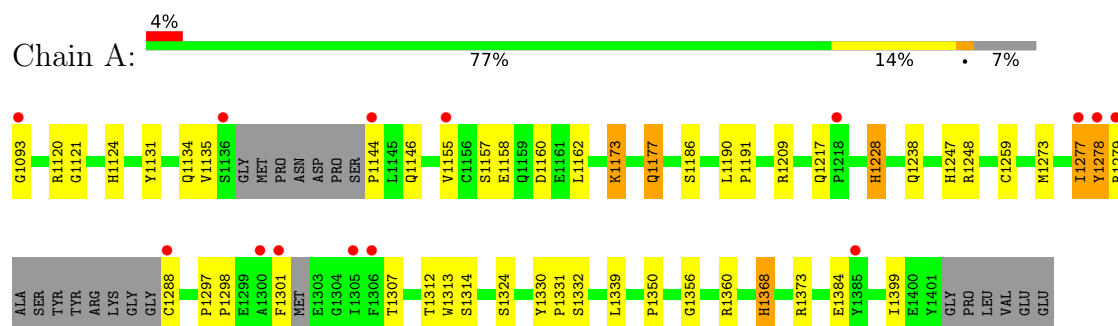
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	359	Total	O	0	0
			359	359		

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: ALK TYROSINE KINASE RECEPTOR



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	52.25Å 58.31Å 104.88Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.96 – 1.70 50.96 – 1.70	Depositor EDS
% Data completeness (in resolution range)	96.3 (50.96-1.70) 96.3 (50.96-1.70)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.06 (at 1.70Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, R_{free}	0.173 , 0.220 0.172 , 0.220	Depositor DCC
R_{free} test set	1772 reflections (5.11%)	wwPDB-VP
Wilson B-factor (Å ²)	21.9	Xtriage
Anisotropy	0.133	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 46.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	2733	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.64% 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: GOL, U4W

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	1.48	13/2394 (0.5%)	1.30	5/3243 (0.2%)

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	2

All (13) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	1228	HIS	ND1-CE1	8.46	1.41	1.32
1	A	1339	LEU	N-CA	-6.36	1.38	1.46
1	A	1384	GLU	N-CA	6.07	1.53	1.46
1	A	1186	SER	CA-C	-5.74	1.46	1.53
1	A	1131	TYR	N-CA	5.71	1.53	1.45
1	A	1259	CYS	N-CA	5.52	1.51	1.46
1	A	1314	SER	CA-C	5.45	1.59	1.52
1	A	1324	SER	N-CA	5.31	1.53	1.46
1	A	1356	GLY	N-CA	5.28	1.49	1.45
1	A	1121	GLY	C-O	5.26	1.29	1.23
1	A	1368	HIS	ND1-CE1	5.21	1.37	1.32
1	A	1124	HIS	CG-CD2	5.17	1.41	1.35
1	A	1228	HIS	CG-CD2	5.02	1.41	1.35

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1350	PRO	CB-CA-C	-7.01	104.58	111.17
1	A	1330	TYR	CA-C-N	-5.85	113.51	119.83
1	A	1330	TYR	C-N-CA	-5.85	113.51	119.83
1	A	1162	LEU	N-CA-C	-5.68	105.17	111.36
1	A	1155	VAL	CB-CA-C	-5.12	105.28	111.88

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	1135	VAL	Peptide
1	A	1278	TYR	Peptide

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	2326	0	2311	39	0
2	A	42	0	0	0	0
3	A	6	0	8	0	0
4	A	359	0	0	19	0
All	All	2733	0	2319	39	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 8.

All (39) 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:1173:LYS:HE2	4:A:2069:HOH:O	1.54	1.05
1:A:1360:ARG:HD2	4:A:2320:HOH:O	1.62	0.99
1:A:1120:ARG:HD2	4:A:2097:HOH:O	1.77	0.84
1:A:1177:GLN:HE21	1:A:1177:GLN:H	1.23	0.84
1:A:1368:HIS:HD2	4:A:2300:HOH:O	1.64	0.80
1:A:1248:ARG:HD3	1:A:1277:ILE:HG21	1.67	0.76
1:A:1177:GLN:H	1:A:1177:GLN:NE2	1.87	0.72

