Full wwPDB X-ray Structure Validation Report (i)

Oct 19, 2026 – 01:28 pm BST

PDB ID	:	9SZH / pdb_00009szh
Title	:	Crystal structure of the human METTL3-METTL14 in complex with PIPC4
Authors	:	Bedi, R.K.; Caflisch, A.
Deposited on	:	2025-10-14
Resolution	:	2.54 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:

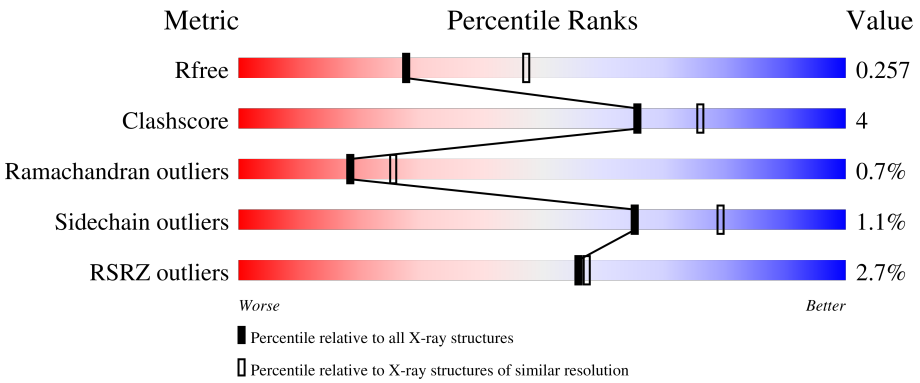
MolProbity	:	4-5-2 with Phenix2.2
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.2
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.51

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 2.54 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	1091 (2.54-2.54)
Clashscore	190562	1120 (2.54-2.54)
Ramachandran outliers	187476	1106 (2.54-2.54)
Sidechain outliers	187428	1106 (2.54-2.54)
RSRZ outliers	180081	1091 (2.54-2.54)

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	228	3% 79% 11% 10%
2	B	307	2% 74% 6% 20%

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 3586 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 N6-adenosine-methyltransferase catalytic subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	205	1607	1031	280	287	9	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	353	MET	-	initiating methionine	UNP Q86U44

- Molecule 2 is a protein called N(6)-adenosine-methyltransferase non-catalytic subunit METTL14.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	247	1893	1214	322	344	13	0	1	0

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	89	MET	-	initiating methionine	UNP Q9HCE5
B	90	HIS	-	expression tag	UNP Q9HCE5
B	91	HIS	-	expression tag	UNP Q9HCE5
B	92	HIS	-	expression tag	UNP Q9HCE5
B	93	HIS	-	expression tag	UNP Q9HCE5
B	94	HIS	-	expression tag	UNP Q9HCE5
B	95	HIS	-	expression tag	UNP Q9HCE5
B	96	SER	-	expression tag	UNP Q9HCE5
B	97	SER	-	expression tag	UNP Q9HCE5
B	98	GLY	-	expression tag	UNP Q9HCE5
B	99	ARG	-	expression tag	UNP Q9HCE5
B	100	GLU	-	expression tag	UNP Q9HCE5
B	101	ASN	-	expression tag	UNP Q9HCE5
B	102	LEU	-	expression tag	UNP Q9HCE5