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1277:ILE:HD13	1:A:1278:TYR:N	2.06	0.70
1:A:1238:GLN:HG3	4:A:2204:HOH:O	1.92	0.70
1:A:1238:GLN:CG	4:A:2204:HOH:O	2.41	0.68
1:A:1248:ARG:CD	1:A:1277:ILE:HG21	2.25	0.67
1:A:1228:HIS:HE1	4:A:2200:HOH:O	1.78	0.65
1:A:1277:ILE:HD13	1:A:1277:ILE:C	2.22	0.64
1:A:1247:HIS:O	1:A:1248:ARG:HB2	1.98	0.62
1:A:1144:PRO:HD3	4:A:2116:HOH:O	2.01	0.60
1:A:1134:GLN:HE21	1:A:1146:GLN:HE22	1.51	0.58
1:A:1228:HIS:HD2	4:A:2198:HOH:O	1.86	0.58
1:A:1177:GLN:HE21	1:A:1177:GLN:N	1.98	0.57
1:A:1277:ILE:O	1:A:1279:ARG:HB2	2.09	0.53
1:A:1209:ARG:HD3	4:A:2182:HOH:O	2.11	0.51
1:A:1331:PRO:O	1:A:1332:SER:HB2	2.11	0.51
1:A:1368:HIS:CD2	4:A:2300:HOH:O	2.50	0.49
1:A:1158:GLU:CG	4:A:2132:HOH:O	2.62	0.47
1:A:1301:PHE:HB2	4:A:2272:HOH:O	2.14	0.47
1:A:1331:PRO:HA	4:A:2287:HOH:O	2.14	0.46
1:A:1273:MET:HE2	1:A:1273:MET:HB2	1.72	0.45
1:A:1134:GLN:HG2	1:A:1146:GLN:NE2	2.32	0.45
1:A:1144:PRO:CD	4:A:2116:HOH:O	2.63	0.44
1:A:1093:GLY:HA2	4:A:2001:HOH:O	2.16	0.44
1:A:1190:LEU:HA	1:A:1191:PRO:C	2.42	0.44
1:A:1173:LYS:HA	1:A:1173:LYS:HD3	1.76	0.43
1:A:1312:THR:HG21	1:A:1373:ARG:HB3	2.00	0.43
1:A:1307:THR:HB	4:A:2277:HOH:O	2.19	0.42
1:A:1144:PRO:HD2	4:A:2117:HOH:O	2.19	0.41
1:A:1157:SER:O	1:A:1160:ASP:HB2	2.21	0.41
1:A:1158:GLU:HG2	4:A:2132:HOH:O	2.20	0.41
1:A:1158:GLU:OE1	1:A:1158:GLU:HA	2.21	0.40
1:A:1297:PRO:HA	1:A:1313:TRP:CE2	2.56	0.40
1:A:1277:ILE:C	1:A:1277:ILE:CD1	2.87	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	289/315 (92%)	285 (99%)	4 (1%)	0	100	100

There are no Ramachandran outliers to report.

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	260/273 (95%)	253 (97%)	7 (3%)	39	23

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1173	LYS
1	A	1177	GLN
1	A	1217	GLN
1	A	1277	ILE
1	A	1288	CYS
1	A	1298	PRO
1	A	1399	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1095	ASN
1	A	1124	HIS
1	A	1146	GLN
1	A	1177	GLN
1	A	1228	HIS
1	A	1336	GLN
1	A	1368	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

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
3	GOL	A	2403	-	5,5,5	0.26	0	5,5,5	1.10	0
2	U4W	A	2402	-	47,47,47	1.50	8 (17%)	64,67,67	2.34	20 (31%)

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	GOL	A	2403	-	-	2/4/4/4	-
2	U4W	A	2402	-	-	2/20/40/40	0/6/6/6

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	2402	U4W	C12-N14	3.25	1.47	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	2402	U4W	C27-C26	3.19	1.45	1.38
2	A	2402	U4W	C34-C35	2.91	1.42	1.37
2	A	2402	U4W	C9-C21	2.70	1.55	1.50
2	A	2402	U4W	C38-C37	2.44	1.41	1.37
2	A	2402	U4W	C10-C11	2.32	1.42	1.38
2	A	2402	U4W	C21-N22	-2.25	1.34	1.37
2	A	2402	U4W	C4-C3	2.03	1.56	1.51