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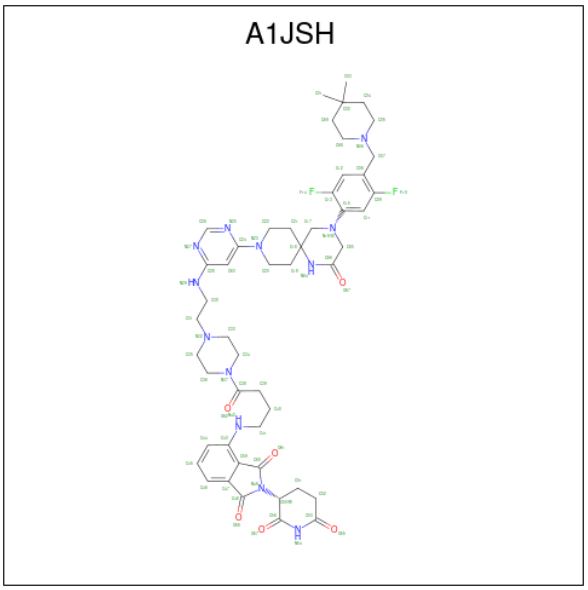
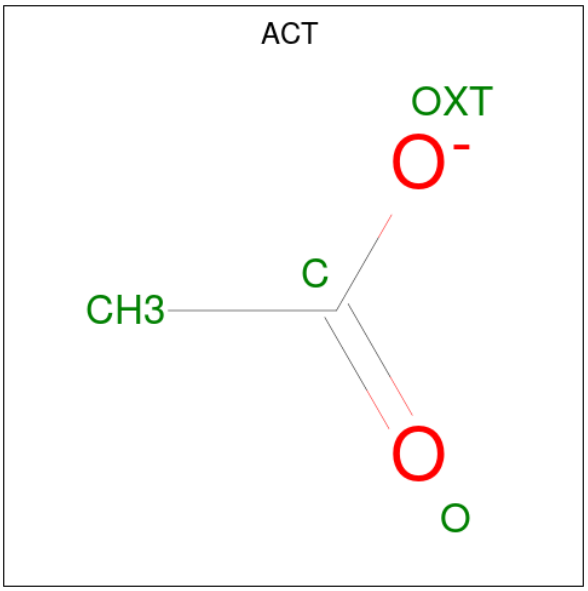
Chain	Residue	Modelled	Actual	Comment	Reference
B	103	TYR	-	expression tag	UNP Q9HCE5
B	104	PHE	-	expression tag	UNP Q9HCE5
B	105	GLN	-	expression tag	UNP Q9HCE5
B	106	GLY	-	expression tag	UNP Q9HCE5

- Molecule 3 is 2-[(3 {R})-2,6-bis(oxidanylidene)piperidin-3-yl]-4-[[4-[4-[2-[[6-[4-[4-[(4,4-dimethylpiperidin-1-yl)methyl]-2,5-bis(fluoranyl)phenyl]-2-oxidanylidene-1,4,9-triazaspiro[5.5]undecan-9-yl]pyrimidin-4-yl]amino]ethyl]piperazin-1-yl]-4-oxidanylidene-butyl]amino]isoindole-1,3-dione (CCD ID: A1JSH) (formula: $C_{49}H_{62}F_2N_{12}O_6$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	F	N	O		
3	A	1	47	34	2	9	2	0	0

- Molecule 4 is ACETATE ION (CCD ID: ACT) (formula: $C_2H_3O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
4	B	1	4	2	2	0	0

- Molecule 5 is water.

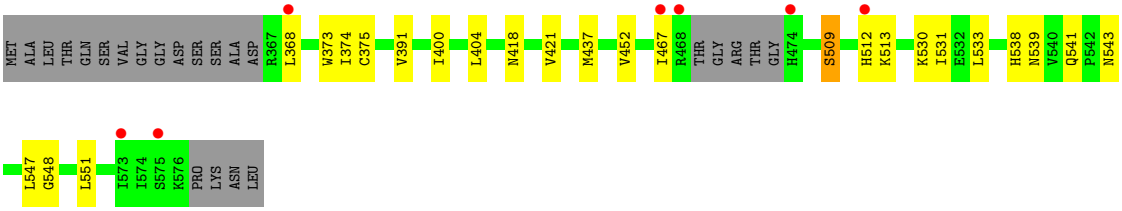
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	8	8	8	0	0
5	B	27	Total	O	0	0
			27	27		

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.

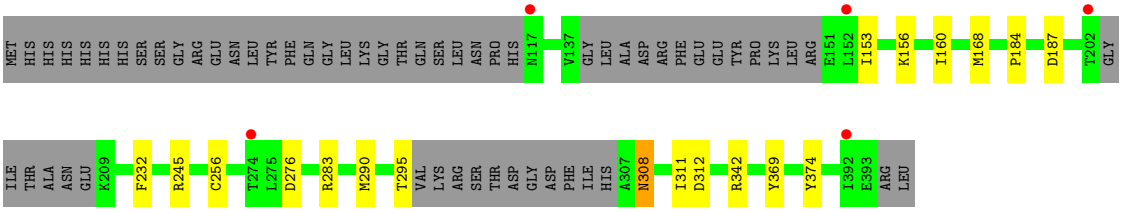
- Molecule 1: N6-adenosine-methyltransferase catalytic subunit

Chain A:



- Molecule 2: N(6)-adenosine-methyltransferase non-catalytic subunit METTL14

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α, β, γ	64.31Å 64.31Å 226.50Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	35.14 – 2.54 35.14 – 2.54	Depositor EDS
% Data completeness (in resolution range)	99.9 (35.14-2.54) 99.9 (35.14-2.54)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.32 (at 2.54Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.194 , 0.258 0.198 , 0.257	Depositor DCC
R_{free} test set	977 reflections (5.18%)	wwPDB-VP
Wilson B-factor (Å^2)	55.6	Xtriage
Anisotropy	0.060	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 37.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.034 for -h,-k,l	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	3586	wwPDB-VP
Average B, all atoms (Å^2)	55.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.77% 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: ACT, A1JSH

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	0/1650	0.55	0/2250
2	B	0.40	0/1944	0.56	0/2647
All	All	0.39	0/3594	0.56	0/4897

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	1607	0	1523	17	0
2	B	1893	0	1743	12	0
3	A	47	0	0	0	0
4	B	4	0	3	0	0
5	A	8	0	0	0	0
5	B	27	0	0	2	0
All	All	3586	0	3269	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 4.

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:A:509:SER:HB2	1:A:512:HIS:HD2	1.40	0.87
2:B:168:MET:HE3	2:B:369:TYR:HA	1.62	0.80
1:A:391:VAL:HB	1:A:530:LYS:HG2	1.70	0.72
1:A:373:TRP:HB2	1:A:551:LEU:HD13	1.75	0.69
1:A:509:SER:HB2	1:A:512:HIS:CD2	2.27	0.65
1:A:437:MET:HE2	2:B:245:ARG:NH2	2.15	0.61
1:A:539:ASN:O	1:A:541:GLN:HG2	2.00	0.61
1:A:512:HIS:ND1	1:A:538:HIS:CE1	2.73	0.57
1:A:368:LEU:HA	1:A:543:ASN:HD21	1.74	0.53
1:A:533:LEU:HD23	1:A:547:LEU:HD12	1.89	0.53
1:A:400:ILE:HG12	1:A:404:LEU:HD11	1.91	0.53
1:A:452:VAL:O	2:B:283:ARG:NH2	2.42	0.52
2:B:311:ILE:HG13	2:B:312:ASP:H	1.76	0.51
1:A:509:SER:CB	1:A:512:HIS:HD2	2.19	0.49
2:B:295:THR:O	5:B:501:HOH:O	2.20	0.48
2:B:187:ASP:OD2	2:B:342:ARG:NH1	2.44	0.48
1:A:437:MET:HE2	2:B:245:ARG:HH22	1.79	0.47
2:B:256:CYS:HB3	5:B:519:HOH:O	2.14	0.46
2:B:184:PRO:HG2	2:B:342:ARG:HD3	1.97	0.46
1:A:418:ASN:O	1:A:421:VAL:HG12	2.16	0.45
1:A:513:LYS:HB3	1:A:513:LYS:HE3	1.77	0.45
2:B:232:PHE:CE2	2:B:290:MET:HG3	2.54	0.43
1:A:375:CYS:HA	1:A:548:GLY:O	2.20	0.42
2:B:156:LYS:O	2:B:160:ILE:HD12	2.20	0.41
2:B:168:MET:HE1	2:B:374:TYR:HB2	2.03	0.41
1:A:374:ILE:HB	1:A:547:LEU:CD2	2.50	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	201/228 (88%)	192 (96%)	8 (4%)	1 (0%)	24	34
2	B	240/307 (78%)	227 (95%)	11 (5%)	2 (1%)	16	22
All	All	441/535 (82%)	419 (95%)	19 (4%)	3 (1%)	18	25