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	2402	U4W	C1-C2-C3	-7.30	99.86	111.53
2	A	2402	U4W	C25-C24-C23	6.23	137.73	130.55
2	A	2402	U4W	C24-C29-N30	6.03	110.92	106.59
2	A	2402	U4W	C28-C29-C24	-5.81	116.56	122.19
2	A	2402	U4W	C18-C19-N14	-4.33	101.68	110.78
2	A	2402	U4W	C29-N30-N31	-3.75	109.11	111.90
2	A	2402	U4W	C28-C27-C26	-3.60	116.27	121.00
2	A	2402	U4W	C5-C4-C3	-3.39	106.11	111.53
2	A	2402	U4W	C11-C12-N14	-3.28	116.83	121.39
2	A	2402	U4W	C27-C28-C29	3.19	125.73	119.57
2	A	2402	U4W	C10-C9-C8	3.17	122.38	118.81
2	A	2402	U4W	C15-C16-N17	-3.15	105.80	110.86
2	A	2402	U4W	C19-N14-C12	-3.08	109.70	118.11
2	A	2402	U4W	C5-C6-C1	-2.84	105.90	110.80
2	A	2402	U4W	C2-C1-C6	-2.72	108.51	111.49
2	A	2402	U4W	C15-N14-C12	-2.69	110.79	118.11
2	A	2402	U4W	C8-C9-C21	-2.38	117.91	120.96
2	A	2402	U4W	C9-C8-N7	-2.23	119.11	121.08
2	A	2402	U4W	C26-C32-C33	-2.15	106.41	113.76
2	A	2402	U4W	C19-C18-N17	-2.01	107.63	110.86

There are no chirality outliers.

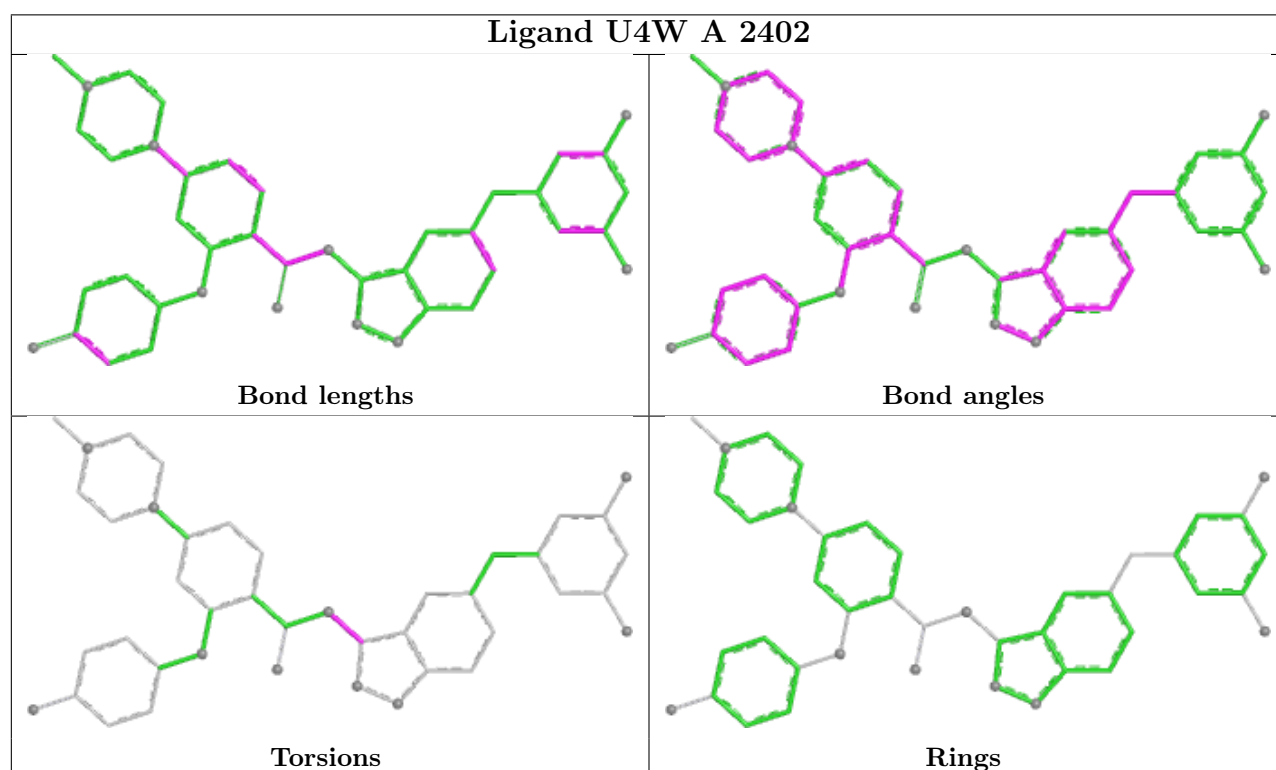
All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	2403	GOL	C1-C2-C3-O3
3	A	2403	GOL	O2-C2-C3-O3
2	A	2402	U4W	N31-C23-N22-C21
2	A	2402	U4W	C24-C23-N22-C21

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 [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	293/315 (93%)	0.04	14 (4%) 35 39	11, 21, 42, 68	4 (1%)