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	467	ILE
2	B	308	ASN
2	B	153	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	166/200 (83%)	164 (99%)	2 (1%)	63	78
2	B	188/274 (69%)	186 (99%)	2 (1%)	65	79
All	All	354/474 (75%)	350 (99%)	4 (1%)	65	79

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	509	SER
1	A	531	ILE
2	B	276	ASP
2	B	308	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	445	ASN
1	A	543	ASN
2	B	122	HIS
2	B	128	HIS

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Mol	Chain	Res	Type
2	B	382	ASN

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 oligosaccharides 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	$\#\|Z\| > 2$
3	A1JSH	A	601	-	51,52,77	2.26	17 (33%)	66,76,113	2.73	25 (37%)
4	ACT	B	401	-	3,3,3	1.38	0	3,3,3	1.33	0

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	A1JSH	A	601	-	-	3/22/70/110	0/6/6/9

All (17) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	601	A1JSH	C28-N29	6.25	1.45	1.36
3	A	601	A1JSH	C24-N23	5.12	1.48	1.37
3	A	601	A1JSH	C66-N64	4.71	1.40	1.34
3	A	601	A1JSH	C30-N29	4.31	1.54	1.45
3	A	601	A1JSH	C38-N37	3.99	1.47	1.35
3	A	601	A1JSH	C34-N37	3.95	1.54	1.47
3	A	601	A1JSH	C17-N16	3.27	1.48	1.46
3	A	601	A1JSH	C20-N23	3.17	1.51	1.46
3	A	601	A1JSH	C08-C09	2.93	1.43	1.38
3	A	601	A1JSH	C12-C13	2.80	1.42	1.37
3	A	601	A1JSH	C65-C66	2.80	1.54	1.51
3	A	601	A1JSH	C39-C38	2.53	1.60	1.50
3	A	601	A1JSH	C36-N37	2.36	1.51	1.47
3	A	601	A1JSH	C31-C30	2.34	1.58	1.51
3	A	601	A1JSH	C63-C28	2.26	1.45	1.39
3	A	601	A1JSH	C11-C09	2.14	1.41	1.37
3	A	601	A1JSH	C28-N27	2.04	1.38	1.34

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	601	A1JSH	C11-C15-C13	-7.30	109.36	116.48
3	A	601	A1JSH	C12-C13-C15	7.20	129.28	123.34
3	A	601	A1JSH	C69-C68-N06	6.07	117.22	111.23
3	A	601	A1JSH	C19-C18-C17	5.95	121.85	110.62
3	A	601	A1JSH	C39-C38-N37	5.71	124.91	118.26
3	A	601	A1JSH	C30-N29-C28	5.44	132.00	123.38
3	A	601	A1JSH	C63-C28-N27	-5.37	115.25	122.75
3	A	601	A1JSH	C65-N16-C17	-5.29	104.22	112.61
3	A	601	A1JSH	C11-C15-N16	4.79	129.62	122.52
3	A	601	A1JSH	C12-C08-C09	-4.30	111.57	116.58
3	A	601	A1JSH	C19-C20-N23	3.24	116.08	110.34
3	A	601	A1JSH	C04-C05-N06	3.16	114.35	111.23
3	A	601	A1JSH	C35-C36-N37	3.15	117.19	110.44
3	A	601	A1JSH	C63-C28-N29	3.08	125.88	120.86
3	A	601	A1JSH	C07-C08-C12	2.87	125.50	120.38
3	A	601	A1JSH	O67-C66-N64	-2.86	117.74	121.54
3	A	601	A1JSH	F14-C13-C12	-2.72	113.19	118.61
3	A	601	A1JSH	N25-C24-N23	2.70	120.83	116.79
3	A	601	A1JSH	C22-N23-C20	-2.62	105.73	111.52
3	A	601	A1JSH	O62-C38-N37	-2.60	117.82	121.02
3	A	601	A1JSH	C08-C07-N06	-2.27	108.78	112.75
3	A	601	A1JSH	C63-C24-N25	-2.20	118.92	122.73