All (14) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1288	CYS	3.0
1	A	1277	ILE	2.9
1	A	1385	TYR	2.8
1	A	1301	PHE	2.8
1	A	1093	GLY	2.8
1	A	1218	PRO	2.7
1	A	1144	PRO	2.7
1	A	1305	ILE	2.5
1	A	1300	ALA	2.4
1	A	1279	ARG	2.3
1	A	1278	TYR	2.2
1	A	1136	SER	2.1
1	A	1306	PHE	2.1
1	A	1155	VAL	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](#)

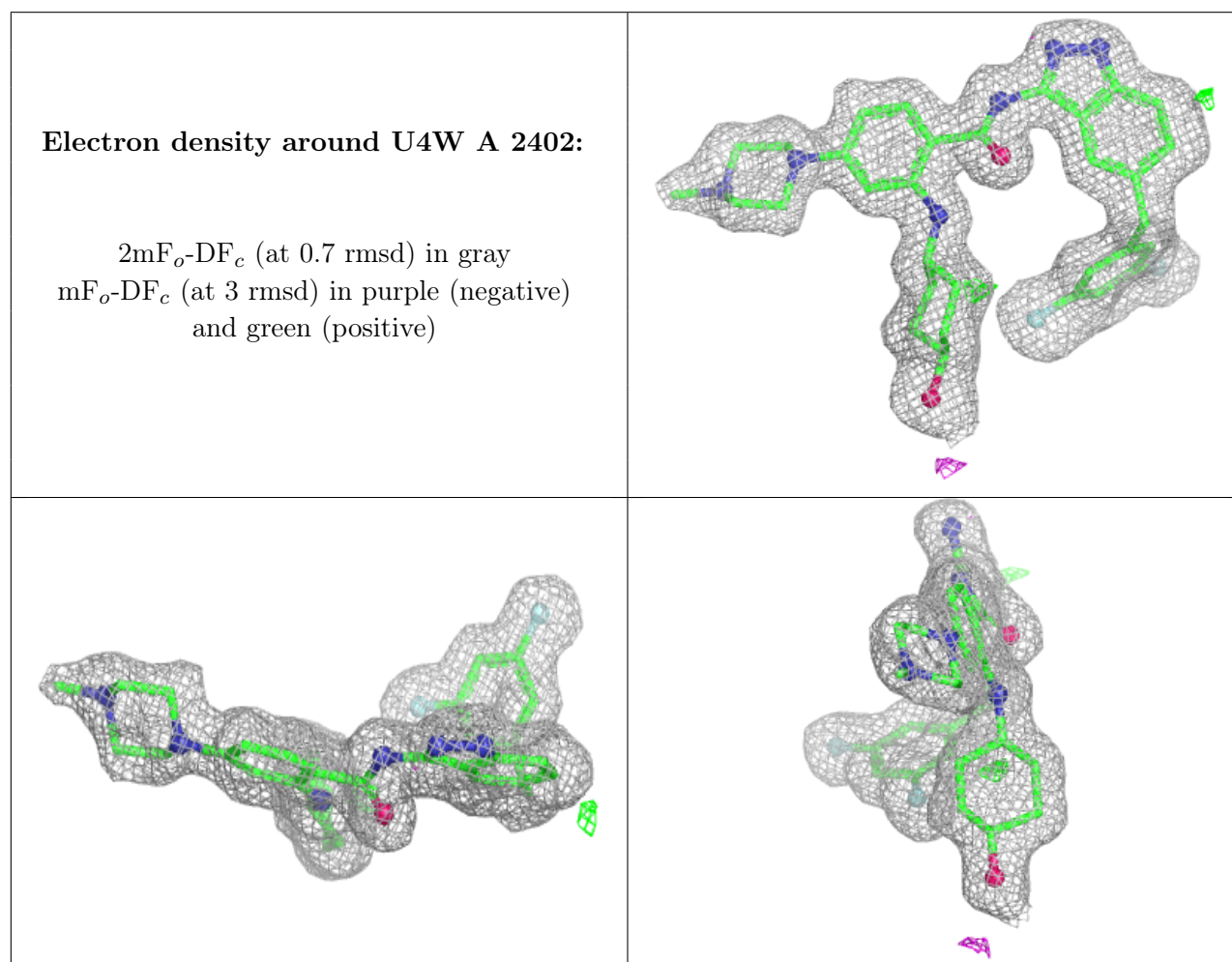
There are no oligosaccharides in this entry.

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
3	GOL	A	2403	6/6	0.83	0.13	32,46,54,54	0
2	U4W	A	2402	42/42	0.97	0.05	12,17,27,30	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.