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	601	A1JSH	O67-C66-C65	2.10	125.00	119.92
3	A	601	A1JSH	C33-C34-N37	2.05	114.82	110.44
3	A	601	A1JSH	C11-C09-C08	2.00	126.60	123.98

There are no chirality outliers.

All (3) torsion outliers are listed below:

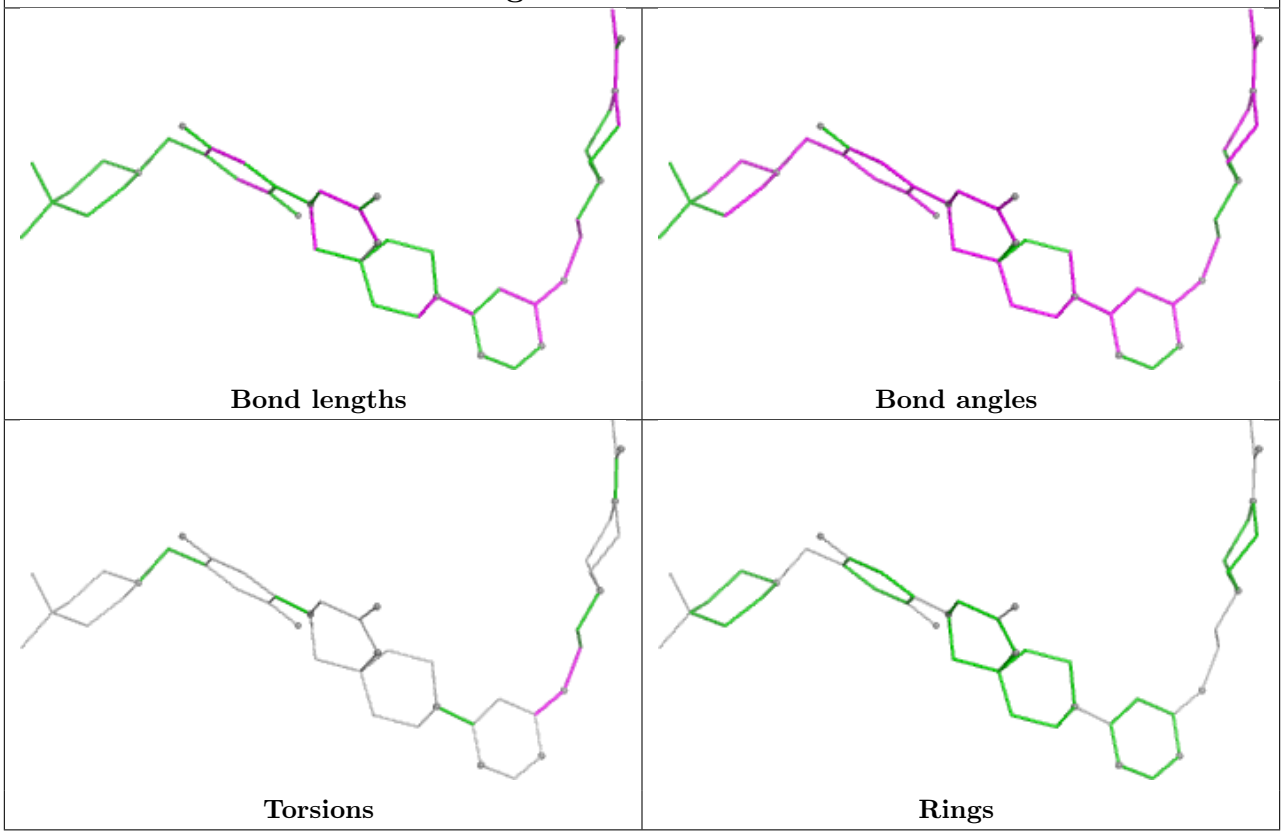
Mol	Chain	Res	Type	Atoms
3	A	601	A1JSH	N27-C28-N29-C30
3	A	601	A1JSH	C63-C28-N29-C30
3	A	601	A1JSH	C31-C30-N29-C28

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 A1JSH A 601



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	205/228 (89%)	0.02	7 (3%)	48	49	40, 54, 80, 96	0
2	B	247/307 (80%)	0.08	5 (2%)	65	65	30, 52, 89, 106	1 (0%)
All	All	452/535 (84%)	0.05	12 (2%)	56	57	30, 53, 87, 106	1 (0%)

All (12) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	152	LEU	4.0
1	A	575	SER	3.0
1	A	474	HIS	2.9
2	B	274	THR	2.5
1	A	468	ARG	2.3
2	B	392	ILE	2.3
2	B	117	ASN	2.2
1	A	512	HIS	2.1
2	B	202	THR	2.1
1	A	368	LEU	2.1
1	A	467	ILE	2.1
1	A	573	ILE	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)

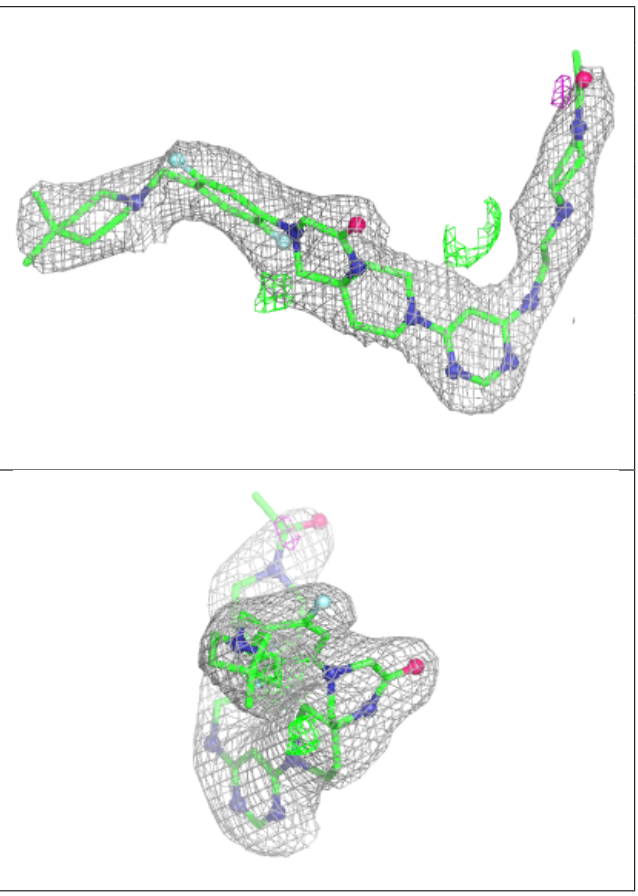
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	A1JSH	A	601	47/69	0.91	0.10	53,60,75,83	0
4	ACT	B	401	4/4	0.94	0.09	47,48,50,61	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 A1JSH A 601:

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.